



FIRST Power Up Rules important to drive team

Spartronics 4915



Objectives

- Cover the Power Up game rules critical to the drive team
- Organize the rules in a way that that makes them easy to learn & remember
- Highlight specific rules that are very important and/or at risk of being missed when scanning the manual. These will be in **yellow like this**.



Section One

Rules the entire drive team should know

Scoring including RPs (from section 4.2)

An ALLIANCE can earn up to four (4) Ranking Points (RP) per Qualification MATCH, as described in Table 4-1. There are no RP, or comparable point bonuses, in Playoff MATCHES.

Table 4-1: FIRST® POWER UPSM rewards

Action	Criteria	MATCH Points		Ranking Points
		AUTO	TELEOP	
AUTO-RUN	For each ROBOT that breaks the vertical plane of the AUTO LINE with its BUMPER at any point in the AUTO stage	5	-	-
OWNERSHIP	SCALE	2 + 2/sec	1 + 1/sec	-
	ALLIANCE'S SWITCH	2 + 2/sec	1 + 1/sec	-
VAULT	For each POWER CUBE placed in the VAULT	-	5	-
PARKING	For each ROBOT fully supported by the SCALE (either directly or transitively), not at all in the opponent's PLATFORM ZONE, and has not CLIMBED	-	5	-
CLIMBING	For each ROBOT fully supported by the SCALE (either directly or transitively) with BUMPERS fully above the BRICKS at T=0, not in direct contact with their PLATFORM, and not at all in the opponent's PLATFORM ZONE	-	30	-
FACE THE BOSS	All three (3) ALLIANCE ROBOTS have CLIMBED or two (2) ROBOTS have CLIMBED and the ALLIANCE has played the LEVITATE POWER UP	-	-	1
AUTO QUEST	ALLIANCE completes three (3) AUTO-RUNS and has OWNERSHIP of their SWITCH at T=0 of the AUTO stage	-	-	1
Win	ALLIANCE's final MATCH score exceeds their opponents'	-	-	2
Tie	ALLIANCE's final MATCH score equals their opponents'	-	-	1

Points are earned for establishing OWNERSHIP, with additional points earned for each additional second of OWNERSHIP. For example, a team that establishes OWNERSHIP of their SWITCH three (3) seconds after the start of AUTO and maintains OWNERSHIP for five (5) seconds earns two (2) points + ten (10) points, for a total of twelve (12) points.

The MATCH points listed in Table 4-1 for OWNERSHIP during the TELEOP stage are increased if the BOOST POWER UP is played. See [Section 4.3](#) for details on BOOST.

AUTO-RUN and CLIMBING are both evaluated and scored by human REFEREES. Teams are encouraged to make these actions obvious and unambiguous.

Power Ups (from section 4.3)

Table 4-2: POWER UPS

Name	# of POWER CUBES	Effect	Duration (seconds)
LEVITATE	3	An additional CLIMBING ROBOT, up to a maximum of three (3) ROBOTS, is credited to the ALLIANCE at the end of the MATCH	N/A
FORCE	1	ALLIANCE earns OWNERSHIP points from their SWITCH regardless of PLATE position	10
	2	ALLIANCE earns OWNERSHIP points from the SCALE regardless of PLATE position	10
	3	ALLIANCE earns OWNERSHIP points from the SWITCH and the SCALE regardless of PLATE position	10
BOOST	1	Doubles the points being earned by the ALLIANCE for OWNERSHIP of their SWITCH.	10
	2	Doubles the points being earned by the ALLIANCE for OWNERSHIP of the SCALE.	10
	3	Doubles the points earned by the ALLIANCE for OWNERSHIP of a) their SWITCH and b) the SCALE.	10

If LEVITATE is played the CLIMB is credited randomly to any ROBOT on the ALLIANCE who is not PARKING or CLIMBING at the end of the MATCH. If all ROBOTS on the ALLIANCE are either PARKING or CLIMBING, one randomly chosen PARKING ROBOT will be upgraded from PARKING to CLIMBING.

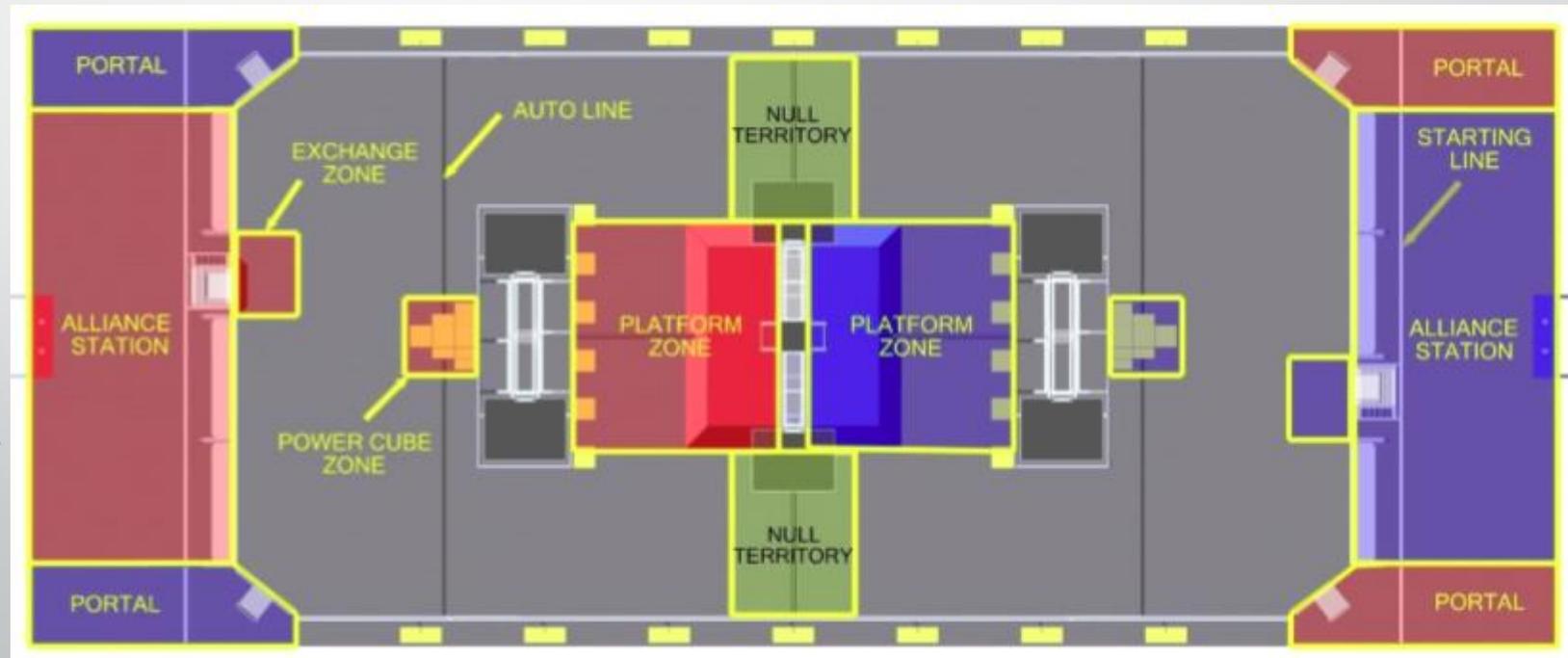
An ALLIANCE plays a POWER UP by pressing the corresponding button on the VAULT. Only one (1) instance of the FORCE or BOOST POWER UP can be active at a time. If an ALLIANCE pushes the button for FORCE/BOOST while their other FORCE/BOOST is active, the button press is ignored. The LEVITATE POWER UP can be played at any time during the TELEOP stage.

A POWER UP is active for the duration listed in Table 4-2. If an ALLIANCE plays BOOST or FORCE during the time when an opposing ALLIANCE's POWER UP is active, the POWER UP is queued and becomes active immediately upon the conclusion of the currently active POWER UP. Once a POWER UP is played, it cannot be cancelled.

Field Areas (from section 3.1)

Note: Platform zones mean nothing until climbing time (last 30 seconds). Either alliance can drive in either platform zone without risk before then.

- **ALLIANCE STATION:** a 22 ft. (~671 cm) wide by 10 ft. (~305 cm) deep by 10 ft. (~305 cm) tall volume formed by, and including three (3) PLAYER STATIONS, an EXCHANGE wall, and 2 in. ALLIANCE colored gaffers tape.
- **AUTO LINE:** a line of 2 in. (~5 cm), black gaffers tape that is the width of the FIELD and is 10 ft. (~305 cm) from each ALLIANCE WALL to the leading edge of the tape.
- **ALLIANCE WALL** to the leading edge of the tape.
- **EXCHANGE ZONE:** A rectangular area 4 ft. (~122 cm) wide by 3 ft. (~91 cm) deep and infinitely tall volume bounded by the EXCHANGE wall and 2 in. (~5 cm) ALLIANCE colored gaffers tape. The EXCHANGE ZONE includes the tape, but excludes the wall.
- **NULL TERRITORY:** one of two, 7 ft. 11 ¼ in. (~242 cm) wide by 6 ft. (~183 cm) deep and infinitely tall volumes formed by 2 in. (~5 cm), white gaffers tape and the GUARDRAILS. The NULL TERRITORY includes the gaffers tape, but excludes the GUARDRAILS. The ALLIANCE'S NULL TERRITORY for a MATCH corresponds to the SCALE PLATE color in that NULL TERRITORY and does not change when the FORCE POWER UP is played.
- **PLATFORM ZONE:** a 11 ft. 1 ½ in. (~339 cm) wide by 9 ft. 11 ¾ in. (~304 cm) deep and infinitely tall volume bounded by 2 in. (~5 cm) ALLIANCE colored gaffers tape, the faces of the OUTRIGGERS, TOWER, and the SWITCH. The PLATFORM ZONE includes the gaffers tape, but excludes the SWITCH and the faces of the OUTRIGGERS AND TOWER.
- **PORTAL:** a 4 ft. (~122 cm) wide by 12 ft. 11 in. (~394 cm) deep infinitely tall volume bounded by, and including, 2 in. (~5 cm). ALLIANCE colored gaffers tape and the PORTAL wall.
- **POWER CUBE ZONE:** A rectangular area 3 ft. 9 in. (~114 cm) wide by 3 ft. 6 in. (~107 cm) deep, bounded by the SWITCH and 2 in. (~5 cm) ALLIANCE colored gaffers tape. The POWER CUBE ZONE includes the gaffers tape, but excludes the SWITCH.
- **STARTING LINE:** a line of 2 in. (~5 cm), white gaffers tape that runs the width of the carpet and is 2 ft. 6 in. (~76 cm) behind the ALLIANCE WALL diamond plate, which includes the tape.



3.5 Plate Lighting – what do the colors mean?

- Each PLATE is highlighted by Philips Color Kinetics Flex LED light strings. These lights indicate ALLIANCE color and OWNERSHIP. The lights have the following states:

Table 3-1: PLATE Lighting

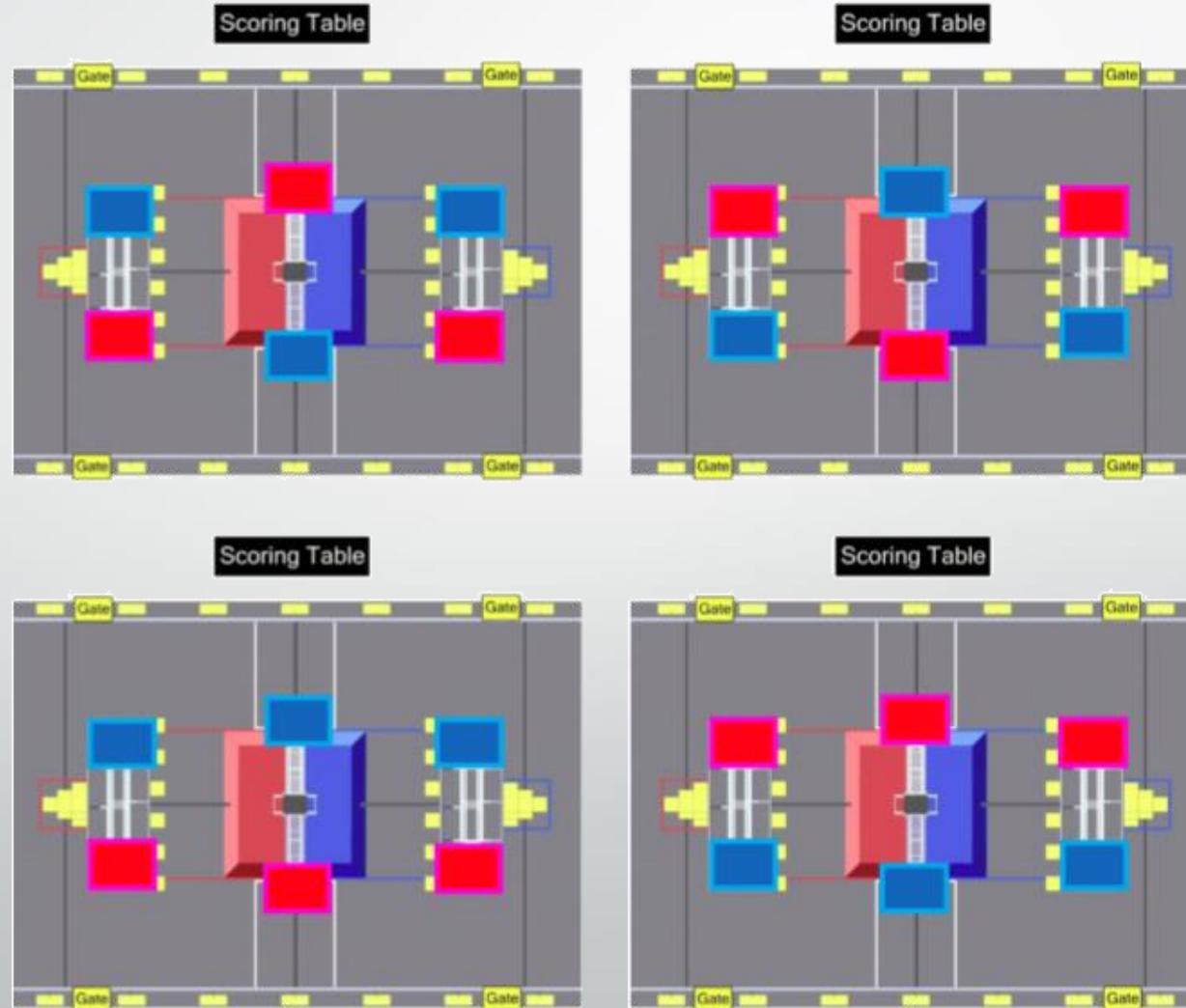
Color	Pre-MATCH	AUTO	TELEOP	Post-MATCH
Blue at 100% brightness			ALLIANCE color	
Blue (pulsing)			Blue OWNERSHIP	
Blue (pulsing) with solid red corners		N/A	Blue FORCE POWER UP is active	
Blue at 25% brightness			Red OWNERSHIP	
Blue (chase pattern)		N/A	Blue BOOST POWER UP is active	
Red at 100% brightness			ALLIANCE color	N/A
Red (pulsing)	N/A		Red OWNERSHIP	
Red (pulsing) with solid blue corners		N/A	Red FORCE POWER UP is active	
Red at 25% brightness			Blue OWNERSHIP	
Red (chase pattern)		N/A	Red BOOST POWER UP is active	
Purple (pulsing)				FIELD is safe for FIELD STAFF
Green			N/A	FIELD is safe for all
OFF	MATCH ready to start			N/A

