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Radio-Electronics

ELECTRONICS FOR EVERYONE

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Radio-Electronics

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n Your Home

LETTERS

(continued from page 22)

AM/FM receiver thru which I can play and tape records but it is not equipped with tape monitor in and out circuit, so I constructed a separate phono preamp using an LM381 IC. Now when I connect the record player thru the preamp, then equalizer, to the tape recorder (Sony model TC-353), I can tape a record and monitor the taped result on my speakers. But at times while taping I'd hear interference—sometimes music, sometimes voices. Checking this out I found I was hearing an FM station and at times an Amateur would be heard.

As suggested by Mr. Feldman, I put a 250 pF capacitor across the input of the preamp and that helped considerably. I tried the capacitor and inductor setup suggested using first a 1.5 μH inductor and then a 5.6 μH, but it didn't seem to improve things. I was told that the shielded cables normally used are made with a spiral shield instead of braided shield. I had some single-conductor braided shield cable and tried that but it didn't help.

Mr. Feldman said if enough interest was shown he would have more information on this subject. Are more articles coming up? I would like to get all information available on this subject. I wrote to the local FCC but they were of no help. I am writing to EIA to see what they will do.

A. A. HOLLIGER
Los Angeles, CA

Mr. Feldman is patiently awaiting reader responses to determine if there is enough interest for a follow-up article. Your response has been taken into consideration.

How about the rest of our readers? If you know of any other sources of information on rectification, let us know so we can pass it on—Editor.

CLEARING HOUSE FOR SECURITY

I've been an avid reader of your publication for many years. I particularly look forward to the excellent articles on security systems and I am presently attempting to write a book on the subject. In reviewing the many articles you have presented over the years, I noted that a gentleman volunteered to act as a "clearing house" for your TV Typewriter. I would like to avail myself as a "clearing house" for security systems. Readers that would like to participate in exchanging ideas, approaches and problems can write to me at the following address: Don Johanson, 1860 Polk St., Concord, CA 94521. In turn I will compile the information and distribute it to those interested. (A self-addressed, stamped envelope will help.)

My book, when completed, will cover fire/intrusion detection, controls and alarms with sections on do-it-yourself circuits and low-cost measures that can be taken to reinforce areas of entry.

Keep the security articles coming—in these times we need them.

DONALD P. JOHANSON
Concord, CA.

R-E

TV games are great fun to play. But they are also exciting examples of how to use modern electronics. Come along and see how they work

by LARRY STECKLER
EDITOR

TV Games At Home

FOR A CONSIDERABLE NUMBER OF YEARS, we sat in front of our TV sets and let them entertain us with moving pictures on that little screen. In the time that we've enjoyed TV, the screen has gotten larger and is still growing, and we've gone from back and white pictures to full living color. And now there are even some experiments with stereophonic sound.

Yet there is a new kind of entertainment being offered on that home TV screen—it's a Ping-Pong game, a soccer field, a shooting gallery and others and you, who until now have been a passive viewer get to control the action.

By now, we've all been exposed to the coin-operated games in hotel lobbies and "penny" arcades, but those games have finally moved into the livingroom. You just take the little black box with two or four knobs on the top, connect it to your TV receiver and instantaneously convert that set into a home game center—a center that lets you play any one of several games, keep score and includes sound effects too.

The first of these games to reach the home was the Magnavox Odyssey. In its original form, it offered no sound, but did permit the user to play a multitude of games by placing printed plastic overlays on the screen of the set to form the gameboard. Now Magnavox has gone one step better. They've added sound effects along with scoring and pattern generation, to create the field upon which you play and produce the sound effects that add realism.

We've all seen the games, but the real question is do we know how they work. Thanks to an awful lot of cooperation from the Magnavox engineering staff in Fort Wayne, Indiana, we are able to bring you details on how their system functions.

Odyssey 200

The 200 is a self-contained unit that connects to the antenna terminals of any TV set. It is powered by either six "C" cells or an external 9-volt DC power supply. Three games are offered—Hockey, Tennis and Smash. Either two or four players can play.

