Roland
WE DESIGN THE FUTURE

CSQ-600
DIGITAL SEQUENCER

ELECTRONIC MUSICAL INSTRUMENTS

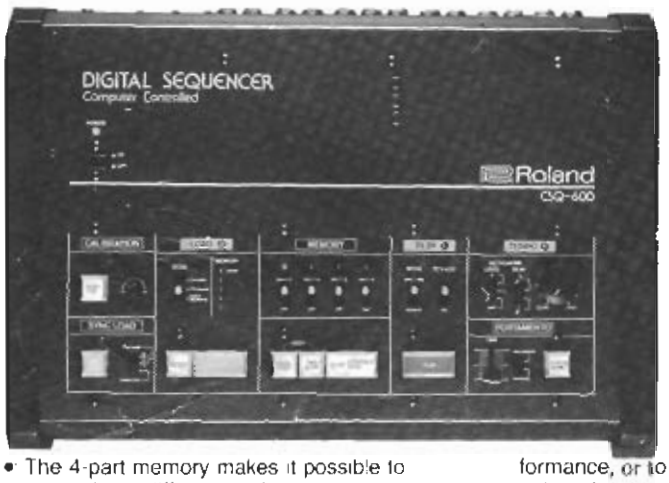
The CSQ-600 Digital Sequencer is capable of simultaneously memorizing up to 600 notes and rhythms. And the Compurhythm CR-78 can be connected for loading and playing!

CSQ-600

DIGITAL SEQUENCER

The CSQ-600 is a digital sequencer incorporating a micro-computer that allows the performance played on a synthesizer keyboard to be loaded exactly as it is.
The CV only mode can be used for loading only pitches (all notes at a tempo). Tempos and rhythms can be loaded afterwards via the GATE REWRITE mode.
A maximum of 600 notes can be stored in the memory. The battery back-up system maintains a memorized performance for a long-term without requiring AC power, and this permits replay when desired.
This is one of the outstanding features of live performance CSQ-600 delivers.
The CSQ-600 is equipped with CLOCK OUT and START/STOP OUT jacks for connection of the Compurhythm CR-78 for a wide variety of rhythm patterns. The TEMPO·CLOCK INPUT and OUTPUT jacks allow parallel connection of two or more CSQ-600 units. The CSQ-600 stores measures accurately to the time controlled by SYNCLOAD, thus precisely determining the load time via synchronized load control for optimum synchronized performance with the CR-78, or multi-performance operation with more than one CSQ-600 unit. In this way, the functions of the synthesizer can be greatly expanded.

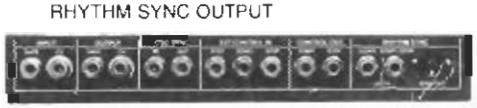
- The Forward Step button and Back Step button enable forward- and back-stepping of each tone by means of manual control. Pushing these 2 buttons simultaneously during LOAD enables rests to be memorized.



- The 4-part memory makes it possible to memorize 4 different performance separately. By changing the position of the Part Selector switch during PLAY, each part of the performance can be played in any order desired.
- CSQ-600 can play stored notes in PORTAMENTO mode by memorizing the data indicating initial and ending parts. It can start or cease portamento anywhere upon receiving manual instructions.
- The tempo of more than one CSQ-600 can be controlled simultaneously through TEMPO·CLOCK jacks.
- The provision of an external control input makes it possible to start or stop the performance, or to step each tone by means of external gate voltage. In addition, the sequence can be started or stopped by the foot switch (DP-2).
- The CSQ-600 is capable of playing a memorized performance at a desired speed by means of the tempo setting knob. It also has a built-in electronic metronome for convenient loading.
- It is possible to add keyboard voltage to stored note data during PLAY, and the memorized sequences can be transposed to any desired key according to the key pressed.
- The repeat function is especially effective for arpeggios or bass patterns.

SPECIFICATIONS

Maximum storage capacity:
  600 notes (or 150 notes per channel)
Calibration:
  CALIBRATION Button
  CALIBRATION ADJUSTEMENT Control
Sync Load Section:
  MODE Switch (OFF; 3/4; 4/4)
  LOAD/STOP button
Load Section:
  LED load indicator
  LED memory indicator (×5)
  LOAD MODE switch (CV ONLY; CV/GATE. GATE REWRITE)
  RESET button
  LOAD button
Memory Section:
  LED memory part indicator (×4)
  PART SELECTOR switch (×4)
Stop/Continue Play & Step Section:
  STOP/CONTINUE PLAY button
  FORWARD STEP button
  BACK STEP button
Play Section:
  LED indicator
  PLAY MODE switch (ONE TIME; REPEAT)
  KCV ADD switch (ON; OFF)
  PLAY button
Tempo & Metronome Section:
  LED tempo indicator (quarter notes)
  TEMPO control
  METRONOME BEAT SELECTOR switch
  METRONOME LEVEL switch (OFF; L; H)
Portamento Section:
  PORTAMENTO control
  MODE switch (MANUAL; PROGRAM)
  PORTAMENTO MEMORY button
Jacks:
  CV INPUT (1 V/oct, 0 to +5 V)
  GATE INPUT (threshold: +2.5 V)
  CV OUTPUT (1 V/oct −2 V to +8 V)
  GATE OUTPUT (off: 0 V; on: +15 V)
  CSQ CLOCK OUTPUT (700 Hz to 4.7 kHz)
  CSQ CLOCK INPUT (700 Hz to 4.7 kHz)
  STEP PULSE INPUT (threshold: 2.5 V)
  START PULSE INPUT (close-open or +15 V pulse)
  STOP PULSE INPUT (close-open or +15 V pulse)
  RHYTHM CLOCK OUTPUT (for CR-78)
  RHYTHM START/STOP OUTPUT (for CR-78)
  RHYTHM SYNC OUTPUT



Power consumption: 8 W
Dimensions: 450 (w) × 305 (d) × 95 (h) mm
  (17.7" × 12.0" × 3.7")
Weight: 3.9 kg (8.58 lbs.)
Accessories supplied: 1.5 m dual cord (×2)

Specifications are subject to change without notice

Roland

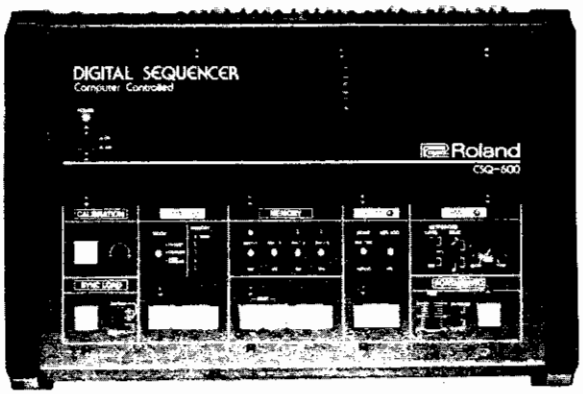
Printed in Japan RAM-051 '80 May B-4 Y

Roland

DIGITAL SEQUENCER

CSQ-600

OWNER'S MANUAL

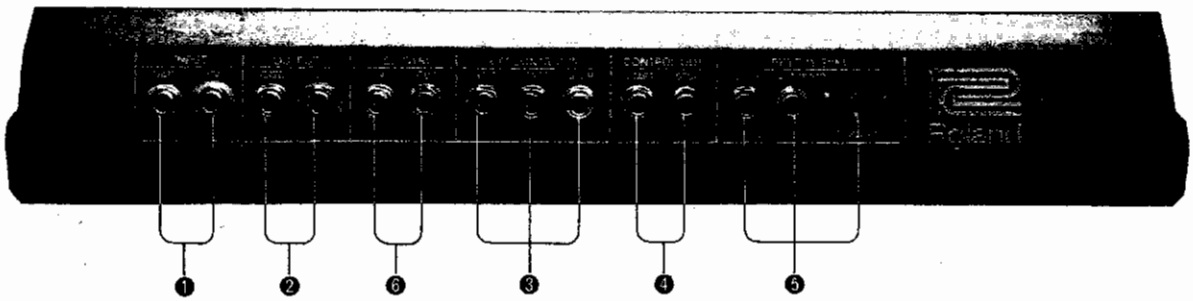


The CSQ-600 is a computer controlled digital sequencer designed for on-stage live performance situations. Connected to a synthesizer the CSQ-600 can be loaded and played back without breaks in rhythm. It can memorize a total of 600 notes with independent time values and can be combined with keyboard generated passages in live performance. The CSQ-600 can be synchronized with a Compu-Rhythm CR-68 or 78 and it can be played simultaneously with another CSQ-600, a CSQ-100 or an analogue sequencer.

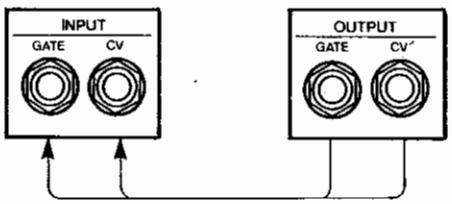
The memory of the CSQ-600 is divided into four parts each consisting of 150 notes. The parts may be played in sequence or in a variety of combinations and orders. The sequences can be loaded directly from the synthesizer keyboard (CV for pitch and GATE for rhythm) or the performer can store the CV for pitch and later either add or correct the rhythm with the GATE REWRITE. The SYNC LOAD circuit allows the performer to add information and measures to sequences and to divide passages into 4/4 and 3/4 measures. The METRONOME circuit allows the performer to accurately synchronize the sequence with the quarter note or eighth note pulse of the measure.

Portamento can be either programmed into the sequence or later added manually while the CSQ-600 is running. The battery back-up function allows sequences to be stored in the CSQ-600 even when the machine is turned off. The CSQ-600 is designed to be used with synthesizers having 1V/oct control voltage and positive gate pulse. It is also designed so that the internal connections will not interfere when the keyboard is used to play passages on the synthesizer without the sequencer functioning.

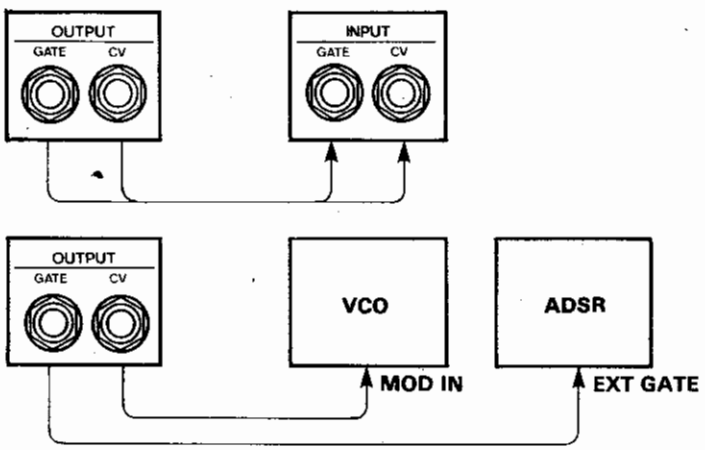
CONNECTIONS



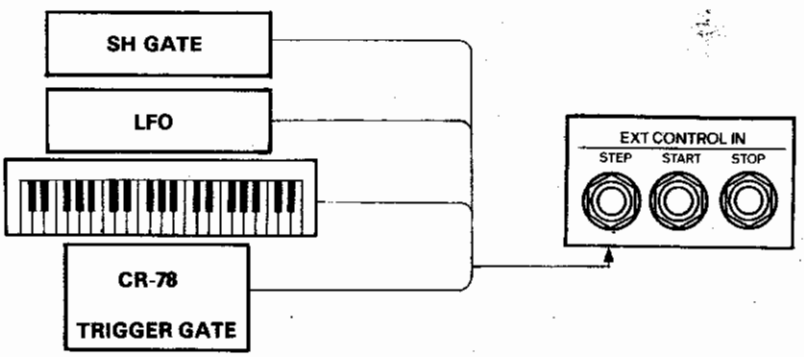
❶ The GATE INPUT and CV INPUT should be connected to the synthesizer keyboard outputs.

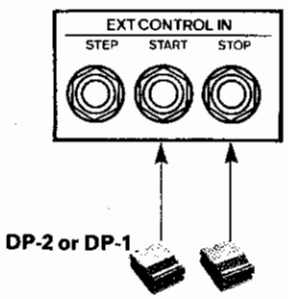


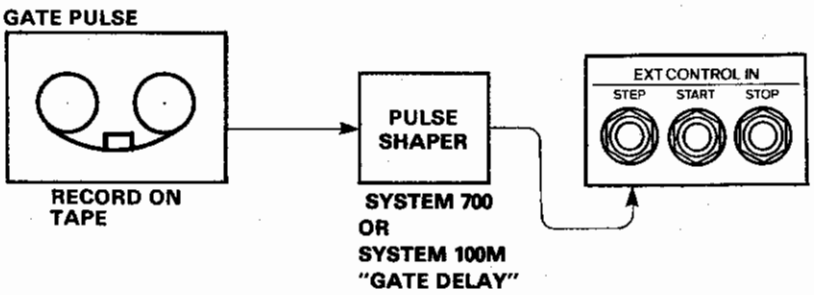
❷ The GATE OUTPUT and the CV OUTPUT should be connected to the synthesizer ENVELOPE GENERATOR (or GATE INPUT) and the VCO Modification Signal Input (or CV INPUT).



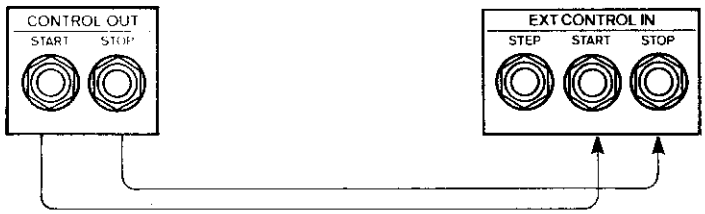
❸ The CSQ-600 is designed to accept external control signals for the purpose of progressing the steps of a sequence and/or triggering the beginning and end of a sequence. The STEP INPUT will control the rhythm of each note in the sequence. The START and STOP INPUTS which can be connected to the Roland DP-2 or DP-1 Pedals allow the performer to start and stop a sequence while simultaneously playing keyboards and manually controlling other circuits.



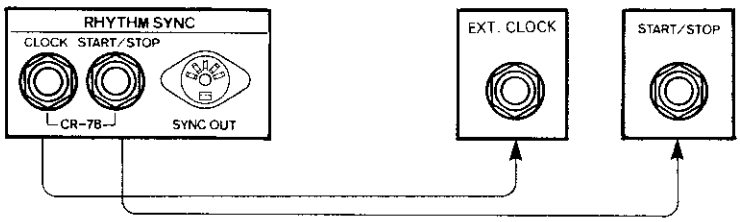




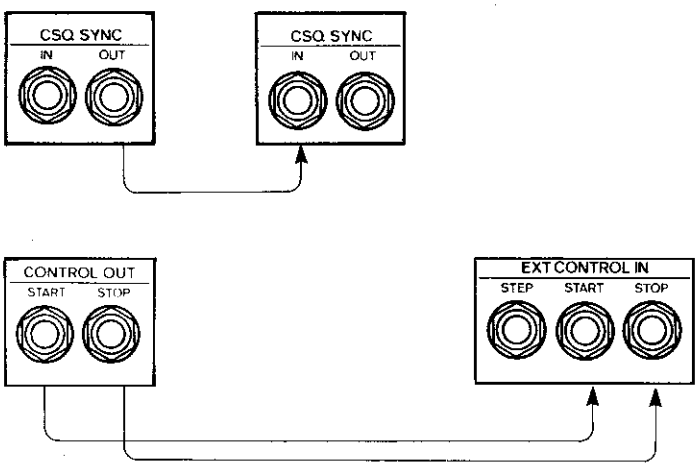
❹ The START and STOP CONTROL SIGNALS are output signals that can be connected to other circuits including a second CSQ-600 for the purpose of synchronizing the beginning and end of programmed sequences with additional circuits and information.



❺ The RHYTHM SYNC jacks are designed for syncronizing the CSQ-600 with the CR-78 Compu-Rhythm. These are output jacks not input jacks. They are used to control the tempo, etc. of the Compu-Rhythm.



❻ The CSQ SYNC jacks are used when the performer wishes to interface the CSQ-600 with another CSQ-600. In this instance the OUT jack should be connected to the IN of the second CSQ-600 and the IN jack should be connected to the OUT of the second machine. In addition the CONTROL OUT START and STOP jacks ❹ must be connected to the second CSQ-600's EXTERNAL CONTROL IN START and STOP jacks ❸ in order to synchronize the pulse (metronome) of the two Sequencers.



CONTROLS AND THEIR FUNCTION

POWER SUPPLY

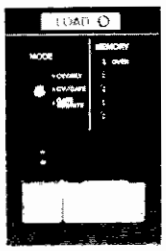
- The power supply for the CSQ-600 is controlled by this switch. Be sure that the switch is OFF before connecting the Sequencer to the line voltage. Also it is important that the Sequencer is OFF when connecting the CSQ-600 to a synthesizer.
- If the line voltage in your area is not stable to within ±10% of the voltage requirements shown on the nameplate use a voltage regulator.
- Some LED's on the front panel will flash brightly for an instant when the power switch is turned on. This is normal and does not indicate malfunction.
- Avoid using the CSQ-600 in places of high temperature, humidity and dust.
- Neon and flourescent lights may induce unwanted noise when placed near the CSQ-600 and other electronic music equipment.

CALIBRATION

- It is essential to calibrate the CSQ-600 with the synthesizer keyboard before loading information to the memory circuit. In order to calibrate the CSQ-600 the player should hold down a key near the center of the keyboard. Press [PUSH CAL]. If this causes a vibrato-like effect in the synthesizer output adjust the knob beside [PUSH CAL] to eliminate this effect. Once adjusted it will probably not need attention unless another synthesizer keyboard is used.

Note: Be sure that the VCO, VCF or VCA of the synthesizer are not being modulated by an LFO etc. while you are calibrating the CSQ-600.

LOAD FUNCTION



- The CSQ-600 is a digital sequencer that can store a total of 600 notes (control voltages) with rhythm (gate). Unlike an analogue sequencer that must be set manually for each note of a sequence, the CSQ-600 can memorize information directly from a synthesizer keyboard. In addition it is possible to memorize the pitches of a sequence and then rewrite the rhythm with the GATE REWRITE circuit.

1. CV (pitch) only LOAD

When the mode switch is set to CV ONLY the control voltages for pitch will be memorized as sixteenth notes. In playback the tempo of the pitches with the same time values can be controlled by the TEMPO control.

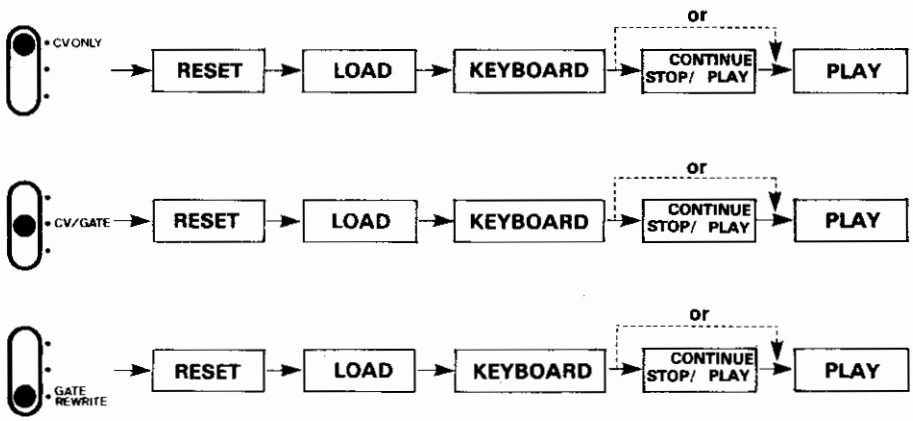
2. CV/GATE (pitch and rhythm) LOAD

When the mode switch is set to CV/GATE the rhythm as well as the pitch information will be memorized. The sequence can then be reproduced exactly as it was played during the loading process.

