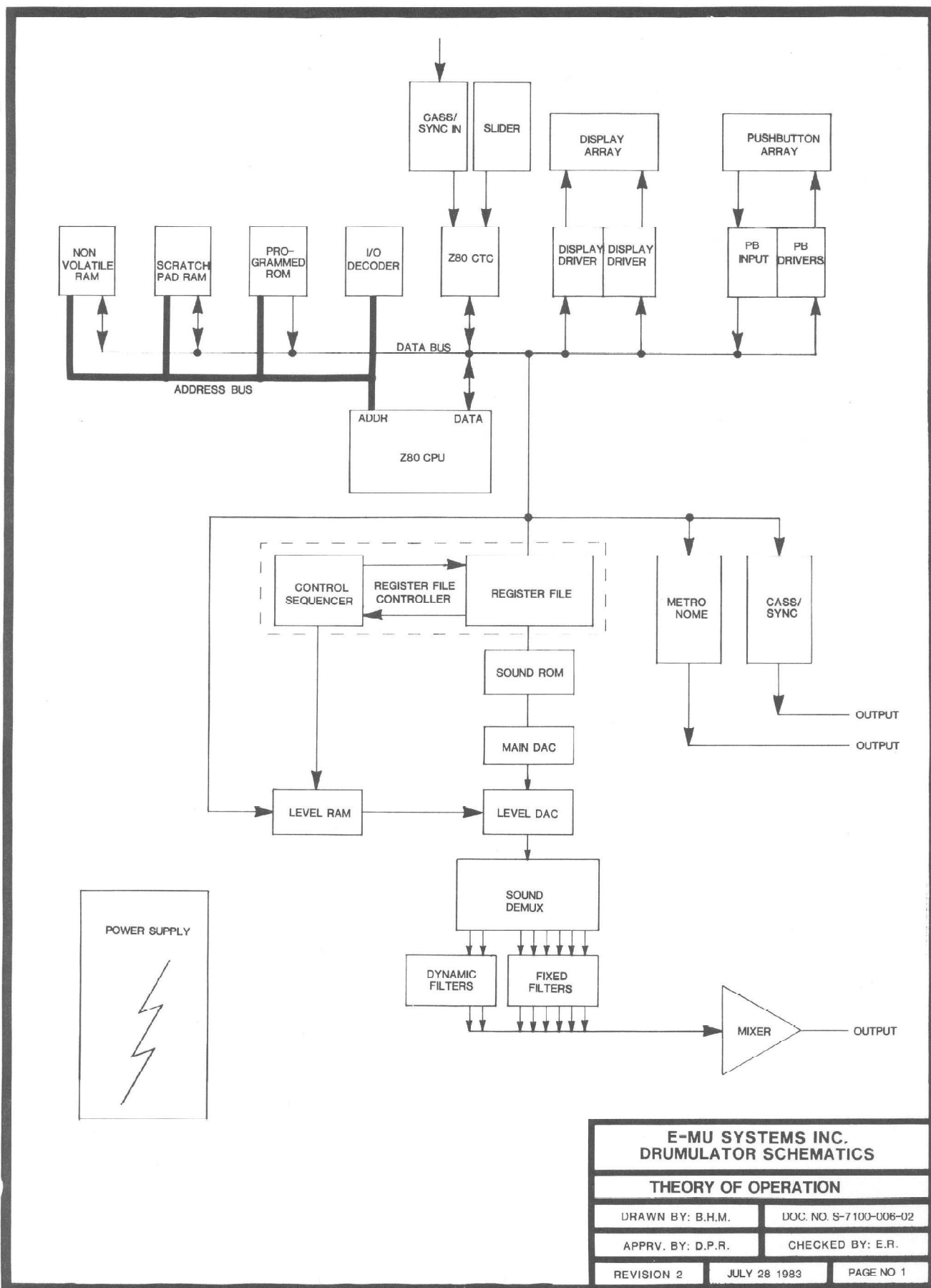
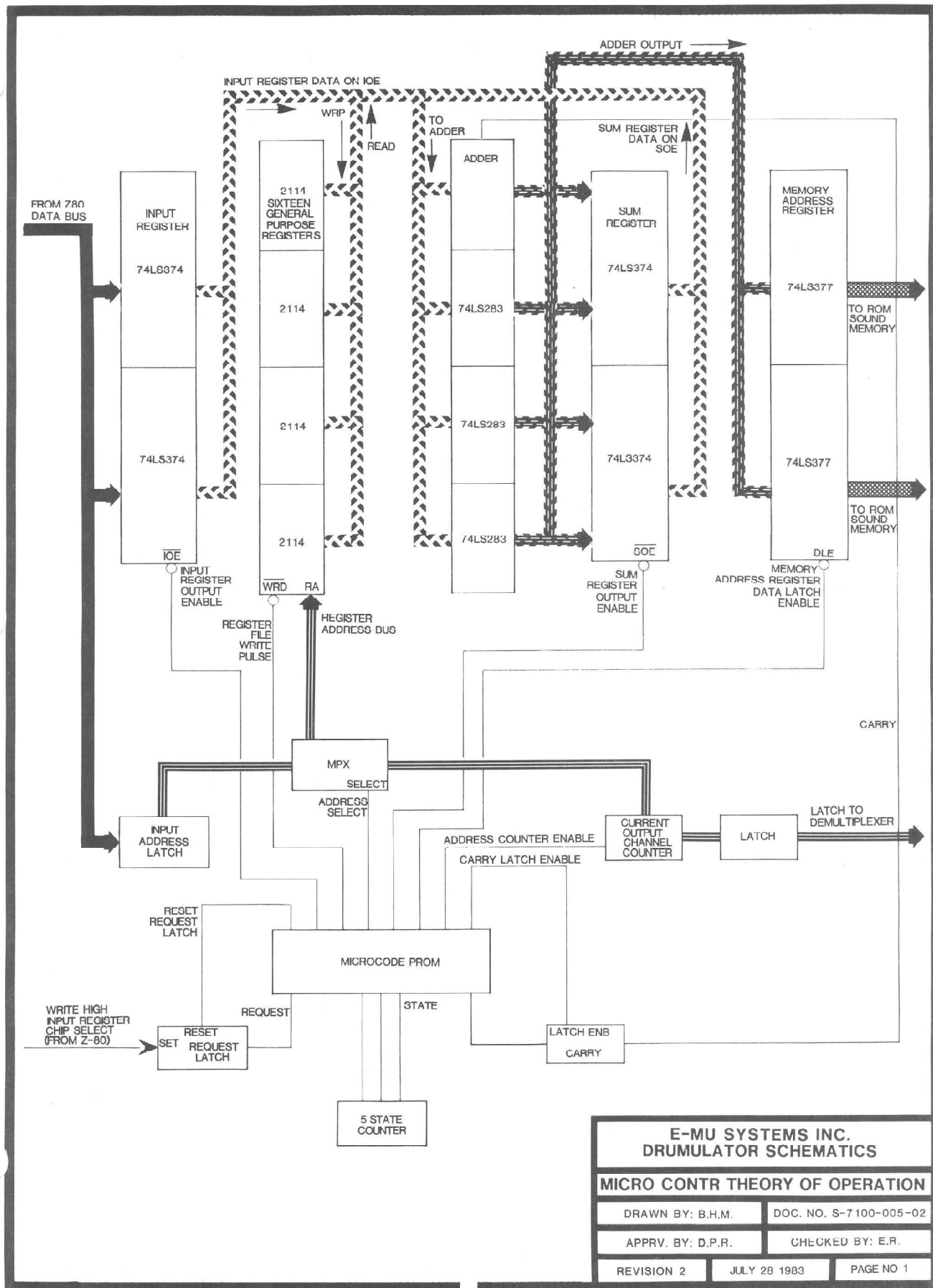


