

# CONTENTS

<b>Changelog</b>	<b>2</b>
<b>Abbreviations</b>	<b>3</b>
<b>DE Formula Student Germany Competition Handbook 2018</b>	<b>4</b>
DE1 General Information . . . . .	4
DE2 Registration . . . . .	5
DE3 Important Dates . . . . .	8
DE4 Competition Site Organization . . . . .	9
DE5 Static Events . . . . .	12
DE6 Dynamic Events . . . . .	13
DE7 Vehicle Requirements and Restrictions . . . . .	15

## CHANGELOG

Rule	Version	Change
DE 1.7.2	1.1	Added technical inspection briefing.
DE 1.7.3	1.1	Added RFID-wristband scanning.
DE 1.7.4	1.1	Missing the briefing means missing the dynamic events for drivers.
DE4.1.1	1.1	Entrance pass handling changed.
DE4.3.3	1.1	Added information about live-timing.
DE4.4.1	1.1	Added information about announcements.
DE4.5.1	1.1	Added information about welding.
DE4.6.1	1.1	Added information about tyre service.
DE4.7	1.1	Added information about fuel station.
DE4.8.1	1.1	Added information about engine test area.
DE4.9.1	1.1	Added information about team package at event control.
DE4.10.1	1.1	Added information about driver registration.
DE4.11.6	1.1	Added technical inspection procedure.
DE4.13.6	1.1	Added technical inspection time slot procedure.
DE4.14.5	1.1	Added re-inspection procedure.
DE4.15.1	1.1	Added accumulator inspection procedure.
DE4.15.3	1.1	Added accumulator inspection drop off.
DE6.3	1.1	Relaxed availability of lines for trackdrive.
DE6.4.1	1.1	Skidpad will not be made artificially “wet”.
DE7.3.14	1.1	Added clarification about EMI with Data Logger.
DE7.5.1	1.1	Clarify gear in neutral for DV combustion if R2D defined off.

## ABBREVIATIONS

<b>AAIR</b>	ASF Add Item Request	<b>ESOQ</b>	Electrical System Officer Qualification
<b>ADR</b>	Autonomous Design Report	<b>ETC</b>	Electronic Throttle Control
<b>AS</b>	Autonomous System	<b>EV</b>	Electric Vehicle
<b>ASF</b>	Autonomous System Form	<b>FSG</b>	Formula Student Germany
<b>ASR</b>	Autonomous System Responsible	<b>FTO</b>	Fuel Type Order
<b>ASRQ</b>	ASR Qualification	<b>HIC</b>	Health Insurance Certificate
<b>BPES</b>	Business Plan Executive Summary	<b>IAD</b>	Impact Attenuator Data
<b>CBOM</b>	Costed Bill of Material	<b>MU</b>	Magazine Uploads
<b>CEST</b>	Central European Summer Time	<b>NMT</b>	Network Management Protocol (CANopen)
<b>CET</b>	Central European Time	<b>PDO</b>	Process Data Object (CANopen)
<b>CRD</b>	Cost Report Documents	<b>R2D</b>	Ready-to-drive
<b>CV</b>	Internal Combustion Engine Vehicle	<b>RES</b>	Remote Emergency System
<b>DL</b>	Data Logger	<b>SDO</b>	Service Data Object (CANopen)
<b>DLDS</b>	Data Logger Download Station	<b>SE3D</b>	Structural Equivalency 3D Model
<b>DNF</b>	Did Not Finish	<b>SES</b>	Structural Equivalency Spreadsheet
<b>DSS</b>	Design Spec Sheet	<b>SESA</b>	SES Approval
<b>DV</b>	Driverless Vehicle	<b>TIS</b>	Technical Inspection Status
<b>EAIR</b>	ESF Add Item Request	<b>TMD</b>	Team Member Designation
<b>EBS</b>	Emergency Brake System	<b>TS</b>	Tractive System
<b>EDR</b>	Engineering Design Report	<b>TSAL</b>	Tractive System Active Light
<b>ESF</b>	Electrical System Form	<b>TSMS</b>	Tractive System Master Switch
<b>ESO</b>	Electrical System Officer	<b>VSV</b>	Vehicle Status Video

# **DE FORMULA STUDENT GERMANY COMPETITION HANDBOOK 2018**

## **DE 1 GENERAL INFORMATION**

### **DE 1.1 One Site - Three Competitions**

DE 1.1.1 Three competitions will be organized by Formula Student Germany (FSG). These are for the Internal Combustion Engine Vehicle (CV) class, the Driverless Vehicle (DV) class and the Electric Vehicle (EV) class. All three competitions will take place during the same week at the same location.

### **DE 1.2 Competition Dates and Place**

DE 1.2.1 FSG 2018 will be held from 6<sup>th</sup> until 12<sup>th</sup> of August 2018 in Hockenheim, Germany.

### **DE 1.3 Competition Website**

DE 1.3.1 The URL of the FSG competition website is <https://www.formulastudent.de>.

### **DE 1.4 Date and Time Format**

DE 1.4.1 The competition date/time format is “YYYY-MM-DD hh:mm” according to ISO 8601<sup>1</sup>.

DE 1.4.2 The competition time zone is Central European Time (CET)<sup>2</sup> or Central European Summer Time (CEST) from last Sunday of March to last Sunday of October, Europe/Berlin.

DE 1.4.3 The time of the competition website is the official time for all deadlines and decisions:  
<https://www.formulastudent.de/time>.

### **DE 1.5 Vehicle Shipping**

DE 1.5.1 Teams are advised to consult their shipping company or freight forwarder to ensure that their shipment fully complies with all relevant customs, import/export and aviation shipping requirements.