The unit connects to the TV receiver and delivers its signal via a 50 ohm coaxial cable through an antenna switchbox to the set's VHF antenna terminals. The switch selects either the game or an external VHF signal. Since this unit is a Class 1 TV device, it meets all of the required FCC regulations. The switch box prevents game signals from being fed into the antenna system.

Before we look at how the unit works, let's briefly describe the three games that can be played. First is Hockey, which can be played with either two or four players, a ball, a left wall and a right wall on the screen. In the 4-player mode, each opponent has vertical position control of two players (both move vertically by means of one control) and horizontal control of one player (the other player is fixed horizontally). The two walls have openings (goals) at the center. As the ball moves across the screen and contacts one of the walls, it reverses direction.

If the ball is moving to the right and contacts the right opponent's player, it reverses direction to the left and the right opponent has ball control. If the ball is moving to the right and touches the left opponent's player (it may have rebounded off the left wall), it continues to the right, but the vertical ball control is now in the possession of the left opponent. The ball cannot go off the top or the bottom because black rebound walls return the ball to the playing field with a bounce. A score is made for the left opponent when the ball passes through the right goal regardless of who has ball control. The right opponent scores when the ball passes out through the left goal.

The second game is Tennis, and again there can be either two or four players, a ball and a center wall. The ball does not rebound from the center wall. The opponents attempt to make each other miss the ball as it moves across the screen. A score is made for the left opponent when the ball passes out the right side of the screen and a score is made for the right opponent when the ball passes out the left side of the screen. Just as in Hockey, the ball will not go off the top or the bottom because black rebound walls return the ball to the playing field with a bounce.

The third game is Smash and there can be only two players, a ball and a left wall. The ball rebounds to the right off the wall and to the left off the players. Opponents attempt to make each other miss the ball. A score is made for the opponent who last had ball control when the ball passes out the right side of the screen. Just as in Hockey and Tennis, the ball will not go off the top or bottom because black rebound walls return the ball to the playing field with a bounce. The ball is reset by touching the wall with a player.

How it works

Signal from the unit is fed into the TV set on either channel 3 or channel 4. The choice is up to the user and the active channels in his area. The heart of the unit is a network of six integrated circuits (see block diagram in Fig. 1), IC1 contains the regulated power supply, right-wall generator, syc generator, and rebound circuitry.

