

MOUSE E MOTION

UNIVERSAL MOBILE DATA LOGGER

Technical Note 1:

Rechargeable Battery Maintenance



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CONTENTS

1. General Information
2. Recharging Deeply Discharged Batteries
 - 2.1 Regenerating Deeply Discharged Batteries
 - 2.2 Testing Regenerated Batteries
3. Solving the Problem of a Reduced Operating Span
 - 3.1 Checking the Battery Capacity
 - 3.2 Checking the Integrated Charging System
 - 3.2 Checking the Data Logger
4. Facts About Rechargeable Batteries
5. Recommended Equipment

1. General Information

The data logger is operated by 2 NiMH rechargeable batteries of the AA (Mignon) size. The operating span is influenced by the quality and in particular by the state of charge of the batteries used. When fully functional and freshly charged batteries with an indicated capacity of 2000mAh are applied, the operating span of the MOUSE-E-MOTION Universal Data Logger is up to 150 days (depending on the configuration of the logger). Note that the *effective* capacity of the utilized batteries is critical for that. The *effective* capacity of rechargeable batteries decreases inevitably over time, even with constantly thorough handling. Rechargeable batteries with an indicated capacity of 2000mAH, for example, will have an effective capacity of about 1500mAH after permanent usage for two years. So, regardless of the quality of maintenance, the effective capacity is only about 75% of the original value. With insufficient care the effective capacity can even go far below 50% of the indicated capacity. Correspondingly, the operating span of the MOUSE-E-MOTION Universal Data Logger is significantly reduced when such batteries are used.

The best way to preserve the reliable functioning of rechargeable batteries is to use a separate, so-called „intelligent“ battery charger, such as the ALC 2000 charger from Conrad Electronic (www.conrad.de). This charging device charges up to 8 batteries of type AA simultaneously and safely. The charging time is 3 to 4 hours. The charger also allows for testing your batteries after a longer period of permanent usage or when a reduced battery capacity is suspected. To reliably achieve optimal performance of your rechargeable batteries, please follow the subsequently listed instructions and recommendations:

- Always power off a data logger after running, otherwise the batteries might become deeply discharged.
- Avoid running a data logger until the batteries are completely discharged. Exchange the batteries in time before starting a new logging task.
- Have a second set of charged batteries for each operating data logger at hand, so you will be able to run the devices without unnecessary interruption.
- Handle the rechargeable batteries thoroughly and check their effective capacity regularly.
- Only use rechargeable batteries of the same type as the ones originally provided with the data logger.
- Never use rechargeable batteries of diverse manufacturers, different age or mismatching capacity in the same data logger.
- Always charge your rechargeable batteries in a separate charging device, regardless of their actual state of charge.
- Do not use incompatible rechargeable batteries with the integrated charging system of the MOUSE-E-MOTION Universal Data Logger as this may result in a radically reduced operating span (such rechargeable batteries are not charged correctly).

2. Recharging Deeply Discharged Batteries

Batteries that have been completely discharged during data logger operation and then remain within the device might become deeply discharged. Such batteries might not be charged without special treatment, neither by the data logger's charging system nor in a separate charger. This is caused by the circumstance that the batteries have been discharged down to a cell voltage of nearly 0V. In this case the charging system cannot recognize the batteries. Moreover, even if deeply discharged batteries have been successfully regenerated, they might not regain their full original capacity.

Using the *ALC 2000* charger, deeply discharged or defective batteries can easily be identified. For this purpose, insert the battery into a charging compartment. The battery should be recognized and after a short period charging should be initiated. This is indicated by the respective green LED indicator. If the LED indicator of a charging compartment is not illuminated after a period of 1 minute the respective battery is not recognized by the charging system, presumably because of it is deeply discharged. Such batteries have to be regenerated prior to being able to charge them (see 2.1). When batteries are being charged, always check if the green LED indicator is illuminated 2 minutes after the batteries have been placed into the charger.

2.1 Regenerating Deeply Discharged Batteries

Usually, applying a short power pulse of 500 to 1,000mA for 5 to 10 seconds to deeply discharged batteries helps to regenerate them. In most cases the batteries are recognized again by the charger afterwards and then properly charged.

The *ALC 2000* charger allows for the easy regeneration of deeply discharged batteries. Insert a battery that is discharged (but *not* deeply discharged) into one of the charging compartments. After a few seconds, charging should commence, signalled by the respective green LED indicator. Now attach the deeply discharged battery in correct polarity to the upper contacts of that compartment where the previously inserted battery is charged. The deeply discharged battery is now supplied with power in parallel to the other battery. Afterwards, this battery can be placed into another empty compartment of the charger. It should be recognized by the charger now and properly be charged (*also see 2.2 Checking Regenerated Batteries*).

