

**STONER
PRO-40
OWNER'S MANUAL**

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THE SIDEBANDERS' CREED

AS an 11 Meter Sideband Operator, I recognize my obligations:

TO my fellow operators, who depend upon me to follow established good practices, procedures and courtesies.

TO my neighbors, who may be required to entrust their lives and safety to my skill and judgment during times of emergency.

TO the Sideband organization, of which I am a member, which relies upon me to present myself to other operators in a manner which will be a credit to that organization.

TO discharge these responsibilities, I will at all times observe the highest standards as an 11 Meter Sideband Operator.

I will never knowingly cause interruption or interference to another Sidebander engaged in communications.

I will make all efforts to respect the proper use of any channel(s) established in my area for the purposes of calling only.

I will operate only on those channels which are normally used for single sideband transmission, and will endeavor to advise others of these channels in order to keep them clear of non-sideband transmissions.

I will use only those sidebands which are normally used by other Sideband operators in my community.

I will aggressively maintain my proficiency as a Sideband operator and keep abreast of electronics and communications developments so that my operation, which largely depends on such knowledge, may be of the highest order.

I will conduct myself on the air to reflect credit upon myself and other Sidebanders.

I will constantly strive to keep my standards high.

I pledge adherence to these principles, so that I may contribute my part to more efficient communications, and advance the dignity and continued growth of the national Sideband movement on the 11 Meter Band.

Operator's Signature

SSB Network ID # _____

S9 March 1977

TABLE OF CONTENTS

Section One*		Page		1
	Introduction			1
	History			1
	AM.			1
	Frequency Counter			1
	Tuning			2
	Speaker Impedance			2
	Transmitter Peaking			2
	The Product			2
Section Two		Page		3
	The STONER Owner			3
	Limited Warranty			3
Section Three		Page		5
	Operating Controls			5
	AC			5
	AM			5
	MIC			5
	NOISE BLANKER (NB1/NB2)			5
	SB			6
	R.F. GAIN			6
	SQUELCH			6
	CLARIFIER			6
	WHISTLESTOP			7
	VOLUME			7
	METERING/SIGNAL STRENGTH			7
	METERING/PEP			7
	METERING/SWR			7
Section Four		Page		8
	Connecting Your PRO-40			8
	Antenna			8
	Speaker			8
	AM Operation			8
	Antenna and Lead In			9
Section Five		Page		10
	Proof of Performance Tests			10
	Sideband Suppression			10
	Adjacent Channel Suppression			10
	AVC Action			10
	Adjacent Channel Rejection			10
	Whistlestop/Null			11
	Whistlestop/Peak			11
Section Six		Page		12
	Theory of Operation			12
	Ease of Service			12
	Exciter Board			12
	Antenna Switch			12
	Receiver Circuitry			12
	AVC Circuit			13
	Noise Blanker			14
	Microphone Preamplifier			14
	Oscillators			14
	Transmit Mode			15
	Synthesizer/Frequency Counter			16
	Synthesizer			16
	Counter			16

Lock-Out	16
Power Supply Board	17
Interconnections	17
Section Seven	Page 18
Test Procedures	
Visual Inspection	18
Power Supply Test	18
PLL and Counter Board Test	19
R.F. Broad Test	20
Transmitter	21

SECTION ONE

INTRODUCTION

This is the place where you are usually complimented on your wisdom and **good judgement** for purchasing the manufacturer's product.

I remember, many years ago, reading such a congratulatory note in a manual. I've retained the memory all this time because I was in a state of shock. I pondered (along with my wife) how I could have taken leave of my senses and **spent \$600** for a camera.

After I read the manual provided with the camera, the answer was clear. I had spent the price of a dozen Instamatics to purchase a NIKON "F", the finest 35mm camera ever made. I've never regretted my decision.

There are many people like me who enjoy owning the very best and cost becomes a secondary consideration. There is a certain amount of satisfaction in knowing you own a piece of equipment, which possesses characteristics, which are superior to that equipment owned by your contemporaries. It's also reassuring to know that you own a handcrafted and performance tested product.

History - The idea for the PRO-40 was born in "CB Magazine" during 1976. At the time, I was writing the "Stoner on Sideband" column and was also one of the owners of a company manufacturing professional marine SSB equipment. As the author of the column, I received many letters from readers lamenting the problems they were having with their equipment.

At the time, much of the CB equipment on the market was really trash. Complaints about "bleedover" interference were actually caused by poor adjacent channel selectivity. I knew I could make a better radio, but would people purchase a "cost is no object, high specification radio?"

I did a survey on the "ultimate CB sideband" in the magazine and the response was phenomenal. Hundreds of letters of complaints, suggestions, improvements, ideas and so on, were received. Many of the features incorporated in the PRO-40 were suggested by my readers.

For example, the 10 turn clarifier would never have been thought of by the typical engineer, yet, to an SSB operator, it is obviously a desirable feature to aid in tuning SSB signals.

AM - In the 25 years I have been producing SSB equipment, I have come to the inexorable conclusion that it is not possible to incorporate the AM mode into an SSB transceiver without compromising the SSB performance. Since this was to be a "no compromise" product, AM operation was never even considered. We did make provision, however, for adding the STONER AM-40 adaptor externally to the PRO-40 for those who feel this mode is essential. Most dedicated 11 meter sidebanders wouldn't be "caught dead" on AM, however.

Frequency Counter - A point should be emphasized regarding the frequency counter. Any true frequency counter has an inherent + I count error. For example, let's say the actual frequency is 27155.5 (approximately channel 1). The counter reads to 6 places (nearest 100 Hz). Thus, the counter circuits will not know if the display should read 27155.5 or 27155.6. Therefore, the right hand digit will **flick back** and forth between 5 and 6. The effect is somewhat annoying, but it does

indicate to the user that the frequency is not exactly on 5 or 6, but in between **the two**. The effect can be used to extrapolate a frequency measurement to + 50 Hz. The "jumping" of the last digit does not indicate frequency instability in this or any other radio with a frequency display.

Unlike most frequency counters, the display in the PRO-40 operates on both receive and transmit. Thus, it can be used for measuring the frequency of an incoming station. Simply tune in the station with the clarifier until the voice sounds clear and natural. The frequency displayed will then be exactly that of the incoming station.

Tuning - Tuning the PRO-40 is done with push buttons, which control a microprocessor. The frequency may be sequenced or made to scan by momentarily depressing the button or holding it in. However, when you wish to stop on a specific channel when scanning, release the button abruptly. If the button is slowly released, the switch contacts can "chatter" and make the microprocessor think that a different channel, other than the desired one, has been selected.

Speaker Impedance - The PRO-40 must be used with an 8 ohm speaker such as our SPK-40. If a 3-4 ohm speaker is used, the audio integrated circuit can supply audio power in excess of its ratings. If full audio power is run continuously into a 3-4 ohm speaker, resistor R505 (which protects the audio IC) may be damaged. Always use an 8-ohm speaker. No damage will occur even at continuous full audio output.

Transmitter Peaking - The PRO-40 has an excellent reserve of power. We have designed the transmitter to provide 18-20 watts of power, then run it at 12 watts. Thus, the distortion products are virtually nonexistent and the PRO-40 is probably the "cleanest" transmitter in existence.

DO NOT be tempted to have the technician "soup up" the transmitter. The slight additional power output will not make much difference, but will certainly "dirty up" the signal you transmit. You will lose sideband suppression and interfere with adjacent channels.

If you require more power, please find some other way to get it. Don't destroy the beautiful modulation of the PRO-40 which we have worked so hard to provide.

