

# VHF/FM DIGITAL AIRBORNE TRANSCEIVER MODEL TDFM-136A



## Installation Instructions

TiL Document No.  
09RE404  
Revision C

JUNE 2009

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### **Technisonic Industries Limited**

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**REVISIONS for 09RE404 Sections 1 – 2**

REV	SECTION - PAGE -	DESCRIPTION	DATE	EDITED
A	- Table 1-1 - STC Approv. - Table 1-5  - FCC Compliance	Changed operating temp to -30 to +60 C. Change references of DO-160C to 160D. Change Temp & Alt to B4 and D1. Change Magnetic Effect to class Z. Add FCC RF Exposure Requirements warning.	May 26/09	H.D.
B	- FCC Compliance  - Table 1-4 - 2.5 Antenna Installation. - Footer, all pages.	Change separation distance from 110cm to 1.0m. Change RF Output Power Low to read "1W". Change 0dB to 3dBi and 20cm (8 inches) to 1.0m (40 inches). Remove "and Operating" from "Installation and Operating Instructions".	June 15/09	H.D.
C	- 2.5	Change antenna supplier & part number to Comant Industries Inc. / Part No. CI 292-3	Jun 26/09	R.D.

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### **CAUTION ! STATIC SENSITIVE !**



This unit contains static sensitive devices. Wear a grounded wrist strap and/or conductive gloves when handling printed circuit boards.

### **FCC COMPLIANCE INFORMATION**

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference and (2) this device must accept any interference received, including interference that may cause undesired operation.

**WARNING:** For compliance with FCC RF Exposure Requirements, the mobile transmitter antenna installation shall comply with the following conditions:

1. The transmitter antenna gain shall not exceed 3 dBi.
2. The transmitter antenna is required to be located outside of a vehicle and kept at a separation distance of 1.0 meter or more between the transmitter antenna of this device and persons during operation.

**NOTE:** This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Re-orient or relocate the receiving antenna
- Increase the separation between the equipment and receiver
- Connect the equipment into an outlet or circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

**WARNING:** Changes or modifications not expressly approved by Technisonic Industries could void the user's authority to operate the equipment.

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### **WARRANTY INFORMATION**

The Model TDFM-136A transceiver is under warranty for one year from date of purchase. Failed units caused by defective parts, or workmanship should be returned to:

Technisonic Industries Limited  
240 Traders Boulevard  
Mississauga, Ontario L4Z 1W7

Tel: (905) 890-2113

Fax: (905) 890-5338

**NOTICE:** The above stated address supersedes all others that may appear otherwise in this manual.

### **STC APPROVAL NOTE**

Presently, no TSO standard exists for airborne FM transceivers. To make it easier for installation agencies to provide their customers with an approved installation supported by an effective Airworthiness Approval, Technisonic has secured Supplemental Type Certificate (STC) Approvals (both US and Canadian) on its Airborne FM products for many helicopters currently being delivered in the US and Canada as well as a number of single engine fixed wing aircraft. The above referenced DO-160D test data is also on file and available from Technisonic to support approval requirements in airframes for which Technisonic does not possess an STC.

Approved aircraft types are listed in the attachments to the formal STC documents. These STC's are the exclusive property of Technisonic and require the written authority of Technisonic for their use. To assist Factory Authorized Technisonic Dealers in the certification process, we have placed copies of our Canadian and US STC's on our web site along with a letter of authorization for their use. These documents may be downloaded and used as support for the technical submission to FAA or Transport Canada. Only authorized factory dealers/installers are permitted to download and make use of these documents on behalf of their customers (end users) in support of regulatory agency approval. Please refer to the Technisonic web site [www.til.ca](http://www.til.ca) for the latest issue of available STC's and letter of authorization for use.

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### **WARNING AND DISCLAIMER**

This manual is designed to provide information about the TDFM-136A. Every effort has been made to make this manual as complete and accurate as possible.

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## **SECTION 1 - GENERAL DESCRIPTION**

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### **1.1 INTRODUCTION**

This publication provides operating and installation information for the TDFM-136A, Digital Transceiver manufactured by Technisonic Industries Limited. The TDFM-136A is Project 25 (P25), Phase 1 compliant. The unit offers digital or conventional analog FM communications over an extended frequency range with selectable channel spacing and is intended for use (in the U.S.) only by government agencies or contractors thereto, who have obtained licensing for operation in the 136-150 MHz portion of the band. If the TDFM-136A transceiver is used in CANADA, operation is restricted to the following sub bands: 138-144, 148-148.99, 149.005-150.005 and 150.05-174 MHz. Furthermore the frequency agile transceiver is restricted to airborne use and must not be operated as a base station in Canada.

### **1.2 DESCRIPTION**

The TDFM-136A, Transceiver is a frequency agile, fully synthesized airborne transceiver capable of operating in the 136.000 MHz to 174.000 MHz frequency range in 2.5 kHz increments with either 25 kHz analog, 12.5 kHz analog channel spacing and P25, 12.5 kHz digital modulation on a channel by channel basis. The Transceiver can operate without restriction on any split frequency pair in the band and also incorporates a two channel synthesized guard receiver.

The TDFM-136A Transceiver provides 230 operator accessible memory positions. Each of which is capable of storing Scan List membership information, up to eight (8) character alphanumeric identifier, and Operating Mode information. In addition each memory position contains information for both transmit and receive including: frequency, CTCSS tone, DCS (DPL) code, P25 TalkGroup, and P25 Network Access Code (NAC) information.

Channel operating parameters, including frequency and other related data, are presented on a 48-character, two-line LED matrix display. Data entry and function control takes place via a 12-button keypad.

### **1.3 PURPOSE OF EQUIPMENT**

The TDFM-136A, Digital VHF/FM Transceiver is designed to provide secondary airborne communications to facilitate operations which are typically performed in a low altitude environment. The transmitter section of this unit has a minimum of 8 watts and does not exceed 10 watts output power, which may be reduced by a front panel switch to 1 watt, in order to reduce interference to land based systems.

#### 1.4 MODEL VARIATION

There are twelve variations of the Model TDFM-136A Transceiver. All units offer identical features and performance except for the following differences:

TDFM-136A, P/N 091258-1-10	GREEN display 28v back lighting, no Encryption.
TDFM-136A, P/N 091258-1-11	GREEN display 28v back lighting, with Encryption.
TDFM-136A, P/N 091258-2-10	RED display 28v back lighting, no Encryption.
TDFM-136A, P/N 091258-2-11	RED display 28v back lighting, with Encryption.
TDFM-136A, P/N 091258-3-10	NV display 28v back lighting, no Encryption.
TDFM-136A, P/N 091258-3-11	NV display 28v back lighting, with Encryption.
TDFM-136A, P/N 091258-4-10	GREEN display 5v back lighting, no Encryption.
TDFM-136A, P/N 091258-4-11	GREEN display 5v back lighting, with Encryption.
TDFM-136A, P/N 091258-5-10	RED display 5v back lighting, no Encryption.
TDFM-136A, P/N 091258-5-11	RED display 5v back lighting, with Encryption.
TDFM-136A, P/N 091258-6-10	NV display 5v back lighting, no Encryption.
TDFM-136A, P/N 091258-6-11	NV display 5v back lighting, with Encryption.



1.5 TECHNICAL CHARACTERISTICS

The tables below provide the technical characteristics for the Technisonic Industries Ltd. Model TDFM-136A.

TABLE 1-1 TDFM-136A – General Characteristics	
Characteristic	Specification
Dimensions (including heat sink)	Approx. 8.0" X 3.0" X 5.75"
Weight	Approx. 3.5 Lbs (1.6 Kg)
Mounting	Panel Mount via DZUS fasteners
Power Requirement: Voltage Current	28.0 VDC, $\pm 15\%$ Receive - 0.7 A Max. Transmit Low Power (1W) - 1.3 A Max. Transmit High Power (8-10W) - 2.0 A Max.
Audio Output Power: Headset Speaker Output	0.5 Watts into 600 ohms 2.5 Watts min. into 4 ohms
Back Lighting	28 Volts (standard) 5 Volts (specify)
Display Colour	Green (standard) Red (specify) NVG (optional)
Temperature Range: Operating Storage	-30°C to +60°C -55°C to +85°C
Altitude	50,000 feet

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<b>TABLE 1-2 TDFM-136A – Operational Characteristics</b>	
<b>Characteristic</b>	<b>Specification</b>
Frequency Range:	136.000 to 174.000 MHz
Operating Modes:	Conventional analog: 12.5 / 25 kHz. P25 CAI: 12 KBPS FSK, 9.6 KBPS C4FM
Channel Spacing:	25 kHz. or 12.5 kHz
Programmable Memories: Scan Lists Description Operating Modes Frequency Squelch Modes	230 memories 15 scan lists Up to 8 characters, alpha-numeric Analog Wide, Analog Narrow, P25 Digital Rx/Tx (Simplex/Duplex), 136.0000 – 174.0000 Rx/Tx (Simplex/Duplex), CTCSS Tones, DCS Codes, P25 TalkGroup, P25 NAC
Guard Receiver: Description Operating Modes Frequency Squelch Modes	2 channels programmed with: Up to 8 characters, alpha-numeric Analog Wide, Analog Narrow, Digital Rx/Tx (Simplex/Duplex), 136.0000 – 174.0000 MHz. Rx/Tx (Simplex/Duplex), CTCSS Tones, DCS Codes, P25 TalkGroup, P25 NAC
CTCSS Tones	42 CTCSS tones, including all standard tones.
DCS Codes	All standard DCS (DPL <sup>1</sup> ) codes
P25 TalkGroup	\$0000 to \$FFFF ( 0 to 65535 )
P25 Network Access Code (NAC)	\$000 to \$FFF ( 0 to 4095 )

DPL<sup>1</sup> is a trademark of Motorola Corporation

<b>TABLE 1-3 TDFM-136A – Receiver Characteristics – Main and Guard</b>	
<b>Characteristic</b>	<b>Specification</b>
Sensitivity at 12 dB SINAD	-116dBm
Adjacent Channel Selectivity	-60dB (25 or 12.5 kHz)
Spurious Attenuation	-70 dB
Third Order Intermodulation	-70 dB
Image Attenuation	-80 dB
FM Acceptance	± 6 kHz
Hum and Noise	better than 45dB
Audio Distortion	less than 5%
Antenna Conducted Emission	less than -57dBm

<b>TABLE 1-4 TDFM-136A – Transmitter Characteristics</b>	
<b>Characteristic</b>	<b>Specification</b>
RF Output Power: Low High	1W. 10W.
Output Impedance	50 ohms
Maximum Deviation: Wide (25 kHz) Narrow (12.5 kHz)	± 5 kHz ± 2.5 kHz
Maximum Deviation – Narrow	± 2.5 kHz (12.5 kHz mode)
Spurious Attenuation	-90 dB below carrier level
Frequency Stability	± 2.5 ppm
Microphone Circuit	Carbon or equivalent
Sidetone Output	0.5W (max) into 600 ohms
Harmonic Attenuation	-65 dB below carrier level
FM Hum And Noise	-40 dB
Audio Input	50 mV at 2.5 into 200 Ω input circuit for ± 3.5 deviation, adjust.
Audio Distortion	Less than 5%

**1.6 CERTIFICATION SUMMARY**

The following table gives a summary of DO-160D Environmental Testing for Technisonic Model TDFM-136A, VHF Digital Transceiver.

<b>TABLE 1-5 TDFM-136A – Environmental Testing Summary</b>		
<b>Conditions</b>	<b>Section</b>	<b>Description of Conducted Tests</b>
Temperature and Altitude	4.0	Equipment tested to categories B4 and D1.
Temperature Variation	5.0	Category B.
Humidity	6.0	Category A.
Operational Shock and Crash Safety	7.0	Category A.
Vibration	8.0	Equipment is tested without shock mounts to categories S and U.
Magnetic Effect	15.0	Equipment is class Z.
Power Input	16.0	Category B.
Voltage Spike	17.0	Category B.
Audio Frequency Susceptibility	18.0	Category B.
Induced Signal Susceptibility	19.0	Category A.
Radio Frequency Susceptibility	20.0	Category U.
RF Emission (DO-160D)	21.0	Category B.
RF Emission (DO-160C)	21.0	Category Z.
Electrostatic Discharge	25.0	Category A.

## **SECTION 2 – INSTALLATION INSTRUCTIONS**

### **2.1 GENERAL**

This section contains information and instructions for the correct installation of the TDFM-136A, VHF/FM Digital Transceiver.

Make certain that the correct frequencies are pre-programmed in accordance with the equipment user's valid FCC operator's license, prior to installation.

### **2.2 EQUIPMENT PACKING LOG**

Unpack the equipment and check for any damage that may have occurred during transit. Save the original shipping container for returns due to damage or warranty claims. Check that each item on the packing slip has been shipped in the container. Verify that the equipment display and back-lighting configuration are the same as those ordered.

### **2.3 TRANSCEIVER INSTALLATION**

The TDFM-136A Transceivers are designed to be Dzus mounted and should be installed in conjunction with an IN-150 installation kit. See Figure 2-1 for an outline drawing of the unit with dimensions to facilitate the installation.

### **2.4 INSTALLATION KIT - CONTENTS**

The IN-150 installation kit consists of:

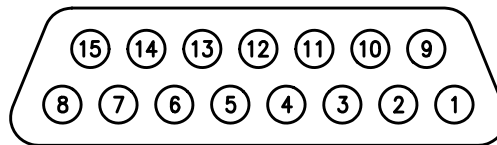
1. One 15-pin (female) Cannon D-mating connector complete with crimp pins and hoods.
2. One BNC antenna mating RF connector (male) and hood.

### **2.5 ANTENNA INSTALLATION**

Antenna, P/N CI 292-3 may be obtained from Comant Industries Inc. or a suitable equivalent 3dBi gain antenna may be used with the TDFM-136A transceivers. The antenna should be mounted on the bottom of the aircraft whenever possible and must be located at least 1.0 meter (40 inches) from any occupant in the airframe. Consult with instructions provided with the antenna. Connect RF cable from antenna to the back of the TDFM-136A unit by utilizing the BNC mating connector provided in the installation kit.

### **2.6 INSTALLATION - PIN LOCATIONS AND CONNECTIONS**

A single 15 pin DSUB connector, mounted on the rear of the unit, provides the means to connect all power, control and audio signals between the TDFM-136A and the airframe. The pin numbers and locations for the 15 pin DSUB connector are shown in figure 2-1 below. The view shown is of the connector mounted in the unit, select mating connector appropriately.



**FIGURE 2.1** Transceiver mounted view of 15-pin male connector

Table 2-1 provides the description of the pin connections for the transceiver.

<b>TABLE 2-1 TDFM-136A - Rear Connector Pin Assignments</b>		
<b>Pin #</b>	<b>Description</b>	<b>Notes</b>
1	Audio - Headset	Output - 600 Ohms
2	Serial Data Out	Output - RS232
3	Power - Panel Lighting	28 VDC Standard, 5VDC Optional
4	Signal - Memory Up	Input - active low
5	Signal - Memory Down	Input - active low
6	Audio - Microphone	Input
7,14	Power - Main +28VDC	Power
8,15	Power - Main Ground	Power
9	Audio - Speaker	4-Ohm Speaker Output
10	Signal Ground	4-Ohm / 600-Ohm Output Ground
11	Serial Data In	Input - RS232
13	Signal - PTT	Input - active low

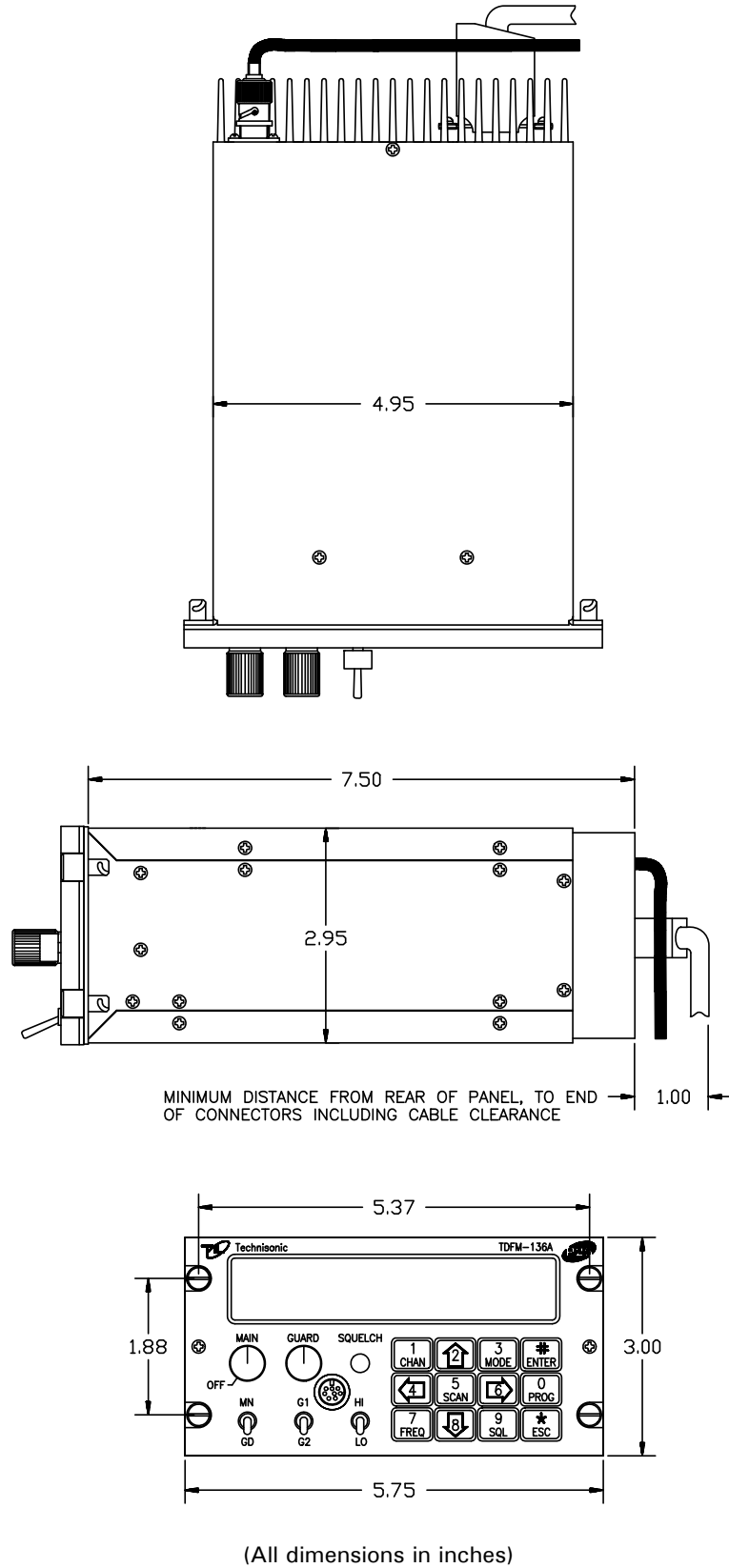


FIGURE 2-2 Outline Drawing for Model TDFM-136A Transceiver

## 2.7 WIRING INSTRUCTIONS – 15-PIN D-CONNECTOR

Figure 2-3 shows all required connections and recommended wire sizes for the TDFM-136A Transceiver operation in the airframe.

### 2.7.1 Main Power +28 VDC

The main power +28VDC ( $\pm 15\%$ ) is connected to pins 7 and 14 of the 15-pin D-connector on the transceiver. Both pins should be connected.

### 2.7.2 Main Ground

Ground connections for the transceiver are made on pins 8 and 15. Both pins should be connected.

### 2.7.3 PTT (Ground Keying)

The PTT line is connected to pin 13 and should be floating when the transceiver is in receive mode, and grounded during transmit mode.

### 2.7.4 Front Panel Back Lighting

Front panel back lighting connection should be made on pin 3 of the transceiver. The opposite end of this lead should be connected to the panel lighting system of the aircraft. Before connecting, verify the required panel lighting voltage (28 VDC or 5 VAC) on the transceiver configuration control label.

### 2.7.5 Audio Outputs (600 Ohms and 4 Ohms)

The audio output from pin 9 can be used to drive a 4 ohm speaker up to 2.5 watts. Audio output from pin 1 is 600 Ohms, 0.5 watts maximum.

### 2.7.6 Audio Output Ground

Pin 10 is the ground for both the 4 and 600 Ohms audio output signals on pins 9 and 1.

### 2.7.7 Mic Signal Input

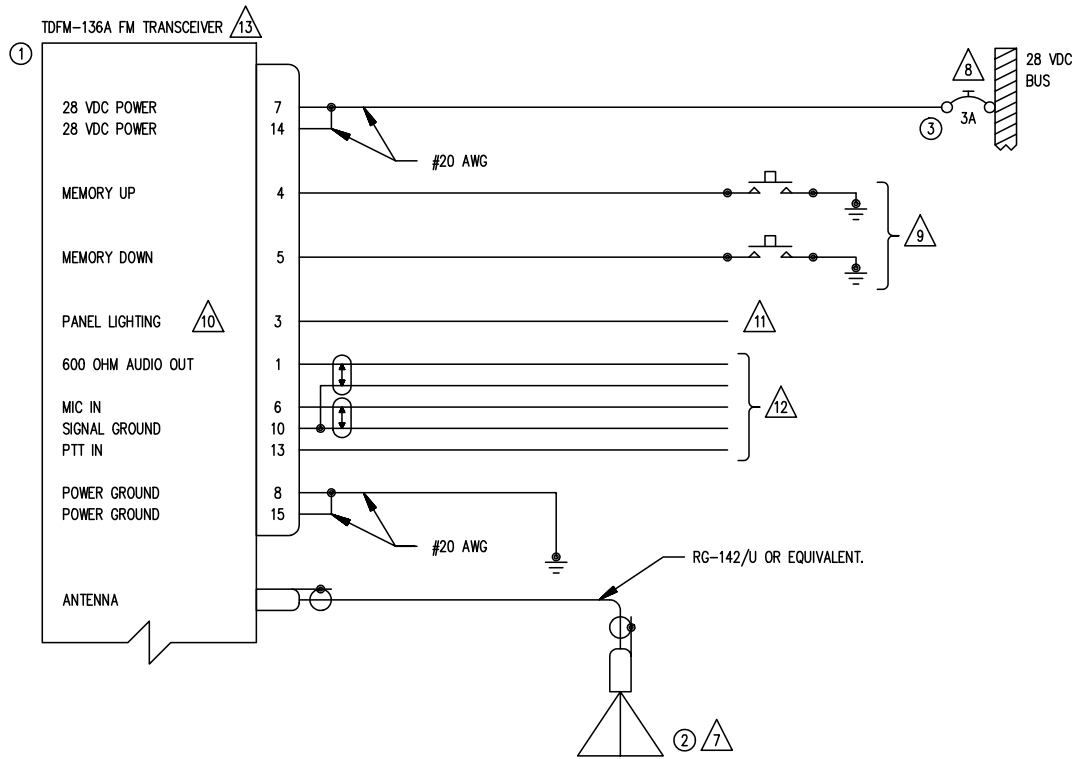
The microphone input signal is to be provided on pin 6, utilizing shielded wire with the shield grounded to pin 10.

### 2.7.8 Memory Up/Memory Down

Remote scrolling through the 25 memory positions can be achieved by providing a ground to pins 4 (up) and 5 (down) through a momentary contact cyclic switch.

### 2.7.9 Data Input

Channel data may be transferred to and from the unit using RS-232 communications protocol via pins 2 and 11.



QTY	ITEM	PART NUMBER	DESCRIPTION	SPEC	MATERIAL
1	1	TDFM-136A	VHF/FM COMMUNICATIONS TRANSCIEVER.	TECHNISONIC INDUSTRIES LIMITED	
1	2	CI-292-3	ANTENNA	COMANT	
1	3	7274-11-3	CIRCUIT BREAKER, 3 AMPS	KLIXON	

**NOTES:**

- 1) ALL WIRE IAW MIL-W-22759 UNLESS OTHERWISE SPECIFIED.
- 2) ALL CABLE IAW MIL-C-27500 UNLESS OTHERWISE SPECIFIED.
- 3) COAXIAL CABLE IAW MIL-C-17 UNLESS OTHERWISE SPECIFIED. DO NOT USE COAX WITH PVC INSULATION.
- 4) FABRICATION & INSTALLATION OF WIRING HARNESS IAW AC 43.13-1A CHAPTER 11, SECTION 3, PARA 445 TO 462 AND SECTION 7.
- 5) GROUNDING AND BONDING IAW AC 43.13-1A CHAPTER 11, SECTION 3, PARA 452.
- 6) ALL SINGLE WIRE TO BE #22 AWG MINIMUM AND ALL SHIELDED WIRE TO BE #24 AWG MINIMUM, UNLESS OTHERWISE SPECIFIED.
- 7) INSTALLATION OF ANTENNA IAW AC 43.13-1A CHAPTER 2, SECTION 3, CHAPTERS 5 & 6, AND AC 43.13-2A CHAPTER 3. IF POSSIBLE, THE ANTENNA SHOULD BE LOCATED A MINIMUM OF 12 FT FROM AIRCRAFT NAVIGATION RECEIVER ANTENNAS AND A MINIMUM OF 4 FEET FROM AIRCRAFT COMMUNICATIONS AND ELT ANTENNAS. BE CAREFUL NOT TO CHOSE SEPARATIONS THAT CLOSELY APPROXIMATE 1/4 OR 1/2 OR WHOLE NUMBER MULTIPLES OF THE NAVIGATION OR COMMUNICATIONS SYSTEM WAVELENGTH.
- 8) AN EQUIVALENT CIRCUIT BREAKER OR FUSE MAY BE USED.
- 9) THE MEMORY UP/DOWN PUSH BUTTONS ARE OPTIONAL.
- 10) THE TDFM-136B IS AVAILABLE WITH 28V OR 5V PANEL LIGHTING. CHECK THE CONFIGURATION CONTROL LABEL FOR THE CORRECT VOLTAGE.
- 11) CONNECT TO THE APPROPRIATE AIRCRAFT DIMMING BUSS.
- 12) CONNECT TO THE AIRCRAFT AUDIO SYSTEM OR STAND-ALONE HEADSET JACKS.
- 13) INSTALLATION OF TRANSCIEVER IAW AC 43.13-1A CHAPTER 2, SECTION 3 AND AC 43.13-2A, CHAPTER 2. PR 3 1/2 DZUS RAIL OR EQUIVALENT MAY BE USED.
- 14) TEST THE SYSTEM IN ACCORDANCE WITH THE POST-INSTALLATION TEST PROCEDURE IN THE INSTALLATION AND OPERATING INSTRUCTIONS MANUAL.
- 15) REFER TO THE AIRCRAFT STRUCTURAL REPAIR MANUAL AND THE MAINTENANCE MANUAL FOR INSTRUCTIONS AND INFORMATION PERTINENT TO THIS INSTALLATION.
- 16) THE USE OF RED DISPLAYS SHOULD BE MINIMIZED OR AVOIDED SO AS NOT TO DETRACT FROM THE ATTENTION GETTING CHARACTERISTICS NEEDED IN WARNING AND CAUTION ANNUNCIATORS. RED SHOULD BE USED TO ANNUNCIATE EMERGENCY CONDITIONS REQUIRING IMMEDIATE RESPONSE BY THE FLIGHT CREW. UNITS WITH RED DISPLAYS SHOULD NOT BE LOCATED IN CLOSE PROXIMITY TO WARNING AND CAUTION ANNUNCIATORS. THE INSTALLATION OF UNITS WITH RED DISPLAYS MUST BE EVALUATED ON A CASE BY CASE BASIS TO ENSURE THAT THE EFFECTIVENESS OF THE WARNING AND CAUTION ANNUNCIATORS IS NOT ADVERSELY AFFECTED.

**Figure 2-3 Wiring Connections for TDFM-136A Transceiver**



## 2.8 TRANSMITTER SIDE TONE LEVEL ADJUSTMENT

The side tone level is set at the factory; however, this level can be altered to suit local conditions as follows:

1. Set the transceiver operating frequency to 155.000 MHz and connect an appropriate test receiver to the RF output connector. Ensure that the output of the transceiver is terminated into a proper dummy load.
2. Key the transmitter and input a 1 kHz audio signal @ -10 dBm (0.25 VRMS) into the microphone input.
3. Select the side-tone adjust command (L2-7) and then adjust the side-tone level using the up/down arrows (keys 2 & 8) to produce a +3.0 dBm (1.0 VRMS) 600 Ohm audio output.

## 2.9 MAIN AND GUARD NOISE SQUELCH ADJUSTMENT

The squelch (on both the main and guard receivers) is factory set to open at approximately 0.5 micro-volts. This adjustment can be altered to suit local conditions as follows:

1. Set the main receiver of the transceiver to 155.000 MHz. Connect a signal generator to the antenna input of the transceiver.
2. Set the signal generator to produce a  $\pm 3$  deviation with a 1 kHz tone on 156.000 MHz. Increase the signal generator RF level from 0.1 uV until the squelch indicator LED is on. Verify the receiver SINAD ratio is between 12 and 14 dB.
3. If not, re-adjust main receiver squelch via the main receiver squelch software command.
4. Repeat the above procedure to adjust the guard receiver squelch setting using guard receiver squelch adjustment software command.

## 2.10 REFERENCE LAYOUTS

A reference layout indicating the position of control points for the MCU board is shown in Figure 2-4.

- J2: Boot Program Enable - factory set **DO NOT INSTALL**  
 J4: Option Jumpers:  
     1-2 Maintenance Mode Enable - **DO NOT INSTALL IN AIRFRAME, BENCH ONLY**  
     2-4 **Factory Use Only – DO NOT INSTALL**  
     5-6 n/u reserved
- R8: Main Rx Audio adjust - factory set  
 R10: Tx Mic Audio Level Adjust – factory set  
 R11: Guard Rx Audio adjust – factory set  
 R17: RF Low power adjust – factory set  
 R18: RF High power adjust – factory set  
 R56: DTMF Level Adjust – factory set

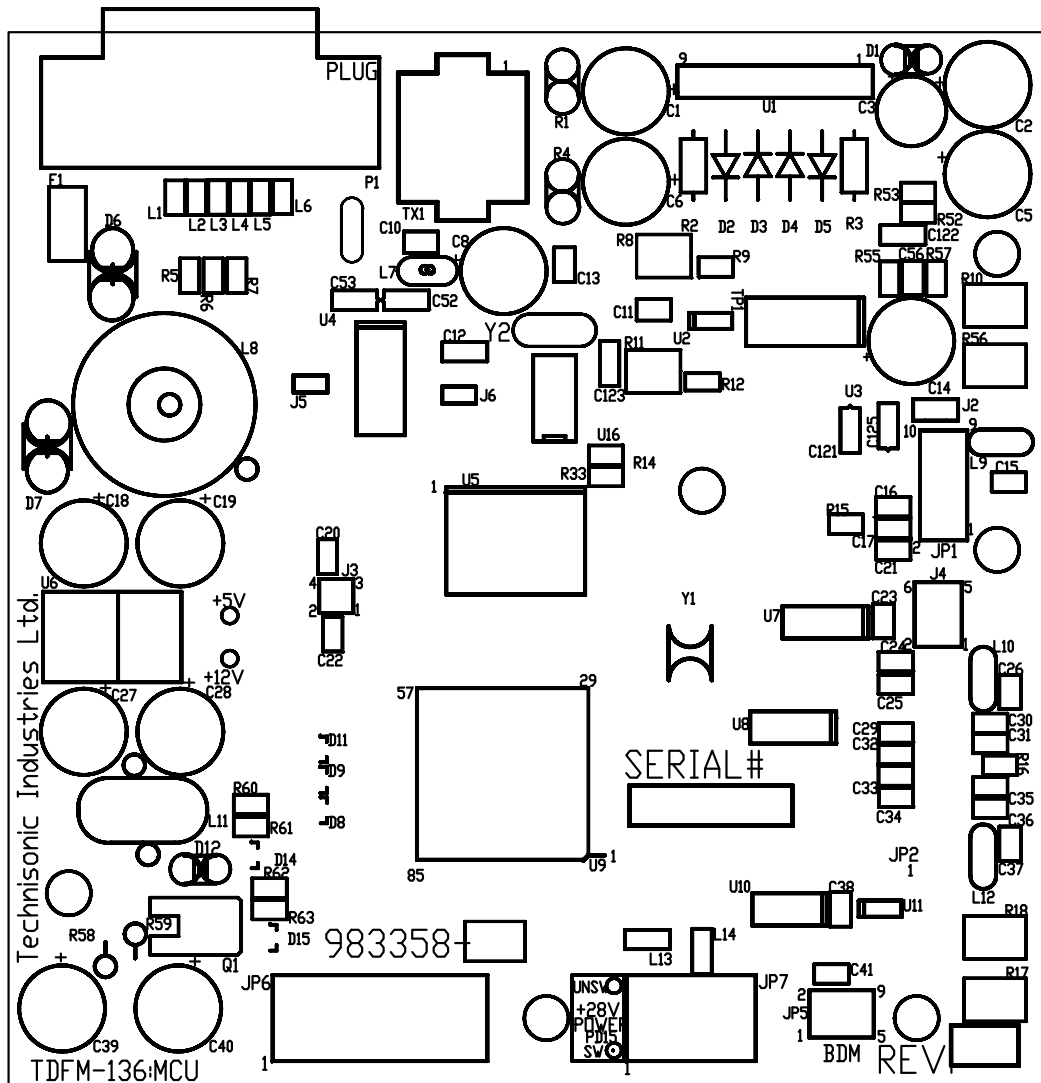


FIGURE 2-4 Control points for the TDFM-136A MCU Board

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## **APPENDIX A – POST INSTALLATION EMI TEST INSTRUCTIONS”**

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### **PURPOSE**

The purpose of these tests is to identify any interference that the TDFM-136A may cause with existing aircraft systems.

### **TEST CONDITIONS**

The TDFM-136A transceiver should be installed and function tested. The antenna VSWR should be checked. A forward/reverse power check with an in-line wattmeter should show no more than 10% reflected power. For the following tests, insure that the power switch is in the high position.

### **METHODOLOGY**

Most of the EMI tests can be accomplished on the ground. In some cases flight testing is required or is easier. If the aircraft is approved for IFR operations, then it is mandatory that interference between the TDFM-136A Airborne FM and the approach aids be checked in flight.

The GPS should be operational and navigating with at least the minimum compliment of satellites. The VHF COMM should be set to the frequencies indicated with the squelch open. VOR/DME receivers should be set to the frequencies indicated and selected for display. If possible, set up a DME ramp test set on the frequencies indicated and adjust the output until the flags are out of view. The transponder and encoder should be monitored with ramp test equipment. Set the output of the transponder test set to 3db above the output necessary to achieve 90% reply. If possible set the ADF to a nearby navigation station.

Modulate the TDFM-136A transmitter on the indicated frequencies for at least 20 seconds. Observe the GPS for any degradation in satellite status or availability or flags. Listen for any noise or detected audio signals on the VHF COMM(s). Listen for any noise or detected audio signals on the VOR/LOC receiver audio; look for any movement of flags or needles on the VOR/LOC/GS navigation display(s). Observe the transponder for any loss of reply or spurious reply.

List the power plant, fuel and other electric instruments in the chart provided and note any anomalies that occur while transmitting. Assess the results.

If the aircraft is equipped with an auto-pilot or a stability augmentation system, then test fly the aircraft and verify that operation of the TDFM-136A transceiver does not have adverse effects on these systems. After checking for gross effects at a safe altitude, fly an approach with each of the different navigation systems coupled to the auto-pilot (ILS, GPS etc.) and look for any anomalies.

### **RESULTS**

If the installed system passes all of the applicable EMI tests, then no further action is required. If interference is observed, then the interference must be assessed against the appropriate standards of airworthiness for the system in question. For example, it is permissible for a VFR certified GPS to lose navigation capability while the TDFM-136A is transmitting providing that it recovers properly and promptly, but is not permissible for an IFR approach certified GPS to be affected in the same way. A complete discussion of all the standards of airworthiness to be applied in assessing EMI effects is beyond the scope of this document.

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**PROCEDURE**

- A.** Operate the TDFM-136A transmitter on the following frequency for at least 20 seconds. Observe the GPS for any degradation in satellite status or availability or flags.

FREQUENCIES	GPS #1		GPS #2	
	PASS	FAIL	PASS	FAIL
143.1800 MHz				
143.1825 MHz				
157.5000 MHz				
157.5425 MHz				

**NOTES:**

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- B.** Determine if the image frequency for the VHF COMM falls within the range of the TDFM-136A. If so, select a set of frequencies that will cause the TDFM-136A to be set as close as possible to the image frequency. Any one of the many possible sets will suffice. Record those values in the spaces provided in the following chart. Modulate the TDFM-136A transmitter on the following frequencies for at least 20 seconds. Listen for any noise or detected audio signals on the VHF Comm.

**EXAMPLE:** Bendix/King KY 196A.

The first IF frequency is 11.4 MHz. The LO is above the receive frequency (high side injection). Therefore, the image frequency is 22.8 MHz above the selected frequency. Set the KY 196A to 120.000 MHz and the TDFM-136A to 142.8000 MHz.

FREQUENCIES		RESULTS	
VHF #1	TDFM-136A	PASS	FAIL
135.975 MHz	135.975 MHz		
121.150 MHz	121.150 MHz		
131.250 MHz	131.250 MHz		
Image			

FREQUENCIES		RESULTS	
VHF #2	TDFM-136A	PASS	FAIL
138.0000 MHz	138.0000 MHz		
157.5000 MHz	157.5000 MHz		
157.5000 MHz	157.5000 MHz		
Image			

**NOTES:**

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- C. Determine if the image frequency for the VOR/ILS Nav falls within the range of the TDFM-136A. If so, select two sets of frequencies that will cause the TDFM-136A to be set a close as possible to the image frequency. Chose one set in the localizer frequency range and one in the VOR frequency range. Record those values in the spaces provided in the following chart. Modulate the TDFM-136A transmitter on the following frequencies for at least 20 seconds. Listen for any noise or detected audio signals on the receiver audio; look for any moment of flags or needles on the navigation display.

FREQUENCIES		RESULTS	
VOR / ILS #1	TDFM-136A	PASS	FAIL
108.000 MHz	162.0000 MHz		
108.100 MHz	162.1500 MHz		
Image			
Image			

FREQUENCIES		RESULTS	
VOR / ILS #2	TDFM-136A	PASS	FAIL
108.000 MHz	162.0000 MHz		
108.100 MHz	162.1500 MHz		
Image			
Image			

**NOTES:**

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- D. Modulate the TDFM-136A transmitter on the following frequencies for at least 20 seconds. Observe the Glide Slope displays. Look for any movement of flags or needles on the Navigation display.

FREQUENCIES		RESULTS	
Glide slope #1	TDFM-136A	PASS	FAIL
334.7 (108.1)	167.3500 MHz		

FREQUENCIES		RESULTS	
Glide slope #2	TDFM-136A	PASS	FAIL
334.7 (108.1)	167.3500 MHz		

**NOTES:**

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For the following tests (E & F), select a frequency at the top, middle and bottom of the band of the TDFM-136A Transceiver.

<b>VHF Band (138 to 174 Mhz)</b>	
Frequency No. 1	
Frequency No. 2	
Frequency No. 3	

- E.** At a safe altitude engage the autopilot or stability augmentation system. Modulate the TDFM-136A on the above frequencies for at least 20 seconds. Observe any effect on the autopilot or stability augmentation system.

**Observations:**

- F.** Perform a coupled ILS approach to the aircraft's certified limits. Modulate the TDFM-136A transmitter on the above frequencies for at least 20 seconds. Observe any effect on the autopilot. Repeat for second flight director/autopilot if so equipped.

**Observations:**



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- G.** List the power plant, fuel and other electric instruments in the chart provided and note any anomalies that occur while transmitting. Assess the results.

<b>STEP</b>	<b>SYSTEM</b>	<b>PASS</b>	<b>FAIL</b>	<b>NOTES</b>
1	COMM 1 and 2			
2	Transponder and Encoder			
3	ADF 1 and 2			
4	Vertical Gyro			
5	Glide slope 1 and 2			
6	VOR/LOC 1 and 2			
7	Directional Gyro			
8	Compass			
9	Fuel Pressure			
10	Oil Temperature			
11	Ammeter			
12	Bus Voltage			
13	Fuel			
14	Nt			
15	TOT			
16	% Torque			
17	Digital Clock			
18	Oil Pressure			
19	Annunciators			



