

TENPIN

an ELECTRONIC WALL GAME BY

GREMLIN INDUSTRIES, INCORPORATED

8401 Aero Drive

San Diego, California 92123

OPERATING INSTRUCTIONS

and

SERVICE MANUAL

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INTRODUCTION

TENPIN is an electronic game that makes extensive use of digital integrated circuits. This manual assumes that the maintenance technician possesses a general knowledge of solid-state circuitry and TTL digital integrated circuits. Any individual not knowledgeable in this area should not attempt to repair the electronic portions of the game. IT SHOULD BE NOTED THAT ANY ATTEMPT TO REPAIR THE GAME IN THE FIELD WITHOUT THE EXPRESS CONSENT OF THE FACTORY WILL IMMEDIATELY VOID THE WARRANTY!

IMPORTANT NOTES:

NEVER replace any component with anything other than an EXACT replacement part. This includes LAMPS, TRANSISTORS, INTEGRATED CIRCUITS, and the like.

LAMPS used in this game are #1813, which operate at 14.4 volts, 100 ma. and #756 lamps which operate at 14.4 volts, 80 ma. NEVER use a lamp that operates at a lower voltage or higher current. To do so will very likely damage the circuitry in the game.

DO NOT use metal objects (screwdrivers, pliers, etc.) around the lamp sockets with the game turned "ON". The outer shell of the sockets have voltage on them, and shorting them to each other or to other points on the game will damage the circuitry.

DO NOT replace the fuse with anything other than the proper value. A blown fuse indicates an overload condition within the game. Replacing the fuse with a larger value can cause severe damage to internal components if an overload occurs.

ALWAYS consult the manual before attempting any repairs.

CORRESPONDENCE regarding this game should be addressed to:

GREMLIN INDUSTRIES, INCORPORATED
8401 Aero Drive
San Diego, California 92123

Phone: 714-277-8700

UNPACKING AND INSPECTION:

The TENPIN Game is normally shipped in a single package containing the game main frame and the accessory kit, which consists of the coin box, transmitter and associated parts.

The box must be opened immediately upon arrival and inspected for freight damage. It is advisable to connect the game for operation and determine that it is operating properly, as some freight damage can occur within the main frame and not be immediately evident during a cursory visual inspection.

If damage has occurred during shipment, the recipient should immediately file a damage claim with the carrier. Filing a claim will protect the recipient from bearing the full cost of any repairs that may arise from the damage.

Any game or accessory claimed to be defective must be returned to GREMLIN INDUSTRIES, INC., 8401 Aero Drive, San Diego, California 92123, transportation charges prepaid. The game will be repaired and returned to the customer, transportation charges prepaid, if still within the warranty period. If the game is found to be damaged by misuse, improper attempts at repair, or abuse, it will be returned to the customer with transportation and repair charges billed.

In the instance of a defect of sub-assemblies or assemblies manufactured by other than GREMLIN INDUSTRIES, every effort will be made to assist the customer in obtaining satisfaction from the original manufacturer.

INSTALLATION PROCEDURE

- 1.) The game is designed to be supported from two points by either hooks or chains (Refer to FIGURE 1.).

IMPORTANT: The game should not be supported by a single hanger.

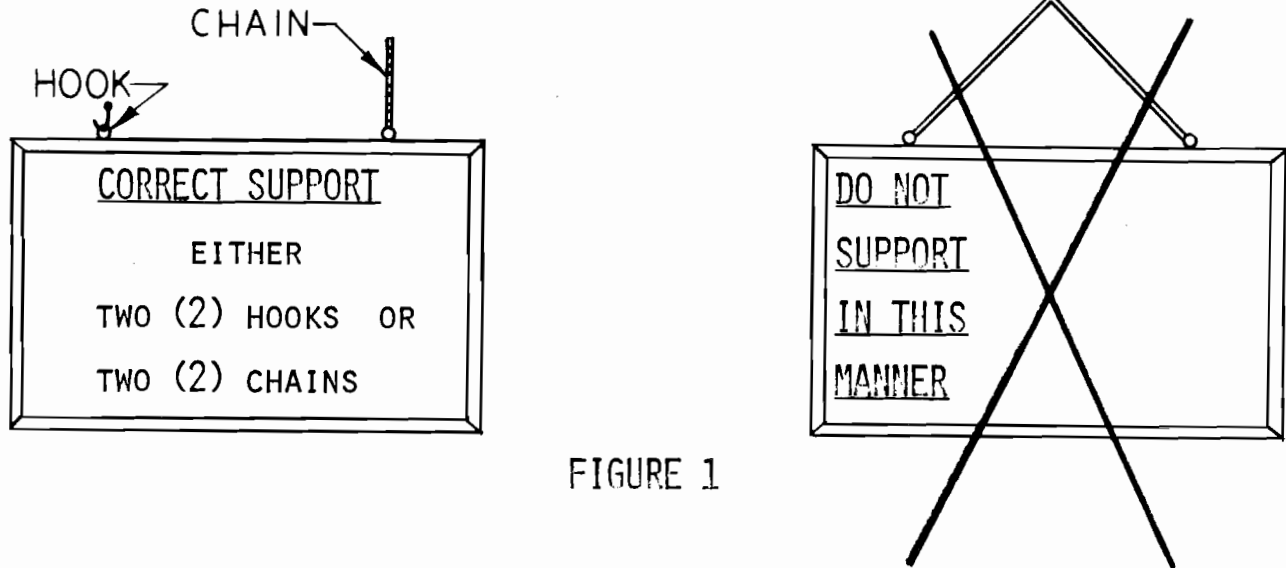


FIGURE 1

- 2.) The coinbox can be mounted in any convenient location and is connected to the game by means of the 10-pin molex connector provided.

After mounting the coinbox (insuring the cable will reach the game), connect the coinbox as follows:

- a) Open front screen of game.
- b) Connect game as illustrated in FIGURE 2.

IMPORTANT: Insure that the coinbox cable is placed in the feed-through hole provided before attempting to secure the front display screen.

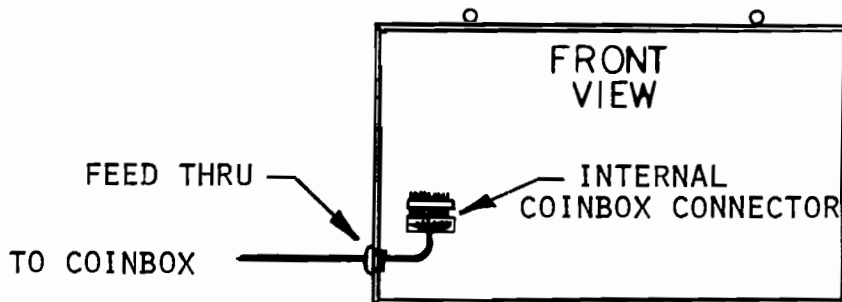


FIGURE 2

MAINTENANCE

The following are recommendations for the care of your GREMLIN wall game. These recommendations are of a non-technical nature. For technical information refer to other sections of this manual.

1.) CLEANING

GREMLIN recommends using an all purpose commercial cleaner such as 409 (or equivalent) for all exterior surfaces.

2.) LAMP REPLACEMENT

Lamps should only be replaced with exact replacements. TENPIN uses #756 and #1813 lamps (12-14 volts, 100 ma), any attempt to use lamps other than ones specified could cause electrical damage and void the game warranty.

IMPORTANT: Always remove power from the game before replacing lamps. The outer shell of the socket has voltage applied and shorting these points to ground can cause damage to the circuitry.

3.) LOGIC BOARD REPLACEMENT

If, for any reason, the logic or sound board in your game needs to be replaced the same rule applies as for lamp replacement: ALWAYS REMOVE POWER from the game!

TENPIN GAME DESCRIPTION

The TENPIN game is a single, wall-mounted unit that needs only an external coinbox and transmitter (control box) to operate. Both of the latter units are supplied with the game.

Within the main frame of the game assembly is a large (2.5 feet by 5.0 feet) printed circuit lamp board, which contains plug-in provisions for the power/sound board and the logic board. Additionally, a receiver module is incorporated on the front of the lamp board to receive and process the signals transmitted from the hand-held transmitter control.

The transmitter/controller is a standard, tone-modulated 49 MHZ transmitter. The only control necessary for its operation is the top-mounted push button that is actuated to play the game.

The coinbox provided with the game is a quarter acceptor type that causes a switch contact closure with each coin inserted. Each coin activates the circuitry in the main frame and allows a game to be played.

The game is played in the following manner:

- 1.) Two players normally compete in TENPIN, each taking turns at the control box that enables them to play from any place in the room. An option is incorporated to allow single player games.
- 2.) A coin is deposited and the game activates, allowing the transmitter control box to initiate action.
- 3.) A triangle indicator moving back and forth across the alley represents 15 possible ball paths which determine the number of pins knocked down on each ball roll. The first player depresses the control button, which stops the movement of the triangle and initiates the ball roll. Depending on how skillfully the player selects the ball path on the first ball, the player may be awarded a strike (20 points; one point per pin plus a 10 point bonus) or a gutter ball (zero points) or anywhere from one to nine points (one point per pin). If the player does not get a strike on the first ball, a second ball is awarded and "Roll Again" will light up. The player can then try to knock down the remaining pins. If the player is successful, he will be awarded a spare (15 points; one point per pin plus a 5 point bonus). Points are awarded for pins knocked down and any pins left standing after the second ball will not score points.

- 4.) When the ball is rolled a realistic sound of the ball rolling down the alley and hitting the pins is generated. If the ball fails to knock down any pins, a frog croak is generated. When a strike is rolled there is a sharp clap of thunder, Rip awakens, and the bowler is saluted by the merry-makers.
- 5.) A free game is awarded when a preselected score is attained or exceeded by either player during the period of a game. This score is selected by a switch on the front of the lamp board.
- 6.) TENPIN is internally programmable to allow control over the speed of the triangle sequencing and the ball roll.
- 7.) The length of the game is controlled by the number of frames to be played and is selected by a rotary switch on the front of the lamp board. The switch is accessed by opening the front display panel.

TENPIN GAME PROGRAMMING AND ADJUSTMENTS

LOGIC BOARD

There are two program adjustments and two speed adjustments on the TENPIN Logic Board, P/N 812-0001. They are:

1. THE NUMBER OF COINS NECESSARY FOR A GAME CREDIT.

For single coin credits a jumper wire must connect Pins E1 and E3 (this is the factory setting). If two coins for a game credit is desired then the jumper should connect Pins E1 and E2. Only one jumper should be in place at a time.

2. THE NUMBER OF PLAYERS PER CREDIT.

For single player per credit a jumper wire must connect Pins E4 and E5 (in this configuration one credit gives a single player game and two credits give a two player game).

For two players per credit a jumper wire must connect Pins E4 and E6 (this is the factory setting and in this configuration no single player game is possible). Only one jumper should be in place at a time.

3. TRIANGLE SPEED ADJUSTMENT.

The triangle speed adjustment is potentiometer R6 and it controls the speed at which the triangle ball path indicators oscillate back and forth across the alley. Speeding up the triangles makes it more difficult to pick the optimum path and therefore makes the game more difficult to play. Slowing down the triangles makes the game easier.

TENPIN GAME PROGRAMMING AND ADJUSTMENTS (Continued)

LOGIC BOARD (Cont'd.)

4. MASTER CLOCK ADJUSTMENT.

The master clock adjustment controls most of the timing/counting functions of the game, such as the ball roll speed, but does not change the length or difficulty of the game. This potentiometer R1 is factory set and does not require adjustment under normal circumstances.

LAMP BOARD

There are two game program adjustments that are accessible from the front of the lamp board and they are:

1. "END OF GAME FRAME" SWITCH.

This four position switch selects the last frame for the end of the game. It selects either 10, 9, 8, or 7 frames per game.

2. THE "FREE GAME FOR" SWITCH.

This eight position switch selects the minimum number of points at least one player must have to be awarded a free game. It selects scores of 130 points thru 190 points.

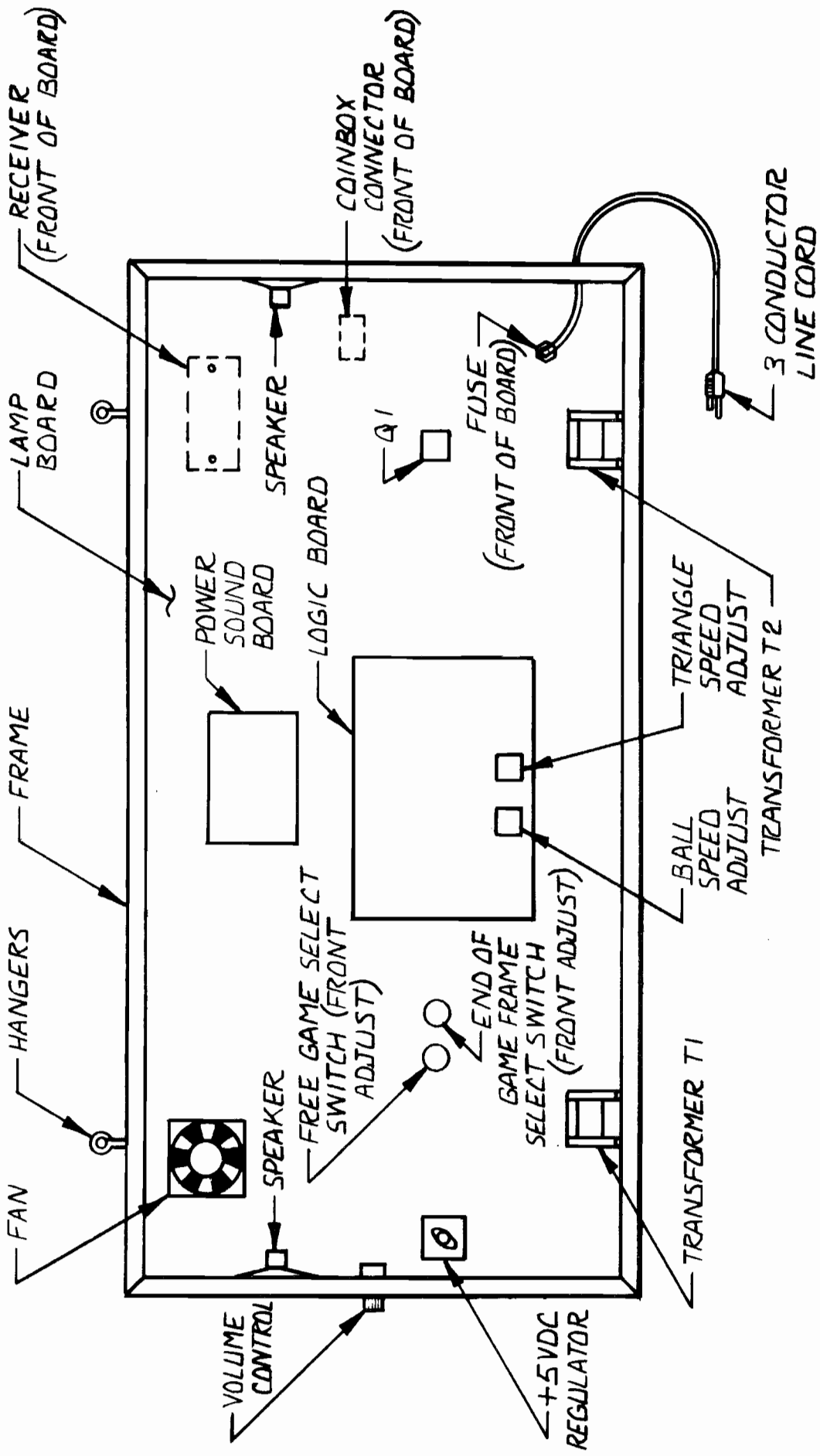


FIGURE 3
 LAYOUT DIAGRAM
 (REAR VIEW OF GAME)

SYSTEM DESCRIPTION

TENPIN is a digitally controlled, sequentially animated game. Digital integrated circuits control the rate, interval, and sequence of events.

Figure 4 is a simplified block diagram of the game. The Credit is applied to the End of Game circuit when a valid coin drop is received by the Coin Discriminator which activates the Triangle Motion/Selector and allows it to begin cycling.

The Receiver output will now stop the cycling of the Triangle Motion/Selector circuit and select a ball path dependent upon the triangle(s) which were lit when the transmitter pushbutton was depressed.

The Triangle Motion/Selector starts the Ball Motion circuit, which rolls the ball down the alley, and inputs to the Pin Proms, which select pins knocked down, and the Score Proms, which add up proper scoring and display it. The Score Proms output to the proper player (1st Up or 2nd Up). The End of Game circuit keeps track of the number of ball rolls.

The 1st Up Score and 2nd Up Score are applied to the Free Game Selector and if either score is high enough to equal or exceed the score selected by the "FREE GAME FOR" switch, a Free Game is awarded and inhibits the End of Game circuit from inactivating the Triangle Motion/Selector, but does reset Frame Counter, 1st Up Score and 2nd Up Score to zero.

The End of Game Selector is activated when the Frame Counter reaches the number selected by the "END OF GAME" switch. The End of Game circuit receives this signal and resets the entire game to zero and awaits another coin drop.

The Power on Delay circuit resets the End of Game logic on initial plug in of the game power cord. This is necessary to clear all of the logic to its zero state.

TENPIN SIMPLIFIED BLOCK DIAGRAM

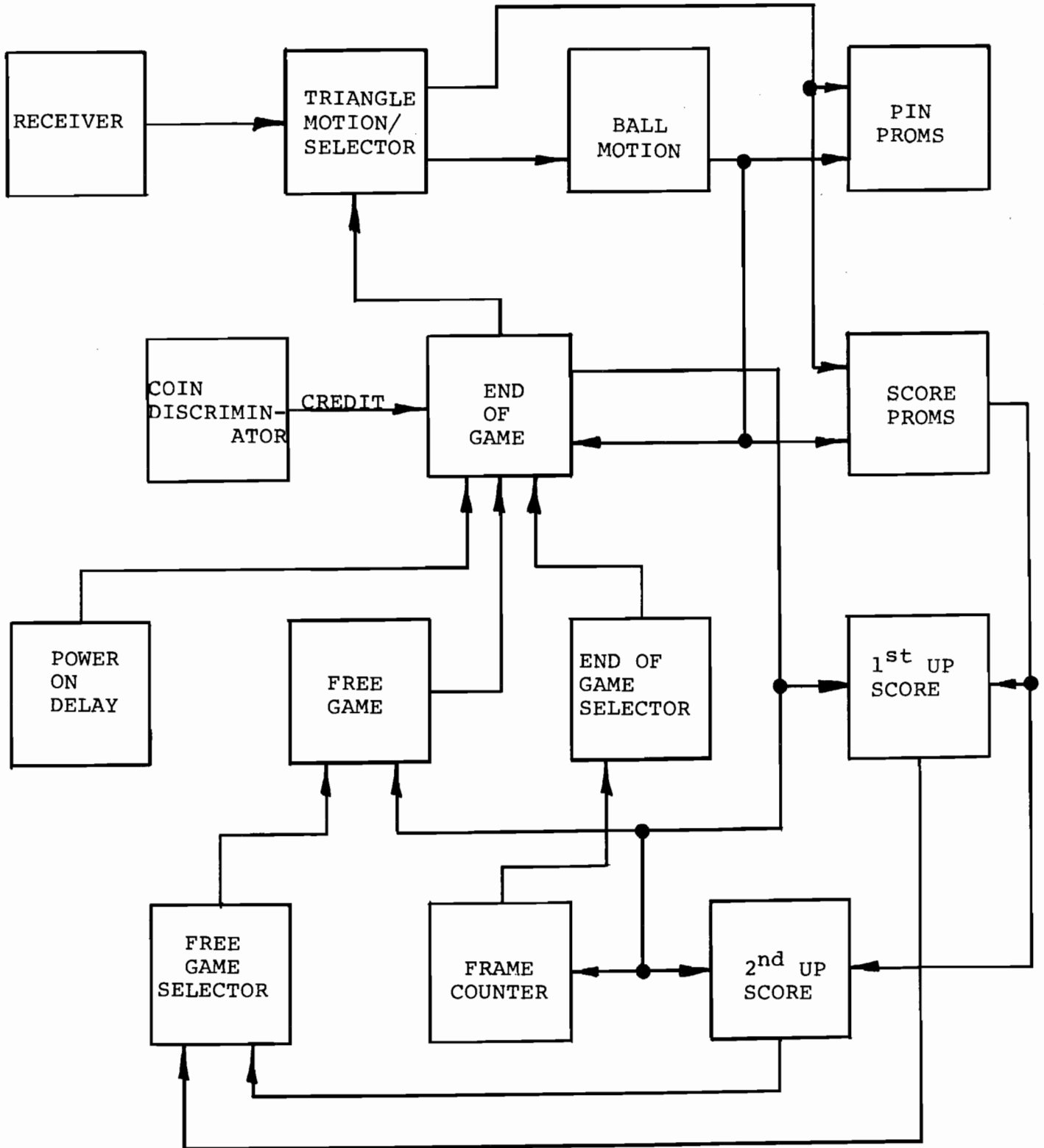


FIGURE 4

TENPIN SOUND EFFECTS AND POWER CONTROL

The sound effects developed for TENPIN are unique and contribute to the life-like action of the game. The four basic sounds and power buss control are described below.

For the following discussion refer to the Power/Sound Board Schematic.

PIN & PIN BACKGROUND SOUNDS

The Strike and Hit sounds are very similar; the basic difference being that the Strike sound is 800 ms long and the Hit sound is 500 ms long.

When a Strike occurs a High is applied to pins 22 and 25 of the Power/Sound Board. When a Hit occurs a High is applied to pin 22 only. As a result, a High of appropriate length appears at pin 3 of U2.

This one-shot action causes the following: First, the leading edge at pin 3 is coupled to Q4 and C6 thus quickly charging C7. The voltage on C7 decays slowly and amplitude modulates the 200Hz noise at the base of Q16. An amplified version then appears at pin 8 of U7 and is summed into the audio output by R138, supplying background noise for the pins falling. Next, the logic High from U2 enables the oscillator of U10. When the oscillator output is High, Q34 and Q31 are turned on and C46 begins to charge. When the

output goes Low, Q32 is turned on and C46 begins to discharge. The resulting waveform is buffered by Q33 and applied to the frequency modulation pins of oscillators U12, U13, and U14.

The frequency of each oscillator is vastly different. This fact coupled with the frequency modulation applied to the oscillators serves to create a psuedo-random event generator that has the cadence of bowling pins falling.

Both the leading and trailing edges of the oscillator outputs are capacitively coupled and appear at R150 and R158. R150 is the input to a three stage resonant filter that has a Q of 100 and a resonant frequency of 1200 Hz. R158 is the input to a single stage resonant filter with a Q of 10 and a resonant frequency of 200 Hz.

Noise with a cut-off frequency of 1200 Hz is applied to the base of Q25 and modulated by the sawtooth appearing at the base of Q24. The resulting modulated noise is injected into the 200 Hz resonant filter at R157.

When a resonant filter receives an impulse, it tends to oscillate at its resonant frequency. The sharp rise and decay of those oscillations, plus the noise applied to the 200 Hz filter, reproduce the familiar wood sound of bowling pins falling. The oscillations from the two filters are summed through R162 and R164 at the summing amplifier of U6 and summed into the final audio at R142.

BALL ROLL

The Ball Roll is reproduced by applying 200 Hz noise to the base of the amplifier Q10. Q10 is gated on and off with Q11. A Low from the Logic Board at pin 23 turns Q10 on. A High turns it off. R36 and R37 provide Q10 with the correct d.c. bias. R38 and R39 set the amplifiers gain to unity. The Ball Roll is summed with the rest of the audio through R139.

FROG CROAK

Whenever a player bowls either a Miss or a Gutter, the Frog croaks the player's misfortune.

A Low at pin 24 of the Sound Board is inverted by Q9 and applied to pin 10 of U4. Pin 9 of U4 produces an oscillation which is High for 50 ms and Low for 200 ms. When pin 9 of U4 is High it enables the oscillator at pin 4 of U4. Thus, pin 5 of U4 oscillates with a frequency of about 20 Hz. R24 couples these oscillations to the resonant filter of U7, R51, R52, C27 and C28.

The FET at pin 13 of U7 shifts the frequency response of the filter. When pin 9 of U4 goes High, C26 is quickly charged and the FET turns on. As the voltage at C26 decays, the FET gradually turns off and lowers the resonant frequency of the resonant filter. The Frog Croak is summed with the rest of the audio through R140.

THUNDER

The Thunder occurs during a strike and is initiated by a High going pulse at pin 21 of the Sound Board.

The Thunder sound is created by applying very low frequency noise to the base of Q29 and modulating it with a slowly decaying exponential voltage applied to the base of Q30. An amplified version of the signal appears at pin 1 of U5 and is summed with the rest of the audio through R141.

POWER BUSSES

In order to cut the parts count and make the game more reliable, a buss switching system is used in TENPIN. When a game is initiated a logic High is applied to pin 40 of the Sound Board. This applies power to one side of the Pins UP lamps. The individual lamps are lighted by grounding the other side of the lamps through a transistor.

The three Ball Path busses have power applied to them by the Triangle sequence. When the Triangle sequence is at the top, Ball Path Buss A is enabled (a High is applied to Pin 38 of the Sound Board), when it is near the middle, Buss B is enabled, etc.

As the Ball Path is sequenced, triplets of lamps are grounded through a single transistor but only one lamp is lighted because only one Ball Path power buss is enabled at any given time.

GENERAL ILLUMINATION DIMMING

When a game is not in progress the Logic Board sends a logic High to pin 1 of the Sound Board. This grounds the anode of D1 through Q7. Q1 on the Lamp Board is robbed of its gate bias and turns off.

As the rectified a.c. at pins 5 and 6 begins to rise, C1 charges through R4. When the voltage on C1 exceeds 5V Q2 and Q3 conduct and supply gate current to Q1. Q1 then conducts until the voltage at C1 drops below 5V. The effect is to drop the rectified a.c. lamp voltage and dim the General Illumination lamps thus saving power and extending lamp life.

AUDIO AMP

The Audio Amplifier used in TENPIN is of the quasi-complimentary type. R88, D8 and R92, D9 provide provide voltage biasing in order to prevent cross over distortion. Q19 and Q20 drive the two TIP 29s which are capable of delivering 10 watts to a 16 ohm load. R86 and R84 set the mid-frequency gain to 11 while C51 gradually rolls the gain off at high frequencies. C55 rolls off the low frequency gain and R87 insures that the amplifier output is always zero when no signal is applied to the input. The summing amplifier of U6 sums all of the audio inputs while C69 blocks and d.c. component of the summed signal.

The volume control (Lamp Board R3) is externally located in order to accommodate any ambient noise level. The summed audio output appears at pin 11 of the Sound Board and is electrically connected to the volume control through the lamp board. The attenuated audio returns to pin 12 of the Sound Board (again via the Lamp Board) and is amplified for output to the two series connected loudspeakers.

RECOMMENDED SPARE PARTS FOR TENPIN
(Per 10 Units)

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PART NO.</u>	<u>QUANTITY</u>
CAPACITOR	Cap, C, Var 6/25pf	154-9001	1
RECEIVER	K-9	190-9010	1
COIN COUNTER	Digital	220-9008	1
COIL	Coin Lockout	220-9061	1
CRYSTALS	T/P Xmtr 49.830	230-9010	2
	T/P Rcvr 49.375	230-9011	1
INTEGRATED CIRCUIT	NE 555	314-9001	1
	7490	314-9003	1
	7474	314-9006	2
	74193	314-9007	1
	7400	314-9009	1
	7448	314-9013	2
	7404	314-9015	2
	Prom T/P U8	316-9044	1
	Prom T/P U9	316-9045	1
	Prom T/P U10	316-9046	1
	Prom T/P U11	316-9047	1
LAMPS	Socket	390-9002	5
	#756	390-9004	50
	#1813	390-9005	150
DIODES	1N4002	481-9001	2
	MR751	481-9002	2
	MR501	481-9004	2
	1N914/1N4148	481-9006	2
TRANSISTORS	2N4403	482-9006	2
	SCR 2N5060	482-9009	4
	PE8050	482-9010	2
	SCR MCR106-1	482-9012	2
	2N4401	482-9014	10
	TIP 29	482-9016	2
SCR 2N6400	482-9024	2	
TRANSFORMERS	Game T-1	560-9110	1
	Game T-2	560-9111	1
LOGIC BOARD	Assy, T/P Logic Bd	812-9001	1
PWR/SND BOARD	Assy, T/P Pwr/Snd Bd	812-9002	1
TRANSMITTER	Assy, XMTR, T/P	812-9007	2

TENPIN LOGIC BOARD SCHEMATIC

ABBREVIATION-DEFINITION LIST

<u>ABBREVIATION</u>	<u>DEFINITION</u>
ADV	ADVERTISE MODE
ASE	ADVERTISE SEQUENCE ENABLE
AVS	ADVERTISE START
BMC	BALL MOTION CLOCK
CDC	CREDIT DOWN COUNT
CNA	CREDIT NOT ADVERTISE
EOG	END OF GAME
FRI	FRAME ONE
GSE	GAME START ENABLE
LBD	LAST BALL DELAY
PLR	PROM LATCH RESET
POD	POWER ON DELAY
PA Ø THRU 7	PROM ADDRESS Ø THRU 7
BEOG	BUFFERED END OF GAME
1P/2P	ONE PLAYER/TWO PLAYER

GREMLIN

PARTS LIST

TITLE ASSY TENPIN LOGIC BOARD

812-0001
DWG NO

SH 1
OF 8

A
REV

RELEASED

DRAWN LIPTAK, L.J.

ENGR

L.J.

DESIGN

CHECK

APPR

L.J.

LTR	AUTH	REVISION DESCRIPTION	DRAFT	CHECK	APPR
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A

RELEASED

L.J.

OCT 13 1977

GREMLIN

PARTS
LISTTITLE
ASSY. TEN PIN
LOGIC BOARD812-0001
DWG NOSH 2
OF 8A
REV

ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	150-0013							2	CAP. E, 100 μ F 25V	C46 - C47
	151-0001							2	CAP. CER. .05 μ F 50V	C2, C4
	151-0008							3	CAP. CER. .001 μ F 50V	C5, C7, C15
	151-0012								CAP. CER. .1 μ F 50V	C8, C16 - C45
	152-0002							2	CAP. F. .22 μ F 100V	C1, C3
	152-0018							1	CAP. F. .01 μ F 50V	C6
	153-0001							4	CAP. TANT. 10 μ F 25V	C9, C11 - C13
	153-0007							1	CAP. TANT. 6.8 μ F 25V	C10
	153-0008							1	CAP. TANT. 100 μ F 25V	C14
1	170-0100							1	PCB TENPIN LOGIC	
	211-0004							20	CONN PIN TEST PT	TPI-TPI4, E1-E6
2	212-0002							14	CONN. FEM 10PIN	
	314-0001							9	IC NE555 DIP	U5, 20, 28, 32, 33,
	" "								" " "	84, - 87
	314-0002							3	IC 7432	U24, 79, 80
	314-0003							6	IC 7490	U46, 53-56, 77
	314-0004							2	IC 7420	U31, 59
	314-0006							15	IC 7474	12-16, 21, 39, 44, 48
	" "								" "	62, 75, 76, 80, 81, 89

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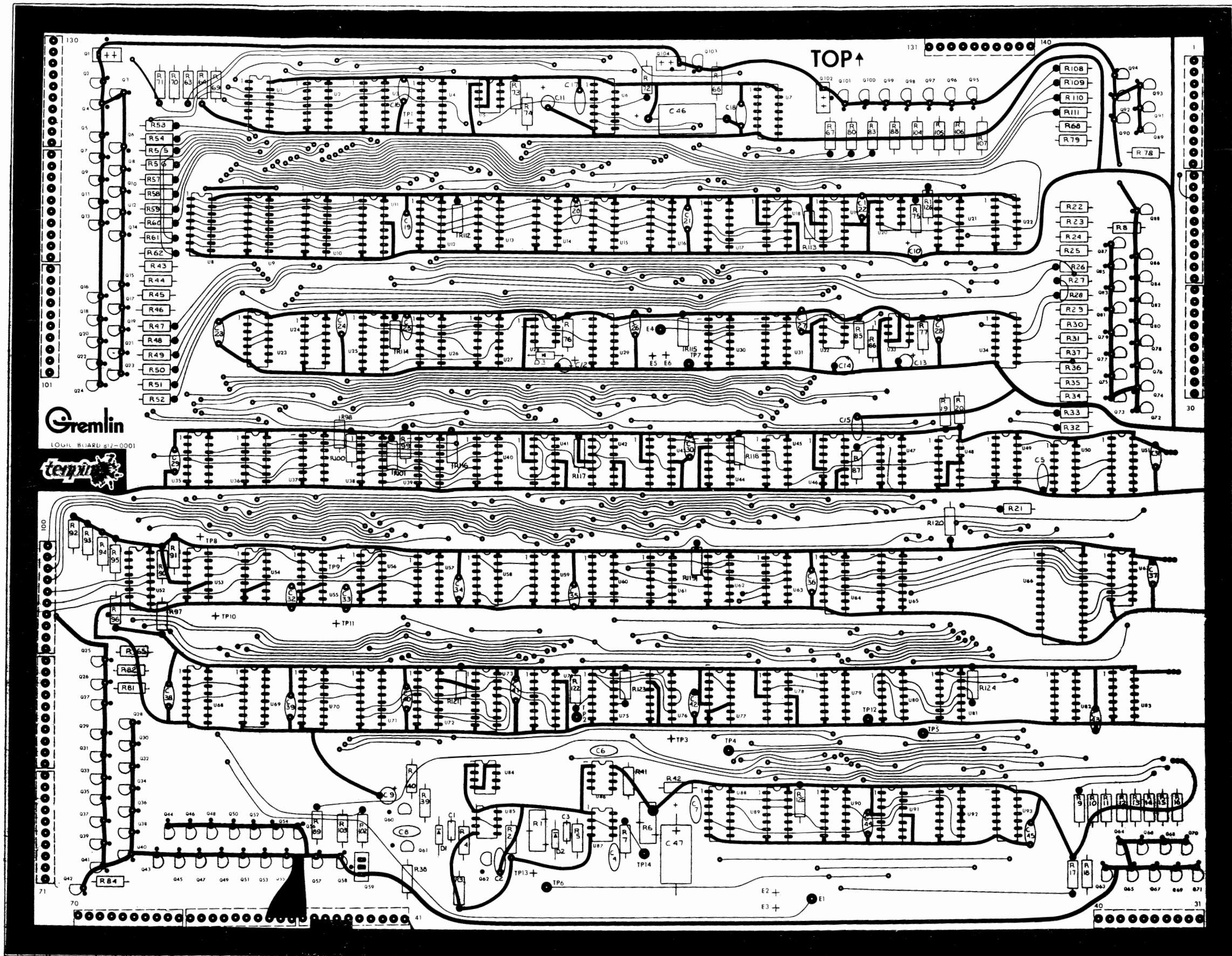
PARTS
LISTTITLE
ASSY. TENPIN
LOGIC BOARD812-0001
DWG NOSH 3
OF 8A
REV

ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	314-0007							1	IC 74193	U51
	314-0008							1	IC 74154	U66
	314-0009							7	IC 7400	U23,27,40,47,50,58,67
	314-0010							3	IC 7410	U82, 83, 92
	314-0012							7	IC 7408	U17,22,30,35,36,61,68
	314-0013							4	IC 7448	U68-71
	314-0014							1	IC 7411	U2
	314-0015							6	IC 7404	U4, 29,38,45,57,90
	314-0022							1	IC 7486	U37
	314-0024							6	IC 7402	U1-3,26,60,93
	314-0027							1	IC 7485	U73
	314-0028							3	IC 74164	U7,34,49
	314-0029							2	IC 74157	U72,74
	314-0038							1	IC 74163	U25
	314-0041							2	IC 74175 FSC	U64,65
	314-0045							7	IC 7473	U18,19,41-43,78,91
	314-0057							1	IC 74147	U52
	316-0044							1	IC PROM T/P U8	U8
	316-0045							1	IC PROM T/P U9	U9
	316-0046							1	IC PROM T/P U10	U10
	316-0047							1	IC PROM T/P U11	U11
	471-0102							24	RES 1K Ω 1/2 W 5%	R2,4,5,7,17 19,20
	" "							"	" " " " " "	73,86 112-126

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PARTS
LISTTITLE ASSY. TENPIN
LOGIC BOARD812-0001
DWG NOSH 4
OF 8A
REV

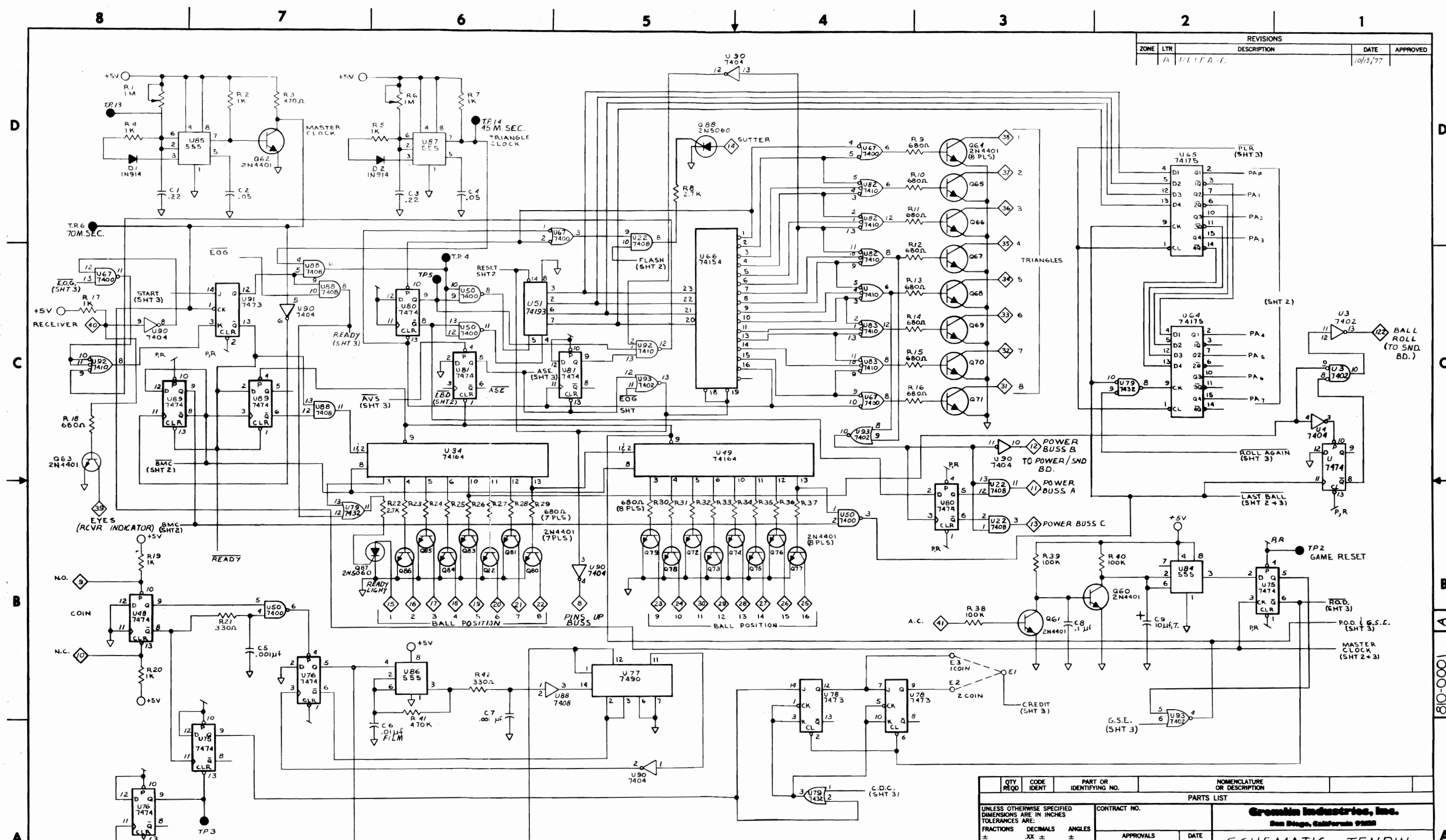
ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	471-0103							3	RES, 10K Ω 1/2W 5%	R63, 64, 78
	471-0104							4	RES, 100K Ω 1/2W 5%	R38, 39, 40, 74
	471-0105							1	RES, 1M, Ω 1/2W 5%	R76
	471-0272							18	RES, 2.7K Ω 1/2W 5%	R8, 22, 65-72, 79-
	" "								" " " "	82, 84, 89, 102, 103
	471-0274							1	RES, 270K Ω 1/2W 5%	R85
	471-0331							2	RES, 330 Ω 1/2W 5%	R21, 42
	471-0334							1	RES, 330K Ω 1/2W 5%	R75
	471-0471							2	RES, 470 Ω 1/2W 5%	R3, 87
	471-0472							12	RES, 4.7K Ω 1/2W 5%	R90-101
	471-0474							2	RES, 470K Ω 1/2W 5%	R42, 77
	471-0681							54	RES 680 Ω 1/2W 5%	R9-16, 18, 23-37
	" "								" " " "	43-62, 83, 88, 104-111
	475-0002							2	POT, CARBON 1M OHM	R1, 6
	481-0006							3	DIODE 1N914	D1-D3
	482-0009							14	XISTOR, SCR 2N5060	Q2, 4, 25-27, 42
	" "								" " " "	57, 58, 87-90, 101, 103
	482-0012							4	XISTOR, SCR MCR106-1	Q1, 59, 102, 104
	482-0014							86	XISTOR, 2N4401	Q3, 5-24, 28-41,
	" " "								" " " "	43-56, 60-86,
	" " "								" " " "	91-100



△ (14PLCS)

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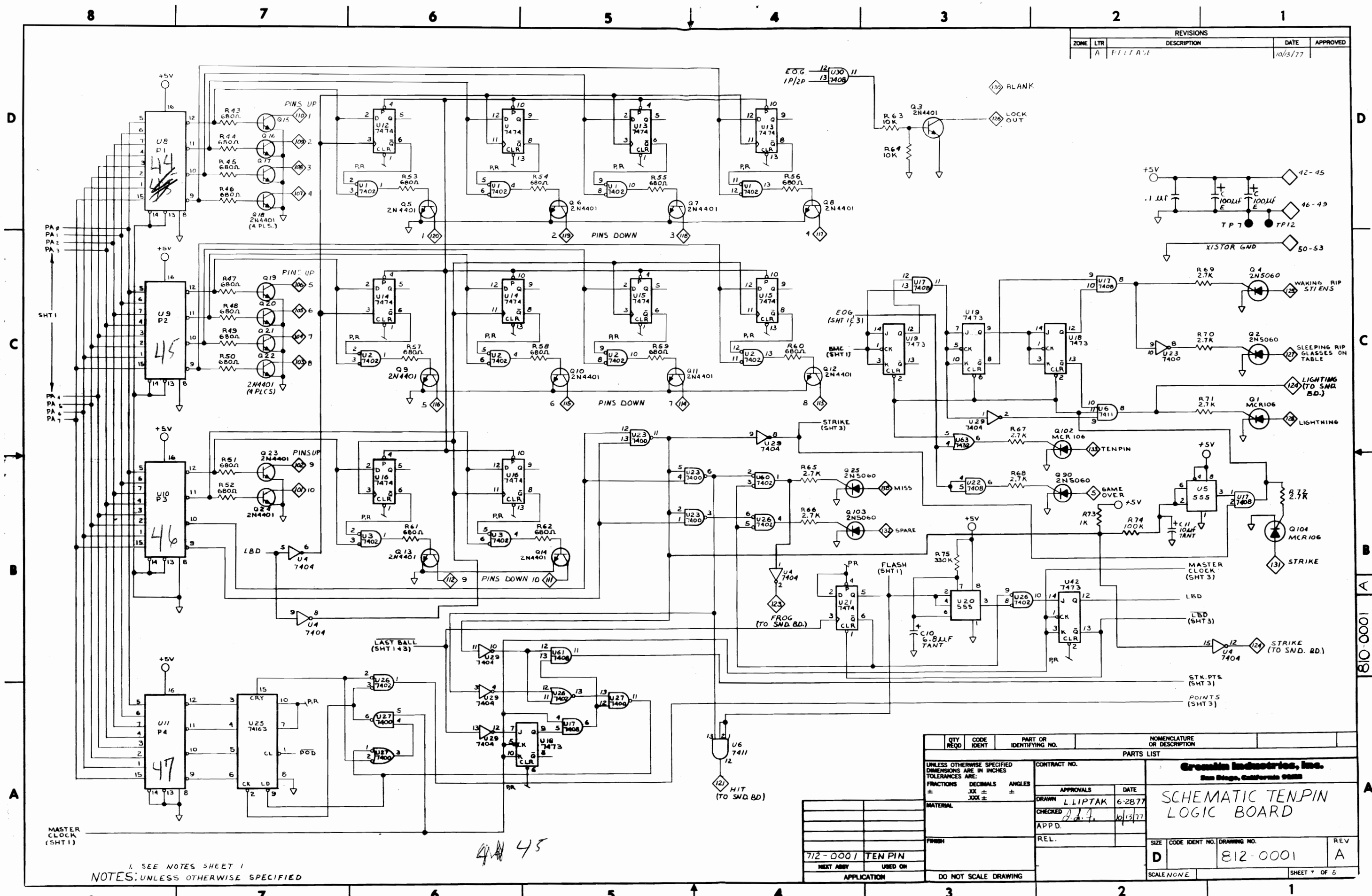
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
A		REVISED	10/13/77	



2. CAPACITANCE VALUES ARE IN MICROFARADS
 1. RESISTANCE VALUES ARE IN OHMS
 NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX ± ± ± .XXX ± ±			
CONTRACT NO.		Grossman Industries, Inc. San Diego, California 92128	
APPROVALS	DATE	DRAWN L. LIPTAK 6-24-77	
CHECKED	DATE	J. J. 10/13/77	
APPD.			
REL.			
FINISH		SIZE	CODE IDENT NO. DRAWING NO. REV
		D	812-0001 A
APPLICATION	USED ON	SCALE NONE	SHEET 6 OF 8
712-0001 TENPIN			
DO NOT SCALE DRAWING			

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
A	FLLFA:1		10/13/77	

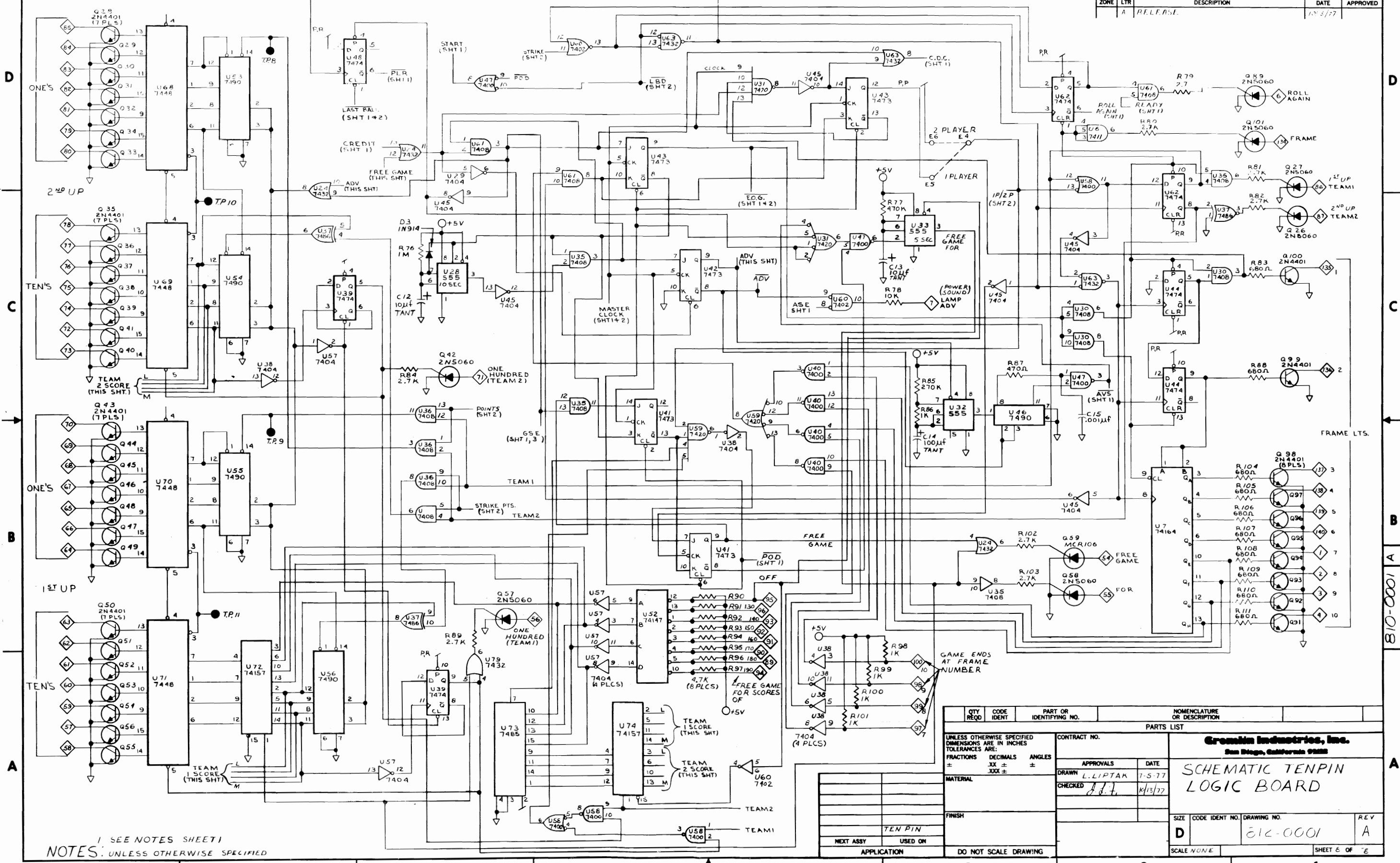


1. SEE NOTES SHEET 1
 NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD		CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.		
FRACTIONS	DECIMALS	ANGLES	APPROVALS	DATE
±	±	±	DRAWN LLIPTAK	6-28-77
MATERIAL		CHECKED J.D.A.		
FINISH		APPD.		
REL.		DATE 10/13/77		
712-0001 TEN PIN		SIZE CODE IDENT NO. DRAWING NO.		
NEXT ARMY USED ON		D 812-0001 A		
APPLICATION		DO NOT SCALE DRAWING		
SCALE NONE		SHEET 7 OF 8		

810-0001 A

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
A	RELEASE		1/13/77	



NOTES: 1. SEE NOTES SHEET 1
UNLESS OTHERWISE SPECIFIED

QTY REQD		CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:				
FRACTIONS	DECIMALS	ANGLES		
±	XX ±	XXX ±		
MATERIAL		FINISH		
NEXT ASSY		USED ON		
APPLICATION		DO NOT SCALE DRAWING		
CONTRACT NO.		APPROVALS		
DRAWN L.LIPTAK		DATE 1-5-77		
CHECKED J.J.T.		DATE 1/13/77		
SIZE D		CODE IDENT NO.	DRAWING NO.	REV
SCALE NONE		810-0001		A

Crown Industries, Inc.
San Diego, California 92108

SCHEMATIC TENPIN LOGIC BOARD

810-0001 A

GREMLIN		PARTS LIST	TITLE	ASSY. TEN PIN LOGIC BOARD	812-0001 DWG NO	SH 2 OF 8	F REV			
ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	150-0010							2	CAP. E, 100 μ F 16V	C46, C47
	151-0001							2	CAP. CER. .05 μ F 50V	C2, C4
	151-0008							3	CAP. CER. .001 μ F 50V	C5, C7, C15
	151-0011							1	CAP. CER. .01 μ F 50V	C48
	151-0012							33	CAP. CER. .1 μ F 50V	C8, C16 - C45, C49, C50
	152-0002							2	CAP. F. .22 μ F 100V	C1, C3
	152-0018							1	CAP. F. .01 μ F 50V	C6
	153-0001							4	CAP. TANT. 10 μ F 25V	C9, C11 - C13
	153-0007							1	CAP. TANT. 6.8 μ F 25V	C10
	153-0008							1	CAP. TANT. 100 μ F 25V	C14
1	170-0100							1	PCB TENPIN LOGIC	
	211-0004							20	CONN PIN TEST PT	TPI-TPI4, E1-E6
2	212-0002							14	CONN. FEM 10PIN	
	314-0001							9	IC NE555 DIP	U5, 20, 28, 32, 33,
	" "							" "	" "	84 - 87
	314-0002							3	IC 7432	U24, U63, U79
	314-0003							6	IC 7490	U46, 53-56, 77
	314-0004							2	IC 7420	U31, 59
	314-0006							15	IC 7474	12-16, 21, 39, 44, 48
	" "							" "	" "	62, 75, 76, 80, 81, 89

GREMLIN		PARTS LIST		TITLE ASSY. TENPIN LOGIC BOARD		812-0001 DWG NO		SH 3 OF 8		F REV	
ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES	
	314-0007							1	IC 74193	U51	
	314-0008							1	IC 74154	U66	
	314-0009							7	IC 7400	U23,27,40,47,50,58,67	
	314-0010							3	IC 7410	U82, 83, 92	
	314-0012							7	IC 7408	U17,22,30,35,36,61,88	
	314-0013							4	IC 7448	U68-71	
	314-0014							1	IC 7411	U6	
	314-0015							6	IC 7404	U4,29,38,45,57,90	
	314-0022							1	IC 7486	U37	
	314-0024							6	IC 7402	U1-3,26,60,93	
	314-0027							1	IC 7485	U73	
	314-0028							3	IC 74164	U7,34,49	
	314-0029							2	IC 74157	U72,74	
	314-0038							1	IC 74163	U25	
	314-0041							2	IC 74175	U64,65	
	314-0045							7	IC 7473	U18,19,41-43,78,91	
	314-0057							1	IC 74147	U52	
	316-0044							1	IC PROM T/P U8	U8	
	316-0045							1	IC PROM T/P U9	U9	
	316-0046							1	IC PROM T/P U10	U10	
	316-0047							1	IC PROM T/P U11	U11	
	471-0102							25	RES 1K Ω 1/2 W 5%	R2,4,5,7,17 19,20	
	" "								" " " " " "	73,86 112-126,78	

