NAV-750/A/B

VOR/LOC/COMM AND G/S BENCH TEST SET

ifr INC

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LIMITED WARRANTY AND SERVICE INSTRUCTIONS

A. Warranty.

B. IFR, Inc., warrants that each new instrument manufactured by it is free from defects in material or workmanship under normal use and service for a period of two years from the shipping date. Each instrument is functionally tested immediately prior to shipment. If, upon examination by IFR, the instrument is determined to be defective in workmanship or material , IFR will, subject to the conditions set forth below, either repair the defective part or replace it with a new part on a pro rata basis. IFR shall not be liable for any delay or failure to furnish a replacement part resulting directly or indirectly from any governmental restriction, priority or allocation or any other governmental regulatory order or action, nor shall IFR be liable for damages by reason of the failure of the instrument to perform properly or for any consequential damages. The warranty does not apply to any instrument that has been subject to negligence, accident, shipping damage, misuse or improper installation or operation, or that in any way has been tampered with, altered or repaired by any person other than any authorized IFR service organization or any employee thereof, or to any instrument whose serial number has been altered, defaced or removed, or to any instrument purchased within, and thereafter removed beyond, the continental limits of the United States. Annual recalibration is not included in warranty.

C. All sales are FOB IFR Factory, Wichita. IFR will assume responsibility for freight charges on all legitimate warranty claims within thirty(30) days from the original shipping date. All legitimate warranty claims within thirty (30) to ninety (90) days should be shipped to IFR freight collect and will be returned freight collect. All freight on warranty claims after ninety (90) days will be paid by the customer.

D. This warranty shall, at IFR's option, become void if the equipment ownership is changed, unless the prior owner or the proposed owner obtains approval of continuation of the warranty prior to the change of ownership.

E. This warranty is in lieu of all other warranties, expressed or implied, and no one is authorized to assume any liability on behalf of IFR or impose any obligation upon it in connection with the sale of any instrument, other than as stated above.

F. Changes in Specifications.

G. The right is reserved to change the published specifications of the equipment at any time and to furnish merchandise in accordance with current specifications without incurring any liability to modify equipment previously sold, or to supply new equipment in accordance with earlier specifications except the classification of special apparatus.

H. Service.

I. When requesting service, the originator shall give IFR information concerning the nature of the failure and the manner in which the equipment was used when the failure occurred. Type, model, and serial number should also be provided.

J. Do not return any products to the factory without first receiving authorization from the factory Customer Service Department.

CONTACT:

IFR, Inc.
4053 Navajo Lane
Wichita, Kansas 67210 USA

ATTN: Customer Service Department

PHONE: (800) 835-2350 (Customer Service Only)

TWX: 910-741-6952

K. Unless otherwise specifically requested, packaging for a return shipment shall be in the original container and packaging material. If the original container and material are not available, information as to suitable packaging techniques will be provided by the IFR Shipping Department.

L. Returned material claimed defective, but found to meet all previously applicable specifications, will be subject to a minimum evaluation charge consisting of the labor charges involved in the status determination of the material.

M. Returned material not accompanied by statement of claimed defects may be returned at the originator's expense.

N. Any departure from the above instructions without specific factory authorization can be considered a breach of warranty, and all expenses incurred as a result will be billed to the originator.

SECTION I

1.1 GENERAL DESCRIPTION. The NAV-750 series bench tests sets are precision simulators of VOR, ILS, (LOC and G/S), and COMM ground stations. In the NAV-750B model, simulation of the Marker Beacon ground station with selectable tones for Outer, Middle and Inner Marker Beacons is included. All model NAV-750 bench test sets are completely self-contained and require no additional equipment for NAV-COMM, ILS and Marker Beacons testing.

1.2 MODEL NAV-750. The model NAV-750 is considered the standard model and is a completely self-contained unit. The unit can remotely channel a receiver using ARINC two out of five select system or parallel BCD code.

1.2.1 The VOR section of the NAV-750 provides pushbutton bearing selection for each 30° of azimuth as well as two pushbuttons which increase or decrease the generated bearing in 10° increments. In addition, the bearing may be varied in .01° or .05° increments with the bearing control. All VOR RF output levels may be varied with a calibrated output attenuator.

1.2.2 The LOC and G/S sections for the NAV-750 use precision 90 and 150 Hz tone generators to provide accurately mixed tones for "on-course" and specific "off-course" signals. All LOC and G/S RF output levels may be varied with a calibrated output attenuator.

1.2.3 COMM receiver frequencies from 118.000 to 156.000 MHz are generated by an RF generator in 25 kHz steps. A 1020 Hz tone may be added. Again, the RF output level of the test set may be varied with a calibrated output attenuator.

1.2.4 In all modes of operation, the RF generator is crystal controlled and phase-locked in 25 kHz steps. Automatic frequency stepping at a variable rate is provided, selectable in 25, 50, 100, or 200 kHz increments. In addition, a Variable Frequency control provides ±30 kHz on Mkr Bcn, ±50 kHz on VOR, LOC and Comm, and ±150 kHz on G/S frequencies.

1.3 MODEL NAV-750A. All features of the NAV-750 are all included in the NAV-750A. In addition, the ILS DDM value accuracies have been improved as well as the spectral purity of the output signal.

1.4 MODEL NAV-750B. Included with all the features of the NAV-750A, is the capability of the NAV-750B to test Marker Beacon receivers. Inner, Middle and Outer Marker Beacon audio tones are selectable. Marker Beacon RF output ranges from 70 to 79.9 MHz and the RF output level is variable with a calibrated output attenuator.

1.5 SPECIFICATIONS. Specifications for each model of the NAV-750 are listed separately in this section.

SPECIFICATIONS

NAV-750

RF POWER OUT

Accuracy:	±1.5 dB to -50 dBm ±2.5 dB from -50 dBm to -120 dBm
Leakage: . . . . (With all unused outputs properly terminated)	Less than 3μV induced in a two-turn, one inch diameter (#20 gauge wire) loop, measured one inch away from any surface and into a 50 ohm receiver.

INTERNAL TEMPERATURE CONTROLLED CRYSTAL OSCILLATOR (TCXO)

Accuracy: . . . . (After calibration at 25° C).	Better than ±1 ppm for 15° to 35° C Better than ±3 ppm for 10° to 45° C
Aging:	Less than ±2 ppm/year

CLOCK OSCILLATOR (2.16 MHz)

Accuracy:	±0.02%

SPECTRAL PURITY

NOTE

All levels observed with the NAV-750 output attenuator set to -10 dBm. However, other levels may be used for convenience to meet test equipment requirements.

Harmonics:	30 dB below carrier, maximum (108.000 through 335.000 MHz)

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SPECTRAL PURITY (cont'd)

Close-In Noise (single-sideband Noise):

At 108.000 MHz . . . . 74 dB below carrier at ±20 kHz in 300 Hz resolution bandwidth, or 79 dB below carrier at ±20 kHz in 100 Hz resolution bandwidth.

At 334.700 MHz . . . . 68 dB below carrier at ±20 kHz in 300 Hz resolution bandwidth, or 73 dB below carrier at ±20 kHz in 100 Hz resolution bandwidth.

Harmonic Spurious Noise:

NOTE

The NAV-750 phase-lock control frequency is 12.5 kHz.

At 108.000 MHz . . . . 68 dB below carrier at ±12.5 kHz and 71 dB below carrier at ±25.0 kHz in 300 Hz resolution bandwidth.

At 334.700 MHz . . . . 63 dB below carrier at ±12.5 kHz, and 74 dB below carrier at ±25.0 kHz in 300 Hz resolution bandwidth.

Broadband Noise:

At 108.000 MHz . . . . 80 dB below carrier at ±100 kHz in 1 kHz resolution bandwidth.

At 334.700 MHz . . . . 80 dB below carrier at ±100 kHz in 1 kHz resolution bandwidth.

Residual FM: (Post-detection noise bandwidth, 20 Hz to 15 kHz)

At 108.000 MHz . . . . ±200 Hz p-p, or less.

At 334.700 MHz . . . . ±400 Hz p-p, or less.

SPECIFICATIONS

NAV-750

MODULATION

AM Depth: . . . . .0% to 98%

Accuracy: . . . . As listed below, with front panel Modulation Controls in CAL positions.

NOTE

* Indicates 0-100 meter scale is selected. All others on 0-30% Modulation Scale. All values are for single-tone modulation of indicated frequency.

Modulation Frequency	RF Range	Acceptable Level of Modulation (absolute) at RF output Connector	Meter Indication Tolerance Referenced to Absolute Value at RF output Connector
30 Hz	VOR	30%(28.8 to 31.2)	±1.2% Modulation
9960 Hz	VOR	30%(28.8 to 31.2)	±1.2% Modulation
90 Hz	LOC	20%(19.2 to 20.8)	±0.8% Modulation
150 Hz	LOC	20%(19.2 to 20.8)	±0.8% Modulation
90 Hz	G/S	*40%(38.4 to 41.6)	±1.6% Modulation
150 Hz	G/S	*40%(38.4 to 41.6)	±1.6% Modulation
1020 Hz	Comm	30%(28.8 to 31.2)	±1.2% Modulation

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TONES

Distortion:

(Measured at Sum of Tones Jack or individual Tone Jacks).

9960Hz	1.5% Max.
30Hz Var	0.5% Max.
30Hz Ref	0.5% Max.
1020Hz	0.5% Max.
90Hz	0.4% Max.
150Hz	0.4% Max.

Frequencies:

90 Hz 150 Hz 30 Hz Ref. 30 Hz Var.	These tones are derived from the 2.16 MHz crystal oscillator and therefore reflect the accuracy of the oscillator. (±0.02%)
9960 Hz	Phase-locked to 30 Hz Ref. tone which is derived from the 2.16 MHz crystal oscillator.
1020 Hz	±0.5%

NOTE

Tone distortion should increase no more than 0.2% at the DEMOD Jack.

SPECIFICATIONS

NAV-750

<u>DDM ACCURACY</u> (Theoretical - not measured)

COMPOSITE AUDIO ERROR = Centering Error +1.5% DDM setting

PERCENTAGE OF MODULATION ERROR = DDM setting X

$$\frac{\left\{\text{measured, single-tone, \% of modulation at centering}\right\} - \left\{\text{desired \% of modulation at centering}\right\}}{\left\{\text{Desired \% of modulation at centering}\right\}} \; *$$

TOTAL ERROR = Composite Audio Error + Percentage of Modulation Error

* desired % of modulation at centering for LOCALIZER 20%
* desired % of modulation at centering for GLIDE SLOPE 40%

DDM setting	Composite Audio Error (DDM)	max % of Mod Error (DDM)	TOTAL (maximum error) (DDM)
LOCALIZER:			
.046	.00169	.00230	.00399
.093	.00240	.00465	.00705
.155	.00333	.00775	.01108
.200	.00400	.01000	.01400
GLIDE SLOPE			
.045	.00168	.00225	.00393
.091	.00237	.00455	.00692
.175	.00363	.00875	.01238
.400	.00700	.02000	.02700

SPECIFICATIONS

NAV-750

Technical Summary

VOR SECTION:

Bearing Selection:	Twelve preset bearings each 30°. Additional +10° and -10° steps from any bearing selected. Bearing control provides continuous bearing adjustment in 0.01° or 0.05° steps.
Bearing Accuracy:	±0.05° on all bearings.
Bearing Monitor:	By independent counter displays bearing to 0.01° resolution.
VOR Tones:	30 Hz REF and 30 Hz VAR tones derived from 2.16 MHz crystal oscillator. 9960 MHz frequency locked to the 2.16 MHz crystal oscillator.
Ident Tone:	1020 Hz tone may be added from 0 to 60% mod.

LOC SECTION:

Deviation:	±0.046 DDM, ±0.93 DDM, ±0.155 DDM, and continuously adjustable ±0.4 DDM. One tone may be deleted while the other is at 20%.
Centering Accuracy:	±0.001 DDM (±.85μA)
Tones:	90 Hz and 150 Hz tones phase-locked to ±.1° or phase variable at five times the angle selected by the VOR bearing selector. 1020 Hz tone may be added.

GS SECTION:

Deviation:	±0.045 DDM, ±0.091 DDM, ±0.175 DDM, and continuously adjustable ±0.8 DDM. One tone may be deleted while the other is at 40%.

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GS SECTION: (cont'd)	
Centering Accuracy:	±0.001 DDM (±1µA)
Tones:	Same as LOC
COMM SECTION:	
Modulation:	1020 Hz tone 0-60% for audio tests. External modulation may also be added.
RF GENERATOR:	
Frequency Range:	108 to 156 MHz in 25 kHz increments and 329 to 335 MHz.
Frequency Selection:	Manually by thumbwheel switch. Automatically at a variable rate in 25, 50, 100, or 200 kHz increments, up in frequency only. Auto channeling stops at 117.950 and 135.975 MHz. External channeling is available via Ext. channeling input at rear panel.
Variable Frequency:	±50 kHz from 108 to 156 MHz ±150 kHz from 329 to 335 MHz. Generator remains phase-locked at all fixed and variable frequencies.
Frequency Accuracy:	Controlled by oven crystal to ±0.0001%.
Frequency Monitor:	By independent counter to 1 kHz or 0.1 kHz resolution. Counter time base ±0.0001%.
Remote Function:	Frequency in use fed to rear panel as 2 out of 5 channeling and parallel BCD. Remote channeling follows manual or auto selection.

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RF GENERATOR: (cont'd)

Modulation Selection:	Automatic by frequency selected. VOR mod applied if on any VOR freq, LOC mod applied if on any LOC freq, GS mod applied if on any LOC freq and LOC/GS switch in GS position.
EXTERNAL MODULATION:	May be added to any signal through rear panel jack. (J18) On sets S/N 408 & on, J-18 must be terminated with 100 ohms or less when External Modulation is not used.
Impedance (J18):	1K ohm nominal
Sensitivity:	For NAV-750 units prior to S/N 408: 9.1V p-p (±0.6V) = 30% (MASTER MOD in Cal position).
	For NAV-750 units S/N 408 and on: 9.1V p-p (±0.6V) = 90% (MASTER MOD in Cal position).
DEMOD OUTPUT:	For any signal at a rear panel jack. (J23)
Impedance (J23)	1K ohm nominal
DC Voltage:	3.75V (±0.3V)
AC Voltage:	2.72V (±0.2V) = 100% Modulation (±0.2V due to difference in sets)

(cont'd next page)

SPECIFICATIONS

NAV-750

Technical Summary

REAR PANEL CONNECTORS:	External Modulation Input VOR Composite Tones output VOR 30 Hz VAR Tone output VOR 9960 Hz FM Tone output 1020 Hz Tone output VOR 30 Hz REF Tone output 150 Hz Tone output 90 Hz Tone output RF Demod output AC Power Input (See power requirements below) External Clock Input Remote Channeling Input Remote Channeling output
POWER REQUIREMENTS:	105 to 120 VAC or 220 to 250 VAC, 50 to 400 Hz (Cooling fan 50/60 Hz only. Optional dc cooling fan available for 400 Hz operation)
POWER CONSUMPTION:	250 W Maximum, 110 W Nominal
SIZE:	7.5" high by 16.75" wide by 18.375 deep.
WEIGHT:	Approximately 45 pounds

RF POWER OUT

Accuracy: . . . . ±1.5 dB from -6 dBm to -50 dBm
±2.5 dB from -50 dBm to -120 dBm

Leakage: . . . . Less than 3μV at 334.700 MHz and 1μV at 108.000 MHz induced in a two-turn one inch diameter (#20 gauge wire) loop, measured one inch away from any surface and into a 50 ohm receiver.
(With all unused outputs properly terminated)

INTERNAL TEMPERATURE CONTROLLED CRYSTAL OSCILLATOR (TCXO)

Accuracy: . . . . Better than ±1 ppm at 15° to 35° C
(After calibration at 25° C) . . . . Better than ±3 ppm at 10° to 45° C

Aging: . . . . Less than ±2 ppm/year

CLOCK OSCILLATOR (2.16 MHz)

Accuracy: . . . . ±0.02%

SPECTRAL PURITY

NOTE

All level observed with the NAV-750 output attenuator set to -10 dBm. However, other level may be used for convenience to meet test equipment requirements.

Harmonics: . . . . 30 dB below carrier, maximum (108.000 through 335.000 MHz).

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SPECTRAL PURITY (cont'd)

Close-In Noise (Single-sideband Noise):

At 108.000 MHz . . . . 78 dB below carrier at ±15 kHz in 300 Hz resolution bandwidth, or 83 dB below carrier at ±15 kHz in 100 Hz resolution bandwidth.

At 130.000 MHz . . . . 78 dB below carrier at ±15 kHz in 300 Hz resolution bandwidth, or 83 dB below carrier at ±15 kHz in 100 Hz resolution bandwidth.

At 334.700 MHz . . . . 74 dB below carrier at ±20 kHz in 300 Hz resolution bandwidth, or 79 dB below carrier at ±20 kHz in 100 Hz resolution bandwidth.

Harmonic Spurious Noise:

NOTE

The NAV-750 phase-lock control frequency is 12.5 kHz.

At 108.000 MHz . . . . 75 dB below carrier at ±12.5 kHz, and 83 dB below carrier at ±25.0 kHz in 300 Hz resolution bandwidth.

At 334.700 MHz . . . . 66 dB below carrier at ±12.5 kHz, and 77 dB below carrier at ±25.0 kHz in 300 Hz resolution bandwidth.

Broadband Noise:

At 108.000 MHz . . . . 82 dB below carrier at ±100 kHz in 1 kHz resolution bandwidth.

At 334.700 MHz . . . . 82 dB below carrier at ±100 kHz in 1 kHz resolution bandwidth.

Residual FM: (Post-detection noise bandwidth, 20 Hz to 15 kHz)

At 108.000 MHz . . . . ±200 Hz p-p, or less.

At 334.700 MHz . . . . ±400 Hz p-p, or less.

MODULATION

AM Depth: . . . . G/S....................0% to 93%
VOR, LOC, & COMM.......0% to 98%

Accuracy: . . . . As listed below, with front panel Modulation controls in CAL position.

NOTE

* Indicates 0-100 meter scale is selected. All others on 0-30% Modulation Scale. All values are for single-tone of the indicated frequency.

Modulation Frequency	RF Range	Acceptable Level of Modulation (absolute) at RF output Connector	Meter Indication Tolerance Referenced to Absolute Value at RF output Connector
30 Hz	VOR	30%(28.8 to 31.2)	±1.2% Modulation
9960 Hz	VOR	30%(28.8 to 31.2)	±1.2% Modulation
90 Hz	LOC	20%(19.2 to 20.8)	±0.8% Modulation
150 Hz	LOC	20%(19.2 to 20.8)	±0.8% Modulation
90 Hz	G/S	*40%(38.4 to 41.6)	±1.6% Modulation
150 Hz	G/S	*40%(38.4 to 41.6)	±1.6% Modulation
1020 Hz	Comm	30%(28.8 to 31.2)	±1.2% Modulation

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SPECIFICATIONS

NAV-750A

TONES

Distortion:

(Measured at Sum of Tone Jack or individual Tone Jacks)

9960Hz	1.5% Max.
30Hz Var	0.5% Max.
30Hz Ref	0.5% Max.
1020Hz	0.5% Max.
90Hz	0.4% Max.
150Hz	0.4% Max.

Frequencies:

90 Hz 150 Hz 30 Hz Ref. 30 Hz Var.	These tones are derived from the 2.16 MHz crystal oscillator and therefore reflect the accuracy of the oscillator (±0.02%).
9960 Hz	Phase-locked to 30 Hz Ref. tone which is derived from the 2.16 MHz crystal oscillator.
1020 Hz	±0.5%

NOTE

Tone distortion should increase no more than 0.2% at the DEMOD jack.

SPECIFICATIONS

NAV-750A

DDM ACCURACY (Theoretical - not measured)

COMPOSITE AUDIO ERROR = Centering Error +.02% DDM Setting (.00025 DDM)

$$\text{PERCENTAGE OF MODULATION ERROR} = \text{DDM setting} \times \frac{\left\{\begin{matrix}\text{measured, single}\\ \text{tone, \% of modu-}\\ \text{lation at centering}\end{matrix}\right\} - \left\{\begin{matrix}\text{desired \% of}\\ \text{modulation at}\\ \text{centering}\end{matrix}\right\}^{*}}{\left[\begin{matrix}\text{Desired \% of modulation}\\ \text{at centering}\end{matrix}\right]}$$

TOTAL ERROR = Composite Audio Error + Percentage of Modulation Error

* desired % of modulation at centering for LOCALIZER 20%
* desired % of modulation at centering for Glide Slope 40%

DDM setting	Composite Audio Error (DDM)	max % of Mod Error (DDM)	TOTAL (maximum error) (DDM)
LOCALIZER:			
.046	.00101	.00230	.00331
.093	.00102	.00465	.00567
.155	.00103	.00775	.00878
.200	.00104	.01000	.01104
GLIDE SLOPE:			
.045	.00101	.00225	.00326
.091	.00102	.00455	.00557
.175	.00104	.00875	.00979
.400	.00108	.02000	.02108

SPECIFICATIONS

NAV-750A

Technical Summary

VOR SECTION:

Bearing Selection:	Twelve preset bearings each 30°. Additional +10° and -10° steps from any bearing selected. Bearing control provides continuous bearing adjustment in 0.01° or 0.05° steps.
Bearing Accuracy:	±0.05° on all bearings.
Bearing Monitor:	By independent counter; displays bearing to 0.01° resolution.
VOR Tones:	30Hz REF and 30Hz VAR tones derived from 2.16 MHz crystal oscillator. 9960 Hz is frequency locked to the 2.16 MHz crystal oscillator.
Ident Tone:	1020 Hz tone may be added from 0 to 60% mod.

LOC SECTION:

Deviation:	±0.046 DDM, ±0.093 DDM, ±0.155 DDM, ±0.200 DDM, and continuously adjustable ±0.4 DDM. One tone may be deleted while the other is at 20%.
Centering Accuracy:	±0.001 DDM (±0.85µA)
Tones:	90Hz and 150Hz tones phase-locked to ±0.1° or phase variable at five time the angle selected by the VOR bearing selector. 1020 Hz tone may be added.

GS SECTION

Deviation:	±0.045 DDM, ±0.091 DDM, ±0.0175 DDM, ±0.400 DDM, and continuously adjustable ±0.8 DDM. One tone may be deleted while the other is at 40%.

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GS SECTION: (cont'd)

Centering Accuracy:	±0.001 DDM (±1µA)
Tones:	Same as LOC

COMM SECTION:

Modulation:	1020 Hz tone 0-60% for audio tests. External modulation may also be added.

RF GENERATOR:

Frequency Range:	108 to 156 MHz in 25 kHz increments and 329 to 335 MHz.
Frequency Selection:	Manually by thumbwheel switch. Automatically at a variable rate in 25, 50, 100, or 200 kHz increments, up in frequency only. Auto channeling stops at 117.950 and 135.975 MHz. External channeling is available via Ext. channeling input at rear panel.
Variable Frequency:	±50 kHz minimum to 108 to 156 MHz 150 kHz minimum from 329 to 335 MHz. Generator remains phase locked at all fixed and variable frequencies.
Frequency Accuracy:	Controlled by oven crystal to ±0.0001%.
Frequency Monitor:	By independent counter to 1 kHz or 0.1 kHz resolution. Counter time base ±0.0001%.
Remote Function:	Frequency in use fed to rear panel as 2 out of 5 channeling and parallel BCD. Remote channeling follows manual or auto selection.

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RF GENERATOR: (cont'd)	
Modulation Selection:	Automatic by frequency selected, VOR mod applied if on any VOR freq, LOC mod applied if on any LOC freq, GS mod applied if on any LOC freq and LOC/GS switch in GS position.
EXTERNAL MODULATION:	May be added to any signal through rear panel jack. (J18). On sets S/N 381 & on, J-18 must be terminated with 100 ohms or less when External Modulation is not used.
Impedance (J18):	1K ohm Nominal
Sensitivity:	For NAV-750A units through S/N 380: 9.1V p-p (±0.6V) = 30% (MASTER MOD in Cal position). For NAV-750A units S/N 381 & on: 9.1V p-p (±0.6V) = 90% (MASTER MOD in Cal position).
DEMOD OUTPUT:	For any signal at a rear panel jack. (J23).
Impedance (J23):	Minimum Resistance: 1K ohms:
DC Voltage:	3.75V (±0.3V)
AC Voltage:	2.72V (±0.2V) = 100% Modulation (±0.2V due to difference in sets)

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SPECIFICATIONS

NAV-750A

Technical Summary

REAR PANEL CONNECTORS:	External Modulation Input Composite Tones output VOR 30 Hz VAR Tone output VOR 9960 Hz FM Tone output 1020 Hz Tone output VOR 30 Hz REF Tone output 150 Hz Tone output 90 Hz Tone output RF Demod output AC Power Input (See power requirements next page) External Clock Input Remote Channeling Input Remote Channeling output Remote Frequency output
POWER REQUIREMENTS:	105 to 120 VAC or 220 to 250 VAC, 50 to 400 Hz (Cooling fan 50/60 Hz only. Optional dc cooling fan available for 400 Hz operation)
POWER CONSUMPTION:	250 W Maximum, 110 W Nominal
SIZE:	7.5" high by 16.75" wide by 18.375" deep.
WEIGHT:	Approximately 45 pounds.

RF POWER OUT

Accuracy:	±1.5 dBm from -6 dBm to -50 dBm ±2.5 dBm from -50 dBm to -120 dBm
Leakage: (With all unused outputs properly terminated)	Less than 3μV @334.700 MHz, 1μV@ 108.000 MHz induced in a two-turn, one inch diameter (#20 gauge wire) loop, measured one inch away from any surface and into a 50 ohm receiver.

INTERNAL TEMPERATURE CONTROLLED CRYSTAL OSCILLATOR (TCXO)

Accuracy: (After calibration	Better than ±1ppm at 15° to 35° C
at 25° C)	Better than ±3ppm at 10° to 45° C
Aging:	Less than ±2ppm/year

CLOCK OSCILLATOR (2.16 MHz)

Accuracy:	±0.02%

SPECTRAL PURITY

NOTE

All levels observed with the NAV-750 output attenuator set to -10 dBm. However, other levels may be used for convenience to meet test equipment requriements.

Harmonics:	30 dB below carrier, maximum, from 108.000 through 335.000 MHz and 20 dB below carrier, maximum, from 70.000 through 79.000 MHz.

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SPECTRAL PURITY (cont'd)

Close-In Noise (Single-sideband Noise):

At 108.000 MHz	78 dB below carrier at ±15 kHz in 300 Hz resolution bandwidth, or 83 dB below carrier at ±15 kHz in 100 Hz resolution bandwidth.
At 130.000 MHz	78 dB below carrier at ±15 kHz in 300 Hz resolution bandwidth, or 83 dB below carrier at ±15 kHz in 100 Hz resolution bandwidth.
At 334.700 MHz	74 dB below carrier at ±20 kHz in 300 Hz resolution bandwidth, or 79 dB below carrier at ±20 kHz in 100 Hz resolution bandwidth.

Harmonic Spurious Noise:

NOTE

The NAV-750 phase-lock control frequency is 12.5 kHz.

At 108.000 MHz	75 dB below carrier at ±12.5 kHz, and 83 dB below carrier at ±25.0 kHz in 300 Hz resolution bandwidth.
At 334.700 MHz	75 dB below carrier at ±12.5 kHz, and 83 dB below carrier at ±25.0 kHz in 300 Hz resolution bandwidth.

Broadband Noise:

At 108.000 MHz	80 dB below carrier at ±100 kHz in 1 kHz resolution bandwidth.
At 334.700 MHz	80 dB below carrier at ±100 kHz in 1 kHz resolution bandwidth.

Residual FM: (Post-detection noise bandwidth, 20 Hz to 15 kHz)

At 108.000 MHz	±200 Hz p-p, or less.
At 334.700 MHz	±400 Hz p-p, or less.

MODULATION

AM Depth . . . . G/S . . . . 0% to 93%
VOR, LOC, COMM, & MKR 0% to 98%

Accuracy: . . . . As listed below, with front panel Modulation controls in CAL position.

NOTE

* Indicates 0-100 Meter scale is selected. (0-100 meter scale is automatically selected for Marker beacon tones.) All others on 0-30% Mod. scale. All values are for single-tone modulation of the indicated frequency. Marker beacon tone maximum modulation depth capability is at least 60% from 70-74 MHz.

Modulation Frequency	RF Range	Acceptable Level of Modulation (absolute) at RF output connector	Meter Indication Tolerance referenced to Absolute Value at RF Output Connector
30 Hz	VOR	30% (28.8 to 31.2)	±1.2% Modulation
9960 Hz	VOR	30% (28.8 to 31.2)	±1.2% Modulation
90 Hz	LOC	20% (19.2 to 20.8)	±0.8% Modualtion
150 Hz	LOC	20% (19.2 to 20.8)	±0.8% Modulation
90 Hz	G/S	*40% (38.4 to 41.6)	±1.6% Modulation
150 Hz	G/S	*40% (38.4 to 41.6)	±1.6% Modulation
1020 Hz	Comm.	30% (28.8 to 31.2)	±1.2% Modulation
400 Hz	Mkr. beacon	95% (92.14 to 97.85)	±3.0% Modulation
1300 Hz	Mkr. beacon	95% (92.14 to 97.85)	±3.0% Modulation
3000 Hz	Mkr. beacon	95% (92.14 to 97.85)	±3.0% Modulation

(cont'd next page)

TONES

Distortion:

(Measured at Tone Jack or Individual Tone Jacks)

9960Hz	1.5% Max.
30Hz Var	0.5% Max.
30Hz Ref	0.5% Max.
1020Hz	0.5% Max.
90Hz	0.4% Max.
150Hz	0.4% Max.
400Hz	0.7% Max.
1300Hz	0.7% Max.
3000Hz	0.7% Max.

Frequencies:

90 Hz 150 Hz 30 Hz Ref. 30 Hz Var.	These tones are derived from the 2.16 MHz crystal oscillator and therefore reflect the accuracy of the oscillator. (±0.02%)
9960 Hz	Phase-locked to 30 Hz Ref. tone which is derived from the 2.16 MHz crystal oscillator
1020 Hz	±0.5%
400 Hz	±0.7%
1300 Hz	±0.7%
3000 Hz	±0.7%

NOTE

Tone distortion should increase no more than 0.2% at the DEMOD jack.

DDM ACCURACY (Theortical - not measured)

COMPOSITE AUDIO ERROR = Centering Error +.02% DDM setting

$$\text{PERCENTAGE OF MODULATION ERROR} = \text{DDM setting} \times \frac{\left(\begin{array}{l}\text{measured, single-}\\\text{tone, \% of modu-}\\\text{lation at centering}\end{array}\right) - \left(\begin{array}{l}\text{desired \% of}\\\text{modulation at}\\\text{centering}\end{array}\right)^{*}}{\left(\begin{array}{c}\text{Desired \% of modulation}\\\text{at centering}\end{array}\right)}$$

TOTAL ERROR = Composite Audio Error + Percentage of Modulation Error

* desired % of modulation at centering for LOCALIZER 20%
* desired % of modulation at centering for GLIDE SLOPE 40%

DDM setting	Composite Audio Error (DDM)	max % of Mod Error (DDM)	TOTAL (maximum error) (DDM)
LOCALIZER:			
.046	.00101	.00230	.00331
.093	.00102	.00465	.00567
.155	.00103	.00775	.00878
.200	.00104	.01000	.01104
GLIDE SLOPE:			
.045	.00101	.00225	.00326
.091	.00102	.00455	.00557
.175	.00104	.00875	.00979
.400	.00108	.02000	.02108

SPECIFICATIONS

NAV-750B

Technical Summary

VOR SECTION:

Bearing Selection:	Twelve preset bearings each 30°. Additional +10° and -10° steps from any bearing selected. Bearing control provides continuous bearing adjustment in 0.01° or 0.05° steps.
Bearing Accuracy:	±0.05° on all bearings.
Bearing Monitor:	By independent counter; displays bearing to 0.01° resolution.
VOR Tones:	30Hz REF and 30Hz VAR tones derived from 2.16 MHz crystal oscillator. 9960Hz is frequency locked to the 2.16 MHz crystal oscillator.
Ident Tone:	1020Hz tone may be added from 0 to 60% mod.

LOC SECTION:

Deviation:	±0.046 DDM, ±0.093 DDM, ±0.155 DDM, ±0.200 DDM, and continuously adjustable ±0.4 DDM. One tone may be deleted while the other is at 20%.
Centering Accuracy:	±0.001 DDM (±0.85μA)
Tones:	90Hz and 150Hz tones phase-locked to ±0.1° or phase variable at five times the angle selected by the VOR bearing selector. 1020Hz tone may be added.

GS SECTION

Deviation:	±0.045 DDM, ±0.091 DDM, ±0.175 DDM, ±0.400 DDM, and continuously adjustable ±0.8 DDM. One tone may be deleted while the other is at 40%.

(cont'd next page)

GS SECTION: (cont'd)	
Centering Accuracy:	±0.001 DDM (±1μA)
Tones:	Same as LOC
COMM SECTION:	
Modulation:	1020 Hz tone 0-60% for audio tests. External modulation may also be added.
MARKER BEACON SECTION:	
Tones:	1020, 400, 1300, and 3000 Hz
Modulation:	Selectable at 95±3% Modulation in CAL position. (Variable 0-98% in UNCAL positions).
RF GENERATOR:	
Frequency Range:	70 to 79.9 MHz, 108 to 156 MHz in 25 kHz increments and 329 to 335 MHz.
Frequency Selection:	Manually by thumbwheel switch. Automatically at a variable rate in 25, 50, 100, or 200 kHz increments, up in frequency only. Auto channeling stops at 117.950 and 135.975 MHz. External Channeling is available via Ext. channeling input at rear panel.
Variable Frequency:	±50 kHz minimum at 108 to 156 MHz and ±150 kHz minimum from 329 to 335 MHz. Generator remains phase locked at all fixed and variable frequencies.
Frequency Accuracy:	Controlled by oven crystal to 0.0001%.
Frequency Monitor:	By independent counter to 1 kHz or 0.1 kHz resolution. Counter time base ±0.0001%.

(cont'd next page)

RF GENERATOR (cont'd)

Remote Function:	Frequency in use fed to rear panel as 2 out of 5 channeling and parallel BCD. Remote channeling follows manual or auto selection.
Modulation Selection:	Automatic by frequency selected. VOR mod applied if on any VOR freq. LOC mod applied if on any LOC freq, G/S mod applied if on any LOC freq and LOC/GS switch in GS position. Tone frequency selectable for MARKER BEACON operation.
EXTERNAL MODULATION:	May be added to any signal through rear panel jack. (J18) When not used, J-18 must be terminated with 100 ohms or less.
Impedance (J18):	1K ohm Nominal
Sensitivity:	9.1V p-p (±0.6V) = 90% (MASTER MOD in Cal position)
DEMOD OUTPUT:	For any signal at a rear panel jack (J23).
Impedance (23):	Minimum Resistance 1K ohms
DC Voltage:	3.75V (±0.3)
AC Voltage:	2.72V (±0.2) = 100% Modulation (±0.2V due to difference in sets)

SPECIFICATIONS

NAV-750B

Technical Summary

<u>REAR PANEL CONNECTORS</u>:	External Modulation Input Composite Tones output VOR 30Hz VAR tone output VOR 9960Hz FM Tone output 1020Hz Tone output VOR 30Hz REF Tone output 150Hz Tone output 90Hz Tone output RF Demod output AC Power Input (See power requirements below) External Clock Input Remote Channeling Input Remote Channeling output Remote Frequency output
<u>POWER REQUIREMENTS</u>:	105 to 120 VAC or 320 to 250 VAC, 50 to 400Hz (Cooling fan 50/60 Hz only. Optional dc cooling fan available for 400 Hz operation)
<u>POWER CONSUMPTION</u>:	250 W Maximum, 110 W Nominal
<u>SIZE</u>:	7.5" high by 16.75" wide by 18.375" deep.
<u>WEIGHT</u>:	Approximately 45 pounds

SECTION II

INSPECTION

2.1 INCOMING INSPECTION. This instrument has been carefully inspected for mechanical and electrical defects. It should be physically free of scratches or mars and in perfect electrical order upon receipt. To confirm this, the instrument should be carefully inspected for physical damage. Also, check for supplied accessories and then test the electrical performance using the procedures outlined in Section V, Performance Evaluation Test Procedures of this manual. If there is any damage or deficiency, file a claim with the carrier and refer to the Warranty portion of Section I of this manual. If it is necessary to ship the instrument, refer to Warranty paragraph 1-K for shipping instructions.

2.2 GROUNDING REQUIREMENTS. To protect operating personnel, the National Electrical Manufacturer's Association (NEMA) recommends that the instrument panel and cabinet be grounded. All IFR instruments are equipped with a three-conductor power cord which, when plugged into an appropriate receptacle, grounds the instrument. The offset pin on the power cord three-prong connector is the ground wire.

2.2.2 To preserve the protection feature when operating the instrument from a two-contact outlet, use a three-prong to two-prong adapter and connect the green pigtail on the adapter to ground.

2.3 BENCH/RACK INSTALLATION. This instrument is normally shippped as a bench-type instrument (unless ordered specially as a rack type) with plastic feet in place. Conversion to a rack-mounted instrument can be accomplished by using the Rack Mounting Kit available from the factory upon request.

2.4 CLEANING. It is prudent to remove dust, cobwebs, etc., out of the test set prior to inspection, repair, or calibration.

2.4.1 It is recommended that dust removal be done with a hand controlled, low pressure (25-50 psi), dry air jet. The fan blades, rotor, and frame should be wiped with a lint-free cloth moistened with rubbing alcohol. The rear panel should be cleaned with a dry cloth only. The front panel may be cleaned whenever necessary with a lint-free cloth moistened with rubbing alcohol.

2.4.2 During cleaning process, avoid breaking wires or shorting

2.5 INSPECTION RECOMMENDATIONS. The general condition of the NAV-750 series test sets, as well as possible electrical or mechanical faults, can be confirmed through judicious visual inspection. However, experience has indicated that deliberate movement of descrete components on PC boards or other assemblies can complicate or cause problems in circuits where none existed before. Therefore, the factory recommends a close visual inspection without touching the components. Electrical faults can often be detected during normal operation and/or isolated using the Performance Evaluation Test Procedures in Section V of this manual.

2.5.1 The following is a list of recommended inspection items which may be used as a guide for a visual inspection:

A. Bearing Pickoff Sensors. The bearing pickoff sensors may be located by looking at the Top View Fig 8-1 Accumulated dirt can cause sluggish operation or failure of the bearing pickoff sensors. It may be cleaned with a soft brush moistened with rubbing alcohol.

B. Chassis. Includes anything mechanical or made from metal. Inspect for tightness of sub-assemblies, damaged connectors, corrosion or damage to the metal surfaces, etc. Surface corrosion may indicate damage inside the affected part.

C. Capacitors. Inspect for loose mounting, body damage, case damage, leakage or corrosion around leads.

D. Jacks. Inspect all coax jacks for loose or broken parts, cracked insulation, bad contacts, etc. Do not disassemble connectors within the test set.

E. Potentiometers. Any potentiometer that feels rough when rotated or produces circuit or voltage irregularities should be checked with an ohmmeter for proper operation.

F. Resistors, Inspect all types of resistors for cracked, broken or charred or blistered bodies and loose or corroded soldering connections.

G. Printed Circuit Boards. Check connectors for corrosion and damage and the mating plugs for similiar damage. Inspect all mounted components for damage including crystals and IC's. The boards should be free of all foreign material.

H. Semiconductors. Inspect all diodes, rectifiers and transistors for cracked, broken, charred or discolored bodies. Check ends of components for seals around leads.

I. Switches. Examine all toggle switches for loose levers and terminals, loose body to frame condition. The line switch contacts should not be bent nor the switch action too loose. The thumbwheel switches should have definite detents and not feel loose.

J. Transformer. Inspect the transformer for signs of excessive heating, broken or charred insulation, loose mounting hardware and other abnormal conditions.

K. Wiring. Inspect all wiring of chassis for broken or loose ends and connections and proper dress relative to other chassis parts. All laced wiring should be tight with ends securely tied.

2.6 REPACKING FOR SHIPMENT. The following is a general guide for repackaging for shipment. If you have any questions, contact the IFR Shipping Department. See Section I, Paragraph K in Warranty Section.

NOTE

If the instrument is to be shipped to IFR for service or repair, attach a tag to the instrument identifying the owner and indicate the service or repair to be accomplished; include the model number and full serial number of the instrument. In any correspondence identify the instrument by prefix, model and serial number.

2.6.1 Place instrument in original container if available. If original container is not available, contact IFR for shipping instructions.

2.6.2 Do not return the instrument or its component parts to IFR, Inc. for repair without first receiving authorization from IFR, Inc. Refer to paragraph 1-H of the warranty section for complete instructions.

SECTION III

NAVIGATION RADIO AIDS SIGNALS AND NAV-750 SERIES TEST SET OPERATING PROCEDURES

3.1 INTRODUCTION. The NAV-750 series bench test sets simulate the VHF OMNIDIRECTIONAL RANGE (VOR) station signals, the INSTRUMENT LANDING SYSTEM (ILS) guidance beams, VHF communications signals, and the MARKER BEACON station (NAV-750B model only) signals used in conjunction with the ILS. The following paragraphs describe the signals generated by these ground navigation aids. The final portion of this section provides general operating procedures for testing NAV-COMM systems.

3.2 VOR STATION. VOR stations radiate bearing signals in the 108.000 to 117.950 MHz band in all directions, much like spokes radiate from the hub of a wheel. These bearings are numbered from 000° to 359° (clockwise) like a compass card or circle. All VOR stations are oriented so that the 000° bearing from the station points to the MAGNETIC NORTH pole. Therefore, all VOR bearing information is "Magnetic" and not to be confused with "True North" or "True Bearings".

3.2.1 VOR stations radiate only bearing information FROM the station and each "FROM" bearing is called a RADIAL.

3.2.2 The basic principle involved in producing RADIALS is the radiation of two 30 Hz tones that vary in phase relationship from 0° to 359°. One 30 Hz tone, called the 30 Hz REFERENCE signal, is stationary in that it is constant in phase all around the VOR antenna. The other 30 Hz tone, called the 30 Hz VARIABLE signal, varies in phase in relation to the reference signal according to rotation around the VOR antenna. For example, as the direction around the VOR antenna increases clockwise from Magnetic North (000°), the two 30 Hz signals become increasingly out of phase until they are again in phase at 360° (000°). Therefore the phase relationship, in degrees, between the two signals is the same as the MAGNETIC BEARING FROM the VOR station to the point of reception.

3.2.3 Both 30 Hz signals are transmitted at a single carrier frequency. An FM/AM multiplexing technique is used to place the 30 Hz REFERENCE signal on the VOR carrier. First, the 30 Hz signal is used to Frequency modulate a 9960 Hz subcarrier. Then the 9960 Hz subcarrier is placed on the 108.000 to 117.950 MHz RF carrier as Amplitude Modulation.

3.2.4 The VARIABLE 30 Hz signal, which varies in phase with respect to the 30 Hz REFERENCE signal, is placed directly on the VOR RF carrier via a special antenna array as amplitude modulation. The signal at the aircraft receiver output is two separate 30 Hz signals, one as reference and the other a signal that is phased in respect to the reference signal.

3.2.5 The VOR receiver measures the phase relationship between the 30 Hz signals and displays the information as a RADIAL. On aircraft equipped with RADIO MAGNETIC INDICATORS (RMI), the double barralled pointer is usually the VOR pointer and the head of the pointer always points to the VOR station. The tail of this pointer indicates the RADIAL.

3.2.6 The COURSE DEVIATION INDICATOR (CDI) of the VOR receiver system is an instrument designed to provide the pilot with a means to guide his aircraft along a selected course TO or FROM a VOR station. The basic CDI consists of a vertical needle or pointer capable of deflecting left and right of center, a course selection control, and a TO-FROM window which indicates whether the selected course will take the aircraft TO or away FROM the VOR station. The vertical pointer of the CDI deflects towards the selected course. FOR example, if the vertical pointer deflects to the left, the aircraft is to the right of the selected course and a heading correction to the left will bring the aircraft back to the selected course. When the vertical needle is centered, the aircraft is on the selected course. Maximum pointer deflection, either left or right of center, represents approximately 10° course deviation.

3.2.7 All NAV-750 models simulate all signals radiated by the VOR ground navigation facility. All VOR frequencies are available via thumbwheel selector switches. Output power of the NAV-750 may be adjusted with the calibrated output attenuator. VOR TO and FROM bearings in .01° increments is possible and a 1020 Hz Ident tone may be added for audio testing.

3.3 INSTRUMENT LANDING SYSTEM. The Instrument Landing System (ILS) consists of two guidance systems that radiate very narrow beams to provide approaching aircraft with precise lateral and vertical guidance to the airport runway.

3.3.1 The lateral guidance portion of the ILS, called the LOCALIZER (LOC), transmits two narrow horizontally parallel beams. One beam is modulated with a 90Hz tone and the other is modulated with a 150 Hz tone. The antennas for the two beams are positioned so that the beams overlap laterally to form an even narrower wedge of equal 90 and 150 Hz tone values. This narrow wedge is the Localizer on-course zone. As long as the aircraft remains in the on-course zone, the aircraft localizer receiver senses that the 90 and 150 Hz tones are balanced and the receiver keeps the COURSE DEVIATION INDICATOR (CDI) pointer centered. If the aircraft deviates from the on-course zone and is displaced more into the 90 or 150 Hz tone beam, the aircraft localizer receiver senses an unbalance between the two tones in that one tone increases in amplitude and the other decreases in amplitude. The resultant difference between the tone amplitudes causes the CDI pointer to be deflected. The predominant tone determines the direction of CDI pointer deflection. The amount of CDI pointer deflection which is directly proportional to aircraft displacement from the on-course zone in degrees, is determined by the magnitude of the difference in tone amplitude. For uniformity and standardization purposes, this tone magnitude difference is expressed in a nondimensional number called DDM, which stands for Difference in Depth of Modulation. DDM numbers are obtained from Modulation percentage figures as follows:

$$DDM = \frac{M_1 - M_2}{100}$$

where M_1 = Larger Modulation percentage value (either 90 or 150 Hz tone Beam)

M_2 = Smaller Modulation percentage value

DDM = Difference in Depth of Modulation

3.3.2 The vertical guidance portion of the ILS, called the GLIDE SLOPE (G/S) is obtained in a manner similar to the LOCALIZER system except that the beams are arranged vertically to provide vertical guidance down to the runway. As in the LOCALIZER guidance system, two narrow beams overlap to form an on-course zone of equal signal strength which slants up from the G/S antennas. If the approaching aircraft descending along the approach course stays within the G/S on-course zone, the G/S receiver senses that the 90 and 150 Hz tones are balanced (0 DDM) and therefore the G/S deviation indicator horizontal pointer remains centered. If the aircraft deviates from the G/S on-course zone, the receiver will sense an unbalance in tone values. The G/S indicator horizontal pointer will then deflect up or down, depending upon the location of the on-course zone in relation to the aircraft, and the amount of deflection will be determined by the DDM.

3.3.3 All NAV-750 models simulate the LOCALIZER tone modulated RF beams precisely at all FAA designated frequencies and the GLIDE SLOPE tone modulated RF beams at corresponding paired frequencies. Specific deviations from LOCALIZER and GLIDE SLOPE on-course zones are simulated with precise LOC and G/S switch positioned DDM values that correpond to 90 and 150 Hz relative tone modulation percentage values (see Table 3-2). DDM values are produced by precise attenuation of one of the two tones as determined by the LOC and G/S DDM switch positions.

3.3.3.1 These specific DDM switch positions correspond to half standard, standard, full scale, and more than full scale LOC and G/S deviation indicator pointer deflections. Clockwise DDM switch position values, as well as cw rotation of the Variable DDM controls, correspond to right CDI pointer deflection and up deflection of the G/S deviation pointer. This relationship is further illustrated as follows:

LOC DDM Selector Rotation	Attenuated Tone	CDI LOC Pointer Movement	Aircraft Position
RIGHT	150 Hz	RIGHT	Left on LOC
LEFT	90 Hz	LEFT	Right on LOC

G/S DDM Selector Rotation	Attenuated Tone	CDI G/S Pointer Movement	Aircraft Position
RIGHT	90 Hz	UP	Low on G/S
LEFT	150 Hz	DOWN	High on G/S

3.3.3.2 DDM values are obtained by attenuation of either the 90 or 150 Hz tone. In addition, each DDM selector switch has 90 and 150 Hz tone positions used to select one of the two tones only for warning flag checks. Output power is adjustable with the calibrated output attenuator.

3.4 MARKER BEACONS AS USED WITH ILS. Marker beacons identify specific locations in space along the Localizer approach course by radiating two or three narrow fan shaped beams upward from transmitters located along the approach course. Each Marker Beacon Beam intersects the Localizer and Glide Slope beams and is tone modulated and keyed according to transmitter location along the approach course. The Outer Marker (OM) beacon, located about five miles from the approach runway threshold, is modulated with a 400 Hz tone keyed at a continuous rate of two dashes per second.

(cont'd next page)

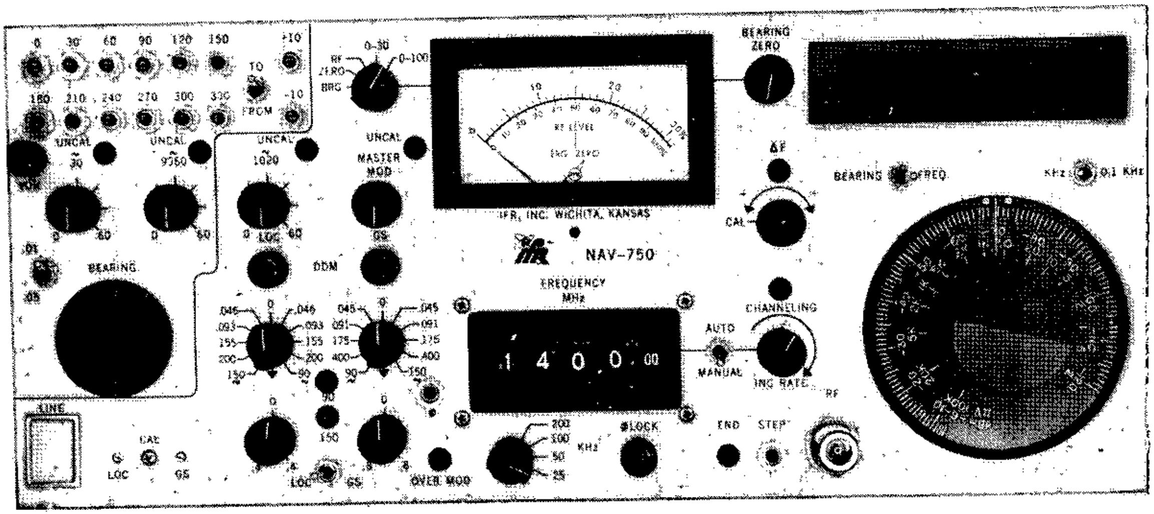
The Middle Marker (MM) beacon, located about 3500 feet from the approach runway threshold, is modulated with a 1300 Hz tone keyed with alternate dots and dashes at a rate of 95 dot/dash combinations per minute. The Inner Marker (IM) beacon, located about 600 feet from the approach runway threshold, is modulated with 3000 Hz tone keyed at rate of six dots per second. An Inner Marker beacon is not used with all Instrument Landing Systems.

3.4.1 As the approaching aircraft, flying along the localizer course, passes over the Marker Beacon transmitters, the Marker Beacon receiver receives the Mkr Bcn signal and provides the modulating tone for the aircraft auido system. In addition, the Marker Beacon receiver activates the appropriate indicator light according to the keyed tone.

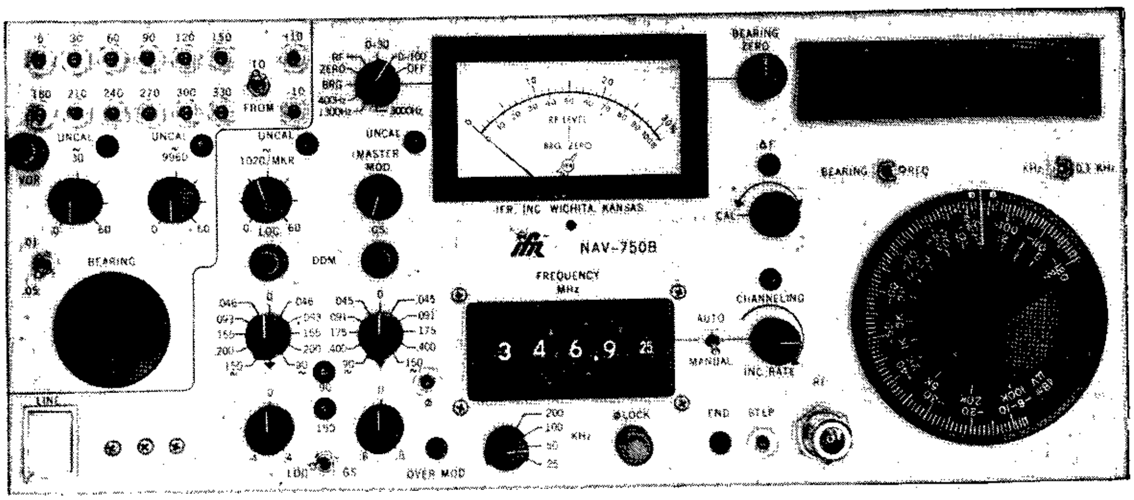
3.4.2 Only the NAV-750B model test set simulates the Marker Beacon. By selecting 75 MHz with the FREQUENCY selector switches, the NAV-750B output will be 75 MHz with tone modulation as selected by the METER FUNCTION and TONE SELECT SWITCH. The tone modulation is variable from 0 to 98%. The RF output may be varied from 70 to 79.9 MHz with the FREQUENCY selector switches. Output power is adjustable using the calibrated output attenuator.

3.5 NAV-750 Series BENCH TEST SET SIMULATION of VHF COMMUNICATION CHANNELS. All NAV-750 series bench test sets generate COMM frequencies from 118.000 through 159.750 MHz. A 1020 Hz tone automatically modulates the RF signal, when the test set is on a COMM frequency, at 30%. Modulation may be varied from 0 to 60% with the 1020 Hz modulation level control. RF output is variable via the calibrated output attenuator.

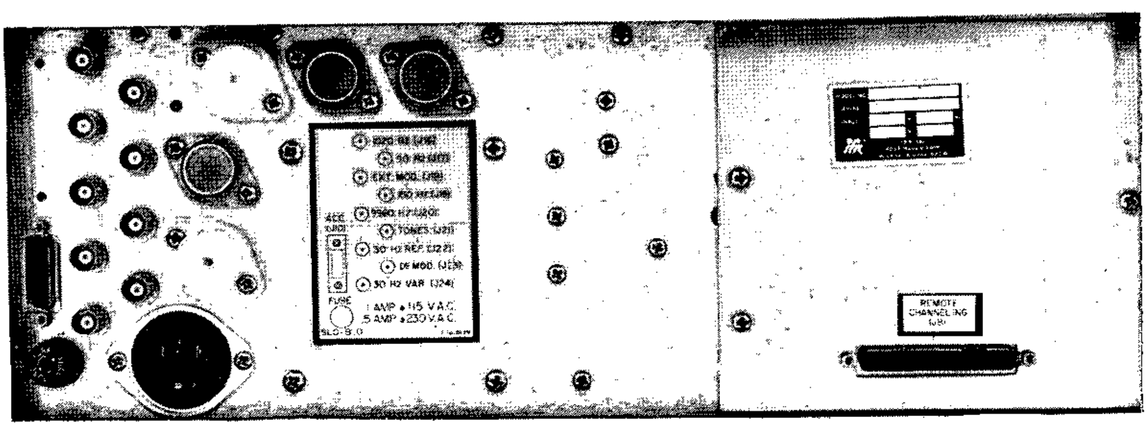
3.6 NAV-750 SERIES CONTROLS, INDICATORS AND CONNECTORS. The NAV-750 series test front and rear panels are illustrated in Figure 3-1. Control, indicator and connector functional descriptions are provided in Figures 3-2 and 3-3.



NAV-750/A



NAV-750B



NAV-750/A/B BACK PANEL

Fig. 3-1 NAV-750 SERIES FRONT AND BACK PANEL

TABLE 3-1

Correspondence Chart for Decibels, Volts, and Watts (50ΩLoad)

Decibels	Volts	Watts
+40dBw	709V	10,000W
+39dBw	633V	7,940W
+38dBw	563V	6,320W
+37dBw	501V	5,000W
+36dBw	447V	3,980W
+35dBw	399V	3,160W
+34dBw	355V	2,510W
+33dBw	317V	2,000W
+32dBw	282V	1,590W
+31dBw	252V	1,260W
+30dBw	224V	1,000W
+29dBw	200V	794W
+28dBw	178V	632W
+27dBw	159V	500W
+26dBw	141V	398W
+25dBw	126V	316W
+24dBw	112V	251W
+23dBw	100V	200W
+22dBw	89.1V	159W
+21dBw	79.5V	126W
+20dBw	70.9V	100W
+19dBw	63.3V	79.4W
+18dBw	56.3V	63.2W
+17dBw	50.1V	50.0W
+16dBw	44.7V	39.8W
+15dBw	39.9V	31.6W
+14dBw	35.5V	25.1W
+13dBw	31.7V	20.0W
+12dBw	28.2V	15.9W
+11dBw	25.2V	12.6W
+10dBw	22.4V	10.0W

Decibels	Volts	Watts
+9dBw	20.0V	7.94W
+8dBw	17.8V	6.32W
+7dBw	15.9V	5.00W
+6dBw	14.1V	3.98W
+5dBw	12.6V	3.16W
+4dBw	11.2V	2.51W
+3dBw	10.0V	2.00W
+2dBw	8.91V	1.59W
+1dBw	7.95V	1.26W
0dBw = +30dBm	7.09V	1.00W = 1000mW
+29dBm	6.33V	794mW
+28dBm	5.63V	632mW
+27dBm	5.01V	500mW
+26dBm	4.47V	298mW
+25dBm	3.99V	316mW
+24dBm	3.55V	251mW
+23dBm	3.17V	200mW
+22dBm	2.82V	159mW
+21dBm	2.52V	126mW
+20dBm	2.24V	100mW
+19dBm	2.00V	79.4mW
+18dBm	1.78V	63.2mW
+17dBm	1.59V	50.0mW
+16dBm	1.41V	39.8mW
+15dBm	1.26V	31.6mW
+14dBm	1.12V	25.1mW
+13dBm	1.00V = 1000mV	20.0mW
+12dBm	891mV	15.9mW
+11dBm	795mV	12.6mW
+10dBm	709mV	10.0mW

Table 3-1 (cont'd)

Decibels	Volts	Watts
+9dBm	633mV	7.94mW
+8dBm	563mV	6.32mW
+7dBm	501mV	5.00mW
+6dBm	447mV	3.98mW
+5dBm	399mV	3.16mW
+4dBm	355mV	2.51mW
+3dBm	317mV	2.00mW
+2dBm	282mV	1.59mW
+1dBm	252mV	1.26mW
0dBm	224mV	1.00mW = 1000uW
-1dBm	200mV	794uW
-2dBm	178mV	632uW
-3dBm	159mV	500uW
-4dBm	141mV	398uW
-5dBm	126mV	316uW
-6dBm	112mV	251uW
-7dBm	100mV	200uW
-8dBm	89mV	159uW
-9dBm	79mV	126uW
-10dBm	70.9mV	100uW
-11dBm	63.3mV	79.4uW
-12dBm	56.3mV	63.2uW
-13dBm	50.1mV	50.0uW
-14dBm	44.7mV	39.8uW
-15dBm	39.9mV	31.6uW
-16dBm	35.5mV	25.1uW
-17dBm	31.7mV	20.0uW
-18dBm	28.2mV	15.9uW
-19dBm	25.2mV	12.6uW
-20dBm	22.4mV	10.0uW
-21dBm	20.0mV	7.94uW
-22dBm	17.8mV	6.32uW
-23dBm	15.9mV	5.00uW
-24dBm	14.1mV	3.98uW
-25dBm	12.6mV	3.16uW

Decibels	Volts	Watts
-26dBm	11.2mV	2.51uW
-27dBm	10.0mV	2.00uW
-28dBm	8.9mV	1.59uW
-29dBm	7.95mV	1.26uW
-30dBm	7.09mV	1.00uW = 1000nW
-31dBm	6.33mV	794nW
-32dBm	5.63mV	632nW
-33dBm	5.01mV	500nW
-34dBm	4.47mV	398nW
-35dBm	3.99mV	316nW
-36dBm	3.55mV	251nW
-37dBm	3.17mV	200nW
-38dBm	2.82mV	159nW
-39dBm	2.52mV	126nW
-40dBm	2.24mV	100nW
-41dBm	2.00mV	79.4nW
-42dBm	1.78mV	63.2nW
-43dBm	1.59mV	50.0nW
-44dBm	1.41mV	39.8nW
-45dBm	1.26mV	31.6nW
-46dBm	1.12mV	25.1nW
-47dBm	1.00mV = 1,000uV	20.0nW
-48dBm	891uV	15.9nW
-49dBm	795uV	12.6nW
-50dBm	709uV	10.0nW
-51dBm	633uV	7.94nW
-52dBm	563uV	6.32nW
-53dBm	501uV	5.00nW
-54dBm	447uV	3.98nW
-55dBm	399uV	3.16nW
-56dBm	355uV	2.51nW
-57dBm	317uV	2.00nW
-58dBm	282uV	1.59nW
-59dBm	252uV	1.26nW
-60dBm	224uV	1.00nW = 1000pW

Table 3-1 (cont'd)

Decibels	Volts	Watts
-61dBm	200uV	794pW
-62dBm	178uV	632pW
-63dBm	159uV	500pW
-64dBm	141uV	398pW
-65dBm	126uV	316pW
-66dBm	112uV	251pW
-67dBm	100uV	200pW
-68dBm	89.1uV	159pW
-69dBm	79.5uV	126pW
-70dBm	70.9uV	100pW
-71dBm	63.3uV	79.4pW
-72dBm	56.3uV	63.2pW
-73dBm	50.1uV	50.0pW
-74dBm	44.7uV	39.8pW
-75dBm	39.9uV	31.6pW
-76dBm	35.5uV	25.1pW
-77dBm	31.7uV	20.0pW
-78dBm	28.2uV	15.9pW
-79dBm	25.2uV	12.6pW
-80dBm	22.4uV	10.0pW
-81dBm	20.0uV	7.94pW
-82dBm	17.8uV	6.32pW
-83dBm	15.9uV	5.00pW
-84dBm	14.1uV	3.98pW
-85dBm	12.6uV	3.16pW
-86dBm	11.2uV	2.51pW
-87dBm	10.0uV	2.00pW
-88dBm	89.1uV	1.59pW
-89dBm	7.95uV	1.26pW
-90dBm	7.09uV	1.00pW = 1000fW
-91dBm	6.33uV	794fW
-92dBm	5.63uV	632fW
-93dBm	5.01uV	500fW
-94dBm	4.47uV	398fW
-95dBm	3.99uV	316fW

Decibels	Volts	Watts
-96dBm	3.55uV	251fW
-97dBm	3.17uV	200fW
-98dBm	2.82uV	159fW
-99dBm	2.52uV	126fW
-100dBm	2.24uV	100fW
-101dBm	2.00uV	79.4fW
-102dBm	1.78uV	63.2fW
-103dBm	1.59uV	50.0fW
-104dBm	1.41uV	39.8fW
-105dBm	1.26uV	31.6fW
-106dBm	1.12uV	25.1fW
-107dBm	1.00uV = 1,000nV	20.0fW
-108dBm	891nV	15.9fW
-109dBm	795nV	12.6fW
-110dBm	709nV	10fW
-111dBm	633nV	7.94fW
-112dBm	563nV	6.32fW
-113dBm	501nV	5.00fW
-114dBm	447nV	3.98fW
-115dBm	399nV	3.16fW
-116dBm	355nV	2.51fW
-117dBm	317nV	2.00fW
-118dBm	282nV	1.59fW
-119dBm	252nV	1.26fW
-120dBm	224nV	1.00fW = 1000aW
-121dBm	200nV	794aW
-122dBm	178nV	632aW
-123dBm	159nV	500aW
-124dBm	141nV	398aW
-125dBm	126nV	316aW
-126dBm	112nV	251aW
-127dBm	100nV	200aW
-128dBm	89.1nV	150aW
-129dBm	79.5nV	126aW
-130dBm	70.9nV	100aW

Table 3-1 (cont'd)

Decibels	Volts	Watts
-131dBm	63.3nV	79.4aW
-132dBm	56.3nV	63.2aW
-133dBm	50.1nV	50.0aW
-134dBm	44.7nV	39.8aW
-135dBm	39.9nV	31.6aW

Decibels	Volts	Watts
-136dBm	35.5nV	25.1aW
-137dBm	31.7nV	20.0aW
-138dBm	28.2nV	15.9aW
-139dBm	25.2nV	12.6aW
-140dBm	22.4nV	10.0aW

dBw - decibels referenced to one watt
dBm - decibels referenced to one milliwatt
V - volts
mV - millivolts (volts x 10^{3})
uV - microvolts (volts x 10^{6})
nV - nanovolts (volts x 10^{9})
W - watts
mW - milliwatts (watts x 10^{3})
uW - microwatts (watts x 10^{6})
nW - nanowatts (watts x 10^{9})
pW - picowatts (watts x 10^{12})
fW - femtowatts (watts x lo^{15})
aW - attowatts (watts x 10^{18})

TABLE 3-2

Correspondence Chart for 90 and 150Hz Tones

LOCALIZER

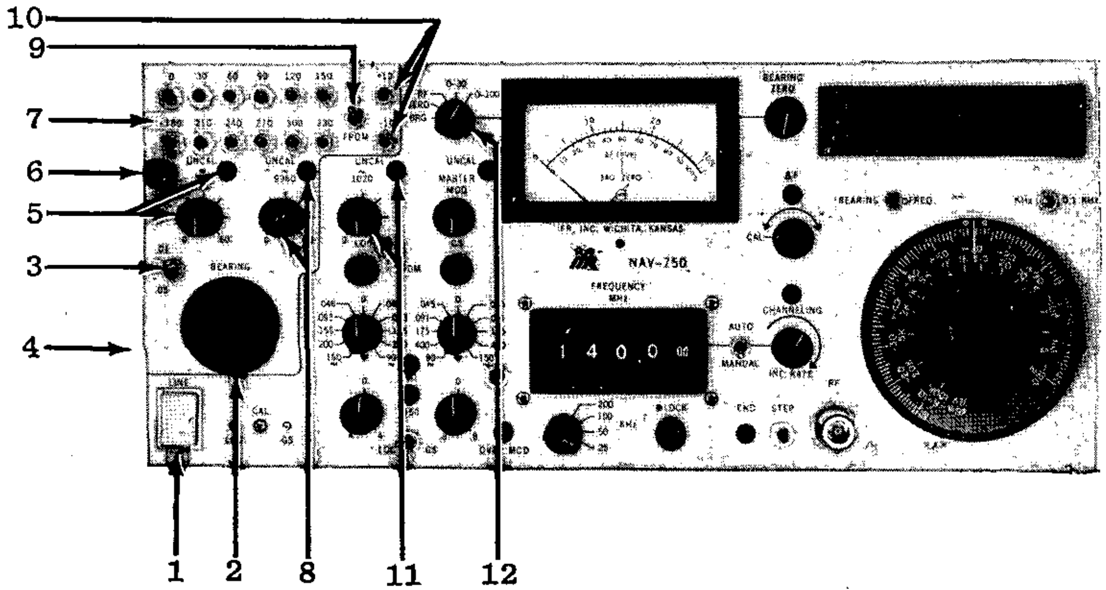
Tone Difference Values: 90 and 150 Hz % Modulation	DDM	dB	Aircraft Receiver Course Deviation Indicator (CDI): Deflection	Microamps
20 and 20	0	0	Centered	0
17.7 and 22.3	0.046	2.007	Half Standard	45
15.35 and 24.65	0.093	4.117	Standard	90
12.25 and 27.75	0.155	7.102	Full Scale	150
10.00 and 30.00	0.200	9.542	More than full scale	194
0.00 and 40.00	0.400	Infinity	Full one tone, other tone off	387

NOTE: Standard CDI course deflection = 60% of Full Scale (linear movement)
0.001 DDM = 2.750 mVrms
Deflection in microamps applies to indicators with full scale deflection current of 150 microamps

GLIDE SLOPE

Tone Difference Values: 90 and 150 Hz % Modulation	DDM	dB	Aircraft Receiver Glide Slope Deviation Indicator: Deflection	Microamps
40 and 40	0	0	Centered	0
37.75 and 42.25	0.045	0.978	Half Standard	39
35.45 and 44.55	0.091	1.985	Standard	78
31.25 and 49.75	0.175	3.682	Full Scale	150
20.00 and 60.00	0.400	9.542	More than full scale	343
0.00 and 80.00	0.800	Infinity	Full one tone, other tone off	686

NOTE: Standard G/S indicator deflection = 52% of full scale (linear movement)
0.001 DDM = 2.750 mVrms
Deflection in microamps applies to indicators with full scale deflection current in 150 microamps



1. AC POWER LINE SWITCH. Applies power to test set. Switch is illuminated when power is ON.

2. VARIABLE BEARING CONTROL. This control smoothly increases the VOR Bearing when rotated clockwise and decreases the VOR Bearing when rotated counterclockwise. The bearing incremental change depends upon the position of the .01-.05 Degree Select Switch.

3. .01 or .05 DEGREE VARIABLE BEARING SELECT SWITCH. This control selects 0.01 or 0.05 degree incremental bearing changes generated by the BEARING control as it is rotated.

4. AUDIO LEVEL CONTROL The audio level applied to the speaker is adjusted with this control. During channeling, when the AUTO-MANUAL channeling switch is on AUTO, a short tone burst aurally indicates when the test set is advanced to a different frequency.

5. 30 Hz TONE MODULATION (VAR.) LEVEL CONTROL AND UNCAL INDICATOR. When set fully counterclockwise in the detent position, the 30 Hz tone modulation level in the VOR mode, is set to 30%. By rotating this control clockwise, the modulation level can be varied from 0 to 60%. The UNCAL indicator is on whenever the control is not in the calibrated detent position.

Figure 3-2 Controls, Indicators, and Connectors (Sheet 1 of 8)

6. VOR MODE INDICATOR. This indicator is on when the test set is operating in the VOR mode.

7. VOR BEARING SELECT PUSHBUTTON SWITCHES. Depressing any one of these twelve switches, labeled 0 to 330, sets the VOR bearing. The switches may be pressed in any sequence.

8. 9960 Hz TONE MODULATION LEVEL CONTROL AND UNCAL INDICATOR. When set fully counterclockwise in the detent position, the 9960 Hz tone modulation level, in the VOR mode, is set to 30%. By rotating this control clockwise, the modulation level can be varied from 0 to 60%. The UNCAL indicator is on whenever the control is not in the calibrated detent position.

9. TO-FROM BEARING SWITCH. This switch sets the phase relationship between the 30 Hz VAR and 30 Hz REF. tones to make the selected bearing either a TO or FROM bearing. The VOR receiver under test TO-FROM indication should agree with the switch position.

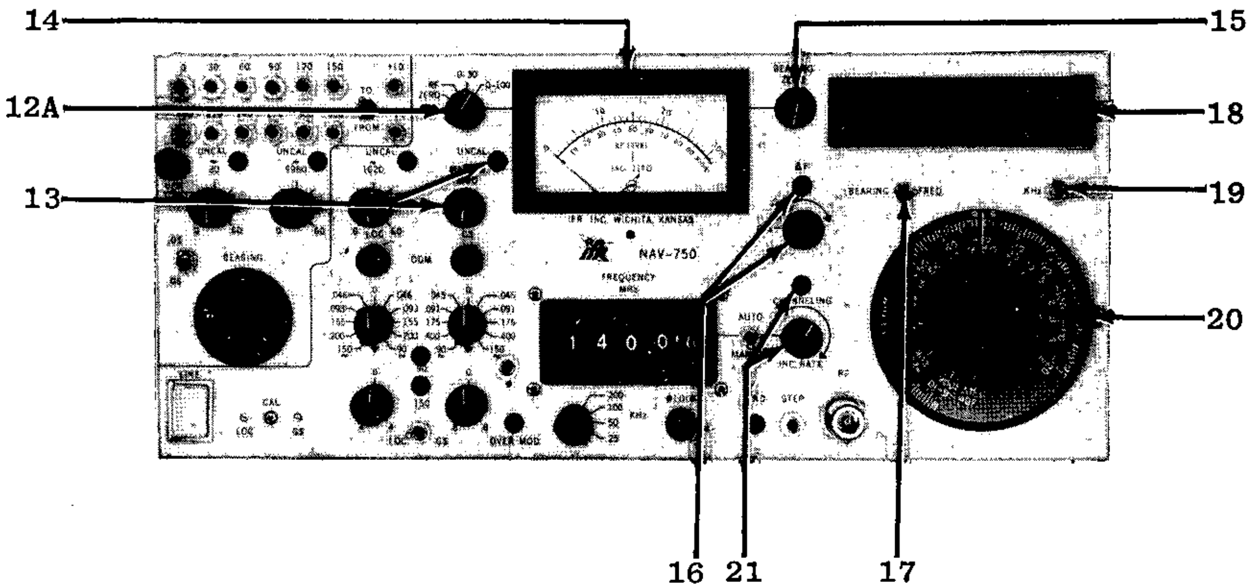
10. +10 and -10 DEGREE BEARING PUSHBUTTON SWITCHES. When depressed, these switches add or subtract exactly 10 degrees from the VOR bearing.

11. 1020 Hz IDENT TONE MODULATION LEVEL CONTROL AND UNCAL INDICATOR (NAV-750/A). When rotated fully counterclockwise into the detent (CAL) position the 1020 Hz tone is off in LOC and VOR modes and on at 30% mod level in COMM mode. On COMM, the tone may be deleted by setting the control to zero, and then varied 0 to 60% mod level. On VOR, the tone is added with clockwise rotation for mod levels from 0 to 60%. The UNCAL indicator is on whenever the control is not in the calibrated detent position.

11A. 1020 Hz IDENT, TONE AND MKR BEACON TONE MODULATION LEVEL CONTROL AND UNCAL INDICATOR (NAV-750B). Operation of this control for the 1020 Hz Ident. tone is identical to that described in item 11. When a MKR Beacon tone is selected while in the MKR Beacon mode, the tone modulation level is automatically set to 95% with the tone modulation level control in the CAL detent. Out of the detent, the control varies the modulation level from 0 to 98%. The UNCAL indicator is on when the control is not in the detent position.

12. METER FUNCTION SWITCH (NAV-750/A). This switch selects the range and function of the front panel meter. The BRG and ZERO positions are for accuracy checks of the VOR output signal. In the RF position the meter monitors the RF signal level at the input of the output attenuator. The 0-30 and 0-100 positions are for setting or monitoring the modulation level of the test set output RF signal.

Figure 3-2 Controls, Indicators, and Connectors (Sheet 2 of 8)



12A. <u>METER FUNCTION AND TONE SELECTOR SWITCH (NAV-750B).</u> On the NAV-750B model test set, this switch has two functions. First, it selects the panel meter range and function. In the BRG and ZERO switch positions, the panel meter indicates the accuracy of the VOR output. In the RF position, the panel meter indicates the test set RF level into the attenuator. The 0-30% and 0-100% positions are for monitoring or setting signal modulation levels. In the last clockwise position of the selector switch, the meter is inoperative with the terminals shorted. This position should be used to protect the meter from damage when the test set is being moved. Second, it selects the output frequency of the internal tone generator. Normally the internal tone generator produces the 1020 Hz audio Ident. tone. However, when the Meter Function and Tone Selector switch is positioned to a marker beacon tone, the internal tone generator produces either 400 Hz, 1300 Hz, or 3000 Hz in place of the 1020 Hz audio Ident tone. Also, when a marker tone is selected, the panel meter is automatically set to the.0 to 100% modulation range.

13. <u>MASTER MODULATION LEVEL CONTROL AND UNCAL INDICATOR.</u> This control when rotated clockwise and all other tone level controls are in the calibration detent (CAL. position), will vary the tone modulation levels from 0% to approximately twice calibrated values or 100%, whichever is greater. The UNCAL indicator is on whenever the control is not in the calibrated detent position.

Figure 3-2 Controls, Indicators, and Connectors (Sheet 3 of 8)

14. METER. The meter indications as related to meter selector switch positions are as follows:

A) BRG. Bearing deviation in 0.1 degree increments. The number 50 on the lower scale represents zero deviation. Each number to the left of 50 equal to -0.1 degrees and each number to the right of 50 is +0.1 degrees. Thus an indication at 20 is -0.3 degrees deviation and 90 is +0.4 degrees bearing deviation.

B) ZERO. The bearing check circuitry is set to zero using the Bearing Zero control.

C) RF. Monitors the RF level at the input of the output attenuator.

D) 0-30. The top scale is used for modulation values at or below 30%.

E) 0-100 The lower scale is used for modulation values at or below 100%.

15. BEARING ZERO ADJUST CONTROL. This control sets the bearing check circuitry to zero as indicated by a center scale indication on the meter.

16. ΔF CONTROL AND INDICATOR. When in the detent (full counterclockwise) position, this control has no effect on the RF output frequency. When the control is rotated clockwise, the RF output frequency is variable as follows:

±30 kHz in 70 MHz to 79 MHz range (NAV-750B)
±50 kHz in 108 MHz to 157 MHz range
±150kHz in 329 MHz to 335 MHz range

The changing frequency is displayed on the BEARING-FREQ display. The ΔF indicator is ON whenever the control is not in the detent position. (See "ΔF Quieting Mode" after Item 14 of Figure 3-3)

17. BEARING-FREQ. DISPLAY SWITCH. This switch selects either output frequency or VOR bearing information for display on BEARING/FREQ display.

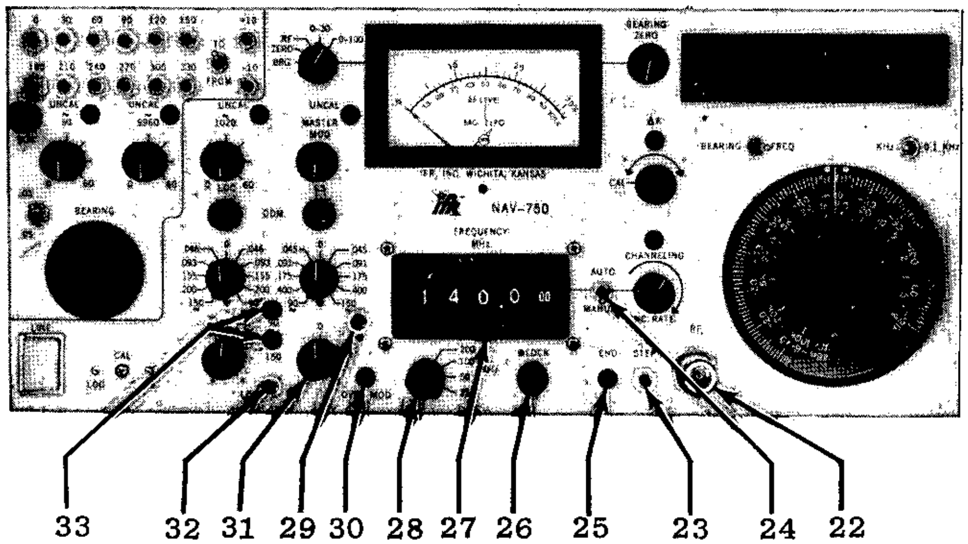
18. BEARING-FREQUENCY DISPLAY. The display indicates the VOR bearing or the generator output frequency.

19. kHz - 0.1 kHz FREQUENCY RESOLUTION SWITCH. This switch selects the readout of the display to indicate the output frequency to the nearest 1 kHz or 100 kHz.

20. RF OUTPUT ATTENUATOR. This control sets the RF output level to any value between -120 dBm and -6 dBm.

21. CHANNELING RATE CONTROL AND INDICATOR. This control sets the desired channeling rate when the AUTO-MANUAL frequency control switch is in the AUTO position. Maximum channeling rate is full clockwise rotation of the control. Full counterclockwise position of this control stops automatic channeling. The channeling indicator is ON when the AUTO-MANUAL Frequency Control Switch is in AUTO.

Figure 3-2 Controls, Indicators, and Connectors (Sheet 3 of 8)



22. RF OUTPUT CONNECTOR (J-3). Output connector, at 50 ohm impedance, that provides RF to receiver under test.

23. MANUAL FREQUENCY STEP SWITCH. This switch is used to advance the RF output one increment each time the switch is pressed. The AUTO-MANUAL Frequency Control switch must be in the AUTO position and the Channeling Rate Control in the full counter-clockwise position. (See "ΔF Quieting Mode" after Item 14 of Figure 3-3)

24. AUTO-MANUAL FREQUENCY CONTROL SWITCH. This switch selects AUTOMATIC or MANUAL channeling. The Channeling Indicator will be ON when this switch is in the AUTO position. (See "ΔF Quieting Mode" after Item 14 of Figure 3-3)

25. END CHANNELING INDICATOR. This indicator is on when channeling reaches 117.95 MHz, 135.975 MHz, or 157.95 MHz. Auto channeling will stop at these frequencies.

26. Ø LOCK INDICATOR. When ON, this indicator confirms that the RF generator is controlled by the phase-lock system. When OFF, the generator is out of frequency control.

27. FREQUENCY SELECTOR SWITCHES. These thumbswitches set the output frequency of the RF generator when the AUTO-MANUAL Frequency Control Switch is in the Manual position. When AUTO channeling is used, these switches set the starting frequency.

Figure 3-2 Controls, Indicators, and Connectors (Sheet 5 of 8)

28. CHANNELING FREQUENCY INCREMENT SWITCH. This switch provides four channel spacing choices for automatic channeling; 25, 50, 100 and 200 kHz steps. Automatic channeling increases the output frequency in the selected frequency increment.

29. 90 Hz - 150 Hz PHASE DEVIATION SWITCH. The phase relationship between the 90 Hz and 150 Hz LOC and G/S tones is normally fixed to within ±0.1 degrees.

NOTE

> The term "phase relationship" as used here refers to the relative phase position of the 90 and 150 Hz tone signals every 1/30 second from a given time. Actually, the phase difference between the two tones is constantly changing but their relative phase positions, for a given set of circuit constants, are the same every 1/30 second.

For testing purposes, this phase relationship can be varied by retarding the 150 Hz tone relative to the 90 Hz tone 5 degrees for each degree of selected VOR bearing while the Ø pushbutton switch is pressed. For example, selecting 10 degrees VOR bearing and pressing the Ø pushbutton will shift the phase relationship between the two tones 50 degrees. When the VOR bearing is 12 degrees and the Ø pushbutton is pressed, there is a 60 degree phase shift and the amplitude summation of the 90 Hz and 150 Hz tones is greatest.

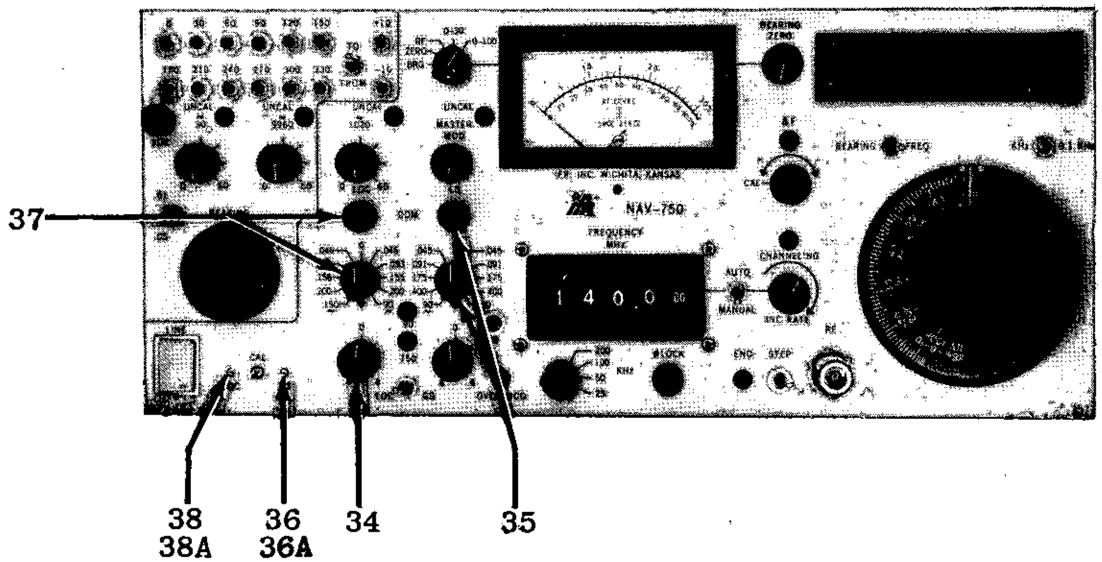
30. OVERMODULATION INDICATOR. This indicator is ON when the RF carrier modulation level reaches 100%.

31. G/S VARIABLE DDM CONTROL. When the G/S DDM selector switch is pointing down, the G/S VARIABLE DDM control is activated and can then be turned left and right of center to obtain G/S deviation of ±0.8 DDM.

32. LOC - G/S FREQUENCY SELECT SWITCH. This switch provides immediate selection of the G/S frequency that is paired to the selected or displayed LOC frequency. In LOC position, and when a LOC frequency has been selected or channeled, the LOC mode and modulation will be selected. In the G/S position, the G/S mode and modulation will be selected if a LOC-G/S paired frequency is channeled.

33. 90 Hz and 150 Hz TONE OFF INDICATORS. Each indicator is on when its respective tone is OFF. When either the LOC or G/S DDM selector switches are set to 150 or 90 Hz the opposite tone is deleted. The tone deleted is shown by one of the two indicator lamps. Both tones can be deleted at the same time which deletes all LOC or G/S tone output (except for Ident. tones and External Modulation).

Figure 3-2 Controls, Indicators, and Connectors (Sheet 6 of 8)



34. LOC VARIABLE DDM CONTROL. When the LOC DDM selector switch is pointing down, the LOC VARIABLE DDM control is activated and can be turned left and right of center to obtain LOC deviation of ±0.4 DDM.

35. G/S DDM SELECTOR SWITCH AND G/S MODE INDICATOR. The G/S DDM Selector Switch provides precise G/S deviations in 0.045, 0.091, 0.175, and 0.400 DDM increments. Right rotation of this selector switch attenuates the 90 Hz tone which simuates "Aircraft Low on G/S condition" and causes the Unit Under Test G/S pointer movement to be up. When the G/S DDM Selector Switch is positioned to either the 90 Hz or 150 Hz detents, only the selected tone is present and the other is off. In the downward position, the Variable DDM control is activated and G/S DDM may be continuously controlled from -0.8 to +0.8 DDM. The G/S Mode Indicator is on when the test set is in the G/S Mode of operation.

36. G/S CALIBRATION ADJUSTMENT (NAV-750/A). This screwdriver adjustment is used to precisely match the 90 Hz modulation level to the 150 Hz modulation level. This control should be moved only for centering adjustments during Calibration Procedures.

Figure 3-2 Controls, Indicators, and Connectors (Sheet 7 of 8)

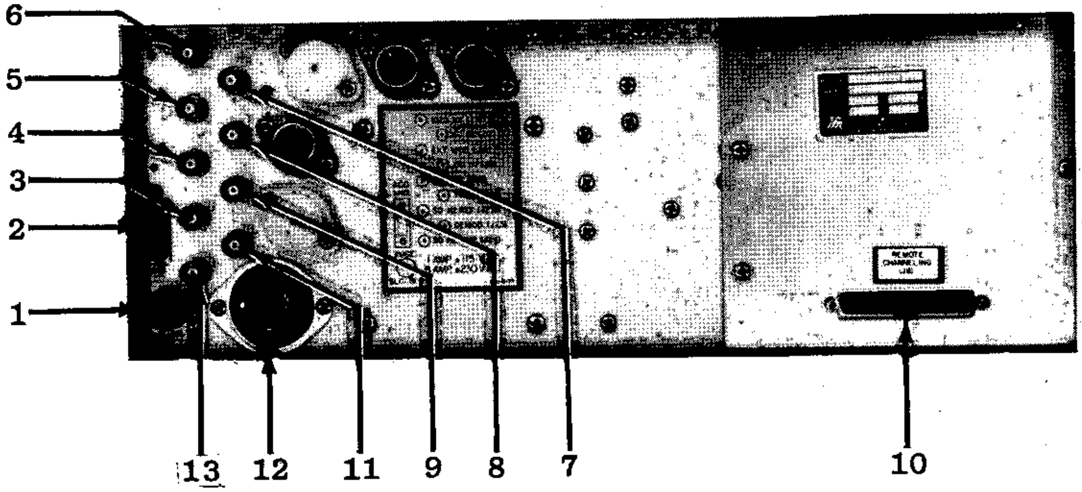
36A. G/S CALIBRATION ADJUSTMENT (NAV-750B). This screwdriver adjustment on the NAV-750B model test set is located behind the front panel, accessible only when the top panel is removed, and should be moved only for centering adjustments during Calibration Procedures. The G/S Calibration Adjustment is used to precisely match the 90 Hz modulation level to the 150 Hz modulation level.

37. LOC DDM SELECTOR SWITCH AND LOC MODE INDICATOR. The LOC DDM Selector Switch provides precise LOC deviations in 0.046, 0.093, 0.155, and 0.200 DDM increments. Right rotation of this selector switch attenuates the 150 Hz tone which simulates "Aircraft Left on LOC condition" and causes the unit under Test LOC pointer movement to the right. When the LOC DDM Selector Switch is positioned to either the 90 Hz or the 150 Hz detents, only the selected tone is present and the other is off. In the downward position, the Variable DDM control is activated and LOC DDM may be continuously controlled from -0.4 to +0.4 DDM. The LOC Mode Indicator is on when the test set is in the LOC MODE of operation.

38. LOC CALIBRATION ADJUSTMENT (NAV-750/A). This screwdriver adjustment is used to precisely match the 90 Hz modulation level to the 150 Hz modulation level. This control should be moved only for centering adjustments during Calibration Procedures.

38A. LOC CALIBRATION ADJUSTMENT (NAV-750B). This screwdriver adjustment on the NAV-750B model test set is located behind the front panel, accessible only when the top panel is removed, and should be moved only for centering adjustments during Calibration Procedures. The LOC Calibration Adjustment is used to precisely match the 90 Hz modulation level to the 150 Hz modulation level.

Figure 3-2 Controls, Indicators, and Connectors (Sheet 8 of 8)



1. AC LINE FUSE. Fuse receptacle for AC power input; 1.0A @ 115 VAC or 0.5A @ 230 VAC.

2. ACCESSORY CONNECTOR (J-10). Various inputs and outputs are available at this connector, such as: remote channeling input, power supply voltages, external modulation input, etc. (See Fig. 3-5 for detailed listing).

3. 30 Hz REFERENCE TONE OUTPUT (J-22). This jack makes the 30 Hz Reference Tone available for external use.

4. 9960 Hz TONE OUTPUT (J-20). This jack makes the 9960 Hz Tone available for external use. (Frequency Modulated at 30 Hz)

5. EXTERNAL MODULATION INPUT (J-18). External audio tones may be applied to this input to add modulation to any signal. (Input Impedance: 1k ohms nominal). NOTE: J-18 must be terminated with 100 ohms, or less, when External Modulation is not in use.

6. 1020 Hz IDENT TONE OUTPUT (J-16) (NAV-750 (A). This jack makes the 1020 Hz Tone available for external use.

7. 90 Hz TONE OUTPUT (J-17). This jack makes the 90 Hz Tone available for external use.

8. 150 Hz TONE OUTPUT (J-19). This jack makes the 150 Hz Tone available for external use.

Figure 3-3 Back Panel Connectors (Sheet 1 of 2)

9. SUM OF TONES OUTPUT (J-21). This jack makes available the sum of all tones for the mode in use. For example, in the VOR mode, the sum of all VOR tones are available at J-21 which can be used for testing VOR receiver accuracy.

10. REMOTE CHANNELING OUTPUT (J-8). This connector provides parallel BCD and ARINC 2 out of 5 code channeling information to remotely control a receiver to track the output frequency of the NAV-750 (See Figure 3-6 for J-8 pin connections).

11. RF DEMOD OUTPUT (J-23). The signal at this jack is the demodulated output signal. The RF signal is demodulated and applied to J-23. This output includes a dc offset of approximately 3.76 volts.

12. AC INPUT CONNECTOR. AC power is applied to this connector. For 230 VAC 50/60 Hz operation, on the primary windings of the power transformer must be rewired.

13. 30 Hz VARIABLE TONE OUTPUT (J-24). This jack makes the 30 Hz Variable Tone available for external use.

14. INTERNAL CONTROLS. All internal controls are provided for calibration only and none are useful for normal test set operation.

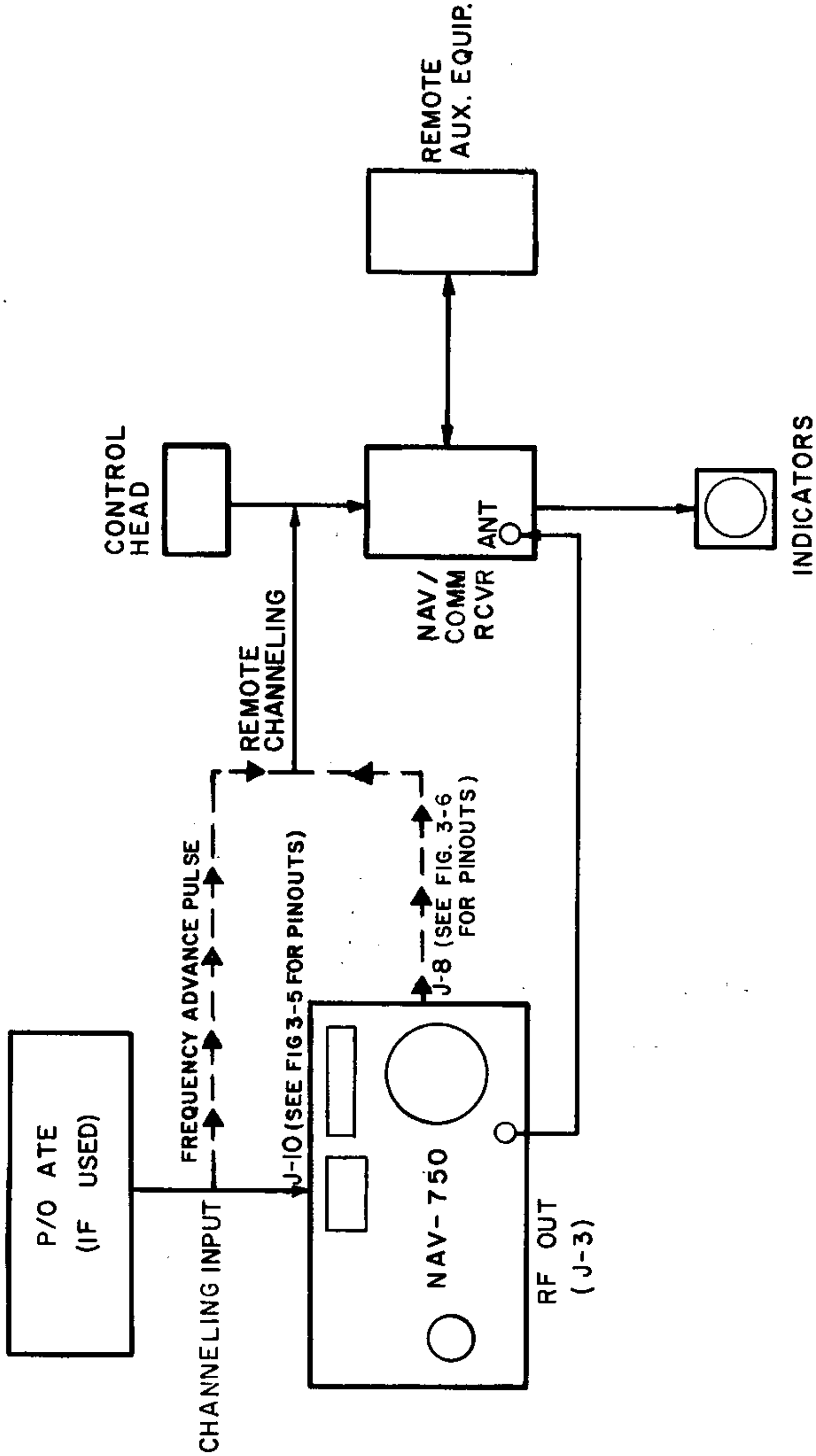
ΔF QUIETING MODE

(Effectivity: NAV-750/A S/N 525 & on, NAV-750B S/N 2044 & on)

When making receiver selectivity test with NAV-750 series test set in the ΔF Mode, it is sometimes advantageous to eliminate close-in low-level spurs caused by a beat frequency between the ΔF 10 MHz oscillator and the counter time base 10 MHz oscillator. Circuitry has been added to stop the counter time base oscillator under the following operator controlled conditions:

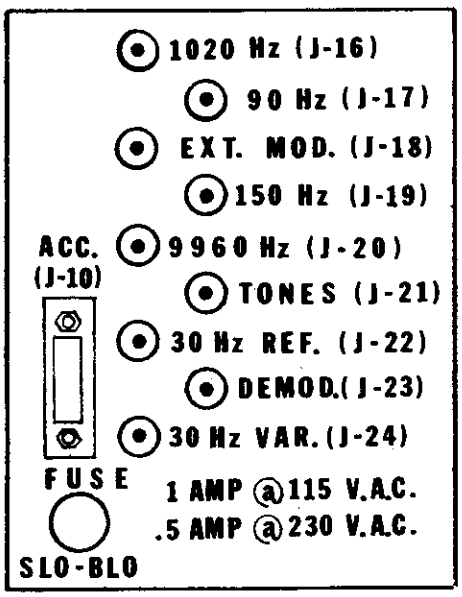
1. AUTO-MANUAL FREQUENCY CONTROL switch in MANUAL.
2. ΔF control out of detent (and indicator ON)
3. Then, when the MANUAL FREQUENCY STEP switch is pressed, the 10 MHz time base oscillator stops. Since the counter is referenced to the time base oscillator, the display will stop at the count before the STEP switch is pressed. While the STEP switch is pressed, the ΔF control may be used to increase or decrease the offset frequency. Then, when the STEP switch is released, the counter display will indicate the output frequency.

Figure 3-3 Back Panel Connectors (Sheet 2 of 2)



CONNECTIONS FOR VOR, LOC,
G/S OR COMM RECEIVER TESTING

Figure 3-4



List of Connections for Accessory Connector-J10

Pin	Function
1	+24 Volts Regulated Output
2	+12 Volts Regulated Output
3	+5 Volts Regulated Output
4	Ground
5	-12 Volts Regulated Output
6	Remote Channeling Input
7	Ground
8	Ground for external Clock Select
9	External Bearing Clock Input
10	1020Hz Tone Output
11	External Modulation Input
12	End of Channeling
13	NC
14	NC
15	NC
16	NC

Figure 3-5

3.7 NAV-750 SERIES BENCH TEST SET OPERATING PROCEDURES. The following paragraphs are intended to supplement the user's test procedures relating to specific equipment and demonstrate, to a large degree, the capability of the NAV-750 Series Bench Test Set. It is expected that the user will design and implement procedures and techniques which satisfy equipment and regulatory requirements. Therefore, the test procedures included in this section should not be considered binding or mandatory but should be used as guides for familiarization purposes. It is assumed that the operator is familiar with the controls, indicators, and connectors on the NAV-750. Control settings called out in the procedures are for the Test Set unless otherwise specified. It is also assumed that the Test Set and Unit Under Test (UUT) are turned on and stabilized.

3.7.1 OPERATING MODES AND TONE MODULATIONS. All NAV-750 Test Sets operate in VOR, LOCALIZER, GLIDE SLOPE, AND COMMUNICATION modes. The NAV-750B model includes a MARKER BEACON mode. Each mode in all models is chosen by selecting the appropriate carrier frequency. The Automatic Channeling feature of the NAV-750 allows receiver channeling in 25, 50, 100, or 200 kHz increments. While operating in the LOC mode, the appropriately paired G/S channel may be instantly selected by positioning the LOC-G/S switch to G/S.

3.7.1.1 In the VOR mode, the RF output is automatically modulated (with all modulation level controls in CAL position) with a standard VOR signal consisting of:

Tone	% Modulation
30 Hz Variable	30%
9960 Hz*	30%

* Frequency modulated at a deviation ratio of 16 by the 30 Hz Reference Tone.

3.7.1.2 In the LOC mode, the RF output is automatically modulated (with all modulation level controls in CAL position) with a standard LOC signal consisting of:

Tone	% Modulation
90 Hz	20%
150 Hz	20%

3.7.1.3 In the G/S mode, the RF output is automatically modulated (with all modulation level controls in CAL position) with a standard G/S signal consisting of:

Tone	% Modulation
90 Hz	40%
150 Hz	40%

3.7.1.4 In VOR, LOC, and G/S modes, the 1020 Hz Ident. tone may be added from 0 to 60% modulation by rotating the 1020 Hz Ident. level control clockwise.

3.7.1.5 In the COMM mode, the RF output is automatically modulated (with all modulation level controls in CAL position) with a 1020 Hz Ident signal at 30%.

3.7.1.6 (NAV-750B only) In the Marker Beacon mode, the RF output is modulated at 95% by a Mkr Bcn tone selected by the Meter Function and Tone Selector switch. When this switch is not positioned to a Mkr Bcn tone, the RF output (70 to 79.9 MHz) is automatically modulated with the 1020 Hz tone at 95%.

3.7.1.7 TONES AVAILABLE FOR SPECIAL TESTING. On the rear panel, each of the modulating tones is available for use in specialized receiver section tests. (See Figures 3-3 and 3-5). For example, when operating in the VOR mode, the Sum of Tones Output jack (J21) provides all tones necessary for checking VOR receiver bearing circuits without using the RF portion of the receiver. Individual tones are available at other jacks for similar purposes.

3.7.2 EQUIPMENT CONNECTIONS. Connections to a NAV-COMM receiver are shown in Figure 3-4. Only the antenna lead needs to be connected if remote channeling is not used. For remote channeling pin out connections to connector J-8, refer to Figure 3-6. Figure 3-6 also provides ARINC 2 out 5 code information available at J-8. The relay outputs provide ARINC 2/5 code and the transistors provide the parallel BCD code. A 37 position connector is supplied with the test set for use in constructing a remote channeling cable between J-8 of the NAV-750 and the unit under test. No further reference to equipment connections will be made in the paragraphs that follow. It will be assumed that the correct and necessary connections have been made to the Test Set and the unit under test.

3.7.3 INITIAL TEST SET CONTROL SETTINGS. Set NAV-750 controls and switches to positions listed below:

TO-FROM bearing switch	FROM
METER FUNCTION switch	0-100 or OFF
MASTER MOD level control	CAL
1020 Hz Ident. Tone Mod level control	CAL
9960 Hz FM Tone Mod level control	CAL
30 Hz Tone Mod. level control	CAL
.01-.05 Degree bearing select switch	.01
LOC DDM selector switch	0
LOC Variable DDM control	0
LOC-G/S Frequency selector switch	LOC
G/S DDM selector switch	0
G/S Variable DDM control	0
FREQUENCY selector switch	108.000 MHz
Channeling frequency increment selector switch	25 kHz
AUTO-MANUAL frequency control switch	MANUAL
CHANNELING rate control	ccw
ΔF control (variable RF control	ccw
BEARING-FREQ. display select switch	BEARING
Attenuator control	-120 dBm

3.7.3.1 At initial set-up, and after warm-up, verify NAV-750 Meter Zero and Bearing Error Circuitry as follows:

A) Set BEARING-FREQ selector switch to BEARING.
B) Set Meter Function Switch to ZERO and verify that display is 0°.
C) Press 90° VOR Bearing select pushbutton switch.
D) Adjust BEARING ZERO control to center meter needle.
E) Set TO/FROM switch to the TO position.
F) Set Meter Function Switch to BRG. Meter indication should remain at bearing zero (±0.05°).
G) Set TO/FROM switch to the FROM position. Meter indication should return to bearing zero (±0.05°).
H) Press 270° VOR Bearing select pushbutton switch. Meter indication should return to bearing zero (±0.05°).
I) Set TO/FROM switch to TO position. Meter indication should return to bearing zero (±0.05°).
J) Set Meter Function Switch to ZERO. Meter Indication should remain at Bearing zero. Readjust BEARING ZERO control if necessary.

3.8 VOR RECEIVER TESTS.

3.8.1 The NAV-750 Series Bench Test Set automatically produces a standard VOR test signal, variable in RF level from -120 dBm to -6 dBm (.224μV to 112,000μV into a 50 ohm load), whenever a VOR frequency is selected. The 30 Hz variable tone percentage of modulation may be varied from 0% to 60% with the 30 Hz Tone Modulation Level Control when this control is rotated out of the Cal. detent position. The 9960 Hz Tone (Freq. Modulated with the 30 Hz Ref. Tone) percentage of modulation can be varied in the same manner with the 9960 Hz Tone Modulation Control. The 1020 Hz Ident tone is normally off in VOR and may be added by rotating the 1020 Hz Modulation level control clockwise. The MASTER Modulation control will vary all tone percent modulation levels from 0% to 60% when rotated out of the Cal. detent position. VOR bearings may be selected using the 12 bearing pushbuttons, the + and -10 degree bearing pushbutton switches, or the Variable Bearing control. The generated bearing is displayed when the BEARING-FREQ. select switch is in the BEARING position. The NAV-750 Test Set will be used in subsequent VOR tests to provide the required test signals.

3.8.1.1 VOR Test Signal Definitions are as follows:

A. Standard VOR Test Signal: An RF VOR frequency, amplitude modulated simultaneously at 30% with a 9960 Hz subcarrier which is frequency modulated at a deviation ratio of 16 by 30 Hz Reference phase tone and, a 30 Hz Variable phase tone at 30% which is varied in phase with respect to the Reference phase tone. The RF level of the Standard VOR Test Signal is usually 1000μ Volts.

B. Standard Centering Signal: A Standard VOR Test Signal in which the difference in phase between the Reference and Variable phase 30 Hz tones is equal to the setting of the U.U.T. omni-bearing course selector.

C. Standard Deflection Signal: A Standard VOR Test Signal of 100μ Volts in which the difference in phase between the Reference and Variable phase 30 Hz tones is 10° from that which produces an on-course CDI indication.

3.8.2 VOR RECEIVER SYSTEM BEARING ACCURACY TESTS

DESCRIPTION: Using a Standard VOR Test Signal Generated by the NAV-750, this test determines the bearing accuracy of a VOR receiver system.

SPECIFICATIONS: Bearing accuracy of U.U.T should be within manufacturer's specifications. Check may include RMI indications as necessary.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . 1000µ Volts (-47 dBm)

   FREQUENCY . . . . 108.00 MHz or any VOR frequency

   All Tone Mod. Level Controls. . . . . CAL

   BEARING-FREQ. switch. . . . . BEARING

   TO-FROM switch. . . . . .FROM

   Meter Function Select Switch. 0-100

2. Press 0° VOR Bearing Select pushbutton.

3. On unit under test (U.U.T.), set omni-bearing selector to 0°.

4. CDI pointer on U.U.T. should be centered and ambiguity indicator should indicate FROM.

   Record CDI pointer error ___________

5. Set TO-FROM switch to TO.

6. U.U.T. ambiguity indicator should indicate TO and CDI pointer should be centered.

   Record CDI pointer error ___________

7. Repeat steps 2 through 6 for each 30° increment (using VOR Bearing Select pushbuttons) through 360°. (Smaller bearing increments are available using the + and -10° bearing pushbuttons and the Variable BEARING control).

3.8.2.1 VOR RECEIVER BEARING ACCURACY TEST WHILE VARYING 30 Hz VAR. TONE MODULATION ±5%.

DESCRIPTION: The bearing error caused by 30 Hz tone modulation fluctuation is determined in this test. All other VOR signal parameters remain at standard values.

SPECIFICATIONS: Bearing accuracy of U.U.T. should be as required by manufacturer. Check may include RMI indications as necessary.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . 1000µ Volts (-47 dBm)

   FREQUENCY . . . . 108.00 MHz or any VOR frequency

   All Tone Mod. Level Controls. . . . . CAL

   BEARING-FREQ. Switch. . . . . BEARING

   TO-FROM Switch. . . . . .FROM

   Meter Function Selector Switch. 0-100

2. Press 0° VOR Bearing Select pushbutton.
3. On U.U.T. , set omni-bearing selector to 0°.
4. CDI pointer on U.U.T. should be centered and ambiguity indicator should indicate FROM.
5. Note % modulation meter indication. (approx. 60%) Rotate 30 Hz Tone Modulation Level control clockwise until % modulation is restored to noted value. (approx. 60%).
6. Vary 30 Hz Tone Mod. Level ±5% Mod. by observing the Test signal % Mod. indication for a ±5% Modulation change.
7. Record CDI pointer error resulting from variation of 30 Hz Var. Tone Mod. level ____________.
8. Set TO-FROM switch to TO.
9. Repeat step 6.
10. Record CDI pointer error resulting from variation of 30 Hz Var. Tone Mod. level ____________.

(cont'd next page)

3.8.2.1 (cont'd)

11. Repeat steps 2 thru 10 for each 30° increment (or as required) through 360°.

12. Return 30 Hz tone Mod. level control to CAL.

3.8.2.1 VOR RECEIVER BEARING ACCURACY TEST WHILE VARYING RF FREQUENCY.

DESCRIPTION: The bearing error caused by carrier signal RF offset is determined in this test. All other signal parameters remain at standard values.

SPECIFICATIONS: As required by U.U.T. manufacturer's specifiations. Check may include RMI indications as necessary.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . 1000μ Volts (-47 dBm)

   FREQUENCY . . . . 108.00 MHz or any VOR frequency

   All Tone Mod. Level Controls. . . . . CAL

   BEARING-FREQ. Switch. . . . . .FREQ

   TO-FROM Switch. . . . . .FROM

   Meter Function Selector Switch. 0-100

2. Press 0° VOR Bearing Select pushbutton.

3. On U.U.T., set omni-bearing selector to 0°.

4. CDI pointer on U.U.T. should be centered and ambiguity indicator should indicate FROM.

5. Vary the ΔF control to offset carrier frequency between limits specified by the manufacturer and record resulting CDI pointer error. ______________.

6. Set TO-FROM switch to TO.

7. Repeat step 5 and record resulting CDI pointer error. ___________.

(cont'd next page)

3.8.2.1 (cont'd)

8. Repeat step 2 through 7 for each 30° increment (or as required) through 360°.

9. Return ΔF control to CAL.

3.8.2.3 VOR RECEIVER ACCURACY TEST WHILE VARYING THE RF SIGNAL LEVEL.

DESCRIPTION: The bearing error caused by RF signal level fluctuation is determined in this test. All other signal parameters remain at standard values.

SPECIFICATIONS: As required by U.U.T. manufacturer's specifications. Check may include RMI indications as necessary.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . 1000μ Volts (-47 dBm)

   FREQUENCY . . . . 108.00 MHz or any VOR Frequency

   All Tone Mod. Level Controls. . . . . CAL

   BEARING-FREQ Switch . . . . BEARING

   TO-FROM Switch. . . . . .FROM

   Meter Function Selector Switch. 0-100

2. Press 0° VOR Bearing Select pushbutton.

3. On U.U.T., set omni-bearing selector to 0°.

4. CDI pointer on U.U.T. should be centered and ambiguity indicator should indicate FROM.

5. Vary ATTENUATOR from 10μ Volts (-87 dBm) to 20,000μ Volts (-21 dBm) and record resulting CDI pointer error.________

6. Set TO-FROM switch to TO.

7. Repeat step 5 and record resulting CDI pointer error.________

8. Repeat steps 2 through 7 for each 30° increment (or as required) through 360°.

3.8.2.4 Additional checks can be made which may cause variation in Bearing Accuracy of a VOR receiver such as:

A. Environmental Conditions.
B. Power input voltage variations.
C. Power Supply frequency variations.

NOTE: Tones may be injected via the Ext. Mod. input on the rear panel for tests which may require a variable tone frequency.

3.8.3 VOR COURSE DEVIATION INDICATOR (CDI) TESTS.

DESCRIPTION: The tests in this paragraph use Standard VOR Test signals to check CDI pointer deflection sensitivity, response and linearity characteristics. Additional equipment required is a stop watch for response time measurement and a means of determining CDI pointer deflection amount, such as a small ruler.

PROCEDURE:

CDI POINTER DEFLECTION SENSITIVITY TEST.

1. Set controls as follows:

ATTENUATOR. . . . . .100µ Volts (-67 dBm)

FREQUENCY . . . . 108.00 MHz or any VOR Frequency

All Tone Mod. Level Controls. . . . . CAL

BEARING-FREQ. Switch. . . . . BEARING

TO-FROM Switch. . . . . .FROM

Meter Function Selector Switch. 0-100

2. Press 0° VOR Bearing select pushbutton.

3. Select 0° on U.U.T. omni-bearing selector.

4. Use Variable Bearing control to obtain on-course (FROM) indication on U.U.T. CDI. (CDI pointer exactly centered).

5. Increase Test Signal Bearing 10° by pressing the +10° Bearing pushbutton switch once and verify that DISPLAY indicates a 10° Bearing increase.

(cont'd next page)

3.8.3 (Cont'd)

6. Measure the amount of CDI pointer deflection. ____________

7. Vary the ATTENUATOR from 10μ Volts (-87 dBm) to 20,000μ Volts (-21 dBm) and record any CDI pointer variation.

____

8. Decrease Test Signal Bearing to -10 from on-course by pressing -10° pushbutton 2 times. Verify that DISPLAY indicates a -20° change.

9. Measure the amount of CDI pointer deflection. ____________

10. Repeat step 7 and record any CDI pointer variation.

____

11. Compare results of step 6, 7, 9, and 10 with U.U.T. manufacturer's specifications.

CDI POINTER RESPONSE TIME TEST

12. Set ATTENUATOR to 100μ Volts (-67 dBm).

13. Press +10° VOR Bearing Select pushbutton to obtain an on-course CDI indication.

14. Press +10° Bearing pushbutton and determine with a stopwatch the time required for the CDI pointer to deflect 70% of its maximum deflection.

____

15. Repeat Step 14 for -10° from on-course. ____________

16. Compare results of steps 14 and 15 with manufacturer's specifications.

CDI POINTER LINEARITY TEST.

17. Press 0° VOR Bearing Select pushbutton and adjust Variable Bearing Control to obtain on-course (FROM) indication on U.U.T. CDI.

18. Increase VOR Test Signal Bearing in 2° increments up to 10° by rotating Variable Bearing control clockwise. Measure the CDI pointer 2° increments. Increments should be equal. ____________(✓)

19. Repeat step 18 in -2° increments up to -10°. Measure CDI pointer 2° increments.

____________(✓)

(cont'd next page)

3.8.3 (cont'd)

20. Press 0° VOR Bearing Select pushbutton.

3.8.3.1 CDI AMBIGUITY (TO-FROM) INDICATION TEST.

DESCRIPTION: Using a Standard VOR Signal, this test checks operation of the ambiguity indicator by varying the test signal bearing ±60 from on-course indication.

SPECIFICATION: The "TO-FROM" indicator will indicate a clear and appropriate "TO" or "FROM" indication as test signal bearing is changed ±60°.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . 1000μ Volts (-47 dBm)

   FREQUENCY . . . . . . 108.00 MHz or any VOR Frequency

   All Tone Mod. Level Controls. . . . . CAL

   BEARING-FREQ. Switch. . . . . BEARING

   Meter Function Selector Switch. 0-100

   TO-FROM Switch. . . . . .FROM

2. Select a test signal on NAV-750 that results in an on-course "FROM" CDI indication on U.U.T. CDI.

3. Using the Variable Bearing control, change the Test Signal Bearing +60° and -60° from on-course. TO-FROM indication should remain a clear "FROM". __________

4. Set TO-FROM switch to TO and repeat step 3. TO-FROM indication should remain a clear "TO". __________

5. Repeat 2, 3, and 4 at various ATTENUATOR settings between 10μ Volts (-87 dBm) and 20,000μ Volts (-21 dBm).

3.8.3.2 CDI ALARM SIGNAL TEST (WARNING FLAG)

DESCRIPTION: This test checks the operation of the alarm system under various signal conditions.

(cont'd next page)

3.8.3.2 (cont'd)

SPECIFICATIONS: Alarm should appear when VOR signal is unreliable or missing in whole or in part but should be "out of sight" or OFF when VOR signal is reliable.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . .100µ Volts (-67 dBm)

   FREQUENCY . . . . 108.00 MHz or any VOR Frequency

   All Tone Mod. Level Controls. . . . . CAL

   BEARING-FREQ. Switch. . . . . BEARING

   TO-FROM Switch. .FROM

   Meter Function Selector Switch. 0-100

NORMAL SIGNAL

2. Verify that U.U.T. Alarm Signal (Warning Flag) is out of sight or OFF.

   __________(✓)

NORMAL SIGNAL, FLUCTUATING RF

3. Vary ATTENUATOR from 10µ Volts (-87 dBm) to 20,000µ Volts (-21 dBm) and verify that Alarm Signal (Warning Flag) is OFF or out of sight.

   __________(✓)

SIGNAL ABSENT

4. Set ATTENUATOR to -112 dBm and disconnect RF output connector from U.U.T.. Verify that Alarm Signal or Warning Flag is visible.

   __________(✓)

MISSING 9960 Hz TONE

5. Reconnect RF connector to U.U.T. and set ATTENUATOR to 100µ Volts (-67 dBm). Alarm Signal should be OFF or Warning Flag should be out of sight.

   __________(✓)

6. Set 9960 Hz Tone Mod. Level control to UNCAL 0 (full ccw & out of detent). Alarm Signal or Warning Flag should be visible.

   __________(✓)

(cont'd next page)

3.8.3.2 (cont'd)

7. Vary ATTENUATOR from 10µ Volts (-87 dBm) to 20,000µ Volts (-21 dBm). Alarm Signal or Warning Flag should remain visible.

__________(✓)

MISSING 30 Hz TONE

8. Return 9960 Hz Tone control to CAL position.

9. Set 30 Hz Tone Mod. Level control to UNCAL 0 (full ccw & out of detent). Alarm Signal or Warning Flag should be visible.

__________(✓)

10. Vary ATTENUATOR from 10µ Volts (-87 dBm) to 20,000µ Volts (-21 dBm). Alarm Signal or Warning Flag should remain visible.

__________(✓)

MARGINAL SIGNAL STRENGTH

11. Return 30 Hz Tone control to CAL position.

12. Set ATTENUATOR to 100µ Volts (-67 dBm).

13. Set omni-bearing selector of U.U.T. to 0° FROM.

14. Press 0° VOR Bearing Selector pushbutton. If necessary, use Variable Bearing control to center CDI pointer.

15. Press +10° VOR Bearing Selector pushbutton. Verify that CDI pointer is deflected for 10° course deviation.

__________(✓)

16. Decrease ATTENUATOR setting to obtain 50% of CDI pointer deflection noted in step 15. The Warning Flag of U.U.T. should just begin to appear or "enter" the alarm condition.

__________(✓)

17. NOTE: The µ Volt indication on the ATTENUATOR dial in Step 17 is the receiver sensitivity in µ Volts.

3.8.4 VOR RECEIVER SENSITIVITY TEST

DESCRIPTION: This test determines the VOR receiver sensitivity in μ Volts. Receiver sensitivity is the minimum RF level in μ Volts of a standard VOR Test Signal required to produce 50% of Standard Deflection of the CDI pointer. (Standard Deflection is produced by a Standard VOR signal at 100μ Volts with the 30 Hz Var. Tone shifted 10° in phase from the selected U.U.T. omni-bearing selector setting.)

SPECIFICATIONS: As stipulated in the manufacturer's specifications.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . .100μ Volts (-67 dBm)

   FREQUENCY . . . . 108.00 MHz or any VOR frequency

   All Tone Mod. Level Controls. . . . . CAL

   BEARING-FREQ. Switch. . . . . BEARING

   TO-FROM Switch. . . . . .FROM

   Meter Function Selector Switch. 0-100

2. Using bearing select switches and/or Variable Bearing control, adjust test signal bearing to produce an on-course (FROM) indication on U.U.T. CDI.

3. Press + or - 10° bearing select pushbutton to obtain Standard Deflection signal. Verify that Bearing Display has changed 10° and U.U.T. CDI pointer is deflected appropriately (Standard Deflection).

4. Adjust ATTENUATOR to decrease signal strength until deflection of CDI pointer is 50% of Standard Deflection.

5. From ATTENUATOR dial and Correspondence Chart (Table 3-1), determine receiver sensitivity in μ Volts. ___________

6. Repeat steps 4 and 5 as necessary for each VOR channel. (This procedure may be combined with the Automatic Channeling test to accelerate individual channel Receiver Sensitivity checks).

3.9 AUTOMATIC FREQUENCY CHANNELING TEST

3.9.1 A VHF NAV-COMM receiver can be automatically channeled, up in frequency only, by the NAV-750 Bench Test Set. The frequency increment is selected with the CHANNELING Frequency Increment selector switch (25, 50, 100, and 200 kHz) according to NAV-COMM receiver channel spacing. By placing the AUTO-MANUAL Frequency control switch in the AUTO position and rotating the CHANNELING rate control clockwise, the operator can select a convenient channeling rate from 0 to a maximum of about 4 advances per second. An audio tone announces each incremental advance and the display will indicate the RF output frequency if the BEARING-FREQ switch is positioned to FREQ. In the interest of saving time, this procedure may be combined with another, such as the Receiver Sensitivity Test. It is a simple matter to set the controls on one channel for minimum requirements and then use AUTO-CHANNELING while checking each channel for specific minimums.

3.9.2 NAV-COMM AUTO-CHANNELING TEST

DESCRIPTION: This test checks the channeling capability of the U.U.T..

NOTE

The NAV-750 AUTO-CHANNELING system is designed to stop automatically at 117.950, 135.975, and 157.950 MHz. To continue channeling when stopped at 117.950 and 135.975 MHz, place the AUTO-MANUAL selector switch to MANUAL and select the frequency of the next channel manually on the FREQUENCY selector switches. Then, when the AUTO-MANUAL switch is returned to AUTO, channeling will continue from the manually selected frequency.

PROCEDURE:

1. Set controls as follows:

   FREQUENCY. . . . . To lowest VOR, LOC, or COMM. frequency to match U.U.T. starting frequency

   ATTENUATOR . . . . As required

(cont'd next page)

3.9.2 (cont'd)

Tone Mod. Level Controls . . . . . As required or CAL

BEARING-FREQ. Switch . . . . .FREQ.

TO-FROM. As required

Meter Function Selector Switch 0-100

2. Rotate CHANNELING control to full counterclockwise.

3. Set AUTO-MANUAL frequency selector switch to AUTO.

4. Rotate CHANNELING control clockwise to set desired channeling rate.

5. Observe that output of U.U.T. is appropriate for input signal from test at each channel.

__________(✓)

6. Channeling can be stopped at any time by rotating CHANNELING control to full counterclockwise position.

7. At completion of test, rotate CHANNEL control to full counterclockwise position and place AUTO-MANUAL switch to MANUAL.

3.10 ILS LOCALIZER RECEIVER TESTS

3.10.1 In the LOC mode when LOC mode indicator is ON, the NAV-750 Series Bench Test Set produces a variable RF output signal from -120 dBm to -6 dBm in the 108.0 to 112 MHz band. The RF is modulated simultaneously with 90 Hz and 150 Hz tones at 20% each. Specific depth of modulation relationships between these tone is available with the LOC DDM selector switch. Continuously variably DDM control is available with the DDM control below the DDM selector switch. Right rotation of the LOC DDM switch or control will result in right deflection of the CDI pointer and left deflection with left control or switch rotation.

3.10.1.2 LOC Test Signal Definitions are as follows:

A. Standard Localizer Test Signal: An RF carrier amplitude modulated simultaneously with 90 and 150 Hz tones so that the sum of their separate modulation percentages equals 40±2%.

(cont'd next page)

3.10.1.2 (cont'd)

B. Standard Localizer Centering Signal: A Standard Localizer Test Signal in which the difference in depth of modulation (DDM) of the 90 and 150 Hz tones is less than 0.002 (0.1 dB) and CDI pointer is centered.

C. Standard Localizer Deviation Signal: A Standard Localizer Test Signal in which the difference in depth of modulation (DDM) of the 90 and 150 Hz tones is 0.093 (4 dB). In the case of indicators in which the deflection from center to full scale is linear, standard deflection of the CDI pointer is 60% (90 μ Amps) of full scale deflection.

3.10.1.3 Difference in Depth of Modulation (DDM) Definition: Difference in depth of modulation is the percentage modulation depth of the larger tone (90 or 150 Hz) minus the percentage modulation depth of the smaller tone divided by 100.

3.10.1.4 In the LOC mode, the 1020 Hz Ident. tone is not added automatically and, when required, must be added from 0 to 60% modulation by rotating the 1020 Hz modulation level control clockwise.

3.10.2 LOC CENTERING ACCURACY TEST

DESCRIPTION: This test checks the centering accuracy of the U.U.T. under the following signal conditions:

A. Standard Centering Signal.

B. Standard Centering Signal with carrier level variation.

C. Standard Centering Signal with carrier frequency variation.

D. Standard Centering Signal with simultaneous variation of 90 and 150 Hz Tone Modulation Percentages.

E. Standard centering signal with variation of 90 and 150 Hz TONE PHASE RELATIONSHIP with Ident. Tone Added.

(cont'd next page)

3.10.2 (cont'd)

SPECIFICATIONS: U.U.T. centering error limits shall be as specified in manufacturer's specifications. (Centering error is usually expressed in percentage of standard deflection).

PROCEDURE:

1. Set controls as follows for Standard Centering Signal Conditions:

   ATTENUATOR. . . . . 1000μ Volts (-47 dBm)

   FREQUENCY . . . . . .108.100 MHz or any LOC Frequency

   BEARING-FREQ Selector Switch. . . . . .FREQ

   LOC-G/S Switch. . . . . LOC

   LOC DDM Selector Switch 0

   G/S DDM Selector Switch 0

   Meter Function Selector Switch. 0-100

   All Tone Mod. Level Controls. . . . . CAL

2. If required, substitute a high accuracy (±1%) deviation meter for the LOC deviation pointer.

STANDARD LOC CENTERING SIGNAL

3. CDI LOC deviation pointer should be centered. Record centering error in μ Amps or pointer deflection.

   __________(✓)

CARRIER LEVEL VARIATION

4. Vary the signal carrier level from 50μ Volts (-73 dBm) to 10,000μ Volts (-27 dBm) with the ATTENUATOR.

5. Record centering error due to carrier level variation in μ Amps or pointer deflection.

   __________(✓)

CARRIER FREQUENCY VARIATION

6. Set ATTENUATOR to 1000μ Volts (-47 dBm).

7. Using the ΔF control, vary the carrier frequency ±9 kHz and note CDI pointer variation.

(cont'd next page)

3.10.2 (cont'd)

8. Record maximum centering error due to carrier frequency variation in μ Amps or pointer deflection.

____

9. Repeat steps 7 and 8 for each LOC frequency.

10. Return ΔF control to CAL position.

SIMULTANEOUS VARIATION OF 90 AND 150 Hz TONE MODULATION PERCENTAGES.

11. Note panel meter normal modulation indication. Using the MASTER MOD control, vary the total modulation level 4% Mod. above and below normal modulation level.

12. Record centering error due to modulation variation in μ Amps or pointer deflection.

____

VARIATION OF 90 AND 150 Hz TONE PHASE RELATIONSHIP (±12° of COMMON 30 Hz SUBHARMONIC) With Ident. Tone Added.

13. Add 30% 1020 Hz tone modulation as follows:

    A. Set G/S DDM switch to 150 Hz.

    B. Set LOC DDM switch to 90 Hz.

    C. Note that Mod. meter now indicates 0% modulation.

    D. Rotate 1020 Hz tone Mod. control clockwise until meter indicates 30% modulation.

    E. Return G/S and LOC DDM switches to 0.

14. Set BEARING-FREQ. switch to BEARING.

15. Press 0° VOR Bearing select pushbutton and verify that display is 0.00°.

16. Rotate variable BEARING control clockwise until display is 12.00°.

17. Press Ø pushbutton. Note centering error and release Ø pushbutton.

18. Record centering error, due to tone phase shift, in pointer deflection or μ Amps.

____

(cont'd next page)

3.10.2 (cont'd)

19. Rotate Variable BEARING control counterclockwise until display is 348.00°.

20. Press Ø pushbutton. Note centering error and release Ø pushbutton.

21. Record centering error, due to tone phase shift, in pointer deflection or μ Amps.

____

22. Return 1020 Hz tone control to CAL position.

23. Press 0° VOR Bearing select pushbutton.

24. Additional LOC Centering Accuracy Tests may be performed which may cause LOC centering errors, such as:

    A. Environmental conditions.

    B. Power input voltage variations.

    C. Power supply frequency variations.

3.10.3 LOC CDI DEFLECTION AGC CHARACTERISTICS and DEFLECTION BALANCE TEST

DESCRIPTION: This test determines the effect of RF input variation on Standard Deviation signal indication.

SPECIFICATION: Deflection caused by RF level variation from 50 to 10,000μ Volts should not be more than ±20% of Standard Deflection.

PROCEDURE:

1. Set controls as follows:

    FREQUENCY. . . . . . . 108.100 MHz or any LOC frequency

    ATTENUATOR . . . . .1000μ Volts (-47 dBm)

    G/S DDM Selector Switch. 0

    LOC DDM Selector Switch. 0

    LOC-G/S Switch . . . . .LOC

(cont'd next page)

3.10.3 (cont'd)

Meter Function Selector Switch. 0-100

All Tone Mod. Level Controls. . . . . .CAL

2. If required, substitute a high accuracy (±1%) deviation meter for the LOC deviation pointer.

3. Set LOC DDM selector switch to Left 0.155 DDM. Verify CDI pointer deflection to be left full scale (150μ Amps).

__________(✓)

4. Repeat step 3 for Right 0.155 DDM and verify that deflection amount is equal to step 3.

__________(✓)

5. Set LOC DDM selector switch to 0 and verify that U.U.T. CDI pointer is centered.

6. Set LOC DDM selector switch to Left 0.093 DDM.

7. U.U.T. CDI pointer should position to Left Standard Deflection (60% of full scale and 90μ Amps).

__________(✓)

8. Vary ATTENUATOR from 50μ Volts (-73 dBm) to 10,000μ Volts (-27 dBm) and note CDI pointer variation.

9. Record effect of RF level variation on CDI pointer deflection in μ Amps or % of Standard Deflection.

__________(✓)

10. Repeat steps 7 through 10 for Right 0.093 DDM.

11. Return LOC DDM Selector switch to 0.

3.10.4 LOC RF SENSITIVITY TEST

DESCRIPTION: This test determines the LOC RF sensitivity in μ Volts. RF sensitivity is the minimum RF signal input level required of a Standard Localizer Deviation Signal to produce at least 60% of Standard Deflection. This test should be made on each available channel.

SPECIFICATION: RF Sensitivity should be 30μ Volts, or better.

(cont'd next page)

3.10.4 (Cont'd)

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . 1000μ Volts (-47 dBm)

   FREQUENCY . . . . . . 108.10 MHz or any LOC frequency

   All Tone Mod. Level Controls. . . . . CAL

   LOC-G/S Switch. . . . . LOC

   BEARING-FREQ Switch . . . . .FREQ

   Meter Function Selector Switch. 0-100

   G/S DDM Selector Switch 0

   LOC DDM Selector Switch 0

2. Verify that U.U.T. CDI pointer is centered.

3. Set LOC DDM selector switch to Left (or Right) 0.093 DDM and verify that U.U.T. CDI pointer is deflected 60% of full scale (90μ Amps).

   __________(✓)

4. Reduce RF input signal level with ATTENUATOR until U.U.T. CDI pointer deflection is 60% of Standard Deflection (result of step 3).

5. From ATTENUATOR dial and correspondence chart (Table 3-1), determine LOC RF sensitivity.

   __________μ Volts

6. Repeat steps 4 and 5 for each LOC channel.

3.10.5 LOC WARNING SIGNAL TEST

DESCRIPTION: This test checks the operation of the alarm system under various signal conditions.

SPECIFICATIONS: Alarm should appear when LOC signal is unreliable or missing in whole or in part but should be "out of sight" or OFF when LOC signal is reliable.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . .100µ Volts (-67 dBm)

   FREQUENCY . . . . . . 108.10 MHz or any LOC frequency

   All Tone Mod. Level Controls. . . . . CAL

   BEARING-FREQ. switch. . . . . FREQ.

   LOC-G/S Switch. . . . . LOC

   Meter Function Selector Switch. 0-100

   G/S DDM Selector Switch 0

   LOC DDM Selector Switch 0

NORMAL SIGNAL

2. Verify that U.U.T. Alarm Signal is OFF or (Warning Flag) out of sight.

   __________(✓)

NORMAL SIGNAL, FLUCTUATING RF

3. Vary ATTENUATOR from 30µ Volts (-77 dBm) to 10,000µ Volts (-27 dBm) and verify that Alarm Signal is OFF or (Warning Flag) out of sight.

   __________(✓)

RF SIGNAL ABSENT

4. Set ATTENUATOR to -112 dBm and disconnect RF output connector from U.U.T.. Verify that Alarm Signal or Warning Flag is visible.

   __________(✓)

MISSING 90 or 150 Hz TONES

5. Reconnect RF connector to U.U.T. and set ATTENUATOR to 100µ Volts (-67 dBm). Verify that Alarm Signal is OFF or Warning Flag is out of sight.

(cont'd next page)

3.10.5 (cont'd)

6. Set G/S DDM selector switch to 150 Hz. Alarm Signal or Warning Flag should be visible.
__________(✓)

7. Set G/S DDM selector switch to 90 Hz. Alarm Signal or Warning Flag should be visible.
__________(✓)

MISSING 90 AND 150 Hz TONES

8. Set LOC DDM selector switch to 150 Hz and verify that G/S DDM selector switch is set to 90 Hz. Alarm Signal or Warning Flag should be visible.
__________(✓)

MARGINAL LOC SIGNAL STRENGTH (STANDARD LOC DEVIATION SIGNAL PRODUCING 50% OF STANDARD DEFLECTION)

9. Set controls as follows to produce standard LOC Deviation Signal:

   ATTENUATOR. . . . . 1000μ Volts (-47 dBm)

   All Tone Mod. Controls. . . . . CAL

   LOC-G/S Switch. . . . . LOC

   G/S DDM Switch. 0

   LOC DDM Switch. . . . . . . (Left or Right) 0.093 DDM

10. Verify that U.U.T. CDI pointer is at standard deflection (60% of full scale).

11. Reduce RF signal level with ATTENUATOR until U.U.T. CDI pointer is deflected 50% of standard deflection. Alarm Signal or Warning Flag should be visible.
__________(✓)

3.10.6 ILS LOC COURSE DEVIATION INDICATION.

DESCRIPTION: This test checks the U.U.T. CDI pointer deflection with precise DDM tone inputs. (A precision meter (±1%) may be substituted for the U.U.T. CDI LOC pointer movement to check receiver circuitry or deflection current).

SPECIFICATIONS: As stipulated in the U.U.T. manufacturer's specifications.

(cont'd next page)

3.10.6 (cont'd)

PROCEDURE:

1. Set controls as follows for Standard Centering Signal:

   FREQUENCY. . . . . . . .108.10 MHz or any LOC frequency

   ATTENUATOR . . . . .1000µ Volts (-47 dBm)

   All Tone Mod. Controls . . . . .CAL

   LOC-G/S Switch . . . . .LOC

   G/S DDM Switch .0

   LOC DDM Switch .0

   BEARING-FREQ. Switch . . . . .FREQ.

2. Verify that U.U.T. CDI LOC pointer is centered.

CDI LOC DEFLECTION RESPONSE AT 0.155 DDM.

3. Set LOC DDM selector switch to Left 0.155 DDM. U.U.T. CDI pointer should reach 67% of full scale deflection within 2 seconds and then stop at full scale (150µ Amps). (Pointer overshoot should not exceed 5% of full scale deflection).

   ___________(✓)

4. Set LOC DDM selector switch to Right 0.155 DDM. U.U.T. CDI pointer should reach 67% of full scale deflection within 2 seconds and then stop at full scale (150µ Amps). (Pointer overshoot should not exceed 5% of full scale deflection).

   ___________(✓)

CDI LOC DEFLECTION AT 0.200 DDM

5. Set LOC DDM selector switch to Right 0.200 DDM and check that pointer deflection does not decrease from full scale.

   ___________(✓)

6. Set LOC DDM selector switch to Left 0.200 DDM and check that pointer deflection does not decrease from full scale.

   ___________(✓)

(cont'd next page)

3.10.6 (cont'd)

CDI LOC DEFLECTION AT 0.093 DDM

7. Set LOC DDM selector switch to Left 0.093 DDM and check that pointer deflection is Left Standard (90μ Amps).

__________(✓)

8. Set LOC DDM selector switch to Right 0.093 DDM and check that pointer deflection is Right Standard (90μ Amps).

__________(✓)

CDI LOC DEFLECTION AT 0.046 DDM

9. Set LOC DDM selector switch to Right 0.046 DDM and check that pointer deflection is Right Half Standard (45μ Amps).

__________(✓)

10. Set LOC DDM selector switch to Left 0.046 DDM and check that pointer deflection is Left Half Standard (45μ Amps).

__________(✓)

11. Return LOC DDM selector switch to 0. CDI pointer should be centered (0μ Amps).

__________(✓)

3.10.7 Other conditions which may be used in the foregoing tests are as follows:

A. Environmental Conditions.

B. Power Input Variations.

C. Power Supply Frequency Variations.

NOTE: Tones may be injected via the ext. Mod. input on the rear panel for tests which require special tone quality or frequency. Outputs of all tones are also available at the rear panel for specialized tests.

3.11 ILS GLIDE SLOPE SYSTEM TESTS.

3.11.1 The NAV-750 Bench Test Set automatically provides a standard Glide Slope signal, variable in RF level from -120 dBm to -6 dBm (in the 330 MHz band) (.224 to 112,000μ Volts into a 50 ohm load), whenever a G/S frequency is selected. The G/S frequency may be selected with either the FREQUENCY selector switches or by placing the LOC-G/S switch to G/S. When operating in the LOC mode, this switch automatically provides the paired G/S frequency for the selected LOC channel. As in the LOC mode, the RF is modulated with 90 Hz and 150 Hz tones. Tone Modulation is at 40% for each tone. Specific depth of modulation relationships between these tones is available with G/S DDM left and right switch positions which correspond to down and up U.U.T. CDI G/S pointer deflections.

3.11.1.2 G/S Test Signal Definitions are as follows:

A. Standard G/S Test Signal: An RF signal carrier amplitude modulated simultaneously with 90 and 150 Hz tones each modulated at 40%.

B. Standard Glide Slope Centering Signal. A Standard G/S Test Signal in which the depth of modulation of the 90 Hz and 150 Hz tones is equal (less than 0.002 DDM).

C. Standard Glide Slope Deviation Signal. A Standard G/S signal Test Signal in which the difference in depth of modulation of the 90 Hz and 150 Hz tones is 0.091 DDM.

3.11.1.3 Difference in Depth of Modulation (DDM) definition: Difference in Depth of Modulation (DDM) is the percentage modulation depth of the larger tone (90 or 150 Hz) minus the percentage modulation depth of the smaller tone, divided by 100.

3.11.1.4 In the G/S mode, the 1020 Hz Ident. tone is not added automatically but may be added from 0 to 60% modulation by rotating the 1020 Hz modulation level control clockwise.

3.11.2 G/S CENTERING ACCURACY TEST

DESCRIPTION: This test check the centering accuracy of the U.U.T. under the following signal conditions:

A. Standard G/S Centering Signal.

B. Standard Centering Signal with Carrier Level Variation.

C. Standard Centering Signal with Carrier Frequency Variation.

D. Standard Centering Signal with Simultaneous Variation of 90 and 150 Hz Tone Modulation Percentages.

E. Standard Centering Signal with Variation of 90 and 150 Hz Tone Phase Relationship with Ident. Tone added.

SPECIFICATIONS: U.U.T. centering error limits shall be as specified in manufacturer's specifications. (Centering error is usually expressed in percentage of Standard Deflection.

PROCEDURE:

1. Set controls as follows:

ATTENUATOR. . . . . .700μ Volts (-50 dBm)

FREQUENCY . . . . .108.10 MHz (LOC Frequency)

BEARING-FREQ Selector Switch. . . . . FREQ.

LOC DDM Selector Switch 0

G/S DDM Selector Switch 0

Meter Function Selector Switch. 0-100

All Tone Mod. Level Controls. . . . . CAL

LOC-G/S Switch. . . . . G/S

(Display should indicate paired G/S frequency of 334.70 MHz for LOC frequency of 108.10 MHz)

(cont'd next page)

3.11.2 (cont'd)

2. Selection of G/S frequencies can be performed one of two ways:

   A. Select a LOC frequency on FREQUENCY switches and obtain its paired G/S frequency by positioning the LOC-G/S switch to G/S. Display will be the RF output.

   B. Select G/S frequency directly using the FREQUENCY switches.

   C. NOTE: This procedure suggests using method A.

   D. A listing of LOC and G/S paired frequency is listed for convenient reference:

LOC	G/S	LOC	G/S
108.10	334.70	110.10	334.40
108.15	334.55	110.15	334.25
108.30	334.10	110.30	335.00
108.35	333.95	110.35	334.85
108.50	329.90	110.50	329.60
108.55	329.75	110.55	329.45
108.70	330.50	110.70	330.20
108.75	330.35	110.75	330.05
108.90	329.30	110.90	330.80
108.95	329.15	110.95	330.65
109.10	331.40	111.10	331.70
109.15	331.25	111.15	331.55
109.30	332.00	111.30	332.30
109.35	331.85	111.35	332.15
109.50	332.60	111.50	332.90
109.55	332.45	111.55	332.75
109.70	333.20	111.70	333.50
109.75	333.05	111.75	333.35
109.90	333.80	111.90	331.10
109.95	333.65	111.95	330.90

3. If required, substitute a high accuracy (±1%) deviation meter for the G/S deviation pointer.

(cont'd next page)

3.11.2 (cont'd)

STANDARD G/S CENTERING SIGNAL.

4. CDI G/S deviation pointer should be centered. Record centering error in μ Amps or pointer deflection.

____

CARRIER LEVEL VARIATION.

5. Vary the signal carrier level from 100μ Volts (-67 dBm) to 10,000μ Volts (-27 dBm) with the ATTENUATOR.

6. Record centering error due to carrier level variation in μ Amps or pointer deflection.

____

CARRIER FREQUENCY VARIATION

7. Set ATTENUATOR to 700μ Volts (-50 dBm)

8. Using the ΔF control, vary the carrier frequency ±21 kHz and note G/S pointer variation.

9. Record maximum centering error due to carrier frequency variation in μ Amps or pointer deflection.

____

10. Repeat steps 8 and 9 for each G/S channel. G/S channel selection may be made manually with the FREQUENCY selector switch or by selecting LOC frequencies and obtaining the paired G/S frequency by operating the LOC-G/S switch.

11. Return ΔF control to CAL position.

SIMULTANEOUS VARIATION OF 90 AND 150 Hz TONE MODULATION PERCENTAGES.

12. Note panel meter normal modulation indication. Using MASTER MOD. control, vary the total modulation level 5% Mod. above and below normal modulation level.

13. Record centering error due to modulation variation in μ Amps or pointer deflection.

____

VARIATION OF 90 AND 150 Hz TONE PHASE RELATIONSHIP (±12° of COMMON 30 Hz SUBCARRIER).

14. Set BEARING-FREQ. switch to BEARING.

15. Press 0° VOR Bearing select pushbutton and verify that display is 0.00°.

(cont'd next page)

3.11.2 (cont'd)

16. Rotate Variable BEARING control clockwise until display is 12.00°.

17. Press Ø pushbutton. Note centering error and release pushbutton.

18. Record centering error, due to tone phase shift, in pointer deflection or μ Amps.

____

19. Rotate Variable BEARING control counterclockwise until display is 348.00°.

20. Press Ø pushbutton. Note centering error and release Ø pushbutton.

21. Record centering error, due to tone phase shift, in pointer deflection or μ Amps.

____

22. Press 0° VOR Bearing select pushbutton.

23. Additional G/S Centering Accuracy Tests may be performed which may cause G/S centering errors, such as:

    A. Environmental conditions.

    B. Power input voltage variations.

    C. Power supply frequency variations.

3.11.3 G/S CDI DEFLECTION AGC CHARACTERISTICS and DEFLECTION BALANCE TEST.

DESCRIPTION: This test determines the effect of RF input variation on Standard Deviation signal indication.

SPECIFICATION: Deflection caused by RF level variation from 100 to 10,000 μ Volts should not be more than ±15% of Standard Deflection.

PROCEDURE:

1. Set control as follows:

   FREQUENCY. . . . . .108.100 MHz or any LOC Frequency

(cont'd next page)

3.11.3 (cont'd)

ATTENUATOR . . . . .700µ Volts (-50 dBm)

All Tone Mod. Level Controls . . . . CAL

Meter Function Selector Switch 0-100

LOC DDM Selector Switch 0

G/S DDM Selector Switch 0

LOC-G/S Switch . . . . G/S

2. If required, substitute a high accuracy (±1%) deviation meter for the G/S deviation pointer.

3. Set G/S DDM selector switch to Right 0.175 DDM. Verify that CDI G/S pointer to be up full scale (150µ Amps).

__________(✓)

4. Repeat step 3 for Left 0.175 DDM and verify that deflection is down an equal amount to step 3.

__________(✓)

5. Set G/S DDM selector switch to 0 and verify that U.U.T. CDI G/S pointer is centered.

6. Set G/S DDM selector switch to Left 0.091 DDM.

7. U.U.T. CDI G/S pointer should position to down Standard Deflection (52% of full scale and 78µ Amps).

__________(✓)

8. Vary ATTENUATOR from 100µ Volts (-67 dBm) to 10,000µ Volts (-27 dBm) and note G/S pointer variation.

9. Record effect of RF level variation on G/S pointer deflection in µ Amps or % of Standard Deflection.

____

10. Repeat steps 7 through 9 for Right 0.091 DDM. (Up deflection).

11. Return G/S DDM selector switch to 0.

3.11.4 G/S RF SENSITIVITY TEST

DESCRIPTION: This test determines the G/S receiver RF sensitivity in μ Volts. RF sensitivity is the minimum RF signal input level required of a Standard G/S Deviation signal to produce at least 60% of Standard Deflection. This test should be made on each available channel.

SPECIFICATION: RF sensitivity should be 40μ Volts or better.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . .700μ Volts (-50 dBm)

   FREQUENCY . . . . . . .108.100 MHz or any LOC Frequency

   All Tone Mod. Level Controls. . . . . CAL

   Meter Function Selector Switch. 0-100

   LOC DDM Selector Switch 0

   G/S DDM Selector Switch 0

   LOC-G/S Switch. G/S

2. If required, substitute a high accuracy (±1%) deviation meter for the G/S deviation pointer.

3. Verify that U.U.T. CDI G/S pointer is centered.

4. Set G/S DDM selector switch to Left (or Right) 0.091 DDM and verify that G/S pointer is deflected 52% of full scale deflection (78μ Amp). ____________

5. Reduce RF input signal level with ATTENUATOR until U.U.T. CDI G/S pointer deflection is 60% of Standard Deflection (result of step 4).

6. From ATTENUATOR dial and Correspondence Chart (Table 3-1), determine G/S RF sensitivity. ____________μ Volts

7. Repeat step 5 and 6 for each G/S channel.

3.11.5 G/S WARNING SIGNAL TEST

DESCRIPTION: This test checks the operation of the alarm system under various signal conditions.

SPECIFICATIONS: Alarm signal should appear when G/S signal is unreliable or missing in whole or in part but should be "out of sight" or OFF when G/S signal is reliable.

PROCEDURE:

1. Set controls as follows:

   ATTENUATOR. . . . . .700µ Volts (-50 dBm)

   FREQUENCY . . . . .108.100 MHz or any LOC Frequency

   All Tone Mod. Level Controls. . . . . CAL

   Meter Function Selector Switch. 0-100

   LOC DDM Selector Switch 0

   G/S DDM Selector Switch 0

   LOC-G/S Switch. G/S

2. Verify that U.U.T. Alarm Signal is OFF or Warning Flag is out of sight.

   __________(✓)

3. Verify that G/S pointer is centered.

   __________(✓)

NORMAL SIGNAL, FLUCTUATING RF

4. Vary ATTENUATOR from 100µ Volts (-67 dBm) to 30,000µ Volts (≃ -17 dBm) and verify that Alarm Signal is OFF or (Warning Flag) out of sight.

   __________(✓)

RF SIGNAL ABSENT

5. Set ATTENUATOR to -112 dBm and disconnect RF output connector from U.U.T.. Verify that Alarm Signal or Warning Flag is visible.

   __________(✓)

MISSING 90 or 150 Hz TONES

6. Reconnect RF connector to U.U.T. and set ATTENUATOR to 700µ Volts (-50 dBm). Verify that Alarm Signal is OFF or Warning Flag is out of sight.

(cont'd next page)

3.11.5 (cont'd)

7. Set LOC DDM selector switch to 150 Hz. Alarm Signal or Warning Flag should be visible.
__________(✓)

8. Set LOC DDM selector switch to 90 Hz. Alarm Signal or Warning Flag should be visible.
__________(✓)

MISSING 90 and 150 Hz TONES

9. Set G/S DDM selector switch to 150 Hz and verify that LOC DDM selector switch is set to 90 Hz. Alarm Signal or Warning Flag should be visible.
__________(✓)

MARGINAL G/S SIGNAL STRENGTH (WITH STANDARD G/S DEVIATION SIGNAL)

10. Set controls as follows:

ATTENUATOR. . . . . .700µ Volts (-50 dBm)

All Tone Mod. Level Controls. . . . . CAL

LOC-G/S Switch. . . . . G/S

LOC DDM Switch. 0

G/S DDM Switch. . . . . Left or Right 0.091 DDM

11. Verify that U.U.T. CDI G/S pointer is at Standard Deflection (52% of full scale).

12. Reduce RF signal level with ATTENUATOR until U.U.T. G/S pointer is deflected 50% of standard deflection. Alarm Signal or Warning Flag should be visible.
__________(✓)

3.11.6 ILS CDI G/S DEVIATION INDICATION

DESCRIPTION: This test checks the U.U.T. CDI G/S pointer deflection with precise tone inputs. (A precision meter (±1%) may be substituted for the U.U.T. G/S pointer movement to check receiver circuitry or deflection current)

SPECIFICATIONS: As stipulated in the U.U.T. manufacturer's specifications.

(cont'd next page)

3.11.6 (cont'd)

PROCEDURES:

1. Set controls as follows for Standard Centering Signal:

   FREQUENCY. . . . . . 108.100 MHz or any LOC Frequency

   ATTENUATOR . . . . 700μ Volts (-50 dBm)

   All Tone Mod. Level Controls . . . . .CAL

   LOC-G/S Switch . . . . .G/S

   G/S DDM Switch .0

   LOC DDM Switch .0

   BEARING-FREQ. Switch . . . . .FREQ.

2. Verify that U.U.T. CDI G/S pointer is centered.

CDI G/S DEFLECTION RESPONSE AT 0.175 DDM

3. Set G/S DDM selector switch to Left 0.175 DDM. U.U.T. G/S pointer should reach 67% of full scale deflection within 0.6 seconds (150μ Amps). Pointer overshoot should not exceed 2% of full scale deflection.

   __________(✓)

4. Set G/S DDM selector switch to Right 0.175 DDM. U.U.T. G/S pointer should reach 67% of full scale deflection within 0.6 seconds (150μ Amps). Pointer overshoot should not exceed 2% of full scale deflection.

   __________(✓)

CDI G/S DEFLECTION AT 0.200 DDM

5. Set G/S DDM selector switch to Right 0.400 DDM and check that pointer deflection does not decrease from up full scale.

   __________(✓)

6. Set G/S DDM selector switch to Left 0.400 DDM and check that pointer deflection does not decrease from down full scale.

   __________(✓)

(cont'd next page)

3.11.6 (cont'd)

CDI G/S DEFLECTION AT 0.091 DDM

7. Set G/S DDM selector switch to Left 0.091 DDM and check that pointer deflection is down Standard Deflection (78μ Amps).
__________(✓)

8. Set G/S DDM selector switch to Right 0.091 DDM and check that pointer deflection is up Standard Deflection (78μ Amps).
__________(✓)

CDI G/S DEFLECTION AT 0.045 DDM

9. Set G/S DDM selector switch to Right 0.045 DDM and check that pointer deflection is up half Standard Deflection (39μ Amps).
__________(✓)

10. Set G/S DDM selector switch to Left 0.045 DDM and check that pointer deflection is down half Standard Deflection (39μ Amps).
__________(✓)

11. Return G/S DDM selector switch to 0. G/S pointer should be centered (0μ Amps).
__________(✓)

3.11.7 Other conditions which may be used in the foregoing tests are as follows:

A. Environmental Conditions

B. Power Input Variations.

C. Power Supply Frequency Variations.

NOTE: Tones may be injected via the ext. Mod. input on the rear panel for tests which require special tone quality or frequency. Outputs of all tones are also available at the rear panel for specialized tests.

3.12 VHF RECEIVER TESTING (118 to 135 MHz Band)

3.12.1 The NAV-750 series test set provides a 1020 Hz signal at 30% modulation on COMM frequencies. Channel spacing in Auto-Channel mode is 25, 50, 100, and 200 kHz. Any channel is selectable with the FREQUENCY selector switches. The External Modulation input jack on the back panel will allow signals other than the 1020 Hz, automatically provided, to be applied to the RF output. When this is done, the 1020 Hz tone may be eliminated by turning the 1020 Hz control to maximum counterclockwise position (0 mod.) out of the CAL detent position. The modulation level of the Ext. Mod. input signal can be adjusted with the MASTER MOD. control from 0 to maximum modulation as indicated on the % modulation meter on the front panel.

3.12.2 COMM TESTS.

DESCRIPTION: This test checks the gain of all COMM. channels. Manual or automatic channeling may be used. In this test an RF level is set and modulated at 30% with a 1020 Hz tone. U.U.T. output measurements must be made with appropriate instrumentation.

ADDITIONAL TEST EQUIPMENT: A meter which measures output in dB.

PROCEDURE:

1. Set controls as follows:

   FREQUENCY. . . . . .118.000 MHz or any COMM Frequency

   ATTENUATOR . . . . .20μ Volts (-81 dBm)

   All Tone Mod. Level Controls . . . . .CAL

COMM CHANNEL GAIN TEST

2. To use the Auto-Channeling feature of the NAV-750, select the channel spacing, set channeling rate control to maximum counterclockwise, and set the AUTO-MANUAL switch to AUTO. Then adjust the channeling rate control for the desired rate.

3. Check each COMM. channel for output that should be not less than manufacturer's specified output.

   __________(✓)

(cont'd next page)

3.12.2 (Cont'd)

COMM CHANNEL SENSITIVITY

4. Reduce RF signal with ATTENUATOR until the signal plus noise-to-noise ratio of 6 dB is obtained. This RF level should not exceed 5μ Volts (-93 dBm) for each COMM channel.

__________(✓)

AVC CHARACTERISTICS

5. Vary RF signal with ATTENUATOR from 10μ Volts (-87 dBm) to 20,000μ Volts (-21 dBm). The audio output should not vary more than 10 dB at input levels of 10, 100, 1000, 3000, 10,000, and 20,000μ Volts for each COMM channel.

__________(✓)

3.12.3 Additional checks may be made using other than 1020 Hz tone modulation. External tone modulation percentage is variable via the MASTER MOD. control on the front panel. To check tuning at each channel, the ΔF control may be used to determine resonance.

3.13 MARKER BEACON RECEIVER TESTS WITH NAV-750B

3.13.1 The NAV-750B Bench Test Set is capable of testing Marker Beacon Receivers operating on 75.000 MHz. The test set provides a tuning range from 70.000 to 79.90 MHz. Tones of 1020, 400, 1300, and 3000 Hz modulated at 95% are selectable with the Meter Function and Tone Selector Switch. External modulation may be added via the Ext. Mod. jack on the back panel and modulation level can be set with the MASTER MOD control.

3.13.2 MARKER BEACON RECEIVER SELECTIVITY TEST

DESCRIPTION: This test essentially checks the frequency response of the U.U.T.

Additional Test Equipment: A meter which measures output in dB.

PROCEDURE:

1. Set controls as follows:

FREQUENCY. . . . . 75.000 MHz

All Tone Mod Controls. . . . . .CAL

(cont'd next page)

3.13.2 (cont'd

Meter Function and Tone Selector Switch. . . .400 Hz

ATTENUATOR. . . . . . . .As required by manufacturer's specifications.

2. Using ΔF control, determine frequencies where output is at least 40 dBc.
(Check both high & low sense modes). ___________

3. Using ΔF control, determine frequency span where output is down less than 6 dBc.
(Check both high & low sense modes). ___________

AGC CHARACTERISTICS

4. Vary ATTENUATOR from lamp threshold input power to 50,000μ Volts (-13 dBm). Audio level should vary not more than 10 dB.

___________(✓)

THREE LAMP OPERATION

5. Verify that Meter Function Tone Selector switch is set to 400 Hz. Set ATTENUATOR to -112 dBm.

6. Increase RF output signal with ATTENUATOR until the Blue Marker Beacon Lamp (outer Mkr) comes on.

   A. At High Sense Mode ___________μ Volts

   B. At Lo Sense Mode ___________μ Volts

   C. Set ATTENUATOR to -112 dBm.

7. Set Meter Function and Tone Selector Switch to 1300 Hz.

8. Increase RF output signal with ATTENUATOR until the AMBER MARKER Beacon Lamp (Middle Marker) comes on.

   A. At High Sense Mode ___________μ Volts

   B. At Lo Sense Mode ___________μ Volts

   C. Set ATTENUATOR to -112 dBm.

9. Set Meter Function and Tone Selector switch to 3000 Hz.

(cont'd next page)

3.13.2 (cont'd)

10. Increase RF output signal with ATTENUATOR until the White Marker Beacon Lamp (Inner Marker) comes on.

    A. At High Sense Mode __________μ Volts

    B. At Lo Sense Mode __________μ Volts

11. Return all controls to normal or CAL.

3.14 The foregoing Operating Procedures are in no way intended to be used with specific Units Under Test. They are included here to illustrate the operational characteristics and capabilities of the NAV-750 series Bench Test Set to those potential users unfamiliar with the IFR NAV-750.

SECTION IV

THEORY OF OPERATION

4.1 INTRODUCTION. This section contains general circuit theory for the NAV-750 Series Bench Test Sets. Included is a general description and a more detailed presentation of the VOR section.

4.2 GENERAL DESCRIPTION. Basically, the NAV-750 series test set may be divided into several sections that can function separately. However, the power supply is common to all other sections. The various sections are : 1) the power supply, 2) the VOR sections, 3) the LOC and G/S section, and 4) the RF generator section.

4.2.1 POWER SUPPLY. The power section supplies six voltages of +5, +12, -12, +24, -18, and +170 volts relative to chassis as common ground. The 170 volts is used only for the high voltage gas discharge counter display. The other voltages are used throughout the test set. The input power is 115 or 240 VAC, 50 Hz to 400 Hz. The standard cooling fan operates on 50 to 60 Hz only. An optional dc fan is available for 400 Hz operation.

4.2.2 VOR SECTION. (See Figure 4-1) The VOR section is located mainly on PC-4 and PC-5. The VOR bearing is selected on these two boards. The bearing oscillator (later referred to as the 2.16 MHz Clock Oscillator) is located on PC-4 and provides the reference signal to the VOR bearing counter system. Four tones are derived from frequencies obtained from the bearing counter system: The 30 Hz Ref. tone, the 30 Hz Var. tone, the 90 Hz tone, and the 150 Hz tone. The two 30 Hz tone signals are applied to PC-2 where the square waves are converted to sine waveforms. combined with a 9960 Hz signal, and fed to PC-3.

4.2.2.1 On PC-3, the VOR tones are applied to controls which vary the modulation level. PC-3 also switches all modulation tones as determined by the output RF selection. The tones are then summed and sent to the Modulator Amplifier assembly where they modulate the RF output signal.

4.2.2.2 The VOR selected bearing is displayed on a front panel counter display. An RF DEMOD output is used to check the accuracy of the bearing at 90° and 270° by circuitry on PC-1.

4.2.3 LOCALIZER AND GLIDE SLOPE. (See Figure 4-1). The 90 Hz and 150 Hz tones used in the LOC and G/S system are picked off the VOR bearing counter on PC-4 and therefore, the tone frequencies are controlled by the 2.16 MHz Clock Oscillator. The phase relationship of the 90 Hz and 150 Hz tones is normally fixed but can be varied by shifting the 150 Hz phase at a value five times the selected VOR bearing. This is accomplished by rotating the front panel VOR BEARING control and pressing the Ø pushbutton switch.

4.2.3.1 The 90 Hz and 150 Hz square wave tone signals are routed from the PC-4 to PC-5 where they are converted to sine waveforms. They are then combined at the front panel DDM selector switches and routed to the Tone Summation board PC-3 and then sent to the Modulator Amplifier

4.2.3.2 For COMM operations, a 1020 Hz tone oscillator on PC-2 provides test tones to modulate the RF output signal from 118.000 MHz to 155.000 MHz. The 1020Hz tone is also used as an Ident. signal on VOR and LOC outputs. In the NAV-750B test set, the 1020 Hz oscillator is switched (by the Meter Function and Tone Selector switch) to provide Marker Beacon Tones at 400 Hz, 1300 Hz, and 3000 Hz.

4.2.4 RF SECTION. (See Figure 4-2). The RF oscillator is controlled by a phase-lock system referenced to the 10 MHz crystal oscillator. The frequency is controlled on PC-6 which is connected to the front panel FREQUENCY control switches that select the desired RF output. (See Figure 4-1 for RF & Frequency Select Block Diagram).

4.2.4.1 The RF signal is translated into 2 out of 5 and parallel BCD code select systems on PC-7 which controls outputs at a rear panel connector (J-8) that may be used to remotely channel a set under test. (See Figure 3-6 for J-8 pin connections).

4.2.4.2 The RF signal from the oscillator assembly is routed to the Modulator Amplifier where tone modulation takes place. The modulated RF signal is then passed through the output attenuator to the front panel output connector (J-3).

4.3 VOR SECTION DESCRIPTION. (See the VOR Systems Block Diagram, Figure 4-1 and Localizer/Brg. Control & Brg. Logic Schematic in the Schematics Section).

4.3.1 The 2.16 MHz crystal oscillator is the reference for VOR bearings via parts of X401 and X431. Capacitor C-401 in the oscillator circuit is the trimmer capacitor used to set the frequency to exactly 2.16 MHz. If an external clock source is required, grounding pin J10-8 stops the oscillator and the external input (which should be TTL compatible, 0 to 5V squarewave) can then be applied to J10-9.

4.3.2 The 2.16 MHz oscillator output is divided to 1.08 MHz (which is the frequency required for a .01° count) and applied to five counter stages to obtain bearing counts of .01, 0.1, 1.0, 10, and 100 degree steps.

4.3.3 BEARING COUNTER. At a count representing 360 degrees, all five counter stages reset to zero and begin to count up again.

4.3.3.1 At a count of 180 degrees, gate X435B senses the 80 degree output of the 10 degree counter and the 100 degree output of the 100 degree counter. The gate output sets Flipflop X429A. (The $\overline{Q}$ output of X429A forms the VOR 30 Hz Reference signal). At 180 degrees $\overline{Q}$ goes to a logic 0 forming the first half of the 30 Hz Reference signal.

4.3.3.2 At 0 degrees, or 360 degrees, another gate senses 360 degrees from appropriate counter outputs. This gate output operates Oneshot X436A which is used to provide a wide reset pulse to reset all bearing counters to zero. Oneshot X436A also resets Flipflop X429A which causes $\overline{Q}$ to go high thereby forming the second half of the 30 Hz Reference signal. Therefore, the VOR 30 Hz Reference signal is high when the bearing counter is between 0 degrees and 180 degrees and low between 180 degrees and 0 degrees.

4.3.3.3 90 Hz AND 150 Hz TONES. A by-product of the Bearing Counter is the derivation of the 90 and 150 Hz tones. The tones are obtained from points in the counter. The output of the 1 degree decade counter is divided by 12 by X426 resulting in a 90 Hz squarewave. This counter is reset at the same time as the bearing count by X436A.

4.3.3.3.1 The output of the 0.1 degree counter is divided by 72 to obtain 150 Hz. Reset to the "divide-by-72" counter is applied from one of two sources. The first source is the "normal" one, Oneshot X436A, which also resets X433 and X434 coincident with the bearing counter. The second reset source is the 30 Hz Variable squarewave output from Flipflop X402 only when the front panel "Ø" (phase) switch

(cont'd next page)

is pressed. This shifts phase relationship of the 150 Hz signal relative to the 90 Hz signal in increments equal to five times the selected VOR bearing.

4.3.4 VOR BEARING SELECTION. (Producing the 30 Hz Variable Signal) The VOR bearing is selected by circuitry on PC-4 and PC-5. A programmable up-down counter is run "parallel" to the bearing counter and contains stages .01, 0.1, 1.0, 10, and 100 degree steps. The up-down counter is connected to the bearing counter through five comparator IC's, one for each counter stage. When the counts in the two counters are exactly equal, all comparator outputs enable a set of gates(X430, X412A, X408D, X415B, X408E) to achieve a logic 0 at the output of X415B. At all other times X415B output is high.

4.3.4.1 For example, assume that the up-down counter has stored in it a bearing of 275 degrees. As the bearing counter counts up from zero degrees, the comparators continuously compare the counts in the two parallel counters. At 275 degrees equality is sensed and X415B output changes to a low state and causes Flipflops X430 and X402 to "set".

4.3.4.2 The "setting" of X430 and X402 causes the Q output of X402B to go high and form the first or positive half of the 30 Hz variable squarewave signal. X402B Q going high also enables gate X431C which allows .01 degree pulses from X430A to be counted by a 180 degree counter consisting of X402, X403, X404, X405, and X406. At the accumulated count of 180 degrees, gate X401A is enabled and in turn resets Flipflop X402B. Resetting X402B causes X402B Q to go low which forms the last half of the 30 Hz variable squarewave output signal.

4.3.4.3 As a result, the 30 Hz variable squarewave is high for 180 degrees until it goes low when the selected bearing appears at the comparator output 180 degrees later. The Q output of X402B is the "TO" 30 Hz output signal and the $\overline{Q}$ output of X402B is the "FROM" 30 Hz output signal. One of these two signals is selected by the front panel TO-FROM selector switch.

4.3.5 UP-DOWN COUNTER. The programmed up-down counter is operated by two sources. One source is a set of gating logic on PC-5 which is operated by 12 pushbutton bearing select switches on the front panel. Depressing any of these pushbutton switches causes that particular bearing to be loaded into the up-down counter.

4.3.5.1 When any bearing pushbutton switch is pressed, either gate X5002 or gate X5001 is disabled and, through other gates, causes the Load Line to go low. While the load input is low, data present at the preset inputs of the up-down counter sets the counter to correspond to that data. When any pushbutton bearing select switch is activated the .01, 0.1, and 1 degree counters are preset to zero.

4.3.5.2 Gate X5003 always causes a bearing of 10 degrees to be preset. X5004 always causes 20 degrees to be preset. X5005A always causes 40 degrees to be preset. X5005B always causes 80 degrees to be preset. All of the above listed gates operate on counter X413, the 10 degree counter. Combinations of inputs can cause any bearing of 10 to 90 degrees to be preset into X413.

4.3.5.3 Gate X5007 always causes 100 degrees to be preset and X5006 always causes 200 degrees to be preset. These two gates operate into X414, the 100 degree counter. Both applied together cause 300 degrees to be preset.

4.3.5.4 When the NAV-750 series test set is turned on, a system normalizer causes the same reaction as depressing the 0 degree pushbutton selector switch and initially sets the up-down counter to zero bearing. The normalizer consists of X5008B and associated circuitry.

4.3.5.5 Two additional pushbutton switches on the front panel allow bearing changes of +10 and -10 degrees to be made to any bearing present in the up - down counter. For example, if the -10 degree switch is depressed, X5011B is disabled and the output goes high. The output of this gate controls the up-down control line of the counter. If the line is high, the counter will count down. Conversely, if the line is low the counter will count up. Thus the -10 degree switch causes the counter to be able to count down.

4.3.5.6 Depressing the +10 degree switch disables gate X5011C, causing its output to go high and enable gate 5011B causing its output to go low. Thus the counter is set to count up.

4.3.5.7 The actual clock pulse causing the +10 or -10 degree count change comes from Oneshot X5012B which is set through either diode CR5002 or CR5003. The output of X5012B operates the Schmitt Trigger X5010D and X5010E which applies one clock pulse to X413 and advances or retards the counter one count (equal to 10 degrees). Because of the way the total up-down counter is connected, the entire counter will retard by a 10 degree step if X413 is at zero bearing and -10 degrees is called for.

(cont'd next page)

This may mean, for example, going from 5.72 degrees (-10 degrees) to 355.72 degrees.

4.3.5.8 The second way to change the count in the up-down counter to determine the VOR Bearing is by the Bearing Control on the front panel which alters the bearing in either .01 or .05 degree steps with each 1/40 revolution. The bearing control consists of a 40-tooth gear whose teeth break the light path of two transducers. As the light path to each transducers is broken the output goes high. One transducer is used as a clock source and the other as a direction of rotation sensor. Clockwise rotation of the bearing control increases the bearing.

4.3.5.9 As the gear teeth break the light path, pulses are formed by X5013 and inverted by X5008C to form clock pulses. These are applied to Oneshot X5012A and to gate X5019B.

4.3.5.10 A front panel switch selects .01, or .05, degree increments. If .01 degrees is selected, X5019 selects clock pulses before Oneshot X5012A. If .05 degree increments are selected, X5019 selects clock pulses from a UJT oscillator. Oneshot X5012A enables the UJT oscillator to operate in pulse groups of five as set by potentiometer R5091.

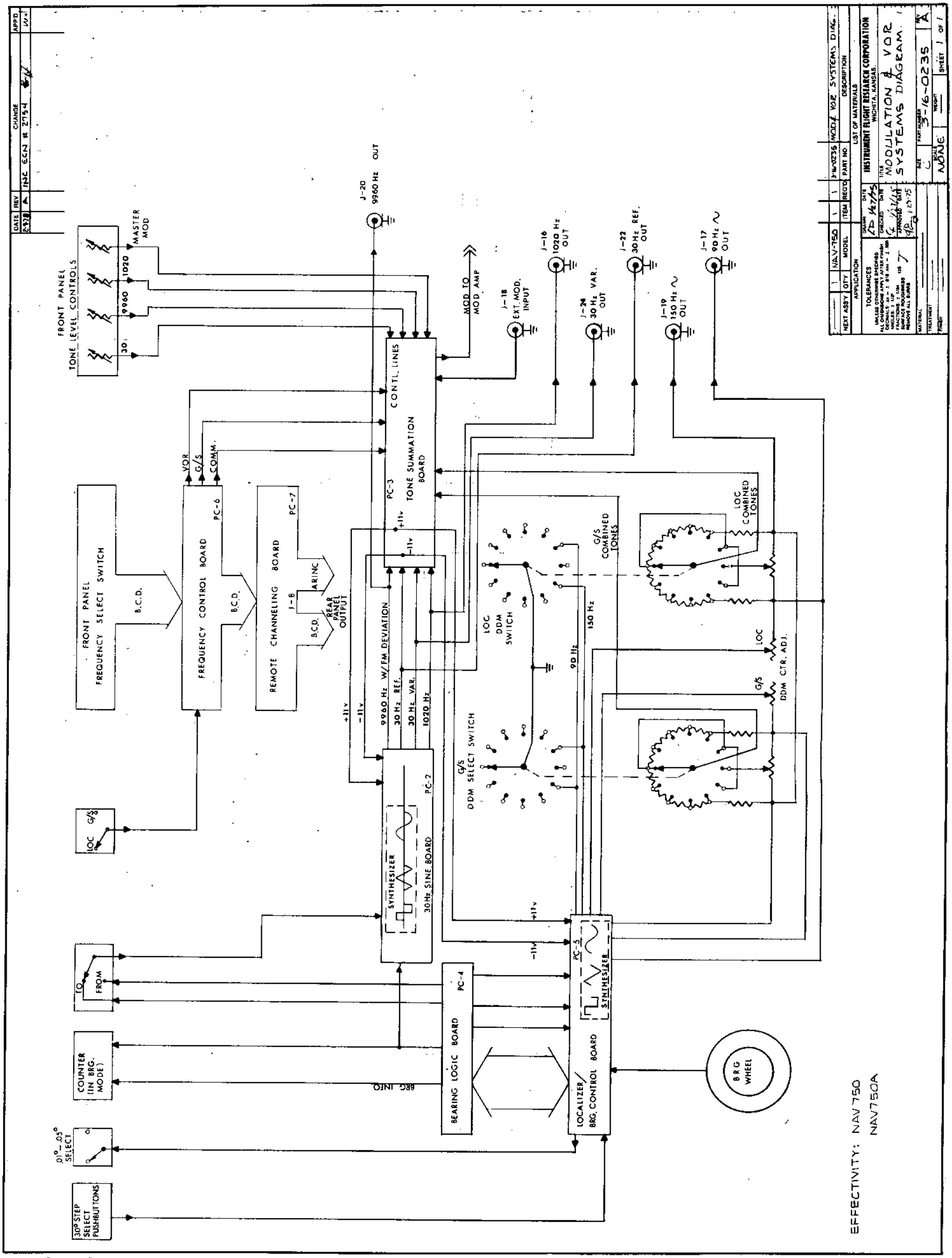
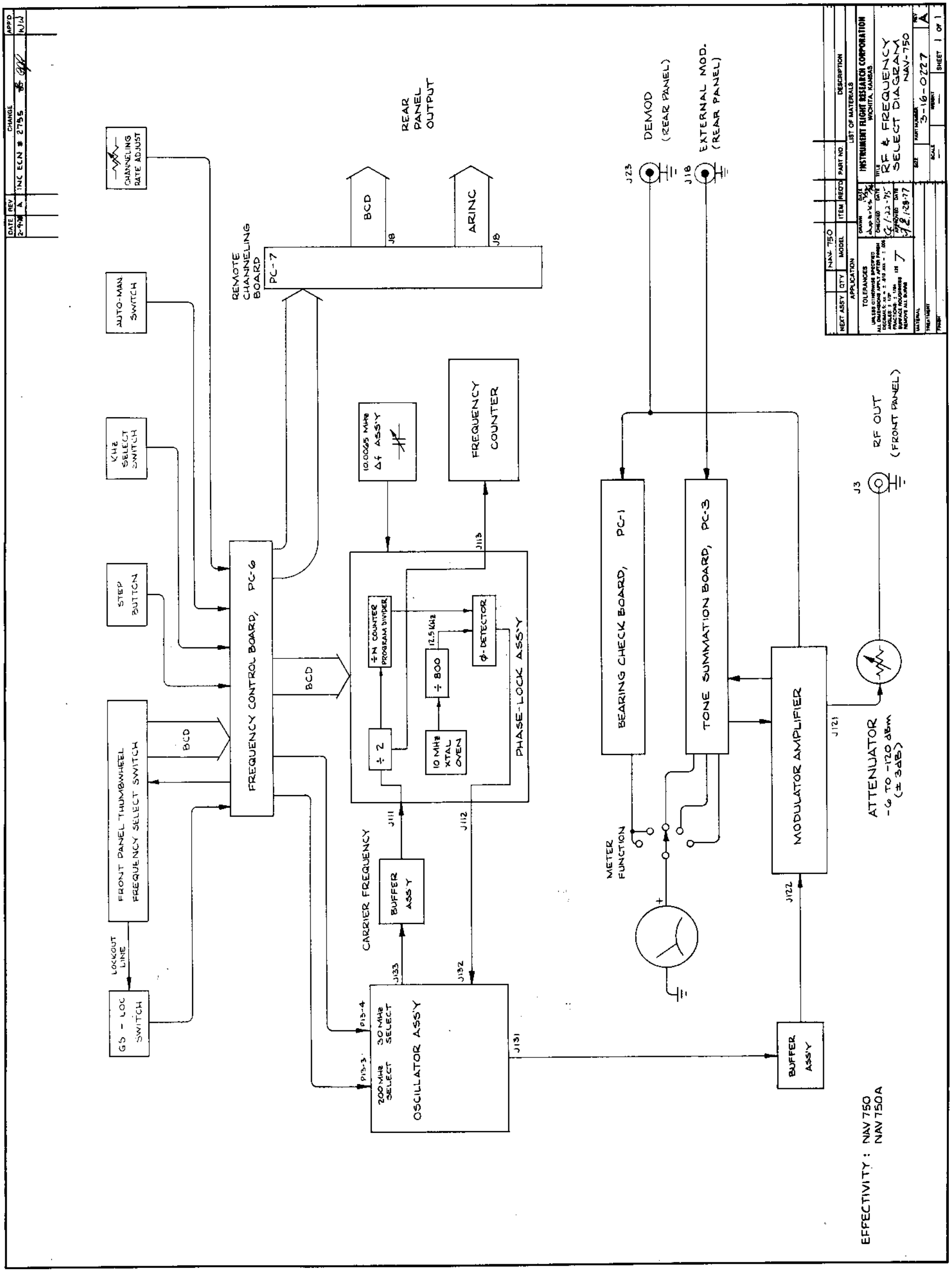

FRONT PANEL TONE LEVEL CONTROLS
MASTER MOD
1020
9960
30
J-20 9960 Hz OUT
MOD TO MOD AMP
J-18 EXT. MOD. INPUT
J-16 1020 Hz OUT
J-24 30 Hz VAR. OUT
J-22 30 Hz REF. OUT
J-19 150 Hz ~ OUT
J-17 90 Hz ~ OUT
CONT'L LINES
PC-3
TONE SUMMATION BOARD
+11v
-11v
FRONT PANEL FREQUENCY SELECT SWITCH
B.C.D.
VOR
G/S
COMM.
PC-6
FREQUENCY CONTROL BOARD
PC-7
REMOTE CHANNELING BOARD
ARINC
J-8
REAR PANEL OUTPUT
9960 Hz W/FM DEVIATION
30 Hz REF.
30 Hz VAR.
1020 Hz
PC-2
SYNTHESIZER
30Hz SINE BOARD
LOC G/S
TO FROM
COUNTER (IN BRG. MODE)
.01°-.05° SELECT
30° STEP SELECT PUSHBUTTONS
PC-4
BEARING LOGIC BOARD
BRG INFO
PC-5
SYNTHESIZER
LOCALIZER/ BRG. CONTROL BOARD
BRG WHEEL
LOC DDM SWITCH
G/S DDM SELECT SWITCH
90 Hz
150 Hz
G/S COMBINED TONES
LOC COMBINED TONES
LOC
G/S
DDM CTR. ADJ.
EFFECTIVITY: NAV 750 NAV750A
INC ECN # 2754
NAV-750
3-16-0235 MOD & VOR SYSTEMS DIAG.
INSTRUMENT FLIGHT RESEARCH CORPORATION WICHITA, KANSAS
MODULATION & VOR SYSTEMS DIAGRAM
3-16-0235
A
NONE
SHEET 1 OF 1

Figure 4-1



CHANNELING RATE ADJUST
AUTO-MAN. SWITCH
KHz SELECT SWITCH
STEP BUTTON
FRONT PANEL THUMBWHEEL FREQUENCY SELECT SWITCH
BCD
LOCKOUT LINE
GS - LOC SWITCH
FREQUENCY CONTROL BOARD, PC-6
REMOTE CHANNELING BOARD
PC-7
BCD
ARINC
J8
REAR PANEL OUTPUT
10.0065 MHz Δf ASS'Y
FREQUENCY COUNTER
J113
÷N COUNTER PROGRAM DIVIDER
12.5 KHz
ϕ-DETECTOR
÷ 800
÷ 2
10 MHz XTAL OVEN
PHASE-LOCK ASS'Y
J111
J112
CARRIER FREQUENCY
BUFFER ASS'Y
J133
J132
P13-4
30 MHz SELECT
P13-3
200 MHz SELECT
OSCILLATOR ASS'Y
J131
BUFFER ASS'Y
J23
DEMOD (REAR PANEL)
J18
EXTERNAL MOD. (REAR PANEL)
BEARING CHECK BOARD, PC-1
TONE SUMMATION BOARD, PC-3
METER FUNCTION
MODULATOR AMPLIFIER
J121
J122
ATTENUATOR -6 TO -120 dBm (± 3dB)
J3
RF OUT (FRONT PANEL)
EFFECTIVITY: NAV 750 NAV 750A
INSTRUMENT FLIGHT RESEARCH CORPORATION WICHITA, KANSAS
RF & FREQUENCY SELECT DIAGRAM NAV-750
3-16-0227
A
SHEET 1 OF 1
INC ECN # 2755
NAV 750

Figure 4-2

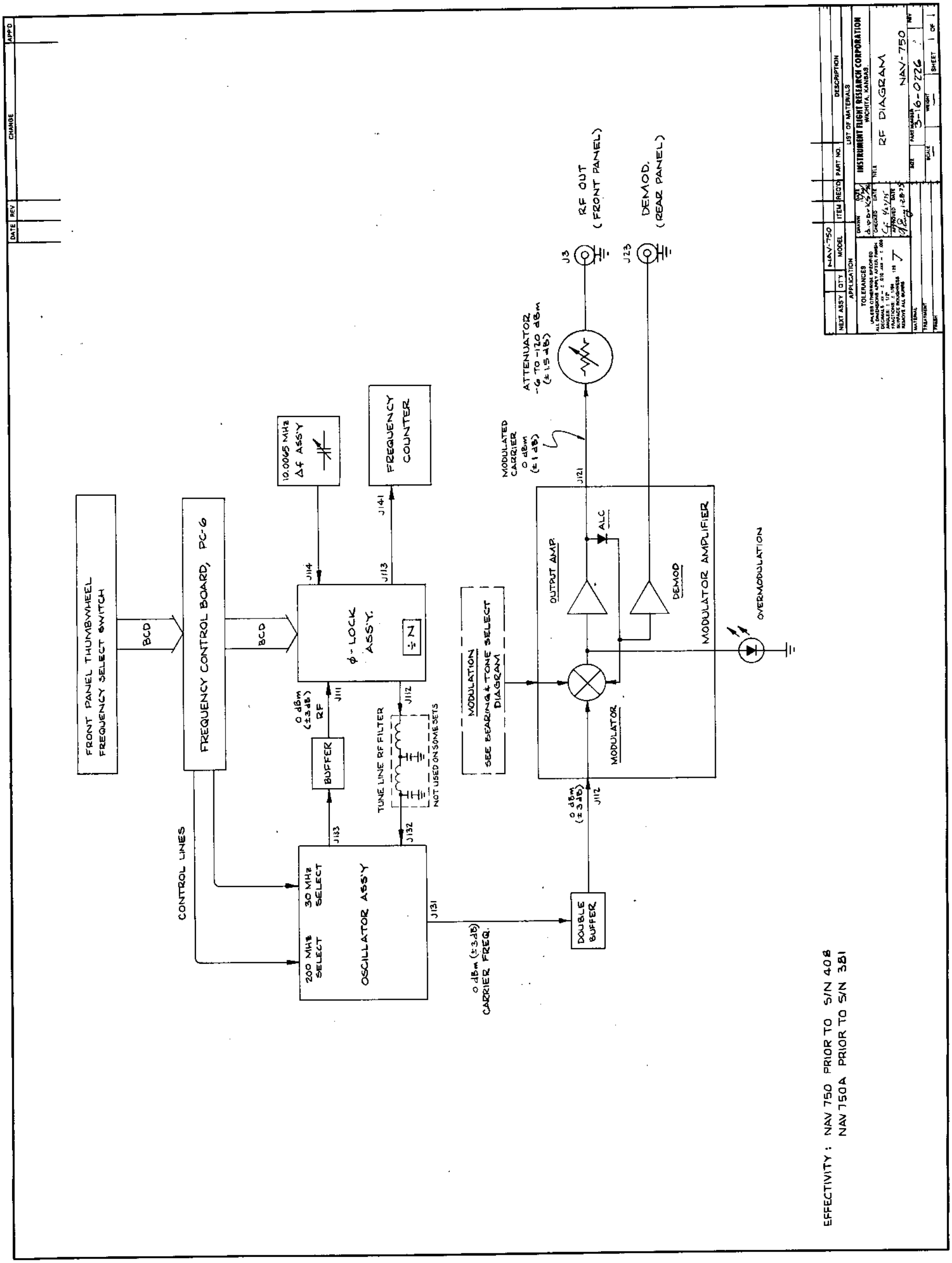

FRONT PANEL THUMBWHEEL FREQUENCY SELECT SWITCH
BCD
FREQUENCY CONTROL BOARD, PC-6
BCD
φ - LOCK ASS'Y
÷ N
10.0065 MHz Δf ASS'Y
FREQUENCY COUNTER
J114
J113
J141
J111
0 dBm (±3dB) RF
BUFFER
J112
TUNE LINE RF FILTER
NOT USED ON SOME SETS
J133
J132
CONTROL LINES
30 MHz SELECT
200 MHz SELECT
OSCILLATOR ASS'Y
J131
0 dBm (±3dB) CARRIER FREQ.
DOUBLE BUFFER
0 dBm (±3dB)
J112
MODULATION
SEE BEARING & TONE SELECT DIAGRAM
MODULATOR
OUTPUT AMP
ALC
DEMOD
MODULATOR AMPLIFIER
OVERMODULATION
J121
MODULATED CARRIER 0 dBm (±1 dB)
ATTENUATOR -6 TO -120 dBm (±1.5 dB)
J3
RF OUT (FRONT PANEL)
J23
DEMOD. (REAR PANEL)
EFFECTIVITY: NAV 750 PRIOR TO S/N 408
NAV 750A PRIOR TO S/N 381
INSTRUMENT FLIGHT RESEARCH CORPORATION
WICHITA, KANSAS
RF DIAGRAM
NAV-750
3-16-0226
SHEET 1 OF 1

Figure 4-3

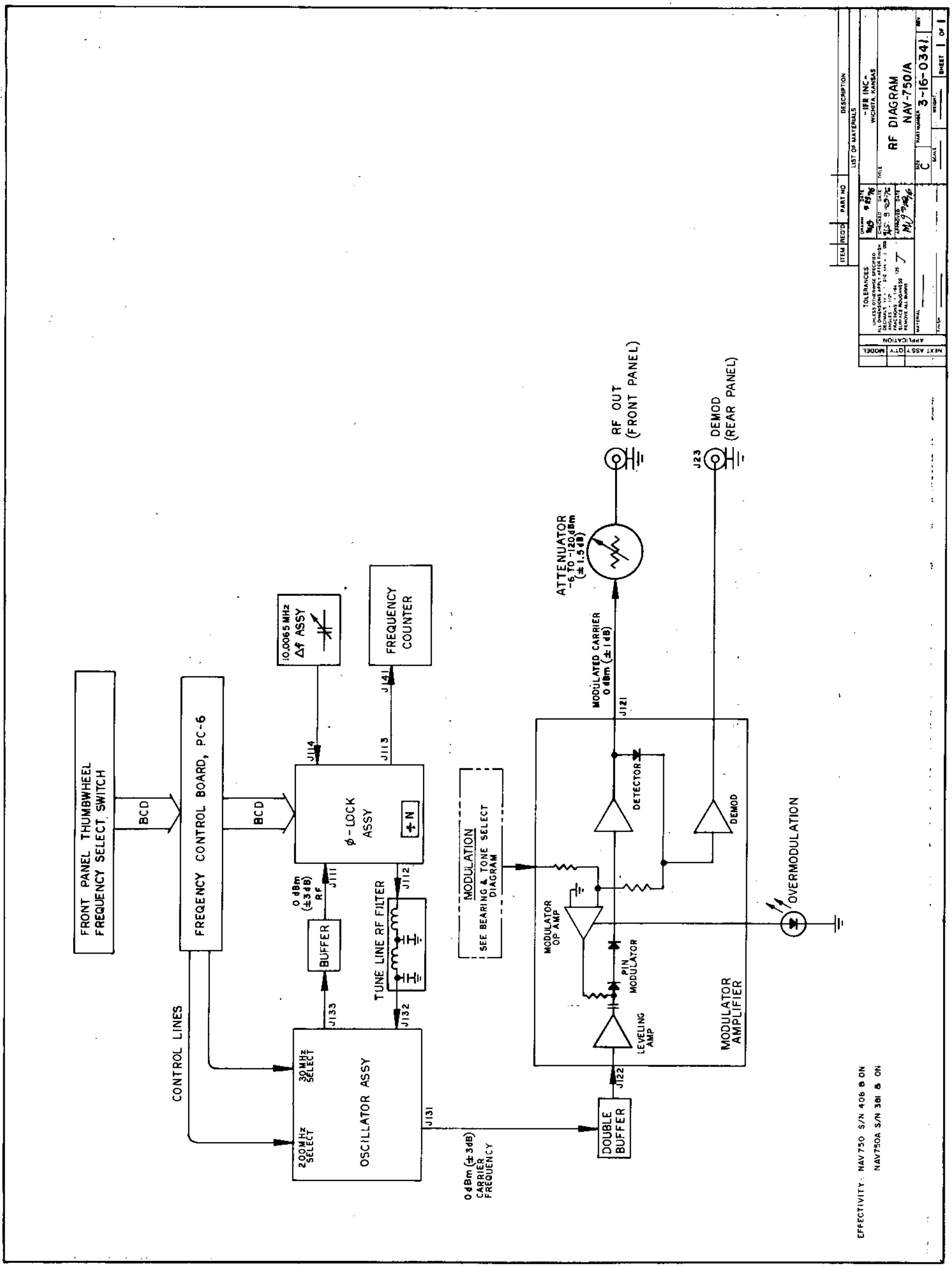
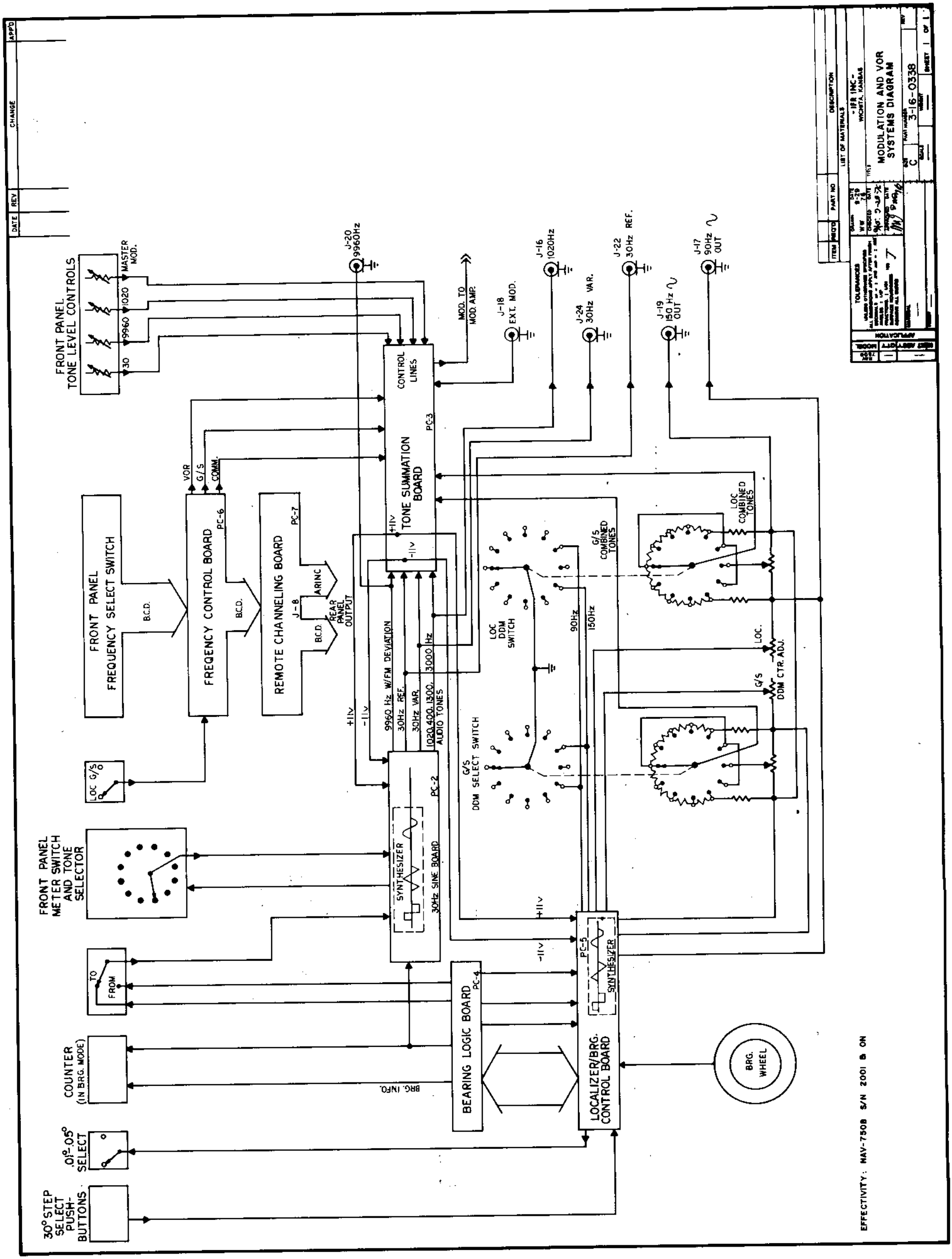

FRONT PANEL THUMBWHEEL FREQUENCY SELECT SWITCH
BCD
FREQUENCY CONTROL BOARD, PC-6
BCD
CONTROL LINES
10.0065 MHz Δf ASSY
FREQUENCY COUNTER
J114
J113
J141
φ-LOCK ASSY
÷N
0 dBm (±3 dB) RF
J111
J112
BUFFER
TUNE LINE RF FILTER
J133
J132
30 MHz SELECT
200 MHz SELECT
OSCILLATOR ASSY
J131
0 dBm (±3 dB) CARRIER FREQUENCY
DOUBLE BUFFER
J122
MODULATION
SEE BEARING & TONE SELECT DIAGRAM
MODULATOR OP AMP
PIN MODULATOR
LEVELING AMP
DETECTOR
DEMOD
MODULATOR AMPLIFIER
OVERMODULATION
J121
MODULATED CARRIER 0 dBm (±1 dB)
ATTENUATOR -6 TO -120 dBm (±1.5 dB)
RF OUT (FRONT PANEL)
J23
DEMOD (REAR PANEL)
EFFECTIVITY: NAV750 S/N 408 & ON
NAV750A S/N 381 & ON
IFR INC. WICHITA, KANSAS
RF DIAGRAM
NAV-750/A
3-16-0341
SHEET 1 OF 1

Figure 4-4



FRONT PANEL TONE LEVEL CONTROLS
MASTER MOD.
1020
9960
30
FRONT PANEL FREQUENCY SELECT SWITCH
B.C.D.
FREQENCY CONTROL BOARD
PC-6
VOR
G/S
COMM.
REMOTE CHANNELING BOARD
PC-7
ARINC
J-8
REAR PANEL OUTPUT
TONE SUMMATION BOARD
PC-3
CONTROL LINES
MOD. TO MOD. AMP.
J-20 9960Hz
J-18 EXT. MOD.
J-16 1020Hz
J-24 30Hz VAR.
J-22 30Hz REF.
J-19 150 Hz OUT
J-17 90Hz OUT
+11v
-11v
9960 Hz W/FM DEVIATION
30Hz REF.
30Hz VAR.
1020,400,1300, AUDIO TONES
3000 Hz
LOC DDM SWITCH
G/S DDM SELECT SWITCH
90Hz
150Hz
G/S COMBINED TONES
LOC COMBINED TONES
LOC.
G/S
DDM CTR. ADJ.
LOC G/S
FRONT PANEL METER SWITCH AND TONE SELECTOR
SYNTHESIZER
30Hz SINE BOARD
PC-2
TO
FROM
COUNTER (IN BRG. MODE)
BRG. INFO.
BEARING LOGIC BOARD
PC-4
LOCALIZER/BRG. CONTROL BOARD
PC-5
SYNTHESIZER
BRG. WHEEL
.01°-.05° SELECT
30° STEP SELECT PUSH-BUTTONS
EFFECTIVITY: NAV-750B S/N 2001 & ON
IFR INC. WICHITA, KANSAS
MODULATION AND VOR SYSTEMS DIAGRAM
3-16-0338

Figure 4-5

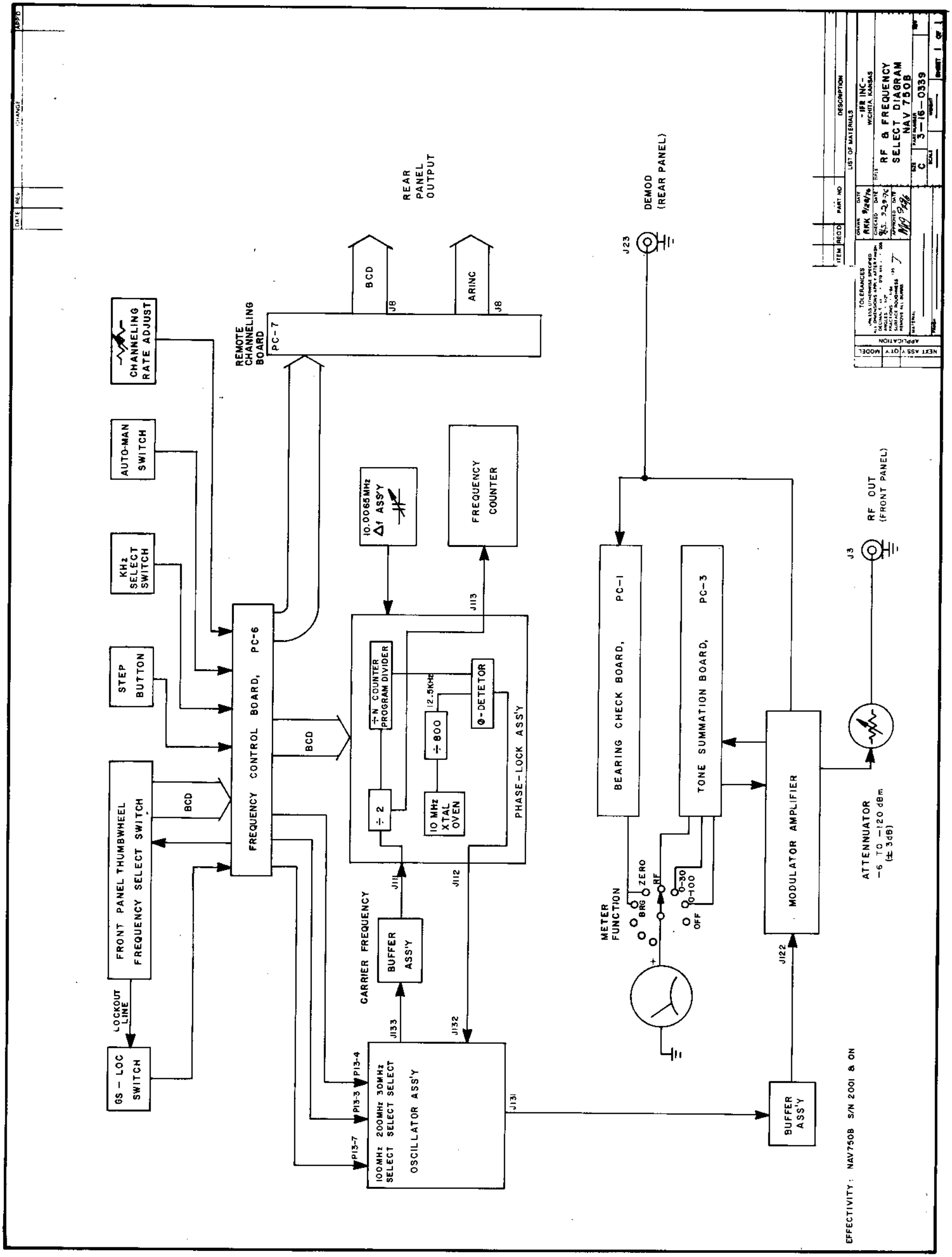
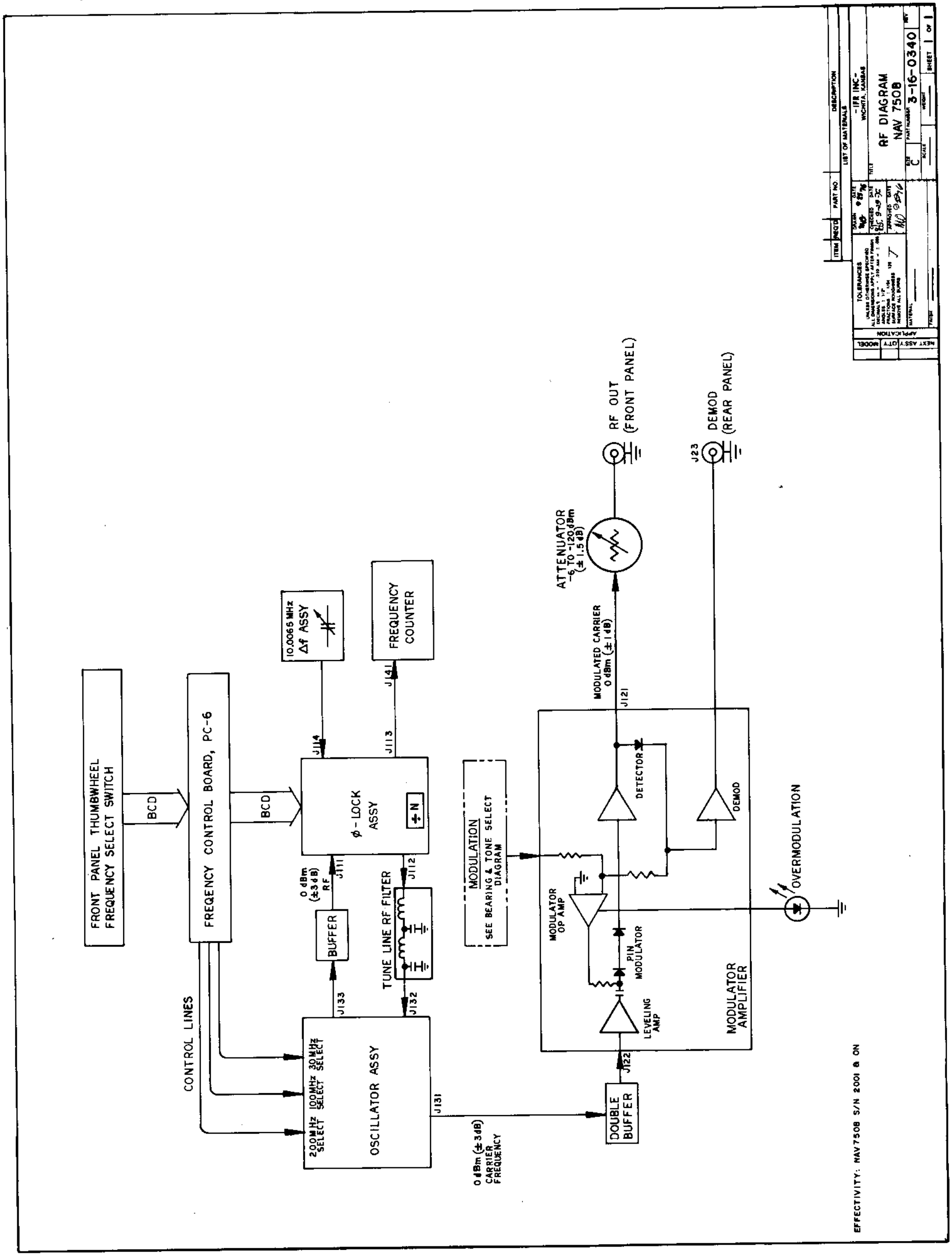

IFR INC.
WICHITA, KANSAS
RF & FREQUENCY SELECT DIAGRAM NAV 750B
3-16-0339
REAR PANEL OUTPUT
BCD
ARINC
J8
J8
REMOTE CHANNELING BOARD
PC-7
CHANNELING RATE ADJUST
AUTO-MAN SWITCH
KHz SELECT SWITCH
STEP BUTTON
FRONT PANEL THUMBWHEEL FREQUENCY SELECT SWITCH
BCD
LOCKOUT LINE
GS - LOC SWITCH
FREQUENCY CONTROL BOARD, PC-6
BCD
10.0065MHz Δf ASS'Y
FREQUENCY COUNTER
J113
÷N COUNTER PROGRAM DIVIDER
Φ-DETETOR
12.5KHz
÷ 800
÷ 2
10 MHz XTAL OVEN
PHASE-LOCK ASS'Y
J111
J112
CARRIER FREQUENCY
BUFFER ASS'Y
J133
J132
P13-4
P13-3
P13-7
100MHz SELECT
200MHz SELECT
30MHz SELECT
OSCILLATOR ASS'Y
J131
BUFFER ASS'Y
J122
MODULATOR AMPLIFIER
TONE SUMMATION BOARD, PC-3
BEARING CHECK BOARD, PC-1
DEMOD (REAR PANEL)
J23
RF OUT (FRONT PANEL)
J3
ATTENNUATOR -6 TO -120 dBm (± 3dB)
METER FUNCTION
BRG
ZERO
RF
0-30
0-100
OFF
EFFECTIVITY: NAV750B S/N 2001 & ON

Figure 4-6



FRONT PANEL THUMBWHEEL FREQUENCY SELECT SWITCH
BCD
FREQUENCY CONTROL BOARD, PC-6
BCD
CONTROL LINES
200MHz SELECT
100MHz SELECT
30MHz SELECT
OSCILLATOR ASSY
J131
0 dBm (±3dB) CARRIER FREQUENCY
J133
BUFFER
0 dBm (±3dB) RF
J111
φ-LOCK ASSY
÷N
J114
J113
J112
J132
TUNE LINE RF FILTER
10.0065 MHz Δf ASSY
J141
FREQUENCY COUNTER
MODULATION
SEE BEARING & TONE SELECT DIAGRAM
DOUBLE BUFFER
J122
LEVELING AMP
PIN MODULATOR
MODULATOR OP AMP
DETECTOR
DEMOD
MODULATOR AMPLIFIER
OVERMODULATION
J121
MODULATED CARRIER 0 dBm (±1dB)
ATTENUATOR -6 TO -120 dBm (±1.5dB)
RF OUT (FRONT PANEL)
J23
DEMOD (REAR PANEL)
EFFECTIVITY: NAV750B S/N 2001 & ON
IFR INC. WICHITA, KANSAS
RF DIAGRAM NAV 750B
C
3-16-0340
SHEET 1 OF 1

Figure 4-7