MAZE ENGINEERS 5CSRTT Software User Guide

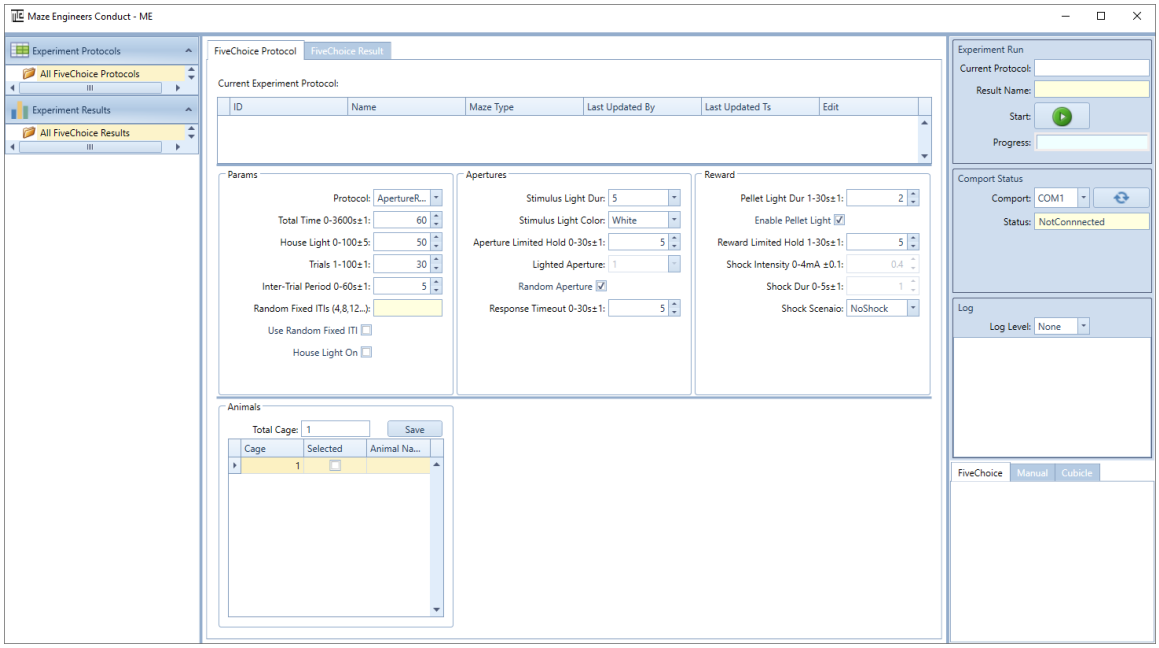
Contents

1. Install and Run Application

The application can be installed in the folder C:\MazeEngineers\appConductFiveChoice\bin

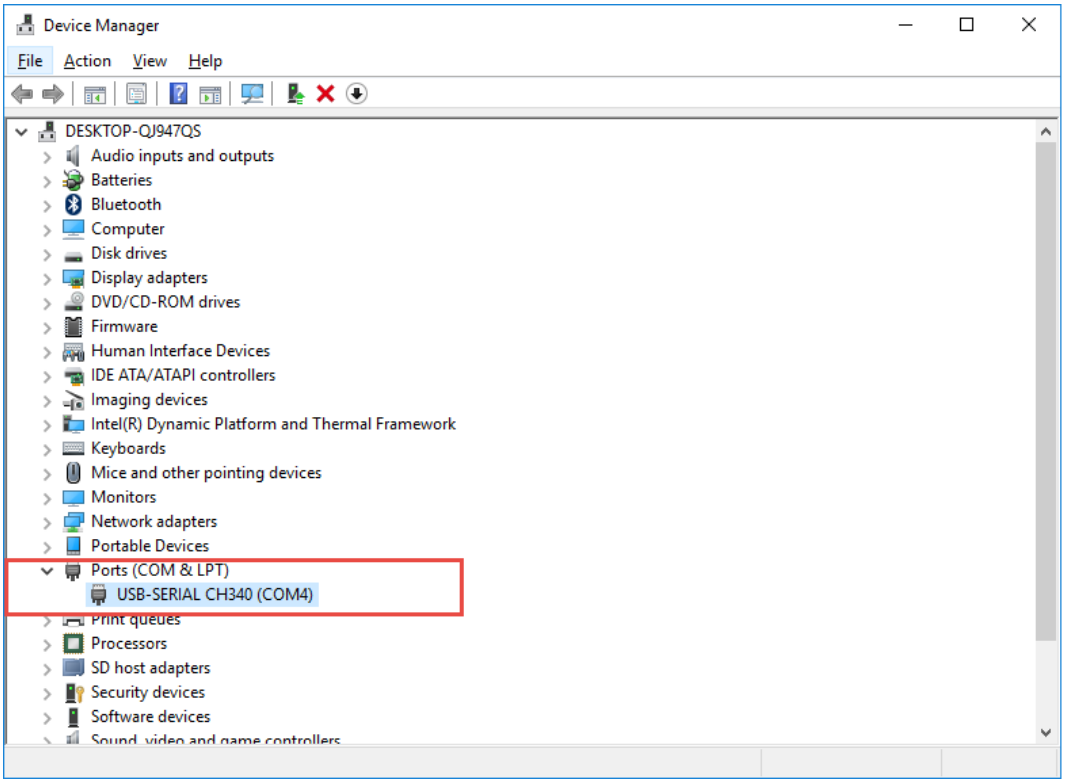
Double click on C:\MazeEngineers\appConductFiveChoice\bin\MazeOriginWpf.exe

The application appears as below:



2. Five Choice connections to computer

When the Five Choice control box is connected to your computer with USB cable (USB to RS485 cable), a port is shown up on the Device Manager.

