

TMAA01-01 Line-Interface Board

Installation Instructions



Introduction

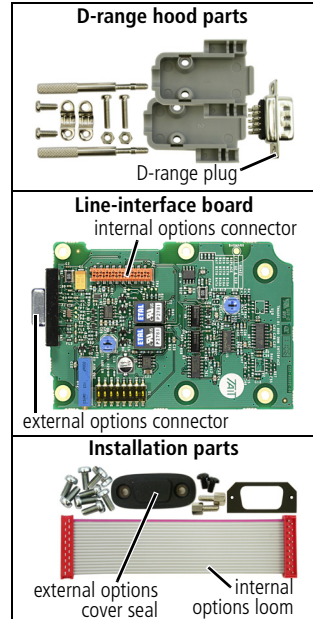
Note: These instructions refer to line-interface PCB issue 220-65202-05 or later. On PCBs earlier than issue 220-65202-02, SK1 pin 5 is ground.

The TMAA01-01 line-interface board provides both audio and digital interfaces for a variety of systems. The interfaces available are:

- an isolated 600 Ω audio interface that is capable of both simplex operation on a two-wire system, or duplex operation on a four-wire system
- a keying interface which allows for two-wire keying or single line bi-directional keying
- a variable delay timer
- a logic sense control.

The line-interface board fits inside the radio in the options cavity and is connected to the main board by the internal options loom. The high-density 15-way D-range connector mounted on the line-interface board fits through the external options connector hole provided in the radio chassis.

Important: The radio does not meet the IP54 protection standard once a line-interface board has been installed unless the external options cover seal is installed.



Operation

One of the control head function keys can be programmed to toggle the line-interface board on and off. The state of the function key LED when the line-interface board is on depends on the way the radio is programmed (see "[Program the radio](#)", on page 3).

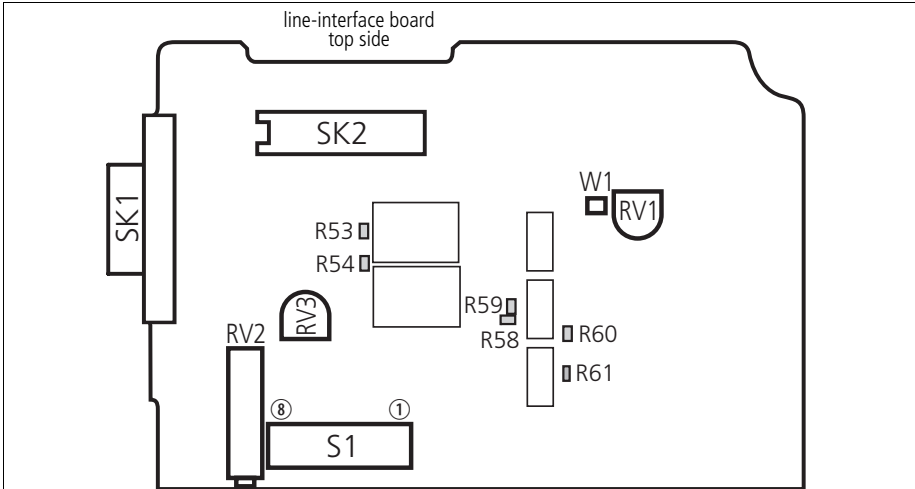
Antistatic Precautions

Important: This equipment contains devices that are susceptible to static charges. The procedures outlined in this installation guide should therefore be carried out in a static-safe environment. You can obtain information on antistatic precautions and the dangers of electrostatic discharge (ESD) from standards such as ESD S4.1-1997 (revised) or BS EN 100015-4 1994. The Electrostatic Discharge Association website is <http://www.esda.org/>.

Adjustment Points on the Line-Interface Board

The following diagram shows the line-interface board adjustment points and describes their function.

Line-interface board adjustment points



PCB issue 220-65202-06 shown. On earlier PCBs the locations of RV1 and RV3 are different.

