



The T-REX on the Jurassic Park Pinball is a ball eating dinosaur. It is a complex mechanical device which has an elaborate computer control of it's motion and animations. This guide is intended to aid in the setup, testing, operation, and trouble shooting of the dinosaur.

## SETUP

When the Jurassic Park Pinball is first set up, the T-REX may be covered, wrapped, fastened, or otherwise secured in position. remove any packing material first. If he has not been jostled out of position during travel or unpacking he may be in operational condition in which case just turn on the game. When the game is powered on there will be T-REX Diagnostics performed by the game CPU. These tests will check for left/right motion and for the ability to bend down and eat a pinball from the eject hole in front of him. If he successfully moves all the way left, all the way right, then finds the center, bends down closes his mouth, goes back up, then gives one or more chomps of his mouth, he is fully functional and no further actions need be taken. If not, then some adjustment will be necessary to make him ready to eat pinballs.

## THEORY OF OPERATION

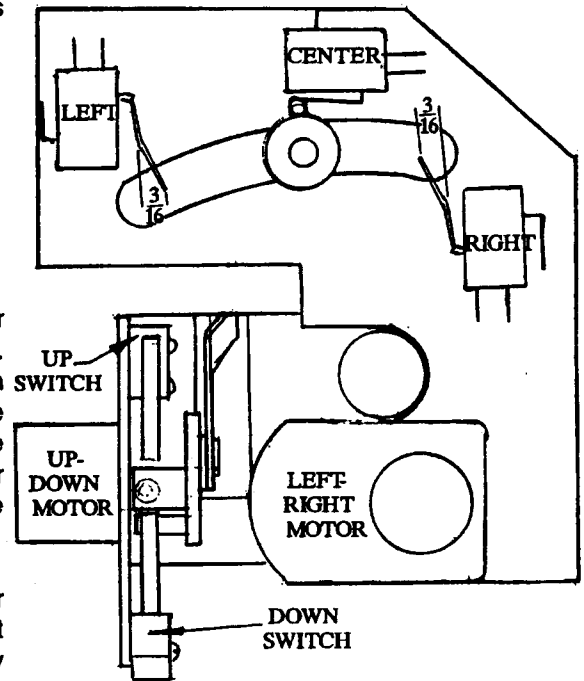
The T-REX Dinosaur consists of a left/right motor, an up/down motor, a solenoid to open and close his mouth, and 5 switches to provide location information. Assuming the Dino assembly is placed correctly with respect to the Dino eject hole, if all the components are in proper adjustment the Dino should be able to eat a pinball. When the conditions to eat are satisfied, the sequence of operations is as follows:

- 1. Find the center switch
- 2. Bend down to the eject hole
- 3. Close mouth (grab ball)
- 4. Move back to up position with ball
- 5. Swallow ball and chomp 1 or more times

The most difficult of the above operations is to find the center switch due to two factors. First, in order to ensure accuracy (i.e. to be sure that when he bends down that he will be centered on the ball,) the range of motion around the center switch where the switch will be seen as closed is very narrow. This leads to the second factor which is that the momentum of the left/right motor will tend to carry the Dino through and past the point where the center switch is seen closed (overshoot).

Because of these two interacting factors a modified 2nd order control system is used to bring Dino to the center switch. What this means is that the Dino initially will move at full speed to try to find the center switch quickly. Many times this will lead to overshoot, so when the Dino goes past the center switch he will attempt to step back slowly towards the center and try to find a point where the center switch remains closed. The direction of the motor is changed by altering the polarity of the voltage applied to the motor through the use of the Bi-directional relay board. Once the center switch is found, the up/down motor is started and will run until the down position switch is found. The down switch has a wide enough range when closed that overshoot is not a problem. Once in the down position, the up/down motor is stopped and the mouth solenoid is activated which will close his mouth on the ball, lifting it from the Dino eject hole. Then the up/down motor is again turned on which will lift Dino with the ball in his mouth to the up position. When the up position switch is found, the up/down motor is stopped, and the mouth solenoid is de-activated which will (in most cases) cause the ball to be swallowed.

During game play, the Dino will move left and right at random based strictly on time.



In diagnostics there is a Dino Test Function which provides information about the switch states and allows the flipper buttons, start button and gun trigger to operate the mechanical components of the T-REX. The switches are named and next to each description the state of the switch is shown (on or off). The flippers allow left and right motion of the T-REX, the start button allows up and down motion, and the trigger allows the mouth to chomp. Using these controls, the Dino can be positioned to enable the power on diagnostics to be performed. The required position for normal operation is that the Dino assembly must be up or on the center switch. If the up switch is not made, left and right motion will not take place. If the center switch is not made, up and down motion will not take place. In other words if neither up nor center switches are closed no motion will occur and the T-REX will shut itself off until power is cycled (or a slam tilt), and he is on one of those two switches. If up is not closed upon power up, but the center switch is closed, the T-REX will move up until the up switch is found, then will move left and right and proceed through an eat cycle. If the center switch is not closed but the up switch is closed, T-REX will move left and right then find center and go through an eat cycle. The Dino test function in diagnostics will allow movement so that T-REX can be positioned on to either of the critical up or center switches. Should one of those switches malfunction, it should be adjusted until it functions properly, or it should be replaced. Caution should be used in the Dino test so that the motors are not over stressed by having them on for too long. It is fun to play with moving T-REX around, just don't overdo it.

Also note: on early versions of cpu code (before 4.00) the diagnostic function required, that the Dino be at the up position in order to allow left and right motion, and that the Dino be on center before up and down motion was allowed. If you have a version of code before 4.00 and the Dino will not move in diagnostics then check the switch states in the display and if neither up nor center switches are closed, then move Dino left or right by hand until the center switch is on, then use the credit button to move him up at which time the flippers will allow left and right motion.

## TROUBLE SHOOTING

**Symptom :** No Movement of the Dino Assembly

**Check:** The Dino Top Switch or Center Switch to insure its ON. Unless one of these switches are ON the game goes into a Fail-Safe condition which prevents further operation of the mechanism until one of these switches are closed. The T-REX test is the best way to check these switches. If the switches appear to function mechanically but don't appear in the test, check the connectors that attach the assembly to the playfield harness to insure they are seated properly and have no loose wires. Also examine fuse F1 on the Shaker power motor board. (This provides the voltage to the Left-Right Motor. Check set screws to make sure they are tight. (See items 13 & 20 on page 70 of manual.) If set screws are secure and motors make noise but don't turn, motors are damaged.

**Symptom:** Dino Assembly jerks during up-down motion.

**Check:** The set screw located on the back of the Dino assembly to insure it is tight. (See item 13 page 70 in game manual.)

**Symptom:** Dino Assembly moves left & right but never eats.

**Check:** The adjustment of the center switch. If the switch does not close, loosen the screws mounting the switch to reposition it, avoid bending the actuator.

**Symptom:** Dino Assembly "eats" but drops the ball out of his mouth.

**Check:** The adjustment of the center switch. If it appears proper, using pliers, slightly bend the upper metal "teeth" outward to insure a good grip on the ball. Also make sure the Dino DOWN switch is actuated when Dino has stooped to its lowest point.

**Symptom:** Ball goes into T-REX hole after spelling T-REX and Dino doesn't eat, ball is ejected.

**Check:** Center switch and make sure program is version 4.0 or higher (in earlier versions center switch requires more settling time.)

Page 2 of 2

Q25- Drives the up-down motor.

Q24- Drives the left-right motor.

Q27- Drives the Bi-directional relay controlling the voltage polarity going to the left-right motor.