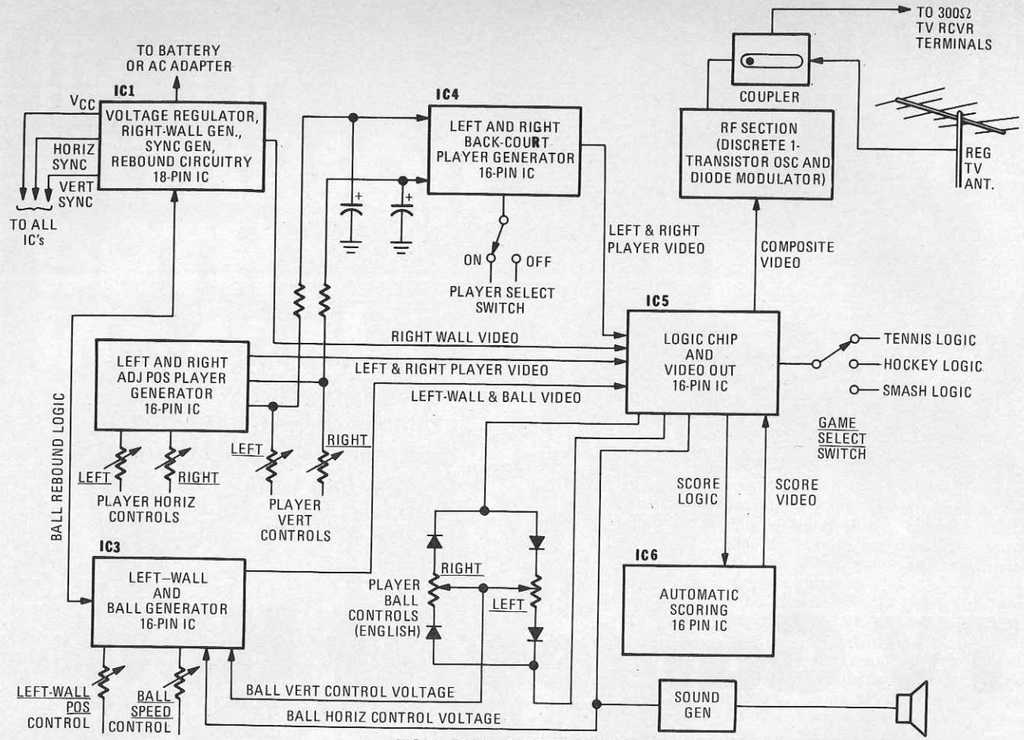


FIG. 1—TOTAL SYSTEM OF MAGNAVOX ODYSSEY shown in block diagram form.

Another, IC2 contains two user adjustable (horizontal and vertical position) player generators. IC3 contains the ball generator, the left-wall generator and the wall gate on-off. IC4, like IC2 has two operator adjustable (vertical position only) player generators. IC5 contains the game select logic, video summer, serving delay, horizontal video blanking, ball horizontal direction and ball vertical control selection flipflops. IC6 contains the circuitry for on-screen bar scorekeeping.

Spot generator

Figure 2 is a block diagram of a spot generator, the basic building block of the Odyssey system. All video spots are generated using this system and varying the size and polarity of the vertical pulse. The vertical and horizontal sections both operate in the same manner so we need only describe one of them here. Vertical sync is used to control the switching that transfers the position control voltage to the timing capacitor. Constant-current source I_1 begins to discharge the timing capacitor. When the voltage reaches the first trip point, voltage comparator 1 output goes high (see timing diagram in Figure 2-b). Since the output of the comparator 2 is still low and the output of inverter 1 is high, the output of AND gate 1 goes high too. This high level turns I_2 on increasing the discharge rate of the timing capacitor.

When the timing voltage reaches the second trip point, the output of comparator 2 goes high, causing the output of AND gate 1 to go low, I_2 turns off and the timing capacitor continues to discharge at the lower rate. The width (height) of the spot is determined by the size of the capacitor and I_2 since I_2 is much larger than I_1. The position of the spot is determined by the capacitor, I_1 and the position control voltage.

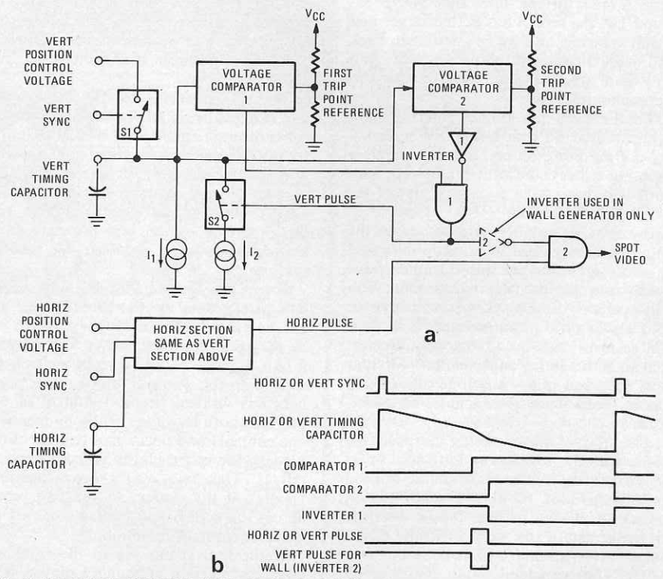


FIG. 2—THE SPOT GENERATOR is the basic building block of the Odyssey system. It creates all the spots on the game field.

To produce the video spot, the output of the vertical section is combined with the output of the horizontal section in an AND gate. In the case of a wall, the output of the vertical section is first inverted. This produces a goal for the hockey game. In tennis and smash, the vertical section is turned off.

