2022-2023 FIRST® Tech Challenge

Forum Answered Questions
Remote
How To Use This Document

The FIRST Tech Challenge Official Q&A Forum is a place where teams can ask questions and receive official answers from game expert moderators. The official FIRST Tech Challenge Question & Answer Forum rulings take precedence over all information in the game manuals.

Moderators will answer team questions beginning each Monday, and close on Thursday at 12:00pm eastern time. The forum answered questions are then converted to PDF (this document) to be easily read by teams and volunteers. This takes place every week for the entire season, so teams should ensure to access the new forum printout each Thursday. Any rule clarifications or changes will apply to events happening that weekend.

For Remote Teams

Teams competing in remote gameplay must use the rules that apply when their specific event started. For example, if a team’s remote event starts on Monday, 11/28/2022, the team would use rules from that date and prior. New rules or clarifications that are posted after the window opens do not apply until the next competition. Make sure to check the date of the forum post.
Traditional and Remote - General Robot Rules

Q1 Will the T265 be legal again this year?

Q: The T265 Intel camera has been legal in years past. We just want to make sure that it will still be legal this year.

A: Depth/tracking cameras that do not include projected laser grid patterns and provide all data as video/image streams fit within the allowances of RE14. The Intel T265 appears to meet these constraints.

(Asked by 12014 answer published at October 11th 2022)

Q2 Reuse previous year robot

Q: May we reuse the previous year's chassis if we replace previous years arm and element gripper?

A: Yes, Teams may re-use any legal parts or assemblies from previous Robots.

(Asked by 17993 answer published at September 29th 2022)

Q57 Clarification Regarding RG07 Detached Robot Parts

Q: According to rule RG07, a tethered part is considered detached and therefore illegal if "either is able to move independently of the other." What is the official ruling on what "move independently" means? If the detached element relies on the main robot for power and control signals, is it legal? If it's not legal, is there any way to make it meet the requirements in the spirit of the competition?

A: A tethered part that relies on the main robot for power or control is considered to be detached and is not legal. We cannot speculate on possible designs that may or may not be legal.

(Asked by 14129 answer published at October 10th 2022)

Q114 Bungee cords legal?

Q: Hello! We are using bungee cords with attached hooks to help provide counterbalance for the arms. My question is the bungee cords legal?

A: Yes, bungee cords are legal.

(Asked by 12722 answer published at November 8th 2022)
Q132 Team Number Display on diagonal

Q:
Can the team number be placed on the robot at a diagonal? For instance. 1 8 8 3 8

A:
Yes, Team Numbers may be placed at an angle providing they are easily viewed and recognized by the Field Personnel.

(Asked by 18838 answer published at November 10th 2022)

Q140 Is leather a prohibited part?

Q:
Our team has a leather strap on the Cone manipulator system. We are wondering if this is an illegal part under Rule <RG01>, Item f.? Leather is an "animal-based material", but i our view does not fit the concern of having "health and safety concerns". Thank you. <RG01> Illegal Parts, Item f.: "Those that contain animal-based materials (because of health and safety concerns)."

A:
No, leather is not an allowed material.

(Asked by 21579 answer published at November 17th 2022)

Q144 Multiple grabbing mechanisms.

Q:
Our team has two interchangeable grabbing mechanisms. One is a regular claw and the other is a tension grabber that tightens around the cone. To clarify, only one grabber is or at a time and the other is used as a replacement backup if one breaks. My question is if we bring both grabbers to inspection would we be able to replace say the tension system with the claw in between matches? or would the entire robot need to be inspected again?

A:
Both configurations must be inspected. As long as the basic functionality of the robot has not changed, there is no need to be re-inspected if the grabber is changed. Remember that the limits on motors and servos will apply to the combined motors/servos of both grabbers and the base robot.

(Asked by 19591 answer published at November 17th 2022)

Q167 G14 and RG02 Clarification

Q:
RG02 and G14 seem to be conflicting in regard to robot starting size. G14 mentions volume, which we assume to mean that we can place the robot in a sizing box diagonally. RG02 specifically says that the robot has to be under 18x18x18 l*w*h. The diagonal of the 18x18 cross-section is around 25". Based off the wording of G14(Robot in its starting location must not exceed a volume of 18x18x18), we should be able to play with a robot that is 14"*22"*18 inches?

A:
The Robot must be inspected in the same self supporting orientation that it will start the Match in. The robot cannot rely on any object (sizing box, playing field wall, cone) to hold at an angled orientation. Without seeing the robot in question it is difficult to make a judgement but if the drive base of a Robot is 14" x 22" there is no orientation in which it will fit into an 18" x 18" area.

(Asked by 12051 answer published at November 20th 2022)

Q170 Q167 Clarification

Q:
Would a robot placed in a sizing tool as shown in this image: https://imgur.com/a/ItSnPdN be legal? The base is approximately 13"x13" with the slides in their fully-retracted position making the length of the robot around 20-22". The wheels are not touching the edges of the box, and the claw can also be assumed as such for the scenario. If the answer is different than that of Q167, how does this affect Q168?

A:
Yes, this is a legal Robot, assuming the gripper is not being held up by the sizing box.

(Asked by 12051 answer published at November 22nd 2022)

Q190 Team Number display on one platform

Q:
Is it legal to have the team number on opposite sides of the same structure? For example. If a team had a plate located in the center of the robot and the team numbers were on either side of that plate would that be allowed?

A:
Yes, provided that the Team numbers are easily readable (i.e., not obscured by other Robot parts).

Note: Keep in mind that rule RG05 states that the Alliance marker must be displayed on the same side of the Robot as the Team number, within a 3-inch distance of the Team number.

(Asked by 8899 answer published at November 29th 2022)
Q206 Title: Clarification on meaning of "Vacuum based mechanism"

Q: Would a suction cup count as "vacuum based mechanism", something that is simply activated like a bathtub or shower suction cup where you just stick it. Would adding a release valve make it fall under this category if it doesn't without one? This system would interact with the cone game scoring elements, and the suction generated only by pushing the cup against a cone, and not by using a cylinder to compress or suck air away. the release would be a mechanically controlled hole in a suction cup.

A: Teams may not use devices that create a vacuum. Suction cups, while being a very simple device, fall into that category and are therefore not legal. Adding a release valve does not change the legality.

(Asked by 16449 answer published at December 7th 2022)

Q224 RG05 Clarification

Q: Which way does the alliance marker have to be 3" from the team number? If the team number is on the outside of the robot and the bottom of the alliance marker is 1" above the top of the number, but the marker is near the center of the robot (4-6" away), is it still legal? Does the marker have to be within 3" vertical/horizontal or 3" vertical/horizontal and 3" deep?

A: The Alliance Marker should be roughly in the same plane as the Team number and no more than 3" away in the horizontal or vertical direction. A Marker 4" - 6" away would not be acceptable.

(Asked by 12051 answer published at December 14th 2022)

Q226 are we allowed to have red and blue on the robot?

Q: Our team is 3d printing some stuff and want to take the opportunity to create the American flag on the print. this would, of course, include having both red and blue on the part. We are printing a rather large part on the robot and are curious if we are allowed to have red and blue as part of the robot because those are the same colors as the alliance markers the idea is that the piece would be easily identifiable as the American flag and not an alliance marker but we are still curious.

A: Yes, it is quite common for robots to have large areas colored red, blue (or green, black, etc.). If you think it may be confusing to have a red alliance marker against a blue robot, you may want to consider adding a white patch on your robot that will outline the alliance marker, but this is not required.

(Asked by 19591 answer published at December 14th 2022)

Q231 Are LEDs Integral to Digital Sensors Allowed

Q: Per Q198 the light integral to the color sensor is "not constrained by RE13." Per Q191, the REV LED indicator is not allowed per RE13.d (presumably, drawing power from an unallowed source/DIO). Other REV sensors powered by digital ports include LEDs that are integral to the sensor and not user manageable (the REV touch sensor and REV magnetic limit switch being two). Are these sensors allowed? If they are, is it under a similar logic to Q198 (LEDs integral to sensors are not constrained by RE13)?

A: Many sensors from many vendors have LEDs as standard parts of their functioning. These types LEDs are allowed in sensors as included by the manufacturer

(Asked by 9205 answer published at December 13th 2022)

Q233 Does the team number need to be visible on both sides at all times?

Q: Do the team numbers need to remain visible on two sides (180 degrees apart) at all times during matches? A number is displayed on the arm, and when it moves, it turns, and the number moves with it and is no longer visible on the left side while the attachment is in use.

A: Yes, the number must be visible to field personnel during the entire Match.

(Asked by 19388 answer published at December 14th 2022)

Q252 Can goBilda 1x15A Motor Controller (30A Peak) be allowed in FTC competitions 2022-2023?

Q: Due to the shortage of REV Control Hub and Expansion Hub, we have to use a mini controller for the 5th DC motor for our slide, but REV SPARKmini Motor Controller is not available for weeks till this FTC season ends as confirmed by REV support, the only option left seems to be goBilda 1x15A Motor Controller (30A Peak) which is not listed <RE09 as legal, CAN FIRST ALLOW IT FOR THIS FTC SEASON BASED ON THE SPECIAL AND DIFFICULT DITUATION?!!

A: This has been addressed in Q5 (qa/5) and Q104 (qa/104)
Q265 Would like a clarification on use of a COTS flashlight. In regards to RE13.

Q:
We would like to use consumer COB work light as a light source. We would like to mask the light to shine a narrow headlight beam to help Drivers navigate the rows and columns. Since there are no lenses or mirrors, we are just masking the light, is this allowed?

A:
As long as the flashlight does not include any sort reflector or a focusing lens it would be allowed.

Be aware that most flashlights include a reflector (frequently parabolic) behind the light source to reflect/focus the illumination into a single direction.

(Asked by 12168 answer published at January 11th 2023)

Q282 Illuminated Alliance Markers and Team Numbers

Q:
May a light source be used to illuminate Alliance Markers or team numbers? For example: https://ironreignrobotics.org/ftcpanels/

A:
No. Team numbers and alliance markers need to be visible/legible regardless of the powered state of the robot.

(Asked by 14140 answer published at January 25th 2023)

Q291 Driver Station Disconnects From Robot

Q:
Hello! When I am driving my robot. If the robot hits a wall or a junction, it sometimes disconnects from the driver station. It moves around, following the gamepad's last action, until it disconnects. I checked the battery connections on my robot. What else can I do?

A:
The FTC Q&A forum is intended to answer questions about gameplay, competition rules, judging rules, robot build rules, field setup and team scoring element rules. The FTC community forum is the best place to ask this particular question. The community forum topics include the official FIRST Tech Challenge Software Development Kit (SDK), programming your robot, using the Machine Learning Toolchain, etc.

You can access the FTC Community forum here: https://ftc-community.firstinspires.org/ (https://ftc-community.firstinspires.org/)

Teams can also access technical resources here: https://ftc-docs.firstinspires.org (https://ftc-docs.firstinspires.org)

(Asked by 22330 answer published at February 2nd 2023)

Q305 External battery at the drivers station due to replacement battery is out of stock

Q:
Is an external power source such as a rechargeable battery able to be used at the drivers station to keep the Rev Drivers Hub powered during a match? This is being asked because Rev's replacement battery has been out of stock for the season, and it is a specific battery design so it cannot be purchased through other battery suppliers. This is the battery inside the Drivers Hub, not the robot power source.

A:
The answer you seek can be found in Game Manual Part 1, rule DS05. Basically, the answer is yes, you can have a battery connected to the Drivers Hub. See DS05 for the specifications.

(Asked by 13474 answer published at January 31st 2023)

Q306 Unpowered USB Hub and Control Hub

Q:
In <Q119> you clarify <RE14> applies to Control Hubs, then in <Q244>, you further clarify that <RE14> is a recommendation, not a requirement to pass inspection and compete. We wanted to make absolutely sure <Q244> also applies to <Q119>: is it legal to use a non-externally powered USB hub connected to a Control Hub, provided it doesn't cause any other issues?

