

Team Update 12

GENERAL

Dean's List Remote Interviews

The [list of events hosting all-remote Dean's List interviews](#) now includes the [Hangzhou Regional](#).

Event Rules

The [Event Rules](#) have been updated as follows:

E101 *Personal safety comes first. All team members must observe the following safety practices throughout the event:

- A. wear safety glasses (only ANSI-approved, UL Listed, CE EN166 rated, AS/NZS certified, or CSA rated non-shaded) while in and around the playing FIELD and in the pit area. Lightly tinted lenses are permitted provided eyes are clearly visible to others, but reflective lenses are prohibited. Accommodations will be made for participants that require tinted safety glasses. The only exception is for teams in their first 10 minutes of their load in and for the first 10 minutes pits are open each day of the event as long as they're not working on the ROBOT or setting up their pit.
- B. wear closed toed/heeled shoes.
- C. tie back long hair while working on or around a ROBOT or ROBOT related materials.
- D. wear appropriate clothing.
- E. walk in the venue.
- F. health and safety requirements in place for that event (e.g. mask wearing).

SECTION 9.8 PNEUMATIC SYSTEM

The [Inspection Checklist](#) and the [Abbreviated Inspection Checklist](#) have been updated to reflect this edit to R812.

R812 *Pressure switch requirements. The pressure switch must be connected to the high-pressure side of the pneumatic circuit (i.e. prior to the pressure regulator) to sense the stored pressure of the circuit.

...

- B. REV Robotics P/N REV-11-1107

The analog output of the sensor must be connected directly to analog input 0 of the PH (with firmware version 22.0.2 or newer) controlling the compressor.

SECTION 12 GLOSSARY

Term	Definition
CARGO RING	1 of 14 small rings used to keep the CARGO in place prior to the start of the MATCH. Rings are 1/8 in. (~3mm) thick, 1 3/4 in. (~4 cm) diameter O-rings (McMaster Item#: 9452K63)

Team Update 11

SECTION 5.1 FIELD

The FIELD is populated with the following elements:

- 1 HUB (including 1 UPPER HUB and 1 LOWER HUB),
- 2 HANGARS (a red HANGAR and a blue HANGAR),
- 2 TERMINALS, and
- 14 CARGO RINGS.

...

A run of black HDPE cable protectors extends from the guardrail on the scoring table side of the FIELD to the nearest LOWER EXIT of the HUB, straddling the CENTER LINE. A cable protector run is made up of multiple floor segments and an exit segment. The total length of the cable protector run is 10 ft. 10 $\frac{5}{8}$ in. (~332 cm). The floor segments are $\frac{3}{8}$ in. (~2 cm) tall, 7 in. (~18 cm) wide, with ~45° lead in ramps on each leading edge.

SECTION 6.7 OTHER LOGISTICS

Note that, except via the TERMINAL, ROBOTS may not deliberately cause **opponent** CARGO to leave the FIELD (see G401).

SECTION 8.3 BEFORE/AFTER THE MATCH

H312 No CARGO shots after the MATCH. After the end of the MATCH (i.e. when the timer displays 0 seconds following TELEOP), DRIVE TEAMS may not enter CARGO into the FIELD.

Violation: FOUL and any CARGO scored as a result of a violation of this rule is negated.

SECTION 9.5 MOTORS & ACTUATORS

R502 *Don't modify motors (mostly). The integral mechanical and electrical system of any motor must not be modified. Motors, servos, and electric solenoids used on the ROBOT shall not be modified in any way, except as follows:

- A. The mounting brackets and/or output shaft/interface may be modified to facilitate the physical connection of the motor to the ROBOT and actuated part.
- B. The electrical leads may be trimmed to length as necessary and connectors or splices to additional wiring may be added.
- C. The locking pins on the window motors (P/N 262100-3030 and 262100-3040) may be removed.
- D. The connector housings on KOP automotive motors listed in Table 9-1 may be modified to facilitate lead connections.
- E. Servos may be modified as specified by the manufacturer (e.g. re-programming or modification for continuous rotation).
- F. The wiring harness of the Nidec Dynamo BLDC Motor may be modified as documented by FIRST in [Nidec Dynamo BLDC Motor with Controller](#).
- G. Minimal labeling may be applied to indicate device purpose, connectivity, functional performance, etc.
- H. Any number of #10-32 plug screws may be removed from the Falcon 500.

- I. Insulation may be applied to electrical terminals.
- J. Repairs, provided the performance and specifications are unchanged.
- K. Maintenance recommended by the manufacturer.

The intent of this rule is to allow teams to modify mounting tabs and the like, not to gain a weight reduction by potentially compromising the structural integrity of any motor.

SECTION 11.2 REFEREE INTERACTION

While FMS tracks quantities of FOULS, *FIRST* instructs REFEREES to not self-track details about FOULS and TECH FOULS; as a result, we don't expect REFEREES to recall details about what FOULS and TECH FOULS were made, when they occurred, and against whom.

Team Update 10

GENERAL

Remote Judging Plans

The [list of events that have opted for remote interviews](#) has been updated to include the [Central Illinois Regional](#).

SECTION 8.1 GENERAL

The answer to [Q89](#) has been updated to reflect the edit to H101.

H101 *Be a good person. All teams must be civil toward **everyone and respectful of team and event equipment** ~~their team members, other team members, competition personnel, FIELD STAFF, and event attendees~~ while at a FIRST Robotics Competition event.

Violation: Behavior will be discussed with team or individual. Violations of this rule are likely to escalate to YELLOW or RED CARDS rapidly (i.e. the threshold for egregious violations is relatively low.)

Examples of inappropriate behavior include, but are not limited to:

- use of offensive language or other uncivil conduct, ~~and~~
- more than MOMENTARY blockage of an opponent HUMAN PLAYER from the TERMINAL or their CARGO, ~~and~~
- use of CARGO as a projectile in an attempt to inhibit an opponent ROBOT.

SECTION 9.7 CONTROL, COMMAND & SIGNALS SYSTEM

R710 *Only specified modifications to control system devices permitted. The Driver Station Software, roboRIO, PDP/PDH, PCM(s)/PH(s), VRM(s)/RPM(s), RSL, 120A breaker, motor controllers, **MXP devices used to control actuators per R713-C**, relay modules (per R503-B), wireless bridge, and batteries shall not be tampered with, modified, or adjusted in any way (tampering includes drilling, cutting, machining, rewiring, disassembling, painting, etc.), with the following exceptions:

SECTION 10 INSPECTION & ELIGIBILITY RULES

At each event, the Lead ROBOT INSPECTOR (LRI) has final authority on the legality of any COMPONENT, MECHANISM, or ROBOT. INSPECTORS may re-inspect ROBOTS at any time to ensure compliance with the rules. Teams are encouraged to consult with INSPECTORS or the LRI if they have any questions regarding the legality of a ROBOT or about how to make a ROBOT legal.

The inspection process may progress in blocks, i.e. it may pause for a team's Practice MATCH, slot on the practice field, lunch break, etc. The process may employ various INSPECTORS throughout the process based on availability. At the team's discretion, they may request a different INSPECTOR or invite the Lead ROBOT INSPECTOR to participate in their ROBOT'S inspection.

Team Update 09

GENERAL

Judged Awards at Small Events

At typical *FIRST* Robotics Competition official events, 15 judged team awards are presented. We think this is an appropriate number; it allows a decent percentage of teams to be celebrated for their accomplishments and keeps awards special and valued.

This season, we have a few multi-day events that are smaller than we see during a normal season. We think giving out the full set of the 15 judged team awards at these events devalues the awards and makes it harder to match individual awards with deserving teams.

For this reason, any multi-day event with 24 or fewer teams will present the following:

- Chairman's Award,
- Engineering Inspiration Award, and
- 6 additional awards, selected by the event judges to best fit participating teams.

Individual awards, i.e. Dean's List and Woodie Flowers Finalist Awards, are unaffected. This approach does not apply to single day events; [check this document for how single-day-event awards will be handled](#). The [Awards page](#) has been updated with this information.

FIRST Championship District Allocation Adjustments

Since establishing the *FIRST* Championship allocations for districts before Kickoff, team counts for some districts have changed, some substantially. If *FIRST* Championship slot allocations remained as is, some Districts would be unfairly under- or over-represented. For this reason, we have reallocated slots based on recent team counts.

As a result, three district allocations increased and one decreased, and these changes are reflected below and on the [FIRST Championship Eligibility Criteria webpage](#). If we strictly followed the numbers, other districts would have lost a slot. However, we are not changing the allocations in those cases, as those changes would have been drops for districts that already have a relatively small allocation and it's too small a change to worry about.

The allocation changes flow through to awards. The new allocations determine maximum and minimum award counts per the standard formula and resulting changes are also reflected.

District	Allocated <i>FIRST</i> Championship Slots	Chairman's Award Winners	Dean's List Finalists
<i>FIRST</i> in Michigan	61 64	3 4	10 11
Ontario	16 11	2 1	3 2
<i>FIRST</i> in Texas	21 23	2 3	4
Peachtree	9 10	1	2

Remote Judging Plans

The [list of events that have opted for remote interviews](#) has been updated to include the [Southern Cross Regional](#).

SECTION 6.6. DRIVE TEAM

Section 6.6 is updated as follows to enable a response to [Q88](#).

A DRIVE TEAM is a set of up to 5 people from the same *FIRST* Robotics Competition team responsible for team performance for a specific MATCH. There are 4 specific roles on a DRIVE TEAM which ALLIANCES can use to assist ROBOTS with RAPID REACT. Only 1 of the 5 DRIVE TEAM members is permitted to be an adult mentor **a non-STUDENT**.

Table 6-4 DRIVE TEAM roles

Role	Description	Max./ DRIVE TEAM	Criteria
COACH	a guide or advisor	1	STUDENT or adult mentor any team member , must wear "COACH" button
DRIVER	an operator and controller of the ROBOT	3	STUDENT, must wear a "DRIVE TEAM" button
HUMAN PLAYER	a CARGO manager		
TECHNICIAN	a resource for ROBOT troubleshooting, setup, and removal from the FIELD	1	STUDENT or adult mentor any team member , must wear "TECHNICIAN" button

Team Update 08

GENERAL

Control System Update

[An update to the NI FRC Game Tools \(version 2022 f1\) has been posted.](#) This update includes the 2022_v4.0 image which corrects issues with Analog Devices gyros and addressable LEDs as well as fixes to a few bugs reported in the LabVIEW libraries. R701 and the [Inspection checklists](#) now reflect this requirement.

An update to [WPILib C++\Java \(version 2022.3.1\) has been posted.](#) This update supports use with (and only works with) the 2022_v4.0 roboRIO image as well as a few other minor bugfixes.

Remote Judging Plans

The [list of events that have opted for remote interviews](#) has been updated to include the [SBPLI Long Island Regional #1](#) and [SBPLI Long Island Regional #2](#).

Rookie Award Eligibility

The Rookie Award descriptions on the [Team Attributes Awards page](#) have been updated to clarify that both 2021 & 2022 Rookies are eligible for Rookie Awards.

SECTION 9.5 MOTORS & ACTUATORS

R501 ***Allowable motors.** The only motors and actuators permitted include the following (in any quantity):

Table 9-1 Motor allowances

Motor Name	Part Numbers Available
Electrical solenoid actuators, no greater than 1 in. (nominal) stroke and rated electrical input power no greater than 10 watts (W) continuous duty at 12 volts (VDC) (if qualifying actuator is then used at 24V, it must be approved by the manufacturer for use at 24V)	

SECTION 9.7 CONTROL, COMMAND & SIGNALS SYSTEMS

R701 ***Control the ROBOT with a roboRIO.** ROBOTS must be controlled via 1 programmable NI roboRIO or roboRIO 2.0 (P/N am3000 or am3000a, both versions referred to throughout this manual as “roboRIO”), with image version 2022_v3.0 **2022_v4.0** or later.

Team Update 07

GENERAL

Autodesk Inventor Files

A zip folder containing the .STEP and converted Autodesk Inventor file formats for the playing field is available from [the Playing Field page](#).

Remote Judging & Single-Day Event Plans

The [list of events that have opted for remote interviews](#) has been updated to include the [Ventura County Regional](#) and the [Aerospace Valley Regional](#).

The [2022 Remote Judging Plan](#) and the [Single-Day Event Plan](#) have been updated to note that

- teams may submit their summary business plan to be eligible for the Entrepreneurship Award and
- teams remain eligible for awards even if they are unable attend their remotely judged event due to COVID restrictions or precautions.

SECTION 9.6 POWER DISTRIBUTION

R620 *Only use specified fuses in PDP/PDH. The only fuses permitted for use in the PDP/PDH are mini automotive blade fuses (ATM style) with the following values:

- for the PDP, values matching the value printed on the device's corresponding fuse holder and
- for the PDH, 15A or lower with the exception of a single 20A fuse for powering a PCM or PH.

R621 *Protect circuits with appropriate circuit breakers. Each branch circuit must be protected by 1 and only 1 circuit breaker or fuse on the PDP/PDH per Table 9-3. No other electrical load can be connected to the breaker or fuse supplying this circuit.

Table 9-3 Branch circuit protection requirements

Branch Circuit	Circuit Breaker Value	Quantity Allowed Per Breaker
PCM/PCH – with compressor	Up to 20A	1
Additional VRM (non-radio)/Additional PCM/PCH (non-compressor)	Up to 20A	3 total

R622 *Use appropriately sized wire. All circuits shall be wired with appropriately sized insulated copper wire (SIGNAL LEVEL cables don't have to be copper):

Table 9-4 Breaker and wire sizing

Application	Minimum Wire Size
6 – 20A breaker protected circuit	18 AWG
11-15 20A fuse protected circuit	(19 SWG or 1 mm ²)

SECTION 11.6.3 QUALIFICATION RANKING

Table 11-2 Qualification MATCH ranking criteria

Order Sort	Criteria
1 st	Ranking Score
2 nd	Average ALLIANCE MATCH points, not including FOULS
3 rd	Average ALLIANCE HANGAR points
4 th	Average ALLIANCE TAXI + AUTO CARGO points
5 th	Random sorting by the FMS

Team Update 06

GENERAL

Drivers' Meetings

Drivers' Meetings are hosted early in each event. Attendees are invited to submit questions for Key Volunteers about rules, field procedures, or match flow in advance and attend from the stands. The process by which they'll be hosted is posted on the [Event Experience webpage](#).

Remote Judging Interviews

As described in [this recent blog](#), events decide if they prefer to host all judged awards interviews remotely. To date, [the list of events that have opted for remote interviews](#) has been updated to include the Minnesota regionals.

The previously published [list of events that have opted to do all Dean's List interviews remotely](#) now includes *FIRST* Indiana events.

Both lists are updated as events relay their decision, and changes are noted in the subsequent Team Update.

SECTION 9.6 POWER DISTRIBUTION

R617 *Power radio as specified – Part 2. The device supplying power to the wireless bridge per R616 must be connected to either:

- A. the designated supply terminals at the end of the PDP, as shown in Figure 9-14. With the exception of a single CTR Electronics Pneumatics Control Module (PCM, P/N am-2858) or REV Robotics Pneumatic Hub (PH, P/N REV-11-1852), no other electrical load shall be connected to these PDP terminals.

Team Update 05

GENERAL

Inspection Checklist

The "Team Compliance Statement" on the [Inspection Checklist](#) has been edited to refer to the 2022 Kickoff instead of the 2020 Kickoff.

Team Update 04

GENERAL

FIRST Choice

FIRST Choice Round 2 has ended, and AndyMark is processing priority lists. Since Round 2 opened, three inventory discrepancies have been discovered. This means that for the following items, fewer items will be available when FIRST Choice opens for normal ordering than what might be expected (AndyMark's confirmed that inventories still exceed demand from priority lists, so these changes have not impacted number of parts assigned to Round 2 priority lists).

- PSoC prototyping kits, PN CY8CKIT-059: 90 short (actual 1,207)
- Duct Tape, Blue, PN 70006315231: 840 short (actual 2,028)
- Duct Tape, Yellow, PN 70006315199: short 24 (actual 2,678)

Single-Day Event Plan

The [Single-Day Event plan](#) has been updated to include links to inspection checklists and emphasis that Inspection is required at the event itself.

SECTION 5.3 HUB

An agitator extends up the center of each HUB and rotates throughout the MATCH. **The motors driving the agitator assemblies are supplied with (nominal) 12V each, and their direction may vary from MATCH to MATCH.** Generally, the agitator causes a single CARGO dropped into the UPPER HUB to reenter play in approximately 7 seconds and a CARGO dropped in the LOWER HUB to reenter play in approximately 5 seconds.

SECTION 5.7 CARGO

CARGO is inflated to 3½ psi. **±½ psi.** (checked **every morning and lunch break and as outliers are suspected** using [this gauge](#) at official events).

SECTION 8 GAME RULES: HUMANS

FIRST is committed to [Equity, Diversity, and Inclusion](#) and as such, FIRST makes reasonable accommodations for persons with disabilities that request accommodation. If a participant needs an accommodation for an event, please talk to a volunteer at the event or contact local leadership before the event so they can help ensure the accommodation is provided. ~~Accommodations are determined reasonable given they do not create an undue hardship or cause safety concerns.~~

Accommodations are adjustments that allow all people with disabilities to access the building and participate in the game. Accommodations are determined reasonable given they do not create an undue hardship or cause safety concerns.

SECTION 10 INSPECTION & ELIGIBILITY RULES

The links to inspection checklists in the Blue Box now point to the live documents.

Team Update 03

GENERAL

Venue Heights

Teams can expect at least 16 ft. of clearance above the surface of the FIELD. Most venue practice fields, but not all, also have this clearance. All practice fields have at least 10 ft. of clearance above the carpet.

Dean's List Update

The remote [2022 Dean's List Award - District & Regional Event Remote Interviews List](#) (hosted on the [Submitted Awards](#) page) now includes the Great Northern Regional and all Minnesota regional events.

Event Rules

Please note the [Safety Manual](#) has been edited to reflect this exception.

- E101 *Personal safety comes first.** All team members must observe the following safety practices throughout the event:
- A. wear safety glasses (only ANSI-approved, UL Listed, CE EN166 rated, AS/NZS certified, or CSA rated non-shaded) while in and around the playing FIELD and in the pit area. Lightly tinted lenses are permitted provided eyes are clearly visible to others, but reflective lenses are prohibited. Accommodations will be made for participants that require tinted safety glasses. **The only exception is for teams in their first 10 minutes of their load in and for the first 10 minutes pits are open each day of the event as long as they're not working on the ROBOT or setting up their pit.**

WPILib Update

An [update for WPILib C++/Java](#), v2022.2.1, has been released. This version fixes a significant bug with joystick data locking up in Java programs, as well as an issue with WPILib tools not launching or quitting unexpectedly. It is strongly recommended that all Java teams upgrade to this version and recommended that C++ teams do as well.

SECTION 5.6.1.1 DRIVER STATION LED STRINGS

DRIVER STATION light strings remain active after TELEOP ends and turn off 5 seconds later (to indicate that the time frame described in [Section 6.4, item C](#) is complete).

SECTION 6.4.1 POINT VALUES

A ROBOT may only earn points for a single RUNG. To qualify for HANGAR points from a given RUNG, a ROBOT may only be contacting:

- RUNG(S) at that level or higher (i.e. the level is determined by the lowest RUNG with which a ROBOT is in contact),
- truss structure,
- LAUNCH PADS,
- the ALLIANCE WALL,
- **CARGO,**
- guardrails, and/or

- another ROBOT qualified for any HANGAR points.

SECTION 11.7.6 SMALL EVENT EXCEPTIONS

District points for Draft Order Acceptance (per [Section 11.8.1.3 Playoff Round Performance](#) [Section 11.8.1.2 ALLIANCE Selection Results](#)) are awarded as if a full set of ALLIANCES was selected (i.e. the second selection of the 3-seed ALLIANCE still receive 3 points regardless of how many ALLIANCES are formed).

SECTION 11.8.2 DISTRICT CHAMPIONSHIP ELIGIBILITY

Table 11-8 2022 District Championship Capacities

District Championship	Capacity
Pacific Northwest District Championship	42 50

Team Update 02

GENERAL

Playing Field Page

A [link to resources to 3D print a RAPID REACT FIELD](#), courtesy of AutomationDirect has been added to the [Playing Field page](#).

Virtual Kit of Parts

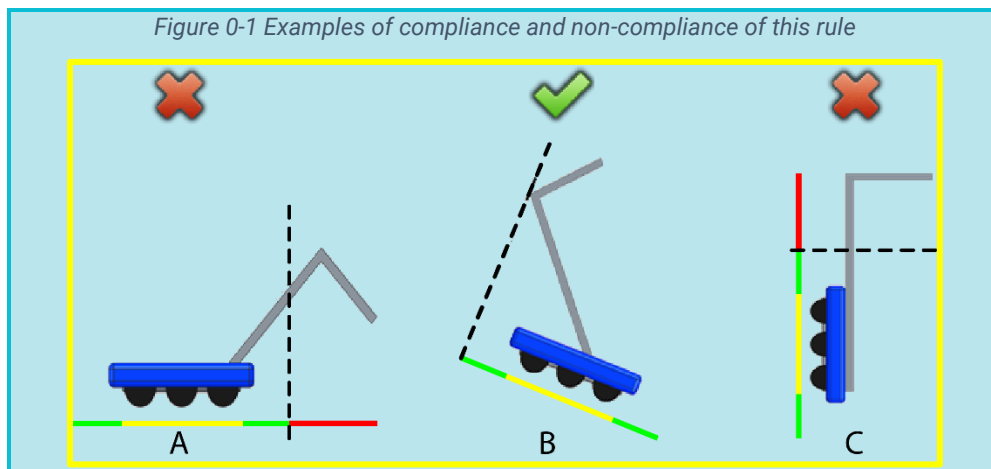
The codes initially loaded for Tableau were corrupted. We've re-uploaded the codes, and initial testing indicates the issue has been resolved. Please retrieve your new code from the Dashboard before authenticating the Tableau software. Our apologies for the inconvenience!

SECTION 5.7 CARGO

CARGO is inflated to 3½ psi. (checked using [this gauge](#) at official events).

SECTION 7.1 ROBOT RESTRICTIONS

G107 *Figure 7-2, example C has been modified to show the extension reaching beyond the ROBOT'S FRAME PERIMETER.*



SECTION 7.4 CARGO

G405 **Don't catch CARGO.** A ROBOT may not REPEATEDLY score or gain greater-than-MOMENTARY CONTROL of CARGO released by an UPPER EXIT until and unless that CARGO contacts anything else besides that ROBOT or CARGO controlled by that ROBOT.

SECTION 8 GAME RULES: HUMANS

FIRST is committed to [Equity, Diversity, and Inclusion](#) and as such, FIRST makes reasonable accommodations for persons with disabilities that request accommodation. If a participant needs an accommodation for an event, please talk to a volunteer at the event or contact [local leadership](#) before the event so they can help ensure the accommodation is provided. Accommodations are determined reasonable given they do not create an undue hardship or cause safety concerns.

SECTION 9.3 BUDGET CONSTRAINTS & FABRICATION SCHEDULE

Item C is removed from R304 because charging batteries is not considered "work on" the robot and does not apply.

R304 *During an event, only work during pit hours. During an event a team is attending (regardless of whether the team is physically at the event location), the team may neither work on nor practice with their ROBOT or ROBOT elements outside of the hours that pits are open, with the following exceptions:

- A. exceptions listed in R302, other than R302-E-c and
- B. software development, and
- C. ~~batteries may be charged during the designated load-in time.~~

SECTION 9.7 CONTROL, COMMAND, & SIGNAL SYSTEMS

R701 *Control the ROBOT with a roboRIO. ROBOTS must be controlled via 1 programmable NI roboRIO or roboRIO 2.0 (P/N am3000 or am3000a, both versions referred to throughout this manual as "roboRIO"), with image version ~~2022_v2.4~~ 2022_v3.0 or later.

R715 *Control PCM/PH(S) and Servo Hubs from roboRIO. Each PCM/PH and REV Robotics Servo Hub must be controlled with signal inputs sourced from the roboRIO and passed via a CAN bus connection from the built-in CAN on the roboRIO (either directly or daisy-chained via another CAN bus device).

SECTION 12 GLOSSARY

Carriage returns have been fixed in the glossary version of the definition of CONTROL.

Term	Definition
CONTROL	the state of a CARGO if any of the following are true: <ul style="list-style-type: none">A. the CARGO is fully supported by the ROBOT,B. the CARGO travels across the FIELD such that when the ROBOT changes direction, the CARGO travels with the ROBOT,C. the ROBOT is holding CARGO against a FIELD element in attempt to guard or shield it, orD. the ROBOT is preventing a CARGO from leaving a LOWER EXIT.

Team Update 01

GENERAL

Control System

The 2022 NI Driver Station software does not run on machines employing Windows 7 (e.g. Classmate PCs or Acer Aspire PCs distributed in Kickoff Kits from 2010-2016) because NI no longer supports Windows 7 as Microsoft ended support for it on January 14, 2020.

Field Tour Videos

The narration in the [2022 Field Tour Video: Hub](#) states an incorrect number of AUTO CARGO required to decrease the CARGO BONUS threshold (states 4 instead of 5). A note has been added in the video description, the close captioning has been updated, and a pop-up has been edited in to correct the number.

Kit of Parts

Drive Base Kit

- Due to a delivery error, some [Drive Base Kits](#) shipped without the 160-tooth belts (part number 800-5M-15).
- Due to a manufacturing error, some [Drive Base Kits](#) shipped with out-of-spec hubs (part number am-4124). The issue is that the center hex hole is not concentric with rest of hub, which could cause assembly and performance issues. To check your hub and learn more about this issue, please refer to [this document](#) published by AndyMark. Some hubs have already been replaced by Kickoff locations that received “good” hubs to distribute with the Kickoff Kits.
- We’re so sorry for these disruptions. Please make sure to inventory your Kickoff Kit and report any missing/damaged/out-of-spec items, including belts and hubs if applicable, using the replacement parts request system (described on the [Kickoff Kit section of the Kit of Parts page](#)) by noon, Friday January 14, 2022.

REV Robotics Compliant Wheel Part Number

The part number listed on the REV Robotics box (in the [Everyone Tote](#)) for the compliant wheel should be REV-21-2030.

Voucher Book

Consider adding the following Voucher Suppliers to the checklist in your Kickoff Kit and at the start of the [2022 Virtual Kit Catalog](#):

- [Swyft Robotics](#)
- [TE Connectivity](#)
- [monday.com](#)
- [Upverter](#)

Please note that the Digi-Key voucher does not apply to Marketplace products.

The following vouchers do not require a code from the team’s dashboard (i.e. the “Access Code:” field on their pages should be “n/a”): Digi-Key, DriveWorks, Mastercam, One IPM, and SolidProfessor.

Kit of Parts Webpage

A link to a [SOLIDWORKS video](#) describing how to access models of Kickoff Kit items has been added to the [Kickoff Kit section of the page](#).

Playing Field Assets

The following assets have been added:

- a link to a [SOLIDWORKS blog](#) with additional information about using SOLIDWORKS field assets.
- field CAD in Onshape
 - [Full Version](#)
 - [Light-weight Version](#) (some nuts and bolts removed to improve load time, recommended for use with Chromebooks or if limited internet connection)
- additional VR tools and references from AutomationDirect.com
 - a link to AutomationDirect.com's [Oculus Quest Support Page](#)
 - [Oculus Quest installation instructions](#)
 - a link to AutomationDirect.com's [SteamVR Support Page](#)
 - [VR Experience for SteamVR](#)
- [Machine Learning imagery](#) from WPI
- drawing [TE-22330](#) which details the Team Element: Cable Protector
- flat versions of the UPPER HUB Plastic (TE-22197) and UPPER HUB Vision Plastic (TE-22201) are included as STEP and SOLIDWORKS Part files in the [Complex Hub Team Element zip packet](#)
- specific links to Team Element assembly drawings in the [Drawings section of the Playing Field Page](#).

The following assets have been modified:

- [Team Element: Complex Hangar](#)
 - A note has been added to TE-22310 to clarify the location of LOW RUNG relative to the other RUNGS.
 - A note has been added to TE-22316 and TE-22322 to clarify RUNG heights when floor protection is absent.
 - The LOW RUNG has been raised by ½ in. on TE-22316 to better match the official FIELD.
- [RAPID REACT specific](#) drawing package (Official Element: HUB)
 - The angle of the plastic ramp in the LOWER EXIT has changed from 5° to 7½° and is reflected in the *FIRST* official CAD model, GE-22324, and all parent assemblies.
- [Team Element: Hub Complex Read Me](#) has been updated to change the quantity of 4 in. x 4 in. x 8 ft. lumber pieces from 6 to 8.

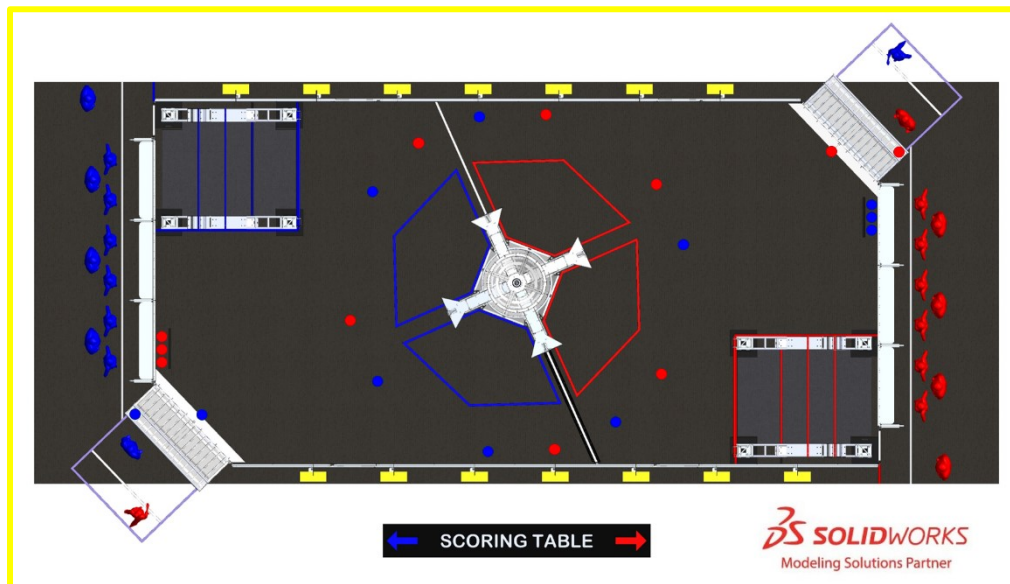
SECTION 5.8 VISION TARGETS

The distance from FIELD carpet to the top of the target assembly is 8 ft. 8 in. (~264 cm); the distance from FIELD carpet to the bottom of the vision tape is 8 ft. 5½ in. (~258 cm).

SECTION 6.1 SETUP

Figure 6-1 is updated to correct the starting location for CARGO not staged in ROBOTS.

Figure 6-1 MATCH setup



SECTION 7.2 ROBOT TO ROBOT INTERACTION

G210 **During AUTO, no defense.** During AUTO, a ROBOT with any part of its BUMPERS on the opposite side of the FIELD (i.e. on the other side of the CENTER LINE from its ALLIANCE'S TARMACS) may contact neither an opponent ROBOT nor CARGO still in its staged location on the opposite side of the FIELD **nor an opponent ROBOT.**

Violation: TECH FOUL

SECTION 8.4 DURING THE MATCH: AUTO

H404 **AUTO CARGO delivery.** **During AUTO,** CARGO may only be introduced to the FIELD by a HUMAN PLAYER in a TERMINAL AREA.

Violation: FOUL per CARGO.

SECTION 8.5 DURING THE MATCH

H504 **TELEOP CARGO delivery.** **During TELEOP,** CARGO may only be introduced to the FIELD

- A. by a HUMAN PLAYER and
- B. through the GUARD.

Violation: FOUL per CARGO.

SECTION 9

Throughout this document, the acronym PCH (Pneumatic Control Hub) is changed to PH (Pneumatic Hub).

SECTION 9.5 MOTORS & ACTUATORS

R501

Table 9-1 Motor allowances

Motor Name	Part Numbers Available	
Current/former KOP automotive motors	Denso AE235100-0160	Denso 262100-3040
	Denso 5-163800-RC1	Bosch 6 004 RA3 194-06
	Denso 262100-3030	Johnson Electric JE-PLG-149
		Johnson Electric JE-PLG-410

R503 *Power (most) actuators off of approved devices. With the exception of servos, fans, or motors integral to sensors of COTS computing devices permitted in R501, each actuator must be controlled by a power regulating device. The only power regulating devices for actuators permitted on the ROBOT include:

- B. relay modules,
 - a. Spike H-Bridge Relay (P/N 217-0220 and SPIKE-RELAY-H),
 - b. Automation Direct Relay (P/N AD-SSR6M12-DC-200D, AD-SSRM6M25-DC-200D, AD-SSR6M45-DC-200D), and
 - c. Power Distribution Hub (PDH) switched channel (P/N REV-11-1850) for controlling non-actuator CUSTOM CIRCUITS only,

R504 *Don't overload controllers. Each power regulating device may control electrical loads per Table 9-2. Unless otherwise noted, each power regulating device shall control 1 and only 1 electrical load.

Table 9-2 Power regulating device allotments

Electrical Load	Motor Controller	Relay Module	Pneumatics Controller
AndyMark PG			
KOP Automotive Motors			
NeveRest	Yes (up to 2 per controller)	Yes	No
Snow Blower Motor			
REV Robotics HD Hex			

R505 *Control servos safely. Servos must be connected to, and only to, 1 of the following:

- A. PWM ports on the roboRIO,
- B. PWM ports on a WCP Spartan Sensor Board (P/N WCP-0045), or
- C. REV Robotics Servo Power Module (P/N REV-11-1144), or
- D. REV Robotics Servo Hub (P/N REV-11-1855).

SECTION 9.6 POWER DISTRIBUTION

R615 *Power roboRIO as specified. The roboRIO power input must be connected to either:

- B. the terminals of 1 of the non-switchable fused channels on the PDH (20,21,22) with a 10A fuse installed in the associated fuse holder.

No other electrical load shall be connected to these terminals that channel.

SECTION 9.8 PNEUMATIC SYSTEM

R812 *Pressure switch requirements. The pressure switch must be connected to the high-pressure side of the pneumatic circuit (i.e. prior to the pressure regulator) to sense the stored pressure of the circuit.

It must be either:

- B. REV Robotics P/N REV-11-1107

The analog output of the sensor must be connected directly to 1 of the analog pressure sensor inputs **analog input 0** of the PCH controlling the compressor.

SECTION 11.1 MATCH SCHEDULE

The top-right label in Figure 11-1 was updated as follows: ~~PLAYER STATION~~ **DRIVER STATION**.

Figure 11-1 Sample MATCH schedule

Qualification Match Schedule								
Matches Per Team		10	Event Name					
Time	Description	Match	Blue 1	Blue 2	Blue 3	Red 1	Red 2	Red 3
Thu 2:30	Qualification 1	1	1	2	3	4	5	6
Thu 2:37	Qualification 2	2	7	8	9	10	11*	12
Thu 2:44	Qualification 3	3	13	14	15*	16	17	18

ALLIANCE Red or Blue

DRIVER STATION number 1, 2, or 3

MATCH Start Time

MATCH Type

MATCH Number

Asterisk (*) indicates SURROGATE MATCH

SECTION 11.4 MEASUREMENT

T401 *Freeze, ROBOT. During the period when the ARENA is open for measurement, ROBOTS can be enabled, but cannot move (i.e. neither the ROBOT, nor anything on the ROBOT, can move) **may neither drive, extend outside their frame perimeter**, nor can they interact with (e.g. score, push, pickup, etc.) CARGO, the HUB, the HANGAR, or other FIELD elements.

Violation: Verbal warning. If subsequent violations at any point during the event or egregious YELLOW CARD.

SECTION 11.8.1.4 AWARDS

In many ways, the team's experience in being selected for awards, especially the Chairman's Award, the Engineering Inspiration Award, and the Rookie All Star Award **(which is optional for District Championship events)**, is beyond measure, and could not be fully captured in its entirety by any points-based system.

SECTION 11.8.2 DISTRICT CHAMPIONSHIP ELIGIBILITY

Table 11-8 2022 District Championship Capacities

District Championship	Capacity
Michigan State Championship	200 160

SECTION 12 GLOSSARY

Term	Definition
CONTROL	the state of a CARGO if any of the following are true: A. the CARGO is fully supported by the ROBOT, B. the CARGO travels across the FIELD such that when the ROBOT changes direction, C. the CARGO travels with the ROBOT, the ROBOT is holding CARGO against a FIELD element in attempt to guard or shield it, or D. the ROBOT is preventing a CARGO from leaving a LOWER EXIT.