To buy, sell, rent or trade-in this product please click on the link below:
http://www.avionteq.com/TIC-Tel-Instruments-T-30D-NAV-Ramp-Test-Set.aspx
AvionTEq
Test with full trust
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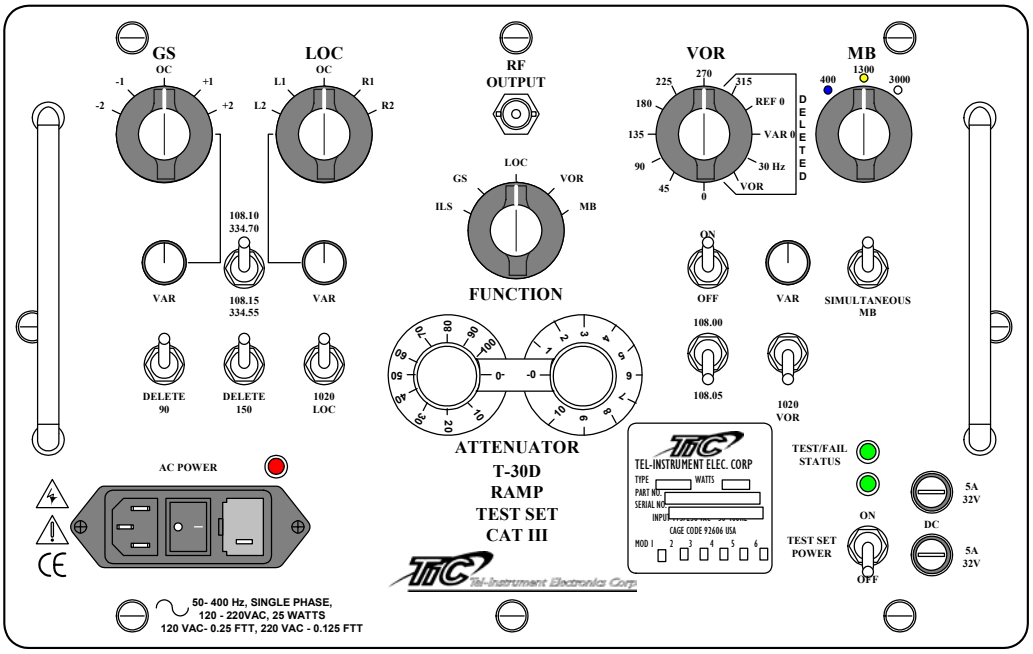
T-30D
VOR/ILS/MB



Ramp Test Set

Operating and Maintenance Manual

S/N Effectivity 597

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

T-30D TABLE OF CHANGES

Date	REV	ECO	Page	Description
2-4-97	B		3-3	Correct sensory input keys to 7 – 13
10-1-97	C		4-5, 4-17	Notes Added on Table 4-2, para. 2.3 and Table 4-3, para 5.0 to set modulation bandwidth
6-10-98	D	1461	5-1, 6-8, 6-9	Added Capacitor from E-1 to GND
7-31-98	E	1470	5-1, 6-8, 6-9	Added Resistor, 100 Ω, from E-20 to R3, pin 2
01-26-99	F		4-3	Text Added- Para 1.2, e
			4-5	Text Added- Para 2.3, h, j, l
			4-13	Text Added- Para 1.2, d
			4-17	Text Added- Para 5.2
			4-17	Text Added- Para 5.3, c
			4-23	Text added- Para 5.2, b, d, f
11-30-02	G		All Pages	Complete Overhaul and rewrite of Manual

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Table of Contents (continued)

Table of Contents (continued)

List of Illustrations (Figures)

List of Tables

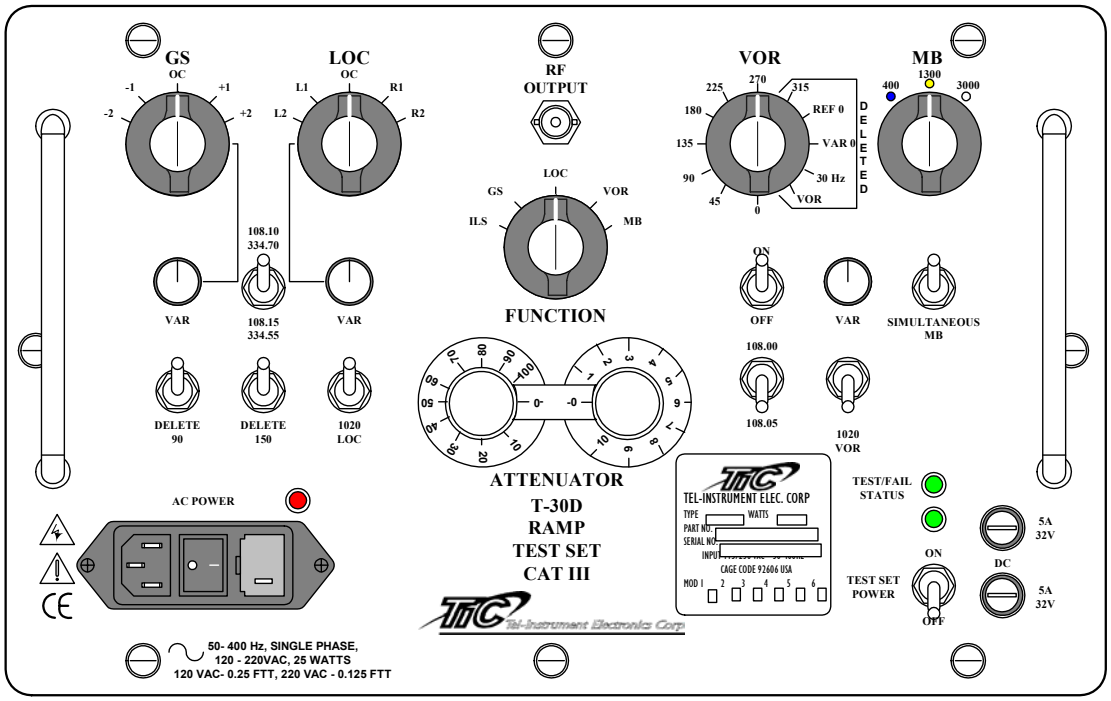
CHAPTER I

INTRODUCTION

SECTION A

1.1 Scope of Manual

This manual is intended to familiarize the operator with the operating and maintenance procedures necessary to utilize and maintain the T-30D Test Set.



T-30D Ramp Test Set

Figure 1-1

1.2 Purpose and Function of Equipment

The T-30D Ramp Test Set is designed for one-man operation of the VOR, MB, GS, LOC, flight director, and autopilot from the cockpit or flight deck. The unit functions by radiating controllable RF signals directly into the aircraft's antennas. The unit will permit compliance with CAT III periodic ramp check certification.

The T-30D is simple and straightforward in operation and functions primarily as a "go-no-go" test set. Instrumentation in all aircraft has certain established operational tolerances. The purpose of the T-30D is to determine that these tolerances are being met.

1.3 Warranty

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.

SECTION B

EQUIPMENT SPECIFICATIONS/DESCRIPTION

1.4 Specifications[1]

VOR

Frequency	108.05 MHz ± 0.025%
	108.00 MHz ± 0.025%
Power	+17/ ± 2 dB
Attenuation	110 dB in 1 dB steps
Modulation	
Audio Frequency	30/9960 Hz
Audio Frequency Accuracy	± 0.01%
AM Depth	30 ± 2%
FM Deviation	480 ± 30 Hz
Distortion	< 5%
Indicator Deflection/Bearing	0-315° /± 0.1º in 45° Steps/Variable ±10 º- 15°
Tone	1020 Hz ± 2%

LOC

Frequency	108.15 MHz ± 0.025%
	108.10 MHz ± 0.025%
Power	+17 ±2 dB
Attenuation	110 dB in 1 dB steps
Modulation	
Audio Frequency	90/150 Hz
Audio Frequency Accuracy	±0.01%
AM Depth	20 ± 2%
Distortion	< 5%
Phase Accuracy	90 to 1150 Hz ±10º
Indicator Deflection	
On Course	0.0 ± 0.01DDM/0.155 ± .02 DDM
Variable	-0.155 to +0.155 DDM
Step	Left and Right; 1 & 2 Dots
Tone	1020 Hz ± 2%

[1] Tel Instruments Electronics Corporation reserves the right to change and modify specifications without notice.

Glide Slope (GS)

Frequency	334.70 MHz ± 0.0025%
	334.55 MHz ± 0.0025%
Power	+11 ±2 dB
Attenuation	110 dB in 1 dB steps
Modulation	
Audio Frequency	90/150 Hz
Audio Frequency Accuracy	± 0.01%
AM Depth	40 ± 3%
Distortion	< 5%
Phase Accuracy	90 to 1150 Hz ± 10º
Indicator Deflection	
On Course	0.0 ± 0.01DDM/0.175 ± .025 DDM
Variable	-0.175 to + 0.175 DDM
Step	Up and Down; 1 & 2 Dots
Delete	90 and/or 150 Hz

Marker Beacon (MB)

Frequency	75.0 MHZ ± 0.005%
Power	+18 ± 2dB
Attenuation	110 dB in 1 dB steps
Modulation	
Audio Frequency	400/1300/3000 Hz
Audio Frequency Accuracy	± 2%
AM Depth	95 ± 4%
Distortion	< 10%

Physical Characteristics

Size	14.5 x 9.4 x 6.5 in.
Weight	18 lbs.
Power	Internal Battery or external 120/220 VAC 50-400 Hz
Environmental	Storage- -51° to + 71° C Operating -30° to +55ºC

1.5 Safety Considerations

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.

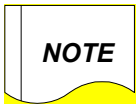
1. When performing any of the tests thoroughly read and understand all procedures before actually performing them.

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

WARNINGS
Alerts the operator to potential dangers associated with a particular tests. 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 test procedure.

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

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

1.6 Abbreviations, Acronyms and Glossary of Terms[2]

A/A	Air to Air
A/A B	Air to Air Beacon
ac or AC	Alternating Current
A/D	Analog to Digital
AM	Amplitude Modulation
ATC	Air Traffic Control
AUT	Aircraft Under Test
BIT	Built in Test
CW	Continuous Wave
D/A	Digital to Analog
dB	Decibel
dBm	Decibels relative to 1 milliwatt
dc or DC	Direct Current
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
FIFO	First In First Out
FREQ	Frequency
ft.	Feet
G/A	Ground to Air
Hz	Hertz
IF	Intermediate Frequency
KHz	Kilohertz
kts.	Knots
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MHz	Megahertz
nmi.	Nautical mile
ns	Nanosecond
PMCS	Preventative Maintenance Checks and Services
PPM	Pulses per Minute
PRF	Pulse Repetition Frequency
PW	Pulse Width
PWR	Power
RF	Radio Frequency
RMS	Root Mean Square
R/T	Receiver Transmitter
RX	Receiver
TX	Transmitter
VORTAC	VOR and TACAN (co-located)
VOR	VHF Omni-Directional Range
VSWR	Voltage Standing Wave Ratio
WOW	Weight On Wheels
UUT	Unit Under Test

2

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.

CHAPTER II

PREPARATION FOR USE AND OPERATION

SECTION A

2.1 General

This Chapter contains all necessary information on the initial unpacking, inspection, and set-up of the T-30D Test Set. From this point forward, the T-30D Test Set will be known as the T-30D, Test Set, or T/S.

2.2 Unpacking

When receiving the T-30D for the first time, ensure that there is no damage to the shipping container. Carefully unpack the unit and save the shipping container in a safe location for shipping or extended storage.

Examine the unit for obvious signs of damage. Check all displays, switches, and connectors before utilizing the Test Set.

If any damage is found, DO NOT use the Test Set until a determination of the Test Sets functions can be assessed. Refer to the procedures outlined in Chapter 4, Section B, Test Set Verification and Acceptance Checks. You may also contact Tel-Instrument Electronics Corp. for assistance.

The T-30D batteries were installed and fully charged when shipped from the factory.

2.3 Installation

The T-30D is ready to use from the factory. There are no installation procedures applicable.

2.4 Accessories

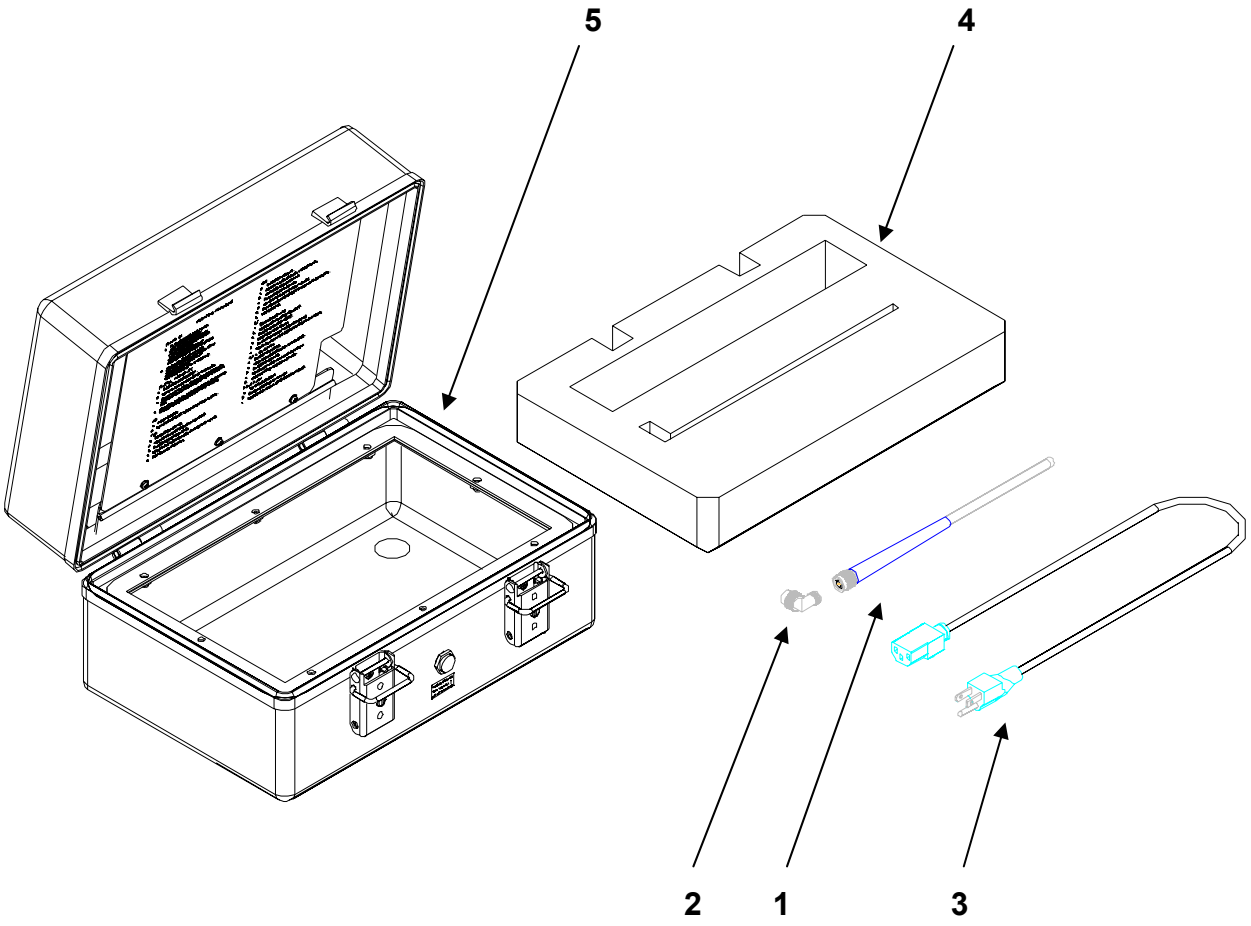
Check that all accessories that you purchased with the Test Set are accounted for. The T-30D comes standard with the following (see Table 2-1 and Figure 2-1):

T-30D Test Set, P/N 90 000 053

#	NOMENCLATURE	P/N	QTY
1	RF Antenna Assembly	40 030 003	1
2	Adapter, TNC, RT Angle	48 000 013	1
3	Power Cable Assembly, AC	75 010 025	1
4	Foam Insert, Case	31 000 009	1
5	Case, Universal	64 030 026	1
6	Manual (not Shown)	90 008 053	1

T-30D Accessories and Part Numbers

Table 2-1



T-30D Accessories

Figure 2-1

SECTION B

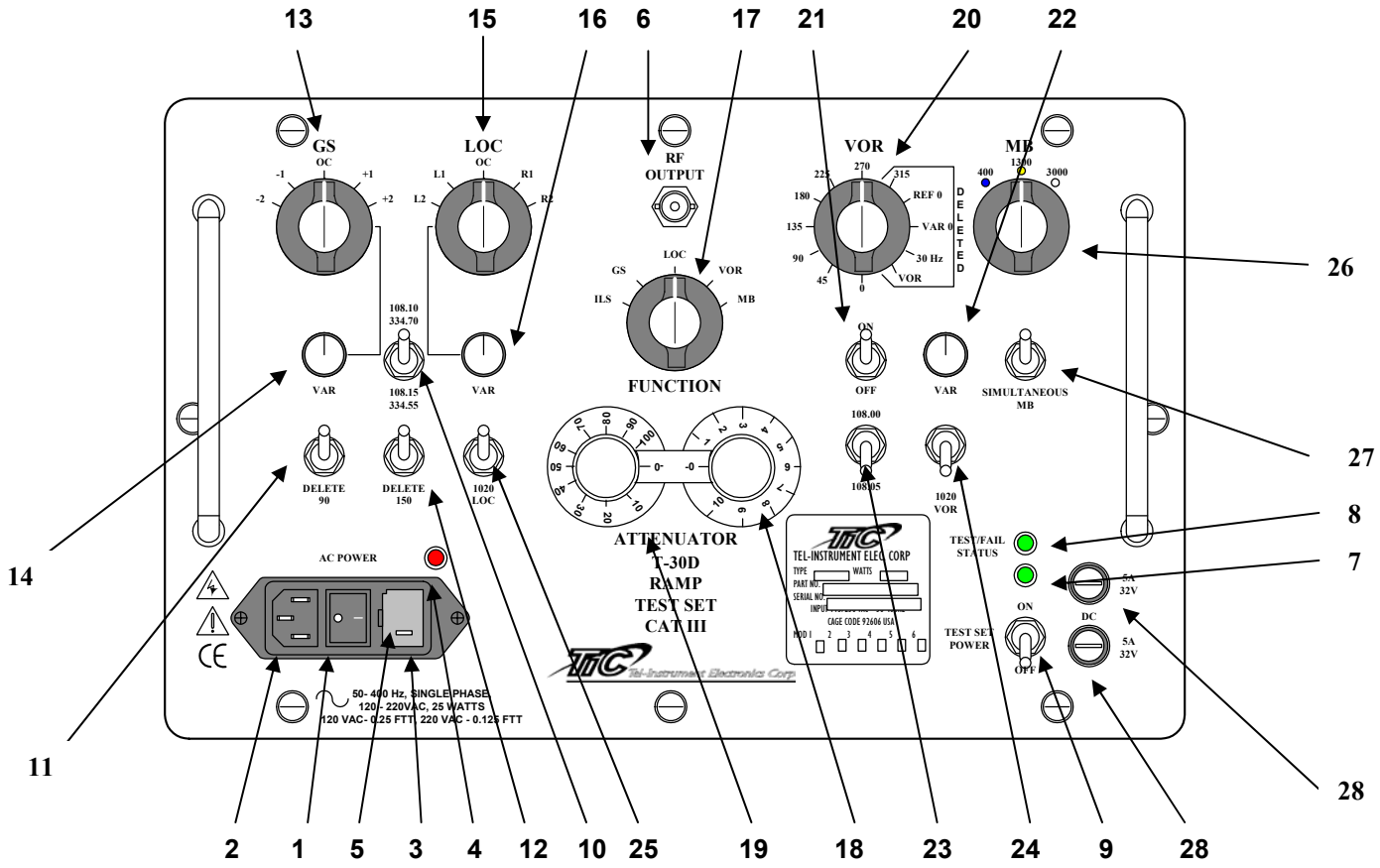
OPERATING CONTROLS, INDICATORS, AND CONNECTORS

2.5 General

This section covers location and function of each control, indicator, or connector. All components are located on the front panel of the Test Set.

2.6 Controls, Indicators, and Connectors

Table 2-2 and Figure 2-2 describes function and location of each control, indicator, and connector.



T-30D Controls, Indicators, and Connector Locations

Figure 2-2

TABLE 2-2 / OPERATING CONTROLS AND FUNCTION		
Index	**Description**	**Function**
1	**AC POWER**	ON/OFF Switch for AC Input power.
2	AC Input	Connector for AC Line Cord.
3	**AC**	Fuses for AC Line Power/ ¼ A SB Fuses.
4	AC Power "ON" Indicator	Light illuminates with AC Power "ON".
5	AC Input	120V or 220 VAC Select fuse drawer.
6	**RF OUTPUT**	RF Output connector for selected Antenna.
7	Energized Light	Illuminates when Test Set is turned "ON".
8	**TEST/FAIL STATUS**	Indicates Self Test Status and battery condition.
9	**TEST SET POWER**	Selects ON/OFF condition of Test Set.
10	**108.10-334.70 108.15-334.55**	Selector Switch for GS and LOC frequency pairing.
11	**DELETE 90~**	Momentary toggle switch, deletes 90 HZ modulation
12	**DELETE 150~**	Momentary toggle switch, deletes 150Hz modulation
13	**GS**	Allows deviation from Glide slope path. OC = On Course +1 = One Dot Above +2 = Two Dots Above -1 = One Dot Below -2 = Two Dots Below
14	**VAR**	With the **108.10/334-70, 108.15/334.55** switch in the **108.10** position, allows continuous variation above or below the on Course signal.
15	**LOC**	Allows deviation from the LOC path. OC = On Course L1 = One Dot Left L2 = Two Dots Left R1 = One Dot Right R2 = Two Dots Right
16	**VAR**	With the **108.10/334-70, 108.15/334.55** switch in the **108.15** position, allows continuous variation Left or Right of the on Course signal.
17	**FUNCTION**	Selects Test Set Operating Modes: **ILS, GS, LOC, VOR, MB**
18	**ATTENUATOR**	Controls RF output of Test Set in 1 dB steps.
19	**ATTENUATOR**	Controls RF Output in 10 dB steps.
20	**VOR**	With **FUNCTION** switch in **VOR**, selects bearing of aircraft to VOR Station in 45° increments from 0 – 315°. Permits deletion of the **REF 0, VAR 0, 30 Hz**, or **VOR** signals.
21	**VAR ON/OFF**	On/Off switch for the **VOR VAR** control.
22	**VAR**	Provides continuous variation for ±10 left/right of VOR bearing.
23	**108.00/108.05**	VOR Frequency selection.
24	**1020 ~ VOR**	Momentary switch enabling the 1020 Hz VOR tone.
25	**1020 ~ LOC**	Momentary switch enabling the 1020 Hz LOC tone.
26	**MB**	Selects Marker Beacon Signals: 400 Hz (Blue Outer Marker), 1300 Hz (Amber Middle Marker), and 3000 Hz (White Inner Marker)
27	**SIMULTANEOUS MB**	Provides Simultaneous MB and ILS tests.
28	**DC**	Fuses for DC Power (5 A/32 V).

2.7 AC and Battery Power Operation

Review the following procedure to maintain the Test Set battery in a fully charged state. It is recommended that you charge the battery fully to ensure that all tests can be completed without interruption. If the battery drains during extended operation, the operator may continue testing by utilizing AC Power.

2.7.1 AC Operation

1. Disengage the two case latches and open the cover.
2. Remove the supplied AC Power cord that was supplied with the Test Set.
3. Connect one end to the **AC INPUT** connector and the other end into a suitable 120 VAC receptacle.
4. Set the **AC POWER** rocker switch to "ON" (—). The AC Power "ON" LED should illuminate. Verify the **TEST/FAIL STATUS** LED briefly illuminates then extinguish. If the **TEST/FAIL STATUS** LED remains lit, this indicates that the Test Set has failed the Self Test. If the LED blinks, this condition indicates the battery voltage is low.

2.7.2 220 VAC Operation

The T-30D may be operated utilizing either 120 or 220 VAC. Before using 220 VAC, the operator must configure the fuse drawer.

WARNING
Failure to properly configure the Test Set for 220 VAC operations before use may result in severe damage to the Test Set.

1. Remove the **FUSE DRAWER** from the Test Set by releasing the Tab and pulling the cartridge straight out.
2. Pull the bottom fuse holder from the rear of the cartridge, rotate, and reinstall back in the cartridge ensuring that **220** is viewable through the front window.

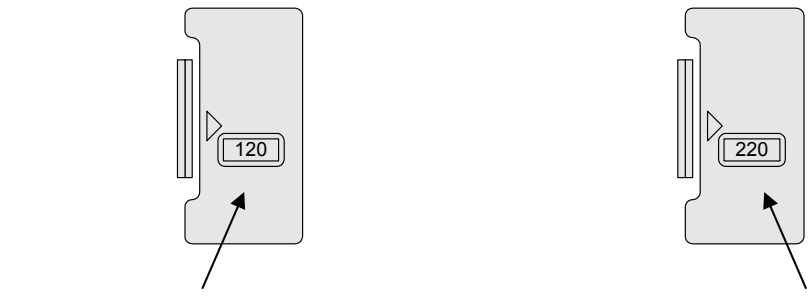


Figure 2-3

2.7.3 Battery Operation

The Battery allows the operator to utilize the Test Set without an AC power cord connected. The Test Set contains a built in charger that will recharge the battery from a 120 or 220 VAC (when properly configured) source. With AC power connected and the Test Set in use, the T-30D will begin to regain its charge.

Several features are built into the Test Set to provide maximum battery life.

1. When the Test Set is turned "ON", the Test/Fail LED indicator will illuminate and at the completion of the *Self-Test*, extinguish.

2. A timing circuit will automatically turn "OFF" the Test Set after 15 minutes of operation (if the test set is being charged, it will not turn "OFF"); the Test Set is also turned "OFF" whenever the cover is closed on the test set.

3. During battery operation, when the **TEST/FAIL STATUS** indicator begins to blink, there are approximately 15 minutes of operating time left. The battery should be recharged or the Test Set plugged in to a suitable AC power source to prevent interruption of tests.

4. The Test Set will continually monitor the battery voltage; if the battery voltage drops to 10 volts, the Test Set will automatically turn OFF.

The Test Set will take approximately 16 hours to fully recharge, once the LED begins to blink. The Test Set may remain plugged in once charging is completed. No adverse effects will occur. Due to the *Memory-Effect* of the batteries, it is not recommended that the T/S battery be fully discharged.

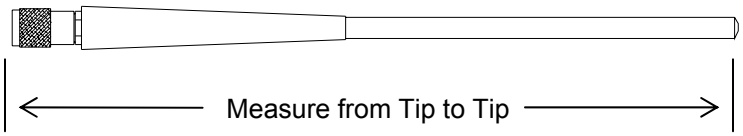
2.8 Omni-Antenna

Most navigation receiver checks will be performed on the ramp utilizing the supplied Omni-Antenna. The Omni-Antenna has been designed in calibrated segments for the correct bandwidth of the frequencies to be used. By extending or collapsing the antenna, dependent on the frequency being tested, the antenna will be properly tuned.

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 **RF OUTPUT** connector located on the front panel of the Test Set.