Function	Adjust	Setting	
two-wire audio interface	S1	DIP1 on	DIP2 off
four-wire audio interface	S1	DIP1 off	DIP2 on
busy/gate = busy	S1	DIP3 on	DIP4 off
busy/gate = rx-gate	S1	DIP3 off	DIP4 on
busy/gate logic (active high)	S1	DIP5 on	DIP6 off
busy/gate logic (active low)	S1	DIP5 off	DIP6 on
bi-directional keying line	S1	DIP7 on	
two-wire keying	S1	DIP7 off	
enable gate/keying delay	S1	DIP8 on	
adjust gate/keying delay	RV1	adjust for required time delay	
gate/keying delay maximum 5 seconds	W1	open (default)	
gate/keying delay maximum 2.5 seconds	W1	closed	
audio line out level	RV2	adjust for required line output level	
audio line in level	RV3	adjust for required line input level	
PTT inhibit on busy	0Ω resistors	R58 fitted (default)	R60 fitted (default)
disable PTT inhibit on busy ^a	0Ω resistors	move R58 to R59	move R60 to R61
unbalanced audio	0Ω resistors	R53 fitted (default)	R54 fitted (default)
balanced audio	0Ω resistors	remove R53	remove R54

a. **Warning:** If 'PTT inhibit on busy' is **disabled**, only two-wire keying can be used (DIP7 must be off).

Overview

Note: The line-interface board configuration must be completed before the board is installed in the radio, as the top side of the line-interface board is not accessible once the board is screwed to the radio lid.

Installing the line-interface board is done in four steps:

1. [Program the radio.](#)
2. [Connect the line-interface board to the radio.](#)
3. [Adjust gate/keying delay, line input and output levels.](#)
4. [Install the line-interface board.](#)

The circled numbers in the following sections refer to items in the diagram on [page 6](#).

Program the radio

Note: See “Additional Programming Information” on [page 7](#) for more information about the GPIO lines, and the online help of the programming application for more information about other selected programming options.

1. Program the radio with the default test settings shown in the following tables.

Line-interface default test settings in the Programmable I/O form, Digital tab:

Pin	Direction	Label	Action	Active	Debounce	Signal State	Mirrored
IOP_GPIO1	Input	PTT	External PTT 1	Low	60	None	None
IOP_GPIO2	Output	0	No Action	Low	None	None	None
IOP_GPIO3	Output	BUSY	Busy Status	High	None	None	None
IOP_GPIO4	Output	FKEY	F1 Key Status	High	None	Latching	None

Note: In the **Action** field, select the function key required to activate the line-interface board. To further configure the function key operation, see [Step 2](#). below.

Line-interface settings in the Programmable I/O form, Audio tab:

Rx/PTT Type	Tap In	Tap In Type	Tap In Unmute	Tap Out	Tap Out Type	Tap Out Unmute
Rx	None	A-Bypass In	On PTT	R7	D - Split	Busy Detect
EPTT1	T5	A-Bypass In	On PTT	None	C-Bypass 0	On PTT

Line-interface settings in the PTT form, External PTT (1) tab:

Field	Setting
Advanced EPTT1	PTT Transmission Type
	Voice
	Audio Source
	Audio Tap In

2. **Key Settings form:** In the required **Function Key Actions** field, select ‘Action Digital Output Line’. This means that the function key LED reflects the status of the line-interface board (on or off).

The behaviour of the LED depends on the setting of the **Active** field for **IOP_GPIO4** in [Step 1](#).

- **Active** field is set to ‘High’: the LED is **off** when the line-interface board is on.
- **Active** field is set to ‘Low’: the LED is **on** when the line-interface board is on.

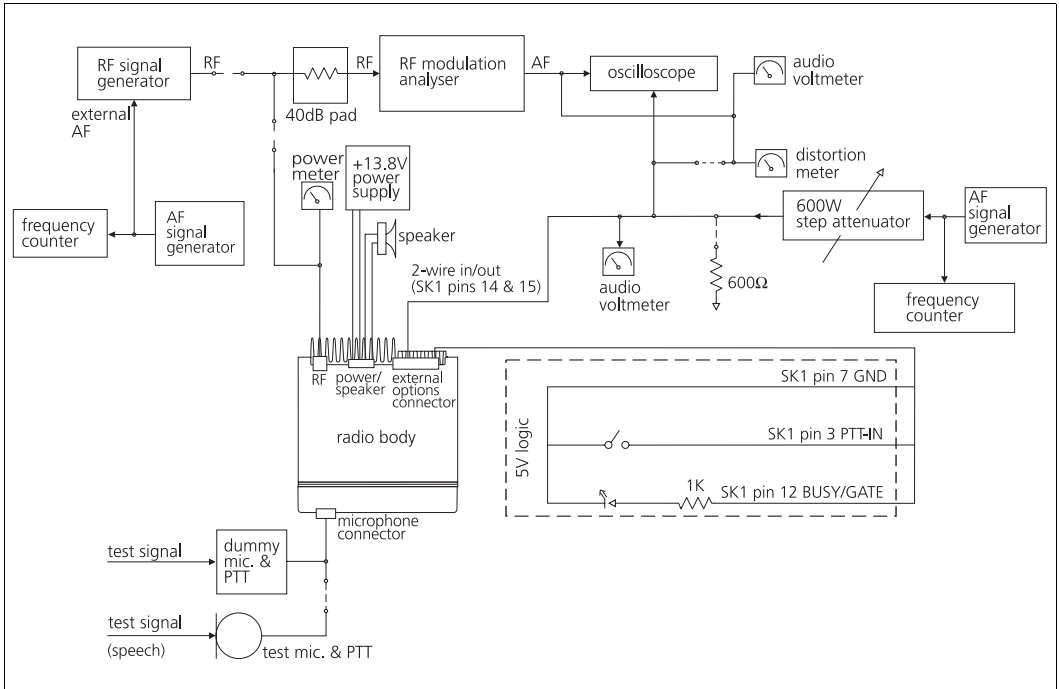
Connect the line-interface board to the radio

1. Unpack the installation parts and D-range hood parts from the line-interface kit.
2. Disassemble the radio in order to gain access to the options cavity. For detailed disassembly instructions, refer to the disassembly procedure in the service manual.
3. Connect the internal options loom ⑩ between SK2 on the line-interface board ⑤ and SK102 on the radio's main board.

Adjust gate/keying delay, line input and output levels

1. Set the S1DIP switches on the line-interface board to the following default test settings:
 - DIP1 on (two-wire audio interface)
 - DIP2 off
 - DIP3 off
 - DIP4 on (busy/gate = rx-gate)
 - DIP5 off (busy/gate logic active low)
 - DIP6 on
 - DIP7 off (two-wire keying)
 - DIP8 on (time delay enabled)
2. Set up the test equipment as shown below, and follow the adjustment procedure for RV1, RV2 and RV3 described in the following sections.

Line-interface test equipment setup



Set the keying time delay (RV1)

The keying time delay circuit is used to prevent the burst of noise occurring before a radio is able to mute the audio when the carrier signal disappears. The keying time delay is used in conjunction with the keying signal (SK1 pin 1).

1. Check that DIP8 is on.
2. Adjust RV1 for the required time delay.

Rotate RV1 clockwise to increase the delay, and counterclockwise to reduce the delay.

Note: If the W1 linking pads are closed, the maximum time delay available is reduced from 5 seconds to approximately 2.5 seconds.

Set the line output level (RV2)

1. Monitor the line output (SK1 pins 14 and 15).
2. Apply an on-channel signal from the RF signal generator at an output level of -47 dBm, modulated to 60% of system deviation, at 1 kHz AF.
3. Adjust RV2 for a line output level of -10 dBm.

Set the line input level (RV3)

1. Apply a line input signal of -10 dBm and key the transmitter.
 - For a two-wire configuration: apply the line input signal to pins 14 and 15 on SK1.
 - For a four-wire configuration: apply the line input signal to pins 4 and 10 on SK1.
2. Adjust RV3 until 60% of system deviation at 1 kHz is achieved.

Install the line-interface board

Note: This procedure assumes that the radio has already been disassembled, and the internal options loom has been installed. See [“Connect the line-interface board to the radio” on page 4](#).

1. Remove the external options connector bung ②, if it is fitted.
2. On the inside of the radio lid place the foam seal ③ over the external options connector cavity ④.
3. With the top side of the line-interface board ⑤ facing the radio lid, guide the external options connector ⑥ into the external options connector cavity.
4. Screw the external options connector to the radio lid using the two screw-lock fasteners ⑦. Use a torque-driver with a 5 mm (3/16 inch) socket to tighten the fasteners to a torque of 0.9 N·m (8 lbf·in).

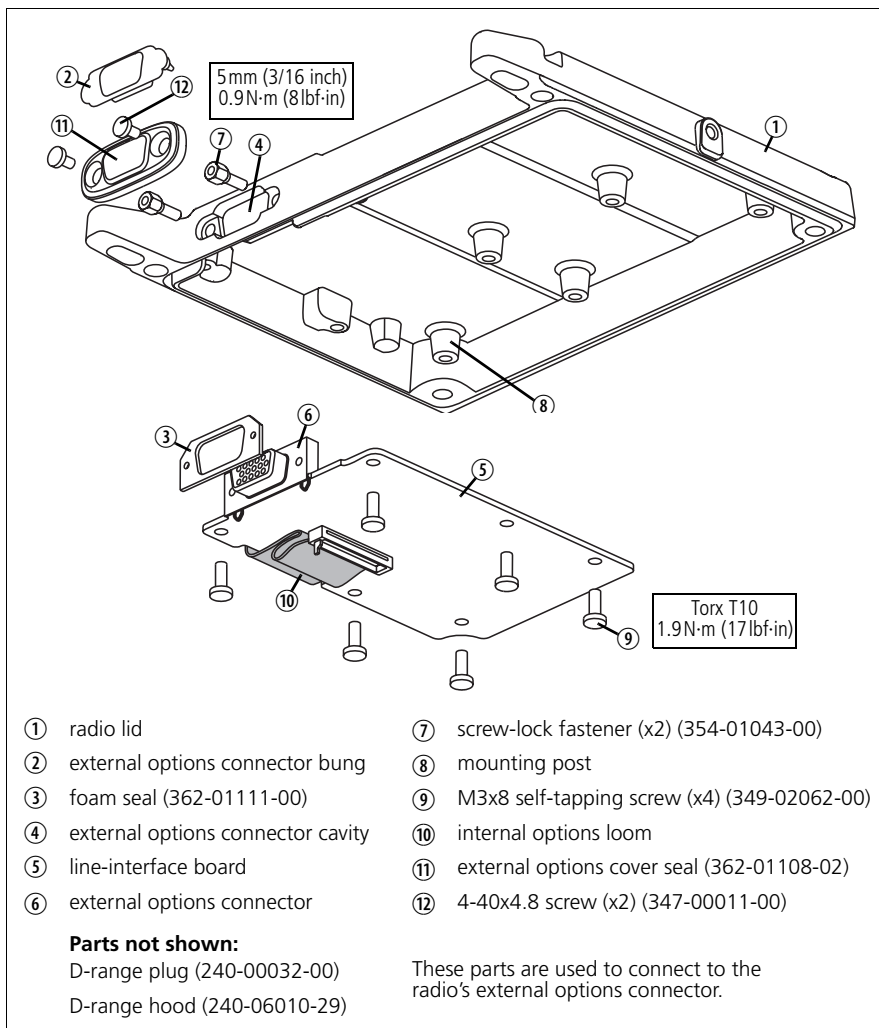
Important: The external options connector screw-lock fasteners must be tightened correctly before screwing the line-interface board onto the mounting posts ⑧.

5. Screw the line-interface board to the mounting posts on the radio lid using six M3x8 screws ⑨. Use a Torx T10 screwdriver to tighten the screws to a torque of 1.9 N·m (17 lbf·in)

Important: For the line-interface board to be installed correctly in the radio's options cavity, the internal options connector loom ⑩ must be looped in the way shown in the diagram.

6. Plug the unattached end of internal options connector loom ⑩ into the internal options connector on the radio main board.
7. Refit the radio lid and top cover to the radio and screw the external options cover seal ⑪ over the external options connector, using the two 4-40x4.8 screws ⑫.

Line-interface board installation



Additional Programming Information

The lines from the radio's internal options connector that are used by the line-interface board are IOP_GPIO1 to IOP_GPIO4. The behaviour of these lines is configured in the Programmable I/O and PTT forms of the programming application. See [“Program the radio” on page 3](#) for more information.

The following table explains the required input and output line-interface connections. The labels for the ‘Radio signal’ and ‘Function’ are taken from the line-interface circuit diagram.

Line-interface input and output connections

Radio signal	Function	Label
GPIO1	PTT FROM OPT	This signal causes the radio to transmit. This normally requires External PTT1 to be set up (Programmable I/O form>Digital tab and PTT form> External PTT (1) tab).
GPIO2	SECONDARY BUSY	This active high signal allows connection to the Busy/Gate output signal. If this is not used, set the Action field to No Action and set the Active field to Low (Programmable I/O form> Digital tab).
GPIO3	BUSY (keying line)	This active high signal allows connection to the Busy/Gate output signal. This signal also allows the single line keying functionality.
GPIO4	AUX	This allows the line-interface board to be turned on and off. This line can be controlled by one of the control head function keys. See Step 2.

Interface Specifications


The following tables summarize the signals used for the line-interface board on the internal options connector (SK2 on the line-interface board) and the external options connector (SK1 on the line-interface board).

External options connector (SK1)—pins and signals

Pin	Signal	Description
1	KEYING	Signal line keying
2	RS-422	Serial data TX-
11	RS-422/RS-232	Serial data TX+/RS-232 TXD
3	PTT-IN	Bi-directional keying input
4	4W_LINE_IN -	4-wire line in negative
10	4W_LINE_IN +	4-wire line in positive
5	RS-422/RS-232	Serial data RX+/RS-232 RXD
6	RS-422	Serial data RX-
7	GND	Ground
8	—	Not connected
9	13V8 FROM RADIO	Switched 13.8V supply from the radio ^a
12	BUSY/GATE	Busy or receiver gate output. 5V CMOS logic level.
13	—	Not connected
14	4W_LINE_OUT -	4-wire line out negative or 2-wire line in/out negative
15	4W_LINE_OUT +	4-wire line out positive or 2-wire line in/out positive

- a. Line-interface PCBs after issue -05: there is a fuse (F1) on the 13V8 line that limits current to 640mA. This provides some protection from a short-circuit on that line. The fuse is IPN 265-10150-00.

Internal options connector (SK2)—pins and signals

	Pin	Radio signal	Line-interface signal	Description
 <p>top view</p>	1	13V8_SW	13V8 FROM RADIO	Switched 13V8 supply from the radio
	2	AUD_TAP_OUT	AUDIO TAP OUT	Programmable tap point out of the receive or transmit audio chain.
	3	AGND	AGND	Analogue ground
	4	AUX_MIC_AUD	—	Not connected
	5	RX_BEEP_IN	—	Not connected
	6	AUD_TAP_IN	AUD_TAP_IN	Programmable tap point into the receive or transmit audio chain.
	7	RX_AUD	—	Not connected
	8	RSSI	—	Not connected
	9	IOP_GPIO1	PTT FROM OPT	IOP_GPIO1 from the radio 3V3 logic level, 5V tolerant
	10	IOP_GPIO2	SECONDARY BUSY	IOP_GPIO2 from the radio 3V3 logic level, 5V tolerant
	11	IOP_GPIO3	BUSY	IOP_GPIO3 from the radio 3V3 logic level, 5V tolerant
	12	IOP_GPIO4	AUX	IOP_GPIO4 from the radio 3V3 logic level, 5V tolerant
	13	IOP_GPIO5	GPIO5	IOP_GPIO5 from the radio 3V3 logic level, 5V tolerant
	14	IOP_GPIO6	—	Not connected
	15	IOP_GPIO7	—	Not connected
	16	DGND	AGND	Analogue ground
	17	IOP_RXD	RXD	Asynchronous serial port - receive data
	18	IOP_TXD	TXD	Asynchronous serial port - transmit data

More Information

Refer to your radio provider for more information about this product.