DE 1.5.2 Customs and other paperwork like ATA Carnet<sup>3</sup>, inspecting shipments as well as reporting and documenting damage of the shipment is the sole responsibility of the team.

<sup>1</sup>[https://en.wikipedia.org/wiki/ISO\\_8601](https://en.wikipedia.org/wiki/ISO_8601)

<sup>2</sup>[https://en.wikipedia.org/wiki/Central\\_European\\_Time](https://en.wikipedia.org/wiki/Central_European_Time)

<sup>3</sup>[https://en.wikipedia.org/wiki/ATA\\_Carnet](https://en.wikipedia.org/wiki/ATA_Carnet)

DE 1.5.3 Detailed vehicle shipping procedures are published on the competition website.

DE 1.5.4 Teams should upload their shipping documents to the competition website.

### **DE 1.6 Confiscated Goods, Lost & Found**

DE 1.6.1 Confiscated goods or lost & found items must be picked up until Sunday 2018-08-12 20:00 CEST.

### **DE 1.7 Team Briefing (A 6.3)**

DE 1.7.1 [EV ONLY] All ESO are required to attend the team briefing.

DE 1.7.2 At the beginning of the competition is a technical inspection briefing. All team captains and inspection responsible persons must attend.

DE 1.7.3 Each team member required in a certain briefing will receive a RFID-wristband which will be scanned at the entrance to log him/her as attendant on the present day.

DE 1.7.4 Drivers without the RFID scan cannot participate at the dynamic events of this particular day.

## **DE 2 REGISTRATION**

### **DE 2.1 Team Registration**

DE 2.1.1 The team registration will take place in the form of a quiz. There will be one quiz for all three classes. The topic for the quiz is: Formula Student Rules 2018 (excluding the specific rules for CV, EV and DV) and basic engineering knowledge.

DE 2.1.2 The URL of the registration website is <https://reg.formulastudent.de>.

DE 2.1.3 Teams must create a team account on the competition website and assign a team captain and two deputies. The deadline for this is 24 h before the registration starts (see DE 3.1). The team captain and his deputies may assign team members as participants simultaneously. Only one person (the team captain or one of his deputies) may complete the registration quiz.

DE 2.1.4 Only one question will be visible at a time and can only be answered once. No feedback if the answer was correct will be provided until the end of the registration quiz at 18:00 CET.

DE 2.1.5 Within teams with the same amount of correct quiz answers, the quiz result order will depend on the time needed for completion of the quiz. This time starts with the opening of the quiz for all teams. Teams with less correct quiz answers will be sorted behind teams with more correct answers.

DE 2.1.6 Once the quiz has been successfully completed, the team captain or one of his deputies must register the team for the competition by agreeing to the rules and by selecting a free vehicle number. Requests for changing the vehicle number are only possible within 168 hours (7 days) after the start of the registration.

	EV	CV	DV(EV)	DV(CV)
vehicle numbers	001-199	201-399	401-499	501-599

- DE2.1.7 The quiz will be closed after five hours so that the registration slots can be assigned (see DE2.2).
- DE2.1.8 After closing of the quiz teams have one hour to hand in protest.
- DE2.1.9 Reserved slots (see DE2.2.2 and DE2.2.3) will be assigned to the teams based on past achievements and home countries. All remaining and unused reserved slots will be assigned to all other teams, with regard to their quiz result.
- DE2.1.10 All assigned teams will be placed on the pending list on the competition website. In order to move to the participating list, they have 72 h to pay the registration fee (see DE2.3). Once all slots have been filled, all additional teams will be placed on a waiting list (see DE2.4). Once this process is completed, the registration for those who missed the quiz will open.
- DE2.1.11 The “team truck” entrance (see DE4.1) and the technical inspection order at the competition will be based on the quiz result.

## DE2.2 Registration Slots

- DE2.2.1 FSG 2018 is limited in total to 60 CV slots, 40 EV slots and 18 DV slots.
- DE2.2.2 Reserved slots for the CV and EV classes will each be assigned to the following teams:
- Five top teams from FSG 2017
  - Eight top teams from latest World Ranking List (<https://fs-world.org>)
- Additional to these teams the following international slots will be reserved for each the CV and EV class:
- Three teams from Australia, China, Japan and New Zealand
  - Three teams from Canada and the United States of America
  - Three teams from Europe (see DE2.2.5), besides Germany
  - Three teams from the rest of the world
- In case a team with a reserved international slot doesn't pay the registration fee in time (see DE2.3) its slot is given to the next team of its world region.
- DE2.2.3 Reserved slots for the DV class will be assigned to the three top teams from FSG 2017.
- DE2.2.4 All remaining and unused reserved slots will become available for all other teams after the registration quiz has been closed on the registration website (see DE2.1.7).
- DE2.2.5 Europe is defined to consist of the following countries:  
Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Kazakhstan, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Monaco, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, Vatican City.

**DE 2.3 Registration Fee**

- DE 2.3.1 The registration fee is 1000 € and includes a 20-person team. More team members can be registered for 50 € per participant until the TMD deadline (see DE 3.2). Team members may register after this deadline for a fee of 100 € per participant. There is no limit in team size and no deadline for late bookings.
- DE 2.3.2 The registration fee must be paid online within 72 h by a verified PayPal account after the team has been moved to the pending list in order to move to the participating list. Otherwise the team will be de-registered.
- DE 2.3.3 Registration fees are not refundable for any reason.

**DE 2.4 Waiting List & Withdrawals**

- DE 2.4.1 Teams on the waiting list may move to the participating list up to two weeks before the start of the competition. This is possible if registered team withdraw from the competition. Once a slot on the participating list has become available again, the next team on the waiting list will move to the pending list and has 72 h to pay the registration fee in order to move to the participating list.
- DE 2.4.2 Teams on the waiting list are required to submit all documents and forms by the same deadlines as teams on the participating list.
- DE 2.4.3 Teams on the waiting and participating lists who find that they will not be able to attend the competition are requested to officially withdraw by notifying the officials.