2. Use Table 2-3 and Figure 2-4, on the following page, and fully extend, *then* retract the antenna to the correct length for the frequency being tested. The Table and correct lengths are also printed on the inside cover of the Test Set.



Omni Antenna

Figure 2-4

FREQUENCY TESTED	ANTENNA LENGTH
Marker Beacon	Fully Extended
VOR	Top three sections retracted (28½")
LOC	Top three sections retracted (28½")
GS	Top five sections retracted (19½")
ILS	Top three sections retracted (28½")

Antenna Lengths

Table 2-3

3. Most tests can be performed while the operator is in the cockpit. Place the Test Set 10-30 ft. from the Unit Under Test (UUT) antenna. Due to the many types of aircraft and their configuration, the operator may need to move the antenna to a different location for each type. Landing gear doors, external fuel tanks and ground support equipment may interfere with the Test Set signals. For accurate results, Line-of-Sight to the antenna being tested is recommended. Relocate the Test Set at a various positions and re-test if test results are erroneous or inaccurate.

SECTION C

OPERATING INSTRUCTIONS

2.9 General Test Procedures

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-30D T/S.

All of the following tests are described utilizing the T-30D Test Set. It is assumed the operator has a detailed knowledge of Avionics Systems and the UUT (Unit Under Test) test requirements. Refer to Table 2-3 for correct antenna lengths for each test performed. Figure 2-5 illustrates a typical HSI/CDI indicator for reference when conducting VOR/LOC/ILS and GS Test.

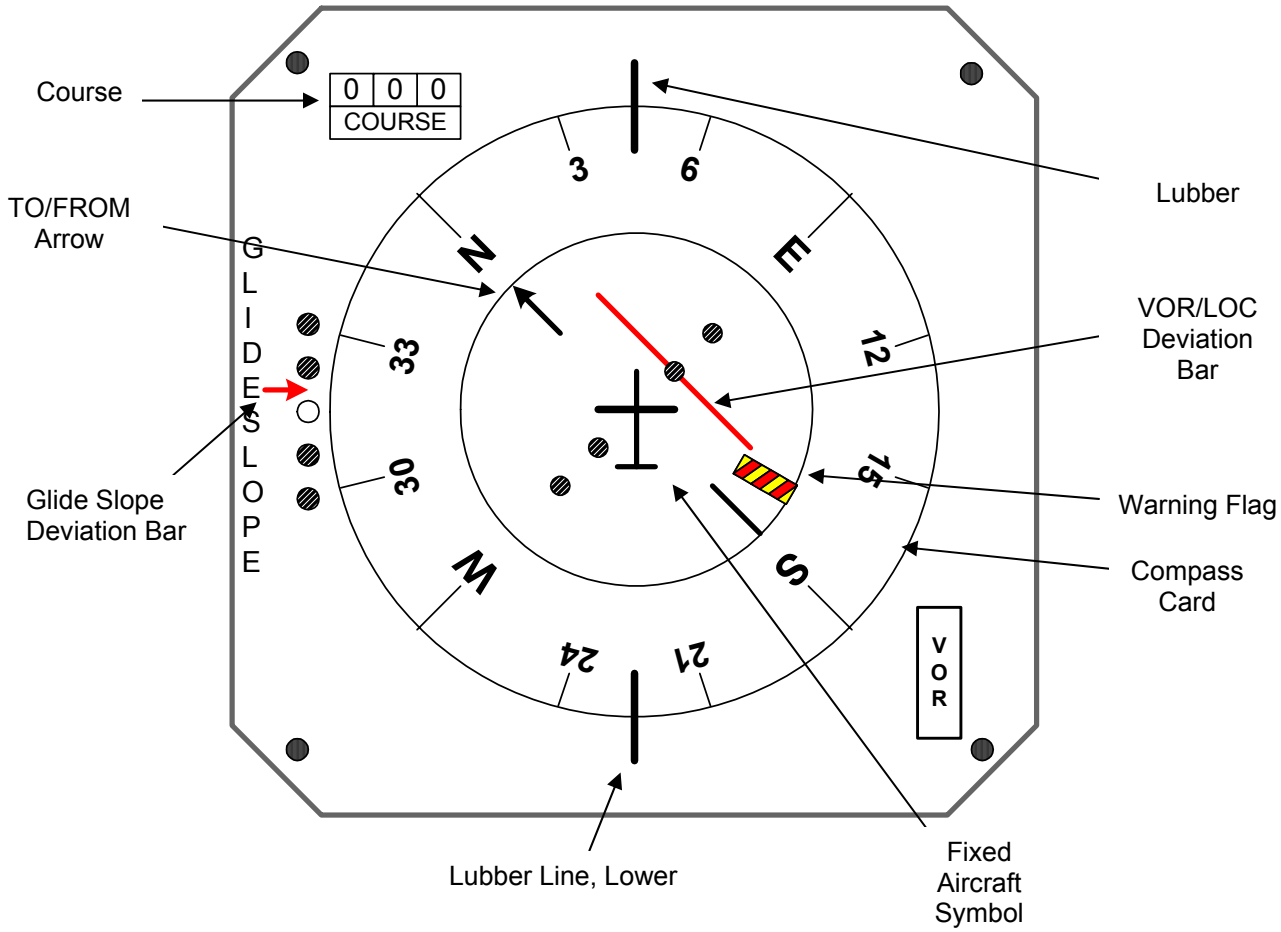


Figure 2-5

Basic HSI/CDI Indicator

2.10 Marker Beacon Tests (MB)

Verify proper operation of an aircraft MB receiver as follows:

1. Connect the Omni-Antenna to the **RF OUTPUT** connector on the Test Set and fully extend the antenna (Table 2-3).

NOTE

It may be necessary to extend the Antenna out of the Cockpit door or window for MB operation.

2. Turn “ON” the MB receiver.

3. Set **FUNCTION** Switch to **MB**, **ATTENUATOR** dials to **0**.

4. Set **MB** Switch to **400**. Blue (outer) marker lamp shall light and a 400 Hz tone shall be audible from the cabin speaker or intercom system.

5. Set **MB** Switch to **1300**. Amber (middle) marker lamp shall light and a 1300 Hz tone shall be audible from the cabin speaker or intercom system.

6. Set **MB** Switch to **3000**. White (inner) marker lamp shall light and a 3000 Hz tone shall be audible from the cabin speaker or intercom system.

7. Gradually increase signal attenuation with the **ATTENUATOR** knobs until the Marker Beacon light extinguishes. This will determine the Marker Beacon receiver sensitivity level.

8. Set both **ATTENUATOR** dials to **0**.

NOTE

When the function switch is in ILS, the MB may be turned “ON” by setting the **SIMULTANEOUS MB** switch "ON."

2.11 VOR Procedures

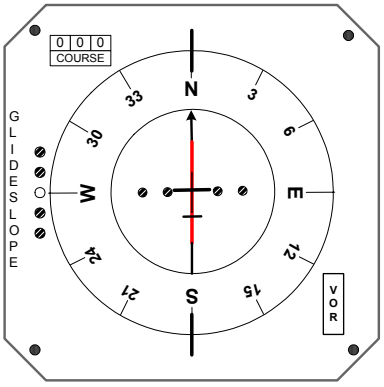
Verify proper operation of an aircrafts VOR receiver as follows:

1. Connect the Omni-Antenna to the **RF OUTPUT** connector on the front panel of the Test Set and extend it fully, then retract it three sections (Table 2-3).

2. Set **VOR** frequency Select Switch to **108.00**.

3. Turn "ON" the VOR receiver and tune it to 108.00 MHz. Set the HSI/BDI to a 0° VOR bearing.

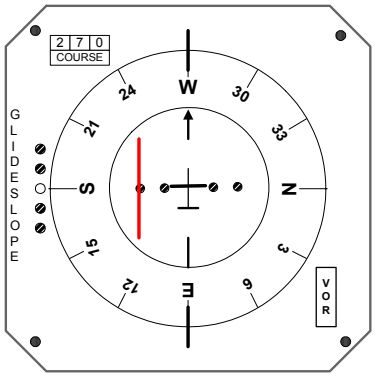
4. Set **FUNCTION** Switch to **VOR** and the **VOR** Switch to **0°**. Vertical pointer shall center and flag shall be retracted.



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

5. Repeat step 4 at the **45°**, **90°**, **135°**, **180°**, **225°**, **270°**, and **315° VOR** Switch positions. For each position, make sure that the corresponding bearing is shown on the VOR display. The vertical pointer shall center and the flag shall be retracted at each position.

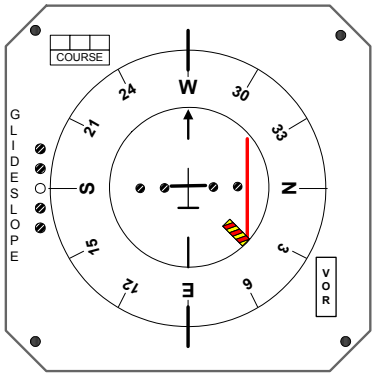
6. With the **VOR** Switch at **270°** and the VOR display or Heading Bug set to 315°, set the **VAR** Switch "ON". Slowly rotate **VAR** knob from the left stop to the right stop. Observe movement of the indicator vertical pointer. Vertical pointer shall move from the two-dot *LEFT* position to the two-dot *RIGHT* position in response to the movement of the **VAR** knob.



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

7. Set **VAR** Switch “OFF”.

8. Set **VOR** Switch to **DELETE REF Ø**. Vertical pointer shall move away from center position and the flag shall appear.



Indicator represents VOR flag in view when **VOR** switch set to **DELETED REF Ø.**

9. Set **VOR** Switch to **270°** vertical pointer shall center and flag shall retract.

10. Repeat Steps 8 and 9 for the **DELETE VAR Ø, DELETE 30 Hz**, and **DELETE VOR** positions of the VOR Switch. The same results shall be observed.

11. Momentarily press the **1020 ~ VOR** Switch. A 1020 Hz tone shall be heard from the cabin speaker or intercom.

12. Reduce the T-30D output signal strength with the **ATTENUATOR** knob. Ensure the flag hides and appears at the prescribed limits as provided by the manufacturer of your equipment.

13. Repeat steps 2-12 at the **108.05** position of the **VOR** frequency Select Switch. The same results shall apply.

14. Set both **ATTENUATOR** dials to 0.

2.12 LOCALIZER (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.

Verify proper operation of aircrafts LOC receiver equipment as follows:

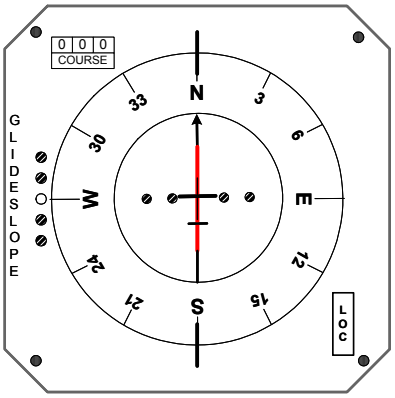
1. Connect the Omni-Antenna to the **RF OUTPUT** connector on the front panel of the Test Set and extend it fully, then retract it three sections (Table 2-3).

2. Set **ILS** Frequency Select Switch to **108.10/334.70**.

3. Turn on the LOC receiver. Tune for an operating frequency of 108.10 MHz.

4. Set the **FUNCTION** Switch to **LOC**.

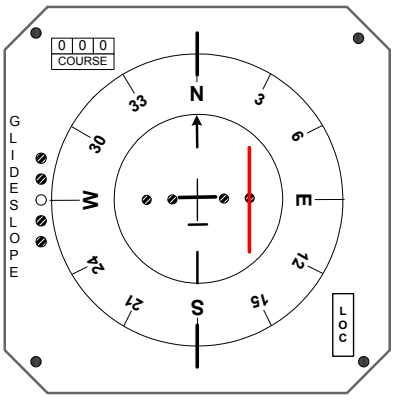
5. Set the **LOC** Switch to **OC** (On Course). Vertical pointer shall center and flag shall be retracted.



Indicator represents LOC, On Course

6. Set **LOC** Switch to **R1**. Vertical pointer shall show an One-Dot *RIGHT* deflection. Turn **LOC** Switch to **R2**. Vertical pointer shall show a Two-Dot *RIGHT* deflection.

7. Set **LOC** Switch to **L1**. Vertical pointer shall show an One-Dot *LEFT* deflection. Turn **LOC** Switch to **L2**. Vertical pointer shall show a Two-Dot *LEFT* deflection.



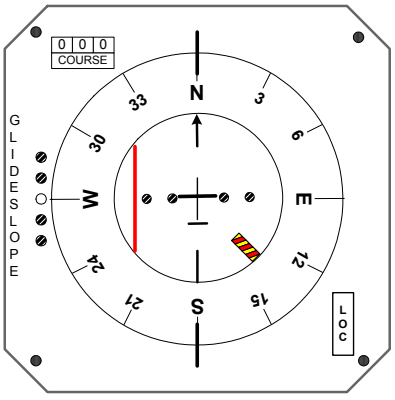
Indicator represents LOC Two Dots right of course

8. Set **LOC** switch to **VAR**. Rotate the **VAR** knob from the *LEFT* to *RIGHT* stop. Vertical pointer shall move from the *LEFT* two-dot position to the *RIGHT* two-dot position in response to the movement of the **VAR** knob.

9. Set **LOC** Switch to **OC**. Reduce the T-30D output signal strength with the **ATTENUATOR** knob. Verify that the flag appears IAW manufacturer's specifications.

10. Set both attenuator dials to **0**. Verify that the **LOC** Switch is at **OC** and that vertical pointer is centered.

11. Momentarily press **DELETE 90 ~** Switch. Vertical pointer shall swing full *LEFT* and the flag shall be visible.



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

12. Momentarily press **DELETE 150 ~** Switch. Vertical pointer shall swing full right and the flag shall be visible.

13. Momentarily press **1020 ~ LOC** Switch. A 1020 Hz tone shall be heard from the cabin speaker or intercom.

14. Repeat steps 2-13 with the **ILS** frequency select switch at **108.15/334.55**. The same results shall be observed.

15. Set both **ATTENUATOR** dials to 0.

2.13 Glide Slope (GS) 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.

Verify proper operation of the aircraft GS receiver equipment as follows:

1. Connect the Omni-Antenna to the **RF OUTPUT** connector on the front panel of the Test Set and extend it fully, then retract it five sections (Table 2-3).

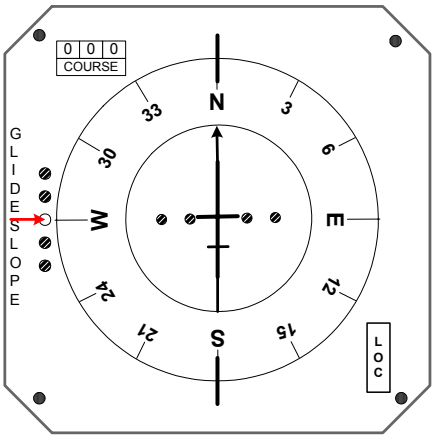
2. Set **ILS** frequency Select Switch to **108.10/334.70**.

3. Turn on the GS receiver. Tune for an operating frequency of 334.70 MHz.

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

5. Set the **GS** Switch to **OC**. Horizontal pointer shall center and flag shall be retracted.

GS Pointer is Centered and On Course (OC).

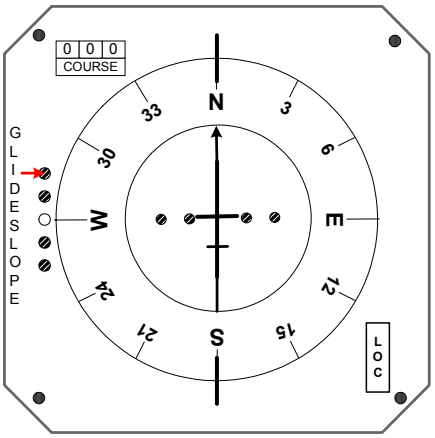


6. Set **GS** Switch to **+1**. Horizontal pointer shall show a One-Dot *UP* deflection. Turn **GS** switch to **+2**. Horizontal pointer shall show a Two-Dot *UP* deflection.

7. Set **GS** Switch to **-1**. Horizontal pointer shall show a One-Dot *DOWN* deflection. Turn **GS** Switch to **-2**. Horizontal pointer shall show a Two-Dot *DOWN* deflection.

8. Set **GS** Switch to **VAR**. Rotate the **VAR** knob from the left to right stop. Horizontal pointer shall move from the *DOWN* Two-Dot position to the *UP* Two-Dot position in response to the movement of the **VAR** knob.

GS Pointer indicates full Two-Dot *UP* Deflection



9. Set GS Switch to OC. Reduce the T-30D output signal strength with the **ATTENUATOR** knob. Verify that the flag appears IAW manufacturer's specifications.

10. Set both attenuator dials to **0**. Verify that the **GS** Switch is at **OC** and that horizontal pointer is centered.

11. Momentarily press **DELETE 90 ~** Switch. Horizontal pointer shall swing full up and the flag shall be visible.

12. Momentarily press **DELETE 150 ~** Switch. Horizontal pointer shall swing full down and the flag shall be visible.

13. Repeat steps 2-13 with the ILS frequency select switch at **108.15/334.55**. The same results shall be observed.

14. Set both **ATTENUATOR** dials to 0.

2.14 Instrument Landing System (ILS) Procedure

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.

Verify proper operation of the aircraft ILS receiver equipment as follows:

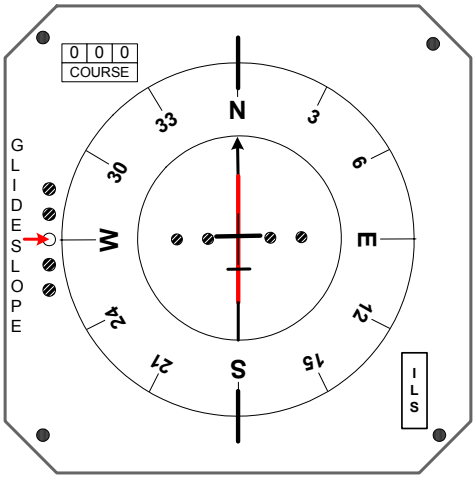
1. Connect the Omni-Antenna to the **RF OUTPUT** connector on the front panel of the Test Set and extend it fully, then retract it three sections (Table 2-3).

2. Set **ILS** frequency select switch to **108.10/334.70**.

3. Turn on the LOC/GS receiver (s). Tune for a LOC operating frequency of 108.10 MHz (GS 334.70 MHz).

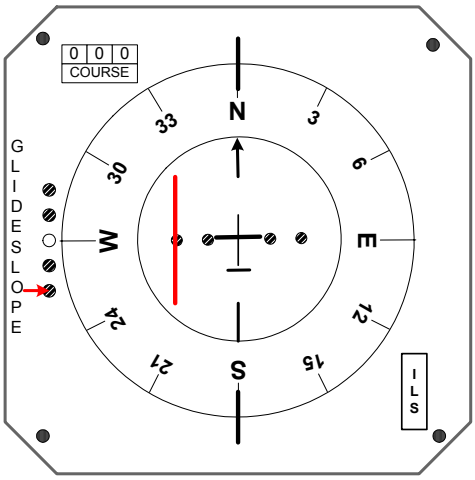
4. Set the **FUNCTION** switch to **ILS**.

5. Set both **LOC** and **GS** switches to **OC**. Vertical and horizontal pointers shall center and both flags shall be retracted.



Glide Slope and Localizer Pointers indicate On Course (OC).

6. Set both **LOC** and **GS** Switches to **VAR**. Rotate the **VAR** knob from the left and right stop. Vertical pointer shall move from *LEFT* Two-Dot position to the *RIGHT* Two-Dot position in response to the movement of the **VAR** knob. Simultaneously, the horizontal pointer shall move from the *DOWN* Two-Dot position to the *UP* Two-Dot position.



Glide Slope and Localizer Pointers indicate Two-Dots *DOWN* and Two-Dots *LEFT* of On Course.

7. Repeat steps 2-6 with the ILS frequency select switch at **108.15/334.55**. The same results shall be observed.

8. Set both ATTENUATOR dials to 0.

9. Simultaneous MB - At any time during ILS operation, the MB may be turned on by setting the **Simultaneous MB** "ON" switch.

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

2.15.1 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, GS- vertical control, 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.

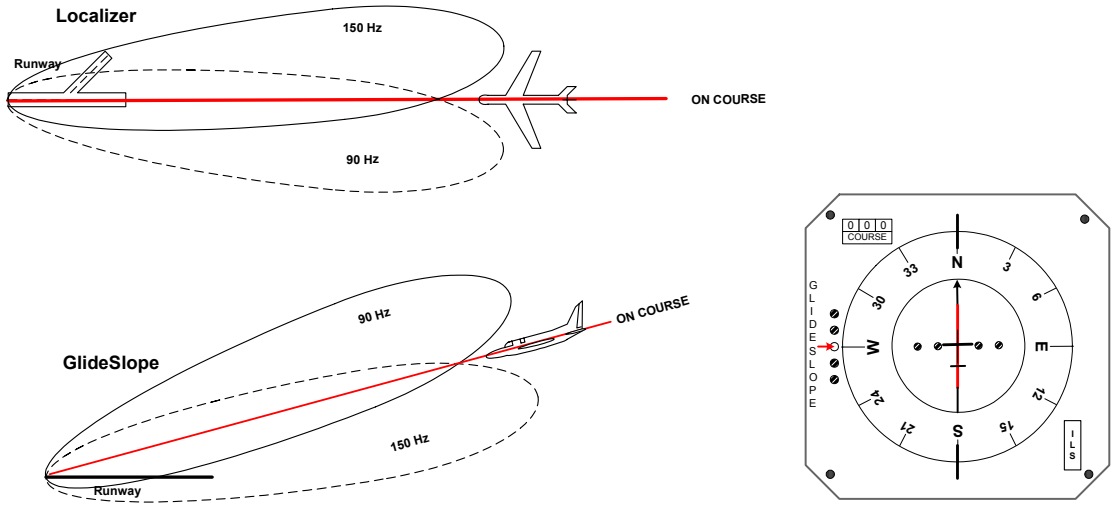
The vertical transmitter utilizing the UHF navigation band from 329.15 – 335.00 MHz provides the vertical guidance (GS).

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.

Marker Beacon transmitters transmit on a frequency of 75 MHz and is not paired with the ILS receiver.

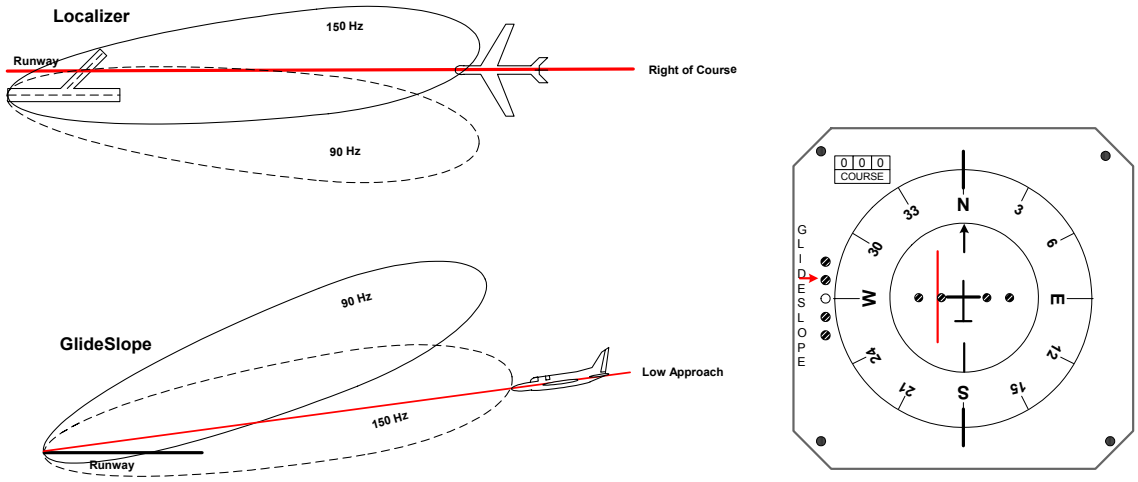
Both the LOC and GS Transmitters transmit a carrier modulated RF with 90 and 150 Hz signals. When an aircraft is receiving the signals and is receiving equal amounts of the 90 and 150 Hz modulation, the aircraft is "On Course", as depicted in Figure 2-6.

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 Figure 2-7.



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

Figure 2-6

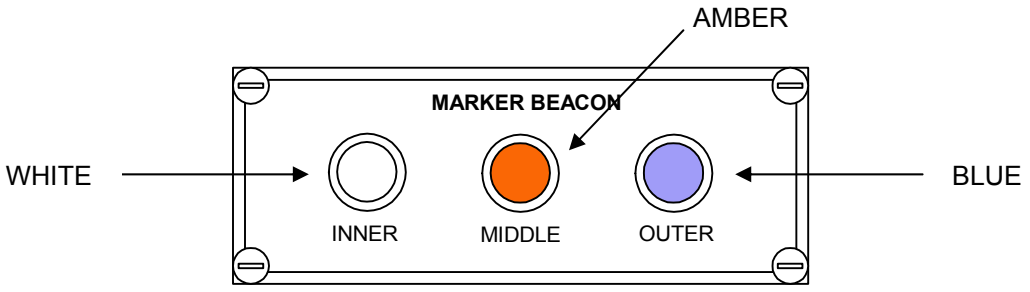


Illustrates an aircraft receiving a higher percentage of LOC 150 Hz modulation, and GS 90 Hz modulation. The Indicator will reflect left and above “On Course” when flying “TO” the VOR station.

Figure 2-7

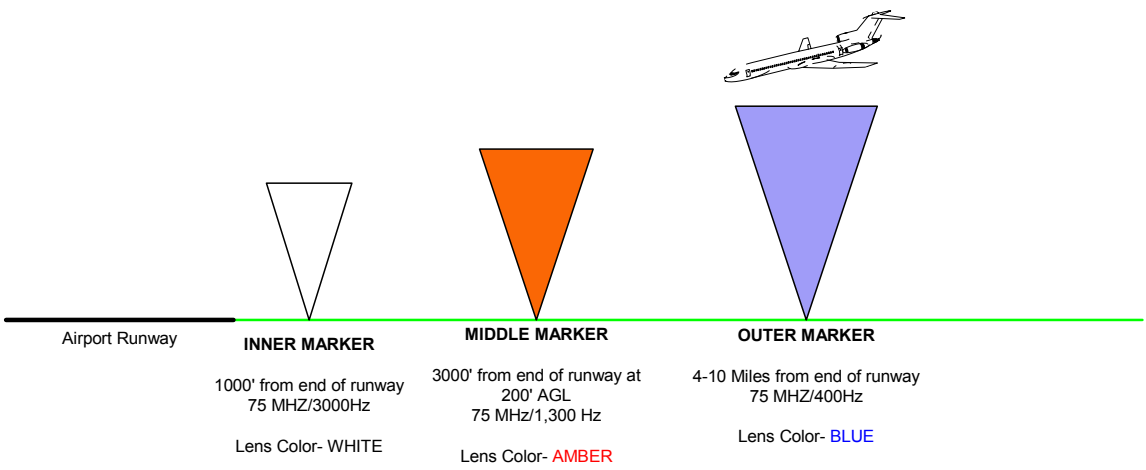
2.15.2 Marker Beacon

The Marker Beacon 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 2-9), illuminate the appropriate light on the panel (Figure 2-8).



Typical MB Display

Figure 2-8



Typical MB Approach Parameters

Figure 2-9

2.15.3 Basic VOR Principles

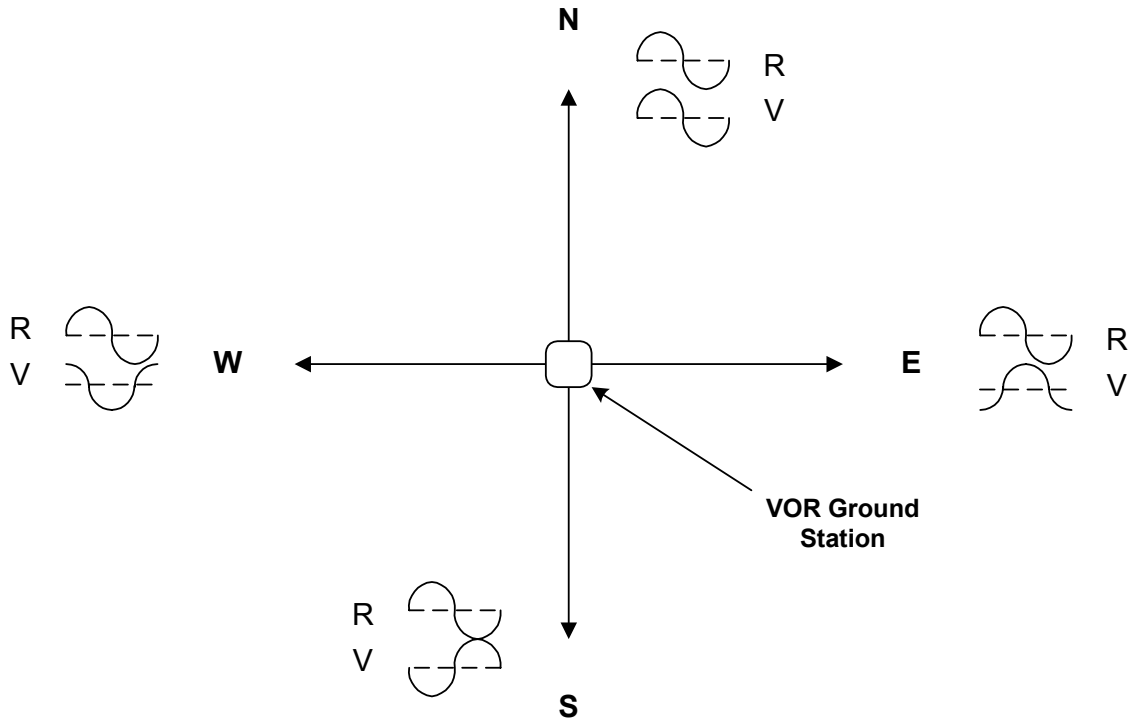
VOR (Variable Omni Range) is a VHF navigational aid utilized to determine the bearing of an aircraft to a designated point. The system comprises of a fixed ground station and the airborne receiver. The ground station transmits two signals, a reference and a variable signal. Within line of sight of a 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 9960 Hz subcarrier. The frequency modulated signal is then used to amplitude modulate (AM) a 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 2-10).



Phase Relationship between Variable and Reference Signals

Figure 2-10

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.

CHAPTER III

THEORY OF OPERATION

3.1 Overall Theory of Operation

The T-30D provides VOR, LOC, GS, MB signal generation, as shown in Fig. 3-1. The VOR and LOC RF carriers are generated using a phase locked loop synthesizer, which is capable of generating frequencies within the entire VHF navigation band. The GS RF carrier is generated with a similar phase locked loop and is capable of generating all GS frequencies. The MB RF carrier is generated with a crystal oscillator.

FIGURE #	DIAGRAM
5-1	System Interconnect
5-2 to 5-5	RF and Digital

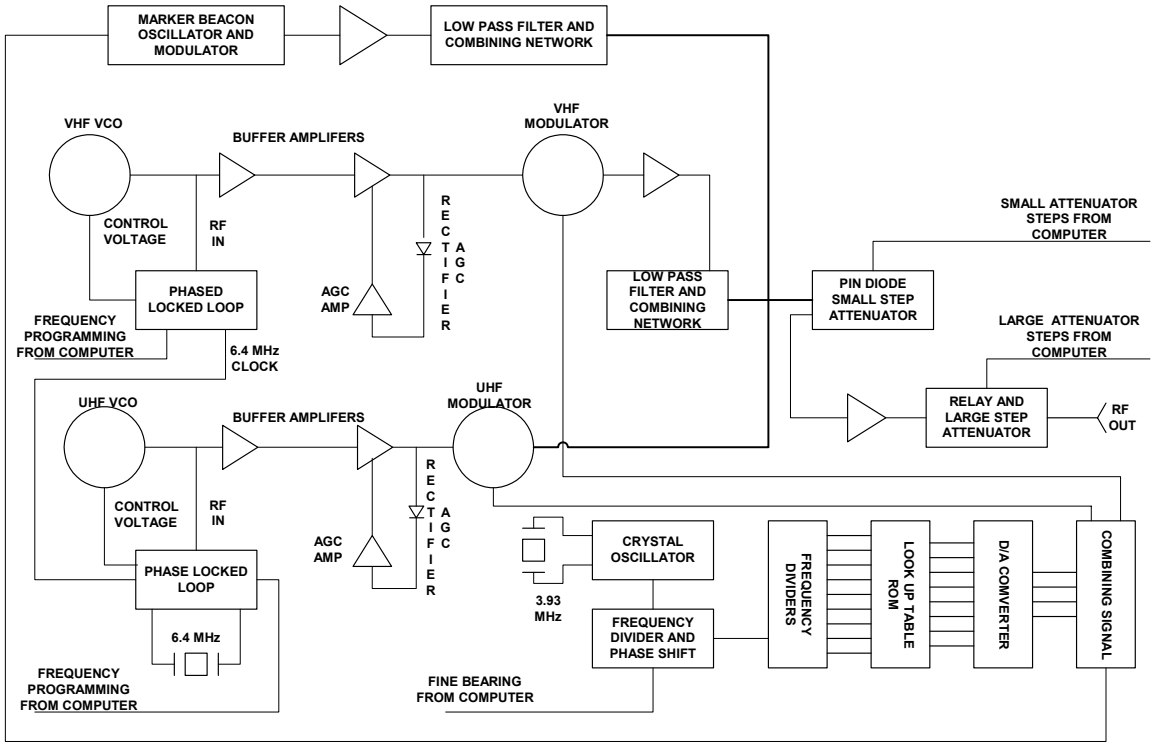
3.2 AC and Battery Power

As shown in Fig. 3-2, AC power is supplied thru the panel connector and thru fuses to the full wave bridge rectifier. The AC power is controlled by the AC Power switch and AC Input voltage select. When the Test Set Power switch is “OFF”, the output from the bridge rectifier is supplied thru fuses to charge the battery pack. When the Test Set Power switch is “ON”, the unit becomes operational. To preserve battery power, if no controls are activated, the unit will turn off after 15 minutes. To signal low battery voltage, the **TEST/FAIL STATUS** LED will begin to blink with approx. 15 minutes of operating time remaining. After this time, the test set will automatically be disabled until the battery is recharged.

The T-30D has a 10-cell series battery pack that provides 12 volts of DC. The capacity of the battery pack is 4 amp hours. The built in charger recharges the battery from the AC source. The battery will be charged with only the AC switch “ON”. The Test Set can be operated when the battery is being charged.

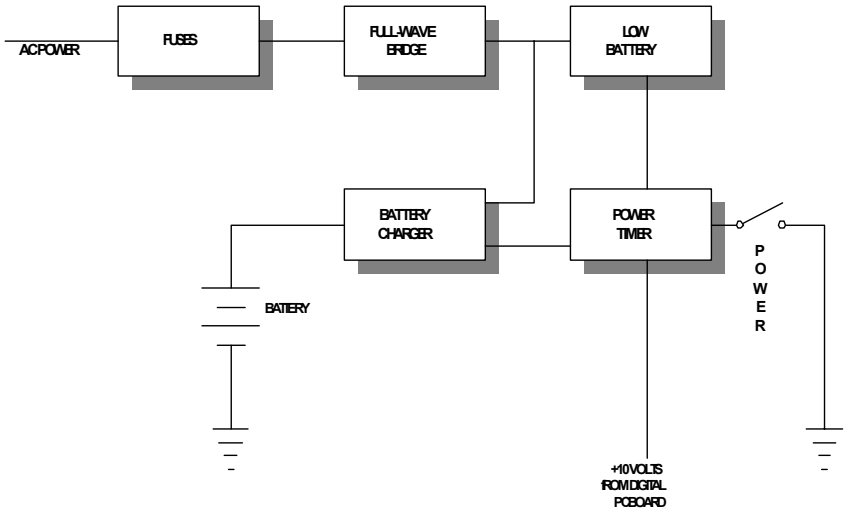
Because the recharge process is not a 100% efficient process, some energy delivered to the cells will generate oxygen and heat. If charging is done at less than 10% of the battery capacity (400ma), the oxygen will recombine in the cell. If the charge rate is greater than 400ma, the oxygen will accumulate and result in a capacity limitation known as *Memory Effect*. The *Memory Effect* is reversible by discharging the battery to a level of 10 volts and then recharging. The battery should never be discharged lower than 9.5 volts or the number a charge cycles (total useful life) will be greatly reduced.

The internal battery charger provides 400ma of current to the battery that, after 16 hours, will completely charge a fully discharged battery pack. The charger can be left on indefinitely without generating the memory effect. Therefore, it is recommended to keep the test set on charge when not in use.



System Block Diagram

Figure 3-1



Power Supply Block Diagram

Figure 3-2

3.3 Microprocessor Operation

The T-30D microcomputer uses an 80C31 processor, U3, operating at 12MHz. The processor RAM is U2 while the PROM is U5. U1 is used for address expansion. The computer monitors the front panel controls, determines the mode of operation, and thus controls the RF frequencies and levels, the modulation tones to be generated and the necessary phase angles when used. The computer also interfaces with an IEEE-488 bus in units fitted with this option.

The front panel switches are scanned using the input and output ports from the microprocessor. There are 6 driver lines, key1 through key6, which are latched into U10. These outputs drive the function switches on the front panel and the switch closures are sensed through the 6 inputs key 7 through key 13.

The microprocessor programs the basic mode of operation of the unit by providing analog switching and the partitions of the look-up PROM used to generate the modulation voltages. The processor also programs the frequency of the synthesizers and the output RF levels. The computer also programs the VOR bearing, both fine and coarse, the percentage of modulation for the LOC and the GS.

The necessary mathematics to convert the front panel controls from the DDM to percentage modulation or the omni bearing to coarse and fine bearing is performed by the microprocessor.

3.4 RF Generation

The RF signal generation involves two phase locked loop synthesizers for the VOR, LOC and GS signal carriers. For the marker carrier a single-frequency, crystal controlled generator is used.

As shown in Fig. 3-3, for the VHF navigation frequencies required of the VOR and localizer, Q3 is the VCO, which is followed by an attenuator to provide isolation from the first buffer amplifier, U66, followed by a second buffer amplifier, U67. The output of the second buffer amplifier is rectified using the Schottky diode CR18 and compared to a reference voltage generated with another Schottky diode, CR19. The output of the feedback amplifier U70 is fed to the base of the transistor, Q4. This transistor adjusts the current to the amplifier, U67, thus changing the gain of this amplifier. The amplitude of the rectified signal from CR18 is adjusted to be equal to and of opposite sign as the current through R185, which sets the RF level at the output of U67.

Having a constant RF voltage input to the modulator permits accurate amplitude modulation from the balanced mixer, U68. The output of the modulator is passed through a low pass filter to eliminate the higher order harmonics created in the balanced modulator, to amplifier U21 and an isolation resistor, R178.

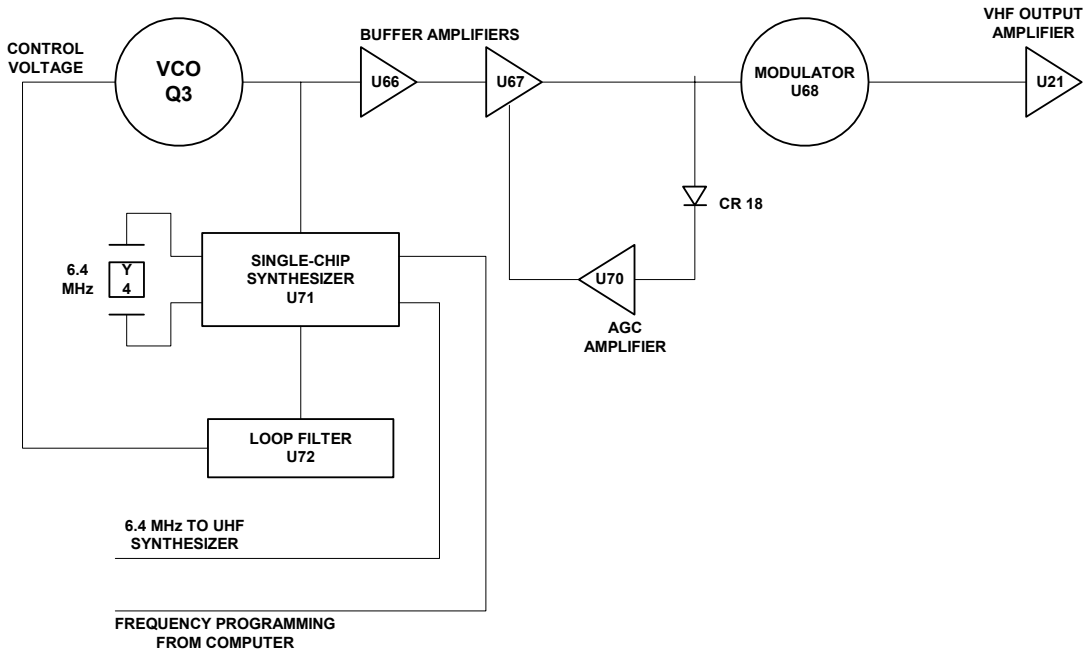
The UHF synthesizer, Fig. 3-4 is very similar; the main difference being the glide slope frequency range is small compared to the VHF NAV band of frequencies. This is evident as the main difference between the VHF and UHF synthesizers, is the VCO.

The VCO for the UHF synthesizer is negative resistance oscillator using Q1. An attenuator follows the VCO, two buffer amplifiers and a feedback level control adjust as the VHF synthesizer. The output of the second buffer amplifier feeds the modulator.

The marker beacon RF signal is generated with a crystal controlled oscillator and modulator, U49. This IC provides a 5th overtone crystal oscillator and a Gilbert cell balanced modulator which is used as an AM modulator. The output of the modulator is amplified and passed through a simple low-pass filter and a 220-ohm isolation resistor.

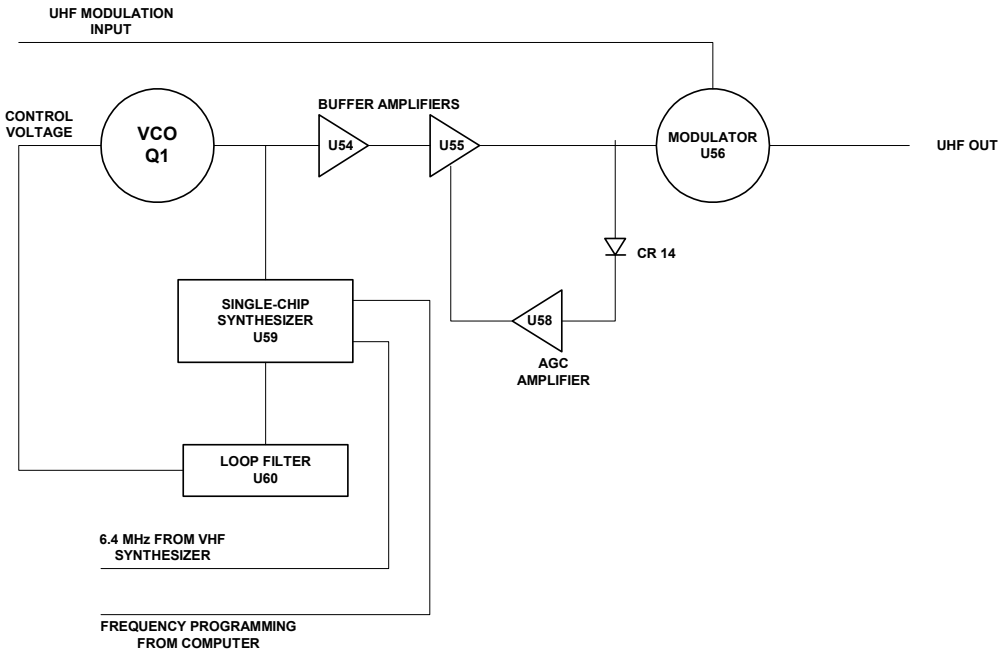
The output signal from the VHF, UHF, and MB are combined and attenuated in 1dB steps with two PIN diode attenuators providing 1, 2, 4, 5, 10, and 20dB steps, for a total of 42dB of attenuation. The output of PIN diode attenuators is amplified by the power amplifier U73. Relay attenuators provide two additional 34dB steps after the power amplifier, bringing the total attenuation to 110dB.

The PIN diode and relay attenuators are controlled by the computer and are set by the front panel attenuation switches.



VHF Block Diagram

Figure 3-3



UHF Block Diagram

Figure 3-4

3.5 Modulation

The modulation waveforms are generated using digital sampling techniques and a look-up table, U35, which is sequentially addressed. The output of the look-up table ROM feeds several D/A converters that create the analog output to feed the modulators. The basic cycle time of the look-up table is 1/30th of a second. There are 2048 samples per cycle, which implies that the addresses change at a 61.44 kHz rate.

The SINE PROM has look-up tables to generate all of the required sine frequencies. In the VOR mode of operation, the PROM provides one cycle (1/30 sec) of 30Hz variable phase, 9960Hz IDENT tone, and a 9960Hz un-modulated frequency for VOR delete modes test.

In the ILS mode of operation, the PROM provides 3 cycles of 90Hz, 5 cycles of 150Hz tones for GS and LOC. It also provides 1020Hz IDENT tone for the LOC when selected by the operator. The 90 and 150Hz tones are loaded to separate LOC and GS D/A converters. The D/A converters and amplifiers set the amplitude of these tones

In the MB mode of operation, the PROM provides 13.5 cycles of 400Hz, 43.5 cycles of 1300Hz, or 100 cycles of 3000Hz, as selected by the operator. The MB tone generation is accomplished differently from the VOR and ILS tones. Because two of the three MB frequencies are not exact multiples of 30Hz, as the VOR, LOC, and GS tones are, the look-up table is read twice for each MB tone and the polarity of the output is reversed between the two readings. This effectively reduces the sample rate from 30 to 15 times per second.

For the 3000Hz MB tone, 100 complete cycles are stored and retrieved 30 times per second which produces an exact 3 kHz output. For the 1300Hz tone, 43.5 cycles are stored and retrieved

at a 30Hz rate. Since the polarity is changed every other sequence, the one-half cycle at the end of one sequence is followed by a reverse polarity cycle at the beginning of the next cycle and results in a continuous sine wave. Sampling 43.5 cycles at 30 times a second, results in a frequency of 1305Hz; and sampling 13.5 cycles at 30 times a second results in a frequency of 405Hz. Both of these tones are within ICAO spec.

U28, U29 and U30 form a 12-bit binary counter. Eleven bits of the counter feed a binary adder consisting of U31, U32 and U33. The output of the adder feeds the address input of the look-up PROM, U35. The adder allows the VOR coarse bearing to be added to the address of the PROM when reading the 30Hz variable signal from the look-up PROM. When operating in the VOR mode, the VOR coarse bearing is added to the PROM address only when the output control of U15 and U16 is low. When the output control is at logic 1, the pull down resistors cause the B input to the adder, U31, U32 and U33, to be all zero and thus the address is the same as the state of the address counters U28, U29 and U30.

On all other modes, the VOR coarse bearing, VCBO through VCB10, is zero, and the address of the EPROM is the same as the address counter, regardless of the state of the output control.

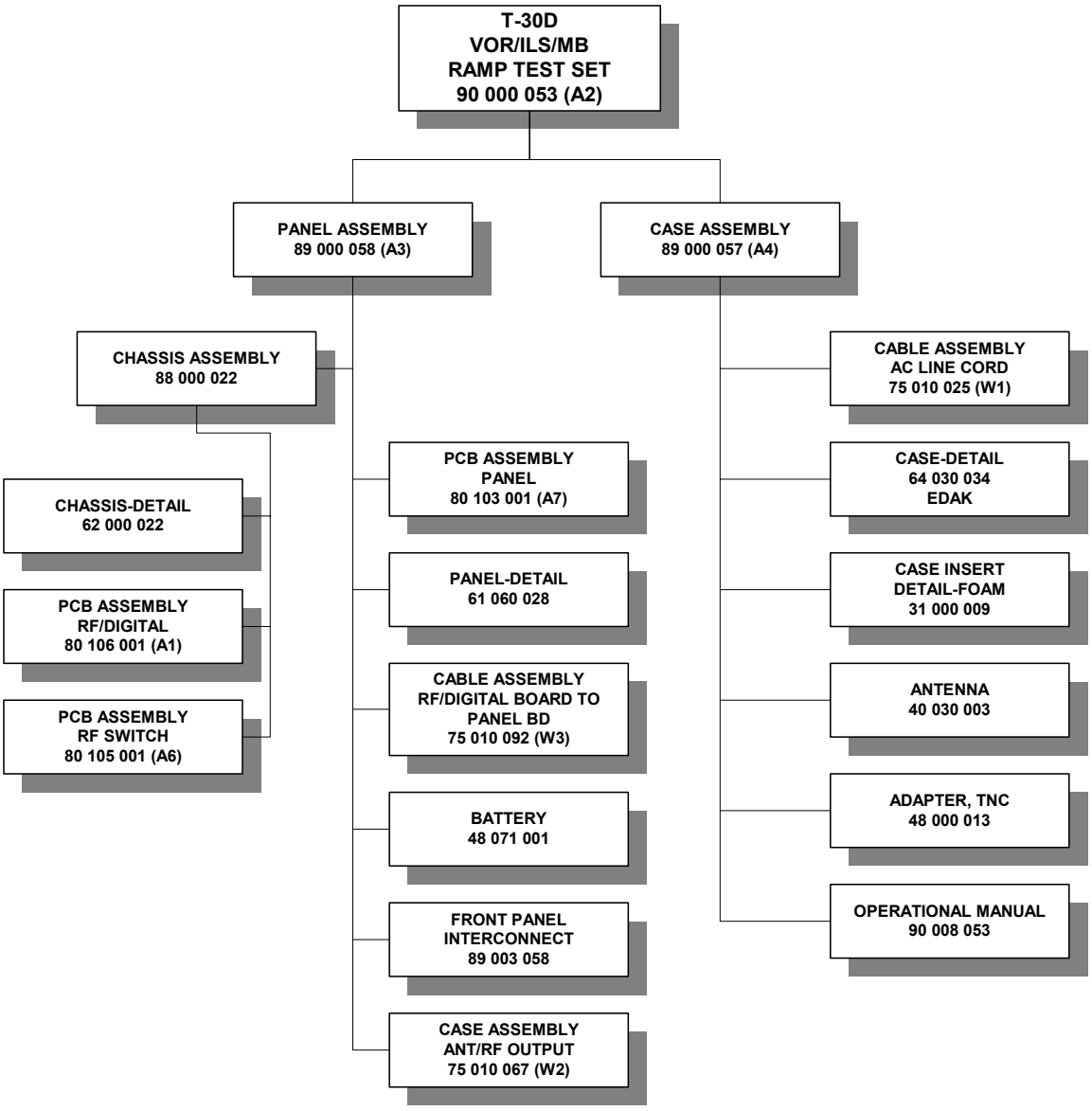
The D/A converters have storage latches and the output of the look-up PROM, that represents the digital amplitude of the waveform, is latched into five D/A converters. The 61.44 kHz address clock is further divided into 4 periods. U40 contains four of the five D/A converters and receives the data for the LOC 90Hz in section A, LOC 150Hz in section C, GS 90Hz in section B and GS 150Hz in section D. There are five D/A converters and only 4 sub-periods for each address. In the ILS modes of operation, where all 5 D/A converters are used, the 90 and 150Hz waveforms are latched into two D/A converters each of the first two sub-periods while the 1020Hz IDENT or one of the marker tones are latched during the remaining two periods.

In the VOR mode, a 30Hz sine function is latched into the D/A converter U39-A, while a 9960 Hz frequency modulated reference waveform is latched into U40 section B and the 1020Hz IDENT is latched into sections A.

In the ILS modes, the 90Hz sine function is latched into U40 A and B while the 150Hz tone is latched into U40C and D. The 1020Hz IDENT tone or the MB tone, depending on whether the MB or IDENT tone is selected, is stored in U39-A. When the MB is not activated, U39-A receives the 1020Hz IDENT tone that is routed to the VHF modulation for the localizer through U42 and R43.

The VOR fine bearing is created by using the second latch available in U39. In U40, the second latch is effectively disabled by permitting the latch to remain transparent. The 61.44 kHz address clock is divided into 16 sub clocks. By delaying, the strobe pulse to the second latch by multiples of 1/16th of the 61.44 kHz period the address clock the phase angle between the reference and variable can be adjusted. Since each 30 Hz cycle is divided into 2048 samples, each sample represents 0.176 degrees, using the 1/16th clock period, the fine adjustment can be made with 0.011-degree resolution.

The reference voltage for all four D/A converters in U40 can be controlled by the D/A converter, U8. U40 receives the samples for localizer and glide slope 90Hz and 150Hz tones. Therefore, the DDM's of the GS and LOC may be set under control of the computer.



T-30D Ramp Test Set Configuration Chart

Figure 3-5

CHAPTER IV

MAINTENANCE AND SERVICING

4.1 General[1]

The use of the current generation of electronic components has dramatically decreased the cost of maintaining and calibrating test equipment. Tel-Instrument Corp. has recommended an annual calibration interval and periodic checks to keep the T-30D Test Set in operational condition. Performing preventative maintenance checks of the Test Set and Test Set Verification and Acceptance Checks if a failure is suspected will reduce down time by detecting and correcting potential problems at their onset. This chapter is broken down in four sections:

1. Routine Maintenance (Section A).
2. Test Set Verification and Acceptance Checks (Section B).
3. Annual Calibration and Alignment (Section C).
4. Battery Replacement (Section D).

Routine Maintenance: By routinely cleaning and inspecting the T-30D Test Set, the operator will be able to reduce down time due to unexpected failures. Routine Maintenance, as outlined in *Section A*, consists of checks and observations performed to maintain the Test Set in a serviceable and ready condition. They should be accomplished each time the Test Set is utilized and after extended storage.

Test Set Verification and Acceptance Checks: If during normal operation, a failure is suspected or unusual or erratic results are displayed, perform the procedures as listed in *Section B*. By conducting and verifying the Test Sets condition. The operator will be able to determine if the Test Set is malfunctioning or the UUT is at fault. Periodic checks will also alert the operator to possible problems and ensure the Test Set is in full operational condition before it is used.

Annual Calibration and Alignment: A full Calibration and Alignment of the Test Set shall be performed under the following conditions:

1. Tel-Instrument Corporation recommends an Annual Calibration & Alignment to ensure accurate test results and improved performance.
2. If any failure occurs or is suspected during *Routine* or *Test Set Verification Checks*, a full Calibration and Alignment shall be performed.
3. If any major assembly is replaced.
4. If during normal operation, the Test Set fails to meet any specification outlined in Chapter 1, Section B.

[1] Tel-Instrument Electronics Corp. reserves the right to change and modify specifications and data without notice.

4.1.1 General Test Requirements

1. All measurements and tests shall be performed at the prevailing conditions of temperature, humidity and barometric pressure.

2. If a test set fails to meet the test specified herein, the calibration procedure outlined in Chapter 4, Section C, should be followed.

3. All test instruments and test equipment shall have an accuracy at least four times better than the tolerance to be measured. When conditions prohibit such instrumentation, or only minimum or maximum values are specified, the measurement limit shall be adjusted to compensate for the calibration limit of uncertainty.

4. Instrument calibration shall be in accordance with MIL-C-45662A.

5. The Test Set shall be permitted to warm up for a period of 10 minutes prior to performing any of the following tests.

6. The Initial Test Set Up Procedure provides the steps necessary prior to performing any of the tests.

7. Record the test results on the data sheets (Appendix's A & B) when each test procedure has been completed, the summary sheets will comprise the test report for that particular unit.

SECTION A

ROUTINE MAINTENANCE

4.2 General

By routinely cleaning and inspecting the T-30D Test Set, the operator will be able to reduce down time due to unexpected failures. Routine Maintenance consists of checks and observations performed to maintain the Test Set in a serviceable and ready condition. They should be accomplished each time the Test Set is utilized and before extended storage.

Routine maintenance consists of the following:

1. Cleaning of the T-30D Test Set exterior case.
2. Inspection of all connectors, cables and the Test Set assembly.
3. Battery Charging.

4.2.1 Cleaning Procedure

Keep the Test Set clean by removing any loose dirt, mildew or mild corrosion with a soft cloth moistened with warm water and a mild detergent. Do not spray any cleaning detergent or water directly on the Test Set. Ensure to dry off the Test Set with a Lint free cloth to remove all deposits and remaining cleaning solution. Strong cleaners and chemicals should be avoided to prevent damage to the display and switches.

4.2.2 Inspection of all Connectors, Cables and Test Set Assembly

By inspecting the cables, connectors, and the Test Set periodically, potential inaccurate test results can be alleviated.

1. Check each antenna supplied with your Test Set for obvious signs of rust, dents and loose parts.
2. Inspect the Test Set case for signs of abuse. Large dents and cracked displays may render the Test Set inoperable.
3. Toggle and push each switch for proper operation. Sticking switches may result in erroneous test results.
4. Inspect for loose bolts, nuts, and screws; tighten if necessary.
5. Periodically clean all exposed connectors with an approved avionics cleaner.

4.2.3 Battery Charging

Charge the battery IAW the procedures outlined in Section II, paragraph 2.7.3.

SECTION B

TEST SET VERIFICATION AND ACCEPTANCE CHECKS

4.3 General

These procedures will be performed on an *UNOPENED* Test Set by measuring inputs/outputs. If the Test Set results are not within tolerances, the Test Set will require a full alignment as outlined in Section C.

4.3.1 Test Equipment Required

The following support equipment (or their equivalent) is necessary to perform the *Test Set Verification and Acceptance Checks* of the T-30D Test Set.

NOMENCLATURE	DESIGNATION
Universal Counter	HP 5335A
RF Power Meter	HP 432A
Spectrum Analyzer	HP 8558B
Modulation Meter	Boonton Electronics 82AD
Digital Voltmeter	Fluke 8000A
Oscilloscope	Tektronix 2235
DC Power Supply	0-12 V @ 1 amp
Autotransformer	115V/230V, 50-60 Hz, 10W min.
Zifor: Radial Standard	Collins 478A-3
Distortion Analyzer	HP 339A
Aircraft Receiver (optional)	Bendix CNS-2220
Photocopy of Data Sheet	Appendix A

Test Set Verification Required Equipment List

Table 4-1

NOTE

Utilize Appendix A to record all of the data. The datasheet provides a location to input the data. Each space is identifiable by the test paragraph number and step number.

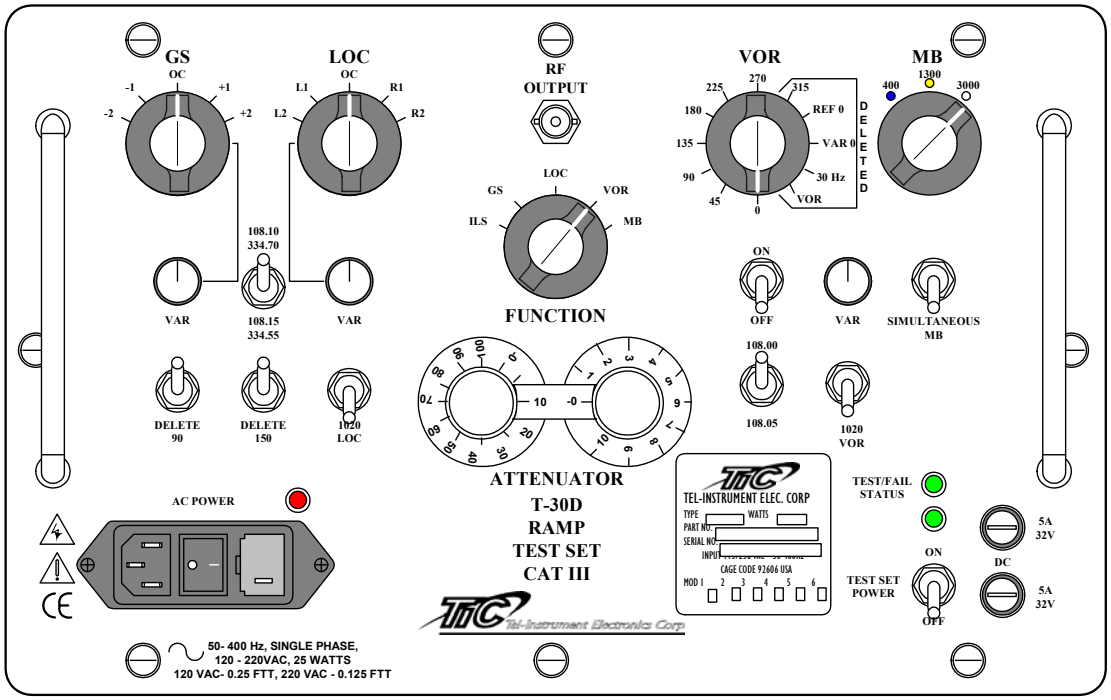
4.3.2 Initial Test Configuration

Set the Test Set switches to the following positions when indicated:

Switch Name	Setting
AC Input	120 VAC
AC Power	OFF
GS	OC
LOC	OC
108.10/334.70 – 108.15/334.55	108.10/334.70
DELETE 90, DELETE 150, 1020 LOC	Released
FUNCTION	VOR
VOR Bearing	0°
VAR	Off
108.00/108.05	108.00
1020 VAR	Released
MB Select	3000
TEST SET POWER	OFF
SIMULTANEOUS MB	OFF
ATTENUATOR	10 dB

Test Set Switch Configuration

Table 4-2



T-30D Test Set

Figure 4-1

4.4 Radio Frequency Measurements

1. Set the Test Set switches to the Initial Configuration IAW Table 4-2.
2. Connect the Universal Counter to the **RF OUTPUT** with the attenuator set at 10dB. Hold the **LOC 1020** closed while turning “ON” the Test set. This procedure removes all audio modulation.
3. Observe on the counter a measurement of 107.9973 – 108.1027 MHz.
4. Toggle the **108.00/108.05** switch to **108.05**.
5. Observe on the counter a measurement of 108.0473 – 108.0527 MHz.
6. Return the **108.00/108.05** switch to **108.00**.
7. Set the **FUNCTION** switch to **LOC**.
8. Observe on the counter a measurement of 108.0973 – 108.1027 MHz.
9. Toggle the **108.10/108.15** switch to **108.15**.
10. Observe on the counter a measurement of 108.1473 – 108.1527 MHz.
11. Return the **108.10/108.15** switch to **108.10**.
12. Set the **FUNCTION** switch to **MB**.
13. Observe on the counter a measurement of 74.99625 – 75.00375 MHz.
14. Set the **FUNCTION** switch to **GS**.
15. Observe on the counter a measurement of 334.6916 – 334.7084 MHz.
16. Toggle the **108.10/334.70 – 108.15/334.55** switch to **108.15/334.55**.
17. Observe on the counter a measurement of 334.5416 – 334.5584 MHz.
18. Toggle the **108.10/334.70 – 108.15/334.55** switch back to **108.10 – 334.70**.
19. Set the **FUNCTION** switch to **VOR** and the **VOR BEARING** to **0º**.
20. Turn the Test Set “OFF”.

4.5 RF Power Measurements

1. Set the Test Set switches to the Initial Configuration IAW Table 4-2.
2. Connect the Power Meter to the **RF OUTPUT** with the attenuator set at 10dB. Hold the **LOC 1020** *Down* while turning “ON” the Test set. This procedure removes all audio modulation.

3. Set the **VOR** bearing switch to **DELETED VOR**.

4. Observe on the Power Meter a measurement of +7/ ± 2 dBm.

5. Set the **FUNCTION** switch to **MB**.

6. Observe on the Power Meter a measurement of + 1/ ± 2 dBm.

7. Set the **FUNCTION** switch to **GS**.

8. Observe on the Power Meter a measurement of ± 8/ ± 2 dBm.

9. Set the **FUNCTION** switch to **VOR** and the bearing to **0º**.

10. Turn the Test Set "OFF".

4.6 Percentage Modulation Measurements

1. Set the Test Set switches to the Initial Configuration IAW Table 4-2.

2. Connect the Modulation Meter to the Test Set **RF OUTPUT** connector with the attenuator set to 10 dB.

3. Set the Modulation Meter Bandwidth to 15 KHz.

4. Turn the Test Set "ON".

5. Set the **VOR** switch to **DELETE REF 0**.

6. Observe a measurement on the Modulation Meter of 28% - 32%.

7. Set the **VOR** switch to **DELETE VAR 0**.

8. Observe a measurement on the Modulation Meter of 28% - 32%.

9. Set the **VOR** switch to **DELETED VOR,** hold down the **1020 ~ VOR** switch, observe a measurement of 15% - 25% on the Modulation Meter.

10. Set the **FUNCTION** switch to **MB**.

11. Set the Modulation Meter bandwidth to 120 KHz.

12. Observe a measurement of 91% - 99% on the Modulation Meter with **MB** switch set to **3000**.

13. Set the **MB** switch to **1300** and observe a measurement of 91% - 99%.

14. Set the **MB** switch to **400** and observe a measurement of 91% - 99%.

15. Set the **MB** switch back to **3000**.

16. Set the **FUNCTION** switch to **GS**.

17. Hold the **DELETE 90 ~** switch *DOWN* and turn the **GS** switch to each position (+2 thru -2) and record the measured results in the assigned locations in *Column A* of the Data Sheet.

18. Hold the **DELETE 150 ~** switch *DOWN* and turn the **GS** switch to each position (+2 thru -2) and record the measured results in the assigned locations in *Column B* of the Data Sheet.

19. Subtract the values entered in *Column B* from *Column A* and compare the results to the specification table in *Appendix A.*

20. Set the **FUNCTION** switch to **LOC**.

21. Hold the **DELETE 90 ~** switch *DOWN* and turn the **LOC** switch to each position (L2 thru R2) and record the measured results in the assigned locations in *Column A* of the Data Sheet.

22. Hold the **DELETE 150 ~** switch *DOWN* and turn the **LOC** switch to each position (L2 thru R2) and record the measured results in the assigned locations in *Column B* of the Data Sheet.

23. Subtract the values entered in *Column B* from *Column A* and compare the results to the specification table in *Appendix A.*

24. Hold *DOWN* the **DELETE 90 ~** and **DELETE 150 ~** switches, energize the **1020 ~ LOC** switch. Observe a measured value on the Modulation Meter of 15% and 25%.

25. Remove the Modulation Meter and connect the Spectrum Analyzer to the **RF OUTPUT** connector.

26. Set the **FUNCTION** switch to **ILS**.

27. Hold *Down* the **SIMULTANEOUS MB** switch and observe signals at:

    75 MHz
    108.10 MHz
    334.70 MHz

28. Set the **FUNCTION** switch to **VOR**. Set both **GS** and **LOC** controls to the **OC** position. Turn the Test Set “OFF”.

4.7 Audio Frequency and Distortion Measurements

1. Set the Test Set switches to the Initial Configuration IAW Table 4-2.

2. Connect the Modulation Meter to the **RF OUTPUT** connector with the attenuator set to 10 dB.

3. Connect the Audio Output of the Modulation Meter to the Distortion Analyzer and a Frequency Counter.

4. Turn the Test set “ON”.

5. Set the **FUNCTION** switch to **MB** and observe that the distortion at 3000 Hz is < 10% and the frequency at 2940 – 3060 Hz.

6. Set the **MB** switch to **1300** and observe that the distortion is < 10% and the frequency at 1274 – 1326 Hz.

7. Set the **MB** switch to **400** and observe the distortion is < 10% and the frequency at 392 – 408 Hz.

8. Set the **FUNCTION** switch to **VOR** and the **MB** switch to **3000**.

9. Set the **VOR** bearing to **DELETED REF 0** and observed that the 30 Hz distortion is < 5% and the frequency is between 29 – 31 Hz.

10. Set the **VOR** bearing switch to **DELETED 30Hz** and observe that the 9960 Hz distortion is < 5% and the frequency is between 9959 – 9961 Hz.

11. Set the **VOR** bearing switch to **DELETED VOR** and hold *Down* the **1020 ~ VOR** and observe that the 1020 distortion is < 10% and the frequency is between 1000 – 1040 Hz.

12. Set the **FUNCTION** switch to **LOC**.

13. Hold *Down* the **DELETE 150 Hz** and observe that the 90 Hz distortion is < 5% and the frequency is between 89 – 91 Hz.

14. Hold *Down* the **DELETE 90 Hz** and observe that the 150 Hz distortion is < 5% and the frequency is between 149 – 151 Hz.

15. Hold *Down* the **DELETE 90 ~, DELETE 150 ~, and 1020 ~ LOC** switch and observe the 1020 Hz distortion is < 10% and the frequency is between 1000 – 1040 Hz.

16. Set the **FUNCTION** switch to **GS**.

17. Hold *Down* the **DELETE 150 ~** switch and observe that the 90 Hz distortion is < 5% and the frequency is between 89 – 91 Hz.

18. Hold *Down* the **DELETE 90 ~** switch and observe that the 150 Hz distortion is < 5% and the frequency is between 149 – 151 Hz.

19. Set the **FUNCTION** switch to **VOR**, the bearing to **0º,** and turn the Test Set "OFF".

4.8 VOR Angle Verification

1. Set the Test Set switches to the Initial Configuration IAW Table 4-2.

2. Connect a Modulation Meter to the **RF OUTPUT** connector with the attenuator at 10 dB, on the Test Set.

3. Connect the Audio Output of the Modulation Meter to the *ZIFOR* test set.

4. Turn the Test Set “ON”.

5. Observe the angle that is displayed on the *ZIFOR* and record the measurement on the *Data Sheet* under ***0***.

6. Repeat Step #5 for the other 7 positions on the **VOR** switch and record the data in the assigned positions the *Data Sheet*.

7. Verify Compliance IAW the supplied formula.

8. Set the **VOR** switch to **0°**.

9. Set the **VAR** switch *UP.*

10. Turn the **VAR** dial fully CCW.

11. Observe that the angle indicated is < 170°.

12. Turn the **VAR** dial fully CW.

13. Observe that the angle indicated is > 190°.

14. Set the **VAR** switch *Down*.

15. Test Set Verification and Acceptance checks complete. Turn the Test Set “OFF” and ensure that all values are correctly entered on the *Data Sheet*.

SECTION C

ANNUAL CALIBRATION AND ALIGNMENT

4.9 General

These procedures will be performed on an annual basis. They will be performed on an opened box to allow access to test points and alignment controls to align the Test Set to manufacturer's specifications. If these adjustments fail to return the Test Set to the specified parameters, the unit may require repair and additional maintenance. By utilizing the following procedures and referring to the schematics (Chapter VI), a qualified technician should be able to troubleshoot the problem. Do not make adjustments for results that meet the specification.

WARNING
Any time you are working with exposed wiring, the potential for electrical shock increases. Ensure all standard electrical safety procedures are strictly enforced to prevent injury.

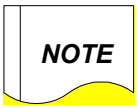
4.9.1 Test Equipment Required

The following support equipment (or their equivalent) is necessary to perform the *Test Set Annual Calibration and Alignment* of the T-30D Test Set.

NOMENCLATURE	DESIGNATION
Universal Counter	HP 5335A
RF Power Meter	HP 432A
Spectrum Analyzer	HP 8558B
Modulation Meter	Boonton Electronics 82AD
Digital Voltmeter	Fluke 8000A
Oscilloscope	Tektronix 2235
DC Power Supply	0-12 V @ 1 amp
Autotransformer	115V/230V, 50-60 Hz, 10W min.
Zifor: Radial Standard	Collins 478A-3
Distortion Analyzer	HP 339A
Aircraft Receiver (optional)	Bendix CNS-2220
Photocopy of Data Sheet	Appendix B

Test Set Annual Calibration Equipment List

Table 4-3



Utilize Appendix B to record all of the data. The datasheet provides a location to input the data. Each space is identifiable by the test paragraph number and step number.

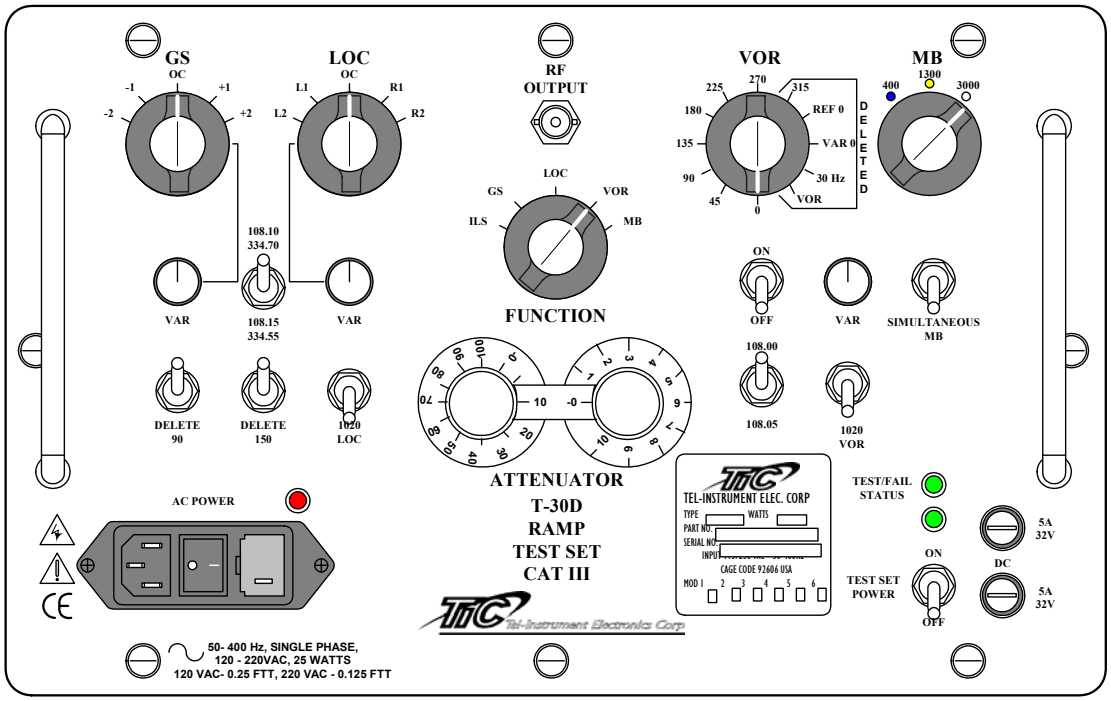
4.9.2 Initial Test Configuration

Set the Test Set switches to the following positions when indicated:

Switch Name	Setting
AC Input	115 VAC
AC Power	OFF
GS	OC
LOC	OC
108.10/334.70 – 108.15/334.55	108.10/334.7
DELETE 90, DELETE 150, 1020 LOC	Released
FUNCTION	VOR
VOR Bearing	0°
VAR	Off
108.00/108.05	108.00
1020 VAR	Released
MB Select	3000
TEST SET POWER	OFF
SIMULTANEOUS MB	OFF
ATTENUATOR	10 dB

Test Set Switch Configuration

Table 4-4



T-30D Test Set

Figure 4-2

4.10 AC Power Tests

NOTE

Locations of adjustment points and test points can be located by utilizing the illustrations located in Chapter VI.

1. Set the Test Set switches to the Initial Configuration IAW Table 4-4.
2. Remove both fuses from the Fuse Cartridge on the front panel of the Test Set.
3. Set the AC Input drawer to 120 VAC (see Chapter 2, Paragraph 2.7.2).
4. Using the Power cable supplied with the Test Set, connect the Test Set to the AC Autotransformer at 120 VAC.
5. Turn the Test Set "ON".
6. Verify the AC voltage between **E9** and **E10** on the A2 PCB Assembly. Verify 16 – 30 VAC.
7. Verify the DC voltage between **E7** and **E1** on the A2 PCB Assembly. Verify 16 – 20 VDC.
8. Turn Power "OFF" to the Test Set. Set the AC Fuse Drawer to 220 VAC (see Chapter 2, Paragraph 2.8.1) and reapply power.
9. Verify the AC voltage between **E9** and **E10** on the A2 PCB Assembly. Verify 8 – 10 VAC.
10. Turn the Test Set "OFF", reset the fuse drawer to 120 VAC and reinsert the fuses.

4.11 Battery Charge

1. Set the Test Set switches to the Initial Configuration IAW Table 4-4. Ensure that the Test Set is properly configured for your line voltage (120/220).
2. Turn the Test Set AC power "ON".
3. Charge the battery for a minimum of 16 Hours.
4. Turn the Test Set Power "OFF".
5. Verify the battery voltage between **E1** and **E7** is 13 VDC ± 1 VDC.
6. Disconnect the AC Power.

4.12 DC Voltage Alignment

1. Set the Test Set switches to the Initial Configuration IAW Table 4-4.
2. On the A1 PCB Board, verify +5.0 VDC ± 0.2 VDC between **TP3** and **TP4**.
3. On the A1 PCB Board, verify +10.0 VDC ± 0.2 VDC between **TP2** and **TP4**.
4. Adjust **R55** on A1 RF/Digital Board, if necessary.

4.13 Radio Frequency and Power Tests

4.13.1 VOR and LOC

1. Set the Test Set switches to the Initial Configuration IAW Table 4-4.
2. Connect the Universal Counter to the **RF OUTPUT** with the attenuator set at 10dB. Hold the **LOC 1020** closed while turning "ON" the Test set. This procedure removes all audio modulation.
3. Connect a DVM to A1 - C152 and Ground. Set the **108.00/108.05** Switch to **108.00**.
4. Adjust AI - L17 for 3.0 – 8.0 VDC.
5. Verify a frequency of 107.9973 – 108.0027 MHz; adjust A1 - C140, if necessary.
6. Set the **108.00/108.05** switch to **108.05**. Verify frequency of 108.0473 – 108.0527 MHz.
7. Turn the **FUNCTION** switch to **LOC**. Set the **108.10/334.70 – 108.15/334.55** switch to **108.15/334.55**. Verify frequency of 108.1473 – 108.1527 MHz.
8. Set the **108.10/334.70 – 108.15/334.55** switch to **108.10/334.70**. Verify a frequency of 108.0973 – 108.1027 MHz.

4.13.2 MB

1. Turn the **FUNCTION** switch to **MB**.
2. Verify a frequency of 74.99625 – 75.00375 MHz; adjust A1 – C165, if necessary.

4.13.3 GS

1. Turn the **FUNCTION** switch to **GS**.
2. Set the **108.10/334.70 – 108.15/334.55** switch to **108.10/334.70**.
3. Connect a DVM between A1 – C109 and Ground.

4. Adjust A1 – L13 to read 3.0 – 7.0VDC.

5. Verify a frequency of 334.6916 – 334.7084 MHz; adjust A1 – C140, if necessary.

6. Set the **108.10/334.70 – 108.15/334.55** switch to **108.15/334.55**.

7. Verify a frequency of 334.5416 – 334.5584 MHz; adjust A1 – C140, if necessary.

8. Turn the Test Set "OFF" and return the Front Panel switches to the Initial Configuration IAW Table 4-2.

4.13.4 POWER

1. Connect the Power Meter to the **RF OUTPUT** with the attenuator set at 10dB. Hold the **LOC 1020** closed while turning "ON" the Test set. This procedure removes all audio modulation.

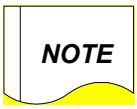
2. Verify +7 ± 2 dBm on the meter; adjust A1 – R181, if necessary.

3. Set the **FUNCTION** switch to **GS**.

4. Verify +1 ± 2 dBm on the meter; adjust A1 – R139, if necessary.

5. Set the **FUNCTION** switch to **MB**.

6. Verify +8 ± 2dBm on the meter; adjust A1 – R60, if necessary.



If an adjustment is made on any of the Power Tests, verify the Modulation and Distortion tests for each respective test (See Paragraph 4.14 and 4.15).

4.14 Percentage Modulation Tests

4.14.1 VOR

1. Set the Test Set switches to the Initial Configuration IAW Table 4-4.
2. Connect the Modulation Meter to the Test Set **RF OUTPUT** connector with the attenuator set to 10 dB.
3. Set the Modulation Meter Bandwidth to 15 KHz.
4. Turn the Test Set "ON".
5. Set the **VOR** switch to **DELETED VAR 0**.
6. Verify between 28% - 32% modulation on the meter; adjust A1 – R48, if necessary.
7. Set the **VOR** switch to **DELETED REF 0**.
8. Verify between 28% - 32% modulation on the meter; adjust A1 – R16, in necessary.
9. Set the **VOR** switch to **DELETED VOR**, while holding down the **1020 ~ VOR** switch, verify between 15% - 25% modulation.

4.14.2 MB

1. Set the Modulation Meter Bandwidth to 120 KHz.
2. Set the **FUNCTION** switch to **MB** and the **MB** switch to **3000.**
3. Verify between 91% - 99% modulation; adjust A1 – R50, if necessary.
4. Set the **MB** switch to **1300**.
5. Verify between 91% - 99% modulation; adjust A1 – R50, if necessary.
6. Set the **MB** switch to **400**.
7. Verify between 91% - 99% modulation; adjust A1 – R50, if necessary.
8. Set the **MB** switch back to **3000**.

4.14.3 GS

1. Set the Modulation Meter to 15 KHz.
2. Set the **FUNCTION** switch to **GS**.
3. Hold the **DELETE 90 ~** *Down*, turn the **GS** switch to **OC** and verify between 39.8% - 40.2% modulation; adjust A1 – R137, if necessary.

4. Switch between the **DELETE 90 ~** and the **DELETE 150 ~** positions and adjust A1 – R32 so that the difference is within 0.4%. It may be necessary to readjust A1 – R137 after making the adjustments.

5. Hold *Down* the **DELETE 90 ~** and turn the **GS** switch from the **+2** to **-2** positions. Record each measurement at each position in Column A of the Data Sheet.

6. Hold *Down* the **DELETE 150 ~** and turn the **GS** switch from the **+2** to **-2** positions. Record each measurement at each position in Column B of the Data Sheet.

7. Subtract the measurements from Column B from Column A, record the result and ensure that it meets the specification. It may be necessary complete steps 3 and 4 again.

4.14.4 LOC

1. Set the **FUNCTION** switch to **LOC**.

2. Hold *Down* the **DELETE 90 ~** switch, turn the **LOC** switch to **OC** and verify between 19.8% - 20.2% modulation; adjust A1 – R182, if necessary.

3. Switch between the **DELETE 90 ~** and the **DELETE 150 ~** positions and adjust A1 – R41 so that the difference is within 0.4%. It may be necessary to readjust A1 – R182 after making the adjustments.

4. Hold *DOWN* both the **DELETE 90 ~** and the **DELETE 150 ~** switches, energize the **LOC ~ 1020** switch and verify between 15% - 25% modulation.

5. Release the switches.

6. Hold *Down* the **DELETE 90 ~** and turn the **LOC** switch from the **L2** to **R2** positions. Record each measurement at each position in Column A of the Data Sheet.

7. Hold *Down* the **DELETE 150 ~** and turn the **LOC** switch from the **L2** to **R2** positions. Record each measurement at each position in Column B of the Data Sheet.

8. Subtract the measurements from Column B from Column A, record the result and ensure that it meets the specification. It may be necessary complete steps 2 and 3 again.

9. Set the **FUNCTION** switch to **VOR**, return the **GS** and **LOC** switches to **OC**, and turn “OFF” the Test Set.

4.14.5 Simultaneous MB and ILS

1. Remove the Modulation Meter and connect the Spectrum Analyzer to the **RF OUTPUT** connector.

2. Set the **FUNCTION** switch to **ILS**.

3. Hold *Down* the **SIMULTANEOUS MB** switch and observe signals at:

   75 MHz
   108.10 MHz
   334.70 MHz

4. Record compliance on the Data Sheet.

4.15 Audio Frequency and Distortion Verification

1. Set the Test Set switches to the Initial Configuration IAW Table 4-4.

2. Connect the Modulation Meter to the **RF OUTPUT** connector with the attenuator set to 10 dB.

3. Connect a Universal Counter to A1 – TP33 and verify a frequency between 982,942 – 983,138; adjust C4, if necessary.

4. Connect the Audio Output of the Modulation Meter to the Distortion Analyzer and a Frequency Counter.

5. Turn the Test set “ON”.

6. Set the **FUNCTION** switch to **MB** and observe that the distortion at 3000 Hz is < 10% and the frequency at 2940 – 3060 Hz.

7. Set the **MB** switch to **1300** and observe that the distortion is < 10% and the frequency at 1274 – 1326 Hz.

8. Set the **MB** switch to **400** and observe the distortion is < 10% and the frequency at 392 – 408 Hz.

9. Set the **FUNCTION** switch to **VOR** and the **MB** switch to **3000**.

10. Set the **VOR** bearing to **DELETED REF 0** and observed that the 30 Hz distortion is < 5% and the frequency is between 29 – 31 Hz.

11. Set the **VOR** bearing switch to **DELETED 30Hz** and observe that the 9960 Hz distortion is < 5% and the frequency is between 9959 – 9961 Hz.

12. Set the **VOR** bearing switch to **DELETED VOR** and hold *Down* the **1020 ~ VOR** and observe that the 1020 distortion is < 10% and the frequency is between 1000 – 1040 Hz.

13. Set the **FUNCTION** switch to **LOC**.

14. Hold *Down* the **DELETE 150 Hz** and observe that the 90 Hz distortion is < 5% and the frequency is between 89 – 91 Hz.

15. Hold *Down* the **DELETE 90 Hz** and observe that the 150 Hz distortion is < 5% and the frequency is between 149 – 151 Hz.

16. Hold *Down* the **DELETE 90 ~, DELETE 150 ~, and 1020 ~ LOC** switch and observe the 1020 Hz distortion is < 10% and the frequency is between 1000 – 1040 Hz.

17. Set the **FUNCTION** switch to **GS**.

18. Hold *Down* the **DELETE 150 ~** switch and observe that the 90 Hz distortion is < 5% and the frequency is between 89 – 91 Hz.

19. Hold *Down* the **DELETE 90 ~** switch and observe that the 150 Hz distortion is < 5% and the frequency is between 149 – 151 Hz.

20. Set the **FUNCTION** switch to **VOR**, the bearing to **0º,** and turn the Test Set "OFF".

4.16 VOR Angle Verification

1. Set the Test Set switches to the Initial Configuration IAW Table 4-4.

2. Connect a Modulation Meter to the **RF OUTPUT** connector with the attenuator at 10 dB, on the Test Set.

3. Connect the Audio Output of the Modulation Meter to the *ZIFOR* test set.

4. Turn the Test Set "ON".

5. Observe the angle that is displayed on the *ZIFOR* and record the measurement on the *Data Sheet* under ***270***.

6. Repeat Step #5 for the other 7 positions on the **VOR** switch and record the data in the assigned positions the *Data Sheet*.

7. Verify Compliance IAW the supplied formula.

8. Turn the Test Set "OFF".

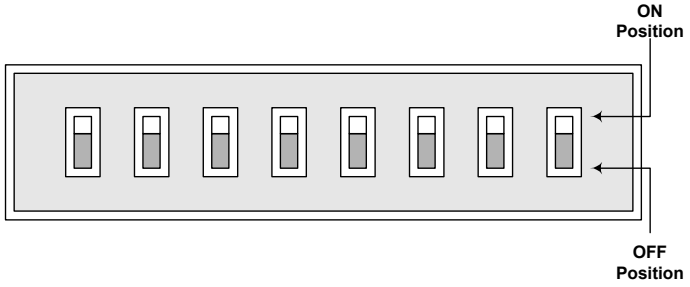
9. Select the bearing whose error is closet to the mean error and select that bearing using the **VOR** switch.

10. Connect the Test Set to the VOR Receiver/Mockup and set Receiver Display for the selected heading in step 8.

11. Set the Test Set **ATTENUATOR** to 50 dB, turn "ON" the Test Set and the VOR Receiver.

12. Observe the bearing indicated on the VOR indicator and verify that it is ± 1° of the selected bearing.

13. If necessary, adjust A2S1 until the indicator is within specification. Record the S1 switch positions on the Data Sheet.



A2 S1

Figure 4-3

SWITCH S1 SECTIONS	
Section	**Degree Offset**
1	0.18
2	0.35
3	0.70
4	1.41
5	2.81
6	5.62
7	11.25
8	22.50

Switch S1 Sections

Table 4-5

14. Set the **VOR** switch to **0º**.

15. Set the **VAR** switch to “ON”.

16. Turn the **VAR** pot to fully CCW.

17. Observe the bearing indicated is < 170°.

18. Turn the **VAR** pot fully CW.

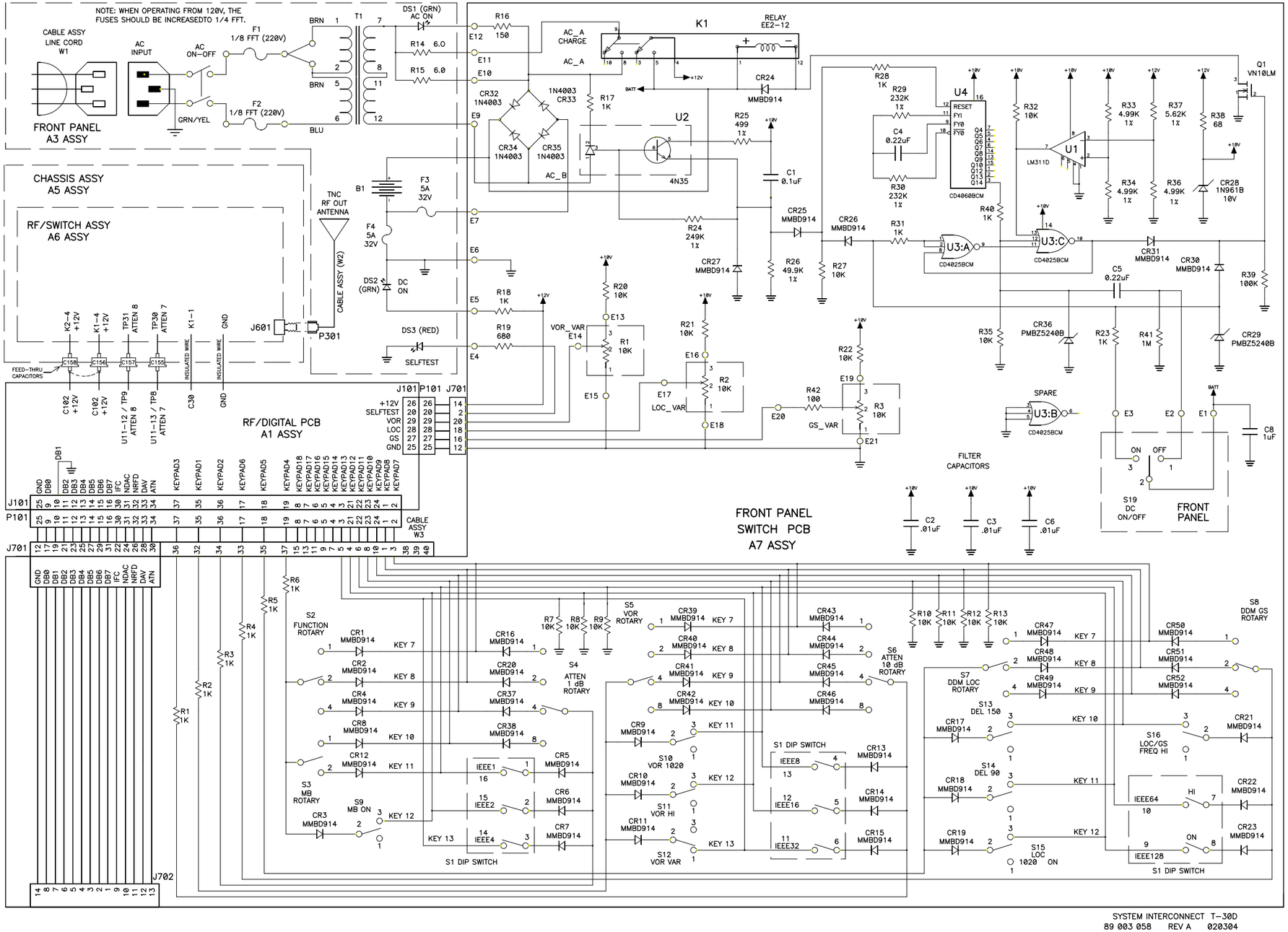
19. Observe the bearing indicated is > 190°.

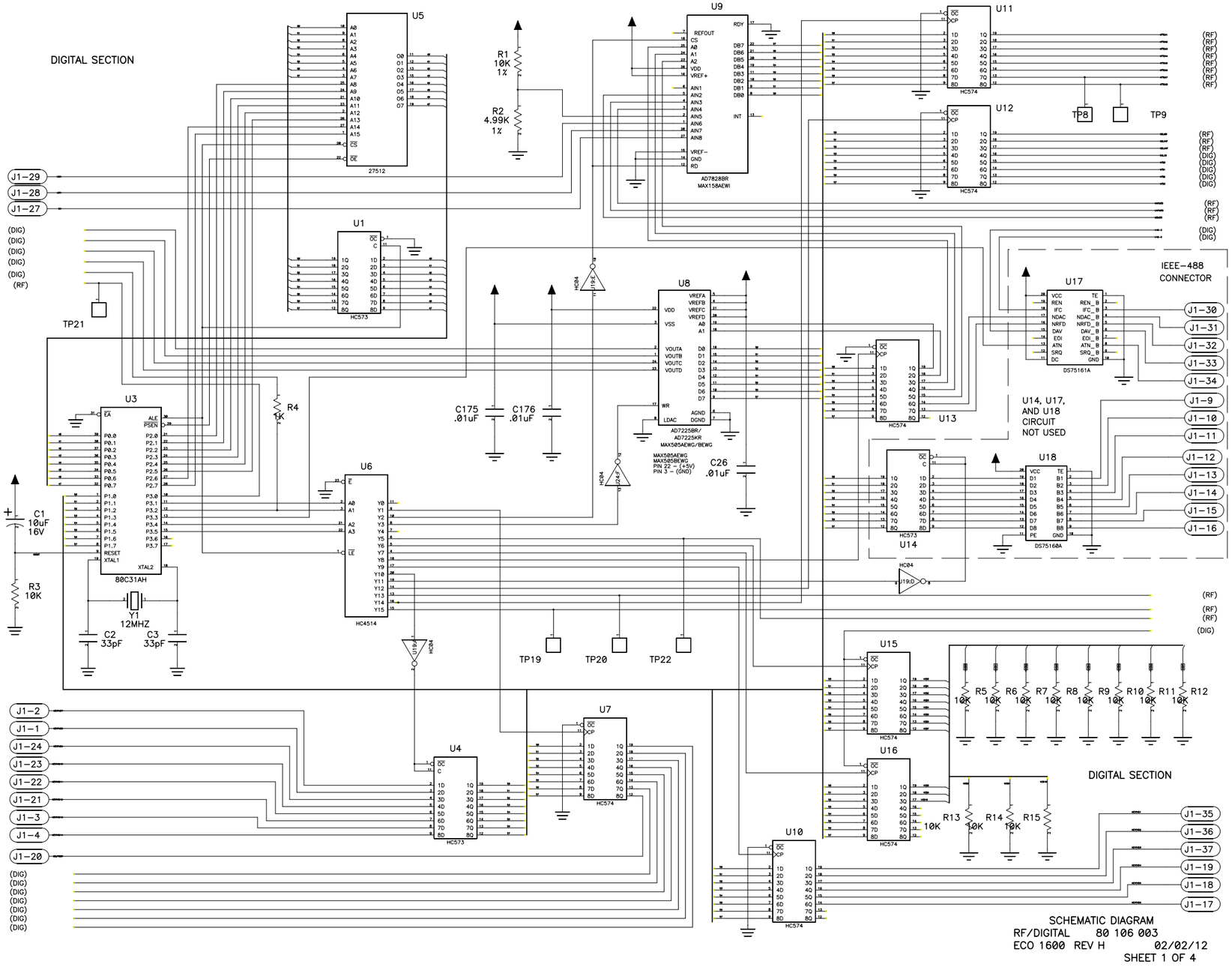
20. Turn the **VAR** switch “OFF”.

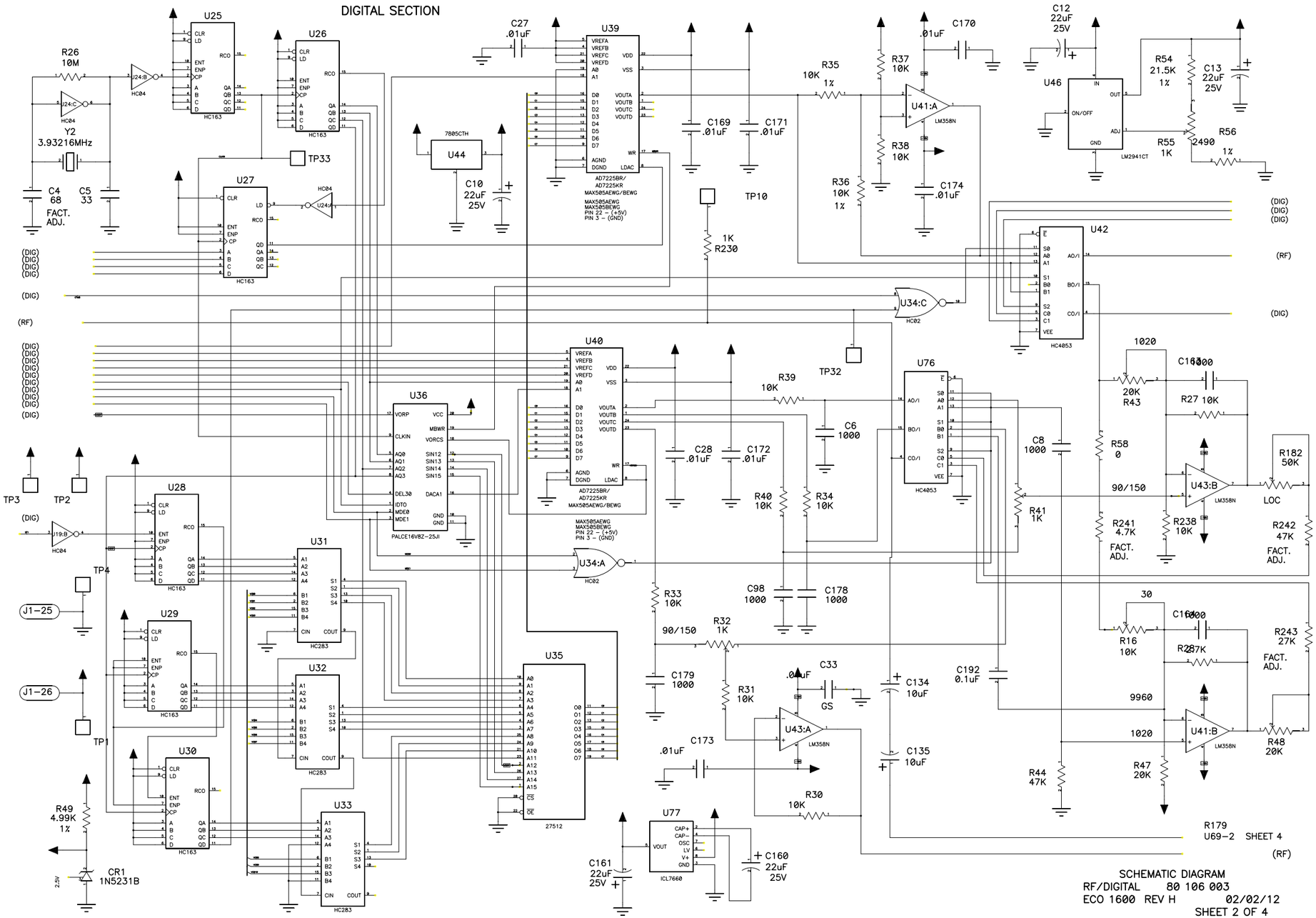
21. Turn the Test Set “OFF”.

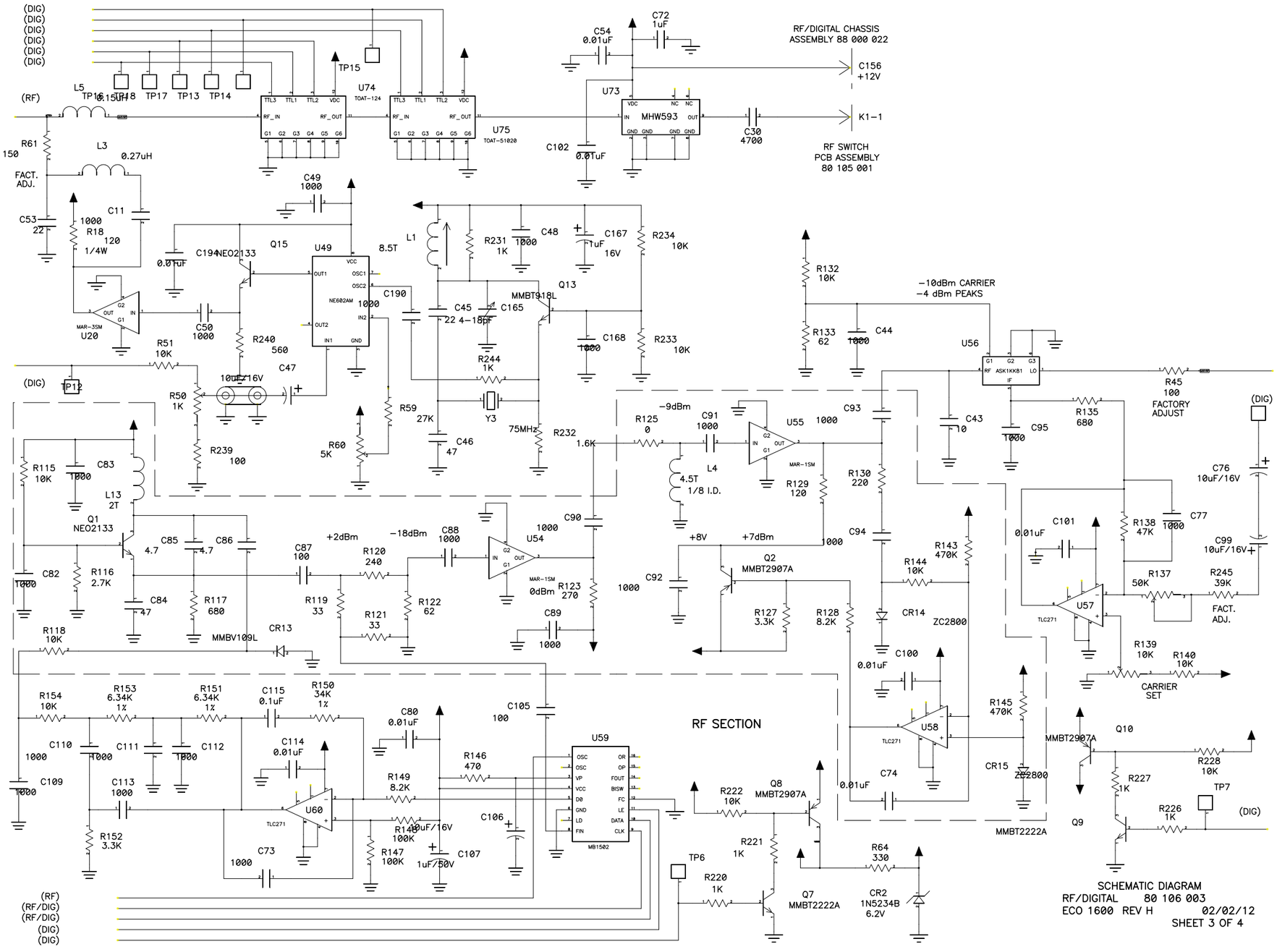
CHAPTER V

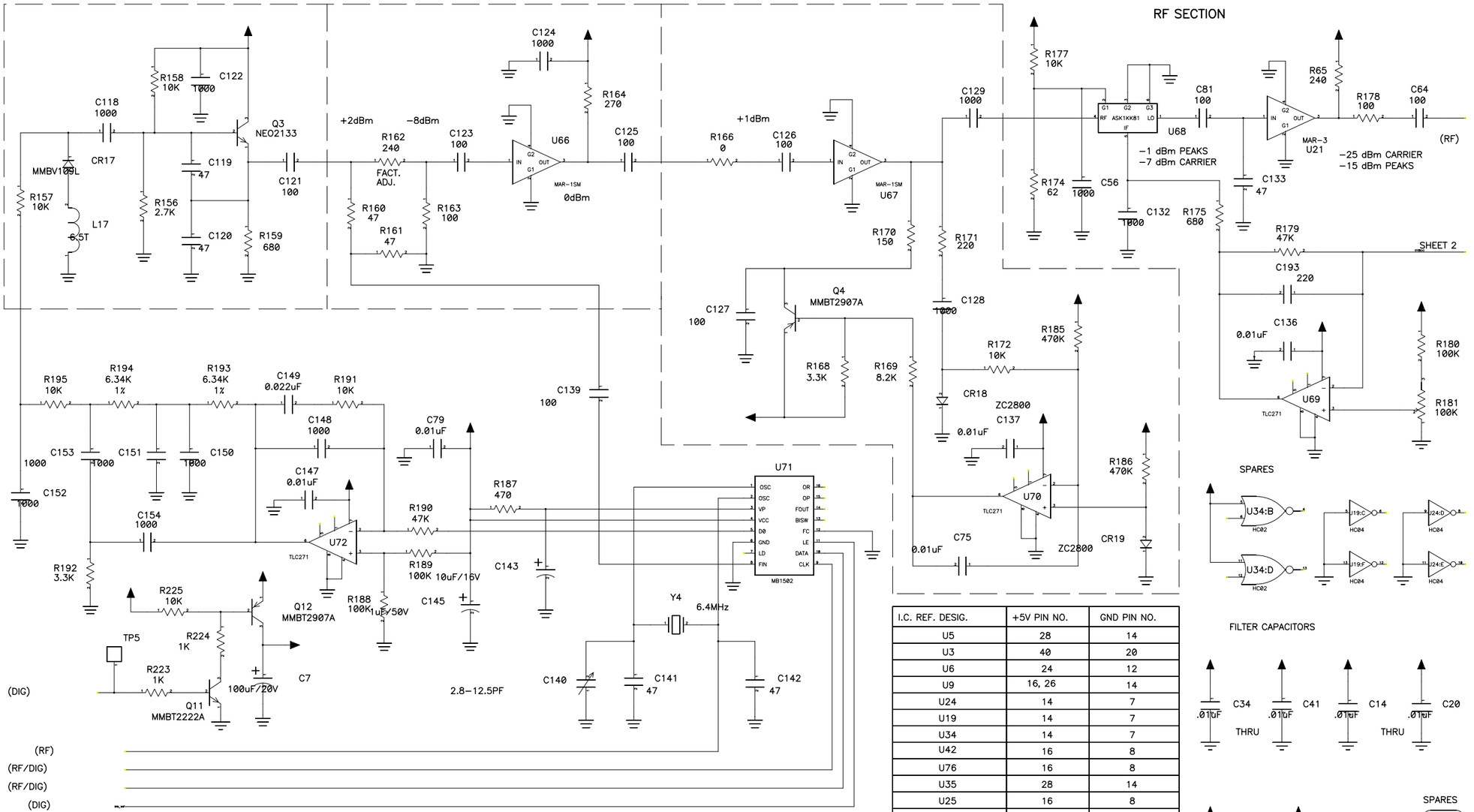
SCHEMATICS


NOTE: WHEN OPERATING FROM 120V, THE FUSES SHOULD BE INCREASEDTO 1/4 FFT.
CABLE ASSY LINE CORD W1
AC INPUT
AC ON-OFF
F1 1/8 FFT (220V)
F2 1/8 FFT (220V)
GRN/YEL
BRN
BLU
T1
DS1 (GRN) AC ON
FRONT PANEL A3 ASSY
CHASSIS ASSY A5 ASSY
RF/SWITCH ASSY A6 ASSY
TNC RF OUT ANTENNA
CABLE ASSY (W2)
J601
P301
F3 5A 32V
F4 5A 32V
DS2 (GRN) DC ON
DS3 (RED) SELFTEST
K1 RELAY EE2-12
AC_A CHARGE
AC_A
AC_B
BATT
+12V
CR24 MMBD914
CR32 1N4003
CR33 1N4003
CR34 1N4003
CR35 1N4003
U2 4N35
R16 150
R14 6.0
R15 6.0
R17 1K
R18 1K
R19 680
R20 10K
R21 10K
R22 10K
R25 499 1%
R24 249K 1%
R26 49.9K 1%
R27 10K
R28 1K
R29 232K 1%
R30 232K 1%
R31 1K
R40 1K
C1 0.1uF
C4 0.22uF
C5 0.22uF
C8 1uF
CR25 MMBD914
CR26 MMBD914
CR27 MMBD914
CR30 MMBD914
CR31 MMBD914
U4 CD4060BCM
U1 LM311D
U3:A CD4025BCM
U3:C CD4025BCM
U3:B CD4025BCM
SPARE
Q1 VN10LM
R32 10K
R33 4.99K 1%
R34 4.99K 1%
R36 4.99K 1%
R37 5.62K 1%
R38 68
R39 100K
CR28 1N961B 10V
CR29 PMBZ5240B
R35 10K
CR36 PMBZ5240B
R23 1K
R41 1M
R42 100
GS_VAR
R1 10K
R2 10K
R3 10K
VOR_VAR
LOC_VAR
E1
E2
E3
ON
OFF
S19 DC ON/OFF
FRONT PANEL
FILTER CAPACITORS
C2 .01uF
C3 .01uF
C6 .01uF
K2-4 +12V
K1-4 +12V
TP31 ATTEN 8
TP30 ATTEN 7
K1-1
GND
FEED-THRU CAPACITORS
C158
C156
C157
C155
C102 +12V
C102 +12V
U11-12 / TP9 ATTEN 8
U11-13 / TP8 ATTEN 7
C30
INSULATED WIRE
INSULATED WIRE
RF/DIGITAL PCB A1 ASSY
J101
P101
J701
J702
CABLE ASSY W3
+12V
SELFTEST
VOR
LOC
GS
GND
DB1
GND DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 IFC NDAC NRFD DAV ATN
KEYPAD3 KEYPAD1 KEYPAD2 KEYPAD6 KEYPAD5 KEYPAD4 KEYPAD18 KEYPAD17 KEYPAD16 KEYPAD15 KEYPAD14 KEYPAD13 KEYPAD12 KEYPAD11 KEYPAD10 KEYPAD9 KEYPAD8 KEYPAD7
FRONT PANEL SWITCH PCB A7 ASSY
R1 1K
R2 1K
R3 1K
R4 1K
R5 1K
R6 1K
R7 10K
R8 10K
R9 10K
R10 10K
R11 10K
R12 10K
R13 10K
S2 FUNCTION ROTARY
S3 MB ROTARY
S4 ATTEN 1 dB ROTARY
S5 VOR ROTARY
S6 ATTEN 10 dB ROTARY
S7 DDM LOC ROTARY
S8 DDM GS ROTARY
S9 MB ON
S10 VOR 1020
S11 VOR HI
S12 VOR VAR
S13 DEL 150
S14 DEL 90
S15 LOC 1020 ON
S16 LOC/GS FREQ HI
S1 DIP SWITCH
IEEE1
IEEE2
IEEE4
IEEE8
IEEE16
IEEE32
IEEE64
IEEE128
HI
ON
KEY 7
KEY 8
KEY 9
KEY 10
KEY 11
KEY 12
KEY 13
CR1 MMBD914
CR2 MMBD914
CR4 MMBD914
CR8 MMBD914
CR12 MMBD914
CR3 MMBD914
CR16 MMBD914
CR20 MMBD914
CR37 MMBD914
CR38 MMBD914
CR5 MMBD914
CR6 MMBD914
CR7 MMBD914
CR39 MMBD914
CR40 MMBD914
CR41 MMBD914
CR42 MMBD914
CR9 MMBD914
CR10 MMBD914
CR11 MMBD914
CR43 MMBD914
CR44 MMBD914
CR45 MMBD914
CR46 MMBD914
CR13 MMBD914
CR14 MMBD914
CR15 MMBD914
CR47 MMBD914
CR48 MMBD914
CR49 MMBD914
CR17 MMBD914
CR18 MMBD914
CR19 MMBD914
CR50 MMBD914
CR51 MMBD914
CR52 MMBD914
CR21 MMBD914
CR22 MMBD914
CR23 MMBD914
SYSTEM INTERCONNECT T-30D
89 003 058 REV A 020304


DIGITAL SECTION
U5
27512
U1
HC573
U9
AD7828BR
MAX158AEWI
U11
HC574
U12
HC574
R1
10K
1%
R2
4.99K
1%
TP8
TP9
J1–29
J1–28
J1–27
(DIG)
(RF)
TP21
U8
AD7225BR/
AD7225KR
MAX505AEWG/BEWG
C175
.01uF
C176
.01uF
C26
.01uF
R4
1K
U3
80C31AH
XTAL2
XTAL1
RESET
C1
10uF
16V
R3
10K
Y1
12MHZ
C2
33pF
C3
33pF
U6
HC4514
TP19
TP20
TP22
U4
HC573
U7
HC574
U10
HC574
U15
HC574
U16
HC574
U13
HC574
U14
HC573
U17
DS75161A
U18
DS75160A
IEEE–488
CONNECTOR
U14, U17,
AND U18
CIRCUIT
NOT USED
R5
R6
R7
R8
R9
R10
R11
R12
10K
R13
R14
R15
10K
DIGITAL SECTION
J1–30
J1–31
J1–32
J1–33
J1–34
J1–9
J1–10
J1–11
J1–12
J1–13
J1–14
J1–15
J1–16
J1–2
J1–1
J1–24
J1–23
J1–22
J1–21
J1–3
J1–4
J1–20
J1–35
J1–36
J1–37
J1–19
J1–18
J1–17
SCHEMATIC DIAGRAM
RF/DIGITAL 80 106 003
ECO 1600 REV H 02/02/12
SHEET 1 OF 4


DIGITAL SECTION
U25
U26
U27
U28
U29
U30
U31
U32
U33
U35
U36
U39
U40
U42
U44
U46
U76
U77
U34:A
U34:C
U41:A
U41:B
U43:A
U43:B
HC163
HC283
HC4053
HC04
HC02
LM358N
LM2941CT
ICL7660
AD7225BR/
AD7225KR
MAX505AEWG/BEWG
MAX505AEWG
MAX505BEWG
PIN 22 – (+5V)
PIN 3 – (GND)
PALCE16V8Z–25JI
27512
7805CTH
Y2
3.93216MHz
FACT.
ADJ.
TP1
TP2
TP3
TP4
TP10
TP32
TP33
J1–25
J1–26
CR1
1N5231B
2.5V
GS
LOC
90/150
9960
1020
1K
R230
R179
U69–2 SHEET 4
(RF)
(DIG)
SCHEMATIC DIAGRAM
RF/DIGITAL 80 106 003
ECO 1600 REV H 02/02/12
SHEET 2 OF 4


(DIG)
(DIG)
(DIG)
(DIG)
(DIG)
(DIG)
TP15
L5
0.15uH
TP16
TP18
TP17
TP13
TP14
(RF)
U74
TOAT-124
U75
TOAT-51020
C54
0.01uF
C72
1uF
RF/DIGITAL CHASSIS
ASSEMBLY 88 000 022
C156
+12V
U73
MHW593
K1-1
C102
0.01uF
C30
4700
RF SWITCH
PCB ASSEMBLY
80 105 001
R61
150
L3
0.27uH
FACT.
ADJ.
C53
22
C11
1000
R18
120
1/4W
C49
1000
C194
0.01uF
Q15
NEO2133
U49
NE602AM
C190
1000
L1
8.5T
R231
1K
C48
1000
C167
1uF
16V
R234
10K
C45
22
4-18pF
C165
Q13
MMBT918L
C168
1000
R233
10K
R244
1K
Y3
75MHz
R232
1.6K
R132
10K
−10dBm CARRIER
−4 dBm PEAKS
R133
62
C44
1000
U56
R45
100
FACTORY
ADJUST
R135
680
C95
1000
C43
10
U20
MAR-3SM
C50
1000
R240
560
R51
10K
C47
10uF/16V
R50
1K
R239
100
R59
27K
C46
47
R60
5K
−9dBm
R125
0
C91
1000
U55
MAR-1SM
L4
4.5T
1/8 I.D.
C93
1000
R130
220
R129
120
C76
10uF/16V
C101
0.01uF
R138
47K
C77
1000
C99
10uF/16V
R137
50K
R245
39K
FACT.
ADJ.
U57
TLC271
R139
10K
R140
10K
CARRIER
SET
R115
10K
C83
1000
L13
2T
Q1
NEO2133
C85
4.7
C86
4.7
C82
1000
R116
2.7K
C84
47
R117
680
C87
100
+2dBm
R120
240
−18dBm
C88
1000
U54
MAR-1SM
0dBm
R123
270
R119
33
R121
33
R122
62
C89
1000
C90
1000
C92
1000
+8V
+7dBm
Q2
MMBT2907A
R127
3.3K
R128
8.2K
R143
470K
R144
10K
CR14
ZC2800
R118
10K
CR13
MMBV109L
C100
0.01uF
U58
TLC271
C74
0.01uF
R145
470K
CR15
ZC2800
MMBT2222A
Q10
MMBT2907A
R228
10K
R227
1K
TP7
(DIG)
R226
1K
Q9
R154
10K
R153
6.34K
1%
R151
6.34K
1%
C115
0.1uF
R150
34K
1%
C110
1000
C111
1000
C112
1000
C109
1000
C113
1000
R152
3.3K
C114
0.01uF
U60
TLC271
C80
0.01uF
C105
100
U59
MB1502
R146
470
R149
8.2K
R148
100K
10uF/16V
C106
C107
1uF/50V
R147
100K
C73
1000
RF SECTION
R222
10K
Q8
MMBT2907A
R221
1K
TP6
R220
1K
Q7
MMBT2222A
R64
330
CR2
1N5234B
6.2V
(RF)
(RF/DIG)
(RF/DIG)
(DIG)
(DIG)
SCHEMATIC DIAGRAM
RF/DIGITAL 80 106 003
ECO 1600 REV H 02/02/12
SHEET 3 OF 4



NOTES: UNLESS SPECIFIED

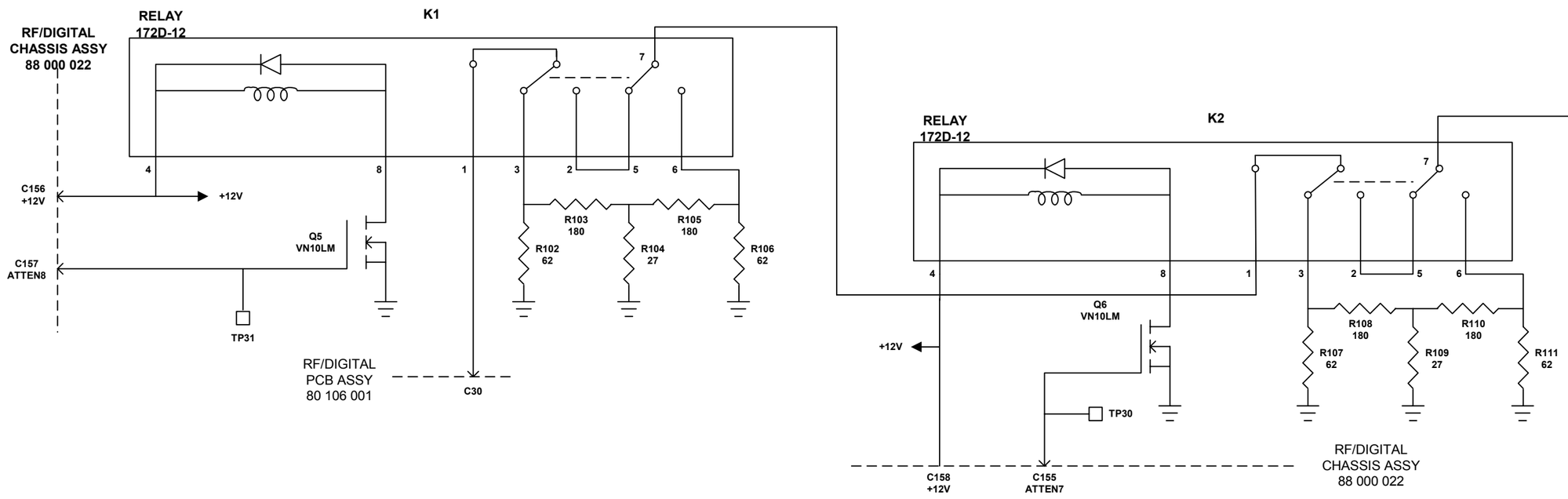
1. ALL CAPACITOR VALUES ARE IN PICOFARADS.
2. ALL RESISTOR VALUES ARE IN OHMS, 1/8W, 5%.

FILTER CAPACITORS

C29 .01uF C31 .01uF C32 .01uF C162 .01uF C177 .01uF C180 .01uF

I.C. REF. DESIG.	+5V PIN NO.	GND PIN NO.
U5	28	14
U3	40	20
U6	24	12
U9	16, 26	14
U24	14	7
U19	14	7
U34	14	7
U42	16	8
U76	16	8
U35	28	14
U25	16	8
U26	16	8
U27	16	8
U28	16	8
U29	16	8
U30	16	8
U1	20	10
U4	20	10
U7	20	10
U10	20	10
U11 – U16	20	10

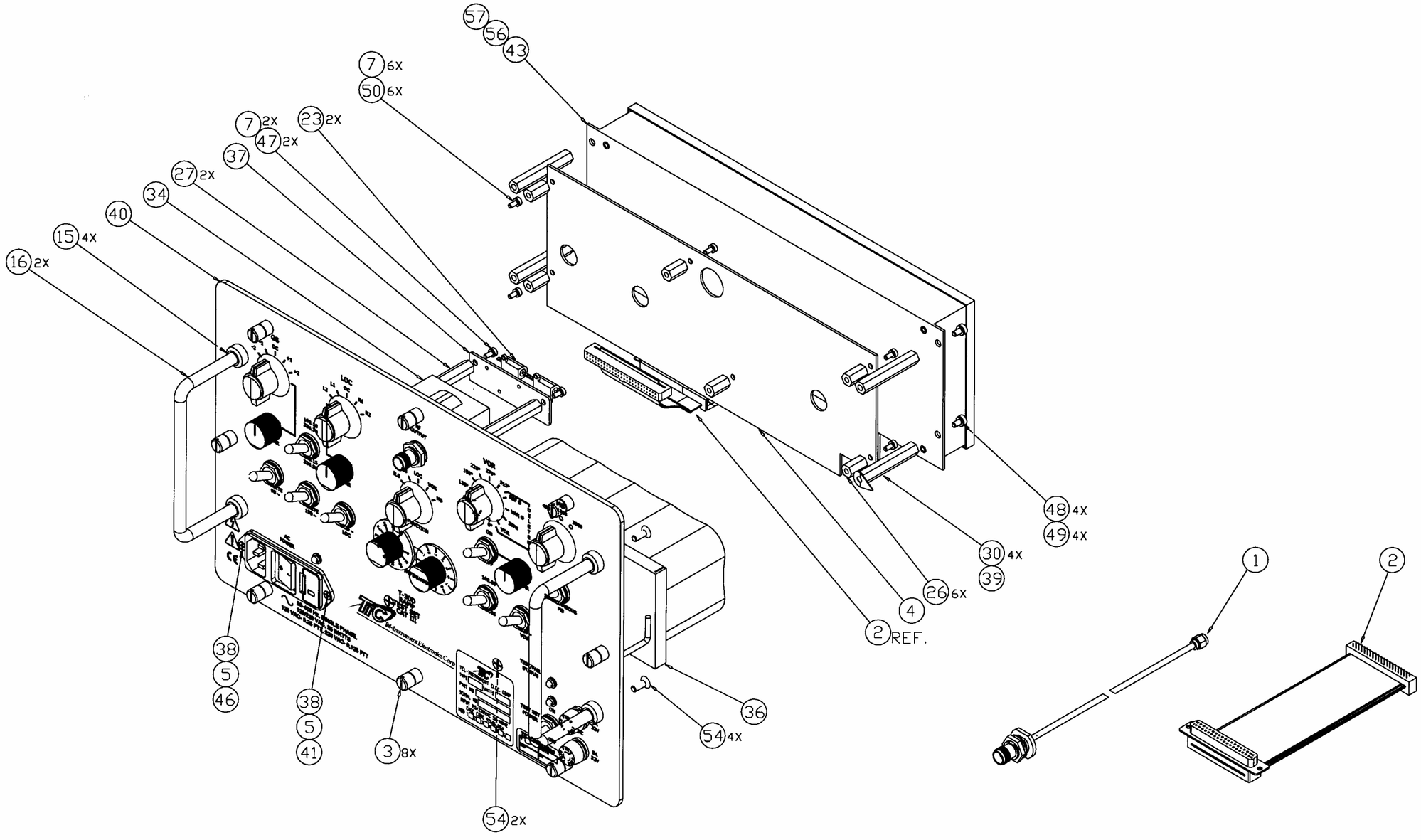
SCHEMATIC DIAGRAM
RF/DIGITAL 80 106 003
ECO 1600 REV H 02/02/12
SHEET 4 OF 4



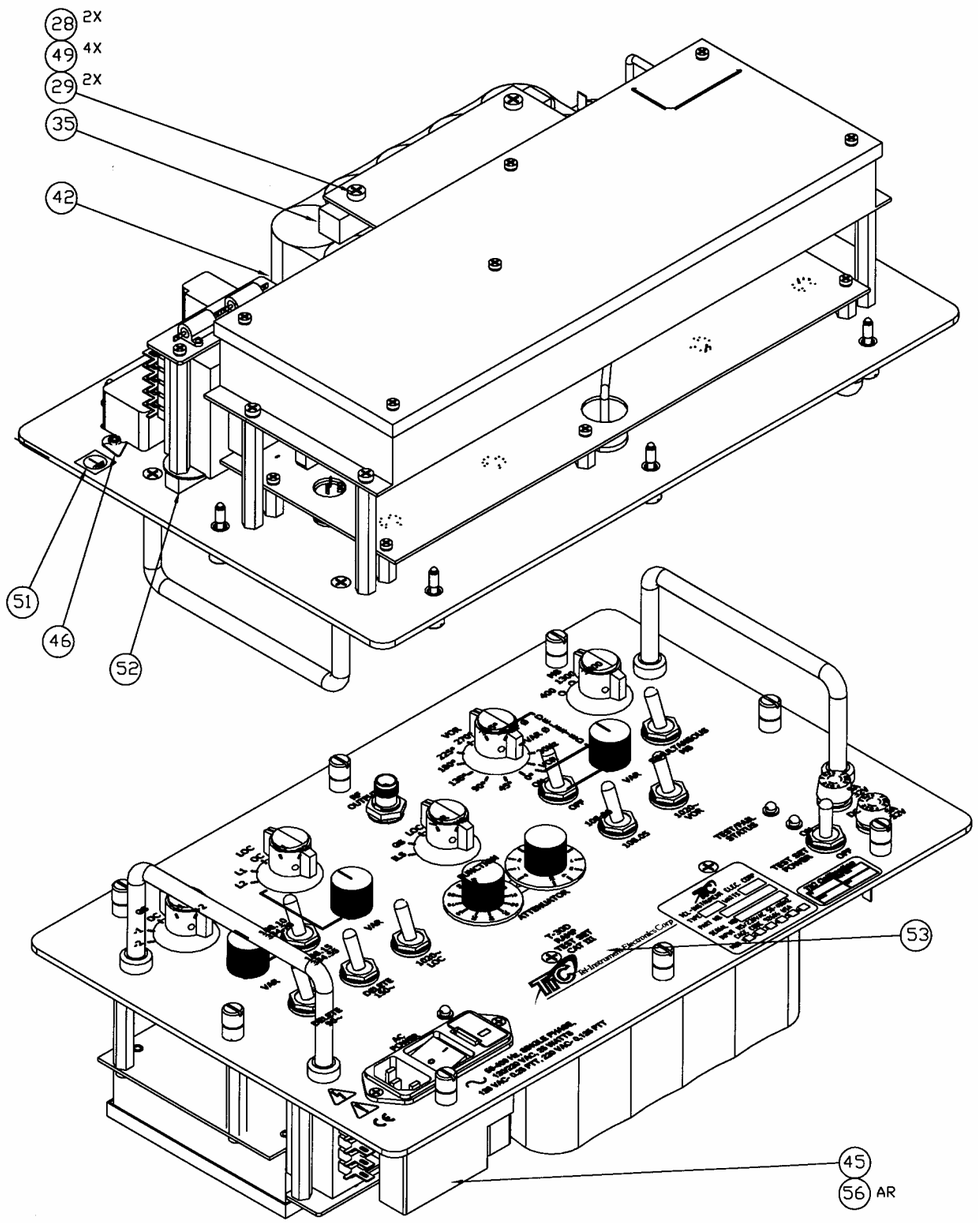
SCHEMATIC DRAWING
RF SWITCH 80 105 003
ECO 1600 REV A 02/02/12

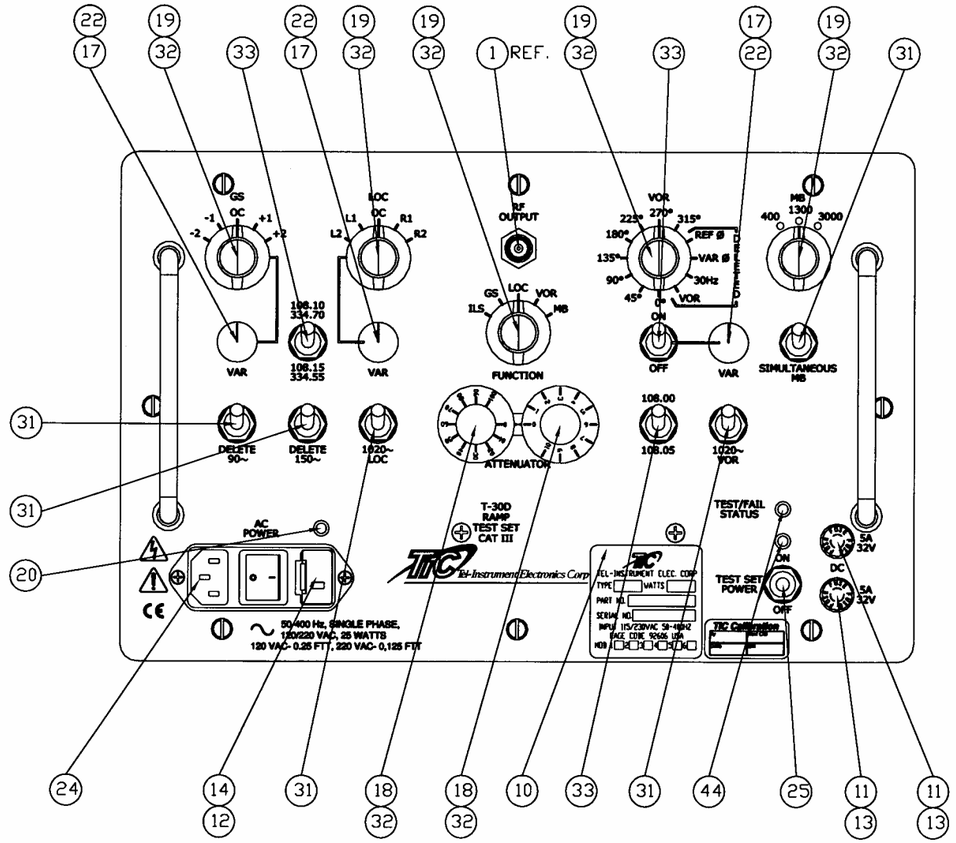
CHAPTER VI

ILLUSTRATED PARTS BREAKDOWN



T-30D
Front Panel Assembly
(A3) 80 000 058 (1 of 2)

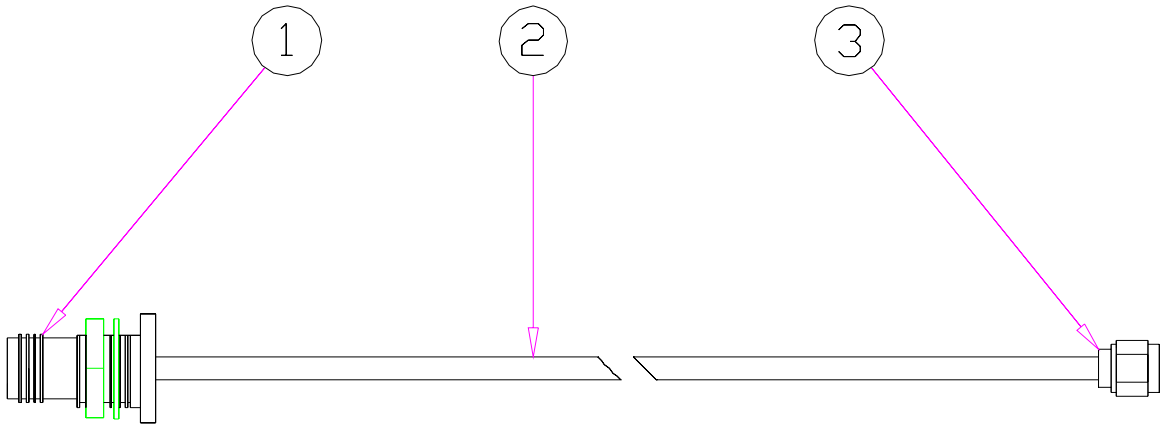




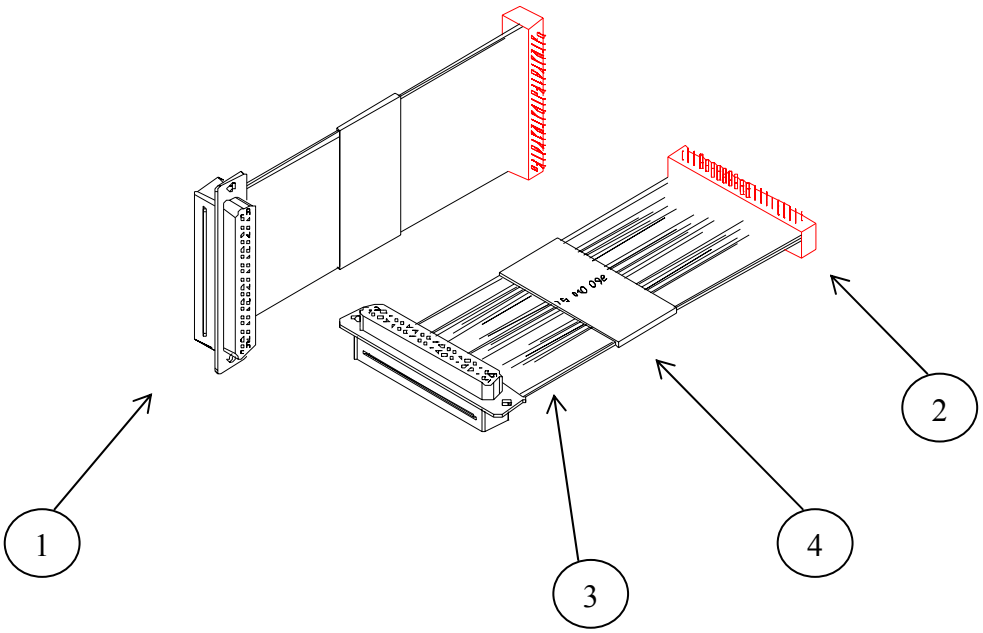
T-30D
Front Panel Assembly.
(A3) 80 000 058 (2 of 2)

T-30D Front Panel Assembly			89 000 058 (A3)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
1		Cable Assy, RF/Dig CHASSIS TO F.P.	**75010067**			1
2		Cable Assy, RF/Dig To Panel Bd.	**75010092**			1
3	PFC2-832-94	Fastener,Panel	**56020001**		PEM	8
4		PCB Ass'y,Panel Switch	**80103001**			1
5	MS35649-244	Nut, Hex, #4	**53010002**			2
6	104480-8	Contacts,Recp	**46053002**		AMP	2
7	MS51957-27	Screw, PH, 6-32 x 5/16 LG.	**50110001**			8
8	104257-1	Conn,Recp,Housing	**46052005**		AMP	1
9	103653-1	Conn,Recp,Housing	**46052004**		AMP	1
10		Nameplate, Generic, 115/230VAC 50-400HZ	**57030014**			1
11	HTB-221SP	Fuseholder	**48063002**		BUSSMAN	2
12	0034.5037	Fuse, 250 MA/250V, SUPER TIME LAG	**45100028**	F1, F2	SCHURTER	2
12	0034.5004	Fuse, 125 MA/250V, SUPER TIME LAG	**45100027**	F3, F4	SCHURTER	ALT
13	AGC-5	Fuse, 5A, (250V)	**45100002**		SCHURTER	2
14	4303.2014.01	Fusedrawer	**48035016**		SCHURTER	1
15	288-09-ALC	Ferrule	**31020035**		PROMPTUS	4
16	231-54AL-8-32-C	Handle	**56025004**		PROMPTUS	2
17	RB67-1-ML	Knob,Blk Line	**57025020**		ROGAN	3
18	RB67-1-TSK-M	Knob,Sktd,Clr	**57025021**		ROGAN	2
19	MS91528-1II1B	Knob	**57025023**		ELECT. HARD.	5
20	559-0101-007	Light,LED,Red	**45001002**		DIALIGHT	1
21		Contacts,Pins	**46053003**	AMP	104505-5	2
22		Pot,10kohm	**41700023**	C'STAT	RV6NAYSD103A	3
23		Res,Power,5W,6.0ohm	**41400002**	DALE	RH-5	2
24		Receptacle,AC	**48035001**	SCHURTER	KD14.4101.151	1
25		Switch,Toggle,1P	**46027516**	C & K	7105TCWZQE	1
26		Standoff, 5/16Hex 9/16Lg.	**52400021**	RAF	2172-632-SS-20	6
27		Standoff, 5/16 Hex (M-F) 2-3/8Lg.	**52700005**	RAF	4602-632-SS-20	2
28		Standoff,5/16Hex,2.562lg	**52400022**	AMATON	P941-M09-F09-832	2
29		Screw, PH, 8-32 x 3/4 Lg.	**50110034**		MS51957-47	2
30		Standoff, 5/16 Hex (F) 2-1/4Lg.	**52400018**	RAF	2197-832-SS-20	4

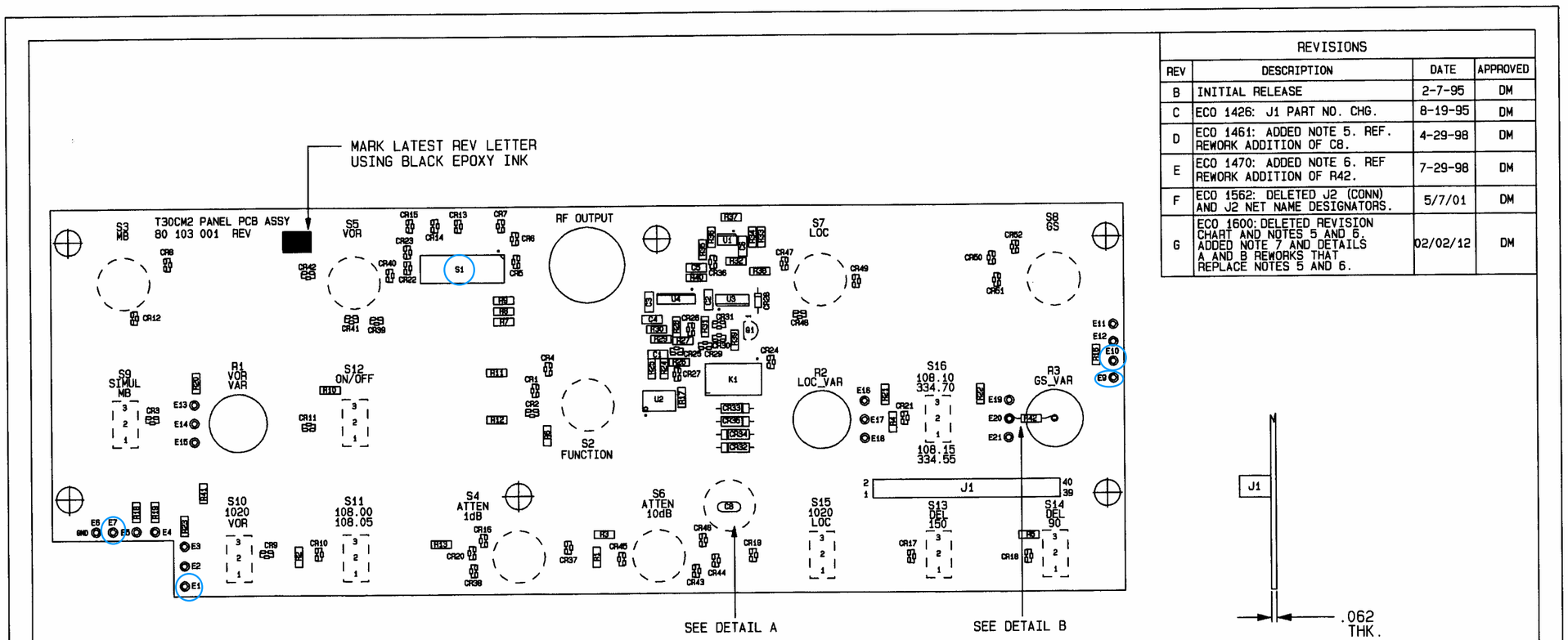
T-30D Front Panel Assembly			89 000 058 (A3)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
31		Switch,Toggle,1P	**46027523**	7108TCWCQE	C & K	5
32		Switch,Rot,BCD,12P	**46020021**	513385	GRAYHILL	7
33		Switch,Toggle,1P	**46027522**	7101TCWCQE	C & K	3
34		Transformer	**43000007**	A41-25-16	SIGNAL	1
35		Battery Spacer, Nylon	**31004015**			1
36		BRACKET,BATTERY MTG BTM	**62020033**			1
37		Plate,Mtg.,Resistors	**62070032**			1
38		Screw, FH, 82 degree (BLK), 4-40 x 3/8 LG.	**50140005**		MS51959-158	2
39		Lug, Ground, #8	**55010003**	Keystone	7313	1
40		Panel,Front	**61060028**		61060068	1
41		Washer, Split-Lock, #4	**52020002**		MS35338-135	1
42		Battery, 12V NICAD	**48071001**	EAC	240001-826	1
43		RF/DIG Chassis Assembly	**88000022**			1
44		Light, LED, Green	**45001015**	DIALIGHT	559-0201-007	2
45		Cover, Protective	**31000021**			1
46		Lug, Ground #4	**55010001**	KEYSTONE	7311	1
47		Washer, Split-Lock, #6	**52020001**		MS35338-136	2
48		Screw, PH, 8-32 x 3/8 LG.	**50110013**		MS51957-43	4
49		Washer, Split-Lock, #8	**52020003**		MS35338-137	4
50		Washer, Flat Reduced O.D. #6	**52010008**		NAS 620C-6L	6
51		Label, Safety Function	**57031011**	PANDUIT	PESC-H-EC	1
52		Adapter Rod, Transformer	**62030008**			1
53		Silkscreen, Front Panel	**57005014**			1
54		Screw, FH, 82 degreee, 8-32 x 3/8 LG.	**50140002**		MS51959-43	6
55		Adhesive, Rubber and Gasket	**31010002**	3M	1300	AR
56		Programmed Memory (Sine)	**48077002-01**			1
		IC Prom Eraseable	**40200104**			1
57		Programmed Memory	**48077004-01**			1
		IC Prom Eraseable	**40200104**			1
58		Wiring Diagram, Front Panel	**79000043**			
59		Interconnect Diagram, Front Panel	**89003058**			
60		Composite Test Procedure	**90006053**			



T-30D Antenna /RF Output Cable			75 010 067 (W2)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
1		CONNECTOR, TNC, BULKHEAD MOUNT	**48040029**	31-2318	AMP	1
2		CABLE, COAXIAL	**71110006**	53284 (RG-316/U)	OLYMPIC	AR
3		CONNECTOR, COAX, SMA	**48040026**	142-0321-001	E.F. JOHNSON	1
4		PRINTABLE HEATSHRINK, WHITE	**73000018**	TMS-SCE-3/16-2.0-9	RAYCHEM	1



T-30D Digital Board to Panel Cable Assy.			75 010 092 (W3)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
1		CONNECTOR, 37 PIN	**48000039**	747303-1	AMP	1
2		HEADER, 40 PIN	**55050006**	3940-0000T(ST. RLF 3448-3940)	3M	1
3		FLEX CABLE, 40 PIN	**75000015**	3302-40	3M	AR
4		LABEL, LASER, RIBBON CABLE	**73100002**	LJSL19-Y3-1	PANDUIT	1

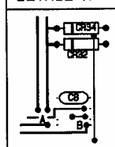


REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
B	INITIAL RELEASE	2-7-95	DM
C	ECO 1426: J1 PART NO. CHG.	8-19-95	DM
D	ECO 1461: ADDED NOTE 5. REF. REWORK ADDITION OF C8.	4-29-98	DM
E	ECO 1470: ADDED NOTE 6. REF REWORK ADDITION OF R42.	7-29-98	DM
F	ECO 1562: DELETED J2 (CONN) AND J2 NET NAME DESIGNATORS.	5/7/01	DM
G	ECO 1600: DELETED REVISION CHART AND NOTES 5 AND 6. ADDED NOTE 7 AND DETAILS A AND B REWORKS THAT REPLACE NOTES 5 AND 6.	02/02/12	DM

NOTES:

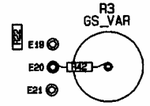
1. REFER TO TIC DOCUMENT ID 20 QP 002-APPENDIX A (SQR1 THRU SQR7) FOR SUPPLIER QUALITY REQUIREMENTS.
2.
3. SEE ASSOCIATED PARTS LIST 80 103 004.
4. THE FOLLOWING COMPONENTS ARE PANEL MOUNTED AND ARE SHOWN FOR REFERENCE: R1, R2, R3, AND S2 THRU S16
5.
6.
7. REFER TO CONFIGURATION CHARTS FOR CURRENT REVISION LEVEL OF PCB ASSEMBLY AND REVISION LEVELS OF ALL RELATED DETAILS.

DETAIL A



INSTALL C8 (1uF/50V) LEADED CAPICATOR. ONE LEAD TO VIA "A" NET NAME - BATTERY, THE OTHER LEAD TO VIA "B" NET NAME - GROUND

DETAIL B



RETROFIT R42 (100 OHM) LEADED RESISTOR TIE ONE LEAD TO E20 TERMINAL AND THE OTHER LEAD TO PIN 2 (ARM) OF R3 PANEL MOUNTED TRIMPOT.

89000058	T-30D
89000055	T-30CM2
NEXT ASSY	USED ON
APPLICATION	

MATERIAL
COPPER CLAD GLASS EPOXY FR4 .062 THK. GFN-0620-B1/B1 A1A

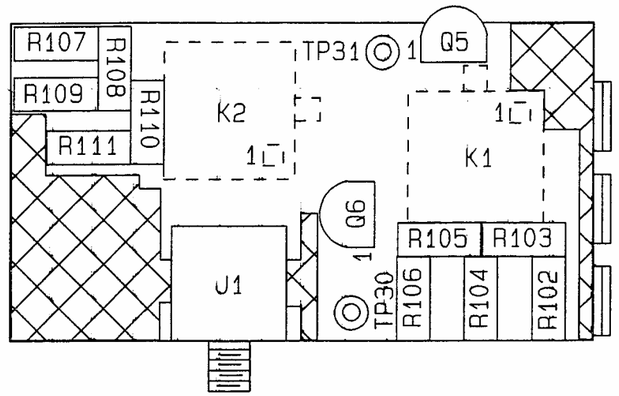
FINISH

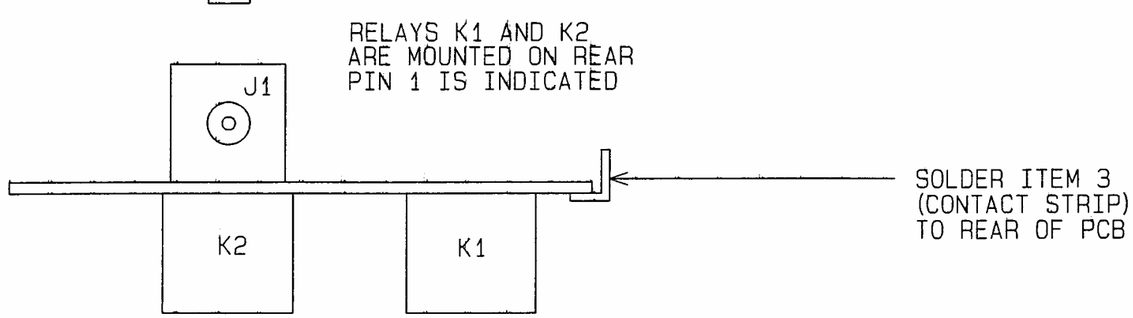
CONTRACT NO.		TEL-INSTRUMENT ELEC. CORP.			
		PCB ASSEMBLY PANEL SWITCH			
APPROVALS	DATE	SIZE	FSCM NO.	DWG. NO.	REV
DRAWN D.McMAHON	2-7-95	D	92606	80 103 001	G
CHECKED DM	7-29-98	SCALE NTS		SHEET 1 OF 1	
ISSUED					

T-30D
Panel, PCB Assembly
(A2) 80 103 001

T-30D Panel, PCB Assembly			80 103 002 (A2)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
1	Panel PCB, Blank	Panel PCB, Blank	**80103002**			1
2	I.C. Octo-Coupler	I.C. Octo-Coupler	**40200098**	4N35	Motorola	1
3	I.C.-SM	I.C.-SM	**40201099**	LM311D	Motorola	1
4	I.C.-SM	I.C.-SM	**40201020**	CD4060BCM	Nat'l Semi.	1
5	I.C.-SM	I.C.-SM	**40201015**	CD4025BCM	Nat'l Semi.	1
6	Term. D-T	Term. D-T	**55025002**	#160-2043-02-01	Cambion	20
7	Transistor	Transistor	**40001012**	VN10LM	Siliconix	1
8	Diode, Zener	Diode, Zener	**40010006**	1N961B	Motorola	1
9	Diode	Diode	**40010012**	1N4003		4
10	Diode, Zener-SM	Diode, Zener-SM	**40010025**	PMBZ5240B	Philips	2
11	Diode-SM	Diode-SM	**40010014**	MMBD914		45
12	Cap, Chip, CC1206, X7R, 0.01uF	Cap, Chip, CC1206, X7R, 0.01uF	**42020001**			3
13	Cap, Chip, CC1206, NPO, 0.22uF	Cap, Chip, CC1206, NPO, 0.22uF	**42025044**			2
14	Cap, Chip, CC1206, X7R, 0.1uF	Cap, Chip, CC1206, X7R, 0.1uF	**42020013**			1
15	Res, Chip, RC1206, 5%, 1M	Res, Chip, RC1206, 5%, 1M	**41160049**			1
16	Res, Chip, RC1206, MF, 1%, 249K	Res, Chip, RC1206, MF, 1%, 249K	**41101423**			1
17	Res, Chip, RC1206, MF, 1%, 5.62K	Res, Chip, RC1206, MF, 1%, 5.62K	**41101265**			1
18	Res, Chip, RC1206, MF, 1%, 499 OHM	Res, Chip, RC1206, MF, 1%, 499 OHM	**41101164**			1
19	Res, Chip, RC1206, MF, 1%, 49.9K	Res, Chip, RC1206, MF, 1%, 49.9K	**41101356**			1
20	Res, Chip, RC1206, MF, 1%, 4.99K	Res, Chip, RC1206, MF, 1%, 4.99K	**41101260**			3
21	Res, Chip, RC1206, MF, 1%, 232K	Res, Chip, RC1206, MF, 1%, 232K	**41101420**			2
22	Res, Chip, RC1206, 5%, 100K	Res, Chip, RC1206, 5%, 100K	**41160025**			1
23	Res, Chip, RC1206, 5%, 68 OHM	Res, Chip, RC1206, 5%, 68 OHM	**41160016**			1
24	Res, Chip, RC1206, 5%, 10K	Res, Chip, RC1206, 5%, 10K	**41160015**			13
25	Res, Chip, RC1206, 5%, 1K	Res, Chip, RC1206, 5%, 1K	**41160003**			12
26	Relay, 12V	Relay, 12V	**46005002**	NEC#EE2-12	NEC	1

T-30D Panel, PCB Assembly			80 103 002 (A2) Continued			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
27	R42	Res, Carbon, RCR07G, 5%, 100 OHM	**41140021**			1
28						
29		Flex Cable, 40 Pin	**75000015**	3M#3302	3M	AR
30	S1	Switch, 8 Pos	**46024002**	90HBW08P	Grayhill	1
31	R16	Res, Chip, RC1206, 5%, 150 OHM	**41160009**			1
32		Conn., 37 Pin	**48000039**	DC37-SF-M-1	T & B	1
33						
34	R19	Res, Chp, RC1206, 5%, 680 OHM	**41160027**			1
35	J1	Header, 40 Pin	**55050006**	3M#3940-0000T	3M	1
36	C8	Cap, Cerm, X7R, 1uF/50V	**42000032**	PAN. ECU-S1H105KBB	Panasonic	1





REVISIONS			
REV	DESCRIPTION	DATE	APPROVED
A	INITIAL RELEASE	6/30/95	DM
B	ECO 1562: REMOVED P/L FROM DWG. ADDED NOTES AND VIEW OF ITEM 3 CONTACT STRIP. CHANGED ASSY NAME FROM RELAY BD. TO RF SWITCH PER MANUFACTURING REFERENCE.	5/3/01	DM
C	ECO 1600: DELETED DETAILS REVISION CHART AND ADDED NOTE 4.	02/02/12	DM

NOTES

1. REFER TO TIC DOCUMENT ID 20 QP 002-APPENDIX A (SQR1 THRU SQR7) FOR SUPPLIER QUALITY REQUIREMENTS.
2.
3. SEE ASSOCIATED PARTS LIST 80 105 004.
4. REFER TO CONFIGURATION CHARTS FOR CURRENT REVISION LEVEL OF PCB ASSEMBLY AND REVISION LEVELS OF ALL RELATED DETAILS.

88000022	T-30D
88000022	T-30CM
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS 1/64 DECIMALS XX .01 XXX .005 ANGLES 1°

MATERIAL
COPPER CLAD GLASS EPOXY FR4 .062 THK. GFN-0620-B1/B1 A1A

FINISH

DO NOT SCALE DRAWING

CONTRACT NO.

APPROVALS	DATE
DRAWN D.MCMAHON	6/30/95
CHECKED DM	6/30/95
ISSUED	

TEL-INSTRUMENT ELEC. CORP.

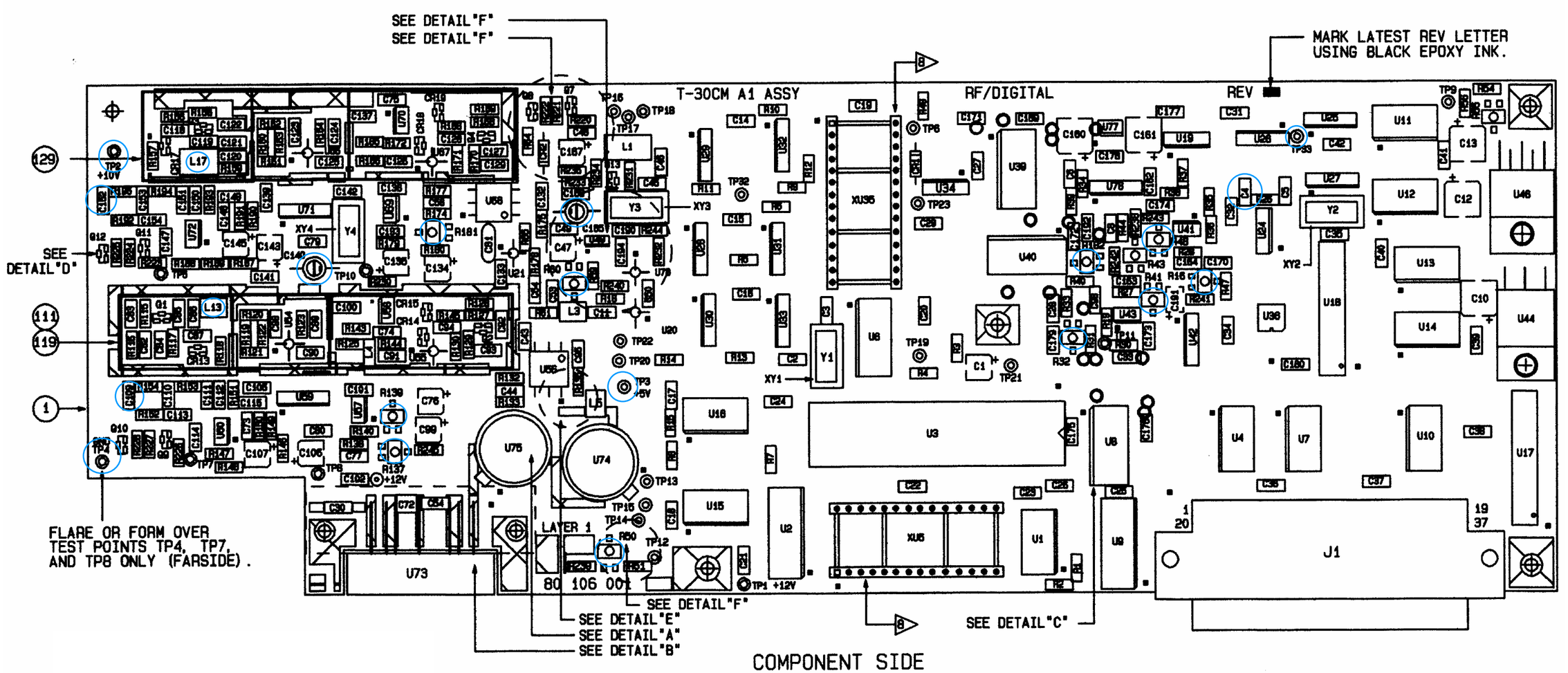
PCB ASSEMBLY
RF SWITCH

SIZE	FSCM NO.	DWG. NO.	REV.
B	92606	80 105 001	C

SCALE NTS

SHEET 1 OF 1

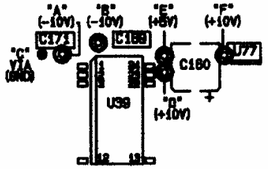
T-30D Panel, PCB Assembly			80 105 001 (A6)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
1		Drilling and Fabrication, RF Switcb PCB (Rev A)	**80105002**			1
2	J1	Connector, Bulkhead, Right Angle	**48040047**	142-0701-321	RAF	1
3		Contact Strip	**55075002**	97-110-01	Inst. Specialties	A/R
4	K1,K2	Relay	**46002004**	172D-12	Teledyne	2
5	Q5,Q6	Transistor	**40001012**	VN10LM	Siliconix	2
6	TP30, TP31	Terminal, Double Turret	**55025002**	160-2043-02-01	Cambion	2
7	R104,R109	Res., Chip, RC1206, 5% 27ohm	**41160012**			2
8	R102, R106, R107, R111	Res., Chip, RC1206, 5% 62ohm	**41160063**			4
9	R103, R105, R108, R110	Res., Chip, RC1206, 5% 180ohm	**41160006**			4



COMPONENT SIDE

T-30D
PCB Assembly
RF/Digital
(A1) 80 106 001 (1 of 2)

DETAIL "C"
NOT TO SCALE

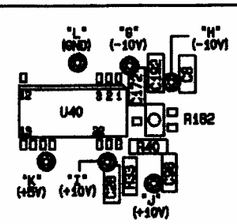


1. IF U39 IS AN AD7225BR OR (KR) (ITEM 11 OF PARTS LIST), ADHERE TO THE FOLLOWING:

A. ADD JUMPER WIRE FROM HOLE "A" (-10V) TO HOLE "B" (-10V).
B. ADD JUMPER WIRE FROM HOLE "D" (+10V) TO HOLE "F" (+10V).

IF U39 IS A MAX505AEWG OR (BEWG) (ITEM 131 OF PARTS LIST), ADHERE TO THE FOLLOWING:

C. ADD JUMPER WIRE FROM HOLE "A" (-10V) TO VIA "C" (GND). DO NOT INSTALL C171.
D. ADD JUMPER WIRE FROM HOLE "D" (+10V) TO HOLE "E" (+5V).

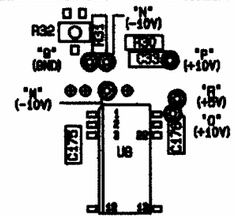


2. IF U40 IS AN AD7225BR OR (KR) (ITEM 11 PF PARTS LIST), ADHERE TO THE FOLLOWING:

A. ADD JUMPER WIRE FROM HOLE "G" (-10V) TO HOLE "H" (-10V).
B. ADD JUMPER WIRE FROM HOLE "I" (+10V) TO HOLE "J" (+10V).

IF U40 IS A MAX505AEWG OR (BEWG) (ITEM 131 OF PARTS LIST), ADHERE TO THE FOLLOWING:

C. ADD JUMPER WIRE FROM HOLE "G" (-10V) TO HOLE "L" (GND). DO NOT INSTALL C172.
D. ADD JUMPER WIRE FROM HOLE "I" (+10V) TO HOLE "K" (+5V).



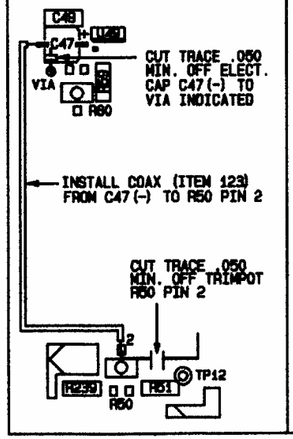
3. IF U8 IS AN AD7225BR OR (KR) (ITEM 11 PF PARTS LIST), ADHERE TO THE FOLLOWING:

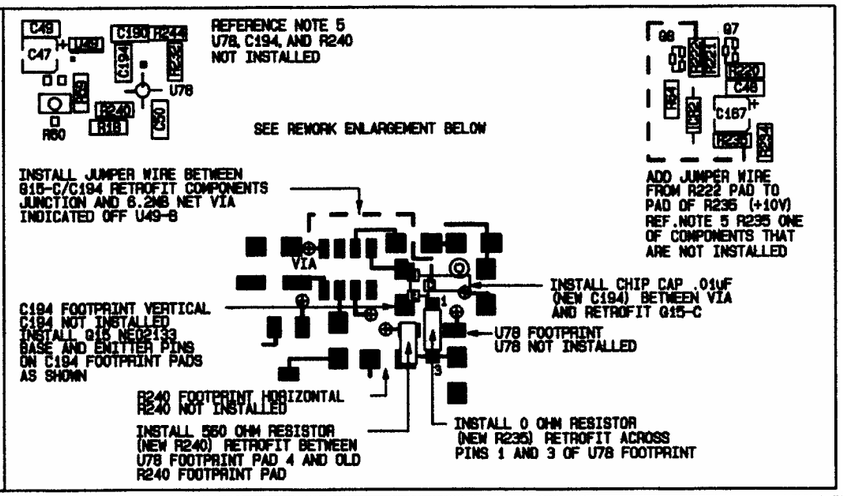
A. ADD JUMPER WIRE FROM HOLE "M" (-10V) TO HOLE "N" (-10V).
B. ADD JUMPER WIRE FROM HOLE "O" (+10V) TO HOLE "P" (+10V).

IF U8 IS A MAX505AEWG OR (BEWG) (ITEM 131 OF PARTS LIST), ADHERE TO THE FOLLOWING:

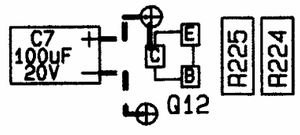
C. ADD JUMPER WIRE FROM HOLE "M" (-10V) TO HOLE "Q" (GND). DO NOT INSTALL C175.
D. ADD JUMPER WIRE FROM HOLE "O" (+10V) TO HOLE "R" (+5V).

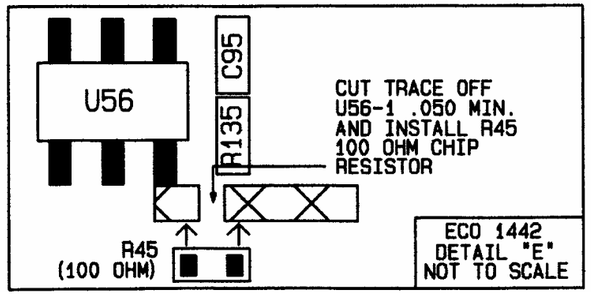
DETAIL "F"
NOT TO SCALE





REWORK REV "D" ECO 1437
ADD CAP. TANT (LEADED)
C7 TO POINTS INDICATED





ECO 1442
DETAIL "E"
NOT TO SCALE

		CONTRACT NO.	TEL-INSTRUMENT ELEC. CORP.
88000022	T-30D		
88000022	T-30CM2	FINISH	PCB ASSEMBLY RF/DIGITAL
NEXT ASSY	USED ON	APPROVALS	DATE
APPLICATION		DRAWN D.McMAHON	2-12-96
MATERIAL COPPER CLAD GLASS EPOXY FR4 .062 THK. GFN-0620-B1/B1 A1A		CHECKED RJM	1-17-00
		ISSUED	

SIZE	FSCM NO.	DWG. NO.	REV
D	92606	80 106 001	K
SCALE			SHEET 1 OF 1

T-30D
PCB Assembly
RF/Digital
(A1) 80 106 001 (2 of 2)

T-30D RF/Digital PCB Assembly			80 106 001 (A1)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
1	A1	PCB Drilling and Fab.	**80106002**			1
2						
3	U1,U4,U14(U14 NOT INSTLLD)	I.C.-SM	**40201014**	74HC573WM	Nat'l Semi.	3
4	U7, U10-U13, U15, U16	I.C.-SM	**40201013**	74HC574WM	Nat'l Semi.	7
5	U19, U24	I.C.-SM	**40201019**	74HC04D	Nat'l Semi.	2
6	U3	I.C.	**40200027**	80C31BH	Intel	1
7	U18 (NOT INSTALLED)	I.C.	**40200106**	DS75160A	Nat'l Semi.	1
8	U17 (NOT INSTALLED)	I.C.	**40200107**	DS75161A	Nat'l Semi.	1
9	L3	Inductor-SM, 0.27uH	**43011028**	300NS-R27M	Toko	1
10	U9	I.C.-SM (REF. ITEM 132 SUBSTITUTE)	**40201105**	AD7828BR	Analog Devices	1
11	U8, U39, U40	I.C.-SM (REF. ITEM 131 SUBSTITUTE)	**40201106**	AD7225BR/AD7225KR		3
12	U25-U30	I.C.-SM	**40201002**	74HC163D	Nat'l Semi.	6
13	U34	I.C.-SM	**40201034**	74HC02D	Nat'l Semi.	1
14	U31-U33	I.C.-SM	**40201095**	74HC283D	Nat'l Semi.	3
15	U77	I.C.-SM	**40201012**	ICL7660CSA	Maxim	1
16	U41, U43	I.C.-SM	**40201051**	LM358M	Motorola	2
17						
18	U36	I.C.-SM Programmable Logic Array	**40201100**	16V8Z-25JI	Lattice Semi.	1
19	U42, U76	I.C.-SM	**40201080**	74HC4053BCM	Nat'l Semi.	2
20	U6	I.C.-SM	**40201018**	74HC4514WM	Nat'l Semi.	1
21	U49	I.C.-SM	**40201145**	SA602AM	Philips	1
22	CR2	Diode, Zener, 6.2V	**40010029**	1N5234B	Motorola	1
23	U73	I.C., Power Amp.	**48085001**	MHW593	Motorola	1
24	U56, U68	I.C.-SM	**40201001**	ASK1KK81	Mini-Circuits	2
25	U57,U58,U60, U69,U70, U72	I.C.-SM	**40201075**	TLC271IP/TI106 B271C	Texas Inst.	6
26	U59, U71	I.C.-SM	**40201057**	MB1502PF	Fujitsu	2
27	U54, U55, U66, U67	I.C.-SM	**40201098**	MAR-1SM	Mini-Circuits	4
28	P1	Connector, 37PIN	**48000033**	FCC17-C37PC-44B	Amphenol	1
29	U44	Volt. Regulator	**56060003**	LM7805CTH	Motorola	1
30	U46	Volt. Regulator	**56060005**	LM2941CT	Nat'l Semi.	1
31	U74	Attenuator	**44001007**	M.C. TOAT-124	Mini-Circuits	1
32	U75	Attenuator	**44001008**	M.C. TOAT-51020	Mini-Circuits	1
33	CR13, CR17	Diode-SM	**40010017**	MMBV109L	Motorola	2
34	CR14, CR15, CR18, CR19	Diode-SM	**40010016**	ZC2800	Zetex	4
35	CR1	Diode, Zener, 5.1V	**40010030**	1N5231B	Motorola	1
36	Y1	Crystal, 12MHz	**40040016**		Bomar	1

T-30D RF/Digital PCB Assembly			80 106 001 (A1)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
37	Y2	Crystal, 3.93216MHz	**40040029**		Bomar	1
38	Y3	Crystal, 75.000MHz	**40040017**		Bomar	1
39	Y4	Crystal, 6.4MHz	**40040026**		Bomar	1
40	U20, U21	I.C.-SM	**40201087**	MAR-3SM	Mini-Circuits	2
41	N/A	Washer, Nylon	**52062002**			8
42	Q1, Q3, Q15	Transistor-SM	**40001013**	NEO2133	NEC	3
43	Q7, Q9, Q11	Transistor-SM	**40001011**	MMBT2222A	Nat'l Semi.	3
44	Q2, Q4, Q8, Q10, Q12	Transistor-SM	**40001014**	MMBT2907A	Nat'l Semi.	5
45	L1	Coil, Formed, 8.5T, CCW, 3/16 I.D. 20AWG, 3/8 LG.	**43025040**			1
46	L5	Inductor-SM, 0.15uH	**43011025**	300NS-R15M	Toko	1
47	C43	Cap, Chip, NPO, CC1206, 10pF	**42025013**			1
48	R150	Res, Chip, RC1206, MF, 34K	**41101340**			1
49	L17	Coil, Formed, 6.5T, CW, .188 I.D. 24AWG	**43025031**			1
50	C81	Cap, Cerm, 100pF	**42000031**	CN15C-101J	C' Lab	1
51	L13	Coil, Formed, 2T, CCW, .125 I.D. 24AWG	**43025038**			1
52	C1,C47,C76,C99,C106, C134,C135,C143	Cap-SM, Elect, 10uF, 16V	**42185030**	ECE-V1CA100R	Panasonic	8
53	C107, C145, C167	Cap-SM, Elect, 1uF, 50V	**42185045**	ECE-V1HA010R	Panasonic	3
54	C10, C12, C13, C160, C161	Cap-SM, Elect, 22uF, 25V	**42185036**	ECE-V1EA220P	Panasonic	5
55	C140	Cap-SM, Trimmer, 2.8-12.5pF	**42260013**	24AA071	Mouser	1
56	C149	Cap, Chip, X7R, CC1206, 0.022uF	**42020021**			1
57	C14-20,C22-29,C31-42,C54,C74-75,C79-80,C100-102,C114, C136-137, C147,C162, C169-C177,C180,C194	Cap,Chip,X7R,CC1206,0.01uF (C35,C38 & 39 AREN'T INSTD.)	**42020001**			51
58	C30	Cap, Chip, X7R, CC1206, 4700pF	**42020049**			1
59	C115, C192	Cap, Chip, X7R, CC1206, 0.1uF	**42020013**			2
60	C193	Cap, Chip, NPO, CC1206, 220pF	**42025029**			1
61	C4	Cap, Chip, NPO, CC1206, 68pF	**42025023**			1
62	R47	Res, Chip, RC1206, 5%, 20K	**41160092**			1
63	L4	Coil, Formed, 4.5T, CW, .125 I.D. 24AWG	**43025034**			1
64	C85, C86	Cap, Chip, NPO, CC1206, 4.7pF	**42025042**			2
65	C2, C3, C5	Cap, Chip, NPO, CC1206, 33pF	**42025019**			3
66	C46,C84,C119-120,C133,C141-142	Cap, Chip, NPO, CC1206, 47pF	**42025021**			7

T-30D RF/Digital PCB Assembly			80 106 001 (A1)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
67	C64,C87,C105, C121, C123,C125-127,C139	Cap, Chip, NPO, CC1206, 100pF	**42025025**			9
68	C6,C8,C11,C44,C48-49,C50, C56,C73,C77, C82-83,C88-95,C98,C109-113, C118,C122,C124,C128-129,C132,C148,C150-154,C163-164,C168,C178-179,C190	Cap, Chip, NPO, CC1206, 1000pF	**42025037**			44
69	C72	Cap, Chip, CC1210, 1uF	**42026001**		Bourns	1
70	R32, R41, R50, R55	Trimpot-SM, 1K	**41050007**	3314G-1-102E	Bourns	4
71	R181	Trimpot-SM, 100K	**41050013**	3314G-1-104E	Bourns	1
72	R16, R139	Trimpot-SM, 10K	**41050010**	3314G-1-103E	Bourns	2
73	R2, R49	Res, Chip, RC1206, MF, 4.99K	**41101260**			2
74	R1, R35, R36	Res, Chip, RC1206, MF, 10.0K	**41101289**			3
75	R54	Res, Chip, RC1206, MF, 21.5K	**41101321**			1
76	R56	Res, Chip, RC1206, MF, 2.49K	**41101231**			1
77	R151, R153, R193, R194	Res, Chip, RC1206, MF, 6.34K	**41101270**			4
78	R18	Res, Chip, RC1210, 5% 120 OHM	**41165003**			1
79	R61, R170	Res, Chip, RC1206, 5% 150 OHM	**41160009**			2
80	R64	Res, Chip, RC1206, 5% 330 OHM	**41160023**			1
81	R128, R149, R169	Res, Chip, RC1206, 5% 8.2K	**41160087**			3
82	C45, C53	Cap, Chip, NPO, CC1206, 22pF	**42025017**			2
83	Q13	Transistor	**40001017**	MMBT918L	Nat'l Semi.	1
84	R137, R182	Trimpot-SM, 50K	**41050012**	3314G-1-503E	Bourns	2
85	R160, R161	Res, Chip, RC1206, 5% 47 OHM	**41160062**			2
86	R58, R125, R166, R235	Res, Chip, RC1206, 5% 0 OHM	**41160145**			4
87	R129	Res, Chip, RC1206, 5% 120 OHM	**41160064**			1
88	R59, R243	Res, Chip, RC1206, 5% 27K	**41160024**			2
89	R146, R187	Res, Chip, RC1206, 5% 470 OHM	**41160021**			2
90						
91	R116, R156, R28	Res, Chip, RC1206, 5% 2.7K	**41160004**			3
92	R117, R135, R159, R175	Res, Chip, RC1206, 5% 680 OHM	**41160027**			4
93	R65, R120, R162	Res, Chip, RC1206, 5% 240 OHM	**41160045**			3
94						
95		PCB Assembly, RF Switch	**80105001**			1

T-30D RF/Digital PCB Assembly			80 106 001 (A1)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
96						
97	R143, R145, R185, R186	Res, Chip, RC1206, 5% 470K	**41160036**			4
98	R44,R138,R179,R190,R242	Res, Chip, RC1206, 5% 47K	**41160031**			5
99	R127, R152, R168, R192	Res, Chip, RC1206, 5% 3.3K	**41160029**			4
100						
101	R123, R164	Res, Chip, RC1206, 5% 270 OHM	**41160001**			2
102	R119, R121	Res, Chip, RC1206, 5% 33 OHM	**41160007**			2
103						
104	R130, R171	Res, Chip, RC1206, 5% 220 OHM	**41160020**			2
105	R122, R133, R174	Res, Chip, RC1206, 5% 62 OHM	**41160063**			3
106	R45, R163, R178, R239	Res, Chip, RC1206, 5% 100 OHM	**41160011**			4
107	R4,R220, R221, R223-224, R226-227, R230-231,R244	Res, Chip, RC1206, 5% 1K	**41160003**			10
108	R26	Res, Chip, RC1206, 5% 10M OHM	**41160033**			1
109	R147-148,R180,R188-189	Res, Chip, RC1206, 5% 100K	**41160025**			5
110	R3,R5-15,R27,R30-31,R33-34,R37-40,R51,R115,R118,R132,R140,R144,R154,R157-158,R172,R177,R191,R195,R222,R225,R228,R233-234,R238	Res, Chip, RC1206, 5% 10K	**41160015**			40
111		Cover, RF Shielding	**62040030**			1
112	R43, R48	Trimpot, 20K	**41050011**	3314G-1-203E	Bourns	2
113		Screw, P.H. 4-40 X 5/16 LG	**50110009**			2
114		Washer, Flat, No. 4	**52010002**			2
115		Washer, Lock, No. 4	**52020002**			4
116		Nut, Plain, Hexagon, No. 4	**53010001**			4
117	TP1-TP23, TP32, TP33	Terminal, Double Turret	**55025002**	160-2043-02-01	Cambion	25
118	XY1-XY4	Crystal Mount	**55080002**	470.025	Bivar	4
119		Shield, Isolation	**31020074**			1
120		Screw, P.H. 4-40 X 1/2 LG	**50110002**			2

T-30D RF/Digital PCB Assembly			80 106 001 (A1)			
Item No.	**Ref. Designation**	**Nomenclature**	**Tel Designation**	**Vendor P/N**	**Resource**	**Qty**
121	XU5, XU35	Socket, I.C., 28PIN	**48064001**	ICN-286-S5-T	Robinson Nugent	2
122	C165	Cap-SM, Trimmer, 3.5-20pF	**42260015**	24AA072	Mouser	1
123		Wire, Coaxial (RG-178B/U)	**71110004**	53265 or equiv.	Olympic	A/R
124						
125	R232	Res, Chip, RC1206, 5% 1.6K	**41160077**			1
126	R241	Res, Chip, RC1206, 5% 4.7K	**41160013**			1
127	R60	Trimpot, 5K	**41050009**	3314G-1-502E	Bourns	1
128	C7	Cap. Tant, 100uF/20V, 10%	**42470021**	199D107X9020F E2	Sprague	1
129	N/A	Shield, Isolation	**31020077**			1
130	R245	Res, Chip, RC1206, 5%, 39K	**41160096**			1
131	U8, U39, U40	I.C.-SM (REF. ITEM 11-SUBSTITUTE)	**40201091**	MAX505AEWG/B EWG	Maxim	3
121	XU5, XU35	Socket, I.C., 28PIN	**48064001**	ICN-286-S5-T	Robinson Nugent	2
122	C165	Cap-SM, Trimmer, 3.5-20pF	**42260015**	24AA072	Mouser	1
123		Wire, Coaxial (RG-178B/U)	**71110004**	53265 or equiv.	Olympic	A/R
124						
125	R232	Res, Chip, RC1206, 5% 1.6K	**41160077**			1
126	R241	Res, Chip, RC1206, 5% 4.7K	**41160013**			1
127	R60	Trimpot, 5K	**41050009**	3314G-1-502E	Bourns	1
128	C7	Cap. Tant, 100uF/20V, 10%	**42470021**	199D107X9020F E2	Sprague	1
129	N/A	Shield, Isolation	**31020077**			1
130	R245	Res, Chip, RC1206, 5%, 39K	**41160096**			1
131	U8, U39, U40	I.C.-SM (REF. ITEM 11-SUBSTITUTE)	**40201091**	MAX505AEWG/B EWG	Maxim	3
132	U9	I.C.-SM (REF. ITEM 10-SUBSTITUTE)	**40201092**	MAX158AEWI	Maxim	1
133		Shield Cover	**62040031**			1
134	R240	Res, Chip, RC1206, 5%, 560 OHM	**41160017**			1

APPENDIX A

DATA TEST SHEET

VERIFICATION AND ACCEPTANCE CHECKS

TEST DATA SHEET

TEST SET VERIFICATION AND ACCEPTANCE CHECKS

Date of Test:	S/N:

4.4 – Radio Frequency Measurements

Step #	Description of Test	Specification	Actual Measurement	Pass/ Fail	Int.
3	108.00 MHz, VOR Frequency	107.9973 – 108.1027 MHz			
5	108.05 MHz, VOR Frequency	108.0473 – 108.0527 MHz			
8	108.10 MHz, LOC Frequency	108.0973 -108.1027 MHz			
10	108.15 MHz, LOC Frequency	108.473 – 108.1527 MHz			
13	75 MHz, MB Frequency	74.99625 – 75.00375 MHz			
15	334.70 MHz, GS Frequency	334.6916 – 334.7084 MHz			
17	334.55 MHz, GS Frequency	334.5416 – 334.5584 MHz			

4.5 – RF Power Measurements

Step #	Description of Test	Specification	Actual Measurement	Pass/ Fail	Int.
4	VOR Power	+7/ ± 2 dBm Minimum			
6	MB Power	+8/ ± 2 dBm Minimum			
8	GS Power	+1/ ± 2 dBm Minimum			

4.6 – Percentage Modulation Measurements

Step #	Description of Test	Specification	Actual Measurement	Pass/ Fail	Int.
6	VOR Percentage of 30 Hz	28% – 32%			
8	VOR Percentage of 9960 Hz	28% – 32%			
9	VOR Percentage of 1020 Hz	15% – 25%			
12	MB Percentage at 3000 Hz	91% - 99%			
13	MB Percentage at 1300 Hz	91% - 99%			
14	MB Percentage at 400 Hz	91% - 99%			

4.6 – Percentage Modulation Measurements (continued)
Glideslope Percentage

Steps 16 - 19

GS SW.	Column A Delete 90	Column B Delete 150	Diff in % A - B	Specification	Pass/ Fail	Int.
+2				15.0 % to 20.0 %		
+1				Not specified (7% - 11%)		
OC				-1.0% to +1.0%		
-1				Not Specified (-7% to -11%)		
-2				-15.0% to -20.0%		

Localizer Percentage

Steps 20 - 23

LOC SW.	Column A Delete 90	Column B Delete 150	Diff in % A - B	Specification	Pass/ Fail	Int.
L2				13.5% to 17.5%		
L1				Not specified (6% - 10%)		
OC				-1.0% - +1.0%		
R1				Not Specified (-6% to -10%)		
R2				-13.5% to -17.5%		

Step #	Description of Test	Specification	Actual Measurement	Pass/ Fail	Int.
24	1020 Hz Modulation Percentage	15% - 25%			

Step #	Description of Test	Specification	Actual Measurement	Pass/ Fail	Int.
27	Simultaneous MB Signals	Observe signals at 75 MHz			
		108.10 MHz			
		334.70 MHz			

4.7 – Audio Frequency and Distortion Measurements

Step #	Description of Test	Specification		Actual Measurement		Pass/ Fail	Int.
		Distortion	Frequency				
5	MB Audio and Distortion 3000 Hz	< 10%	2940–3060 Hz				
6	MB Audio and Distortion 1300 Hz	< 10%	1274–1326 Hz				
7	MB Audio and Distortion 400 Hz	< 10%	392 – 408 Hz				
9	VOR 30 Hz Distortion	< 5%	29 – 31 Hz				
10	VOR 9960 Hz Distortion	< 5%	9959 - 9961 Hz				
11	VOR 1020 Hz Distortion	< 10%	1000-1040 Hz				
13	LOC 90 Hz Distortion	< 5%	89 – 91 Hz				
14	LOC 150 Hz Distortion	< 5%	149 – 151 Hz				
15	LOC 1020 Hz Distortion	< 10%	1000 - 1040 Hz				
17	GS 90 Hz Distortion	< 5%	89 - 91 Hz				
18	GS 150 Hz Distortion	< 5%	149 – 151 Hz				

4.8 – VOR Angle Verification

Steps 5-7

Switch Position	0	45	90	135	180	225	270	315
ZIFOR Expected	180	225	270	315	0	45	90	135
ACTUAL								
Difference < 2º Pass/Fail								

Step #	Description of Test	Specification	Actual Measurement	Pass/ Fail	Int.
11	0 Degree VOR Variable CCW Stop	< 170°			
13	0 Degree VOR Variable CW Stop	> 190°			

Date _____Technician_____

APPENDIX B

DATA TEST SHEET

ANNUAL CALIBRATION AND ALIGNMENT

TEST DATA SHEET

ANNUAL CALIBRATION AND ALIGNMENT

Date of Test:	S/N:

4.10 – AC Power Tests

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
6	AC Voltage, E9 & E10	+16 – 30 VAC				
7	AC Voltage, E7 & E1	+16 – 20 VAC				
9	AC Voltage, E9 & E10	+8 – 10 VAC				

4.11 – Battery Charge

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
5	Battery Voltage, E1 & E7	+13 VDC ±1 V				

4.12 – DC Voltage Adjustment

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
2	DC Voltage, TP3 & TP4	+5 VDC ±0.2 VDC				
3	DC Voltage, TP2 & TP4	+10VDC ±0.2 VDC				

4.13.1 – VOR and LOC

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
4	L17 Voltage	3.0 – 8.0 VDC				
5	VOR, Frequency, 108.00	107.9973 – 108.0027 MHz				
6	VOR, Frequency, 108.05	108.473 – 108.0527 MHz				

4.13.1 – VOR and LOC (Continued)

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
7	LOC, Frequency, 108.15	108.1473 – 108.1527 MHz				
8	LOC, Frequency, 108.15	108.0973 – 108.1027 MHz				

4.13.2 – MB

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
2	MB, Frequency, 75 MHz	74.99625 – 75.00375 MHz				

4.13.3 – GS

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
4	L13 Voltage	3.0 – 7.0 VDC				
5	GS, Frequency, 334.70 MHz	334.6916 – 334.7084 MHz				
7	GS, Frequency, 334.55 MHz	334.5416 – 334.5584 MHz				

4.13.4 – RF Power

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
2	VOR/LOC	+7/± 2 dBm				
4	GS	+1/± 2 dBm				
6	MB	+8/± 2 dBm				

4.14.1 – VOR Modulation Test

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
6	VOR, Deleted VAR	28 – 32%				
8	VOR, Deleted Ref	28 – 32%				
9	VOR, 1020 Deleted	15 – 25%				

4.14.2 – MB Modulation Test

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
3	MB, 3000Hz	91 – 99%				
5	MB, 1300 Hz	91 – 99%				
7	MB, 400 Hz	91 – 99%				

4.14.3 – GS Modulation Test

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
3	GS, Delete 90	39.8 – 40.2%				
4	Delete 90/Delete 150, Difference	0.4%				

4.14.3 Step 5 & 6 – GS Modulation INITIAL

GS SW.	Column A Delete 90	Column B Delete 150	Diff in % A - B	Specification	Pass/ Fail	Int.
+2				15.0 % to 20.0 %		
+1				Not specified (7% - 11%)		
OC				-1.0% to +1.0%		
-1				Not Specified (-7% to -11%)		
-2				-15.0% to -20.0%		

4.14.3 Step 7 – GS Modulation FINAL (if necessary)

GS SW.	Column A Delete 90	Column B Delete 150	Diff in % A - B	Specification	Pass/ Fail	Int.
+2				15.0 % to 20.0 %		
+1				Not specified (7% - 11%)		
OC				-1.0% to +1.0%		
-1				Not Specified (-7% to -11%)		
-2				-15.0% to -20.0%		

4.14.4 – LOC Modulation

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
2	LOC, Delete 90	19.8 – 20.2%				
3	Delete 90/Delete150, Difference	0.4%				
4	LOC, Delete 1020	15 – 25%				

4.14.4 Step 6 & 7 – LOC Modulation INITIAL

GS SW.	Column A Delete 90	Column B Delete 150	Diff in % A - B	Specification	Pass/ Fail	Int.
L2				13.5 to 17.5%		
L1				Not specified (6% - 10%)		
OC				-1.0% to +1.0%		
R1				Not Specified (-6% to -10%)		
R2				- 13.5 to -17.5%		

4.14.4 Step 8 – LOC Modulation FINAL (if necessary)

GS SW.	Column A Delete 90	Column B Delete 150	Diff in % A - B	Specification	Pass/ Fail	Int.
L2				13.5 to 17.5%		
L1				Not specified (6% - 10%)		
OC				-1.0% to +1.0%		
R1				Not Specified (-6% to -10%)		
R2				- 13.5 to -17.5%		

4.14.5 – MB and ILS Simultaneous

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
3	Verification of Signals at 75 MHz 108.10 MHz 334.70 MHz	All Present		N/A		

4.15 – Audio Frequency and Distortion Verification

Step #	Description of Test	Specification	Actual	Adjusted	Pass/ Fail	Int.
3	TP33	982,942 – 938,138				
6	MB, 3000 Hz Distortion	Less than 10% 2940 – 3060 Hz		N/A		
7	MB, 1300 Hz Distortion	Less than 10% 1274 – 1326 Hz		N/A		
8	MB, 400 Hz Distortion	Less than 10% 392 – 408 Hz		N/A		
10	VOR, 30 Hz Distortion	Less than 5% 29 – 31 Hz		N/A		
11	VOR, 9960 Hz Distortion	Less than 5% 9959 – 9961 Hz		N/A		
12	VOR, 1020 Hz Distortion	Less than 10% 1000 – 1040 Hz		N/A		
14	LOC, 90 Hz Distortion	Less than 5% 89 – 91 Hz		N/A		
15	LOC, 150 Hz Distortion	Less than 5% 149 – 151 Hz		N/A		
16	LOC, 1020 Hz Distortion	Less than 10% 1000 – 1040 Hz		N/A		
18	GS, 90 Hz Distortion	Less than 5% 89 – 91 Hz		N/A		
19	GS, 150 Hz Distortion	Less than 5% 149 – 151 Hz		N/A		

4.16 – VOR Angle Verification INITIAL

Switch Position	0	45	90	135	180	225	270	315
ZIFOR Expected	180	225	270	315	0	45	90	135
ACTUAL								
Difference Pass/Fail								

Compute the Maximum Peak to Peak error:

MAX Error_____ – MIN Error_____ =

Tolerance_____<2º

Compute the Mean Error:

(MAX Error_____ + MIN Error_____) (0.5) =

Mean Error_____

SI Switch Positions	1	2	3	4	5	6	7	8

4.16 – VOR Angle Verification FINAL

Switch Position	0	45	90	135	180	225	270	315
ZIFOR Expected	180	225	270	315	0	45	90	135
ACTUAL								
Difference Pass/Fail								

Compute the Maximum Peak to Peak error:

MAX Error_____ – MIN Error_____ =

Tolerance_____<2º

Compute the Mean Error:

(MAX Error_____ + MIN Error_____) (0.5) =

Mean Error_____

SI Switch Positions	1	2	3	4	5	6	7	8

Step #	Description of Test	Specification	Actual Measurement	Pass/ Fail	Int.
11	0 Degree VOR Variable CCW Stop	< 170°			
13	0 Degree VOR Variable CW Stop	> 190°			

Date Test Completed_____/_____/_____

Signature of Technician_____