



OPERATOR'S MANUAL

MODEL 422
MULTIFUNCTION
SIGNAL GENERATOR

 WARNING

**READ AND UNDERSTAND THIS MANUAL BEFORE
USING THE INSTRUMENT.**

**Failure to understand and comply with the WARNINGS
and operating instructions can result in serious or fatal
injuries and/or property damage.**

OBSOLETE

DIGITAL INSTRUMENT WARRANTY

SIMPSON ELECTRIC COMPANY warrants each digital instrument manufactured by it to be free from defects in material and workmanship under normal use and service. Its obligation under this warranty being limited to making good at its factory any instrument which shall within one (1) year after delivery of such instrument or other article of equipment to the original purchaser be returned intact to it, or to one of its authorized service stations, with transportation charges prepaid, and which its examination shall disclose to its satisfaction to have been thus defective; this warranty being expressly in lieu of all other warranties expressed or implied and of all other obligations or liabilities on its part, and SIMPSON ELECTRIC COMPANY neither assumes nor authorizes any other persons to assume for it any other liability in connection with the sale of its products.

This warranty shall not apply to any digital instrument which shall have been repaired or altered outside the SIMPSON ELECTRIC COMPANY factory or authorized service stations, nor which has been subject to misuse, negligence or accident, incorrect wiring by others, or installation or use not in accord with instructions furnished by the manufacturer.

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SAFETY INFORMATION

WARNING

This Instrument is designed to prevent accidental shock to the operator when properly used. However, no engineering design can render safe an instrument which is used carelessly. Therefore, this manual must be read carefully and completely before making any measurements. Failure to follow directions can result in a serious or fatal accident.

SHOCK HAZARD: As defined in American National Standard, C39.5, Safety Requirements for Electrical & Electronic Measuring & Controlling Instrumentation, a shock hazard shall be considered to exist at any part involving a potential in excess of 30 volts rms (sine wave) or 42.4 volts DC or peak and where a leakage current from that part to ground exceeds 0.5 milliampere, when measured with an appropriate measuring instrument defined in Section 11.6.1 of ANSI C39.5.

NOTE: The proper measuring instrument for the measurement of leakage consists essentially of a network of a 1500 ohm non-inductive resistor shunted by a 0.15 microfarad capacitor connected between the terminals of the measuring instrument. The leakage current is that portion of the current that flows through the resistor. The Simpson 229-Series 2 AC Leakage Current Tester meets the ANSI C39.5 requirements for the measurement of AC leakage current and can be used for this purpose. To measure DC Leakage current, connect a 1500 ohm non-inductive resistor in series with a Simpson 0-500 DC microammeter and use this as the measuring instrument.

SAFETY SYMBOLS



This marking adjacent to another marking or a terminal or operating device indicates that the operator must refer to an explanation in the Operating Instructions to avoid damage to the equipment and/or personal injury.

WARNING

This **WARNING** sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly performed or adhered to, could result in personal injury.

CAUTION

This **CAUTION** sign denotes a hazard. It calls attention to a procedure, practice or the like, which if not correctly adhered to could result in damage to or destruction of part or all of the instrument.



GROUNDING TERMINAL (PROTECTIVE):

A terminal which is connected to earth ground for personal protection from electrical shock.

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MULTIFUNCTION SIGNAL GENERATOR/COUNTER

SECTION I

INTRODUCTION

1.1 GENERAL

1.1.1 The Simpson 422 Function Generator (hereafter referred to as the 422 or the Instrument) is a multiple waveform generator suitable for use in general electronic maintenance, production, school, and the laboratory. The 422 is capable of generating a sine, triangular or square waveform. A TTL output is produced simultaneously. The Instrument is capable of generating waveforms from .05Hz to 5MHz. The 422 is also capable of automatically sweeping the frequency over a 1000:1 range on any of the generator's seven ranges. In order to simplify the process of setting the frequency, the 422 has a built-in 80MHz frequency counter capable of measuring either the generator's operating frequency or measuring an external frequency source.

The 422 is available in two versions, wired for 120V (Cat. No. 12732) and 220V (Cat. No. 12734). Before

operating the Instrument, verify the operating voltage of the Instrument you are about to use.

1.2 SAFETY CONSIDERATIONS

1.2.1 This operator's manual contains cautions and warnings alerting the user to hazardous operating and servicing conditions. This information is flagged by CAUTION and WARNING headings throughout this publication, where applicable, and is defined at the front of the manual under SAFETY SYMBOLS. To ensure the safety of operating and servicing personnel and to retain the operating conditions of the Instrument, these instructions must be adhered to.

1.3 TECHNICAL DATA

1.3.1 Table 1-1 lists the technical data for the 422 under the reference conditions of $23^{\circ}\text{C} \pm 1^{\circ}\text{C}$ ambient temperature and 30 - 60 % relative humidity.

TABLE 1-1. TECHNICAL DATA

I. GENERAL

Basic Outputs:	Sine, Triangle, Square, DC and TTL (separate BNC)
Frequency Range:	.05Hz to 5MHz in seven ranges
Output Amplitude Control:	Continuously variable, >30dB; fixed attenuation, 0-30dB
DC Offset:	± 10 volts adjustable into $1\text{M}\Omega$

II. SPECIFICATIONS

Counter Accuracy:	± 1 Count \pm (10ppm x Frequency)
Sine Wave Distortion:	< 1% .05Hz to 100KHz @ 10V p-p into 50Ω
Harmonic Distortion:	Better than -24dB, 100KHz - 5mHz
Triangle Wave Non-Linearity:	< 1% up to 100KHz
Triangle Wave Non-Symmetry:	< 1% up to 100KHz
Square Wave Rise/Fall Time:	< 100ns
Square Wave Non-Symmetry:	< 1% up to 100KHz
VCF Range:	1000:1 (from end of frequency range)
TTL Output:	Fixed TTL compatible output will drive up to 10 TTL loads. 25ns rise/fall time.
Sweep Range:	100:1 Linear 1000:1 Log
Sweep Time:	.05 seconds - 30 seconds
Trigger Modes:	Free Running External Trigger (TTL input) Manual

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Counter Time Bases: (manually selected)	10 seconds, 1 second, .1 seconds, .01 seconds
External Counter Input:	0 to 80MHz, 100mV minimum, 30V RMS Maximum
Counter Resolution:	.1Hz (10 second range) 1Hz (1 second range) 100Hz (.1 second range) 1000Hz (.01 second range)
Output Impedance:	50Ω
Amplitude Flatness:	± 0.1dB up to 20KHz ± 0.3dB at all other frequencies, sine wave
Square Wave Aberration:	< 3%
III. <u>TEMPERATURE STABILITY</u> (after 15 minutes warm-up time)	
Frequency:	± 0.1%/°C
Amplitude:	± 0.05dB/°C
IV. <u>LINE VOLTAGE STABILITY</u>	
Frequency:	± 0.1% per ± 10 VAC variation
Amplitude:	± 0.05dB per ± 10 VAC variation
V. <u>TEMPERATURE RANGE</u>	
Operation:	0 to +50°C
Storage:	-10 to +60°C
VI. <u>POWER REQUIREMENTS</u>	120/220 VAC ± 10%, 50/60Hz, 24VA
VII. <u>DIMENSIONS</u>	
Height:	3.9 in. (99.1 mm)
Width:	9.875 in. (250.8 mm)
Depth:	10.5 in. (255.7 mm)
VIII. <u>WEIGHT</u>	Approximately 4.25 lbs. (1.93 Kg.)