# **DRUMULATOR SERVICE MANUAL**

**Version 1.0  
11 April 1983**

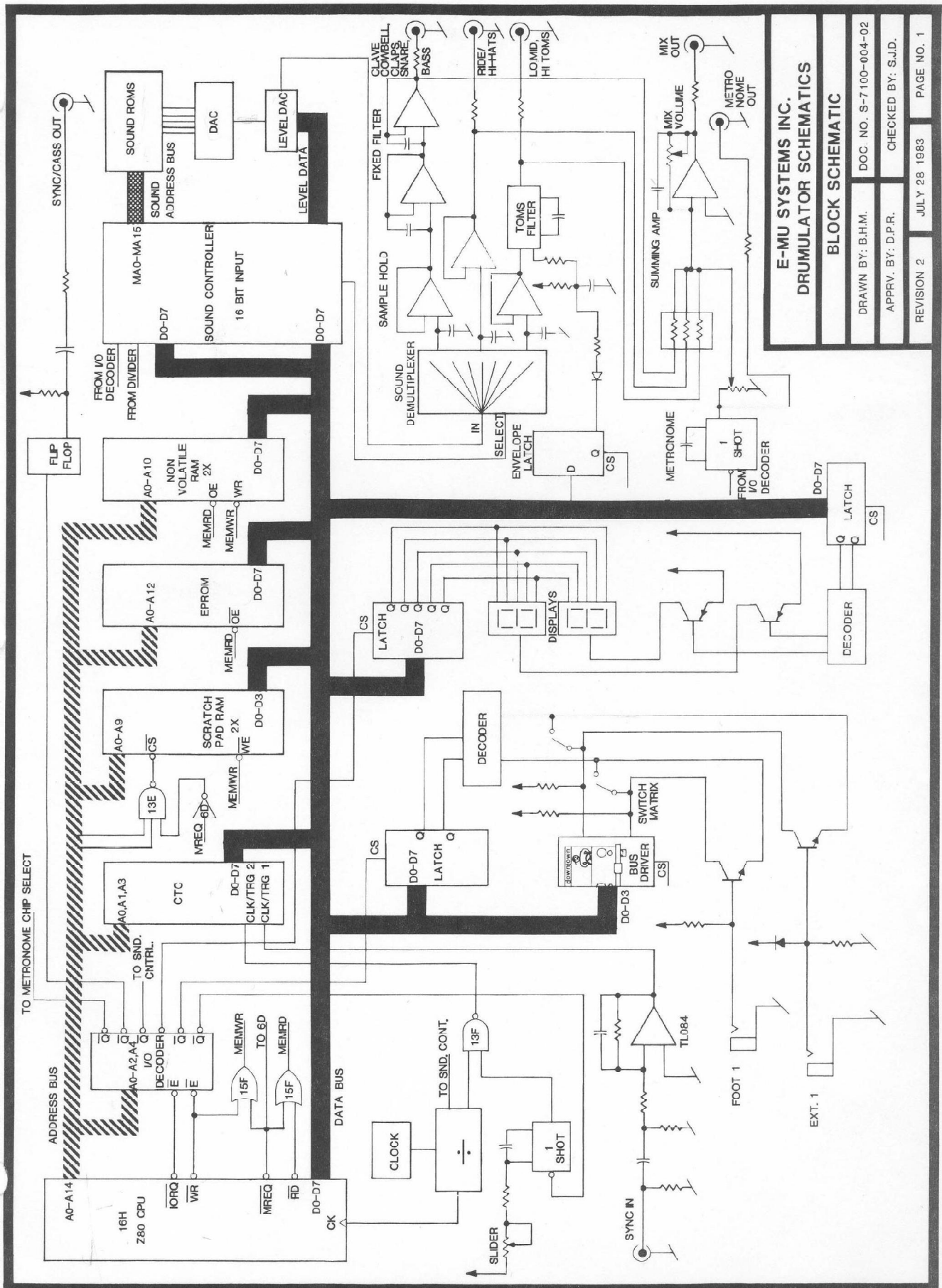
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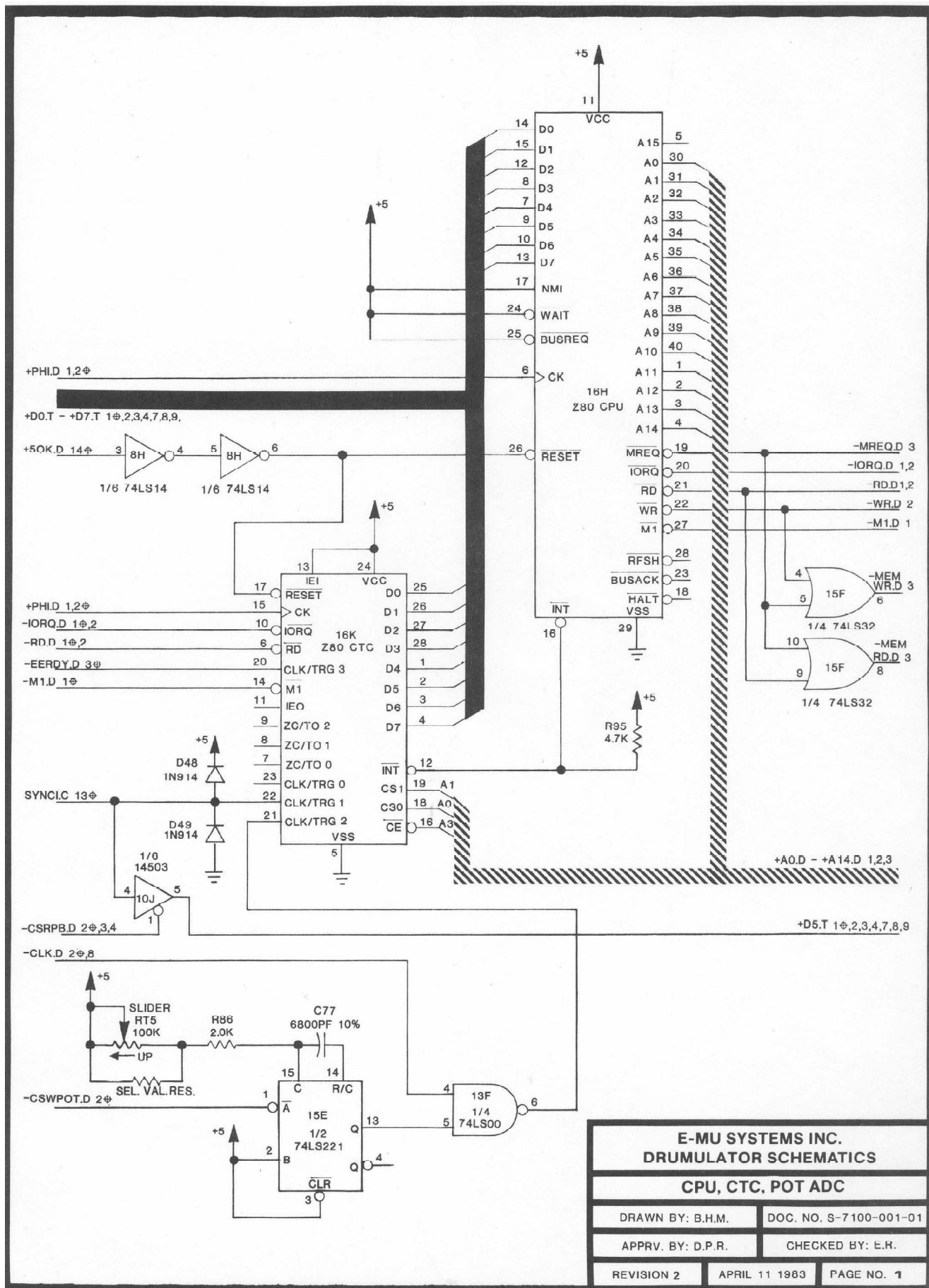
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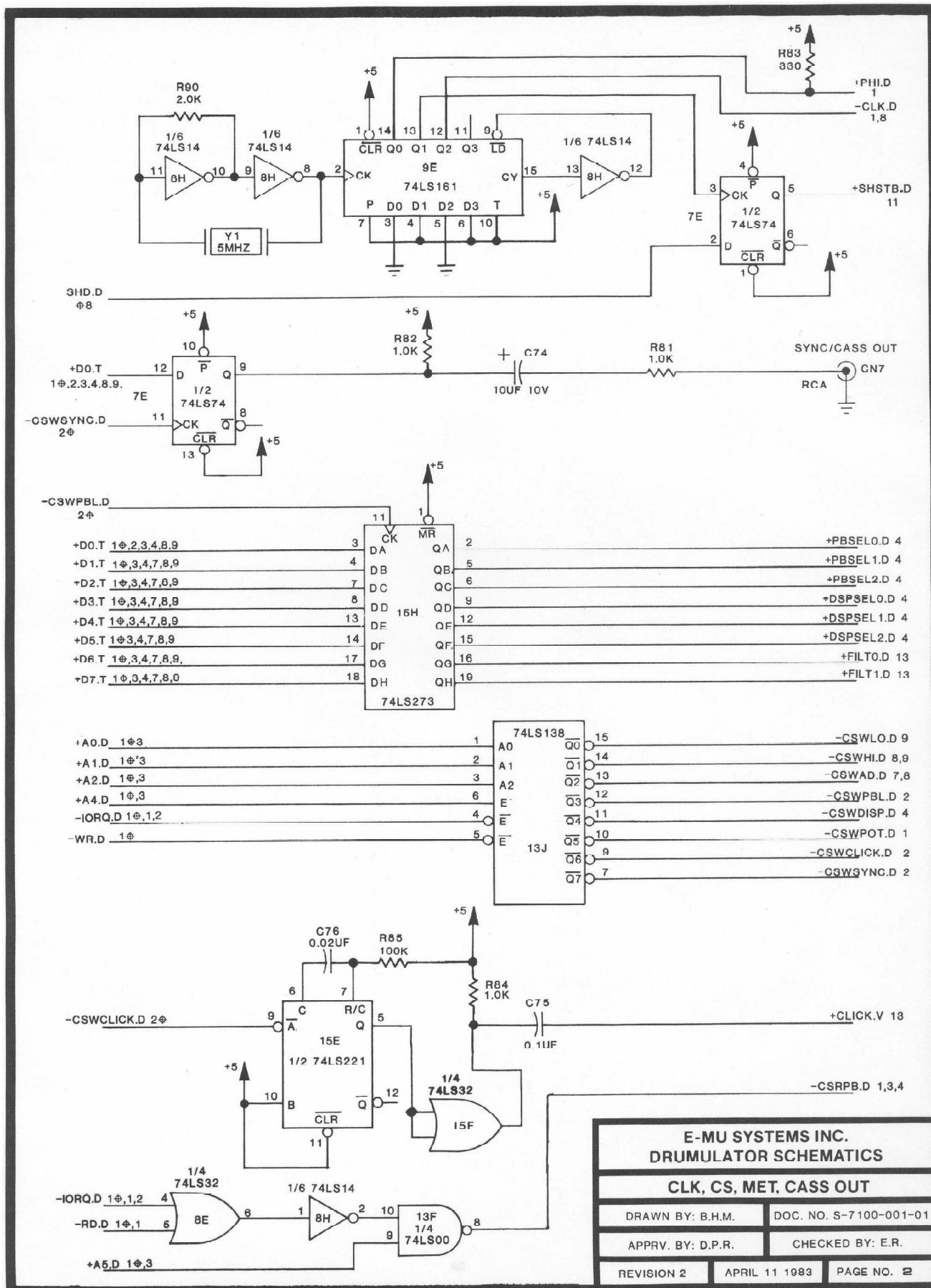
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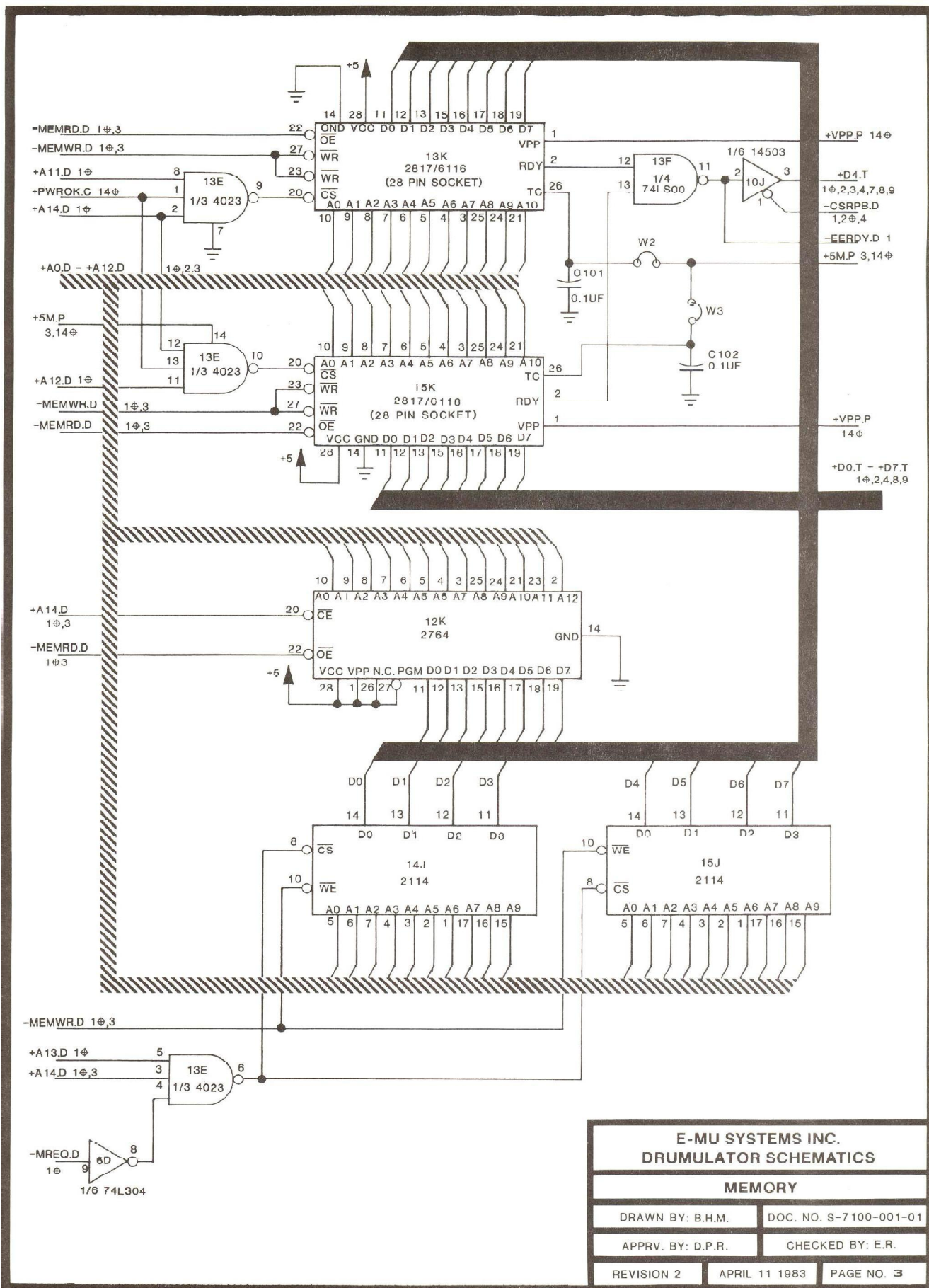
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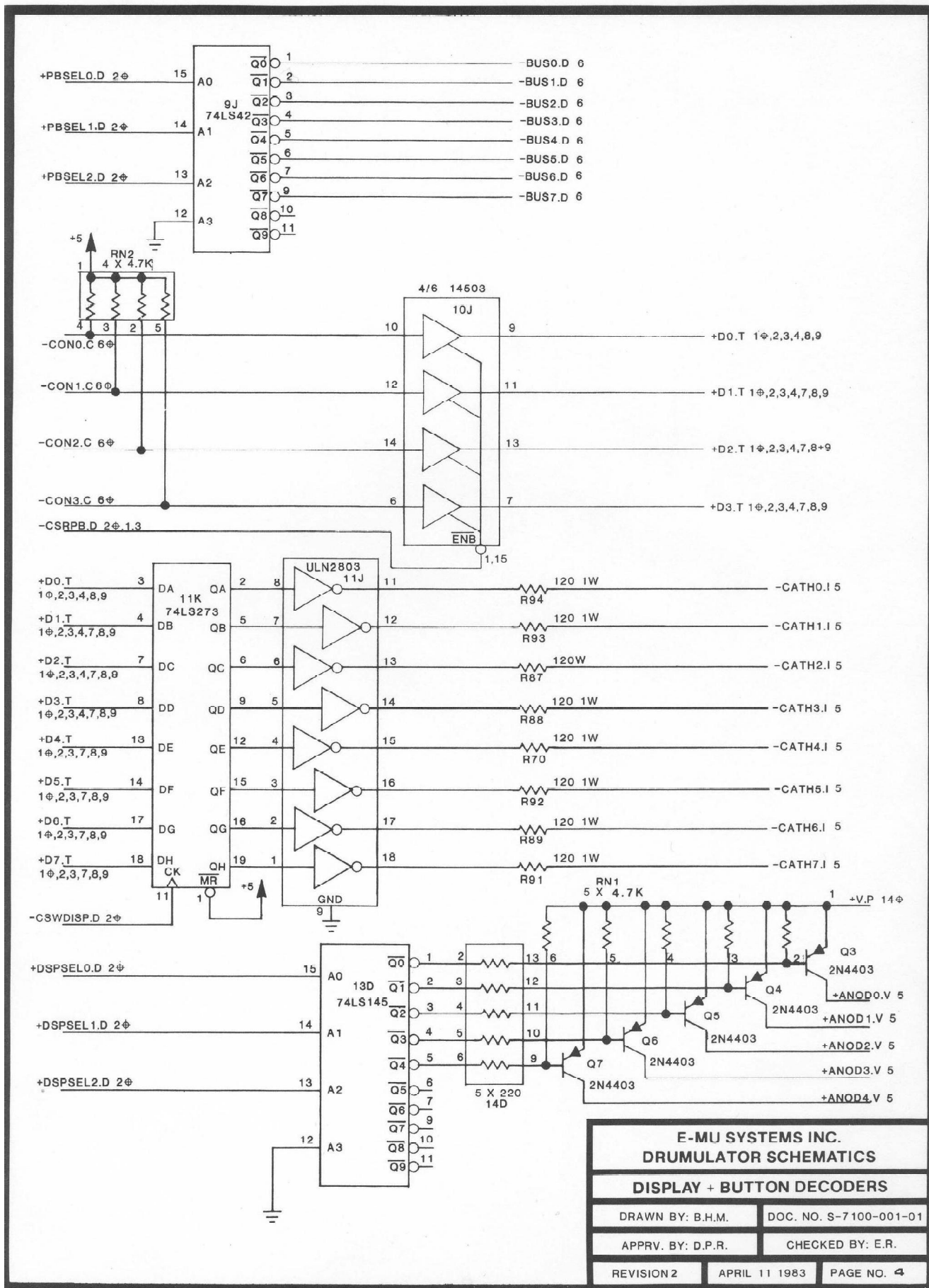
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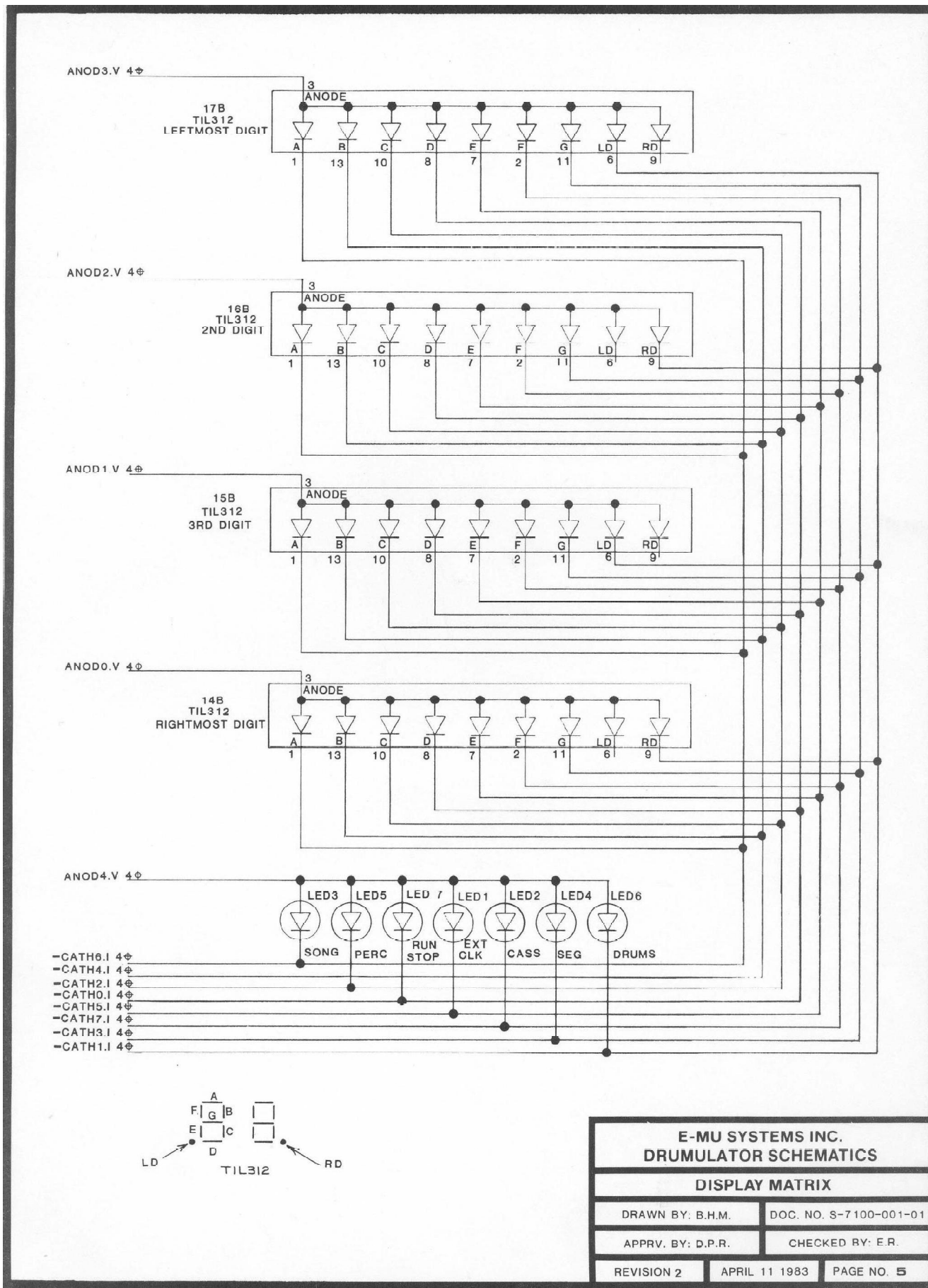
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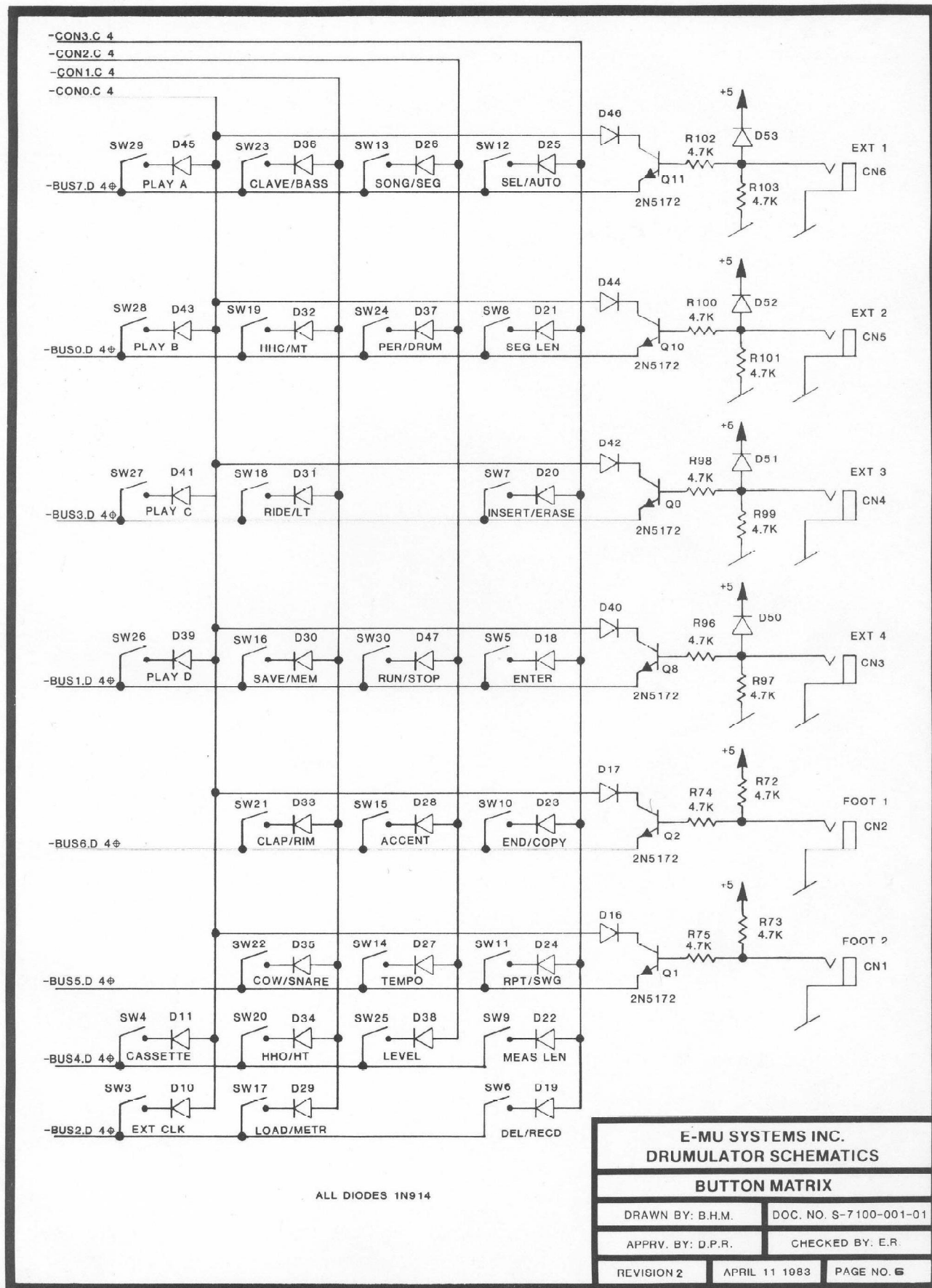
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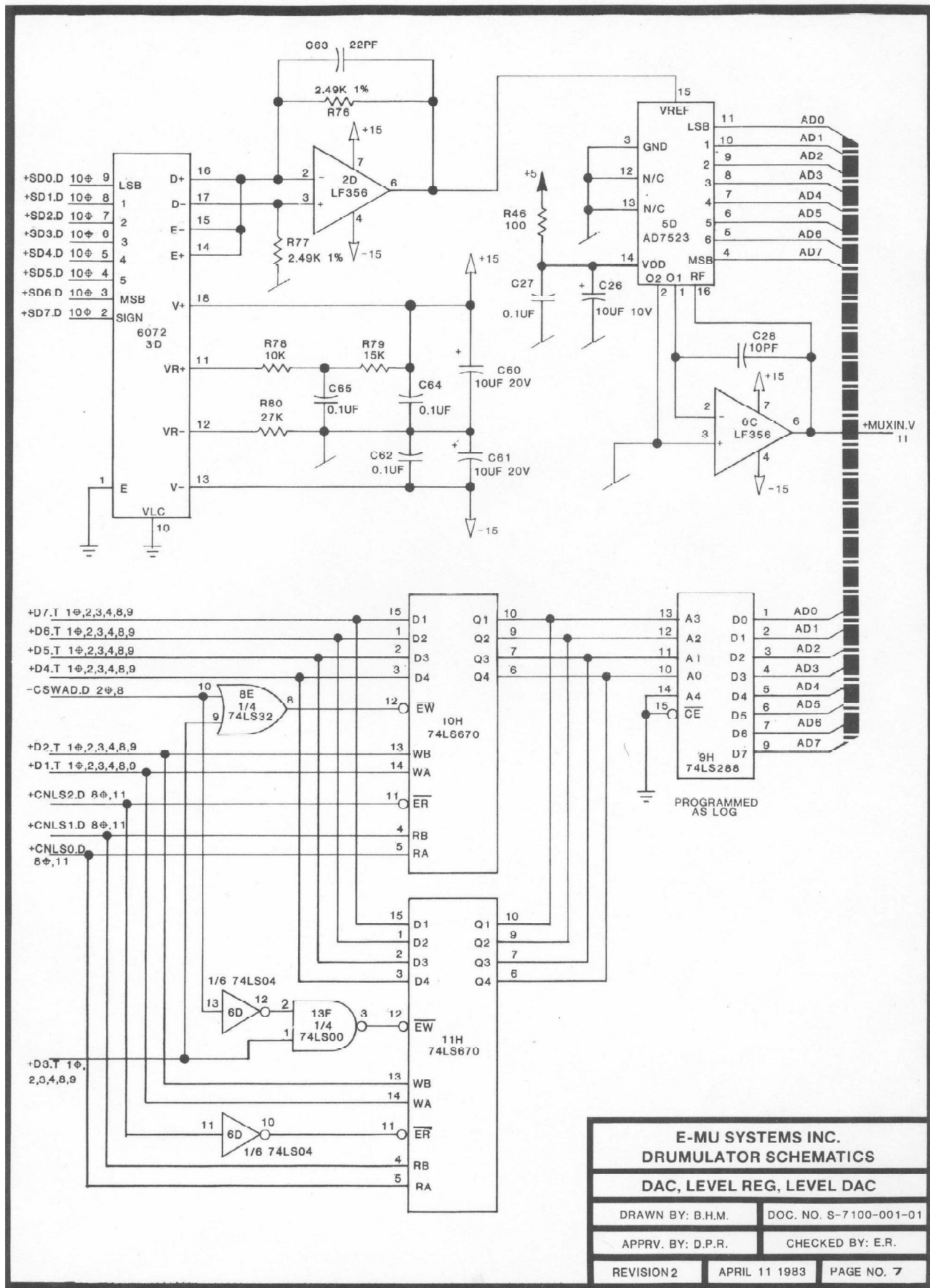
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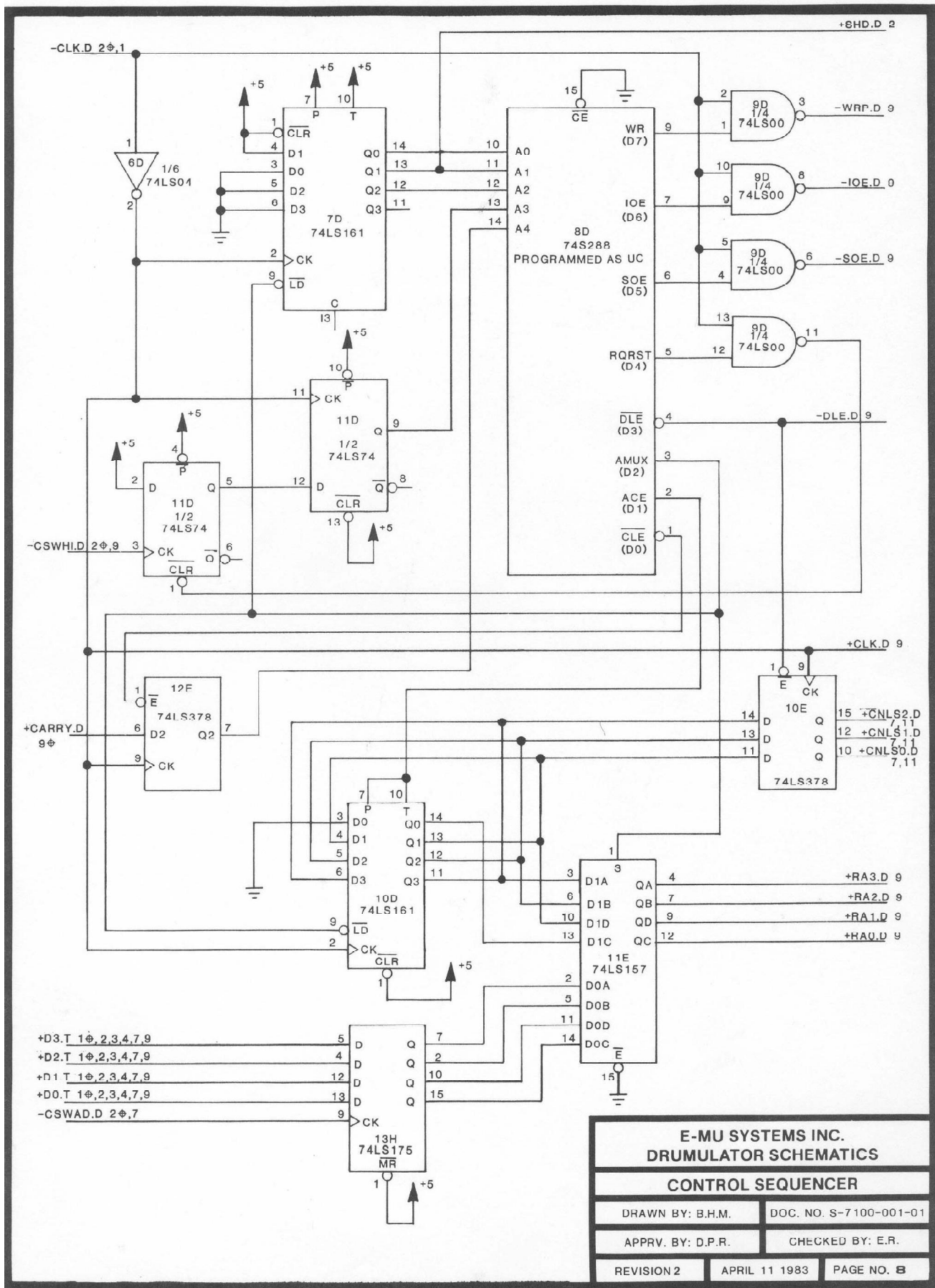
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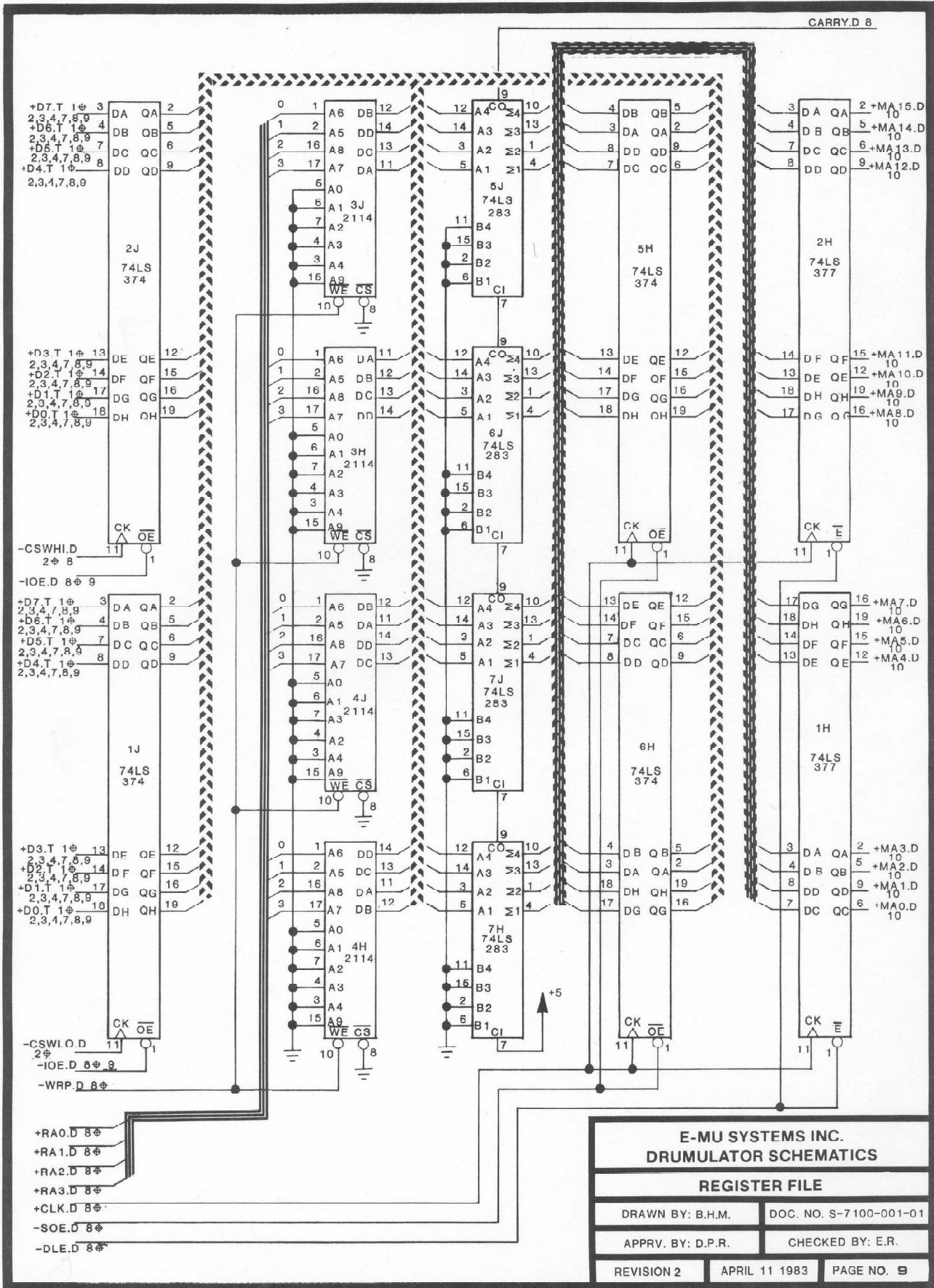
