Technical Inspection (General)

FSG Academy – Main Workshop for FSG 2024
on 21st of October 2023 at Schaeffler in Herzogenaurach


Automated External Defibrillator
entrance only
NO ENTRY
KEIN ZUTRITT
NO ENTRY
KEIN ZUTRITT

Technical Inspection – Organization

Chassis / SES

Jet
Tuitert

M-Inspection

Christoph
Beißwanger

D-Inspection

Nicolas
Velz

A-Inspection

Sarah
Battige

E-Inspection

Mathias
Gebhardt

Technical
Inspection

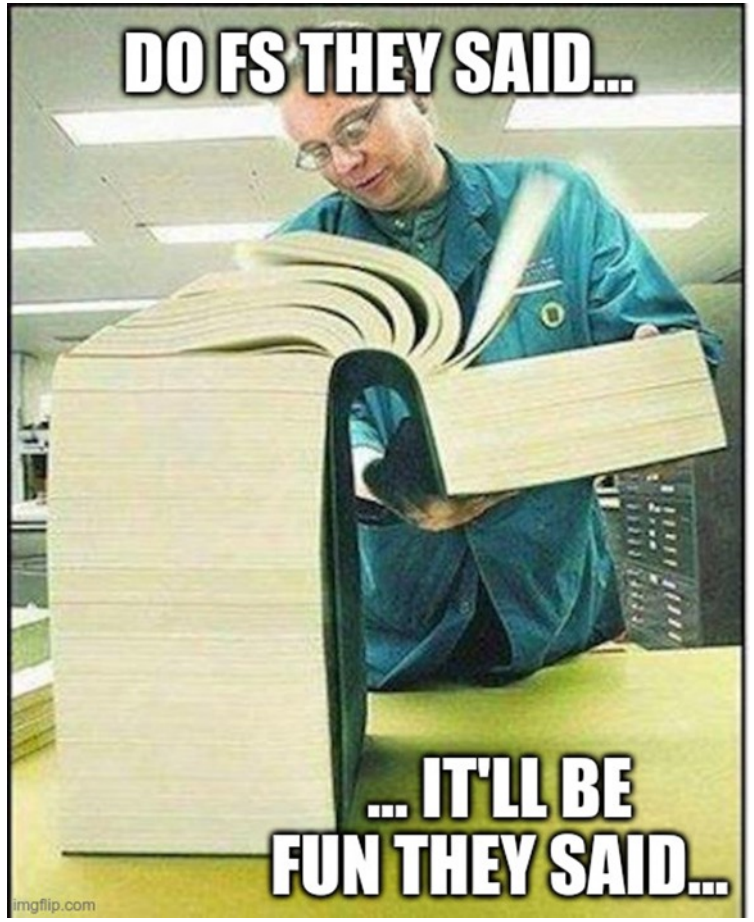
Mathias
Gebhardt

Rules and important documents

- All information, documents and advices published on the FSG website (www.formulastudent.de) in the section "Rules & Important Documents" are **OFFICIAL documents** for the FS Germany events.
- All advice given in this presentation are rule clarifications that support the FSG 2024 rules.
- Further rules clarification can be found in the FAQ section and support the interpretation of the intent of the rules.

Rules Questions

- 2022/23 requests 880 => ~2,4 a day
- What should I ask?
  - *‚the rules tracker's intent is **not** to confirm any of your design choices'*
  - *‚if you are asking for design confirmation, we suspect there is an issue with interpreting the rules yourself'*
- Check the FAQ before asking a question
- Only one question and rule per ticket
- Provide all dimensions and illustrations that support your request.



Vehicle Design vs. Inspection

- Formula Student is a design and **engineering** competition
- The rules gives you as much freedom for your design as possible
  - NOT to provide you with a guideline on how to build a formula student vehicle
- T2.1.1 The vehicle must be designed and fabricated in accordance with good engineering practices
- A1.2.3 The competition starts with a series of technical inspections described in chapter IN to check the vehicle for safety and compliance with the rules
- A3.5.1 Violation of the intent of a rule will be considered a violation of the rule itself

We need your Feedback!

- The best way to improve the event is to implement your feedback! So please feel invited to use our feedback tools :-)

- If you have good ideas for the rules use the rules feedback tracker. https://www.formulastudent.de/nc/fsg/rules/feedback/

- If you have smart ideas about the technical inspection, please use the general feedback tool --> dynamics --> inspection https://www.formulastudent.de/fsg/feedback/

Electrical Inspection

APPS/Brake Plausibility Checks

- Whole section removed
- Not mandatory anymore

- (But still quite helpful to avoid triggering the BSPD)

TS to LVS Isolation and Spacing

- The working voltage of each isolation barrier must be than the max. TS voltage
  EV1.2.1

- Exception for commercially available IC removed
- Ensure that your ICs have fulfill the spacing requirements
  EV4.3.5

HVD

- Any ESO [of your team] must be able to remove the HVD within 10 s
  EV4.8
- The HVD is the last option if both AIRs are welded
- The only thing between you [ESO] and a (backwards) moving EV is the R2D → which is actually software only
- It’s your [ESO] decision, how far you want to bent yourself into a R2D vehicle

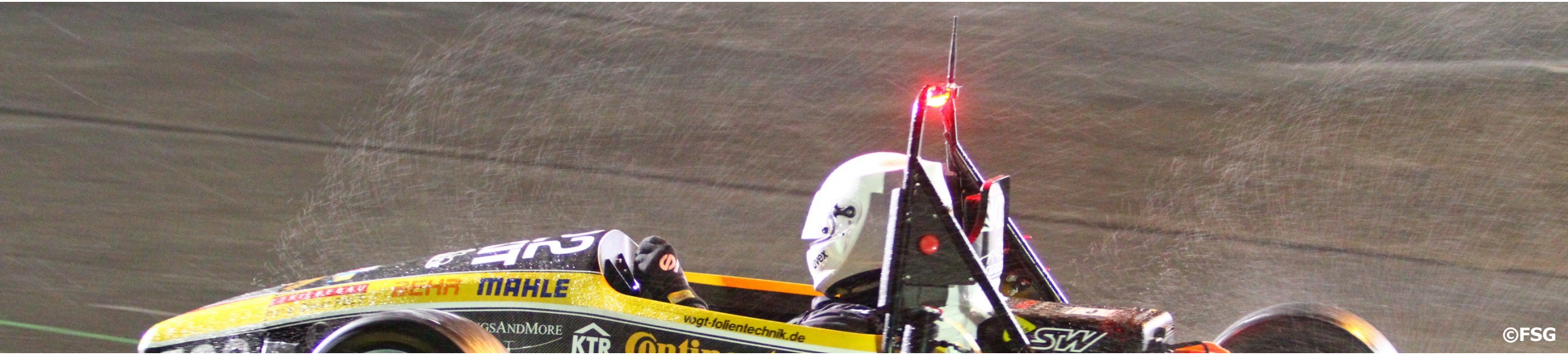
Grounding

- TS enclosures:
  - **either** fully isolated **or**
  - containing a aluminium layer <300 mΩ
- seat, driver harness, and TS firewall
  - 300 mΩ
- min 10% of TS main fuse current continuously
- other parts <100 Ω

Outboard Wheel Motor Interlock(s)

- A dedicated interlock
  - along the TS wire **and**
  - along a (single) suspension member
  - ensure that the wire (connectors) breaks before the mounting