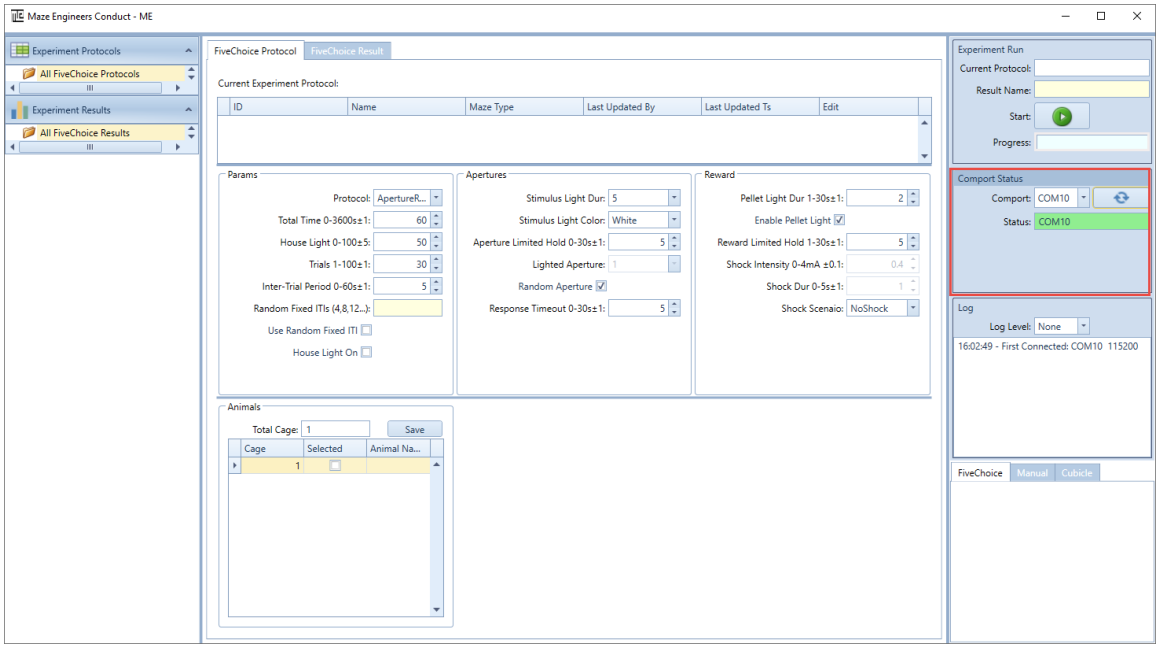


- If the device is not shown on the Ports section, it will appear on different section. This is because the computer could not find the driver for the hardware device. In this case, you will need to install the driver (small disc in the box of UNITEK) which is included in shipping.

- Once your computer recognizes Five Choice hardware, try to connect to it. This connection is used for the communication between software and hardware components.

2.3 Connections status

On the right panel, there is a Comport Status panel as shown below:



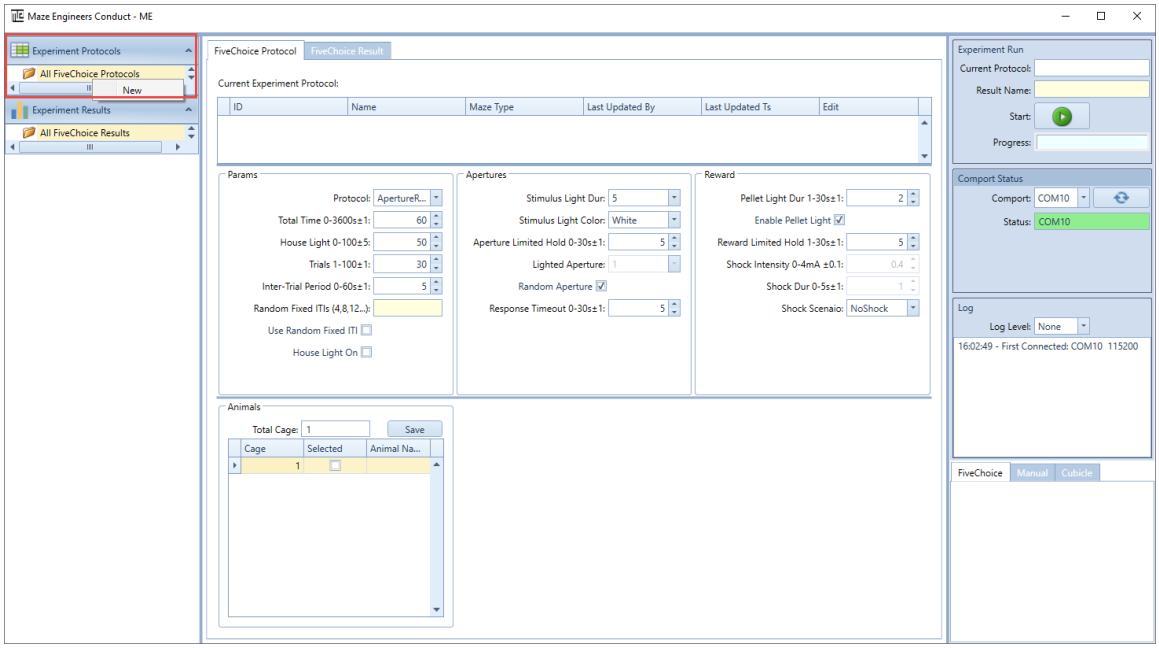
- Choose comport that matches the one on the device manager for Five Choice box and click on the Connect button. If the connection is established, the Status field shows comport being connected and background becomes green.