You can also use an external power supply to apply a power pulse to the deeply discharged battery (500 to 1,000mA, 2V maximum voltage).



2.2 Testing Regenerated Batteries

Deeply discharged batteries that have been successfully regenerated sometimes do not regain their full original capacity. Using the *ALC 2000* charger you can test the present capacity of a battery („Test“ function, refer to the *ALC 2000* operating instructions). The battery is being charged, discharged and then recharged. The present cell voltage and the charging/discharging current is monitored on the display. The *ALC 2000* charger also supports optimizing batteries (*Regenerating*, refer to the *ALC 2000* operating instructions). Often it is possible to completely regenerate the original capacity of a battery.

3. Solving the Problem of a Reduced Operating Span

A reduced operating span of the MOUSE-E-MOTION Universal Data Logger can have one of the following causes:

- the batteries are defective
- the batteries are not charged properly by the integrated charging system
- the data logger has a malfunction

3.1 Checking the Battery Capacity

Using the ALC 2000 charger, check the capacity of a battery freshly charged by the integrated charging system of a data logger. The determined *effective* capacity should not be less than 80% of the value (mAH) indicated on the battery, otherwise this battery should be discarded. If a battery does not reach its indicated capacity any more, it might be recovered with the „Refresh“ function of the ALC 2000 charger (refer to the ALC 2000 operating instructions).

3.2 Checking the Integrated Charging System

Using the supplied power adapter, charge two functional and discharged (but *not deeply* discharged) batteries of the recommended type with the integrated charging system of the MOUSE-E-MOTION Universal Data Logger. After charging has been completed, check the battery capacity with the ALC 2000 charger. If the measured capacity is considerably smaller than the indicated capacity (mAH) on the battery, there may be a malfunction of the charging electronics of the data logger. Return the data logger for an extensive investigation. (If this is observed when batteries different from the recommended types are used, these batteries are probably not compatible with the integrated charging system.)

3.3 Checking the Data Logger

To check for a malfunction in the data logger's electronics connect the device to an external power supply and determine the power consumption with an appropriate measuring instrument. The instrument should be capable to compute an average value (AVG). Remove the batteries from the battery compartment of the data logger. Connect the contacts in the battery compartment with an external power supply ensuring the correct polarity. Apply a voltage of 2.2 to 2.7V and a current limitation of 150 to 500mA. **Warning: A voltage higher than 4V will cause irreparable damage to the device!** The MOUSE-E-MOTION Universal Data logger has an automatic fuse, so it is not possible to cause damage to the device if the polarity is swapped. The fuse will re-enable itself after a short time if triggered. Determine the power consumption of the data logger. The subsequent values should be observed in average mode (AVG) and are within the tolerance range:

Data logger is powered off:

min. 0.01mA	typ. 0.02mA	max. 0.1mA	peak value (non-AVG): 0.1mA
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Data logger is in standby mode, PC-interface cable not connected to the device:

min. 2.0mA	typ. 3.5mA	max. 7.0mA	peak value (non-AVG): 25mA
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Data logger is in logging mode, PC-interface cable not connected to the device:

min. 0.6mA	typ. 1.2mA	max. 2.0mA	peak value (non-AVG): 25mA
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If higher values are detected the data logger might have a malfunction. Please return the device for inspection and repair.

4. Facts About Rechargeable Batteries

- It is not necessary to completely discharge partially discharged batteries. It even might reduce their life span. (The so-called „memory effect“ is practically not detectable with Ni-MH batteries.)
- Using the *ALC 2000* to charge rechargeable batteries will limit the loss of capacity caused by normal ageing to less than 35% over a period of 2 years.
- Frequent deep discharge of rechargeable batteries will result in an acute and enduring loss of capacity.
- Self-discharge of NiMH rechargeable batteries is about 2% to 5% per month. If an overall loss of capacity of 10% is acceptable, charged batteries may be stored up to 3 months before they are used.

5. Recommended Equipment

5.1 Rechargeable Batteries

Type *NiMH 2000* or *NiMH 2100* from *Panasonic*.

These rechargeable batteries function very reliable, even when they are regenerated after having been deeply discharged.

5.2 Battery Charger

ALC 2000 Expert from *Conrad Electronic* (www.conrad.de)

Item-No. 25 03 85-50, ~ 149,00 € (w/o VAT)