TECHNISONIC
Communications

YOU DESIGN IT. WE BUILD IT.

Technisonic TDFM - 9000 P25

Technisonic Industries Limited
TDFM-9000
SW Version 0.0.3

RF Module 1	Type A	700/800	VHF
RF Module 2	Type A	UHF LO	VHF
RF Module 3	Type A	UHF HI	VHF
RF Module 4	Type A	UHF LO	UHF HI
RF Module 5	Type A	UHF LO	700/800
RF Module 6	Type A	700/800	UHF HI

HOME

1 F1	2 F2	3 F3	# F4
FUNC	4 MUP	5 UP	6 BRT	0 ESW
MODE	7 MDN	8 DN	9 DIM	* TSW

POWER   PGM

TDFM-9000 SERIES
ANALOG/DIGITAL/ENCRYPTED/TRUNKED/ MULTI-BAND AIRBORNE AM/FM TRANSCEIVERS

TDFM-9000 SERIES

## ANALOG/DIGITAL/ENCRYPTED/TRUNKED/MULTI-BAND AIRBORNE AM/FM TRANSCEIVERS

The TDFM-9000 / 9200 / 9300 series radios offer Project 25 Analog/Digital/Encrypted/ Multi-band AM/FM radio transceivers capable of meeting your most demanding operating requirements in both Phase I (FDMA) and Phase II (TDMA) modes. The TDFM-9000 Series consists of multiple models which are configurable to meet each user's specific requirement. Each model is Dzus panel mount and each unit is completely self-contained (no remote mount box).

Capabilities of each are as follows:

:: TDFM-9000 can support up to six P25 compliant analog/digital FDMA/TDMA radio modules of your choice.

:: TDFM-9200 can support two Analog radio modules and two P25 digital modules capable of covering all four P25 frequency bands simultaneously, FDMA/TDMA Compliant.

:: TDFM-9300 can support one Analog along with up to four P25 compliant FDMA/TDMA modules of your choice.

:: Radio modules can be individually configured to include any P25 options such as trunking, encryption, OTAR, etc.

:: Optional Encryption protocols: DES, DES-XL, DVP, DVP-XL, DVI, AES, ADP.

:: Available Multiple Encryption Keys: 64 Common Key Reference (CKR) or 16 Physical Identifier Reference (PID) keys.

:: Each radio module can store 2000 channels and can be programmed to operate in digital or analog mode on a channel-by-channel basis.

:: Each radio module independently supports SCAN across its entire frequency spectrum.

:: Built-in audio switching allows multiple RF modules in either combined or separate transceiver configurations.

:: Supports simulcast and cross-band repeat.

:: Programming is via a Motorola CPS software program.

:: Dimensions: 4.5" (H), 5.75" (W) and 8.5" (D)

PROTOCOLS SUPPORTED

:: **P25 Phase II TDMA**
:: **Conventional Analog**
:: **Smartnet II / SMARTZONE**

:: **P25 Phase I FDMA**
:: **Conventional P25**
:: **P25 Trunking**
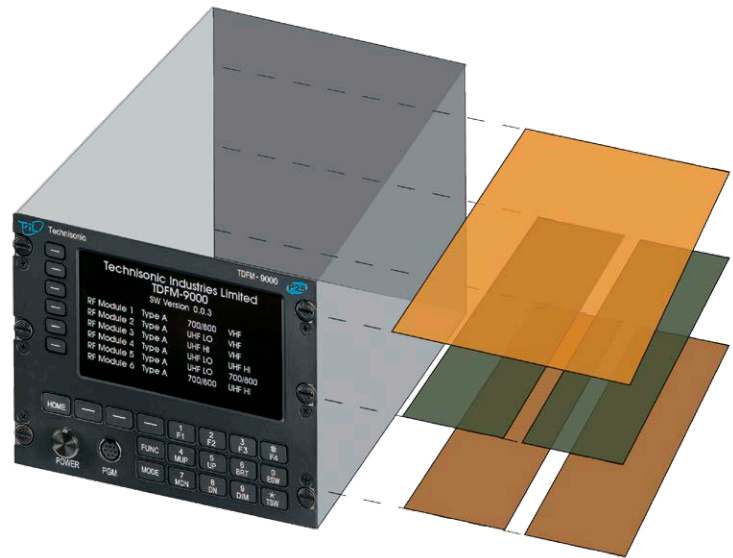
Technisonic radios are built with you in mind.
Modular configurations allow you to only buy what you need.

SINGLE BAND

:: **VHF**
(136 -174 MHz)
:: **UHF Low**
(380-470MHz)
:: **UHF Hi**
(450-520 MHz)
:: **800**
(includes 700 MHz)

NEW DUAL BAND

:: **VHF/ UHF Low**
:: **VHF / UHF Hi**
:: **VHF / 800**
:: **UHF Low / UHF Hi**
:: **UHF Low / 800**
:: **UHF Hi / 800**

TIL ANALOG RADIO MODULES

:: **Low Band FM** (30 to 50 MHz)
:: **VHF/AM Aeronautical Band** (118 to 136 MHz)
:: **UHF/AM Military Band** (225 to 400 MHz)

MORE CAPABLE. LESS COST.

TDFM-9200
MULTIBAND P25 AIRBORNE TRANSCEIVER

Installation Instructions

TiL Document No. 13RE472
Rev. B

MAY 2014

Technisonic Industries Limited

240 Traders Boulevard, Mississauga, Ontario L4Z 1W7
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www.til.ca

TECHNISONIC INDUSTRIES LIMITED

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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-9200. Every effort has been made to make this manual as complete and accurate as possible.

WARRANTY INFORMATION

The Model TDFM-9200 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-160G ENVIRONMENTAL TESTING

Summary of DO-160G Environmental Testing for Technisonic Model TDFM-9200 Transceiver:

Conditions	Category
Temperature and Altitude	A2, B1, C4, D1
Temperature Variation	B
Humidity	A
Operational shock and Crash Safety	A
Vibration	S, U
Magnetic Effect	Z
Power Input	B
Voltage Spike	B
Audio Frequency Susceptibility	B
Induced Signal Susceptibility	AC
Radio Frequency Susceptibility	T
Radio Frequency Emission	M
Electrostatic Discharge	A

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) approval. The above referenced DO-160G 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 website 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 website www.til.ca for the latest issue of available STCs and letter of authorization for use.

Trademark Notices
TDFM-9200 Transceivers contain two-way radio protocols licensed from Motorola, Inc.
© 1997, 1998 Motorola, Inc.
Motorola KVL 3000+® is a registered trademark of Motorola.

TECHNISONIC INDUSTRIES LIMITED

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SECTION 1: GENERAL DESCRIPTION

1.1 INTRODUCTION

This publication provides operating information on the TDFM-9200 airborne transceiver. The exact configuration depends on which and how many RF modules are installed.

1.2 DESCRIPTION

The TDFM-9200 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. RF modules are available in single or dual bands that support VHF, UHF-LO, UHF-HI, and 700-800 MHz bands. Up to 5 single or dual band modules can be supported.

These optional additional features include P25 9600 trunking Phase 1 and 2 that may be combined with AES and/or DES-OFB encryption with OTAR in any of the available modules.

Bands 1 and 2 on the TDFM-9200 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 TDFM-9200 has provisions for two of the above RF modules as well as two analog only modules. These additional modules are fully frequency programmable from the associated front panel. Analog only modules support CTCSS, DCS, wide, and narrow band operation where applicable.

1.3 MODEL VARIATION

There are several variations of the Model TDFM-9200 Transceiver. Each variation offers different features and performance based on the type of RF modules and options installed.

Rf Modules are mounded in trays of two with up to 3 trays supported.
The following is a breakdown of the TDFM-9200 model variations:

P/N 101263-D-90-TBB-TBB-TBB-P9XXXX

(PRODUCT TYPE)-(D)-(9X)-(Tray 1)-(Tray2)-(Tray3)-(Project)

PRODUCT TYPE: 101263 = TDFM 9200 series, 3 trays, 2 – 6 modules

D= Display type:

1)   Color TFT
2)   Standard Green/NV

9X = TDFM-9200 series variant:

92 = TDFM-9200

Tray Breakdown: (TBB):
T= Module type: A= T30xx RF modules (Single or Dual)
B is Band code for each module in the tray.

Band Codes

1	VHF (136-174)
2	UHF LO (380-470)
3	UHF HI (450-520)
4	700/800 (764-870)
A	V/700/800
B	V/ UHF LO
C	V/ UHF HI
D	UL/UH
E	UL/700/800
F	UH/700/800

Band numbers indicate single band modules and letters indicate dual band modules.

Project Number: P9XXXX represents a 5 digit project number that identifies specific options that are contained in each module and describes the full TDFM-9200 configuration.

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 in the TDFM-9200 Operating Instructions manual available at www.til.ca. Damage will not occur if the incorrect voltage is applied.

1.4 TECHNICAL CHARACTERISTICS

Specification	**Characteristic**
Model Designation:	TDFM-9200
Physical Dimensions:	Approx. (L) 8.0" x (W) 5.75" x (H) 4.5"
Weight:	~7.0 Lbs (3.2 Kg)
Operating Temperature Range:	-30° C to +60° C
Power Requirement:	
Voltage:	28.0 VDC ± 15%
Current:	500 mA minimum / 7.5A maximum
Audio Output Power (including sidetone):	65 mW into 600 Ω
Microphone Inputs:	Carbon or Equivalent
Panel Back Lighting:	
Voltage:	28 or 5 Volts AC or DC (selectable)
Current:	10 uA

RF Modules

Specification	**Characteristic**
RF Output Power:	1 or 6 Watts (VHF)
	1 or 5 Watts (UHF)
	1 or 3 Watts (700/800)
Frequency Range	
VHF Band:	136 to 174 MHz
UHF LO Band:	380 to 470 MHz
UHF HI Band:	450 to 520 MHz
700 / 800 Bands:	764 to 870 MHz
No. of channels per band:	2000 pre-programmable channels

Transmitter section	VHF	UHF	800
FM Hum and noise in dB (wideband):	-48	-45	-45
Audio Distortion:	1%	1.0%	1.0%
Frequency Stability in ppm:	± 1.0	± 1.0	± 1.5
Modulation Limiting:	Wide band		± 5 kHz
	Narrow band		± 2.5 kHz

Receiver section	VHF	UHF	800
Sensitivity in uV:			
* Digital 1% BER (12.5 kHz)	0.29	0.32	0.40
* Digital 5% BER (12.5 kHz)	0.21	0.28	0.30
** Analog with 12 dB SINAD	0.25	0.25	0.25
Selectivity in dB:			
25 kHz Channel	-80	-78	-72
12.5 kHz Channel	-70	-68	-67
Intermodulation * **	-80	-80	-80

* Measured in digital mode per TIA / EIA IS 102.CAAA under nominal conditions.
** Measured in analog mode per TIA / EIA 603 under nominal conditions.

ANALOG MODULE SPECIFICATIONS

GENERAL

Frequency Ranges:	
VHF FM Lo module	30 - 50 MHz
VHF FM High module	136 - 174 MHz
UHF FM module	403 - 512 MHz
VHF FM Lo 2 module	66 - 88 MHz
VHF AM module	118 - 138 MHz
UHF AM module	225 - 400 MHz
Operating Mode:	F3E simplex or semi-duplex (FM modules)
	A3E simplex (AM modules)
Channel Spacing:	25 or 12.5 kHz (25 kHz only for AM)
FM Frequency Selection:	200 memories per band programmed with:
via front panel	a) TX Frequency/RX Frequency
	b) TX/RX CTCSS tone or DPL code
	c) 9-character alphanumeric title
CTCSS squelch/encoder:	* All CTCSS tones available (FM modules only)
DPL digital squelch/encoder:	* All standard DPL codes (FM modules only)
DTMF encoder:	All standard DTMF tones

  * Available only on FM Modules.