The Product - The PRO-40 represents what I believe to be a state-of-the-art 11 meter single sideband transceiver. It is a very limited production product and our personnel have sufficient time to tune, test and quality control the PRO-40 before it is shipped to the customer.

Everyone at STONER-The Sideband People is extremely proud of the PRO-40 and we hope you will be equally proud as an owner/operator of our radio.

Professionalism, as well as profit, is the primary goal at STONER. We intend to make the best possible product and do whatever is necessary to insure customer satisfaction with STONER-The Sideband People.

With best regards,

Donald L. Stoner
President
STONER-The Sideband People

SECTION TWO

THE STONER OWNER

In the upper left-hand corner of your PRO-40, you will notice a "STONER number". This is your own personal club call as a "STONER Owner". Naturally, these do not replace your FCC call letters, but supplement them. No one else has the same number, which, by the way, is also the serial number of your radio.

However, there is a "hitch". To register as a "STONER Owner", you must fill in and return the warranty card we provided with your radio. As soon as you are signed up, you'll start receiving the mailings that go to the "STONER Owner". One item, which I think you'll like, is 100 PRO-40 color QSL cards which you can send to the stations you contact.

You will also receive a letter from the Sideband People authorizing you to receive a 10% discount on all future STONER accessories, which become available for your PRO-40. We'll be announcing some exciting new items in the near future.

You will also receive monthly propagation forecasts to indicate when the band will be open and to what areas of the world. As interesting technical articles come along on Sideband, we'll include them in our club publication, "The STONER Owner".

If that isn't enough inducement to get you to fill in the warranty card, here's a very powerful one. Since the PRO-40 is a limited production **radio** and is registered to the STONER owner, we'll know who is using them. If one is stolen, call us immediately and give us your STONER number. When the radio shows up here at the factory or at a warranty station, we will contact you immediately and give you details of where the radio came from. Naturally, any radios with the serial number altered or removed will not be serviced and the original owner will be contacted. By the same token, if you sell your radio, let us know so we can transfer ownership.

Limited Warranty - STONER, Inc. warrants this product to be free of defects in materials and workmanship. We agree to remedy any such defect, which may occur during a period of one year from the purchase date, provided:

1. We have a valid warranty registration card on file.
2. The defect is, in our opinion, due to improper materials or workmanship.

The warranty does not cover units, which have been subject to misuse, neglect, drop damage, improper installation, or if the serial number has been removed, defaced or changed. We reserve the right to void the warranty if modifications have been made to the product, which can damage components or violate the FCC Type Acceptance.

If a problem arises in your PRO-40, the unit should be taken or shipped (prepaid) to a STONER Authorized Warranty Station. A defective unit may also be sent (prepaid) to the factory for repair. We will return the unit prepaid upon completion of repairs. When returning a unit, be certain to provide complete details regarding the nature of the defect.

Approximately 11 months from the purchase date, STONER will notify you that your warranty is about to expire. At that time, we suggest that you send your unit to a STONER Authorized Warranty Station for a checkup. They will install the various factory modification that may have been incorporated since your unit was produced. There is a \$25.00 charge for this updating service. At any time after the warranty expires, the unit may be sent to an Authorized Warranty Station or the factory for repair and/or modification for a maximum charge of \$50.00.

This warranty is in lieu of all warranties expressed or implied and no representative or person is authorized to assume for us any other liability in connection with the sale of our products.

SECTION THREE

OPERATING CONTROLS

Most CB radios are sufficiently uncomplicated that it is only necessary to find the ON/OFF switch and the volume control for proper operation.

The PRO-40 is a bit more complicated and you should be familiar with the operating controls for maximum operating pleasure. Let's run through them in detail, starting with the switches.

AC - This is the master power switch which turns the radio on and off.

AM - Normally, this switch is left in the out position. However, if you have the STONER AM-40, external 40 channel AM adapter (or any other external AM radio), this switch will be used. When depressed, it turns off the transmitter portion of the PRO-40 and transfers the internal 13.6 volt, 3-ampere, electronically regulated power supply to the rear apron terminal strip. This voltage can be used to supply power to the external AM radio or the STONER AM-40 adapter. The antenna line will also be transferred from the PRO-40 to the external AM radio. When transmitting AM, the frequency counter will display the AM carrier frequency. Note that it is normal for the counter to read "20000.0" when the AM button is depressed. The left-hand digit is hardwired to always display the number 2.

MIC - This is an important switch and you should fully understand its operation. Normally, the switch will be left in the out position and the operator should "close talk" the D104 microphone. This will produce a flat audio curve with excellent fidelity and excellent low frequency response. In fact, you probably never heard a D104 sound so good. For local contacts, use this switch position.

For weak signal contacts, the MIC switch can be depressed. This causes several things to happen inside the PRO-40. First, the audio level will be increased considerably and you should back away from the microphone by four inches or so. At the same time, the audio frequency response will also be tilted to significantly boost the high frequencies. This boosted modulation produces an uncanny ability to cut through QRM and skip interference.

A dynamic microphone can be substituted for the D104 if desired. The MIC switch should be left depressed for a substitution of this type. In the out position, there may be insufficient modulation.

If you insist on using a "power microphone" (other than one supplied by STONER, Inc.), always leave the switch in the out position for best results.

NOISE BLANKER (NBI/NB2) - The noise blanker consists of a separate receiver tuned to 26 MHz. Two switch positions are incorporated to provide a long (NBI) and short (NB2) tone constant. Depending on the type of electrical noise, one switch should be more effective than the other. If depressing either switch introduces noise, it indicates excessive gain in the noise blanker receiver. This can be corrected by tuning the core in transformer T503 slightly in a counter clockwise direction.

SB - This switch determines which Sideband is transmitted and received. In the out position, the radio operates on upper Sideband. When depressed, the lower Sideband is in use. Note that a light emitting diode indicates which Sideband has been selected.

The PEAK and NULL switches are described in detail in the Section titled "Proof of Performance Tests".

Channel selection is determined by the switches labeled SLOW (UP/DOWN) and FAST (UP/DOWN) which control the PLL microprocessor. When the SLOW (UP) button is depressed, the microprocessor will move up one channel and pause. If you hold the button depressed, the microprocessor knows you want to scan slowly up through the channels. After a pause of one second or so, the scanning action will commence. You can also change channels manually by repeatedly depressing this or the SLOW (DOWN) button.

The FAST switch buttons (UP/DOWN) do the same thing at a much faster rate. It is used for going from one end of the band to the other very quickly. Since the scanning rate is so fast, you probably won't be able to stop exactly on the desired channel. After you are "in the ballpark", use the SLOW buttons to reach the desired channel. Note that the buttons must be released abruptly to avoid contact "chatter" and channel jumping (refer to Section One).

The control knobs perform the following functions:

R.F. Gain - This knob controls the "front end" gain of the PRO-40. It may be useful in the presence of strong off-channel stations. However, because of the superb adjacent channel rejection of the PRO-40, the radio will probably always be operated with full r.f. gain (control full clockwise).

Squelch - This control is useful for eliminating background noise when monitoring a channel. It should be very carefully set just past the point where the receiver just silences. If the control is tuned too far clockwise, you will miss all but the strongest signals. The care you use in setting this control will determine how weak a signal is able to unquench the receiver.

Since the squelch is activated by audio peaks, it will switch on and off as the person talks. Depending on voice characteristics and the squelch setting, this effect may be annoying. Thus, the squelch should be turned off when a station comes on the channel being monitored.

