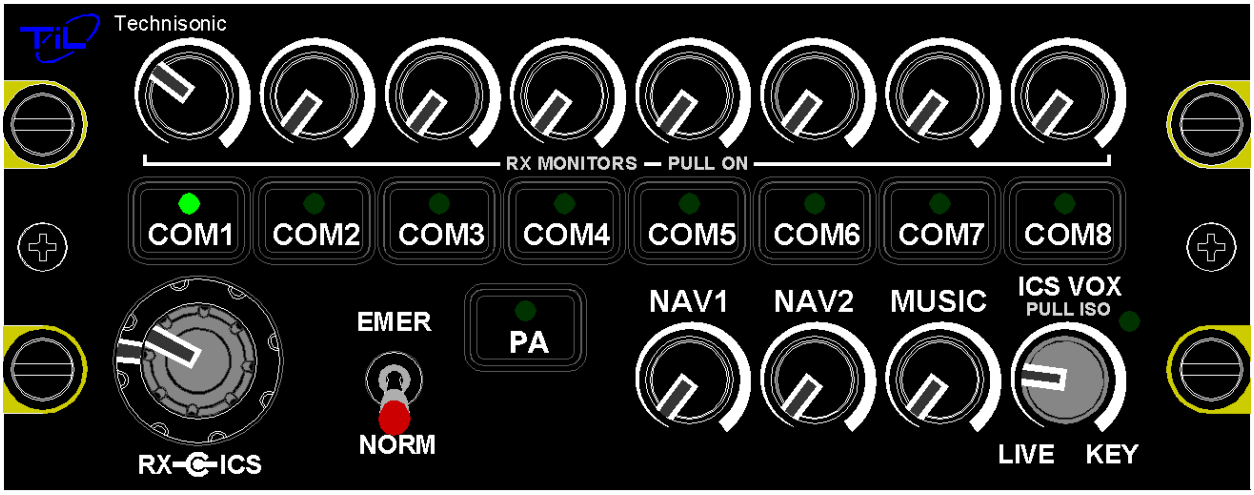
TDAP-650
AUDIO PANEL



Operating Instructions

TiL Document No. 17RE584
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October 2020

Technisonic Industries Limited
240 Traders Boulevard, Mississauga, Ontario L4Z 1W7
Tel: (905) 890-2113 Fax: (905) 890-5338
www.til.ca

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REVISION HISTORY
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N/C		Original document release.	26 Oct 2020	SM

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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.

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 TDAP-650. Every effort has been made to make this manual as complete and accurate as possible.

WARRANTY INFORMATION

The Model TDAP-650 Audio Panel 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 the Technisonic Model TDAP-650 Audio Panel:

Conditions	Paragraph	Category
Temperature and Altitude	4.0	A2, B2, D1
Temperature Variation	5.0	B
Humidity	6.0	A
Operational Shocks and Crash Safety	7.0	B
Vibration: Sinusoidal Profile M Random Profile B Sine-on-random Profile G	8.0	S, U
Magnetic Effect	15.0	Z
Power Input	16.0	B
Voltage Spike	17.0	B
Audio Frequency Susceptibility	18.0	B
Induced Signal Susceptibility	19.0	ACE
Radio Frequency Susceptibility	20.0	T
Emission of Radio Frequency Energy	21.0	M
Lightning Induced Transient Susceptibility	22.0	A3E3XX
Electrostatic Discharge	25.0	A
Fire, Flammability	26.0	C

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SECTION 1: GENERAL DESCRIPTION

1.1 INTRODUCTION

This publication provides operating information on the TDAP-650 Audio Panel.

1.2 DESCRIPTION

The Technisonic Digital Audio Panel (TDAP) Audio Management System TDAP-650 is a panel mounted Digital Audio System that provides centralized control and management for all audio signals within the airframe for up to 7 distinct Users (Pilot, Copilot, and five passengers) with varying degrees of connectivity depending on their station. The TDAP-650 connects to all aircraft Transceivers (up to a maximum of 8 distinct Transceiver Inputs), Navigational Receivers (up to a maximum of 8 distinct Receiver Inputs), External Alerting Sirens, and User Headsets. The TDAP-650 also includes functionality allowing expansion to an external PA or Paging system. The TDAP-650 supports full Simulcast transmitting as well as Monitor Only functionality amongst all connected Transceivers. The TDAP-650 can provide a digital audio interface with the TDFM-9000 series transceivers as well as a Bluetooth link to a smart phone. The TDAP-650 User Stations can deliver >250 mW of audio into 150 Ω headsets at less than 1% total distortion. Pushbutton transmit selector switches allow immediate selection of any of the eight supported aircraft communications transceivers and a PA amplifier, while additional pull on volume knob audio input selector controls allow selection of any or all of the supported transceiver's receive audio lines. To reduce pilot workload and avoid operational problems, ACCESS/D™ systems have auto-RX switching when a transmitter is selected. The TDAP-650 has a front panel selectable and adjustable VOX, LIVE or KEYED intercom (ICS) functions. An EMERGENCY mode, locking toggle provides "straight through" or "fail-passive" transmit and receive audio for the pilot or other user on a pre-set radio. In the NORMAL position (front panel LED is green), the pilot's audio is provided as selected by all of the panel controls and is part of the ICS system. Separate RX and ICS volume controls are provided on the panel along with an ICS VOX threshold control.