VHF FM RECEIVER

Sensitivity at 12 dB SINAD	Better than 0.35 µV
Adjacent Channel Selectivity	-75 dB (25 kHz)
	-70 dB (12.5 kHz)
Spurious Attenuation	-90 dB
Third Order Intermodulation	-70 dB
Image Attenuation	-80 dB
FM Acceptance	± 6 kHz
Hum and Noise	Better than 45 dB
Audio Distortion	Less than 5%
Antenna Conducted Emission	Less than -70 dBm

UHF FM RECEIVER

Sensitivity at 12 dB SINAD	Better than 0.35 µV
Adjacent Channel Selectivity	-70 dB (25 kHz)
	-60 dB (12.5 kHz)
Spurious Attenuation	-80 dB
Third Order Intermodulation	-70 dB
Image Attenuation	-60 dB
FM Acceptance	± 6 kHz
Hum and Noise	Better than 40 dB
Audio Distortion	Less than 5%
Antenna Conducted Emission	Less than -70 dBm

VHF LO and VHF LO 2 FM RECEIVER
All specifications identical to VHF receiver

VHF, VHF LO, VHF LO 2 and UHF FM TRANSMITTER

RF Power Output	1 watt or 10 watts
Output Impedance	50 ohms
Maximum Deviation	± 5 kHz (25 kHz mode)
(In narrowband mode)	± 2.5 kHz (12.5 kHz mode)
Spurious Attenuation	-90 dB below carrier level
Frequency Stability	± 2.5 ppm
Harmonic Attenuation	-60 dB below carrier level
FM Hum And Noise	-40 dB
Audio Input	50 mV at 2.5 kHz into 200 ohms input circuit for ± 3.5 kHz deviation, adjust.
Audio Distortion	Less than 5%

VHF AM RECEIVER

Sensitivity at 12 dB SINAD	Better than 2.0 µV
Adjacent Channel Selectivity	-70 dB (25 kHz)
Spurious Attenuation	-70 dB
Third Order Intermodulation	-70 dB
Image Attenuation	-60 dB
Hum and Noise	Better than 40 dB
Audio Distortion	Less than 5%
Antenna Conducted Emission	Less than -70 dBm

VHF AM TRANSMITTER

RF Power Output	5 watts (2.5 watts carrier)
Output Impedance	50 ohms
Maximum Modulation (max)	95%
Maximum Modulation (min)	75%
Spurious Attenuation	-60 dB below carrier level
Frequency Stability	± 2.5 ppm
Harmonic Attenuation	-60 dB below carrier level
Signal to Noise Ratio	-35 dB
Audio Input	50 mV at 2.5 kHz into 200 ohm input circuit for 30% modulation (adjustable)
Audio Distortion	Less than 5%

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SECTION 2: INSTALLATION INSTRUCTIONS

2.1 GENERAL

This section contains information and instructions for the correct installation of the TDFM-9200 Transceiver.

2.2 EQUIPMENT PACKING LOG

Unpack the equipment and check for any damage that may have occurred during transit. Save the original shipping container for returns due to damage or warranty claims. Check that each item on the packing slip has been shipped in the container.

2.3 INSTALLATION

The TDFM-9200 Transceiver is designed to be Dzus mounted and should be installed in conjunction with an IN-9300 installation kit. See Figure 2.1 for an outline drawing of the unit with dimensions to facilitate the installation.

2.4 INSTALLATION KIT – CONTENTS

The IN-9300 installation kit (P/N 129292) consists of:
1. One 25 Pin Cannon D mating connector (female) complete with crimp pins and hood.
2. Three 15 Pin HD Cannon D mating connector (female) complete with crimp pins and hood.
3. One 15 Pin HD Cannon D mating connector (male) complete with crimp pins and hood.
4. 4 BNC connectors.

2.5 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:

VHFLO	30 to 50 MHz	Foxtronics Part # FLX-3050B or
		Sensor Systems Part # S65-8282-34*
VHF AM	118 to 138 MHz	Comant Part # CI-292-1
VHF	136 to 174 MHz	Comant Part # CI-292-3
UHFLO	403 to 470 MHz	Comant Part # CI-275
UHFHI	450 to 520 MHz	Comant Part # CI-285
800	800 to 870 MHz	Comant Part # CI-306
800/700	764 to 870 MHz	Comant Part # CI-285

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.
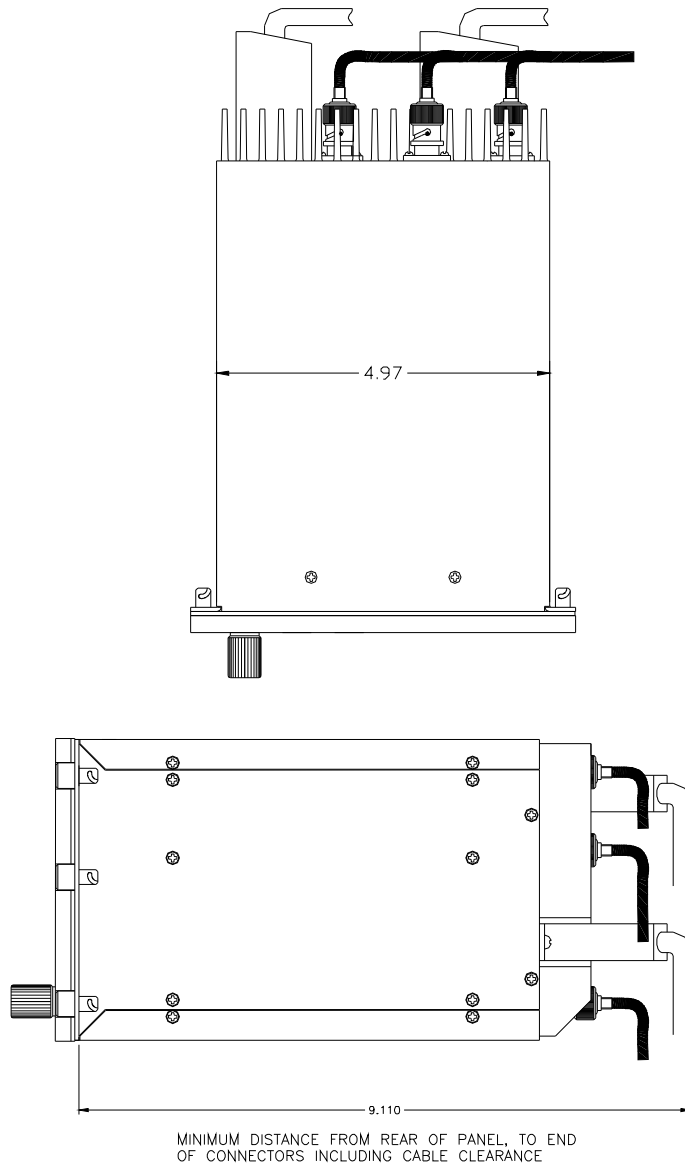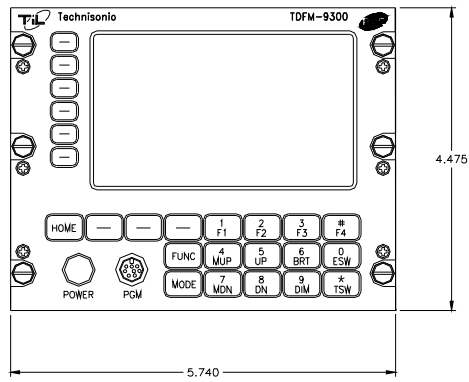
FIGURE 2.1 Outline Drawing for Model TDFM-9200
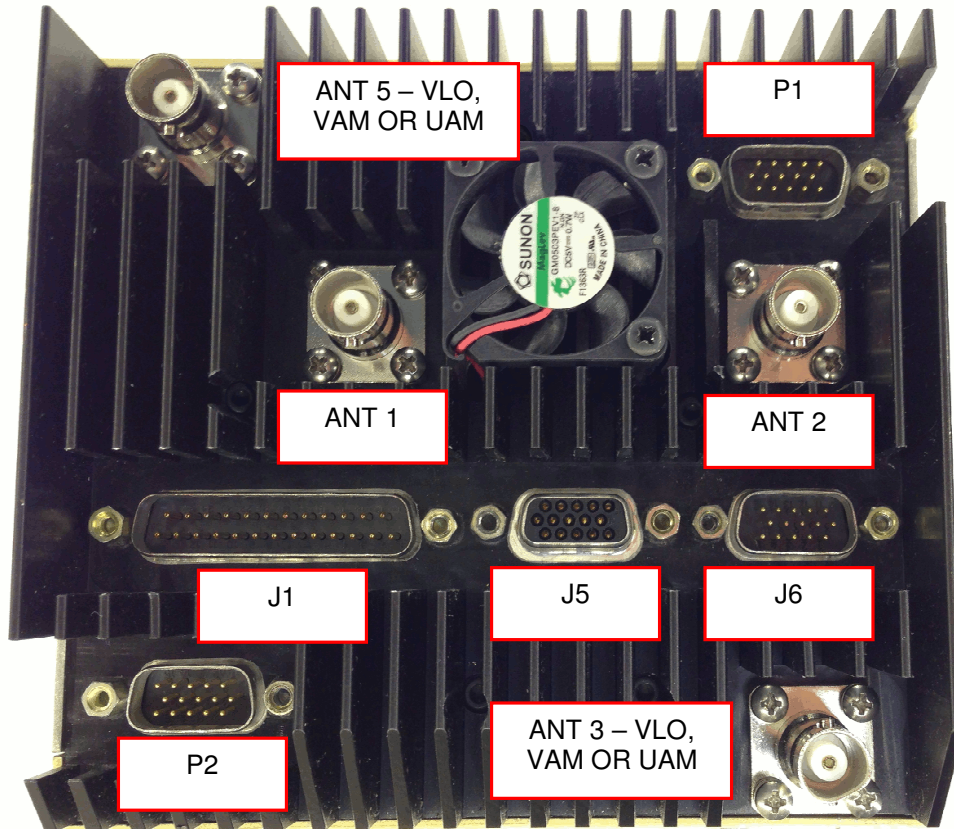
FIGURE 2.2 TDFM-9200 Antenna & Connector Locations

FIGURE 2.3 TDFM-9200 Band Display Orientation

2.6   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	Up
17	Down
18	Channel / Band
19	Mic 5
20	Audio 5
21	PTT 5
22	Mic 6
23	Audio 6
24	PTT 6
25	Panel Backlighting

TABLE 2.1 J1 (25 Pin D) Connections

J6 (15 Pin High Density D Connections) – Use FEMALE Connector	
Pin #	**Description**
1	Ground
2	Audio Combined 1
3	PTT4
4	PTT Combined 1
5	Audio 4
6	Mic 4
7	Mic Combined 1
8	Speaker Lo
9	Speaker Hi
10	Audio Combined 2
11	Misc In
12	PTT Combined 2
13	Mic Combined 2
14	Misc In/Out
15	Audio Combined Ground 2

TABLE 2.2 J6 (15 Pin HDD) Connections

J5 (15 Pin High Density D Connections) – Use MALE Connector	
Pin #	**Description**
1	Audio 2
2	Audio 5
3	Audio 6
4	Audio 3
5	Audio 4
6	Audio Ground 2
7	Audio Ground 5
8	Audio Ground 6
9	Audio Ground 3
10	Audio Ground 4
11	Audio 1
12	Audio Ground 1
13	Ground
14	Audio Combined Ground 1
15	Audio Combined 1

TABLE 2.3 J5 (15 Pin HDD) Connections

P1 Connections (15 Pin [High Density] FEMALE D Connector)	
Pin #	**Description**
1	Band 3 - 4 MHz
2	Band 3 - 8 MHz
3	Band 3 - 10 MHz
4	Band 3 - 20 MHz
5	Band 3 - 40 MHz
6	Audio 3
7	No connection
8	No connection
9	No connection
10	Band 3 - Tune Indicator
11	Speaker 3
12	Band 3 - Tune Enable
13	Ground
14	PTT3
15	Mic 3

TABLE 2.4 Wire Connections on a 15 Pin [High-Density] FEMALE D Connector

P2 Connections (15 Pin [High Density] FEMALE D Connector)	
Pin #	**Description**
1	Band 5 - 4 MHz
2	Band 5 - 8 MHz
3	Band 5 - 10 MHz
4	Band 5 - 20 MHz
5	Band 5 - 40 MHz
6	Audio 5
7	No connection
8	No connection
9	No connection
10	Band 5 - Tune Indicator
11	Speaker 5
12	Band 5 - Tune Enable
13	Ground
14	PTT5
15	Mic 5

TABLE 2.4 Wire Connections on a 15 Pin [High-Density] FEMALE D Connector

2.7   INSTALLATION – WIRING INSTRUCTIONS

Figure 2-2(a, b, and c) show all required connections and recommended wire sizes for the TDFM-9200 transceiver. The TDFM-9200 allows for either a single audio output ground or separate grounds for each audio output. If a single point ground is required for a pre-existing installation, the dongle supplied in the installation kit must be plugged into J5. If this is a new installation, it is recommended to use the isolated ground returns to the audio panel for reduced cross talk between bands and airframe noise. The audio panel must have isolated grounds for each audio input (such as Technisonic's A710, A711, A711L, and TDAP-711) to take advantage of this feature. There are receive audio, mic audio, and Push To Talk (PTT) lines for each band as well as two sets of lines combining all six bands. The TDFM-9200 can be wired such that band selection can be made on the audio panel. Up to 6 positions need to be available on the audio panel; otherwise, the TDFM-9200 can be wired into one or two positions of the audio panel where band selection and audio monitoring is done on the TDFM-9200 front panel. An installation can be wired in a combination of both methods since all inputs and outputs are always active.

