

TDFM-136B

VHF/FM DIGITAL AIRBORNE TRANSCEIVER



INSTALLATION INSTRUCTIONS

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Technisonic Industries Limited

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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

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 two 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.

WARRANTY INFORMATION

The Model TDFM-136B, VHF/FM Digital Transceiver is under warranty for one year from date of purchase. Failed units caused by defective parts, or workmanship should be returned to:

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Ontario L4Z 1W7

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STC APPROVALS

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 it's 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 DO-160C test data, referenced below, are 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 Industries Ltd., 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 factory authorized 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 for the latest issue of available STC's and letter of authorization for use.

Table of Contents

Table of Contents.....	vi
Table of Tables.....	vii
Table of Figures.....	vii
SECTION 1 - GENERAL DESCRIPTION	1-1
1.1 Introduction.....	1-1
1.2 Description.....	1-1
1.3 Purpose of Equipment.....	1-1
1.4 Model Variation.....	1-2
1.5 Technical Characteristics.....	1-2
1.6 Certification Summary.....	1-4
SECTION 2 - INSTALLATION INSTRUCTIONS	2-1
2.1 General.....	2-1
2.2 Equipment Packing Log.....	2-1
2.3 Transceiver Installation	2-1
2.4 Installation Kit - Contents.....	2-1
2.5 Antenna Installation	2-1
2.6 Installation - Pin Locations and Connections.....	2-2
2.7 Wiring Instructions.....	2-4
2.7.1 Main Power +28VDC.....	2-4
2.7.2 Main Ground.....	2-4
2.7.3 PTT (Ground Keying).....	2-4
2.7.4 Front Panel Back Lighting.....	2-4
2.7.5 Audio Outputs (600 ohms and 4 Ohms).....	2-4
2.7.6 Audio Output Ground	2-4
2.7.7 Mic Signal Input.....	2-4
2.7.8 Memory Up/Memory Down.....	2-6
2.7.9 Data Input/Output.....	2-6
2.8 Transmitter Side Tone Level Adjustment.....	2-6
2.9 Main and Guard Noise Squelch Adjustment.....	2-6
2.10 Reference Layouts.....	2-7
SECTION 3 - APPENDICIES	3-1
3.1 Appendix A CTCSS TONE TABLES and DCS CODE TABLES.....	3-1
3.2 Appendix B - POST INSTALLATION EMI TEST INSTRUCTIONS.....	3-2
3.2.1 PURPOSE.....	3-2
3.2.2 TEST CONDITIONS.....	3-2
3.2.3 METHODOLOGY.....	3-2
3.2.4 RESULTS.....	3-3
3.2.5 PROCEDURE.....	3-4

Table of Figures

Figure 2-1. Transceiver Mounted View of the 15 Pin Connector.....	2-2
Figure 2-2. Wiring Connections for TDFM-136B Transceiver.....	2-3
Figure 2-3. Outline Drawing for TDFM-136B Transceiver.....	2-4
Figure 2-4. Control points for the TDFM-136B MCU Board.....	2-7

Table of Tables

Table 1-1. TDFM-136B – Model Variation.....	1-2
Table 1-2. TDFM-136B – General Characteristics.....	1-2
Table 1-3. TDFM-136B – Operational Characteristics.....	1-3
Table 1-4. TDFM-136B – Receiver Characteristics – Main and Guard.....	1-3
Table 1-5. TDFM-136B – Transmitter Characteristics.....	1-4
Table 1-6. TDFM-136B – Environmental Testing Summary.....	1-4
Table 3-1. TDFM-136B - Rear Connector Pin Assignments.....	2-2

GENERAL DESCRIPTION

1.1 Introduction

This publication provides operating and installation information for the TDFM-136B, Digital Transceiver manufactured by Technisonic Industries Limited. The TDFM-136B 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-136B 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-136B, Transceiver is a frequency agile, fully synthesized airborne transceiver capable of operating in the 136.000 MHz to 174.000 MHz frequency range in 2.5kHz 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-136B 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-136B, 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

The base Part Number for the Model TDFM-136B is 081252, there are three parameters that affect model variation: display lighting, number of antennae, and encryption operation. The possible combinations result in 12 possible extensions to the base part number, these are shown in Table 1-1 below.