- ALLIANCE color of the PLATES is provided to the Driver Station software by the Field Management System. More details are in Section 3.10 The Field Management System

Possible Plate Assignments (from 4.11)

Prior to the start of AUTO, the assignments of ALLIANCE colors for SWITCH and SCALE PLATES are randomized among the four states in Figure 4-1 and transmitted to the OPERATOR CONSOLE by the Field Management System (FMS).

Figure 4-1 Possible PLATE assignments



4.12 Match Setup

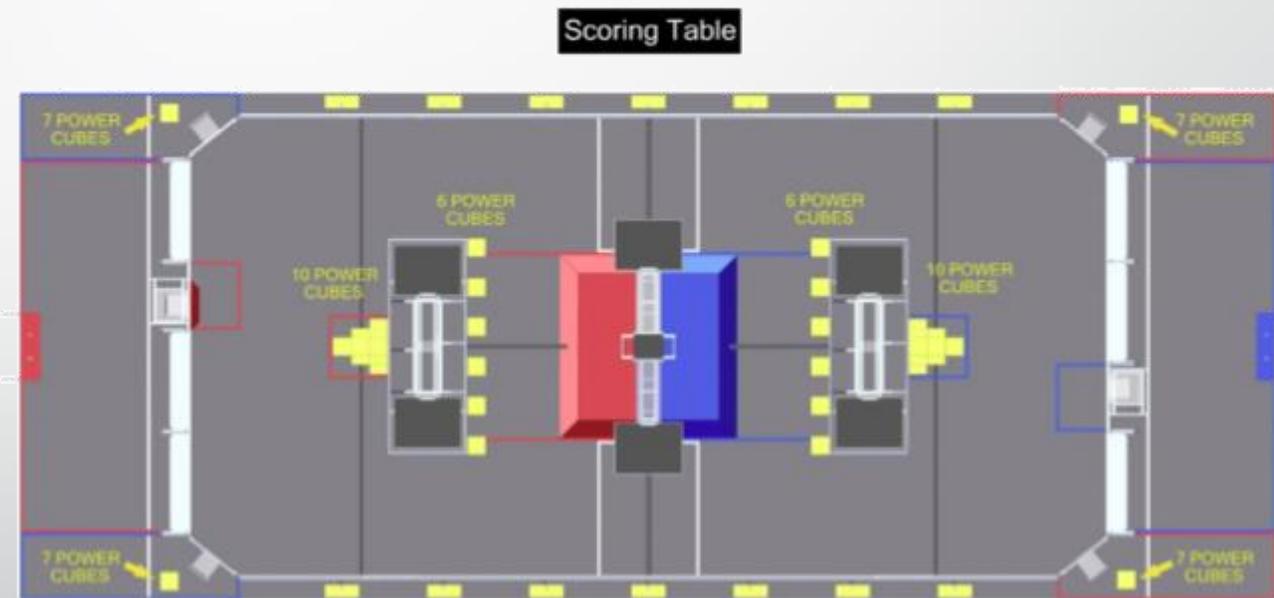
Prior to the start of each MATCH, POWER CUBES, elements used to affect the position of the SCALE and SWITCHES and earn POWER UPS, are staged as shown in Figure 4-2. Staging details are as follows:

- Seven (7) in each PORTAL (on the carpet between the PORTAL wall and the STARTING LINE), minus any preloaded POWER CUBES,
- Six (6) next to each SWITCH. They are arranged approximately equidistant from each other along the face of the FENCE closest to the SCALE, FIRST logo facing up
- Ten (10) located in each ALLIANCE POWER CUBE PILE (in a pyramid formation, with six on the bottom, three in the middle, and one on top, justified toward the SWITCH, FIRST logo facing up)

When a DRIVE TEAM loads their ROBOT onto the FIELD for a MATCH they may elect to preload up to one (1) POWER CUBE in or on their ROBOT such that it is fully and only supported by the ROBOT. A minimum of five (5) POWER CUBES must remain in each of their two (2) PORTALS after any preloads.

If order placement of ROBOTS matters to either or both ALLIANCES, the ALLIANCE must notify the Head REFEREE during setup for that MATCH. Upon notification, the Head REFEREE will require ALLIANCES alternate placement of all ROBOTS. In a Qualification MATCH, ROBOTS will be placed in the following order: Red Station 1 ROBOT, Blue Station 1 ROBOT, Red Station 2 ROBOT, Blue Station 2 ROBOT, Red Station 3 ROBOT, Blue Station 3 ROBOT. In a PLAYOFF MATCH, the same pattern is applied, but instead of Red ALLIANCE placing, the higher seeded ALLIANCE (regardless of color) will place last.

Figure 4-2: POWER CUBE staging



Notes:

- Since pre-loaded cubes come from the portals, it will need to be determined which portal should have 2 cubes removed for pre-load (with 1 removed from the other portal). Presumably it'll make sense to take 2 from the portal on the other side of the field.
- Need to discuss implications of robot placement order described at left.

4.6 Logistics

Any POWER CUBE that leaves the FIELD will not be returned to MATCH play. POWER CUBES that inadvertently deflect back in to the FIELD will be considered fair game.

There will not be an ARCADE FAULT called for MATCHES that accidentally begin with an incorrect number of, incorrectly positioned, or damaged POWER CUBES. Damaged POWER CUBES will not be replaced until the next FIELD reset period. DRIVE TEAMS should alert the FIELD STAFF to any missing or damaged POWER CUBES prior to the start of the MATCH.

Note: The above implies that while the field crew will do its best, it is up to the drive teams to make sure they are set up with the right number of non-broken cubes in the right places.

Once the MATCH is over, if the Head REFEREE determines that the FIELD is safe for FIELD STAFF but not safe for everyone (e.g. the SCALE is full of POWER CUBES that create a falling hazard for a DRIVE TEAM carrying a ROBOT), they will turn the LED lights on the PLATES purple. Once the FIELD is ready for DRIVE TEAM traffic, the Head REFEREE will change the LED lights to green and DRIVE TEAMS may retrieve their ROBOT in accordance with So2.