GREMLIN		PARTS LIST	TITLE ASSY. TENPIN LOGIC BOARD				812-0001 DWG NO		SH 4 OF 8	F. REV
ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	471-0103							3	RES, 10K Ω 1/2W 5%	R63, 64, 128
	471-0104							4	RES, 100K Ω 1/2W 5%	R38, 39, 40, 74
	471-0105							1	RES, 1M, Ω 1/2W 5%	R76
	471-0272							18	RES, 2.7K Ω 1/2W 5%	R8, 22, 65-72, 79-
	" "								" " " "	82, 84, 89, 102, 103
	471-0274							1	RES, 270K Ω 1/2W 5%	R85
	471-0331							3	RES, 330 Ω 1/2W 5%	R21, 42, 127
	471-0334							1	RES, 330K Ω 1/2W 5%	R75
	471-0471							2	RES, 470 Ω 1/2W 5%	R3, 87
	471-0472							12	RES, 4.7K Ω 1/2W 5%	R90-101
	471-0474							1	RES, 470K Ω 1/2W 5%	R77
	471-0681							54	RES 680 Ω 1/2W 5%	R9-16, 18, 23-37
	" "								" " " "	43-62, 83, 88, 104-111
	471-0684							1	RES 680K Ω 1/2W 5%	R41
	475-0002							2	POT, CARBON 1M OHM	R1, 6
	481-0006							3	DIODE 1N914/1N4148	D1-D3
	482-0009							14	XISTOR, SCR 2N5060	Q2, 4, 25-27, 42
	" "								" " " "	57, 58, 87-90, 101, 103
	482-0012							4	XISTOR, SCR MCR106-1	Q1, 59, 102, 104
	482-0014							86	XISTOR, 2N4401	Q3, 5-24, 28-41,
	" " "								" " " "	43-56, 60-86,
	" " "								" " " "	91-100
	801-0019							2	ASSY. CONN JUMPER	USED ON E1, E4

17.000 REF



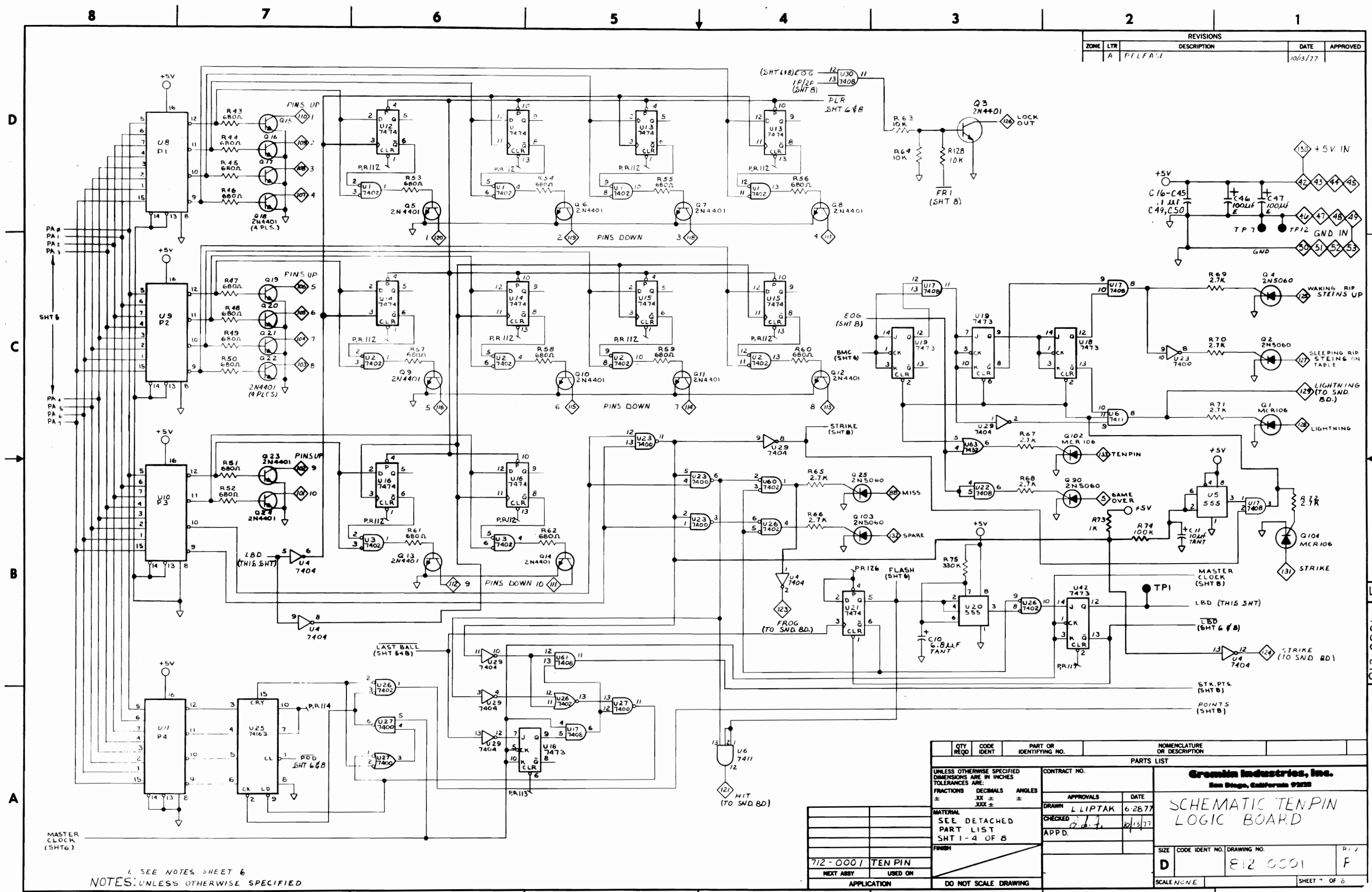
NOTES:
 ▲ C48 ADDED IN TEST AS REQUIRED
 ▲ CONNECTORS MOUNTED ON BACK OF BOARD

② ▲
 (14 EA)

①

QTY	CODE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
			PC.ASSY. TENPIN LOGIC BOARD
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:			CONTRACT NO. Gremlin Industries, Inc. San Diego, California 92133
FRACTIONS	DECIMALS	ANGLES	
	.XXX =	°	APPROVALS
MATERIAL: SEE DETACHED PARTS LIST SHT 1-4 OF 8			DATE: 1/6/78
FINISH:			CHECKED: J.S.T. 2/17/78
NEXT ASSY: T12-0001 TENPIN USED ON:			SIZE: E
APPLICATION: DO NOT SCALE DRAWING			CODE IDENT NO: 812-0001
			REV: F
			SCALE: 2 X 1
			SHEET 5 OF 8

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
A	PLFA:1		10/13/77	



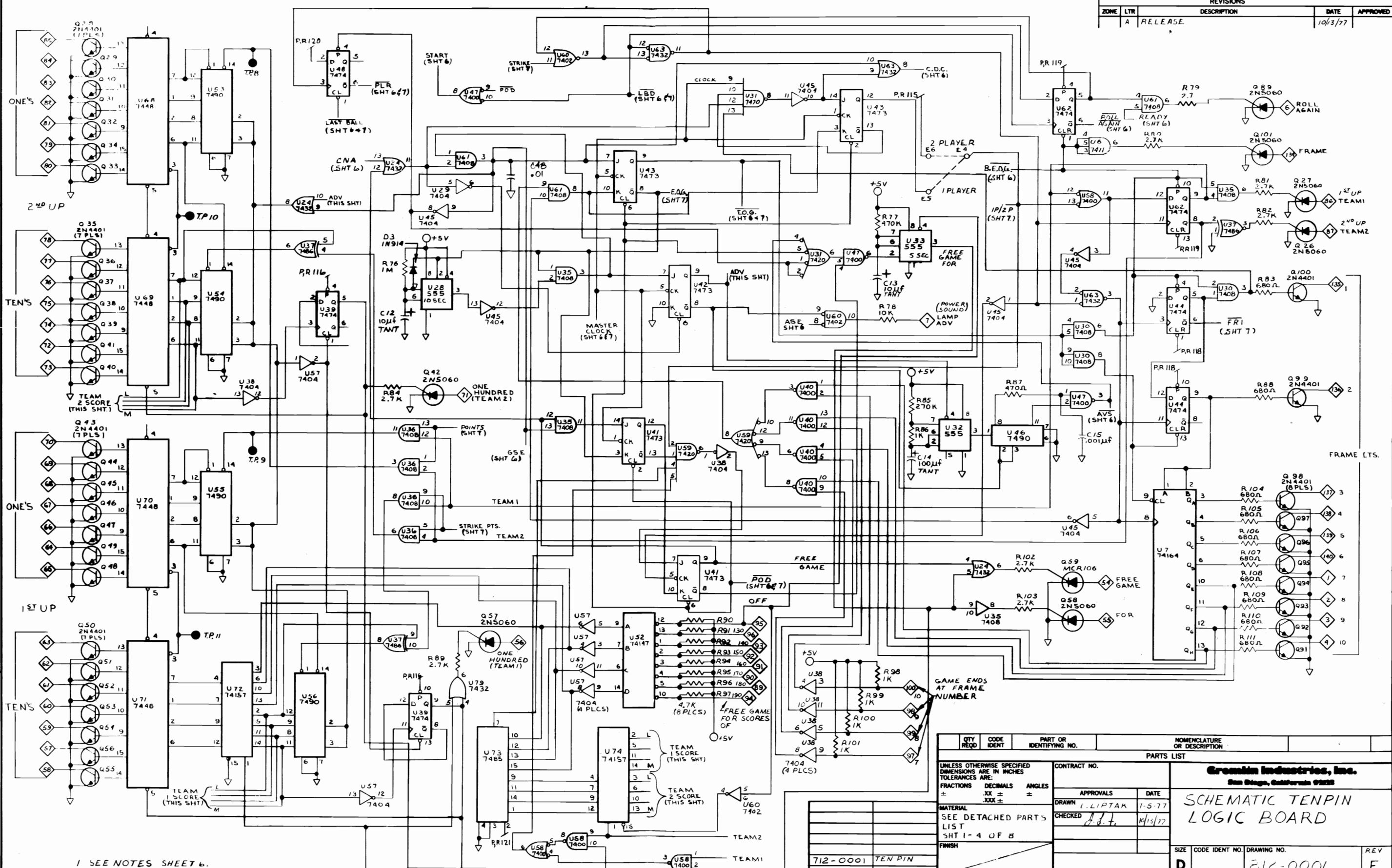
1. SEE NOTES SHEET 6
 NOTES: UNLESS OTHERWISE SPECIFIED

QTY REQD		CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX ± ± .XXX ± ±				
MATERIAL		CONTRACT NO.		
SEE DETACHED PART LIST		APPROVALS DATE		
FINISH		DRAWN L LIPTAK 6-28-77		
712-0001 TEN PIN		CHECKED [Signature] 10/13/77		
NEXT ASSY USED ON		APPD.		
APPLICATION		DO NOT SCALE DRAWING		

PARTS LIST		Gromlin Industries, Inc. San Diego, California 92122	
SCHEMATIC TEN PIN LOGIC BOARD			
SIZE	CODE IDENT NO.	DRAWING NO.	R. V.
D	812 0001	F	
SCALE NONE	SHEET 7 OF 6		

812-0001 F

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE
A	RELEASE		10/3/77



NOTES: 1. SEE NOTES SHEET 6.
UNLESS OTHERWISE SPECIFIED

QTY	REQD	CODE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:				
FRACTIONS	DECIMALS	ANGLES		
±	.XX ±	±		
MATERIAL				
SEE DETACHED PARTS LIST SHT 1-4 OF 8				
FINISH				
CONTRACT NO.				
APPROVALS				
DATE				
DRAWN L. LIPTAK 1-5-77				
CHECKED J.D.F. 10/15/77				
Gromlin Industries, Inc. San Diego, California 92122				
SCHEMATIC TENPIN LOGIC BOARD				
SIZE	CODE	IDENT NO.	DRAWING NO.	REV
D			812-0001	F
SCALE NONE				
SHEET 8 OF 8				

712-0001	TENPIN
NEXT ASSY	USED ON
APPLICATION	
DO NOT SCALE DRAWING	

812-0001 F

GREMLIN

PARTS LIST

TITLE ASSEMBLY
POWER SOUND BD.
TEN PIN

812-0002
DWG NO

SH 1
OF 8

A
REV

RELEASED

DRAWN LIPTAK L.J.

ENGR

SIGN

CHECK

APPR

R	AUTH	REVISION DESCRIPTION	DRAFT	CHECK	APPR
		RELEASED	<i>[Handwritten initials]</i>		
		ECN 145			
		ECN 151			
OCT 13 1977					
SHT 6-8 "D" SIZE DRAWINGS					

GREMLIN

PARTS
LISTTITLE ASSEMBLY
POWER SOUND BD.
TEN PIN812-0002
DWG NOSH 2
OF 8

REV

ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	150-0013							2	CAP.E. 100UF 25V	C 49, 54
	151-0001							20	CAP.CER. .05UF 50V	C3,5,8,10,11,14,16
	" "								" " " " "	18,19,24,29,31,32,36
	" "								" " " " "	38,39,45,59,77,78
	151-0002							1	CAP.CER 100PF 50V	C56
	151-0006							4	CAP.CER .02UF 50V	C60-63
	151-0008							1	CAP.CER. .001UF 50V	C51
	151-0011							4	CAP.CER. .01UF 50V	C2,13,20,22
	151-0012							1	CAP.CER. .1UF 50V	C1
	151-0009							1	CAP.CER. .003UF 100V	C79
	152-0001							4	CAP.F. .1UF 100V	C69,72,73,34
	152-0007							1	CAP.F. .001UF 250V	C70
	152-0009							1	CAP.F. .0033UF 25V	C35
	152-0010							1	CAP.F. .022UF 100V	C71
	152-0012							3	CAP.F. .047UF 200V	C42,75,76
	152-0017							4	CAP.F. .33UF 100V	C47,48,52,53
	152-0020							5	CAP.F. .47UF 100V	C27,28,43,67,68
	152-0004							1	CAP.F. .0022UF 100V	C66
	153-0001							11	CAP.TANT 10UF 25V	C7,15,23,26,41,55
	" " "								" " " " "	58,64,65,74, 80 , 4
	153-0002							7	CAP.TANT 1UF 25V	C6,12,17,25,33,40,57
	153-0003							4	CAP.TANT 2.2UF 25V	C9,30,37,44
	153-0006							2	CAP.TANT. 33UF 25V	C21,46

GREMLIN

PARTS
LISTTITLE ASSEMBLY
POWER SOUND BD.
TEN PIN812 - 0002
DWG NOSH 3
OF 8

REV

ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
1	170 - 0106							1	PCB. T/P PWR/SND	
2	212 - 0002							4	CONN. FEM 10 PIN	
	313 - 0004							1	I.C. LM741EN DIP	U11
	313 - 0005							3	I.C. LM566 CN DIP	U12 - 14
	313 - 0008							3	I.C. LM348 DIP	U5 - 7
	313 - 0014							1	I.C. LM 340T-12	U15
	313 - 0015							1	I.C. LM 320T-12	U16
	313 - 0022							3	I.C. LM556	U1, 4, 10
	314 - 0001							1	I.C. NE555 DIP	U9
	315 - 0033							1	I.C. 4016	U8
	315 - 0034							1	I.C. 4001	U2
	315 - 0035							1	I.C. MM5837	U3
	471 - 0271							2	RES 270 Ω 1/2 W 5%	R85, 91
	471 - 0102							33	RES 1K 1/2 W 5%	R1, 2, 9, 12, 13, 20, 30
	" "							"	" " " " "	32, 38, 39, 42, 47, 54, 61
	" "							"	" " " " "	71, 84, 89, 93, 96,
	" "							"	" " " " "	97, 112 - 123, 126
	471 - 0103							36	RES 10K 1/2 W 5%	R11, 16, 27-29, 33, 34
									48, 52, 55, 62, 67-69, 72, 73, 78, 80, 86, 102, 104	
									106, 107, 110, 111, 129 - 132, 149, 150, 154, 155, 158	
									162, 163	

GREMLIN

PARTS
LISTTITLE ASSEMBLY
POWER SOUND BD
TENPIN812-0002
DWG NOSH 4
OF 8

REV

ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	471-0104							9	RES 100K 1/2W 5%	R4,31,35,49,58,60
	" " "								" " "	70,87,98
	471-0122							2	RES 1.2K 1/2W 5%	R133,134
	471-0124							2	RES 120K 1/2W 5%	R103,161
	471-0151							1	RES 150Ω 1/2W 5%	R160
	471-0152							3	RES 1.5K 1/2W 5%	R151,152,156
	471-0154							1	RES 150K 1/2W 5%	R37
	471-0222							3	RES 2.2K 1/2W 5%	R17,82,101
	471-0223							8	RES 22K 1/2W 5%	R65,77,135,143,144
	" " "								" " "	146,147,157
	471-0224							4	RES 220K 1/2W 5%	R43,81,136,137
	471-0272							2	RES 2.7K 1/2W 5%	R88,92
	471-0330							1	RES 33Ω 1/2W 5%	R51
	471-0331							3	RES 330Ω 1/2W 5%	R7,14,18
	471-0332							12	RES 3.3K 1/2W 5%	R8,19,24,40,41,45
	" " "								" " "	46,74,79,95,100,108
	471-0334							4	RES 330K 1/2W 5%	R26,36,66,105
	471-0333							1	RES 33K 1/2W 5%	R99
	471-0471							1	RES 470Ω 1/2W 5%	R3
	471-0472							3	RES 4.7K 1/2W 5%	R6,23,59
	471-0473							7	RES 47K 1/2W 5%	R21,22,44,56,57,83,
	" " "								" " "	145
	471-0512							1	RES 5.1K 1/2W 5%	R164
	471-0561							2	RES 560Ω 1/2W 5%	R124,127
	471-0562							1	RES 5.6K 1/2W 5%	R109

GREMLIN

PARTS
LISTTITLE ASSEMBLY
POWER SOUND BD
TEN PIN812-0002
DWG NOSH 5
OF 8

REV

ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	471-0563							2	RES 56K 1/2W 5%	R128,148
	471-0623							1	RES 62K 1/2W 5%	R64
	471-0682							3	RES 6.8K 1/2W 5%	R5,63,125
	471-0683							4	RES 68K 1/2W 5%	R15,76,25,75
	471-0823							2	RES 82K 1/2W 5%	R10,53
	471-0510							2	RES 51Ω 1/2W 5%	R50,165
	472-0010							2	RES 1Ω 1W 5%	R90,94
	471-0821							2	RES 820Ω 1/2 5%	R166,167
	475-0004							1	POT 1K TRIMMER	R159
	475-0006							1	POT 100K	R153
	475-0008							5	POT 50K CTS	R138-142
	481-0001							6	DIODE 1N4002	D1,2,10-13
	481-0006							9	DIODE 1N914	D4-9,16,17
	481-0008							2	DIODE ZENER 1N5231	D14,15
	482-0006							8	XISTOR 2N4403	Q3,14,20,26,31,32,37,39
	482-0009							3	XISTOR SCR 2N5060	Q5,6,27
	482-0012							1	XISTOR SCR MCR106-1	Q1
	482-0014							24	XISTOR 2N4401	Q2,4,7-13,16-19
	" " "							" " " "	" " " "	23-25,28-30
	" " "							" " " "	" " " "	33-36,38
	482-0016							2	XISTOR TIP 29	Q21,22
	482-0023							1	XISTOR 2N4093	Q15
3	530-0007							1	HEATSINK THM 6106B-13	

