Zeroing the S-Meter

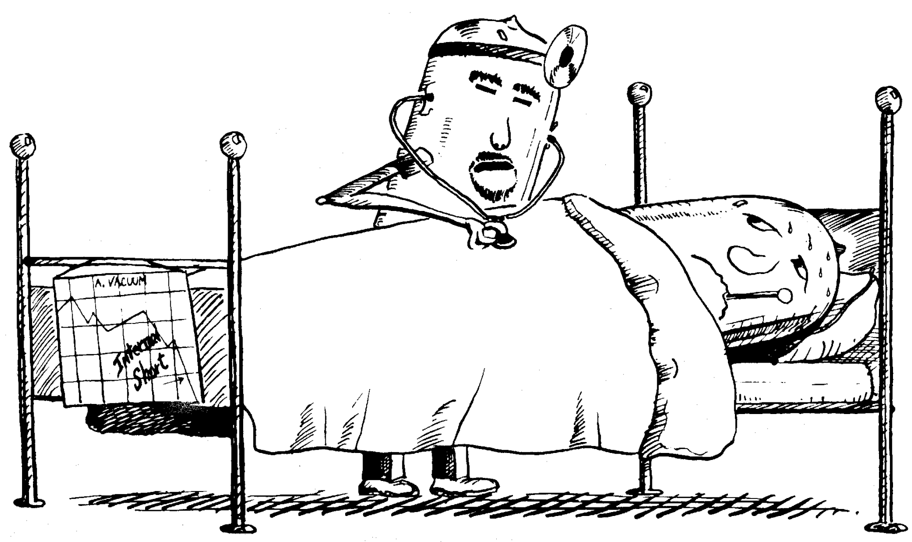
To check and adjust S-Meter zero proceed as follows: (allow ½ hour warm-up)

CAUTION Hazardous voltages and high temperatures may be encountered within the D201A cabinet. Keep hands clear of hot tubes and chassis components in general. REMOVE MIC CORD to prevent high voltages from appearing on the RF Board should the Transmitter accidentally be keyed.

1. Place CRYSTAL/MANUAL SWITCH in the CRYSTAL position.
2. Turn the RF GAIN fully CCW.
3. Disconnect the antenna.
4. Place the METER SWITCH in the S/PWR position. The meter should read zero.
5. If adjustment is required, remove top cover and locate the S-Meter zero control (R422) on the Receiver 'A' board next to the relay K600 as shown in fig. 3.
6. Momentarily defeat the AC interlock on the Top Cover and adjust R422 for a Zero reading on the meter.
7. Replace Top Cover and restore controls to normal operating positions.

NOTES ON TUBE REPLACEMENT

1. If V701 is replaced the Final Amplifier circuit will require reneutralization. This procedure must be performed by a First or Second Class F.C.C. license.
2. If V300 is replaced the S-Meter circuit may require calibration.
3. If V401 or V602 is replaced the S-Meter circuit will require zeroing.



"YOU MAY HAVE TO BE REPLACED."

TUBE TROUBLE LOCATOR

MOST PROBABLE CAUSE

SYMPTOM WEAK OR NO OPERATION	6BQ7A V 300	6BK7B V 301	6BK7B V 302	6BA6 V 400	6GH8A V 401	12AX7 V 402	6BA6 V 500	6BA6 V 501	6GH8A V 502	6GH8A V 600	6GH8A V 601	6GH8A V 602	6L6 GC V 603	12BY7A V 700	6DG6 V 701
AM AND SSB RECEIVE	O	O				O						O	O		
AM RECEIVE		O	O	O	O										
SSB RECEIVE							O	O	O						
MANUAL RECEIVE			O												
AM AND SSB TRANSMIT										O	O			O	O
AM MODULATION										O	O	O	O		
SSB TRANSMIT/ MODULATION										O	O			O	O
SSB RECEIVE MICROPHONIC							O	O	O						
IMPROPER S-METER						O			O			O			
SQUELCH						O			O						

RECEIVER FAILURE CHART

Symptom	Possible Cause
1. Receives in SSB but not AM, or AM receive drop off intermittently.	V400, V401, T400, T401. If dead in Manual Receive, V302, T400, T401, X300.
2. Receives in AM, but not SSB.	V500, V501, V502. If no SSB transmit, Balanced Modulator Module.
3. No S-Meter response in SSB receive.	No SSB AGC. Q500, Q501, + 14V power supply.
4. Low gain in all modes, but normal S-Meter readings.	V402, V602, V603. If transmitter modulation is good, V402 only.
5. No audio, but normal S-Meter readings.	Same as above.
6. Low gain in all modes, meter readings low.	V300, V301, Synthesizer Module.
7. No USB receive or transmit.	6.2535 crystal (X200) See fig. 12
8. No AM/LSB receive or transmit.	6.2565 crystal (X201) See fig. 12
9. Every fourth channel dead in crystal receive.	(See trouble crystal chart page 36)
10. Four sequential channels dead in crystal receive.	(See trouble crystal chart page 36)
11. Receives in crystal but not in Manual.	V302, L301, K600, X108, X109.
12. Receives in Manual, but not in crystal.	Synthesizer Module.
13. Erratic or inaccurate Manual Tune.	X108, X109. (See fig. 11)
14. Manual Tuning dial, out of calibration.	See Manual Tuning alignment procedure.
15. Manual tuning dial slips or binds.	Loosen tuning capacitor mounting screws, rotate knob several turns, tighten screws. CAUTION: Never Lubricate or degrease Vernier drive Assembly.
17. Receiver noise increases with Noise Blanker on.	Tuning condenser shaft binding.
18. Feedback at high Volume levels in SSB.	Blanker oscillating. Turn slug of T802 approximately 1/4 to 1/2 turn, until oscillation stops.
19. Receive and Transmit dead.	
	Microphonic Tube: V501, V502
	Synthesizer Module, 14V supply.