TSAL

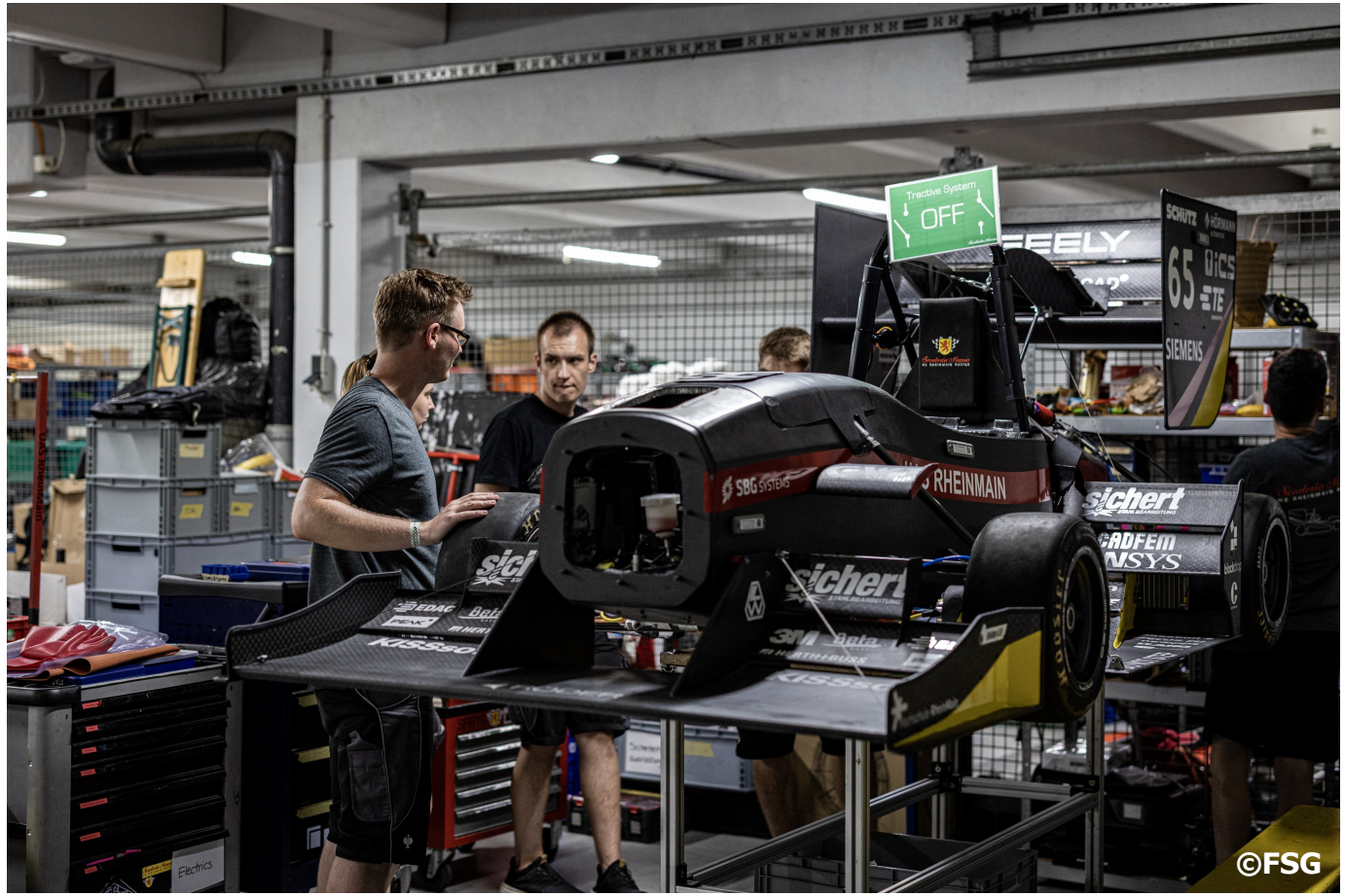


The Tractive System Active Light

TSAL – States

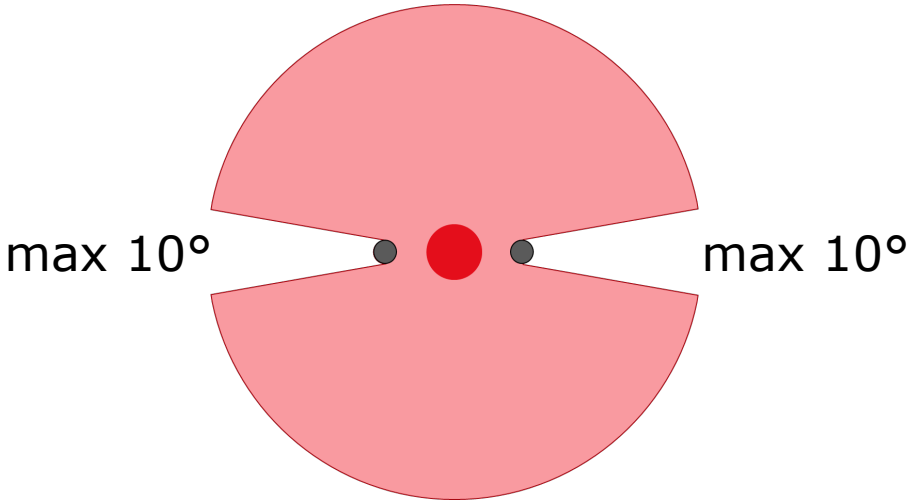
TSAL	State
	safe	TS off
	safe	TS on → vehicle might move
	unsafe	TSAL broken → watch out
	unsafe	TSAL broken → watch out
	safe	LVS off → organizational measure

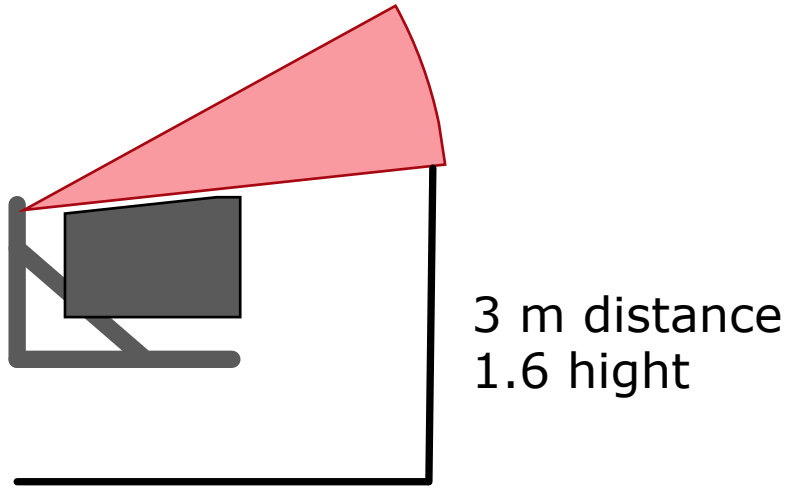
TSAL – “Manual“ Green Light



TSAL Visibility

- The illuminated surface may be blocked by up to 10° on each side by the main hoop
  EV4.10.8
- Also mind the wings and Antennas in side view





Accumulator Inspection

Please Join the Accumulator Session

16:00 – 17:00	60‘	Driverless Cup Winner Chalmers TU	Accumulator

Mechnical Inspection

Rules 2024

- There are plenty of rule changes
- Please read the rules carefully (before the event)

CHANGELOG

Rule	Version	Change
A 1.2.1	1.0	Included CV Hybrid into CV class
A 3.7	1.0	Simplified and clarified protest rules
A 3.8.1	1.0	Defined minimum penalty for rules violation
A 3.8.2	1.0	Defined penalty handling for DC
A 4.2.8	1.0	Defined “first competition”
A 4.3.8	1.0	Replaced reference to HV by TS
A 4.4.2	1.0	Clarified total number of ESOs and ASRs
A 5.3.1	1.0	Simplified rule
A 5.4	1.0	Extended late submission handling to all deadlines

T13 Helmets, HANS and clothing

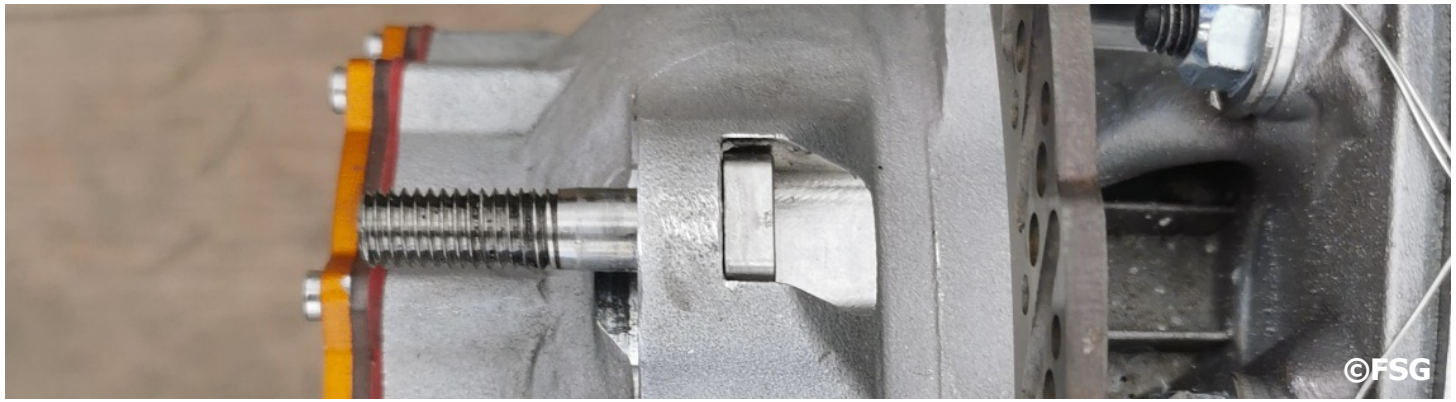
- Removed helmet standards that expire after 31.12.2023
- Frontal head restraint systems are recommended
- Added validity of fire resistant clothing
  - 10 years after manufacturing
- Clarified embroidered driver´s clothing

- Likely change in Rules 2025:
  - Snell K and M, and SFI 41.1 not valid anymore

Critical Fasteners T10.1.3 & T10.1.5

- **T10.1.3** New Wording since 2023 "equivalent standard"

- **T10.1.5** New rule according to 2023 FAQ for 2024: For steering and suspension systems, alternative fasteners are allowed if equivalency to T10.1.2 and T10.1.3 can be shown.

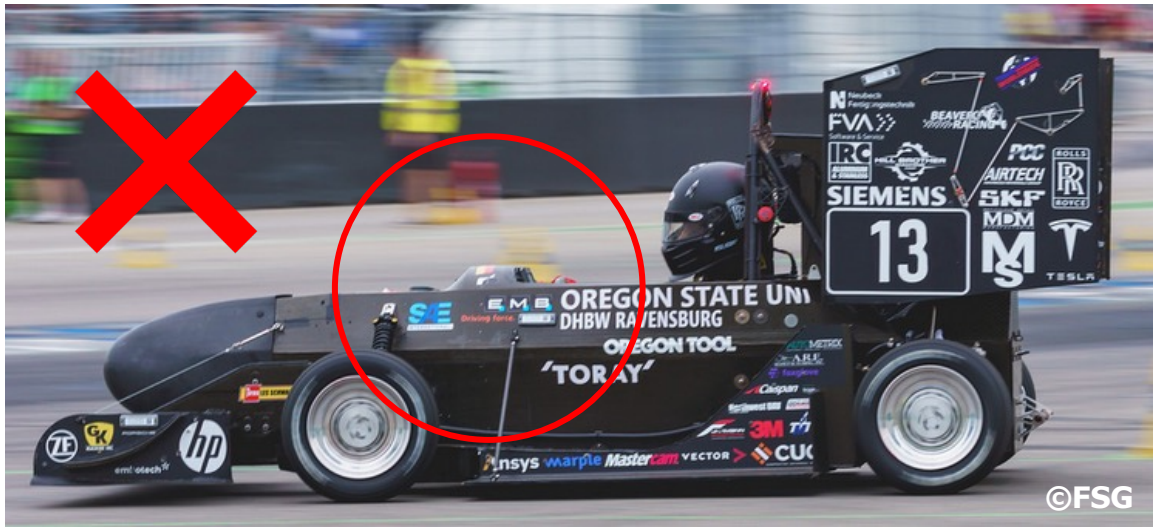


T2.4 Minimum Edge Radii

- All edges of the bodywork and aerodynamic devices that could come into contact with a pedestrian must have a minimum radius of 3 mm.
- FAQ/(Rules 1.1) possible if there are a lot of requests
- Please give us feedback

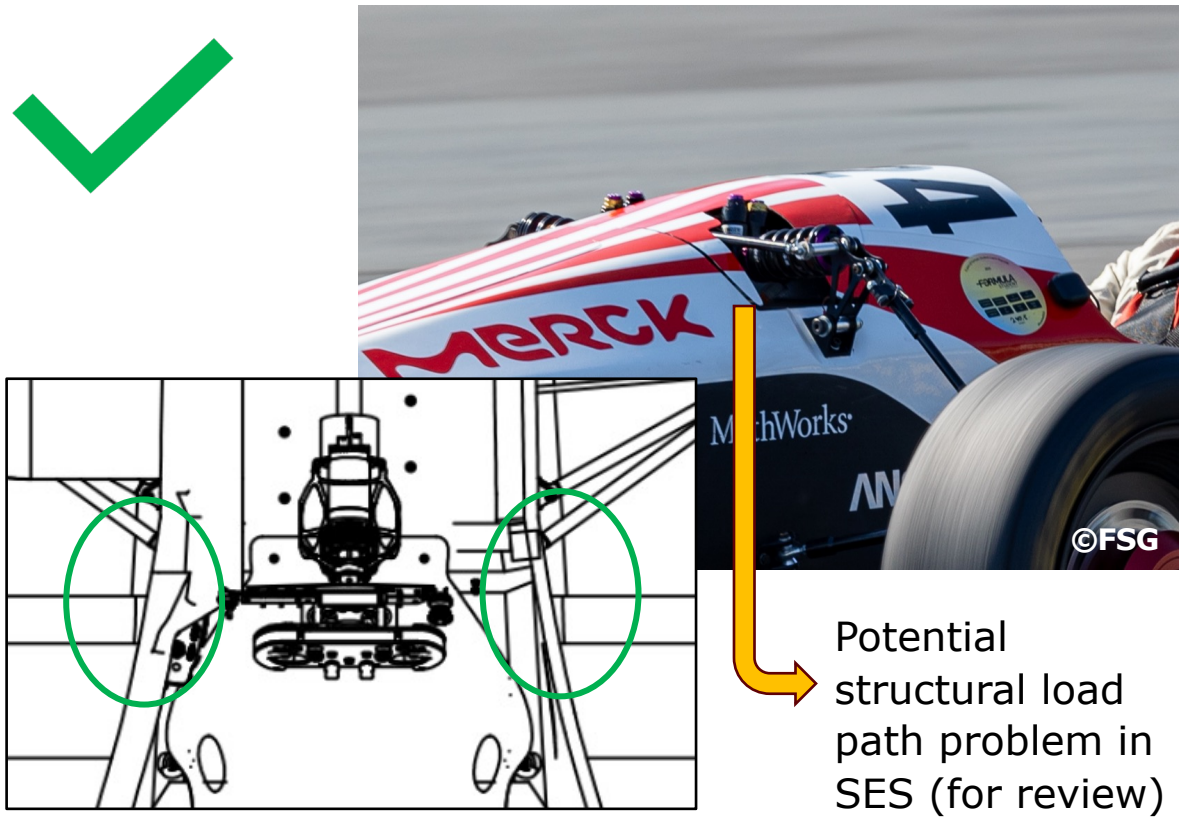
T1.1.2 & T2.3.2 Bodywork

- Bodywork – the outer surface of the chassis, including any fairing parts and covers.
- In front of the cockpit opening and outside the area defined in T8.2 all parts of the bodywork must have no external concave radii of curvatures.
  - Cutouts for dampers are ok as they are no bodywork (only small gaps allowed)
  - Adding a cover is a permissible solution



Good news: Rules 2024 V1.1

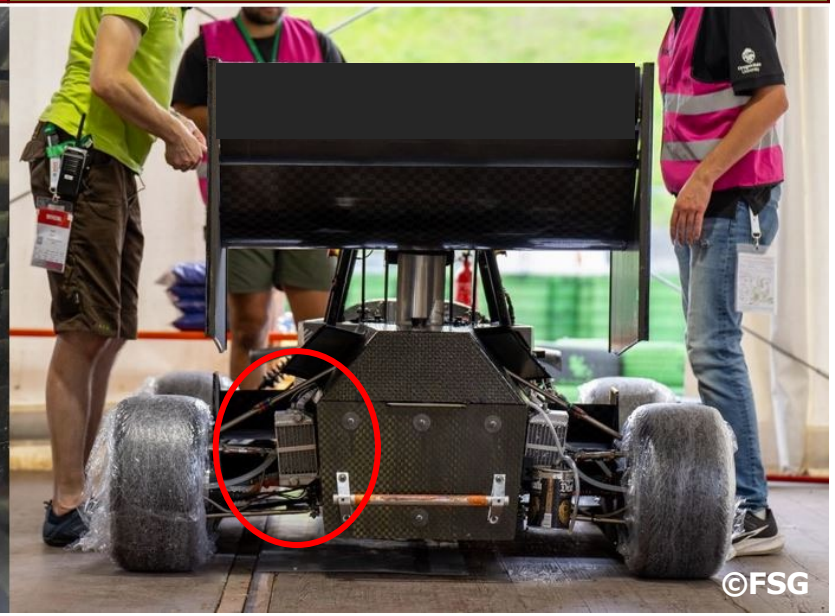
- In any side view in front of the cockpit opening and outside the area defined in T8.2 all parts of the bodywork must have no external concave radii of curvatures.



IN1.5 Modifications and Repairs

- It's not worth cheating
- Penalties can ruin the whole season!
  - Endurance
  - Offence
    - IN 1.5.1 & T 7.3.5
  - Reason 1
    - Modification to vehicle after technical inspection (IN 1.5.1)
  - Decision 1
    - 40 penalty points according to IN 1.2.8.
  - Reason 2
    - No protection against rotating parts (T 7.3.5).
  - Decision 2
    - 30 seconds time penalty. Violation of the rules without advantage for the team. IN 12.1.4.

Post Inspection	Mechanical Inspection



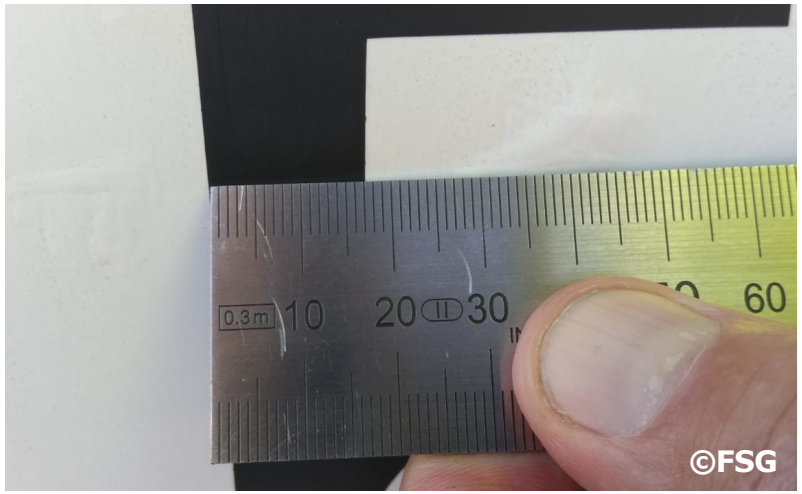
Is it worth it?

- Think about
  - Your tolerances (E.g. T2.2: ground clearance, T8.2: aerodynamic device restrictions)
  - Suspension setup (active suspension?)
  - Wear of tires
  - Driver changes

- Vehicle numbers (T12.1)
  - MINIMUM REQUIREMENTS

Hint: just make them bigger ;-)

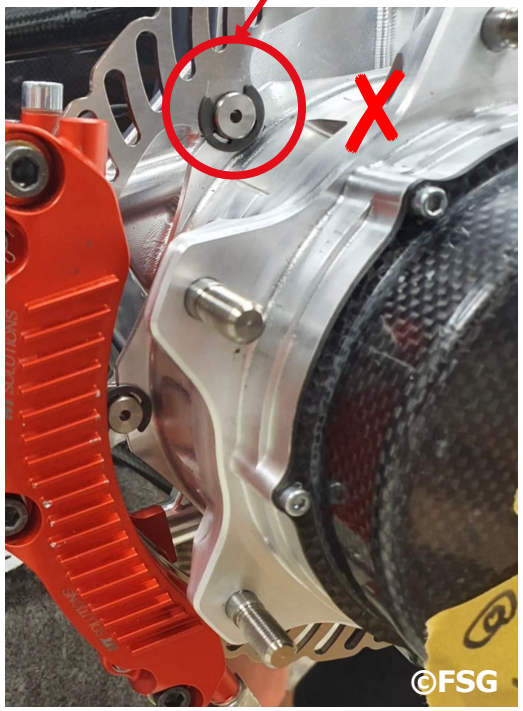
(We must be strict to be fair to all teams!)



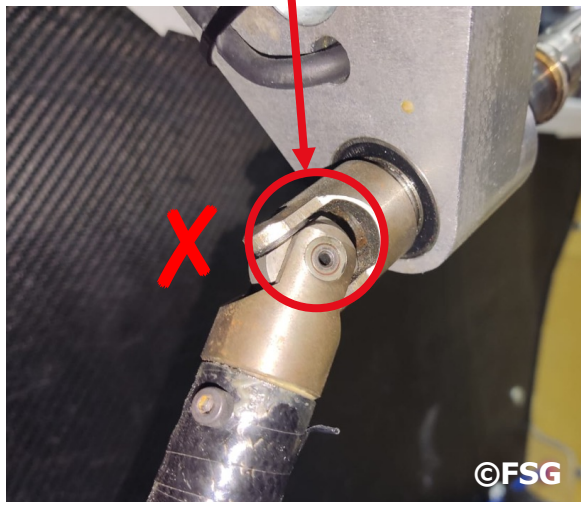
Usual suspects #1: Fasteners (T10), the bad's

- T 10.2.3 -> Snap and retaining rings are allowed in **some** assemblies (OEM applications and for securing bearings and springs given that they do not bear any loads under normal driving conditions)

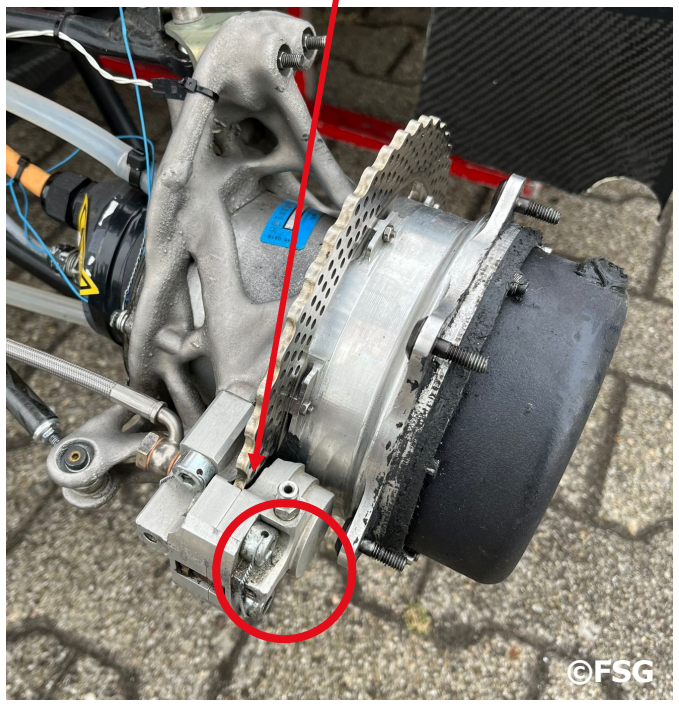
Not allowed @ brakes (not safe due to loading condition)



U-joint **not** positively locked to quick-release



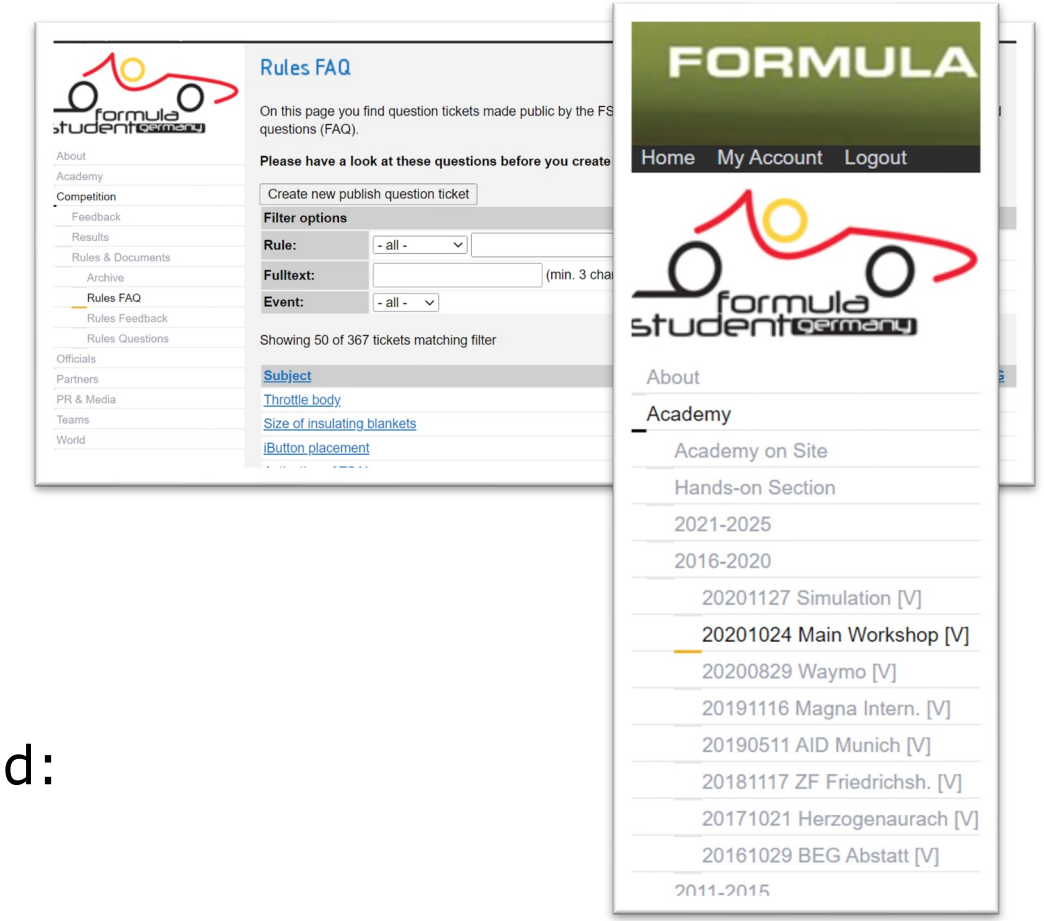
No need for safety wire on OEM caliper



Good engineering practice???

Resources availability reminder

- For more information and examples of good/bad engineering practises, have a look at the:
  - Academy -> e.g. 2016-2020
  - Competition > Rules & Documents -> Rules FAQ, set Event to '- all -'
  - Competition -> Rules & Documents -> Archive -> Documents 2023



- Rules questions
  - Before submitting a rules question, please read: [the rules questions tool guidelines]

Driverless Inspection

General

Applicability of DV-related rules:

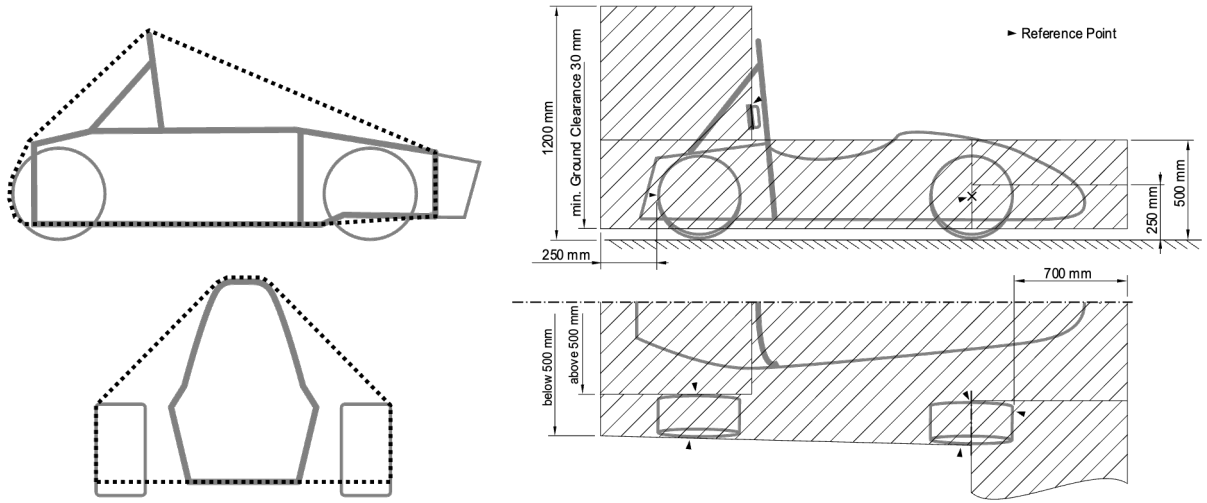
- Rule sections T 14 and T 15 only need to be considered, if the car shall run in autonomous mode
- Otherwise no AS or ASB/EBS needs to be implemented (e.g. no ASMS is needed)

System Critical Signals (SCS):

Important: If an AS is implemented, all its signals must be monitored accordingly (T 11.9 + T 14.5.1)

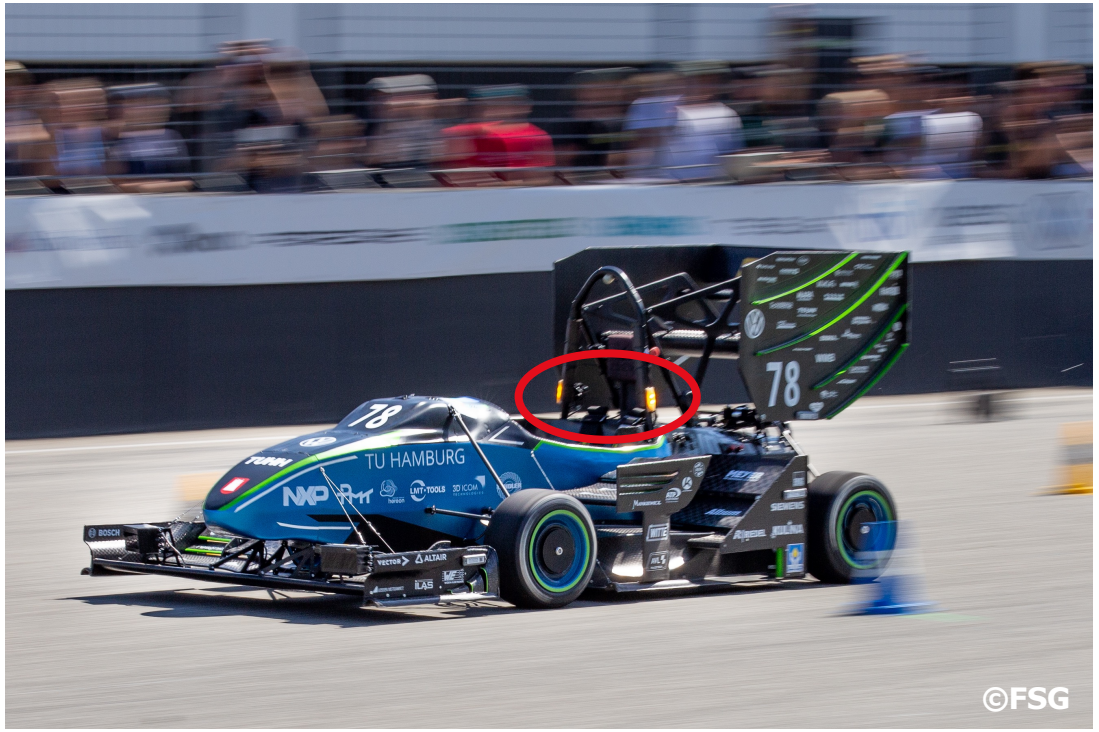
Sensors, cameras and components (T 11.11)

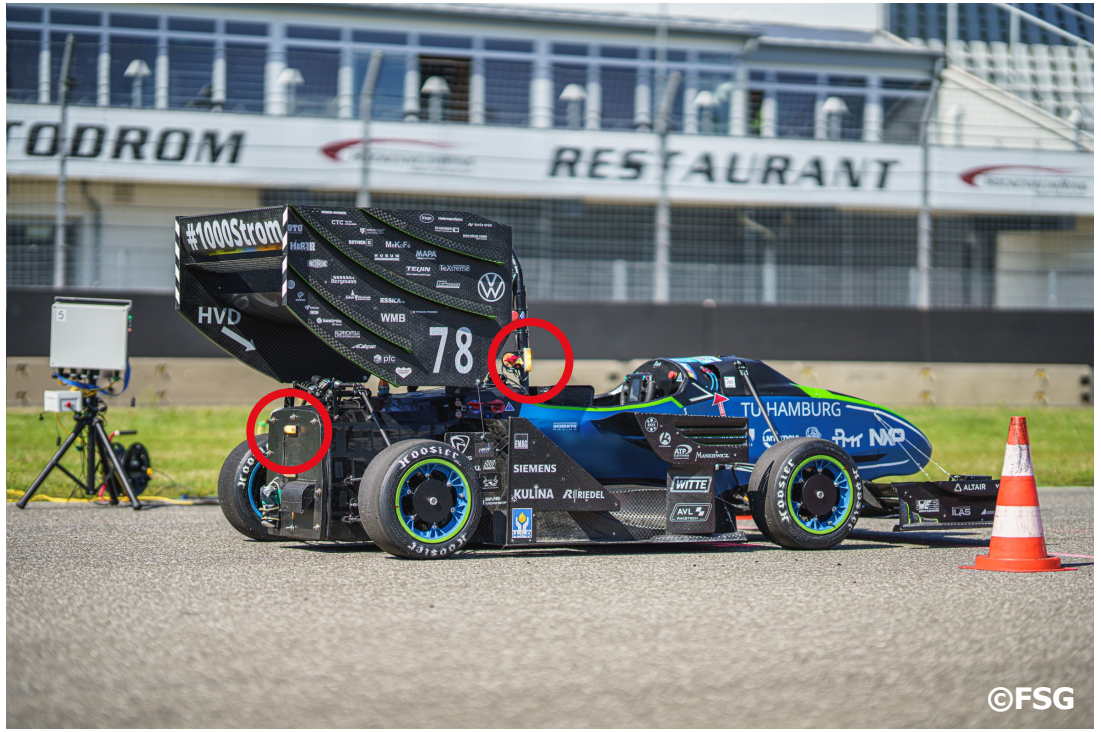
- must be positioned within the surface envelope or within the box defined in T 8.2



- must not come into contact with the driver's helmet under any circumstances

ASSI Visibility (T 14.10 + T 11.10.1)



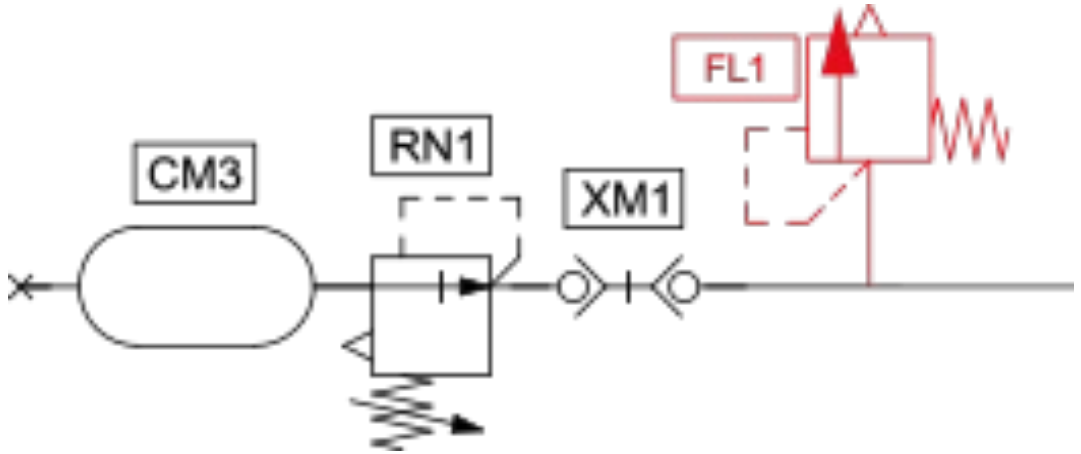


- There need to be <u>exactly</u> three ASSIs (T 14.10.1)
- At least one ASSI must be visible from any angle (T 14.10.3)
- Each ASSI must be visible in bright sunlight (T 11.10.1)

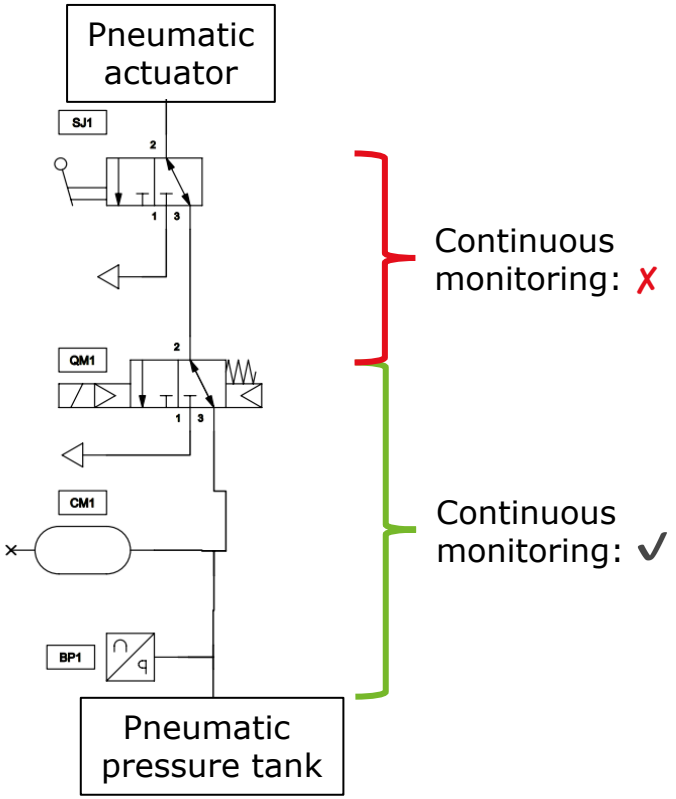
Overpressure protection for ASB (T 9.1.1)

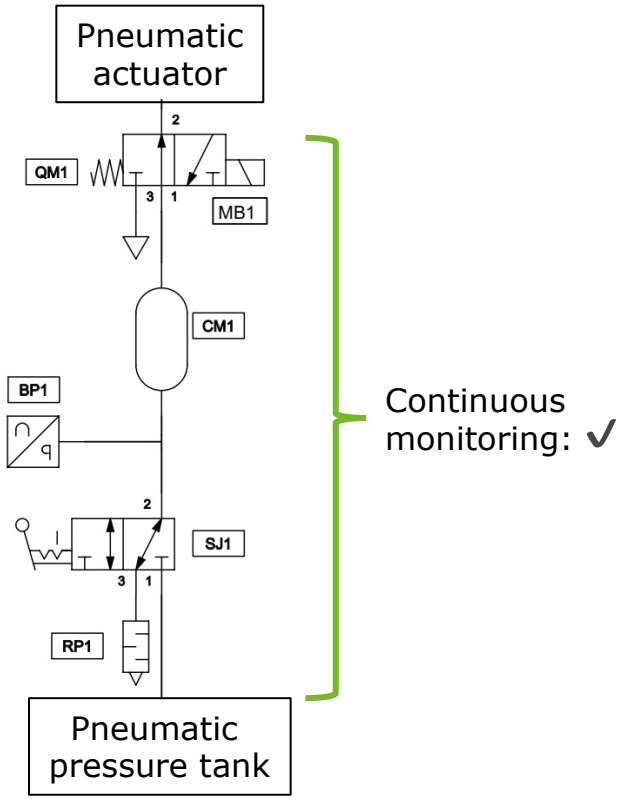
- **Intention:** Avoid damage due to (significant) overpressure
- Only required, if a pressure can occur that might damage any part in the pneumatic system
- For valves without a fixed pressure threshold, the properly adjusted threshold must be demonstrated during technical inspection

- **Example:** Pressure relief valve, also see AS guide



Continuous monitoring of ASB/EBS (T 15.3.2)





Important: Always make sure that all parts of the ASB/EBS are monitored continuously!

New AS guide published

New version of the FSG beginner's guide on the Autonomous System published:

https://fsg.one/as-guide

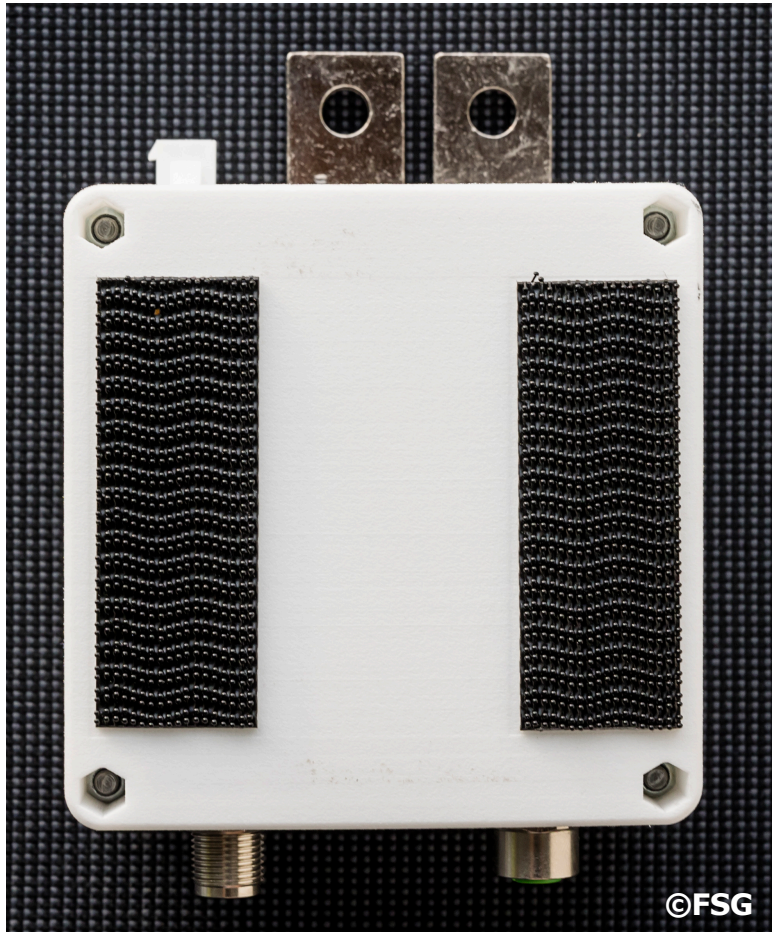
Contents

Data Logger

FS Datalogger in 2022 & 2023

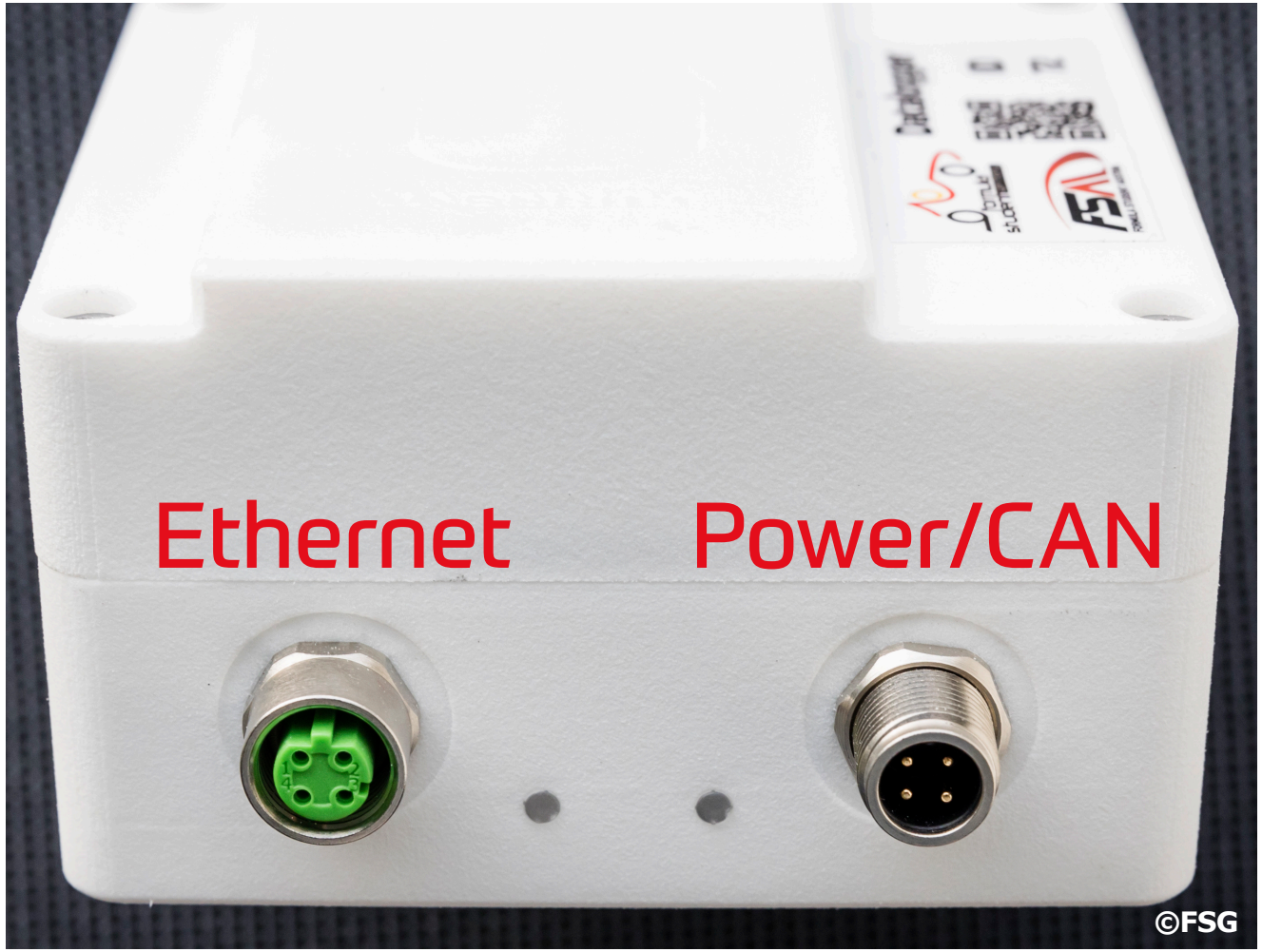
- 13 Events
- 23.078 recorded logfiles (66 GB)
- 77.099 times booted
- 2496 discipline runs

Mounting of the datalogger



- Must be mounted with Dual Lock™
- All other mounting options are not allowed

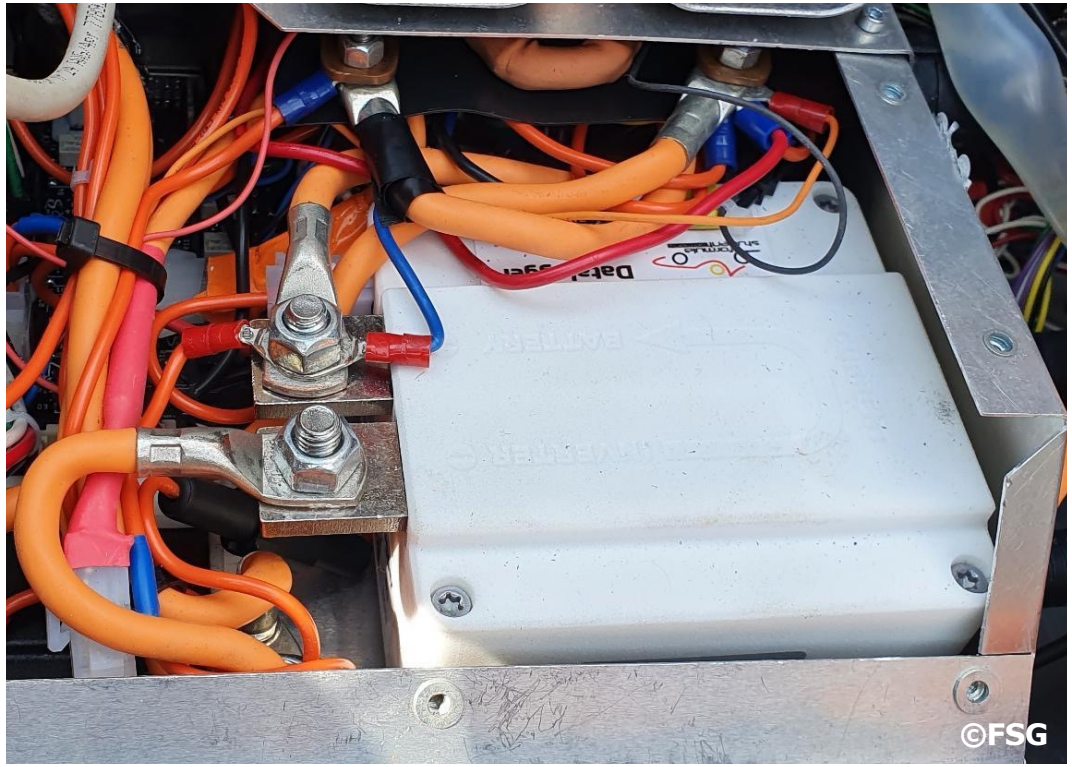
Connectors of the datalogger



TS wiring

- no TS wires on top of the datalogger
- Connect your wires from the side

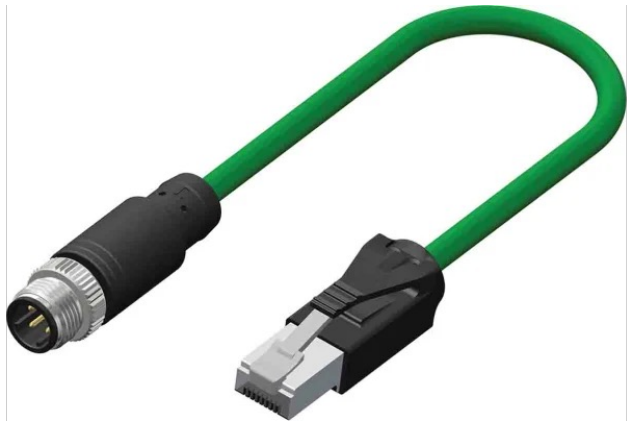
TS wiring dont's



Datalogger Tutorial

- https://fsg.one/fsdl22

Low voltage wiring



- Use commercial off the shelf components
- Use preassembled connectors on the DL side
- Avoid to build your own cables

Check your data!

- Check your data by your own!
- You receive a Leaflet with your logger where a QR Code printed on it

PoE support

- All dataloggers support 802.3af PoE

Thank you for your attention