3. Experiment Configuration

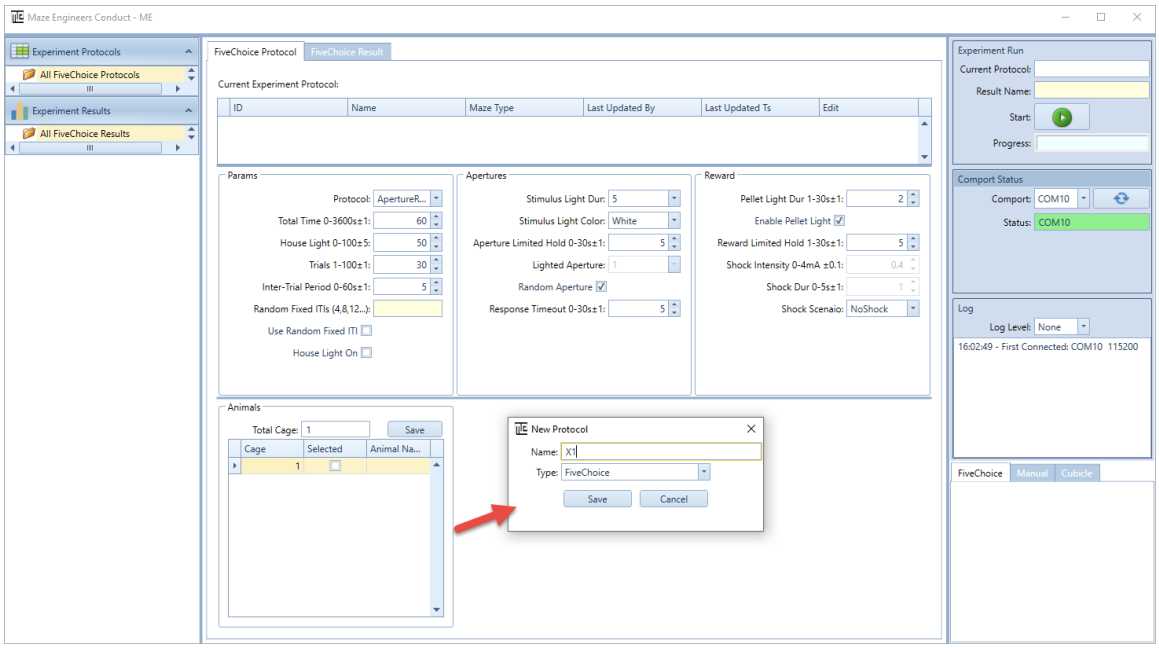
The application provides a user interface to configure and execute experiments (protocols) and view execution results.

3.1 New Experiment

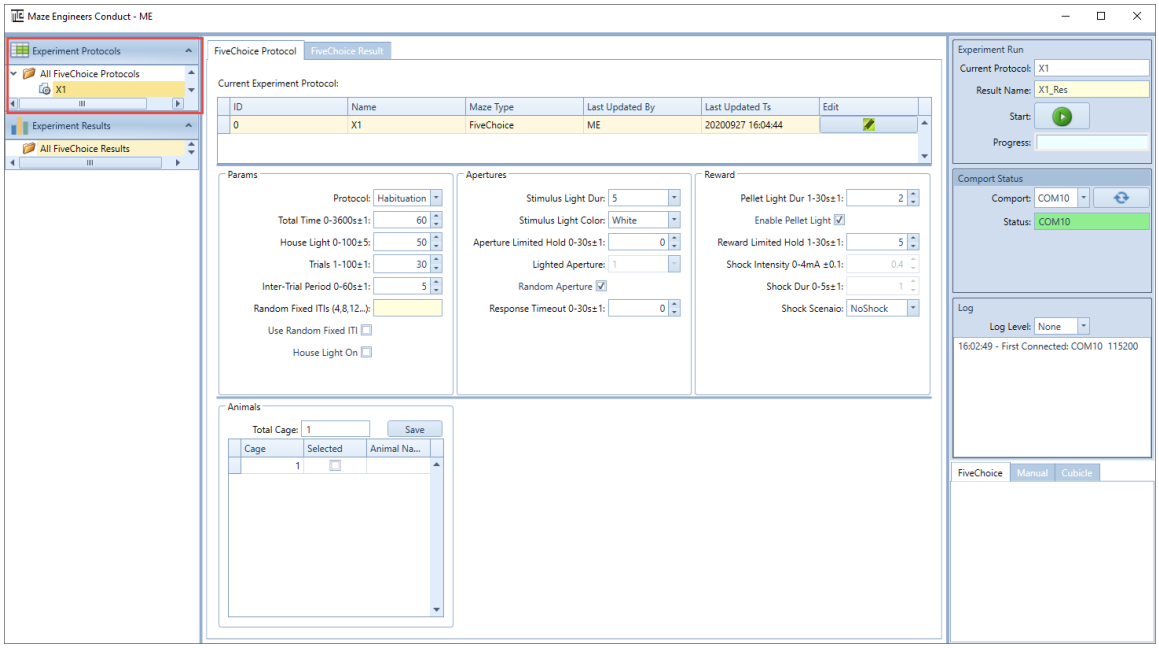
To create an experiment protocol, right click on "All FiveChoice Protocols" on left panel. A menu item New appears as shown below:



Click on New menu item, a "New Experiment" window appears as shown below. Fill in an experiment name and click on Save button.