A:
Yes, per RE15.c.ii - allows for either a powered or a non-powered USB hub

(Asked by 18438 answer published at February 1st 2023)

Q352 Clarification of Q282 - Illuminated Team Numbers and Alliance Markers

Q:
We are seeking clarification on the ruling for Q282. Does this ruling mean that - A. All Illuminated Alliance Markers or Team Numbers are illegal as their visibility becomes dependent on the powered state of the robot or, B. Illuminated Team Numbers or Alliance Markers may still be allowed so long as they are sufficiently visible when the robot is off.

Take for instance this backlit light configuration, https://imgur.com/n9tDlLP (When Powered off) https://imgur.com/RpfGLl1 (When Powered on)
A: The ruling from Q282 does not apply to the robot numbering scheme presented in these pictures. Q282 specifically addressed the use of LED panels as the sole means of communicating the team number and alliance marker.

(Asked by 18527 answer published at February 16th 2023)

Q367 Can you be more specific regarding placement of alliance marker "roughly in the same plan?"

Q: Can you be more specific regarding placement of alliance marker "roughly in the same plane" (Q224 RG05)? Is this example alliance marker placement acceptable? https://imgur.com/tzIinek Markers are within 3" of team number, so specifically the question is about the "roughly in the same plane". Head Referees at last meet were divided on this. Thank you for the wonderful job you all are doing!

A: The intent of the rule is to insure that the Team Marker is clearly visible and easy to find, hence the requirement to be close to the Team Number. The Team Marker on this robot meets both these criteria and is allowed.

(Asked by 14295 answer published at March 1st 2023)

Traditional and Remote - Commercial Of The Shelf Components

Q5 Are motor controllers illegal?

Q: Are motor controllers illegal? The REV control hub only has four ports to plug in a motor and to get more you need to purchase the REV expansion hub. However, the REV expansion hub is sold out for the season and I can't find a used one anywhere. I was wondering if it is legal to use a motor controller as an adaptor to change a servo port to a motor port.

A: Beyond the REV Control Hub and REV Expansion Hub, there is exactly two legal motor controllers listed as allowed in RE08 and RE09, The REV Robotics Spark Mini Motor Controller and the Vex Motor Controller 29. All other motor controllers are not allowed.

(Asked by 19591 answer published at October 4th 2022)

Q19 Axon Robotics Codex Odometry Module legality

Q: Is the Axon Robotics Codex Odometry pod legal according to the COTS rules? It is an odometry module sold without an encoder. Link is here: https://axon-robotics.com/products/codex-odo. The encoder is available here: https://axon-robotics.com/products/redux-encoder

A: This part violates rule RM02 and is not legal.

It is the intent of FIRST to encourage Teams to design their own mechanisms rather than buying pre-designed and pre-manufactured solutions to achieve the game challenge. Purchased mechanism kits (for example, grippers) that violate the single degree of freedom rule, either assembled or requiring assembly, are not allowed. COTS drive chassis (for example, AndyMark TileRunner, REV Robotics Build Kit) are allowed provided none of the individual parts violate any other rules. Holonomic wheels (omni or mechanism) are allowed.

(Asked by 365 answer published at September 29th 2022)

Q31 Reaffirmation of Intel D435 Distance Camera

Q: We've been experimenting with the Intel D435 distance camera based on the answer to forum question Q293 "RE13 is specifically about light sources, not about sensors in general. The two cameras mentioned [D415 and D435] do not fall under the limitations applied to light sources." But now the answer to question 306 appears to reverse field, since it states "Due to the unknown aspects of laser light sources on the playing field, the laser prohibition in RE13 has, in general, been applied to all e

A: Due to the usage of an infrared laser to project a grid of dots within the camera field of view, this depth camera is not allowed per RE13.a

(Asked by 4348 answer published at October 11th 2022)

Q52 Are preassembled non-robotic slides allowed?

Q: Can linear slides prepared for non robotics applications be used like the ones we see used in previous years such as drawer slides?

A: Yes.

(Asked by 12978 answer published at October 6th 2022)
Q53 GoBilda Parts and Kits

Q:
Are GoBilda parts and kits allowed for this year's game?

A:
Teams may acquire parts and materials from any readily available source, including GoBilda, providing they do not violate any robot build rules. Pay specific attention to Rules RM01 and RM02 when purchasing parts and kits.

(Asked by 19832 answer published at October 10th 2022)

Q63 Legality of D4O5

Q:
The Intel D405 camera does NOT infrared laser to project a grid of dots within the camera field of view (as per your response to “Q31 Reaffirmation of Intel D435 Distance Camera.” I asked Intel Support and their official response to my question was as follows, and I quote, “The D405 camera model is not equipped with the Class 1 laser-based infrared projector that other 400 Series camera models (D415, D435, D435i, D435f, D455) have.” Is the Intel D405 camera therefore legal? Thank

A:
Yes. As a depth camera without laser grid functionality, it is allowed as a video source.

(Asked by 10738 answer published at October 14th 2022)

Q99 Legality of Swerve Module Kits per <RM02>?

Q:
Rule <RM02> in game manual 1 states that "COTS drive chassis are allowed provided none of the individual parts violate any other rules." Do swerve module kits such as https://www.armabot.com/collections/motion-articulation/products/microswerve?variant=3089410932930 fall under this umbrella? A) This kit has enough modules for a full robot, B) has no otherwise illegal components included in the kit, C) and can easily be adapted to use MATRIX motors with a single part.

A:
Swerve module kits are not legal COTS.

(Asked by 16379 answer published at November 1st 2022)

Q103 Parts from Vex-robotics not listed as "FTC allowed" or "illegal for FTC", can we use them?

Q:
This part...https://www.vexrobotics.com/276-7285.html (2x2x2x20 Aluminum U-Channel (6-pack). ) is an example that we are not sure if we can use on FTC robot. We cannot verify if it is allowed, nor if it is illegal. We also found that https://www.vexrobotics.com/217-7768.html. (FTC starter kit) is claimed on that web page as FTC legal, but not listed on FTC document as allowed. (nor as illegal) Please offer a clear answer.

A:
Q1: Rule RM01 allows for the use of readily available extrusions and post-processed materials. The Vex U-channel is such a material and is therefore legal.
Q2: The kit is legal but some of the parts, such as the traction wheels, may be subject to other rules (RG01a).

(Asked by 21852 answer published at November 3rd 2022)

Q107 Legality of Universal Joints

Q:
To ensure we don't run into any issues with our current claw, I wanted to check the legality of universal joints. All I could find on the topic was a Reddit post from 5 years ago where the answer was a resounding no, and an archived forum post from Ultimate goal where they were deemed legal. There are universal joints from gobilda I have seen other teams use, though we are currently using generic ones from amazon. (www.amazon.com/dp/B07WGD4ZR6) (www.gobilda.com/universal-joints/)

A:
Yes, universal joints are legal.

(Asked by 18527 answer published at November 9th 2022)

Q158 Axon Robotics Odometry Bundle

Q:
Hi, this is a followup to question Q19. Following Q19 & Q21, Axon changed their product offering to just be a bundle of odometry-related parts (bearings, springs, housing for encoders, etc) from which a number of open-source odometry pods can be built. Part A) Is it legal to buy this bundle and build one of the open-source encoders with it? Part B) is legal to buy this bundle and build Axon's original odometry pod design (which is also open-source)?

A:
QA: Not this is not legal QB: No this is not legal.

(Asked by 21376 answer published at November 20th 2022)
Q171 Re: Q158 Axon Robotics Odometry Bundle Legality

Q:
Per Q158, the GDC determined the Axon Robotics Odometry Bundle illegal. We were wondering if the GDC can clarify exactly on what grounds this decision was made. The product is simply a bundle of parts that a team can theoretically use to build anything using the parts contained. With the bundle, we have the ability to use our own custom odometry designs with the parts. Would our own, custom design be deemed illegal as well? We cannot find anything in GM1 or GM2 that makes the bundle illegal.

A:
Answer Part 1 re: Axon Robotics odometry module: We believe [Q19 (qa/19)] and [Q158 (qa/158)] answers your question.

Rule RM02 in Game Manual Part 1 states in part: "It is the intent of FIRST to encourage Teams to design their own mechanisms rather than buying pre-designed and pre-manufactured [Commercial Off-The-Shelf (COTS)] solutions to achieve the game challenge.

The Axon odometry module is a COTS solution to the POWERPLAY Autonomous Period tasks that benefit from accurate Robot movement along the Playing Field Floor (e.x., Navigation, Cone Scoring, and Signal Bonus tasks) and is therefore an illegal COTS mechanism as stated in [Q19 (qa/19)]. The universal Robot construction parts contained in the odometry module kit are allowed (e.x., bearings, screws, nuts, omni wheel) when they are used in a Team designed part or general construction part (e.x., extruded aluminum structural element). Custom COTS parts in the Axon odometry module (e.x., side plates) are not legal for Robot construction.

After the Axon odometry module kit was deemed illegal for Robot construction in [Q19 (qa/19)], the custom parts appear to have been removed from the odometry module kit and the custom parts are now available as "open source" from Axon Robotics. This is an unsuccessful attempt to find a loophole in the Robot construction rules. The Axon Robotics custom odometry module parts (the original design or derived versions) even when they are manufactured by Teams are not allowed for Robot construction.

Answer Part 2 re: Team designed odometry modules: Teams may use their own custom designed and fabricated parts. For example, Teams may design and 3D print, mill, hand form, etc. structural parts for an odometry module. On the opposite end of the spectrum of allowed Robot construction parts, Teams may not incorporate a Commercial Off The Shelf odometry design and/or kit in their Robot.

(Asked by 10539 answer published at November 29th 2022)

Q174 Degree of Freedom Clarification

Q:
According to RM02, parts with 2 degrees of freedom are not allowed. Does this prohibit the use of https://www.revrobotics.com/rev-51-1555/ on a robot? If so, are the isolated out bearings adding degrees of freedom to the central pivots?

A:
This spinner can be considered a bearing mount, it is legal.

(Asked by 12051 answer published at November 23rd 2022)

Q176 GoBilda Battery

Q:
A follow up to Q76. It has been asked for years if the GoBilda 12v battery is legal and for years no explanation has been given for the answer of no. The battery uses the same cells, same capacity, same voltage, with the only difference a physical cell layout. There have been years when Rev battery and Matrix battery are out of stock but the GoBilda battery is in stock. This would be very helpful for teams to have an additional source for purchasing batteries. So why is it illegal?

A:
The GoBilda battery is not allowed because it is not on the approved list.

(Asked by 7592 answer published at November 22nd 2022)

Q183 Further clarification Q176

Q:
To further clarify Q176, why is the GoBilda battery not on the approved list?

A:
The only allowed Robot main power battery packs are listed in Game Manual Part 1, rule RE03. All of these batteries were at one time the battery pack recommended by the vendor that supplied the required Robot control system.

When transitioning to a next-generation Robot control system, the FTC program chose to continue to allow the prior seasons compatible 12V DC battery packs so that Teams may utilize their existing inventory of battery packs and continue to purchase more of the same battery pack model if that is their preference.

Fun Fact: The FTC program used a 7.2V DC battery pack prior to the 2008-2009 season.

(Asked by 7592 answer published at November 29th 2022)

Q192 Clarification around Q173, Q171, and Q158

Q:
Q173 says that it is legal to use open-source non-commercial odometry designs. Q171 says that it is legal to use the universal components in the CODEX bundle in a Team designed or general construction part. Q158 says that it is not legal to use the CODEX bundle in open source odometry designs. Does this mean that the universal non-custom parts in the CODEX bundle can be used in: A) A custom odometry design B) A non-commercial open source odometry design C) How do inspectors enforce this?

A:
Answer A: Yes.
Answer B: Yes.

Answer C: Robot parts and assemblies that are hidden from full view are difficult to inspect. The FIRST Tech Challenge program relies on a combination of robot inspector skill and Team Gracious Professionalism to assure compliance with Robot construction rules.

(Asked by 16379 answer published at November 30th 2022)

Q207 Badge Reel Legality

Q: The mechanics of a badge reel seem very similar to a tape measure, which is acceptable. Q1) Would these be legal - https://www.staples.com/Staples-Name-Tag-Reel-Clips-Assorted-5-Pack-36682-3747217/product_511099 ? Q2) If the reel portion is legal, would the clip on the back be considered a 2nd degree of freedom? Q3) Would it be legal if the clip was removed?

A: Q1: Yes, a badge reel is a legal COTS. Q2: The clip on back is not considered a second degree of freedom. Q3: The clip does not have to be removed.

(Asked by 12833 answer published at December 7th 2022)

Q215 Is the Open Odometry design legal

Q: Is the Open Odometry design legal? This relates to the illegal nature of the Axon Robotics odometry bundle that has several questions on, and has been ruled illegal. Many teams use the Open Odometry. This is not designed by the teams. Design is downloaded from Open Odometry website. Parts list gotten from Open Odometry. Axon Robotics supplies the parts from one source. A team must still assemble.

A: We believe Q173 ([/qa/173]) answers your question.

It is legal to use non-commercial open source designs. OpenOdometry ([https://openodometry.weebly.com](https://openodometry.weebly.com)) was created by FTC team 18219 and is therefore an allowed non-commercial open source design.

The universal Robot construction parts contained in the Axon Robotics odometry module kit are allowed (e.x., bearings, screws, nuts, omni wheel). Any COTS custom parts or designs in the current or past Axon Robotics odometry kits are not allowed (e.x., side plates).

(Asked by 13474 answer published at December 8th 2022)

Q218 Ball bearings

Q: Are we allowed to use ball bearings in an enclosed space on the robot?

A: Loose bearing in a bag, box, or other enclosed structure is not allowed. Ball bearings in a bearing assembly are still allowed.

(Asked by 20373 answer published at December 11th 2022)

Q220 Clarification of Q192 and Q215 Regarding Universal Parts

Q: In the CODEX bundle, there is some gray area on what parts are universal. Here are the relevant parts in the bundle: shorturl.at/AENQ1. The main concern is the wheel inserts pictured above the omni wheel. They mount the omni wheel to universal shaft standards. The design behind the inserts was created by FTC 16379, for a different open source odometry pod (BabyOdo). These parts can be used outside an odometry pod in order to mount this wheel. Are these wheel inserts legal?

A: Based on the description of the wheel inserts provided in the question, they should be classified the same as the Axon Robotics custom COTS side plates that are addressed in Q171 ([/qa/171]), Q173 ([/qa/173]) and Q215 ([/qa/215]).

The wheel inserts contained in the Axon Robotics CODEX bundle are not allowed for robot construction.

Note: We understand that some teams may have already incorporated the illegal parts from the CODEX bundle in their Robot. Since there are other legal ways to build an equivalent odometry module, the use of these illegal parts for a limited time do not provide an unfair competitive advantage. Therefore, the Game Design Committee is allowing a grace period for teams participating in events that are about to happen. Teams may continue to use the illegal CODEX bundle parts through December 31, 2022. Starting January 1, 2023, the illegal CODEX bundle parts may not be used for Robot construction.

(Asked by 16379 answer published at December 15th 2022)

Q232 Is our intake legal (RM06 check)?

Q: Our head ref suggested that we confirm that our intake is legal. Our intake consists of a hot pink T-Mobile megaphone (cone-shaped) with a slot cut in one side and a servo/tracti wheel mounted over the slot which is used to pull in and push out scoring elements (cones). As far as we can tell this does not violate a) or b). Thank you.

A: Rule RM06 prohibits Teams from using the game element or a Team produced version of the game element in their robot. A pink megaphone, even though it is cone shaped, does not violate this rule.

(Asked by 15297 answer published at December 15th 2022)
Q242 Is this servo legal?

Q: We are wondering if this servo is legal and running into some confusion with its specs. We are operating it unmodified through the Control hub using the 3-pin connector or the Servo Power Module from REV. https://www.amazon.com/Hiwonder-LD-220MG-Digital-Bearing-Aluminium/dp/B07CMBMWZW/ref=sr_1_4?crid=3GMAHAZU003TW&keywords=servo+bracket&qid=1671768378&sr=8-4

A: It is not possible for us to rule on the legality of each and every servo. As long as the servo meets the requirements in RE11 and has not been modified in any way that would violate RE16, it is allowed.

(Asked by 20681 answer published at December 21st 2022)

Q254 Usage of an anti-static brush.

Q: Can we use a Martin Anti-Static Control Brush on our FTC robot during the competitions? I understand that it is a tool used to prevent static electricity build-up, causing unexpected reboots, but I would like to make sure it is not considered a violation of any rules before using it on our robot. Are these types of tools allowed in FTC competitions? The tool is located here: https://www.amazon.com/gp/product/B00EYRXEIA/

A: The legality of these brushes depend on how they are used. They are legal if used to manage static on the robot prior to a match. They can also be part of the robot itself providing they are not contacting the tile floor.

(Asked by 19970 answer published at January 4th 2023)

Q262 Q255 regarding the Axon MINI+

Q: We kindly ask that you reconsider Q255 regarding the Axon MINI+, which hundreds of teams have purchased. We believe they are legal as they: a) Abide by the limitations listed in RE11, as RE11 does not specify a max number of servo connectors or imply the illegality of additional connectors. b) Does not fall under RE17 as it is a servo covered by the preceding rule RE11. c) Past precedent (bit.ly/S83547) has ruled such servos legal. If not, would the removal of this wire constitute legal servo?

A: Please see the answer to Q259 (/qa/259)

(Asked by 14575 answer published at January 6th 2023)

Q267 Legal part?

Q: We are re-designing part of our lift and would like to know if a lead screw assembly from Amazon is legal? My research is leaning towards being ok, but would like to be sure before we purchase and rework it. Thank you very much in advance. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwi97oYbrb76AhUkrHABHcNND58QFnoECBYQAQ&url=https%3A%2F%2Fwww.amazon.com%2FLinea-Support-Bearings-Flexible-Couplings%2Fdp%2FB094HTHSNJ&usg=AOvVaw21obYTSNtWai35U_1QXF

A: Yes, this lead screw assembly is a legal part.

(Asked by 20512 answer published at January 18th 2023)

Q274 Based on Q220 and Q171 are these parts legal or illegal COTS components to use on a robot?


A: USB bracket: yes Mounting Plate: yes Expansion hub cable bracket: yes

(Asked by 8581 answer published at January 18th 2023)

Q312 Follow Up to Q99 and Swerve Module Kits

Q: After Q99 was answered, https://www.revrobotics.com/rev-21-3005/ was dropped. Assuming the kit itself is illegal, some of the parts in this kit are useful to teams and only available through this kit. Each part in the kit has a separate SKU. To what extent are teams allowed to use the parts provided in this kit?

A: Individually, the parts are legal but purchasing the parts with the intent of assembling a swerve module is illegal.
Q368 Are the all-black wires from Axon servos (except for the grey pwm pin) legal under GM1?

Q:
Axon servos are wired with black cabling for the positive, negative, and encoder wires. Although they’re already very common with FTC teams, is this at odds with GM1’s requirement for a consistent wiring color scheme and different colors for positive and ground power? Although it would be possible to replace the wires with appropriately colored ones, this would be very time-consuming and jeopardize the reliability of the servos. Instead, would labeling the pins or adding colored tape suffice?

A:
The wiring guidance in GM1 RE15 is for any wiring done by a team. Teams are NOT responsible for the color choices made by manufacturers.

Traditional and Remote - Raw and Post Processed Materials

Q217 Can we use holographic vinyl?

Q:
Can we use holographic vinyl as a design element as it gives us no competitive advantage or does it fall under rule re13?

A:
Holographic film used as a decorative item is allowed. Teams should be aware that if the films interfere with their opponents robots, the Teams will be asked to remove the film. Films used as a mirror to get around rule RE13 is not allowed.

Traditional and Remote - Miscellaneous Robot Electrical Parts and Materials

Q32 Allowed modifications to sensor pins: Definition of illegal internal modifications?

Q:
This question is related to <RE16>. Are we allowed to modify (i.e. cut or solder to) pins that are built into a Sensor module to make the module more usable? Or is this specifically classified as internal modifications that is illegal?

A:
Changing/extending the connectors on sensors fits within the allowed modifications in RE16. Connections to other internal points within in the sensor would not be allowed (i.e. it would be considered an internal modification).

Q38 XT30 Power Distribution Block is this a legal part

Q:
XT30 Power Distribution Block is this a legal ftc part

A:
Yes, per RE15.d

Q40 Batteries for LED lights

Q:
Game Manual 1 states that functional and/or decorative LEDs may be powered by Internal Commercial off the Shelf battery packs or holders. Is this constrained to just pre-made LED strips or custom cut / soldered LED strips as well? If custom LED strips are allowed, what constraints are there on the battery in question?

A:
The battery packs allowed under RE07.d.i for powering light sources are specifically limited to only the battery packs that are built into COTS light sources and supplied by the manufacturer of those COTS light sources.

Q46 Is the Adafruit I2C QT Rotary Encoder legal?

Q:
Q: Is the Adafruit I2C QT Rotary Encoder legal for use on FTC robots? It's an I2C-based "sensor" that will interface with the I2C ports on the REV Control Hub or REV Expansion hub. However, it requires that a team connect a rotary switch to use it, which makes it sound like it might violate <RE17>. The encoder is described at https://www.adafruit.com/product/4991 . Thank you!

A: The above mentioned breakout board is actually two separate devices in one board. An addressable LED (NeoPixel) and an interface board to a standard rotary encoder. Both devices appear to be allowed. RE13 allows the LED. RE12c allows the addition of the passive rotary encoder to the board.

(Asked by 7172 answer published at October 14th 2022)

Q51 Custom Cases for Other REV Robotics Products

Q: In the past, custom cases for webcams or encoders have been ruled legal and not a violation of <RE16>. Does this ruling apply to a REV: A) Servo Power Module, B) Control Hub, C) Expansion Hub, D) Spark MINI, E) Core Hex Motor, or D) 2M Distance Sensor?

A: Due to the need for inspectors to be able to readily identify the main components of a legal robot, custom cases for the listed parts are not allowed.

(Asked by 16379 answer published at October 13th 2022)

Q72 Can we use the digital ports for custom LED lights similar to REV Digital LED Indicators?

Q: We asked this last year and it was pushed to be evaluated between seasons. We worked with REV in 2019 and the digital ports can sink a reasonable current (they later came out with Digital LED Indicators, DLI). Can we make our own LED lights (LED plus passive resistor) using the Digital ports for switching ground and the 5V AUX port for power. Individually these are all allowed but we wanted to check. If not, are we allowed to make our own REV DLI equivalent using just the 3.3v digital port?

A: For this season, the answer remains no - LEDs and other light sources may only connect to the ports listed in RE13

(Asked by 10138 answer published at November 8th 2022)

Q76 GoBilda 12V Battery - Legal Part?

Q: Is the following GoBilda battery legal for use in FTC Competitions? NiMH Battery (12V, 3000mAh, XT30 Connector [MH-FC], 20A Fuse, 12-20) SKU: 3100-0012-0020 See https://www.gobilda.com/nimh-battery-12v-3000mah-xt30-connector-mh-fc-20a-fuse-12-20/, last visited Oct 19, 2022

A: No. The only allowed batteries are those listed in RE03

(Asked by 13643 answer published at October 24th 2022)

Q77 Infrared Proximity Sensor

Q: Are infrared proximity sensors allowed? For example E18-D80NK-N or SEN0239. These sensors project an infrared light to detect an object at a certain distance. There are also break beam sensors like the Adafruit IR 5mm Break beam sensor. Thank you!

A: This sensor appears to be legal.

(Asked by 7288 answer published at October 24th 2022)

Q93 Are we allowed to add external enhancements to the game pads?

Q: Our drivers would like to use an external enhancement to our game pad to allow it to have a wheel type driving mechanism similar to the one at https://www.thingiverse.com/thing:3049220 but with the logitech controller . Is this allowed?

A: Yes, mechanical enhancements to the game pad that do not involve opening up the game pad or modifying the electronics are legal.

(Asked by 12978 answer published at November 1st 2022)

Q97 REV Robotics magnetic sensor?

Q: We ordered the Rev Robotics Sensor pack from their FTC parts section, Included are (2) magnetic limit sensors: REV-31-1462. When looking at the allowed/legal parts list this PN# does not show up. Same question on the Rev#: REV-11-1271 Through Bore Encoder. This is a bit confusing as it is being advertised in the FTC section as well?

A:
As long as a sensor meets the constraints listed in RE12, it is legal per RE12 as long as it doesn't violate other rules (i.e. focused light sources, etc).

(Asked by 19727 answer published at November 8th 2022)

Q104 Is the GoBilda 1x15A Motor Controller legal

Q:
Since the REV Robotics Spark Mini Motor Controller is sold out for the season, is the GoBilda 1x15A Motor Controller SKU 3105-0101-0015 legal? If not, there aren't a lot of options because the REV Expansion Hub is also sold out.

A:
We believe Q5 (qa5) answers this question. If not, please post a followup

(Asked by 21534 answer published at November 8th 2022)

Q108 Legal Sensors

Q:
Sorry, my Q97 question was confusing! These parts are not listed in the Legal-Illegal Parts list. Are the following parts legal? REV-31-1462 Magnetic Sensor REV-11-1271 Through Bore Encoder they appear to comply with Rule: <RE12> Sensors

A:
Please see the answer to Q97 (qa97).

(Asked by 19727 answer published at November 8th 2022)

Q141 Power Switch Placement on Robot

Q:
Is there a specific placement/orientation of the robot power switch required on the robot? Clearly the switch needs to be in an accessible location, and the POWER BUTTON label needs to be placed on the robot to identify the location of the switch (per RE01), but I’m concerned that I might place my power switch and label on my robot and be required to move it later. Can competition staff at an event require a specific location/orientation for the power switch, and if so where?

A:
The Main Power Switch must be visible and accessible. Other than that there should be no reason for the competition staff to request a change. Pro-Tip: place the switch in a position where it cannot be accidently bumped during a match.

(Asked by 12789 answer published at November 15th 2022)

Q163 Axon Robotics Odometry Bundle

Q:
Hi, this is a followup to question Q19. Following Q19 & Q21, Axon changed their product offering to just be a bundle of odometry-related parts (bearings, springs, housing for encoders, etc) from which a number of open-source odometry pods can be built. Part A) is it legal to buy this bundle and build one of the open-source pods with it? Part B) is it legal to buy this bundle and build Axon's original odometry pod design (which is also open-source)? Thank you!

A:
We believe Q158 answers your question. If it does not, please rephrase your question and resubmit.

(Asked by 21376 answer published at November 20th 2022)

Q164 Are we allowed to use an AA Holder to power LED's on our robot?

Q:
In game manual 1, <RE13> states that light sources may be powered by a COTS battery pack or **battery holder**. I need more clarification as to if a AA holder would be a legal "battery holder" to power LEDs with. The reason I want to do this is because I would like to power my LEDs separately so that my motors can run without an inconsistent power draw.

A:
The only battery holders that are allowed for light source power are those that are provided as a part of the light source by the manufacturer (RE13.d.i)

(Asked by 14644 answer published at November 22nd 2022)

Q166 Custom circuit

Q:
Please, could you share: what does mean a custom circuit in the <re17> section of rules?

A:
for custom circuit, we use a standard dictionary-type definition:
custom - made specially for specific use
circuit - an assembly of electrical components to perform a function

please be aware that RE17 applies to all electronic devices that are not mentioned in the other robot electronics rules. Custom circuits is only one example of disallowed electron devices.
Q172 Is Swaytail Premium 97mm Mecanum Wheel legal to use.

Q:
Can I use the below Mecanum Wheel on my robot, i am getting it from Amazon and its 97mm similar to Gobilda. Swaytail Premium 97mm Mecanum Wheel https://a.co/d/gxXQMf
Please confirm whether its legal to use.

A:
Mechanum wheels are legal, regardless of the manufacturer. However, because different wheels have different surfaces/materials, they may need to be evaluated for Tile damage.

Q175 LED Allowed power ports

Q:
Are the USB ports on the control hub allowed power ports for LED lights?

A:
No. The only allowed power sources for light sources are listed in RE13.d.

Q182 Use the module

Q:
https://aliexpress.ru/item/4000699413842.html?sku_id=10000006190798077&spm=a2g2w.productlist.list.17.2a4313d4JSm7VP#coupon_anchor
https://aliexpress.ru/item/1005003244920492.html?sku_id=12000024831274011 Can we use this modules?

A:
No. The module appears to be either a voltage regulator or a voltage step-up device. Neither type of module is listed in RE01-RE16 and as such are not allowed per RE17.

Q191 REV Digital LED Indicator

Q:
Rule RE13 states that "Power sources for light sources are motor control ports, XT30 ports, 5V Aux power port and i2c ports." 1) Is the REV Digital LED Indicator (https://www.revrobotics.com/rev-31-2010/) legal if it is used as intended by connecting it to the DIO port of the control hub? In this config, power would be drawn from the DIO port's power and ground pins. 2) If not, could the wiring to the REV Digital LED indicator be modified to get power from the i2C port's power and ground pins?

A:
THE REV Digital LED Indicator is not legal per rule RE13.d.

Q211 Clarification on on RE13 b. "control" of light sources on digital or servo ports

Q:
Our team would like to power RGB LEDs. Per RE13 d. ii. these can be powered by available XT30 ports. We would like to use this driver. https://www.sparkfun.com/products/13716 While the LEDs would be powered by the XT30 ports, control (on, off, or dimming) would need to come from the servo or digital ports on the control or expansion hub. RE13 b. allows for control by "compatible ports on the REV hub." Would these LED drivers be allowed to be controlled by servo or digital ports on the hub?

A:
The driver module referenced does not fit into the category of interface modules allowed by RE13 and is not allowed. This is a voltage step-down converter. As such, it is disallowed by RE17.

Q225 USB webcam connection to Rev expansion hub and RC android phone controller

Q:
For the setup for android phone controller and a webcam, are the instructions here (wiring diagram first one, not the diagram needed electric work)? https://github.com/ftctechnh/ftc_app/wiki/Using-an-External-UVC-Camera-and-a-Powered-USB-Hub If yes, the charger has a sensitive on / off button. Is it legal to protect this area with a partial hard cover or would this need to be marked as a power button similar to main power switch? If needs labeling, what would label say?

A:
Yes, while the information in the referenced web page is old (the specific rule references are out of date), the information is essentially correct.

A commercial USB battery may be used to provide power for your powered USB hub. If you are worried about the switches/buttons on the USB battery, there is nothing in the rule that prohibits you from protecting them. The only power switch that needs labeling is the main power switch. The USB battery buttons/switches do not need specific labels.
Q227 Led lights

Q: Are underglow LEDS allowed for our robot?

A: Yes, as long as they follow the limits in RE13.

(Asked by 7002 answer published at December 13th 2022)

Q228 Is it allowed to switch the battery connectors?

Q: Last year we had problems with our batteries wires pulling out of the connector, raising a danger of it creating a short and potentially causing a battery to explode. At the suggestion of other teams we replaced the default connectors on our TETRIX (W39057) 12V DC battery pack with standard automotive 2 pin waterproof connectors. (search Amazon.com for Automotive 2-pin waterproof connector to see an example). No other changes were made to the battery or fuse. Is this modification allowed?

A: Yes, per RE15.e

(Asked by 12978 answer published at December 13th 2022)

Q245 Continuing search for allowable *switchable* LED lights/indicators

Q: In our continuing search for a legal way to have switchable LEDs that doesn't involve motor ports, SPARK mini ports, or ruled illegal solutions (Q191, Q211, Q72) we'd like to check another possibility. Can a multiposition rotary switch such as (a) https://www.amazon.com/uxcell-Channel-Rotary-Selector-Plastic/dp/B07JKWBWNF or (b) a single position microswitch be used in conjunction with a legal servo to provide a switched power source for legal LED with the power provided by 12v or 5v AUX?

A: No. As described, the usage would fall into RE17 Other Electronics and is not allowed.

(Asked by 10138 answer published at December 28th 2022)

Q250 REV Digital LED Indicator device (REV-31-2010) Legal?

Q: In light of the current response to Q191, please explain how the REV Digital LED Indicator device (REV-31-2010) is not legal. Since this LED is directly connected to a Hub DIO port and does not draw power explicitly from any other source, we would like to understand (under <RE13>.ii how "Teams may still use LED lights to signal events" because that indeed our Use Case - steady light no flashing. Sorry for my personal confusion because I've seen other teams use this device in matches.

A: The device is not powered from one of the legal power sources allowed for light sources listed in RE13 and as such is not allowed under current rules.

(Asked by 18738 answer published at February 2nd 2023)

Q268 Are standard dome (or bullet) LEDs allowed or are they considered focused lights?

Q: In an abundance of caution, we want to verify if COTS LEDs, e.g. the classic 5mm dome shaped single device (https://en.wikipedia.org/wiki/Light-emitting_diode#/media/File:Verschiedene_LEDs.jpg) are allowed, powered by a legal power source per <RE13d.ii>? We believe so but worry they might be considered "focused" Additionally, while they can be purchased with internal resistors (12V), can standard ones be used with a team provided current limiting resistor (cheaper, easier to adjust intensity)?

A: Yes. Typically, the dome shape at the end of an LED is intended as a diffuser, not as a concentrator.

Yes, current limiting resistors with LED's are acceptable.

(Asked by 10138 answer published at January 11th 2023)

Q271 Servo 3 Wire Replacement

Q: Internally, Legal Servos have 3 wires that are soldered to the board. These Servo wires can rip out off or wear down from normal use. Assuming <RE15>b(iii) is met. can a team resolder the wires when the Team wants to: A) replace the wires with identical gauge and length B) lengthen the wire to avoid the need for an extension wire C) run thicker gauge wire to the servo for added durability. If no to all 3, what can Teams do to use their servos again?

A: All three cases of replacing/extending servo wiring (as long as no internal modifications are made) are examples of the types of modifications allowed under RE16

(Asked by 16379 answer published at January 12th 2023)
Q299 Are joiner boards legal?


A: Yes. these boards are just simple connectors and are allowed per RE15.i

(Asked by 21355 answer published at January 25th 2023)

Q314 Is a metal ball used to balance our robot illegal?

Q: We have a metal ball under our linear extension to help balance the robot. We have our grounding strip connected from our control hub to the chassis. Is the metal ball illegal since it electrically grounds the robot to the field? Is the ball legal since it is classified as a wheel and is not one of the specific banned wheels?

A: Items that electrically ground the robot to the playing field floor are not allowed per Rule RG01i, regardless of the shape, size etc. Therefore the metal ball that you have described is illegal.

(Asked by 7951 answer published at February 1st 2023)

Q328 Clarification around <RE15> and Allowable Servo Wiring

Q: Hey HQ Staff. We were reading through the FRC Q&A and saw Q45 which ruled that it is allowed for Servos to have common power wires from a single port on the SPM, while still having per-Servo signal wires. This got us thinking: A) Provided <RE15.i.iii> is met, is this wiring configuration allowed for FTC as well? B) If instead of an SPM an Expansion/Control Hub was used, is this also allowed? Thank you and have a good day.

A: No. Shared power/ground wires but separated signal wires is not allowed.

For reference, FRC and FTC are distinct programs. Rules/rulings for one program have no bearing on the other.

(Asked by 16379 answer published at February 8th 2023)

Q340 Are Pink/Grey Anderson Power Pole housings legal?

Q: For many years, our team has used Pink/Grey Anderson Powerpoles (https://powerwerx.com/anderson-powerpole-colored-housings) on motors to distinguish the 15AMP connectors from the 30AMP connectors but have consistently had pink on the positive side and grey on the negative side and to prevent students from accidentally plugging the motor into the power connection. <RE15>.f indicates only that the wiring must be consistent. Is the use of the pink/grey on motor cables legal?

A: Yes.

(Asked by 2901 answer published at February 15th 2023)

Q354 Use of ZED camera


A: Due to a combination of lateness in the season and the complexities of this camera/sensor system and the time required to assess the camera's legality, this camera is NOT allowed this season.

(Asked by 22924 answer published at February 22nd 2023)

Q370 Can we use mirrored acrylic side panels? re13?

Q: The kids are using mirrored acrylic side panels for protection and decoration on the robot. They are laser cut and cover most of the robot. I wanted to clarify with rule re13-light sources, if they can do that. Its not a functional light source but it is mirrored, they are green if it helps at all and laser etched with their logo. No game play intent just looks cool. thanks for any clarification

A: These panels are not illegal but teams should be aware that large mirrored surfaces run the risk of distracting other Teams during a match. If this happens, you may be asked to cover up the mirrors.

(Asked by 22523 answer published at March 12th 2023)
Q376 USB Battery Mounted To Driver Station Carrier?

Q:
DS07 states that non-decorative electronics are not allowed on the Driver Station Carrier. Given that DS05 explicitly allows for a COTS USB external battery to be used to charge the Driver Station, does this mean that the COTS USB external battery cannot be in any way mounted or secured to the Driver Station Carrier?

A:
No, DS07 does not apply to the USB battery allowed by DS05. DS07 allows a carrier to be used to organize and transport the components of the driver station, this includes a US battery as allowed by DS05. DS07.c applies only to non-decorative electronics that are NOT part of the driver station components.

(Asked by 3507 answer published at March 8th 2023)

Q393 Wire Gauge Requirements for COTS LED Light Strip

Q:
Game Manual 1 <RE15> specifies the minimum wire gauges for power, motor, servo, encoder, and sensor wires. Is there a minimum wire gauge for COTS light sources?

A:
Robots should use the following wire gauge size guidance for LED light sources:
1st: Follow the manufacturer’s recommendation. For example, the REV Blinkin LED Driver ships with a 24 AWG LED adapter cable, Robots may use 24 AWG or larger (e.g., 22 AWG, 20 AWG, 18 AWG, etc.) wires to connect their compatible LEDs to the REV LED adapter cable.
2nd: If the manufacturer does not specify a recommendation and the LED or LED strip has wires attached, use the same or larger size as the wires provided by the manufacturer
3nd: If there are no attached wires and the LED manufacturer does not recommend a wire gauge, use the following guidance: a) 5V LEDs: 22 AWG or larger; b) 12V LEDs: 18 AWG or larger.

(Asked by 9889 answer published at April 6th 2023)

Traditional and Remote - Motors and Servos

Q7 Is Flashing Servo Firmware Illegal per <RE16>?

Q:
Using a manufacturer provided programmer, certain servos can be flashed with manufacturer supplied firmware to put the servo in continuous or standard mode. If the: A) person using, B) vendor selling, C) or manufacturer producing the servos was to perform this action, would this be deemed an illegal modification of electronics and thus violate <RE16>?
For context, REV and goBILDA servos store the two different modes internally, but the swap is done via a bit-flip versus an upload.

A:
Servo updates and/or programming done using vendor supplied tools and vendor supplied firmware images is allowed.

(Asked by 16379 answer published at October 4th 2022)

Q20 Axon Robotics Servos

Q:
Are the Axon Robotics servos legal for FTC use? While the FTC rules regarding servos are relatively open, the programmable nature of these servos gave us cause to verify. Link is here: https://axon-robotics.com/products/duo

A:
As long as the servos abide by the limitations listed in RE11, they are allowed; i.e. 6v or less operating voltage and a standard 3-pin servo connector.

(Asked by 365 answer published at October 4th 2022)

Q62 goBilda Yellow Jacket motors

Q:
Are goBilda Yellow Jacket motors that are advertised for FTC Illegal?

A:
goBILDA Yellow Jacket motors utilize the Modern Robotics/MATRIX 12V DC Motors and are legal per rule RE10c. The motors are allowed as are the single degree-of-freedom gearboxes attached to those motors.

(Asked by 22313 answer published at October 26th 2022)

Q68 Can goBilda servo power distribution board be used legally?

Q:
Rule <RE09> specifically lists allowed servo power and control sources. The goBilda servo power distribution board (https://www.gobilda.com/servo-power-distribution-board-8-channel/) is functionally equivalent to the REV Servo Power Module. Can the goBilda servo power distribution board be added to the allowed sources list of Rule <RE09>?

A:
The above servo distribution board is not mentioned in the other RE rules as an allowed device and therefore falls into RE17 - Additional Electronics and is not allowed.
**Q78 GoBilda Dual Mode Servo Legal?**

**Q:**
Is the GoBilda Dual Mode Servo (2000-0025-0002) and 3102 Series Dual Mode Servo Programmer (3102-0001-0001) Legal?

**A:**
If the servo has a standard 3-wire servo connector and is compatible with 6v drive, then it is allowed pre RE11. Servo programmers provided by the servo manufacturer are allow for servo configuration, but not as a part of a robot.

(Asked by 11329 answer published at October 15th 2022)

**Q102 Is It allowed to use a motor port to energize an LED light**

**Q:**
Since the GoBilda PWM switches are not legal and the Blinkin Led modual are not available. Is it allowed to use a motor port set to "unspecifled" to energize a gobilda LED light panel?

**A:**
Per RE13.d.ii, motor ports on REV Expansion and Control Hubs may be used to control allowed light sources

(Asked by 20786 answer published at November 8th 2022)

**Q247 Legality of Servo Signal Reversers**

**Q:**
Is it legal to use a servo signal reverser (a wired device whose purpose is to reverse the direction of a servo signal) similar to this: https://hobbyking.com/en_us/turnigy-servo-signal-reverser.html

**A:**
No. This type of servo controller falls into the RE17 Additional Electronics category and is not allowed.

(Asked by 7393 answer published at December 28th 2022)

**Q255 Are Axon MINI+ servos with an extra position wire legal?**

**Q:**
Q20 asked about Axon servos, and the answer referred to RE11. This question is regarding the Axon MINI+ servos that have the normal 3-wire servo connector but also have a 1 bit analog absolute position wire (https://axon-robotics.com/products/mini). Are they legal by RE11 because they operate at 6V and have the 3-wire servo connector? The extra wire is basically an analog encoder sensor, which by itself, should be legal. But is it still legal when the servo and encoder are combined into one?

**A:**
No. These servos do not fit within the allowed servos per RE11 (i.e. they have more than a three-wire servo connector). With the added sensor output they fall under RE17 Additional Electronics and are not allowed.

(Asked by 14343 answer published at January 5th 2023)

**Q259 We graciously request that you reconsider Q255 and/or clarify the answer**

**Q:**
We ask you to classify the Axon+ servos as two devices that share a case. One device is the standard FTC legal servo, and one device is the FTC legal analog position sensor. The plus versions of their servos are only $5 more than the versions without the analog output. Affordability is key. Many teams have invested in the Axon+ servos, largely due to the precedent ruling from skystone that allowed the same thing for an adafruit servo Otherwise please allow the analog wire to exist unconnected.

**A:**
We normally don't answer questions after Thursday at noon Eastern time ... but in the interest of not ruining a team's weekend ...

Teams should not rely on prior season's rulings to determine the legality of robot components. When in doubt, you should always ask.

For the remainder of this season only (unless explicitly allowed under next season's rules) servos with a single analog sensor type of output are allowed.

(Asked by 6832 answer published at January 6th 2023)

**Q389 Can we run two motors off of one control hub port?**

**Q:**
We have an implement powered by two motors. We always want these motors to run in parallel, and they are physically/mechanically connected. We would like to solder a y-cable and run both motors off of the same port on the control hub, as the hub is capable of handling this wattage. This is not an attempt to use more motors than we are allowed. We aren't clear from RE15 (or other rules) whether this is a violation, but we had a judge warn us about it.

**A:**
There is nothing in the current robot construction rules that prohibits this. While not illegal, this is not a recommended practice. Without careful selection and management of motors and their usage, it is possible to build a robot that can exceed the current limits for the motor ports leading to potential robot failure and/or damage to robot components.

(Asked by 15005 answer published at March 30th 2023)
Traditional and Remote - Control System

Q17 Is it legal to add a touch display for use with the REV Control Hub

Q:
Under rule <RE07> robots which are using a smart phone have available a touch screen to view status and configure the robot. However Teams using the REV Control Hub do not have any way to diagnose problems on the robot. Given that Touchscreens such as https://www.sunfounder.com/collections/touchscreens/products/10inch-touchscreen-for-raspberryypi work with the Control HUB and offer no play advantage but provides FTAs with a way to diagnose the robot, would it be legal to use them?

A:
No.

Touchscreens/displays would fall under RE17 as additional electronics and are not allowed.

(Asked by 2901 answer published at October 4th 2022)

Q28 we want to use an optical mouse for odometry that illuminates the surface with an infrared

Q:
we want to use an optical mouse for odometry that illuminates the surface with an infrared LED for its sensor input and light source that plugs into the control hub in the same way that uvc cameras do. It does not use lasers. Is this legal?

A:
Per RE12, allowed sensors may only be connected to specific inputs on the REV Control and Expansion Hubs; I2C, digital I/O, encoder, and analog inputs. Sensors may not connect to the USB interface.

(Asked by 10738 answer published at October 4th 2022)

Q66 Control Hub & Driver Hub Nomenclature

Q:
We have multiple Control Hubs and Driver Hubs in use. Our naming convention is <team number>-<internal Id>-<hub acronym> where team number is self-explanatory internal Id is a character, e.g. A, B, .. to distinguish each Hub pair uniquely hub acronym is either DS or CH as appropriate This nomenclature fails the Self-Inspection Report correctly on account of <RS01>. My question is how can teams bring multiple Hubs to matches with pre-configured settings for only one robot? Thanks.

A:
Answer edited 10/14/2022 7:00am et - This question is answered in Game Manual Part 1 Rule RS01-Android Device Names. Based on your question, you should change CH to RC.

(Asked by 18738 answer published at October 13th 2022)

Q101 Using D435 Distance Camera without laser

Q:
Distance cameras like D435 can be used with the laser turned off. The laser produces a visible red dot when turned on. Would this camera be allowed if the laser is turned off?

A:
No. The presence of the laser makes the camera violate RE13's prohibition on lasers

(Asked by 19895 answer published at November 8th 2022)

Q105 phone usage

Q:
I'm looking into using the correct phones for our robot. Regarding rule RE07 my team was able to get a Moto Z2 Force device directly from Motorola to be able to use on our robot but the device is not listed on the list of devices. Is there a way to have this phone added to approved devices, as this device is running the same operating system and android version as other devices?

A:
We do not allow any phones outside of the list in rule RE07. The specific phones listed in this rule have been tested and are compatible with the FTC software. Using phones outside of this list could put teams at a competitive disadvantage, therefore are not allowed.

(Asked by 15387 answer published at November 16th 2022)

Q123 Secondary Camera Display on Driver Hub

Q:
Are you able to run a secondary display on the driver hub? For example, a camera attachment on the robot creates images the drivers can view on the driver hub (in a split screen format with the driver station app).

A:
No. RS09 prohibits the streaming of audio, video or other data from the robot to the driver station
**Q149 Control Hub Driver Update**

**Q:**
Our team has only one Control Hub. However its USB-C port is not working anymore. REV cannot repair it until their stock is replenished. There will be an update to the SDK very soon. We will not be able to upgrade the Control Hub with the new drivers using the REV Hardware Client. Will there be an exception (during Inspection) for teams such as ours that are facing this predicament? Thanks.

**A:**
If you connect your Laptop with the REV Hardware Client installed to the Wi-Fi network of your Control Hub, the REV Hardware Client will be able to detect the Control Hub and able to perform all actions wirelessly on the Control Hub the same as if it was connected via USB-C.

(Asked by 8743 answer published at November 10th 2022)

**Q200 REV Control Hub v0 REV-31-1152 FTC 22/23 legal?**

**Q:**
We got for our participation at the FTC SCRIMMAGE ITALY event in March 2023 an old second hand FGC kit with a REV Control Hub v0 REV-31-1152. We can not find it in the legal parts list for the current FTC 22/23 season. The Android Robot & Driver Apps ver. 8.1 load fine without problems but with a warning about the Control Hub OS. Also Blocks code seems to run fine without issues. So is this old Control Hub legal to use for a traditional 22/23 FTC event?

**A:**
The REV Control Hub v0 REV-31-1152 may be used for unofficial scrimmages or a demo, but cannot be used in a official tournament.

(Asked by 18738 answer published at November 17th 2022)

**Q289 Control Hub REV-31-1595 FTC 22/23 legal?**

**Q:**
We have a Control Hub and it's version is REV-31-11595. It is a legal part for the FTC season 22/23 in a official event? It does not appear in the legal parts but it is the version that appears on the Rev page Thank you in advance

**A:**
The version of control hub mentioned is the current version and is listed in the explicitly in the 2022-2023 Legal and Illegal Parts List document (top of page 3) as an example of a allowed REV Control Hub

(Asked by 22850 answer published at December 13th 2022)

**Q359 Power switch on turret**

**Q:**
Is it legal to have a power switch mounted on a turret, provided it is well-labelled and all other constraints for the switch have been met?

**A:**
As long as the Main Power Switch is clearly visible in all turret orientations, then it is legal to put your Main Power Switch on a turret.

(Asked by 5356 answer published at February 21st 2023)

**Q365 PS4 DualShock 4 Wireless allowable colors**

**Q:**
The ASIN (B01LWVX2RG) listed in GM1 <DS03>c is for the Jet Black color of the DualShock controller. However, this controller also comes in various colors each with a different ASIN number. Is only the Black version legal or can a team compete with any color?

**A:**
The other colors of the same model DualShock controller are allowed to be used.

(Asked by 10836 answer published at February 28th 2023)

**Traditional and Remote - Sensors**

**Q11 Is the OctoQuad Encoder Sensor legal?**

**Q:**
https://www.tindie.com/products/digitalchickenlabs/octoquad-8-channel-encoder-sensor/ It is a smart, non-user-programmable sensor like the allowed PixyCam New teams can only get a single REV Hub due to shortages; SPARKminis allow running extra motors, but without encoder feedback this is unfair disadvantage. Adding an OctoQuad allows encoder feedback from all motors. OctoQuad satisfies RE17 more than the REV Blinkin which contains an Arduino for which REV has public programming documentation.

**A:**
No.
The product is a sensor interface board and requires sensors to be plugged into it to enable operation. Each of these sensors would violate RE12 since they do not plug into allowed inputs on a REV Control or Expansion Hub.
Additionally, since this type of sensor interface is not specifically addressed in any of the other RE rules, it falls into RE17 as additional electronics and is not allowed. (Asked by 17160 answer published at October 4th 2022)

**Q18 Use of color sensors for Signal detection**

**Q:**
Would anything prohibit the use of a color sensor or sensors for detecting the orientation of the signal / signal sleeve in lieu of using image recognition?

**A:**
No. There is nothing in the robot construction or gameplay rules that dictates what sensing technology is used to detect the orientation of the Signal/Signal Sleeve. (Asked by 12915 answer published at October 4th 2022)

**Q30 OpenCV AI Kit: OAK—D**

**Q:**
Can we use the openCV AI Kit OAK-D camera for vision this year? Here is the site page for it: https://store.opencv.ai/products/oak-d It appears to be similar to the Intel T265, except it has not been discontinued.

**A:**
It would appear that this camera is designed to have AI models trained and uploaded to it, providing an effective co-processing type of operation. As such, it should be considered as a programmable device and is not allowed. (Asked by 10091 answer published at October 14th 2022)

**Q41 Is the SEN0304 Ultrasonic Distance Sensor from DFRobot legal for use?**

**Q:**
We are wanting to use a ultrasonic distance sensor for our robot this year but a Modern Robotics Range Sensor is hard to find and expensive. Is the SEN0304 legal?

**A:**
Any sensor that is compatible with the REV Control or Expansion Hub, connects to the allowed inputs, and does not violate other rules is allowed. (Asked by 17235 answer published at October 4th 2022)

**Q65 Are LIDAR Sensors Legal?**

**Q:**
We are looking into other ways to track our robot's movement during autonomous and were wondering if LIDAR was possible. We found these two sensors (https://www.adafruit.com/product/4010 and https://www.adafruit.com/product/4441) that we think would work and are wondering if they violate RE13 as they produce "directed light sources". Assuming we're able to attach these sensors to a REV hub, could we use them in a real match?

**A:**
No, per rule R13a. LIDAR is both a laser and a focused/directed light source and is thus not allowed. (Asked by 14779 answer published at October 13th 2022)

**Q85 Is this sensor legal?**

**Q:**
We are looking into other ways to track our robot's movement during autonomous and were wondering if this sensor that we found was legal as it uses an LED which may fall under the category of RE13 as it does produce a "directed light source". Here is the sensor we found: https://www.adafruit.com/product/4441. Assuming we can connect this sensor to a REV hub, are we able to use it?

**A:**
With the obvious lenses on its front surface, this sensor appears to violate RE13.a. (Asked by 14779 answer published at October 26th 2022)

**Q86 Is the DFRobot HuskyLens sensor legal for use?**

**Q:**
Just checking for clarity: Is the Gravity:HuskyLens sensor legal for use? It connects to the REV Expansion/Control Hub via I2C. Like the PixyCam, it is not user-programmable but has modes to train the sensor on different objects and vision patterns. The sensor is available from DFRobot as well as other vendors. More details about this sensor can be found at https://www.dfrobot.com/product-1922.html and https://wiki.dfrobot.com/HUSKYLENS_V1.0_SKU_SEN0305_SEN0336#target_3. Thanks, FTC 7172

**A:**
This sensor appears to be equivalent to the PixyCam and is legal for use. (Asked by 7172 answer published at October 26th 2022)

**Q119 Are two UVC cameras allowed on the robot?**

**Q:**
This question relates to <RE14>. Are two UVC cameras allowed on the robot as long as they are attached to the Rev control hub or robot control system through a powered USB hub?

A:
Yes. This is allowed and supported.

This is a common use-case among teams, there is even an OpMode sample designed to help teams use two cameras (you can find it in the Samples under ConceptTensorFlowObjectDetectionSwitchableCameras). The major caveats with using two cameras are:

1. You can only have one camera active as a UVC source at once; the sample code provided shows how to change which camera is currently the “active” camera.
2. Even with a Control Hub, teams using multiple cameras need to use a powered USB hub – the Control Hub only provides a limited amount of current to the USB ports, and more than one USB Camera may draw more current than the Control Hub can provide on its own. A powered USB hub (like the REV UltraUSB Hub) can power two USB cameras easily.
3. If you’re configuring and aligning multiple webcams during Pre-Match setup, be sure not to violate rule G13e (do not delay the start of the match).

(Asked by 6165 answer published at November 29th 2022)

Q155 Passive self-made electronic system

Q: Are we allowed to use passive self-made electronic system as a sensor? We want to use optocouplers and self-made electronic circuit that contain only passive elements as an encoder, are we allowed to do that?

A: No. This type of fabrication of a sensor would fall under the "custom circuits" portion of RE17

(Asked by 17504 answer published at November 17th 2022)

Q173 Followup to Q158: Is it legal to build any open-source odometry pod?

Q: Various designs for odometry pods exist like OpenOdo and they are widely used in FTC competition. As Q158 has clarified that we cannot build OpenOdo using Axon parts, A) is illegal to include OpenOdo or other open source designs at all? or B) is it only illegal to use the Axon bundle to build OpenOdo? We are having a really hard time knowing what is legal and how to procure parts for odometry. P.S. apologies for past Q163 duplicate; system would not let me delete.

A: Answer A: It is legal to use non-commercial open source designs (e.x., OpenOdo).
Answer B: The Axon Robotics and all other commercial odometry custom designs and/or custom component parts are illegal.

(Asked by 21376 answer published at November 29th 2022)

Q189 Use of Endoscope USB camera

Q: I was wondering if a USB Endoscope camera would be legal. The use case for this would be to stick it down the middle of a cone for a targeting system, and be able to see the pole as the robot moves the arm/lift up with the cone in possession. Reading the rules (RE14) it only says a UVC compatible camera. Is there any rule that an endoscope camera without a light source would violate? (I haven’t found a specific product for illustration yet)

A: There is nothing in RE14 that would prohibit an endoscopic type of camera. You are correct that a light source included would cause the camera to be disallowed, unless the light source conforms to the limits of RE13 for power/control.

(Asked by 20771 answer published at November 29th 2022)

Q198 Clarification on RE13

Q: Our team is looking for clarification on <RE13.a>. We are planning to use the REV Color Sensor V3 to help illuminate our Signal Sleeves at a distance for better accuracy when scanning with our camera (the light is projecting parallel with the floor about 3.5cm high) It is not possible to turn off the LED programmatically between autonomous and teleop periods as it is a physical switch. Does this count as a focused or directed light source? Are we allowed to have the light on the entire match?

A: The light within the sensor is not constrained by RE13. It is a simple LED designed to provide a relatively pure white light source to improve the color readings determined by the sensor. It is allowed to be on.

(Asked by 5155 answer published at December 7th 2022)

Q201 REV Color Sensor Light

Q: Hello. The list of legal parts states that the REV Color Sensor V3 (REV-31-1557) is legal. However, there is a light on the front that can be switched on/off (manually). Can this light be ON or does it violate the Light Source rule (RE13)? The REV datasheet states that this light should be ON for the sensor to work properly on unlit objects. Thank you

A: As you mention the sensor is listed as legal. There are no limitations the on features of the sensor for its usage. The light on does not violation RE13.
Q243 Can we have two UVC cameras active at the same time?

Q: We have 2 cameras on our robot, and we use OpenCV, which supports concurrent camera use. In Q119, it says that, "You can only have one camera as a UVC source at once." This a limitation with the built in Vuforia/Tensorflow tracking, or is it a rule that we can only have one camera active as a UVC source at a time.

A: We believe Q119 ([qa/119]) answers this question.

The limitation is a vision processing limitation

(Asked by 14343 answer published at December 21st 2022)

Q244 Do we need to use a powered USB hub if using more than one UVC camera?

Q: Q119 states "teams using multiple cameras need to use a powered USB hub." We currently have two UVC cameras on our robot working fine without a powered USB hub. Is this rule that a powered USB hub is required for multiple cameras, or is this a suggestion to help ensure teams don't have issues?

A: This is a recommendation based on power consumption of the cameras.

(Asked by 14343 answer published at December 21st 2022)

Q246 Are three or more UVC cameras allowed on the robot?

Q: During the interleague, our robot passed inspection with two UVC cameras but the inspector seemed to suggest that three would not be allowed. Q119 states that two are allowed but does not appear to place any limit on additional cameras. Can you clarify whether three or more UVC cameras is permitted?

A: There is nothing in the rules that limits the number of cameras that can be built into the robot. Be aware that each additional camera on the USB bus requires additional USB power.

Plan accordingly.

(Asked by 14343 answer published at December 28th 2022)

Q251 5V Addressable LED Strip

Q: Is the (REV-11-1198) 5V Addressable LED Strip legal when it is driven by REV BLINKIN Driver (REV-11-1105)? The 12V version of the strip is not very useful for our "ergonomic" use and prefer the addressable nature of the 5V version. We are mindful of the legal power sources and voltage restrictions. The Strip in question operates at 5V but the source is the BLINKIN Driver which will operate through XT30 connectivity with a hub and rely on PWM signalling. Thanks.

A: Yes. The REV Blinkin Driver you reference is an example of the types of COTS interface modules allowed by RE13c.

(Asked by 18738 answer published at December 28th 2022)

Q257 Sensor Interface Bridges

Q: I have a sensor that I would like to use on my robot, but it's an SPI sensor instead of I2C. I also have a simple passive SPI-to-I2C bridge that will allow my sensor to communicate with the I2C bus on the Control Hub. Am I allowed to use the SPI-to-I2C bridge on my robot between the Hub's I2C bus and my device per RE12c even though it's not explicitly called out in documentation from the manufacturer for the device? Q46 is the closest example similar to this, so I am checking before I do it.

A: No. Sensor interfaces as you describe would fall under RE17 Additional Electronics and as such are not allowed. The allowance in RE12c for passive electronics is intended to cover simple passive components such as resistors or capacitors that a sensor manufacturer may recommend as a part of using their sensor.