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TABLE 1-2. SUPPLIES AND ACCESSORIES FURNISHED WITH THE INSTRUMENT

<u>Quantity</u>	<u>Description</u>	<u>Part No.</u>
1	Operator's Manual	6-114271
1	Line Cord	5-118916

SECTION II

INSTALLATION

2.1 GENERAL

2.1.1 This section contains instructions for the installation and shipping of the 422. Included are unpacking and inspection procedures, warranty, shipping, power source requirements and installation.

2.2 UNPACKING AND INSPECTION

2.2.1 Upon receipt of the Instrument, examine the external carton and the instrument for possible shipping damage. If found, notify the carrier and the supplier. **DO NOT USE THE INSTRUMENT.** Finding no evidence of shipping damage, read this instruction book in its entirety to become familiar with the controls and their function before applying power and attempting to check the Instrument's electrical performance. Also check that all items in Table 1-2 are include with the Instrument.

2.2.2 Save the shipping carton and packing materials for future storing or shipping of the Instrument.

2.3 SHIPPING

2.3.1 When returning the Instrument for warranty repairs, pack it carefully and ship it prepaid and insured to the desired destination.

2.4 WARRANTY

2.4.1 The Simpson Electric Company warranty policy is printed on the inside front cover of this manual. Read it carefully prior to requesting a warranty repair.

NOTE: For assistance of any kind, including help with the Instrument under warranty, read the warranty printed on the inside front cover of this manual, then contact the dealer or factory. Either will ask for date of purchase, the model and serial number of the unit and a brief description of the problem encountered. Based on the information given, the customer will be advised how to proceed in returning the Instrument for service. See the Authorized Service Center Listing in the back of this manual.

2.5 POWER SOURCE REQUIREMENTS

2.5.1 The 422 is designed to be operated from the AC line only.

The 422 is available from the factory wired for 120V or 220V operation. Before using the 422, verify that it's power supply is compatible with your AC line source.

2.6 INSTALLATION

2.6.1 The Instrument may be set and operated horizontally on its four rubber feet or the Instrument can be set at an inclined angle by positioning the 8-position carrying handle under the unit. To set the Instrument at a desirable viewing angle, use the following procedures. (See Figure 2-1.)

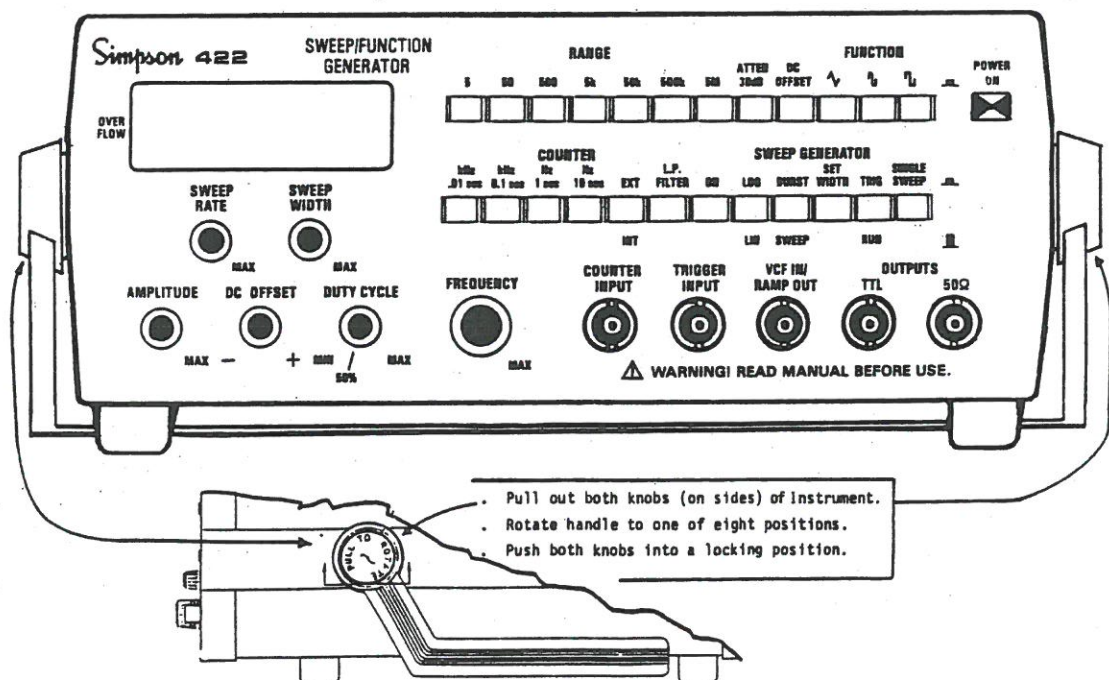


Figure 2-1. Viewing Adjustments

SECTION III

CONTROLS, CONNECTORS AND INDICATORS

3.1 GENERAL

3.1.1 All controls, connectors, indicators and other operational items are described in Table 3-1, and shown in Figure 3-1. Become thoroughly familiar with the name and purpose of each item before operating the Instrument.

3.2 FRONT PANEL DESCRIPTION

3.2.1 Description of front panel controls, connectors and indicators are as listed in Table 3-1 and shown in Figure 3-1.

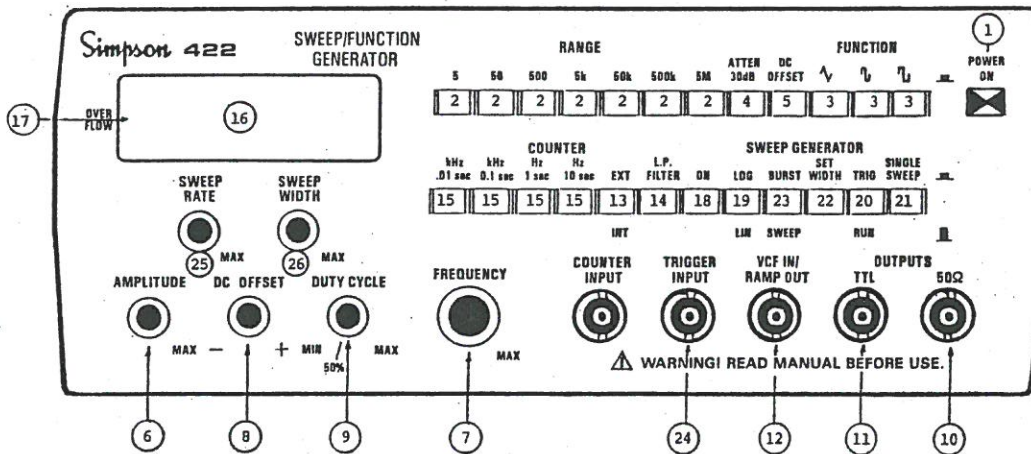


Figure 3-1. Front Panel Description

TABLE 3-1. CONTROLS, CONNECTORS AND INDICATORS

- | | | |
|----|------------------------------------|---|
| 1. | POWER SWITCH:
ON
OFF | Applies primary POWER to the Instrument.
Disconnects primary POWER from all circuits. |
| 2. | RANGE-SELECTOR SWITCHES: | Depressing one of the seven RANGE selector switches selects the output frequency in decades. In conjunction with the frequency control the output frequency will vary from 0.001 times to one times the range selected. |
| 3. | FUNCTION-SELECTOR SWITCHES: | The WAVEFORM switches select the sine (—), triangular (∧) or square (⌊) WAVEFORM which is available at the 50Ω OUTPUT connector. |
| 4. | ATTENUATOR 0/-30dB SWITCH: | In the "in" position, this switch will cause the amplitude of the output signal to be reduced by approximately 30dB. |
| 5. | DC OFFSET SWITCH: | The DC OFFSET switch enables and disables the DC component of the 50Ω output. |
| 6. | AMPLITUDE CONTROL: | Controls the AMPLITUDE of the output signal. In conjunction with the 0/30dB SWITCH, the output signal can be attenuated by 60dB (approximately). |
| 7. | FREQUENCY DIAL: | The dial setting is used to set the frequency for the range indicated by the switch position. |