**DE 2.5 Team Member Designation (TMD)**

- DE 2.5.1 Participating team members must be assigned prior to the competition by the team captain or his deputies.
- DE 2.5.2 If there are any team members who are studying at a different university, they must choose the team's university during their registration process as a team member.
- DE 2.5.3 Team members may only be selected as participants by the team captain, if they have entered the following personal information in their user profiles:
- Personal address
  - Clothing size
  - Emergency contact person and phone (e.g. parents)
  - Valid Health Insurance Certificate (HIC) for Germany (e.g. travel insurance)
  - Current target degree of study
- DE 2.5.4 All participants who passed the HIC-check, will find personalized standard terms in their account overview. This document must be printed out, signed by the participant and brought to the on-site registration in alphabetical order by the team captain.

**DE 2.6 Visa for Participants**

- DE 2.6.1 All participants which passed the HIC-check, will find a personalized letter of invitation with a digital signature in their account overview.
- DE 2.6.2 An invitation letter with a hand signature can be ordered on the competition website. Once a fee of 90 € has been paid, the letter will be sent out within two weeks.

**DE 3 IMPORTANT DATES****DE 3.1 Team Registration**

- DE 3.1.1 Team registration (see DE 2.1) for all teams starts on 2018-01-22 13:00 CET and ends 336 hours (14 days) later.

**DE 3.2 Deadlines**

- DE 3.2.1 All required documents and information must be uploaded to the competition website by the team captain and/or his/her deputies by the following deadlines:

Date	Deadline	Class
2018-03-16 13:00 CET	ASF Add Item Request (AAIR)	DV
2018-03-16 13:00 CET	Electronic Throttle Control (ETC)	CV
2018-03-16 13:00 CET	ESF Add Item Request (EAIR)	EV
2018-03-16 13:00 CET	Impact Attenuator Data (IAD)	ALL
2018-03-16 13:00 CET	Structural Equivalency 3D Model (SE3D)	ALL
2018-03-16 13:00 CET	Structural Equivalency Spreadsheet (SES)	ALL
2018-04-13 13:00 CEST	Autonomous System Form (ASF)	DV
2018-04-13 13:00 CEST	Electrical System Form (ESF)	EV
2018-04-13 13:00 CEST	SES Approval (SESA)	ALL
2018-06-01 13:00 CEST	Autonomous Design Report (ADR)	DV
2018-06-01 13:00 CEST	Business Plan Executive Summary (BPES)	ALL
2018-06-01 13:00 CEST	Design Spec Sheet (DSS)	ALL
2018-06-01 13:00 CEST	Engineering Design Report (EDR)	ALL
2018-06-01 13:00 CEST	Magazine Uploads (MU)	ALL
2018-06-15 13:00 CEST	ASR Qualification (ASRQ)	DV
2018-06-15 13:00 CEST	Electrical System Officer Qualification (ESOQ)	EV
2018-06-15 13:00 CEST	Fuel Type Order (FTO)	CV
2018-06-15 13:00 CEST	Team Member Designation (TMD)	ALL
2018-06-29 13:00 CEST	Vehicle Status Video (VSV)	ALL
2018-07-20 13:00 CEST	Cost Report Documents (CRD)	ALL
2018-07-20 13:00 CEST	Final dbc file upload	DV

Table 2: Document deadlines



**DE 4 COMPETITION SITE ORGANIZATION****DE 4.1 Entering the Competition Site**

- DE4.1.1 A pink “team truck” entrance pass with a green “unload card” attached to it is handed to each team at the registration. This entrance pass must be filled out completely and displayed behind the windscreen of the “team truck” used to transport the competition vehicle and equipment to the pits.
- DE4.1.2 The total length of the “team truck” including a possible trailer must not exceed 12 m.
- DE4.1.3 The team is entitled to enter the competition site only once with their “team truck” for a maximum of 30 min for the purpose of unloading their competition vehicle and equipment.
- DE4.1.4 Afterward the “team truck” must be moved to the designated parking spaces outside the pit area.
- DE4.1.5 It is not possible to drive to the pit area again with the “team truck” during the event before loading on Sunday.
- DE4.1.6 On Sunday 2018-08-12 the team is entitled to enter the pits once with the “team truck” for a maximum of 30 min for the purpose of loading.
- DE4.1.7 On request, teams may receive an additional yellow entrance pass that allows one passenger vehicle to enter the pit area for the next hour. These passes are only given out from Wednesday 2018-08-08 until Sunday 2018-08-12 11:00 CEST.
- DE4.1.8 All teams must leave the parking area by Monday 2018-08-13 10:00 CEST.

**DE 4.2 [CV ONLY] Cranking Engines in the Pits**

- DE4.2.1 Cranking engines in the pits is allowed under the supervision of an official if the following conditions apply:
- Vehicle has passed technical inspection
  - The driven axles are jacked up using the quick jack
  - Gearbox is in neutral
  - All driven wheels are removed
  - Connectors to all injectors and ignition coils are detached
  - A fire extinguisher must be placed next to the engine

**DE 4.3 Transponders / Time-Keeping**

- DE4.3.1 Three RFID-tags will be mounted on the vehicle during technical inspection using adhesive tape. The size of each tag is 104 mm x 33 mm.
- DE4.3.2 After the competition, these tags must be returned to the event control.
- DE4.3.3 Live-timing is provided at <http://tk.formulastudent.de>. The shown data is unofficial.

### **DE4.4 Announcements**

- DE4.4.1 All announcements can be found on the FSG twitter channel “@FormulaStudentG” and on the competition website <https://www.formulastudent.de/pr/announcements/>.

### **DE4.5 Welding**

- DE4.5.1 FSG provides an approved welder. Outside of the opening hours it is possible to weld with own equipment in the welding area only, using appropriate safety gear.

### **DE4.6 Tyres**

- DE4.6.1 FSG provides a tyre changing service.

### **DE4.7 Fuel Station**

- DE4.7.1 Open fuel containers are not permitted at the event.
- DE4.7.2 All fuel containers must be DOT approved.
- DE4.7.3 Refueling is only allowed at the fuel station.
- DE4.7.4 Waste oil is to be taken to the fuel station for disposal.

### **DE4.8 [CV ONLY] Engine Test Area**

- DE4.8.1 Engines may only be run in the designated engine test area during the opening times and only after passing the tilt test.

### **DE4.9 Event Control**

- DE4.9.1 The team captain will receive a package containing shirts, programs, etc. at event control. Large teams may bring one or two extra people to help carrying.

### **DE4.10 Driver Registration**

- DE4.10.1 Drivers must register personally at the event control where they have to show their valid driver's license and a student ID.

### **DE4.11 Technical Inspection**

- DE4.11.1 Until Tuesday 2018-08-07 12:00 CEST mechanical, electrical and driverless inspection will take place in the pits, afterward it will take place at the technical inspection area.
- DE4.11.2 Designated parking spots for technical inspection are located in front of the technical inspection area gate, for re-inspection inside the technical inspection area.

- DE4.11.3 Repairing the vehicle at these parking spots and parking the vehicle anywhere else in the area is prohibited.
- DE4.11.4 Vehicles should be moved to the technical inspection area gate when the team captain receives an e-mail informing about the Technical Inspection Status (TIS) of the vehicle is set to “M/E Waiting Queue”. The TIS status can also be checked via the competition website and is visible on the screens in the recreation tent.
- DE4.11.5 On arrival at the technical inspection gate the team should report to the coordinating technical inspector.
- DE4.11.6 Teams that bring their vehicle and do not have a TIS status “M/E Waiting Queue” will be send back to the pit.

**DE4.12 Pre-Inspection**

- DE4.12.1 Pre-inspection will be conducted in the pit, where the technical inspectors will visit the teams according to the registration quiz order.
- DE4.12.2 A team that is not present or ready at the first visit have to contact the technical inspectors in the pit for a new appointment.
- DE4.12.3 Pre-inspection must be completed latest before the tilt test.
- DE4.12.4 The driver egress is mandatory for all drivers. Before participating in a dynamic event, the driver must have passed the egress test.

**DE4.13 Technical Inspection Time Schedule**

- DE4.13.1 The technical inspection parts accumulator inspection, mechanical inspection, electrical inspection and driverless inspection will be conducted within a strict time schedule where every team will get a predesignated time slot based on the registration quiz order. The time schedule will be published on the website shortly before the start of the competition.
- DE4.13.2 The length of these slots is 1.5 hours for mechanical and accumulator inspection and 2 hours for electrical inspection. [DV ONLY] For driverless inspection the mechanical inspection is extended by 0.5 hours.
- DE4.13.3 The start time of these slots will be announced before the start of the competition on the competition website.
- DE4.13.4 A team can enter the inspection bay 5 min in advance of the start time.
- DE4.13.5 If a team shows up later than 15 min after the start time, it will loose its time slot and will be put last in the respective inspection order.
- DE4.13.6 After the end of a time slot a team has 5 min to clear the inspection bay for the next team.

**DE 4.14 Re-Inspection**

- DE4.14.1 The re-inspection for the mechanical, electrical and driverless inspection will take place in the technical inspection area and the accumulator re-inspection will take place in the accumulator tent.
- DE4.14.2 If a re-inspection is needed the coordinating technical inspector will direct the team into the waiting queue for re-inspection.
- DE4.14.3 The re-inspection will be handled according to the “first-in-first-out-principle” and when a re-inspection slot opens the coordinating technical inspector will direct the first team of the re-inspection waiting queue to its re-inspection bay.
- DE4.14.4 The re-inspection slots have no fixed starting times, but are limited to 30 min duration.
- DE4.14.5 If more than 30 min is needed the team must queue again for another re-inspection slot.

**DE 4.15 [EV ONLY] Accumulator Inspection**

- DE4.15.1 Accumulator inspection will take place in the accumulator tent.
- DE4.15.2 All TS accumulators need to be placed in the accumulator tent at latest 3 hours after the team is allowed to enter the competition site.
- DE4.15.3 If a team misses the before mentioned deadline, a penalty of 10 points is deducted of its overall score for every additional commenced 12 hours up to a maximum total of 20 penalty points.

**DE 5 STATIC EVENTS****DE 5.1 Costed Bill of Material (CBOM)**

- DE5.1.1 For FSG 2018 a CBOM for the “Chassis and Body System” must be submitted.

**DE 5.2 Cost and Manufacturing Event Finals**

- DE5.2.1 Cost and manufacturing event finals can be conducted in case the best teams scored the same amount of points.
- DE5.2.2 A maximum of 10 team members are allowed per team.
- DE5.2.3 Finalists will be informed two hours prior to the finals.
- DE5.2.4 During the finals each team has 15 min to prepare their answer to 2 questions about cost and manufacturing on a flip chart.
- DE5.2.5 After the preparation time, the team has 15 min for discussion with the judges.
- DE5.2.6 Based on the discussion the judges will define the final scoring order of the finalists. The points scored will not change.

**DE 5.3 Engineering Design Event**

- DE 5.3.1 [EV ONLY] Specific change of S 3.5: Only sealed accumulator containers which passed the accumulator inspection may be presented or mounted in the vehicle. They must not be opened.
- DE 5.3.2 [EV ONLY] Only fully discharged and electrically shortened spare accumulator cells or spare stacks may be presented.

**DE 6 DYNAMIC EVENTS****DE 6.1 [EV ONLY] Dynamic Area and Dynamic Vests (D 1.2)**

- DE 6.1.1 The charging area is a separated dynamic area including separate entrance restrictions.
- DE 6.1.2 Only three members per team may enter the charging area at the same. One of them must be a Electrical System Officer (ESO) or Autonomous System Responsible (ASR), respectively.
- DE 6.1.3 Inside the charging area, team members must not wear any conductive jewelery and must not wear any conductive objects of any kind which could touch the accumulator.
- DE 6.1.4 CEE charging connectors 16 A, 32 A and CEE 7/3 “Schuko” are available in the charging area.

**DE 6.2 Endurance Driver Change Procedure (D 7.4)**

- DE 6.2.1 [EV ONLY] The Tractive System Master Switch (TSMS) must be switched off by the ESO and the Tractive System Active Light (TSAL) must have changed to green color, before anyone is allowed to touch the vehicle or to start the driver change.

**DE 6.3 [DV ONLY] Track Marking**

- DE 6.3.1 The markings of all dynamic events will have the following characteristics:
- The track is marked with cones.
  - The left borders of the track are marked with small blue cones.
  - The right borders of the track are marked with small yellow cones.
  - Exit and entry lanes are marked with small orange cones.
  - Big orange cones will be placed before and after start, finish and timekeeping lines.
  - If not defined otherwise in chapter D of the rules, the maximum distance between two cones in driving direction is 5 m. In corners, the distance between the cones is smaller for a better indication.
  - The start, finish and timekeeping lines as well as keep out zones around the timekeeping equipment are marked with red, orange or pink paint.
  - Additionally for skid pad and trackdrive, track limit lines on either side of the track and entry/exit lanes may be marked with yellow, green or white paint.

- There are no track limit lines for acceleration and Emergency Brake System (EBS)-test.

- DE6.3.2 All lines are spray painted with the chalk-based marking paint “Soppec - Tempo T.P.”<sup>4</sup>.
- DE6.3.3 The cones used at the competition are equal to the cones listed in Table 3 despite that there will be letters “FSG” on the black/white band of the cones (white/black respectively).
- DE6.3.4 The manufacturer WEMAS<sup>5</sup> does not sell the cones to end customers, but they may be purchase from baustellenabsicherung24.de<sup>6</sup>.





			
big orange cone two white stripes	small orange cone single white stripe	small yellow cone single black stripe	small blue cone single white stripe
WEMAS 307.610500.00.00	WEMAS 400.000013.00.00	WEMAS 400.000013.01.10	WEMAS 400.000043.00.00
285 mm × 285 mm × 505 mm 1.05 kg		228 mm × 228 mm × 325 mm 0.45 kg	

Table 3: Cone specs

- DE6.3.5 There are the following limitations mainly resulting from the Hockenheim track conditions and organizational/authorizational issues:
- The lines may not be perfectly and continuously drawn.
  - There may be further markings, to those mentioned above, that are not part of the track (e.g. markings, including cone position markings, lines from other events or different colored surface, etc.) on or close to the track which will not be removed by the officials.
  - No special artificial landmarks are provided by officials. The team must not place additional landmarks on the track or inside the dynamic area.
  - No map data is provided by the officials.
- DE6.3.6 Figures 1, 2 and 3 visualize the track layout descriptions given in D4.3, D5.1, and D8.1.

## DE6.4 Skidpad Event

- DE6.4.1 Contrary to D4.1.7 the skidpad will not be made artificially “wet”.