(Asked by 12789 answer published at January 5th 2023)

Q270 Is LoonyOdo + REV encoder FTC legal?

Q: Please take a look here: https://www.theloonysquad.com/open-source/loonyodo This is a CAD design which some teams are using. The COTS REV encoder is disassembled and some of its inner parts are removed and installed into a 3D printed casing. Will this be considered legal for FTC? or will it violate RE02 or some other rule?

A: The modifications to the REV Encoder present challenges for inspectors in verifying the type of sensor.

The case replacement would be allowed, but only with supporting documentation that details the process was followed and the steps. Suggestion would be to include pictures that show the disassembly of the original REV Encoder and the assembly of the new encoder housing.

https://ftc-qa.firstinspires.org/admin/report
Q294 NAVX2-Micro Navigation Sensor

Q: Is the NAVX2-Micro Navigation Sensor sold by AndyMark FTC legal?

A: It is not possible for us to rule on the legality of every possible sensor.
Apply the conditions of RE12 to the sensor - is the sensor able to be connected via allowed ports (RE12.a) either with or without a adapter cable or level shifter (RE12.b)
So since the NAVX2-Micro satisfies these two constraints and isn't subject to any of the other constraints of RE12, it is legal

(QAsked by 15167 answer published at January 12th 2023)

Q316 Distance Sensor

Q: The REV ToF 2m Distance Sensor supply is constrained. I encountered the RCWL-1601 at Hardware Component Overview/Robot Controller Overview/Sensors at FTC Docs 0.1 I know this sensor as HC-SR504. Can our team substitute this equivalent model (identical specs) for our solution? We have spare ports and would like to use multiple quantities of these. Thanks.

A: The sensor you list is an ultrasonic rangefinder and is part of a general class of allowed sensors.
The REV ToF 2m distance sensor (REV-31-1505) is a laser-ranging sensor. While the two perform similar functions, there are not the same technology. The REV sensor is the only allowed laser-based sensor for FTC

(Asked by 6168 answer published at January 25th 2023)

Q330 Rotary Encoder with LEDs

Q: We have some rotary encoders that combine several features on a single board. https://github.com/ahmsville/Magnetic_rotary_encoding (Model 1) One feature is addressable LEDs. Another is Hall effect sensors that read the magnetic field. There is also a chip for digital-to-analog conversion. The features can be connected individually so that one wire connects to the sensor and another to the lights. Does it conflict with the rules to connect two different wires to the same board?

A: With the way this collection of devices is combined, there is no way to connect/use it without violating either the LED power rules or the sensor power rules. i.e. LEDs cannot be powered from sensor/digital I/O ports while sensors cannot be powered from anything other than the analog or digital I/O ports.
There is no means to connect this device legally

(Asked by 18738 answer published at February 1st 2023)

Q331 Strain Gauge Sensors

Q: Can we use strain gauges that use HX711 breakout boards as sensors? https://www.digikey.com/htmldatasheets/production/1836471/0/0/1/hx711.html is the datasheet of the breakout board. And https://learn.sparkfun.com/tutorials/getting-started-with-load-cells/all explains how to use them. We see the breakout board as part of the sensor, is this fine or does it have to meet the definition of passive circuitry? And if so, does it?

A: The breakout board described does not fit the description of passive electronics and falls into the category of additional electronics and as such is not allowed.

(Asked by 19895 answer published at February 8th 2023)

Q341 Rotary Encoder with LEDs Part II

Q: Regarding Q330, doesn't the answer to this question contain an error? <RE 13> d.ii states that LEDs may be powered from I2C ports among others. The answer also states that there is no way to connect it legally, but it is possible to connect a single analog sensor wire or I2C sensor wire to the board to just read the Hall effect sensors, not even connect to the lights. Wouldn't that be legal?

A: Q330 [/qa/330] is the final answer for this device under the current rules.

(Asked by 19895 answer published at February 16th 2023)

Q343 Can we use an off the shelf Opto-Coupler

Q: Can we use the following opto-coupler - https://www.amazon.com/Measuring-Optocoupler-Interrupter-Detection-Arduino/dp/B08977QFKS/ref=sr_1_1?keywords=optocoupler+sensor&qid=1676088527&sr=8-1 It only has 3 pins - 1) 5V 2) GND and 3) Digital OUT and does not require any custom circuits. We will just connect it directly to the control or expansion hubs' digital port.

https://ftc-qa.firstinspires.org/admin/report
Traditional and Remote - Robot Software Rules

Q3 Reuse of previous software

Q: May we reuse last year’s software, replacing obsolete code with new game specific logic and other improvements?

A: It depends on a number of factors given that requires that you update at least to the Minimum FTC Software Version (version 8.0). If you’re a Blocks user this can be accomplished by updating the Robot Controller and Driver Station apps (preferably through the REV Hardware Client), and no changes are necessary in your Op Modes (besides game-specific changes, as you pointed out). If you’re an OnBot Java user you must also update your apps but there may be specific changes required in your Op Modes - see the Breaking Changes section in the SDK 8.0 release notes. However if you’re an Android Studio user you must not only update the Driver Station app to at least version 8.0 but you must also merge the SDK 8.0 FtcRobotController repository changes into your Android Studio Project; this is in addition to any changes required in your Op Modes based on SDK 8.0 Breaking Changes.

(Question by 11039 answer published at February 15th 2023)

Q39 Programming in Kotlin

Q: Kotlin can compile into JVM bytecode and is interchangeable with Java. Are there any rules against using Kotlin to program the robot?

A: While there is no rule prohibiting Kotlin as a programming option, it is not one of the recommended tools as listed in RS02. Teams that use Kotlin do so at their own risk and should expect that there will not be technical help/support available at events in the case of software issues.

(Question by 14779 answer published at October 11th 2022)

Remote - Gameplay - All Match Periods

Q303 Scoring Dangling Cones

Q: I was recently discussing the answer to Q263 with a colleague and the following scenario was posited: “My robot is carrying a BLUE cone near a High Junction with a BLUE cone hanging/dangling on top of it. My robot bumps into the Junction Pole, and the BLUE cone slides down into a Scoring position, am I in violation of any rules?” I say that there are no rules that prohibit this or penalize this, because my robot was never in possession/control of more than one cone. Am I right?

A: The Robot's actions described in the scenario do not violate any gameplay rules.

(Question by 12789 answer published at January 30th 2023)

Remote - Pre-match

Q369 Is Pattern Randomized for Remote Matches?

Q: We are submitting remote matches due to snow so we are learning the scoring system. We noticed that there is a “Random” button on the left by the pattern options. Does that mean the pattern for each match is randomized? The game manual 1 Remote has illustrations on pp 48-51 showing the “H-1 pattern for Remote Match 1”, “H-2 pattern for Remote Match 2”, etc. It’s confusing if the patterns need to be done in a sequence. Can you please clarify this?

A: Remote matches include a randomization during pre-match setup that defines to teams which signal pattern with be used in the autonomous period. The circuit patterns must follow the order outlined in Appendix H for each match and must not be randomized.

(Question by 8610 answer published at March 16th 2023)

Remote - Driver-Controlled Period

Q139 Human Player Cone Placement - Upside Down

Q: Question 1: Can a human player place a cone into their team's substation in any orientation? Question 2: For example, could a cone be placed upside down (where the wider base is on top) into the substation?

https://ftc-qa.firstinspires.org/admin/report
**Traditional and Remote - Team Scoring Element**

**Q25 Beacon Design**

**Q:**
We have designed a custom beacon that has a square base (3") and a round open top (2") with a nominal height of 3". The model lofts from a square to a conical top. Is this design legal (considering that the top part is conical)?

**A:**
It appears that this design can be clearly distinguished from a circular cone, therefore it is legal. However, I would suggest that you make the Beacon slightly larger than 3" square at the base and slightly taller than 3" so that you do not run into problems at inspection.

(Asked by 1885 answer published at November 14th 2022)

**Q79 Clarification on TE06**

**Q:**
Our team is looking for clarification on rule <TE06> COTS Scoring Elements – The Team Scoring Element may not resemble any current season’s COTS scoring elements. Our current design looks like a funnel, beaker, or Apollo re-entry craft. The base is an octagon as opposed to a cylinder. The heights are different and the sides are polygons. The geometry/science teacher in me says their design is fine, but someone outside those fields might say they are close.

**A:**
The intent of rule is to insure that the Referee scorers can clearly and quickly discern the difference between a Beacon and a Cone. A flat sided, octagonal cone is acceptable but simple, round funnel is probably too close. Adding additional features to the funnel would help to make it stand out from the Cones.

(Asked by 18738 answer published at October 4th 2022)

**Q100 Clarifying - Team Scoring Element: <TE03> Size Constraints**

**Q:**
TE03 states: "In other words, a Team Scoring Element must be small enough to fit inside a 4 inch x 4 inch x 4 inch cube and large enough to not fit in a 3 inch x 3 inch x 3 inch cube." A cubic object with size of 3.9"x3.9"x2" will fit inside a 4x4x4 box but not fit inside a 3x3x3 box (even diagonally.) Do we interpret TE03 correctly that this TSE is still legal since it will not fit inside a 3x3x3 box even though one dimension (x2") is smaller than x3"?

**A:**
Rule TE03 clearly states that the minimum size of the Team Scoring Element is 3" x 3" x 3". The object in your question is not legal.

(Asked by 19746 answer published at November 1st 2022)

**Q116 Beacon Size**

**Q:**
Our custom beacon has a round base with outer diameter 4", and round top with 2". and the height of 4". The top and base are not straight lofts like a cone. It has 3 braces ribs connect top and base. Is this design legal (not sure if the 2" top is illegal)?

**A:**
There has been some confusion as to how a Beacon should be measured. The Beacon should be placed in a self-supporting position, that means it is not held at an odd angle by another object, such as the Beacon measuring tool. If, in any of the possible self-supporting positions, the Beacon meets the size requirements (larger than 3" x 3" x 3" and small than 4" x 4" x4") and it is visually distinguishable from a Cone, then the Beacon is legal. This design appears to meet those requirements. The 2" diameter top by itself does not make this design illegal.

(Asked by 19571 answer published at November 8th 2022)

**Q124 Beacon design/shape**

**Q:**
There is much debate at our first few league meets about beacons being too close to the shape of cones. We have teams using a red/blue plastic cup and just add tape to the outside to discern it as a beacon. Can it be merely a visible distinction using tape, or should the actual physical shape be different? Inspections would go a lot smoother if we have a clear yes or no to using a cup :-(

**A:**
A plastic conical cup, i.e Solo cup, is not allowed.

(Asked by 14568 answer published at November 8th 2022)
Q136 Double sided tape on inside of beacon?

Q:
While designing our beacon, we were looking through GM1 and thought of the idea of using double-sided tape on the inside of the beacon to allow it to attach better to the cone a we delivered it to the playing field. We would place a cone, then drop the beacon onto the cone, and the tape would help the beacon stay on the cone as we delivered it. It doesn' damage the cone in any way so in our eyes it should be legal but wanted to confirm.

A:
There is strong possibility that the tape will transfer adhesive to the Cone thus changing its properties for the next team that has to use it. This would be considered Field Damage per rule G26 and would result in a penalty. Please find another method to secure your Beacon.

(Asked by 8693 answer published at November 15th 2022)

Q146 Beacon orientation at inspection

Q:
Must a beacon be in any particular orientation to pass inspection? If a beacon meets size requirements in ONE, but not EVERY orientation, does it meet the size requirements?

A:
The Beacon must be in a self-supporting orientation when measured for size. If there are multiple self-supporting orientations, only ONE of the orientations needs to meet the size requirement for the Beacon to be legal.

(Asked by 16597 answer published at November 17th 2022)

Q153 Beacon Color

Q:
In GM2, rule GS14 part C states: "A Beacon's color must correspond with the Alliance in order to be used by that Alliance. If the color does not correspond, it cannot be used." Does this mean the whole Beacon, or just the majority. We want to make the top half neon-yellow so that it is easier to see from a distance.

A:
GS14C is not the only rule discussing the Beacon's color. Rule TE01 in Game Manual Part 1 states "The predominant color of a Team Scoring Element must match the Team's assigned Alliance for the Match (red or blue)." The word "predominant" is key here so that the teams and the audience can easily associate the Beacon with the Alliance. This means the majority of the Beacon must be red or blue. As a word of advice, we suggest at least 70% of the Beacon be red or blue. Half of the beacon being neon yellow would not be acceptable.

(Asked by 19368 answer published at November 17th 2022)

Q154 Beacon Similarity

Q:
If we had a conical cup of the right measurements covered in a nonslip fabric for rugs (the foamy ones in mesh patterns) and spray painted in the correct color would it be visually distinct from the cones? If not, how much would we need to change for it to be legal?

A:
A circular cone shaped cup covered with a fabric or other material is not sufficiently different from a Cone and is not legal. Designing and fabricating a legal Beacon is a task for the Teams.

(Asked by 16643 answer published at November 20th 2022)

Q185 Can we provide a beacon to our alliance partner to use after passing re-inspection

Q:
We have read Q156. Would like further clarification. According to rule I10, team supplied elements need to pass re-inspection prior to the game if they are changed after initial inspection. If a team brought a spare beacon and put their alliance partner's number on it, would it be legal for the alliance team to use that beacon in game if the alliance team goes past re-inspected per rule I10?

A:
No, this request is beyond the intended scope of re-inspections performed after qualification Match play begins at an event.

Section 7.4 in Game Manual Part 1 states in part that "the Beacon is an optional Team designed and manufactured Scoring Element." The Game Design Committee's intent is that the Robot, Beacon, and Signal Sleeve are all designed and manufactured by the Team that brings them to the Playing Field for a Match.

(Asked by 13356 answer published at November 29th 2022)

Q186 Beacon shape and material to be used

Q:
1. Can a cylinder of 3.5 diameter and 3.5 inch height be considered a valid beacon? 2. Can the beacon bend little bit when being picked up by the claw? Or does it have to be sturdy? Thank you for your help

A:
Q216 A scored “skinny” beacon is not seen by the referee crew

**Q:**
Our team designed a “skinny” beacon so it can be easily placed by the human player onto a cone in the substation. When the cone and beacon combination is scored on a junction, it can be difficult to see the beacon. We are concerned the referee crew may not always see our scored beacon. Question 1: What happens if the referee crew doesn’t see the scored beacon? Question 2: What happens if the referee crew doesn’t see the beacon and the opposing alliance scores their cone over over our beacon?

**A:**
Answer 1: Referees record Scoring task achievements and apply gameplay rules based on what they see. A Scored Beacon that is not visible to the referee crew has zero Score value, does not convey Junction Ownership to the Alliance, etc. The Match will be scored as if the obscured or difficult to see Beacon does not exist. Simply stated, if a referee didn’t see it, it didn’t happen.

It is the Team’s responsibility to follow the guidance stated in Game Manual Part 1 rule TE01: "The purpose of this [Beacon color] rule is to ensure that field personnel, Teams, an the audience can easily associate Team Scoring Elements [Beacons] with their corresponding Alliance." The Game Design Committee’s intent for this statement is that Beacon designs need to be readily visible with sufficient color surface area to be easily seen.

Answer 2: Same as answer #1. The playing field is scored based on what the referee crew is able to see from their normal locations outside the Playing Field. If a referee didn’t see the "skinny" Beacon, the Playing Field is scored as if the Beacon does not exist.

Note 1: It is highly unlikely that a discussion with the Head Referee in the question box will change a final Match score because a "skinny" Beacon was not seen by the referee crew.

Note 2: Beacon inspection does not include a visibility test and we are not going to add such a test. A Beacon that passes inspection can still be difficult for the referee crew to see depending how it is used during gameplay. Just like a legally constructed Robot can use an assembly in an illegal way (e.g., grab a Junction pole), a legal Beacon that is difficult to see, may not be counted as Scored.

Pro Tip: Design a Beacon that is highly visible when Scored on a Junction. Make it easy for the referee crew and the other Drive Teams to see.

(Asked by 1000 answer published at December 7th 2022)

Q221 Additional clarification on the custom beacon sizing

**Q:**
Hello, there is still confusion on the sizing of the Team Element. Q188 seems to state that a custom TSE must be over 3" in all 3 directions. However Per <TE03> In other words, Team Scoring Element must be small enough to fit inside a 4 inch x 4 inch x 4 inch cube and large enough to not fit in a 3 inch x 3 inch x 3 inch cube. ← At the events we have seen rings and other such that will not fit in the 3” cube but are not 3” in the height measurement. Please clarify

**A:**
We believe Q116 (qa/116) and Q146 (/qa/146) answers your question. Also, search for the keyword "Beacon" in this forum to find several other posts about Beacon size that may enhance your understanding of measuring Beacon size. If the previous answers in this Q&A forum do not answer your question, please rephrase your question and resubmit.

The short answer to your question is that a Beacon must be self-supporting in the measurement tool and satisfy the minimum and maximum size requirements in this one orientation. A Beacon that does not comply with the size requirement rule TE03 in Game Manual Part 1 and the additional guidance provided in this Q&A forum should not pass inspection.

(Asked by 9225 answer published at December 12th 2022)

Q236 Pushing down on a Team's Beacon During Endgame

**Q:**
During endgame if the human player places a cone into their substation and then places their beacon onto that cone, is the human player allowed to push down on the beacon in order to ensure the beacon is fully seated on the cone? For some teams their beacon hangs onto the cone through friction, and thus pushing down on the beacon is needed to ensure a proper fit.

**A:**
Pushing the Beacon down onto a Cone violates rule G29 for illegal use of Game Elements; the pressed connection is viewed as an attempt to use the Beacon to make the task of Scoring the Cone+Beacon combination easier.

Also, a rule G26 violation for damage to the Cone is possible, depending on the circumstances.

Note: The recommend method for placing a Beacon onto a Cone In the Substation is for the Human Player to drop the Beacon onto the Cone. Otherwise, there is risk of concurring Human Player, Beacon, and Cone contact that could cause illegal movement of a previously placed Cone.

(Asked by 11212 answer published at December 20th 2022)

Q237 Silicone Material on the inside of our Beacon

**Q:**
On the inside of our flexible beacon we painted a thin layer of Specialty Resin's Cast-A-Mold 25T Tin Cured Silicone Rubber. The referee was concerned it may not be an allowed material. The purpose of this material is to increase the coefficient of friction between the outside of the cone and our beacon. It doesn’t leave a residue or break off onto the cone. Is this material a legal substance on the beacon?

**A:**
https://ftc-qa.firstinspires.org/admin/report
This silicone material is allowed but if it flakes off or contaminates the field, Teams maybe penalized for field damage.

(Asked by 13415 answer published at December 22nd 2022)

**Q238 Forcing a Beacon on a Cone Clarification**

**Q:**
The referee has told us that they will turn the cone/beacon over at the end of a match to determine if the beacon was forced onto the cone. When our beacon is first placed onto the cone you can turn it upside down and it will fall off, but once the robot places it on the high junction and it impacts the ground, it is pushed farther down on the cone and no longer falls off when turned upside down. Is there any reason why our beacon shouldn’t be allowed or should result in a penalty?

**A:**
The post Match test described in the question should not be performed. If it is performed, no Penalty consequences should be levied based on the results. Based on the limited information contained in the question. There is no obvious reason "why our[your] beacon shouldn’t be allowed or should result in a penalty.”

Note: Rule G26 would come into play if visual inspection of the Cone shows qualifying damage that is directly attributed to the Beacon.

(Asked by 13415 answer published at December 20th 2022)

**Q239 Can a beacon expand or contract beyond the team scoring element size constraints?**

**Q:**
Can a beacon expand or contract beyond the team scoring element size constraints during gameplay, so long as it was legal during inspection and returns to within the size constraints when scored? Our teams planned beacon changes shape when grasped by the robot but returns to it's starting shape (using spring or surgical tubing) when released.

**A:**
Yes, provided that:

1) When the Beacon is released by the Robot (i.e., Capped a Junction) it satisfies the size requirements described in Game Manual Part 1, rule TE03; and
2) During inspection, the Beacon when placed in a self-supporting position in the measuring tool, meets the size requirements (equal to or larger than 3” x 3” x 3”, and no larger than 4” x 4” x 4”).

(Asked by 18634 answer published at December 20th 2022)

**Q297 Clarification on rule 7.4 <TE06>**

**Q:**
For the design of the team signal sleeve, would simply printing one out using three lines in colors similar to the default signal sleeve design for each orientation be considered to be too closely resembling the default signal sleeve? For instance, the default has three sets of four yellow lightbulbs, would using a design that is just three horizontal yellow lines be considered to be too closely resembling the lightbulb design?

**A:**
This sounds like the type of similarity that is intended to be disallowed in TE06 ... i.e. the images too closely resemble the default images.

As a guide, if the images on your signal sleeve are correctly recognized by the default model in the SDK, they are likely in violation of TE06

(Asked by 8271 answer published at January 25th 2023)

**Q388 Legality of Beacon?**

**Q:**
Our team has come up with a beacon that is designed to push horizontally onto the Junction poles rather than going over the top of them. The beacons are equipped with two flexible "doors", shaped to guarantee they close so that the beacon completely surrounds the circumference of a Junction pole as described in the GM2 definition of Cap/Capping The beacon has been accepted at multiple state level competitions, but we would like to request a ruling as to its legality before Worlds.

**A:**
Providing the Beacon meets all the other requirements, this type of Beacon is legal.

(Asked by 7842 answer published at March 30th 2023)

**Traditional and Remote - Signal Sleeve**

**Q8 Does the team supplied signal sleeve get inspected?**

**Q:**
Per game manual part 1, there's requirements for the signal sleeve that teams would need to comply with. However, there's no mention of the signal in the inspection checklists. I teams need to present their signal during robot inspections?

**A:**
Yes.

(Asked by 8695 answer published at October 4th 2022)
Q88 Clarification on definition of images in <SS02>

Q: Please clarify the definition of 'image' as it relates to <SS02>. For example, can an 'image' be anything from a team logo to a pattern of dots to a photographic image to a barcode or QR code or anything similar as long as the 'image' in no way resembles the current season's signal image or COTS game elements and fits within the designated areas on the template?

A: An image is "a physical likeness or representation of a person, animal, or thing, photographed, painted, sculptured, or otherwise made visible." The examples you specified in your question are valid with respect to the constraints you also listed.

(Asked by 11129 answer published at October 25th 2022)

Q117 Signal Sleeve Images <SS7.5>

Q: For the images we create on the signal sleeve, can we use one large image or are we required to use three smaller images like the original supplied signal? If we can use just one large image, can it take up most of the space on the template or does it need to have a large amount of white space around it?

A: Images may be placed only in the three allowed white spaces in the template. The rest of the template must remain as is.

(Asked by 18119 answer published at November 9th 2022)

Q118 signal sleeve

Q: can we use just colored boxes for the signal sleeves?

A: Yes, Teams may place colored boxes in any of the three trapezoidal shaped spaces on the template. The space outside the three white spaces must remain as is.

(Asked by 14382 answer published at November 8th 2022)

Q131 Signal Sleeve Images <SS7.5>

Q: We asked Q117. We understand we have to keep our images to within the defined area of the template. What we needed to know was if we can fill that defined area with with a solid color or we have to have a smaller image (or images), only placed in the defined area. At inspection for our last meet judges were rather unsure about what was acceptable. Q118's answer only makes this more confusing as it is not clear if you mean an image of 3 small boxes or a solid fill of the defined area is okay.

A: Sorry for the confusion. Teams may put any image in the trapezoidal area, including filling the entire space with a solid color, pattern, etc.

(Asked by 18119 answer published at November 10th 2022)

Q275 Team number on sleeve.

Q: We were told that the team number on the sleeve can not be handwritten. Is this true?

A: That is correct. Rule 7.5 states "The intent is for Teams to add custom images and Team Numbers to the Signal Sleeve template and print their customized Signal Sleeve ahead of time. Add-ons after printing are not allowed." Writing a team number on after printing is considered an Add-on. Teams may hand write a number on the template then scan the template and print out the sleeve.

(Asked by 4327 answer published at January 18th 2023)