Table 1-1. TDFM-136B - Model Variation			
Parameter			Part Number
Display Lighting	Antennae	Encryption Capable	
Green	Single	No	081252-1-10
Green	Single	Yes	081252-1-11
Green	Dual	No	081252-1-20
Green	Dual	Yes	081252-1-21
Red	Single	No	081252-2-10
Red	Single	Yes	081252-2-11
Red	Dual	No	081252-2-20
Red	Dual	Yes	081252-2-21
N/V	Single	No	081252-3-10
N/V	Single	Yes	081252-3-11
N/V	Dual	No	081252-3-20
N/V	Dual	Yes	081252-3-21

1.5 Technical Characteristics

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

Table 1-2. TDFM-136B - 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 / 5 Volts
Display Colour	Green (standard) Red (specify) NVG (specify)
Temperature Range: Operating Storage	-45°C to +70°C -55°C to +85°C
Altitude	50,000 feet

Table 1-3. TDFM-136B – Operational Characteristics	
Characteristic	Specification
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:	230 memories
Scan Lists	15 scan lists
Description	Up to 8 characters, alpha-numeric
Operating Modes	Analog Wide, Analog Narrow, P25 Digital
Frequency	Rx/Tx (Simplex/Duplex), 136.0000 – 174.0000
Squelch Modes	Rx/Tx (Simplex/Duplex), CTCSS Tones, DCS Codes, P25 TalkGroup, P25 NAC
Guard Receiver:	2 channels programmed with:
Description	Up to 8 characters, alpha-numeric
Operating Modes	Analog Wide, Analog Narrow, Digital
Frequency	Rx/Tx (Simplex/Duplex), 136.0000 – 174.0000 MHz.
Squelch Modes	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*) codes
P25 TalkGroup	\$0000 to \$FFFF (0 to 65535)
P25 Network Access Code (NAC)	\$000 to \$FFF (0 to 4095)

* DPL is a trademark of Motorola Corporation

Table 1-4. TDFM-136B – Receiver Characteristics – Main and Guard	
Characteristic	Specification
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

Table 1-5. TDFM-136B – Transmitter Characteristics	
Characteristic	Specification
RF Output Power: Low High	1 watt 10 watts
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
Side-tone Output	0.5W (max) into 600ohms
Harmonic Attenuation	-65 dB below carrier level
FM Hum And Noise	-40 dB
Audio Input	50 mV at 2.5 into 200Ω 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-136B, VHF Digital Transceiver.

Table 1-6. TDFM-136B – Environmental Testing Summary		
Conditions	Section	Conducted Test
Temperature and Altitude	4.0	Equipment tested to Categories B2 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 A.
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

This section contains information and instructions for the correct installation of the TDFM-136B, 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.

2.1 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.

2.2 Transceiver Installation

The TDFM-136B Transceivers are designed to be Dzus mounted and should be installed in conjunction with a IN-150 installation kit. See Figure 2-3 for an outline drawing of the unit with dimensions to facilitate the installation.

2.3 Installation Kit - Contents

The IN-150 installation kit consists of:

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

2.4 Antenna Installation

Antenna, P/N CI-292, or a suitable equivalent, may be used with the TDFM-136B 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 the instructions provided with the antenna. Connect RF cable from antenna to the back of the TDFM-136B unit by utilizing the BNC mating connector provided in the installation kit.

2.5 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-136B 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.

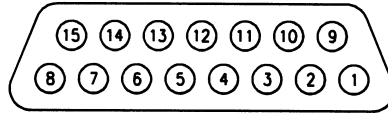
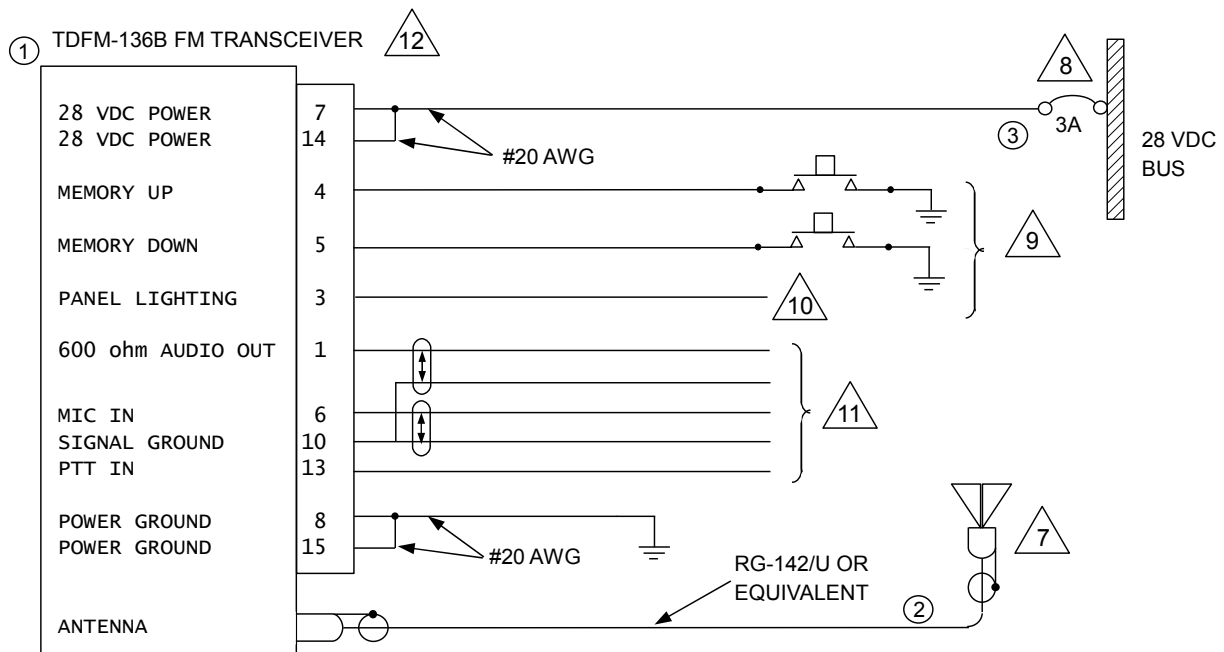


Figure 2-1. Transceiver Mounted View of the 15 Pin Connector

The description of the pin connections for the transceiver are provided in TABLE 3-1.

Pin #	Description	Notes
1	Audio - Headset	output – 600 ohm
2	Serial Data Out	output – RS232
3	Power - Panel Lighting	28VDC standard, 5VDC option
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	output – 4 ohm
10	Signal Ground	
11	Serial Data In	input – RS232
13	Signal – PTT	input – active low

Detailed wiring information is supplied in figure 2-2 below.



QTY	ITEM	PART NUMBER	DESCRIPTION	SPEC	MATERIAL
1	1	TDFM-136B	VHF/FM COMMUNICATIONS TRANSCEIVER	TECHNISONIT INDUSTRIES LTD.	
1	2	CI-292	ANTENNA	COMANT INDUSTRIES	
1	3	11/03/74	CIRCUIT BREAKER, 3A	KLIXON	

NOTES:

- 1) ALL WIRE IAW MIL-W-22579 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 AC43.13-2A 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) CONNECT TO THE APPROPRIATE AIRCRAFT DIMMING BUSS.

11) CONNECT TO THE AIRCRAFT AUDIO SYSTEM OR STAND-ALONE HEADSET JACKS.

12) INSTALLATION OF TRANSCEIVER IAW AC 43.13-1A CHAPTER 2, SECTION E AND AC 43.13-2A, CHAPTER 2. PR 3 1/2 DZUS RAIL OR EQUIVALENT MAY BE USED.

- 13) TEST THE SYSTEM IN ACCORDANCE WITH THE POST-INSTALLTION TEST PROCEDURE IN THE INSTALLATION MANUAL.
- 14) REFER TO THE AIRCRAFT STRUCTURAL REPAIR MANUAL AND THE MAINTENANCE MANUAL FOR INSTRUCTIONS AND INFORMATION PERTINENT TO THIS INSTALLATION.
- 15) 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 2-2. Detailed Wiring Connections for TDFM-136B Transceiver

2.6 Physical Dimensions

Figure 2-3 below shows the physical dimensions of the unit

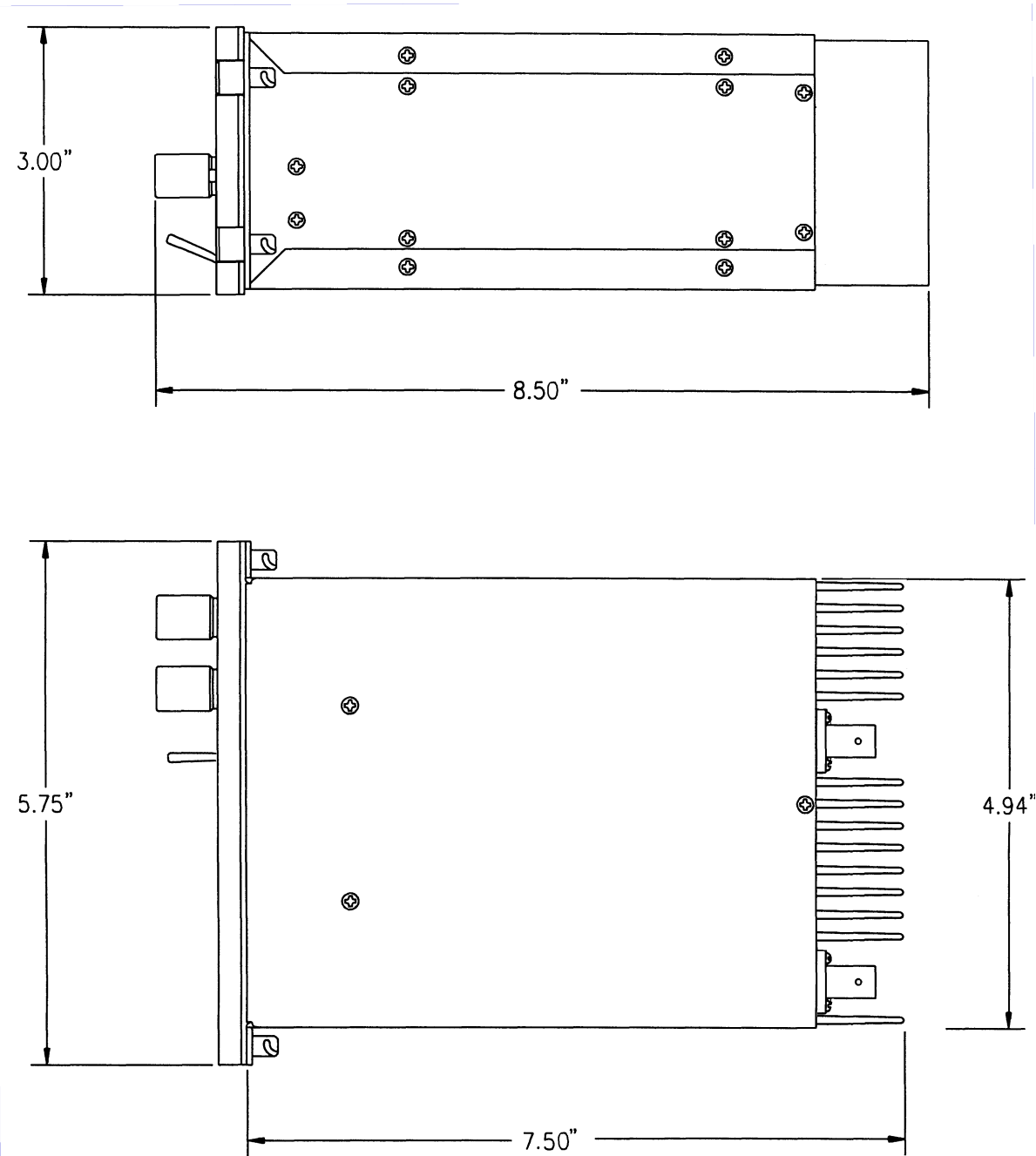


Figure 2-3. Outline Drawing for TDFM-136B Transceiver

2.7 Wiring Instructions

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

2.7.1 Main Power +28VDC

The main power +28VDC ($\pm 15\%$) is connected to pins 7 and 14 of 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, the unit is compatible with both 28V and 5V lighting bus voltages.

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 ohm and 600 ohm 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, utilising shielded wire with the shield grounded to pin 10.

2.7.8 Memory Up/Memory Down

Remote scrolling through the 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/Output

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

2.8 Transmitter Side Tone Level Adjustment

The side tone level is set at the factory and there is no hardware adjustment. However, this level can be altered, via the radio software, to suit local conditions as follows:

1. Set the transceiver operating frequency to 155.0000 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, and then adjust the side-tone level using the up/down arrows (keys 2 & 8) to produce a +3.0 dBm (1.0 VRMS) at the 600 ohm audio output (headset 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 microvolts, there is no hardware adjustment. However, this value can be altered, via the radio software, 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 ± 3 deviation with a 1 kHz tone on 156.0000 MHz. Increase the signal generator RF level from 0.1 μ V 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 Edit 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

The reference layout shown in figure 3-4 below, shows the position of jumper control points for the MCU board.

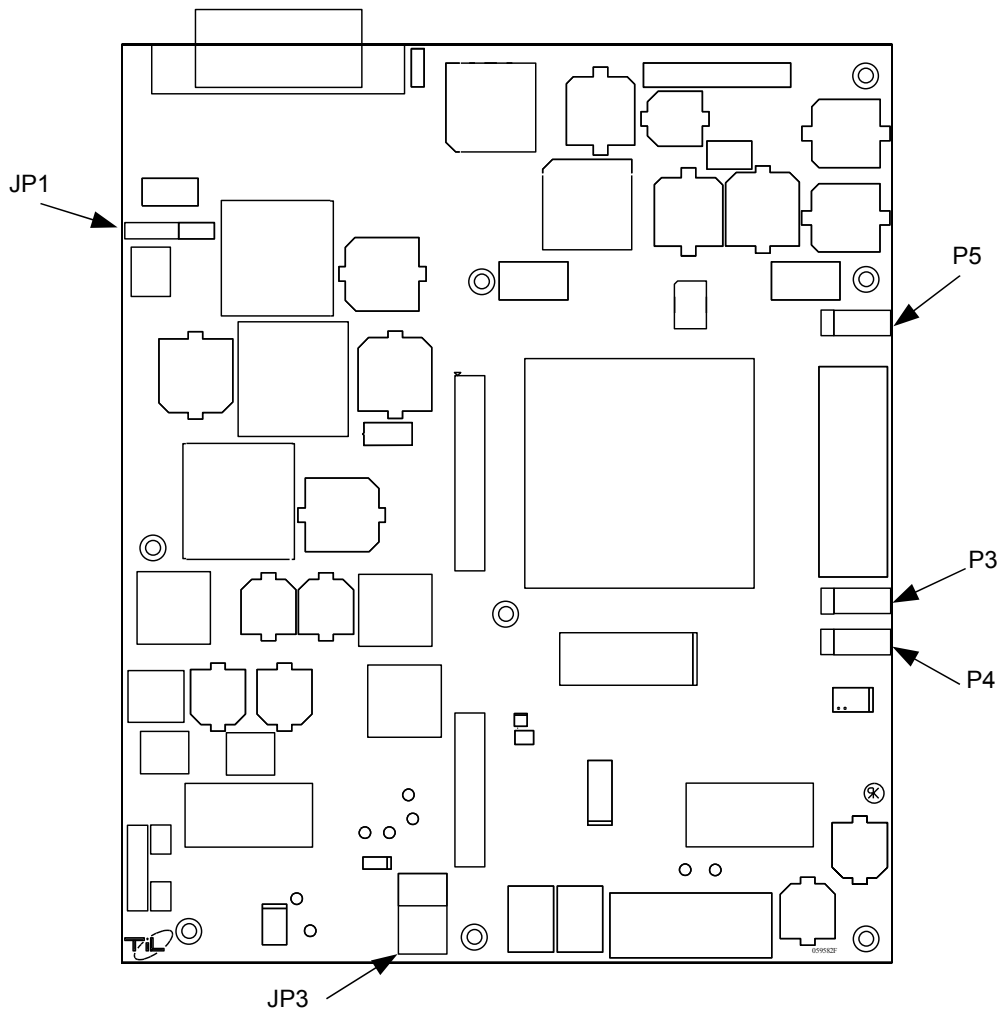


Figure 2-4. Control points for the TDFM-136B MCU Board

- JP1: Front Panel Power Switch bypass jumper. Insert a shunt to power unit with no front panel attached. Default: no shunt installed.
- JP3: Serial Communications Protocol Select Jumper:
 1-3 & 2-4: RS-485 - default
 3-5 & 4-6: RS-232
 all other combinations are invalid.
- P3: factory use only, no shunt installed
 P4: factory use only, no shunt installed
 P5: Restricted Access Lock Select.

SECTION 3

Appendices

3.1 Appendix A CTCSS TONE TABLES and DCS CODE TABLES

Available CTCSS Tones
Tone
67
69.3
71.9
74.4
77
79.7
82.5
85.4
88.5
91.5
94.8
97.4
100
103.5
107.2
110.9
114.8
118.8
123
127.3
131.8
136.5
141.3
146.2
151.4
156.7
162.2
167.9
173.8
179.9
186.2
192.8
203.5
206.5
210.7
218.1
225.7
229.1
233.6
241.8
250.3
254.8

Available DCS Codes	
Code	Code
23	315
25	331
26	343
31	346
32	351
43	364
47	365
51	371
54	411
65	412
71	413
72	423
73	431
74	432
114	445
115	464
116	465
125	466
131	503
132	506
134	516
143	532
152	546
155	565
156	606
162	612
165	624
172	627
174	631
205	632
223	654
226	662
243	664
244	703
245	712
251	723
261	731
263	732
265	734
271	743
306	754
311	

3.2 APPENDIX B - POST INSTALLATION EMI TEST INSTRUCTIONS

3.2.1 PURPOSE

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

3.2.2 TEST CONDITIONS

The TDFM-136B 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.

3.2.3 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-136B 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-136B 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-136B 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.

3.2.4 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-136B 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.

3.2.5 PROCEDURE

- A. Operate the TDFM-136B 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:

- B. Determine if the image frequency for the VHF Comm falls within the range of the TDFM-136B. If so, select a set of frequencies that will cause the TDFM-136B 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-136B 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 L.O. 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-136B to 142.8000 MHz.

Frequencies		Results	
VHF #1	TDFM-136B	Pass	Fail
135.975 MHz	138.0000 MHz		
121.150 MHz	157.5000 MHz		
131.250 MHz	157.5000 MHz		
Image			

Frequencies		Results	
VHF #2	TDFM-136B	Pass	Fail
135.975 MHz	138.0000 MHz		
121.150 MHz	157.5000 MHz		
131.250 MHz	157.5000 MHz		
Image			

NOTES:

- C. Determine if the image frequency for the VOR/ILS Nav falls within the range of the TDFM-136B. If so, select two sets of frequencies that will cause the TDFM-136B to be set as close as possible to the image frequency. Choose 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-136B 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-136B	Pass	Fail
108.000 MHz	162.0000 MHz		
108.100 MHz	162.1500 MHz		
Image			
Image			

Frequencies		Results	
VOR / ILS #2	TDFM-136B	Pass	Fail
108.000 MHz	162.0000 MHz		
108.100 MHz	161.1500 MHz		
Image			
Image			

NOTES:

- D. Modulate the TDFM-136B 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-136B	Pass	Fail
334.7 (108.1)	167.3500 MHz		

Frequencies		Results	
Glide slope #2	TDFM-136B	Pass	Fail
334.7 (108.1)	167.3500 MHz		

NOTES:

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

VHF Band (138 to 174 Mhz)	
Frequency No. 1	
Frequency No. 2	
Frequency No. 3	

- E. At a safe altitude engage the autopilot or stability augmentation system. Modulate the TDFM-136B 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-136B 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:

- 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.

Step	System	Pass	Fail	Notes
1	Comm 1 and Comm 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			

Step	System	Pass	Fail	Notes
20				
21				
22				
23				
24				
25				
26				
27				

NOTES: