



# **Tait Orca Handportable Radios**

## **Service Manual**

**Issue 03**  
**September 2001**

**IPN: 449-51000-03**

---

# Preface

---

## Enquiries and Comments

If you have any enquiries regarding this manual, or any comments, suggestions and notifications of errors, please contact Customer Support, Tait Electronics Ltd, Christchurch, New Zealand. Refer to <http://www.taitworld.com/> for more information.

## Disclaimer

There are no warranties extended or granted by this manual. Tait Electronics Ltd accepts no responsibility for damage arising from use of the information contained in the manual or of the equipment and software it describes. It is the responsibility of the user to ensure that use of such information, equipment and software complies with the laws, rules and regulations of the applicable jurisdictions.

## Updating Equipment And Manuals

In the interests of improving performance, reliability or servicing, Tait Electronics Ltd reserve the right to update their equipment and/or manuals without prior notice.

## Copyright

All information contained in this manual is the property of Tait Electronics Ltd. All rights are reserved. This manual may not, in whole or in part, be copied, photocopied, reproduced, translated, stored, or reduced to any electronic medium or machine-readable form, without prior written permission from Tait Electronics Limited. All trade names referenced are the service mark, trademark or registered trademark of the respective manufacturers.

## Publication History

Issue	Publication Date	Product Code	Description
00	August 1998	449-51000-00	New manual.
01	December 1998	449-51000-01	New revision.
02	April 2001	449-51000-02	Includes Temporary Revisions: TR1, TR2, TR3, TR4, TR5.
03	August 2001	449-51000-03	New revision.

## Contacting Tait Electronics Ltd

To contact your nearest Tait Electronics regional office, refer to the Tait Website: <http://www.taitworld.com/>

---

# Contents

---

## Part A: Introduction

<b>Servicing Tait Orca handportables .....</b>	<b>A-3</b>
WWW technical support .....	A-3
What does this manual contain? .....	A-3
What is included in the calibration service kit? .....	A-3
Programming kit .....	A-4
Conventions .....	A-4
<b>The Tait Orca series of handportables .....</b>	<b>A-5</b>
Product codes .....	A-5
The Tait product code scheme .....	A-5
Operating instructions .....	A-6
Accessories .....	A-6
<b>Important information .....</b>	<b>A-8</b>
Basic servicing precautions .....	A-8
Programming .....	A-8
Calibrating .....	A-9
Test facilities .....	A-9
Basic maintenance .....	A-9

## Part B: Radio specifications and circuit descriptions

<b>Radio specifications .....</b>	<b>B-3</b>
General specifications.....	B-3
Receiver performance .....	B-4
Transmitter performance .....	B-5
<b>Circuit descriptions .....</b>	<b>B-6</b>
Transmitter .....	B-6
Transmit (Tx) audio .....	B-6
Receiver .....	B-6
Receive (Rx) audio .....	B-7
Synthesiser and VCO .....	B-7
Power supplies .....	B-7
Accessory connector interface .....	B-8
Universal band versus wideband IF filtering.....	B-8

Part C: Diagnostics and fault finding

**Test facilities .....C-3**

Error codes ..... C-3

Test commands..... C-5

Calculating the parameters required for test command 101..... C-7

**Fault finding charts .....C-8**

Fault finding – Radio cannot be switched on ..... C-9

Fault finding – Cannot change channel (Orca Elan and Orca Excel) ..... C-10

Fault finding – No serial communication ..... C-11

Fault finding – Receive faults ..... C-12

Fault finding – Cannot transmit ..... C-13

Fault finding – No transmit audio ..... C-14

Part D: Servicing the radio

**Servicing the radio .....D-3**

Screw head types ..... D-3

**Disassembling the radio .....D-4**

Removing the front panel from the chassis ..... D-4

Removing the shield from the chassis ..... D-5

Removing the PCB from the chassis ..... D-6

Removing the rear panel ..... D-7

**Replacing key mechanical and ancillary devices .....D-8**

Replacing the lens (Orca Excel and Orca Eclipse) ..... D-8

Replacing the PTT keypad ..... D-8

Replacing the speaker ..... D-9

Replacing the LCD display (Orca Excel and Orca Eclipse) ..... D-9

Replacing the shield, user interface PCB assembly and polyester dome  
(Orca Excel and Orca Eclipse) ..... D-12

Replacing the antenna connector, channel selector switch (Orca Elan and Orca Excel)  
and volume control switch (Orca Elan and Orca Excel) ..... D-12

Replacing the microphone ..... D-12

Replacing the battery and speaker contacts ..... D-12

Replacing the tact switch ..... D-12

**Reassembling the radio .....D-13**

Rear panel reassembly and replacing the auxiliary flexible PCB ..... D-13

Fitting the PCB to the chassis and replacing the RF out assembly ..... D-14

Fitting the shield to the chassis ..... D-14

Fitting the front panel to the chassis ..... D-15

**Spares kits .....D-16**

Orca Elan spares kit (TOPA-SP-101)..... D-17

Orca Excel spares kit (TOPA-SP-103)..... D-18

Orca Eclipse spares kit (TOPA-SP-108)..... D-19

Orca Elan re-skinning kit (TOPA-SP-102)..... D-20

Orca Excel re-skinning kit (TOPA-SP-104) ..... D-20

Orca Eclipse re-skinning kit (TOPA-SP-109)..... D-20

**Part E: Battery packs and chargers**

**Battery packs ..... E-3**

Battery shift life .....E-3

Disposing of used nickel-cadmium batteries .....E-4

**Battery chargers ..... E-5**

**Desktop fast charger ..... E-6**

Fast charger operation .....E-6

Using the fast charger .....E-9

Repairing the fast charger .....E-10

**Desktop trickle charger ..... E-12**

Trickle charger operation .....E-12

Using the trickle charger .....E-13

Repairing the trickle charger .....E-13

Troubleshooting .....E-13

**Multi-charger ..... E-15**

Multi-charger operation .....E-15

Repairing the multi-charger .....E-15

Fuse replacement .....E-16

**Part F: Accessories**

**Tait Orca accessory connector ..... F-3**

Connecting an accessory ..... F-3

Connecting a headset ..... F-5

Accessory connector signal descriptions ..... F-6

**7.5 mm accessory adaptor ..... F-8**

**Tait Orca vehicle kit ..... F-10**

Product codes ..... F-10

Installing a vehicle kit ..... F-10

Vehicle kit operation ..... F-10

Vehicle kit specifications ..... F-12

Servicing the vehicle kit ..... F-13

Spares kits ..... F-14

Vehicle kit spares kit (TOPA-SP-301)..... F-15

Vehicle kit reskinning kit (TOPA-SP-302)..... F-15

Custom modifications ..... F-16

Vehicle kit circuit descriptions ..... F-18

**Part G: Additional information**

**Glossary ..... G-3**

**Tait Electronics Limited Software Licence Agreement ..... G-7**

# PART A Introduction

This part provides an introduction to servicing Tait Orca handportables. It includes an outline of the Tait Orca handportable range of products and precautions that should be taken before servicing Tait Orca handportables.

Detailed servicing instructions and information about spare parts are found in *Part D: Servicing the radio*.

---

## Contents

<b>Servicing Tait Orca handportables .....</b>	<b>A-3</b>
WWW technical support .....	A-3
What does this manual contain? .....	A-3
What is included in the calibration service kit? .....	A-3
Programming kit .....	A-4
Conventions .....	A-4
<b>The Tait Orca series of handportables .....</b>	<b>A-5</b>
Product codes .....	A-5
The Tait product code scheme .....	A-5
Operating instructions .....	A-6
Accessories .....	A-6
<b>Important information .....</b>	<b>A-8</b>
Basic servicing precautions .....	A-8
Programming .....	A-8
Calibrating .....	A-9
Test facilities .....	A-9
Basic maintenance .....	A-9





---

# Servicing Tait Orca handportables

---

The Tait Orca series of handportables is a range of high performance, microprocessor-controlled radios manufactured using an RF-shielded PCB and high-density SMD componentry.

The manufacturing process does not allow direct servicing access to components on the main PCB, although replacement PCBs are available on an exchange basis. Service repairs of Tait Orca handportables are therefore limited to key mechanical and ancillary devices associated with the main PCB. These include:

- the front panel assembly;
- the lens (Orca Excel and Orca Eclipse);
- the PTT keypad;
- the speaker;
- the keypad (Orca Excel and Orca Eclipse);
- the volume plate and keypad (Orca Eclipse);
- the LCD display (Orca Excel and Orca Eclipse);
- the shield, complete with user interface PCB assembly and polyester dome (Orca Excel and Orca Eclipse);
- the main PCB assembly;
- the antenna connector;
- the channel selector switch (Orca Elan and Orca Excel);
- the volume control switch (Orca Elan and Orca Excel);
- the microphone;
- the speaker contacts;
- the battery contacts;
- the PTT tact switch;
- the RF out assembly; and
- the auxiliary flexible PCB.

The repair of PCB-related faults is the responsibility of the Tait repair centre, Tait Communications Ltd, Christchurch, New Zealand.

Detailed schematics and component location information for the main PCB may be obtained from the Customer Service Department at Tait Electronics Ltd. Contact your Tait dealer for more information about these two services.

