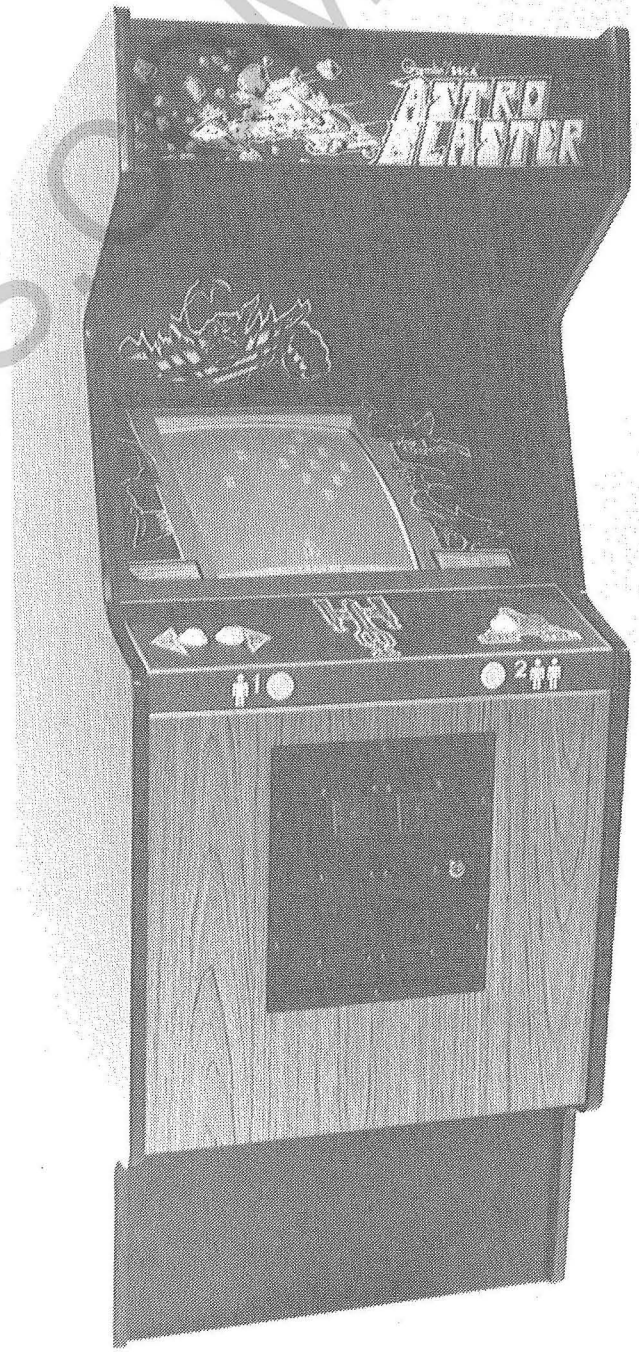
Gremlin/SEGA

# Data Bus

volume 2 number 2 | a service newsletter | february/march 1981




**New Speech Synthesis Unveiled**

## Voice Attracts New Players—High Profits

It's Saturday night and you're spending these few precious weekend hours wandering aimlessly through your favorite arcade. Carefully you consider the bleeping, barking, honking, and whining sounds that bombard your ears from all sides. You are right in the middle of trying to decide where to drop your last few coins, when suddenly the answer comes booming through the clouds in crystal clear tones:

**"FIGHTER PILOTS NEEDED IN SECTOR WARS . . PLAY ASTRO-BLASTER!"**

Instantly you realize why you are here. Life takes on a new glow as you step confidently up to the source of the Voice. Your skills are needed desperately in the defense against the endless hordes of invaders and you must answer the call!

Gremlin has it and it's sweeping the land. It's our first video game with speech synthesis and it literally demands attention in any arcade. The voice of Mission Control constantly monitors all game activity and informs the player of fuel status, ships remaining, warp countdown and laser overheat.

The game is divided into various sectors containing 29 different alien forms. As each sector is overcome, the player enters the asteroid belt and has an opportunity to pick up some extra fuel. The player then enters the docking sequence and is refueled for the next mission. Players must also keep track of fuel consumption and laser temperature. To further amplify excitement there are a number of secret tasks that can be performed during the course of the game to receive bonus points, and it takes a good player to discover and keep track of these.

