



TDFM-7000

MULTIBAND P25 AIRBORNE TRANSCEIVER

(With Modification No. 3 Installed)



Installation and Operating Instructions

**TiL Document No. 05RE375
Rev. N/C Issue 14**

AUGUST 2010

Technisonic Industries Limited

240 Traders Boulevard, Mississauga, Ontario L4Z 1W7

Tel: (905) 890-2113 Fax: (905) 890-5338

www.til.ca

Copyright by Technisonic Industries Limited. All rights reserved.

IMPORTANT INFORMATION

As of January 1st, 2013, the FCC will no longer allow transceivers to be delivered to the USA that are capable of wide band (25kHz) channel spacing in the commercial 2 way mobile / base sections of the VHF and UHF bands. TDFM-7000 transceivers delivered to the USA after this date will no longer support wide band operation on those bands. The 700 and 800 MHz bands are not affected.

REVISION HISTORY

[05RE375]

REV	SECTION - PAGE -	DESCRIPTION	DATE	EDITED BY
N/C Issue 4	Global A ii 3-6	CR# 09501 Added Headers/Footers and Editing may have caused pages to be added and re-sequenced as a result. Removed US address. Added NOTICE to the street address and postal code change that may appear different throughout this manual. Table of Contents -added Fig 2.2 (missing) Figure 3-2 contains typo VHFHI (II) should read UHFHI (II)		
Issue 5	2-10	CR# 09781 Tables 2.1 & 2.2 updated/changed Revisions made to the tone/code tables (PL and DPL) that are supported by the TDFM-7000	JAN 2009	FM
	3-6,7	Fig 3.2 split in half and enlarged.	JUN 2009	FM
Issue 6	3-18,3-19 added	Appendix is now section 3.18. 3.19 added for Software Option to Control Latitude Satellite Gateway S200-SG11		
	Section 2	Updated programming section and added TIBFM 12-01 Rev E as Appendix A	SEP 2009	FM
Issue 7	2-6 3-4 3-7	Para 2.16 correct typo regarding appendix A Para 3.10,3.11,3.12 correct typo correct TOC as well Fig 3.2b correct typo c1-292 to c1-292-3,-4 Revision history sheet correct typo	OCT 2009	FM
Issue 8	iv v 2-12	Added Edited by column in Revision History. Motorola KVL 3000+® is a reg'd. trademark of Motorola. Table of Contents updated Re-Sequenced paragraph 2.18&2.19 as 2.19 and 2.20 Added KEYLOADING MODE paragraph as 2.18 Added warranty to back page		
Issue 9	Back pg.		FEB 2010	FM
Issue 9	Section 3	Added flight test option to glide slope test	AUG 2010	SM
Issue 10	Section 1	Changed dimming voltages to include 28 VAC and 5 VDC.	OCT 2010	SM

REVISION HISTORY

[05RE375]

REV	SECTION - PAGE -	DESCRIPTION	DATE	EDITED BY
Issue 11	-2- 3-1 3-4 3-6,3-7	Correct typos (RF module frequencies) as found Correct typo in para. 3.4 to kit (P/N 069662-1) Para 3-5 added to CI-292 (-3 or -4), the "MALE" BNC Para. 3.7 added "All harness connectors are Female." Update wiring diagram added SRA-6000 option Changed item 2 to CI-292-3,-4, item 8 to 7.5A Added notes 19-22	JAN 2012	FM
Issue 12	2-15	Added Information about Auto Test feature with Aeroflex 3920 Digital Test Set	JUL 2012	JR
Issue 13		Jan 01, 2013 FCC narrowband notice added	JAN 2013	SM
Issue 14	3-14	Corrected typo in the Post Installation Test section to '1020 (112.2)' for DME 1 & DME 2.	OCT 2025	MM

NOTES

ESD CAUTION



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 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 70 cm 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 A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his/her own expense.

WARNING AND DISCLAIMER

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

This manual is designed to provide information about the TDFM-7000. Every effort has been made to make this manual as complete and accurate as possible.

WARRANTY INFORMATION

The Model TDFM-7000 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

SUMMARY OF DO-160C ENVIRONMENTAL TESTING

Summary of DO-160C Environmental Testing for Technisonic Model TDFM-7000 Transceiver:

Conditions	Section	Description of Conducted Tests
Temperature and Altitude	4.0	Equipment tested to categories C4 and D1.
Vibration	8.0	Equipment is tested without shock mounts to categories B, M and N.
Magnetic Effect	15.0	Equipment is class Z.
Power Input	16.0	Equipment tested to category B.
Voltage Spike	17.0	Equipment tested to category B.
RF Emission	21.0	Equipment tested to category Z.

INSTALLATION 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-160C 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 STCs 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 STCs 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 for the latest issue of available STCs and letter of authorization for use.

Trademark Notices

TDFM-7000 Transceivers contain two-way radio protocols licensed from Motorola, Inc.

© 1997, 1998 Motorola, Inc.

Motorola KVL 3000+® is a registered trademark of Motorola.

TABLE OF CONTENTS

SECTION	TITLE	PAGE
SECTION 1 GENERAL DESCRIPTION		
1.1	INTRODUCTION	1-1
1.2	DESCRIPTION	1-1
1.3	MODEL VARIATION	1-1
1.4	TECHNICAL CHARACTERISTICS	1-3
SECTION 2 OPERATING INSTRUCTIONS		
2.1	GENERAL	2-1
2.2	FRONT PANEL	2-1
2.3	POWER SWITCH	2-2
2.4	KNOB	2-2
2.5	SOFT KEYS AND HOME	2-2
2.6	BAND KEY	2-3
2.7	FUNC KEY	2-3
2.8	F1 – F4 KEYS	2-3
2.9	MUP(4) AND MDN(7) KEYS (Memory Up and Down Keys)	2-5
2.10	UP(5) AND DN(8) KEYS	2-5
2.11	BRT(6) AND DIM(9) KEYS	2-5
2.12	ESW(0) KEY (Ergo Switch)	2-5
2.13	TSW (*) KEY	2-5
2.14	DISPLAY	2-5
2.15	GENERAL OPERATION	2-6
2.16	CUSTOMER PROGRAMMING SOFTWARE (CPS™)	2-6
2.17	CONFIGURATION MENU	2-11
2.18	KEYLOADING MODE	2-12
2.19	FLASH UPGRADE MODE	2-12
2.20	FRONT PANEL PROGRAMMING (FPP) MODE - OPTIONAL	2-13
2.21	AUTOTEST CABABILITY	2-15
SECTION 3 INSTALLATION INSTRUCTIONS		
3.1	GENERAL	3-1
3.2	EQUIPMENT PACKING LOG	3-1
3.3	INSTALLATION	3-1
3.4	INSTALLATION KIT - CONTENTS	3-1
3.5	ANTENNA INSTALLATION	3-1
3.6	INSTALLATION - PIN LOCATIONS AND CONNECTIONS	3-3
3.7	INSTALLATION - WIRING INSTRUCTIONS	3-4
3.8	MAIN GROUND – PINS 1 AND 14	3-4
3.9	MAIN POWER + 28VDC – PINS 2 AND 15	3-4
3.10	MIC 1, 2, 3, 4 and COMBINED – J1 PINS 3, 6, 9 and J2 PIN 6; J2 PIN 7 (COMB)	3-4
3.11	AUDIO 1, 2, 3, 4 and COMBINED – J1 PINS 4, 7, 10 and J2 PIN 5; J2 PIN 2 (COMB)	3-4
3.12	PTT 1, 2, 3, 4 and COMBINED – J1 PINS 5, 8, 11 and J2 PINS 3; J2 PIN 4 (COMB)	3-4
3.13	TX DATA AND RX DATA – J1 PINS 12 AND 13	3-4
3.14	CHANNEL UP AND CHANNEL DOWN – J1 PINS 16 AND 17	3-4
3.15	LH DATA, SB9600 BUSY, OPTB+, CTS OUT, BOOT DIN, RTSBIN AND RS232DIN –	3-4
3.16	J1 PINS 18 THROUGH 24	3-4
	PANEL BACKLIGHTING – J1 PIN 25	3-5

SECTION	TITLE	PAGE
(Continued)		
3.17	POWER JUMPER	3-5
3.18	POST INSTALLATION EMI TEST	3-8
3.19	TDFM-7000/7300 SOFTWARE OPTION FOR CONTROL OF LATITUDE SATELLITE GATEWAY S200-SG11	3-19
3.19.1	GENERAL	3-19
3.19.2	INSTALLATION	3-19
3.19.3	OPERATING INSTRUCTIONS	3-20
3.20	SATCOM MENUS	3-21
APPENDIX A Support Notes		A-1
WARRANTY		

LIST OF FIGURES

FIGURE	TITLE	PAGE
2.1	Front Panel Controls – TDFM-7000 Transceiver	2-1
2.2	PC 7000(II) Programming cable for TYPE II radios P/N 047365-1	2-7
2.3	Encryption Keyload cable for TYPE I and TYPE II radios P/N 037348-1)	2-7
2.4	TYPE I Programming cable P/N 037347-1	2-9
2.5	Motorola RIB box for TYPE I Radios P/N RLN 1015D	2-9
2.6	Type I (XTS-3000) Programming Cable (Requires RIB)	2-10
2.7	USB to Serial Adaptor for Computers without Serial Ports	2-11
3.1	Outline Drawing	3-2
3.2a	Wiring Connections for the TDFM-7000 Transceiver	3-6
3.2b	Wiring Connections for the TDFM-7000 Transceiver	3-7
3.3	TDFM-7000 and SG200-SG11 Wiring Diagram	3-19

LIST OF TABLES

TABLE	TITLE	PAGE
2.1	TDFM 7000 Series PL(Hz)/MOT Codes	2-14
2.2	TDFM 7000 Series DPL Codes	2-14
3.1	25 Pin D Connections	3-3
3.2	9 Pin D Connections	3-3

SECTION 1 - GENERAL DESCRIPTION

1.1 INTRODUCTION

This publication provides operating and installation information on the TDFM-7000 airborne transceiver. The exact configuration depends on which and how many RF modules are installed.

1.2 DESCRIPTION

The TDFM-7000 transceiver is an airborne multi-band radio capable of operation in conventional analog and P25 digital FM systems, SmartNet/SmartZone trunking systems and P25 9600 trunking systems. **Type I** RF modules are available in VHF, UHF-LO, UHF-HI and 800 MHz bands. **Type II** RF modules support additional optional features not available in type I modules and are currently available in VHF, UHF-LO, UHF-HI and 700/800 MHz.

These optional additional features include P25 9600 trunking that may be combined with AES and/or DES-OFB encryption with OTAR in any of the available modules. The factory will normally install only type II RF modules as the type I modules have limited availability. However type I modules are fully supported and either some or all of the TDFM-7000's RF modules can be type I. If a unit is built with both types, two different programming software packages will have to be purchased.

The TDFM-7000 is not normally frequency agile. In order to have the ability to change the frequencies at the front panel, the FPP (front panel programming) option must be ordered for each band. FPP is only available on the VHF and UHF modules. The FPP option precludes trunking and limits available channels to 240 (15 zones/16 channels) on that module instead of 1000 channels. Please note that all 240 memories must be filled if FPP is ordered.

1.3 MODEL VARIATION

There are several variations of the Model TDFM-7000 Transceiver. Each variation offers different features and performance based on the type of RF modules and options installed.

Irrespective of module type the bands are numbered 1, 4, 5 and 8 for VHF, UHF low, UHF Hi and 800/700 respectively. The transceivers part number indicates whether Type I (-1, -2) or Type II (-3, -4) modules are installed along with which type of modules are installed.

The following part numbers represent typical TDFM-7000 model variations:

3 band TDFM-7000 Variations

P/N 051240-1-7188	One VHF and two 800 MHz, type I modules with Green display.
P/N 051240-3-7148	One VHF, UHF low and 800/700, type II modules with Green display.

4 band TDFM-7000 Variations

P/N 051240-2-71558	One VHF, two UHF hi and one 800 MHz, type I modules with Red display.
P/N 051240-1-71148	Two VHF, one UHF low and 800/700, type II modules with Green display.

TDFM-7000 Model Variations with type I Modules**3 Band TDFM-7000 Model Variations (-7XXX)**

TDFM-7000, P/N 051240-1-7XXX/P7YYY	GREEN display.
TDFM-7000, P/N 051240-2-7XXX/P7YYY	RED display.
TDFM-7000NV, P/N 051240-1-7XXXNV/P7YYY	GREEN NV display.

4 Band TDFM-7000 Model Variations (-7XXXX)

TDFM-7000, P/N 051240-1-7XXXX/P7YYY	GREEN display.
TDFM-7000, P/N 051240-2-7XXXX/P7YYY	RED display.
TDFM-7000NV, P/N 051240-1-7XXXXNV/P7YYY	GREEN NV display.

X is represented by:

- 1 for VHF (136-174MHz) module
- 4 for UHF Lo (403-470MHz) module
- 5 for UHF Hi (450-512MHz) module
- 8 for 800 MHz (806-870)

Module numbers must always be specified in ascending order.

P7YYY represents a 4-digit project number that identifies specific options that are contained in the module. The Technisonic sales department assigns project numbers based on customer requirements. P7001 and up series project numbers are used in transceivers with type I modules.

TDFM-7000 Model Variations with type II Modules**3 Band TDFM-7000 Model Variations**

TDFM-7000, P/N 051240-3-7XXX/P7YYY	GREEN display.
TDFM-7000, P/N 051240-4-7XXX/P7YYY	RED display.
TDFM-7000NV, P/N 051240-3-7XXXNV/P7YYY	GREEN NV display.

4 Band TDFM-7000 Model Variations (-7XXXX)

TDFM-7000, P/N 051240-3-7XXXX/P7YYY	GREEN display.
TDFM-7000, P/N 051240-4-7XXXX/P7YYY	RED display.
TDFM-7000NV, P/N 051240-3-7XXXXNV/P7YYY	GREEN NV display.

X is represented by:

- 1 for VHF (136-174MHz) module
- 4 for UHF Lo (380-470MHz) module
- 5 for UHF Hi (450-520 MHz) module
- 8 for 700/800 MHz (764-870)

Module numbers must always be specified in ascending order.

P7YYY represents a 4-digit project number that identifies specific options that are contained in the module. P7001 and up project numbers are used in transceivers with type II modules.

All model variations are capable of supporting both 28 Volt and 5 Volt AC or DC back lighting. The units are shipped set to operate on 28 Volt back lighting. Equipment can be set to operate on 5V back lighting by using the software based configuration menu. See Section 2.17 configuration menu. (Damage will not occur if the incorrect voltage is applied.)

1.4 TECHNICAL CHARACTERISTICS

<u>Specification</u>	<u>Characteristic</u>
Model Designation:	TDFM-7000
Physical Dimensions:	Approx. (L) 8.0" x (W) 5.75" x (H) 3.75"
Weight:	~6.0 Lbs (2.7 Kg)
Operating Temperature Range:	-30° C to +60° C
Power Requirement:	
Voltage:	28.0 VDC ± 15%
Current:	500 mA minimum / 5A maximum
Audio Output Power (including sidetone):	600 mW into 600 Ω
Microphone Inputs:	Carbon or Equivalent
Panel Back Lighting:	
Voltage:	28 or 5 Volts AC or DC (selectable)
Current:	10 uA

Type I Modules

<u>Specification</u>	<u>Characteristic</u>
RF Output Power:	1 or 5 Watts (VHF) 1 or 4 Watts (UHF) 1 or 3 Watts (800)
Frequency Range	
VHF Module:	136 to 174 MHz
UHF LO Module:	403 to 470 MHz
UHF HI Module:	450 to 512 MHz
800 Module:	806 to 870 MHz
No. of channels per band:	255 pre-programmable channels

Transmitter section

	VHF	UHF	800
FM Hum and noise in dB (wideband):	-48	-45	-45
Frequency Stability in ppm:	±2.0	±2.0	±1.5
Audio Distortion (at 1000Hz):	<2%	<2%	<2%
Modulation Limiting:	Wide band	±5kHz	
	Narrow band	±2.5kHz	

Receiver section

<i>Sensitivity</i> in uV:	VHF	UHF	800
*Digital 1% BER (12.5kHz)	0.35	0.35	0.45
*Digital 5% BER (12.5kHz)	0.25	0.25	0.25
**Analog with 12dB SINAD	0.25	0.25	0.25

Selectivity in dB:

25 kHz Channel	-78	-78	-75
12.5 kHz Channel	-67	-68	-63
Intermodulation (dB) * **	-78	-77	-74

1.4 TECHNICAL CHARACTERISTICS (continued)

Type II Modules

Specification	Characteristic		
RF Output Power:	1 or 6 Watts (VHF)	1 or 5 Watts (UHF)	1 or 3 Watts (800)
Frequency Range			
VHF Module:	136 to 174 MHz		
UHF LO Module:	380 to 470 MHz		
UHF HI Module:	450 to 520 MHz		
700 / 800 Module:	764 to 870 MHz		
No. of channels per band:	1000 pre-programmable channels 850 for older radios 240 channels (15 zones of 16 channels) in modules with Front Panel Programming.		
Transmitter section	VHF	UHF	800
FM Hum and noise in dB (wideband):	-48	-45	-45
Audio Distortion:	1%	1.5%	1.5%
Frequency Stability in ppm:	±2.0	±2.0	±1.5
Modulation Limiting:	Wide band	±5kHz	
	Narrow band	±2.5kHz	
Receiver section	VHF	UHF	800
<i>Sensitivity</i> in uV:			
*Digital 1% BER (12.5kHz)	0.25	0.25	0.40
*Digital 5% BER (12.5kHz)	0.25	0.25	0.25
**Analog with 12dB SINAD	0.25	0.25	0.25
<i>Selectivity</i> in dB:			
25 kHz Channel	-80	-78	-72
12.5 kHz Channel	-63	-63	-63
Intermodulation * **	-78	-77	-75

*Measured in digital mode per TIA / EIA IS 102.CAAA under nominal conditions.

** Measured in analog mode per TIA / EIA 603 under nominal conditions.

SECTION 2 – OPERATING INSTRUCTIONS

2.1 GENERAL

A 5-line display and a keypad and a rotary knob provide the operator control of up to 4 RF modules installed in the unit. The display is showing the activity of all 4 modules (bands) as well as the menu of the active band, selected by pressing the BAND key. The knob has multiple functions including volume, and channel. The microphone, key line and headphone audio can be wired separately for each of the 4 bands therefore switching from band to band is performed at an audio panel such as the Technisonic A71X series. This allows for separate and simultaneous operation on each of the bands just like having 4 separate radios. The transceiver can also be connected so that all bands are available on the combined output. In this configuration, the BAND key on the transceiver must perform switching between bands and the user can only transmit on one band at a time. It is possible to connect the transceiver such that both methods are used.

2.2 FRONT PANEL

Refer to the diagrams below:

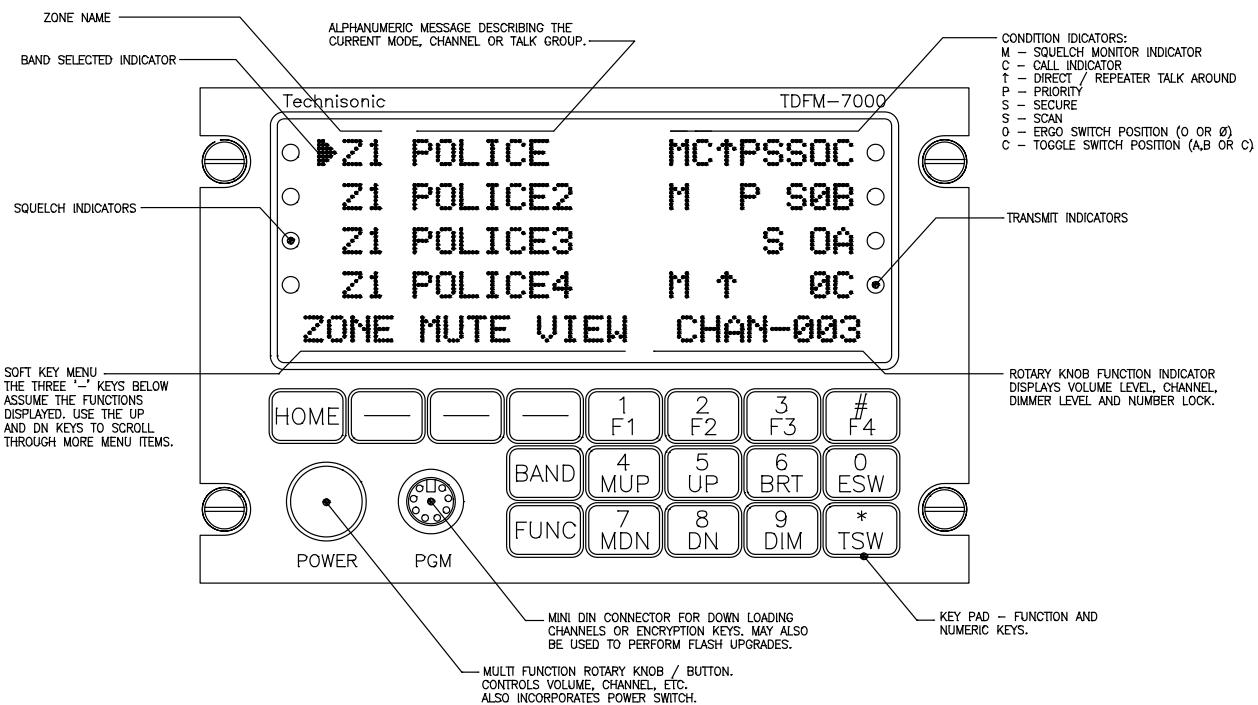


FIGURE 2.1 Front Panel Controls – TDFM-7000 Transceiver

2.3 POWER SWITCH

To switch the transceiver on, press and hold the knob until the radio powers up. The display will show TECHNISONIC and the software version installed followed by the model number along with which RF modules are installed. The display will then show the normal display. To switch off the transceiver at any time, press and hold the knob for 2 seconds until the display shows OFF then release. If it is desired that the radio turns on with the radio master in the aircraft, a power jumper may be installed (see installation instructions) such that the radio is always on. The battery master must be used to turn the radio off with this jumper installed.