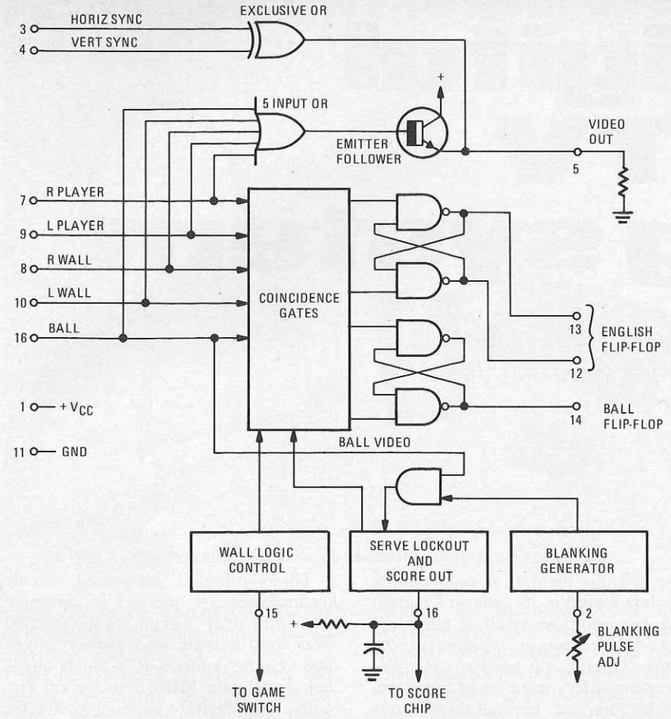


FIG. 3—THERE ARE THREE DISTINCT PARTS to this IC; the video summer, coincidence controls, and a logic control system.

Video summer-logic

IC5 (Fig. 3) has three distinct sections, the video summer, coincidence circuits (which operate ball and vertical ball control flip flops) and logic control systems.

The video summer is a 5-input OR gate with horizontal and vertical sync added to the output of the gate through an EXCLUSIVE-OR gate.

The purpose of the coincidence gate is to detect coincidence of the ball with the players or walls, depending on which game is being played. The proper coincidence will immediately operate the ball and vertical ball control flip flops. Vertical ball control flip flop controls polarity of the voltage applied to the player control and thus determines who has control over the vertical direction of the ball. In the tennis game, the flip flop output is also used to determine horizontal direction of the ball, since in this game ball direction change and vertical ball control must occur at the same time.

The ball flip-flop output operates the sound beeper and in hockey and handball it also controls ball horizontal direction. The sound beeper, by the way, is simply a ceramic transducer that produces a sound output each time the ball strikes the side of the game or one of the paddles (players).

Logic-control circuitry is connected to the GAME SELECT switch. When this switch is on, as in the handball (SMASH) position,

(Continued on page 71)

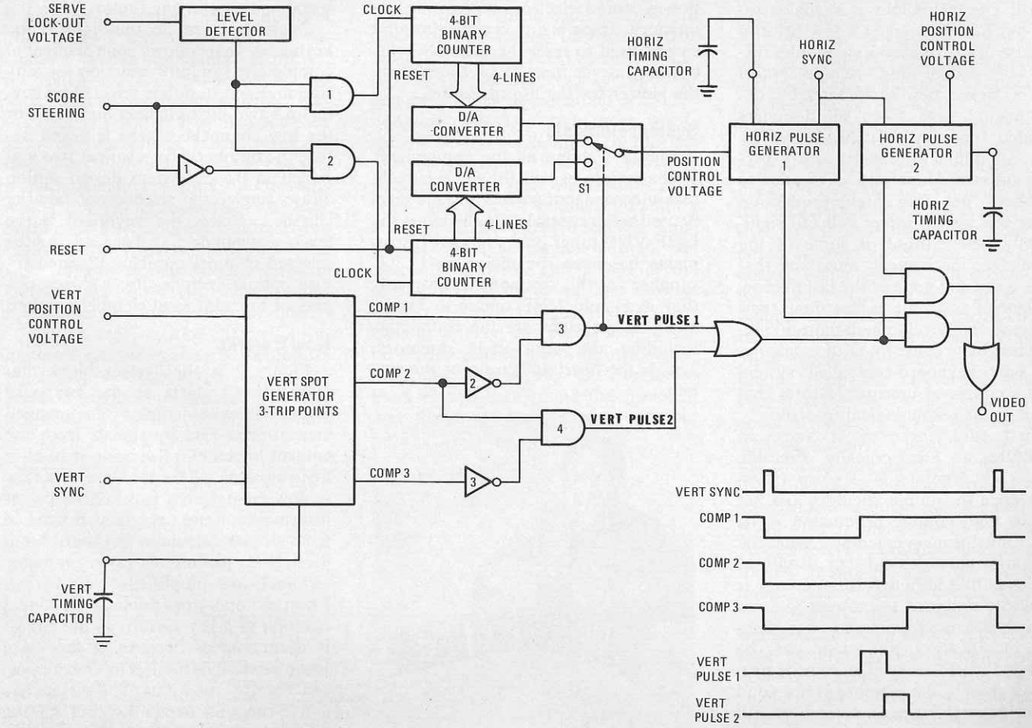
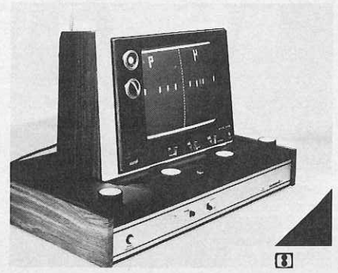


