



TDFM-600/6000

MULTIBAND P25 AIRBORNE TRANSCEIVER



Installation and Operating Instructions

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REVISION HISTORY
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REV / ISSUE	SECTION - PAGE -	DESCRIPTION	DATE	EDITED BY
F issue 5	3-5	added paragraph 3.18 Post EMI as APPENDIX Added Headers and Footers to document TOC updated and corrected typos	JUN 2008	F.M.
F issue 6	2-10 3-3 3-6,7 3-8	Added revision page to track changes Tables 2.1 & 2.2 updated/changed Revisions made to the tone/code tables (PL and DPL) that are supported by the TDFM-600/6000 J1(25 Pin D Connector) - Use FEMALE Connector Fig 3.2 split in half and enlarged. Paragraph 3.19 now contains the Appendix	JUN 2009	F.M.
F issue 7	3-9	Remove from Procedure A freq 787.7100 MHz Incapable of operating in that frequency Document layout/format - New title page includes Logo, product photo. - Rev History pg to be added if missing in manuals. - Approvals column will become "edited by" column, added if missing from here on. - Frontal matter, Contents and/or footer updated. - Warranty added to inside of back cover. - All other data remains unchanged.	NOV 2009	F.M.
F issue 8	3	Added flight test option to glide slope test	AUG 2010	S.M.
F issue 9	3	Added quick functional test.	Oct 2010	S.M.
F Iss. 10	Sect 1	Correct VHF Module Freq typos to (136-174MHz) Insert Appendix A (Band Splits)	NOV 2011	F.M.
F Iss. 11	2.18	Added Information about Auto Test feature with Aeroflex 3920 Digital Test Set	JULY 2012	J.R
F Iss.12	3.18	Removed reference to TFM-30 ATU. Added FCC notice regarding wide band operation after 1 Jan 2013.	JAN 2013	S.M.



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-600/6000 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.

INFORMATION 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-600/6000. Every effort has been made to make this manual as complete and accurate as possible.

WARRANTY INFORMATION

The Model TDFM-600/6000 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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SUMMARY OF DO-160C ENVIRONMENTAL TESTING

The following table gives a summary of DO-160C Environmental Testing for Technisonic Model TDFM-600/6000 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.

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SECTION 1 - GENERAL DESCRIPTION

1.1 INTRODUCTION

This publication provides operating and installation information on the TDFM-600/6000 series airborne transceiver with firmware version TR14 and above. The exact model number depends on which and how many RF modules are installed.

1.2 DESCRIPTION

The TDFM-600/6000 series of transceivers are airborne multi-band radios capable of operation in conventional analogue and P25 digital FM systems, SmartNet/SmartZone and P25 9600 trunking systems. Type I RF modules are available in VHF, UHFLO, UHFHI and 800 MHz bands. Type II RF modules support additional optional features not available in type I modules and are also available in VHF, UHFLO, UHFHI 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 only produce radios with all modules of the type I or type II configuration since different Motorola CPS programming software is required for each type of module.

It may be possible to retrofit existing type I transceivers with one or more type II modules to support optional features not available on type I modules. Contact Technisonic for details.

Irrespective of module type the bands are numbered 1, 4, 5 and 8 respectively. The front panel LED display indicates whether type I or II modules are present upon radio start-up. The transceiver's part number will also indicate which type of modules it contains. Please see section 1.3 on Model Variation below for details

The following are typical model examples:

TDFM-680	- One 800 MHz module
TDFM-655	- Two UHF high band modules
TDFM-688	- Two 800 MHz modules
TDFM-6148	- One VHF, UHF low and 800 MHz module
TDFM-6158	- One VHF, UHF high and 800 MHz module

Module numbers are always specified in ascending numerical order (e.g. TDFM-6814 is not available). The one exception to this numbering scheme is the model TDFM-636 which is a VHF transceiver with two type II VHF modules and a 10 watt RF amplifier for each module.

1.3 MODEL VARIATION

There are several variations of the Model TDFM-600/6000 Transceiver. Each variation offers different features and performance based on the type of RF modules and options installed. Single Band Transceivers are available with the following Model numbers: TDFM-610 (VHF), TDFM-640 (UHF Lo), TDFM-650 (UHF Hi) and TDFM-680 (800).

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TDFM-600 Model Variations with type I Modules

*TDFM-6X0, P/N 011210-1-6X0/PYYY/28	GREEN display and 28 Volt back lighting.
*TDFM-6X0, P/N 011210-1-6X0/PYYY/5	GREEN display and 5 Volt back lighting.
TDFM-6XX, P/N 011210-1-6XX/PYYY/28	GREEN display and 28 Volt back lighting.
TDFM-6XX, P/N 011210-1-6XX/PYYY/5	GREEN display and 5 Volt back lighting.
TDFM-6XX, P/N 011210-2-6XX/PYYY/28	RED display and 28 Volt back lighting.
TDFM-6XX, P/N 011210-2-6XX/PYYY/5	RED display and 5 Volt back lighting.
TDFM-6XXNV, P/N 011210-1-6XXNV/PYYY/28	GREEN NV display and 28 Volt back lighting
TDFM-6XXNV, P/N 011210-1-6XXNV/PYYY/5	GREEN NV display and 5 Volt back lighting.

TDFM-6000 Model Variations with type I Modules

TDFM-6XXX, P/N 011210-1-6XXX/PYYY/28	GREEN display and 28 Volt back lighting.
TDFM-6XXX, P/N 011210-1-6XXX/PYYY/5	GREEN display and 5 Volt back lighting.
TDFM-6XXX, P/N 011210-2-6XXX/PYYY/28	RED display and 28 Volt back lighting.
TDFM-6XXX, P/N 011210-2-6XXX/PYYY/5	RED display and 5 Volt back lighting.
TDFM-6XXXNV, P/N 011210-1-6XXXNV/PYYY/28	GREEN NV display and 28 Volt back lighting
TDFM-6XXXNV, P/N 011210-1-6XXXNV/PYYY/5	GREEN NV display and 5 Volt back lighting.

X is represented by:

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

Module numbers must always be specified in ascending order.

***Note:** 0 used when only one module installed.

PYYY represents a 3-digit project number that identifies specific options that are contained in the module. The Technisonic sales department assigns project numbers based on customer requirements. P100 and P200 series project numbers are used in transceivers with type I modules.

TDFM-600 Model Variations with type II Modules

*TDFM-6X0, P/N 011210-3-6X0/PYYY/28	GREEN display and 28 Volt back lighting.
*TDFM-6X0, P/N 011210-3-6X0/PYYY/5	GREEN display and 5 Volt back lighting.
TDFM-6XX, P/N 011210-3-6XX/PYYY/28	GREEN display and 28 Volt back lighting.
TDFM-6XX, P/N 011210-3-6XX/PYYY/5	GREEN display and 5 Volt back lighting.
TDFM-6XX, P/N 011210-4-6XX/PYYY/28	RED display and 28 Volt back lighting.
TDFM-6XX, P/N 011210-4-6XX/PYYY/5	RED display and 5 Volt back lighting.
TDFM-6XXNV, P/N 011210-3-6XXNV/PYYY/28	GREEN NV display and 28 Volt back lighting
TDFM-6XXNV, P/N 011210-3-6XXNV/PYYY/5	GREEN NV display and 5 Volt back lighting.

TDFM-6000 Model Variations with type II Modules

TDFM-6XXX, P/N 011210-3-6XXX/PYYY/28	GREEN display and 28 Volt back lighting.
TDFM-6XXX, P/N 011210-3-6XXX/PYYY/5	GREEN display and 5 Volt back lighting.
TDFM-6XXX, P/N 011210-4-6XXX/PYYY/28	RED display and 28 Volt back lighting.
TDFM-6XXX, P/N 011210-4-6XXX/PYYY/5	RED display and 5 Volt back lighting.
TDFM-6XXXNV, P/N 011210-3-6XXXNV/PYYY/28	GREEN NV display and 28 Volt back lighting
TDFM-6XXXNV, P/N 011210-3-6XXXNV/PYYY/5	GREEN NV display and 5 Volt back lighting.

X is represented by:

- 1 for VHF (136-174 MHz) module
- 4 for UHF Lo (380-470 MHz) 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.

***Note:** 0 used when only one module installed.

PYYY represents a 3-digit project number that identifies specific options that are contained in the module. P300, P400 and P500 project numbers are used in transceivers with type II modules.

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TDFM-636 Model Variations with type II VHF Modules

TDFM-636, P/N 011210-5-636/PYYY/28	GREEN display and 28 Volt back lighting.
TDFM-636, P/N 011210-5-636/PYYY/5	GREEN display and 5 Volt back lighting.
TDFM-636, P/N 011210-6-636/PYYY/28	RED display and 28 Volt back lighting.
TDFM-636, P/N 011210-6-636/PYYY/5	RED display and 5 Volt back lighting.
TDFM-636NV, P/N 011210-5-636NV/PYYY/28	GREEN NV display and 28 Volt back lighting
TDFM-636NV, P/N 011210-5-636NV/PYYY/5	GREEN NV display and 5 Volt back lighting.

1.4 TDFM-636 PROJECT NUMBER NOTE

PYY represents a 3 digit project number that identifies specific options that are contained in the module. All TDFM-636 transceivers are shipped as P600 units unless a custom project number is requested. P600 defines specific options in each VHF module. VHF Module 1 supports P25 Trunking, SmartZone and SmartNet trunking protocols. VHF Module 2 supports conventional (non-trunked) operation with FPP (front panel programming) capability. Both modules support secure communications using AES/DES-OFB/DES/DES-XL encryption formats and P25 OTAR. Custom project numbers can be assigned by the Technisonic sales department to meet non-standard requirements.

All model variations are provided with 28 Volt back lighting unless a specific request is made for 5 Volt AC operation. NV (Night Vision) compatible option is only available with green display.

1.5 TECHNICAL CHARACTERISTICS

The tables below provide the technical characteristics for the Technisonic Industries Ltd. Model TDFM-600/6000.

Specification	Characteristic
Model Designation:	TDFM-600/6000
Physical Dimensions:	Approx. (L) 8.0" x (W) 5.75" x (H) 3.0"
Weight:	4.2 Lbs (1.9 Kg)
Operating Temperature Range:	-30° C to +60° C
Power Requirement:	
Voltage:	28.0 VDC ± 15%
Current:	350 mA minimum / 5A maximum
Audio Output Power (including sidetone):	500 mW into 600 Ω
Microphone Inputs:	Carbon or Equivalent
Panel Back Lighting:	
Voltage:	28 VDC or 5VAC (specified when ordered)
Current:	100 mA max. @28VDC 400 mA max. @5VAC

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Type I Modules

Specification	Characteristic
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	VHF UHF 800
<i>Sensitivity</i> in uV:	
*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
<i>Selectivity</i> in dB:	
25 kHz Channel	-78 -78 -75
12.5 kHz Channel	-67 -68 -63
Intermodulation (dB) * **	-78 -77 -74

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

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

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Type II Modules

Specification	Characteristic
RF Output Power:	1 or 7 Watts (VHF) 1 or 5 Watts (UHF) 1 or 3 Watts (800) 1 or 10 Watts (TDFM-636)
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:	512 pre-programmable channels 240 channels (15 zones of 16 channels) for modules with Front Panel Programming.
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:	1% 1.5% 1.5%
Modulation Limiting:	Wide band ± 5kHz Narrow band ± 2.5kHz
Receiver section	VHF UHF 800
<i>Sensitivity</i> in μ V:	
* 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.

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SECTION 2 – OPERATING INSTRUCTIONS

2.1 GENERAL

A 2 line display and a keypad and 2 or 3 rotary knobs provide the operator control of the 1, 2 or 3 RF modules installed in the unit. The display is showing the activity of one RF module at a time, selected by pressing the desired knob. If the second rotary encoder on a single band unit is depressed the display will indicate that a RF module is not installed for the second band. The knobs have multiple functions including volume, channel, and display dimmer. The microphone, key line and headphone audio are separate for each of the two or three bands therefore switching from band to band is performed at an audio panel such as the Technisonic A710 series. This allows for separate and simultaneous operation on each of the bands just like having 2 or 3 separate radios. If combined operation is desired, a Technisonic AMS-6000 audio mode selector may be used ahead of the audio controller.

2.2 FRONT PANEL

Refer to the diagrams below:

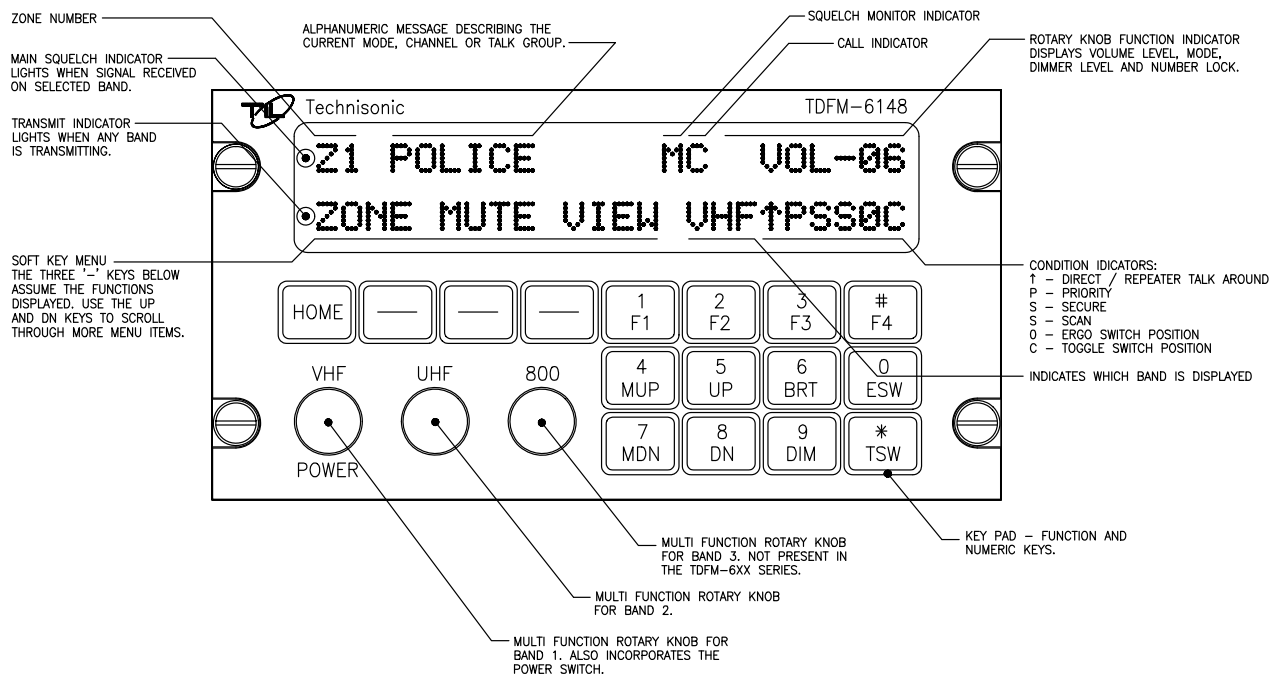


FIGURE 2-1 Front panel Controls – TDFM-600/6000 Series Transceivers (TDFM-636 not included)

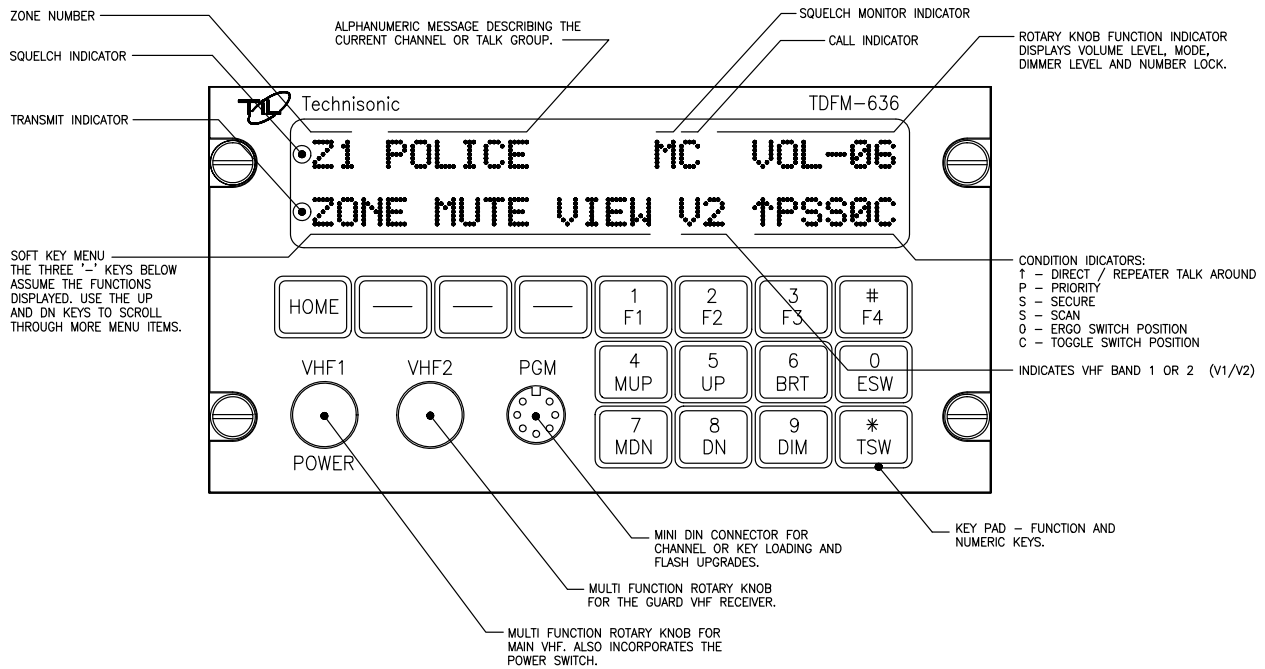


FIGURE 2-2 Front panel Controls – TDFM-636 Transceiver Only

2.3 POWER SWITCH

To switch the transceiver on, press and hold the left most knob until the radio powers up. The display will show TECHNISONIC and the software version installed followed by the model number as determined by which RF modules are installed. The display will then show the normal display for band 1. To switch off the transceiver at any time, press and hold the leftmost knob for 2 seconds until the display shows OFF, then release. If it is desired that the radio comes on with the radio master in the aircraft, a power jumper may be installed (see installation instructions) such that the radio is always on.

2.4 KNOBS

The transceiver will have two or three knobs depending on how many RF modules are installed. The knobs are rotary encoders which turn endlessly which means their actual position is not important. Each knob also has a push button incorporated in it so you can press the knob as well as turn it. Pressing a different knob will cause the display and keyboard to switch to the band associated with that knob. The knob will start out as a volume control. Pressing the same knob again will change its function to act as the channel / talkgroup selector depending on how that band is programmed. Pressing the same knob again changes the function of the knob to a display dimmer control. Pressing the knob again causes the key pad function to change from function keys to number keys. The knob in this mode acts as a volume control. Another knob press will bring you the recall mode (if this feature is enabled in the configuration menu). 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 first mode of volume control. The current function of the knob is shown at the top right of the display.

The function of the knobs for the unselected bands is always the volume control mode. The starting mode (when the band is selected) of the knob can be programmed in the configuration menu to be VOLUME or CHAN.

2.5 SOFT KEYS AND HOME

The transceiver has three soft keys which assume the function shown above them on the display. The functions displayed depend on how the module was programmed with the radio service software (CPS™). Functions can be different on a channel by channel basis as well. These may include:

- ZONE** - Pressing this function will prompt you for a new zone number which can be entered directly 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 phone numbers, call lists and or page.
- 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. The ability for the user to program phone numbers, etc can be enabled or disabled by the CPS™.
- FPP** - The Front Panel Programming (FPP) mode allows you to program channels at the front panel without the customer programming software. This option usually is on VHF band 2 (V2) in the TDFM-636 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 CPS™, 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 FUNCTION 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 – Top-side-button (purple button) on the portable.**
- F2 – Centre-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.**

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TDFM-600/6000 Transceiver Recommended Keypad Menu Defaults:

TDFM-600 / 6000 Series Transceiver ITEM	Portable ITEM	Conventional Operation	SmartNet Operation	SmartZone Operation
F1 Key	Top Side Button 1	Monitor	Phone	Phone
F2 Key	Center Side Button 2	Scan	Scan	Scan
F3 Key	Bottom Side Button 3	Talkaround/ Direct	Private Call	Site Display/Search
F4 Key	Orange (Top) Button	Emergency	Emergency	Emergency
MUP and MDN keys	16-Position Rotary Knob	Channel Select	Channel Select	Channel Select
ESW Key	Two-Position Concentric or Ergo Switch	Blank (O) Low Power (Ø)	Blank (O) Low Power (Ø)	Blank (O) Low Power (Ø)
TSW Key	Three-Position Toggle Switch	Blank (A) Scan (B) Blank (C)	Blank (A) Scan (B) Blank (C)	Blank (A) Scan (B) Blank (C)

NOTE: It is possible to use Motorola's Customer Programming Software (CPS™) to alter the default keypad settings of the TDFM-600/6000 series radios. 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-600/6000 series Transceivers are 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	

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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 key pad, revert to normal number keys during transmit and when NUM LOCK is selected by pressing the rotary knob.

2.7 MUP AND MDN 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.

2.8 UP AND DN 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.

2.9 BRT AND DIM 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.

2.10 ESW 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 bottom of the display, 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, channel, and secure mode.

2.11 TSW 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 bottom of the display, 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, channel, and secure mode.

2.12 DISPLAY

The transceiver has a two line, 48 character LED display which gives information about the selected band. On the top line is shown the zone number, channel name and rotary knob

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function. The bottom line displays the soft key menu, the band selected, and the ESW/TSW condition. Also displayed are letters and symbols indicating scan, direct/repeater talk around, monitor, secure, priority and call. In addition to the character display, there are two LED indicators on the left. The top LED indicates a signal is being received on the selected band while the bottom LED indicates that any one or more of the installed bands are transmitting.

2.13 GENERAL OPERATION

Switch on the transceiver as described in 2.3. Select the desired band by pressing the appropriate knob. Select the same band on the 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. Remember that the band selected by pressing the rotary knobs is what is displayed on the screen but the band selected by the audio panel is band that you are actually transmitting and receiving on. If another band is displayed, the rotary knob for the band you are using is still operating the volume level. To use the DTMF key pad while transmitting, the band you are using must be displayed on the screen.

2.14 CUSTOMER PROGRAMMING SOFTWARE (CPS™)

To make any changes to the programming in the radio, CPS™ software must be used. There is no provision in the radio to allow the user to change frequencies, zones, talk groups, etc. 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-600/6000. Each band in the TDFM-600/6000 is considered a type I (XTS-3000) or a type II (XTS-5000) portable by the CPS™ software. To program a band in the transceiver, it must be selected by pressing the appropriate knob 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-600/6000, therefore you will need to fabricate or purchase the type I programming cable, P/N 013524-1.

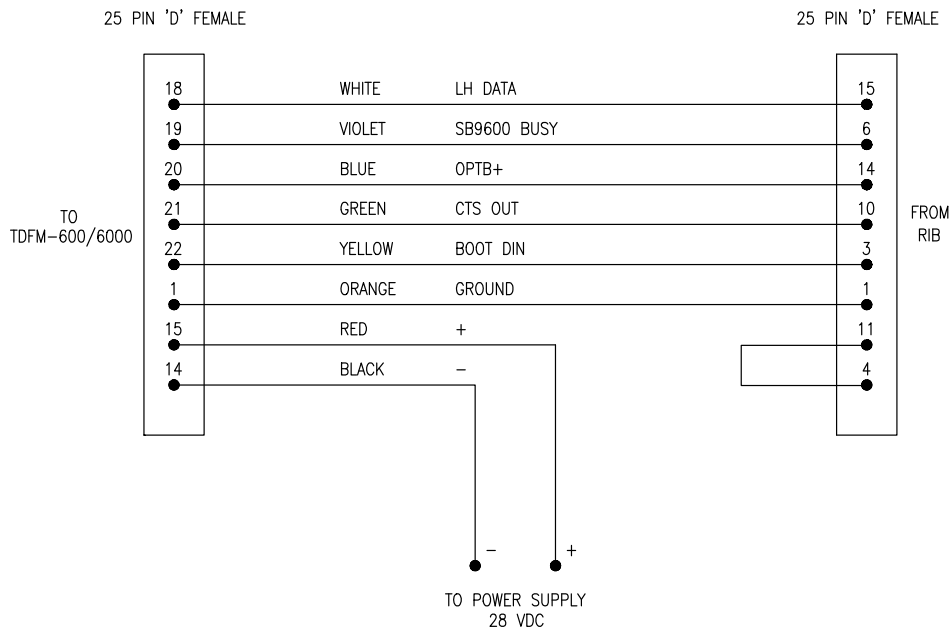


FIGURE 2-3 Type I (XTS-3000) Programming Cable (Requires RIB)

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CUSTOMER PROGRAMMING SOFTWARE (CPS™) - continued

Programming Cables for units with Type I modules

The following items are Motorola part numbers and are required to program the TDFM-600/6000 with type I modules. They must be purchased from Motorola Customer service (1-888-567-7347).

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

A Technisonic type I programming cable P/N 013524-1 is also required and available from Technisonic. If encryption keys need to be loaded via a KVL-3000, key loader cable P/N 047381-1 may be also be obtained from Technisonic. This keyloader cable will plug into the rear connector of the TDFM-600/6000 transceiver and work with type I or type II modules.

If the AMS-6000 is used with a TDFM-600/6000 transceiver with type I modules the following programming cables plug directly into the AMS-6000 front panel connector. They are available from Technisonic.

P/N 037347-1	AMS-6000 Download/Programming Cable that mates with RIB interface Box to program TDFM-600/6000 units employing type I modules.
P/N 037352-1	AMS-6000 Encryption Keyload Cable that mates with Motorola KVL-3000 keyloader uses the same part number Same P/N for type I or type II modules.

Programming cables for units with Type II modules

The TDFM-600/6000 series transceivers that employ type II modules do not require a Smart RIB box, AC power pack or computer RIB cable. A Technisonic PC-6000 II programming cable, P/N 047366-1 and Motorola CPS Programming software, P/N RVN4186 (Latest revision) is all that is required to program transceivers with type II modules. Programming cable P/N 047366-1 must be ordered from Technisonic and cannot be field fabricated. The CPS Programming software P/N RVN4186 must be ordered from Motorola Customer service (1-888-567-7347).

If encryption keys need to be loaded via a KVL-3000, key loader cable P/N 047381-1 may be also be obtained from Technisonic. This keyloader cable will plug into the rear connector of the TDFM-600/6000 transceiver and work with type I or type II modules.

If the AMS-6000 is used with a TDFM-600/6000 transceiver with type II modules the following programming cables plug directly into the AMS-6000 front panel connector. They are available from Technisonic.

P/N 047365-1	AMS-6000/TDFM-636 Download/Programming Cable that mates with PC computer to program TDFM-600/6000 units employing type II modules.
P/N 037352-1	AMS-6000/TDFM-636 Encryption Keyload Cable that mates with Motorola KVL-3000 Keyloader uses the same part number for type I or type II modules.

The TDFM-636 transceiver employs a front panel programming connector identical to the AMS-6000. The above cables can plug directly into the TDFM-636 front panel.

2.15 CONFIGURATION MENU:

Some features of the TDFM-600 / 6000 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 configurable items are:

- Knob default -** Rotating the leftmost knob will toggle the condition between volume and channel. Which ever condition is chosen will be the state of the knob after the radio is switched on or another band is selected. Press the left knob to continue.
- Vol / Chan mode -** Rotating the knob will toggle between Both and Single. If both are selected, the knob will start off in the default condition selected above but the other mode will still be available. If single is selected, only the default mode will be available. If volume is set default and vol / chan mode is single, the channels can still be scrolled using the MUP and MDN buttons on the key board. Press the left knob to continue.
- Dimmer mode -** Used to control the display brightness with the knob. The dimmer function can be either enabled or disabled. If disabled, the BRT and DIM buttons on the key board will still perform the dimmer function.
- Numlock mode -** The numlock mode can be enabled or disabled. Numlock mode is used if you have programmed a feature into one of the RF modules which requires access to number keys while in normal operating mode.
- Recall mode -** Recall mode can also be enabled or disabled. Recall mode can be useful when there are many channels programmed such that scrolling through them would be too time consuming.
- Band 1 channels -** Rotating the left knob will scroll the numbers up or down through 001 to 255. Set this number to the highest channel number that is programmed into band one.
- Band 2 channels -** Same as above for band 2.
- Band 3 channels -** Same as above for band 3. (if installed)
- Auto Reset -** Can be enabled or disabled. This should normally be set to enable. This feature automatically reboots an RF module if a problem is encountered. If however a module fails, this feature should be disabled so the radio will stop trying to revive the failed module.
- Boot Speed -** Can be set to normal or quick. If quick is selected, some of the boot up messages will be skipped reducing the boot up time.

Press the left knob to accept the setting. The radio will then power up normally. The radio will keep these settings until they are changed again by the configuration menu.

2.16 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 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 desired band knob. 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.

2.17 FRONT PANEL PROGRAMMING (FPP) MODE:

One 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. When the FPP soft key is pressed, you will be prompt 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. Mixed mode will allow the receiver to decode analog and P25 digital signals as needed.

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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-600/6000 SERIES

The following is a list of TDFM-600/6000 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-600/6000 SERIES PL(Hz)/MOT CODE

The following is a list of TDFM-600/6000 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-600/6000 SERIES DPL CODES

2.18 AUTOTEST CABABILITY

The TDFM-600/6000 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-600/6000 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-600/6000 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-600/6000 transceivers.

SECTION 3 – INSTALLATION INSTRUCTIONS

3.1 GENERAL

This section contains information and instructions for the correct installation of the TDFM-600/6000 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 TRANSCEIVER INSTALLATION

The TDFM-600/6000 Transceiver is designed to be DZUS mounted and should be installed in conjunction with an IN-600 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-600 installation kit (P/N 019301-1) consists of:

1. One 25 pin Canon D-mating (female) connector complete with crimp pins and hood.
2. Three 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
UHFLO	403 to 470 MHz	Comant part # CI-275
UHFHI	450 to 512 MHz	Comant part # CI-275
UHFHI*	450 to 520 MHz	Comant part # CI-285
800	806 to 870 MHz	Comant part # CI-306
800/700*	764 to 870 MHz	Comant part # CI-285

* The CI-285 antenna is only required if operation in the upper portion (512-520MHz) of the UHF Hi band is required or if operation in the 700MHz band is required. The CI-285 is a broadband antenna that covers 400-960MHz.

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 BNC connectors provided in the installation kit.

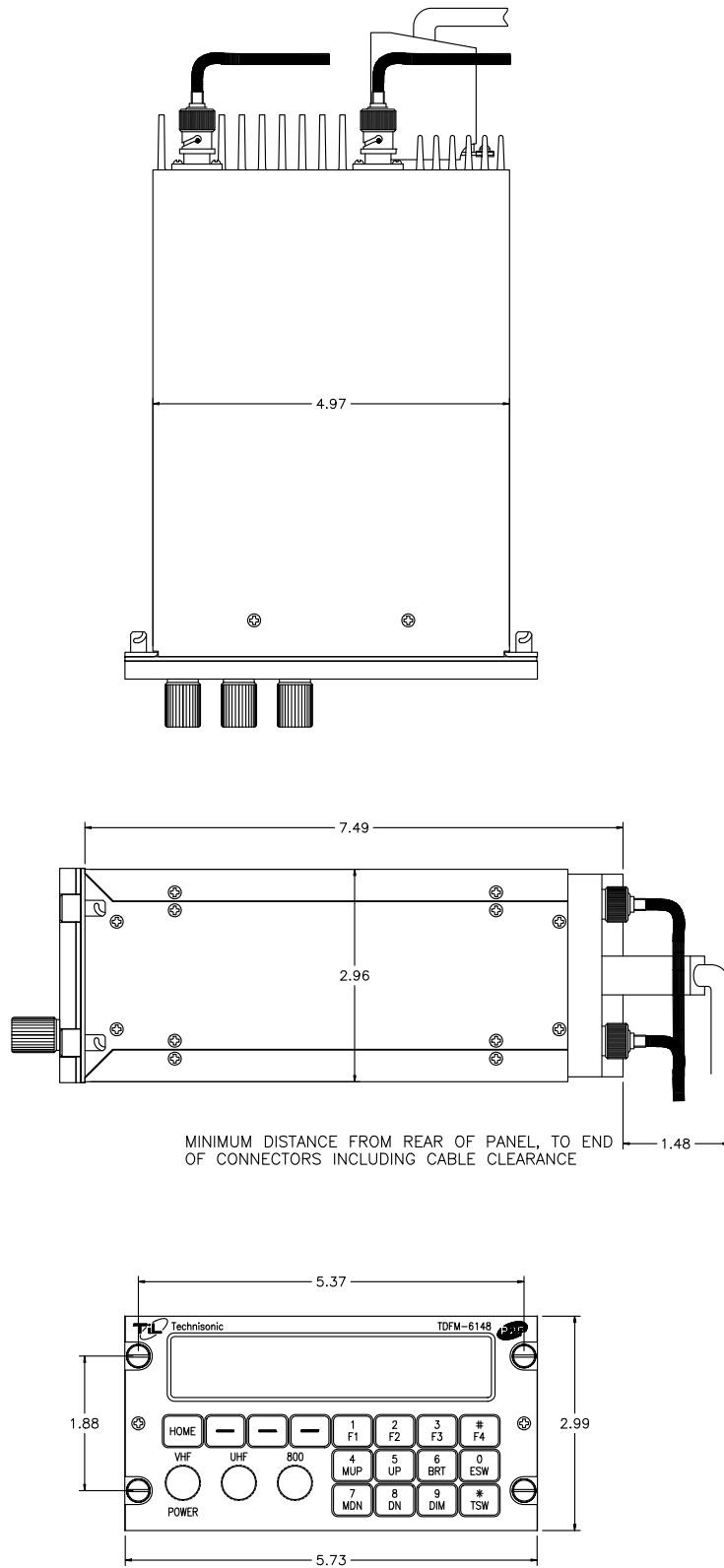


FIGURE 3-1 Outline Drawing for Model TDFM-600/6000

3.6 INSTALLATION - PIN LOCATIONS AND CONNECTIONS

J1 (25 Pin D Connector) – 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 (TDFM-6000 only)
10	Audio 3 (TDFM-6000 only)
11	PTT 3 (TDFM-6000 only)
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 on a 25 Pin D Connector

Note: The TDFM-600 / 6000 has one set of Mic, Audio and PTT lines for each RF band installed. Single band units will only use Mic 1, Audio 1 and PTT 1. Dual band units will use Mic 1 & 2, Audio 1 & 2, and PTT 1 & 2.

A three band unit will require all three Mic lines, all three Audio lines and all three PTT lines to be connected. The AMS-6000 can be used with a three band TDFM-6000 unit to combine all the three sets of lines together for installation on only one audio controller position. However only one RF band can transmit at a time, as selected on the AMS-6000, if this type of installation is made.

3.7 INSTALLATION - WIRING INSTRUCTIONS

Figure 3-2(a and b) show all required connections and recommended wire sizes for the TDFM-600 / 6000 transceiver.

3.8 MAIN GROUND – 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 – PINS 2 AND 15

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

3.10 MIC 1, 2 AND 3 – PINS 3, 6 AND 9

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 this case the shield must be connected to the low input. See the Note under Table 3-1 for the number of connections required on single band, dual band and three band units.

3.11 AUDIO 1, 2 AND 3 – PINS 4, 7 AND 10

Audio outputs 1, 2 and 3 are 600 ohms impedance against ground. The output power is 500 mW maximum. See the Note under Table 3-1 for the number of connections required on single band, dual band and three band units.

3.12 PTT 1, 2 AND 3

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. See the Note under Table 3-1 for the number of connections required on single band, dual band and three band units.

3.13 TX / RX DATA – PINS 12 AND 13

These are an RS-232 serial port for the RC-6000 remote control head if installed. Consult the RC-6000 installation manual for details.

3.14 CHANNEL UP / DOWN – 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.

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

These pins are used for programming or updating the transceiver using Motorola Radio Service Software (RSS™) or encryption key loading and are generally left unconnected. However, if it is desirable to update the radio without removing it from the aircraft, these lines can be run to a 25 pin D male connector located on the panel where a laptop computer can plug in. Use the same pin numbers so the programming cable described in section 2 can be used (minus the power pins).

3.16a PANEL BACKLIGHTING – PIN 25

Connect to aircraft panel dimming bus. The transceiver comes with either 28 VDC or 5 VAC backlighting circuits. Check the label on the side of the transceiver before applying power.

3.16b 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 a 0.1" jumper across JP1 (two pins) near the rear of the radio on the right side of the MCU board. If you attempt to turn off the radio with the jumper installed, it will just come back on again in 5 seconds.

3.16c SIDE TONE LEVEL

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

On the Test Bench:

1. Set the transceiver operating frequency to a usable frequency and connect to an appropriate test set up with a test receiver.
2. Input a 1 kHz audio signal at -13 dBm (0.466 Vrms) into the microphone input.
3. Locate the access hole for "Side Tone" adjustment for the appropriate RF band on the transceiver side panel.
4. Key the transmitter and monitor the side tone level.
5. Use an appropriate tool to adjust the side tone level of 3.0 to 3.5 dBm (to increase rotate clockwise, to decrease rotate counter-clockwise).

In the Aircraft:

1. Set the transceiver to a usable frequency.
2. Gain access to the "Side Tone" adjustment hole on the transceiver side panel by removing the transceiver from the Dzus mount, keeping all connections in place.
3. Key the transmitter while speaking into the microphone. Use a suitable tool to set and/or adjust the appropriate RF band, side tone level in the headset as desired (to increase rotate clockwise, to decrease rotate counter-clockwise).
4. Key down the transmitter as soon as practical to minimize transmit time.
5. Re-install the transceiver.

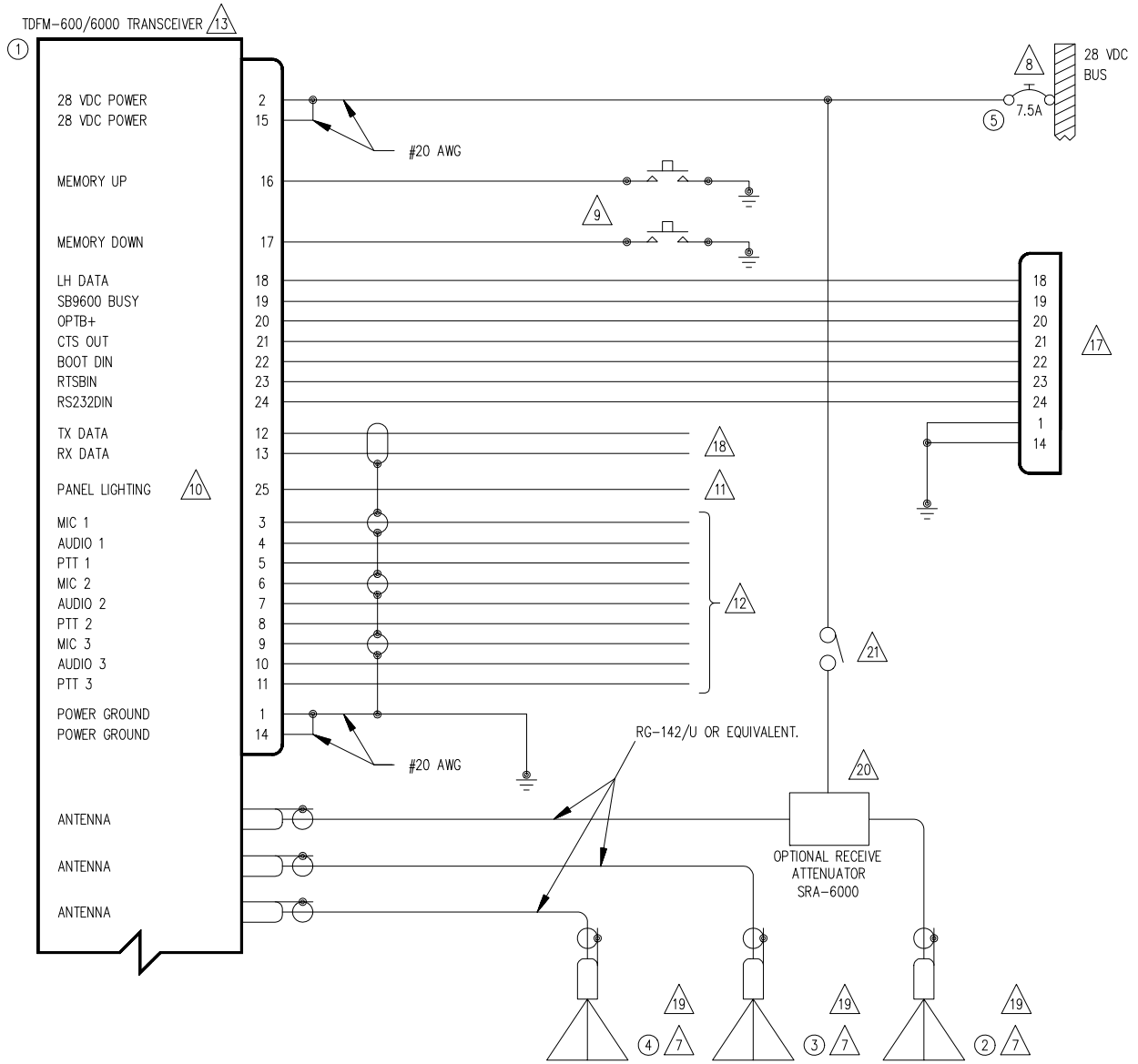


FIGURE 3-2a Wiring connections for the TDFM-600/6000 Transceiver

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QTY	ITEM	PART NUMBER	DESCRIPTION	SPEC	MATERIAL
1	1	TDFM-600/6000	VHF/FM COMMUNICATIONS TRANSCEIVER.	TECHNISONIC INDUSTRIES LIMITED	
SEE NOTE 19	2	CI-292	VHF ANTENNA	COMANT INDUSTRIES	
SEE NOTE 19	3	CI-275	UHF ANTENNA	COMANT INDUSTRIES	
SEE NOTE 19	4	CI-306	800 ANTENNA	COMANT INDUSTRIES	
1	5	7274-11-7.5	CIRCUIT BREAKER, 7.5 AMPS	COMANT INDUSTRIES	
SEE NOTE 19	6	SRA-6000	RECEIVE ATTENUATOR	TECHNISONIC INDUSTRIES LIMITED	

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.
- 7) 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 CHOSE 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) THE TDFM-600/6000 IS AVAILABLE WITH 28V OR 5V PANEL LIGHTING. CHECK THE CONFIGURATION CONTROL LABEL FOR THE CORRECT VOLTAGE.
- 11) CONNECT TO THE APPROPRIATE AIRCRAFT DIMMING BUSS.
- 12) CONNECT TO THE AIRCRAFT AUDIO SYSTEM OR STAND-ALONE HEADSET JACKS.
- 13) INSTALLATION OF 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) OPTIONAL EXTERNAL DOWNLOAD PLUG. USE PANEL MOUNT 25 PIN 'D' FEMALE CONNECTOR.
- 18) CONNECTION TO AN OPTIONAL RC-6000 SLAVE CONTROL HEAD.
- 19) THE QUANTITY AND COMBINATION OF ANTENNAS REQUIRED VARIES IN ACCORDANCE WITH THE TRANSCEIVER PART NUMBER.
- 20) OPTIONAL RECEIVE ATTENUATOR. CAN BE USED IN SIMULCAST TRUNKING SYSTEMS IF REQUIRED TO IMPROVE RECEIVE VOTING OPERATION.
- 21) SWITCH SHOULD BE MOUNTED ON THE PANEL NEAR THE TDFM-600/6000. THE ON POSITION SHOULD BE LABELED 'IN FLIGHT' AND THE OFF POSTION LABELED WITH 'ON GROUND'.

FIGURE 3-2b Wiring notes for the TDFM-600/6000 Transceiver

3.17 FUNCTIONAL TEST

The purpose of this test is to verify the operation of the TDFM-600 / 6000 transceiver when the unit has been reinstalled after service or an upgrade in firmware was performed either on the bench or while in the aircraft. For a new installation, both this test and the post EMI test in section 3.18 shall be performed.

3.17.1 PROCEDURE

- 1) Turn on main power and the radio master in the aircraft.
- 2) Verify on start up that receive and transmit LEDs illuminate.
- 3) Check that the unit recognizes all installed RF modules and displays the current firmware version.
- 4) Use the Band Key(s) to switch through all the bands on the display.
- 5) On each band verify the channel selector mode and the MUP & MDN buttons change channels.
- 6) Change mode to Volume. Verify the volume changes on all bands.
- 7) Verify the operation of the Home, Soft Menu keys (if programmed) and the four Function keys (if programmed).
- 8) Toggle the TSW and ESW keys and check to see if the display symbols change accordingly.
- 9) Switch on aircraft night lighting and verify the radio backlighting operates.
- 10) Operate the unit on each band by communicating with a known station or by using a portable radio or communications tester. Verify clear transmit and receive audio. Note that when the unit is in transmit mode that the TX LED should illuminate on the band selected and when the unit receives a signal that the RX LED illuminates on the band selected.

3.18 POST INSTALLATION EMI TEST

PURPOSE

The purpose of this test is to identify any interference that the TDFM-600 / 6000 transceiver may cause with existing aircraft systems. This test is only required when the TDFM-600 / 6000 is installed for the first time.

TEST CONDITIONS

The TDFM-600 / 6000 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-600 / 6000 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 3 dB above the output necessary to achieve 90% reply. If possible set the ADF to a nearby navigation station.

Modulate the TDFM-600 / 6000 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-600 / 6000 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.

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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-600 / 6000 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.

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-600 / 6000 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
TDFM-600 / 6000				
143.2125 MHz				
143.2250 MHz				
157.5375 MHz				
157.5500 MHz				
512.0000 MHz				
520.0000 MHz				

NOTES:

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- B.** Determine if the image frequency for the VHF Comm falls within the range of the TDFM-600 / 6000. If so, select a set of frequencies that will cause the TDFM-600 / 6000 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-600 / 6000 transmitter on the following frequencies for at least 20 seconds. Listen for any noise or detected audio signals on the VHF comm. The TDFM-636 must be modulated on two frequencies simultaneously as indicated.

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-600 / 6000 to 142.8000 MHz.

FREQUENCIES		RESULTS	
VHF #1	TDFM-600 / 6000	PASS	FAIL
135.975	136.0000		
121.150	157.5000		
131.250	157.5000		
	TDFM-636		
118.000	147.0000 / 176.0000		
Image:			

FREQUENCIES		RESULTS	
VHF #1	TDFM-600 / 6000	PASS	FAIL
135.975	136.0000		
121.150	157.5000		
131.250	157.5000		
	TDFM-636		
118.000	147.0000 / 176.0000		
Image:			

NOTES:

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- C. Determine if the image frequency for the VOR/ILS Nav falls within the range of the TDFM-600 / 6000. If so, select two sets of frequencies that will cause the TDFM-600 / 6000 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-600 / 6000 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-600 / 6000	PASS	FAIL
108.000	162.0000		
108.100	162.1500		
	TDFM-636		
108.000	140.0000 / 172.0000		
108.100	140.0000 / 171.9000		
Image:			

FREQUENCIES		RESULTS	
VOR/ILS #2	TDFM-600 / 6000	PASS	FAIL
108.000	162.0000		
108.100	162.1500		
	TDFM-636		
108.000	140.0000 / 172.0000		
108.100	140.0000 / 171.9000		
Image:			

NOTES:

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- D. The following procedure checks for second harmonic interference to the glide slope receiver from the TDFM-600/6000. All transceivers produce harmonics (multiples of the wanted frequency) and while the TDFM-600/6000 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-600/6000 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-600/6000. Fly the aircraft to intercept the localizer and glide slope (both needles centered) at 26 nm from the runway. Transmit on the TDFM-600/6000 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-600/6000 shall be placarded "Do not transmit while on ILS approach".

<u>Localizer</u>	<u>Glide slope</u>	<u>Localizer</u>	<u>Glide slope</u>
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

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FREQUENCIES		RESULTS	
G/S #1	TDFM-600 / 6000	PASS	FAIL
334.7 (108.1)	167.35		

FREQUENCIES		RESULTS	
G/S #2	TDFM-600 / 6000	PASS	FAIL
334.7 (108.1)	167.35		

NOTES:

- E. Operate the TDFM-600 / 6000 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	TRANSPONDER #1		TRANSPONDER #2	
	PASS	FAIL	PASS	FAIL
512 MHz (type I)				
515 MHz (type II)				

NOTES:

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- F. Modulate the TDFM-600 / 6000 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-600 / 6000	PASS	FAIL
978 (108.0)	489		
1020 (112.1)	510		

FREQUENCIES		RESULTS	
DME 2	TDFM-600 / 6000	PASS	FAIL
978 (108.0)	489		
1020 (112.1)	510		

NOTES:

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- G.** Modulate the TDFM-636 on the following two frequencies simultaneously. Monitor the HF on the given frequency. Listen for any noise or detected audio signals on the HF comm.

FREQUENCIES		RESULTS	
HF 1	TDFM-636	PASS	FAIL
12.0000 MHz	160.0000 / 172.0000		

FREQUENCIES		RESULTS	
HF 1	TDFM-636	PASS	FAIL
12.0000 MHz	160.0000 / 172.0000		

NOTES:

NOTE: For the following tests, select a frequency at the top, middle and bottom of each band of the TDFM-600 / 6000 transceiver.

	136 to 174 MHz Band	380 to 470 MHz Band	450 to 520 MHz Band	764 to 870 MHz Band
Frequency #1				
Frequency #2				
Frequency #3				

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- H. At a safe altitude engage the autopilot or stability augmentation system. Modulate the TDFM-600 / 6000 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-600 / 6000 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:

- 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			

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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)			

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STEP	SYSTEM	PASS	FAIL	NOTES

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APPENDIX A

TDFM 6000/7000 BAND SPLITS

TDFM 6000/7000 II BAND SPLITS IN 700-800 MHZ BAND	
Frequencies can only be entered in the CPS software if they fall in these specific bands.	
764.0125	RECEIVE, TRANSMIT
766.9875	RECEIVE, TRANSMIT
773.0125	RECEIVE, TRANSMIT
775.9875	RECEIVE, TRANSMIT
794.0125	TRANSMIT ONLY
796.9875	TRANSMIT ONLY
806.0125	TRANSMIT ONLY
824.9875	TRANSMIT ONLY
851.0125	RECEIVE, TRANSMIT
868.9875	RECEIVE, TRANSMIT

TDFM 600/6000 Type I BAND SPLITS IN 800 MHz BAND	
806.0125	TRANSMIT ONLY
824.9875	TRANSMIT ONLY
851.0125	RECEIVE , TRANSMIT
868.9875	RECEIVE , TRANSMIT

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**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 expressed 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.**