(TMIN) ET427-BA-MMC-010/8151 GT1026

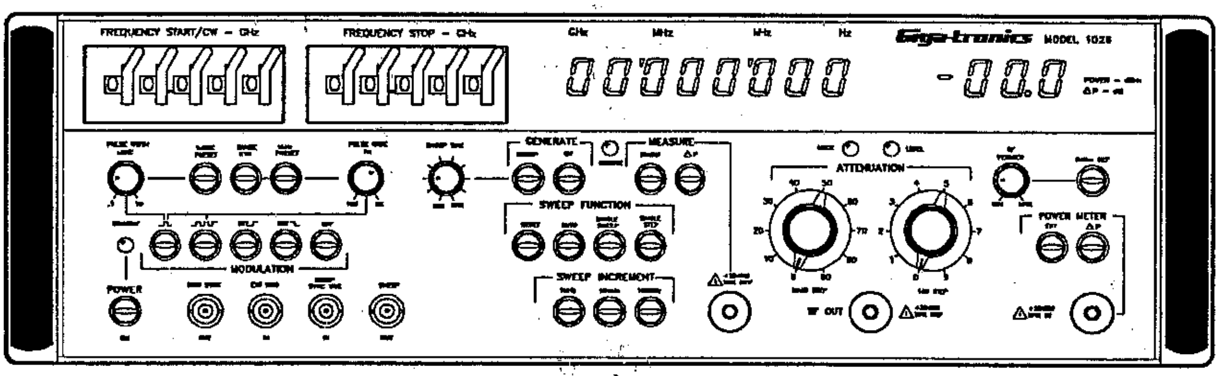
Giga-tronics

OPERATION & MAINTENANCE MANUAL

MODEL 1026

Microwave Synthesized Signal Generator

50 MHz to 26 GHz



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Serial Numbers

The instrument has a five-digit serial number, which appears on a sticker on the rear panel. This manual applies to all serial numbers listed in Manual Changes (Section 10 of the manual).

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IMPORTANT INFORMATION

Options and Special Configurations

Examine the Model/Serial/Config. sticker affixed to the rear panel of the instrument. If the "Config." line is blank, there are no options or special modifications installed in the instrument. If the line contains one or more two-digit numbers (e.g., '05'), the options corresponding to those numbers are installed. Information concerning them will be found in Section 8 of this manual.

If the "Config." line of the Model/Serial/Config. sticker includes a three-digit number (e.g., '221'), there is a combination of options and/or special modifications installed in the instrument. Information concerning any special configuration of this kind will be found in Section 9 of this manual.

Serial Numbers

This instrument has a six-digit serial number, which appears on the Model/Serial/Config. sticker affixed to the rear panel.

Manual Changes

Differences may exist between the manual and the instrument for which it is supplied, due to errors or circuit changes. These diffferences are described in Section 10 of this manual, with reference to individual instruments by serial number.

Introduction & Performance Specifications

Section 1

1 Introduction & Performance Specifications

1.1 MANUAL INFORMATION

This Operation and Maintenance Manual covers all aspects of the Giga-tronics Model 1026 microwave synthesized signal generator. All information required to operate, calibrate, and maintain the instrument is included.

The manual is divided into the following sections:

Section 1 -- INTRODUCTION & PERFORMANCE SPECIFICATIONS -- This section contains a brief introduction to the instrument and its performance parameters.

Section 2 -- OPERATIONAL INFORMATION -- A user's guide to the instrument and its controls.

Section 3 -- THEORY OF OPERATION -- A description of the instrument's design and its internal functioning, to the block diagram level.

Section 4 -- CALIBRATION & TESTING -- Procedures for inspection, calibration and performance testing.

Section 5 -- MAINTENANCE -- Procedures for maintenance and troubleshooting.

Section 6 -- PARTS LISTS -- Parts lists for all circuit boards and other assemblies.

Section 7 -- DIAGRAMS -- Component diagrams and schematic diagrams for all circuit boards and other assemblies.

Section 8 -- OPTIONS -- Descriptions of the available options for this instrument.

Section 9 -- SPECIAL CONFIGURATIONS -- A description of any special modifications to the instrument with which this manual is supplied.

Section 10 -- MANUAL CHANGES -- Errata information, and notices of any changes made to the instrument after the printing of the manual.

1.2 INTRODUCTION

1.2.1 Purpose and Function

The Model 1026 Microwave Synthesized Signal Generator/Counter is to provide, in one portable instrument, the capability to generate signals over a wide range of frequencies and power levels and to measure unknown frequencies and power levels.

1.2.2 Capabilities

Model 1026 generates output signals (fixed frequency or swept) over a frequency range of 50 MHz to 26 GHz, and a power range of -99 dBm to +5 dBm. The output can be internally or externally pulse modulated.

Model 1026 is also capable of measuring unknown frequencies in the range of 50 MHz to 26 GHz, and of measuring unknown power levels in the same frequency range and in the power range of -30 dBm to +10 dBm.

1.2.3 Performance Characteristics

Complete specifications are described later in this chapter (see section 1.3).

1.2.4 Weight and Dimensions

The Model 1026 has a weight of 65 lbs; the dimensions are 5.25 inches (height) by 16.75 inches (width) by 24 inches (depth).

1.2.5 Power Requirements

100/120/220/240 VAC ±10%, 50-400 Hz.

1.2.6 Environmental Requirements

The Model 1026 is type tested to MIL-T-28800, Type III, Class 5, Style E, Color R for Navy shipboard, submarine and shore applications, except as follows:

Operating temperature range is 0 to 50 degrees Celsius.

Relative humidity is limited to 0-90%, non-condensing.

Amplitude Calibration Valid is 25 ± 10 degrees Celsius.

Warm-up time is 20 minutes.

1.2.7 Items Furnished

In addition to options and/or accessories specifically ordered, items furnished with the instrument are as follows:

1 ea. - Operation and Maintenance Manual

1 ea. - 6 ft. power cord

3 ea. - PC Extender Board

1 ea. - PC Card Extractor

1.2.8 Items Required

The only non-furnished items required to operate the Model 1026 with a unit under test are applicable input/output cables (Accessory A001, Cable Kit is recommended) and an IEEE-488 Interface cable if operating under remote control.

1.2.9 Tools and Test Equipment

Special tools are not required to operate the Model 1026.

1.2.10 Storage

Storage of the instrument should be in an environment that does not exceed the temperature range of -40 degrees Celsius to +75 degrees Celsius.

1.2.11 Cooling

A cooling fan is installed in the instrument. The cooling air intake and exhaust are both located on the instrument's rear panel. Care must be taken to avoid obstructing the flow of air into and out of the instrument.

1.2.12 Cleaning

The air inlet screen should be cleaned whenever a significant amount of dirt or dust has accumulated. Whenever the instrument covers are removed, the interior should be blown out with dry air at a low velocity.

1.2.13 Installation and Preparation for Use

The instrument is shipped in operational condition and no special installation procedures are required. A warm-up time of 20 minutes is recommended.

1.2.14 Receiving Inspection

When the instrument is received, check the carton for evidence of damage. If damage is found, notify the carrier immediately, and open the carton only in the carrier's presence.

Use care in removing the instrument from the carton and check immediately for evidence of shipping damage: loose or broken control knobs, bent or broken connectors, dents or scratches on the panels, etc.

Each Giga-tronics instrument must pass rigorous inspections and tests prior to shipment. Upon receipt, it should immediately be subjected to a performance check to insure that its operation has not been impaired during shipment.

1.2.15 Preparation for Reshipment

To protect the instrument during reshipment, use the best packaging materials available. If possible, re-use the original shipping container. If this is not possible, a strong carton (350 lbs./sq.in. bursting strength) or a wooden box should be used.

Wrap the instrument in heavy paper or plastic before placing it in the shipping container. Completely fill the areas on all sides of the instrument with packaging material, taking extra precautions to protect the front and rear panels.

Seal the package with strong tape or metal bands. Mark the outside of the package "FRAGILE -- DELICATE INSTRUMENT".

If corresponding with the factory or the local Giga-tronics sales office regarding reshipment, please reference the full model number and serial number. If the instrument is being reshipped for repair, be sure to enclose all available pertinent data regarding the problem that has been found.

1.2.16 Safety Precautions

CAUTION

The instrument can be damaged if operated with the line voltage selector set inappropriately for the applied line voltage. Before operating the instrument, make sure that the instrument power source requirements are compatible with the power source to be used. The instrument has been designed for international use over a broad range of voltages: 100, 120, 220, or 240, ±10%, at 50-400 Hz. The Model 1026 uses an internationally approved connector that includes voltage selection, fuse and filter for RFI protection.

WARNING

The instrument has a 3-wire power cord with a 3-terminal polarized plug for connection to the power source and safety-ground. The ground, or safety ground, is connected directly to the chassis; therefore, if a 3-to-2 wire adapter is used, be sure to connect the ground lead from the adapter to earth ground. Failure to do this could cause the instrument to float above earth ground, posing a shock hazard.

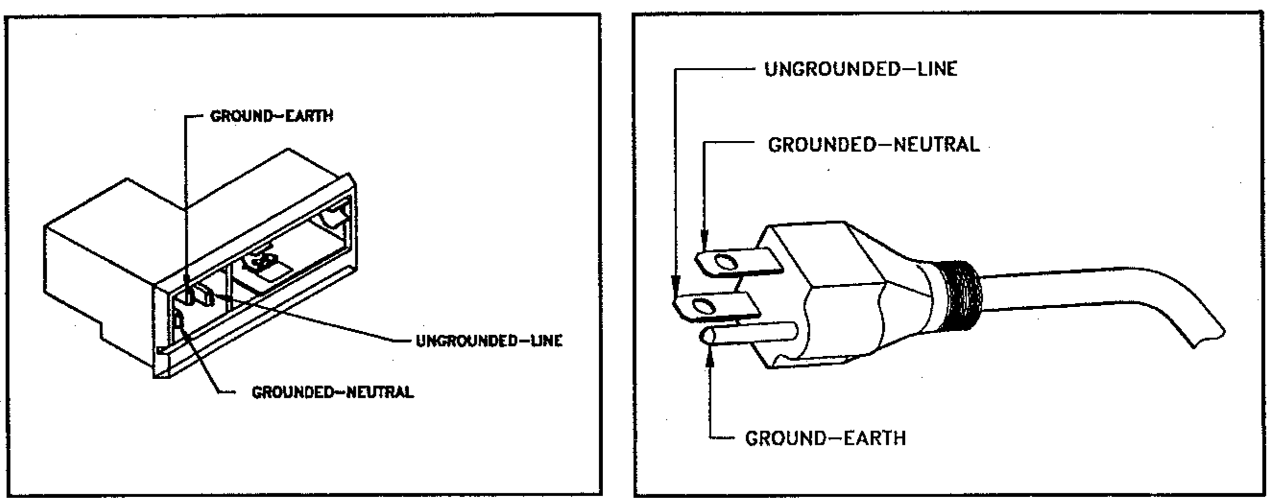


Figure 1.1: Power Line Connection

1.2.17 Voltage Selection

To select the correct operating line voltage, proceed as follows:

Open the cover door and rotate the fuse-pull to the left; remove fuse.

Select the operating voltage by orienting the PC board in order to position the desired voltage label on the top left side.

Push the board firmly into the module slot.

Rotate the fuse-pull back into the normal position and reinsert the fuse into the holder, using care to select the correct fuse value.

1.2.18 Fuse Selection

When the instrument is shipped from the factory, it is set for a particular power line voltage (normally 120V for domestic shipping destinations). The power line fuse for this setting is a 2.5A 3AG Slo-Blo. If the instrument is set to operate on a 240V power line, the fuse must be changed to a 1.5A 3AG Slo-Blo.

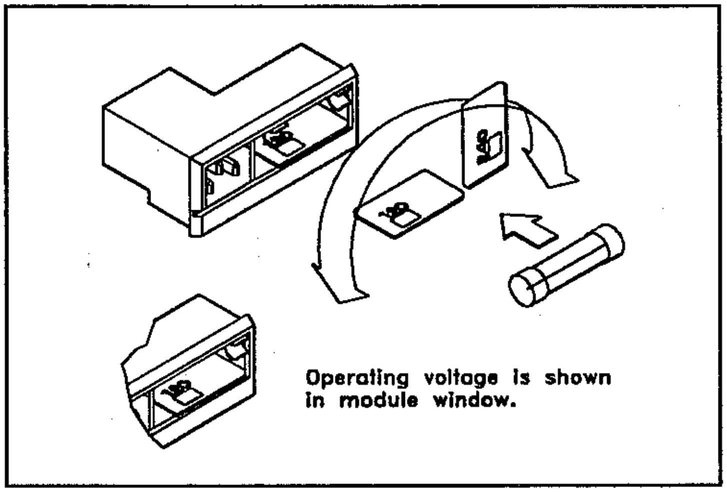


Figure 1.2: Voltage Selector/Fuse Holder

1.3 PERFORMANCE SPECIFICATIONS

1.3.1 Frequency Synthesizer

Frequency Range:	50 MHz to 26 GHz
Frequency Resolution:	1 MHz (Note 1)
Time Base Stability:	<1 x 10^{-6}/year

1.3.2 Spectral Purity

Harmonics, Subharmonics:	Less than -55 dBc
Spurious (Nonharmonics):	Less than -55 dBc (Note 2)

1.3.3 RF Output

Output Level:	-99 dBm to 5 dBm leveled
Output Accuracy:	±1 dB from 50 MHz to 18 GHz, ±2 dBm from 18 GHz to 26 GHz
Output Attenuation:	90 dB in 10 dB steps 9 dB in 1 dB steps
Level Adjustment:	-5 dB to +15 dB
Source Impedance:	50 ohm nominal

1.3.4 Pulse Modulation

Squarewave:	Variable rate from 100 Hz to 50 kHz with a fixed point at 1 kHz.
Pulse:	Variable rate from 100 Hz to 50 kHz with a fixed point at 1 kHz. Variable width from 10 microsec to 0.1, microsec with a fixed point at 1 microsec.
On/Off Ratio:	>30 dB
Rise/Fall Time:	<25 nanosec
Overshoot/Undershoot/Ringing:	±2 dB max
Settling Time:	±1 dB within 100 nanosec
External:	10 Hz to 1 MHz rate with a min of 0.1 microsec width. Rising or falling edge triggering.
Sync Output:	Modulation waveform TTL Level

1.3.5 Sweep Output

Sweep Range:	50 MHz to 26 GHz
Sweep Mode:	Auto, Single Sweep, and Single Step
Step Increments:	1 MHz, 10 MHz and 100 MHz
Sweep Time:	Variable from 10 millisec to 100 sec
Sweep Rate:	Typically 50 MHz per millisec

Ramp Output:	0 to 10 volts ±10% proportional to frequency for any sweep width. Ramp operates in all sweep modes.
Sweep Trigger:	1 volt transistor switch to ground
Pen Lift:	1 volt transistor switch to ground during retrace

1.3.6 Frequency Counter

Range:	100 MHz to 26 GHz
Resolution	
Direct:	100 Hz
Offset:	10 Hz
Sensitivity:	>-30 dBm 100 Hz to 8 GHz, >-25 dBm to 18 GHz, >20 dBm to 26 GHz (typical)
Input Impedance:	50 ohm nominal
Pulse Measurement:	Min pulse width 0.5 microsec

1.3.7 Power Meter

Frequency Range:	50 MHz to 26 GHz
Accuracy:	± 1 dB internal ±1 dB external -10 dBm to +10 dBm ±2 dB external -10 dBm to -30 dBm
External Power Range:	-30 dBm to +10 dBm
Resolution:	0.1 dBm, 3-1/2 digits

1.3.8 General Specifications

Interface:	IEEE - 488
Operating:	Type tested to MIL-T-28800 Type III, Class 5, Style E
Power Requirements	
Line Voltage Ranges:	100/120/220/240 VAC (±10%)
Line Frequency:	50 Hz to 400 Hz
Dimensions:	5.25 in. high x 16.75 in. wide x 24 in. deep, 65 lbs. (nominal)

PERFORMANCE NOTES

NOTE 1:

Frequency Resolution. An input is provided on the rear of the instrument marked PLL-Ref. A signal on this input will override the internal 5 MHz reference to the phase-lock loop controlling the master RF reference. Any shift in this frequency will cause a one for one shift in the output RF frequency. The range of frequency shift that can be achieved is typically 15 MHz at a rate within the bandwidth of the phase-lock loop, typically 50 kHz. This allows the instrument to operate with a low frequency (5 MHz to 20 MHz) synthesizer to achieve greatly increased resolution or to be used with a 5 MHz to 20 MHz swept source to achieve a narrowband swept RF output.

NOTE 2:

Spectral Purity. The Model 1026 uses an indirect phase-locked master RF reference method of controlling fundamental YIG oscillators as output RF sources. This method of synthesis takes advantage of the differences in noise characteristics of the master reference which is a low noise crystal controlled oscillator and the master RF reference. Within the bandwidth of the phase-locked loops the principal source of phase noise is that of the crystal controlled reference multiplied up only to the master RF reference. Beyond the bandwidth of the phase-locked loops the phase noise is completely related to the noise characteristics of the master RF reference YIG oscillator which is extremely low.

Operational Information — *Section 2*

2 Operational Information

2.1 THE FRONT PANEL

The major controls, connections, and displays for Model 1026 are located on the front panel, as illustrated below.

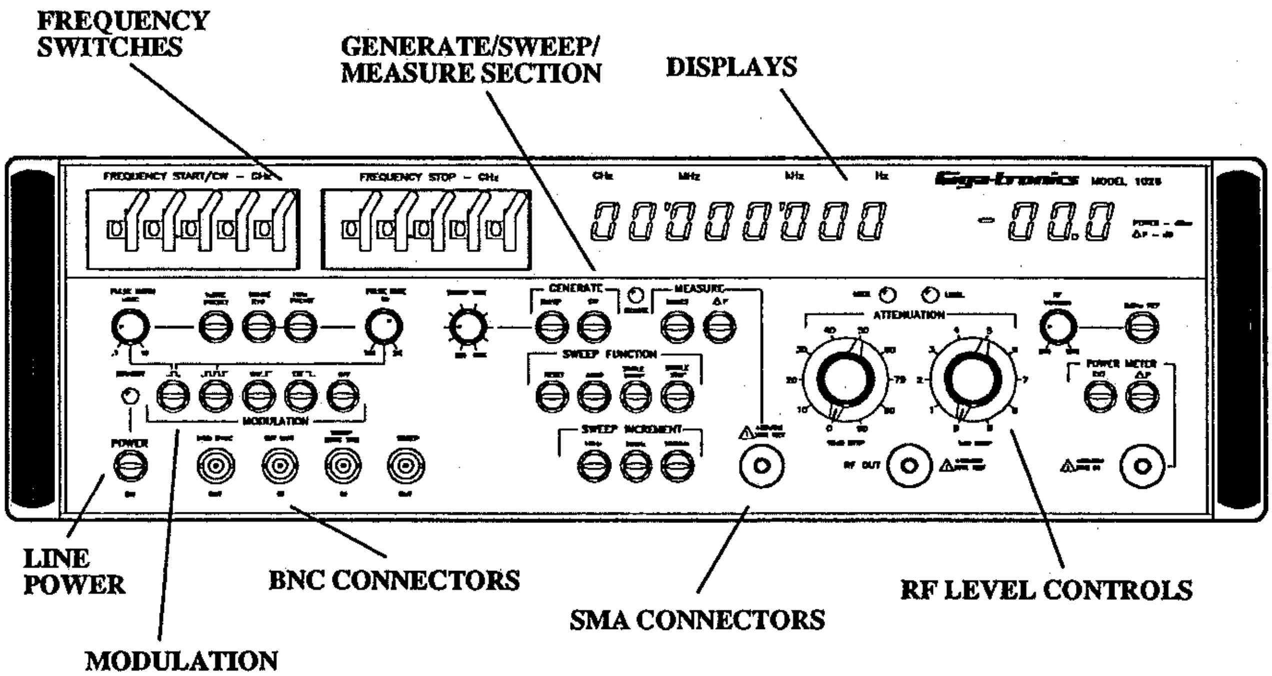


Figure 2.1: The front panel

2.1.1 Frequency Switches

The 'FREQUENCY START\CW' switches select the RF output frequency (in generate mode), the sweep start frequency (in sweep mode), the search start frequency (in frequency measurement search mode), and the reference frequency (in frequency measurement offset mode).

The 'FREQUENCY STOP' switches select the sweep stop frequency (in sweep mode), and the search stop frequency (in frequency measurement search mode).

2.1.2 Displays

The frequency display shows the RF output frequency (in generate mode or sweep mode), and the measured input frequency (in frequency measurement mode).

The power display shows the RF output power, the measured input power, or the difference between the two, as selected by the power meter pushbuttons.

The 'LOCK' LED is lit to indicate that the instrument's output frequency is phase locked. The 'LEVEL' LED is lit to indicate that the instrument's output level is within the control range of the automatic level control circuit.

2.1.3 RF Level Controls

The 'ATTENUTATION' switches are used to set attenuation of the RF output in 10 dB steps and 1 dB steps.

When the 'LEVELED' pushbutton is pressed, attenuation is referenced to 0 dBm (that is, the RF output level is 0 dBm, minus the total attenuation set by the two attenuation switches).

When the 'LEVELED' pushbutton is released, attenuation is referenced to a level which is adjustable rather than fixed at 0 dBm. The level is adjusted by the 'RF VERNIER'; this control provides an adjustment range of approximately 10 dB.

2.1.4 SMA Connectors

These gold connectors are used for high-frequency inputs and outputs. The 'MEASURE' connector accepts an RF input to the instrument's built-in frequency counter. The 'RF OUT' connector provides the instrument's RF output. The 'POWER METER' connector accepts an RF input to the instrument's built-in power meter.

2.1.5 Generate/Sweep/Measure Section

The controls in this area of the front panel select the basic operating mode of the instrument.

The 'GENERATE' buttons select sweep mode or CW (fixed frequency) mode.

The 'MEASURE' buttons select direct mode (absolute frequency measurement) or ΔF mode (measuement relative to a specified frequency).

The 'SWEEP FUNCTION' buttons specify sweep reset, automatic repetitive sweep, single sweep, or single step.

The 'SWEEP INCREMENT' buttons specify the sweep step size as 1 MHz, 10 MHz, or 100 MHz.

The 'SWEEP TIME' knob provides ten settings to adjust the speed of the sweep.

2.1.6 Modulation Section

The controls in this area of the front panel specify modes and parameters for pulse modulation.

The 'PULSE WIDTH μSEC' and 'PULSE RATE Hz' knobs adjust pulse width and repetition rate. To expand the ranges of these knobs by a factor of ten, press the 'RANGE X10' button.

The '1 mSEC PRESET' and '1 kHz PRESET' can be used to substitute fixed values for the width and rate set by the knobs.

The 'MODULATION' pushbuttons select the modulation mode (adjustable duty cycle, 50% duty cycle, external rising trigger, external falling trigger, and modulation off).

2.1.7 BNC Connectors

These silver connectors are used for control inputs and outputs related to modulation and sweep functions. The 'MOD SYNC OUT' connector provides a sample output of the modulation waveform at TTL levels. The 'EXT MOD IN' connector accepts an external TTL-level trigger input for pulse modulation. The 'SWEEP SYNC TRIG IN' connector accepts an external TTL-level trigger input for frequency sweeping. The 'SWEEP OUT' connector provides a ten-volt ramp proportional to progress between sweep limits.

2.1.8 Line Power

The POWER ON switch is used to activate all of the instrument's DC power supplies. The STANDBY LED is illuminated whenever line power is connected to the instrument.

2.1.9 Error Messages

The instrument's computer uses the frequency readout to display error messages to the operator when certain controls have been incorrectly set.

NOTE: An "invalid mode" message may indicate that none of the possible modes has been selected.

Error 00 -- Invalid generate/measure mode.

Error 01 -- Invalid frequency (out of range).

Error 02 -- Invalid modulation mode.

Error 03 -- Invalid sweep increment.

Error 04 -- Invalid sweep mode.

Error 05 -- Frequency start must be less than frequency stop.

Error 06 -- Modulation must be off when using external ALC.

Error 07 -- No cable calibration data is in memory.

Error 08 -- Modulation must be off when in ΔP mode.

Error 09 -- Invalid search start frequency (search must start above 100 MHz).

Error 10 -- Cable calibration cannot be used simultaneously with external ALC.

Error 11 -- 10 dB step attenuator must be set to 0 dB during cable calibration.

Error 12 -- Requested level for cable calibration is out of the range of the control system.

Error 13 -- 10 dB step attenuator must be set to 0 when using external ALC.

Error 14 -- IEEE-488 interface address of 31 (all ones) is invalid.

Error 15 -- Sweeping across multiplier bands is not permitted (see Option 14).

Error 16 -- Frequency multiplication in delta-P mode is not permitted (see Option 14).

Error 17 -- Modulation must be off during frequency multiplication (see Option 14).

Error 18 -- External ALC must be off during frequency multiplication (see Option 14).

2.1.10 Additional Display Symbols

The rightmost digit of the frequency display is used as an indicator of certain operating modes.

'c' -- The lower case 'c' indicates the instrument is in cable calibration mode.

'E' -- The upper case 'E' indicates the instrument is in external ALC mode.

'd' -- The lower case 'd' indicates the instrument is in frequency doubler mode; this mode applies only to instruments with option 14 (frequency extender control bus).

't' -- The lower case 't' indicates the instrument is in frequency tripler mode; this mode applies only to instruments with option 14 (frequency extender control bus).

'q' -- The lower case 'q' (not to be confused with a '9') indicates the instrument is in frequency quadrupler mode; this mode applies only to instruments with option 14 (frequency extender control bus).

'[ ]' -- When the readouts are disabled by a 'DISPzOFF' command, the leftmost digit is illuminated as '[' and the rightmost digit as ']'; the brackets serve as a standby indication. Error messages will continue to be displayed, but frequency and level will not.

2.2 FRONT PANEL OPERATION

Model 1026 performs four basic functions: (1) it generates fixed frequencies within the range of 50 MHz to 26 GHz, (2) it sweeps between any two frequencies in the same range, (3) it measures the frequency of an input signal in the same range, and (4) it measures the power of an input signal in the same range.

This section includes step-by step procedures for each of these basic functions.

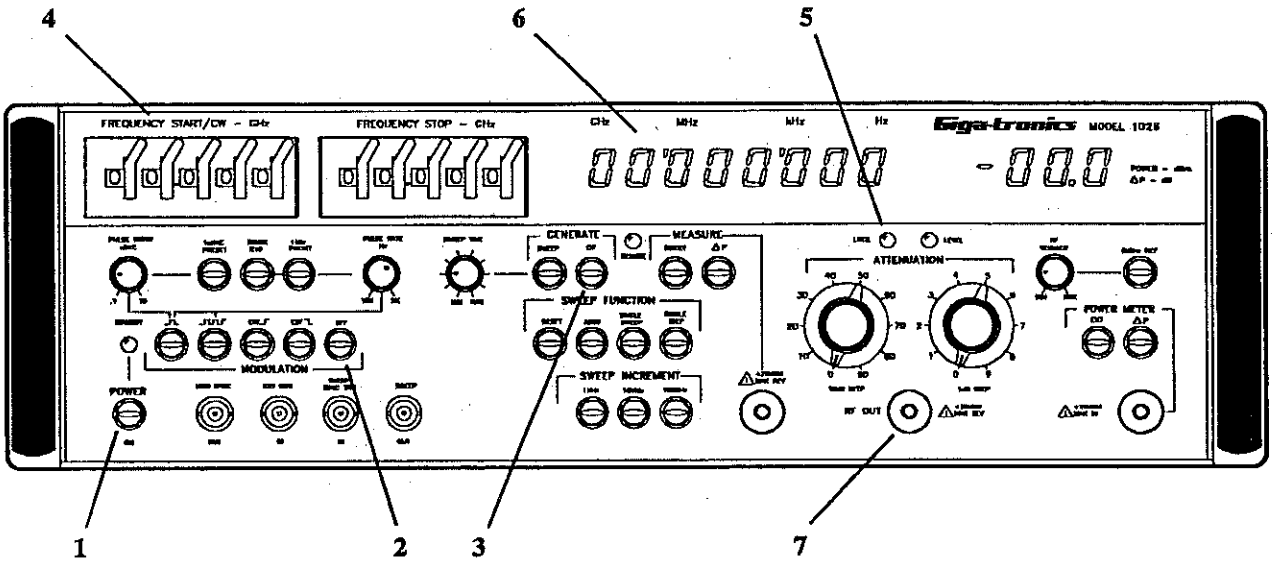


Figure 2.2: Fixed Frequency

2.2.1 Generating A Fixed Frequency

1.Power on.

2. Modulation off.

3. Generate CW on.

4. Set leverwheel switch to desired frequency.

5. Verify 'LOCK' indicator is lit.

6. Check frequency readout.

7. Output frequency is available at RF OUT connector.

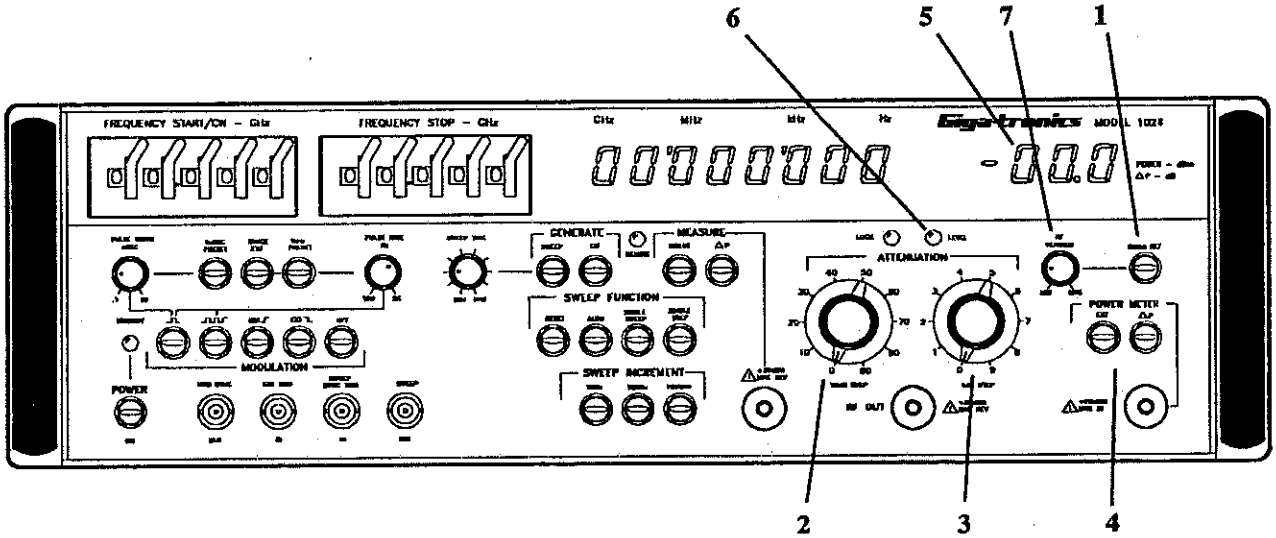


Figure 2.3: Output level

2.2.2 Setting Signal Output Level

1. Push the '0 dBm REF' button (this refers all attenuation settings to a 0 dBm reference level).

2. Set the 10 dB step attenuator to any of the ten available positions.

3. Set the 1 dB step attenuator to any of the ten available positions.

4. Make sure that both the 'EXT' and 'ΔP' power meter buttons are OUT.

5. Read RF output power at the power readout.

6. 'LEVEL' LED lights to indicate when output signal is leveled (that is, the leveling system is within the operating limits of its range).

7. Vernier control of the output power (over a control range of approximately 10 dB) can be obtained by releasing the 'LEVELED' pushbutton and adjusting the RF vernier knob; this is also a means of getting maximum power above 0 dBm.

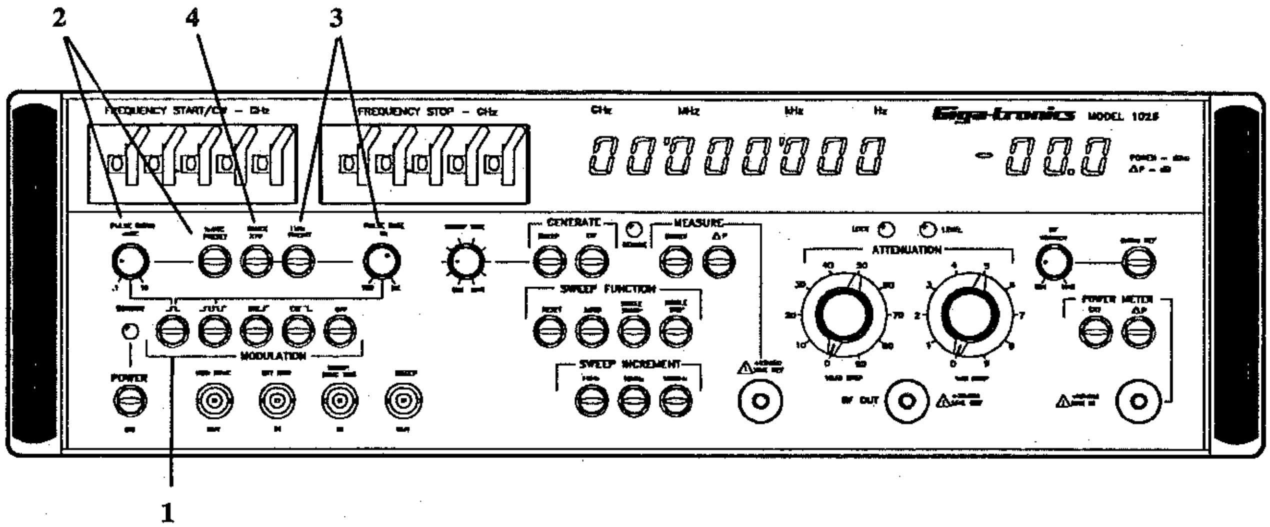


Figure 2.4: Pulse modulation

2.2.3 Pulse Modulation

1. Select pulse modulation: ⎍

2. Select 1 microsecond fixed pulse width, or release the 1 microsecond preset button and use the pulse width knob to vary the width over the adjustment range.

3. Select 1 kHz fixed pulse rate, or release the 1 microsecond preset button and use the pulse rate knob to vary the rate over the adjustment range.

4. If desired, use the X10 button to increase the pulse rate by a factor of 10.

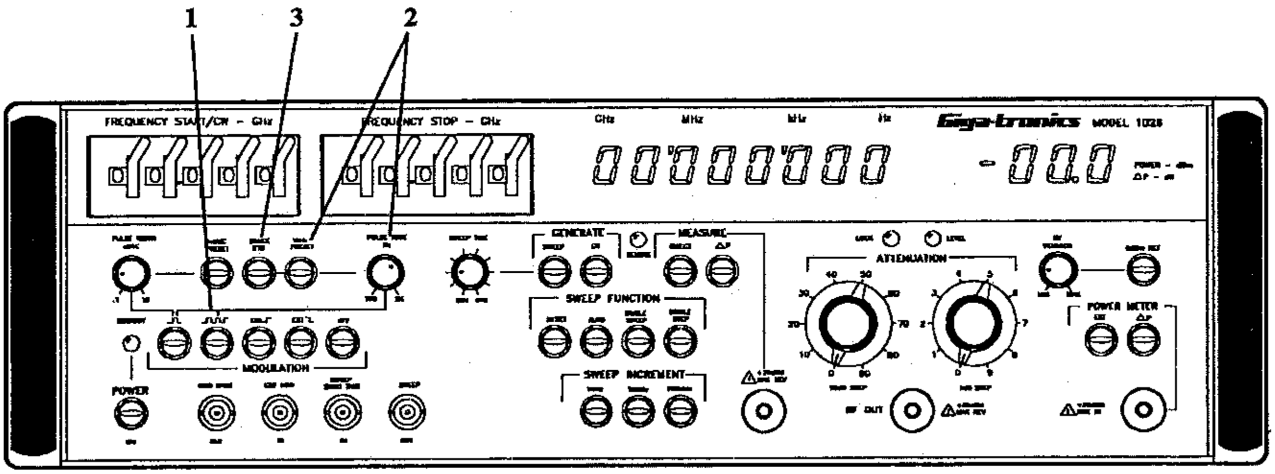


Figure 2.5: Square wave modulation

2.2.4 Square Wave Modulation

1. Select square wave modulation:
2. Select 1 kHz fixed rate, or release the 1 kHz preset button and vary the rate over the adjustment range.
3. If desired, use the X10 button to increase the rate by a factor of 10.

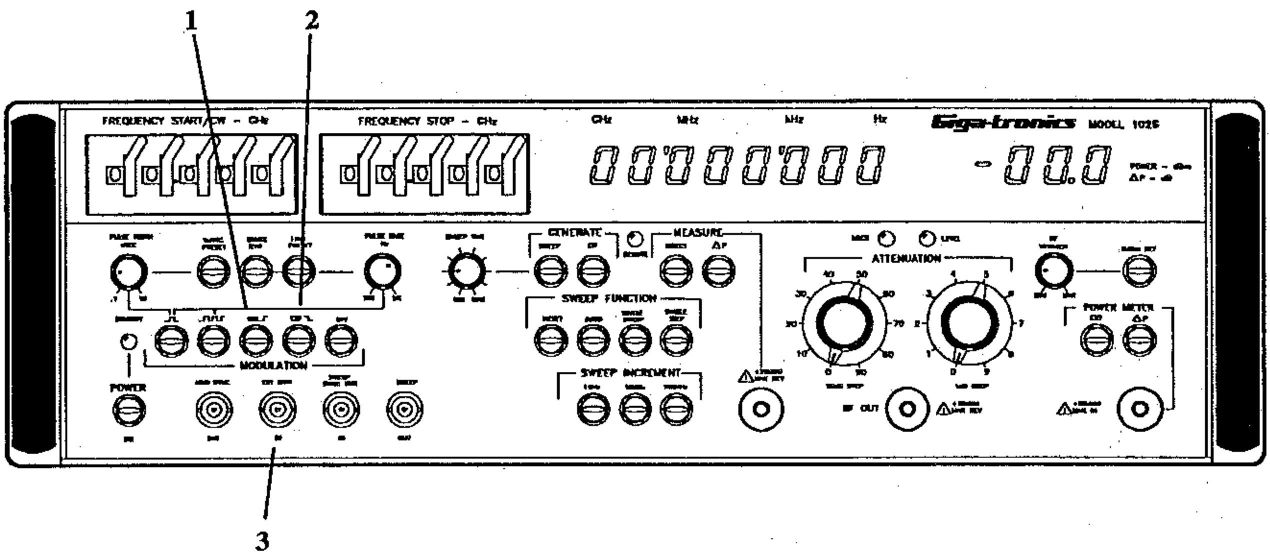


Figure 2.6: External Pulse Modulation

2.2.5 External Pulse Modulation

1. Select external high trigger EXT_|‾

In this mode, pulse 'on' is triggered at >+2.2 volts, and pulse 'off' is triggered at <+0.8 volts.

2. Or, select external low trigger EXT‾|_

In this mode, pulse 'on' is triggered at <+0.8 volts, and pulse 'off' is triggered at >+2.2 volts.

3. Apply the external signal at the 'EXT MOD IN' connector. The instrument will accept any TTL-level signal from 10 Hz to 1 MHz with a minimum pulse width of 0.1 microsecond.

NOTE: This instrument will not operate properly when it is set for external pulse modulation (whether for high or low triggering) if there is no input pulse applied. During modulation, output leveling is driven by a sampling system which requires input pulses to trigger the sample. In the absence of a modulation input, the instrument will not be leveled, output power may drift or may remain "off" continuously, the power readout may be incorrect and the level LED may go out.

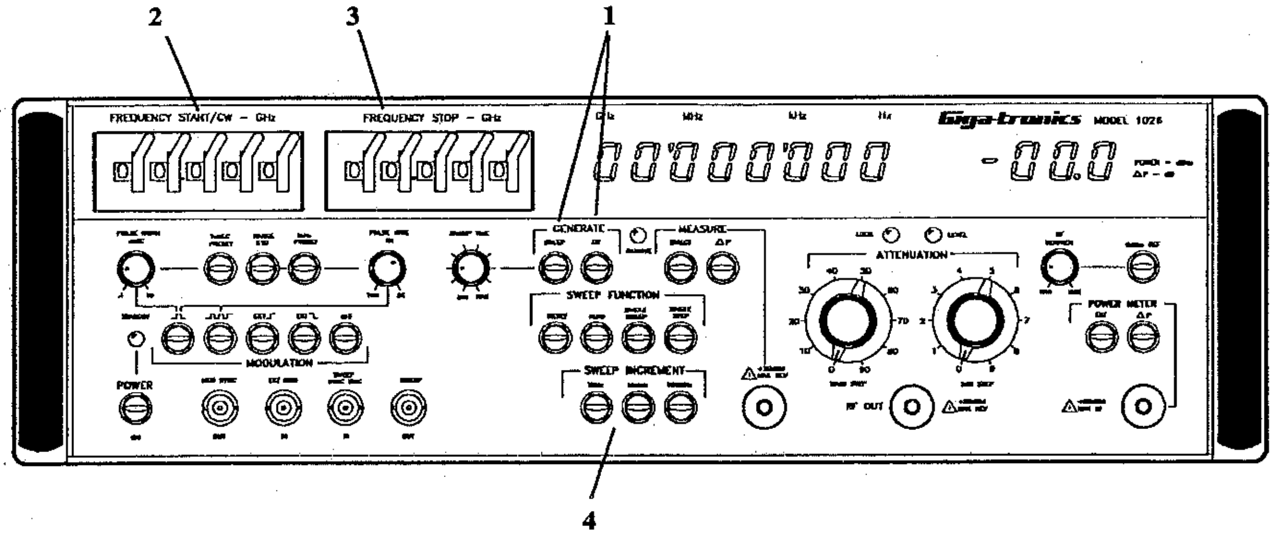


Figure 2.7: Frequency sweeping

2.2.6 Frequency Sweeping

It should be noted that there are two methods of sweeping between frequency limits. One method creates an unlocked incremental sweep between the start and stop points, while the other method digitally increments and achieves a momentary lock after each step.

1. Select the unlocked sweep mode by pressing 'SWEEP', or select the locked sweep mode by pressing 'SWEEP' and 'CW' simultaneously.

NOTE: The difference between the two modes is that, in locked sweep mode, the output phase lock loop circuit is enabled, and acquires phase lock before proceeding to the next frequency increment.

2. Use the leverwheel switches to set the desired start frequency.

3. Use the leverwheel switches to set the desired stop frequency.

4. Select the sweep increment (1 MHz, 10 MHz, or 100 MHz).

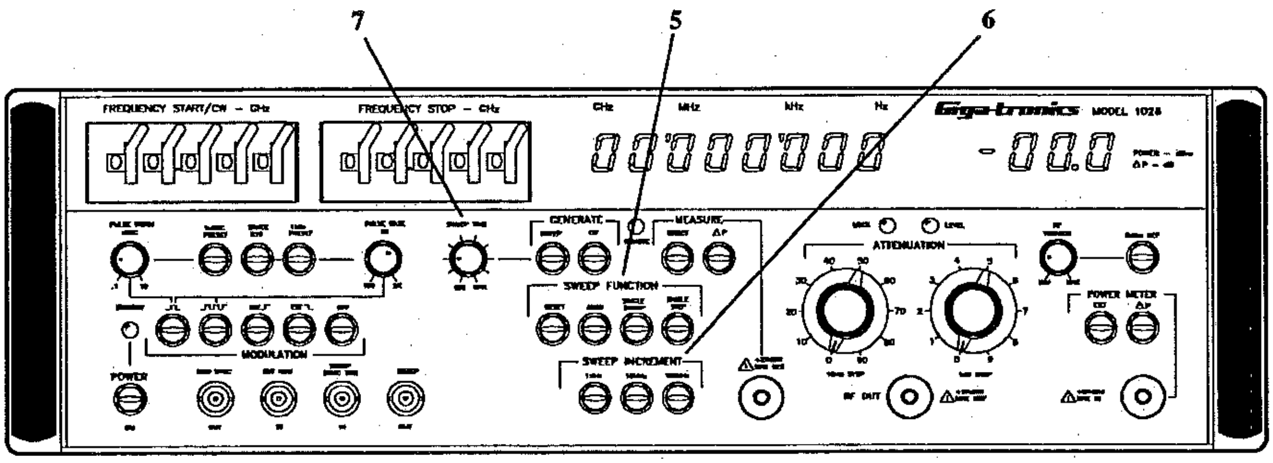


Figure 2.8: Frequency sweep functions

5. Select the sweep function:

   a. Select 'AUTO'. This initiates a sweep, increasing from the start frequency to the stop frequency, which resets to the start frequency and repeats indefinitely.

   b. Or, select 'SINGLE SWEEP'. This initiates a sweep from start frequency to stop frequency, which resets to the start frequency but does not repeat.

   c. Or, select 'SINGLE STEP'. Each time this button is pushed, output frequency increases by one increment, until the stop frequency is reached and the sweep resets to the start frequency.

   d. If the 'EXT' button is pressed, a single sweep or single step (depending on which mode was activated last) can then be initiated by applying a TTL-low pulse to the 'SWEEP SYNC TRIG IN' connector.

   e. Pushing the 'RESET' button at any time during a sweep will return the instrument to the start frequency.

6. Select sweep time, if the instrument is in 'AUTO' or 'SINGLE SWEEP' mode; there are ten available speeds.

7. A 0V to +10V ramp, with voltage proportional to progress through the sweep, is available at the 'SWEEP OUT' connector.

8. During sweep retrace, a TTL-low pulse is available at the 'PEN LIFT' output connector on the rear panel.

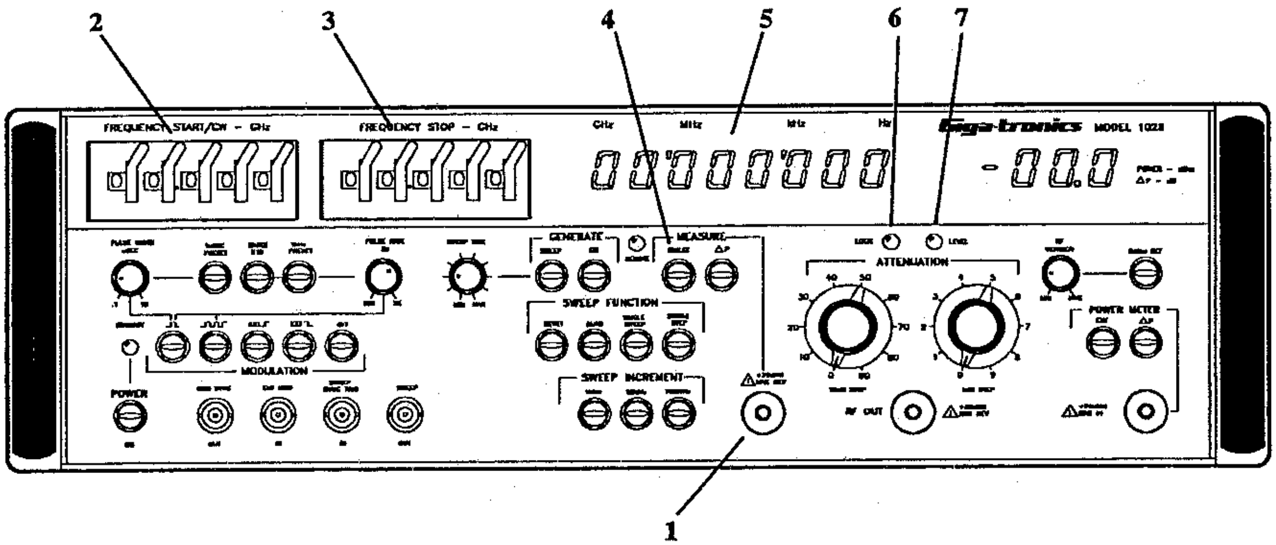


Figure 2.9: Frequency Measurement

2.2.7 Frequency Measurement

1. Apply any frequency from 100 MHz to 26.5 GHz with a minimum level of -30 dBm (nominal). NOTE: Counter sensitivity may be appreciably less than -30 dBm at frequencies above 12 GHz.

2. Set the start frequency leverwheel switches to the start point of the frequency search.

3. Set the stop frequency leverwheel switches to the stop point of the frequency search.

4. Activate the button marked Measure Direct.

5. The readout will indicate the first frequency the instrument detects from the start frequency search setting (step 2).

6. The Lock light will indicate that a valid signal has been detected.

7. The level light will indicate gate time.

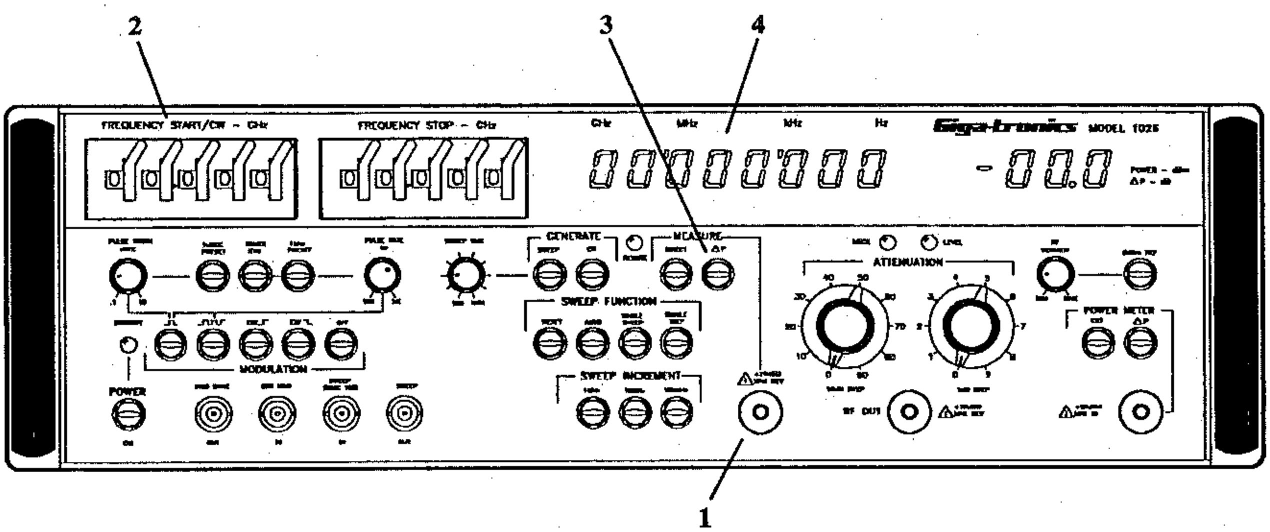


Figure 2.10: Frequency Offset Measurement

2.2.8 Frequency Offset Measurement

1. Apply any frequency from 100 MHz to 26.5 GHz with a minimum level of -30 dBm (nominal). NOTE: Counter sensitivity may be appreciably less than -30 dBm at frequencies above 12 GHz.

2. Set the frequency start/CW leverwheel switches to within 500 MHz of the unknown input frequency. This then becomes the reference frequency.

3. Activate the pushbutton marked ΔF.

4. The readout will indicate the frequency offset from the reference frequency selected in step 2.

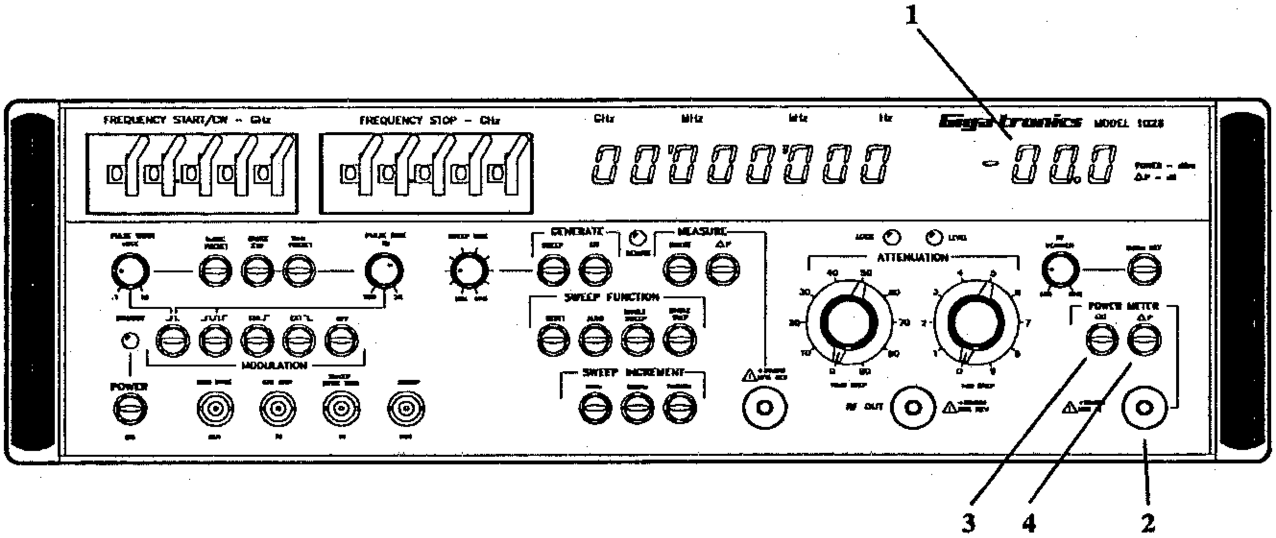


Figure 2.11: Power Level Measurement

2.2.9 Power Level Measurement

The power meter provides three modes of operation, measuring the level of the generator output, of an unknown input, or of the difference between them.

1. With both power meter buttons (see 3 and 4) released, the power meter readout indicates the power level of the signal generator output.

2. To measure the level of an external source, apply the source output to the power meter input SMA connector, and select one of the following external power meter modes.

3. Activate the 'EXT' pushbutton to select measurement of the power meter input signal.

4. Activate the 'ΔP' pushbutton to select measurement of the difference between the signal generator output and the power meter input. (This mode is generally used to make gain or loss measurements, by connecting the output of the signal generator to the device under test and connecting the device's output to the power meter input connector).

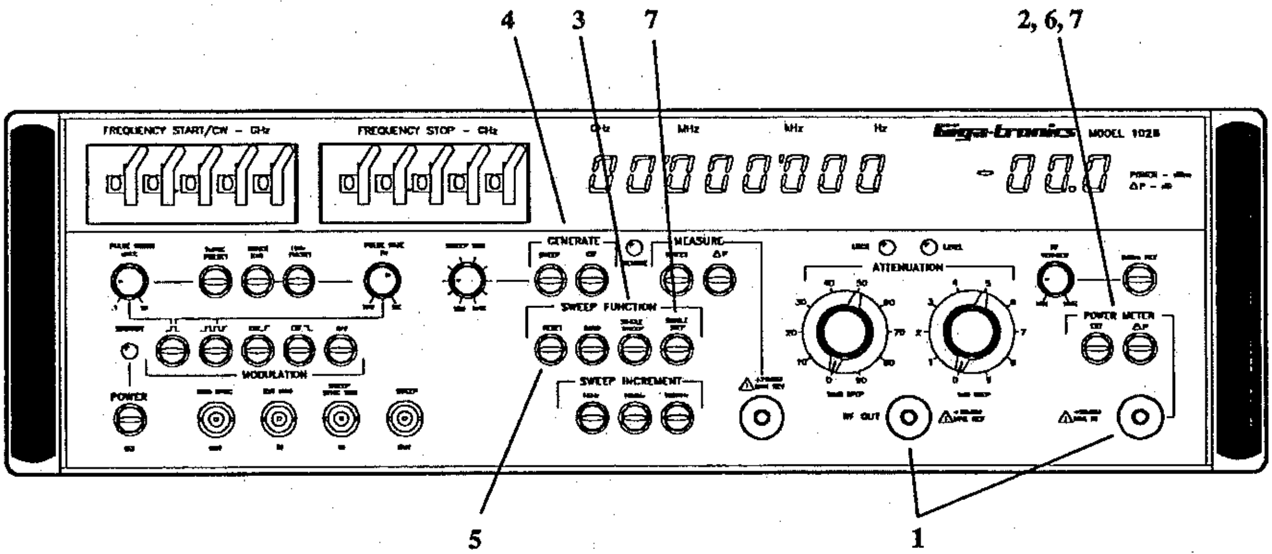


Figure 2.12: Cable Calibration

2.2.10 Generator Output Cable Calibration

This feature makes it possible for the instrument to compensate automatically for cable loss. Corrections are made in 1 GHz increments, to 26 GHz.

1. Connect the cable from the generator output to the power meter input.
2. Press both the 'EXT' and 'ΔP' power meter buttons. The readout will show "Cal=?".
3. Press the 'SINGLE SWEEP' button. When the calibration sweep is completed, the readout will show "Cal=Yes".
4. Select any generator mode. The instrument will compensate for cable loss; a small "c" will appear after the frequency readout to indicate that the cable calibration mode is active.
5. To deactivate the compensation for cable loss, press both the 'EXT' and 'ΔP' power meter buttons and press the 'RESET' sweep button. The readout will show "Cal=No".
6. To return to uncalibrated operation, release one or both of the power meter buttons after the 'RESET' sweep button has been pressed.
7. To reactivate the cable compensation, press both power meter buttons, then press the 'SINGLE STEP' sweep button.

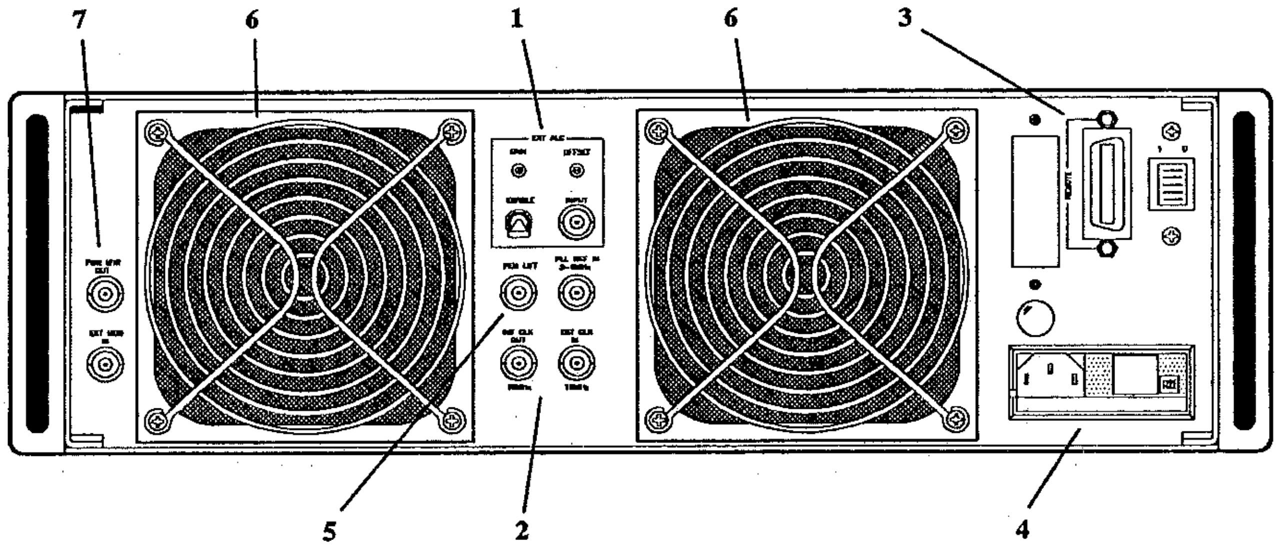


Figure 2.13: Rear Panel

2.3 THE REAR PANEL

The rear panel contains the input and output connections used for interfacing the instrument with auxiliary devices. The illustration above shows the various sections of the rear panel.

1. External ALC Section
2. Master Reference Section
3. Interface Section
4. Line Power & Fuse Section
5. Pen Lift
6. Air Intake & Exhaust
7. Power Meter Output and Rear Panel Ext Mod In

2.3.1 External ALC Section

ENABLE (switch) -- When the switch is in the enable position, the leveling system is programmed to ignore the internal detectors and use instead the input signal from an external detector.

INPUT (BNC connector) -- Accepts an input signal from an external detector.

GAIN (potentiometer) -- Screwdriver adjustment used to calibrate the instrument's leveling system to match the slope of an external detector's transfer curve.

OFFSET (potentiometer) -- Screwdriver adjustment used to calibrate the instrument's leveling system to match the intercept point of an external detector's transfer curve.

2.3.2 Master Reference Section

INT CLK OUT, 10 MHz (BNC connector) -- Provides a sample of the 10 MHz internal reference frequency, at 2 Vpp into 50 ohms.

EXT CLK IN, 10 MHz (BNC connector) -- Accepts an external 10 MHz reference input at 1 Vpp, which is automatically substituted for the internal reference.

PLL REF IN, 5 MHz (BNC connector) -- Accepts an external 5 MHz signal at 1 Vpp, which is automatically substituted for the reference frequency of the Reference Phase Lock Loop circuit; varying this input between 5 and 6 MHz causes a one for one change in the frequency of the RF output.

2.3.3 Interface Section

REMOTE (multiple-pin connector) -- Provides an interface connection between the Model 1026 and other equipment; the standard interface is the GPIB IEEE-488-1978, which uses a 24-pin connector.

ADDRESS (5-place DIP switch) -- Used to set the address of the instrument as a 5-bit binary number.

2.3.4 Line Power And Fuse Section

POWER INPUT (AC plug) -- A 3-terminal polarized connector with safety ground wired to the chassis.

LINE SELECTION (PC board) -- The card can be oriented four ways to select four different line voltages: 100, 120, 220 and 240 volts.

FUSE HOLDER -- Retains the power fuse, which should be 2.5A 3AG Slo-Blo for 100/120 volt operation and 1.25A 3AG Slo-Blo for 220/240 volt operation.

2.3.5 Pen Lift

The Pen Lift BNC connector provides a TTL low during sweep retrace; it can be used to control a recorder pen or other data recording device.

2.4 REAR PANEL OPERATION

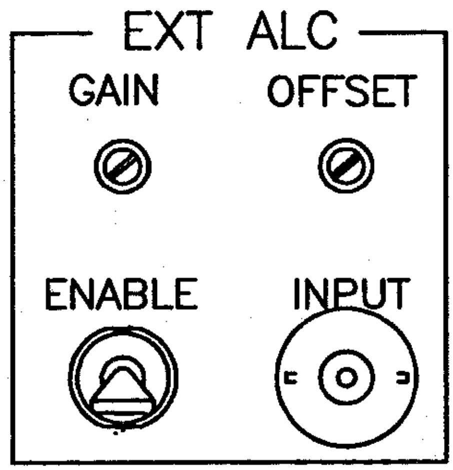


Figure 2.14: External ALC

2.4.1 External ALC

The external ALC function provides remote leveling capability. The circuit is designed to operate with a directional coupler/diode detector having a standard negative output. Gain and offset adjustments permit calibration of the instrument to match individual detectors. Note that losses in the cable between the instrument RF output and the remote detector will place a limit on both maximum output and leveling range.

1 -- Connect the remote cable and detector to the Model 1026. Connect the coupler/detector ouput to the rear panel 'EXT ALC' connector.

2 -- Connect a power meter to the detector output and set the 'EXT ALC' enable on.

3 -- With the front panel attenuators at 0 and the vernier off, adjust the rear panel 'GAIN' to maximum (clockwise) and then adjust the rear panel 'OFFSET' for a power meter reading of 0 dBm (assuming the cable loss permits).

4 -- Select -9 dBm on the front panel 1 dB attenuator. Readjust the offset for a power meter reading of -9 dBm.

5 -- Reset the instrument to 0 dBm out, and adjust 'GAIN' for a power meter reading of 0 dBm.

6 -- Repeat steps 4 and 5 as needed.

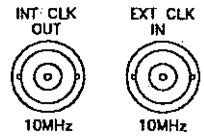


Figure 2.15: External master reference

2.4.2 External Master Reference

The clock output provides a buffered 10 MHz derived directly from either the internal master reference or any external standard applied. This output will drive a 50 ohm load to 2 Vpp.

The clock input accepts an external 10 MHz standard with an amplitude between .5 and 5 Vpp. The frequency of the standard must be accurate to within one part per million to insure that the Model 1026 will lock to it. Model 1026 automatically substitutes the external standard for the internal master reference whenever an input signal is present.

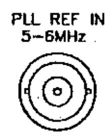


Figure 2.16: External PLL Reference

2.4.3 External PLL Reference

An external signal near 5 MHz, applied to the 'PLL REF IN/5-6 MHz' connector, can be substituted for the 5 MHz reference input to the Reference PLL, thereby shifting the RF output frequency by an amount equal to the difference between the input frequency and 5 MHz. The frequency range of the input is from 5 MHz to 20 MHz, and the rate is approximately 50 kHz. The formula is:

Fout = Fset + (Fx - 5 MHz), where Fout is the RF output frequency, Fset is the frequency setting of the Model 1026, and Fx is the frequency of the external signal.

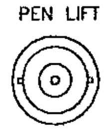


Figure 2.17: Pen lift

2.4.4 Pen Lift

The pen lift signal is provided to allow controlling the recorder pen lift. The signal goes low (a transistor to ground) whenever the sweep ramp is resetting or the sweep is in hold. During the sweep, the transistor is off and the pen lift output is pulled to +5 volts through a resistor.

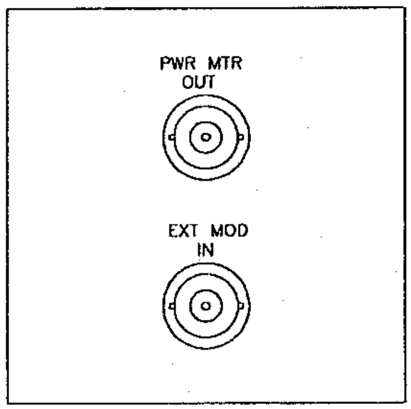


Figure 2.18: Power meter out & ext modulation in

2.4.5 Power Meter Output, and External Modulation Input

The power meter output provides an analog signal proportional to the external power meter reading in all modes of operation. The sensitivitiy is 0.5 V/dBm, nominal, with +10V and +10 dBm and -10 V at -30 dBm into 2 kΩ, min.

The external modulation input (if required) provides a rear panel input for the external pulse modulation input signal.

2.5 REMOTE CONTROL INTERFACE

Model 1026 permits data bus control in accordance with the IEEE-488 Standard Digital Interface for Programmable Instruments, IEEE-STD-488-1978. The table below shows which sets of the standard are implemented in the 1026.

SUBSET	TITLE	1026 IMPLEMENTATION
SH1	Source Handshake	Complete Capability
AH1	Acceptor Handshake	Complete Capability
T8	Talker	Basic Talker, No Serial Poll, No Talk Only, Unaddress if MLA
TEO	Extended Talker	No Capability
L4	Listener	Basic Listener, No Listen Only, Unaddressed if MTA
LEO	Extended Listener	No Capability
SRO	Service Request	No Capability
RL2	Remote/Local	No Local Lockout
PPO	Parallel Poll	No Capability
DCO	Device Clear	No Capability
DTO	Device Trigger	No Capability
CO	Controller	No Capability

2.5.1 Interface Hardware Configuration

A standard IEEE-488 interface cable may be used to connect the instrument to a controller. The 24-pin interface connector, located on the rear panel, has the following pin assignments:

PIN	SIGNAL	PIN	SIGNAL	PIN	SIGNAL
1	D101	9	IFC	17	REN
2	D102	10	SRQ	18	GND (6)
3	D103	11	ATN	19	GND (7)
4	D104	12	Shield	20	GND (8)
5	EO1	13	D105	21	GND (9)
6	DAV	14	D106	22	GND (10)
7	NRFD	15	D107	23	GND (11)
8	NDAC	16	D108	24	GND Logic

2.5.2 Address Assignment

The remote control bus address is assigned by the five small switches next to the interface connector. Switch 1 is the LSB; switch 5 is the MSB. For example, to assign the 1026 a bus address of 6 (listen address '&' and talk address 'F'), the switches would be set as follows:

Switch Number	1	2	3	4	5
Switch Setting	0	1	1	0	0

NOTE: A bus address of 31 (all ones) is invalid.

2.5.3 Command Interpretation

The instrument employs a 40-character buffer to accept and store characters sent to it via the interface. Multiple sequential spaces are compressed to a single space character for storage in the buffer. The buffer's contents are interpreted and the buffer is reset upon receipt of a character sent with the EOI line asserted or upon receipt of any of the following delimiter characters:

'<CR>' '<LF>' ',' ':' ';' '/' '\'

Multiple commands may be sent in a single message if they are separated from each other by a space or one of the above delimiter characters. If the commands are separated by delimiter characters, each command will be interpreted individually upon receipt. If the commands are separated by spaces, they will not be interpreted until the entire message has been sent. Note that if spaces are used to separate commands, care must be taken to assure that the 40 character buffer does not overflow. Buffer overflow may cause some commands to be ignored.

2.5.4 Interface Initialization Values

The IEEE-488 interface is initialized upon assertion of IFC by the controller, upon instrument power up (CPU reset), and whenever the rear panel address switch settings are changed. The 1026's remote control data is initialized to the 'GENzFIXED' mode with no modulation. Frequency and output level are initialized to the minimum values. The power meter is configured to measure internal power.

2.6 GIGA-TRONICS REMOTE PROGRAMMING SYNTAX

2.6.1 Character Representation

Command names are represented in capital letters. Small letters are used for special characters, as shown in the table below:

Shown as	Interpreted as
(cr)	carriage return
(lf)	line feed
s	one space
z	zero or more spaces
b	one or more spaces
d	one decimal digit
a	one alphabetic character
n	numeric argument (see below)

2.6.2 Command Format

The standard command line format consists of a verb, followed by zero or more spaces, followed by an argument. In the command 'MODzOFF', MOD is the verb and OFF is the argument.

Sometimes the argument consists of a number. In the command 'FAz9E+3', FA is the verb and 9E+3 is the argument. Numeric arguments are represented in command descriptions by a lower case 'n'. The format for numeric arguments is sufficiently flexible that no special formatting will be needed when using most IEEE-488 controllers. Signed or unsigned numbers are acceptable. Integers or decimal fractions are permitted and may be followed by a signed or unsigned one or two digit exponent. Leading zeroes are permitted, but spaces within a number are not permitted. The integer and optional fractional part are each restricted to a maximum length of 10 digits. The table below shows examples of valid numeric arguments.

Entered as	Interpreted as
_25.7	25.7
_7_	7
-32.1	-32.1
2.6E-6	2.6×10^{-6}
6E-10	6×10^{-10}
-000.145E+9	-0.145×10^{9}
1E6	1×10^{6}

2.6.3 Commands

The tables which follow present all of the remote control commands. Command verbs are listed and defined in parentheses, followed by the available verb/argument combinations. For commands requiring a numeric argument, the acceptable range of values is determined by instrument specifications; for example, it is not permitted to specify a frequency outside the range of the instrument.

Remote Control Commands, IEEE-488 Interface	
Command	**Description**
(GEN)	**(set signal generation mode)**
GENzFIXED	generate fixed (CW) frequency
GENzUSWP	generate unlocked sweep
GENzLSWP	generate locked sweep
(MEAS)	**(set frequency measurement mode)**
MEASzDIR	measure direct (no frequency offset)
MEASzDEL	measure ΔF (with frequency offset) NOTE: Option 03 (1 kHz resolution) applies only in the locked generate modes. Therefore, the offset frequency setting for frequency measurement has a resolution of 1 MHz. Any digits of lower significance are ignored.
(MOD)	**(set modulation mode)**
MODzOFF	modulation off
MODzPULSE	internal pulse modulation
MODzSQR	internal square wave modulation
MODzEXT+	external pulse modulation, positive-going trigger (see note below)
MODzEXT-	external pulse modulation, negative-going trigger (see note below)
NOTE:	The 1026 will not operate properly if it is set for external pulse modulation and no trigger input is applied to the EXT MOD IN connector. In the pulse modulation mode, output leveling is controlled by a sampling system which is triggered by the external modualtion input. When the necessary input is not provided, output power may drift to unpredictable levels, the power display may be incorrect, and the 'LEVEL' indicator may or may not be lit.
(MODRATE)	**(set internal modulation rate)**
MODRATEzFIXED	fixed 1 kHz rate
MODRATEzVAR	rate variable via front panel controls
(PWIDTH)	**(set internal pulse width)**
PWIDTHzFIXED	1 usec width
PWIDTHzVAR	width variable via front panel control

Command	Description
(AGC)	**(set leveling loop time constant for external modulation)**
AGCzFAST	short time constant (see note below)
AGCzSLOW	long time constant (see note below)
NOTE:	This command, used during external pulse modulation, sets the approximate response time for the leveling loop. Use 'SLOW' for modulation rates of less than 1 kHz, and 'FAST' for higher modulation rates.
(LVERN)	**(set front panel level vernier control)**
LVERNzON	enable vernier control
LVERNzOFF	disable vernier control
(EXTALC)	**(set external ALC mode)**
EXTALCzON	enable external ALC
EXTALCzOFF	disable external ALC
(POWER)	**(set power meter mode)**
POWERzINT	measure internal power
POWERzEXT	measure external power
POWERzDELTA	measure difference between internal and external power (ΔP mode)
POWERzCAL	call up cable normalization functions (see CAL command below)
(CAL)	**(set cable normalization mode)** **NOTE: Changing between local and remote control does not alter the cable normalization function or erase the stored data.**
CALzRUN	sweep cable and record cable compensation data (the status message will be 'CALs0' while data is being taken, 'CALs1' when calibration is complete)
CALzNO	disable cable normalization
CALzYES	enable cable normalization with current stored cable compensation data
CALzCLEAR	delete previously stored cable compensation data (cable normalization will be disabled, and cannot be re-enabled until another calibration sweep has been run)

Remote Control Commands, IEEE-488 Interface	
Command	**Description**
(SWEEP)	**(set frequency sweep function)**
SWEEPzAUTO	automatic repetitive sweep
SWEEPzONCE	single sweep, not triggered (a complete sweep is done each time this command is received; compare to SWEEPzTRIG)
SWEEPzTRIG	single sweep, triggered (a pulse on the sweep trigger input causes one complete sweep)
SWEEPzSTEP	single step, not triggered (one step equal to FC is done each time this command is received; compare to SWEEPzSTPTRIG))
SWEEPzSTPTRIG	triggered single step (one step equal to FC is done each time a pulse is received at the sweep trigger inpu)
SWEEPzRESET	sweep reset (immediately terminates sweep; to restart, send the desired sweep comand)
SWEEPzNUL	effect is determined by current sweep function (for ONCE, STEP, or RESET, it has no effect; for TRIG or STPTRIG, it produces the same effect as RESET; for AUTO it produces the same effect as RESET but not until the end of the sweep)
(SWPRATE)	**(set sweep rate)**
SWPRATEza	'a' signifies any alphabetic character from A through J (the letters correspond to the positions of the front panel sweep rate control, A being the slowest)
(DISP)	**(set front panel 7-segment displays)**
DISPzON	enable 7-segment displays
DISPzOFF	disable 7-segment displays
NOTE:	When the displays are disabled, the leftmost and rightmost digits are illuminated as brackets to serve as standby indicators; all other digits are blank, but any error messages will continue to appear in the frequency display panel. The displays are enabled upon initialization and at all times during local operation.

Remote Control Commands, IEEE-488 Interface	
Command	**Description**
('F' commands)	**(set frequency)** **FA, FB, and FC require a numeric argument specifying frequency in MHz; digits in excess of the instrument's resolution are ignored without rounding. The following conventional frequencies specify limits:** **F min = minimum CW generate frequency (normally 50 MHz),** **F max = maximum CW generate frequency (normally 26500 MHz),** **F lo = minimum measurement frequency (normally 100 MHz),** **F hi = maximum measurement frequency (normally 26000 MHz).**
FAzn	*set the frequency under any of the following commands to 'n' MHz:*
	for GENzFIXED, set output frequency; F min ≤ 'n' ≤ F max
	for GENzUSWP, set sweep start frequency; F min ≤ 'n' < F max
	for GENzLSWP, set sweep start frequency; F min ≤ 'n' < F max
	for MEASzDIR, set search start frequency; F lo ≤ 'n' < F hi
	for MEASzDEL, set measurement offset frequency; F lo ≤ 'n' ≤ F hi
FBzn (NOTE: 'FBzn' commands are ignored in 'GENzFIXED' and 'MEASzDEL' modes.)	*set the frequency under any of the following commands to 'n' MHz:*
	for GENzUSWP, set sweep stop frequency; 'FAzn' < 'n' ≤ F max
	for GENzLSWP, set sweep stop frequency; 'FAzn' < 'n' ≤ F max
	for MEASzDIR, set search stop frequency; 'FAzn' < 'n' ≤ F hi
FCzn (NOTE: 'FCzn' commands are ignored in 'GENzFIXED', 'MEASzDIR' and 'MEASzDEL' modes.)	*set the frequency step size under either of these commands to 'n' MHz:*
	for GENzUSWP, set step size; 1.0 ≤ 'n' ≤ F max
	for GENzLSWP, set step size; 1.0 ≤ 'n' ≤ F max (for units with Option 03: 0.001 ≤ 'n' ≤ F max)

Remote Control Commands, IEEE-488 Interface	
Command	**Description**
(leveling commands)	**(set level)** **LEVEL, LVLCRS and LVLFNE require a numeric argument specifying level in dBm with .1 dB resolution; digits specifying finer resolution than this are ignored without rounding.**
NOTES:	The 'LEVEL' command specifies an output level, for which an appropriate combination of settings of the 10 dB step attenuator and leveling loop is programmed automatically. The attenuator is programmed to increment upon argument values that are evenly divisible by 10 (such as '-10.0', '-20.0', etc.). In some applications, it may be desirable to prevent the step attenuator from incrementing at such crossover points, in order to maximize the accuracy of very small level changes occurring near those points; to do this, use the 'LVLCRS' and 'LVLFNE' commands to set the attenuator and leveling loop values independently. Any of the following command messages will set the level to -28.5 dBm: 'LEVELz-28.5' [attenuator is set to -20 dB] 'LVLCRSz-20bLVLFNEz-8.5' [attenuator is set to -20 dB] 'LVLCRSz-30bLVLFNEz1.5' [attenuator is set to -30 dB]
LEVELzn	set output level to 'n' dBm valid argument range: $-99.9 \leq$ 'n' $\leq +15.0$
LVLCRSzn	set attenuator to 'n' dB valid argument range: $-90.0 \leq$ 'n' ≤ 0.0, in increments of 10; output power is the sum of LVLCRSzn and LVLFNEzn arguments, in dBm
LVLFNEzn	set leveling loop value to 'n' dB valid argument range: $-15.0 <$ 'n' $< +15.0$; output power is the sum of LVLCRSzn and LVLFNEzn arguments, in dBm
Leveling loop range limitations:	The leveling loop range is limited by the maximum output power which the instrument can produce. At very low levels, the on/off ratio of the instrument's PIN diode attenuators may also limit the leveling loop's range. Both the front panel vernier control and cable normalization, if enabled, may place demands upon the leveling loop in addition to those of the level commands. When the loop's dynamic range is exceeded, the front panel level light will go out. This condition can also be checked remotely by sending a 'SENDzSTATUS' command. If a very large correction is needed for cable normalization, the dynamic range of the leveling loop may be exceeded, causing 'ERRORs12' to be issued. 'ERRORs12' will also be issued upon receipt of invalid level command arguments. Leveling loop accuracy is reduced at very low levels (below about -12 dB). The internal power meter operates down to about -17 dB; lower levels will cause the power display to blank.

Remote Control Commands, IEEE-488 Interface	
Command	***Description***
(reply messages)	A reply message will be sent over the interface by the 1026 whenever it is addressed to talk. If unaddressed in the middle of a message, any remaining characters are cleared from the output buffer. EOI is asserted during the last character ('<LF>') of each message. The type of message sent is determined by the 'SEND' commands described below. If an error condition exists, a 'SENDzERROR' message type will be sent instead of the message type requested except for 'SENDzNUL' which always returns a null line ('<CR><LF>'). Numeric values have leading zeroes to the left of the units position suppressed to spaces. Numeric precision is expressed as (X) for integers and (X.Y) for numbers with fractional parts where X and Y specify the number of digits before and after the decimal point, respectively. For signed numbers, the sign is included in X [e.g., '+22.7' is (3.1)].
('SEND' commands)	**(these commands cause the 1026 to transmit requested messages over the remote control bus; the reply messages are described below for each command)**
SENDzNUL	sends a null line ('<CR><LF>'), even if an error condition is present
SENDzFREQ	Sends a message which specifies a frequency in MHz. If no valid measurement is available in 'MEAS' modes, 'n' = '-----'. For 'MEAS' modes the message is 'sFsINsn<CR><LF>'; 'n' is unsigned (5.4) for 'MEASzDIR', signed (4.5) for MEASzDEL'. For 'GEN' modes the message is 'sFsOUTsn<CR><LF>'; 'n' is unsigned (5) without Option 03, unsigned (5.3) with Option 03, '0' when sweep is reset.
SENDzPOWER	Sends a message which specifies power in dB or dBm, as appropriate, and is always signed (4.1). If no valid power reading is available, 'n' = '-----'. For 'POWERzINT', the message is 'sPsINTsn<CR><LF>. For 'POWERzEXT', the message is 'sPsEXTsnCR><LF>. For 'POWERzDELTA', the message is 'sPsDELsn<CR><LF>. When the instrument is running a cable measurement sweep, the message is 'sPsCALsn<CR><LF>.
SENDzSTATUS	Sends a message which specifies the status of three indicators; the message format is 'sLOCKsdsLEVELsdsCALsd<CR><LF>', where 'd' is either '1' or '0' to represent true of false. 'LOCK' and 'LEVEL' are true when their corresponding front panel lights are on. 'CAL' is true when cable normalization is enabled.

Theory of Operation Section 3

3 Theory of Operation

3.1 THE COMPUTER

Model 1026 is controlled by an internal microcomputer which is based on the 6809 microprocessor. The microprocessor controls, and communicates with, other circuits by means of several Peripheral Interface Adapters or PIAs. These devices act as windows through which information and commands are transmitted to and from the processor's 8-bit data bus. The microprocessor, the PIAs and the semiconductor memory will be referred to collectively as the computer.

The computer's internal clock is controlled by a 3.579 MHz crystal. This clock frequency was selected to minimize beat notes generated by its harmonics and the various instrument frequencies, most of which are exact multiples of 1 MHz.

The standard memory package includes a memory board holding 8K of RAM and 40K of ROM, with a socket providing room to add 8K of extra RAM or ROM. This accounts for 56K of the microprocessor's 64K memory addressing capability; the remaining 8K is taken up by the PIAs and the "reset" ROM on the CPU circuit card. The "reset" ROM is programmed with initialization data, correction data for the leveling control system, and other information unique to the individual instrument.

The computer generates and receives digital information required for operation of almost every instrument function. It receives and interprets the operator's commands, through either the front panel switches or the remote interface; it returns information to the operator, through either the front panel displays or the remote interface; it selects appropriate reference frequencies and intermediate frequencies in order to generate the RF output; it activates the appropriate YIG oscillators and tunes them; it selects appropriate filter lines, detectors and RF paths for a given frequency; it controls the power level and modulation of the output meter; it monitors the functioning of the instrument and supplies error messages and fault indications to the operator.

3.2 PHASE LOCK LOOPS

The purpose of a phase lock loop is to control the frequency of a variable oscillator in order to give it the same accuracy and stability as a fixed reference oscillator. It works by comparing two frequency inputs, one fixed and one variable, and supplying a correction signal to the variable oscillator to reduce the difference between the two inputs. For example, suppose that we have a 10 MHz source with a stability of 1×10^{-6}/year, and we wish to transfer that stability to a voltage controlled oscillator (VCO). The 10 MHz source is applied to the reference input of a phase lock loop circuit. The signal from the VCO is applied to the variable input. A phase detector in the PLL compares the two inputs and determines whether the variable input waveform is leading or lagging the reference. The phase detector has two outputs; pulses will appear at one of them (which one depends on whether the variable is leading or lagging), and the width of the pulses is proportional to the degree of phase difference. The pulses are averaged by a low pass filter and DC amplifier into a correction signal which (depending on polarity) causes the VCO to increase or decrease in frequency in order to reduce the phase difference. When the two inputs match, the loop is said to be "locked", and the variable input from the VCO then equals the reference input in phase, frequency, accuracy, and stability.

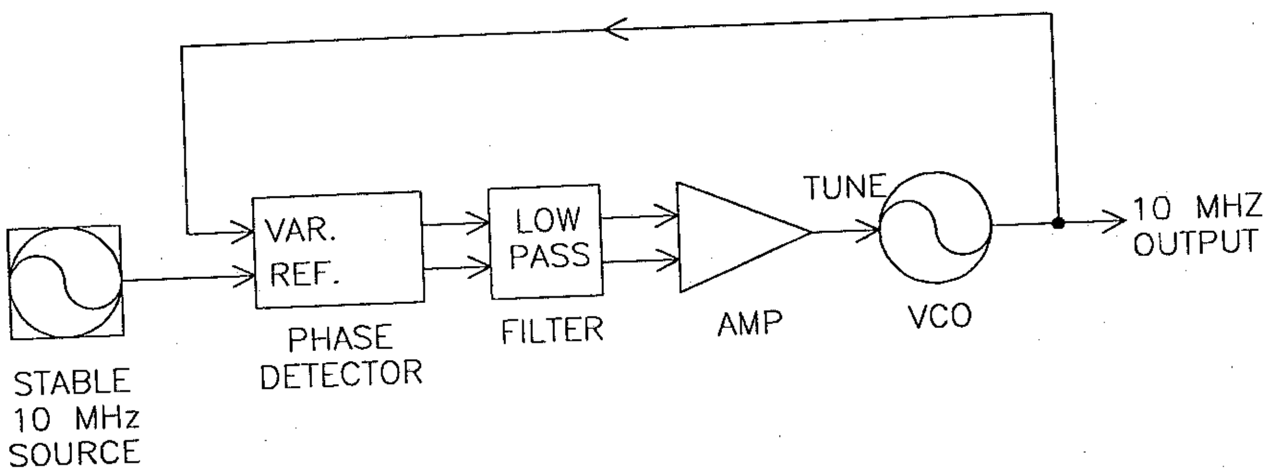


Figure 3.1: Phase lock loop circuit

The preceding description implies that the two oscillators must be of equal frequency, but that is not the case in practical applications. Usually, a prescaler (that is, a frequency divider) is introduced between the output of the variable oscillator and the variable input to the PLL. The circuit can then be used to control a frequency that is an exact multiple of the reference. If a divide-by-two circuit is used, the variable oscillator can be twice the frequency of the reference and still be phase locked to it; the variable oscillator acquires the stability of the reference without equalling its frequency. A 100 MHz VCO can be controlled by a PLL using a 10 MHz reference, provided a divide-by-ten circuit intervenes between the VCO's output and the variable input to the PLL. Then both inputs to the phase detector will be 10 MHz when the loop is locked.

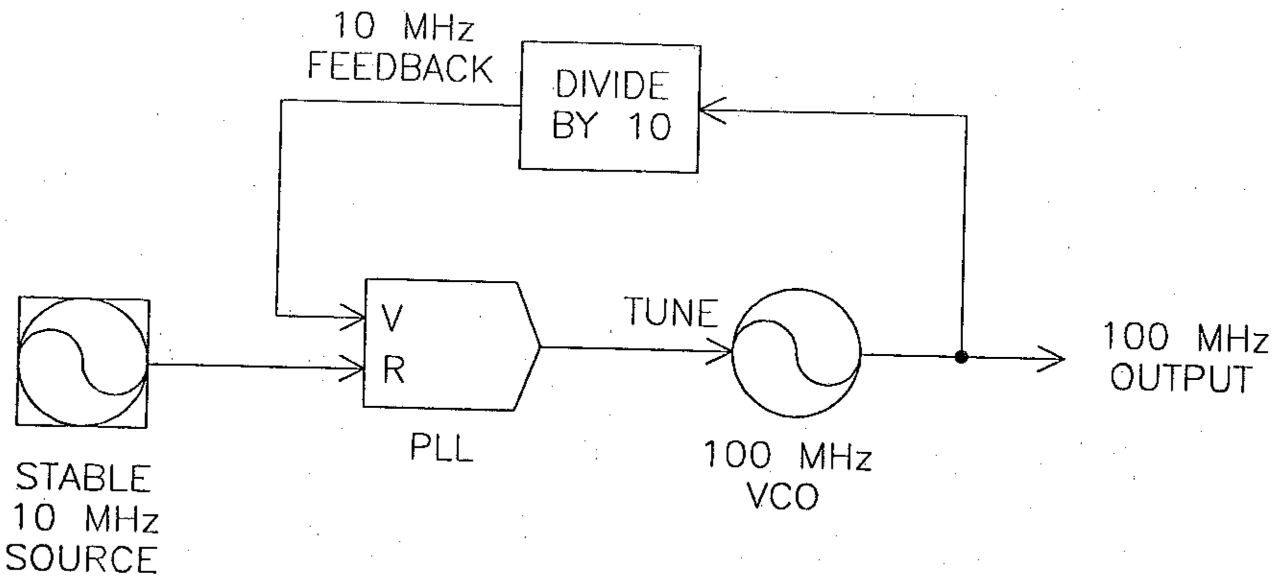


Figure 3.2: Phase lock loop, with prescaler

If the prescaler is a programmable divider, a number of different frequencies can be phase locked to the same reference, with the limitation that all must be even multiples of that reference. One of the PLLs employed in this instrument, for example, has a "divide-by-N" circuit that can be programmed with 300 different integer divisors; therefore it can phase-lock 300 different frequencies to the same reference.

The phase lock loops used in Giga-tronics instruments employ integrated circuit phase detectors, with external filter components and amplifiers designed to minimize the sidebands which the output pulses of the phase detector tend to contribute to the variable frequency.

3.3 DUAL-LOOP INDIRECT SYNTHESIS

The output of a synthesized signal generator is phase locked to a stable reference signal, such as that produced by a crystal oscillator, in order to give the generator output the stability and accuracy of the reference. This can be difficult to achieve, however, in broad-band generators.

In order to produce stable, spectrally pure frequencies over a wide frequency range, Giga-tronics employs a dual-loop synthesis technique. The two loops are (1) the output loop, which phase-locks the synthesizer output frequency to a reference frequency, and (2) the reference loop, which phase-locks the reference frequency to the timebase. The timebase or "master reference" is a highly stable 10 MHz source built into the instrument; an external source can be easily substituted for it at the option of the user.

3.4 THE OUTPUT LOOP

Depending on the range of the instrument, up to four fundamental YIG oscillators are needed to generate the RF output. The ranges of the individual YIGs are 2-8 GHz, 8-12 GHz, 12-18 GHz, and 18-26 GHz. Frequencies below 2 GHz are produced by downconversion (mixing the outputs of two oscillators to obtain an intermediate frequency). The frequency of a YIG oscillator is controlled by means of (1) its tuning coil and (2) its FM coil.

The tuning coil is used for coarse tuning under the direct control of the computer. The computer sends digital data to the appropriate YIG driver circuit, where a digital-to-analog converter and an amplifier turn this data into a controlled current supply to the YIG tuning coil. In this way the oscillator can be tuned to within about 10 MHz of the desired output frequency.

The FM coil is used for fine tuning of the oscillator under the control of the output phase lock loop circuit. The output PLL controls the current through the FM coil in order to phase-lock the YIG to the reference frequency.

When the operator selects an output frequency, the computer selects the appropriate YIG oscillator and (using the tuning coil) coarse-tunes it to within about 10 MHz of the desired output. The signal produced by this YIG will, at some point in the instrument's RF path, pass through a coupler which will return a sample of it to the reference mixer.

The other input to the reference mixer is not generated within the output loop; it comes from the reference loop, and is generated by the 1.9-8.7 GHz YIG (the reference YIG). This reference frequency is selected by the computer, and is 95 to 395 MHz lower than the frequency of the output YIG. The IF output of the reference mixer is equal to this difference between reference and output frequencies (in other words, the IF output has a range of 95 to 395 MHz).

The output loop requires a 1 MHz signal from the divide-by-N circuit regardless of the output frequency, because the output loop's phase detector compares the output of the divide-by-N with a timebase-derived 1 MHz reference. Therefore, the divide-by-N must be programmed so as to divide the mixer IF down to 1 MHz (the range of divisors for this circuit is 95 to 395). The divisor ("N") selected by the computer is equal to the mixer IF, in MHz. If the mixer IF is 195 MHz, "N" is set to 195. The 195 MHz IF is divided by 195 and a 1 MHz quotient results. The output PLL then compares its two 1 MHz inputs, and adjusts the current in the FM coil of the output YIG oscillator in order to achieve and maintain phase lock.

For example, if the user requests a 3000 MHz RF output, the computer selects the 2-8 YIG and tunes it to 3000 MHz, but only roughly (the YIG could, at this point, be generating 2994 or 3003 MHz, for example). At the same time, the computer selects the appropriate reference frequency (in this case 2805 MHz) and the appropriate divisor for the divide-by-N circuit (in this case 195, since there is a 195 MHz difference between the two loops). A sample of the output frequency is furnished to the reference mixer by means of a coupler in the RF path. The other input to the mixer is the 2805 MHz reference frequency. The mixer produces an IF equal to the difference between the reference and output the divide-by-N circuit, as programmed by the computer, divides this IF by 195 and supplies the result to the output phase lock loop.

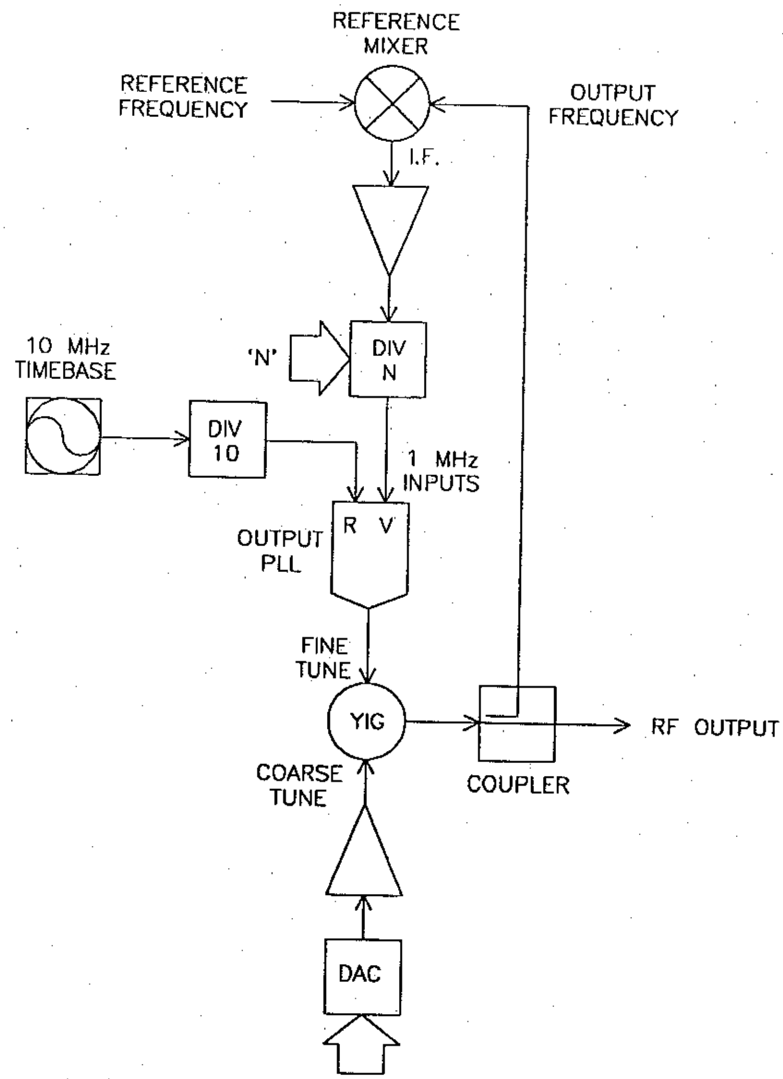


Figure 3-3: The output loop

However, since the output oscillator is not tuned to precisely 3000 MHz, the two loops will not be precisely 195 MHz apart, the mixer IF will not be precisely 195 MHz, and the result of dividing the IF by 195 will NOT be precisely 1 MHz. The output phase lock loop must correct the error. Comparing the rough 1 MHz signal from the divide-by-N circuit to an exact 1 MHz signal (derived from the timebase), the output PLL determines whether the mixer IF, and therefore the output loop (since the reference loop is assumed to be correct) is too high or too low in frequency, and sends to the output YIG's FM coil whatever correction is needed to reduce the error. In this way the output frequency can be fine-tuned to 3000 MHz, with the result that the mixer IF becomes precisely 195 MHz, the divide-by-N (programmed with a divisor of 195) supplies a precise 1 MHz input to the output PLL, and phase lock has been achieved.

3.5 THE REFERENCE LOOP

The operation of the output loop requires a stable reference frequency that is relatively close to the RF output frequency (the limitations of the divide-by-N circuit demand that the difference between the two loops be no greater than 395 MHz). Therefore, the reference loop must accomplish the task of generating a broad range of frequencies and locking them to a single timebase.

The heart of the reference loop is the step recovery diode multiplier, which is located within the sampling mixer module. This circuit generates multiple harmonics of the signal that is applied to it by the 100 MHz VCXO. Even frequencies as high as 8700 MHz (the 87th harmonic) are generated at useful amplitudes; this permits mixing of the desired harmonic with the microwave signal produced by the reference oscillator.

Since these harmonics generated by the multiplier are all based on the 100 MHz VCXO, they have the same stability as the VCXO. Since the 100 MHz VCXO is phase locked to the master reference, these harmonics have the same stability as the master reference. The 100 MHz VCXO is controlled by the 100 MHz PLL circuit, which compares the 10 MHz master reference to the output of the VCXO (suitably divided by ten) and sends a correction signal to the VCXO to maintain phase lock. The harmonics generated by the multiplier thus have not only the stability and accuracy of the master reference, but also the superior phase-noise characteristics of the VCXO. By phase locking the reference loop to one of the harmonics, it is possible to impart these desirable characteristics to the reference frequency as well.

The reference frequencies selected by the computer are always slightly offset from a multiple of 100 MHz. This offset is equal to either 5 MHz, or 1.667 MHz (which is 5 MHz divided by three). For example, a reference frequency of 2705 MHz is the 27th harmonic of 100 MHz, plus an offset of 5 MHz; the sampler would mix 2705 MHz with 2700 MHz (the 27th harmonic of 100 MHz) to yield a 5 MHz IF. If the reference frequency were 7601.667 MHz, the sampler would mix it with 7600 MHz to yield a 1.667 MHz IF. The 5 MHz or 1.667 MHz IF (following amplification and filtering) is supplied to the reference phase lock loop, which compares the IF to a timebase-derived reference and sends to the reference YIG's FM coil whatever correction signal is needed to maintain phase lock. As with the output YIGs, the 1.9-8.7 Reference YIG has a tuning coil for coarse tuning under the direct control of the computer, and an FM coil for fine tuning under the control of the reference PLL.

The reference loop operates in virtually the same way for any reference frequency. What varies is the harmonic used and the size of the offset (5 MHz or 1.667 MHz). The sampling mixer is not actually capable of choosing harmonics; its IF output includes many intermodulation products, but these higher frequencies are excluded by a low-pass filter on the sampling mixer output. Only an IF in the desired range can pass through to the phase detector of the reference loop.

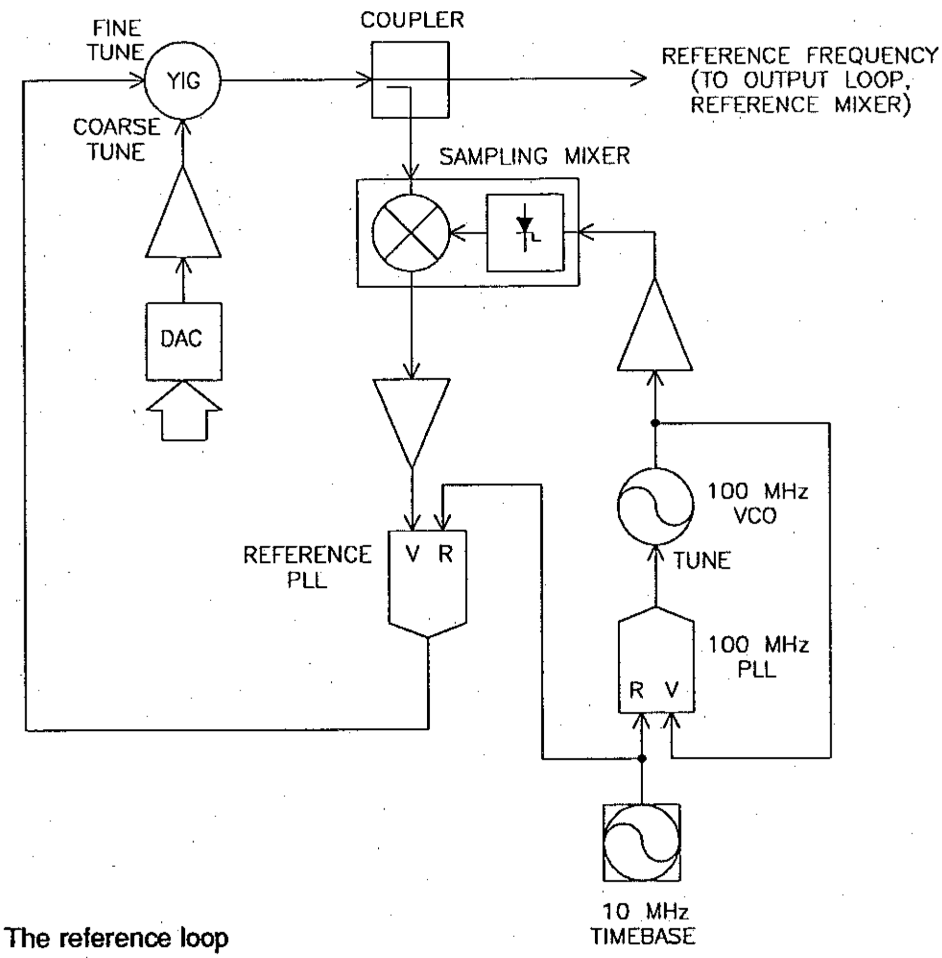


Figure 3.4: The reference loop

The choice of a 5 MHz or 1.667 MHz offset is determined by the output frequency. The 1.667 MHz offset is used when the frequency of the output oscillator exceeds the range of the reference oscillator. For example, an output frequency of 15000 MHz is well outside the range of the reference oscillator. In this case the reference frequency is set to 4901.667. The third harmonic of that frequency, 14705, is only 295 MHz lower than the output frequency; the reference mixer produces a 295 MHz IF based on the difference between the output frequency and the third harmonic of the reference frequency. This kind of third-harmonic mixing is required at output frequencies above 8499 MHz and also at down-converted frequencies from 495 to 1999 MHz. It has no effect on the reference loop, except that the timebase must be divided differently in order to provide a 1.667 MHz reference to the reference PLL phase detector. Reference frequencies (fREF) for all output frequencies (fOUT) are shown in the following tables.

OUTPUT & REFERENCE FREQUENCIES (all frequencies in MHz)							
fOUT	fREF		fOUT	fREF		fOUT	fREF
50-95	7905		5101-5200	5005		14801-15100	4901.667
96-195	8005		5201-5300	5105		15101-15400	5001.667
196-295	8105		5301-5400	5205		15401-15700	5101.667
296-395	8205		5401-5500	5305		15701-16000	5201.667
396-494	8305		6701-6800	6605		16001-16300	5301.667
495	2701.667		6801-6900	6705		16301-16600	5401.667
496-795	2801.667		6901-7000	6805		16601-16900	5501.667
796-1095	2901.667		7001-7100	6905		16901-17200	5601.667
1096-1395	3001.667		7101-7200	7005		17201-17500	5701.667
1396-1695	3101.667		7201-7300	7105		17501-17800	5801.667
1696-1995	3201.667		7301-7400	7205		17801-18100	5901.667
1996-1999	3301.667		7401-7500	7305		18101-18400	6001.667
2000-2100	1905		7501-7600	7405		18401-18700	6101.667
2101-2200	2005		7601-7700	7505		18701-19000	6201.667
2201-2300	2105		7701-7800	7605		19001-19300	6301.667
2301-2400	2205		7801-7900	7705		19301-19600	6401.667
2401-2500	2305		7901-8000	7805		19601-19900	6501.667
2501-2600	2405		8001-8100	7905		19901-20200	6601.667
2601-2700	2505		8101-8200	8005		20201-20500	6701.667
2701-2800	2605		8201-8300	8105		20501-20800	6801.667
2801-2900	2705		8301-8400	8205		20801-21100	6901.667
2901-3000	2805		8401-8499	8305		21101-21400	7001.667
3001-3100	2905		8500	2701.667		21401-21700	7101.667
3101-3200	3005		8501-8800	2801.667		21701-22000	7201.667
3201-3300	3105		8801-9100	2901.667		22001-22300	7301.667
3301-3400	3205		9101-9400	3001.667		22301-22600	7401.667
3401-3500	3305		9401-9700	3101.667		22601-22900	7501.667
3501-3600	3405		9701-10000	3201.667		22901-23200	7601.667
3601-3700	3505		10001-10300	3301.667		23201-23500	7701.667
3701-3800	3605		10301-10600	3401.667		23501-23800	7801.667
3801-3900	3705		10601-10900	3501.667		23801-24100	7901.667
3901-4000	3805		10901-11200	3601.667		24101-24400	8001.667
4001-4100	3905		11201-11500	3701.667		24401-24700	8101.667
4101-4200	4005		11501-11800	3801.667		24701-25000	8201.667
4201-4300	4105		11801-12100	3901.667		25001-25300	8301.667
4301-4400	4205		12101-12400	4001.667		25301-25600	8401.667
4401-4500	4305		12401-12700	4101.667		25601-25900	8501.667
4501-4600	4405		12701-13300	4201.667		25901-26200	8601.667
4601-4700	4505		13301-13600	4401.667		26201-26500	8701.667
4701-4800	4605		13601-13900	4501.667			
4801-4900	4705		13901-14200	4601.667			
4901-5000	4805		14201-14500	4701.667			
5001-5100	4905		14501-14800	4801.667			

3.6 THE DOWNCONVERTER

Frequencies below 2000 MHz are generated by mixing the outputs of two YIG oscillators. The 2-8 YIG provides a fixed 8005 MHz LO input to the downconverter mixer. The 8-12 YIG provides a variable RF input to the same mixer. The IF produced by the mixer (which is equal to the difference between these two inputs) is amplified and filtered in the downconverter module. Since two output oscillators are used simultaneously, there arises the problem of phase-locking both of them with only one output phase lock loop circuit. Therefore, an extra PLL must be added to any instrument which includes the downconverter (.05-2 GHz) band. This is the Fixed LO PLL circuit, which employs a sampling mixer indentical to that in the reference PLL; it mixes the 8005 MHz fixed LO with the 80th harmonic of 100 MHz (8000 MHz) to yield a 5 MHz IF. This IF is supplied to the phase detector of the Fixed LO PLL and compared to a timebase-derived 5 MHz reference. The PLL circuit adjusts the frequency of the 2-8 YIG in order to achieve and maintain phase lock. Note that, for frequencies below 2 GHz, the 2-8 YIG is fine-tuned by the Fixed LO PLL, while for frequencies from 2 to 8 GHz, it is fine-tuned by the output PLL.

Since the 8005 MHz fixed LO is provided with its own PLL circuit, the output PLL is free for use by the RF YIG (8-12). During operation in the downconverter range, the RF YIG is controlled by the output PLL in the same way that the output YIG would be during operation in the higher frequency ranges; the only real difference is that the frequency of the output loop and the actual output frequency of the instrument are not the same.

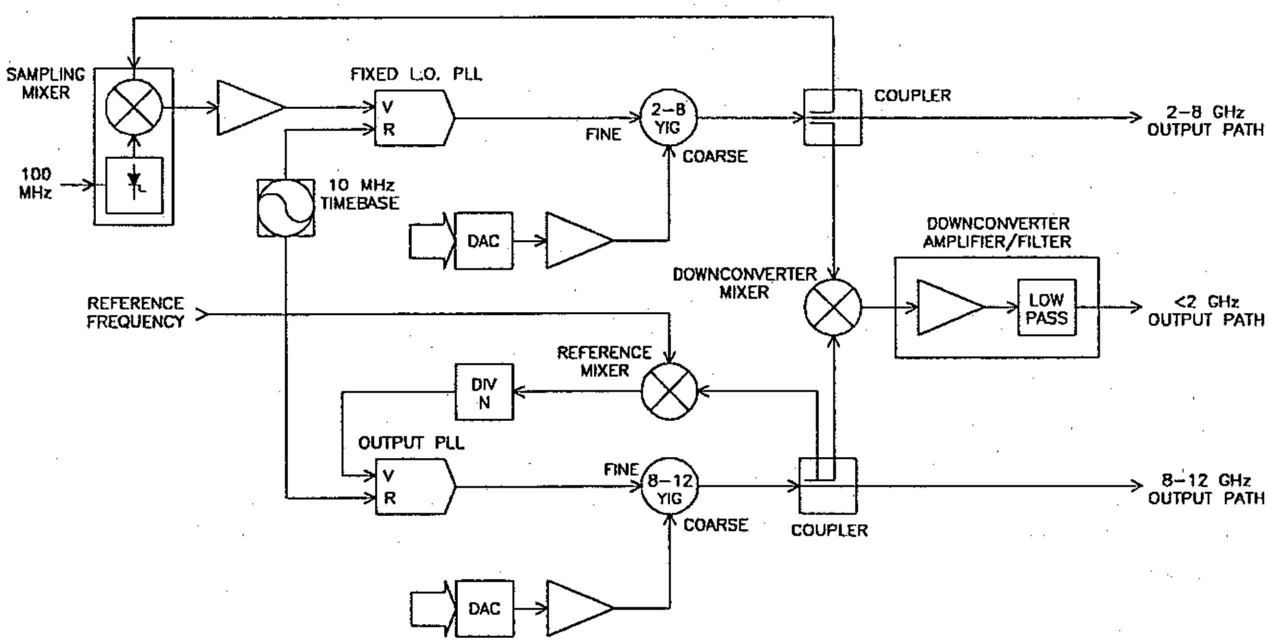


Figure: 3.5: The downconverter circuit

3.7 THE RF PATH

The path of transmission between the output of the fundamental YIG oscillator and the output of the instrument includes circuits which perform such functions as RF coupling, modulation, leveling, switching and filtering. It is important to simplify this path RF path as much as possible, because power is inevitably lost at interconnections. Giga-tronics cuts this loss to a minimum by designing hybrid RF circuits which incorporate several functions into single modules. The 2-8 and 8-12 output YIG oscillators each have a coupler/leveler/modulator/filter module on their outputs; the same functions are performed for the 12-18 and 18-26 bands by circuits included in the output switch module. This clustering of RF circuits greatly reduces the power loss which occurs at interconnections between circuits. All path switching is performed by PIN diode circuits, rather than by mechanical switches, for increased reliability.

3.8 PULSE MODULATION

Pulse modulation is essentially a means of shutting off the output signal for short periods. The modulation "off" pulses are applied to PIN diode switches in the RF modules. During "off" intervals, the particular RF path which is otherwise activated for the present output frequency is temporarily shut down. That is, during the "on" periods one output path is open, and during the "off" periods no output path is open. For frequencies in the downconverter range (below 2 GHz), the modulating pulses are applied to the 8-12 GHz module, shutting down the RF input to the downconverter mixer.

The very fast rising and falling edges of the modulating pulses are produced by driver circuits in response to a modulation waveform. The modulation waveform can be generated within the instrument, or it can be applied from an external source. The internal modulation source is a pulse/square wave generator with variable pulse rate and pulse width. The 10 MHz timebase is used to create the fixed 1 kHz rate and the fixed 1 usec width. For the purpose of synchronizing auxiliary instruments, a TTL level modulation waveform output is available, whether the modulation source is internal or external.

3.9 AMPLITUDE CONTROL

RF output amplitude is controlled by a combination of fixed-step attenuation and closed-loop leveling. The output stage of the synthesizer consists of a step attenuator providing up to 110 dB of attenuation in 10 dB steps. Finer control of the output power level is provided by the closed loop leveling system, also referred to as Automatic Level Control or ALC.

The level control system is similar to a phase lock loop, in that it compares a feedback input to a reference input and generates an output correction signal. The feedback input comes from a level coupler/detector in the RF path. The reference input is generated by the computer, based on the requested level setting and on correction data stored in memory. The output correction signal drives a variable attenuator circuit, placed in the RF path ahead of the level detector.

There are two internal level detectors, one for frequencies below 2 GHz, and another for higher frequencies. A remote detector is substituted for the internal detectors during operation in the External ALC mode. The detector feedback signal is amplified by a level sampler and processed by a logarithmic amplifier, in order to give the leveling loop a response that is linear in dB. In order to correct for variations in detector sensitivity with temperature, a temperature compensation circuit is included; as the ambient temperature changes, this circuit contributes a correction voltage to the detector feedback signal. Another correction added to the detector feedback signal comes from the front panel RF vernier; this permits the user to increase or decrease the RF level directly when the vernier is activated.

The RF path includes PIN diode attenuator circuits dedicated to the 2-8, 8-12, 12-18 and 18-26 bands. During operation in the downconverter band (below 2 GHz), the 2-8 attenuator circuit is used to adjust the level of the LO input to the downconverter mixer. The level control circuit furnishes a correction signal to the appropriate attenuator, adjusting the output level until the detector feedback input is equalized with the computer-generated reference input.

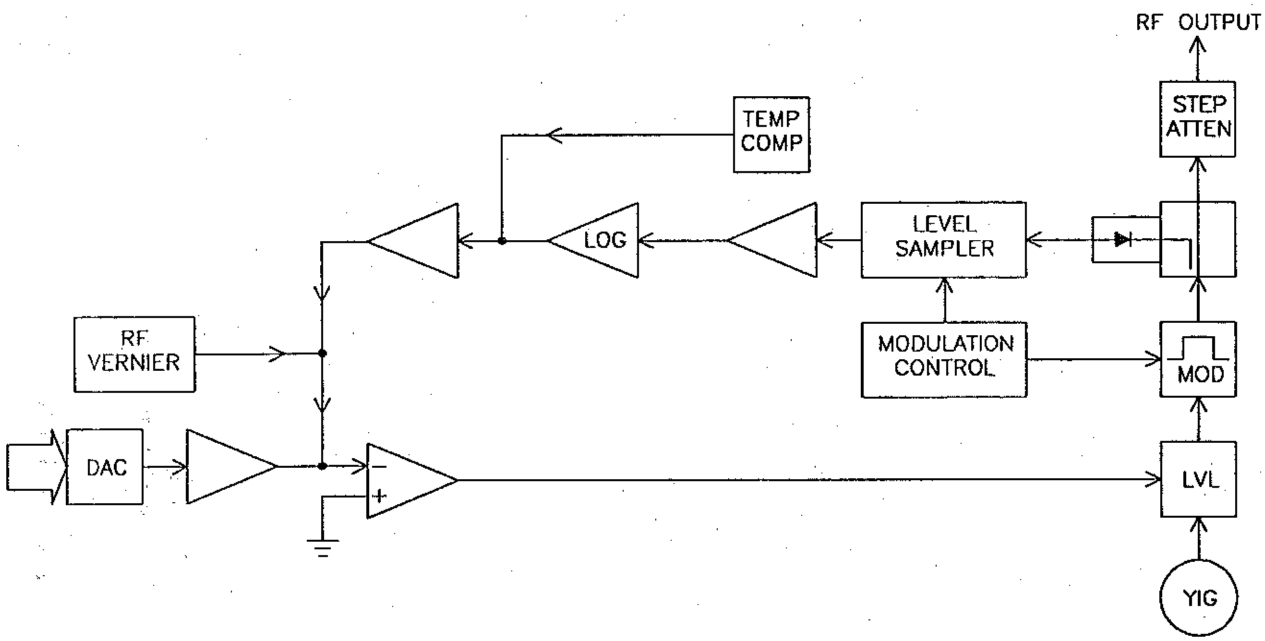


Figure 3.6: Amplitude control

3.10 THE RF SWEEPER

Because it is computer controlled, the synthesizer can easily be used as a sweeper. The user selects start and stop frequencies, and the instrument sweeps between those limits once or repetitively, by various increments, at various rates or in single steps. The sweep always increments from a lower frequency to a higher frequency, resetting to the lower. An analog output proportional to progress between sweep limits is available, with 0 volts at the start frequency and +10 volts at the stop frequency. A pen lift output signal is provided for controlling a recorder pen: the signal is low (a transistor to ground) during sweep reset or when the sweep is in hold. A single sweep or a single step can be initiated by means of a trigger input as well as by pushbutton.

There are two basic sweep modes, "locked" and "unlocked". In the first, the output phase lock loop remains active and the computer waits for the loop to acquire phase lock at each new frequency before moving on to the the next. In the second mode, the output phase lock loop is disabled and the free-running oscillator slew through the required range under the coarse-tuning control of the computer.

3.11 THE FREQUENCY COUNTER

When the instrument is used as a frequency counter, the input frequency to be measured is mixed with a known frequency, synthesized by the instrument, in order to yield an intermediate frequency which is low enough to drive digital counter circcuits. There are two counter mixers. The low range mixer (located within the 'Power Splitter' module, which directs the RF input to one mixer or the other) takes its LO input (<2 GHz) from the downconverter. The high range mixer, located outside the power splitter, takes its LO input from the 'Mixer Switch' module; this LO input comes ultimately from the 2-8 and 8-12 YIG oscillators. For input frequencies above 12 GHz, third-harmonic mixing is used.

The IF output lines from the mixers are connected to the Counter Input Amplifier board (A104), where a switch circuit directs the IF from the active mixer to the automatic gain control circuit. The AGC circuit consists of a variable attenuator and amplifier; feedback from the amplifier output drives the variable attenuator in order to stabilize the amplifier output at a particular level regardless of the signal strength of the original input. This circuit is needed because the IF outputs from the counter mixers are highly variable in power. A detector circuit monitors for the presence of input power; if the RF input to be counted is pulse-modulated, the detector circuit produces logical pulses which trigger the counter so that it counts only during the "on" periods.

The amplified IF, and the detector circuit output, are applied to the Counter Logic board (A105). Also applied to that board is a fixed 100 MHz reference signal. A gating circuit allows two digital counters to count the IF and the reference signal during synchronized intervals (for pulse modulated inputs, the detector circuit output insures that these intervals occur only during pulse "on" periods). The circuits which count these frequencies are complex, and portions of them are on a separate PC board (the Counter PIA board (A6). By counting the IF and the 100 MHz reference during identical periods, the system computer establishes the frequency ratio between them, and calculates the frequency of the IF. Since the frequency of the LO input to the counter mixer is known, the computer is also able to calculate RF input frequency from the IF. The resulting RF frequency measurement is furnished to the operator, via the front panel displays or the remote interface.

In order to "capture" the input frequency, the computer has to set an appropriate value for the LO frequency to the counter mixer. The LO frequency must be close enough to the RF frequency to yield a mixer IF within the range of the digital counter circuits (<200 MHz). Depending on the search range defined by the user, the computer sweeps through a range of LO frequencies until an IF is captured. Even after the IF has been found, the computer must experiment with changes in the LO frequency, in order to determine whether the RF input is higher than, or lower than, the LO, and also to determine whether IF is a result of fundamental mixing or third-harmonic mixing.

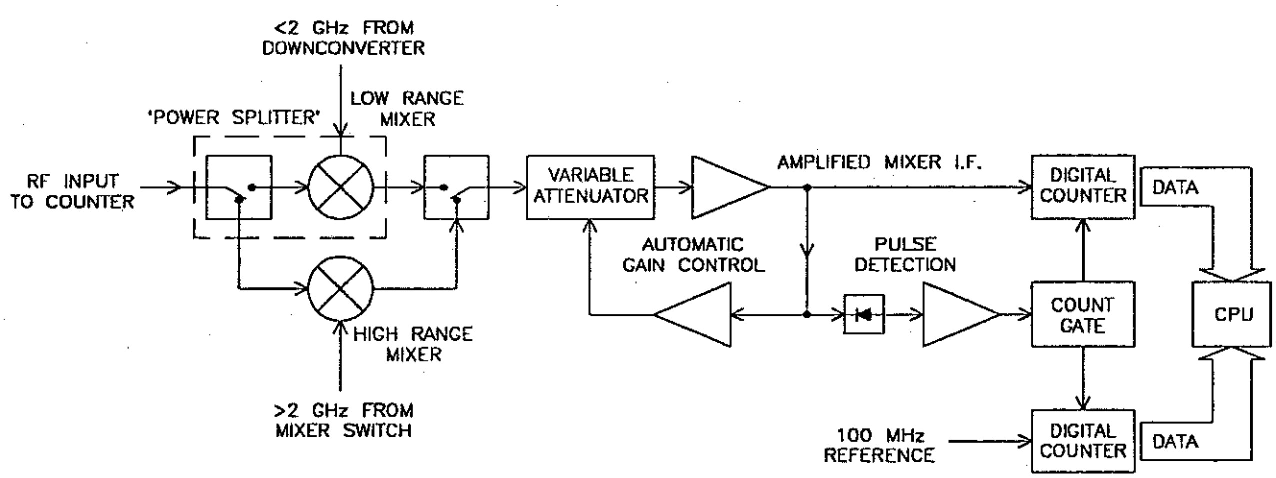


Figure 3.7: The frequency counter

3.12 THE RF POWER METER

A built-in power meter monitors the RF output of the instrument. An external RF power input is also included, so that this meter may also be used to measure the power output of external RF sources, over a range of -30 dBm to +10 dBm, from 50 MHz to 26 GHz. A third mode of operation enables the meter to read the power difference between the output of this instrument and the output of an external source.

The external power meter input is applied to a level detector, similar to the detectors used by the level control system. The processing of the detector signal involves a number of corrections which must be made in order to insure that the meter's response is accurate throughout its 40 dB range. A logarithmic amplifier (located on the Leveling Log Amp board, A19) conditions the detector output to be linear in dB. Amplifier stages before and after the log amp provide other corrections, including low-power compensation. In order to prevent low-level detector inputs to the log amp from being overwhelmed by noise, the amplifier stage ahead of the log amp provides extra gain when the signal is below a certain level; this is compensated for by the amplifier stage following the log amp. The compensated log amp output is supplied to the AM Level Control board (A7), where an analog-to-digital converter translates it into digital data. In order to compensate for the non-linearity of detector response at high power levels, the system computer adds an adjustment factor when it processes the power meter data.

The internal power meter operates similarly. There are two internal detectors for the ranges above and below 2 GHz; the output of the active detector is processed by a log amplifier on the A19 board, and converted into digital data by the analog-to-digital converter on the A7 board. The system computer converts the data into a power meter reading.

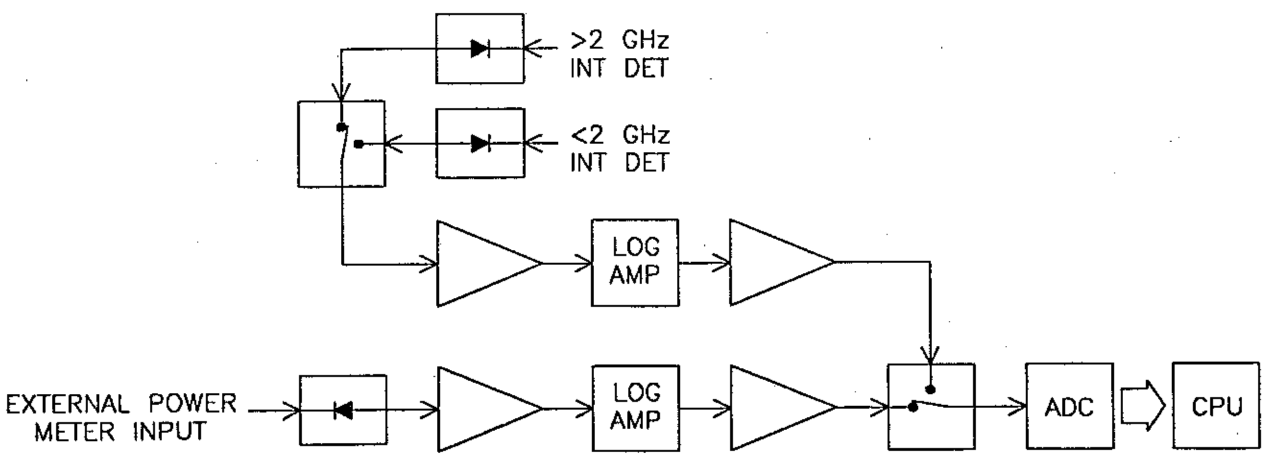


Figure 3.8: The power meter

Calibration and Testing — Section 4

4 Calibration & Testing

CALIBRATION PROCEDURE

Required Test Equipment

Frequency Standard, 10 MHz

Oscilloscope, .1 microsec timebase, min

Frequency Counter, 26 GHz

Power Meter/Sensor, 0.5 to 4 GHz, -9 to +10 dBm

Detector

Spectrum Analyzer, 2 GHz

4.1 MASTER OSCILLATOR CALIBRATION

1. Turn on Unit Under Test and allow a 20 minute warm-up, covers on.

2. Connect the 10 MHz output on the rear panel of the UUT to the oscilloscope vertical input, adjust oscilloscope for a mid- to full-scale display at .1 microsec/cm timebase setting.

3. Connect the output from the frequency standard (1, 2, 5, 10 MHz) to the oscilloscope external trigger input and adjust the oscilloscope to trigger on this signal.

4. Remove the UUT top cover and adjust the master oscillator frequency adjust (located under a screw-in cap) until the scope display stands still. Use the X10 expander for more resolution.

5. Replace the screw-in cap on the oscillator.

4.2 100 MHZ PHASE LOCK LOOP ADJUSTMENT

1. Turn on the UUT and allow a 20 minute warm-up, both covers off.

2. Monitor TP1 on the 100 MHz PLL PC board (A8) with the oscilloscope (DC coupled, 1 V/cm).

3. Using a non-metallic tuning tool (or one which has only a small metal tip) adjust the trimmer capacitor on the 100 MHz oscillator module for an oscilloscope reading of 3.5 $\pm$.25 V. This adjustment is accessible through a hole in the module cover on the bottom side of the UUT.

4.3 REFERENCE OSCILLATOR TRACKING

1. Turn on the UUT and allow a 20 minute warm-up, covers off.

2. Connect the frequency counter to the test port, TJ1, on the reference coupler (see the Reference Oscillator Assembly diagram, p. 7-14).

3. Connect the oscilloscope to the test point on the (A16) reference PLL. (DC coupled 1v/cm, GND @ center).

4. Select CW mode, no modulation.

5. Set the Start-CW switches to 2.005 GHz.

6. Adjust the "MIN" pot (R3) on A13, 1.9-8.7 YIG driver, for 0 ±.25V on the oscilloscope with the frequency at 1.905 GHz (on the counter).

7. Set the Start-CW switches to 7.005 GHz.

8. Adjust the "MAX" pot (R4) on A13, 1.9 -8.7 YIG driver, for 0 ± .25V on the oscilloscope with the frequency at 6.905 GHz (on the counter).

9. Repeat steps 4 to 8 as required.

4.4 OUTPUT OSCILLATOR TRACKING

1. Turn on UUT, select auto sweep, 10 MHz steps, mid-range rate, start at 2.000, stop at 26.500. Allow a 20 minute warm-up, covers off.

2. Set output for 0 dBm and connect the frequency counter to the front panel RF output.

3. Connect the oscillator to the A9, Output PLL, test point (DC coupled, 1V/cm, Gnd @ center).

4. Select CW mode and guided by the following table adjust each of the four output oscillators such that the test point voltage is 0 ±.5V with the counter reading the selected frequency to 1 MHz resolution.

STEP	FREQUENCY	ADJUSTMENT
1	2.000	(A11) MIN (R3)
2	7.900	(A11) MAX (R4)
3	Repeat 1 & 2 As Required	
4	8.000	(A14) MIN (R3)
5	11.900	(A14) MAX (R4)
6	Repeat 4 & 5 As Required	
7	12.000	(A12) MIN (R3)
8	17.900	(A12) MAX (R4)
9	Repeat 7 & 8 As Required	
10	18.000	(A10) MIN (R3)
11	26.500	(A10) MAX (R4)
12	Repeat 10 & 11 As Required	

5. Starting at 2 GHz, increment the frequency in 100 MHz steps, monitoring the A9 test point. Within each of the above bands, readjust the appropriate controls, if necessary, to maintain the voltage within 2V of ground.

4.5 RF OUTPUT AMPLITUDE CALIBRATION – CW

1. Turn on UUT and allow a 20 minute warm-up, covers on.

2. Connect the power meter sensor to the RF output connector and set both attenuator switches to 0.

3. Enable the vernier and turn it fully clockwise.

4. Find a frequency in the 2-4 GHz band where an output in excess of +10 dBm can be obtained. If not possible, pick the next lower 1 dB increment.

5. Adjust the vernier knob until the power meter reads +10 dBm (or +9, etc., as appropriate).

6. With the vernier disabled, set the 1 dB attenuator to -9. Adjust "-10 dB" (R30) on A7 for a power display reading of -9 dBm. Adjust "CW OS" (R15) on A19 for a power meter reading of -9 dBm ±.2 dB. Repeat if necessary.

7. Set the 1 dB attenuator to 0. Adjust "0 dB" (R29) on A7 for a power display reading of 0 dBm. Adjust "LG GN" (R28) on A19 for a power meter reading of 0 dBm ± .2 dB. Repeat if necessary.

   NOTE: Variations in level detector response from one instrument to another are sometimes large enough to require a change in nominal resisitor values when a spare Leveling Log Amp board is installed. If R28 reaches the end of its adjustment range, it may be necessary to replace the series resistor R26, which has a nominal value of 10K ohms. R26 may be changed to as low as half its nominal value, or as high as twice its nominal value, as needed for calibration.

8. Set the vernier enable on and adjust the vernier for a power display reading of +10 dBm (+9, etc.). The level light must be on. Adjust "CW GN" (R25) on A19 for a power meter reading of +10 dBm ± .2 dB. The level light must be on.

   NOTE: Variations in level detector response from one instrument to another are sometimes large enough to require a change in nominal resisitor values when a spare Leveling Log Amp board is installed. If R25 reaches the end of its adjustment range, it may be necessary to replace the series resistor R16, which has a nominal value of 90.9K ohms. R16 may be changed to as low as half its nominal value, or as high as twice its nominal value, as needed for calibration.

9. Repeat steps 6 through 8 as required.

10. Recheck the actual power output vs. the power display at -9, 0, and +5. Verify the output is ± .3 dB at -9 dBm; ± .2 dB at 0 dBm; ± .3 dB at +5 dBm. Readjust the appropriate controls as required (see steps 6 through 8).

11. Set the frequency to 500 MHz, both attenuators to 0, vernier off.

12. Adjust "C GN" (R11) on A18 for a power meter reading of 0 dBm.

13. Set the 1 dB attenuator to -9 dB and adjust "C OS" (R24) on A19 for a power meter reading of -9 dBm.

14. Repeat steps 11 through 13 as required.

15. Starting at .1 GHz, with the amplitude set to 0 dBm, increment the frequency in 100 MHz steps up to 1.9 GHz. Verify that the power meter reading maintains 0 ±1 dB. If needed, readjust "C GN" (R11) on A18 and "C OS" (R24) on A19 to achieve this tolerance.

4.6 RF OUTPUT AMPLITUDE CALIBRATION – PULSE

1. Turn on UUT and allow a 20 minute warm-up, covers on. Be sure that the CW calibration has been done.

2. Connect the detector to the RF output connector. Connect the detector output to the DC coupled oscilloscope input.

3. Set the frequency to 2 GHz, CW mode, leveling on, both attenuators to 0, modulation off. Set the ground reference on the scope at the top of the screen. Use about 50 mV/Div sensitivity.

4. Note the amplitude produced by the detector at this 0 dBm level. Now change the 1 dB attenuator to -9 dBm and again note the amplitude.

5. Set the modulation rate mid-range, X10 on. Select squarewave mode and adjust "PL OS" (R6) on A19 for the same amplitude as in CW at -9 dBm.

6. Change the 1 dB attenuator to 0 dBm and adjust "PL GN" (R1) on A19 for the same amplitude as in CW at 0 dBm.

7. Repeat steps 5 and 6 as needed.

8. Select a frequency of 500 MHz. Again calibrate the oscilloscope as in step 4.

9. Adjust "P OS" (R27) on A19 for calibration at -9 dBm.

10. Adjust "P GN" (R12) on A18 for calibration at 0 dBm.

11. Repeat steps 9 and 10 as needed.

4.7 POWER METER CALIBRATION

1. Turn on UUT and allow a 20 minute warm-up, covers on. Be certain that the CW calibration has been done. Set CW mode, no modulation.

2. Connect the power meter to the RF output. Enable the vernier and set it fully clockwise for maximum output. Find a frequency above and as close to 2 GHz as possible where the power meter will read in excess of +10 dBm. If none is found under 3 GHz then use +9 or +8 and subtract the 1 or 2 dB as needed. Turn the level vernier down until the level light is on with the power at +10 (or +9, etc.).

3. Connect a <u>very short</u> piece of low loss coaxial cable from the RF output to the power meter input. It is best to use .141 diameter semi-rigid.

4. With the 10 dB step attenuator at -20 dBm, switch the power meter switch to external and adjust "-10" (R45) on A19 for a reading of -10 dBm, ±.3 dB.

5. Set the 10 dB attenuator to 0 dBm and adjust "TRK" (R51) on A19 for a reading of +10 dBm, ±.3dB.

6. Repeat steps 4 and 5 as needed.

7. Set the 10 dB attenuator to -10 dBm and adjust "-20" (R31) on A19 for a reading of 0 dBm, ±.3 dB.

8. Repeat steps 4 through 7 as required.

9. Set the 10 dB attenuator to -40 dBm and adjust "-30" (R29) on A19 for a reading of -30 dBm, ±1 dB.

10. Check the power meter accuracy at each 10 dB step from 0 to -40 and insure that the readout is within the required accuracy of ±2 dB, -11 to -30 dBm; ±1 dB, -10 to +10 dBm.

4.8 OUTPUT PHASE LOCK LOOP BALANCE

1. Select 2 GHz and 0 dBm out. Connect the analyzer to the RF output.
2. Tune the analyzer to 2 GHz, using 1 MHz/Div scanwidth.
3. Adjust the balance pot (R4) on A9 for minimum 1 MHz sidebands.

NOTE: Adjustments R60 on Counter Input Amp Assembly A104 and R4 on Detector Assembly A111 are preset at the factory and do not require readjustment unless the assemblies are replaced. These adjustments should only be performed by authorized service representatives.

PERFORMANCE CHECK

Required Test Equipment

Frequency Standard -- 10 MHz

Frequency Counter -- .05 to 26.5 GHz; time base accuracy better than 1 part in 10^7. IEEE-488 interface

Computer/Controller -- Any IEEE-488 interface equipped unit such as HP9825, HP85

Power Meter/Sensor -- Giga-tronics 8541 with 80303A

Spectrum Analyzer -- Tektronix 492 or equal, with external mixers A/R

Oscilloscope -- Tektronix 475 or equal

Detector -- Wiltron 70550B or equal

50 ohm Termination -- Tektronix 011-0049-01 or equal

Pulse Generator -- .1 to 10 µs width; 100 Hz to 50 kHz rate; 15 ns rise/fall

Synthesized RF source -- .05 to 26.5 GHz: Giga-tronics 1026 or equal

4.9 INITIALIZATION

1. Install test covers on UUT and connect to power source.
2. Set controls as follows:

Modulation:	Off
Mode:	Sweep
Sweep:	Auto
Step Size:	10 MHz
Sweep Rate:	Mid Range
Attenuators:	Both at "0"
Leveling:	On
Power Meter:	Internal
(Rear Panel) ALC Enable:	Off
Start Frequency:	.1 GHz
Stop Frequency:	26.0 GHz
Other Controls:	Not Important

3. Turn on main power switch and allow UUT to warm up for at least 20 minutes.

4.10 FREQUENCY RANGE, ACCURACY AND STABILITY

4.10.1 Frequency Range Tests

1. Set controls as follows:

Modulation:	Off
Mode:	CW
Attenuators:	Both at "0"
Leveling:	On
Power Meter:	Internal
(Rear Panel) ALC Enable:	Off
Other Controls:	Not Important

2. Connect the frequency counter to the UUT RF output connector.

3. Vary the Start Freq selector switches over the range .05 to 26 GHz. At any setting in this range the lock and level indicators should be on and the counter should indicate the selected frequency to the required accuracy. A minimum of 20 frequencies shall be checked at a minimum spacing of 1 GHz.

4.10.2 Frequency Accuracy And Resolution

1. Set the Start Freq selector switches to 10.000 GHz. Record the counter reading.

2. Vary the 1 MHz selector switch of the Start Freq switches from 0 to 9. Verify that the counter changes accordingly. Return the switch to 0.

3. Vary the 10 MHz selector switch of the Start Freq switches from 0 to 9. Verify that the counter changes accordingly. Return the switch to 0.

4. Vary the 100 MHz selector switch of the Start Freq switches from 0 to 9. Verify that the counter changes accordingly. Return the switch to 0.

5. Vary the 1 GHz selector switch of the Start Freq switches from 0 to 9. Verify that the counter changes accordingly. Return the switch to 1.

6. Vary the 10 GHz selector switch of the Start Freq switches from 0 to 2. Verify that the counter changes accordingly.

7. (OPTION O3) Vary each of the three leftmost digits of the Stop Freq switches from 0 to 9. Verify that the counter changes accordingly.

4.11 R.F. OUTPUT CHARACTERISTICS

4.11.1 Maximum Output Amplitude

1. Set controls as follows:

Modulation:	Off
Mode:	CW
Attenuators:	Both at "0"
Leveling:	Off
Level Vernier:	Maximum (CW)
Power Meter:	Internal
(Rear Panel) ALC Enable:	Off
Other Controls:	Not Important

2. Connect power meter sensor to UUT RF output.
3. Set the <u>Start Freq</u> switches for an output of .1 GHz.
4. Vary the frequency in .05 GHz steps up to 26 GHz and verify that the minimum output is as required.

NOTE: Apply correction factor for sensor as appropriate.

4.11.2 Output Power Accuracy

1. Set controls as follows:

Modulation:	Off
Mode:	CW
Attenuators:	Both at "0"
Leveling:	On
Power Meter:	Internal
(Rear Panel) ALC Enable:	Off
Other Controls:	Not Important

2. Connect Power Meter Sensor to UUT RF output.
3. Set the <u>Start Freq</u> switches for an output of .1 GHz.
4. Vary the frequency in .05 GHz steps up to 26 GHz and verify that the output amplitude is to the required accuracy.

NOTE: Apply correction factor for sensor as appropriate.

4.11.3 Spectral Purity

1. Set controls as follows:

Modulation:	Off
Mode:	CW
Attenuators:	Both at "0"
Leveling:	On
Power Meter:	Internal
(Rear Panel) ALC Enable:	Off
Other Controls:	Not Important

HARMONICS -- Note: Perform Harmonics, Spurious, and Residual FM/Phase Noise tests simultaneously. The frequencies to be checked are listed on data sheet.

1. For each selected frequency, select the harmonic to be checked and temporarily set the UUT Start Freq swtiches to its frequency.

2. Tune the analyzer to this frequency and establish a reference level. Use a sufficiently narrow I.F. bandwidth to permit 60 dB dynamic range without fundamental overload.

3. Without changing any analyzer settings, set the UUT Start Freq switches to the fundamental frequency.

4. Measure the resultant harmonic amplitude.

NOTE: 1) In the range up to 1.8 GHz, the analyzer R.F. attenuator must be set to at least 30 dB to avoid generating harmonics in the analyzer itself.

2) For fundamental frequencies over 13 GHz, it is necessary to carefully evaluate analyzer calibration as no calibrating signal is available from the UUT.

SPURIOUS -- Note: Perform simultaneously with Harmonics test above.

1. For each selected frequency, tune the anlayzer to center the signal on the display.

2. Starting at a span of 100 MHz/div, reduce the span to 5 kHz/div while maintaining an appropriate bandwidth and filter to allow a 60 dB dynamic range.

3. Observe the amplitude of any spurious signals.

RESIDUAL FM/PHASE NOISE -- Note: Perform simultaneously with Harmonics test above.

1. For each selected frequency, tune the analyzer to center the signal on the display.

2. Set the analyzer controls for 10 kHz/div span, 1 kHz BW, wide video filter, minimum noise, with the signal at the 0 dB reference line.

3. Observe the amplitude of the signal presentation at an offset of 10 kHz.

4.12 MODULATION CHARACTERISTICS

The frequencies to be checked are listed on the data sheet.

1. Set controls as follows:

Modulation:	Pulse:
Mode:	CW
Attenuators:	Both at "0"
Leveling:	On
Power Meter:	Internal
(Rear Panel)	
ALC Enable:	Off
Preset 1 μs:	Off
X10:	On
Preset 1 kHz:	Off
Pulse Rate:	5 kHz
Pulse Width:	10 μsec
Other Controls:	Not Important

4.12.1 Pulse Shape

1. Connect the detector to the UUT RF Output. Terminate the detector output in 50 ohms at the oscilloscope input. Connect the oscilloscope external trigger input to the UUT MOD SYNC OUT.

2. For each selected frequency, adjust the oscilloscope to position the detected pulse in alignment with the two dashed lines running horizontally across the CRT.

3. Now increase the time base speed to 20 NS/CM and measure the rise and fall time between the 10% and 90% points as shown on the CRT. Use the +/- trigger slope to shift edges.

4. Observe the pulse and note any overshoot, etc. The 1 dB step attenuator may be used to verify the amount of any abberations.

4.12.2 Pulse On/Off Ratio

The frequencies to be checked are listed on the data sheet.

1. Change the following control settings:

Modulation:	Squarewave:
X10:	Off
Pulse Rate:	Midrange

2. Connect the UUT RF Output to the spectrum analyzer.

3. For each selected frequency, center the signal on the analyzer and adjust the span control for zero. Now adjust the sweep speed and trigger to display the recovered pulse. Verify proper on/off ratio (the peak-to-peak waveform height).

NOTE: Be certain analyzer has a sufficient signal to noise ratio to be able to see the dynamic range. Use 100 kHz BW for best results.

4.12.3 Modulation Level Tests

1. Change the following control settings:

X10:	On

2. Connect the detector to the UUT RF Output. Connect the unterminated detector output to the oscilloscope input.

3. Set the UUT to 3 GHz, temporarily select modulation off and establish reference levels on the scope display for outputs of 0 dBm and -9 dBm. Adjust the scope gain to give levels about 1 division from the top and bottom.

4. Select squarewave and verify that the peak power (negative excursion) of the pulse is within ±1.5 dB of the CW reference levels at 0 & -9 dBm. Use the 1 dB attenuator to determine the difference.

5. Set the UUT to 1 GHz and repeat steps 3 and 4.

4.12.4 Modulation Function Tests

1. Using a 50 ohm termination at the counter, connect the sync output to the frequency counter low frequency input.

2. Select 'square' waveform modulation, set X10 off, 1 kHz preset off. Verify that the squarewave frequency can be varied from a minimum of 100 Hz to about 5 kHz.

3. Set X10 on and verify that the upper frequency is at least 50 kHz.

4. Set the 1 kHz preset on and verify that the squarewave frequency is 1 kHz.

5. Connect the sync output, terminated in 50 ohms to the oscilloscope input.

6. Select 'pulse' waveform modulation, set the X10 on and pulse rate to 5K. Verify that, using the pulse width control the pulse can be varied from a minimum of .1 µsec to at least 10 µsec.

7. Set the 1 µsec preset on and verify the pulse width is 1 µsec, ±10%.

8. Select EXT modulation (rising edge triggered, then falling edge triggered) and, using a pulse generator, verify the operation of the external pulse input.

4.13 SWEEP CHARACTERISTICS

1. Set controls as follows:

Modulation:	Off
Mode:	Sweep
Attenuators:	Both at "0"
Leveling:	On
Power Meter:	Internal
(Rear Panel) ALC Enable:	Off
Start Freq:	.1 GHz
Stop Freq:	26.5 GHz
Sweep:	Auto
Sweep Rate:	Mid Range
Sweep Increment:	10 MHz
Other Controls:	Not Important

2. Connect the UUT RF Output to the frequency counter.

3. Observe that both the UUT frequency display and the counter increment, repeatedly, from .1 to 26.5 GHz.

4. Change the increment to first 100 MHz, then 1 MHz and verify proper operation.

NOTE: Sweep rate may be slowed to ease viewing. Return increment to 10 MHz and rate to mid range.

5. Connect the power meter sensor to the UUT RF Output. Verify that (except at band crossovers) the output maintains the required accuracy.

NOTE: Sweeprate may be varied as required to ease viewing.

6. Connect the UUT SWEEP OUT to the oscilloscope input. Select the Auto Sweep mode. Verify that the ramp voltage is 0 to 10 V, ±10%.

7. Select Single Sweep. Push Reset. Verify that the UUT sweeps once and resets.

8. Select Single Step. Verify that each time the button is depressed, the frequency and ramp both increment. Return to Auto Sweep.

9. Monitor the rear panel pen lift connector with the oscilloscope. Verify a logic low signal during sweep retrace.

4.14 POWER METER CHARACTERISTICS

1. Set controls as follows:

Modulation:	Off
Mode:	CW
Attenuators:	Both at "0"
Leveling:	On
Power Meter:	Internal
(Rear Panel) ALC Enable:	Off
Start Freq:	2 GHz
Other Controls:	Not Important

4.14.1 Internal Operation

1. Connect the power meter sensor to the UUT RF Output. Verify that the output is 0 dBm ±1 dB, and the power display is 0.0 ±.1 dB.

2. Set the 1 dB step attenuator to 9. Verify that the output is -9 dBm ±1 dB, and that the power display is -9.0 ±.2 dB.

3. Return the attenuator to 0. Turn off the leveling and adjust the level vernier for a power display reading of +5 dBm. Verify that the output is +5 dBm ±1 dB. Turn the leveling on.

4. Monitor the UUT RF Output with the spectrum analyzer and use the 10 dB step attenuator to reduce the output in 10 dB steps. Verify that the power display and analyzer decrement by 10 dB for each 10 dB change from 10 to 90 dB. Return attenuator to 0 dB.

4.14.2 External Operation

1. Locate an output frequency between 2 & 3 GHz where, with the leveling off and the vernier adjusted, an output of +10 dBm is achieved with the level indicator on.

2. Connect a low loss jumper cable from the UUT RF Output to the power meter input.

3. Select EXT power meter and verify that the power display reads +10 dBm ±1 dB.

4. Insert 10 dB of attenuation with the 10 dB step attenuator. Verify that the power display reads 0 dBm ±1 dB.

5. Insert a total of 20 dB of attenuation as before. Verify that the power display reads -10 dBm ±1 dB.

6. Insert a total of 30 dB as before. Verify that the power display reads -20 dBm ±2 dB.

7. Insert a total of 40 dB, as before. Verify that the power display reads -30 dBm ±2 dB.

4.15 COUNTER TESTS

1. Set controls as follows:

Mode:	Measure Direct
Other Controls:	Not Important

2. Connect the synthesized RF source to the UUT Measure In. Connect the EXT CLK out to the UUT EXT CLK IN.

3. Select several frequencies below 2 GHz. For each frequency, set the RF source to generate that frequency.

   With the RF source unmodulated, set the UUT Start Freq and Stop Freq switches to bracket the RF source frequency.

   Verify proper operation of the UUT.

   Set the RF source for pulse modulation (1 μsec width, 10 kHz rate) and again verify proper UUT operation.

4. Select several frequencies above 2 GHz. Repeat the procedure as in step 3 above.

5. With the RF source unmodulated, set some convenient frequency.

   Set the UUT to Measure ΔF.

   Set the UUT Start Freq 300 MHz below the RF source frequency and verify proper operation.

   Set the UUT Start Freq 300 MHz above the RF source frequency and verify proper operation.

4.16 OTHER FUNCTIONS

1. Set controls as follows:

Modulation:	Off
Mode:	CW
Attenuators:	Both at "0"
Leveling:	On
Power Meter:	Internal
Start Freq:	2 GHz
(Rear Panel) ALC Enable:	Off
Other Controls:	Not Important

4.16.1 Reference Input

1. Connect a 10 MHz source to the rear panel EXT CLK IN. Verify proper UUT lock with the external source set between .5 and 3 volts rms.

4.16.2 Reference Output

1. Monitor the INT CLK OUT with a 50 ohm terminated oscilloscope. Verify the amplitude is at least 2 Vpp and that the duty cycle is between 20% and 80%.

4.16.3 External 5-6 MHz Input

1. Connect the frequency counter to the UUT RF Output.
2. Connect a coax cable from the INT CLK OUT to the PLL REF IN.
3. Verify that the UUT output frequency increases by 5 MHz.

4.16.4 External ALC

1. Connect a directional coupler to the UUT RF Output with the coupler through port terminated with the power meter sensor and the detector connected to the coupled port.
2. Connect the detector output to the EXT ALC INPUT.
3. Place the EXT ALC ENABLE switch in the on (up) position and verify that adjusting the gain and offset controls will cause the power meter reading to change.
4. Return the EXT ALC ENABLE switch to off (down).

4.16.5 Cable Calibration

1. Connect a coax cable from the UUT RF Output to the Power Meter Input.
2. Perform the cable calibration.
3. Select EXT Power Meter and verify proper operation.
4. Deselect the calibration and verify proper operation in both EXT and ΔP power meter modes.

Model 1026 Test Data Sheet

Frequency Range, Accuracy, and Stability (4.10)		[✓]
UUT Locks & Levels from .05 to 26 GHz		
Counter Reading at 10.000 GHz (Limit: ± 10 kHz)		
Frequency Resolution	1 MHz Digit	
	10 MHz Digit	
	100 MHz Digit	
	1 GHz Digit	
	10 GHz Digit	
	(Option 03) kHz Digits	

Output Amplitude (4.11.1-2)		[✓]
Maximum Output Amplitude (≥ +5 dBm)		(see plot)
Output Power Accuracy (Maximum Error, 5 dBm Reference)	.05-18 GHz (Limit ± 1 dB)	(see plot)
	18-26.5 GHz (Limit ± 2 dB)	(see plot)

Spectral Purity (4.11.3)

Note: For units without Option 03, ignore frequency digits which exceed the resolution of the instrument.

Frequency (MHz)	Harmonics (<-55 dBc)	Spurious (<-55 dBc)	Noise
770.550			
1513.425			
3536.171			
6869.742			
9182.433			
13317.392	N/A		
15421.056	N/A		
17361.522	N/A		
19425.625	N/A		
23541.349	N/A		
25976.056	N/A		

Modulation Characteristics (4.12)				
Frequency	**Pulse Shape**		**On/Off Ratio (>30 dB)**	
	Rise/Fall (<25 ns)	**Abber. (<2 dB)**		
1.0 GHz				
4.5 GHz				
10.5 GHz				
15.5 GHz				
23.5 GHz				
Modulation Level Tests				**[✓]**
Levels Set >1.5 GHz				
Levels Set < 1.5 GHz				
Modulation Function Tests				**[✓]**
Squarewave .1 to 5 kHz				
Squarewave 1 to 50 kHz				
1 kHz Preset Squarewave				
Pulse .1 to 10 µs				
1 µs preset pulse				
External Input				

Sweep Characteristics (4.13)	**[✓]**
Full Range Sweep	
1, 10, 100 MHz Increments	
Amplitude variation $\leq \pm 1$ dB to 18 GHz, ± 2 dB to 26.5 GHz	
Ramp out (0-10V)	
Single Sweep	
Single Step & Ramp Function	
Pen Lift Function	

Power Meter Characteristics (4.14)	[✓]
Output and Display = 0.0 ± 1 dB	
Output and Display = -9.0 ± 1 dB	
Output and Display = +5.0 ± 1 dB	
10 dB step operation	
External Power Meter +10, ± 1 dB	
External Power Meter = 0, ± 1 dB	
External Power Meter = --10, ± 1 dB	
External Power Meter = --20, ± 2 dB	
External Power Meter = --30, ± 2 dB	

Counter Tests (4.15)	[✓]
<2 GHz CW	
< 2 GHz Pulse	
>2 GHz CW	
> 2 GHz Pulse	
+ Offset	
- Offset	

Other Tests (4.16)	[✓]
Reference Input	
Reference Output	
External 5-6 MHz	
External ALC	
Cable Calibration	
ΔP Mode	
External Power Meter Analog Out	

5 Maintenance

5.1 ROUTINE MAINTENANCE

Under normal circumstances, the instrument requires little regular maintenance. The air inlet screen should be cleaned whenever a noticeable amount of dirt has accumulated.

It is recommended that the calibration procedure (as described in Section 4 of this manual) should be performed at one year intervals to insure operational accuracy.

5.2 SERVICE

WARNING!

There is no switch in the power line of this instrument! Therefore, whenever it is connected to a power source, all primary and secondary voltages, plus some rectified voltages, are present. Always unplug the instrument when servicing!

CAUTION!

There are many MOS and CMOS devices used in this instrument. Be certain to use appropriate anti-static procedures whenever is is necessary to handle them.

During the warranty period of this instrument, it is recommended that no user initiated service work be performed without first contacting the factory (or an authorized Giga-tronics representative). Often, problems can be readily isolated to a particular plug-in module which can be sent as a replacement.

Some of the larger integrated circuits are plugged into locking sockets, rather than soldered directly onto the circuit board. To release the locking mechanism, insert the tip of a small screwdriver in the slot at the Pin-1 end of the socket. Press down gently and tilt the screwdriver toward the socket. The IC may now be removed easily. To insert an IC into a socket, just press down hard, making certain that all pins are straight and centered in their guides. Avoid removing ICs from sockets unnecessarily.

5.3 FAULT FINDING HINTS

Because the unit is highly modular, most faults can be quickly isolated. Certain steps should be taken *prior to any other analysis.*

First, be sure that the External ALC switch on the rear panel is set in the proper position! The level control system will not work if External ALC is ON and no external detector is connected.

Second, recheck the front panel controls to make sure that all of them are properly set. The computer will identify most incorrect combinations, but some settings, while not necessarily incorrect, can cause problems. For example, selecting an external modulation mode, without supplying an external modulating signal, will simply cause the RF output to shut down.

Verify ALL power supply voltages:

+5V (computer)

+5V (other)

-5.2V

+15V (oven)

+15V (other)

-15V

+20V

5.4 TROUBLESHOOTING PROCEDURE

If it appears that the instrument is not operating normally, use the troubleshooting procedure shown in the following tables to identify the problem; then use the troubleshooting notes in section 5.5 (as cited in the right-hand column of the following table) to find the most likely cause and correction for the problem.

Step	Action or Conditon	Problem/Observaton	See Note:
1	Connect the unit to correct power source; leave power switch OFF	A) Standby indicator lights B) Standby indicator does not light	5.5.1
2	Check power supplies for standby condition	A) Power supplies as listed below: +15V oven supply on at +15V +20V regulated supply off (<1V) +20V unregulated suply off (< +15V supply off (<1V) -15V supply off (<1V) +5V computer supply off (<1V) +5V supply off (<1V) -5.2V supply off (<1V) B) Any supply not as listed	5.5.2
3	Turn on main power switch	A) Fan should run. All regulated power supplies should be at rated voltage +10%; unregulated +20V supply should be approx. 25-30 V. B) Any supply not correct	5.5.3
4	Press CW button, set both attenuator switches to zero, press 0 dBm REF button. Set each of the following frequencies on the FREQ START/CW switches: 0.900 GHz 5.000 GHz 10.000 GHz 15.000 GHz 22.000 GHz	A) At each frequency: The selected frequency should be displayed The lock light should be on The leveled light should be on B) The frequency display is incorrect The lock light is not on The level light is not on	5.5.4 5.5.5 5.5.6
5	Set CW Mode, 2 GHz, no modulation, INT power meter, 0 dBm REF, both attenuators at 0	A) Power display reads 0 dBm ±.5 dB B) Power display is incorrect	5.5.7
6	Rotate the 1 dB attenuator from 0 to -9. Return to 0	A) Power display should decrement by 1 dB for each step B) Power display is incorrect	5.5.8
7	Rotate the 10 dB attenuator from 0 to -90. Return to 0	A) Power display should decrement by 10 dB for each step B) Power display is incorrect	5.5.9
8	Release the 0 dBm REF button (vernier enabled) and rotate the vernier from min to max. Return to 0 dBm REF.	A) Power display should vary from about -5 dBm to maximum available power (typically +10 dBm) B) Power display does not vary or has incorrect range	5.5.10
9	Connect a short length of low loss cable from the RF out to the power meter in. Be sure the instrument is set for leveled operation at 0 dBm. Push the EXT power meter button.	A) Power display should read 0 dBm less the cable loss. B) Power display is incorrect.	5.5.11

Step	Action or Conditon	Problem/Observaton	See Note:
10	Vary the 10 dB step attenuator from 0 to 20 dB. Return to 0.	A) Power display should decrement by 10 dB for each step ± accuracy spec B) Power display is incorrect	5.5.12
11	Connect a lossy element from the RF out to power meter in (6 to 20 dB). Note power display reading (in EXT mode). Now release the EXT button and push the ΔP button.	A) Power display should read the same value as with the EXT button pushed, ±1 dB B) Power display is incorrect	5.5.13
12	Set sweep mode, 100 MHz start, 18.000 GHz stop, 100 MHz increment, auto sweep, sweep time mid-range, leveled at 0 dBm	A) Lock light should be off. Display should be incrementing in 100 MHz steps. Level light should be on, blink at reset. B) Display does not increment Level light goes out at some places.	5.5.14 5.5.15
13	Change the sweep increment first to 10 MHz then to 1 MHz. Return to 100 MHz.	A) Display increment should change to 10 MHz then 1 MHz B) Display increment is incorrect	5.5.16
14	Push single sweep button	A) Unit should complete its current sweep and go to hold B) Sweep does not operate properly	5.5.16
15	Push single sweep button again	A) Unit should make one complete sweep and go to hold B) Sweep does not operate properly	5.5.16
16	Push single step button	A) Display should go to 100 MHz B) Display does not read 100 MHz	5.5.16
17	Repeatedly push the single step button	A) Display should increment in whatever increment size is selected B) Display increments incorrectly	5.5.16
18	With unit in sweep mode, any increment, and single step; connect a pulse generator (TTL output) to the sweep sync trigger connector. Set pulser for about a 100 Hz rate.	A) Display should continually increment at the selected increment size B) Display does not increment	5.5.17
19	With unit in sweep mode, 100 MHz increment, auto sweep; connect a DC coupled scope to the sweep output connector	A) Scope should show a step like increase from 0 to 10V from start to end of sweep B) No sweep output, or incorrect sweep output	5.5.18
20	Change the stop frequency to 10 GHz	A) Sweep should remain a 0 to 10V signal but speed up B) Sweep output does not change	5.5.19
21	Set Meas Direct Mode, 100 MHz start, 18 GHz stop, no input	A) Display should show dashes, power meter should be off, lock light should remain off. Level light should alternate from a fast to a slow rate of blinking (which indicates the fast and slow search modes) B) Display indicates a false reading Level Light does not blink	5.5.20 5.5.21
22	Change mode to meas ΔF. Other settings same as in Step 21.	Conditions and errors the same as in Step 21	5.5.20, 5.5.21
23	Change mode to meas direct. Connect an RF source (.1-26 GHz) to the measure input.	A) Unit should search (level light blinks), lock light should come on (signal found), and display should read out the input frequency. NOTE: strong harmonics of the input are valid readings. Reduce the stop frequency to eliminate them. B) Lock Light does not come on. Display does not give a stable, correct reading.	5.5.22 5.5.23

Step	Action or Conditon	Problem/Observaton	See Note:
24	Change mode to meas ΔF. Set FREQ START to within 500 MHz of the RF source frequency	A) Display should indicate the difference (+ or -) between start frequency setting and the RF source frequency B) Display is incorrect	5.5.24
25	Set CW mode, both attenuators to 0, leveled button in, 'square' waveform, 1 kHz preset. Connect a scope to the MOD SYNC output connector.	A) Scope should show a 1 kHz rate squarewave, TTL levels B) No modulation SYNC output waveform, or rate incorrect	5.5.25
26	Select 'pulse' waveform, 1 μsec preset, X10 off, pulse rate to 5 kHz. Retain scope connection.	A) Scope should show a 1 μsec wide pulse at about 5 kHz rate B) Waveform incorrect	5.5.26
27	Turn off 1 μsec preset and vary the pulse width. Reset to 10.	A) Scope should show the changing width B) Pulse width does not change	5.5.27
28	Vary the pulse rate from 5 kHz to 100	A) Scope should show the changing rate B) Pulse rate does not change	5.5.28
29	Push the X10 button	A) Scope should show a 10X rate change B) Rate does not change	5.5.29
30	Push the EXT 'falling edge' button and connect a pulse generator to the EXT MOD in. Set the pulser to about 10 μsec width at about 10 kHz rate, TTL levels.	A) Scope should show the input pulse waveform B) No output	5.5.30
31	Leaving the pulse generator connected, push the EXT 'rising edge' button	A) Scope should show an inverted input pulse waveform B) Waveform does not invert	5.5.31
32	Remove pulse generator, select 'square' waveform, 1 kHz preset. Connect a detector to the RF output connector. Connect the detector to the scope input. Set each of the following frequencies on the FREQ START 1 CW switches: 1) 5 GHz 2) 10 GHz 3) 15 GHz 4) 22 GHz	A) At each frequency the scope should show the 1 kHz squarewave. The amplitudes will vary slightly. The level light should be on. B) No waveform seen at any frequency Level light is not on at any frequency Either no waveform, or level light out, at a particular frequency	5.5.32 5.5.33 5.5.34

5.5 TROUBLESHOOTING NOTES

5.5.1 Standby indicator does not light

Check line fuse. Replace fuse -- if fuse blows, check primary and secondary circuits.

Verify voltages on filter capacitors.

Check indicator and its wiring.

5.5.2 Any supply not as listed

All Supplies Stay On

Check -2V source on power supply control circuits (IC1, Q3, VR1 on A102).

Any Supply On

Check individual supply controls on A101 or A102.

5.5.3 Any supply not correct

Remove all plug in cards if overload is still present open output lead from regulator and verify regulator input and output voltages.

Replace cards one at a time to isolate faulty card.

5.5.4 Frequency display is incorrect

Display is blank

Check heater and anode supplies for the display. If not correct, repair the power supply.

Verify computer drive signals to display. If not correct, refer to computer repair procedure.

Repair display board.

Display shows incorrect characters

Verify strobes to lever wheels are correct. If not, refer to computer repair procedures.

Verify lever wheel data is correct. If not, repair lever wheel board.

Refer to computer repair procedures.

5.5.5 The lock light is not on

Check the phase lock loop PC boards, to see which board- mounted unlock indicator is on.

If all indicators are out, check lock detector inputs to computer.

If any are low then repair source board. If all inputs are correct and the computer output is wrong, refer to computer repair procedure. Otherwise repair lock indicator circuit.

Any unlock problems should be repaired in the following order:

1 -- 100 MHz PLL
2 -- Reference PLL
3 -- Output PLL
4 -- Fixed LO PLL

100 MHz PLL unlocked

Check for 10 MHz from master reference. If no, check the 10 MHz source.

Check for approximately 100 MHz from the A103 assembly. If not, check the A103 assembly.

Check the A8 assembly.

Reference PLL is unlocked

Set the frequency to 3110 MHz. Connect a counter to the reference test port. Remove the A16 board. Verify that the counter reads 3005 ±50 MHz. If not, refer to the oscillator/driver repair procedure.

Check the IF from the reference sampler channel (P/O A103). If not present, check the sampler channel.

Check the A16 reference PLL.

NOTE: With the reference PLL working, it is fairly safe to assume that the computer and YIG drivers are functional. Therefore the problem is likely to be associated with the mixer, mixer switch (or its drive) A20 divide by N, or A8 output PLL.

Output PLL is unlocked at 900 MHz

Set the frequency to 1 GHz and check the fixed LO sampler IF output (P/O A105). If not present, check the sampler channel.

Check the A15 fixed LO PLL.

Output PLL is unlocked at various frequencies

Measure the frequency of the signal going into the mixer switch from the 2-8 module. It should be within about 100 MHz of the set frequency (in the appropriate range). If not, refer to the oscillator driver repair procedure.

The problem is likely in the mixer switch or its driver.

5.5.6 The level light is not on

Level light out at all frequenciess

The problem is likely on the A7 level control board, or level LED circuit.

Level lights out at 900 MHz

Verify that the front panel output is 0 dBm or more. If not, check the drive signals for the 2-8 and 8-12 modules. They should be negative. If not, the problem is likely on the A6 or A7 boards. Otherwise, check the downconverter and RF path.

The possible problem areas are:

a) The coupler/detector for the <1 GHz range
b) The detector switching on the A18 board
c) The leveling drivers on the A7 board
d) The leveling PIN attenuators in the 2-8 or 8-12 modules

Level light out at certain frequencies

If there is no leveling above 1 GHz check the following:

a) Output Coupler/detector
b) Output RF swtich

If there is no leveling in one or more ranges check the following:

a) Individual module
b) Output switch
c) Switch/leveler drivers

5.5.7 Power display is incorrect (0 dBm)

Problem is likely to be the A/D converter on A7 or the computer interface.

5.5.8 Power display is incorrect (1 dB steps)

Problem is likely the 1 dB switch assembly and its interface or a failure on A7.

5.5.9 Power display is incorrect (10 dB steps)

Problem is likely the 10 dB switch assembly or its interface.

5.5.10 Power display does not vary or has incorrect range

Problem is likely to be one of the following:
a) Vernier control or button
b) IC7 on A7

5.5.11 Power display is incorrect (0 dBm less cable loss)

Problem is likely to be one of the following:
a) Power meter detector
b) Power meter LOG AMP on A19
c) IC8 on A7

5.5.12 Power display is incorrect (10 dB steps)

Use a power meter to verify that the RF attenuator is correct. If so the problem is the A19 LOG AMP.

5.5.13 Power display is incorrect (EXT)

Problem is in the ΔP control button or its interface.

5.5.14 Display does not increment

Problem is likely either the push button switches or the stop frequency select lever wheels (or their interface).

5.5.15 Level light goes out at some places

This indicates an RF problem at the frequencies involved. It is likely a bad component or connector causing excessive loss.

5.5.16 Sweep functions are incorrect

The problem is likely the push buttons involved or their interface.

5.5.17 Display does not increment

Defective IC1 on A3.

5.5.18 No sweep output or incorrect sweep output

Problem is likely the sweep circuit (IC1 & IC2) on A7.

5.5.19 Sweep output does not change

Problem is likely the stop frequency lever wheels or their interface.

5.5.20 Display indicates a false reading

Problem is likely that the counter input amplifier threshold adjustment is incorrect.

5.5.21 Level light does not blink

Problem is likely the push buttons involved or their interface.

5.5.22 Lock light does not come on

Input one frequency below 1.5 GHz and then one above 2.5 GHz. If the counter operates on one but not the other, the problem is associated with the particular mixer, its LO signal, or the counter input amplifier control.

If it does not work at all, the problem is likely in the A104 or A105 counter circuits or the counter circuitry on A6.

5.5.23 Display does not give a stable, correct reading

Be certain that the test signal is stable and of sufficient level.

5.5.24 Display is incorrect

Problem is likely the push buttons involved or their interface.

5.5.25 No modulation SYNC output waveform, or rate incorrect

The problem is likely the square wave circuit IC1, IC3 or buffer IC5 on A17 (if not, then check the pushbuttons involved and their interface).

5.5.26 Waveform incorrect

Problem is likely the 1µs width generator IC2 or the pulse generator Q2/Q3 on A17.

5.5.27 Pulse width does not change

Problem is likely the pulse generator Q2/Q3 on A17.

5.5.28 Pulse rate does not change

Problem is likely the rate generator IC6 on A17 or the front panel control.

5.5.29 Rate does not change (X10)

Problem is likely the X10 switch or wiring or the capacitors on A17.

5.5.30 No output

Problem is likely IC4 on A17.

5.5.31 Waveform does not invert

Problem is possibly IC4 on A17.

5.5.32 No waveform seen at any frequency

Problem is likely IC12 or IC11 on A7 or the associated drivers.

5.5.33 Level light is not on at any frequency

Problem is likely the level sampler board A18.

5.5.34 Either no waveform, or level light out, at a particular frequency

Problem is either the RF module involved with that frequency or its driver on A7.

5.6 GENERAL PROCEDURE TO EVALUATE YIG OSCILLATOR DRIVER PROBLEMS

Monitor the voltage across the sensing resistor (one end is ground) of the band under test. This voltage is also available on PIN 15 of the driver card. The sensitivity of the 18-26.5 GHz oscillator is 30 MHz/mA; for all other oscillators it is 20 MHz/mA.

By selecting various frequencies in the range and calculating the sense resistor current, which is also the tuning coil current, one can readily determine if the driver is giving the oscillator the approximately correct current. If not, the driver card D/A converter (IC2) output should be checked. If the D/A is incorrect, the computer interface should be checked.

If the tuning current is correct then any voltage controls should be checked at the oscillator module. Also check all oscillator power supplies.

If no obvious problems are found, monitor the oscillator output with a spectrum analyzer to see if the frequency and power output are correct.

If the approximate frequency and power are correct, then the driver and control circuit for the FM coil should be checked.

5.7 COMPUTER SYSTEM TROUBLESHOOTING

The computer system in the unit is based on a Motorola 6809 microprocessor. It uses a bus architecture which corresponds on a one-to-one basis with the signals from and to the 6809 chip, A21C2, with the following exceptions.

The three high order address lines from the 6809 are decoded by A21C9 into 8 page lines for the bus.

The DMA/BREQ signal into the 6809 is not used.

The most effective way to troubleshoot the computer system is to isolate the problem to the PC board level by substituting known good PC boards. If the system does not operate correctly with a full compliment of known good PC boards, the problem is probably on the mother board or its wiring.

If most of the unit is functioning correctly, and a computer system failure is suspected, the problem is probably in the portions of the system which interfaces with the rest of the instrument. The schematics, block diagrams and circuit descriptions in this manual will allow one to isolate the probable cause of malfunction to one or two computer PC boards.

If the unit operation is such that "almost nothing works", then the most effective way to isolate the problem is to replace all of the computer system PC boards, A1 through A6 with known good boards. If the problem is still present, the mother board or some part of the unit other than the computer system is the probable cause.

Parts Lists

Section 6

6 Parts Lists

Parts List for 104DA00710 M1026 SHIPPING ASSY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
0	104DA00002	Ref	58900	104DA00002	PRODUCT TREE 1026
1	104DA00510	1	58900	104DA00510	M1026 TEST ASSY
2	101DA33000	1	58900	101DA33000	BENCH MOUNT DRESS (STD)
3	104AM01100	1	58900	104AM01100	INSTRUCTION MANUAL 1026
4	104DF00101	1	58900	104DF00101	FRONT PANEL M1026

Parts List for 104DA00510 M1026 TEST ASSY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	104DA00210	1	58900	104DA00210	CHASSIS ASY 1026
2	101AAH0103	1	58900	101AAH0103	H0103 MEMORY SET
4	104DA01401	1	58900	104DA01401	FRONT PANEL ASY M1026-01
101	HBFP-63204	5	96906	MS-24693-24	6-32 X 1/4 FLAT
102	HBPP-63205	2	96906	MS-51957-27	6-32 X 5/16 PAN
103	HWSS-60400	2	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
104	HWFS-60600	2	96906	MS15795-806	#6 X 3/8 FLAT WASHER
A 1	101CA06702	1	58900	101CA06702	IEEE PIA PCA
A 2	101CA35800	1	58900	101CA35800	CPU (64K) PCA
A 3	101CA07000	1	58900	101CA07000	FRONT PANEL SW PIA PCA
A 4	101CA35700	1	58900	101CA35700	MEMORY (64K) PCA
A 5	101CA29500	1	58900	101CA29500	DISPLAY PIA PCA
A 6	101CA07200	1	58900	101CA07200	COUNTER PIA PCA
A 7	101CA26205	1	58900	101CA26205	AM LVL CONTROL PCA M1026
A 8	101BA04900	1	58900	101BA04900	100MHZ REF LOOP PCA
A 9	101BA31701	1	58900	101BA31701	OUTPUT PLL PCA
A 10	101BA28215	1	58900	101BA28215	YIG DRIVER 18-26 PCA
A 11	101BA28212	1	58900	101BA28212	YIG DRIVER 2-8 PCA
A 12	101BA28214	1	58900	101BA28214	YIG DRIVER 12-18 PCA
A 13	101BA28211	1	58900	101BA28211	YIG DRIVER 1.9-8.7 PCA
A 14	101BA28213	1	58900	101BA28213	YIG DRIVER 8-12 PCA
A 15	101BA07401	1	58900	101BA07401	FIXED LO PLL PCA
A 16	101BA07402	1	58900	101BA07402	REFERENCE PLL PCA
A 17	101CA06610	1	58900	101CA06610	PULSE MODULATION PCA
A 18	101CA25500	1	58900	101CA25500	LEVELLING SAMPLER PCA
A 19	101CA25600	1	58900	101CA25600	LEVELLING LOG AMP PCA
A 20	101CA06300	1	58900	101CA06300	DIVIDE BY N PCA

Parts List for 104DA00210 CHASSIS ASY 1026 Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101DA17720	1	58900	101DA17720	COMPUTER DECK ASY
2	101CA15000	1	58900	101CA15000	uWAVE CARDCAGE ASY
3	104CA01000	1	58900	104CA01000	ATTEN CHASSIS ASY M1026
4	101BC12607	1	58900	101BC12607	SINGLE POS SWITCH
5	101CA15700	1	58900	101CA15700	SAMPLER ELECTR ASY(.05+)
6	101BA18100	1	58900	101BA18100	COUNTER HARNESS ASY
7	101CA41800	1	58900	101CA41800	COUNTER ASY
8	101DA15113	1	58900	101DA15113	HEATSINK ASSY
9	101DA17000	1	58900	101DA17000	REAR PANEL ASY
10	104DA01700	1	58900	104DA01700	MICROWAVE DECK ASY M1026
13	101CA17200	1	58900	101CA17200	DISPLAY INTERFACE CABLE
14	101CA17300	1	58900	101CA17300	IEEE INTERFACE CABLE
18	101DF23700	1	58900	101DF23700	SIDE GUSSET
19	104AW02002	Ref	58900	104AW02002	COMPUTER BUS W/L
20	104AW02400	Ref	58900	104AW02400	MICROWAVE CARDCAGE W/L
21	104AW02300	Ref	58900	104AW02300	ATTENUATOR CHASSIS W/L
22	101AW37902	Ref	58900	101AW37902	ATTENUATOR DRIVER W/L
23	101AW18100	Ref	58900	101AW18100	COUNTER HARNESS W/L
24	101AW26900	Ref	58900	101AW26900	COUNTER W/L
25	101AW26800	Ref	58900	101AW26800	SOFT COAX CABLES W/L
26	101AW15113	Ref	58900	101AW15113	HEATSINK ASY W/L
27	101AW36100	Ref	58900	101AW36100	LEVER SWITCH CABLE W/L
28	106AW04501	Ref	58900	106AW04501	POWER SUPPLY W/L
29	101AW19000	Ref	58900	101AW19000	REAR PANEL W/L
30	101AW15203	Ref	58900	101AW15203	1.9-8.7 OSCILLATOR W/L
31	101AW15303	Ref	58900	101AW15303	2-8 OSCILLATOR W/L
32	101AW15403	Ref	58900	101AW15403	8-12 OSCILLATOR W/L
33	101AW15503	Ref	58900	101AW15503	12-18 OSCILLATOR W/L
34	104AW00403	Ref	58900	104AW00403	18-26 OSCILLATOR W/L
35	104AW01800	Ref	58900	104AW01800	MODULE W/L
36	101CA17504	1	58900	101CA17504	.085 CABLE #18 ASY
37	101CA17505	1	58900	101CA17505	.085 CABLE # 9 ASY
38	101CA17506	1	58900	101CA17506	.085 CABLE # 5 ASY
39	101CA17509	1	58900	101CA17509	.085 CABLE # 4 ASY
40	101CA17510	1	58900	101CA17510	.085 CABLE #19 ASY
41	101CA17511	1	58900	101CA17511	.085 CABLE # 3 ASY
42	101CA17512	1	58900	101CA17512	.085 CABLE #16 ASY
43	101CA17514	1	58900	101CA17514	.085 CABLE #21 ASY
44	101CA17517	1	58900	101CA17517	.085 CABLE #24A ASY
45	101CA17518	1	58900	101CA17518	.085 CABLE #24B ASY
46	101CA17602	1	58900	101CA17602	.141 CABLE # B ASY
47	101CA17603	1	58900	101CA17603	.141 CABLE #11 ASY
48	101CA17606	1	58900	101CA17606	.141 CABLE # A ASY
49	101CA17607	1	58900	101CA17607	.141 CABLE #12 ASY
50	101CA17503	1	58900	101CA17503	.085 CABLE #17 ASY
51	101CA17610	1	58900	101CA17610	.141 CABLE # 2 ASY
52	101CA17611	1	58900	101CA17611	.141 CABLE # 6 ASY
53	101CA17612	1	58900	101CA17612	.141 CABLE #10 ASY
54	101CA17618	1	58900	101CA17618	.141 CABLE #13 ASY
55	101CA17609	1	58900	101CA17609	.141 CABLE # F ASY
56	101CA17519	1	58900	101CA17519	.085 CABLE #24C ASY
57	101CA17604	1	58900	101CA17604	.141 CABLE # 1 ASY
58	BHG0-05000	2	23936	5504	5' FAN FINGER GUARD
59	BHS0-05000	1	23936	5502	5' FAN SCREEN
60	101CA17508	1	58900	101CA17508	.085 CABLE #15 ASY
101	HBFP-63204	13	96906	MS-24693-24	6-32 X 1/4 FLAT
102	HBPP-63204	10	96906	MS-51957-26	6-32 X 1/4 PAN

Parts List for 104DA00210 CHASSIS ASY 1026 Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
103	HWSS-60400	20	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
104	HWFS-60500	14	96906	MS15795-805	#6 X 5/16 FLAT WASHER
105	HSDH-60604	2	55566	4532-632-SS	6-32 X 3/8 M/F HEX SPACE
106	HNKS-63204	2	96906	MS35649-***	6-32 KEP NUT
107	HBPP-63208	8	96906	MS-51957-30	6-32 X 1/2 PAN
A 111	101BA29400	1	58900	101BA29400	DETECTOR TEMP COMP PCA

Parts List for 101DA17720 COMPUTER DECK ASY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101DF03301	1	58900	101DF03301	COMPUTER CHASSIS
2	101CF03500	1	58900	101CF03500	CARDCAGE FRONT WALL
3	101CF03400	1	58900	101CF03400	CARDCAGE REAR WALL
4	101CA04101	1	58900	101CA04101	COMPUTER BUS PCA
5	101BA39000	1	58900	101BA39000	TIME BASE OSC MOUNT ASY
6	101DF23700	1	58900	101DF23700	SIDE GUSSET
7	101CC01601	1	58900	101CC01601	PWR TRANSFORMER W/HEADER
8	JPSG-20022	1	11769	6022-044-450-001	44 PIN PC GUIDE CONN
9	HGP0-02500	2	07556	HS2500-38	2.5' CARD GUIDE
10	HGP0-04125	14	07556	58-30-40	4.125' CARD GUIDE
13	ETIM-10312	1	83330	3010	10POSITION TERM STRIP
14	101BF38700	1	58900	101BF38700	AM MODULATOR MOUNT
15	420BF09200	1	58900	420BF09200	TRANSFORMER SHIELD 7XXX
101	HBPP-63204	10	96906	MS-51957-26	6-32 X 1/4 PAN
102	HWSS-60400	10	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
103	HIGP-00090	6	65664	WG201	FLEXIBLE GROMMET
104	HTM0-00001	1	06383	TA1S8	ANCHOR MOUNT
105	HBPP-83206	4	96906	MS-51957-43	8-32 X 3/8 PAN
106	HWSS-80400	6	96906	MS35338-137	#8 X 1/4 SPLIT LOCK
107	HWFS-80600	4	96906	MS15795-807	#8 X 3/8 FLAT WASHER
108	HBPP-44005	8	96906	MS-51957-14	4-40 X 5/16 PAN
109	HLLT-40210	2	79963	505-#4	#4 SOLDER LUG
110	HLST-A1211	16	79963	627-.196	#10 SOLDER LUG
111	HBPP-63206	24	96906	MS-51957-28	6-32 X 3/8 PAN
112	HLLT-60212	5	79963	505-#6	#6 SOLDER LUG
113	HNKS-63204	24	96906	MS35649-***	6-32 KEP NUT
114	HBFP-63204	9	96906	MS-24693-24	6-32 X 1/4 FLAT
115	HBPP-A3206	1	96906	MIL STD	10-32 X 3/8 PAN
118	HWSS-40300	12	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
119	HWFS-40400	12	96906	MS15795-803	#4 X 1/4 FLAT WASHER
120	HBPP-83204	1	96906	MS-51957-41	8-32 X 1/4 PAN
121	HLLT-80212	1	79963	505-#8	#8 SOLDER LUG
122	HBPP-44009	6	96906	MS-51957-120	4-40 X 9/16 PAN
123	HSDH-80406	2	55566	4620-832-SS-0	8-32 X 1/4 M/F SPACER
C 1	CE15-09180	1	65517	EMC183AG15T	18000 UF 15V ELECT.
C 2	CE15-09180	1	65517	EMC183AG15T	18000 UF 15V ELECT.
C 3	CE15-09180	1	65517	EMC183AG15T	18000 UF 15V ELECT.
C 4	CE35-08900	1	65517	EMC922AH35T	9000 UF 35V ELECT.
C 5	CE35-08900	1	65517	EMC922AH35T	9000 UF 35V ELECT.
C 6	CE35-08900	1	65517	EMC922AH35T	9000 UF 35V ELECT.
C 7	CE35-08900	1	65517	EMC922AH35T	9000 UF 35V ELECT.
C 8	CE35-08900	1	65517	EMC922AH35T	9000 UF 35V ELECT.

Parts List for 101CA04101 COMPUTER BUS PCA Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF04101	1	58900	101CF04101	COMPUTER BUS PCB
2	JPP0-20030	8	31781	345-060-524-202	60 PIN PC EDGE CONN
3	JPP0-20017	6	31781	345-034-524-201	34 PIN PC EDGE CONN
4	JPP0-20013	7	31781	345-026-524-201	26 PIN PC EDGE CONN
5	ETSB-06216	16	88245	2000B	BIFURCATED TERMINAL 5/32
6	JIA1-34730	2	52072	CA-D34-23B-73	34 PIN STRIPLINE PLUG

Parts List for 101BA39000 TIME BASE OSC MOUNT ASY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF39000	1	58900	101BF39000	TIME BASE OSC MOUNT
2	JPS0-20006	1	31781	307-012-500-202	12 PIN PC EDGE CONN
3	HLLT-40210	2	79963	505-#4	#4 SOLDER LUG

Parts List for 101CA15000 uWAVE CARDCAGE ASY Rev F

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101DF03800	1	58900	101DF03800	MICROWAVE CARDCAGE
2	JPS0-20022	9	81312	HCB22S0	44 PIN PC EDGE CONN
3	HGP0-02500	18	07556	HS2500-38	2.5' CARD GUIDE
4	101BA11500	4	58900	101BA11500	PC SHIELD PCA
8	CT20-07100	1	56289	150D107X0020S2	100 UF 20V TANTALUM
9	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
10	CT30-07100	2	31433	T140D107M030AS	100 UF 30V TANTALUM
12	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U

Parts List for 101BA11500 PC SHIELD PCA Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF11500	1	58900	101BF11500	PC SHIELD PCB
2	HSTX-44002	4	88245	A1591A	4-40 CORNR BLOCK 1/32 MT

Parts List for 104CA01000 ATTEN CHASSIS ASY M1026 Rev F

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF03600	1	58900	101CF03600	ATTENUATOR CHASSIS
2	101BF02300	1	58900	101BF02300	CONNECTOR MOUNTING PLATE
3	101BA19601	1	58900	101BA19601	ATTEN. CHASSIS WIRING HA
4	JRAB-00200	3	93459	9934-3	SMA F BULK MT CONN
5	004BA03000	1	58900	004BA03000	POWER SPLITTER (M160)
6	MMDC-00126	1	99899	80014	2-26 GHZ 500 MHZ IF MIX
7	JRAA-00200	1	98291	50-673-0159-31	SMA M TO SMA M ADAPT
8	101BA39700	1	58900	101BA39700	ATTENUATOR ASY 26GHz
9	101BF12500	2	58900	101BF12500	O/P COUPLER BRACKET
10	MDS0-00026	1	62331	202-S	.01-26GHZ DETECTOR
11	HSTR-62004	2	06540	8165-A0632	6-32 X 1 1/4 SPACER
12	HIGP-00090	6	65664	WG201	FLEXIBLE GROMMET
13	HSCR-40404	2	06540	9224A115	#4 X 1/4 CLEAR SPACER
101	HBPP-44008	2	96906	MS-51957-17	4-40 X 1/2 PAN
102	HWSS-40300	14	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
103	HBPP-44005	10	96906	MS-51957-14	4-40 X 5/16 PAN
104	HBPP-44004	2	96906	MS-51957-13	4-40 X 1/4 PAN
105	HWFS-40500	6	96906	MS15795-804	#4 X 5/16 FLAT WASHER
106	HBPP-63204	1	96906	MS-51957-26	6-32 X 1/4 PAN
107	HWSS-60400	1	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
108	HBFP-63204	3	96906	MS-24693-24	6-32 X 1/4 FLAT

Parts List for 101BA19601 ATTEN. CHASSIS WIRING HA Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	JPSG-20022	3	11769	6022-044-450-001	44 PIN PC GUIDE CONN
2	HLLT-40210	6	79963	505-#4	#4 SOLDER LUG
3	HSDH-40604	6	55566	4532-440-SS-0	4-40 X 3/8 M/F SPACER

Parts List for 004BA03000 POWER SPLITTER (M160) Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
0	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
1	101CF11100	1	58900	101CF11100	POWER SPLITTER HOUSING
2	101BF11200	1	58900	101BF11200	POWER SPLITTER COVER
3	101BF11800	Ref	58900	101BF11800	LOW BAND MIXER BD
4	101CF10200	Ref	58900	101CF10200	SPLITTER BD
5	JRAF-00010	2	2J899	9954-0732-6210	SMA F BULK MT CONNECTOR
6	JRAF-00051	2	98291	50-645-4504-89	SMA F BULK MT CONNECTOR
7	ETI0-07555	1	98291	0011038000479	FEED THRU TERMINAL
8	TCC0-01260	2	29990	111UG261M100AP	260PF CHIP CAPACITOR
10	TLW0-01227	3	60450	50-1847-CAT	227 NH INDUCTOR
11	TDPB-00040	2	17540	DSG6474B	BEAM LEAD PIN DIODE
12	MMDC-00003	1	15542	SRA-11	.05-2 GHZ 600 MHZ IF MIX
13	001BF01002	Ref	58900	001BF01002	MODULE LABEL 004BA03000

Parts List for MMDC-00126 MIXER;2-26 GHZ IN;0 TO 5 Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	005BA31100	1	58900	005BA31100	2-26 MIXER ASY
2	001BF01066	1	58900	001BF01066	LABEL 004BA31100

Parts List for 101BA39700 ATTENUATOR ASY 26GHz Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	MP90-02603	1	28480	33323K-90	90DB 26GHZ 10DB STEP ATT
A 112	101BA37900	1	58900	101BA37900	ATTENUATOR DRIVER PCA

Parts List for 101CA15700 SAMPLER ELECTR ASY(.05+) Rev G

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	004BA00001	1	58900	004BA00001	SAMPLER ASSEMBLY
2	101BF04300	2	58900	101BF04300	SAMPLER IF WALL
3	101BF04400	1	58900	101BF04400	SAMPLER DRIVER WALL
4	101BF04500	1	58900	101BF04500	SAMPLER DRIVER SUPPORT
5	101BF04600	2	58900	101BF04600	SAMPLER IF SUPPORT
6	101BF25901	1	58900	101BF25901	CONNECT.MTG PLATE 100MHz
7	004BA00101	1	58900	004BA00101	SAMPLER ASSY REVERSE MTG
8	101CF25801	1	58900	101CF25801	100 MHz MODULE COVER
9	LFT0-83208	9	59660	4205-005-S	FEED-THRU FILTER 15A
10	JRBM-00000	4	98291	51-045-0000	SMB M BULK MOUNT
11	004BA09000	1	58900	004BA09000	DOWNCONVERTER (M167)
15	HQIS-01260	1	55285	7403-09FR-51	TO126 INSULATOR
16	ETI0-07555	2	98291	0011038000479	FEED THRU TERMINAL
23	RN55-01300	1	81349	RN55C1300F	130 OHMS 1% MET FILM
24	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
101	GELS-26125	Ref	04552	LS26-1/8	LS26 ECCOSORB
102	HBPP-44005	1	96906	MS-51957-14	4-40 X 5/16 PAN
103	HWSS-40300	4	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
104	HQWN-02200	1	04713	B51547F019	TO220 SHOULDER WASHER
105	HBFP-25605	4	96906	MS-24693-***	2-56 X 5/16 FLAT
106	HBFP-25603	23	96906	MS-24693-***	2-56 X 3/16 FLAT
107	HWSS-20200	4	96906	MS35338-134	#2 X 1/8 SPLIT LOCK
108	HBPP-25606	4	96906	MS-51957-5	2-56 X 3/8 PAN
109	HBPP-44004	4	96906	MS-51957-13	4-40 X 1/4 PAN
110	HWFS-40400	5	96906	MS15795-803	#4 X 1/4 FLAT WASHER
111	HQWC-01260	1	04713	B52200F006	TO126 DOME WASHER
A 103	101CA04200	1	58900	101CA04200	100MHZ MODULE PCA
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 65	CC50-01120	1	51642	150-100-COG-121	120 PF CERAMIC NPO
L 6	LAD0-06270	1	72259	WEE-27	27 UH INDUCTOR
L 7	LAD0-04150	1	72259	WEE-.15	.15 UH INDUCTOR
L 8	LAD0-04150	1	72259	WEE-.15	.15 UH INDUCTOR
U 1	URC0-07905	1	04713	MC7905.2CT	MC7905.2CT 1A -5.2V REG

Parts List for 004BA00001 SAMPLER ASSEMBLY Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	005CA00000	1	58900	005CA00000	SAMPLER MODULE
2	001BF01069	1	58900	001BF01069	MODULE LABEL 004BA00001
3	004AT00000	Ref	58900	004AT00000	TEST PROCEDURE SAMPLER
4	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM

Parts List for 004BA00101 SAMPLER ASSY REVERSE MTG Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	005CA00100	1	58900	005CA00100	SAMPLER MODULE; INVERTED
2	001BF01070	1	58900	001BF01070	MODULE LABEL 004BA00101
3	004AT00000	Ref	58900	004AT00000	TEST PROCEDURE SAMPLER
4	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM

Parts List for 004BA09000 DOWNCONVERTER (M167) Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BA05200	1	58900	101BA05200	HIGH BAND FILTERS PCA
2	101BA06000	1	58900	101BA06000	LOW BAND FILTERS PCA
3	101BF26000	1	58900	101BF26000	END PLATE 100 MHZ MODULE
4	101BF19900	1	58900	101BF19900	DOWNCONVERTER BOT COVER
5	101CF20000	1	58900	101CF20000	DOWNCONVERTER TOP COVER
6	JRAF-00051	3	98291	50-645-4504-89	SMA F BULK MT CONNECTOR
7	MMDD-00711	1	21847	MX11500	7-11 GHZ 3.5 GHZ IF MIX
8	101CF19800	1	58900	101CF19800	DOWNCONVERTER HOUSING
9	LFT0-83216	12	59660	4201-014-s	FEED-THRU FILTER 15A
10	101BF27500	1	58900	101BF27500	MIXER MOUNTING PLATE
11	HLLT-80212	1	79963	505-#8	#8 SOLDER LUG
12	101BF26100	2	58900	101BF26100	SIDE PLATE 100 MHZ MODUL
13	001BF01017	Ref	58900	001BF01017	MODULE LABEL 004BA09000
14	HBPP-25603	2	96906	MS-51957-2	2-56 X 3/16 PAN
15	HWSS-20200	2	96906	MS35338-134	#2 X 1/8 SPLIT LOCK
16	HWFS-20400	2	96906	MS15795-802	#2 X 1/4 FLAT WASHER

Parts List for 101BA05200 HIGH BAND FILTERS PCA Rev Q

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF05200	1	58900	101CF05200	HIGH BAND FILTERS PCB
2	TDPB-00040	17	17540	DSG6474B	BEAM LEAD PIN DIODE
3	TDPG-00200	5	1HJ31	MA-4P404-54	GLASS PACK PIN DIODE
4	MA12-00003	1	24539	MSA-0335-21	0-3000 MHZ +10DBM AMP
5	MA08-00003	1	24539	MSA-0435	0-3000 MHZ +13DBM AMP
6	MA07-00002	1	14482	WJ-A39	10-2000 HZ +20DBM AMP
7	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
8	RN55-00750	1	81349	RN55C75R0F	75.0 OHMS 1% MET FILM
9	RN55-01210	1	81349	RN55C1210F	121 OHMS 1% MET FILM
10	RN55-01500	1	81349	RN55C1500F	150 OHMS 1% MET FILM
11	CK50-03100	5	31433	VJ08050A103KXAMB	.01 UF X7R CHIP
12	TLW0-01227	10	60450	50-1847-CAT	227 NH INDUCTOR
13	LAD0-06270	2	72259	WEE-27	27 UH INDUCTOR
14	RN55-05620	2	81349	RN55C5620F	562 OHMS 1% MET FILM

Parts List for 101BA06000 LOW BAND FILTERS PCA Rev I

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF06000	1	58900	101CF06000	LOW BAND FILTERS PCB
3	RN55-04750	9	81349	RN55C4750F	475 OHMS 1% MET FILM
4	RN55-11000	2	81349	RN55C1001F	1 K OHMS 1% MET FILM
5	CC50-00270	2	52763	EDPT-27-NPO-5%	27 PF CERAMIC NPO
6	CC50-00390	2	51642	150-100-COG-390J	39 PF CERAMIC NPO
9	CC50-00560	2	51642	150-100-COG-560J	56 PF CERAMIC NPO

Parts List for 104DA01700 MICROWAVE DECK ASY M1026 Rev D

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101DF03700	1	58900	101DF03700	MICROWAVE CHASSIS
2	101CA15203	1	58900	101CA15203	REF OSC ASY(2+,XSTR)
3	101CA15303	1	58900	101CA15303	2-8GHz ASY(XSTR,STD)
4	101CA15403	1	58900	101CA15403	8-12GHz ASY(XSTR,STD)
5	101CA15503	1	58900	101CA15503	12-18GHz ASY(XSTR,STD)
6	104CA00403	1	58900	104CA00403	18-26GHz ASY(XSTR,STD)
7	004BA05010	1	58900	004BA05010	2-8 MODULE 1026
8	004BA06301	1	58900	004BA06301	8-12 MOD. (M184) BRN DOT
9	101BF37100	1	58900	101BF37100	DIRECTIONAL DET MOUNT
10	004BA08000	1	58900	004BA08000	REF. SWITCH, 1026(M165)
11	004BA04100	1	58900	004BA04100	O/P SW, 1026(M166)
12	HSDH-42503	2	55566	4522-440-SS-0	4-40 X 1 9/16 HEX SPACER
13	JRAB-18200	1	98291	50-675-0000-31	SMA F BULK MT CONN
14	101BF27700	1	58900	101BF27700	8-12 MODULE BRACKET
15	MDS0-00002	1	62331	301E	.01-20GHz SMA DETECTOR
16	MC15-10002	1	15542	ZFDC-15-5	.1-2000 MHZ 15 DB CPLR
17	MIMM-20812	1	1Y147	VX-8012	8-12 GHZ DUAL ISOLTR
18	101BF36800	1	58900	101BF36800	DETECTOR MOUNT
19	MCD1-00226	1	62331	2616S	1.7-26.5 GHZ DIR DET
20	101BF36900	1	58900	101BF36900	COUPLER MOUNTING PLATE
21	JRAA-00200	1	98291	50-673-0159-31	SMA M TO SMA M ADAPT
22	HIGP-00090	3	65664	WG201	FLEXIBLE GROMMET
23	HIGP-00750	1	28520	2096	3/4' GROMMET
101	HBFP-44004	2	96906	MS-24693-02	4-40 X 1/4 FLAT
102	HBPP-63205	1	96906	MS-51957-27	6-32 X 5/16 PAN
103	HWSS-60400	5	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
104	HBPP-63204	2	96906	MS-51957-26	6-32 X 1/4 PAN
105	HNKS-63204	6	96906	MS35649-***	6-32 KEP NUT
106	HBPP-63206	4	96906	MS-51957-28	6-32 X 3/8 PAN
107	HBFP-44015	2	96906	MS-24693-***	4-40 X 15/16 FLAT
108	HNKS-44004	2	96906	MS35649-***	4-40 KEP NUT
109	HBPP-44005	5	96906	MS-51957-14	4-40 X 5/16 PAN
110	HWSS-40300	9	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
111	HWFS-40500	6	96906	MS15795-804	#4 X 5/16 FLAT WASHER
112	HBPP-44004	6	96906	MS-51957-13	4-40 X 1/4 PAN
113	HBPP-25605	3	96906	MS-51957-4	2-56 X 5/16 PAN
114	HWSS-20200	5	96906	MS35338-134	#2 X 1/8 SPLIT LOCK
115	HWFS-20400	3	96906	MS15795-802	#2 X 1/4 FLAT WASHER

Parts List for 101CA15203 REF OSC ASY(2+,XSTR) Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	004BA07000	1	58900	004BA07000	REF.COUPLER,(M164)
2	101CF07800	1	58900	101CF07800	1.9-8.7GHZ BRACKET
3	HQCP-00030	1	13103	8903VB	T03 STYLE COVER
4	HQIS-00030	1	55285	K4-05	TO3 INSULATOR
5	HSCR-40204	2	06540	9222A115	#4 X 1/8 CLEAR SPACER
6	HSCR-40404	2	06540	9224A115	#4 X 1/4 CLEAR SPACER
7	JRAA-00200	2	98291	50-673-0159-31	SMA M TO SMA M ADAPT
8	JSS0-30003	1	06776	MD3452-G	TO3 SOCKET
9	MMDC-00126	1	99899	80014	2-26 GHZ 500 MHZ IF MIX
10	MOYT-00209	1	24539	S080-1342	1.9-8.7 GHZ YIG XSTR OSC
11	RC20-00430	1	01121	EB-430-5	43 OHMS 5% 1/2W CARBON
12	QBNP-05881	1	04713	2N5881	2N5881 15A 60V 160W NPN
13	RW25-00070	1	15915	TM25-7 OHM-1%Y	7 OHM 25W KELVIN LEAD
14	DPAB-05391	2	04713	1N5391	IN5391 1.5A 35V DIODE
15	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
16	ETIT-44050	3	88245	1470F-4-11.2	INSULATED TURRET TERMINA
17	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
18	HLLT-40210	1	79963	505-#4	#4 SOLDER LUG
19	JRAB-18200	1	98291	50-675-0000-31	SMA F BULK MT CONN
20	101BF36800	1	58900	101BF36800	DETECTOR MOUNT
21	101AW15203	Ref	58900	101AW15203	1.9-8.7 OSCILLATOR W/L
101	HBPP-63208	2	96906	MS-51957-30	6-32 X 1/2 PAN
102	HWSS-60400	6	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
103	HBPP-63205	4	96906	MS-51957-27	6-32 X 5/16 PAN
104	HBPP-44006	2	96906	MS-51957-15	4-40 X 3/8 PAN
105	HBPP-44008	2	96906	MS-51957-17	4-40 X 1/2 PAN
106	HBPP-44004	2	96906	MS-51957-13	4-40 X 1/4 PAN
107	HBFP-44008	1	96906	MS-24693-06	4-40 X 1/2 FLAT
108	HWFS-40400	5	96906	MS15795-803	#4 X 1/4 FLAT WASHER
109	HWSS-40300	12	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
110	HNSS-44004	6	96906	MS35649-244	4-40 HEX NUT
111	HBFP-44005	2	96906	MS-24693-03	4-40 X 5/16 FLAT

Parts List for 004BA07000 REF.COUPLER,(M164) Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	005BA07000	1	58900	005BA07000	REFERENCE COUPLER ASY
2	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
3	001BF01012	Ref	58900	001BF01012	MODULE LABEL 004BA07000

Parts List for 101CA15303 2-8GHz ASY(XSTR,STD) Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF07900	1	58900	101CF07900	2-8GHZ BRACKET
2	MOYT-30208	1	24539	YO87-4408	2-8 GHZ YIG XSTR OSC
3	DPAB-05391	2	04713	1N5391	IN5391 1.5A 35V DIODE
4	RW25-00070	1	15915	TM25-7 OHM-1%Y	7 OHM 25W KELVIN LEAD
5	RC20-00220	1	01121	EB-220-5	22 OHMS 5% 1/2W CARBON
6	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
7	JSS0-30003	1	06776	MD3452-G	TO3 SOCKET
8	HQIS-00030	1	55285	K4-05	TO3 INSULATOR
9	HQCP-00030	1	13103	8903VB	T03 STYLE COVER
10	QBNP-05881	1	04713	2N5881	2N5881 15A 60V 160W NPN
11	ETIT-44050	3	88245	1470F-4-11.2	INSULATED TURRET TERMINA
12	CC50-05100	2	56289	2C2525U105M050B	1 UF CERAMIC Z5U
13	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
14	HLLT-40210	1	79963	505-#4	#4 SOLDER LUG
15	HIGP-00090	1	65664	WG201	FLEXIBLE GROMMET
101	HBPP-44005	2	96906	MS-51957-14	4-40 X 5/16 PAN
102	HBFP-44008	1	96906	MS-24693-06	4-40 X 1/2 FLAT
103	HBPP-63208	2	96906	MS-51957-30	6-32 X 1/2 PAN
104	HBFP-63204	4	96906	MS-24693-24	6-32 X 1/4 FLAT
105	HNSS-44003	3	96906	MS35649-***	4-40 HEX NUT
106	HWSS-40300	3	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
107	HWFS-40400	1	96906	MS15795-803	#4 X 1/4 FLAT WASHER
108	HWSS-60400	2	96906	MS35338-136	#6 X 1/4 SPLIT LOCK

Parts List for 101CA15403 8-12GHz ASY(XSTR,STD) Rev D1

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF07700	1	58900	101CF07700	8-12GHZ BRACKET
2	MOYT-00513	1	24539	Y085-2638	5.4-12.5 GHz YIG OSC
3	HIGP-00090	1	65664	WG201	FLEXIBLE GROMMET
5	DPAB-05391	2	04713	1N5391	IN5391 1.5A 35V DIODE
6	QBNP-05881	1	04713	2N5881	2N5881 15A 60V 160W NPN
7	QBPP-05193	1	04713	2N5193	2N5193 4A 40V 40W PNP
8	RW25-00050	1	15915	TM25-5 OHM-1%Y	5 OHM 25W KELVIN LEAD
9	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
10	RC20-00330	1	01121	EB-330-5	33 OHMS 5% 1/2W CARBON
11	JSS0-30003	1	06776	MD3452-G	TO3 SOCKET
12	HQIS-00030	1	55285	K4-05	TO3 INSULATOR
13	HQCP-00030	1	13103	8903VB	T03 STYLE COVER
14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
15	HQIS-01260	1	55285	7403-09FR-51	TO126 INSULATOR
16	HQWC-01260	1	04713	B52200F006	TO126 DOME WASHER
17	ETIT-44050	3	88245	1470F-4-11.2	INSULATED TURRET TERMINA
18	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
19	HLLT-40210	1	79963	505-#4	#4 SOLDER LUG
101	HBPP-63208	2	96906	MS-51957-30	6-32 X 1/2 PAN
102	HWSS-60400	6	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
103	HBPP-63206	4	96906	MS-51957-28	6-32 X 3/8 PAN
104	HBFP-44008	1	96906	MS-24693-06	4-40 X 1/2 FLAT
105	HWFS-40400	1	96906	MS15795-803	#4 X 1/4 FLAT WASHER
106	HWSS-40300	6	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
107	HNSS-44004	6	96906	MS35649-244	4-40 HEX NUT
108	HBFP-44005	2	96906	MS-24693-03	4-40 X 5/16 FLAT
109	HBPP-44006	1	96906	MS-51957-15	4-40 X 3/8 PAN

Parts List for 101CA15503 12-18GHz ASY(XSTR,STD) Rev D

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF07600	1	58900	101CF07600	12-18GHZ BRACKET
2	MOYT-01018	1	24539	Y085-2639	10-18 GHZ YIG XSTR OSC
3	MIMF-21218	1	1Y147	VX-1218	12-18 GHZ DUAL ISOLTR
4	QBNP-05881	1	04713	2N5881	2N5881 15A 60V 160W NPN
5	QBPP-05193	1	04713	2N5193	2N5193 4A 40V 40W PNP
6	RW25-00050	1	15915	TM25-5 OHM-1%Y	5 OHM 25W KELVIN LEAD
7	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
8	RC20-00330	1	01121	EB-330-5	33 OHMS 5% 1/2W CARBON
9	JSS0-30003	1	06776	MD3452-G	TO3 SOCKET
10	HQIS-00030	1	55285	K4-05	TO3 INSULATOR
11	HQCP-00030	1	13103	8903VB	T03 STYLE COVER
12	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
13	HQIS-01260	1	55285	7403-09FR-51	TO126 INSULATOR
14	HQWC-01260	1	04713	B52200F006	TO126 DOME WASHER
15	DPAB-05391	2	04713	1N5391	IN5391 1.5A 35V DIODE
16	ETIT-44050	3	88245	1470F-4-11.2	INSULATED TURRET TERMINA
17	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
18	HLLT-40210	1	79963	505-#4	#4 SOLDER LUG
101	HBPP-63208	2	96906	MS-51957-30	6-32 X 1/2 PAN
102	HWSS-60400	6	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
103	HBPP-63205	4	96906	MS-51957-27	6-32 X 5/16 PAN
104	HBPP-25605	3	96906	MS-51957-4	2-56 X 5/16 PAN
105	HWSS-20200	3	96906	MS35338-134	#2 X 1/8 SPLIT LOCK
106	HWFS-20400	3	96906	MS15795-802	#2 X 1/4 FLAT WASHER
107	HBFP-44008	1	96906	MS-24693-06	4-40 X 1/2 FLAT
108	HWFS-40400	1	96906	MS15795-803	#4 X 1/4 FLAT WASHER
109	HWSS-40300	5	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
110	HNSS-44004	7	96906	MS35649-244	4-40 HEX NUT
111	HBFP-44005	2	96906	MS-24693-03	4-40 X 5/16 FLAT
112	HBPP-44006	1	96906	MS-51957-15	4-40 X 3/8 PAN

Parts List for 104CA00403 18-26GHz ASY(XSTR,STD) Rev D

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	104CF02500	1	58900	104CF02500	18-26.5 GHZ BRACKET
2	MOYT-L1826	1	24539	YO89-4084	18-26.5 LO NOISE YIG
3	QBNP-05881	1	04713	2N5881	2N5881 15A 60V 160W NPN
4	QBPP-05193	1	04713	2N5193	2N5193 4A 40V 40W PNP
5	RW25-00050	1	15915	TM25-5 OHM-1%Y	5 OHM 25W KELVIN LEAD
6	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
7	RC20-00330	1	01121	EB-330-5	33 OHMS 5% 1/2W CARBON
8	JSS0-30003	1	06776	MD3452-G	TO3 SOCKET
9	HQIS-00030	1	55285	K4-05	TO3 INSULATOR
10	HQCP-00030	1	13103	8903VB	T03 STYLE COVER
11	HQIS-01260	1	55285	7403-09FR-51	TO126 INSULATOR
12	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
13	HQWC-01260	1	04713	B52200F006	TO126 DOME WASHER
14	MIMF-01826	1	1Y147	VX1826	18-26 GHZ ISOLATOR
15	DPAB-05391	2	04713	1N5391	IN5391 1.5A 35V DIODE
16	ETIT-44050	3	88245	1470F-4-11.2	INSULATED TURRET TERMINA
17	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
18	HLLT-40210	1	79963	505-#4	#4 SOLDER LUG
19	HIGP-00090	1	65664	WG201	FLEXIBLE GROMMET

Parts List for 004BA05010 2-8 MODULE 1026 Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	005BA05010	1	58900	005BA05010	2-8 MODULE,1026
2	001BF01074	Ref	58900	001BF01074	MODULE LABEL 004BA05010

Parts List for 004BA06301 8-12 MOD. (M184) BRN DOT Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF20300	1	58900	101CF20300	8-12 MODULE #2 HOUSING
2	101BF10900	1	58900	101BF10900	8-12 MODULE COVER
3	005CF06300	Ref	58900	005CF06300	8-12 MODULE BD
4	JRAF-00010	4	2J899	9954-0732-6210	SMA F BULK MT CONNECTOR
5	ETI0-07555	3	98291	0011038000479	FEED THRU TERMINAL
6	TRC0-01250	1	27851	2MCB1250F	125 OHM CHIP RESISTOR
7	TRC0-00500	1	27851	2MCB0500F	50 OHM CHIP RESISTOR
8	TCC0-00220	3	29990	111SF220K100AP	22PF CHIP CAPACITOR
9	TDPB-00040	1	17540	DSG6474B	BEAM LEAD PIN DIODE
10	TDPC-00050	4	17540	CSB7002-85	CHIP PIN DIODE
11	TCC0-00100	2	29990	111SJ100K100AP	10PF CHIP CAPACITOR
12	TRC0-00200	1	27851	2MCB0200F	20 OHM CHIP RESISTOR
13	TDPC-01010	2	59365	M5X2326	0.01 CHIP PIN DIODE
14	TDPB-04025	1	28480	HPND4018	BEAM LEAD PIN DIODE
15	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
16	001BF01011	Ref	58900	001BF01011	MODULE LABEL 004BA06301
17	HLST-21105	1	79963	341-.093	#2 SOLDER LUG
18	HBPP-44003	1	96906	MS-51957-12	4-40 X 3/16 PAN
19	HLLT-40210	2	79963	505-#4	#4 SOLDER LUG

Parts List for 004BA08000 REF. SWITCH, 1026(M165) Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101DF00500	1	58900	101DF00500	REF LOOP SWITCH HOUSING
2	101BF11000	1	58900	101BF11000	REF LOOP SWITCH COVER
3	101BF02100	Ref	58900	101BF02100	REFERENCE LOOP SWITCH BD
4	JRAF-00010	6	2J899	9954-0732-6210	SMA F BULK MT CONNECTOR
5	ETI0-07555	4	98291	0011038000479	FEED THRU TERMINAL
6	TRC0-00200	1	27851	2MCB0200F	20 OHM CHIP RESISTOR
7	TRC0-03000	1	27851	2MCB3000F	300 OHM CHIP RESISTOR
8	TLW0-01227	3	60450	50-1847-CAT	227 NH INDUCTOR
10	TRC0-01250	1	27851	2MCB1250F	125 OHM CHIP RESISTOR
11	TCC0-00220	5	29990	111SF220K100AP	22PF CHIP CAPACITOR
12	TLW0-00400	2	60450	10-1847-CAT	40 NH INDUCTOR
13	TDPB-00040	6	17540	DSG6474B	BEAM LEAD PIN DIODE
14	001BF01013	Ref	58900	001BF01013	MODULE LABEL 004BA08000
15	HSDH-42503	2	55566	4522-440-SS-0	4-40 X 1 9/16 HEX SPACER
16	HWSS-40300	2	96906	MS35338-135	#4 X 3/16 SPLIT LOCK

Parts List for 004BA04100 O/P SW, 1026(M166) Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	005BA04100	1	58900	005BA04100	O/P SW, 1026(M166)
2	101BF12300	1	58900	101BF12300	O/P LOOP SWITCH MOUNT
3	001BF01004	Ref	58900	001BF01004	MODULE LABEL 004BA04100
4	HWSS-40300	2	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
5	HBPP-44004	2	96906	MS-51957-13	4-40 X 1/4 PAN
6	HLLT-40210	2	79963	505-#4	#4 SOLDER LUG
7	HBPP-44003	1	96906	MS-51957-12	4-40 X 3/16 PAN
8	HLST-21105	1	79963	341-.093	#2 SOLDER LUG
9	CC50-03100	3	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
10	CC50-02100	2	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
11	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO

Parts List for 101CA41800 COUNTER ASY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
A 104	101CA05600	1	58900	101CA05600	COUNTER INPUT PCA
A 105	101CA05900	1	58900	101CA05900	COUNTER CONTROL PCA

Parts List for 101BA18100 COUNTER HARNESS ASY Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	JHP0-10016	1	51167	16-600-10	16 PIN DIP HEADER

Parts List for 101DA15113 HEATSINK ASSY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
0	101BS14101	Ref	58900	101BS14101	POWER SUPPLY SCHEMATIC
1	101AW15113	Ref	58900	101AW15113	HEATSINK ASY W/L
3	101CF03901	2	58900	101CF03901	POWER SUPPLY HEATSINK
4	101BF03211	1	58900	101BF03211	FAN SHROUD,LEFT (STD)
5	101BF04001	2	58900	101BF04001	FAN SHROUD COVER
8	JSS0-30003	8	06776	MD3452-G	TO3 SOCKET
9	HQIS-00030	8	55285	K4-05	TO3 INSULATOR
10	BD00-15024	1	23936	A31257-10A	2AVDC 4 5/8' FAN
11	HIGR-00750	1	06540	1131D	3/4' GROMMET
12	HLLT-40210	2	79963	505-#4	#4 SOLDER LUG
13	101BF03212	1	58900	101BF03212	FAN SHROUD,RIGHT (STD)
14	HQWN-02200	1	04713	B51547F019	TO220 SHOULDER WASHER
15	HQIS-01260	1	55285	7403-09FR-51	TO126 INSULATOR
16	HIGR-00437	4	06540	1155A	7/16' GROMMET
17	HSCR-60404	4	06540	9224A140	#6 X 1/4 CLEAR SPACER
18	HTM0-00001	1	06383	TA1S8	ANCHOR MOUNT
19	WTT0-20000	16	29005	#20 TFE TW	#20 CLEAR TFE SLVNG
101	HBPP-63204	12	96906	MS-51957-26	6-32 X 1/4 PAN
102	HWSS-60400	38	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
103	HWFS-60500	26	96906	MS15795-805	#6 X 5/16 FLAT WASHER
104	HBPP-63210	20	96906	MS-51957-31	6-32 X 5/8 PAN
106	HNKS-63204	4	96906	MS35649-***	6-32 KEP NUT
107	HBPP-44004	3	96906	MS-51957-13	4-40 X 1/4 PAN
108	HBPP-63212	4	96906	MS-51957-32	6-32 X 3/4 PAN
109	HBPP-63209	2	96906	MS-51957-123	6-32 X 9/16 PAN
110	HWFS-40500	10	96906	MS15795-804	#4 X 5/16 FLAT WASHER
111	HQWC-01260	2	04713	B52200F006	TO126 DOME WASHER
112	HBPP-44005	2	96906	MS-51957-14	4-40 X 5/16 PAN
113	HBPP-44007	8	96906	MS-51957-16	4-40 X 7/16 PAN
114	HWSS-40300	9	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
A 101	101BA06400	1	58900	101BA06400	POWER SUPPLY A101 PCA
A 102	101BA06500	1	58900	101BA06500	POWER SUPPLY A102 PCA
C 9	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 10	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 15	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 16	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 17	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 18	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 19	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 20	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 21	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 22	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
CR 1	DBMC-00980	1	04713	MDA980-2	MDA980-2 BRIDGE RECT.
CR 2	DBMC-00980	1	04713	MDA980-2	MDA980-2 BRIDGE RECT.
CR 3	DBMC-00980	1	04713	MDA980-2	MDA980-2 BRIDGE RECT.
CR 4	DBMC-00980	1	04713	MDA980-2	MDA980-2 BRIDGE RECT.
Q 1	QBNP-05881	1	04713	2N5881	2N5881 15A 60V 160W NPN
Q 2	QBNP-05881	1	04713	2N5881	2N5881 15A 60V 160W NPN
R 1	RC07-00051	1	01121	RC07GF5R1J	5.1 OHMS 5% 1/4W CARBON
S 1	SSL0-00225	1	14604	3450-88-145	225DEG THERMAL SWITCH
U 1	URK0-03500	1	27014	LM350K	LM350K 3A ADJ REGULATOR
U 2	URK0-03170	1	27014	LM317K	LM317K 1.5A ADJ REGULATO
U 3	URK0-03500	1	27014	LM350K	LM350K 3A ADJ REGULATOR
U 4	URK0-79150	1	04713	MC7915CK	MC7915CK 1A -15V REG
U 5	URK0-03500	1	27014	LM350K	LM350K 3A ADJ REGULATOR
U 7	URK0-03380	1	27014	LM338K	LM338 5A ADJ REGULATOR
U 8	URC0-07824	1	04713	MC7824CT	MC7824CT 1A 24V REG
U 9	URC0-07905	1	04713	MC7905.2CT	MC7905.2CT 1A -5.2V REG

Parts List for 104DA01401 FRONT PANEL ASY M1026-01 Rev C3

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
	104AW01300	Ref	58900	104AW01300	FRONT PANEL W/L 1026
1	101DF01310	1	58900	101DF01310	FRONT SUB-PANEL
2	101BA36100	1	58900	101BA36100	LEVERWHEEL SWITCH CABLE
4	101BA02800	1	58900	101BA02800	ROTARY SWITCH ASY
5	101BF05100	3	58900	101BF05100	LEVER SWITCH MOUNT
6	101DA15801	1	58900	101DA15801	POWER METER SWITCH ASY
7	101DA15802	1	58900	101DA15802	SWEEP SWITCH ASY
8	101DA15803	1	58900	101DA15803	5 BUTTON MOD. SW ASY
9	RABA-21000	2	01121	70B1N040R103W	10K POT 1/8'SH 1T PNL
10	RABA-31000	1	01121	70B1N040R104W	100K POT 1/8'SH 1T PNL
11	ILGR-00200	4	58361	MV5253	GREEN LED
12	JRDF-00001	4	02660	31-221	BNC F PANEL MOUNT
13	ILMC-00200	4	58361	MP51	LED MOUNTING CLIP
14	HLLT-40210	2	79963	505-#4	#4 SOLDER LUG
15	HLLT-K1114	3	79963	814	3/8' (BNC) SOLDER LUG
16	HSTH-42503	3	06540	8120-SS-0440	4-40 X 1 9/16 X 3/16 AF
17	RN55-06810	1	81349	RN55C6810F	681 OHMS 1% MET FILM
18	101BA39400	1	58900	101BA39400	ROTARY SWITCH PCA
19	KGR0-50125	4	32767	G-1-103	1/8' SHFT GRAY RND KNOB
20	KGBD-63250	2	32767	G-106D	1/4' SHFT GRAY BAR KNOB
A 106	101CA03000	1	58900	101CA03000	DISPLAY PCA
A 107	101BA02700	1	58900	101BA02700	LEVER SWITCH PCA

Parts List for 101BA36100 LEVERWHEEL SWITCH CABLE Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	JHP0-10016	1	51167	16-600-10	16 PIN DIP HEADER
2	101AW36100	Ref	58900	101AW36100	LEVER SWITCH CABLE W/L

Parts List for 101BA02800 ROTARY SWITCH ASY Rev D

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF02800	1	58900	101BF02800	ROTARY SWITCH PCB
2	UTN0-01470	1	01295	SN74147N	SN74147N 10 TO 4 DEC
3	UTN0-01261	1	01295	SN74LS126N	SN74LS126N QUAD BUFFER
4	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
5	SRP0-00110	1	81073	50CDP36-01-1-AJN	1P 10T 36DEG ROT SW PC
6	WSTD-240XX	7	29005	EXE2419/36 24GA	24 GA BLACK TFE WIRE

Parts List for 101DA15801 POWER METER SWITCH ASY Rev D

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF02900	1	58900	101BF02900	PUSH BUTTON SWITCH PCB
2	DSA0-04148	4	07263	1N4148	1N4148 G.P. DIODE
7	101BC12605	1	58900	101BC12605	PULSE CALIB SWITCH 3 POS
9	101BC12607	1	58900	101BC12607	SINGLE POS SWITCH
11	101BF02600	1	58900	101BF02600	POWER METER SWITCH PLATE

Parts List for 101DA15802 SWEEP SWITCH ASY Rev D

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF02900	3	58900	101BF02900	PUSH BUTTON SWITCH PCB
2	DSA0-04148	11	07263	1N4148	1N4148 G.P. DIODE
4	101BC12602	1	58900	101BC12602	FUNCTION SWITCH 4 POS
5	101BC12603	1	58900	101BC12603	SWEEP FUNCTION SW 4 POS
6	101BC12604	1	58900	101BC12604	SWEEP RATE SWITCH 3 POS
12	101BF02500	1	58900	101BF02500	SWEEP SWITCH PLATE

Parts List for 101DA15803 5 BUTTON MOD. SW ASY Rev D1

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF02900	2	58900	101BF02900	PUSH BUTTON SWITCH PCB
2	DSA0-04148	7	07263	1N4148	1N4148 G.P. DIODE
7	101BC12605	1	58900	101BC12605	PULSE CALIB SWITCH 3 POS
9	101BC12607	1	58900	101BC12607	SINGLE POS SWITCH
10	101BC12608	1	58900	101BC12608	MODULATION SWITCH 6 POS
13	101BF02400	1	58900	101BF02400	MODULATION SWITCH PLATE

Parts List for 101BA39400 ROTARY SWITCH PCA Rev D

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF39400	1	58900	101BF39400	ROTARY SWITCH PCB
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 2	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
S 1	SRP1-00110	1	81073	24878-10N	1P10T 36 DEG .25 SH PC
S 2	SRP1-00110	1	81073	24878-10N	1P10T 36 DEG .25 SH PC
U 1	UTN0-01470	1	01295	SN74147N	SN74147N 10 TO 4 DEC
U 2	UTN0-01261	1	01295	SN74LS126N	SN74LS126N QUAD BUFFER
U 3	UTN0-01470	1	01295	SN74147N	SN74147N 10 TO 4 DEC
U 4	UTN0-01261	1	01295	SN74LS126N	SN74LS126N QUAD BUFFER

Parts List for 101DA17000 REAR PANEL ASY Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101DF00700	1	58900	101DF00700	REAR PANEL
2	JLFL-01504	1	05245	JA414	2.5A 120V LABEL
7	JLFF-06250	1	05245	6J4	LINE FILTER/CONNEC
8	JRDF-00001	6	02660	31-221	BNC F PANEL MOUNT
10	HLLT-K1114	4	79963	814	3/8' (BNC) SOLDER LUG
11	101BF23401	1	58900	101BF23401	BLOCK OFF PLATE, 36 PIN
12	FSAC-00250	1	75915	31302.5	2.5A SB FUSE 3AG
13	HPM0-00375	3	83330	652	3/8' HOLE PLUG
101	HBPP-44004	2	96906	MS-51957-13	4-40 X 1/4 PAN
102	HWSS-40300	2	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
103	HBPP-63206	2	96906	MS-51957-28	6-32 X 3/8 PAN
104	HWSS-60400	2	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
A 109	101BA04700	1	58900	101BA04700	ADDRESS SWITCH PCA
A 117	101BA36200	1	58900	101BA36200	EXT ALC POT/SW PCA

Parts List for 101DA33000 BENCH MOUNT DRESS (STD) Rev C1

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BA01000	2	58900	101BA01000	OVAL HANDLE ASY
2	101BF01900	2	58900	101BF01900	FOOT SUPPORT
3	101BF09400	2	58900	101BF09400	FRONT TRIM SIDE
4	101CF00100	1	58900	101CF00100	TOP COVER
5	101CF00200	1	58900	101CF00200	BOTTOM COVER
6	101BA01001	2	58900	101BA01001	ROUND HANDLE ASY
7	101CF09500	2	58900	101CF09500	FRONT TRIM
8	101DF01200	2	58900	101DF01200	SIDE TRIM
9	101DF01700	4	58900	101DF01700	CORNER FRAME
10	HSEH-61104	12	05791	SS6981M.125-0.688-01	6-32 X 11/16 M/F 1/8THD
11	HSCR-60404	2	06540	9224A140	#6 X 1/4 CLEAR SPACER
13	HSDH-81006	6	55566	4626-832-SS	8-32 X 5/8 M/F HEX SPACE
16	101CF23600	2	58900	101CF23600	SUB COVER
17	HFBI-00012	1	21604	MP-40008-4	12' INSIDE MOUNT BAIL
18	HFFL-63202	2	21604	PP 40012-1	LEFT FRONT FOOT
19	HFFR-63202	2	21604	PP 40012-2	RIGHT FRONT FOOT
20	HNTU-63206	8	78553	MP40366	#6 TINNERMAN NUT
21	101BF21400	Ref	58900	101BF21400	CHASSIS NOMENCLATURE LBL
22	001BF01100	Ref	58900	001BF01100	FOIL CAL
23	101BA08000	1	58900	101BA08000	COMPUTER EXTENDER PCA
24	101BA08100	1	58900	101BA08100	MICROWAVE EXTENDER PCA
25	101BA08200	1	58900	101BA08200	FLOATING EXTENDER PCA
26	101BF21600	1	58900	101BF21600	PC BOARD PULLER
27	WMP0-03006	1	16428	17506	RT ANG IEC POWER CORD
28	BHG0-05000	2	23936	5504	5' FAN FINGER GUARD
29	BHS0-05000	2	23936	5502	5' FAN SCREEN
101	HBFP-63204	32	96906	MS-24693-24	6-32 X 1/4 FLAT
102	HBPP-63204	8	96906	MS-51957-26	6-32 X 1/4 PAN
103	HWSS-60400	16	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
104	HBFP-44004	18	96906	MS-24693-02	4-40 X 1/4 FLAT
105	HBPP-83206	8	96906	MS-51957-43	8-32 X 3/8 PAN
106	HWSS-80400	8	96906	MS35338-137	#8 X 1/4 SPLIT LOCK
107	HBPP-63208	8	96906	MS-51957-30	6-32 X 1/2 PAN
108	HWFS-60500	8	96906	MS15795-805	#6 X 5/16 FLAT WASHER
109	HBFP-83206	6	96906	MS-24693-48	8-32 X 3/8 FLAT
110	HBFP-63210	8	96906	MS24693-29	6-32 X 5/8 FLAT

Parts List for 101BA01000 OVAL HANDLE ASY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF01000	1	58900	101BF01000	HANDLE FLANGE
2	HHO0-62456	1	88245	A1034-30	OVAL BLACK HANDLE
3	HBPP-A3208	2	96906	MIL STD	10-32 X 1/2 PAN
4	HWSS-A0500	2	96906	MS35338-138	#10 X 3/16 SPLIT LOCK
H 1	HBPP-83206	2	96906	MS-51957-43	8-32 X 3/8 PAN
H 2	HWSS-80400	2	96906	MS35338-137	#8 X 1/4 SPLIT LOCK

Parts List for 101BA01001 ROUND HANDLE ASY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF01000	1	58900	101BF01000	HANDLE FLANGE
2	HHR0-31456	1	88245	A1013-30	ROUND BLACK HANDLE
3	HBPP-A3208	2	96906	MIL STD	10-32 X 1/2 PAN
4	HWSS-A0500	2	96906	MS35338-138	#10 X 3/16 SPLIT LOCK
H 1	HBPP-83206	2	96906	MS-51957-43	8-32 X 3/8 PAN
H 2	HWSS-80400	2	96906	MS35338-137	#8 X 1/4 SPLIT LOCK

Parts List for 101BA08000 COMPUTER EXTENDER PCA Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF08000	1	58900	101BF08000	COMPUTER EXTENDER PCB
2	JPP0-20013	1	31781	345-026-524-201	26 PIN PC EDGE CONN
3	JPP0-20017	1	31781	345-034-524-201	34 PIN PC EDGE CONN
4	JPP0-20030	1	31781	345-060-524-202	60 PIN PC EDGE CONN

Parts List for 101BA08100 MICROWAVE EXTENDER PCA Rev A1

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF08100	1	58900	101BF08100	MICROWAVE EXTENDER PCB
2	JPS0-20022	1	81312	HCB22S0	44 PIN PC EDGE CONN

Parts List for 101BA08200 FLOATING EXTENDER PCA Rev B1

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF08200	1	58900	101BF08200	FLOATING EXTENDER PCB
2	JPS0-20022	1	81312	HCB22S0	44 PIN PC EDGE CONN

Parts List for 101CA30211 NO 1kZ HI RESOLUTION PCA Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF30211	1	58900	101CF30211	HI RESOLUTION PCB
J 2	JRBM-00101	1	98291	51-053-0000	SMB M RTANG PC MOUNT
J 3	JRBM-00101	1	98291	51-053-0000	SMB M RTANG PC MOUNT
R 1	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM

Parts List for 101CA06702 IEEE PIA PCA Rev B (A1)

Item		Part Number	Qty	CAGE	Mfr's Part Number	Description
	1	101CF06700	1	58900	101CF06700	IEEE PIA PCB
	2	ETST-06224	1	88245	1280B	TURRET TERMINAL
C	1	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C	2	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C	3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C	4	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C	5	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C	6	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C	7	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C	8	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
IC	1	UTN0-03651	1	01295	SN74LS365N	SN74LS365 HEX DRIVER
IC	2	UGN0-09914	1	01295	TMS9914NL	TMS9914NL IEEE-488
IC	3	UIN0-75162	1	01295	SN75162N	SN75162N IEEE BUFFER
IC	4	UIN0-75160	1	01295	SN75160N	SN75160N IEEE BUFFER
IC	5	UTN0-00170	1	01295	SN7417N	SN7417N HEX BUFFER
IC	6	UTN0-02451	1	01295	SN74LS245N	SN74LS245N 8X TRANSCEIVE
IC	7	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC	8	101AC28401	1	58900	101AC28401	ADDRESS ROM A1
IC	9	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC	10	UTN0-00321	1	01295	SN74LS32N	SN74LS32N QUAD OR
IC	11	UTN0-00001	1	01295	SN74LS00N	SN74LS00 QUAD NAND
IC	12	UTN0-01381	1	01295	SN74LS138N	SN74LS138N 3 TO 8 DEC
IC	13	UGN0-06821	1	04713	MC6821P	MC6821P PIA
R	1	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	2	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	3	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	4	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	5	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	6	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	7	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	8	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	9	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	10	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	11	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	12	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	13	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	14	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	15	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	16	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	17	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R	18	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
TP	1	ETST-06224	1	88245	1280B	TURRET TERMINAL
W	1	WJIB-05022	1	53387	923345-05	.5' INSULATED JUMPER
W	2	WJIB-05022	1	53387	923345-05	.5' INSULATED JUMPER
X	1	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET
X	2	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET

Parts List for 101CA35800 CPU (64K) PCA Rev D (A2)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF35800	1	58900	101CF35800	CPU (64K) PCB
2	ETST-06224	1	88245	1280B	TURRET TERMINAL
3	101DS35800	Ref	58900	101DS35800	CPU (64K)
4	101DS35850	Ref	58900	101DS35850	CPU(64K)-SB
5	WSB0-22000	2	70903	8021-100	22 GAUGE BUS WIRE
C 1	CC50-00270	1	52763	EDPT-27-NPO-5%	27 PF CERAMIC NPO
C 2	CC50-00270	1	52763	EDPT-27-NPO-5%	27 PF CERAMIC NPO
C 3	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 4	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 5	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 6	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 7	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 8	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 9	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 10	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 11	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 13	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
Q 1	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
R 11	RN55-21210	1	81349	RN55C1212F	12.1 K OHMS 1% MET FILM
R 12	RN55-24750	1	81349	RN55C4752F	47.5 K OHMS 1% MET FILM
R 13	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 14	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 15	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 16	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 17	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 18	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 19	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 20	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 21	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
S 1	SDP0-00801	1	71450	206-8	8 SPST DIP SWITCH
S 2	SPP0-00101	1	09353	TP11-H8ABE	SPST PC MT PUSHBUTTON
U 1	UTN0-01230	1	01295	SN74123N	SN74123N DUAL ONE SHOT
U 2	UGN0-06809	1	04713	MC6809P	MC6809P MICROPROCESSOR
U 3	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
U 4	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
U 5	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
U 6	UTN0-02451	1	01295	SN74LS245N	SN74LS245N 8X TRANSCEIVE
U 7	UTN0-02451	1	01295	SN74LS245N	SN74LS245N 8X TRANSCEIVE
U 9	UTN0-01381	1	01295	SN74LS138N	SN74LS138N 3 TO 8 DEC
U 10	UTN0-02401	1	01295	SN74LS240N	SN74LS240 8X DRIV/RECV
U 11	101AC28410	1	58900	101AC28410	ADDRESS ROM A2-1
U 12	UTN0-00170	1	01295	SN7417N	SN7417N HEX BUFFER
U 13	UTN0-00021	1	01295	SN74LS02N	SN74LS02 QUAD NOR
U 14	UGN0-06522	1	55576	SYP6522	SYP6522 VIA
XU 2	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET
XU 8	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET
XU 14	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET
Y 1	Y180-00358	1	63468	A-3.579545S	3.58MHZ FUND XTAL

Parts List for 101CA07000 FRONT PANEL SW PIA PCA Rev E (A3)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF07000	1	58900	101CF07000	FRONT PANEL SW PIA PCB
2	ETST-06224	1	88245	1280B	TURRET TERMINAL
C 1	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 2	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 4	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 6	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 7	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 8	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
R 1	RN55-01210	1	81349	RN55C1210F	121 OHMS 1% MET FILM
R 2	RN55-01210	1	81349	RN55C1210F	121 OHMS 1% MET FILM
R 3	RN55-01210	1	81349	RN55C1210F	121 OHMS 1% MET FILM
R 4	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 5	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 6	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 7	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 8	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 9	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 10	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 11	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 12	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 13	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 14	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 15	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 16	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 17	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
TP 1	ETST-06224	1	88245	1280B	TURRET TERMINAL
U 1	UGN0-06821	1	04713	MC6821P	MC6821P PIA
U 2	UCN0-05550	1	04713	MC14555BCP	MC14555BCP DUAL 1 OF 4
U 3	UTN0-02451	1	01295	SN74LS245N	SN74LS245N 8X TRANSCEIVE
U 4	UTN0-00170	1	01295	SN7417N	SN7417N HEX BUFFER
U 5	UTN0-00321	1	01295	SN74LS32N	SN74LS32N QUAD OR
U 6	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
U 7	101AC28403	1	58900	101AC28403	ADDRESS ROM A3
U 8	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
U 9	UGN0-06821	1	04713	MC6821P	MC6821P PIA
U 10	UCN0-00280	1	04713	MC14028BCP	MC14028BCP BCD/DECIMAL
X 2	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET
X 3	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET

Parts List for 101CA35700 MEMORY (64K) PCA Rev D (A4)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF35700	1	58900	101CF35700	MEMORY (64K) PCB
3	ETST-06224	1	88245	1280B	TURRET TERMINAL
C 1	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 2	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 4	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 6	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 7	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 8	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 9	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 10	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 11	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 13	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
R 1	RN50-21000	1	65940	CRB20FX1002	10.0 K OHMS 1% MET FILM
U 6	UMN0-06264	1	61485	HM6264LP-15	HM6264LP-15 8K X 8 RAM
U 8	UTN0-00101	1	01295	SN74LS10N	SN74LS10 TRIPLE NAND
U 9	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
U 10	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
U 11	UTN0-02451	1	01295	SN74LS245N	SN74LS245N 8X TRANSCEIVE
U 12	UTN0-02401	1	01295	SN74LS240N	SN74LS240 8X DRIV/RECV
U 13	UTN0-00111	1	01295	SN74LS11N	74LS11 TRIPLE 3 IN AND
X 1	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET
X 2	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET
X 3	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET
X 4	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET
X 5	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET
X 6	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET
X 7	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET

Parts List for 101CA29500 DISPLAY PIA PCA Rev B (A5)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF29500	1	58900	101CF29500	DISPLAY PIA PCB
C 1	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 2	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 4	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 6	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 7	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 8	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 9	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
IC 1	UCN0-00400	1	04713	MC14040BCP	MC14040BCP 12 BIT CTR
IC 2	UMN0-01824	1	02735	CDP1824CD	CDP1824CD 32X8 RAM
IC 3	UCN0-00280	1	04713	MC14028BCP	MC14028BCP BCD/DECIMAL
IC 4	UCN0-00290	1	04713	MC14029BCP	MC14029BCP 4 BIT CTR
IC 5	UMN0-01824	1	02735	CDP1824CD	CDP1824CD 32X8 RAM
IC 6	UCN0-00280	1	04713	MC14028BCP	MC14028BCP BCD/DECIMAL
IC 7	UGN0-06821	1	04713	MC6821P	MC6821P PIA
IC 8	UTN0-02451	1	01295	SN74LS245N	SN74LS245N 8X TRANSCEIVE
IC 9	UTN0-00170	1	01295	SN7417N	SN7417N HEX BUFFER
IC 10	UTN0-00321	1	01295	SN74LS32N	SN74LS32N QUAD OR
IC 11	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC 12	101AC28409	1	58900	101AC28409	ADDRESS ROM A5-1
IC 13	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC 14	UGN0-06821	1	04713	MC6821P	MC6821P PIA
IC 15	UGN0-06821	1	04713	MC6821P	MC6821P PIA
R 1	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 2	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 3	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
TP 1	ETST-06224	1	88245	1280B	TURRET TERMINAL
X 1	JSP0-10018	1	09922	DILB18P-108	18 PIN DIP SOCKET
X 2	JSP0-10018	1	09922	DILB18P-108	18 PIN DIP SOCKET
X 4	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET
X 5	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET
X 6	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET

Parts List for 101CA07200 COUNTER PIA PCA Rev K (A6)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF07200	1	58900	101CF07200	COUNTER PIA PCB
2	WSIB-249XX	5	26923	UL1429-24-9	24 GA PVC COLOR 9
C 1	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 2	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 3	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 4	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 6	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 7	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 8	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 9	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 10	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 11	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 12	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 13	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 14	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 15	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 16	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 17	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 18	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 19	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 20	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 21	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 22	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
IC 1	UCN0-00280	1	04713	MC14028BCP	MC14028BCP BCD/DECIMAL
IC 2	UON0-00074	1	01295	TL074CN	TL074CN QUAD FET OP AMP
IC 3	UON0-00074	1	01295	TL074CN	TL074CN QUAD FET OP AMP
IC 4	UON0-00074	1	01295	TL074CN	TL074CN QUAD FET OP AMP
IC 5	UON0-00324	1	27014	LM324N	LM324N QUAD OP AMP
IC 6	UON0-00324	1	27014	LM324N	LM324N QUAD OP AMP
IC 7	UTN0-02601	1	01295	SN74LS260N	SN74LS260N DUAL 5 IN NOR
IC 8	UCN0-00110	1	04713	MC14011BCP	MC14011BCP QUAD NAND
IC 9	UTN0-00081	1	01295	SN74LS08N	SN74LS08 QUAD AND
IC 10	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC 11	101AC28406	1	58900	101AC28406	ADDRESS ROM A6
IC 12	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC 13	UGN0-07061	1	55261	LS7061	LS7061 32 BIT COUNTER
IC 14	UTN0-02451	1	01295	SN74LS245N	SN74LS245N 8X TRANSCEIVE
IC 15	UEN0-10125	1	04713	MC10125P	MC10125P QUAD ECL TO TTL
IC 16	UGN0-07061	1	55261	LS7061	LS7061 32 BIT COUNTER
IC 17	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC 18	UTN0-00931	1	01295	SN74LS93N	SN74LS93N 4 BIT COUNTER
IC 19	UTN0-00741	1	01295	SN74LS74N	DUAL D F/F
IC 20	UTN0-00041	1	01295	SN74LS04N	SN74LS04 HEX INVERTER
Q 1	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 2	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 3	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 4	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 5	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 6	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 7	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 8	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 9	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 10	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 11	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 12	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 13	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN

Parts List for 101CA07200 COUNTER PIA PCA Rev K (A6)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
Q 14	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 15	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 16	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 17	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 18	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 19	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 20	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 21	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 22	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 23	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 24	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 25	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 26	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
R 1	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 2	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 3	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 4	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 5	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 6	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 7	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 8	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 9	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 10	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 11	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 12	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 13	WJIB-05022	1	53387	923345-05	.5' INSULATED JUMPER
TP 1	ETST-06224	1	88245	1280B	TURRET TERMINAL
X 1	JSP0-10024	1	09922	DILB24P-108	24 PIN DIP SOCKET
X 2	JSP0-10024	1	09922	DILB24P-108	24 PIN DIP SOCKET

Parts List for 101CA26205 AM LVL CONTROL PCA M1026 Rev C (A7)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF26205	1	58900	101CF26205	AM LVL CONTROL PCB M1026
C 1	CC50-00220	1	52763	EDPT-22-NPO-5%	22 PF CERAMIC NPO
C 2	CC50-00220	1	52763	EDPT-22-NPO-5%	22 PF CERAMIC NPO
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 4	CT15-06220	1	56289	150D226X90015B2	22 UF 15V TANTALUM
C 5	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 7	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 8	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 9	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 10	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 11	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 12	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 13	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 16	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 17	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 18	CT15-06220	1	56289	150D226X90015B2	22 UF 15V TANTALUM
C 19	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 20	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 21	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 24	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 25	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 26	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 27	CC50-00560	1	51642	150-100-COG-560J	56 PF CERAMIC NPO
C 28	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 29	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 30	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 31	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 32	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 35	CC50-01470	1	51642	150-100-COG-471	470 PF CERAMIC NPO
C 37	CC50-?????	Ref	51642	150-100-COG-???J	SELECTED IN TEST
C 38	CC50-?????	Ref	51642	150-100-COG-???J	SELECTED IN TEST
C 39	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 4	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 5	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 6	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 7	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 8	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 9	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
IC 1	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 2	UIN0-07542	1	24355	AD7542KN	AD7542KN 12 BIT D/A
IC 3	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 4	UIN0-07542	1	24355	AD7542KN	AD7542KN 12 BIT D/A
IC 5	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 6	UON0-00074	1	01295	TL074CN	TL074CN QUAD FET OP AMP
IC 7	ULN0-05010	1	32293	IH5010CPD	IH5010CPD SP4T SWITCH
IC 8	ULN0-05042	1	32293	IH5042CPE	IH5042CPE SPDT SWITCH
IC 9	UIN0-00571	1	24355	AD571JD	AD571JD 10 BIT A/D
IC 10	UCN0-05550	1	04713	MC14555BCP	MC14555BCP DUAL 1 OF 4
IC 11	UTN0-00001	1	01295	SN74LS00N	SN74LS00 QUAD NAND
IC 12	UTN0-00001	1	01295	SN74LS00N	SN74LS00 QUAD NAND
IC 13	ULN0-05018	1	32293	IH5018CPA	IH5018CPA SPDT SWITCH
IC 14	UTN0-01381	1	01295	SN74LS138N	SN74LS138N 3 TO 8 DEC
IC 15	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
Q 1	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN

Parts List for 101CA26205 AM LVL CONTROL PCA M1026 Rev C (A7)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
Q 2	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 3	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 4	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 5	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 6	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 7	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 8	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 9	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 10	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 11	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 12	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 13	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 14	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 15	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 16	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 17	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 18	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 19	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 20	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 21	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
R 1	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 2	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 3	RN55-21780	1	81349	RN55C1782F	17.8 K OHMS 1% MET FILM
R 4	RN55-21100	1	81349	RN55C1102F	11 K OHMS 1% MET FILM
R 5	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 6	RN55-24320	1	81349	RN55C4322F	43.2 K OHMS 1% MET FILM
R 7	RN55-24320	1	81349	RN55C4322F	43.2 K OHMS 1% MET FILM
R 8	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 9	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 10	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 11	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 13	RN55-22000	1	81349	RN55C2002F	20 K OHMS 1% MET FILM
R 14	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 16	RN55-13010	1	81349	RN55C3011F	3.01 K OHMS 1% MET FILM
R 17	RN55-32000	1	81349	RN55C2003F	200 K OHMS 1% MET FILM
R 18	RN55-33010	1	81349	RN55C3013F	301 K OHMS 1% MET FILM
R 19	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 21	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 22	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 23	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 24	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 25	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 26	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 27	RN55-31500	1	81349	RN55C1503F	150 K OHMS 1% MET FILM
R 28	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 29	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 30	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 31	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 32	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 33	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 34	RN55-03920	1	81349	RN55C3920F	392 OHMS 1% MET FILM
R 35	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 36	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 37	RN55-03920	1	81349	RN55C3920F	392 OHMS 1% MET FILM
R 38	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 39	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 40	RN55-03920	1	81349	RN55C3920F	392 OHMS 1% MET FILM

Parts List for 101CA26205 AM LVL CONTROL PCA M1026 Rev C (A7)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 41	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 42	RN55-01500	1	81349	RN55C1500F	150 OHMS 1% MET FILM
R 43	RN55-03920	1	81349	RN55C3920F	392 OHMS 1% MET FILM
R 44	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 45	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 46	RN55-03920	1	81349	RN55C3920F	392 OHMS 1% MET FILM
R 47	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 48	RN55-01500	1	81349	RN55C1500F	150 OHMS 1% MET FILM
R 49	RN55-03920	1	81349	RN55C3920F	392 OHMS 1% MET FILM
R 50	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 53	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 54	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 56	WJIB-05022	1	53387	923345-05	.5' INSULATED JUMPER
R 57	WJIB-05022	1	53387	923345-05	.5' INSULATED JUMPER
R 58	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 59	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 60	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 61	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 62	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 63	RN55-21240	1	81349	RN55C1242F	12.4 K OHMS 1% MET FILM
R 64	RN55-24220	1	81349	RN55C4222F	42.2 K OHMS 1% MET FILM
R 65	RN55-22800	1	81349	RN55C2802F	28 K OHMS 1% MET FILM
R 66	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 67	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 68	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 69	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 71	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 72	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 73	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 74	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 75	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 76	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 77	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 78	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 79	RN55-24990	1	81349	RN55C4992F	49.9 K OHMS 1% MET FILM
R 80	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 82	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 83	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 84	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 85	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 86	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 88	WJIB-05022	1	53387	923345-05	.5' INSULATED JUMPER
R 90	WJIB-05022	1	53387	923345-05	.5' INSULATED JUMPER
TP 1	ETST-06224	1	88245	1280B	TURRET TERMINAL
VR 1	DRAE-00827	1	04713	1N827	1N827 6.2V REF. DIODE

Parts List for 101BA04900 100MHZ REF LOOP PCA Rev I (A8)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF04900	1	58900	101BF04900	100MHZ REF LOOP PCB
2	HQH0-00010	2	05820	651-B	IC HEATSINK
3	ETST-06224	2	88245	1280B	TURRET TERMINAL
C 1	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 2	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 4	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 6	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 7	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 10	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 11	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 12	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 13	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 14	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 15	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 16	CT20-07100	1	56289	150D107X0020S2	100 UF 20V TANTALUM
C 17	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 4	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 5	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
DS 1	ILRR-00125	1	58361	MV5077C	RED LED
IC 1	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
IC 2	UTN0-00000	1	01295	SN7400N	SN7400 QUAD NAND
IC 3	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
IC 4	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 5	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
IC 6	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
IC 7	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
L 1	LAD0-06270	1	72259	WEE-27	27 UH INDUCTOR
Q 1	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 2	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 3	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 4	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 5	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 6	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 7	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
R 1	RC20-00510	1	01121	EB-510-5	51 OHM 5% 1/2W CARBON
R 2	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 3	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 4	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 5	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 6	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 7	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 8	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 9	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 10	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 11	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 12	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 13	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 14	RN55-32740	1	81349	RN55C2743F	274 K OHMS 1% MET FILM
R 15	RN55-24750	1	81349	RN55C4752F	47.5 K OHMS 1% MET FILM
R 16	RN55-24750	1	81349	RN55C4752F	47.5 K OHMS 1% MET FILM
R 17	RN55-32740	1	81349	RN55C2743F	274 K OHMS 1% MET FILM
R 18	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM

Parts List for 101BA04900 100MHZ REF LOOP PCA Rev I (A8)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 19	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 20	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 21	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 22	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 23	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 24	RN55-21210	1	81349	RN55C1212F	12.1 K OHMS 1% MET FILM
R 25	RN55-12740	1	81349	RN55C2741F	2.74 K OHMS 1% MET FILM
R 26	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 27	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 28	RN55-01300	1	81349	RN55C1300F	130 OHMS 1% MET FILM
R 29	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 30	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 31	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 32	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 33	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 34	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM

Parts List for 101BA31701 OUTPUT PLL PCA Rev C (A9)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF31701	1	58900	101BF31701	OUTPUT PLL PCB
2	HQH0-00010	1	05820	651-B	IC HEATSINK
C 1	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 2	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 4	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 6	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 7	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 8	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 9	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 10	CC50-03220	1	51642	150-100-W5R-223K	.022 UF CERAMIC X7R
C 11	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 13	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 15	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 16	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 17	CC50-00330	1	52763	EDPT-33-NPO-5%	33 PF CERAMIC NPO
C 18	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 19	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 20	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 21	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 22	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 23	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
DS 1	ILRR-00125	1	58361	MV5077C	RED LED
K 1	SEP0-00101	1	95348	831A-4	5V DIP REED SWITCH
K 2	SEP0-00101	1	95348	831A-4	5V DIP REED SWITCH
K 3	SEP0-00101	1	95348	831A-4	5V DIP REED SWITCH
K 4	SEP0-00101	1	95348	831A-4	5V DIP REED SWITCH
L 1	LAD0-08120	1	72259	WEE-1200	1200 UH INDUCTOR
Q 1	QBPS-03645	1	27014	PN3645	PN3645 .5A 60V .6W PNP
Q 2	QBNS-03643	1	27014	PN3643	PN3643 .5A 30V .6W NPN
Q 3	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 4	QBNS-03643	1	27014	PN3643	PN3643 .5A 30V .6W NPN
Q 5	QBPS-03645	1	27014	PN3645	PN3645 .5A 60V .6W PNP
R 3	RN55-12740	1	81349	RN55C2741F	2.74 K OHMS 1% MET FILM
R 4	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 5	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 6	RN50-41000	1	65940	CRB20FX1004	1.00M;M F;1/5W;1%;100PPM
R 7	RN55-13320	1	81349	RN55C3321F	3.32 K OHMS 1% MET FILM
R 10	RN55-21820	1	81349	RN55C1822F	18.2 K OHMS 1% MET FILM
R 11	RN55-17500	1	81349	RN55C7501F	7.5 K OHMS 1% MET FILM
R 12	RN55-17500	1	81349	RN55C7501F	7.5 K OHMS 1% MET FILM
R 13	RN55-21820	1	81349	RN55C1822F	18.2 K OHMS 1% MET FILM
R 16	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 17	RC07-00051	1	01121	RC07GF5R1J	5.1 OHMS 5% 1/4W CARBON
R 18	RC07-00051	1	01121	RC07GF5R1J	5.1 OHMS 5% 1/4W CARBON
R 19	RN55-13920	1	81349	RN55C3921F	3.92 K OHMS 1% MET FILM
R 21	RN50-11000	1	81349	RN50D1001F	1.00 K OHMS 1% MET FILM
R 22	RN50-13320	1	65940	CRB20FX3321	3.32K;M F;1/5W;1%;100PPM
R 23	RN50-13320	1	65940	CRB20FX3321	3.32K;M F;1/5W;1%;100PPM
R 24	RN50-01000	1	65940	CRB20FX1000	100;M F;1/5W;1%;100PPM
R 25	RN50-01000	1	65940	CRB20FX1000	100;M F;1/5W;1%;100PPM
R 28	RN50-01000	1	65940	CRB20FX1000	100;M F;1/5W;1%;100PPM
R 29	RN50-01000	1	65940	CRB20FX1000	100;M F;1/5W;1%;100PPM

Parts List for 101BA31701 OUTPUT PLL PCA Rev C (A9)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 30	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 31	RN50-21000	1	65940	CRB20FX1002	10.0 K OHMS 1% MET FILM
R 32	RN50-22000	1	65940	CRB20FX2002	20.0K;M F;1/5W;1%;100PPM
R 33	RN50-21000	1	65940	CRB20FX1002	10.0 K OHMS 1% MET FILM
R 34	RN50-21000	1	65940	CRB20FX1002	10.0 K OHMS 1% MET FILM
R 35	RN50-21000	1	65940	CRB20FX1002	10.0 K OHMS 1% MET FILM
R 36	RN50-21000	1	65940	CRB20FX1002	10.0 K OHMS 1% MET FILM
R 37	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 38	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
RM 1	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
TP 1	ETST-06224	1	88245	1280B	TURRET TERMINAL
TP 2	ETST-06224	1	88245	1280B	TURRET TERMINAL
U 1	UTN0-01251	1	04713	MC74LS125N	MC74LS125N QUAD BUFFER
U 2	UON0-00027	1	24355	AD OP27GN	OP27GN LOW DRIFT OP AMP
U 3	UON0-00027	1	24355	AD OP27GN	OP27GN LOW DRIFT OP AMP
U 4	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
U 5	UEN0-10138	1	04713	MC10138P	MC10138P BI-QUINARY CTR
U 6	ULN0-05018	1	32293	IH5018CPA	IH5018CPA SPDT SWITCH

Parts List for 101BA28215 YIG DRIVER 18-26 PCA Rev H (A10)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
0	101BS28210	Ref	58900	101BS28210	YIG DRIVER
1	101BF28200	1	58900	101BF28200	YIG DRIVER PCB
2	ETST-06224	1	88245	1280B	TURRET TERMINAL
3	WSB0-24000	1	70903	8022-100	24 GAUGE BUS WIRE
4	WTT0-24001	1	29005	#24 TFE TW	#24 TEFLON SLEEVE
5	120BA17103	Ref	58900	120BA17103	TEMP COMP RES ASSY 499K
C 1	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 2	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 4	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 10	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 11	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 13	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 15	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 16	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 18	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 19	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 20	CC50-03220	1	51642	150-100-W5R-223K	.022 UF CERAMIC X7R
C 21	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 22	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 23	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
IC 3	UIN0-07542	1	24355	AD7542KN	AD7542KN 12 BIT D/A
IC 4	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
IC 6	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
IC 7	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 8	URP0-79120	1	04713	MC79L12CP	MC79L12 .1A -12V REG
IC 9	URP0-78120	1	04713	MC78L12CP	MC78L12CP .1A 12V REG
Q 1	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 2	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 3	QBNS-00012	1	04713	MPSA12	MPSA12 20K HFE NPN
Q 4	QBPS-03645	1	27014	PN3645	PN3645 .5A 60V .6W PNP
R 4	RN55-18250	1	81349	RN55C8251F	8.25 K OHMS 1% MET FILM
R 6	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 7	RN55-23650	1	81349	RN55C3652F	36.5 K OHMS 1% MET FILM
R 8	RN55-17500	1	81349	RN55C7501F	7.5 K OHMS 1% MET FILM
R 9	RN55-16190	1	81349	RN55C6191F	6.19 K OHMS 1% MET FILM
R 10	RAPD-11000	1	73138	89PR1K	1K POT 15T PC MNT
R 11	RN55-12740	1	81349	RN55C2741F	2.74 K OHMS 1% MET FILM
R 12	RN55-06650	1	81349	RN55C6650F	665 OHMS 1% MET FILM
R 13	RAPD-12000	1	73138	89PR2K	2K POT 15T PC MNT
R 14	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 15	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 16	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 17	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 18	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 19	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 20	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 21	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 22	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 23	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM

Parts List for 101BA28215 YIG DRIVER 18-26 PCA Rev H (A10)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 24	RN55-31240	1	81349	RN55C1243F	124 K OHMS 1% MET FILM
R 25	RN55-21500	1	81349	RN55C1502F	15 K OHMS 1% MET FILM
R 26	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 27	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 28	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
VR 1	DRAE-00827	1	04713	1N827	1N827 6.2V REF. DIODE

Parts List for 120BA17103 TEMP COMP RES ASSY 499K Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	120BA17100	Ref	58900	120BA17100	TEMP COMP RES ASSY
R 1	RTC0-25000	1	75263	AL03006-29.1K-97	50K RESISTOR
R 2	RN50-24990	1	65940	CRB20FX4992	49.9K;M F;1/5W;1%;100PPM
R 3	RN50-34990	1	65940	CRB20FX4993	499K;M F;1/5W;1%;100PPM

Parts List for 101BA28212 YIG DRIVER 2-8 PCA Rev F1 (A11)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF28200	1	58900	101BF28200	
2	ETST-06224	1	88245	1280B	YIG DRIVER PCB
3	WSB0-24000	1	70903	8022-100	TURRET TERMINAL
4	WTT0-24001	1	29005	#24 TFE TW	24 GAUGE BUS WIRE
C 1	CC50-04100	1	56289	1C20Z5U104M050B	#24 TEFLON SLEEVE
C 2	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 3	CC50-05100	1	56289	2C2525U105M050B	.1 UF CERAMIC Z5U
C 4	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 10	CC50-03100	1	51642	150-100-W5R-103K	1 UF CERAMIC Z5U
C 11	CC50-04100	1	56289	1C20Z5U104M050B	.01 UF CERAMIC X7R
C 12	CC50-03100	1	51642	150-100-W5R-103K	.1 UF CERAMIC Z5U
C 13	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 14	CC50-05100	1	56289	2C2525U105M050B	.01 UF CERAMIC X7R
C 15	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 16	CC50-03100	1	51642	150-100-W5R-103K	1 UF CERAMIC Z5U
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 18	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 19	CC50-02100	1	52763	EDPT-1000-Y5P10%	.01 UF CERAMIC X7R
C 20	CC50-03220	1	51642	150-100-W5R-223K	.001 UF CERAMIC Y5P
C 21	CC50-03100	1	51642	150-100-W5R-103K	.022 UF CERAMIC X7R
C 22	CC50-05100	1	56289	2C2525U105M050B	.01 UF CERAMIC X7R
C 23	CC50-00470	1	52763	EDPT-47-NPO-5%	1 UF CERAMIC Z5U
CR 1	DSA0-04148	1	07263	1N4148	47 PF CERAMIC NPO
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
IC 3	UIN0-07542	1	24355	AD7542KN	1N4148 G.P. DIODE
IC 4	UOG0-00027	1	24355	AD OP27GH	AD7542KN 12 BIT D/A
IC 6	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
IC 7	UON0-00072	1	01295	TL072CP	OP27GH LOW DRIFT OP AMP
IC 8	URP0-79120	1	04713	MC79L12CP	TL072CP DUAL FET OP AMP
IC 9	URP0-78120	1	04713	MC78L12CP	MC79L12 .1A -12V REG
Q 1	QBNS-02222	1	27014	PN2222	MC78L12CP .1A 12V REG
Q 2	QJNS-04091	1	04713	2N4091	PN2222 .5A 30V NPN
Q 3	QBNS-00012	1	04713	MPSA12	2N4091 30OHM N CH JFET
Q 4	QBPS-03645	1	27014	PN3645	MPSA12 20K HFE NPN
R 4	RN55-18250	1	81349	RN55C8251F	PN3645 .5A 60V .6W PNP
R 6	RN55-31000	1	81349	RN55C1003F	8.25 K OHMS 1% MET FILM
R 7	RN55-22550	1	81349	RN55C2552F	100 K OHMS 1% MET FILM
R 8	RN55-22000	1	81349	RN55C2002F	25.5 K OHMS 1% MET FILM
R 9	RN55-11000	1	81349	RN55C1001F	20 K OHMS 1% MET FILM
R 10	RAPD-11000	1	73138	89PR1K	1 K OHMS 1% MET FILM
R 11	RN55-11500	1	81349	RN55C1501F	1K POT 15T PC MNT
R 12	RN55-11000	1	81349	RN55C1001F	1.5 K OHMS 1% MET FILM
R 13	RAPD-12000	1	73138	89PR2K	1 K OHMS 1% MET FILM
R 14	RN55-21000	1	81349	RN55C1002F	2K POT 15T PC MNT
R 15	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 16	RN55-25620	1	81349	RN55C5622F	10 K OHMS 1% MET FILM
R 17	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 18	RN55-02210	1	81349	RN55C2210F	56.2 K OHMS 1% MET FILM
R 19	RN55-15620	1	81349	RN55C5621F	221 OHMS 1% MET FILM
R 20	RN55-14990	1	81349	RN55C4991F	5.62 K OHMS 1% MET FILM
R 21	RN55-11000	1	81349	RN55C1001F	4.99 K OHMS 1% MET FILM
R 22	RN55-14990	1	81349	RN55C4991F	1 K OHMS 1% MET FILM
R 23	RN55-31000	1	81349	RN55C1003F	4.99 K OHMS 1% MET FILM
R 24	RN55-31240	1	81349	RN55C1243F	100 K OHMS 1% MET FILM
R 25	RN55-21500	1	81349	RN55C1502F	124 K OHMS 1% MET FILM
					15 K OHMS 1% MET FILM

Parts List for 101BA28212 YIG DRIVER 2-8 PCA Rev F1 (A11)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 26	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 27	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 28	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
VR 1	DRAE-00827	1	04713	1N827	1N827 6.2V REF. DIODE

Parts List for 101BA28214 YIG DRIVER 12-18 PCA Rev F1 (A12)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF28200	1	58900	101BF28200	YIG DRIVER PCB
2	ETST-06224	1	88245	1280B	TURRET TERMINAL
3	WSB0-24000	1	70903	8022-100	24 GAUGE BUS WIRE
4	WTT0-24001	1	29005	#24 TFE TW	#24 TEFLON SLEEVE
C 1	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 2	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 4	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 10	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 11	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 13	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 15	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 16	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 18	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 19	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 20	CC50-03220	1	51642	150-100-W5R-223K	.022 UF CERAMIC X7R
C 21	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 22	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 23	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
IC 3	UIN0-07542	1	24355	AD7542KN	AD7542KN 12 BIT D/A
IC 4	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
IC 6	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
IC 7	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 8	URP0-79120	1	04713	MC79L12CP	MC79L12 .1A -12V REG
IC 9	URP0-78120	1	04713	MC78L12CP	MC78L12CP .1A 12V REG
Q 1	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 2	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 3	QBNS-00012	1	04713	MPSA12	MPSA12 20K HFE NPN
Q 4	QBPS-03645	1	27014	PN3645	PN3645 .5A 60V .6W PNP
R 4	RN55-18250	1	81349	RN55C8251F	8.25 K OHMS 1% MET FILM
R 6	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 7	RN55-22610	1	81349	RN55C2612F	26.1 K OHMS 1% MET FILM
R 8	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 9	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 10	RAPD-11000	1	73138	89PR1K	1K POT 15T PC MNT
R 11	RN55-16190	1	81349	RN55C6191F	6.19 K OHMS 1% MET FILM
R 12	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 13	RAPD-12000	1	73138	89PR2K	2K POT 15T PC MNT
R 14	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 15	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 16	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 17	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 18	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 19	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 20	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 21	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 22	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 23	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 24	RN55-31240	1	81349	RN55C1243F	124 K OHMS 1% MET FILM
R 25	RN55-21500	1	81349	RN55C1502F	15 K OHMS 1% MET FILM

Parts List for 101BA28214 YIG DRIVER 12-18 PCA Rev F1 (A12)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 26	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 27	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 28	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
VR 1	DRAE-00827	1	04713	1N827	1N827 6.2V REF. DIODE

Parts List for 101BA28211 YIG DRIVER 1.9-8.7 PCA Rev G1 (A13)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF28200	1	58900	101BF28200	YIG DRIVER PCB
2	ETST-06224	1	88245	1280B	TURRET TERMINAL
3	WSB0-24000	1	70903	8022-100	24 GAUGE BUS WIRE
4	WTT0-24001	1	29005	#24 TFE TW	#24 TEFLON SLEEVE
C 1	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 2	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 4	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 10	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 11	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 13	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 14	CC50-05100	1	56289	2C2525U105M050B	.01 UF CERAMIC X7R
C 15	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 16	CC50-03100	1	51642	150-100-W5R-103K	1 UF CERAMIC Z5U
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 18	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 19	CC50-02100	1	52763	EDPT-1000-Y5P10%	.01 UF CERAMIC X7R
C 20	CC50-03220	1	51642	150-100-W5R-223K	.001 UF CERAMIC Y5P
C 21	CC50-03100	1	51642	150-100-W5R-103K	.022 UF CERAMIC X7R
C 22	CC50-05100	1	56289	2C2525U105M050B	.01 UF CERAMIC X7R
C 23	CC50-00470	1	52763	EDPT-47-NPO-5%	1 UF CERAMIC Z5U
CR 1	DSA0-04148	1	07263	1N4148	47 PF CERAMIC NPO
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
Q 1	QBNS-02222	1	27014	PN2222	1N4148 G.P. DIODE
Q 2	QJNS-04091	1	04713	2N4091	PN2222 .5A 30V NPN
Q 3	QBNS-00012	1	04713	MPSA12	2N4091 30OHM N CH JFET
Q 4	QBPS-03645	1	27014	PN3645	MPSA12 20K HFE NPN
R 4	RN55-18250	1	81349	RN55C8251F	PN3645 .5A 60V .6W PNP
R 6	RN55-31000	1	81349	RN55C1003F	8.25 K OHMS 1% MET FILM
R 7	RN55-21690	1	81349	RN55C1692F	100 K OHMS 1% MET FILM
R 8	RN55-21270	1	81349	RN55C1272F	16.9 K OHMS 1% MET FILM
R 9	RN55-11820	1	81349	RN55C1821F	12.7 K OHMS 1% MET FILM
R 10	RAPD-11000	1	73138	89PR1K	1.82 K OHMS 1% MET FILM
R 11	RN55-08250	1	81349	RN55C8250F	1K POT 15T PC MNT
R 12	RN55-11000	1	81349	RN55C1001F	825 OHMS 1% MET FILM
R 13	RAPD-12000	1	73138	89PR2K	1 K OHMS 1% MET FILM
R 14	RN55-21000	1	81349	RN55C1002F	2K POT 15T PC MNT
R 15	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 16	RN55-25620	1	81349	RN55C5622F	10 K OHMS 1% MET FILM
R 17	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 18	RN55-02210	1	81349	RN55C2210F	56.2 K OHMS 1% MET FILM
R 19	RN55-15620	1	81349	RN55C5621F	221 OHMS 1% MET FILM
R 20	RN55-14990	1	81349	RN55C4991F	5.62 K OHMS 1% MET FILM
R 21	RN55-11000	1	81349	RN55C1001F	4.99 K OHMS 1% MET FILM
R 22	RN55-14990	1	81349	RN55C4991F	1 K OHMS 1% MET FILM
R 23	RN55-31000	1	81349	RN55C1003F	4.99 K OHMS 1% MET FILM
R 24	RN55-31240	1	81349	RN55C1243F	100 K OHMS 1% MET FILM
R 25	RN55-21500	1	81349	RN55C1502F	124 K OHMS 1% MET FILM
R 26	RN55-21000	1	81349	RN55C1002F	15 K OHMS 1% MET FILM
R 27	RN55-01000	1	81349	RN55C1000F	10 K OHMS 1% MET FILM
R 28	RN55-21000	1	81349	RN55C1002F	100 OHMS 1% MET FILM
R 29	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
U 3	UIN0-07542	1	24355	AD7542KN	10 K OHMS 1% MET FILM
U 4	UOG0-00027	1	24355	AD OP27GH	AD7542KN 12 BIT D/A
					OP27GH LOW DRIFT OP AMP

Parts List for 101BA28211 YIG DRIVER 1.9-8.7 PCA Rev G1 (A13)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
U 6	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
U 7	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U 8	URP0-79120	1	04713	MC79L12CP	MC79L12 .1A -12V REG
U 9	URP0-78120	1	04713	MC78L12CP	MC78L12CP .1A 12V REG
VR 1	DRAE-00827	1	04713	1N827	1N827 6.2V REF. DIODE
VR 2	DZAA-04618	1	04713	1N5986A	1N4618 2.7 V ZENER

Parts List for 101BA28213 YIG DRIVER 8-12 PCA Rev F1 (A14)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF28200	1	58900	101BF28200	YIG DRIVER PCB
2	ETST-06224	1	88245	1280B	TURRET TERMINAL
3	WSB0-24000	1	70903	8022-100	24 GAUGE BUS WIRE
4	WTT0-24001	1	29005	#24 TFE TW	#24 TEFLON SLEEVE
C 1	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 2	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 4	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 10	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 11	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 13	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 15	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 16	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 18	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 19	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 20	CC50-03220	1	51642	150-100-W5R-223K	.022 UF CERAMIC X7R
C 21	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 22	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 23	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
Q 1	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 2	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 3	QBNS-00012	1	04713	MPSA12	MPSA12 20K HFE NPN
Q 4	QBPS-03645	1	27014	PN3645	PN3645 .5A 60V .6W PNP
R 4	RN55-18250	1	81349	RN55C8251F	8.25 K OHMS 1% MET FILM
R 6	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 7	RN55-24530	1	81349	RN55C4532F	45.3 K OHMS 1% MET FILM
R 8	RN55-21580	1	81349	RN55C1582F	15.8 K OHMS 1% MET FILM
R 9	RN55-13160	1	81349	RN55C3161F	3.16 K OHMS 1% MET FILM
R 10	RAPD-11000	1	73138	89PR1K	1K POT 15T PC MNT
R 11	RN55-11820	1	81349	RN55C1821F	1.82 K OHMS 1% MET FILM
R 12	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 13	RAPD-12000	1	73138	89PR2K	2K POT 15T PC MNT
R 14	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 15	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 16	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 17	RN55-25620	1	81349	RN55C5622F	56.2 K OHMS 1% MET FILM
R 18	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 19	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 20	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 21	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 22	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 23	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 24	RN55-31240	1	81349	RN55C1243F	124 K OHMS 1% MET FILM
R 25	RN55-21500	1	81349	RN55C1502F	15 K OHMS 1% MET FILM
R 26	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 27	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 28	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
U 3	UIN0-07542	1	24355	AD7542KN	AD7542KN 12 BIT D/A
U 4	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
U 6	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP

Parts List for 101BA28213 YIG DRIVER 8-12 PCA Rev F1 (A14)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
U 7	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U 8	URP0-79120	1	04713	MC79L12CP	MC79L12 .1A -12V REG
U 9	URP0-78120	1	04713	MC78L12CP	MC78L12CP .1A 12V REG
VR 1	DRAE-00827	1	04713	1N827	1N827 6.2V REF. DIODE

Parts List for 101BA07401 FIXED LO PLL PCA Rev J (A15)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF07400	1	58900	101BF07400	REFERENCE PLL PCB
2	HQH0-00010	1	05820	651-B	IC HEATSINK
3	ETST-06224	2	88245	1280B	TURRET TERMINAL
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 2	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 6	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 7	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 8	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 9	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 10	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 11	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 12	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 13	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 14	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 15	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 19	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 20	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 21	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 22	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 4	DSA0-00300	1	07263	FDH300	FDH300 LOW LEAK DIODE
CR 5	DSA0-00300	1	07263	FDH300	FDH300 LOW LEAK DIODE
CR 6	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 7	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 8	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 9	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
DS 1	ILRR-00125	1	58361	MV5077C	RED LED
IC 1	UON0-13080	1	27014	LM13080N	LM13080N 250MA OP AMP
IC 2	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 3	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 4	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
IC 5	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
Q 1	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 2	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
R 1	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 2	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 3	RN55-21870	1	81349	RN55C1872F	18.7 K OHMS 1% MET FILM
R 4	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 5	RN55-18250	1	81349	RN55C8251F	8.25 K OHMS 1% MET FILM
R 6	RN55-12740	1	81349	RN55C2741F	2.74 K OHMS 1% MET FILM
R 7	RN55-21210	1	81349	RN55C1212F	12.1 K OHMS 1% MET FILM
R 8	RN55-22210	1	81349	RN55C2212F	22.1 K OHMS 1% MET FILM
R 9	RN55-32000	1	81349	RN55C2003F	200 K OHMS 1% MET FILM
R 10	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 11	RN55-24640	1	81349	RN55C4642F	46.4 K OHMS 1% MET FILM
R 12	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 13	RN55-13320	1	81349	RN55C3321F	3.32 K OHMS 1% MET FILM
R 14	RN55-18250	1	81349	RN55C8251F	8.25 K OHMS 1% MET FILM
R 15	RN55-18250	1	81349	RN55C8251F	8.25 K OHMS 1% MET FILM
R 16	RN55-11500	1	81349	RN55C1501F	1.5 K OHMS 1% MET FILM
R 17	RN55-33010	1	81349	RN55C3013F	301 K OHMS 1% MET FILM
R 18	RN55-21500	1	81349	RN55C1502F	15 K OHMS 1% MET FILM
R 19	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM

Parts List for 101BA07401 FIXED LO PLL PCA Rev J (A15)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 20	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 21	RN55-26340	1	81349	RN55C6342F	63.4 K OHMS 1% MET FILM
R 22	RN55-24640	1	81349	RN55C4642F	46.4 K OHMS 1% MET FILM
R 23	RN55-24640	1	81349	RN55C4642F	46.4 K OHMS 1% MET FILM
R 24	RN55-31500	1	81349	RN55C1503F	150 K OHMS 1% MET FILM
R 25	RN55-24750	1	81349	RN55C4752F	47.5 K OHMS 1% MET FILM
R 26	RN55-28250	1	81349	RN55C8252F	82.5 K OHMS 1% MET FILM
R 28	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 29	RN55-01300	1	81349	RN55C1300F	130 OHMS 1% MET FILM
R 30	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 31	RN55-01300	1	81349	RN55C1300F	130 OHMS 1% MET FILM
RM 1	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM 2	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK

Parts List for 101BA07402 REFERENCE PLL PCA Rev C (A16)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF07400	1	58900	101BF07400	REFERENCE PLL PCB
2	HQH0-00010	1	05820	651-B	IC HEATSINK
3	ETST-06224	2	88245	1280B	TURRET TERMINAL
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 2	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 4	CC50-?????	Ref	51642	150-100-COG-???J	SELECTED IN TEST
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 6	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 7	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 8	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 9	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 10	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 11	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 12	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 13	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 14	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 15	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 16	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 18	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 19	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 20	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 21	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 4	DSA0-00300	1	07263	FDH300	FDH300 LOW LEAK DIODE
CR 5	DSA0-00300	1	07263	FDH300	FDH300 LOW LEAK DIODE
CR 6	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 7	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 8	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
DS 1	ILRR-00125	1	58361	MV5077C	RED LED
Q 1	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 2	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 3	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
R 1	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 2	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 3	RN55-21870	1	81349	RN55C1872F	18.7 K OHMS 1% MET FILM
R 4	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 5	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 6	RN55-12740	1	81349	RN55C2741F	2.74 K OHMS 1% MET FILM
R 7	RN55-21210	1	81349	RN55C1212F	12.1 K OHMS 1% MET FILM
R 8	RN55-22210	1	81349	RN55C2212F	22.1 K OHMS 1% MET FILM
R 9	RN55-32000	1	81349	RN55C2003F	200 K OHMS 1% MET FILM
R 10	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 11	RN55-31240	1	81349	RN55C1243F	124 K OHMS 1% MET FILM
R 12	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 13	RN55-13320	1	81349	RN55C3321F	3.32 K OHMS 1% MET FILM
R 14	RN55-28250	1	81349	RN55C8252F	82.5 K OHMS 1% MET FILM
R 15	RN55-28250	1	81349	RN55C8252F	82.5 K OHMS 1% MET FILM
R 16	RN55-11500	1	81349	RN55C1501F	1.5 K OHMS 1% MET FILM
R 17	RN55-33010	1	81349	RN55C3013F	301 K OHMS 1% MET FILM
R 18	RN55-21500	1	81349	RN55C1502F	15 K OHMS 1% MET FILM
R 19	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 20	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 21	RN55-26340	1	81349	RN55C6342F	63.4 K OHMS 1% MET FILM

Parts List for 101BA07402 REFERENCE PLL PCA Rev C (A16)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 22	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 23	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 24	RN55-31500	1	81349	RN55C1503F	150 K OHMS 1% MET FILM
R 25	RN55-24750	1	81349	RN55C4752F	47.5 K OHMS 1% MET FILM
R 26	RN55-31500	1	81349	RN55C1503F	150 K OHMS 1% MET FILM
R 27	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 31	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 32	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 33	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 34	RN55-00562	1	81349	RN55C56R2F	56.2 OHMS 1% MET FILM
R 35	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
RM 1	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM 2	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
U 1	UON0-13080	1	27014	LM13080N	LM13080N 250MA OP AMP
U 2	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U 3	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U 4	UEN0-12040	1	04713	MC12040P	MC12040P PHASE/FREQ DET
U 5	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
U 6	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U 7	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F

Parts List for 101CA06610 PULSE MODULATION PCA Rev A3 (A17)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF06610	1	58900	101CF06610	PULSE MODULATION PCB
2	ETST-06224	1	88245	1280B	TURRET TERMINAL
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 2	CC50-01510	1	51642	200-100-NPO-511J	510 PF CERAMIC NPO
C 3	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 4	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CC50-01220	1	51642	150-100-COG-221	220 PF CERAMIC NPO
C 6	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 7	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 8	CC50-?????	Ref	51642	150-100-COG-???J	SELECTED IN TEST
C 9	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 10	CC50-03680	1	51642	150-100-W5R-683	.068 UF CERAMIC X7R
C 11	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 13	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 15	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 16	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 18	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
Q 1	QBNS-03563	1	27014	PN3563	PN3563 15V 600MHZ NPN
Q 2	QBPS-03645	1	27014	PN3645	PN3645 .5A 60V .6W PNP
Q 3	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 4	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
R 1	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 2	RC20-00680	1	01121	EB-680-5	68 OHMS 5% 1/2W CARBON
R 3	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 4	RN55-01300	1	81349	RN55C1300F	130 OHMS 1% MET FILM
R 5	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 6	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 7	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 8	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 9	RN55-11300	1	81349	RN55C1301F	1.3 K OHMS 1% MET FILM
R 10	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
R 11	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 12	RN55-00475	1	81349	RN55C47R5F	47.5 OHMS 1% MET FILM
R 13	RN55-11500	1	81349	RN55C1501F	1.5 K OHMS 1% MET FILM
R 14	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 15	RN55-13320	1	81349	RN55C3321F	3.32 K OHMS 1% MET FILM
R 16	RC20-00680	1	01121	EB-680-5	68 OHMS 5% 1/2W CARBON
R 17	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
R 18	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 19	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
U 1	UTN0-03901	1	01295	SN74LS390N	SN74LS390N DUAL COUNTER
U 2	UTN0-03901	1	01295	SN74LS390N	SN74LS390N DUAL COUNTER
U 3	UTN0-00741	1	01295	SN74LS74N	DUAL D F/F
U 4	UTN0-01261	1	01295	SN74LS126N	SN74LS126N QUAD BUFFER
U 5	UTN0-00861	1	01295	SN74LS86N	SN74LS86N QUAD EX OR
U 6	UTN0-01261	1	01295	SN74LS126N	SN74LS126N QUAD BUFFER
U 7	ULN0-00555	1	04713	MC1455P	MC1455P 200MA TIMER

Parts List for 101CA25500 LEVELLING SAMPLER PCA Rev K (A18)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF24100	1	58900	101BF24100	LEVELLING SAMP REAR SHLD
2	101CF25500	1	58900	101CF25500	LEVELLING SAMPLER PCB
3	101BF24000	1	58900	101BF24000	LEVELLING SAMP FRONT SHL
4	HSTS-40204	1	06540	9531B-A-0440	4-40 X 1/8 SWAGE SPACER
5	HSTS-40604	1	55566	3049-B-440-A-0	4-40 X 3/8 SWAGE SPACER
6	ETST-06224	1	88245	1280B	TURRET TERMINAL
7	WTT0-24001	3	29005	#24 TFE TW	#24 TEFLON SLEEVE
101	HBPP-44003	1	96906	MS-51957-12	4-40 X 3/16 PAN
102	HBPP-44004	1	96906	MS-51957-13	4-40 X 1/4 PAN
103	HBPP-44007	1	96906	MS-51957-16	4-40 X 7/16 PAN
104	HWSS-40300	3	96906	MS35338-135	#4 X 3/16 SPLIT LOCK
C 1	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 2	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 3	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 5	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 6	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 7	CC50-03680	1	51642	150-100-W5R-683	.068 UF CERAMIC X7R
C 8	CC50-03680	1	51642	150-100-W5R-683	.068 UF CERAMIC X7R
C 9	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 10	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 11	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 12	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 13	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 14	CF00-02470	1	56289	192P47292	.0047 UF POLY FILM
C 15	CF00-02470	1	56289	192P47292	.0047 UF POLY FILM
C 16	CC50-03680	1	51642	150-100-W5R-683	.068 UF CERAMIC X7R
C 17	CC50-03680	1	51642	150-100-W5R-683	.068 UF CERAMIC X7R
C 18	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 19	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 20	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 21	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 22	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 23	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 24	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 25	CC50-00560	1	51642	150-100-COG-560J	56 PF CERAMIC NPO
C 26	CC50-00100	1	51642	100-100-COG-100J	10 PF CERAMIC NPO
C 27	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 3	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 4	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 5	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 6	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
IC 1	ULN0-02901	1	27014	LM2901N	LM2901N QUAD COMPARATOR
IC 2	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
IC 3	UANP-00733	1	07263	UA733DC	UA733DC VIDEO AMP
IC 4	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 5	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
IC 6	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
IC 7	UON0-00074	1	01295	TL074CN	TL074CN QUAD FET OP AMP
IC 8	UEN0-10125	1	04713	MC10125P	MC10125P QUAD ECL TO TTL
IC 10	UTN0-00081	1	01295	SN74LS08N	SN74LS08 QUAD AND
IC 11	UTN0-01231	1	01295	SN74LS123N	SN74LS123N DUAL ONE SHOT
J 1	JRBM-00101	1	98291	51-053-0000	SMB M RTANG PC MOUNT
J 2	JRBM-00101	1	98291	51-053-0000	SMB M RTANG PC MOUNT
Q 1	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 2	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET

Parts List for 101CA25500 LEVELLING SAMPLER PCA Rev K (A18)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
Q 3	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 4	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 5	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 6	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 7	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
Q 9	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 10	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 11	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 12	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
R 1	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 2	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 3	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 4	RN55-22210	1	81349	RN55C2212F	22.1 K OHMS 1% MET FILM
R 5	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 6	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 7	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 8	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 9	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 10	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 11	RAPD-15000	1	73138	89PR5K	5K POT 15T PC MNT
R 12	RAPD-15000	1	73138	89PR5K	5K POT 15T PC MNT
R 13	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 14	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 15	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 16	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 17	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 18	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 19	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 20	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 21	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 22	RN55-21910	1	81349	RN55C1912F	19.1 K OHMS 1% MET FILM
R 23	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 24	RN55-21050	1	81349	RN55C1052F	10.5 K OHMS 1% MET FILM
R 25	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 26	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 27	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 28	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 29	RN55-32000	1	81349	RN55C2003F	200 K OHMS 1% MET FILM
R 30	RN55-32740	1	81349	RN55C2743F	274 K OHMS 1% MET FILM
R 31	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 32	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 33	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 34	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 35	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 36	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 37	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 38	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 39	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 40	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 41	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 42	RN55-22670	1	81349	RN55C2672F	26.7 K OHMS 1% MET FILM
R 43	RN55-22210	1	81349	RN55C2212F	22.1 K OHMS 1% MET FILM
R 44	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 45	RN55-22210	1	81349	RN55C2212F	22.1 K OHMS 1% MET FILM
R 46	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
R 49	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 53	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM

Parts List for 101CA25500 LEVELLING SAMPLER PCA Rev K (A18)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 54	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 55	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 56	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 57	RN55-34990	1	81349	RN55C4993F	499 K OHMS 1% MET FILM
R 58	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 59	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 60	RN50-41000	1	65940	CRB20FX1004	1.00M;M F;1/5W;1%;100PPM

Parts List for 101CA25600 LEVELLING LOG AMP PCA Rev I1 (A19)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF25600	1	58900	101CF25600	LEVELLING LOG AMP PCB
2	ETST-06224	1	88245	1280B	TURRET TERMINAL
C 1	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 2	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 3	CC50-01510	1	51642	200-100-NPO-511J	510 PF CERAMIC NPO
C 4	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 6	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 7	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 8	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 9	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 10	CT20-06022	1	56289	150D225X9020A2	2.2 UF 20V TANTALUM
C 11	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 12	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 14	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 15	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 16	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
CR 2	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
IC 1	UON0-00074	1	01295	TL074CN	TL074CN QUAD FET OP AMP
IC 2	ULN0-05010	1	32293	IH5010CPD	IH5010CPD SP4T SWITCH
IC 3	ULN0-05018	1	32293	IH5018CPA	IH5018CPA SPDT SWITCH
IC 4	UAN0-00100	1	13919	LOG 100JP	LOG 100JP LOG AMP
IC 5	UOG0-00027	1	24355	AD OP27GH	OP27GH LOW DRIFT OP AMP
IC 7	UAN0-00100	1	13919	LOG 100JP	LOG 100JP LOG AMP
IC 8	UON0-00074	1	01295	TL074CN	TL074CN QUAD FET OP AMP
Q 1	QBNS-00012	1	04713	MPSA12	MPSA12 20K HFE NPN
Q 2	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 3	QBNS-00012	1	04713	MPSA12	MPSA12 20K HFE NPN
Q 5	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
R 1	RAPD-15000	1	73138	89PR5K	5K POT 15T PC MNT
R 2	RN55-32000	1	81349	RN55C2003F	200 K OHMS 1% MET FILM
R 3	RN55-21400	1	81349	RN55C1402F	14 K OHMS 1% MET FILM
R 4	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 5	RN55-33010	1	81349	RN55C3013F	301 K OHMS 1% MET FILM
R 6	RAPD-31000	1	73138	89PR100K	100K POT 15T PC MNT
R 7	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 8	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 9	RN55-24990	1	81349	RN55C4992F	49.9 K OHMS 1% MET FILM
R 10	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 11	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 12	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 14	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 15	RAPD-31000	1	73138	89PR100K	100K POT 15T PC MNT
R 16	RN55-29090	1	81349	RN55C9092F	90.9 K OHMS 1% MET FILM
R 17	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 18	RN55-16190	1	81349	RN55C6191F	6.19 K OHMS 1% MET FILM
R 19	RN55-24990	1	81349	RN55C4992F	49.9 K OHMS 1% MET FILM
R 20	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 21	RN55-24990	1	81349	RN55C4992F	49.9 K OHMS 1% MET FILM
R 22	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 23	RN55-22800	1	81349	RN55C2802F	28 K OHMS 1% MET FILM
R 24	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 25	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 26	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 27	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 28	RAPD-21000	1	73138	89PR10K	10K POT 15T PC MNT
R 29	RAPD-21000	1	73138	89PR10K	10K POT 15T PC MNT

Parts List for 101CA25600 LEVELLING LOG AMP PCA Rev I1 (A19)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 30	RN55-16810	1	81349	RN55C6811F	6.81 K OHMS 1% MET FILM
R 31	RAPD-15000	1	73138	89PR5K	5K POT 15T PC MNT
R 32	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 33	RN55-26810	1	81349	RN55C6812F	68.1 K OHMS 1% MET FILM
R 34	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 35	RN55-14990	1	81349	RN55C4991F	4.99 K OHMS 1% MET FILM
R 36	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 37	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 38	RN55-21050	1	81349	RN55C1052F	10.5 K OHMS 1% MET FILM
R 39	RN55-33010	1	81349	RN55C3013F	301 K OHMS 1% MET FILM
R 40	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 43	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 44	RN55-16190	1	81349	RN55C6191F	6.19 K OHMS 1% MET FILM
R 45	RAPD-31000	1	73138	89PR100K	100K POT 15T PC MNT
R 46	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 47	RN55-22490	1	81349	RN55C2492F	24.9 K OHMS 1% MET FILM
R 48	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 49	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 51	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 53	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 56	RN55-23920	1	81349	RN55C3922F	39.2 K OHMS 1% MET FILM
R 57	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 61	RN55-28250	1	81349	RN55C8252F	82.5 K OHMS 1% MET FILM
VR 1	DRAE-00827	1	04713	1N827	1N827 6.2V REF. DIODE

Parts List for 101CA06300 DIVIDE BY N PCA Rev M2 (A20)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF06300	1	58900	101CF06300	DIVIDE BY N PCB
2	HQH0-00010	6	05820	651-B	IC HEATSINK
C 1	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 3	CK50-03100	1	31433	VJ08050A103KXAMB	.01 UF X7R CHIP
C 4	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 5	CC50-00220	1	52763	EDPT-22-NPO-5%	22 PF CERAMIC NPO
C 6	CK50-03100	1	31433	VJ08050A103KXAMB	.01 UF X7R CHIP
C 7	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 8	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 9	CC50-00220	1	52763	EDPT-22-NPO-5%	22 PF CERAMIC NPO
C 10	CK50-03100	1	31433	VJ08050A103KXAMB	.01 UF X7R CHIP
C 11	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 12	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 13	CC50-00220	1	52763	EDPT-22-NPO-5%	22 PF CERAMIC NPO
C 14	CK50-03100	1	31433	VJ08050A103KXAMB	.01 UF X7R CHIP
C 15	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 16	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 18	CK50-03100	1	31433	VJ08050A103KXAMB	.01 UF X7R CHIP
C 19	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 20	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 21	CK50-03100	1	31433	VJ08050A103KXAMB	.01 UF X7R CHIP
C 22	CC50-00220	1	52763	EDPT-22-NPO-5%	22 PF CERAMIC NPO
C 23	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 24	CK50-03100	1	31433	VJ08050A103KXAMB	.01 UF X7R CHIP
C 25	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 26	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 27	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 28	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 29	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 30	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 31	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 32	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 33	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 34	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 35	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 36	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 37	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 38	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 39	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 40	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 41	CC50-01330	1	51642	150-100-COG-331J	330 PF CERAMIC NPO
C 42	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
J 1	JRBM-00101	1	98291	51-053-0000	SMB M RTANG PC MOUNT
Q 1	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 2	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 3	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 4	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 5	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 6	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 7	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
R 1	RN55-03920	1	81349	RN55C3920F	392 OHMS 1% MET FILM
R 2	RN55-00221	1	81349	RN55C22R1F	22.1 OHMS 1% MET FILM
R 3	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 4	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 5	RN55-00221	1	81349	RN55C22R1F	22.1 OHMS 1% MET FILM
R 6	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 7	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM

Parts List for 101CA06300 DIVIDE BY N PCA Rev M2 (A20)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 8	RN55-00221	1	81349	RN55C22R1F	22.1 OHMS 1% MET FILM
R 9	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 10	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 11	RN55-00221	1	81349	RN55C22R1F	22.1 OHMS 1% MET FILM
R 12	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 13	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 14	RN55-00221	1	81349	RN55C22R1F	22.1 OHMS 1% MET FILM
R 15	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 16	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 17	RN55-00221	1	81349	RN55C22R1F	22.1 OHMS 1% MET FILM
R 18	RN55-00562	1	81349	RN55C56R2F	56.2 OHMS 1% MET FILM
R 19	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 20	RN55-00475	1	81349	RN55C47R5F	47.5 OHMS 1% MET FILM
R 21	RN55-11500	1	81349	RN55C1501F	1.5 K OHMS 1% MET FILM
R 22	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 23	RN55-03920	1	81349	RN55C3920F	392 OHMS 1% MET FILM
R 24	RN55-00221	1	81349	RN55C22R1F	22.1 OHMS 1% MET FILM
R 25	RN55-00475	1	81349	RN55C47R5F	47.5 OHMS 1% MET FILM
R 26	RN55-11500	1	81349	RN55C1501F	1.5 K OHMS 1% MET FILM
R 27	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 28	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 29	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 30	RN50-00511	1	65940	CRB20FX51R1	51.1;M F;1/5W;1%;100PPM
R 31	RN55-01820	1	81349	RN55C1820F	182 OHMS 1% MET FILM
R 32	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
RM 1	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM 2	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM 3	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
RM 4	RM7S-05600	1	71450	750-81-R560	560 OHM X 7 SIP NETWRK
TP 1	ETST-06224	1	88245	1280B	TURRET TERMINAL
U 1	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
U 2	UEN0-08743	1	52648	SP8743B	SP8743B 500MHZ 8/9 CTR
U 3	UEN0-10109	1	04713	MC10109P	MC10109P DUAL OR/NOR
U 4	UEN0-10136	1	04713	MC10136P	MC10136P HEX COUNTER
U 5	UEN0-10136	1	04713	MC10136P	MC10136P HEX COUNTER
U 6	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
U 7	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U 8	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U 9	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR
U 10	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
U 11	UEN0-10102	1	04713	MC10102P	MC10102P QUAD NOR

Parts List for 101BA09702 TCXO PCA Rev B2 (A32)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF09702	1	58900	101BF09702	TCXO PCB
C 1	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 2	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 3	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
R 1	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
U 1	UTN0-01322	1	01295	SN74HC132N	SN74HC132N 4X SCHMIDT NA
U 2	URP0-78120	1	04713	MC78L12CP	MC78L12CP .1A 12V REG
Y 1	101BC18300	1	58900	101BC18300	10 MHZ TCXO SPECIFICATIO

Parts List for 101BA06400 POWER SUPPLY A101 PCA Rev A (A101)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF06400	1	58900	101BF06400	POWER SUPPLY A101 PCB
2	ETSB-06224	21	88245	1309B	BIFURCATED TERMINAL 15/6
3	HSCS-60404	2	06540	9533B-A-140	#6 X 1/4 SWAGE CLR SPACE
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 2	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 4	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 6	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 7	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 8	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 9	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 10	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 11	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 12	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 13	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 15	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
CR 1	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 2	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 3	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 4	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 5	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
R 1	RN55-13320	1	81349	RN55C3321F	3.32 K OHMS 1% MET FILM
R 2	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 3	RN55-12430	1	81349	RN55C2431F	2.43 K OHMS 1% MET FILM
R 4	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 5	RN55-12430	1	81349	RN55C2431F	2.43 K OHMS 1% MET FILM
R 6	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 7	RN55-06650	1	81349	RN55C6650F	665 OHMS 1% MET FILM
R 8	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 9	RW03-00820	1	91637	RS-2B-82-1	82 OHM 2W WIREWOUND
R 10	RN55-06650	1	81349	RN55C6650F	665 OHMS 1% MET FILM
R 11	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM

Parts List for 101BA06500 POWER SUPPLY A102 PCA Rev D (A102)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF06500	1	58900	101BF06500	POWER SUPPLY A102 PCB
2	ETSB-06216	31	88245	2000B	BIFURCATED TERMINAL 5/32
3	HSCS-60404	4	06540	9533B-A-140	#6 X 1/4 SWAGE CLR SPACE
4	HQWC-01260	3	04713	B52200F006	TO126 DOME WASHER
5	HNSS-44004	3	96906	MS35649-244	4-40 HEX NUT
6	HBPP-44006	3	96906	MS-51957-15	4-40 X 3/8 PAN
7	HITP-00001	1	06383	PLM1M	NYLON CABLE TIE WITH TAG
C 1	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 2	CE63-07220	1	56289	501D227F063PR	220 UF 63V ELECT.
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
CR 1	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 2	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 3	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 4	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 5	DPAB-05391	1	04713	1N5391	IN5391 1.5A 35V DIODE
CR 6	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
IC 1	URP0-79050	1	04713	MC79L05CP	MC79L05 .1A -5V REG
Q 1	QBPP-05193	1	04713	2N5193	2N5193 4A 40V 40W PNP
Q 2	QBNP-05190	1	04713	2N5190	2N5190 4A 40V 40W NPN
Q 3	QBPP-05193	1	04713	2N5193	2N5193 4A 40V 40W PNP
Q 4	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 5	QBNS-00042	1	04713	MPSA42	MPSA42 300V NPN
Q 6	QTTS-00924	1	04713	MAC97-A5	MAC92-4 .45A 200V TRIAC
R 1	RW03-08000	1	91637	RS-2B-800-1	800 OHM 2W WIREWOUND
R 2	RW03-08000	1	91637	RS-2B-800-1	800 OHM 2W WIREWOUND
R 3	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
R 5	RN55-22740	1	81349	RN55C2742F	27.4 K OHMS 1% MET FILM
R 6	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 7	RN55-24750	1	81349	RN55C4752F	47.5 K OHMS 1% MET FILM
R 8	RN55-14320	1	81349	RN55C4321F	4.32 K OHMS 1% MET FILM
R 9	RN55-14320	1	81349	RN55C4321F	4.32 K OHMS 1% MET FILM
R 10	RC07-00470	1	01121	CB-470-5	47 OHMS 5% 1/4W CARBON
VR 1	DZAD-04728	1	04713	1N4728	IN4728 3.3 V ZENER
VR 2	DZAD-04753	1	04713	1N4753	IN4753 36 V ZENER

Parts List for 101CA04200 100MHZ MODULE PCA Rev R (A103)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF04200	1	58900	101CF04200	100MHZ MODULE PCB
2	ETSB-06216	24	88245	2000B	BIFURCATED TERMINAL 5/32
C 1	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 2	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 3	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 4	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 5	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 6	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 7	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 8	CC50-00120	1	51642	150-100-COG-120J	12 PF CERAMIC NPO
C 9	CC50-00120	1	51642	150-100-COG-120J	12 PF CERAMIC NPO
C 10	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 11	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 12	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 13	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 14	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 16	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 17	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 18	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 19	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 20	CC50-00330	1	52763	EDPT-33-NPO-5%	33 PF CERAMIC NPO
C 21	CC50-00150	1	52763	EDPT-15-NPO-5%	15 PF CERAMIC NPO
C 22	CC50-00330	1	52763	EDPT-33-NPO-5%	33 PF CERAMIC NPO
C 23	CV00-01012	1	18736	EF14	1-14 PF VARIABLE
C 24	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 25	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 26	CC50-00047	1	51642	100-100-COG-479J	4.7 PF CERAMIC NPO
C 27	CC50-00100	1	51642	100-100-COG-100J	10 PF CERAMIC NPO
C 28	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 29	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 30	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 31	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 32	CV00-09035	1	59660	538011D 9-35	9-35 PF VARIABLE
C 33	CV00-09035	1	59660	538011D 9-35	9-35 PF VARIABLE
C 34	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 35	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 36	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 37	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 38	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 39	CC50-00680	1	51642	150-100-COG-680J	68 PF CERAMIC NPO
C 40	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 41	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 42	CC50-00680	1	51642	150-100-COG-680J	68 PF CERAMIC NPO
C 43	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 44	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 45	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 46	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 47	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 48	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 49	CC50-00150	1	52763	EDPT-15-NPO-5%	15 PF CERAMIC NPO
C 50	CC50-00180	1	51642	150-100-COG-180J	18 PF CERAMIC NPO
C 51	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 52	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 53	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 54	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 55	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 57	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO

Parts List for 101CA04200 100MHZ MODULE PCA Rev R (A103)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
C 58	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 59	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 60	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 61	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 62	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 63	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 66	CC50-00018	1	51642	100-100-NPO-189C	1.8 PF CERAMIC NPO
CR 1	DVA0-00109	1	26629	KV3901	MV109 6-30 PF DIODE
CR 2	DSA0-02810	1	28480	5082-2810	5082-2810 SCHOT. DIODE
HR 1	Y35H-00150	1	12020	TO5M-2D	15V H-35/U CRYSTAL OVEN
L 1	LAD0-05150	1	72259	WEE-1.5	1.5 UH INDUCTOR
L 2	LAD0-05270	1	72259	WEE-2.7	2.7 UH INDUCTOR
L 3	420BA18006	1	58900	420BA18006	HANDWOUND INDUCTOR, 6 1/
L 4	420BA18006	1	58900	420BA18006	HANDWOUND INDUCTOR, 6 1/
Q 1	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 2	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 3	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 4	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 5	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 6	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 7	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
R 1	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 2	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 3	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 4	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 5	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 6	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 7	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 8	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 9	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 10	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 11	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 12	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 14	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 15	RN55-22210	1	81349	RN55C2212F	22.1 K OHMS 1% MET FILM
R 16	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 17	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 18	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 19	RN55-16810	1	81349	RN55C6811F	6.81 K OHMS 1% MET FILM
R 20	RN55-13920	1	81349	RN55C3921F	3.92 K OHMS 1% MET FILM
R 21	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 22	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 23	RN55-11300	1	81349	RN55C1301F	1.3 K OHMS 1% MET FILM
R 24	RN55-01500	1	81349	RN55C1500F	150 OHMS 1% MET FILM
R 25	RN55-01500	1	81349	RN55C1500F	150 OHMS 1% MET FILM
R 26	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 27	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 28	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 29	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 30	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 31	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 32	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 33	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 34	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 35	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 36	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 37	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM

Parts List for 101CA04200 100MHZ MODULE PCA Rev R (A103)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 38	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 39	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 40	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 41	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 42	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 43	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
U 1	UEN0-10216	1	04713	MC10216P	MC10216P TRIPLE RCVR
U 2	UANP-00733	1	07263	UA733DC	UA733DC VIDEO AMP
U 3	URP0-78120	1	04713	MC78L12CP	MC78L12CP .1A 12V REG
U 4	UEN0-10216	1	04713	MC10216P	MC10216P TRIPLE RCVR
U 5	UEN0-10216	1	04713	MC10216P	MC10216P TRIPLE RCVR
U 6	UANP-00733	1	07263	UA733DC	UA733DC VIDEO AMP
Y 1	Y350-10000	1	00809	C357-44/100.0000MHz	100MHz CRYSTAL HC-35U

Parts List for 101CA05600 COUNTER INPUT PCA Rev N2 (A104)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF05600	1	58900	101CF05600	COUNTER INPUT PCB
2	ETSB-06216	9	88245	2000B	BIFURCATED TERMINAL 5/32
3	101CF09100	1	58900	101CF09100	COUNTER INPUT HOUSING
4	101CF09200	1	58900	101CF09200	COUNTER INPUT COVER
5	JRBM-00000	2	98291	51-045-0000	SMB M BULK MOUNT
6	HSDH-60404	2	55566	9737-A-0632	6-32 X 1/4 M/F HEX SPACE
7	HLLT-60212	1	79963	505-#6	#6 SOLDER LUG
8	HSDH-60804	4	55566	9739-SS-0632	6-32 X 1/2 M/F SPACER
9	HIGR-00375	2	06540	2170	3/8' GROMMET
10	HQIS-00180	7	55285	K4-13	T018 INSULATOR
C 1	CC50-00047	1	51642	100-100-COG-479J	4.7 PF CERAMIC NPO
C 2	CC50-00150	1	52763	EDPT-15-NPO-5%	15 PF CERAMIC NPO
C 3	CC50-00220	1	52763	EDPT-22-NPO-5%	22 PF CERAMIC NPO
C 4	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 6	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 7	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 8	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 9	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 10	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 11	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 12	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 13	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 14	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 15	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 16	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 17	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 18	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 19	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 20	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 21	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 22	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 23	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 24	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 25	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 26	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 27	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 28	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 29	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 30	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 31	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 32	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 33	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 34	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 35	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 36	CC50-00150	1	52763	EDPT-15-NPO-5%	15 PF CERAMIC NPO
C 37	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 38	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 39	CC50-00100	1	51642	100-100-COG-100J	10 PF CERAMIC NPO
C 40	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 41	CC50-00470	1	52763	EDPT-47-NPO-5%	47 PF CERAMIC NPO
C 43	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 44	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 46	CC50-01220	1	51642	150-100-COG-221	220 PF CERAMIC NPO
C 47	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
CR 1	DAA0-03401	1	04713	MPN3401	MPN3401 PIN DIODE
CR 2	DAA0-03401	1	04713	MPN3401	MPN3401 PIN DIODE

Parts List for 101CA05600 COUNTER INPUT PCA Rev N2 (A104)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
CR 3	DAA0-03401	1	04713	MPN3401	MPN3401 PIN DIODE
CR 4	DAA0-03401	1	04713	MPN3401	MPN3401 PIN DIODE
CR 5	DAA0-03401	1	04713	MPN3401	MPN3401 PIN DIODE
CR 6	DAA0-03401	1	04713	MPN3401	MPN3401 PIN DIODE
CR 7	DAA0-03401	1	04713	MPN3401	MPN3401 PIN DIODE
CR 8	DSA0-02810	1	28480	5082-2810	5082-2810 SCHOT. DIODE
CR 9	DSA0-02810	1	28480	5082-2810	5082-2810 SCHOT. DIODE
CR 10	DSA0-02810	1	28480	5082-2810	5082-2810 SCHOT. DIODE
IC 1	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 2	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
IC 3	UEG0-09685	1	24355	AD9685BH	AD9685BH COMPARATOR
IC 4	UEN0-10231	1	04713	MC10231P	MC10231P DUAL D F/F
IC 5	UEN0-10216	1	04713	MC10216P	MC10216P TRIPLE RCVR
L 1	LAD0-?????	1	58900	LAD0-?????	SELECTED IN TEST
L 2	LAD0-?????	1	58900	LAD0-?????	SELECTED IN TEST
L 3	LAD0-04150	1	72259	WEE-.15	.15 UH INDUCTOR
L 4	LAD0-?????	1	58900	LAD0-?????	SELECTED IN TEST
L 5	LAD0-?????	1	58900	LAD0-?????	SELECTED IN TEST
L 6	LAD0-?????	1	58900	LAD0-?????	SELECTED IN TEST
L 7	LAD0-05270	1	72259	WEE-2.7	2.7 UH INDUCTOR
L 8	LAD0-05270	1	72259	WEE-2.7	2.7 UH INDUCTOR
L 9	LAD0-04150	1	72259	WEE-.15	.15 UH INDUCTOR
L 10	LAD0-05470	1	72259	WEE-4.7	4.7 UH INDUCTOR
L 11	LAD0-05470	1	72259	WEE-4.7	4.7 UH INDUCTOR
L 12	LAD0-04150	1	72259	WEE-.15	.15 UH INDUCTOR
L 13	LAD0-04150	1	72259	WEE-.15	.15 UH INDUCTOR
L 14	LAD0-05270	1	72259	WEE-2.7	2.7 UH INDUCTOR
Q 1	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 2	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 3	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 4	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 5	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 6	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 7	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 8	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 9	QJNS-04091	1	04713	2N4091	2N4091 30OHM N CH JFET
Q 10	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 11	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
Q 12	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 13	QBPS-05771	1	27014	2N5771	2N5771 15V 850MHZ PNP
Q 14	QBPS-02907	1	27014	PN2907	PN2907 .5A 40V .6W PNP
Q 15	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
R 1	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 2	RN55-12740	1	81349	RN55C2741F	2.74 K OHMS 1% MET FILM
R 3	RN55-12740	1	81349	RN55C2741F	2.74 K OHMS 1% MET FILM
R 4	RN55-32000	1	81349	RN55C2003F	200 K OHMS 1% MET FILM
R 5	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 6	RN55-12740	1	81349	RN55C2741F	2.74 K OHMS 1% MET FILM
R 7	RN55-22740	1	81349	RN55C2742F	27.4 K OHMS 1% MET FILM
R 8	RN55-04750	1	81349	RN55C4750F	475 OHMS 1% MET FILM
R 9	RN55-18250	1	81349	RN55C8251F	8.25 K OHMS 1% MET FILM
R 10	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 11	RN55-21100	1	81349	RN55C1102F	11 K OHMS 1% MET FILM
R 12	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 13	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 14	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 15	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM

Parts List for 101CA05600 COUNTER INPUT PCA Rev N2 (A104)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 16	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 17	RN55-01820	1	81349	RN55C1820F	182 OHMS 1% MET FILM
R 18	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 19	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 20	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 21	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 22	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 23	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 24	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 25	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 26	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 27	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 28	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 29	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 30	RN55-41000	1	81349	RN55C1004F	1 M OHMS 1% MET FILM
R 31	RN55-08250	1	81349	RN55C8250F	825 OHMS 1% MET FILM
R 32	RN55-01820	1	81349	RN55C1820F	182 OHMS 1% MET FILM
R 33	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 34	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 35	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 36	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 37	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 38	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 39	RN55-08250	1	81349	RN55C8250F	825 OHMS 1% MET FILM
R 40	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 41	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM
R 42	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 43	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 44	RN55-22210	1	81349	RN55C2212F	22.1 K OHMS 1% MET FILM
R 45	RN55-06650	1	81349	RN55C6650F	665 OHMS 1% MET FILM
R 46	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 47	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 48	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 49	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 50	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 51	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 52	RN55-21500	1	81349	RN55C1502F	15 K OHMS 1% MET FILM
R 53	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 54	RN55-12210	1	81349	RN55C2211F	2.21 K OHMS 1% MET FILM
R 55	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 56	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 57	RN55-01210	1	81349	RN55C1210F	121 OHMS 1% MET FILM
R 58	RN55-01000	1	81349	RN55C1000F	100 OHMS 1% MET FILM
R 59	RN55-00100	1	81349	RN55C10R0F	10 OHMS 1% MET FILM
R 60	RAPD-15000	1	73138	89PR5K	5K POT 15T PC MNT
R 61	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 62	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 63	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 64	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 65	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 66	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 67	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 68	RN55-23010	1	81349	RN55C3012F	30.1 K OHMS 1% MET FILM
R 69	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 70	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 71	RN50-00221	1	81349	RN50D2211F	22.1 OHM 1% METAL FILM
R 72	RC07-44700	1	01121	CB-475-5	4.7 MEG 5% 1/4W CARBON

Parts List for 101CA05600 COUNTER INPUT PCA Rev N2 (A104)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 73	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 74	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 75	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 76	RN50-00511	1	65940	CRB20FX51R1	51.1;M F;1/5W;1%;100PPM
R 77	RN50-00511	1	65940	CRB20FX51R1	51.1;M F;1/5W;1%;100PPM

Parts List for 101CA05900 COUNTER CONTROL PCA Rev H (A105)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF05900	1	58900	101CF05900	COUNTER CONTROL PCB
2	HSCS-60204	5	06540	9531B-A-140	#6 X 1/8 SWAGE CLR SPACE
3	HSTX-44004	2	88245	A1591B	4-40 CORNR BLOCK 1/16 MT
4	101CF05000	2	58900	101CF05000	DELAY LINE BD
5	ETSB-06216	8	88245	2000B	BIFURCATED TERMINAL 5/32
6	101BF12200	4	58900	101BF12200	DELAY LINE SHIELD BD
7	HBPP-63210	3	96906	MS-51957-31	6-32 X 5/8 PAN
8	HWSS-60400	3	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
9	HNSS-63205	3	96906	MS35649-264	6-32 HEX NUT
C 1	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 2	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 4	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 5	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 6	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 7	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 8	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 9	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 10	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 11	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 12	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
IC 1	UEN0-01692	1	04713	MC1692L	MC1692L QUAD RECEIVER
IC 2	UEN0-10211	1	04713	MC10211P	MC10211P DUAL 3 IN NOR
IC 3	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
IC 4	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
IC 5	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
IC 6	UEN0-10131	1	04713	MC10131P	MC10131P DUAL D F/F
IC 7	UEN0-10125	1	04713	MC10125P	MC10125P QUAD ECL TO TTL
IC 8	UEN0-10124	1	04713	MC10124P	MC10124P QUAD TTL TO ECL
J 1	JSP0-10016	1	09922	DILB16P-108	16 PIN DIP SOCKET
J 2	JRBM-00101	1	98291	51-053-0000	SMB M RTANG PC MOUNT
R 1	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 2	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 3	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 4	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 5	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 6	RN55-00681	1	81349	RN55C68R1F	68.1 OHMS 1% MET FILM
R 7	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 8	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 9	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 10	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 11	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 12	RN55-02740	1	81349	RN55C2740F	274 OHMS 1% MET FILM
R 13	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 14	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 15	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 16	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 17	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 18	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 19	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 20	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 21	RN55-03320	1	81349	RN55C3320F	332 OHMS 1% MET FILM
R 22	RN55-14750	1	81349	RN55C4751F	4.75 K OHMS 1% MET FILM
R 23	RN55-00825	1	81349	RN55C82R5F	82.5 OHMS 1% MET FILM
R 24	RN55-01300	1	81349	RN55C1300F	130 OHMS 1% MET FILM
R 25	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM
R 26	RN55-05620	1	81349	RN55C5620F	562 OHMS 1% MET FILM

Parts List for 101CA03000 DISPLAY PCA Rev C (A106)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF03000	1	58900	101BF03000	DISPLAY PCB
2	JSP0-10018	4	09922	DILB18P-108	18 PIN DIP SOCKET
3	JSPR-10016	2	06776	ICN163S3T	16 PIN DIP CLIP SOCKET
4	JSPR-90016	2	06776	RC76	16 PIN RETAINER CLIP
7	HSTX-44004	4	88245	A1591B	4-40 CORNR BLOCK 1/16 MT
8	ETSB-06216	6	88245	2000B	BIFURCATED TERMINAL 5/32
9	GFU0-00002	4	26066	4108	FOAM TAPE .50W X .125THK
10	GFU0-00003	8	26066	4108	FOAM TAPE .25W X .125THK
C 1	CE50-07100	1	90201	TC3501D	100 UF 50V ELECT.
DS 1	IMF0-00090	1	0HFH6	9LT-03	9 DIGIT FLUOR DISPLAY
DS 2	IMF0-00050	1	0HFH6	5LT-03	5 DIGIT FLUOR DISPLAY
IC 1	UIN0-00594	1	18324	NE594N	NE594 8X DISP DRIVE
IC 2	UIN0-00594	1	18324	NE594N	NE594 8X DISP DRIVE
IC 3	UIN0-00594	1	18324	NE594N	NE594 8X DISP DRIVE
IC 4	UIN0-00594	1	18324	NE594N	NE594 8X DISP DRIVE
R 1	RN55-02210	1	81349	RN55C2210F	221 OHMS 1% MET FILM

Parts List for 101BA02700 LEVER SWITCH PCA Rev A (A107)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF02700	1	58900	101BF02700	LEVER SWITCH PCB
3	101BC12701	2	58900	101BC12701	LEVER SWITCH 5 DIGIT
4	DSA0-04148	40	07263	1N4148	1N4148 G.P. DIODE
5	JSP0-10016	1	09922	DILB16P-108	16 PIN DIP SOCKET

Parts List for 101BA04700 ADDRESS SWITCH PCA Rev E (A109)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF04700	1	58900	101BF04700	ADDRESS SWITCH PCB
2	SDP0-00501	1	71450	206-5	5 SPST DIP SWITCH
3	JSPR-10016	1	06776	ICN163S3T	16 PIN DIP CLIP SOCKET
4	JSPR-90016	1	06776	RC76	16 PIN RETAINER CLIP
5	HSTS-60304	2	06540	9532B-A-0632	6-32 X 3/16 SWAGE SPACER

Parts List for 101BA29400 DETECTOR TEMP COMP PCA Rev C (A111)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF29400	1	58900	101BF29400	DETECTOR TEMP COMP PCB
2	ETSB-06216	6	88245	2000B	BIFURCATED TERMINAL 5/32
3	JHP0-10016	1	51167	16-600-10	16 PIN DIP HEADER
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 2	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
CR 1	DSA0-04148	1	07263	1N4148	1N4148 G.P. DIODE
J 1	JSP0-10016	1	09922	DILB16P-108	16 PIN DIP SOCKET
R 1	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 2	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 3	RN55-21000	1	81349	RN55C1002F	10 K OHMS 1% MET FILM
R 4	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 5	RN55-11000	1	81349	RN55C1001F	1 K OHMS 1% MET FILM
R 6	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 7	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 8	RN55-31000	1	81349	RN55C1003F	100 K OHMS 1% MET FILM
R 9	RN55-?????	Ref	81349	RN55C????F	SELECTED IN TEST
R 10	RN55-?????	Ref	81349	RN55C????F	SELECTED IN TEST
R 11	RN55-?????	Ref	81349	RN55C????F	SELECTED IN TEST
R 12	RN55-?????	Ref	81349	RN55C????F	SELECTED IN TEST
R 13	RN55-?????	Ref	81349	RN55C????F	SELECTED IN TEST
R 14	RN55-?????	Ref	81349	RN55C????F	SELECTED IN TEST
U 1	ULP0-00335	1	27014	LM335Z	TEMP. SENS
U 2	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U 3	ULN0-05018	1	32293	IH5018CPA	IH5018CPA SPDT SWITCH
VR 1	DRAE-00827	1	04713	1N827	1N827 6.2V REF. DIODE

Parts List for 101BA37900 ATTENUATOR DRIVER PCA Rev A (A112)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF37900	1	58900	101BF37900	ATTENUATOR DRIVER PCB
2	ETSB-06216	8	88245	2000B	BIFURCATED TERMINAL 5/32
3	HSCS-40203	6	55566	1531-A-4-A-7	#4 X 1/8 CLEAR SPACER
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
J 1	JSP0-10014	1	09922	DILB14P-108	14 PIN DIP SOCKET
R 1	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 2	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 3	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
R 4	RN55-15620	1	81349	RN55C5621F	5.62 K OHMS 1% MET FILM
U 1	UCN0-00710	1	04713	MC14071BCP	MC14071 QUAD OR
U 2	UIN0-01413	1	04713	MC1413P	MC1413P X7 DRIVER .5A
U 3	UIN0-01413	1	04713	MC1413P	MC1413P X7 DRIVER .5A

Parts List for 101BA36200 EXT ALC POT/SW PCA Rev B2 (A117)

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF36200	1	58900	101BF36200	EXT ALC POT/SW PCB
2	ETSB-06216	12	88245	2000B	BIFURCATED TERMINAL 5/32
3	STW0-00102	1	09353	7101-P4-D	SPDT TOGGLE SWITCH
R 1	RAPF-15000	1	73138	66WR5K	5K 10% 20T VERT PC
R 2	RAPF-22000	1	73138	66WR20K	20K 10% 20T VERT PC

LIST OF MANUFACTURERS

The names and addresses of manufacturers cited in the preceding parts lists are shown on the following pages. Each manufacturer is listed under its CAGE number (COMMERCIAL AND GOVERNMENT ENTITY), as noted in the parts lists. In a few cases, no CAGE number has been assigned; these manufacturers are referenced by Giga-tronics codes which are shown at the end of the list.

CAGE	NAME	ADDRESS
0AG18	Hirose Electric USA Inc	Chatsworth, CA
0AX52	Ditom	1180 Coleman Ave #103 San Jose, CA 95110
0B0A9	Dallas Semiconductor Corp	6350 Beltwood Pky S Dallas, TX 75244
0BE81	Aerovox-Mallory	20 Aberdeen Dr Glasgow, KY 42141
0D2A6	Mitsubishi Electronics Inc	1050 East Arques Ave Sunnyvale, CA 94086
0D3V2	Menlo Industries Inc	44060 Old Warm Springs Blvd Fremont, CA 94538
0GP12	Radiall Inc	150 Long Beach Blvd Stratford, CT 06497
0HS44	Pacific Millimeter	189 Linbrook Dr San Diego, CA 92111
0HFH6	Futaba Corporation of America	555 West Victoria St Compton, CA 90220
0HFJ2	Microplastic	9180 Gazette Ave Chatsworth, CA 91311
0J7V3	Amp Inc	19200 Stevens Creek Blvd Suite 1 Cupertino, CA 95014
00443	Waveline Inc	160 Passaic Ave West Caldwell, NJ 07006
00656	Aerovox Inc	740 Belleville Ave New Bedford, MA 02745
00750	Air Track Mfg Corp	College Park, MD
00809	Croven Crystals	500 Beech St Whitby, Ontario, CAN L1N5S5
00815	Midland - Ross	357 Beloit St Burlington, WI 53105
01121	Allen-Bradley Co	1201 South 2nd St Milwaukee, WI 53204
01295	Texas Instruments Inc	13500 N. Central Expwy Dallas, TX 75265
01963	Cherry Electrical Products	3600 Sunset Ave Waukegan, IL 60087
02660	Amphenol Corp	2801 South 25th Ave Broadview, IL 60153
02735	RCA Corp	Route 202 Somerville, NJ 08876
03614	Bussman Mfg	114 Old St Rd PO Box 144 St Louis, MO 63178
04222	AVX Ceramics Div of AVX Corp	19th Ave South PO Box 867 Myrtle Beach, SC 29577
04426	ITW Switches	6615 West Irving Park Rd Chicago, IL 60634
04552	Grace W R and Co	869 Washington St Canton, MA 02021
04713	Motorola Inc	5005 East McDowell Rd Phoenix, AZ 85008
05236	Jonathan Manufacturing Corp	1101 South Acacia Ave Fullerton, CA 92631
05245	Corcom Inc	1600 Winchester Rd Libertyville, IL 60048
05276	ITT Pomona Electronics Div	1500 E 9th St PO Box 2767 Pomona, CA 91766
05791	Lyn-Tron Inc	3150 Damon Way Burbank, CA 91505
05820	EG and G Wakefield Engineering	60 Audubon Rd Wakefield, MA 01880
05905	Jerobee Industries Inc	Redmond, WA

CAGE	NAME	ADDRESS
06049	Topaz Inc	9192 Topaz Way San Diego, CA 92123
06349	Cam-Lok Div Empire Product Inc	10540 Chester Rd Cincinnati, OH 45215
06383	Panduit Corp	17301 Ridgeland Tinley Park, IL 60477
06540	Mite Corp	466 Blake St New Haven, CT 06515
06776	Robinson Nugent Inc	800 East 8th St New Albany, IN 47150
07180	Sage Laboratories Inc	East Natick Industrial Park 3 Huron Dr Natick, MA 01760
07263	Fairchild Camera & Instrument	464 Ellis St Mountain View, CA 94039
07512	Oak Materials Group Inc	McCaffery St Hoosick Falls, NY 12090
07556	Calabro Industries Inc	1372 Enterprise Dr West Chester, PA 19380
09022	Cornell-Dubilier Electric Corp	1605 Rodney French Blvd New Bedford, MA 93790
09353	C and K Components Inc	15 Riverdale Ave Newton, MA 02158
09922	Burndy Corp	Richards Ave Norwalk, CT 06856
09969	Dale Electronics Inc	East Highway 50 PO Box 180 Yankton, SD 57078
1AU47	Lucas Weinschel Inc	1 Weinschel Ln PO Box 6001 Gaithersburg, MD
1BR23	CW Industries	
1CY63	Sierra Microwave Technology	11295-B Sunrise Gold Circle Rancho Cordova, CA 95670
1DS68	Sumner Mfg Inc	Hwy 411 S-Sumner Dr PO Drawer A Rome, GA 30162
1ES66	Maxim Intergrated Products	510 North Pastoria Ave Sunnyvale, CA 94086
1FN41	Atmel Corp	2125 Onel Dr. San Jose, CA 95131
1W232	Spacek Labs	528 Santa Barbara St Santa Barbara, CA 93101
1Y147	Virtech	805 G University Ave Los Gatos, CA 95030
11532	Teledyne Relays	12525 Daphne Ave Hawthorne, CA 90250
11769	Elco/Dyntech Div of Elco Corp	1225 East Wakeham Ave Santa Ana, CA 92702
12020	Ovenaire Div of Electronic Tech	706 Forrest St Charlottesville, VA 22901
12457	Merrimac Industries Inc	41 Fairfield Pl West Caldwell, NJ 07006
13103	Thermalloy Co Inc	2021 W. Valley View Lane Dallas, TX 75381
13511	Amphenol Cadre Div Bunker Ramo Corp	Los Gatos, CA
13708	Allied Components	Inglewood, CA
13919	Burr-Brown Reserch Corp	6730 South Tucson Blvd Tucson, AZ 85734
14482	Watkins-Johnson Co	3333 Hillview Ave Palo Alto, CA 94304
14604	Elmwood Sensors Inc	500 Narragansett Park Dr Pawtucket, RI 02861
14936	General Instrument	600 West John St Hicksville, NY 11820

CAGE	NAME	ADDRESS
15268	RHG Electronics Laboratory Inc	161 East Industry Ct Deer Park, NY 11729
15542	Mini-Circuits Laboratory	2625 East 14th St Brooklyn, NY 11235
15915	Tepro of Florida Inc	2608 Enterprise Rd Clearwater, FL 33517
16179	M/A-Com Omni Spectra Inc	21 Continental Blvd Merrimack, NH 03054
16352	Codi Corp	350 Hurst St Linden, NJ 07036
16428	Cooper Belden Electronic Wire	Northwest N St Richmond, IN 47374
16453	Western Microwave Inc	495 Mercury Dr Sunnyvale, CA 94086
16508	Aerovox Corp	19th Ave S. PO Box 867 Myrtle Beach, SC 29577
16733	Cablewave Systems Inc	60 Dodge Ave North Haven, CT 06473
17217	Gore W L and Associates Inc	555 Paper Mill Rd Newark, DE 19714
17540	Alpha Industries Inc	20 Sylvan Rd Woburn, MA 01801
17856	Siliconix Inc	2201 Laurelwood Rd Santa Clara, CA 95054
18310	Concord Electronic Corp	30 Great Jones St New York, NY 10012
18324	Signetics Corp	4130 South Market Ct Sacramento, CA 95834
18364	Mag-Tool Co	940 American St San Carlos, CA 94070
18714	RCA Corp Findlay Plant	1700 Fostoria Rd Findlay, OH 45840
18736	Voltronics Corp	West St East Hanover, NJ 07936
19089	Swimrite Mfg Co Inc	Van Nuys, CA
19701	Mepco/Electra Inc	P.O. Box 760 Mineral Wells, TX 76067
2J873	Celeritex Inc	617 River Oaks Pky San Jose, CA 95134
2J899	Dynawave Inc	94 Searle St PO Box 938 Georgetown, MA 01833
2M734	Panasonic Co	P.O. Box 1502 Secaucus, NJ 07094
2V941	Microsource Inc	1269 Corporate Ctr Pky Sana Rosa, CA 95407
20550	Engineering Mfg Co	Sheboygan, WI
20944	Wiltron Co	805 East Middlefield Rd Mountain View, CA 94042
20999	Minnesota Mining and Mfg Co	3M Center St Paul, MN 55101
21604	Buckeye Stamping Co	555 Marion Rd Columbus, OH 43207
21847	TRW Microwave Inc	825 Stewart Dr Sunnyvale, CA 94086
22519	Data Delay Devices	385 Lakeview Ave Clifton, NJ 07011
23899	Van Petty Mfg Inc	1168 Tourmaline Dr Newbury Park, CA 91320
23936	Pamotor	770 Airport Blvd Burlingame, CA 94010
24355	Analog Devices Inc	Rt 1 Industrial Park Norwood, MA 02062
24253	ITT Pomona Electronics Div	1500 E 9th St PO Box 2767 Pomona, CA 91766

CAGE	NAME	ADDRESS
24539	Avantek Inc	3175 Bowers Ave Santa Clara, CA 95051
24931	Specialty Connector Co Inc	2100 Earlywood Dr PO Box 547 Franklin, IN 46131
24995	Enviromental Container System	3560 Rouge River Hwy Grants Pass, OR 97526
26066	Minnesota Mining and Mfg. Co	3M Center St Paul, MN 55101
26629	Frequency Sources Inc	16 Maple Rd Chelmsford, MD 01824
26692	B and S Tool & Die Company	2300 Sulphur Spring Rd Baltimore, MD 21227
26922	Cetec Corp	9900 Baldwin Place El Monte, CA 91731
26923	Control Master Products Inc	1062 Shary Circle Concord, CA 94518
27014	National Semiconductor Corp	2900 Semiconductor Dr Santa Clara, CA 95051
27264	Molex Inc	2222 Wellington Ct Lisle, IL 60532
27802	Vectron Laboratories Inc	166 Gover Ave Norwalk, CT 06850
27851	Film Microelectronics	17 A St Burlington, MA 01803
28480	Hewlett Packard Co	3000 Hanover St Palo Alto, CA 94304
28520	Heyco Molded Products	750 Boulevard PO Box 160 Kenilworth, NJ 07033
29005	Storm Products Co	112 South Glasglow Ave Inglewood, CA 90301
29111	Trak Microwave Corp	735 Palomar Ave Sunnyvale, CA 94086
29990	American Technical Ceramics	One Nordon Lane Huntington Stn, NY 11746
3A054	McMaster-Carr Supply Co	9630 Norwalk Blvd Santa Fe Springs, CA 90670
3E364	Vemaline	333 Strawberry Field Rd Warwick, RI 02887
3W023	Philips Components Discrete Product Div	5083 Kings Hwy Saugerties, NY 12477
31433	Union Carbide Corp	Hwy 276 SE Greenville, SC 29606
31703	Gudrun Frederickson Co	Oakland, CA
31757	Micrpac Industries Inc	905 E. Walnut St Garland, TX 75040
31781	Edac Inc	20 Railside Rd Don Mills, Ont CAN M3A1A4
31918	ITT Schadow Inc	8081 Wallace Rd Eden Prarie, MN 55344
32293	Intersil Inc	10600 Ridgeview Ct Cupertino, CA 95014
32559	Bivar Inc	4 Thomas St Irvine, CA 92718
32767	Griffith Plastics Corp	1027 California Dr Burlingame, CA 94010
32997	Bourns Inc Trimpot Division	1200 Columbia Ave Riverside, CA 92507
33592	Miteq Inc	100 Davids Dr Huappauge, NY 11787
34031	Analog Devices	7810 Success Rd Greensboro, NC 27409
34078	Midwest Microwave Inc	3800 Packard Rd Ann Arbor, MI 48104
34576	Rockwell International Corp	4311 Jamboree Rd Newport Beach, CA 92660
34781	MCW Industries	129 Southside Drive Charlotte, NC 28210

CAGE	NAME	ADDRESS
34785	Dek Inc	3480 Swenson Ave St Charles, IL 60174
36437	Star Stainless Products Ltd	Montreal, Que CAN H4T1N8
4F708	Hammond Mfg Co US Inc	1690 Walden Drive Buffalo, NY 14225
4R125	Magnetec Corp	61 W Dudleytown Rd Bloomfield, CT 06002
46384	Penn Engineering & Mfg Corp	Old Easton Rd PO Box 1000 Danboro, PA 18916
5J927	Interface Technology Div of Dynatech Corp	2100 E Alcosta Ave Glendora, CA 91740
50721	General Electric	11 Chabot Blvd Mansfield, MA 02048
51167	Aries Electronics Inc	62 Trenton Ave Frenchtown, NJ 08825
51284	Mos Technology Inc	950 Rittenhouse Rd Norristown, PA 19401
51642	Centre Engineering Co	2820 East College Ave State College, PA 16801
51705	Icco Rally	2575 East Bayshore Rd Palo Alto, CA 94303
52063	Exar Integrated Systems	750 Palomar Ave Sunnyvale, CA 94088
52072	Circuit Assembly Corp	18 Thomas St Irvine, CA 92714
52648	Plessey Trading Corp	1641 Kaiser Ave Irvine, CA 92714
52683	Baytron Co Inc	344 Salem St Medford, MA 02155
52763	Stettner Electronics Inc	6135 Airways Blvd Chattanooga, TN 37421
52840	Western Digital Corp	3128 Red Hill Ave Costa Mesa, CA 92626
53387	Minnesota Mining & Mfg Co Electronic Products Div 3M	Auxtin, TX
54186	Micro Power Systems Inc	3100 Alfred St Santa Clara, CA 95050
54343	Riedel M W and Co	300 Cypress Ave Alhambra, CA 91801
54487	Micronetics Inc	36 Oak St Norwood, NJ 07648
54583	TDK Electronics Corp	12 Harbor Park Dr Port Washington, NY 11550
55153	Dielectric Laboratories Inc	69 Albany St Cazenovia, NY 13035
55261	LSI Computer Systems Inc	1235 Walt Whitman Rd Melville, NY 11747
55285	Bergquist Co Inc	5300 Edina Industrial Blvd Minneapolis, MN 55435
55322	Samtec Inc	810 Progress Blvd PO Box 1147 New Albany, IN 47150
55387	Pamtech	8030 Remmet Ave Canoga Park, CA 91304
55566	R A F Electronic Hardware	95 Silvermine Rd Seymour, CT 06483
55576	Synertek	3001 Stender Way Santa Clara, CA 95051
55680	Nichicon America Corp	927 E State Pky Schaumburg IL 60195
56248	Consolidated Refining Co	115 Hoyt Ave Mamaroneck, NY 10543
56289	Sprague Electric Co	87 Marshall St North Adams, MA 01247
56501	Thomas & Betts Corp	920 Route 202 Raritan, NJ 08869

CAGE	NAME	ADDRESS
56563	Alatec Products	12747 Saticoy St North Hollywood, CA 91605
57032	Daden Associates Inc	23011 Moulton Pky A-12 Laguna Hills, CA 92653
57793	United Microwave Products Inc	185 West 205th St Torrance, CA 90503
58202	Innowave Inc	15555 Concord Circle Morgan Hill, CA 95037
58361	General Instrument Corp	3400 Hillview Ave Palo Alto, CA 94304
58377	National Electronics	11731 Markon Dr Garden Grove, CA 92641
58684	Magnetec Corp	61 W Dudleytown Rd Bloomfield, CT 06002
58900	Giga-tronics Inc	2495 Estand Way Pleasant Hill, CA 94523
59124	KOA Speer Electronics Inc	Bolivar Dr PO Box 547 Bradford, PA 16701
59365	Metelics Corp	975 Stewart Dr Sunnyvale CA 94086
59660	Tusonix Inc	2155 N. Forbes Blvd #107 Tucson, AZ 85745
59942	AVX Filters Corp	11144 Penrose St Sun Valley, CA 91352
59980	Midwest Polychem Ltd	1502 N 25th Ave Melrose Park, IL 60160
6A566	Tecknit Corp	320 North Nopal St Santa Barbara, CA 93103
6V806	Frammar Mfg Inc (formerly Omni Spectra Corp)	6859 Tujunga Ave North Hollywood CA 91605
6Y341	Microwave Technology Inc	4268 Solar Way Fremont, CA 94538
60393	Precision Resistive Products	655 Main St Mediapolis, IA 52637
60395	Xicor Inc	851 Buckeye Ct Milpitas, CA 95035
60450	Microwave Components Inc	7 Meehan Dr Chelmsford, MA 01824
60583	Narda Microwave Corp	11040 White Rock Rd Suite 200 Rancho Cordova, CA 95670
60644	CSDC	P.O. Box 2116 Wayne, NJ 07470
61104	Aris Engineering Corp	30 Bond St Haverhill, MA 01830
61485	Hitachi Denshi America Ltd	175 Croossways Park Way Woodbury, NY 11797
61638	Advanced Interconnections	5 Energy Way West Warwick, RI 02893
61772	Integrated Device Technology	3236 Scott Blvd PO Box 58015 Santa Clara, CA 95052
61802	Toshiba International	13131 West Little York Rd Houston, TX 77041
61964	Omron Electronics Inc	1E Commerce Schaumburg, IL 60173
62331	Krytar Inc	1292 Anvilwood Ct Sunnyvale, CA 94086
62559	Schroff Inc	170 Commerce Dr Warwick, RI 02886
63058	McKenzie Socket Technology Inc	44370 Old Warm Springs Blvd Fremont, CA 94538
63132	Time Microwave	398 Martin Ave Santa Clara, CA 95050
63468	Electro Dynamics	5625 Foxridge Dr Shawnee Mission, KS 66201
63542	Hall-Mark Electronics Corp	11333 Pagemill Rd Dallas, TX 75222

CAGE	NAME	ADDRESS
64135	Filter Concepts	2624 S. Rousselle St Santa Ana, CA 92707
64155	Linear Technology Corp	1630 McCarthy Blvd Milpitas, CA 95035
64671	Inmet Corp	7155 Jackson Rd Ann Arbor, MI 48103
64859	AP Products Inc	9325 Progress Parkway Mentor, OH 44061
65032	Rogers Corp	P.O. Box 700 Chandler, AZ 85224
65449	Amtex Intl Inc	1878 Star Batt Rochester, MI 48063
65517	Ayer Engineering Co	1250 West Roger Rd Tucson, AZ 85705
65664	Catamount Mfg Inc	Governor Dr PO Box 720 Orange, MA 01364
65940	Rohm Corp	8 Whatney Irvine, CA 92714
66039	Kaycor International	1732 Central St Evanston, IL 60201
66148	Fairlane Fluid/Air Products	23435 Industrial Park Dr Farmington, MI 48024
66449	Microsource Inc	1269 Corporate Center Pky Santa Rosa, CA 95407
66466	Standard Instrumentation Inc	3322 Pennsylvania Ave Charleston, WV 25302
66544	Continental Microwave & Tool Co	10 Merrill Industrial Dr Hampton, NH 03842-0998
66579	Waferscale Intergraton	47280 Kato Rd Fremont, CA 94538
66958	SGS Semiconductor Corp	7117 E. 3rd Ave Scottsdale, AZ 52251
67297	Herotek Inc.	265 J Sobrante Way Sunnyvale, CA 94086
68459	River Run Enterprises Inc	2001 Jefferson Davis Ave Selma, AL 36701
7E222	Littlefuse Tracor Inc	800 E Northwest Hwy Des Plaines, IL 60016
7E585	Zero Mfg	777 Front St Burbank, CA 91303
7M800	Analog Devices Inc	2444 Moorpark Ave San Jose, CA 95128
7W263	Huber - Suhner Ltd	Tumbleinstrass 20 Pfaffikon, Switz CH-8330
70364	American Electric Switch Corp	Route 4 Rocky Hill Hwy Lancaster, SC 29720
70903	Belden Corp	200 South Batavia Ave Geneva,IL 60134
71218	Bud Industries	4605 E 355th St Willoughby, OH 44094
71450	CTS Corp	905 North West Blvd Elkhart, IN 46514
71468	ITT Cannon Electric	10550 Talbert Ave Fountain Valley, CA 92708
71785	TRW Inc	1501 Morse Ave Elk Grove Village, IL 60104
72259	Nytronics Inc	475 Park Ave South New York, NY 10016
72982	Murata Erie North America Inc	645 West 11th St Erie, PA 16512
73138	Beckman Industrial	2500 Harbor Ave Fullerton, CA 92634
74840	Illinois Capacitor Inc	3757 W. Touhy Ave Lincoln, IL 60645
74970	Johnson E F Co	299 10th Ave South West Waseca, MN 56093
75263	Keystone Carbon Co	1935 State St St Marys, PA 15857

CAGE	NAME	ADDRESS
75332	Kings Electronics Co Inc	Brooklyn, NY (relocated; see CAGE 91836)
75378	CTS Knights Inc	400 Reimann Ave Sandwich, IL 60548
75915	Tracor Littlefuse Inc	800 East Northwest Hwy Des Plains, IL 60016
78553	Eaton Corp	8700 Brookpark Rd Cleveland, OH 44101
79963	Zierick Mfg Co	Radio Circle Mt Kisko, NY 10549
8B649	Intel Corp	3065 Bowers Ave Santa Clara, CA 95051
8E631	Solitron-MIC	Port Salerno, FL (relocated; see CAGE 95077)
8G639	Wavecom	Sunnyvale, CA 94086
8K805	Omni Spectra Inc	Los Altos, CA
8Z313	LMS Electronics	34101 Monroe Rd Charlotte, NC 28205
81073	Grayhill Inc	561 Hillgrove Ave La Grange, IL 60525
81312	Winchester Electronics	400 Park Rd Watertown, CT 06795
81349	'Military specification promulgated by military departments/agencies under authority of Defense Standardization Manual 4120 3-M.'	
81703	Mulberry Metal Products Inc	2199 Stanley Terrace Union, NJ 07083
81774	Carol Wire and Cable Corp	249 Roosevelt Ave Pawtucket, RI 02860
82152	Transco Products Inc	4241 Glenco Ave Marina Del Ray, CA 90295
82199	Polarad Electronics Inc	5 Delaware Drv Lake Success, NY 11042
82877	Rotron Inc	7 Hasbrouck Lane Woodstock, NY 12498
83330	Kulka Smith Inc	1913 Atlantic Ave Manasquan, NJ 08736
84084	American Iron and Machine Work	720 Industrial Blvd Oklahoma City, OK
86797	Rogan Corp	3455 Woodhead Dr Northbrook, IL 60062
88245	Winchester Electronics	13536 Saticoy St Van Nuys, CA 91409
89110	Amp Inc	1595 South Mt Joy St Elizabethtown, PA 17022
9W826	EZ Form Cable Corp	315 Peck St Bldg 24 New Haven, CT 06513
90201	Mallory Capacitor Co	4760 Kentucky Ave Indianaplolis, IN 46206
91303	KOL Inc	St Paul, MN
91506	Augat Inc	33 Sperry Ave Attleboro, MA 02703
91637	Dale Electronics Inc	2064 12th Ave Columbus, NE 68601
91662	Elco Corp	Industrial Park Huntington, PA 16652
91833	Keystone Electronics Corp	31-07 20th Rd Astoria, NY 11105
91836	Kings Electronics Co Inc	40 Marbledale Road Tuckahoe, NY 10707
92194	Alpha Wire Corp	711 Lidgerwood Ave Elizabeth, NJ 07207
93459	Weinschel Engineering Co	1 Weinschel Lane Gaithersburg, MD 20877
94696	Magnecraft	1910 Techny Rd Northbrook, IL 60062

CODE	NAME	Address
95054	Sermax Corp	Milwaukee, WI
95077	Solitron Devices Inc	1177 Blue Heron Blvd Bldg 2 Riviera Beach, FL 33404
95146	Alco Electronics Products Inc	1551 Osgood St North Andover, MA 01845
95275	Vitramon Inc	Box 544 Bridgeport CT 06601
95348	Gordos Corp	250 Glenwood Ave Bloomfield, NJ 07003
95987	Weskesser Co Inc	727 West Glendale Ave Milwaukee, WI 53209
96341	Microwave Associates Inc	N.W. Industrial Park S. Ave Burlington, MA 01803
96733	San Fernando Electric Mfg Co	1501 First St San Fernando, CA 91341
96906	'Military standards promulgated by military departments under authority of defense standardization manual 4120 3-M.'	
98291	Sealectro Corp 06611	40 Lindeman Dr Trumbull, CT
99800	American Precision Industries	270 Quaker Rd East Aurura, NY 14052
99899	Narda Microwave/Loral Corp	435 Moreland Rd Hauppage, NY 11788

ARBITRARY CODES (assigned by Giga-tronics)		
CODE	NAME	Address
I000E	Intergrated Power	
M0006	3M Products	
P0009	Princeton Case	

Diagrams

Section 7

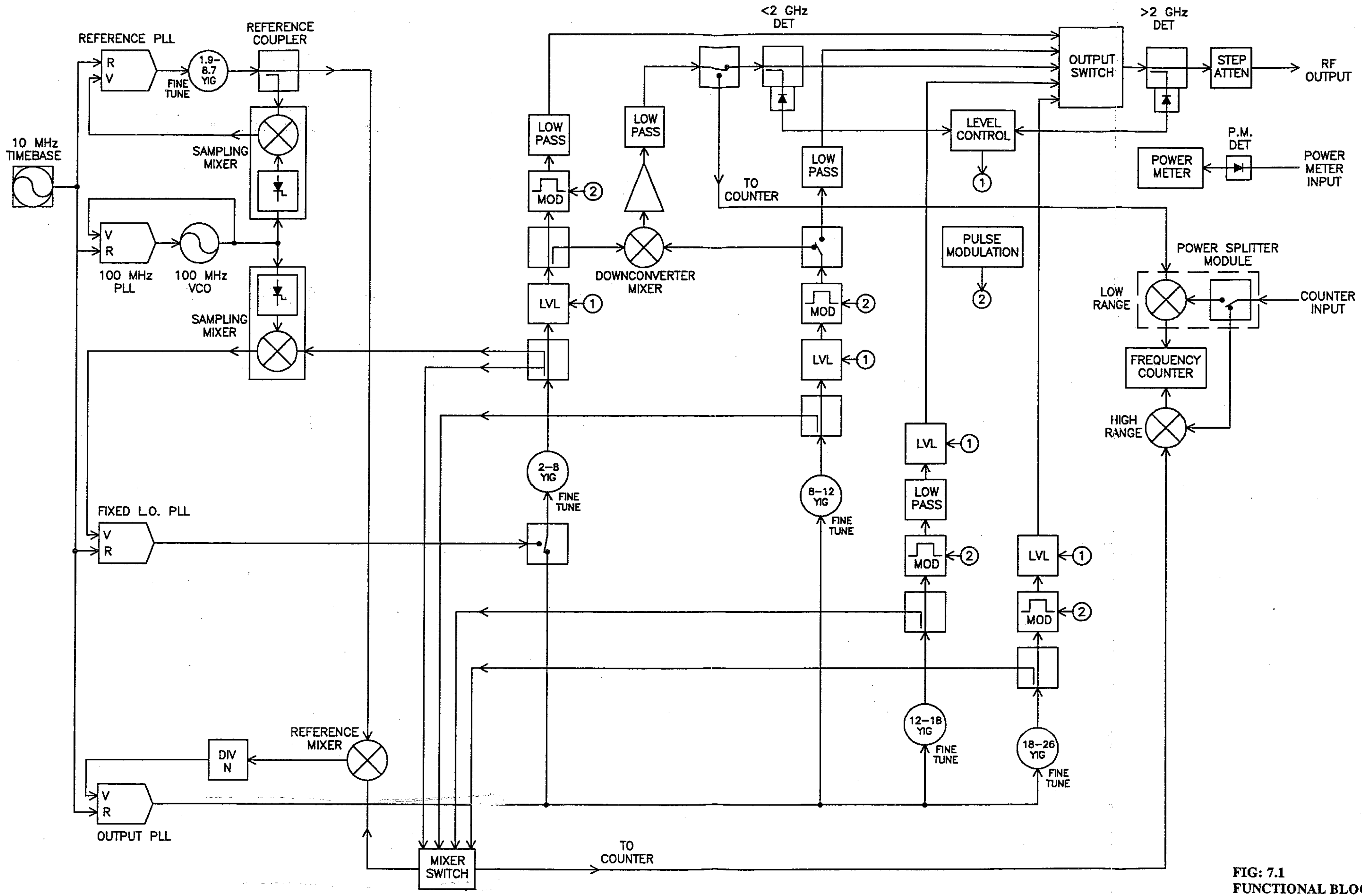
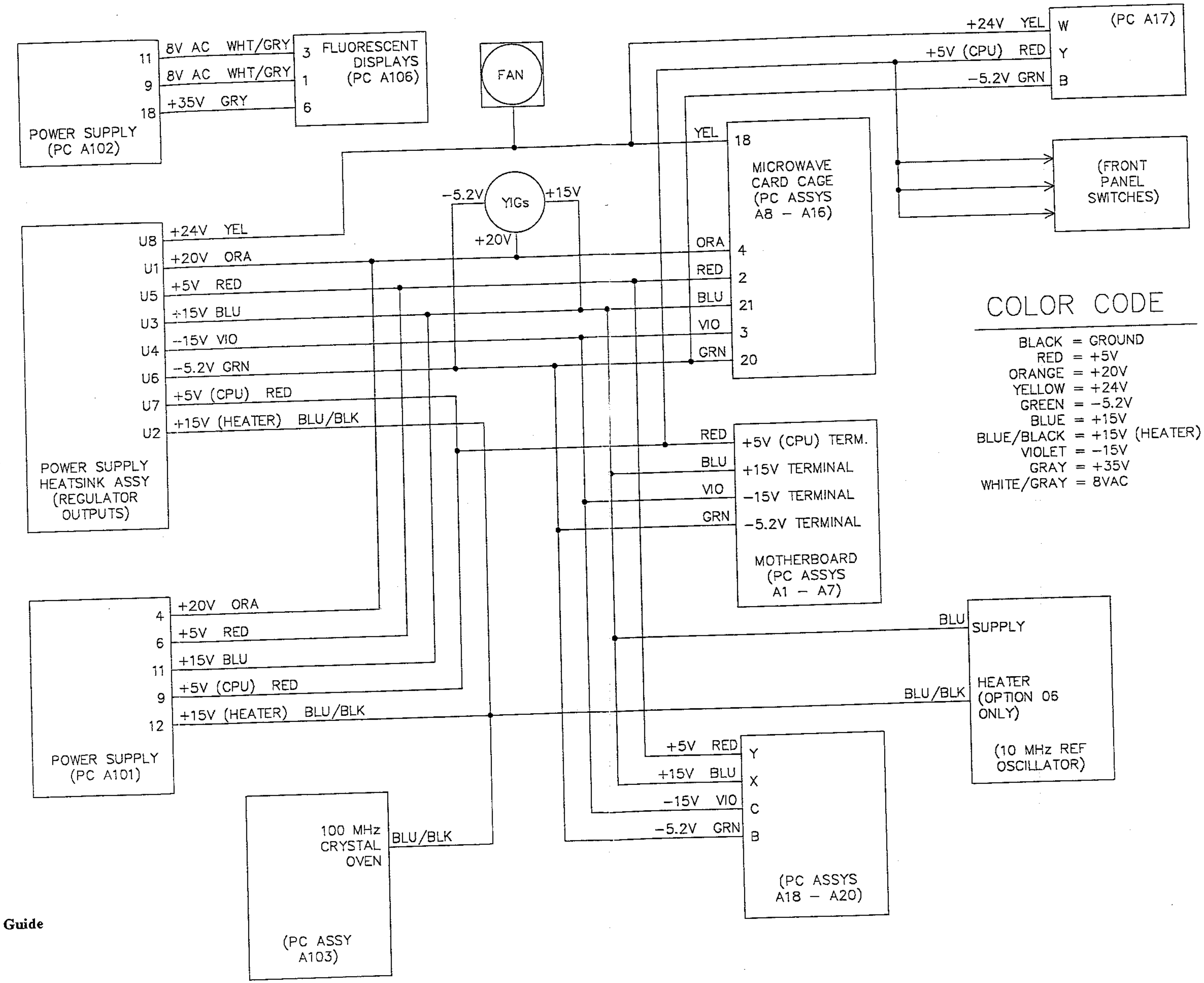


FIG: 7.1
FUNCTIONAL BLOCK DIAGRAM
DWG# 101BM14000

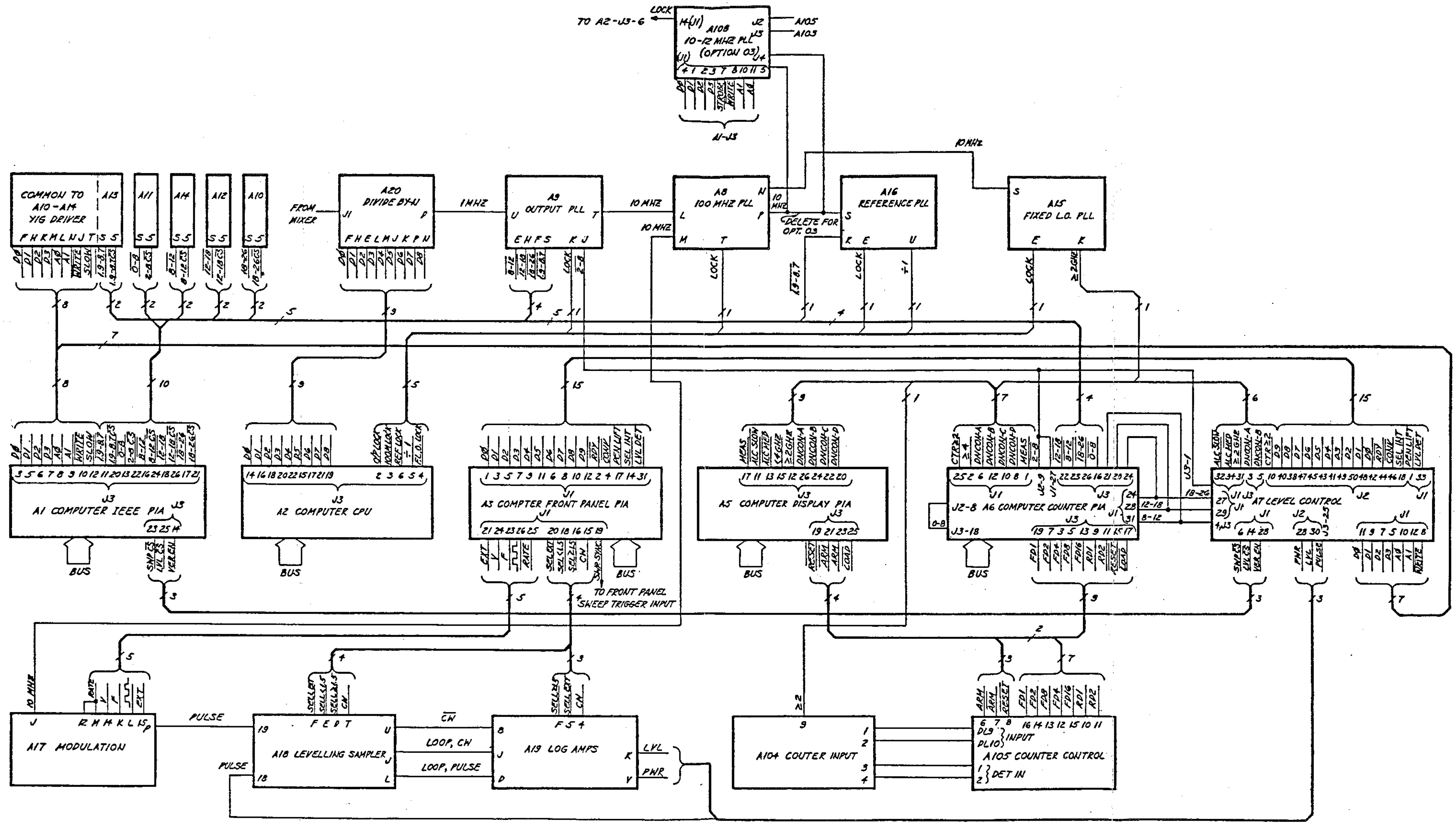
REV B



Power Supply Wiring Color Guide

DWG# 101BM31000 Rev A

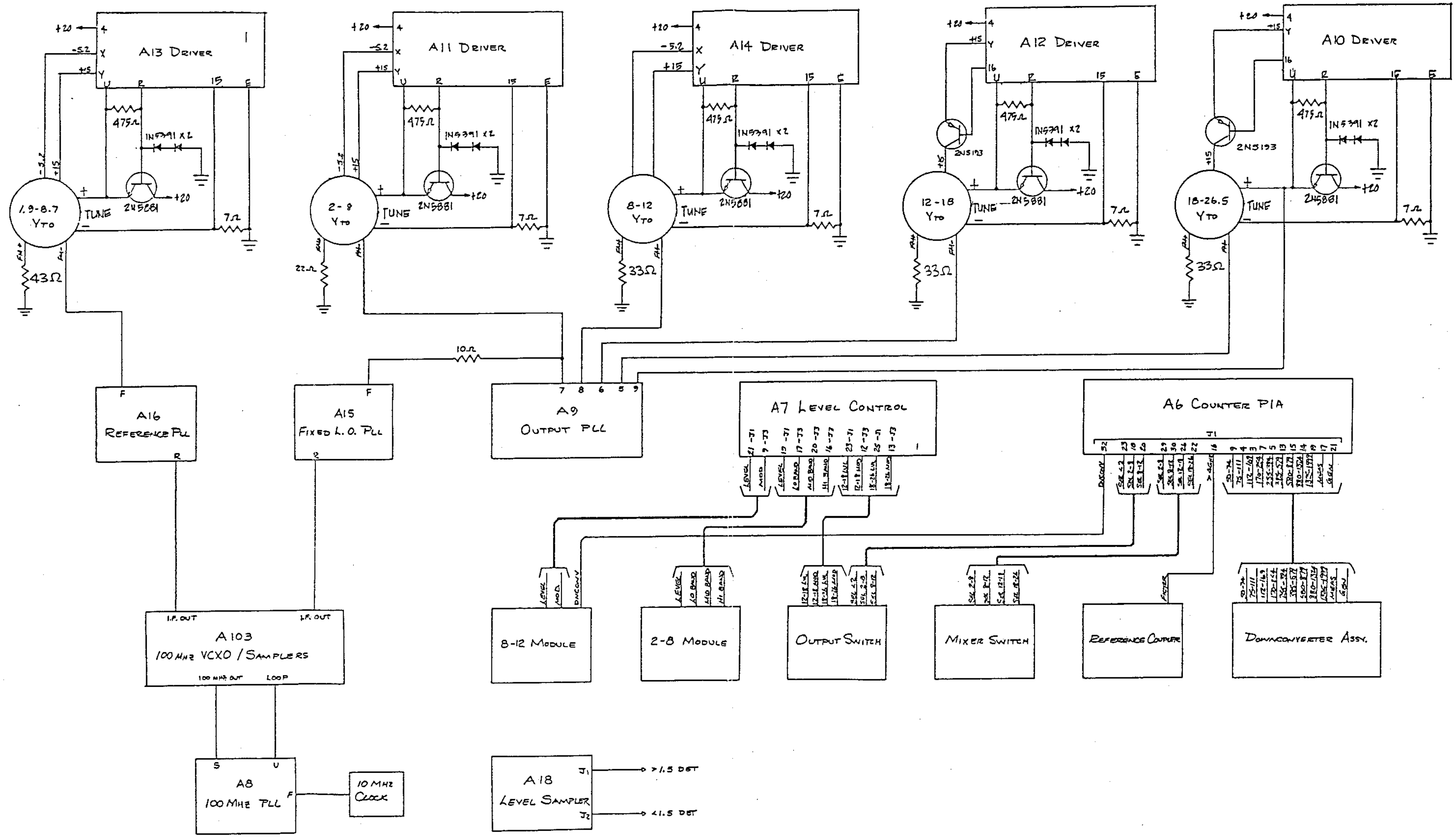
Sheet 1 of 1



Main Chassis Wiring Interconnect

DWG# 101BM14700 Rev A

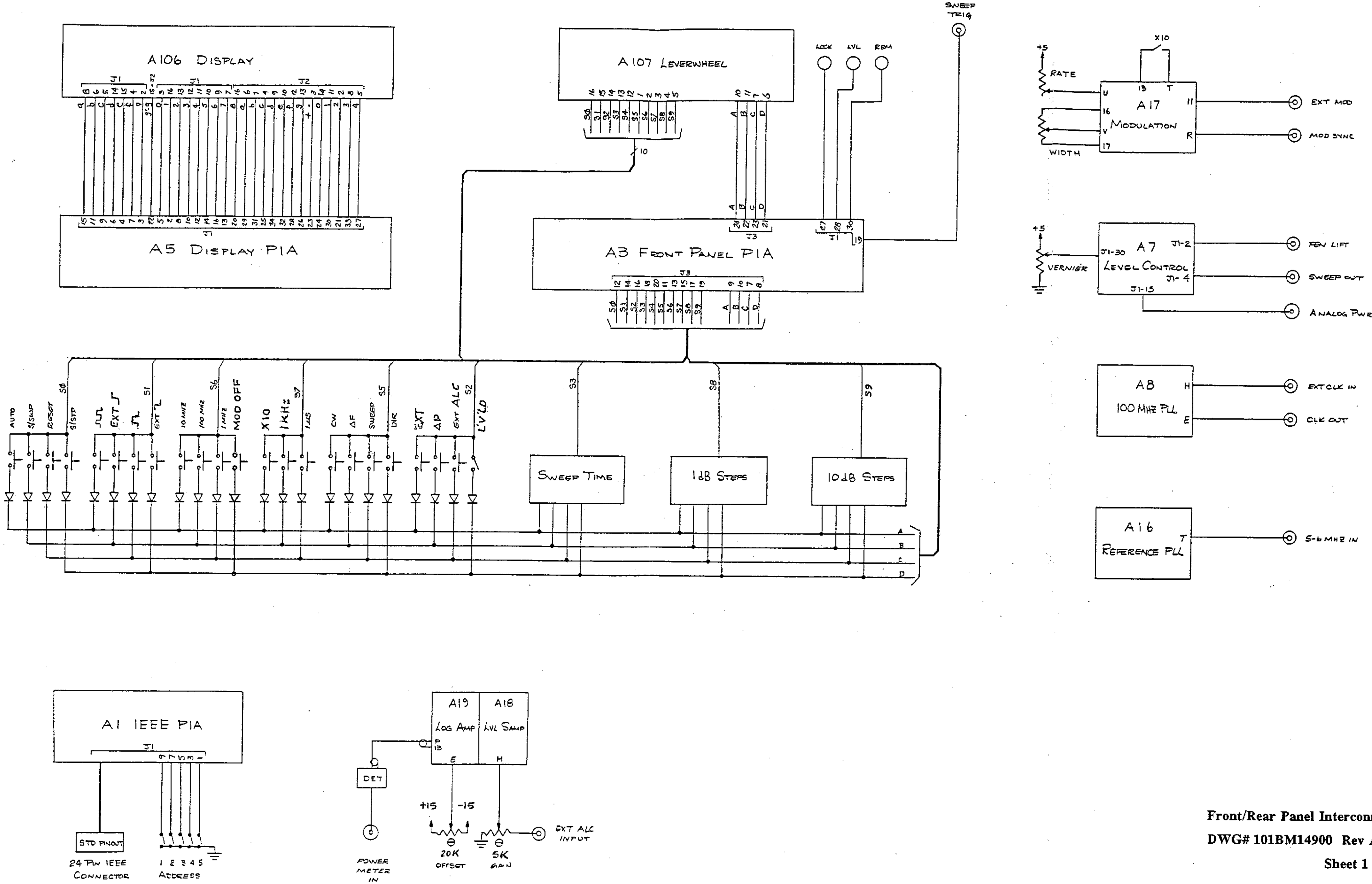
Sheet 1 of 1



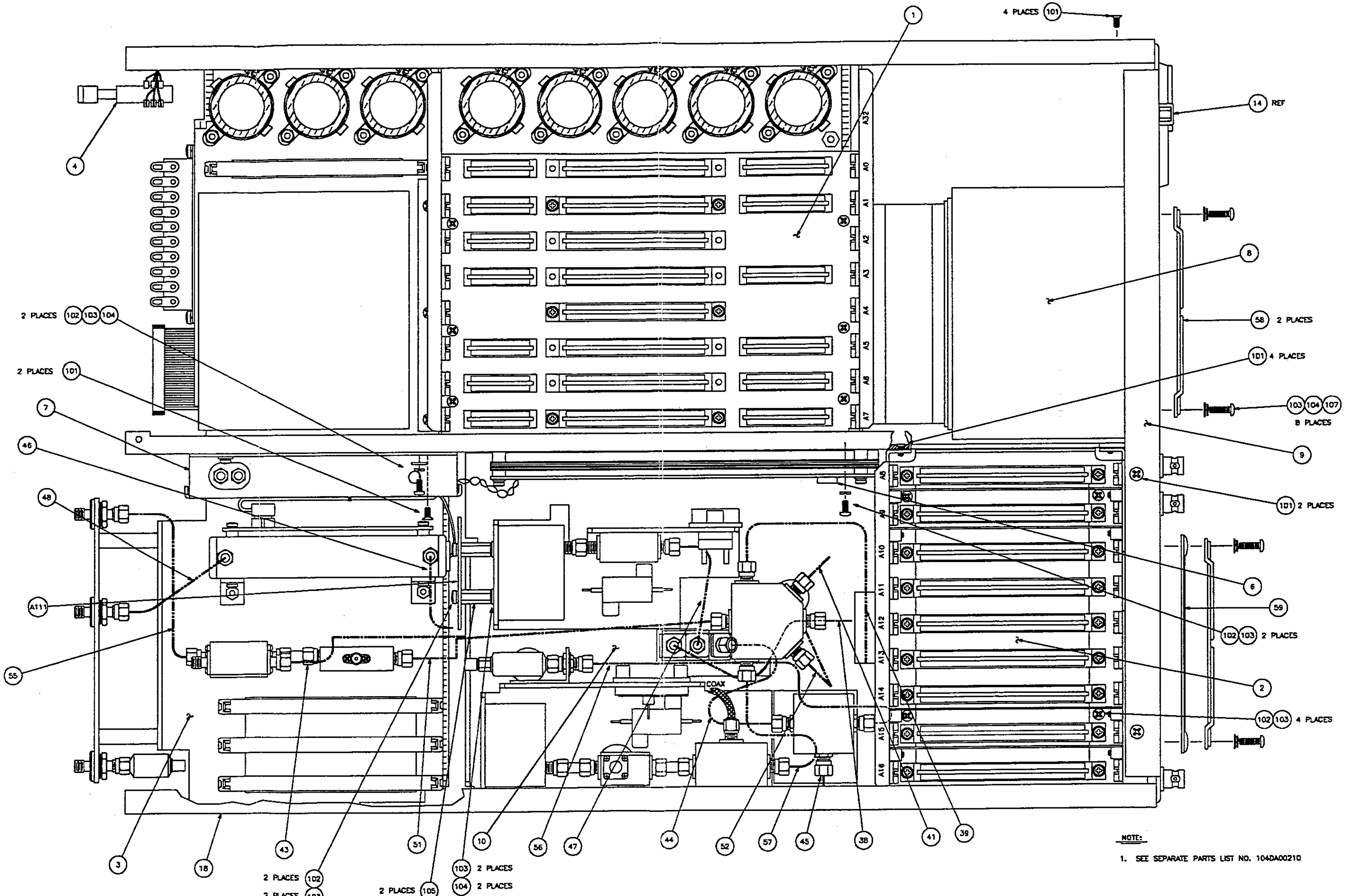
Microwave Interconnections

DWG# 101BM14800 Rev B

Sheet 1 of 1



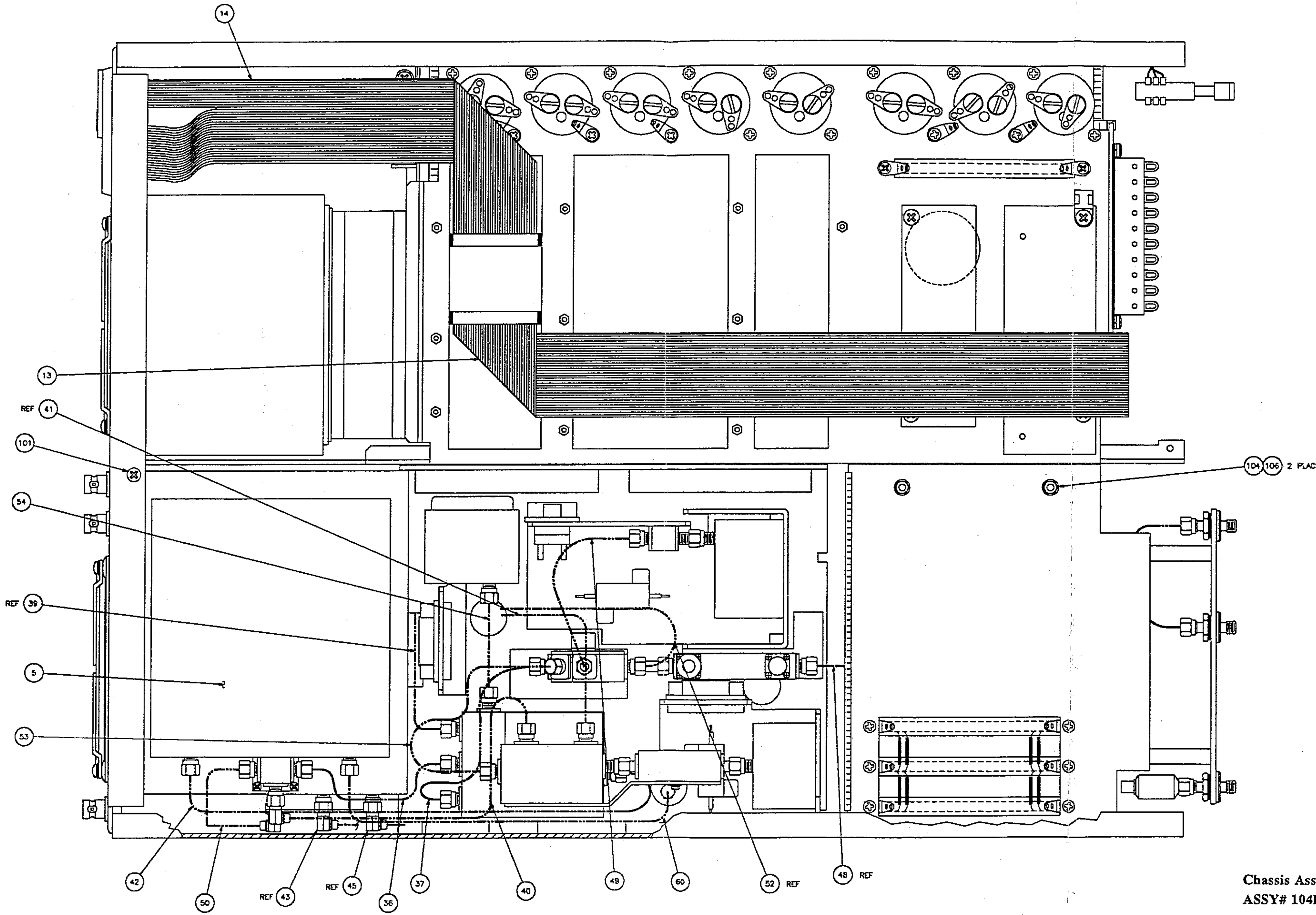
Front/Rear Panel Interconnect
DWG# 101BM14900 Rev A
Sheet 1 of 1



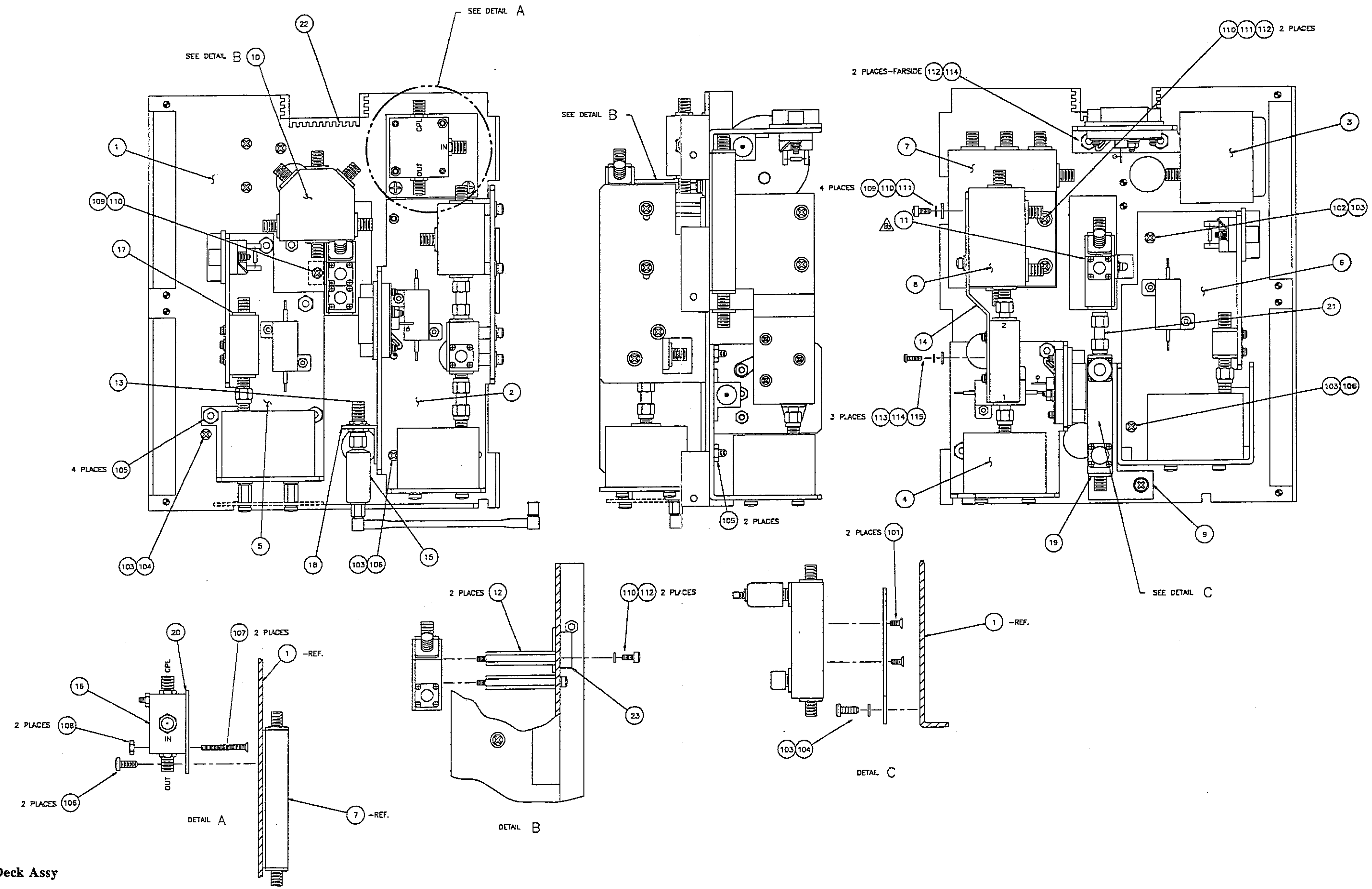
NOTE:

1. SEE SEPARATE PARTS LIST NO. 104DA00210

Chassis Assy
ASSY# 104DA00210 Rev B
Sheet 1 of 2



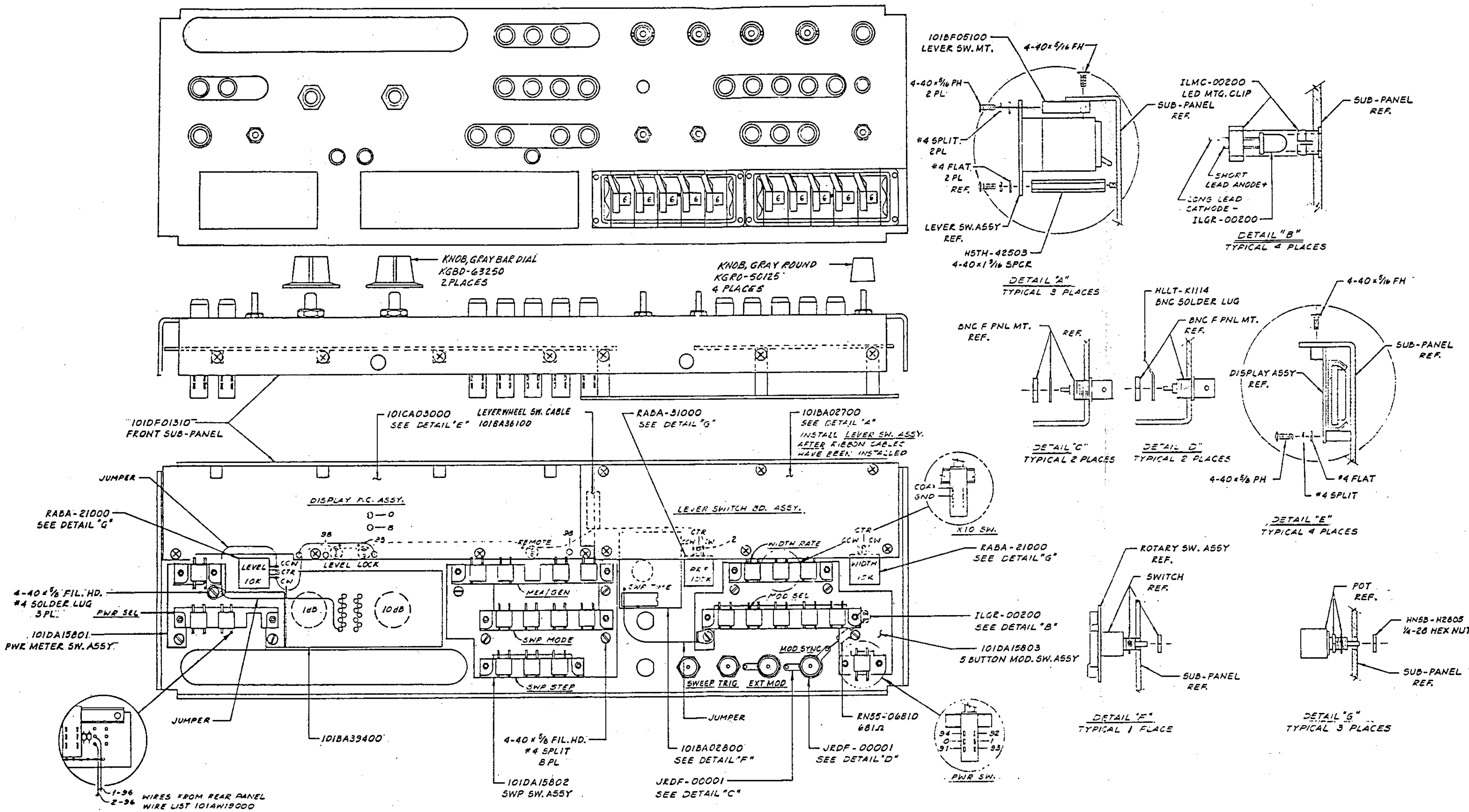
Chassis Assy
ASSY# 104DA00210 Rev B
Sheet 2 of 2



Microwave Deck Assy

ASSY# 104DA01700 Rev D

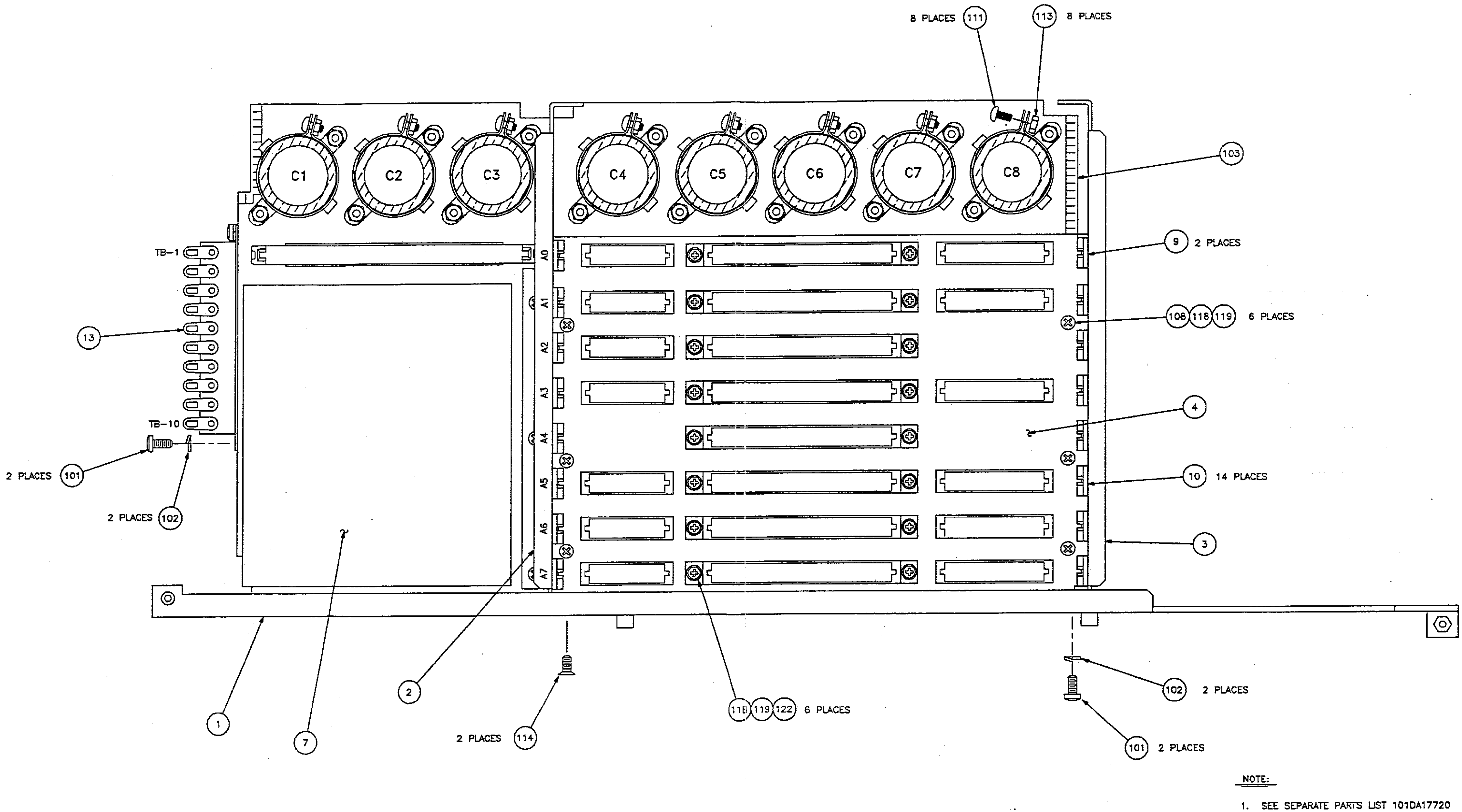
Sheet 1 of 1



Front Panel Assy

ASSY# 104DA01401 Rev C

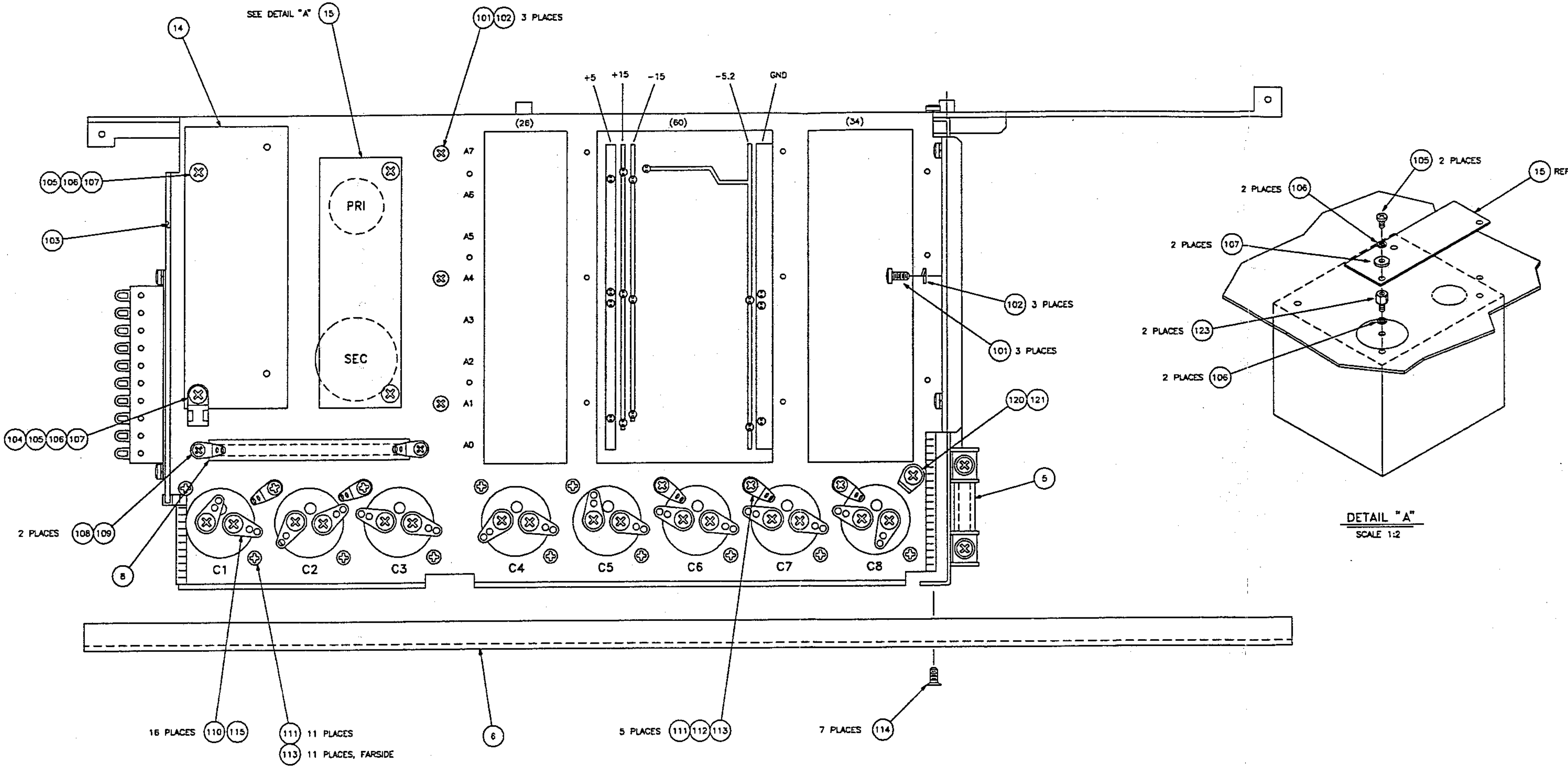
Sheet 1 of 1



Computer Deck Assy

DWG# 101BM17720 Rev A

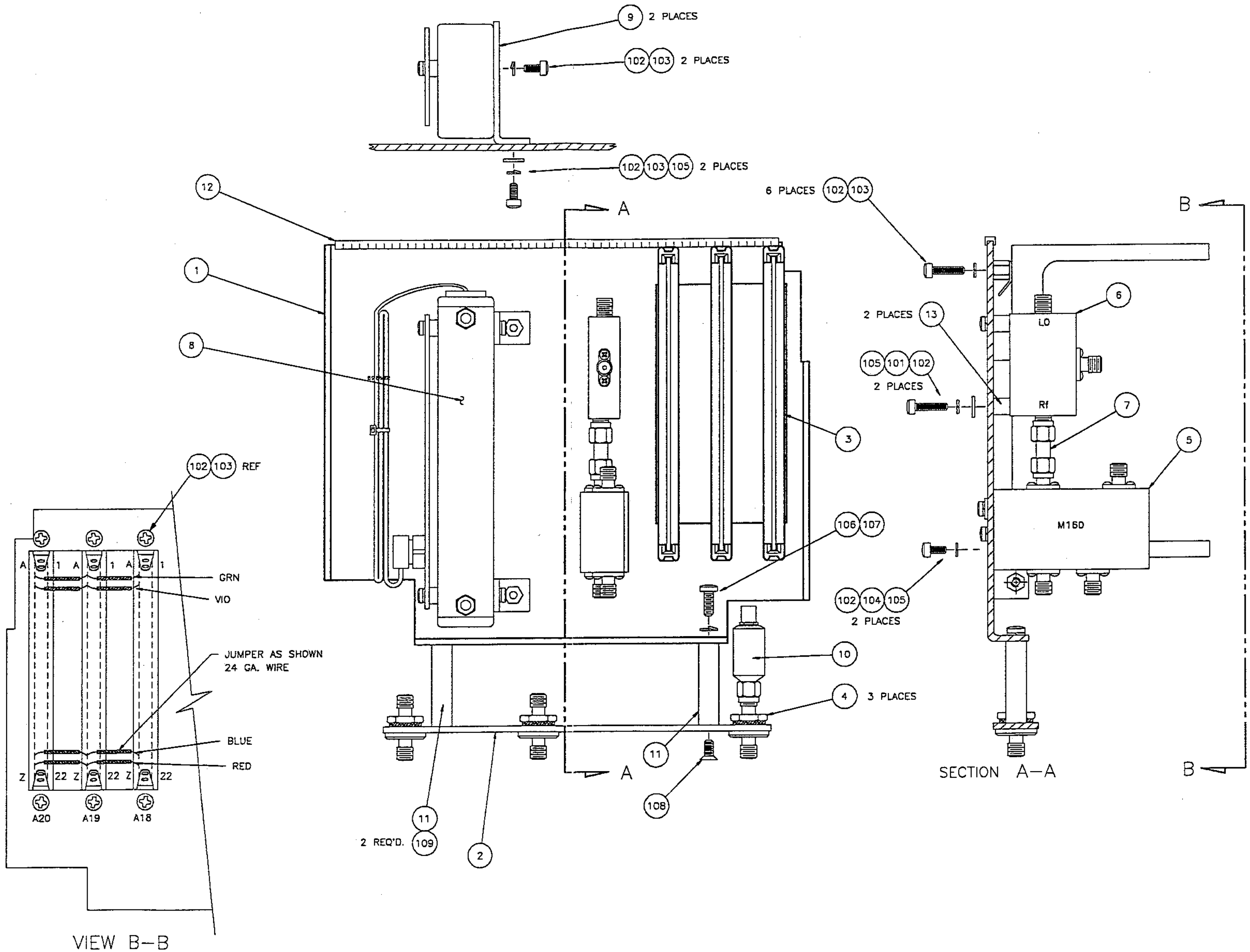
Sheet 1 of 2



Computer Deck Assy

DWG# 101BM17720 Rev A

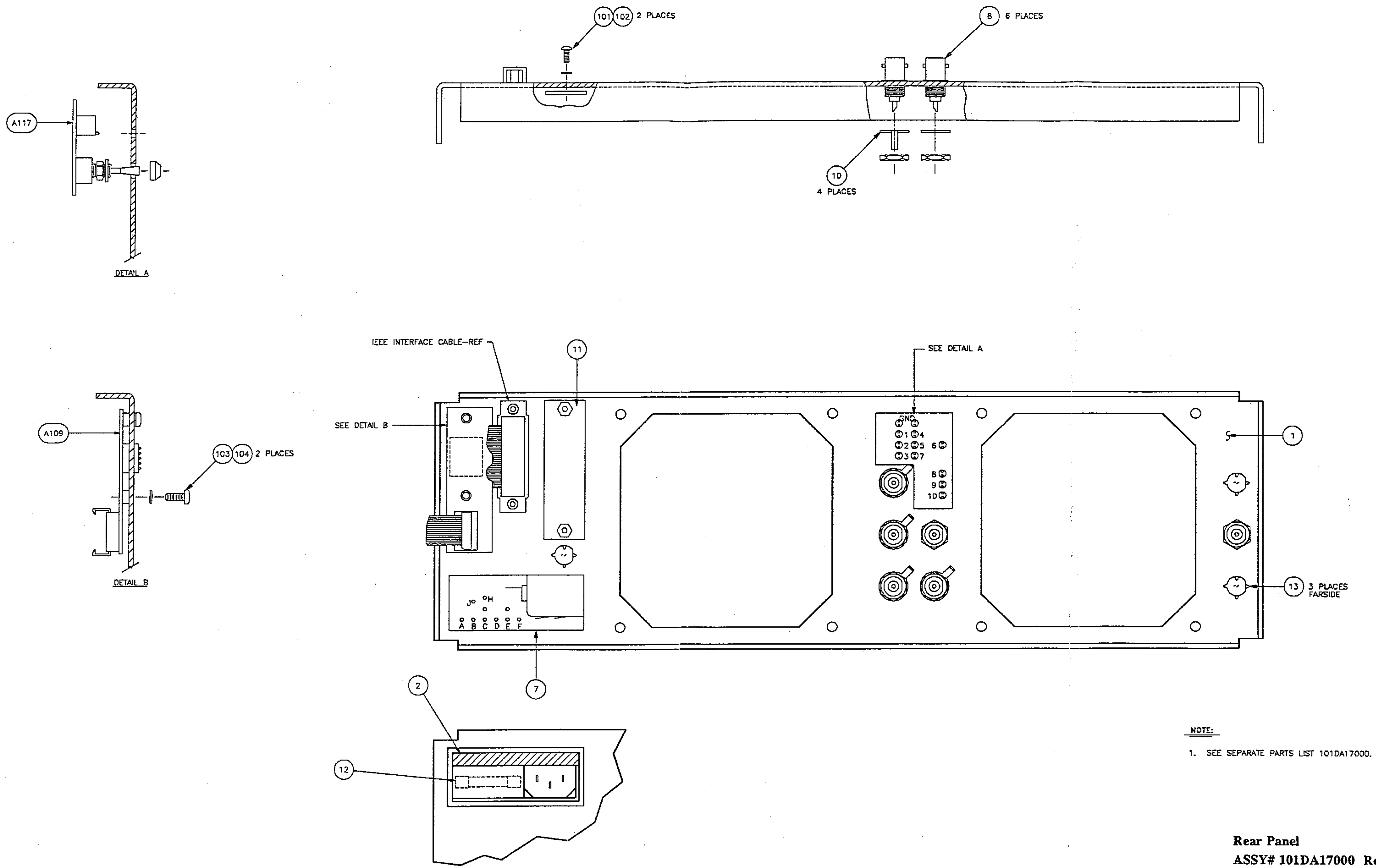
Sheet 2 of 2



Attenuator Chassis Assy

ASSY# 104CA01000 Rev F

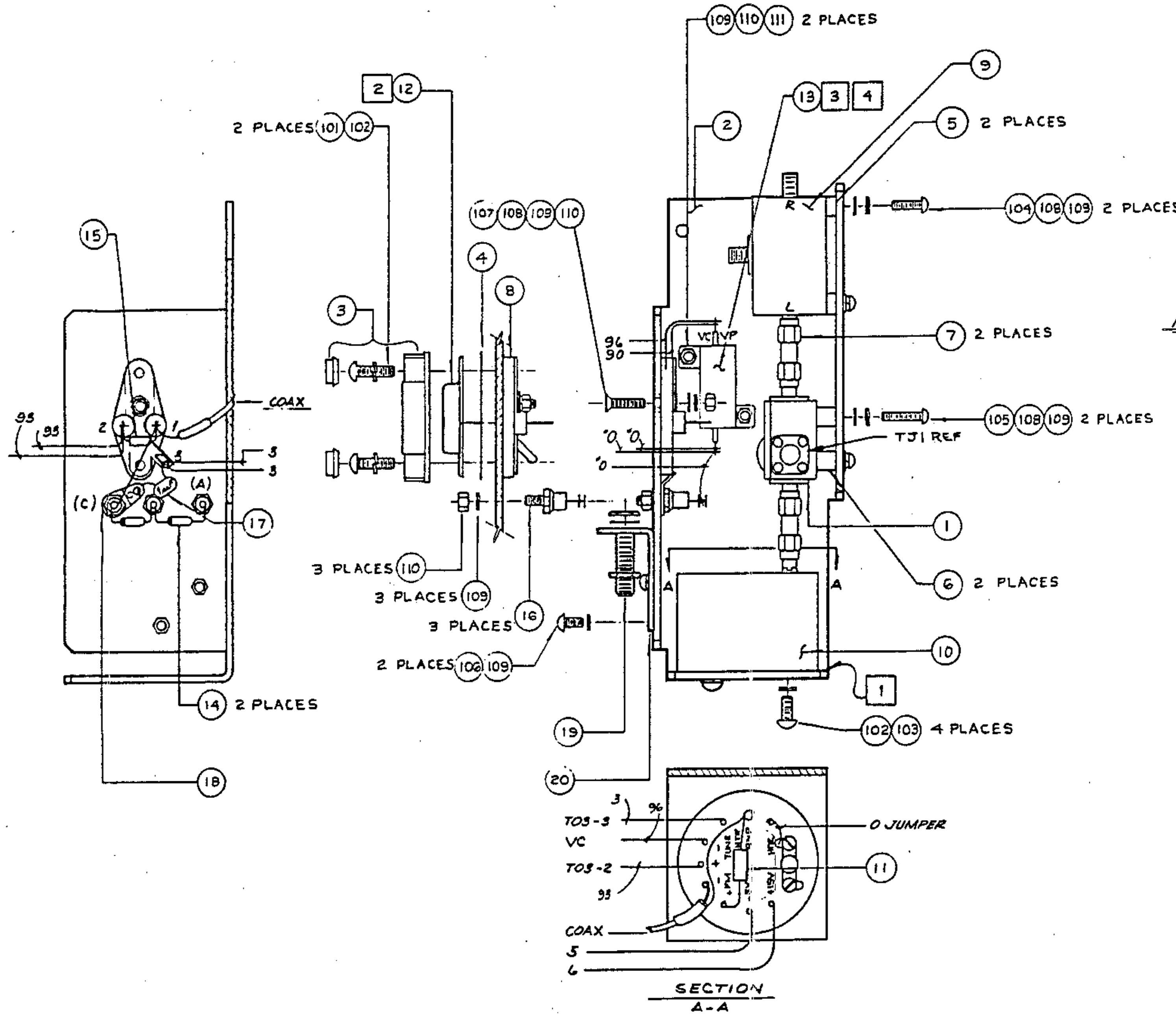
Sheet 1 of 1



NOTE:

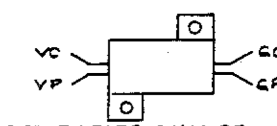
1. SEE SEPARATE PARTS LIST 101DA17000.

Rear Panel
ASSY# 101DA17000 Rev C
Sheet 1 of 1

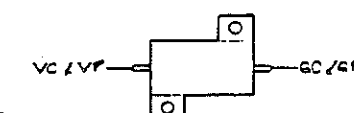


NOTES:

1. APPLY THERMAL COMPOUND TO AREAS SHOWN.
2. INSTALL TO3 SOCKET BEFORE INSTALLING 2N5881 REG.

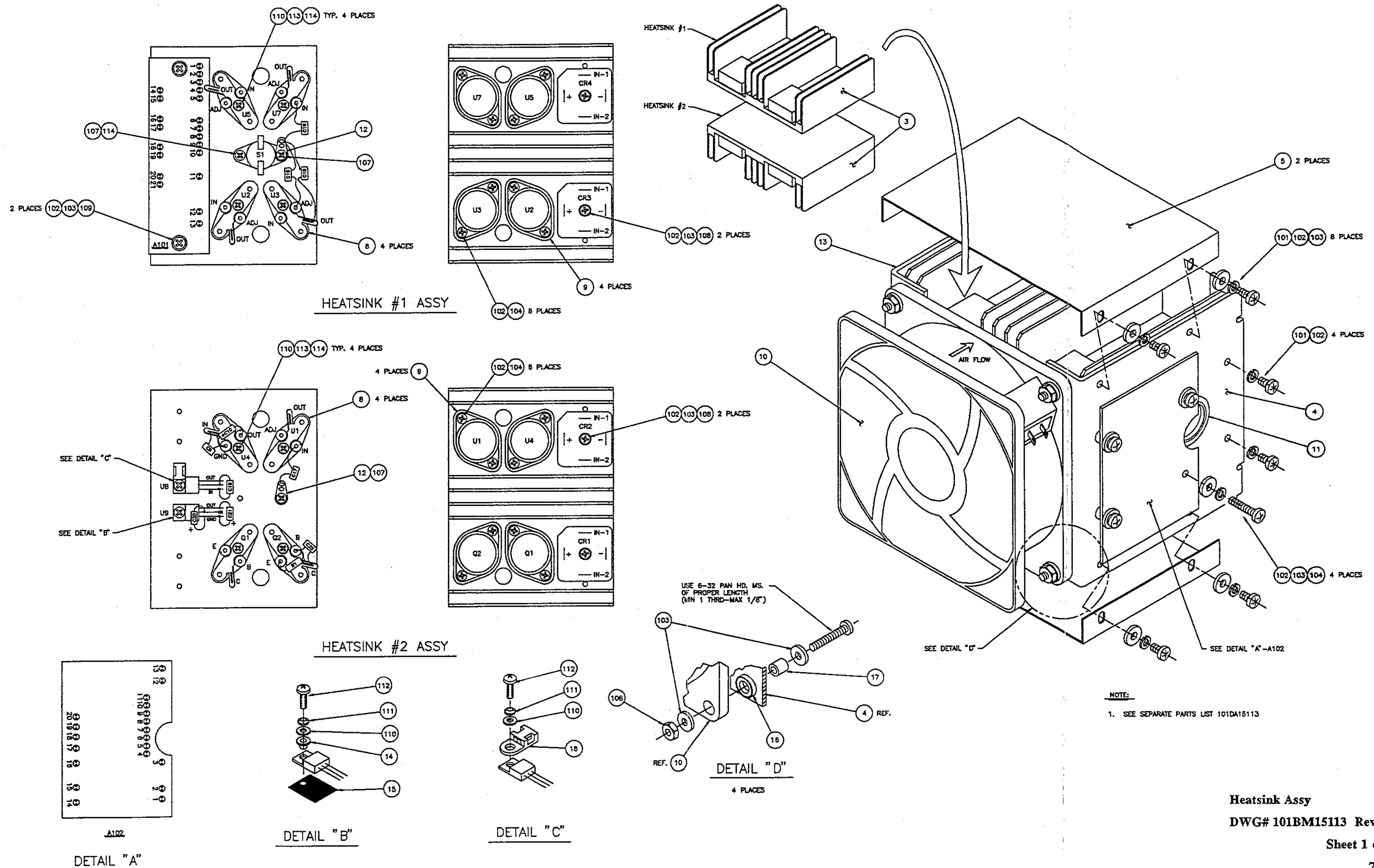


3. RESISTOR LEADS SHALL BE REFERRED TO AS INDICATED ON CORRESPONDING WIRELIST.



4. CONNECT WIRES FOR VC AND VP TO APPROPRIATE LEAD BASED ON WIRELIST.
   CONNECT WIRES FOR GC AND GP TO APPROPRIATE LEAD BASED ON WIRELIST.
5. SEE SEPARATE PARTS LIST 101CA15203

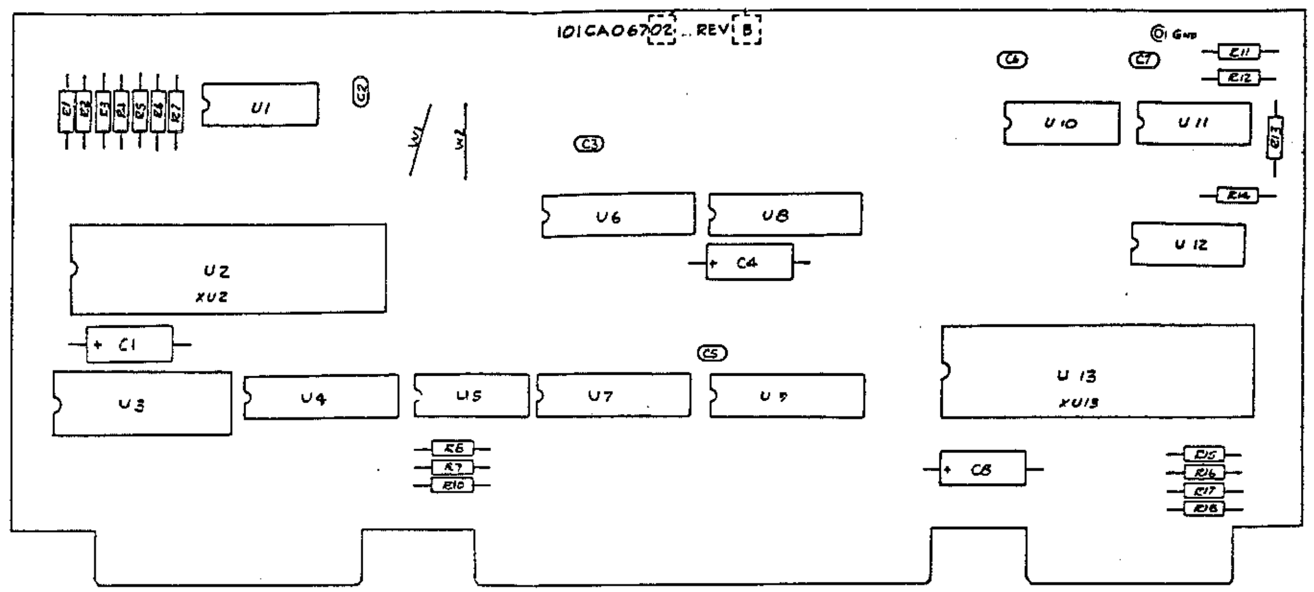
Reference Oscillator Assy
ASSY# 101CA15203 Rev C
Sheet 1 of 1



Heatsink Assy

DWG# 101BM15113 Rev A

Sheet 1 of 1



IEEE PIA (A1)

DWG# 101BM06702 Rev B

Sheet 1 of 2

IEEE-488 INTERFACE -- PC ASSY A1

GENERAL

This portion of the system computer provides communication between the microprocessor and any external controller using the IEEE-488 general purpose interface bus (GPIB). The circuit board also houses a peripheral interface adapter (PIA) which is used for a variety of instrument control functions.

COMPUTER BUS

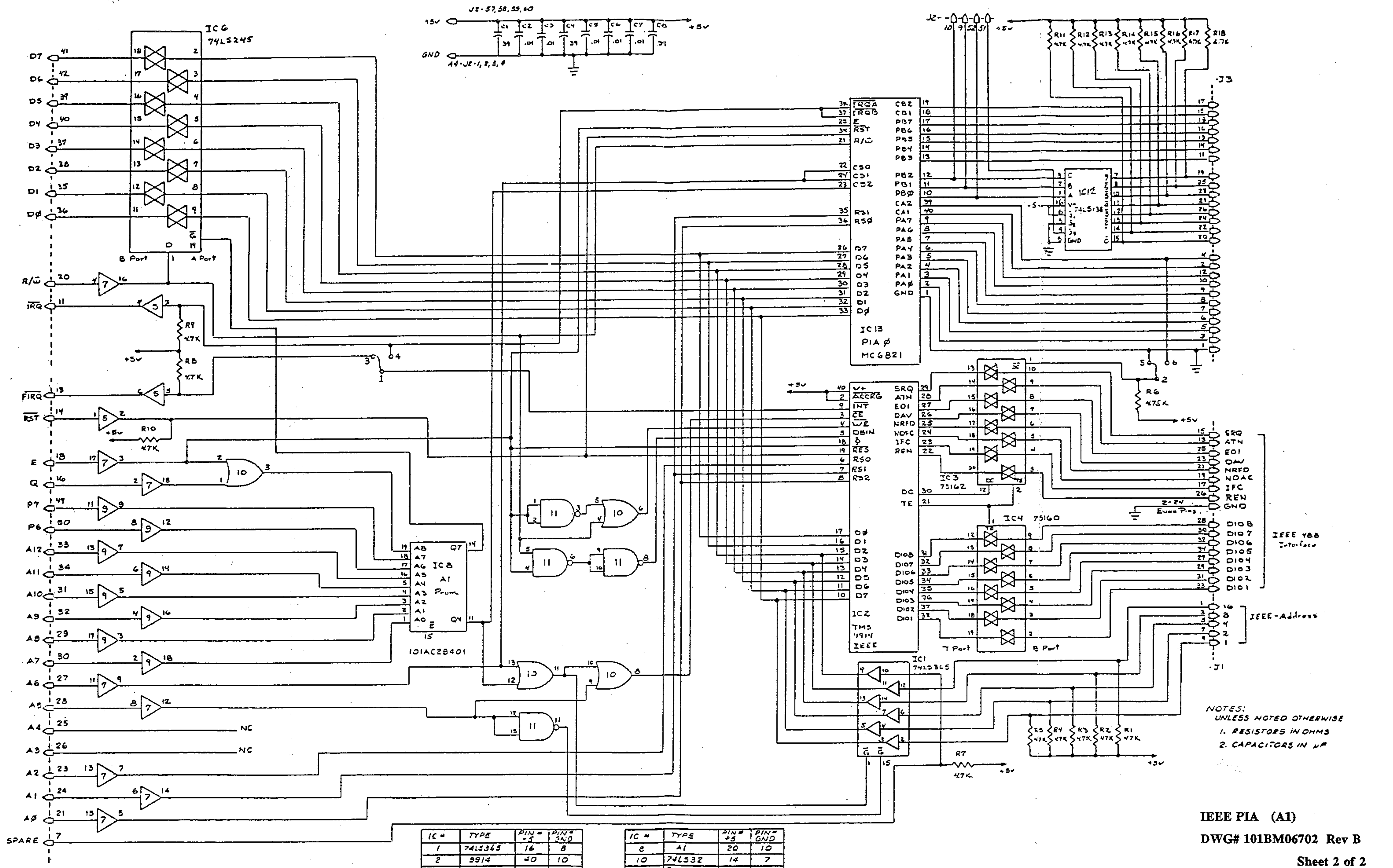
A bidirectional buffer (IC6) is used to interconnect the computer's 8-bit data bus with the PIA and GPIB devices. The computer's address bus and some control lines are buffered by IC5, IC7 and IC9, and are decoded by a high speed bipolar PROM, IC8, and by additional logic gates. The outputs of the decoder PROM are used to drive chip select lines on the PIA and GPIB devices and also to drive the data direction gate of the buffer (IC6).

IEEE-488 INTERFACE

The GPIB adapter (IC2) facilitates communication between the IEEE-488 interface bus and the system computer's data bus. It processes the general "interface" messages received from the controller, and transmits device-dependent messages (such as commands addressed specifically to this instrument) to the computer. The computer interprets these messages, using a vocabulary stored in ROM, and responds appropriately; the GPIB adapter transmits the computer's outgoing messages to the bus. The data and control lines between the GPIB adapter and the 24-pin connector on the rear panel are buffered by IC3 and IC4. The device address inputs from the IEEE Adress PC board (A111) are buffered by IC1.

PERIPHERAL INTERFACE ADAPTER

The PIA (IC13) is a programmable port through which information is transmitted between the computer's data bus and other devices. Three of its outputs are decoded by IC12 into eight control lines. The PIA is used for various instrument control functions, including the programming of digital to analog converters.



NOTES:
UNLESS NOTED OTHERWISE
1. RESISTORS IN OHMS
2. CAPACITORS IN μF

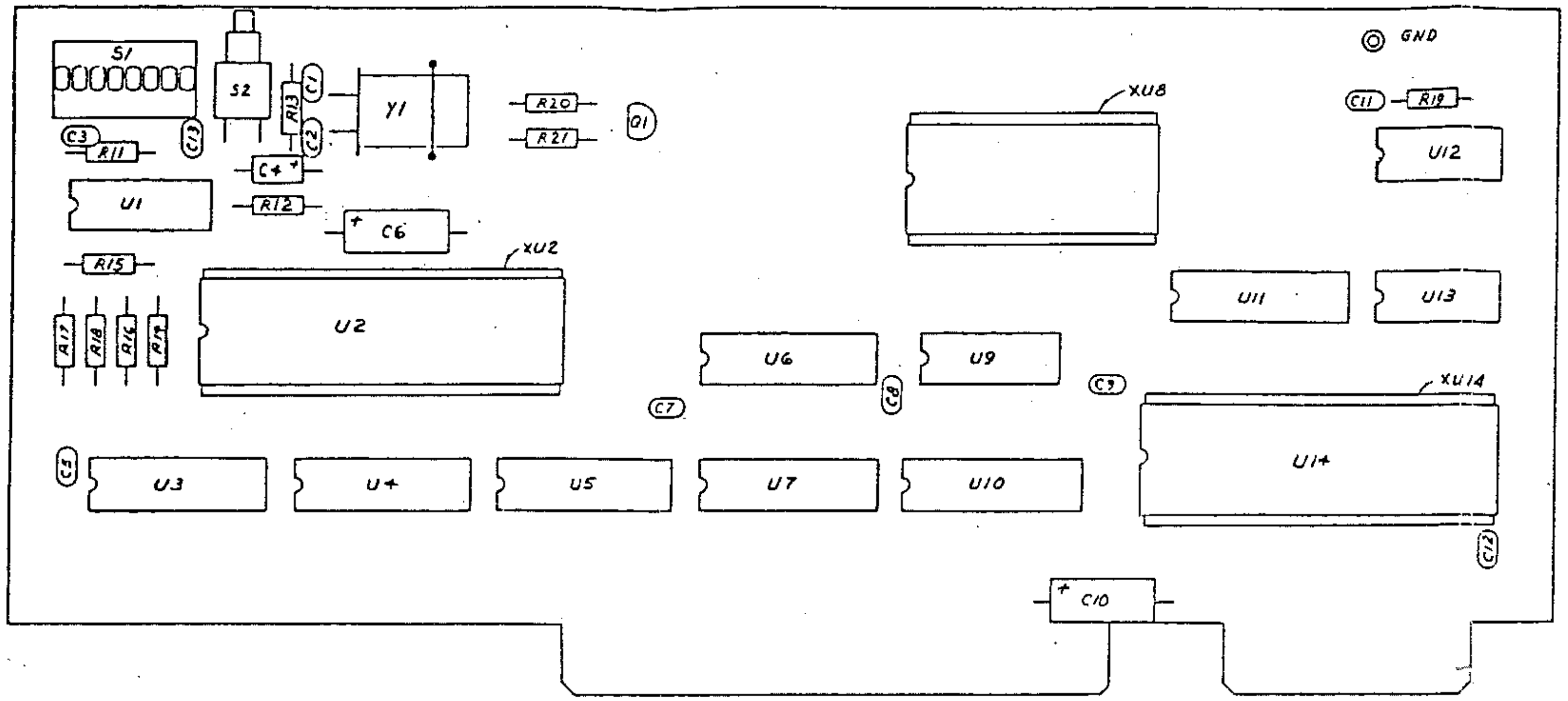
IC #	TYPE	PIN # +5	PIN # GND
1	74LS365	16	8
2	9914	40	10
3	75162	11	1
4	75160	20	10
5	74LS17	14	7
6	74LS245	20	10
7, 9	74244	20	10

IC #	TYPE	PIN # +5	PIN # GND
8	A1	20	10
10	74LS32	14	7
11	74LS00N	14	7
12	74LS138	16	8
13	MC6821	20	1

IEEE PIA (A1)

DWG# 101BM06702 Rev B

Sheet 2 of 2



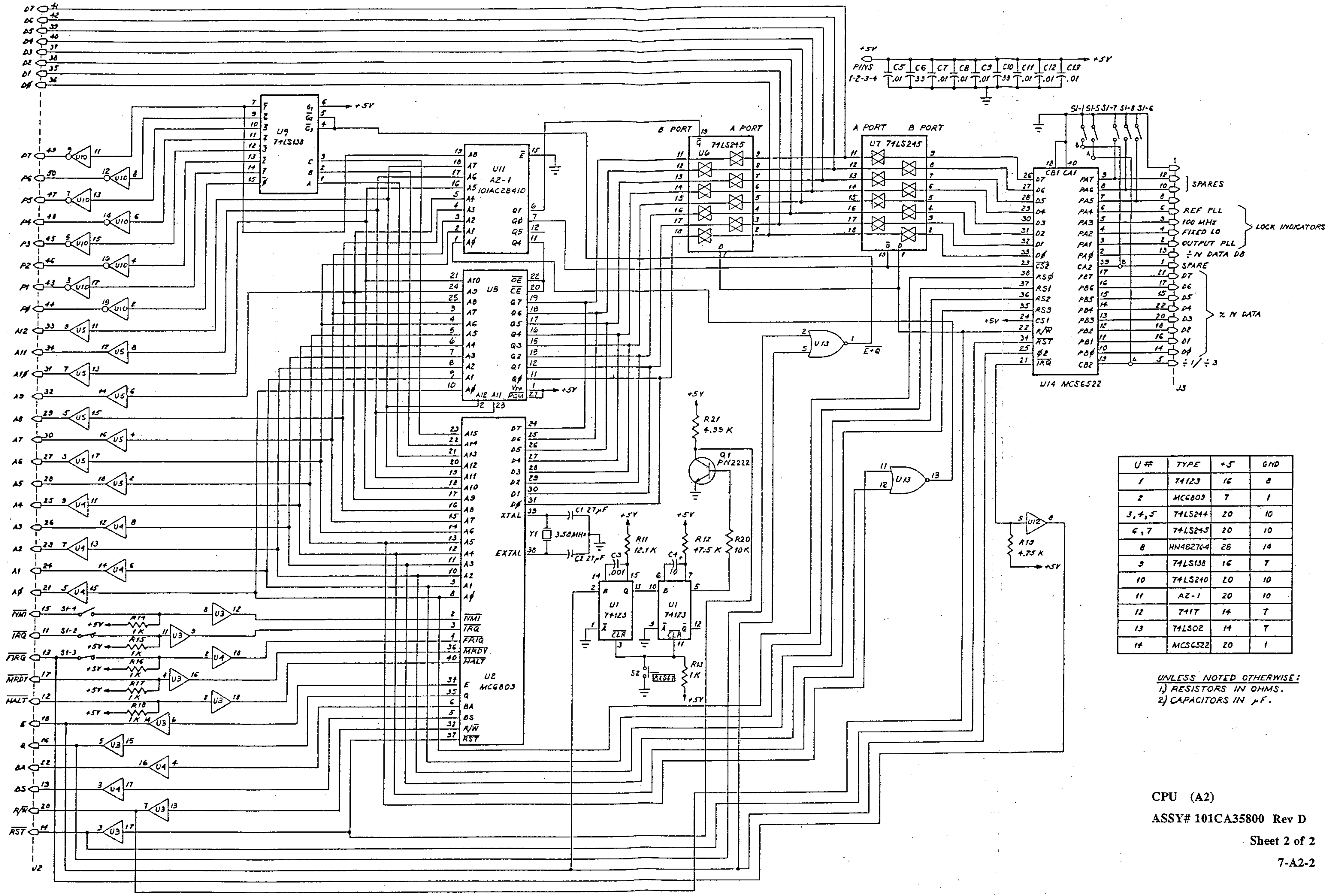
CPU -- PC ASSY A2

This portion of the computer houses the central processing unit, which is in the form of an MC6809 microprocessor (U2). Also present on the board are buffers, initialization memory and an input/output device.

The microprocessor has an 8-bit data bus and a 16-bit address bus; it has an internal clock oscillator regulated (at 3.579 MHz) by crystal Y1. The clock frequency was chosen to avoid the generation of beat frequencies between its harmonics and the various reference signals produced within the synthesizer (most of the latter are multiples of 1 MHz). Multivibrator U1 furnishes a reset "low" pulse to the microprocessor upon power-up or whenever S2 is pressed.

U8, a PROM having a capacity of 8K bytes, represents the instrument's initialization memory; it includes level characterization data and other information unique to the individual instrument in which it is installed. Output buffers U3, U4, U5, and U10 interconnect the microprocessor's address bus and control lines with the computer bus. Address decoding is aided by the 3-to-8 line decoder, U9, which converts the three high-order address lines to eight page-lines. The computer uses these page-lines to select peripheral devices on other circuit boards. Within this circuit board, device address decoding is performed by U11, a high speed bipolar PROM, whose decoded outputs drive the chip select lines and data direction select lines of the board's other IC's. The microprocessor's data bus is connected to the computer bus, and to input/output device U14, via bi-directional gates U6 and U7.

U14 is a programmable input/output device through which information is transmitted between the microprocessor data bus and other circuits. It is used for a number of instrument control and monitoring functions, such as programming the 10 dB step attenuator and polling the various PLL "lock" indicators.



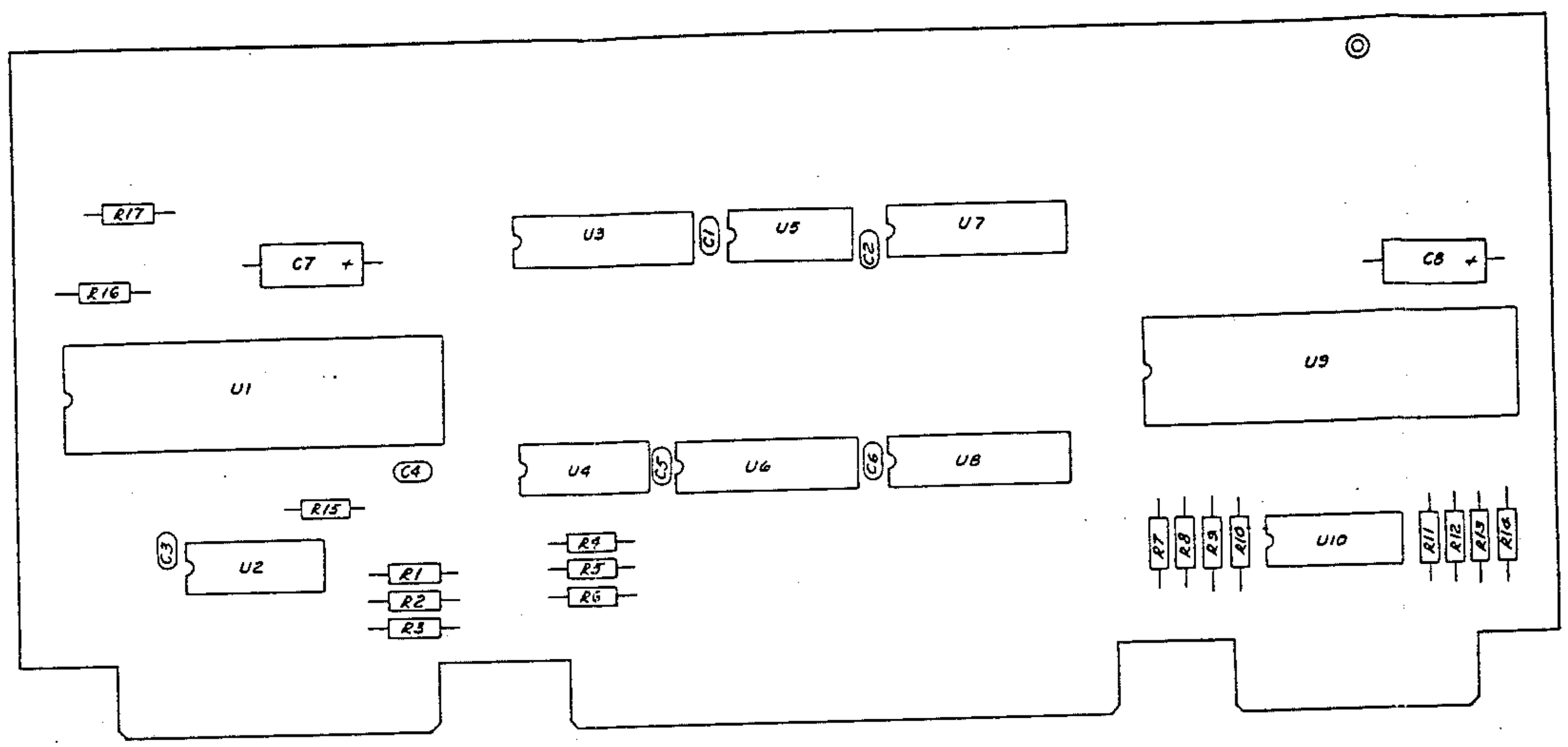
U #	TYPE	+5	GND
1	74123	16	8
2	MC6809	7	1
3, 4, 5	74LS244	20	10
6, 7	74LS245	20	10
8	HN482764	28	14
9	74LS138	16	7
10	74LS240	20	10
11	A2-1	20	10
12	741T	14	7
13	74LS02	14	7
14	MCS6522	20	1

UNLESS NOTED OTHERWISE:
1) RESISTORS IN OHMS.
2) CAPACITORS IN μF.

CPU (A2)

ASSY# 101CA35800 Rev D

Sheet 2 of 2



FRONT PANEL PIA -- PC ASSY A3

Among other functions, this circuit acts as an interface between the computer bus and the front panel switches and indicators. Bidirectional buffer IC3 is used to interconnect the data lines of the bus with the two interface adapters, PIA 1 (IC9) and PIA 2 (IC1). The bus address and function lines are buffered by IC4, IC6 and IC8. PROM IC7 is used to decode address information in order to select PIAs and to set the data direction for IC3.

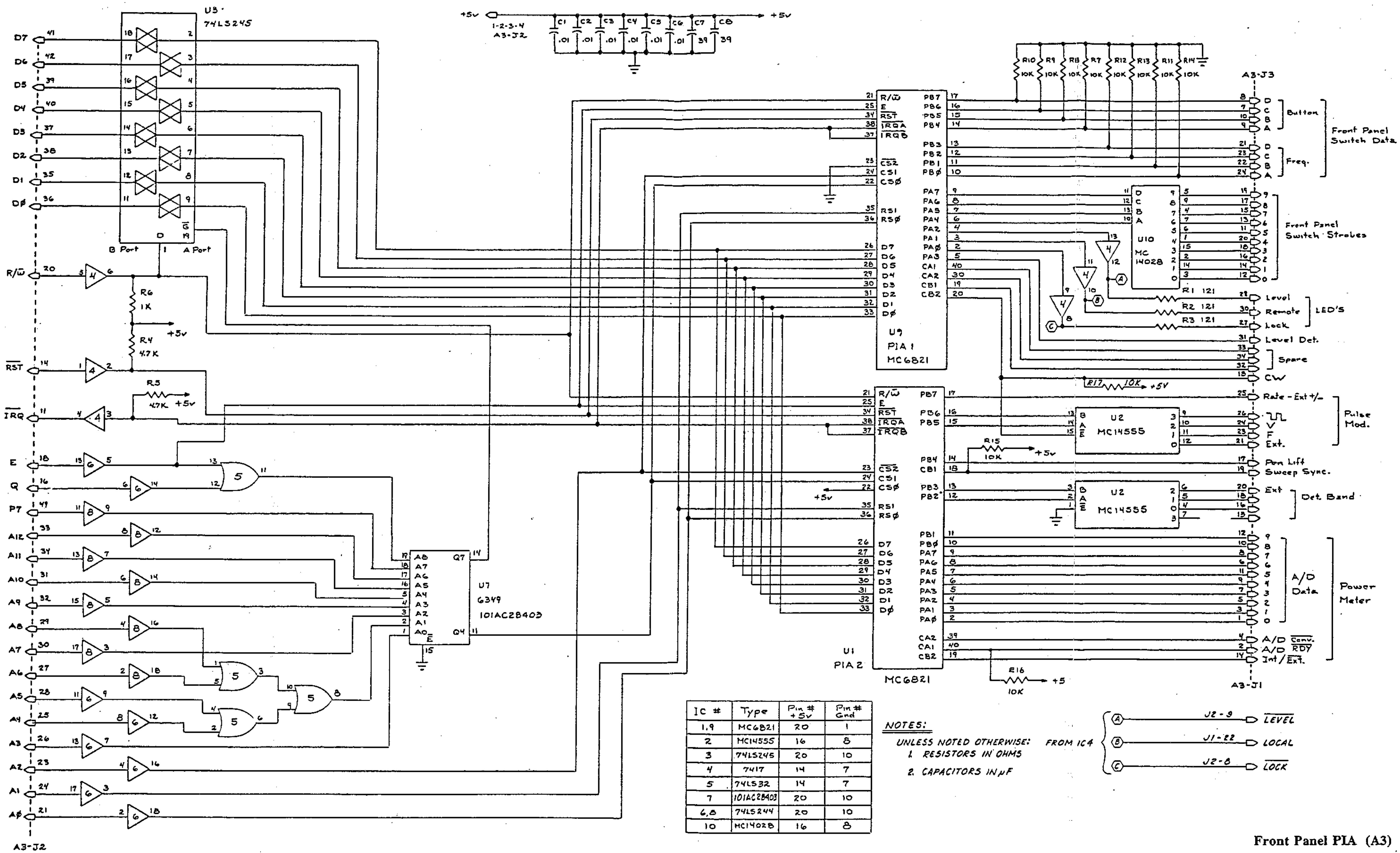
The majority of the I/O lines from PIA 1 (IC9) are used to interrogate the front panel switches. Decoder IC10 allows four output lines from this PIA to provide ten strobe lines for switch polling. The data from the switches is received by IC9 at PB0-PB3 (for the frequency switches) and at PB4-PB7 (for the pushbutton switches). The Lock, Level and Remote indicators are also controlled by this PIA through IC4, via R1, R2, and R3.

PIA 2 (IC1) is used for miscellaneous instrument functions; its main task is to accept A/D data from the power meter (PC board A7).

Front Panel PIA (A3)

ASSY# 101CA07000 Rev E

Sheet 1 of 2



IC #	Type	Pin # +5v	Pin # Gnd
1,9	MC6821	20	1
2	MC14555	16	8
3	74LS245	20	10
4	7417	14	7
5	74LS32	14	7
7	101AC28403	20	10
6,8	74LS244	20	10
10	MC14028	16	8

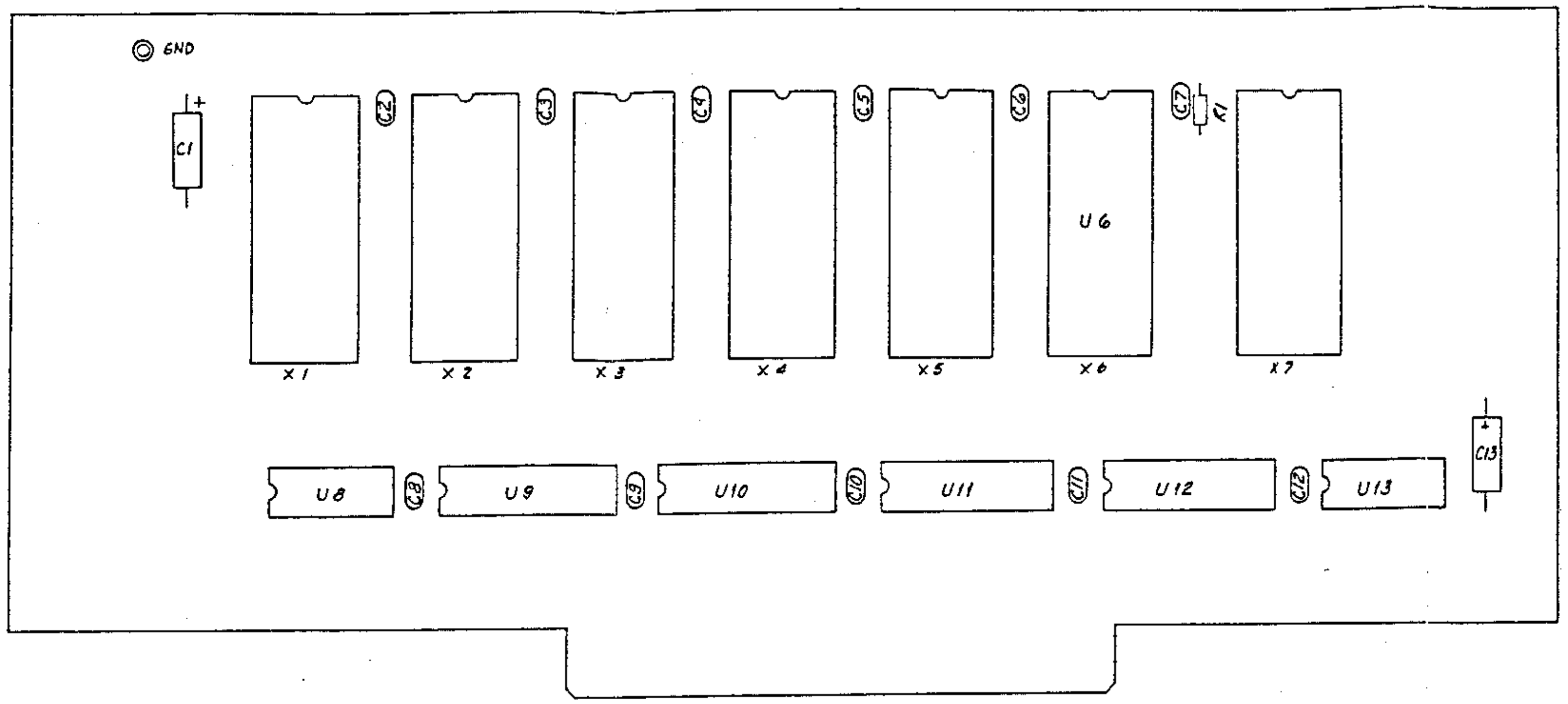
NOTES:

UNLESS NOTED OTHERWISE:
1. *RESISTORS IN OHMS*
2. *CAPACITORS IN μF*

Front Panel PIA (A3)

ASSY# 101CA07000 Rev E

Sheet 2 of 2

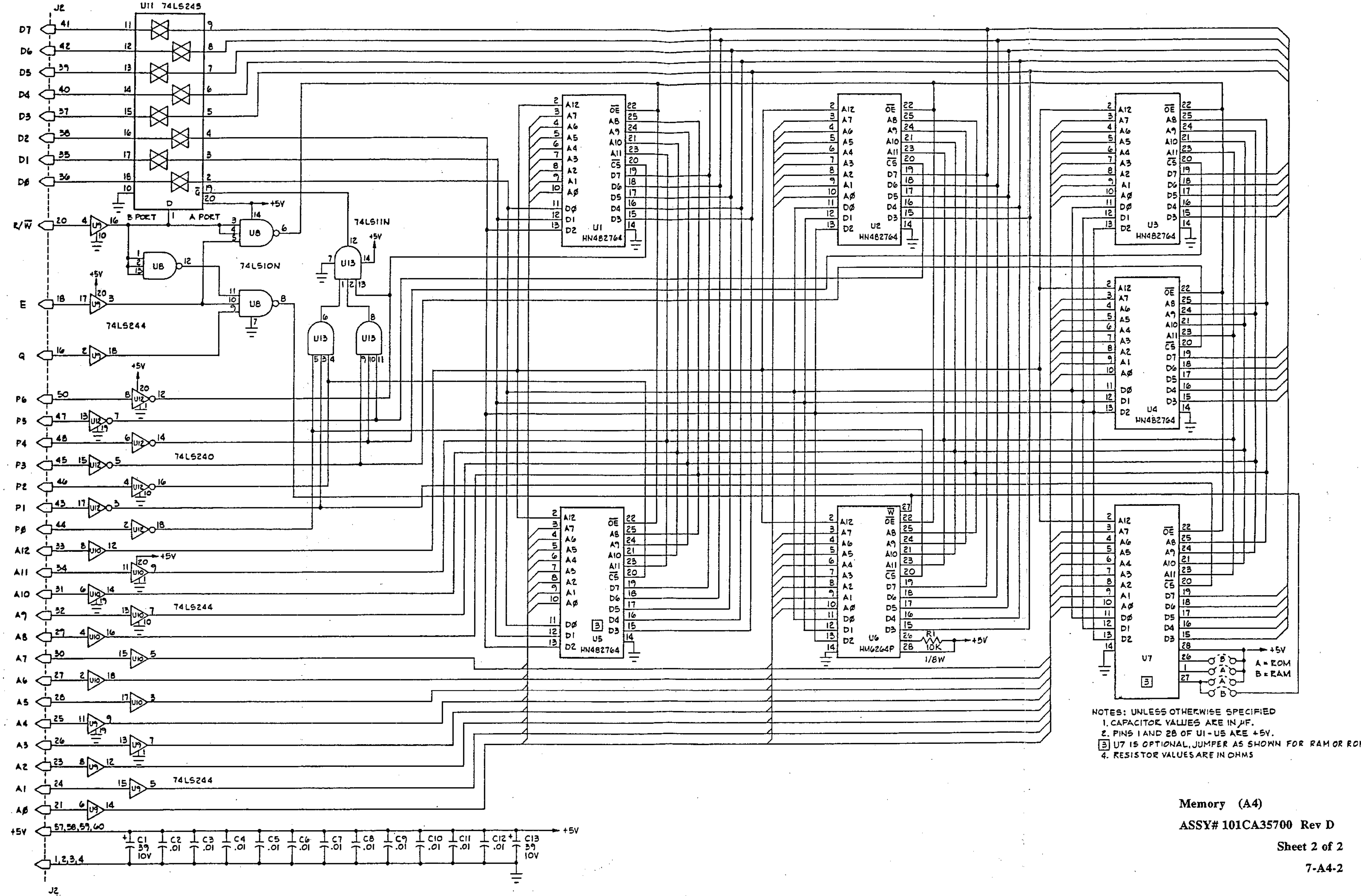


COMPUTER MEMORY -- PC ASSY A4

This circuit board houses up to six programmable read-only memory ICs (U1 through U5, and in some versions U7). The PROMs hold the instrument's operational software. The amount of memory actually used is variable among individual instruments, depending on the frequency range, options, and special modifications implemented. U7 can be a RAM or a PROM, depending on the requirements of a particular instrument configuration. The board also houses a RAM IC (U6) with an 8K capacity. The remaining 8K of the microprocessor's addressing capability is taken up by the "reset" PROM on the CPU board and by input/output ports.

A bi-directional buffer (U11) interconnects the computer's 8-bit data bus with the memory devices. The computer's address bus and some control lines are buffered by U9, U10 and U12. Logic gates U8 and U13 decode some of these inputs in order to derive control signals for the memories and for the bi-directional buffer. The computer uses page lines P0 through P6 to select individual memory chips.

The address and data buses of the memory ICs are all connected in parallel; this is possible because the ICs have tri-state outputs (the outputs enter a high impedance state when the chip is de-selected).

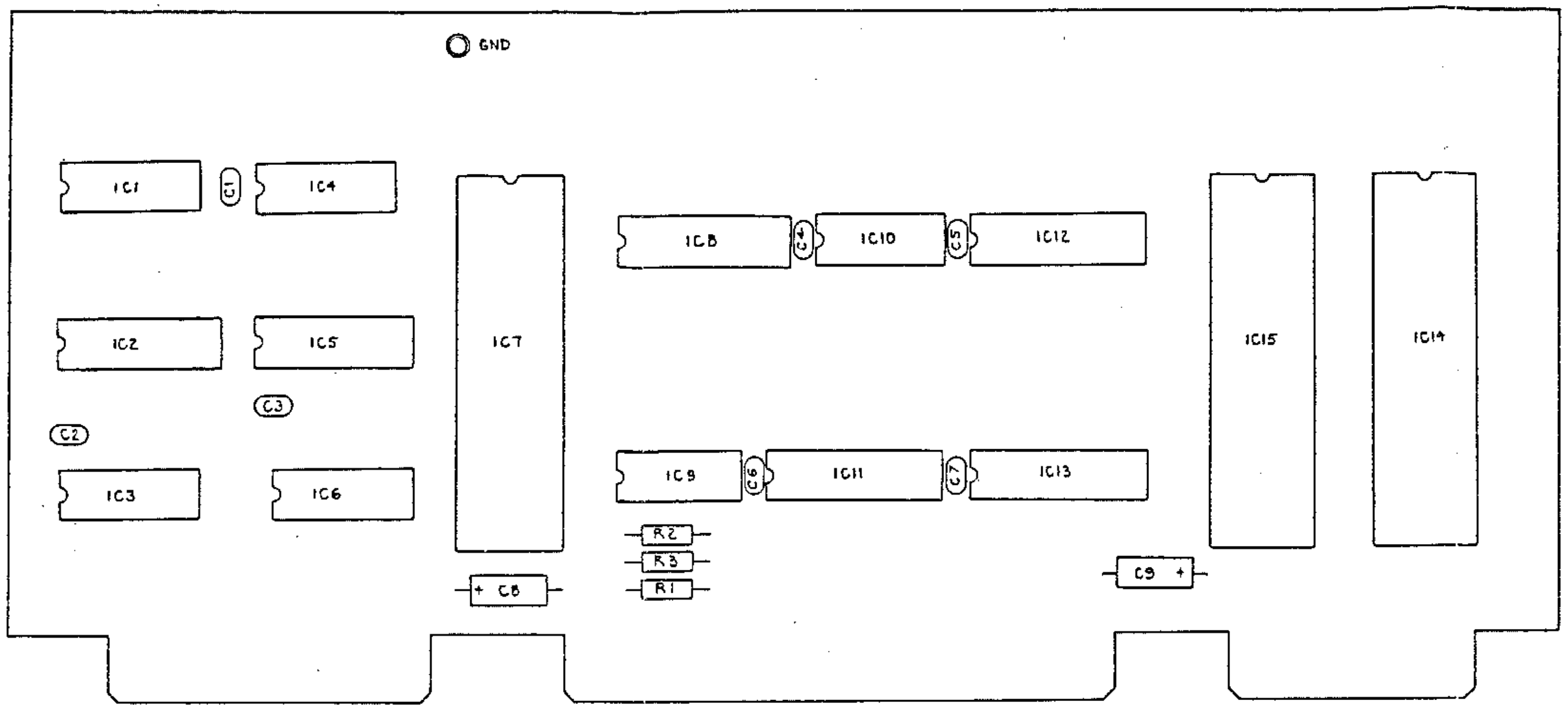


NOTES: UNLESS OTHERWISE SPECIFIED
1. CAPACITOR VALUES ARE IN µF.
2. PINS 1 AND 28 OF U1-U5 ARE +5V.
3 U7 IS OPTIONAL, JUMPER AS SHOWN FOR RAM OR ROM
4. RESISTOR VALUES ARE IN OHMS

Memory (A4)

ASSY# 101CA35700 Rev D

Sheet 2 of 2



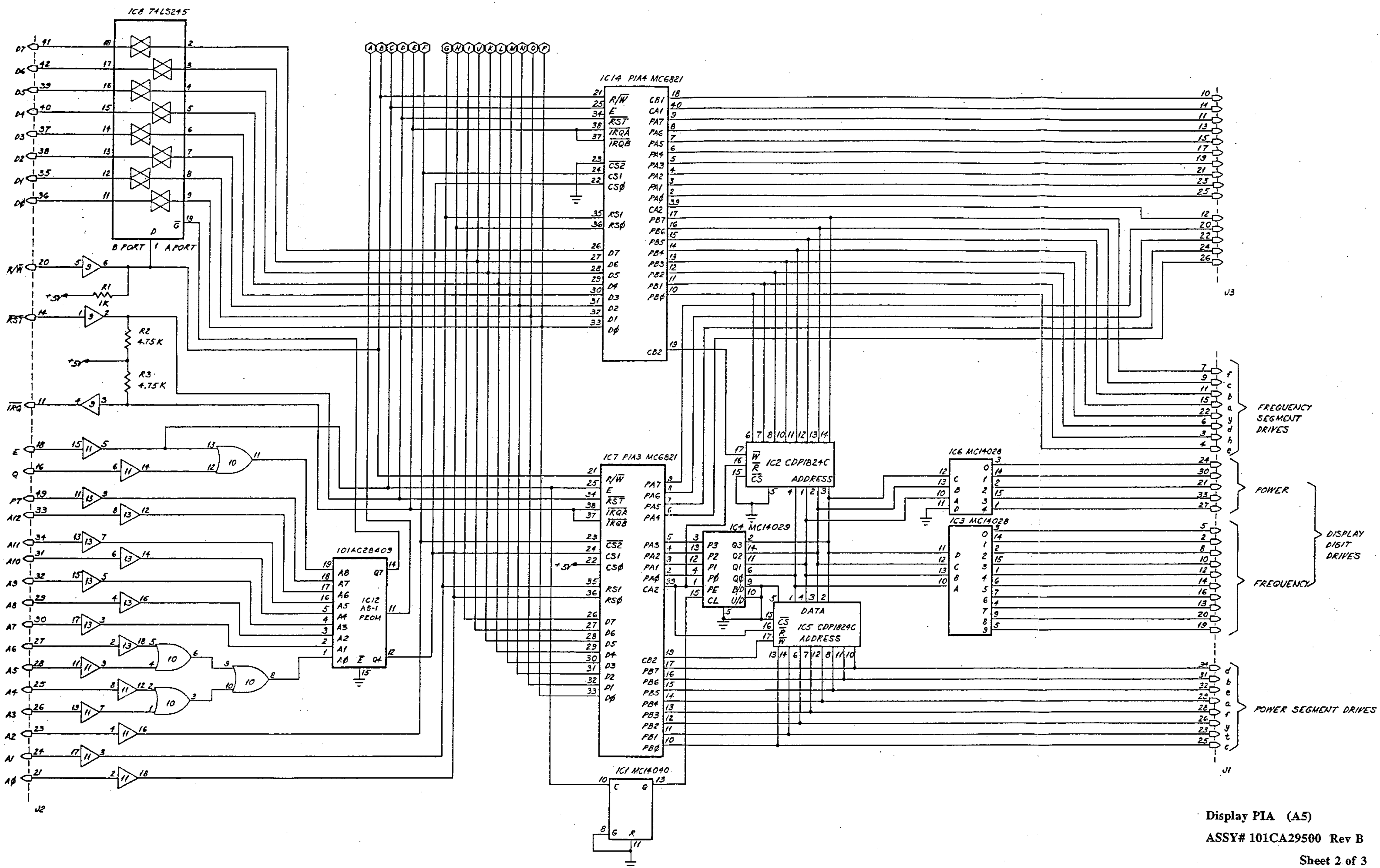
DISPLAY PIA -- PC ASSY A5

This portion of the system computer provides the interface between the microprocessor and the front panel displays. It is also used to implement a variety of control functions.

Three peripheral interface adapters (IC4, IC7, IC15) are included in the circuit. The PIAs act as programmable ports through which information is transmitted between the computer's data bus and other devices. A bidirectional buffer (IC8) is used to interconnect the 8-bit computer data bus with these PIAs. Address and control lines from the microprocessor are buffered by IC9, IC11 and IC13 and decoded by PROM IC12; the decoding scheme results in three control lines which are applied to the chip select lines of the PIAs and to the gate of the bidirectional buffer.

The frequency and level readouts on the front panel are mulitple-digit, seven-segment fluorescent displays which must be refreshed continuously. To free the system computer from this task, an independent refresh circuit is used, in which the display data is stored by the computer in volatile memory and continuously retransmitted to the readouts. PIA IC7 programs the two RAM chips, IC2 and IC5, by using the binary counter, IC4. The counter, when in the preset mode (pin 1 high) acts as a buffer, applying its input data to the address buses of the two RAMs. The data buses and read/write controls of the RAMs are programmed by other outputs of IC7 and of IC4, another PIA. In this way, the two RAMs are filled with display data (IC2 for the level display, IC5 for the frequency display). When the display data has been set up by the computer, the counter is taken out of the preset mode and is clocked by an input from IC1, causing the RAMs to cycle through the segment data compiled for each display digit in sequence. IC6 and IC3 decode the RAM address lines into drive signals to activate the particular display digit appropriate to the segment-data being read. The RAM data lines furnish the segment data directly. Because there are fewer digits in the level readout, the level display is "doubled up" (the least significant address line is ignored and each RAM data entry appears twice) in order to give a more continuous scan.

Other outputs of PIA IC4, and PIA IC15, are used for a variety of control functions in the instrument, such as strobe and data lines for the front panel switches.

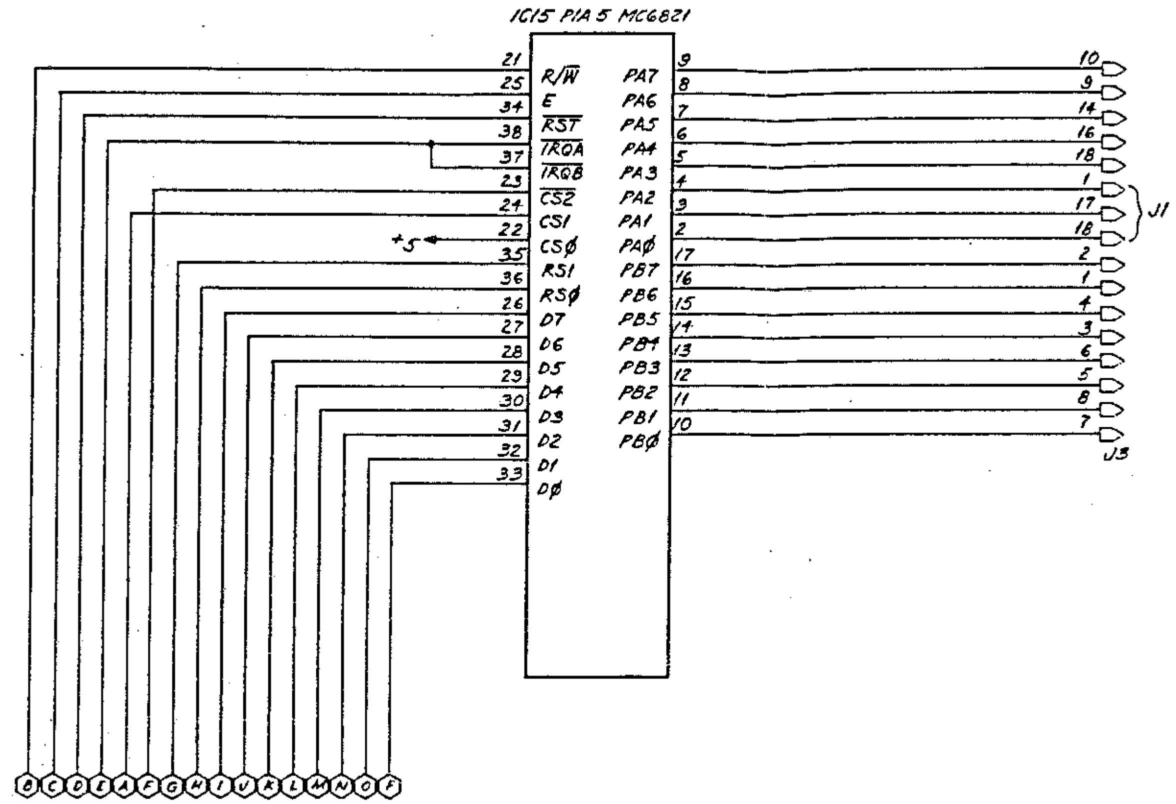


Display PIA (A5)

ASSY# 101CA29500 Rev B

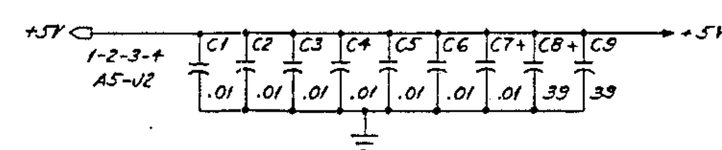
Sheet 2 of 3

7-A5-2

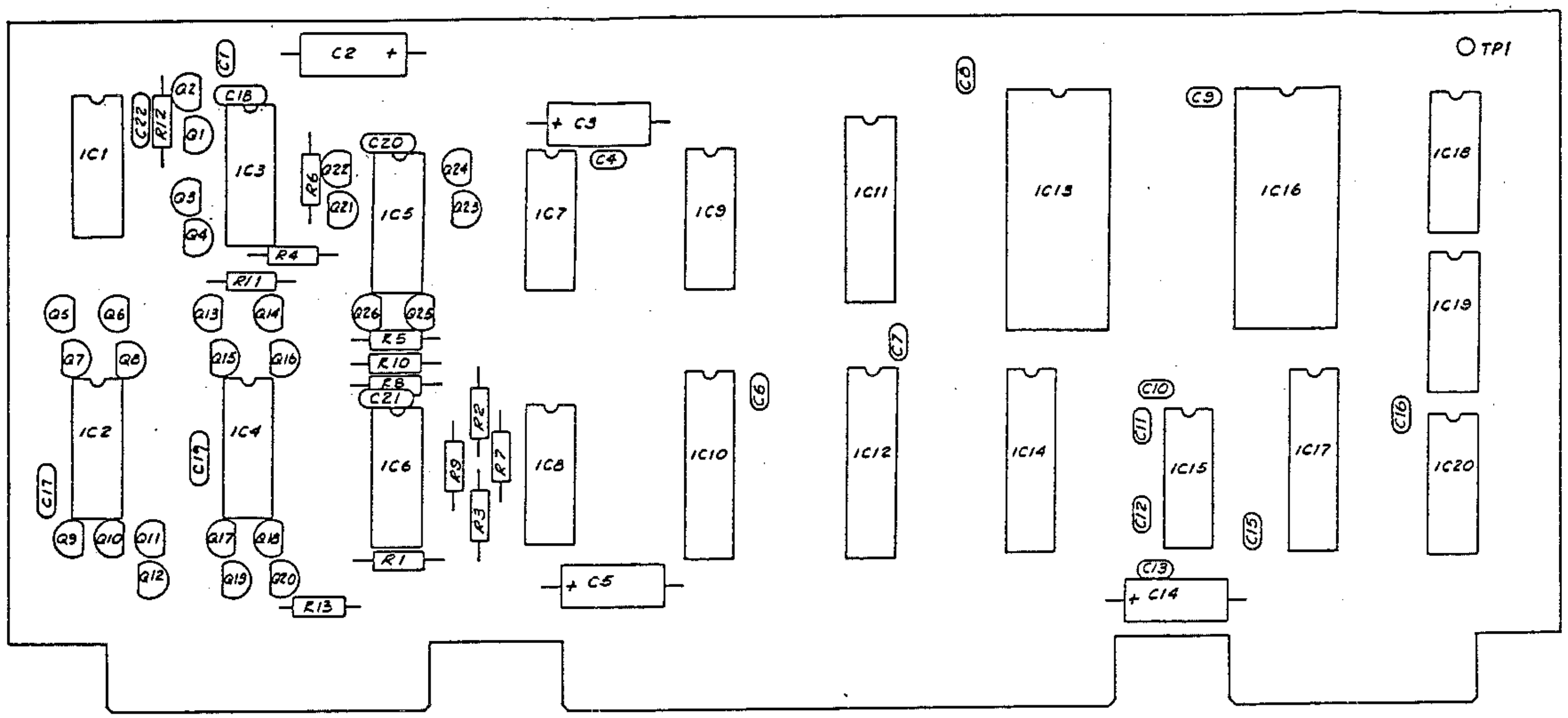


NOTES:
UNLESS NOTED OTHERWISE:
1. RESISTORS IN OHMS
2. CAPACITORS IN μF

IC#	TYPE	+5	GND
1	MC14040	16	8
2,5	CDP1824	18	9
3,6	MC14028	16	8
4	MC14029	16	8
7,14,15	6821	20	1
8	74LS245	20	10
9	7417	14	7
10	74LS32	14	7
11,13	74LS244	20	1,10,19
12	A5-1	20	10



Display PIA (A5)
ASSY# 101CA29500 Rev B
Sheet 3 of 3



COUNTER PIA - Circuit Board A6

This circuit interfaces the computer to the frequency counter circuits, including the 32-bit counter ICs, which are housed on the board, and the counter input amplifier and counter logic circuits, which are located elsewhere. The board also contains switch drivers which are used to select filter lines in the downconverter and the RF modules.

The computer address bus is connected to the counter through buffers IC10 and IC12. Address decoding is performed by a 512-byte PROM (IC 11) in combination with gates IC7 and IC9. The devices addressed are the 32-bit binary counters (IC13 and IC16) and the output tri-state buffer, IC14, through which output data from those counters is supplied to the computer data bus. Each counter IC uses an 8-bit input latch, and a series of 8-bit counters clocked by the most significant bit of the input latch, to accumulate its count. The count total, of which the input latch forms the least significant 8 bits, is transferred to the output bus one byte at a time when the chip's SCAN pin is addressed.

IC16 counts the reference frequency data received from the counter logic board (A105). The two lines received from that board are buffered by IC17 and expanded to eight lines by the 4-bit counter IC18 together with the flip flops, IC19. These lines are applied to the counter chip's input latch, with bit 7 (IC19, pin 5) being used to clock the counter series.

IC13 counts the RF data received from the counter logic board. Of the five lines received from that board, two are buffered by IC17, and the remaining three, which are received at ECL levels, are translated to TTL by IC15. These lines are applied to the five most significant bits of the counter chip's input latch, with bit 7 (IC17, pin 9) being used to clock the counter series; the three least significant inputs are grounded.

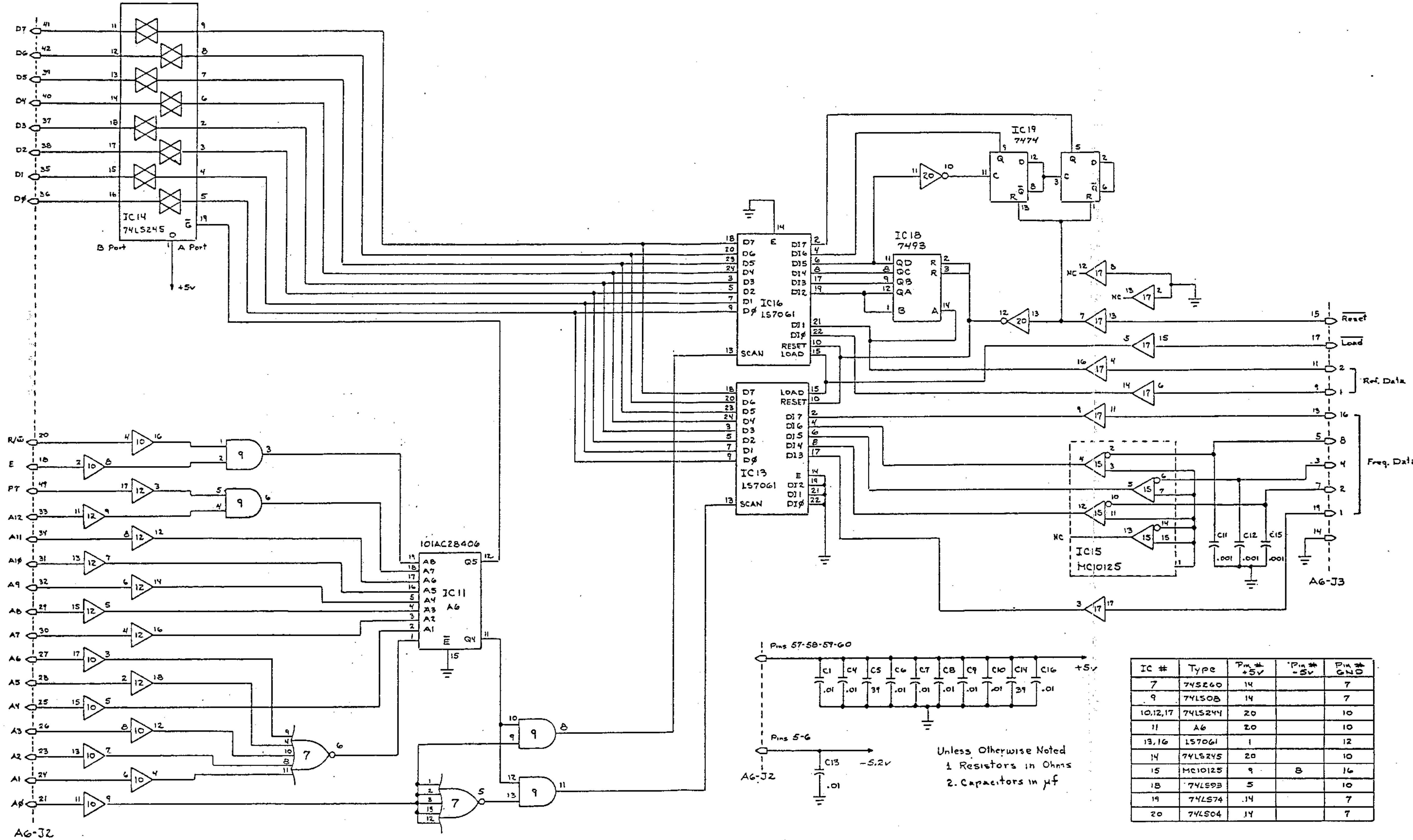
The counting of both ICs is controlled by the LOAD and RESET inputs, which are buffered by IC17. The outputs of the counter ICs are sent to the computer's data bus, one byte at a time, through tri-state bus IC14 when it is enabled and the appropiate counter is scanned.

The switch driver circuits are shown on the second page of the schematic diagram. A four-bit input from the computer is decoded by IC1 into nine driver signals that are used to select the various filter lines of the downconverter. Each of these nine signals is converted to +15/-15 volt levels by an operational amplifier and transistor-pair combination. Various switches in the other RF modules are controlled by drive signals produced on this board, usually by means of an operational amplifier and/or transistor pair. In addition, some functional control lines used throughout the instrument are generated on this board by inversion (see IC20).

Counter PIA (A6)

ASSY# 101CA07200 Rev K

Sheet 1 of 3

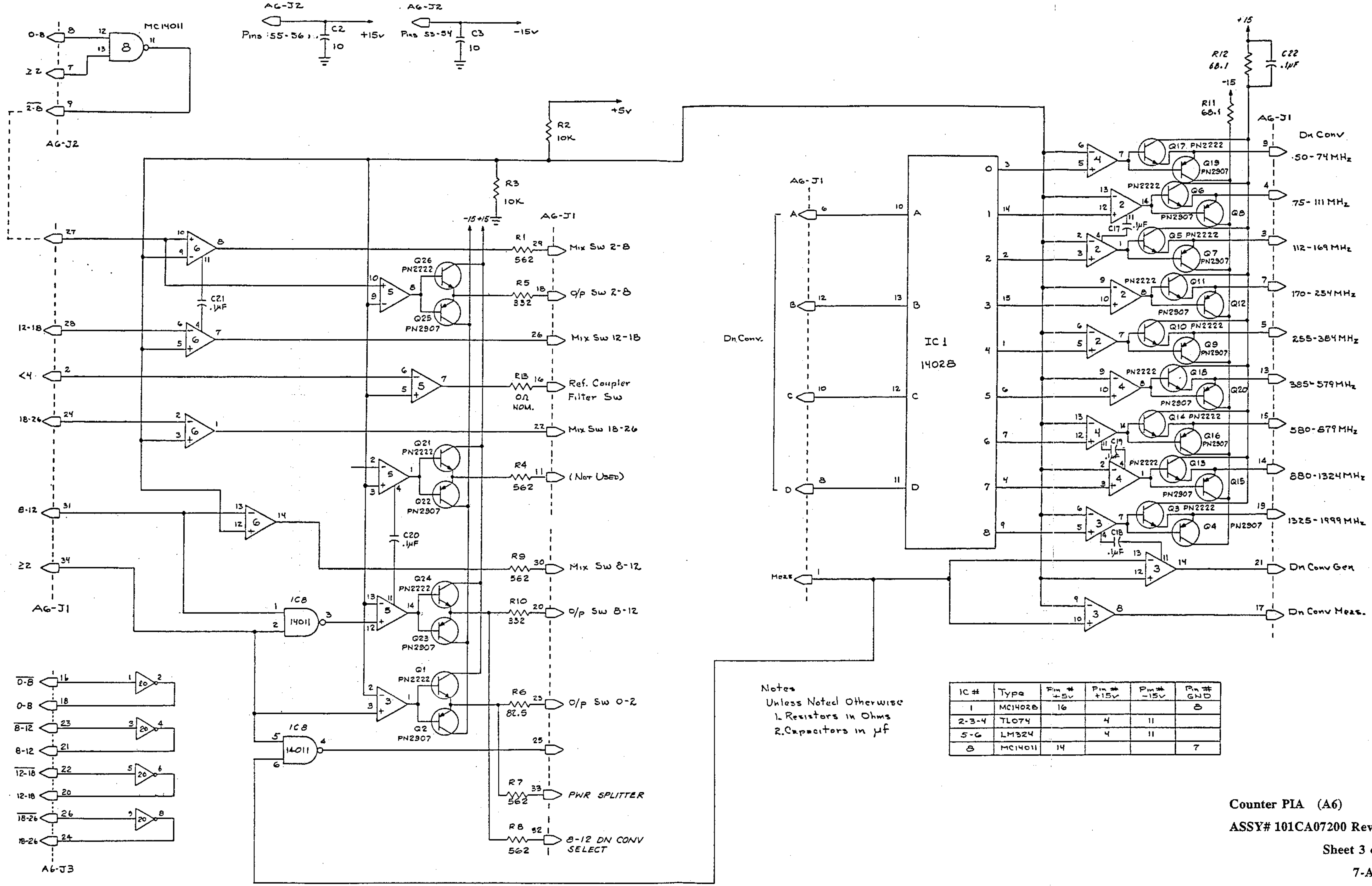


IC #	Type	Pin # +5V	Pin # -5V	Pin # GND
7	74S260	14		7
9	74LS08	14		7
10,12,17	74LS244	20		10
11	A6	20		10
13,16	LS7061	1		12
14	74LS245	20		10
15	MC10125	9	8	16
18	74LS93	5		10
19	74LS74	14		7
20	74LS04	14		7

Counter PIA (A6)

ASSY# 101CA07200 Rev K

Sheet 2 of 3



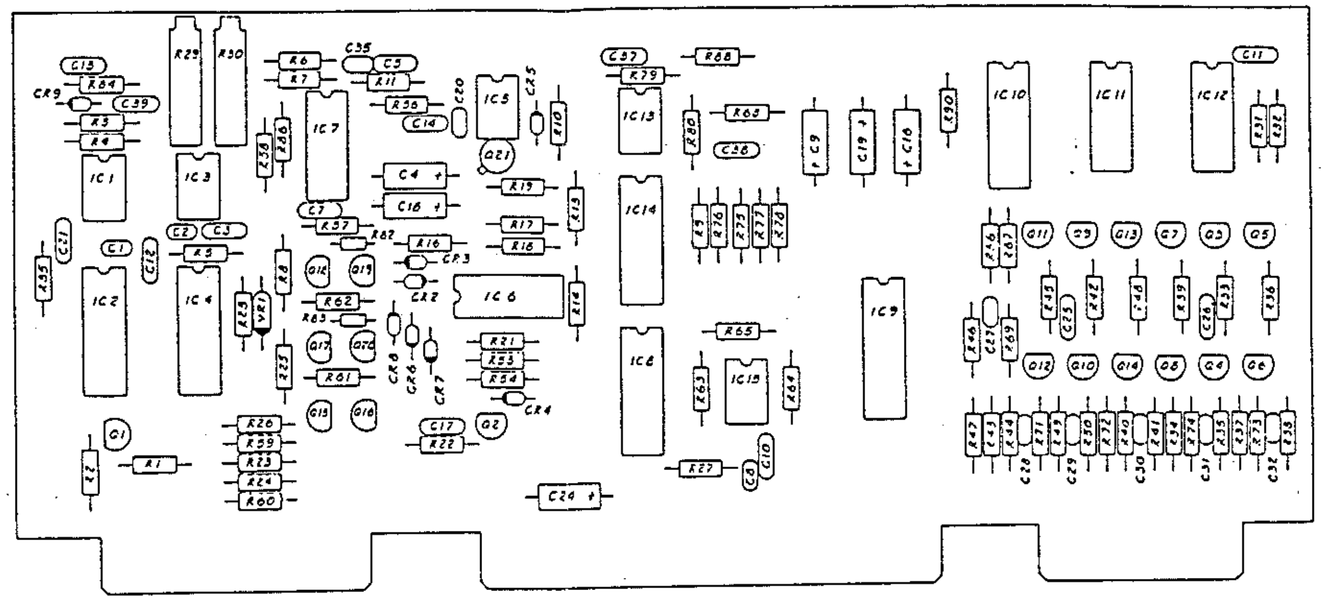
Notes
Unless Noted Otherwise
1. Resistors in Ohms
2. Capacitors in µf

IC #	Type	Pin # +5v	Pin # +15v	Pin # −15v	Pin # GND
1	MC14028	16			8
2-3-4	TL074		4	11	
5-6	LM324		4	11	
8	MC14011	14			7

Counter PIA (A6)

ASSY# 101CA07200 Rev K

Sheet 3 of 3



AM Level Control (A7)

ASSY# 101CA26205 Rev C

Sheet 1 of 4

LEVEL CONTROL -- PC ASSY A7

This circuit board performs a number of functions related to amplitude control, frequency sweeping and pulse modulation.

AMPLITUDE CONTROL

Digital to analog converter IC4 is used by the computer to generate the level reference. The analog reference output is applied to IC5-2, the summing junction of the Automatic Level Control (ALC) loop amplifier. Other inputs to the amplifier include the log amplified level detector input from the Level Log Amp (A19), the AM input if any and the front panel RF vernier.

The loop amplifier (IC5-1) has multiple feedback paths; these are selected by the computer via IC7 and IC14 in order to set the loop speed appropriately. The loop amplifier also has multiple outputs, selected via IC6, which drive the leveler circuit in the appropriate RF module.

IC6-1 and Q2 are used as an indicator circuit; the output at Q2's collector goes low ('UNLEVELED') when the leveling loop is out of range.

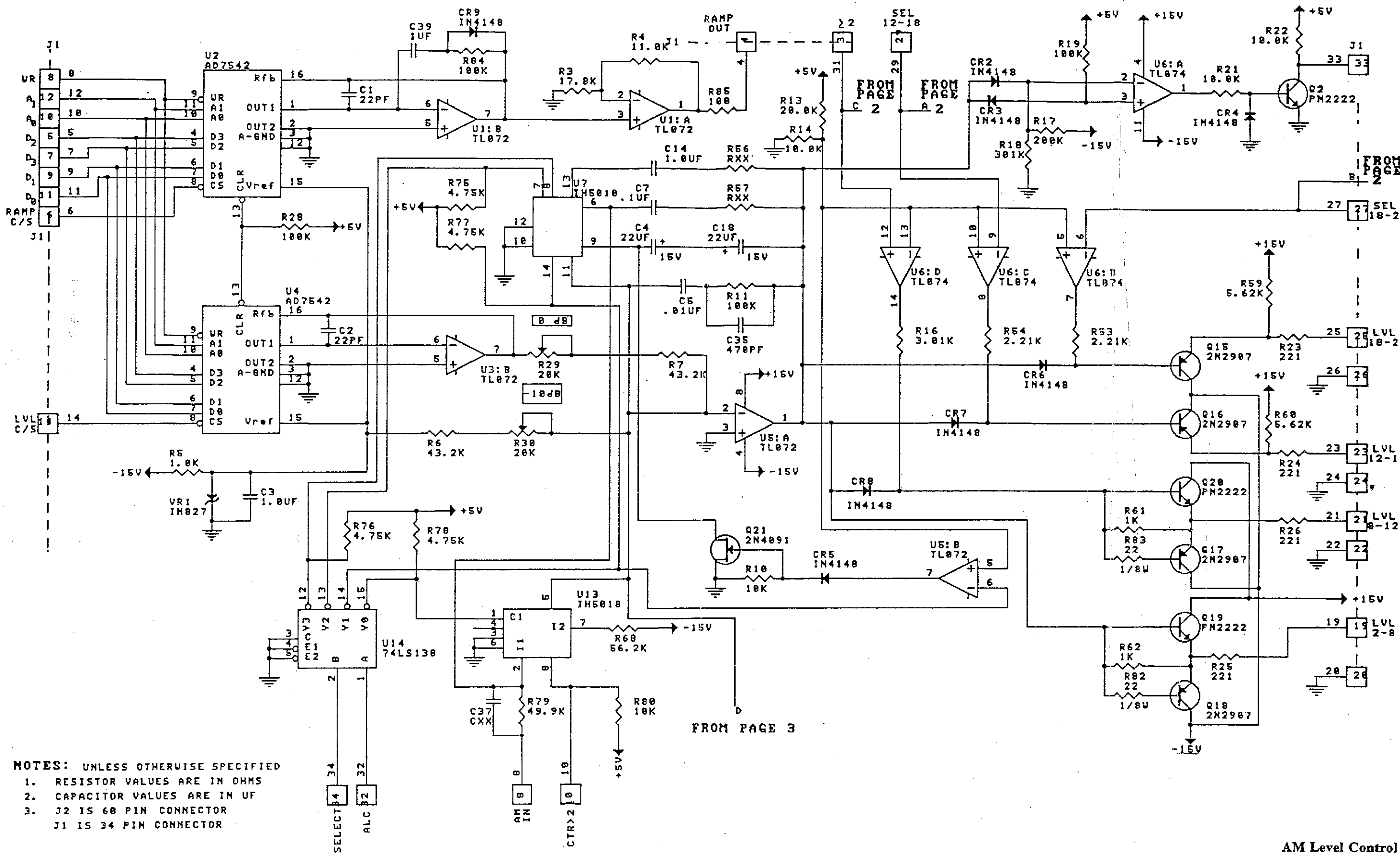
Analog to digital converter IC9 accepts the amplified signal from the power detector and converts it into a digital number for use by the front panel power display.

SWEEP FUNCTIONS

Digital to analog converter IC2 is used by the computer to generate a voltage ramp during a frequency sweep. The DAC is programmed with numbers in sequence corresponding to a 0 volt to +10 volt ramp from start to sweep stop. Transistor Q1 (sheet 2) converts the computer's pen lift command into an output signal compatible with most recorders.

PULSE MODULATION

The driver circuits for all pulse modulators are located on this board. The computer uses IC10, together with six NAND gates, to direct the modulation pulses (received from the A17 PC board) to the appropriate driver.

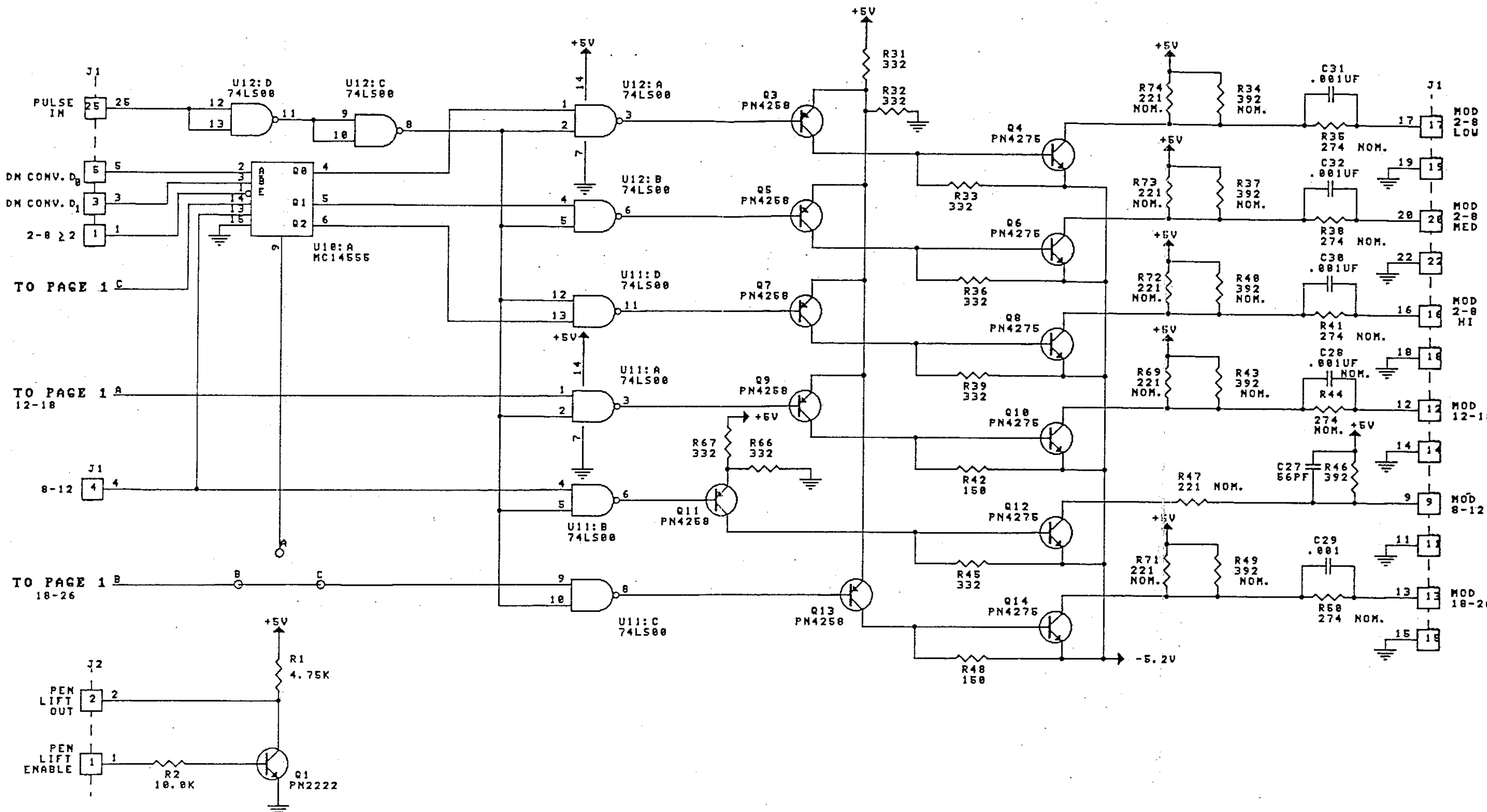


NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTOR VALUES ARE IN OHMS
2. CAPACITOR VALUES ARE IN UF
3. J2 IS 60 PIN CONNECTOR
   J1 IS 34 PIN CONNECTOR

AM Level Control (A7)

ASSY# 101CA26205 Rev C

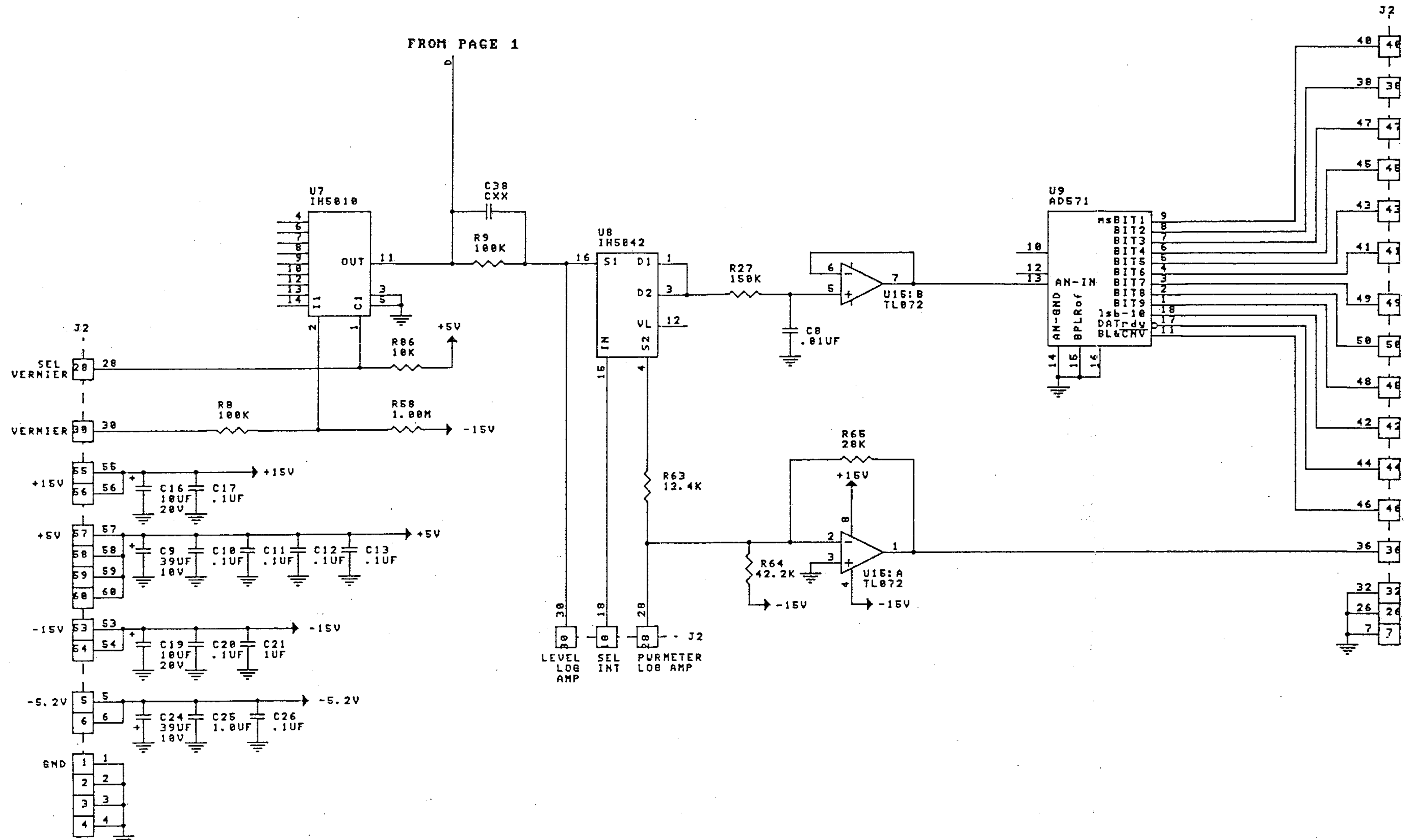
Sheet 2 of 4



AM Level Control (A7)

ASSY# 101CA26205 Rev C

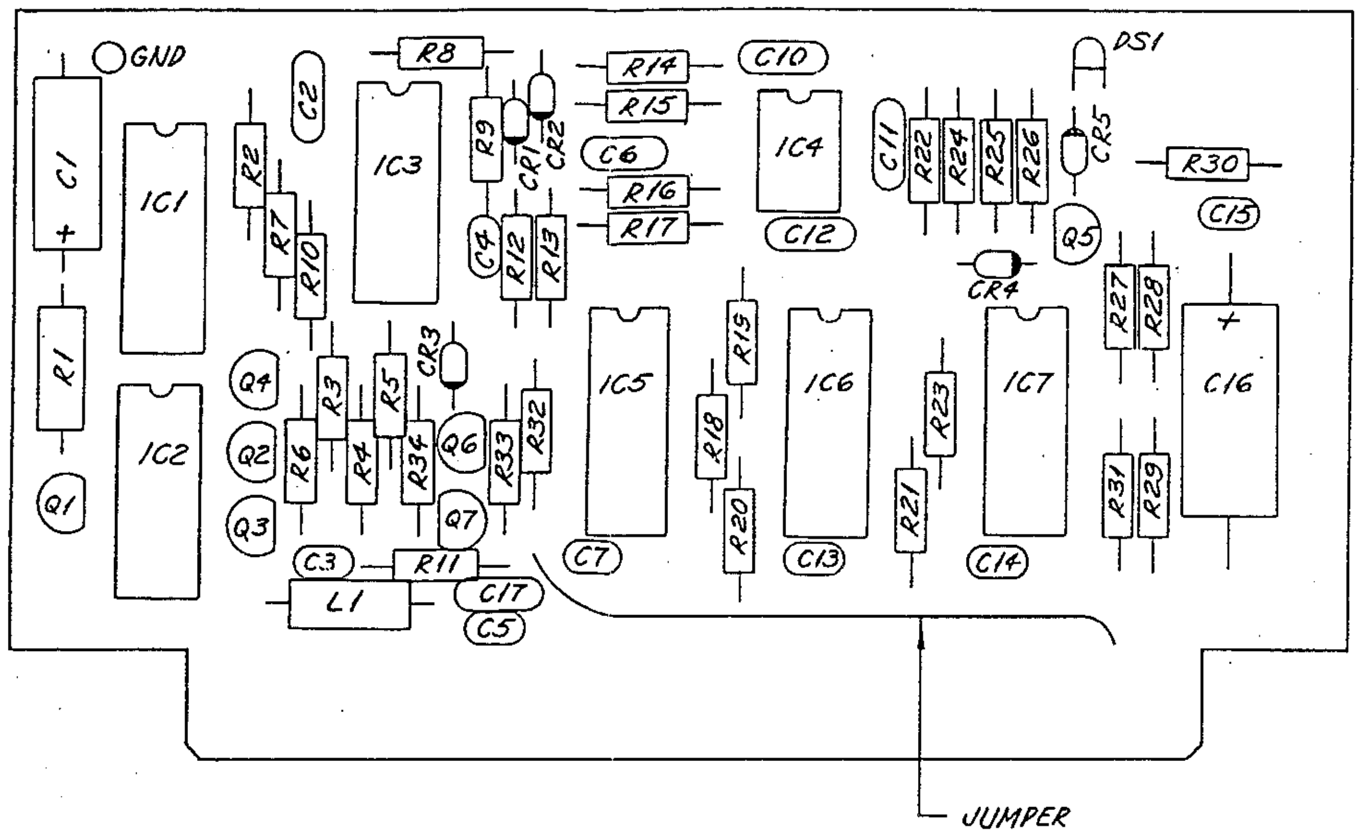
Sheet 3 of 4



AM Level Control (A7)

ASSY# 101CA26205 Rev C

Sheet 4 of 4



100 MHz PHASE LOCK LOOP - PC ASSY A8

This circuit is used to phase lock the 100 MHz oscillator (A103) to the internal 10 MHz timebase or to an external timebase; in addition to the loop output it produces a lock indicator signal and a set of buffered 10 MHz outputs.

The 100 MHz input at pin S is divided down to 10 MHz by the four-stage divider circuit consisting of flip flops IC7 and IC6. This 10 MHz is buffered by IC5 and furnished through pins K, L, N, M and P to the various points in the instrument at which a 10 MHz reference is needed. The signal is also applied directly to the variable input of the phase detector (IC3-9).

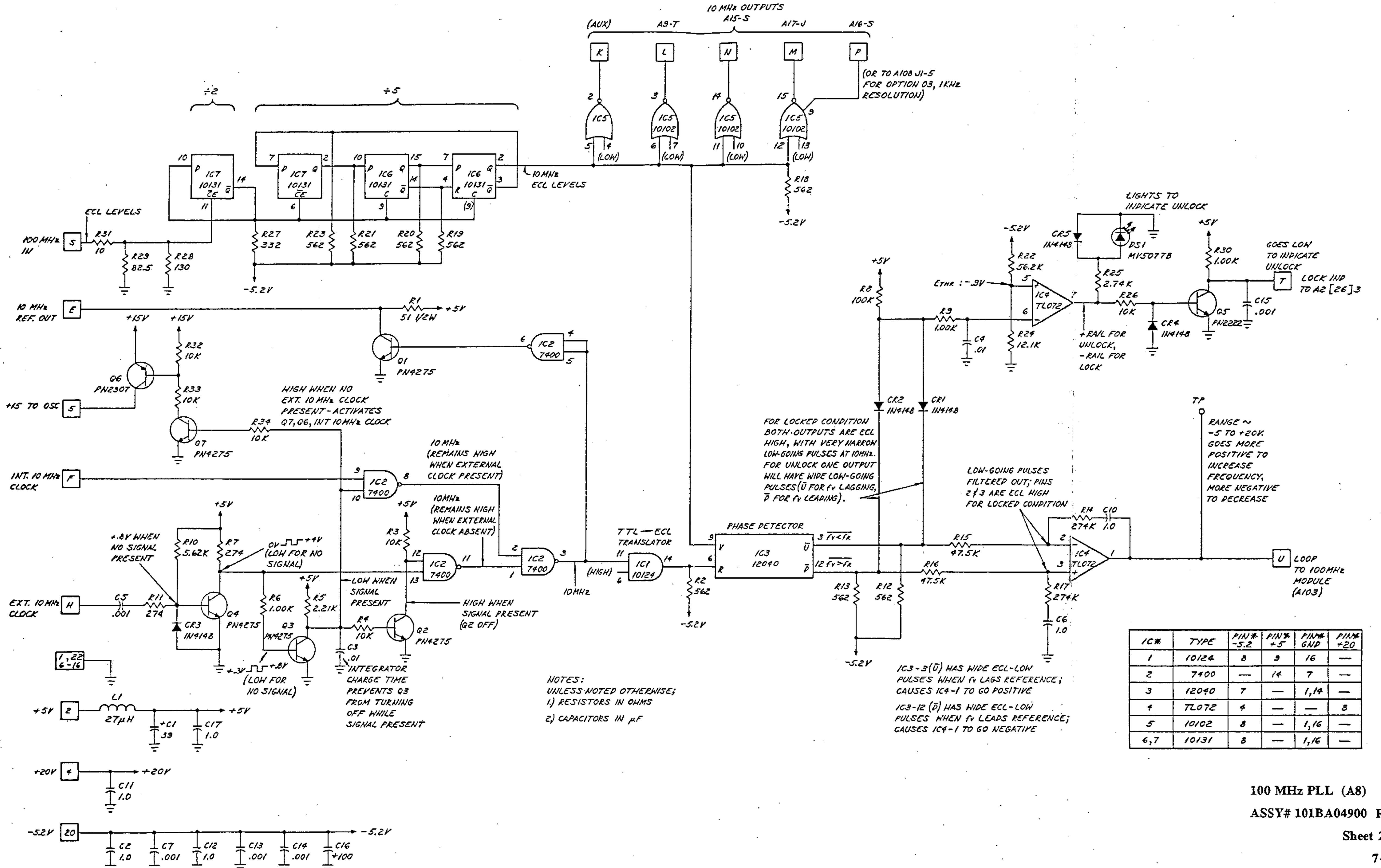
The reference input to the phase detector (IC3-6) comes from a switching circuit, which selects either an internal or external TTL-level 10 MHz reference. When no external timebase signal is provided, the internal timebase signal (received at pin F) is allowed to propagate through IC2-8 and IC2-3 to the TTL-ECL translator, IC1, which furnishes the 10 MHz to the phase comparator in the ECL form which that device requires. When an external timebase signal (received at pin H) is present, the switching circuit blocks the internal timebase at IC2-8 and allows the external signal to propagate through IC2-11 and IC2-3 to the translator. In either case, the 10 MHz signal appearing at the input to the translator is supplied, through IC2-6 and Q1, to pin E where it is used as the 10 MHz reference output.

When no external timebase signal is present, Q4 is on, Q3 is off and Q2 is on. IC2-10 is high, allowing the internal 10 MHz signal to propagate through IC2-8; IC2-12 is low, holding IC2-11 high and allowing the internal 10 MHz at IC2-8 to propagate through IC2-3.

When an external timebase signal is applied, the signal appears on the collector of Q4 and at IC2-13; the signal is also applied to the base of Q3, but the charge time of the integrator (R5/C3) on Q3's collector prevents the transistor from turning off and so the collector remains low as long as the 10 MHz signal is present. This low level accomplishes three things: it holds IC2-10 low, blocking the internal 10 MHz signal; it turns off Q7 and Q6, eliminating the +15V supply to the internal 10 MHz oscillator (so that it will not generate beat frequencies with the external timebase); and it turns off Q2, supplying a high to IC2-12 and permitting the external 10 MHz signal to propagate through IC2-11.

The phase-comparator IC3 compares the 10 MHz reference with the output of the divider and determines whether the variable input (pin 9) is greater than or less than the reference input (pin 6). If the variable lags the reference, wide low-going pulses will appear at pin 3; if the variable is leading, the pulses appear at pin 12. The two outputs, averaged by low-pass filters (R16/C9 and R15/C8), are applied to the amplifier IC4, which generates the correction voltage for the 100 MHz VCXO (more positive to increase frequency, more negative to decrease). When the loop is locked, both outputs will be high, with extremely narrow low-going glitches at 10 MHz. The frequency compensation networks (R14/C10, R17/C6) insure loop stability; the low-pass filters prevent IC3's output pulses from adding noise to the loop.

When the loop is unlocked, IC3's wide output pulses drive comparator IC4 to the positive rail, lighting the LED fault indicator and turning on Q5, causing pin T (the lock indicator line) to go low.

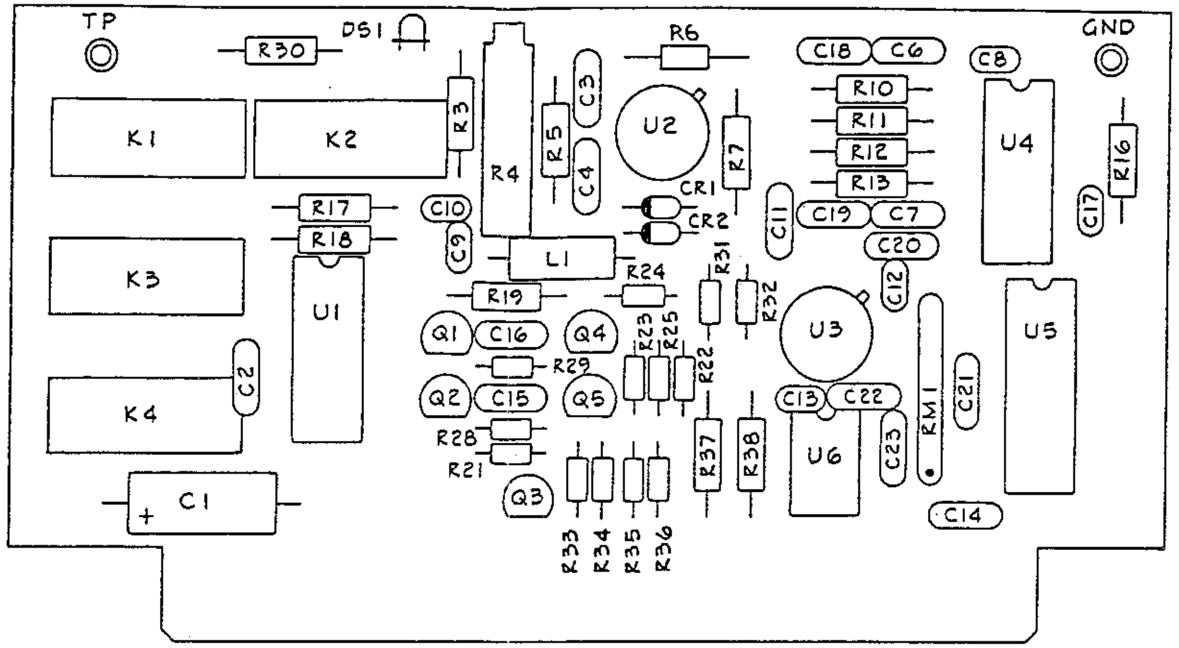


IC#	TYPE	PIN# -5.2	PIN# +5	PIN# GND	PIN# +20
1	10124	8	9	16	—
2	7400	—	14	7	—
3	12040	7	—	1,14	—
4	TL072	4	—	—	8
5	10102	8	—	1,16	—
6,7	10131	8	—	1,16	—

100 MHz PLL (A8)

ASSY# 101BA04900 Rev I

Sheet 2 of 2



Output PLL (A9)

ASSY# 101BA31701 Rev C

Sheet 1 of 2

OUTPUT PHASE LOCK LOOP -- PC ASSY A9

This circuit fine-tunes the active output YIG oscillator, in order to phase-lock the RF output to the 10 MHz Master Reference.

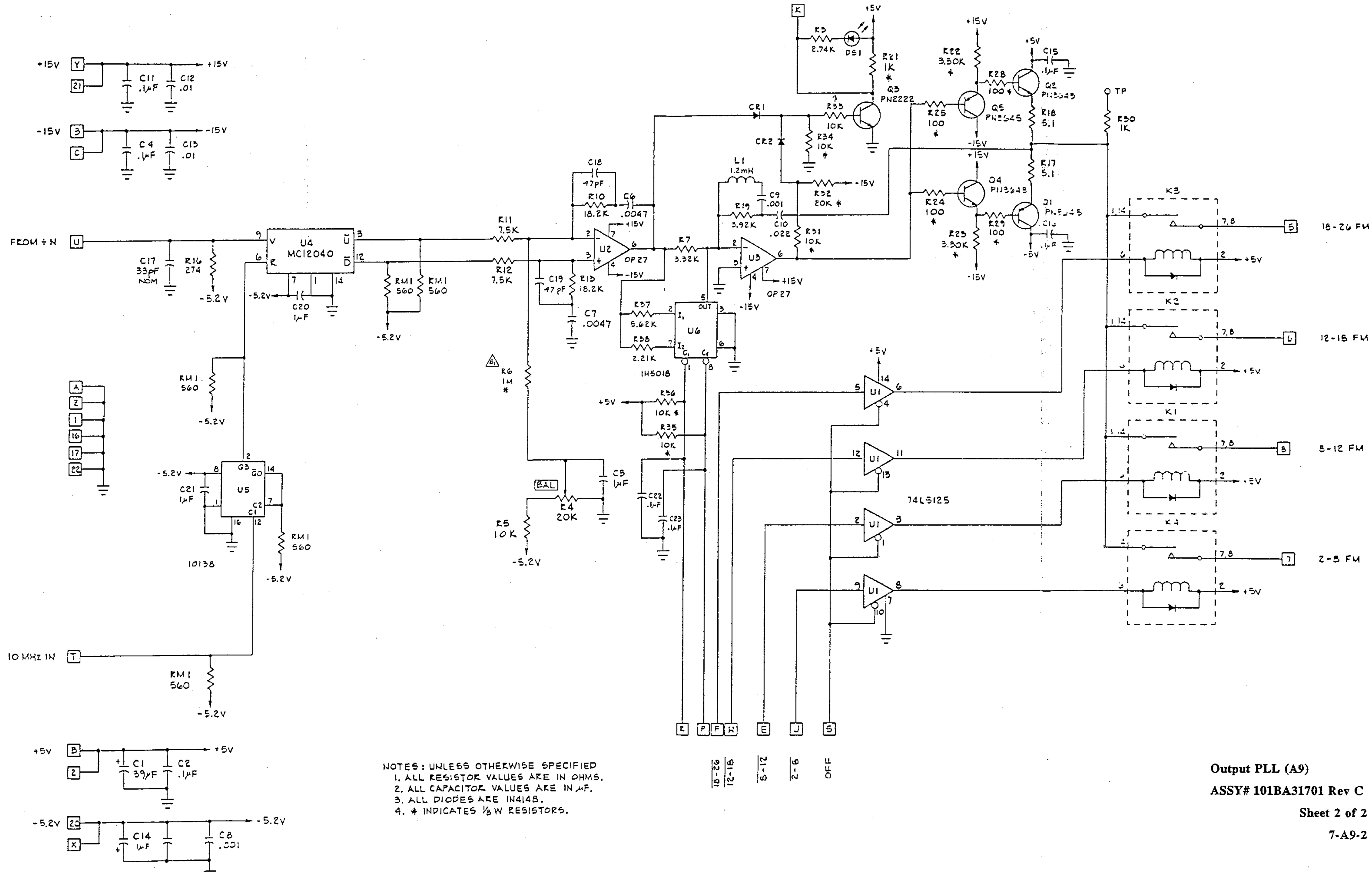
U4 is a phase comparator; it measures the phase relationship between the reference and variable inputs. The reference input (U4-6) is 1 MHz; this is the Master Reference (10 MHz) received at pin T and divided by 10 (see U5). The variable input (U4-9) comes from the Divide-By-N circuit (A20), and is equal to 1 MHz when the output loop is locked. U4 produces narrow pulses at one of its two outputs (U4-3 or U4-12) depending on whether the variable input is leading or lagging the reference.

The loop amplifier (see U2-6, U3-6, Q1, Q2, Q4 and Q5) converts U4's output pulses into a DC voltage which fine-tunes the appropriate YIG oscillator. Filter elements, including a 'BALANCE' calibration pot, remove spurious frequencies generated by the pulses. The correction voltage adjusts the YIG frequency in the direction that will reduce the phase difference between U4's inputs. The correction signal to the YIG becomes more negative to increase output frequency, more positive to reduce output frequency.

The output stage of the amplifier (see Q1, Q2) is connected to the FM coil of the appropriate YIG oscillator through relays K1-K4. The relays are activated (see the four gates of U1) by the computer. Only one relay is active at a time: during downconversion, when the 2-8 and 8-12 YIGs are used simultaneously, the fine-tuning of the 8-12 oscillator is performed by the A9 circuit board and the 2-8 oscillator is fine-tuned by the Fixed L.O. PLL circuit (A15).

When the two inputs to U4 are in phase (and therefore at the same frequency), the loop is "locked". When the two inputs are well out of phase, the loop is "unlocked" and U4's output pulses become very wide. The DC voltages at U2-6 and U3-6 are used to determine locked or unlocked conditions. The lock indicator circuit (see CR1, CR2, Q3, etc.) indicates the unlocked condition by illuminating DS1 and pulling the 'LOCK' output (pin K) low.

As the divisor of the Divide-by-N circuit increases, the loop gain decreases. To compensate for this, analog switch U6 places resistors R37 or R38 in parallel with R7 to increase the loop gain as N increases. For N values of 96 to 153, the gain is set by R7. For N values of 154 to 247, the gain is set by R7 in parallel with R37. For N values of 248 to 395 the gain is set by R7 in parallel with R38. This yields a total gain difference of approximately 12 dB.



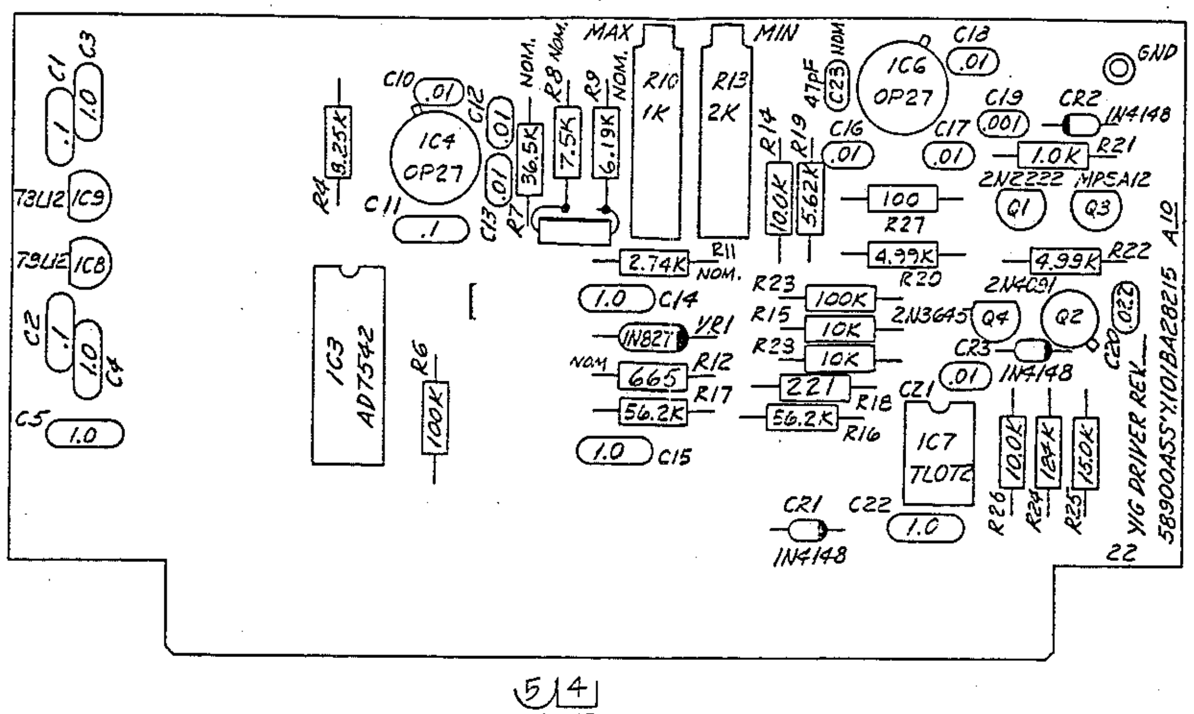
NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL RESISTOR VALUES ARE IN OHMS.
2. ALL CAPACITOR VALUES ARE IN µF.
3. ALL DIODES ARE IN4148.
4. * INDICATES 1/8 W RESISTORS.

Output PLL (A9)

ASSY# 101BA31701 Rev C

Sheet 2 of 2



JUMPER PINS 1 & 3, SLEEVED 24 GA.

NOTES:
UNLESS NOTED OTHERWISE;
1) RESISTORS IN OHMS
2) CAPACITORS IN μF
3) SEE SEPARATE PARTS LIST NUMBER 101BA28215

18-26 YIG OSCILLATOR DRIVER -- PC ASSY A10

This circuit controls the current source for the tuning coil of the 18-26 YIG oscillator, making it possible for the computer to coarse-tune the oscillator in 1 MHz increments. The frequency of a YIG oscillator increases with coil current. For 18-26 GHz oscillators the sensitivity is 30 MHz/mA. Because the impedance of the coil varies with temperature, it must be driven by a current source to ensure accuracy. The current source consists of the +20V supply, a 2N5881 transistor, and a four-terminal sense resistor. These components are not located on the YIG driver circuit board, but are illustrated in the schematic diagram to clarify circuit function. The YIG driver supplies a control voltage to the base of the 2N5881 transistor, and receives feedback inputs from both terminals of the YIG tuning coil.

Digital to analog converter U3 produces a voltage proportional to the reference input at pin 15 times the binary number with which it is programmed by the computer (this multiplier is a 12-bit number, programmed in successive blocks via the four input data bits). In this way the computer is able to select from a range of values corresponding to the frequency range of the YIG oscillator. This DAC output is amplified by U4 and applied to the inverting input of the driver amplifier, U6. The other inputs to this point consist of a reference voltage (derived from the DAC reference input) and the DC and AC feedback paths from the tuning coil.

In order to adapt the driver circuit to the tuning characteristics of an individual oscillator, two calibration potentiometers are used. The 'MAX' pot is placed between the DAC reference input and U6's inverting input. The 'MIN' pot is placed between the amplified DAC output and U6's inverting input.

NOISE REDUCTION

The current source is driven by the output of U6, via Q1. There are two feedback loops from the terminals of the YIG tuning coil. The "DC" loop, from the junction of the minus terminal and the sense resistor, is a resistive feedback path which is always active. The sense resistor has a high power rating and high temperature stability; its voltage drop, fed back to the driver, gives a precise indication of coil current which is not affected by changes in coil impedance. The "AC" loop, which includes a capacitor, comes from the plus terminal of the coil. It acts as a filter by slowing down the amplifier response so that AC noise cannot be propagated through the loop. Because it slows down the amplifier, the AC loop must be deactivated during a rapid frequency change (as occurs repeatedly during a sweep). The computer toggles the 'SLOW' line in order to turn FET Q2 on and off. Ordinarily, the 'SLOW' line is high, Q2 is off, and the AC loop is active. During frequency transitions the 'SLOW' line is low and Q2 turns on, shunting AC feedback to ground.

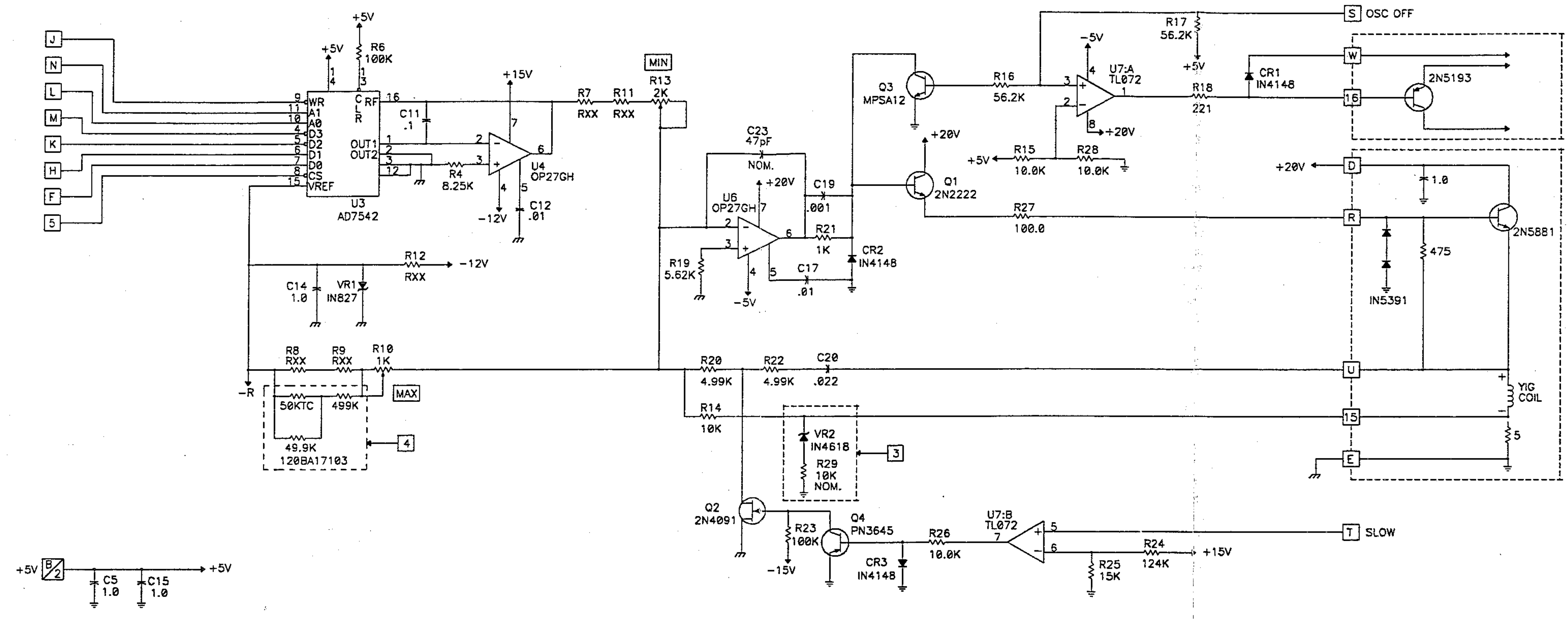
OSCILLATOR SHUTOFF

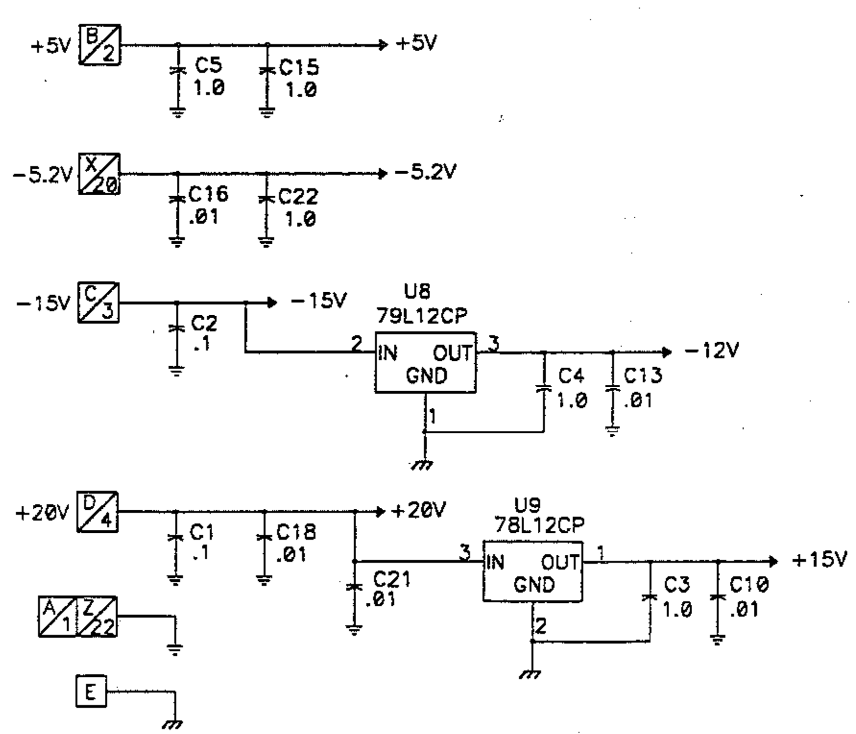
The 'OSC OFF' input, through Q3 and Q1, is used by the computer to shut down the tuning coil current source when the oscillator is not in use. In addition, the 'OSC OFF' input drives U7-1 to switch the 2N5193 transistor through which the +15V supply reaches the oscillator.

18-26 YIG Osc Driver (A10)

ASSY# 101BA28215 Rev H

Sheet 1 of 2





NOMINAL RESISTOR VALUES						
BD. NO.	REF.	R7	R8	R9	R11	R12
101BA28211	A13	16.9K	12.7K	1.82K	825	1K
101BA28212	A11	25.5K	20.0K	1.0K	1.5K	1K
101BA28213	A14	45.3K	15.8K	3.16K	1.82K	1K
101BA28214	A12	26.1K	10K	2.21K	6.19K	1K
101BA28215	A10	36.5K	7.5K	6.19K	2.74K	665

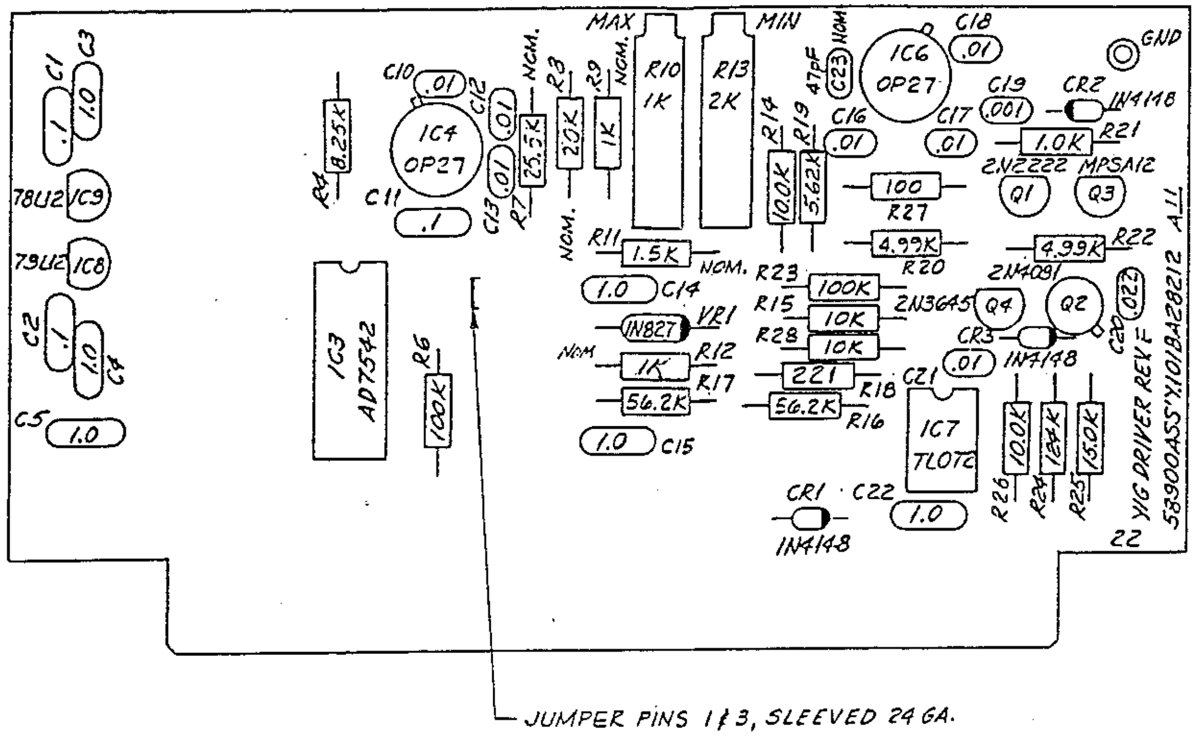
NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTORS IN OHMS
2. CAPACITORS IN uF
3. VR2 & R29 USED ON A13 101BA28211 ONLY.
4. 120BA17103 USED ON A10 101BA28215 ONLY,IF REQ'D.

18-26 YIG Osc Driver (A10)

ASSY# 101BA28215 Rev H

Sheet 2 of 2



NOTES:
UNLESS NOTED OTHERWISE;
1) RESISTORS IN OHMS
2) CAPACITORS IN μF
3) SEE SEPARATE PARTS LIST NUMBER 101BA28212

2-8 YIG Osc Driver

ASSY# 101BA28212 Rev F

Sheet 1 of 2

2-8 YIG OSCILLATOR DRIVER -- PC ASSY A11

This circuit controls the current source for the tuning coil of the 2-8 YIG oscillator, making it possible for the computer to coarse-tune the oscillator in 1 MHz increments. The frequency of a YIG oscillator increases with coil current. For 2-8 GHz oscillators the sensitivity is 20 MHz/mA. Because the impedance of the coil varies with temperature, it must be driven by a current source to ensure accuracy. The current source consists of the +20V supply, a 2N5881 transistor, and a four-terminal sense resistor. These components are not located on the YIG driver circuit board, but are illustrated in the schematic diagram to clarify circuit function. The YIG driver supplies a control voltage to the base of the 2N5881 transistor, and receives feedback inputs from both terminals of the YIG tuning coil.

Digital to analog converter U3 produces a voltage proportional to the reference input at pin 15 times the binary number with which it is programmed by the computer (this multiplier is a 12-bit number, programmed in successive blocks via the four input data bits). In this way the computer is able to select from a range of values corresponding to the frequency range of the YIG oscillator. This DAC output is amplified by U4 and applied to the inverting input of the driver amplifier, U6. The other inputs to this point consist of a reference voltage (derived from the DAC reference input) and the DC and AC feedback paths from the tuning coil.

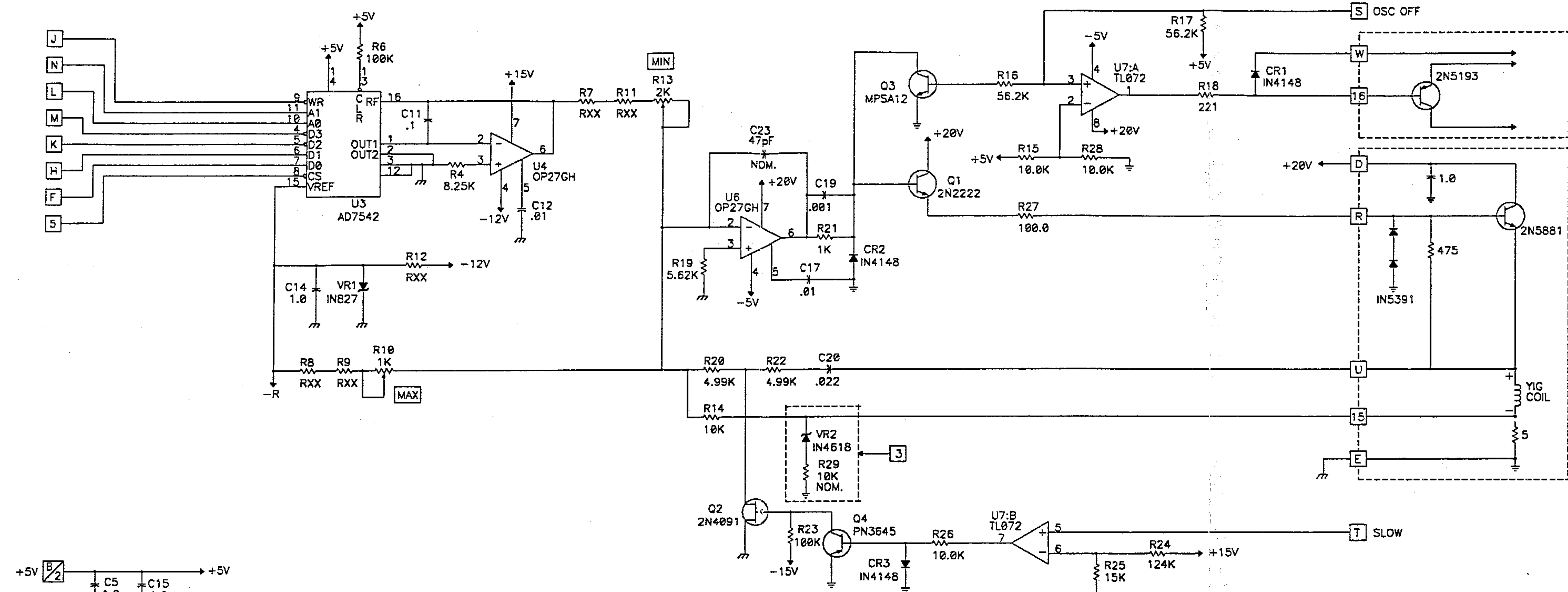
In order to adapt the driver circuit to the tuning characteristics of an individual oscillator, two calibration potentiometers are used. The 'MAX' pot is placed between the DAC reference input and U6's inverting input. The 'MIN' pot is placed between the amplified DAC output and U6's inverting input.

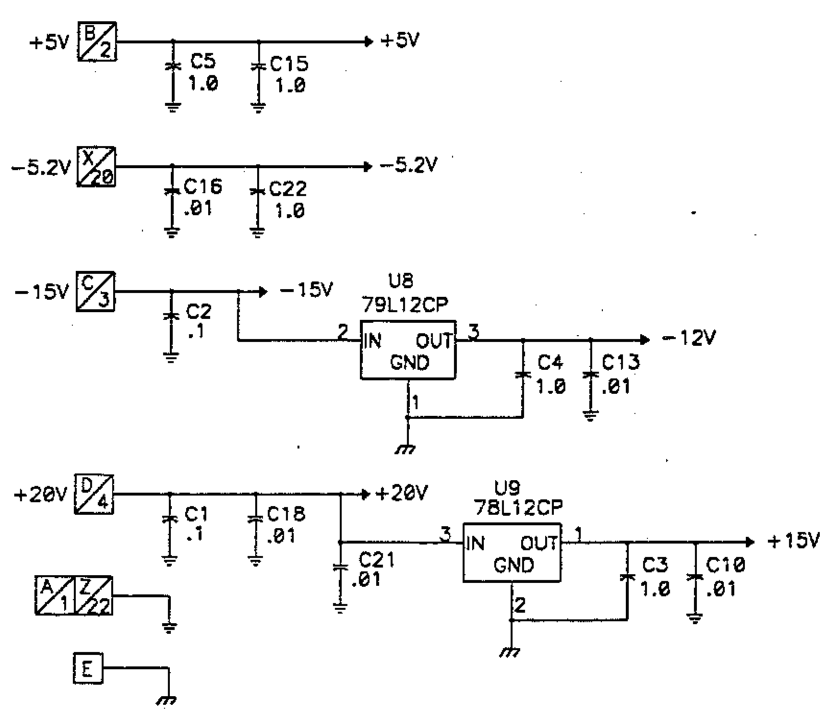
NOISE REDUCTION

The current source is driven by the output of U6, via Q1. There are two feedback loops from the terminals of the YIG tuning coil. The "DC" loop, from the junction of the minus terminal and the sense resistor, is a resistive feedback path which is always active. The sense resistor has a high power rating and high temperature stability; its voltage drop, fed back to the driver, gives a precise indication of coil current which is not affected by changes in coil impedance. The "AC" loop, which includes a capacitor, comes from the plus terminal of the coil. It acts as a filter by slowing down the amplifier response so that AC noise cannot be propagated through the loop. Because it slows down the amplifier, the AC loop must be deactivated during a rapid frequency change (as occurs repeatedly during a sweep). The computer toggles the 'SLOW' line in order to turn FET Q2 on and off. Ordinarily, the 'SLOW' line is high, Q2 is off, and the AC loop is active. During frequency transitions the 'SLOW' line is low and Q2 turns on, shunting AC feedback to ground.

OSCILLATOR SHUTOFF

The 'OSC OFF' input, through Q3 and Q1, is used by the computer to shut down the tuning coil current source when the oscillator is not in use. NOTE: the additional shutoff circuit, which includes U7-1 and a 2N5193 transistor located off the circuit board, is not implemented in the case of the 2-8 YIG oscillator; it is used by other YIG driver circuits.





NOMINAL RESISTOR VALUES						
BD. NO.	REF.	R7	R8	R9	R11	R12
101BA28211	A13	16.9K	12.7K	1.82K	825	1K
101BA28212	A11	25.5K	20.0K	1.0K	1.5K	1K
101BA28213	A14	45.3K	15.8K	3.16K	1.82K	1K
101BA28214	A12	26.1K	10K	2.21K	6.19K	1K
101BA28215	A10	36.5K	7.5K	6.19K	2.74K	665

NOTES: UNLESS OTHERWISE SPECIFIED

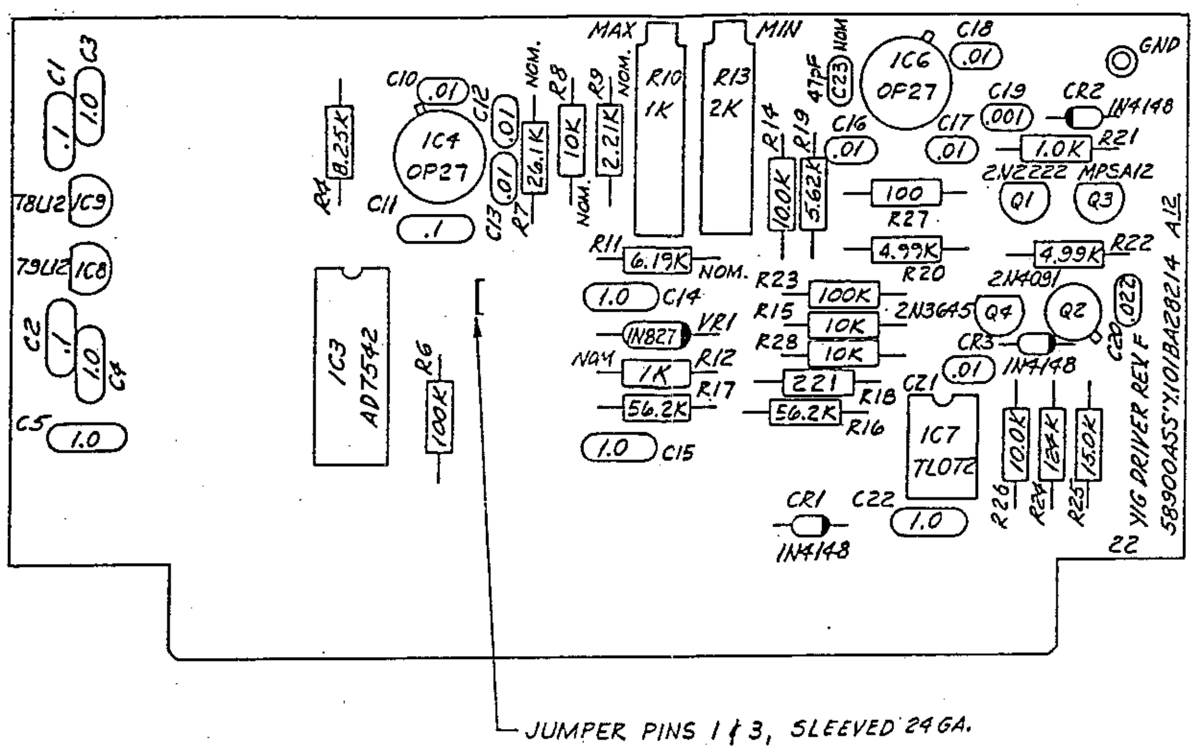
1. RESISTORS IN OHMS
2. CAPACITORS IN uF

3 VR2 & R29 USED ON A13 101BA28211 ONLY.

2-8 YIG Osc Driver

ASSY# 101BA28212 Rev F

Sheet 2 of 2



NOTES:
UNLESS NOTED OTHERWISE;
1) RESISTORS IN OHMS
2) CAPACITORS IN µF
3) SEE SEPARATE PARTS LIST NUMBER 101BA28214

12-18 YIG OSCILLATOR DRIVER -- PC ASSY A12

This circuit controls the current source for the tuning coil of the 12-18 YIG oscillator, making it possible for the computer to coarse-tune the oscillator in 1 MHz increments. The frequency of a YIG oscillator increases with coil current. For 12-18 GHz oscillators the sensitivity is 20 MHz/mA. Because the impedance of the coil varies with temperature, it must be driven by a current source to ensure accuracy. The current source consists of the +20V supply, a 2N5881 transistor, and a four-terminal sense resistor. These components are not located on the YIG driver circuit board, but are illustrated in the schematic diagram to clarify circuit function. The YIG driver supplies a control voltage to the base of the 2N5881 transistor, and receives feedback inputs from both terminals of the YIG tuning coil.

Digital to analog converter U3 produces a voltage proportional to the reference input at pin 15 times the binary number with which it is programmed by the computer (this multiplier is a 12-bit number, programmed in successive blocks via the four input data bits). In this way the computer is able to select from a range of values corresponding to the frequency range of the YIG oscillator. This DAC output is amplified by U4 and applied to the inverting input of the driver amplifier, U6. The other inputs to this point consist of a reference voltage (derived from the DAC reference input) and the DC and AC feedback paths from the tuning coil.

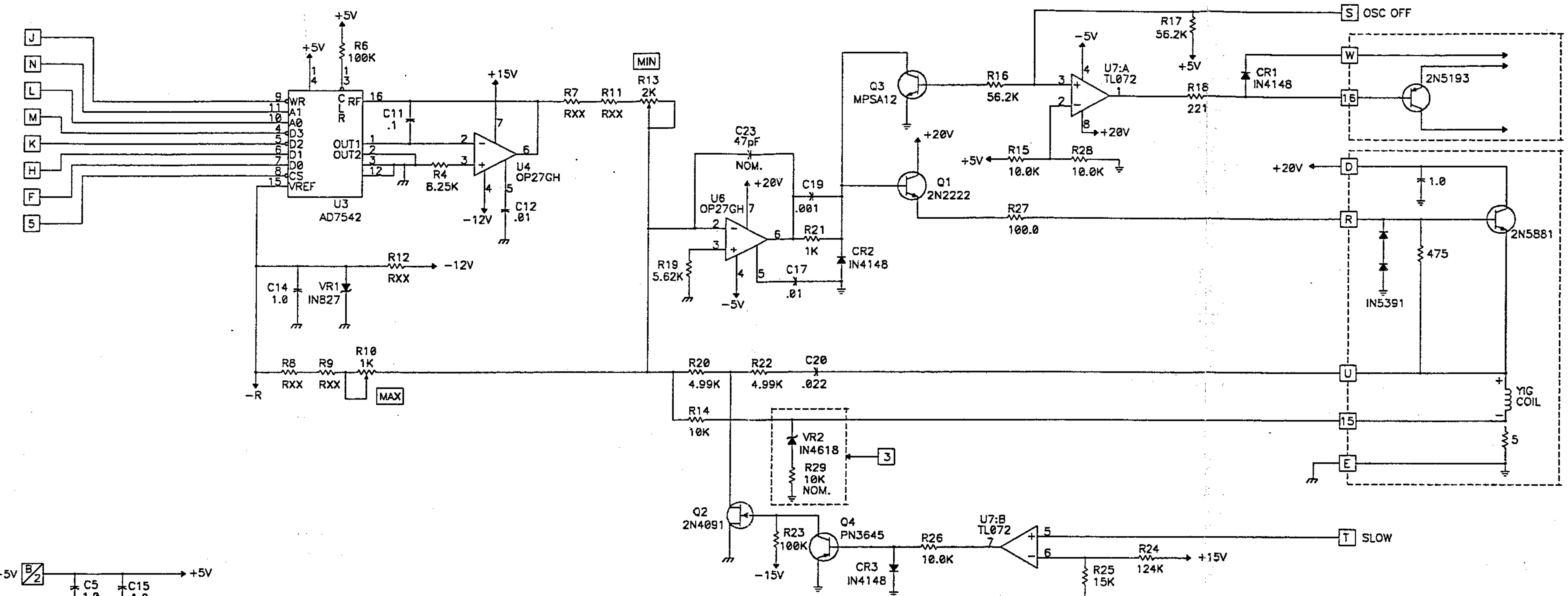
In order to adapt the driver circuit to the tuning characteristics of an individual oscillator, two calibration potentiometers are used. The 'MAX' pot is placed between the DAC reference input and U6's inverting input. The 'MIN' pot is placed between the amplified DAC output and U6's inverting input.

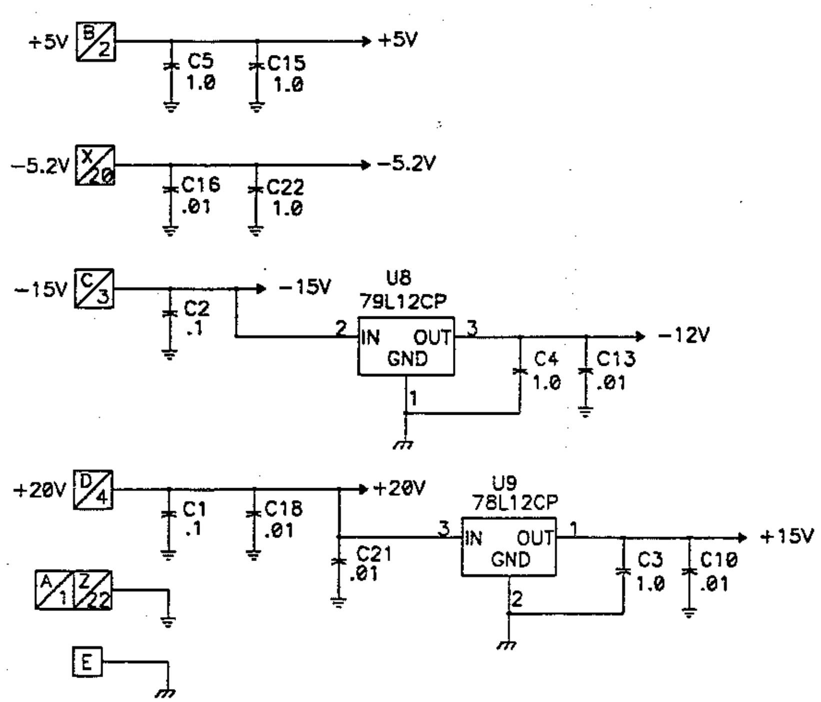
NOISE REDUCTION

The current source is driven by the output of U6, via Q1. There are two feedback loops from the terminals of the YIG tuning coil. The "DC" loop, from the junction of the minus terminal and the sense resistor, is a resistive feedback path which is always active. The sense resistor has a high power rating and high temperature stability; its voltage drop, fed back to the driver, gives a precise indication of coil current which is not affected by changes in coil impedance. The "AC" loop, which includes a capacitor, comes from the plus terminal of the coil. It acts as a filter by slowing down the amplifier response so that AC noise cannot be propagated through the loop. Because it slows down the amplifier, the AC loop must be deactivated during a rapid frequency change (as occurs repeatedly during a sweep). The computer toggles the 'SLOW' line in order to turn FET Q2 on and off. Ordinarily, the 'SLOW' line is high, Q2 is off, and the AC loop is active. During frequency transitions the 'SLOW' line is low and Q2 turns on, shunting AC feedback to ground.

OSCILLATOR SHUTOFF

The 'OSC OFF' input, through Q3 and Q1, is used by the computer to shut down the tuning coil current source when the oscillator is not in use. In addition, the 'OSC OFF' input drives U7-1 to switch the 2N5193 transistor through which the +15V supply reaches the oscillator.





NOMINAL RESISTOR VALUES						
BD. NO.	REF.	R7	R8	R9	R11	R12
101BA28211	A13	16.9K	12.7K	1.82K	825	1K
101BA28212	A11	25.5K	20.0K	1.0K	1.5K	1K
101BA28213	A14	45.3K	15.8K	3.16K	1.82K	1K
101BA28214	A12	26.1K	10K	2.21K	6.19K	1K
101BA28215	A10	36.5K	7.5K	6.19K	2.74K	665

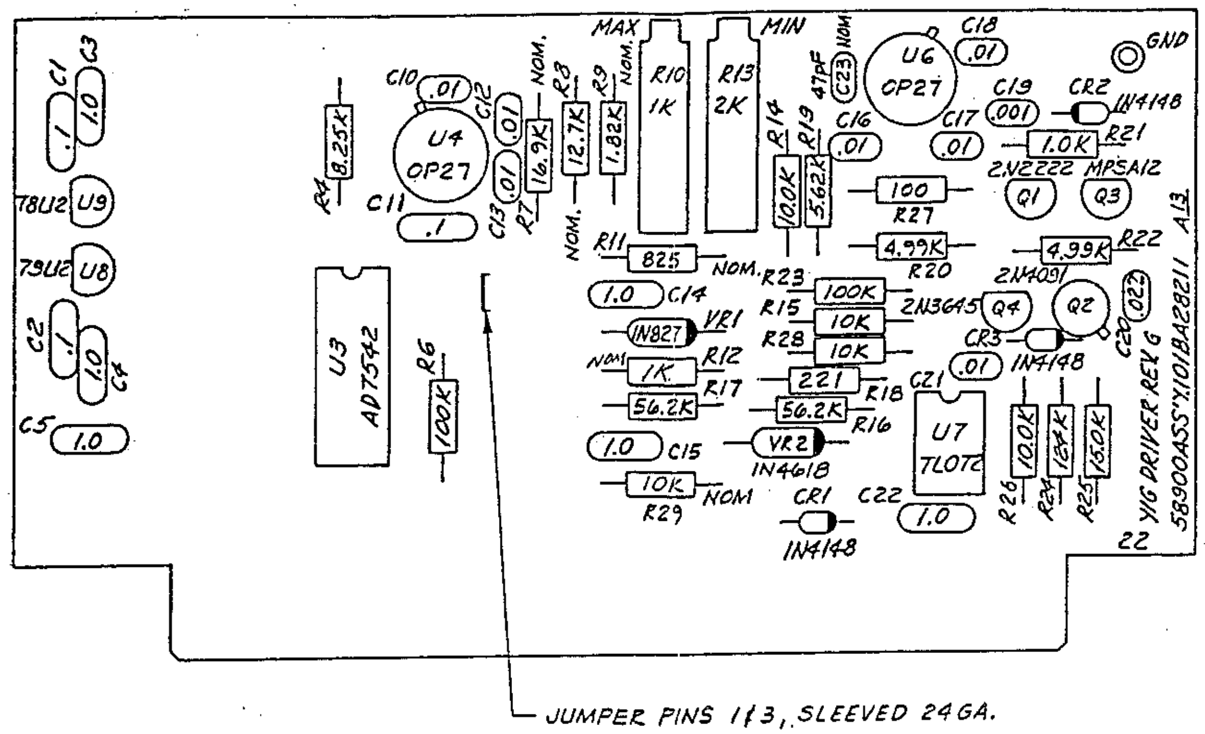
NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTORS IN OHMS
2. CAPACITORS IN uF
3. VR2 & R29 USED ON A13 101BA28211 ONLY.

12-18 YIG Osc Driver (A12)

ASSY# 101BA28214 Rev F

Sheet 2 of 2



NOTES:
UNLESS NOTED OTHERWISE;
1) RESISTORS IN OHMS
2) CAPACITORS IN μF
3) SEE SEPARATE PARTS LIST NUMBER 101BA28211.

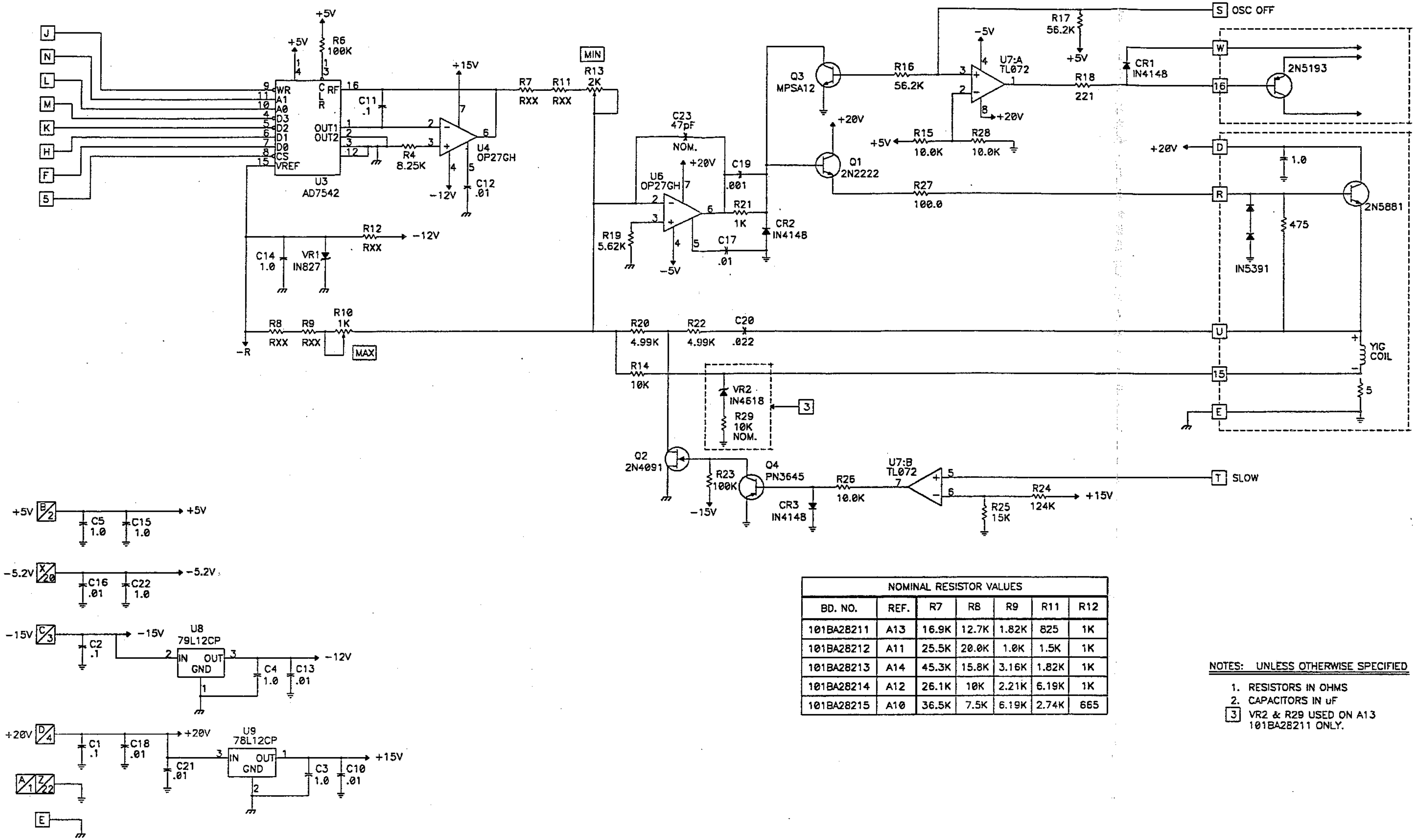
REFERENCE YIG OSCILLATOR DRIVER -- PC ASSY A13

This circuit controls the current source for the tuning coil of the 1.9 - 8.7 GHz reference YIG oscillator, making it possible for the computer to coarse-tune the oscillator in 1 MHz increments. The frequency of the YIG oscillator increases with coil current (the sensitivity is 20 MHz/mA). Because the impedance of the coil varies with temperature, it must be driven by a current source to ensure accuracy. The current source consists of the +20V supply, a 2N5881 transistor, and a four-terminal sense resistor. These components are not located on the YIG driver circuit board, but are illustrated in the schematic diagram to clarify circuit function. The YIG driver supplies a control voltage to the base of the transistor, and receives feedback inputs from both terminals of the YIG tuning coil.

Digital to analog converter U3 produces a voltage output proportional to the product of the reference voltage input at U3-15 and the binary number with which it is programmed by the computer. The reference voltage is fixed; the computer sets the YIG frequency by programming the DAC. The DAC output is amplified by U4 and applied to the inverting input of the driver amplifier, U6. The other inputs at U6-2 consist of a reference voltage (derived from the DAC reference input) and the DC and AC feedback paths from the YIG tuning coil. R10 ('MAX') and R13 ('MIN') are calibration pots used to adapt the driver circuit to the tuning characteristics of a particular oscillator.

The "AC" feedback path from the YIG coil's positive terminal acts to slow down the amplifier response so that AC noise will not be propagated through the loop. Because it slows down the amplifier, the AC loop is deactivated during a frequency change. The 'SLOW' line (pin T), normally high during fixed-frequency operation, is driven low (turning on Q2 and shunting the AC feedback path to ground) during frequency transitions.

The 'OSC OFF' circuit (pin S, Q3) is used by the computer to shut down the tuning coil current source when the oscillator is not in use. NOTE: The additional shutoff circuit, which includes U7-1 and a 2N5193 transistor located off the circuit board, is not implemented in the case of the Reference YIG Oscillator; it is used by other YIG driver circuits.



NOMINAL RESISTOR VALUES						
BD. NO.	REF.	R7	R8	R9	R11	R12
101BA28211	A13	16.9K	12.7K	1.82K	825	1K
101BA28212	A11	25.5K	20.0K	1.0K	1.5K	1K
101BA28213	A14	45.3K	15.8K	3.16K	1.82K	1K
101BA28214	A12	26.1K	10K	2.21K	6.19K	1K
101BA28215	A10	36.5K	7.5K	6.19K	2.74K	665

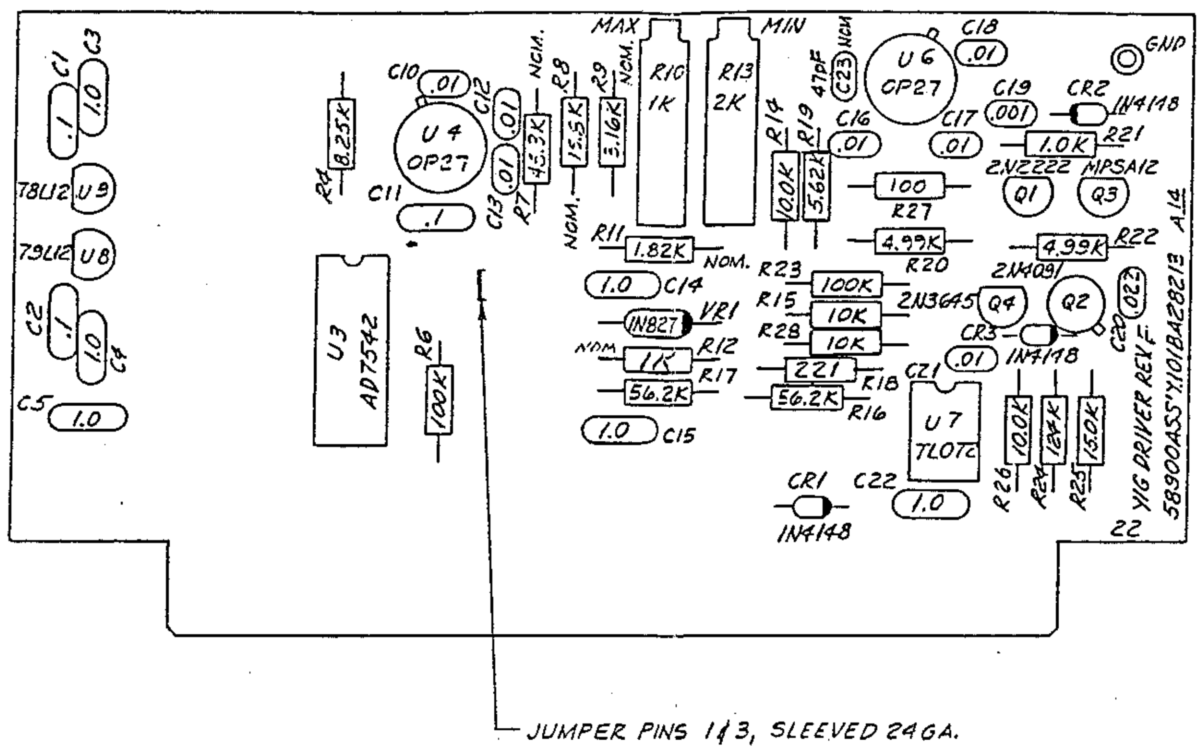
NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTORS IN OHMS
2. CAPACITORS IN uF
3. VR2 & R29 USED ON A13 101BA28211 ONLY.

Ref YIG Osc Driver (A13)

ASSY# 101BA28211 Rev G

Sheet 2 of 2



NOTES:
UNLESS NOTED OTHERWISE;
1) RESISTORS IN OHMS
2) CAPACITORS IN µF
3) SEE SEPARATE PARTS LIST NUMBER 101BA28213

8-12 YIG OSCILLATOR DRIVER -- PC ASSY A14

This circuit controls the current source for the tuning coil of the 8-12 YIG oscillator, making it possible for the computer to coarse-tune the oscillator in 1 MHz increments. The frequency of a YIG oscillator increases with coil current. For 8-12 GHz oscillators the sensitivity is 20 MHz/mA. Because the impedance of the coil varies with temperature, it must be driven by a current source to ensure accuracy. The current source consists of the +20V supply, a 2N5881 transistor, and a four-terminal sense resistor. These components are not located on the YIG driver circuit board, but are illustrated in the schematic diagram to clarify circuit function. The YIG driver supplies a control voltage to the base of the 2N5881 transistor, and receives feedback inputs from both terminals of the YIG tuning coil.

Digital to analog converter U3 produces a voltage proportional to the reference input at pin 15 times the binary number with which it is programmed by the computer (this multiplier is a 12-bit number, programmed in successive blocks via the four input data bits). In this way the computer is able to select from a range of values corresponding to the frequency range of the YIG oscillator. This DAC output is amplified by U4 and applied to the inverting input of the driver amplifier, U6. The other inputs to this point consist of a reference voltage (derived from the DAC reference input) and the DC and AC feedback paths from the tuning coil.

In order to adapt the driver circuit to the tuning characteristics of an individual oscillator, two calibration potentiometers are used. The 'MAX' pot is placed between the DAC reference input and U6's inverting input. The 'MIN' pot is placed between the amplified DAC output and U6's inverting input.

NOISE REDUCTION

The current source is driven by the output of U6, via Q1. There are two feedback loops from the terminals of the YIG tuning coil. The "DC" loop, from the junction of the minus terminal and the sense resistor, is a resistive feedback path which is always active. The sense resistor has a high power rating and high temperature stability; its voltage drop, fed back to the driver, gives a precise indication of coil current which is not affected by changes in coil impedance. The "AC" loop, which includes a capacitor, comes from the plus terminal of the coil. It acts as a filter by slowing down the amplifier response so that AC noise cannot be propagated through the loop. Because it slows down the amplifier, the AC loop must be deactivated during a rapid frequency change (as occurs repeatedly during a sweep). The computer toggles the 'SLOW' line in order to turn FET Q2 on and off. Ordinarily, the 'SLOW' line is high, Q2 is off, and the AC loop is active. During frequency transitions the 'SLOW' line is low and Q2 turns on, shunting AC feedback to ground.

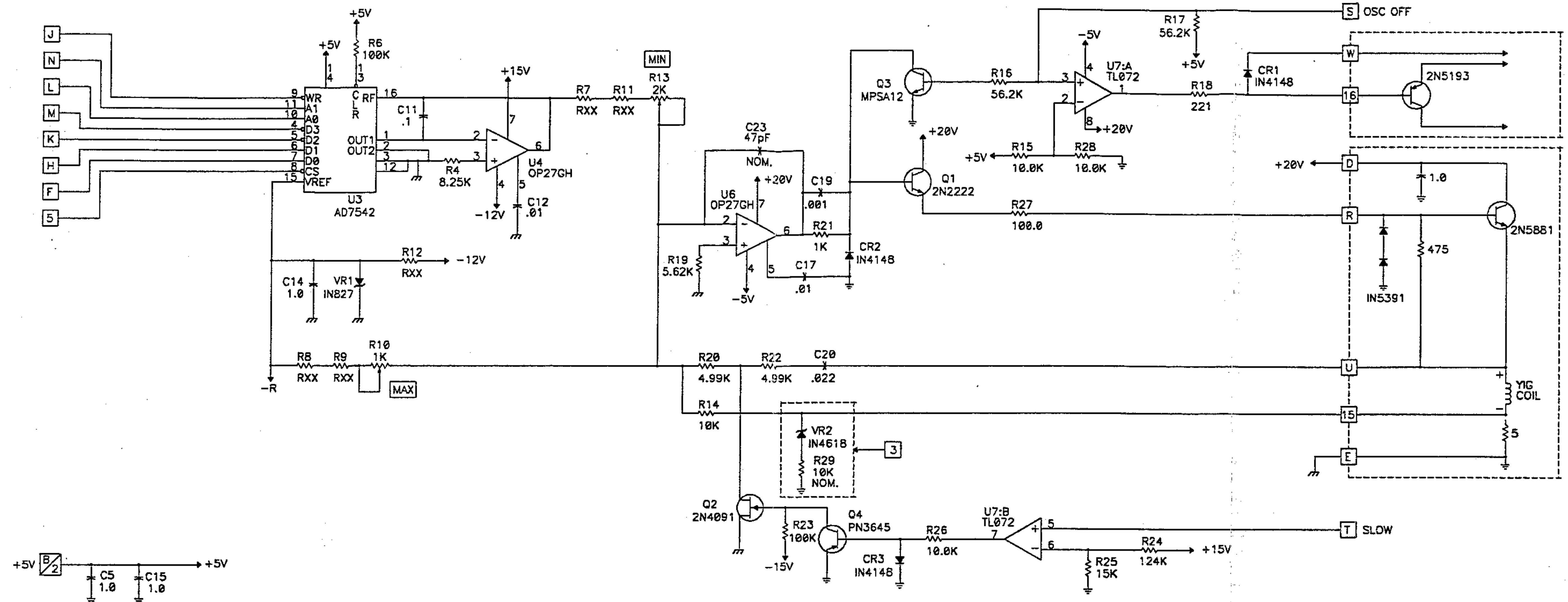
OSCILLATOR SHUTOFF

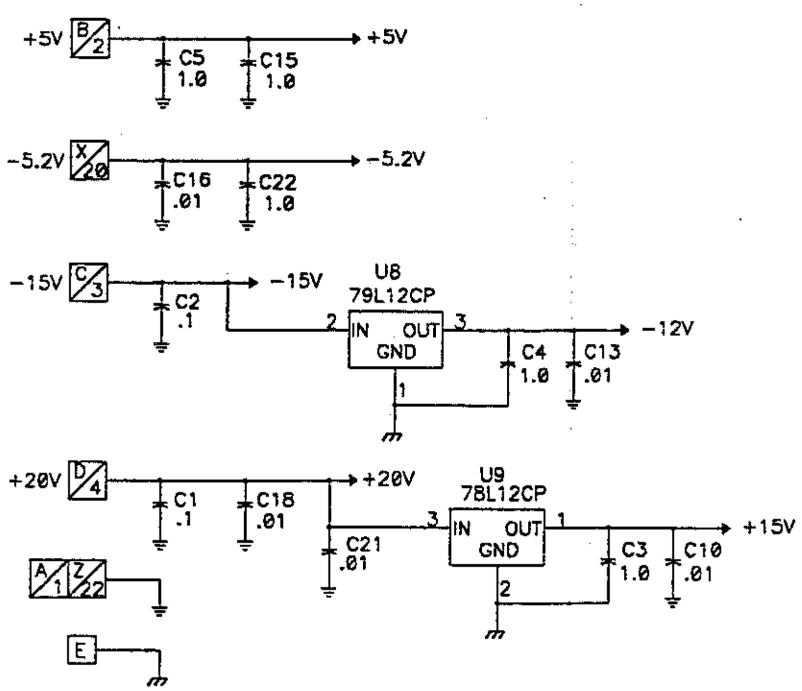
The 'OSC OFF' input, through Q3 and Q1, is used by the computer to shut down the tuning coil current source when the oscillator is not in use. In addition, the 'OSC OFF' input drives U7-1 to switch the 2N5193 transistor through which the +15V supply reaches the oscillator.

8-12 YIG Osc Driver

ASSY# 101BA28213 Rev F

Sheet 1 of 2





NOMINAL RESISTOR VALUES						
BD. NO.	REF.	R7	R8	R9	R11	R12
101BA28211	A13	16.9K	12.7K	1.82K	825	1K
101BA28212	A11	25.5K	20.0K	1.0K	1.5K	1K
101BA28213	A14	45.3K	15.8K	3.16K	1.82K	1K
101BA28214	A12	26.1K	10K	2.21K	6.19K	1K
101BA28215	A10	36.5K	7.5K	6.19K	2.74K	665

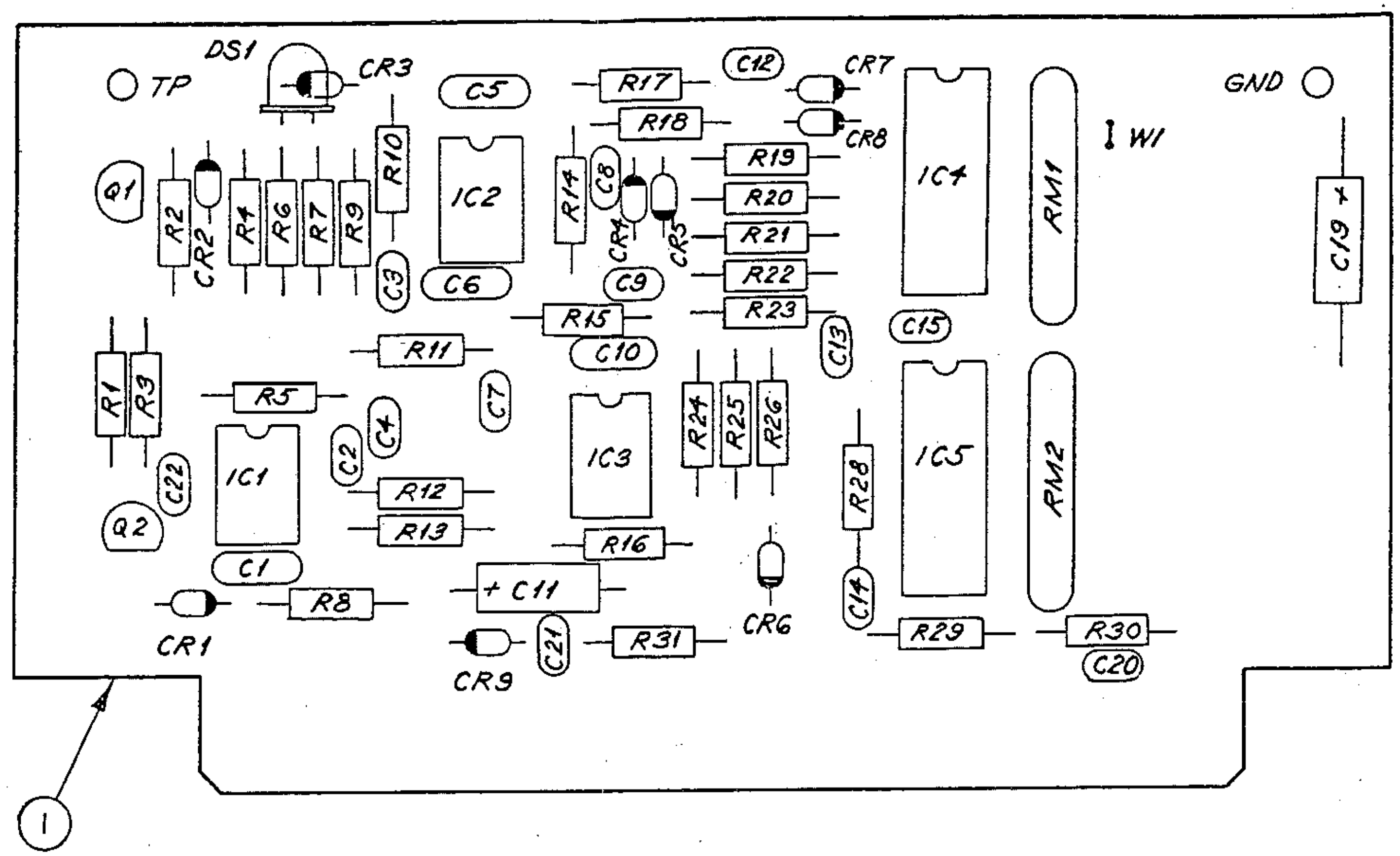
NOTES: UNLESS OTHERWISE SPECIFIED

1. RESISTORS IN OHMS
2. CAPACITORS IN uF
3. VR2 & R29 USED ON A13 101BA28211 ONLY.

8-12 YIG Osc Driver

ASSY# 101BA28213 Rev F

Sheet 2 of 2



Fixed LO PLL (A15)

ASSY# 101BA07401 Rev J

Sheet 1 of 2

FIXED L.O. PHASE LOCK LOOP -- PC ASSY A15

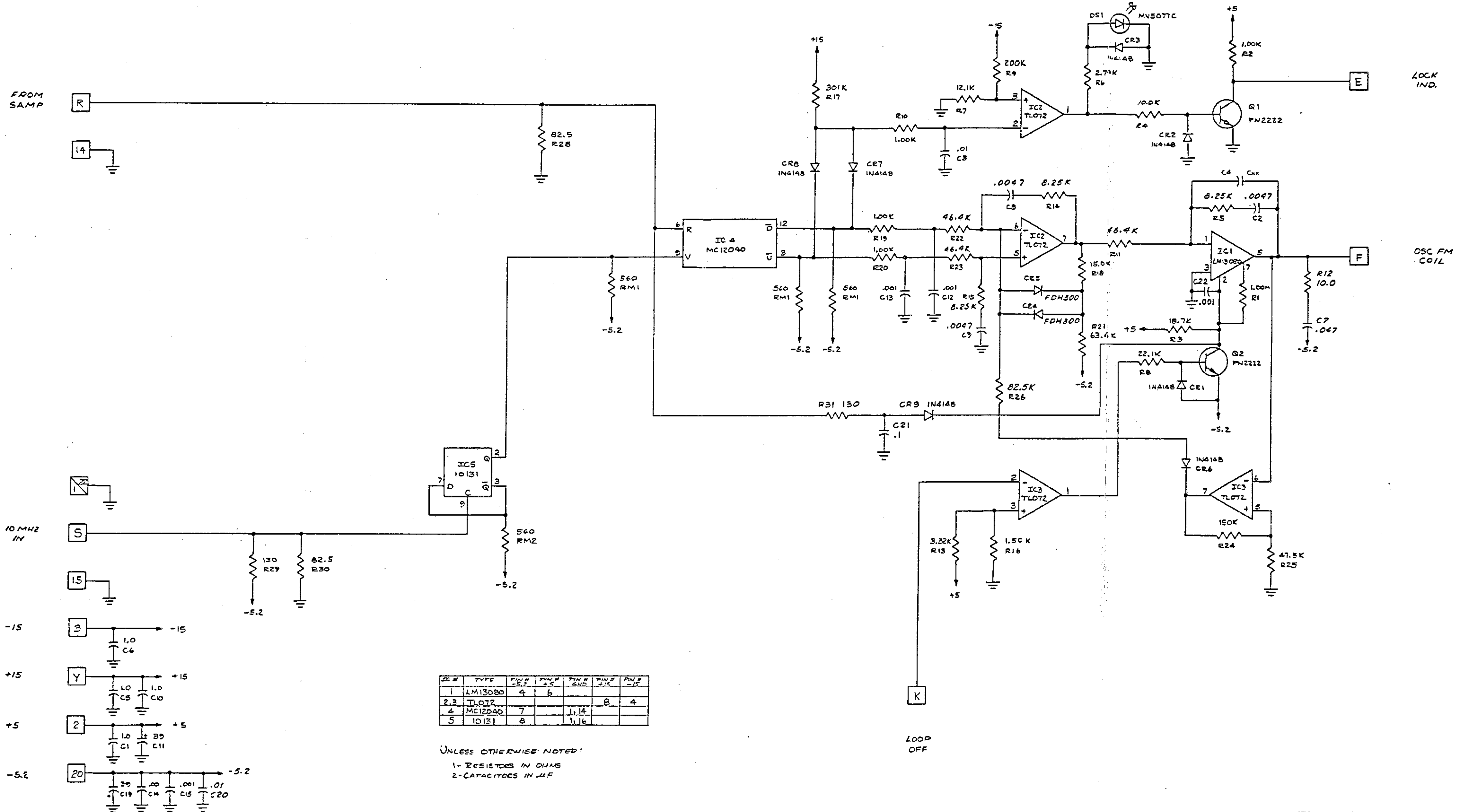
This circuit is needed only for output frequencies below 2 GHz; it is used to phase lock the 8005 MHz fixed L.O. frequency supplied by the 2-8 YIG oscillator to the 10 MHz timebase.

The Fixed L.O. sampling mixer on the A103 PC board combines the 8005 MHz L.O. frequency with the 80th harmonic of the 100 MHz oscillator on that board, yielding a 5 MHz IF. This IF is applied to the phase detector (IC4, pin 6). The other input to the detector is the 10 MHz timebase, divided by two (see flip flop IC5). The phase detector produces pulses at one of its outputs, depending on whether the 5 MHz IF input is leading or lagging the timebase. These pulsed outputs, filtered by IC2-7 and its RC network, are amplified by IC1 and furnished to the FM coil of the 2-8 YIG oscillator. In this way, the YIG oscillator output frequency is fine-tuned to exactly 8005 MHz and phase locked to the 10 MHz timebase. The control voltage at IC1-5 goes more negative to increase the frequency of the YIG oscillator.

When not in use, this circuit must be disabled in order to prevent it from contributing spurious signals to the RF output. To that end, the output amplifier qIC1) is shut down and the -5.2 volt ECL termination for the 5 MHz sampler input signal is switched out of the input circuit. PIN K is low during operation below 2 GHz; IC3-1 goes high and switches Q2 on. The collector of Q2, pulled low, provides the termination for the input 5 MHz signal (by way of CR9), and activates IC1 as well. Pin K goes high during operation above 2 GHz; Q2 is shut off and its collector is pulled high, eliminating the termination for the input signal and disabling IC1.

The desired frequency of the Fixed L.O. is 8005 MHz -- that is, slightly above the sampling mixer comb line at 8000 MHz. If the YIG oscillator is below 8000 MHz instead of above it, the phase lock loop circuit, in attempting to lock on the resulting IF input, will ramp in the wrong direction and become stuck at its maximum positive control voltage (driving the YIG too low). A search circuit (see IC3-7) is included as a remedy for this potential problem. If the control voltage output at IC1-5 becomes too positive, IC3-7 supplies a negative voltage (via CR6) to the amplifier input at IC2-6, temporarily driving IC1-5 to the negative rail. The frequency search then resumes from a frequency above the 8000 MHz comb line.

Amplifier IC2-1 is used as a lock detection circuit. Wide negative pulses appear at one or the other of the two phase detector outputs when the PLL circuit is unlocked. These pulses, furnished to the lock detector by way of diodes CR7 and CR8, are used to turn the LED indicator (DS1) on (indicating unlock) and to turn Q1 on (driving the output at pin E low, again indicating unlock).



IC #	TYPE	PIN # -5.2	PIN # +5	PIN # GND	PIN # +15	PIN # -15
1	LM13080	4	6			
2,3	TL072				8	4
4	MC12040	7		1, 14		
5	10131	8		1, 16		

UNLESS OTHERWISE NOTED:

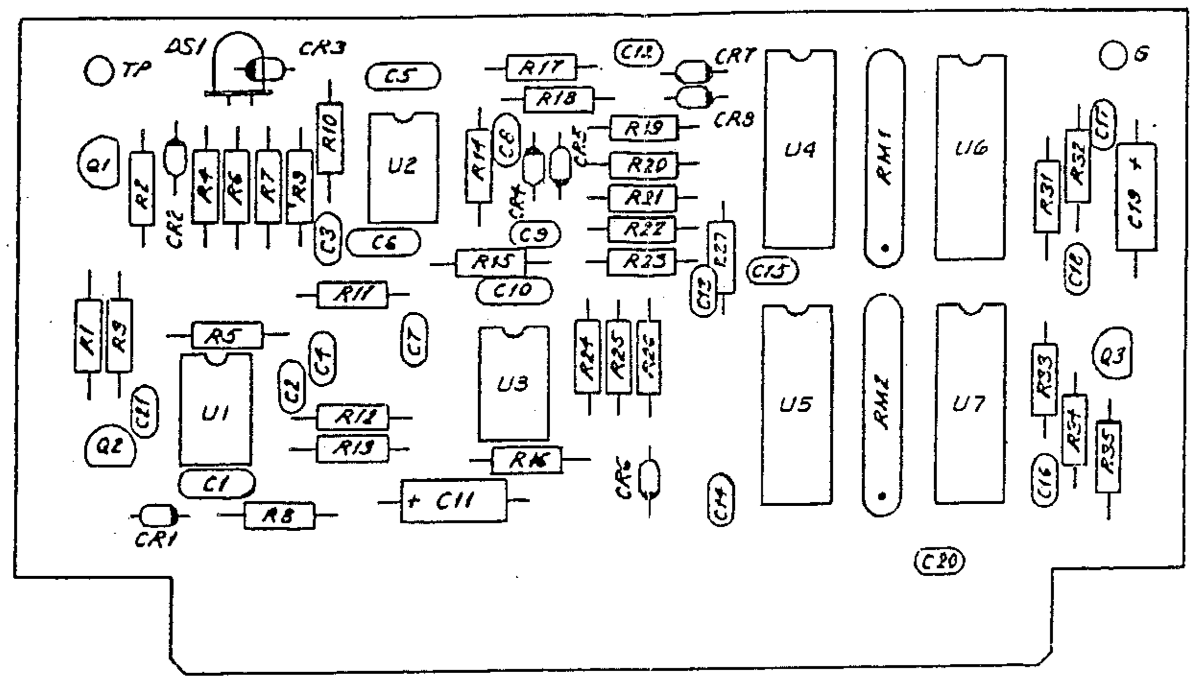
1- RESISTORS IN OHMS
2- CAPACITORS IN µF

Fixed LO PLL (A15)

ASSY# 101BA07401 Rev J

Sheet 2 of 2

7-A15-2



REFERENCE PHASE LOCK LOOP -- PC ASSY A16

This board contains a phase detector and a loop amplifier with an automatic switching circuit to accept an external reference and a divide by three circuit.

The phase/frequency detector, U4 operates at one of two reference frequencies, depending on the select output frequency. For frequencies below 8 GHz, the reference is 5 MHz. For frequencies above 8 GHz the reference is 1.667 MHz (5/3). The fixed L.O. PLL always operates at 5 MHz. The output from the sampler is the other input to the phase detector.

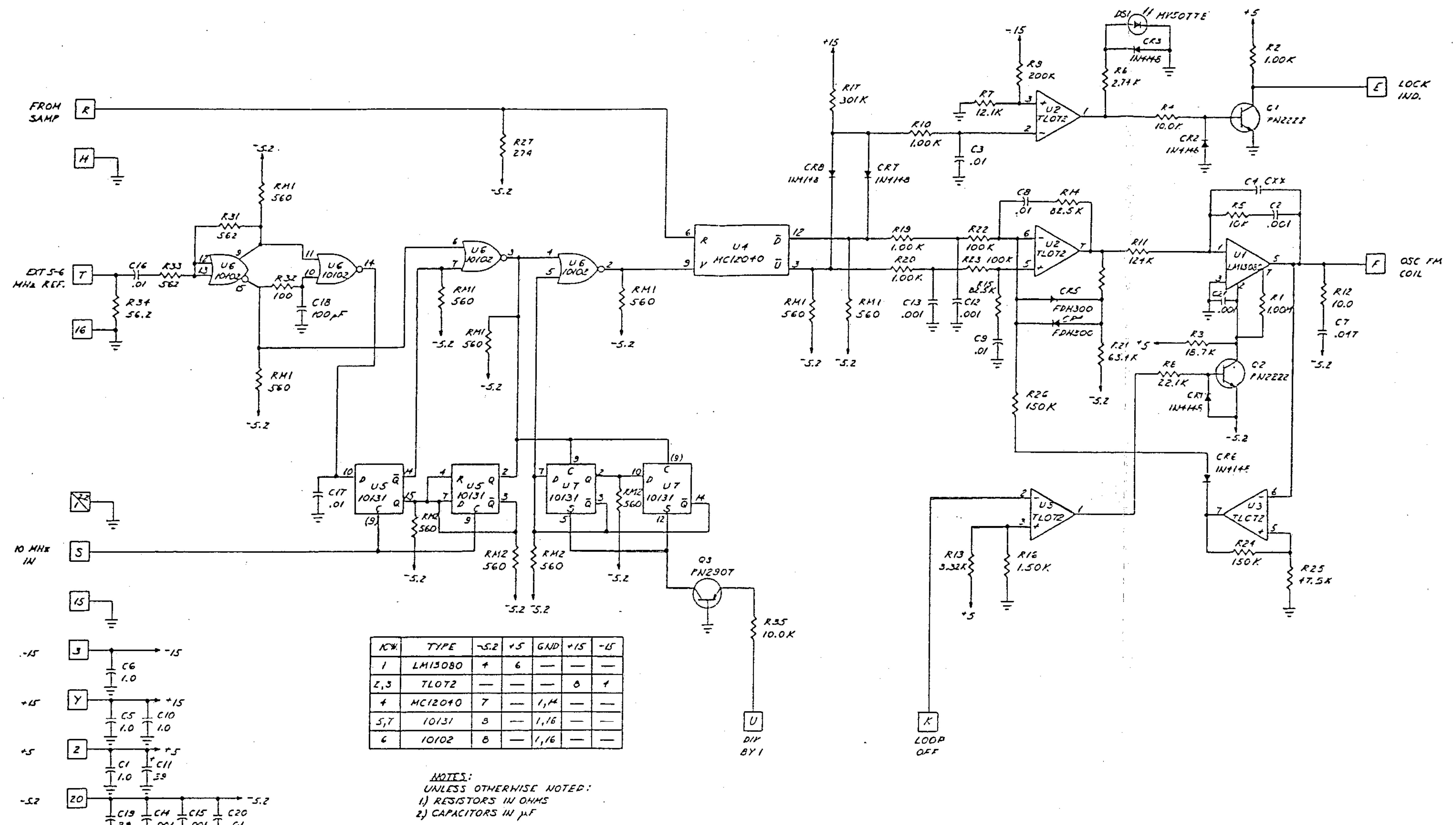
The outputs from the phase detector, filtered by R19-C12 and R20-C13 to reduce the reference frequency component, are applied to loop amplifiers U2-7 and U1. Compensation networks R14-C8, R15-C9, and R5-C2 provide proper rolloff to stabilize the loop. Diodes CR4 and CR5 with divider R18-R21 clamp the output of U2-7 to prevent saturation during search. The output stage of the loop amplifier, U1, has a shutdown provision controlled by U3-1 and Q2. With the signal on pin K low, Q2 is turned on to -5.2V thus enabling the amplifier in U1. Conversely, a high signal level on pin K turns the loop off.

Because the I.F. is small (5 MHz) compared to the dynamic range (40 MHz) it is possible for the system to have a proper I.F. but be on the wrong sideband. Proper operation calls for the oscillator to operate above the appropriate 100 MHz comb line. If lock is attempted with the oscillator below the comb line, the loop will latch up at the maximum positive control voltage. This condition will cause U3-7 to go low, forcing the loop control voltage ramps positive, it will cause the loop to acquire lock on the proper sideband.

When the phase/frequency detector inputs are not phase stable, one of the outputs will have wide pulses. Diodes CR7 and CR8 are used to detect the pulses. Resistor R10 and capacitor C3 filter the signal and apply it to comparator U2-1. When the unlock condition is detected, the comparator output is high, lighting DS1, turning on Q1 and therefore taking the lock detect line low.

The system 10 MHz clock on Pin S is divided by two by U5-2. The other half of U5 is used to switch from internal to external reference. When an external reference is connected to PIN T it is amplified by U6-9. U6-14 has a small delay in one input (R32-C18) thus its output will remain low when an input is present. This causes U5-15 Q to be low, turning off U5-2 and, via the low signal at U5-14, turn on U6-3.

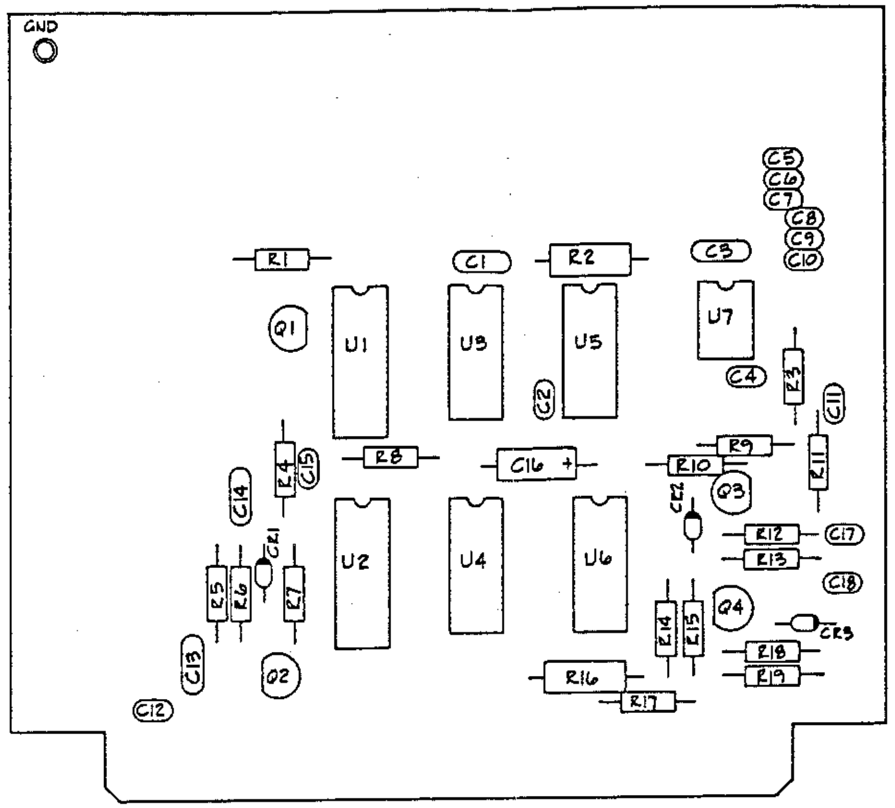
When the signal selected output frequency is over 8 GHz third harmonic mixing is used. This essentially triples the 1.9-8.7 GHz reference frequency. Therefore the loop must operate at 1/3 of 5 MHz. Divider U7 essentially operates to remove 2 pulses out of each 3 coming from either U6-3 or U5-2. This signal, at U6-2 is applied to the phase detector.



IC#	TYPE	-5.2	+5	GND	+15	-15
1	LM13080	4	6	—	—	—
2,3	TLO72	—	—	—	8	4
4	MC12040	7	—	1,14	—	—
5,7	10131	8	—	1,16	—	—
6	10102	8	—	1,16	—	—

NOTES:
UNLESS OTHERWISE NOTED:
1) RESISTORS IN OHMS
2) CAPACITORS IN µF

Reference PLL (A16)
ASSY# 101BA07402 Rev C
Sheet 2 of 2



Pulse Modulation (A17)

ASSY# 101CA06610 Rev A

Sheet 1 of 2

PULSE MODULATION CONTROL -- PC ASSY A17

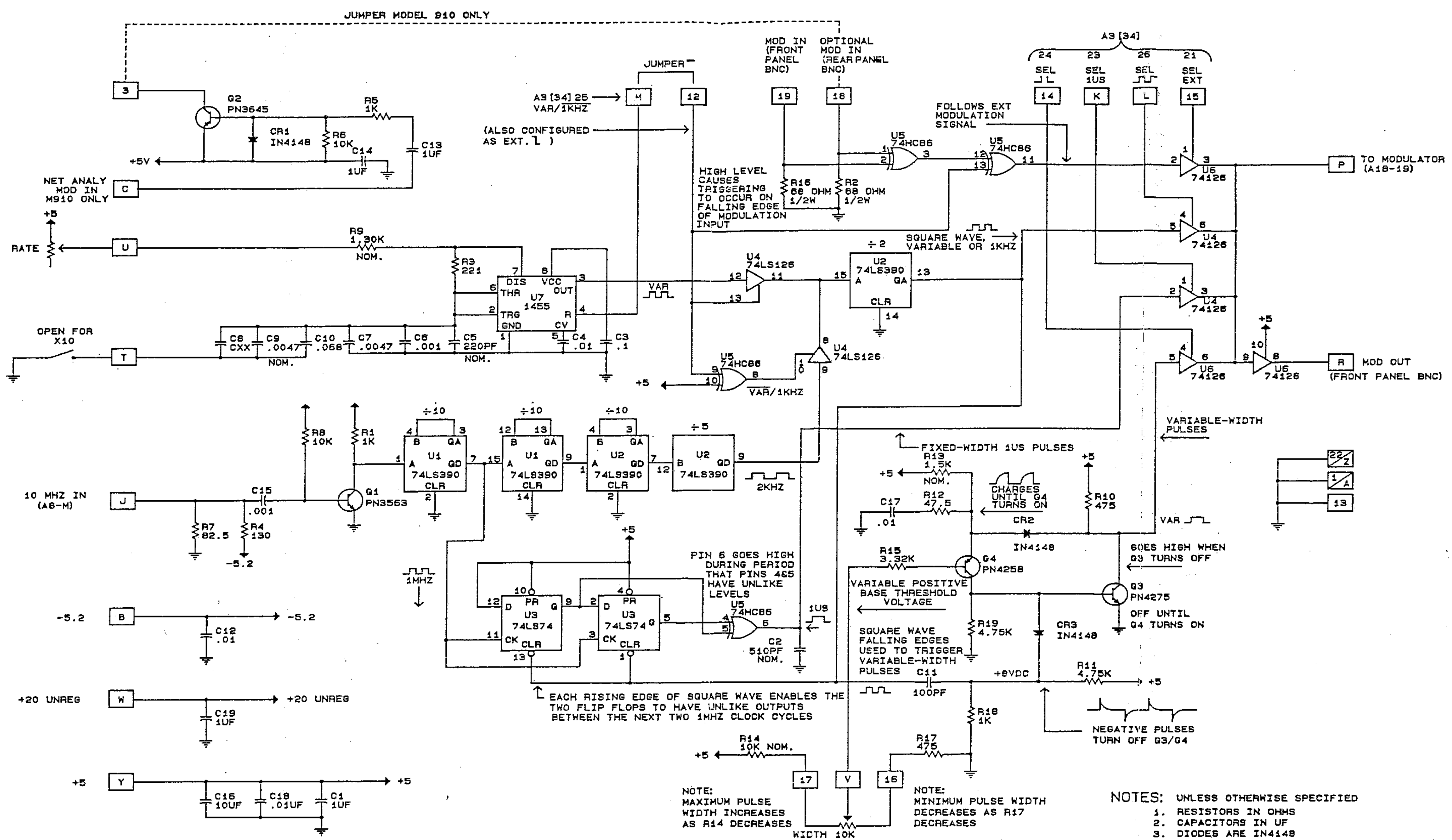
U7 is a timer configured as an astable multivibrator. Its frequency of oscillation is determined by the RC network consisting of C5 through C10, R3, R9 and the front panel 'RATE' potentiometer. When the 'X10' button is pressed, C8 through C10 are switched out of the RC network, reducing capacitance by a factor of 10 and increasing the frequency of oscillation by the same factor. Further adjustment is made possible by the 'RATE' pot. The multivibrator has a total range of 200 Hz to 100 kHz; its output is divided by two (see U5-13), yielding the desired range of 100 Hz to 50 kHz (actually divided into two ranges, depending on the position of the 'X10' button).

A 10 MHz, ECL-level signal is received at pin J and is converted by Q1 to TTL levels. The divider chain U1/U2 derives from this 10 MHz input two frequencies required by independent portions of this circuit. The 1 MHZ signal (U1-7) is used to generate fixed-width 1 microsecond pulses; the 2 kHz signal (U2-9) is used to generate a fixed-rate 1 kHz modulation waveform (after a further division by two, at U2-13). The VAR/1 kHz control line (received at pin M) is used to select either the variable rate generated by U10 or the fixed rate derived from the 10 MHz input.

The waveform at U5-13 is a square wave, and can be sent to the modulator in that form by enabling buffer U6-4. However, it also can be used as a trigger to generate pulses having the same rate as the square wave, but a variable duty cycle. The switching circuit consisting of Q4 and Q3 produces pulses of variable width; the start of the pulse is triggered by the falling edge of a pulse received from U2-13, and the end of the pulse is determined by the setting of the front panel 'WIDTH' potentiometer. This mode is selected by enabling buffer U6-4.

The square wave produced by U2-13 can also be used as a trigger to generate pulses having a fixed width of one microsecond. Two flip-flops (see U3) and an exclusive-OR gate (see U5-6) are used in combination to create the necessary one microsecond interval. The flip-flops use a fixed 1 MHz clock signal (received from U1-7) as a clock signal. The square wave output from U2-13 is applied to the clear inputs of both flip-flops. Each rising edge of the square wave input enables the flip-flops to have unlike outputs between the next two clock cycles (that is, for a 1 microsecond interval). The exclusive-OR gate produces a high output during that interval. This mode is selected by enabling buffer U4-1.

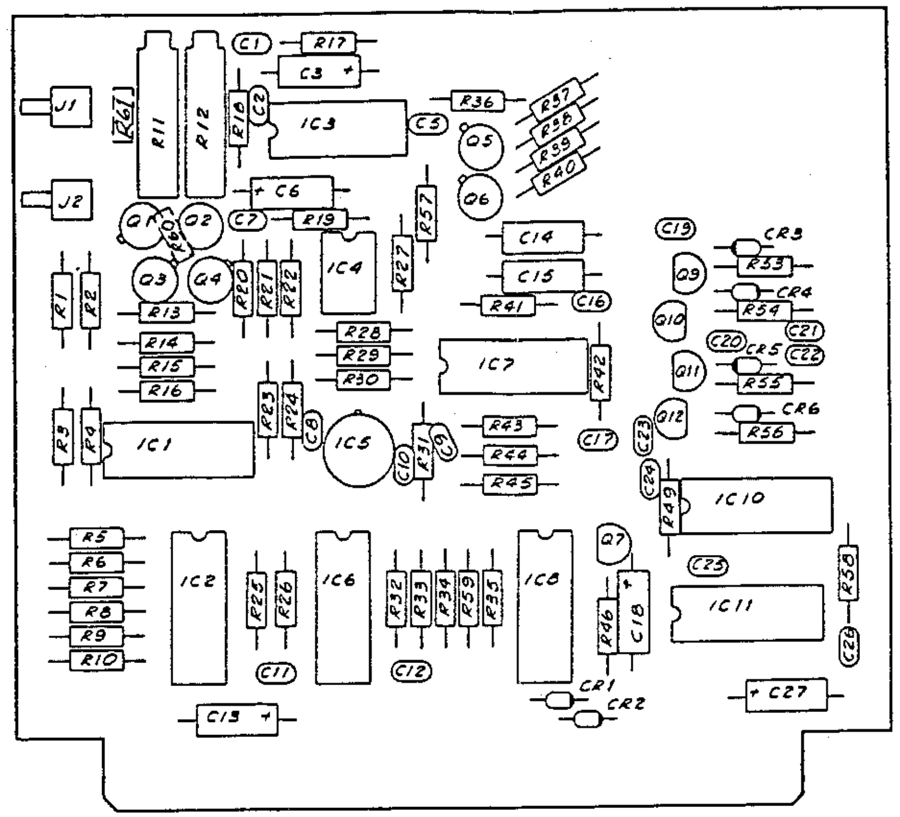
An external modulation signal may be applied to the front panel input connector (or the rear panel connector, if one is installed). The external input is received at pin 19 (or 18). The exclusive-OR gate U5-11 is used to select falling-edge or rising-edge triggering, depending on the level supplied through pin 12 to U5-13. The resulting modulation signal is supplied through U6-3 to the modulator. This mode is enabled by enabling buffer U6-1.



Pulse Modulation (A17)

ASSY# 101CA06610 Rev A

Sheet 2 of 2



LEVELING SAMPLER -- PC ASSY A18

This circuit provides amplification of the leveling detector in both the CW and pulsed modes of operation. It also provides gain and offset adjustment for the two detectors.

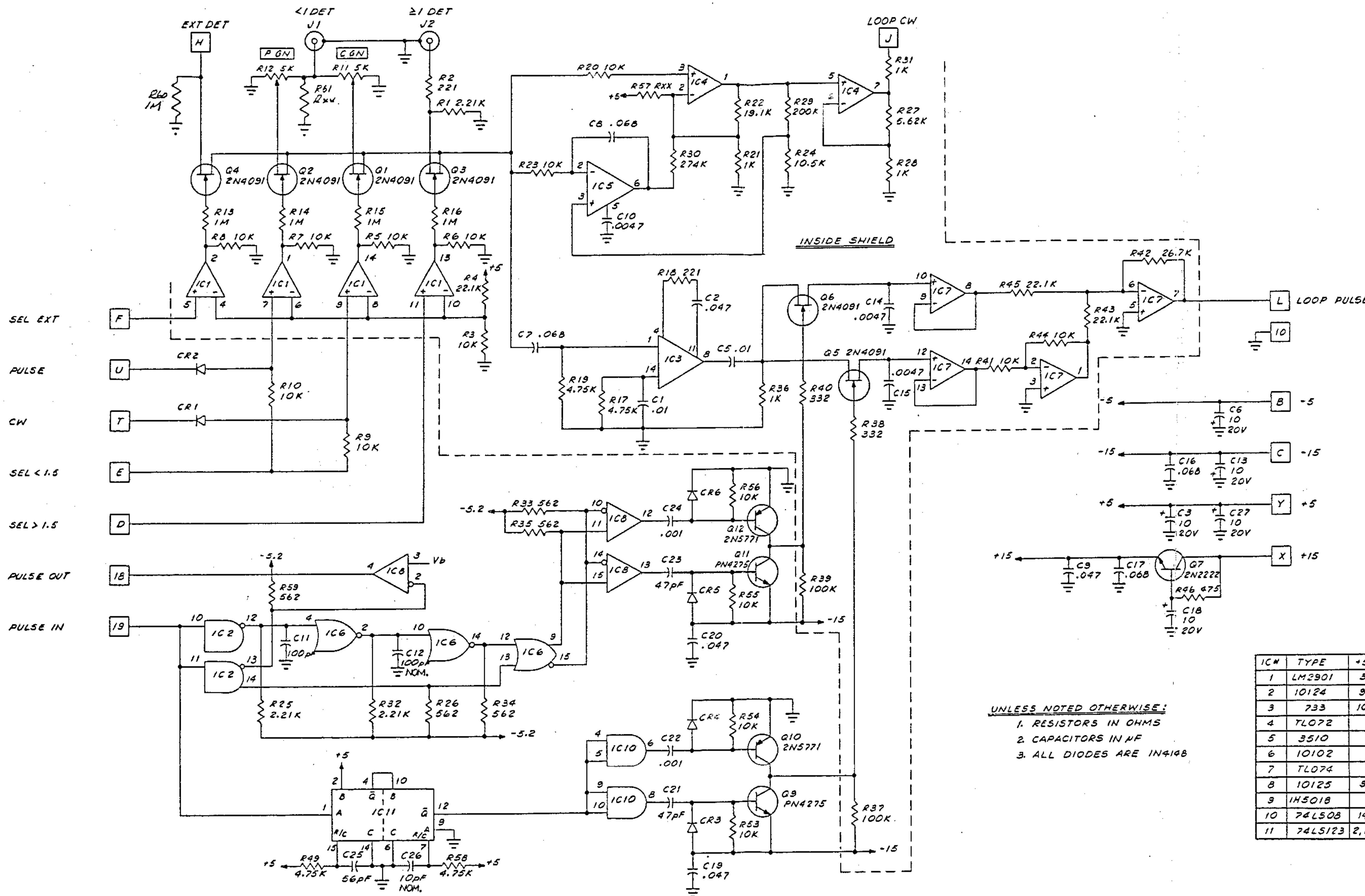
The detector switching section is comprised of four FET switches and their drivers. The external detector, the .1 to 1 GHz detector and the 1 to 26.5 GHz detector are selected via FETS Q1, Q2, Q3, and Q4. Each FET is driven by one part of IC1. This IC translates the TTL logic level to the -15V (off) and open circuit (on), levels required. The 1 to 26.5 GHz detector has about 10% attenuation (R1, R2) to allow the GHz gain adjust (R11, R12) sufficient dynamic range.

When operating in the CW mode (or with external ALC) a D.C. coupled amplifier IC4 and IC5 is used to provide detector amplification. IC4 provides high speed, with IC5 giving DC stabilization.

The pulse (or squarewave) modulation mode requires a sampling system to produce the required DC level. In order to obtain sufficient gain while maintaining the pulse shape a video amplifier (IC3), operating AC coupled is used. The output of the amplifier is fed to two sampling gates (Q5 and Q6). IC2 and IC6 provide a delay in the modulating signal to allow the sampling pulse produced by IC8, Q11 and Q12 to occur just prior to the pulse edge. IC11, IC10, Q9, and Q12 provide a pulse just following the pulse edge.

Amplifier IC7 has two sections used as high impedance buffers for the sampling capacitors, the remaining to further amplify and combine the pulse and reference samples to yield a DC level proportional to the peak to peak pulse value.

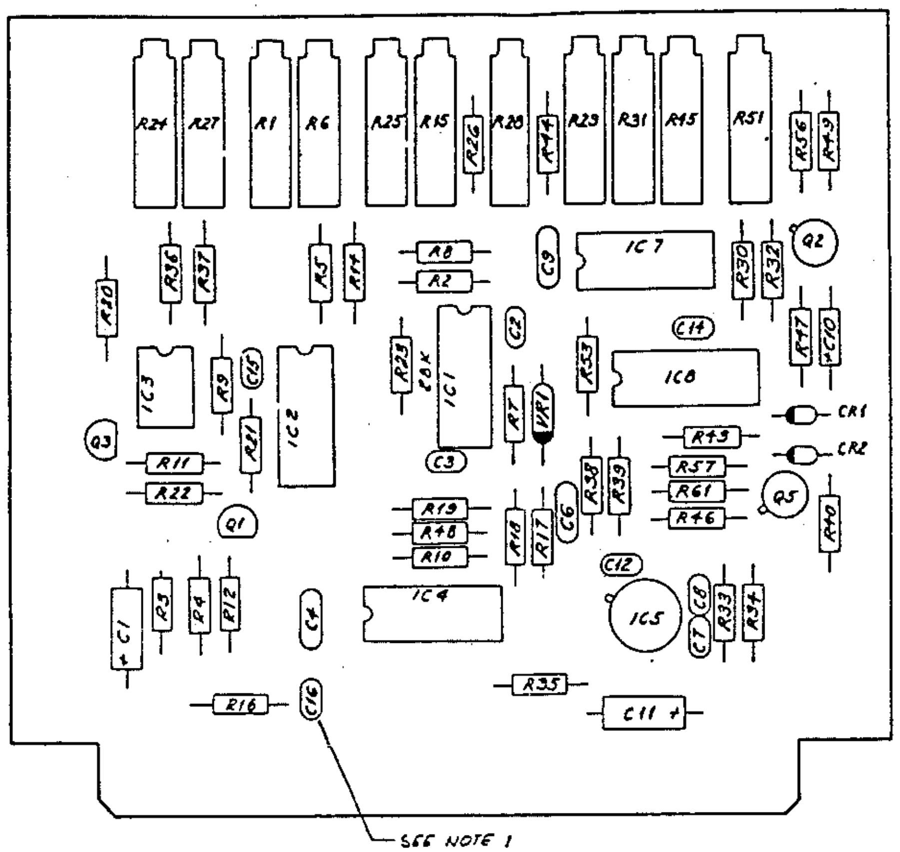
Leveling Sampler (A18)
ASSY# 101CA25500 Rev K
Sheet 1 of 2



UNLESS NOTED OTHERWISE:
1. RESISTORS IN OHMS
2. CAPACITORS IN μF
3. ALL DIODES ARE IN4148

IC#	TYPE	+5	-5	GND	+15	-15
1	LM2901	3				12
2	10124	9	8	16		
3	733	10	5			
4	TL072				8	4
5	3510				7	4
6	10102		8	1,16		
7	TL074				4	11
8	10125	9	8	16		
9	IH5018					
10	74LS08	14		7		
11	74LS123	2,16		8		

Leveling Sampler (A18)
ASSY# 101CA25500 Rev K
Sheet 2 of 2
7-A18-2



NOTES:

1. INSTALL IN UNITS WITHOUT AM
2. PCB TO BE LABELLED 101CA25600 REV. I
3. RESISTOR VALUES ARE IN OHMS.
4. CAPACITOR VALUES ARE IN µF.
5. SEE SEPARATE PARTS LIST NUMBER 101CA25600 REV. I.

Leveling Log Amp (A19)

ASSY# 101CA25600 Rev I

Sheet 1 of 2

LEVELING LOG AMPLIFIERS -- PC ASSY A19

GENERAL

This board includes two logarithmic amplifiers which are used to change the amplified signal from a detector to be linear in dB; one log amp conditions the CW and PULSE detector outputs from the leveling sampler board (A18) and one conditions the signal from the power meter input detector (after preliminary amplification at IC5 and IC8). A number of potentiometers permit gain and offset calibration. The system computer acts to compensate for the nonlinearity of detector response at higher power levels, but this correction is implemented elsewhere (see the AM Level Control circuit board, A7).

LEVELING SYSTEM

The CW and PULSE detector signals from the leveling sampler board are received at pins J and D, conditioned by the gain and offset pots, and applied to inputs of the analog switch IC2. The other two inputs to the switch are offset voltages for External ALC (received at pin E) and for the low-frequency detector (received from IC3, another analog switch). More than one input to the switch can be active at once; the control lines at pins 5, F, 8 and 4 select the appropriate combination of inputs depending on whether the mode of operation is CW or pulse, internal ALC or external, high frequency or low (the transition between detectors occurs at 1.5 GHz).

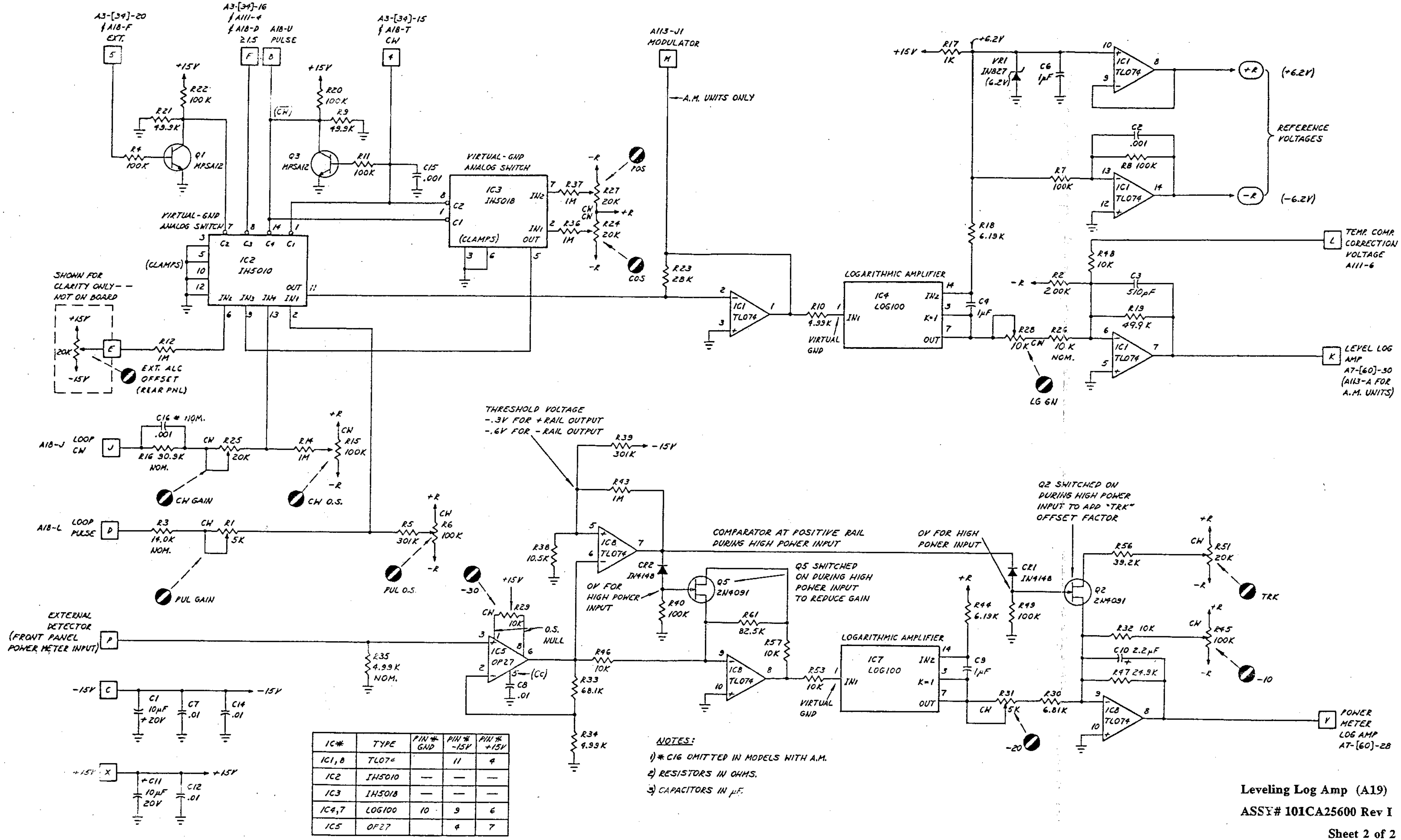
The common output of IC2 is applied to the inverting input at IC1-2 (in units with AM, a modulation signal from pin H is introduced at this point). The amplified and inverted signal (a positive voltage increasing with power) is applied to the input of the log amp IC4 through R10. The output of the log amp is a negative voltage which decreases as detected power increases.

Log amp gain is calibrated by R28. The output amplifier's input junction (IC1-6) sums the log amp output, a correction voltage from the detector temperature compensation board (A111), and a negative voltage reference. The output to the A7 board is a positive voltage, decreasing as detected power increases. The +6.2 V reference used by the log amplifier (see VR1) is buffered by IC1-8 and IC1-14 to produce reference voltages of +6.2V and -6.2V ("+R" and "-R") for use by the offset adjustment circuits.

POWER METER SYSTEM

The signal received at pin P comes directly from the external power detector. In order to work over its 40 dB range, the log amp needs extra input gain when input power is low; this keeps the low-level voltage supplied to the log amp from being drowned by noise. Of course, a compensating factor is needed at the output, so that the extra gain (added only at low input levels) does not distort the meter's overall power response.

The detector signal is applied to a low-drift amplifier (IC5); pot R29, placed across the nulling pins of the amplifier, is used to calibrate the meter at the lowest input levels. The output (a negative voltage increasing with input power) goes to the input at IC8-9, and also is sent to the comparator input IC8-6. For power below a certain threshold, the comparator output goes negative to turn off Q5, increasing the gain of the input amplifier to the log amp. The transition varies with detectors; speaking very roughly, it is near -8 dBm. The input to the log amp (through R53) is a positive voltage increasing with input power; the output is a negative voltage decreasing as power increases. A gain pot (R31) and an offset reference (see R45) are used to calibrate the output, which is a positve voltage decreasing as power increases. In the low-gain mode, when input power is higher, Q2 is turned on by the comparator, adding the "TRK" offset voltage to the summing junction at IC8-9. This factor makes up for the loss of gain at the input stage.



IC#	TYPE	PIN # GND	PIN # -15V	PIN # +15V
IC1,8	TL074		11	4
IC2	IH5010	—	—	—
IC3	IH5018	—	—	—
IC4,7	LOG100	10	9	6
IC5	OP27		4	7

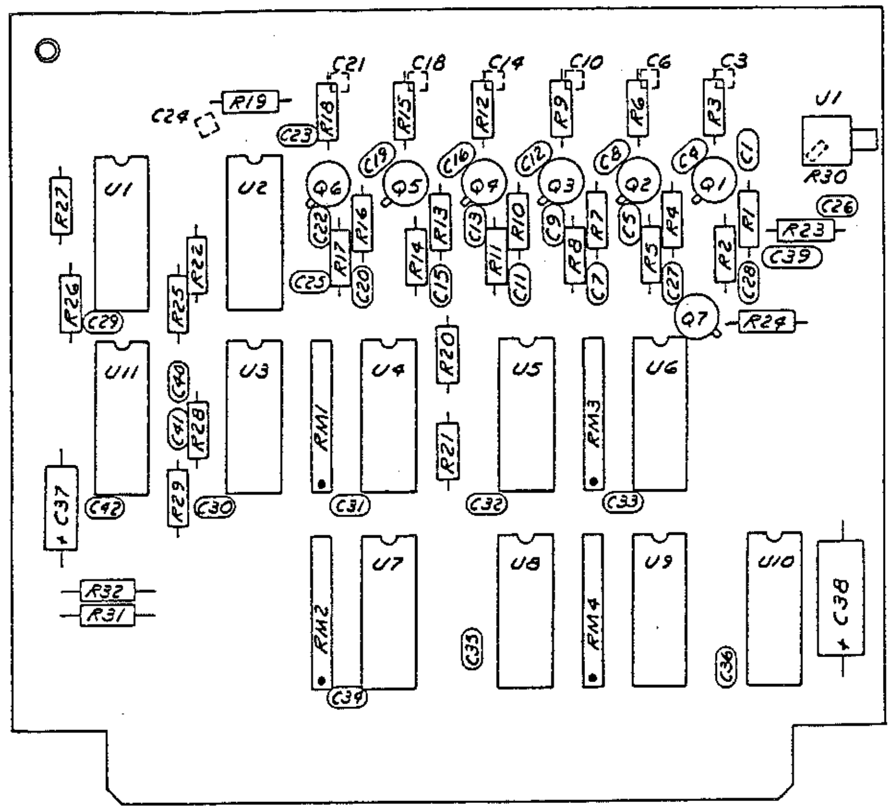
NOTES:

1) * C16 OMITTED IN MODELS WITH A.M.
2) RESISTORS IN OHMS.
3) CAPACITORS IN μF.

Leveling Log Amp (A19)

ASSY# 101CA25600 Rev I

Sheet 2 of 2



DIVIDE-BY-N -- PC ASSY A20

This circuit is a programmable frequency divider. It is set by the computer with a divisor between 95 and 395. Its frequency input is the 95 to 395 MHz I.F. from the reference mixer. The divided I.F. is supplied to the output phase lock loop and should be exactly 1 MHz when the output loop is locked. A six stage limiting amplifier is used to provide enough gain throughout the operating frequency range to drive the Mod-8/9 counter (IC2). Q1 through Q6 are the gain components; Q7 is a bias regulator.

In the discussion of the divider circuit, terms are defined as follows: "I.F. cycles" refers to the amplified I.F. from the reference mixer, which is used as a timing clock by the Mod 8/9 counter; "clock cycles" refers to the output of the Mod 8/9 counter, IC2-8, which is used as a timing clock by the three-bit and six-bit counters; "division cycles" refers to the output signal, IC1-14, which should have a rate of 1 MHz when the loop is locked. I.F. cycles are the fastest of the three; division cycles are the slowest.

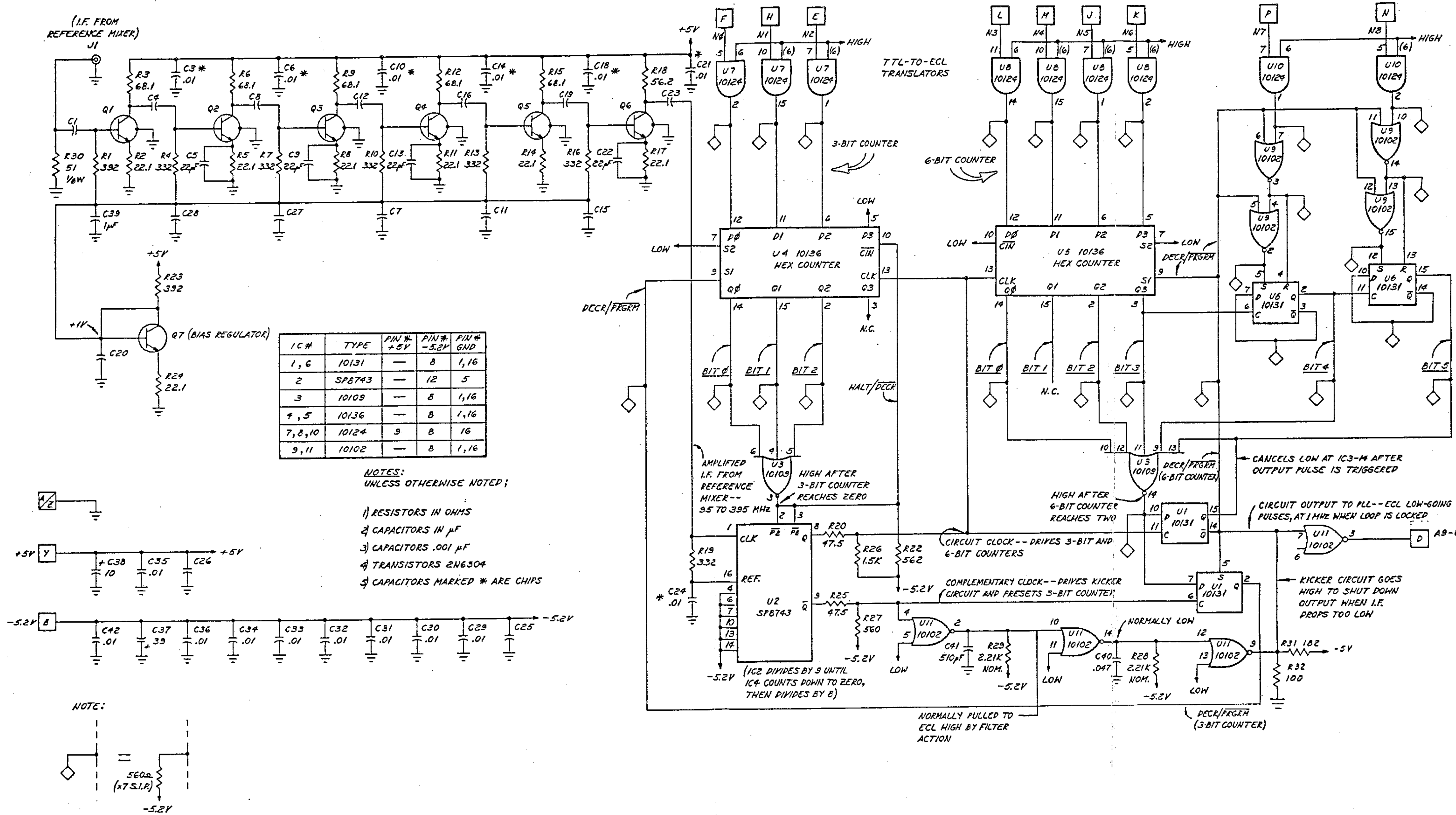
The divisor selected by the computer is supplied as a nine-bit binary number at TTL levels to the 10124 translators (ICs 7, 8, and 10), which convert the bits to ECL levels. Bits 0, 1 and 2 control the three-bit counter (IC4) and Bits 3 through 8 control the six-bit counter consisting of ICs 5, 6 and 9. These two counters operate independently, but they use the same timing clock and they count down simultaneously.

The outputs of the three-bit counter IC4, by way of gate IC3, program the Mod-8/9 counter IC2; while IC4 is counting down, IC2 divides the I.F. by 9, and after IC4 has counted down to zero, IC2 divides the I.F. by 8. In the case of most divisors, it is necessary for the I.F. to be divided by 9 for some portion of the division cycle; only when the three lowest bits are all zero is IC2 programmed as a Mod-8 counter throughout the division cycle (a situation which can only occur if the divisor itself happens to be an even multiple of eight). Whenever it reaches zero, IC4 stops counting until it is preset at the next division cycle.

The six-bit counter (IC5/IC6) continues counting down after IC4 has reached zero and IC2 has entered the Mod-8 phase of the division cycle. The lowest number it ever counts down from is 11, (binary 001011) whereas the highest number the three-bit counter ever counts down from is 7 (binary 111); therefore the three-bit counter always finishes first. When the six-bit counter has completed its count, gate IC3-14 goes high; this line, applied to the 'D' inputs of IC1, allows IC1-14 to go low (this represents the falling edge of the output waveform) on the next clock transistion; the output is also used to preset the six-bit counter. The three-bit counter is preset by IC1-2; this transition occurs a half-cycle later than for the other counter because IC1-2, unlike IC1-15, is triggered by the complement of the divider circuit's clock (IC2-9). The delays involved in driving the output low, presetting the counters, and triggering them to count down again result in the addition of two clock cycles to the division cycle--that is, IC2 will perform two extra divisions by 8 before the next division cycle can begin. To compensate for this, IC5's Q1 output is not connected to the OR gate IC3-14; the six-bit counter counts down only to two, not to zero, before sending to IC1 the high level that initiates the output transition and presets the counters. The duration of the output low pulse is one clock cycle, which is equal to eight I.F. cycles; because the I.F. is variable, the width of the low pulse varies (between about .02 and .08 microseconds).

EXAMPLE: When the divisor is to be 195 (this occurs when the I.F. is 195 MHz), the translators are programmed with the binary equivalent of 195 (011000011). This breaks down as 3 for the three-bit counter (binary 011) and 24 for the six-bit counter (binary 011000). For the first three clock cycles IC2 divides the I.F. by 9, for a total of 3 X 9 = 27 I.F. cycles. The three-bit counter then reaches zero and programs IC2 to divide by 8 for the remaining clock cycles (21, since three of the six-bit counter's 24 cycles have already been counted simultaneously with the other counter). After 21 X 8 = 168 further I.F. cycles (bringing the total counted so far to 195) the low-going pulse of the output waveform occurs, the counters are preset and the division cycle recommences. Of course, to compensate for the cycles added by delay in presetting the counters, the six-bit counter actually stopped early by 2 clock cycles (2 X 8 = 16 I.F. cycles); the high level at IC3-14 occurs two clock cycles before the beginning of the next division cycle because two clock pulses are need to intiate that division cycle. Since 195 I.F. cycles occurred during one division cycle, the circuit has divided the input frequency by 195.

The OR gate IC11 and four passive components are used to shut down the output of the circuit under conditions that would interfere with normal operation of the phase lock loop. Under normal conditions, with an I.F. input in the 95-395 MHz range, the clock frequency applied to IC11-4 will be above 10 MHz. The filter components between the three gates produce a low at IC11-12, and the third gate does not interfere with the circuit output frequency. If the I.F. drops substantially below the normal range, however, and the clock frequency at IC11-4 falls well below 10 MHz, the filter action will not be sufficient to have the same effect; IC11-9 will go to an ECL high, preventing any waveform from reaching the phase lock loop. The reason for this precaution is that the Mod 8/9 counter responds erratically to frequencies below its intended range, and could prevent the PLL circuit from recovering phase-lock when the output frequency is too low. When the output waveform has been shut down, the PLL circuit reacts by "kicking" the output frequency to a higher value; this forces the I.F. to a higher frequency within the range of the divider circuit. After the I.F. has been forced higher, the "kicker" circuit again allows the output frequency to reach the PLL.

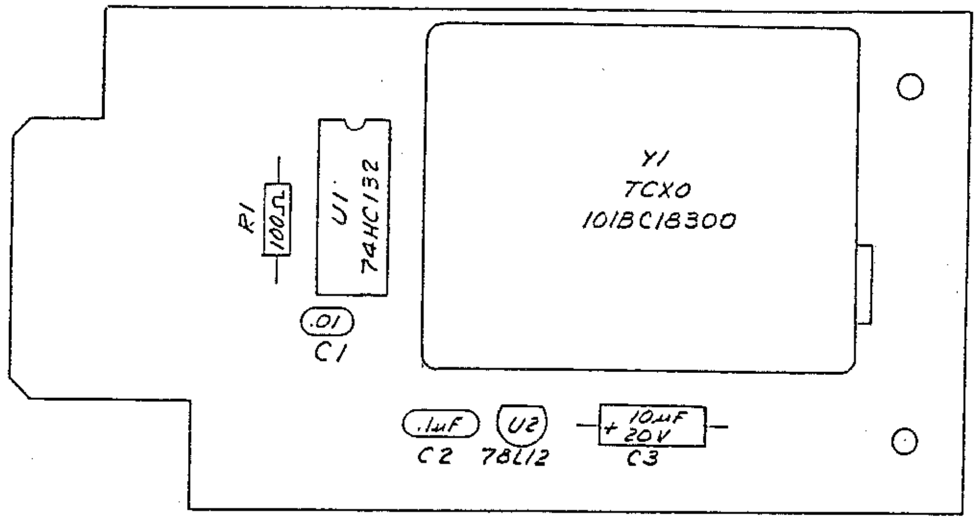


IC #	TYPE	PIN # +5V	PIN # -5.2V	PIN # GND
1, 6	10131	—	8	1, 16
2	SP8743	—	12	5
3	10109	—	8	1, 16
4, 5	10136	—	8	1, 16
7, 8, 10	10124	9	8	16
9, 11	10102	—	8	1, 16

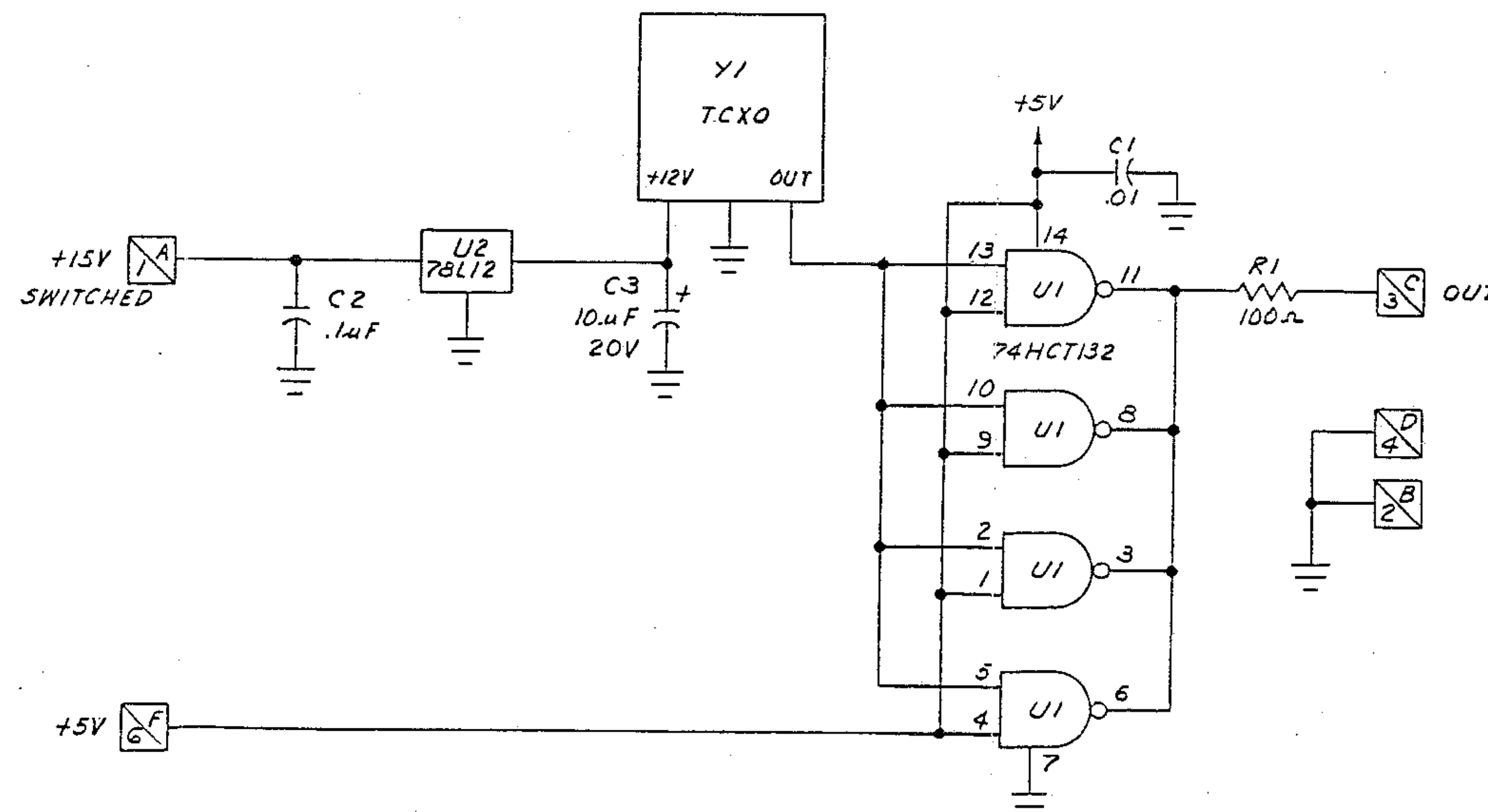
NOTES:
UNLESS OTHERWISE NOTED;

1) RESISTORS IN OHMS
2) CAPACITORS IN µF
3) CAPACITORS .001 µF
4) TRANSISTORS 2N6304
5) CAPACITORS MARKED * ARE CHIPS

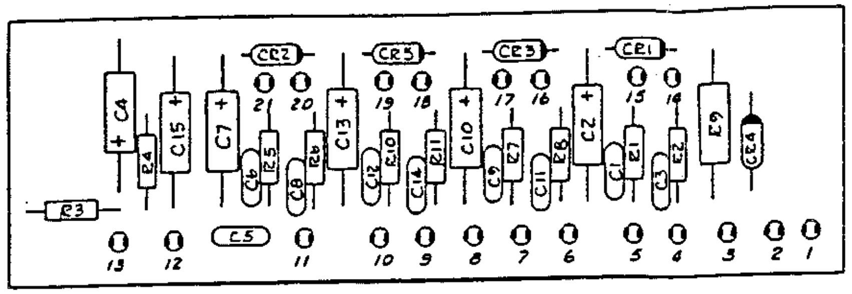
Divide-by-N (A20)
ASSY# 101CA06300 Rev M



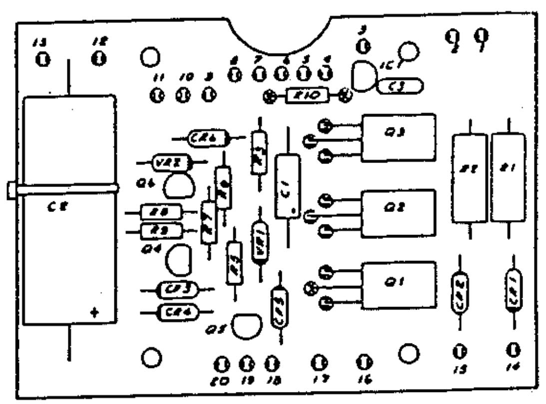
NOTES: UNLESS OTHERWISE SPECIFIED
1.) CAPACITOR VALUES IN uF
2.) RESISTOR VALUES IN OHMS



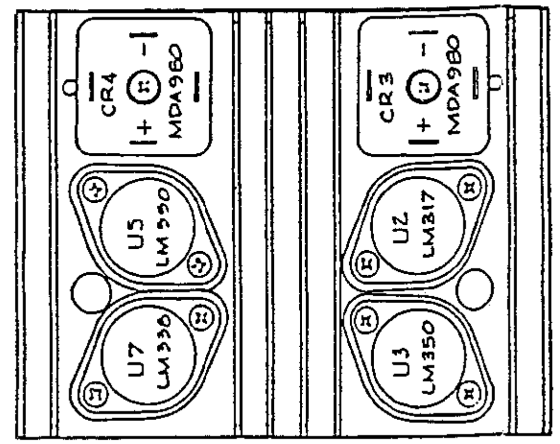
TCXO (A32)
ASSY# 101BA09702 Rev B
Sheet 1 of 1
7-A32-1



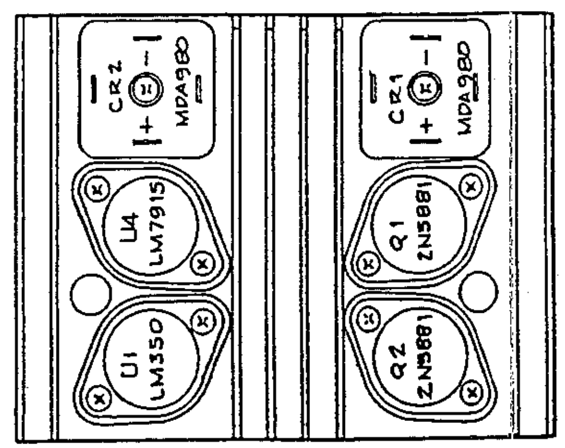
A101



A102



HEATSINK ASSY



POWER SUPPLY -- PC ASSEMBLIES A101 and A102

GENERAL

A variety of regulated and unregulated voltages are produced by the power supply, which uses a conventional transformer/rectifier/filter/regulator approach; the output voltages are electronically switched. To provide adequate heat dissipation, all high power components are located on finned heat sinks and cooled by the direct exhaust of a fan. The fan is powered by a DC motor connected to the unregulated +20V supply; its speed increases with line voltage but is independent of line frequency. A switch increases fan speed when the instrument's top cover is in place.

The power transformer primary is connected directly to the line through filter/voltage-selector/fuse holder LF1. The transformer is always energized when the unit is plugged in. Rectifiers CR1 through CR4, and capacitors C1 through C8, furnish the unregulated voltages for the majority of the power supply. Thermal switch S1, mounted on the heatsink, acts as a high temperature safety.

POWER SUPPLY CIRCUIT BOARD A102

This board is mounted outside the heat sink and is used to generate two unregulated outputs and three regulated outputs. A positive rectified voltage is received at pin 17 (from CR1+) and applied to the emitter of Q1. The collector supplies the output to pin 16; this is the unregulated "+20V" supply (in practice, usually nearer +30V). The base diode CR1 is used to switch the supply: when the power switch is in the "on" position it ties CR1's cathode (A102-14) to the -1.6V supply, forward-biasing both it and Q1. The unregulated -15V supply is similar; a negative rectified voltage is received at A102-2 (from CR2-) and applied to the emitter of Q2. The collector supplies the -15V output to A102-1. The base diode CR2 switches the supply: with the power switch "on" CR2's anode (A102-15) is tied to ground, forward-biasing both it and Q2.

The -1.6V supply is used solely to switch other supplies. Regulator IC1 takes a negative rectified voltage at A102-4 (from CR3-), and produces a -5V output; the circuit including Q3, R3 and R10 reduces this to a -1.6V supply on its collector (see A102-5 and -6). A zener diode (VR1) limits the ouput voltage.

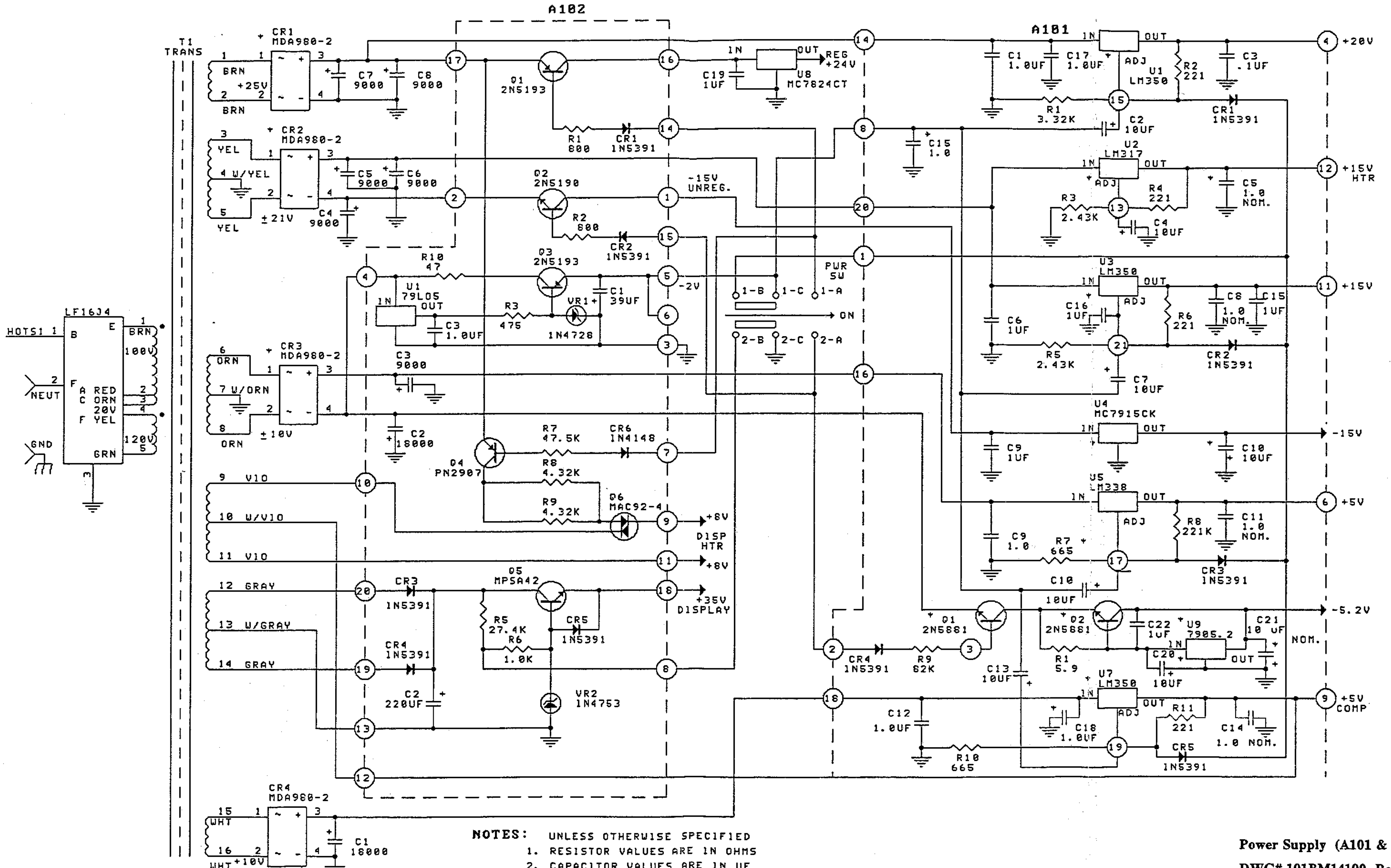
The two remaining supplies on this board are used by the fluorescent displays. The display heater voltage is an 8V (RMS) AC supply taken directly from a center-tapped secondary transformer winding. A +5V DC component is applied to the tap (see A102-12; the voltage comes from the Computer +5V supply). Triac Q6 switches the supply; the circuit including Q4 and CR6 turns the supply on by applying a positive voltage to the gate of the triac when the power switch connects the -1.6V supply to the cathode of CR6, forward-biasing it. The heater voltage appears at A102-9 and -11. The other supply needed by the fluorescent displays is the +35V output at the emitter of Q5 (A102-18). An AC voltage from a transformer secondary is rectified by CR3 and CR4, filtered by C2 and regulated by zener diode VR2 and applied to the base of the transistor. The supply is shut off when the power switch applies a ground to the junction of R5 and R6 (see A102-8).

POWER SUPPLY CIRCUIT BOARD A101

This board is mounted inside the heat sink and includes the components connected to the high power regulators. At A101-1, the -1.6V supply is furnished to the board whenever the power switch is in the off position. Through diodes CR1, CR2, CR3 and CR5, this negative voltage is applied to the adjust pins of regulators IC1 (+20V), IC3 (+15V), IC5 (+5V), and IC7 (Computer +5V), shutting them off. IC2 (Heater +15V) is not furnished with this control voltage because it's output must be active whenever the instrument is plugged in (it warms the 100 MHz oscillator). The output voltages of these positive regulators are determined by simple resistor networks. Filter capacitors between the adjust pins and the -1.6V supply take noise on the positive supplies "below ground".

IC6 produces a -5.2V supply required for ECL logic. Its input comes from Q1's collector; the negative voltage applied to Q1's emitter comes from rectifier CR3- (see A102-4). The supply is switched on by applying a ground to the cathode of CR4 (at A101-2), forward-biasing it and Q1.

The output of IC4 is the -15V supply; the input to the regulator is the unregulated -15V output from A102-1, switched as described above.



NOTES: UNLESS OTHERWISE SPECIFIED

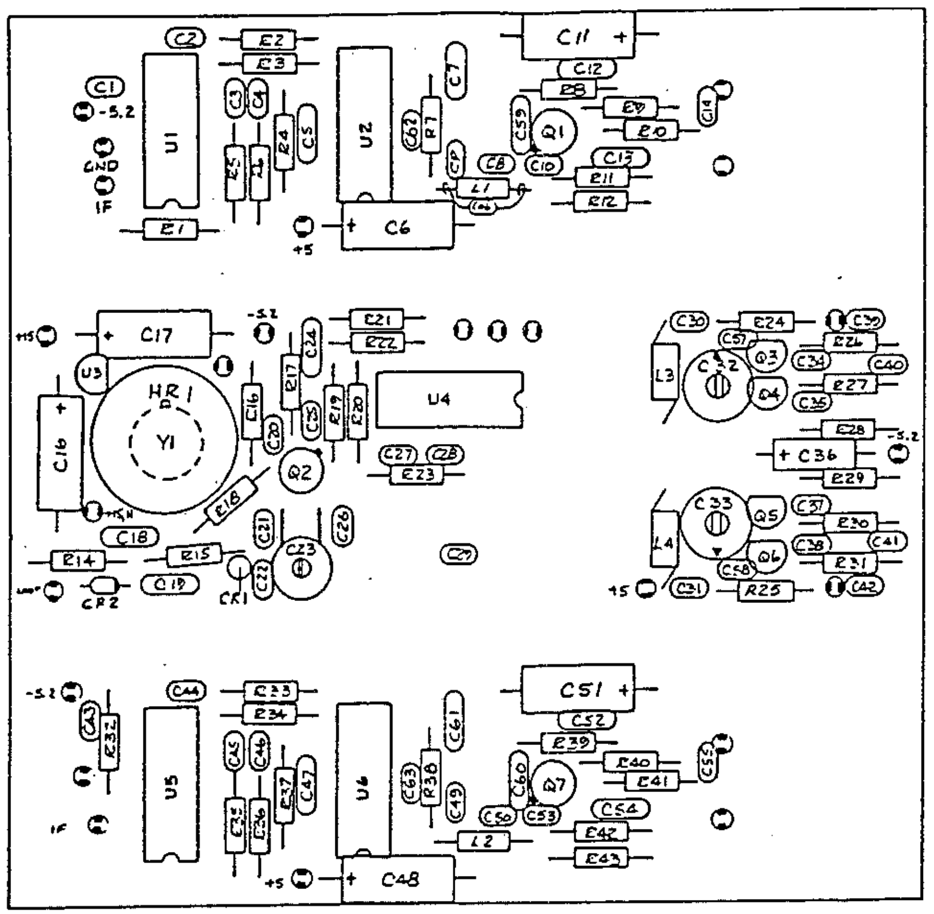
1. RESISTOR VALUES ARE IN OHMS
2. CAPACITOR VALUES ARE IN UF
3. * INDICATES PART OF HEATSINK ASSY

Power Supply (A101 & A102)

DWG# 101BM14100 Rev L

Sheet 2 of 2

7-A101-2



100 MHz Reference Osc (A103)

ASSY# 101CA04200 Rev R

Sheet 1 of 3

7-A103-1

100 MHz OSCILLATOR/SAMPLER DRIVER -- PC ASSY A103

GENERAL

This module includes a 100 MHz Voltage Controlled Crystal Oscillator that is used to drive the sampling mixers, and two identical amplifier circuits that are used to increase the low level IF from those mixers to ECL voltage levels.

100 MHz OSCILLATOR

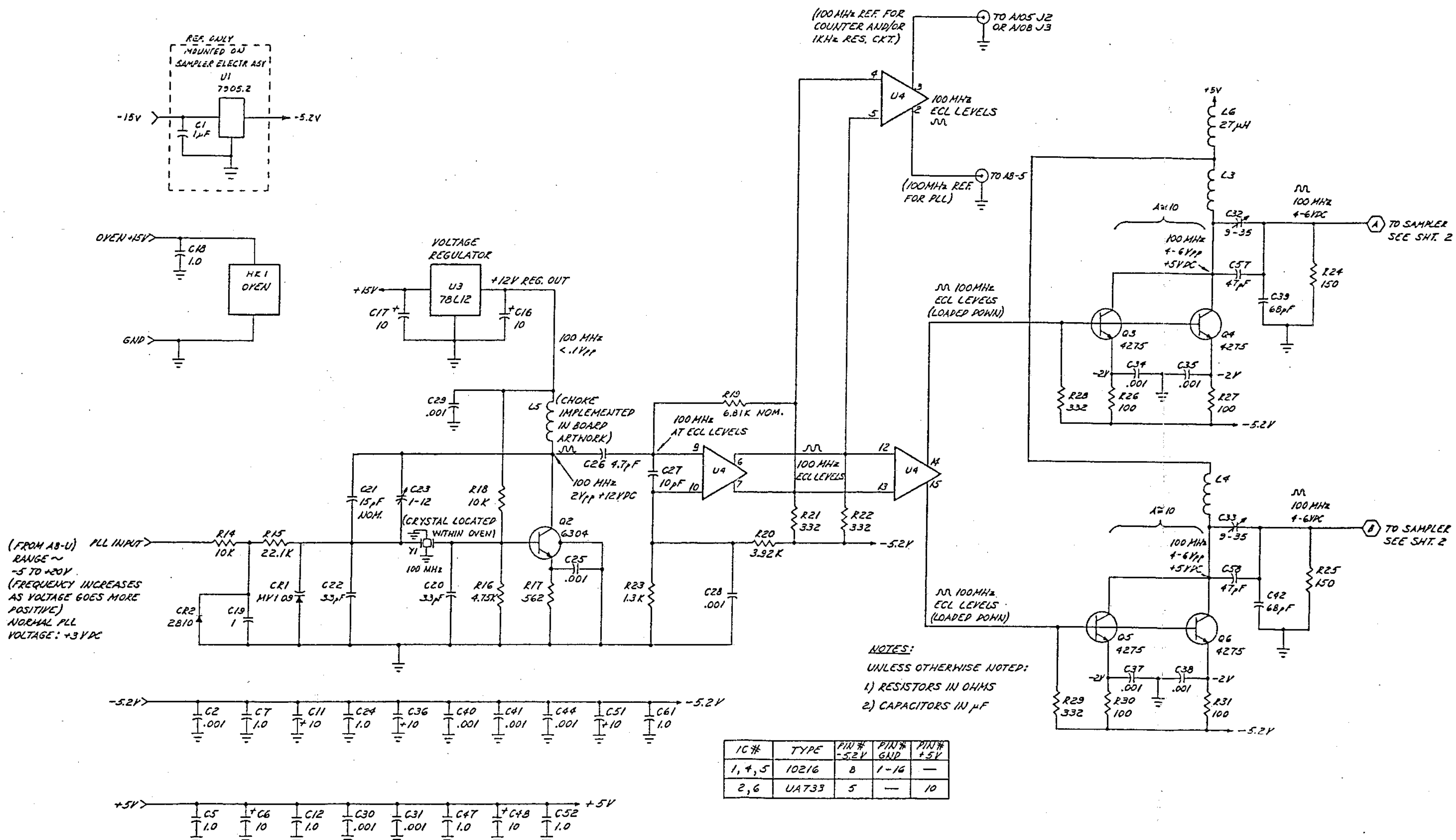
Transistor Q2, regulated by crystal Y-1, oscillates at a frequency very near 100 MHz. This frequency can be varied slightly by changing the Phase Lock Loop input voltage (and thus changing the capacitance of tuning diode CR1). This variation permits the oscillator to be phase-locked to the Master Reference. In order to bring the oscillator frequency within the relatively narrow adjustment range of the PLL circuit, nominal capacitor C21 is selected during production test, and variable capacitor C23 is adjusted during calibration. With the circuit correctly set up, the 100 MHz loop should become locked with a PLL voltage of +3V DC (this voltage is most easily measured at the Test Point on PC Assy A8, the 100 MHz PLL). Buffer IC4 produces four 100 MHz outputs; two are used to drive the sampling mixers, one returns to the 100 MHz PLL, and one is used to supply a stable 100 MHz reference to the Frequency Counter and/or the 10-12 MHz PLL (1 kHz Resolution Circuit), if installed.

SAMPLER DRIVE

The twin amplifier circuits (Q3-Q4 and Q5-Q6) are used to supply a large (4-6 Vpp) 100 MHz signal to the sampling mixers. Variable capacitors C32 and C33 are used for peaking this signal. The sampling mixers include a step-recovery diode multiplier, which produces numerous harmonics of the 100 MHz input. The RF input to the sampler is mixed with these high frequencies, one of which will be near enough to it in frequency to create an IF that is within the bandwidth of the Sampler IF Amplifier. Example: For an RF input to the sampler of 6905 MHz, the sampler will mix the 69th harmonic of 100 MHz (6900 MHz) with the RF input and produce a 5 MHz IF output.

SAMPLER IF AMPLIFIER

The twin amplifier circuits (Q1-U2-U1 and Q7-U6-U5) convert the low level IF produced by the samplers to ECL-level signals. Between the transistor amplifier stage and the video amplifier (IC2/IC6) is a low-pass filter that limits the bandwidth to 50 MHz, in order to block undesired high frequencies produced by the mixer. Low frequency noise is blocked by capacitors C62 and C63. The buffers (IC1/IC5) convert the IF to an ECL-level signal for use by the Reference and Fixed L.O. PLL circuits. Typically, this IF is 5 MHz; for output frequencies above 7999 MHz or below 2000 MHz, the Reference Sampler's IF will be 1.667 MHz.



NOTES:

UNLESS OTHERWISE NOTED:

1) RESISTORS IN OHMS

2) CAPACITORS IN µF

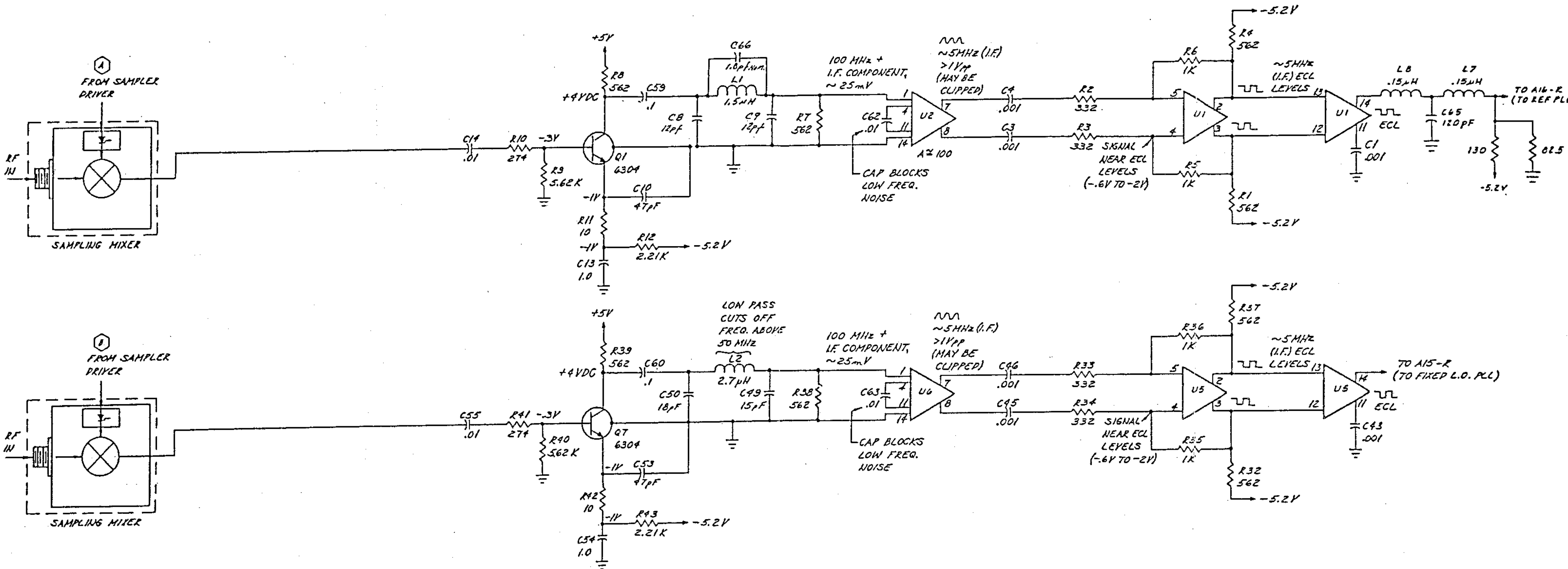
IC #	TYPE	PIN # -5.2V	PIN # GND	PIN # +5V
1, 4, 5	10216	8	1-16	—
2, 6	UA733	5	—	10

100 MHz Reference Osc (A103)

ASSY# 101CA04200 Rev R

Sheet 2 of 3

7-A103-2

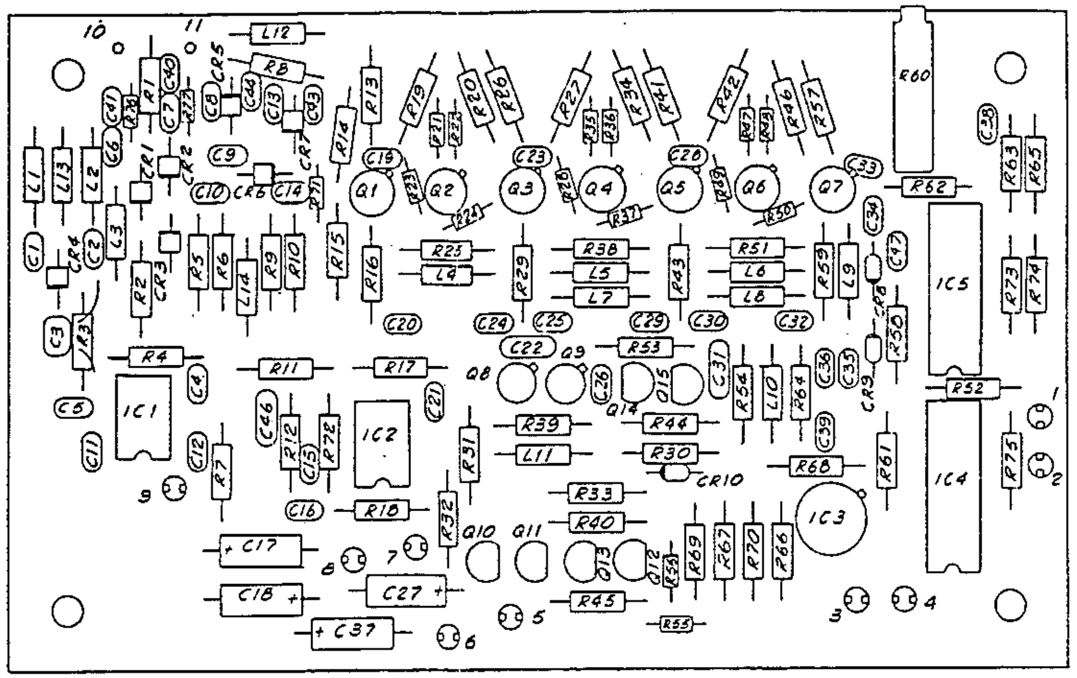


100 MHz Reference Osc (A103)

ASSY# 101CA04200 Rev R

Sheet 3 of 3

7-A103-3



COUNTER INPUT AMPLIFIER -- PC ASSY A104

The "low" and "high" inputs (pins 10 and 11) are the IF outputs of the low and high counter mixers. The words "low" and "high" refer to the frequencies received by the mixers themselves, rather than to the mixer IF outputs, which are similar in range (80-180 MHz and 80-200 MHz). After the input filter circuits, the IF inputs are furnished to a switching circuit (see IC1). In response to the 'LOW ENABLE' control line, CR3 is turned on to select the low input, and CR2 is turned on to select the high input. The next stage is a voltage controlled attenuator circuit (CR5, CR6, CR7), controlled by feedback from the automatic gain control circuit at IC2-7 which provides a variable DC bias to the anode of CR6. The AGC voltage goes more negative to increase attenuation. The RF signal is then amplified by the circuit consisting of Q1 through Q7. The amplified signal is supplied through CR8 to the AGC circuit, and through IC5-7 to the RF output stage.

The signal from the RF amplifier is detected by CR8 (that is, converted to a DC voltage). The detector signal is filtered (see L10) and furnished to the AGC amplifier at IC2-3. The AGC amplifier drives the attenuator circuit (CR6) so as to increase or decrease the detected signal level from the RF amplifier. The circuit is designed to reach equilibrium when the amplifier output at the anode of CR8 is about 1 Vpp. If the RF input received by this board (at pin 10 or pin 11) declines in power level, the AGC circuit decreases the attenuation enough to make up the difference.

The frequency counter of which this circuit board represents the input stage is designed to count pulse-modulated frequencies as well as CW frequencies. This necessitates a system for distinguishing the "on" periods during pulse modulation, so that the frequency count will not be distorted through averaging of active and inactive periods. Comparator IC3 produces complementary pulsed outputs during the pulse "on" periods by comparing the detected signal (see IC3-3) to a reference level (see IC3-2).

CW MODE -- The output of the RF amplifier section is detected by diode CR8; a second diode (CR9) is used to compensate for the drop across the first diode and also for temperature compensation. A low pass filter (L10, C36, C39) attenuates the RF component. The DC detector voltage is applied (through R30) to a buffer stage and an inverting amplifier stage (both IC2). The output of the inverting amplifier (IC2-7) drives the voltage-controlled attenuator (through L14) in order to maintain a constant level out of the RF amplifier (approximately 1 Vpp at the anode of CR8) and therefore a constant detector voltage. Shunt diode CR10 permits the AGC voltage to change more rapidly when an input signal is first applied.

The detector voltage is also applied to the inverting input of IC3, which is used as a comparator. When an RF input of sufficient amplitude is present, the output at pin 7 goes to an ECL low; this low is used as a clock-enable to permit the RF signal to propagate through flip flop IC5. Because this low is fed back to the non-inverting input via R67, the comparator threshold is lowered and the circuit has sufficient hysteresis to prevent false output switching.

PULSE MODE -- When the frequency input consists of bursts (pulse-modulated RF), the AGC loop must respond only to the "on" intervals, rather than take a misleading average of the detector voltage during both "on" and "off" time periods. The complementary outputs of the comparator (IC3), amplified by transistor pairs Q12/Q13 and Q10/Q11, are used to turn the FETs Q8 and Q9 on and off in order to accomplish this purpose.

When no input signal is present, IC3-7 is high and IC3-8 is low; this drives the gate of Q8 to -10V (turning it off) and the gate of Q9 to 0V (turning it on). C26 discharges to ground through Q9. Because Q8 is off, any charge on C22 is maintained.

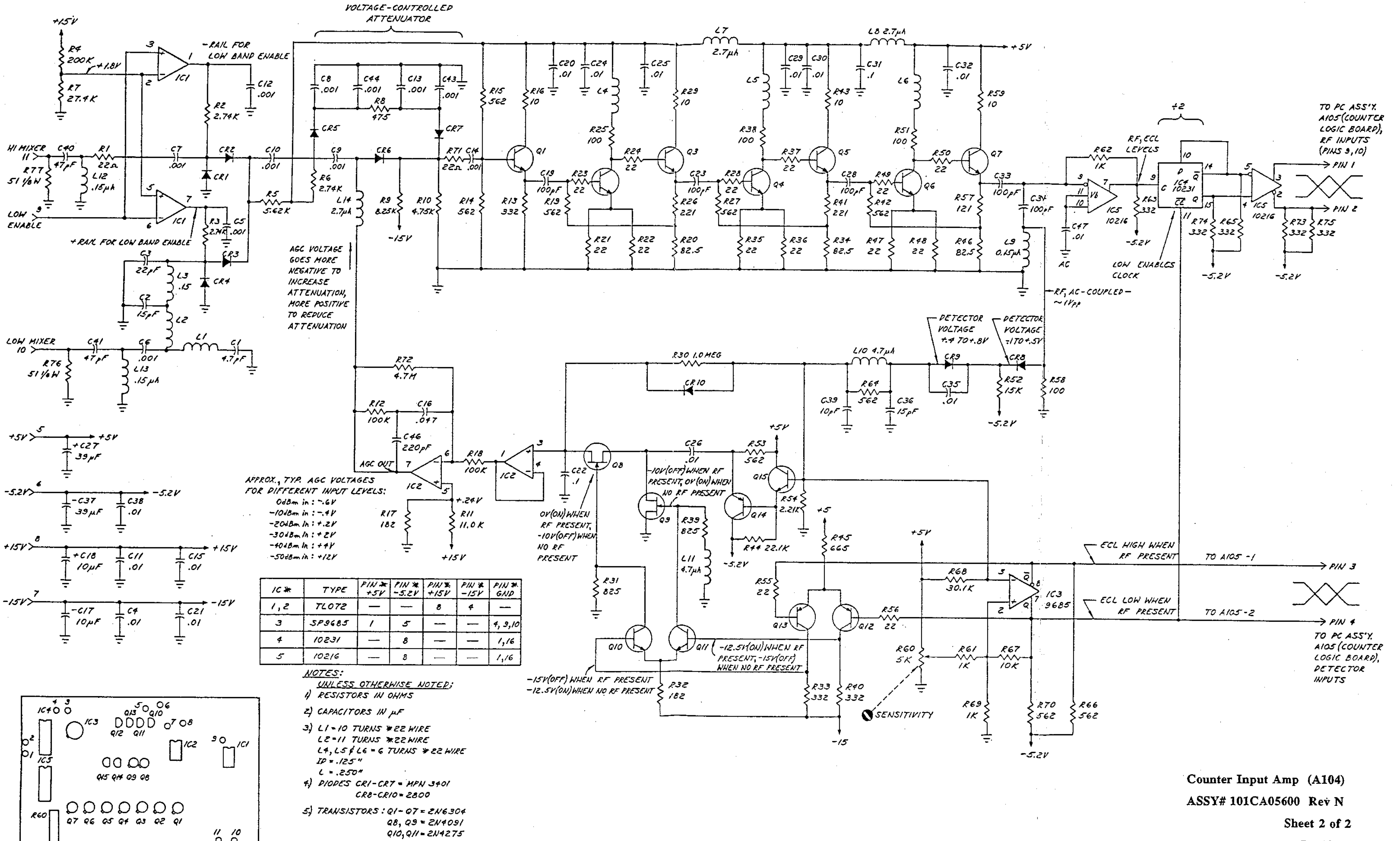
When an input signal is received, the comparator is triggered and the above conditions are inverted (Q8 is on, Q9 off). The detector voltage is applied (via the voltage follower circuit Q14/Q15) to C26. C26 and C22 charge through Q8. C22, being larger than C26 by a decade, charges to only about 10 per cent of the detector voltage.

The FET switching is arranged so that C22 retains its charge during "no signal" time periods while C26 does not. During successive pulses, the charge on C22 builds. Eventually C22 charges to the peak voltage at the emitter of Q14. Since C26 discharges between pulses, this voltage continues to be referenced to ground.

Because of its long time constant, the branch represented by R30 does not interfere with the charging of C22 during pulse mode. During CW mode, C26 blocks the DC detector voltage at the emitter of Q14. Therefore, the CW-mode and PULSE-mode branches operate independently.

OUTPUT DETECTION AND DRIVE

The complementary outputs of the comparator (IC3) are supplied (through a twisted pair) to the counter logic board (A105), where they are used as a "signal present" indicator. The output IC3-7, which goes low when signal is present, is also used as a clock enable permitting the RF signal to propagate through flip flop IC4. IC4 divides the input frequency by two. The flip flop is buffered at both input and output by line driver IC5. The complementary outputs of the line driver at IC5-3 and IC5-2 (consisting of the RF input, at ECL levels, divided by two) are supplied (through a twisted pair) to the counter logic board.



IC *	TYPE	PIN * +5V	PIN * -5.2V	PIN * +15V	PIN * -15V	PIN * GND
1, 2	TL072	—	—	8	4	—
3	SP9685	1	5	—	—	4, 9, 10
4	10231	—	8	—	—	1, 16
5	10216	—	8	—	—	1, 16

NOTES:

UNLESS OTHERWISE NOTED:

1) RESISTORS IN OHMS
2) CAPACITORS IN μF
3) L1 = 10 TURNS #22 WIRE
   L2 = 11 TURNS #22 WIRE
   L4, L5 & L6 = 6 TURNS #22 WIRE
   ID = .125"
   L = .250"
4) DIODES CR1-CR7 = MPN 3401
   CR8-CR10 = 2800
5) TRANSISTORS: Q1-Q7 = 2N6304
   Q8, Q9 = 2N4091
   Q10, Q11 = 2N4275
   Q12, Q13 = 2N5771
   Q14 = PN2907
   Q15 = PN2222

PC BOARD LAYOUT

Counter Input Amp (A104)

ASSY# 101CA05600 Rev N

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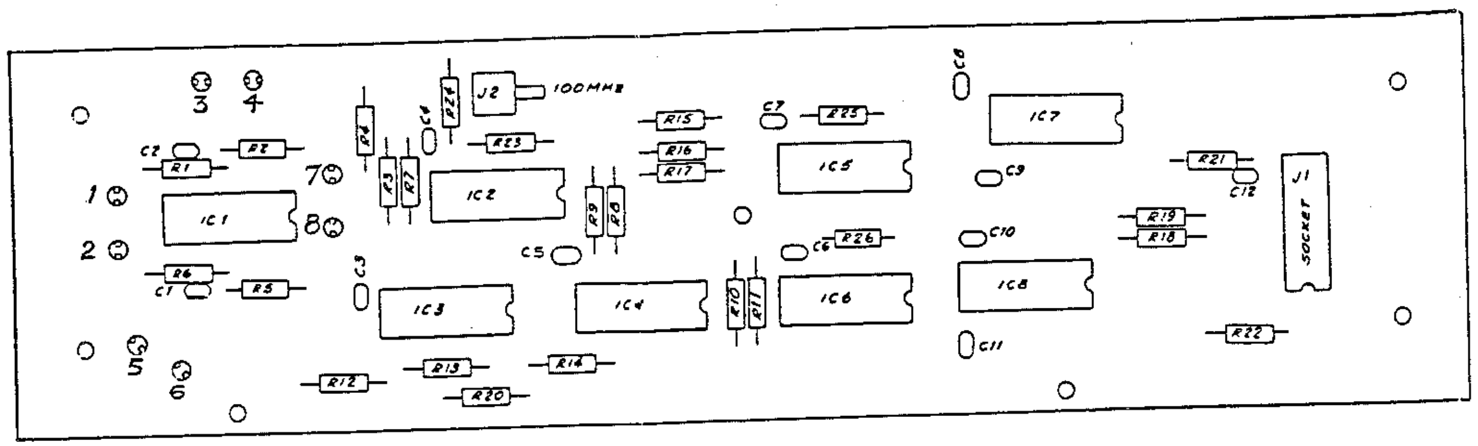
7-A104-2



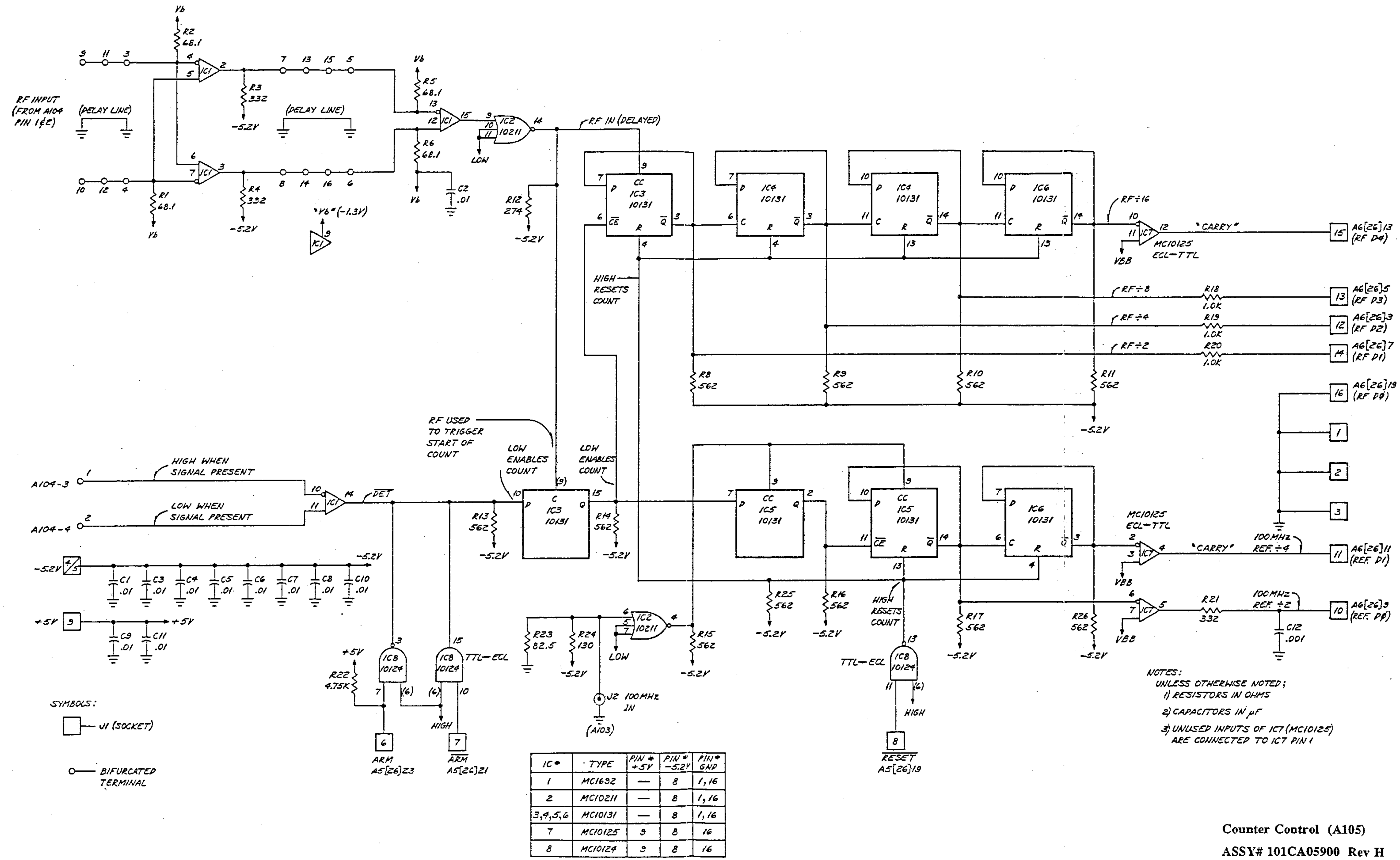
COUNTER CONTROL -- PC ASSY A105

This circuit board processes frequency data for use by the Counter PIA circuit (A6). In addition to the RF input from the Counter Input Amplifier (A104), a reference frequency is received from the 100 MHz Oscillator (A103); both are counted simultaneously over a fixed time period and the ratio of counts between the two is used by the system computer to determine the input frequency.

The RF input, received from the A104 board at pins 9 and 10, passes through two sections of a balanced printed-circuit delay line, each followed by line input. In order to count pulsed RF accurately, it is necessary to enable the counters only during those periods when signal is present, and this enabling is controlled by, among other inputs, the DET input from A104. If the "window" created by the DET signal is not precisely synchronized with the RF "on" period, some counts will be lost. The risetime of the detector on the A104 board causes the Schmitt-trigger DET output of that circuit to lag the RF pulse by about 75 nanoseconds; therefore the delay line on A105 is needed to retard the RF pulse by the same amount. The result is that the beginning of the DET window and the beginning of the received RF pulse coincide.

The RF counter (beginning with IC3-9) is clocked by the RF from the delay line. The Reference counter (beginning with IC5-9) is clocked by the 100 MHz input. Both counters require a low level at their Clock Enable inputs (IC3-6 and IC5-11 respectively) in order to count, and it is by means of this signal that the counters are controlled. The flip flop IC3-15 can supply the necessary low which enables the counters only when the following conditions are met: the DET window is present (IC1-14 goes low), ARM is low, ARM is high, and a rising edge of the RF has been received at IC3-9. The Reference counter requires a rising edge of the 100 MHz signal before the enabling low level is allowed to propagate through IC5-2 to IC5-11. Both counters are reset to zero by a high from IC8-13.

The Reference counter has two stages, producing outputs equal to the 100 MHz Reference divided by two (J1-10) and divided by four (J1-11). The RF counter has four stages, producing outputs equal to the RF input divided by two (J1-14), divided by four (J1-12), divided by eight (J1-13) and divided by sixteen (J1-15). This last output is translated from ECL to TTL levels by IC7, as are the two outputs of the Reference counter; the remaining three outputs of the RF counter are transmitted to the A6 board in ECL form and are translated to TTL at that location. The frequency data from the Reference and RF counters is divided into the multiple outputs described above in order to drive the input latches of the 32-bit counters (IC type LS7061) located on the Counter PIA board (A6).



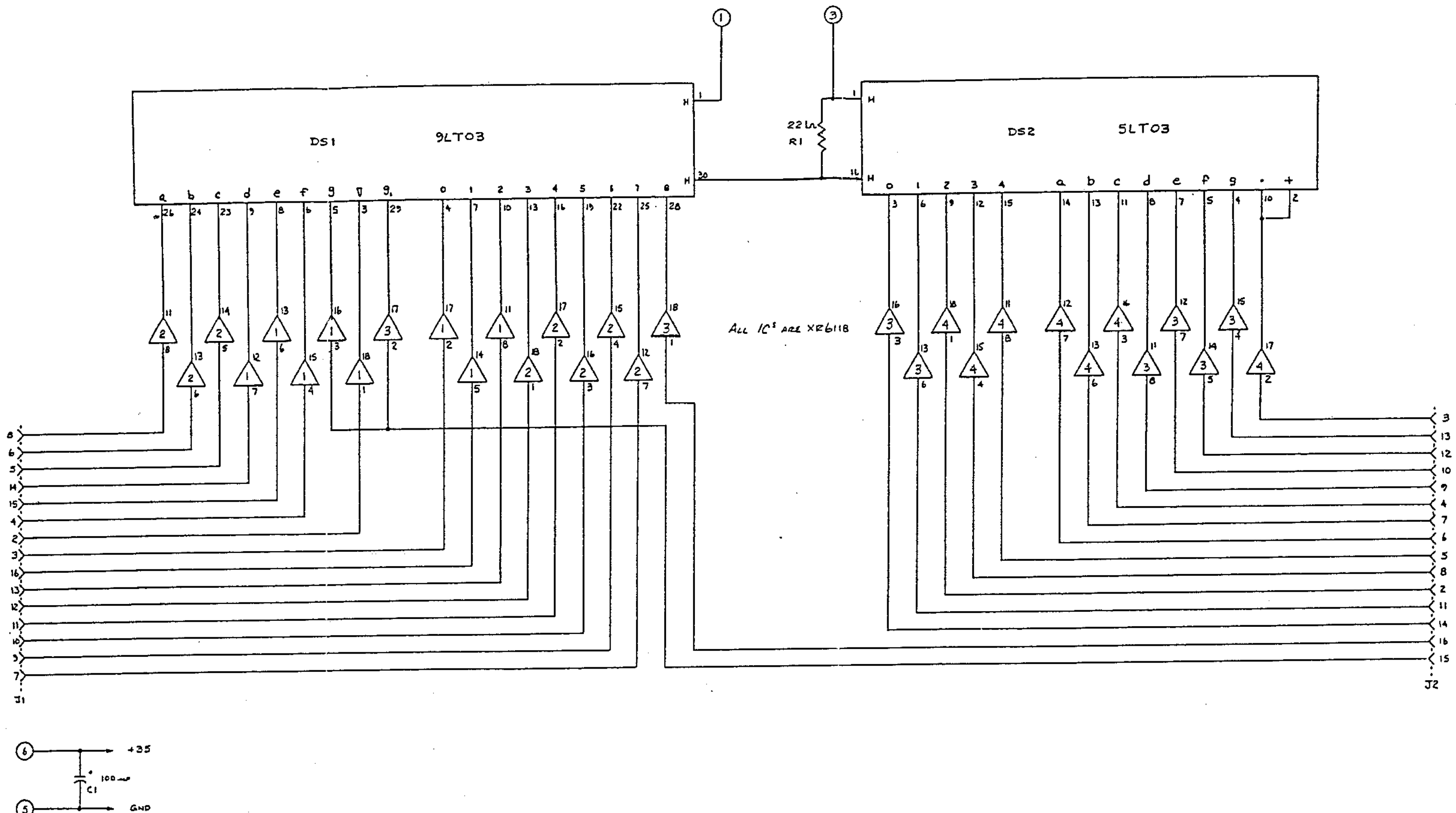
IC#	TYPE	PIN # +5V	PIN # −5.2V	PIN # GND
1	MC1692	—	8	1,16
2	MC10211	—	8	1,16
3,4,5,6	MC10131	—	8	1,16
7	MC10125	9	8	16
8	MC10124	9	8	16

Counter Control (A105)

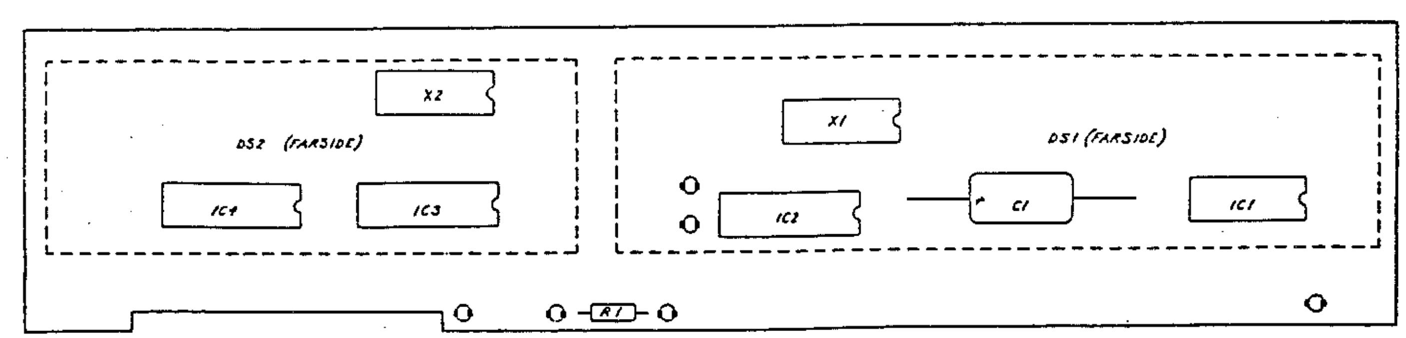
ASSY# 101CA05900 Rev H

Sheet 2 of 2

7-A105-2



IC #	TYPE	PIN # +35	PIN # GND
1,2,3,4	XR6118	10	9

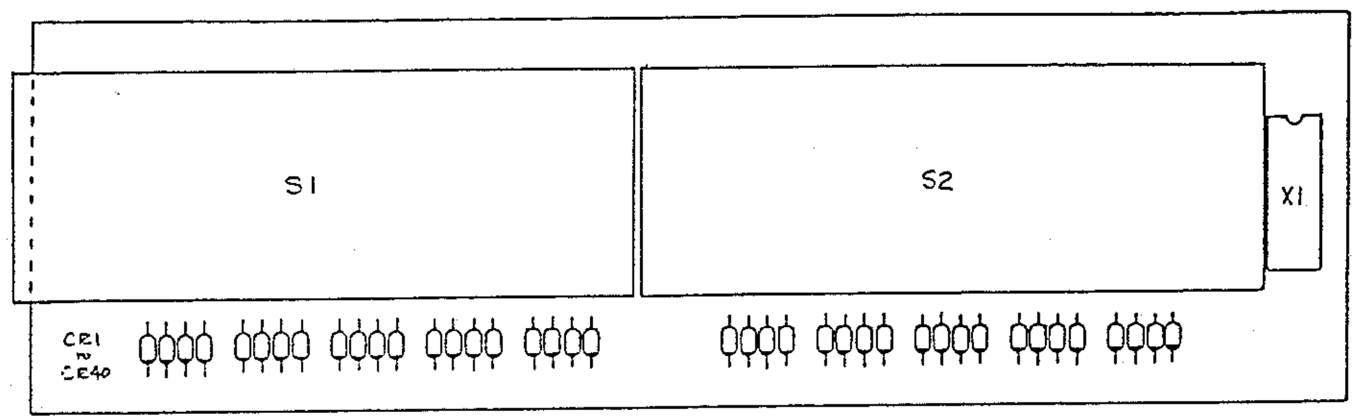


Display (A106)

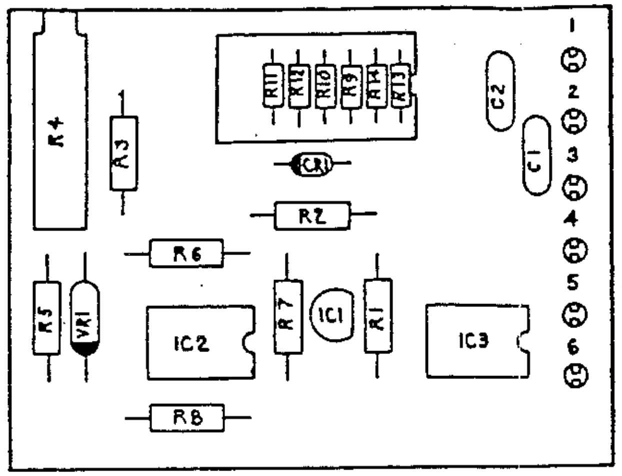
ASSY# 101CA03000 Rev C

Sheet 1 of 1

7-A106-1



Lever Switch (A107)
ASSY# 101BA02700 Rev A
Sheet 1 of 1
7-A107-1

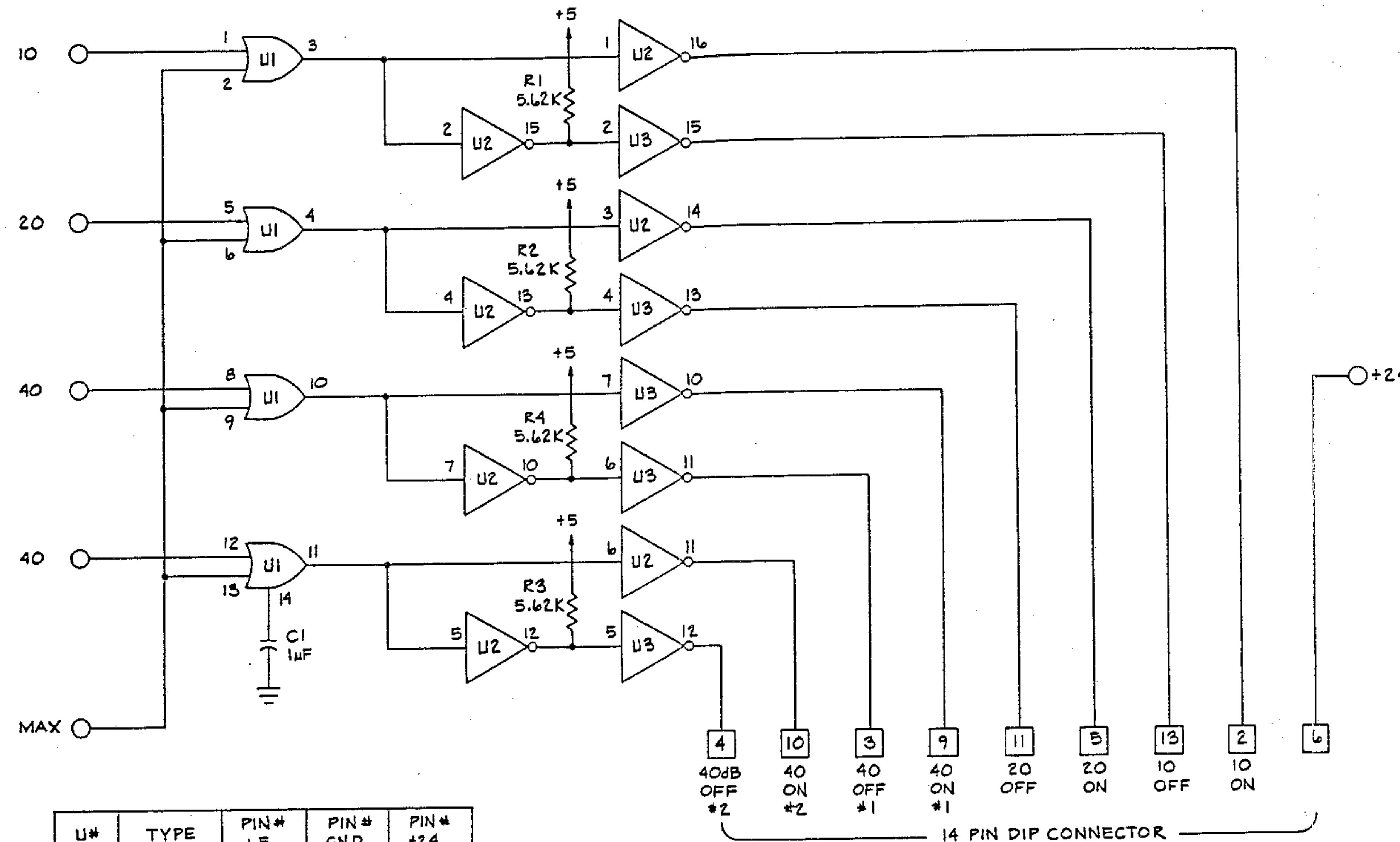


DETECTOR TEMPERATURE COMPENSATION -- PC ASSY A111

This circuit provides a correction voltage to compensate for variations in the output of the level detector due to temperature changes. The circuit provides for independent correction of '<26 GHz' and '>25 GHz' detectors, and also for both positive and negative temperature coefficients.

IC1, a linear temperature sensor, provides a 10 mV/°C output. The signal, combined with the "zero" adjustment input from VR1 and R4, is furnished to the inverting input of IC2-2. The circuit is calibrated to yield a zero volt output at IC2-1 at ambient temperature. The voltage at IC2-1 normally goes negative as temperature increases, and the correction signal is sent to analog switch IC3 through resistors R9 and R10. The switch selects the correction signal appropriate to the detector in use. At temperatures below ambient, IC2-1 normally goes positive, turning on diode CR1 and adding additional signal paths (R11 and R12) for the correction signal in order to compensate for the detector's steeper temperature coefficient curve at low temperatures. The circuit output at pin 6 is furnished to the level control circuit (A7).

For detectors with negative temperature coefficients, R13 and R14 are added. The signal at IC2-1 is inverted by IC2-7 and is furnished through R13 and R14 to IC3 as a reverse compensation signal.



U#	TYPE	PIN# +5	PIN# GND	PIN# +24
1	MC14071	14	7	——
2 & 3	MC1413	——	8	9

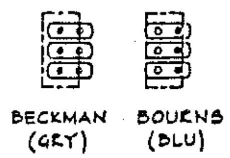
Attenuator Driver (A112)

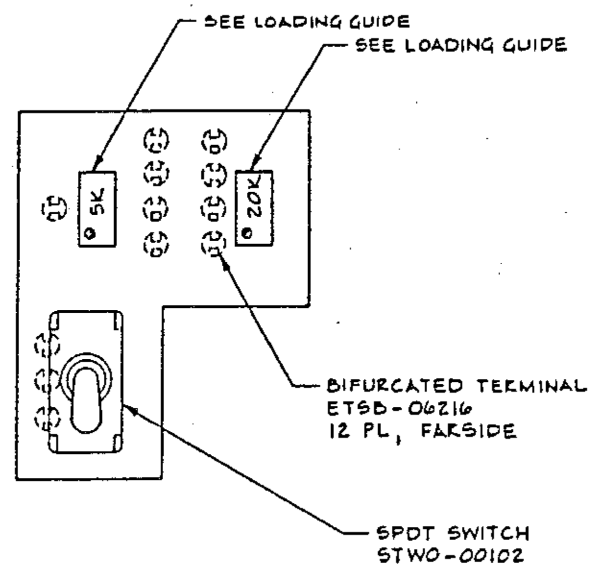
ASSY# 101BA37900 Rev A

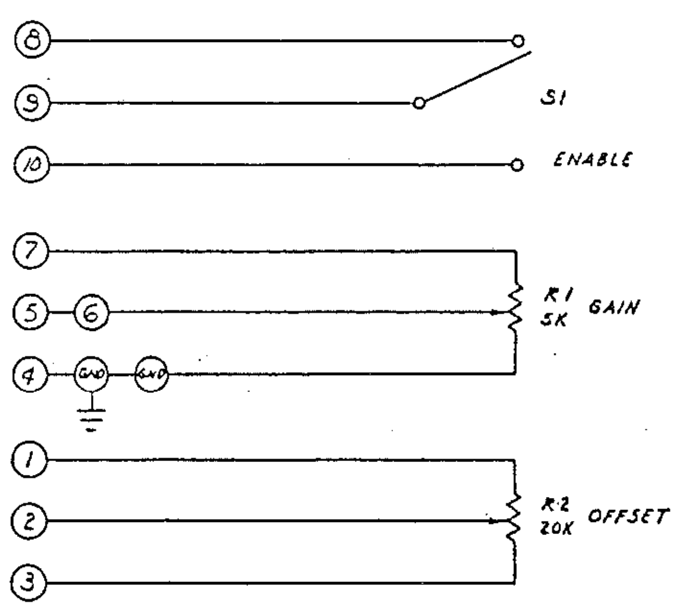
Sheet 2 of 2

7-A112-2

LOADING GUIDE







NOTES: UNLESS OTHERWISE SPECIFIED
1) RESISTOR VALUES IN OHMS

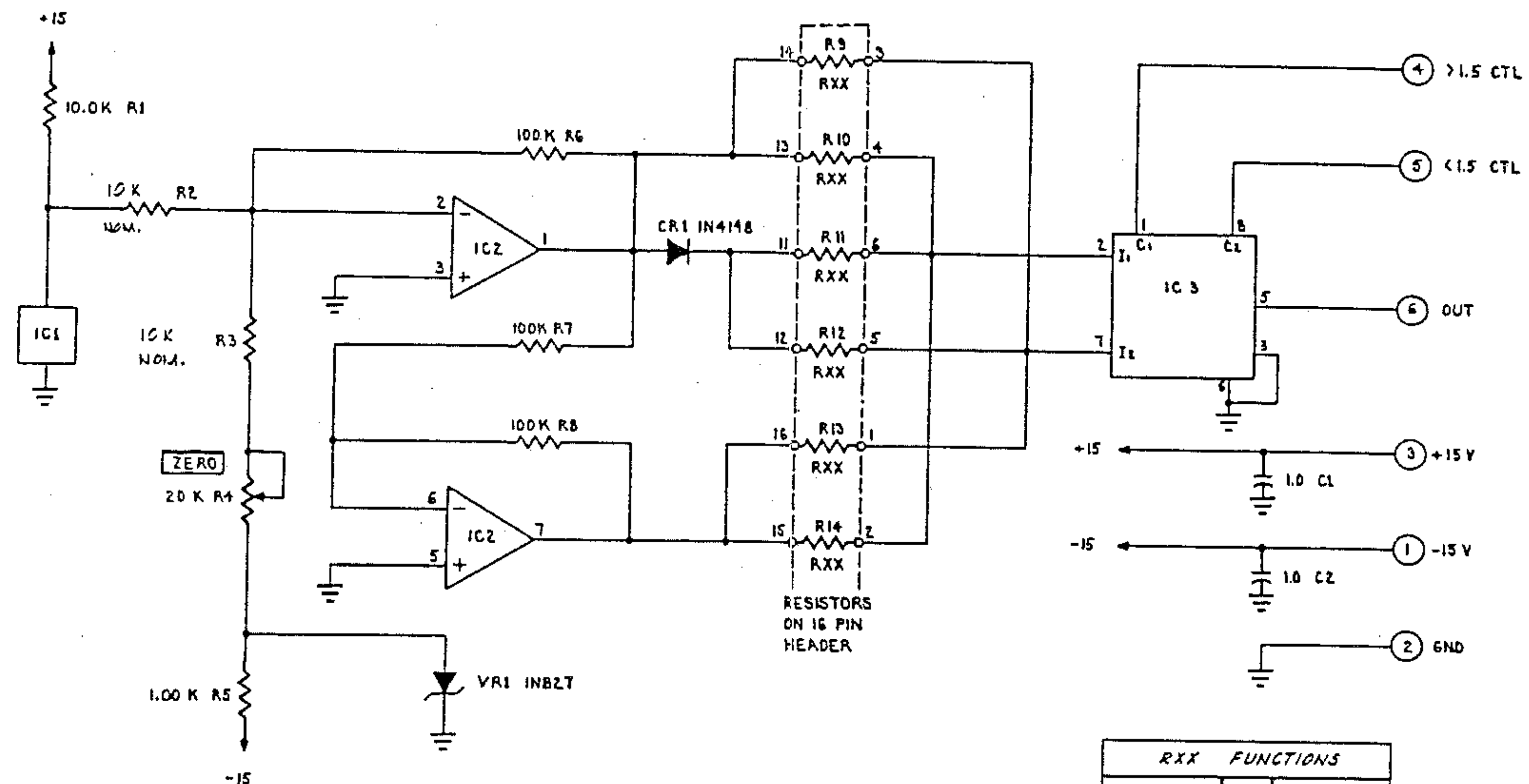
EXTERNAL ALC POT SWITCH -- PC ASSY A117

This circuit, which is mounted at the rear of the instrument, provides three inputs to the level control system, all of which are related to external ALC operation.

The 'ENABLE' switch (S1) is used by the operator to select or deselect the external ALC mode. It furnishes a TTL high or low to the level control circuit.

The input from the external detector is received at pin 7 (from the connector on the rear panel). The detector signal is taken from the wiper of R1 and is furnished to the level control circuit via pin 5. R1 is the 'GAIN' pot and is used to calibrate the leveling loop at the high end of its power range, in order to match the slope of the external detector's transfer curve.

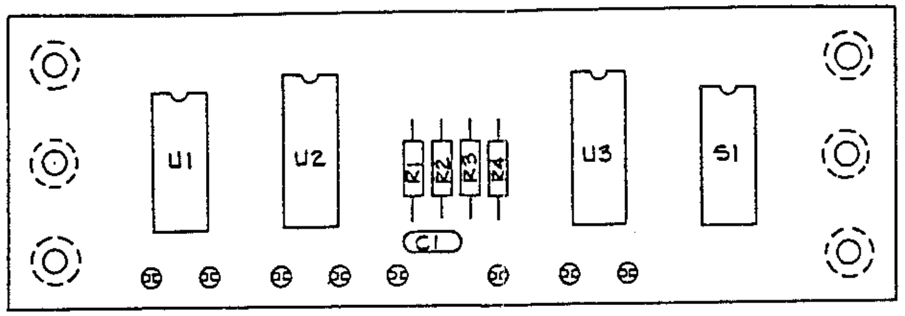
R2 is the 'OFFSET' potentiometer; the voltage taken from its wiper at pin 2 is furnished to the level control circuit. The offset voltage is used to calibrate the leveling loop at the low end of its power range, in order to match the intercept point of an external detector's transfer curve.



IC#	TYPE	+15V	-15V
IC1	LM335	—	—
IC2	TL072	8	4
IC3	IH5018	—	—

RXX FUNCTIONS		
A111		A124
HOT>1.5	R9	HOT<26
HOT<1.5	R10	HOT>26
COLD<1.5	R11	COLD>26
COLD>1.5	R12	COLD<26
-TC>1.5	R13	-TC<26
-TC<1.5	R14	-TC>26

Detector Temp Comp (A111)
ASSY# 101BA29400 Rev C
Sheet 2 of 2
7-A111-2



ATTENUATOR RELAY DRIVER -- PC ASSY A112

This circuit drives a multiple-relay 10 dB step attenuator. U2 and U3 are Darlington relay drivers, responding to TTL-level inputs and providing output levels at zero volts and at the voltage of the unregulated +20 supply (usually near +25 volts).

The attenuator is set to the desired value by activating an appropriate combination of four elements (10 dB, 20 dB, 40 dB #1, and 40 dB #2). Each element has an "on" and an "off" driver input. The logic levels are low to activate, high to deactivate; therefore the 10 dB step is selected by driving '10 ON' low and '10 OFF' high. The four logic inputs to the OR gates of U1 (high to select a given element) are inverted once for the associated 'ON' output and twice for the associated 'OFF' output. For example, in order for the 20 dB element to be selected, U1-5 must go high. This causes U2-14 and U2-13 to go low, and U3-13 to go high.

When the 'MAX' input goes high, all attenuation elements are selected at once for a total attenuation of 110 dB.

Options

The following options are available for the Series 1026, and are discussed under separate headings:

Option 02: Downconverter Band (.05-2 GHz) Deleted

Option 03: 1 kHz Resolution

Option 04: RS-232 Interface

Option 06: High Stability Time Base

Option 10: +10 dBm Output Power

Option 11: 5 MHz External Time Base Input

Option 12: 12-18 GHz and 18-26 GHz Bands Deleted

Option 14: Control Bus for Frequency Extenders

Option 18: 18-26 GHz Band Deleted

Option 22: Rear Panel RF Output

8.1 OPTION 02: DOWNCONVERTER BAND (.05-2 GHz) DELETED

When this option is installed, the downconverter circuits are deleted. Disregard all references to the down-converter (and to output frequencies between 50 MHz and 2 GHz) in this manual.

8.2 OPTION 03: 1 kHz RESOLUTION

This option incorporates a low frequency synthesizer into the reference phase lock loop in order to provide three additional digits of output frequency resolution. The first three lever switches of the Stop Frequency selector are used as the 100 kHz, 10 kHz and 1 kHz switches. All digits are displayed. The additional digits may also be set via the remote interface simply by specifying the frequency to 1 kHz resolution.

This option requires installation of a High Resolution PLL circuit (see the following parts lists and diagrams).

Parts List for 003CA00310 OPT 03 1KHZ RESOL 1026 Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CA30220	1	58900	101CA30220	HI RESOLUTION PLL PCA
2	101BA14601	1	58900	101BA14601	10-12 MHZ PLL MOUNT/SHLD
3	101BA27301	1	58900	101BA27301	10-12 MHZ WIRE HARN ASY

Parts List for 101CA30220 HI RESOLUTION PLL PCA Rev B

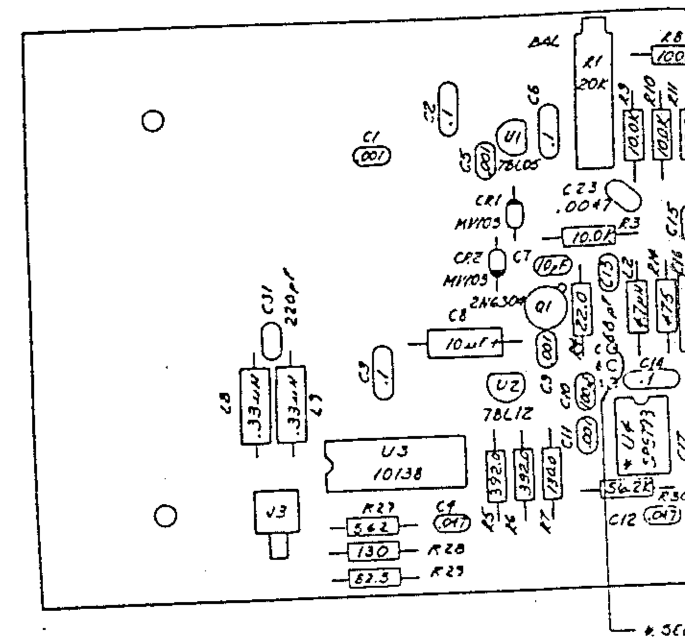
Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF30220	1	58900	101CF30220	HI RESOLUTION PLL PCB
2	ETST-06224	3	88245	1280B	TURRET TERMINAL
C 1	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 2	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 3	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 4	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 5	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 6	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 7	CC50-00100	1	51642	100-100-COG-100J	10 PF CERAMIC NPO
C 8	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 9	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 10	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 11	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 12	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 13	CC50-00680	1	51642	150-100-COG-680J	68 PF CERAMIC NPO
C 14	CC50-04100	1	56289	1C20Z5U104M050B	.1 UF CERAMIC Z5U
C 15	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 16	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 18	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 19	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 20	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 22	CC50-01100	1	51642	150-100-COG-101J	100 PF CERAMIC NPO
C 23	CC50-02470	1	51642	200-100-W5R-472K	.0047 UF CERAMIC X7R
C 24	CC50-03470	1	51642	150-100-W5R-473	.047 UF CERAMIC X7R
C 25	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 26	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 27	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 28	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 29	CT20-06100	1	56289	150D106X9020B2	10 UF 20V TANTALUM
C 30	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 31	CC50-01220	1	51642	150-100-COG-221	220 PF CERAMIC NPO
CR 1	DVA0-00109	1	26629	KV3901	MV109 6-30 PF DIODE
CR 2	DVA0-00109	1	26629	KV3901	MV109 6-30 PF DIODE
CR 5	DSA0-04148	1	07263	1N4148	IN4148 G.P. DIODE
CR 6	DSA0-04148	1	07263	1N4148	IN4148 G.P. DIODE
DS 1	ILRR-00125	1	58361	MV5077C	RED LED
J 1	JSP0-10016	1	09922	DILB16P-108	16 PIN DIP SOCKET
J 2	JRBM-00101	1	98291	51-053-0000	SMB M RTANG PC MOUNT
J 3	JRBM-00101	1	98291	51-053-0000	SMB M RTANG PC MOUNT
L 2	LAD0-05470	1	72259	WEE-4.7	4.7 UH INDUCTOR
L 3	LAD0-05270	1	72259	WEE-2.7	2.7 UH INDUCTOR
L 4	LAD0-06220	1	72259	WEE-22	22 UH INDUCTOR
L 5	LAD0-06220	1	72259	WEE-22	22 UH INDUCTOR
L 6	LAD0-06220	1	72259	WEE-22	22 UH INDUCTOR
L 7	LAD0-06220	1	72259	WEE-22	22 UH INDUCTOR
L 8	LAD0-04330	1	72259	WEE-.33	.33 UH INDUCTOR

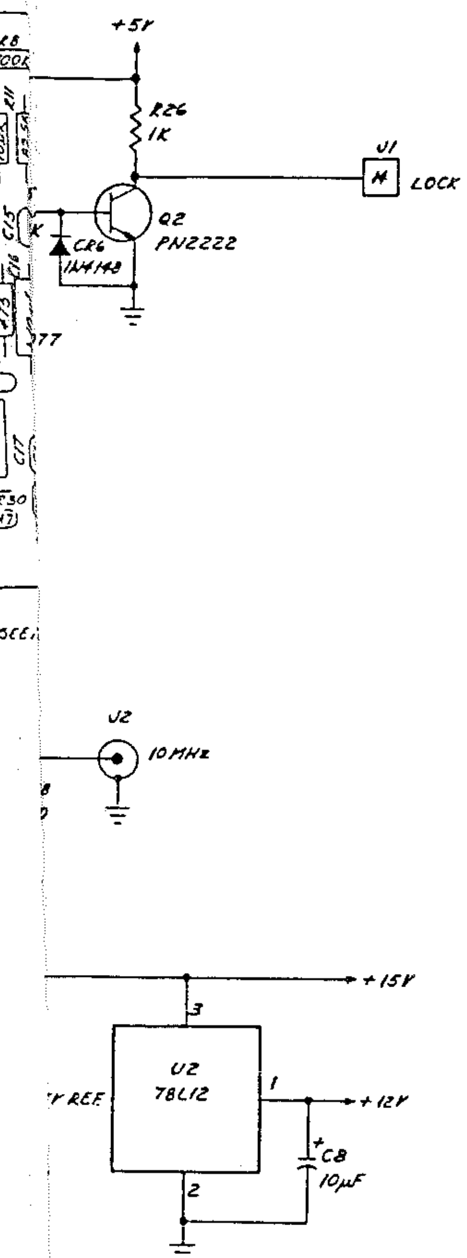
Parts List for 101CA30220 HI RESOLUTION PLL PCA Rev B

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
L 9	LAD0-04330	1	72259	WEE-.33	.33 UH INDUCTOR
Q 1	QBNS-06304	1	04713	2N6304	2N6304 15V 1400MHZ NPN
Q 2	QBNS-02222	1	27014	PN2222	PN2222 .5A 30V NPN
R 1	RAPD-22000	1	73138	89PR20K	20K POT 15T PC MNT
R 3	RN55-21000	1	81349	RN55D1002F	10 K OHMS 1% MET FILM
R 4	RN50-00221	1	81349	RN50C2211F	22.1 OHM 1% METAL FILM
R 5	RN55-03920	1	81349	RN55D3920F	392 OHMS 1% MET FILM
R 6	RN55-03920	1	81349	RN55D3920F	392 OHMS 1% MET FILM
R 7	RN55-01300	1	81349	RN55D1300F	130 OHMS 1% MET FILM
R 8	RN55-31000	1	81349	RN55D1003F	100 K OHMS 1% MET FILM
R 9	RN55-21000	1	81349	RN55D1002F	10 K OHMS 1% MET FILM
R 10	RN55-21000	1	81349	RN55D1002F	10 K OHMS 1% MET FILM
R 11	RN55-28250	1	81349	RN55D8252F	82.5 K OHMS 1% MET FILM
R 12	RN55-41000	1	81349	RN55D1004F	1 M OHMS 1% MET FILM
R 13	RN55-28250	1	81349	RN55D8252F	82.5 K OHMS 1% MET FILM
R 14	RN55-04750	1	81349	RN55D4750F	475 OHMS 1% MET FILM
R 15	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 16	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 17	RN55-00825	1	81349	RN55D82R5F	82.5 OHMS 1% MET FILM
R 18	RN55-01300	1	81349	RN55D1300F	130 OHMS 1% MET FILM
R 19	RN55-32000	1	81349	RN55D2003F	200 K OHMS 1% MET FILM
R 20	RN55-31000	1	81349	RN55D1003F	100 K OHMS 1% MET FILM
R 21	RN55-12490	1	81349	RN55D2491F	2.49 K OHMS 1% MET FILM
R 22	RN55-12490	1	81349	RN55D2491F	2.49 K OHMS 1% MET FILM
R 23	RN55-31000	1	81349	RN55D1003F	100 K OHMS 1% MET FILM
R 24	RN55-12740	1	81349	RN55D2741F	2.74 K OHMS 1% MET FILM
R 25	RN55-22210	1	81349	RN55D2212F	22.1 K OHMS 1% MET FILM
R 26	RN55-11000	1	81349	RN55D1001F	1 K OHMS 1% MET FILM
R 27	RN55-05620	1	81349	RN55D5620F	562 OHMS 1% MET FILM
R 28	RN55-01300	1	81349	RN55D1300F	130 OHMS 1% MET FILM
R 29	RN55-00825	1	81349	RN55D82R5F	82.5 OHMS 1% MET FILM
R 30	RN55-25620	1	81349	RN55D5622F	56.2 K OHMS 1% MET FILM
U 1	URP0-78050	1	04713	MC78L05ACP	MC78L05 .1A 5V REG
U 2	URP0-78120	1	04713	MC78L12CP	MC78L12CP .1A 12V REG
U 3	UEN0-10138	1	04713	MC10138P	MC10138P BI-QUINARY CTR
U 4	UIN0-08793	1	52648	SP8793	DIVIDE BY 40/41
U 5	UCN0-51460	1	04713	MC145146P	MC145146P FREQ SYNTH
U 6	UON0-00072	1	01295	TL072CP	TL072CP DUAL FET OP AMP
U 7	UCN0-00490	1	04713	MC14049UBCP	MC14049UBCP HEX INV BUFR

Parts List for 101BA27301 10-12 MHZ WIRE HARN ASY Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	JHP0-10016	1	51167	16-600-10	16 PIN DIP HEADER
2	107AW01400	0	58900	107AW01400	HI RESOLUTION W/L





NOTES:
UNLESS NOTED OTHERWISE:
RESISTORS IN OHMS
CAPACITORS IN µF
* COIL IS PART OF P.C.
U4 ALTERNATE PART [illegible]
MAYBE USED BY INSTALLING JUMPER FROM [illegible]
INSTEAD OF "A" TO "C"

HI RES PLL PC Assy (A108)
DWG# 101BM30220 SHEET 1 of 2

REV B

HI RES PLL PC ASSY (A108)
DWG# 101BM30220 SHEET 2 OF 2

REV B

8.3 OPTION 04: RS-232 INTERFACE

Option 04 provides for remote control of the instrument by way of an RS-232 interface, rather than the standard IEEE-488 interface.

For instruments containing Option 04, the external programming guide in section 1 of the manual is replaced by the guide which follows.

EXTERNAL PROGRAMMING, RS-232

RS-232 HARDWARE CONFIGURATION

Interface Connector

The rear panel interface connector is a "DB25S" type as is common practice with RS-232 channels. The following table indicates connector pin assignments.

Contact	Signal	Function
1	SHLD	Shield ground
2	TXD	Data from controller
3	RXD	Data to controller
4	RTS	Request to send *
5	CTS	Clear to send **
6	DSR	Data set ready
7	COM	Signal common (ground)
8	DCD	Data carrier detect **
20	DTR	Data terminal ready *

* These input lines are ignored by the instrument, but line receivers are present on these contacts.

** These output lines are set to a logic low (negative voltage) when the instrument is powered up and may be used to enable handshaking for controllers that require it.

This connector configuration will mate directly with an unmodified HP85 RS-232 interface - option 001 interface connector. Pins 2, 3 and 7 supply the signals and ground. Pin 1 is the shield.

BAUD Rate Selection

Switch sections 1 and 2 of the rear panel ADDRESS switch select the interface BAUD rate. The other switches are not used.

Rate	S1	S2
300	0	0
600	1	0
1200	0	1
2400	1	1

GENERAL COMMAND STRUCTURE

Character Representation

In this manual, the ASCII characters sent in a message will be represented in single quotes.
e.g.: 'MESSAGE' corresponds to a string of seven bytes whose hexadecimal values are $4D, $45, $53, $41, $47, $45.

Special characters will be represented as follows:

'<CR>'	Carriage return, $0D
'<LF>'	Line Feed, $0A
'b'	One or more spaces, $20
'z'	Zero or more spaces
's'	One space
'd'	Decimal digit

Command Interpretation

The 1026 uses a 40 character buffer to accept and store characters sent to it via the interface. Multiple sequential spaces are compressed to a single space character for storage in the buffer. The buffer's contents are interpreted and the buffer is reset upon receipt of a character sent with the EOI line asserted or upon receipt of any of the following delimiter characters:

'<CR>' '<LF>' ',' ':' ';' '/' '\'

Multiple commands may be sent in a single message if they are separated from each other by a space or one of the above delimiter characters. If the commands are separated by delimiter characters, each command will be interpreted individually upon receipt. If the commands are separated by spaces, they will not be interpreted until the entire message has been sent. Note that if spaces are used to separate commands, care must be taken to assure that the 40 character buffer does not overflow. Buffer overflow may cause some commands to be ignored.

Command Format

Each command consists of a verb, followed by zero or more spaces, followed by an argument.

e.g.: 'GENzFIXED' GEN is the verb and FIXED is the argument

'FAZ12.3E+3' FA is the verb and 12.3E+3 is the argument

Numeric Arguments

Frequency and level setting commands use numeric arguments (represented in command descriptions as 'n'). The format for numeric arguments (described below) is sufficiently flexible that no special formatting will be necessary when using most IEEE-488 controllers. Signed or unsigned numbers are acceptable. Integers or decimal fractions are permitted and may be followed by a signed or unsigned one or two digit exponent. Leading zeroes are permitted, but spaces within a number are not permitted. The integer and optional fractional part are each restricted to a maximum length of 10 digits.

'b25.7' / '-32.1' / '0.3' / '2958.763E-2'

'6E-10' / '-000.000000001E+10' / 'b7b' / '1E6'

COMMAND DESCRIPTIONS

Each subsection describes a verb and its valid arguments. Most commands perform functions in a way that is similar to the 1026's front panel controls except where noted.

'GEN' Set Signal Generation Mode

'GENzFIXED':	generate fixed (CW) frequency
'GENzUSWP':	generate unlocked sweep
'GENzLSWP':	generate locked sweep

'MEAS' Set Frequency Measurement Mode

'MEASzDIR':	measure direct (no frequency offset)
'MEASzDEL':	measure delta F (with offset)

Note that option 03 (1 kHz resolution) only operates in the locked generate modes. Thus, the offset frequency can only be set to 1 MHz resolution. Any lower significance digits are ignored.

'MOD' Set Modulation Mode

'MODzOFF':	modulation off
'MODzPULSE':	internal pulse
'MODzSQR':	internal square wave
'MODzEXT+':	external
'MODzEXT-':	external

'MODRATE' Set Internal Modulation Rate

'MODRATEzFIXED':	1 kHz rate
'MODRATEzVAR':	rate variable via front panel controls

'PWIDTH' Set Internal Pulse Width

'PWIDTHzFIXED':	1 μsec width
'PWIDTHzVAR':	width variable via front panel control

'LVERN' Enable/Disable Front Panel Level Vernier Control

'LVERNzON':	Enables
'LVERNzOFF':	Disables

'EXTALC' Enable/Disable External ALC

'EXTALCzON':	Enables
'EXTALCzOFF':	Disables

'POWER' Set Power Meter Configuration

'POWERzINT':	Measure internal power
'POWERzEXT':	Measure external power
'POWERzDELTA':	Measure power difference

'SWEEP' Control Sweep Function

The 'SWEEP' command has seven valid arguments. The commands provide the same sweep functions as the front panel pushbuttons. Separate commands are used to control triggered sweep via the sweep trigger input connector and to control non-triggered modes.

'SWEEPzAUTO':	Automatic repetitive sweep
'SWEEPzONCE':	Single sweep
'SWEEPzSTEP':	Single step sweep. One step equal to FC is done each time this command is received.
'SWEEPzTRIG':	Triggered single sweep. A pulse on the sweep trigger input causes one complete sweep.
'SWEEPzSTPTRIG':	Triggered single step. A pulse on the sweep trigger input does one step equal to FC.
'SWEEPzRESET':	Reset. Immediately terminates sweep. To restart the sweep, send the 'SWEEP' command for the function desired.
'SWEEPzNUL':	The action of this command depends upon what the current sweep function is. If it is 'ONCE', 'STEP', or 'RESET', it has no effect. If it is 'TRIG' or 'STPTRIG', 'NUL' acts the same as 'RESET'. If it is 'AUTO', it acts the same as 'RESET', but not until the end of the current sweep.

The front panel sweep reset button functions in both local and remote modes.

'SWPRATE' Set Sweep Rate

Valid arguments are the ASCII letters 'A' through 'J'. The letters correspond to the positions of the front panel control, 'A' being the slowest.

Set Frequency Commands

The three frequency commands each require a numeric argument. Digits specifying a frequency resolution in excess of the instruments capabilities are ignored (no rounding). The instrument's frequency resolution is 1 MHz except where noted below. The argument always specifies frequency in MHz (e.g., 'n' = '2345' specifies 2.345 GHz). In the range specifications given with each command, the following conventions are used to specify limits.

F min =	minimum CW generate frequency 0 Hz except for option 02 where F min = 2 GHz
F max =	maximum CW generate frequency
F lo =	minimum measurement frequency 100 MHz except for option 02 where F lo = 2 GHz
F hi =	maximum measurement frequency F hi = 26.999 GHz if F max ≥12 GHz F hi = 24 GHz if F max <12 GHz

'FA' Set Start Frequency

'GENzFIXED':	Sets output frequency F min ≤ 'n' ≤ F max, 1 kHz resolution with option 03
'GENzUSWP':	Set sweep start frequency F min ≤ 'n' < F max
'GENzLSWP':	Set sweep start frequency F min ≤ 'n' < F max, 1 kHz resolution with option 03
'MEASzDIR':	Set search start frequency F lo ≤ 'n' < F hi
'MEASzDEL':	Set measurement offset frequency F lo ≤ 'n' ≤ F hi

'FB' Set Stop Frequency

'GENzUSWP':	Set sweep stop frequency 'FAzn' < 'n' ≤ F max
'GENzLSWP':	Set sweep stop frequency 'FAzn' < 'n' ≤ F max, 1 kHz resolution with option 03
'MEASzDIR':	Set search stop frequency 'FAzn' < 'n' ≤ F hi

'FB' commands are ignored in 'GENzFIXED' and 'MEASzDEL' mode.

'FC' Set Frequency Step

'GENzUSWP':	Set step 1.0 ≤ 'n' ≤ 'F max'
'GENzLSWP':	Set step 0.001 ≤ 'n' ≤ F max, 1 kHz resolution with option 03, 1.0 ≤ 'n' ≤ F max without option 03

'FC' commands are ignored in 'GENzFIXED' and both 'MEAS' modes.

Set Level Commands

The three set level commands all require a numeric argument. The arguments specify levels in dBm with .1 dB resolution. Digits specifying a finer resolution are ignored (no rounding).

The 'LEVEL' command causes appropriate values for the step attenuator and leveling loop programming to be computed from the argument. The computation causes the step attenuator to switch at argument values which are evenly divisible by 10 (e.g., between '-29.9' and '-30.0'). Some applications may require that very small, but accurate level changes be made. If such a change causes a change in step attenuator setting, the accuracy of a very small change will be lost. Therefore, the 'LVLCRS' and 'LVLFNE' commands have been provided to independently set the step attenuator and leveling loop. Each of the following three messages will program the instrument to -28.5 dBm.

'LEVELz-28.5' (attenuator at -20 dB)
'LVLCRSz-20bLVLFNEz-8.5'
'LVLCRSz-30bLVLFNEz1.5'

'LEVEL' Set Output Level

The argument specifies that output level in dBm. Valid argument ranges are:

Manual attenuator:	-9.9 ≤ 'n' ≤ +15.0
90 dB remote attenuator:	-99.9 ≤ 'n' ≤ +15.0
110 dB remote attenuator:	-119.9 ≤ 'n' ≤ +15.0

'LVLCRS' Set Step Attenuator

The argument specifies the step attenuator setting in dB. It must be evenly divisible by 10.0. Valid ranges are:

90 dB remote attenuator:	-90.0 ≤ 'n' ≤ 0.0
110 dB remote attenuator:	-110.0 ≤ 'n' ≤ 0.0

'LVLFNE' Set Leveling Loop

The argument specifies the leveling loop program value in dB. Output power is the sum of the 'LVLCRS' and 'LVLFNE' arguments. The range of valid arguments is - 15.0 ≤ 'n' ≤ +15.0.

Units With Manual Step Attenuator

Units supplied with a manual step attenuator ignore the 'LVLCRS' command and invalid 'LEVEL' and 'LVLFNE' messages (no error messages are issued). The 'LEVEL' command behaves identically to the 'LVLFNE' command, except for the difference in argument ranges. Either of these commands may be used along with the front panel 10 dB step knob to set the instrument's output level.

Leveling Loop Range Limitations

The leveling loop range is limited by the maximum output power which the instrument can produce. At very low levels, the on-to-off ratio of the instrument's PIN attenuators may also limit the loop's range. Both the front panel vernier control and cable normalization, if enabled, may place demands upon the leveling loop in addition to those of the level commands. When the loop's dynamic range is exceeded, the front panel level light will go out. This condition can also be checked remotely by sending a 'SENDzSTATUS' command and examining the message returned by the instrument.

If a very large correction is needed for cable normalization, the dynamic range of the D/A converter which programs the leveling loop may be exceeded, causing 'ERRORs12' to be issued. 'ERRORs12' will also be issued upon receipt of invalid level command arguments by instruments with remote control attenuators. Leveling loop accuracy is reduced at very low levels (below about -12 dB). The internal power meter circuitry operates down to approximately -17 dB. Lower levels will cause the power display to blank.

Reply Messages

A reply message will be sent over the interface by the 1026 whenever it is addressed to talk. If unaddressed in the middle of a message, any remaining characters are cleared from the output buffer. EOI is asserted during the last character ('<LF>') of each message. The type of message sent is determined by the 'SEND' commands described in the following subsections. If an error conditon exists, a 'SENDzERROR' type message will be sent instead of the message type requested except for 'SENDzNUL' which always returns a nul line ('<CR><LF>').

Numeric values have leading zeroes to the left of the units position suppressed to spaces. Numeric precision is expressed as (X) for integers and (X.Y) for numbers with fractional parts where X and Y specify the number of digits before and after the decimal point, respectively. For signed numbers, the sign is included in X [e.g., '+22.7' is (3.1)].

'SENDzNUL' Nul Line

Message will be a nul line ('<CR><LF>') even if an error condition is present.

'SENDzFREQ' Frequency Message

The value sent always represents frequency in MHz.

'MEAS' modes:	'sFsINsn<CR><LF>' 'n' = '----' if no valid measurement is available 'n' = unsigned (5.4) in 'MEASzDIR' 'n' = signed (4.5) in 'MEASzDEL'
'GEN' modes:	'sFsOUTsn<CR><LF>' 'n' = unsigned (5) in 1 MHz resolution modes 'n' = unsigned (5.3) in 1 kHz resolution modes 'n' = has a value of 0 when sweep is reset.

'SENDzPOWER' Power Message

The value sent represents power in dB or dBm, as appropriate, and is always signed (4.1). If no valid power reading is available the message is sent with 'n' = '-----'.

'POWERzINT' sends 'sPsINTsn<CR><LF>'

'POWERzEXT' sends 'sPsEXTsn<CR><LF>'

'POWERzDELTA' sends 'sPsDELsn<CR><LF>'

'sPsCALsn<CR><LF>' is sent while the instrument is doing a cable measurement sweep.

'SENDzSTATUS' Status Message

The message sent is:

'sLOCKsdsLEVELsdsCALsd<CR><LF>'
where each 'd' is either '1' or '0' to represent true or false;
'LOCK' and 'LEVEL' are true when their corresponding front panel lights are on;
'CAL' is true when cable normalization is enabled.

'SENDzERROR' Error Message

The message sent is '<CR><LF>' if no error exists. When an error condition does exist, the message sent is 'sERRORsdd', where 'dd' is the error code displayed on the front panel.

Cable Normalization

Changing between local and remote control does not alter the cable normalization functions within the instrument. Thus one may, if desired, calibrate the loss of a cable using the front panel controls; and then, operate the instrument via the remote control interface. One can determine if cable normalization is enable by using the 'SENDzSTATUS' message. Cable normalization is controlled remotely by using the command sequences given in the following subsections.

To sweep a cable and record loss data do the following:

1. Connect cable to be calibrated between the instrument's RF output and power meter input.
2. Send 'CALzRUN'.
3. The status message will be 'CALs0' while data is being taken and 'CALs1' when calibration is complete. Normalization will be enabled.

To disable normalization, send 'CALzNO'.

To enable normalization with current data, send 'CALzYES'.

To delete previously recorded data send 'CALzCLEAR'. Normalization will be disabled and cannot be re-enabled until another calibration sweep has been done.

SPECIAL RS-232 COMMANDS

Local Remote

'LOCAL':	Enables front panel controls
'REMOTE':	Instrument is controlled by commands sent over the interface.

Output Control

'OUTPUTzLINE':	Causes a single line of information to be sent to the controller.
'OUTPUTzON':	Causes lines of information to be sent continuously.
'OUTPUTzOFF':	Cancels 'OUTPUTzON' at the end of the current line.

In most situations it will be most convenient to send 'OUTPUTzLINE' each time information from the instrument is desired.

Option 04 requires installation of the RS-232 PIA PC board (see the following parts lists and diagrams).

Parts List for 003CA00400 OPTION 04 RS232 Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CA22300	1	58900	101CA22300	RS232 PIA PCA
2	101CA27600	1	58900	101CA27600	RS232 INTERFACE CABLE
3	101CA06700	-1	58900	101CA06700	IEEE PIA PCA
4	101CA17300	-1	58900	101CA17300	IEEE INTERFACE CABLE
5	003AI00400	0	58900	003AI00400	OPTION 04 INSTRUCTIONS
6	003AT00400	0	58900	003AT00400	OPTION 04 TEST PROCEDURE

Parts List for 101CA22300 RS232 PIA PCA Rev C

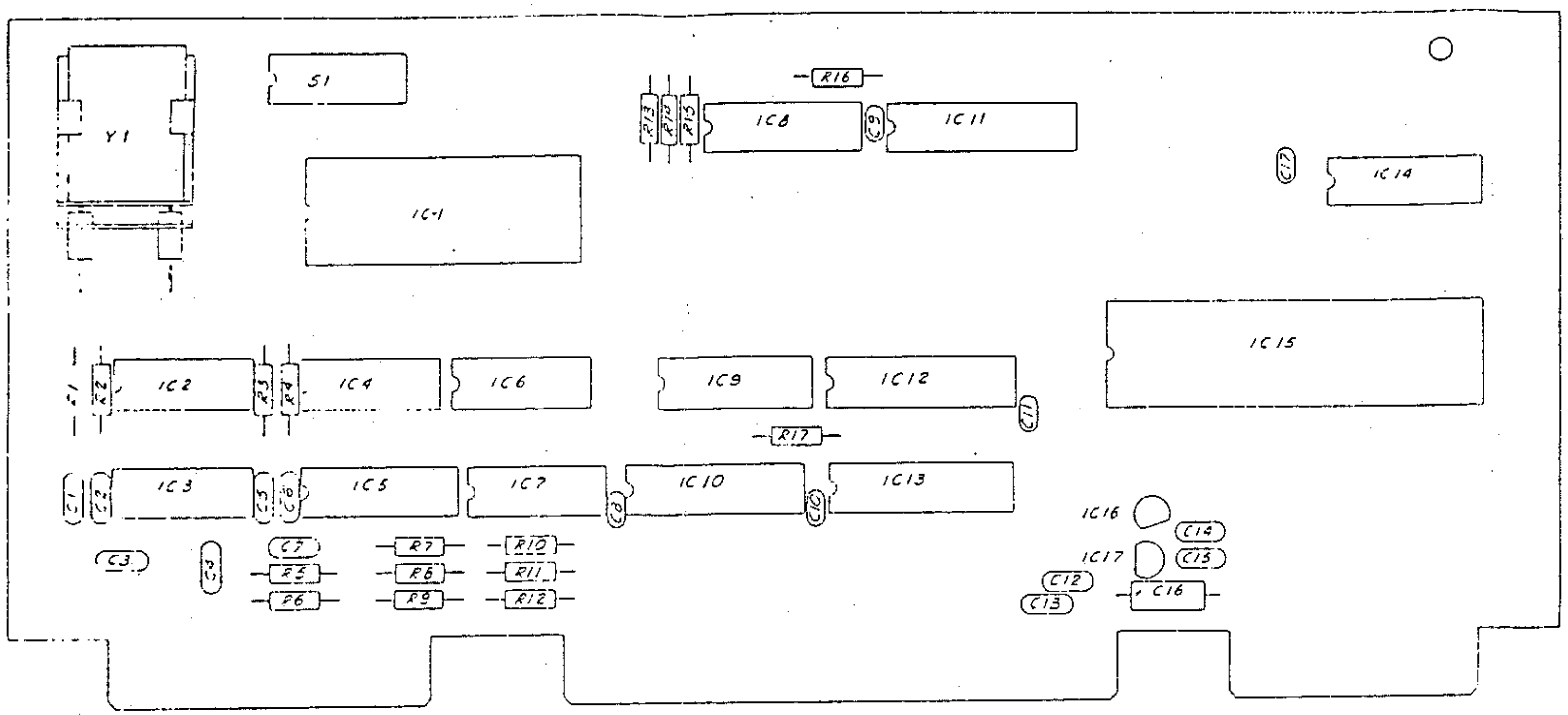
Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101CF22300	1	58900	101CF22300	RS232 PIA PCB
C 1	CC50-01330	1	51642	150-100-COG-331J	330 PF CERAMIC NPO
C 2	CC50-01330	1	51642	150-100-COG-331J	330 PF CERAMIC NPO
C 3	CC50-01330	1	51642	150-100-COG-331J	330 PF CERAMIC NPO
C 4	CC50-01330	1	51642	150-100-COG-331J	330 PF CERAMIC NPO
C 5	CC50-01330	1	51642	150-100-COG-331J	330 PF CERAMIC NPO
C 6	CC50-01330	1	51642	150-100-COG-331J	330 PF CERAMIC NPO
C 7	CC50-01330	1	51642	150-100-COG-331J	330 PF CERAMIC NPO
C 8	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 9	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 10	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 11	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 12	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 13	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 14	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 15	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 16	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 17	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
IC 1	UGN0-06551	1	55576	6551	6551 ACIA W/BAUD GEN
IC 2	UTN0-00081	1	01295	SN74LS08N	SN74LS08 QUAD AND
IC 3	UIN0-01489	1	04713	MC1489AN	MC1489 QUAD LINE RECEIVE
IC 4	UIN0-01488	1	04713	MC1488LDS	MC1488 QUAD LINE DRIVER
IC 5	UTN0-03651	1	01295	SN74LS365N	SN74LS365 HEX DRIVER
IC 6	UTN0-00321	1	01295	SN74LS32N	SN74LS32N QUAD OR
IC 7	UTN0-00170	1	01295	SN7417N	SN7417N HEX BUFFER
IC 8	UTN0-03651	1	01295	SN74LS365N	SN74LS365 HEX DRIVER
IC 9	UTN0-01381	1	01295	SN74LS138N	SN74LS138N 3 TO 8 DEC
IC 10	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC 11	UTN0-02451	1	01295	SN74LS245N	SN74LS245N 8X TRANSCEIVE
IC 12	101AC28401	1	58900	101AC28401	ADDRESS ROM A1
IC 13	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC 14	UTN0-01381	1	01295	SN74LS138N	SN74LS138N 3 TO 8 DEC
IC 15	UGN0-06821	1	04713	MC6821P	MC6821P PIA
IC 16	URP0-79120	1	04713	MC79L12CP	MC79L12 .1A -12V REG
IC 17	URP0-78120	1	04713	MC78L12CP	MC78L12CP .1A 12V REG
R 1	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 2	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 3	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 4	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 5	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 6	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 7	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 8	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 9	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM

Parts List for 101CA22300 RS232 PIA PCA Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
R 10	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 11	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 12	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 13	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 14	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 15	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 16	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
R 17	RN55-14990	1	81349	RN55D4991F	4.99 K OHMS 1% MET FILM
S 1	SDP0-00801	1	71450	206-8	8 SPST DIP SWITCH
X 1	JSP0-10028	1	09922	DILB28P-108	28 PIN DIP SOCKET
X 3	JSP0-10040	1	09922	DILB40P-108	40 PIN DIP SOCKET
X 4	Y06M-00001	1	91506	8000-DG1	HC6 XTAL MOUNT
Y 1	Y330-00184	1	75378	MP018	1.84 MHZ FUND XTAL

Parts List for 101CA27600 RS232 INTERFACE CABLE Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	JFF0-02034	1	1BR23	CWR-220-034-0021	34 PIN FLAT CABLE CONN
2	JFF0-02025	1	1BR23	CWR-283-25-0021	DB-25 FLAT CABLE CONN
3	JFM0-02016	1	1BR23	CWR-130-16-0000	16 PIN DIP FLAT CBL CONN
4	WMC0-03428	17	1BR23	C-03-000-34	FLAT CABLE;34 COND;28AWG



COMPUTER RS-232 PIA -- Circuit Board A1

GENERAL

Part of the microprocessor interface system, this card has two major functions. It provides the RS-232 interface and, via a peripheral interface adapter, controls the various D/A converters in the unit.

COMPUTER BUS INTERFACE

A generalized buffer/decoder circuit is employed to connect the two functional circuits to the computer bus. IC11 provides a bi-directional buffer for the data lines. IC7, IC10, and IC13 buffer the remaining lines, as required. Bipolar prom IC12 and decoder IC9 provide enable signals at the proper address for the data buffers, IC5 and IC8.

RS-232 INTERFACE

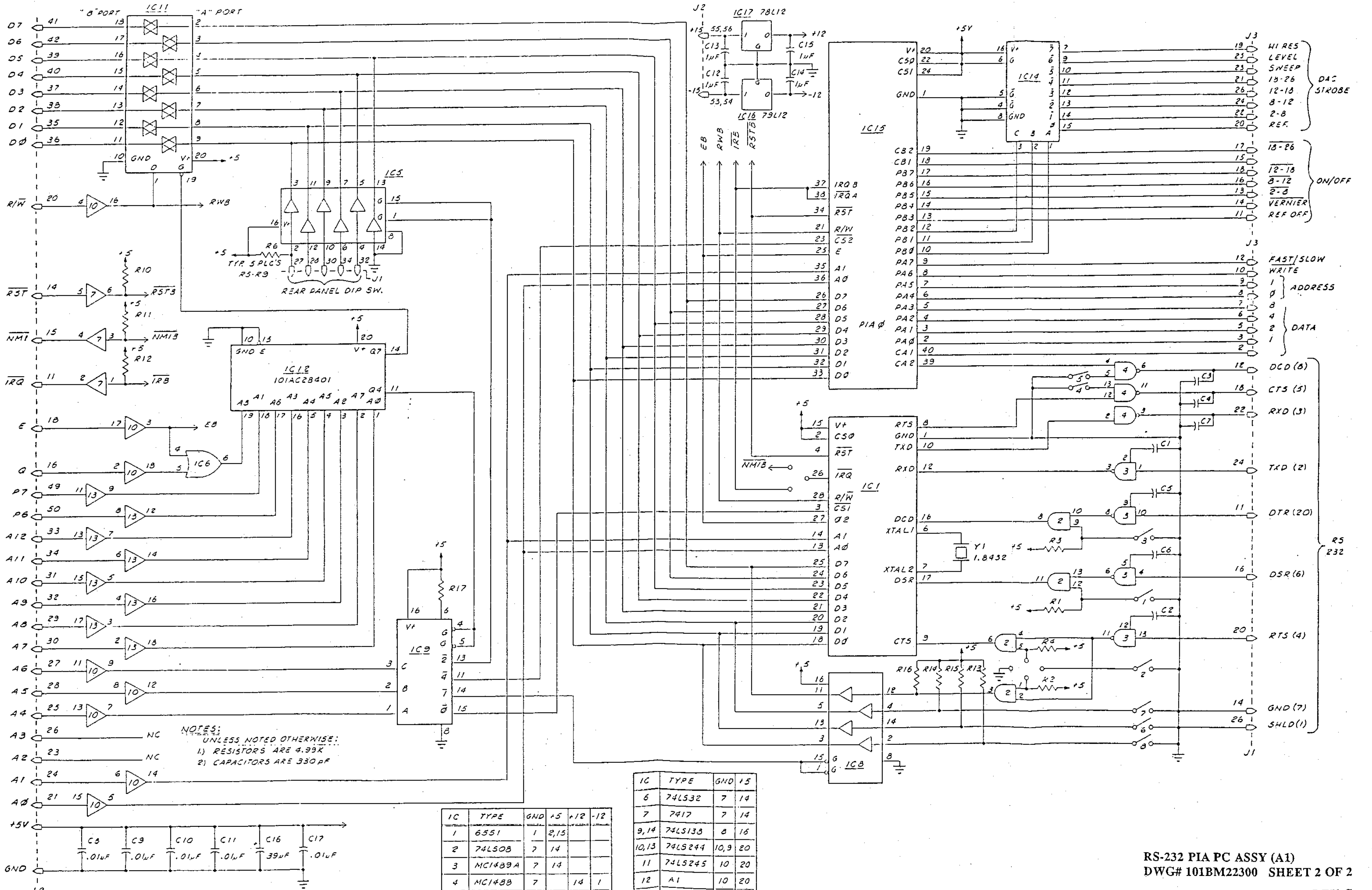
The RS-232 interface is implemented by IC1, under control of the microprocessor. This single integrated circuit develops the required protocol and data translation, thus freeing the processor from a considerable amount of work. Buffers IC3 and IC4 connect to the rear panel interface connector. The only function not implemented in the RS-232 interface IC is that of baud rate selection. This is handled directly by the processor, via buffer IC8.

PERIPHERAL INTERFACE ADAPTER

P.I.A. IC15 is used to provide control of the various D/A converters in the unit. It also controls the enable signal for the microwave oscillator drivers and selects their speed. The "CS" (chip select) lines for the various D/A converters are supplied via a 3-line to 8-line decoder, IC14. All the remaining D/A control lines are all driven in parallel directly by the P.I.A.

RS-232 PIA PC ASSY (A1)
DWG# 101BM22300 SHEET 1 OF 2

REV C

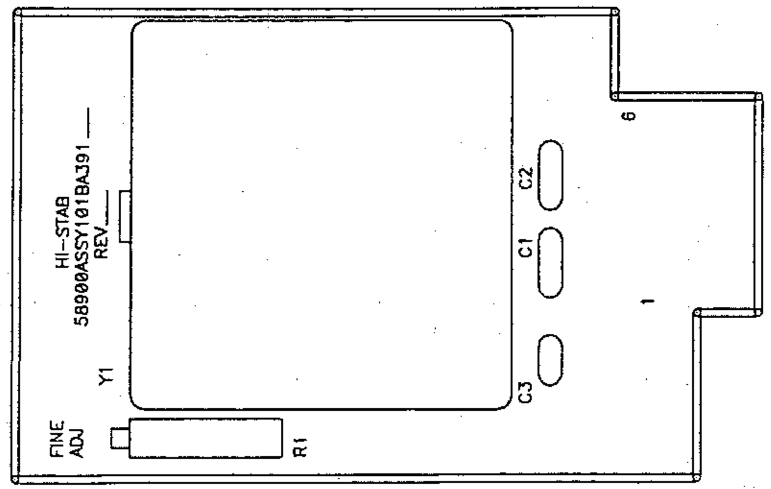


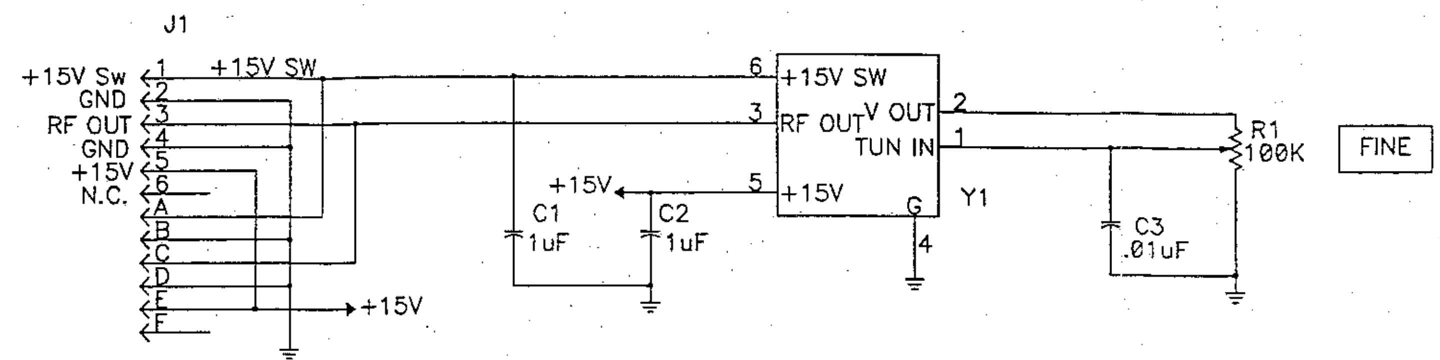
IC	TYPE	GND	+5	+12	-12
1	6551	1	2,15		
2	74LS08	7	14		
3	MC1489A	7	14		
4	MC1488	7		14	1
5,8	74LS365	8,14	16		

IC	TYPE	GND	+5
6	74LS32	7	14
7	7417	7	14
9,14	74LS138	8	16
10,13	74LS244	10,9	20
11	74LS245	10	20
12	A1	10	20
15	MC6821	1	20,22

RS-232 PIA PC ASSY (A1)
DWG# 101BM22300 SHEET 2 OF 2

REV C





NOTES: UNLESS OTHERWISE SPECIFIED

1. CAPACITOR VALUES ARE IN uF
2. RESISTOR VALUES ARE IN OHMS
3. RESISTORS ARE 1/5W,1%

HIGH STABILITY OSC PC ASSY (A32)
DWG# 101BM39101 SHT 1 OF 1

REV B

8.4 OPTION 06: HIGH STABILITY TIME BASE

This option replaces the standard (10^{-6}/year) master reference oscillator with a high stability time base (10^{-9}/day). The time base PC board (A32) is replaced by an alternative version (DWG# 101BA39101; see the following parts lists and diagrams).

Parts List for 003CA00601 HI STAB 1X10E-9/DAY ASY Rev E

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
101	HBPP-63205	2	96906	MS-51957-27	6-32 X 5/16 PAN
102	HWSS-60400	2	96906	MS35338-136	#6 X 1/4 SPLIT LOCK
103	HWFS-60500	2	96906	MS15795-805	#6 X 5/16 FLAT WASHER
A 32	101BA39101	1	58900	101BA39101	HI STAB OSC PCA

Parts List for 101BA39101 HI STAB OSC PCA Rev B

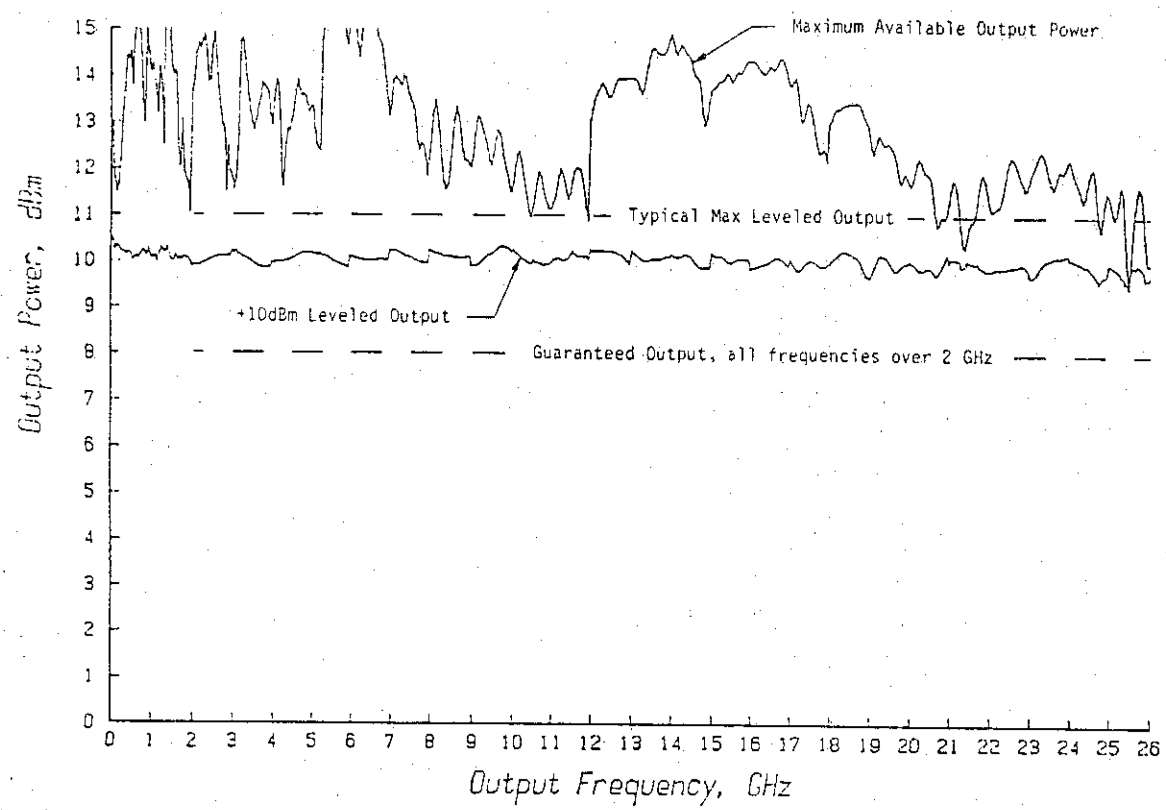
Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
0	101BS39101	0	58900	101BS39101	HI STAB OSC
1	101BF39101	1	58900	101BF39101	HI STAB OSC PCB
C 1	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 2	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
C 3	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
R 1	RAPD-31000	1	73138	89PR100K	100K POT 15T PC MNT
Y 1	OXO0-00010	1		250-0578	10MHz OVEN XTAL OSC

8.5 OPTION 10: +10 dBM OUTPUT POWER

This option increases the maximum leveled output power of signal generators that normally provide +5 dBm output power. It is implemented by substituting high power YIG oscillators for the standard YIG oscillators normally supplied. These high powered oscillators are capable of increasing available output power by approximately 5 dBm.

Option 10 provides maximum leveled output power of +10 dBm (nominal) at all output frequencies above 2 GHz, over a temperature range of +15°C to +35°C. Typically, maximum leveled output power will be >+11 dBm throughout this frequency range. There may, however, be one or more frequencies at which available power is slightly less than the nominal value, due to the characteristics of the particular high powered YIG oscillator involved. Output power at these frequencies is always >+8 dBm. Plots of the maximum available output power and the leveled output from a typical 26 GHz instrument with Option 10 are shown below. A plot of maximum available output power is supplied with each instrument.

NOTE: The instrument's harmonic specification (<-55 dBc at 0 dBm, CW mode) may degrade at outputs >0 dBm when Option 10 is installed. The instrument's rise/fall time specification is degraded to 60 nanoseconds when Option 10 is installed.



8.6 OPTION 11: 5 MHZ EXTERNAL TIME BASE INPUT

This option modifies the external time base input to accept a 5 MHz, rather than a 10 MHz, reference signal. In order to adapt the instrument to this modification, a frequency doubler is introduced between the time base input and the 100 MHz phase lock loop (PC A8).

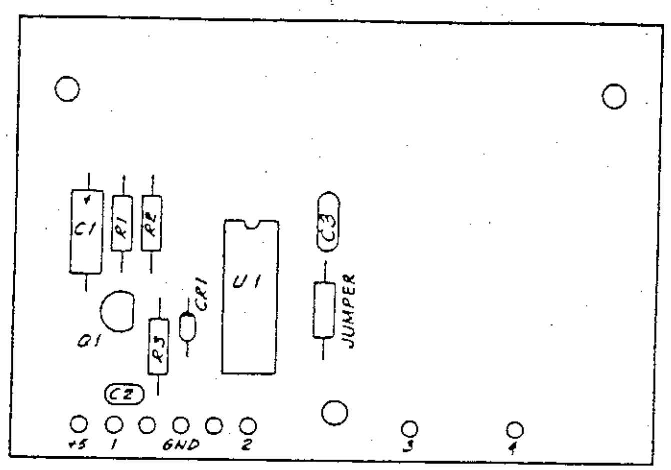
This option requires the installation of a special circuit board, the 5 MHz External Clock PC assembly (A115; see the following parts lists and drawings).

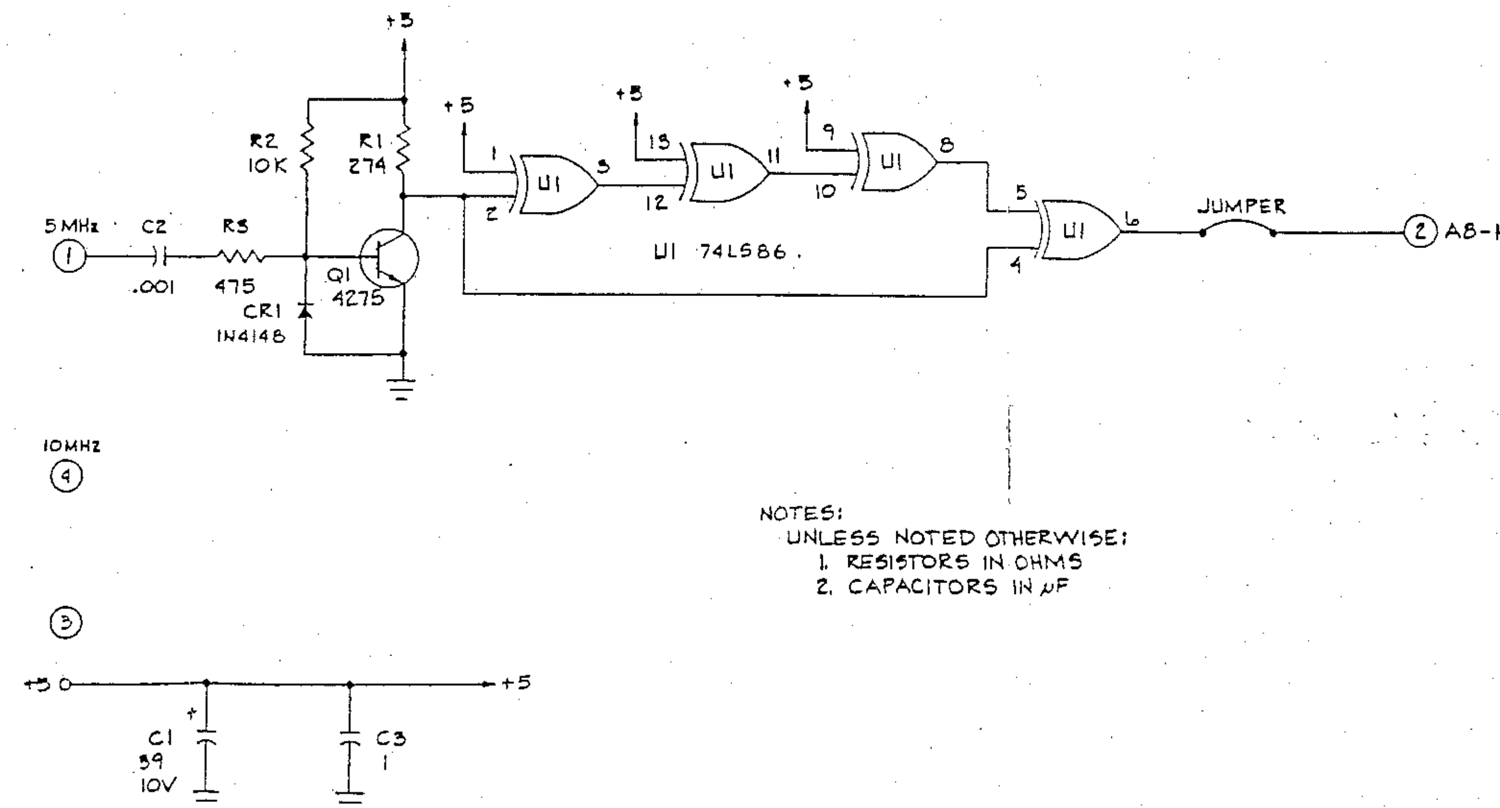
Parts List for 003CA01100 OPT 11 5MHz EXT CLOCK Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	105BA02500	1	58900	105BA02500	5 MHZ EXT CLOCK PCA
2	003AI01100	0	58900	003AI01100	OPT 11 5MHz EXT CLOCK
3	003AT01100	0	58900	003AT01100	OPT 11 5MHz EXT CLOCK
4	105AW02501	0	58900	105AW02501	5MHz EXT CLOCK,OPT 11 W/

Parts List for 105BA02500 5 MHZ EXT CLOCK PCA Rev C

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	105BF02500	1	58900	105BF02500	5 MHZ EXT CLOCK PCB
2	HSTS-40404	3	06540	9533B-A-0440	4-40 X 1/4 SWAGE SPACER
3	WJIB-05022	1	53387	923345-05	.5' INSULATED JUMPER
C 1	CT10-06390	1	56289	150D396X9010B2	39 UF 10V TANTALUM
C 2	CC50-02100	1	52763	EDPT-1000-Y5P10%	.001 UF CERAMIC Y5P
C 3	CC50-05100	1	56289	2C2525U105M050B	1 UF CERAMIC Z5U
CR 1	DSA0-04148	1	07263	1N4148	IN4148 G.P. DIODE
Q 1	QBNS-04275	1	27014	PN4275	PN4275 .1A 15V .6W NPN
R 1	RN55-02740	1	81349	RN55D2740F	274 OHMS 1% MET FILM
R 2	RN55-21000	1	81349	RN55D1002F	10 K OHMS 1% MET FILM
R 3	RN55-04750	1	81349	RN55D4750F	475 OHMS 1% MET FILM
U 1	UTN0-00861	1	01295	SN74LS86N	SN74LS86N QUAD EX OR





5 MHz EXT CLOCK PC ASSY (A115)
DWG# 105BM02500 SHT 1 OF 1

REV C

8.7 OPTION 12: 12-18 GHz AND 18-26 GHz BANDS DELETED

This option removes the 12-18 and 18-26 YIG oscillators and their associated circuitry. Disregard all references in this manual to those oscillators, and to output frequencies from 12 to 26 GHz.

8.8 OPTION 14: CONTROL BUS FOR FREQUENCY EXTENDERS

Option 14 permits remote control of all parameters (except power on/off) of Giga-tronics frequency extenders (Series 800) from the signal generator. The extender's parameters may be set manually from the signal generator's front panel, or automatically via the IEEE-488 or RS-232 bus.

FREQUENCY EXTENDER REMOTE OPERATION

Initialization

1. Determine that the signal generator to be used is equipped with option 14.

2. Apply AC power to both the signal generator and the frequency extender.

3. Connect the parallel control bus between the signal generator and the frequency extender; this automatically places the extender under the control of the generator. Verify that the frequency extender 'REMOTE' indicator is lit any time the generator is set to frequencies above its upper range (e.g., frequencies greater than 26 GHz in a .05-26 GHz signal generator).

For Frequencies Within the Range of the Generator

1. Operate the signal generator normally, as instructed in this manual, at all frequencies that are within the range of the signal generator (e.g., at frequencies lower than 26 GHz in a .05-26 GHz signal generator).

For Frequencies Above the Range of the Generator

1. Connect the RF output from the signal generator to the input connector of the frequency extender.

2. To set the frequency for CW operation, select 'CW' and 'MODULATION OFF' on the signal generator. Set the signal generator to the desired final output frequency, via the leverwheel switches or the remote control bus. The signal generator's computer automatically sets the proper input frequency to the extender, and the extender's output frequency is displayed on the signal generator front panel readout and may also be read over the bus.

NOTE:
The extender is a frequency multiplier. It requires an input frequency equal to the output frequency divided by the multiplying factor (f/2 for a doubler, f/3 for a tripler, etc.). If an output frequency, f, is selected such that f/2 (or f/3, etc.) is not available from the signal generator, owing to its finite frequency resolution capability (1 MHz standard, 1 kHz with option 03), the signal generator will automatically be set for an output frequency as close as possible to that requested. If two output frequencies are equally close, the lower of the two is selected.

3. To set the frequency extender's power levels from 0 to -15 dBm, select 'LEVELED' output (i.e., 0 dBm reference) on the signal generator, and set the desired level with the signal generator's 'ATTENUATION' controls. The signal generator automatically supplies the proper input level to the frequency extender to attain the desired output level, and programs the extender's leveling system. For frequency extender output levels above 0 dBm, release the 'LEVELED' control on the signal generator and set the generator's 'ATTENUATION' controls for 10 dB less than the desired output power. Verify that the signal generator's 'OUTPUT INDICATOR' displays the desired frequency extender output level.

NOTE:
If an output level is selected which is beyond the output capability of the frequency extender, its output will be limited to its maximum capability although the readout will display the output level selected (the 'LEVELED' indicators on the generator and extender will be dark when this condition occurs).

4. To pulse or square wave modulate the output of the frequency extender, select the appropriate 'MODULATION' control on the signal generator. The frequency extender will automatically be modulated as selected on the generator.

5. To modulate the output of the frequency extender while sweeping through a frequency range, select the desired 'SWEEP' and 'MODULATION' modes on the signal generator. The frequency extender will automatically be placed in the 'PULSE FAST' leveling speed mode and the output of the frequency extender will be swept and modulated as selected.

Additional Error Messages

In addition to the error messages described in section 1 of this manual, the following error messages are added when the frequency extender control bus is in use:

ERROR 15	Sweep range crosses multiplier band
ERROR 16	ΔP mode (power meter) is invalid with multiplier
ERROR 17	AM and SCAN are invalid with multiplier
ERROR 18	Ext ALC is invalid with multiplier
ERROR 19	Multiplier range is incompatible with generator's range

Option 14 requires installation of a special Buffer PC board (A114, DWG# 101BA29602; see the following parts lists and drawings).

Parts List for 003CA01400 OPT 14 M800 INTERFACE AS Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BA29602	1	58900	101BA29602	1026-007 BUFFER PCA
2	198AW03800	0	58900	198AW03800	1026-007 BUFFER W/L
3	101BF30000	1	58900	101BF30000	INTERFACE CONNECTOR MNT
4	JMF0-03600	1	02660	57-40360	36 PIN FEMALE CONNECTOR
5	203CA02201	1	58900	203CA02201	PARALLEL I/F CABLE-36 PI

Parts List for 101BA29602 1026-007 BUFFER PCA Rev A

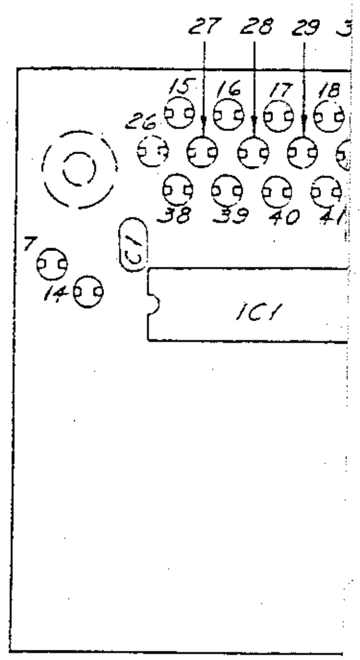
Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	101BF29600	1	58900	101BF29600	BUFFER PCB
2	ETSB-06216	35	88245	2000B	BIFURCATED TERMINAL 5/32
3	HSTS-40204	3	06540	9531B-A-0440	4-40 X 1/8 SWAGE SPACER
C 1	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
C 2	CC50-03100	1	51642	150-100-W5R-103K	.01 UF CERAMIC X7R
IC 1	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
IC 2	UTN0-02441	1	01295	SN74LS244N	SNL4LS244N 8X DRIV/RECV
R 1	RN55-21000	1	81349	RN55D1002F	10 K OHMS 1% MET FILM
R 2	RN55-21000	1	81349	RN55D1002F	10 K OHMS 1% MET FILM

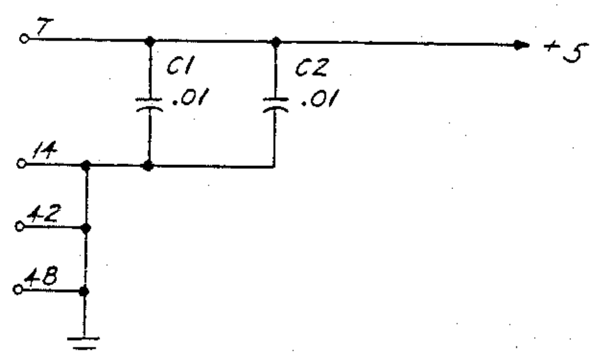
Parts List for 203CA02201 PARALLEL I/F CABLE-36 PI Rev A

Item	Part Number	Qty	CAGE	Mfr's Part Number	Description
1	JMM0-01500	1	02660	747908-4	15 PIN MALE CONNECTOR
2	JMPM-00001	1	02660	66570-3	MALE CONNECTOR PIN
3	JMSM-00001	1	02660	205980-1	MALE JACK SCREW
4	JMH0-01501	1	02660	206390-1	15 PIN CONNECTOR HOOD
5	JMM0-03600	1	02660	57-30360	36 PIN MALE CONNECTOR
6	WMCS-01524	1	16428	6541	15 CONDUCTOR CABLE

Option 14 Buffer -- Circuit Board A114

This circuit, consisting of two 74LS24
equipped with the Frequency Extender
used to buffer the control lines ru
bus connector on the rear panel of thi





IC#	TYPE	+5	GND
1,2	74LS244	20	1,10

1026-007 BUFFER PC ASSY (A114)
DWG# 101BM29602 SHT 1 OF 1

8.9 OPTION 18: 18-26 GHz BAND DELETED

This option removes the 18-26 YIG oscillator and its associated circuitry. Disregard all reference in the manual to that oscillator, and to output frequencies from 18 to 26 GHz.

8.10 OPTION 22: REAR PANEL RF OUTPUT

When this option is installed, the RF output connector is relocated to the instrument's rear panel.

ACCESSORIES

The following accessories are available for use with Model 1026.

Accessory	Giga-tronics Part#	Description
A001		**Cable Kit, consisting of:**
1 each	WCA0-26015	Gore Cable, 18 in., with male SMA connectors at each end.
1 each	WCA0-26060	Gore Cable, 6 ft., with male SMA connectors at each end.
1 each	JRAA-26200	Adapter, SMA male to SMA female
1 each	JRAC-26200	Adapter, SMA female to SMA female
A002	HRSA-20000	Rack Mount with Chassis Slides
A003	101BF18200	Rack Mount without Chassis Slides