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OPERATING INSTRUCTIONS

MODEL 304-B

RUBIDIUM FREQUENCY STANDARD

Serial No. 462

GENERAL TECHNOLOGY CORPORATION
9610 Bellanca Avenue
Los Angeles, California 90045

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APPENDIX

1. GENERAL DESCRIPTION

1.1 Description. A brief description of the standard, along with general specifications, is given in the Technical Data Sheet on the following page.

1.2 Equipment Supplies. An MS-3106A-10SL-3S connector for use in connecting the standard to a DC power source is supplied.

1.3 Accessories Available.

1.3.1 Standby Power Supplies. In applications where the standard must operate during times of primary power interruption either the Model 311-A or 311-B Standby Power Supply may be used. Both supplies use sealed nickel-cadmium cells. The 311-A charges at a gradual rate satisfactory in most applications. The 311-B provides rapid recharging.

1.3.2 Time Scale Selector. The gas cell of each rubidium standard is made to a specified International Time Scale. Those units on UT-2, Universal Time, may need a new gas cell each time a new value of UT-2 time is announced because the fine tuning control will not usually cover such changes.

The gas cell can be changed at the factory, but the user must be without his standard for 30-45 days while the change is being made. General Technology Corporation has developed a step synthesizer, called the Time Scale Selector, which can be included in the Model 304-B (or added later) and which provides quick changes of time scale and encompasses a range from Ephemeris Time (zero reference) to about 600×10^{-10} below Ephemeris.

2. INSTALLATION

2.1 Unpacking and Inspection. Inspect for damage in shipment immediately on unpacking the instrument. If reshipment is expected, save the shipping container. If the instrument is damaged in any way, notify the carrier.

2.2 Installation. The instrument may be rack mounted or operated on a bench. Remove the four rubber feet prior to mounting in a rack. Holes in the side panels are located to accept "Chassis-Trak" brand CTD type slides. In bench operation the rubber feet should be in place, or some other means used to provide ventilation space between the instrument and the bench.

2.3 AC Power. The power cord should be plugged into a three-prong receptacle of the NEMA approved type. If a two-prong adapter is used, the external adapter wire to ground should be grounded. Input power required is 115 VAC (nominal), 50-400 cps.

2.4 DC Power. For operation from DC the positive supply lead should be connected to pin A of the connector at the rear of the instrument and the negative (ground) to pin B. A mating connector type MS-3106-A-10SL-3S is supplied. For proper DC operation, the supply voltage should not fall below 23 volts. If both AC and DC power are applied simultaneously, power will be drawn from the external DC supply only if the AC line is below approximately 90 volts.

2.5 Ambient Magnetic Fields. The instrument will be affected somewhat if operated in regions of large AC or static magnetic fields. For best operation, the static ambient field should not exceed three gauss (the earth's magnetic field is about one-half gauss).

2.6 Installation of Time Scale Selector Kit.

Remove power from the rubidium frequency standard during installation of the Time Scale Selector.

The installation kit consist of one (1) Time Scale Selector Board 9 and one (1) crystal filter and mounting bracket.

2.6.1 Remove Boards 2 and 3.

2.6.2 Remove the three red jumpers on Board 2 as indicated in Dwg. G-34112. Solder two jumpers indicated with wire provided.

2.6.3 Remove the red jumper in Board 3 as indicated in Dwg. G-34111.

2.6.4 Remove paper back from part number tag provided and place securely over old part number.

2.6.5 Replace Boards 2 and 3 in their respective slots.

2.6.6 Place Board 9 in Board 9 slot.

2.6.7 Place crystal filter and bracket on the chassis where indicated in Final Assembly (Item 26 - Dwg. G-52288). Fasten in place with the two screws provided.

2.6.8 There are two unterminated cables marked with filter-in (P28) and filter-out (P29). These are spot tied together with black lacing cord. Connect the input cable to the input terminal of the filter. Connect the output cable to the output terminal.

NOTE: Board 9 MUST BE REMOVED BEFORE BOARD 8.

3. OPERATION

3.1 Initial Checks. With AC power applied, throw the front panel power switch to the "ON" position; the front panel red indicator will light. If operation is from external DC power, the instrument is energized independent of the position of the front panel power switch. The three small switches on the internal panel (accessible on opening the hinged cover on top of the instrument) should all be in the left hand position, i.e., with toggles toward the meter. The OSCILLATOR FREQUENCY CONTROL dial on the internal panel should be set at approximately mid-scale or at the value last determined in periodic maintenance. In initial use the value set at the factory and recorded in Table 5-1 is appropriate.

3.2 Warmup. A warmup period of at least one hour, and preferably two hours, is recommended. During the warmup period a slight audible click may come from within the instrument at approximately 30 second intervals. This is due to a relay closure initiating the frequency sweep of the automatic search circuits. The click may be accompanied by a momentary flash of the front panel indicator lights.

Within an hour the AFC loop will come into lock. In this condition the front panel red light indicator is off and the green light is on. The instrument may then be used, but accuracy is somewhat reduced, perhaps 1×10^{-9} or better; specified accuracy and stability are not achieved until after the full warmup period.

3.3 Outputs. The outputs are nominal 50 ohms with a power level of at least 10 dbm. If not properly terminated the output waveforms will be distorted, but with no effect on accuracy or stability.

3.4 Fine Frequency Adjustment. Output frequency of the standard may be adjusted over a range of about 5×10^{-9} by means of the FINE TUNING control dial; it is accessible on opening the top cover. Two calibration charts associated with this control are provided. One gives the control dial setting vs. frequency change; the other shows the control dial change required to cause a frequency change of 1×10^{-11}. It should be noted that the control is not linear; at the high end of the scale a unit dial change produces a larger frequency change than at the low end. The dial is set at the factory to make the output frequencies correspond to the desired time or frequency scale. This setting is recorded in Table 5-1. The dial may be locked to prevent inadvertent movement. This adjustment is also used during Time Scale changes (See Section 6).

3.5 Monitoring Functions. The internal panel containing the LOOP ERROR SIGNAL meter, the OSCILLATOR FREQUENCY CONTROL dial, and the three toggle switches is provided for use in monitoring and maintenance of the instrument. In normal operation these switches should be in the normal or automatic position.

3.5.1 The CONTROL switch opens and closes the AFC loop; in the AUTOMATIC position the loop is closed. If the loop is opened the output frequency of the standard may be varied manually over a range of about 6×10^{-7} by means of the OSCILLATOR FREQUENCY CONTROL.

3.5.2 The ACQUISITION switch controls the automatic acquisition circuit. In the DISABLE position the automatic frequency sweep recurs continuously (the sweep range is approximately that which can be effected manually by the OSCILLATOR FREQUENCY CONTROL). In the NORMAL position the sweep ceases

when the loop comes into lock.

3.5.3 Use of the SWEEP switch is required only in certain diagnostic maintenance tests; it should be left in the NORMAL position.

GENERAL HEADING

TRACOR

DATA SHEET

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DESCRIPTION

The GTC Model 304-B Rubidium Frequency Standard is an accurate, stable, compact, and rugged standard intended for general laboratory and field use. It consists of a quartz crystal oscillator whose frequency is automatically maintained at a subharmonic of the F=2, m=0, $\longrightarrow$ F=1, m=0 microwave resonance (6834.6826 MHz) in the ground state of rubidium 87. A synthesizer translates the oscillator frequency to outputs at standard frequencies.

Since the atomic resonance frequency is almost entirely unaffected by environmental factors, it provides a fixed and precisely known reference point in the radio frequency spectrum. This resonance is used as the discriminator of an AFC loop in which the crystal oscillator is the controlled element. Accordingly, the stability of the atomic resonance is transferred to the crystal oscillator.

DESCRIPTION (continued)

The rubidium in which the resonance occurs is in the form of a vapor contained within a small glass cell. The cell itself is inside a resonant cavity excited by a signal at an integral multiple of the crystal oscillator frequency. Optical radiation generated in a rubidium discharge lamp and filter cell combination passes through the gas cell and considerably enhances the strength of the microwave resonance by the process of optical pumping. The extent to which optical radiation is absorbed in the gas cell depends on the relative absorption of microwave energy and, thus, provides a measure of the departure of the microwave excitation frequency from resonance. An error signal derived from detection of the transmitted optical radiation controls the crystal oscillator.

Temperature of the cavity and lamp are controlled in order to stabilize operating characteristics of each and to eliminate second-order variations of the atomic resonance frequency with temperature. Magnetic shielding of the gas cell eliminates the effects of variations in ambient fields. All active components are solid state devices, i.e., transistors and diodes, operating well derated; no unusual circuits are employed.

OPERATION

After initial warmup, the AFC loop is brought into lock by an automatic sweep system. Condition of the loop is indicated by the front panel lights. Routine maintenance is simple and can be performed using normally available laboratory test equipment. There are no moving parts or materials to be replenished.

Except for the optical-microwave unit, main power supply, and the crystal oscillator, all circuits are mounted on plug-in circuit boards. Nine such boards are used. The crystal oscillator, optical-microwave unit, and main power supply can each be replaced as individual entities. Plug-in circuit boards are interchangeable between standards without adjustment

OPERATION (continued)

or alignment. Replacement of interchangeable boards does not affect the frequency of the standard.

OPTIONS & ACCESSORIES AVAILABLE

Model 332-B Time Scale Selector

This accessory synthesizer can be installed in the 304-B to give it a versatility unequaled and previously unavailable in either atomic or crystal frequency standards. It achieves (1) quick changes of time scale value or (2)convenient calibration offsets by shifting the rubidium standard output with a precision of 1 part in 10^{11} to any desired value within the range 940×10^{-10}.

Model 311-A Standby Power Supply

Although rubidium frequency standards experience no shifting of frequency due to power outages, users keeping precise time must operate the standards continuously through power failures. The Model 311-A furnishes 8 hours of standby power from Nickel-Cadmium cells.

SPECIFICATIONS

Electrical

Initial Frequency Setting:	$\pm 5 \times 10^{-11}$ relative to customer prescribed frequency or time scale ($\pm 2 \times 10^{-11}$ if set at the National Bureau of Standards)
Accuracy:	After initial setting, Accuracy is determined by the Long-Term Stability.
Long-Term Stability:	5×10^{-11} (Standard Deviation) for one year
Medium-Term Stability:	5×10^{-12} (Standard Deviation) for 100 second averaging.
Short-Term Stability:	1×10^{-11} (Standard Deviation) for one second averaging time.

SPECIFICATIONS (continued)

Electrical (continued)

Tunability:	At least $\pm 1 \times 10^{-9}$ about the initial frequency setting; total range 4×10^{-9}. A calibration chart of frequency change vs. tuning control dial setting is provided.
Output Frequencies & Levels:	5 MHz, 1 MHz, 100 kHz; others, 1 kHz to 100 MHz, can be supplied; 1 volt rms at 50 ohms, each output.
Spectrum:	Equivalent bandwidth 1 Hz at 24 GHz, AC line frequency sidebands more than 100 db below carrier. Non-harmonically related signals more than 70 db below carrier.
Input Voltage:	90 to 130 VAC, 50 to 400 Hz, single phase, or 23 to 31 VDC. If both are applied, DC source provides power only if AC fails.
Operating Power:	35 watts AC, 30 watts DC
Warmup Power:	58 watts AC, 50 watts DC
DC Connector Supplied:	MS 3106A-10SL-3S

Environment Sensitivity

Ambient Temperature:	Long and short-term stability is maintained over the operating temperature range.
Magnetic:	Less than 5×10^{-12} for any orientation in the earth's magnetic field.
Operating Temperature:	0 to 45°C
Storage Temperature:	-65 to 100°C
Relative Humidity:	0 to 95%
Altitude:	0 to 40,000 feet.

SPECIFICATIONS (continued)

Physical

Size:	5-7/32" high x 16-1/2" long x 19" wide for standard rack mounting. (Also accepts Chassis-Trak CTD 118 slides).
Weight:	39 pounds.
Shipping Weight:	50 pounds.
Output Connectors:	Type BNC (front panel)

Controls and Indicators

Front Panel:	Loop lock indicator lights. AC power switch.
Internal Panel:	Crystal oscillator bias control, control loop error signal meter, automatic-manual sweep switch, acquisition disabling switch, sweep disabling switch, Fine tuning control.
Test Points	Regulated voltages, heater voltages, 2nd harmonic signal; all accessible from the rear of the standard.

4. PRINCIPLES OF OPERATION

4.1 Introduction. The Model 304-SC Rubidium Frequency Standard derives its long term stability from the unvarying frequency of an absorption resonance in the element rubidium. This resonance is used as the reference in an AFC loop having as its controlled element a quartz crystal oscillator. A simplified block diagram illustrating this AFC concept is shown in Figure 4-1.

The rubidium resonance frequency f_o is approximately 6834.68 Mc; the crystal oscillator operates nominally at an integral submultiple of this frequency. In the absence of a correcting signal the frequency-multiplied output of the crystal oscillator is at some frequency f, near f_o. An error signal proportional to the difference between f and f_o is developed and applied to the crystal oscillator in such a way that this difference always is reduced toward zero. In this manner the stability of the rubidium resonance is transferred to the crystal oscillator.

A synthesizer translates the oscillator signal to frequency outputs of 5 MHz and 3.58 MHz.

4.2 Resonance Frequency Sensing. In many respects the rubidium absorption resonance characteristics are similar to those of a tuned circuit. In this sense, if rubidium atoms are subjected to a radiation field with frequency close to f_o they will absorb energy from that field. The amount of energy absorbed is extremely small, however, and it is impractical to sense the resonance by straight-forward microwave absorption techniques. In addition to absorbing microwave energy of a particular frequency, rubidium also absorbs, in a similar fashion, optical radiation of characteristic wavelengths. If rubidium atoms are subjected to radiation at a particular one of these wavelengths

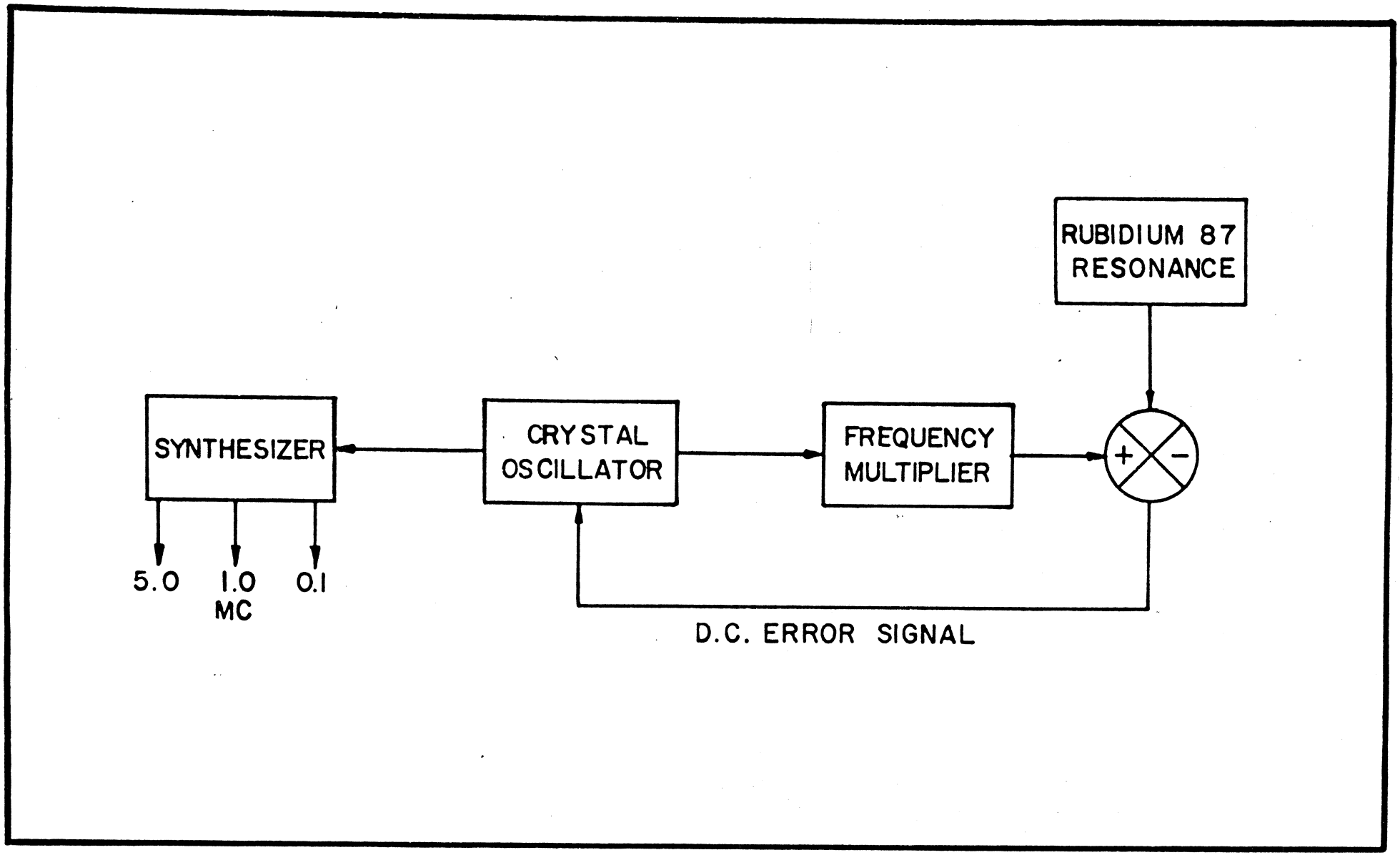


FIG. 4-1: Illustration of the AFC Loop Concept.

while at the same time being under the influence of microwave radiation at a frequency f near f_o, the degree to which the optical radiation is absorbed depends on the difference between f and f_o. This phenomenon provides a practical means of monitoring the microwave absorption.

Irradiating with the appropriate characteristic optical radiation also greatly enhances the ability of the rubidium to absorb microwave resonance radiation, through the process of optical pumping. This enhancement and the relative ease of detecting the absorbed optical energy form the basis of the method for sensing the resonance frequency. Figures 4-2 and 4-3 illustrate the essential features of this method.

To obtain an error signal which depends on the sign of $f - f_o$, the microwave signal frequency is varied symmetrically about f at audio rate. In practice this is accomplished by phase modulation produced in the frequency multiplier.

As illustrated in Figure 4-4 the optical transmission of the rubidium, and thus the current I in the optical detector, is thereby amplitude modulated. Note that the phase of the detector current for $f > f_o$ is 180° different from the phase for $f < f_o$; in addition, for $f = f_o$ the component of the detector current at the modulation rate vanishes. Note also that the amplitude AC detector current depends on the frequency difference $f - f_o$.

After amplification, the detector current is synchronously demodulated using as a reference the audio signal used to produce the modulation on f. For f near f_o the DC error signal so obtained is proportional to the difference, $f - f_o$. The form of the error voltage is shown in Figure 4-5.

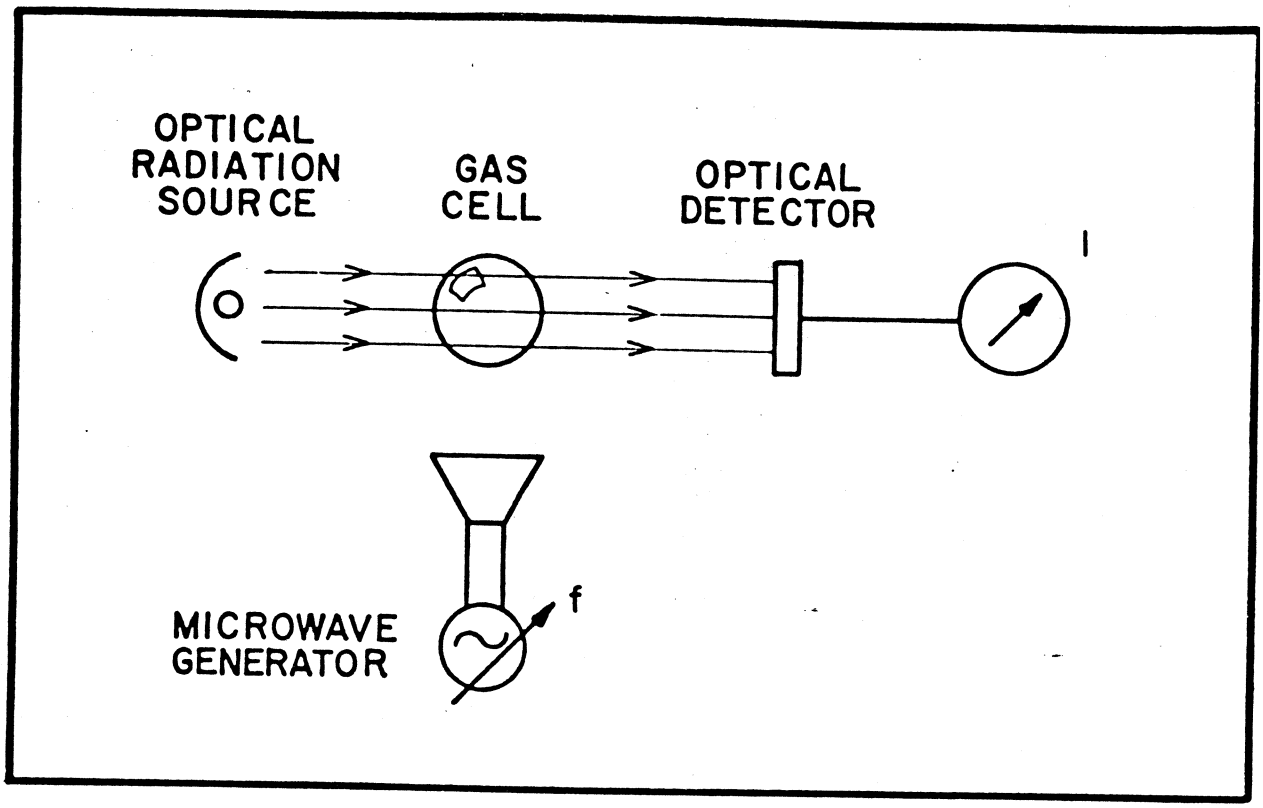


FIG. 4-2: Simplified Arrangement to Illustrate Optical Detection of Rubidium Resonance.

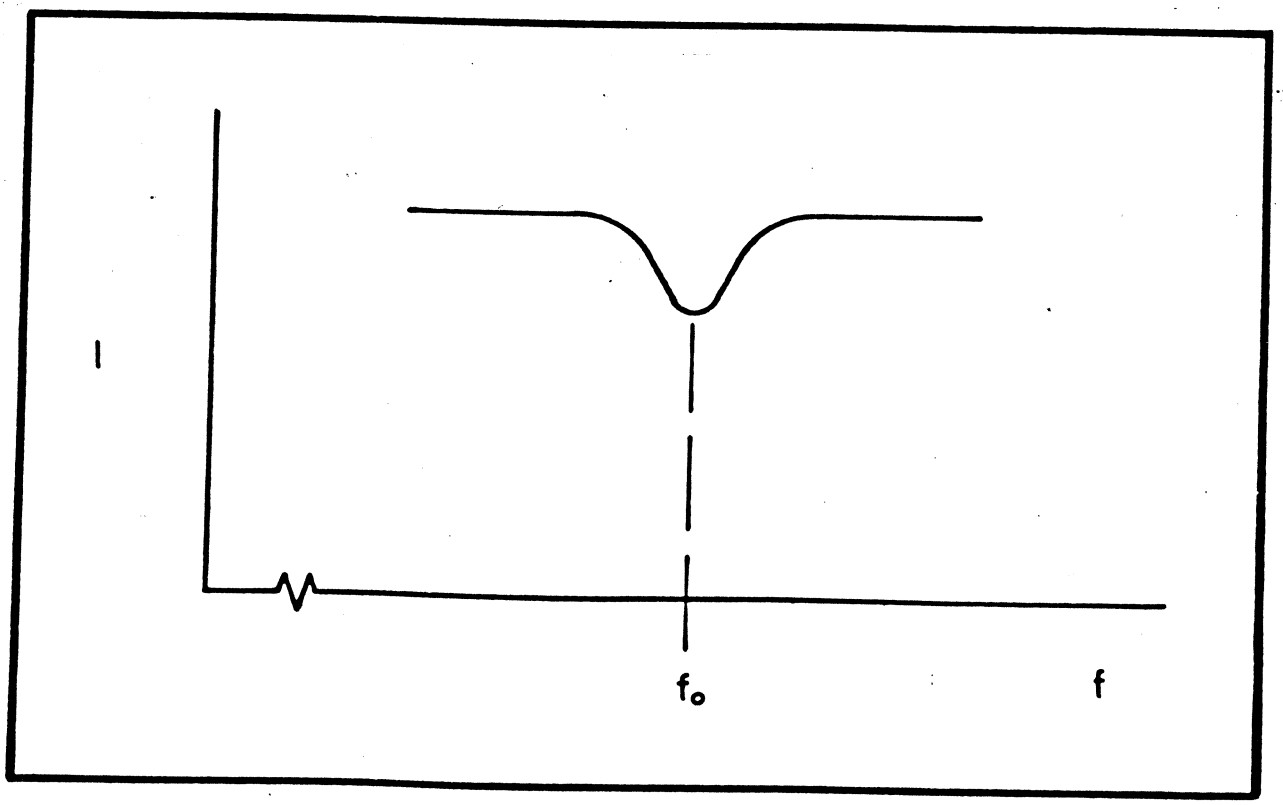


FIG. 4-3: Dependence of Photodetector Current on Microwave Generator Frequency. Drop is at the Rubidium Resonance Frequency.

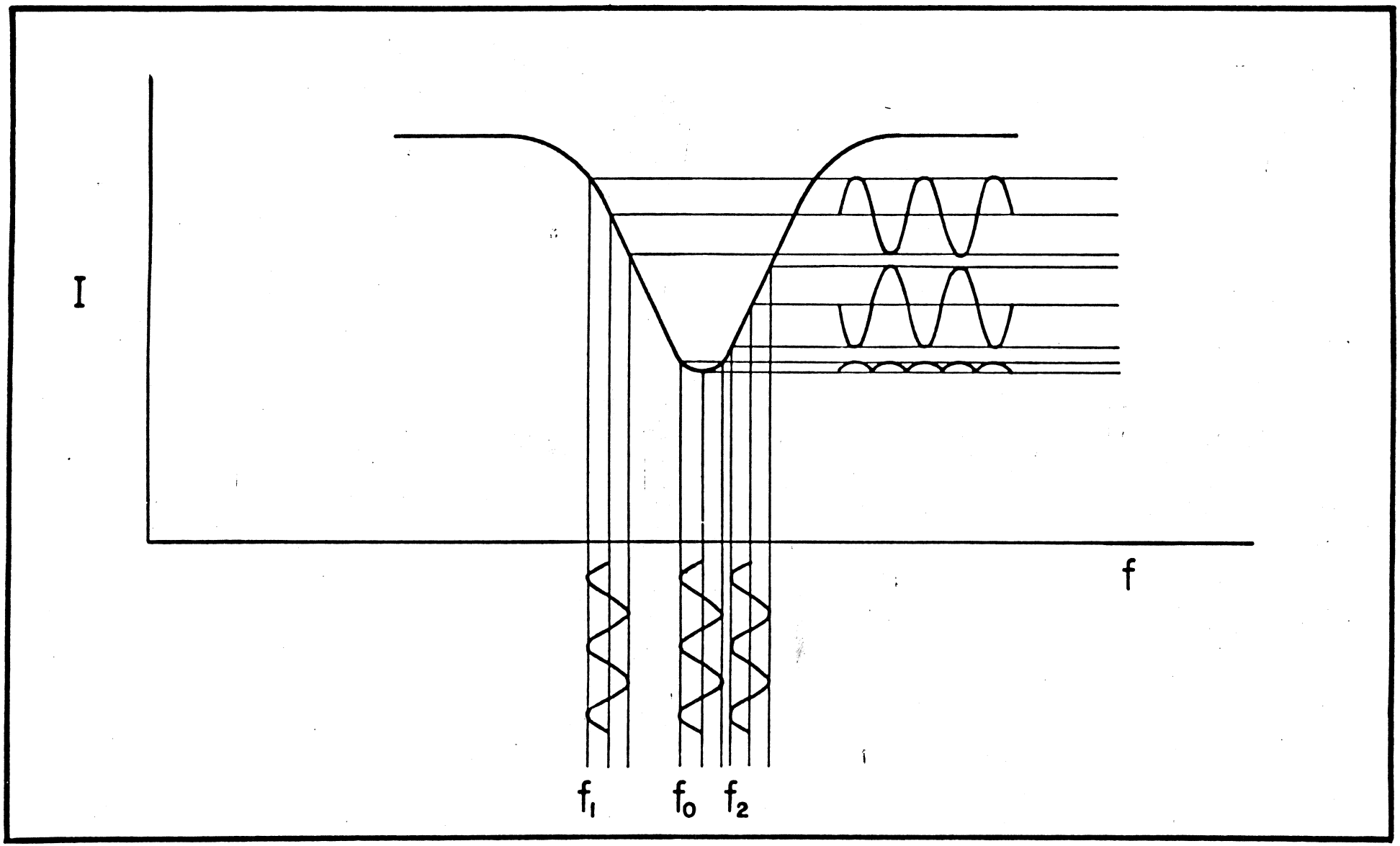


FIG. 4-4: Illustration of How Modulation of the Microwave Generator Produces Modulation of the Photodetector Current.

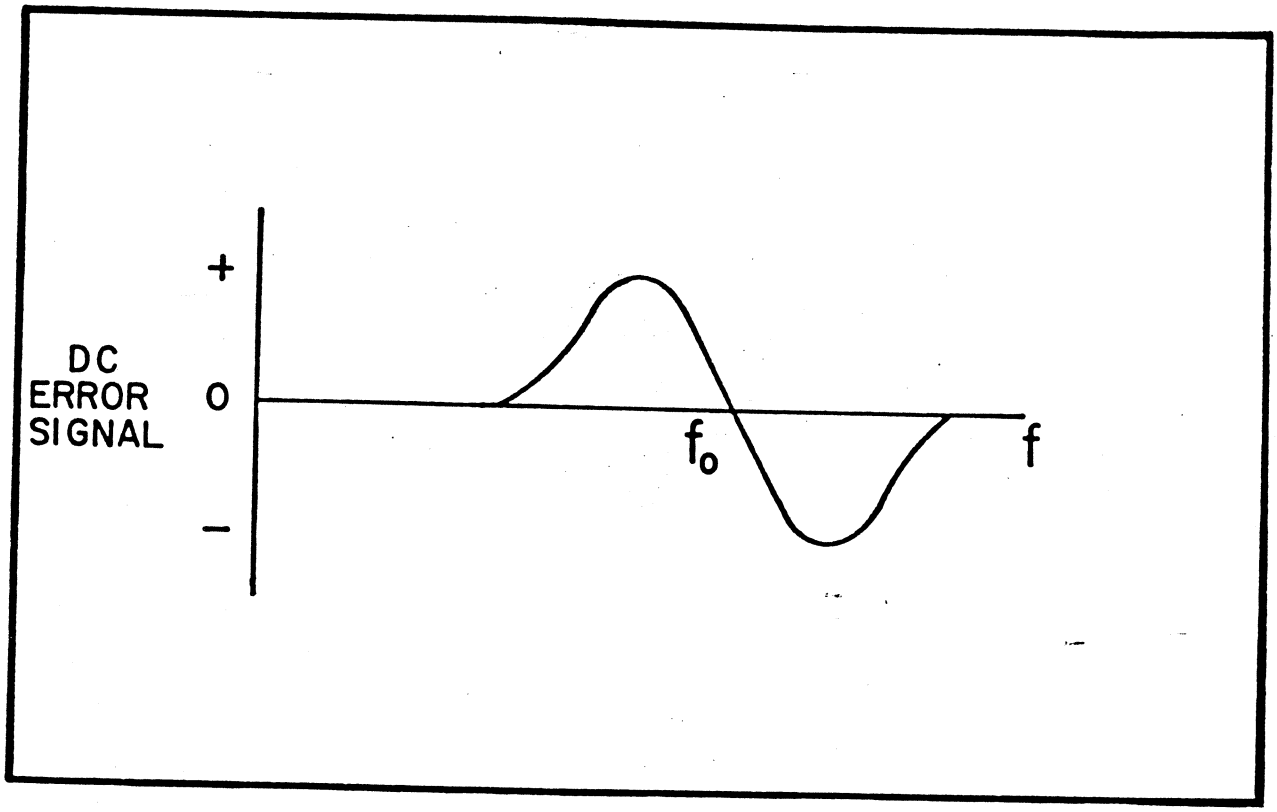


FIG. 4-5: Photodetector Current after Synchronous Demodulation.

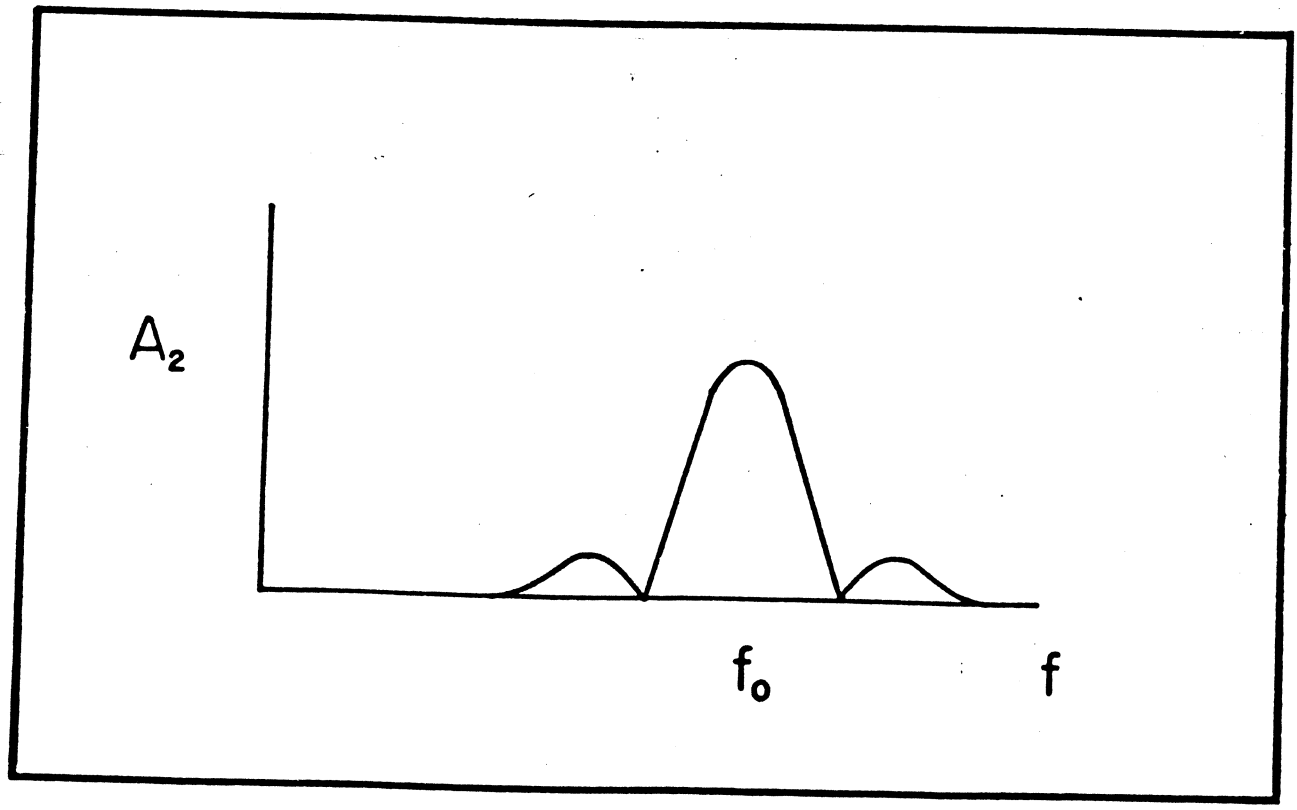


FIG. 4-6: Amplitude of the Photodetector Current at Twice the Modulation Rate.

4.3 Fine Frequency Adjustment

4.3.1 Magnetic Field Effect. The exact value of the frequency, f_o, depends to a small degree on the magnetic field. In particular,

$$f_o = f_1 + 573\ H^2\ \text{cps} \qquad (1)$$

where f_1 is the field-free value of f_o, and H is the strength of the magnetic field component, in gauss, parallel to the optical pumping light beam. This dependence allows the output frequency of the standard to be tuned over a small range; however, it requires that the gas cell be shielded from the earth's field and other magnetic sources.

4.3.2 C-field Solenoid. A controllable magnetic field, called the C-field, is produced by means of a solenoid coil. The axis of the coil is coincident with that of the optical pumping light beam. Value of the C-field is established by the current through the solenoid. This current is controlled by the FINE TUNING control dial providing a means for adjusting the output frequency of the standard.

4.4 Detailed Description

4.4.1 General. A block diagram showing the principle functional subsystems and their interrelations is given in Drawing 32327*. The elements forming the AFC loop are the crystal oscillator, frequency multiplier and phase modulator, the optical-microwave unit containing the optical radiation source, gas cell, etc., the 155 cps amplifier, 155 cps oscillator, and synchronous detector.

The function of these subsystems has been discussed above. The acquisition and sweep circuits automatically bring the AFC into lock by causing the crystal oscillator frequency to be swept slowly through the region where the loop may lock and sensing if lock has occurred. Power supplies, heater control circuits, and the synthesizer make up the remainder of the standard. Viewing the instrument from the top with the cover open, the black box on the right near the front panel is the main power supply. The box on which are mounted the meter and control switches contains also the crystal oscillator. The black rectangular structure located in the left rear is the optical-microwave unit. All other components are mounted on circuit boards; these and the optical-microwave unit are accessible by removal of the rear cover.

* Drawing No. 33799, if the Model 304-B is with a Time Scale Selector.

4.4.2 Optical-Microwave Unit. A cross section of this unit is shown in Drawing 22331. The rubidium in which the resonance occurs is in the form of a vapor contained in the gas cell. The cell itself is inside a cavity resonant at 6834 Mc in the TE011 mode. Apertures in the cylindrical ends of the cavity allow transmission of the optical pumping radiation. A silicon solar cell serves as the photodetector. Affixed to the cavity, and in thermal equilibrium with it, is the supporting structure for the filter cell. A bifilar heater is wound about the cavity periphery; a thermistor temperature sensor is imbedded in the cavity. Also attached to the cavity are the preamplifier, and the power amplifier which drives the SRD frequency multiplier.

The optical pumping lamp is excited by a radio frequency discharge. A parabolic reflector directs radiation from the discharge region toward the filter cell and gas cell. The lamp exciter is mounted on a circuit board which forms, along with the thermal insulating material, the lamp support. A bifilar heater is wound on the outer surface of the reflector, and thermistor temperature sensor is attached to the reflector.

Both the lamp and the cavity are rigidly mounted in a phenolic tube. This tube serves to reduce heat transfer from the lamp to the cavity, which operates at a lower temperature than the lamp. The tube also provides a mounting form for the C-field solenoid. A multi-layer magnetic shield surrounds the components comprising the optical-microwave unit.

4.4.2.1 Preamplifier (Drawing 42140). This subsystem amplifies the AC photodetector current. It is an AC coupled amplifier of conventional design. Q1101 is factory selected for low noise characteristics. Heavy decoupling is used to prevent interstage interaction through the 15 volt supply. The output is fed to the 155 cps and 310 cps amplifiers located on Board 6 (Drawing 42137).

4.4.2.2 70 MHz Power Amplifier (Drawing 34864). This subsystem raises the power level of the 70 MHz phase modulated signal, produced on Board 7, (see paragraph 4.4.4) and drives the step recovery diode (SRD) frequency multiplier. The combination C1211, L1204 C1213 and C1214 form a pi-network to match the amplifier output to the SRD CR1901. C1901 is a microwave bypass built into the SRD mount.

4.4.2.3 Lamp Oscillator (Drawing 32133). Excitation to the lamp proper is obtained from this subsystem. L1301 is wound around the lamp bulb. The oscillator frequency is between 21 and 25MHz per second.

4.4.3 Crystal Oscillator (Drawing 44801). The crystal oscillator and its temperature control circuits are contained in a single sub-assembly. This assembly is housed inside the box mounting the meter and control switches.

4.4.3.1 Crystal Oscillator. The crystal is a fifth overtone contour ground unit mounted in an evacuated bulb. The bulb is in good thermal contact with a temperature controlled housing. Operation is in the parallel

resonance mode at a frequency of 4.981550 Mc. The oscillator stage, Q1401, is followed by two stages of amplification. AC voltage developed in the last stage is rectified in diodes CR1402 and CR1403 and applied back to the base of Q1401. This provides AGC action to maintain the crystal drive at a constant level. Voltage control of the oscillator frequency is accomplished by means of the voltage variable capacitor CR1401. The sensitivity is about 2×10^{-7} per volt.

4.4.3.2 Temperature Control. A thermistor bridge, RT1401, R1430, R1432, R1433 R1434, followed by the difference amplifier A1401 and Q1404, and current amplifier Q1405 and Q1406 forms the temperature control circuit. The bridge is set at the factory by adjustment of R1432 to attain the operating temperature required for the particular crystal used. The thermistor is imbedded near the heater coil, and both are in close thermal contact with the crystal envelope.

4.4.4 Frequency Multiplier - Phase Modulator, Board 7, (Drawing 42969). This subsystem accepts the output of the crystal oscillator, and produces a phase-modulated output at 69.7417 Mc. The input is applied to buffer-amplifiers Q701 and Q702. Output of the latter drives the frequency synthesizer. Multiplication by a factor of 2 is accomplished in the diode CR701 followed by the bandpass filter, T703 and T704, and associated capacitors. Phase modulation is produced by means of the voltage variable capacitor CR702 across the tank circuit of Q703. CR702 is heavily back biased

and the 155 cps modulating signal is applied to it through a voltage divider, filter, and phase shift network. Multiplication by a factor of 7 is accomplished in Q704. This stage is followed by two stages of amplification, Q705 and Q706. The two intervening bandpass filters remove undesired sidebands.

4.4.5 Modulation Oscillator and Synchronous Detector, Board 5, (Drawing 42136). The modulation oscillator provides a signal at 155 cps which is used to produce the phase modulation in the frequency multiplier, and to demodulate the amplified AC signal from the photodetector. Design of this oscillator is conditioned on the requirement that even harmonic distortion be low. Frequency is set by L501 and associated capacitors. Amplification and regenerative feedback take place in the stages Q501 and Q502. Output is taken from the emitter follower Q503. The diodes CR501 and CR 502 clip the output of Q501 and the resulting waveform is AC coupled to the input through C501. This feedback insures that the even harmonic distortion is low.

The diode bridge (CR503 - CR506) synchronous detector has transformer coupled inputs. R515 is set at the factory and does not need readjustment. R524, R525, C517, and C518 provide filtering for the LOOP ERROR SIGNAL meter. Filtering for the control loop error signal is provided by R526 and C1602; the latter is shown on Drawing 32132.

4.4.6 Signal Amplifiers, Board 6, (Drawing 42137). This subsystem is a two channel narrow-band amplifier. It accepts the preamplifier output. One channel amplifies signals centered on the modulation frequency of 155 cps and the other at 310 cps. The 155 cps amplifier consists of the stages Q601, Q602, Q603 and Q604. Center frequency and bandpass are defined by the tuned circuit L601, R601 and associated capacitors. Input for the essentially identical 310 cps amplifier is derived from the emitter of Q601.

4.4.7 Lock Indicator, Sweep and Starter System, Board 8, (Drawing 42386). The function of these subsystems is to provide an indication of whether the AFC loop is in lock, to generate a frequency sweep for the automatic acquisition control, and to provide a high voltage pulse to initiate the discharge in the optical pumping lamp.

4.4.7.1 Lock Indicator. The manner in which the amplitude of the 155 cps and 310 cps signals vary when the excitation to the gas cell is near resonance (see Figures 4-5 and 4-6) allows a positive indication to be made of the condition of the AFC loop. Note that if the loop is in lock the amplitude of the 155 cps signal is practically zero, while the amplitude of the 310 cps signal is a maximum. The 155 cps signal from the 155 cps and 310 cps amplifier (Board 6) is rectified by CR811 and CR812; similarly the 310 cps signal is rectified in the network CR806, CR807; C804 and R805 are common to the two rectifiers. A positive voltage is obtained from rectification of the 155 cps signal and a negative voltage from the 310 cps signal. In addition the 310 cps rectifier is biased positively

by the adjustable level set, R806. If the rectified 310 cps signal exceeds the bias and there is no rectified 155 cps signal, Q804 is then cut off and consequently, Q805 conducts, causing RY802 to be energized. Contact G of RY802 is then switched from A to B causing the front panel green light to go on and the red light to extinguish. In addition, the connection between contacts C and E is opened when RY 802 is energized, stopping the frequency sweep.

4.4.7.2 Frequency Sweep. A slowly rising voltage waveform is developed by charging C801 and C1602 through R801. This voltage is applied to the same point in the crystal oscillator as the DC loop error voltage, thus causing the oscillator frequency to be swept. The voltage across C801 and C1602 is compared with that of the diode string CR802-CR805; isolation and current again are provided by Q801 and Q802. When the sweep voltage reaches about 4.5 V, Q803 conducts thus energizing RY801. The closing of G to B interrupts the charging process and returns the potential of C801 and C1602 to about 1.5 volts. RY801 then returns to its normal, unenergized state and the charging process repeats.

4.4.7.3 Lamp Starter. The excitation lamp is not self starting and requires a high voltage pulse to initiate the discharge. This pulse is generated by discharging C807 through the step-up transformer T802. C807 is charged to several hundred volts by the voltage multiplying-rectifier chain CR809, CR810, CR814, CR815. The AC source is the 155 cps signal taken from the modulation oscillator and applied to the chain through Q806 and the step-up transformer T801.

4.4.8 Synthesizer. The synthesizer performs two functions; first, it converts the 4.981550 Mc signal from the crystal oscillator to a signal at exactly 5 Mc; and second, generates from the 5 Mc signal outputs at 1 Mc and 100 Kc. These operations are indicated in the block diagram.

4.4.8.1 Divide by 270 or 272, Board 2F (Schematic No. G-34509) The Board 2 is normally in a divide by 270 condition except when installed in a unit with a Time Scale Selector as explained in 4.4. Division is accomplished by binary divider chains with feedback appropriate to achieve the desired division factor.

Q201 is a buffer amplifier which provides the binary divider chain A201 through A206 with a 4.981550 MHz input signal. Capacitor C216 couples the buffered 4.98.... MHz signal to Board 9 in those units equipped with Time Scale Selector.

In the conventional rubidium standard the output from the third binary is fed back to the first two binaries yielding a division factor of 5; the next five binaries are connected to give a division factor of 27. The last, A206, divides by 2 to give an overall division by 270.

Note that modules A201, A203, and A205 each contain two flip flops so that there are indeed nine binaries.

For the Time Scale Selector, the first three binaries perform a simple divide by 8 (there is no feedback); the next five binaries are connected to give a division factor of 17. The last, A206, again divides by 2 but the overall division ratio is 272.

Output is taken from various resistors in the emitter follower, Q202, depending on whether or not the unit is for a Time Scale Selector system.

Since each digital module requires a supply voltage of 5 volts, they are series connected in pairs (1 dual and 1 single flip flop) and tied to the 15 volt supply. Capacitors C202, C205, and C211 provide voltage stabilization during switching.

4.4.8.2 Mixer and Filter Board 3 (Schematic No. 44054).

In this subsystem the 18.45 Kc signal from the divide by 270 or from Board 9 via the 18.45 crystal filter in Time Scale Selector units is mixed with the 4.98155 Mc signal from the crystal oscillator to produce the even output frequency of 5,000,000.0 cps.

Q301 amplifies the 4.98 Mc to the mixer and isolates the amplified signal from the input. Q305 and Q306 perform the same function for the 18.45 Kc signal. T301 is the mixer and Q302 is a buffer stage. The crystal filter removes unwanted sidebands. Q303 and Q304 form another buffer amplifier for the 5 Mc signal to the divide by 50 circuits (Bd. 4). Q307 is the driver for the 5.0 Mc output on the front panel.

4.4.8.3 Divide-by-50, Board 4D (Drawing No. G-44474)

This subsystem derives signals at 1 MHz and 100 kHz from that at 5 MHz. Integrated circuit binary dividers are used to effect the required frequency divisions. The gating techniques used are particularly convenient because of the integrated circuits chosen. A logic and a timing diagram are shown on the schematic diagram (G-44474).

Q401 is a buffer amplifier which provides the binary divider chain with a 5.0 MHz input signal. Q402 and Q403 form the 1 MHz output buffer and Q404 the 100 kHz output buffer.

4.4.9 15 Volt Power Supply and Controls, Board 1, (Drawing 42478).

4.4.9.1 15 Volt Power Supply. This is a series regulator type supply of conventional design. Output voltage of the supply is compared with the Zener diode CR101 in the difference amplifier Q101 and Q102. The error voltage is amplified in Q103 and the resultant signal used to control the regulator Q105.

4.4.9.2 18 Volt Power Supply. The 18 volts is used only for the lamp exciter. It is derived from the 20 volt supply through the double emitter follower regulator Q112 and Q113.

4.4.9.3 Heater Controls. These circuits are similar to that used for the temperature control of the crystal oscillator (see 4.3.3.2). Temperature sensitive resistors R115 and R121 are used for compensation against environmental changes.

4.4.10 20 Volt Power Supply (Drawing G-34091). DC power for the standard is obtained from this series regulator type supply. T1 and CR1 convert 115 V AC to 30 V DC which is then filtered by C4. Q1 is used as a decoupling rectifier so that the standard can be operated from 115 V AC or from a 24 - 30 V DC source.

Q8 and Q9 form the difference amplifier which compares the output voltage with that set by the zener reference VR 2. Q6 and Q7 amplify the difference output and control the series regulators Q2, Q3, and Q4. Q5 and R2 form a current limiting circuit to protect the power supply from overload. A thermostatic switch, S1, opens when the supply base plate

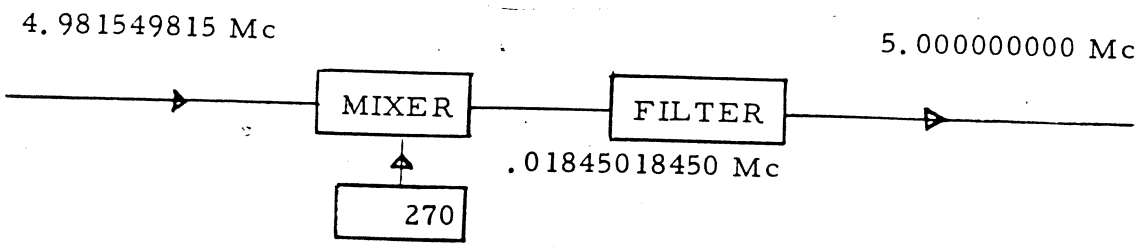
temperature rises above 115° C. A fuse, F1, is provided for protection against catastrophic failure.

4.4.11 Monitor Box (Drawing 34803). Connections within the box housing the crystal oscillator and mounting the internal panel switches, etc., are shown in this drawing.

4.4.12 Cabling (Drawings 44110 and 32942). Interconnections between circuit boards and other subsystems are shown in these drawings. In the first, the code in the right hand columns of the various jacks shows the wire color or type and the jack and pin numbers at which the connections terminates. The pi-network filter on the AC and DC input power lines are for radio frequency interference suppression.

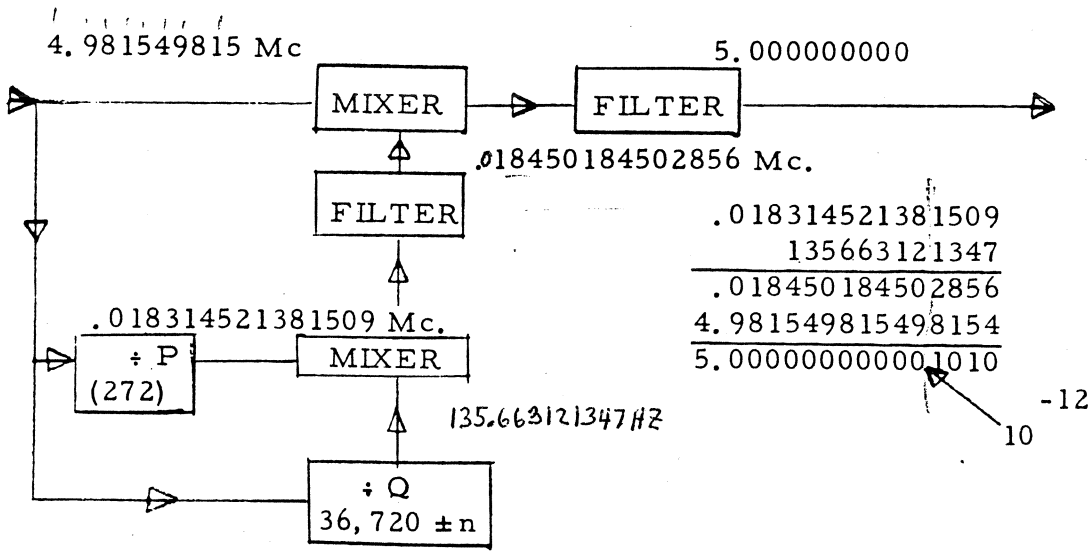
4.5 Principles of Operation of Time Scale Selector

4.5.1 In General Technology Rubidium Frequency Standard the synthesis of 5.0 Mc is achieved as shown in the block diagram below.

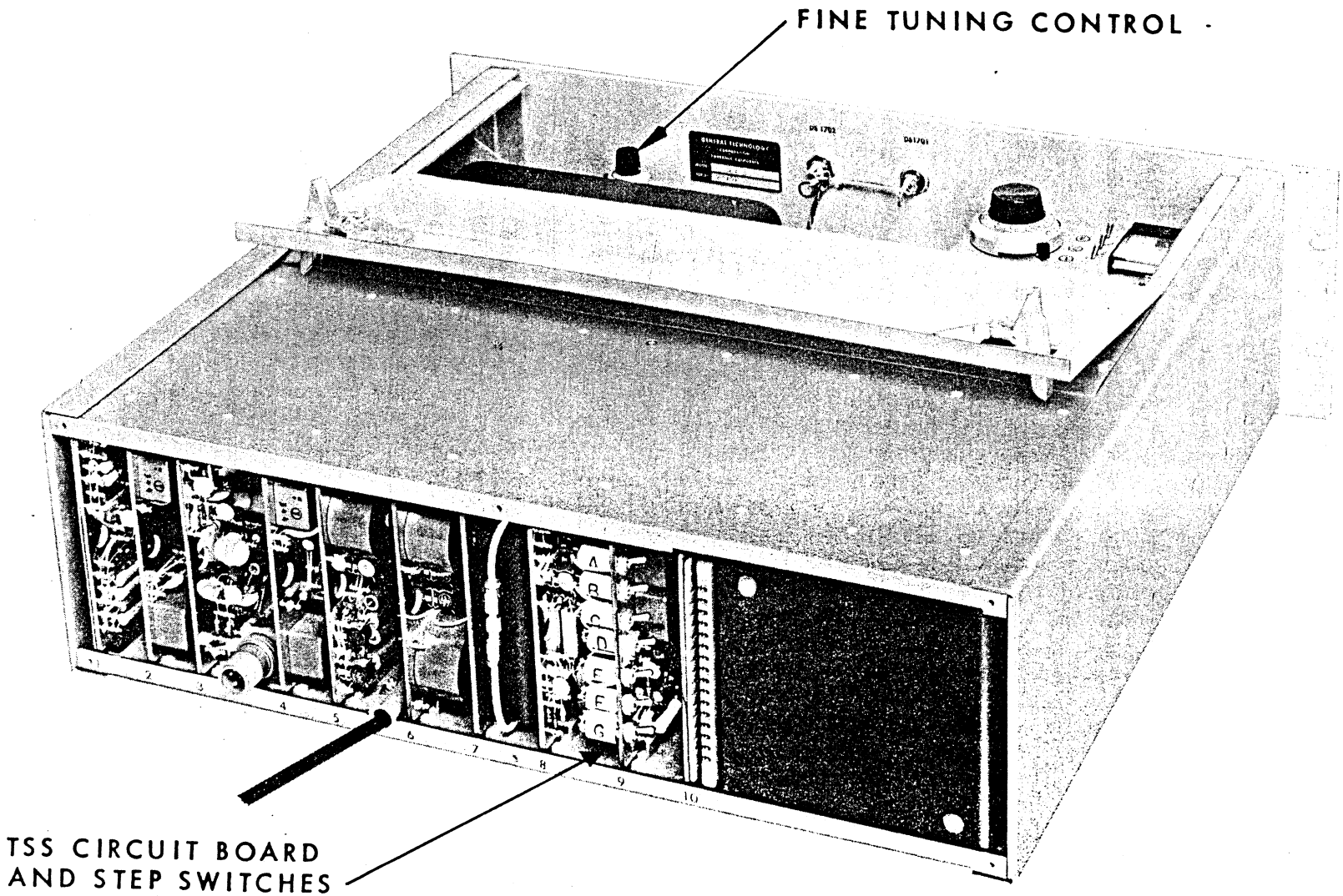


If to the arrangement shown above, we add a second digital divider network as shown in the following diagram, and mix the outputs of the two dividers, there is a combination of division ratios P and Q which will yield the right size steps in the output frequency as the division ratio Q is changed in steps of one digit (n). That combination for steps of about 7×10^{-10} is P=272 and Q=36,720±n.

4.5.2 The digital division by Q=36, 720±n is accomplished by a binary divider chain mounted on circuit board number 9 at the rear of the instrument as seen in the following photograph. The toggle switches labeled A, B, C, etc., which are accessible with the rear cover removed, serve to gate certain of the flip-flops in the divider chain and thereby add to or subtract from the 36,720 divisor and thereby shift the output frequencies in steps of about 7.4×10^{-10}. The Fine Tuning Control, also shown in the photograph, is used in conjunction with its calibration curve to achieve any desired value between the steps.



18450185



GENERAL TECHNOLOGY
TIME SCALE SELECTOR
(INSTALLED IN 304-B RUBIDIUM STANDARD)

5. MAINTENANCE

5.1 General

The standard has been aligned and tested at the factory; no adjustment should be necessary in normal use other than that indicated in the simple periodic test outlined below. Repairs of the optical-microwave unit should not be attempted. If it is suspected that this subsystem is not operating properly contact the factory for instructions.

5.2 Periodic Maintenance

At three to six month intervals, the following test and adjustment should be made: After a warmup of at least four hours open the control loop by throwing the CONTROL switch on the internal panel to the MANUAL position. Unlock the OSCILLATOR FREQUENCY CONTROL dial and rotate it, observing the deflection of the LOOP ERROR SIGNAL meter. As the oscillator frequency is steadily increased (or decreased) a region will be reached where the meter deflects full scale in one direction, then quickly in the other, and then returns to mid-scale. Well away from this region the meter should read zero, although there will be small random deflections. Set and lock the dial at the point where the meter reads mid-scale between the deflection extremes. Return the CONTROL switch to the NORMAL position. Note and record the dial reading. If this instrument is in continuous use and it is desirable not to open the AFC loop, an approximate readjustment of the OSCILLATOR FREQUENCY CONTROL may be made by positioning it for minimum average deflection from zero of the LOOP ERROR SIGNAL meter. Although the precision of this closed loop adjustment is much less than with the loop open, it is entirely adequate.

As the crystal oscillator ages, its frequency changes. This adjustment corrects the oscillator frequency to compensate for ageing. Such oscillator frequency changes as may normally be expected over a period of several years can be accommodated in this way.

5.3 Test Point Indications. Voltage at several places within the instrument are brought out at test points, accessible by removing the back cover. Test points are the outermost terminal pins on the circuit board. The lowest numbered test point, as called out below, is the uppermost terminal. After a two-hour warmup, normal indications are as tabulated.

6-4-69

Board	Test Point	Indication*
1	1. Cavity Heater	10.5 v DC**
	2. +20 Volts	20.0 ± 0.1v DC
	3. +15 Volts	15.0 ± 0.1v DC
	4. Oscillator Heater	15.8 v DC**
	5. +18 Volts	18.5 ± 0.5v DC
	6. Lamp Heater	10.5 v DC
	7. Ground	
5	1. 155 Hz	155 ± 1 cps .7 v p-p
	2. Ground	
6*** (2) 2vpf	1. 155 Hz Signal	Narrow band noise centered at 155 Hz 1 to 2v p-p
(2) 9vp-p	2. 310 Hz Signal	Twice the frequency of TP 1 Board 5 8 - 9v p-p limiting waveform
	3. Ground	

* Values will depend somewhat on ambient temperature.

** With indicator impedance of 20,000 ohms per volt, or greater.

*** Indications are for AFC loop in lock.

5.4 Fuses and Indicator Lights

There are two fuses, one on Board 1 and the other inside the 20 volt power supply. The fuse on Board 1 is a type 3AG with a 6/10 ampere rating. It protects the 15 volt and 18 volt supplies. The most probable cause that this fuse will blow is inadvertent shorting or overload in maintenance operations. The fuse in the 20 volt power supply is a type 3AG with a 2 ampere rating located in the AC input.

Front panel indicator lights are type 327, red, and 387, green. They are accessible by unscrewing jewel from front of front panel.

TABLE 5 -1

INITIAL FREQUENCY SETTING PARAMETERS

SERIAL NO. 462

Time or Frequency Scale	UT-2'69
FINE TUNING Dial	4.95
OSCILLATOR FREQUENCY CONTROL DIAL at Resonance	5.49

Date 6-4-69

6. TIME SCALE SELECTOR

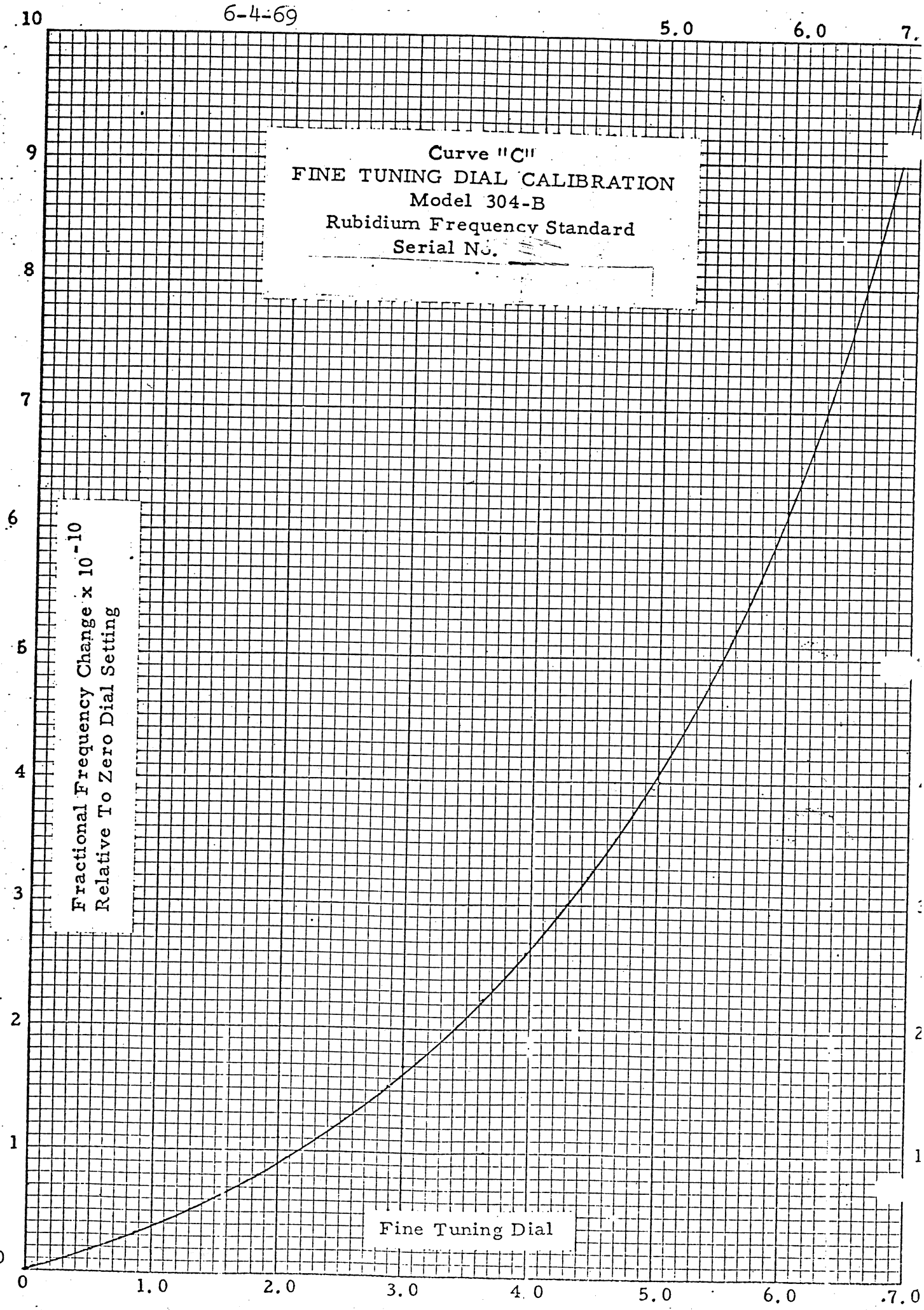
6.1 Instructions for Changing Time Scales

On the following page the serial number and natural gas cell frequency of this particular rubidium standard have been entered at the factory. The natural gas cell frequency is defined as the frequency offset from Ephemeris (A1) as measured at the factory with the Fine Tuning dial set at 0.0 and the Board Number 9 stepping switches set at 1111001 (no stepping). NOTE: The toggle handle is Up in the "0" position and down in the "1" position.

Also entered on the following page are the switch positions and Fine Tuning dial settings for obtaining from this standard the commonly used time scales.

To change from one time scale to another remove the back cover for access to the Board Number 9 stepping switches and open the top cover for access to the Fine Tuning dial. It is not necessary to turn off power to the standard or to remove Board No. 9 to make a change. Either the switch positions or the Fine Tuning may be changed first. Be sure to unlock and then relock the Fine Tuning dial.

6-4-69


Curve "C"
FINE TUNING DIAL CALIBRATION
Model 304-B
Rubidium Frequency Standard
Serial No.
Fractional Frequency Change x 10^{-10}
Relative To Zero Dial Setting
Fine Tuning Dial
0
1
2
3
4
5
6
7
8
9
10
0
1.0
2.0
3.0
4.0
5.0
6.0
7.0

6-4-69

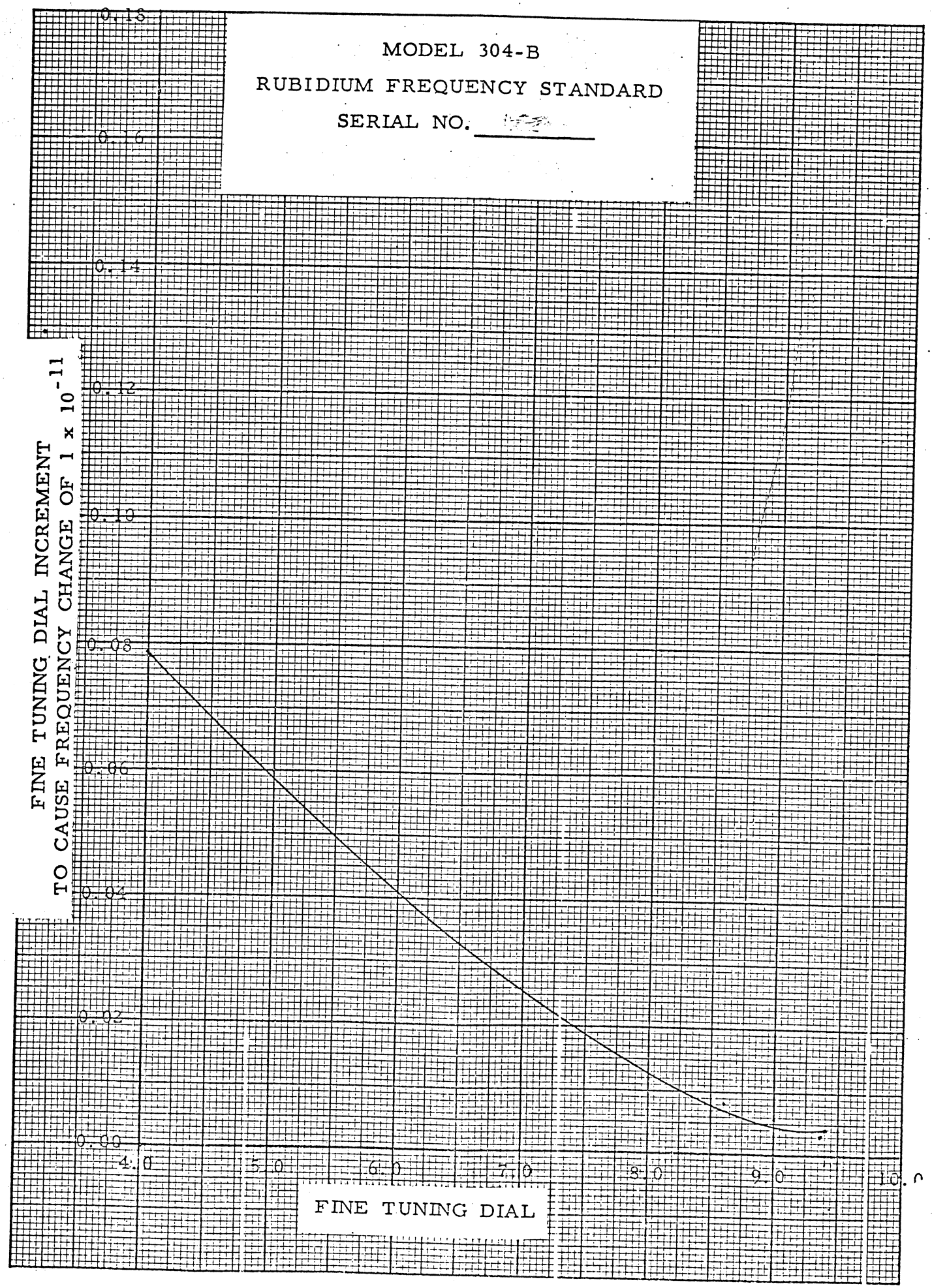

MODEL 304-B
RUBIDIUM FREQUENCY STANDARD
SERIAL NO.
FINE TUNING DIAL INCREMENT
TO CAUSE FREQUENCY CHANGE OF 1 x 10^-11
0.18
0.16
0.14
0.12
0.10
0.08
0.06
0.04
0.02
0.00
4.0
5.0
6.0
7.0
8.0
9.0
10.0
FINE TUNING DIAL

TABLE OF FREQUENCY STEPS

(Showing frequency steps, $\frac{\Delta F \times 10^{-10}}{F}$ above and below the "gas cell frequency")

$\frac{\Delta F}{F}$	Switch Settings A	B	C	D	E	F	G
+355.15	1	1	1	1	1	1	1
+347.73	0	1	1	1	1	1	1
+340.32	1	0	1	1	1	1	1
+332.92	0	0	1	1	1	1	1
+325.51	1	1	0	1	1	1	1
+318.10	0	1	0	1	1	1	1
+310.70	1	0	0	1	1	1	1
+303.29	0	0	0	1	1	1	1
+295.89	1	1	1	0	1	1	1
+288.48	0	1	1	0	1	1	1
+281.08	1	0	1	0	1	1	1
+273.67	0	0	1	0	1	1	1
+266.27	1	1	0	0	1	1	1
+258.86	0	1	0	0	1	1	1
+251.46	1	0	0	0	1	1	1
+244.06	0	0	0	0	1	1	1
+236.66	1	1	1	1	0	1	1
+229.25	0	1	1	1	0	1	1
+221.85	1	0	1	1	0	1	1
+214.45	0	0	1	1	0	1	1
+207.05	1	1	0	1	0	1	1
+199.65	0	1	0	1	0	1	1
+192.25	1	0	0	1	0	1	1
+184.85	0	0	0	1	0	1	1
+177.45	1	1	1	0	0	1	1
+170.06	0	1	1	0	0	1	1
+162.66	1	0	1	0	0	1	1
+155.26	0	0	1	0	0	1	1
+147.86	1	1	0	0	0	1	1
+140.47	0	1	0	0	0	1	1
+133.07	1	0	0	0	0	1	1
+125.67	0	0	0	0	0	1	1
+118.28	1	1	1	1	1	0	1
+110.88	0	1	1	1	1	0	1
+103.49	1	0	1	1	1	0	1
+ 96.09	0	0	1	1	1	0	1
+ 88.70	1	1	0	1	1	0	1
+ 81.30	0	1	0	1	1	0	1
+ 73.91	1	0	0	1	1	0	1
+ 66.52	0	0	0	1	1	0	1
+ 59.13	1	1	1	0	1	0	1
+ 51.73	0	1	1	0	1	0	1
+ 44.34	1	0	1	0	1	0	1

$\frac{\Delta F}{F}$	Switch Settings A	B	C	D	E	F	G
+ 36.95	0	0	1	0	1	0	1
+ 29.56	1	1	0	0	1	0	1
+ 22.17	0	1	0	0	1	0	1
+ 14.78	1	0	0	0	1	0	1
+ 7.39	0	0	0	0	1	0	1
0.00	1	1	1	1	0	0	1
- 7.39	0	1	1	1	0	0	1
- 14.78	1	0	1	1	0	0	1
- 22.17	0	0	1	1	0	0	1
- 29.55	1	1	0	1	0	0	1
- 36.94	0	1	0	1	0	0	1
- 44.33	1	0	0	1	0	0	1
- 51.71	0	0	0	1	0	0	1
- 59.10	1	1	1	0	0	0	1
- 66.49	0	1	1	0	0	0	1
- 73.87	1	0	1	0	0	0	1
- 81.26	0	0	1	0	0	0	1
- 88.64	1	1	0	0	0	0	1
- 96.02	0	1	0	0	0	0	1
-103.41	1	0	0	0	0	0	1
-110.79	0	0	0	0	0	0	1
-118.17	1	1	1	1	1	1	0
-125.56	0	1	1	1	1	1	0
-132.94	1	0	1	1	1	1	0
-140.32	0	0	1	1	1	1	0
-147.70	1	1	0	1	1	1	0
-155.08	0	1	0	1	1	1	0
-162.46	1	0	0	1	1	1	0
-169.84	0	0	0	1	1	1	0
-177.22	1	1	1	0	1	1	0
-184.60	0	1	1	0	1	1	0
-191.98	1	0	1	0	1	1	0
-199.36	0	0	1	0	1	1	0
-206.74	1	1	0	0	1	1	0
-214.11	0	1	0	0	1	1	0
-221.49	1	0	0	0	1	1	0
-228.87	0	0	0	0	1	1	0
-236.24	1	1	1	1	0	1	0
-243.62	0	1	1	1	0	1	0
-251.00	1	0	1	1	0	1	0
-258.37	0	0	1	1	0	1	0

$\frac{\Delta F}{F}$	Switch Settings A	B	C	D	E	F	G
-265.75	1	1	0	1	0	1	0
-273.12	0	1	0	1	0	1	0
-280.49	1	0	0	1	0	1	0
-287.87	0	0	0	1	0	1	0
-295.24	1	1	1	0	0	1	0
-302.61	0	1	1	0	0	1	0
-309.99	1	0	1	0	0	1	0
-317.36	0	0	1	0	0	1	0
-324.73	1	1	0	0	0	1	0
-332.10	0	1	0	0	0	1	0
-339.47	1	0	0	0	0	1	0
-346.84	0	0	0	0	0	1	0
-354.21	1	1	1	1	1	0	0
-361.58	0	1	1	1	1	0	0
-368.95	1	0	1	1	1	0	0
-376.32	0	0	1	1	1	0	0
-383.69	1	1	0	1	1	0	0
-391.06	0	1	0	1	1	0	0
-398.42	1	0	0	1	1	0	0
-405.79	0	0	0	1	1	0	0
-413.16	1	1	1	0	1	0	0
-420.52	0	1	1	0	1	0	0
-427.89	1	0	1	0	1	0	0
-435.26	0	0	1	0	1	0	0
-442.62	1	1	0	0	1	0	0
-449.98	0	1	0	0	1	0	0
-457.35	1	0	0	0	1	0	0
-464.71	0	0	0	0	1	0	0
-472.08	1	1	1	1	0	0	0
-479.44	0	1	1	1	0	0	0
-486.80	1	0	1	1	0	0	0
-494.17	0	0	1	1	0	0	0
-501.53	1	1	0	1	0	0	0
-508.89	0	1	0	1	0	0	0
-516.25	1	0	0	1	0	0	0
-523.61	0	0	0	1	0	0	0
-530.97	1	1	1	0	0	0	0
-538.33	0	1	1	0	0	0	0
-545.69	1	0	1	0	0	0	0
-553.05	0	0	1	0	0	0	0
-560.41	1	1	0	0	0	0	0
-567.77	0	1	0	0	0	0	0
-575.12	1	0	0	0	0	0	0
-582.48	0	0	0	0	0	0	0

6-4-69

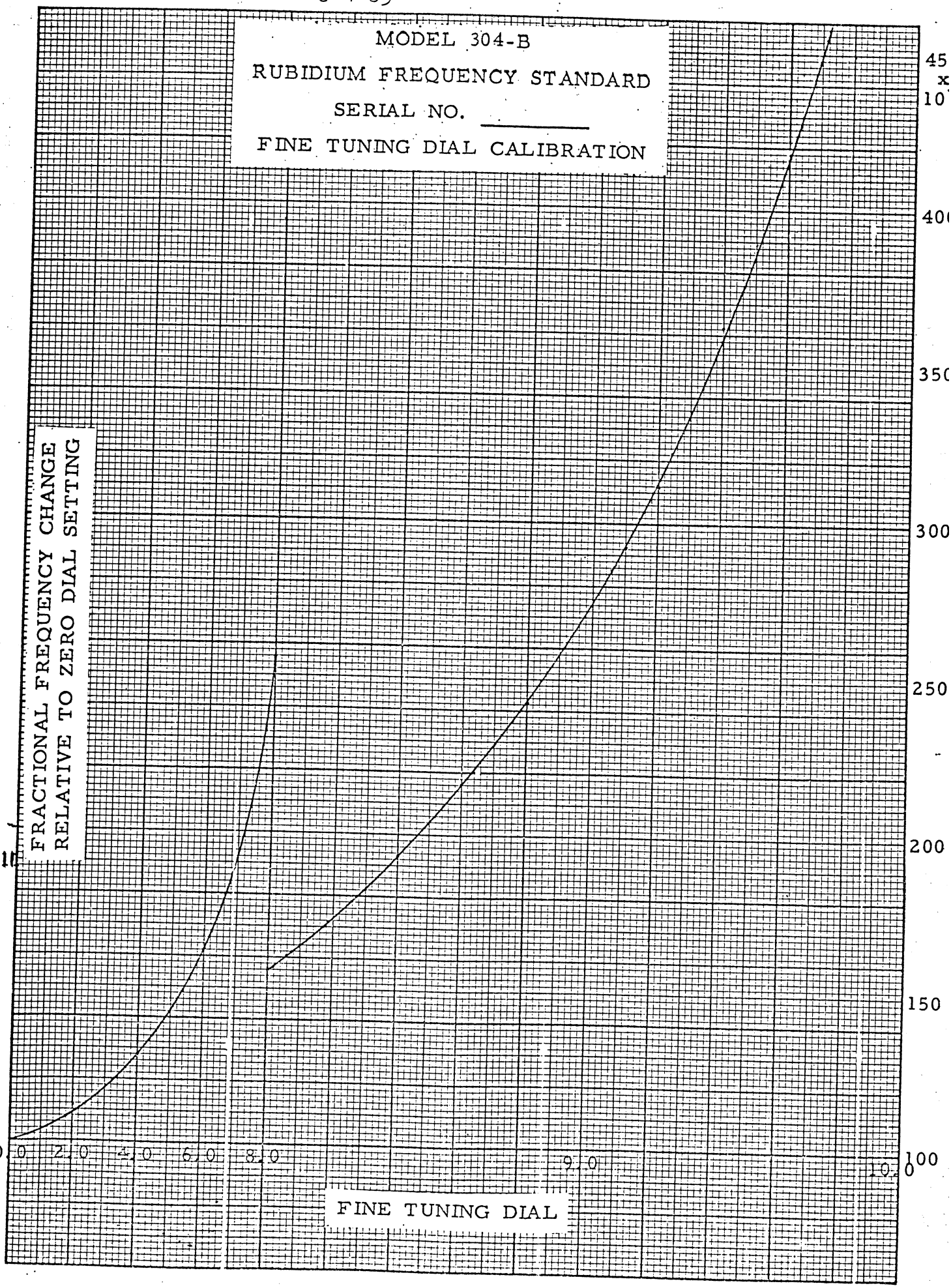

MODEL 304-B
RUBIDIUM FREQUENCY STANDARD
SERIAL NO. _____
FINE TUNING DIAL CALIBRATION
FRACTIONAL FREQUENCY CHANGE
RELATIVE TO ZERO DIAL SETTING
100 x 10^-10
50
0
0
2.0
4.0
6.0
8.0
9.0
10.0
FINE TUNING DIAL
450 x 10
400
350
300
250
200
150
100

TABLE OF REPLACEABLE PARTS - MODEL 304-B and 304-C

CIRCUIT BOARD NO. 1 + 15 V Power Supply and Control

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident
C-101	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-102	Capacitor, .001μF, 1KV, 10%	SM .001	91418
C-103	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-104	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-105	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-106	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-107	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-108	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-109	Capacitor, .01μF, 100V, 20%	TA .01	91418
CR-101	Diode	1N823	12065
CR-102	Diode	G296	01295
F-101	Fuse, 6/10 amp	3 AG	75915
Q-101	Transistor	T1495	01295
Q-102	Transistor	T1495	01295
Q-103	Transistor	T1495	01295
Q-104	Transistor	T1495	01295
Q-105	Transistor	2N1481	02735
Q-106	Transistor	T1484	01295
Q-107	Transistor	2N1991	07263
Q-108	Transistor	2N1481	02735
Q-109	Transistor	T1484	01295
Q-110	Transistor	2N1991	07263
Q-111	Transistor	2N1481	02735
Q-112	Transistor	T1484	01295
Q-113	Transistor	T1484	01295
Q-114	Transistor	T1484	01295
Q-115	Transistor	T1484	01295

TABLE OF REPLACEABLE PARTS - MODEL 304-B and 304-C

CIRCUIT BOARD NO. 1 + 15 V Power Supply and Control

Circuit Reference	Description		Mfr. Part No.	Mfr. Code Ident.
R-101	Resistor, 5. 1K ohm,	1/4W, 5%	RC07GF512J	01121
R-102	Resistor, 1K ohm,	1/4W, 5%	RC07GF102J	01121
R-103	Resistor, 510 ohm,	1/4W, 5%	RC07GF511J	01121
R-104	Resistor, 2. 4K ohm,	1/4W, 5%	RC07GF242J	01121
R-105	Resistor, 2. 4K ohm,	1/4W, 5%	RC07GF242J	01121
R-106	Resistor, 1. 5K ohm,	1/4W, 5%	RC07GF152J	01121
R-107	Resistor, 1180 ohm,	1/4W, 1%	RN65B-1181F	81483
R-108	Resistor, 4320 ohm,	1/4W, 1%	RN65B-4321F	81483
R-109	Potentiometer, 200 ohm,		273-1-201	80294
R-110	Resistor, 3090 ohm,	1/4W, 1%	RN65B-3091F	81483
* R-111	Resistor			
* R-112	Resistor			
R-113	Resistor, 2. 2K ohm,	1/4W, 5%	RC07GF222J	01121
R-114	Resistor, 7. 5K ohm,	1/4W	RN65B-7501F	81483
R-115	Sensistor 470 ohm,	5%	TM-1/4	012[illegible]
R-116	Resistor, 1820 ohm,	1/4W, 1%	RN65B-1821F	81483
* R-117	Resistor			
* R-118	Resistor			
R-119	Resistor, 2. 2K ohm,	1/4W, 5%	RC07GF222J	01121
R-120	Resistor, 4. 99K ohm,	1/4W, 1%	RN65B-4991F	81483
R-121	Sensistor, 470 ohm,	5%	TM-1/4	01295
R-122	Resistor, 1K ohm,	1/4W, 1%	RN65B-1001F	81483
R-123	Resistor, 2K ohm,	1/4W, 5%	RC07GF202J	01121
R-124	Resistor, 5.1K ohm,	1/4W, 5%	RC07GF512J	01121
R-125	Resistor, 51K ohm,	1/4W, 5%	RC07GF513J	01121
R-128	Resistor, 5. 1K ohm,	1/4W, 5%	RC07GF512J	01121
R-129	Resistor, 300 ohm,	1/4W, 5%	RC07GF301J	01121
R-130	Resistor, 300 ohm,	1/4W, 5%	RC07GF301J	01121
R-131	Resistor, 1K ohm,	1/4W, 5%	RC07GF102J	01121
R-132	Resistor, 1K ohm,	1/4W, 5%	RC07GF102J	01121

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 2F Digital Synthesizer ÷ 270 or 272

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
A-201	Integrated Circuit	SN7473N	01295
A-202	Integrated Circuit	SN7472N	01295
A-203	Integrated Circuit	SN7473N	01295
A-204	Integrated Circuit	SN7472N	01295
A-205	Integrated Circuit	SN7473N	01295
A-206	Integrated Circuit	SN7472N	01295
C-201	Capacitor .01uF, 100V, 20%	TA .01	91418
C-202	Capacitor 2.2uF, 20V, 20%	K2R2J20S	05397
C-203	Capacitor .001uF, 500V, 20%	SM .001	91418
C-204	Capacitor 50pF, 500V, 5%	DM-10-500J	04062
C-205	Capacitor 2.2uF, 20V, 20%	K2R2J20S	05397
C-206	Capacitor .02uF, 100V, 20%	TA .02	91418
C-207	Capacitor 2.2uF, 20V, 20%	K2R2J20S	05397
C-208	Capacitor 100pF, 500V, 5%	DM-10-101J	04062
C-209	Capacitor .01uF, 100V, 20%	TA .01	91418
C-210	Capacitor .01uF, 100V, 20%	TA .01	91418
C-211	Capacitor 2.2uF, 100V, 20%	K2R2J20S	05397
C-212	Capacitor 50pF, 500V, 5%	DM-10-500J	04062
C-213	Capacitor .01uF, 100V, 20%	TA .01	91418
C-214	Capacitor 20pF, 500V, 5%	DM-10-200J	04062
C-215	Capacitor 2.2uF, 20V, 20%	K2R2J20S	05397
C-216	Capacitor .01uF, 100V, 20%	TA .01	91418
L-201	Choke 56uH 5%	1537-64	99800
L-202	Choke 56uH 5%	1537-64	99800
L-203	Choke 22uH 5%	1537-44	99800
L-204	Choke 10uH 10%	1537-36	99800

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 2F Digital Synthesizer ÷270 or 272

Circuit Reference	Description			Mfr. Part No.	Mfr. Code Ident.
Q-201	Transistor			2N4122	07263
Q-202	Transistor			2N3646	07263
R-201	Resistor	2K,	1/4W, 5%	RC07GF202J	01121
R-202	Resistor	5.6K,	1/4W, 5%	RC07GF562J	01121
R-203	Resistor	150 ohm,	1/4W, 5%	RC07GF151J	01121
R-204	Resistor	33 ohm,	1/4W, 5%	RC07GF330J	01121
R-205	Resistor	2.2K,	1/4W, 5%	RC07GF222J	01121
R-206	Resistor	13K,	1/4W, 5%	RC07GF133J	01121
R-207	Resistor	100 ohm,	1/4W, 5%	RC07GF101J	01121
R-208	Resistor	1K,	1/4W, 5%	RC07GF102J	01121
R-209	Resistor	4.7K,	1/4W, 5%	RC07GF472J	01121
R-210	Resistor	2K,	1/4W, 5%	RC07GF202J	01121
R-211	Resistor	4.7K,	1/4W, 5%	RC07GF472J	01121
R-212	Resistor	1K,	1/4W, 5%	RC07GF102J	01121
R-213	Resistor	820 ohm,	1/4W, 5%	RC07GF821J	01121
R-214	Resistor	82 ohm,	1/4W, 5%	RC07GF820J	01121
R-215	Resistor	51 ohm,	1/4W, 5%	RC07GF510J	01121

TABLE OF REPLACEABLE PARTS - MODEL 304-B - S/N 165 , 167, 17
& 241-280 & ALL 304-C

CIRCUIT BOARD No. 3E Synthesizer Mixer & Filter

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
C-301	Capacitor, .02μF, 100V, ±35%	TA .02	82560
C-302	Capacitor, .001μF, 500V, ±20%	SM .001	82560
C-303	Capacitor, 75μF, 500V, ± 5%	DM-10-750J	84171
C-304	Capacitor, .01μF, 100V, ±35%	TA .01	82560
C-305	Capacitor, 6.8μF, 20 V, ±20%	K6R8J20S	05397
C-306	Capacitor, .02μF, 100V, ±35%	TA .02	82560
C-307	Capacitor, .02μF, 100V, ±35%	TA .02	82560
C-308	Capacitor, .001μF, 500V, ±20%	SM .001	82560
C-309	Capacitor, .02μF, 100V, ±35%	TA .02	82560
C-310	Capacitor, 2.2μF, 20V, ±20%	K2R2J20S	05397
C-311	Capacitor, 2.2μF, 20 V, ±20%	K2R2J20S	05397
C-312	Capacitor, .001μF, 500V, ±20%	SM .001	82560
C-313	Capacitor, 1.0μF, 20 V, ±20%	K1J20S	05397
C-314	Capacitor, 6.8μF, 20 V, ±20%	K6R8J20S	05397
C-315	Capacitor, 2.2μF, 20 V, ±20%	K2R2J20S	05397
C-316	Capacitor, 2.2μF, 20 V, ±20%	K2R2J20S	05397
C-317	Capacitor, .001μF, 500V, ±20%	SM .001	82560
C-318	Capacitor, 510 pF, 300 V, ± 5%	DM-15-511J	84171
C-319	Capacitor, .02μF, 100 V, ±35%	TA .02	82560
C-320	Capacitor, .02μF, 100 V, ±35%	TA .02	82560
C-321	Capacitor, .01μF, 100 V, ±35%	TA .01	82560
C-322	Capacitor, 33μF, 20V, ± 5%	K33J20S	05397
CR-1	Diode	1N914	01295
CR-2	Diode	1N914	01295
FL-301	Filter, 5MC Crystal	12906	GTC
L-301	Choke, 56μH ± 5%	1537-64	99800
L-302	Choke, 56μH ± 5%	1537-64	99800
L-303	Choke, 56μH ± 5%	1537-64	99800

TABLE OF REPLACEABLE PARTS - MODEL 304-B - S/N 165 , 167, 17
& 241-280 & ALL 304-C

CIRCUIT BOARD No. 3E Synthesizer Mixer & Filter

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
Q-301	Transistor	2N708	07263
Q-302	Transistor	2N2222	04713
Q-303	Transistor	2N708	07263
Q-304	Transistor	2N708	07263
Q-305	Transistor	2N2222	04713
Q-306	Transistor	2N2222	04713
Q-307	Transistor	2N2218	04713
R-301	Resistor 51 ohm 1/4W, 5%	RC07GF510J	01121
R-302	Resistor 4.3K ohm 1/4W, 5%	RC07GF432J	01121
R-303	Resistor 2.4K ohm 1/4W, 5%	RC07GF242J	01121
R-304	Resistor 1.2K ohm 1/4W, 5%	RC07GF122J	01121
R-305	Resistor 240 ohm 1/4W, 5%	RC07GF241J	01121
R-306	Resistor 620 ohm 1/4W, 5%	RC07GF621J	01121
R-307	Resistor 3.6K ohm 1/4W, 5%	RC07GF362J	01121
R-308	Resistor 1.5K ohm 1/4W, 5%	RC07GF152J	01121
R-309	Resistor 100 ohm 1/4W, 5%	RC07GF101J	01121
R-310	Resistor 10 ohm 1/4W, 5%	RC07GF100J	01121
R-311	Resistor 390 ohm 1/2W, 5%	RC07GF391J	01121
R-312	Resistor 43 ohm 1/4W, 5%	RC07GF430J	01121
R-313	Resistor 51 ohm 1/4W, 5%	RC07GF510J	01121
R-314	Resistor 4.3K ohm 1/4W, 5%	RC07GF432J	01121
R-315	Resistor 2.4K ohm 1/4W, 5%	RC07GF242J	01121
R-316	Resistor 1K ohm 1/4W, 5%	RC07GF102J	01121
R-317	Resistor 75 ohm 1/4W, 5%	RC07GF750J	01121
R-318	Resistor 1.1K ohm 1/4W, 5%	RC07GF112J	01121
R-319	Unused		
R-320	Resistor 1K ohm 1/4W, 5%	RC07GF102J	01121
R-321	Resistor 150 ohm 1/4 W, 5%	RC07GF151J	01121
R-322	Resistor 47 ohm 1/4W, 5%	RC07GF470J	01121
R-323	Resistor 91K ohm 1/4W, 5%	RC07GF913J	01121
R-324	Resistor 13K ohm 1/4W, 5%	RC07GF133J	01121
R-325	Resistor 1.5K ohm 1/4W, 5%	RC07GF152J	01121
R-326	Resistor 300 ohm 1/4W, 5%	RC07GF301J	01121
R-327	Resistor 51 ohm 1/4W, 5%	RC07GF510J	01121
R-328	Resistor 6.2K ohm 1/4W, 5%	RC07GF622J	01121
R-329	Resistor 2.4K ohm 1/4W, 5%	RC07GF242J	01121
R-330	Resistor 1.5K ohm 1/4W, 5%	RC07GF152J	01121
R-331	Resistor 36 ohm 1/4W, 5%	RC07GF360J	01121

TABLE OF REPLACEABLE PARTS - MODEL 304-B - S/N 165, 167, 17
& 241-280 & All 304-C

CIRCUIT BOARD No. 3E Synthesizer Mixer & Filter

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
R-332	Resistor 820 ohm 1/4W, 5%	RC07GF821J	01121
R-333	Resistor 10K ohm 1/4W, 5%	RC07GF103J	01121
R-334	Resistor 51 ohm 1/4W, 2%	RL07GF510G	75042
R-335	Resistor 51 ohm 1/4W, 2%	RL07GF510G	75042
R-336	Resistor 3K ohm 1/4W, 5%	RC07GF302J	01121
R-337	Resistor 1K ohm 1/4W, 5%	RC07GF102J	01121
R-338	Resistor 100 ohm 1/4W, 5%	RC07GF101J	01121
R-339	Resistor 10 ohm 1/4W, 5%	RC07GF100J	01121
T-301	Transformer, Toroid	33918	GTC
T-302	Transformer, Assembly	24060	GTC

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 4D Digital Synthesizer 50

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident.
A-401	Integrated Circuit				SN7473N	01295
A-402	Integrated Circuit				SN7472N	01295
A-403	Integrated Circuit				SN7490N	01295
C-401	Capacitor	.05uF,	100V,	20%	TA .05	91418
C-402	Capacitor	6.8uF,	35V,	20%	K6R8J35KS	05397
C-403	Capacitor	2.2uF,	35V,	20%	K2R2J20S	05397
C-404	Capacitor	.02uF,	100V,	20%	TA .02	91418
C-405	Capacitor	100pF,	500V,	5%	DM-10-101J	04062
C-406	Capacitor	.01uF,	100V,	20%	TA .01	91418
C-407	Capacitor	1200pF,	300V,	5%	DM-20-122J	04062
C-408	Capacitor	1200pF,	300V,	5%	DM-20-122J	040[illegible]
C-409	Capacitor	.01uF,	100V,	20%	TA .01	91418
C-410	Capacitor	2.2uF,	35V,	20%	K2R2J20S	05397
C-411	Capacitor	.02uF,	100V,	20%	TA .02	91418
C-412	Capacitor	750pF,	300V,	5%	DM-15-751J	04062
C-413	Capacitor	3900pF,	300V,	5%	DM-20-392J	04062
C-414	Capacitor	3900pF,	300V,	5%	DM-20-392J	04062
C-415	Capacitor	.01uF,	100V,	20%	TA .01	91418
C-416	Capacitor	.02uF,	100V,	20%	TA .02	91418
C-417	Capacitor	2.2uF,	35V,	20%	K2R2J20S	05397
C-418	Capacitor	.0082uF,	100V,	5%	DE1-822D	99515
C-419	Capacitor	2.2uF,	35V,	20%	K2R2J20S	05397
L-401	Choke	100uH,		5%	1537-76	99800
L-402	Choke	22uH,		10%	1537-44	99800
L-403	Choke	10uH,		10%	1537-36	99800
L-404	Choke	22uH,		10%	1537-44	99800

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 4D Digital Synthesizer 50

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident.
L-405	Choke	39uH,		5%	1537-56	99800
L-406	Choke	22uH,		10%	1537-44	99800
L-407	Choke	22uH,		10%	1537-44	99800
L-408	Choke	33uH,		5%	1537-52	99800
L-409	Choke	500uH,		5%	2500-14	99800
L-410	Choke	1MH,		5%	2500-28	99800
L-411	Choke	500uH,		5%	2500-14	99800
L-412	Choke	22uH,		10%	1537-44	99800
L-413	Choke	300uH,		5%	2500-02	99800
Q-401	Transistor				2N4122	07263
Q-402	Transistor				2N3646	07263
Q-403	Transistor				2N4122	07263
Q-404	Transistor				2N4122	07263
R-401	Resistor	130 ohm,	1 W,	5%	RC32GF131J	01121
R-402	Resistor	150 ohm,	1/4W,	5%	RC07GF151J	01121
R-403	Resistor	33 Ohm,	1/4W,	5%	RC07GF330J	01121
R-404	Resistor	2.2K,	1/4W,	5%	RC07GF222J	01121
R-405	Resistor	13K,	1/4W,	5%	RC07GF133J	01121
R-406	Resistor	100 ohm,	1/4W,	5%	RC07GF101J	01121
R-407	Resistor	220 ohm,	1/4W,	5%	RC07GF221J	01121
R-408	Resistor	200 ohm,	1/4W,	5%	RC07GF201J	01121
R-409	Resistor	200 ohm,	1/4W,	5%	RC07GF201J	01121
R-410	Resistor	2.2K,	1/4W,	5%	RC07GF222J	01121
R-411	Resistor	10K,	1/4W,	5%	RC07GF103J	01121
R-412	Resistor	82 ohm,	1/4W,	5%	RC07GF820J	01121

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 4D Digital Synthesizer 50

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident.
R-413	Resistor	150 ohm,	1/4W,	5%	RC07GF151J	01121
R-414	Resistor	470 ohm,	1/4W,	5%	RC07GF471J	01121
R-415	Resistor	510 ohm,	1/4W,	5%	RC07GF511J	01121
R-416	Resistor	510 ohm,	1/4W,	5%	RC07GF511J	01121
R-417	Resistor	10K,	1/4W,	5%	RC07GF103J	01121
R-418	Resistor	2.2K,	1/4W,	5%	RC07GF222J	01121
R-419	Resistor	150 ohm,	1/4W,	5%	RC07GF151J	01121
R-420	Resistor	91 ohm,	1/4W,	5%	RC07GF910J	01121
R-421	Resistor	470 ohm,	1/4 W,	5%	RC07GF471J	01121

TABLE OF REPLACEABLE PARTS - MODEL 304-B AND 304-C

CIRCUIT BOARD NO. 5B Modulation Oscillator and Sync. Detector

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
C-501	Capacitor, 1μF, 200V, 5%	1Q2105C	02777
C-502	Capacitor, .1μF, 200 V, 5%	1Q2104C	02777
*C-503	Capacitor, .05μF, 200V, 5%	PO 52M	02777
C-504	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-505	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-506	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-507	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-508	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-509	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-510	Capacitor, .01μF, 100V,20%	TA .01	91418
C-511	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-512	Capacitor, .01μF, 100V,20%	TA .01	91418
C-513	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-514	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-515	Capacitor, 33μF, 20V,20%	K33J20S	05397
C-516	Capacitor, 2.2μF, 20V,20%	K2R2J20S	05397
C-517	Capacitor, 2.2μF, 20V,20%	K2R2J20S	05397
C-518	Capacitor, 2.2μF, 20V,20%	K2R2J20S	05397
CR-501	Diode	G296	01295
CR-502	Diode	G296	01295
CR-503	Diode	G296	01295
CR-504	Diode	G296	01295
CR-505	Diode	G296	01295
CR-506	Diode	G296	01295
L-501	Choke, 900MH	O-3945-1	04620

TABLE OF REPLACEABLE PARTS - MODEL 304-B AND 304-C

CIRCUIT BOARD NO. 5B Modulation Oscillator and Sync. Detector

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
Q-501	Transistor	2N526	24446
Q-502	Transistor	2N526	24446
Q-503	Transistor	2N1306	01295
Q-504	Transistor	2N526	24446
Q-505	Transistor	2N697 or TI484	01295
R-501	Resistor, 9.1K ohm, 1/4W, 5%	RC07GF912J	01121
R-502	Resistor, 820 ohm, 1/4W, 5%	RC07GF821J	01121
R-503	Resistor, 2.4K ohm, 1/4W, 5%	RC07GF242J	01121
R-504	Resistor, 7.5K ohm, 1/4W, 5%	RC07GF752J	01121
R-505	Resistor, 2.7K ohm, 1/4W, 5%	RC07GF272J	01121
R-506	Resistor, 150 ohm, 1/4W, 5%	RC07GF151J	01121
R-507	Resistor, 2.4K ohm, 1/4W, 5%	RC07GF242J	01121
R-508	Resistor, 5.1K ohm, 1/4W, 5%	RC07GF512J	01121
R-509	Resistor, 9.1K ohm, 1/4W, 5%	RC07GF912J	0112[illegible]
R-510	Resistor, 510 ohm, 1/4W, 5%	RC07GF511J	0112[illegible]
R-511	Resistor, 2K ohm, 1/4W, 5%	RC07GF202J	01121
R-512	Resistor, 180 ohm, 1/4W, 5%	RC07GF181J	01121
R-513	Resistor, 1.3K ohm, 1/4W, 5%	RC07GF132J	01121
R-514	Resistor, 51 ohm, 1/4W, 5%	RC07GF510J	01121
R-515	Resistor, 200 ohm Pot	273-1-201	80294
R-516	Resistor, 100 ohm, 1/4W, 5%	RC07GF101J	01121
R-517	Resistor, 1.6K ohm, 1/4W, 5%	RC07GF162J	01121
R-518	Resistor, 10K ohm, 1/4W, 5%	RC07GF103J	01121
R-519	Resistor, 10K ohm, 1/4W, 5%	RC07GF103J	01121
R-520	Resistor, 5.1K ohm, 1/4W, 5%	RC07GF512J	01121
R-521	Resistor, 5.1K ohm, 1/4W, 5%	RC07GF512J	01121
R-522	Resistor, 510 ohm, 1/4W, 5%	RC07GF511J	01121
R-523	Resistor, 91K ohm, 1/4W, 5%	RC07GF913J	01121
R-524	Resistor, 51K ohm, 1/4W, 5%	RC07GF513J	01121
R-525	Resistor, 51K ohm, 1/4W, 5%	RC07GF513J	01121
R-526	Resistor, 1 Meg. ohm 1/4W, 5%	RC07GF105J	01121
R-527	Resistor, 1K ohm, 1/4W, 5%	RC07GF102J	01121
T-501	Transformer	H-219	80223
T-502	Transformer	H-219	80223

TABLE OF REPLACEABLE PARTS - MODEL 304-B AND 304-C

CIRCUIT BOARD NO. 6B 155 CPS and 310 CPS Amplifiers

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
C-601	Capacitor, 1μF, 200V, 5%	1Q2105C	02777
C-602	Capacitor, .1μF, 200V, 5%	1Q2104C	02777
*C-603	Capacitor, .05μF, 200V, 5%	PO52M	02777
C-604	Capacitor, 100μF, 20V, 20%	K100J20S	05397
C-605	Capacitor, 100μF, 20V, 20%	K100J20S	05397
C-606	Capacitor, 100μF, 20V, 20%	K100J20S	05397
C-607	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-608	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-609	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-610	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-611	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-612	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-613	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-614	Capacitor, .25μF, 200V, 5%	1Q2254C	02777
*C-615	Capacitor, .05μF, 200V, 5%	PO52M	02777
C-616	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-617	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-618	Capacitor, 33μF, 20 V, 20%	K33J20S	05397
C-619	Capacitor, 33μF, 20 V, 20%	K33J20S	05397
C-620	Capacitor, 33μF, 20 V, 20%	K33J20S	05397
C-621	Capacitor, 33μF, 20 V, 20%	K33J20S	05397
C-622	Capacitor, .03μF, 200V, 5%	PO32M	02777
C-623	Capacitor, .01μF, 200V, 5%	PO12M	02777
C-624	Capacitor, .02μF, 100V, 20%	PO22M	02777
C-625	Capacitor, .015μF, 100V, 20%	PO151M	02777
L-601	Choke, 900 MH	0-3945-1	04620
L-602	Choke, 900 MH	0-3945-1	04620
L-603	Choke, 7.5 MH	MO-7.5	80223
Q-601	Transistor	2N526	03508
Q-602	Transistor	2N526	03508
Q-603	Transistor	2N526	03508
Q-604	Transistor	2N526	03508
Q-605	Transistor	2N526	03508
Q-606	Transistor	2N526	03508
Q-607	Transistor	2N526	03508
Q-608	Transistor	2N526	03508

TABLE OF REPLACEABLE PARTS - MODEL 304-B AND 304-C

CIRCUIT BOARD NO. 6B 155 CPS and 310 CPS Amplifiers

Circuit Reference	Description	Mfr. Part No.	Mfr Code Ident.
R-601	Resistor, 43K ohm, 1/4W, 5%	RC07GF433J	01121
R-602	Resistor, 9.1K ohm, 1/4W, 5%	RC07GF912J	01121
R-603	Resistor, 3.6K ohm, 1/4W, 5%	RC07GF362J	01121
R-604	Resistor, 100 ohm, 1/4W, 5%	RC07GF101J	01121
R-605	Resistor, 47K ohm, 1/4W, 5%	RC07GF473J	01121
R-606	Resistor, 8.2K ohm, 1/4W, 5%	RC07GF822J	01121
R-607	Resistor, 9.1K ohm, 1/4W, 5%	RC07GF912J	01121
R-608	Resistor, 3.6K ohm, 1/4W, 5%	RC07GF362J	01121
R-609	Resistor, 150 ohm, 1/4W, 5%	RC07GF151J	01121
R-610	Resistor, 9.1K ohm, 1/4W, 5%	RC07GF912J	01121
R-611	Resistor, 20K ohm, 1/4W, 5%	RC07GF203J	01121
R-612	Resistor, 6.8 K ohm, 1/4W, 5%	RC07GF682J	01121
R-613	Resistor, 680 ohm, 1/4W, 5%	RC07GF681J	01121
R-614	Resistor, 7.5K ohm, 1/4W, 5%	RC07GF752J	01121
R-615	Resistor, 5.1K ohm, 1/4W, 5%	RC07GF512J	01121
R-616	Resistor, 51 ohm, 1/4W, 5%	RC07GF510J	01121
R-617	Resistor, 560 ohm, 1/4W, 5%	RC07GF561J	01121
R-618	Resistor, 510 ohm, 1/4W, 5%	RC07GF511J	01121
R-619	Resistor, 750 ohm, 1/4W, 5%	RC07GF751J	011
R-620	Resistor, 2.4K ohm, 1/4W, 5%	RC07GF242J	01121
R-621	Resistor, 100 ohm, 1/4W, 5%	RC07GF101J	01121
R-622	Resistor, 3.6K ohm, 1/4W, 5%	RC07GF362J	01121
R-623	Resistor, 27K ohm, 1/4W, 5%	RC07GF273J	01121
R-624	Resistor, 47K ohm, 1/4W, 5%	RC07GF473J	01121
R-625	Resistor, 9.1K ohm, 1/4W, 5%	RC07GF912J	01121
R-626	Resistor, 8.2K ohm, 1/4W, 5%	RC07GF822J	01121
R-627	Resistor, 270 ohm, 1/4W, 5%	RC07GF271J	01121
R-628	Resistor, 3.6K ohm, 1/4W, 5%	RC07GF362J	01121
R-629	Resistor, 20K ohm, 1/4W, 5%	RC07GF203J	01121
R-630	Resistor, 9.1K ohm, 1/4W, 5%	RC07GF912J	01121
R-631	Resistor, 3.3K ohm, 1/4W, 5%	RC07GF332J	01121
R-632	Resistor, 300 ohm, 1/4W, 5%	RC07GF301J	01121
R-633	Resistor, 3K ohm, 1/4W, 5%	RC07GF302J	01121
R-634	Resistor, 5.1K ohm, 1/4W, 5%	RC07GF512J	01121
R-635	Resistor, 51 ohm, 1/4W, 5%	RC07GF510J	01121
R-636	Resistor, 560 ohm, 1/4W, 5%	RC07GF561J	01121
R-637	Resistor, 510 ohm, 1/4W, 5%	RC07GF511J	01121
R-638	Resistor, 3.3K ohm, 1/4W, 5%	RC07GF332J	01121

TABLE OF REPLACEABLE PARTS - MODEL 304-B and 304-C

CIRCUIT BOARD NO. 7E x 14 Multiplier

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
C-701	Capacitor, 75μμF, 500V, 5%	DM-10-750J	04062
C-702	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-703	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-704	Capacitor, .01μF, 100V, 20%	TA .01	91418
* C-705	Capacitor, .01μF, 200V, 20%	PO12M	02777
C-706	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-707	Capacitor, 10μF, 20V, 20%	K10J20S	05397
C-708	Capacitor, 75μμF, 500V, 5%	DM-10-750J	04062
C-709	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-710	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-711	Capacitor, 1 μμF, 500V, 5%	DM-10-010J	04062
C-712	Capacitor, 10μμF, 500V, 5%	DM-10-100J	04062
C-713	Capacitor, .8-8μμF, Trimmer	TM-9	16509
C-714	Capacitor, .8-8μμF, Trimmer	TM-9	16509
C-715	Capacitor, 10μμF, 500V, 5%	DM-10-100J	04062
C-716	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-717	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-718	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-719	Capacitor, .8-8μμF, Trimmer	TM-9	16509
C-720	Capacitor, .01μF, 200V, 20%	PO12M	02777
C-721	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-722	Capacitor, .8-8μμF Trimmer	TM-9	16509
C-723	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-724	Capacitor, .8-8μμF Trimmer	TM-9	16509
C-725	Capacitor, .001μF, 500V, 10%	SM .001	91418
C-727	Capacitor, .001μF, 500V, 10%	SM .001	91418
C-728	Capacitor, .8-8μμF Trimmer	TM-9	16509
C-729	Capacitor, .8-8μμF Trimmer	TM-9	16509
C-730	Capacitor, .001μF, 500V, 10%	SM .001	91418
C-731	Capacitor, .001μF, 500V, 10%	SM .001	91418
C-732	Capacitor, .001μF, 500V, 10%	SM .001	91418
C-733	Capacitor, .8-8μμF Trimmer	TM-9	16509
C-734	Capacitor, .001μF, 500V, 10%	SM .001	91418
C-735	Capacitor, 10μμF, 500V, 5%	DM-10-100J	04062
C-736	Capacitor, .001μF, 500V, 10%	SM .001	91418
CR-701	Diode	FD828	07263
CR-702	Diode	V56E	01281

TABLE OF REPLACEABLE PARTS - MODEL 304-B and 304-C

CIRCUIT BOARD NO. 7E x 14 Multiplier

Circuit Reference	Description		Mfr. Part No.	Mfr. Code Ident.
L-701	Choke, 4.7μH 10%		1537-28	99800
L-702	Choke, 4.7μH 10%		1537-28	99800
L-703	Choke, 22μH 10%		1537-44	99800
L-704	Choke, 4.7μH 10%		1537-28	99800
L-705	Choke, 22μF 10%		1537-44	99800
R-701	Resistor, 1K ohm,	1/4W, 5%	RC07GF102J	01121
R-702	Resistor, 30 ohm,	1/4W, 5%	RC07GF300J	01121
R-703	Resistor, 390 ohm,	1/4W, 5%	RC07GF391J	01121
R-704	Resistor, 51 ohm,	1/4W, 5%	RC07GF510J	01121
R-705	Resistor, 510 ohm,	1/4W, 5%	RC07GF511J	01121
R-706	Resistor, 4.3K ohm,	1/4W, 5%	RC07GF432J	01121
R-707	Resistor, 30 ohm,	1/4W, 5%	RC07GF300J	01
R-708	Resistor, 200 ohm,	1/4W, 5%	RC07GF201J	01121
R-709	Resistor, 100 ohm,	1/4W, 5%	RC07GF101J	01121
R-711	Resistor, 100 ohm,	1/4W, 5%	RC07GF101J	01121
R-712	Resistor, 15 ohm,	1/4W, 5%	RC07GF150J	01121
R-713	Resistor, 200 ohm,	1/4W, 5%	RC07GF201J	01121
R-714	Resistor, 1K ohm,	1/4W, 5%	RC07GF102J	01121
R-715	Resistor, 20K ohm	1/4W, 5%	RC07GF203J	01121
R-716	Resistor, 51K ohm,	1/4W, 5%	RC07GF513J	01121
R-717	Resistor, 100 ohm,	1/4W, 5%	RC07GF101J	01121
R-718	Resistor, 390 ohm,	1/4W, 5%	RC07GF391J	01121
R-719	Resistor, 100 ohm,	1/4W, 5%	RC07GF101J	01121
R-720	Resistor, 390 ohm,	1/4W, 5%	RC07GF391J	01121
R-721	Resistor, 470 ohm,	1/4W, 5%	RC07GF471J	01121
R-722	Resistor, 100 ohm,	1/4W, 5%	RC07GF101J	01121
R-723	Resistor, 2.2K ohm,	1/4W, 5%	RC07GF222J	01121
R-724	Resistor, 150 ohm,	1/4W, 5%	RC07GF151J	01121
R-725	Resistor, 1K ohm,	1/4W, 5%	RC07GF102J	01121
R-727	Resistor, 51K ohm,	1/4W, 5%	RC07GF513J	01121
J21	Receptacle, Coax		50-010-4300	98[illegible]1

TABLE OF REPLACEABLE PARTS - MODEL 304-B and 304-C

CIRCUIT BOARD NO. 7E x 14 Multiplier

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
T-701	Coil Assembly	22311	GTC
T-702	Coil Assembly	22801	GTC
T-703	Coil Assembly	22802	GTC
T-704	Coil Assembly	22802	GTC
T-705	Coil Assembly	22803	GTC
T-706	Coil Assembly	22804	GTC
T-707	Coil Assembly	22805	GTC
T-708	Coil Assembly	22804	GTC
T-709	Coil Assembly	22805	GTC
T-710	Coil Assembly	22806	GTC
Q-701	Transistor	2N274	02735
Q-702	Transistor	2N274	02735
Q-703	Transistor	2N1195	04713
Q-704	Transistor	2N1195	04713
Q-705	Transistor	2N1195	04713
Q-706	Transistor	2N1195	04713

TABLE OF REPLACEABLE PARTS - MODEL 304-B and 304-C

CIRCUIT BOARD NO. 8B Lock Indicator, Sweep, and Starter

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
C-801	Capacitor, 100μF, 20V, 20%	K100J20S	05397
C-802	Capacitor, 100μF, 20V, 20%	K100J20S	05397
C-803	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-804	Capacitor, 100μF, 20V, 20%	K100J20S	05397
C-805	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-806	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-807	Capacitor, .1μF, 400V, 20%	1M4104	02777
C-809	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-810	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C-811	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-812	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-813	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-814	Capacitor, .001μF, 1K V, 10%	SM .001	91418
CR-801	Diode	G296	07263
CR-802	Diode	G296	07263
CR-803	Diode	G296	07263
CR-804	Diode	G296	07263
CR-805	Diode	G296	07263
CR-806	Diode	G296	07263
CR-807	Diode	G296	07263
CR-808	Diode	G296	07263
CR-809	Diode	1N3728	94145
CR-810	Diode	1N3728	94145
CR-811	Diode	G296	07263
CR-812	Diode	G296	07263
CR-813	Diode	1N749A	99942
CR-814	Diode	1N3728	94145
CR-815	Diode	1N3728	94145
CR-816	Diode	G296	07263

TABLE OF REPLACEABLE PARTS - MODEL 304-B and 304-C

CIRCUIT BOARD NO. 8B Lock Indicator, Sweep, and Starter

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
Q-801	Transistor	2N697	01295
Q-802	Transistor	2N697	01295
Q-803	Transistor	2N697	01295
Q-804	Transistor	2N697	01295
Q-805	Transistor	2N697	01295
Q-806	Transistor	2N1991	07263
RY-801	Relay 24V	SC11DC	77342
RY-802	Relay 24V	SC11DC	77342
R-801	Resistor, 200K ohm, 1/4W, 5%	RC07GF204J	01121
R-802	Resistor, 11K ohm, 1/4W, 5%	RC07GF113J	01121
R-803	Resistor, 9.1K ohm, 1/4W, 5%	RC07GF912J	01121
R-804	Resistor, 100K ohm, 1/4W, 5%	RC07GF104J	01121
R-805	Resistor, 10K ohm, 1/4W, 5%	RC07GF103J	01121
R-807	Resistor, 5.1K ohm, 1/4W, 5%	RC07GF512J	01121
R-808	Resistor, 200 ohm, 1/4W, 5%	RC07GF201J	01121
R-809	Resistor, 20K ohm, 1/4W, 5%	RC07GF203J	01121
R-810	Resistor, 220 ohm, 1/4W, 5%	RC07GF221J	01121
R-811	Resistor, 510 ohm, 1/4W, 5%	RC07GF511J	01121
R-812	Resistor, 510 ohm, 1/4W, 5%	RC07GF511J	01121
R-806	Potentiometer 1 K ohm	273-1-102	80294
R-813	Resistor, 7.5 Meg ohm, 1/4W, 5%	RC07GF755J	01121
R-814	Resistor, 100 ohm, 1/4W, 5%	RC07GF101J	01121
R-815	Resistor, 2K ohm, 1/4W, 5%	RC07GF202J	01121
R-816	Resistor, 330 ohm, 1/4W, 5%	RC07GF331J	01121
T-801	Transformer	H2	80223
T-802	Transformer Assembly	22321	GTC

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 9 - Time Scale Selector

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
A901	Integrated Circuit	SN7473N	01295
A902	" "	"	"
A903	" "	"	"
A904	" "	"	"
A905	" "	"	"
A906	" "	"	"
A907	" "	"	"
A908	" "	"	"
A909	" "	SN7472N	"
C901	Capacitor, 0.1 uF, 25V	5815-000-Y5U-104Z	15450
C902	" " "	"	"
C903	" " "	"	"
C904	" " "	"	"
C905	" " "	"	"
C906	" " "	"	"
C907	" " "	"	"
C908	" " "	"	"
C909	" " "	"	"
C910	" " "	"	"
C911	" 6.8uF, 35V, 10%	CS13BF685K	56289
C912	" "	"	"
C913	" "	"	"
C914	" "	"	"
C915	" "	"	"
C916	" 120pF, 500V, 5%	DM-10-121J	04062
C917	" 0.1uF, 25V,	5815-000-Y5U-104Z	15450
C918	" 120pF, 500V, 5%	DM-10-121J	04062
C919	" 0.1uF, 25V	5815-000-Y5U-104Z	15450
C920	" 120pF, 500V, 5%	DM-10-121J	04[illegible]
C921	" 6.8uF, 35V, 10%	CS13BF685K	56289
C922	" 120pF, 500V, 5%	DM-10-121J	04062

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 9 - Time Scale Selector

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident.
C923	Capacitor,	.001uF,	500V,	20%	SM .001	91418
C924	"	.01uF,	500V,	20%	TA .01	01418
C925	"	6.8uF,	35V,	10%	CS13BF685K	56289
C926	"	"	"	"	"	"
C927	"	.01uF,	500V,	20%	TA .01	91418
C928	"	120pF,	500V,	5%	DM-10-121J	04062
C929	"	"	"	"	"	"
C930	"	.01uF,	500V,	20%	TA .01	91418
C931	"	6.8uF,	35V,	10%	CS13BF685K	56289
C932	"	120pF,	500V,	5%	DM-10-121J	04062
C933	"	6.8uF,	35V,	10%	CS13BF685K	56289
C934	"	.47uF,	35V,	10%	CS13BF474K	56289
CR901	Diode				IN4148	03508
CR902	Diode				"	"
CR903	"				"	"
CR904	"				"	"
CR905	"				"	"
CR906	"				"	"
CR907	"				"	"
CR908	"				"	"
CR909	"				"	"
CR910	"				"	"
CR911	"				"	"
CR912	"				"	"
CR913	"				"	"
CR914	"				"	"
CR915	"				"	"
CR916	"				"	"
CR917	"				"	"
CR918	"				IN4148	03508
CR919	Diode, Zener				IN751A	04713

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 9 - Time Scale Selector

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
CR920	Diode	IN4148	03508
CR921	"	"	"
CR922	"	"	"
CR923	"	"	"
CR924	"	"	"
CR925	"	"	"
CR926	"	"	"
CR927	"	"	"
CR928	"	"	"
CR929	"	"	"
CR932	"	HD1871	73293
CR933	Diode	HD1871	73[illegible]3
L901	Inductor, 56uH, 5%	1537-64	99800
Q901	Transistor,	2N3646	01295
Q902	Transistor,	2N3646	07263
Q903	"	"	"
Q905	"	"	"
R901	Resistor, 2K ohm, 1/4W, 5%	RC07GF202J	01121
R902	" "	"	"
R903	" "	"	"
R904	" "	"	"
R905	" "	"	"
R906	" "	"	"
R907	" "	"	"
R908	" "	"	"
R909	" "	"	"
R910	" "	"	"

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 9 - Time Scale Selector

Circuit Reference	Description				Mfr. Part No.	Mfr Coc Ide
R911	Resistor,	2K ohm,	1/4W,	5%	RC07GF202J	011
R912	"	"			"	"
R913	"	"			"	"
R914	"	1K ohm,	1/4W,	5%	RC07GF102J	"
R915	"	1.3K ohm,	1/4W,	5%	RC07GF512J	"
R916	"	1K ohm,	1/4W,	5%	RC07GF102J	"
R917	"	2K ohm,	1/4W,	5%	RC07GF202J	"
R918	"	750 ohm,	1/2W,	5%	RC20GF751J	"
R919	"	2K ohm,	1/4W,	5%	RC07GF202J	"
R920	"	"			"	"
R921	"	"			"	"
R922	"	10K ohm,	1/4W,	5%	RC07GF103J	"
R923	"	620 ohm,	1/4W,	5%	RC07GF621J	"
R924	"	2K ohm,	1/4W,	5%	RC07GF202J	"
R925	"	3.3K ohm,	1/4W,	5%	RC07GF332J	"
R926	"	"			"	"
R927	"	4.7K ohm,	1/4W,	5%	RC07GF472J	"
R930	"	2K ohm,	1/4W,	5%	RC07GF202J	"
R931	"	12K ohm,	1/4W,	5%	RC07GF123J	"
R932	"	1K ohm,	1/4W,	5%	RC07GF102J	"
R933	"	3.3K ohm,	1/4W,	5%	RC07GF 332J	"
R934	"	1K ohm,	1/4W,	5%	RC07GF102J	"
R935	"	24K ohm,	1/4W,	5%	RC07GF243J	"
R936	"	13K ohm,	1/4W,	5%	RC07GF133J	"
R937	"	220 ohm,	1/4W,	5%	RC07GF221J	"
R938	"	"	1/4W,	5%	RC07GF221J	"
R939	"	"	1/4W,	5%	RC07GF221J	"
R940	"	"	1/4W,	5%	RC07GF221J	"
R941	"	4.3K ohm,	1/4W,	5%	RC07GF432J	"

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 9 - Time Scale Selector

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
S901	Switch, SPDT	T3103	09298
S902	" "	"	"
S903	" "	"	"
S904	" "	"	"
S905	" "	"	"
S906	" "	"	"
S907	" DPDT	T2150	09298
T901	Transformer	PCT-23	80223

TABLE OF REPLACEABLE PARTS - MODEL 304B

OPTICAL - MICROWAVE UNIT consisting of:

Pre-Amplifier, Board No. 11B (1100 numbers).
70 Megahertz Power Amplifier, Board No. 12C (1200 numbers).
Lamp Assembly and Circuit Board No. 13B (1300 numbers).
Cavity Heater and Thermistor, 19B (1900 numbers).

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident.
C-1101	Capacitor	33μF,	20V,	20%,	K33J20S	05397
C-1102	Capacitor,	33μF,	20V,	20%	K33J20S	05397
C-1103	Capacitor,	33μF,	20V,	20%	K33J20S	05397
C-1104	Capacitor,	100μF,	20V,	20%	K100J20S	05397
C-1105	Capacitor,	100μF,	20V,	20%	K100J20S	05397
C-1106	Capacitor,	100μF,	20V,	20%	K100J20S	05397
C-1107	Capacitor,	33μF,	20V,	20%	K33J20S	05397
C-1108	Capacitor,	33μF,	20V,	20%	K33J20S	05397
C-1109	Capacitor,	33μF,	20V,	20%	K33J20S	05397
C-1110	Capacitor,	33μF,	20V,	20%	K33J20S	05397
C-1210	Capacitor,	.001μF,	500V,	10%	SM.001	91418
C-1202	Capacitor,	.001μF,	500V,	10%	SM.001	91418
C-1203	Capacitor,	30μμF,	500V,	5%	DM-10-300J	04062
C-1204	Capacitor,	2-25μμF,	Trimmer		TF25AR	16509
C-1205	Capacitor,	.001μF,	500V,	10%	SM.001	91418
C-1207	Capacitor,	.001μF,	500V,	10%	SM.001	91418
C-1208	Capacitor	2-25μμF	Trimmer		TF25AR	16509
C-1209	Capacitor,	.001μF,	500V,	10%	SM.001	91418
C-1210	Capacitor	.001uF	500V,	10%	SM.001	91418
C-1211	Capacitor,	33μμF	500V,	5%	DM-10-330J	04062
C-1212	Capacitor,	.001μF,	500V,	10%	SM.001	91418
C-1213	Capacitor,	22μμF,	500V,	5%	DM-10-220J	04062
C-1214	Capacitor,	2-25μμF,	Trimmer		TF25AR	16509
C-1216	Capacitor,	.001μF,	500V,	5%	SM.001	91418
C-1217	Capacitor,	.001μF,	500V,	5%	SM.001	91418
C-1301	Capacitor,	110μμF,	500V,	5%	DM-10-111J	04062

TABLE OF REPLACEABLE PARTS - MODEL 304B

OPTICAL - MICROWAVE UNIT consisting of:

Pre-Amplifier, Board No. 11B (1100 numbers).
70 Megahertz Power Amplifier, Board No. 12C (1200 numbers).
Lamp Assembly and Circuit Board No. 13B (1300 numbers).
Cavity Heater and Thermistor, 19B (1900 numbers).

Circuit Reference	Description	Mfr Part No.	Mfr. Code Ident.
C-1309	Capacitor, 2.2μF, 20V, 20%	K2R2J20S	05397
C-1310	Capacitor, 2.2μF, 20V, 20%	K2R2J20S	05397
C-1311	Capacitor, 2.2μF, 20V, 20%	K2R2J20S	05397
C-1901	Dielectric, Varactor Mount 3-5 uuF,	12003	91418
C-1902	Capacitor, .01μF, 100V 20%	TA.01	91418
C-1903	Capacitor, .01μF, 100V 20%	TA.01	91418
CR-1101	Solar Cell Assembly	23647	GTC
CR-1203	Diode	HD1871	13480
CR-1204	Diode	HD1871	13480
CR-1206	Diode, Zener	1N4739	04[illegible]
CR-1901	Diode, Varactor	HP 0151	96341
L-1201	Choke 4.7 μH 10%	1537-28	99800
L-1202	Choke, .15 μH 20%	1537-00	99800
L-1204	Choke, .15 μH 20%	1537-00	99800
L-1205	Choke, 4.7μH 10%	1537-28	99800
L-1301	Coil, Lamp Exciter		GTC
L-1302	Choke, 22 μH	1537-44	99800
L-1303	Choke, 22 μH	1537-44	99800
L-1304	Choke, 22 μH	1537-44	99800
P-11	Male Block	200837-3	09769
	Shield	200517-1	09769
	Male Pin	201330-1	09769
	Ferrule	323930	09769
	Corner Guide Pin, Male	200833-4	09769
	Corner Guide Pin, Female	200835-4	09769
P-16	Connector, Coax	50-007-0000	98291

TABLE OF REPLACEABLE PARTS - MODEL 304B

OPTICAL - MICROWAVE UNIT consisting of:

Pre-Amplifier, Board No. 11B (1100 numbers).

70 Megahertz Power Amplifier, Board No. 12C (1200 numbers).

Lamp Assembly and Circuit Board No. 13B (1300 numbers).

Cavity Heater and Thermistor, 19B (1900 numbers).

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident
Q-1101	Transistor (pink dot)				2N526	03508
Q-1102	Transistor				2N526	03508
Q-1103	Transistor				2N526	03508
Q-1201	Transistor				2N3866	02735
Q-1202	Transistor				2N2222	01295
Q-1301	Transistor				2N3498	04713
R-1101	Resistor	2K ohm,	1/4W,	5%	RC07GF202J	01121
R-1102	Resistor,	9.1K ohm,	1/4W,	5%	RC07GF912J	01121
R-1103	Resistor,	9.1K ohm,	1/4W,	5%	RC07GF912J	01121
R-1104	Resistor,	9.1K ohm,	1/4W,	5%	RC07GF912J	01121
R-1105	Resistor,	7.5K ohm,	1/4W,	5%	RC07GF752J	01121
R-1106	Resistor,	3.6K ohm,	1/4W,	5%	RC07GF362J	01121
R-1107	Resistor,	100 ohm,	1/4W,	5%	RC07GF101J	01121
R-1108	Resistor,	8.2K ohm,	1/4W,	5%	RC07GF822J	01121
R-1109	Resistor,	47K ohm,	1/4W,	5%	RC07GF473J	01121
R-1110	Resistor,	9.1K ohm,	1/4W,	5%	RC07GF912J	01121
R-1111	Resistor,	8.2K ohm,	1/4W,	5%	RC07GF822J	01121
R-1112	Resistor,	150 ohm,	1/4W,	5%	RC07GF151J	01121
R-1113	Resistor,	8.2K ohm,	1/4W,	5%	RC07GF822J	01121
R-1114	Resistor,	100 ohm,	1/4W,	5%	RC07GF101J	01121
R-1115	Resistor,	510 ohm,	1/4W,	5%	RC07GF511J	01121
R-1116	Resistor,	470 ohm,	1/4W,	5%	RC07GF471J	01121
R-1117	Resistor,	510 ohm,	1/4W,	5%	RC07GF511J	01121
R-1118	Resistor,	100 ohm,	1/4W,	5%	RC07GF101J	01121
R-1201	Resistor,	3.9K ohm,	1/4W,	5%	RC07GF392J	01121
R-1202	Resistor,	1.5K ohm,	1/4W,	5%	RC07GF152J	01121
R-1203	Resistor,	1K ohm,	1/4W,	5%	RC07GF102J	01121

TABLE OF REPLACEABLE PARTS - MODEL 304B

OPTICAL - MICROWAVE UNIT consisting of:

Pre-Amplifier, Board No. 11B (1100 numbers).

70 Megahertz Power Amplifier, Board No. 12C (1200 numbers).

Lamp Assembly and Circuit Board No. 13B (1300 numbers).

Cavity Heater and Thermistor, 19B (1900 numbers).

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident.
R-1204	Resistor,	100 ohm,	1/4W,	5%	RC07GF101J	01121
R-1205	Resistor,	22K ohm,	1/4W,	5%	RC07GF223J	01121
R-1207	Resistor,	220 ohm,	1/4W,	5%	RC07GF221J	01121
R-1208	Resistor,	820 ohm,	1/4W,	5%	RC07GF821J	01121
R-1209	Potentiometer 2K				3280W-1-202	80294
R-1210	Resistor,	100 ohm,	1/4W,	5%	RC07GF101J	01121
R-1211	Resistor,	15 ohm,	1/4W,	5%	RC07GF150J	01121
R-1301	Resistor,	2.2K ohm,	1/4W,	5%	RC07GF222J	01121
R-1302	Resistor,	39K ohm,	1/4W,	5%	RC07GF393J	01121
R-1303	Resistor,	1.8K ohm,	1/4W,	5%	RC07GF182J	0112
RT-1301	Thermistor (lamp)				GA45P1	15801
RT-1901	Thermistor (cavity)				GB41P1	15801
T-1201	Transformer				33959	21926

TALBE OF REPLACEABLE PARTS - MODEL 304-B and 304-C

OPTICAL - MICROWAVE UNIT consisting of:

Pre-Amplifier, Board No. 11B (1100 numbers).
70 Megacycle Power Amplifier, Board No. 12C (1200 numbers).
Lamp Assembly and Circuit Board No. 13B (1300 numbers).
Cavity Heater and Thermistor, 19B (1900 numbers).

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
*C-1302	Capacitor, 27uuF, 500V, 5%	DM-10-270J	04062
*C-1303	Capacitor, 68uuF, 500V, 5%	DM-10-680J	04062
C-1304	Capacitor, 100uuF, 500V, 5%	DM-10-101J	04062
C-1305	Capacitor, .003uF, 1KV, 10%	CCD-302	04062
C-1306	Capacitor, .003uF, 1KV, 10%	CCD-302	04062
C-1307	Capacitor, .003uF, 1KV, 10%	CCD-302	04062

TABLE OF REPLACEABLE PARTS - MODEL 304-B

OSCILLATOR ASSEMBLY 5 Mc CRYSTAL FINAL ASSEMBLY

First and Second Stages - Board 14 aB

Last Stage Board - 14bB

Power Supply and Regulator - Board 14cB

Circuit Reference	Description					Mfr. Part No.	Mfr. Code Ident
AR1401	Amplifier					CA 30000	02735
C1401	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1402	Capacitor,	.01uF,	100V,	20%		TA.01	91418
C1403	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1404	Capacitor,	200uuF,	500V,	5%		DM-10-201J	04062
C1405	Capacitor,	270uuF,	300V,	5%		DM-10-271J	04062
C1406	Capacitor,	2.2uF,	20V,	20%		K2R2J20S	05397
C1407	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1408	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1409	Capacitor,	2.2uF,	20V,	20%		K2R2J20S	05397
C1410	Capacitor,	2.2uF,	20V,	20%		K2R2J20S	05397
C1411	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1412	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1413	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1414	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1415	Capacitor,	.01uF,	100V,	20%		TA .01	91418
*C 1416	Capacitor,	150pF,	500V,	5%		DM-10-151J	04062
C1417	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1418	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1419	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1420	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1421	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1422	CApacitor,	.01uF,	100V,	20%		TA .01	91418
C1423	Capacitor,	.01uF,	100V,	20%		TA .01	91418
C1424	Capacitor,	100uF,	20V,	20%		CS13BE107K	56289
C1425	Capacitor,	.01uF,	35V,	10%		150D104X9035A2	56289
CR1401	Varicap					V15	01[illegible]1
CR1402	Diode					IN4148	07263
CR1403	Diode					IN4148	07263
CR1404	Diode, Zener					IN751A	01295

TABLE OF REPLACEABLE PARTS - MODEL 304B

OSCILLATOR ASSEMBLY 5Mc CRYSTAL FINAL ASSEMBLY

First and Second Stages - Board 14aB

Last Stage Board - 14bB

Power Supply and Regulator - Board 14cB

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident.
CR1405	Crystal,	5Mc			BG61A-5	71034
L1401	Choke,	10uH,	5%		1537-36	99800
L1402	Choke,	56uH,	5%		1537-64	99800
L1403	Choke,	56uH,	5%		1537-64	99800
Q1401	Transistor				2N2708	02735
Q1402	Transistor				2N3646	07263
Q1403	Transistor				2N3646	07263
Q1404	Transistor				2N4121	07263
Q1405	Transistor				2N1711	01295
Q1406	Transistor				2N4921	07235
RT1401	Thermistor				GA42P1	15801
R1401	Resistor,	20K ohm,	1/8W,	5%	RC05GF203J	01121
R1402	Resistor,	510K ohm,	1/8W,	5%	RC05GF511J	01121
R1403	Resistor,	10K ohm,	1/8W,	5%	RC05GF513J	01121
R1404	Resistor,	51K ohm,	1/8W,	5%	RC05GF510J	01121
R1405	Resistor,	2K,	1/8W,	5%	RC05GF202J	01121
R1406	Resistor,	100 ohm,	1/8W,	5%	RC05GF101J	01121
R1407	Resistor,	510 ohm,	1/8W,	5%	RC05GF511J	01121
R1408	Resistor,	510 ohm,	1/8W,	5%	RC05GF511J	01121
R1409	Resistor,	300 ohm,	1/8W,	5%	RC05GF301J	01121
R1410	Resistor,	3.6K ohm,	1/8W,	5%	RC05GF362J	01121
R1411	Resistor,	18K ohm,	1/8W,	5%	RC05GF183J	01121
R1412	Resistor,	15K ohm,	1/8W,	5%	RC05GF153J	01121

TABLE OF REPLACEABLE PARTS - MODEL 304B

OSCILLATOR ASSEMBLY 5Mc CRYSTAL FINAL ASSEMBLY

First and Second Stages - Board 14aB

Last Stage - Board 14bB

Power Supply and Regulator - Board 14cB

Circuit Reference	Description				Mfr. Part No.	Mfr. Code Ident.
R1413	Resistor,	180 ohm,	1/8W,	5%	RC05GF181J	01121
R1414	Resistor,	100 ohm,	1/8W,	5%	RC05GF101J	01121
*R1415	Resistor,	470 ohm,	1/8W,	5%	RC05GF471J	01121
R1416	Resistor,	620 ohm,	1/8W,	5%	RC05GF621J	01121
R1417	Resistor,	180 ohm,	1/8W,	5%	RC05GF181J	01121
R1418	Resistor,	10K ohm,	1/8W,	5%	RC05GF100J	01121
R1419	Resistor,	10K ohm,	1/8W,	5%	RC05GF103J	01121
R1420	Resistor,	180 ohm,	1/8W,	5%	RC05GF181J	01121
*R1421	Resistor,	510 ohm,	1/4W,	5%	RC07GF511J	01121
*R1422	Resistor,	33K ohm,	1/4W,	5%	RC07GF333J	01121
R1423	Resistor,	100 ohm,	1/8W,	5%	RC05GF101J	011
R1424	Resistor,	1K ohm,	1/8W,	5%	RC05GF102J	01121
*R1425	Resistor,	3K ohm,	1/4W,	5%	RC07GF302J	01121
R1426	Resistor,	51K ohm,	1/8W,	5%	RC05GF513J	01121
*R 1427	Resistor,	4.3K ohm,	1/8W,	5%	RC05GF433J	01121
R1428	Resistor,	1K ohm,	1/8W,	5%	RC05GF102J	01121
R1429	Resistor,	1.3K ohm,	1/4W,	5%	RC07GF133J	01121
R1430	Resistor,	10K,	1/8W,	1%	RN60C1002F	81483
R1431	Resistor,	750 ohm,	1/8W,	5%	RC05GF751J	01121
R1432	Potentiometer, 5K ohm,			5%	3280W66-502	80294
R1433	Resistor,	10K,	1/8W,	1%	RN60C1002F	81483
R1434	Resistor,	4.32K,	1/8W,	1%	RN60C4321F	81483
R1435	Resistor,	5.49K,	1/8W,	1%	RN60C5491F	81483
R1436	Resistor,	10K,	1/8W,	5%	RC05GF103J	01121
R1437	Resistor,	10K,	1/8W,	5%	RC05GF103J	01121
R1438	Resistor,	20K,	1/4W,	5%	RC07GF203J	01121
R1439	Resistor,	3.3 Meg,	1/4W,	5%	RC07GF335J	01121
R1440	Resistor,	270 ohm,	1/4W,	5%	RC07GF271	01
T1401	Coil Assembly				G-23737	21926

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 15 - 20 Volt Power Supply

Circuit Reference	Description	Mfr. Part No.	Mfg. Code. Ident.
C-1501	Capacitor, 6.8μF, 35V	350D685X0035B2	56289
C-1502	Capacitor, .001μF	SM .001	82560
C-1503	Capacitor, 1000μF, 25V	BR1000-25	88419
C-1504	Capacitor, 3900μF, 50V	36D39260506A	56289
CR-1501	Diode	MDA952-3	04713
F-1501	Fuse, 2 Amp	312002	75915
J-1501	Receptable, Box Mtg.	K02-16-10P	16133
Q-1501	Transistor	2N442	Delco
Q-1502	Transistor	2N3715	04713
Q-1503	Transistor	2N3715	04713
Q-1504	Transistor	2N2405	02734
Q-1505	Transistor	2N1481	02734
Q-1506	Transistor	2N1711	01295
Q-1507	Transistor	2N1711	01295
Q-1508	Transistor	40233	79089
Q-1509	Transistor	40233	79089
R-1501	Resistor, 510 ohm, 10W, 3%	RH-10-510-3%	04387
R-1502	Resistor, .25 ohm, 10W, 3%	RH-10-.25-3%	04387
R-1503	Resistor, 100 ohm, 1/4W, 5%	RC07GF101J	01121
R-1504	Resistor, 3.3K ohm, 1/4W, 5%	RC07GF332J	01121
R-1505	Resistor, 3.3K ohm, 1/4W, 5%	RC07GF332J	01121
R-1506	Resistor, 1.6K ohm, 2W, 3%	3962X	44655
R-1507	Potentiometer, 500 ohm, 1W, 5%	1287-500-5%	04387
R-1508	Resistor, 680 ohm, 2W, 3%	3949X	44655
R-1509	Resistor, 1.3K ohm, 1/4W, 5%	RC07GF132J	01121
R-1510	Resistor, 511 ohm, 1/8W, 1%	RN55C5110F	75042
R-1511	Resistor, 1.3K ohm, 1/4W, 5%	RC07GF132J	01121
R-1512	Resistor, 1.8K ohm, 2W, 3%	3963X	44655
S-1501	Thermostat	3BTL2-47	01295

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CIRCUIT BOARD NO. 15 - 20 Volt Power Supply

Circuit Reference	Description	Mfr. Part No.	Mfg. Code Ident.
T-1501	Transformer 115V AC	56-1	08779
VR-1501	Diode, Zener 10V	UZ810	12969
VR-1502	Diode, Zener	1N823	04713

TABLE OF REPLACEABLE PARTS - MODEL 304-B AND 304-C

CIRCUIT BOARD No. 16B - Harness Assembly Monitor Box Wiring.

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
C1601	Capacitor, 33μF, 20V, 20%	K33J20S	05397
C1602	Capacitor, 140μF, 6V,	PP140B6A1	21520
R1601	Potentiometer, 1K ohm, 5%	7500-5023B	81483
R1602	Resistor, 3.65K ohm, 1/4W, 1%	RN65B3651F	81483
R1603	Resistor, 511 ohm, 1/4W, 1%	RN65B5110F	81483
R1604	Resistor, 1K ohm, 1/4W, 5%	RC07GF102J	01121
S1601	Switch DPDT	T2150	09298
S1602	Switch DPDT	T2150	09298
S1603	Switch DPDT	T2150	09298
	Duo Dial	RB	80740
M1601	Meter -10V-0- -10V DC uA	1212C	16902
XY1	Socket	R92	82893
P12	Male Block	200837-3	09769
	Male Pin	201330-1	09769
	Shield	200517-1	09769
	Ferrule, Violet	323930	09769
	Corner Guide Pin, Male	200833-4	09769
	Corner Guide Pin, Female	200835-4	09769

TABLE OF REPLACEABLE PARTS - MODEL 304-B

FINAL ASSEMBLY PARTS

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
J18	Connector, Coax	1-190-1 NT-34	95712
J19	Connector, Coax	1-190-1 NT-34	95712
J20	Connector, Coax	1-190-1 NT-34	95712
XDS1701	Light Assembly GREEN	162-8430-972	13812
XDS1702	Light Assembly RED	162-8430-971	13812
DS1701	Lamp	387	24446
DS1702	Lamp	327	24446
	Power Supply, +20V DC	44085	GTC
	Bumper, Rubber (foot)	0403-0004	28480
	Connector, D.C. Input	MS310A-10SL-3S	16133

TABLE OF REPLACEABLE PARTS - MODEL 304-B

FRONT PANEL HARNESS ASSEMBLY

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
J15	Plug	K03-16-10SN	16133
J15	End Bell (shell)	K06-16-3/8	16133
P13	Connector Assembly		
	Male Block	200837-3	00779
	Male Pin	201330-1	00779
	Male Corner Guide	200833-1	00779
	Female Corner Socket	200835-4	00779
R1701	Potentiometer, 5K ohm	7500-5024B	12400
R1702	Resistor, 1180 ohm, 1/4W, 1%	RN65B118F	81483
S1701	Power Switch	81024BP	04009
	DuoDial	2606	80053

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CHASSIS HARNESS ASSEMBLY

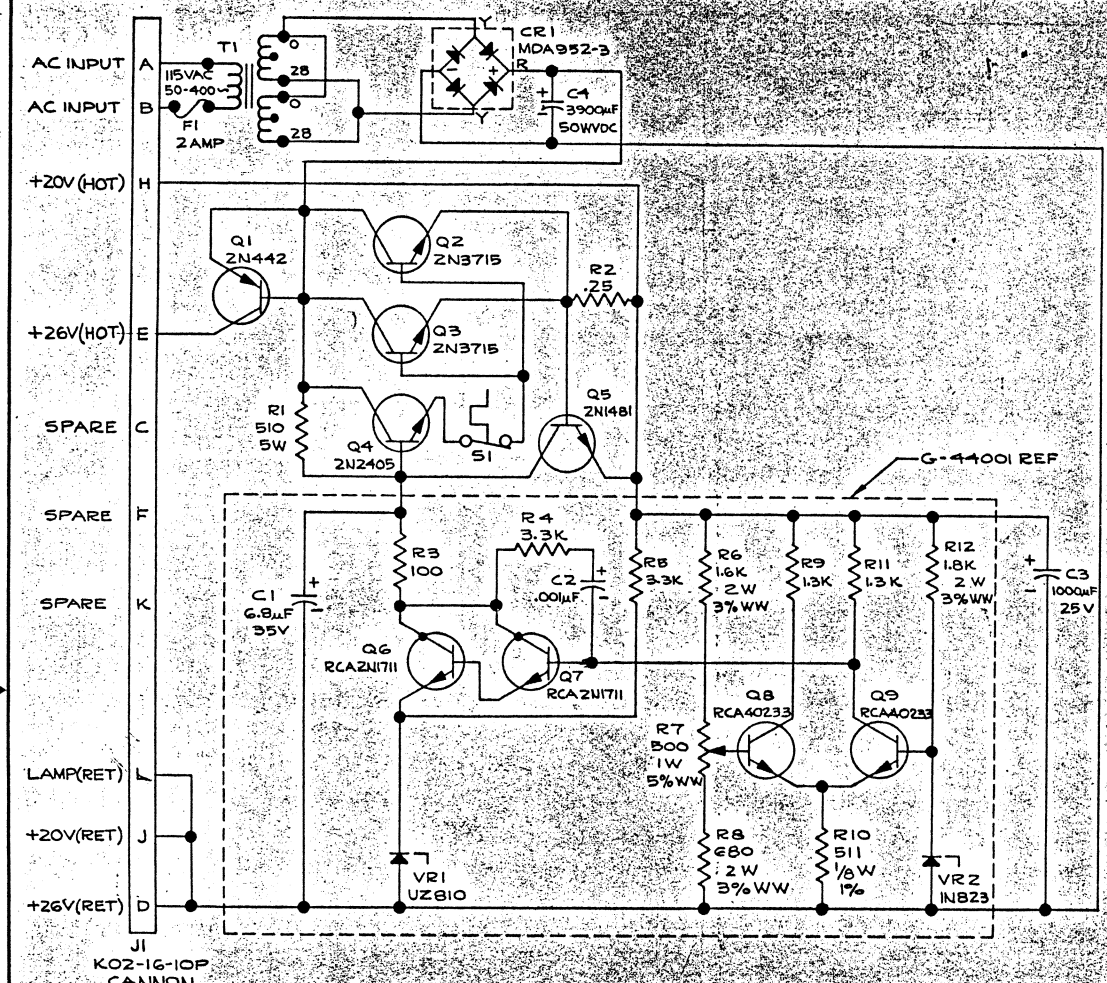
Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
C-1801	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-1802	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-1803	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-1804	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-1805	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-1806	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-1807	Capacitor, .01μF, 600V, 20%	BYA6S1	14655
C-1808	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-1809	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-1810	Capacitor, .01μF, 100V, 20%	TA .01	91418
C-1811	Capacitor, .01μF, 100V, 20%	TA .01	91418
L-1801	Choke, 3.3μH	2890-08	99800
L-1802	Choke, 3.3μH	2890-08	99800
L-1803	Choke, 3.3μH	2890-08	99800
L-1804	Choke, 3.3μH	2890-08	99800
L-1805	Choke, 1.5μH	2890-02	99
L-1806	Choke, 1.5μH	2890-02	99800
J-1 thru J-10	Connectors (10)	00-5009-016-163-002	73690
J-1 thru J-10	Plastic Locating Tab	50-5006-3424	73690
J-11, J-12, J-13	Female Block(Connector)	200838-3	09769
J-11, J-12, J-13	Male Corner Guide Pin	200833-4	09769
J-11, J-12, J-13	Female Corner Guide Pin	200835-4	09769
J-11, J-12, J-13	Female Socket	201328-1	09769
J-16	Jack, Bulkhead	50-010-4300	98291
FL-1801	Filter	G13459	GTC
R-1801	Resistor, 22K ohm, 1/4W, ±5%	RC07GF223J	01121

MANUFACTURERS BY CODE IDENTIFICATION NUMBERS

Code Ident. No.	Manufacturer	Location
21926	General Technology Corporation	Los Angeles, Calif
01121	Allen Bradley Co.	Milwaukee, Wisc.
01281	Pacific Semiconductors Inc.	Culver City, Calif.
01295	Texas Instruments	Dallas, Texas
01961	Pulse Engineering Co.	Santa Clara, Calif.
02735	Radio Corp. of America	Camden, New Jers
02777	Hopkins Engineering Co.	San Fernando, Cali
02985	Tepro Electric Corp.	Rochester, New Yc
03508	General Electric Co.	Syracuse, New Yor
04009	Arrow-Hart	Fullerton, Calif.
04062	Elmenco Products Co.	New York, New Yo
04620	Rayco Electronic Mfg. Co.	N. Hollywood, Cali
04713	Motorola Inc.	Phoenix, Arizona
05397	Kemet Co.	Cleveland, Ohio
06111	Fairchild Control Corp.	Los Angeles, Calif
06473	Amphenol-Borg Electronics Corp.	Los Angeles, Calif
07263	Fairchild Camera & Semiconductors	Mountain View, Ca
08779	Signal Transformer Co. Inc.	Brooklyn, New Yor
09219	GTI-Glentronics	Glendora, Calif.
09298	Control Switch Inc.	Los Angeles, Calif
09769	Amp Inc.	Harrisburg, Pa.
12065	Transitron Electronics Corp.	East Boston, Mass
12400	International Resistance Co.	Philadelphia, Pa.
13812	Dialco Electric Corp.	Brooklyn, New Yor
14655	Cornell Dubilier Electric Corp.	So. Plainfield, N.J.
15801	Fenwal Electronics Inc.	Farmingham, Mas
15450	Erie Resistor Corp.	Erie, Pa.
16133	Cannon Electric	Anaheim, Calif.
16509	Voltronics	Chicago, Ill.

MANUFACTURES BY CODE IDENTIFICATION NUMBERS

Code Ident. No.	Manufacturer	Location
16902	Simpson Instruments Inc.	Escondido, C
21520	Fansteel Corp.	No. Chicago,
28480	Hewlett-Packard	Palo Alto, Ca
28959	Hoffman Electronic Corp.	Los Angeles,
44655	Ohmite Mfg. Co.	Chicago, Ill.
56289	Sprague Electric Co.	North Adams
71034	Bliley Electric Co., Inc.	Erie, Pa.
71400	Bussman Mfg. Div.	St. Louis, M
71590	Centralab, Div. of Globe Union Inc.	Milwaukee, W
73690	Electro Resistor Co.	New York, N
75915	Littelfuse, Inc.	Des Plaines,
77342	Potter and Brumfield	Princeton, N
80223	United Transformer	New York, N
80294	Bourns Lab., Inc.	Riverside, C
80740	Beckman Instrument	Fullerton, Ca
81483	International Rectifier Corp.	El Segund
82893	Vector Electronic Corp.	Glendale, Ca
88419	Cornell Dubilier Electric Co.	Indianapolis,
88870	Walkirt Co.	Inglewood, C
91418	Radio Material Corp.	Chicago, Ill.
93410	Stevens Mfg. Co.	Mansfield, O
94145	Raytheon Mfg. Co.	Newton, Mas
95712	Dage Corp.	Stamford, Co
96341	Microwave Assoc., Inc.	Burlington, M
97567	Electron-Radar Products	Chicago, Ill.
98291	Sealectro Corp.	Mamaroneck,
98350	Daystrom, Inc.	Los Angeles,
98376	Nero	Burbank, Cal
98978	International Electronic Research	Burbank, Cal
99800	Delevan Electronics Corp.	East Aurora,



REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	R6 WAS ½W IS 2W; R8 WAS 650Ω, ½W IS 680Ω, 2W; R10 WAS 510Ω, ⅛W IS 511Ω ⅛W 1%; R12 WAS ½W IS 2W. PER EO. 01628	13 DEC 65	
B	Q6,7,8 & 9 WAS 40233 EO11717 R.L.	28 MAR 66	
C	Q8 & Q9 WERE 2N1711 ARE 40233 EO11775	2 JUN 66	

18. LAST REF DES USED: C4, CR1, J1, VR2, R12, Q9, S1
16. RESISTOR VALUES IN OHMS EXCEPT K=KILOHMS
15. ALL RESISTORS 1/4 W ± 5%

14. DIMENSIONING AND TOLERANCING PER MIL-STD-8
13. STANDARD HOLE TOLERANCES PER AND 16287
12. REMOVE BURRS AND SHARP EDGES .010 MAX.
11. MACHINED SURFACES FLAT WITHIN .005 PER INCH TO A MAX OF .006 FOR ANY SURFACE
10. MACHINED SURFACES NORMAL & PARALLEL WITHIN .002 PER INCH TO A MAX OF .012 FOR ANY SURFACES
9. MACHINED DIAS ON A COMMON ℄ CONCENTRIC WITHIN .005 TIR, UNMACHINED DIAS CONCENTRIC WITHIN .008 TIR
8. DIMENSION LIMITS HELD AFTER PLATING
7. MACHINED FILLET RADII .015 ± .005
6. SCREW THREADS PER MIL-STD-7-48
5. WELD SYMBOLS PER JAN-STD-19
4. MACHINE FINISH 125 PER MIL-STD-10
3. TOLERANCES: X ± .1
XX ± .03
XXX ± .015
ANGLES ± 0°30'
2. DO NOT SCALE DRAWING
1. DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED

QTY REQD.			ITEM NO.	PART NO.	SYM	ELECT DSN	DESCRIPTION	CODE IDENT	MATL	SPECIFICATION
			← ASSYS				LIST OF MATERIAL			
REF	REF		G-44085	330B						
REF	REF		G-44085	304B						
NEXT ASSY	FINAL ASSY	QTY REQD	NEXT ASSY	USED ON						

HEAT TREAT	PROCESS
HARDNESS	NAME
SPEC	SPEC

SIGNATURES	DATES
DFT R.L. Fornia	25AUG65
CHK	
APPD L.M. Anderson	25AUG65
APPD	
APPD	
APPD	
Q APPROVAL	
OTHER APPROVAL	

GENERAL TECHNOLOGY CORPORATION
TORRANCE CALIF.

SCHEMATIC
20 V POWER SUPPLY

CODE IDENT NO.	SIZE	
	C	G-34091
SCALE NONE	WT ACT	WT CALC	SHEET 1 OF 1

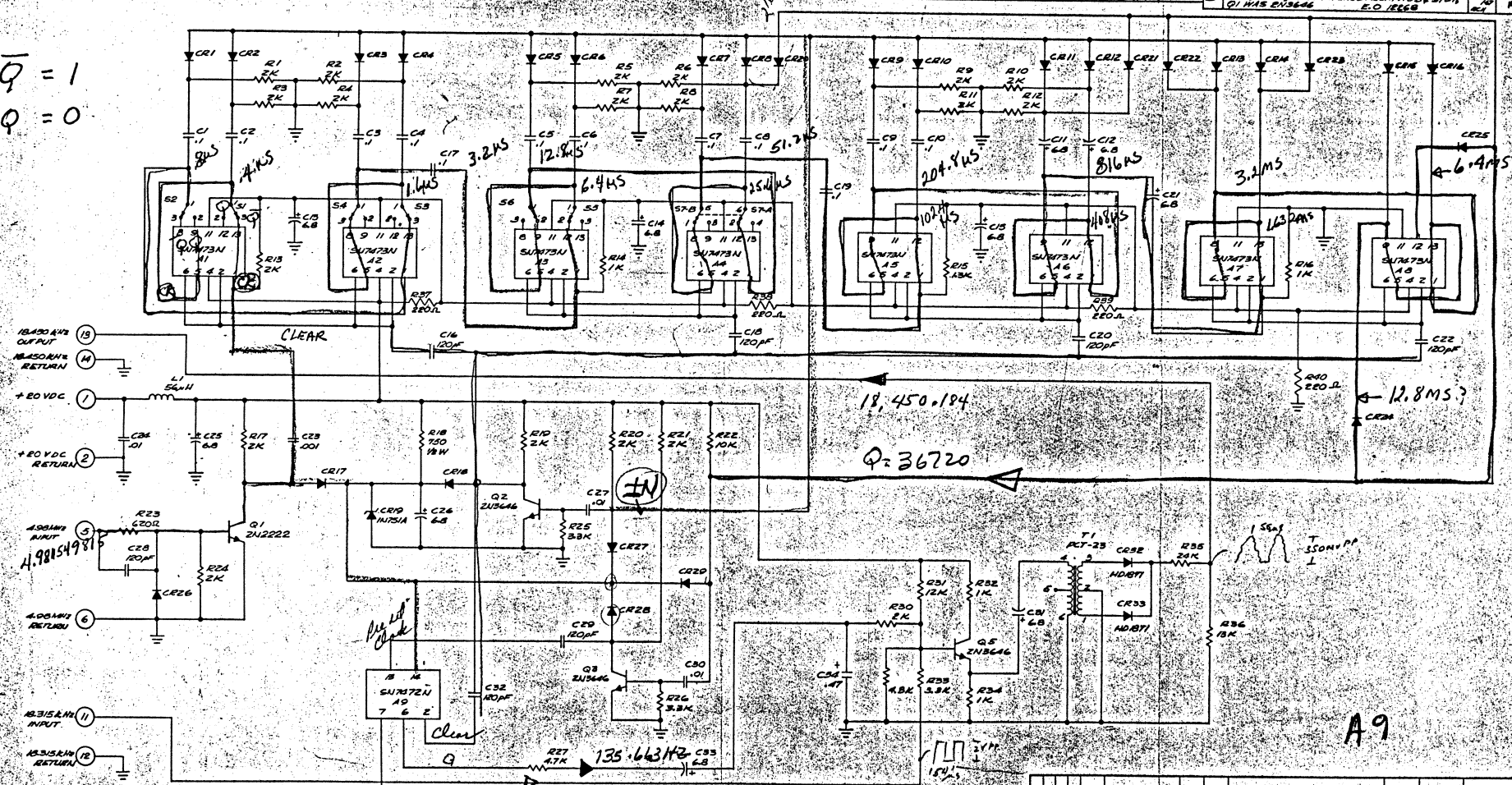
G-34091 C

SYM	DESCRIPTION	DATE	APPROVED
F	REMOVED: R28 62K, R29 10K, Q4 2N1613A, CR21/CR28 - 1N148; ADDED: C34 .47µF; CR28/CR29 1N4148, R30 1N15 4.8K, R33 1N15 10K. E.O. 12712	4/11/68	

SYM	DESCRIPTION	DATE	APPROVED
C	R14 WAS 2K, R24 WAS 2K, R15 WAS 5.1K, C8 WAS .01 E.O. 12506	3/16/67	
D	ADDED R37, R38, R39 1/4W E.O. 12511	3/16/67	
E	C17 WAS .01µF, ADDED NOTE 18. E.O. 12542	11/14/67	

REVISIONS

SYM	DESCRIPTION	DATE	APPROVED
A	+20VDC WAS 19; +20VDC RET WAS 13. E.O. 12554	7/14/67	
B	A4 CONNECTIONS TO S7 CHGD FROM B701, 1 TO 3 TO A1 2 TO 4; 11 CONN. CHGD FROM 1 TO 2 & B701, 01 WAS EN3646 E.O. 12668	8/29/67	



QTY REQD.	ITEM NO.	PART NO.	SYM	ELECT DSN	DESCRIPTION	CODE IDENT	MATL	SPECIFICATION
← ASSYS					LIST OF MATERIAL			BOARD 9F

	SIGNATURES	DATES
WT		10/25/67
CHK		3 APR 67
APPD		8/2/67
APPD		
APPD		
APPD		

G 0 0 2 5 4 4 7 0 1 3 0 4 B

NEXT ASSY	TYPE ASSY	NEXT ASSY	USED ON
QTY REQD			

HEAT TREAT — PROCESS

CUSTOMER APPROVAL — OTHER APPROVAL

GENERAL TECHNOLOGY CORPORATION
TORRANCE CALIF.

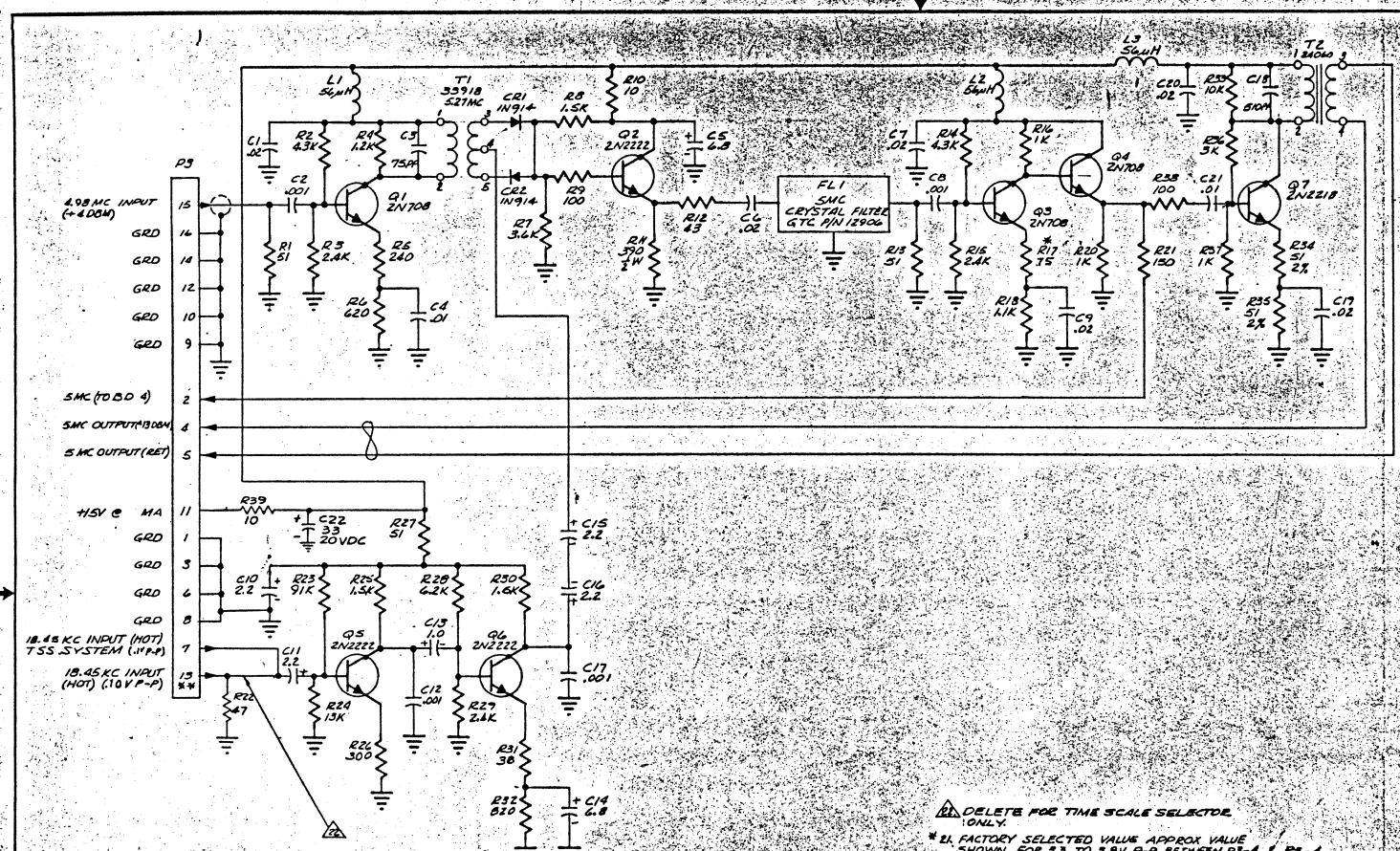
SCHEMATIC DIAGRAM
TIME SCALE SELECTOR

CODE IDENT NO. D — SIZE — G-44741 — REV F

SCALE NONE — WT ACT — WT CALC — SHEET 1 OF 1

G-44741 F

UNLESS OTHERWISE SPECIFIED



SYM	DESCRIPTION	DATE	APPROVED
A	REV'D NOTE 22 PER EO 11500	8-24-65	
B	ADDED R39 & C22, IN NOTE 19 C22 & R39 WAS C21 & R38 PER EO 16266	22 FEB 66	

REVISIONS

22. DELETE FOR TIME SCALE SELECTOR ONLY.

* 21. FACTORY SELECTED VALUE APPROX VALUE SHOWN, FOR 3.3 TO 3.8V P-P BETWEEN P3-4 & P3-4.

20. UNUSED REF DESIGNATIONS: 219.

19. LAST REF DESIGNATIONS USED: C22, CR2, FL1, L3, Q7, R39, T2.

18. ALL RESISTANCE VALUES IN OHMS, EXCEPT K = KILOHMS & MEG = MEGOHMS.

17. CAPACITANCE VALUES IN μF.

16. ALL RESISTORS ARE ¼W, 5%.

15. REF DESIGNATIONS ARE ABBREVIATED ADD 300 TO COMPONENTS.

14. DIMENSIONS AND TOLERANCES PER MIL-STD-8
13. STANDARD HOLE TOLERANCES PER AND 1000
12. REMOVE BURRS AND SHARP EDGES .005 MAX.
11. MACHINED SURFACES FLAT WITHIN .005 PER INCH TO A MAX OF .015 FOR ANY SURFACE
10. MACHINED SURFACES NORMAL & PARALLEL WITHIN .005 PER INCH TO A MAX OF .015 FOR ANY SURFACE
9. MACHINED BAR ON A DIAMETER & CONCENTRIC WITHIN .005 THE UNMACHINED BARS CONCENTRIC WITHIN .015 THE
8. DIMENSIONS LIMITS HOLD AFTER PLATING
7. MACHINED FILLET RADII .015-.025
6. SCREW THREADS PER MIL-STD-1740
5. WELD SYMBOLS PER AWS-STD-2
4. MACHINE FINISH 125" PER MIL-STD-10
3. TOLERANCES: .X ± .1
.XX ± .03
.XXX ± .010
ANGLE ± 1°
2. DO NOT SCALE DRAWING
1. DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED

QTY REQD.	ITEM NO.	PART NO.	SYM	ELECT DSN	DESCRIPTION	CODE IDENT	MATL	SPECIFICATION
	← ASSYS							

LIST OF MATERIAL

SIGNATURES	DATES
DFT	5/14/65
CHK	5/14/65
APPD	6/7/65
APPD	6-28-65
APPD	
APPD	
& APPROVAL	
OTHER APPROVAL	

NEXT ASSY	NEXT ASSY	USED ON
/ /	14051	304C

HEAT TREAT — PROCESS

GENERAL TECHNOLOGY CORPORATION
TORRANCE CALIF.

SCHEMATIC DIAGRAM
SYNTHESIZER, MIXER & FILTER
BOARD 3

CODE IDENT NO. — SIZE D — G-44054

SCALE — WT ACT — WT CALC — SHEET 1 OF 1

A3

G44054 B

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	REVISED PER EO 11631	8 JAN 68	
B	REVISED PER EO 11786	16 JUN 68	
C	REMOVED REF. TO P19, J19, & G-5287 FROM PANEL	17 JUL 68	
D	REMOVED 6 PTCH CBLE, CORRS CHANGED REF.		

TEST BOARD J10

1	+20V(HOT)	RED J9-1	J12-K
2	+20V(COLD)	BLK J9-2	J12-L
3	+15V (HOT)	ORN J1-11	J9-3
4	+15V(COLD)	BLK J1-12	J9-4
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16	SHIELD	BLK CHAS	

AUXILIARY CONTROL J9

1	+20V(HOT)	RED J1-1	J10-1
2	+20V(COLD)	BLK J1-2	J10-2
3	+15V (HOT)	ORN J10-3	J9-11 J11-A
4	+15V(COLD)	BLK J10-4	J1-B
*5	4.98MC (B)	COAX J2-4	
*6	4.98MC (B) RET	COAX J2-5	
7			
8			
9			
*10			
*11	18.3KC(HOT)	COAX J2-6	
*12	18.3KC(RET)	COAX J2-7	
*13	18.4KC T(HOT)	COAX P22	
*14	18.4KC T(RET)	SHIELD P22	
*15			
*16			

LOCK INDICATOR, SWEEP & STARTER J8

1	START PULSE	BRN P22	J11-HH
2	BLANK SOCKET PIN		
3	155 CPS LOCKOUT (HOT)	GRN J5-14	
4	155 CPS (HOT) 5V	YEL J5-6	
5	155 CPS @ 4V OSC BIAS V (RET)	GREY J2-HH	J5-16
6	OSC CONT VOLTAGE (HOT)	WHT J12-S	COAX J5-15
7	SWEEP DISABLE	GREY J12-P	
8	OSC. BIAS VOLT (HOT)	BLU J12-JJ	
9	GRN LIGHT	GRN J13-F	
10	RED LIGHT & 20V ENERGIZE	RED J13-H	J12-R
11	ACQ. ENABLE	BLU J12-N	
12	310CPS SIG & DISABLE (RET)	BRN J6-16	J12-T
13	310CPS SIG (HOT)	WHT J6-15	
14	SWEEP ENERGIZE (HOT)	VIO J12-M	
15	+20V(HOT)	RED J13K	J5-2
16	+20V(COLD)	BLK J13-L	J5-3

X4 MULTIPLIER J7

1			
2	4.9MC INPUT	COAX J12-CC	
3	4.9MC(RET)	COAX SHIELD J12-EE	
4			
5			
6			
7			
8	MOD (RET)	BRN J5-5	
*9	4.9MC (A) (HOT)	COAX J2-2	
*10	4.9MC (A) (RET)	COAX SHIELD J2-3	
11	+15V(HOT)	ORN J6-9	J10-3
12	+15V(COLD)	BLK J6-10	J10-4
13	MOD (HOT) .7V	YEL J5-4	
14			
15			CHAS
16			GRD

155CPS & 310CPS AMPLIFIERS J6

1			
2	155CPS SIG OUTPUT (HOT)	GRN J5-8	
3	155CPS SIG OUTPUT (RET)	BRN J5-9	
4			
5			
6			
7			
8			
9	+15V(HOT)	ORN J4-5	J7-11
10	+15V(COLD)	BLK J4-6	J7-12
11	155CPS FROM PREAMP (HOT)	ORN J11-U	
12	155CPS FROM PREAMP (RET)	BRN J11-V	
13			
14			
15	310CPS SIG OUTPUT (HOT)	WHT J6-13	
16	310CPS SIG OUTPUT (RET)	BRN J6-12	

MOD. OSCILLATOR & SYNC DETECTOR J5

1			
2	+20V(HOT)	RED J1-1	J6-15
3	+20V(COLD)	BLK J1-2	J6-16
4	MOD (HOT) (.7V)	YEL J7-13	
5	MOD (RET)	BRN J7-5	
6	155 CPS (6V) HOT	YEL J5-10	J6-9
7		BLK J5-10	J6-10
8	155 CPS SIG (HOT)	GRN J6-2	
9	155 CPS SIGNAL (RET)	BRN J6-3	
10	OSC D.C. VOLTAGE (HOT)	ORN J12-A	
11	OSC D.C. VOLTAGE (RET)	GREY J12-B	
12	METER +	BLU J12-H	
13	METER −	GRN J12-J	
14	155 CPS LOCKOUT (HOT)	GRN J5-3	
15	OSC CONTROL VOLTAGE (HOT)	COAX J6-6	
16	OSC CONT V.C. 155CPS (6V) (RET)	COAX SHIELD J6-5	

SYNTHESIZER ÷ 50 J4

1			
2	5MC(HOT)	COAX J5-2	
3	5MC (RET)	COAX SHIELD J5-3	
4			
5	+15V(HOT)	ORN J5-11	J6-9
6	+15V(COLD)	BLK J5-10	J6-10
7			
8			
9	X 1MC TO FRONT PANEL	COAX P19	
10	X 1MC TO (RET) FRONT PANEL	COAX SHIELD P19	
11			
12			
13			
14			
15	X 100KC TO FRONT PANEL	COAX P20	
16	X 100KC TO FRONT PANEL	COAX SHIELD P20	

SYNTHESIZER MIXER & FILTER J3

1			
2	5MC(HOT)	COAX J4-2	
3	5MC (RET)	J4-3	
4	5MC TO FRONT PANEL (HOT)	COAX P18	
5	X 5MC TO FRONT PANEL (RET)	COAX SHIELD P18	
6			
7	18.4KC (T) HOT FILTERED	COAX P23	
*8	18.4KC (T) RET. FILT	COAX SHIELD P23	C1813 .1μF 25V
9			
*10	15V(COLD)	BLK J2-9	BLK J4-6
11	15V (HOT)	ORN J2-8	ORN J4-5
12	18KC(RET)	BRN J2-16	
13	18KC(HOT)	BLU J2-15	
14			
15	4.9KC (HOT)	COAX J2-2	
16	4.9 MC(RET)	COAX SHIELD J2-3	

SYNTHESIZER ÷ 270 or ÷ 272 J2

1			
*2	4.9MC (B) (HOT)	COAX J7-9	COAX J3-9
*3	4.9MC (B) (RET)	COAX SHIELD J7-10	COAX SHIELD J3-16
*4	4.98MC (B) (HOT)	COAX J3-8	
*5	4.98MC (B) (RET)	COAX SHIELD J3-8	
*6	18.3KC (HOT)	COAX J9-11	
*7	18.3KC(RET)	COAX SHIELD J9-12	
8	+15V (HOT)	ORN J1-3	J3-11
9	+15V(COLD)	BLK J1-4	J3-12
10			
11			
12			
13			
14			
15	18KC(HOT)	BLU J3-13	
16	18KC (RET)	BRN J3-12	

+15V POWER SUPPLY & CONTROL CIRCUITS J1

1	+20V (HOT)	RED J9-1	RED J3-2
2	+20V (COLD)	BLK J9-2	BLK J9-3
3	+15V (HOT)	ORN J2-E	COAX J11-W
4	+15V (COLD)	BLK J2-D	COAX SHIELD J11-X
5	+18V (RET)	BRN J11-L	
6	CAV. THERM (HOT)	GRN J11-C	
7	CAV. THERM (RET)	GREY J11-D	CHAS GRD
8	LAMP THERM (HOT)	COAX J11-H	
9	LAMP THERM (RET)	COAX SHIELD J11-J	
10	+18V(HOT)	COAX J11-K	
11	OSC HTR T.P	BRN J12-D	
12	CAV HTR (HOT)	RED J11-M	
13	CAV HTR (RET)	GREY J11-N	
14	LAMP HTR (HOT)	COAX J11-P	
15	LAMP HTR (RET)	COAX SHIELD J11-R	
16			CHAS GRD

OPTICAL MICROWAVE UNIT CONNECTOR J11

A	+18V HOT	ORN J9-3	
B	+15V COLD	BLK J9-4	
C	CAV THERM HOT	GRN J1-6	
D	CAV THERM RET	GREY J1-7	
E	SOLENOID HOT	VIO J13-M	
F	SOLENOID RET	GREY J2-4	
H	LAMP THERM (HOT)	COAX J1-8	
J	LAMP THERM (RET)	COAX SHIELD J1-9	
K	+18V (HOT)	COAX J1-10	
L	+18V (RET)	COAX SHIELD J1-5	
M	CAV TY HTR (HOT)	RED J1-12	
N	CAV TY HTR (RET)	GREY J1-15	
P	LAMP HTR (HOT)	COAX J1-14	
R	LAMP HTR (RET)	COAX SHIELD J1-15	
*S			
*T			
U	155CPS (HOT)	ORN J6-11	
V	155CPS (RET)	BRN J6-12	
W	+15V (HOT)	COAX J1-3	
X	+15V (COLD)	COAX SHIELD J1-4	
Y			
Z			
AA			
BB			
CC			
DD			
EE			
FF			
HH	START PULSE	COAX SHIELD J8-1	
JJ			
KK			
LL			
MM			
NN			

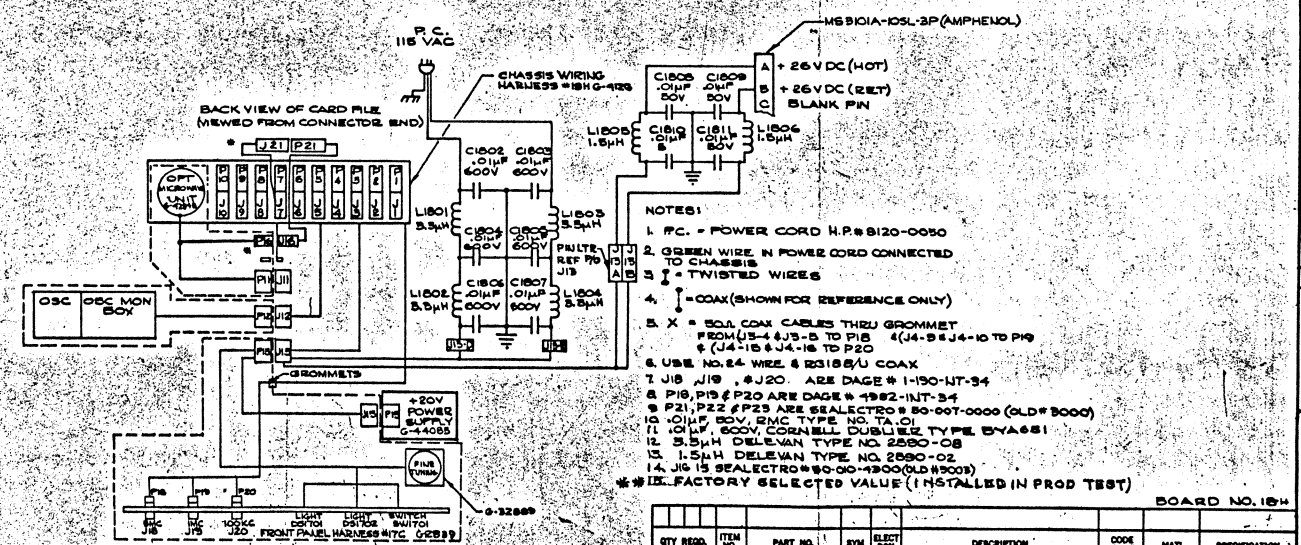
OSCILLATOR MONITOR BOX CONNECTOR J12

A	OSC DCV (HOT)	ORN J5-10	
B	OSC DCV (RET)	GREY J5-11	
C			
D	OSC HTR T.P.	BRN J1-11	
E	+15V (HOT)	ORN J1-3	
F	+15V (COLD)	BLK J1-4	
H	METER +	BLU J5-12	
J	METER −	GRN J5-13	
K	+20V (HOT)	RED J10-1	
L	+20V (COLD)	BLK J10-2	
M	SWEEP ENERGIZE	VIO J8-14	
N	ACQ ENABLE	BLU J8-11	
P	SWEEP DISABLE	GREY J8-7	
R	20V ENERGIZE	RED J8-10	
S	OSC CONT V (HOT)	WHT J8-6	
T	SWEEP DISABLE (RET)	BRN J8-12	
U			
V			
W			
X			
Y	SHIELD PIN		J12-EE
Z			
AA	SHIELD PIN		J12-EE
BB	SHIELD PIN		J12-EE
CC	4.9MC (HOT)	COAX	J7-2
DD			
EE	4.9MC (RET)	COAX SHIELD	J7-3
FF	SHIELD PIN		J12-EE
HH	SHIELD PIN		J12-EE
JJ	OSC BIAS (HOT)	BLU	J8-5
KK			
LL			
MM			
NN	OSC BIAS (RET)	GREY	J8-3

FRONT PANEL & FINE TUNING CONNECTOR J13

A	+26V (HOT)	YEL	L1801
B	+26V (RET)	BLK	L1806
C			
D	115V AC	WHT	L1802
E	115V AC	BLK	L1804
F	GRN LIGHT	GRN	J8-9
H	RED LIGHT	RED	J8-10
J			
K	+20V (HOT)	RED	J8-15
L	+20V (COLD)	BLK	J8-16
M			
N			
P			
R			
S			
T			
U			
V			
W			
X			
Y			
Z			
AA			
BB			
CC			
DD			
EE			
FF			
HH			
JJ			
KK	DUMMY PIN		
LL	DUMMY PIN		
MM	SOLENOID (HOT)	VIO	J11-E
NN	+15V (HOT)	ORN	J9-3

J11-H, J11-K, J11-P, J11-W & J12-CC TO HAVE VIOLET FERRULE A-MP # 328920



NOTES:

1. P.C. = POWER CORD H.P. # 8120-0050
2. GREEN WIRE IN POWER CORD CONNECTED TO CHASSIS
3. = TWISTED WIRES
4. = COAX (SHOWN FOR REFERENCE ONLY)
5. X = 50Ω COAX CABLES THRU GROMMET FROM J3-4 & J3-5 TO P18 & (J4-9 & J4-10 TO P19 & (J4-15 & J4-16 TO P20
6. USE NO. 24 WIRE & RG188/U COAX
7. J18, J19, & J20. ARE DAGE # 1-190-NT-34
8. P18, P19 & P20 ARE DAGE # 4982-1NT-34
9. P21, P22 & P23 ARE SEALECTRO # 80-00T-0000 (OLD # 3000)
10. .01μF, 50V, RMC TYPE NO. TA-01
11. .01μF, 600V, CORNELL DUBILIER TYPE BYA651
12. 3.5μH DELEVAN TYPE NO. 2590-08
13. 1.5μH DELEVAN TYPE NO. 2590-02
14. J19 15 SEALECTRO # 80-010-4300 (OLD # 3003)

*# IS FACTORY SELECTED VALUE (INSTALLED IN PROD TEST)

BOARD NO. 18H

QTY REQD.	ITEM NO.	PART NO.	SYM	ELECT DWN	DESCRIPTION	CODE IDENT	MATL	SPECIFICATION
← ASSYS								

LIST OF MATERIAL

REF	REF	G-5728B	304B
REF	REF	G-4126	304B

SIGNATURES	DATES
DFT	18 SEPT 68
CHK	
APPD	30 SEP 68
APPD	
APPD	
APPD	

HEAT TREAT | PROCESS

APPROVAL

OTHER APPROVAL

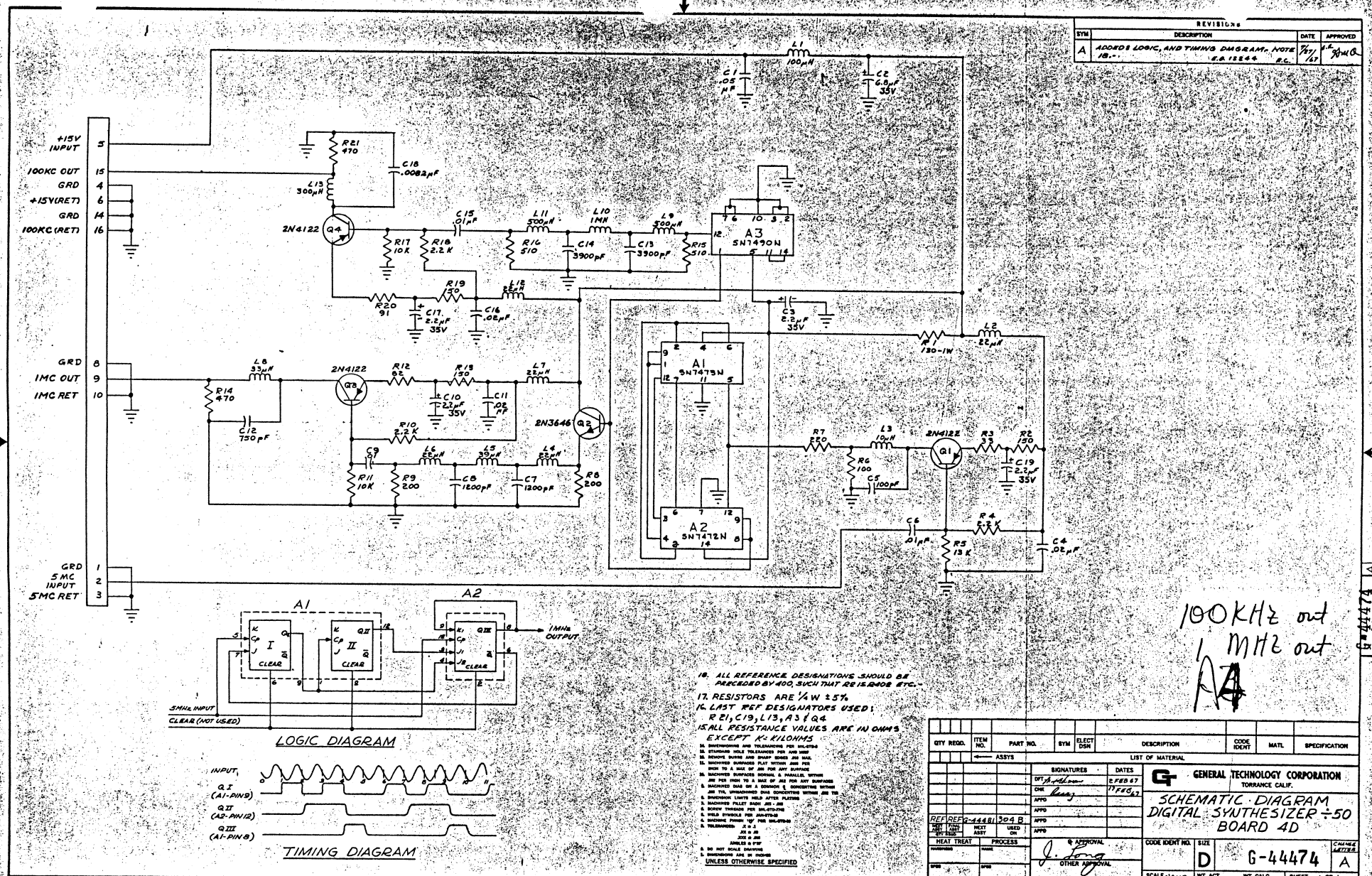
GENERAL TECHNOLOGY CORPORATION
TORRANCE CALIF.

WIRING DIAGRAM, CHASSIS - WITH FIELD INSTALLABLE T.S.S.

CODE IDENT NO. | SIZE D | G-44110 | REV D

SCALE NONE | WT ACT | WT CALC | SHEET 1 OF 1

G-44110 D



15V 100mA will work with TTL in or sink > -7dbm
50mA (old style)

TABLE OF REPLACEABLE PARTS - MODEL 304-B

CHASSIS HARNESS ASSEMBLY

Circuit Reference	Description	Mfr. Part No.	Mfr. Code Ident.
P-18	Connector, Coax	4982-1 NT-34	95712
P-19	Connector, Coax	4982-1 NT-34	95712
P-20	Connector, Coax	4982-1 NT-34	95712
P-21	Plug, Coax	50-010-4300	98291
	Receptacle	MS 310A-10SL-3P	06473
	Power Cord, A. C. Line	8120-0050	28480
	Guide, Power Supply Board No. 1	32075	GTC
	Guide Card, Boards 2 thru 10	22162	GTC
	Nameplate, Card File Numbering	22364	GTC

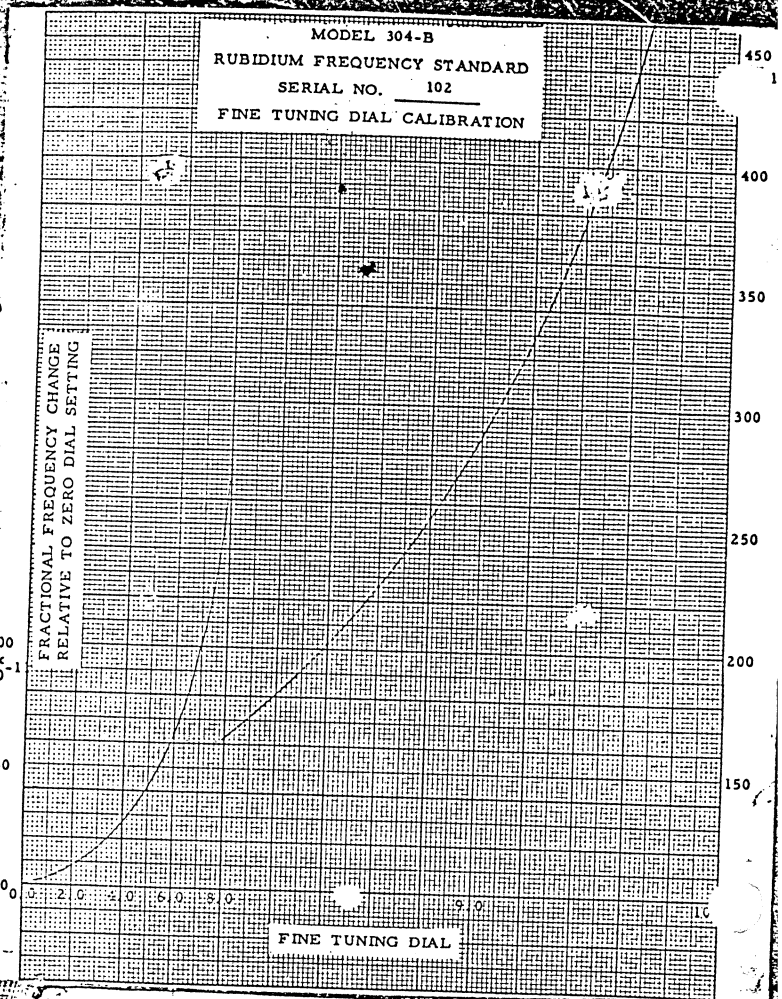


TABLE OF FREQUENCY STEPS

(showing frequency steps, $\frac{\Delta F \times 10^{-10}}{F}$ above and below the "gas cell frequency").

$\frac{\Delta F}{F}$	Switch Settings A	B	C	D	E	F	G
+347.73	1	1	1	1	1	1	1
+340.32	0	1	1	1	1	1	1
+332.92	1	0	1	1	1	1	1
+325.51	0	0	1	1	1	1	1
+318.10	1	1	0	1	1	1	1
+310.70	0	1	0	1	1	1	1
+303.29	1	0	0	1	1	1	1
+295.89	0	0	0	1	1	1	1
+288.48	1	1	1	0	1	1	1
+281.08	0	1	1	0	1	1	1
+273.67	1	0	1	0	1	1	1
+266.27	0	0	1	0	1	1	1
+258.86	1	1	0	0	1	1	1
+251.46	0	1	0	0	1	1	1
+244.06	1	0	0	0	1	1	1
+236.66	0	0	0	0	1	1	1
+229.25	1	1	1	1	0	1	1
+221.65	0	1	1	1	0	1	1
+214.45	1	0	1	1	0	1	1
+207.05	0	0	1	1	0	1	1
+199.65	1	1	0	1	0	1	1
+192.25	0	1	0	1	0	1	1
+184.85	1	0	0	1	0	1	1
+177.45	0	0	0	1	0	1	1
+170.06	1	1	1	0	0	1	1
+162.66	0	1	1	0	0	1	1
+155.26	1	0	1	0	0	1	1
+147.86	0	0	1	0	0	1	1
+140.47	1	1	0	0	0	1	1
+133.07	0	1	0	0	0	1	1
+125.67	1	0	0	0	0	1	1
+118.28	0	0	0	0	0	1	1
+110.88	1	1	1	1	1	0	1
+103.49	0	1	1	1	1	0	1
+ 96.09	1	0	1	1	1	0	1
+ 88.70	0	0	1	1	1	0	1
+ 81.30	1	1	0	1	1	0	1
+ 73.91	0	1	0	1	1	0	1
+ 66.52	1	0	0	1	1	0	1
+ 59.13	0	0	0	1	1	0	1
+ 51.73	1	1	1	0	1	0	1
+ 44.34	0	1	1	0	1	0	1
+ 36.95	1	0	1	0	1	0	1

$\frac{\Delta F}{F}$	Switch Settings A	B	C	D	E	F	G
+ 29.56	0	0	1	0	1	0	1
+ 22.17	1	1	0	0	1	0	1
+ 14.78	0	1	0	0	1	0	1
+ 7.39	1	0	0	0	1	0	1
0.00	0	0	0	0	1	0	1
- 7.39	1	1	1	1	0	0	1
- 14.78	0	1	1	1	0	0	1
- 22.17	1	0	1	1	0	0	1
- 29.55	0	0	1	1	0	0	1
- 36.94	1	1	0	1	0	0	1
- 44.33	0	1	0	1	0	0	1
- 51.71	1	0	0	1	0	0	1
- 59.10	0	0	0	1	0	0	1
- 66.49	1	1	1	0	0	0	1
- 73.87	0	1	1	0	0	0	1
- 81.26	1	0	1	0	0	0	1
- 88.64	0	0	1	0	0	0	1
- 96.02	1	1	0	0	0	0	1
-103.41	0	1	0	0	0	0	1
-110.79	1	0	0	0	0	0	1
-118.17	0	0	0	0	0	0	1
-125.56	1	1	1	1	1	1	0
-132.94	0	1	1	1	1	1	0
-140.32	1	0	1	1	1	1	0
-147.70	0	0	1	1	1	1	0
-155.08	1	1	0	1	1	1	0
-162.46	0	1	0	1	1	1	0
-169.84	1	0	0	1	1	1	0
-177.22	0	0	0	1	1	1	0
-184.60	1	1	1	0	1	1	0
-191.98	0	1	1	0	1	1	0
-199.36	1	0	1	0	1	1	0
-206.74	0	0	1	0	1	1	0
-214.11	1	1	0	0	1	1	0
-221.49	0	1	0	0	1	1	0
-228.87	1	0	0	0	1	1	0
-236.24	0	0	0	0	1	1	0
-243.62	1	1	1	1	0	1	0
-251.00	0	1	1	1	0	1	0
-258.37	1	0	1	1	0	1	0
-265.75	0	0	1	1	0	1	0

$\frac{\Delta F}{F}$	Switch Settings A	B	C	D	E	F	G
-273.12	1	1	0	1	0	1	0
-280.49	0	1	0	1	0	1	0
-287.87	1	0	0	1	0	1	0
-295.24	0	0	0	1	0	1	0
-302.61	1	1	1	0	0	1	0
-309.99	0	1	1	0	0	1	0
-317.36	1	0	1	0	0	1	0
-324.73	0	0	1	0	0	1	0
-332.10	1	1	0	0	0	1	0
-339.47	0	1	0	0	0	1	0
-346.84	1	0	0	0	0	1	0
-354.21	0	0	0	0	0	1	0
-361.58	1	1	1	1	1	0	0
-368.95	0	1	1	1	1	0	0
-376.32	1	0	1	1	1	0	0
-383.69	0	0	1	1	1	0	0
-391.06	1	1	0	1	1	0	0
-398.42	0	1	0	1	1	0	0
-405.79	1	0	0	1	1	0	0
-413.16	0	0	0	1	1	0	0
-420.52	1	1	1	0	1	0	0
-427.89	0	1	1	0	1	0	0
-435.26	1	0	1	0	1	0	0
-442.62	0	0	1	0	1	0	0
-449.98	1	1	0	0	1	0	0
-457.35	0	1	0	0	1	0	0
-464.71	1	0	0	0	1	0	0
-472.08	0	0	0	0	1	0	0
-479.44	1	1	1	1	0	0	0
-486.80	0	1	1	1	0	0	0
-494.17	1	0	1	1	0	0	0
-501.53	0	0	1	1	0		
-508.89	1	1	0	1	0		
-516.25	0	1	0	1	0	0	0
-523.61	1	0	0	1	0	0	0
-530.97	0	0	0	1	0	0	0
-538.33	1	1	1	0	0	0	0
-545.69	0	1	1	0	0	0	0
-553.05	1	0	1	0	0	0	0
-560.41	0	0	1	0	0	0	0
-567.77	1	1	0	0	0	0	0
-575.12	0	1	0	0	0	0	0
-582.48	1	0	0	0	0	0	0
-589.84	0	0	0	0	0	0	0

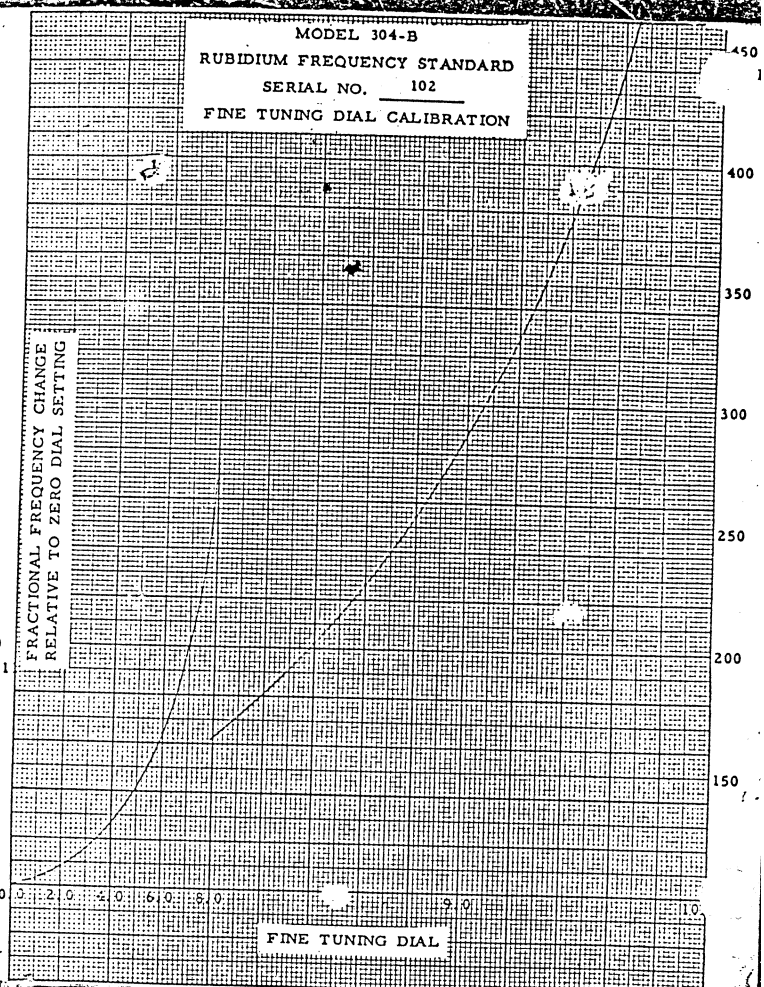
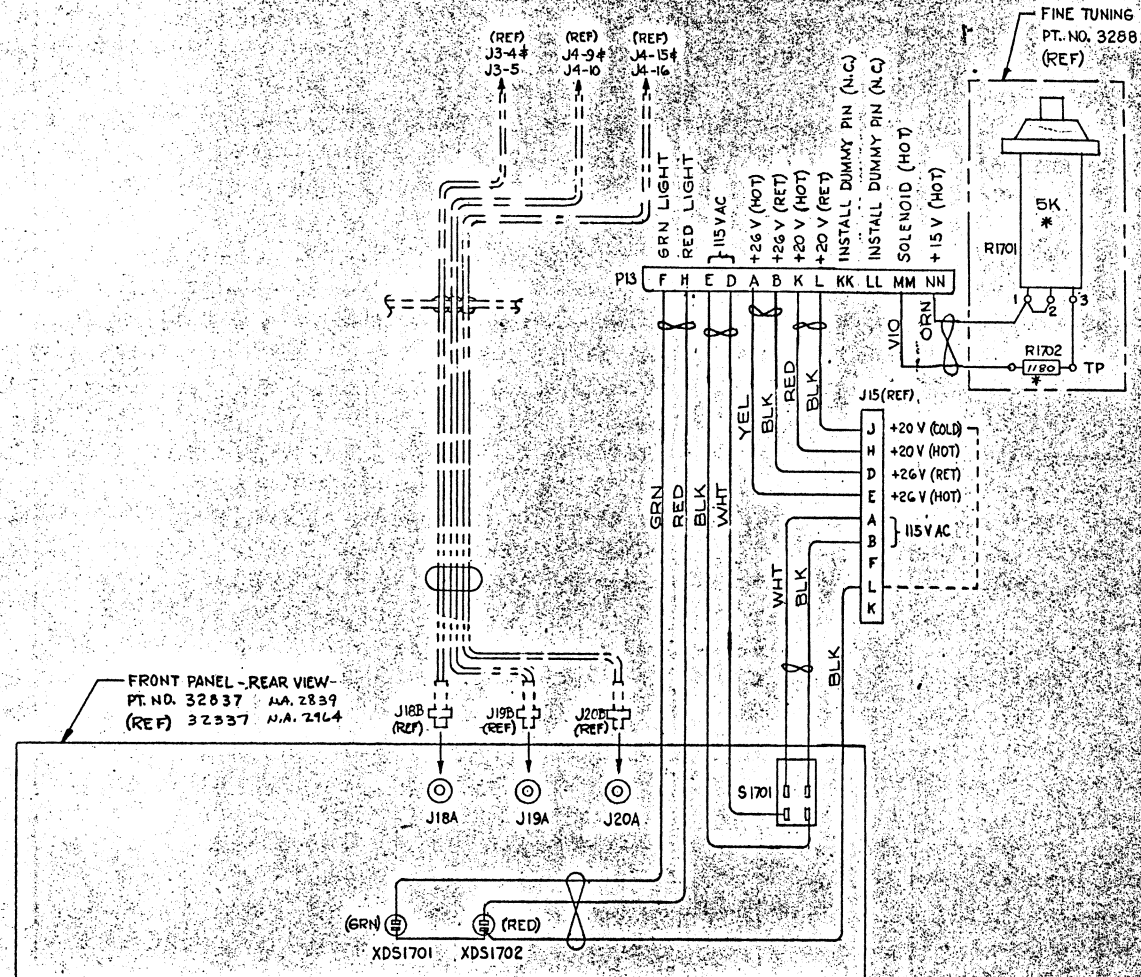


TABLE OF FREQUENCY STEPS

(showing frequency steps, $\frac{\Delta F \times 10^{-10}}{F}$ above and below the "gas cell frequency").

$\frac{\Delta F}{F}$	Switch Settings A B C D E F G	$\frac{\Delta F}{F}$	Switch Settings A B C D E F G	$\frac{\Delta F}{F}$	Switch Settings A B C D E F G
+347.73	1 1 1 1 1 1 1	+ 29.56	0 0 1 0 1 0 1	-273.12	1 1 0 1 0 1 0
+340.32	0 1 1 1 1 1 1	+ 22.17	1 1 0 0 1 0 1	-280.49	0 1 0 1 0 1 0
+332.92	1 0 1 1 1 1 1	+ 14.78	0 1 0 0 1 0 1	-287.87	1 0 0 1 0 1 0
+325.51	0 0 1 1 1 1 1	+ 7.39	1 0 0 0 1 0 1	-295.24	0 0 0 1 0 1 0
+318.10	1 1 0 1 1 1 1	0.00	0 0 0 0 1 0 1	-302.61	1 1 1 0 0 1 0
+310.70	0 1 0 1 1 1 1			-309.99	0 1 1 0 0 1 0
+303.29	1 0 0 1 1 1 1	- 7.39	1 1 1 1 0 0 1	-317.36	1 0 1 0 0 1 0
+295.89	0 0 0 1 1 1 1	- 14.78	0 1 1 1 0 0 1	-324.73	0 0 1 0 0 1 0
+288.48	1 1 1 0 1 1 1	- 22.17	1 0 1 1 0 0 1	-332.10	1 1 0 0 0 1 0
+281.08	0 1 1 0 1 1 1	- 29.55	0 0 1 1 0 0 1	-339.47	0 1 0 0 0 1 0
+273.67	1 0 1 0 1 1 1	- 36.94	1 1 0 1 0 0 1	-346.84	1 0 0 0 0 1 0
+266.27	0 0 1 0 1 1 1	- 44.33	0 1 0 1 0 0 1	-354.21	0 0 0 0 0 1 0
+258.86	1 1 0 0 1 1 1	- 51.71	1 0 0 1 0 0 1	-361.58	1 1 1 1 1 0 0
+251.46	0 1 0 0 1 1 1	- 59.10	0 0 0 1 0 0 1	-368.95	0 1 1 1 1 0 0
+244.06	1 0 0 0 1 1 1	- 66.49	1 1 1 0 0 0 1	-376.32	1 0 1 1 1 0 0
+236.66	0 0 0 0 1 1 1	- 73.87	0 1 1 0 0 0 1	-383.69	0 0 1 1 1 0 0
+229.25	1 1 1 1 0 1 1	- 81.26	1 0 1 0 0 0 1	-391.06	1 1 0 1 1 0 0
+221.65	0 1 1 1 0 1 1	- 88.64	0 0 1 0 0 0 1	-398.42	0 1 0 1 1 0 0
+214.45	1 0 1 1 0 1 1	- 96.02	1 1 0 0 0 0 1	-405.79	1 0 0 1 1 0 0
+207.05	0 0 1 1 0 1 1	-103.41	0 1 0 0 0 0 1	-413.16	0 0 0 1 1 0 0
+199.65	1 1 0 1 0 1 1	-110.79	1 0 0 0 0 0 1	-420.52	1 1 1 0 1 0 0
+192.25	0 1 0 1 0 1 1	-118.17	0 0 0 0 0 0 1	-427.89	0 1 1 0 1 0 0
+184.85	1 0 0 1 0 1 1	-125.56	1 1 1 1 1 1 0	-435.26	1 0 1 0 1 0 0
+177.45	0 0 0 1 0 1 1	-132.94	0 1 1 1 1 1 0	-442.62	0 0 1 0 1 0 0
+170.06	1 1 1 0 0 1 1	-140.32	1 0 1 1 1 1 0	-449.98	1 1 0 0 1 0 0
+162.66	0 1 1 0 0 1 1	-147.70	0 0 1 1 1 1 0	-457.35	0 1 0 0 1 0 0
+155.26	1 0 1 0 0 1 1	-155.08	1 1 0 1 1 1 0	-464.71	1 0 0 0 1 0 0
+147.86	0 0 1 0 0 1 1	-162.46	0 1 0 1 1 1 0	-472.08	0 0 0 0 1 0 0
+140.47	1 1 0 0 0 1 1	-169.84	1 0 0 1 1 1 0	-479.44	1 1 1 1 0 0 0
+133.07	0 1 0 0 0 1 1	-177.22	0 0 0 1 1 1 0	-486.80	0 1 1 1 0 0 0
+125.67	1 0 0 0 0 1 1	-184.60	1 1 1 0 1 1 0	-494.17	1 0 1 1 0 0
+118.28	0 0 0 0 0 1 1	-191.98	0 1 1 0 1 1 0	-501.53	0 0 1 1 0
+110.88	1 1 1 1 1 0 1	-199.36	1 0 1 0 1 1 0	-508.89	1 1 0 1 0
+103.49	0 1 1 1 1 0 1	-206.74	0 0 1 0 1 1 0	-516.25	0 1 0 1 0 0 0
+ 96.09	1 0 1 1 1 0 1	-214.11	1 1 0 0 1 1 0	-523.61	1 0 0 1 0 0 0
+ 88.70	0 0 1 1 1 0 1	-221.49	0 1 0 0 1 1 0	-530.97	0 0 0 1 0 0 0
+ 81.30	1 1 0 1 1 0 1	-228.87	1 0 0 0 1 1 0	-538.33	1 1 1 0 0 0 0
+ 73.91	0 1 0 1 1 0 1	-236.24	0 0 0 0 1 1 0	-545.69	0 1 1 0 0 0 0
+ 66.52	1 0 0 1 1 0 1	-243.62	1 1 1 1 0 1 0	-553.05	1 0 1 0 0 0 0
+ 59.13	0 0 0 1 1 0 1	-251.00	0 1 1 1 0 1 0	-560.41	0 0 1 0 0 0 0
+ 51.73	1 1 1 0 1 0 1	-258.37	1 0 1 1 0 1 0	-567.77	1 1 0 0 0 0 0
+ 44.34	0 1 1 0 1 0 1	-265.75	0 0 1 1 0 1 0	-575.12	0 1 0 0 0 0 0
+ 36.95	1 0 1 0 1 0 1			-582.48	1 0 0 0 0 0 0
				-589.84	0 0 0 0 0 0 0

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		ADDED N.A. INFORMATION	APR 29 65	



32942 A

N.A. 2839 BOARD #17C
N.A. 2964 BOARD #17D

QTY REQD	ITEM NO.	PART NO.	SYM	ELECT DSN	DESCRIPTION	CODE IDENT	MATL	SPECIFICATION	ZONE
← ASSYS					LIST OF MATERIAL				

NEXT ASSY	FINAL ASSY	NEXT ASSY	USED ON
1	1	2964	304B
1	1	2839	304B

QTY REQD

HEAT TREAT	PROCESS
HARDNESS	NAME
SPEC	SPEC

SIGNATURES	DATES
DFT	29JAN63
CHK	2-11-63
APPD	2-11-63
APPD	
APPD	
APPD	

G APPROVAL

OTHER APPROVAL

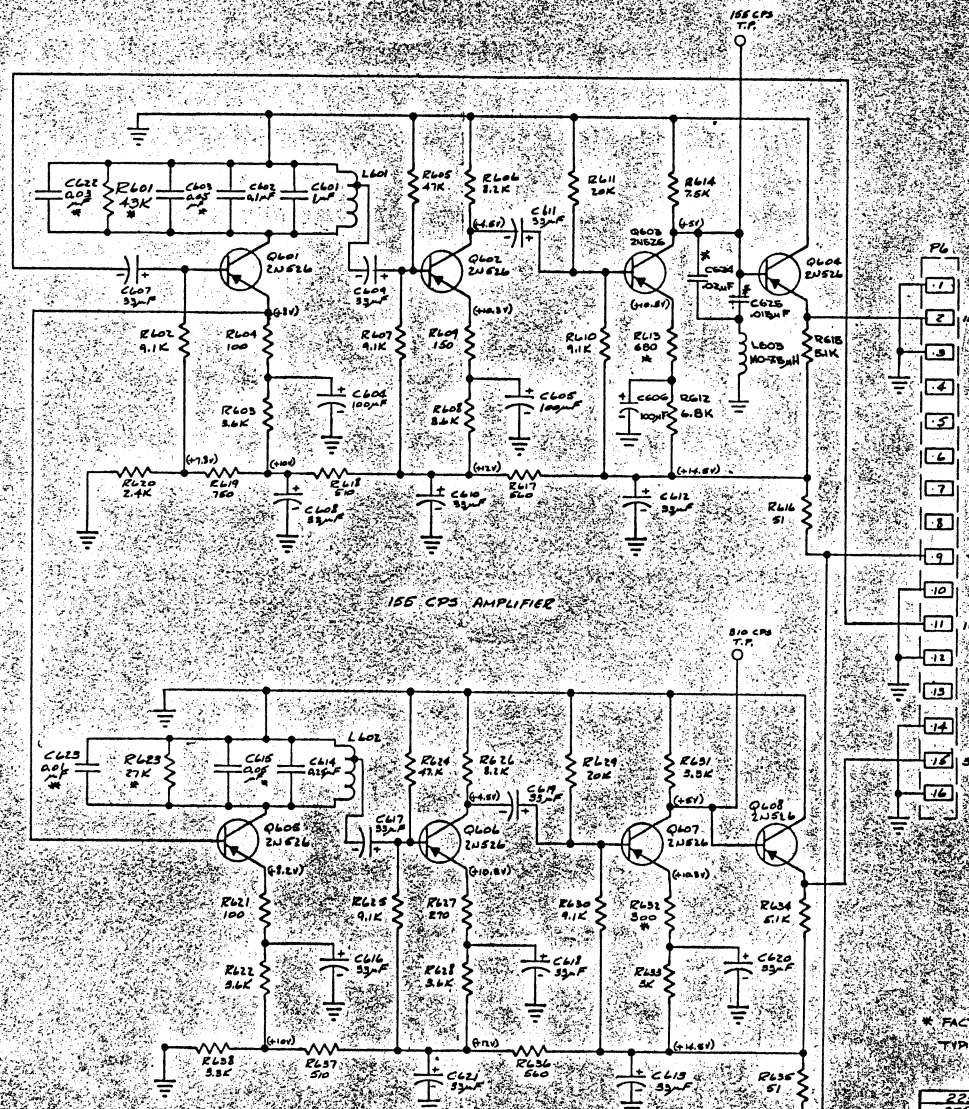
GENERAL TECHNOLOGY CORPORATION
TORRANCE CALIF.

DIAGRAM - FRONT PANEL HARNESS WIRING
RFS 304B

CODE IDENT NO.	SIZE	
	C	32942
SCALE NONE	WT ACT	WT CALC	SHEET OF

R633
C625
L603

REVISIONS				
SYMBOL	REVISION		DATE	APPROVAL
	ADD CONDITIONS [illegible]			
A	[illegible]		[illegible]	[illegible]



* FACTORY SELECTED
TYPICAL VALUES SHOWN

G 42137 A

A6

BOARD #6-B

2252	304B	REF	REF										
2252	304C	REF	REF										
PART NOMT.	WIRE SIZE	PART NOMT.	PART NOMT.	REQ'D	REQ'D	PART NO.	DESCRIPTION	MATERIAL	MATL. SPEC.	ITEM
APPLICATION		QUANTITY REQ'D					LIST OF MATERIAL			

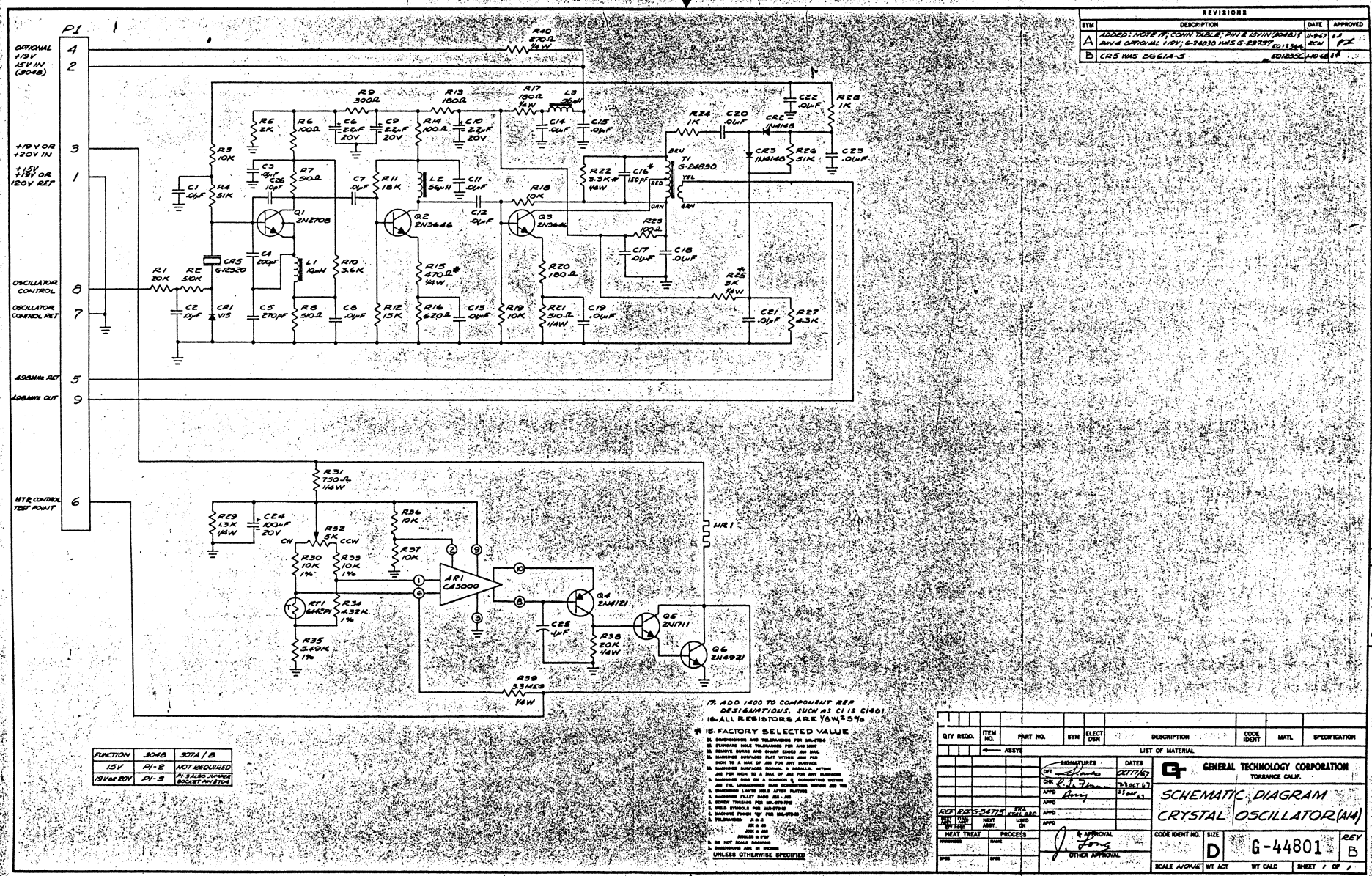
UNLESS OTHERWISE SPECIFIED

SIGNATURES	DATE	HEAT TREATMENT		PROCESS	
	7-18-64	HARDNESS	SPEC.	DATE	SPEC.
	7-8-64				
	7-14-64				

SCHEMATIC-RFS 3048
155 CPS & 310 CPS
AMPLIFIERS

GENERAL TECHNOLOGY CORPORATION

42137 A



FUNCTION	304B	307A / B
15V	P1-2	NOT REQUIRED
13V or 20V	P1-3	P1-3 ALSO JUMPER SOCKET PIN 8 TO 4

17. ADD 1400 TO COMPONENT REF DESIGNATIONS, SUCH AS C113 C1401
16. ALL RESISTORS ARE 1/8W ±5%

* 15. FACTORY SELECTED VALUE

14. DIMENSIONS AND TOLERANCES PER MIL-STD-8
13. STANDARD HOLE TOLERANCE PER AND SMAL
12. REMOVE BURRS AND SHARP EDGES AND SMAL
11. MACHINED SURFACES FLAT WITHIN .005 PER INCH TO A MAX OF .015 PER ANY SURFACE
10. MACHINED SURFACES NORMAL & PARALLEL WITHIN .005 PER INCH TO A MAX OF .015 PER ANY SURFACE
9. MACHINED DIAS ON A MACHINED & CONCENTRIC WITHIN .005 TIR, UNMACHINED DIAS CONCENTRIC WITHIN .015 TIR
8. DIMENSION LIMITS HOLD AFTER PLATING
7. MACHINED FILLET RADII .015 - .025
6. SCREW THREADS PER MIL-STD-8
5. WELD SYMBOLS PER AWS-A2.4
4. MACHINE FINISH 125 PER MIL-STD-10
3. TOLERANCES .X ± .1 .XX ± .03 .XXX ± .010 ANGLES ± 0°30'
2. DO NOT SCALE DRAWING
1. DIMENSIONS ARE IN INCHES

UNLESS OTHERWISE SPECIFIED

SYM	DESCRIPTION	DATE	APPROVED
A	ADDED: NOTE 17; CONN TABLE; PIN 8 15V IN (304B) & PIN 4 OPTIONAL +13V; G-24830 WAS G-23737 ECO 13344	11-9-67 RCN	
B	CR5 WAS BG61A-5 ECO 13359	NOV 68	

QTY REQD.	ITEM NO.	PART NO.	SYM	ELECT DSN	DESCRIPTION	CODE IDENT	MATL	SPECIFICATION
		ASSY						

LIST OF MATERIAL

SIGNATURES	DATES
DFT	OCT 7/67
CHK	7 OCT 67
APPD	13 OCT 67
APPD	
APPD	
APPD	

DCF 0035-24775 SH. 1 OF 1 BASIC

NEXT HIGH ASSY | HEAT ASSY. | USED ON

HEAT TREAT | PROCESS

APPROVAL

OTHER APPROVAL

GENERAL TECHNOLOGY CORPORATION
TORRANCE CALIF.

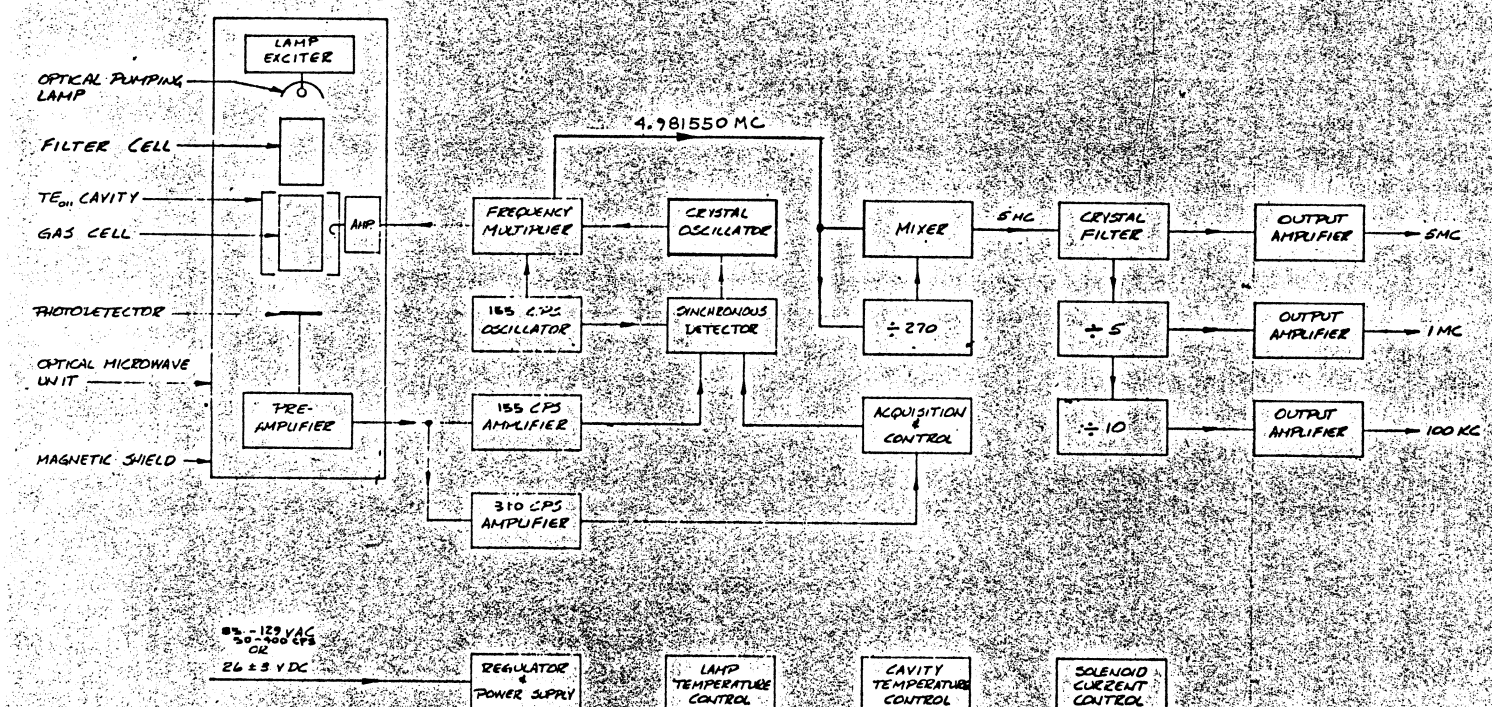
SCHEMATIC DIAGRAM
CRYSTAL OSCILLATOR (AM)

CODE IDENT NO. | SIZE D | G-44801 | REV B

SCALE NONE | WT ACT | WT CALC | SHEET 1 OF 1

G-44801 E

REVISIONS				
SYMBOL	DESCRIPTION	DATE	APPROVED
A	REVISED XSTAL OSCILLATOR	2-11-63	



32327 A

NEXT ASSY.	USED ON	NEXT ASSY	FINAL ASSY.	REQ'D RH	REQ'D LH	PART NO.	DESCRIPTION	MATERIAL	MATL. SPEC.	ITEM
52288	304B	1	1							

APPLICATION — QUANTITY REQ'D — LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS ARE IN INCHES.
2. TOLERANCES ON DECIMALS ±0.005 ANGLES ±0°30'
3. REMOVE BURRS AND SHARP EDGES.
4. REMOVE FINGER PRINTS AND GREASE.
5. DIMENSIONS LIMITS TAKE AFTER PLATING.
6. REFER TO A SEPARATE SPECIFICATION FOR PLATING, PAINTING AND T.L.A. REQUIREMENTS.
7. DIMENSIONS ARE FOR THE FINALIZED OF SUBASSY DIMENSIONS AND FOR USE TO A BASE LINE FOR A SINGLE PART.
8. DO NOT SCALE DRAWING FOR DIMENSIONS ONLY.

SIGNATURES — DATE

2-11-63
2-11-63
2-11-63

HEAT TREATMENT: HARDNESS, SPEC. — FINISH, SPEC.

DWN. TITLE: BLOCK DIAGRAM - MODEL 304-B RUBIDIUM FREQUENCY STANDARD

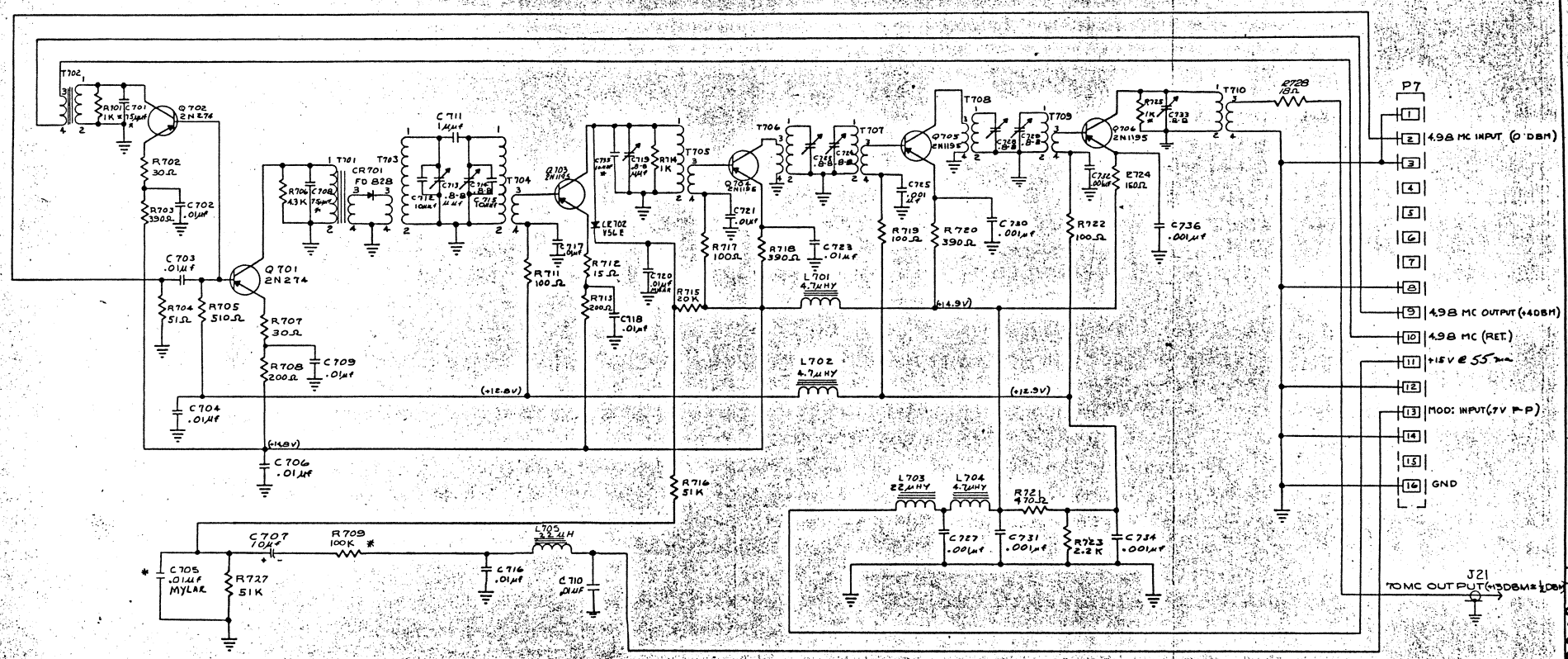
SCALE: NONE — WT.

GENERAL TECHNOLOGY CORPORATION

SIZE C — DWG. NO. 32327

C736
R728
L705
T710
CR702
C724

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	70MC RF WAS OUT OF PT PIN 15	4 APR 63	
B	DELETED C726 .01µf PER EO 11429	3 JUN 63	
C	ADDED J21 PER EO 11797	1 JUL 63	
D	ADDED RESISTOR R728 E.O. 12708	10 JUL 63	



A7

BOARD #7 E

* FACTORY SELECTED, TYPICAL VALUES SHOWN

NOTES:

1. DIMENSIONING AND TOLERANCING PER MIL-STD-8
2. STANDARD HOLE TOLERANCES PER AND SHEET
3. REMOVE BURRS AND SHARP EDGES .005 MAX.
4. MACHINED SURFACES FLAT WITHIN .005 PER INCH TO A MAX OF .005 FOR ANY SURFACE
5. MACHINED SURFACES NORMAL & PARALLEL WITHIN .005 PER INCH TO A MAX OF .005 FOR ANY SURFACES
6. MACHINED DIAS ON A COMMON ℄ CONCENTRIC WITHIN .005 TIR, UNMACHINED DIAS CONCENTRIC WITHIN .005 TIR
7. DIMENSION LIMITS HOLD AFTER PLATING
7. MACHINED FILLET RADII .015 - .025
8. SCREW THREADS PER MIL-STD-1312
9. WELD SYMBOLS PER AN-STD-30
10. MACHINE FINISH 125 PER MIL-STD-10
11. TOLERANCES .X ± .1
.XX ± .03
.XXX ± .005
ANGLES ± 1°30'
12. DO NOT SCALE DRAWING
13. DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED

QTY REQD.	ITEM NO.	PART NO.	SYM	ELECT DSN	DESCRIPTION	CODE IDENT	MATL	SPECIFICATION
					← ASSYS			

LIST OF MATERIAL

SIGNATURES	DATES
DFT S. Hirasuna	3-12-63
CHK	3/12/63
APPD	3/12/63
APPD	
APPD	
APPD	

REF	REV	2967	3048
NEXT ASSY QTY REQD	FIND NO. NEXT ASSY	NEXT ASSY	USED ON

HEAT TREAT	PROCESS
HARDNESS	FINISH
SPEC	SPEC

APPROVAL

OTHER APPROVAL

GENERAL TECHNOLOGY CORPORATION
TORRANCE CALIF.

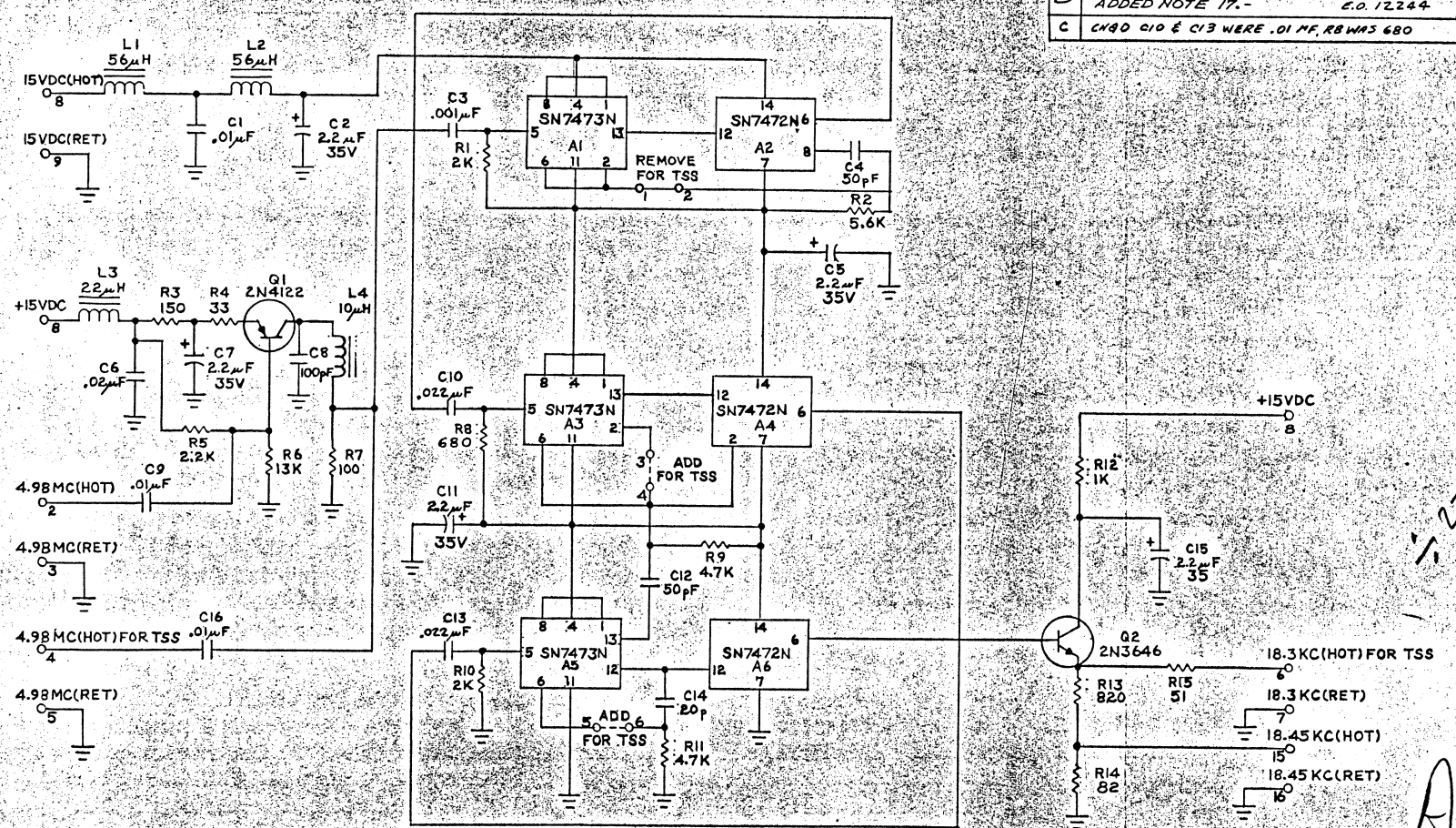
SCHEMATIC R.F.S.
X 14 MULTIPLIER

CODE IDENT NO. | SIZE D | DG42969 | REV D

SCALE ——— | WT ACT | WT CALC | SHEET 1 OF 1

DG42969 D

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVED
A	SEE E.O. NO. 12099	7/27/67	G.R.
B	CHANGED C8 VALUE FROM 10pF, TO 100pF.- ADDED NOTE 17.- E.O. 12244 RC	7/27/67	G.R.
C	CHGD C10 & C13 WERE .01 MF, R8 WAS 680	4-11-68	G.R.



17. ALL COMPONENT DESIGNATIONS SHOULD BE PRECEDED BY 200, SUCH AS R2 IS R202, ETC.

16. RES VALUES ARE IN OHMS, 1/4 W ±5%

15. LAST REF DES USED R15, C16, A6, Q2, L4

14. DIMENSIONING AND TOLERANCING PER MIL-STD-8
13. STANDARD HOLE TOLERANCES PER AND 10387
12. REMOVE BURRS AND SHARP EDGES .010 MAX.
11. MACHINED SURFACES FLAT WITHIN .0005 PER INCH TO A MAX OF .005 FOR ANY SURFACE
10. MACHINED SURFACES NORMAL & PARALLEL WITHIN .005 PER INCH TO A MAX OF .012 FOR ANY SURFACES
9. MACHINED DIAS ON A COMMON ℄ CONCENTRIC WITHIN .005 TIR, UNMACHINED DIAS CONCENTRIC WITHIN .005 TIR
8. DIMENSION LIMITS HELD AFTER PLATING
7. MACHINED FILLET RADII .015 - .005
6. SCREW THREADS PER MIL-STD-7742
5. WELD SYMBOLS PER JAN-STD-19
4. MACHINE FINISH - 125' PER MIL-STD-10
3. TOLERANCES: .X ± .1
.XX ± .03
.XXX ± .015
ANGLES ± 0°30'
2. DO NOT SCALE DRAWING
1. DIMENSIONS ARE IN INCHES

UNLESS OTHERWISE SPECIFIED

QTY REQD.	ITEM NO.	PART NO.	SYM	ELECT DSN	DESCRIPTION	CODE IDENT	MATL	SPECIFICATION
	← ASSYS				LIST OF MATERIAL			

REF NEXT ASSY QTY REQD	REF FINAL ASSY	NEXT ASSY	USED ON
		G-44490	304 B

HEAT TREAT	PROCESS
HARDNESS	NAME
SPEC	SPEC

SIGNATURES	DATES
DFT	31 JAN 67
CHK	17 FEB 67
APPD	
APPD	
APPD	
APPD	
Q APPROVAL	
OTHER APPROVAL	

GENERAL TECHNOLOGY CORPORATION
TORRANCE CALIF.

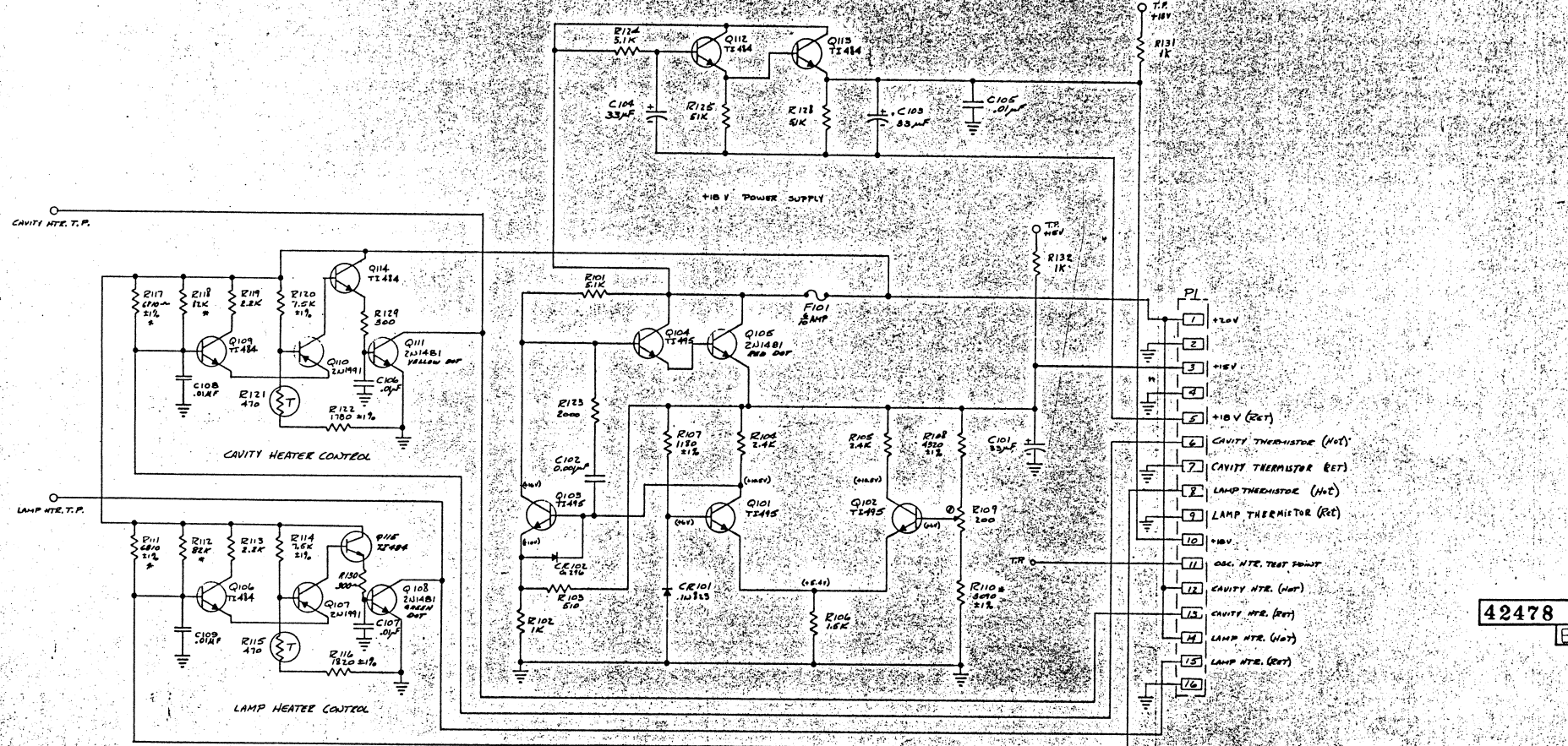
SCHEMATIC DIAGRAM
DIGITAL SYNTHESIZER ÷ 270
BOARD 2F - 304B

CODE IDENT NO.	SIZE		CHANGE LETTER
	C	G-34509	C
SCALE NONE	WT ACT	WT CALC	SHEET 1 OF 1

G-34509 C

K 132 CAVITY THERMISTOR : GB41P1 FENWALL ELECTRONICS
C 109 OSC " : GA42P1 " "
LAMP " : GA45P1 " "

REVISIONS			
SYMB.	DESCRIPTION	DATE	APPR.
A	ADDED C108 & C109	1/2/63	
B	REV TO 'C' REV ON U/M-8011550		



FACTORY SELECTED
TYPICAL VALUES SHOWN

42478 B

A1

BOARD #1-B

2247	3048	1	1								
DEPT ASST.	TYPE SYS	PROJ. ASST.	PROD. ASST.	REQ'D	REQ'D	PART NO.	DESCRIPTION	MATERIAL	MATL. SPEC.	ITEM	
APPLICATION		QUANTITY REQ'D					LIST OF MATERIAL				

UNLESS OTHERWISE SPECIFIED

SIGNATURES	DATE
DRAWN	7-18-62
CHECKED	8-8-62
ENGR.	8-14-62
ENGR.	
ENGR.	

HEAT TREATMENT: HARDNESS, SPECIAL — PROCESS: NAME, SPECIAL

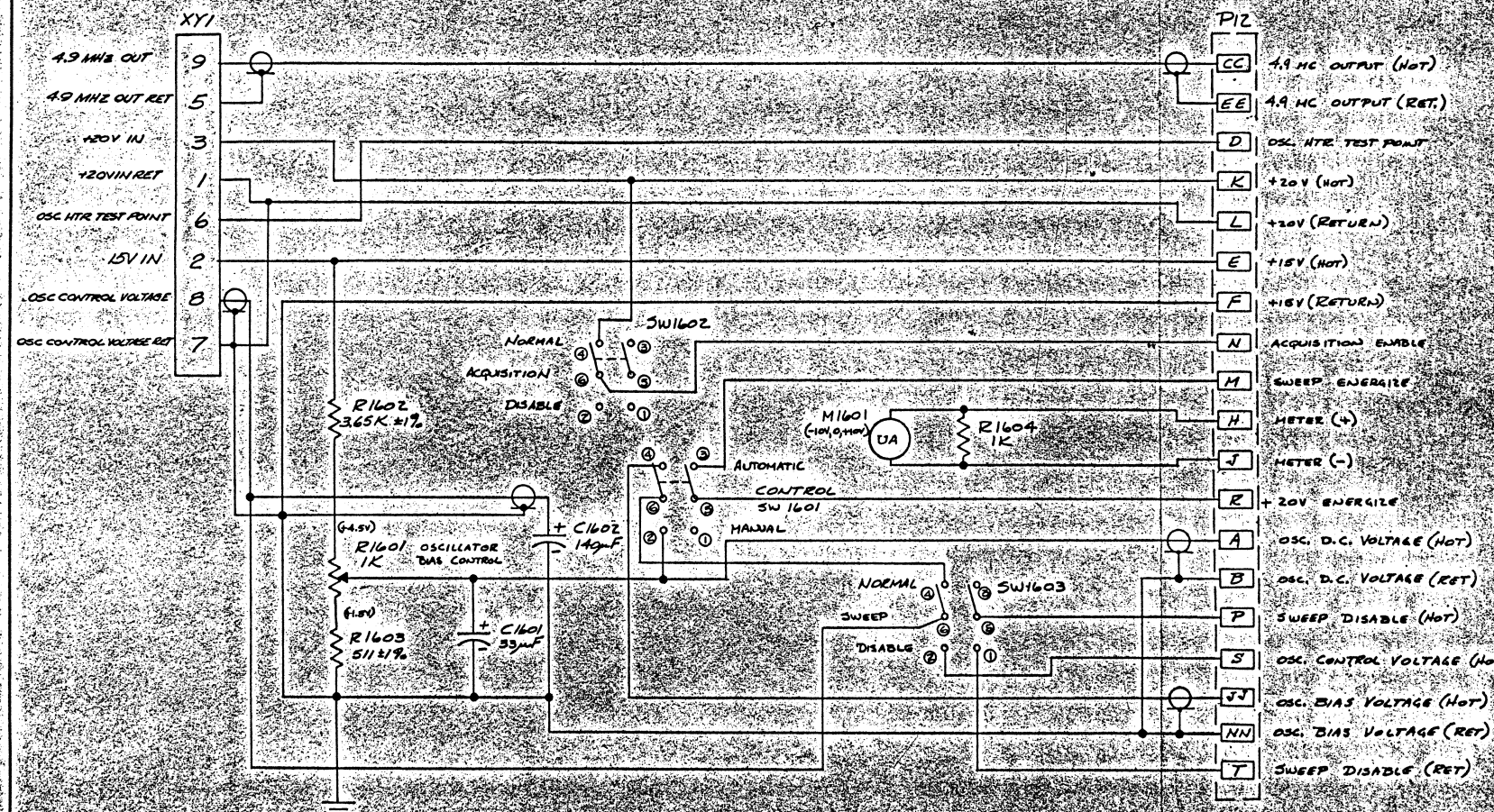
DWG. TITLE: SCHEMATIC-R.F.S. 3048 15 VOLT POWER SUPPLY & CONTROL CIRCUITS

SCALE: WT.

GENERAL TECHNOLOGY CORPORATION
TORRANCE, CALIF.

SIZE D DWG. NO. 42478

REVISIONS				
ZONE	SYMBOL	DESCRIPTION	DATE	APPROVAL
	A	ADDED PIN 2 15V IN TO XY1 EO 12343	11-9-67	



G-34803

A

BOARD #16 D

NEXT ASSY.	USED ON	NEXT ASSY.	FINAL ASSY.	REQ'D RH	REQ'D LH	PART NO.	DESCRIPTION	MATERIAL	MATL. SPEC.	ITEM
G14803	304B	REF	REF							

APPLICATION — QUANTITY REQ'D — LIST OF MATERIAL

UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS ARE IN INCHES.
2. TOLERANCES ON: DECIMALS ±.01 ANGLES ±0°30'
3. MACHINE FINISH 125 PER MIL-STD-10.
4. REMOVE BURRS AND SHARP EDGES .010 MAX.
5. MACHINED FILLET RADII .005-.015.
6. DIMENSION LIMITS HOLD AFTER PLATING.
7. MACHINED DIA. ON A COMMON CENTERLINE BORE, CENTRIC WITHIN .002 T.I.R. UNMACHINED DIA. CONCENTRIC WITHIN .004 T.I.R.
8. NORMALITY, SQUARENESS AND PARALLELISM OF MACHINED SURFACES .001" PER INCH, TO A MAX. OF .015" FOR A SINGLE SURFACE.
9. DO NOT SCALE DRAWING WORK TO DIMENSIONS ONLY.

SIGNATURES	DATE
DWN.	10/18/67
CHK.	23 OCT 67
APR.	10/24/67
APR.	
APR.	

HEAT TREATMENT: HARDNESS, SPEC. — PROCESS: NAME, SPEC.

DWG. TITLE: SCHEMATIC-R.F.S. 304 MONITOR BOX

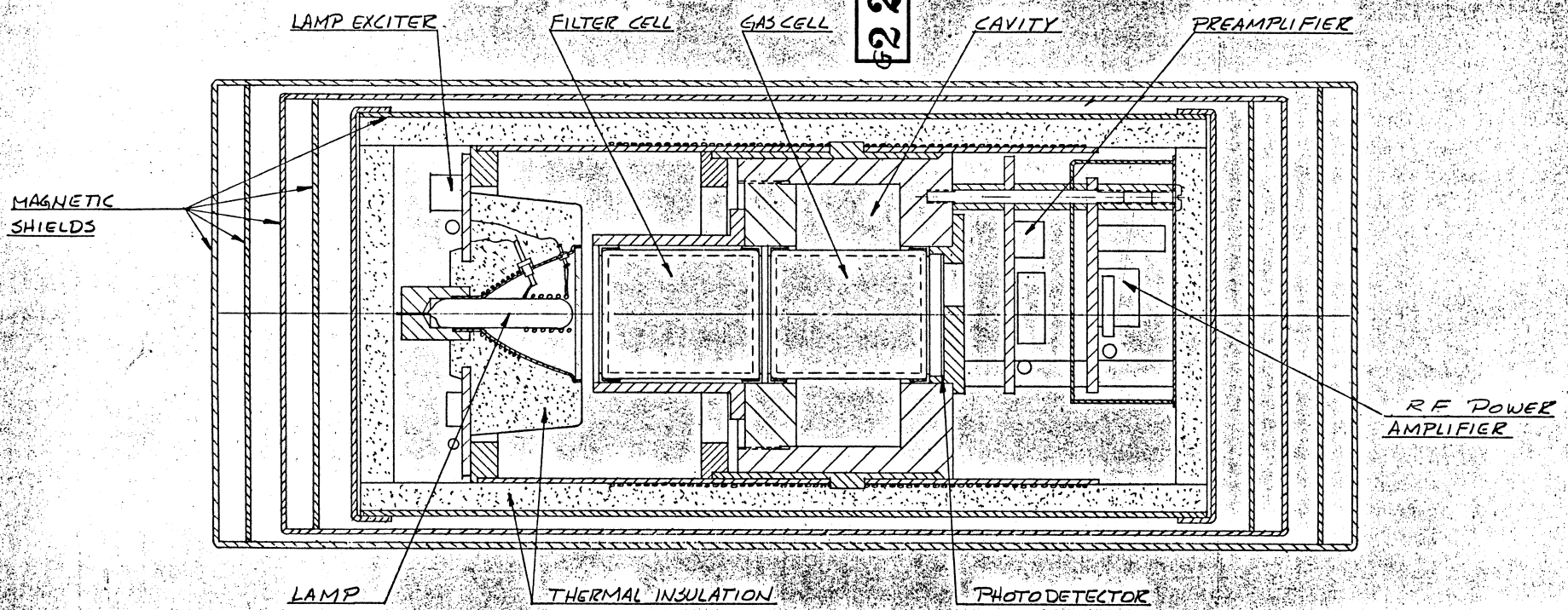
SCALE: — WT.

GENERAL TECHNOLOGY CORPORATION
TORRANCE, CALIF.

DWG. C — DWG. NO. G-34803 REV A

REVISIONS				
ZONE	SYMBOL	DESCRIPTION	DATE	APPROVAL

22331



NEXT ASSY.	USED ON	NEXT ASSY.	FINAL ASSY.	REQ'D	REQ'D	PART NO.	DESCRIPTION	MATERIAL	MATL. SPEC.	ITEM
G-42848	304C	REF	REF							
52288	304B	REF	REF							
APPLICATION		QUANTITY REQ'D		RH	LH		LIST OF MATERIAL			

UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS ARE IN INCHES.
2. TOLERANCES ON: DECIMALS ±.01 ANGLES ±0°30'
3. MACHINE FINISH 125/PER MIL-STD-10.
4. REMOVE BURRS AND SHARP EDGES .010 MAX.
5. MACHINED FILLET RADII .005-.015.
6. DIMENSION LIMITS HELD AFTER PLATING.
7. MACHINED DIA. ON A COMMON CENTERLINE CONCENTRIC WITHIN .003 T.I.R. UNMACHINED DIA. CONCENTRIC WITHIN .032 T.I.R.
8. NORMALITY, SQUARENESS AND PARALLELISM OF MACHINED SURFACES .002" PER INCH, TO A MAX. OF .015" FOR A SINGLE SURFACE.
9. DO NOT SCALE DRAWING WORK TO DIMENSIONS ONLY.

SIGNATURES	DATE
DWN.	3-22-62
CHK.	3-22-62
APP.	2-11-63
APP.	
APP.	
APP.	

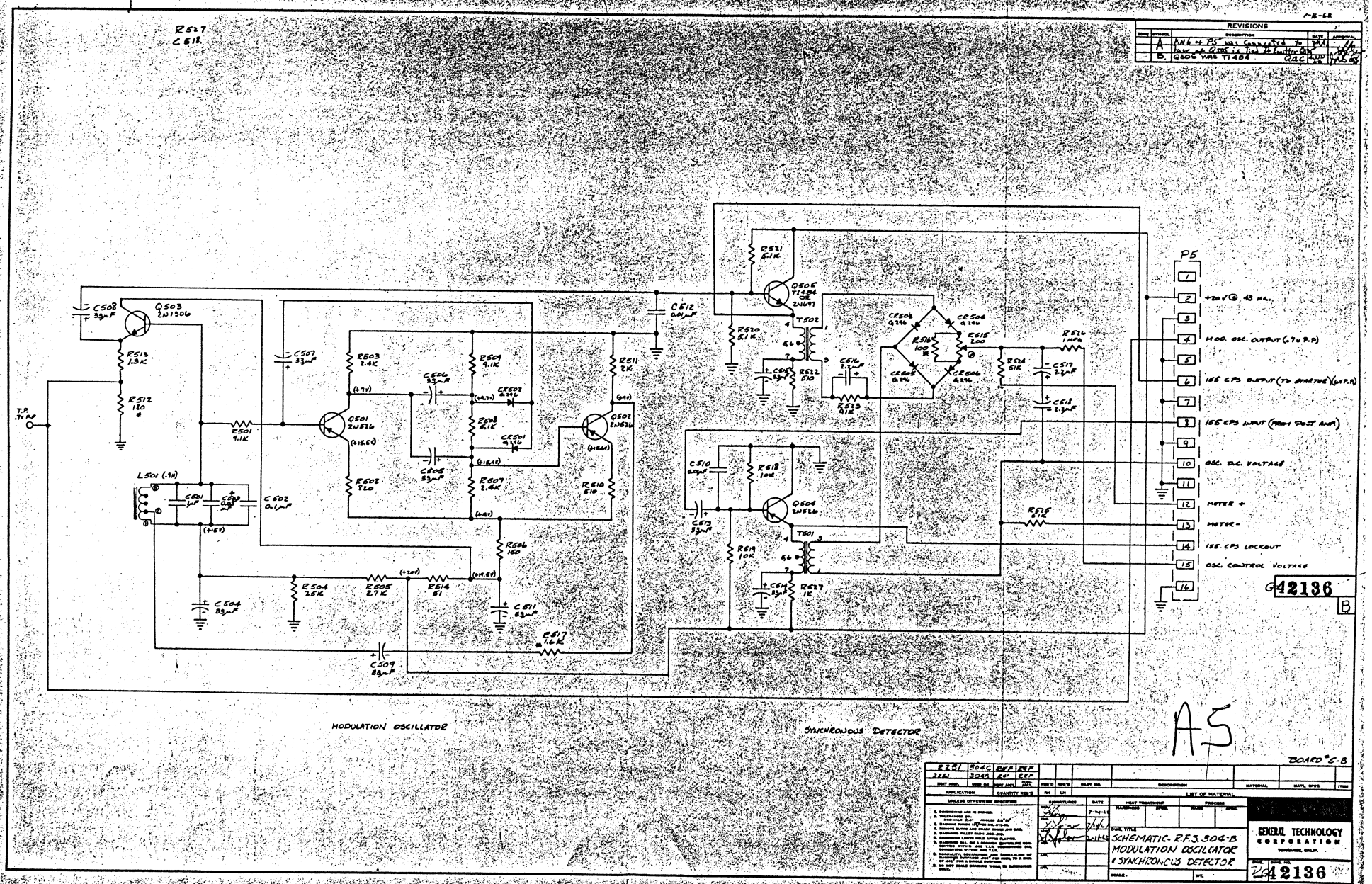
HEAT TREATMENT		PROCESS	
HARDNESS	SPEC.	NAME	SPEC.

DWG. TITLE: SECTION — OPTICAL MICROWAVE UNIT

SCALE - FULL SIZE WT.

GENERAL TECHNOLOGY CORPORATION
TORRANCE, CALIF.

DWG. SIZE B DWG. NO. 22331


R527
C612
C508 33μF
Q503 2N1506
R513 1.3K
R512 180
T.P. .7V RF
R501 9.1K
C507 33μF
R503 2.4K
Q501 2N526
R502 820
C506 33μF
C505 33μF
R509 9.1K
R508 6.1K
CR502 9.1V
CR501 9.1V
R507 2.4K
R511 2K
Q502 2N526
R510 510
L501 (.9H)
C601 1μF
C603 .01μF
C602 0.1μF
C504 33μF
R504 25K
R505 2.7K
R514 51
R506 100
C511 33μF
R517 1.6K
C509 33μF
C512 0.01μF
R521 6.1K
Q505 T1484 OR 2N697
T502
R520 6.1K
C605 33μF
R512 510
C516 2.2μF
R513 9.1K
CR503 9.1V
CR504 9.1V
CR505 9.1V
CR506 9.1V
R515 100
R516 2.00
R524 51K
R526 1MΩ
C517 2.2μF
C518 2.2μF
C510 .01μF
R518 10K
Q504 2N526
C513 33μF
R519 10K
T501
C514 33μF
R527 1K
R525 6.1K
P5
+20V @ 43 MA.
MOD. OSC. OUTPUT (.7V R.F.)
165 CPS OUTPUT (TO METER)
165 CPS INPUT (FROM POST AMP)
OSC. D.C. VOLTAGE
METER +
METER -
165 CPS LOCKOUT
OSC. CONTROL VOLTAGE
G42136
B
MODULATION OSCILLATOR
SYNCHRONOUS DETECTOR
A5
BOARD #S-B
REVISIONS
A
B
SCHEMATIC- R.F.S. 304-B
MODULATION OSCILATOR
& SYNCHRONOUS DETECTOR
GENERAL TECHNOLOGY CORPORATION
G42136