T-36C
NAV/COMM RAMP and BENCH TEST SET

Operational & Maintenance Manual
P/N: 90008077-2

REVISION

A	B	C	D	E	F	G	H	I	J	K	L	M
N	O	P	Q	R	S	T	U	V	W	X	Y	Z

30 June 2004
For Test Sets Containing Software Revision 3.04 or greater

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Leading the AVIONICS TEST industry into the 21st Century!

NOTICE:

The information contained in this manual is subject to change without notice.

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PART NUMBER	VOLUMES INCLUDED	CHAPTERS INCLUDED
90008077-1	VOLUME 1	CHAPTERS I & II
90008077-2	VOLUMES 1 & 2	CHAPTERS I - VI

Chapter I – Introduction
Chapter II – Preparation for Use and Operation
Chapter III – Theory of Operation
Chapter IV – General Maintenance and Servicing Procedures
Chapter V – Schematics
Chapter VI – Illustrated Parts Catalog

Safety Precautions

The following are general safety precautions that are not related to a particular test or procedure. These are recommended procedures that all personnel must apply during many phases of operation and maintenance. It is assumed that the operator has general knowledge of electrical theory and the dangers associated with it.

1. When performing any of the preceding; thoroughly read and understand all procedures before actually performing them.

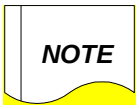
2. The various front panel connectors, switches, and controls specified can be located by referring to Figure 2-1 on page 2-3.

3. Take the time to learn the proper operation and function of the Test Set as outlined in Chapters 1, 2, and 3. Through knowledge of the Test Set and its capabilities greatly improves the time it takes to complete the tests.

4. Pay particular attention to **NOTES** and **WARNINGS** that may accompany some test and operational procedures.

WARNINGS

Alerts the operator to potential dangers associated with a particular test. Thoroughly understand the warning before proceeding to prevent a potentially dangerous situation or damage to the Test Set.



NOTES

Provides supplemental information that enhances the procedure or further explains in detail additional information to ensure understanding or proper operation.

5. Observe all standard safety procedures when working with live voltages. The potential for electric shock exists any time the Test Set is removed from its case.

6. DO-NOT service the unit or make adjustments alone. Always be in the presence of another person when working with live voltages.

7. Thoroughly inspect the equipment and the local area for potential hazards. Loose clothing and jewelry should be removed anytime the test set is being utilized or being serviced.

8. Be familiar with general first aid procedures and CPR (Cardiopulmonary Resuscitation). Contact your local Red Cross for more information.

9. Ensure the test equipment and the tools you utilize are in good operational condition and not damaged in any way.

10. Use only specified replacement parts as listed in the IPB. Failure to utilize factory approved parts may cause damage to personnel; the test set's, and possibly void the warranty.

ESD Safety and Protection

Many parts contained in the Test Set are sensitive to ESD (Electro-Static Discharge) damage. ESD can damage integrated circuits or semiconductors located within the Test Set. Only qualified personnel should service the Test Set to prevent damage. The following are guidelines to avoid ESD damage while still performing tests and or maintenance. These guidelines are meant only as a reminder, consult local directives and follow standard operating procedures before servicing, or repairing the Test Set.

- Wear a properly grounded wrist strap and remain in contact with an approved grounding point.
- Do not touch the connector pins or backplanes of ESD Sensitive circuits or parts.
- Ensure soldering irons are grounded before use.
- Do not remove any components or disconnect any connectors located in the Test Set with the power “ON”.
- Properly ground all test equipment being utilized. Refer to the test equipment operating manual for information.
- Place all removed components or parts in or on an approved conductive package.

Most ESD devices or circuits and common points are readily identified utilizing several different methods. Below are some examples.

VOLUME 1

OPERATIONAL PROCEDURES

T-36C TABLE OF CHANGES

Date	REV	ECO	Page	Description
2-10-03	B		All pages were affected	Overhaul of entire Manual
1-17-04	C		Chap 2 & 4	Chap 2 – Added additional Tests Chap 4 – Revised entire Calibration
6-30-04	D		Chap 2 Chap 4	Improved Operating Procedures Updated Calibration/Added additional procedures

Table of Contents

Chapter			Page

Chapter			Page

Chapter	Page

Chapter	Page

APPENDIX

List of Illustrations (Figures)

Figure	Title	Page

List of Tables

CHAPTER I

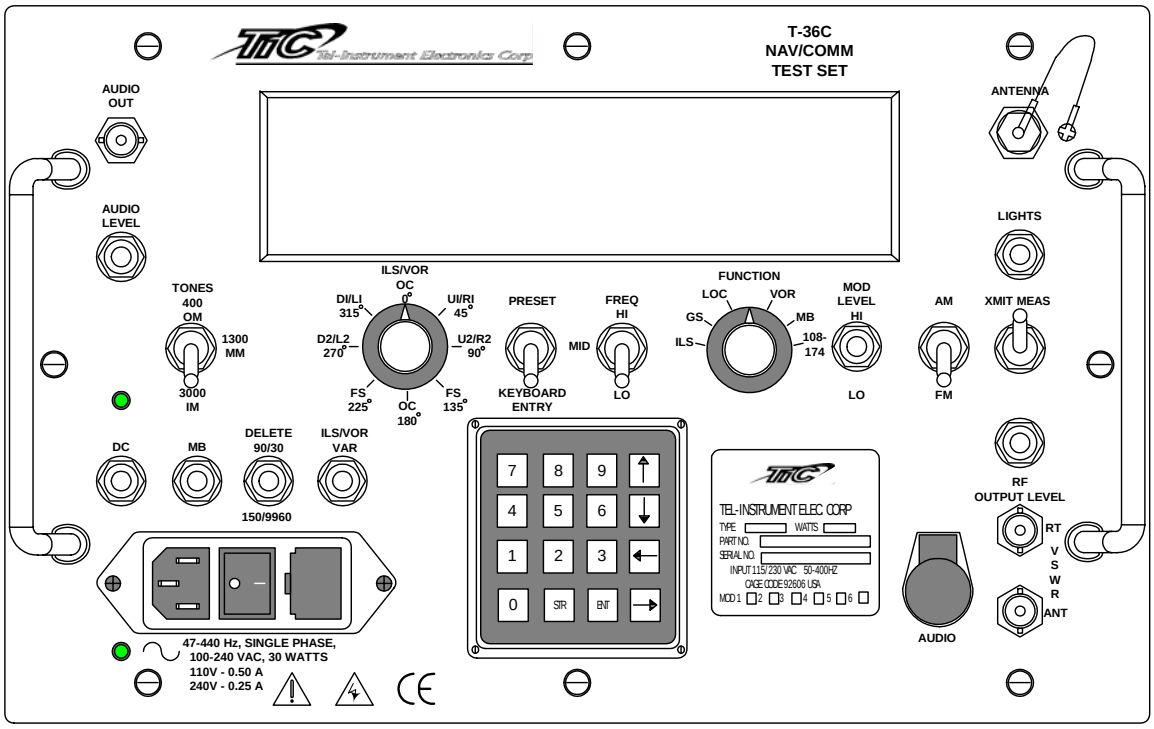
INTRODUCTION

SECTION A

GENERAL INFORMATION

1.1 Scope of Manual

This manual provides operator guidance for the T-36C CAT III NAV/COMM Test Set, hereafter referred to as the T-36C, the Test Set, or the T/S. The T-36C is a precision VHF signal simulator, used for ramp, cockpit, or bench testing of VOR, LOC/GS (ILS), and MB NAV receivers, or VHF COMM transceivers.



T-36C Test Set

Figure 1-1

1.2 Purpose and Function of Equipment

The T-36C is a portable, rugged, user friendly instrument designed for rapid, ICAO Annex 10 CAT III precision functional testing and calibration of military and general aviation VOR, LOC/GS, MB and VHF COMM transceivers. The Test Set can be operated in either a "preset" mode for rapid simple access to preset test conditions accessible to gloved personnel for ramp/flight-line go, no-go testing, or a "keypad" mode for direct parametric entry for full function bench testing and diagnostics. Operational test flexibility is enhanced by the T-36C's ability to store three carrier frequencies and output power levels for each operating mode, and UUT connection with either a provided antenna or direct connect cable. Stored test frequencies can be pre-programmed to match unique test environments and locations. The Test Set is powered by either an internal NiCad battery or by 100-240 VAC, 47-440 Hz source. An internal battery charger is enabled whenever the Test Set is powered from external AC. All required accessories are stored in the weather resistant MIL-PRF-28800, Style C case.

1.3 Warranty[1]

The Tel-Instrument Electronics Corporation warrants that each product it manufactures is free from defective material and workmanship for a period of two (2) years subject to the following terms and conditions. Tel-Instrument Electronics Corporation will remedy any such warranted defect subject to the following:

This warranty requires the unit to be delivered by the owner to Tel-Instrument intact for examination, with all transportation charges prepaid to the factory, within two (2) years from the date of sale to original purchaser. Tel-Instrument will solely determine when such defect exists.

This warranty does not extend to any of Tel products which have been subject to misuse, neglect, accident, improper installation, or used in violation of operating instructions. This warranty does not extend to units which have been repaired, calibrated, or altered in any way by a facility that is not approved, in writing, by Tel-Instrument Electronics Corp. to perform such work. This warranty does not apply to any product where the seals or serial number thereof has been removed, defaced or changed, nor to accessories not of our own manufacture.

Repair parts will be made available for a minimum period of five (5) years after the manufacture of this equipment has been discontinued.

This warranty is in lieu of all other warranties expressed or implied and all such other warranties are hereby expressly excluded. No representative or person is authorized to assume for us any other liability or warranty in connection with the sale of Tel's products.

This warranty does not cover or include batteries (batteries have a separate 90 day warranty).

Additional information with regard to the applications and maintenance of this equipment will be available from time to time.

[1] Tel Instrument Electronics Corp reserves the right to change or modify the warranty without notice.

1.4 Obtaining Warranty Service

In the event the Test Set may require service or repair that is included under the warranty provided with the Test Set; the following is necessary to ensure proper handling:

1. Contact Tel-Instrument Customer Support before shipping any Test Set back under a warranty condition.

   Tel-Instrument Electronics Corp. Customer Support can be reached by calling:

   - (201) 933-1600 (telephone)
   - (201) 933-7340 (fax)

2. The Customer Support Department will discuss the matter and if validated, issue an RMA (Return Material Authorization) number and form. Do not return any product without first receiving this authorization.
3. The Test Set must be returned with the completed RMA form. This will ensure prompt handling and expedited service.
4. Products must be returned in the Original Shipping Container (see Paragraph 1.4.1). If the original container is no longer available, please contact Tel-Instrument for guidance. Include in or on the shipping container the following information:

   - RMA Form on top of the product
   - The assigned RMA number written in bold letters on the outside of the shipping container
   - Model, Serial Number, and specific details regarding the problem
   - POC name, return address, telephone number, and email address

5. Freight Charges to the factory are the responsibility of the owner/operator. Tel-Instrument will provide return shipping if the problem is determined to be warranty covered.

1.4.1 Shipping and Packing the Test Set

1. Repackage the Test Set in the Original container utilizing the provided packing material. Do Not Ship the Test Set with out using a shipping container, this will prevent damage to the case and or finish during transit.
2. Wrap the Test set within plastic sheeting and firmly seat the Test Set in the original corner molds. Place all necessary documentation (RMA Form, POC, etc…), on top of the Test Set.
3. Utilize Package Tape and seal all seams. If the use of an industrial box stapler is used, be sure that they do not protrude through the box to prevent injury to personnel handling the package.
4. Firmly affix a shipping label and mail the Test Set to the following:

Tel-Instrument Electronics Corp.
728 Garden Street
Carlstadt, NJ 07072

Attn: Repair Department

SECTION B EQUIPMENT DESCRIPTION

1.5 Specifications[2] [3]

TRANSMITTER

FUNCTION	PRESET (DEFAULT) FREQUENCY	ACCURACY
MB	74.5 – 75.5 MHz	± 150 Hz
VOR	108.0500 – 117.9500 MHz	± 150 Hz
Localizer (LOC)	108.1000 – 119.9500 MHz	± 150 Hz
Glideslope (GS)	329.1500 – 335.0000 MHz	± 300 Hz
COMM	108.0000 – 174.0000 MHz	± 150 Hz
Channel Spacing in 25 and 8.33 KHz Steps		

RF CHARACTERISTICS

FUNCTION	DIRECT CONNECT	ANTENNA
MB	-115 dBm to -25 dBm / ±1 dB	-100 to +13 dBm / ± 1 dB
VOR	-115 dBm to -25 dBm / ±1 dB	-100 to +6 dBm / ± 1 dB
Localizer (LOC)	-115 dBm to -25 dBm / ±1 dB	-100 to +6 dBm / ± 1 dB
Glideslope (GS)	-115 dBm to -30 dBm / ±1 dB	-100 to +0 dBm / ± 1 dB
ILS	-115 to -30 dBm / ± 1 dB	-100 to +0 dBm / ± 1 dB
COMM	-115 dBm to -25 dBm / ±1 dB	-100 to +0 dBm / ± 1 dB
Selectable in 1 dB Steps		

NAV CHARACTERISTICS

NAV CHARACTERISTIC		ILS / VOR PRESETS									KEYPAD ENTRY SELECTION	
											RANGE	RESOLUTION
VOR	Degrees	0°	45	90	135	180	225	270	315	360	0° to 360°	1°
			U1/R1	U2/R2	FS	0C	FS	D2/L2	D1/L1			
LOC	DDM		0.093	0.155	0.200	0.000	0.200	0.155	0.093		0 to 0.200 DDM (L/R)	± 0.001 DDM
GS	DDM		0.091	0.175	0.400	0.000	0.400	0.175	0.091		0 to 0.400 DDM (U/D)	± 0.001 DDM

[2] Tel Instrument Corp reserves the right to change specifications without notice.
[3] Standard Condition Values

MODULATION CHARACTERISTICS

MODULATION CHARACTERISTICS		SOFTWARE PRESET VALUES			SLEW SWITCH ADJUSTMENT		
FUNCTION	FREQUENCY	CONDITIONS	DEFAULT	ACCURACY	RANGE	RESOLUTION	SWITCH NAME
Marker	0.4, 1.3, 3.0 kHz	-----	20 % mod	+/- 3 %	-----	-----	-----
VOR OMNI	9960 Hz & 30 Hz	0° Bearing	30 % mod	+/- 0.5 %	0° to 360°	.33°	ILS/VOR VAR
Localizer	90 Hz & 150 Hz	0.0 DDM	20 % mod	+/- 0.5 %	0 to 0.200 DDM (L/R)	0.001 DDM	ILS/VOR VAR
Glide Slope	90 Hz & 150 Hz	0.0 DDM	40 % mod	+/- 0.5 %	0 to 0.400 DDM (U/D)	0.001 DDM	ILS/VOR VAR
Ident	1020 Hz	-----	0 to 95 % modulation	+/- 1 %	-----	-----	-----
COMM AM	150 Hz, 1020 Hz	-----	0 to 95 % modulation	+/- 1 %	0 to 95 %	1 %	MOD LEVEL
COMM FM	1020 Hz	-----	0 to 15 kHz deviation	+/- 1 kHz	0 to 10 kHz	1 kHz	MOD LEVEL

RECEIVER CHARACTERISTICS

RECEIVER CHARACTERISTICS			
Frequency Range	Same as COMM Ranges	Frequency Measurement Range	+/- 8 kHz of selected
Maximum Input Level (RT port)	25 W	Frequency Measurement Accuracy	+/- 0.5 kHz
Sensitivity (Antenna port)	-10 dBm AM; -30 dBm FM	Power Measurement Range	0 dBW to +14 dBW (1 to 25 W) Direct Connect
VSWR Measurement	1.0 to 5.0; +/- 0.5	Power Measurement Accuracy	+/- 1 dB
AM Measurement Range	0 to 100%	FM Measurement Range	0 to 15 kHz
AM Measurement Tolerance	+/- 5%	FM Measurement Tolerance	+/- 1 kHz

MISCELLANEOUS SPECIFICATIONS

Size	15.5 x 9.4 x 6.5 inches	Operating Temperature	-28 to + 55° C
Weight	20 Pounds	Input Current	0.17 Amps AC
Case Style	MIL-PRF-28800, Class 2	Color	Yellow
Input Power	100 – 240 VRMS ± 10%	Power Consumption	20 Watts
Input Power Frequency	47 – 440 Hz		
Input Power Specified – Simultaneous Battery Charging and Test Set Operation			

1.6 Abbreviations, Acronyms and Glossary Terms[4]

A/A	Air to Air
A/A B	Air to Air Beacon
ac or AC	Alternating Current
A/C	Aircraft
A/D	Analog to Digital
AM	Amplitude Modulation
AGC	Automatic Gain Control
AM	Amplitude Modulation
ATCRBS	Air Traffic Control Radar Beacon System
ATC	Air Traffic Control
AUT	Aircraft under Test
BIT	Built in Test
CAT I, II & III	Categories of ILS Approaches
CDI	Course Deviation Indicator
COMM	Communications, Communication Equipment
CW	Continuous Wave
D/A	Digital to Analog
DH	Decision Height
dB	Decibel
dBm	Decibels relative to 1 milliwatt
dBw	dB-watts or referenced to 1 watt
dc or DC	Direct Current
DME	Distance Measuring Equipment
EMI	Electromagnetic Interference
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FD	Flight Director
FIFO	First In First Out
FM	Frequency Modulation
FREQ	Frequency
ft.	Feet
G/A	Ground to Air
GS	Glideslope
Hz	Hertz
HDG	Heading
HSI	Horizontal Situation Indicator
IF	Intermediate Frequency
IFF	Identify Friend or Foe
ILS	Instrument Landing System
IM	Inner Marker (one of three Marker Beacon signals)
kHz	Kilohertz
kts.	Knots
LCD	Liquid Crystal Display
LED	Light Emitting Diode

[4] Further definitions may be found in the following reference books and documents: Helfrick, A.D. Principles of Avionics. Leesburg: Quality Books, 2000. RTCA/DO-181B. Minimum Operational Performance Standards for Air Traffic Control RADAR Beacon System/Mode Select (ATCRBS/Mode S) Airborne Equipment. Washington D.C.: 1999. United States. Federal Aviation Administration. Federal Register Fed 3, 1987 FAA rules Part 91.

LOC	Localizer
MB	Marker beacon
MF	Medium Frequency
MHz	Megahertz
MM	Middle Marker (one of three Marker beacon signals)
NAV	Navigation, Navigational Equipment
nmi.	Nautical mile
ns	Nanosecond
OBS	Omni Bearing Selector
OM	Outer Marker (one of three Marker Beacon signals)
PAM	Pulse Amplitude Modulation
PDME	Precision Distance Measuring Equipment
PMCS	Preventative Maintenance Checks and Services
PPM	Pulses per Minute
PRF	Pulse Repetition Frequency
PW	Pulse Width
PWR	Power
RA	Resolution Advisories
RF	Radio Frequency
RMI	Radio Magnetic Indicator
RMS	Root Mean Square
R/T	Receiver Transmitter
TA	Traffic Advisories
TACAN	Tactical Air Navigation
TCAS	Traffic Alert and Collision Avoidance System
TX	Transmitter
UHF	Ultra High Frequencies, 300 MHz – 3000 MHz
VHF	Very High Frequencies, 30 MHz – 300 MHz
VOR	VHF Omnidirectional Range
VORTAC	VOR and TACAN (co-located)
VSWR	Voltage Standing Wave Ratio
WOW	Weight On Wheels
UUT	Unit Under Test
XPDR	Transponder

CHAPTER II

PREPARATION FOR USE AND OPERATION

SECTION A

GENERAL INFORMATION

2.1 General

This section contains all necessary information on the initial unpacking, inspection, and setup of the T-36C Test Set. Each Test Set has already undergone a comprehensive series of tests, full calibration and Quality Assurance Checks before shipment from Tel-Instrument Corporation.

2.2 Unpacking and Inspection

After receiving the Test Set for the first time, ensure there is no damage to the shipping container, before opening the box. Carefully unpack the unit and save the shipping container in a safe location for subsequent shipping or extended storage.

Examine the unit for obvious signs of damage. Carefully check each switch. Connector and display before utilizing the Test Set for the first time.

If damage is found, DO NOT use the Test Set until a determination of the Test Set's condition can be assessed. Contact Tel-Instrument Corporation as soon as possible for further instructions.

Check that all the accessories that you purchased with the Test Set are accounted for. The T-36C Test Set is equipped with the following standard accessories:

NOMENCLATURE	P/N	QTY
T-36C Test Set	90 000 077	1
AC Line Cord	75 010 025	1
Direct Connect Cable Assembly	75 010 134	1
Omni Antenna	40 030 003	1
Adapter, Right Angle	48 000 013	1
Operators and Maintenance Manual	90 008 077-2	1

T-36C Accessories

Table 2-1

2.3 Installation

The T-36C Test Set is ready to use from the factory. There are no installation procedures applicable. The Test Set batteries were installed and fully charged before shipping.

2.3.1 Extended Storage

If the Test Set is to be stored or not utilized for a period of 3 months or more, perform the following:

1. Disconnect the Test Set from any AC Power source.

2. Store all of the accessories in the Test Set lid.

3. Disconnect the battery, see Chapter 4; Paragraph 4.9. Place a tag on the Test Set that indicates that the battery has been disconnected and needs to be reconnected before use.

