SEGA/Gremlin

Data Bus

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New Game Takes The Field

Sega/Gremlin has a new game winning acclaim throughout the country. **Frogger**, a game for all ages, is making other game manufacturers sit up and take notice. Its lighthearted and uncomplicated game play has universal appeal for young and old alike. **Frogger** is available in both upright and cocktail models. Either could prove a boon for any location.

In the upright version there are several different game assemblies. Each one may have a different assembly to complete the game. Ensure when servicing or ordering parts that you know which game you are working on. This can easily be identified by checking the part number for your game, located on the rear panel, and matching it with the proper top assembly number in the manual. The top assemblies are listed first, 700-0066 through 700-0070, then followed by the assembly kits, 800-3182 through 800-3184 and 800-3187, and finally smaller sub-assemblies used in different assembly kits. As you can see, it is very important to keep track of the part number of the game you are working on.

There are also two different sets of game electronics. The one you have can be identified by referring to the parts list. The manual contains troubleshooting for the Sega-built electronics, 834-0086. The Gremlin-built electronics is similar in design to Moon Cresta. For troubleshooting, the techniques you have learned for Moon Cresta will apply.

Frogger joins the long list of Sega/Gremlin hits and will prove to be a money-maker in any location.

Frogger upright and cocktail by SEGA/Gremlin.

Service Schools Completed

Sega/Gremlin's service school has completed its route around the country. We thank all of those who attended for their interest and hospitality extended our instructors. In the future, we will provide service schools only upon request. If you desire to have a service school in your area, contact Sega/Gremlin Customer Service Manager, Bob Klinefelter, at (714) 277-8700.

tech—tips

G-80 POWER SUPPLY (800-0170)

GENERAL DESCRIPTION

The G-80 Power Supply incorporates all of the voltages and audio power amplification necessary to power any G-80 based video game. One of the major differences between this and other Gremlin power supplies is that the transformer (560-0055) is mounted separately from the P.C.B./heatsink/chassis combination. This transformer is noticeably larger than previous units, mainly because it has isolation windings for driving an X-Y color monitor as well as windings for a raster scan color monitor. Multiple primary taps are available for using 100, 115 or 230 VAC as the input voltage.

Table I lists the ratings of the regulated DC voltages (a standard test load) as well as the ratings of the transformer's windings used to drive the X-Y or raster scan monitor.

TABLE I

REGULATED DC VOLTAGES

+5V @ 6A
–5V @ 1A
+12V @ 1A
–12V @ 1A

AC (MONITOR) VOLTAGES

X-Y: 92 VCT @ 2A
RASTER: 100 or 115 @ 0.65A

VOLTAGE REGULATOR CIRCUIT DESCRIPTION

The +5 volt supply consists mainly of U1 and the TIPl41. U1 is a 723 voltage regulator I.C. which contains a voltage reference, error amplifier, series pass darlington transistor pair and a current limit transistor. Potentiometer R31 (+5V ADJ) divides the 7.15 (NOM) reference to 5.0 volts as the input to pin 5, the non-inverting input of the 723's error amp. Pin 4, the inverting input, senses the output voltage. The internal error amp maintains a voltage at U1 pin 10 which is higher than the 5.0V output by an amount equal to the two VBE drops of the TIP141 (a high current darlington) which acts as a current amplifier, and the IR drop across R25. Any change in the output voltage is sensed at pin 4 which causes the error amp to drive pin 10 higher or lower in order to keep the output at a steady 5.0 volts.

A "foldback" current limiter circuit is composed of R25, R26, R32, Q7 and the internal current limit transistor of U1. This circuit allows the regulator to operate normally until the load current increases to the point where the voltage across R32 reaches the value which starts turning on the internal current limit transistor. This transistor reduces the output current of the regulator to a fraction of the "knee" current when the output is shorted to ground. This feature greatly reduces the power dissipated in the TIP141 when the output is accidentally short circuited. This action occurs so quickly during a short that fuse F3 should not blow. The value of the knee current is approximately 6.5 amps, and can be increased or decreased by decreasing or increasing R26, respectively.

Capacitors C20 and C21 frequency compensate the regulator so it won't oscillate and C17 filters high frequencies at the output. Q7 temperature compensates the current limit circuit. Temperature variations of its emitter-base voltage closely match and cancel the base-emitter voltage of the internal current limit transistor. Therefore, the knee current of this regulator stays quite constant over wide temperature variations. The short circuit current is less than 100 ma.

The –5V, +12V and –12V regulators utilize three-terminal I.C.'s. These are 320T-5, 340T-12 and 320T-12 respectively. Capacitors C31, C19, C24, C18, C26, and C23 bypass high frequencies so that these regulators won't oscillate.

AUDIO AMPLIFIER CIRCUIT DESCRIPTION

The G-80 power supply has provisions for two audio power amplifiers. The input signal from the volume control is coupled to differential pair Q2 and Q3 **via** C5. Resistor R5 sets the input impedance at 22K ohms. Resistor R6 sets a current of approximately 2 ma for Q2 and Q3 to divide equally. The voltage gain of Q2 is

tech—tips

determined by its emitter current, R7, and the impedance looking into Q1, the second stage of voltage gain. Resistor R8 provides local negative feedback in the emitter of Q1 for increased open loop linearity while C9 and Q1's voltage gain provide a dominant pole open loop roll-off to ensure stability of the amplifier. Diodes D4 and D5 provide a small amount of turn on bias for the TIP120 and TIP125 darlington current amplifiers. Resistor R22 is boot-strapped by C10 to make R22 look like a current source. This technique allows maximum negative voltage swing for a symmetrical output waveform at full power. Local feedback in the output stage is provided by R14 and R15. The overall voltage gain of the amplifier is set by the ratio of R9 and R10. The actual value is

$$\frac{R9}{R10} + 1 = \frac{22K}{1K} + 1 =$$

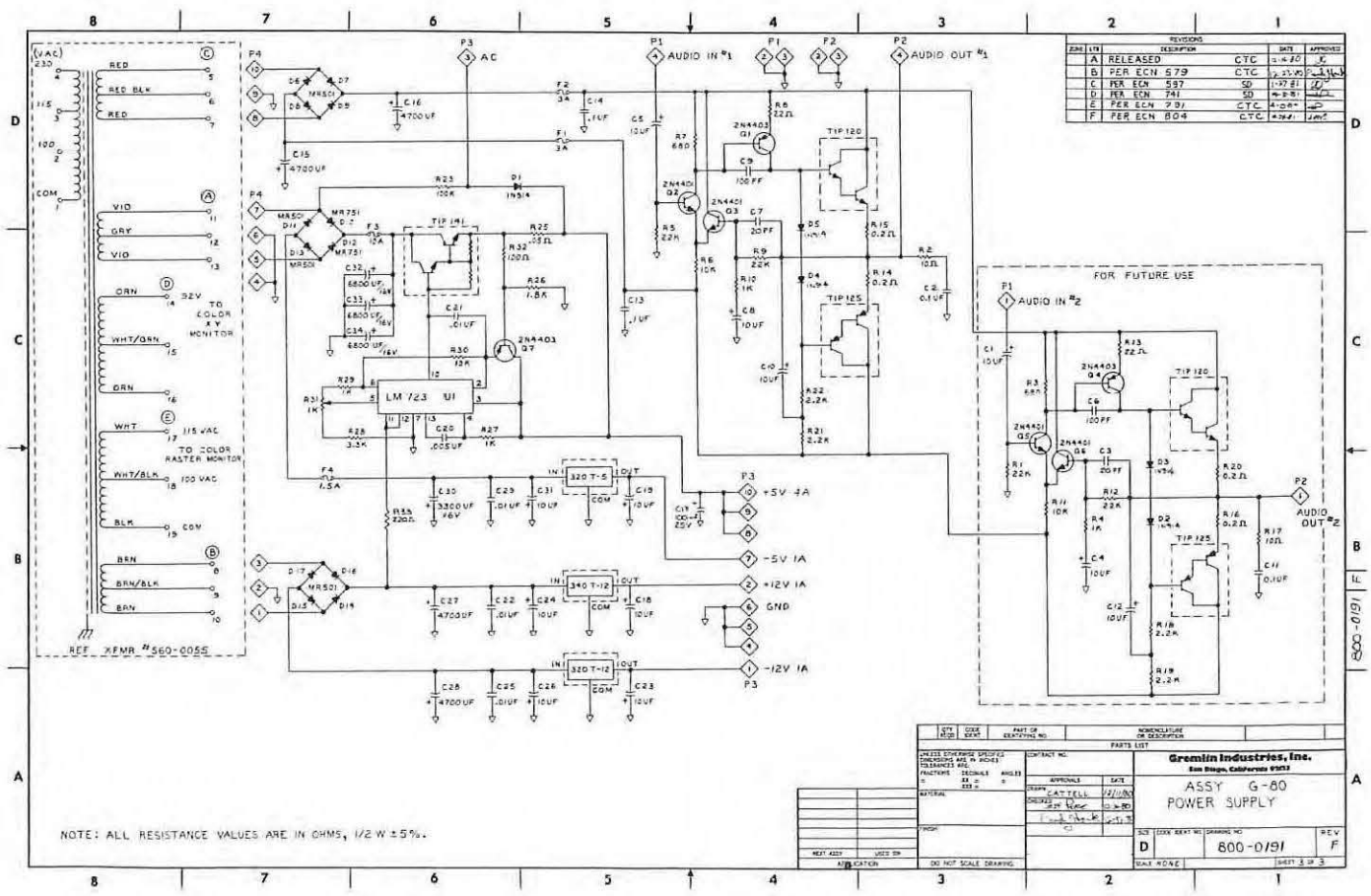
23 or 27db

Capacitor C7 adds additional high frequency compensation and the C8 — R10 combination determines the low fequency roll off point of −3db at 16 Hz. The C11 — R17 combination provides feedback loop stability in the event that a speaker is not connected. The maximum output is approximately 25 watts into 4 ohms and 15 watts into 8 ohms.

ADJUSTMENTS

1. Adjust R31 for 5.0V at the load. This compensates for wiring losses.
2. There are no other adjustments. The tolerances are as follows:

−5V ± 0.2V
+12V ± 0.5V
−12V ± 0.5V

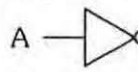


the ROM line

Starting with this installment of The ROM Line, we'll look closely at the workings of integrated circuits. We'll concentrate on those ICs commonly used in almost any video game computer. In trouble-shooting a game logic board, it is very important to have a working knowledge of the elements of that board — the ICs that compose the assorted circuits. If a technician becomes familiar with all the inputs and outputs of the ICs he is troubleshooting, he takes a big step in reducing repair time and improving his ability. So, let's start with the basic IC circuits from which more complex ICs are made. Keep in mind that in digital electronics, we are concerned with 2 voltage levels; one represents a high, or about +5 volts, the other a low, or about 0 volts. These levels are usually labelled "1" or "H" for high, and "0" or "L" for low.

High and low levels can be formatted in two ways — serial and parallel. The serial representation is simply a single line, say an input to an IC, that varies high and low. The parallel format consists of many lines that contain highs and lows. This format is commonly used in computers as either the address or data bus from the microprocessor. At any one time, there is a pattern of highs and lows on all lines of the address or data bus. Now, the basic IC elements consist of gates, or logic circuits, that produce one and only one output for a particular set of inputs. The rules for determining what output level will occur are set by the truth table for each gate. The basic gates, then, are called NOT, AND, NAND, OR, and NOR. There are only five; but we can combine them to form more complex logic circuits. For now, here's how the simplest gates work:

NOT — The schematic symbol is

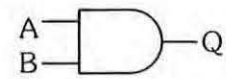


labelled A, the output is Q. So, with only one input, we have only two possible input combinations to deal with, 1 or 0. If 1 is present at A, the NOT circuit inverts the output, so a 0 appears at Q. 0 at the input produces a 1 at the output. We can construct a truth table for the NOT gate as follows:

(INPUT)	(OUTPUT)
A	Q
0	1
1	0

The truth table tells us that the NOT gate should always work this way; if you were troubleshooting one that had a low input and a low output, you would know immediately that something is wrong. The gate itself, or something connected to it, could be bad. The truth table for any IC, then, tells you what **should** occur. When the IC acts differently from the rules in its table, you know something is wrong immediately. How's that for a handy piece of test equipment? By the way, the common numerical identifier for the NOT gate is a 7404.

AND — Schematic symbol:

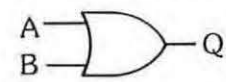


This and the remaining gates have two inputs; so, four possible combinations exist, as shown in the truth table:

A	B	Q
0	0	0
0	1	0
1	0	0
1	1	1

The AND gate always produces the outputs shown. If they are different from these, you'll know that either the gate or its connecting circuits are bad, or that you are looking at another kind of gate. The common identifier for the AND gate is 7408.

OR — Schematic symbol:

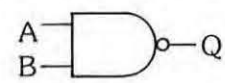


Truth table:

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	1

Again, we have the same sets of inputs as the AND gate, but as you see we have a unique set of outputs for the OR gate. The common ID # for this gate is 7432.

NAND — Schematic symbol:



continued on page 5

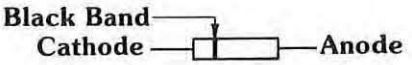
service notes

This column is intended to keep you informed on service notes you may have missed about our games. They are important items and only repeated here for further emphasis.

X-Y Timing Board

To ensure that the vertical and horizontal outputs of the G-80 X-Y Timing Board do not exceed a present level, the addition of 2 diodes is recommended. The diodes, type 1N914, are installed as follows:

1. Remove the G-80 Timing Board from the card cage.
2. Solder the **ANODE** of one diode to **Pin 1** of the Molex connector located on the front edge of the Timing Board. It is recommended that the diode be installed on the underside of the board.
3. Solder the **CATHODE** of the diode to a **+5 volt pad** on the back of the board. This can be found at the +5 volt pin on the closest IC.
4. Install the **CATHODE** of the second diode to **+5**, in the same way. Then, solder the **ANODE** of this diode to **Pin 4** of the Molex connector.



DIODE 1N914

continued from page 4

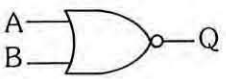
the ROM line

Truth Table:

A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

See anything familiar? The NAND gate is simply an AND gate with its outputs inverted. The common ID # for this gate is 7400.

NOR — Schematic symbol:



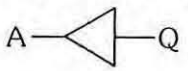
Truth table:

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	0

Again, the NOR gate inverts the outputs of the OR gate. See the OR truth table above. The common ID # for this gate is 7402.

There we have the basic gates. In addition, you should know about the following gates that are found in many game computers:

BUFFER — Schematic symbol:

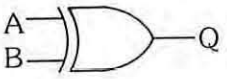


Truth table:

A	Q
0	0
1	1

The BUFFER, then, outputs the level on the input. It is primarily used to increase the output drive to other circuits. The common ID numbers are 7407, 7417 or 74367.

EXCLUSIVE OR — Schematic symbol:

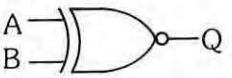


Truth table:

A	B	Q
0	0	0
0	1	1
1	0	1
1	1	0

You can see that the outputs of this gate are high only if **both** inputs are different. Common ID # for this gate is 7486.

EXCLUSIVE NOR — Schematic symbol:



Truth table:

A	B	Q
0	0	1
0	1	0
1	0	0
1	1	1

The outputs are inverted from the exclusive OR gate to form exclusive NOR.

continued on page 6

input port

On our recent Data Bus questionnaire, many of you asked for a question and answer column, so we are starting one in this issue. It's called Input Port and through it, we'll answer technical questions you have asked in phone calls or written requests. We hope you find it interesting; and, be sure to keep those questions coming! Address any technical questions to:
Editor — Data Bus
SEGA/Gremlin Customer Service
8401 Aero Drive
San Diego, CA 92123

Q: On the Astro Blaster EPROM Board, some EPROMs work loose from their sockets, causing several different symptoms, for example, coin/credit problems. We suggest using rubber sealant to hold these chips in place.
Columbus, Mississippi

A: An easy solution to the problem of EPROMs coming out of their sockets is to bend the EPROM legs inward slightly to make a tighter fit in the socket. Using rubber sealant to hold a socketed IC works fine . . . until you have to remove the chip. If care is not taken in removing the sealant, you could cut away part of the printed circuit clad.

Q: Some people say an isolation transformer is dangerous. Yes or No?
D. Clements
Saint John, Nebraska

A: An isolation transformer, if wired properly, is not dangerous; instead, it prevents a potentially dangerous situation. It is used to isolate a game component, usually the monitor, from the main AC line. Without an isolation transformer, the monitor's chassis could become the "hot" side of the AC line, if the game was plugged in the wrong way. This, of course, would create a definite shock hazard.

Q: How do I adjust the voice in Astro Blaster in relation to the sound effects; that is, turn the voice up and sound effects down independently of each other?
D. Morgan
Stockton, California

A. To do this, adjust the trim pot, R73, on the G-80 Speech Board. This adjusts the volume of the sound effects only. The voice is not adjustable.

continued from page 5

the ROM line

So far, we have seen the most basic IC circuits that are common to almost any video game computer. Next issue, we'll look at the more involved IC circuits that are composed of these basic elements. Get familiar with the truth tables for the gates discussed so far. Keeping them in mind now could save you precious repair time later.

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WE WELCOME YOUR COMMENTS!

Your comments and suggestions will assist us in improving the usefulness of our publications. They are an integral part of preparing for revisions of manuals and parts catalogs.

If you have any technical questions about any SEGA/Gremlin game, are requesting additional publications, or have a suggestion about how we can make our publications more useful to you, drop us a line or use the handy form below.

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