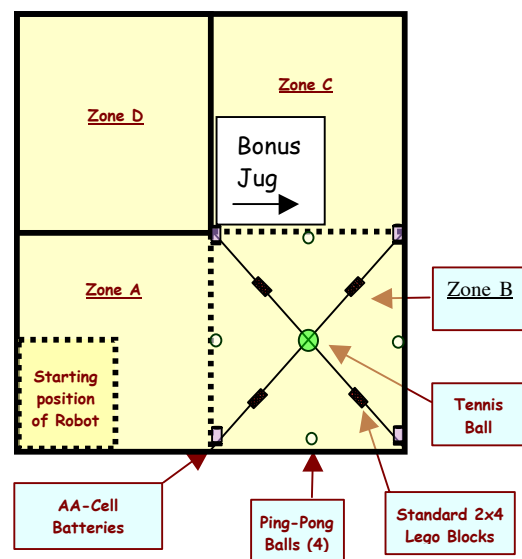


## Robo-Cross

1. **DESCRIPTION:** Teams design and build a robot capable of performing certain tasks on a prescribed Field.  
**A TEAM OF UP TO:** 2      **IMPOUND:** No      **APPROXIMATE TIME:** 5 minutes
2. **CONSTRUCTION PARAMETERS:**
  - a. Each team may enter only one Robot that must be built prior to the competition.
  - b. The Robot may be controlled remotely by radio, infrared, or wired control boxes to the Robot. The Robot and Controller(s) are defined as the Device.
  - c. A commercial kit must have at least one functional modification. A functional modification is defined as a modification such that the lack of it will result in the Robot not working or working differently.
  - d. The Robot in the ready to run position must fit entirely inside an imaginary 30.0 cm x 30.0 cm x 30.0 cm cube. The Robot is not restricted to these dimensions during the run.
  - e. The Robot may drop passive components, but must not separate into two or more active components.
  - f. All Robot motion must be powered only by electrical, elastic, or gravitational energy. These forms of energy must not be converted to other forms such as hydraulics or pneumatics to power the Robot.
  - g. Commercial batteries, not exceeding 14.4 volts as labeled, may be used to energize each of the electrical circuits in the Robot and its controller(s). Multiple batteries may be connected in series or parallel as long as the expected voltage output across any points does not exceed 14.4 volts as calculated using their labeled voltage. All power sources must be contained either in the Robot or as part of the controller(s).
  - h. Competitors must go to [www.soinc.org](http://www.soinc.org), Robo Cross to check legal and permitted frequencies for the radio controlled equipment for surface devices.
3. **TECHNICAL DOCUMENTATION:** In addition to the Device, teams must develop and submit at check-in (or as announced by the director) the following three technical documents-see samples at [www.soinc.org](http://www.soinc.org).
  - a. Illustration (any form, photo, drawings, etc.) of the basic structure of the Device with labels must show:
    - i. All motors, numbered for reference in 3.b.i.
    - ii. All energy sources
    - iii. Controls **used** to interact with the Robot
  - b. Operating Description: i. Robot reaction to each control input, ii. Tentative/proposed plan of movement (i.e., which items in the Competition Area will be moved; how the Robot plans to move each item)
  - c. Written Practice Log: i. Record at least 10 runs, ii. Record at least 3 parameters. The parameters recorded must include score and time. Any additional data recorded will qualify as the third parameter.
4. **PLAYING FIELD:** See diagram of the Playing Field
  - a. The Playing Field must be a smooth, rigid surface, 4' by 4' nominal outer dimension. Acceptable surfaces teams must be prepared for include, but are not limited to: hardboard, plywood, tile, hard foam board, etc.
  - b. The perimeter of the playing field will have a border of commercial 1" x 2" (nominal, 3/4" x 1 1/2" actual) wood, attached to the top surface of the field with the 2" dimension placed vertical.
  - c. The Playing Field will be equally divided into square zones labeled A, B, C, D counterclockwise. Zone D will have a border of commercial 5/8" to 11/16" quarter round molding separating it from the other zones attached on the inside of the Zone's borders. Rounded side must face Zone A & Zone C with the greater height placed vertical.
  - d. The other interior boundaries must be designated by a line made with a fine tipped marker.
  - e. Zone A will contain a marked 30.0 cm x 30.0 cm square in the outside corner as the Starting Position for the Robot.
  - f. Zone B will contain all of the items listed in 4.i. at the start of the competition.
  - g. Playing field may be designed to fold or separate along the zone boundaries. When in use they must not separate, and must not have more than 3 mm gap or step. One layer of tape, up to two inches wide, may be used to secure these seams.
  - h. The Event Supervisor will supply the Playing Field, **Bonus Jug**, and items in 4.i.
  - i. At the start of the competition, the Event Supervisor must place the following objects in Zone B: 4 Ping-Pong balls (approx. diameter 38 mm), 4 AA batteries on their sides, 1 tennis ball, and 4 Lego bricks (standard 2x4 size), as shown in the Playing Field diagram. To prevent premature movement of ping-pong balls, the Supervisor may put on the Playing Field a small dimple or paper reinforcement rings.
  - j. **The Bonus Jug must be the bottom of a plastic gallon jug cut off to a height of 14.5 cm to 15.5 cm placed in the inside corner of Zone C with the opening facing away from Zone D.**