4.4 Rule Violations and 10.7 Yellow & Red Cards

Table 4-3: Penalty Table

Action	Penalty
FOUL	5 points credited towards the opponent's total score.
TECH FOUL	25 points credited towards the opponent's total score.
YELLOW CARD	a warning issued by the Head REFEREE for egregious ROBOT or Team member behavior or rule violations. A subsequent YELLOW CARD within the same tournament phase will lead to a RED CARD.
RED CARD	a penalty assessed for egregious ROBOT or Team member behavior, or rule violations, which results in a Team being DISQUALIFIED for the MATCH.
DISABLED	ROBOT will be commanded to deactivate all outputs, rendering the ROBOT inoperable for the remainder of the MATCH.
DISQUALIFIED	the state of a Team in which they receive zero (0) MATCH points in a qualification MATCH or causes their ALLIANCE to receive zero (0) MATCH points in a Playoff MATCH

10.7 YELLOW and RED CARDS

In addition to rule violations explicitly listed throughout the 2018 Game and Season Manual, YELLOW CARDS and RED CARDS are used in FIRST® Robotics Competition to address Team and ROBOT behavior that does not align with the mission of FIRST®.

A YELLOW or RED CARD is indicated by the Head REFEREE standing in front of the Team's PLAYER STATION and holding a YELLOW and/or RED CARD in the air. YELLOW CARDS are additive, meaning that a second YELLOW CARD is automatically converted to a RED CARD. A Team is issued a RED CARD for any subsequent incident in which they receive an additional YELLOW CARD, including earning a second YELLOW CARD during a single MATCH. A second YELLOW CARD is indicated by the Head REFEREE standing in front of the Team's PLAYER STATION and holding a YELLOW CARD and RED CARD in the air simultaneously after the completion of the MATCH. A Team that has received either a YELLOW CARD or a RED CARD carries a YELLOW CARD into subsequent MATCHES, except as noted below. A RED CARD results in DISQUALIFICATION.

Once a Team receives a YELLOW or RED CARD, its Team number will be presented with a yellow background on the audience screen at the beginning of all subsequent MATCHES, including any replays, as a reminder to the Team, the REFEREES, and the audience that they carry a YELLOW CARD.

10.7 Yellow & Red Cards

All YELLOW CARDS are cleared at the conclusion of Qualification MATCHES, providing teams a clean slate at the beginning of Playoff MATCHES.

During the Playoff MATCHES, if a Team receives a YELLOW or RED CARD, it results in the entire ALLIANCE receiving the YELLOW or RED CARD for that MATCH. If two different Teams on the same ALLIANCE are issued YELLOW CARDS, the entire ALLIANCE is issued a RED CARD. A RED CARD results in zero (0) points for that MATCH, and the ALLIANCE loses the MATCH. If both ALLIANCES receive RED CARDS, the ALLIANCE which committed the action earning the RED CARD first chronologically loses the MATCH.

YELLOW and RED CARDS are applied based on the following:

Table 10-4: YELLOW and RED CARD application

Time YELLOW or RED CARD earned:	MATCH to which CARD is applied:
prior to the start of Qualification MATCHES	Team's first Qualification MATCH
during the Qualification MATCHES	Team's current (or just-completed) MATCH. In the case where the Team participated as a SURROGATE in the current (or just completed) MATCH, the card is applied to the Team's previous MATCH (i.e. the Team's second Qualification MATCH.)
between the end of Qualification MATCHES and the start of Playoff MATCHES	ALLIANCE'S first Playoff MATCH
during the Playoff MATCHES	ALLIANCE'S current (or just-completed) MATCH.

5 Safety Rules, 6 Conduct Rules, & 7 Game Rules (excerpts)

So2. Wait for the green lights. DRIVE TEAMS may only enter the FIELD if the LED strings are green, unless explicitly instructed by a REFEREE or an FTA.

So3. Never step/jump over the GUARDRAIL. DRIVE TEAMS may only enter or exit the FIELD through open gates.

So6. Stay out of the tunnels. DRIVE TEAMS may not extend any body part into the RETURN chute, the PORTAL chute, or the EXCHANGE tunnel. Momentary encroachment into these volumes is an exception to this rule

Co1 – Co5. Behave yourselves. Don't do things like acting/speaking in anger (that includes swearing), colluding with other teams to throw matches (is that really a thing?), and so on

Co6. Show up to your MATCHES. Keep track of time and whether or not the event is on schedule. Remember that events can sometimes even get AHEAD of schedule.

Co7. Don't expect to gain by doing others harm. Strategies clearly aimed at forcing the opposing ALLIANCE to violate a rule are not in the spirit of FIRST® Robotics Competition and not allowed. Rule violations forced in this manner will not result in an assignment of a penalty to the targeted ALLIANCE.

Co8. One student, one Head REFEREE. A Team may only send one (1) pre-college student from its DRIVE TEAM to address the Head REFEREE.

Go1. Know your ROBOT setup. When placed on the FIELD for a MATCH, each ROBOT must be: A. in compliance with all ROBOT rules, i.e. has passed Inspection (for exceptions regarding Practice MATCHES, see Section 9 Inspection & Eligibility Rules), B. the only item left on the FIELD by the DRIVE TEAM, C. confined to its STARTING CONFIGURATION, D. set on the carpet, E. in contact with its ALLIANCE WALL diamond plate, F. not in contact with the EXCHANGE wall, G. not breaking the plane of the EXCHANGE ZONE, and H. supporting not more than one (1) POWER CUBE (as described in Section 4.1.2 MATCH Setup).

7 Game Rules & 8 Human Action Rules (excerpts)

Go2. Be prompt/safe when coming to and going from the FIELD. DRIVE TEAMS may not cause significant or repeated delays to the start of a MATCH and/or to the FIELD reset after the MATCH.

Go3. Know your DRIVE TEAM positions. Prior to the start of the MATCH, DRIVE TEAMS must be positioned as follows: A. DRIVERS and COACHES must be in their ALLIANCE STATION and behind the STARTING LINE B. HUMAN PLAYERS must be behind the STARTING LINE and either in their ALLIANCE STATION or one of their ALLIANCE PORTALS C. TECHNICIANS must be in their designated area outside the ALLIANCE STATION and PORTALS.

Go4. Leave the POWER CUBES alone. Prior to the start of the MATCH, DRIVE TEAMS may not rearrange the POWER CUBES within a PORTAL, staged on the FIELD (that are not staged inside a ROBOT), or transfer POWER CUBES from one PORTAL to another.

→ Thoughts on Go4 and the earlier point under logistics that an ARCADE fault will not be called for MATCHES that accidentally begin with an incorrect number of, incorrectly positioned, or damaged POWER CUBES: You'll need to use your eyes to make sure the set up is correct and no cubes are obviously damaged.

Go5. Don't overextend yourself. ROBOTS may not extend more than 16 in (41 cm). beyond their FRAME PERIMETER (see Figure 8-1). This rule doesn't apply to a ROBOT fully within its PLATFORM ZONE during the ENDGAME.

→ Thoughts on Go5: Of course, we will design our robot to not overextend, but it's a good idea to consider how we might accidentally break this rule and then avoid those things.

Ho5. Identify yourself. DRIVE TEAMS must wear proper identification while in the ARCADE. Proper identification consists of: A. All DRIVE TEAM members wearing their designated buttons above the waist in a clearly visible location at all times while in the ARCADE. The COACH wearing the "Coach" labeled DRIVE TEAM button The DRIVERS and HUMAN PLAYERS each wearing a DRIVE TEAM button The TECHNICIAN wearing the "Technician" labeled DRIVE TEAM button B. During a Playoff MATCH, the ALLIANCE CAPTAIN clearly displaying the designated ALLIANCE CAPTAIN identifier (e.g. hat or armband). Violation: MATCH will not start until the situation is corrected. Those not displaying identification must leave the ARCADE.

