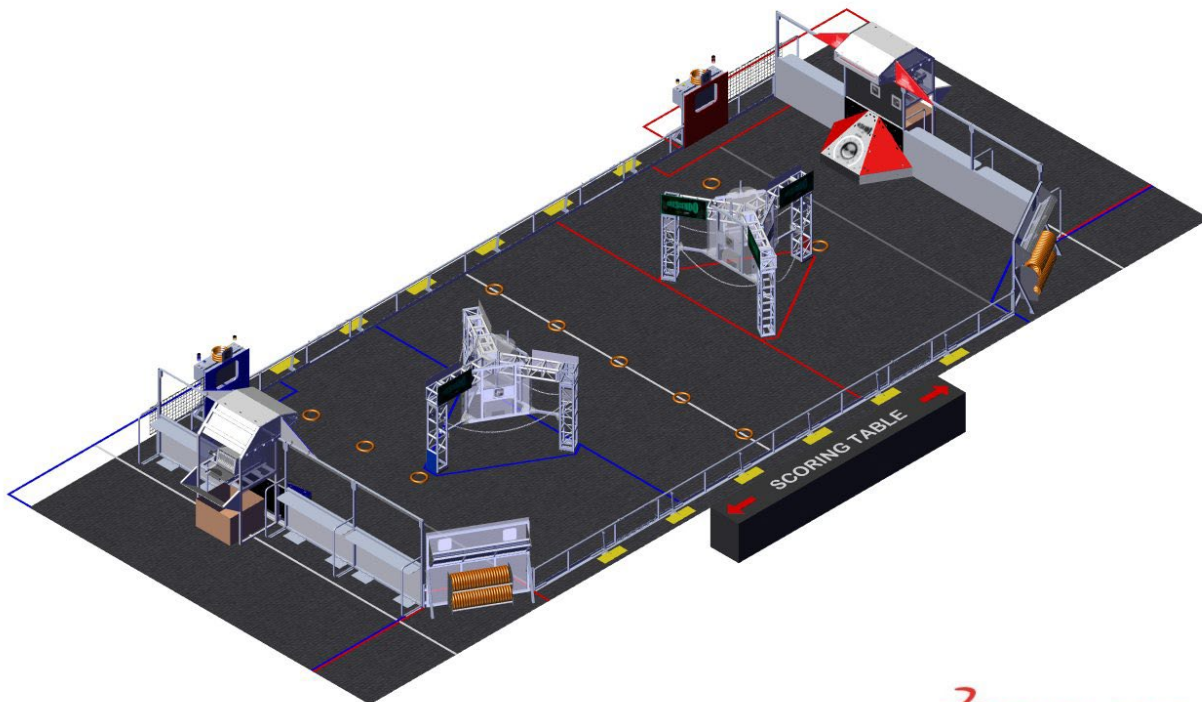# 6 Game Details

Figure 6-1 CRESCENDO

In CRESCENDO, 2 ALLIANCES (an ALLIANCE is a cooperative of up to 4 *FIRST* Robotics Competition teams) play MATCHES, set up and implemented per the details described below.

6.1 MATCH Overview

MATCHES run on 7–10-minute cycles, which consist of pre-MATCH setup, the 2-minute and 30-second MATCH, and the post-MATCH reset.

During the MATCH, ROBOTS score NOTES in their SPEAKER or AMP. HUMAN PLAYERS use NOTES scored through the AMP to AMPLIFY the points associated with NOTES scored in their SPEAKER for 10 seconds at a time or engage in *Coopertition* with their opponents.

ROBOTS conclude the MATCH PARKING in their STAGE ZONE, getting ONSTAGE via a chain, and/or scoring a NOTE in a TRAP.

Additional points are awarded if an ALLIANCE HARMONIZES (i.e. more than 1 ROBOT is ONSTAGE via the same chain) and if HUMAN PLAYERS SPOTLIGHT ROBOTS (i.e. score a HIGH NOTE on a MICROPHONE to increase points awarded for those ONSTAGE ROBOTS).