<sup>4</sup><http://soppec.com/en/worksite-markers/13-tempo-tp.html>

<sup>5</sup><http://www.wemas.de>

<sup>6</sup><https://baustellenabsicherung24.de/leitkegel-titan-180-1934.html>

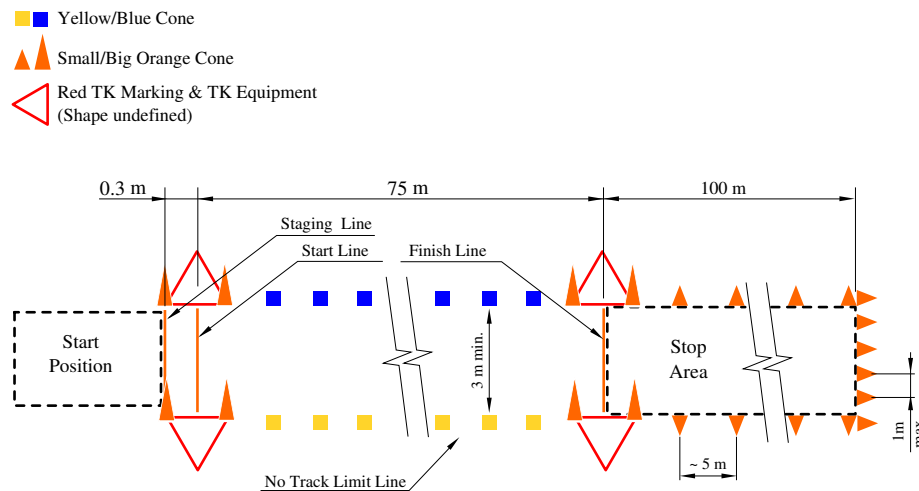


Figure 1: Acceleration

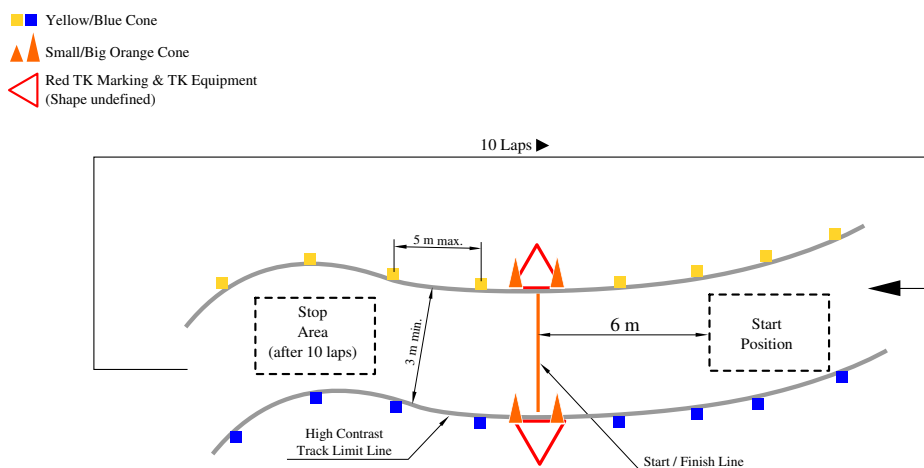


Figure 2: Trackdrive

## DE 7 VEHICLE REQUIREMENTS AND RESTRICTIONS

### DE7.1 Technical Inspection Sticker (IN1.4)

DE 7.1.1 For the competition technical inspection sticker, a space 50 mm tall x 180 mm wide must be made available on the nose of the vehicle directly in front of the cockpit opening.

### DE7.2 [EV ONLY] Cell Temperature Monitoring Device (EV 6.8.5)

DE 7.2.1 The temperature measuring device DS1922T-F5 (iButton) will be provided by the officials and must be installed by the team. It is recommended to use an iButton holder (DS9093S) for mounting.

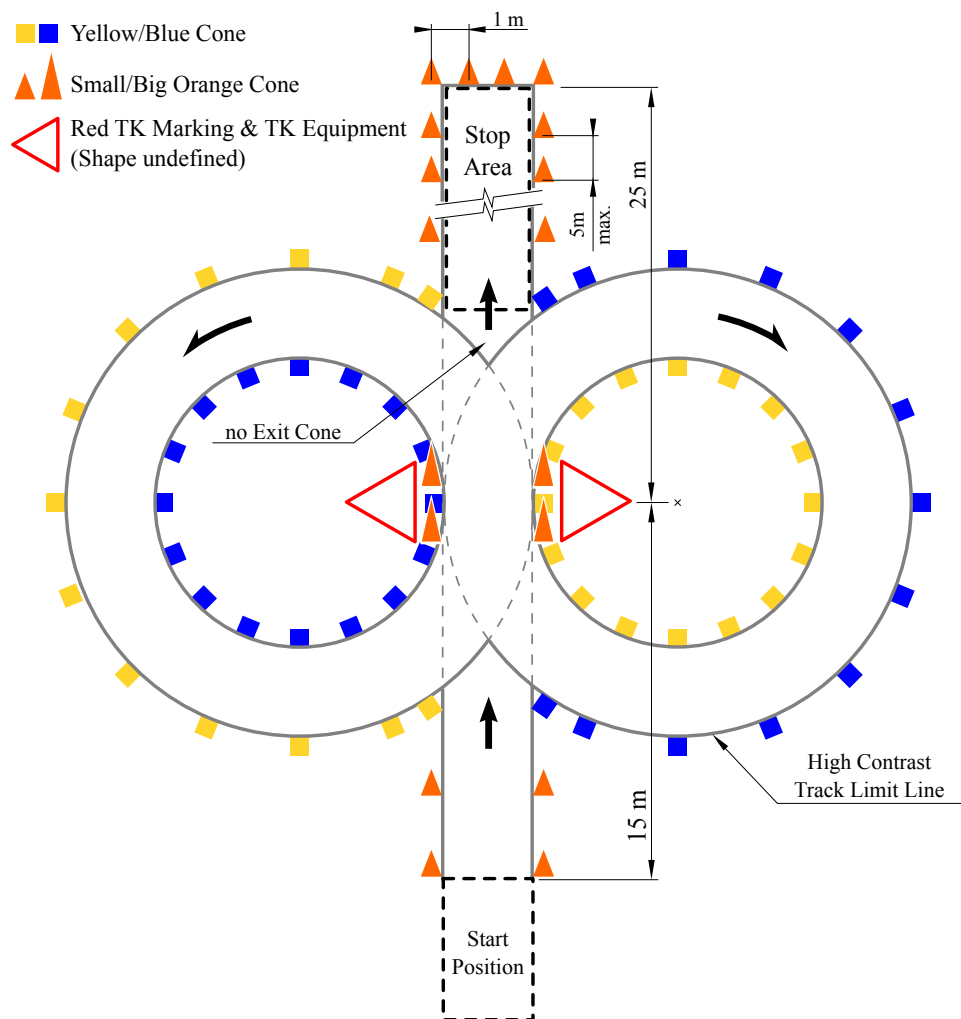


Figure 3: Skidpad base configuration according to rule D4.3

**DE7.3 [EV OR DV ONLY] Data Logger (EV 5.6 and DV 1.3)**

- DE7.3.1 A Data Logger (DL) according to “FSG Data Logger Specification”<sup>7</sup> will be used and provided by the officials.
- DE7.3.2 This DL will be the official measuring system according to EV 5.6 and DV 1.3.
- DE7.3.3 All requirements of the data sheets are seen as part of the competition handbook. E.g. the data logger must be properly fastened, be mounted at a place where it is protected from water and the Ethernet interface must be made accessible.
- DE7.3.4 At the competition several Data Logger Download Station (DLDS) will be provided as self-service terminals.