8 Human Action Rules (excerpts)

Ho6. No wandering. DRIVE TEAM members may not contact anything outside the zone in which they started the MATCH (e.g. the ALLIANCE STATION, PORTAL, designated area for the TECHNICIAN) during the MATCH. Exceptions will be granted for inadvertent, momentary, and inconsequential infractions and in cases concerning safety. Violation: FOUL. If strategic, RED CARD.

Ho7. You can't bring/use anything you want. The only equipment that may be brought to the ARCADE and used by DRIVE TEAMS during a MATCH is listed below. Regardless if equipment fits criteria below, it may not be employed in a way that breaks any other rules, introduces a safety hazard (e.g. a step stool or large signaling device in the confined space of the PORTAL are safety concerns), blocks visibility for FIELD STAFF or audience members, or jams or interferes with the remote sensing capabilities of another Team, or the FIELD, including vision systems, acoustic range finders, sonars, infrared proximity detectors, etc. (e.g. including imagery that, to a reasonably astute observer, mimics the Vision Targets used on the FIELD). A. the OPERATOR CONSOLE, B. non-powered signaling devices, C. reasonable decorative items, D. special clothing and/or equipment required due to a disability, E. devices used solely for planning or tracking strategy, F. devices used solely to record gameplay, G. non-powered Personal Protective Equipment (examples include, but aren't limited to, gloves, eye protection, and hearing protection) Items brought to the ARCADE under allowances B-G must meet all of the following conditions: do not connect or attach to the OPERATOR CONSOLE do not connect or attach to the FIELD or ARCADE do not connect or attach to another ALLIANCE member (other than items in category G) do not communicate with anything or anyone outside of the ARCADE. do not communicate with the TECHNICIAN do not include any form of enabled wireless electronic communication (e.g. radios, walkie-talkies, cell phones, Bluetooth communications, Wi-Fi, etc.) do not in any way affect the outcome of a MATCH, other than by allowing the DRIVE TEAM to a. plan or track strategy for the purposes of communication of that strategy to other ALLIANCE members or b. use items allowed per part B to communicate with the ROBOT (provided A02 is not violated). Violation: MATCH will not start until situation remedied. If discovered or used inappropriately during a MATCH, YELLOW CARD.

Ho8. TECHNICIANS, no coaching. TECHNICIANS may not verbally coach or use non-powered signaling devices. Exceptions will be granted for inconsequential infractions and in cases concerning safety. Violation: YELLOW CARD

8 Human Action Rules & 10.6 Referee Interaction

(excerpts)

H11. COACHES, no POWER CUBES. During a MATCH, COACHES may not touch POWER CUBES unless for safety purposes. Violation: TECH FOUL per instance.

H12. COACHES, stay clear of the VAULT. During a MATCH, COACHES may not touch any component of the VAULT (including the buttons) unless for safety purposes. Violation: TECH FOUL per instance

H13. POWER CUBES only enter the FIELD as designated. DRIVE TEAMS may only deliberately cause POWER CUBES to leave an ALLIANCE STATION or PORTAL A. during TELEOP, B. by a HUMAN PLAYER or DRIVER, and C. through a PORTAL wall or the RETURN Violation: FOUL per POWER CUBE. If strategic, RED CARD.

10.6 REFEREE Interaction

The Head REFEREE has the ultimate authority in the ARCADE during the event, but may receive input from additional sources, e.g. Game Designers, FIRST personnel, FTA, and technical staff. The Head REFEREE rulings are final. No event personnel, including the Head REFEREE, will review video, photos, artistic renderings, etc. of any MATCH, from any source, under any circumstances.

If a DRIVE TEAM needs clarification on a ruling or score, per Co8, one (1) pre-college student from that DRIVE TEAM should address the Head REFEREE after the ARCADE Reset Signal (e.g. LED lights turn green). A DRIVE TEAM member signals their desire to speak with the Head REFEREE by standing in the corresponding Red or Blue Question Box, which are located on the floor near each end of the scoring table. Depending on timing, the Head REFEREE may postpone any requested discussion until the end of the subsequent MATCH as necessary.

While FMS tracks quantities of FOULS and TECH 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 or TECH FOULS were made, when they occurred, and against whom.

Any reasonable question is fair game in the Question Box, and Head REFEREES will do good faith efforts to provide helpful feedback (e.g. how/why certain FOULS are being called, why a particular ROBOT may be susceptible to certain FOULS based on its design or game play, how specific rules are being called or interpreted), but please know that they will likely not be able to supply specific details

10.9 Timeouts & Backup Teams

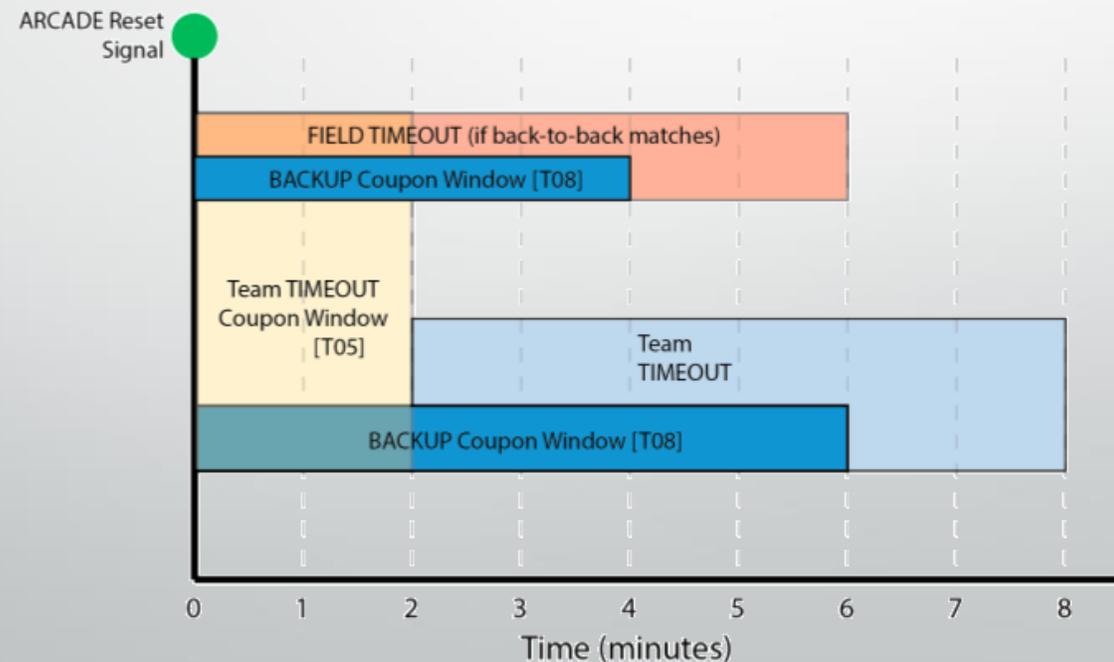
A TIMEOUT is a period of up to six (6) minutes between MATCHES which is used to pause Playoff MATCH progression.