TRANSMITTER FAILURE CHART

Symptom	Possible Cause
1. Low SSB output, AM normal.	Mic. Gain or TTC fully CCW, V601, V600, Balanced Modulator module. If AM modulation is good, suspect Bal. Mod. or ALC adjustment.
2. Low AM & SSB output. Poor modulation.	Improper loading to antenna, V700, V701, Balanced Modulator Module not seated.
3. Transmit OK, but no meter indication.	Ungrounded antenna or fiberglass antenna resulted in static discharge across RF Bridge Board. D700 and/or D701 blown. (see fig. 13)
4. Every 4th or 5th channel dead.	4 MHz crystal (see crystal trouble chart p. 36)
5. Four or five sequential channels.	16 MHz crystal (see crystal trouble chart p. 36)
6. Transmitter quits when clarifier is turned to extreme CCW or CW.	Same as above.
7. Won't unkey, or delay in receive returning.	V600 or K600. C424. High SWR on transmission line.
8. Transmitter dead. Transmitter/rec. dead.	Balanced modulator module, V700, V701. Synthesizer module.
9. No USB transmit.	6.2535 crystal (X200) See fig. 12
10. NO LSB transmit.	6.2565 crystal (X201) See fig. 12
11. Carrier on SSB, with fuzzy AM modulation.	V701 unneutralized. See neutralizing instructions. NOTE CAUTION.
12. Carrier on SSB, with good AM & AM modulation.	Balanced modulator module.
13. Hum on carrier.	Transmitter bias improperly set. C8, C7, DII.
14. Modulation tinny, or too bassy.	TTC or microphone head faulty.
15. Low power out, High SWR.	Antenna cable, antenna.

FUSES

Circuit protection is provided by four fuses:

1. F1 is the primary fuse. (3MDL) See fig. 2.
2. F2 is the low voltage fuse. (AGC1) See fig. 3.
3. F3 is the 6.3V filament fuse. (A short piece of #28 bus wire one inch long) See fig. 5.
4. F600 is the Aux. Audio Board protection fuse. It is a 0.1A pigtail type. (See fig.10)This fuse is a failsafe device. Should it blow the D201A should be returned to an authorized factory service center. **Never** replace this or any other fuse with one of larger value.

LAMPS

The dial lights in the D201A are #47 pilot lamps. Replacing these lamps necessitates removal of the reflective light shield. It is important that it be properly positioned when reinstalled. To reinstall the shield:

1. Slide the shield between the CRYSTAL SELECTOR SWITCH and its mounting bracket.
2. Slide right end of shield down on to MANUAL TUNING bracket. **BE SURE** bracket edge fits into slot in bottom of shield.
3. Tuck top edge of shield under lip on front panel and work in until vent holes are directly over pilot lamps.

Troubleshoot & Alignment

General Information

WARNING The following alignment instructions are for qualified technicians only. Improper adjustments will result in degraded performance and may damage certain components. Obvious tampering will void our warranty.

Alignment should not be attempted until all other possible causes of faulty operation have been identified and corrected.

Refer to Figs. 6-13 for component locations.

WARNING Transmitter adjustments may be made only by, or under the immediate supervision of, a person holding an F.C.C. first or second class radio operator license. (This applies specifically to modulation, power, and frequency determining circuits)

Test Equipment

Alignment should be performed using reliable, accurate equipment, as listed below.

DC VTVM-RCA Voltohmyst WV-77E or equivalent.
OSCILLOSCOPE-Hewlett-Packard HP-180A or equivalent.
AUDIO SIGNAL GENERATOR-Hewlett-Packard HP-209A or equivalent.
RF SIGNAL GENERATOR-Hewlett-Packard HP-606 or equivalent.
ELECTRONIC FREQUENCY COUNTER-Hewlett-Packard Model 5248L or equivalent.
50 OHM DUMMY LOAD-Bird Model 52839 or equivalent.
RF WATTMETER-Bird Model 43 or equivalent.

High Voltage Power Supplies

The D201A uses two power supplies, producing 410 VDC & 14.4 VDC. In addition a dropping circuit provides 270 VDC.

The 410 VDC is supplied through diode bridge D7-D10, filtered by C5a, b, c, and switched through K600 to various points in the radio.

Dropping circuit R8, R9 and D6 develops 270 VDC. This voltage is used throughout the receiver and should contain less than 20 MV PP ripple.

14.4 VDC is supplied by D1-D4, filtered by C2, C3, and C4 and regulated by the zener diode/transistor combination of D5 and Q1. All solid state circuits run off the 14V supply and frequency standards are dependent on its accuracy. 10 MV PP ripple is maximum allowable for this supply.

If the radio blows the primary fuse or if troubles occur in the H.V. supply care must be taken to isolate any short circuits in the B+ line. D6 through D11 should be checked for forward/reverse resistance and a careful visual inspection of all associated components made. Particular attention should be given to IF transformers and vacuum tubes for internal short circuits. C5 or C624 also may be at fault.

Low Voltage Supply Troubles

If problems occur in the 14V supply, D1 through D5 as well as associated filter capacitors should be checked. If the 14V supply is running beyond the tolerance established for it, (14.4 ±0.4V), D5 should be replaced. If proper operation is not restored Q1 should be suspect.

NOTE: All supply voltage dependent on 117 VAC input.

Synthesizer

General Information

The synthesizer board is the main frequency determining element for both transmit and receive modes. It consists of 2 oscillator circuits running at 4.4 MHz and 16 MHz, a mixer circuit, and a 20 MHz amplifier circuit. Twenty-three crystals provide frequency standards for all crystal controlled functions on each of the 40 channels in AM/LSB and USB, as well as a 4 MHz signal used in manual receiver calibration and a 16 MHz signal used in the Manual Tune mode.

Synthesizer defects may be best characterized by complete loss of Receive and Transmit, low signal levels or no tuning action at T100. Suspect the Synthesizer only after determining that a tube is not at fault. Circuit alignment and frequency calibration requires proper test equipment and must be performed by a licensed technician.

Should crystal replacement, alignment and calibration not restore proper operation, the entire board should be returned to the factory for full service.

WARNING According to F.C.C. Regulations, only a person holding an F.C.C. First or Second Class Commercial license may perform the alignment procedures outlined for the Synthesizer module.

Circuit Description – Synthesizer

The Synthesizer Board consists of two oscillators, a mixer, a 20 MHz amplifier and diode switching circuits used to select the various crystals and modes of operation.

The output of the 4 MHz oscillator Q100 is mixed with the output of the 16 MHz oscillator (Q102) at the gate of mixer FET Q103. The output of this mixer is tuned at 20 MHz by T101, amplified by Q104 and Q105 and fed out jack J100B. Crystal selection is accomplished by S3 and the action of the diode switching circuits. In the various modes switching voltages will be present at the pins on the Synthesizer main power plug. Failure of these voltages to appear may indicate problems in the associated diode switch circuits. (See pin voltage chart for specific values)

The Synthesizer Board also provides a 4 MHz signal used in manual receive calibrate and a 16 MHz signal used in the manual tune mode.

Synthesizer Crystal Trouble Chart

Crystal designation
By schematic number

AM & LSB	X100	X101	X102	X122	X103	USB
X105	1	2	3	X	4	X104
X107	5	6	7	X	8	X106
X109	9	10	11	X	12	X108
X111	13	14	15	X	16	X110
X113	17	18	19	X	20	X112
X115	21	22	24	25	23	X114
X117	26	27	28	29	30	X116
X119	31	32	33	34	35	X118
X121	36	37	38	39	40	X120

Use of Crystal Trouble Chart

1. Determine channels involved and sequence of failure:
   A. If a group of 4 or 5 consecutive channels, use left or right index.
   B. If every 4th or 5th channel, use top index.
2. Determine mode in which failure occurs:
   A. For AM/LSB failures, use left index.
   B. For USB failures, use right index.
3. If channel failure does not occur on every 4th channel or in groups of 4, synthesizer crystal problems are unlikely. (The Synthesizer should be returned to the factory for service if this is the case.)

Notes on crystal replacement

Tram/Diamond Corporation can certify continued operation to F.C.C. requirements only if replacement crystals are obtained from the factory. If evidence of general off frequency operation is detected or if replacement crystals do not restore proper operation, service or recalibration to restore proper operation must be performed by a technician with a First or Second Class Commercial license as required by Part 95 of the F.C.C. rules and regulations.

Anytime a crystal requires replacement, the Synthesizer Board must be removed from the radio. Proper procedure for Synthesizer removal is outlined below and should be followed to prevent damage to the Synthesizer Board and associated components.

Synthesizer Pin Voltage Chart: — PIN —

Mode	1	2	3	4	5	6	7	8	9	10	11	12
Xtal Rec. AM	1.5	14	4.7	0	14V	2.3	GND	0	0	14	13	14
Xtal Rec. USB	1.5	14	4.7	0	14V	2.3	GND	14	13	0	0	14
Man. Rec. AM	0	0	0	14	14V	2.3	GND	0	0	0	13.5	0
Man. Rec. USB	0	0	0	14	14V	2.3	GND	0	14	0	0	0
Xtal Xmit AM	1.5	13.6	0	0	14V	2.3	GND	0	0	14	13.5	14
Xtal Xmit USB	1.5	13.6	0	0	14V	2.3	GND	14	12.4	0	0	14
Man. Xmit AM	1.5	13.6	0	0	14V	2.3	GND	0	0	13.5	12.5	13.5
Man. Xmit USB	1.5	13.6	0	0	14V	2.3	GND	13.6	12.4	0	0	13.5
Rec. Cal. "Out"						2.3						14

NOTE: 1. For pin location see Synthesizer inset on schematic.
2. All voltages $\pm$ 5% with plug connected to board.
3. Clarifier set at 12 o'clock (4.75V @ pin 3).

4 MHz Calibrate

1. Connect a frequency counter directly to J100A.
2. Remove plug from J100A.
3. Set CRYSTAL MANUAL switch to CRYSTAL, CRYSTAL SELECTOR to channel indicated. Adjust appropriate 4 MHz crystal calibration capacitor as follows:

CHANNEL	SELECTED 4 MHz CRYSTAL	CAL CAP	FREQUENCY (MHz)
1	4.400	C102	4.40000
2	4.410	C104	4.41000
3	4.420	C106	4.42000
4	4.440	C108	4.44000
25	4.430	C169	4.43000

20 MHz Calibrate

1. Set CLARIFIER to 12 O'Clock position. (4.75V on pin 3)
2. Mode to CRYSTAL, CHANNEL as required.
3. Connect a frequency Counter directly to J100B. Adjust as indicated.

CHANNEL	MODE	CAL-CAP	FREQUENCY (MHz)
1	AM	C137	20.7085
1	USB	C136	20.7115
5	AM	C135	20.7585
5	USB	C134	20.7615
9	AM	C133	20.8085
9	USB	C132	20.8115
13	AM	C131	20.8585
13	USB	C130	20.8615
17	AM	C129	20.9085
17	USB	C128	20.9115
21	AM	C127	20.9585
21	USB	C126	20.9615
26	AM	C163	21.0085
26	USB	C164	21.0115
31	AM	C165	21.0585
31	USB	C166	21.0615
36	AM	C167	21.1085
36	USB	C168	21.1115

20 MHz Mixer

a. Select Channel 20.

b. Connect a DC VTVM to Pin 8 V301.

c. Tune T100 to top peak, and top and bottom slugs of T101 for maximum DC. (If T101 is badly detuned, it may be necessary to connect an oscilloscope to J100B and tune T101 for a 20 MHz signal. The oscilloscope should then be removed and T101 slugs peaked for maximum DC voltage.)

Synthesizer Module Replacement

TRAM/DIAMOND CORPORATION has designed the synthesizer module with the technician in mind; should the D201A ever become inoperative due to a synthesizer defect, the technician may simply remove the module and forward it to the factory for replacement or repair.

Note that both the Balanced Modulator and Synthesizer modules contain adjustable components. Every care must be taken in the removal, packaging for shipment, or the installation of these modules to see that adjustments are not disturbed.

Synthesizer Module Removal

1. Set the channel selector to channel 1.
2. Remove tubes V600 and V603.
3. Remove the plugs P100A and P100B.
4. Remove the balanced modulator circuit board.
5. Remove the light shield.
6. Remove the channel selector knob.
7. Loosen the set screw on the channel selector dial.
8. Remove the screws and lock washers that hold the "L" shaped bracket to the chassis.
9. Remove the screw that holds the Synthesizer Module to the chassis. Take care not to loose the nylon spacer and washer.
10. Holding the dial toward the front panel, draw the Synthesizer Module to the rear rotating it slightly counter clockwise and remove the cable connected at the lower front.
11. The Synthesizer Module may now be removed by rotating and drawing it towards the rear of the chassis.

Synthesizer Module Return

If it becomes necessary to return the Synthesizer Board to the factory for service, several precautions should be observed.

1. The board must be adequately protected to withstand the rigors of shipping. Packaging should be 2" thick on all sides and firmly hold the board in place.
2. The board should be insured against loss for $200.00.
3. A detailed note indicating the type of failure should accompany the board and make mention of the mode and channels involved.

D201 Receiver

General Information

The D201A uses a high gain, multi-mode, super-heterodyne receiver. In the AM mode dual-conversion at 6.25 MHz and 455 KHz occurs using two separate ceramic filters to insure best selectivity and adjacent channel rejection.

In the sideband mode single conversion at 6.25 MHz in conjunction with Product Detection and a steep sided 2.1 KHz, 6 pole crystal filter combine to give an extremely sharp and sensitive receiver.

Normal tube replacement does not necessitate re-alignment.

Circuit Description — S-Meter

The meter circuit of the D201A utilizes an integrated circuit operational amplifier (1C801) to provide stable and accurate metering.

It is powered from the +14 volt bias supply (Pin 7) and a negative supply, obtained by rectifying the filament supply, connected to Pin 4. The +14 volt supply is connected to both the inverting (Pin 2) and noninverting (Pin 3) inputs of 1C801 via R418 and R420. R420 is adjusted to provide equal voltage at pins 2 and 3. This, of course, results in zero feedback current through M400. When a signal to be measured is applied to the noninverting input (Pin 3) via 55 sufficient feedback current will flow through M400 to cause the voltage at the inverting input (Pin 2) to equal the voltage at Pin 3. Capacitor C421 provides a time constant to dampen the meter and capacitor C420 provides transient protection for IC801.

S-Meter Calibrate

The S-Meter circuit in the D201A may require recalibration if V300 is replaced or if the meter is reading inaccurately on incoming signals. Calibration of the circuit is accomplished using a calibrated Signal Generator as follows:

1. Allow 1/2 hour warm-up.
2. Set mode to CRYSTAL.
3. Zero the meter. (See page 30)
4. Adjust RF Gain fully CW.
5. Connect a calibrated RF signal generator to the D201A antenna jack.
6. Place the D201A in AM receive, Crystal Selector to channel 20.
7. Set generator output at 50 microvolts on channel 20.
8. Adjust R429 (S-Meter sensitivity) for an S-9 reading on panel meter. (See fig. 7 for component location)

Circuit Description - AGC

AM — Control voltage for V300 and V400 is obtained from the diode combination D401 and D402. Negative voltage developed by these diodes in the presence of signal is fed to V300 pin 3, and V400 pin 1.

Single Sideband — Detected audio of V502A is applied to and amplified by the other half of this tube, V502B. Further amplification is accomplished by Q500. At this point the Sideband receive signal is picked off and fed to the audio stage. A portion of this signal is also applied to the base of Q501. Here the resulting voltage at the emitter is rectified by D500 and D501 with a negative AGC potential resulting. This voltage, when applied to V300 and V400, controls the gain of each. The R/C combination C424/R430 supply fast-attack, slow-decay characteristics for the SSB AGC circuit.

Squelch

The front panel squelch control and the AGC voltage determine the squelch condition in the D201A. Voltages sampled at S3B pin 1 are fed to pin 7 of V402B where they are used to bias off this tube. When the receiver is squelched, V402b is conducting and V402A is cut off due to the increased bias voltage at its grid. A negative AGC signal will bias V402B reducing plate current. The resulting drop in bias at V402A pin 2 places it in conduction. Signal is passed when AGC voltage is present. The receiver returns to a squelched state when AGC signal is removed.

AGC Check

If local signal overload is a problem, or erratic S-Meter readings are observed, the AGC circuits may be at fault. Both the AM and Sideband portions of the D201A receiver have AGC generation capability and should be treated independently.

To check the AGC functions in the AM mode proceed as follows:

1. Allow five minutes warm-up time.
2. Set mode to AM.
3. Set RF Gain fully CW.
4. Connect a VTVM to S3B pin 1. (green/white lead)
5. With no signal input at the antenna approximately +0.3VDC should be observed.
6. With 50 microvolts input at the antenna − 5VDC ± 1VDC should be observed.

If AGC voltage is not present, or is low, the AGC diodes D401 and D402 may be faulty. The AM AGC voltage can be observed at the grids of V300 and V400. If present here with no AGC action, one of these tubes may be at fault.

To check AGC functions in the sideband mode proceed as follows:

1. Allow five minute warm-up time.
2. Set mode to USB or LSB.
3. Set RF Gain fully CW.
4. Connect a VTVM to S3B pin 1. (white/green lead)
5. With no signal input observe approximately +0.3VDC.
6. With a 50 microvolt input at the antenna observe −2.8VDC ± 1VDC.

Most Sideband AGC failures are characterized by a complete lack of S-Meter readings in the Sideband mode. If this is the case Q501 should be suspect. D500 and D501 may also be faulty.

Manual Tuning Calibrate

The manual tuning portion of the D201A receiver may require calibration and alignment if significant inaccuracies are observed in the manual dial position. This procedure should be performed after the D201A has reached operating temperature and stabilized. A warm-up period of one hour is mandatory to insure accurate calibration.

After a one hour warm-up proceed as follows:

1. Check the mechanical dial to variable capacitor setting. The capacitor, C317, should not reach either of its own stops. Its rotation should be limited by the stop screw located in the dial hub.
2. Connect a frequency counter, through a 5 pf cap, to J100a.
3. Set CRYSTAL/MANUAL Switch to MANUAL.
4. Set CRYSTAL SELECTOR and MANUAL TUNING each to channel nine.
5. Pull CAL switch out. (ON).
6. Tune L301 for an audio zero-beat. (freq. 4.400 MHz) See fig. 3

7. Set MANUAL DIAL for 27.450 MHz, adjust C319 for 4.785 MHz.
8. Repeat steps 6 and 7 until both lower and higher readings are correct.

TUNE	MANUAL DIAL	FREQUENCY (MHz)
Coil (L301)	9	4.400
CAP C319	27.450	4.785

Circuit Description – 27MHz RF Amplifier

27 MHz signals enter the radio through J1, pass through a low pass filter network, through K600 via pin 14, through RF Gain control R326 and are fed to antenna trransformer T300. T300 feeds the grid of V300 the RF amplifier. V300 is a cascode connected dual triode which is neutralized by L300. T301 couples the 27 MHz output of V300 to the grid of the first mixer, V301. At this point a 20 MHz signal supplied by the synthesizer module and coupled through T100 is also applied. Mixing results in a 6 MHz signal which is tuned by T302. Depending on the mode of operation, this 6 MHz signal may be applied to either FL200 on the Balanced Modulator board in the SSB mode, or the second mixer, V302, in the AM mode.

In the AM mode mixing of the 6 MHz IF signal and the receiver local oscillator running at 5.8 MHz at the grid of V302 results in the 455 KHz AM IF signal.

R.F. Amp. and Receiver Mixer Alignment

Low gain observed in both the AM and SSB modes may indicate the need for alignment of the front end and mixer circuits. If alignment is necessary proceed as follows:

1. Connect an RF signal generator to the antenna jack. Adjust generator modulation for 50% at 1 KHz.
2. Place D201A in CRYSTAL receive, AM mode.
3. Set RF Gain fully CW.
4. Set CHANNEL SELECTOR to 20. (except as noted in step 8)
5. Set CLARIFIER at 12 o'clock position.
6. Observe audio output at external speaker jack through a 4 Ohm termination.
7. Peak T300 for maximum indication using top peak of can. Peak T302 for maximum indication. Peak T301 for maximum indication.
8. Set D201A Crystal Selector and RF Signal Generator to channel 40. Detune top slug of T301 for a 15 db drop in audio output. Peak bottom slug of T301.

10.9 Set D201A Crystal Selector and RF signal Generator to channel 1. Peak top slug of T301 for maximum audio output.

If R.F. Amp and Mixer circuits won't align properly and low gain or intermittant condition persists in both the AM and Sideband modes routine signal tracing may isolate failures of T300, V300, T301 or V301. Signal injection levels are noted on the schematic at all feasible injection points. Audio output at the external speaker jack should be at least 2V RMS for injection values indicated.

NOTE: All double tuned IF transformers should be tuned with slugs toward the ends of the can.

455 KHz AM IF: Circuit Description

The AM IF strip consists of V302, the second mixer, two Ceramic filters, V400, the first AM IF amplifier, T400, V401 the second AM IF amplifier, and T401.

6.25 MHz IF signals mixed at the grid of V302 with the 5.80 local oscillator result in the 455 KHz IF signal. This signal is amplified, filtered and applied to the first AM IF AMP. Further tuning and amplification by T400 and V401 results in IF output at T401. This output is then fed to the detector diode D400.

455 KHz AM IF Alignment

Low gain observed in the AM mode only may indicate the need for alignment the 455 KHz IF. If alignment is necessary proceed as follows:

1. Connect an RF Signal Generator (455±1KHz) through a 0.01uf capacitor to V302 pin 2. Adjust generator modulation for 30% at 1 KHz.
2. Set RF Gain fully CW.
3. Observe audio output of D201A with a VTVM through a 4 ohm termination at the external speaker jack. (The D201AS-Meter can be used as an indicator for IF peaking if an unmodulated signal generator is used).
4. Adjust generator for a usable meter indication.
5. Tune L400, T400 and T401 for greatest meter indication. It will be necessary to reduce the generator level as each coil is tuned to permit more accurate alignment. Note that both top and bottom slugs are to be tuned in T400 and T401.

NOTE: All double tuned IF transformers should be tuned with slugs toward the ends of the can.

If the AM IF won't align properly and low gain or intermittant condition persists in the AM mode, routine signal tracing may isolate failures of: V302, the 455 KHz filter, V400, T400, V401 or T401. Signal injection levels are noted on the schematic at all feasible injection points. Audio output at the external speaker jack should be at least 2V RMS for injection values indicated.

Sideband 6 MHz IF: Circuit Description

The 6 MHz output of the First Mixer V301, is fed to pin 16 of the Balanced Modulator board. It passes through the bilateral filter FL200, (a six pole, 2.1KHz crystal type) and is fed out through pin 19 to T500. T500 feeds the grid of V500, the first sideband IF amplifier, and the resulting signal is applied to T501 which in turn feeds V501, the second sideband IF amplifier. The 6 MHz Carrier BFO signal is inserted at V502 pin 8. Product detection results in audio output, which in turn, is used to generate sideband AGC voltages.

Sideband 6 MHz IF: Alignment

Low gain observed in the Sideband mode only may indicate the need for alignment of the 6 MHz Sideband IF. If alignment is necessary proceed as follows:

1. Connect an RF signal generator to the Antenna jack. (no modulation)
2. Place D201A in USB receive, Channel 20.
3. Set RF Gain fully CW, CLARIFIER to 12 o'clock.
4. Adjust generator for a meter indication at the external speaker jack. Level should be adequate for tuning, and frequency 1.5 KHz at output.
5. Tune T500, T501 and T502 for maximum indication, reducing the generator level as required.

6. With generator input of 0.1 microvolts, observe at least 2V RMS audio output.

If 6 MHz IF won't align properly, and low gain or intermittant condition persists in the Sideband mode routine signal tracing may isolate failures of T302, the Balanced Modulator, T500, V500, T501, V501, T502 or V502. Signal injection levels are noted on the schematic in both the 27 MHz and 6 MHz sections of the Sideband receiver circuits. Audio output at the external speaker jack should be at least 3V RMS for the injection values indicated.

RF Noise Blanker: Circuit Description

The D201A uses an RF Noise Blanker to eliminate impulse type noise. This device detects, amplifies and rectifies noise pulses which are then used to ground the receiver input at the First Mixer.

Noise is sensed at the primary of T300 and coupled through T800 at 25 MHz. IC800 amplifies the 25 MHz signal and applies it to T801. T801 tunes the signal at 25 MHz and applies it to the base of Q800. Positive going pulses turn on Q800 and drop the collector voltage toward zero. This drop in voltage is seen at the base of Q801 which turns off with a resulting collector swing to +14 VDC. This 14 VDC, dropped through R807, is applied to the base of Q802 which instantaneously turns on, dropping its collector voltage to zero. As the collector voltage of Q802 approaches zero the reverse bias is removed from D800, a 1N67A. With its bias removed the diode effectively shunts all signals to ground through Q802 for the duration of the noise pulse. The result of this switching is extremely short duration "holes" in the received signal coinciding with the noise pulses. By detecting the noise impulses before the selective and high-gain circuits of the receiver, noise pulse duration and therefore "hole" duration, is kept to a minimum.

RF Noise Blanker: Alignment

If inadequate blanking action is observed, the Noise Blanker may be in need of alignment. To align the Blanker circuit proceed as follows:

1. Set power on, Mode to CRYSTAL.
2. CHANNEL SELECTOR to channel 20.
3. BLANKER on (pulled out)
4. Connect a VTVM to R802/Q800 junction and adjust R802 for +0.4VDC. (See fig. 6)
5. Place probe on base of Q802.
6. Connect a signal generator to the antenna jack and adjust output for a 25 MHz signal with 1KHz, 30% modulation.
7. Increase generator output until VTVM indication is obtained.
8. Alternately tune T800 and T801 for peak reading on the meter. Reduce generator level to keep meter reading less than +0.5VDC. T800 and T801 will normally tune with slugs near top of cans.
9. Repeat step 8 until T800 and T801 are peaked at the minimum output level from the generator necessary for a reading of +0.3 VDC on the VTVM. A generator level of 250 microvolts (48db) is maximum allowable for adequate blanking. 40db is nominal.

CAUTION: When fully peaked the Blanker may oscillate with the antenna jack terminated in 50 ohms. If this is the case additional noise will be observed when the Blanker is activated in the Sideband mode. A slight detuning of the Blanker circuit (1/4 to 1/2 turn of T800) is required to stop this high-gain oscillation. The blanking efficiency will not be reduced by this slight detuning.

If alignment does not restore blanking action, or the Blanker does not respond to input signals D800 may be open or failures in the transistor amplifier or switching circuits may be found.

AM Noise Limiter: Circuit Description

The D201A uses a low level, series gate type, audio frequency Noise Limiter. A normally conducting, forward biased diode, D403, is connected in series with the AF line between the Detector and first audio amplifier. Under normal signal and low noise conditions detected audio is passed and fed to the audio amplifier. When a short duration, high level noise pulse rides in on the detected audio the limiting diode is forced into nonconduction by the negative voltage developed at the detector and applied through R411. Thus the signal path is blocked for the duration of the noise pulse since the AGC cannot respond quickly enough to raise the voltage at R416. R431 adjusts the amount of resistance seen by the incoming audio and therefore the level of bias on D403. This varies the limiting ability of the circuit.

Since the limiting diode reacts to any high-level signal the audio from extremely strong stations will be distorted slightly by the signal blocking process.

Receiver Audio

The receiver audio strip in the D201A is comprised of V402, the first audio amplifier, V602 the audio driver, and V603, the audio power amplifier. If S-Meter indications are normal, but there is no audio output at the speaker, trouble is indicated in the receiver audio circuits. These circuits may be checked by injection of signals indicated on the schematic. Failures of V402, V602, V603 or associated circuitry can be isolated in this manner. An audio output of at least 2 VRMS should be observed at the external speaker jack with injection valued indicated.

Transmitter

General Information

The D201A transmitter uses a Class C Final amplifier with plate and screen grid modulation in the AM mode. A compression circuit controlling the Audio Gain at V601 insures 95% modulation for widely varying input signals.

In the single sideband mode a Balanced Modulator/Filter combination generate either upper or lower sideband signals which are automatically level controlled (ALC) to insure a full 12 watt PEP output with low intermodulation distortion. RF final amplification takes place using vacuum tubes in Class AB_1 operation.

Power sensing and SWR measurements are supplied by directional detector circuits on the RF Bridge Board. TVI filtering also occurs on the RF Bridge Board to insure a minimal amount of radiated harmonic interference.

WARNING The following alignment instructions are for qualified technicians only. Improper adjustments will result in degraded performance and possibly permanent damage to certain components. Obvious tampering will void the warranty.

Alignment should not be attempted until all other possible causes of faulty operation have been identified and corrected.

Refer to Figs. 3-12 for component locations.

WARNING Transmitter adjustments may be made only by, or under the immediate supervision of, a person holding a First or Second Class Radio Operator License. (This applies specifically to Transmitter Alignment.)

Power Metering Circuit Description

The D201 uses a directional detector system to sample power in the forward and reverse direction. Forward power is indicated directly in watts on the S/PWR scale of the meter. Reverse power is translated into SWR and displayed on the SWR scale. In the forward direction induced current flows through the forward biased D700 where DC is picked off and fed to S5-pin 11.

In the reverse direction induced currents flow through D701 where DC is picked off and fed to S5-pin 12. The detected DC voltage is fed to pin 3 of IC via S5 causing the meter to deflect.

Power Meter Calibrate:

The power meter on the D201A may occasionally require recalibration. To accomplish this, proceed as follows:

1. Allow 5 minutes warm-up.
2. Set mode to AM, channel selector to 20.
3. Microphone gain fully CCW.
4. Zero the meter (see page 30)
5. Connect wattmeter to antenna terminal.
6. Observe reading on external PWR meter in transmit.
7. Adjust R427 so that D201A panel meter reads the same as external meter.

WARNING The procedures outlined below may only be carried out by those with First or Second Class F.C.C. Commercial Licenses.

Antenna Loading

For optimum performance the final amplifier circuits of the D201A should be tuned to the antenna system. To accomplish this proceed as follows:

Set Controls:

Power off/vol	ON
AM-LSB-USB	AM
Mic Gain	CCW
Meter Switch	S/PWR

1. Select a quiet midband channel and be sure it is not in use.
2. Key the transmitter by depressing the mic touch bar and sliding the locking collar up the shaft.
3. Observe the Power reading on the meter and alternately adjust the tune and load controls on the D201A Rear Panel until a peak reading is achieved on the meter.
4. Unkey the microphone.

Under normal conditions 1/4 turn of each adjustment should be adequate to match the final Amplifier to the antenna lead-in.

If more than 1/2 turn of either is required the antenna system should be checked for abnormally high SWR. This adjustment should be carried out quickly to minimize interference with other stations and once done insures the transmitter is efficiently matched to the antenna system in use.

RF Driver, RF Final Amplifier and Neutralization

1. Remove B+ from V701 (RF Final) by disconnecting the orange wire from the junction of L704-C720.
2. Connect a 50 ohm dummy load and RF wattmeter to the D201A antenna jack.
3. Connect a DC VTVM to the junction of L702, C719 and R709 and R710.
4. Place D201A in AM receive and adjust R708 (AM bias) for – 40 VDC.
5. Place D201A in LSB receive and adjust R707 (SSB bias) for – 40 VDC.
6. Place D201A in Channel 20 AM transmit.
7. Retune T700 for maximum DC indication.
8. Place D201A meter switch in SWR CAL position, SWR CAL control fully CW, C712 (RF Final Load Capacitor) one turn from maximum capacitance (1 turn from full CCW from backside of D201 chassis).
9. Tune C711 (RF FINAL TUNE capacitor) for maximum SWR CAL meter indication (meter reading may be small but visible).
10. Tune C706 for a null on the D201A meter.
11. Place D201A in receive and reconnect the V701 B (orange wire).
12. Place the meter switch in S/PWR position and D201A in AM transmit.
13. Retune C711 and C712 for maximum power output (3.8-4.2) watts.
14. Adjust R427 (Power Cal) for the D201A power meter reading to agree with external wattmeter.
15. Place D201A in LSB transmit with MIC. GAIN fully off (CCW).
16. Adjust R707 (SSB bias) for .37 volts at pin 8 of V701.
17. Measure the DC voltage at the junction of L702, C719 and R709 and R710. (– 55 VDC typical)

14\. Adjust R427 (Power Cal) for the D201 power meter reading to agree with external wattmeter.

Circuit Description – Balanced Modulator Board

The Balanced Modulator Board is used to generate the carrier signal for AM transmit, the carrier injection signal for sideband receive and low level sideband signals in upper and lower sideband transmit.

In the AM transmit mode X201 (6.2565MHz) is selected by S3B. The emitter follower oscillator circuit of Q200 and Q205 provides carrier oscillator output through D208. This signal is mixed with a 20 MHz signal from the synthesizer at Q202, is coupled through T201 to 27MHz amplifier, Q203, and after tuning by T202 exits the board at pin 13.

In the single sideband receive mode a signal (6.2535 in USB, 6.2565 in LSB) is picked directly off Q205 and fed to V502A, the product detector. Here it is mixed with the 6 MHz sideband IF signal resulting in an audio frequency output.

In the sideband transmit mode audio from V601 and V600 is applied via pin 18 to amplifier Q204 and Q206. The resulting audio signal is applied simultaneously with RF from the carrier oscillator/buffer Q200 and Q205, to the input of the ring balanced modulator D211-D214. The output of the ring is double sideband suppressed carrier which is tuned by T200 and fed to the 6 MHz amplifier Q201. C207 and R214 balance the circuit for a null on carrier signals. This signal is then applied to FL200, a steep sided 2.1 KHz crystal filter. The unwanted sideband and any remaining carrier are filtered out at FL200 with the resulting output mixed at the base of Q202 with a 20 MHz signal from the synthesizer. A 27 MHz, upper or lower sideband signal results, (depending on which 6 MHz crystal is selected) and is fed to V700 the RF driver. V701 then amplifies the drive signal at a full 12 watts PEP.

Balanced Modulator Alignment

If low sideband receiver gain, low sideband power out, off frequency operation or poor quality sideband audio is observed, the Balanced Modulator may be in need of alignment.

Balanced Modulator alignments must be performed by those holding First or Second Class F.C.C. Commercial licenses.

If alignment fails to restore proper operation the entire Balanced Modulator Board should be returned to the factory for service.

Carrier Oscillator Calibration (Balanced Modulator Board)

1. Connect a frequency counter to Pin 7 of Balanced Modulator board (See fig. 12)
2. Place D201A in USB mode and adjust C227 for a frequency of 6.2535 MHz.
3. Place D201A in LSB mode and adjust C230 for a frequency of 6.2565 MHz.

Balanced Modulator, Transmit Mixer, 27 MHz Amplifier (Balanced Modulator Board)

1. Remove B+ from V701 (RF Final Amplifier) by disconnecting the orange wire from the junction of R716 and terminal strip.
2. Connect an oscilloscope to V701 Pin 5 (grid of RF Final).
3. Place the D201A in Channel 20, AM transmit.
4. Tune T201 (top and bottom slugs), T202, and T700 for maximum indication. Make note of this indication as reference.
5. Place the D201A in LSB transmit.
6. Connect an audio signal generator to the MIC jack (1500 Hz).
7. Adjust audio generator level and MIC GAIN control for about 1/3 of previous AM transmit indication. Note in the following step it may be necessary to reduce the generator level or MIC GAIN to keep the oscilloscope indication less than the previously noted reference.
8. Tune T200 and T500, and retune T201 (both slugs), T202 and T200 for maximum indication.
9. Place the CRYSTAL SELECTOR to channel 40 and adjust L203 for maximum indication.
10. Return the CRYSTAL SELECTOR to channel 20.

9\. Remove the audio generator and turn MIC GAIN CCW (minimum).

10\. Increase the oscilloscope sensitivity as required and alternately adjust R214 and C207 to suppress the carrier to minimum.

Balanced Modulator Module Replacement

TRAM/DIAMOND CORPORATION has designed the Balanced Modulator module to be easily replaceable. Should the Balanced Modulator module need extensive repair, the technician can simply remove the module and forward it to the factory for replacement or repair.