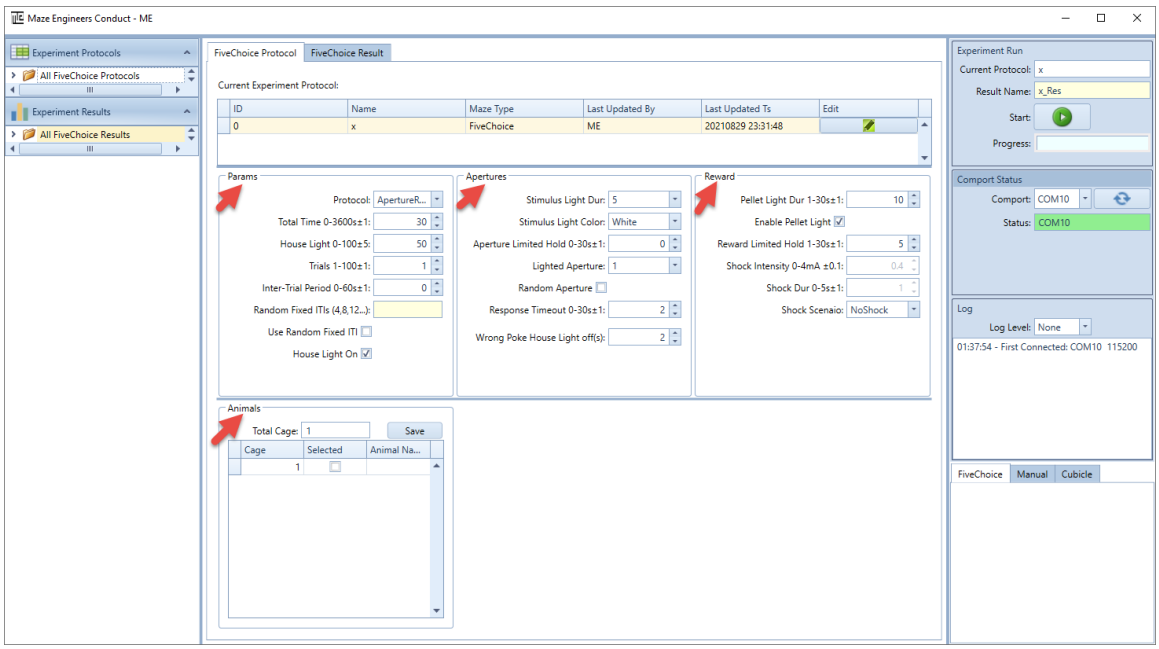
Once the experiment is created, it appears in the folder "All FiveChoice Protocols" as shown below:



An experiment can be deleted by right click on the experiment.

3.2 Configure Parameters

To configure an experiment, double click on the experiment under the folder "All FiveChoice Protocols". The content of the experiment is shown on the tab "FiveChoice Protocol".



Parameters (Params Section)

- **Protocol** – protocol types of "Aperture Response" and "Habutuation" (see protocol section 7 for more details)
- **Total Time** (1-3600 seconds) - total time of the experiment session
- **House Light** (0-100) - represents the house light intensity
- **Trials** (1-100) - represents number of the trials to continuously run in the session
- **Inter-Trial Period** (0-60 seconds) - represents the time break between trials
- **Random Fixed ITIs** - the field allows user to input a few fixed ITIs that are randomized
- **Use Random Fixed ITI** – if selected, the Random Fixed ITI will be used; otherwise, Inter-Trial Period will be used
- **Use House Light** – Turn on house light during the experiment
- **Cue Light Intensity** (0-100, step 1) – represents the cue light (in the nose poke holes) intensity

Parameters (Aperture Section)

- **Stimulus Light Dur (0.5 – 30 seconds)** - stimulus cue light duration in the aperture
- **Cue Light Color** - four colors to choose: white, red, green or blue
- **Aperture Limit Hold** - time period in addition to cue light duration for the animal to perform nose poke. If the animal performs nose poke in the lit aperture with (light duration + aperture limit hold), the response is correct
- **Aperture** (1-5) - the aperture to be lit
- **Random Aperture** - if selected, the lit aperture will be randomized; otherwise, the lit aperture will be the user selected one
- **Wrong Poke House Light off** - when the mouse pokes the wrong aperture, turn off the house light for this period in seconds

Parameters (Reward Section)

- **Reward Light Dur** (1-30 seconds) – represents duration of pellet light in the receptacle
- **Enable Pellet Light** – if selected, the pellet light is on for up to the reward light duration; otherwise, the light is not on while the pellet is delivered
- **Reward Limit Hold** (1-30 seconds) – represents time period for the house light to be on if the animal does not pick up before end of the pellet light
- **Shock Intensity** (0-4mA) - the shock current level in case it is used as punishment
- **Shock Duration** – one-time shock duration if it is used as punishment
- **Shock Scenario** – No Shock, Premature, Omission, Incorrect, All Three

Parameter (Animals)