During a TIMEOUT, the ARCADE Timer will display the time remaining in the TIMEOUT. Both ALLIANCES will enjoy the complete six (6) minute window. If an ALLIANCE completes their repairs before the ARCADE Timer expires, the ALLIANCE CAPTAIN is encouraged to inform the Head REFEREE that they are ready to play. If both ALLIANCES are ready to play before the TIMEOUT expires, the next MATCH will start.

There are no TIMEOUTS in the Practice or Qualification MATCHES.

If circumstances require an ALLIANCE to play in back-to-back MATCHES during the Playoff MATCHES, the Head REFEREE will issue a FIELD TIMEOUT to allow Teams to prepare for the next MATCH. FIELD TIMEOUTS are the same time duration as TIMEOUTS.

Figure 10-4: TIMEOUT Timeline



10.9 Timeouts & Backup Teams

To4. An ALLIANCE may not call more than one (1) TIMEOUT during the Playoff MATCHES.

Teams are expected to have their ROBOTS staged on the FIELD by the end of the TIMEOUT. Teams that cause a significant delay to the start of a MATCH after a TIMEOUT are subject to Go2.

To5. If an ALLIANCE wishes to call a TIMEOUT, the ALLIANCE CAPTAIN must submit their TIMEOUT coupon to the Head REFEREE within two (2) minutes of the ARCADE reset signal preceding their MATCH. If there is no preceding MATCH, the TIMEOUT coupon must be submitted no later than two (2) minutes before the scheduled MATCH time. The TIMEOUT will begin two (2) minutes after the ARCADE reset signal (i.e. at the end of the TEAM TIMEOUT Coupon Window depicted in Figure 10-4)

To6. There are no cascading TIMEOUTS. If an ALLIANCE calls a TIMEOUT during a FIELD TIMEOUT, the FIELD TIMEOUT will expire two (2) minutes after the ARCADE reset signal and the ALLIANCE'S TIMEOUT will begin.

If an ALLIANCE wishes to call a TIMEOUT during a FIELD TIMEOUT, it must still do so within two (2) minutes of the ARCADE reset signal preceding their MATCH, per To5.

To8. If during a TIMEOUT an ALLIANCE CAPTAIN determines that they need to call up a BACKUP TEAM, they must submit their BACKUP TEAM coupon to the Head REFEREE while there are still at least two (2) minutes remaining on the ARCADE Timer. After that point, they will not be allowed to utilize the BACKUP TEAM.

Alternatively, an ALLIANCE CAPTAIN may choose to call up a BACKUP TEAM without using their TIMEOUT by informing the Head REFEREE directly within two (2) minutes of the Head REFEREE issuing the ARCADE reset signal preceding their MATCH. If there is no preceding MATCH, the BACKUP TEAM coupon must be submitted no later than two (2) minutes before the scheduled MATCH time.

In the case where the ALLIANCE CAPTAIN'S ROBOT is replaced by a BACKUP TEAM, the ALLIANCE CAPTAIN is allowed as a sixteenth ALLIANCE member.

The Head REFEREE will not accept the BACKUP TEAM coupon unless it lists the number of the Team whose ROBOT is being replaced, and is initialed by the ALLIANCE CAPTAIN. Once a BACKUP TEAM coupon is submitted and accepted by the Head REFEREE, the BACKUP TEAM coupon may not be withdrawn by the ALLIANCE.

To9. An ALLIANCE may request neither a TIMEOUT nor a BACKUP TEAM after a Playoff MATCH is stopped by the Head REFEREE (e.g. due to an ARCADE FAULT or a safety issue). The sole exception is if the replay is due to an ARCADE FAULT that rendered a ROBOT inoperable. If a Playoff MATCH is replayed per To9, the Head REFEREE has the option of calling a FIELD TIMEOUT.



Section Two

Rules critical to the student drive coach,
driver, & operator

3.6.1 Player Station (AKA Driver Station)

A PLAYER STATION is one (1) of three (3) assigned positions in an ALLIANCE WALL from where a DRIVE TEAM operates their ROBOT. Each PLAYER STATION is made from a 3 ft. (~91 cm) tall diamond plate panel base topped with a 3 ft. 6 in. (~107 cm) tall transparent plastic panel. An aluminum shelf is attached to each PLAYER STATION to support the DRIVE TEAM'S OPERATOR CONSOLE. The shelf is 5 ft. 9 in. (~175 cm) wide and 1 ft. (~30 cm) deep. There is a 4 ft. 6 in. (~137 cm) long by 2 in. (nominal) wide strip of hook-and-loop tape ("loop" side) along the center of the support shelf that may be used to secure the OPERATOR CONSOLE to the shelf.

- Each PLAYER STATION contains the following components for Teams:
 - One Ethernet Cable: attaches to the Ethernet port of the OPERATOR CONSOLE and provides connectivity to the FIELD Management System.
 - One 120VAC NEMA 5-15R power outlet: located on each PLAYER STATION shelf and protected by its own 2-Amp circuit breaker. It can be used to power the OPERATOR CONSOLE. DRIVE TEAMS are responsible for monitoring their power consumption as a tripped breaker in the outlet does not constitute an ARCADE fault.
 - One Emergency Stop (E-Stop) button: located on the left side of the PLAYER STATION shelf and should be used to deactivate a ROBOT in an emergency.
 - One Team sign: displays the Team number and located at the top of each PLAYER STATION.
 - One Team LED: indicates ALLIANCE color, ROBOT status, and E-Stop status and centered at the top of each PLAYER STATION. Team LED states include:
 - Solid: indicates that the ROBOT is connected and enabled. This will only happen during a MATCH.
 - Blinking: indicates that either the Field Management System is preset for the MATCH or it's during a MATCH and the corresponding ROBOT has lost connectivity.
 - Off: indicates that the MATCH has not started yet, but the ROBOT is linked and disabled.
 - If the amber LED is on, the E-stop button has been pressed.
 - One Timer (in the PORTAL adjacent to PLAYER STATION 1): displays the official time remaining in AUTO, TELEOP, and TIMEOUTS and marked with white tape along the bottom edge.

Field Management System hardware and wiring: mostly located below the center PLAYER STATION shelf.

3.10 Field Management System (key excerpts)

The FIELD Management System (FMS) is the electronics core responsible for controlling the FIRST Robotics Competition playing field. The FMS encompasses all field electronics, including the computers, REFEREE touchscreens, wireless access point, sensors, stack lights, E-Stops, etc.

When a DRIVE TEAM connects the Ethernet cable from their assigned PLAYER STATION to their OPERATOR CONSOLE, the Driver Station software on the OPERATOR CONSOLE computer will begin to communicate with the Field Management System (FMS).

FMS alerts participants to milestones in the MATCH using audio cues. Please note that audio cues are intended to be a courtesy to participants and not intended as official MATCH markers. If there is a discrepancy between an audio cue and the FIELD timers, the FIELD timers are the authority.

- MATCH Start: "Cavalry Charge"
- T=0 for AUTO: Buzzer
- Start of TELEOP: Three (3) Bells
- T-30 seconds in TELEOP: Train Whistle
- T=0 for TELEOP/MATCH end: Buzzer
- MATCH stopped: Foghorn
- POWER UP activated: "Linear Popping"

7 Game Rules (excerpts)

G09. Launching POWER CUBES is okay, but keep it short. A ROBOT is not permitted to launch POWER CUBES except: A. When any part of its BUMPERS are inside its ALLIANCE'S NULL TERRITORY, and it's attempting to place a POWER CUBE on the SCALE PLATE in its ALLIANCE'S NULL TERRITORY, or B. when any part of its BUMPERS are contacting a FENCE, and it's attempting to place a POWER CUBE on the nearest PLATE of that FENCE's SWITCH, or C. when any part of its BUMPERS are inside its ALLIANCE'S EXCHANGE ZONE, and it's attempting to place a POWER CUBE in its ALLIANCE'S EXCHANGE tunnel.

G10. Don't tear others down to lift yourself up. Strategies aimed at the destruction or inhibition of ROBOTS via attachment, damage, tipping, or entanglements are not allowed. MECHANISMS outside the FRAME PERIMETER are particularly susceptible to causing such damage, drawing this penalty, and/or drawing penalties associated with violations of G11. Teams are encouraged to be cautious in their use of such MECHANISMS when engaging in ROBOT to ROBOT MATCH play.

G11. Stay out of other ROBOTS. Initiating deliberate or damaging contact with an opponent ROBOT on or inside the vertical extension of its FRAME PERIMETER, including transitively through a POWER CUBE, is not allowed.

G12. Don't collude with your partners to shut down major parts of game play. Two or more ROBOTS may not isolate or close off any major component of MATCH play, e.g. blocking the EXCHANGE, shutting down all access to POWER CUBES, quarantining all opponents to a small area of the FIELD, etc. Violation: YELLOW CARD for the ALLIANCE.

A single ROBOT blocking access to a particular area of the FIELD is not a violation of G12. Two ROBOTS independently playing defense on two opposing ROBOTS is not a violation of this rule.

G13. If an opponent's down, back off. Fallen (i.e. tipped over) ROBOTS attempting to right themselves (either by themselves or with assistance from a partner ROBOT) have one ten (10) second grace period in which they may not be contacted by an opponent ROBOT. This protection lasts for either ten (10) seconds or until the protected ROBOT has completed the righting operation, whichever comes first.

7 Game Rules (excerpts)

G14. There's a 5-count on pins. ROBOTS may not pin an opponent's ROBOT for more than five (5) seconds. A ROBOT will be considered pinned until the ROBOTS have separated by at least six (6) feet. The pinning ROBOT(s) must then wait for at least three (3) seconds before attempting to pin the same ROBOT again. Pinning is transitive through other objects. If the pinned ROBOT chases the pinning ROBOT upon retreat, the pinning ROBOT will not be penalized, and the pin will be considered complete.

G15. Opponent's EXCHANGE ZONE: no camping. A ROBOT may not block their opponent's EXCHANGE ZONE for more than five (5) seconds. A ROBOT is considered "blocking" if any part of their ROBOT is breaking the plane of the EXCHANGE ZONE, and will continue to be considered blocking until the ROBOT has moved at least six (6) feet from the EXCHANGE ZONE. If an opposing ROBOT attempts to stop the blocking ROBOT from moving the required distance to clear the block, the blocking ROBOT will not be penalized, and the block will be considered complete. A ROBOT that is being pinned is exempt from G15. Once the pin is over, the 5-second count begins for this rule.

G16. The NULL TERRITORY is safe. A ROBOT whose BUMPERS are breaking the plane of its NULL TERRITORY and not breaking the plane of the opponent's PLATFORM ZONE may not be contacted by an opposing ROBOT, regardless of who initiates the contact. A ROBOT forced into breaking the plane of an opponent's NULL TERRITORY resulting in it being wedged underneath the SCALE is not a violation of this rule. **Violation: TECH FOUL**

G18. Don't mess with opponents in their PLATFORM ZONE. During the ENDGAME, ROBOTS may not contact an opponent ALLIANCE ROBOT, completely contained within their ALLIANCE'S PLATFORM ZONE, regardless of who initiates the contact. Violation: The contacted opponent ROBOT, and all partner ROBOTS it's fully supporting, are considered to have CLIMBED at the end of the MATCH.

7 Game Rules (excerpts)

G19. Be careful about what you interact with. DRIVE TEAMS, ROBOTS, and OPERATOR CONSOLES are prohibited from the following actions with regards to interaction with ARCADE elements. Items A and B exclude DRIVE TEAM interaction with FIELD elements in their areas. Item C excludes use of the PLAYER STATION hook-and-loop tape, plugging in to the provided power outlet, and plugging the provided Ethernet cable in to the OPERATOR CONSOLE. Items A-D exclude RUNGS and POWER CUBES. A. Grabbing B. Grasping C. Attaching to (including the use of hook-and-loop tape against the FIELD carpet) D. Hanging E. Deforming F. Becoming entangled

G22. One POWER CUBE per ROBOT. ROBOTS may not control more than one (1) POWER CUBE at a time. Violation: FOUL per additional POWER CUBE. Repeated violations of this rule are likely to escalate rapidly to YELLOW or RED CARDS Moving or positioning a POWER CUBE to gain advantage is considered "control."

Examples include, but are not limited to:

- A. "carrying" (holding a POWER CUBE inside a ROBOT)
- B. "herding" (intentionally pushing a POWER CUBE to a desired location or direction)
- C. "trapping" (holding a POWER CUBE against a FIELD element in an attempt to shield or guard it)
- D. "launching" (shooting POWER CUBES into the air, kicking across the floor, or throwing in a forceful way)

Examples of interaction with POWER CUBES that are not "control" include, but are not limited to:

- E. "bulldozing" (inadvertent contact with POWER CUBES while in the path of the ROBOT moving about the FIELD)
- F. "deflecting" (being hit by a POWER CUBE that bounces into or off of a ROBOT)
- G. "plowing" (brief contact with a large quantity of POWER CUBES while attempting to break up a pile, or gain access to an area of the FIELD. Sustained contact or contact after the brief plowing action will be subject to "herding")
- H. "nudging" (contact with a POWER CUBE that is on a PLATE while attempting to place additional POWER CUBES on that PLATE)

If a POWER CUBE becomes lodged in or on a ROBOT, it will be considered controlled by the ROBOT. It is important to design your ROBOT so that it is impossible to inadvertently or unintentionally control more than the allowed maximum.

7 Game Rules & 8 Human Action Rules (excerpts)

G25. PLATES are moved by POWER CUBES, not ROBOTS. Except via the placement of POWER CUBES, ROBOTS may not affect the movement of PLATES. Incidental contact that does not result in PLATES changing scoring state is not a violation of this rule. A ROBOT forced to affect the position of a PLATE (e.g. a ROBOT wedged underneath the SCALE by the opposing ALLIANCE either intentionally or accidentally) is not a violation of this rule.

Violation: FOUL per instance plus an additional TECH FOUL for every five (5) seconds in which the situation is not corrected. Repeated or extended violations of this rule are likely to escalate rapidly to YELLOW or RED CARDS.

H01. COACHES and other Teams: hands off the controls. A ROBOT shall be operated solely by the DRIVERS and/or HUMAN PLAYERS of that Team. Violation: Offending ROBOT will be DISABLED.