**continued on page 6**

# tech—tips

## Power Supply

The Game Power Supply (800-0128) incorporates all of the voltages and audio power amplification necessary to power Astro Blaster. In addition to the logic supply voltages available, VAC and 115 VAC isolated supplies are available for the TV monitor and fluorescent light. Also, multiple primary taps are available for using 100 VAC, 115 VAC, or 230 VAC as the input voltage. Table 1 lists the ratings of the supply when all outputs are used simultaneously.

TABLE 1

| | | |
|---|---|---|
| +5 V @ | 2A = | 10W |
| −5 V @ | 1A = | 5W |
| +12 V @ | 1.5A = | 18W |
| −12 V @ | 1A = | 12W |
| MONITOR & LIGHT | | |
| 100 VAC or 115 VAC | | 75W |
| TOTAL | | 120W |

a) Circuit Description: The +5 volt supply consists mainly of U1 and Q5. U1 is a 723 voltage regulator IC, which contains a voltage reference, error amplifier, series pass Darlington transistor pair and a current limit transistor. Potentiometer R5 (+5V ADJ) divides the 7.15V (nominal) 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 5.0 V output by an amount equal to the two $V_{BE}$ drops of Darlington Q5, which acts as a current amplifier, and the IR drop across R32.

A foldback current limiter circuit is composed of R32, R2, R3, Q1iand the internal current limit Q1 and the internal current limit transistor of U1. This circuit 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 internal 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 Q5 when the output is accidentally short circuited. This action occurs so quickly during a short that fuse F1 should not BLOW. The value of the "knee" current can be increased or decreased by decreasing or increasing R3, respectively. Capacitors C4 and C5 frequently compensate the regulator so it won't oscillate, and C1 and C26 perform high frequency bypassing . Q1 is included for temperature compensation. 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 of about 6 amps stays quite constant over wide temperature variations. The short circuit current is less than 100 ma. The +12 volt regulator uses 7.15 volts as a reference. U2 compares this voltage with the voltage at the wiper of R23 (+12V ADJ). Darlington PNP Q6 is the series pass element: Transistor Q2 and current sense resistor R12 form the current limit circuit to protect Q6 from excessive load currents. The trip point is about 3 amp. Resistor R10 shuts the circuit off even harder if the output is short circuited. resistor R11 and electrolytic C7 form a low pass filter which prevents short current pulses from activating the current limit circuit. The —5V and —12V regulators utilize three terminal ICs, 7905 and 7912, respectively. Capacitors C2, C3, C11 and C14 bypass high frequencies so that U4 and U5 won't oscillate.

the audio power amplifier is composed of op-amp U3 and transistors Q3, Q4, Q7 and Q8. U3 provides most of the voltage gain while the transistors supply most of the current gain. This amplifier differs from previous ones in that the output stage also exhibits a voltage gain of about 2 so that the output can swing close to both power

continued on page 6

# 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.

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### Installation of SEGA Coin Board

The following procedure should be used for installing the 1-2-3-4 coin board, part #601-0461.

1. Cut and strip the three wires connecting the coin switches to the logic board.
2. Solder the wire connected to the coin switch normally open (NO) contact to pad #4 on the 1-2-3-4 coin board. Solder the coin switch wire, normally closed (NC) to pad #3 on the coin board. The ground or common (COM) lead on the coin switch is soldered to the coin board pad labelled "GND".
3. Solder the lead coming from the logic board pin #15 to pad #2 on the coin board. Solder the logic board lead at pin 17 to pad #1 on the coin board. solder the ground lead from the logic board to the "GND" pad on the coin board.
4. Finally, run a lead from +5 volt supply on the logic board to the pad labelled "Vcc" on the coin board.

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### STATIC MODIFICATION

To eliminate the possibility of credits from a static discharge on your Single VIC, Dual VIC, and Extended ROM Logic Boards, follow these instructions carefully to modify the logic board:

1. Solder connector pin to U18, pin 2, perpendicular to board.
2. Install static antenna wire by wrapping antenna wire one full wrap around each harness attached to logic board. Do this by forming a loop in the antenna wire and inserting harness through loop. Connect to connector pin at U18, pin 2.
3. On the back of the board, cut the etch between Q2 and the positive side of the capacitor located directly below. Also cut the etch from the positive side of the same capacitor U18, pin 2 and from pin 2 to pin 6 of U18.
4. Install jumper from Q2 to U18, pin 2 and another jumper from the positive side