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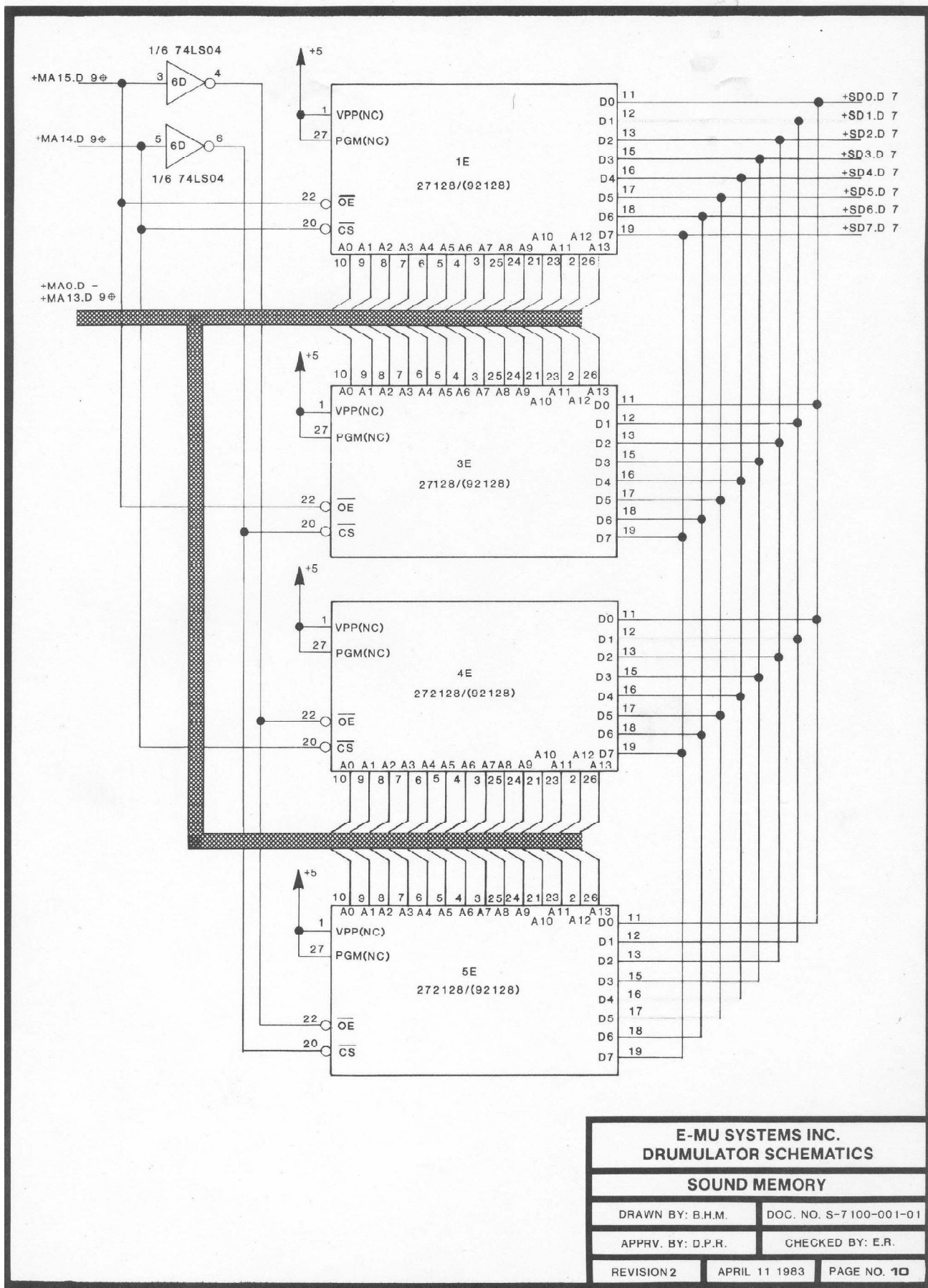
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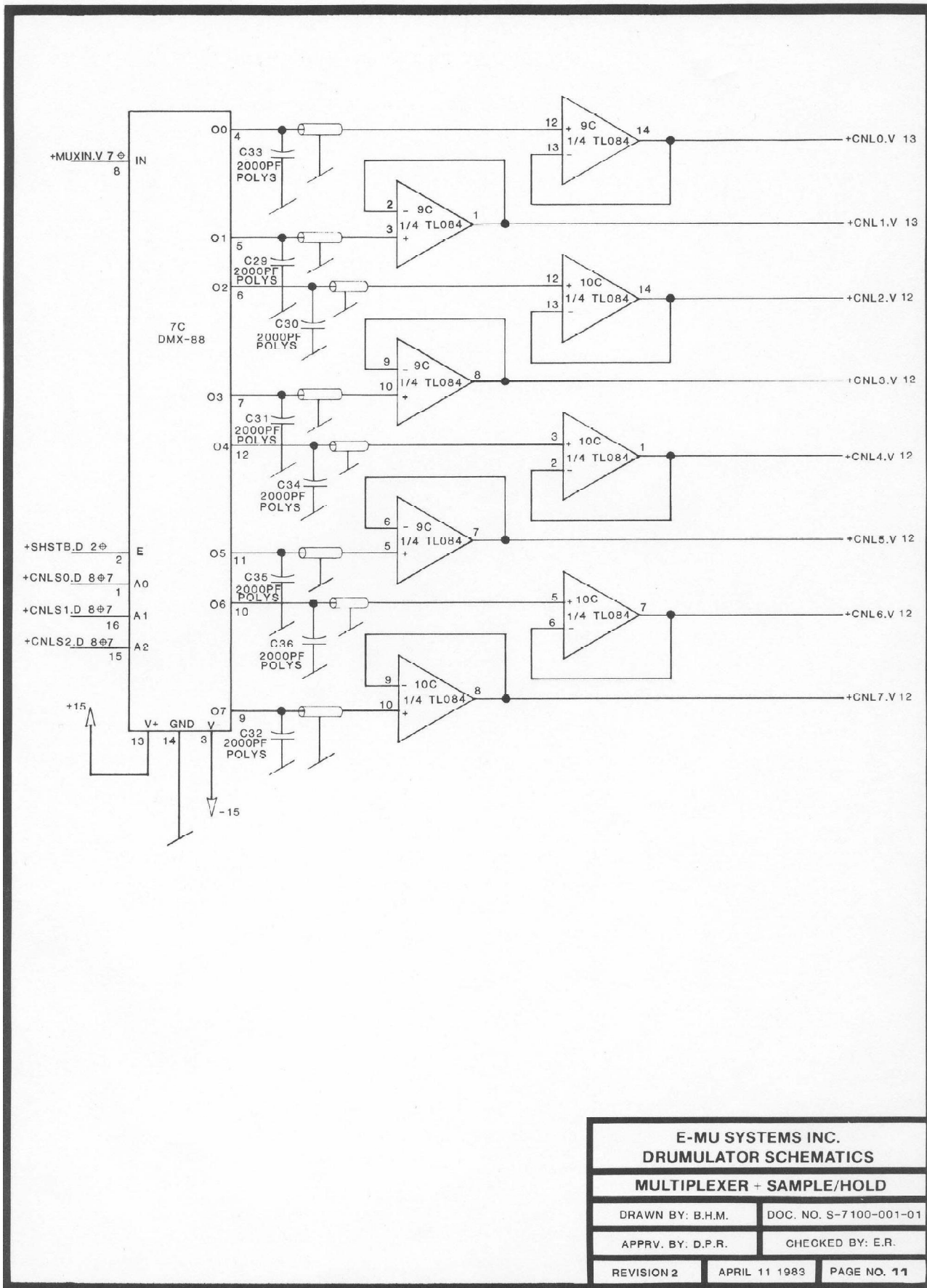
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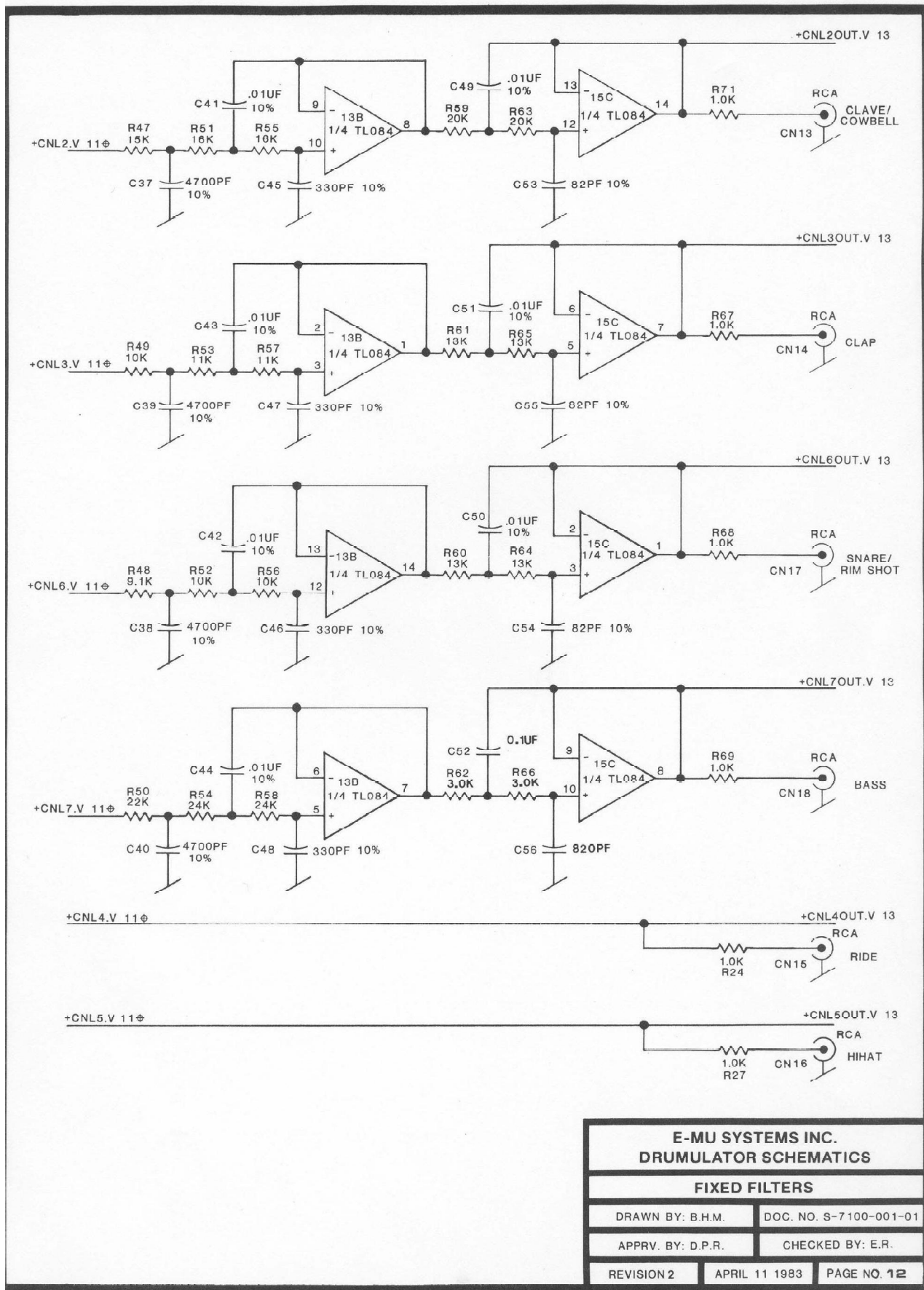
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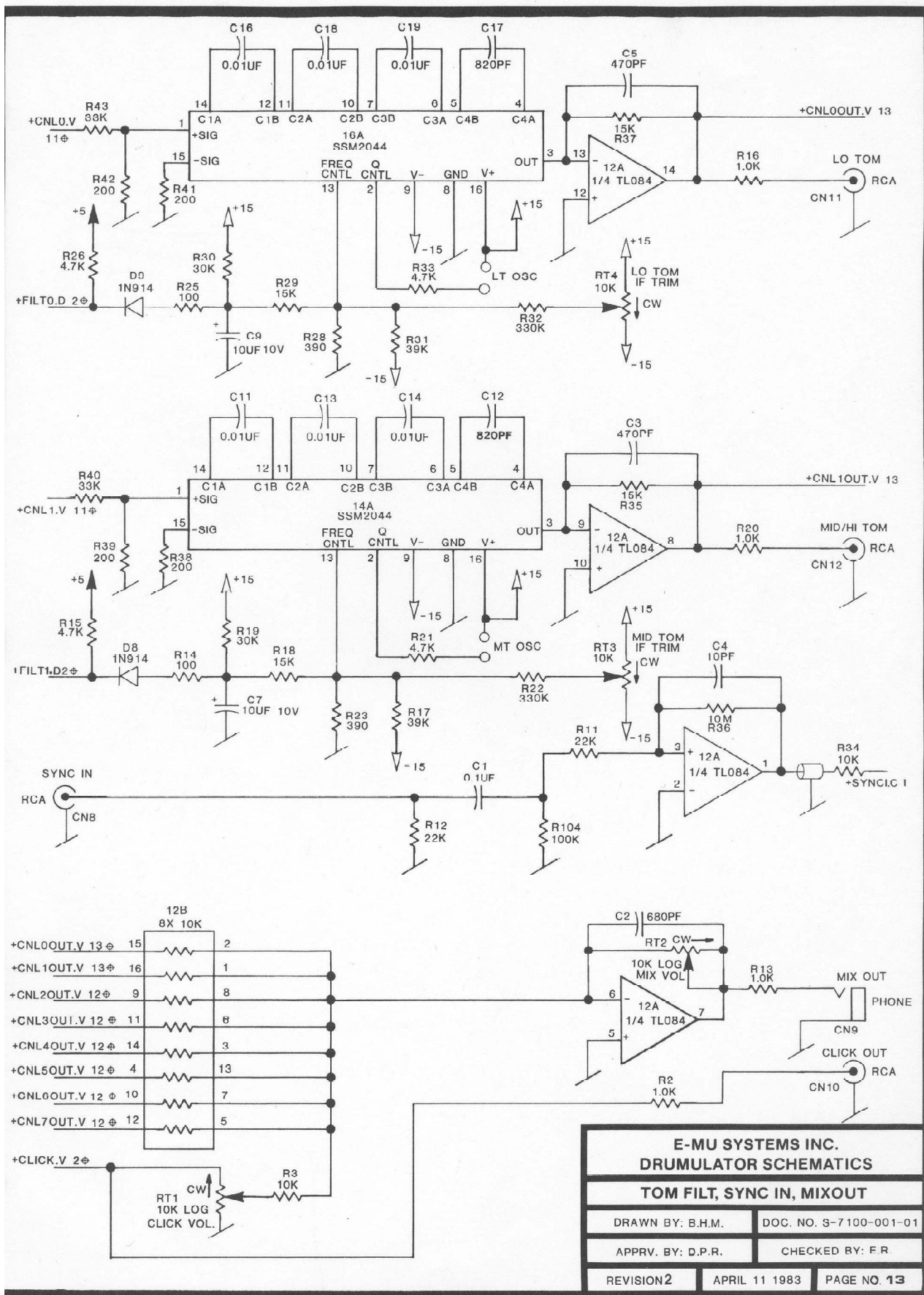
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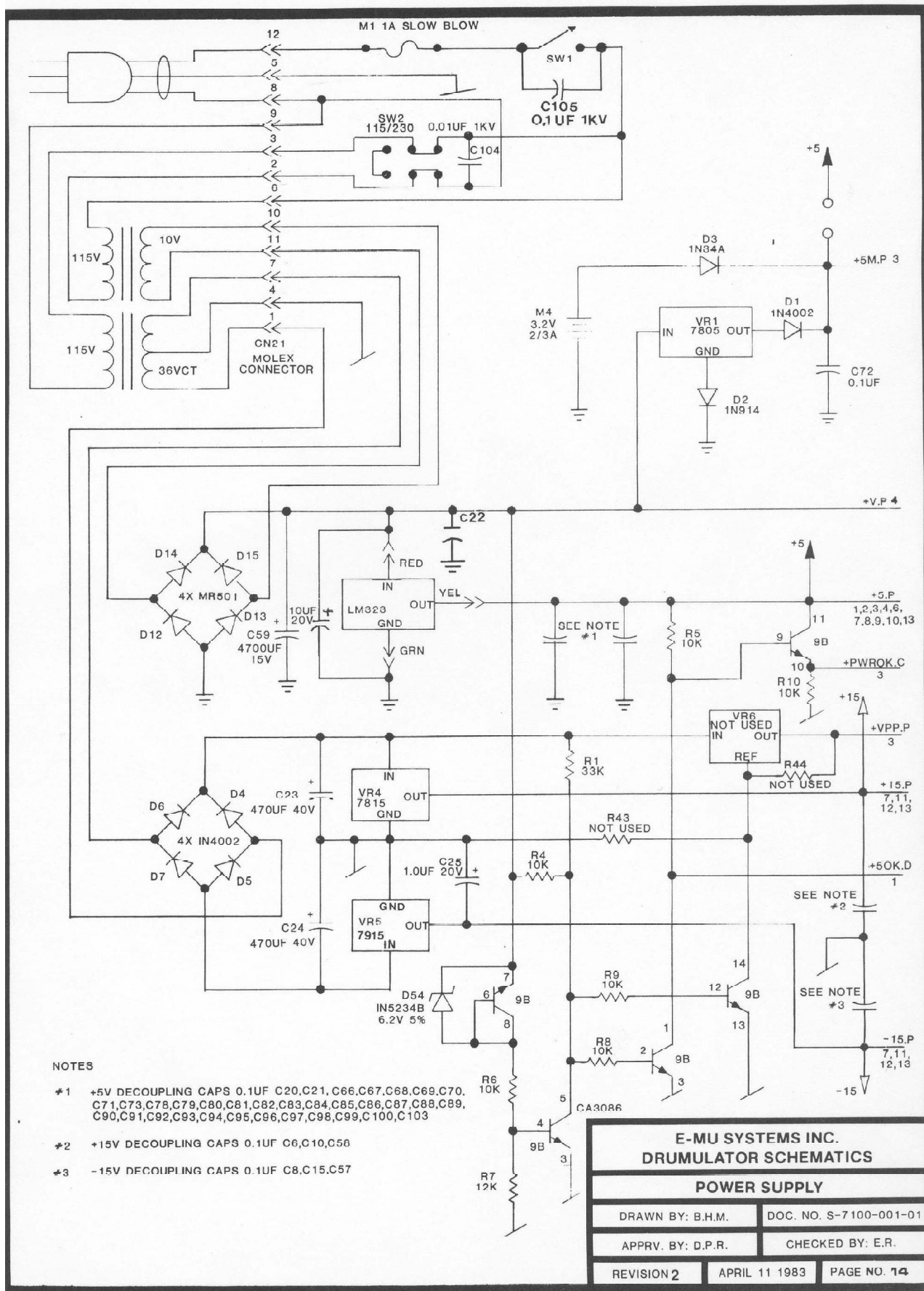
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## 7 Drumulator Signal Name Definitions

The signal names are comprised of: (a) + or - specifying active high or low. (b) An abbreviation of the signal function. (c) An abbreviation of the signal type. (d) The signal's destination and source page numbers. Source page is indicated by an ⊕ following the page number. If there is no ⊕ after a page number then the present page is the source page. If the present page is listed with the destination page numbers then the signal appears again on the same page.

EXAMPLE: (a) (b) (c) (d)  
 - CSWHI .D 2⊕, 9

(a) (b) (c) (d)  
 (Low) (Chip select to write high sound address) (TTL) (Source pg 2, destination 9).

Ground Symbols Definition:

Digital Ground



Analog Ground



Chassis Ground



Bus Symbol Definitions:

Data Bus

Register Address Bus

Address Bus

Register Data Bus

Level Control Bus

Sum Output Address Bus

Memory Address Bus

Drumulator Signal Name List:

Name	Source	Destination	Type	Description
+D0.T	1	1,2,3,4,8,9.	TRISTATE	DATA BUS 0 LSB
+D1.T	1	1,2,3,4,7,8,9.	TRISTATE	DATA BUS 1
+D2.T	1	1,2,3,4,7,8,9.	TRISTATE	DATA BUS 2
+D3.T	1	1,2,3,4,7,8,9.	TRISTATE	DATA BUS 3
+D4.T	1	1,2,3,4,7,9.	TRISTATE	DATA BUS 4
+D5.T	1	1,2,3,4,7,9.	TRISTATE	DATA BUS 5
+D6.T	1	1,2,3,4,7,9.	TRISTATE	DATA BUS 6
+D7.T	1	1,2,3,4,7,9.	TRISTATE	DATA BUS 7 MSB
+A0.D	1	1,2,3.	TTL	CPU ADDRESS BUS 0 LSB
+A1.D	1	1,2,3.	TTL	CPU ADDRESS BUS 1
+A2.D	1	2,3.	TTL	CPU ADDRESS BUS 2
+A3.D	1	1,3.	TTL	CPU ADDRESS BUS 3
+A4.D	1	2,3.	TTL	CPU ADDRESS BUS 4
+A5.D	1	2,3.	TTL	CPU ADDRESS BUS 5
+A6.D	1	3.	TTL	CPU ADDRESS BUS 6
+A7.D	1	3.	TTL	CPU ADDRESS BUS 7
+A8.D	1	3.	TTL	CPU ADDRESS BUS 8
+A9.D	1	3.	TTL	CPU ADDRESS BUS 9
+A10.D	1	3.	TTL	CPU ADDRESS BUS 10
+A11.D	1	3.	TTL	CPU ADDRESS BUS 11
+A12.D	1	3.	TTL	CPU ADDRESS BUS 12
+A13.D	1	3.	TTL	CPU ADDRESS BUS 13
+A14.D	1	3.	TTL	CPU ADDRESS BUS 14
-MREQ.D	1	3.	TTL	CPU MEMORY REQUEST
-IORQ.D	1	1,2.	TTL	CPU INPUT/OUTPUT REQUEST
-RD.D	1	1,2.	TTL	CPU READ REQUEST
-WR.D	1	2.	TTL	CPU WRITE REQUEST
-MEMWR.D	1	3.	TTL	CPU MEMORY WRITE REQUEST
-MEMRD.D	1	3.	TTL	CPU MEMORY READ REQUEST
-M1.D	1	1.	TTL	CPU INSTRUCTION FETCH
+PHI.D	2	1.	TTL	CPU CLOCK
-CLK.D	2	1,8.	TTL	MICROCONTROLLER CLOCK

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Name	Source	Destination	Type	Description
+SYNCL.C	13	1.	CMOS	SYNC/CASSETTE INPUT
-CSWPOT.D	2	1.	TTL	CHIP SEL. TO WRITE POT 1 SHOT
-EERDY.D	3	1.	TTL	EEPROM WRITE READ
-CSRPB.D	2	1,3,4.	TTL	CHIP SELECT TO READ PUSHBUTT
+SHD.D	8	2.	TTL	SAMPLE/HOLD STROBE LATCH DAT
+SHSTB.D	2	11.	TTL	SAMPLE/HOLD STROBE
-CSWLO.D	2	9.	TTL	CHP SEL-WRITE LO SOUND ADDR
-CSWHI.D	2	8,9.	TTL	CHP SEL-WRITE HI SOUND ADDR
-CSWAD.D	2	7,8.	TTL	CHP SEL-WRITE SOUNDCHAN DAT
-CSWPBL.D	2	2.	TTL	CHP SEL-WRITE PUSHBUT LATCH
-CSWDISP.D	2	4.	TTL	CHP SEL-WRITE DISPLAY LATCH
-CSWCLICK.D	2	2.	TTL	CHP SEL-WRITE CLICK 1SHOT
-CSWSYNC.D	2	2.	TTL	CHP SEL-WRITE SYN/CASS LATCH
+PBSEL0.D	2	4.	TTL	PUSHBUTT DECODE STROBE 0 LSB
+PBSEL1.D	2	4.	TTL	PUSHBUTT DECODE STROBE 1
+PBSEL2.D	2	4.	TTL	PUSHBUTT DECODE STROBE 2 MSB
+DSPSEL0.D	2	4.	TTL	DISPLAY DECODE STROBE 0 LSB
+DSPSEL1.D	2	4.	TTL	DISPLAY DECODE STROBE 1
+DSPSEL2.D	2	4.	TTL	DISPLAY DECODE STROBE 2 MSB
+FILT0.D	2	13.	TTL	VCF TRIGGER CHANNEL 0
+FILT1.D	2	13.	TTL	VCF TRIGGER CHANNEL 1
+CLICK.V	2	13.	ANAL.VOLT.	METRONOME CLICK
+VPP.P	14	3.	POWER	EEPROM PROGRAMMING VOLTAGE
+5M.P	14	3.	POWER	+5 SUPPLY FOR MEMORY
+PWROK.C	14	3.	CMOS	+5 POWER OK SIGNAL
+V.P	14	4.	POWER	UNREGULATED SUPPLY FOR LED
+5.P	14	1-4,6-10,13.	POWER	+5 SUPPLY
+15.P	14	7,11,12,13.	POWER	+15 SUPPLY
+5OK.D	14	1.	TTL	+5 VOLTAGE OK SIGNAL
-15.P	14	7,11,12,13.	POWER	-15 SUPPLY
-BUS0.D	4	6.	TTL	PUSHBUTTON BUS 0 DRIVE
-BUS1.D	4	6.	TTL	PUSHBUTTON BUS 1 DRIVE
-BUS2.D	4	6.	TTL	PUSHBUTTON BUS 2 DRIVE
-BUS3.D	4	6.	TTL	PUSHBUTTON BUS 3 DRIVE
-BUS4.D	4	6.	TTL	PUSHBUTTON BUS 4 DRIVE
-BUS5.D	4	6.	TTL	PUSHBUTTON BUS 5 DRIVE
-BUS6.D	4	6.	TTL	PUSHBUTTON BUS 6 DRIVE
-BUS7.D	4	6.	TTL	PUSHBUTTON BUS 7 DRIVE
-CON0.C	6	4.	CMOS	CONTACT 0 PUSHBUTTON OUTPUT
-CON1.C	6	4.	CMOS	CONTACT 1 PUSHBUTTON OUTPUT
-CON2.C	6	4.	CMOS	CONTACT 2 PUSHBUTTON OUTPUT
-CON3.C	6	4.	CMOS	3 PUSHBUTTON OUTPUT
+ANOD0.V	4	5.	ANAL.VOLT	DISPLAY ANODE 0 DRIVE
+ANOD1.V	4	5.	ANAL.VOLT	DISPLAY ANODE 1 DRIVE
+ANOD2.V	4	5.	ANAL.VOLT	DISPLAY ANODE 2 DRIVE
+ANOD3.V	4	5.	ANAL.VOLT	DISPLAY ANODE 3 DRIVE
+ANOD4.V	4	5.	ANAL.VOLT	DISPLAY ANODE 4 DRIVE
-CATH0.I	4	5.	CURRENT	DISPLAY CATHODE 0 DRIVE
-CATH1.I	4	5.	CURRENT	DISPLAY CATHODE 1 DRIVE
-CATH2.I	4	5.	CURRENT	DISPLAY CATHODE 2 DRIVE
-CATH3.I	4	5.	CURRENT	DISPLAY CATHODE 3 DRIVE
-CATH4.I	4	5.	CURRENT	DISPLAY CATHODE 4 DRIVE
-CATH5.I	4	5.	CURRENT	DISPLAY CATHODE 5 DRIVE
-CATH6.I	4	5.	CURRENT	DISPLAY CATHODE 6 DRIVE
-CATH7.I	4	5.	CURRENT	DISPLAY CATHODE 7 DRIVE
+CNLS0.D	8	7,11.	TTL	CHANNEL SELECT 0 LSB
+CNLS1.D	8	7,11.	TTL	CHANNEL SELECT 1
+CNLS2.D	8	7,11.	TTL	CHANNEL SELECT 2
-WRP.D	8	9.	TTL	uC. RAM WRITE PULSE
-IOE.D	8	9.	TTL	uC. INPUT LATCH OUTPUT ENABL
-SOE.D	8	9.	TTL	uC. SUM LATCH OUTPUT ENABLE
-DLE.D	8	9.	TTL	uC. DATA LATCH CONTROL ENABL
+CLK.D	8	9.	TTL	uC. CLOCK
+RA0.D	8	9.	TTL	uC. RAM ADDRESS 0 LSB
+RA1.D	8	9.	TTL	uC. RAM ADDRESS 1
+RA2.D	8	9.	TTL	uC. RAM ADDRESS 2

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Name	Source	Destination	Type	Description
+RA3.D	8	9.	TTL	uC. RAM ADDRESS 3 MSB
+CARRY.D	9	8.	TTL	uC. ADDER CARRY OUTPUT
+MA0.D	9	10.	TTL	SOUND ROM ADDRESS 0 LSB
+MA1.D	9	10.	TTL	SOUND ROM ADDRESS 1
+MA2.D	9	10.	TTL	SOUND ROM ADDRESS 2
+MA3.D	9	10.	TTL	SOUND ROM ADDRESS 3
+MA4.D	9	10.	TTL	SOUND ROM ADDRESS 4
+MA5.D	9	10.	TTL	SOUND ROM ADDRESS 5
+MA6.D	9	10.	TTL	SOUND ROM ADDRESS 6
+MA7.D	9	10.	TTL	SOUND ROM ADDRESS 7
+MA8.D	9	10.	TTL	SOUND ROM ADDRESS 8
+MA9.D	9	10.	TTL	SOUND ROM ADDRESS 9
+MA10.D	9	10.	TTL	SOUND ROM ADDRESS 10
+MA11.D	9	10.	TTL	SOUND ROM ADDRESS 11
+MA12.D	9	10.	TTL	SOUND ROM ADDRESS 12
+MA13.D	9	10.	TTL	SOUND ROM ADDRESS 13
+MA14.D	9	10.	TTL	SOUND ROM ADDRESS 14
+MA15.D	9	10.	TTL	SOUND ROM ADDRESS 15 MSB
+SD0.D	10	7.	TTL	SOUND ROM DATA 0 LSB
+SD1.D	10	7.	TTL	SOUND ROM DATA 1
+SD2.D	10	7.	TTL	SOUND ROM DATA 2
+SD3.D	10	7.	TTL	SOUND ROM DATA 3
+SD4.D	10	7.	TTL	SOUND ROM DATA 4
+SD5.D	10	7.	TTL	SOUND ROM DATA 5
+SD6.D	10	7.	TTL	SOUND ROM DATA 6
+SD7.D	10	7.	TTL	SOUND ROM DATA 7 MSB
+MUXIN.V	7	11.	ANAL.VOLT.	DAC OUTPUT—MULTIPLEX INPUT
+CNL0.V	11	13.	ANAL.VOLT.	CHANNEL 0 UNFILTERED SOUND
+CNL1.V	11	13.	ANAL.VOLT.	CHANNEL 1 UNFILTERED SOUND
+CNL2.V	11	12.	ANAL.VOLT.	CHANNEL 2 UNFILTERED SOUND
+CNL3.V	11	12.	ANAL.VOLT.	CHANNEL 3 UNFILTERED SOUND
+CNL4.V	11	12.	ANAL.VOLT.	CHANNEL 4 UNFILTERED SOUND
+CNL5.V	11	12.	ANAL.VOLT.	CHANNEL 5 UNFILTERED SOUND
+CNL6.V	11	12.	ANAL.VOLT.	CHANNEL 6 UNFILTERED SOUND
+CNL7.V	11	12.	ANAL.VOLT.	CHANNEL 7 UNFILTERED SOUND
+CNL0OUT.V	13	13.	ANAL.VOLT.	CHANNEL 0 FINAL OUTPUT
+CNL1OUT.V	13	13.	ANAL.VOLT.	CHANNEL 1 FINAL OUTPUT
+CNL2OUT.V	12	13.	ANAL.VOLT.	CHANNEL 2 FINAL OUTPUT
+CNL3OUT.V	12	13.	ANAL.VOLT.	CHANNEL 3 FINAL OUTPUT
+CNL4OUT.V	12	13.	ANAL.VOLT.	CHANNEL 4 FINAL OUTPUT
+CNL5OUT.V	12	13.	ANAL.VOLT.	CHANNEL 5 FINAL OUTPUT
+CNL6OUT.V	12	13.	ANAL.VOLT.	CHANNEL 6 FINAL OUTPUT
+CNL7OUT.V	12	13.	ANAL.VOLT.	CHANNEL 7 FINAL OUTPUT

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## 8

# Drumulator Specifications

## Controls

### Play Section

**Run/Stop** — Starts and stops playback of segments and songs. LED lights when running and flashes to indicate the beginning of a segment.

**Play Buttons (1-4)** — Used to play and program the drum sounds. Sounds are assigned by pressing and holding a Play button and then pressing either a Sound Select button or (to assign an accented sound) the Accent button followed by a Sound Select button. Any sound may be assigned to any Play button and a sound may be assigned to multiple buttons.

### Parameter Control

**Tempo** — Used with the slider to program the tempo (in beats per minute) of each song, and to program tempo changes within a song.

**Accent** — Used with the slider to program the individual accent level of each instrument for each song.

**Level** — Used with the slider to program the mix level of each instrument for each song.

### Sound Selection

**Drums/Perc.** — Toggles the function of the Sound Select buttons between drum sounds (lower labels) and percussion sounds (upper labels). LEDs indicate the current state.

**Sound Select (1-6)** — Select the sounds to be assigned to each play button. Also used to enter numerical data, to set the Auto Correct resolution, and to set the metronome and trigger rate.

**Met/Trig (7)** — Used in combination with the Select buttons to set the metronome rate (i.e., quarter note, eighth note triplet, etc.) and to program the trigger output in Song Mode.

**Mem (8)** — Pressed to display the amount of unused memory remaining.

## Programming Section

Programming the Drumulator is a two level process. Segment Mode is used to create short rhythmic patterns (typically a few measures in length). In Song Mode these segments are linked together into complete songs. The functions of the programming buttons depend on which mode the Drumulator is in.

**Song/Segment** — Toggles the Drumulator between Song and Segment modes. The LEDs indicate the current state.

### Segment Mode

**Auto Correct** — Sets the resolution at which the Drumulator corrects rhythmic inaccuracies in your playing.

**Swing** — Adjusts the degree of "swing" in previously recorded segments (hard to describe, easy to hear).

**Copy** — Allows the copying of one segment into another segment number and the appending of a segment to itself from one to eight times.

**Measure Length** — Sets a segment's time signature.

**Segment Length** — Sets the number of measures in a segment.

**Erase** — Used to erase entire segments, a particular instrument within a segment, and specific notes within a segment.

**Record** — Pressed along with the Run/Stop button to enter Record Mode.

**Enter** — Enters programming data into the Drumulator.

### Song Mode

**Select** — Selects the song to be programmed or played. Used with the Run/Stop button to start playback anywhere in the middle of a song. Used with the Tempo button to program tempo changes within a song. Used with the Level button to copy mix and accent data from one song to another.

**Repeat** — Defines repeat loops within a song. Loops may be repeated a preprogrammed number of times or can be set to repeat indefinitely until cued to continue by pressing the Repeat button or Repeat footswitch during playback.

**End** — Marks the end of a song. Songs may end and stop, end and repeat, or end and link to another song.

**"<" and ">"** — Used to step forward and backward through a song for purposes of programming or editing.

**Insert** — Allows data to be inserted into the middle of an existing song.

**Delete** — Causes data to be deleted from an existing song.

**Enter** — Same as in Segment Mode.

## Level

**Mix Volume** — Sets the level of the mono mix output. Does not affect the separate channel outputs.

**Metronome Volume** — Sets the level of the metronome, trigger, and signal "beeps" in the mix output. Does not affect the independent Met/Trig output.

## Cassette

**Cassette** — Places the Drumulator in Cassette Mode. In this mode buttons 7 and 8 are used to store songs and segments in digital form on standard audio tape and to reload previously stored data into the Drumulator.

## External Clock

**External Clock** — Allows the Drumulator to be controlled by clocks from synthesizers, sequencers, and other drum machines. The Drumulator includes a programmable clock divider function which will convert incoming clock signals to the correct frequency for controlling the Drumulator.

## Footswitch Controls

**Run/Stop** — Duplicates the function of the Run/Stop button.

**Repeat** — When running in Song Mode, pressing the repeat footswitch causes the Drumulator to exit from repeat loops. When stopped in Song Mode, pressing this footswitch causes the Drumulator to step to the next song.

## Specifications

**Sounds** — Twelve, digitally recorded: Bass, Snare, Rim, High Tom, Mid Tom, Low Tom, Clave, Cowbell, Hand Claps, Open Hi Hat, Closed Hi Hat, Ride Cymbal.

**Storage Capacity** — 36 Segments, 8 Songs.

**Maximum Memory Capacity** — 10,088 notes.

**Maximum Song Length** — 6 hours.

**Measure Length** — 1-99 beats (in units of quarter, eighth, or sixteenth notes).

**Segment Length** — 1-99 measures.

**Song Length** — 1-99 steps (a step may contain a segment, repeat sign, tempo change, or trigger information).

**Auto Correction Resolution** — Selectable: 8th note, 8th triplet, 16th note, 16th triplet, 32nd note, 32nd triplet, High Resolution.

**Tempo Range** — 40-240 BPM.

**Clock Rate** — 24 clicks per quarter note.

**External Trigger Threshold** — 1.5 volts.

**Audio Outputs (10)** — Mono mix, metronome/trigger, 8 individual instrument channels (bass, snare/rim, hi/mid toms, low toms, clave/cowbell, claps, open/closed hi hat, ride).

**Trigger Inputs (4)** — Parallel the 4 Play buttons.

**Cassette/External Clock Input** — In Cassette Mode, accepts data from an audio tape recorder. In External Clock Mode, accepts a clock at 24 clicks per quarter note or at any integer multiple of 24 with programmable divide down.

**Cassette/External Clock Output** — In Cassette Mode, outputs digital data for storage on an audio tape recorder or Emulator disk. Otherwise, outputs internal clock at a rate 24 clicks per quarter note whenever the Drumulator is running.

**Cassette Dump and Load Time** — 15 seconds.

**Computer Interface** — The Drumulator can be controlled by any computer equipped with an RS-232, 9600 baud, eight bit serial interface (contact factory for details).

**Power Requirements** — 115v/230v; 60Hz/50Hz; 42W max.

Specifications subject to change without notice.

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