H14. POWER CUBES stay in the VAULT. POWER CUBES may not be removed from the VAULT. Violation: FOUL. If strategic (i.e. re-used within the VAULT or introduced to the FIELD), RED CARD



Section Three

Rules critical to the human player

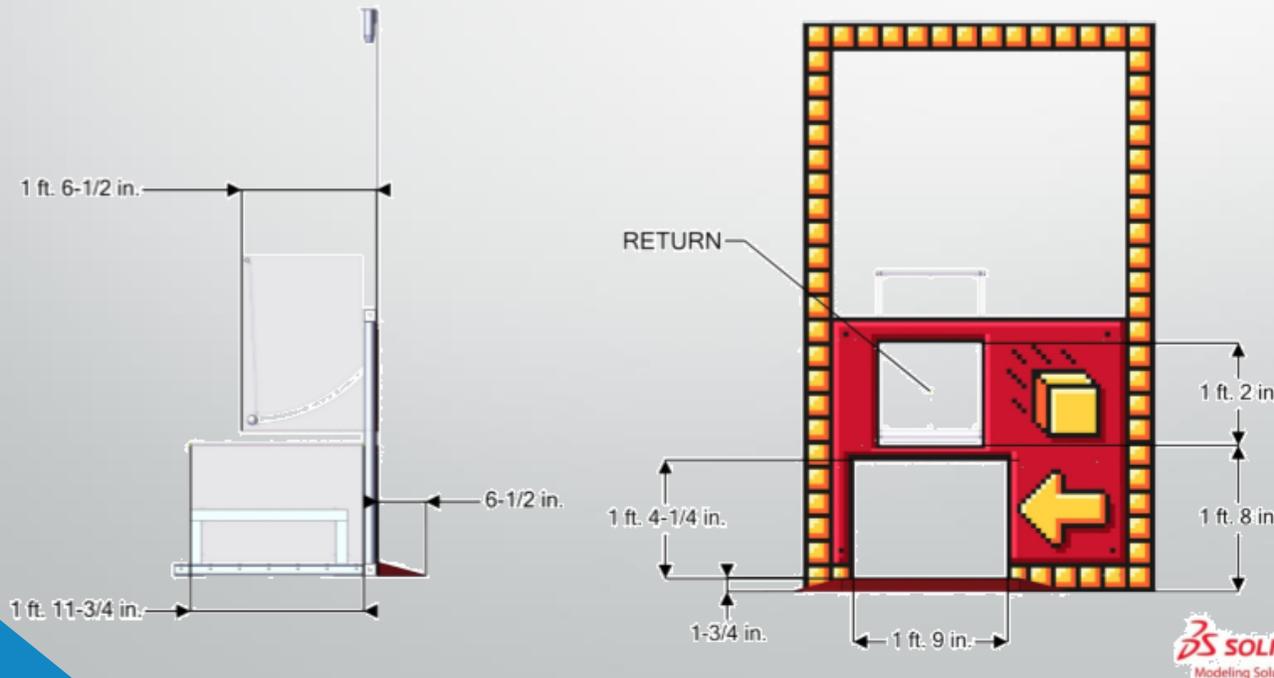
3.6.2 Exchange

An EXCHANGE is a polycarbonate wall 6 ft. 5 $\frac{3}{4}$ in. (~197 cm) tall by 4 ft. (~122 cm) wide located between PLAYER STATION 1 and PLAYER STATION 2 and used by ROBOTS to deliver POWER CUBES to HUMAN PLAYERS. HUMAN PLAYERS can then either place POWER CUBES in the VAULT or feed them back to the ROBOT through the RETURN.

Each EXCHANGE has a lower opening 1 ft. 4 $\frac{1}{4}$ in. (~41 cm) tall and is 1 ft. 9 in. (~53 cm) wide used to deliver POWER CUBES to the HUMAN PLAYER. A small ramp, 1 $\frac{3}{4}$ in. (~4 cm) tall by 6 $\frac{1}{2}$ in. (~17 cm) deep, leads to a series of conveyor rollers. The conveyor rollers are spun by the HUMAN PLAYER to move the POWER CUBE through a polycarbonate tunnel that is 1 ft. 11 $\frac{3}{4}$ in. (~60 cm) deep.

Each EXCHANGE also features a RETURN used to deliver POWER CUBES to ROBOTS. The RETURN opening is a 1ft. 2 in. (~36 cm) square, centered above the lower opening and is located 1 ft. 8 in. (~51 cm) above the carpet. Behind the RETURN opening is a 1 ft. 6 $\frac{1}{2}$ in. (~47 cm) deep polycarbonate chute. The chute features a swinging wall designed to push the POWER CUBE onto the FIELD.

Figure 3-18: EXCHANGE



Notes:

- Stockpiling cubes in the alliance station area until they need to be used is best approach because it keeps your options open (Power Up Vault columns vs. return to field).
- If a robot is trying to deliver a cube to the exchange, human player should be spinning the conveyor rollers hard (sort of like an intake) to help pull the cube in.

3.6.3 Vault

The VAULT is an aluminum and plastic structure used by HUMAN PLAYERS to turn POWER CUBES in to POWER UPS. There are three (3) columns within the VAULT. Each column is 1 ft. 1-1/2 in. (~34 cm) wide by 3 ft. 3-1/4 in. (~100 cm) tall with the bottom located 1 ft. 3-1/2 in. (~39 cm) above the carpet. Each of the three (3) columns in the VAULT correspond to a POWER UP. When standing in the ALLIANCE STATION and facing the open columns of the VAULT the column to the left is the FORCE POWER UP, the center column is the LEVITATE POWER UP and the column on the right is the BOOST POWER UP.

Figure 3-19: Blue ALLIANCE VAULT



Caution, there may be orientations where all three (3) POWER CUBES will not fit in a VAULT column, but if HUMAN PLAYERS place POWER CUBES logo side up they'll fit with room to spare.

3.6.3.1 Vault Lighting

Lights at the top of each VAULT column display the POWER CUBE count for that column. The lights have the following states:

Table 3-2: VAULT Lighting

Color	Meaning
● ● ● ● ●	No POWER CUBES in column
● ● ● ● ●	One (1) POWER CUBE in column
● ● ● ● ●	Two (2) POWER CUBES in column
● ● ● ● ●	Three (3) POWER CUBES in column
● ● ● ● ● (pulsing)	Blue POWER UP in queue
● ● ● ● ●	Blue POWER UP played
● ● ● ● ● (pulsing)	Red POWER UP in queue
● ● ● ● ●	Red POWER UP played

The lights illuminate one bulb per POWER CUBE and show one (1), two (2), three (3) or none (0) by lighting up from left to right. To play a POWER UP, the button corresponding to the column and associated POWER UP is pressed by the HUMAN PLAYER. Once played, all five (5) lights in the corresponding column are illuminated in the ALLIANCE color. If an ALLIANCE plays a POWER UP during the time when an opposing ALLIANCE's POWER UP is active, the POWER UP is queued, indicated by five (5) pulsing lights. See Section 4.3 POWER UPS for more details.

3.7 Portal

HUMAN PLAYERS may deliver POWER CUBES to ROBOTS through either of the PORTAL walls. Each PORTAL wall features a 1 ft. 2 in. (~36 cm) square opening, centered across the width of the panel and located 1 ft. 8 in. (~51 cm) from the carpet. Behind the opening is a 1 ft. 6 ½ in. (~47 cm) polycarbonate chute. **The chute features a swinging wall that the HUMAN PLAYER uses to push the POWER CUBE onto the FIELD**

Note: Be sure to watch videos of how this works this prior to first competition.

[Official First Portal and Exchange Video](#)

[Video of 118's Everybot optimized to take cubes from portal](#)

Figure 3-20: PORTAL