2.8   MAIN GROUND – J1 PINS 1 AND 14

Both pins should be connected to power ground. These pins are internally connected to the chassis.

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

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

2.10   MIC 1, 2, 3, 4, AND 5 – J1 PINS 3, 6, 9, J6 PIN 6, AND P1 PIN 15

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, A711, A711L, or TDAP-711) in which case the shield must be connected to the lo input. These are individual inputs for each band.

2.11   MIC COMBINED 1 AND 2 – J6 PINS 7 AND 13

The combined mic inputs should be wired and shielded as the individual mic inputs above. These mic inputs that can be used for any band. Band selection is made at the TDFM-9200 front panel.

2.12   AUDIO 1, 2, 3, 4 – J1 PINS 4, 7, 10, J6 PIN 5, AND P1 PIN 6

These are individual audio outputs from each band. All outputs are 600 ohms impedance. The output power is 65 mW maximum. Unused outputs do not have to be terminated and should be left unconnected. These outputs are also found on J5 along with their respective grounds such that a separate wire bundle can be run with only audio outputs, further reducing the possibility of cross talk.

2.13   AUDIO COMBINED 1 AND 2 – J6 PINS 2 AND 10

These are combined audio outputs from all bands as selected from the front panel. The specifications are the same as the individual outputs above.

2.14   PTT 1, 2, 3, 5, 6, AND 4 – J1 PINS 5, 8, 11, 21, 24, AND J6 PIN 3

There are individual PTT lines for each band. These 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.

2.15   PTT COMBINED 1 AND 2 – J6 PINS 4 AND 12

These are combined PTT inputs to all bands as selected from the front panel. The specifications are the same as the individual inputs above.

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

These pins provide RS-232 serial communications for use with the RC-9000 remote control head if installed. Consult the RC-9000 installation manual for details.

2.17   UP AND DOWN – J1 PINS 16 AND 17

These pins can be used to scroll up and down through the bands or channels for the band currently selected depending on the band input below. 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.

2.18   CHANNEL/BAND – J1 PIN 18

The Channel / Band input determines the function of the up down inputs above. If left unconnected, the inputs are for channel selection. If grounded, the input is for band selection.

2.19   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 in the TDFM-9200 Operating Instructions manual). No damage will occur if the wrong setting is made.

2.20   SPEAKER LO AND HI – J6 PINS 8 AND 9

Not normally connected in the aircraft. This output is 4 / 8 ohms at 1.1 watts max and has the audio associated with Audio Combined 1. This output does not have to be terminated when not used and should be left unconnected.

2.21   ANTENNA TUNER CONTROL LINES: P1 (PINS 1, 2, 3, 4, 5, 6, 10, AND 12)

These connections are to control an antenna tuner system such as the Foxtronics FLX-3050B. Connect according to the manufacturer's instructions. In the case of the FLX-3050B, the tune indicator (which is normally connected to a light) can be connected to pin 10 so that the tuning indication will show on the TDFM-9200 display. If a passive antenna is used, these lines shall remain unconnected.

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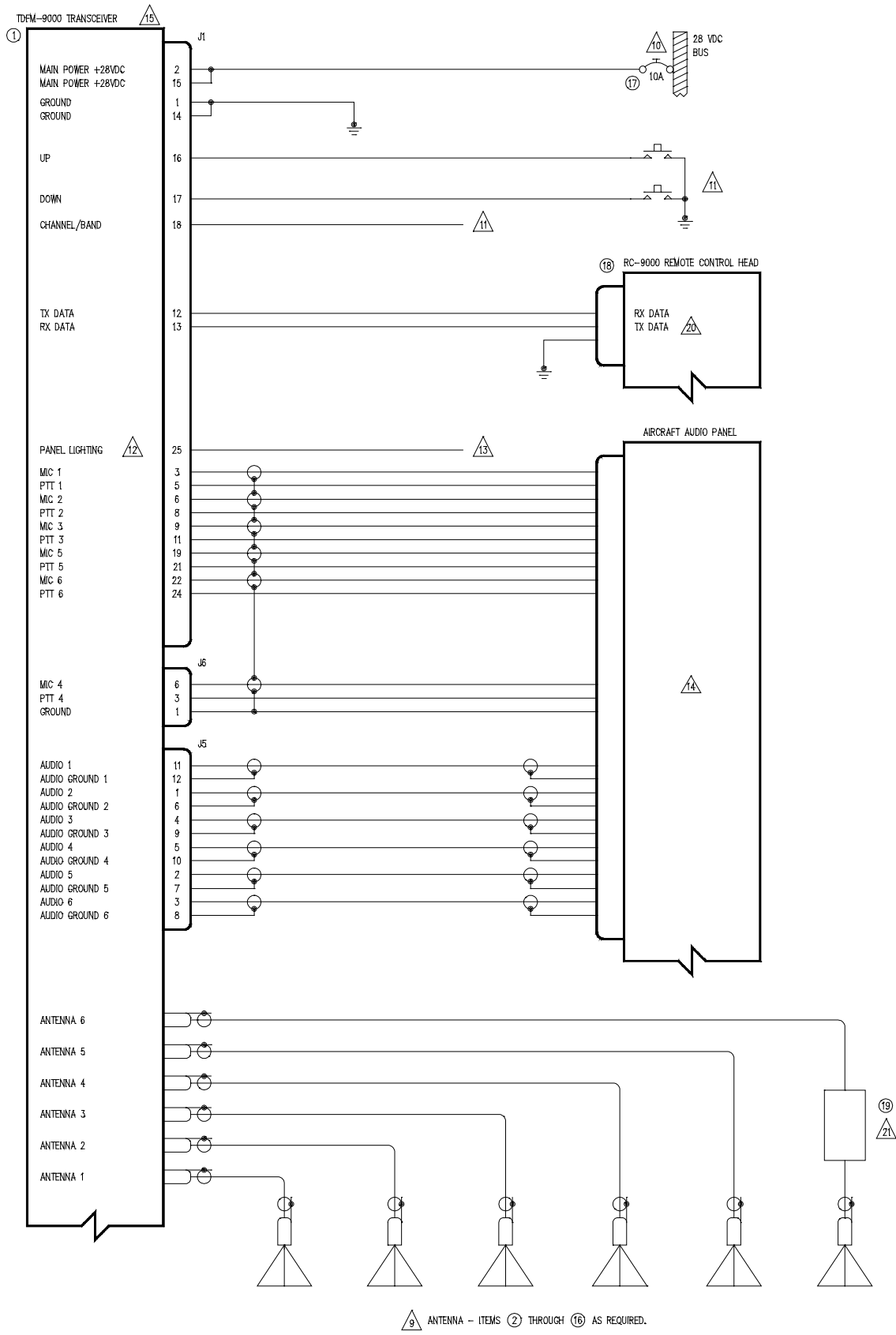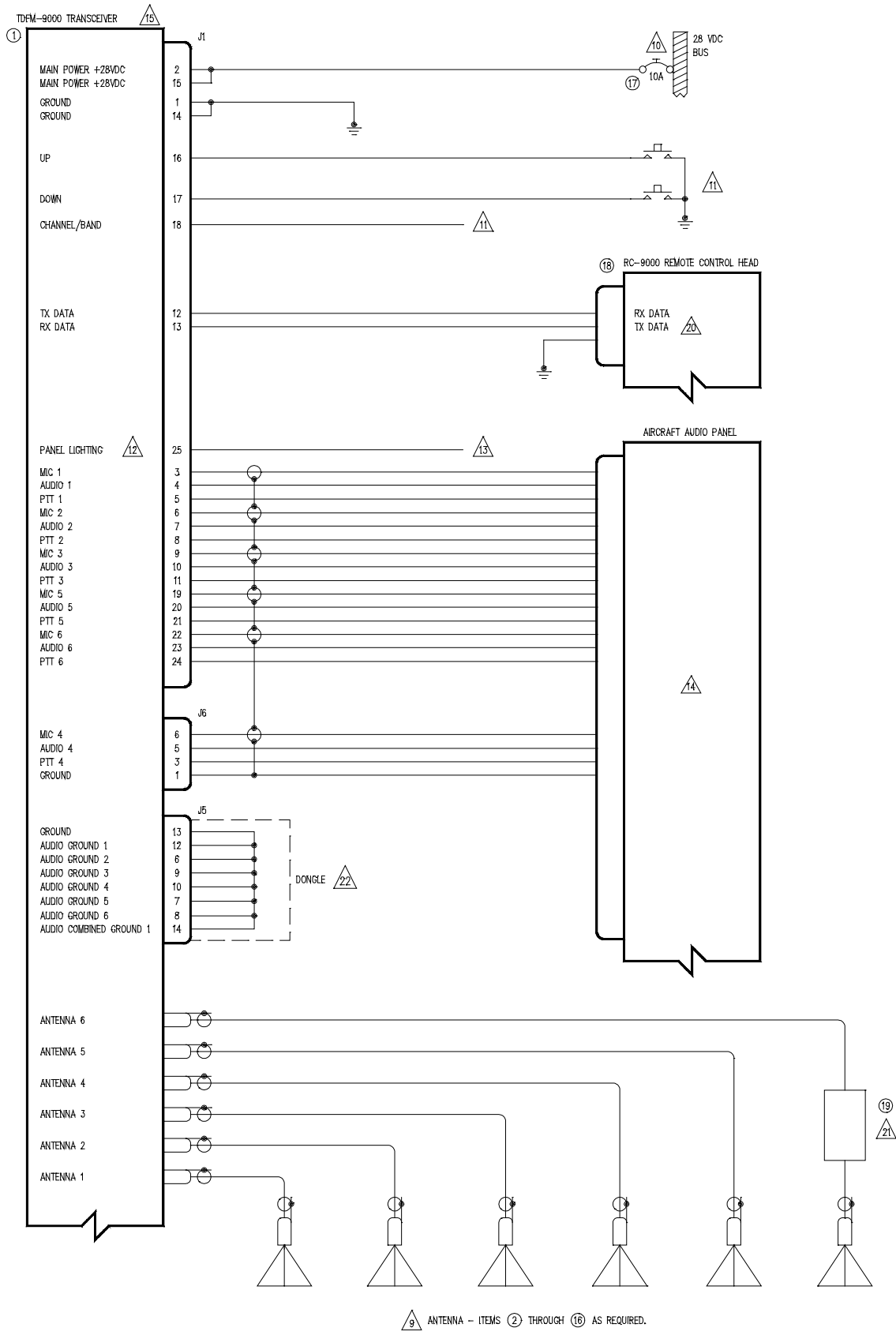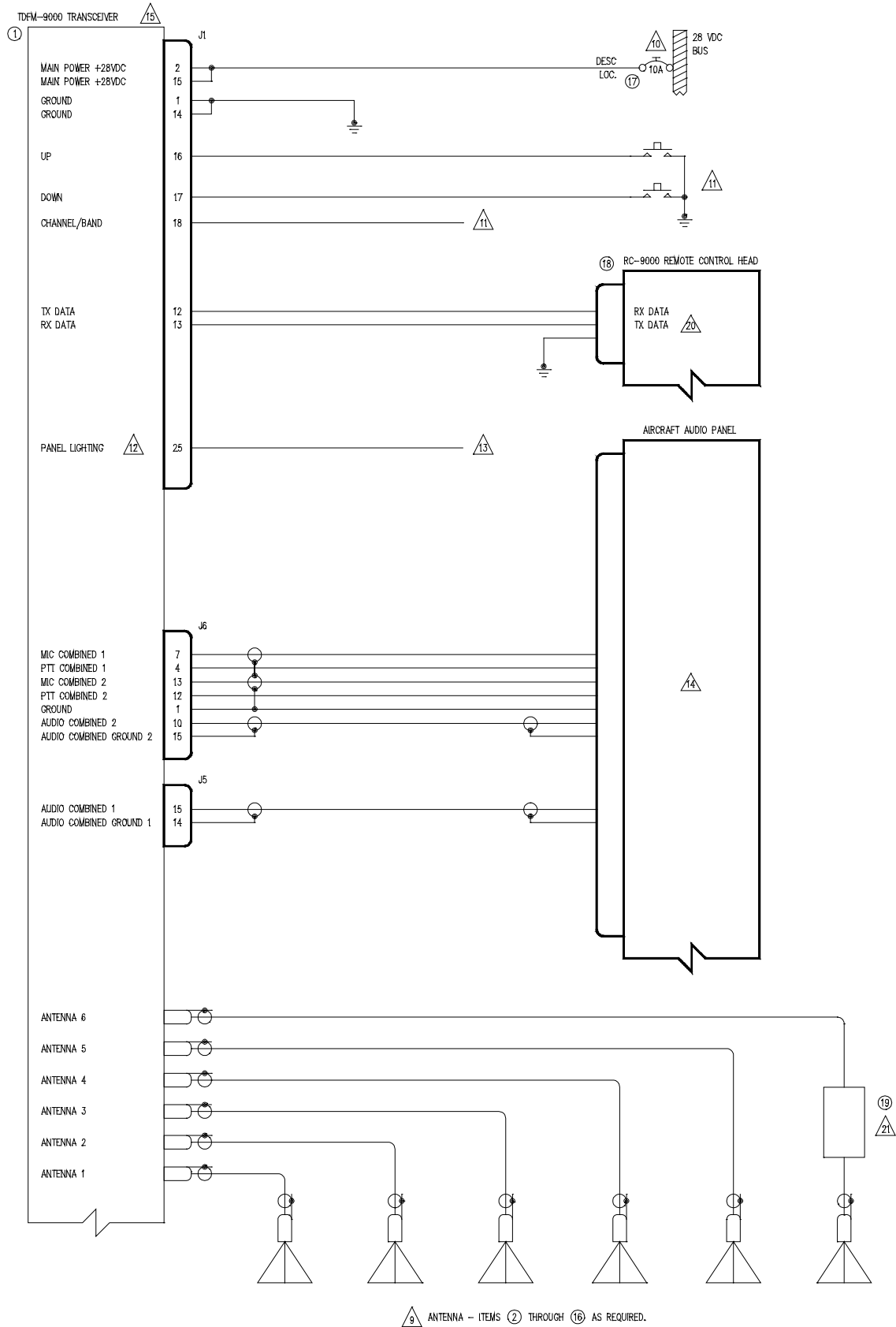**FIGURE 2.4** Wiring Connections for Individual Band Control with Separate Ground Returns.

