FAQ - QUESTIONS AND ANSWERS RELATED TO LITHIUM-ION

1. How should I store my batteries?

Lithium-ion batteries (Li-ion) should not be stored over a longer period of time either uncharged or fully charged. The optimum storage as determined by extensive experiments is with 40% to 50% capacity and at low temperatures, which should not drop below 0°C. Storage at 5°C to 10°C is optimal. As a result of self-discharge, a recharge is necessary every 12 months, at the latest.

2. Should the battery be taken from the device in case of a long period of non-use?

Yes. A small current can also flow in the switched-off device, which leads to a complete discharge which, after a longer period of time, can damage the battery and at the very worst destroy it.

3. What is understood by self-discharge?

In the case of lithium-ion batteries, 3% to 5% loss of charge monthly is possible the self-discharge is temperature-dependent and higher with increased temperatures.

4. What is understood by complete discharge?

By complete discharge is understood the "squeezing-out" of a battery until it does not yield this any more current at all. The voltage drops to 0 volt in this case. If this status is retained, chemically reactions progress at the electrodes in the battery, which make it partially to completely unusable. The result is that the battery loses capacity massively and possibly cannot be charged up any longer. For this reason batteries should not be discharged to below a type-dependent final cut-off voltage and should be charged up again as quickly as possible. Therefore lithium-ion

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batteries and lithium-ion-polymer batteries should basically not be discharged completely.

The following rule of thumb applies: *A lithium-ion or lithium-ion-polymer battery should be charged only when it still has approx. 10% to 20% capacity remaining. Good Li-ion rechargeable batteries generally have extensive protection and/or monitoring circuits in the battery pack, which prevent a complete discharge / overcharge and an explosion.*

5. In which temperature range should I operate my batteries?

The use of a lithium-ion battery is possible in a temperature range of 10°C to +55°C. However, the charging should take place only at a battery temperature of +5°C to +45°C. The deal temperature range of the batteries is room temperature. A sensor in the battery ensures that no boost charging is implemented outside of this range. Maschinenfabrik

6. How long is the service life of batteries?

Li-ion batteries can be charged up to 1000x times (capacity-dependent). However, these values are only achieved under optimum conditions. According to handling and care of the batteries, the number of cycles can decrease. Capacity decreases in the course of the service life. Generally batteries are described as worn-out when they are below 70% nominal capacity.

7. What does memory effect mean (with NiCd technology) and/or lazy-battery effect?

The battery notes how strongly it has been used. If the battery is not discharged completely before the charging, small crystals are formed on the electrodes and

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they reduce the possibility to accept charge. Therefore if you do not discharge your battery completely repeatedly one time after another, the operational times become increasingly shorter. In case of the NiMH technology a battery inertia effect (lazy-battery effect) can occur, which is comparable with the classical memory-effect. Lithium-ion batteries and lithium-ion-polymer batteries can be and may be recharged at any time. There is no memory effect in case of these batteries and only frequent short charging should be avoided. Also full charging in several stages with or without partial discharging in between does not cause any damage. However, lithium-ion batteries and lithium-ion-polymer batteries should not be discharged completely.

The following rule of thumb applies: *Charge a lithium-ion-polymer battery if it still has about 10% to 20% capacity remaining. Please note that a disconnection and renewed connection of a full battery block to the charging unit does not result in a higher charging. This procedure damages the performance capability of the battery.*

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Rules for lithium-ion rechargeable battery care:

- The first charging process is decisive! Please charge the battery completely before first use.
- Every battery has only a limited number of charging cycles. Therefore do not recharge the battery again at every opportunity, rather always continue to use it for so long until it is almost empty (10% to 20% of charging status).
- If the battery is discharged below its nominal voltage, this can lead to processes which damage or destroy the battery. FEIN batteries therefore have electronics which warn the user and switch off the device before such a complete discharge results.
- Also frequent overcharging can damage the battery permanently. Therefore the charging unit automatically ends the charging process as soon as the battery is fully charged. After this, do not provide the battery with more charge under any circumstances through repeated connecting.
- The charging should generally take place at room temperature only (approx. 18°C - 21°C). Avoid charging a cold battery as this damages the cells. Especially in case of cold outside temperatures in the winter, always allow the battery to first warm up to room temperature in order to then charge it under optimum conditions.
- Also high temperatures damage the battery. Never leave the battery or your device case in the car exposed to the sun on hot sunny days. At temperatures above +60°C the Li-ion battery loses capacity constantly and thus performance capability.
- Li-ion batteries should not be stored over a longer period of time either empty or fully charged. Optimum storage conditions, as determined in

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extensive experiments, is with a capacity of 40% to 50% and at low temperatures not below 0°C. A retention at 5°C to 10°C is optimal. As a result of self-discharge, a recharge is necessary every 12 months, at the latest.

- A battery which is not used should be stored cool, however not cold. Also in the unused status, batteries lose energy. In case of a Li-ion battery, the energy loss is approx. 3% to 5% monthly.
- If a Li-ion battery is not used for a longer time, it should be charged after 12 months, at the latest. This is necessary since otherwise the battery is damaged irreparably and cannot be used any longer.
- Please always dispose of old and used batteries non-polluting.

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