8. DC OFFSET CONTROL: Varies the DC component of the output signal at the 50Ω OUTPUT.
9. DUTY CYCLE CONTROL: Varies the DUTY CYCLE of the signal at the 50Ω and TTL OUTPUTS. By turning the control full CCW, the DUTY CYCLE is set in the calibrated position.
10. 50 Ω OUTPUT: Signal selected by the FUNCTION selector switches and the DC OFFSET voltage are available at this connector.
11. TTL OUTPUT: (BNC) A TTL-compatible square wave is available at this connector. The frequency is the same as the frequency of the waveform at the 50Ω OUTPUT. Changing the AMPLITUDE control (5), OFFSET control (7) or ATTEN/30dB SWITCH (4) will NOT affect the TTL OUTPUT signal.
12. VCF IN/RAMP OUT CONNECTOR: This connector serves a dual function. In the fixed frequency mode, the VCF IN/RAMP OUT connector allows an external voltage source to control the generator frequency.
In the sweep mode, this connector outputs a ramp for driving a plotter or other similar device.
13. EXT INT This switch selects the counter input source. When it is out, the counter displays the generator frequency. When in, the external counter input is enabled.
14. LP FILTER SWITCH: This switch enables the low pass filter on the input to the External Counter. This filter attenuates higher frequency signals to help reduce false counter readings.
15. COUNTER KHz/Hz: SWITCHES: These switches select the counter frequency range. The time base number indicates how long each reading will take. The Hz or KHz tells the user the units for the counter display.
16. COUNTER DISPLAY: This digital display indicates the current frequency or the frequency of the external input source.
17. OVERFLOW: This annunciator lights when the counter input exceeds the maximum allowable input frequency for the range selected.

SWEEP GENERATOR

18. ON SWITCH: This switch enables the SWEEP GENERATOR. When no other controls are engaged, the generator will sweep continuously over the range set by the FREQUENCY CONTROL (7) and the SWEEP WIDTH (26).
19. LOG LIN: This switch selects the type of sweep which the Model 422 will produce. In the LIN position, the generator sweeps from the start to stop frequency in a linear fashion. In the LOG position, the generator will sweep from the start frequency to the top of the range in a logarithmic fashion.

- 20. **TRIG:** When TRIG is engaged, the generator will sweep once only when TRIGGER INPUT (24) is pulled low or when SINGLE SWEEP is depressed. Upon completing the sweep, the generator will return to the start frequency.
- 21. **SINGLE SWEEP:** This switch manually triggers a single sweep when in the TRIG mode.
- 22. **SET WIDTH:** This switch forces the generator to the sweep stop frequency to allow the user to set the sweep width.
- 23. **BURST:** This control mutes the generator output between sweeps. It is used in conjunction with the TRIG switch and allows the operator to produce either a swept frequency burst or a single frequency burst.
- 24. **TRIGGER INPUT:** This input allows the user to electronically trigger a single sweep when in the TRIG mode.
- 25. **SWEEP RATE:** This control is used to set the speed at which the SWEEP GENERATOR sweeps.
- 26. **SWEEP WIDTH:** This control is used to set the STOP FREQUENCY for the SWEEP GENERATOR.

**SECTION IV
OPERATION**

4.1 GENERAL

4.1.1 This section of the manual contains information required to use and operate the 422 in a safe and proper manner. Special notes and instructions have been provided for added user safety and convenience.

4.2 SAFETY PRECAUTIONS

4.2.1 The 422 is intended to be used only by personnel qualified to recognize shock hazards and trained in the safety precautions required to avoid possible injury.

4.2.2 Do not work alone when making measurements or adjustments where a shock hazard can exist. Notify another (nearby) person that you are making, or intend to make such measurements.

CAUTION

Voltages may appear unexpectedly in defective equipment. An open bleeder resistor can result in a capacitor's retaining a dangerous charge. Remove all power and discharge all capacitors in the circuit being measured before making connections or disconnecting the Instrument.

4.2.3 Locate all voltage sources and current accessibility paths before making any connections.

4.2.4 Before each use, inspect the test leads, probes, connectors, and power cable for cracks, breaks or crazes in the insulation. If any defects exist, destroy, and replace the defective item(s) immediately.

4.2.5 For maximum safety, test leads, circuit and Instrument should not be touched while power is applied to the circuit being measured.

4.2.6 When using the 422 be sure that it is connected to the three-wire power line outlet that is correctly wired in accordance with the latest National Electrical Code.

WARNING

Do not exceed the maximum input voltage ratings of the 422 which are tabulated in Table 1-1. To do so endangers personal safety and may also damage the Instrument.

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4.2.7 Do not attempt to float the Instrument. To do so risks personal safety and may damage the 422 as well as the equipment under test.

4.3 OPERATING PROCEDURES, FUNCTION GENERATOR

4.3.1 Connect the Instrument to a proper AC power source and depress the power ON/(OFF) switch to power the unit.

Select one of the FUNCTION switches. The corresponding waveform will be available at the 50 Ω output connector.

4.3.2 **Frequency Selection:** Select one of the seven RANGE-Hz switches. If the COUNTER SOURCE SWITCH is set for INT, the counter will display the operating frequency. The frequency range numbers over the range switches, indicate the full scale frequency for that range in Hz.

4.3.3 **Amplitude Adjustment:** The amplitude of the selected output signal available at the 50 Ω OUTPUT is adjusted by the AMPLITUDE control.

The amplitude of the 50 Ω OUTPUT signal will be attenuated approximately 30dB by pushing the 0dB/30dB SWITCH in.

The TTL output amplitude is a fixed level. It is not affected by DC OFFSET, amplitude adjustment or 0dB/30dB ATTENUATOR.

4.3.4 **DC Offset Control:** With the DC OFFSET function switch off, the waveform at the 50 Ω output is symmetrical around ground.

With the DC OFFSET function switch on the waveform at the 50 Ω OUTPUT can be DC level shifted $\pm 10V$ into an open ckt ($\pm 5V$ into 50 Ω). For large DC offsets, an oscilloscope should be used to observe any unwanted waveform clipping.

4.3.5 **DC Output Operation:** Leave all of the FUNCTION selection switches in the out position. (This is done by depressing the FUNCTION switches slightly.)

The output available at 50 Ω OUTPUT becomes a DC voltage supply.

The output level, controlled by the DC OFFSET control, is limited to $\pm 10V$ circuit or $\pm 5V$ into a 50 Ω load. An external filter can be used to reduce the AC output impedance.

4.3.6 **Voltage Controlled Frequency (VCF) Operation:** The output frequency of the 422 can be varied by applying an external control voltage into the VCF IN jack. A positive (going) voltage will decrease the output frequency while the negative voltage will increase it. More than 1000:1 ratio from the maximum dial setting is achievable. In the sweep mode, the VCF feature is not available.

4.3.7 **TTL Output:** This is a TTL compatible square wave output which can be directly applied to any TTL circuit. The AMPLITUDE and DC OFFSET controls have no effect on this output. The frequency is determined by the FREQUENCY dial setting and the selected RANGE switch even when the generator is under DC Output operation as described in 4.3.5.

4.3.8 **Sweep Generator Operation:** The Sweep Generator is enabled by pressing the ON button.

4.3.9 **LOG/LIN Sweep:** The type of sweep is selected by the LOG/LIN button. With the button out, the generator will sweep the frequency linearly, from the start to the stop frequency. When the LOG/LIN button is in, the generator will sweep logarithmically from the start frequency to the top of the range.

4.3.10 **Setting Start and Stop Frequency:** To set the stop frequency, depress TRIG. The generator may complete one cycle, and then it will return to the starting frequency. The starting frequency is then set using the FREQUENCY CONTROL.

To set the stop frequency, depress SET WIDTH. The generator output will go to the stop frequency. For linear sweeps, this point can be adjusted by adjusting the SWEEP WIDTH CONTROL.

After setting frequency points, return TRIG switch (20) and SET WIDTH (22) to their original positions.

4.3.11 **Triggered Sweep:** When TRIG is in, the generator will make a single logarithmic or linear sweep when triggered by pulling the trigger input to ground or when Single Sweep is depressed.

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When TRIG is in, the starting frequency for either triggered sweep or continuous sweep is present at the output. To change this frequency, adjust the Main Frequency Control.

4.3.12 Time Base Selection: The four switches marked:

KHz	KHz	Hz	Hz
.01	.1	1	10
sec	sec	sec	sec

are used to select the counter time base. The top line indicates the units currently in effect for frequency measurement while the lower line indicates the amount of time the counter is allowed to count. Generally, the longer the count time, the more accurate the reading. Also, the counter is only specified for 80MHz, but most units will work up to 100MHz with no degradation.

4.3.13 Low Pass Filter: The LP FILTER switch engages a low pass filter when pressed in. This filter is to be used when measuring low frequency signals to avoid false reading caused by various high frequency signals.

4.3.14 Burst Mode: The BURST mode switch operates in conjunction with the TRIG switch. When both are in, the generator will mute between sweeps.

If Logarithmic sweep is selected, the output is a single logarithmic sweep with the generator muted before and after the sweep.

When Linear sweep in selected, a single tone burst will appear when the generator is triggered. The length of the burst is controlled by the Sweep Rate Control.

4.3.15 Counter Operation: The built-in counter gives the user the option of monitoring either the generator frequency, or an external signal up to 80MHz.

4.3.16 External/Internal: When the EXT/INT switch is out, the counter will display the frequency of signal applied to the COUNTER INPUT.

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REPLACEMENT PARTS

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
5-116787	CAPACITOR, CERAMIC, .022 μ F, 20%	5-117737	CAPACITOR, ELECTROLYTIC 100 μ F
5-116787	CAPACITOR, CERAMIC, .022 μ F, 20%	6-113517	CAP., POLY, .047 μ F, 10%, 63VDC
5-116235	CAPACITOR, VAR., 5.5-60 pF	5-119320	CAPACITOR, CERAMIC, 30 pF, 10%
5-114061	CAPACITOR, POLYSTYRENE, 450 pF	5-119660	CAPACITOR, CERAMIC, .1 μ F
6-114224	CAPACITOR, .0047 μ F, FILM 63V	5-119660	CAPACITOR, CERAMIC, .1 μ F
6-113517	CAPACITOR, POLY, .047 μ F, 10%, 63VDC	5-119660	CAPACITOR, CERAMIC, .1 μ F
6-113517	CAPACITOR, POLY, .047 μ F, 10%, 63VDC	5-112004	DIODE, 1N914, SIL
6-114131	CAPACITOR, 0.47 μ F	5-112004	DIODE, 1N914, SIL
6-114226	CAPACITOR, 4.7 μ F, TANTALUM, 25V	5-112004	DIODE, 1N914, SIL
5-112695	CAPACITOR, CERAMIC, 560 pF, 20%	5-112004	DIODE, 1N914, SIL
6-114225	CAPACITOR, 2200 μ F, LTYIC, 35V	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
6-114284	CAPACITOR, 1000 μ F, LYTIC, 50V	5-116324	DIODE, 1N4004, SILICONE
5-119660	CAPACITOR, CERAMIC	5-116324	DIODE, 1N4004, SILICONE
6-114284	CAPACITOR, 1000 μ F, LYTIC, 50V	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	5-116324	DIODE, 1N4004, SILICONE
5-119660	CAPACITOR, CERAMIC	5-116324	DIODE, 1N4004, SILICONE
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	1-119245	DIODE, SILICON 1N457
5-119660	CAPACITOR, CERAMIC	1-119245	DIODE, SILICON 1N457
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	6-113231	DIODE, 1N6263
5-119660	CAPACITOR, CERAMIC	6-113231	DIODE, 1N6263
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL
5-119660	CAPACITOR, CERAMIC	5-116324	DIODE, 1N4004, SILICONE
5-119660	CAPACITOR, CERAMIC	5-116324	DIODE, 1N4004, SILICONE
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-117206	CAPACITOR, ELECTROLYTIC, 100 μ F	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-110057	CAPACITOR, CERAMIC, 6.8 pF	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-119660	CAPACITOR, CERAMIC	5-112004	DIODE, 1N914, SIL, PIV, 75V
5-119660	CAPACITOR, CERAMIC	5-113866	DIODE, ZENER, 12 V
5-119660	CAPACITOR, CERAMIC	6-114261	I.C., AD648JN
5-111119	CAPACITOR, CERAMIC, 1000 pF	6-114273	I.C., LF412ACN
5-117609	CAPACITOR, CERAMIC, 25 pF	5-119447	I.C., DUAL, 14 PIN, LM3046N
6-113196	CAPACITOR, CERAMIC, 820 pF	6-112159	I.C., DUAL, 14 PIN, 74LS00
5-110057	CAPACITOR, CERAMIC, 6.8 pF	5-119447	I.C., DUAL, 14 PIN, LM3046N
5-119660	CAPACITOR, CERAMIC	6-114263	I.C. LM7815CT
5-119660	CAPACITOR, CERAMIC	6-114262	I.C. LM7915CT
5-119660	CAPACITOR, CERAMIC	6-111407	I.C., NEG 12V REG, LM320MP-12
6-114132	CAPACITOR, 0.1 μ F, 10%, 63V, MP	6-111405	I.C., POS 12V REG, LM341P-12
6-110364	CAPACITOR, FILM, .22 μ F, 10%	5-117149	I.C., TO-220, 3 TERMINAL
5-115534	CAPACITOR, ELECTROLYTIC 15 μ F	6-112159	I.C., DUAL, 14 PIN, SN74LS00N
6-114132	CAPACITOR, 0.1 μ F, 10%, 63V, MP	6-112217	I.C., CMOS, 74C221
5-116187	CAPACITOR, MICA, 62pF, 5%	5-118312	I.C., DUAL, 74C74
5-111425	CAP, CERAMIC, 1000 pF, 20%	5-117432	I.C., DUAL, OP AMP, 1458
5-115534	CAPACITOR, ELECTROLYTIC 15 μ F	5-118747	I.C., QUAD, COMPAR, LM2901
5-111425	CAP, CERAMIC, 1000 pF, 20%	5-117146	I.C., DUAL, 74S00
5-117737	CAPACITOR, ELECTROLYTIC 100 μ F	5-117147	I.C., DUAL, DECADE COUNTER
5-115534	CAPACITOR, ELECTROLYTIC 15 μ F	6-114267	I.C., M7216D
5-111425	CAP, CERAMIC, 1000 pF, 20%	6-114157	I.C., LINE RECEIVER, 16 PIN
5-115534	CAPACITOR, ELECTROLYTIC 15 μ F	5-117432	I.C., DUAL, OP AMP, 1458
5-116235	CAPACITOR, VAR., 5.5-60 pF	5-117432	I.C., DUAL, OP AMP, 1458
5-118561	CAPACITOR, CERAMIC 39 pF, 5%	5-117432	I.C., DUAL, OP AMP, 1458
5-112691	CAP, CERAMIC, 220 pF, 20%	5-117149	I.C., TO-220, 7805
5-118426	CAPACITOR, ELECTROLYTIC, 10 μ F	6-113563	JUMPER WIRE, .40 IN., 898PCB
5-119660	CAPACITOR, CERAMIC, .1 μ F	6-113563	JUMPER WIRE, .40 IN., 898PCB
5-119660	CAPACITOR, CERAMIC, .1 μ F	6-113563	JUMPER WIRE, .40 IN., 898PCB
5-119660	CAPACITOR, CERAMIC, .1 μ F	6-113563	JUMPER WIRE, .40 IN., 898PCB
5-119660	CAPACITOR, CERAMIC, .1 μ F	6-113563	JUMPER WIRE, .40 IN., 898PCB
5-119660	CAPACITOR, CERAMIC, .1 μ F	6-113563	JUMPER WIRE, .40 IN., 898PCB
5-119660	CAPACITOR, CERAMIC, .1 μ F	6-113561	JUMPER WIRE, .2 IN., 898PCB
5-119660	CAPACITOR, CERAMIC, .1 μ F	6-114255	BEAD
5-118426	CAPACITOR, ELECTROLYTIC, 10 μ F	6-114255	BEAD
5-118426	CAPACITOR, ELECTROLYTIC, 10 μ F	6-114255	BEAD
5-118426	CAPACITOR, ELECTROLYTIC, 10 μ F	6-114255	BEAD
5-119660	CAPACITOR, CERAMIC, .1 μ F	6-114255	BEAD

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REPLACEMENT PARTS

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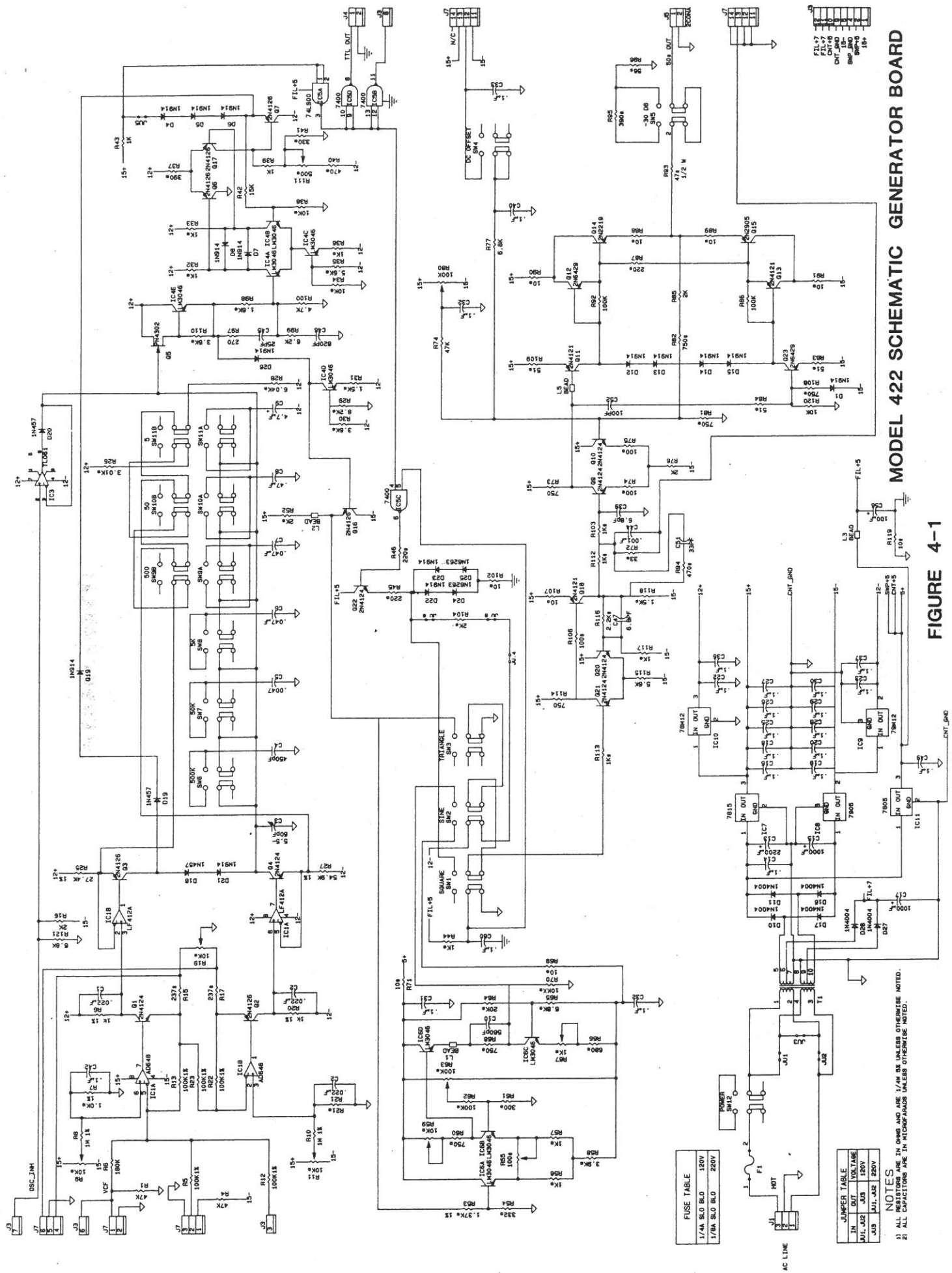
PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	
5-118128	TRANSISTOR, 2N4124	Q1	RESISTOR 1K OHM, 5%, CF	R43
5-116458	TRANSISTOR, 2N4126	Q2	RESISTOR 1K OHM, 5%, CF	R44
5-116458	TRANSISTOR, 2N4126	Q3	RESISTOR, 220 OHM, 5%, CF	R45
5-118128	TRANSISTOR, 2N4124	Q4	RESISTOR, 220 OHM, 5%, CF	R46
6-110059	TRANSISTOR, 2N4302	Q5	RESISTOR, 2K OHM, 5%, 1/4W CF	R52
5-116458	TRANSISTOR, 2N4126	Q6	RESISTOR, 1.37K OHM, 1%, MF	R54
5-116458	TRANSISTOR, 2N4126	Q7	RESISTOR, 332 OHM, 1% MF	R54
5-118128	TRANSISTOR, 2N4124	Q9	POT., SLT, 100 OHM, 10%, .5W	R55
5-118128	TRANSISTOR, 2N4124	Q10	RESISTOR 1K OHM, 5%, CF	R56
5-115939	TRANSISTOR, 2N4121	Q11	RESISTOR 1K OHM, 5%, CF	R57
5-117065	TRANSISTOR, 2N6429, SIL., VCE, 45V	Q12	RESISTOR, 3.9K OHM, 10%, CC	R58
5-115939	TRANSISTOR, 2N4121	Q13	POT., SLT, 1K OHM, 10%, .5W	R59
5-118666	TRANSISTOR, 2N2219A	Q14	RESISTOR, 750 OHM, 5%, CF	R60
5-116512	TRANSISTOR, 2N2905A	Q15	RESISTOR, 300 OHM, 5%, CF	R61
5-116458	TRANSISTOR, 2N4126	Q16	RESISTOR, 47K, 5%, 1/4W CF	R62
5-116458	TRANSISTOR, 2N4126	Q17	POT., SLT, 100 OHM, 10%, .5W	R63
5-117827	TRANSISTOR, 2N5571	Q18	RESISTOR, 20K OHM, 5%, .25W CF	R64
5-118128	TRANSISTOR, 2N4124	Q20	RESISTOR, 6.8K OHM, 5%, CF	R65
5-118128	TRANSISTOR, 2N4124	Q21	RESISTOR, 680 OHM, 5%, CF	R66
5-118128	TRANSISTOR, 2N4124	Q22	POT., SLT, 1K OHM, 10%, .5W	R67
5-117065	TRANSISTOR, 2N6429	Q26	RESISTOR, 750 OHM, 5%, CF	R68
5-116458	TRANSISTOR, 2N4126, SILICON	Q201	RESISTOR 10 OHM, 5%, CC	R69
5-118128	TRANSISTOR, 2N4124	Q202	RESISTOR 10 OHM, 5%, CC	R71
5-116458	TRANSISTOR, 2N4126, SILICON	Q203	RESISTOR, 33 OHM, 5%, CF	R72
6-114290	TRANSISTOR, 2N7000	Q204	RESISTOR, 750 OHM, 5%, CF	R73
6-110373	TRANSISTOR, 2N4416, FET, N-CHNL	Q205	RESISTOR, 100 OHM, 5%, CF	R74
5-117827	TRANSISTOR, 2N5771	Q206	RESISTOR, 100 OHM, 5%, CF	R75
5-117827	TRANSISTOR, 2N5771	Q207	RESISTOR, 2K OHM, 5%, 1/4W CF	R76
5-117827	TRANSISTOR, 2N5771	Q208	RESISTOR, 6.8K OHM, 5%, CF	R77
5-118128	TRANSISTOR, 2N4124	Q209	RESISTOR, 47K, 5%, 1/4W CF	R78
5-118128	TRANSISTOR, 2N4124	Q210	POT., SLT, 100K OHM, 10%, .5W	R80
5-116458	TRANSISTOR, 2N4126, SILICON	Q212	RESISTOR, 750 OHM, 5%, CF	R81
5-116458	TRANSISTOR, 2N4126, SILICON	Q213	RESISTOR, 750 OHM, 5%, CF	R82
5-118160	RESISTOR, 4.7K OHM, 5%, CF	R1	RESISTOR, 270 OHM, 5%, CF	R83
5-114980	RESISTOR, 47K, 5%, 1/4W CF	R4	RESISTOR, 1.5K OHM, 5%, CF	R85
5-115506	RESISTOR, 100K OHM, 1% MF	R5	RESISTOR, 100K OHM, 5%, CF	R86
5-116633	RESISTOR, 180K OHM, 5%, CC	R6	RESISTOR, 220 OHM, 5%, CF	R87
5-117679	RESISTOR, 1K OHM, 1% MF	R7	RESISTOR 10 OHM, 5%, CC	R88
5-117693	RESISTOR, 1M OHM, 1% MF	R8	RESISTOR 10 OHM, 5%, CC	R89
5-118081	POT., SLT, 10K OHM, 10%, .5W	R9	RESISTOR 10 OHM, 5%, CC	R90
5-117693	RESISTOR, 1M OHM, 1% MF	R10	RESISTOR 10 OHM, 5%, CC	R91
5-118081	POT., SLT, 10K OHM, 10%, .5W	R11	RESISTOR, 100K OHM, 5%, CF	R92
5-115506	RESISTOR, 100K OHM, 1% MF	R12	RESISTOR, 47 OHM, 5%, CF	R93
5-115506	RESISTOR, 100K OHM, 1% MF	R13	RESISTOR, 150 OHM, 5%, 1/4W CF	R95
5-117679	RESISTOR, 1K OHM, 1% MF	R14	RESISTOR, 51 OHM, 5%, CF	R96
51-110734	RESISTOR, 237 OHM, 1%, 1/4W MF	R15	RESISTOR, 270 OHM, 5%, CF	R97
51-110734	RESISTOR, 237 OHM, 1%, 1/4W MF	R17	RESISTOR, 1.5K OHM, 5%, CF	R98
5-118128	RESISTOR, 100 OHM, 5%, CF	R18	RESISTOR, 6.2K, 5%, 1/4W	R99
5-118081	POT., SLT, 10K OHM, 10%, .5W	R19	RESISTOR, 4.7K OHM, 5%, CF	R100
5-117679	RESISTOR, 1K OHM, 1% MF	R20	RESISTOR 10 OHM, 5%, CC	R102
5-117679	RESISTOR, 1K OHM, 1% MF	R21	RESISTOR 740 OHM, 5%, CF	R103
5-115506	RESISTOR, 100K OHM, 1% MF	R22	RESISTOR, 2K OHM, 5%, 1/4W CF	R104
5-115506	RESISTOR, 100K OHM, 1% MF	R23	RESISTOR, 100 OHM, 5%, CF	R106
6-114222	RESISTOR, 27.4K	R25	RESISTOR 10 OHM, 5%, CC	R107
6-114223	RESISTOR, 3.01K OHM, 1%, 1/4W	R26	RESISTOR, 750 OHM, 5%, CF	R108
5-119060	RESISTOR, 54.9K OHM, 1%	R27	RESISTOR, 51 OHM, 5%, CF	R109
6-112848	RESISTOR, 6.04K OHM, 1%, RN55	R28	RESISTOR, 3.6K OHM, .25W CC	R110
5-114977	RESISTOR, 8.2K OHM, 5%, 1/4W CF	R29	POT., SLT, 500 OHM, 10%, .5W	R111
5-117473	RESISTOR, 3.6K OHM, .25W CC	R30	RESISTOR 1K OHM, 5%, CF	R112
5-119637	RESISTOR, 1.5K OHM, 5%, CF	R31	RESISTOR 1K OHM, 5%, CF	R113
5-118155	RESISTOR 1K OHM, 5%, CF	R32	RESISTOR, 750 OHM, 5%, CF	R114
5-118155	RESISTOR 1K OHM, 5%, CF	R33	RESISTOR, 5.6K OHM, 5%, CF	R115
5-118161	RESISTOR, 10K OHM, 5%, CF	R34	RESISTOR, 2.2K OHM, 5%, CF	R116
5-118257	RESISTOR, 5.6K OHM, 5%, CF	R35	RESISTOR 1K OHM, 5%, CF	R117
5-118155	RESISTOR 1K OHM, 5%, CF	R36	RESISTOR, 1.5K OHM, 5%, CF	R118
5-119631	RESISTOR, 390 OHM, 5%, CF	R37	RESISTOR 10 OHM, 5%, CC	R119
5-118161	RESISTOR, 10K OHM, 5%, CF	R38	RESISTOR, 10K OHM, 5%, CF	R120
5-118155	RESISTOR 1K OHM, 5%, CF	R39	RESISTOR, 6.8K, 5%, CF	R121
5-119633	RESISTOR, 470 OHM, 5%, CF	R40	RESISTOR, 10K OHM, 5%, CF	R201
5-119758	RESISTOR, 330 OHM, 5%, 1/4W	R41	RESISTOR, 10K OHM, 5%, CF	R202
5-113621	RESISTOR, 15K, 5%, 1/4W CF	R42	RESISTOR, 10K OHM, 5%, CF	R203
			RESISTOR, 10K OHM, 5%, CF	R204

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REPLACEMENT PARTS

PART NO.	DESCRIPTION	PART NO.	DESCRIPTION	PART NO.	DESCRIPTION
5-118157	RESISTOR, 2.2K OHM, 5%, CF	R205	RESISTOR, 56 OHM, 5%, CF	R260	
5-118161	RESISTOR, 10K OHM, 5%, CF	R206	RESISTOR, 4.7K OHM, 5%, CF	R261	
5-118160	RESISTOR, 4.7K OHM, 5%, CF	R207	RESISTOR 10 OHM, 5%	R263	
5-114980	RESISTOR, 47K, 5%, 1/4W CF	R208	RESISTOR, 1K OHM, 1%, MF	R264	
5-119637	RESISTOR, 1.5K OHM, 5%, CF	R209	RESISTOR, 8.87K OHM, 1%, MF	R265	
5-118155	RESISTOR, 1K OHM, 5%, CF	R210	RESISTOR, 14K OHM, .5%, MF,	R266	
5-118602	RESISTOR, 1K OHM, 5%, CF	R211	RESISTOR, WW, 1K OHMS, 5%	R267	
5-118152	RESISTOR, 100 OHM, 5%, CF	R212	RESISTOR, 1K OHM, 5%, CF	R268	
5-117679	RESISTOR, 1K OHM, 1%, MF	R213	RESISTOR, 150K, 5%, .25W, CF	R269	
5-116625	RESISTOR, 499 OHM, 1%, MF	R214	RESISTOR, 100K OHM, 5%, CF	R270	
5-118168	RESISTOR, 100K OHM, 5%, CF	R215	RESISTOR, 1K OHM, 5%, CF	R271	
5-118155	RESISTOR, 1K OHM, 5%, CF	R216	RESISTOR, 2.7K OHM, 5%, CF	R272	
5-118154	RESISTOR, 560 OHM, 5%, CF	R217	RESISTOR, 10K OHM, 5%, CF	R273	
5-115506	RESISTOR, 100K OHM, 1%, MF	R219	RESISTOR, 10K OHM, 5%, CF	R274	
5-115506	RESISTOR, 100K OHM, 1%, MF	R220	RESISTOR, 1K OHM, 5%, CF	R275	
5-117510	RESISTOR, 82.5K OHM, 1%, MF	R221	RESISTOR, 100K OHM, 5%, CF	R276	
5-117272	RESISTOR, 17.4K OHM, 1%, MF	R222	RESISTOR, 10K OHM, 5%, CF	R277	
5-118168	RESISTOR, 100K OHM, 5%, CF	R223	RESISTOR, 47K, 5%, 1/4W CF	R278	
5-118160	RESISTOR, 4.7K OHM, 5%, CF	R224	RESISTOR, 1K OHM, 5%, CF	R279	
5-118081	POT., SLT, 10K OHM, 10%, .5W	R225	RESISTOR, 100K OHM, 5%, CF	R280	
5-114980	RESISTOR, 47K, 5%, 1/4W CF	R226	RESISTOR, 1K OHM, 5%, CF	R281	
5-113030	RESISTOR, 4.99K OHM, 1%, MF	R227	RESISTOR, 10K OHM, 5%, CF	R282	
5-118081	POT., SLT, 10K OHM, 10%, .5W	R228	RESISTOR, 10K OHM, 5%, CF	R283	
5-114962	RESISTOR, 10K OHM, 1%, MF	R229	RESISTOR, 100K OHM, 5%, CF	R284	
5-119006	RESISTOR, 1.8K OHM, 5%, CC	R230	RESISTOR, 220 OHM, 5%, CF	R285	
5-118161	RESISTOR, 10K OHM, 5%, CF	R232	POT., SLT., 100K OHM, 10%, .5W	R286	
5-118168	RESISTOR, 100K OHM, 5%, CF	R233	RESISTOR, 1K OHM, 5%, CF	R287	
5-118155	RESISTOR, 1K OHM, 5%, CF	R234	RESISTOR, 10K OHM, 5%, CF	R288	
5-119006	RESISTOR, 1.8K OHM, 5%, CC	R235	RESISTOR, 4.7K OHM, 5%, CF	R289	
5-118154	RESISTOR, 560 OHM, 5%, CF	R236	RESISTOR, 47 OHM, 5%, CF	R290	
5-116093	RESISTOR 470 OHM, 5%, CC	R237	RESISTOR, 10K OHM, 5%, CF	R291	
5-118161	RESISTOR, 10K OHM, 5%, CF	R238	RESISTOR, 10K OHM, 5%, CF	R292	
5-118160	RESISTOR, 4.7K OHM, 5%, CF	R239	6-114258	POTENTIOMETER, 10K	R301
5-118888	RESISTOR, 120 OHM, 5%, CF	R240	6-114257	POTENTIOMETER, 2.2K W/SWITCH	R302
5-118160	RESISTOR, 4.7K OHM, 5%, CF	R241	5-110363	RESISTOR, 240 OHM, 1%	
5-118308	RESISTOR, 2.2M OHM, 5%, CF	R242	6-114258	POTENTIOMETER, 10K	R303
5-118152	RESISTOR, 100 OHM, 5%, CF	R243	6-114258	POTENTIOMETER, 10K	R304
5-118160	RESISTOR, 4.7K OHM, 5%, CF	R244	6-114258	POTENTIOMETER, 10K	R305
5-118305	RESISTOR, 1M OHM, 5%, CF	R245	6-114258	POTENTIOMETER, 10K	R306
5-118305	RESISTOR, 1M OHM, 5%, CF	R246	5-110363	RESISTOR, 240 OHM, 1%	
6-110362	RESISTOR, 160 OHM, 5%, CF	R247	6-114230	CABLE, 16 PIN	P301
6-110361	RESISTOR, 130 OHM, 5%, CF	R248	6-114227	CABLE, 8 PIN	P302
5-118153	RESISTOR, 180 OHM, 5%, CF	R249	6-114229	CABLE, 14 PIN	P307
5-119993	POT., SLT, 100 OHM, 10%, .5W	R250	6-114154	CRYSTAL, 10.000 MHz	X201
5-116093	RESISTOR 470 OHM, 5%, CC	R251	6-114199	PAD, SPACER FOR CRYSTAL	
5-115117	RESISTOR 10 OHM, 5%	R252	6-114251	8 PIN HEADER, .100 CTR	
5-114969	RESISTOR, 270 OHM, 5%, .25W CF	R253	6-114254	16 PIN HEADER, .100 CTR	
5-114969	RESISTOR, 270 OHM, 5%, .25W CF	R254	6-113901	HEATSINK	
5-114969	RESISTOR, 270 OHM, 5%, .25W CF	R255	3-261206	PUSHBUTTON, MOLDED, RED	
5-114965	RESISTOR, 510 OHM, 5%, CF	R256	3-261211	PUSHBUTTONS, MOLDED, GRAY	
5-114969	RESISTOR, 270 OHM, 5%, .25W CF	R257	6-114264	SWITCH, P/BUT/ 14 STA, CP	
6-110362	RESISTOR, 160 OHM, 5%, CF	R258			
		R259			

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MODEL 422 SCHEMATIC GENERATOR BOARD

FIGURE 4-1

FUSE TABLE

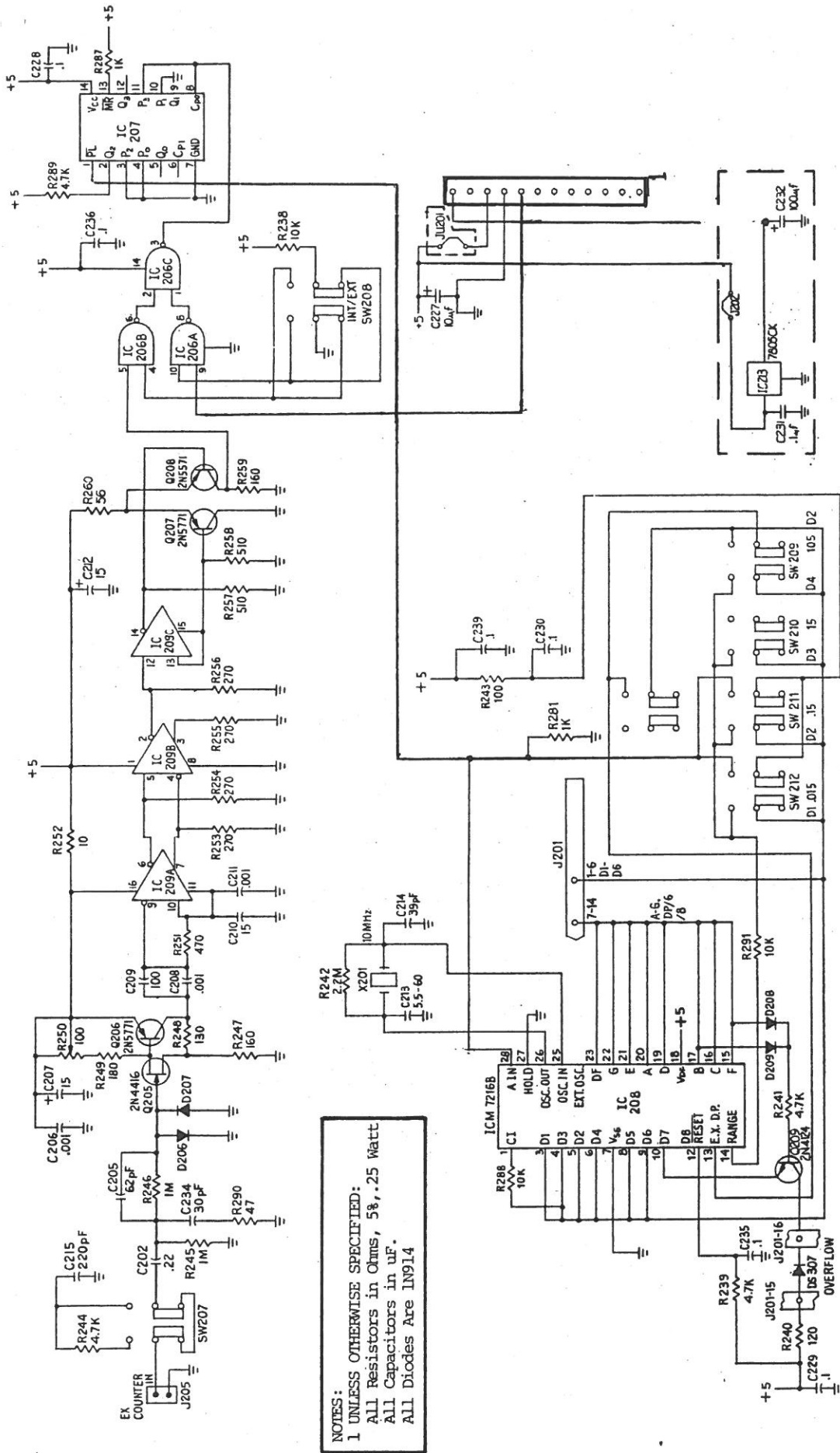
1/AA SLO BLO	120V
1/BA SLO BLO	250V

JUMPER TABLE

IN	OUT	VOLTAGE
J11	J12	120V
J13	J14	250V

NOTES
 1) ALL RESISTORS ARE IN OHMS AND ARE 1/4W UNLESS OTHERWISE NOTED.
 2) ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE NOTED.

MODEL 422 MULTIFUNCTION SIGNAL GENERATOR



NOTES:
 1 UNLESS OTHERWISE SPECIFIED:
 ALL Resistors in Ohms, 5%, .25 Watt
 ALL Capacitors in μ F.
 ALL Diodes Are IN914

FIGURE 4-2

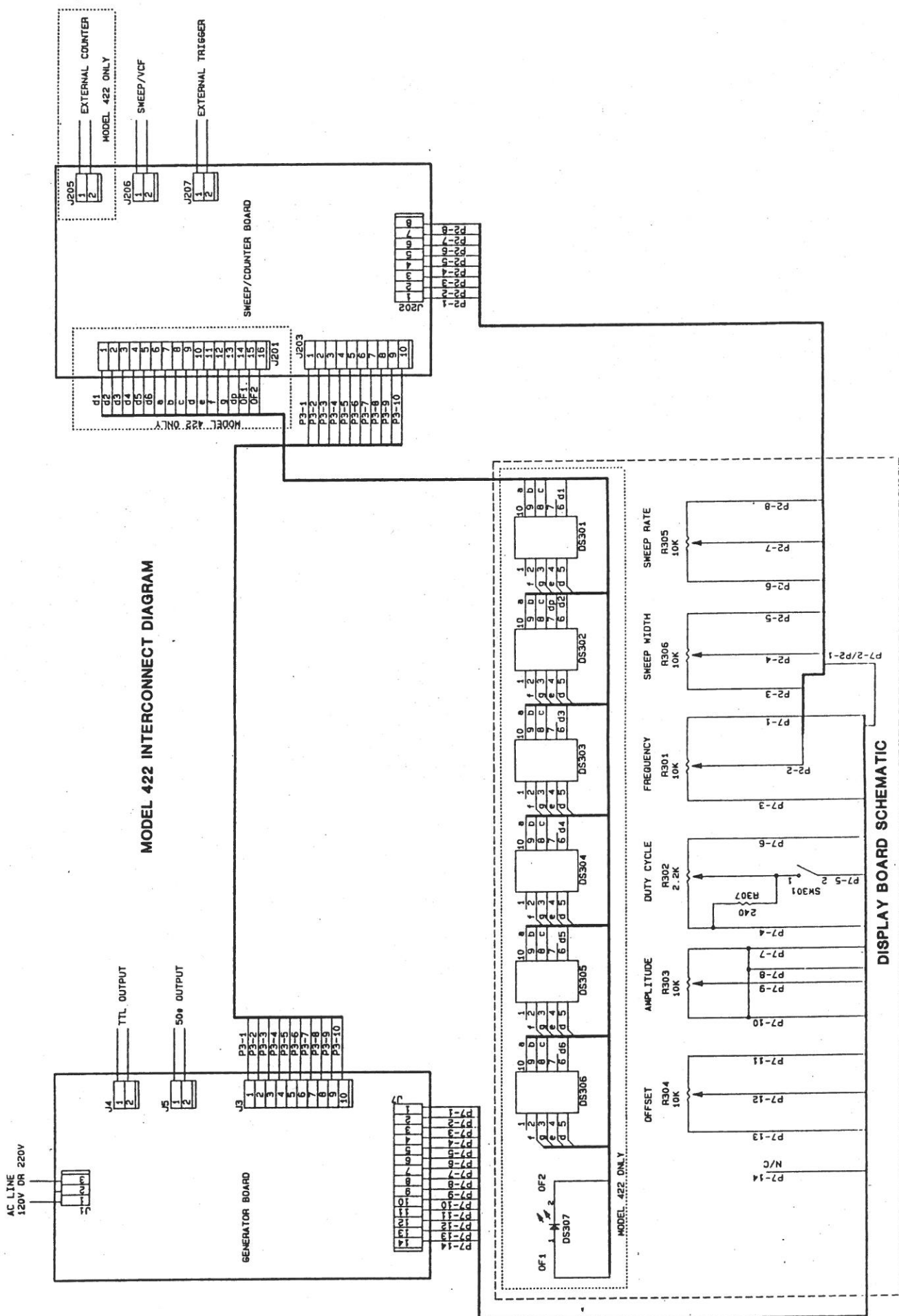


FIGURE 4-3