

ANDS

for two pairs of players

with coincidence-detecting circuitry

ANDS combines basic concepts of musical instrument, structure, and form into one set of circuits. The structure of any particular performance is determined by coordinations between the players and the circuit. The form of the piece results from relationships that develop among the players in performance. The primary score is the circuit itself.

Awareness of the form is necessary for performance. This awareness can best be attained through some direct experience with the instrument and the structure. Someone who understands the circuit-as-score should design rehearsal instructions that will expose the players to the factors that shape the piece.

The instructions for the first rehearsals can be task-like and relatively mechanical, so that the players may develop a feeling for their instrument and its controls. Later rehearsals should shift the players' attention to the circuit's structuring of time and to their possible roles within that structure. (An example of an instruction set for such a rehearsal is included in this notation.) Finally, the performers' understanding of their ability to play with each other through the circuitry signals their readiness to perform ANDS. At this point they begin to use the circuit as a score for a kind of ensemble activity in which no single player "leads," "follows," or

otherwise dominates any moment of the piece. The current rehearsal instructions may now be treated as a general format, or supplementary guidelines, for performance.

Most of the ANDS circuitry is housed in a 3"x5"x8" aluminum box. Four control devices are attached to this central unity with five-foot long sections of ribbon cable. Two of the controls are small keyboards, which are used by the players in Pair 1; each contains four momentary switches, a miniature condenser microphone, and two potentiometers. The other controls are two strips of four potentiometers each, which are played by Pair 2. The outputs from the central circuitry are connected to seven channels of amplification. The speakers are distributed throughout the available space.

Coincidences between the keyboards in Pair 1 change the output channel assignment of two Phase-Locked-Loop Oscillators. The rate of radical change in the sound texture of the oscillators reflects the density of the performers' activity.

Coincidences between rhythmic patterns controlled by the players in Pair 2 change the tuning of a digital oscillator. Non-coincident patterns alter its timbre. The transformations in the oscillator's sound reflect trends in the rhythmic interplay within the pair.

An additional circuit controls the final output of ANDS in response to coincidences between the two pairs of players.

Pair 1

Each player can depress any combination of the four momentary switches (A, B, C, D) on his/her keyboard. Coincidence between Player 1 and Player 2 occurs when they press A1 and A2, or/and B1 and B2, or/and C1 and C2, or/and D1 and D2. A coincidence assigns each performer's Phase-Locked-Loop Oscillator (PLLO) to output channels corresponding to the switches depressed at that moment. For example: Player 1 presses A, B, and C; Player 2 presses B and D; coincidence is detected between B1 and B2; PLLO-1 is sent to channels A, B, and C; PLLO-2 is sent to B and D. The channel assignment is held until the next coincidence.

Each PLLO alternates between two modes of operation after every eight pressings of the switches on its keyboard. In the "tracking" mode it attempts to lock in frequency and phase with any sounds it detects through the microphone mounted in the keyboard. It creates complex patterns as it tries to track the output of the other PLLO, the other sounds of ANDS, ambient sounds, and its own square-wave output. These patterns vary with the PLLO's channel assignment, and are also affected by the room acoustics. When the PLLO changes to the "holding" mode, it initially locks on the pitch it is producing at the moment of the change and then slowly drifts upward in frequency.

When the outputs of the two PLLOs are sent to the same channel they are mixed digitally, so that they are not heard as two

separate sounds but rather as a single complex one. Each of the four output channels employs a different mixing circuit, and so sounds different from the others.

Each keyboard has controls to adjust the sensitivity of the microphone and the tracking speed of the PLL0.

Pair 2

Each performer manipulates four potentiometers connected to a circuit that generates pulse sequences in complex periodic patterns. Three of the pots influence the rhythmic pattern and tempo; the fourth primarily affects the timbre of the pulses. The two circuits are completely independent, each being controlled by one player, and each having its own channel of output.

When both circuits coincide by producing a pulse at the same time, they shift the frequency of a digital oscillator to the next pitch in a sequence of pre-set tunings. After every eight non-coincident pulses, the oscillator is similarly shifted to the next in a sequence of different timbres (which includes silence).

Additional counting circuitry divides the performance into four major sections. During the first section the digital oscillator operates in a low frequency range. In the second it produces high frequencies only. Its waveform becomes extremely complex in the third section, and in the last the oscillator is silent. A transition from one section to the next occurs every time a predetermined

number of pulses has been counted.

The sequences of pitches and timbres, and the pulse-count and tunings for the sections are all programmed with trimpots and a matrix on the circuit board.

Output Circuitry

Every time coincidences occur simultaneously in Pair 1 and Pair 2, a circuit randomly selects one of four possible output modes: 1) only Pair 1 is audible (four channels on); 2) only Pair 2 (three channels); 3) both pairs (seven channels); 4) neither pair (all channels off). The output mode is held until the next double coincidence.

A switch, mounted on the box containing the central circuitry, overrides the random control. It directly selects either pair's output for the purpose of practicing or "tuning" either circuit. It is also used to initialize the circuitry at the beginning of a performance by selecting Pair 2's output and resetting all counters and sequences.

Sample Rehearsal Instructions

Prior to the rehearsal, the rehearsal director programs the matrix, selects tunings for the sensitivity and slew controls of the PLLOs, and sets Pair 2's pulses to a slow rate. The performers are told that the piece is divided into four sections, which are marked by changes in the range of Pair 2's digital oscillator. The circuitry is initialized.

Section 1. Only Pair 2 is audible. Only Pair 2 plays. The oscillator is in the low frequency range. The players evolve a sequence of rhythmic patterns. The pause between any changes in the rhythm should be long enough to allow the pattern of the oscillator's tunings and timbres to establish the character of the current rhythmic interplay. The two players should seek cross-rhythms that produce significant changes in the oscillator's behaviour. They should gradually increase the speed of the pulses to an average rate of one pulse per second by the end of this section.

Section 2. The oscillator's shifting to the high frequency range signals Pair 2 to stop playing and Pair 1 to begin. Each full coincidence between the pulses and the keyboards will randomly select any one of the four output modes. Whenever Pair 2's pulses are audible, the players in Pair 1 should play "in time" with them --they need not attempt to synchronize exactly with the pulses, but should scale their tempo accordingly. When the pulses are inaudible, the players are free to explore the effects of other gestural styles. They should attempt to allow several occurrences of each output mode within this section.

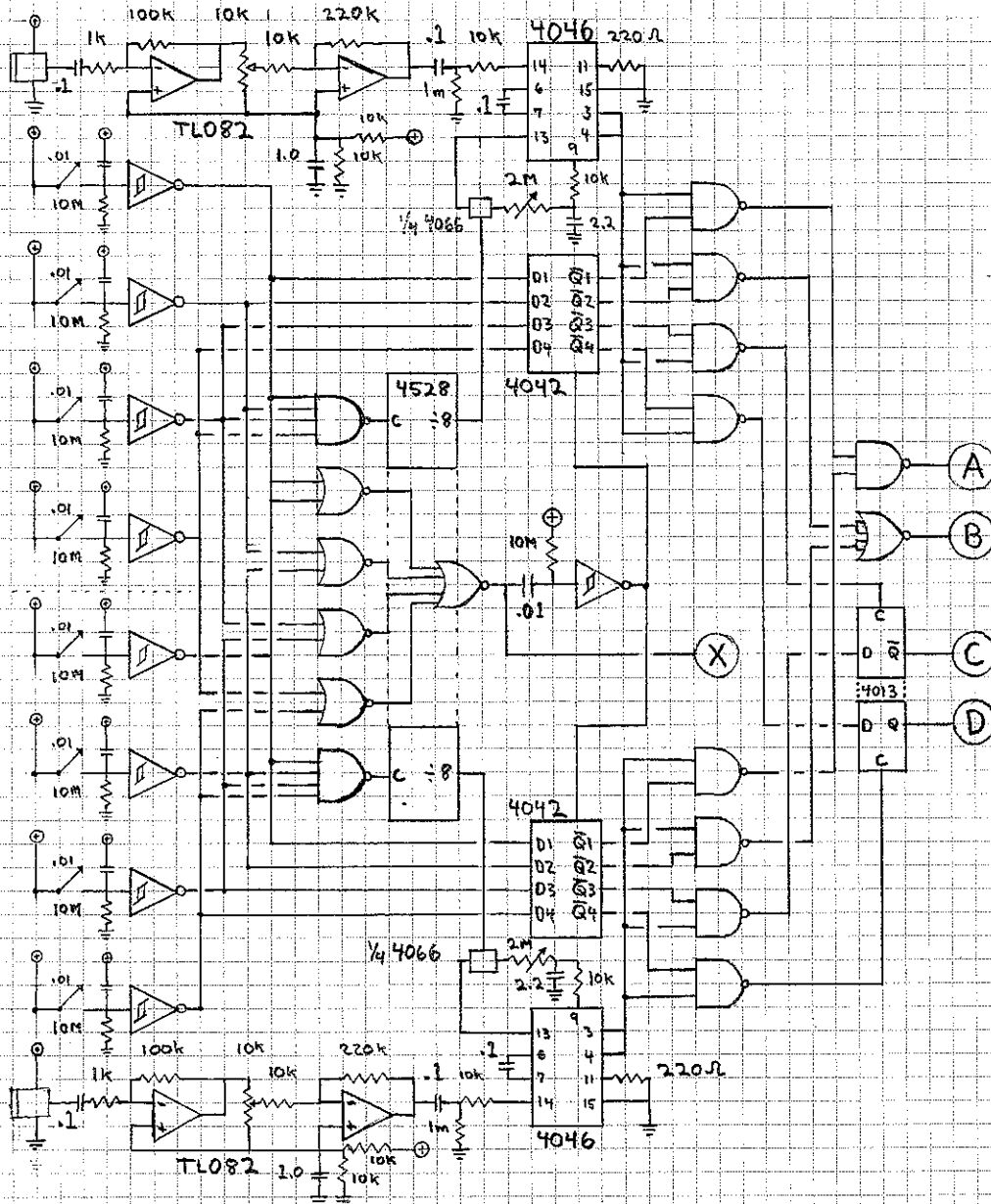
Section 3. This section begins as soon as Pair 2's oscillator is heard producing the complex timbres of its third tuning stage. Both Pair 1 and Pair 2 play. Pair 1 should mark the transition by tuning the sensitivity and slew controls of the PLLOs to new settings,

and by adopting gestural styles that are significantly different from those of the preceding section. Pair 2 should play the rhythm and speed of the pulses with the intent of varying the rate of the changes among the various output modes.

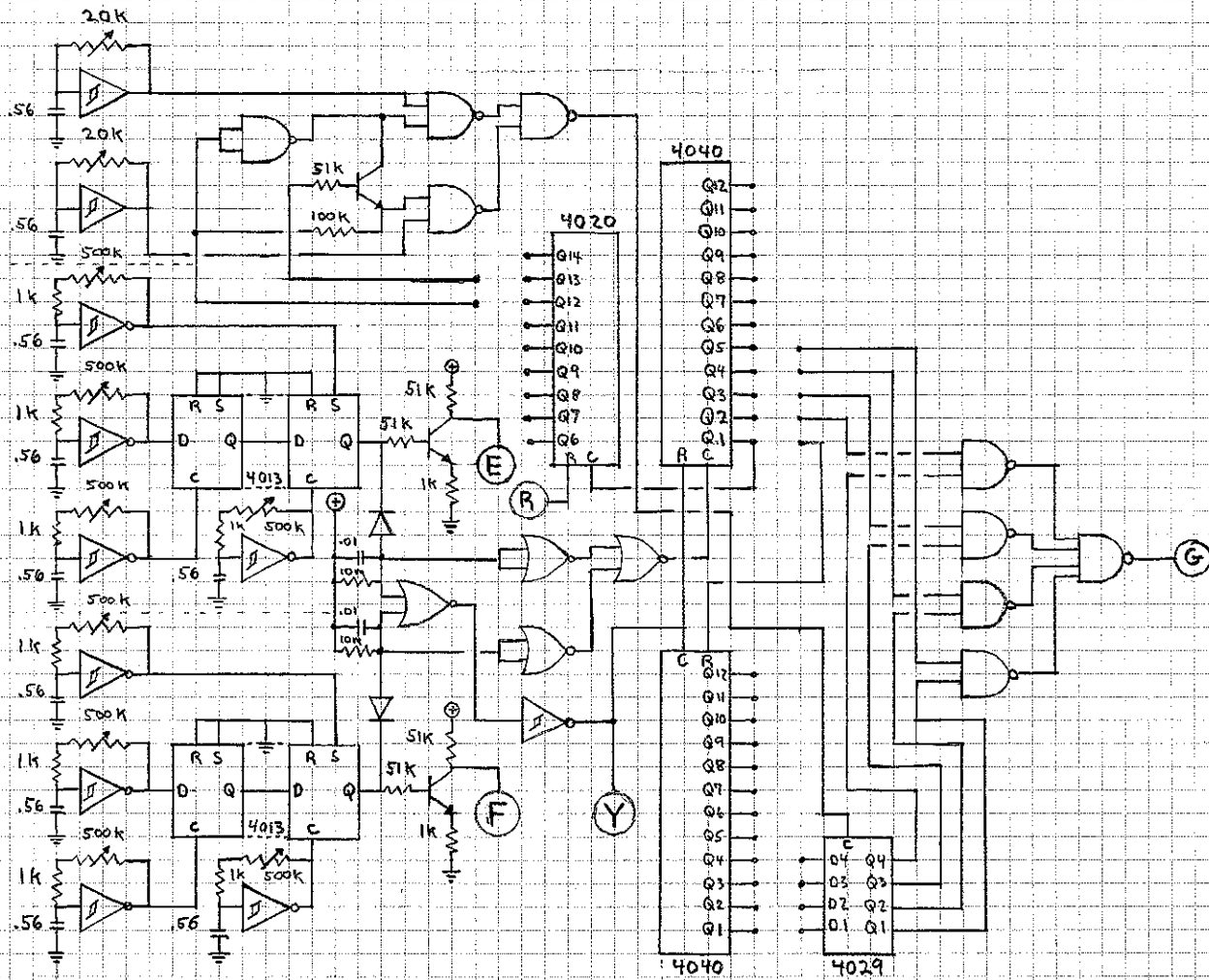
Section 4. As soon as it is clear that Pair 2's oscillator is in its last, silent stage, the players should perform whatever actions are necessary to achieve the "Pair 2 only" output mode. After waiting in this state for several minutes, the players should try to effect the silent mode. The piece ends once silence has been established.

The players and director should discuss the piece after it has ended. They should address themselves to the following questions in particular: Did the players perceive any causal relationships within the piece? Did they have any sense of control over the sounds and shape of the piece? Did they adopt particular performance roles? Did any player or either pair tend to dominate the piece? How would the players describe the ensemble of the piece? How might they try to change another runthrough based on the same set of instructions? How might they change the instructions for another rehearsal? Are they ready to perform the piece?

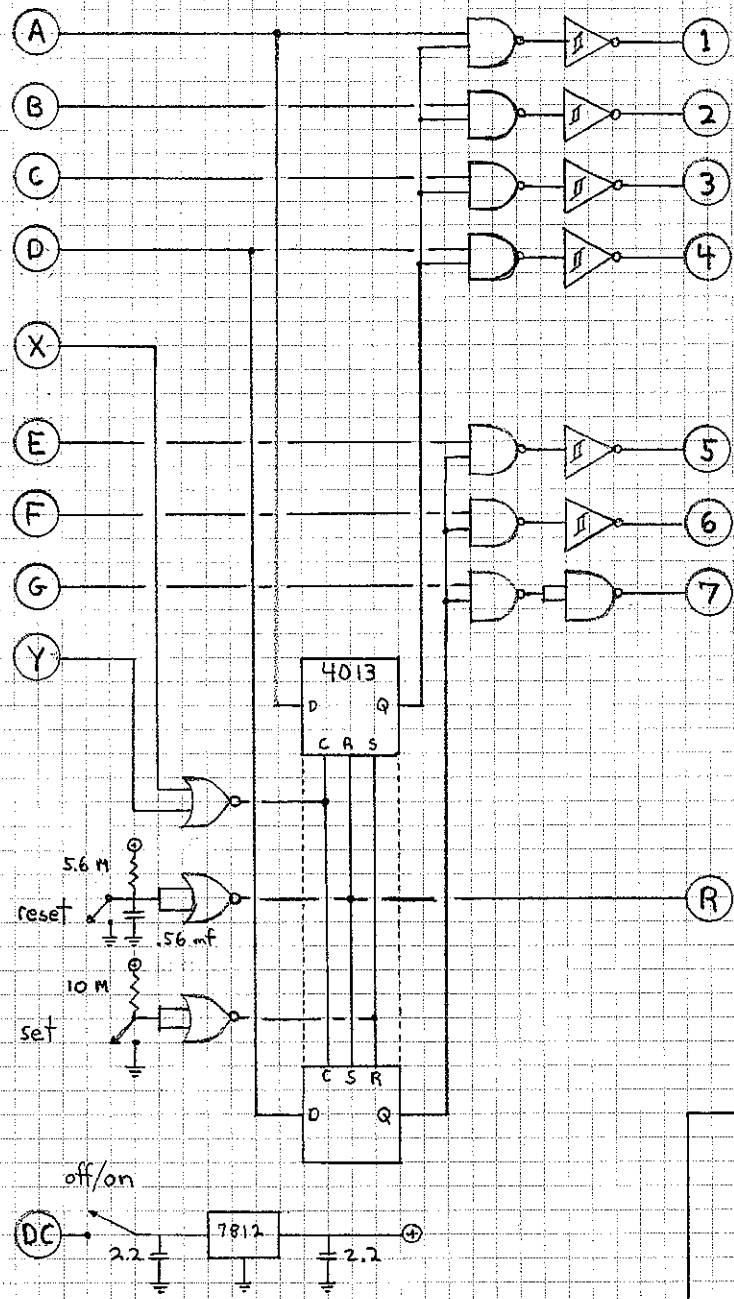
CIRCUIT BOARD 1





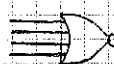


CIRCUIT BOARD 2

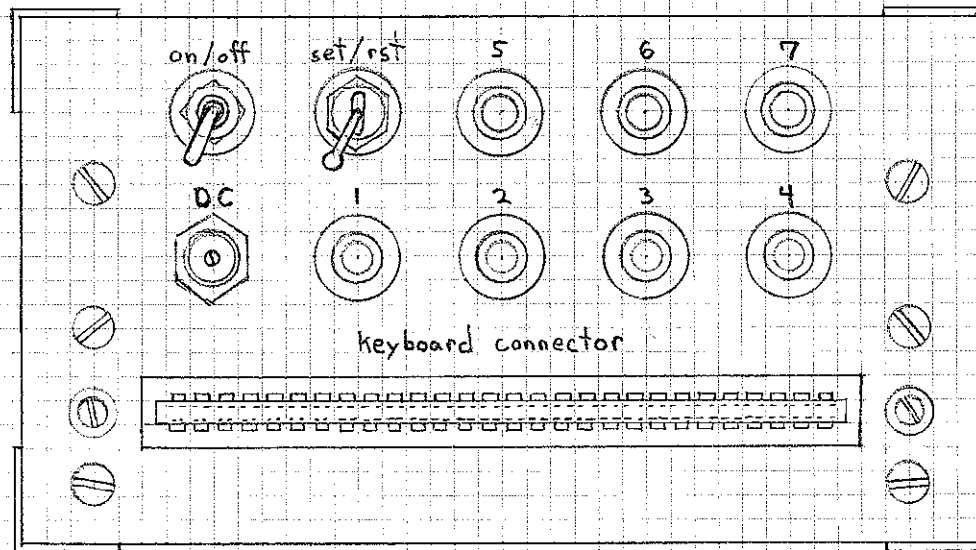


CIRCUIT BOARD 3



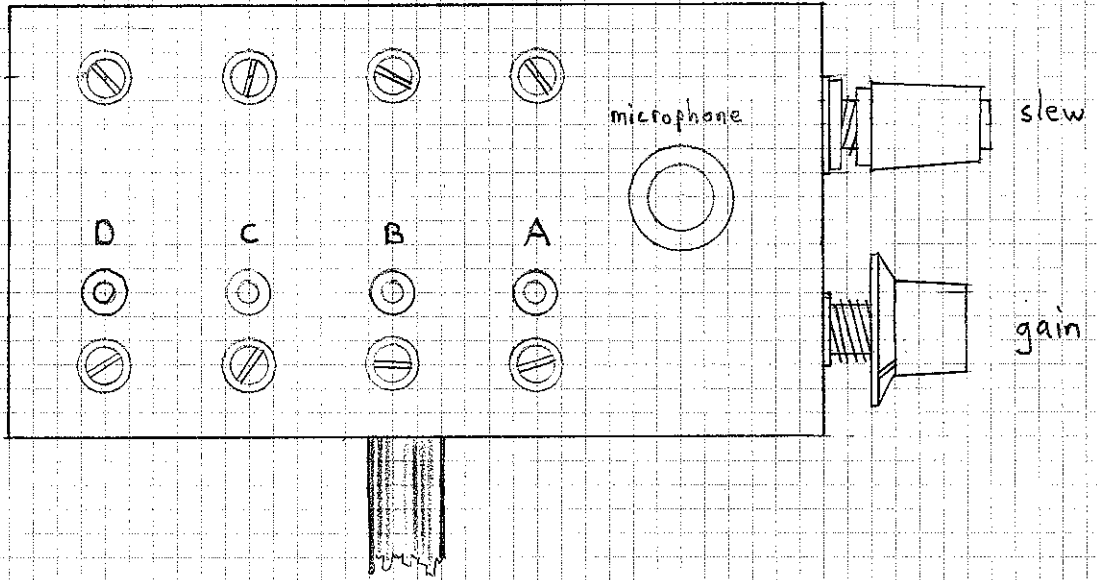
-  74C14
-  4011
-  4012
-  4001
-  4002

ACCESS PANEL



KEYBOARDS

Pair 1



Pair 2