<sup>7</sup><https://www.formulastudent.de/fsg/rules/>



- DE7.3.5 It is the responsibility of the team to ensure that the data logger data from each event is made available to the officials by having it downloaded at a DLDS one hour after the closing of the respective event latest.
- DE7.3.6 Failure to make the data available within the specified time period due to the teams fault will result in the team not being scored for the respective event.
- DE7.3.7 [DV ONLY] The Remote Emergency System (RES) and the data logger must share the same CAN bus.
- DE7.3.8 [DV ONLY] The communication described in section DE7.4.8 must be traceable in the logs.
- DE7.3.9 [DV ONLY] Beside RES messages (see DE7.4.8), the messages defined in Table 4 must be provided to the data logger with a cycle time of 100 ms each. Steering angle  $\delta$  and vehicle coordinate system is defined in Figure 4.

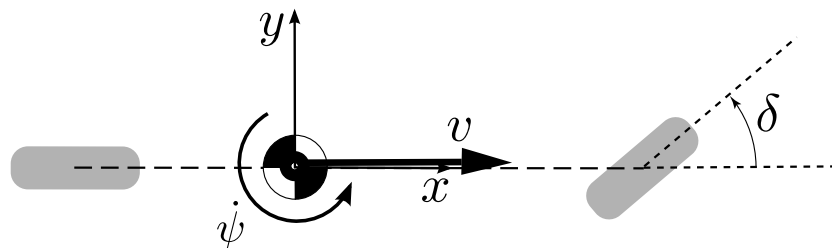


Figure 4: Bicycle model defining steering angle  $\delta$  (drawn in positive direction after “ISO 8855” coordinate system  $\Rightarrow$  z up) and speed  $v$ .

- DE7.3.10 [DV ONLY] All signals are little-endian (Intel). Scale, if not defined, is 1.
- DE7.3.11 [DV ONLY] Messages 0x500 and 0x502 must be filled in any case. If some values are not directly available, they should be interpolated or calculated (i.e. target values). 0x501 depends on available sensor data.
- DE7.3.12 [DV ONLY] All signals mentioned in the team's Autonomous System Form (ASF) have to be provided within the up to five messages with CAN-IDs 0x511 to 0x515. Each message can be up to 8 B of data length. Cycle time is 100 ms.
- DE7.3.13 [DV ONLY] A valid dbc<sup>8</sup> file containing the message definition of the ASF messages must be uploaded with the ASF. It may be updated afterwards until the deadline mentioned in 2.
- DE7.3.14 Non-availability of data logger data due to excessive electromagnetic emission by the vehicle will be treated as a power and voltage violation according to D9.4.4.

## DE7.4 [DV ONLY] Remote Emergency System

- DE7.4.1 The RES that has to be used for the competition is a GF2000i-codec/T53R98 combination from Gross-Funk GmbH<sup>9</sup>.
- SIL3 (EN61508) certified
  - EMV certified

<sup>8</sup>see [https://vector.com/vi\\_candb\\_en.html](https://vector.com/vi_candb_en.html) for more informations

<sup>9</sup>[https://f.fs-g.org/2017/important\\_docs/FSG2017\\_Gross-Funk\\_v20170126.pdf](https://f.fs-g.org/2017/important_docs/FSG2017_Gross-Funk_v20170126.pdf)

CAN-ID	Name	Length	Format	Unit	Scale
0x500	DV driving dynamics 1	8 B			
	Speed_actual	bit 0-7	unsigned	km/h	
	Speed_target	bit 8-15	unsigned	km/h	
	Steering_angle_actual	bit 16-23	signed	°	0.5
	Steering_angle_target	bit 24-31	signed	°	0.5
	Brake_hydr_actual	bit 32-39	unsigned	%	
	Brake_hydr_target	bit 40-47	unsigned	%	
	Motor_moment_actual	bit 48-55	signed	%	
	Motor_moment_target	bit 56-63	signed	%	
0x501	DV driving dynamics 2	6 B			
	Acceleration longitudinal	bit 0-15	signed	m/s <sup>2</sup>	$\frac{1}{512}$
	Acceleration lateral	bit 16-31	signed	m/s <sup>2</sup>	$\frac{1}{512}$
	Yaw rate	bit 32-47	signed	°/s	$\frac{1}{128}$
0x502	DV system status	5 B			
	ASSI_state_off		1		
	ASSI_state_ready		2		
	ASSI_state_driving	bit 0-2	3		
	ASSI_state_emergency_brake		4		
	ASSI_state_finish		5		
	EBS_state_unavailable		1		
	EBS_state_armed	bit 3-4	2		
	EBS_state_triggered		3		
	AMI_state_acceleration		1		
	AMI_state_skidpad		2		
	AMI_state_trackdrive	bit 5-7	3		
	AMI_state_braketest		4		
	AMI_state_inspection		5		
	Steering_state	bit 8	bool		
	Service_brake_state_disengaged		1		
	Service_brake_state_engaged	bit 9-10	2		
	Service_brake_state_available		3		
	Lap_counter	bit 11-14	unsigned		
	Cones_count_actual	bit 15-22	unsigned		
	Cones_count_all	bit 23-39	unsigned		

Table 4: Message definition of logged general DV data

- communication in 430 MHz to 440 MHz band
- increased signal strength of 88 mW
- 12 V to 24 V supply voltage (0.26 A @ 12 V)
- 450 g, 173 mm × 113 mm × 35 mm
- IP20 (receiver) / IP65 (sender)

DE7.4.2 Please contact Mr. Keller (christian.keller@grossfunk.de) at Gross-Funk for purchasing.