6.2 DRIVE TEAM

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 CRESCENDO, and no more than 1 member of the DRIVE TEAM may be a non-STUDENT.

> The intent of the definition of DRIVE TEAM and DRIVE TEAM related rules is that, barring extenuating circumstances, the DRIVE TEAM consists of people who arrived at the event affiliated with that team and are responsible for their team's and ROBOT'S performance at the event (this means a person may be affiliated with more than 1 team). The intent is not to allow teams to "adopt" members of other teams for strategic advantage for the loaning team, borrowing team, and/or their ALLIANCE (e.g. an ALLIANCE CAPTAIN believes 1 of their DRIVERS has more experience than a DRIVER on their first pick, and the teams agree the first pick team will "adopt" that DRIVER and make them a member of their DRIVE TEAM for Playoffs).
>
> The definition isn't stricter for 2 main reasons. First, to avoid additional bureaucratic burden on teams and event volunteers (e.g. requiring that teams submit official rosters that Queuing must check before allowing a DRIVE TEAM into the ARENA). Second, to provide space for exceptional circumstances that give teams the opportunity to display *Gracious Professionalism* (e.g. a bus is delayed, a COACH has no DRIVERS, and their pit neighbors agree to help by loaning DRIVERS as temporary members of the team until their bus arrives).

Table 6-1 DRIVE TEAM roles

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

A STUDENT is a person who has not completed high-school, secondary school, or the comparable level as of September 1 prior to Kickoff.

The TECHNICIAN provides teams with a technical resource for pre-MATCH setup, ROBOT connectivity, OPERATOR CONSOLE troubleshooting, and post-MATCH removal of the ROBOT. Some pre-MATCH responsibilities for the TECHNICIAN may include, but are not limited to:

– location of the ROBOT radio, its power connection, and understanding of its indicator lights
– location of the roboRIO and understanding of its indicator lights
– username and password for the OPERATOR CONSOLE

- restarting the Driver Station and Dashboard software on the OPERATOR CONSOLE
- changing the bandwidth utilization (e.g. camera resolution, frame rate, etc.)
- changing a battery
- charging pneumatics

> While the TECHNICIAN may be the primary technical member of the DRIVE TEAM, all members of the DRIVE TEAM are encouraged to have knowledge of the basic functionality of the ROBOT, such as the location and operation of the main circuit breaker, connecting and resetting joysticks or gamepads from the OPERATOR CONSOLE, and removing the ROBOT from the FIELD.

If an ALLIANCE does not have at least 2 HUMAN PLAYERS, 1 of the ALLIANCE'S teams may substitute a STUDENT TECHNICIAN as a HUMAN PLAYER for that MATCH only. In this case,

- the Head REFEREE must be notified,
- all HUMAN PLAYER rules now apply to this DRIVE TEAM member, and
- this DRIVE TEAM member is no longer considered a TECHNICIAN for that MATCH.

6.3 Setup

Before each MATCH begins, FIELD STAFF stage GAME PIECES as described in Section 6.3.4 GAME PIECES. DRIVE TEAMS stage their ROBOTS (as described in Section 6.3.3 ROBOTS) and OPERATOR CONSOLES (as described in Section 6.3.2 OPERATOR CONSOLES). Then, DRIVE TEAMS take their places as described in Section 6.3.1 DRIVE TEAMS.

6.3.1 DRIVE TEAMS

DRIVE TEAMS prepare for a MATCH by staging in the appropriate areas, according to their role on the DRIVE TEAM, and by identifying themselves accordingly. DRIVE TEAM starting conditions are listed below, and a DRIVE TEAM obstructing or delaying any of the conditions is at risk of violating G301.

