

# PART **F** Accessories

This part describes how to interface accessories with Tait Orca 5000 handportables, using the Tait Orca accessory connector and the 7.5 mm accessory adaptor (both with and without the D-clip).

Detailed servicing information about the Tait Orca vehicle kit is also provided on page F-11.

A list of audio accessories currently available for use with Tait Orca 5000 handportables is found in Table A-1, on page A-8.

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## Contents

<b>Tait Orca Accessory Connector .....</b>	<b>F-3</b>
Connecting an Accessory .....	F-3
Connecting a Headset .....	F-5
Accessory Connector Signal Descriptions .....	F-6
<b>7.5 mm Accessory Adaptor .....</b>	<b>F-9</b>
<b>Tait Orca Vehicle Kit .....</b>	<b>F-11</b>
Product Codes .....	F-11
Installing a Vehicle Kit .....	F-11
Vehicle Kit Operation .....	F-11
Vehicle Kit Specifications .....	F-13
Servicing the Vehicle Kit .....	F-14
Spares Kits .....	F-15
Reskinning Kit .....	F-17
Custom Modifications .....	F-18
Vehicle Kit Circuit Descriptions .....	F-20



# Tait Orca 5000 Accessory Connector

The Tait Orca 5000 handportable has a versatile accessory interface on the rear of the radio for connecting external accessories, such as speaker microphones and headsets.

There are four Tait accessory connector kits available for Tait Orca 5000 handportables:

- Accessory Connector Kit without D-clip (TOPA-AA-006);
- RF Accessory Connector Kit without D-clip (TOPA-AA-007).
- Accessory Connector Kit with D-clip (TOPA-AA-106); and
- RF Accessory Connector Kit with D-clip (TOPA-AA-107)

Each kit contains the accessory connector PCB with the required spring probes soldered on. The board supplied with the RF accessory connector kit has four additional probes for RF applications.

Figure F-1 shows the bottom side of the accessory connector PCB and a circuit diagram of the accessory connector is shown in Figure F-4.

Table F-1 shows the signals available at the accessory connector, and the signals are described in more detail in “Accessory Connector Signal Descriptions” on page F-7.

## Connecting an Accessory

Check that your accessory is compatible with the accessory connector by referring to Table F-1 “Accessory connector signal specifications” on page F-6. If connecting a headset, refer to “Connecting a Headset” on page F-6 for connection details.

## Accessory Connector PCB Link Options

There are two optional links on the accessory connector PCB.

To turn off the radio’s internal speaker, short link 1 (‘LINK1’, shown in Figure F-1).

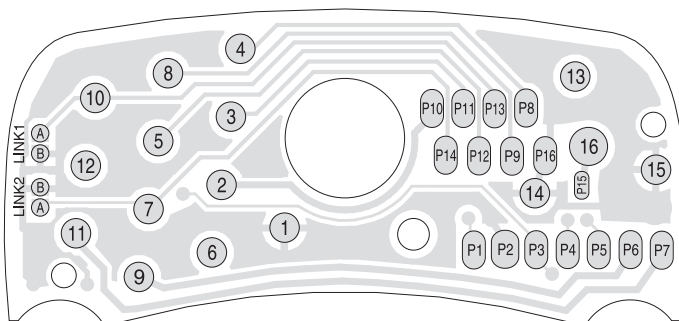
If an external switch is to be used to control the EXT-PTT line, for example in a handsfree vehicle kit, short link 2 (‘LINK2’, shown in Figure F-1).

## Accessory Connector PCB Connections

Solder pads P1 to P16 are provided on the bottom side of the accessory connector PCB for connection to external accessories. The location of these pads is shown in Figure F-1.

This diagram also shows the locations of the spring probes 1 to 16, and links 1 and 2.

Figure F-1: Tait Orca accessory connector PCB - bottom side



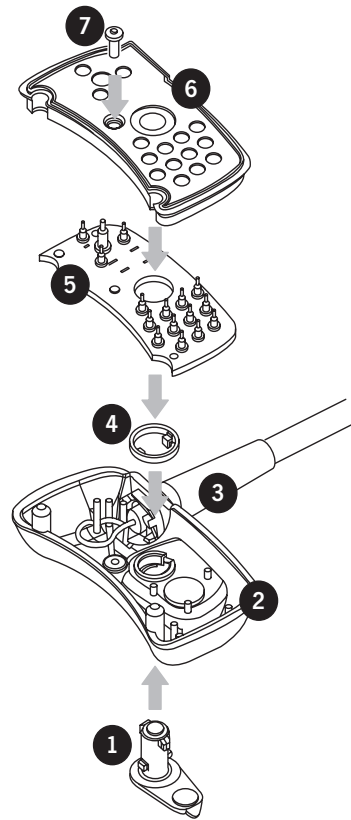
### Accessory Connector Assembly

Assemble the accessory connector (for TOPA-AA-006 and TOPA-AA-007) as shown in Figure F-2.

The order of assembly is as follows.

- 1 Fit the lock to the accessory connector housing.
- 2 Fit the retainer ring so that it holds the lock firmly to the housing.
- 3 Thread the cable from your accessory through the accessory housing, making sure it goes through in the proper direction.
- 4 Slide a grommet of appropriate size onto the cable and pull firmly so the cable and grommet fit in place.
- 5 Strip and tin the accessory signal wires.
- 6 Solder the accessory wires to the correct pads on the accessory connector PCB (refer to Table F-2 for headset connections).
- 7 Fit the accessory connector PCB links, if required.
- 8 Crimp the cable at an appropriate distance along the cable, approximately in line with the edge of the PCB.
- 9 Use narrow-nose pliers to pull out the appropriate plugs in the seal and fit it onto the PCB.
- 10 Fit the grommet and PCB/seal into the housing and secure it with the supplied screw.

Figure F-2: Accessory connector assembly diagram



- 1 lock
- 2 accessory connector housing
- 3 grommet
- 4 retainer ring
- 5 accessory PCB, complete with pins
- 6 PCB seal
- 7 screw M2\*5 Pan Pozi

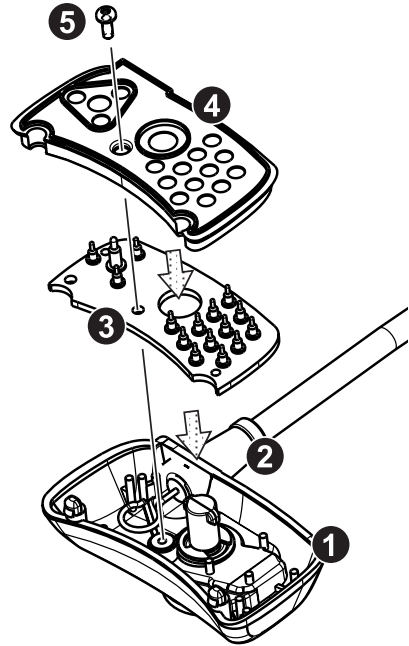
### Accessory Connector Assembly (with D-clip)

Assemble the accessory connector (for TOPA-AA-106 and TOPA-AA-107) as shown in Figure F-3.

**Note:** the accessory connector housing comes with the D-clip components already attached.

- 1 Thread the cable from your accessory through the accessory housing, making sure it goes through in the proper direction.
- 2 Slide a grommet of appropriate size onto the cable and pull firmly so the cable and grommet fit in place.
- 3 Strip and tin the accessory signal wires.
- 4 Solder the accessory wires to the correct pads on the accessory connector PCB (refer to Table F-2 for headset connections).
- 5 Fit the accessory connector PCB links, if required.
- 6 Crimp the cable at an appropriate distance along the cable, approximately in line with the edge of the PCB.
- 7 Use narrow-nose pliers to pull out the appropriate plugs in the seal and fit it onto the PCB.
- 8 Fit the grommet and PCB/seal into the housing and secure it with the supplied screw.

Figure F-3: Accessory connector assembly (with D-clip)



- 1 accessory connector housing and D-clip
- 2 grommet
- 3 accessory PCB, complete with pins
- 4 PCB seal
- 5 screw M2\*5 Pan Poz

Table F-1: Accessory connector signal specifications

Signal	Description	Type	Signal level	Output impedance /current	Input impedance
RX-DET-AF-ACC	Unmuted receive audio	Analogue audio 1.15-1.6 VDC	53-225 mV <sub>rms</sub>	2.2 kΩ	–
MOD-AUDIO	Modulator input	Analogue audio	0-4.8 V <sub>pp</sub> 2.4 VDC	–	470 Ω
+7V5-ACC*	Accessory power	DC supply	7.0 V* nominal	20 mA (max)	–
RXD-ACC	Serial receive data	CMOS	high = 0 low = 1	–	–
TXD-ACC	Serial transmit data	CMOS	high = 0 low = 1	1 mA (max)	–
SENSE-0-ACC	Accessory sense (internal speaker disable)	CMOS	high = 1 low = 0	1 mA (max)	–
SENSE-1-ACC	Accessory sense (VOX mode)	CMOS	high = 1 low = 0	1 mA (max)	–
EXT-MIC	External microphone input (electret)	Analogue audio	11 mV <sub>pp</sub> (typical) DC coupled	–	1 kΩ
EXT-PTT	External press-to-talk input	Analogue DC	0-5 V, PTT = 0 V	–	27 kΩ
EXT-SPKR	External speaker differential output	Analogue audio	±6.5 V <sub>pp</sub> differential	To drive 16 Ω differentially	–
EXT+SPKR	External speaker differential output	Analogue audio	±6.5 V <sub>pp</sub> differential	To drive 16 Ω differentially	–
RF	Accessory antenna connection	Radio frequency	Tx: 5 W <sub>rms</sub> (max)	50 Ω	–

\* Dependent on battery charge level.

## Connecting a Headset

The headset must meet the following basic specifications:

- speaker impedance: 32 Ω (16 Ω min);
- speaker power: 1/4 W<sub>rms</sub> (min);
- microphone: electret, approximately 1 kΩ; and
- PTT: switch not in line with microphone. Note that if your headset has a PTT in line with the microphone, it can be connected with the 7.5 mm accessory adaptor. See “7.5 mm Accessory Adaptor” on page F-9 for more information.

Determine the compatibility/suitability of your headset by checking Table F-1. If it is compatible, follow the assembly procedure outlined previously, on page F-4.

Solder the headset wires onto the accessory connector PCB pads, as shown in Table F-2.

To turn the radio speaker off and only have the headset speaker on, short link 1 (LK1). This ties SENSE-0-ACC to GND, telling the radio to turn the speaker off.

Note that SPEAKER+ and SPEAKER- must not short to GND, or to any other signal.

Table F-2: Accessory connector headset connections

Solder to these pads	Signal from headset
P1	MIC
P2	GND
P3	PTT
P6	SPEAKER–
P7	SPEAKER+

## Accessory Connector Signal Descriptions

### RX-DET-AF-ACC

The RX-DET-AF-ACC line carries unprocessed receive audio from the output of the detector IC.

### MOD-AUDIO

The MOD-AUDIO line is used during calibration to set up the modulation balance and by some accessories, such as modems.

### +7V5-ACC

The +7V5-ACC line supplies +7.5 V to accessories and is limited to 20 mA maximum. The output voltage itself will change depending on the battery voltage level, and there will be some voltage differential between the battery voltage and 7V5-ACC, depending on the current drawn by the accessory.

### RXD-ACC

The RXD-ACC line carries data from the accessory connector to the controller during tasks such as radio programming and calibration.

### TXD-ACC

The TXD-ACC line is a digital data line from the microprocessor and carries synchronous data from the controller to the accessory connector during tasks such as radio programming and calibration.

### SENSE-0-ACC and SENSE-1-ACC

SENSE-0-ACC and SENSE-1-ACC lines are used to detect accessories.

SENSE-0-ACC is used to turn off the radio's internal speaker. To turn off the internal speaker, tie SENSE-0-ACC to GND by shorting link 1 (LK1). The external speaker outputs are always active.

SENSE-1-ACC is used to put the radio in VOX mode when an external voice-operated switch is used to control EXT-PTT (e.g. in a handsfree vehicle kit). To do this, tie SENSE-1-ACC to GND by shorting link 2 (LK2). If the radio is being used in VOX mode on a conventional channel, then

EXT-PTT will only be sensed when it is not busy. If the radio is being used on a trunking network, then EXT-PTT will only be sensed when it is on a valid traffic channel. A trunking call must be initiated by an internal key on the radio.

### EXT-MIC

The EXT-MIC signal is an analogue input from the microphone of an accessory.

Connecting a microphone to EXT-MIC automatically turns off the radio's internal microphone.

### EXT-PTT

The EXT-PTT is an analogue signal from the accessory interface to the control area and indicates an external request for PTT and external function buttons.

### GND

The GND pin is the ground point of the accessory connector.

### BUTTON-1 and BUTTON-2

Two external accessory function buttons are available, BUTTON-1 and BUTTON-2.

The sensing of the external function buttons is determined by a voltage divider on EXT-PTT. This consists of a 27 k $\Omega$  pull up to 5 V inside the radio and a pull down resistor on the accessory PCB. The resistor pull downs for BUTTON-1 and BUTTON-2 are as follows:

- PTT function: resistor pull down 0  $\Omega$ , voltage level on EXT-PTT is 0 V;
- BUTTON-1 function: resistor pull down 12 k $\Omega$ , voltage level on EXT-PTT is 1.5 V;
- BUTTON-2 function: resistor pull down 27 k $\Omega$ , voltage level on EXT-PTT is 2.5 V.

These resistors are already fitted to the accessory PCB.

### EXT-SPKR +/-

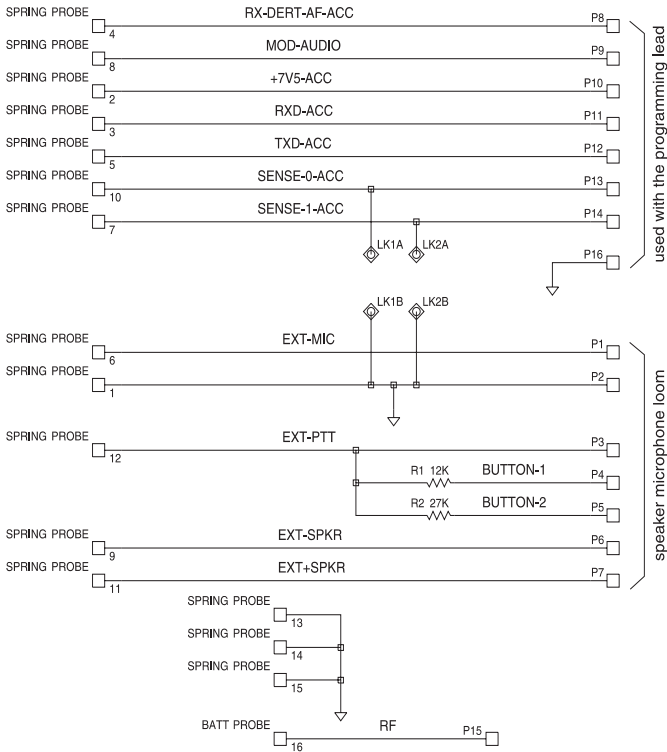
The EXT-SPKR +/- line can be used to drive an external speaker. Neither terminal should be grounded, as the output is differential.

# RF

This pin provides a connection for accessories requiring RF, such as the RF speaker micro-

phone. When an RF accessory is connected, the main antenna is switched out.

Figure F-4: Tait Orca accessory connector circuit diagram





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# 7.5 mm Accessory Adaptor

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You can connect non-Tait accessories that require a 7.5 mm adaptor to the Tait Orca handportable using the 7.5 mm accessory adaptor (TOPA-AA-005, or TOPA-AA-105 (with D-clip)).

Such accessories use 3.5 mm and 2.5 mm phono plugs with 7.62 mm spacing between them. The speaker and microphone/PTT jacks for the 7.5 mm adaptor are shown in Figure F-5.

To connect an accessory to the Tait Orca handportable that uses PTT in series with the microphone, wire the accessory to a 3.5 mm plug and 2.5 plug according to Figure F-5.

The 7.5 mm accessory adaptor differs from the standard accessory connector in that with the 7.5 mm adaptor, the PTT signal is in series with the microphone signal. The standard accessory connector has separate PTT and microphone signals. If the accessory has function buttons, they will not work with the 7.5 mm adaptor.

The main function of the 7.5 mm adaptor is to demultiplex the accessory's MIC/PTT line into

two separate lines for the Tait Orca handportable. The adaptor also detects the presence of the accessory speaker and turns off the radio's speaker.

Figure F-6 shows the circuit diagram for the 7.5 mm accessory adaptor.

When the accessory PTT switch is pressed, it connects the microphone to the adaptor between ground and the base of Q3 (see Figure F-6). This pulls Q3 low turning it on. Q3 in turn pulls the base of Q2 high which pulls the EXT-PTT line low, enabling the transmitter. Audio from the accessory microphone passes through C4 to the radio's EXT-MIC line.

When the accessory speaker is connected, the base of Q1 is pulled high via R3 and R1, turning it on. This pulls the SENSE-0-ACC line low, which tells the radio to turn off the internal speaker, and only the accessory speaker is operational. C1, C2 and C3 filter out the audio signal, so that the voltage swing of the signal will not turn off Q1.

Figure F-5: Plugs for the 7.5 mm accessory adaptor

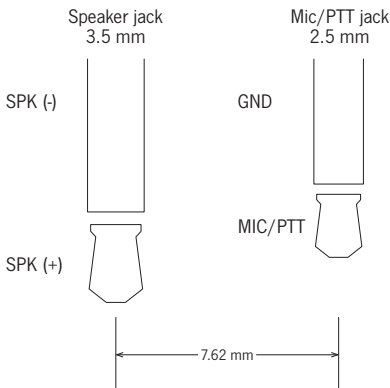
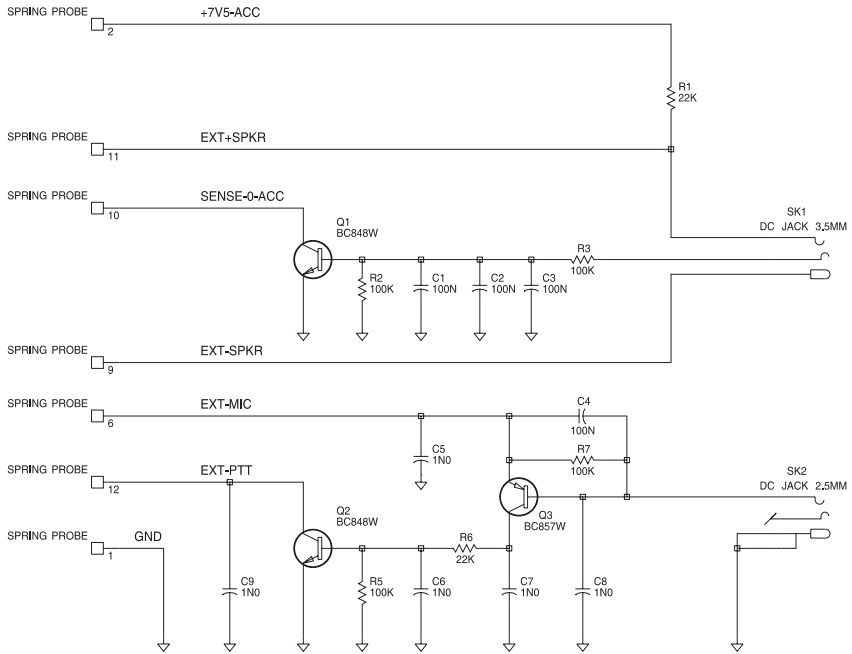


Figure F-6: Tait Orca 7.5 mm accessory adaptor circuit diagram



# Tait Orca Vehicle Kit

The Tait Orca vehicle kit provides a secure environment for a Tait Orca handportable used in a vehicle. The vehicle kit allows the radio to be connected to the vehicle's external antenna and also acts as a fast charger for the radio's NiCd battery.

Note that NiMH batteries are not charged by the vehicle kit, and that the desktop fast charger should still be used to short condition NiCd batteries each week.

This section outlines the vehicle kit operation, specifications and servicing. A detailed circuit and interface description is also provided, to allow customised modification of the vehicle kit.

## Product Codes

Table F-3 gives the product codes of available vehicle kit options and accessories.

The vehicle kits in Group A include selected mounting options and accessories. These accessories and other installation options are available separately as items in Group B.

Table F-3: Vehicle kit product codes

Product code	Description
TOPA-VK-002	Vehicle kit, no installation accessories
TOPA-VK-006	Vehicle kit with mobile microphone & mounting hardware
TOPA-VK-007	Vehicle kit with mobile microphone, speaker & mounting hardware
TOPA-VK-008	Vehicle kit with heavy duty mobile microphone & mounting hardware
TOPA-VK-009	Vehicle kit with heavy duty mobile microphone, speaker & mounting hardware
TOPA-VK-011	Vehicle kit with heavy duty microphone & speaker (no additional mounting hardware)

Group A

Product code	Description
TOPA-VK-010	Vehicle kit mounting adaptor
TOPA-VK-020	Vehicle kit single height U bracket
TOPA-VK-030	Vehicle kit double height U bracket
TOPA-VK-040	Vehicle kit triple height U bracket
TOPA-VK-050	Vehicle kit mounting plate
TOPA-VK-060	Vehicle kit charger disable kit
TOPA-VK-100	Vehicle kit mobile microphone
TOPA-VK-200	Vehicle kit external speaker
TOPA-VK-300	Vehicle kit visor microphone
TOPA-VK-400	Vehicle kit remote PTT
TOPA-VK-500	Vehicle kit heavy duty mobile mic.

Group B

## Installing a Vehicle Kit

Detailed installation instructions are provided in the *Tait Orca vehicle kit installation guide* (IPN 429-40000-xx). This guide is included with each vehicle kit.

## Vehicle Kit Operation

### Inserting the Radio

Remove the accessory connector cover from the radio.

Ensure the vehicle kit release button is down and insert the radio into the radio cavity.

Push the radio firmly into place against the locating pegs and radio interface. You should hear the radio snap into place and the release button will pop up.

### Locking a Radio in the Vehicle Kit

You can use the supplied key to lock the radio into the vehicle kit when you leave the vehicle unattended.

To lock the radio in the vehicle kit, insert the supplied key in the lock and turn it clockwise.

To unlock the radio from the vehicle kit, turn the key counterclockwise.

### Removing the Radio

To remove the radio from the vehicle kit, push the release button down. The radio can now be removed from the radio cavity.

### Charging the Battery

Once the radio is inserted into the radio cavity, the charger status LED will glow amber for three seconds, then red. When the LED glows green, the battery is charged to a minimum of 70% capacity.

If the battery is too hot or too cold, the LED will glow amber until the battery temperature is within the safe range for recharging (0°C to 50°C). If the indicator remains amber, consider turning on your air conditioning. Optimum battery charging performance is obtained between 15°C and 25°C.

Charge times when the radio is turned off are:

- up to 1½ hours for the 1100 mAh NiCd battery; and
- up to 2 hours for the 1500 mAh NiCd battery.

You can still use the radio while the battery is being charged, but the charge times will vary, depending on how much the radio is being used.

The vehicle charger functional indicators are summarised in Table F-4.

Table F-4: Charger status LED indicators

Indicator	Meaning
steady green	battery charging
steady green	battery charged to a minimum of 70% capacity
steady amber	charge suspended until battery temperature is within correct range
flashing red	battery not seated properly in the charger, contacts dirty, battery faulty or NiMH battery inserted

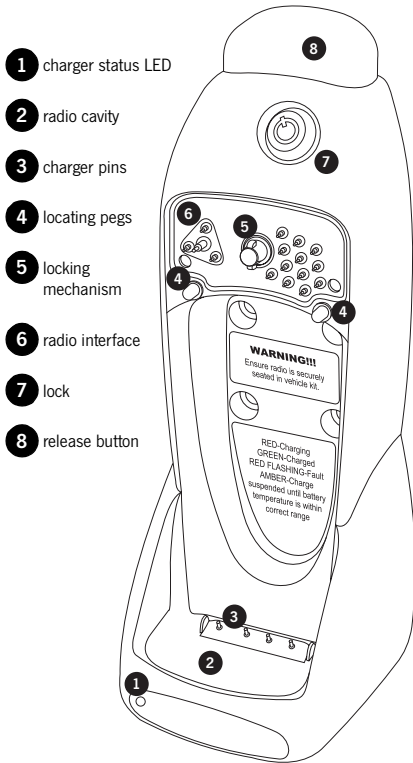


Figure F-7: Vehicle kit assembly

### Using the Radio while in the Vehicle Kit

While the radio is seated in the vehicle kit, operation remains the same, except:

- the radio's microphone will be inoperative and an external microphone such as a mobile microphone must be used; and
- the radio's speaker will be inoperative when an external speaker has been installed. Volume can be adjusted from the radio's volume control.

The standard installation results in the charger and external speaker being turned off when the ignition is off.

If the vehicle kit determines that the vehicle's battery is too low (less than 11 V), the vehicle kit will turn off.

**WARNING:** The vehicle kit uses less than 30 mA from the vehicle's battery when the ignition is off. For this reason, if you are leaving your vehicle unattended for an extended period of time (for example, more than one month), the positive fuse should be removed.

### Basic Care and Safety

- It is essential to short condition your battery weekly using the desktop fast charger.
- Wipe the radio contacts and accessory interface with a dry, lint-free cloth to remove any dirt, oil or grease.
- Do not allow the vehicle kit to come into contact with detergents, alcohols, aerosol sprays or petroleum-based products, as they may permanently damage the case.

## Vehicle Kit Specifications

The following table outlines the vehicle kit specifications. Details of test methods can be obtained from Tait Electronics Ltd.

Table F-5: General specifications

Supply voltage	13.8 VDC (nominal)
range	11 to 16 V range
protection	3 A fuses in power lead
Ambient temperature range	-10 to +60°C
Battery charger temperature range	0 to +50°C
Weight	375 g
Size W x H x D	80 mm x 230 mm x 95 mm (2 in x 5.8 in x 2.4 in)
Product supported	<ul style="list-style-type: none"><li>• all Tait Orca handportables (frequency bands up to 530 MHz supported)</li><li>• all Tait Orca belt clips</li><li>• all Tait Orca NiCd batteries</li></ul>
Note that NiMH batteries are not charged.	
Technical compliance	complies with FCC part 15, CISPR 14 and CISPR 14-2
Fast charger charge current	0.8 A
Charger control	the charger uses voltage, temperature and temperature change to safely charge and maintain battery capacity

## Servicing the Vehicle Kit

The vehicle kit contains four PCBs, and the following servicing instructions outline the disassembly of the vehicle kit to allow replacement of these PCBs.

### Servicing Warnings: Screw Head Types

There are four different types of Torx screws used in the vehicle kit: KC22x6, KC25x6, KC30x8 and KC30x10. All these screws require a Torx head screwdriver. When tightening any screws, be careful not to strip the threads in the plastic mouldings by exerting too much force.

The following table explains the torque settings required for the different Torx screw types.

Figure F-8: Vehicle kit torque specifications

Screw Type	IPN	Quantity	Torque (in.lb)
KC22x6	346-10022-06	2	2
KC25x6	346-10025-06	3	2
KC30x8	346-10030-08	2	6
KC30x10	346-10030-10	4	6

### Removing the Vehicle Kit Back Cover

The back cover is held to the front moulding by two plastic clips at the base of the unit. Insert the tip of a round screwdriver into the two holes at the bottom of the rear panel. Lever the tip upwards towards the top of the unit.

Hold the unit in such a way that your forefinger and thumb exert a slight pressure to separate the rear panel away from the front moulding, while you lever the clips with the screwdriver.

### Replacing the Accessory Probe PCB

Remove the back cover and unplug the accessory loom at the top of the options PCB. Unscrew the two KC30x10 screws holding the trigger assembly together. The trigger assembly can now be lifted out.

Note that the trigger assembly must be pressed

**downwards** while undoing these screws, as there are springs underneath.

Unplug the loom from the accessory probe PCB. Carefully use narrow nose pliers to unplug the MCX connector from the accessory probe PCB. Now remove the two KC22x6 screws on the front of the vehicle kit holding the accessory probe PCB into the front moulding. The accessory probe PCB can now be tilted upwards and removed from the moulding.

Fit the seal onto the new accessory probe PCB and reassemble the vehicle kit. Read the assembly instructions for more information.

### Replacing the Charger Probe PCB

Remove the back cover and unplug the accessory loom at the top of the options PCB. Lift the options/charger PCB assembly out of the front moulding, until the charger loom is accessible.

Unplug the charger loom and remove both PCBs from the front moulding. Note that these PCBs are still attached via the RF cable.

Unscrew the two KC30x8 screws holding the charger probe moulding into the front moulding, and slide out the probe moulding. Unscrew the three KC25x6 screws holding the probe PCB to the probe moulding. Fit the seal onto the new charger probe PCB and reassemble the vehicle kit.

### Removing the Options or Charger PCBs

Remove the two DB25 fasteners holding the back panel to the accessory/options connector. Remove the two KC30x10 screws holding the back plate to the audio PA. Unclip the backplate from the options PCB. The PCBs can now be unplugged and replaced.

When putting the options/charger assembly back into the front moulding, make sure that the charger PCB is running in its tracks. Be careful that you do not bump the LED at the bottom of the charger PCB; the PCB does not require any force to insert.

## Reassembling the Vehicle Kit

To assemble the vehicle kit, reverse the disassembly process.

Note that when doing up the KC30x10 screws the threads in the plastic PA moulding must **not** be stripped. It is important that the audio PA is held firmly against the backplate, as the backplate serves as a heatsink.

## Trigger Reassembly

When reassembling the trigger assembly, insert the peg moulding into the front panel. Insert the quarter turn moulding and rotate it until the peg moulding prevents it from turning. Drop the two springs into the peg moulding. While pressing in the trigger cap, replace the trigger assembly.

While holding the trigger assembly cover together (before doing up the screws) check that the locking mechanism works correctly. To do this, press in the locating pegs and check that the trigger cap pops up. Press the trigger cap down and check that the locating pegs pop out. If the trigger assembly does not work correctly, check that the quarter turn moulding is in the correct position and repeat the assembly process.

Tighten the two KC30x10 trigger assembly screws, while holding the trigger assembly in place.

## Rear Cover Reassembly

Locate the top of the rear cover into the back of the trigger assembly. Press the bottom of the rear cover to click/lock the cover into the front moulding.

## Spares Kits

The following table shows a list of spares kits which are currently available for servicing Tait Orca vehicle kits. These can be ordered from you local Tait dealer.

Table F-6: Vehicle kit spares kits

Product code	Description
TOPA-SP-301	Vehicle kit spares kit
TOPA-SP-302	Vehicle kit reskinning kit

The contents of these kits are shown in Tables F-6 and F-7.

Note that the 'IPN' column is the ten digit 'internal part number' which uniquely identifies any component used in a Tait product.

The numbers in the 'Legend' column refer to Figure numbers in which the spares item is shown. The numbers in brackets refer to the numbered legend within the figure, where appropriate.

Table F-7: Vehicle kit spares kit (TOPA-SP-301)

IPN	Description	Quantity supplied	Legend
OPA-VK-010	TOP vehicle kit charger PCB	1	F-13
OPA-VK-020	TOP vehicle kit options PCB	1	F-14
OPA-VK-030	TOP vehicle kit accessory probe PCB	5	F-11
OPA-VK-040	TOP vehicle kit charger probe PCB	10	F-12
219-02665-00	Cable - RF (MCX to BNC connectors)	5	F-10
219-02666-00	Cable - charger to charger probe PCBs	5	F-10
219-02667-00	Cable - options to accessory PCBs	5	F-10
240-04021-74	Mobile microphone socket (6-way vertical phone jack)	5	F-9 (3)
240-04021-82	External speaker & remote PTT sockets (3. 5 mm DC jack)	10	F-9 (4), F-9 (5)
240-04021-83	Visor microphone socket (2.5 mm DC jack)	5	F-9 (6)
240-04021-85	Power/ignition sense socket (4-way right angle PCB mounting)	5	F-9 (7)
303-11204-00	Chassis moulding	10	—
305-00007-00	Trigger moulding	10	—
305-00008-00	Quarter turn moulding	10	F-7 (5)
305-00009-00	Peg moulding	10	F-7 (4)
305-00010-00	Trigger cap moulding	10	F-7 (8)
305-00021-00	Trigger spring	10	—
305-00022-00	Peg spring	20	—
305-00023-00	Lock	5	F-7 (7)
353-05006-00	Washer 7/16 beryllium	1	—
365-00011-54	Label R1556/2 90 x 24mm	19	—
399-00010-69	Plastic bag 75 x 100mm	6	—
399-00010-53	Plastic bag 150 x 250mm	8	—
399-00010-86	Static shielding bag 127 x 203mm	2	—
365-00011-38	Yellow static warning label	2	—
937-00000-79	Label 60 x 25.4mm	0	—
410-01153-00	Packaging - unprinted carton	1	—



Table F-8: Vehicle kit reskinning kit (TOPA-SP-302)

IPN	Description	Quantity supplied	Legend
305-00003-00	Lens	4	—
305-00004-00	Front moulding	4	—
305-00005-00	Rear moulding	4	—
305-00006-00	Probe moulding	4	—
305-00012-00	Auxiliary seal	4	—
305-00013-00	Probe seal moulding	4	—
305-00015-00	Back plate	4	—
305-00023-00	Lock	4	F-7 (7)
353-05006-00	Washer 7/16 beryllium	1	—
365-01610-00	Front warning label	5	—
365-01611-00	Front operation label	5	—
365-01612-00	Rear type approval label	5	—
365-00011-54	White label R1556/2 90 x 24mm	11	—
399-00010-53	Plastic bag 150 x 250mm	1	—
399-00010-69	Mini grip plastic bag 75 x 100mm	10	—
410-01153-00	Pkg Carton SII unprinted	1	—
937-00000-79	Blazer label 60 x 25.4mm	0	—

## Custom Modifications

The following information is provided to enable modifications to be made to the standard vehicle kit installation:

- signal descriptions and specifications for the vehicle kit external connectors;
- block diagrams of the vehicle kit PCBs; and
- circuit descriptions for each vehicle kit PCB.

Detailed circuit diagrams and component location information for the vehicle kit PCBs may be obtained from the Customer Services Division. Contact your Tait dealer for more information.

### Using External Function Buttons

It is possible to interface to the radio's external function buttons through any of the vehicle kit's external PTT connections:

- the accessory data connector (SK3);
- the mobile microphone socket (SKT1); or
- the remote PTT socket (EXT-PTT).

A resistor and a switch is needed for each external function button. See "BUTTON-1 and BUTTON-2" on page F-7 for more details.

For example, it is possible to modify a standard TOP speaker microphone (e.g. TOPA-AA-001) to allow the use of external function buttons. To do this, add two resistors inside the microphone, disconnect the speaker, and crimp a 6-way phone plug onto the cable.

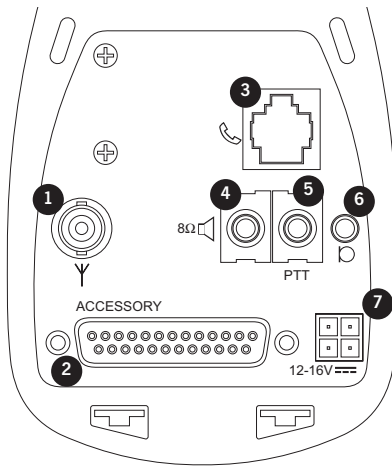
### Setting up 'Hookswitch' Functionality for a Trunked Radio

'Hook switch' functionality can be achieved by programming external function BUTTON-1 to **Clear**. As long as the microphone clip is grounded, then whenever the mobile microphone is on-hook, the call will be cleared down. You must unclip the microphone before a call can be initiated.

Note that you do not need to add any resistors,

as the mobile microphone already has an internal 12 k $\Omega$  resistor wired correctly.

Figure F-9: Vehicle kit - rear view showing external connectors



- 1 Antenna BNC connector
- 2 Accessory/data connector
- 3 Mobile microphone socket
- 4 External speaker connector
- 5 Remote PTT connector
- 6 Visor microphone connector
- 7 Power/ignition sense connector

### Vehicle Kit External Connectors

The tables on page F-19 document the signals available on all of the vehicle kit's external connectors.

Note that the 25-way accessory/data connector provides access to all of the radio's accessory signals, as well as a few vehicle kit specific signals.

See "Tait Orca 5000 Accessory Connector" on page F-3 for further details about handportable accessory signals.

Table F-9: Vehicle kit power connector  
(SK1 on the charger PCB)

Pin	Signal	Description
1	N/C	-
2	GND	Main ground connection
3	IGN	Switched accessory power - connect to permanent power to disable ignition sense
4	+13V8	Main connection to +13.8 V (vehicle battery). Use 3 A fuses.

Table F-10: Vehicle kit mobile microphone connector  
(SKT1 on the options PCB)

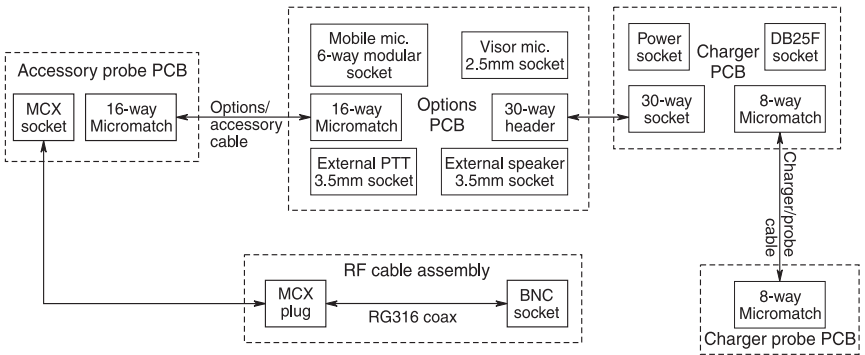
Pin	Signal	Description
1	+13V8LIM	Power out Zout = 10 $\Omega$ ; 100 mA maximum
2	N/C	-
3	EXT-PTT	External PTT and function buttons*
4	MOB-MIC	Dynamic microphone input impedance = 600 $\Omega$
5	GND	Ground
6	N/C	-

\* EXT-PTT is pulled high inside the radio by 27 k $\Omega$ . Function buttons are implemented by pull-downs to ground. For BUTTON-1, R = 12 k $\Omega$ ; for BUTTON-2, R = 27 k $\Omega$ .

Table F-11: Vehicle kit accessory/data connector  
(SK3 on the charger PCB)

Pin	Signal	Description
1	GND	Signal ground
2	RX-IN	RS-232 Receive data to radio
3	TX-OUT	RS-232 Transmit data from radio
4	N/C	-
5	BUSY	Radio receiving low = busy (including beeps)
6	AUDIO-D25	Single ended audio. Zout = 3 k $\Omega$ ; AC coupled
7	GND	Signal ground
8	EXT-MIC-D25	Microphone input Zin = 1 k $\Omega$
9	MOD-AUDIO	To modulator
10	EXT-PTT	PTT and function buttons low = PTT
11	SPKR-OFF	Turns radio and external speaker off low = off
12	RX-DET-AF	Detected receive audio (unmuted)
13	GND	Signal ground
14	+5V	5 V power 25 mA maximum
15	+7V5-ACC	7.5 V from radio 25 mA maximum
16	SENSE-0-ACC	Radio internal speaker control low = off
17	SENSE-1-ACC	-
18	SPKR+	Balanced output from audio PA
19	SPKR-	Balanced output from audio PA
20	N/C	-
21	N/C	-
22	N/C	-
23	N/C	-
24	LVSD	Low voltage shut down - turns off vehicle kit
25	+13V8FILT	13.8V power 500 mA maximum

Figure F-10: Vehicle kit interconnection diagram



### Vehicle Kit Circuit Descriptions

This section provides an outline of the design and describes the modular assembly of the vehicle kit. The vehicle kit contains four PCBs:

- the accessory probe and charger probe PCBs, interfacing to the radio and battery; and
- the charger and options PCBs, containing the electronic circuitry.

A block diagram showing how the four PCBs interconnect and naming the connectors on each PCB is shown in Figure F-10.

The following subsections and their associated diagrams expand on the functionality of each vehicle kit PCB.

### Vehicle Kit Accessory Probe PCB (IPN 220-01506-xx)

This PCB provides the interface to the handportable accessory connector. The audio/control signals connect to the options PCB via a 16-way Micromatch ribbon cable. The RF signal is routed via an MCX connector and coaxial cable to a BNC connector on the rear of the vehicle kit. A block diagram of this PCB is shown in Figure F-11.

Figure F-11: Vehicle kit accessory probe PCB block diagram

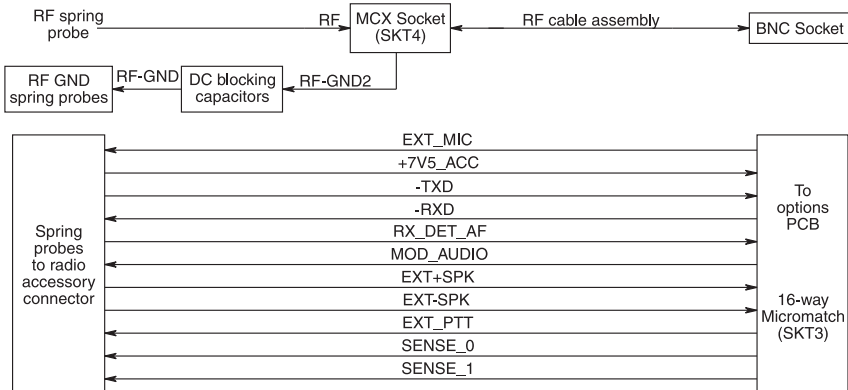
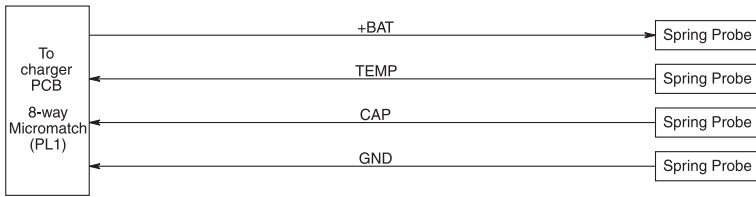


Figure F-12: Vehicle kit charger probe PCB block diagram



### Vehicle Kit Charger Probe PCB (IPN 220-01564-xx)

This PCB provides the interface to the radio battery for charging and is connected to the charger PCB via an 8-way Micromatch ribbon cable. A block diagram of this PCB is shown in Figure F-12.

### Vehicle Kit Charger PCB (IPN 220-01504-xx)

This PCB contains the fast charger circuit module, the majority of the power supply module and about half of the power save module. A block diagram of this board is shown in Figure F-13.

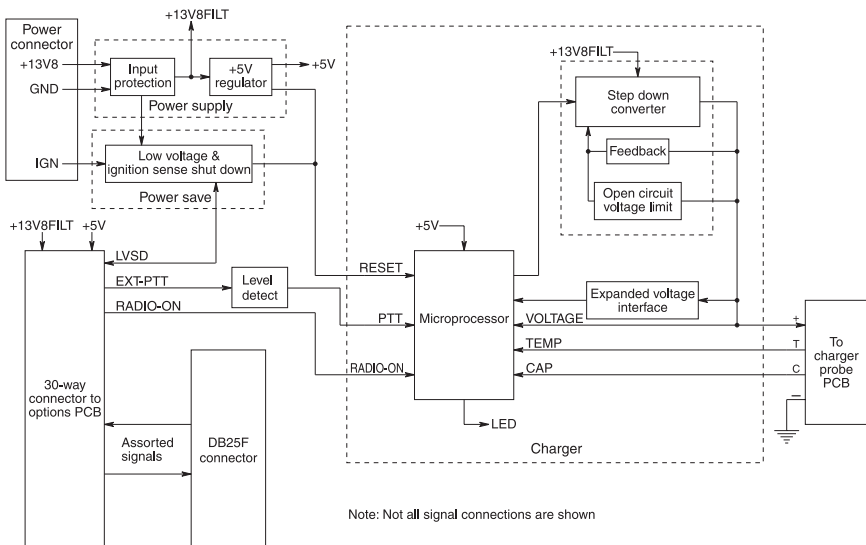
#### Current Source

The switch mode current source is based around a Maxim MAX1627 100% duty cycle,

high efficiency, step down DC-DC controller (IC4). The core of the current source is a Buck converter consisting of Q9, L2, C46, C47 and D5. The feedback for the controller (IC4) is via current sense resistors (R58, R59) and a differential amplifier (IC5:B).

In steady state, approximately 0.8 A flows through R58 and R59, generating a voltage which is amplified by the differential amplifier, IC5:B. The output of this is fed into pin 2 of IC4 (FB). The threshold of the feedback input (IC4 pin 2) is 1.3 V, relative to VGND. When the feedback signal on pin 2 is above 1.3 V, the controller (IC4) turns off Q9. Similarly, when the feedback signal is below 1.3 V, the controller turns on Q9.

Figure F-13: Vehicle kit charger PCB block diagram



D4 and R46 create a virtual ground (VGND) and protect the MAX1627 from over voltages. Conducted noise is filtered by C42, C43 and L5. The blocking diode, D6, stops the radio battery from powering the vehicle kit when the current source is off.

The radio is protected from over voltages at the battery terminal by IC5:C, IC5:D and their associated circuitry. If the voltage at the output (BAT1) reaches approximately 10.3 V, then Q3 is turned on by the Schmitt trigger IC5:D. This changes the feedback from current controlled (via IC5:B) to voltage controlled (via IC5:C). The non inverting amplifier of IC5:C is configured such that it overrides the output of IC5:B and sets the output voltage to approximately 10.6 V.

The current source is normally controlled by the micro controller (IC3). When pin 20 goes low, the current source is turned on.

#### Fast Charger Micro Controller

IC3 is a 68HC05 based micro controller, which runs custom charger software to control the current source and intelligently monitor the charge state of the battery. Note that this software behaves differently from the desktop fast charger software. When working correctly the microcontroller will always make the LED glow orange for 3 seconds whenever power is reapplied.

The line into IC3 pin 1 (RESET) is used by the 5 V regulator (IC1) to control the startup of IC3. RESET is only released by IC1, once power has stabilised and the circuits are powered up. The RESET line is also controlled by the power save circuitry, so that the fast charger can be turned off.

The control line for the current source is IC3 pin 20, with low being on and high impedance being off. This line controls the current source, via Q7.

The coarse voltage input used for general voltage measurements is IC3 pin 16. The expanded voltage input used for fine voltage

measurements is IC3 pin 17. Battery temperature is measured via IC3 pin 18. This pin is pulled to ground via a 10 k $\Omega$  (nominal) thermistor inside the battery case. The battery capacity input used to tell the charger whether the battery is NiCd or NiMH is IC3 pin 19.

The line to IC3 pin 7 is an input which tells the micro controller when the vehicle kit PTT is activated. The line to IC3 pin 9 is an input which tells the micro controller when the radio is on.

#### Vehicle Kit Power Supply Input Protection

Power to the circuit (13.8 V nominal) is provided through a Mini Fit Molex connector. Protection circuitry consists of a 22 V transient suppressor (D1) and a 2.5 A polyswitch (PS1). C11 and C12 provide some filtering of the input power.

Over voltage protection is also provided by D1. Short transient over voltage (>22 V) pulses will be clamped by D1, preventing harm to the circuit. Longer sustained over voltage conditions, such as incorrect connection to a 24 V vehicle supply, will cause D1 to conduct and eventually fail to a short circuit state. This will result in a power lead fuse blowing or PS1 tripping, if the fuses are of the incorrect rating (> 3A) or not fitted (i.e. the line is shorted).

#### Vehicle Kit Power Supply 5 Volt Regulator

IC1, an L4949, is the 5 V regulator for the vehicle kit and produces the +5 V rail. It also controls the RESET line of the micro controller under startup and will reset the micro controller if there are any voltage dips. C13 is fitted to improve output noise and transient response. C14 sets the reset delay time. The tantalum capacitor C15 maintains the stability of the output voltage. The maximum current available from the +5 V rail is 100mA.

#### Vehicle Kit Power Supply Power Save

The low voltage shut down (LVSD) circuitry on the charger PCB is used to power down sections of the vehicle kit under various condi-

tions. If the vehicle battery gets below 11 V, the Schmitt trigger built around IC2:A will go high, turning on Q1 and pulling the RESET line low. This will turn off the fast charger to conserve the vehicle battery. The output of IC2:A is also fed to the options PCB and the base of Q6. This puts the audio power amplifier (IC4) into standby to conserve the vehicle battery.

The ignition sense input to the charger PCB (IGN on pin 3 of the power connector) can be used to turn off the vehicle kit when the vehicle ignition is off. If IGN is wired to permanent power, then this feature is disabled. If IGN is wired to switched accessory power, then when the ignition is off the fast charger and the audio power amplifier are turned off via IC2:A.

LK4 is not fitted. It can be used to disable ignition sense for bench testing.

The diode (D2) in the feedback path of IC2:A is used to increase the hysteresis of the Schmitt trigger. Thus when low vehicle battery voltage triggers IC2:A, the vehicle battery must recover by approximately 1 V above the threshold before the vehicle kit will be powered up.

Note that to adjust the LVSD threshold, voltage

divider R22, R24, R25 and R26 must be changed.

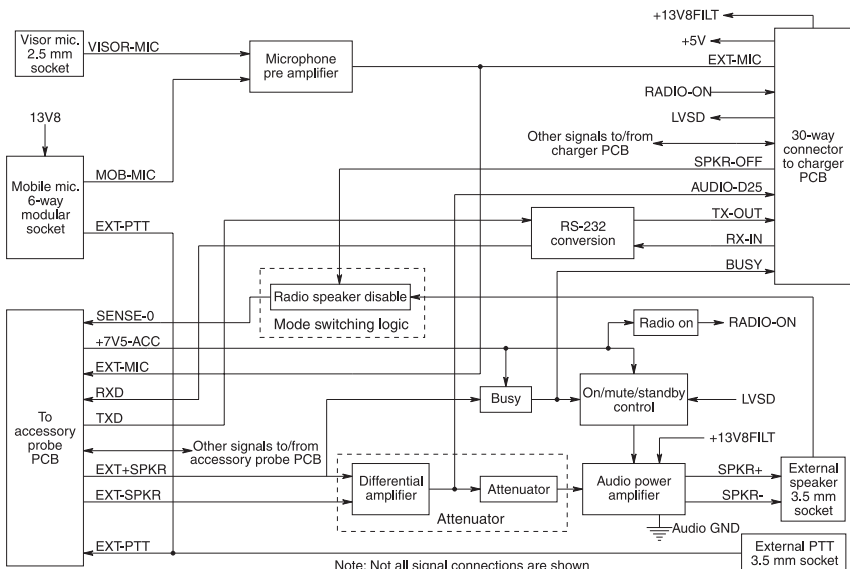
### Vehicle Kit Options PCB (IPN 220-01505-xx)

This PCB contains the mode switching logic, the microphone pre-amp, the RS-232 conversion module, the audio power amplifier with its associated input circuitry and the mute/standby module. A block diagram of this board is shown in Figure F-14.

#### Audio Power Amplifier and Associated Circuitry

The audio power amplifier takes the differential audio available at the radio accessory pins and amplifies it to drive an external speaker. The first stage is a differential amplifier (IC2:B) with a gain of -6 dB (0.5). This produces a single ended audio signal at pin 7 which is tapped off along two paths. The first path is via the voltage divider R69 and R68 which attenuate the signal by a factor of 100 (-40 dB). This signal is then AC coupled into IC4 which is configured for Bridge Tied Load (BTL) operation and has a fixed gain of 46 dB (200). IC4 is a Philips TDA1519A car audio power amplifier chip.

Figure F-14: Vehicle kit options PCB block diagram



Note that the recommended method for changing the gain of the audio power amplifier is to adjust the ratio of the voltage divider formed by R69 and R68.

The second path for the single ended audio signal present at pin 7 of IC2:B is via R78 and C52, to become the AUDIO-D25 signal. This signal has its output at pin 6 on the D25 connector on the charger PCB. The minimum input impedance of a circuit that connects to AUDIO-D25 is 6k $\Omega$ . The recommended input impedance would be 47k  $\Omega$ .

The audio PA has three modes of operation (standby, mute and on) which are set by the voltage at pin 8. A pull-up for the on mode is provided by R75, while Q3 controls the mute mode, by switching in R73 to form a voltage divider with R75. Q4 pulls IC4 pin 8 low to control the standby mode. The following table summarises the PA operation.

Table F-12: Vehicle kit option PCB - audio PA operation

Mode	Voltage Level	Controlled By
On	> 8.5 V	Q3: off Q4: off R75: Pull up
Mute	3.3 V - 6.4 V	Q3: on Q4: off R75/R73: divider
Standby	< 2 V	Q4: on

When the audio PA is in either the mute or on mode, its outputs (pins 4 & 6) are biased with a DC level of approximately 6.5 V.

A BUSY signal is created by looking at the DC bias on the EXT+SPKR signal. IC2:A is configured as a Schmitt trigger and is used to produce the BUSY signal (pin 1). R67 and C27 provide filtering of the audio signal so that IC2:A is not falsely triggered by large audio peaks. The reference signal is produced from +7V5-ACC via the voltage divider of R65 and R66.

The 7V5-ACC signal is accessory power from the radio and indicates if the radio is switched on. If there is no 7V5-ACC signal then the

audio PA is held in its standby mode via Q7 and Q4. When the DC bias is absent from EXT+SPKR, BUSY is high and the audio PA is held in its mute mode via Q3. The audio PA can also be put into standby mode via the SPK-CUT control signal being high. Q4 will always override Q3.

Putting the audio PA into standby is part of the power save feature of the vehicle kit. LVSD is a control line from the charger PCB which goes high when the vehicle battery is too low (<11V). If LVSD is high then the audio PA is put into standby mode via Q6, Q7 and Q4.

A 3.5mm stereo phono socket is used to connect the external speaker. When the mono plug of an external speaker is attached, the middle connection of the stereo socket (SPKSENSE) is shorted to one of the audio PA output signals. When the audio PA is operating there is a DC bias of approximately 6.5 V (half rail) on both of its outputs. This bias is used to turn on Q5, which pulls SENSE-0-ACC low, disabling the radio's internal speaker.

The D25 connector has a control line called SPKR-OFF on pin 2. If the accessory connected to the D25 connector has a speaker, then by pulling SPKR-OFF low all other speakers can be disabled. The SPKR-OFF signal is inverted by Q9 to produce SPK-CUT. If SPK-CUT is high, then the audio PA will be placed in standby mode via Q4 (which turns off an external speaker if it is connected). SENSE-0-ACC is pulled low to disable the radio's internal speaker.

#### Microphone Pre-Amp

A capacitor multiplier formed by Q2, R2 and C19 is used to filter the +5 V supply producing +5V-FIL which is used to provide DC bias for the microphones via R3 and R22.

The internal microphone in the radio is disabled by an impedance to ground, which is typically the electret microphone of a speaker microphone. In the vehicle kit this is accomplished by R28, which is connected to the EXT-MIC-D25 line. Thus whenever the radio is in



the vehicle kit the internal microphone is disabled.

#### RS-232 Conversion

An RS-232 level 3 wire serial port is provided at the DB25 connector (TX-OUT, RX-IN, GND), for use by devices such as data terminals. The radio provides CMOS level serial communications via the RXD and TXD signals. These signals are converted to full RS-232 voltage levels (i.e. +10 V for a logic 0, and -10 V for a logic 1) by IC3.