Figure 5: RES sender &amp; receiver

- |          |   |
|----------|---|
| DE 7.4.3 | Regarding the increased signal strength, the BNetzA registration for Hockenheim will be provided by the officials.  |
| DE 7.4.4 | The receiver includes a normally-open (NO) relays which must be part of shutdown circuit. It opens on switching shutdown, on signal loss, and on power loss. Maximum current rating is 4 A. |

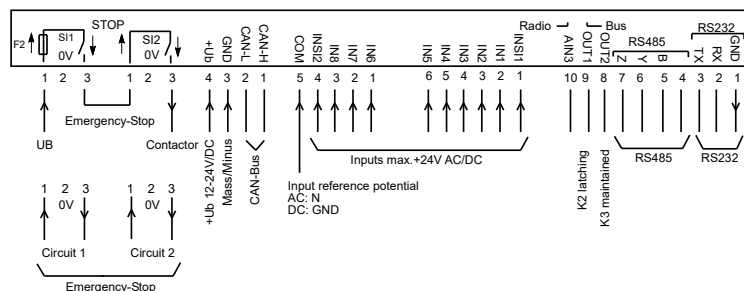


Figure 6: Connections at the RES receiver

- |          |   |
|----------|---|
| DE 7.4.5 | <p>The CANopen interface of the receiver has the following properties:</p> <ul style="list-style-type: none"> <li>• 1000 kbit/s, 125 kbit/s, 250 kbit/s and 500 kbit/s in standard configuration.</li> <li>• Cyclic PDOs containing states of switches (Go-signal) and radio</li> <li>• Warns if signal loss detected (200 ms in advance to shutdown, contained in cyclic PDO)</li> </ul> |
| DE 7.4.6 | <p>The Node-ID and baud rate settings of the vehicle-side installed receiver can be configured with the external DIP switch:</p>  |
| DE 7.4.7 | <p>The Node-ID has to be set to 0x011 at the competition. Only in severe cases, there will be an exception. Please give a detail problem description with the request.</p>  |
| DE 7.4.8 | <p>The receiver is booted up and sends a message to signalize its initialization (NMT message with CAN-ID 0x700 + Node-ID and a single data byte 0x00). A CAN/CANopen master</p>  |

DIP SW	1	2	3	4	5	6	7	8	Baud Rate
Node-ID	+1	+2	+4	+8	+16	+32	0	0	1 Mbit/s
Bit	0	1	2	3	4	5	1	0	125 kbit/s
							0	1	250 kbit/s
							1	1	500 kbit/s
	Node-ID						Baud Rate		

Table 5: DIP switch configuration RES.

device must set the receiver to operational mode (NMT message CAN-ID = 0x000, byte 1 = 0x01 (requested state), byte 2 = addressed Node-ID or 0x00 for all). After setting to operational mode, the receiver starts sending a status message of 8 bytes containing PDOs 2000 - 2007 (one byte each, CAN-ID = 0x180 + Node-ID) every 30 ms.

- DE 7.4.9 Resetting manually the RES before sending the operational mode message may be used to check if the device is online (NMT message CAN-ID = 0x000, byte 1 = 0x80 (requested state), byte 2 = addressed Node-ID). This will be answered with the boot-up message.
- DE 7.4.10 Beside the CAN-IDs mentioned in DE 7.4.8 and DE 7.4.9, be aware not to use the CANopen-related IDs listed in Table 6 on the bus<sup>10</sup>.

Communication object	CAN-ID	Slave nodes
NMT node control	0x000	Receive only
Sync	0x080	Receive only
Emergency	0x080 + Node-ID	Transmit
TimeStamp	0x100	Receive only
PDO	0x180 + Node-ID	1. Transmit PDO
	0x200 + Node-ID	1. Receive PDO
SDO	0x580 + Node-ID	Transmit
	0x600 + Node-ID	Receive
NMT node monitoring	0x700 + Node-ID	Transmit
LSS	0x7E4	Transmit
	0x7E5	Receive

Table 6: Reserved message IDs for RES.

- DE 7.4.11 System misbehavior and faulty logs caused by misuse of these messages eliminates the demand for a re-run and may lead to a Did Not Finish (DNF).
- DE 7.4.12 The status of the switch (K2) and the button (K3) at the sender is contained in the PDO 2000 (bit 1 and 2) as well as on the digital outputs. The E-Stop is signaled by PDO 2000 bit 0 and PDO 2003 bit 7. PDO 2006 contains the radio quality (0 % to 100 %) whereas PDO 2007 summarizes several radio states, i.e. the pre-alarm radio communication interruption (bit 6, 200 ms in advance to shutdown).
- DE 7.4.13 Either K2 or K3 are allowed to be used to signalize the Go-signal for switching from “Ready” to “Driving” state, see DV 2.4, Figure 19. Both the CAN message or the digital outs can be used.

<sup>10</sup>[http://www.canopensolutions.com/english/about\\_canopen/predefined.shtml](http://www.canopensolutions.com/english/about_canopen/predefined.shtml)

### **DE7.5 [DV ONLY] Autonomous System (AS) Clarifications**

- DE7.5.1 For DV combustion vehicles, it is considered to be in neutral gear in any state that has Ready-to-drive (R2D) defined off.
- DE7.5.2 The EBS unavailable state (DV 2.4.6) may be achieved by performing manual steps.
- DE7.5.3 The TSMS remains the last switch in the shutdown circuit (EV 7.1.4). The EBS may not check for it to be opened to trigger as defined in DV 1.5.2.