

# **MODEL FS710**

## **Distribution Amplifier**



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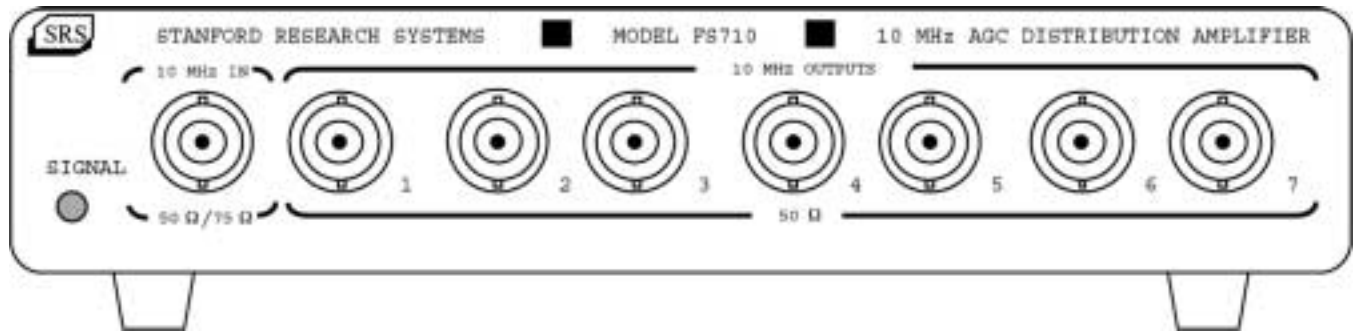
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Revision 2.5 (10/2001)

## **INTRODUCTION**

The Model FS710 10 MHz AGC Distribution Amplifier provides seven sine wave outputs from a single 10 MHz source. Designed as an accessory to the FS700 LORAN Receiver, the

FS710 AGC circuitry compensates for up to 30 dB of cable loss. This makes the FS710 ideal for distributing a 10 MHz timebase as far as a mile from a FS700 receiver.



**Figure 1 – FS710 Front Panel**

### **TYPICAL SPECIFICATIONS**

|            |                                                        |                                                                                                     |
|------------|--------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| INPUT      | Frequency:                                             | 10 MHz $\pm$ 100 kHz                                                                                |
|            | Type:                                                  | Insulated BNC, transformer coupled                                                                  |
|            | Impedance:                                             | 50 $\Omega$ or 75 $\Omega$ (jumper selectable)                                                      |
|            | Level:                                                 | 35 mV to 5 VAC peak-to-peak                                                                         |
|            | VSWR:                                                  | < 1.2 at 10 MHz                                                                                     |
| OUTPUT     | Type:                                                  | 7 local grounded BNC's                                                                              |
|            | Level:                                                 | 1 V peak-to-peak into 50 $\Omega$ , $\pm$ 10% or<br>2 V peak-to-peak into 10 k $\Omega$ , $\pm$ 10% |
|            | VSWR:                                                  | < 1.2 at 10 MHz (50 $\Omega$ )                                                                      |
|            | Distortion:                                            | < -30 dBc                                                                                           |
| MECHANICAL | 7.75" x 7.5" x 2" (w x l x h)                          |                                                                                                     |
| WEIGHT     | 3 lbs.                                                 |                                                                                                     |
| POWER      | 100/120/220/240 VAC, 10 Watts, 50/60 Hz                |                                                                                                     |
| WARRANTY   | One year parts and labor on materials and workmanship. |                                                                                                     |

## **OPERATION**

Normal operation is indicated by a green light in the lower left corner of the front panel. A red light indicates that the input signal is too low to maintain the set amplitude output.

## **TROUBLESHOOTING**

**WARNING:** Dangerous voltages are present on the printed circuit board. Always turn the power off and disconnect the line cord before removing the cover or changing components.

If front panel indicator is not lit, check the rear panel power switch, the power cord, and the fuse. If the Signal indicator is red, check for proper input signal frequency ( $10\text{ MHz} \pm 1\%$ ) and sufficient amplitude. Also, check for opens and shorts on the input and output connections.

## **CALIBRATION**

Either J50 or J75 (not both) should be installed to match the input signal impedance (50 or 75 ohms, respectively). The output level can be set to any level from .75 to 1.25 volts peak to peak by adjusting P1. Of the 8 round holes in the top of the box, P1 is accessible through the right-rear position.