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FIGURE 2.5 Wiring Connections for Individual Band Control with a Single Ground Return.

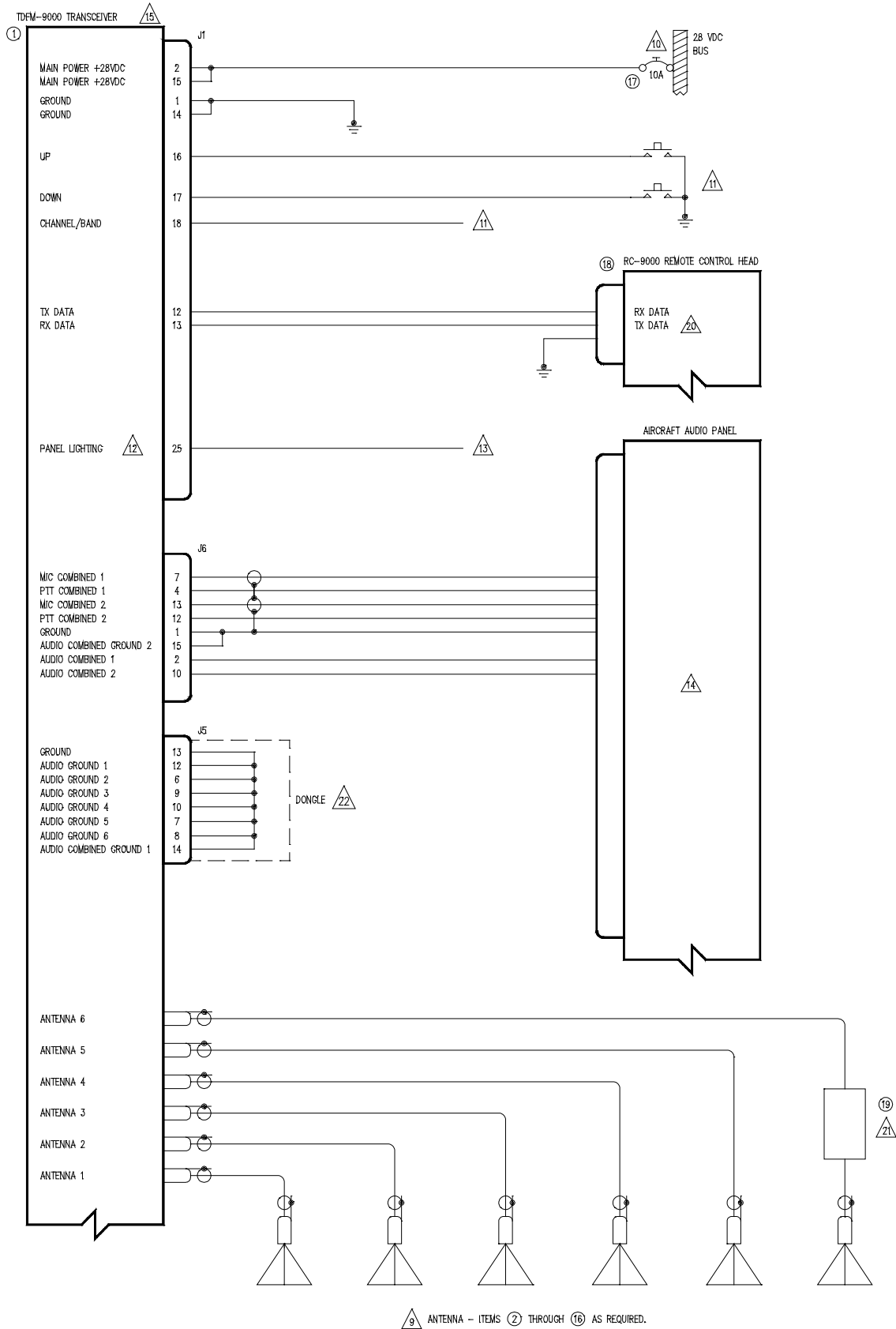**FIGURE 2.6** Wiring Connections for Combined Band Control with Separate Ground Returns.

FIGURE 2.7 Wiring Connections for Combined Band Control with a Single Ground Return.

QTY	ITEM	PART NUMBER	DESCRIPTION	MANUFACTURER	MATERIAL
1	1	TDFM-9000	MULTIBAND FM COMMUNICATIONS TRANSCEIVER.	TECHNISONIC INDUSTRIES LIMITED	
A/R	2	CI-292-3	VHF ANTENNA, 136 TO 174 MHz	COMANT INDUSTRIES	
A/R	3	CI-292-4	VHF ANTENNA, 136 TO 174 MHz	COMANT INDUSTRIES	
A/R	4	CI-275	UHFLO ANTENNA, 403 TO 470 MHz	COMANT INDUSTRIES	
A/R	5	CI-275	UHFHI ANTENNA, 450 TO 512 MHz	COMANT INDUSTRIES	
A/R	6	CI-285	UHFHI (II) ANTENNA, 450 TO 520 MHz	COMANT INDUSTRIES	
A/R	7	CI-308	800 ANTENNA, 806 TO 870 MHz	COMANT INDUSTRIES	
A/R	8	CI-285	800/700 (II) ANTENNA, 700 TO 870 MHz	COMANT INDUSTRIES	
A/R	9	CI-295-200	VHF/UHF ANTENNA, 136 TO 174 / 380 TO 520 MHz	COMANT INDUSTRIES	
A/R	10	CI-295-250	VHF/700/800 ANTENNA, 136 TO 174 / 764 TO 870 MHz	COMANT INDUSTRIES	
A/R	11	21-50-45	VHF/UHF/700/800 ANTENNA, 136 TO 174 / 380 TO 870 MHz	COOPER ANTENNAS	
A/R	12	AV-925	VHF/UHF/700/800 ANTENNA, 136 TO 174 / 380 TO 520 / 760 TO 870 MHz	RAMI ANTENNAS	
A/R	13	AT-1108/ARC	VHF/UHF ANTENNA, 116 TO 152 / 225 TO 400 MHz	RAMI ANTENNAS	
A/R	14	S65-8282-34	VHF LO/VHF/UHF ANTENNA, 30 TO 88 / 108 TO 174 / 225 TO 400 MHz	SENSOR SYSTEMS INC	
A/R	15	S65-1227	UHF ANTENNA, 225 TO 400 MHz	SENSOR SYSTEMS INC	
A/R	16	AT-258A/ARC	UHF ANTENNA, 225 TO 400 MHz	RAMI ANTENNAS	
1	17	7274-11-10	CIRCUIT BREAKER, 10 AMPS	KLIXON	
1	18	RC-9000	REMOTE CONTROL HEAD	TECHNISONIC INDUSTRIES LIMITED	
1	19	SRA-6000	SWITCHED 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 WIRE TO BE #24 AWG MINIMUM, UNLESS OTHERWISE SPECIFIED.

7) POWER AND GROUND WIRES TO BE #20 AWG.

8) ANTENNA COAX TO BE RG-142/U OR EQUIVALENT.

△9 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 APROXIMATE 1/4 OR 1/2 OR WHOLE NUMBER MULTIPLES OF THE NAVIGATION OR COMMUNICATIONS WAVELENGTH.

△10 AN EQUIVALENT CIRCUIT BREAKER OR FUSE MAY BE USED.

△11 THE CHANNEL/BAND UP/DOWN PUSH BUTTONS ARE OPTIONAL. GROUND CHANNEL/BAND INPUT FOR BAND CONTROL, LEAVE UNCONNECTED FOR CHANNEL CONTROL.

△12 THIS INPUT IS FOR BOTH 28 VDC AND 5 VAC PANEL LIGHTING. SELECT THE APPROPRIATE VOLTAGE IN THE CONFIGURATION MENU.

△13 CONNECT TO THE APPROPRIATE AIRCRAFT DIMMING BUSS.

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

△15 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.

16) TEST THE SYSTEM IN ACCORDANCE WITH THE POST-INSTALLATION TEST PROCEDURE IN THE INSTALLATION AND OPERATING INSTRUCTIONS MANUAL.

17) REFER TO THE AIRCRAFT STRUCTURAL REPAIR MANUAL AND THE MAINTENANCE MANUAL FOR INSTRUCTIONS AND INFORMATION PERTINENT TO THIS INSTALLATION.

18) 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.

△19 NOT NORMALLY USED IN AIRCRAFT.

△20 CONNECTION TO AN OPTIONAL RC-9000 SLAVE CONTROL HEAD.

△21 CONNECTION TO AN OPTIONAL SRA-6000 SWITCHED RECEIVE ATTENUATOR.

△22 OPTIONAL DONGLE USED WHEN A SINGLE AUDIO OUTPUT GROUND RETURN IS REQUIRED.

**FIGURE 2.8** Wiring Connection Notes for the TDFM-9200 Transceiver

2.22   ANTENNA SELECTION AND INSTALLATION CONSIDERATIONS

Antenna installations will vary according to the number / type of bands installed in the TDFM-9200, types of antennas selected, and space available on the aircraft. The materials list above contains many but not all antennas available. If dual band RF modules are installed in the TDFM-9200, it is suggested to use a single connector, multiband antenna for each of the RF modules installed. When single band modules are installed, a single band antenna should be used.

If the TDFM-9200 has more than one single band module installed that are on different frequency bands, a single multiband antenna with separate connectors or a multiband antenna with a coupler can be used if the frequencies in use are not multiples of each other. For example, transmitting near 150 MHz on VHF may interfere with frequencies near 450 MHz on the UHF band. Antennas should be spaced as far as possible from each other with the Comm antennas on the opposite side (top or bottom) from the FM antennas.