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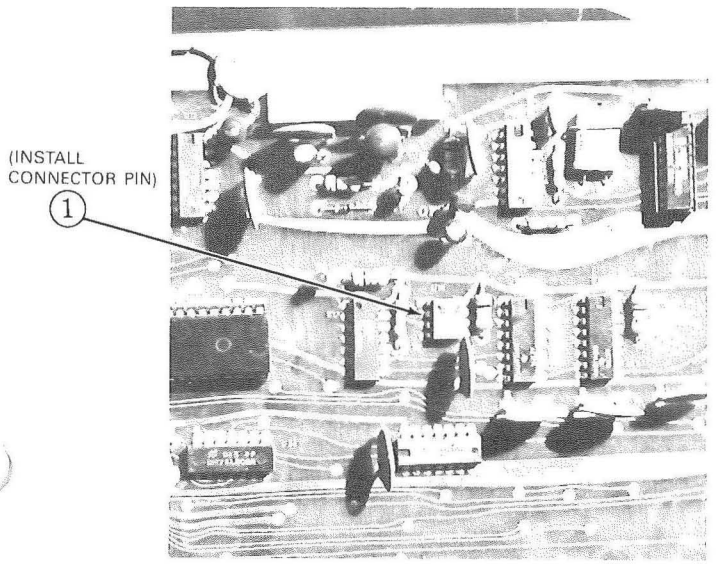



FIGURE 1

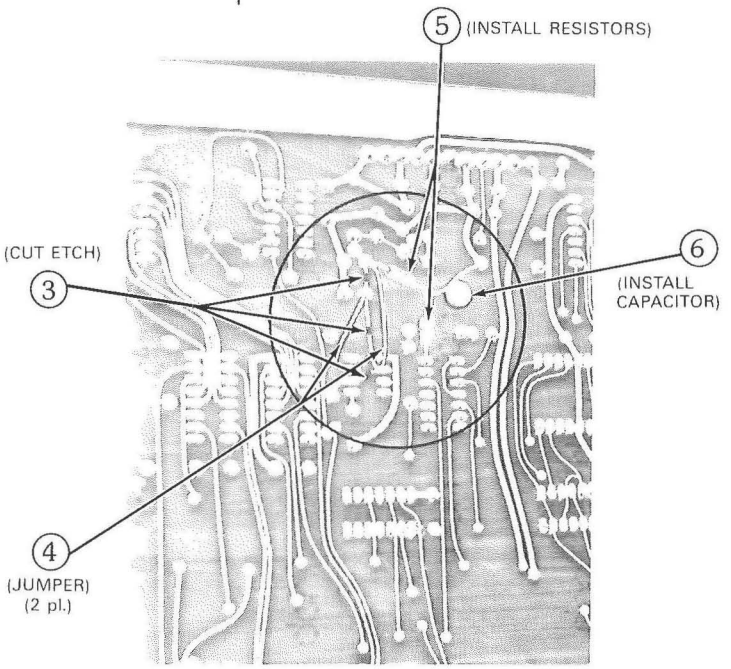



FIGURE 2

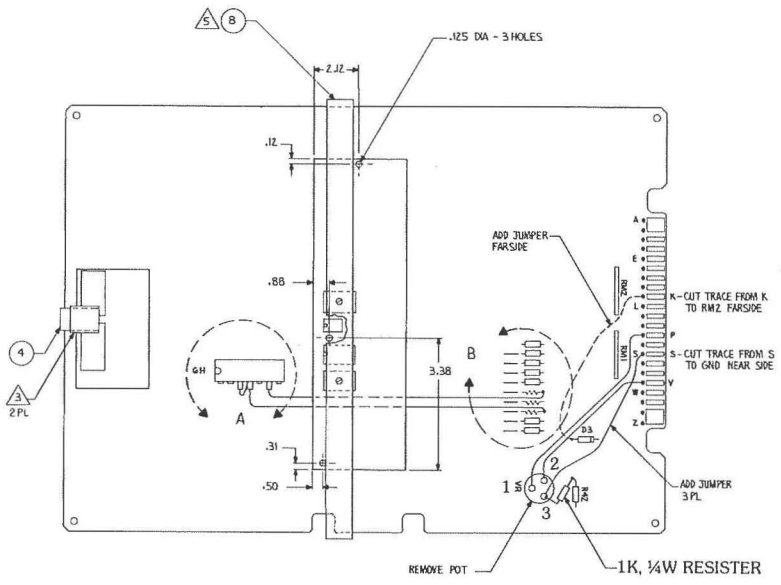
# service notes

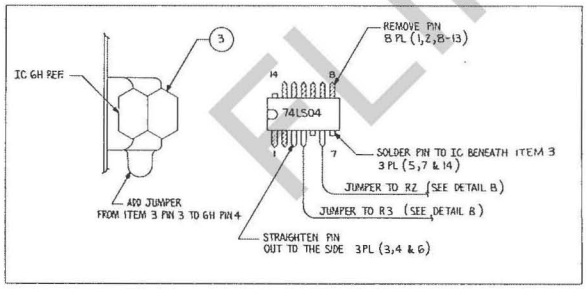
### Moon Cresta Logic Board Conversions

This is to inform you that the Moon Cresta upright games from Gremlin and from SEGA have slightly different logic boards. Games manufactured by SEGA use an unmodified board. Because Gremlin uses a different monitor, the logic board must be modified for its games. This service note explains the differences and how one board can be modified to another, and vice versa. Follow these instructions carefully to modify the logic board: (Refer to illustration)

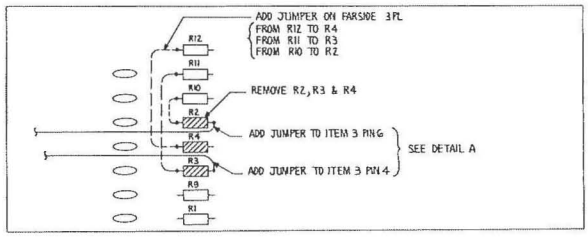
1. Take a 74LS04 IC and remove pins 1,2,8,9,10,11, 12, and 13.
2. Install the 74LS04 on top of IC 6H by soldering pins 5,7 and 14 to the corresponding pins below.
3. Straighten pins 3, 4 and 6 on the 74LS04 out to the side.
4. Install a jumper from pin 3 of the 74LS04 IC to pin 4 of IC 6H.
5. Remove R2, R3 and R4.
6. Add jumpers from R12 to R4, from R11 to R3 and from R10 to R2.
7. Add jumpers from pin 6 on the 74LS04 IC to R2 and from pin 4 to R3.
8. Locate the edge connection pads and cut the trace from pad K to resistor pack RM2 on the under side.
9. Cut the trace from pad S to ground on the top side. Make sure the etch cut is clean and accurate.
10. Install a jumper on under side from pad K to D3.
11. At position VR, remove the volume pot and install a jumper from pad 1 on VR to pad P on the edge connection pads.
12. Install a jumper from VR pad 2 to V on the edge connection pads.
13. Install a jumper from VR pad 3 to S on the edge connection pads. Also, install a 1K, ¼W resistor from VR pad 3 to the side of R42, as shown.

To remove the modification on a Gremlin Moon Cresta board for use in a SEGA game, simply reverse the above process.




**DETAIL A**




**DETAIL B**

# the ROM line

## I/O Ports

So far in our discussion of a computer, we've looked at circuits that cannot communicate meaningfully with a human.

There must be additional circuits that allow a computer operator to control the flow of information to and from the computer. That is exactly what the input and output ports do in any computer. They are the direct means through which an operator communicates with the computer, or the computer with the operator. Let us look at an input port, first.

In a computer, the data bus is the bi-directional path for the flow of computer information. The data on the data bus is used by the microprocessor to perform certain functions. When the data is input by a human operator, it must be placed on the data bus at the proper time for use by the computer. So, an input port is tied directly to the data bus and the information available at the port is "read" by the computer and acted on.

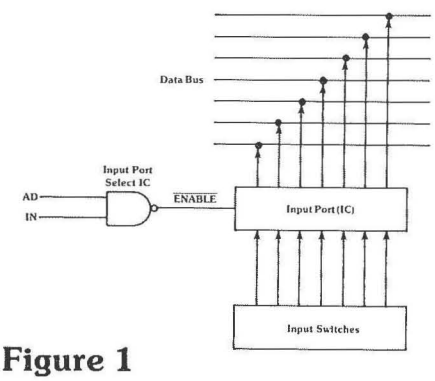



**Figure 1**

The input switches are operated by the player (in the case of video game computers), then, at a predetermined time, the computer enables the input port IC so that the switch levels (either high or low) can be placed on the data bus. Now, the switch levels can be understood by the computer and acted on accordingly. Note that the input port is not enabled all the time. Through the input port select IC, the computer "looks at" this input port only and takes in the data. The "AD" and "IN" signals must both be active high for the "ENABLE" signal to be active LO and select and input port IC. Both "AD" and "IN" are signals generated by the microprocessor under control of the computer program. Remember, both signals must be high to enable the port.

In the case of output ports, the exact opposite procedure occurs. Data to be output to the player (for example, a game sound), is placed on the data bus. At the right moment, again controlled by the program, the output port is selected and the data is sent to the sound board to trigger the appropriate sound board circuit. Figure 2 shows a typical output port configuration.

Again, the computer must be told by the program when to

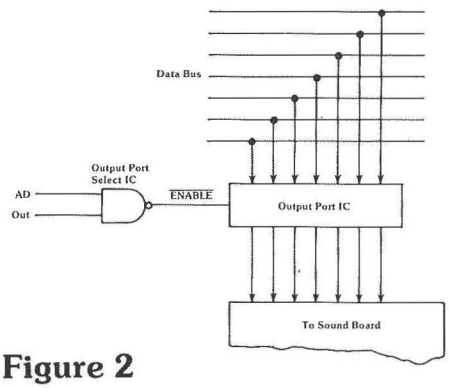



**Figure 2**

select the output port. This is done by the "AD" and "OUT" signals applied to the output port select IC. Both signals must go high to make "ENABLE" active low.

This is, of course, a general introduction to the I/O ports, but it describes common designs in I/O ports. More complex I/O designs are often necessary because of the larger number of I/O ports available in a particular computer. The important points to remember in any I/O circuits are that 1) the computer must select the I/O port under program control and 2) the computer, in selecting a port, must then enable that port. Keep these points in mind when troubleshooting a game that, for example, does not output data to a sound board, or does not allow the player switches to activate the game.

In the next issue, we'll see the need for power. Keep tech'ing!

## ATTENTION SERVICE MANAGERS . . .SPACE TACTICS ADJUSTMENTS JUST A REMINDER . . .

1) If it becomes necessary to adjust your Space Tactics games, refer to the Space Tactics Manual (#420-0556). Pages 13-19 in the manual show you exactly how to fine tune your games, should that be necessary.
2) Also, if you move your games to a different location, we strongly recommend putting all shipping brackets and bolts (see page 2 of the manual) back in the game to prevent mis-alignment and/or damage.
Please call Gremlin/SEGA Customer Service if you have any questions regarding your game.

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**continued from page 1**

Astro-Blaster has an elaborate self-test feature. It will check for bad CPU and video rams, input switches, coin switches, game EPROMS, color circuitry, game sounds, and speech. Since each board has a separate function, it is much easier to isolate a problem to one board, thus greatly reducing down time.

All in all it's a sign of the times. Thousands have heard the Voice and are responding. Don't be left behind!

**continued from page 3**

of the capacitor mentioned above to pin 7 of U18.

5. Install one 100K resistor from Q2 and the other 100K resistor from U17, pin 14. Solder both unconnected resistor leads together.
6. Add a .1uF capacitor from the junction of the two resistor leads to the annode of the diode located just to the left of transistor Q1.

If you have any questions regarding any of these notes, need schematics or manuals, please contact Gremlin/SEGA Customer Service, (714) 277-8700.

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**continued from page 2**

supply rails. This allows this amplifier to supply 36 watts into 4 OHMS and 24 watts into 8 OHMS. The overall voltage gain of the circuit is set by the ratio of R20 and R28.

The actual value is:

$$\frac{R20}{R28} + 1 = \frac{47K}{2.2K} + 1 = 22.4 \text{ or } 27 \text{ db}$$

Capacitor C13 determines the low frequency roll off (about 7 HZ) and forces the DC voltage. The input impedance is 47k OHMS and is direct coupled.
b) Adjustments:

i. Adjust R5 for 5.0V at the load. This compensates for wiring losses.
ii. Adjust R23 for 12.0V at the load.
iii. There are no adjustments for the —5V or —12V supplies or for the amplifier. The values should be —5v ±0.2V and —12V ±0.5V.

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If you have any technical questions about any Gremlin/Sega 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. We value your input.

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