3. GATE REWRITE

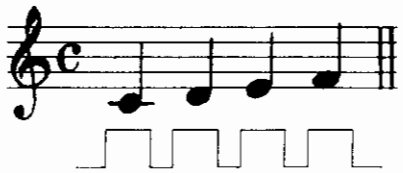
When the mode switch is set to GATE REWRITE the rhythm of the memorized sequence can be reprogrammed. This can be accomplished by tapping the desired rhythm on one key of the synthesizer keyboard after the RESET and LOAD buttons have been depressed.

- The five LED lights indicate the percentage of notes stored in one part.
This is a useful indicator for determining how many piches can be added to a sequence that is being memorized (each part can store a total of 150 notes with rhythm).
- The most common procedure for loading information in the CSQ-600 is to push the [RESET] and [LOAD] buttons and then to play the sequence on the synthesizer keyboard. In sequences that will be repeated continuously it is suggested that the player press the [PLAY] button at the end of the loading procedure rather than the [STOP/CONTINUE PLAY] button. It is also possible to correct or change notes in a memorized sequence. After listening to the sequence push the [STOP/CONTINUE PLAY] button just before the first note that is to be changed. Then push the [LOAD] button (not the [RESET] button) and play the new information on the keyboard. Note that all of the information after the first note that is corrected will automatically be erased.

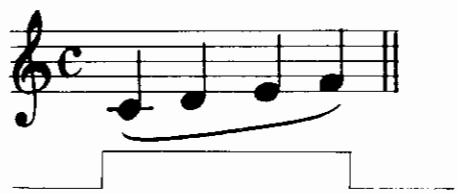


In the normal load procedure the GATE will trigger on and off each time a key is depressed.
However with the Legato Keyboard technique the GATE will trigger ON at the beginning of the phrase and will not change to OFF until the phrase has been completed and the final key has been released.
For Legato Style where it is desired to have no break in sound between pitches, play on two keys using the technique sometimes used for playing trills on synthesizers where one key is held down continuously while the second key is tapped on and off.

● **Non Legato**



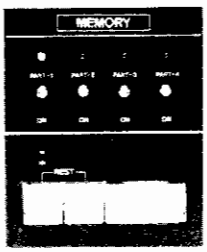
● **Legato**



● By pressing the [FWD STEP] and the [BACK STEP] buttons at the **same time** you can load rests in to the sequence.
When using the CV ONLY mode one rest will be added to the sequence each time you press both the [FWD STEP] and [BACK STEP] buttons. When using the CV/GATE mode a series of rests will be memorized until you play the first note on the keyboard.

● CSQ-600 can be synchronized with the CR-78 or CR-68. By loading rests in the sequence you can effectively create a pattern (such as a bass pattern) that can be combined with the rhythm patterns of the rhythm machines.

MEMORY

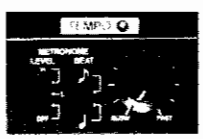


● The memory of the CSQ-600 is divided into four parts each consisting of 150 notes. The parts may be played in sequence (1-4) or may be played in one of the following sequences by activating the necessary switches (1234, 123, 124, 12, 13, 14, 134, 234, 23, 24, 34, 1, 2, 3, 4). In addition the order of the four parts can be controlled manually during perfomance by activating the desired part switch. However it should be noted that the memory of one channel must be completed before the newly activated part can be played. If the part switch is changed before the first sequence has been completed a silence the length of the remaining memory of the first part will be created before the second part can be played.

● The [BACK STEP] button progresses the sequence one step backward each time that it is depressed. The [FWD STEP] button progresses the sequence one step foward each time it is depressed. By pressing the [STOP/CONTINUE PLAY] button the sequence will be stopped. By pressing the [STOP/CONTINUE PLAY] button a second time the sequence will continue where it left off.

● The CSQ-600 is equipped with a back-up system for the memory circuit. This battery allows the information to be stored up to a maximum of six months without the power supply on.

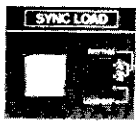
TEMPO-METRONOME



● The METRONOME is activated whenever the [LOAD] button is depressed. The LED above the TEMPO control flashes at either quarter note or eighth note intervals. If the METRONOME LEVEL switch is set to H or L an audible metronome beat will occur.
● The TEMPO control is adjustable and can be used to set or change the speed of the sequence and any machine or circuit connected to the CSQ-600.

● The audible signal can be set to produce either quarter note references or eighth note references.
● When you are not using the Metronome when loading information set the controller to the approximate TEMPO of the music.
● If you load slow music while the controller is set to a fast TEMPO, the memory capacity will be used up quickly.
● If, on the other hand you load fast music while the controller is set to a slow TEMPO, the rhythm may become distorted during playback.
● When CV only is used all the notes will have the same duration. The TEMPO and Rhythm will only be added during playback by varying the TEMPO controller, etc.

SYNC LOAD



● By using the SYNC LOAD it is possible to memorize information divided into measures of 4/4 and 3/4 time. The SYNC LOAD circuit can also be used for repeating measures and is essential for synchronizing complex rhythms (such as a bass line) with 4/4 measure patterns of the Compu-Rhythm CR-78 and for synchronizing the CSQ-600 with another CSQ-600.

● Procedure for using the SYNC LOAD:

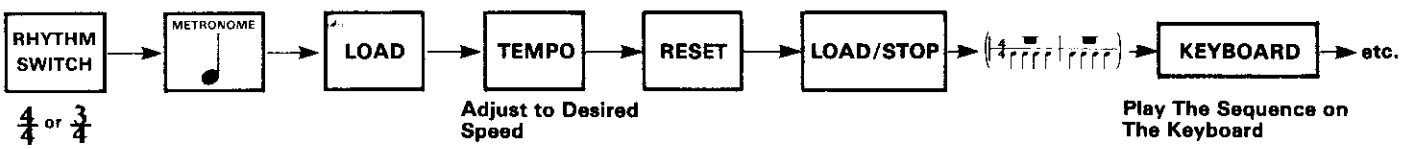
1. Set the RHYTHM switch to the 4/4 or 3/4 setting (note that the switch must be in the OFF position when you are not using the SYNC LOAD circuit).

2. Set the metronome beat switch to quarter note position. Then press the [LOAD] button and control the metronome speed by the TEMPO control.

3. Press the [RESET] and then the [LOAD/STOP] buttons.

4. Start playing the sequence on the keyboard at the beginning of the third measure of the metronome count. (The SYNC LOAD circuit uses the first two measures (8 beats for 4/4 and 6 beats for 3/4) to set the tempo and beat of the sequence to be memorized. Note that during this time even if you press a key **no sound** will be memorized. It should also be noted that starting with the third measure (actually the first measure of the sequence) all information will be memorized. Therefore if you do not play a note at the beginning of the third measure a silence will be memorized into the circuit until you play the first note.

5. If you press the [LOAD/STOP] button again it will stop after the next even measure has been added. (Note that when the SYNC LOAD circuit is used the information is memorized in two measure groups. Therefore if you stop the Loading sequence in the middle of the 7th measure the SYNC LOAD circuit will stop at the end of the 8th measure.).



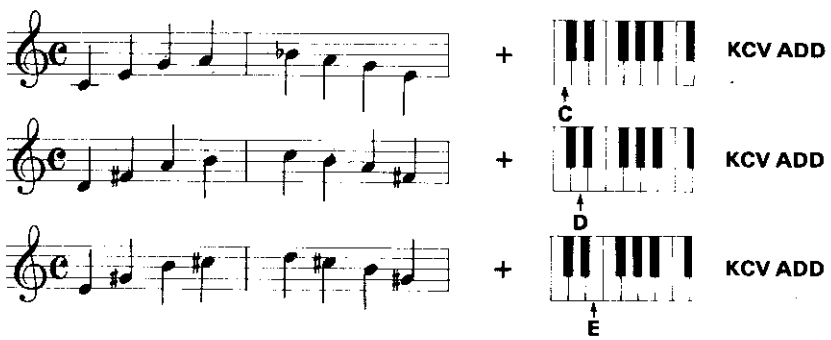
PLAY FUNCTION

● Pressing the [PLAY] button causes the sequence to start from the beginning. The sequence may be stopped at any point by pressing the [STOP/CONTINUE PLAY] button. Pressing the [STOP/CONTINUE PLAY] again will start the sequence from where it left off.

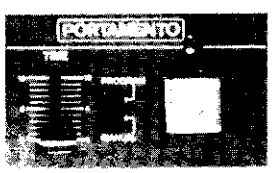
● By setting the mode switch to ONE TIME the sequence will be played one time only. By setting the mode switch to REPEAT the sequence will be repeated continuously until you push the [STOP/CONTINUE PLAY] button.

● The KCV ADD (keyboard control voltage add) switch allows the synthesizer keyboard to transpose the sequence to whatever key is depressed on the keyboard. The transpose function is based on the standard in which a voltage of +2 volts from the keyboard will produce the pitch of middle C when the VCO is set for the 8' range. The ROLAND SH-5 and System 100 (model 101) use different voltages to produce the pitch of middle C. This means that with the SH-5 pressing F will produce the sequence in its original key and on the System 100 pressing E will do the same.

● However when using the KCV ADD function with most ROLAND synthesizers pressing middle C will cause the sequence to be reproduced in the key that was used when it was loaded. Pressing D above middle C will transpose the sequence up a major second. If the original sequence was loaded in the key of C pressing F will transpose it to the key of F, pressing G will transpose it to the key of G, etc.

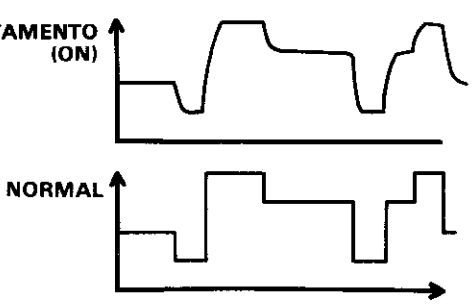


PORTAMENTO



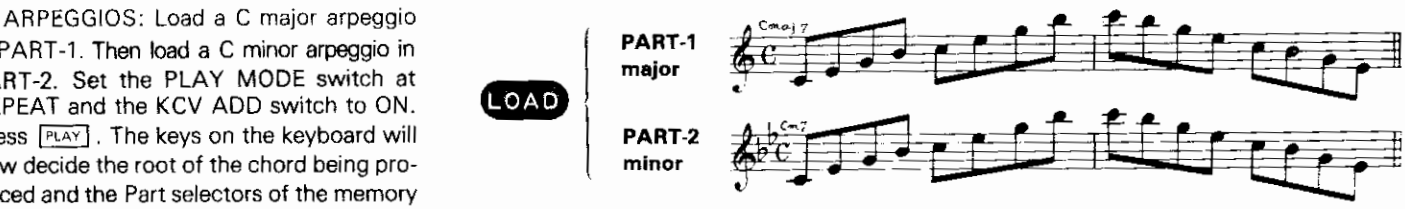
● Portamento is the gliding of a note from one pitch to another. The PORTAMENTO control adds this effect to the control voltage (pitch) of the output of the CSQ-600. The effect can be added manually during playback of a sequence or it can be programmed into the sequence.

In order to program the portamento effect set the Portamento switch to program, adjust the slide control to the desired amount of glide between notes and push the [PORTA MEMO] button while loading information. The higher the sliding control is set the smoother the glide from one note to the next will be.



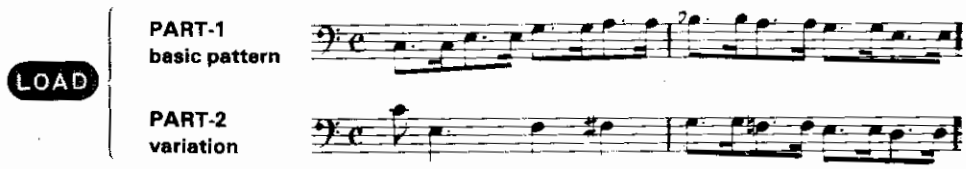
EXAMPLES OF HOW TO USE THE CSQ-600

1. ARPEGGIOS: Load a C major arpeggio in PART-1. Then load a C minor arpeggio in PART-2. Set the PLAY MODE switch at REPEAT and the KCV ADD switch to ON. Press [PLAY]. The keys on the keyboard will now decide the root of the chord being produced and the Part selectors of the memory circuit will control whether the chord is major or minor.

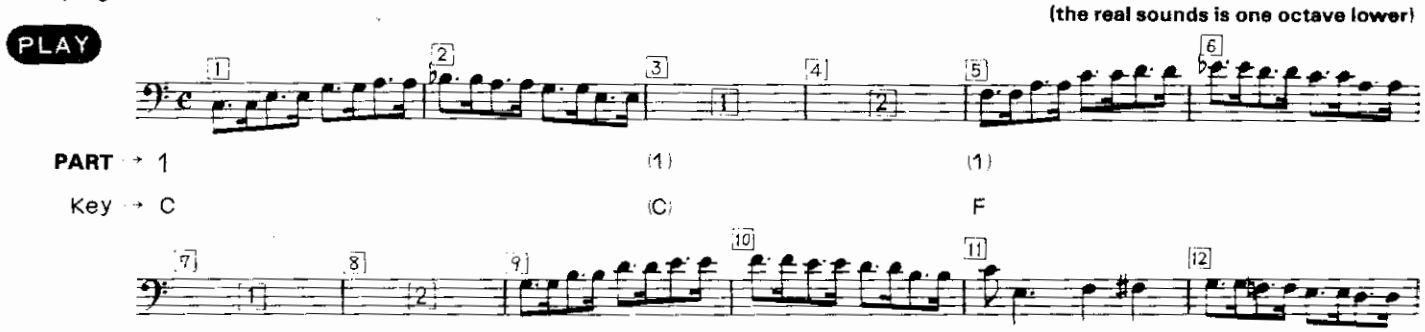


PART →	1	2	(2)
Key →	C	D	E

2. BASS PATTERNS: Set the PART-1 switch to the ON position and load a basic bass pattern. Then set the PART-2 switch to the ON positon and load a variation of the pattern. During playback you can choose either PART-1 or PART-2 as the music progresses.



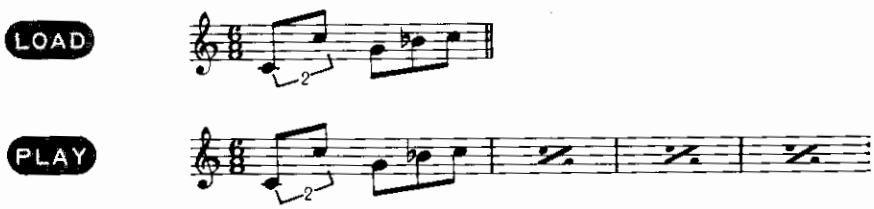
(the real sounds is one octave lower)



PART →	1	(1)	(1)
Key →	C	(C)	F

PART →	(1)	(1)	2
Key →	C	G	C

3. REPEATING PHRASE: Set the sequencer to LOAD and PLAY the phrase that you want to be repeated.
When you finish loading the phrase don't press the [STOP/CONTINUE PLAY] button. Instead press the [PLAY] button immediately.
When the PLAY MODE is set to REPEAT the sequence will be repeated as many times as you want. You can experiment with numerous techniques and applications of this circuit. You can produce an "echo" effect by gradually lowering the volume while the sequence is being repeated. You can also experiment with variations in tone color while the sequence is being repeated by varying the VCF controls.



procedure (● **VOLUME—"echo" effect**
● **VCF—variation in tone color**)

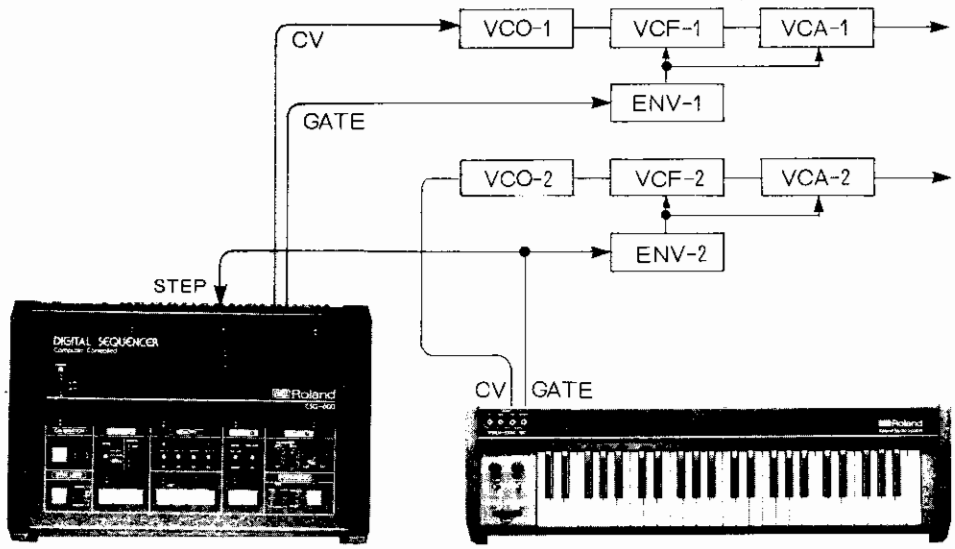
ADDITIONAL INFORMATION:

1. Starting the sequencer with a pedal:
The START jack allows the start of the sequencer play function to be controlled by an external source. The input circuit of the START jack is designed to accept shorting type switches such as the ROLAND DP-1 or DP-2.

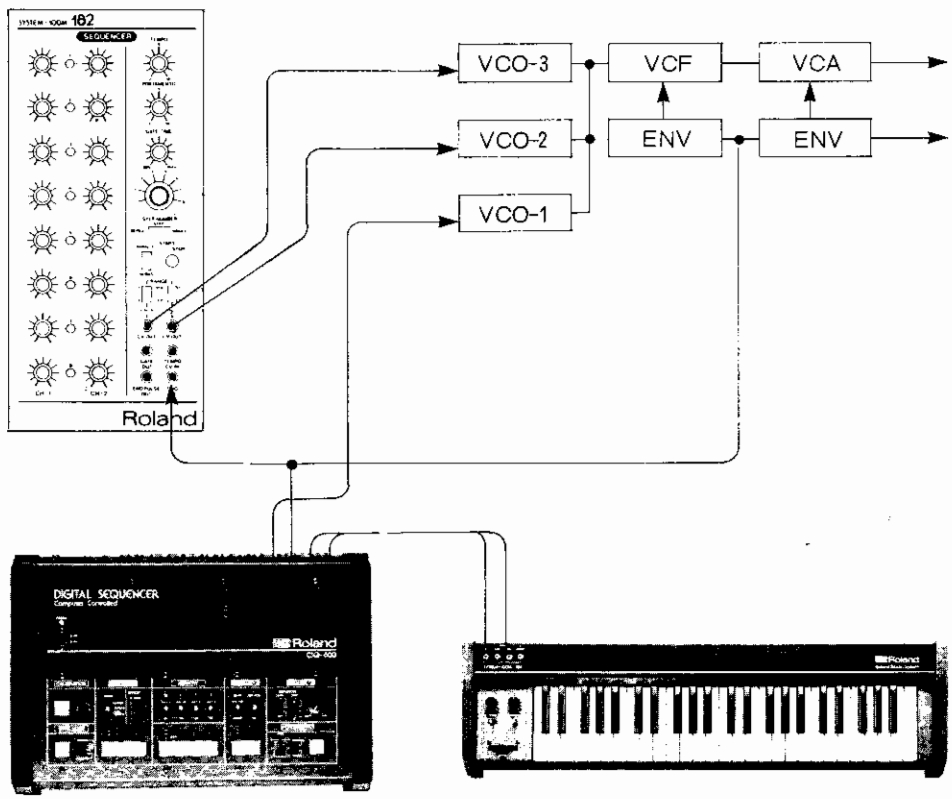
2. Starting the Sequencer with a SYNTHESIZER GATE:
The input jack will accept a positive going pulse (+3V to +15V) from a synthesizer keyboard, etc. Using the keyboard pulse for starting a sequence can be very useful when you wish to trigger an arpeggio with the KCV ADD function included.

3. Progressing the Sequencer by STEP with the synthesizer Keyboard:
By adding the external pulse voltage (+3V to +15V) to the EXT STEP jack it is possible to step the sequence one note at a time. The diagram shows how the CSQ-600 can be stepped by the GATE voltage of the synthesizer (The CV which has been loaded into the CSQ-600 can be used to control the VCF as well as the VCO).

4. Playing a Duet in the Same Rhythm:
With two synthesizer systems (two VCO, VCF, VCA and ENV) it is possible to play two voices in the same rhythm. Load pitches into the sequencer with the first synthesizer in the normal manner. Next, press [RESET] and play a melody in counterpoint to the second synthesizer. The rhythm of the previously loaded pitches will follow the rhythm being played on the second synthesizer.



5. Playing chords with the CSQ-600 and an analogue sequencer:
By combining the CSQ-600 with an analogue sequencer it is possible to play chords simultaneously. The diagram shows how to connect the CSQ-600 to the M-182 sequencer of the System 100M.
Connect the GATE OUT of the CSQ-600 to the TRIG IN of the M-182 and control the step of the M-182 by the CSQ-600. Set the REPEAT/STEP/SINGLE switch of the M-182 to the STEP position. Load the first voice (VCO1) in the CSQ-600. Set the second and third voices on the 2 channels of the M-182 (VCO2 and VCO3). Step the M-182 to the last step and start the CSQ-600 (The M-182 will step with the GATE of the CSQ-600 simultaneously producing three note chords in the same rhythm.



6. Playing Simultaneously with in Rhythm (Step):

When the trigger of the Compu-Rhythm CR-68, CR-78 or the Boss Doctor-Rhythm DR-55 is connected to the STEP jack of the CSQ-600 it is possible to Play (STEP) one step at a time. Load pitches and set the PLAY MODE switch at REPEAT. Press the sequencer [RESET] button before pressing the Compu-Rhythm [START] button. When you put the KCV ADD switch ON you can play with the root of any chord you want.

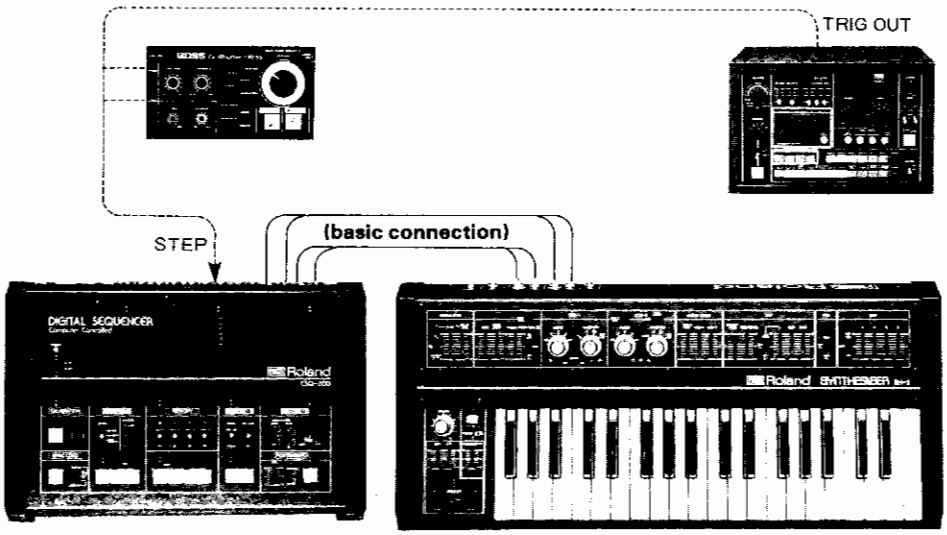
- Example one shows an arpeggio pattern using the 16 beat trigger of the DR-55, or the CR-68, 78.
- Example two shows a bass pattern using the 8 beat trigger of the CR-68, 78.
- Example three shows how the CSQ-600 can be controlled by the output of the DR-55 in the accent position.

7. Simultaneously Playing with the CR-78 (CLOCK):

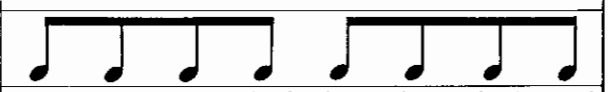
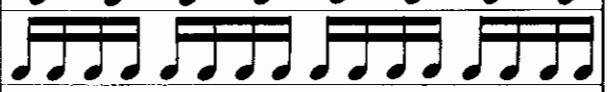
By connecting the CR-78 with the CSQ-600 as in the diagram it is possible to play a completely free rhythm.

- In this case you must load with the SYNC LOAD. Set the MODE switch of the SYNC LOAD to 4/4.
- When you press the SYNC LOAD button the CR-78 will start with the metronome. After that proceed with the SYNC LOAD operation. (If the START/STOP of the CSQ-600 and the CR-78 functions are in the opposite mode press the START/STOP button of the CR-78 once.).

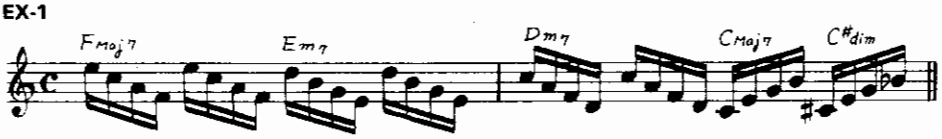
● Connect to DR-55, CR-68, CR-78



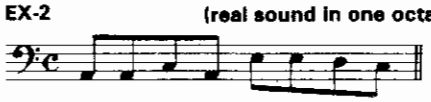
● Each output power pulse of DR-55, CR-68, CR-78

DR-55	DBS	
	CSQ	**rhythm with accent**
CR-68 CR-78	8"	
	16"	
	COMBI	**the output pulse of the base drums, high bongo**

EX-1

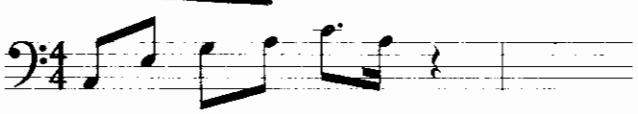


EX-2 **(real sound in one octave lower)**

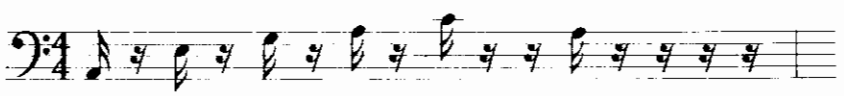


▲ auto arpeggio using the 16 beat trigger
◀ auto base using the 8 beat trigger

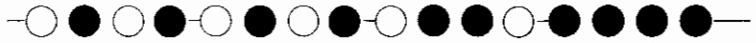
EX-3



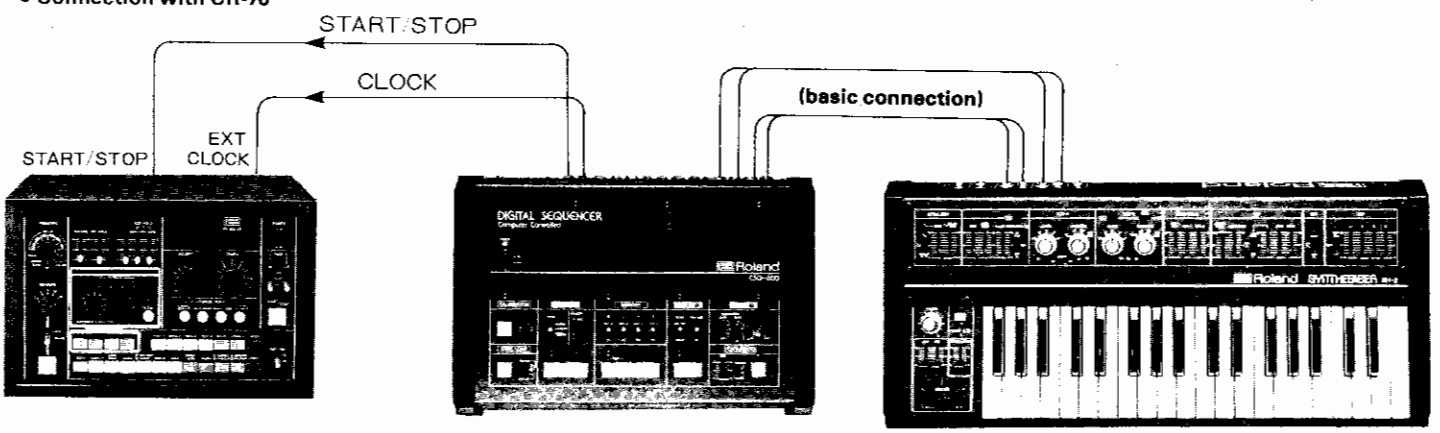
EX-3'



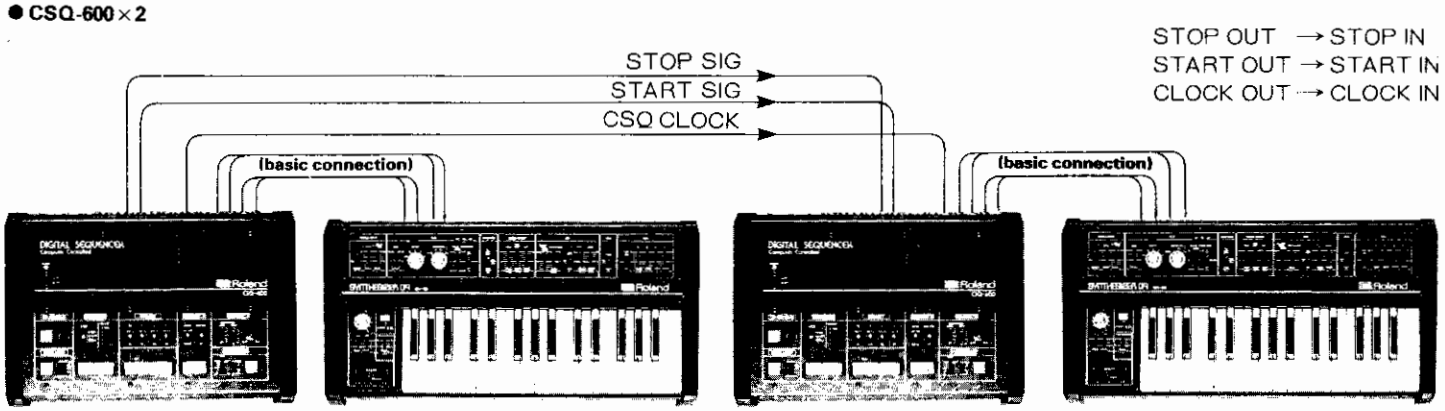
DR-55 accent



● Connection with CR-78



● CSQ-600 × 2



The second LOAD CSQ-600 + Synthesizer

The first LOAD CSQ-600 + Synthesizer

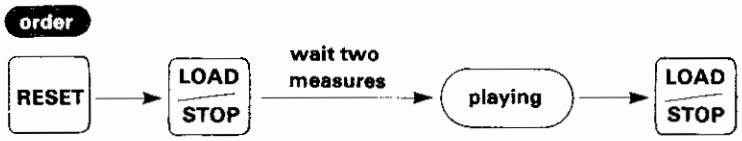
8. Playing Simultaneously with another CSQ-600:

As shown in the diagram you need three extra cords to run the two CSQ-600 Sequencers (one for the CLOCK PULSE to make the tempo of the two CSQ-600 Sequencers equal and two for sending the START and STOP signals.).

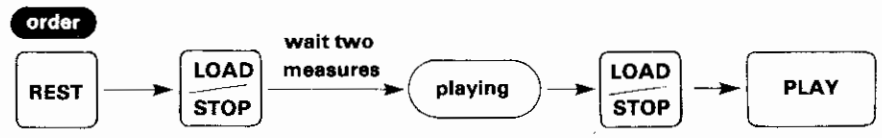
● You must load the information in the SYNC LOAD position when you use the multiple CSQ-600 system. The first load is exactly the same as the regular SYNC LOAD procedure. The second load should be made while listening to the information in the first load procedure.

● When the LOAD/STOP button of the second CSQ-600 is pressed it is possible to hear the metronome. Information can be loaded starting with the **third** measure. Because the first CSQ-600 is in the PLAY mode it is possible to hear the information on the first CSQ-600 while programming the second sequencer.

The first CSQ-600

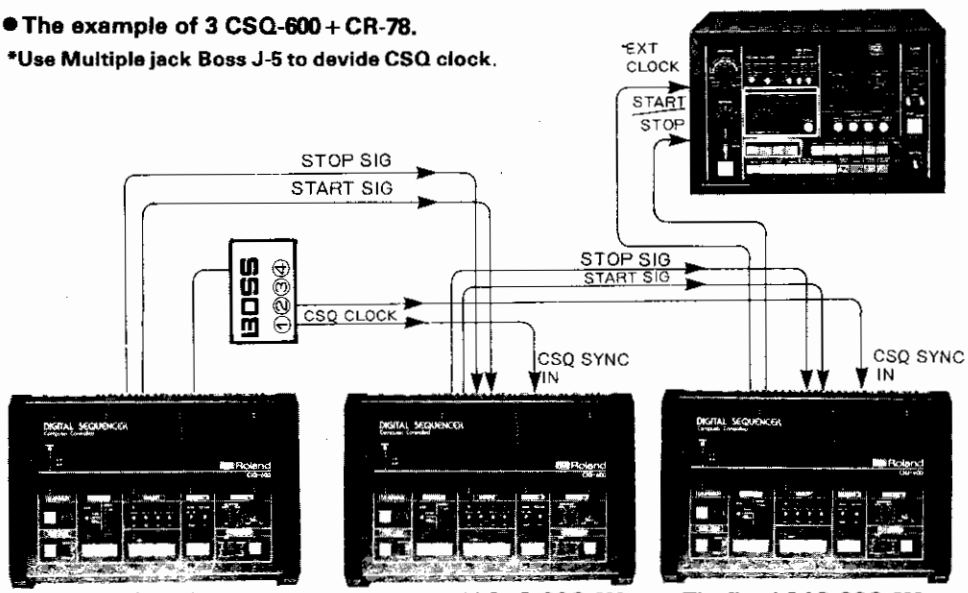


The second CSQ-600



● **The example of 3 CSQ-600 + CR-78.**

***Use Multiple jack Boss J-5 to devide CSQ clock.**



The third LOAD CSQ-600 The second LOAD CSQ-600 The first LOAD CSQ-600

SPECIFICATIONS

Maximum storage capacity:
600 notes (150 notes x four parts)

Calibration:
CALIBRATION button
CALIBRATION adjustment control

Metronome:
LED tempo indicator
Metronome level switch (H, L, OFF)
Quarter note, eighth note, switch
Tempo control

Load Section:
LED load indicator
LED memory indicator (x5)
LOAD MODE switch (CV ONLY, CV/GATE, GATE REWRITE)
RESET button
LOAD button

Sync Load Section:
Rhythm meter selector (4/4, 3/4, OFF)
LOAD/STOP button

Memory Section:
LED memory part indicator (x4)
PART SELECTOR switches (1-4)
STOP/CONTINUE PLAY button
BACK STEP button
FOWARD STEP button

Play Section:
LED indicator
PLAY MODE switch (ONE TIME, REPEAT)
KCV ADD switch

Portamento Section:
PORTAMENTO button
TIME level
PROGRAM/MANUAL switch

Power Supply:
POWER on-off button

Jacks:
GATE, CV input (CV = 1 oct./V, 0V ~ +5V) (Gate = on at +2.5V)
GATE, CV output (CV = 1 oct./V, −2V ~ +8V) (Gate = OFF: 0V, ON: +15V)
CSQ SYNC in, out (clock)
EXT CONT IN step, start, stop
STEP (+2.5V), START (open or +15V), STOP (open or +15V)
CONTROL OUT start, stop
RHYTHM SYNC clock, start/stop, sync out (START SIGNAL, GND, CLOCK)

Power Consumption:
8W

Dimensions:
450(W) x 305(D) x 95(H) mm

Weight:
3.9kg

Accessories supplied:
1.5m dual cord (H-41) x2

Note: Specifications are subject to change without notice.

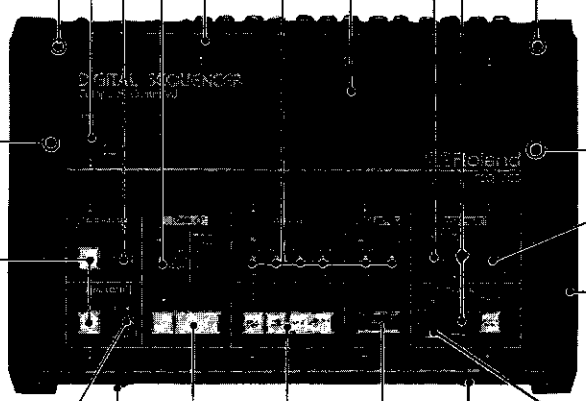
Optional

PEADAL SWITCH DP-2

CSQ-600 SERVICE NOTES

First Edition

Maximum storage capacity -----	600 notes (150 notes/part x 4)
CV ------- Input - 1V/oct, 0V to +5V;	Output - 1V/oct, -2V to +8V
GATE ----- Input - Threshold +2.5V;	Output - Off: 0V, On: +15V
CLOCK ----------	Output & Input - 700Hz to 4.7kHz
STEP PULSE INPUT ----------	Threshold +2.5V
START & STOP PULSES INPUT ----	Close-Open or +15V
START PULSE OUTPUT ----------	Normal: 0V, LOAD or PLAY: +15V
STOP PULSE OUTPUT ----------	Normal: +15V, LOAD or PLAY: 0V
Power consumption ----------	8 watts
Dimensions ----------	450 (W) x 305 (D) x 95 (H) mm 17.7 x 12.0 x 3.7 in
Weight ----------	3.8 kg 8.58 lbs



Panel H75 (072H075)

Switch SLE-623-18PS(001-201)

Pot. EVHLWAD25B15 (030-951)

Button no.8 (016-008)

Screws 3 x 20mm Trus.Br

LED LR0601R (019-009)

Screws(11 places) 3 x 6mm Fe,Br

Switches w/button SCK41167 (001-276)

Switch SSB02335-12PN (001-183)

Switches w/button SCK41168 (001-275)

Switches SLE-622-18PS (001-268)

Rubber bushings no.20 (068-020)

Switch SSB02335-12PN(001-183)

Switch SSB02242-12PN(001-182)

Screws ① - ④ 3 x 10mm Fe,Br Tap-tight,bind

Knob no.103 (016-103)

Pot.VM10RK20B16 (028-766)

Side panel H21 (066H021) set of R & L

Knob no.4 (016-004)

pot. EVALOPC15A26 (029-577)

When ordering keyswitch, denote the legend.

DISASSEMBLY

TO AVOID ABRASION on inside surfaces of side panels, open the top and side panels simultaneously by removing the screws indicated with circled numbers, except ① - ④ .

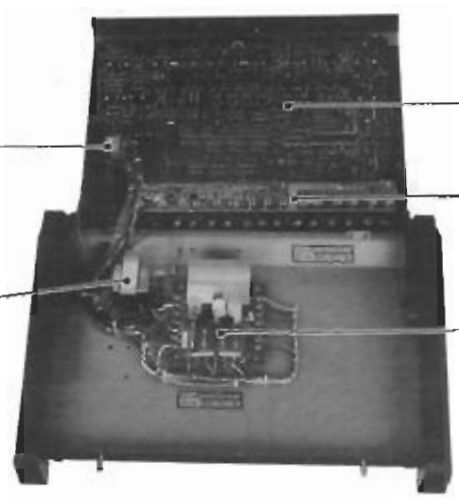
OPH114 can be removed off the top panel by unscrewing at the foil side and by pulling out TEMPO and TIME knobs on the top panel.

Switch

SDG5P001-1 (001-215)
100V

SDG5P001-2 (001-216)
117V

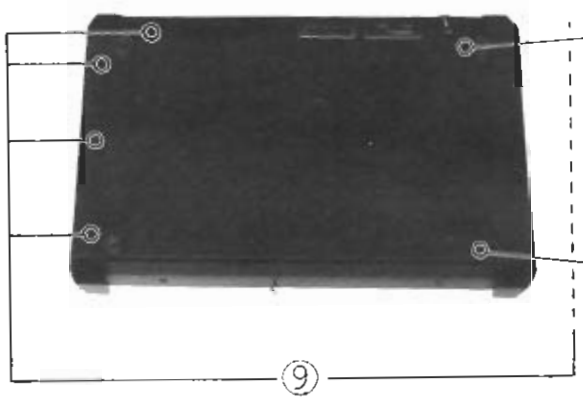
SDG5P502 (001-217)
220/240V



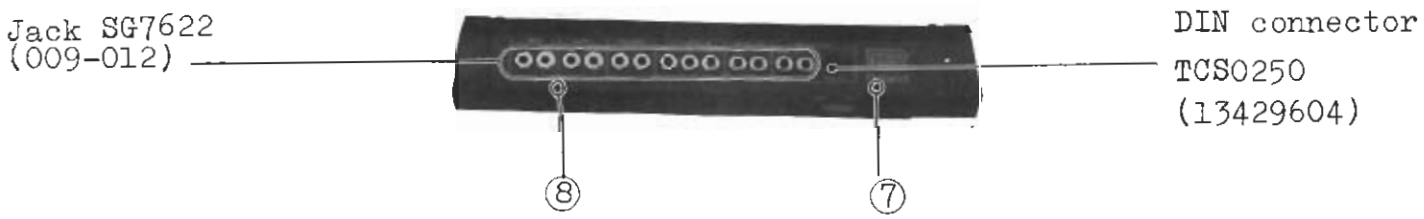
Power transformer

022H024J 100V
022H024C-A 117V
022H024D 220/240V

* In ordering PCB replacement, suffix alphabet to the name , if any.



Screws 3 x 10 mm Fe, Br, tap-tight B, binder



Screws 3 x 10 mm Fe, Br, tap-tight B, binder

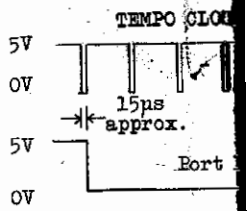
μPD8048C

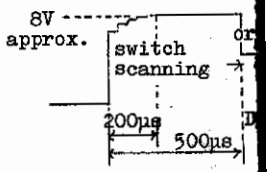
Designation		Pin No.	Function
DB (Data bus)	0	12	CV data; Switching scanning; LED; RAM address; CV and GATE data during RAM address
	1	13	
	2	14	
	3	15	
	4	16	
	5	17	
	6	18	
	7	19	Output Gate signal
P 1 (Port 1)	0	27	RAM address, LED select
	1	28	RAM address
	2	29	RAM address
	3	30	RAM address
	4	31	LED timing
	5	32	Output CV, S/H, Gate hold timing
	6	33	RAM CS enable
	7	34	Metronome timing
P 2 (Port 2)	0	21	...
	1	22	...
	2	23	CV IN by-pass enable during the STOP mode
	3	24	Portamento ON/OFF
	4	35	Read switches status during switch scanning
	5	36	
	6	37	
	7	38	
RESET		4	Input to reset the 8048 when power is ON
INT		6	External gate input
T0		1	Digital data input during A-D conversion
T1		39	Accepts TEMPO clock output
XTAL 1		2	External source inputs for internal oscillator
XTAL 2		3	

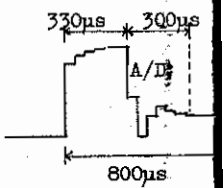
μPD8048C-077 & μPD8048C-256
Difference in Function between the Two in STOP MODE

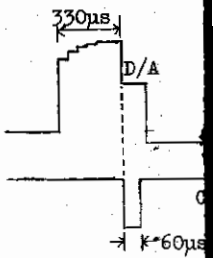
-077
Accesses to another memory chip upon PART switches resettings.

-256
Keeps the same PART until PLAY or LOAD is pressed.

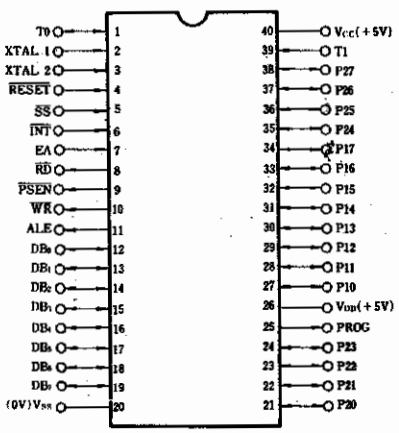




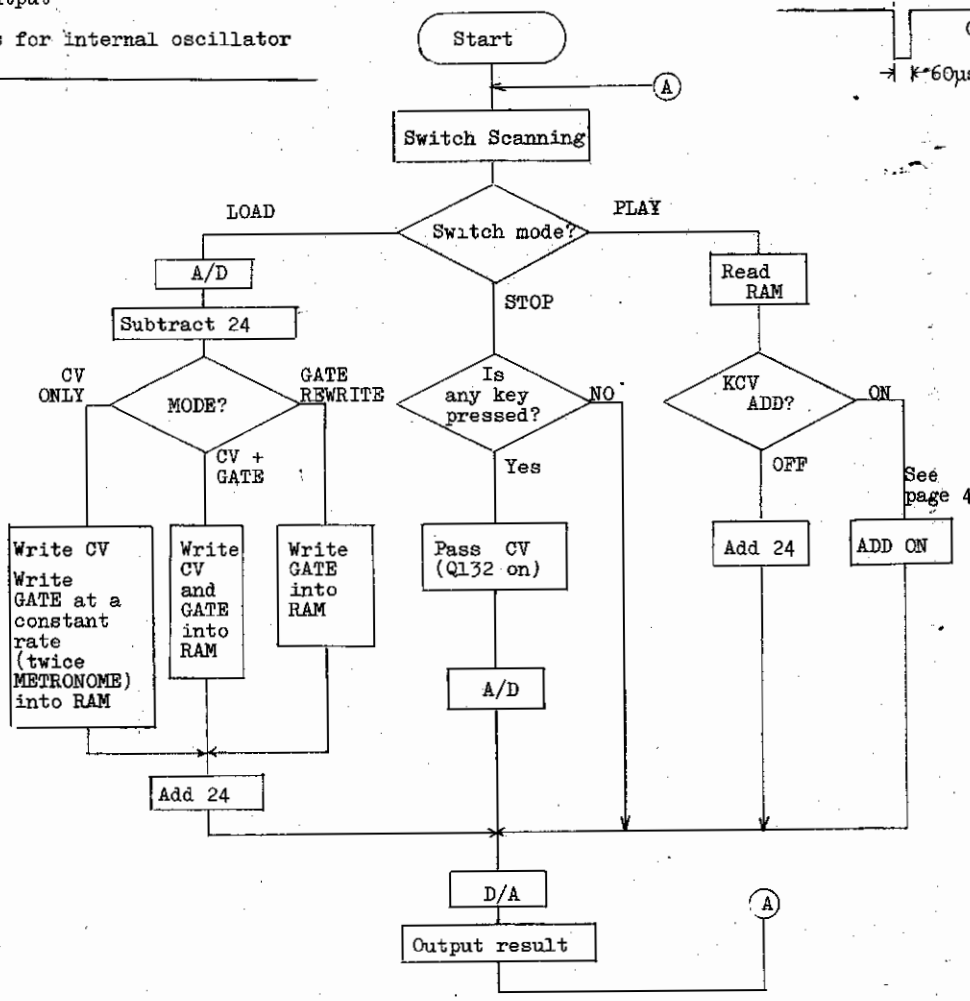




(Top View)



The μPD8048 is an 8-bit parallel computer fabricated on a single sillicon chip. The 8048 contains a 1k x 8 ROM program memory, 27 I/O lines, an 8-bit timer/counter and clock circuits.
Used in the CSQ-600 is a μPD8048C-077 or 256 version. Program and data dedicated to the CSQ-600 are stored in the resident memory.



CV and
GATE data
during
RAM address

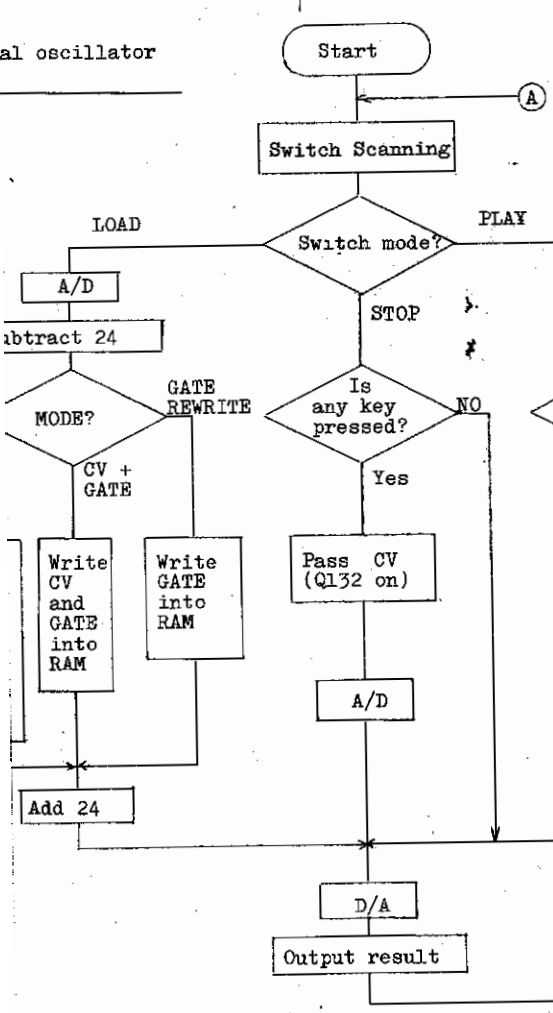
μPD8048C-077 & μPD8048C-256
Difference in Function between the Two in STOP MODE

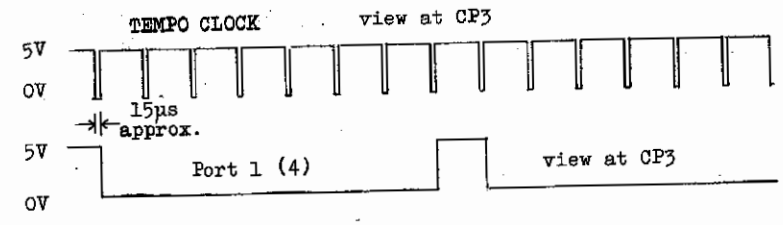
-077

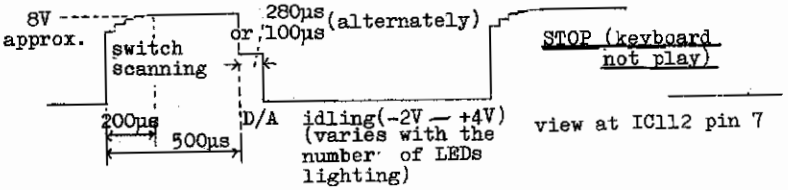
Accesses to another memory chip upon PART switches resettings.

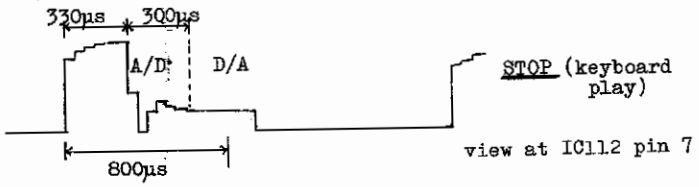
-256

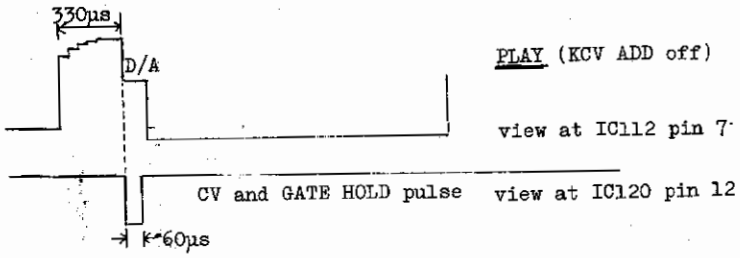
Keeps the same PART until PLAY or LOAD is pressed.



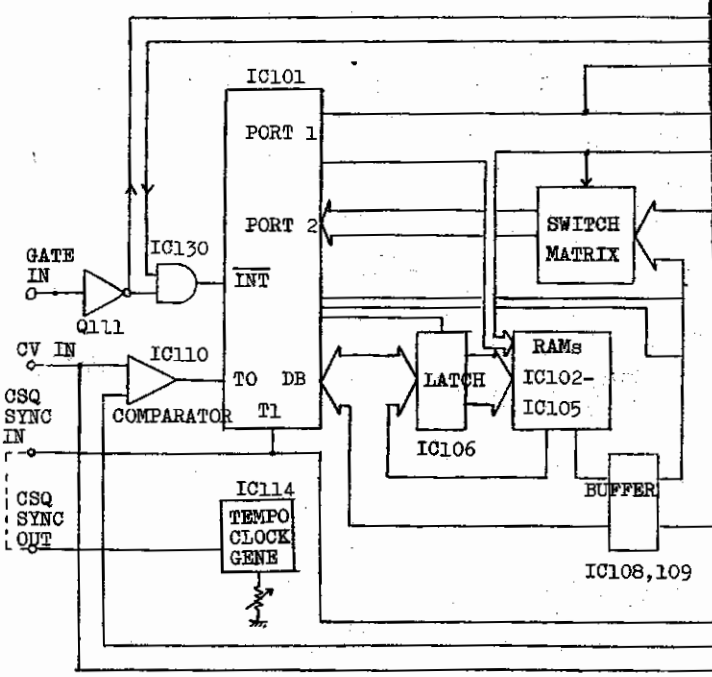


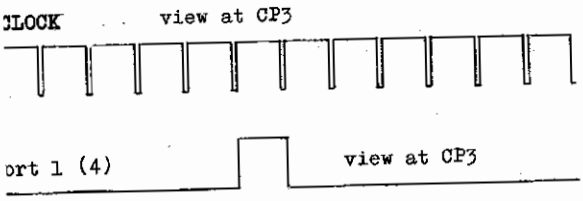


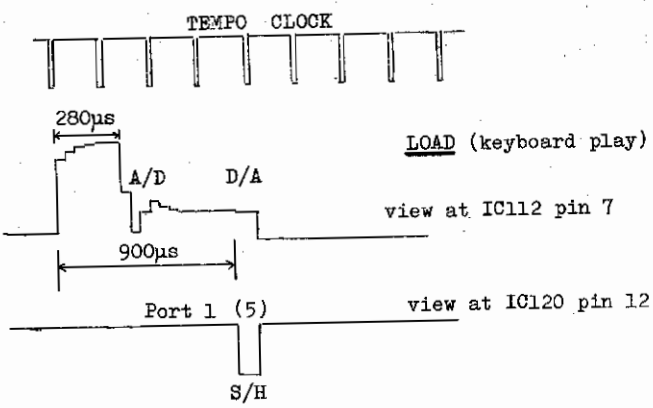


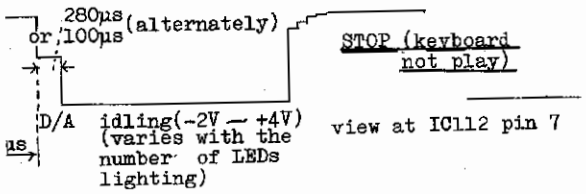


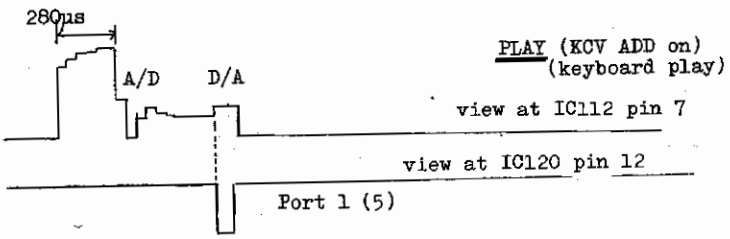
BLOCK DIAGRAM

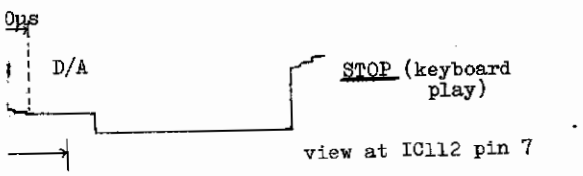


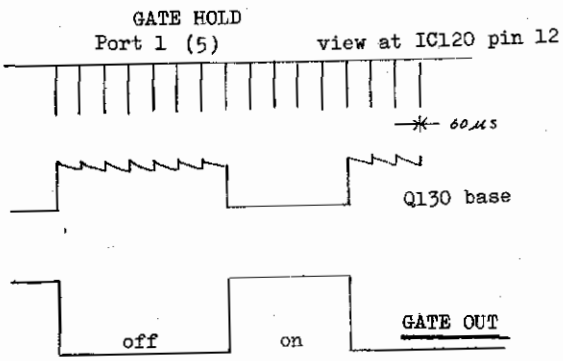


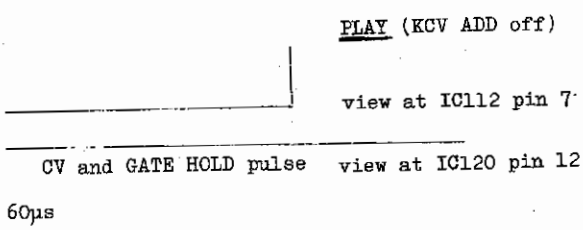




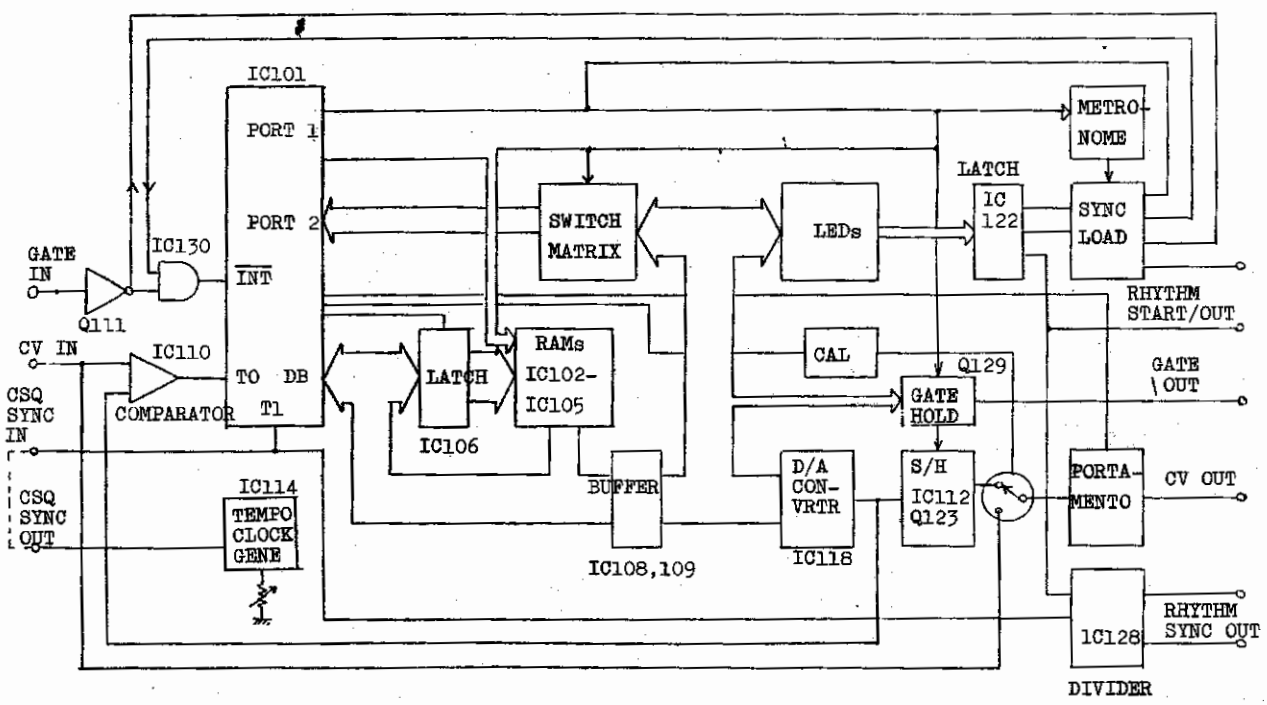








BLOCK DIAGRAM



CIRCUIT DESCRIPTION

This description is composed of two parts: the General description which outlines the functions of CSQ-600, and the Details which centers around A/D and D/A converters since these are practically the heat of this unit. Complete understanding of A/D and D/A conversion circuits will be a great help in performing adjustments in Section II. Also described in Details are functions of SYNC LOAD and RHYTHM SYNC circuits.

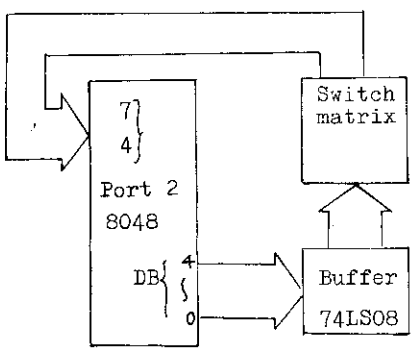
Function of "One chip computer" μPD8048

CSQ-600 performs its functions with μPD-8048 at the center position for all, including the following in its performance cycles:

1. Switch Scanning
2. D/A Conversion
3. A/D Conversion
4. Write/Read of Data to or from External RAM
5. Timing for Lighting LED Indicator
6. Triggering of METRONOME
7. Holding of GATE OUT

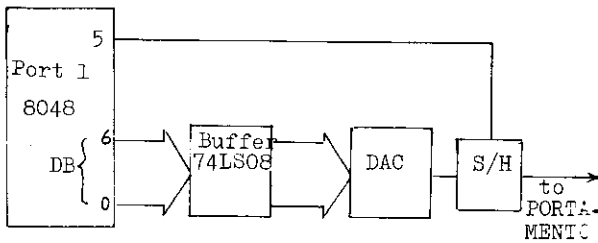
GENERAL

1. SWITCH SCANNING



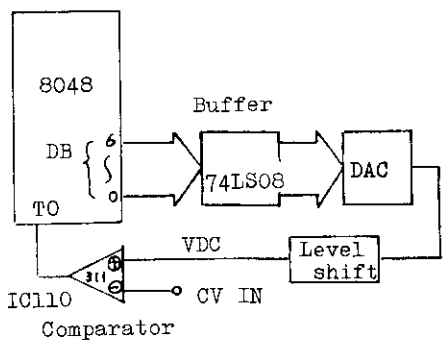
μPD8048 starts its running cycles beginning with switch scanning. Into DB0-DB4(data bus) of 8048, 5-bit signals are being output in accordance with the resident program, which are then brought to the switch matrix via the buffer. At first, L is output from DB4 while having H from other DB0 to DB3. At the next instant DB3 becomes L while DB4 to H; and still next L on DB2 and so on, repeating such output changes 5 times on these bit signal combinations. Depending on which key is depressed or in what position the switches are, corresponding signals are fed back through 4-7 on Port 2.

2. D/A CONVERSION -Digital to Analog -



The D/A Converter transforms the sequential data (switch scanning, RAM address, CVs, etc.), which a being output from the 8048 through internal programming, into analog voltages.
Since the D/A converter (DAC) employed here is a summing type, with a weight-resistor-tree connect to an inverting input of an op amp, each bit in t digital data is converted to an analog voltage in value to double the one immediately subordinate t each. When CV data are on output, pulses synchronized with CV data are supplied from no.5 of port to the Sample and Hold (S/H) circuit, and the ana CV voltage corresponds to the data are held on C

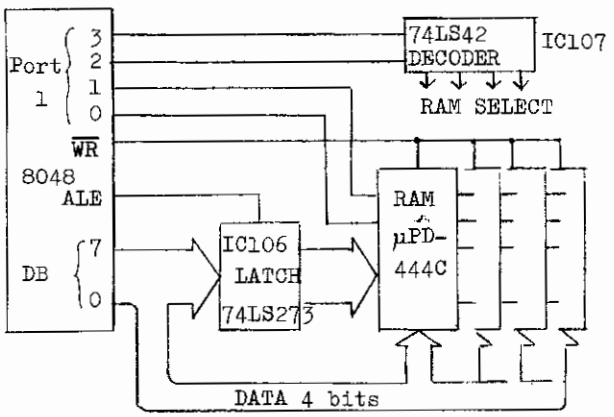
3. A/D CONVERSION - Analog to Digital -



Since the CV IN is an analog voltage, it must be converted to digital data for making the storing in RAM possible.
The method employed in the CSQ-600 is called "successive approximation conversion" where each bit, from DB6 (for MSB: most significant bit, to DB0 (LSB: least significant bit), is being set successively to output "1" which, after being D/A converted, is to be compared with CV IN at the comparator (311).
The comparator will then output "0" (low) if CV> VDC, or "1" (high) if CV<VDC, onto TO. When H is output to TO, the corresponding digital data is "reset" and becomes 0. Such "set" and

"reset" is repeated 7 times for bits from DB6 to DB0 and with the resultant value from such "set" and "reset", the digital data of the CV IN is produced.

4. ADDRESSING EXTERNAL DATA MEMORY



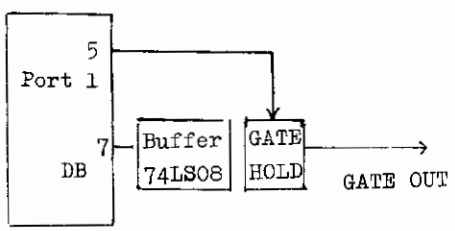
Although the data are 8-bit format, they are divided into two groups of 4-bits, upper and lower 4 bits, and are written/read into separately from external RAMs(μPD444C). Storage locations for PARTs are as follows. Every block consists of 256 bytes.

* μPD444 is a 1k-byte (1k-word by 4-bit) CMOS RAM organized as 256-byte x 4.
1k = 1024, 4096 bits

LOWER HALF		UPPER HALF	
IC102	IC103	IC104	IC105
PART 1	PART 3	PART 1	PART 3
PART 1	PART 3	PART 1	PART 3
PART 2	PART 4	PART 2	PART 4
PART 2	PART 4	PART 2	PART 4

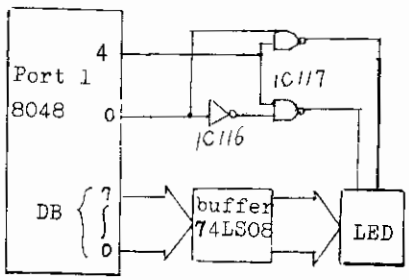
Decoded signals from Port 1, nos. 2 and 3 select a RAM.
Signals from Port 1 nos. 0 and 1 select a chip in the RAM.
Address signals from DB, latched on IC106 by ALE, select memory cells in the chip.
When $\overline{WR}$ goes low, the data are written into, and when high, read from the cells.

5. GATE HOLD



From DB7, the GATE signals are also being output. They are held by the signal (the same as for S/H) to become output of GATE signal.

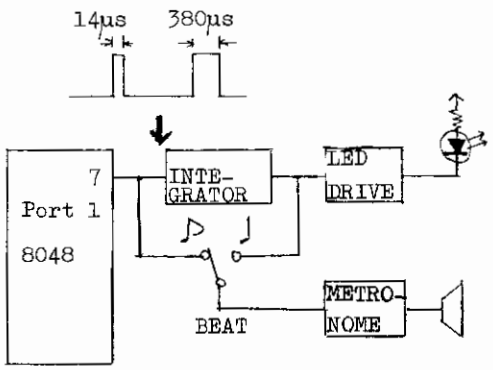
6. LIGHTING of LEDs

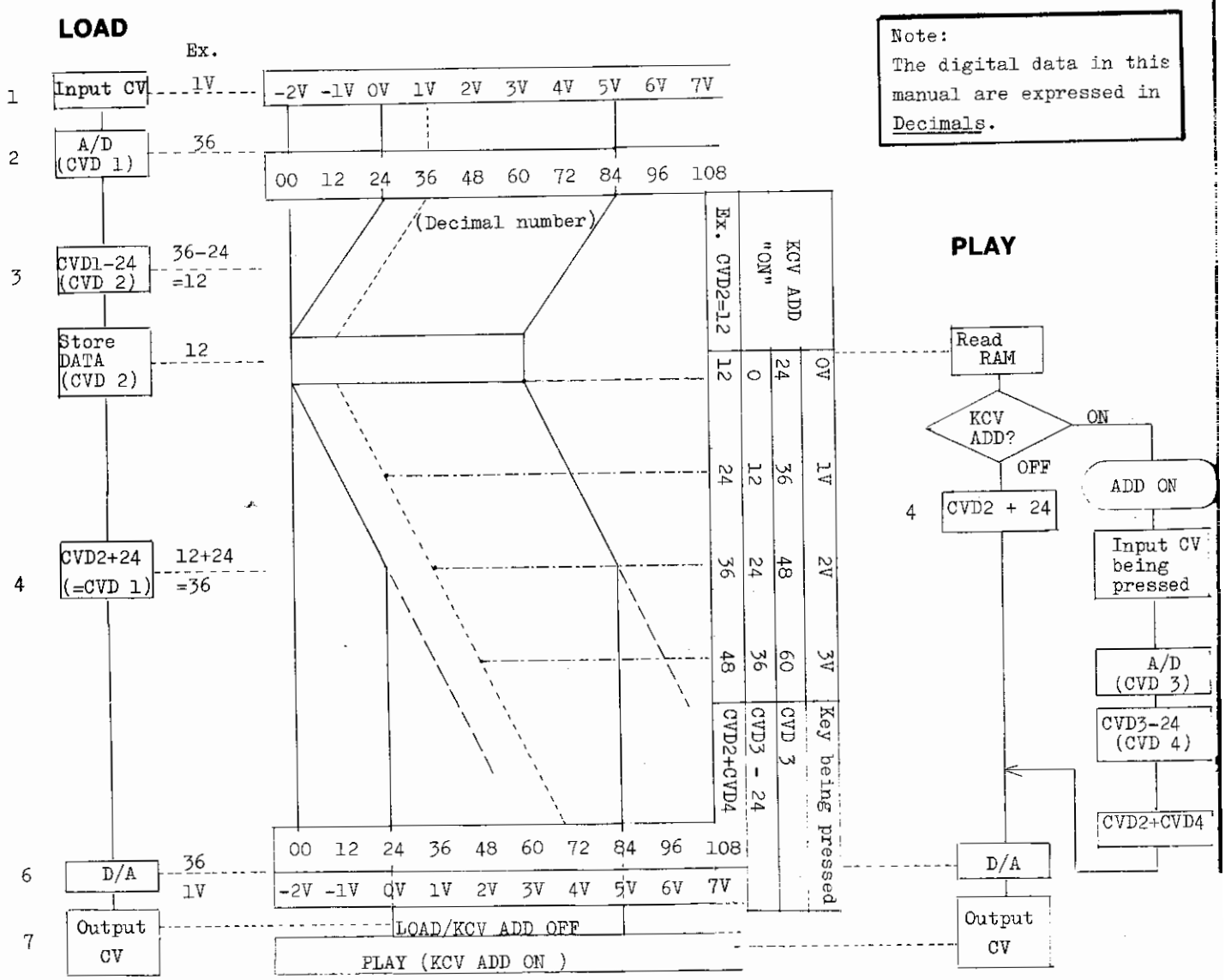


Signals for lighting LEDs (except TEMPO) are supplied from DB. However, various signals are transferred over DB lines at every instance, timing pulses are given from Port 1 nos. 0 and 4 to control the LEDs being driven when there are lighting signals.
The pulses are synchronized with those of TEMPO CLOCK GENERATOR and are output at a rate of one pulse for every eight CLOCK pulses. Because of this, lighting on/off cycling rate is also changed along with change in TEMPO, but the current amount to LED is still being kept unchanged through a means to maintain duty ratio constant.

7. METRONOME DRIVE

In LOAD mode, two pulses concurrent with TEMPO are being output (in period 480 times the CLOCK pulse, in pulse width 14μs and 380μs for alternate output). METRONOME amp is driven by both pulses but since the shorter pulses of 14μs are filtered out by the integration circuit before arriving at LED, the longer pulse of 380μs only is used for lighting the TEMPO LED.





Note:
The digital data in this manual are expressed in Decimals.

DETAILED CIRCUIT DESCRIPTION

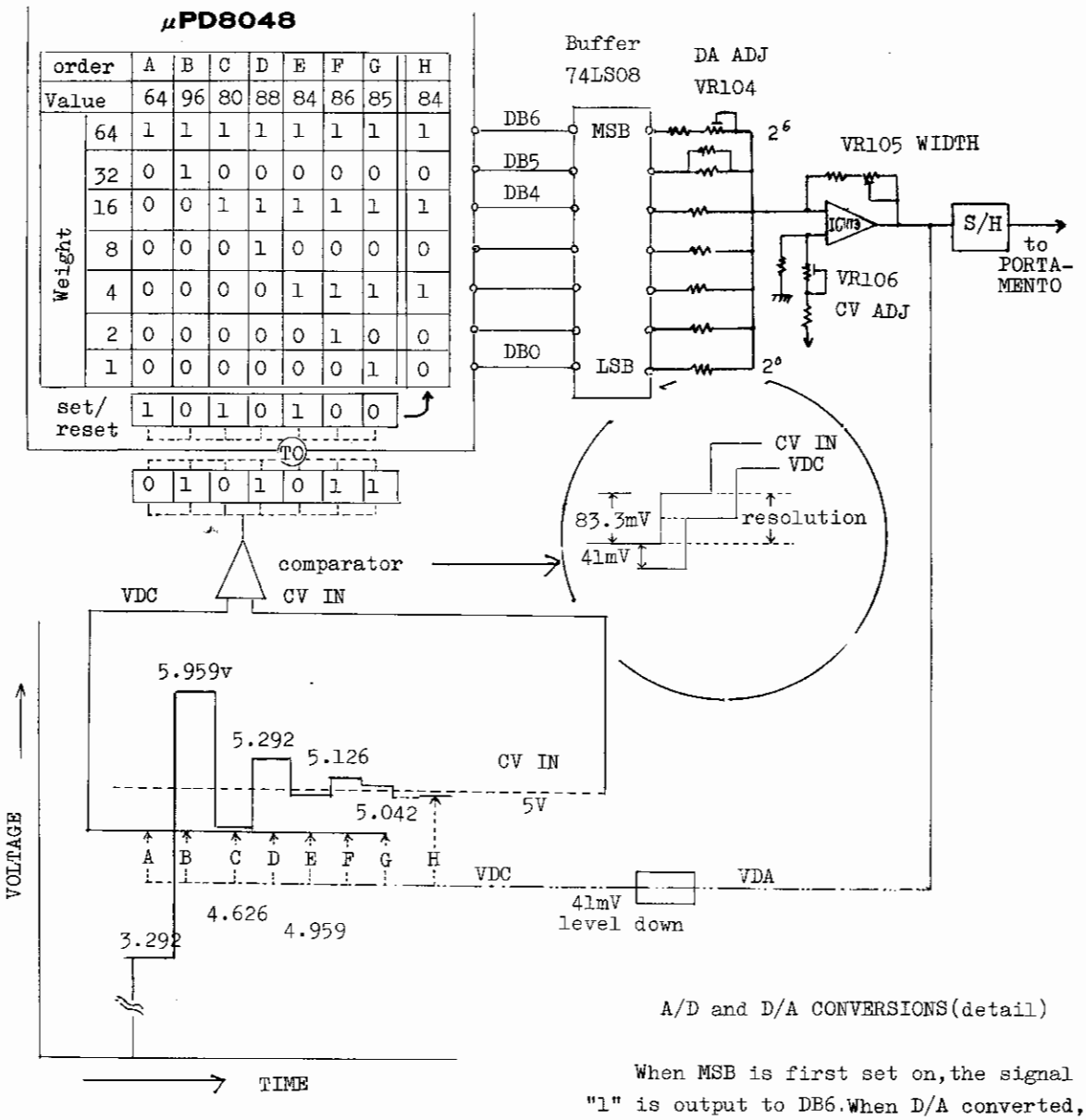
Since in the CSQ-600, the key voltage which are analog quantam are first converted to digital for storing in RAM and again afterward are converted to analog for CV OUT. These A/D and D/A conversions are just as important as the heart is to man. It might be said that without understanding of these conversion principles and pertinent analog vs digital data relationship, all adjustment services which are related to key voltage circuits become difficult to perform correctly. With this in mind our description will proceed along with the line as numbered in the figure above.

1. Storage capacity of the RAM in the CSQ-600 is 5 volts in terms of analog quantity. It accepts KCV within the range of 0V to 5V or 61 notes.

2. As described on later section 5, CSQ-600 is so designed that it can output -2V KCV from 0V KCV input. Therefore, the smallest CV to be processed in the CSQ-600 circuitry is -2V and the digital data are made to 00 for -2V, 24 for 0V.

3. For this reason, storing data for KCV IN lower than 0V into RAM is unnecessary. Besides, 6 bits ($2^6 = 64$) are enough in handling voltages 0 to 5V; the number of pitches are 61 if taken in the ratio of 1V/oct. But 7 digits would be required for covering 61 notes if started from 0V = 24.
To make 0V = 00(in decimal), numbers 24 are being subtracted after A/D conversion. Digit "1" in the data corresponds to analog voltage 83.3mV or 84mV - a potential difference between adjacent keys on the keyboard.

4. Reproduction of CV in Memory --- 1
- LOAD or PLAY (with KCV ADD "off") -
In this case, when D/A conversion is done after addition of 24, which is the same as subtracted before storing, to the data from RAM, the same original analog voltage can be reproduced after D/A conversion.



A/D and D/A CONVERSIONS(detail)

When MSB is first set on, the signal "1" is output to DB6. When D/A converted, the analog voltage (VDA) here must be 3.333V which, after shifted down by 41mV, becomes 3.292V (VDC). This time VDC goes to noninverting input of the comparator and is compared with CV IN. In the case shown in figure above, this CV is 5V, so CV IN > VDC bringing the comparator's output to L, to have DB6 remainded as has been set to "1". Next, DB5 is set to "1". This time the digital data is the sum of DB6 and DB5, and the comparison becomes CV IN < VDC, to output H and to "reset" signal of TO and to have DB5 return to "0". This kind of comparison is repeated 7 times down to DB0 (LSB). The sum of the digital data of the bits remained "unreset", then, is made to be the data of this CV IN, with which the CV IN is stored in the external RAM.

Although CV IN is in fact an analog voltage, it steps up or down like a stircase wave as the note changes. Therefore, if VDC is shifted down by an amount equal to about one-half of the voltage difference between adjacent keys (KCV resolution), a voltage fluctuation within the resolution of the comparator does not bring effect on the digital data, as shown in the circle in the figure avobe.

5. Reproduction of CV in Memory ----- 2
- Transpose under PLAY mode, with KCV ADD "on" -

CSQ-600 has the function to have the notes in play mode transposed up or down by adding an external key voltage to the CV from memory: with a 2 volts key voltage added original notes are reproduced in the same pitch as they were; and 0V key added, the notes are downed by 2 octaves.

The key that delivers 2V KCV is designated as a reference key in this book.

For instance, when 0V is stored in cells, depressing a 0V key(the lowest key to be accommodated) will cause the CSQ-600 to output -2V. To furnish this the following must be ture:

0V digital data stored in RAM (CVD2 = 00) + 0V KCV digital data (CVD3 = 24) = 00

To satisfy the above,

" CVD2 + CVD3 - 24 = output data"

Sept. 1, 1980

RELATIONSHIP BETWEEN CV ADJ (VR106) and CV DATA

In LOAD mode and with the converter that is correctly adjusted, suppose that we turn VR106 (CV ADJ) slowly clockwise while holding 1V key depressed on the keyboard. Then you can observe VDA (i. e. CV OUT) increases gradually, and likewise VDC (VDA - 41.7mV) ascends along the dotted area as shown in Fig. 3.
That is to say, although the digital data is unchanged, the voltage for that data is increased.
But, still kept on turning VR106 to have VDC overcome 1V line for the digital data 36 as shown in Fig. 4, it causes the output of the comparator to be turned to "H" and the digital data re-written to 35.

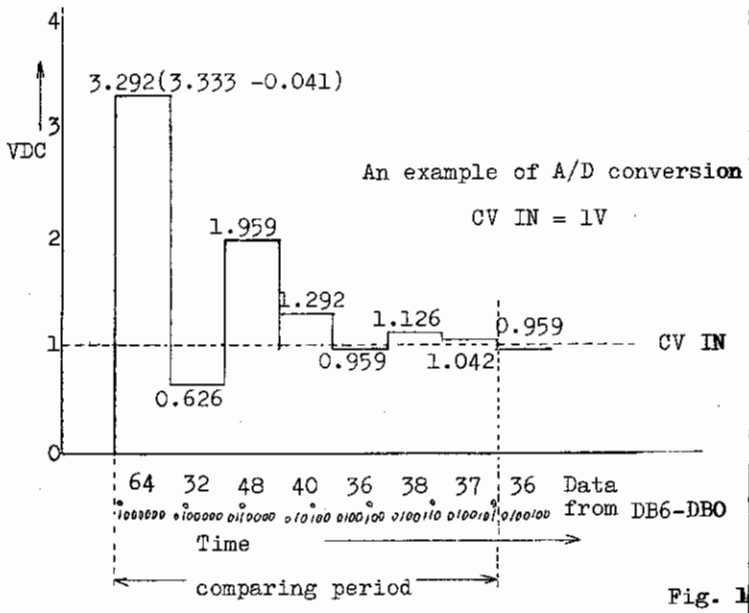


Fig. 1

Figure 5 shows that state as being adjusted by turning VR106 clockwise to have CV OUT again to 1.000V.

Still turning VR106 further will repeat the same as above and to rewrite to 34.
But, when turned counterclockwise, the data will be rewritten to a larger number each time.

When watching this on a digital voltmeter connected for observation, the display will be as illustrated in Fig. 2.

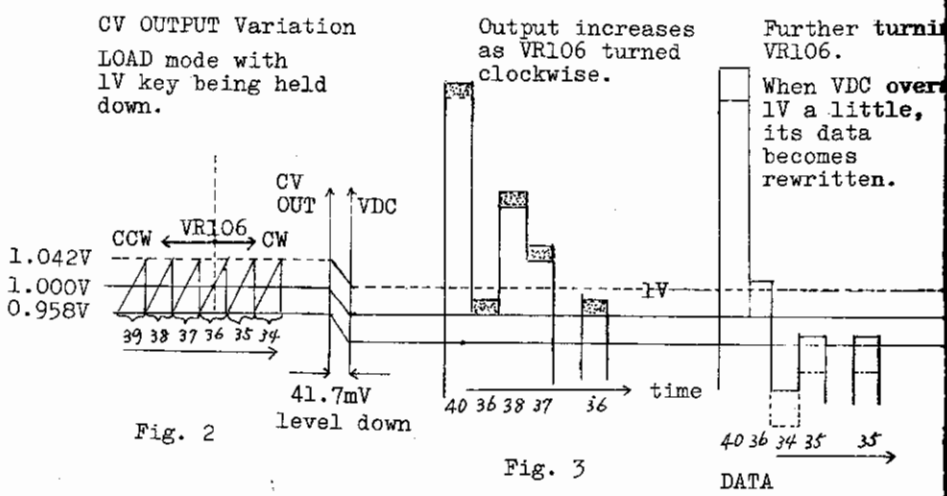


Fig. 2

Fig. 3

Fig. 4

Now, suppose that we have turned VR106 a little too far to have the digital data 35 for CV IN of 1V (as in Fig.5). It is all right and causes no problem as long as we have KCV ADD turned off, because under these circumstances, any shortage or excess of voltage could be compensated for by biasing through this CV ADJ potentiometer.
But, once we have turned KCV ADD on, the whole matter would become different, to be explained in the next paragraph.

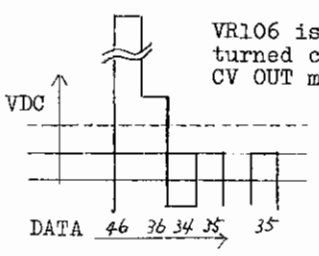


Fig. 5

WHEN DATA IS INCORRECT, ERROR WILL BE PRODUCED on CV OUT With KCV ADD "ON"

Taking for instance the case of each having CV IN 1V converted into digital 35 (B and C, table right) in place of 36, we will explain as follows:

NOTE: Figures in top row refer to those in illustration at left on opposite page.

	MODE	2 CVD1	3 substraction	CVD2	4, 5' addition	6 D/A INPUT	7 CV OUT
A	LOAD (normal)	36	24	12	24	36	1V
B	KCV ADD "off"	35	24	11	24	35	1V
C	KCV ADD "on"	35	24	11	*(CVD-24) 47-24=23	34	0.9167V

* This is when the 2V key is depressed so as to have the same pitch on CV OUT with CV IN in memory

Case B is when VR106 is adjusted to reproduce CV OUT of 1V even if in earlier stage the digital data lacks by 1.
In this case, since the numbers in previous subtraction, and subsequent addition are both the same (24), the analog amount at the output receives no effect to differ after A-D-A conversions.
In C, however, despite the fact that the KCV (being pressed) is converted to digital data number short of 1, it is added to RAM-stored-data after subtracting 24. As a result there is a double shortage, bringing after all the shortage by 2 before D/A conversion prior to CV OUT. Through this D/A once again, 1 out of these 2 can be compensated for by VR106, but there is still remained of 1, which brings lack in pitch of a semitone ("1" in digital data) on tone reproduction.
Thus, a maladjustment of VR106 produces a deviation on reproduction when played with KCV ADD "on". Or, it can be said conversely that, through finding such deviation on analog voltage, it is possible to check digital data errors.

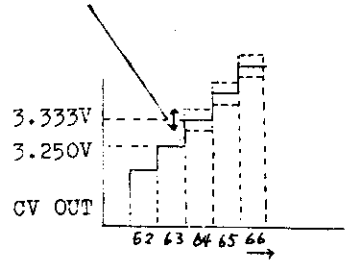
WIDTH ADJUSTMENT with VR107

This potentiometer VR107 is for use to correct the gain of IC112 so as to have D/A in proper relation of 1V/oct, that is, when the data changes by 1, CV OUT changes by 83.3mV.
When VR107 is required for readjustment, it may also be necessary to readjust VR106, since turning either VR results in interaction between the adjustments. Therefore, both VRs need to be adjusted in turn.
Also care must be exercised to avoid an excessive turn of the VRs which will bring difficulties in performing these adjustments.

D/A ADJUSTMENT with VR104

This potnetiometer is for the gain adjustment of the D/A converter, and it is in particular for DB6. This DB6 is for the data weighing the most significant bit, so its adjustment is the most critical one and warrants the careful attention. Sources of fluctuation and deviation such as those coming from the preceding stage of IC118, IC119, on impedance or on output voltage, and resistance variation in resistor, etc. are to be compensated for by this VR104.
Since the digital data that makes DB6 active is in number over 64 or 3.333V in CV, fluctuation brought through DB6 data will effect all CV of higher voltages as shwon in the figure. In practice, it will be best to adjust VR104 as follows:
set the LOAD mode and complete both CV ADJ and WIDTH ADJ, then, holding down the key for 4V. Set VR104 so that CV OUT equals 4.000V.

Deviation in this step will be carried through the upper steps.



RHYTHM SYNC

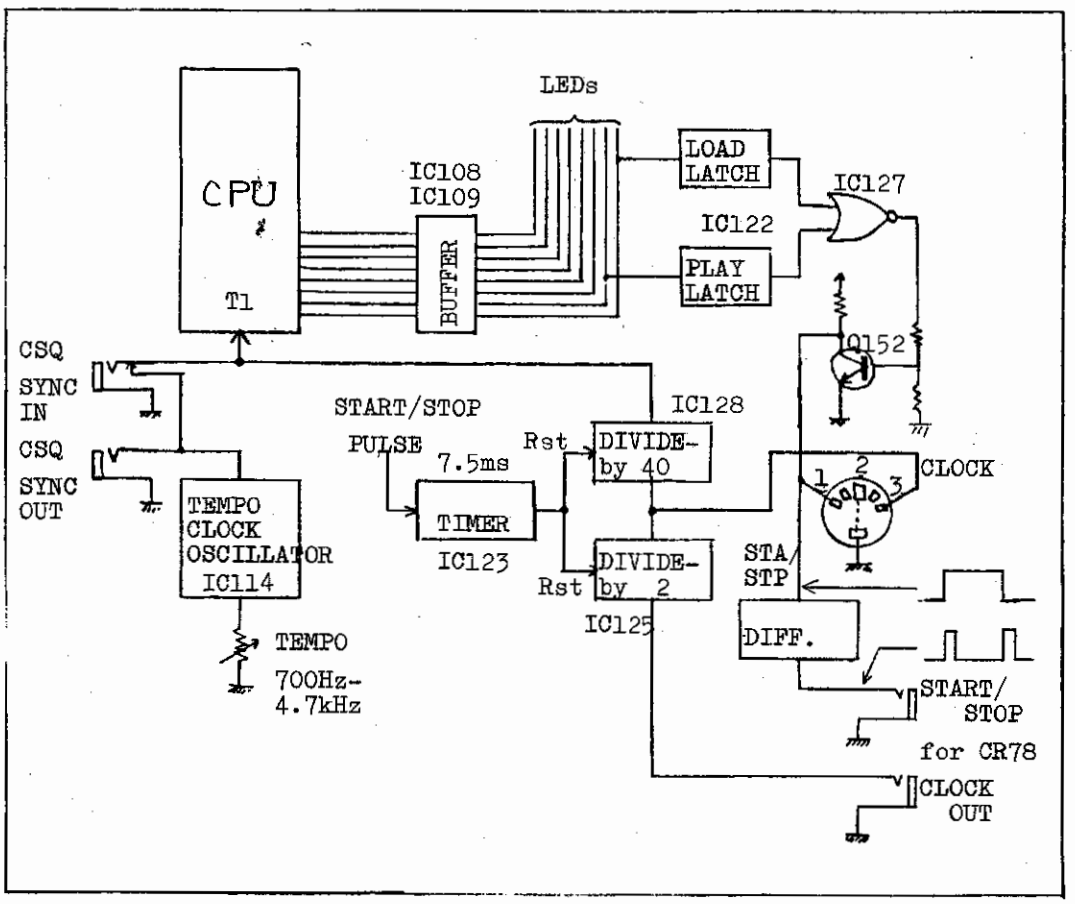
- CLOCK PULSE -

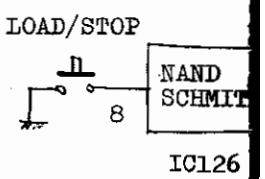
In CSQ-600, tempo (duration of a beat) for BEAT ♩ is designed equal to that of 120 clocks of the tempo oscillator. CPU 8048 divides tempo oscillator's output by 8 in frequency - 960/8 = 120.
The output of the oscillator is also divided by 40 in IC128 to create tempo of 24 clocks to be used for CLOCK OUT through DIN socket, 24 clocks per ♩.
This output is further divided by 2 in IC125 to provide tempo for BEAT ♪ consisting of 12 clocks, TEMPO CLOCK for CR78.

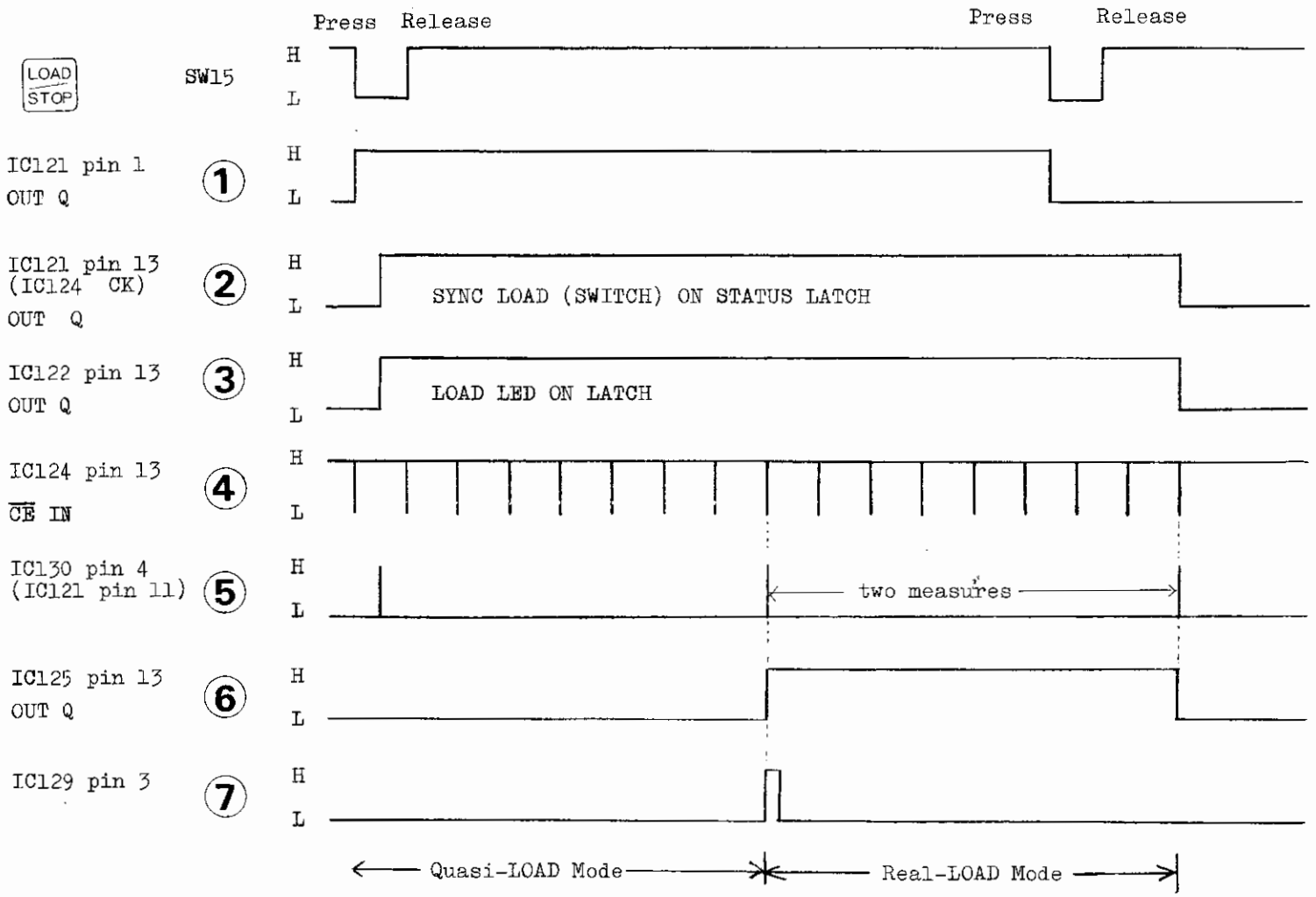
- START & STOP PULSES -

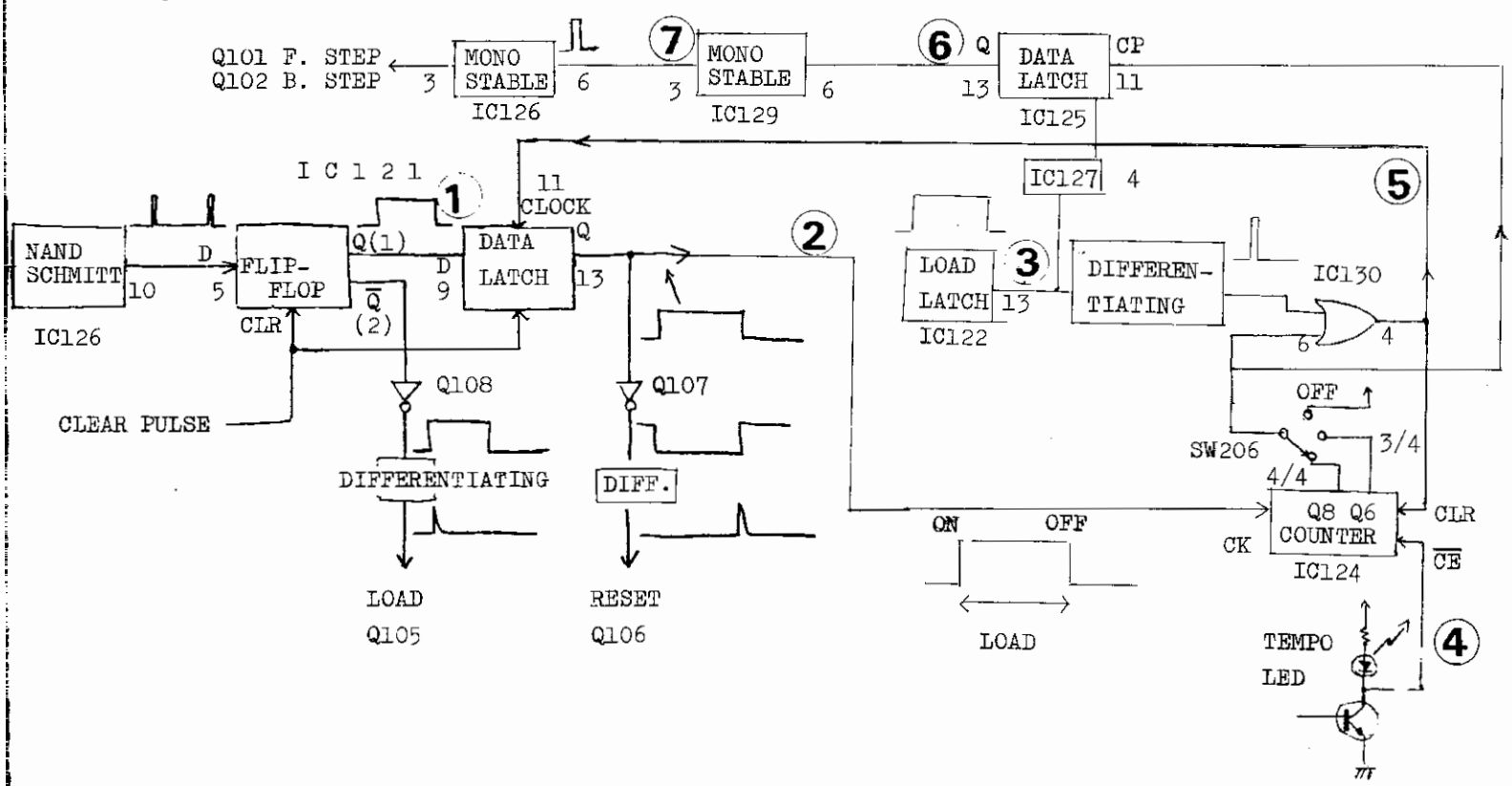
Rhythm unit, when connects and works with CSQ-600, starts and stops in synchronous with the switchings of LOAD/PLAY and STOP/RESET on the sequencer.
Either ½IC122 senses LED drive signal (LOAD or PLAY) and latches it which is sent to NOR gate IC127.
Upon receiving one of latched signals; IC127 output switches to low and stays low during PLAY or LOAD mode. For starting and stopping CR78 rhythm the high output (inverted) from Q152 is differentiated at its rising and falling edges; resulting pulses are then ORed and inverted respectively to become distinct positive going pulses. CR78 will run and stop only when positive going pulse is applied to its START/STOP jack.

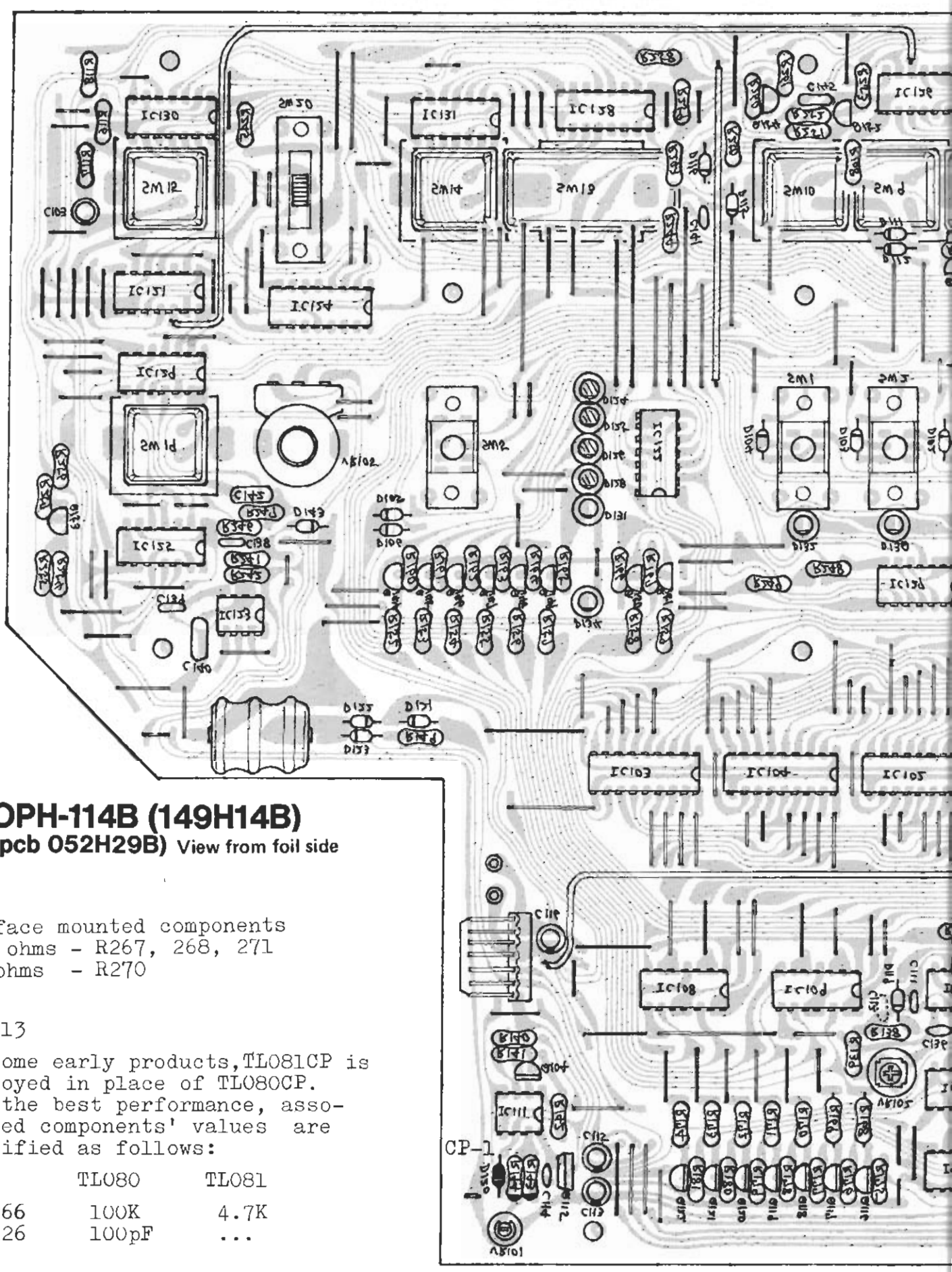
* Output from pin 3 of Timer IC123 signals Clock dividers to keep clock pulses low for 5-10ms after PLAY or LOAD is pressed.






Press
Release
Press
Release
LOAD/STOP
SW15
H
L
IC121 pin 1
OUT Q
1
IC121 pin 13
(IC124 CK)
OUT Q
2
SYNC LOAD (SWITCH) ON STATUS LATCH
IC122 pin 13
OUT Q
3
LOAD LED ON LATCH
IC124 pin 13
CE IN
4
IC130 pin 4
(IC121 pin 11)
5
two measures
IC125 pin 13
OUT Q
6
IC129 pin 3
7
Quasi-LOAD Mode
Real-LOAD Mode


Q101 F. STEP
Q102 B. STEP
MONO STABLE
IC126
MONO STABLE
IC129
DATA LATCH
IC125
CP
IC121
NAND SCHMITT
IC126
FLIP-FLOP
CLR
DATA LATCH
CLOCK
IC127
LOAD LATCH
IC122
DIFFEREN-TIATING
IC130
OFF
ON
SW206
3/4
4/4
Q8 Q6 COUNTER
IC124
CK
CLR
CE
TEMPO LED
CLEAR PULSE
Q108
Q107
DIFFERENTIATING
DIFF.
LOAD
Q105
RESET
Q106
LOAD



OPH-114B (149H14B)
(pcb 052H29B) View from foil side

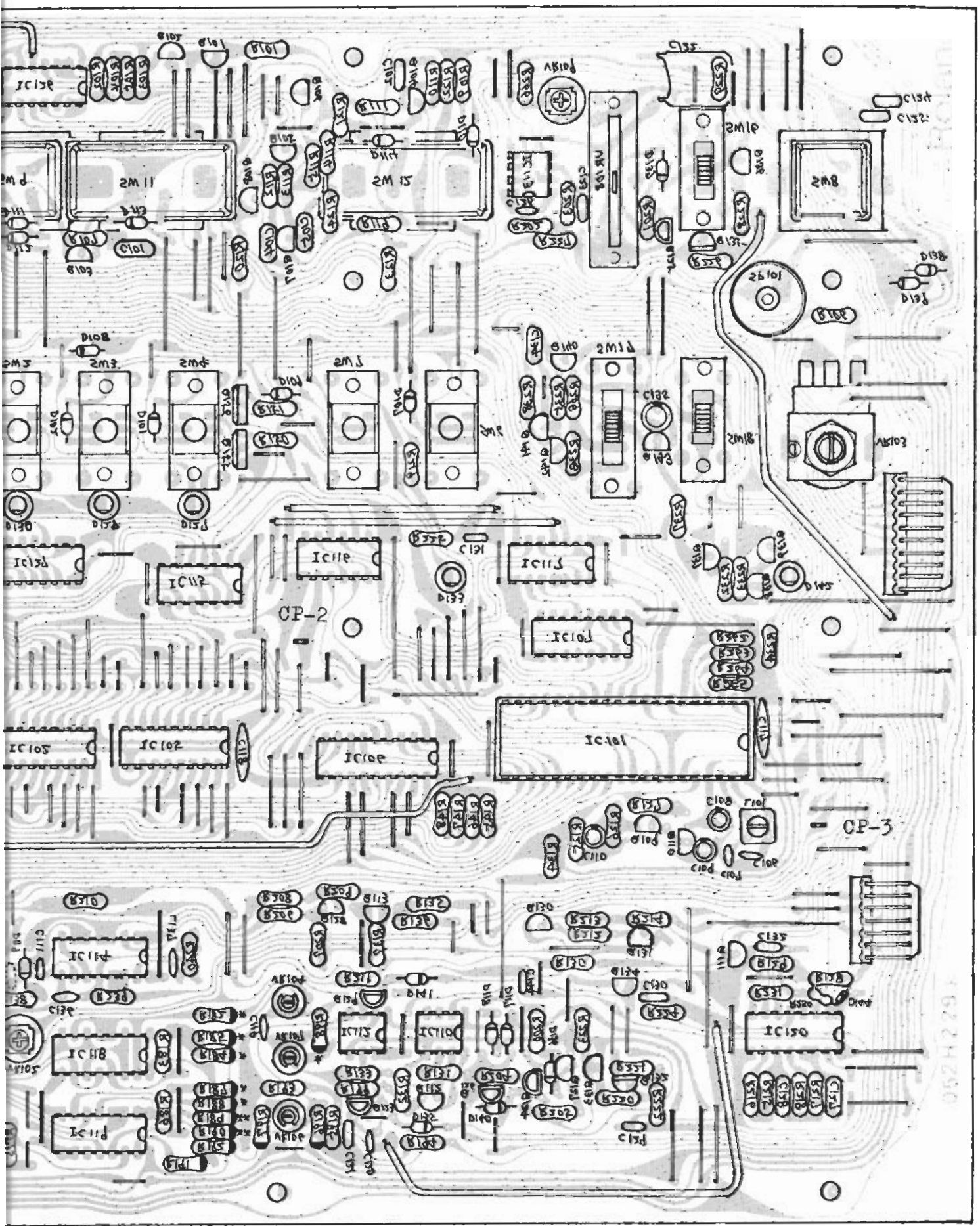
Surface mounted components
10k ohms - R267, 268, 271
1M ohms - R270

IC 113

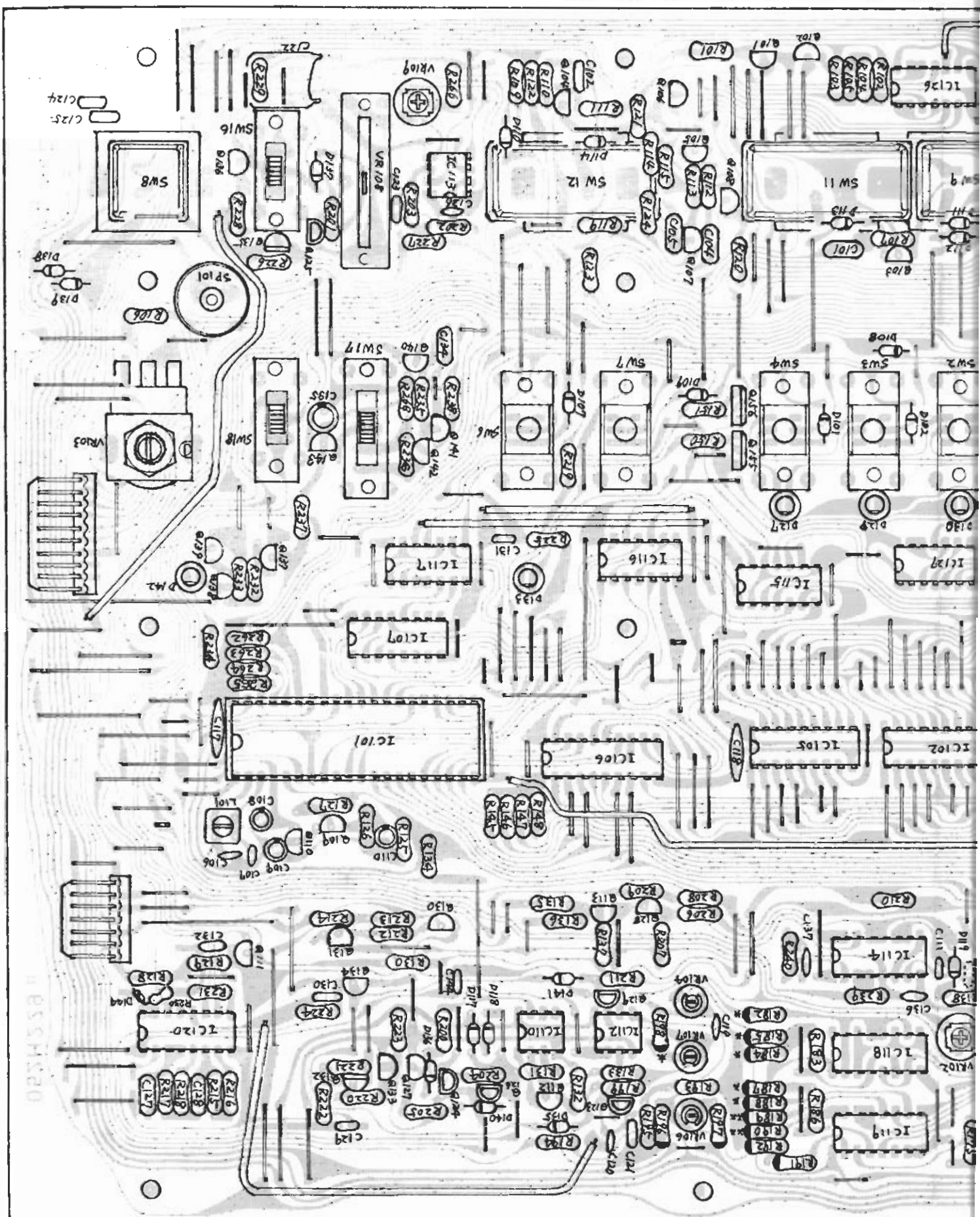
In some early products, TL081CP is employed in place of TL080CP. For the best performance, associated components' values are specified as follows:

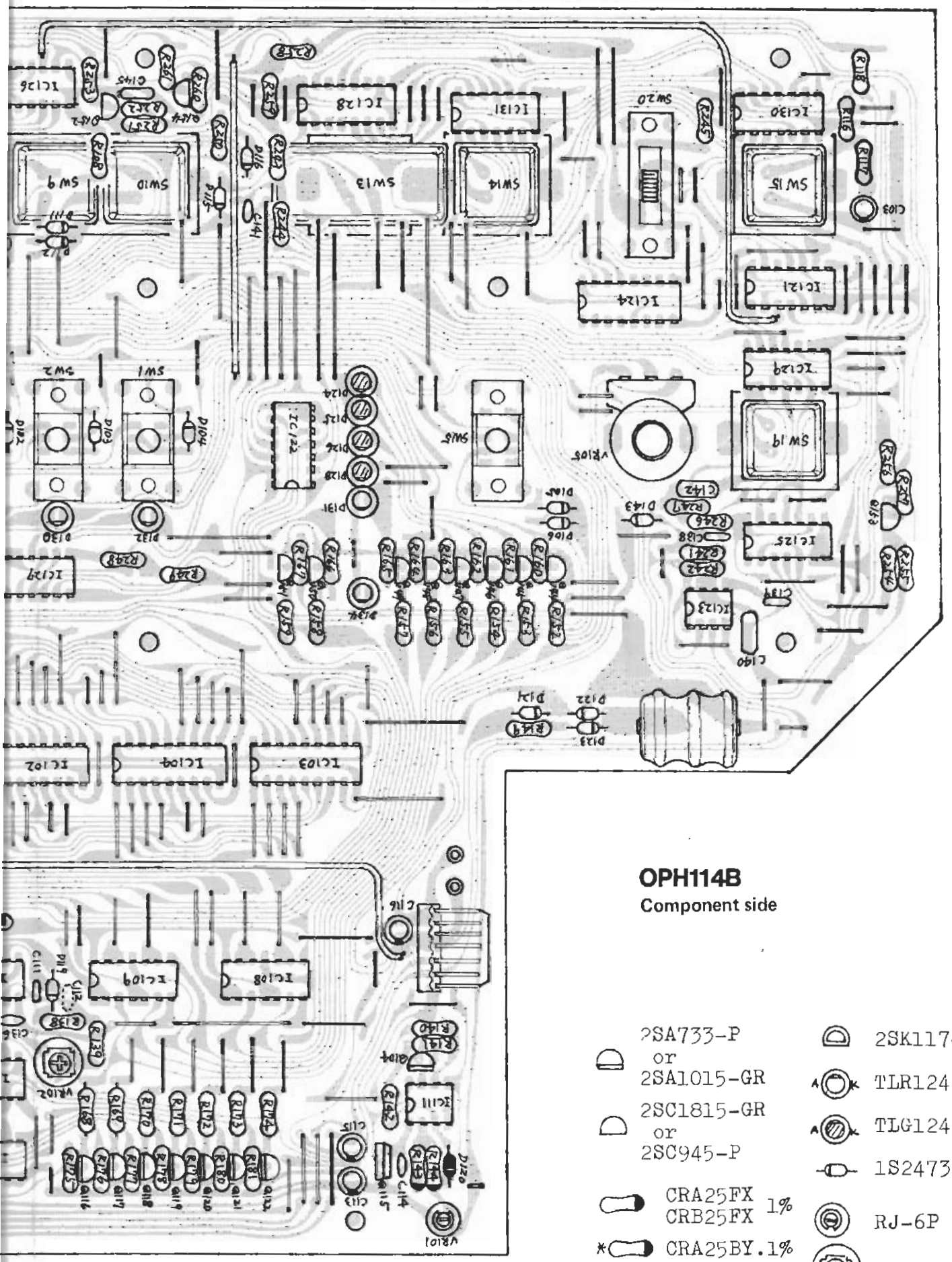
	TL080	TL081
R266	100K	4.7K
C126	100pF	...

The printed wiring layouts of this page and back side are registered to help s



help simulate turning the pc board inside out without removing the front panel off.


SW8
SW16
SW17
SW18
SW12
SW11
SW7
SW6
SW4
SW3
SW2
VR103
VR104
VR109
SP101
IC101
IC102
IC105
IC106
IC107
IC110
IC111
IC112
IC114
IC115
IC116
IC117
IC118
IC119
IC120
IC126
IC127



OPH114B
Component side

2SA733-P
or
2SA1015-GR

2SC1815-GR
or
2SC945-P

CRA25FX
CRB25FX 1%

* CRA25BY.1%

** CRA25DY.5%

2SK117-GR

TLR124

TLG124

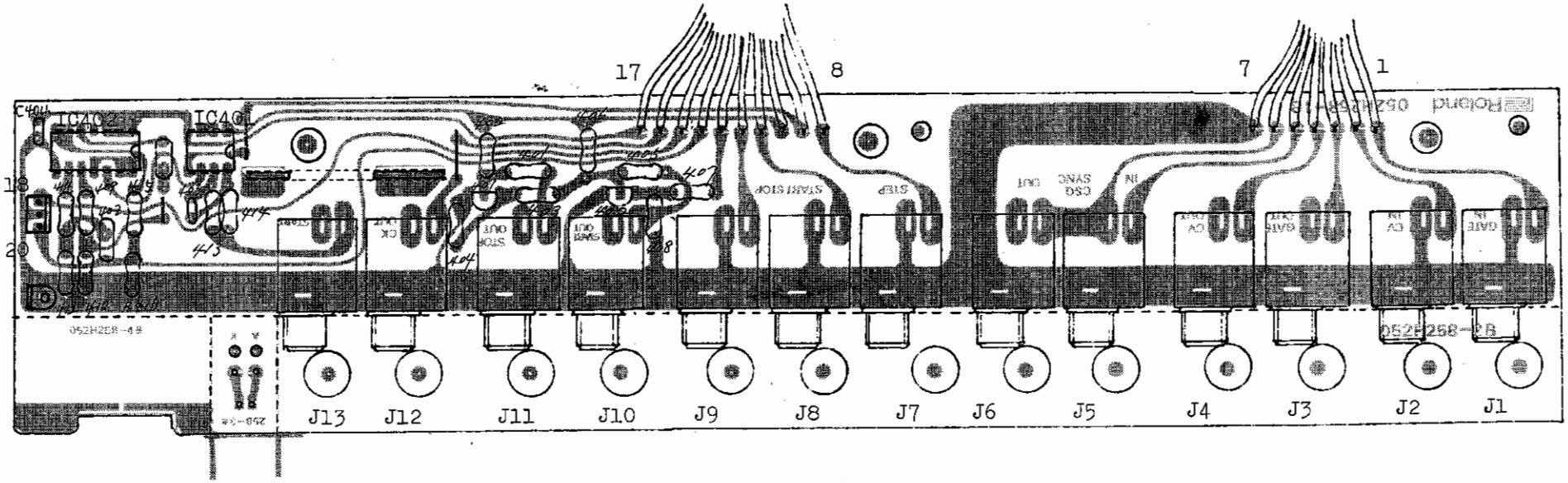
1S2473

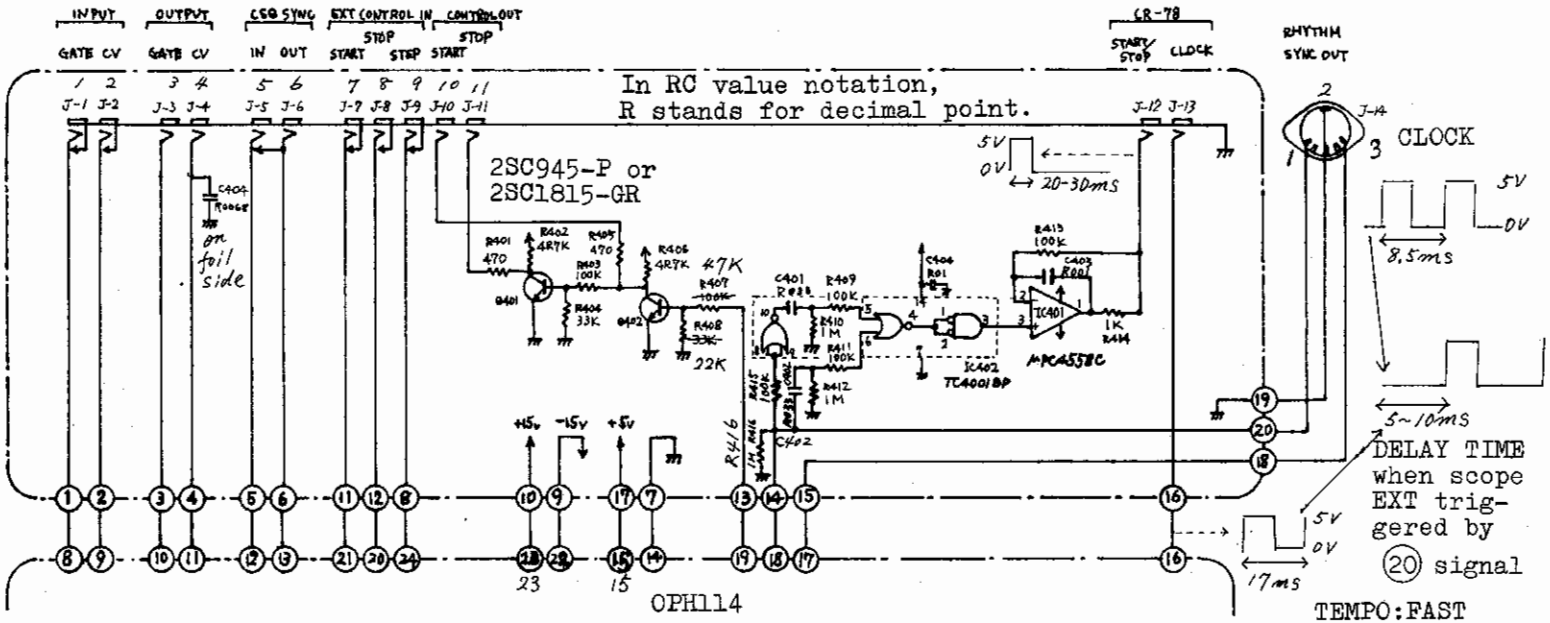
RJ-6P

SR-19R

Sept.1,1980

OP-115B (149H115B) (pcb 052H258B) View from foil side





19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40

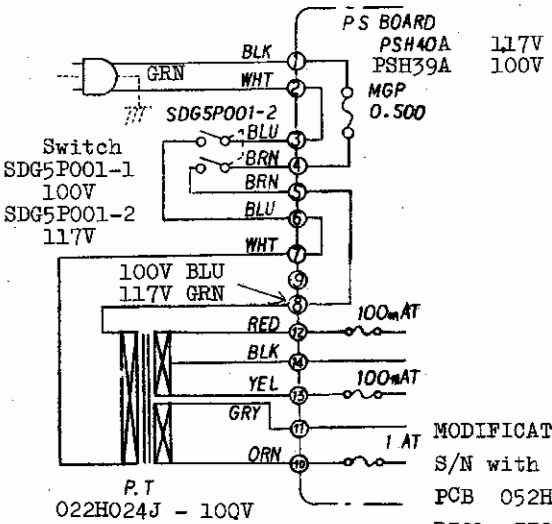
TEMPO:FAST

OPH114

POWER SUPPLY BOARD
PSH39A (146H039A) 100V
PSH40A (146H040A) 117V
PSH41A (146H041A) 220/240V
(Etch mask 052H172A)

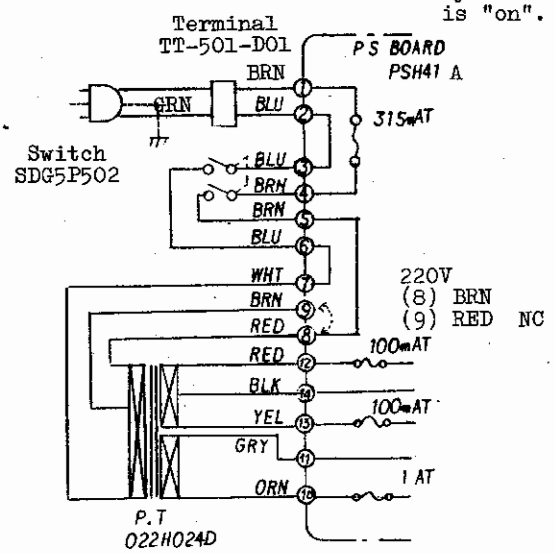
When replacing, use C version.

100/117V



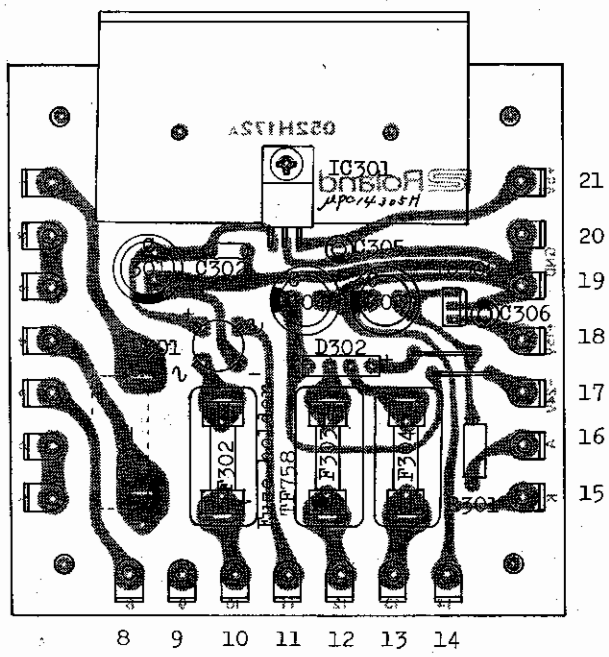
MODIFICATION
S/N with 001050
PCB 052H172C
R301: 330 ohms with the one lead connected to (21). This prevents D303 from being lit when CSQ600 is "off"while synthesizer connected is "on".

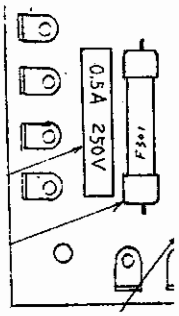
220/240V



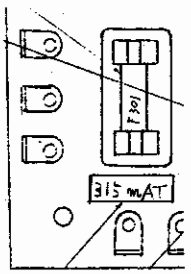
220V
(8) BRN
(9) RED NC

Heat sink H-17

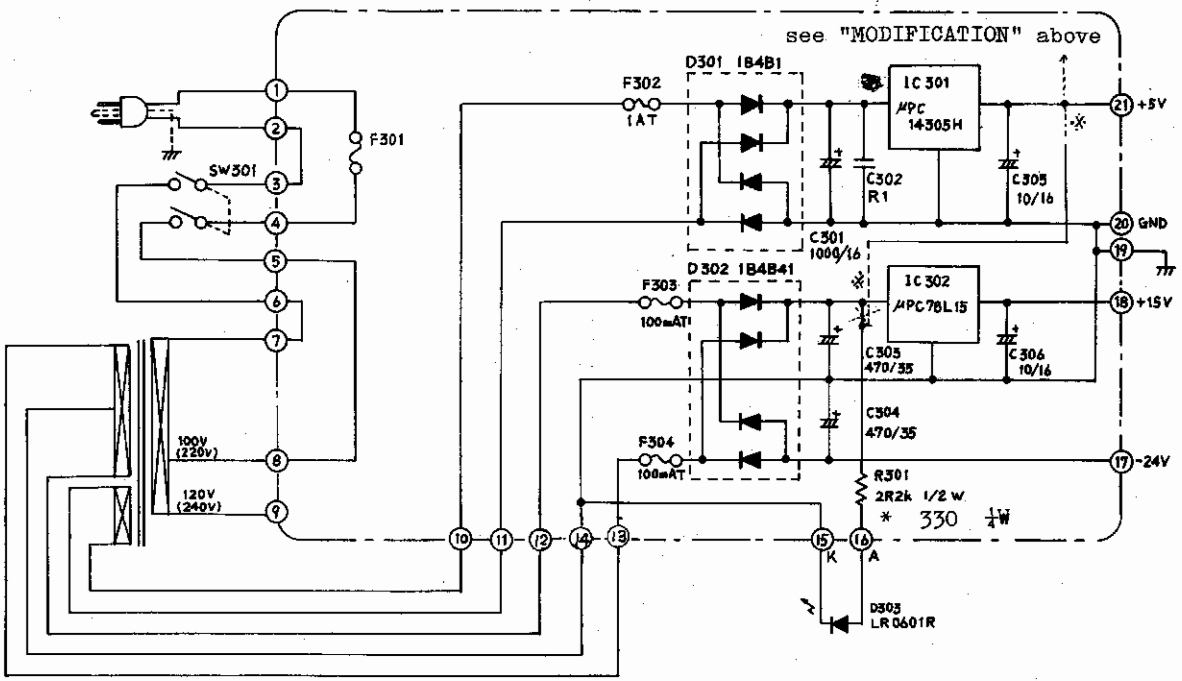




F301:
PSH39/40
MGP 0.500 CSA
(008-040)



F301:
PSH41
SEMKO
T315mA
(008-061)



ADJUSTMENTS

The adjustment is composed of two parts: Section I and Section II. It is recommended that the adjustment which is necessitated after the replacement of failing component or others are, as a rule, to be conducted as described in Section I.

Difinitions
In this adjustment, the following terms have the following meanings.

DVM --- Digital voltmeter Scope --- Oscilloscope
LOAD, PLAY, etc. ---------- Key on the CSQ-600 control panel

2V key, 3V key, etc. ------- A key on the synthesizer keyboard connected
TEMPO, CAL, FAST, etc. ----- Control,Switch,Jack,Legend on the CSQ-600
CP1, CP2, etc. ------------- Check point on the PCB

NOTE: Allow at least ten minutes for warm up period before adjusting.

CAUTION: Do not trun adjusting potentiometers excessively.

SECTION I

Adjustment is usually necessary only after replacing parts:

CALIBRATION PROCEDURES

After replacing		Connect-, to	Adjust, or Check	for (remark)
IC101 (μPD8048) L101 (47μH)	1.	Frequency counter, CP2	L101	365kHz±10kHz (8048 Clock frequency)
IC114 (TC4049))	2.	Frequency counter, CP3	VR102 Clock Adj.	(Tempo clock frequency) 4.7kHz±5% with TEMPO at FAST
Check that frequency is 0.7kHz $^{+5\%}_{-10\%}$ with TEMPO set at SLOW. If deviates from this range, readjust VR102 for within the range of 4.7kHz±5% with TEMPO set at FAST. Or, tailor C112.				
IC113 (TL080CP)	3.	No connection, CV IN jack DVM, CV OUT	VR109 Offset	(Press RESET) 0±0.5mV
IC111 (μPC4558) D120 (1SZ52)	4.	DVM, CP1	VR101 -15V Adj.	-15V±2mV
NOTE: Since any variation in the DC supplies will have the most pronounced effect on the D-A converter, check CV OUT for error through the next steps (5).				
IC118,IC119 (TC4049) IC112 (TL082CP)	5.	CV IN, Synthe CV OUT GATE IN, Synthe GATE OUT DVM, CV OUT	VR106 CV Adj.	(D/A Adj.) CAUTION: Adjustment of the DA converter is very subtle. Always rotate Adj. pots by small degrees, excessive turn will bring great difficulty on the subsequent adjustments, requiring a waste of time.
Setting:				
PORTAMENTO on the synthesizer ------ Off or TIME "0" LOAD MODE ---- CV/GATE MEMORY ------- PART-1 PLAY MODE ---- KCC ADD ON REPEAT			TEMPO ---------- Its midpoint PORTAMENTO ------- TIME 0 CALIBRATION ------ Its midpoint	

- TO BE CONTINUED -

continued from the pr

5-1. Press RESET and
5-2. Press 2V key, DV
When DVM reading
pot for 2V CV OU
5-3 and 5-4.
If reading is outsi
at its midway and a
3mV reading.
5-3. Verfication of KCV
While pressing 2V k
same value.
a) If reading chang
set at incorrect
b) When the readings
readings are with
below with respe

RESET-LOAD-2V k	
Key being playe	
2V	
3V	
4V	

If any of the re
make adjustment
5-4. Press RESET and LOA
While playing 4V ke
read 6.000±3mV. If

SECTION

1. ADJUSTING DIGITAL TO
- Refer to NOTE at the

Some procedures are the
In the following steps,
specified key being held
Connections and Settings
Section I.
1-1. Press RESET and LOA
1-2. While playing 2V ke
2.000V reading. Then
a) If the reading st
b) If changes, proce
1-3. Press RESET , LOAD a
While holding down
following "2V" accor
step 1-2, b.
As discussed earlier
DATA), DVM reading
as VR106 is being t
Ordinal numbers in
top right show numbe

continued from the preceding table

5-1. Press RESET and LOAD.

5-2. Press 2V key, DVM should read 2.000±3mV.
When DVM reading is within ±3mV, adjust CALIBRATION pot for 2V CV OUT with PUSH CAL depressed. Proceed to 5-3 and 5-4.
If reading is outside ±3mV range, set CALIBRATION pot at its midway and adjust VR106 (CV Adj.) for 2.000± 3mV reading.

5-3. Verfication of KCV ADD Function
While pressing 2V key, push PLAY. DVM should read the same value.
a) If reading changes, it means that VR106 has been set at incorrect point. Proceed to Section II.
b) When the reading is steady, make sure that the DVM readings are within the ranges shown in the table below with respective key pressed:
RESET-LOAD-2V key-PLAY-2V key-3V key-4V key

Key being played	DVM reading (CV OUT)
2V	2.000±2mV
3V	3.000±2mV
4V	4.000±2mV

If any of the readings deviates from the limit, make adjustment under Section II, - 1-6.

5-4. Press RESET and LOAD.
While playing 4V key, push PLAY.The meter should read 6.000±3mV. If not, proceed to Section II,- 1-7.

SECTION II

1. ADJUSTING DIGITAL TO ANALOG CONVERTER

- Refer to NOTE at the end of this page -

Some procedures are the same as described in Section I. In the following steps, adjustment should be made with specified key being held down.
Connections and Settings - follow the instruction "5" in Section I.

1-1. Press RESET and LOAD.

1-2. While playing 2V key, adjust VR106 (CV Adj.) for 2.000V reading. Then, press PLAY.
a) If the reading stays still, proceed to step 1-5.
b) If changes, proceed to step 1-3(note the reading).

1-3. Press RESET , LOAD and 2V key.
While holding down the 2V key, adjust VR106 for the following "2V" according to the deviation noted at step 1-2, b.
As discussed earlier (RELATIONSHIP between CV ADJ and DATA), DVM reading will repeat the cycle of 2V±41mV as VR106 is being turned.
Ordinal numbers in the right colum of the table at top right show number of repetition.

DVM reading at step 1-2. b	Turn VR106 in this direction	Step DVM
2.083V	clockwise (CW)	
2.167V	CW	
2.250V	CW	
1.917V	counterCW (CCW)	
1.833V	CCW	
1.750V	CCW	

1-4. Press RESET, LOAD, 2V key and PLAY.(2V
DVM must keep the same reading.

1-5. Press RESET and LOAD.

	Key to be pressed	Adjust	for reading	(
a)	3V	VR107 (WIDTH)	3.000V	Repeat
b)	2V	VR106 (CV ADJ)	2.000V	exact. are ob
c)	4V	VR104 (DA ADJ)	4.000V	Repeat
d)	2V	VR106	2.000V	respec
e)	3V	VR107	3.000V	voltag displa

1-6. Press RESET, LOAD, 4V key (kept down) a
DVM should read 6.000±2mV . If a disc
noted, it may be cured by the sacrifice
e adjustments of above 1-5 with their
allowed to deviate within tolerance.

a) Return to steps d and e of 1-5. This
only VR107 for the readings which dec
tion at 6.000V, e.g. if 6.000+3mV, set
2.000 minus 1-2mV and 3.000V minus 1-2m
proceed to 6.000V adjustment. Readings
of d and e may be considered as the

2. CHECKING CV OUT

With DVM connected to CV OUT and LOAD p
DVM readings for 1V/oct across keyboard

NOTE: Most difficulties in getting correct V
WIDTH and CV result from wrong settings of
trimmers: VR104,VR107 and/or 106 might have b
far from their proper position.Reset them to
imate positions illustrated in the figures
Adjust again from appropriate step.

VIEW FROM PANEL SIDE

VR104
DA ADJ

VR107
WIDTH

V
CV

eceding table

LOAD.

M should read 2.000±3mV.

is within ±3mV, adjust CALIBRATION
T with PUSH CAL depressed. Proceed to

tside ±3mV range, set CALIBRATION pot
d adjust VR106 (CV Adj.) for 2.000±

CV ADD Function

V key, push PLAY. DVM should read the

anges, it means that VR106 has been
ect point. Proceed to Section II.
ing is steady, make sure that the DVM
within the ranges shown in the table
spective key pressed:

V key-PLAY-2V key-3V key-4V key

layed	DVM reading (CV OUT)
	2.000±2mV
	3.000±2mV
	4.000±2mV

readings deviate from the limit,
nt under Section II, - 1-6.

LOAD.

key, push PLAY. The meter should
If not, proceed to Section II,- 1-7.

ION II

TO ANALOG CONVERTER

the end of this page -

he same as described in Section I.
s, adjustment should be made with
eld down.
ngs - follow the instruction "5" in

LOAD.

key, adjust VR106 (CV Adj.) for
Then, press PLAY.
g stays still, proceed to step 1-5.
roceed to step 1-3(note the reading).
AD and 2V key.
wn the 2V key, adjust VR106 for the
ccording to the deviation noted at

lier (RELATIONSHIP between CV ADJ and
ng will repeat the cycle of 2V±41mV
g turned.
in the right colum of the table at
umber of repetition.

DVM reading at step 1-2. b	Turn VR106 in this direction	Stop turning when DVM reads 2.000V of
2.083V	clockwise (CW)	1st
2.167V	CW	2nd
2.250V	CW	3rd
1.917V	counterCW (CCW)	1st
1.833V	CCW	2nd
1.750V	CCW	3rd

1-4. Press RESET, LOAD, 2V key and PLAY.(2V key held down) DVM must keep the same reading.

1-5. Press RESET and LOAD.

	Key to be pressed	Adjust	for reading	(remark)
a)	3V	VR107 (WIDTH)	3.000V	Repeat until exact readings are obtained
b)	2V	VR106 (CV ADJ)	2.000V	
c)	4V	VR104 (DA ADJ)	4.000V	Repeat until respective voltages are displayed on DVM
d)	2V	VR106	2.000V	
e)	3V	VR107	3.000V	

1-6. Press RESET, LOAD, 4V key (kept down) and PLAY. DVM should read 6.000±2mV. If a discrepancy is noted, it may be cured by the sacrifice of d and e adjustments of above 1-5 with their readings allowed to deviate within tolerance.

a) Return to steps d and e of 1-5. This time, adjust only VR107 for the readings which decrease deviation at 6.000V, e.g. if 6.000+3mV, set VR107 for 2.000 minus 1-2mV and 3.000V minus 1-2mV and again proceed to 6.000V adjustment. Readings within ±2mV of d and e may be considered as the tolerance.

2. CHECKING CV OUT

With DVM connected to CV OUT and LOAD pressed, check DVM readings for 1V/oct across keyboard.

NOTE: Most difficulties in getting correct voltages of WIDTH and CV result from wrong settings of adjustment trimmers; VR104, VR107 and/or 106 might have been set too far from their proper position. Reset them to the approximate positions illustrated in the figures below. Adjust again from appropriate step.

VIEW FROM PANEL SIDE