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BATTERY HANDLING

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Universität Bremen

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1. Battery Safety
2. Turtlebot Battery Handling

Battery Safety

Disclamer

Listen to the experts!

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This is NOT a safety briefing

This video/lecture is NOT part of a safety briefing!

Always follow instructions of safety delegates and read data sheets!

At DFKI RIC: Join mandatory safety instructions and ask your advisors!

Battery handling

JPL-Video: exploding battery

https://www.youtube.com/watch?v=JECJAgRsp-4

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Battery charging in general

- Safety instructions for everyone!
- Always supervise your battery while charging!
- Batteries have to be placed on a fireproof base
- No potential fire load located above batteries
- No exposed contacts, check state of the battery
- Do not overcharge
- Store safely
- at DFKI RIC we have a metallic charging cabin!

Figure – Battery cabin at DFKI

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Especially for LiPo, LiFe etc.

- Free space above the battery (do not charge in wood shelves etc.)
- Do not connect batteries showing a bulge or damages!

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Especially for LiPo, LiFe etc.

- Use a LiPo Guard while charging
- Do not put the charger inside the LiPo Guard (it needs air for cooling)
- We also have sand-filled ceramic containers for other batteries

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Safe battery usage.

- Don't let the battery get empty. Most batteries should always be above ∼20 % charge → see data sheet.
- Assure good operation temerature.
- Secure the battery in a way that it does not move while your robot moves.
- Do not apply physical stress on the battery.
- Balance all cells from time to time so they discharge equally during use. (or use a charger that automatically balances the cells while charging).

Battery storage

Storing batteries.

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- Charge to $\sim$70% $\rightarrow$ check data sheet and/or
- Use the storing program of the charger.
- Check regularly, at least every 3 months
  - Voltage of each cell has to be between 3.8 and 3.9 Volt $\rightarrow$ check data sheet.
  - No visual damage or bulge of the cells.
  - No visible contacts or damage to the isolation.
  - Manage a LiPo-register where you write down the voltages of each cell (at least charge date).
- Store in special fire-proof boxes with integrated extinguishing agent.
- Charge at right temperature (depending on battery type)!

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Use a Storage program

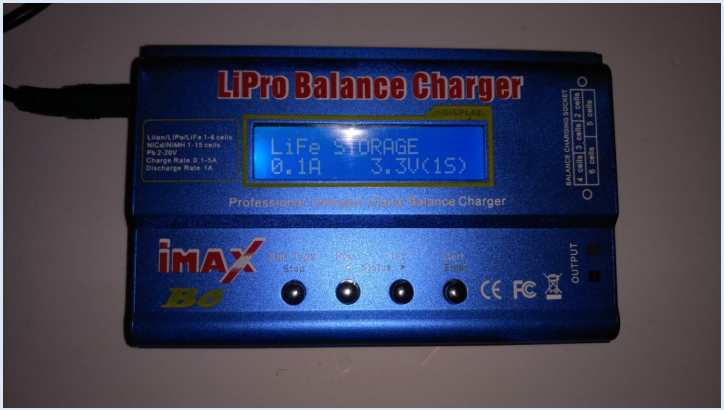

Figure – Some chargers have a special storage program..

Soldering batteries

Be very careful soldering batteries!

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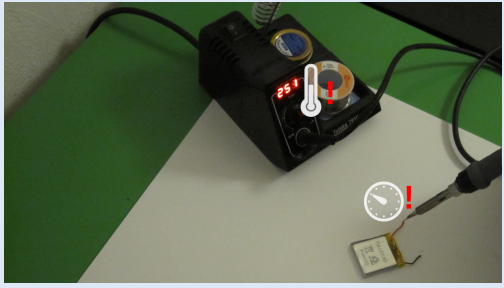
Know what you are doing!

- **Ask someone who is more experienced in soldering instead of doing it yourself!**
- The connecting wires to the battery can become very hot!
- Only touch the wires with the tip of the soldering iron for a very short time.



In case of a fire

Keep cool, stay safe, call the experts, fight or escape

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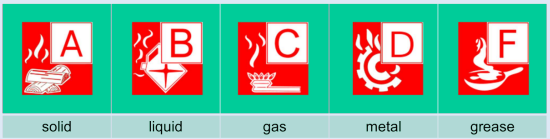
In case of a battery fire.

- When in doubt just escape and call the fire department!
- Only use class D fire extinguisher for batteries.
- Do not use water!
- Alternatively use a fire blanket.



CO_2 → ← metal

Figure – fire blanket

Turtlebot Battery Handling

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Power to the robots!

- Be careful putting the battery in place (avoid physical stress on the battery)
- Be careful to not break the plastic (apply force upwards, not to the side when removing the bracket!)
- Tip: Keep the wheels in the air when connecting the battery!

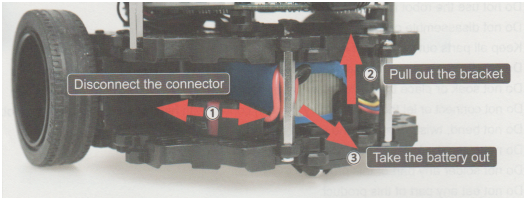

Figure – battery connection (from the official documentation by ROBOTIS)

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Before charging!

- Make sure you are allowed to charge the battery in the room.
- Make sure the fire fighting equipment is nearby and the windows can be opened!
- Disconnect and remove the battery from the robot before charging!
- Check cables and battery for damage!
- Take enough time (a full charge takes around 1.5 to 2 hours)
- **Do not charge unattended!**
- Update the charging table when you are done.
- Check your calendar to make sure you charge it again in 3 months (latest).
- **Disconnect the battery when something is strange and inform a tutor!**

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Power to the robots!

Battery charging using the default charger (from the official documentation by ROBOTIS)

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Power to the robots!

- Alternative: the TURNIGY-charger
- It will detect the battery automatically
- 12.6 Volt for a brand new 11.1 V battery is what it should be!
- You can check individual cells with this chargers.
- Recommendation: do not charge 2 batteries at the same time (it charges each cell at a time and is not faster, use multiple chargers instead)!

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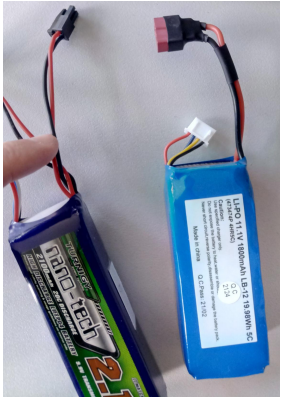
Lithium iron phosphate ($LiFePo_4$ - LiFe) or Lithium-polymer ion ($LiCoO_2$/$LiMnO_2$ - LiPo)

- LiFe are safer.
  $\Rightarrow$ Use LiFe batteries for self-build robots
- LiFe has lower voltage and lower capacity.
- The turtlebot comes with LiPo batteries.
  $\rightarrow$ it will sound a low-battery-alarm when connected to a LiFe battery although the battery is fully charged.



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Conclusion

- Batteries can be scary but handled correctly they are very safe.
  (Most of you are carying LiPo batteries in your pockets inside of a smartphone or Laptop right now - it is very unlikely that something happens with the turtlebot)
- Handling batteries is easy most of the time.
- Follow safety guidelines.
- Ask your tutors or lecturers for help if you feel uncomfortable.
- Use your common sense and don't do stupid stuff (no short-circut, opening or soldering).

Thank you for your attention.