The following example uses a single RAMI AV-925 antenna and triplexer AV-926 with up to three single band modules operating in the following Frequency ranges:
- 136-174 MHz
- 380-520 MHZ
- 760-870 MHz
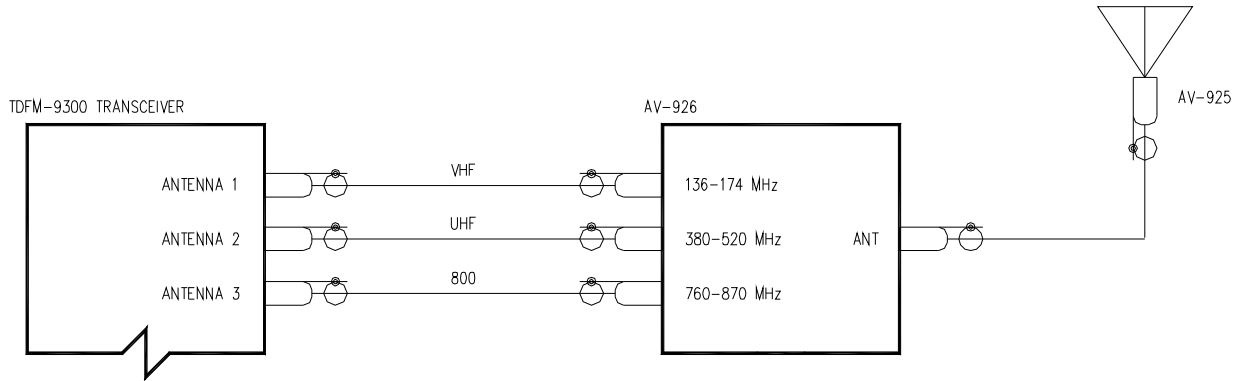
See Technisonic's Transceiver Installation guide and Antenna Selection Guide for more details.

2.23 POST INSTALLATION EMI TEST

PURPOSE

The purpose of this test is to identify any interference that the TDFM-9200 transceiver may cause with existing aircraft systems.

TEST CONDITIONS

The TDFM-9200 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, ensure 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-9200 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-9200 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-9200 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-9200 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.

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PROCEDURE

A. Operate the TDFM-9200 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	
TDFM-9200	PASS	FAIL	PASS	FAIL
143.2125 MHz				
143.2250 MHz				
157.5375 MHz				
157.5500 MHz				
512.0000 MHz				
39.3850 MHz				

NOTES:

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B. Determine if the image frequency for the VHF Comm falls within the range of the TDFM-9200. If so, select a set of frequencies that will cause the TDFM-9200 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-9200 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-9200 to 142.8000 MHz.

FREQUENCIES		RESULTS	
VHF #1	**TDFM-9200**	**PASS**	**FAIL**
135.975	136.0000		
121.150	157.5000		
131.250	157.5000		
118.000	34.000		
118.000	45.000		
Image:			

FREQUENCIES		RESULTS	
VHF #2	**TDFM-9200**	**PASS**	**FAIL**
135.975	136.0000		
121.150	157.5000		
131.250	157.5000		
118.000	34.000		
118.000	45.000		
Image:			

NOTES:

C. Determine if the image frequency for the VOR/ILS Nav falls within the range of the TDFM-9200. If so, select two sets of frequencies that will cause the TDFM-9200 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-9200 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-9200**	**PASS**	**FAIL**
108.000	162.0000		
108.100	162.1500		
108.000	36.0000		
108.100	36.0325		
Image:			

FREQUENCIES		RESULTS	
VOR/ILS #2	**TDFM-9200**	**PASS**	**FAIL**
108.000	162.0000		
108.100	162.1500		
108.000	36.0000		
108.100	36.0325		
Image:			

NOTES:

D. The following procedure checks for second harmonic interference to the glide slope receiver from the TDFM-9200. All transceivers produce harmonics (multiples of the wanted frequency) and while the TDFM-9200 far exceeds FCC requirements, interference can still be experienced depending upon antenna position and separation. Furthermore, other equipment in the aircraft and the structure of the aircraft can generate harmonics 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-9200 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-9200. Fly the aircraft to intercept the localizer and glide slope (both needles centered) at 26 nm from the runway. Transmit on the TDFM-9200 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-9200 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

FREQUENCIES		RESULTS	
G/S #1	**TDFM-9200**	**PASS**	**FAIL**
334.7 (108.1)	167.35		
334.7 (108.1)	33.4700		

FREQUENCIES		RESULTS	
G/S #2	**TDFM-9200**	**PASS**	**FAIL**
334.7 (108.1)	167.35		
334.7 (108.1)	33.4700		

NOTES:

E. Operate the TDFM-9200 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	
TDFM-9200	**PASS**	**FAIL**	**PASS**	**FAIL**
512 MHz				
36.0000				

NOTES:

F. Modulate the TDFM-9200 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-9200**	**PASS**	**FAIL**
978 (108.0)	489		
1020 (112.1)	510		

FREQUENCIES		RESULTS	
DME 2	**TDFM-9200**	**PASS**	**FAIL**
978 (108.0)	489		
1020 (112.1)	510		

NOTES:

G. **NOTE:** For the following tests, select a frequency at the top, middle, and bottom of each band of the TDFM-9200 transceiver.

	136 to 174 MHz Band	403 to 470 MHz Band	450 to 512 MHz Band	806 to 870 MHz Band	Analog Band
Frequency #1					
Frequency #2					
Frequency #3					

H. At a safe altitude, engage the autopilot or stability augmentation system. Modulate the TDFM-9200 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-9200 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			
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:

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

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.

TDFM-9200

MULTIBAND P25 AIRBORNE TRANSCEIVER

Operating Instructions

TiL Document No. 13RE473
Rev. B

NOVEMBER 2014

TECHNISONIC INDUSTRIES LIMITED

REV	SECTION - PAGE -	DESCRIPTION	DATE	EDITED BY
N/C		Original Document Release.	May 05, 2014	AL
A	i	Replaced Front Panel Image with clearer image.	Nov. 14, 2014	AL
	i & ii	Corrected Mislabeled TiL Document Numbers.		
	iv	Corrected DO-160 Information.		
	All	Changed Format for Section Headers.		
B	1-6	Added UHF AM Specs.	Nov. 25, 2014	JR
	2-4	Updated CBR info with RBC.		
	2-10	Updated Configuration Menu info.		
	2-14	Added Talkgroup ID Programming to FPP info.		
	2-17	Added Analog FPP menu info.		
	All	Corrected Mislabeled Footers.		

REVISION HISTORY
[13RE473 **]**

NOTES

CAUTION STATIC SENSITIVE !

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

FCC COMPLIANCE INFORMATION

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

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

1. The transmitter antenna gain shall not exceed 3 dBi.
2. The transmitter antennas shall be located outside of a vehicle and must not be co-located (kept at a separation distance of more than 20cm from each other when installed). Also they must be installed in such a way that they always maintain a separation distance of more than 90cm from any person 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

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

WARRANTY INFORMATION

The Model TDFM-9200 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-160G ENVIRONMENTAL TESTING

Summary of DO-160G Environmental Testing for Technisonic Model TDFM-9200 Transceiver:

Conditions	Category
Temperature and Altitude	A2, B1, C4, D1
Temperature Variation	B
Humidity	A
Operational Shock and Crash Safety	A
Vibration	S, U
Magnetic Effect	Z
Power Input	B
Voltage Spike	B
Audio Frequency Susceptibility	B
Induced Signal Susceptibility	AC
Radio Frequency Susceptibility	T
Radio Frequency Emission	M
Electrostatic Discharge	A

STC APPROVAL NOTE

Presently, no TSO standard exists for airborne FM transceivers. To make it easier for installation agencies to provide their customers with an approved installation supported by an effective Airworthiness Approval, Technisonic has secured Supplemental Type Certificate (STC) Approvals (both US and Canadian) on its Airborne FM products for many helicopters currently being delivered in the US and Canada as well as a number of single engine fixed wing aircraft. The above referenced DO-160G 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 website 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 website www.til.ca for the latest issue of available STCs and letter of authorization for use.

WARNING AND DISCLAIMER

This manual is designed to provide information about the TDFM-9200. Every effort has been made to make this manual as complete and accurate as possible.

TRADEMARK NOTICES

TDFM-9200 Transceivers contain two-way radio protocols licensed from Motorola, Inc.
© 1997, 1998 Motorola, Inc.

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LIST OF FIGURES

LIST OF TABLES

SECTION 1: GENERAL DESCRIPTION

1.1   INTRODUCTION

This publication provides operating information on the TDFM-9200 airborne transceiver. The exact configuration depends on which and how many RF modules are installed.

NOTE: This publication supports radios with Version 2.0.0 or higher Software.

1.2   DESCRIPTION

The TDFM-9200 transceiver is an airborne multi-band radio capable of operation in conventional, analog, P25 and P25 phase II digital FM systems, SmartNet/SmartZone trunking systems, and P25 9600 trunking systems. RF modules are available in single or dual bands that support VHF, UHF-LO, UHF-HI, and 700-800 MHz bands. Both single or dual band P25 modules can be supported.

P25 9600 trunking Phase 1 and 2 may be combined with AES and/or DES-OFB encryption with OTAR in any of the available modules.

In addition, the TDFM-9200 has capacity for two analog only RF modules. The analog slots can support any combination of the following RF modules: VHF FM low band (30 – 50 MHz), VHF AM com (118 – 138 MHz) or UHF AM com (225 – 400 MHz).

1.3   MODEL VARIATION

There are several variations of the Model TDFM-9200 Transceiver. Each variation offers different features and performance based on the type of RF modules and options installed.

Type A RF Modules are mounted 2 to a tray.(with two analog trays supported).
The following is a breakdown of the TDFM-9200 model variations:

P/N 121267-D-92-TBB-TX-TX-P92XXX

(PRODUCT TYPE)-(D)-(9X)-(Tray 1)-(Tray2)-(Tray3)-(Project)

PRODUCT TYPE: 111267 = TDFM-9200 series, 3 trays: Tray 1: 2 x P25 Type A Modules
                   and Trays 2 & 3: 1 Analog Module each.

D= Display type:

      1) Color
      2) Color/NV

9X = TDFM-9000 series variant:

92 = TDFM-9200

Tray Breakdown: (TBB):

   T= Module type: A= T30xx P25 RF modules (Single or Dual), Module type "T" is T3X00 TIL analog only.

   B is Band code for each module in the tray.

TYPE "A" P25 Band Codes

1	VHF (136-174)
2	UHF LO (380-470)
3	UHF HI (450-520)
4	700/800 (764-870)
A	V/700/800
B	V/UHF LO
C	V/UHF HI
D	UL/UH
E	UL/700/800
F	UH/700/800
* G	700/800/V
* H	700/800/UL
* I	700/800/UH
* J	UHF LO/V
* K	UHF HI/V
* L	UH/UL

Band numbers indicate single band modules and letters indicate dual band modules.

* Band codes are special order and are not standard configuration.

TYPE "T" Analog Band Codes

1	VHF Low (30-50)
4	VHF AM (118-138)
5	UHF AM (225-400)

Project Number: P92XXX represents a 5 digit project number that identifies specific options that are contained in each module and describes the full TDFM-9200 configuration.

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

Specification	Characteristic
Model Designation:	TDFM-9200
Physical Dimensions:	Approx. (L) 8.0" x (W) 5.75" x (H) 4.5"
Weight:	~7.0 Lbs (3.2 Kg)
Operating Temperature Range:	-30° C to +60° C
Power Requirement:	
Voltage:	28.0 VDC ± 15%
Current:	700 mA minimum / 10A maximum
Audio Output Power (including sidetone):	65 mW into 600 Ω
Microphone Inputs:	Carbon or Equivalent
Panel Back Lighting:	
Voltage:	28 or 5 Volts AC or DC (selectable)
Current:	10 uA

RF Modules

Specification	Characteristic
RF Output Power:	1 or 6 Watts (VHF)
	1 or 5 Watts (UHF)
	1 or 3 Watts (700/800)
Frequency Range	
VHF Band:	136 to 174 MHz
UHF LO Band:	380 to 470 MHz
UHF HI Band:	450 to 520 MHz
700 / 800 bands:	764 to 870 MHz
No. of channels per band:	3000 pre-programmable channels

Transmitter section	VHF	UHF	800
FM Hum and noise in dB (wideband):	-48	-45	-45
Audio Distortion:	1%	1.0%	1.0%
Frequency Stability in ppm:	± 1.0	± 1.0	± 1.5
Modulation Limiting:	Wide band	± 5 kHz	
	Narrow band	± 2.5 kHz	

Receiver section	VHF	UHF	800
Sensitivity in uV:			
* Digital 1% BER (12.5 kHz)	0.29	0.32	0.40
* Digital 5% BER (12.5 kHz)	0.21	0.28	0.30
** Analog with 12 dB SINAD	0.25	0.25	0.25
Selectivity in dB:			
25 kHz Channel	-80	-78	-72
12.5 kHz Channel	-70	-68	-67
Intermodulation * **	-80	-80	-80

* Measured in digital mode per TIA / EIA IS 102.CAAA under nominal conditions.
** Measured in analog mode per TIA / EIA 603 under nominal conditions.

ANALOG MODULE SPECIFICATIONS

GENERAL

Frequency Ranges:	
VHF FM Lo module	30 - 50 MHz
VHF AM module	118 - 138 MHz
UHF AM module	225 - 400 MHz
Operating Mode:	F3E simplex or semi-duplex (FM modules)
	A3E simplex (AM modules)
Channel Spacing:	25 or 12.5 kHz (25 kHz only for AM)
FM Frequency Selection:	200 memories per band programmed with:
via front panel	a) TX Frequency/RX Frequency
	b) TX/RX CTCSS tone or DPL code
	c) 9-character alphanumeric title
CTCSS squelch/encoder:	* All CTCSS tones available (FM modules only)
DPL digital squelch/encoder:	* All standard DPL codes (FM modules only)
DTMF encoder:	All standard DTMF tones

* Available only on FM Modules.

VHF LO FM RECEIVER

Sensitivity at 12 dB SINAD	Better than 0.35 µV
Adjacent Channel Selectivity	-75 dB (25 kHz)
	-70 dB (12.5 kHz)
Spurious Attenuation	-90 dB
Third Order Intermodulation	-70 dB
Image Attenuation	-80 dB
FM Acceptance	± 6 kHz
Hum and Noise	Better than 45 dB
Audio Distortion	Less than 5%
Antenna Conducted Emission	Less than -70 dBm

VHF LO TRANSMITTER

RF Power Output	1 watt or 10 watts
Output Impedance	50 ohms
Maximum Deviation	± 5 kHz (25 kHz mode)
(In narrowband mode)	± 2.5 kHz (12.5 kHz mode)
Spurious Attenuation	-90 dB below carrier level
Frequency Stability	± 2.5 ppm
Harmonic Attenuation	-60 dB below carrier level
FM Hum And Noise	-40 dB
Audio Input	50 mV at 2.5 kHz into 200 ohms input circuit for ± 3.5 kHz deviation, adjust.
Audio Distortion	Less than 5%

VHF AM RECEIVER

Sensitivity at 12 dB SINAD	Better than 2.0 µV
Adjacent Channel Selectivity	-70 dB (25 kHz)
Spurious Attenuation	-70 dB
Third Order Intermodulation	-70 dB
Image Attenuation	-60 dB
Hum and Noise	Better than 40 dB
Audio Distortion	Less than 5%
Antenna Conducted Emission	Less than -70 dBm

VHF AM TRANSMITTER

RF Power Output	2 to 3 watts carrier
Output Impedance	50 ohms
Maximum Modulation (max)	95%
Maximum Modulation (min)	75%
Spurious Attenuation	-60 dB below carrier level
Frequency Stability	± 2.5 ppm
Harmonic Attenuation	-60 dB below carrier level
Signal to Noise Ratio	-35 dB
Audio Input	50 mV at 2.5 kHz into 200 ohm input circuit for 30% modulation (adjustable)
Audio Distortion	Less than 5%

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UHF AM RECEIVER

Sensitivity at 12 dB SINAD	Better than 5.0 µV
Adjacent Channel Selectivity	-70 dB (25 kHz)
Spurious Attenuation	-70 dB
Third Order Intermodulation	-70 dB
Image Attenuation	-60 dB
Hum and Noise	Better than 40 dB
Audio Distortion	Less than 5%
Antenna Conducted Emission	Less than -70 dBm

UHF AM TRANSMITTER

RF Power Output	3 to 4 watts carrier
Output Impedance	50 ohms
Maximum Modulation (max)	95%
Maximum Modulation (min)	75%
Spurious Attenuation	-60 dB below carrier level
Frequency Stability	± 2.5 ppm
Harmonic Attenuation	-60 dB below carrier level
Signal to Noise Ratio	-40 dB
Audio Input	50 mV at 2.5 kHz into 200 ohm input circuit for 30% modulation (adjustable)
Audio Distortion	Less than 5%

SECTION 2: OPERATING INSTRUCTIONS

2.1   GENERAL

A colour LCD display, a keypad, and a rotary knob provide the operator control of up to 4 RF modules installed in the unit. The display shows the activity of all the modules as well as the soft key menu of the active band. The active module is selected by pressing the corresponding soft key on the left of the display. The knob has multiple functions including volume and channel. The microphone, key line, and headphone audio can be wired separately for each of the modules; 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 one of the combined outputs. In this configuration, the soft keys on the transceiver provide the audio panel function. It is possible to connect the transceiver such that both methods are used.
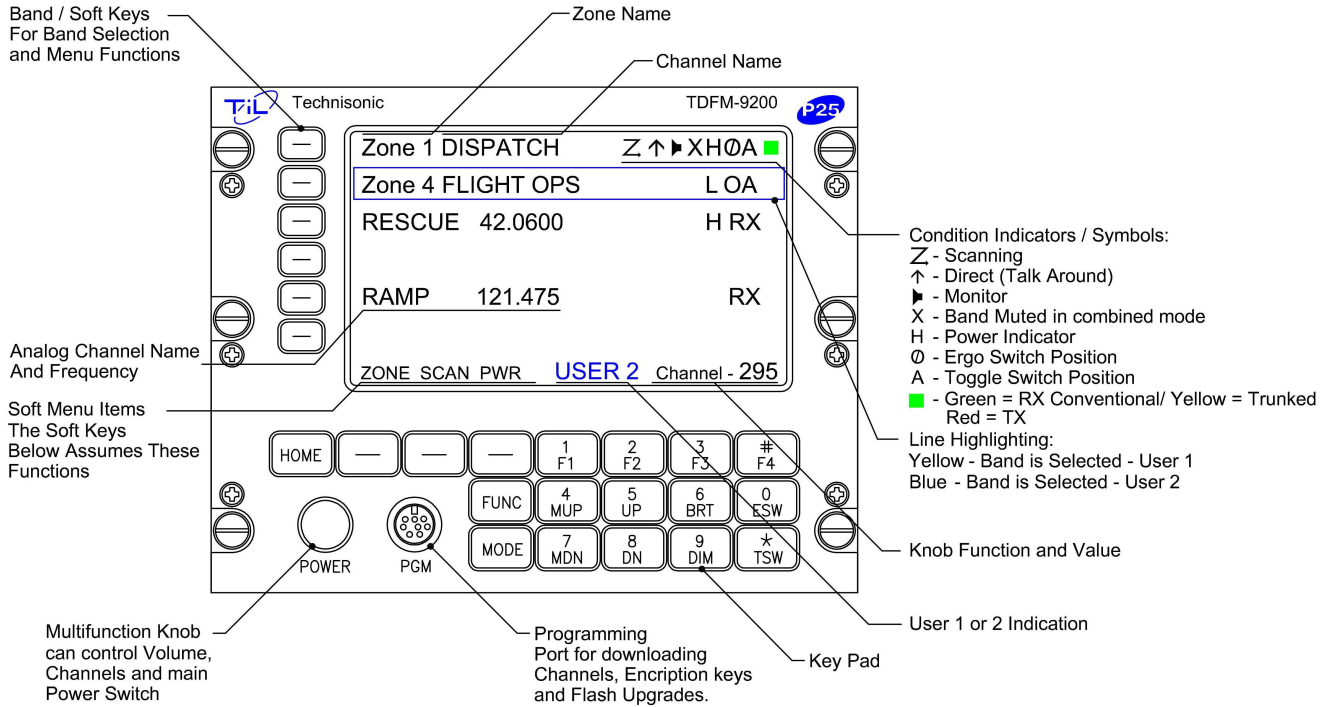
2.2   FRONT PANEL

Refer to the diagram below:

FIGURE 2-1 Front Panel Controls – TDFM-9200 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 and then release. If it is desired that the radio powers up with the radio master in the aircraft, an 'always on' mode can be set in the configuration menu.

2.4   KNOB

The knob is a rotary encoder, which turns endlessly. 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. Another knob press will bring you to the recall mode. In the recall mode, typing in the zone and channel number will bring you quickly to that channel without scrolling through many channels. Another press with switch to Numlock mode. 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 nine soft keys. The 3 soft keys below the display assume the function shown on the menu above them. The functions displayed depend on how the module was programmed with the customer programming software (APX CPS)™. 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 NUM LOCK mode) or scrolled using the UP(5) and DN(8) 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.
PWR	Selecting PWR will allow the power output of the radio to be set to high or low.
VIEW	The view function is used to view lists. Lists can include scan lists, phone numbers, call lists, and/or paging.
FPP	Front Panel Programming mode allows you to program at the front panel without the customer programming software. This option is available on all standard modules.

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 knob.

The soft keys to the left of the display are used to select the active band for which the knob and keyboard will control. If the radio is connected using the one or both of the combined inputs, the selected band will also be selected for transmit. If you press a key on a band that is already selected, the receive audio will be toggled off and on. This can be useful to temporarily mute distracting traffic.

2.6 MODE KEY

This button selects USER 1 or USER 2 mode when the unit is installed with both combined input/outputs connected. USER 1 or 2 will be indicated at the bottom of the display and the selected band box will show yellow for USER 1 and blue for USER 2.

2.7 FUNC KEY

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

Quick Channels   Pressing one of the side menu keys or F1-F4 keys will load a pre-programmed channel.
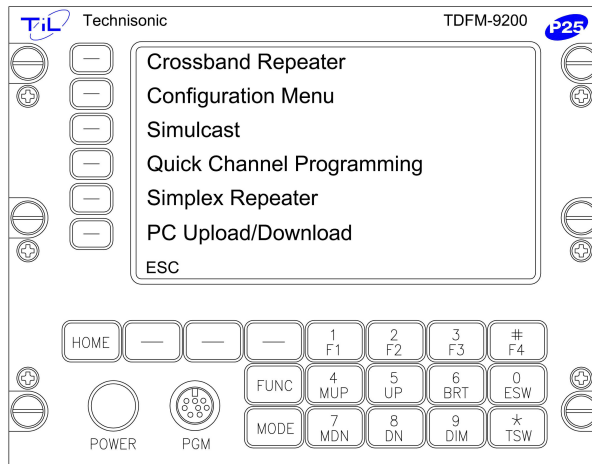
Record Next Message   Pressing this menu key will cause the transceiver to record the next message received on the selected band.

Play Last Message   Pressing this menu key will play the last message recorded.

After selecting one of the above, the radio will return to normal operating mode. Pressing the ESC soft key will return to normal operating mode without making any changes. Pressing the NEXT soft key will bring up the second function menu.

Cross Band Repeat	You can select any two bands to cross band repeat. The repeat function is semi-duplex. This means the TDFM-9200 will retransmit from one band to another in both directions but not simultaneously.
	Once enabled, the Repeater Broadcast (RBC) is also enabled by default. If the radio is keyed from either of the combined inputs, then Cross Band Repeat (CBR) is suspended and both bands are keyed so that a simulcast broadcast can be made. Once unkeyed, the CBR will resume after 3 seconds.
Configuration	Enters the Configuration Menu (see 2.17 Configuration Menu). This menu allows customisation of the TDFM-9200.
Simulcast	You can select 2 or more bands to transmit simultaneously. Simulcast is only available when using the one or both of the combined input/outputs. Simulcast can be used in conjunction with the cross band repeat mode.
Quick Channel Programming	Allows you to program a Hot Memory (zone/channel) to the F1 to F4 keys for each band.
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.
PC Upload/Download	When the Band selector is set to Band 3 or Band 5, this switches the front panel program connector to the selected Analog RF module. This is used when programming with MultiTDP software.
SUPV Soft Key	This key accesses the Supervisor Menu. This menu is password protected. Supervisor Menu is used to limit user access to some or all of the advanced features in the function menus.

Pressing the ESC soft key or the FUNC key will return the radio to normal operating mode without making any changes.

NOTE: Some or all of the above features may be disabled via the Supervisor Menu. Consult TIL or the local Sysop for changes to the enhanced features that are restricted.

2.8 F1 to F4 KEYS

Four function keys at the top of the keypad (when not programmed for quick channels as mentioned above) provide the same actions as the three side buttons and the top button found on the APX-7000 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-9200 Transceiver Recommended Keypad Menu Defaults:

TDFM-9200 Transceiver	Portable	Conventional Operation	Trunked Operation	Analog Band Operation
ITEM	ITEM	Bands 1 & 2	Bands 1 & 2	Bands 3 & 5
F1 Key	Upper Side Button 1	Monitor	Unprogrammed	Monitor
F2 Key	Middle Side Button 2	Nuisance Delete	Unprogrammed	Band 5 Scan
F3 Key	Bottom Side Button 3	Talkaround/ Direct	Unprogrammed	Talkaround/ Direct
F4 Key	Top Button	Volume Set Tone	Volume Set Tone	No function
MUP and MDN keys	16-Position Rotary Knob	Channel Select	Talkgroup Select	Channel Select
ESW Key	Two-Position Concentric or Ergo Switch	Unprogrammed A (Ø) Unprogrammed B (O)	Unprogrammed A Unprogrammed B	No function No function
TSW Key	Three-Position Toggle Switch	Blank (A) PL Disable (B) Blank (C)	Blank (A) Blank (B) Blank (C)	No function No function No function

NOTE: It is possible to use Motorola's Customer Programming Software (APX CPS™) to alter the default keypad settings of the TDFM-9200 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 customizing the settings. Technisonic recommends that the default key settings stay in place until all airframe installation and operational issues have been overcome.

The Function keys and Soft keys have fixed functions for Band 3 & 5 Analog modules and are not user programmable.

Modules 1 & 2 of the TDFM-9200 Transceiver are programmable by Motorola CPS™. The following settings may be programmed for each Conventional Channel in a module:

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 Numbers	TX Power
Talkgroup IDs	Private Call Type
Encryption Key Assignment	

The following settings can be programmed for each mode in a P25 Trunked and/or SmartNet/SMART ZONE equipped radio:

System Type	TG Strapping
System ID (NAC)	Zone
Individual ID (UID)	Scan List
Coverage Type	Scan Type
Affiliation Type	Interconnect
Control Channel (s)	Phone Display Format
Talkgroups	Private Call Operation
Status	Site Alias
Encryption Key Assignment	

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

The F1 – F4 keys can be programmed as Hot Memory keys as mentioned in Section 2.7. Depending on the setting in the configuration menu, the keys can be permanently set to Hot Memories (channels) or used for other functions (normal). When the F1 – F4 keys are in the normal mode, they can still be used for Hot Memory Recall 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. These keys can be used to scroll through the channels. A single press will step the channel by one, but a push and hold will scroll to a desired channel number. The function of the rotary knob is automatically set to CHAN when either of these keys is pressed.

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 and the DN is the left. These keys are used for a variety of functions, but in the normal operating 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. The display dimmer has 31 steps. If the display is at max normal brightness (31), pressing the BRT key will force the display to step 32 "Daylight" level for viewing in direct sunlight. This mode is temporary and will revert to max normal level when the key is released.

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. This key has no function when analog bands are selected.

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 far 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 APX CPS™ to a variety of functions such as low power, scan, zone select, or PL disabled mode. This key has no function when analog bands are selected.

2.14   DISPLAY

The transceiver has a full colour LCD display. The zone name, channel name, condition symbols (scan, direct, call, secure, monitor, etc.), and switch settings will be displayed for each module. The active band as selected by the soft keys will be highlighted. The bottom line displays the menu items associated with the module selected and the mode of the knob.

2.15   GENERAL OPERATION

Switch on the transceiver by pressing the knob. Select the desired band by pressing one of the band select keys on the left of the display. Select the TDFM-9200 on the aircraft audio panel. Press the knob again so that CHAN shows up on the bottom 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 the soft keys is what menu is displayed on the screen but the band selected by the audio panel is the band that you are transmitting and receiving on. To use the DTMF keypad while transmitting, the band you are using must be selected on the display. If the radio is installed using both of the combined input/outputs, then pressing the MODE key will alternate the display between the two users.

2.16 PROGRAMMING SOFTWARE

APX CUSTOMER PROGRAMMING SOFTWARE (APX CPS™)

Programming the first two bands in the TDFM-9200 is usually done with the use of third party programming software. Customer Programming Software, or "APX CPS," must be supplied by Motorola. However, conventional analog or P25 channels can be programmed at the front panel. See section 2.19 for details.

A Programming cable "PC-9000" is required to connect the computer to the TDFM-9200. Bands 1 & 2 in the TDFM-9200 are considered an APX-7000 portable by the APX CPS™ software. To program a band in the transceiver, it must be selected by pressing the appropriate band select key before running the APX CPS™. Follow the instructions supplied with the APX CPS™.

The APX CPS Programming software (P/N RVN5224) must be purchased from Motorola On Line (MOL).

For instructions on ordering Motorola parts and APX CPS software see Technical Information Bulletin TIBFM 18-01.

This document is available on the Technisonic website at www.til.ca. On the main page, hover the cursor over "Project 25 Airborne FM." A pull-down menu should appear. Click the TDFM-9200 link to go directly to the TDFM-9200 page and click the link for "APX CPS Programming Software/Cables Ordering Guide." Refer to the section for Type III or "A" modules.

MULTITDP SOFTWARE

Programming the Analog Bands 3 & 5 of the TDFM-9200 requires the Technisonic MultiTDP software. This software is free and is available from the Technisonic website www.til.ca.
Click on the "Programming Software" section and select "MultiTDP" software for download. Multi TDP also uses the programming cable PC-9000.

If encryption keys need to be loaded via a KVL-3000+ or KVL 4000 keyloader, cable P/N 127500 may be also be obtained from Technisonic. This keyloader cable will plug into the front mini DIN connector of the TDFM-9200 transceiver.

The following cables for support of the TDFM-9200 can be purchased from Technisonic:
P/N 127499   Download/Programming Cable (See Figure 2.2).
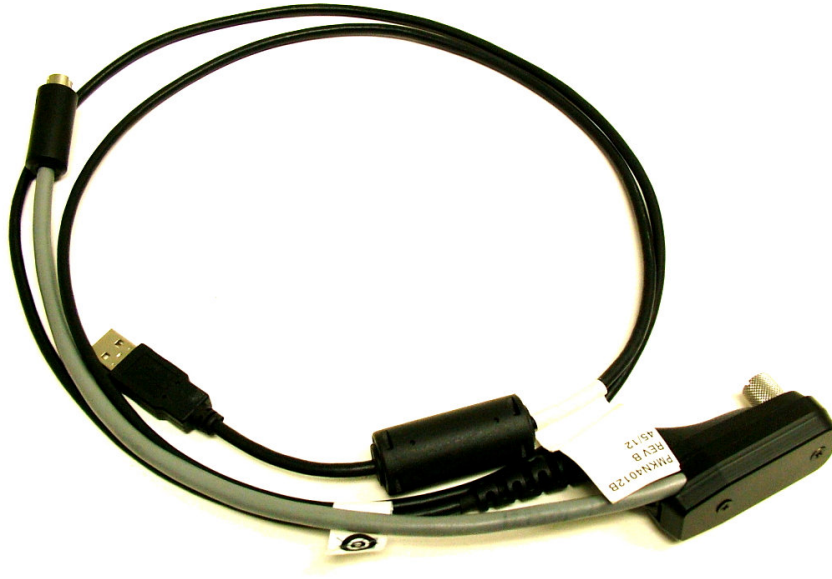P/N 127500   Encryption Keyloading Cable (See Figure 2.3).

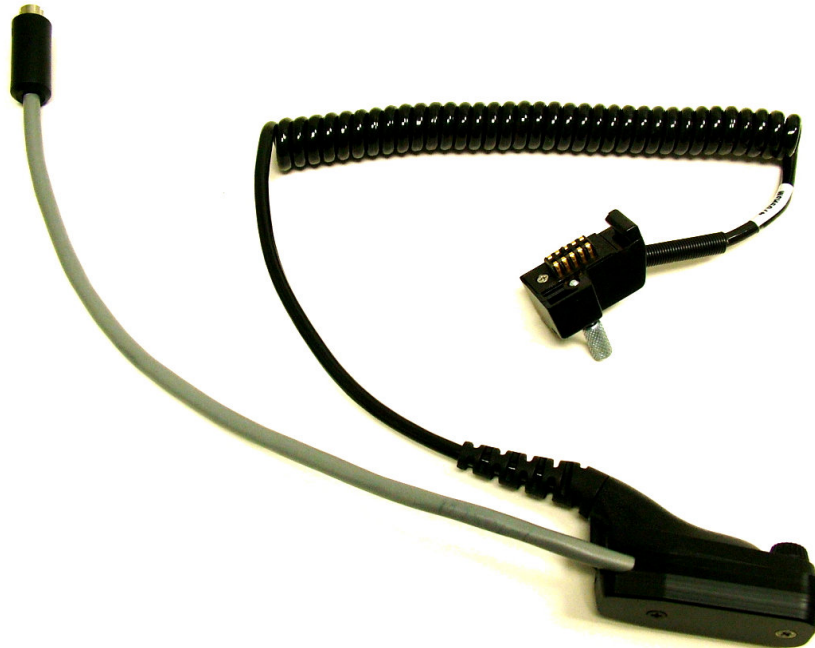**FIGURE 2.2:** Programming Cable: P/N 127499

FIGURE 2.3: Encryption Keyloading Cable: P/N 127500

2.17   CONFIGURATION MENU

Some features of the TDFM-9200 transceiver can be configured to the user's preference. To enter the configuration menu, press the FUNC button, then NEXT, and then select "Configuration" from the 2nd side button. Select the item by pressing the side button. Rotate the knob to select the desired condition. Press the "NEXT" soft key to access the next page of configuration items. Press "ESC" Soft key to exit Configuration at any time.

NOTE: The Configuration Menu maybe disabled via the Supervisor Menu. Consult TIL or the local System Operator (Sysop) if changes are required.

The following menu items can be changed or modified:

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. If set to single, only the function set in the above knob default will be available.
Numlock Mode	Numlock Mode changes the keys to a numeric keypad. Numlock can be set to Disabled, Enabled, Revert, or TMR Revert. When enabled, the Numlock mode is available by pressing the Channel Knob. The knob mode will remain in Numlock until the knob is pushed again. When set to Revert and the knob is pressed to select Numlock, the mode will wait until a number key is pressed, then the knob mode will revert to its preset default. If Numlock is set to Tmr Revert, the same is true as Revert, except the mode returns to its default after a preset timer.
Recall Mode	When enabled, recall of a Zone and Channel is added to the available knob functions.
Backlighting	Select 28 volts DC or 5 volts AC. 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.
Dual User Mode	Set to enabled when the radio is installed with both combined ports connected.
Always On Mode	When enabled, the radio turns on and off with the aircraft radio master.
CSQ Indicator	Toggles the CSQ Indicator ! on or off. Default is on.
Hi/Lo power Indicator	Toggles the HI/LO Indicator +/, on or off. Default is on.
ESW Indicator	Toggles the ESW Indicator #/$ on or off. Default is on.
TSW Indicator	Toggles the TSW Indicator A/B/C on or off. Default is on.

Sidetone Level	Sets the sidetone level. The microphone and headphone audio become live while in this mode to facilitate setting to a comfortable level.
Squelch Blink	When disabled, the squelch indicator lights will function normally. When enabled, the receive squelch lights will stay lit while a signal is present and then blink for a couple of seconds after the signal disappears. This can help to determine which band made the last call.
RFM 3 FPP	This menu item enables or disables the FPP soft key of the Analog Band 3 module.
RFM 3 F2 Key	This menu item enables or disables the F2 SCAN function for the Analog Band 3 module.
RFM 3 F3 Key	This menu item enables or disables the F3 TALK-AROUND / DIRECT function for the Analog Band 3 module.
RFM 5 FPP	This menu item enables or disables the F2 SCAN function for the Analog Band 5 module.
RFM 5 F2 Key	This menu item enables or disables the F2 SCAN function for the Analog Band 5 module.
RFM 5 F3 Key	This menu item enables or disables the F3 TALK-AROUND / DIRECT function for the Analog Band 5 module.
Tmr Revert	This menu sets the time from 1 to 10 seconds for Numlock Mode to revert to the knob default. (applies only if Numlock set to Tmr Revert.

Press the ESC button to exit configuration mode. The radio will return to normal operation display. The radio will keep these settings until they are changed again in the configuration menu.

2.18   KEYLOADING MODE

If the TDFM-9200 is equipped with hardware encryption, then the Encryption keys will need to be loaded using a Motorola KVL 3000+® or KVL 4000 Keyloader and a KVL-9000 cable, (TiL P/N 127500).

Modules in the TDFM-9200 can easily be keyloaded by simply selecting the band and plugging in the keyloader and cable into the programming connector on the front of the radio.

Turn on the keyloader and connect the cable to the TDFM-9200. The selected band will display "KEYLOADING". Follow the Motorola Keyloader instructions for uploading the actual keys to the radio.
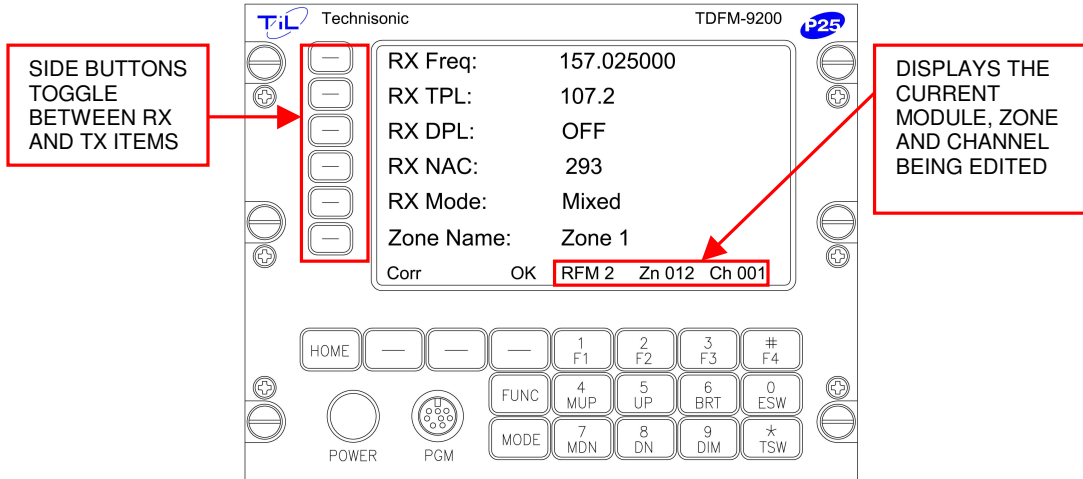
If other bands require keys, press the next soft key to select the next module, wait 1 second for the module to sense the keyloader, and then upload the key(s).

When keyloading is done, remove the keyloader cable. The module will resume normal operation.

NOTE: Keyloading can only be done on Bands 1 & 2. There is no encryption option for the Analog Modules in Bands 3 & 5.

2.19 FRONT PANEL PROGRAMMING (FPP) MODE

TDFM-9200 radios can be ordered with optional Front Panel Programming (FPP) for each Digital module. In addition, the Analog modules also support FPP. Type "A" modules 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, the following screen will appear:

SIDE BUTTONS TOGGLE BETWEEN RX AND TX ITEMS

DISPLAYS THE CURRENT MODULE, ZONE AND CHANNEL BEING EDITED

RX Freq:	157.025000
RX TPL:	107.2
RX DPL:	OFF
RX NAC:	293
RX Mode:	Mixed
Zone Name:	Zone 1
Corr	OK	RFM 2 Zn 012 Ch 001

FPP Menu for TYPE A modules

FPP ON TYPE A MODULES:

The display shows all of the information contained in the current channel. Pressing one of the side menu keys will select the attribute to be edited. Toggling between transmit and receive can be done by either pressing the menu key again or by pressing the knob with the exception of the Name line which toggles between Zone Name and Channel Name.
Toggle the RX NAC/TX NAC key to access the Talkgroup ID menu.

RX/TX Freq.   The RX and TX frequencies can be changed by entering a new value via the keyboard. After entering the RX frequency press the OK soft key. The menu will prompt for a TX Freq. Push the top side button to manually toggle between RX and TX frequencies.

RX/TX TPL   Rotate the knob to scroll through the available RX TPL (CTCSS tones). Press the OK soft key to accept. The menu will prompt for a TX TPL tone. Rotate the knob to select. Press Ok to accept. The second side button also toggles between the RX and TX TPL codes. TPL tones cannot be programmed if DCS codes are already active. See Table 2.1 for supported TPL tone codes.

RX/TX DPL   Rotate the knob to scroll through the available RX DPL (DCS codes). Press the OK soft key to accept. The menu will prompt for a TX DPL code. Rotate the knob to select. Press Ok to accept. The third side button also toggles between the RX and TX DPL codes. DPL tones cannot be programmed if TPL tones are already active. See Table 2.2 for supported DPL codes.

RX/TX NAC   Enter the desired NAC via the keyboard. The Network Access Code is a hex number between 000 and FFF. The standard number is 293. The middle soft menu key will allow toggling between 0-9 and A-F. In A-F mode the number keys 1-6 program A- F. Programming a NAC code on an analog channel has no effect.

Talkgroup ID	Toggle the 4th side button 2 times to enter the desired Talkgroup ID via the keyboard. The Talkgroup ID is a hex number between 0001 and FFFF. The default number is 0001. The middle soft menu key will allow toggling between 0-9 and A-F. In A-F mode, the number keys 1-6 program A-F. Talkgroup ID is only used when the channel is programmed to transmit in digital mode.
RX/TX Mode	Rotate the knob to scroll through Analog, Digital (P25), or Mixed. When the RX mode is set to Analog, then the TX mode is automatically set the same. If the RX mode is set to Digital, then TX Mode is also Digital. If the RX mode is set to Mixed, then the TX Mode can be set to either Analog or Digital. If the RX mode is set to mixed, then this channel will receive both Analog and Digital based on the TPL/DPL and NAC/Talkgroup criteria. The fifth side button toggles between the RX and TX Mode.
Zone/Channel Name	Rotate the knob to scroll through the available characters. Press the NEXT soft key to get to the next position. Pressing NEXT at the end of the name will loop back to the first character position. Press OK to save and toggle to the Channel Name. Limit the Zone Name to 8 characters and the Channel Name can accept up to 14. The bottom side bottom toggles between the Zone Name and Channel Name.

After editing any parameter press the OK soft key to accept the changes. The next item will be highlighted upon pressing the OK key. Press the HOME key to save your current changes and return to normal operating mode.

FPP can only be used on a memory containing a conventional Analog or conventional P25 Digital channel. P25 Trunked or Motorola Trunking channels can only be programmed via APX CPS software.

NOTE: The FPP mode will only accept changes if the channel is in a Zone that is FPP enabled in the codeplug. If the channel is in a Zone that is <u>not</u> enabled for FPP, the channel data will be displayed but no changes will be accepted.

The following is a list of TDFM-9200 TYPE A Module TPL (CTCSS) 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-9200 Series TYPE A TPL (CTCSS) Codes

The following is a list of TDFM-9200 TYPE A DPL (DCS) CODES:

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

TABLE 2.2 TDFM-9200 Series DPL Codes (All Bands)
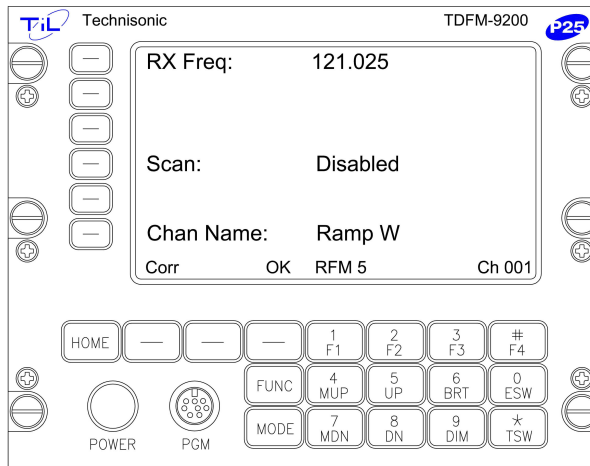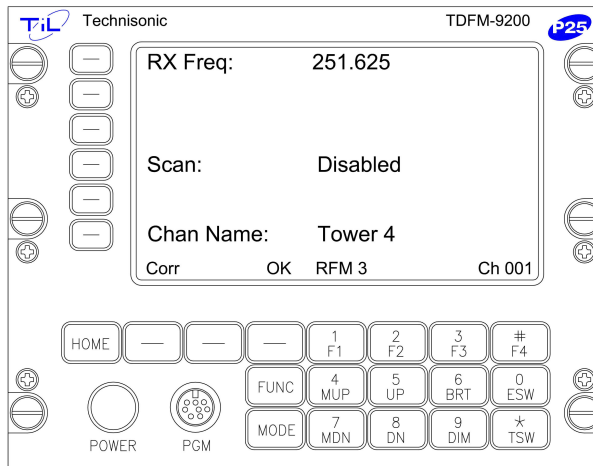
FPP ON ANALOG RF MODULES:

FPP is supported on all Analog modules installed in the Band 3 & 5 positions. Channel information can be altered via the FPP menu on all VHF LO FM as well as the VHF AM and UHF AM RF modules.
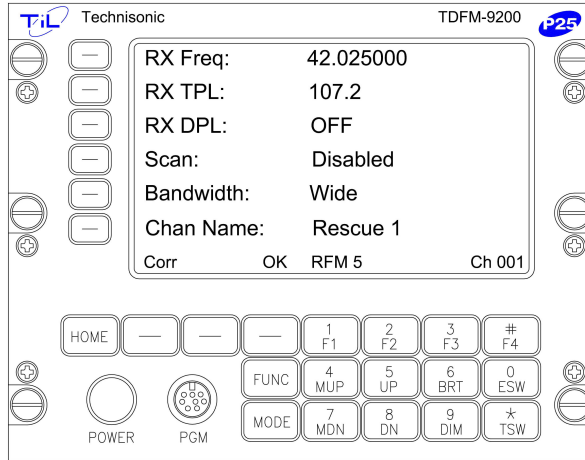
FPP Menu for VHF LO Analog module

FPP Menu for VHF AM Analog module

FPP Menu for UHF AM Analog module

ANALOG FPP SETTINGS:

RX/TX Freq.	The RX and TX frequencies can be changed by entering a new value via the keyboard. After entering the RX frequency, press the OK soft key. The menu will prompt for a TX Freq. Push the top side button to manually toggle between RX and TX frequencies.
RX/TX TPL	Rotate the knob to scroll through the available RX TPL (CTCSS tones). Press the OK soft key to accept. The menu will prompt for a TX TPL tone. Rotate the knob to select. Press OK to accept. The second side button also toggles between the RX and TX TPL codes. TPL tones cannot be programmed if DCS codes are already active. The TPL menu is only available for VLO modules. See Table 2.3 for supported TPL codes.
RX/TX DPL	Rotate the knob to scroll through the available RX DPL (DCS codes). Press the OK soft key to accept. The menu will prompt for a TX DPL code. Rotate the knob to select. Press OK to accept. The third side button also toggles between the RX and TX DPL codes. DPL tones cannot be programmed if TPL tones are already active. The DPL menu is only available for VLO modules. See Table 2.2 for supported DPL codes.
Scan	Rotate the knob to Enable or Disable this channel for scan.
Bandwidth	Rotate the knob to select Wide (25 KHz) or Narrow (12.5 KHz) deviation for this channel. The Bandwidth menu only applies to the VLO module.
Chan Name	Rotate the knob to scroll through the available characters. Press the NEXT soft key to get to the next position. Pressing NEXT at the end of the name will loop back to the first character position. Press OK to save the channel name.

The following is a list of TDFM-9200 Analog Band VHF LO TPL (CTCSS) Codes:

TONE #	PL (Hz)	TONE #	PL (Hz)	TONE #	PL (Hz)
0	CSQ	11	97.4	22	141.3
1	67.0	12	100.0	23	146.2
2	71.9	13	103.5	24	151.4
3	74.4	14	107.2	25	156.7
4	77.0	15	110.9	26	162.2
5	79.7	16	114.8	27	167.9
6	82.5	17	118.8	28	173.8
7	85.4	18	123.0	29	179.9
8	88.5	19	127.3	30	186.2
9	91.5	20	131.8	31	192.8
10	94.8	21	136.5	32	203.5

TONE #	PL (Hz)	TONE #	PL (Hz)	TONE #	PL (Hz)
33	33.0	44	56.8	55	199.5
34	35.4	45	58.8	56	206.5
35	36.6	46	63.0	57	210.7
36	37.9	47	69.4	58	218.1
37	39.6	48	150.0	59	225.7
38	44.4	49	165.5	60	229.1
39	47.5	50	171.3	61	233.6
40	49.2	51	177.3	62	241.8
41	51.2	52	183.5	63	250.3
42	53.0	53	189.9	64	CSQ
43	54.9	54	196.6		

TABLE 2.3 TDFM-9200 Analog Band TPL (CTCSS) Tones

Notes: