details of the two synthesizer boards mounted in the bottom of the radio:

ATR-157	Synthesizer #1 Schematic
ATR-169	Synthesizer #2 Schematic (Sheet 1 of 2)
ATR-169	Synthesizer #2 Schematic (Sheet 2 of 2)

C. Receiver

In following the receiver theory of operation discussion, reference is made to the following schematics:

ATR-184	RF Filter and Band Switch Schematic Assembly
ATR-175	Receiver Board Schematic (Sheet 1 of 3)
ATR-175	Receiver Board Schematic (Sheet 2 of 3)
ATR-175	Receiver Board Schematic (Sheet 3 of 3)

The ASTRO-200A incorporates RF bandpass filtering ahead of a single conversion to the 5.6MHz IF circuitry. There is a 30MHz low pass filter for each of the five operating bands of the transceiver. In addition, the filter assembly incorporates a 10MHz bandpass filter for the WWV receiver. This RF filtering is located on two circuit boards integral to the band select switch and T-R relay.

The output of the RF filter assembly is fed to the receiver board via coax cable. The RF input is amplified through a dual gate MOS FET and emitter follower compound amplifier before being applied to the double balanced first mixer. This RF amplifier maintains the receiver threshold essentially constant, up through 30MHz.

The source of the input FET amplifier incorporates a feedback signal attenuator for RF gain control of very large input signal levels.

The receiver local oscillator frequency is applied to the receiver mixer with the RF amplified input signal. The frequency of the receiver local oscillator is determined by the mode of operation selected, and is generated by the frequency synthesizer.

The output of the receiver mixer is transformer coupled to a push-pull IF amplifier and fed through either the 5.6MHz sideband filter, or the 5.6MHz 400Hz narrow band CW filter, to additional IF gain stages. The selection of the filter is made through front panel controls which direct diode and transistor logic for the proper filter selection.

PIN diode AGC control is incorporated in the IF amplifier stages. The IF output is applied to a product detector as is the proper carrier frequency. The audio output is then fed to the audio amplifier circuits. The audio amplifier is an IC, LM380N.

The meter circuits for ALC, AGC (receive level), and carrier power are also incorporated on the receiver circuit board. In addition, the microphone preamplifier and amplifier, the diode logic for the sidetone CW operation, and the receiver delay circuitry are on this board. Adjustments for VOX, anti-VOX, sidetone, meter functions, ALC, AGC, and receiver delay time are available.

The WWV receiver is also located on the receiver board. The signal from the WWV 10MHz filter is fed to a dual gate MOS FET for direct conversion to audio, utilizing the 5.0MHz reference oscillator as the local oscillator. The signal is amplified by an operational amplifier and passes through a two pole active low pass filter. The output of the filter is coupled to the volume control.

The noise blanker circuit accepts the wide band IF signal, amplifiers the WBIF in two tuned stages, and drives two separate detectors; one average detector for wide band signal and noise, and a second pulse detector. The IF bandwidth of the noise blanker is set to optimize S/N of the unwanted impulse noise. The output of the average detector is used to generate the WBIF AGC signal. The pulse detector feeds a comparitor to generate the blanking pulse. This pulse blanks the received signal prior to the narrowband crystal filter to minimize filter ringing on impulse noise.

D. Transmitter

The transmitter circuits are shown schematically on the previously mentioned receiver board drawings, and Drawing ATR-190, Power Amplifier Board Schematic.

On the receiver board, the modulation input is applied to the first mixer as is the appropriate carrier frequency. The output of this mixer is a 5.6MHz sideband signal (or CW as selected) which is transformer coupled to the push-pull 5.6MHz amplifier. The sideband signal is filtered by the crystal sideband filter and followed by an emitter follower. The output of the emitter follower is fed to the transmitter mixer with the synthesizer derived local oscillator to give the proper RF sideband frequency f_x. The CW output is generated in a similar manner and transmitted on upper-sideband, 1KHz up from the indicated carrier frequency. The transmitter mixer output is fed to the transmitter preamplifier. The transmitter preamplifier supplies required linear amplification before going to the bandpass filters and the power amplifier board. The bandpass filters present a clean spectrum to the power amplifier.

The power amplifier circuit board has three stages with the last two connected in a push-pull configuration. This amplifier will supply 100 Watts PEP across each band.

WARNING: For maximum power transistor life, 100 Watt (full scale on FWD position of meter) CW output should not be exceeded.

The microphone amplifier utilizes logarithmic response to compress the audio peaks and improve voice average power. The log amplifier is followed by a two pole active filter to limit voice bandwidth to 3KHz. The microphone gain in USB or LSB operation will progressively increase the drive level to the power amplifier. This allows operator controlled RF compression.

8.0 CALIBRATION, SERVICE, AND REPAIR

Most circuit alignment and calibration is factory performed at final check-out and bake-in, and should require no further adjustment. In cases where it becomes necessary for some reason to align circuits other than those described in this section, it is recommended that the unit be returned to the factory for a complete alignment and check-out.

Operator-owner calibration and alignment may be desirable for the following function.

A. Carrier Oscillator Frequency Alignment

NOTE: For setting frequency on USB and LSB, the MIC GAIN should be full CCW and key down to activate f_{CX} signal with minimum transmitter power. For setting CWW, MIC GAIN should be full CW and key down. These tests should be performed with transmitter loaded into a dummy load to prevent unwanted transmissions.

Refer to Figure 7.2 for location of adjustments and circuit board. A frequency counter should be connected to f_{CX} (place probe on center connector at the coax connection). With the front panel switch in USB and the FINE and RIT controls at the 12 o'clock position, adjust C180 until the frequency on the counter is 5.601650MHz.

With the front panel switch in the LSB position, adjust C174 until the frequency on the counter is 5.598350MHz. With the front panel switch in the CWW position, adjust C 204 until the counter reads 5.600600MHz.

B. Reference Oscillator Calibration

Refer to Figure 7.4 and 7.2 for the circuit board location of C52 and the coax 5MHz input to the WWV receiver. This oscillator may be calibrated with either a counter, or the WWV receiver. If the WWV receiver is employed, select the WWV receiver position on the front panel and adjust C52 for a zero beat in the received WWV signal. An oscilloscope monitoring the audio signal is helpful in this. If a counter is used, connect it to the 5MHz coax input to the WWV receiver input point with the counter probe and adjust C52 to 5.000000MHz.

C. Receiver Delay Adjustment

Refer to Drawing Number ATR-176, Receiver Board Layout, and Figure 7.2 for the location of R239 on the receiver circuit board. R239 adjusts the time delay from the time the VOX or key is released, until the receiver circuitry is activated. This adjustment is not critical and may be set to individual operator preferences.

D. VOX Trip and Anti-Trip Adjustments

Refer to Drawing Number ATR-176, Receiver Board Layout, and Figure 7.2 for location of R181 and R158. R181 sets the gain of the VOX activation level and R158 sets the anti-VOX level.

E. Synthesizer Notes

The synthesizer design incorporates essentially non-adjustable components throughout the logic scheme and routine maintenance or tuning is not required. It should be noted that it will not be possible to see many of the pulses in the digital circuits with the normally used general purpose oscilloscope. These circuits require precision high speed oscilloscopes in order to accurately trace the synthesizer waveforms. Further, test equipment used at many of the circuit points will cause erroneous data, including synthesizer loop unlocking, due to loading or peripheral effect of the test equipment.

F. Power Meter, Reflected Power Meter Adjustment

Refer to Drawing Number ATR-176, Receiver Board Layout, and Figure 7.2 for the location of R306 and R312. R306 calibrates the forward power reading while R312 calibrates the VSWR shutdown of power. The RF output cable should be connected to a through line calibrated Wattmeter and terminated into a 50 Ohm non-reactive load. With the function selector in the CWW position, and meter switch in FWD position, key the microphone and set the MIC gain for 100 Watts as indicated on the through-line Wattmeter. Now set R306 for full scale indication on the ASTRO-200A meter.

To set VSWR shut-down it is necessary to load the transmitter with a known 2:1 VSWR; for example two 50 ohm loads in parallel. With the mic gain in the full counter clockwise position key the transmitter and adjust R312 to limit power output to about 90 watts. With this adjustment the VSWR should read about 2 in the REF meter mode.

NOTE: DO NOT OPERATE TRANSMITTER INTO MISMATCH ANY LONGER THAN NECESSARY TO MAKE SHUT-DOWN ADJUSTMENT.

G. ALC Set

Refer to figure 7.2 and Drawing ATR-176 for location of R296. Terminate the transceiver with a 50 ohm load. Set MIC GAIN full clock-wise, meter mode FWD, Key transmitter, and whistle into microphone. Adjust R296 to a meter reading equivalent to +30dB on the S scale. This will set the ALC to hold an average power of 40 watts.

H. ALC Meter Sensitivity

Refer to Figure 7.2 and Drawing ATR-176, for the location of R291. To adjust ALC meter sensitivity set function switch to CWW, meter mode to ALC, and MIC GAIN full <u>clockwise</u>. Key transmitter and note minimum RF power output. Adjust R291 for full scale meter deflection.

I. AGC Setting

Refer to figure 7.2 and Drawing ATR-176 for location of R280. To adjust receiver for proper AGC threshold, inject a signal in the 20M band at 1.5μ volt level and tune receiver for about a 1KHz signal at the speaker. Set R280 for a meter reading of S-3.

J. AGC Meter Set

Using the same set up as in I above increase the signal level to 50μ volts and adjust R272 to give a meter reading of S-9.

K. Sidetone Level Set

Refer to Figure 7.2 and Drawing Number ATR-176, Receiver Board Layout, for R257 location. This control sets the audio listening level for CW sidetone during CW operation.

L. Component Replacement and Repair Notes

Should component replacement be necessary, it must be recognized that the circuit boards in the ASTRO-200A utilize plated-through holes. Therefore, in order to remove components without destroying etch, the solder must be removed before the component is removed. Solder wick dipped in flux should be laid over the joint to be de-soldered. Apply heat with a 25 Watt iron over the braid (wick) and "wick" off the solder. Do not force pull out the component. They will come much easier and leave the etch if all solder is removed first. Do not use large hot irons for repair work.

9.0 OPERATING NOTES

A. External Local Oscillator

The ASTRO-200A may be tuned by means of an external local oscillator. The transistor switch for this function is on the receiver board. (See ATR-175, Sheet 3). Q22 and Q23 are connected as a differential switch. To activate the external L.O. function, a 12 to 15VDC gating signal is applied to Pin 9 of the accessory connector. This gating voltage turns on Q22 and turns off Q23. An L.O. signal of about 0dBm (.2Vrms) should be supplied by coax to Pins 7 and 6 of the accessory connector. This gating has no effect on synthesizer tuning and does not effect the frequency readout.

The external L.O. Frequency may be determined by the following formula:

$$f_{LO}MHz = (f_{tune}MHz + 5.6MHz) \pm .00165MHz$$

+ .00165MHz for USB

- .00165MHz for LSB

For example: Suppose the desired tuned frequency is 21.00000MHz - USB, then:

$$f_{LO}MHz = 21.00 + 5.6 + .00165 = 26.60165MHz$$

It should be noted that frequencies slightly outside the specified bands can be tuned with only minor loss in performance.

B. Synthesizer

The operational characteristics of a complete digitally synthesized transceiver are superior to the traditional VFO or phase locked loop VFO approach to frequency generation. Upon inital turn-on of the unit, about one minute is required for both synthesizer loops to lock. When changing from one band to another, about 15 seconds are required for the synthesizer loops to stabilize.

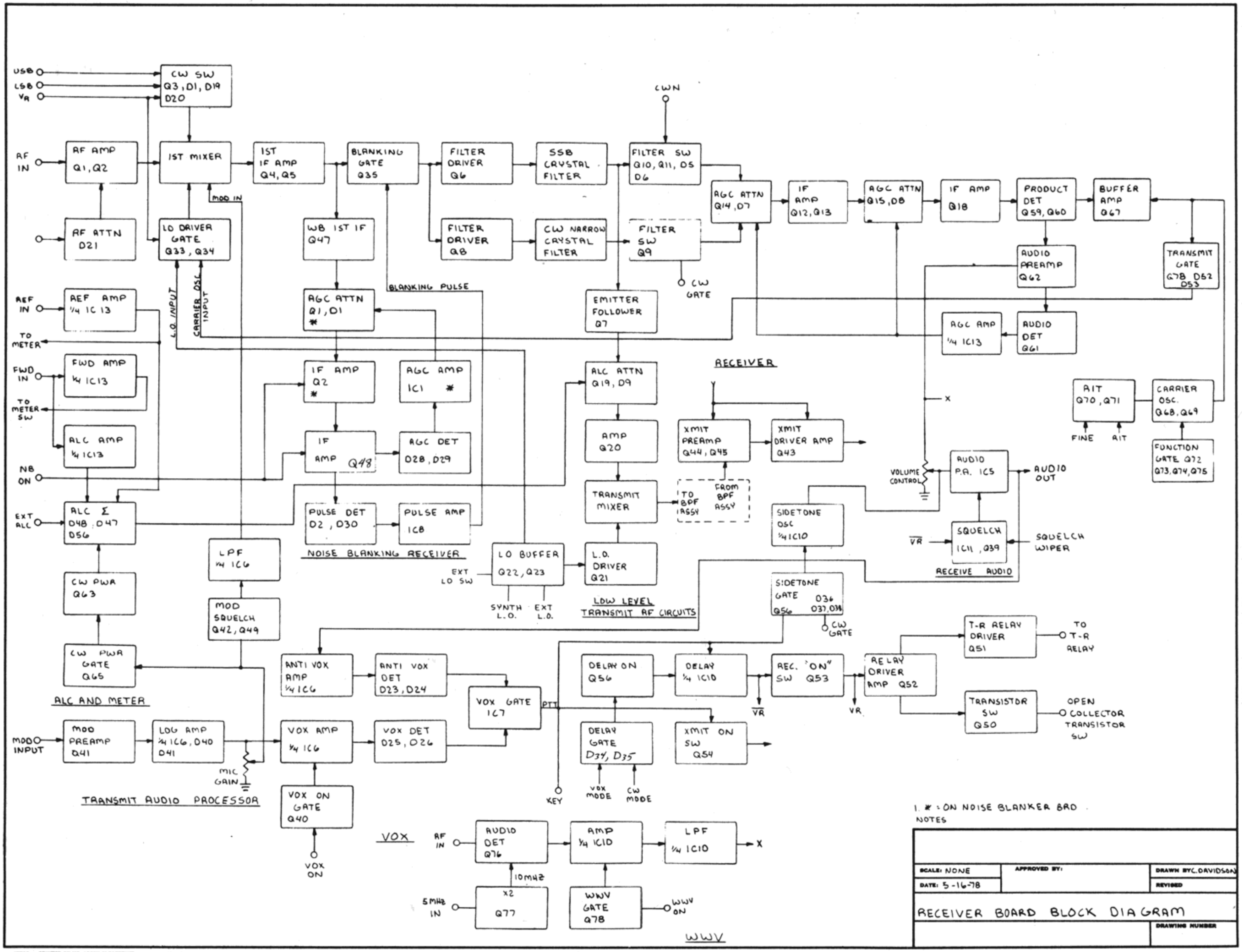
After the loops have stabilized, it is not necessary to wait for the loops to stabilize while tuning within a band.

C. Grounding

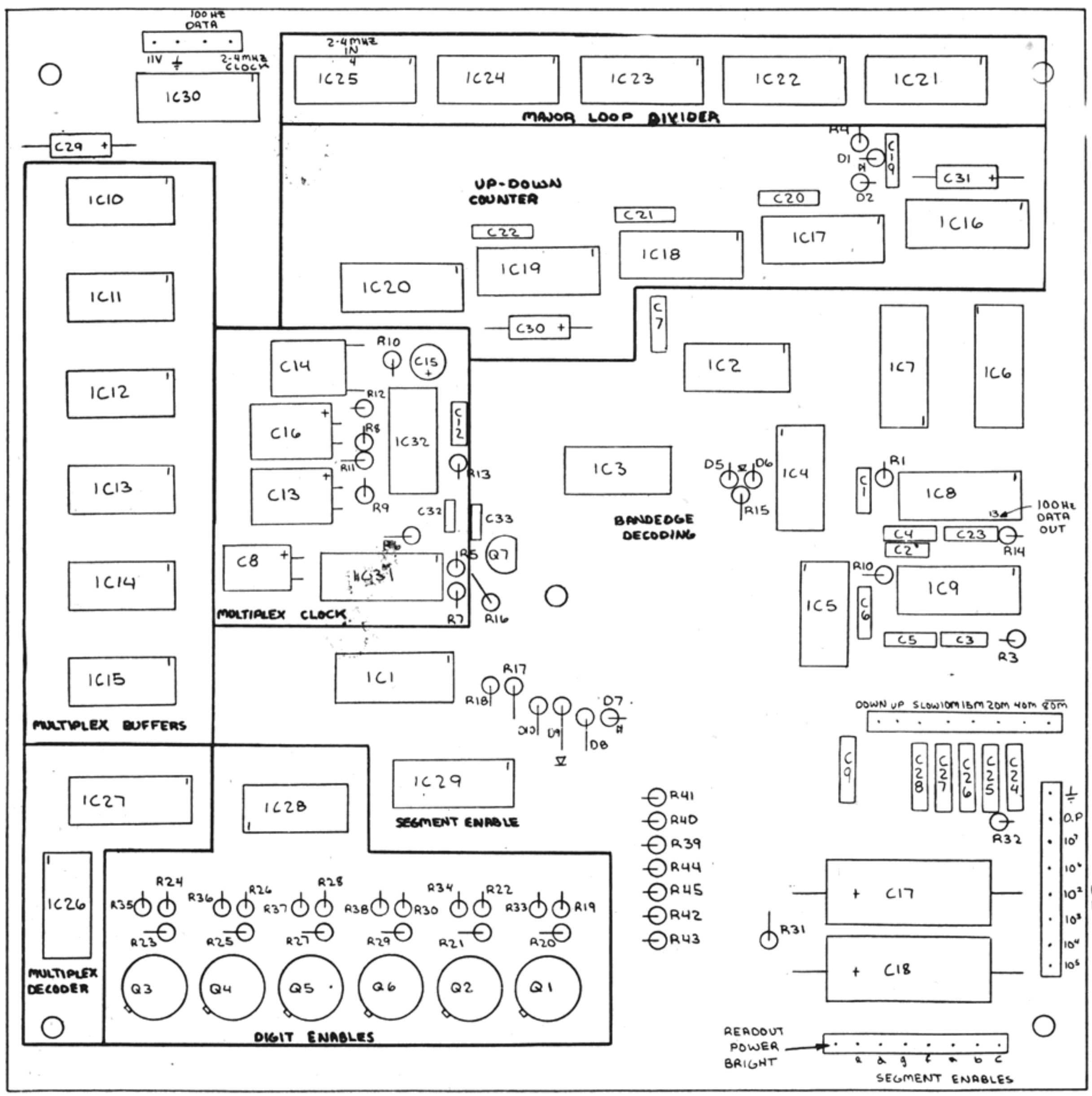
As with all H.F. transceiving equipment, a good earth (or car frame) ground is important for optimum performance.

D. Mobile Operation

The ASTRO-200A will give stable performance in mobile operation. Electronic tuning is a major improvement in tuning ease and stability, especially in a moving vehicle. It should be noted that a slight frequency shift will be noticed if the bottom cover is deformed or hit. With the unit mounted in a good mobile mount, vehicle vibration, even in off-road vehicles, will not generate frequency shifts.



USB
LSB
VR
CW SW Q3, D1, D19 D20
RF IN
RF AMP Q1, Q2
1ST MIXER
1ST IF AMP Q4, Q5
BLANKING GATE Q35
FILTER DRIVER Q6
SSB CRYSTAL FILTER
CWN
FILTER SW Q10, Q11, D5 D6
AGC ATTN Q14, D7
IF AMP Q12, Q13
AGC ATTN Q15, D8
IF AMP Q18
PRODUCT DET Q59, Q60
BUFFER AMP Q67
RF ATTN D21
LO DRIVER GATE Q33, Q34
MOD IN
WB 1ST IF Q47
FILTER DRIVER Q8
CW NARROW CRYSTAL FILTER
FILTER SW Q9
CW GATE
AUDIO PREAMP Q62
TRANSMIT GATE Q78 D52 D53
L.O. INPUT
CARRIER OSC INPUT
BLANKING PULSE
REF IN
REF AMP 1/4 IC 13
AGC ATTN Q1, D1 *
EMITTER FOLLOWER Q7
AGC AMP 1/4 IC13
AUDIO DET Q61
TO METER
FWD IN
FWD AMP 1/4 IC13
TO METER SW
IF AMP Q2 *
AGC AMP IC1 *
ALC ATTN Q19, D9
RECEIVER
RIT Q70, Q71
CARRIER OSC. Q68, Q69
X
FINE
RIT
ALC AMP 1/4 IC13
IF AMP Q48
AGC DET D28, D29
AMP Q20
XMIT PREAMP Q44, Q45
XMIT DRIVER AMP Q43
FUNCTION GATE Q72 Q73, Q74, Q75
NB ON
VOLUME CONTROL
AUDIO P.A. IC5
AUDIO OUT
EXT ALC
ALC Σ D48, D47 D56
PULSE DET D2, D30
PULSE AMP IC8
TRANSMIT MIXER
TO BPF ASSY
FROM BPF ASSY
SIDETONE OSC 1/4 IC10
NOISE BLANKING RECEIVER
VR
SQUELCH IC11, Q39
SQUELCH WIPER
LPF 1/4 IC6
LO BUFFER Q22, Q23
L.O. DRIVER Q21
EXT LO SW
RECEIVE AUDIO
CW PWR Q63
SIDETONE GATE Q56 D36 D37, D38
SYNTH L.O.
EXT L.O.
MOD SQUELCH Q42, Q49
LOW LEVEL TRANSMIT RF CIRCUITS
CW GATE
T-R RELAY DRIVER Q51
TO T-R RELAY
CW PWR GATE Q65
ANTI VOX AMP 1/4 IC6
ANTI VOX DET D23, D24
DELAY ON Q56
DELAY 1/4 IC10
REC. "ON" SW Q53
RELAY DRIVER AMP Q52
ALC AND METER
VOX GATE IC7
PTT
VR
VR
TRANSISTOR SW Q50
OPEN COLLECTOR TRANSISTOR SW
MOD INPUT
MOD PREAMP Q41
LOG AMP 1/4 IC6, D40 D41
VOX AMP 1/4 IC6
VOX DET D25, D26
DELAY GATE D34, D35
XMIT ON SW Q54
MIC GAIN
KEY
VOX MODE
CW MODE
TRANSMIT AUDIO PROCESSOR
VOX ON GATE Q40
1. * : ON NOISE BLANKER BRD
NOTES
VOX
RF IN
AUDIO DET Q76
AMP 1/4 IC10
LPF 1/4 IC10
X
VOX ON
10MHZ
X2
5MHz IN
Q77
WWV GATE Q78
WWV ON
WWV
SCALE: NONE
APPROVED BY:
DRAWN BY: C. DAVIDSON
DATE: 5-16-78
REVISED
RECEIVER BOARD BLOCK DIAGRAM
DRAWING NUMBER
17232 PRINTED ON NO. 1000H CLEARPRINT



LTR	DESCRIPTION	DATE	APPD
E	REPLACED D3,D4 WITH C32 + C33 WITH .005 uf CD 12-21-77		
D	DELETED C10, C11 FROM LAYOUT. CD 7-7-77	7-7-77	Jw
C	ADDED R10, C15 TO LAYOUT, CORRECTED REFERENCE NUMBERS CD 5-5-77	5-5-77	Jw
B	REVISED + REDRAWN INCREASING SIZE 2:1 FOR CLARITY CD 3-1-77	3-2-77	Jw

REVISIONS

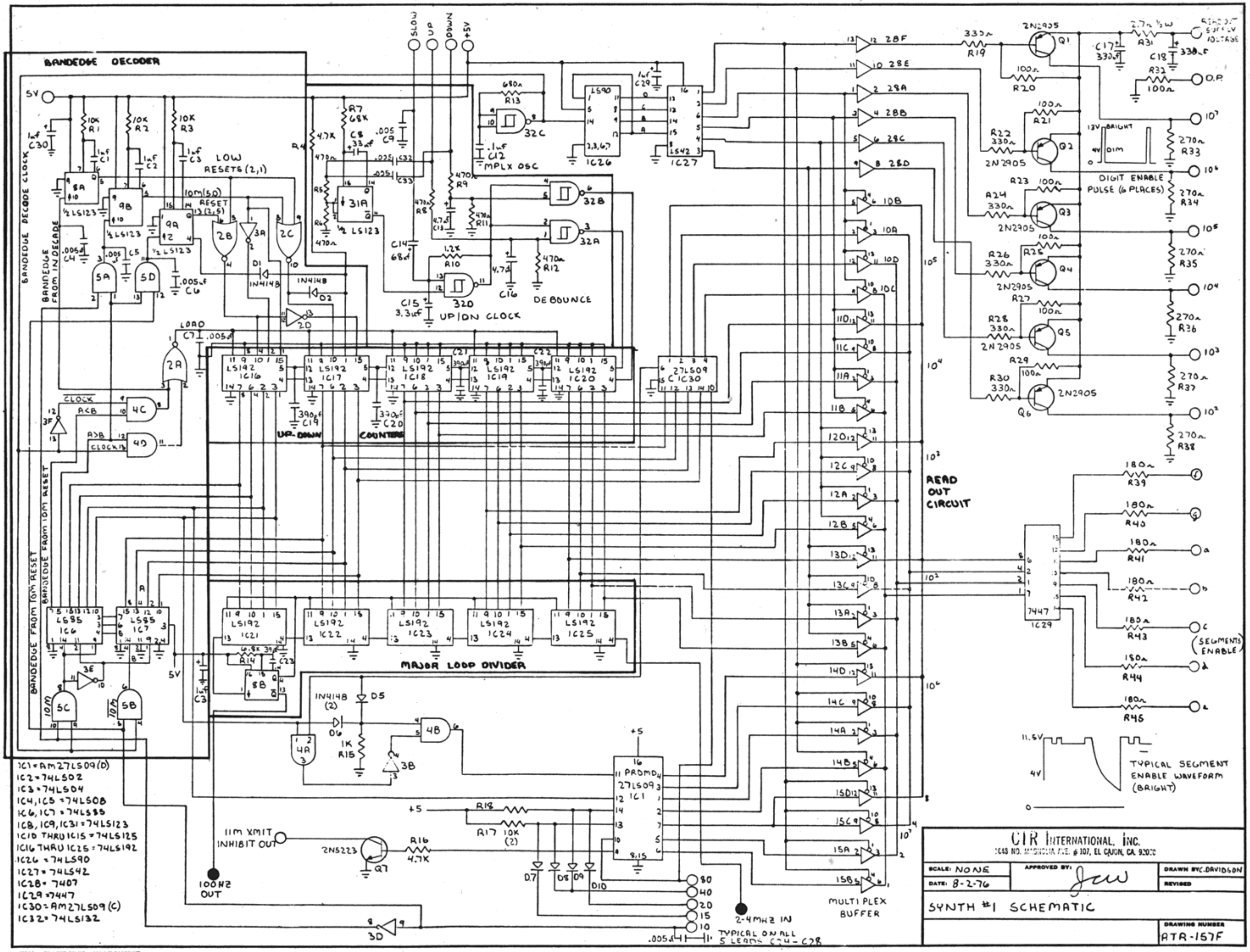
CIR INDUSTRIES, INC.
1... W. MAGNOLIA AVE. # 107, EL CAJON, CA 92020

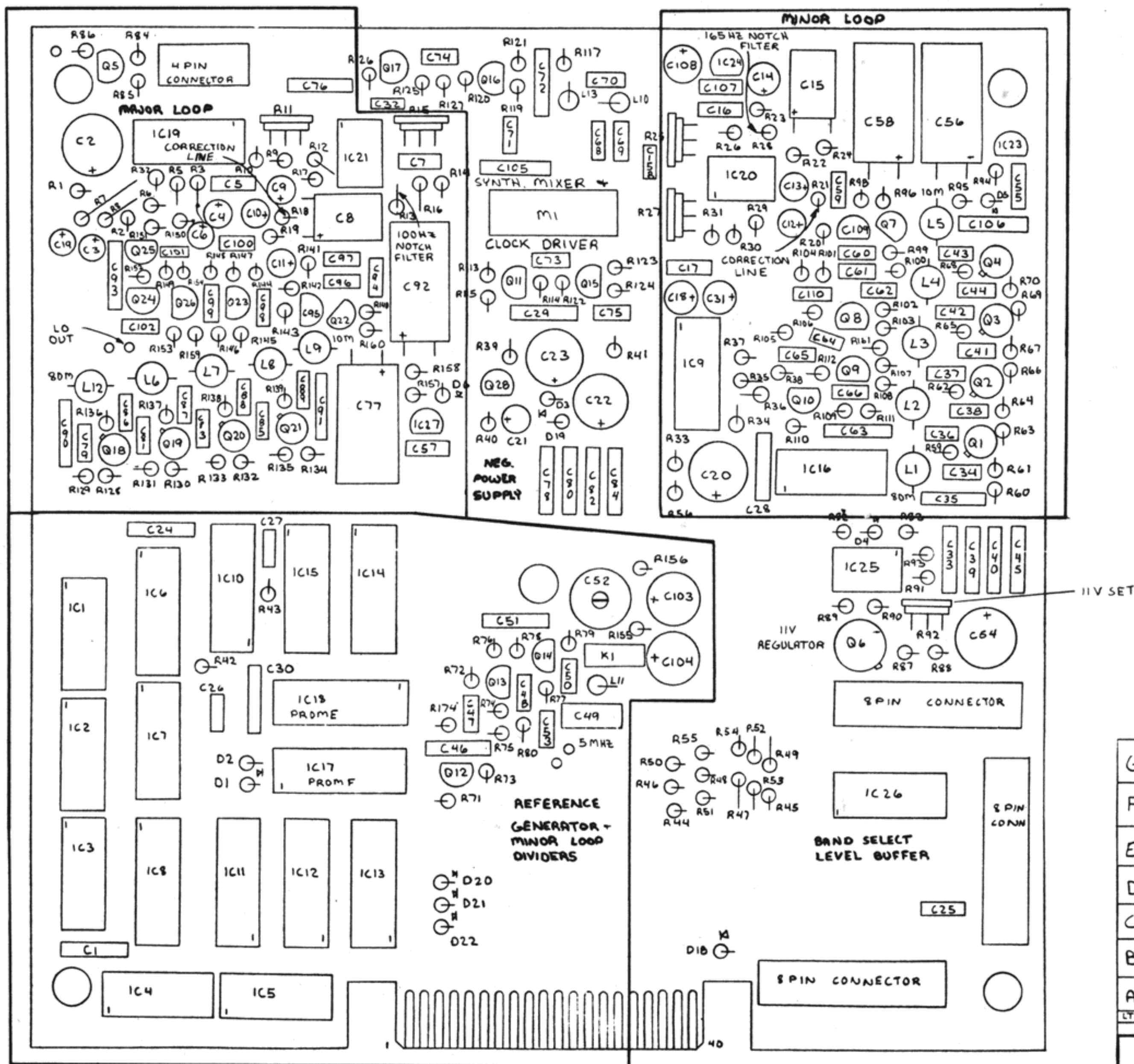
SCALE: NONE	APPROVED BY:	DRAWN BY C. DAVIDSON
DATE: 3-1-77		REVISED

SYNTH. #1 LAYOUT

DRAWING NUMBER ATR-158 E

17533 PRINTED ON NO. 1000H CLEARPRINT


BANDEDGE DECODER
LOW RESETS (2,1)
UP/DN CLOCK
DEBOUNCE
MPLX OSC
UP-DOWN COUNTERS
MAJOR LOOP DIVIDER
READ OUT CIRCUIT
MULTI PLEX BUFFER
DIGIT ENABLE PULSE (6 PLACES)
TYPICAL SEGMENT ENABLE WAVEFORM (BRIGHT)
(SEGMENTS ENABLE)
READOUT SUPPLY VOLTAGE
11M XMIT INHIBIT OUT
100HZ OUT
2-4MHZ IN
TYPICAL ON ALL 5 LEADS C24-C28
BANDEDGE DECODE CLOCK
BANDEDGE FROM IN DECADE
BANDEDGE FROM 10M RESET
SLOW
UP
DOWN
+5V
IC1=AM27LS09(D)
IC2=74LS02
IC3=74LS04
IC4,IC5=74LS08
IC6,IC7=74LS85
IC8,IC9,IC31=74LS123
IC10 THRU IC15=74LS125
IC16 THRU IC25=74LS192
IC26=74LS90
IC27=74LS42
IC28=7407
IC29=7447
IC30=AM27LS09(C)
IC32=74LS132
CIR INTERNATIONAL, INC.
1648 NO. MAGNOLIA AVE. # 107, EL CAJON, CA 92020
SCALE: NONE
DATE: 8-2-76
APPROVED BY:
DRAWN BY: C. DAVIDSON
REVISED
SYNTH #1 SCHEMATIC
DRAWING NUMBER
ATR-157F



LTR	DESCRIPTION	DATE	APPD
G	ADDED NEW MIXER CIRCUIT TO LAYOUT CD 10-3-77	10-5-77	Jw
F	CHANGED LAYOUT TO MATCH LATEST CIRCUIT BRD CD 7-7-77	7-7-77	Jw
E	DELETE C73 ADD R161, C73 MOVED R105, C64 CD 5-23-77	5-24-77	Jw
D	CORRECTED TRANSISTORS ON LAYOUT ADDING TABS ON THEM CD 4-12-77	4-19-77	C&F
C	CHANGED COLORS ON Z BEAD TRANSFORMERS CD 3-10-77	3-10-77	C&F
B	DELETED C67 MOVED R32, R34 C101 CD 3-3-77	3-3-77	Jw
A	ADDED COLORS TO Z BEAD TRANSFORMERS CD 2-23-77	3-1-77	Jw

REVISIONS

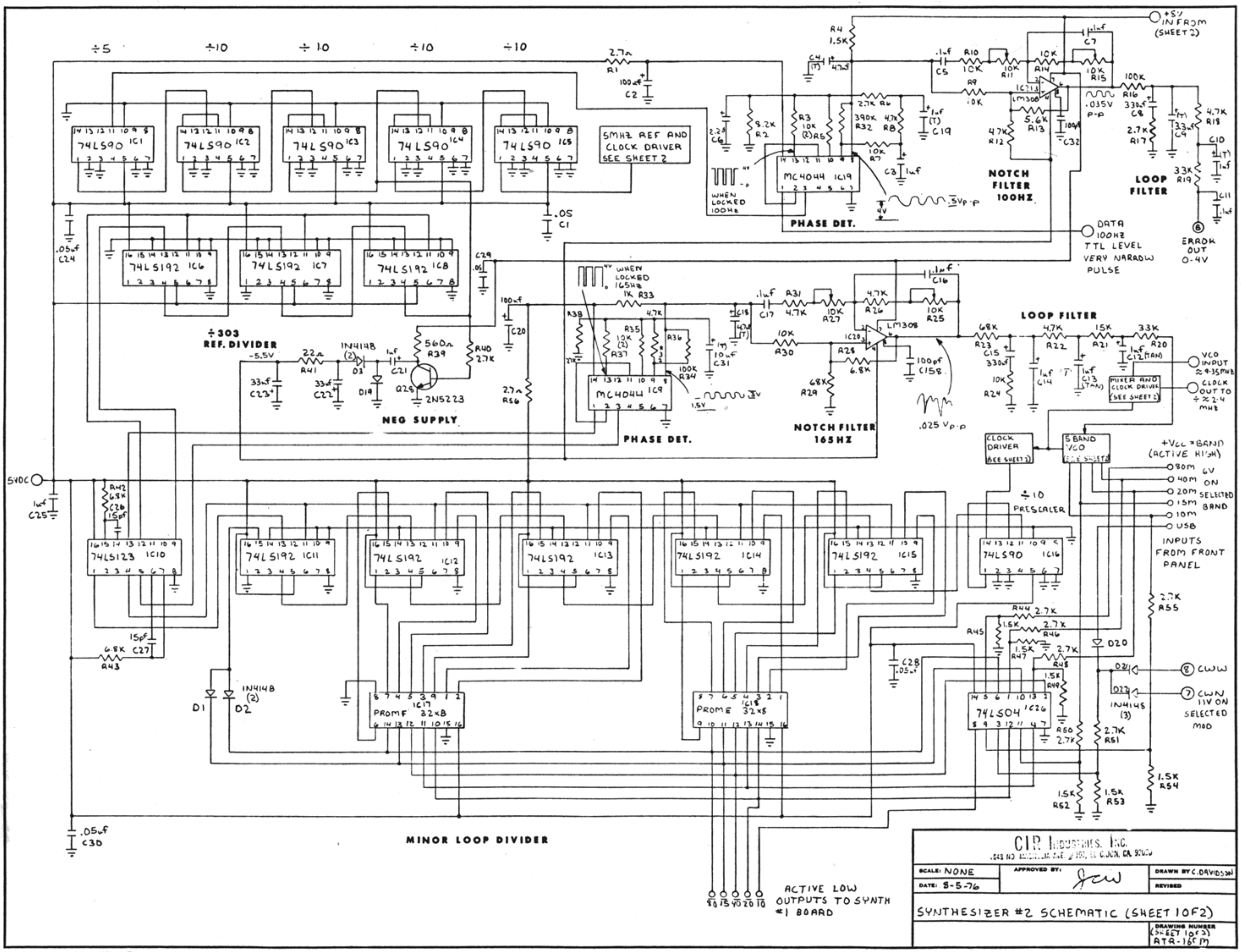
CIR Industries

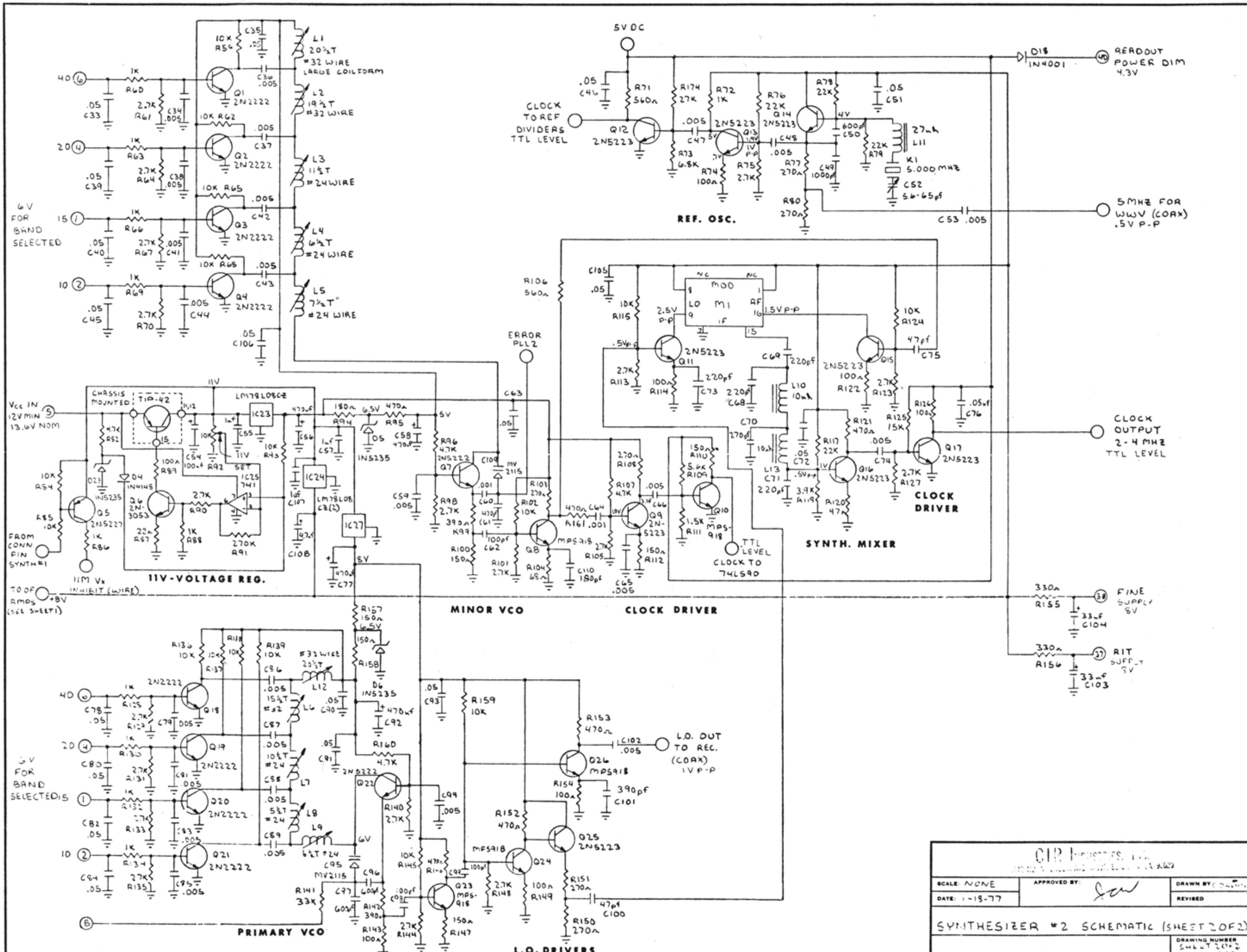
SCALE: NONE
DATE: 2-11-77
APPROVED BY: Jw
DRAWN BY: C DAVIDSON
REVISED

SYNTH #2 LAYOUT

DRAWING NUMBER ATR-170G

NOTES
1. SET OF MATCHED DIODES D14, D15, D16, D17


÷5
÷10
÷10
÷10
÷10
74LS90 IC1
74LS90 IC2
74LS90 IC3
74LS90 IC4
74LS90 IC5
5MHZ REF AND CLOCK DRIVER SEE SHEET 2
74LS192 IC6
74LS192 IC7
74LS192 IC8
÷303 REF. DIVIDER
NEG SUPPLY
2N5223
MC4044 IC9
PHASE DET.
WHEN LOCKED 165Hz
NOTCH FILTER 165HZ
LM308
.025 Vp-p
LOOP FILTER
VCO INPUT ≈ 4-35 MHZ
CLOCK OUT TO ÷ ≈ 2-4 MHZ
MIXER AND CLOCK DRIVER (SEE SHEET 2)
CLOCK DRIVER (SEE SHEET 2)
5 BAND VCO (SEE SHEET 2)
+Vcc = BAND (ACTIVE HIGH)
80m
40m
20m
15m
10m
USB
6V ON SELECTED BAND
INPUTS FROM FRONT PANEL
MC4044 IC19
WHEN LOCKED 100Hz
PHASE DET.
NOTCH FILTER 100HZ
LOOP FILTER
+5V IN FROM (SHEET 2)
ERROR OUT 0-4V
DATA 100HZ TTL LEVEL VERY NARROW PULSE
5VDC
74LS123 IC10
74LS192 IC11
74LS192 IC12
74LS192 IC13
74LS192 IC14
74LS192 IC15
74LS90 IC16
÷10 PRESCALER
PROMF 32x8 IC17
PROME 32x8 IC18
74LS04 IC26
CWW
CWN 11V ON SELECTED MOD
MINOR LOOP DIVIDER
ACTIVE LOW OUTPUTS TO SYNTH #1 BOARD
CIP INDUSTRIES, INC.
SCALE: NONE
DATE: 8-5-76
APPROVED BY:
DRAWN BY C. DAVIDSON
REVISED
SYNTHESIZER #2 SCHEMATIC (SHEET 1 OF 2)
DRAWING NUMBER (SHEET 1 OF 2) ATR-16(P)



CIR Industries, Inc.

SCALE: NONE	APPROVED BY:	DRAWN BY:
DATE: 1-18-77		REVISED

SYNTHESIZER #2 SCHEMATIC (SHEET 2 OF 2)

DRAWING NUMBER: SHEET 2 OF 2 ATP 109M

17533 PRINTED ON NO. 1000H CLEARPRINT

II DETAILED DESCRIPTION

1.0 GENERAL COMMENTS

In the following sections each circuit function is described in the following format:

1. Brief functional description including typical operating characteristics.
2. Expanded schematic with typical operating voltages.

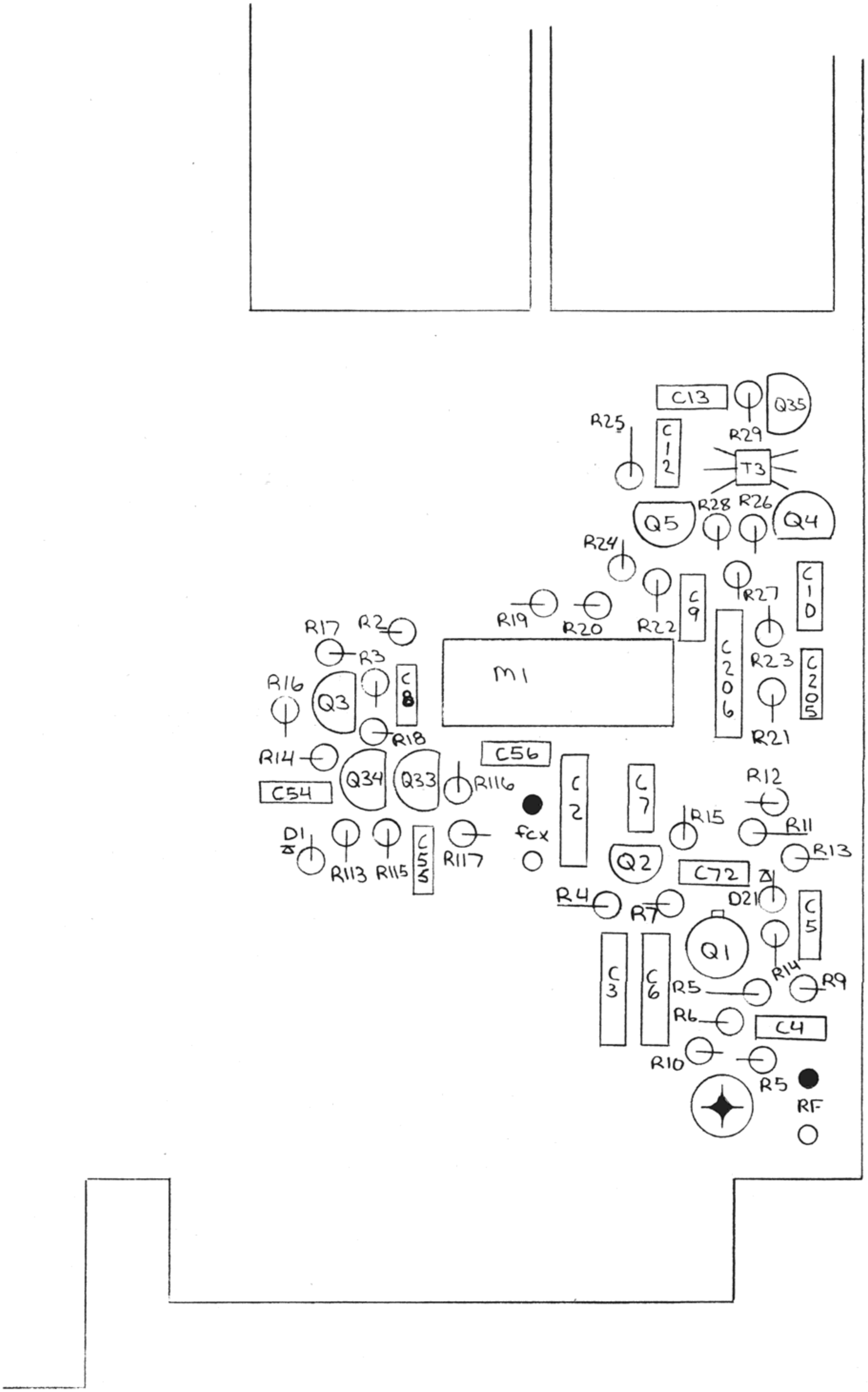
3. Expanded layout with test points noted.

2.0 RF AMP, 1st MIXER, 1st IF AMP, AND BLANKING GATE

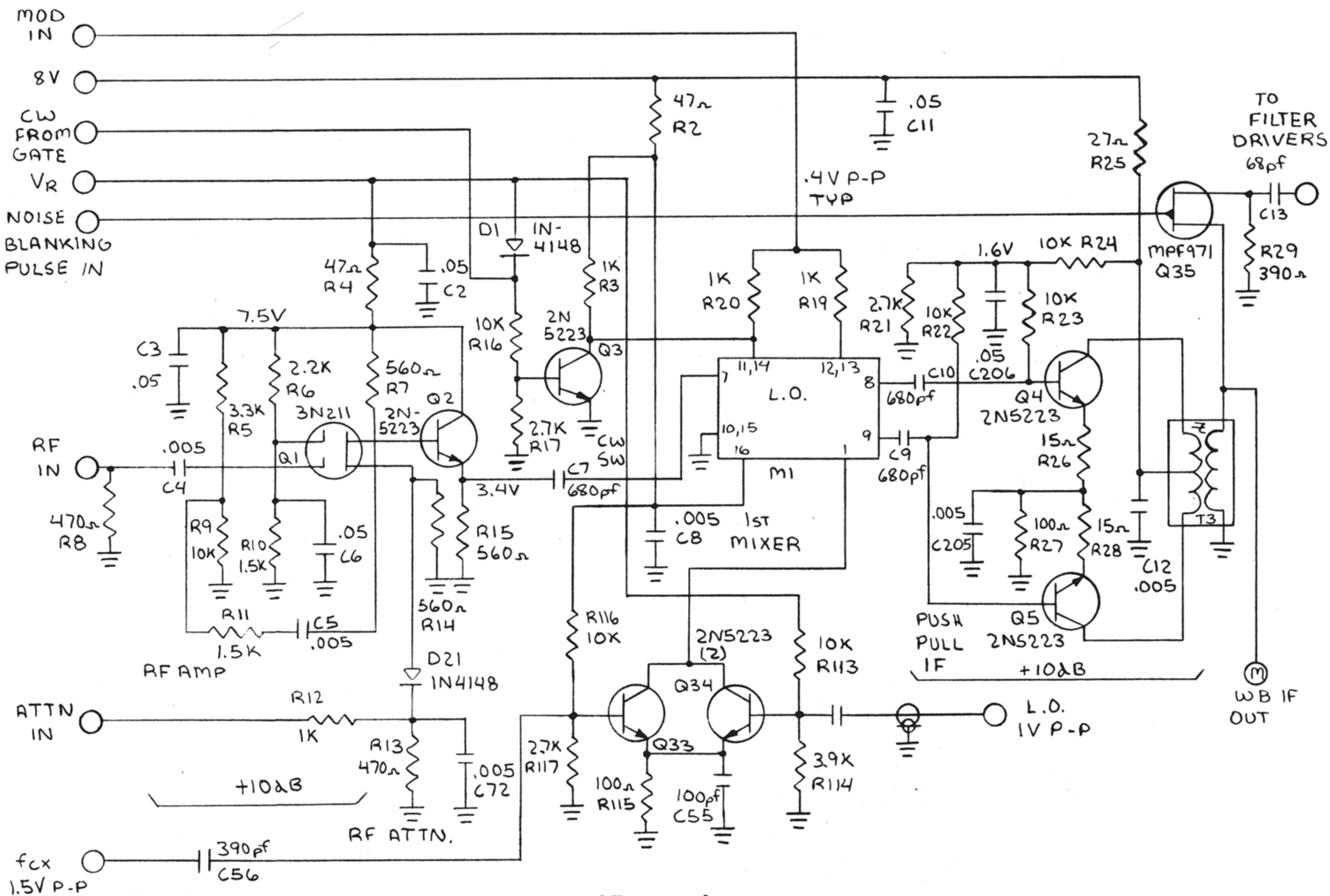
Received input signal is amplified 10dB by the RF feedback amplifier couple Q1 and Q2. Amplified RF signal is fed to the 1st mixer. L.O. is supplied to the mixer by the driver Q34. In the transmit mode carrier oscillator signal is fed by Q33. Transistors Q33 and Q34 are an emitter coupled switch pair.

The mixer balanced output is fed to a push-pull 1st IF amp. This amplifier feeds the crystal filter drivers Q6 and Q8 through the blanking gate Q35.

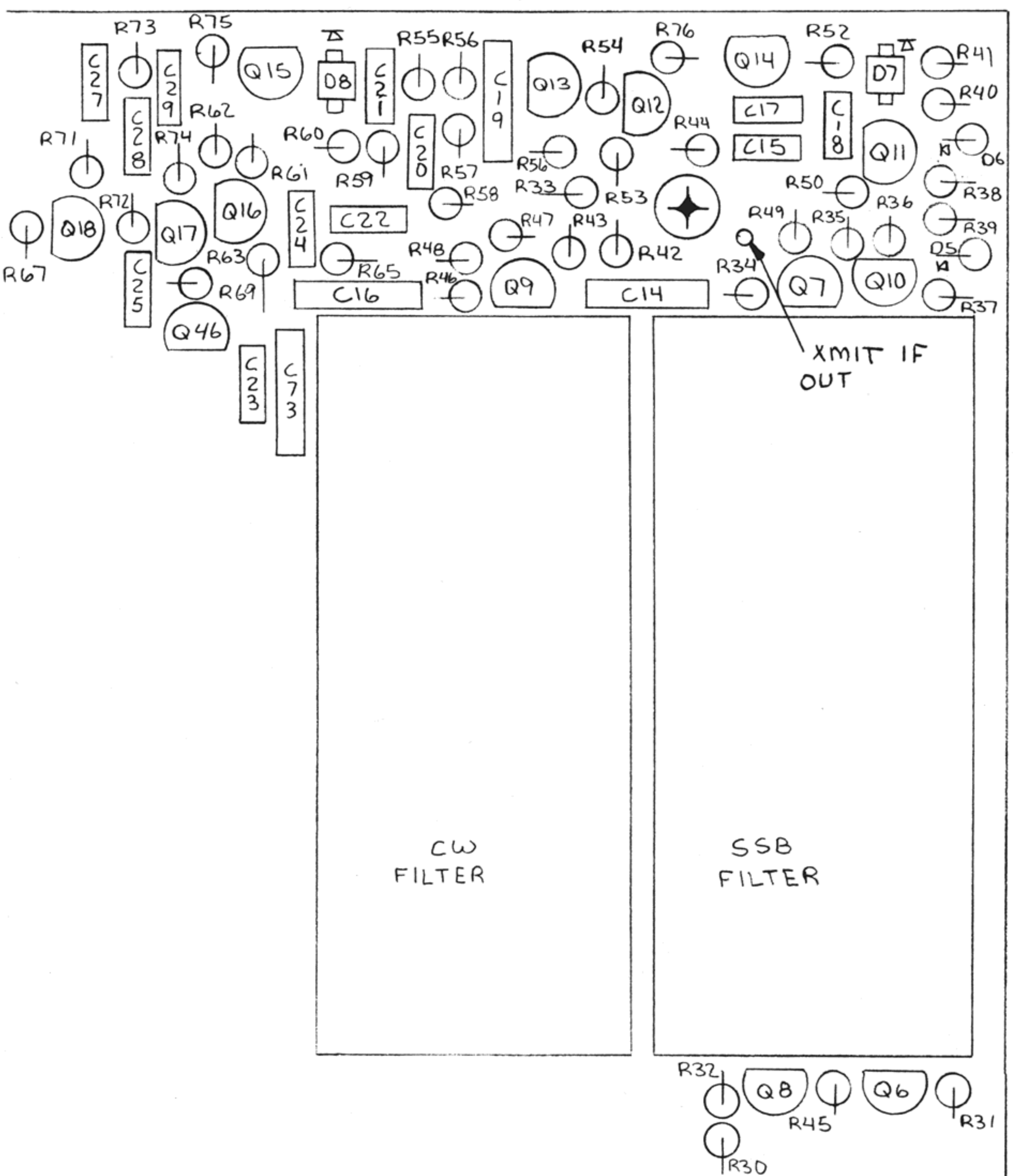
In the SSB transmit mode modulation is applied through R19 and R20. For CW transmit the mixer is unbalanced by Q3 thus allowing carrier signal feedthrough.


C13
Q35
R25
C12
R29
T3
R28
R26
Q5
Q4
R24
C9
C10
R27
R19
R20
R22
C206
R17
R2
R23
C205
R3
M1
R16
Q3
C8
R21
R18
R14
C56
R12
Q34
Q33
R116
C54
C2
C7
R15
R11
D1
fcx
R13
R113
R115
C55
R117
Q2
C72
R4
R7
D21
C5
Q1
C3
C6
R14
R9
R5
R6
C4
R10
R5
RF

LAYOUT 2.0

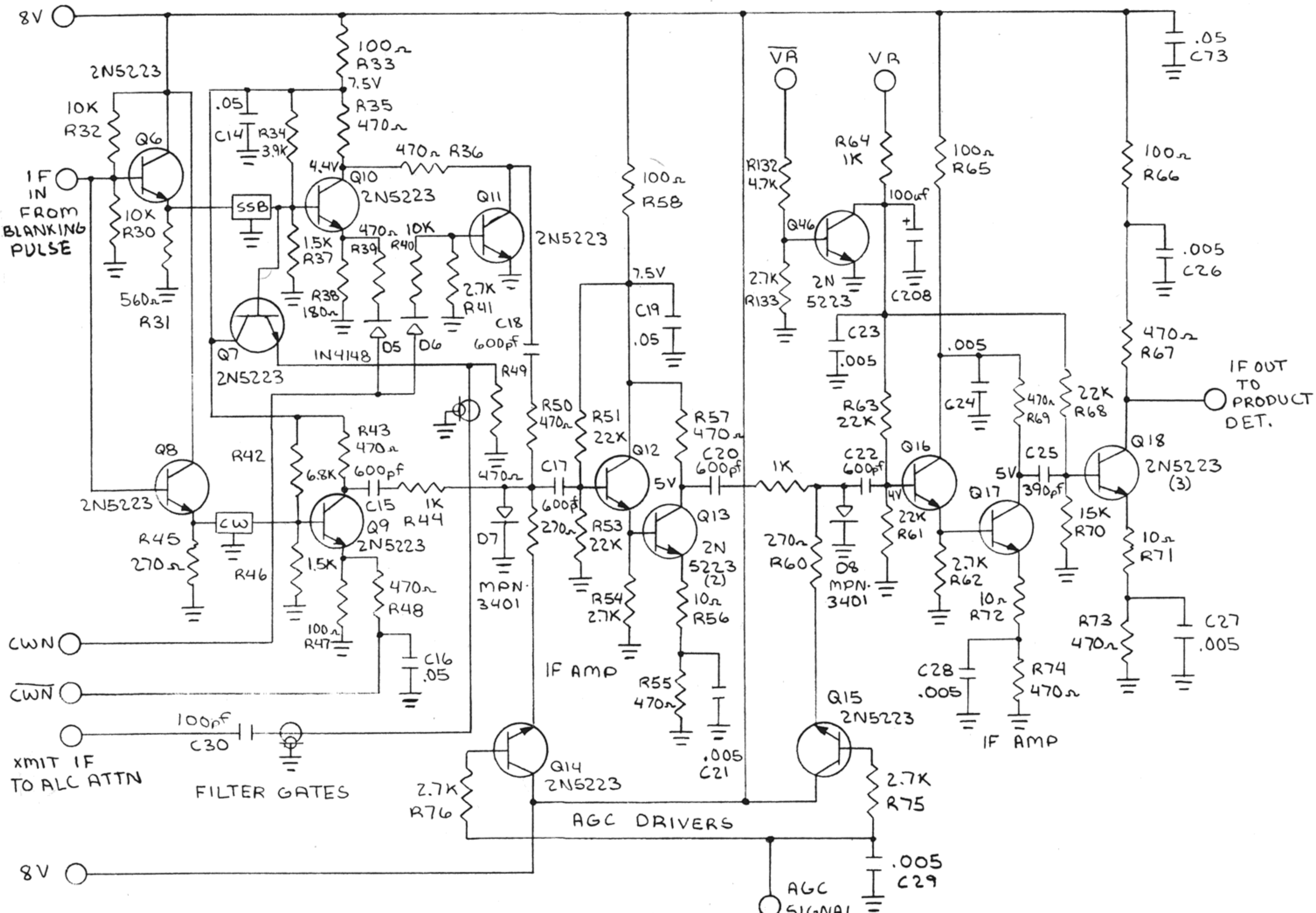


SCHEMATIC 2.0



R73
R75
Q15
D8
R55
R56
C21
C19
R54
Q13
Q12
R76
Q14
R52
D7
R41
R40
C27
C29
C28
R62
R71
R74
R60
R61
R59
C20
R57
R56
R53
R44
C17
C15
C18
Q11
D6
R38
R39
R50
R33
R58
R47
R43
R42
R49
R35
R36
D5
R72
Q18
Q17
Q16
C24
C22
R67
R63
R48
R65
R46
Q9
C16
C14
R34
Q7
Q10
R37
C25
R69
Q46
C23
C73
XMIT IF OUT
CW FILTER
SSB FILTER
R32
Q8
R45
Q6
R31
R30

LAYOUT 3.0



SCHEMATIC 3.0

RF attenuation function is performed by applying reverse bias to D21.

No adjustments are necessary on these circuits. Nominal gain through these stages is net 20dB.

3.0 CRYSTAL FILTER SWITCHING, IF AMP AND AGC ATTN.

Each of the two (CWN filter optional) crystal filters are driven by emitter followers. The output of each filter is coupled to amplifier transistors Q9 and Q10.

Transistor Q7 is a buffer emitter follower that drives the ALC attenuator. Transistors Q9, Q10, and Q11 switch the signal path to connect either the SSB filter or the CWN filter.

The switching transistor outputs are summed by resistors that feed the first AGC attenuator. Each of the two AGC attenuators has greater than 50dB attenuation. The remaining circuits are three RC coupled IF amplifiers.

Transistor Q46 is a switch used to instantly cut off the receiver when the transmitter is keyed. Capacitor C208 delays receiver turn-on when Key is released for 10 milliseconds.

No adjustments are necessary on these circuits.

4.0 PRODUCT DETECTOR AND AUDIO AGC

The product detector is an emitter coupled pair Q59 and Q60. The product detector output is amplified by Q62 and the audio is detected by Q61. The detected audio drives the AGC amplifier; which in turn drives the AGC attenuator circuits.

Automatic noise limiter (ANL) diodes are used to clip noise spikes about 6-10dB greater than average audio level. This prevents excessive popping or AGC pumping.

Alignment:
AGC threshold: Adjust R280 for an AGC reading of S-3 at a receiver input of 1.5μ volts.

5.0 AUDIO POWER AMP AND SQUELCH

Audio power output is generated by IC5, and two squelch functions are generated by IC11 and Q39. IC11 squelches audio as a function of front panel control and signal AGC level. Transistor Q39 squelches audio in the transmit mode.

6.0 CARRIER OSCILLATOR

The carrier oscillator generates the carrier frequency