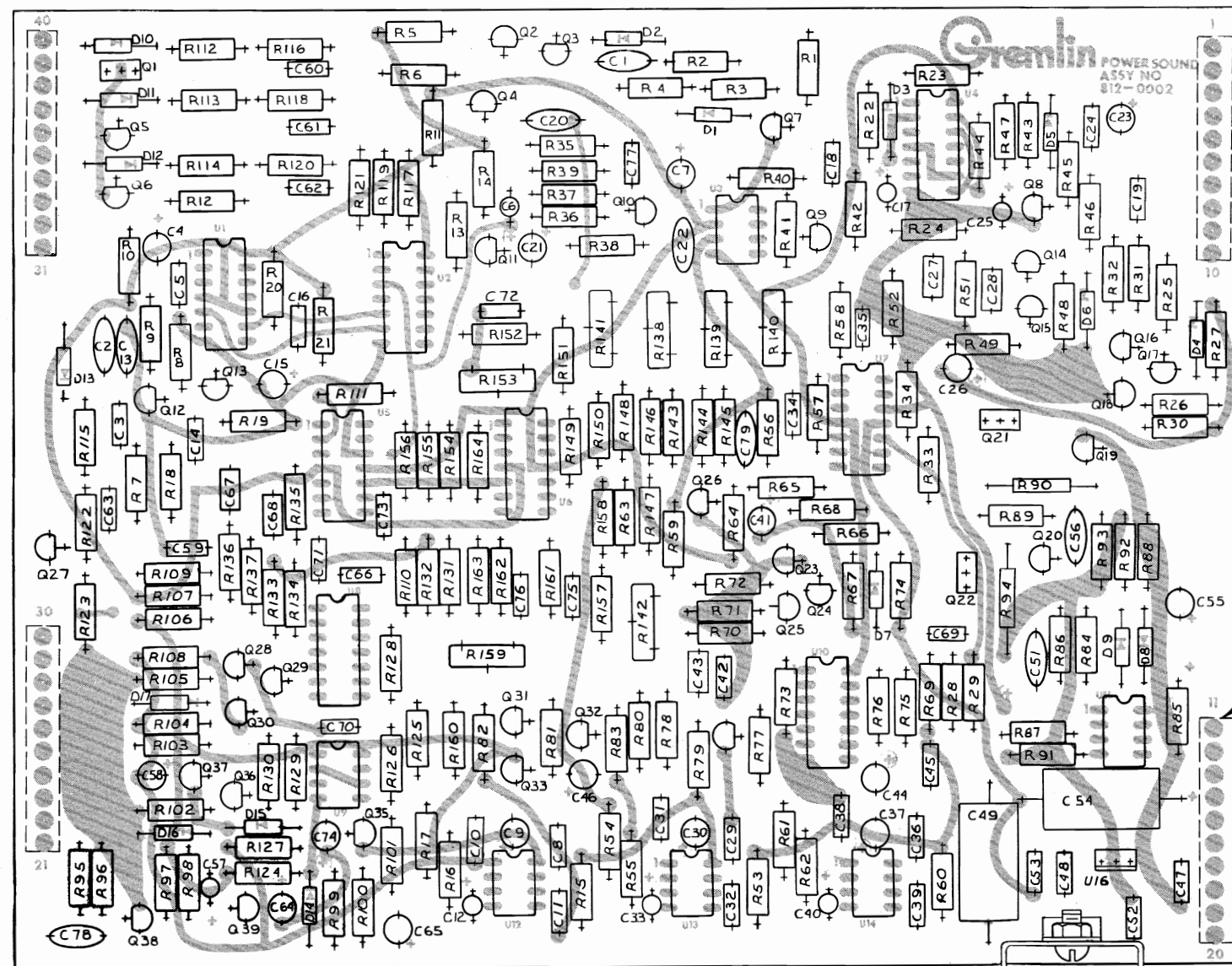
GREMLIN		PARTS LIST	TITLE ASSEMBLY POWER SOUND BD. TEN PIN				812-0002 DWG NO		SH 2 OF 8	C REV
ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	150-0013							2	CAP. E. 100uf 25V	C49, 54
	151-0001							20	CAP. CER. .05uf 50V	C3, 5, 8, 10, 11, 14, 16
	" "								" " " " "	18, 19, 24, 29, 31, 32 36
	" "								" " " " "	38, 39, 45, 59, 77, 78
	151-0002							1	CAP. CER 100PF 50V	C56
	151-0006							4	CAP. CER .02uf 50V	C60-63
	151-0008							1	CAP. CER. .001uf 50V	C51
	151-0011							4	CAP. CER. .01uf 50V	C2, 13, 20, 22
	151-0012							1	CAP. CER. .1uf 50V	C1
	151-0009							1	CAP. CER. .003uf 100V	C79
	152-0001							4	CAP. F. .1uf 100V	C69, 72, 73, 34
	152-0007							1	CAP. F. .001uf 250V	C70
	152-0009							1	CAP. F. .0033uf 25V	C35
	152-0010							1	CAP. F. .022uf 100V	C71
	152-0012							3	CAP. F. .047uf 200V	C42, 75, 76
	152-0017							4	CAP. F. .33uf 100V	C47, 48, 52, 53
	152-0020							5	CAP. F. .47uf 100V	C27, 28, 43, 67, 68
	152-0004							1	CAP. F. .0022uf 100V	C66
	153-0001							11	CAP. TANT 10uf 25V	C7, 15, 23, 26, 41, 55
	" " "								" " " " "	58, 64, 65, 74, 4
	153-0002							7	CAP. TANT 1uf 25V	C6, 12, 17, 25, 33, 40, 57
	153-0003							4	CAP. TANT 2.2uf 25V	C9, 30, 37, 44
	153-0006							2	CAP. TANT 33uf 25V	C21, 46

GREMLIN		PARTS LIST	TITLE ASSEMBLY POWER SOUND BD. TEN PIN				812 - 0002 DWG NO		SH 3 OF 8	C REV
ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
1	170 - 0106							1	PCB. T/P PWR/SND	
2	212 - 0002							4	CONN. FEM 10 PIN	
	313 - 0004							1	I.C. LM741EN DIP	U11
	313 - 0005							3	I.C. LM566 CN DIP	U12 - 14
	313 - 0008							3	I.C. LM348 DIP	U5 - 7
	313 - 0014							1	I.C. LM 340T-12	U15
	313 - 0015							1	I.C. LM 320T-12	U16
	313 - 0022							3	I.C. LM556	U1, 4, 10
	314 - 0001							1	I.C. NE 555 DIP	U9
	315 - 0033							1	I.C. 4016	U8
	315 - 0034							1	I.C. 4001	U2
	315 - 0035							1	I.C. MM 5837	U3
	471 - 0271							2	RES 270 Ω 1/2 W 5%	R85, 91
	471 - 0102							33	RES 1K 1/2 W 5%	R1, 2, 9, 12, 13, 20, 30
	" "							"	" " " " "	32, 38, 39, 42, 47, 54, 61
	" "							"	" " " " "	71, 84, 89, 93, 96,
	" "							"	" " " " "	97, 112 - 123, 126
	471 - 0103							36	RES 10K 1/2 W 5%	R11, 16, 27-29, 33, 34
									48, 52, 55, 62, 67-69, 72, 73, 78, 80, 86, 102, 104	
									106, 107, 110, 111, 129 - 132, 149, 150, 154, 155, 158	
									162, 163	

GREMLIN		PARTS LIST	TITLE ASSEMBLY POWER SOUND BD TENPIN				812-0002 DWG NO		SH 4 OF 8	C REV
ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
	471-0104							9	RES 100K 1/2W 5%	R4,31,35,49,58,60
	" " "								" " "	70,87,98
	471-0122							2	RES 1.2K 1/2W 5%	R133,134
	471-0124							2	RES 120K 1/2W 5%	R103,161
	471-0151							1	RES 150Ω 1/2W 5%	R160
	471-0152							3	RES 1.5K 1/2W 5%	R151,152,156
	471-0154							1	RES 150K 1/2W 5%	R37
	471-0222							3	RES 2.2K 1/2W 5%	R17,82,101
	471-0223							8	RES 22K 1/2W 5%	R65,77,135,143,144
	" " "								" " "	146,147,157
	471-0224							4	RES 220K 1/2W 5%	R43,81,136,137
	471-0272							2	RES 2.7K 1/2W 5%	R88,92
	471-0330							1	RES 33Ω 1/2W 5%	R51
	471-0331							3	RES 330Ω 1/2W 5%	R7,14,18
	471-0332							12	RES 3.3K 1/2W 5%	R8,19,24,40,41,45
	" " "								" " "	46,74,79,95,100,108
	471-0334							4	RES 330K 1/2W 5%	R26,36,66,105
	471-0333							1	RES 33K 1/2W 5%	R99
	471-0471							1	RES 470Ω 1/2W 5%	R3
	471-0472							3	RES 4.7K 1/2W 5%	R6,23,59
	471-0473							7	RES 47K 1/2W 5%	R21,22,44,56,57,83,
	" " "								" " "	145
	471-0512							1	RES 5.1K 1/2W 5%	R164
	471-0561							2	RES 560Ω 1/2W 5%	R124,127
	471-0562							1	RES 5.6K 1/2W 5%	R109

GREMLIN		PARTS LIST	TITLE ASSEMBLY POWER SOUND BD TENPIN				812-0002 DWG NO		SH 5 OF 8	C REV
ITEM NO	PART NO	QTY PER ASSY						DESCRIPTION	REF DES	
	471-0563						2	RES 56K 1/2W 5%	R128,148	
	471-0623						1	RES 62K 1/2W 5%	R64	
	471-0682						3	RES 6.8K 1/2W 5%	R5,63,125	
	471-0683						4	RES 68K 1/2W 5%	R15,76,25,75	
	471-0823						2	RES 82K 1/2W 5%	R10,53	
	471-0510						2	RES 51Ω 1/2W 5%	R50,165	
	472-0010						2	RES 1Ω 1W 5%	R90,94	
	471-0821						2	RES 820Ω 1/2 5%	R166,167	
	475-0004						1	POT 1K TRIMMER	R159	
	475-0006						1	POT 100K	R153	
	475-0008						5	POT 50K CTS	R138-142	
	481-0001						6	DIODE 1N4002	D1,2,10-13	
	481-0006						9	DIODE 1N914	D4-9,16,17	
	481-0008						2	DIODE ZENER 1N5231	D14,15	
	482-0006						8	XISTOR 2N4403	Q3,14,20,26,31,32,37,39	
	482-0009						3	XISTOR SCR 2N5060	Q5,6,27	
	482-0012						1	XISTOR SCR MCR106-1	Q1	
	482-0014						24	XISTOR 2N4401	Q2,4,7-13,16-19	
	" " "							" " " "	23-25,28-30	
	" " "							" " " "	33-36,38	
	482-0016						2	XISTOR TIP 29	Q21,22	
	482-0023						1	XISTOR 2N4093	Q15	
3	530-0007						1	HEATSINK THM6106B-13		

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
C		RELEASED	10/14/77	J. L. F.



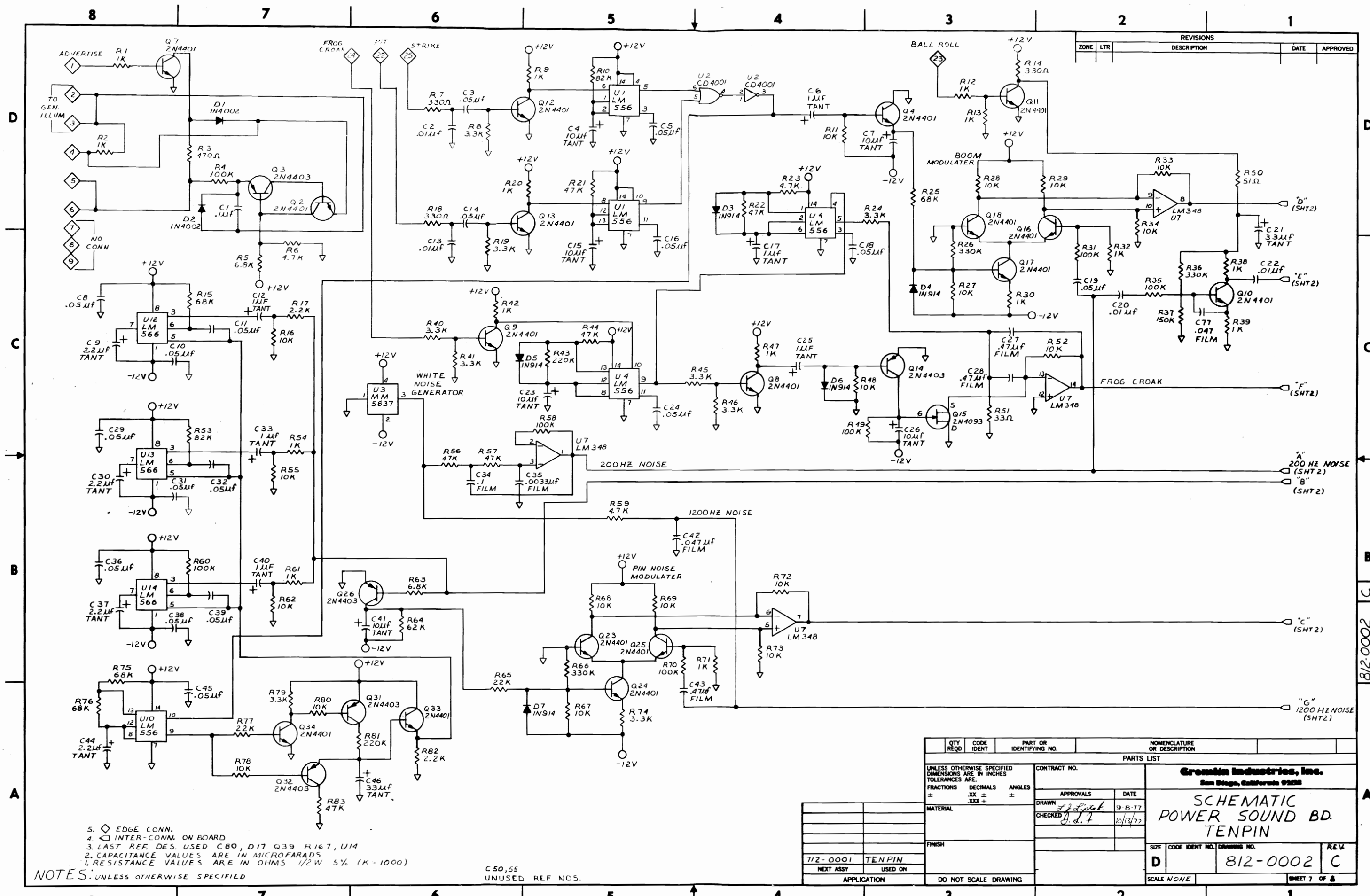
SEE DETACHED PARTS LIST 812-0002

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.	
FRACTIONS ±	DECIMALS .XX ±	ANGLES ±	Gremlin Industries, Inc. San Diego, California 92123
APPROVALS			
DRAWN LIPTAK L.J.			DATE 10/3/77
CHECKED J. L. F.			DATE 10/14/77
MATERIAL		FINISH	
712-0001 TENPIN		NEXT ASSY USED ON	
APPLICATION		DO NOT SCALE DRAWING	
SIZE D		CODE IDENT NO. 812-0002	DRAWING NO. C
SCALE 2x1		SHEET 6 OF 8	

NOTES: MOUNT CONN. ON CIRCUIT SIDE OF BOARD
UNLESS OTHERWISE SPECIFIED

712-0001	TENPIN
NEXT ASSY	USED ON
APPLICATION	DO NOT SCALE DRAWING

812-0002 C



REVISIONS			
ZONE	LTR	DESCRIPTION	DATE

QTY	CODE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:			
FRACTIONS	DECIMALS	ANGLES	
±	XX ±	±	
CONTRACT NO.			
APPROVALS		DATE	
DRAWN		9-8-77	
CHECKED		10/13/77	
MATERIAL			
FINISH			
7/2-0001 TEN PIN			
NEXT ASSY USED ON			
APPLICATION			
DO NOT SCALE DRAWING			
SCALE NONE		SHEET 7 OF 8	

Gremkin Industries, Inc.
San Diego, California 92108

SCHEMATIC POWER SOUND BD. TENPIN

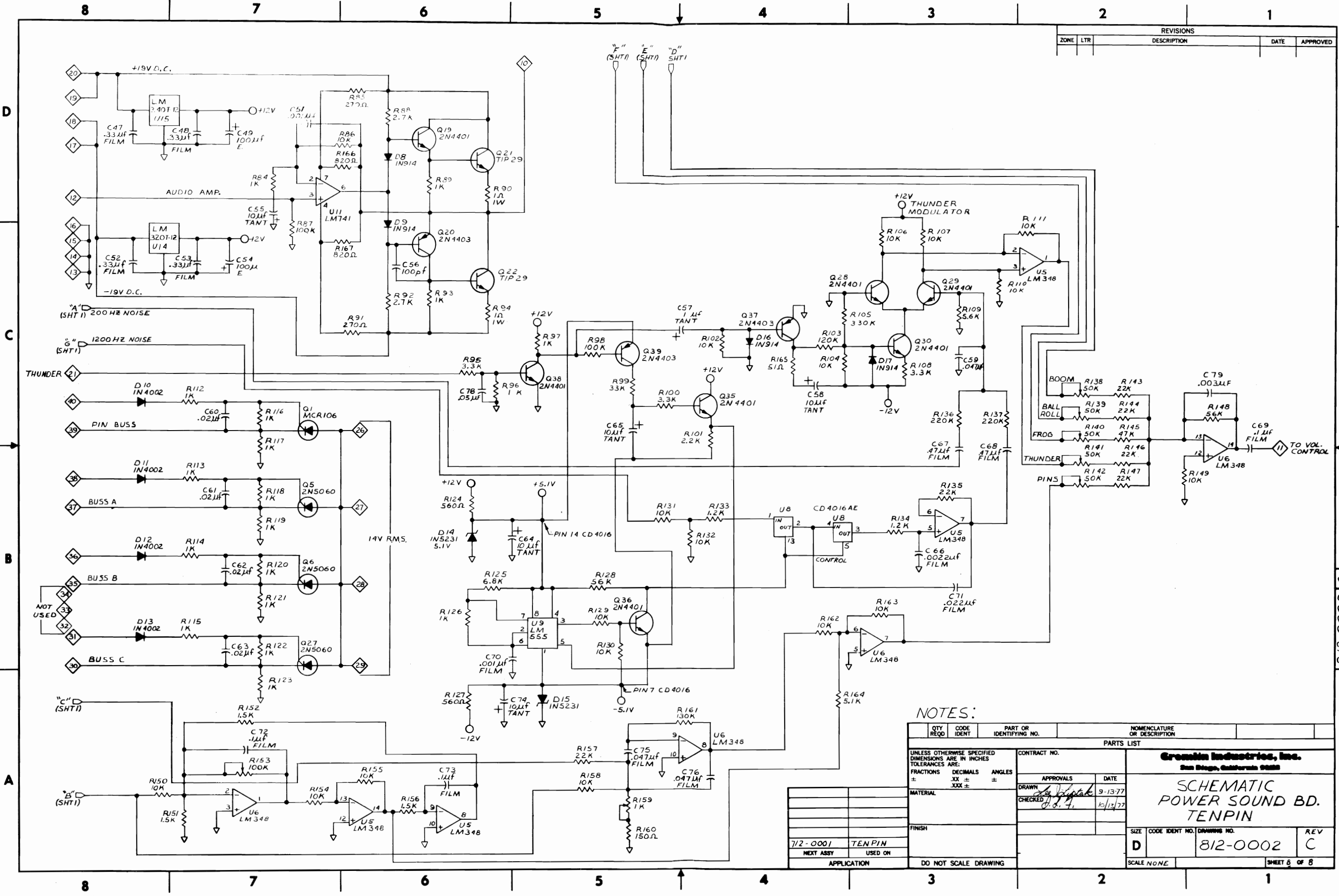
SIZE CODE IDENT NO. DRAWING NO. R.E.V.
D 812-0002 C

NOTES: 5. \diamond EDGE CONN.
4. \square INTER-CONN. ON BOARD
3. LAST REF. DES. USED C80, D17 Q39 R167, U14
2. CAPACITANCE VALUES ARE IN MICROFARADS
1. RESISTANCE VALUES ARE IN OHMS 1/2W 5% (K=1000)

C50,55 UNUSED REF NOS.

812-0002

REVISIONS			
ZONE	LTR	DESCRIPTION	DATE



NOTES:

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.	
FRACTIONS	DECIMALS	ANGLES	
± .XX ±	± .XXX ±	±	
MATERIAL		APPROVALS	
		DATE	
FINISH		DRAWN	
		CHECKED	
7/2-0001	TENPIN		
NEXT ASSY	USED ON		
APPLICATION		DO NOT SCALE DRAWING	

Gromlin Industries, Inc.		San Diego, California 92161	
SCHEMATIC POWER SOUND BD. TENPIN			
SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		812-0002	C
SCALE NONE		SHEET 6 OF 8	

GREMLIN		PARTS LIST	TITLE ASSEMBLY POWER SOUND BD. TEN PIN				812 - 0002 DWG NO		SH 3 OF 8	G REV
ITEM NO	PART NO	QTY PER ASSY							DESCRIPTION	REF DES
1	170 - 0106							1	PCB. T/P PWR/SND	
2	212 - 0002							1	CONN. FEM 10 PIN	
	313 - 0004							1	I.C. LM741EN DIP	U11
	313 - 0005							3	I.C. LM566 CN DIP	U12 - 14
	313 - 0008							3	I.C. LM348 DIP	U5 - 7
	313 - 0014							1	I.C. LM340T-12	U15
	313 - 0015							1	I.C. LM320T-12	U16
	313 - 0022							3	I.C. LM556	U1, 4, 10
	315 - 0034							1	I.C. 4001	U2
	315 - 0035							1	I.C. MM5837	U3
	471 - 0271							2	RES 270 Ω 1/2 W 5%	R85, 91
	471 - 0102							32	RES 1K 1/2 W 5%	R1, 2, 9, 12, 13, 20, 30
	" "							"	" " " " "	32, 38, 39, 42, 47, 54, 61
	" "							"	" " " " "	71, 84, 89, 93, 96,
	" "							"	" " " " "	97, 112 - 123
	471 - 0103							32	RES 10K 1/2 W 5%	R11, 16, 27-29, 33, 34
									48, 52, 55, 62, 67-69, 72, 73, 78, 80, 86, 102, 104	
									106, 107, 110, 111,	149, 150, 154, 155, 158
									162, 163	

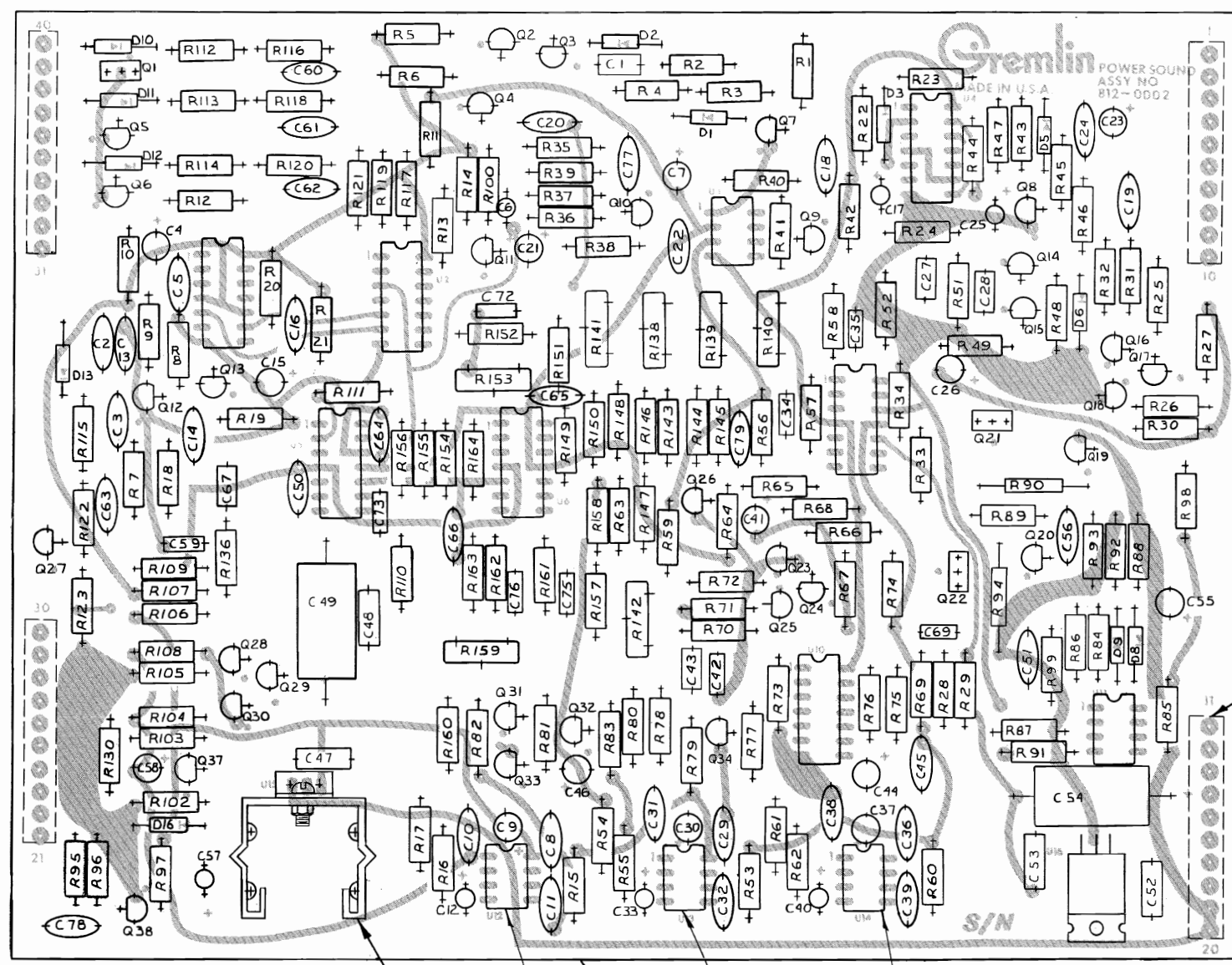
GREMLIN		PARTS LIST	TITLE ASSEMBLY POWER SOUND BD TENPIN					812-000Z DWG NO		SH 4 OF 8	G REV
ITEM NO	PART NO	QTY PER ASSY						DESCRIPTION	REF DES		
	471-0104						8	RES 100K 1/2W 5%	R4,31,35,49,58,60		
	" " "							" " "	70,87		
	471-0124						2	RES 120K 1/2W 5%	R103,161		
	471-0151						1	RES 150Ω 1/2W 5%	R160		
	471-0152						3	RES 1.5K 1/2W 5%	R151,152,156		
	471-0154						1	RES 150K 1/2W 5%	R37		
	471-0222						2	RES 2.2K 1/2W 5%	R17,82		
	471-0223						7	RES 22K 1/2W 5%	R65,77, 143,144		
	" " "							" " " "	146,147,157		
	471-0224						3	RES 220K 1/2W 5%	R43,136,81		
	471-0272						2	RES 2.7K 1/2W 5%	R88,92		
	471-0330						1	RES 33Ω 1/2W 5%	R51		
	471-0331						3	RES 330Ω 1/2W 5%	R7,14,18		
	471-0332						11	RES 3.3K 1/2W 5%	R8,19,24,40,41,45		
	" " "							" " " "	46,74,79,95, ,108		
	471-0334						4	RES 330K 1/2W 5%	R26,36,66,105		
	471-0471						1	RES 470Ω 1/2W 5%	R3		
	471-0472						3	RES 4.7K 1/2W 5%	R6,23,59		
	471-0473						7	RES 47K 1/2W 5%	R21,22,44,56,57,145		
									R83		
	471-0512						1	RES 5.1K 1/2W 5%	R164		
	471-0562						1	RES 5.6K 1/2W 5%	R109		

GREMLIN

PARTS
LISTTITLE ASSEMBLY
POWER SOUND BD
TENPIN812-0002
DWG NOSH 5
OF 86
REV

ITEM NO	PART NO	QTY PER ASSY								DESCRIPTION	REF DES
	471-0563								1	RES 56K 1/2W 5%	R14B,
	471-0623								1	RES 62K 1/2W 5%	R64
	471-0682								2	RES 6.8K 1/2W 5%	R5,63,
	471-0683								4	RES 68K 1/2W 5%	R15,76,25,75
	471-0823								2	RES 82K 1/2W 5%	R10,53
	471-0510								2	RES 51Ω 1/2W 5%	R100,130
	472-0010								2	RES 1Ω 1W 5%	R90,94
	471-0821								2	RES 820Ω 1/2 5%	R98,99
	475-0004								1	POT 1K TRIMMER	R159
	475-0006								1	POT 100K	R153
	475-0008								5	POT 50K CTS	R138-142
	481-0001								2	DIODE 1N4002	D1,2,
	481-0006								10	DIODE 1N914/1N4148	D5,6,8-13,16,3
	482-0006								7	XISTOR 2N4403	Q3,14,20,26,31,32,37,
	482-0009								3	XISTOR SCR 2N5060	Q5,6,27
	482-0012								1	XISTOR SCR MCR106-1	Q1
	482-0014								22	XISTOR 2N4401	Q2,4,7-13,16-19
	" " "									" " " "	23-25,28-30
	" " "									" " " "	33,34,38
	482-0016								2	XISTOR TIP 29	Q21,22
	482-0023								1	XISTOR 2N4093	Q15
3	530-0007								1	HEATSINK 295-1	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED



② (4 PLCS)

③

②

①

②

②

NOTES:
 ⚠ USE ONLY NATIONAL SEMICONDUCTOR LM566 PER ECN 196 A
 ⚠ MOUNT CONN. ON CIRCUIT SIDE OF BOARD
 UNLESS OTHERWISE SPECIFIED

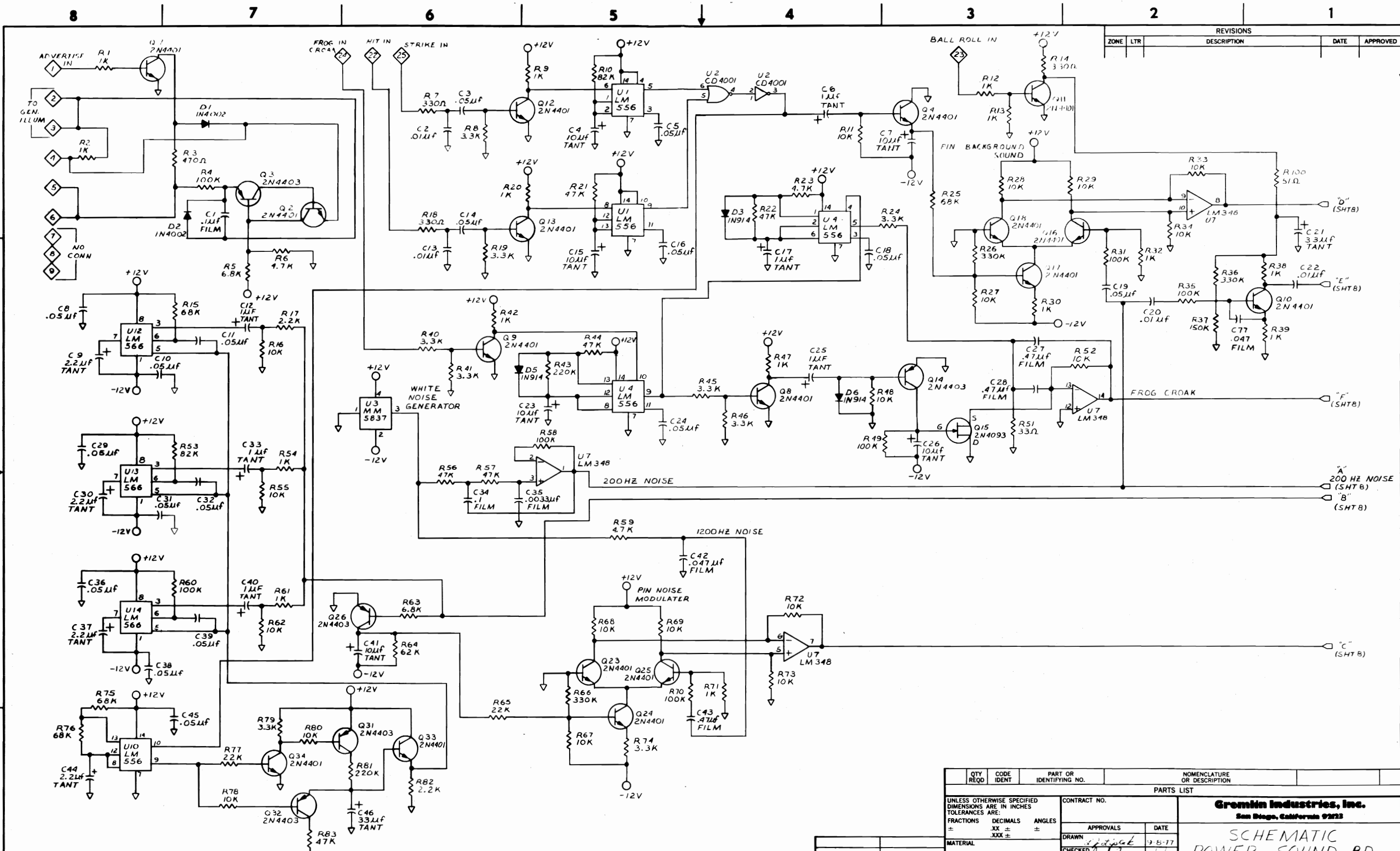
SEE DETACHED PARTS LIST 812-0002

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.	
FRACTIONS ±	DECIMALS .XX ±	ANGLES ±	APPROVALS
	.XXX ±		DATE
MATERIAL		DRAWN LIPTAK L.J. 10/3/77	
FINISH		CHECKED J.L.F. 10/14/77	
NEXT ASSY		SIZE CODE IDENT NO. DRAWING NO. REV	
USED ON		D 812-0002 G	
APPLICATION		SCALE 2X1 SHEET 6 OF 8	

Gremlin Industries, Inc.
 San Diego, California 92123

ASSEMBLY
 POWER SOUND
 BOARD

812-0002 G



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

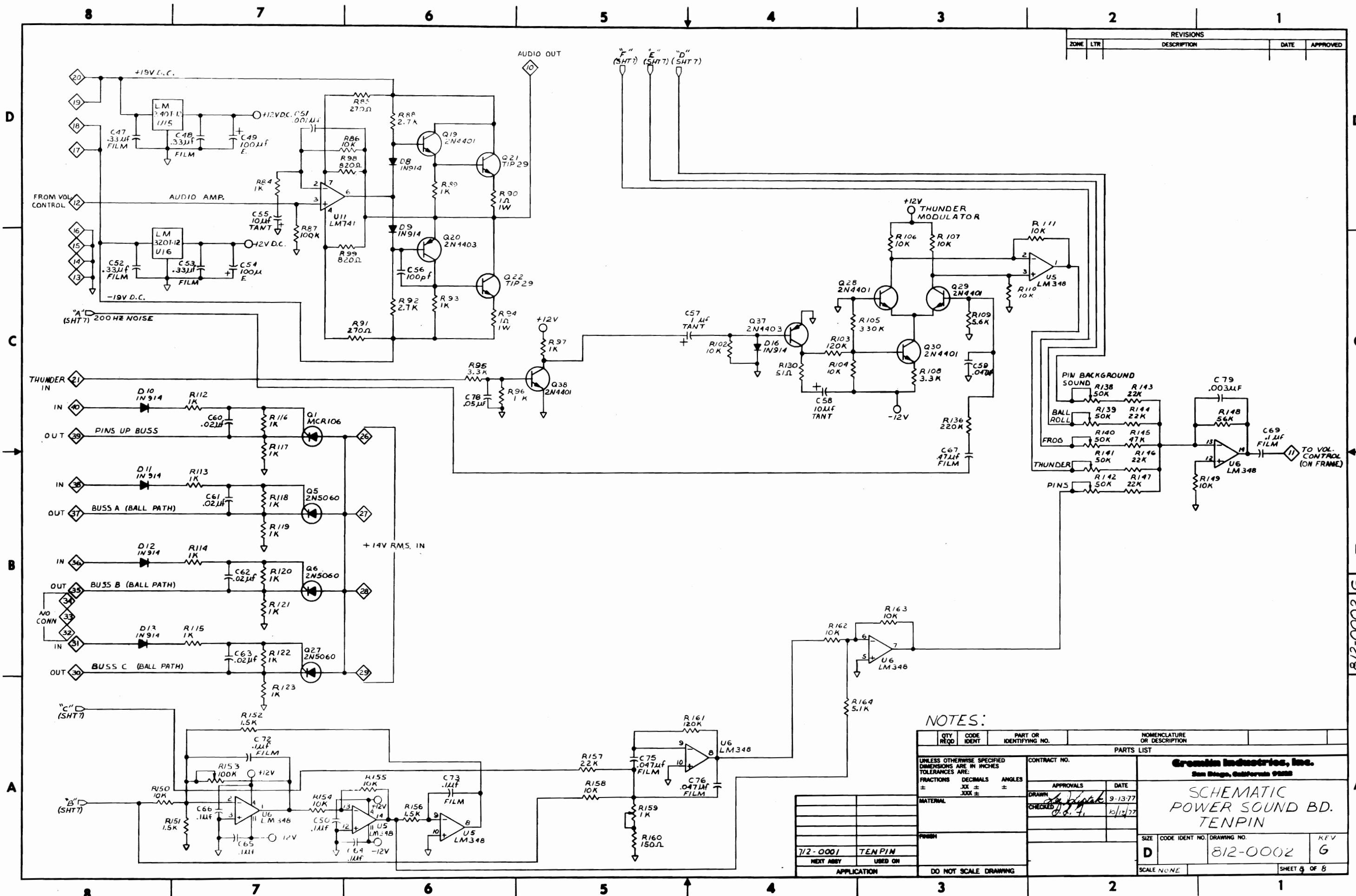
5. \diamond EDGE CONN.
 4. \square INTER-CONN. ON BOARD
 3. LAST REF. DES. USED C79, D16 Q36 R164, U14
 2. CAPACITANCE VALUES ARE IN MICROFARADS
 1. RESISTANCE VALUES ARE IN OHMS 1/2W 5% (K=1000)

Q 35,36
 R 50,101,124-129,131 135 137
 D 4,7,14,15
 U 8,9
 C 68,70,71,74
 UNUSED REF NOS.

QTY	REQD	CODE	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST				
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:				Gremlin Industries, Inc. San Diego, California 92123
FRACTIONS DECIMALS ANGLES				
± .XX ± ±				CONTRACT NO. APPROVALS DATE
MATERIAL				DRAWN CHECKED
FINISH				SIZE CODE IDENT NO. DRAWING NO. REV. D 812-0002 G
APPLICATION				SCALE N/C/NL SHEET 7 OF 8

7/2-0001	TENPIN
NEXT ASSY	USED ON
DO NOT SCALE DRAWING	

B12-0002



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED

NOTES:

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:			
FRACTIONS	DECIMALS	ANGLES	
±	.XX ±	±	
MATERIAL			
FINISH			
CONTRACT NO.			
APPROVALS		DATE	
DRAWN <i>[Signature]</i>		9-13-77	
CHECKED <i>[Signature]</i>		10/12/77	
Growth Industries, Inc. San Diego, California 92108			
SCHEMATIC POWER SOUND BD. TENPIN			
SIZE	CODE IDENT NO.	DRAWING NO.	REV
D		812-0002	G
SCALE NONE			SHEET 6 OF 8

712-0001	TENPIN
NEXT ASSY	USED ON
APPLICATION	

DO NOT SCALE DRAWING

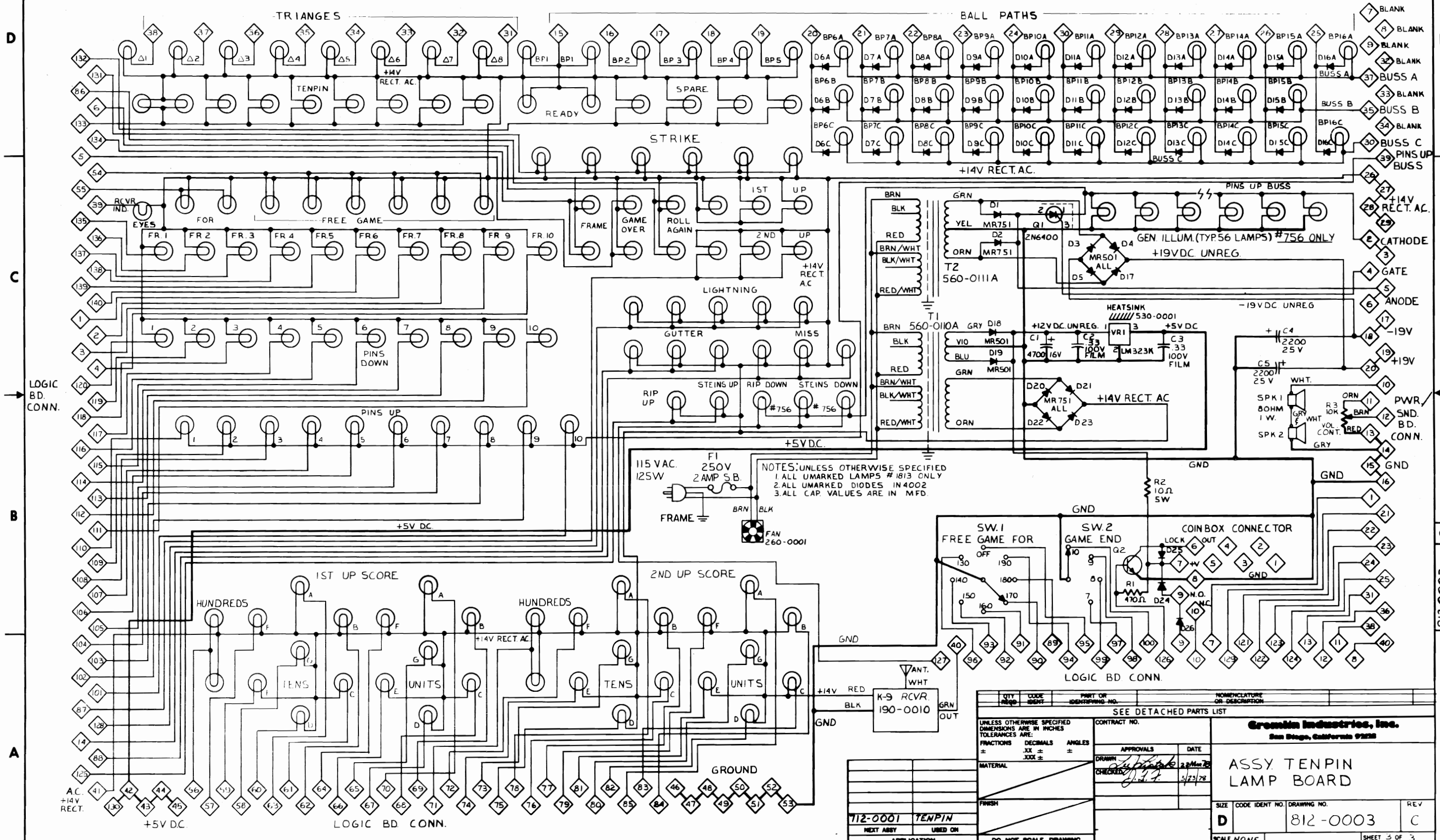
812-0002 G

Gremlin Industries, Inc. San Diego, California 92123		PARTS LIST	TITLE ASSY. TENPIN LAMP BOARD		812-0003 DWG NO		SH / OF 3	C REV
SHT 3 "D" SIZE			DRAWN <i>Lee J. Liptak</i>		ENGR			
			CHECK		APPR			
LTR	DATE	REVISION DESCRIPTION			DRAFT	CHECK	APPR	
A	3/23/78	RELEASED			<i>[Signature]</i>			
B	10/18/77	CHG'D PER ECN 159			<i>[Signature]</i>			
C	1/19/78	CHG'D PER ECN 201			<i>[Signature]</i>			

Gremlin Industries, Inc. San Diego, California 92123		PARTS LIST		TITLE ASSY. TENPIN LAMP BOARD		812 - 0003 DWG NO		SH 2 OF 3		C REV	
ITEM NO	PART NO	QTY PER ASSY					DESCRIPTION	REF DES			
1	150-0005					1	CAP E 4700 MFD 16V	C1			
2	150-0008					2	CAP E 2200 MFD 25V	C4, C5			
3	152-0017					2	CAP F .33 MF 100V	C2, C3			
4	170-0107					1	PCB T/P LAMP				
5	211-0018					3	CONN FEM. QUICK 1/8				
6	212-0003					18	CONN M 10 PIN				
7	212-0020					1	CONN M RTA 10 PIN				
8	313-0011					1	I.C. LM323K	VR1			
9	390-0002					222	SKT LAMP				
10	471-0471					1	RES 470Ω 1/2W 5%	R1			
11	474-0010					1	RES 10Ω 5W 10%	R2			
12	481-0001					35	DIODE 1N4002	D6A-D16C, D24-D26			
13	481-0002					6	DIODE MR751	D1, D2, D20-D23			
14	481-0004					6	DIODE MR501	D3-D5, D17-D19			
15	482-0010					1	XSTR PE8050	Q2			
16	482-0024					1	SCR 2N6400	Q1			
17	511-0003					1	SW SINGLE POLE 4 POS	SW2			
18	511-0005					1	SW SINGLE POLE 8 POS	SW1			
19	530-0001					1	HEATSINK				
20											
21											
22											
23											
24											
25											

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
A		RELEASED	3/1/78	U.S.F.
SEE P/L FOR FURTHER REVISIONS				

LOGIC BD. CONN.



NOTES: UNLESS OTHERWISE SPECIFIED
 1. ALL UNMARKED LAMPS #1813 ONLY
 2. ALL UNMARKED DIODES IN 4002
 3. ALL CAP. VALUES ARE IN MFD

QTY	CODE	PRINT OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
SEE DETACHED PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.	
FRACTIONS	DECIMALS	ANGLES	APPROVALS
±	.XX ±	±	DATE
±	.XXX ±		
MATERIAL		DRAWN: [Signature] 3/23/78	
FINISH		CHECKED: [Signature] 3/23/78	
APPLICATION		DO NOT SCALE DRAWING	
NEXT ASSY USED ON		SCALE NONE	

Green Industries, Inc. San Diego, California 92128			
ASSY TENPIN LAMP BOARD			
SIZE	CODE	IDENT NO.	DRAWING NO.
D			812-0003
			REV C
			SHEET 3 OF 3

112-0001 TENPIN
 NEXT ASSY USED ON
 APPLICATION

812-0003

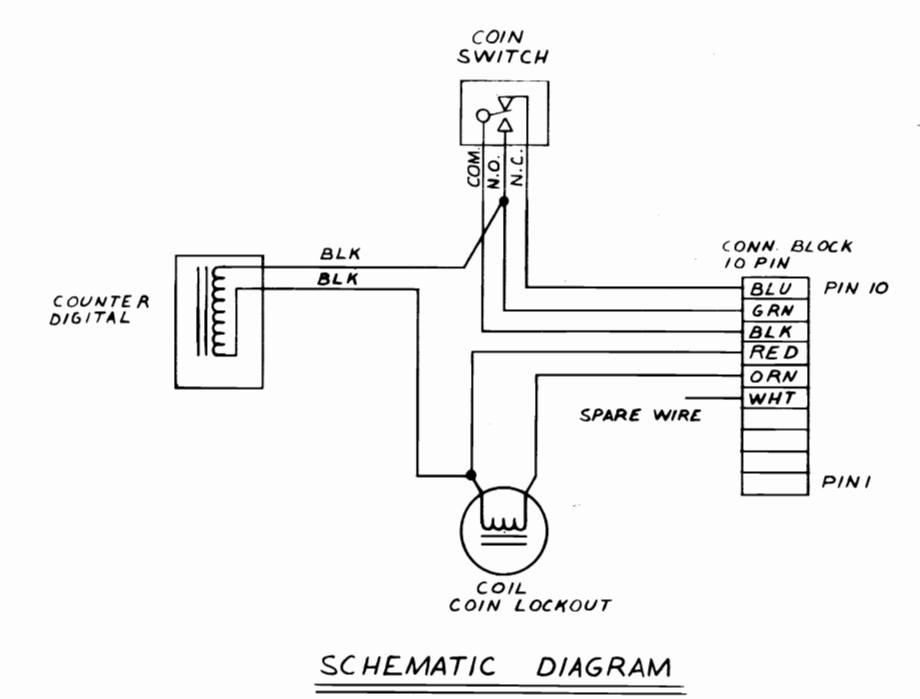
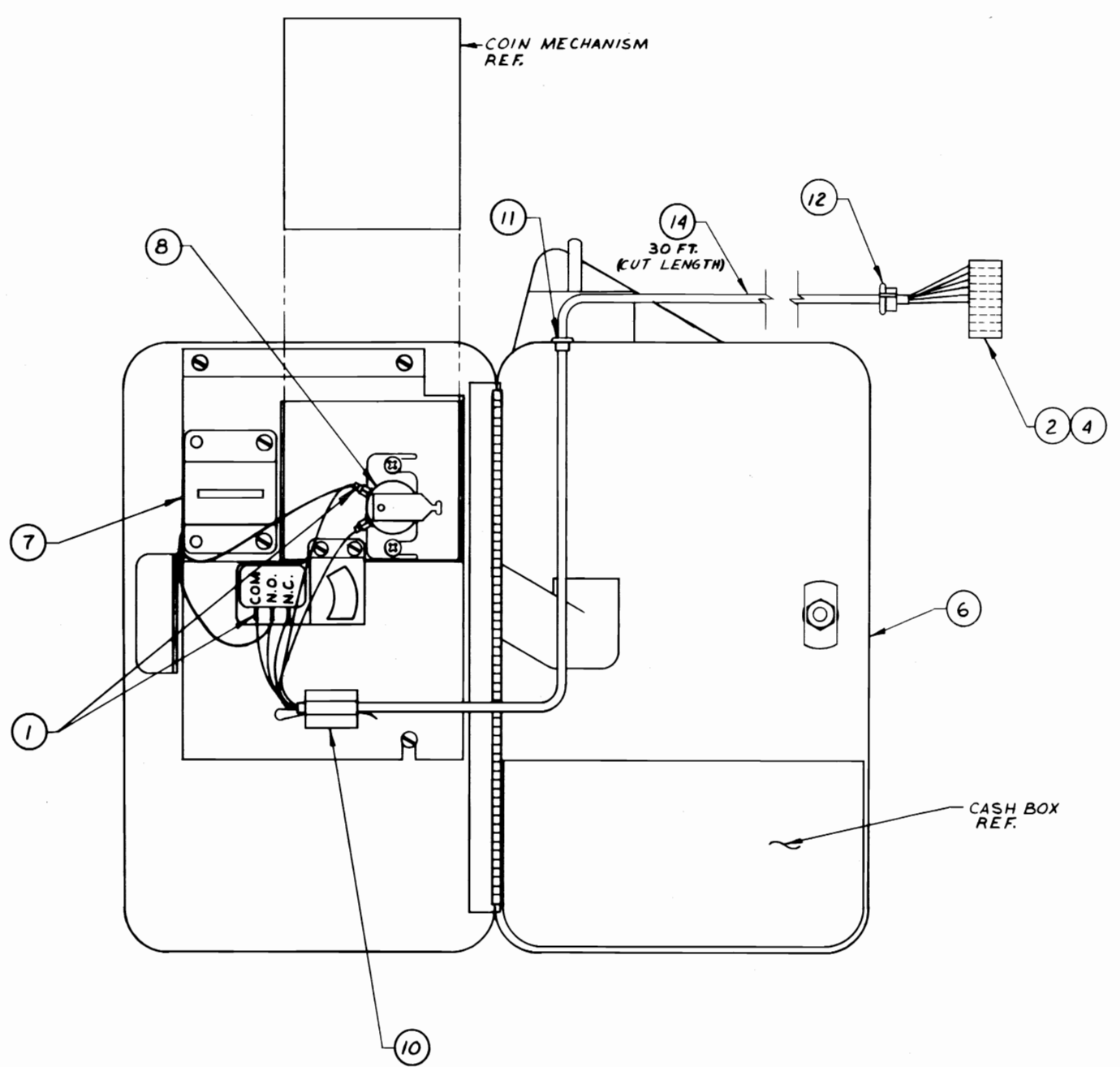
Gremlin Industries, Inc. San Diego, California 92123		PARTS LIST		TITLE ASSEMBLY UNDECALED COIN BOX		812-0005 DWG NO		SH 1 OF 3		A REV	
SHEET 3 "D" SIZE		DRAWN <i>Lee J. Lipata</i>		ENGR		CHECK		DRAFT		APPR	
LTR DATE		REVISION DESCRIPTION		DRAFT		CHECK		APPR			
A 2/25/78		RELEASED		<i>[Signature]</i>		<i>[Signature]</i>		<i>[Signature]</i>		<i>[Signature]</i>	

FORM NO. 001-1500

Gremlin Industries, Inc. San Diego, California 92123		PARTS LIST	TITLE ASSEMBLY UNDECALED COIN BOX	812-0005 DWG NO	SH 2 OF 3	A REV
ITEM NO	PART NO	QTY PER ASSY	DESCRIPTION	REF DES		
1	211-0001		5 CONN CRIMP COIN BOX			
2	211-0005		6 CONN CRIMP LOCK			
3						
4	212-0016		1 CONN, BLOCK 10 PIN FEM			
5						
6	220-0001		1 COIN BOX			
7	220-0008		1 COUNTER DIGITAL, 6V			
8	220-0061		1 COIL COIN LOCKOUT			
9						
10	280-0004		1 CLIP WIRE HOLD DOWN			
11	280-0006		1 BUSHING S/REL 3/16			
12	280-0073		1 BUSHING S/REL SPLIT			
13						
14	600-0006	30	CABLE 6 CONDCT	(30 FT. CUT LENGTH REF)		
15						
16						
17			2 SCREW PAN HD #6-32 X 3/8 (SELF TAPPING)			
18			2 SCREW FLAT HD #6-32 X 3/16			
19			2 WASHER INT. TOOTH #6 NOM.			
20						
21						
22						
23						
24						
25						

FORM NO. 001-1501

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
A		RELEASED	2/25/78	C.S.T.

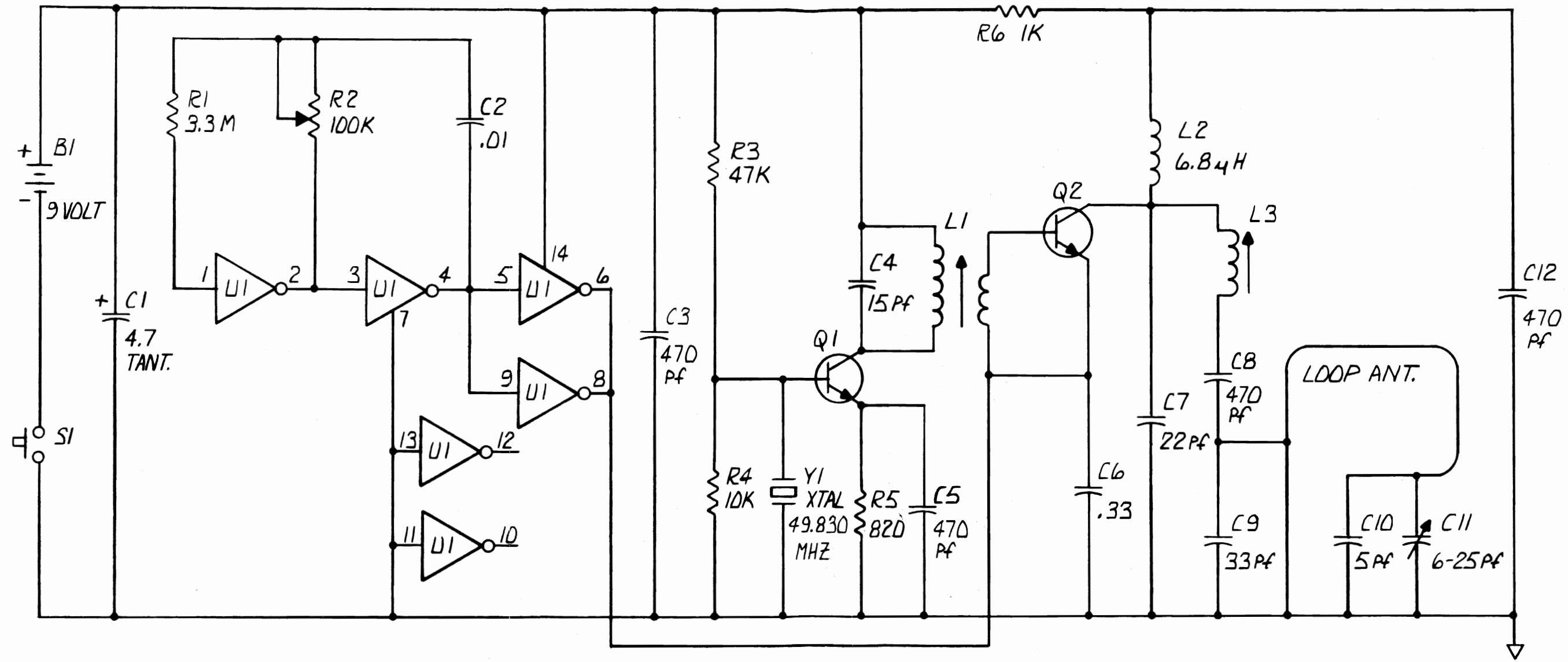


NOTES:

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
			Gremlin Industries, Inc. San Diego, California 92123
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.	ASSY COINBOX UNDECALED
FRACTIONS ±	DECIMALS XX ±	APPROVALS	
	ANGLES ±	DATE	REV
MATERIAL	XXX ±	DRAWN	D
SEE P/L		CHECKED	812-0005
FINISH			SCALE NONE
712-0001	TENPIN		SHEET 3 OF 3
NEXT ASSY	USED ON	APPLICATION	DO NOT SCALE DRAWING

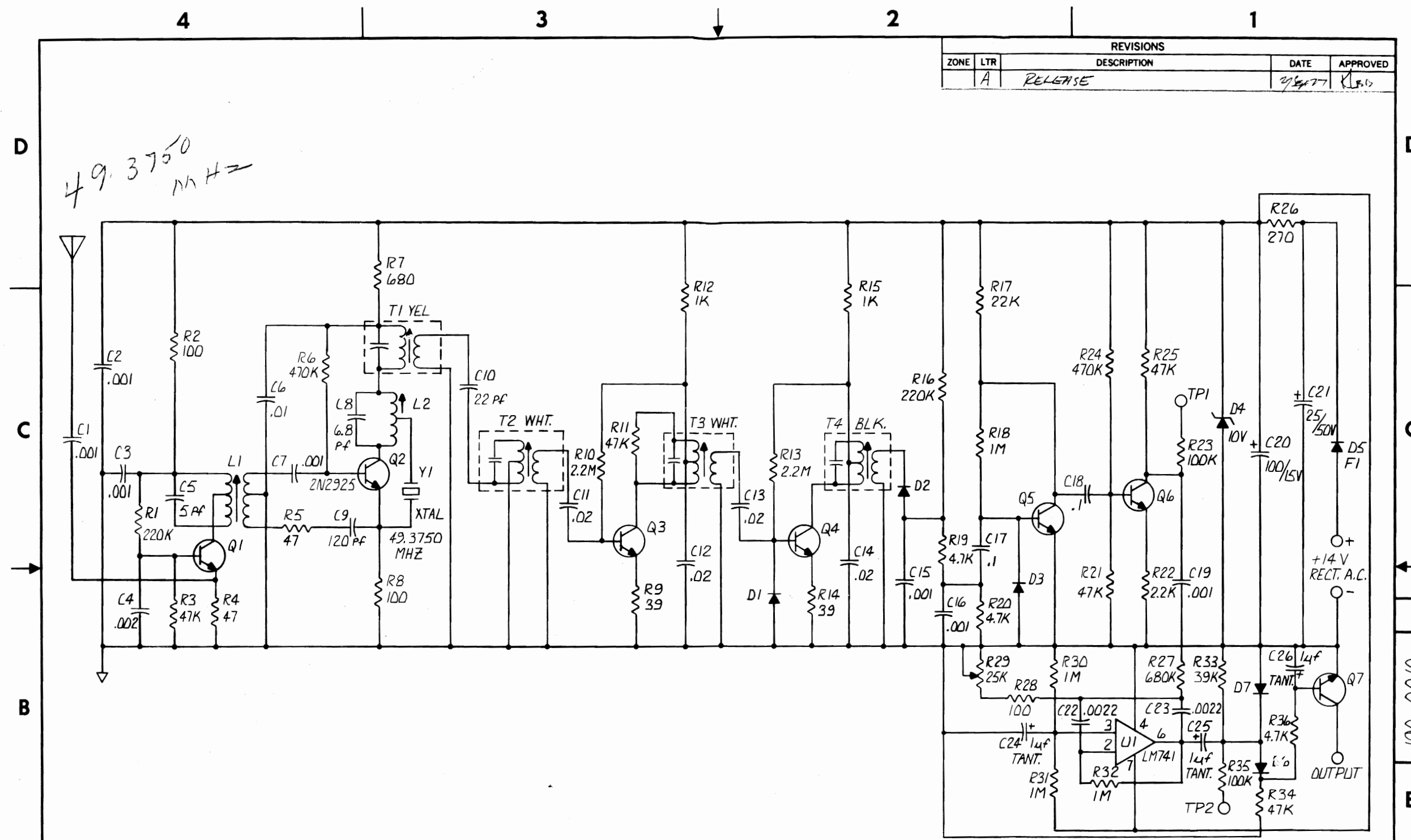
812-0005 A

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	RELEASED	36 SEP 77	K. J. P.



NOTES: (UNLESS OTHERWISE SPECIFIED.)
 1. ALL CAPACITOR VALUES IN MICROFARADS.
 2. ALL RESISTOR VALUES OHMS, 1/4 WATT, 10%.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS DECIMALS ANGLES ± .XX ± ± .XXX ±		CONTRACT NO.		Gremlin Industries, Inc. San Diego, California 92123	
MATERIAL		APPROVALS			
FINISH		DATE		49 MHz TRANSMITTER, K-9 (SCHEMATIC DIAGRAM)	
NEXT ASSY		DRAWN J. J. G. 9/26/77			
USED ON		CHECKED K. J. P. 36 SEP 77		SIZE B	
APPLICATION		DO NOT SCALE DRAWING		CODE IDENT NO. 190-0009	
				DRAWING NO. A	
				SCALE NONE	
				SHEET 1 OF 1	



49.375¹⁰
MHz

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	RELEASE	2/27/77	K.F.S.

QTY REQD	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION
PARTS LIST			
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:		CONTRACT NO.	
FRACTIONS	DECIMALS	ANGLES	Gremlin Industries, Inc. San Diego, California 92123
±	.XX ±	±	
MATERIAL		APPROVALS	DATE
FINISH		DRAWN	9/27/77
NEXT ASSY		CHECKED	9/27/77
USED ON		49 MHz RECEIVER, K-9 (SCHEMATIC DIAGRAM)	
APPLICATION			
712-0001		SIZE	CODE IDENT NO.
DO NOT SCALE DRAWING		C	190-0010
		DRAWING NO.	REV
			A
		SCALE	SHEET 1 OF 1
		NONE	

2. ALL RESISTOR VALUES IN OHMS, 1/4 WATT, 10%.
1. ALL CAPACITOR VALUES IN MICROFARADS.
NOTES: (UNLESS OTHERWISE SPECIFIED.)

190-0010

PRIMARY WINDING HOOKUP PROCEDURE FOR WALL GAME TRANSFORMERS,
PART NUMBER 560-0110A and 560-0111A.

FOR 230 VAC OPERATION HOOK:

- A. Red wires to brown/white wires.
- B. Brown wires to one side of line voltage cord.
- C. Red/white wires to other side of line voltage cord.
- D. Cap off black wires separately.
- E. Cap off black/white wires separately.

FOR 200 VAC OPERATION HOOK:

- A. Black wires to brown/white wires.
- B. Brown wires to one side of line voltage cord.
- C. Black/white wires to other side of line voltage cord.
- D. Cap off red wires separately.
- E. Cap off red/white wires separately.

FOR 115 VAC OPERATION HOOK:

- A. Brown wires to brown/white wires and to one side of line voltage cord (tie all five wires together).
- B. Red wires to red/white wires and to other side of line voltage cord (tie all five wires together).
- C. Cap off black wires separately.
- D. Cap off black/white wires separately.

FOR 100 VAC OPERATION HOOK:

- A. Brown wires to brown/white wires and to one side of line voltage cord (tie all five wires together)

FOR 100 VAC OPERATION HOOK (Continued)

- B. Black wires to black/white wires and to other side of line voltage cord (tie all five wires together).
- C. Cap off red wires separately.
- D. Cap off red/white wires separately.

NOTE:

Use wire nut type connectors for all hookups and cap offs and make sure all connections are insulated before applying power.

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PROCEDURE: (Cont'd.)

8. Return game to normal operating conditions..
9. If there are any questions concerning this service note,
please contact Customer Services at the Gremlin factory.

GREMLIN INDUSTRIES, INC.

Mike Gawarecki
Supervisor, Customer Service

TOP LEFT HAND CORNER OF LOGIC BD.

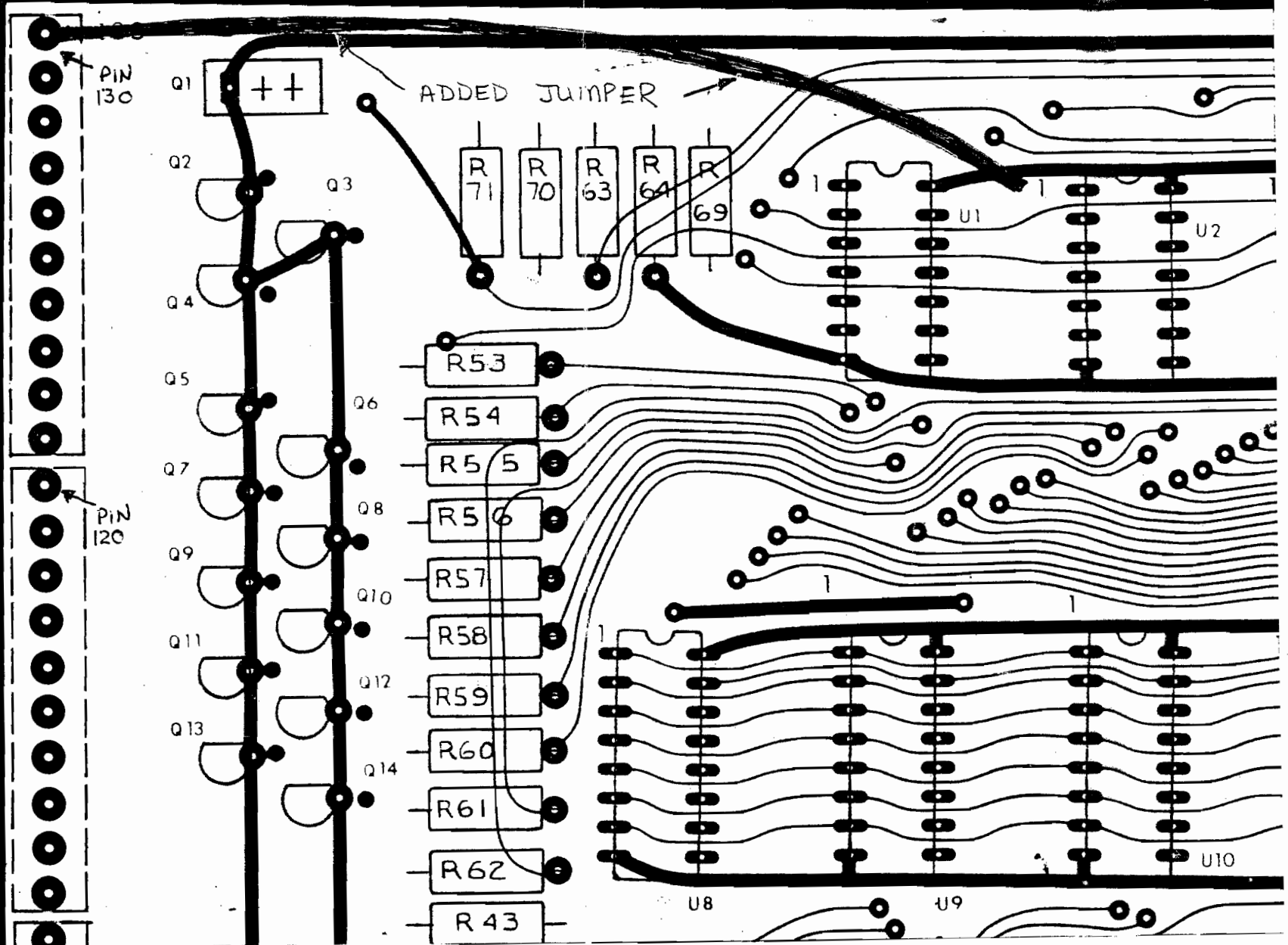
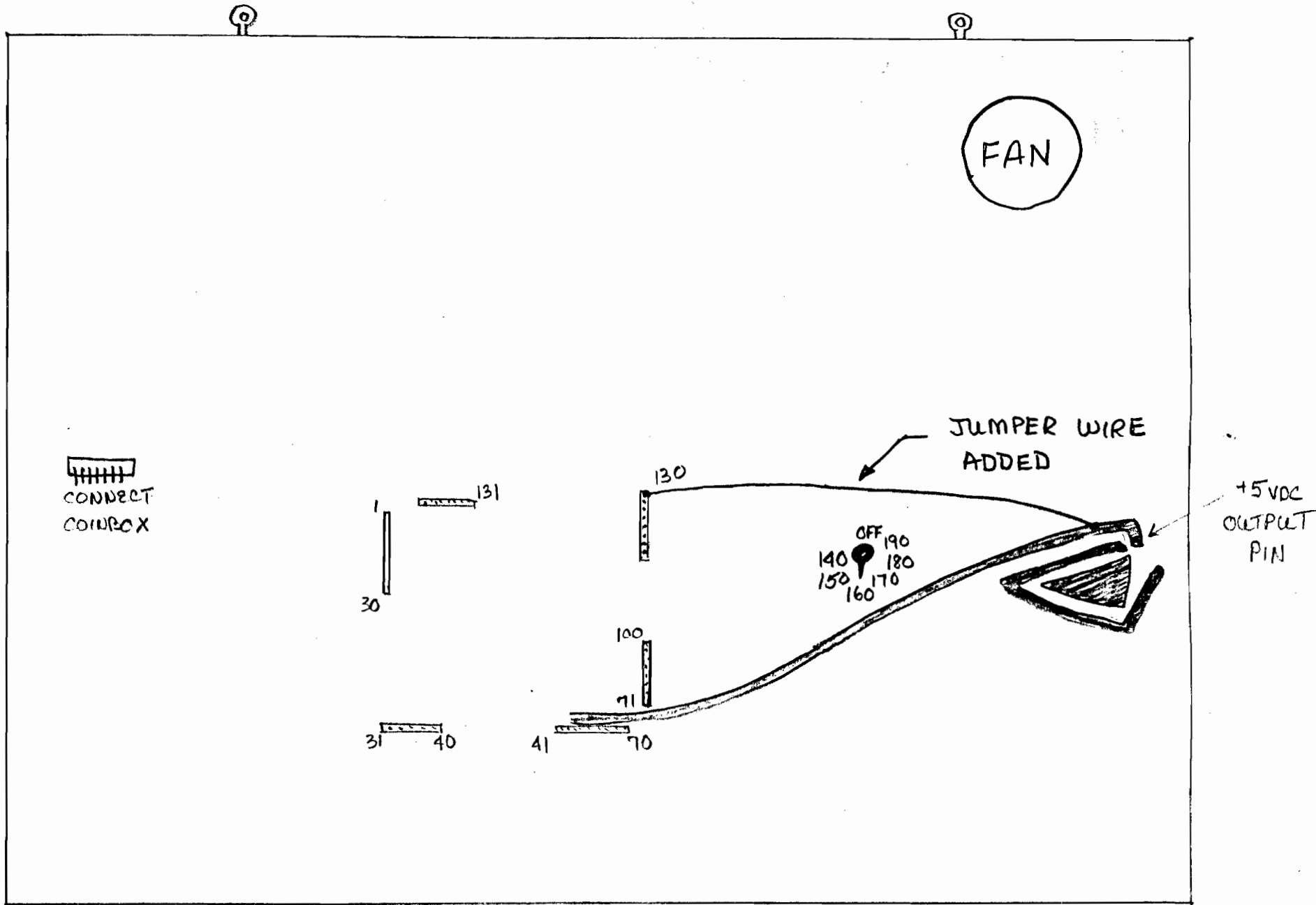


FIGURE 1



FRONT VIEW

FIGURE 2