FIG. 5—SCOREKEEPING IS HANDLED by this circuit. It's not as simple as it seems and it is an interesting way of scoring without usng a character generator.

(continued from page 31)

the logic circuitry enables the coincidence gates to detect ball coincidence with the back side of the left player. In handball, the ball must bounce off either player and reverse its direction back towards the wall which is always on the far left of the TV screen.

The serve lockout and score output on this IC provide a score indication pulse for the score IC and also through discharging of an external capacitor prevents the ball from re-entering the playing field once a score has been made until that score has been registered by the score IC (IC6). This capacitor allows approximately 1.5 seconds delay before the ball can be returned to play. Since the ball reset is accomplished by the player who lost the score touching his player to a wall, the delay prevents cheating.



BROADMOOR 4-PLAY combines monochrome TV and game chassis. Game signal is video and is fed directly to video circuitry.

The blanking generator provides a logic pulse slightly wider than the horizontal sync and is centered, timewise, about horizontal sync. Coincidence of the ball and this pulse enables the score output and

PONG BY ATARI is available at Sears stores now. It plays only the one game.

initiates the serve lockout circuitry. This blanking pulse is needed to prevent the ball from travelling into and disappearing in the horizontal sync. If this were allowed to happen, the ball video would not be generated to operate the logic or coincidence gates.

(continued on page 90)

Regulator sync generator

The regulator/sync generator IC (IC1) contains a fairly conventional 5-volt short-circuit protected active regulator, vertical and horizontal sync generators. Fig. 4 shows only the sync generator, right-wall generator and ball-rebound circuitry.

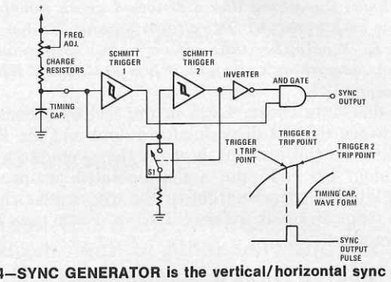


FIG. 4—SYNC GENERATOR is the vertical/horizontal sync generator shown, plus right-wall and ball-rebound circuits that are not shown here.

The sync generators are nearly identical and only the horizontal generator will be described. The oscillator consists of two Schmitt triggers, whose inputs are both connected to a common timing capacitor. As this capacitor charges towards VC_C, the voltage across it passes the trip point of Schmitt trigger 1. The output of trigger 1 goes high and is ANDed together with the inverted low from trigger 2 to give a positive output at the sync output.

As the timing capacitor continues to charge, trigger 2 trip point is reached and its output goes high, activating switch 1 which discharges the timing capacitor. Trigger 2's high output is inverted and puts a low at ANDgate 1, thus turning off the sync output. As soon as the timing capacitor discharges to a voltage level low enough to turn trigger 2 off, the switch opens and the capacitor begins charging all over again.

Operation of the top and bottom rebound circuitry is as follows: Two voltage caparators with the same reference voltage are used to detect whether a high- or a low-voltage condition exists on the ball vertical control line. Ball vertical position on the screen is determined by the voltage on this control line. This voltage is controlled by the setting of the player's ENGLISH control. If the ball reaches a pre-determined point on the screen near the top or bottom the appropriate comparator transfers a voltage high to the damping capacitor on its output. The high remains on the capacitor long enough to turn one of the switching transistors full on. When it does turn on, a voltage high (or low) is applied to the ball's vertical control line which counteracts the voltage already there and causes the ball to reverse its vertical direction or bounce away from the rebound wall (both switching are normally off when the ball is at or near the center of the playing field).

As the ball continues in its direction away from the rebound wall, the comparator that supplied the voltage high to the damping capacitor now switches off. However, the capacitor discharges slowly through a 100,000-ohm resistor until the appropriate switching transistor turns off. When the switching transistor turns off, the ball control voltage is no longer being opposed and the control voltage line then assumes whatever voltage is being applied to it by the player ENGLISH control. If the player having ENGLISH control is forcing the ball into an extreme upward (or downward) direction, the ball will return to the rebound wall and the comparator recharges the damping capacitor and the switching transistor again forces counter-acting voltage onto the ball vertical control line.

If the player leaves his ENGLISH control in this extreme position long enough, the ball bounce will eventually decay down until the ball remains at the rebound line. This happens because the damping capacitor requires less and less current to restore its charge each time and the switching transistor remains on all the time.

Scorekeeping

When the ball leaves the screen, the reset-lockout voltage begins to rise. This is detected by the level detector (see Fig. 5 on page 31). This sends a pulse to a counter steered by the score steering logic. This increments the 4-bit binary counter of the player who scores a point. Each counter stores the score of the appropriate player. The output of the counters is converted to analog voltages by digital-to-analog converters.

The horizontal portion of the score index mark is generated by horizontal pulse generator No. 1. The position is controlled by the analog voltage from one of the two digital-to-analog converters selected by switch S1. S1 is controlled by vertical pulse 1.

The vertical portion of the score is generated by a spot generator section with three comparators. The outputs of these comparators are gated together to generate two consecutive vertical pulses. The first pulse controls which counter is selected.

The end-mark horizontal position is generated by a separate generator. Its position is set to coincide with the position of the index mark when the counter is at binary state 1111 (15). And there you have a detailed description of how the Odyssey game works.

Other games

Odyssey is not the only TV game available today. Broadmoor Industries also makes a TV game. Theirs consists of a console and a TV set. The game unit itself cannot be used with any TV set, but must be used with the one Broadmoor supplies. The reason is theirs connects the game signa, into the video circuitry of the TV receiver. Their game offers two different versions, hockey and tennis, for either two or four players. It is complete with sound and digital scoring. After each player scores a point, the score appears on the screen. Details of this circuit's operation were not available at the time this article was prepared and therefore, we can give you only this brief description and a couple of photographs of the unit.

Another game called Pong, is made available through Sears-Roebuck stores. It's made by a company called Atari, the same people who make the game Pong that you find in hotel lobbies. Pong is an electronic adaption of table tennis in which two players manipulate dials on a control console to move computerized panels and hit a ball of light back and forth across a video display screen. The home version of Pong can be played on any size color or black-and-white TV set. The unit connects to the antenna terminals of any TV set and like Odyssey, can be used on either channel 3 or channel 4. It too is battery powered or can be powered by a 9 volt DC power supply. The game sells for approximately $100.00.

Atari also makes fifteen different coin operated computer video games designed around sports such as table tennis, soccer, volley ball, hunting and auto racing. Newer models challenging players to maneuver tanks or airplanes have been developed using some of the most sophisticated computer technology available for electronic games. We can be sure that this is just the beginning of a whole new industry and many of these games will be available in the months and years to come for home entertainment use. **R-E**

WE RAN OUT OF ROOM

In this issue we had planned on describing a new remote control system made by RCA. Its a very special system in that there are no controls, that's right NO CONTROLS on the TV itself. Also, there is a special digital clock built in, and the channel number you have selected appears on the screen. Since we ran out of room in this issue and could not include this story, we have been forced to delay its publication until January 1976. Our apologies for not delivering what we promised, and please do look for this story next month.