## **CIRCUIT DESCRIPTION**

T1, L101, C101, R101, and R102 comprise the input network and provide ground isolation, bandpass filtering, and impedance matching. The signal is amplified by U1 and further filtered by a "stagger tuned" network consisting of L103, C107, R105, C108, C109, and L102.

U2 controls the gain of U1 by comparing the peak voltage at L102 with the reference voltage from P1, R117 and R118. D1 indicates loss of signal (red) if the control voltage from U2 becomes less than -2.5 volts. Q8 buffers the signal for distribution to the output transistors Q1 through Q7. Final bandpass filtering and impedance matching is provided by L11-L71, C11-C71, and R11-R71.

## **LINE VOLTAGE SELECTION**

The FS710 operates from a 100, 120, 220 or 240 Volt AC nominal, 50 or 60 Hz power source. Before applying power, verify that the line selector card (located in the power entry module) is in the correct position. The selected voltage is indicated by the white dot on the voltage list.

To change the line voltage selection, disconnect the line cord and remove the fuse module with a small screwdriver. Pull out the voltage selection card (located at the right of the power entry module) with a pair of needle nose pliers. Rotate the plastic indicator until it lines up with the correct voltage indicated on the fuse holder and reinsert the card. Install the correct fuse, reinsert the fuse holder and replace the line cord.

## **LINE FUSE**

Verify that the correct line fuse is installed before connecting the line cord. The rear panel indicates the correct fuse size, 1/4 Amp @ 100/120 Volts or 1/8 Amp @ 220/240 Volts. If necessary the fuse can be changed as indicated in the line voltage selection section.

## FS710 PARTS LIST

| <u>REF.</u> | <u>SRS PART</u> | <u>VALUE</u>   | <u>DESCRIPTION</u>                     |
|-------------|-----------------|----------------|----------------------------------------|
| C 11        | 5-00132-501     | 56P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 12        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 13        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 21        | 5-00132-501     | 56P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 22        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 23        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 31        | 5-00132-501     | 56P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 32        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 33        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 41        | 5-00132-501     | 56P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 42        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 43        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 51        | 5-00132-501     | 56P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 52        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 53        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 61        | 5-00132-501     | 56P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 62        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 63        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 71        | 5-00132-501     | 56P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 72        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 73        | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 101       | 5-00132-501     | 56P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 102       | 5-00002-501     | 100P           | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 103       | 5-00002-501     | 100P           | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 104       | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 105       | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 106       | 5-00027-503     | .01U           | Capacitor, Ceramic Disc, 50V, 20%, Z5U |
| C 107       | 5-00015-501     | 39P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 108       | 5-00003-501     | 10P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 109       | 5-00015-501     | 39P            | Capacitor, Ceramic Disc, 50V, 10%, SL  |
| C 110       | 5-00027-503     | .01U           | Capacitor, Ceramic Disc, 50V, 20%, Z5U |
| C 111       | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 112       | 5-00027-503     | .01U           | Capacitor, Ceramic Disc, 50V, 20%, Z5U |
| C 113       | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 114       | 5-00027-503     | .01U           | Capacitor, Ceramic Disc, 50V, 20%, Z5U |
| C 115       | 5-00023-529     | .1U            | Cap, Monolythic Ceramic, 50V, 20%, Z5U |
| C 116       | 5-00100-517     | 2.2U           | Capacitor, Tantalum, 35V, 20%, Rad     |
| C 117       | 5-00100-517     | 2.2U           | Capacitor, Tantalum, 35V, 20%, Rad     |
| C 118       | 5-00100-517     | 2.2U           | Capacitor, Tantalum, 35V, 20%, Rad     |
| C 119       | 5-00100-517     | 2.2U           | Capacitor, Tantalum, 35V, 20%, Rad     |
| C 120       | 5-00030-520     | 2200U          | Capacitor, Electrolytic, 16V, 20%, Rad |
| C 121       | 5-00030-520     | 2200U          | Capacitor, Electrolytic, 16V, 20%, Rad |
| C 122       | 5-00083-516     | 200P           | Capacitor, Silver Mica, 500V, 5%,      |
| D 1         | 3-00377-305     | GLPED2         | LED, Rectangular, Bicolor              |
| D 2         | 3-00203-301     | 1N5711         | Diode                                  |
| D 3         | 3-00203-301     | 1N5711         | Diode                                  |
| D 4         | 3-00062-340     | KBP201G/BR-81D | Integrated Circuit (Thru-hole Pkg)     |
| J 1         | 1-00003-120     | BNC            | Connector, BNC                         |

|             |                 |              |                                          |
|-------------|-----------------|--------------|------------------------------------------|
| J 2         | 1-00003-120     | BNC          | Connector, BNC                           |
| <b>REF.</b> | <b>SRS PART</b> | <b>VALUE</b> | <b>DESCRIPTION</b>                       |
| J 3         | 1-00003-120     | BNC          | Connector, BNC                           |
| J 4         | 1-00003-120     | BNC          | Connector, BNC                           |
| J 5         | 1-00003-120     | BNC          | Connector, BNC                           |
| J 6         | 1-00003-120     | BNC          | Connector, BNC                           |
| J 7         | 1-00003-120     | BNC          | Connector, BNC                           |
| J 8         | 1-00073-120     | INSL         | Connector, BNC                           |
| J 9         | 1-00065-114     | 7 PIN; WHITE | Header, Amp, MTA-100                     |
| J 50        | 0-00001-000     | WIRE         | Hardware, Misc.                          |
| L 11        | 6-00048-603     | 4.7UH        | Inductor, Axial                          |
| L 21        | 6-00048-603     | 4.7UH        | Inductor, Axial                          |
| L 31        | 6-00048-603     | 4.7UH        | Inductor, Axial                          |
| L 41        | 6-00048-603     | 4.7UH        | Inductor, Axial                          |
| L 51        | 6-00048-603     | 4.7UH        | Inductor, Axial                          |
| L 61        | 6-00048-603     | 4.7UH        | Inductor, Axial                          |
| L 71        | 6-00048-603     | 4.7UH        | Inductor, Axial                          |
| L 101       | 6-00081-603     | 4.7UH        | Inductor, Axial                          |
| L 102       | 6-00081-603     | 4.7UH        | Inductor, Axial                          |
| L 103       | 6-00081-603     | 4.7UH        | Inductor, Axial                          |
| P 1         | 4-00370-441     | 500          | Pot, Multi-Turn Trim, 3/8" Square Top Ad |
| PC1         | 7-00332-701     | FS710        | Printed Circuit Board                    |
| Q 1         | 3-00021-325     | 2N3904       | Transistor, TO-92 Package                |
| Q 2         | 3-00021-325     | 2N3904       | Transistor, TO-92 Package                |
| Q 3         | 3-00021-325     | 2N3904       | Transistor, TO-92 Package                |
| Q 4         | 3-00021-325     | 2N3904       | Transistor, TO-92 Package                |
| Q 5         | 3-00021-325     | 2N3904       | Transistor, TO-92 Package                |
| Q 6         | 3-00021-325     | 2N3904       | Transistor, TO-92 Package                |
| Q 7         | 3-00021-325     | 2N3904       | Transistor, TO-92 Package                |
| Q 8         | 3-00197-321     | 2N2907       | Transistor, TO-18 Package                |
| Q 9         | 3-00022-325     | 2N3906       | Transistor, TO-92 Package                |
| Q 10        | 3-00022-325     | 2N3906       | Transistor, TO-92 Package                |
| R 11        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 12        | 4-00062-401     | 270          | Resistor, Carbon Film, 1/4W, 5%          |
| R 13        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 14        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 21        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 22        | 4-00062-401     | 270          | Resistor, Carbon Film, 1/4W, 5%          |
| R 23        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 24        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 31        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 32        | 4-00062-401     | 270          | Resistor, Carbon Film, 1/4W, 5%          |
| R 33        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 34        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 41        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 42        | 4-00062-401     | 270          | Resistor, Carbon Film, 1/4W, 5%          |
| R 43        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 44        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 51        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |
| R 52        | 4-00062-401     | 270          | Resistor, Carbon Film, 1/4W, 5%          |
| R 53        | 4-00080-401     | 47           | Resistor, Carbon Film, 1/4W, 5%          |

|             |                 |                 |                                       |
|-------------|-----------------|-----------------|---------------------------------------|
| R 54        | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 61        | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| <b>REF.</b> | <b>SRS PART</b> | <b>VALUE</b>    | <b>DESCRIPTION</b>                    |
| R 62        | 4-00062-401     | 270             | Resistor, Carbon Film, 1/4W, 5%       |
| R 63        | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 64        | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 71        | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 72        | 4-00062-401     | 270             | Resistor, Carbon Film, 1/4W, 5%       |
| R 73        | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 74        | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 101       | 4-00242-407     | 73.2            | Resistor, Metal Film, 1/8W, 1%, 50PPM |
| R 102       | 4-00086-401     | 51              | Resistor, Carbon Film, 1/4W, 5%       |
| R 103       | 4-00074-401     | 33K             | Resistor, Carbon Film, 1/4W, 5%       |
| R 104       | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 105       | 4-00045-401     | 2.0K            | Resistor, Carbon Film, 1/4W, 5%       |
| R 106       | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 107       | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 108       | 4-00080-401     | 47              | Resistor, Carbon Film, 1/4W, 5%       |
| R 109       | 4-00057-401     | 220             | Resistor, Carbon Film, 1/4W, 5%       |
| R 110       | 4-00032-401     | 100K            | Resistor, Carbon Film, 1/4W, 5%       |
| R 111       | 4-00032-401     | 100K            | Resistor, Carbon Film, 1/4W, 5%       |
| R 112       | 4-00051-401     | 2.7K            | Resistor, Carbon Film, 1/4W, 5%       |
| R 113       | 4-00060-401     | 240             | Resistor, Carbon Film, 1/4W, 5%       |
| R 114       | 4-00071-401     | 33              | Resistor, Carbon Film, 1/4W, 5%       |
| R 115       | 4-00079-401     | 4.7K            | Resistor, Carbon Film, 1/4W, 5%       |
| R 116       | 4-00079-401     | 4.7K            | Resistor, Carbon Film, 1/4W, 5%       |
| R 117       | 4-00350-407     | 3.74K           | Resistor, Metal Film, 1/8W, 1%, 50PPM |
| R 118       | 4-00204-407     | 750             | Resistor, Metal Film, 1/8W, 1%, 50PPM |
| R 119       | 4-00057-401     | 220             | Resistor, Carbon Film, 1/4W, 5%       |
| R 120       | 4-00090-401     | 560             | Resistor, Carbon Film, 1/4W, 5%       |
| T 1         | 6-00009-610     | T1-1-X65        | Transformer                           |
| T 2         | 6-00077-610     | SR445/FS710     | Transformer                           |
| U 1         | 3-00386-340     | MC1590          | Integrated Circuit (Thru-hole Pkg)    |
| U 2         | 3-00090-340     | LF411           | Integrated Circuit (Thru-hole Pkg)    |
| U 3         | 3-00119-329     | 7905            | Voltage Reg., TO-220 (TAB) Package    |
| U 4         | 3-00112-329     | 7805            | Voltage Reg., TO-220 (TAB) Package    |
| Z 0         | 0-00043-011     | 4-40 KEP        | Nut, Kep                              |
| Z 0         | 0-00108-054     | 1" #26          | Wire #26 UL1061                       |
| Z 0         | 0-00165-003     | TO-18           | Insulators                            |
| Z 0         | 0-00187-021     | 4-40X1/4PP      | Screw, Panhead Phillips               |
| Z 0         | 0-00208-020     | 4-40X3/8PF      | Screw, Flathead Phillips              |
| Z 0         | 0-00209-021     | 4-40X3/8PP      | Screw, Panhead Phillips               |
| Z 0         | 0-00220-002     | 5EFM4S          | Power_Entry Hardware                  |
| Z 0         | 0-00221-000     | SR440FOOT       | Hardware, Misc.                       |
| Z 0         | 0-00231-043     | #4 SHOULDER     | Washer, nylon                         |
| Z 0         | 0-00243-003     | TO-220          | Insulators                            |
| Z 0         | 0-00522-053     | 3-1/2" #24      | Wire #24 UL1007 Strip 1/4x1/4 Tin     |
| Z 0         | 0-00532-053     | 3-1/2 YEL NOTIN | Wire #24 UL1007 Strip 1/4x1/4 Tin     |
| Z 0         | 1-00066-112     | 7 PIN; 24AWG/WH | Connector, Amp, MTA-100               |
| Z 0         | 6-00002-611     | .25A 3AG        | Fuse                                  |
| Z 0         | 7-00119-720     | SR440-1         | Fabricated Part                       |

|     |             |         |                 |
|-----|-------------|---------|-----------------|
| Z 0 | 7-00120-720 | SR440-2 | Fabricated Part |
| Z 0 | 7-00331-709 | FS710-1 | Lexan Overlay   |
| Z 0 | 9-00267-917 | GENERIC | Product Labels  |



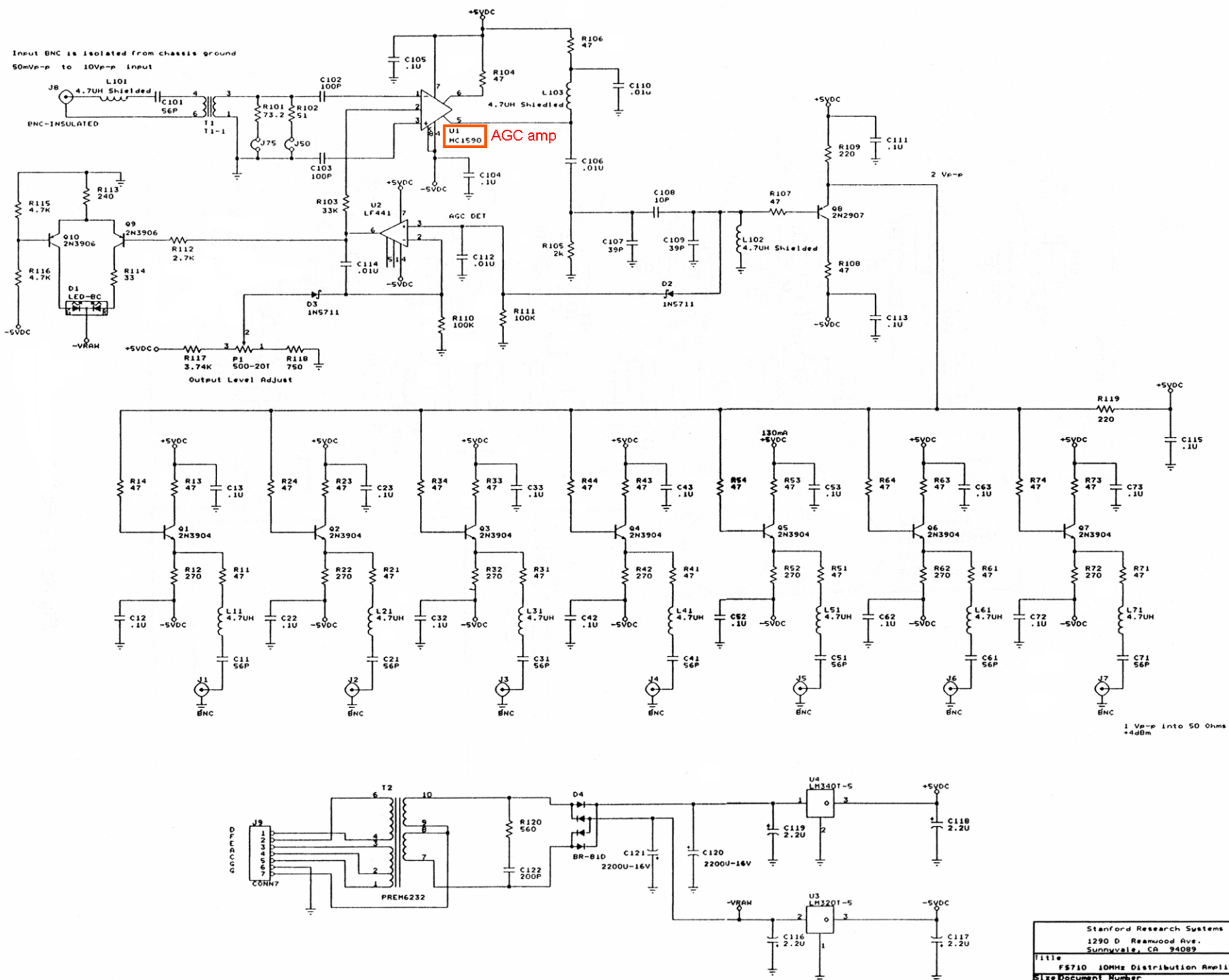


Figure 3 - FS710 Schematic