2.4 KNOB

The knob is a rotary encoder, which turns endlessly, meaning its actual position is not important. The knob also has a push button incorporated in it so you can press the knob as well as turn it. The knob will start out as a volume control. Pressing the knob again will change its function to act as the channel selector. Pressing the knob again causes the keypad function to change from function keys to number keys. In Vol mode the knob acts as a volume control. Several knob presses will bring you to the recall mode. In the recall mode, typing in the channel number will bring you quickly to that channel without scrolling through channels in between. Pressing the knob again brings it back to the volume control mode. The current function of the knob is shown at the bottom right of the display.

2.5 SOFT KEYS AND HOME

The transceiver has three soft keys, which assume the function shown on the menu above them on the display. The functions displayed depend on how the selected module was programmed with the customer programming software (CPS)TM. These menu items can be different on a channel by channel basis. Typical menu items may include:

- ZONE** - Pressing this function will prompt you for a new zone number which can be entered directly (if the keypad is in numlock mode) or scrolled using the UP and DN keys.
- MUTE** - Selecting this function will prompt you for an on or off entry using the soft keys to mute the tones. Tones refer to the beeps heard when pressing buttons.
- VIEW** - The view function is used to view lists. Lists can include scan lists, phone numbers, call lists and or paging.
- PWR** - Selecting PWR will allow the power output of the radio to be set to high or low.
- PROG** - Selecting PROG allows brings you to user programmable features of the radio such as telephone numbers or scan lists. The ability for the user to program phone numbers, scan lists, etc can be enabled or disabled by the CPSTM.
- FPP** - Front Panel Programming mode allows you to program at the front panel without the customer programming software. This option is available on VHF and UHF type II modules only.

At any time while in one of these functions, you can escape back to the normal mode by pressing the HOME key. When programming the modules with the CPSTM, it is suggested not to double up functions. For example, programming a soft key to CHAN would be redundant since there is already a channel function using the knobs. Using the CHAN soft key would also not update the channel number on the display, causing some confusion.

2.6 BAND KEY

Pressing the BAND key will select the next band in sequence. A solid arrow will indicate which band is selected. If the TDFM-7000 audio routing (see the configuration menu) is set up in single mode, the band key also acts as the transmit select.

2.7 FUNC KEY

Pressing the FUNC key will bring up the first functions menu:

F1-F4 = Channels - Pressing one of these keys will load a pre-programmed channel.

4 = Record - Pressing 4 will cause the transceiver to record the next message received on the band selected.

5 = Playback - Pressing 5 will play the last message recorded.

Pressing the FUNC key again will bring up the second menu. The following functions are available:

1 = Crossband Repeat - You can select any two bands to cross band repeat. The repeat function is semi-duplex. This means the TDFM-7000 will retransmit from one band to another in both directions but not simultaneously.

2 = Configuration - Enters the configuration menu (see 2.18 configuration menu). This is the same menu that can be invoked during boot up.

3 = Simulcast - You can select bands to transmit simultaneously. Simulcast is not available when audio routing is set to separate mode and will not show up in the functions menu.

4 = F1-F4 Programming - Allows you to program a channel and zone to the F1 to F4 keys.

5 = Simplex Repeat - When turned on, the band selected will become a simplex repeater. Simplex repeat (sometimes called parrot repeat) will record an incoming message and immediately retransmit the message on the same frequency.

2.8 F1-F4 KEYS

Four function keys at the top of the keypad provide the same actions as the three side buttons and the top button found on the XTS-3000 or XTS-5000 portable. They are as follows:

F1 - Upper side button (purple button) on the portable.

F2 - Middle side button (with one dot) on the portable.

F3 - Bottom side button (with two dots) on the portable.

F4 - Top button (orange button) on the portable.

TDFM-7000 Transceiver Recommended Keypad Menu Defaults:

TDFM-7000 Series Transceiver ITEM	Portable ITEM	Conventional Operation	SmartNet Operation	SmartZone Operation
F1 Key	Upper Side Button 1	Monitor	Unprogrammed	Unprogrammed
F2 Key	Middle Side Button 2	Nuisance Delete	Nuisance Delete	Nuisance Delete
F3 Key	Bottom Side Button 3	Talkaround/ Direct	Unprogrammed	Unprogrammed
F4 Key	Top Button	Volume Set Tone	Volume Set Tone	Volume Set Tone
MUP and MDN keys	16-Position Rotary Knob	Channel Select	Channel Select	Channel Select
ESW Key	Two-Position Concentric or Ergo Switch	Unprogrammed A (Ø) Unprogrammed B (O)	Unprogrammed A (Ø) Unprogrammed B (O)	Unprogrammed A (Ø) Unprogrammed B (O)
TSW Key	Three-Position Toggle Switch	Blank (A) PL Disable (B) Scan (C)	Blank (A) PL Disable (B) Scan (C)	Blank (A) PL Disable (B) Scan (C)

NOTE: It is possible to use Motorola's Customer Programming Software (CPS™) to alter the default keypad settings of the TDFM-7000 radio. However if custom key settings are chosen it will not be possible for Technisonic to help the Pilot or other Radio User through operational difficulties. These questions will have to be referred to the Radio System Administrator responsible for customising the settings. Technisonic recommends that the default key settings stay in place until all airframe installation and operational issues have been overcome.

The TDFM-7000 Transceiver is programmable by Motorola CPS™. The following settings may be programmed for each Channel in a Conventional Radio:

Tx Frequency	Zone
Tx PL/DPL Code	Channel
Rx Frequency	Name
Rx PL/DPL Code	RX Signal Voice Type
Time-Out Timer	TX Signal Voice Type
Scan List	Network Access Code
Phone	Tx Power
Smart PTT	

The following settings must be programmed for each mode in a Trunked (P25 9600, SmartNet or SmartZone) Radio:

System Type	TG Strapping
System ID	Zone
Individual ID	Scan List
Coverage Type	Scan Type
Affiliation Type	Interconnect
Control Channel 1	Phone Display Format
Control Channel 2	Private Call
Talkgroup 1	Private Call Type
Talkgroup 2	Private Call Operation

The function keys along with the rest of the keypad, revert to normal number keys during transmit and when NUM LOCK is selected by pressing the rotary knob.

The F1 – F4 keys can be programmed as quick channel keys as mentioned in 2.7. Depending on the setting in the configuration menu, the keys can be permanently set to channels or used for other functions (normal). When the F1 –F4 keys are in the normal mode they can still be used for quick channels if the FUNC key is pressed first.

2.9 MUP(4) AND MDN(7) KEYS (Memory Up and Down Keys)

These keys provide the same function as the rotary knob does when it is set to CHAN. This equates to the 16 position rotary knob on the portable. When one of these keys is pressed, the function of the rotary knob is automatically set to CHAN.

2.10 UP(5) AND DN(8) KEYS

The keys provide the same function as the left and right arrow keys on the portable. The UP key equates to the right arrow key. These keys are used for a variety of functions but in the normal mode they are used to scroll through the soft key menus.

2.11 BRT(6) AND DIM(9) KEYS

Use these keys to dim or brighten the display. The radio powers up at full brightness for normal use but can be dimmed for night operations.

2.12 ESW(0) KEY (Ergo Switch Key)

The ESW key provides the function of the concentric or 'ergo' switch on the portable. The switch has two conditions which are represented by 'O' and 'Ø'. Pressing the ESW key toggles the condition back and forth. The condition is displayed at the right hand side of the display line, second character from the right. The ergo switch condition is saved when the unit is turned off. There are separate conditions for each band installed. The ESW key can be programmed with the CPS™ to a variety of functions such as low power, scan and secure or encrypted mode.

2.13 TSW (*) KEY (Toggle Switch Key)

The TSW key provides the function of the toggle switch on the portable. The switch has three conditions which are represented by 'A', 'B' and 'C'. Pressing the TSW key toggles the condition A,B,C,A,B, etc. The condition is displayed at the right hand side of the display line, last character on the right. The toggle switch condition is saved when the unit is turned off. There are separate conditions for each band installed. The TSW key can be programmed with the CPS™ to a variety of functions such as low power, scan, zone select, or pl disabled mode.

2.14 DISPLAY

The transceiver has a 5-line, 120-character LED display. The top 4 lines display the zone name, channel name, condition symbols (scan, direct, call, secure, monitor, etc) and switch settings for each band. An LED on the left side of each band indicates a receive condition while an LED on the right side of each line indicates transmit. A solid arrow on the first character indicates which band is selected. The fifth line displays the menu items associated with the band selected and the mode the knob is in.

2.15 GENERAL OPERATION

Switch on the transceiver as described in 2.3. Select the desired band by pressing the BAND key. Select the TDFM-7000 on the aircraft audio panel. Press the knob again so that CHAN shows up on the top right of the display. Rotate the knob until the desired channel or talk group is selected. Press the knob until VOL is again shown on the display. You can adjust the volume by waiting until a signal is received or by pressing F1 (factory programmed for monitor function) and adjusting the rotary knob. The radio is ready to use. If the radio is installed in separate mode, remember that the band selected by pressing the BAND key is what menu is displayed on the screen but the band selected by the audio panel is band that you are actually transmitting and receiving on. To use the DTMF keypad while transmitting, the band you are using must be selected on the display.

2.16 CUSTOMER PROGRAMMING SOFTWARE (CPS™)

Programming the TDFM 7000 is usually done with the use of third party programming software. Customer programming software or "CPS" must be supplied by Motorola.

There are 2 different software packages that can be used to program the TDFM 7000. The software package required depends what type of modules are installed. Most TDFM 7000 radios are built with TYPE II modules. These radios can be identified by the P/N 051240-[3] or -[4]. For TDFM 7000s built with TYPE I modules (P/N 051240-[1] or -[2]) see the section on TYPE I programming.

To make any changes to the programming in the Type II radio, Motorola CPS™ software must be used. There is no provision in the TYPE II radio to allow the user to change frequencies, zones, PL tones etc. unless the Front Panel Programming (FPP) option has been purchased in each band. CPS™ software must be purchased from Motorola directly.

A Programming cable is required to connect the computer to the TDFM-7000 if type II modules are installed. Each band in the TDFM-7000 is considered a type II (XTS-5000) portable by the CPS™ software. To program a band in the transceiver, it must be selected by pressing the BAND key before running the CPS™. Follow the instructions supplied with the CPS™.

The CPS Programming software must be purchased from Motorola On Line (MOL). For instructions on ordering Motorola parts and CPS software see TIB TIBFM 12-01 REV E.

This document is available from App xx or on the Technisonic Web site at www.til.ca. Follow the link for TDFM 7000 and click in the Link for "CPS Programming software/Cables ordering Guide". Refer to the section for TYPE II modules.

