TM8000 and TM9000 mobiles

TA2922 Universal Line Interface Board Service Manual

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Contents

Preface

Scope of Manual

This manual provides information about the TA2922-01 universal line interface board.

Document Conventions

Within this manual four types of alerts may be given to the reader: Warning Caution Important and Note. The following paragraphs illustrate each type of alert and its associated symbol.

Warning!! **This alert is used when there is a potential risk of death or serious injury.**

Caution **This alert is used when there is a risk of minor or moderate injury to people.**

Important This alert is used to warn about the risk of equipment damage or malfunction.

Note This alert is used to highlight information that is required to ensure procedures are performed correctly.

Associated Documentation

The following documents provide instructions for the correct use and handling of a TA2922-01. The -xx represents the issue number of the manual.

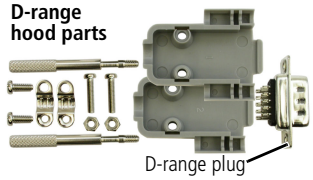
- TM8100/TM8200 Service Manual (MMA-00005-xx)
- TM9100 Service Manual (MMA-00017-xx)

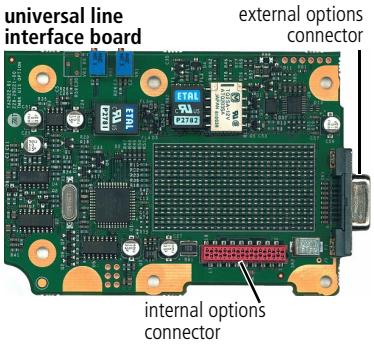
Always get the latest issue of a manual from the Tait Support website www.taitworld.com/technical. In addition to software release notes and the latest issue of a manual, useful downloads from the Support website include Technical notes (TN) which provide technical details not yet in the manuals or solve any problems that may have arisen.

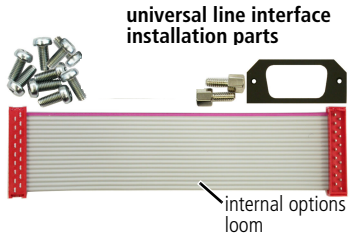
Publication Record

Issue	Publication Date	Description
1	March 2010	Initial release.

1 Introduction







The TA2922 TM8/TM9 universal line interface board is fitted into the TM8000 and TM9000 radios, and is functionally equivalent to the AM8000-UIS manufactured by Tait Australia. It features hardware and software-configurable options for:

- 8-wire line interface
- 2-wire line interface with phantom DC keying options,
- 4-wire line interface with phantom DC keying options, and
- 6-wire E&M interface.

The field programmable microcontroller allows linking/repeating options to be configured by software, including tail and anti-kerchunker timers and a flexible supply voltage monitoring alarm.

A configuratble matrix allows the integrator to allocate any of 26 different I/O signals to any of the nine pins on the external 9-way D-range socket.

The interface board fits inside the radio in the options cavity and is connected to the main PCB by the internal options loom. The 9-way D-range connector mounted on the 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 an interface board has been installed unless the external options cover seal is installed.

1.1 Operation

The TA2922 universal line interface board provides an interface between balanced 600 ohm lines and the TM8000 and TM9000 series radios.

Unbalanced audio allows direct interfacing to equipment using unbalanced audio (audio referenced to ground) where the input and output levels need to be adjustable.

Using an appropriate cable, two TA2922 interfaces can be installed into two TM8000 and/or TM9000 radios for linking purposes. This includes linking of repeaters (same RF band or mixed RF band) and mobile linking applications, for example an in-vehicle repeater that communicates between a wide area VHF radio network and a UHF portable radio.

Data equipment such as a GPS receiver or Computer Controlled Data Interface (CCDI) is able to be connected to the TA2922 at the same time as the audio interface is used.

The built in low voltage monitor alarm can be used to send a status message or Selcall to advise a remote monitoring station of a potential power supply issue.

The TA2922 can be used together with conventional, MPT1327 trunked or P25 radio modes of operation.

1.2 Specifications

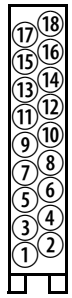
Power supply input voltage	10.8 - 16.0VDC, negative ground
Power supply input current	30mA nominal
Over current protection	300mA self-resettable poly-switch fuse
Line out level	-30dBm to +10 dBm
Line out impedance	600 ohms
Line in level	-30dBm to +5dBm
Line in impedance	600 ohms
PTT in	Opto coupled, non polarised, 10 to 50V input range
Gate out	Voltage free (normally open) relay contacts. Relay contacts rated 1A @ 50V DC
PTT in direct	Active Low (pull to Ground)
Gate out direct	Active low, open collector, 70mA max
EXT_GPIO3 to 7	Five bi-directional digital I/O lines, active low Input range 0 to 3.3V (3.6V max) Output range 0 to 3.3V @ 2mA

1.3 Connections

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

The signals on SK1 are dependant on the configuration of the matrix. Refer to "SK1 I/O signal configuration" on page 26.

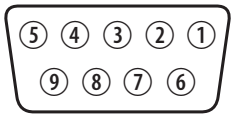
Internal options connector (SK2)



top view

Pin	Radio Signal	Signal	Description
1	13V8_SW	+13V8_SW	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	AUX_MIC_AUD	Electret auxiliary external mic
5	RX_BEEP_IN	RX_BEEP_IN	beep audio to radio (not implemented)
6	AUD_TAP_IN	AUD_TAP_IN	Programmable tap point into the receive or transmit audio chain
7	RX_AUD	RX_AUD	volume controlled Rx audio
8	RSSI	RSSI	analogue receive signal strength indicator
9	IOP_GPIO1	GPIO1 Radio PTT	IOP_GPIO1 to/from the radio 3V3 logic level, 5V tolerant
10	IOP_GPIO2	GPIO2 Radio Busy	IOP_GPIO2 to/from the radio 3V3 logic level, 5V tolerant
11	IOP_GPIO3	GPIO3	IOP_GPIO3 to/from the radio 3V3 logic level, 5V tolerant
12	IOP_GPIO4	GPIO4 Disable Line Interface	IOP_GPIO4 to/from the radio 3V3 logic level, 5V tolerant
13	IOP_GPIO5	GPIO5	IOP_GPIO5 to/from the radio 3V3 logic level, 5V tolerant
14	IOP_GPIO6	GPIO6	IOP_GPIO6 to/from the radio 3V3 logic level, 5V tolerant
15	IOP_GPIO7	GPIO7	IOP_GPIO7 to/from the radio 3V3 logic level, 5V tolerant
16	DGND	—	analogue ground
17	IOP_RXD	IOP_RXD	asynchronous serial port - receive data
18	IOP_TXD	IOP_TXD	asynchronous serial port - transmit data

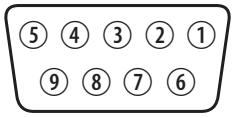
External options connector (SK1) - TA2922-01 8-wire isolated line interface



outside view

Pin	Signal	Description
1	Line out 1	balanced Rx audio output -10dBm into 600 ohms
2	Gate out 1	Rx gate relay contact 1
3	GND	DC ground
4	PTT in +	DC into Tx key opto coupler (10 to 50V)
5	Line in 1	balanced Tx audio input, 600 ohm impedance, -10dBm
6	Line in 2	balanced Tx audio input, 600 ohm impedance, -10dBm
7	PTT in -	DC into Tx key opto coupler (10 to 50V)
8	Gate out 2	Rx gate relay contact 2
9	Line out 2	balanced Rx audio output -10dBm into 600 ohms

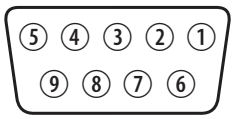
External options connector (SK1) - TA2922-02 2-wire line interface



outside view

Pin	Signal	Description
1	Line audio 1	balanced Tx and Rx audio, 600 ohm impedance - 10dBm for 2kHz deviation (wide band)
2	Line audio 2	balanced Tx and Rx audio, 600 ohm impedance -10dBm for 2kHz deviation (wide band)
3	—	
4	—	
5	GND	DC ground
6	—	
7	—	
8	RAD_DATA_IN	RS-232 data from PC for programming
9	RAD_DATA_OUT	RS-232 data to PC for programming

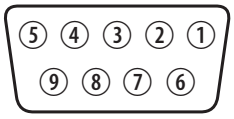
External options connector (SK1) - TA2922-03 6-wire line interface



outside view

Pin	Signal	Description
1	Line out 1	balanced Rx audio output -2dBm into 600 ohms for 2kHz deviation (wide band)
2	GND	DC ground
3	GND	DC ground
4	+13.8V-SW	Switched 13.8V output (unregulated) @ 150mA
5	Line in 1	balanced Tx audio input, 600 ohm impedance, -14dBm for 2kHz deviation (wide band)
6	Line in 2	balanced Tx audio input, 600 ohm impedance, -14dBm for 2kHz deviation (wide band)
7	Tx Key	PTT in (active low)
8	Rx Gate	Rx gate output (connect to gnd via relay contacts when active)
9	Line out 2	balanced Rx audio output -2dBm into 600 ohms for 2kHz deviation (wide band)

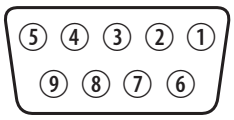
External options connector (SK1) - TA2922-04 balanced line input with unbalanced speaker output



outside view

Pin	Signal	Description
1	Speaker out	unbalanced volume controlled audio output 0 to 4.5Vrms into 50 ohms
2	GND	DC ground
3	GND	DC ground
4	+13.8V-SW	Switched 13.8V output (unregulated) @ 150mA
5	Line in 1	balanced Tx audio input, 600 ohm impedance, -14dBm for 2kHz deviation (wide band)
6	Line in 2	balanced Tx audio input, 600 ohm impedance, -14dBm for 2kHz deviation (wide band)
7	Tx Key	PTT in (active low)
8	Rx Gate	Rx gate output (connect to ground via relay contacts when active)
9	GND	DC ground

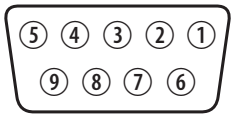
External options connector (SK1) - TA2922-05 6-wire line interface (marine)



outside view

Pin	Signal	Description
1	Line out 1	balanced Rx audio output 0dBm into 600 ohms
2	GND	DC ground
3	GND	DC ground
4	+13.8V-SW	+13.8V-SW Switched 13.8V output (unregulated) @ 150mA
5	Line in 1	balanced Tx audio input, 600 ohm impedance, 0dBm
6	Line in 2	balanced Tx audio input, 600 ohm impedance, 0dBm
7	Tx Key	PTT in (active low)
8	Rx Gate	Rx Gate Rx gate output (connect to ground via relay contacts when active)
9	Line out 2	balanced Rx audio output -2.5dBm into 600 ohms

External options connector (SK1) - TA2922-06 6-wire -10dBm line interface



outside view

Pin	Signal	Description
1	Line out 1	balanced Rx audio output -10dBm into 600 ohms
2	GND	DC ground
3	GND	DC ground
4	+13.8V-SW	Switched 13.8V output (unregulated) @ 150mA
5	Line in 1	balanced Tx audio input, 600 ohm impedance, -10dBm
6	Line in 2	balanced Tx audio input, 600 ohm impedance, -10dBm
7	Tx Key	PTT in (active low)
8	Rx Gate	Rx gate output (connect to ground via relay contacts when active)
9	Line out 2	balanced Rx audio output -10dBm into 600 ohms

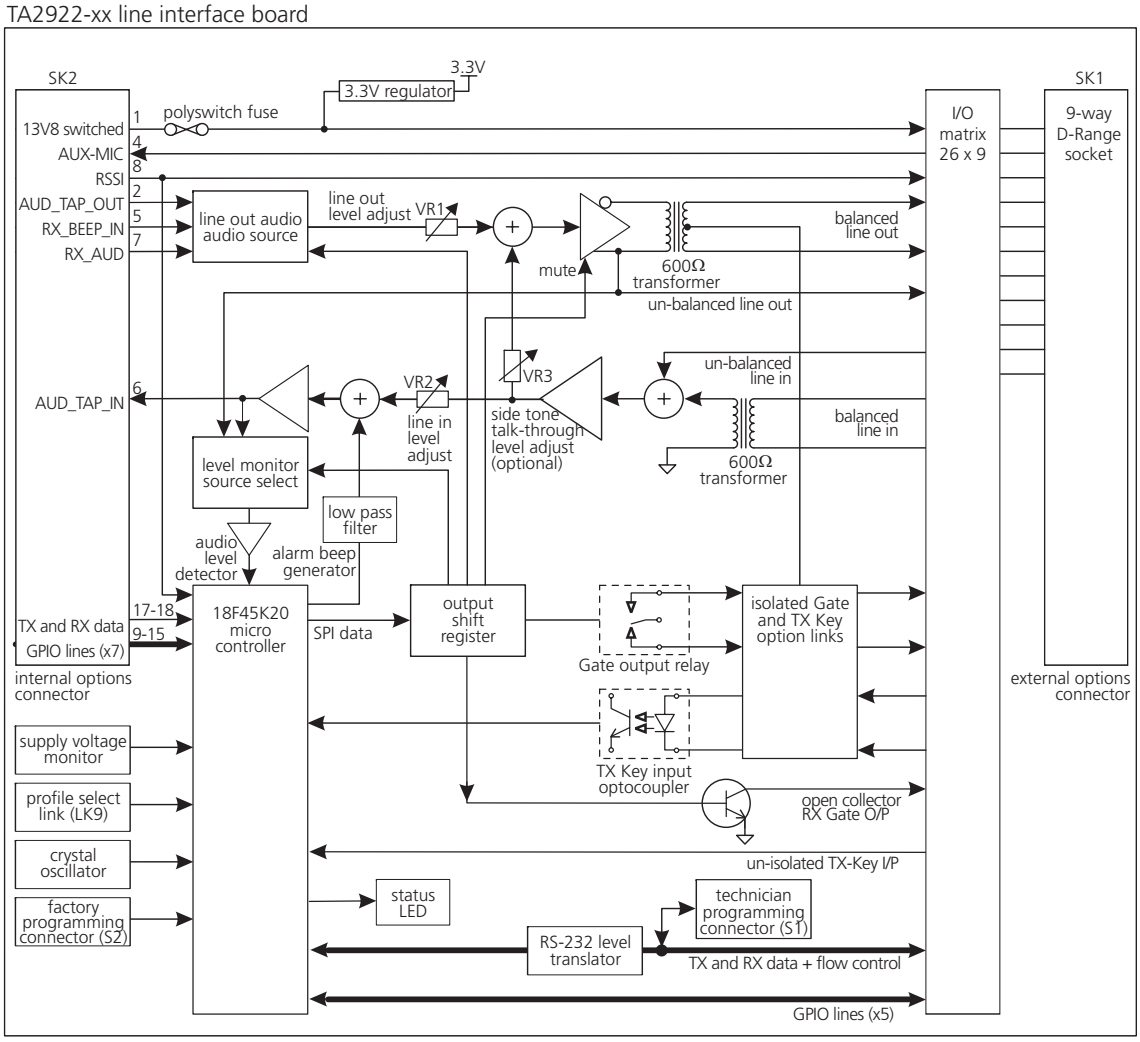
1.4 Compliance

This product complies with the following standards:

- EMC conducted and radiated emissions, CISPR22 for Australia/NZ
- RoHS.

2 Circuit description

TA2922-xx line interface board



The TA2922 Universal Line Interface is the TEL production copy of the AM8000-UIS board designed and manufactured by Tait Australia.

The Universal Line Interface is a TM8000/TM9000 internal options board which occupies the internal options space within the TM series radio. It performs a range of flexible audio and digital interfacing between the radio and outside world via a 9-way D-range socket.

The function of each pin in the D-range socket can be user-selected to any of the board's available analogue or digital I/O lines by way of a solder shorting link in an I/O matrix. A number of pre-existing variants of the TA2922 are available with pre-populated pin functions and pre-calibrated line levels. Refer to "Connections" on page 9 for pin descriptions on the available variants.

Key functions of the board are:

- each external connector pin function can be user-defined in hardware links
- isolated 2-wire or 4-wire balanced 600 ohm audio interface

- isolated E&M interface with a flexible range of configurations
- unbalanced audio input and output
- all audio I/O is adjustable by high precision 12-turn potentiometers which are accessible by opening the radio lid
- open collector gate output
- 3.3V TX key input
- analogue RSSI and auxiliary microphone lines from radio available as I/O options
- optional RX line to TX line adjustable level talk-though for headset side tones and voice recorder systems
- radio internal serial port available as I/O options
- programmable tail/hang time
- programmable 'anti-kerchunker' timer
- programmable supply voltage alarm with beeps superimposed on radio TX audio
- PC based real time monitoring of input and output conditions
- field upgradable software for future upgrades.

2.1 Audio Interface

The audio interface consists of two sections.

Line out

The line out audio interface features:

- radio RX audio to a balanced 600 ohm transformer isolated output
- radio RX audio to an unbalanced 100 ohm un-isolated output.

The line out audio source is software selectable between the fixed level AUD_TAP_OUT line or the volume controlled RX_AUX line of the TM8000/TM9000 radio. The audio mute characteristics and flat/de-emphasised configuration of AUD_TAP_OUT is defined in the programming of the radio audio options. RX_AUD is de-emphasised and is controlled in level according to the control head volume control.

Caution **In some TM8000/TM9000 configurations the RX_AUD line becomes fixed in level and is not controlled with the radio's volume control, such as when remote head or multi head configurations are used. Consult your Tait dealer for more information.**

The audio output level is adjusted by potentiometer VR1. Various TA2922 configurations are available from Tait Electronics with the audio output set to a pre-defined level.

The balanced output is isolated by a 1:1 600 ohm line transformer, T1. The transformer secondary has a centre tap for use with DC keying options.

Unbalanced audio is sourced from one half of the power amplifier's output which drives the line transformer. The signal is AC coupled and has an output impedance of 100 ohms, making it suitable for driving loads such as audio headsets.

Line in

The line in audio interface features:

- balanced 600 ohm line in audio to radio TX audio
- unbalanced 50k ohm impedance audio input to radio TX audio.

The line in audio is always available to the radio transmitter at the AUD_TAP_IN line of the radio internal option connector. The transmitter is enabled when the TX Key or PTT input to the TA2922 board is activated. The audio filtering and flat/pre-emphasis selection is defined in the programming of the radio audio options.

Balanced line input enters the board through a 1:1 600 ohm line transformer, T2, which also provides line isolation. If a 2-wire audio interface is configured, transformer T2 is not used and instead all transmit and receive line audio is via transformer T1. In this 2-wire configuration, link LK4/R62 is fitted for audio routing which makes the unbalanced audio input unavailable.

When link LK4/R62 is not fitted, the unbalanced line input is available for ground referenced audio. Input impedance is 50k ohms and the signal is AC coupled.

2.2 TX Key Input

Both opto-isolated and un-isolated transmitter keying options are available.

The optocoupler input operates between 10 to 50V and is not polarity sensitive. It can be connected to two input lines on the external connector, or be connected to the centre tap of transformer T1 for line DC keying (also known as phantom keying) with the suitable placement of option links. Both positive and negative keying voltages are supported.

The un-isolated TX key input PTT_DIRECT is 3.3V logic compatible where a DC voltage of under 2.5V keys the transmitter. A 10k ohm 3.3V pull up resistor is included on this line. The maximum voltage on this line should not normally exceed 5V. This line can be driven directly from any open collector or relay contact output.

2.3 RX Gate Output

Both relay isolated and un-isolated open collector outputs are available for RX gate/busy detect output.

The default configuration is for 'clean' relay contact outputs in the form of two isolated lines. A variety of relay contact options are available with the specific population of option links, including 12V or DC ground permanently on one of the contacts. The relay contacts outputs can also be configured for DC keying output to the line for centre tap 'phantom' DC keying configuration.

An open collector output available as GATE_OUT_DIRECT can sink a 50mA load. The voltage on this line must never exceed 45V.

2.4 Digital I/O

Five I/O lines from the radio internal options port, IOP_GPIO3 to IOP_GPIO7 are available as bidirectional inputs or outputs which can be connected to any of the external D-range connector pins with the appropriate population of the I/O matrix.

An exception is the use of the GPIO4 line. When this is activated (connected to ground) on the radio IOP_GPIO4 as an output from the radio, the TA2922 enters a disabled state where all transmit and receive audio and keying functions are inhibited.

2.5 Serial Data

In the standard configuration, the microcontroller TX and RX data lines are available as RS-232 inputs and outputs at internal connector S1 for serial programming of the TA2922 board configuration and for board software upgrades if required. The same RS-232 data lines can be routed to pins on the D-range connector for programming the board without opening the radio lid. These lines connect directly to a PC serial port for communication with the option board programming software. See "Programming the TA2922 board with the PGM-UIS" on page 41.

RTS and CTS hardware flow control lines are also available at RS-232 levels, however, at the time of release, hardware flow control functionality is not a supported feature of the option board software.

3.3V TTL logic levels are available as opposed to RS-232 levels. This involves the removal of U8 and the fitting of components D13, R52, R53, R54, R55, R84 and R85.

The TA2922 may be configured to transparently pass serial data to and from the radio internal option serial port through to the outside world. In this configuration the same external TX and RX data lines are used for programming, but a power up timer allows a short period of time where the programming application may read or write to the TA2922 shortly after power on.

2.6 Microcontroller

A Microchip PIC 18F45K20 microcontroller, U1, forms the centre of the digital processing, control and monitoring. The device is responsible for:

- RX gate output control
- TX key input control
- all timing functions
- audio muting
- alarm state detection
- generation of alarm tones
- TX line audio source selection
- bi-directional I/O line processing
- real time monitoring of digital signal states, RSSI level and audio line level.

Serial input to parallel output shift register U5 is used to expand the digital output functionality of the microcontroller.

The microcontroller is factory programmed with the option board software and default configuration settings. The configuration settings are technician programmable via a serial connection to a PC running the option board programming software. See "Programming the TA2922 board with the PGM-UIS" on page 41.

3 Installation

Note If using the universal line interface board link options on the top side of the board, these must be set before the board is installed in the radio as the top side of the universal line interface board is not accessible once the board is screwed to the radio lid.

3.1 Parts Required

The following table describes the parts required to install a universal line interface board in a radio. The parts marked with an asterisk (★) are not shown and are used to connect to the radio's external options connector.

Quantity	Internal Part Number	Description	Reference
1	362-01111-00	foam seal	③
1	362-01108-02	cover seal	⑪
2	347-00011-00	4-40x3/16 screws	⑫
2	354-01043-00	screw-lock fasteners	⑦
6	349-02062-00	M3x8 screws	⑨
★1	240-00034-00	D-range plug	—
★1	240-06010-29	D-range hood	—

3.2 Installation Procedure

1. Disassemble the radio in order to gain access to the options cavity.

   For detailed disassembly instructions, refer to the TM8000 Service Manual.

The circled numbers in the following instructions refer to items in the diagram.

2. Remove the top cover and lid ① from the radio to access the options cavity.

3. Remove the external options connector bung ②, if it is fitted.

4. On the inside of the radio lid place the foam seal ③ over the external options connector cavity ④.

5. With the top side of the universal line interface board ⑤ facing the radio lid, guide the external options connector ⑥ into the external options connector cavity.

6. Screw the external options connector to the radio lid using the two screw-lock fasteners ⑦.

   Tighten the fasteners to a torque of 0.9N·m (8lbf·in).

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

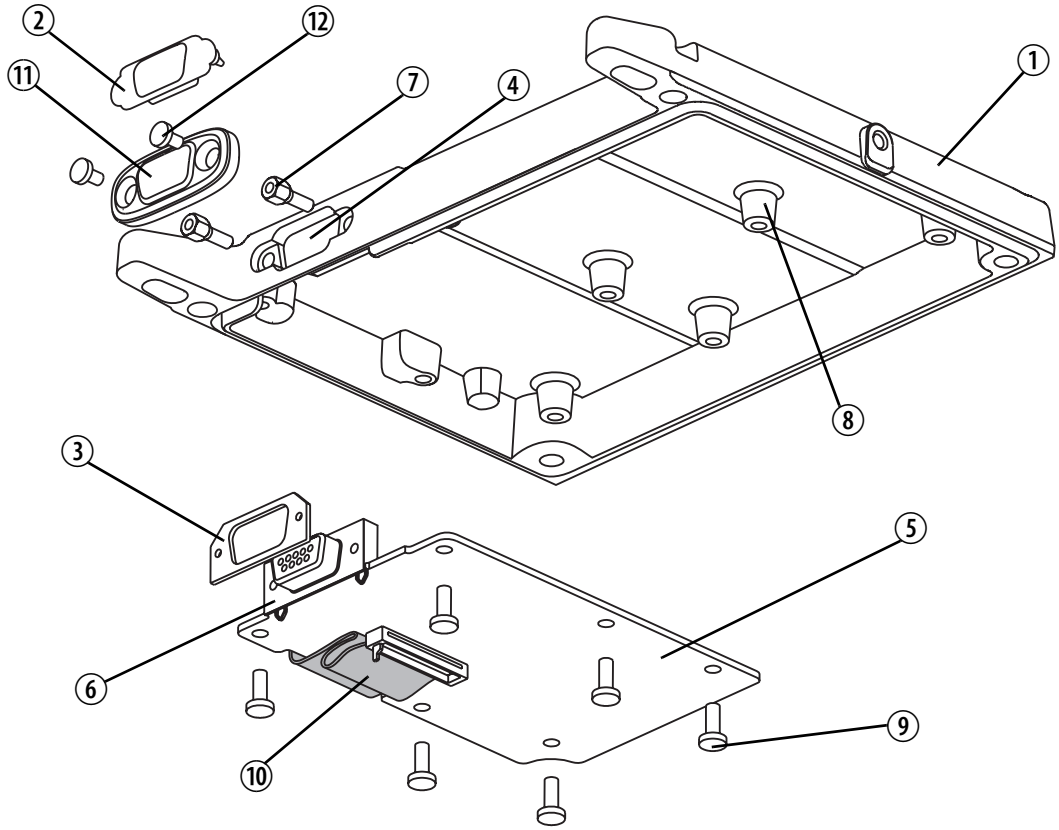
7. Screw the universal line interface board to the mounting posts on the radio lid using six M3x8 self-tapping screws ⑨.

   Tighten the M3x8 screws to a torque of 1.9N·m (17lbf·in)

Important For the universal 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.

8. Plug the unattached end of internal options connector loom ⑩ into the internal options connector on the radio main PCB.

9. 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 4-40x3/16 screws ⑫.



① radio lid
② external options connector bung
③ foam seal
④ external options connector cavity
⑤ universal line interface board
⑥ external options connector
⑦ screw-lock fasteners
⑧ mounting posts
⑨ M3x8 self-tapping screws
⑩ internal options loom
⑪ external options cover seal
⑫ 4-40x3/16 screws

4 Hardware configuration

Important This equipment contains devices which are susceptible to damage from static charges.

The following hardware configuration is available for the TA2922 universal line interface board:

- Line input and output audio level adjustment
- Talk-through level adjustment
- SK1 I/O signal configuration
- Additional configuration links

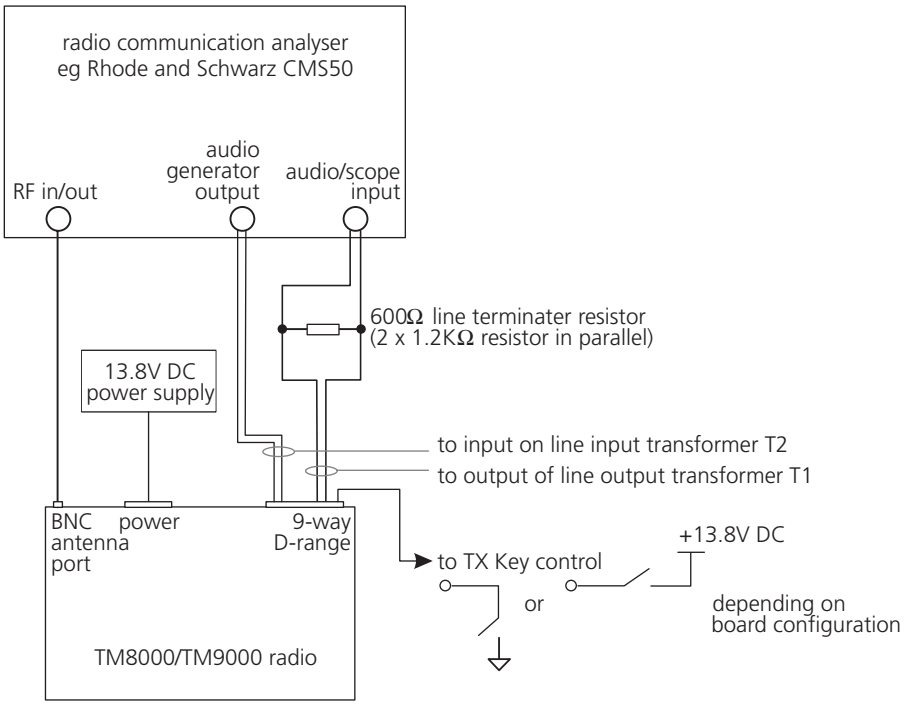
Note Configuration on the top side of the universal line interface board must be completed before the board is installed in the radio, as the top side is not accessible once the board is screwed to the radio lid.

4.1 Line input and output audio level adjustment

Potentiometers VR1 and VR2 are used to preset the line in and line out audio levels. These 12-turn pots are accessible at the side of the TA2922 options board while the option board is screwed into the TM series radio lid.

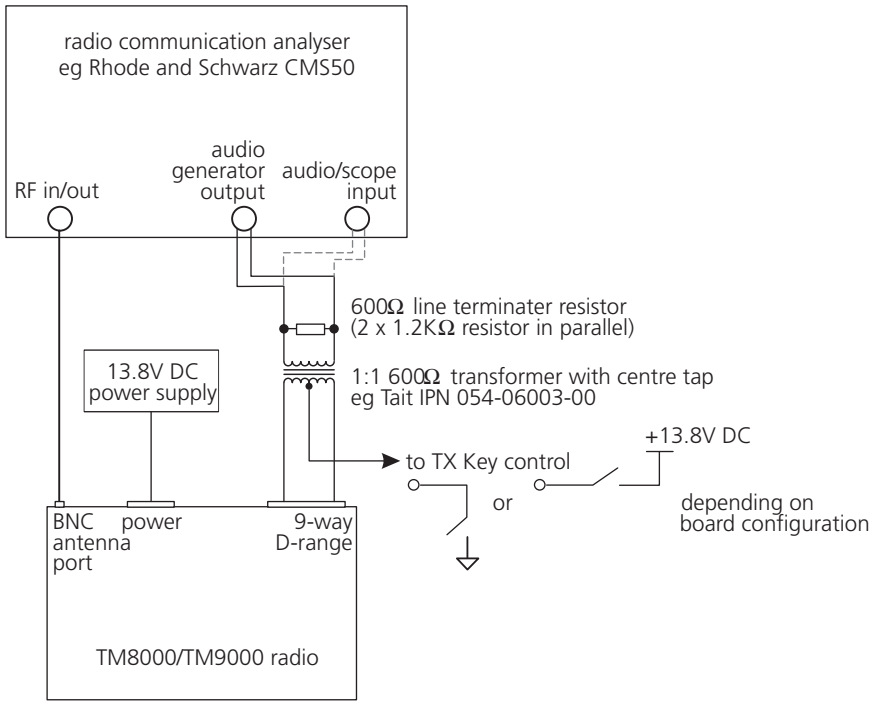
4-wire equipment setup

Test equipment set up as described below is required to measure and adjust line audio levels in a 4-wire configuration with separate E&M keying.



2-wire equipment setup

Similar equipment set up is required to measure and adjust line audio levels in a 2-wire configuration with centre tap or 'phantom' DC keying, though a 1:1 600 ohm line transformer with a centre tap is required.



Setting line output level (VR1)

1. Ensure the TM8000/TM9000 radio is programmed according to the programming instructions. See "Programming" on page 39.
2. Open the lid of the radio by unclipping the plastic top cover and removing the four T20 screws.
3. Connect the radio to the instruments as shown in the diagram.
4. Set the radio communications analyser to generate an on-signal frequency at a level of -70dBm. Modulate with a 1kHz tone at a level of 60% system deviation (1.5kHz for narrow band, 3kHz for wide band).
5. Ensure there is a 600 ohm termination resistor fitted across the two balanced line out audio wires.
6. Monitor the audio level using the communications analyser and adjust RV1 on the TA2922 interface to achieve the desired output level.

Setting line input level (VR2)

1. Ensure the TM8000/TM9000 radio is programmed according to the programming instructions. See "Programming" on page 39.
2. Open the lid of the radio by unclipping the plastic top cover and removing the four T20 screws.
3. Connect the radio to the instruments as shown in the diagram.

4. Set the radio communications analyser to monitor the radios RF transmission.
5. Set the audio generator to produce a 1kHz audio tone at the desired level.
6. Activate the TX key input to the TA2922 interface to set the radio to transmit.
7. Monitor the transmitter deviation using the communications analyser and adjust RV2 on the TA2922 interface to achieve 60% system deviation (1.5kHz for narrow band, 3kHz for wide band).

4.2 Talk-through level adjustment

The talk-through or side-tone feature is enabled by fitting optional component VR3 (Tait IPN 040-06000-00). This allows audio which enters the TA2922 interface on the balanced or un-balanced line in path to be re-routed back out on the balanced or un-balanced line out path.

Situations where this would be used is to provide microphone-to-earpiece side tone, or when a single input voice recorder system needs to record both transmit and receive sides of a two-way conversation.

Important This feature cannot be used when the TA2922 is operating in 2-wire mode. Fitting VR3 when in 2-wire mode may cause audio oscillations or instability.

1. Fit VR3 to the TA2922 interface by soldering in the three component leads.
2. Align both the line in and line out audio levels as described in the previous section.
3. Disable the RF output of the communications analyser so that the radio is in an idle state (not transmitting and not receiving a RF signal).
4. On the communications analyser, generate a 1kHz tone at the nominal audio level, connect this to the TA2922 line input.
5. Ensure there is a 600 ohm termination resistor fitted across the two balanced line out audio wires.
6. While continuing to generate the 1kHz tone, monitor the TA2922 line output on the communications analyser.
7. Adjust VR3 on the TA2922 line interface to set the desired talk through audio level.

4.3 SK1 I/O signal configuration

All nine of the lines on D-range connector SK1 are configured according to the 29 x 9 I/O matrix which can be factory SMD populated on the top side of the board or configured by a technician placing solder links on specific pads in the matrix on the bottom side of the board.

Important All variants of the TA2922 option board have all or some SK1 lines configured using zero ohm resistors on the top side of the I/O matrix. Before fitting solder links to the bottom side of the matrix, it is essential to remove existing components from the top side of the matrix, or check carefully that existing links do not conflict with newly populated solder links on the bottom side. Failure to do so may result in unexpected operation or permanent damage to the TA2922 interface.

There are 26 individual signals which are assignable to any of the nine lines of SK1. It is possible, and in some cases necessary, to link two signals to one SK1 pin. For example, one side of the optocoupler can be connected to DC ground by fitting a link between /PTT IN2 and a SK1 pin and a link from the same pin to GND.

Not all of the signals are available in the initial option board software release but may be implemented in future software updates.

SK1 I/O signal summary

The 26 I/O signals configurable via the I/O matrix are:

Signal Number	Signal Name	Description	Direction (relative to TA2922)	Level
A	LINE OUT 1	Balanced line output (4W) /balanced line in/out (2W)	Output	-30 to +10dBm into 600 ohms
B	/GATE OUT 1	RX gate output via relay contacts, configurable	Output	0-50VDC @1A
C	GROUND	Analogue/DC ground	Bidirectional	0V
D	/PTT IN 1	PTT input to opto-coupler	Input	10-50VDC
E	LINE IN 1	Balanced line input (4W)	Input	-30 to +5dBm
F	LINE IN 2	Balanced line input (4W)	Input	-30 to +5dBm
G	/PTT IN2	PTT input to opto-coupler	Input	10-50VDC
H	/GATE OUT 2	RX gate output via relay contacts, configurable	Output	0-50VDC @1A
I	LINE OUT 2	Balanced line output (4W) /balanced line in/out (2W)	Output	-30 to +10dBm into 600 ohms
J	+13V8_SW	Switched DC supply output,	Output	10.8-16VDC @150mA
K	AUX MIC AUD	Mic audio directly to the radio aux microphone input	Input	2.3VDC 15mV RMS

Signal Number	Signal Name	Description	Direction (relative to TA2922)	Level
L	RSSI	Analogue RSSI output from the radio	Output	0-3VDC
M	LINE IN UNBAL	Unbalanced transmitter audio input	Input	8mV to 1V RMS
N	LINE OUT UNBAL	Unbalanced receiver audio output	Output	25mV to 1V RMS
O	GATE OUT DIRECT	Open collector RX gate output	Output	45VDC max
P	PTT DIRECT	Un-isolated PTT input	Input	5VDC max
Q	EXT GPIO3	Bidirectional I/O to/from radio	Bidirectional	0-3.3VDC
R	EXT GPIO4	Bidirectional I/O to/from radio and line interface disable	Bidirectional	0-3.3VDC
S	EXT GPIO5	Bidirectional I/O to/from radio	Bidirectional	0-3.3VDC
T	EXT GPIO6	Bidirectional I/O to/from radio	Bidirectional	0-3.3VDC
U	EXT GPIO7	Bidirectional I/O to/from radio	Bidirectional	0-3.3VDC
V	RADIO DATA IN	Data to microcontroller (RS-232 level)	Input	-10 to +10V
W	RADIO DATA OUT	Data from microcontroller (RS-232 level)	Output	-10 to +10V
X	RTS IN	RTS input to microcontroller (RS-232 level) [not yet implemented]	Input	-10 to +10V
Y	CTS OUT	CTS output from microcontroller (RS-232 level) [not yet implemented]	Output	-10 to +10V
Z	AUX I/O	AC coupled line to J1, can connect to radio speaker output via internal wire	Bidirectional	N/A

SK1 I/O signal descriptions

A LINE OUT 1

- Signal direction: output
- Signal level: -30 to +10dBm
- Signal impedance: 600 ohms

Half of the isolated balanced audio output line, paired with LINE OUT 2. Audio is from radio receiver which is optionally summed with line in audio when the optional side tone adjustment pot RV3 is fitted. The radio RX audio to line output level is adjusted by VR1. The radio signal source is fixed in level with AUD_TAP_OUT is selected or is varied with the radio volume control if the RX_AUD source is selected as an option in the TA2922 programmable options.

Note that in some radio configurations the RX_AUD level becomes fixed and is not volume controlled, such as when some remote head or multi-head options are in use. The frequency response of audio sourced from AUD_TAP_OUT is defined in the programmable audio options of the radio, while audio sourced from RX_AUD is de-emphasised. Depending on link population, the line output pair can be used for 2-wire audio in and out and for centre tap 'phantom' DC keying options. See "Additional configuration links" on page 38. Frequency response is from 50Hz to 3kHz.

B GATE OUT 1

- Signal direction: output
- Signal level: 0 to 50VDC
- Signal impedance: < 1 ohm

Isolated relay contact output. Normally configured to connect directly with /GATE OUT 2 when radio receiver is in a busy state. Can be configured to output +12VDC @150mA in a normally open or normally closed configuration, depending on link population. See "Additional configuration links" on page 38.

Maximum voltage on this line is 50VDC when configured for clean relay contact operation. Maximum current through relay contacts and PCB is 500mA continuous or 1A for less than one second.

C GROUND

- Signal direction: bidirectional
- Signal level: 0VDC
- Signal impedance: < 1 ohm

Connection to AC and DC ground. Maximum current on this line is 500mA continuous or 1A for less than one second.

D /PTT IN 1

- Signal direction: input
- Signal level: 10-50VDC to activate TX key input
- Signal impedance: 5k ohm

Connection to input of TX key optocoupler. Between 10V and 50V DC is required across the optocoupler input (normally between /PTT IN 1 and /PTT IN 2) in order to activate the optocoupler. Input signal is bridge rectified so signal is not polarity sensitive. Current input at 50V is 10mA.

Can be configured for permanent or gate relay connection to +12VDC or DC ground, depending on link population. See "Additional configuration links" on page 38.

E LINE IN 1

- Signal direction: input
- Signal level: -30 to +5dBm
- Signal impedance: 600 ohms

Half of the isolated balanced audio input line, paired with LINE IN 2. The frequency response and filtering of the signal of the signal depends on the configuration of the AUD_TAP_IN as defined in the programmable audio options of the radio. See "Programmable I/O form, Audio tab" on page 40.

The frequency response of this line through the TA2922 board is from 50Hz to 3kHz. This input is used with 4-wire balanced configurations and is not used in 2-wire configurations.

F LINE IN 2

- Signal direction: input
- Signal level: -30 to +5dBm
- Signal impedance: 600 ohms

Half of isolated balanced audio input line, paired with LINE IN 1. The frequency response and filtering of the signal of the signal depends on the configuration of the AUD_TAP_IN as defined in the programmable audio options of the radio. See "Programmable I/O form, Audio tab" on page 40.

The frequency response of this line through the TA2922 board is from 50Hz to 3kHz. This input is used with 4-wire balanced configurations and is not used in 2-wire configurations.

G /PTT IN2

- Signal direction: input
- Signal level: 10-50VDC to activate TX key input
- Signal impedance: 5k ohm

Connection to input of TX key optocoupler. Between 10V and 50V DC is required across the optocoupler input (normally between /PTT IN 1 and /PTT IN 2) in order to activate the optocoupler. Input signal is bridge rectified so signal is not polarity sensitive. Current input at 50V is 10mA. Can be configured for permanent connection to DC ground, depending on link population. See "Additional configuration links" on page 38.

H /GATE OUT 2

- Signal direction: output
- Signal level: 0 to 50VDC
- Signal impedance: < 1 ohm

Isolated relay contact output. Normally configured to connect directly with /GATE OUT 1 when radio receiver is in a busy state. Can be permanently connected to +12VDC or DC ground, depending on link population. See "Additional configuration links" on page 38.

Maximum voltage on this line is 50VDC when configured for clean relay contact operation. Maximum current through relay contacts and PCB is 500mA continuous or 1A for less than one second.

I LINE OUT 2

- Signal direction: output
- Signal level: -30 to +10dBm
- Signal impedance: 600 ohms

Half of the isolated balanced audio output line, paired with LINE OUT 1. Audio is from radio receiver which is optionally summed with line in audio when the optional side tone adjustment pot RV3 is fitted. The radio RX audio to line output level is adjusted by VR1. See "Setting line output level (VR1)" on page 24.

The radio signal source is fixed in level with AUD_TAP_OUT selected or is varied with the radio volume control if the RX_AUD source is selected as an option in the TA2922 programmable options. See "RX Line Out uses RX_AUD" on page 43.

Note that in some radio configurations, the RX_AUD level becomes fixed and is not volume controlled, such as when some remote head or multi-head options are in use. The frequency response of audio sourced from AUD_TAP_OUT is defined in the programmable audio options of the radio, while audio sourced from RX_AUD is de-emphasised. See "Programmable I/O form, Audio tab" on page 40.

Depending on link population, the line output pair can be used for 2-wire audio in and out and for centre tap 'phantom' DC keying options. Frequency response is from 50Hz to 3kHz. See "Additional configuration links" on page 38.

J +13V8_SW

- Signal direction: output
- Signal level: 10.8-16VDC
- Signal impedance: <1 ohm

Unregulated DC supply output switched by radio power on/off. 150mA continuous or 300mA for less than one second. Protected by 300mA self-resettable polyswitch fuse.

K AUX MIC AUD

- Signal direction: input
- Signal level: 15mV RMS for 60% system deviation
- Signal impedance: 2.2k ohms

Connection for auxiliary microphone. Supports direct connection to electret type microphone, 2.3VDC bias to operate the microphone is included on this line.

L RSSI

- Signal direction: output
- Signal level: 0-3VDC
- Signal impedance: > 1k ohm

Analogue received signal strength indicator out of radio. Analogue signal is proportional to received signal strength within the operating range of the receiver. Refer to the radio documentation for details.

M LINE IN UNBAL

- Signal direction: input
- Signal level: 8mV to 1V RMS
- Signal impedance: 50k ohms

Unbalanced line in audio to transmitter (referenced to ground). This input cannot be used when link LK4/R62 is fitted for 2-wire line operation. See "Additional configuration links" on page 38.

The frequency response and filtering of the signal of the signal depends on the configuration of the AUD_TAP_IN as defined in the programmable audio options of the radio. See "Programmable I/O form, Audio tab" on page 40. The frequency response of this line through the TA2922 board is from 50Hz to 3kHz.

N LINE OUT UNBAL

- Signal direction: output
- Signal level: 25mV to 1V RMS
- Signal impedance: 100 ohms

Unbalanced line out audio from receiver (referenced to ground). The frequency response and filtering of the signal of the signal depends on the configuration of the AUD_TAP_OUT as defined in the programmable audio options of the radio. See "Programmable I/O form, Audio tab" on page 40.

The frequency response of this line through the TA2922 board is from 100Hz to 3kHz into 100 ohms, or 50Hz to 3kHz into 600 ohms. This output can be used to drive low power audio loads such as headsets.

If the RX line out audio source is set to use 'RX_AUD' as defined in the option board software programmed configuration, the audio level out of LINE OUT UNBAL can be varied in level according to the control head volume control. See "RX Line Out uses RX_AUD" on page 43.

Note that in some remote head and multi-head radio configurations, the RX_AUD line becomes fixed in level and is not varied with the control head volume control.

O GATE OUT DIRECT

- Signal direction: output
- Signal level: 45VDC max
- Signal impedance: < 10 ohms

Un-isolated open collector RX gate output, active (pulled to DC ground) when radio is receiving a valid signal. Maximum voltage on this line should not exceed 45V, maximum current sunk when active is 70mA. No pull-up resistors are fitted as standard, but an option to fit pull-ups to 3.3V or 13.8V is provided.

P PTT DIRECT

- Signal direction: input
- Signal level: 5VDC max
- Signal impedance: 5k ohms

Un-isolated TX gate output, active low. Has internal pull-up resistor to 3.3V, radio transmitter is keyed when the input voltage is pulled below 2.5V. Suitable for direct

connection to a open collector output from third-party equipment. The maximum voltage on this line should not exceed 5V to prevent damage to the input transistor.

Q EXT GPIO3

- Signal direction: bidirectional
- Signal level: 3.3VDC max
- Signal impedance: 470 ohms

General purpose programmable digital input/output line. The action of this line is defined by the radio programmable digital I/O section of the radio programming application. See "Programmable I/O form, Digital tab" on page 39.

The radio programming defines if the signal is an input or an output while the TA2922 options board transparently passes the digital signal between the radio internal options port and the external connector.

The digital signal travels through the microcontroller on the TA2922 board which scans and updates I/O lines once every 10ms, so this latency time should be allowed for in timing calculations. The maximum voltage applied to this line should not exceed 3.3VDC.

R EXT GPIO4

- Signal direction: bidirectional
- Signal level: 3.3VDC max
- Signal impedance: 470 ohms

Option board disable and general purpose programmable digital input/output line.

Note When the radio IOP_GPIO4 line is set as an output from the radio and the output becomes active (low), all audio and keying functions of the TA2922 board are disabled.

In the disabled state, the state of IOP_GPIO4 is still passed through to the external output section. All other GPIO operations are not affected when the TA2922 is in disabled state. The action of this line is defined by the radio programmable digital I/O section of the radio programming application. See "Programmable I/O form, Digital tab" on page 39.

The radio programming defines if the signal is an input or an output while the TA2922 options board transparently passes the digital signal between the radio internal options port and the external connector. The digital signal travels through the microcontroller on the TA2922 board which scans and updates I/O lines once every 10ms, so this latency time should be allowed for in timing calculations. The maximum voltage applied to this line should not exceed 3.3VDC.

S EXT GPIO5

- Signal direction: bidirectional
- Signal level: 3.3VDC max
- Signal impedance: 470 ohms

General purpose programmable digital input/output line. The action of this line is defined by the radio programmable digital I/O section of the radio programming application. See "Programmable I/O form, Digital tab" on page 39.

The radio programming defines if the signal is an input or an output while the TA2922 options board transparently passes the digital signal between the radio internal options port and the external connector. The digital signal travels through the microcontroller on the TA2922 board which scans and updates I/O lines once every 10ms, so this latency time should be allowed for in timing calculations. The maximum voltage applied to this line should not exceed 3.3VDC.

T EXT GPIO6

- Signal direction: bidirectional
- Signal level: 3.3VDC max
- Signal impedance: 470 ohms

General purpose programmable digital input/output line. The action of this line is defined by the radio programmable digital I/O section of the radio programming application. See "Programmable I/O form, Digital tab" on page 39.

The radio programming defines if the signal is an input or an output while the TA2922 options board transparently passes the digital signal between the radio internal options port and the external connector. The digital signal travels through the microcontroller on the TA2922 board which scans and updates I/O lines once every 10ms, so this latency time should be allowed for in timing calculations. The maximum voltage applied to this line should not exceed 3.3VDC.

U EXT GPIO7

- Signal direction: bidirectional
- Signal level: 3.3VDC max
- Signal impedance: 470 ohms

General purpose programmable digital input/output line. The action of this line is defined by the radio programmable digital I/O section of the radio programming application. See "Programmable I/O form, Digital tab" on page 39.

The radio programming defines if the signal is an input or an output while the TA2922 options board transparently passes the digital signal between the radio internal options port and the external connector. The digital signal travels through the microcontroller on the TA2922 board which scans and updates I/O lines once every 10ms, so this latency time should be allowed for in timing calculations. The maximum voltage applied to this line should not exceed 3.3VDC.

V RADIO DATA IN

- Signal direction: input
- Signal level: -10 to +10V
- Signal impedance: 5k ohms

RS-232 data from PC to TA2922 board for programming parameters and option board software upgrades. The TA2922 may be configured to transparently pass

serial data to and from the radio internal option serial port through to the outside world. See "Powerup Serial Timer Enable" on page 43.

In this configuration the same external TX and RX data lines are used for programming, but a power up timer allows a short period of time where the programming application may read or write to the TA2922 shortly after power on. The serial TX and RX port may optionally be configured for 3.3V TTL operation as opposed to RS-232 with a different component population.

W RADIO DATA OUT

- Signal direction: output
- Signal level: -10 to +10V
- Signal impedance: < 1k ohms

RS-232 data from TA2922 board to PC for programming parameters and option board software upgrades. The TA2922 may be configured to transparently pass serial data to and from the radio internal option serial port through to the outside world. See "Powerup Serial Timer Enable" on page 43.

In this configuration the same external TX and RX data lines are used for programming, but a power up timer allows a short period of time where the programming application may read or write to the TA2922 shortly after power on. The serial TX and RX port may optionally be configured for 3.3V TTL operation as opposed to RS-232 with a different component population.

X RTS IN

- Signal direction: input
- Signal level: -10 to +10V
- Signal impedance: 5k ohms

RS-232 'ready to send' flow control input from PC to TA2922 board. This feature is not implemented in software at time of release and may be included in a future software release.

Y CTS OUT

- Signal direction: output
- Signal level: -10 to +10V
- Signal impedance: < 1k ohms

RS-232 'clear to send' flow control output from TA2922 board to PC. This feature is not implemented in software at time of release and may be included in a future software release.

Z AUX I/O

- Signal direction: bidirectional
- Signal level: N/A
- Signal impedance: 50 ohms

AC coupled line to unconnected I/O pad, J1. J1 can be manually hard-wired to another signal on the TA2922 interface board or within the radio itself for external access to signals which are not normally available.

For example, a piece of 0.22mm^2 hookup wire 110mm in length can be used to connect to one half of the radio's speaker power amplifier by soldering internally to the radio power/speaker connector. This would enable speaker level audio to drive audio loads of greater then 50 ohms for volume controlled speaker level audio when the 'RX_AUD' line is not volume controlled in the case of the radio being used with a remote head or multi-head configuration.

If desired, resistor R79 can be fitted in place of AC coupling capacitor C56 if DC level signals are required.

SK1 I/O matrix SMD resistor placement

The top side of the I/O matrix is a 26 row x 9 column matrix of 0603 sized resistor pads which are used to factory define the input and output signals of each of the nine pins on the external D-range connector SK1.

Each pad is connected in parallel with a pair of solder link pads on the bottom side of the board, used for technicians to manually customise the function of each connector pin. See "SK1 I/O matrix bottom-side solder links" on page 37.

Important All variants of the TA2922 option board have all or some SK1 lines configured using zero ohm resistors on the top side of the I/O matrix. Before fitting solder links to the bottom side of the matrix, it is essential to remove existing components from the top side of the matrix or check carefully that existing links do not conflict with newly populated solder links on the bottom side. Failure to do so may result in unexpected operation or permanent damage to the TA2922 interface.

The table below indicates the relationship between each solder link pad and its associated SMD resistor location. Columns 1-9 are the external D-range connector pins while rows A-Z are the selectable I/O signals. See "SK1 I/O signal summary" on page 26.

	SK1 external D-Range connector								
I/O Signals	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
A	R1-2	R2-2	R3-2	R4-2	R5-2	R6-2	R7-2	R8-2	R9-2
B	R10-2	R11-2	R12-2	R13-2	R14-2	R15-2	R16-2	R17-2	R18-2
C	R19-2	R20-2	R21-2	R22-2	R23-2	R24-2	R25-2	R26-2	R27-2
D	R28-2	R29-2	R30-2	R31-2	R32-2	R33-2	R34-2	R35-2	R36-2
E	R37-2	R38-2	R39-2	R40-2	R41-2	R42-2	R43-2	R44-2	R45-2
F	R46-2	R47-2	R48-2	R49-2	R50-2	R51-2	R52-2	R53-2	R54-2
G	R55-2	R56-2	R57-2	R58-2	R59-2	R60-2	R61-2	R62-2	R63-2
H	R64-2	R65-2	R66-2	R67-2	R68-2	R69-2	R70-2	R71-2	R72-2
I	R73-2	R74-2	R75-2	R76-2	R77-2	R78-2	R79-2	R80-2	R81-2
J	R82-2	R83-2	R84-2	R85-2	R86-2	R87-2	R88-2	R89-2	R90-2
K	R91-2	R92-2	R93-2	R94-2	R95-2	R96-2	R97-2	R98-2	R99-2
L	R100-2	R101-2	R102-2	R103-2	R104-2	R105-2	R106-2	R107-2	R108-2
M	R109-2	R110-2	R111-2	R112-2	R113-2	R114-2	R115-2	R116-2	R117-2
N	R118-2	R119-2	R120-2	R121-2	R122-2	R123-2	R124-2	R125-2	R126-2

O	R127-2	R128-2	R129-2	R130-2	R131-2	R132-2	R133-2	R134-2	R135-2
P	R136-2	R137-2	R138-2	R139-2	R140-2	R141-2	R142-2	R143-2	R144-2
Q	R145-2	R146-2	R147-2	R148-2	R149-2	R150-2	R151-2	R152-2	R153-2
R	R154-2	R155-2	R156-2	R157-2	R158-2	R159-2	R160-2	R161-2	R162-2
S	R163-2	R164-2	R165-2	R166-2	R167-2	R168-2	R169-2	R170-2	R171-2
T	R172-2	R173-2	R174-2	R175-2	R176-2	R177-2	R178-2	R179-2	R180-2
U	R181-2	R182-2	R183-2	R184-2	R185-2	R186-2	R187-2	R188-2	R189-2
V	R190-2	R191-2	R192-2	R193-2	R194-2	R195-2	R196-2	R197-2	R198-2
W	R199-2	R200-2	R201-2	R202-2	R203-2	R204-2	R205-2	R206-2	R207-2
X	R208-2	R209-2	R210-2	R211-2	R212-2	R213-2	R214-2	R215-2	R216-2
Y	R217-2	R218-2	R219-2	R220-2	R221-2	R222-2	R223-2	R224-2	R225-2
Z	R226-2	R227-2	R228-2	R229-2	R230-2	R231-2	R232-2	R233-2	R234-2

SK1 I/O matrix bottom-side solder links

Rather than fitting resistors to the 26 row x 9 column I/O matrix on the top side of the board, solder link pairs on the bottom side can be alternatively fitted. Each pad is connected in parallel with a pair of solder link pads on the bottom side of the board. These links also define the input and output signals of each of the nine pins on the external D-range connector SK1. See "SK1 I/O signal summary" on page 26.

Solder link pads on the bottom side of the board have a 'W' designation which is equivalent to the resistor 'R' designation on the top side. For example, R46-2 on the top side is in parallel with link W46-2 on the bottom side (grid location F1).

It is essential to remove existing components from the top side of the matrix, or check carefully that existing links do not conflict before fitting solder links to the bottom side of the matrix. Failure to do so may result in unexpected operation or permanent damage to the TA2922 interface.

4.4 Additional configuration links

In addition to the 26 x 9 I/O matrix for configuring signals to the pins of SK1, a range of other solder link pads exist for configuring:

- 2-wire/4-wire operation
- keying options
- gate out relay operation
- software profile configurations.

These bottom-side solder link pads can alternatively be fitted with top side 0603 resistor pads for the machine population of the hardware variants listed below. The table below indicates the relationship between bottom side solder link pads and top side resistor locations.

Note Some solder link pads are 2-way while others are 3-way links.

Solder link	SMD resistor	Description
LK1 1-2	R46	Connect normally open relay contact to /GATE OUT 1
LK1 2-3	R78	Connect normally closed relay contact to /GATE OUT 1
LK4	R62	Enable RX line audio from line TX pair (2-wire line operation)
LK5 1-2	R82	Connect 2-wire line transformer centre tap to RX gate relay output
LK5 2-3	R80	Connect 2-wire line transformer centre tap to optocoupler input
LK6 1-2	R77	Connect normally open relay contact to /PTT IN 1
LK6 2-3	R76	Connect normally closed relay contact to /PTT IN 1
LK7	R65	Connect +13.8V to relay common and /GATE OUT 2
LK8	R81	Connect half of optocoupler input and /PTT IN 2 to DC ground
LK9	R42	Select configuration profile 2 (if enabled in programming)

5 Programming

A TM8000/TM9000 radio fitted with a TA2922 universal line interface board requires programming using two different programming applications:

- the standard radio programming application suitable for your radio type,
- the dedicated TA2922 PGM-UIS programming application.

5.1 Programming using the radio programming application

The lines from the radio's internal options connector that are used by the universal line interface board are IOP_GPIO1, IOP-GPIO2 AND IOP_GPIO4. The behaviour of these lines is configured in the Programmable I/O and PTT forms of the programming application. Refer to the online help of the programming application for more information.

The following table explains the required input and output universal line interface connections.

Radio Signal	Function	Comments
GPIO1	PTT FROM OPT	This signal causes the radio to transmit. This normally requires External PTT1 to be set up in the Digital tab of the Programmable I/O form and the External PTT (1) tab of the PTT form. External PTT1 is active low.
GPIO2	Busy/Gate	This active LOW signal allows connection to the Busy/Gate output signal.
GPIO4	Disable	This allows the universal line interface board to be disabled. One of the four control head function keys is selected to control this Disable line. The Function Key Action field on the Key Settings form must be set to Action Digital Output Line.

Program the radio in which the universal line interface board is being installed using the following default settings.

Programmable I/O form, Digital tab

Pin	Direction	Label	Action	Active	Debounce	Signal State	Mirrored
IOP_GPIO1	Input	PTT	External PTT 1	Low	10	None	None
IOP_GPIO2	Output	BUSY	Busy Status	Low	None	None	None

If line interface enable/disable control is needed, set the following:

Pin	Direction	Label	Action	Active	Debounce	Signal State	Mirrored
IOP_GPIO4	Output	DISABLE	F1 Key Status	Low	None	Latching	None

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 Out	On PTT

PTT form, External PTT (1) tab

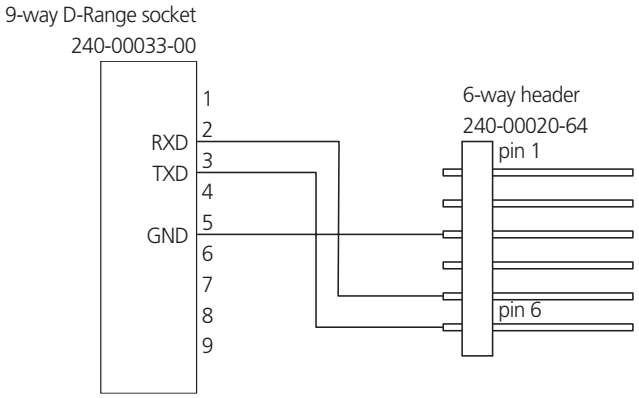
Field		Setting
Advanced EPTT1	PTT Transmission Type	Voice
	Audio Source	Audio Tap In

5.2 Programming the TA2922 board with the PGM-UIS

The PGM-UIS programming application is available from the support area of the TaitWorld website http://www.taitworld.com/technical/. The download is available from the Custom Solutions section after logging in.

Programming cable and connection

Program the TA2922-01, 03, 04 and 05 versions of the TA2922 universal line interface board by connecting the cable shown below to a PC running the PGM-UIS programming application.

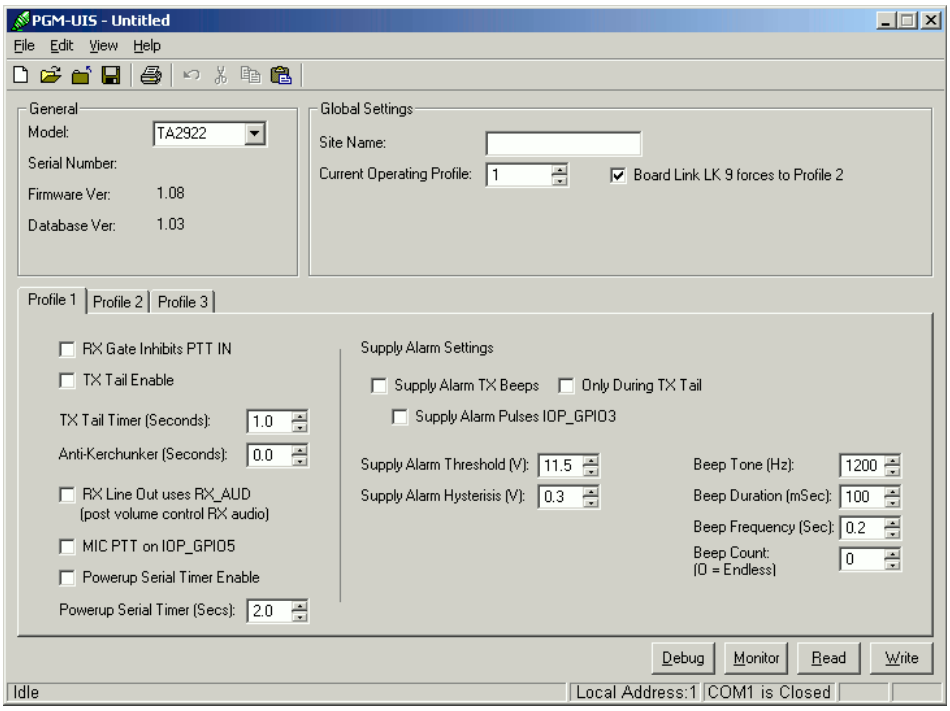


Connect the 6-way header to S1 on the bottom side of the TA2922 universal line interface board.

The cable is not required for the TA2922-02 2-wire interface as data lines are available on the external options connector SK1.

Programmable fields in the PGM-UIS programming application:

The fields shown below are the factory programmed defaults.



Site Name

A 16-character description of customer's name, job, site or any other text to identify the owner or purpose of the TA2922 board.

Current Operating Profile

Selects which of the three operating profiles are used. If the Board Link LK9 forces to Profile 2 check box is selected, then this field is over-ridden and profile 2 is selected if option link LK9 or SMD link R42 is fitted. Refer to "Additional configuration links" on page 38.

Board Link LK9 forces to Profile 2

If this check box is selected, the Current Operating Profile field is over-ridden and profile 2 is selected when option link LK9 or SMD link R42 is fitted. Refer to "Additional configuration links" on page 38.

Profile 1, 2, 3, tabs

Three different operating profiles contain different sets of operating parameters which can be selected by altering the Current Operating Profile field. This is useful when one customer has multiple operational variants of the TA2922 board as all of the customer's data can be saved in a single data file on disk.

Each TA2922 board variant is programmed with the same data when the operating profile field is set prior to programming.

RX Gate Inhibits PTT IN

If the TA2922 board has a valid RX gate output, all TX key inputs are ignored until RX gate becomes invalid. This is useful for 2-wire line configurations where the presence of +12V on the transformer centre tap can indicate either RX gate output from the TA2922 board or TX key into the TA2922 board.

TX Tail Enable

When this check box is selected, the TX Tail Timer is enabled.

TX Tail Timer

Also known as transmitter hang time. After a valid TX key signal has been removed from the TA2922 board input, the radio transmitter continue to be keyed for the period of this timer. Note that line input audio is not muted during the TX tail and any line audio present during the TX tail is passed to the radio transmitter.

Adjustable between 0.1 and 25.5 seconds

Anti-Kerchunker

After the TX key signal is removed and the radio stops transmitting, if the radio begins receiving immediately afterwards, the TA2922 board delays the activation of the RX gate signal according to the Anti-Kerchunker timer. This is used when linking to repeaters that have a transmitter tail or hang time.

When the Anti-Kerchunker timer is set to the same duration as the repeater tail, this prevents the repeater tail from affecting link radio operation.

Adjustable between 0.1 and 25.5 seconds

RX Line Out uses RX_AUD

When this check box is cleared, the RX line audio source is the radio's programmable AUD_TAP_OUT audio source, resulting in a fixed line level with the flat/de-emphasised response set according to the tap point location programmed in the radio software.

When this check box is selected, the RX line out audio source is after the radio volume control. This results in de-emphasised variable level line audio output level. Note that in some TM8000/TM9000 configurations, the RX_AUD line becomes fixed in value, such as when multi-head configurations are used, or with some remote head options. Consult your Tait dealer for more information.

MIC PTT on IOP_GPIO5

If the radio IOP_GPIO5 line becomes active (low), the TA2922 board outputs a valid RX gate signal. This is for applications where receiver line audio out must carry audio from the radio's receiver as well as audio from the control head fist microphone. The is possible when the radio is programmed so that a microphone PTT press is mirrored on IOP_GPIO5, and the programmable audio from Mic PTT is configured to split the audio to a Tap Out location.

Powerup Serial Timer Enable

When this check box is selected, the Powerup Serial Timer is enabled (see below) to enable serial data to be passed transparently from the radio's internal option connector to the RS-232 lines on the option TA2922 board I/O

Powerup Serial Timer

When the Powerup Serial Timer expires after power on, all serial data to/from the radio internal options port is transparently routed to the option TA2922 board RS-232 I/O lines for communication with external data equipment, e.g. GPS or a CCDI interface.

The purpose of the Powerup Serial Timer is to provide a short period of time where the TA2922 board can be read or programmed by the programming application. After the Powerup Serial Timer expires, the TA2922 board is only

accessible to the UIS-PGM application after switching the radio power off then back on.

Adjustable between 0.1 and 25.5 seconds

Supply Alarm TX Beeps

When this check box is selected, voltage alarm beeps are mixed with the line in audio to the radio transmitter, when the supply voltage falls below the Supply Alarm Threshold.

Only During Tail

The supply voltage alarm beeps are only applied to the transmitter for the duration of the TX Tail Timer. If there is no TX Tail Enable, the alarm beeps are not heard on the radio transmission.

Supply Alarm Pulses IOP_GPIO3

When the supply voltage alarm is first activated by the supply voltage falling below the Supply Alarm Threshold, a single active low pulse of 100ms duration is applied to the IOP_GPIO3 on the radio internal option connector. This can be used in a number of applications, or example, to send a Selcall signal to remotely indicate a low voltage condition. The pulse is only provided once, for the duration that the alarm is active for.

Supply Alarm Threshold

The supply voltage alarm becomes active when the supply voltage to the radio falls below this value.

Adjustable between 5.0 and 20.0 Volts

Note that the input supply range of the radio is 10.8V to 16V

Supply Alarm Hysteresis

The supply voltage alarm becomes inactive once the supply voltage to the radio rises by this value. The supply voltage must rise to a value of Supply Alarm Threshold + Supply Alarm Hysteresis to cancel the alarm condition.

Adjustable between 0.2 and 25.5 Volts

Beep Tone

Sets the frequency of the supply voltage beeps which are mixed in with the line in audio to the radio transmitter.

Adjustable between 400 and 2000Hz

Beep Duration

The length of each beep tone. If the Beep Duration is longer than the Beep Frequency, the alarm tone is continuous.

Adjustable between 100 and 25500 milliseconds (0.1 to 25.5 seconds)

Beep Frequency

How often a beep tone is repeated. For example, to generate an alarm tone of 0.4 seconds on, 0.6 seconds off, set Beep Duration to 400 and Beep Frequency to 0.6.

Adjustable between 0.1 and 25.5 seconds

Beep Count How many beeps are announced in each transmission period. If this value is set to zero, the beep pattern is repeated endlessly during the transmission, or during the TX tail time if Only During Tail is checked.

Adjustable between 0 and 255

Functions

Debug Opens a window which displays the raw serial communications from the TA2922 board.

Monitor Opens the real time monitor window. When 'Start' is clicked in the real time monitor window, the real time states of the TA2922 analogue and digital lines are displayed.

Note that the audio level monitor is an approximate guide only and only applies to line out (receiver) audio. Indicates audio level to +/- 3dB in the range of -10dBm and +6dBm.

Read Reads the data from a TA2922 board and displays in the window of the PGM-UIS application. Note that if the Powerup Serial Timer is enabled, the radio must be switched on and then the data written before the Powerup Serial Timer expires.

Write Writes the data displayed in the window to the TA2922 board. Note that if the Powerup Serial Timer is enabled, the radio must be switched on and then the data written before the Powerup Serial Timer expires.

6 Testing and fault finding

6.1 S1 Technician Programming Connector

S1 is a 6-way single in-line connector for programming TA2922 software options and also for upgrades to the option board software.

Pin number	Signal name	Function
1	+13V8_SW	+13.8V unregulated DC supply
2	/GATE OUT 2	Gate relay common
3	GND	DC ground
4	/PTT IN 2	TX key to optocoupler
5	DATA OUT	RS-232 data from TA2922 to PC serial port
6	DATA IN	RS-232 data from PC serial port to TA2922

6.2 S2 Factory Programming Connector

S2 is a 2x3-way connector intended for factory programming only

Pin number	Signal name	Function
1	VDD	+3.3V regulated supply
2	N/C	Not connected
3	PGC	Program clock
4	GND	DC ground
5	MCLR	Master clear/reset
6	PGD	Program data

7 PCB information

The following information applies to the universal line interface board with the PCB IPN 228-29221-00. The component values in the circuit diagram are indicative only. Refer to the parts lists for actual values used.

7.1 Parts List XA2922-0x-PBA revision 001

The following part list contains the majority of the parts used on the 228-29221-00 PCB. Some additional parts are fitted, as defined in "Variant parts" on page 53.

Ref	IPN	Description	PCB	Schem
C1	018-16100-10	CAP 100n 50V 10% 0603 X7R	E10	1H5
C2	018-16100-10	CAP 100n 50V 10% 0603 X7R	G7	1J5
C3	018-16100-10	CAP 100n 50V 10% 0603 X7R	G7	1J6
C4	018-16100-10	CAP 100n 50V 10% 0603 X7R	E9	1H7
C5	018-16100-10	CAP 100n 50V 10% 0603 X7R	F9	1J8
C6	018-16100-10	CAP 100n 50V 10% 0603 X7R	D9	1H9
C7	015-27100-08	CAPCer 1uF 16V 10% 0805 X7R	D10	1B11
C8	018-16100-10	CAP 100n 50V 10% 0603 X7R	C10	1F7
C9	018-16100-10	CAP 100n 50V 10% 0603 X7R	D10	1H5
C10	018-16100-10	CAP 100n 50V 10% 0603 X7R	B10	1J4
C11	018-16100-10	CAP 100n 50V 10% 0603 X7R	E10	1H4
C12	018-16100-10	CAP 100n 50V 10% 0603 X7R	B10	1J4
C13	018-16100-10	CAP 100n 50V 10% 0603 X7R	C6	1E4
C14	018-16100-10	CAP 100n 50V 10% 0603 X7R	C8	1E3
C15	018-16100-10	CAP 100n 50V 10% 0603 X7R	D8	1F4
C16	018-16100-10	CAP 100n 50V 10% 0603 X7R	A7	1K11
C17	018-16100-10	CAP 100n 50V 10% 0603 X7R	F2	1C6
C18	018-16100-10	CAP 100n 50V 10% 0603 X7R	F2	1B6
C19	018-16100-10	CAP 100n 50V 10% 0603 X7R	F2	1C7
C20	018-16100-10	CAP 100n 50V 10% 0603 X7R	G2	1C8
C21	018-16100-10	CAP 100n 50V 10% 0603 X7R	F2	1C8
C22	015-27100-08	CAPCer 1uF 16V 10% 0805 X7R	C10	1B10
C23	018-16100-10	CAP 100n 50V 10% 0603 X7R	B6	1K9
C24	016-08100-03	CAP eltro 10uF 35V 105° 2000h	F8	1J7
C25	016-08100-03	CAP eltro 10uF 35V 105° 2000h	E9	1J7
C26	015-27100-08	CAPCer 1uF 16V 10% 0805 X7R	B10	1F5
C27	016-08100-03	CAP eltro 10uF 35V 105° 2000h	B6	1K8
C28	018-13100-00	CAP 100p 50V NPO ±5% 0603	F9	1J7
C29	018-13100-00	CAP 100p 50V NPO ±5% 0603	D10	1H4
C30	018-16100-10	CAP 100n 50V 10% 0603 X7R	G8	1J6
C31	016-08100-03	CAP eltro 10uF 35V 105° 2000h	F9	1H10
C32	018-13100-00	CAP 100p 50V NPO ±5% 0603	D9	1G8
C33	018-13100-00	CAP 100p 50V NPO ±5% 0603	E8	1C9
C34	018-13470-00	CAP 470p 50V ±10% 0603 X7R	E6	1J8
C35	018-15100-00	CAP 10n 50V ±10% 0603 X7R	G5	1J10
C36	018-15100-00	CAP 10n 50V ±10% 0603 X7R	F6	1G10
C37	018-14100-00	CAP 1n 50V ±10% 0603 X7R	D1	1J13
C38	018-14100-00	CAP 1n 50V ±10% 0603 X7R	C1	1J13
C39	018-14100-00	CAP 1n 50V ±10% 0603 X7R	C1	1J13

Ref	IPN	Description	PCB	Schem
C40	018-14100-00	CAP 1n 50V ±10% 0603 X7R	C1	1J13
C41	018-14100-00	CAP 1n 50V ±10% 0603 X7R	C1	1H13
C42	018-14100-00	CAP 1n 50V ±10% 0603 X7R	D1	1J14
C43	018-14100-00	CAP 1n 50V ±10% 0603 X7R	C1	1J14
C44	018-14100-00	CAP 1n 50V ±10% 0603 X7R	C1	1J14
C45	018-14100-00	CAP 1n 50V ±10% 0603 X7R	C1	1H14
C46	015-26330-08	CAPCer 330n 10V 5% 0805 X7R	A3	1G3
C47	018-12220-10	CAP 22p 50V NPO ±1% 0603	C8	1B4
C48	018-12220-10	CAP 22p 50V NPO ±1% 0603	C8	1B4
C49	016-08100-03	CAP eltro 10uF 35V 105° 2000h	B7	1K10
C50	018-16100-10	CAP 100n 50V 10% 0603 X7R	B6	1J10
C51	015-27100-08	CAPCer 1uF 16V 10% 0805 X7R	A7	1K11
C52	018-16100-10	CAP 100n 50V 10% 0603 X7R	B8	1E6
C53	018-13100-00	CAP 100p 50V NPO ±5% 0603	E3	1D8
C54	018-14100-00	CAP 1n 50V ±10% 0603 X7R	A7	1E3
C55	018-14100-00	CAP 1n 50V ±10% 0603 X7R	F1	1F10
C56	016-08100-03	CAP eltro 10uF 35V 105° 2000h	E1	1F10
C57	018-14100-00	CAP 1n 50V ±10% 0603 X7R	E1	1F11
D1	001-10000-99	DIODE BAV99Dual sw SOT23	F3	1E8 1F8
D2	001-10335-00	DIODE Array 3V3 ESD ptctn SC88	D7	1D2 1D1
D3	001-10084-51	DIODE BZX84C5V1 Zen SOT23	G5	1J10
D4	001-10084-51	DIODE BZX84C5V1 Zen SOT23	G5	1J10
D5	001-10084-51	DIODE BZX84C5V1 Zen SOT23	E6	1G10
D6	001-10084-51	DIODE BZX84C5V1 Zen SOT23	F6	1G10
D7	001-10000-99	DIODE BAV99Dual sw SOT23	C10	1F7
D8	001-10000-99	DIODE BAV99Dual sw SOT23	D10	1F5
D9	008-10004-00	LED 0603 grn KGKTUltrabright	C8	1E5
D10	001-10000-99	DIODE BAV99Dual sw SOT23	G3	1D10
D11	001-10000-99	DIODE BAV99Dual sw SOT23	G3	1D10
D12	001-10000-99	DIODE BAV99Dual sw SOT23	D8	1F3
DS1	002-10181-00	IC HCPL181 OPTO Fpak SO4	F3	1D9
F1	265-10055-00	FUSE 0.3A Reset SMD030-2	B2	1J2
FL1	059-16220-00	IND 0603CS 220nH 5%	G5	1J9
FL2	059-16220-00	IND 0603CS 220nH 5%	G5	1H9
FL3	059-16220-00	IND 0603CS 220nH 5%	F6	1G9
FL4	059-16220-00	IND 0603CS 220nH 5%	E6	1G9
Q1	000-10008-17	XSTR SMD BC817-25 NPN SOT23	E9	1H6
Q2	000-10008-17	XSTR SMD BC817-25 NPN SOT23	A8	1B10
Q3	000-10008-17	XSTR SMD BC817-25 NPN SOT23	F3	1E8
Q4	000-10008-57	XSTR SMD BC857 PNP SOT23	D8	1C9
Q5	000-10008-57	XSTR SMD BC857 PNP SOT23	E3	1D8
Q6	000-10008-17	XSTR SMD BC817-25 NPN SOT23	B8	1J4
Q7	000-10008-17	XSTR SMD BC817-25 NPN SOT23	B8	1J5
Q8	000-10008-17	XSTR SMD BC817-25 NPN SOT23	C9	1F7
R1	038-15100-10	RES 0603 10k 1% 1/10W	D10	1H4
R2	038-15100-10	RES 0603 10k 1% 1/10W	G8	1G6
R3	038-16105-10	RES 0603 105k 1% 1/10W	C10	1F5
R4	038-15270-00	RES 0603 27k 5% 1/10W	D9	1H5
R5	038-14470-10	RES 0603 4k7 1% 1/10W	D9	1G5

Ref	IPN	Description	PCB	Schem
R6	038-15100-10	RES 0603 10k 1% 1/10W	G8	1G7
R7	038-15100-10	RES 0603 10k 1% 1/10W	D9	1G7
R8	038-15100-10	RES 0603 10k 1% 1/10W	E3	1D8
R9	038-15100-10	RES 0603 10k 1% 1/10W	A8	1B9
R11	038-15100-10	RES 0603 10k 1% 1/10W	A7	1E3
R12	038-15100-10	RES 0603 10k 1% 1/10W	D8	1C8
R13	038-15100-10	RES 0603 10k 1% 1/10W	E3	1D8
R14	038-15100-10	RES 0603 10k 1% 1/10W	D8	1C9
R15	038-15100-10	RES 0603 10k 1% 1/10W	F3	1E8
R16	038-15100-10	RES 0603 10k 1% 1/10W	E8	1C9
R17	038-15100-10	RES 0603 10k 1% 1/10W	D8	1F3
R18	038-16100-10	RES 0603 100k 1% 1/10W	D6	1D1
R19	038-16100-10	RES 0603 100k 1% 1/10W	D6	1E1
R20	038-15220-10	RES 0603 22k 1% 1/10W	E8	1H6
R21	038-15220-10	RES 0603 22k 1% 1/10W	E9	1H7
R22	038-16100-10	RES 0603 100k 1% 1/10W	D6	1D1
R23	038-16100-10	RES 0603 100k 1% 1/10W	D6	1E1
R24	038-15100-10	RES 0603 10k 1% 1/10W	F7	1J6
R25	038-15220-10	RES 0603 22k 1% 1/10W	E9	1J7
R26	038-16180-00	RES 0603 180k 5% 1/10W	F9	1J7
R27	038-16120-10	RES 0603 120k 1% 1/10W	D9	1H8
R28	038-16100-10	RES 0603 100k 1% 1/10W	D9	1H8
R29	038-16100-10	RES 0603 100k 1% 1/10W	E9	1G9
R30	038-17100-10	RES 0603 1M 1% 1/10W	C10	1F6
R31	038-16100-10	RES 0603 100k 1% 1/10W	D9	1G8
R32	038-16100-10	RES 0603 100k 1% 1/10W	D9	1G8
R33	038-13560-10	RES 0603 560R 1% 1/10W	F6	1J8
R34	038-13560-10	RES 0603 560R 1% 1/10W	D9	1G8
R35	038-13100-10	RES 0603 100R 1% 1/10W	F9	1H9
R36	038-16100-10	RES 0603 100k 1% 1/10W	D6	1D1
R37	038-15120-10	RES 0603 12k 1% 1/10W	D10	1H4
R38	038-14100-10	RES 0603 1k0 1% 1/10W	E10	1H3
R39	038-15100-10	RES 0603 10k 1% 1/10W	C10	1F5
R40	038-15120-10	RES 0603 12k 1% 1/10W	B10	1J4
R41	038-14100-10	RES 0603 1k0 1% 1/10W	B10	1J3
R43	038-17100-10	RES 0603 1M 1% 1/10W	C8	1B4
R44	038-15100-10	RES 0603 10k 1% 1/10W	C10	1F6
R45	038-15100-10	RES 0603 10k 1% 1/10W	F3	1D8
R47	038-13470-00	RES 0603 470R 5% 1/10W	D7	1F12
R48	038-13470-00	RES 0603 470R 5% 1/10W	D7	1F12
R49	038-13470-00	RES 0603 470R 5% 1/10W	D7	1F12
R50	038-13470-00	RES 0603 470R 5% 1/10W	D6	1F12
R51	038-13470-00	RES 0603 470R 5% 1/10W	D6	1F12
R56	038-14470-10	RES 0603 4k7 1% 1/10W	G3	1D9
R57	036-05100-01	RES 1206 10k 5%	G3	1D10
R58	036-05100-01	RES 1206 10k 5%	G3	1D10
R59	038-15100-10	RES 0603 10k 1% 1/10W	F8	1J6
R60	038-14240-10	RES 0603 2K4 1% 1/10W	D8	1F3
R61	036-02100-03	RES 1218 10R 5% 1W	B5	1K8
R63	038-14100-10	RES 0603 1k0 1% 1/10W	A7	1K11
R64	038-16100-10	RES 0603 100k 1% 1/10W	B8	1E5
R66	038-15100-10	RES 0603 10k 1% 1/10W	B8	1J4
R67	038-15100-10	RES 0603 10k 1% 1/10W	B8	1J4
R68	038-15100-10	RES 0603 10k 1% 1/10W	C9	1F7
R69	038-13470-00	RES 0603 470R 5% 1/10W	C8	1E5

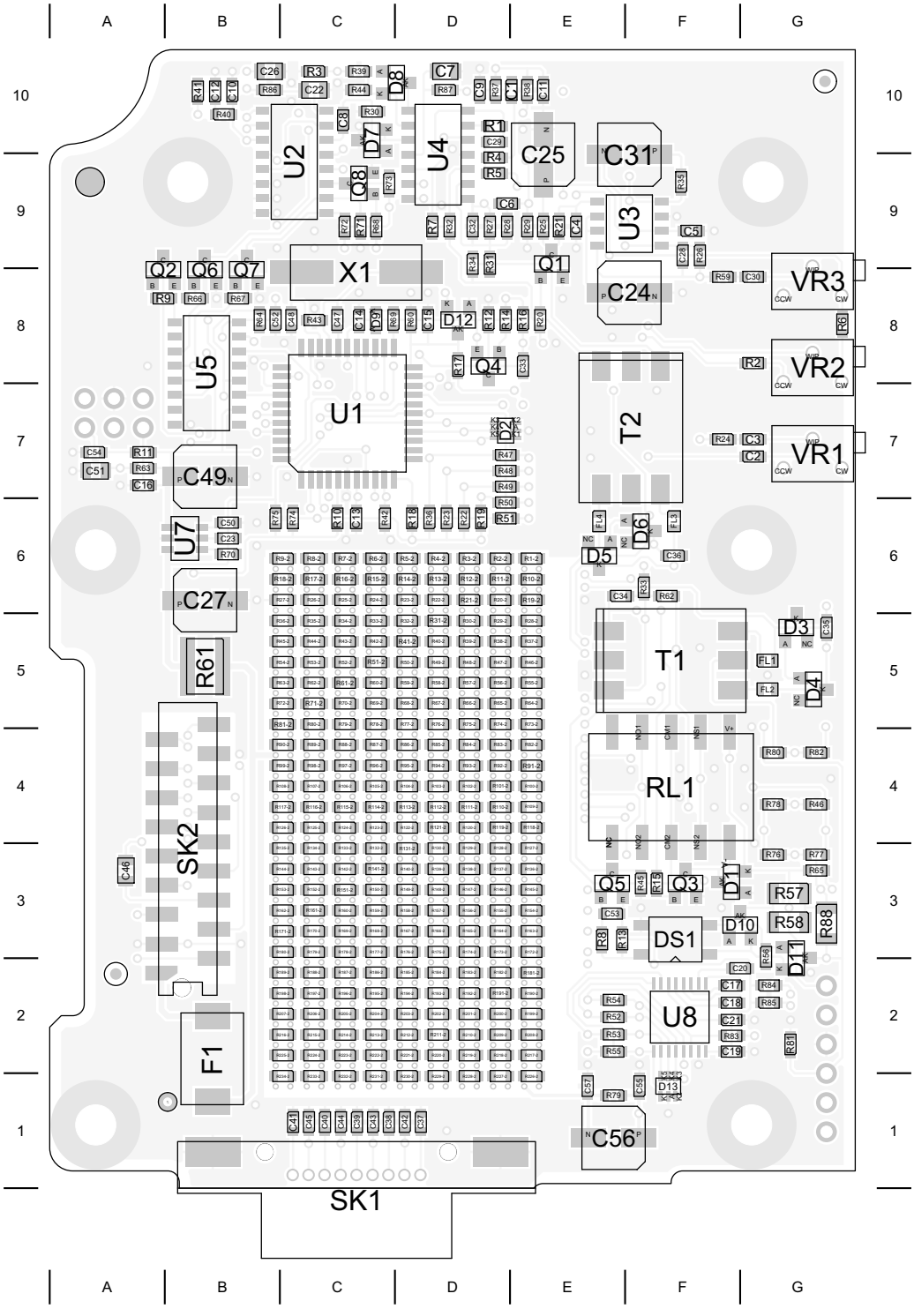
Ref	IPN	Description	PCB	Schem
R70	038-14100-10	RES 0603 1k0 1% 1/10W	B6	1K9
R71	038-16100-10	RES 0603 100k 1% 1/10W	C9	1K4
R72	038-16100-10	RES 0603 100k 1% 1/10W	C9	1J5
R73	038-16100-10	RES 0603 100k 1% 1/10W	C9	1F7
R83	038-13470-00	RES 0603 470R 5% 1/10W	F2	1E12
R86	038-12100-10	RES 0603 10R 1% 1/10W	B10	1B10
R87	038-12100-10	RES 0603 10R 1% 1/10W	D10	1B11
RL1	237-10010-00	RELAY 12V DPDT 10pin SMD	F4	1F8 1E9 1F9
SK1	240-06009-20	CONN 9wy DIP D-sub fem	D1	1K14
SK2	240-10000-11	CONN 18wy skt M/M SMD	B3	1J1
T1	054-00010-20	XFMR CT ETAL2782	F5	1J9
T2	054-00010-18	XFMR Line 600R P2781	F7	1G9
U1	002-11845-20	IC PIC18F45K20 MCU TQFP44	C7	1C3
U2	002-10040-53	IC 4053B Break BBM Make	C9	1B10 1K4 1J5 1G7
U3	002-10854-10	IC TDA8541T 1W aud amp	F9	1J8
U4	002-10003-24	IC LM324 quad OP-amp SO14	D9	1B11 1F6 1G6 1G8 1G4
U5	002-74905-95	IC 74HC595 shift rgstr SO16	B8	1D6
U7	002-11133-00	IC TK11233C 3V3 rgltr 480mA	B6	1K10
U8	002-10032-02	IC RS-232 3V ESD ptct TSOP16	F2	1B7
VR1	040-06000-00	RES pot 100k 12T side adj 6mm	G7	1J6
VR2	040-06000-00	RES pot 100k 12T side adj 6mm	G8	1G6
X1	274-10023-00	XTAL 12.288MHz HC49/SM ±30ppm	C8	1B4

7.2 Variant parts

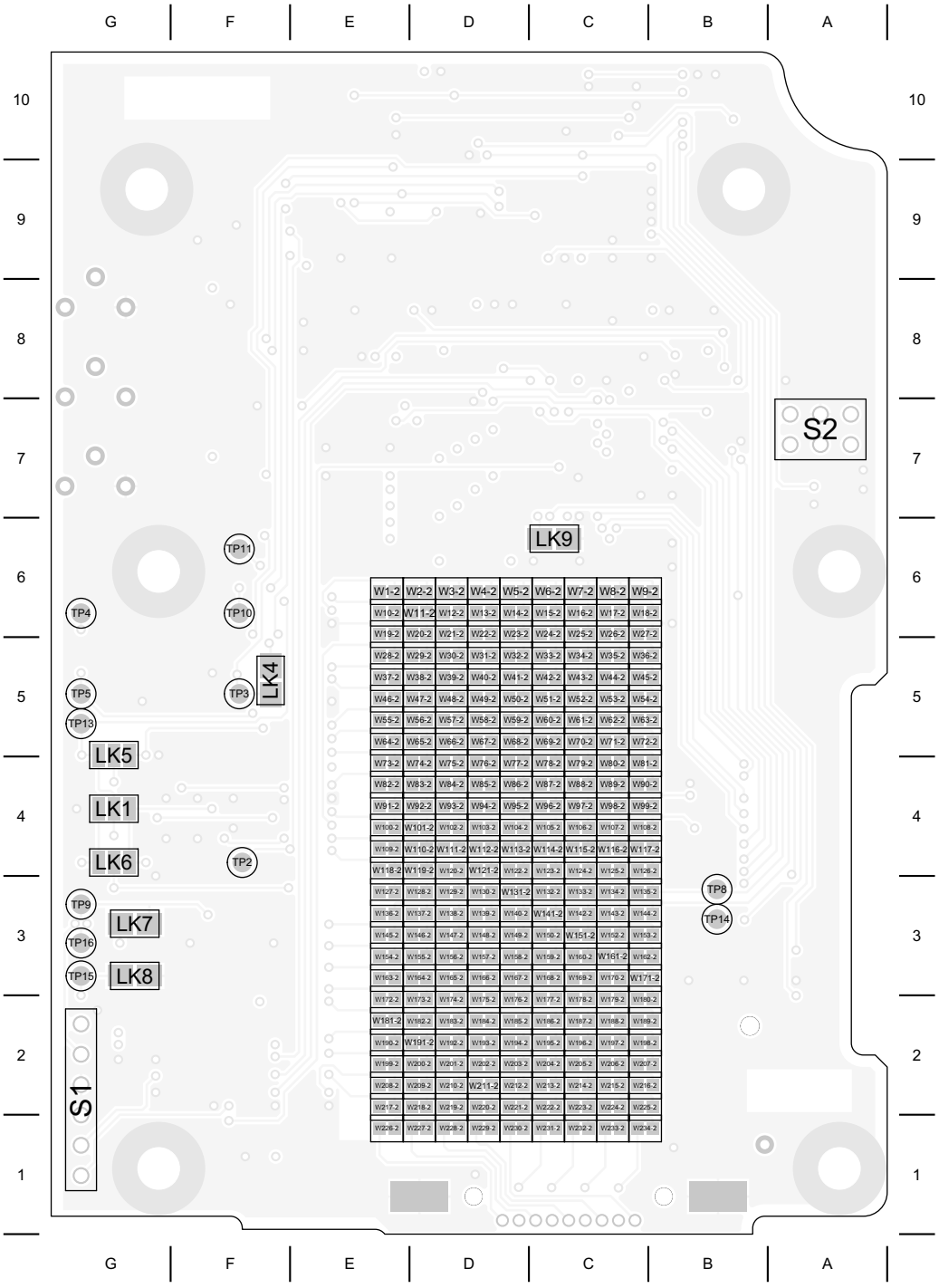
Zero ohm resistors (038-10000-00, RES 0603 0R 5% 1/10W) are fitted to the assemblies:

Ref	PCB	Schem	XA2922-01	XA2922-02	XA2922-03	XA2922-04	XA2922-05	XA2922-06
R1-2	E6	2F2	•	•	•		•	•
R11-2	D6	2F3	•		•	•	•	•
R12-2	D6	2E3			•	•	•	•
R21-2	D6	2E3	•		•	•	•	•
R23-2	D6	2D3		•				
R27-2	C6	2B3				•		
R31-2	D5	2E4	•		•	•	•	•
R41-2	D5	2D4	•		•	•	•	•
R42	C6	1C2		•				
R46	G4	1E10	•	•	•	•	•	•
R51-2	C5	2D5	•		•	•	•	•
R61-2	C5	2C5	•		•	•	•	•
R62	F6	1H8		•				
R65	G3	1F9		•				
R71-2	C5	2C6	•		•	•	•	•
R74-2	D5	2F7		•				
R77	G3	1E10		•				
R81	G2	1C11		•				
R81-2	C5	2B7	•		•		•	•
R82	G4	1E11		•				
R85-2	D4	2E7			•	•	•	•
R197-2	C2	3C7		•				
R207-2	C2	3B7		•				
R226-2	E1	3F9				•		

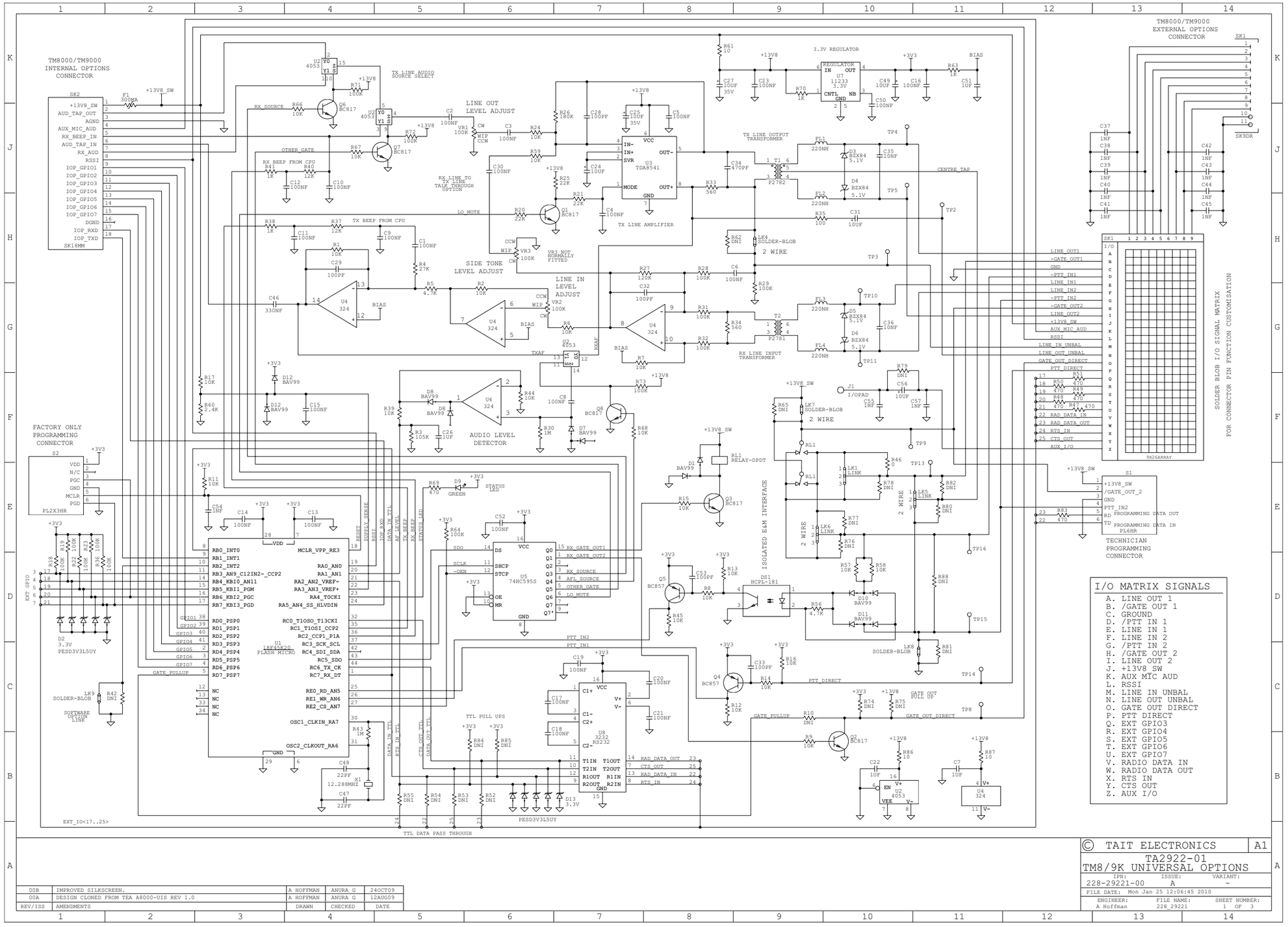
7.3 PCB layout - top side (228-29221-00)



7.4 PCB layout - bottom side (228-29221-00)



Circuit diagram (228-29221-00)



Circuit Diagram - page 2 of 11

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