1.3 TECHNICAL CHARACTERISTICS

TDAP-650 GENERAL SPECIFICATIONS

MODEL TDAP-650 - ACCESS/A Audio Controller:

PHYSICAL CHARACTERISTICS:

Width (max.)	5.73 inches
Height (max.)	2.24 inches
Depth (behind panel)	4.59 inches
Weight	2.23 lbs. (1.01 Kg)
Mounting	Standard Dzus, 4 fasteners

POWER SOURCE REQUIREMENTS:

DC Voltage (MIN, TYPICAL, MAX)	15.0 V, 28 V, 32.2 V (System performance will be degraded at upper and lower limits)
DC Current	< 1 A
Backlighting Input:	
High Level Backlighting Voltage	0-28 V_{DC} @ 20 mA Max.
Low Level Backlighting Voltage	0-5 V_{DC} @ 20 mA Max.

TECHNICAL CHARACTERISTICS:

Input Impedance (Normal Mode, any RX input)	5k1 Ω (approx.)
Headset Channel Output Impedance	30 Ω
H/S Audio Power Output	At least 250 mW into 150 Ω
Speaker Power Output	At least 2.5 W into 8 Ω
Audio Distortion (Speaker or H/S)	Less than 2% THD @ 1 kHz at total rated output
Audio Frequency Response (ICS)	Within 3 dB from 300 Hz to 6000 Hz
Audio Frequency Response (RX & NAV)	Within 3 dB from 300 Hz to 3000 Hz
Hum and Noise Level	Better than -60 dB below 500 mW
Input to Input Isolation	Better than -70 dB between inputs
Deselected Input Isolation	better than -65 dB

ENVIRONMENTAL:

Temperature (Operating)	-45°C to +70° Celsius
Temperature (Survival Non-Operating)	-55°C to +85° Celsius
Humidity	95% Non-condensing
Shock	12 g (any axis)
Altitude	15,000 feet

TABLE 1: TDAP-650 General Specifications

1.4 SYSTEM LIMITATIONS

A summary of the relevant system limitations is given below.

1.4.1 POWER LIMITATIONS

With Standard Set-up, which consists of seven headsets connected, a power output of not less than 250 mW is delivered per headset (as represented by 150 ohms).

Nominal microphone input: 250 mV_{rms}; Nominal Communications/Navigational Input: 2.5 V_{rms}.

1.4.2 FREQUENCY RESPONSE LIMITATIONS

In accordance with the provisions made in RTCA/DO-214 Sections 2.8.1 and 1.5.1, the communications transmit out and receiver channels (communications and navigational) possess an effective bandwidth of 300 Hz – 3000 Hz with a maximum amplitude variation of 3 dB within the frequency range.

1.4.3 CROSSTALK LIMITATIONS

To ensure that the crosstalk specifications are in accordance with the applicable sections of DO-214, it is essential that

1) Manufacturer's maximum microphone input voltage of -4.7 dBu must not be exceeded in order to avoid jeopardising input to microphone output crosstalk results, particularly at the low frequency end.
2) In the instance where only two access units are daisy chained via their ICS tie-lines, a resistor of not greater than 600 ohms must be maintained across the ICS tie-line in order to avoid jeopardising station to station crosstalk results in RX mode at the high frequency end.

When multiple transceivers are selected for simulcast operation, they are bound together at the station output; thus, they are also bound together for other stations as well and defeat crosstalk measurements. All measurements are based on single transceiver (TX) selection.

1.4.4 TRANSMISSION PRIORITY

Where Pilot and Co-pilot transmit simultaneously, the Pilot transmissions take precedence over those of the Co-pilot. Co-pilot transmissions in this case would be rendered inactive.

1.4.5 INDUCED SIGNAL SUSCEPTIBILITY, RF SUSCEPTIBILITY, AND RF EMISSION

The wiring connections called out in Chapter 2 describe shield terminations for minimum ground loop noise. The test harnesses used for RTCA/DO-160 Sections 19, 20, and 21 – Induced Signal Susceptibility, RF Susceptibility, and Emission of RF Energy respectively – used shield terminations at both ends of the cable. Should RF susceptibility pose a problem in a particular installation, the installer may wish to try terminating shields at both ends of the cable. If this does not produce satisfactory results, then double shielding may be required.

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SECTION 2: OPERATING INSTRUCTIONS

2.1 FRONT PANEL

This section explains the operation of the TDAP-650 Audio Panel, and how to use the system in a typical aircraft environment. All normal user controls are on the front panel of the unit and are either variable rotating controls, or selectable pushbutton switches.

The exact radio legends on the buttons of the TDAP-650 may vary from the illustration shown, due to the final legend inserted into the buttons that is installed for the specific aircraft installation. For a full view of the controls given, please see Figure 1. All rotary controls are illuminated for night flight.

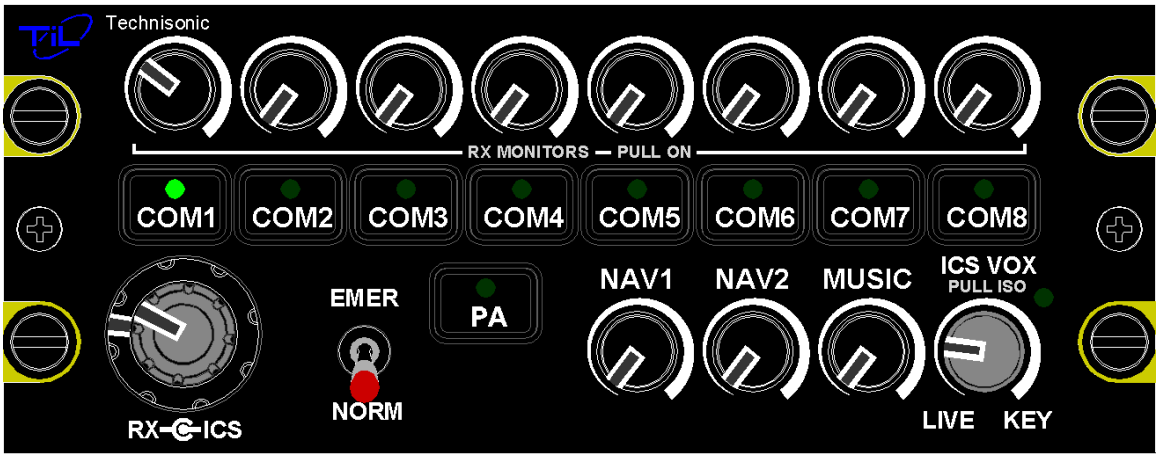

FIGURE 1: TDAP-650 Front Panel Operators Switches and Control

The top row of variable controls sets the level of the incoming RX or RECEIVER audio from the associated Communications Transceiver radio as listed on the button immediately below the knob (COM1, COM2, etc. through to COM8). The volume controls also have a push-on / pull-off functionality that selects which of the incoming receiver audio will be sent to the crew headsets. The volume control and the switch function independently of each other. Pull out the switch to be able to monitor the receiver audio and adjust the volume to the desired level.

The middle row of pushbuttons selects the transceiver (or COM radio) to be used when transmitting. When a COM transceiver has been selected, its associated indicator will be illuminated and any incoming RX or RECEIVER audio will be sent to the crew headsets. This function is often referred to as Auto-RX select. Press the button again to deselect the COM transceiver.

Any combination of RX sources may be selected at one time for system monitoring purposes. Multiple TX destinations may also be selected by pressing in two or more buttons simultaneously to set up simulcast operation. Pressing any TX button in automatically resets any previous selection, but RX selections are independent push on / push off switches.

The left-most pushbuttons are normally for AM COM transceivers; the remaining pushbuttons are for tactical radios.

The dual-concentric knobs at the right side of the unit adjust ICS VOLUME (intercom, inner knob) and RX VOLUME (outer knob).

Selecting the PA pushbutton deselects any active COM transceiver; however, the COM transceiver set-up is stored in memory, so deselecting the PA pushbutton will restore your original set-up. When the PA is selected, all transmit audio will be delivered to the PA system.

The bottom row of variable controls sets the level of the incoming RX (receiver) audio (or MUSIC, for the knob furthest to the right) from the associated Navigation Receivers or connected music player. The volume controls also have a push-on / pull-off functionality that selects which of the incoming receiver audio will be sent to the crew headsets. The volume control and the switch function independently of each other. Pull out the switch to be able to monitor the receiver audio and adjust the volume for the desired level.

The knob at the far right adjusts the VOX LEVEL of the INTERCOM as well as its exact mode of operation (KEY, VOX, or LIVE). The VOX control also has a push-on / pull-off functionality that controls the ICS Mode of the audio controller (all connected or CREW/PAX ISOLATION). An indicator beside the knob shows which mode the audio controller is in.

2.2 COM SELECTION AND VOLUME CONTROLS

To select a COM transceiver to transmit on, press the associated COM SELECT pushbutton (middle row of the front panel). When selected, the associated indicator will be illuminated. All RECEIVER audio associated with that COM transceiver will be heard by the crew. When a crew member transmits, only his/her activated microphone audio will be sent to the associated COM transceiver. The pilot has transmit priority over the co-pilot.

To transmit on multiple radios at the same time (Simulcast), press multiple pushbuttons at the same time. All activated COM transceiver indicators will illuminate.

To deselect a COM transceiver, press the associated pushbutton again. The associated indicator will no longer be illuminated.

To monitor the RECEIVER audio of a specific COM transceiver without selecting it for transmit, pull the associated RX LEVEL volume knob (top row of the front panel) out. Now, all receiver audio associated with that COM transceiver will be heard by the crew.

The RX LEVEL volume control knob (top row) controls the volume level of the specific COM transceiver it is associated with in order to balance the levels coming from various radio sources. The MAIN RX VOLUME control (outer control of the dual concentric knob on the bottom left of the front panel) controls the volume level of all COM transceivers at once.

2.3 NAV SELECTION AND VOLUME CONTROLS

To monitor the RECEIVER audio of a specific NAV receiver, pull the associated RX LEVEL volume knob (bottom row of the front panel) out; now, all receiver audio associated with that NAV transceiver will be heard by the crew.

The RX LEVEL volume control knob (bottom row) controls the volume level of the specific NAV Receiver(s) it is associated with in order to balance the levels coming from various radio sources. The MAIN RX VOLUME control (outer control of the dual concentric knob on the bottom left of the front panel) controls the volume level of all NAV transceivers at once (as well as all COM transceivers).

2.4 INTERCOM (ICS) SELECTION AND VOLUME CONTROLS

The ICS VOX knob selects how the intercom system is activated. In the VOX (Voice Activated) mode, the audio produced by any of the microphones will break the squelch of the intercom and the audio will be routed through the system. The threshold audio level required to break the squelch is adjusted by this knob. Turning the knob more counter-clockwise makes the system more sensitive to incoming mic audio. A fully counter-clockwise setting on the knob will leave the intercom on at all times giving LIVE or HOT MIC operation. When set fully clockwise, the intercom is in the KEYED mode and will only produce audio when the intercom PTT line is keyed.

While the co-pilot, pilot, and passengers have individual mic VOX gates (3 in total), they are controlled from a common front panel control. Individual gating reduces the amount of unwanted noise when the intercom is triggered and makes intercom communication more intelligible as a result. The passengers may have their VOX threshold offset by an internal adjustment (PAX VOX) to accommodate differing headset types or ambient noise conditions.

With only a single TDAP-650 Audio Panel, best operation of all ICS functions is obtained when the microphones are all of the same type (or have very similar characteristics). Headsets with significantly different microphones or earpiece efficiencies make it difficult to achieve satisfactory control adjustments for all users, unless they also have individual level controls. Good quality headsets (such as David Clark, Telex, or Bose), with noise reducing, amplified dynamic microphones and individual headset volume controls, give the most effective and user-adjustable performance and minimal system difficulties. The use of “clone” headsets that visually resemble these higher quality units, but have much poorer electrical and acoustic performance, is strongly discouraged, as the entire system operation will suffer. This is especially true under high noise conditions.

The ICS LEVEL knob controls the intercom volume level for all users. Fully clockwise is the maximum volume level and fully counter-clockwise is the minimum.

The TDAP-650 contains two Intercom systems, one that services the Pilot and Co-pilot and one that services the passengers. If the ICS VOX knob is pushed in, the two Intercom systems are interconnected and the crew members can communicate with the passengers through the intercom system. If the ICS VOX knob is pulled out and the indicator is illuminated, the Crew and Passenger intercom systems are isolated from one another on completely separate intercom systems and communication between the two groups through the intercom system is not possible.

2.5 PA CONTROLS

To select the PA to transmit on, press the PA pushbutton. When selected, the associated indicator will be illuminated. Selecting the PA pushbutton deselects any active COM transceiver; however, the COM transceiver set-up is stored in memory, so deselecting the PA pushbutton will restore the original set-up. When the PA is selected, all transmit audio will be delivered to the PA system.

If the PA is selected for longer than 30 seconds, the PA select pushbutton indicator will begin to flash to warn users they will be talking on the PA system and not a radio. This is a safety feature to prevent accidental transmission over the PA system, which can have significant repercussions.

2.6 EMERGENCY SWITCH OPERATION

The operation of the TDAP-650 control can be changed from NORMAL to EMERGENCY operation in two different ways.

First, if DC power fails to the unit, the internal auto-emergency function is enabled; this transfers the unit to a passive emergency mode to enable critical communication to continue for the pilot.

Second, the EMER/NORM can be placed in the EMER position (up) and will force this transfer.

In both cases, the backlighting will be extinguished and the panel will go black. In either case, the Pilot (or primary user of the control) is connected directly to the COM1 radio. Boom Mic Transmit operates normally, as does receive, but the headset power level is reduced to the passive (un-amplified) radio level.

2.7 DIRECT AUDIO CONNECTIONS

The TDAP-650 has three different un-switched, direct audio inputs. One is routed directly to the Pilot's headset output via a resistive pad. This is used when an existing airframe threat alerting system must be tied directly to the pilot's headset. This function is active when in either the normal or emergency mode, and its volume is a function of the external generating source and the headset impedance. This should be tested (if implemented) to ensure adequate headset level is possible in the specific application. Excessive loading back through this connection may reduce headset volume or adversely affect the pilot's headset, so please be certain this function is correctly implemented.

The other direct inputs are un-switched only and are mixed with the regular RX audio bus. They will be partially muted during TX operation and must be used carefully to ensure correct system operation. This signal should NOT be wired in the harness if not needed, as it will serve merely as a source of noise if left stowed in the aircraft wiring. It cannot be switched off and will be lost during emergency operation.

2.8 TONE ALERTING

Alerting tones are activated by a ground trigger at the corresponding input pin and play once the alert line is triggered. The #3 (Decision Height) alert is timed and the #2 alert (Low Rotor) over-rides tone #1 (Engine Failure). Always confirm alerting is working correctly and is at an acceptable level before completing any installation.

ALERT FUNCTION	CORRESPONDING TONE INPUT	FORMAT	INPUT PIN
Engine Failure	1 (Steady tone)	Repeat continuously.	Pin 15, Alert 1
Low Rotor RPM	2 (Pulsing tone)	Repeat continuously. Over-rides tone 1.	Pin 14, Alert 2
Decision Height	3 (Two-tone)	Timed, 2-3 sec. Typical.	Pin 13, Alert 3

2.9 SPEAKER AUDIO

The TDAP-650 has a speaker channel that may be used as a “music only” feed for a passenger cabin area, if desired. This is an optional connection and does not have to be used. The speaker level is driven by the front panel MUSIC control and by an optionally attached external music volume control.

2.10 CHANGING RADIO LEGENDS

The legends on the TDAP-650 front panel pushbuttons can all be easily changed in the field to suit special requirements. The legend insert is adhesive and can be removed by lifting a corner free with a sharp X-acto knife blade and then gently pulling the entire Lexan strip free. Remove the backing from a new legend strip (with the desired legends), line it up evenly, and press it into place on the overlay recess. The adhesive will cure fully in 48 hours. Be sure any bubbles are pressed out, and that all edges are firmly attached with no exposed lighted edges.

2.11 DIGITAL AUDIO INTERFACE

The digital audio interface allows the TDAP-650 to be connected to a Technisonic TDFM-9000 Series transceiver over a serial interface. The advantage being far less wiring during installation and cleaner audio. The transceiver is programmed as to which audio panel com it will appear. The audio panel is operated normally as the digital interface is transparent to the user.

2.12 BLUETOOTH LINK

The TDAP-650 provides a Bluetooth link allowing a smart phone or music player to be connected through the mic and headset. The link will show up as ‘TDAP-650’ when you enable Bluetooth search on the smart phone or player. The linked audio is provided to all headsets through the intercom.

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 online Warranty Registration Form found at www.til.ca.