Programming cables for units with Type II modules

The TDFM-7000 transceiver that employs type II modules does not require a Smart RIB box, AC power pack or computer RIB cable. A Technisonic programming cable, and Motorola "ASTRO 25 Portable CPS" Programming software, P/N RVN4181 (Latest revision) is all that is required to program transceivers with type II modules.

If encryption keys need to be loaded via a KVL-3000+, keyloader cable P/N 037348-1 may be also be obtained from Technisonic. This keyloader cable will plug into the front mini DIN connector of the TDFM-7000 transceiver and work with type I or type II modules.

The following cables can be purchased from Technisonic:

P/N 047365-1 TYPE II Download/Programming Cable that mates the 7000 front panel 8-pin mini DIN to PC computer 9 pin serial port.

P/N 037348-1 Encryption Keyload Cable that mates the 7000 front panel 8-pin Mini DIN with Motorola KVL-3000+ Keyloader. Same P/N for type I or type II modules.



FIGURE 2.2 PC 7000(II) Programming cable for TYPE II radios P/N 047365-1



FIGURE 2.3 Encryption Keyload cable for TYPE I and TYPE II radios P/N 037348-1

Programming Cables for units with Type I modules

To make any changes to the programming in the radio, CPS™ software must be used. There is no provision in the Type I radio to allow the user to change frequencies, zones, talk groups, etc. from the front panel.

"ASTRO Saber & XTS 3000" CPS™ software can be purchased from Motorola Customer Service (see following page). A Motorola Radio Interface Box (RIB) is required to connect the computer to the TDFM-7000 if Type I modules are installed. Each band in the TDFM-7000 is considered a Type I (XTS-3000) portable by the CPS™ software. To program a band in the transceiver, it must be selected by pressing the BAND key before running the CPS™. Follow the instructions supplied with the CPS™ and RIB. The radio cable supplied with the RIB will not connect to the TDFM-7000, therefore you will need to purchase the Type I programming cable, P/N 037347-1.

The CPS Programming software must be purchased from Motorola on Line (MOL). For instructions on ordering Motorola parts and CPS software see TIB TIBFM 12-01 REV E. This document can be found in Appendix A or is available on the Technisonic Web site at www.til.ca. Follow the link for TDFM 7000 and click in the Link for "CPS Programming software/Cables ordering Guide". Refer to the section for Type I Modules.

P/N RVN4182	CPS Programming Software, Note: Latest revision will be provided.
P/N RLN10150	Smart RIB Interface Box
P/N 0180202E27	Smart RIB AC PWR PAC 110V
P/N 3080390B48	Computer RIB Cable

The XTS-3000 and XTS-5000 are products of Motorola, Inc.
The KVL-3000 is a product of Motorola, Inc.

A Technisonic Type I programming cable P/N037347-1 is also required and available from Technisonic. If encryption keys need to be loaded via a KVL-3000+, keyloader cable P/N 037348-1 may be also be obtained from Technisonic. This keyloader cable will plug into the front connector of the TDFM-7000 transceiver and will work with Type I or Type II modules.

To use the programming connector on the front of the TDFM-7000 transceiver, which is preferable when the unit is installed in an aircraft, use the following:

P/N 037347-1	Download/Programming Cable that mates with RIB interface Box to program TDFM-7000 units employing Type I modules.
P/N 037348-1	Encryption Keyload Cable that mates with Motorola KVL-3000 Keyloader. Same P/N for Type I or Type II modules.
P/N 013524-1	Alternate programming cable that mates with Rear DB 25 connector.



FIGURE 2.4 TYPE I Programming cable P/N 037347-1



FIGURE 2.5 Motorola RIB box for TYPE I Radios P/N RLN 1015D

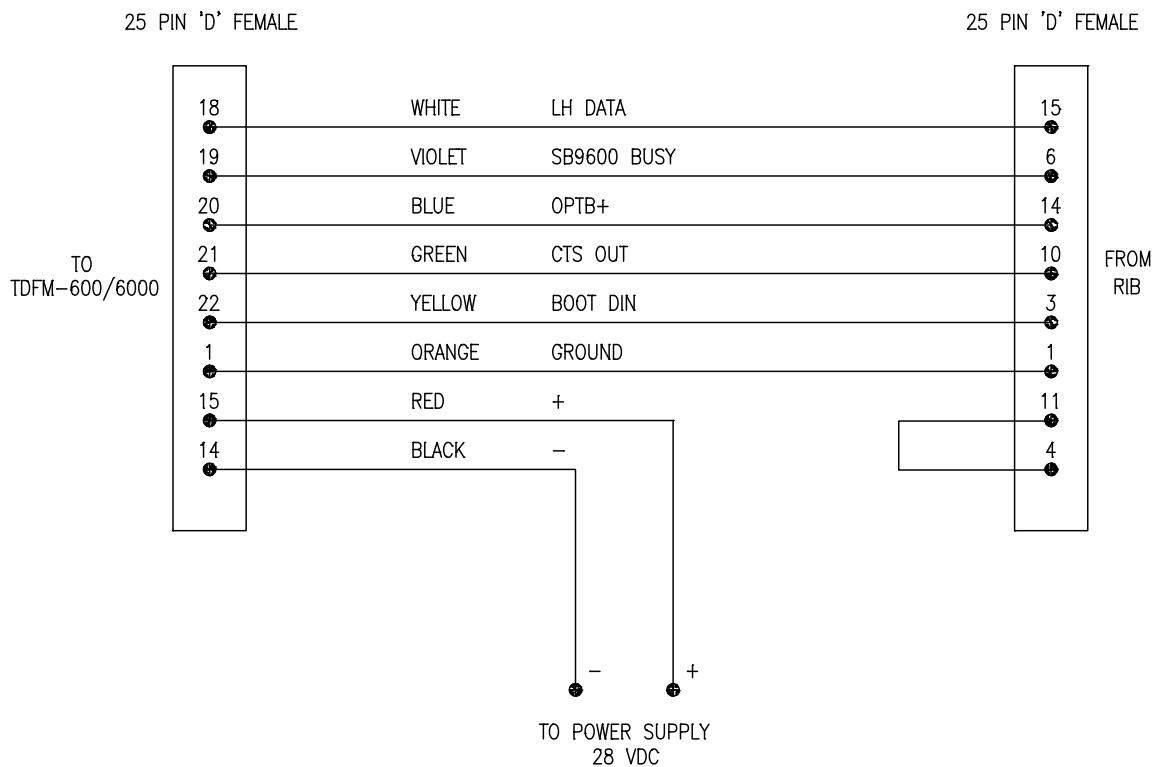


FIGURE 2.6 Alternate Type I Programming Cable (Requires RIB)

Programming Using Computers with No Serial Ports

Newer PCs and laptops are now being made without serial ports. For those computers to program the TDFM 7000 a USB to serial adaptor will be required. USB to serial adaptors can be found at most computer stores.

To use the adaptor, plug in the USB cable and install the USB to serial driver on the target PC. The driver is usually supplied with the adaptor on a CD. This will create a "virtual serial port.

Once the adaptor is installed on the PC, find out what com port has been created by the adaptor. Usually it will be Com 3, Com 4 or Com 5.

The serial port will have to be set in the CPS software before programming can take place. Start the CPS software, then click on **VIEW** then **OPTIONS**. Click on the **MAIN tab** and go to the bottom pull down menu called "**Port Selection**".

Select the com port that is the virtual port created by the adaptor. Click **APPLY**, then **OK**. The CPS should now work with the USB to serial adaptor.



FIGURE 2.7 USB to Serial Adaptor for Computers without Serial Ports

2.17 CONFIGURATION MENU

Some features of the TDFM-7000 transceiver can be configured to the user's preference. To enter the configuration menu, turn the unit on while simultaneously pressing the F4, ESW and TSW keys. Hold the keys until the display reads 'Configuration Menu'. The following menu items can be changed or modified. Rotate the knob to select the desired condition and press the knob to continue to the next configuration item:

Knob default - This will select which mode (volume or channel) the knob will be when the radio is first turned on.

Vol / Chan mode - When set to both, volume and channel functions are both available while if set to single, only the function set in the above knob default will be available.

Numlock mode - When enabled, num lock mode is added to the available knob functions.

Recall mode - When enabled, recall is added to the available knob functions.

Band 1 channels - This number should be set to the highest channel number programmed in band 1 so that the channel scrolling wrap around will work properly up and down.

Band 2 channels - This number should be set to the highest channel number programmed in band 2 so that the channel scrolling wrap around will work properly up and down.

Band 3 channels - This number should be set to the highest channel number programmed in band 3 so that the channel scrolling wrap around will work properly up and down.

Band 4 channels - This number should be set to the highest channel number programmed in band 4 so that the channel scrolling wrap around will work properly up and down.

Squelch Blink - When disabled, the squelch indicator lights will function normally. When enabled, the squelch lights will stay lit while a signal is present and then blink for a couple of seconds after the signal disappears. This helps you determine which band made the last call as typically the squelch light is out by the time you look.

Boot Speed - When set to quick, some boot up messages will be skipped. When set to normal, all messages will be displayed.

Panel Lighting – Select 28 volts AC/DC or 5 volts AC/DC. No damage will occur if the wrong setting is made.

F1-F4 Keys – If set to normal, the keys will emulate the side buttons on the portable. If set to channels, the keys become quick channel load keys. The channels can be programmed in the second function menu.

Sidetone 1 Level – Sets the sidetone level for band 1. The microphone and headphone audio becomes live while in this mode to facilitate setting to a comfortable level. The factory setting is 11.

Sidetone 2 Level – Sets the sidetone level for band 2. The microphone and headphone audio becomes live while in this mode to facilitate setting to a comfortable level. The factory setting is 11.

Sidetone 3 Level – Sets the sidetone level for band 3. The microphone and headphone audio becomes live while in this mode to facilitate setting to a comfortable level. The factory setting is 11.

Sidetone 4 Level – Sets the sidetone level for band 4. The microphone and headphone audio becomes live while in this mode to facilitate setting to a comfortable level. The factory setting is 11.

2.18 KEYLOADING MODE

If the TDFM 7000 is equipped with hardware encryption, then the Encryption keys will need to be loaded using a **Motorola KVL 3000+®** Keyloader.

Keyloading must be done by putting the transceiver into flash upgrade mode by turning on the radio while holding the HOME key. Select the band to be keyed-loaded by pressing the BAND key. Press the RESET Key to reset the modules and to put them into keyload mode. Wait until the display returns to the “Flash Upgrade mode” Power up the keyloader and plug the cable into the 7000 Program port. Follow the Motorola Keyloader instructions for uploading the actual keys to the radio.

If other bands require keys, press the BAND key to select the next module, wait 1 second for the keyloader to since to that module, then upload the key(s).

When keyloading is done, remove the keyloader cable and press the EXIT key to reboot the transceiver back to normal operation

2.19 FLASH UPGRADE MODE

On occasion it may be required to flash upgrade one or more of the modules in the radio to change or add new features. This can be done using the Motorola RIB box and/or software supplied in a Motorola flash upgrade kit. The transceiver must be put into flash upgrade mode by turning on the radio while holding the HOME key. Select the band to be upgraded by pressing the band key. Follow the software instructions. During the flash procedure, the software will ask you to turn off and on the radio, use the RESET soft-key, do not turn off the transceiver.

2.20 FRONT PANEL PROGRAMMING (FPP) MODE - OPTIONAL

One or more of the bands may have the capability to program channel information such as frequencies, PL tones, modulation types, etc from the front panel. 'FPP' will show up as one of the soft menu items at the bottom of the screen if this option has been ordered. When the FPP soft key is pressed, you will be prompted for channel information. Wait until the cursor is flashing then press 'OK' for the next input or press 'QUIT' to finish and get out of the programming mode. All changes up to that point will be saved. The prompts are as follows:

TX Frequency	– Enter the desired transmit frequency using the numeric key pad. If the frequency entered is not within band limits or not on proper channel spacing, the frequency will automatically be changed to the closest valid channel.
RX Frequency	– Enter the desired receive frequency.
TX PL	– Enter the desired transmit PL tone frequency. After the last digit is pressed the radio will verify that it is a valid frequency and flash the first cursor again. Press 'OK' at this time. The transceiver supports all standard PL tones. (Also known as CTCSS tones) TXPL tones are generally used to open repeaters or in talk groups where the receivers are squelch protected by PL tones. Enter '000.0' for no tone. PL tones are used by analog mode only.
RX PL	– Enter the desired receive PL tone frequency. Enter '000.0' no tone – carrier squelch operation.
TX DPL	– Enter the desired DPL code. You can not have both a PL and a DPL at the same time. The one that is entered last will turn the other off. A DPL of 000 means off. DPL codes are also known as DCS codes.
RX DPL	– Enter the receive DPL code as above.
TX NAC	– Enter the desired transmit P25 NAC code if using digital, otherwise just press 'OK'. The code is hexadecimal therefore the letters A to F could also be used. Press the 'A-F' soft key to use buttons 1-6 as A-F. A NAC or Network Access Code is used like PL tones but are only used by P25 (digital) mode. A value of 293 is considered to be the standard code for open channel.
RX NAC	– Enter the desired receive P25 NAC code as above.
RX TYPE	– Select the receive mode using the UP and DN keys – Analog, digital or mixed. The mixed mode will allow the receiver to decode analog and P25 digital signals as needed.
TX TYPE	– This prompt will only come up if you selected mixed for RX. Select analog or digital.
BANDWIDTH	– Select 12.5, 20.0 or 25.0 kHz using the UP and DN keys. Bandwidth may also be called 'Channel Spacing'.
CHANNEL NAME	– Use the UP and DN keys to scroll to the desired letter and press the NXT soft key to get to the next character. Press 'OK' when done. There will be a delay while the channel is saved, then the display will return to normal.

MOTOROLA TONE /CODE TABLE FOR THE TDFM-7000 SERIES

The following is a list of TDFM-7000 SERIES PL(Hz)/MOT CODES:

PL(Hz)	MCODE	PL(Hz)	MCODE	PL(Hz)	MCODE	PL(Hz)	MCODE
67.0	XZ	97.4	ZB	141.3	4A	206.5	8Z
69.3	WZ	100.0	1Z	146.2	4B	210.7	M2
71.9	XA	103.5	1A	151.4	5Z	218.1	M3
74.4	WA	107.2	1B	156.7	5A	225.7	M4
77.0	XB	110.9	2Z	162.2	5B	229.1	9Z
79.7	WB	114.8	2A	167.9	6Z	233.6	M5
82.5	YZ	118.8	2B	173.8	6A	241.8	M6
85.4	YA	123.0	3Z	179.9	6B	250.3	M7
88.5	YB	127.3	3A	186.2	7Z	254.1	OZ
91.5	ZZ	131.8	3B	192.8	7A	CSQ	CSQ
94.8	ZA	136.5	4Z	203.5	M1		

TABLE 2.1 TDFM-7000 SERIES PL(Hz)/MOT CODES

The following is a list of TDFM-7000 SERIES DPL CODES:

023	331	072	431	152	565	244	712
025	343	073	432	155	606	245	723
026	346	074	445	156	612	251	731
031	351	114	464	162	624	261	732
032	364	115	465	165	627	263	734
043	365	116	466	172	631	265	743
047	371	125	503	174	632	271	754
051	411	131	506	205	654	306	
054	412	132	516	223	662	311	
065	413	134	532	226	664	315	
071	423	143	546	243	703		

TABLE 2.2 TDFM-7000 SERIES DPL CODES

2.21 AUTOTEST CABABILITY

The TDFM-7000 series of radios are equipped with an Autotest feature that will greatly reduce the time it takes to align and test the radios performance.

Technisonic has teamed up with Aeroflex to provide the user with advance tools to manage there fleet of radios.

The TDFM-7000 radios can be tested and aligned quickly with the Aeroflex 3920 Digital Radio Test Set and optional custom Autotest scripts. Aeroflex offers the custom Autotest scripts developed specifically for the Technisonic TDFM series of radios.

The Aeroflex 3920 and OPTION 614 (for TYPE I radios) and OPTION 615 (for TYPE II) are required in order to take advantage of the Autotest feature in the TDFM 7000 radios.

There are several advantages to having the 3920 and the Autotest scripts:

- The Autotest scripts can greatly reduce the time to align each RF module (typically ~ 6 to 8 minutes). A full alignment can be performed or the "Test and Tune" mode can test, then only tunes parameters that need to be adjusted- thus speeding up the process.
- The Autotest scripts test the radio based on the Technisonic factory specifications that are listed in a Technisonic configuration file. This configuration file is available on the TIL web site www.til.ca or available on request.
- The Autotest feature can verify that the RF modules are functioning correctly without having to reprogram the radio. This is very useful when the programmed frequencies are not known or if Trunking is programmed and cannot be tested easily in the field.
- The Autotest feature can give a Quick "GO/NO GO" of the radio to aid with fault finding.
- The Autotest scripts can generate a test log for each RF module. This is very useful to keep track of the radios health in preventative maintenance.

Contact Technisonic for further instructions on using the Aeroflex 3920 and the Autotest scripts with the TDFM-7000 transceivers.

TECHNISONIC INDUSTRIES LIMITED
www.til.ca

This page left intentionally blank.

SECTION 3 – INSTALLATION INSTRUCTIONS

3.1 GENERAL

This section contains information and instructions for the correct installation of the TDFM-7000 Transceiver.

3.2 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.

3.3 INSTALLATION

The TDFM-7000 Transceiver is designed to be Dzus mounted and should be installed in conjunction with an IN-7000 installation kit. See Figure 3.1 for an outline drawing of the unit with dimensions to facilitate the installation.

3.4 INSTALLATION KIT - CONTENTS

The IN-7000 installation kit (P/N 069662-1) consists of:

1. One 25 pin Cannon D mating connector (female) complete with crimp pins and hood.
2. One 9 pin Cannon D mating connector (female) complete with crimp pins and hood.
3. 4 BNC connectors.

3.5 ANTENNA INSTALLATION

The type and number of antennas depends on the model of transceiver being installed. The following is a list of recommended antennas for the various RF modules:

VHF	136 to 174 MHz	Comant part # CI-292-3 or -4
UHFLO	403 to 470 MHz	Comant part # CI-275
UHFHI	450 to 512 MHz	Comant part # CI-275
UHFHI (II)	450 to 520 MHz	Comant part # CI-285
800	806 to 870 MHz	Comant part # CI-306
800/700 (II)	764 to 870 MHz	Comant part # CI-285

Type II (II) modules have a wider bandwidth in some cases. If this communications are going to occur in this wider bandwidth area, the antennas with wider coverage should be used.

The antenna should be mounted on the bottom of the aircraft whenever possible. Consult with instructions provided with the antenna. Connect the RF cables to the back of the transceiver using the MALE BNC connectors provided in the installation kit. It is possible to use equivalent 50 ohm aviation antennas that cover the appropriate bandwidths.

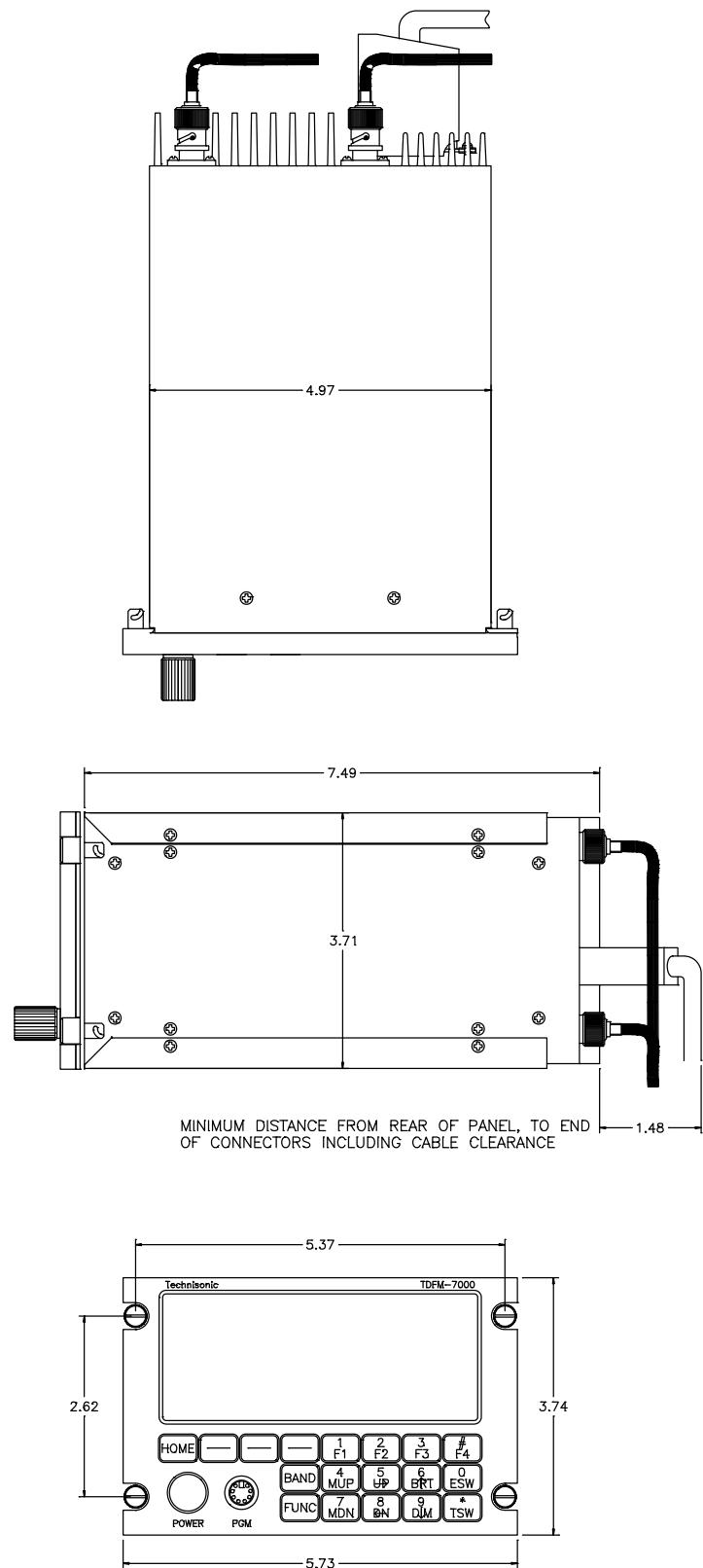


FIGURE 3.1 Outline Drawing for Model TDFM-7000

3.6 INSTALLATION - PIN LOCATIONS AND CONNECTIONS

J1 (25 Pin D Connections) - Use FEMALE Connector	
Pin #	Description
1	Ground
2	Main Power +28 VDC
3	Mic 1
4	Audio 1
5	PTT 1
6	Mic 2
7	Audio 2
8	PTT 2
9	Mic 3
10	Audio 3
11	PTT 3
12	TX Data
13	RX Data
14	Ground
15	Main Power +28 VDC
16	Channel Up
17	Channel Down
18	LH Data
19	SB9600 Busy
20	OPTB+
21	CTS Out
22	Boot DIN
23	RTSBIN
24	RS232 DIN
25	Panel Backlighting

TABLE 3.1 Wire connections

J2 (9 Pin D Connections) – Use FEMALE Connector	
Pin #	Description
1	Ground
2	Audio Combined
3	PTT 4
4	PTT Combined
5	Audio 4
6	Mic 4
7	Mic Combined
8	On Power
9	Speaker Combined

TABLE 3.2 Wire connections

3.7 INSTALLATION - WIRING INSTRUCTIONS

Figure 3-2(a and b) show all required connections and recommended wire sizes for the TDFM-7000 transceiver. All harness connectors are FFEMALE.

3.8 MAIN GROUND – J1 PINS 1 AND 14

Both pins should be connected to ground. The main ground is internally connected to the chassis.

3.9 MAIN POWER + 28VDC – J1 PINS 2 AND 15

Both pins should be connected to +28 volts DC +/- 15%.

3.10 MIC 1, 2, 3, 4 AND COMBINED – J1 PINS 3, 6, 9 AND J2 PIN 6; J2 PIN 7 (COMB)

The microphone input signals shall be connected using shielded wire with the shield connected to ground (pin 1 or 14). It is recommended for best results to leave the other end of the shield floating to prevent ground currents unless you are connecting to an audio panel with floating hi and lo inputs (like the Technisonic A710 or A711 series) in which case the shield must be connected to the lo input.

3.11 AUDIO 1, 2, 3, 4 AND COMBINED – J1 PINS 4, 7, 10 AND J2 PIN 5; J2 PIN 2 (COMB)

Audio outputs are 600 ohms impedance against ground. The output power is 600 mW maximum. Unused outputs do not have to be terminated and should be left unconnected.

3.12 PTT 1, 2, 3, 4 AND COMBINED – J1 PINS 5, 8, 11 AND J2 PINS 3; J2 PIN 4 (COMB)

The PTT lines should be floating when in receive and grounded for transmit. The input has a pull up resistor to 5 volts. Connecting an audio panel that wishes to see more, may result in no receive audio. Connect a 1N4006 diode in series with the cathode towards the audio panel in this case.

3.13 TX DATA AND RX DATA – J1 PINS 12 AND 13

These pins provide RS-232 serial communications for use with the RC-7000 remote control head if installed. Consult the RC-7000 installation manual for details.

3.14 CHANNEL UP AND CHANNEL DOWN – J1 PINS 16 AND 17

These pins can be used to scroll up and down through the zone/channel mode/talk group selections for the band currently displayed on the screen. The inputs normally floating are grounded to activate. Two push buttons or a center off, SPDT, spring loaded toggle switch are typically used on these inputs. If both pins are grounded simultaneously, the next band will be selected.

3.15 LH DATA, SB9600 BUSY, OPTB+, CTS OUT, BOOT DIN, RTSBIN AND RS232DIN – J1 PINS 18 THROUGH 24

These pins are used for programming or updating the transceiver using Motorola Customer Programming Software (CPS™) or encryption key loading and are left unconnected. They may be used to update the radio once it is removed from the aircraft. These pins are also brought out to the TDFM-7000's front panel mini-DIN connector to allow programming in the aircraft.

3.16 PANEL BACKLIGHTING – J1 PIN 25

Connect to aircraft panel dimming bus. The transceiver is capable of supporting 28 VAC/DC or 5 VAC/DC backlighting circuits. Select 28 volts or 5 volts via the configuration menu (see section 2.17). No damage will occur if the wrong setting is made.

3.17 POWER JUMPER

The radio must be turned on manually each time the avionics bus is switched on. If it is desired that the radio comes on with the radio master in the aircraft, remove the right side panel from the radio and install the supplied 0.1" jumper across JP1 (two pins) near the rear of the radio on the right side of the MCU board. The radio is shipped with the jumper on only one of the two pins. If you attempt to turn off the radio with the jumper installed, it will just come back on again in 5 seconds. Turning the avionics bus or battery master switch off will now be required to de-energize the radio.

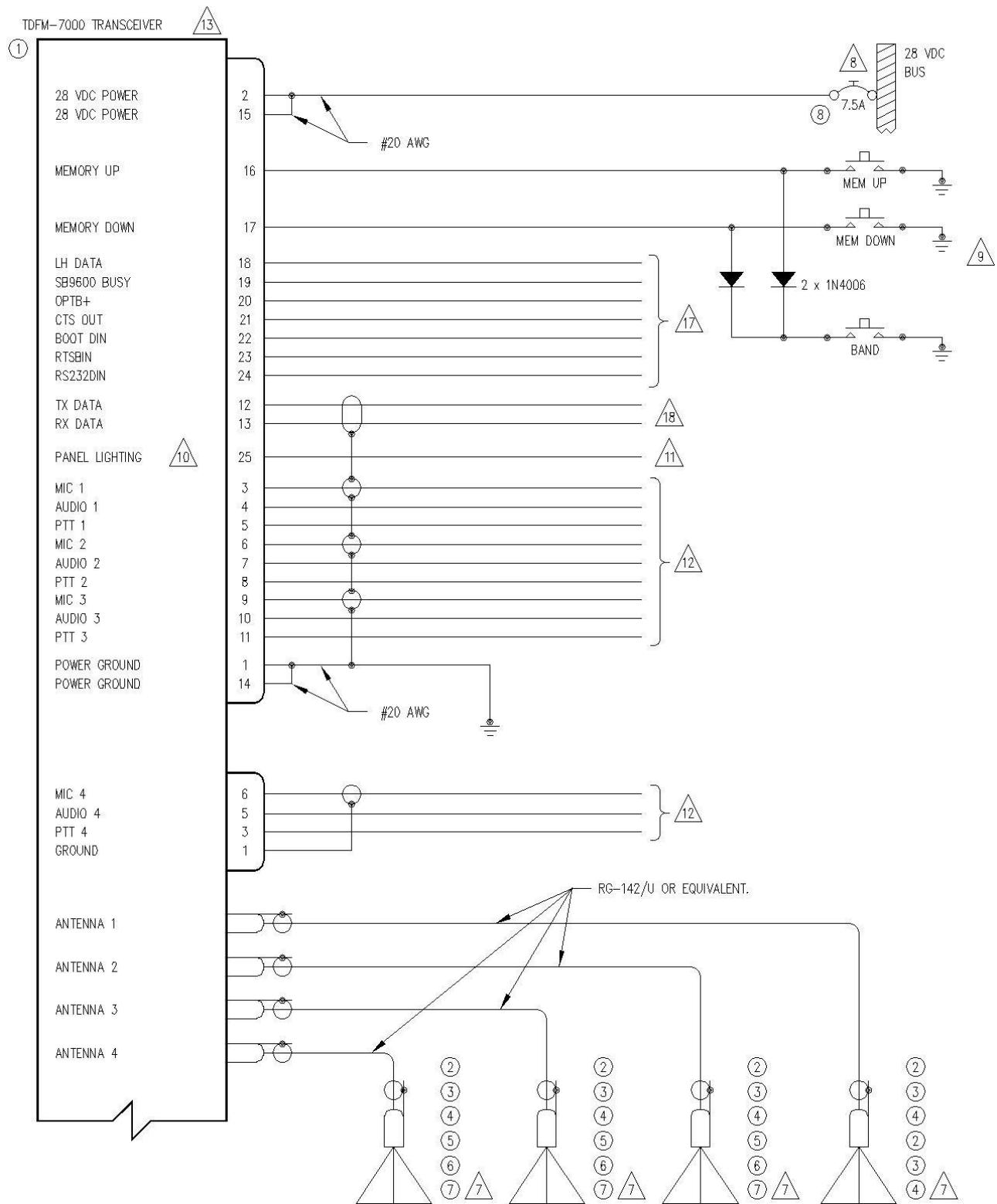


FIGURE 3.2a Wiring connections for the TDFM-7000 Transceiver

TECHNISONIC INDUSTRIES LIMITED

www.til.ca

QTY	ITEM	PART NUMBER	DESCRIPTION	SPEC	MATERIAL
1	1	TDFM-7000	VHF/UHF/800 COMMUNICATIONS TRANSCEIVER.	TECHNISONIC INDUSTRIES LTD	
1	2	CI-292-3,-4	VHF ANTENNA, 136 TO 174 MHZ	COMANT INDUSTRIES	
1	3	CI-275	UHFLO ANTENNA, 403 TO 470 MHZ	COMANT INDUSTRIES	
1	4	CI-275	UHFHI ANTENNA, 450 TO 512 MHZ	COMANT INDUSTRIES	
1	5	CI-285	UHFHI (ii) ANTENNA, 450 TO 520 MHZ	COMANT INDUSTRIES	
1	6	CI-306	800 ANTENNA, 806 TO 870 MHZ	COMANT INDUSTRIES	
1	7	CI-285	800/700 (II) ANTENNA, 700 TO 870 MHZ	COMANT INDUSTRIES	
1	8	7274-11-10	CIRCUIT BREAKER, 7.5 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 43.13-1B CHAPTER 11.
- 5) GROUNDING AND BONDING IAW AC 43.13-1B CHAPTER 11, SECTION 15.
- 6) ALL SINGLE WIRE TO BE #22 AWG MINIMUM AND ALL SHIELDED WIRES TO BE #24 AWG MINIMUM, UNLESS OTHERWISE SPECIFIED.

 INSTALLATION OF ANTENNA IAW AC 43.13-1B CHAPTER 4, SECTION 4, CHAPTERS 6 & 7, 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 CHOOSE SEPARATIONS THAT CLOSELY APPROXIMATE 1/4 OR 1/2 OR WHOLE NUMBER MULTIPLES OF THE NAVIGATION OR COMMUNICATIONS WAVELENGTH.

 8 AN EQUIVALENT CIRCUIT BREAKER OR FUSE MAY BE USED.

 9 THE MEMORY UP/DOWN PUSH BUTTONS ARE OPTIONAL.

 10 THIS INPUT IS FOR BOTH 28 AND 5 VAC OR VDC PANEL LIGHTING. SELECT THE APPROPRIATE VOLTAGE IN THE CONFIGURATION MENU. SEE PARA 2.17.

 11 CONNECT TO THE APPROPRIATE AIRCRAFT DIMMING BUSS.

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

 13 INSTALLATION OF TRANSCEIVER IAW AC 43.13-1B CHAPTER 4, SECTION 4 AND AC 43.13-2A, CHAPTER 2. PR3 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.

 17 NOT NORMALLY USED IN AIRCRAFT.

 18 CONNECTION TO AN OPTIONAL RC-7000 SLAVE CONTROL HEAD.

 19 CONNECT TO GROUND FOR THE UNIT TO POWER UP WHEN THE POWER BUS IS SWITCHED ON. LEAVE UNCONNECTED OTHERWISE.

 20 OPTIONAL 4 OHM SPEAKER OUTPUT FOR COMBINED AUDIO. LEAVE UNCONNECTED IF NOT USED.

 21 OPTIONAL RECEIVE ATTENUATOR. CAN BE USED ON ANY BAND AS REQUIRED FOR TRUNKING SYSTEMS.

 22 SWITCH SHOULD BE MOUNTED ON THE PANEL NEAR THE TDFM-7000. THE ON POSITION SHOULD BE LABELED 'IN FLIGHT' AND THE OFF POSITION LABELED 'ON GROUND'

FIGURE 3.2b Wiring connections for the TDFM-7000 Transceiver

3.18 POST INSTALLATION EMI TEST

PURPOSE

The purpose of this test is to identify any interference that the TDFM-7000 transceiver may cause with existing aircraft systems.

TEST CONDITIONS

The TDFM-7000 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 output power is set to high.

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-7000 transceiver 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-7000 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 moment 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 autopilot or a stability augmentation system, then test fly the aircraft and verify that operation of the TDFM-7000 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 autopilot (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-7000 unit is transmitting, providing that it recovers properly and promptly, but it 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.

PROCEDURE

A. Operate the TDFM-7000 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
143.2125 MHz				
143.2250 MHz				
157.5375 MHz				
157.5500 MHz				
512.0000 MHz				

NOTES:

B. Determine if the image frequency for the VHF Comm falls within the range of the TDFM-7000. If so, select a set of frequencies that will cause the TDFM-7000 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-7000 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 received 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-7000 to 142.8000 MHz.

FREQUENCIES		RESULTS	
VHF #1	TDFM-7000	PASS	FAIL
135.975	136.0000		
121.150	157.5000		
131.250	157.5000		
Image:			

FREQUENCIES		RESULTS	
VHF #2	TDFM-7000	PASS	FAIL
135.975	136.0000		
121.150	157.5000		
131.250	157.5000		
Image:			

NOTES:

C. Determine if the image frequency for the VOR/ILS Nav falls within the range of the TDFM-7000. If so, select two sets of frequencies that will cause the TDFM-7000 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-7000 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-7000	PASS	FAIL
108.000	162.0000		
108.100	162.1500		
Image:			

FREQUENCIES		RESULTS	
VOR/ILS #2	TDFM-7000	PASS	FAIL
108.000	162.0000		
108.100	162.1500		
Image:			

NOTES:

D. The following procedure checks for second harmonic interference to the glide slope receiver from the TDFM-7000. All transceivers produce harmonics (multiples of the wanted frequency) and while the TDFM-7000 far exceeds FCC requirements, interference can still be experienced depending upon antenna position and separation. Furthermore, harmonics can be generated by other equipment in the aircraft and the structure of the aircraft where dissimilar metals make contact or where grounds are isolated, etc. This is also true of aircraft hangars, therefore testing should be done outside away from any structures where possible.

With a portable glide slope generator, provide enough signal to firmly activate the indicator needle and hide all flags. Increase the signal level by 3 dB. Modulate the TDFM-7000 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. If an interference condition is detected, then the installation will have to be flight tested according to the following procedure. Using the table below, determine the glide slope frequency based on the localizer frequency of the ILS to be used. Divide the glide slope frequency by 2 and program into the TDFM-7000. Fly the aircraft to intercept the localizer and glide slope (both needles centered) at 26 nm from the runway. Transmit on the TDFM-7000 for 10 seconds and watch for any deflections or flags. Repeat the test every 2 nm until the indicators are not affected. If the distance is greater than 18 nm then a pass shall be recorded. Otherwise the TDFM-7000 shall be placarded "Do not transmit while on ILS approach".

Localizer	Glide slope	Localizer	Glide slope
108.10	334.70	110.10	334.40
108.15	334.55	110.15	334.25
108.30	334.10	110.30	335.00
108.35	333.95	110.35	334.85
108.50	329.90	110.50	329.60
108.55	329.75	110.55	329.45
108.70	330.50	110.70	330.20
108.75	330.35	110.75	330.05
108.90	329.30	110.90	330.80
108.95	329.15	110.95	330.65
109.10	331.40	111.10	331.70
109.15	331.25	111.15	331.55
109.30	332.00	111.30	332.30
109.35	331.85	111.35	332.15
109.50	332.60	111.50	332.90
109.55	332.35	111.55	332.75
109.70	333.20	111.70	333.50
109.75	333.05	111.75	333.35
109.90	333.80	111.90	331.10
109.95	333.65	111.95	330.95

TECHNISONIC INDUSTRIES LIMITED
www.til.ca

FREQUENCIES		RESULTS	
G/S #1	TDFM-7000	PASS	FAIL
334.7 (108.1)	167.35		

FREQUENCIES		RESULTS	
G/S #2	TDFM-7000	PASS	FAIL
334.7 (108.1)	167.35		

NOTES:

E. Operate the TDFM-7000 transmitter on the following frequency for at least 20 seconds. Observe the Transponder for any spurious replies or loss of reply to test set.

FREQUENCIES	TRANSPOUNDER #1		TRANSPOUNDER #2	
TDFM-7000	PASS	FAIL	PASS	FAIL
512 MHz				

NOTES:

TECHNISONIC INDUSTRIES LIMITED

www.til.ca

F. Modulate the TDFM-7000 transmitter on the following frequencies for at least 20 seconds. Observe the DME displays. Look for loss of distance information on the display.

FREQUENCIES		RESULTS	
DME 1	TDFM-7000	PASS	FAIL
978 (108.0)	489		
1020 (112.2)	510		

FREQUENCIES		RESULTS	
DME 2	TDFM-7000	PASS	FAIL
978 (108.0)	489		
1020 (112.2)	510		

NOTES:

G. **NOTE:** For the following tests, select a frequency at the top, middle and bottom of each band of the TDFM-7000 transceiver.

136 to 174 MHz 403 to 470 MHz 450 to 512 MHz 806 to 870 MHz
 Band Band Band Band

Frequency #1

Frequency #2

Frequency #3

H. At a safe altitude engage the autopilot or stability augmentation system. Modulate the TDFM-7000 transmitter on the above frequencies for at least 20 seconds. Observe any effect on the autopilot or stability augmentation system.

Observations:

I. Perform a coupled ILS approach to the aircraft's certified limits. Modulate the TDFM-7000 transmitter on the above frequencies for at least 20 seconds. Observe any effect on the autopilot. Repeat for second flight director/autopilot if equipped.

Observations:

TECHNISONIC INDUSTRIES LIMITED

www.til.ca

J. 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	Com 1&2 (UHF Lo, UHF Hi, and 800 MHz)			
2	Transponder & Encoder (VHF, UHF Lo, and 800 MHz)			
3	ADF 1 & 2			
4	VG			
5	Glideslope 1&2 (UHF Lo, UHF Hi, and 800 MHz)			
6	VOR/LOC 1&2 (UHF Lo, UHF Hi, and 800 MHz)			
7	Compass			
8	Directional Gyro			
9	Fuel Pressure			
10	Oil Temp			
11	Amps			
12	Bus Voltage			

13	Fuel %			
14	Ng			
15	TOT			
16	Torque %			
17	Annunciators			
18	Digital Clock			
19	Oil Pressure			
20	DME 1&2 (VHF, UHF Lo, and 800 MHz)			
21	GPS 1&2 (UHF Lo and 800 MHz)			

STEP	SYSTEM	PASS	FAIL	NOTES

NOTES:

3.19 TDFM-7000/7300 SOFTWARE OPTION FOR CONTROL OF LATITUDE SATELLITE GATEWAY S200-SG11

3.19.1 GENERAL

The TDFM-7000/7300 software option for control of the Latitude satellite gateway S200-SG11 allows the TDFM-7000 to act as a controller for the above system replacing the usual controller thereby saving space and weight in the aircraft and providing a larger display and keypad. The satellite gateway provides three main functions:

1. Satellite Phone capability
2. Outgoing Text Messages to e-mail addresses
3. Automated GPS Position Reporting

The transceiver controls the satellite gateway system through the RS-232 port on the back of the unit. All audio and keying is connected separately to a free position on the aircraft audio panel. The TDFM-7000 acts as a controller only. This option precludes the use of an RC-7000 at this time. This option is identified as Mod 4 on the modification record label.

3.19.2 INSTALLATION

Connect the TDFM-7000 and the S200-SG11 as shown in figures 3.3. See the S200-SG11 installation instructions for details.

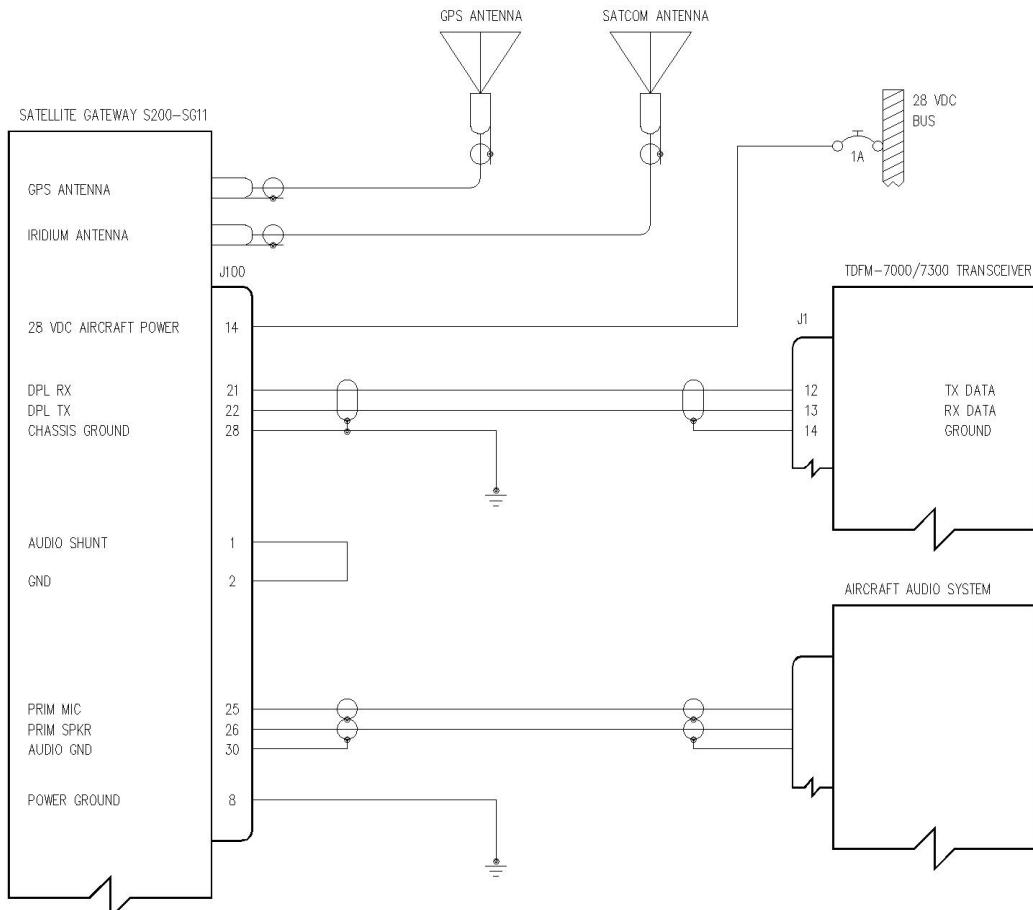


FIGURE 3.3 TDFM-7000 and S200-SG11 Wiring Diagram

3.19.3 OPERATING INSTRUCTIONS

Control of the S200-SG11 satellite gateway is provided by a series of menus under the main function menu. To open the main satcom menu, press [FUNC] and then press [6]. The following selections are available:

1 = Voice Call	Press 1 to initiate the sat phone call menu.
2 = Text Message	Press 2 to for outgoing text message menu.
3 = GPS info	Press 3 for the automated position reporting menu.
* = PRG	Press * for the download menu

Voice Call When the voice call menu is selected, you can either select one of ten preset phone numbers by pressing 0 through 9 or you can enter a new number by pressing [#] followed by the number. Dial “001” then the area code followed by the number. The leading zeros are required by the Iridium satellite system. Rotating the knob will scroll through the pre-programmed phone numbers. After the number is selected or entered, press [*] to initiate the phone call. Pressing [*] again will terminate the call. Pressing [HOME] at anytime will bring you to the previous menu.

To answer an incoming phone call (as indicated by a **flashing symbol** and the **bottom line of the display flashing** along with a ringing sound in the headset) press [FUNC] then [6] and the incoming call menu will appear. Press [*] to answer the call or [#] to reject the call.

Text Message When this menu is selected, you must select one of ten pre-programmed messages by pressing a number key [0-9] as indicated by the > to the left of the option. Rotating the knob at this point will scroll through the available messages. The message selected will show for a few seconds then the menu will return. If it is desired to see the message for longer, press [#] and the message will stay until [#] is pressed again. To move the > to the next option, press the knob. Then press a number key [1-5] to select one of five pre-programmed email addresses. Again, the knob can be used to scroll through the email addresses. Press [*] to send or press [HOME] to return to the previous menu.

GPS Info The current position, direction and speed of the aircraft will be displayed. The time since the last position report is displayed at the bottom. Position reporting is normally updated automatically but a manual update can be sent by pressing *. Press [HOME] to return to the previous menu.

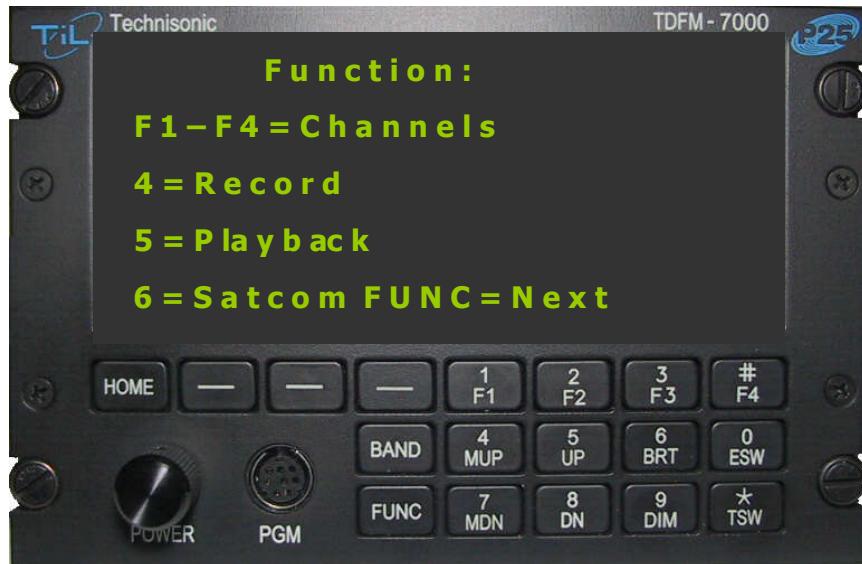
When the radio in normal operating mode, an indicator will flash on the bottom line for a few seconds when an automated position report is occurring.

PRG Pressing the [*] key will invoke the download function. The pre-programmed messages, email addresses and phone numbers can be downloaded into the radio using Technisonic's MultiTDP software.

3.20 SATCOM Menus

To Open Satcom Menu:

Press [FUNC + 6].



Satcom Menu Options:

- Press [1] to access [Voice call],
- Press [2] to access [Text MSG (Message)],
- Press [3] to access [GPS Info],
- Press [*] – [Program Text MSG & Phone Data],
- Select [HOME] to access previous menu.



Satcom Menu [Voice Call Menu]:

To select a preset number, press any [**0** to **9**] buttons,
or use the rotary encoder/knob to view/select one of the preset numbers.
Press [**#**] to manually enter a phone number.
Press [**HOME**] for previous menu.

**Satcom Menu [Voice Call Menu] [Make Call Menu]:**

Press the [*****] button to make/cancel a phone call,
To enter a phone #, use numerical [**0** to **9**] and [**-**] buttons to delete character,
delete all, or recall last number,
Press [**HOME**] for previous menu.



Satcom Menu [Text MSG Menu]:

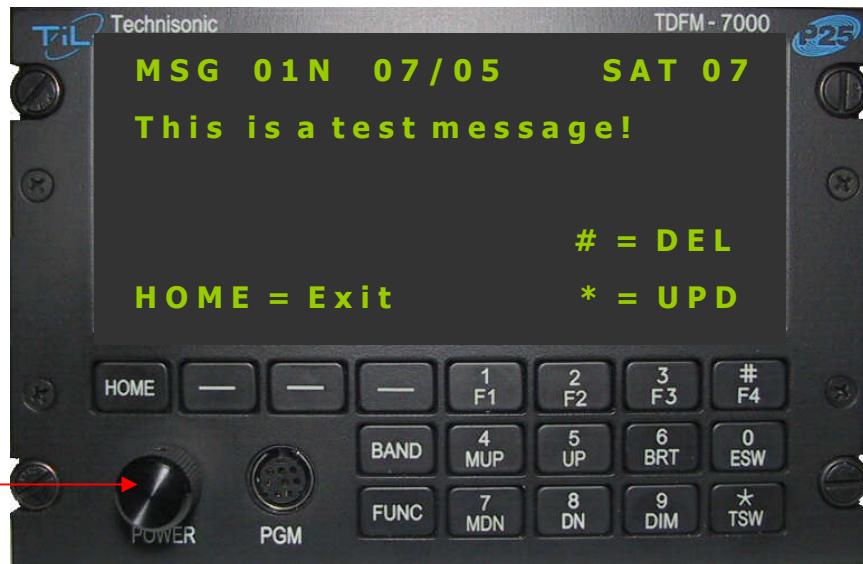
To toggle between preset email address/message - use rotary encoder knob,
 To select message - press button [**0 to 9**],
 To select address - press button [**1 to 5**],
 To view selected addr/msg press [**#**],
 To view received addr/msg press any of the 3 [-] buttons beside the HOME key,
 To send selected message to selected address, press [*****],
 Press [**HOME**] for previous menu.

**[Text MSG Receive]:**

Pressing any of the 3 [-] buttons beside the HOME key displays receive addr/msg,
 Press the [**#**] button to delete message,

NOTE: Display top line "01N" means 1 new msg, "07/05" means 7 total/5 new.
 Press [**HOME**] for previous menu.

Pressing on the rotary encoder button toggles between MSG and ADDR.



Satcom Menu [GPS Menu]:

Press the [*] button to manually update GPS data,
Press [HOME] for previous menu.



To Receive a Phone Call

(incoming call indicator is flashing on the main transceiver screen):

Press [FUNC + 6] [Satcom menu / incoming call],
Press [*] answer the incoming call,
Press [#] reject the incoming call,
Press [HOME] for previous menu.

APPENDIX A

SUPPORT NOTES

- For the latest Service Bulletin(s) refer to the Publication Index list under the section for this model (*login required*).
- For the latest Technical Information Bulletins refer to the Publication Index list under the section for this model (*login required*).
- For the latest Software Release(s) refer to the Publication Index list under the section for this model's software/firmware history index (*login required*).

TECHNISONIC INDUSTRIES LIMITED

www.til.ca

APPENDIX A - Support Notes

NOTES

Technisonic Industries Limited
240 Traders Blvd., Mississauga, ON Canada L4Z 1W7
Tel: (905) 890-2113 Fax: (905) 890-5338

**IMPORTANT
WARRANTY**

All communication equipment manufactured by Technisonic Industries Limited is warranted to be free of defects in Material or Workmanship under normal use for a period of one year from Date of Purchase by the end user.

Warranty will only apply to equipment installed by a factory approved and/or authorized facility in accordance with Technisonic published installation instructions. Equipment falling under the following is not covered by warranty:

- equipment that has been repaired or altered in any way as to affect performance,
- equipment that has been subject to improper installation,
- equipment that has been used for purposes other than intended,
- equipment that has been involved in any accident, fire, flood, immersion or subject to any other abuse.

Expressly excluded from this warranty are changes or charges relating to the removal and re-installation of equipment from the aircraft. Technisonic will repair or replace (at Technisonic's discretion) any defective transceiver (or part thereof) found to be faulty during the Warranty Period.

Faulty equipment must be returned to Technisonic (or its authorized Warranty Depot) with transportation charges prepaid. Repaired (or replacement) equipment will be returned to the customer with collect freight charges. If the failure of a transceiver occurs within the first 30 days of service, Technisonic will return the repaired or replacement equipment prepaid.

Technisonic reserves the right to make changes in design, or additions to, or improvements in its products without obligation to install such additions and improvements in equipment previously manufactured. This Warranty is in lieu of any and all other warranties express or implied, including any warranty of merchantability or fitness, and of all other obligations or liabilities on the part of Technisonic.

This Warranty shall not be transferable or assignable to any other persons, firms or corporations.

**For warranty registration please complete the on-line
Warranty Registration Form found at www.til.ca.**