4. If available, store the Test set in the original Shipping Container.

Before returning the Test Set to operational use after an extended storage, make sure to reconnect and fully charge the battery as required in Chapter II, Paragraph 2.7.

SECTION B

OPERATING CONTROLS, INDICATORS, AND CONNECTORS

2.4 General

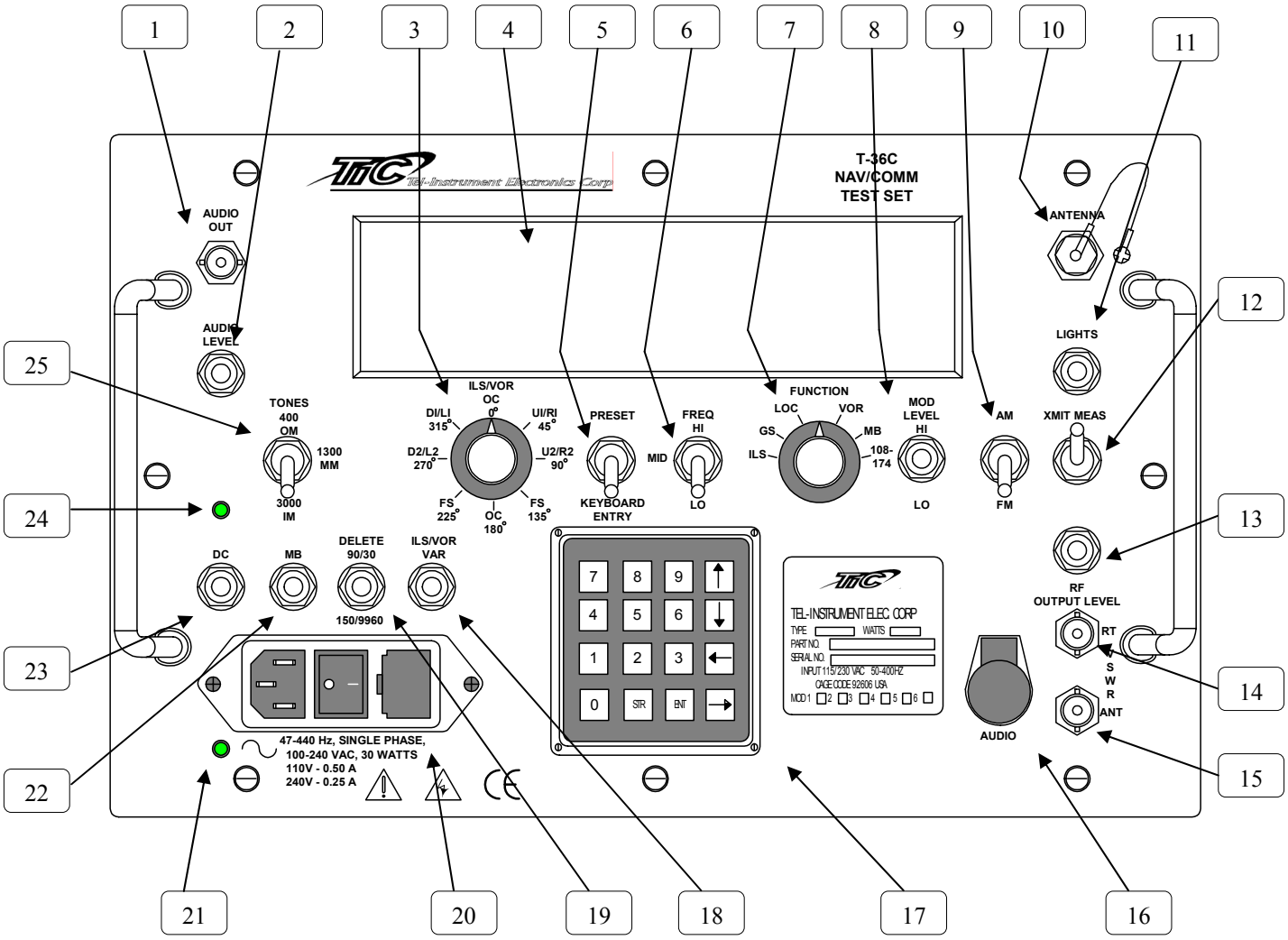
This section explains location and function of the operating controls, indicators and connectors. All controls, indicators, connectors are located on the front panel of the Test Set.

2.5 Controls, Indicator, and Connectors

Figure 2-1 and Table 2-2 describes and shows location for each of the T-36C Test Set controls, switches and displays.

TABLE 2-2 Controls, Indicators, and Connectors

Ref	CONTROL, INDICATOR, OR CONNECTOR	FUNCTION
1	**AUDIO OUT** Connector	Calibrated audio tone providing UUT audio modulation at 1020 Hz.
2	**AUDIO LEVEL** Toggle	Sets Audio Out level.
3	**ILS/VOR** Rotary Switch	Used in conjunction with the **FUNCTION** Rotary switch. Allows selection of *On Course Bearing* information for VOR and ILS/GS/LOC *Offset deflection*.
4	**LCD** Display	Provides Operator interface with Test Set functions.
5	**KEYPAD ENTRY/PRESET** Toggle Switch	Selects NAV and COMM frequencies (MHz).
6	**FREQ HI/MID/LO** Toggle Switch	Selects low, mid, and high frequencies. Used in conjunction with the **FUNCTION** Rotary Switch.
7	**FUNCTION** Rotary Switch	Selects Test Set operating Modes. ILS, GS, LOC, VOR MB, and COMM Frequencies of 108.0-174.0 MHz.
8	**MOD LEVEL** Toggle Switch	Sets modulation level.
9	**AM/FM** Toggle Switch	Selects *AM* (Amplitude Modulation) or *FM* (Frequency Modulated) transmission signals.
10	**ANTENNA** Connector	TNC Connector for ramp mode testing utilizing Omni-Antenna.
11	**LIGHTS** Toggle Switch	Enables momentary or continuous background lighting for **LCD** Display.
12	**XMIT MEAS** Toggle Switch	Selects transmission measurements display.
13	**OUTPUT LEVEL** Toggle Switch	Controls RF Output Level.
14	**VSWR** Connector **RT**	Allows Direct Connection of UUT R/T's.
15	**VSWR** Connector **ANT**	Direct Connection connector for UUT *Voltage Standing Wave Ratio*.
16	**AUDIO** Jack	Audio Connector to monitor COMM transmitters.
17	**KEYPAD**	Utilized for direct data entry.
18	**ILS/VOR VAR** Toggle Switch	Slews VOR Bearing, GS and LOC DDM.
19	**DELETE 90/150**, **30/9960** Toggle Switch	Allows the operator to delete the 90/150Hz component of the LOC/GS signals or the 30/9960 Hz component of the VOR output.
20	**FUSE** and **AC Power** Panel	1. Provides connection to AC input power via the supplied cable. 2. **AC ROCKER** switch to Charge Test Set battery or operation utilizing AC Power. 3. **FUSE Cartridge-** provides Test Set power protection.
21	**AC** Lamp Indicator	Indicates AC power is being utilized.
22	**MB/NAV ID** Toggle Switch	Momentary switch providing *IDENT*, 400, 1300, or 3000 Hz simultaneous MB RF signals.
23	**DC** Toggle Switch	Operates Turns Test Set *ON/OFF* when utilizing internal battery.
24	**DC** Lamp Indicator	Power *ON* Indicator.
25	**TONES 400/OM, 1300/MM, 3000/IM** Toggle Switch	Selects simulated Marker Beacon audio tones. **400/OM-** 400 Hz/Outer Marker **1300/MM**- 1300 Hz /Middle Marker **3000/IM**- 3000 Hz/Inner Marker



T-36C Test Set Controls, Indicators, and Connectors

Figure 2-1

SECTION C

OPERATING INSTRUCTIONS

2.6 General

The T-36C Test Set is capable of testing VOR/LOC/MB/GS and VHF Communications by either direct connection of the UUT or remote testing by use of the supplied Omni-Directional Antenna. Preset frequencies for quick ramp checks of NAV/COMM equipment are built-in the Test Set's memory. The operator also has the capability of manually varying a variety of frequencies, bearing, and heading information.

2.7 Battery Operation

The Test Set is factory equipped with a rechargeable Ni-Cad battery capable of operating the Test Set using a 20% Duty Cycle for up to 8 hours at 77 ° F (25ºC). This represents a full day of testing on a single charge. When operating the Test Set in lower temperatures, the battery life will decrease.

Due to the Ni-Cad batteries ability to maintain a constant current level, the operator will be able to use the Test Set until the batteries are nearly depleted. By plugging the unit into an AC power source and maintaining a 20% Duty Cycle, the operator may continue to utilize the Test Set and the batteries will begin regaining their charge.

After 16 minutes utilizing battery power, the Test Set will automatically turn ***OFF*** to conserve battery strength.

It is strongly recommended that the Test set batteries be charged for a short time each week, regardless if the Test Set has been utilized or not. A completely discharged battery will require approximately 8 hours to completely recharge. Occasional charges of 8 hours on partially depleted batteries will have no adverse affects.

2.7.1 Battery Charging

Utilize the following procedures to charge the batteries:

1. Remove the **AC Power Cord** from the Test Set cover.
2. Connect the cord to a suitable 120 VAC outlet (220 VAC if configured).
3. Depress the **AC Rocker** switch to the "**—"** position. Ensure the green **AC** lamp indicator illuminates signifying that battery charging has commenced.

2.7.2 Battery Replacement

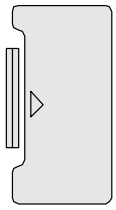
See Chapter IV, Paragraph 4.9.

2.7.3 220 AC Operation

The T-36C may be operated using 220VAC. The following procedures are necessary before using the Test Set. Failure to properly configure the T-36C may result in severe damage to the Test Set.

1. Remove the **FUSE Cartridge** from the **FUSE** panel located on the front panel (figure 2-2).

WARNING
Failure to configure the Test Set for 220VAC operation may result in severe damage to the Test Set and/or injury.



Fuse Cartridge

Figure 2-2

2. Remove and store/dispose the two fuses.

3. Replace the fuses with 250V/0.25A FFT fuses and reinstall the cartridge back in the panel.

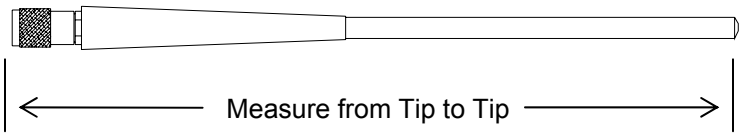
2.8 Omni-Directional Antenna

Most navigation receiver checks will be performed on the ramp utilizing the supplied Omni-Antenna. The Omni-Antenna will be most effective if the operator adjusts the length for the selected frequency range. Though not necessary, the operator will notice a marked improvement in performance when adjusting to the correct length.

In order to perform ramp testing, Antenna to Antenna, perform the following steps:

1. Remove the Omni-Antenna from the Test Set Cover. Connect it to the **ANTENNA** connector located on the front panel of the Test Set.

2. Use Table 2-3 and Figure 2-3 to adjust the antenna length to the frequency range that you will be testing in.



Omni Antenna

Figure 2-3

NAV FREQUENCIES	
FREQUENCY TESTED	**ANTENNA LENGTH**
MB	Fully Extended
VOR	Approx, 30 inches
LOC	Approx, 30 inches
GS	Approx, 20 inches
ILS	Approx, 30 inches

COMM FREQUENCIES	
FREQUENCY TESTED	**ANTENNA LENGTH**
75 MHz	Fully Extended
108-118 MHz	Approx, 30 inches
118-156 MHz	Approx, 24 inches
156-174 MHz	Approx, 20 inches

Antenna Lengths

Table 2-3

3. Place the Test Set 10 to 30 ft. from the UUT antenna. Ensure a clear view without obstructions. Nearby ramp equipment or aircraft may interfere with the results. If incorrect results are observed, relocate the Test Set to a different position and re-test. Most tests can be performed from within the aircraft.

2.9 Keypad Entry

The T-36C allows the operator to modify and vary numerous parameters allowing unique and more detailed tests to be performed. The flexibility of the variable parameters is sufficient enough to allow *Acceptance Level Testing*. The following parameters can be modified:

1. RF Frequency
2. RF Output Level
3. Audio Output Level
4. Modulation Level (AM or FM Deviation)

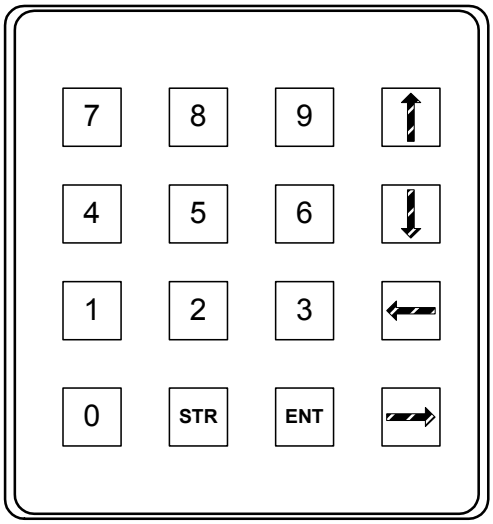
In addition to these parameters, the frequencies assigned to the LO, MID, and HI preset functions can be changed within permitted operating ranges for the function selected.

NOTE

Only valid frequencies within normal bandwidths and at 25 KHz or 8.33 KHz increments can be modified.

2.9.1 Keypad Entry Instructions

Entering variable parameters utilizing the Keypad requires only that the operator select a parameter within the T-36C normal range and depress the **ENT** pad. Utilize Figure 2-4 for reference.



Keypad

Figure 2-4

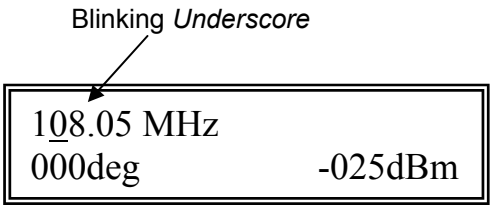
To enter data, the following procedure is used:

1. On the Test Set front panel, toggle the **PRESET/KEYPAD** entry switch to the **KEYPAD** position.

2. Select the desired function utilizing the **FUNCTION** rotary switch.

3. The Test Set display will indicate the current frequency, RF output level, modulation level and audio output level.

4. A flashing *Underscore-Bar* will be displayed under the first entry position in the frequency position.

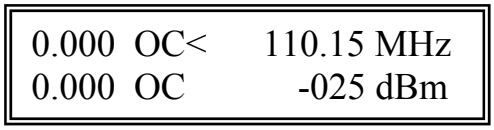


5. Enter the desired frequency by depressing the appropriate numbers on the keypad. Each time a number is selected, the *Underscore* will advance one position.

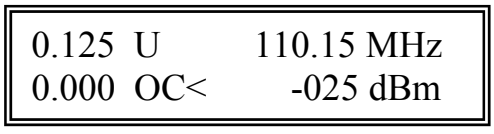
6. Depress the **ARROW** keypads to advance or maneuver the underscore to a different parameter.

7. When all values have been entered, select the **ENT** button.

8. A Carrot (<) next to a value, also indicates that this can be modified be utilizing a combination of keypad entries or front panel switches.



The illustration above indicates that the DDM value, in ILS, can be changed. Toggle the **ILS/VOR VAR** switch to the desired value. Then utilizing the keypad arrows, move the Carrot to the second value that you desire to change.



Toggle the **ILS/VOR VAR** switch to the desired value. You may also utilize the keypad to manually enter the value. Once you have selected, press the **ENT** button.

NOTE

In order to use the new test value, **ENT** must be pressed or a valid parameter must be entered. When all positions of the value are entered and the Test Set recognizes a valid entry, the Test Set will process the parameter with an Automatic **ENT.**

9. The following are exceptions that apply to the data entry process:

   a. RF frequencies can only be varied with the keypad method.

   b. Manually entered parameters are reset to factory defaults when a new test is selected or the Test Set is turned *OFF*.

   c. In the **NAV** or **LOC** functions, the 10 kHz position can be varied, but the Test Set will not allow entry of invalid parameters.

   d. **GS** frequencies cannot be varied as they are directly coupled to the **LOC** selection.

2.9.2 Stored Parameter Changes

The T-36C Test Set condition presets can be changed as desired by the operator. To enter new preset values, the following procedure should be used:

1. Select the FUNCTION desired and the appropriate frequency, LO/MID/HI position, desired to be changed.

2. Vary the displayed parameter fields with utilizing the method described in Para 2.9.1.

3. Press **ENT** or enter all parameter value positions to transfer the new display value into the active test value.

4. Press **STR** to transfer the new test value into the preset frequency LO/MID/HI register position.

5. The new preset value will be retained until it is changed. Test Set power *OFF/ON* cycling will not change the preset value.

6. Only legitimate frequency assignments can be entered for VOR, LOC and GS channel assignments. All other functions selected allow frequency assignments to any 100 Hz increment in the selected frequency ranges.

2.10 T-36C Typical Test Displays

Figure 2-5 depicts several typical displays for numerous Test Set functions. These represent only a small percentage of the possible displays that are shown when conducting tests with various types of equipment. Before utilizing the Test Set, thoroughly review this manual and the procedures necessary to properly test the desired equipment. A quick reference guide is located inside the Test Set cover and as an Appendix at the end of the manual.

Tel-Instrument T-36C Ver. 3.04 xx/xx/xx	T-36C Start-up Display. Current Software and date installed shown.
118.0000 MHz 1.4 kHz 80% AM 15W 2.1 VSWR	COMM Transmitter Testing **XMIT MEAS, AM**
18.0000 MHz 1.4 kHz 5.0 KHz FM 15W 2.1VSWR	COMM Transmitter Testing **XMIT MEAS, FM**
118.0000 MHz 100 mV 80% AM -063 dBm	COMM Receiver Testing **118-156 AM**
18.0000 MHz 100 mV 7.5 KHz FM -063 dBm	COMM Receiver Testing **118-156, FM**
75.0000 MHz -075 dBm	Marker Beacon Testing **MB; OM, MM, or IM**
117.95 MHz 225 Deg -075 dBm	VOR Receiver Testing **VOR, 225 º**
108.15 MHz 0.045 R -075 dBm	Localizer Receiver Testing **LOC, U1/R1**
110.15 MHz/334.25 MHz 0.045 U -075 dBm	Glideslope Receiver Testing **GS, U1/R1**
0.045 U < 110.15 MHz 0.045 R < -075 dBm	**ILS** System Testing

T-36C Typical Displays

Figure 2-5

2.11 General Test Procedures: Navigation, Antenna to Antenna

All of the following tests are described utilizing the T-36C Test Set. It is assumed the operator has a detailed knowledge of Avionics Systems and the UUT test requirements. Refer to Table 2-3 for correct antenna lengths for each test performed. Figure 2-6 illustrates a typical HSI/CDI indicator, utilize for reference when conducting VOR/LOC/ILS and GS Tests.

NOTE

The following tests are not meant to replace the testing criteria required for your particular model of equipment. They are general testing procedures to assist the operator in properly utilizing the T-36C T/S.

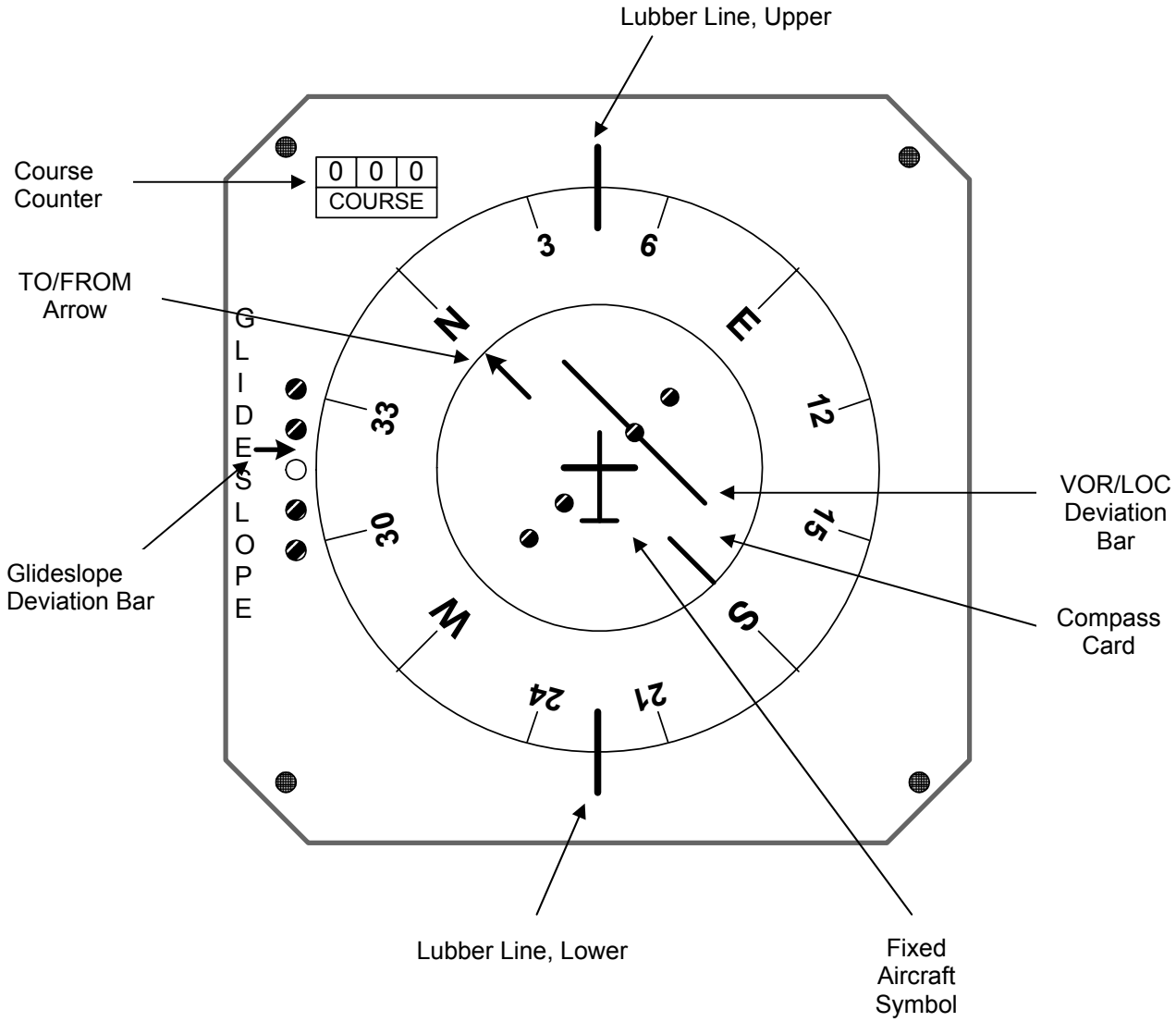


Figure 2-6

Basic HSI/CDI Indicator

2.11.1 ILS Test Procedures

WARNING

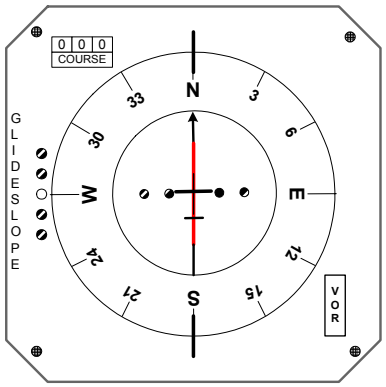
When conducting tests with the aircrafts autopilot engaged, any variation of the aircrafts controls may move the associated control services. Use caution to ensure that all personnel and ground support equipment are clear of the control services.

1. Toggle the **KEYPAD ENTRY/PRESET** switch to **PRESET.**
2. Extend the omni-antenna to 28½" (Top three sections retracted) and connect to the **ANTENNA** connector located on the front panel of the Test Set.
3. Place the **FUNCTION** rotary switch in **ILS**.
4. Toggle the **HI/MID/LO** switch to the **LO** position (108.01 – 334.70 MHz).
5. Turn the GS and LOC receivers *ON* in the Aircraft Under Test (AUT) and select corresponding frequencies on the aircraft panel and Test Set.
6. Select **OC** utilizing the **ILS/VOR** rotary switch. Observe a similar display.

```
0.000 OC <      108.15MHz
0.000 OC <         000dBm
```

7. The Horizontal pointers on your CDI should center and any flags are retracted.

Indicator shown with Deviation Bar centered and course at 000 degrees.



8. Utilizing the **ILS/VOR VAR** toggle switch, depress *Up* and *Down* observing the deviation pointers respond to the movement of the slew switch.

9. Repeat the procedure using different frequencies in the spectrum. Similar results should be observed.

2.11.2 GS Test Procedures

WARNING

When conducting tests with the aircrafts autopilot engaged, any variation of the aircrafts controls may move the associated control services. Use caution to ensure that all personnel and ground support equipment are clear of the control services.

1. Toggle the **KEYPAD ENTRY/PRESET** switch to **PRESET.**

2. Extend the omni-antenna to 19” (Top five sections retracted) and connect to the **ANTENNA** connector on the front panel of the Test Set.

3. Place the **FUNCTION** rotary switch in **GS**.

4. Toggle the **HI/MID/LO** switch to the **LO** position (334.70 MHz).

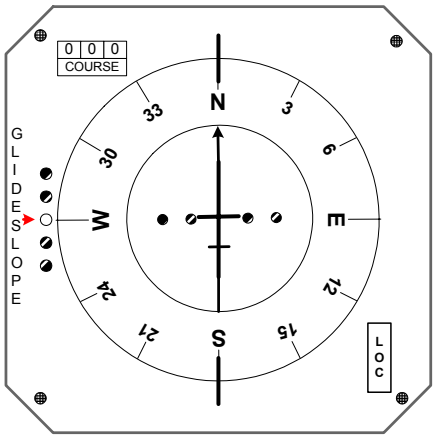
5. Turn the AUT GS receiver *ON* and select corresponding frequencies on the Test Set and aircraft.

6. Select **OC** utilizing the **ILS/VOR** rotary switch.

```
108.15MHz / 334.55MHz
0.000 OC          000 dBm
```

7. Verify the aircraft CDI deviation pointer is centered and no flags present.

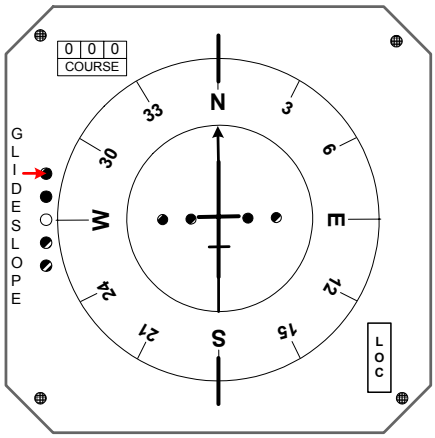
GS Pointer is Centered and On Course (OC).



8. Vary the **ILS/VOR** to **U1/R1**. The GS deviation pointer should indicate a one-dot deflection *UP*.

9. Vary the **ILS/VOR** to **U2/R2**. The GS deviation pointer should indicate a two-dot deflection *UP*.

GS Pointer indicates full Two-Dot *UP* Deflection



10. Vary the **ILS/VOR** to **D1/L1**. The GS deviation pointer should indicate a one-dot deflection *DOWN*.

11. Vary the **ILS/VOR** to **D1/L1**. The GS deviation pointer should indicate a two-dot deflection *DOWN*.

12. Return the **ILS/VOR** rotary knob to **OC**.

13. Momentarily toggle the **DELETE- 90/30 - 150/9960** switch to **90**. Observe a full *UP* deflection on the GS Pointer. Flag should be visible.

14. Momentarily toggle the **DELETE- 90/30 - 150/9960** switch to**150**. Observe a full *DOWN* deflection on the GS Pointer. Flag should be visible.

15. Repeat the procedure using different frequencies in the spectrum. Similar results should be observed.

2.11.3 LOC Test Procedures

WARNING

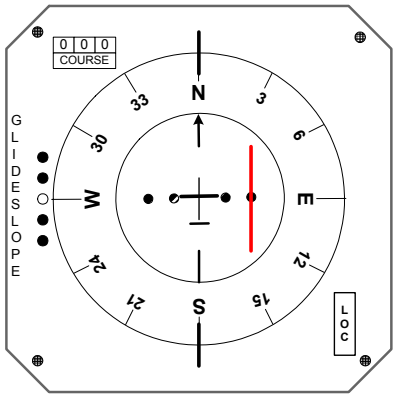
When conducting tests with the aircrafts autopilot engaged, any variation of the aircrafts controls may move the associated control services. Use caution to ensure that all personnel and ground support equipment are clear of the control services.

1. Toggle the **KEYPAD ENTRY/PRESET** switch to **PRESET.**
2. Extend the omni-antenna to 28½" (top three sections retracted) and connect to the **ANTENNA** connector on the front panel of the Test Set.
3. Place the **FUNCTION** rotary switch in **LOC**.
4. Toggle the **HI/MID/LO** switch to the **LO** position (108.01MHz).
5. Turn the LOC receiver *ON* in the AUT and select corresponding frequencies on the aircraft panel and Test Set.
6. Select **OC** utilizing the **ILS/VOR** rotary switch. Observe a similar display as shown below.

108.15MHz	
0.000 OC	+006 dBm

7. The CDI deviation bar should center with no flags present.
8. Select **U1/R1** utilizing the **ILS/VOR** rotary switch. The LOC deviation bar should indicate a one-dot deflection to the right.
9. Select **U2/R2** utilizing the **ILS/VOR** rotary switch. The LOC deviation bar should indicate a two-dot deflection to the right.

Indicator represents LOC Two Dots right of course



10. Select **D1/L1** utilizing the **ILS/VOR** rotary switch. The LOC deviation bar should indicate a one-dot deflection to the left.

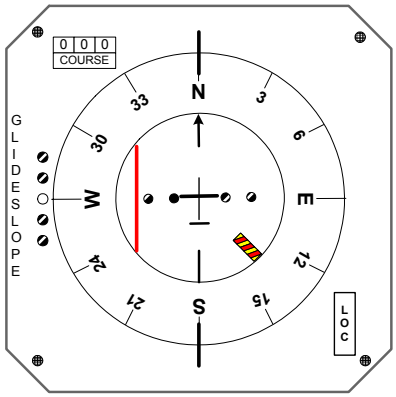
11. Select **D2/L2** utilizing the **ILS/VOR** rotary switch. The LOC deviation bar should indicate a two-dot deflection to the left.

12. Return the **ILS/VOR** rotary knob to **OC**.

13. Momentarily toggle the **DELETE- 90/30 - 150/9960** switch to **90**. Observe a full *LEFT* deflection on the LOC Deviation Bar. Corresponding flag should be visible (see next page).

14. Momentarily toggle the **DELETE- 90/30 - 150/9960** switch to**150**. Observe a full *RIGHT* deflection on the LOC Deviation Bar. Corresponding flag should be visible.

Indicator indicates Full Left Deflection and Flag visible. LOC **DELETE 90 ~** switch pressed.



15. Repeat the procedure using different frequencies in the spectrum. Similar results should be observed.

2.11.4 VOR Test Procedures

WARNING

When conducting tests with the aircrafts autopilot engaged, any variation of the aircrafts controls may move the associated control services. Use caution to ensure that all personnel and ground support equipment are clear of the control services.

1. Toggle the **KEYPAD ENTRY/PRESET** switch to **PRESET.**

2. Extend the omni-antenna to 28½" (top three sections collapsed) and connect to the **ANTENNA** connector on the front panel of the Test Set.

3. Place the **FUNCTION** rotary switch in **VOR** and the **ILS/VOR** rotary switch to **OC.**

4. Toggle the **HI/MID/LO** switch to the **LO** position (108.05MHz).

5. Turn the VOR receiver *ON* in the AUT and select corresponding frequencies on the aircraft panel and Test Set.

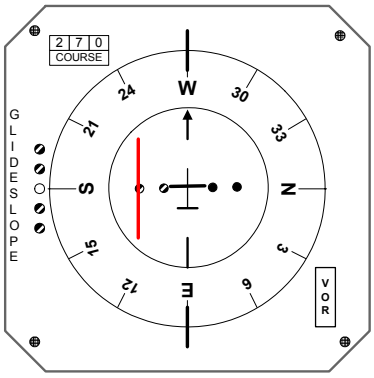
6. Observe the following display.

108.05MHz 000 deg +006 dBm

7. Utilizing the **RF OUTPUT LEVEL** toggle switch, reduce the preset power to *–47dBm*.

8. Turn the **ILS/VOR** rotary switch through each position and observe that the corresponding bearings (0º, 45º, 90º, 135º, 180º, 225º, 270º, and 315º) are displayed on the VOR indicator.

Indicator represents **VOR** variable fully CCW (2 Dots Left) and course at 270º



9. Utilize the **ILS/VOR VAR** toggle switch and vary the bearing with the VOR deviation bar centered. Ensure the Deviation Bar tracks smoothly left and right of the centered position.

10. Return the **ILS/VOR** rotary knob to **OC**.

11. Delete either the 30 or 9960 Hz component using the **DELETE** toggle switch. The Deviation Bar should deflect full scale from the center and the warning flag should appear.

12. Release the toggle switch and observe a centered bar and no flag.

13. Offset the Test Set frequency by ±50KHz by utilizing the instructions in Paragraph 2.9.1.

14. Verify the appropriate failure flag appears.

2.11.5 MB Test Procedures

1. Select **MB** using the **FUNCTION** rotary switch.

2. Extend the antenna to its fullest length and attach it to the **ANTENNA** connector located on the Test Set front panel.

3. Toggle the **PRESET/KEYBOARD ENTRY** switch to the **PRESET** position.

4. Toggle the **LO/MID/HI** switch to the **MID** position (75MHz).

5. Set the RF Output to +13dBm using the **RF OUTPUT LEVEL** toggle switch.

6. Select **400/OM** using the **TONES** toggle switch.

7. Verify the *BLUE* Marker Lamp for the Outer MB illuminates on the aircraft instrument panel. Ensure a 400 Hz tone is audible from the speaker or intercom system (if applicable).

8. Select **1300/MM** using the **TONES** toggle switch.

9. Verify the *AMBER* Marker Lamp for the Middle MB illuminates on the aircraft instrument panel. Ensure a 1300 Hz tone is audible from the speaker or intercom system (if applicable).

10. Select **3000/IM** using the **TONES** toggle switch.

11. Verify the *WHITE* Marker Lamp for the Inner MB illuminates on the aircraft instrument panel. Ensure a 3000 Hz tone is audible from the speaker or intercom system (if applicable).

2.12 Communications and Transceiver Tests

The following tests for Communication equipment are described with the use of the Test Set antenna and include preset parameters to rapidly determine the state of the equipment being tested. These tests are best performed with two technicians, one located in the aircraft under test, the other operating the Test Set and controls. When conducting antenna-to-antenna checks, ensure that you properly extend the antenna to the correct length IAW Table 2-3.

NOTE

The following tests are not meant to replace the testing criteria required for your particular model of equipment. They are general testing procedures to assist the operator in properly utilizing the T-36C T/S.

2.12.1 Modulation, Frequency, and Deviation Measurements

The T-36C is capable of conducting Modulation, Frequency, and Deviation measurements Antenna to Antenna. The following procedures will ensure that the received results are accurate.

1. For best results, follow the procedures as listed in the previous paragraph (2.8). Turn the Test Set *ON* and ensure the Test Set passes the Self Test. Select the frequency on the UUT, and select the corresponding frequency on the Test Set. Key the transmitter to be tested and at the same time, hold *DOWN* the **XMIT – MEAS** switch and observe the following displays:

```
Making Transmitter
Measurements . . .
```

Designate Frequency Selected

Frequency measured ± center

```
120.000 MHz      +0.3 kHz
20% AM           Pwr in Rng
```

% of AM Modulation Measured (FM would indicate deviation)

Signal acquired was in Range of Test Set

2. Release the **XMIT – MEAS** switch once the measurement is completed.

3. If the acquired signal strength too low or high, the following may be displayed:

   Power Too High
   Low Power
   No Power

4. Move the Test Set to a different location to receive the "**Pwr in Rng**" display. This will ensure accurate measurements.

NOTE

The following tests are not meant to replace the testing criteria required for your particular model of equipment. They are general testing procedures to assist the operator in properly utilizing the T-36C T/S.

2.12.2 Receiver Squelch Test

1. Select **108-174** using the **FUNCTION** rotary switch.
2. Toggle the **HI/MID/LO** toggle position in the **LO** position.
3. Turn the T/S *ON* and the preset values of 108.000 MHz, 10% modulation at 0 dBm will be displayed.
4. Turn *ON* the AUT VHF COMM equipment, set to the corresponding frequency and adjust the audio to a normal listening level.
5. The Test Set will transmit a 1020 Hz signal, which should be audible in the aircraft headset.
6. Reduce the Test Set RF output level by toggling the **RF OUTPUT** toggle switch until the cockpit audio is not heard (squelched).
7. Slowly increase the RF output by 6 dB. The audio should return and be heard on the headset.
8. Repeat the steps in each position of the **HI/MID/LO** toggle switch.

2.12.3 Communication Test

1. Select **108-174** using the **FUNCTION** rotary switch.
2. Toggle the **HI/MID/LO** toggle position in the **MID** position.
3. Turn the T/S *ON* and the preset values of 113.000 MHz, 10% modulation at 0 dBm will be displayed.
4. Turn *ON* the aircraft under test VHF COMM equipment, set to the corresponding frequency and adjust the audio to a normal listening level.
5. Connect a set of headphones to the **AUDIO** jack on the Test Set front panel.
6. Key the transmitter in the AUT and speak in a moderate tone.
7. While transmitting from the aircraft, toggle down the **XMIT MEAS** switch and monitor the transmission from the aircraft.
8. Repeat the procedure for each frequency range or manually select a frequency by placing the **PRESET/KEYBOARD ENTRY** switch in the **KEYBOARD ENTRY** position. The operator may now select any legal frequency within the Test Set capabilities for testing.

NOTE

The following tests are not meant to replace the testing criteria required for your particular model of equipment. They are general testing procedures to assist the operator in properly utilizing the T-36C T/S.

2.13 Enhanced Testing Procedures

The T-36C provides all the necessary signals for Bench Top Checks of Navigation and Communication Equipment (within its frequency range). The flexibility and enhanced testing that can be performed with the T-36C by varying the preset test parameters is sufficient to permit acceptance testing and diagnostic capability of the various sensors covered. It is not the purpose here to define all test variations and enhancements that can be achieved, but to establish some concept of the possibilities. As an example, receiver selectivity of COMM receivers can be tested by varying the T-36C output frequency on a desired channel and then varying the Test Set RF output level to establish signal-to-noise ratios, AGC levels, or recovered audio output of the UUT to determine selectivity.

In order to perform these tests, it is necessary to disconnect the omni-directional antenna and utilize the supplied Direct Connect Cable. Connect the UUT Antenna output to the **VSWR RT** or **ANT** connectors located on the front panel of the Test Set. The following guidelines will assist the operator when enhanced testing is required.

WARNING
Ensure the Transmitter does not exceed 25 Watts before Direct Connect Transceiver Checks are commenced.

NOTE

All transceiver measurements should be made quickly to minimize heating of the Test Set dummy Load.

2.14 DIRECT CONNECT NAV SYSTEMS TESTS

Utilize the following procedures as a guide in making Direct Connect Navigation Checks. Please refer to your Maintenance Manual to provide exact parameter and conditions.

2.14.1 MB Sensitivity

Connect the 10K termination adapter to the antenna port. Connect **RT** Port to NAV/COM Receiver antenna input using a 50Ω coaxial cable for all ILS NAV functions.

1. Turn on the aircraft **MB** receiving equipment. Set the HI/LOW switch to **HI** position.
2. Set Test Set **FUNCTION** knob to **MB**.
3. Set the **KEYPAD ENTRY/PRESET** toggle switch to **PRESET**.

4. Set the **FREQ LO/MID/HI** switch to the **MID** position (75.00 MHz).

5. Set the **MB TONES** knob to **400 Hz**.

6. Starting at RF output level of -25 dBm, gradually reduce the **RF OUTPUT LEVEL** with the **RF OUTPUT LEVEL** slew switch until blue lamp goes out. Read RF level.

   This level should be less than the minimum sensitivity specified in the MB receiver documentation.

7. Repeat Step 6 for each additional tone.

8. The UUT marker lamps should all go out at approximately the same RF signal level for all three tones.

9. Increase the RF output level by 30 dB above the highest RF level read in Step 6.

NOTE

If the sensitivity level is > - 55 dBm, set RF output level to the following formula:

$$\left\lceil \frac{-25 + \text{Sen Level}}{2} \right\rceil$$

10. Set the TONES knob to 400 (OM). The blue (outer) marker lamp on the aircraft instrument panel should light and a 400 Hz tone should be audible from the cabin speaker (if applicable).

11. Repeat Step 10 for each tone (1300 MM) amber lamp, (3000 IM) white lamp.

12. Set the MB HI/LOW switch to LOW sensitivity. Repeat steps 1. through 11.

2.14.2 MB 3 dB Bandwidth

1. Turn on aircraft MB receiver, and Test Set.

2. Set FREQ using the **KEYPAD** to 75.0 MHz, and the tones switch to 400.

3. Adjust RF output levels to 3 dB above the Receiver Sensitivity Level identified in Step 2.14.1.

4. Decrease the frequency in 10 kHz steps starting at 75.0 MHz until 400 (OM) blue lamp comes on (this is the low end selectivity of the MB receiver).

5. Repeat Steps 1-4 increasing the frequency in 10 KHz steps starting at 75.02 MHz until 400 (OM) blue lamp comes on (this is the high end Sensitivity Level of the MB receiver).

6. The bandwidth is the difference between the two threshold frequencies.

2.14.3 LOC Sensitivity

1. Set the Test Set **KEYPAD ENTRY/PRESET** toggle switch to **PRESET**.

2. Set the **FREQ LO/MID/HI** select switch to **LO** (108.10 MHz).

3. Turn on the aircraft Localizer receivers and select this frequency on the aircraft NAV panel.

4. Set the Test Set **FUNCTION** knob to **LOC**.

5. Starting at RF output signal level of -25 dBm, gradually reduce the RF OUTPUT LEVEL with the **RF OUTPUT LEVEL** slew switch. The UUT CDI flag should appear for each LOC receiver at approximately the same RF signal level. Increase the RF output level by 30 dB for subsequent tests.

NOTE

If the sensitivity level is > - 55 dBm, set RF output level to the following formula:

$$\left\lceil \frac{-30 + \text{Sen Level}}{2} \right\rceil$$

6. Set the **ILS/VOR** knob to **OC**. The CDI should center and the indicator flag should be retracted.

7. Set **ILS/VOR** knob to **U1/R1**. The CDI should deflect one-dot to the right.

8. Turn the **ILS/VOR** knob to **U2/R2**. The CDI should deflect two-dots to the right.

9. Repeat this process for ILS/VOR knob positions **D1/L1** and **D2/L2**. The CDI should deflect one and two dot positions to the left. Momentarily disable the 90 Hz modulation component by selecting **DELETE 90**. The CDI should indicate full left and the flag should be visible.

10. Momentarily disable the 150 MHz modulation component by selecting **DELETE 150**. The CDI should indicate full right and the flag should be visible.

11. Repeat steps 5-11 at the other LO/MED/HI positions of the **FREQ** select switch. Similar LOC system test results should be observed.

2.14.4 GS Sensitivity

1. Set the Test Set **KEYPAD ENTRY/PRESET** toggle switch to **PRESET**.

2. Set **FREQ LO/MID/HI** select switch to **LO** (334.70 MHz).

3. Turn on the aircraft Glide Slope receivers and select this frequency on the aircraft NAV panel.

4. Set the **FUNCTION** knob to **GS**.

5. Starting at RF output level of -30 dBm, gradually reduce the RF OUTPUT LEVEL with the RF OUTPUT LEVEL slew switch. The UUT CDI flag should appear for each GS receiver frequency at approximately the same RF signal level. Increase the RF output level by 30 dB for subsequent tests.

NOTE

If the sensitivity level is > - 55 dBm, set RF output level to the following formula:

$$\left\lceil \frac{-30 + \text{Sen Level}}{2} \right\rceil$$

6. Set the **ILS/VOR** knob to **OC**. The horizontal pointer should indicate a center glide path position and the flag should be retracted.

7. Set **ILS/VOR** knob to **U1/R1**. The horizontal pointer should indicate an one-dot up deflection.

8. Set the **ILS/VOR** knob to **U2/R2**. The horizontal pointer should indicate show a two-dot up deflection.

9. Set **ILS/VOR** knob to **D1/L1**. Horizontal pointer should show an one-dot down deflection. Turn the **ILS/VOR** knob to **D2/L2**. Horizontal pointer should show a two-dot down deflection.

10. Momentarily disable the 90 Hz modulation component by selecting **DELETE 90**. The horizontal pointer should indicate a full up glide path and the flag should be visible.

11. Momentarily disable the 150 Hz modulation component by selecting **DELETE 150**. The horizontal pointer should indicate full down glide path and the flag should be visible.

12. Repeat steps 5-11 at the other LO/MID/HI positions of the **FREQ** select switch. Similar GS system test results should be observed.

2.14.5 ILS Sensitivity

1. Set the Test Set **KEYPAD ENTRY/PRESET** toggle switch to **PRESET**.
2. Set **FREQ** select switch to LO, MID, or HI.
3. Turn on the aircraft Localizer and Glide Slope receivers and select the test frequencies on the aircraft NAV panel.
4. Set the Test Set **FUNCTION** knob to **ILS**.
5. Starting at RF output level of -30 dBm, gradually reduce the RF OUTPUT LEVEL with the **RF OUTPUT LEVEL** slew switch. The UUT CDI flags should appear for each ILS receiver frequency at approximately the same RF signal level. Increase the RF output level by 30 dB for subsequent tests.

NOTE

If the sensitivity level is > - 55 dBm, set RF output level to the following formula:

$$\left\lceil \frac{-30 + \text{Sen Level}}{2} \right\rceil$$

6. Set the **ILS/VOR** knob to **OC**. The CDI and horizontal pointers should center and both flags should be retracted.
7. Using the **ILS/VOR VAR** slew switch, depress the switch up, then down, following the on screen data. The CDI should move from the left two-dot position to the right two-dot position in response to the movement of the slew switch. Simultaneously, the horizontal pointer should move from the down two-dot position to the up two-dot position.
8. Repeat steps 5-8 at the other **LO/MID/HI** positions of the **FREQ** select switch. Similar ILS system test results should be observed.

2.15 DIRECT CONNECT COMM TRANSCEIVER TESTS

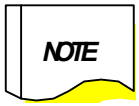
Utilize the following procedures as a guide in making Direct Connect Transceiver Checks. Please refer to your Maintenance Manual to provide exact parameter and conditions.

2.15.1 Transceiver Test

1. Attach the 10K termination adapter to the **ANTENNA** connector of the Test Set.
2. Connect the T-36C **RT** connector to the **RF** output connector of the UUT using the 10 foot, 50 ohm co-axial cable supplied with the Test Set.
3. Connect the UUT antenna to the **ANT** port of the Test Set if the VSWR check is to be conducted.

4. Connect an audio generator or the Test Set **AUDIO** connector to the microphone input connector of the UUT.

5. Connect an oscilloscope to the UUT headphone connector.



All measurements should be made quickly to minimize heating of the Test Set internal dummy load.

2.15.2 Receiver AGC Range

1. Select desired UUT frequency. Set Test Set AM modulation to 1000 Hz, 30%.

2. Adjust UUT audio gain control to Maximum.

3. Reduce UUT audio gain control to ½ of P-P value on oscilloscope.

4. Reduce test set RF until oscilloscope signal is at Step 2 level x 0.707 (this is receiver's low AGC level).

5. Increase test set RF until oscilloscope signal is at Step 2 level X 1.414 (this is the receiver's high AGC level).

2.15.3 Receiver Sensitivity

1. Adjust test set RF level to low AGC level as indicated in Step 2.15.2.

2. Reduce modulation to 0%.

3. Read P-P value of noise level on oscilloscope at the UUT headphone connector.

4. Turn modulation on 1000 Hz/30%. **AM/FM** Switch to **AM**.

5. Adjust RF level until modulation P-P level is 2X P-P value of noise in Step 3. The RF level at this point is the receiver sensitivity level.

2.15.4 Receiver Signal To Noise Ratio

1. Set the UUT channel frequency to the selected Test Set RF output frequency.

2. Select the Test Set modulating frequency of 1000 Hz with the TONES knob @ 30% modulation.

3. Adjust the Test Set RF OUTPUT LEVEL to –67 dBm and connect to the RF output connector of the UUT.

4. Adjust the UUT audio level control to obtain an audio output signal about ½ of the receiver's rated maximum output level.

5. Using an oscilloscope, measure the audio output P-P level (signal level).

6. Remove the 1000 Hz modulation by slewing the MOD LEVEL to 0%.

7. Using an oscilloscope measure the drop in audio output P-P level (noise level).

8. Signal-to-noise level equals 20 log (signal level) / (noise level). This is the signal-to-noise level of the receiver.

2.15.5 Transmitter Power Output

WARNING
Ensure the Transmitter does not exceed 25 Watts before Direct Connect Transceiver Checks are commenced.

1. Verify that the Test Set is set for the same frequency as the UUT.

2. Key the UUT transmitter.

3. Read the transmitter output power as indicated on the Test Set display.

2.15.6 Transmitter Modulation Capability

1. Connect the T-36C RT connector to the RF output connector of the UUT using a 10 foot, 50 ohm coaxial cable supplied with the Test Set.

2. Connect audio generator or the Test Set **AUDIO** connector to microphone input connector of the UUT.

3. Adjust output of audio generator or Test Set AUDIO output to 1000 Hz. 30% modulation, as measured at the output of the UUT.

4. Key the transmitter.

5. Read the measured percentage of modulation as indicated by the T-36C display.

6. Set AM/FM toggle switch of Test Set to **FM** (if function is available on UUT).

7. Set UUT for FM Modulation.

8. Key the transmitter.

9. Read the measured deviation.

2.15.7 Transmitter Frequency Accuracy

1. With the test set up connected as per 2.15.6.

2. Key the transmitter.

3. Read the deviation in frequency from nominal as indicated by the T-36C display.

2.15.8 Transmitter VSWR

1. Connect the T-36C RT connector to the RF output connector of the UUT using a 10 foot, 50 ohm coaxial cable supplied with the Test Set.

2. Connect UUT antenna to the **ANT** port of the Test Set.

3. Key the transmitter.

4. While depressing the XMIT MEAS switch on the Test Set, note the VSWR reading displayed on the T-36C display.

2.16 Basic Principles of VOR, LOC, GS, and MB

2.16.1 Basic ILS Principles

ILS (Instrument Landing System) was introduced in the 1930's. The system consists of antennas and transmitters located at the end of the runway at centerline, providing horizontal, vertical, and distance guidance. The system is broken down into: LOC- horizontal control (left & right), GS- vertical control (up & down), and MB- distance control.

The localizer transmitter utilizing the VHF navigation band from 108.10 – 111.95 MHz provides horizontal guidance (LOC), using every odd 100 KHz position.

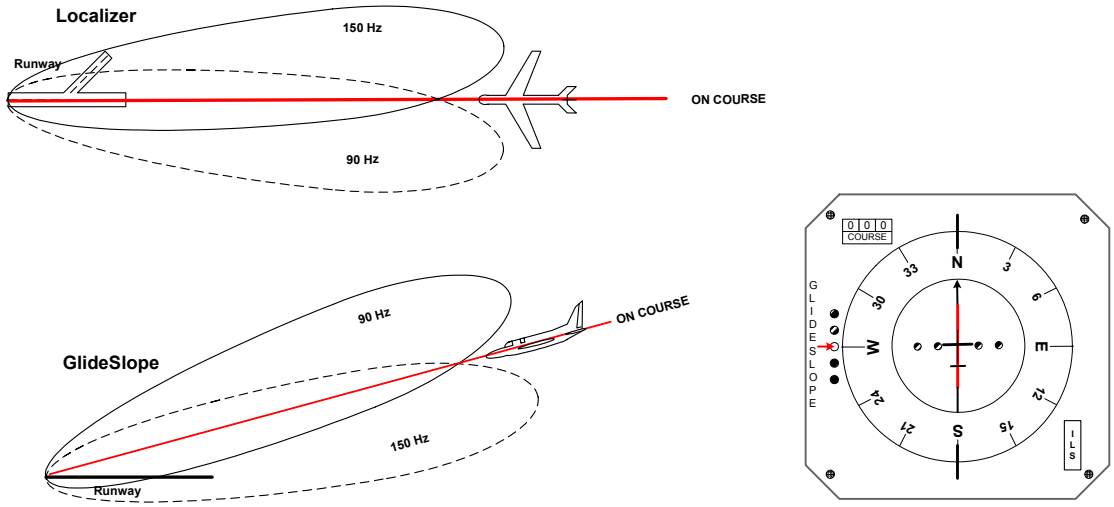
The vertical transmitter utilizing the UHF navigation band from 329.15 – 335.00 MHz provides the vertical guidance (GS).

The LOC and GS Frequencies are typically paired; where as- when you select the appropriate LOC frequency, the ILS receiver will automatically select the paired GS frequency.

MB transmitters, transmit on a frequency of 75 MHz, and are not paired with the ILS receiver.

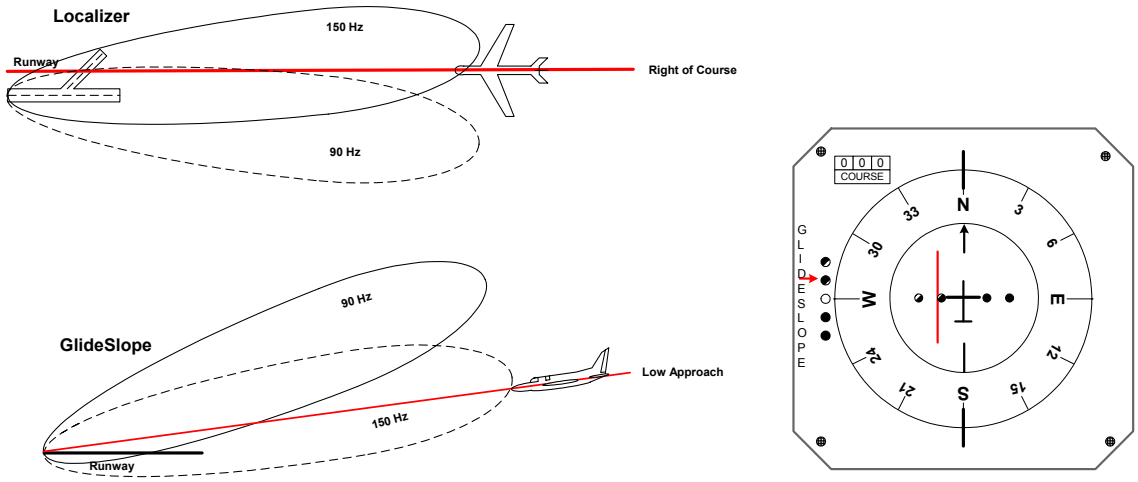
Both the LOC and GS Transmitters transmit a carrier modulated RF with 90 and 150 Hz signals. When an aircraft is receiving the signals and is receiving equal amounts of the 90 and 150 Hz modulation, the aircraft is "On Course", as depicted in Figure 2-7.

If the aircraft is receiving a percentage of modulation greater than the other, the receiver will display an offset either Left/Right or Above/Below "On Course", as shown in Fig. 2-8.



Illustrates an "On Course" aircraft, receiving equal amounts of 90 and 150 Hz modulation.

Figure 2-7

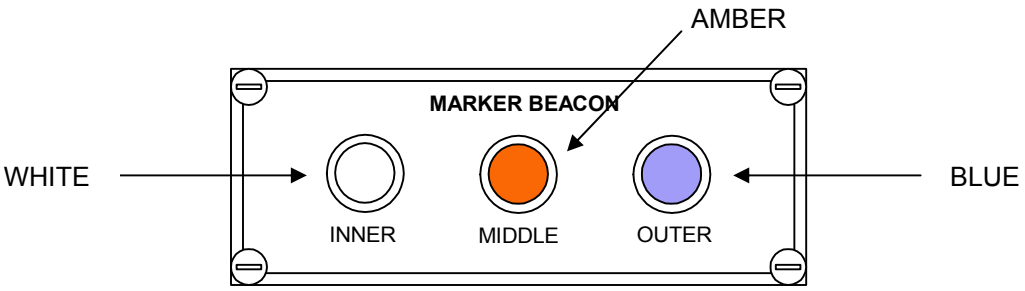


Illustrates an aircraft receiving a higher percentage of LOC 150 Hz modulation, and GS 90 Hz modulation. The Indicator will reflect left and above “On Course” when flying “TO” the VOR station.

Figure 2-8

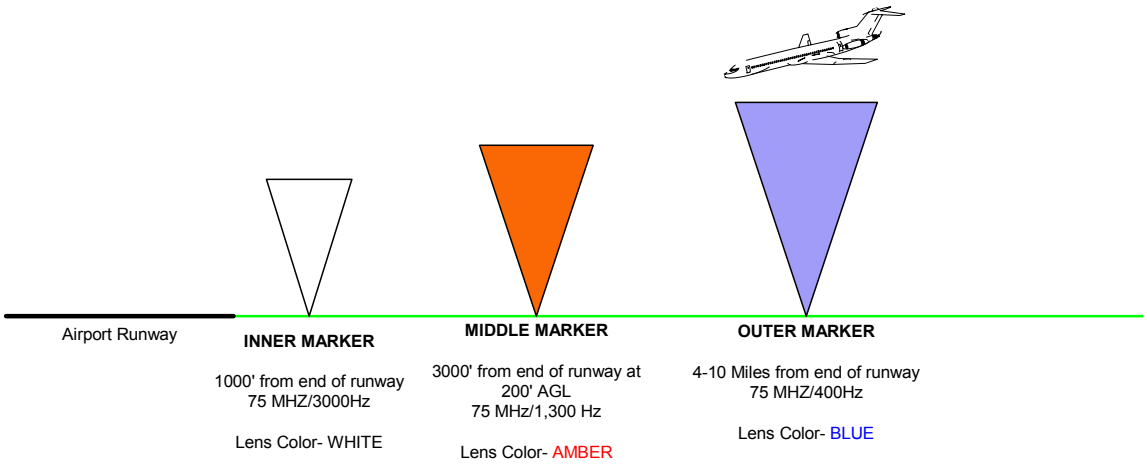
2.16.2 Marker Beacon

The MB provides distance to the airport runway. There are normally three transmitters, Outer Marker, Middle Marker and Inner Marker. All three transmit at 75 MHz, modulated at different frequencies for identification. The Inner marker is modulated at 3000 Hz, Middle at 1300 Hz, and the Outer at 400 Hz. As the aircraft flies over the transmitters, located at the approach end of the runway, the MB receiver will receive the signal and dependent on the modulation (Figure 2-10), illuminate the appropriate light on the panel (Figure 2-9).



Typical MB Display

Figure 2-9



Typical MB Approach Parameters

Figure 2-10

2.16.3 Basic VOR Principles

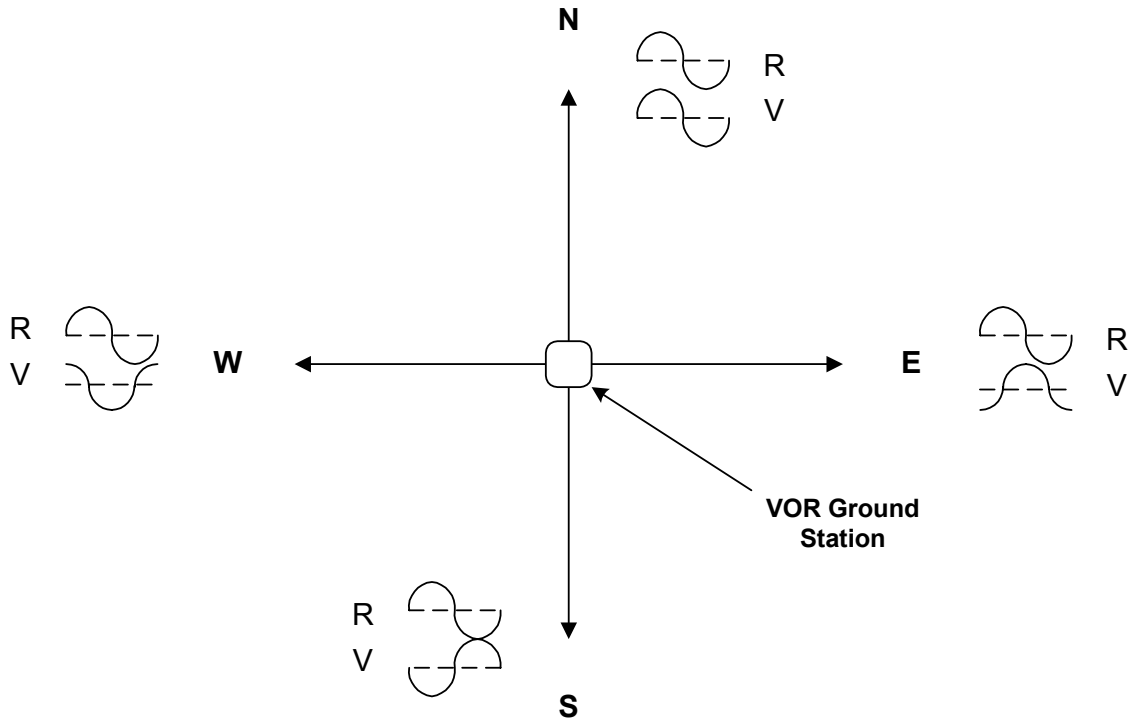
VOR (Variable Omni Range) is a VHF navigational aid utilized to determine the bearing of an aircraft to a designated point. The system comprises of a fixed ground station and the airborne receiver. The ground station transmits two signals, a reference and a variable signal. Within line of sight of a VOR ground station, the aircraft receiver will detect, then compare the phase relationship between the *reference* and *variable signals* and translate it to a bearing from the ground station.

The basic principle of VOR is the measurement of time (phase) difference between the two signals.

The *reference signal* is a 30 Hz signal which frequency modulates (FM) a 9960Hz subcarrier. The frequency modulated signal is then used to amplitude modulate (AM) the RF carrier.

The *variable signal* uses the same carrier frequency but no modulation from the transmitter. The signal is modulated at 30 Hz by the rotation of the antenna.

The *variable* 30 Hz AM signal and the 30 Hz FM *reference* signal are timed (by the rotation of the antenna) to be in phase at a relative position of due north of the VOR station (see figure 2-11).



Phase Relationship between Variable and Reference Signals

Figure 2-11

Using Figure 2-10, Note at due North, the signals are *IN* phase. At due East - the signals are 90° out of phase, due South - 180° out of phase, due West – 270° out of phase. The VOR receiver in the aircraft, measures this phase difference and displays the information as the correct bearing TO or FROM the ground station.