SP400SX
I.F. - AVC AND BFO ALIGNMENT

1. Connect the high side of the output cable of a Hammarlund Model E F.M. Signal Generator (465 K.C.) or equivalent to grid cap of V3 (6L7 1st detector). Ground output cable shield to chassis.

2. Connect sync. output of signal generator to external sync. terminals of oscilloscope.

3. Connect high side of scope lead (vertical input) to **left** terminal (front view) of phone input strip located at rear of chassis. Connect ground side of scope to chassis.

4. Set receiver controls as follows:

Limiter - off	AVC - manual
Phasing - arrow	Signal - mod.
Band Width -3	Main Dial - 1250 KC
Band Switch - 1250-2500 KC	Band Spread - 100

5. With crystal in OFF position adjust lower inductor (L26) in crystal assembly until traces appear on scope. Next adjust I.F. capacitors for maximum amplitude as follows. First I.F. lower plate capacitor (C36) then upper grid capacitor (C37). Second I.F. lower plate capacitor (C38) then upper grid capacitor (C39). Third I.F. adjust plate capacitor C40. (Caution must be exercised in adjusting plate capacitors of all I.F. stages due to B+ voltage and if contact is made between adjusting screw and case assembly a short circuit will occur which may destroy the dropping resistors.)

6. Turn crystal selectivity switch to position #1 and adjust the upper (grid) inductor (L27) of the crystal filter Y1 for maximum amplitude.

7. Set crystal selectivity switch to position #2 and adjust phasing control to obtain identical images. When this is obtained the phasing control setting should be at the arrow. If such is not the case adjust trimmer capacitor (C35) in crystal filter so that identical images are obtained with the phasing control at the arrow.

8. Set frequency control of signal generator to exact frequency of the crystal as indicated by coincidence of the traces on the oscilloscope. Recheck adjustment of L27. Do not change setting of signal generator frequency control for remainder of procedure.

9. Turn crystal to off position and readjust capacitors of I.F. stages for maximum amplitude as outlined in #5 procedure, reducing sensitivity control where amplitude becomes too great to be seen on scope.

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SP400SX
I.F. - AVC AND BFO ALIGNMENT

10. The crystal should now be turned to #1 position and upper inductor (L27) in crystal assembly should be rechecked for max. amplitude. Turn crystal to #2 position and recheck trimmer capacitor (C35) for symmetry.

AVC

Change AVC - MAN Sw. to AVC and turn sensitivity control to max. sensitivity. Adjust capacitor (C51) in A.V.C. amplifier assembly can for minimum width of trace.

BFO

Change A.V.C. - MAN. Sw. to MAN. Turn crystal selectivity #5 position and Signal Sw. to C.W. position. Either visual or audible method may be used.

VISUAL METHOD

Adjust trace to suitable size by adjusting Sens. control. Turn Beat Osc. control on front panel to zero and with audio gain at suitable level adjust capacitor C47 on B.F.O. can assembly for zero beat which will appear as horizontal lines on scope. A further check for zero beat is made by observing trace on scope when front panel B.F.O. control is turned an equal distance on each side of zero. The amplitude of the trace on both sides should be equal.

AUDIBLE METHOD

Using headphones or speaker turn Beat Osc. control on front panel to zero. Adjust C47 on B.F.O. can assembly for zero beat. A further check for zero beat is made by observing whether tone pitch is the same when Beat Osc. control on front panel is turned an equal distance each side of zero.

If either of the above adjustments are made and zero beat does not occur at zero on scale a check should be made to see that flat on shaft and pointer are correctly aligned and that rotor plates are half meshed between upper and lower stator plates.

ALL DIMENSIONS IN INCHES

DO NOT SCALE THIS DRAWING

TOLERANCES
FRACTIONS:
DECIMALS:
UNLESS OTHERWISE SPECIFIED

TITLE SP400SX
I.F. - AVC AND BFO ALIGNMENT
MATERIAL
FINISH

HAMMARLUND
NEW YORK

DESCRIPTION

No. 6/90/9

SHEET 2 - FINAL

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REVISIONS

APPROVED 6-7-46

CRYSTAL CALIBRATION FOR SP400SX

Connect output of crystal controlled calibrator consisting of a 100 KC and 1000 KC source to antenna terminals of receiver.

Connect speaker terminals at rear of set and set receiver controls as follows:

Limiter - off	Crystal - off	AVC Sw. - MANUAL
Send Receive Sw. - approx. 8		Beat Oscillator - 0
Band Spread Dial - 100		Audio - approx. 7
		Bandwidth - 3
		Signal - CW

Calibration of Main Dial

After the receiver has been properly aligned by RF Alignment Procedure, the calibration points at the high end and low end of all bands should be "on the nose". Before entering data on data sheets, the above should be ascertained and if a very slight adjustment of the inductor slug on low end, or trimmer on high end will not bring it "on the nose" the receiver should be realigned. If slight adjustments are made, both ends should be rechecked with final check at high end. When ends of band are "on the nose" the inductor slug and trimmer should not be touched while taking intermediate check points. If zero beat is not obtained at intermediate check points on dial, enter difference readings to 1/4 division on data sheet.

On band #1 use 100 Kc crystal. End calibration points are 1.30 Mc for low end and 2.5 Mc. for high end. Intermediate check points are 1.60-1.80-2.00 and 2.20 Mc.

Band #2 use 100 Kc crystal for low end of calibration point of 2.5 Mc and 1000 Kc crystal for high end of calibration point of 5.0 Mc. Intermediate points are 3.0- 3.5- 4.0 and 4.5 Mc, Use 100 Kc crystal on 3.5 and 4.5 and 1000Kc crystal on 3.0 and 4.0 Mc.

Band #3 use 1000 Kc crystal. End calibration points are 5 Mc for low end and 10 Mc. for high end. Intermediate check points are 6-7-8 and 9 Mc.

Band #4 use 1000 Kc crystal. End calibration points are 10 Mc. for low end and 20 Mc. for high end. Intermediate check points are 12-14-16 and 18 Mc.

Band #5 use 1000 Kc crystal. End calibration points are 20 Mc for low end and 40 Mc for high end. Intermediate check points are 24-28-32 and 36 Mc.

TOLERANCES
FRACTIONS
DECIMALS
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TITLE Crystal Calibration for SP400SX
MATERIAL
FINISH:

HAMMARLUND
NEW YORK

FIRST MADE FOR
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PT. No. | CHG | DESCRIPTION | QUANT | FIN.

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No. 19116

R.F. ALIGNMENT FOR SP400SX

1. Connect output of Hammarlund frequency modulated signal generator, model E or equivalent, to antenna terminals.

2. Connect speaker leads to terminals marked speaker on rear of set.

3. Connect high side of scope lead (vertical input) to left terminal (front view) of phono input strip located at rear of chassis. Connect ground side of scope to chassis.

4. Check dressing of wiring.

5. Preset trimmer condensers on 1st and 2nd R.F. and 1st Det. on all bands excepting 20 to 40 Mc by unscrewing trimmer screws approximately 2 turns. On 20-40 Mc band adjust trimmer approx. 1/2 turn.

6. Set receiver controls as follows:

Audio - any setting	A.V.C. - man.
Sens. - approx. 7	Limiter off
Phasing - arrow	Crystal #1
Send Receive Sw. - receive	Signal - mod.
Band Spread Dial - 100	Band Width - 3

7. Turn receiver on.

8. Set band switch at 1250-2500 Kc Generator at 2.5 Mc. Main tuning dial at 2500 Kc.
The signal generator gain control should be kept as low as good operating conditions will permit. This is to keep the receiver from overloading. The sensitivity control on the receiver can be varied but should be kept fairly high. The order of tuning should be as follows; Oscillator, first detector, second R.F., and then first R.F.

9. Turn osc. band #1 trimmer until two traces appear on scope, then bring them together until they coincide.

10. Adjust 1st det., 2nd R.F. and 1st R.F. trimmers for maximum amplitude of trace.

11. Set signal generator at .126 Mc and main dial at 1260 Kc. Adjust inductor slug until the two traces coincide. Adjust inductor slugs of 1st det., 2nd R.F. and 1st R.F. for maximum amplitude. Next reset signal generator at 2.5 Mc and main dial at 2500 Kc. If the two traces do not now coincide adjust oscillator trimmer until they do. The 1st det., 2nd R.F. and 1st R.F. trimmers should now be rechecked for maximum amplitude. This operation may have to be repeated at the high and low ends until trace coincides and maximum amplitude is obtained.

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HAMMARLUND MFG. CO. INC. NEW YORK

TITLE R.F. ALIGNMENT FOR SP400SX

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No. 1

R.F. ALIGNMENT FOR SP400SX - cont'd.

12. Repeat procedures 9-10-11 for band #2 setting signal generator and main dial at 5.0 Mc for trimmer tuning and 2.5 Mc for inductor slug tuning.

13. Repeat procedures 9-10-11 for band #3 setting generator and main dial at 10 Mc for trimmer tuning and 5 Mc for inductor tuning.

14. Repeat procedures 9-10-11 for band #4 setting generator and main dial at 20 Mc for trimmer tuning and 10 Mc for inductor slug tuning.

15. Repeat procedures 9-10-11 for band #5 setting generator and main dial at 40 Mc for trimmer tuning and 20 Mc for inductor slug tuning.

The image frequency on the first four bands namely #1, #2, #3, #4 will be found lower in frequency than the signal generator. On the last band, #5, the image frequency will be found higher on the receiver than the generator frequency.

Fundamental frequencies will show the highest amplitude of trace on scope.

When adjusting inductor slugs and trimmers in the different stages, the final adjustment should always be made on the trimmer condenser at the high end.

On band #5 and to a lesser degree on band #4 the oscillator pull in action will occur when tuning the 1st detector stage. This can be recognized by the wave forms moving apart when the 1st detector stage is peaked up. To compensate for this the trimmer on the oscillator should be readjusted to make the traces coincide.

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TITLE: R.F. ALIGNMENT FOR SP400SX
MATERIAL
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HAMMARLUND NEW YORK

DESCRIPTION

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No. 18654

SP400SX FINAL TEST PROCEDURE

R.F. Sensitivity and Image Response

a. R.F. Sensitivity

Connect a 100 ohm carbon resistor in series with the signal generator to the antenna terminals of the receiver.

Set receiver controls as follows:

Audio - max.	A.V.C. - man.	Sens. approx. 9
Limiter - off	Crystal - off	Band Spread - 100
Bandwidth - 3	Signal - Mod.	

Adjust receiver main dial to first frequency indicated on data sheet, and adjust signal generator to the same frequency, setting its dial for maximum output from the receiver.

Adjust attenuator for a reading of 500 mw on the output meter. Turn generator modulation switch to "off" and adjust sensitivity control for a reading of 50 mw on the meter. Turn modulation switch back to 400 cycles and re-adjust attenuator to produce 500 mw. It may be necessary to repeat this last step two or three times to obtain the desired 10:1 signal plus noise to noise ratio.

When the correct condition is obtained record the generator output voltage under "Sens. uv." next to the first frequency on the data sheet.

The above procedure is repeated for all frequencies.

b. Image Response

The procedure for image testing is similar to the procedure covering r.f. sensitivity, but the signal generator is tuned to the image frequency. The control settings are the same as above.

The image test should be made immediately after the sensitivity is measured on each frequency. When checking image response, do not alter the setting of receiver controls from that made during the sensitivity test.

To obtain output from the receiver on the image frequency considerable signal generator output will be required, and the generator is tuned approximately 930 Kc from the receiver dial setting. The signal generator is set either higher or lower in frequency by the above amount depending upon the frequency band as follows:

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TOLERANCES
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TITLE- SP400SX Final Test Procedure
MATERIAL-
FINISH-
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DESCRIPTION
K

No. 19020

SHEET 1 - CONT'D ON SH. 2

SP600SX FINAL TEST PROCEDURE - cont'd.

Band	Signal Generator Frequency
1	930 KC higher
2	930 KC higher
3	930 KC higher
4	930 KC higher
5	930 KC lower

Tune signal generator dial for maximum receiver output, and adjust attenuator for 500 mw output reading.

Record generator output voltage under "Image uV" for the particular frequency on the data sheet.

C.W. Operation

Set receiver controls as follows:

Limiter - off	Crystal - off	Main Dial - 4.0 mc.
A.V.C. - man.	Band Spread - 100	Audio - max.
Sens. - 0	Bandwidth - 3	Signal - Mod.

With the signal generator set to 4.0 mc, feed a 400 cycle 30% modulated signal into the receiver. Adjust signal generator output to 50 uV.

Adjust generator dial for maximum receiver output. Set sensitivity control for 50 mw reading on the output meter.

Turn generator modulation switch to "off" and set receiver on "CW". Adjust main dial for maximum output. The output meter should indicate approximately 500 mw.

If satisfactory check data sheet under "C.W. Operation."

A.V.C. Operation

Set receiver controls as follows:

A.V.C. - on	Main Dial - 4.0 mc.	Sens. - max.
Limiter - off	Band Spread - 100	Crystal - off
Bandwidth - 3	Signal - Mod.	

Set signal generator to 4.0 mc and adjust attenuator for output of 10 uV. Tune generator for maximum receiver output.

Adjust audio control for 0 DB output. Increase signal input to 100,000 uV. Record reading of output meter in DB on test data sheet.

The maximum increase in output should be approximately 12 DB.

No. 10030

SP400SX FINAL TEST PROCEDURE - cont'd.

Max. Undistorted Output

Set receiver controls as follows:

Limiter - off	Crystal - off	Main Dial - 4.0 mc.
A.V.C. - on	Band Spread - 100	Sens.-max.
Bandwidth - 3	Signal - Mod.	

Set output meter multiplier to +30 DB the meter is now calibrated for 50 watts full scale reading.

Feed a 5000 uV 30% modulated signal into the receiver. Tune signal generator to 4.0 mc and adjust its dial for maximum output from the receiver.

Connect vertical input of oscilloscope across output meter terminals.

Increase audio volume control until the waveform just begins to distort.

Read output meter and record power output on data sheet.

The output must be a minimum of 5 watts.

Phone Jack

Plug a pair of head phones into phone jack while testing for max. undistorted output.

Push phone plug into jack a few times to assure that jack makes good contact and does not short circuit.

Check data sheet.

S- Meter

Set receiver controls as follows:

Limiter - off	Sens. - max.	Main Dial - 4.0 MC
A.V.C. - on	Crystal - off	Band Spread - 100
Bandwidth - 3	Signal - Mod.	

Feed a 50 uV signal into the receiver and tune generator dial for maximum indication on the S- Meter.

Adjust meter control potentiometer for a reading of S-9.

Check data sheet.

Limiter Operation

Set receiver controls as follows:

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TOLERANCES
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SP400SX FINAL TEST PROCEDURE - cont'd.

A.V.C. - on	Main Dial - 4.0 mc	Crystal - off
Limiter - off	Band Spread - 100	Audio - max.
Bandwidth - 5	Signal - Mod.	

Feed a 100 uv modulated signal into the receiver at 4.0 mc. Tune signal generator for maximum receiver output.

Observe oscilloscope pattern. Adjust sensitivity control for 1/2 inch deflection on oscilloscope.

Clip noise generator output to high antenna terminal. Turn noise generator switch on.

Observe noise output on oscilloscope.

Turn limiter switch on.

The noise peaks should drop down to approximately the height of the sine wave.

Check test data sheet.

Operation of controls etc.

1. Check for correct setting of control knobs.
2. Check volume and sensitivity controls for smoothness of operation.
3. Check operation of CW adjustment with c.w. signal input.
4. Check dial lights.
5. Check operation of both tuning mechanisms.
6. Check smoothness and ease of operation of bandswitch.
7. Check hairline of dial indicator to see that it is held firmly in place.

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TOLERANCES UNLESS OTHERWISE SPECIFIED — FRACTIONAL: DECIMALS:

TITLE SP400SX Final Test Procedure

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