Clarifier - The clarifier control employs a special variable resistor geared to a planetary drive. It requires 10 turns of the knob to go from one extreme to the other. Note that there is a clutch at each end of the control range so that no damage will occur if you keep turning the knob. You'll feel a slight increase in friction when you reach the end of the control range.

The clarifier provides a minimum tuning range of ± 5 kHz each side of "center slot". If you want to hear what is happening on 27160.0, for example, you can switch to channel 16 and tune up 5 kHz or channel 17 and tune lower in frequency the same amount.

Whistlestop - This knob adjusts the frequency of the audio filter in the PRO-40. Use of this control is described in detail in the Section titled "Proof of Performance Tests".

Volume - This control, as the name implies, adjusts the receiving volume of the PRO-40. Simply set it for a comfortable listening level.

Metering/Signal Strength - The left meter is used to indicate the strength of the incoming signal. Like most S-meters, its reading is relative and is primarily used to compare strengths of the various stations you receive.

Metering/PEP - The power output meter detects the transmitted voice peaks and is calibrated in peak envelope power. The reading is rather accurate when compared to the relative reading of an S-meter. Since a peak reading wattmeter is incorporated in the PRO-40, there is no need to purchase this rather expensive accessory.

Metering/SWR - The SWR metering in the PRO-40 is quite unique and was developed by STONER - The Sideband People. Apparently, it is sufficiently popular to be copied by a number of CB manufacturers.

The metering circuit employs a discriminator, which compares the phase angles of the radio frequency voltage, and current sent up the coax cable to the antenna. If the phases are the same, the antenna is in resonance and will have a low SWR. The meter will read near center scale under these conditions.

However, if the phases lead or lag each other, it indicates the antenna is tuned above or below the operating frequency of the PRO-40. This causes the meter to deflect toward the plus or minus end of the scale.

Note that this "error voltage" is brought out to the rear apron terminal strip and can be used to drive the servo system of a tunable antenna. Such an antenna is not presently available, but would provide minimum SWR over the entire Citizens Band. When a tunable antenna is introduced, your PRO-40 will be ready for it and already provides the necessary tuning error information.

SECTION FOUR

CONNECTING YOUR PRO-40

There are several precautions, which must be observed when connecting your PRO-40.

Antenna - The incoming antenna system should go to the coax connector labeled "ANTENNA". It should not go to the connector labeled "CB-AM". This is used to connect the STONER AM-40 external AM adapter or an existing AM radio to your **PRO-40**.

Speaker - The audio fidelity of the PRO-40 is superb. Please do not degrade it by using an improper speaker. In particular, do not use tiny little speakers in plastic boxes. Naturally, we recommend the matching STONER SPK-40 speaker. Although somewhat expensive compared to plastic box speakers, the SPK-40 is actually tuned for maximum base response and internally padded with fiberglass to remove cabinet resonance's which can cause annoying vibrating sounds.

In lieu of the SPK-40, you can employ a speaker cabinet designed for a high fidelity system. The impedance must not be 3-4 ohms (see Section One). An 8Ω speaker must be used and will provide excellent performance. .

The speaker should be connected to the two screws labeled "SPEAKER" on the rear apron terminal strip. The polarity of the connections is not important. DO NOT hook the speaker to the connector labeled "AUDIO OUT" on the rear apron. This is a low-level connection for the STONER phone patch and other audio accessories.

AM Operation - If you require AM operation, an external AM radio (either 14or 40 channel) can be connected to the STONER Model PRO-40. The following instructions refer to the STONER Model AM-40 adapter, but apply equally well to any AM radio which operates from a 12-14 volt supply.

Connect the red power lead from the external AM radio to the "CB-AM +14" screw on the rear apron terminal strip. Connect the black lead to the screw labeled "GND". Also, connect the short length of coax cable supplied with the AM-40 between the "CB-AM" coax outlet on the rear apron of the PRO-40 and the antenna input on the AM-40.

To test the connections, turn on the PRO-40 and depress the AM switch button. The counter should read "20000.0". Turn the AM-40 power switch on and adjust the AM radio per the instructions supplied with the unit.

Depress the push-to-talk button on the AM-40 microphone. The carrier frequency being transmitted should read on the PRO-40 frequency counter. Also, the SWR meter may deflect, depending on the SWR of the antenna systems.

Note that any AM radio can be added externally as part of the PRO-40 system. If an AC operated base station is used instead of the 12-14 volt unit described, the red and black power leads mentioned would be ignored. It will be necessary to turn the external AC operated base on and off independently of the **PRO-40**.

Antenna and Lead In - While the antenna system is a matter of personal choice, we do have some definite thoughts on the subject.

For local conditions, best results will be obtained with a 5/8 wave vertical antenna that has tuning stubs to match 50Ω coaxial cable. Some vertical antennas tend to change SWR radically when they get wet. For directional coverage to greater distances, a beam antenna is essential. Many kinds of beams are available ranging from the single boom, three-element type to stacked and quad arrays. In areas where there is a lot of activity, a beam antenna, because of its directional characteristics, will reduce interference from other CB stations not directly in the path of the beam's directivity. Generally, we feel that dual polarity beams are not as efficient as single polarity beams. At The STONER offices, we use a Wilson 5 element horizontal polarized beam. It can't be beat for gain, front-to-back ratio and side rejection.

Whatever type you choose, install the antenna in the open, away from surrounding objects and, most important, power lines. Care should be taken to use a grounded type of antenna. Static charges collected along the antenna elements can generate annoying noise in the receiver. A lightning arrestor installed in the transmission line provides essential protection from static discharge damage.

Most commercially available antennas are designed for use with 50Ω coaxial cable. The PRO-40 output will match a 50Ω system, but will not correct for a mismatch between the antenna and the cable feeding it. The PRO-40 antenna discriminator meter can be used to read the SWR of your antenna system and is extremely useful in tuning antenna systems. When it reads near the center of the scale, the antenna system is perfect. If it deflects off scale in either direction, it indicates the antenna tuning is plus or minus of the desired frequency.

For feedline lengths under 50 feet, RG-58A/U coaxial cable will be satisfactory. For less loss or longer runs, the larger RG-8A/U is recommended. Exercise extreme care when attaching coaxial fitting to either cable. Be sure that the center conductor is soldered. Remember that a cold soldered joint will result in a loss of power. Solder the braid carefully and measure the cable with an ohmmeter to insure there are no opens or shorts. Screw the fitting firmly on the antenna. Where the fitting is exposed to the weather, wrap it with vinyl tape.

Here's a clever trick many "pros" use when putting up a new antenna system. Most antennas do not provide continuity between the center and ground conductor of the coax. For example, beams use a gamma match that employs a capacitor in series with the center conductor. Thus, there is no complete circuit **path** for ohmmeter measurements. At the receiver end of the coax, you can tell if the cable is shorted, but not if it is open. Before putting up any antenna of this type, add a 10K, 2-watt carbon resistor across the coax cable at the antenna end. At the receiver end of the coax, check for a complete circuit across the two conductors of the coax with an ohmmeter. If the meter measures a very low value, the cable is shorted. If it measures an infinitely high resistance, the cable is open. Naturally, because of the resistor, it should measure 10,000 ohms across the cable.

SECTION FIVE

PROOF OF PERFORMANCE TESTS

If you take the time to make the tests described in this Section, you will easily understand why the PRO-40 is so expensive and why we claim the PRO-40 is the world's most professional 11-meter single Sideband transceiver.

At the factory, we perform each of these tests on every radio that is shipped. Companies who ship thousands of radios each month simply don't have the time for the attention to detail that we give the PRO-40.

Sideband Suppression - One often hears the opinion expressed that 11 meter Sidebanders should only use lower sideband because the sidebands interfere with each other.' This is pure hokum! They interfere with each other because the typical mass produced sideband set is putting out "trash" on the unwanted sideband. The -whole idea of SSB is to permit simultaneous conversations on either sideband without mutual interference.

Some evening when the band is quiet, make the following test with a friend who has a high quality SSB set with good sideband rejection. Have him back down his r.f. Gain and advance his volume wide open. Now, bring up the r.f. Gain so you are heard with very loud volume. Now, while he is listening to you count switch sidebands. The sound of your voice should disappear! He may hear a very low growl since the sideband rejection of the receiver you are talking to gets less at the less at the low voice frequencies. If a PRO-40 is talking to a PRO-40, however, nothing will be heard.

For this test, the r.f. Gain of the receiver must be reduced as described disable the automatic volume control circuit (AVC) in the receiver.

Adjacent Channel Suppression - The same test can be made to test the adjacent channel suppression of the PRO-40 transmitter. Have the receiving station listen to the channels on either side of the one you are transmitting on. No splatter or modulation products should be heard. If they can be heard, it indicates the adjacent channel rejection of the receiver is poor.

AVC Action - The automatic volume control circuit in the PRO-40 is outstanding. If you have access to a 27 MHz signal generator, make the follow- test.

Tune in a signal of 1-microvolt (one millionth of a volt). Now advance the output of the signal generator. At the AVC knee (approximately 4 microvolts), the audio should stop increasing. Note this reading on an audio voltmeter connector to the speaker. Now, advance the signal generator to full output, which represents a signal level of one-tenth of a volt (100,000 times stronger than the original signal) at the antenna connector. The audio volume will remain virtually constant between these two extremes!

Adjacent Channel Rejection - It takes an extremely good signal generator for this test. The adjacent channel noise of most generators (particularly solid state units) exceeds the 90-dB adjacent channel rejection specification of the PRO-40.

Tune in a one-microvolt signal from the generator and note the level of the tone. Now, advance the generator output by +90 dB and switch the PRO-40 to the next adjacent channel. The tone should be inaudible or buried in the hiss noise from the generator.

Whistlestop/Null - The purpose of the Whistlestop Null is to remove annoying AM carriers that may come on the channel you are using.

Use a signal generator to produce a tone to simulate AM carrier interference or tune in a stable AM station. Depress the "NULL" switch button. Now, slowly rotate the "Whistlestop" knob. At one point, you should hear the tone drop in volume. Usually, the first few times you practice making this adjustment, you will probably "bite over" the correct setting. The adjustment is extremely critical because we are using the control to cover the audio frequencies between 300 and 3000 Hz in only 270 degrees of knob rotation. However, with a bit of practice, you will become quite proficient in setting this adjustment and suppressing AM interference. Practice until you get the "hang of it" because you are really going to appreciate its effectiveness when you have AM interference.

When the "Whistlestop" circuit is properly set up, you should be able to almost completely null out the AM carrier tone. You may find that the depth of the null gets less after a few weeks of operation. Because of the tremendous selectivity of this circuit, there seems to be a "break in" period required. If the "Whistlestop" does not fully suppress the AM carrier interference, there is an internal adjustment you can make to improve the depth of the null. The setup procedure is described in the Section titled "Service Adjustments".

When operating the PRO-40, you can leave the NULL switch button depressed and the "Whistlestop" knob set at one end of its rotation. The notch in the audio will not be noticeable. The "Whistlestop" control can then be quickly adjusted without being concerned about the NULL switch position.

The "Whistlestop" will not be effective when the skip is in and many carriers are on the channel at the same time. Obviously, the unit can only null out one whistle frequency at a time. During these conditions, use the peak control.

Whistlestop/Peak - When the skip is flying, phenomenal selectivity is required to separate the stations and the PRO-40 has it.

A peaking function has been incorporated to accentuate a single audio frequency. The frequency that is boosted is determined by the setting of the "Whistlestop" control. The peak in the audio band is the reciprocal of the notch produced when only the "NULL" switch button is depressed.

Tune in a busy channel and leave the NULL switch button depressed. However, also depress the PEAK switch button and advance the volume control slightly. The sound from the speaker will have a strange ringing sound. Now, as you slowly rotate the "Whistlestop" knob, you will hear the various stations jump out of the background racket and the others will be suppressed.

Use the peaking function only when the going gets rough and high selectivity is required as the restricted audio can be somewhat annoying when not required with normal signal conditions.

SECTION SIX

THEORY OF OPERATION

When the PRO-40 is examined, you will note that the digital and r.f. circuitry have been separated by two distinct circuit boards. These are called the "exciter board" (40-305) and "synthesizer/frequency counter" (40-306). These two boards are separated by a complete chassis shield to prevent digital pulse interference with the r.f. circuitry and r.f. from the transmitter output from disturbing the digital circuitry. The boards are interconnected by two 10 pin connectors, P501 (near front) and P502 (slightly aft of center).

Ease of Service - Note that if major service is required on the exciter board, it is necessary to remove the counter board. However, because of the plated through hole construction in the STONER p.c. boards, virtually any repair can be made from the topside without removing either board. Note that the drive and final power transistors are butt soldered to the top of the board. The board need not be removed to replace either transistor, should a failure occur.

Five LED diode indicators are included so that the service technician can instantly determine if the 13.6V, 5.0V, 9.0V, 9R and 9T circuits are operative. Test points are liberally used and clearly indicated.

EXCITER BOARD (refer to schematic 40-305)

Antenna Switch - Signals from the antenna enter the exciter board at pins 9 and 10 of connector P504. This connector is located directly aft of the noise blanker switch. The signals pass through the antenna SWR. sensing circuitry **and the low** pass TVI filter (L510 and associated capacitors) and are reconnected to P504 at pins 5 and 6.

However, the signal is also connected to the cathode of diode D529, which switches the antenna to the receiver with virtually no loss. The circuit should be well understood since it can cause strange transmitter problems if a component fails. The diode switch action is controlled by switching transistor Q518. The 13.6 volt supply is connected to the center of Q518. The transmitter conducts during receive periods since R577 goes to the 9T line (which is low), thereby forward biasing Q518. Thus, B+ appears at the collector of Q518 and is used to forward bias diode D529 in series with current limiting resistor R576. Thus, the signal passes through the diode, uninhibited, to the receiver input (T504). When transmitting, Q518 must be totally open and TP29 must measure negative 20-30 volts (use VTVM only) which back biases diode D529. To test this circuit, put a VTVM on point 29. It should measure approximately 13.6 volts. Depress the microphone PTT button. Test point 29 should "flick" negative then return back to zero with no modulation. With modulation, the meter should go negative up to 30 volts or so. If the circuit does not function in this manner, the transmitter r.f. could be coupled into the balanced modulator and cause r.f. feedback, serious distortion and loss of power.

Receiver Circuitry - Signals appearing at T504 are coupled to T505 via C520. This bandpass filter eliminates unwanted signals outside the 11-meter band.

The incoming r.f. is applied directly to a hot carrier diode mixer (D508-11) before any amplification takes place. The local oscillator energy (10.7 MHz below the incoming signal) is applied to the arm of potentiometer R511. This L.O. energy mixes with the incoming signal and creates a 10.7 MHz i.f. which appears across **transformer** T506.

SECTION SIX

THEORY OF OPERATION

When the PRO-40 is examined, you will note that the digital and r.f. circuitry have been separated by two distinct circuit boards. These are called the "exciter board" (40-305) and "synthesizer/frequency counter" (40-306). These two boards are separated by a complete chassis shield to prevent digital pulse interference with the r.f. circuitry and r.f. from the transmitter output from disturbing the digital circuitry. The boards are interconnected by two 10 pin connectors, P501 (near front) and P502 (slightly aft of center).

Ease of Service - Note that if major service is required on the exciter board, it is necessary to remove the counter board. However, because of the plated through hole construction in the STONER p.c. boards, virtually any repair can be made from the topside without removing either board. Note that the drive and final power transistors are butt soldered to the top of the board. The board need not be removed to replace either transistor, should a failure occur.

Five LED diode indicators are included so that the service technician can instantly determine if the 13.6V, 5.0V, 9.0V, 9R and 9T circuits are operative. Test points are liberally used and clearly indicated.

EXCITER BOARD (refer to schematic 40-305)

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The entire 11 meter spectrum appears across the primary of T506. If we were to amplify this energy, extremely strong signals could cause crossmodulation and channel bleedover. However, the signal is applied to a monolithic crystal filter before amplification. This filter (FL501) provides approximately 30 dB of attenuation 20 kHz off its center frequency of 10.7 MHz. Thus, adjacent channel signals are suppressed sufficiently to prevent overload by strong signals.

The filtered signal is amplified in a low noise field effect transistor cascade pair consisting of Q504 and Q505. This amplified energy is applied to the main crystal filter FL502 via transformer T507. This filter is 3 kHz wide at the -6 dB point and provides outstanding unwanted sideband rejection.

The crystal filter is followed by a two-stage i.f. amplifier consisting of transistors Q507 and Q508 which, in turn, feed a 1496 balanced modulator product detector (IC504). Audio output appears on pin 6 of this IC and is coupled to an audio preamplifier IC (IC505). The output of this stage is coupled out of the **board** via connector S0506 to the top end of the volume control. The arm of the volume control (pin 5 of the same connector) returns to audio integrated circuit (IC505), which provides approximately 3 watts of audio at the speaker terminals. Note that R505 (15 ohms) limited the current that IC508 can draw. Thus, an 8 Ω speaker must be used since a 3-4 Ω speaker causes excessive current flow in this resistor.

Note that an audio notch filter is incorporated in the receiver to eliminate heterodyne interference from AM carriers. When the NULL push button is depressed, the audio is routed through integrated circuits IC506 and IC507. This circuit puts a sharp notch (approximately 40 dB) in the audio passband to eliminate AM carrier interference. The frequency of the notch is tunable by means of the front panel control labeled "WHISTLESTOP". When the PEAK push button switch is depressed (along with the NULL button), the circuit is converted to a peak filter (rather than a notch filter). This sharpens the audio response and is extremely useful in the presence of heavy QRM interference.

AVC Circuit - R.f. is taken from the second i.f. amplifier (Q508) and applied to an integrated circuit (IC502). The amplified i.f. energy appears across transformer T510 and is rectified by diodes D517, D518 and D519. Transistor Q510 acts as a d.c. amplifier and Q512 as an emitter follower which feeds AVC voltage to the receiver. When a strong signal appears in the i.f. chain, a positive voltage is developed at Q510 which causes it to conduct. This, in turn, lowers the collector voltage of Q510 and the emitter voltage of Q512. When this occurs, diodes D504, D513, D514 and D516 conduct, which shunts a low impedance across the associated transformers these diodes are connected to. This, in turn, lowers the i.f. gain of the amplifier and results in an audio level at the speaker which is constant within a few db, once the AVC "knee" at 4 microvolts is reached. Transistor Q511 is included in the AVC circuit to prevent switching transients from paralyzing the AVC circuit between the receive and transmit mode. Transistor Q514 is included in the AVC circuit to disable the i.f. amplifier in the event the phase lock loop circuit fails.

R.f. voltage from transformer T510 is also rectified by diode D517 and applied to a field effect transistor Q509. The increasing source voltage (with increasing signal) makes the S-meter read up-scale and also actuates the squelch d.c. amplifier (IC503). A coarse squelch control is included as an internal adjustment to permit squelching action to occur when the front panel SQUELCH control is approximately centered. Transistor Q513 is included to prevent the radio from squelching on a strong signal (regardless of the setting of the front panel SQUELCH

control) to conform with EIA standards.

Noise Blanker - The input signal is also applied to a 25 MHz TRF re- via transformers T501, T502 and T503. The 25 MHz energy (which samples noise near the 11 meter band) is amplified by integrated circuit IC501 and detected by transistor Q501. The noise pulses are shaped by transistors Q502 and Q503. When a noise pulse occurs, transistor Q503 conducts and shunts capacitor C530 across the primary of T507. This effectively suppresses the noise pulse and prevents it from reaching the crystal filter, FL502.

Microphone Preamplifier - Audio from the microphone is applied between pins 3 and 4 (see diagram 40-304B) of S0305/P305. The energy is routed along the front panel "mother board" to pins 9 and 10 of S0506 on the exciter board. A gain control (R203 -see schematic 40-302C) is connected in series with this line for impedance matching of the high impedance D104 crystal microphone.

The audio energy from the microphone is applied to the non-inverting input of a type 741 operational amplifier (IC511). The amplified energy appears at pin 6 and is coupled to the transmitter balanced modulator via capacitor C5137.

To prevent overmodulation, an automatic level control (ALC) circuit is incorporated at the microphone input. The source of ALC is a peak detector, consisting of a voltage divider (R572 and R573) connected across the 50 ohm transmitter line and diodes D525 and D526. The rectified voltage appears across potentiometer R574. A portion of this voltage is applied to the anode of diode D534 which permits only the very peaks of rectified r.f. energy to be coupled to the base of Q527.

When a positive voltage peak appears at the base of Q527, it conducts and applies voltage to the base of Q528. Note that this transistor is shunting the audio line. Thus, as the modulation increases beyond a predetermined point (est- by the setting of the ALC potentiometer, R574), transistor Q528 conducts and shunts the audio path with a low impedance. This overall loop from antenna to microphone insures that the modulation level will not exceed 12 watts PEP and cause transmitter distortion.

Oscillators - Two oscillators, the local oscillator (which determines the channel) and the carrier oscillator (which determines the suppressed and reinserted carrier frequency) are applied to the "exciter board" (schematic 40-305). The local oscillator energy appears at pin 7 of P501. The carrier oscillator is applied to pin 7 of P502.

The oscillator circuitry is described in the section relative to the synthesizer/frequency counter" circuit board (schematic 40-306).

The local oscillator is permanently connected to the transmitter mixer, IC509, via a low pass filter consisting of L516, L517 and associated capacitors. The carrier oscillator is permanently applied to the receive mixer, IC504, (pin 7) via C558.

However, since the hot carrier diodes (D508-11) are used as a mixer on receiver and a balanced modulator on transmit, the input port (arm of R511) must be switched between the local (receive) and carrier (transmit) oscillators. This is the purpose of switching transistors Q515 and Q516. The carrier oscillator is applied to the base of Q517 which acts as a buffer to isolate the carrier oscillator. This carrier oscillator energy is then applied to the base of switching transistor

istor Q516 which is forward biased by the 9T line via resistor R566. The carrier oscillator energy then appears across the emitter resistor common to both transistors (R564) and drives the hot carrier diodes in series with C570.

On receive, Q516 is cut off and Q515 conducts since it is biased from the 9R line via resistor R562. Thus, local oscillator energy is applied to the hot carrier diodes when receiving.

Note that T511 may not be peaked, but is sometimes detuned to minimize signal leakage which can cause erroneous up-scale reading of the S-meter.

Transmit Mode - The receiver balanced mixer is also used as a balanced modulator on the transmit mode. By adjusting potentiometer R511 and trimmer capacitor C526, it is possible to completely balance out the local oscillator energy and leave the sidebands intact. The double sideband suppressed carrier energy is applied to the FET-IF amplifier (Q504, Q505). The gain of these transistors is appreciably reduced by transistor Q506 (which is energized upon the application of 9 volts transmit). When transistor Q506 conducts, it causes diode D513 and resistor R507 to be shunted across the primary of T507, thereby effectively reducing the gain of this stage. Double sideband suppressed carrier signals are applied to filter FL502, which removes the unwanted sideband. Single sideband suppressed carrier energy is taken from the collector of Q507 and applied to the input of the transmitter balanced mixer (IC509) via transformer T517. Local oscillator energy is also applied to pin 7 of this integrated circuit and the sum signal at 27 MHz appears across transformer T516. This transformer (in conjunction with T515, T518 and T519) forms a bandpass filter to suppress unwanted mixer products outside the 11 meter band. Energy is coupled to preamplifier transistor Q522 and the amplified output appears across L515. This energy is further amplified by transistor Q521, the transmitter driver. Note that coils L522, L519 and L518 are also tuned to 27 MHz to eliminate out of band products. The output of transistor Q520 (approximately 12 watts PEP) appears across capacitor C591 and is coupled to connector P504 (pins 1 and 2).

The purpose of routing the r.f. signals in and out of connector P504 is as follows; Note that the Model PRO-40 provides for an external AM capability. It is designed to be used in conjunction with a customer's existing AM radio or the STONER AM-40, a 40 channel AM adaptor. When the AM button on the front panel is depressed, it switches the antenna line to the external AM radio via the low pass TVI filter L510 (C582, C583 and C584). Thus, the user's AM radio performance is improved in the area of TVI rejection by utilizing the TVI filter in the PRO-40. When the button is released (single sideband mode), the transmitter output is coupled through pins 1 and 2 of P504 through the AM/SSB switch and back into the circuit board at pins 5 and 6. It then passes through the TVI filter. The energy also passes through the phase detector SWR (L509) and exits the board on pins 9 and 10 of connector P504. It is then routed to the rear apron connector by means of coaxial cable.

The purpose of transistor Q518 is to act as a receive/transmit antenna switch. In the receive mode, diode D529 conducts heavily and passes the r.f. signal to the receiver input. On transmit, transistor Q518 opens and prevents any current flow through diode D529, thereby preventing any self-rectification and the generation of spurious signals. Transistors Q524 and Q525 are fed by the 9 volt regulated line and act as a receive/transmit switch. The base of transistor Q524 is controlled by the push-to-talk line. Integrated circuit IN510 is the 9 volt regulator. Note that five LED diodes (LED501 through LED505) are connected to various voltage points in the transmitter for trouble shooting information. Four LED diodes should be lit at any particular time and when switching from receive to

transmit, LED503 should extinguish and LED502 should illuminate.

SYNTHESIZER/FREQUENCY COUNTER (Assembly and circuit 40-206)

Synthesizer - Refer to schematic 40-306 labeled SYNTHESIZER AND FREQUENCY COUNTER BOARD SCHEMATIC. The synthesizer section is shown in the upper half of the schematic. Transistors Q601 and Q602 provide a source of carrier energy on 10.700 MHz or 10.697 MHz, depending on whether bias is applied to pin 9 and pin 10 of connector S0602. This bias voltage is derived from the upper USB/LSB switch. The output of the 10.700 MHz oscillator drives transistor Q603, a frequency mixer. The master oscillator, Q605, operates at 13.027 MHz and the second harmonic energy (26.054 MHz) is extracted by means of a tuned circuit (T603). The second harmonic energy is further amplified by buffer transistor Q606, which employs a tuned circuit in the collector (T604) to extract the wanted second harmonic energy and reject the fundamental and harmonics of the 13 MHz signal. Thus, the second harmonic energy at 26.054 MHz is also applied to transistor Q603 along with the 10.700 MHz energy. The beat difference at 15.350 MHz is extracted by means of T601 and is further amplified by buffer transistor Q604. The 15.35 MHz energy is applied to mixer transistor Q607, a dual gate MOSFET (type 3N203).

Energy from the VCO (Q610) drives a low pass filter consisting of L604, C643 and C642 and is applied to buffer Q611. The output of Q611 is applied to the other gate of MOSFET Q607. The beat difference between the two signals between 910-1650 KHz is amplified by buffer Q608 and squared by transistor Q609. The square wave energy between these two frequency extremes is applied to the synthesizer microprocessor, IC601. At the same time, energy at 2650 KHz, supplied by transistor Q619, is applied to pin 22 of the synthesizer microprocessor and is divided down to provide a 10 KHz reference for the phase lock loop circuit.

The VCO output is amplified to Q612 and Q613 and appears across tuned circuit T605, tuned to the local oscillator injection frequency. The local oscillator output is applied to pin 7 of S0601 and is used for heterodyning signals on receive and transmit.

Counter - The frequency counter works in the following manner; 10.7 MHz energy is applied to transformer T606. The VCO output is applied to transformer **T608 and both** of these signals are applied to an integrated circuit, balanced mixer IC604, a 1496. The sum frequency at 27 MHz appears across transformer T607. This energy is applied to a squaring amplifier consisting of section A of IC605 (a 74S00). The carrier frequency from an external AM radio is also applied to the squaring amplifier after buffering by section C of IC605. The squared energy at 27 MHz is then applied to the second section of IC605 (b) which acts as a gate. A unijunction transistor is incorporated to provide a time base for the counting and display period. The 2560 oscillator is also divided down to provide a one millisecond counting period for the dividers. Integrated circuits IC612 and IC616 divide the input signal down so that it can be decoded by IC617 and IC621 and displayed on the 7-segment LED indicators. IC602 and IC603 are decoders for the channel indicator which is also connected to 7-segment LED's.

Lock-Out - A protection circuit is provided so that if the VCO does not provide locking information, transistors Q614 and Q615 conduct and cause the decimal point near the hyphen to light up. At the same time, the voltage on pin 8 (lock-out) drops to a low value which disables the i.f. circuitry in the r.f. portion of the transmitter and receiver. Thus, should the VCO fall out of lock, both the transmitter and receiver are disabled which prevents transmission of spurious signals.

Power Supply Board - Input voltage is supplied from the AC power line through P314 (the AC plug) via a three conductor power cord with a safety ground line. Note that the power line is filtered by means of chokes L307 and L308. The power supply section of the radio is protected by a fuse, F301 (1 ampere).

When SW202 is energized, voltage is applied to the primary of T301 and bridge rectifier CR201. Rectified d.c. voltage is filtered by capacitor C312 and applied to a voltage regulator consisting of Q203 and IC204. The output of Q203 (approximately 13.6 volts d.c.) goes to the arm of switch SW201A. The 13.6 volt d.c. circuit is routed to the PRO-40 in the SSB position of the switch. The same voltage is used to power an external AM radio in the AM position. A second section of this switch serves to transfer the antenna between the PRO-40 and the external AM radio.

There is a second voltage point at the centertap of T301 which feeds a 5 volt regulator consisting of Q202 and IC203. The output of this circuit provides a positive regulated 5 volt signal which is used to power the frequency counter and TTL circuitry in the PRO-40.

Interconnections - Note that all lines entering and exiting the PRO-40 are bypassed and/or contain ferrite bead r.f. chokes to minimize radiation of unwanted signals external to the radio.

Interconnections between the power supply board and the various circuits on the r.f. board are accomplished by means of circuit board 40-104. This board simply replaces a wiring harness and is used to mount several of the adjustment potentiometers (both internal and external). Note that all connections of the microphone plug are bypassed and filtered by means of capacitors and chokes.

The display board (40-101) is used to mount the LED indicators and provide the interconnect between these indicators and the digital circuit board. The wiring of this is shown in schematic diagram 40-301.

SECTION SEVEN

TEST PROCEDURES

Since there is no way of knowing what service information the technician may require, this Section provides the entire test procedure for the PRO-40.

The material which follows is a duplicate of the document used by STONER checkout technicians when the PRO-40 arrives at their stations once the assembly of the radio is completed.

CHECKOUT PROCEDURE FOR COMPLETED PRO-40

Visual Inspection

1. Dress all wiring to isolate from circuitry and to provide neat professional appearance.
2. Verify that all connectors and fuse holders are securely tightened and will not rotate.
3. Verify that all mica insulated transistors have thermal compound and mounting screws are tight.
4. Install 1 ampere 3 AG (fast blow) fuse in holder.
5. Install knobs. Pointer should be on a 7 o'clock - 1 o'clock axis with set screw toward top when potentiometer shaft is positioned full CCW.

Power Supply Test

1. Check resistance from collector to ground of 5V (Q202) and 14V (Q203) reg- The collector is the heavy center pin. The meter should read in excess of 10 ohms. If zero ohms is measured, check for shorts at mica washer.
2. Depress AC switch and measure resistance across line cord pins. The meter should read approximately 5 ohms. Measure resistance from one side of the line to ground. The meter should read infinity ohms. Switch AC off. Remove connectors (2) from r.f. board.
3. Apply primary power. Depress AC line switch. The pilot lamps should immediately illuminate. Check the voltage at the collector of Q202. It should measure approximately 11.5 volts. Check the voltage at the collector of Q203. It should measure approximately 20 volts.
4. Check the voltage at pin 3 of connector S0504 (third from rear). It should measure approximately 13.6 VDC. Check the voltage at pin 4 of the same connector. It should measure 4.8 to 5.2 volts.
5. Check the voltage at pin 3 of connector S0311. It should measure approximately 20 volts.

6. Check continuity to ground at +12 and +5 volts circuit of pins 3 and 4 respectively of connector P504. Check continuity at driver (Q521) and final (Q520) to ground. If a short is noted, check mica insulator. Insure that screws are tight.
7. Check continuity to ground of +9 volt circuit (test point 1).
8. Energize AC power. Four of the LED lamps on the main circuit board should light immediately. The 9T lamp should not be lit. The counter should display channel number, hyphen, frequency and sideband. Verify that all segments are evenly illuminated. Adjust potentiometer R536 to zero the meter.

This completes the testing of the power supply section. Switch off AC and insert connectors on r.f. board.

PLL and Counter Board Test

Net all oscillators on PLL/counter board as follows:

1. Connect frequency counter to carrier oscillator test point (COTP) in series with 10 pF isolation capacitor. Note that it may be necessary to trim resistors R601 and R602 (LSB) or resistors R605 and R606 (USB) so that both oscillators produce approximately 0.2 V.R.M.S. at the COTP.
2. Switch to LSB and set LSB oscillator to exactly 10700.200 KHz.
3. Switch to USB and set USB oscillator to exactly 10697.200 KHz.
4. Connect frequency counter to frequency standard test point (FSTP).
5. Connect frequency counter to time base test point (TBTP) and set frequency to exactly 2560.0 KHz.
6. Disconnect frequency counter.

Peak to r.f. circuits on the PLL/counter board as follows:

1. Connect HP410B r.f. probe to 26 MHz test point (26TP).
2. Peak T603 and T604 for a maximum reading. The meter should indicate approximately 1 V.R.M.S.
3. Connect HP410B probe to 15 MHz test point (15TP).
4. Peak T601 and T602 for a maximum reading. The meter should indicate approximately 1.2 V.R.M.S.
5. Connect HP410B r.f. probe to local oscillator test point (LOTP).
6. Peak transformer T605 for a maximum reading. The meter should indicate approximately 0.6 V.R.M.S.

7. Set L603 so that PLL locks reliably.
8. Temporarily short VCTOP to ground. Note that the "out of lock" indicator lamp comes on and the receiver goes silent. The transmitter will also be shut down in this condition.
9. Connect HP410B r.f. probe to frequency display test point (FDTP). Switch to channel 40 and peak T606, T607 and T608 for a maximum reading. The meter should indicate approximately 0.6 V.R.M.S.

This completes the alignment of the PLL/counter board.

R.F. BOARD TEST (40-305)

Receiver

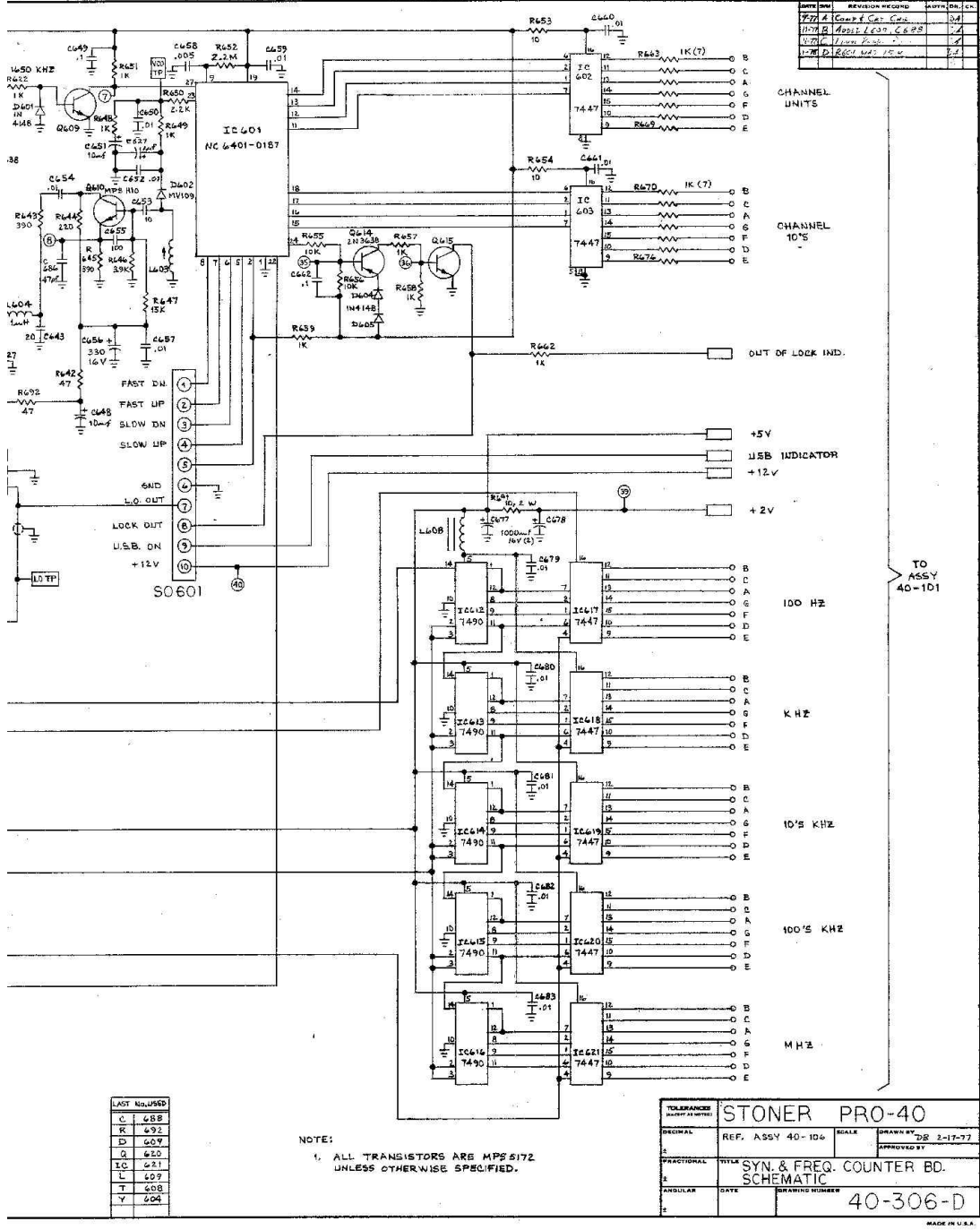
1. With volume and r.f. gain full clockwise, a hiss noise should be heard in the speaker. If not, set front panel squelch control at center of its range and rotate course squelch pot (R525) until sound is heard.
2. Adjust T600 so that the clarifier control has a minimum range of ± 5 KHz, as indicated by the frequency counter.
3. Clip r.f. signal generator to the plastic case of Q507. Tune generator to approximately 10.7 MHz for a 1000 Hz beat note and advance attenuator until a whistle is heard.
4. Connect an audio voltmeter to the speaker. Adjust signal and/or volume control for a reading of zero db.
5. Peak transformers T508 and T509 for a maximum reading. Keep reducing generator attenuator and/or volume control to maintain a reading of approximately zero db.
6. Set potentiometer R511 in the center of its range. Clip generator on to potentiometer R511 and readjust generator frequency slightly for a 1000 Hz beat note and generator attenuator for approximately zero db. Peak transformers T506 and T507 for a maximum reading. Reduce generator output as required to maintain a zero db reading.
7. Reconnect generator to antenna terminal and preset capacitors C519 and C521 to slightly less than half capacity.
8. Tune generator to 27405 MHz (channel 40) and advance attenuator until a 1 KHz beat note is heard. Peak C519 and C521, alternately, for maximum gain. Reduce attenuator, as necessary, to maintain zero db.
9. Tune the clarifier to sweep the beat note through the audio bandpass. Adjust T506 and T507 slightly, as required, for the flattest possible audio response.

10. Set generator for a 4 microvolt signal. Adjust transformer T510 so that the AVC just starts to reduce the gain of the receiver.
 11. Increase the signal injection. Between 4 microvolts and full output (0.1 volts) the audio should not increase more than 6 db.
 12. Return to the 1 microvolt/1 KHz setting. Adjust audio gain for +10 db on the audio voltmeter. Remove the r.f. signal. The meter must drop to -5 db or better (15 db change).
 13. Depress the "NULL" switch. Set generator to 1 KHz note with +10 db output. Alternately, adjust the "Whistlestop" control and R556 for the deepest possible null of audio tone.
 14. Switch to channel 10 and increase generator (correctly tuned for channel 9) for maximum output. Adjust coil L603 until beat note is no longer audible. Switch unit off and on several times to insure synthesizer locks promptly. Return generator to 1 microvolt output.
 15. Spot check 40 channels to look for excessively loud "birdies".
 16. Note that 10.7 MHz leakage can cause the S-meter to read upscale. If necessary, add a 10 to 22K resistor between arm of R536 and +9R line to bring meter to zero.
 17. Tune generator to 26.0 MHz with internal modulation. Connect scope to collector of Q502. Depress NB2 switch and adjust generator output until "spike" pattern is noted on scope. Peak transformers T501, T502 and T503 for maximum amplitude spike while reducing generator output. Pronounced spikes should be visible with +50 db generator output.
- This completes the testing of the receiver section of the exciter board. Disconnect signal generator and audio voltmeter.

Transmitter

1. Connect dummy load to antenna terminal and two-tone generator to microphone input of radio under test. Turn R203 (MIC GAIN) to center of rotation. Set channel selection to channel 40.
2. Disconnect transmitter signal plug (J501) and connect oscilloscope to drain of Q526 (test point 25).
3. Energize transmitter. Before inserting two-tone, verify that test point 29 goes to zero and, in fact, "flicks" slightly negative during the period of the switching transient. Peak T511 and T517 for maximum. Peak transformers T515, T516 and T518 for maximum. Use caution not to "bottom out" coil slugs or they may freeze in this position.
4. Peak T519, then turn slug CCW slightly for an equal amplitude between channel 1 and channel 40. Scan through all channels to verify gain does not vary by more than 3 db.

5. Insert plug P501 in J501. Move oscilloscope to antenna connector and connect radio to dummy load. Turn off ALC potentiometer. Set bias potentiometer at the center of its range.
6. Adjust two-tone output for high output which causes the transmitter to flattop. Alternately peak coils L510, L515, L518 and L522 for a maximum reading on the wattmeter. Keep increasing the two-tone generator output to maintain the flattopping appearance on the scope. Spread or compress the turns of L519 for maximum power output.
7. The output power should measure 1-6-18 watts minimum. Increase setting of ALC potentiometer so the power is reduced to 12 watts PEP.
8. Switch a monitor receiver to the next adjacent channel (39) and adjust bias potentiometer for minimum interference from the two-tone signal.
9. Turn off the two-tone drive and note residual signal (carrier) on oscilloscope with the gain near maximum. Adjust R511 and R526 for minimum amplitude. It may be necessary to add a 5-15 pF capacitor to either side of the diode bridge to achieve total carrier balance. When balance is complete, there should be less than 0.1 volts across the antenna terminal, indicating a carrier suppression in excess of 50 db.
10. Reinsert two-tone. Check the appearance of the two-tone signal. It should be ideal, without flattopping and sharp crossovers.
11. Increase two-tone level by 30 db. The output power should not increase by more than 1 watt.
12. Set transmitter frequency on channel 40 for 27405.0 with minimum flicker of the "0" digit.
13. Make a short "air check" to verify transmitter is stable on antenna.
14. Connect external AM radio, depress "AM" switch button. Depress push-to-talk microphone switch on external AM radio and note that counter accurately reads carrier frequency.
15. This completes testing of the PRO-40. Epoxy all toroids. Give radio complete visual inspection. Install covers and forward to shipping.



REV	REVISION RECORD	DATE	BY
1	Comp. Cont. Cont.	10/17/77	DB
2	Assy. Cont. Cont.	10/17/77	DB
3	Assy. Cont. Cont.	10/17/77	DB
4	Assy. Cont. Cont.	10/17/77	DB

LAST	NO.	ISSUE
C	688	
K	692	
D	699	
Q	620	
J	621	
L	607	
T	610	
V	604	

NOTE:
1. ALL TRANSISTORS ARE MPS 6172
UNLESS OTHERWISE SPECIFIED.

TOLERANCES UNLESS OTHERWISE SPECIFIED			
DECIMAL	REF. ASSY 40-104	SCALE	DRAWN BY DB 2-17-77
FRACTIONAL	SYN. & FREQ. COUNTER BD. SCHEMATIC		APPROVED BY
ANGULAR	DATE	DRAWING NUMBER	40-306-D

MADE IN U.S.A.