5. **COMPETITION:** At check in, the Event Supervisor inspects and measures the Device, selects 4 items from the Technical Documentation, and has the competitors point them out on their Device.
- Before starting the competition, competitors must place their Robot in the designated starting position in the outside corner of Zone A. The Robot must be in ready to run configuration.
  - The competition must start by having the Event Supervisor verify that the Timers and competitors are ready. It is suggested that 3 Timers be used with the middle time recorded as the Run Time. The Event Supervisor will then count aloud “1, 2, 3, go”. Teams will be allowed three minutes, starting with the word “Go”, to complete the task of moving the items into scoring areas.
  - The Robot may move the **Bonus Jug** (which must remain inside the playing field in any zone).
  - If an item is moved by the control wires, it must be out of play and must not be used to attain any points.
  - Miscellaneous Robot parts may end up in **or on the Bonus Jug** without penalty.
  - The run must stop (and the time recorded to the precision of the instruments) when any of the following occurs (none of these actions will move the team to a lower tier):
    - Three minutes have elapsed from the word “Go”
    - The team says “Stop”
    - Any part of the Robot or Bonus Jug that is Out of Bounds. Out of Bounds is defined as touching the floor outside of the Playing Field.
    - The team touches the Robot
    - The Robot is physically moved by the wires connecting it to a control box
    - A team member steps on the playing field after the team has received a warning
  - The Robot must stop within 2 seconds of the run completion.
  - Any items moved/moving after the time has stopped must be scored where they were prior to that time.
  - Teams who wish to file an appeal must leave their Documentation and Device with the Event Supervisor.
6. **SCORING:** At the end of the competition, points will be awarded based on the number and types of items that are in the specified scoring areas. Maximum score is **183**.

- If the Robot (parts touching the ground) is completely in:
  - Zone A at the end of the competition, the team will receive 0 points
  - Zone B at the end of the competition, the team will receive 3 points
  - Zone C at the end of the competition, the team will receive 5 points
  - Zone D at the end of the competition, the team will receive 15 points
  - If Robot parts (including dropped pieces) touch the ground in multiple zones, the lesser zone score will be awarded.
- Teams will receive the following points for each item moved into the following areas:

<u>Item</u>	<u>Quantity</u>	<u>Points if in Zone C</u>	<u>Points if in Zone D</u>
<b>Lego blocks</b>	<b>4</b>	<b>1</b>	<b>2</b>
<b>Ping-Pong Balls</b>	<b>4</b>	<b>2</b>	<b>4</b>
<b>AA batteries</b>	<b>4</b>	<b>3</b>	<b>6</b>
<b>Tennis ball</b>	<b>1</b>	<b>4</b>	<b>8</b>

- Each item may earn points for a single zone.**
  - A 2x multiplier** will apply to any item in or fully supported by the Bonus Jug while on **its side**.
  - A 3x bonus** will apply to any item in or fully supported by the Bonus Jug if the opening is **facing up**.
  - An item that touches Out of Bounds, even if it is under the control of the Robot, is out of play and may not be used to attain points.
  - If any part of the **Bonus Jug** is Out of Bounds, the items within will have no point value.
  - Any item on the line or straddling 2 zones will receive the lesser score.
- The score will be reduced one point for each incorrect identification in 5.a.
  - Teams with no or incomplete Technical Documentation will have 5% deducted from their score.
  - The team with the most points will be the winner.
  - Tie Breakers: 1. Shortest run time; 2. Lowest mass of Device.
  - Tiers:
    - Tier 1: Devices that meet all requirements are ranked by highest score.
    - Tier 2: Devices with Competition violations are ranked by highest score.
    - Tier 3: Devices with Construction violations or both Construction and Competition violations are ranked by highest score.
    - Participation Points only: Devices that violate the frequency rules or are unable to compete.
    - No Show Points only: Devices that have no capability by design to score points by moving objects.

**Recommended Resource:** The **Robo-Cross DVD** and training resources are available at [www.soinc.org](http://www.soinc.org)