  A. only DRIVE TEAM members assigned to the upcoming MATCH are present,
  B. only DRIVE TEAM members whose ROBOTS have passed initial, complete Inspection are present,
  C. SOURCE AREA HUMAN PLAYERS are behind the STARTING LINE,
  D. ALLIANCE AREA DRIVE TEAM members are behind the STARTING LINE,
  E. TECHNICIANS are in the event-designated area near the FIELD,
  F. DRIVE TEAM members clearly display their designated buttons above their waists (COACH - "Coach", DRIVERS and HUMAN PLAYERS - "Drive Team", and TECHNICIAN - "Technician"), and
  G. if a Playoff MATCH, the ALLIANCE CAPTAIN clearly displays their designated ALLIANCE CAPTAIN identifier (e.g. hat or armband).

6.3.2 OPERATOR CONSOLES

DRIVE TEAMS set up their OPERATOR CONSOLE as soon as the DRIVE TEAM from the previous MATCH has cleared the area. OPERATOR CONSOLES must be compliant with all relevant rules, specifically those in Section 8.9 OPERATOR CONSOLE. The OPERATOR CONSOLE is plugged into the team's assigned DRIVER STATION, as indicated on the team sign. Any control devices worn or held by their HUMAN PLAYERS and/or DRIVERS during the MATCH must be disconnected from or set on or beside the OPERATOR CONSOLE before the MATCH can begin. A DRIVE TEAM obstructing or delaying OPERATOR CONSOLE setup is at risk of violating G301.

For the purposes of *FIRST* Robotics Competition, any device connected to the OPERATOR CONSOLE is considered a control device because REFEREES are not expected to differentiate between devices that can or cannot control the ROBOT.

6.3.3   ROBOTS

DRIVE TEAMS stage their ROBOT in accordance with G303. A DRIVE TEAM obstructing or delaying ROBOT setup requirements is at risk of violating G301.

If order of placement matters to either or both ALLIANCES, the ALLIANCE notifies the Head REFEREE during setup for that MATCH, and the Head REFEREE instructs ALLIANCES to alternate placement of ROBOTS. In a Qualification MATCH, REFEREE instructions are that ROBOTS are placed in the following order:

1. red DRIVER STATION 1 ROBOT
2. blue DRIVER STATION 1 ROBOT
3. red DRIVER STATION 2 ROBOT
4. blue DRIVER STATION 2 ROBOT
5. red DRIVER STATION 3 ROBOT
6. blue DRIVER STATION 3 ROBOT

In an intra-Division Playoff MATCH, the same pattern is applied, but instead of blue ALLIANCE placing last, the higher seeded ALLIANCE (regardless of color) places last. For inter-Division Playoff MATCHES, the ALLIANCE that places last is determined by a (real or virtual) coin flip facilitated by the Head REFEREE where a "heads" result invites the red ALLIANCE to place last.

6.3.4 GAME PIECES

Before each MATCH begins, FIELD STAFF stage GAME PIECES.

Figure 6-2 SPIKE MARK locations and GAME PIECE staging positions
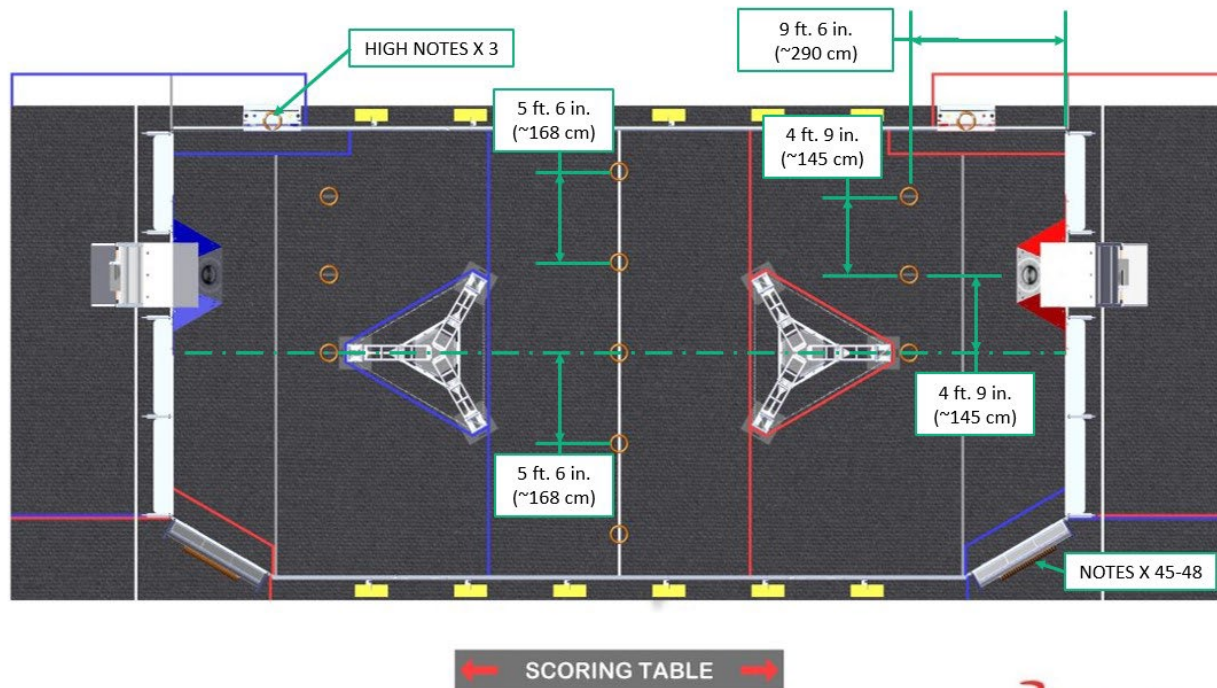
3 HIGH NOTES are staged on top of each AMP.

107 NOTES are staged for each MATCH as follows (reference Figure 6-2):

- A. 90 NOTES are staged in the SOURCE AREAS (45 NOTES in each SOURCE AREA),
- B. 6 NOTES are staged on WING SPIKE MARKS (3 NOTES in each WING),
- C. 5 NOTES are staged on CENTER LINE SPIKE MARKS,
- D. 6 NOTES may be preloaded in ROBOTS, 1 per ROBOT, by the ROBOTS' DRIVE TEAMS such that the NOTE is fully supported by the ROBOT. A NOTE not pre-loaded in a ROBOT is staged with NOTES in the ALLIANCE'S SOURCE AREA.

NOTES on SPIKE MARKS are staged such that each NOTE covers the opposite ends of each SPIKE MARK.

6.4 MATCH Phases

The first phase of each MATCH is 15 seconds long and called the Autonomous Period (AUTO). During AUTO, ROBOTS operate without any DRIVE TEAM control or input. ROBOTS attempt to score NOTES, exit their ROBOT STARTING ZONE, and retrieve additional NOTES. There is a 3-second delay between AUTO and TELEOP for scoring purposes as described in Section 6.5 Scoring.

The second phase of each MATCH is the remaining 2 minutes and 15 seconds (2:15) and called the Teleoperated Period (TELEOP). During TELEOP, DRIVERS remotely operate ROBOTS to retrieve and score NOTES and take their STAGE.

6.5 Scoring

ALLIANCES are rewarded for accomplishing various actions through the course of a MATCH, including leaving their ROBOT STARTING ZONE, scoring NOTES in their SPEAKER and AMP, taking their STAGE, SPOTLIGHTING ONSTAGE ROBOTS by scoring HIGH NOTES, cooperating with their opponents, and winning or tying MATCHES.

Rewards are granted either via MATCH points, *Coopertition* points, or Ranking Points (often abbreviated to RP, which increase the measure used to rank teams in the Qualification Tournament).

All scores are assessed and updated throughout the MATCH, except as follows:

A. assessment of NOTES scored in SPEAKERS continues for up to 3 seconds after the ARENA timer displays 0:00 following AUTO.
B. assessment of NOTES scored in SPEAKERS continues for up to 5 seconds after the ARENA timer displays 0:00 following TELEOP.
C. assessment of STAGE points is made 5 seconds after the ARENA timer displays 0:00 following TELEOP, or when all ROBOTS have come to rest following the conclusion of the MATCH, whichever happens first.

6.5.1 NOTE Scoring Criteria

A NOTE is scored in a SPEAKER once it passes through the FIELD-facing opening of the SPEAKER and through the sensor array.

A NOTE is scored in the AMP once it passes through the FIELD-facing opening of the AMP and through the sensor array.

A NOTE is scored in the TRAP if it enters the TRAP from above (i.e. through the cutout above the AprilTag).
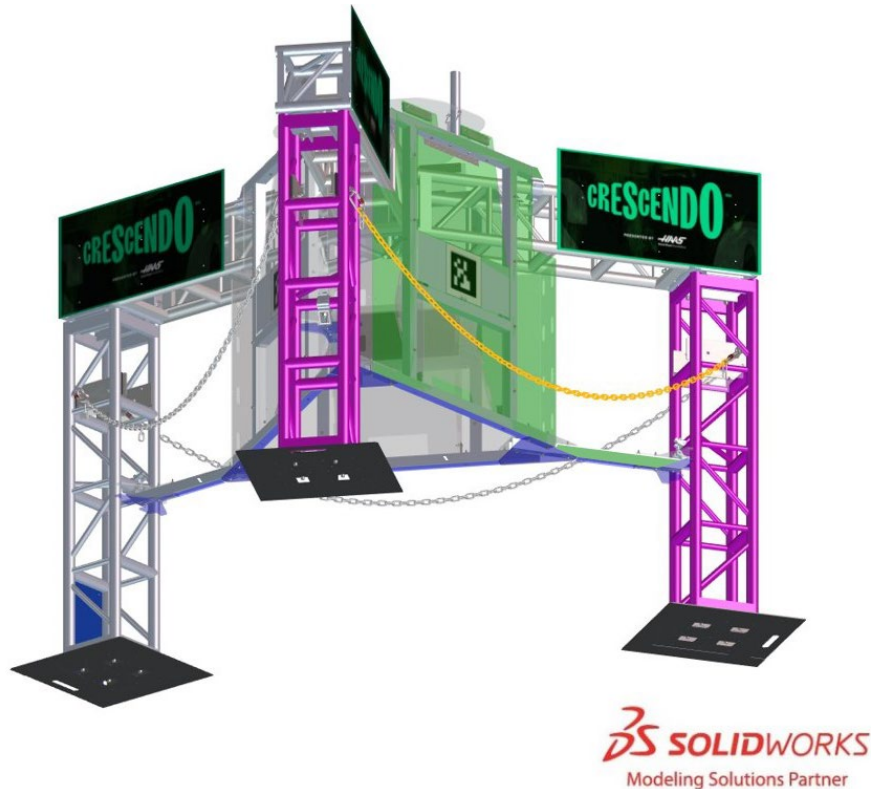
6.5.2 ROBOT Scoring Criteria

To qualify for LEAVE points, a ROBOT'S BUMPERS must completely clear its ROBOT STARTING ZONE at any point during AUTO.

To qualify for PARK points, a ROBOT'S BUMPERS must be partially or completely contained in the STAGE ZONE at the end of the MATCH (more specifically, per criteria described in item C of Section 6.5 Scoring) and does not meet the criteria for ONSTAGE.

To qualify for ONSTAGE points, a ROBOT may only be contacting:

A. their truss legs (pink shaded elements in Figure 6-3) via ROBOT BUMPERS,
B. GAME PIECES,
C. chain-facing vertical surfaces of their core or the nearest flap (with regards to the chain used by the ONSTAGE ROBOT, green shaded elements in Figure 6-3),
D. carpet-facing surfaces of their core (blue shaded elements in Figure 6-3), and
E. a single STAGE chain (on their STAGE) (highlighted in orange in in Figure 6-3),
F. another ROBOT qualified for ONSTAGE points,
G. a partner ROBOT contacted by an opponent in violation of G424, and
H. an opponent ROBOT.

a MICROPHONE, ONSTAGE ROBOTS paired with (i.e. below) the MICROPHONE on which the HIGH NOTE was scored are awarded a greater number of points per Table 6-2.

6.5.5 *Coopertition* Bonus

If both ALLIANCES use a NOTE scored in their AMP to engage in *Coopertition* (by pressing their *Coopertition* button) within the first 45 seconds of TELEOP (i.e. remaining MATCH time is greater than 1:30), all teams earn a *Coopertition* Bonus, and the threshold for the MELODY decreases as described in Table 6-2.

A NOTE used for *Coopertition* is no longer eligible for contribution to AMPLIFICATION.

See Section 10.5.3 Qualification Ranking for more information about *Coopertition* influence on Qualification Ranking order.

In Playoff MATCHES, the *Coopertition* button is unused.

6.5.6 Point Values

Point values for tasks in CRESCENDO are detailed in Table 6-2.

Table 6-2 CRESCENDO point values

		MATCH points		Ranking Points	*Coopertition* Points
		AUTO	TELEOP		
LEAVE		2			
NOTES	AMP NOTE	2	1		
	SPEAKER NOTE (not AMPLIFIED)	5	2		
	SPEAKER NOTE (AMPLIFIED)		5		
STAGE	PARK		1		
	ONSTAGE (not SPOTLIT)		3		
	ONSTAGE (SPOTLIT)		4		
	HARMONY		2		
	NOTE in TRAP (max. 1/TRAP)		5		
Coopertition Bonus					1
MELODY	at least • 18 (15 if *Coopertition* Bonus) AMP & SPEAKER NOTES* for Regional & District level events or • 21 (18 if *Coopertition* Bonus) AMP & SPEAKER NOTES for District Championship events, or • 25 (21 if *Coopertition* Bonus) AMP & SPEAKER NOTES for the *FIRST* Championship			1	
ENSEMBLE	At least 10 STAGE points and at least 2 ONSTAGE ROBOTS*			1	
Tie	completing a MATCH with the same number of MATCH points as your opponent			1	
Win	completing a MATCH with more MATCH points than your opponent			2	

*For District Championship and/or *FIRST* Championship events, the MELODY and ENSEMBLE requirements may increase.

6.6 Violations

Upon any instance of a rule violation, unless otherwise noted, 1 or more of the penalties listed in Table 6-3 are assessed.

Table 6-3 Rule violations

Penalty	Description
FOUL	a credit of 2 points towards the opponent's MATCH point total
TECH FOUL	a credit of 5 points towards the opponent's MATCH point total
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 results in a RED CARD.

Penalty	Description
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	the state in which a ROBOT is 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 0 MATCH points and 0 Ranking Points in a Qualification MATCH or causes their ALLIANCE to receive 0 MATCH points in a Playoff MATCH

6.6.1   YELLOW and RED CARDS

In addition to rule violations explicitly listed throughout this document, YELLOW CARDS and RED CARDS are used in *FIRST* Robotics Competition to address team and ROBOT behavior that does not align with the mission, values, and culture of *FIRST*.

The Head REFEREE may assign a YELLOW CARD as a warning, or a RED CARD for egregious behavior inappropriate at a *FIRST* Robotics Competition event.

A YELLOW or RED CARD is indicated by the Head REFEREE holding a YELLOW and/or RED CARD in the air while the Game Announcer describes the violation.

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 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.

Once a team receives a YELLOW or RED CARD, its team number is 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.

Figure 6-4 Example audience screen graphic showing YELLOW CARD indicators
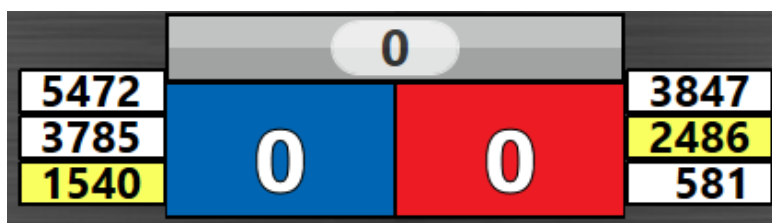
All YELLOW CARDS are cleared in FMS at the conclusion of Practice, Qualification, and division Playoff MATCHES. Verbal warnings are cleared after Practice MATCHES and persist from Qualification MATCHES through subsequent tournament phases. The Head REFEREE may opt to perpetuate a verbal warning or YELLOW CARD earned during Practice MATCHES through to Qualification MATCHES for particularly egregious behavior.

6.6.2 YELLOW and RED CARD application

YELLOW and RED CARDS are applied based on the following:

Table 6-4 YELLOW and RED CARD application

Time YELLOW or RED CARDS earned:	MATCH to which CARD is applied:
prior to Practice MATCHES	team's first Practice MATCH
during the Practice MATCHES	team's current (or just-completed) MATCH.
between the end of PRACTICE MATCHES and 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

> Please see examples of the application of YELLOW and RED CARDS as shown in Section 6.6.4 Violation Details.

6.6.3 YELLOW and RED CARDS during Playoff MATCHES

During Playoff MATCHES, YELLOW and RED CARDS are assigned to the violating team's entire ALLIANCE instead of to only the violating team. If an ALLIANCE receives 2 YELLOW CARDS, the entire ALLIANCE is issued a RED CARD which results in DISQUALIFICATION for the associated MATCH. If both ALLIANCES receive a RED CARD, the ALLIANCE assessed the first RED CARD, chronologically, is DISQUALIFIED and loses the MATCH.

6.6.4 Violation Details

There are several styles of violation wording used in this manual. Below are some example violations and a clarification of the way the violation would be assessed. The examples shown do not represent all possible violations, but rather a representative set of combinations.

Table 6-5 Violation examples

EXAMPLE VIOLATION	EXPANDED INTERPRETATION
FOUL	Upon violation, a FOUL is assessed against the violating ALLIANCE.
TECH FOUL AND YELLOW CARD	Upon violation, a TECH FOUL is assessed against the violating ALLIANCE. After the MATCH, the Head REFEREE presents the violating team with a YELLOW CARD.

EXAMPLE VIOLATION	EXPANDED INTERPRETATION
FOUL PER ADDITIONAL NOTE. IF EGREGIOUS, YELLOW CARD	Upon violation, a number of FOULS are assessed against the violating ALLIANCE equal to the number of additional NOTES beyond the permitted quantity. Additionally, if the REFEREES determine that the action was egregious, the Head REFEREE presents the violating team with a YELLOW CARD after the MATCH.
FOUL, PLUS TECH FOUL IF REPEATED	Upon initial violation in a MATCH, a FOUL is assessed against the violating ALLIANCE. If the ALLIANCE ROBOT repeats the infraction in the MATCH, a FOUL and a TECH FOUL are assessed against the violating ALLIANCE. Assuming no additional infractions of that rule by that ROBOT in that MATCH, the ROBOT has "earned" 2 FOULS and a TECH FOUL for their ALLIANCE.
TECH FOUL, AND FOR EVERY 5 SECONDS IN WHICH THE SITUATION IS NOT CORRECTED, A TECH FOUL IS ASSESSED	Upon violation, a TECH FOUL is assessed against the violating ALLIANCE and the REFEREE begins to count. Their count continues until the criteria to discontinue the count are met, and for each 5 seconds within that time, an additional TECH FOUL is assessed against the violating ALLIANCE. A ROBOT in violation of this type of rule for 15 seconds receives a total of 4 TECH FOULS (assuming no other rules were being simultaneously violated).
RED CARD FOR THE ALLIANCE	After the MATCH, the Head REFEREE presents the violating ALLIANCE with a RED CARD in the following fashion: In a PLAYOFF MATCH, a single RED CARD is assessed to the ALLIANCE. In all other scenarios, each team on the ALLIANCE is issued a RED CARD.

6.7 Head REFEREE and FTA Interaction

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

6.7.1 Question Box

Each ALLIANCE has a designated Question Box near the scoring table. If a DRIVE TEAM has a question about a MATCH, the FIELD, etc., they may send 1 DRIVE TEAM member to their corresponding Question Box. Depending on timing, the Head REFEREE or FTA may postpone any requested discussion until the end of the subsequent MATCH.

Technical questions regarding FIELD or ROBOT operation are addressed by the FTA, and additional team members are invited to participate in these conversations if necessary. If a DRIVE TEAM needs clarification on a ruling or score, per Q101, 1 STUDENT from that DRIVE TEAM should address the Head REFEREE after the ARENA Reset Signal (e.g. FIELD lights turn green).

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.

> Any reasonable question is fair game in the Question Box, and Head REFEREES will make 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 may not be able to supply specific details.

Q101 ***1 STUDENT, 1 Head REFEREE.** A team may only address the Head REFEREE with 1 STUDENT. The STUDENT may not be accompanied by more than 1 silent observer.

Violation: The Head REFEREE will not address additional, non-compliant team members or peripheral conversations.

> Some events may restrict ARENA access to members of the DRIVE TEAM.
>
> Laws regarding recording of conversations vary state-to-state and country-to country, and, in some cases, recording without consent may be criminal. Introducing the idea of recording a conversation with an implied reason of proving someone's error can escalate a discussion and is likely to increase its adversarial nature. Sometimes it's appropriate; often it's neither appropriate nor constructive.
>
> Please do not record *FIRST* event staff, or anyone at an event, without the person's consent and please do not challenge the decision to decline consent to be recorded. *FIRST* event staff are empowered to excuse themselves from an interaction in which they are being recorded after declining consent.

6.8 Other Logistics

NOTES that leave the FIELD are not returned to game play by FIELD STAFF.

> Except via the SPEAKERS or AMPS, ROBOTS may not deliberately cause NOTES to leave the FIELD (see G407).

An ARENA FAULT (an error in ARENA operation described in Section 10.2 MATCH Replays) is not called for MATCHES that accidentally begin with damaged NOTES. Damaged NOTES are not replaced until the next ARENA reset period. DRIVE TEAMS should alert the FIELD STAFF to any missing or damaged NOTES prior to the start of the MATCH.

Once the MATCH is over and the Head REFEREE determines that the FIELD is safe for FIELD STAFF and DRIVE TEAMS, they or their designee change the FIELD lights to green and DRIVE TEAMS may retrieve their ROBOT.

During ARENA reset, the ARENA is cleared of ROBOTS and OPERATOR CONSOLES from the MATCH that just ended, ROBOTS and OPERATOR CONSOLES for the subsequent MATCH are loaded into the ARENA by DRIVE TEAMS, and FIELD STAFF reset ARENA elements.

FIRST Robotics Competition uses 3 words in the context of how durations and actions are assessed with regards to evaluation of rules and assignment of violations. These words provide general guidance to describe benchmarks to be used across the program. It is not the intent for REFEREES to provide a count during the time periods.

- – MOMENTARY describes durations that are fewer than approximately 3 seconds.
- – CONTINUOUS describes durations that are more than approximately 10 seconds.
- – REPEATED describes actions that happen more than once within a MATCH.