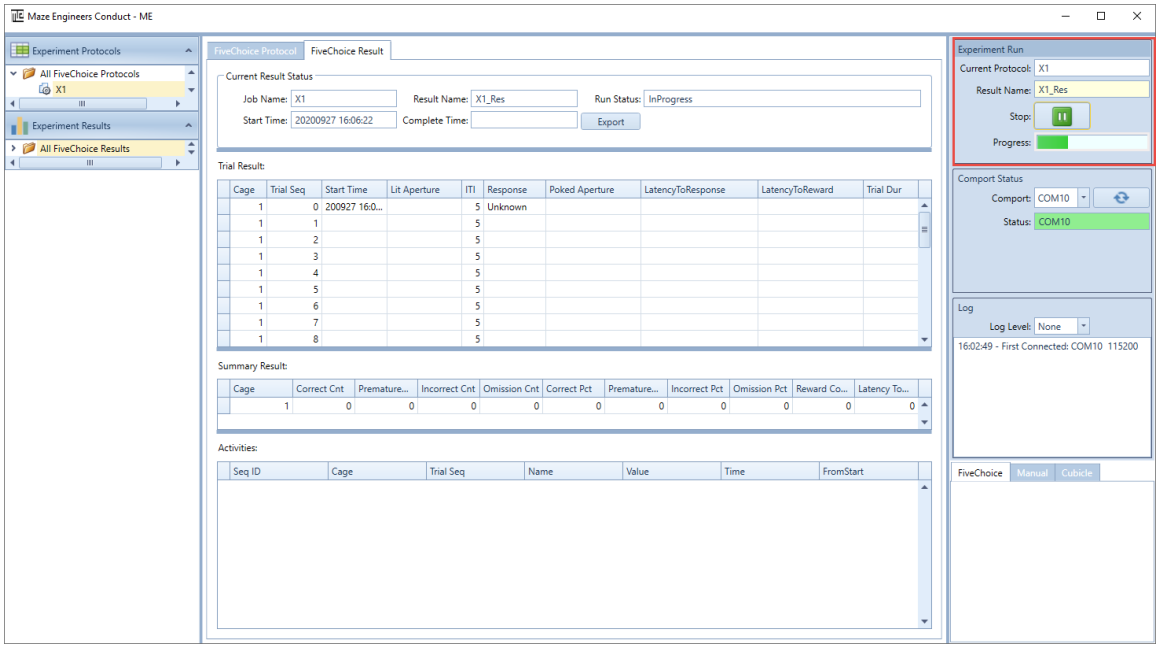
- **Cage** (1-N) - represents the number of cages that are physically connected to the system.
- The system supports up to 8 cages in total. The number is in the configuration file: C:\MazeEngineers\appConductFiveChoice\bin\MazeOriginWpf.exe.config
- If the number of cages are greater than 1, the user can select a subset of the cages to run the experiment

4. Experiment Run

To execute an experiment, select the experiment under "All Experiment Protocols" on the left navigation panel and double click on it. Make sure the Five Choice box is connected to PC and communication is properly established.

4.1 Run Experiment

Enter a name for the experiment run and click Start button. This will set system in the running state. The tab "FiveChoice Result" appears as below:



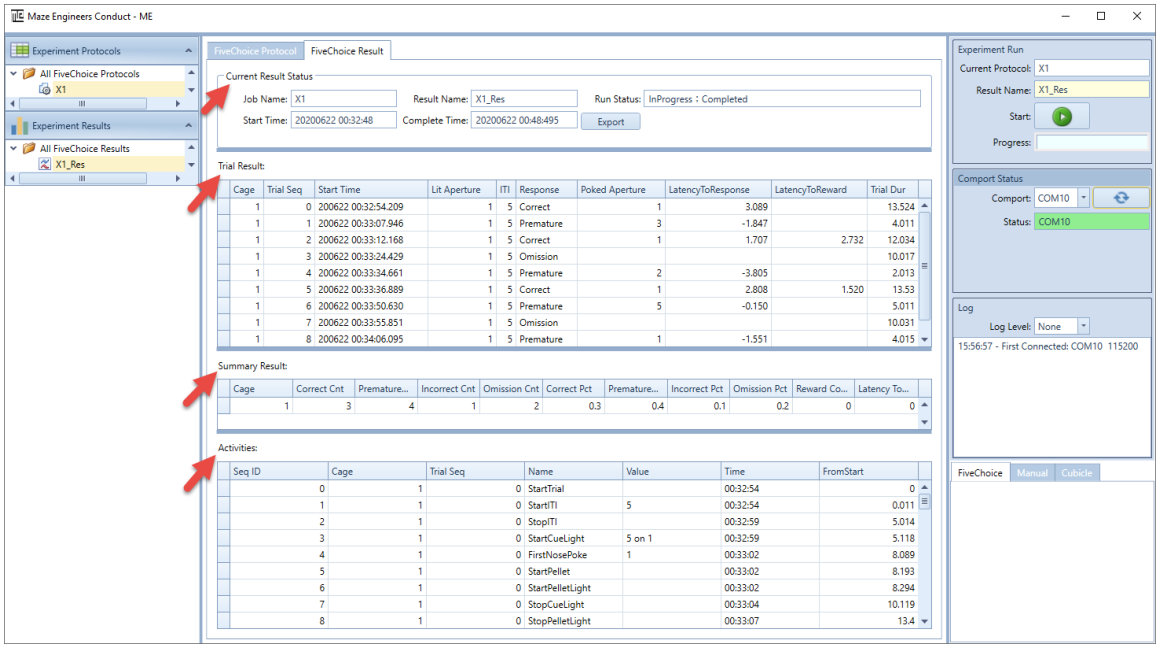
When the start button is clicked, the button state becomes stop. User can click on a stop button to stop the cage run.

The experiment will stop when total time reaches, or all trials are completed, or the user stops it.

4.2 Result Tables

The results are shown on the FiveChoice Result tab. There are four grids.

Current Result Status: show the protocol name, result name, protocol run start time, complete time and run status



Trial Result: shows the trial result for each cage and each trial. The columns include

Start time, Lighted Aperture, ITI, Response, Poked Aperture, Latency to Response, Latency to Reward and trial duration

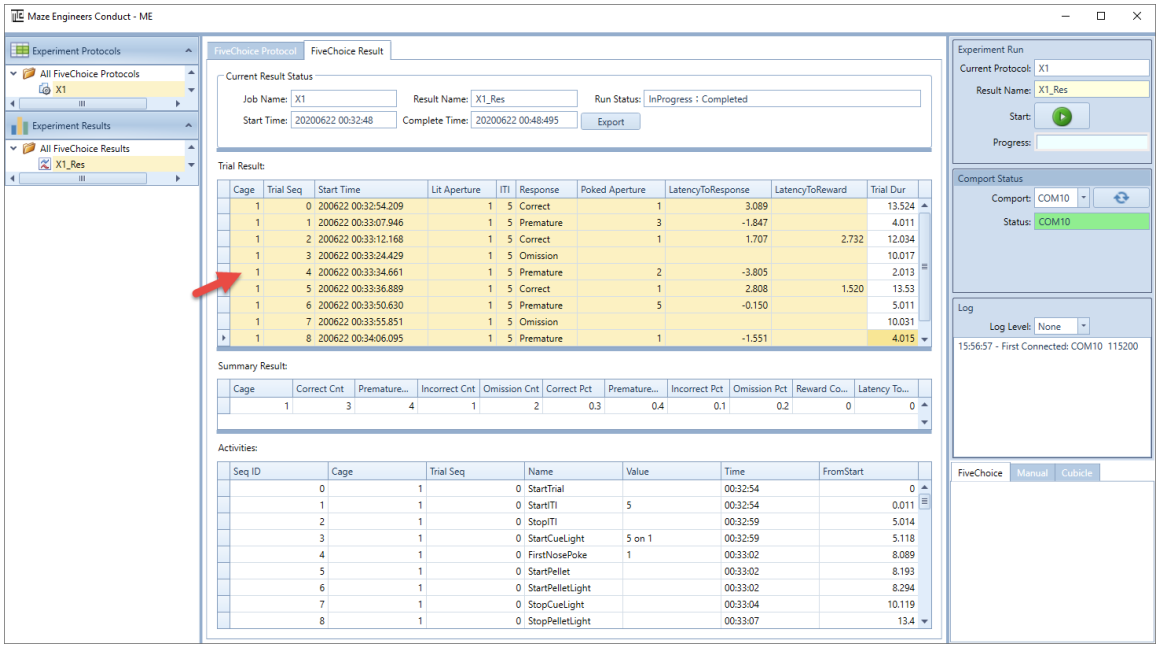
Summary Result: shows the statistics of trials for each cage. The columns include the count and percentage of each responses (correct, premature, incorrect and omission)

Sequential Activity: shows the detailed activities for each trial. This will help to understand sequence of the animal events and system actions

4.3 Save Result

The execution states are saved to your computer and you can view it at any time.
You can click Export button to export the result to a .csv file.
The grid data can also be **copied / pasted** to the Spreadsheet.

1) To select the data section, say entire grid, select the first row and first column cell, hold Shift Key (on the keyboard), then select the last row and last column cell. The entire grid data should be selected (background color light yellow) as shown below:



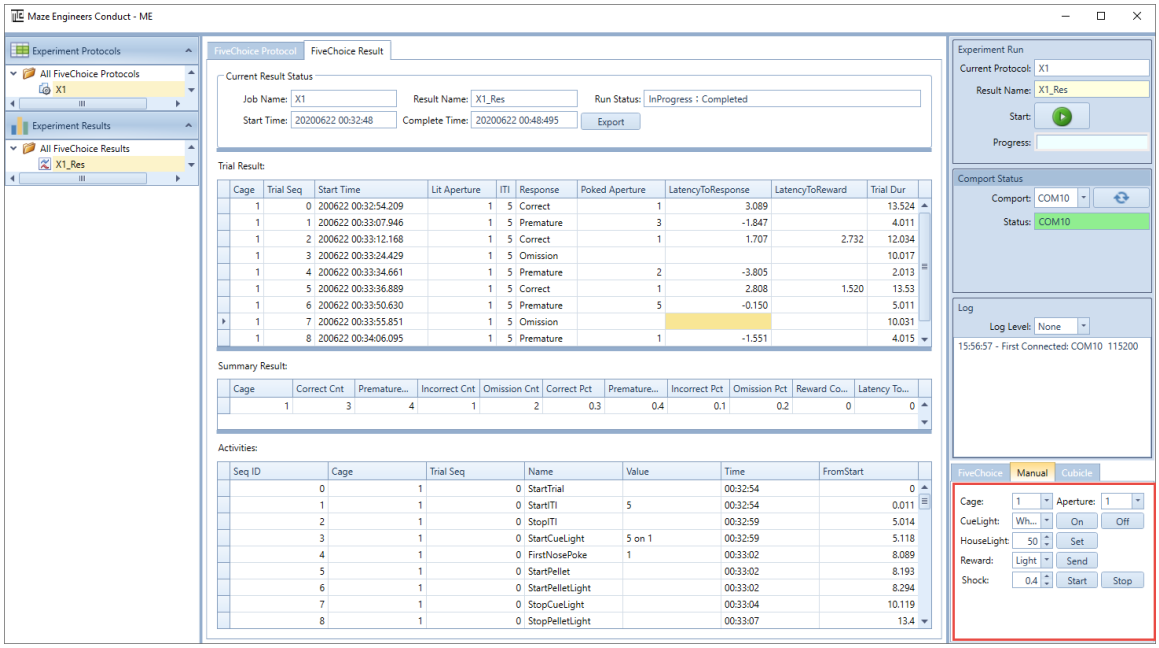
After the selection, you can leave the Shift Key.

2) Press Ctrl + C to copy the data (saved to system board)
3) Go to a Spreadsheet page and press Ctrl + P to paste the data. The grid data along with header are pasted on the spreadsheet page.

If you have large number of results and want to programmatically handle them, the result file is in C:\MazeEngineers\appConductFiveChoice\database\JobResult.txt

5. Manual Operations

The panel on the right lower corner labelled Manual is for manual control of the operations of components. It is a handy tool, but you would not need to use it normally.



6. Troubleshooting

The log file is in the Log folder under your deployment folder

C:\MazeEngineers\appFiveChoice\bin\Log

7. Protocol Types

There are three types of the Protocol the user can choose:

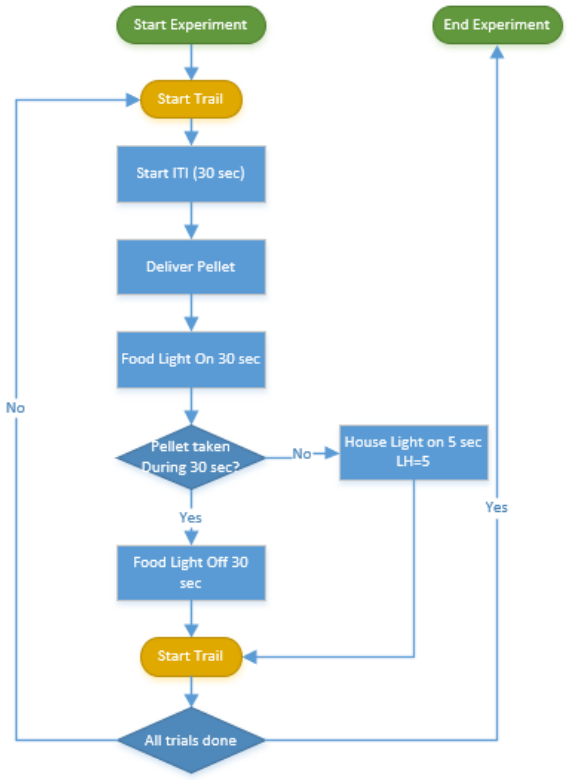
- Habituation
- Training
- Aperture Response

7.1 Habituation Phase

We use a typical habituation training as an example to show how to configure the system.

The goal of habituation sessions is to acclimate each animal to the testing chamber and to lead them to associate the light in the food receptacle with delivery of food reward. Animals spend 2 days habituating to the testing box.

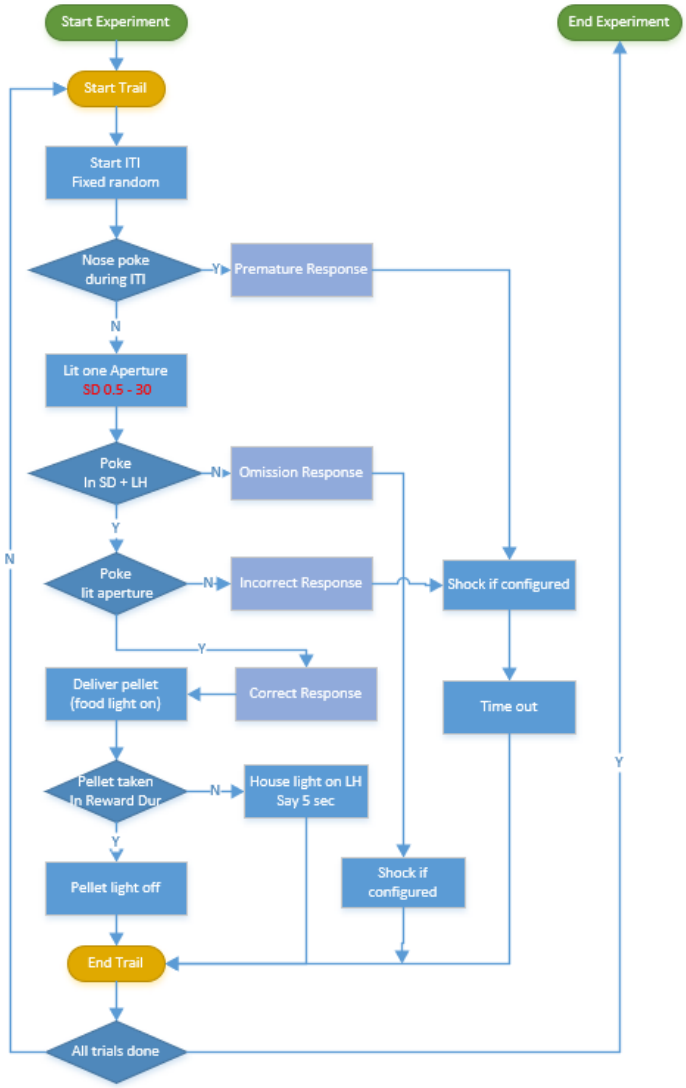
Each habituation session lasts for 30 minutes. During each habituation session, a light in the food receptacle is turned on for 30 seconds and turned off for the remaining 30 seconds of each 60-second period. If the animal fails to retrieve the pellet within the allotted time period, the house light above the food receptacle is illuminated for 5 seconds. The period during which a rat could obtain the food pellet once the light in the receptacle is turned off is referred to as the limited hold period. The limited hold period provided an opportunity for a rat to respond correctly even when the light stimulus has been turned off.



7.2 Aperture Response Phase

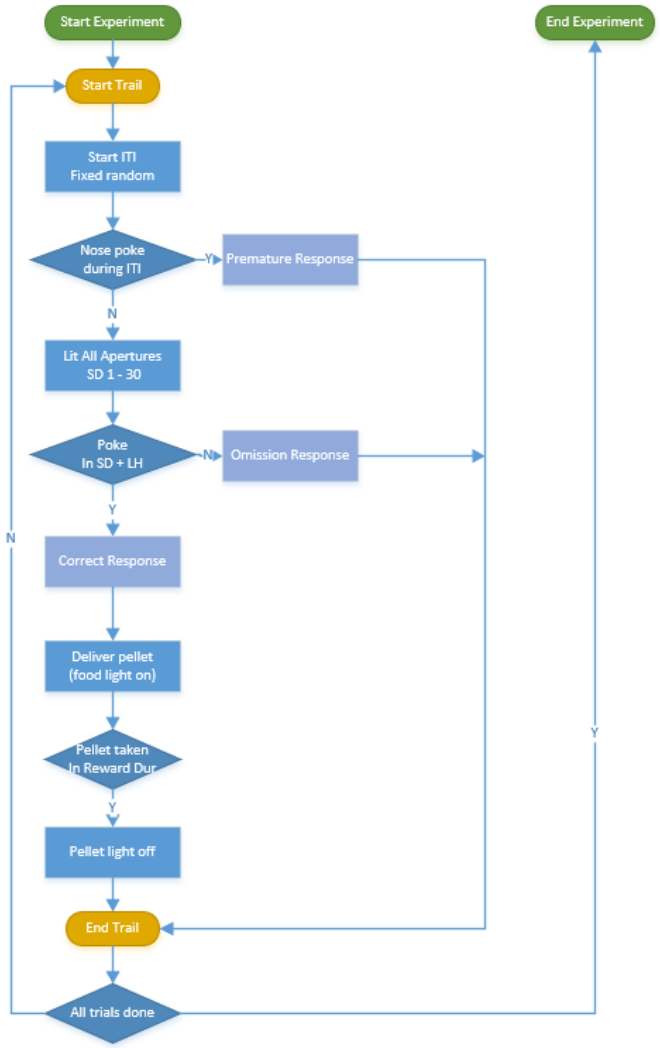
During this phase, animal learns to nose poke into one of five apertures located on the wall opposite the food receptacle. Each session during this phase lasts for 30 minutes or 100 complete trials. For each trial, a light is illuminated pseudorandomly in one of the five apertures; each animal must learn to nose poke into the lit aperture. Animal learns to pay attention to the wall of apertures in order to correctly detect the location of the lit aperture, and then to subsequently collect their food reward from the receptacle. Once the food pellet is retrieved, a 5 second inter-trial interval commences, followed by initiation of the next trial.

When an animal has learned to respond correctly for at least 50 of 100 possible trials over a 30-minute session, the task difficulty is gradually increased by reducing the amount of time that the stimulus aperture is lit on the next testing session. At the beginning of the aperture response phase, animals have 30 seconds to locate the illuminated aperture. As the animals acquire the task during the aperture-response phase, the length of time that the aperture is illuminated is reduced to a 2.5 second duration.



7.3 Training Response Phase

During this phase, animal learns to nose poke into any of five apertures located on the wall opposite the food receptacle. For each trial, all aperture lights are illuminated; each animal must learn to nose poke into an aperture. If the animal nose pokes, food reward is delivered following the simar logic as aperture response phase in the above section 7.2.



7.4 Probe Trial Phase

After a stable performance is achieved (less than 20% omissions; more than 80% correct responses) at a 2.5 second stimulus duration over 2 consecutive testing sessions, animal begin the probe trial phase. During the probe trial phase, the length of stimulus presentation during a given session is decreased from 2.5 seconds to one of four different durations (1.5, 1.0, 0.5, and 0.25 seconds), presented over the course of the next testing session on a pseudorandom schedule. The 5-second limited hold period become especially important during the probe trial phase, as the light in an aperture is only visible for a short amount of time. This makes the completion of a nose poke in an aperture while the stimulus is presented difficult, if not impossible. Probe trials are not administered on consecutive testing days, meaning that each probe trial is separated by at least one day of testing at baseline parameters (2.5-second stimulus duration).

Each animal is presented with each of the four different stimulus durations on three different testing sessions, and each probe trial session continues for 30 minutes or the completion of 100 trials.

This phase uses the protocol type of Aperture Response with proper protocol parameters.

8. Key Terms

Premature response: the animal performs nose poke before the stimulus (cue light on), i.e. the nose poke occurs during ITI. It is used as an index of impulsive action.

Incorrect response: the rat responds in an incorrect aperture after the cue light stimulus is turned on.

Omission: a failure to respond within the limited hold (LH) period (SD + LH)

Correct: the animal performs a nose poke in the lit aperture within (SD + LH) time period. In this case, a reward is given

inter-trial interval (ITI): the period after the end of a trial and the initiation of the next trial

Reward Limited Hold: If the animal fails to retrieve the pellet within the allotted time period (the period the food light is on), the house light above the food receptacle is illuminated for an additional period - Reward LH. This reward LH provides an opportunity for the animal to respond correctly even when the light stimulus had been turned off.