## WWW technical support

Tait Electronics Ltd provides product support at the following address:

<http://www.taitworld.com/support>

At this site, you can send a request for support.

## What does this manual contain?

This manual is supplied as part of the Tait Orca handportable service kit, and provides the following:

- general information and specifications on the Tait Orca series of handportables;
- basic circuit descriptions;
- information on finding and servicing of non-PCB-related faults;
- information on Tait Orca battery packs and chargers;
- information on interfacing accessories to Tait Orca handportables; and
- a glossary of key terms.

For servicing information on Tait Orca 5000 series handportables, refer to the Orca 5000 service manual, order number M5000-00-10X.

## What is included in the calibration service kit?

The calibration service kit contains:

- calibration test unit (TOPA-SV-004);
- radio calibration cable for connecting the radio to the calibration test unit (TOPA-SV-007);
- 25 pin RS232 to modular phone jack programming lead for connecting the calibration test unit to a PC (TOPA-SV-012);
- DC service adaptor (TOPA-SV-005);
- SMA to N-type RF test lead for connecting to the radio's antenna connector (TOPA-SV-006);
- T6 driver bit and 8 mm socket (TOPA-SV-011);
- this manual; and
- Programming Utilities CD, which contains the Calibration Application, Conventional and Trunked Programming Applications, and Download and Configuration Application. It also contains PDF versions of all associated manuals.

Other items required for calibration but not included as part of the service kit are:

- RF communications test set (e.g. HP8920, MI2945/55, CMS52);
- digital current meter capable of measuring current up to 3 A, accurate to two decimal places;;
- DC power supply, 7.5 V, 3 A for handportables; and
- DC power supply, 13.8 V, 7 A for mobile radios.

## Programming kit

The programming kit for the Tait Orca series of handportables contains:

- accessory connector to modular phone

socket programming cable for connecting the radio to the programming lead (TOPA-SV-003); and

- 25 pin RS232 to modular phone jack programming lead for connecting the programming cable to a PC (TOPA-SV-012); and
- Programming Utilities CD, which contains the Calibration Application, Conventional and Trunked Programming Applications, and Download and Configuration Application. It also contains PDF versions of all associated manuals.

## Conventions

Throughout this manual, the names of software screen, field and menu names are referred to in **bold sans serif font**. For example:

Check that the information in the **Radio Model** fields (**Specifications** screen) is correct.

# The Tait Orca series of handportables

There are three Tait Orca series handportables available:

- the Orca Elan;
- the Orca Excel; and
- the Orca Eclipse.

This manual includes information specific to all three handportables. As new features and enhancements occur, new revisions of this manual will be released.

## Product codes

The digits in the Tait Orca product code provide information about the radio's functional parameters and various hardware options, according to the scheme outlined in Figure A-1. The product code scheme is not intended to imply that any particular combination of radio features is at present available or planned for later release. For more information on the products, contact your nearest Tait dealer.

Figure A-1: The Tait Orca product code scheme

TOP-abcde-mn	
Compliance Code (see note 8)	
TOP – Tait Orca Portable	c – User interface:
a – Frequency band:	1 Elan
A 66~88 MHz	2 Excel
B 136~174 MHz	3 Eclipse
C 174~225 MHz	d – Air interface:
D reserved	1 Conventional PMR
E reserved	2 MPT 1327 trunked
F reserved	3 <i>LTR trunked (see note 1)</i>
G 336~400 MHz	e – Reserved for compliance-relevant changes:
H 400~470 MHz	0 Initial default
I 450~530 MHz	m – Badging:
J 806~870 MHz Tx	G Reserved
851~870 MHz Rx	T Tait
K 896~941 MHz Tx	V TEL (Argentina, see note 7)
935~941 MHz Rx	U Unbadged (see note 8)
b – Channel space/IFBW:	Z Reserved
1 12 kHz <i>Medium IFBW (MB) –</i>	n – Custom variations not affecting compliance:
20/25/30 kHz <i>Channel spacing</i>	0 Initial default
(see note 1)	
2 10 kHz Universal IFBW (UB) –	
12.5/15/20/25/30 kHz Channel	
spacing	

## The Tait product code scheme

The Tait product code scheme is intended to describe the meaning of the various characters used in Tait Orca Product Codes. It is not a design-a-product menu. Supply of products not yet built can be negotiated, but are subject to commercial justification by Tait Electronics Ltd, and possible regulatory compliance.

### Notes:

1. Information in *italics* refers either to obsolete or planned new items which are not available at the issue date of this document.
2. The offer of any product in any market is subject to adequate regulatory compliance.

3. Care must be taken not to enter alpha O instead of numeral 0, or alpha I instead of numeral 1. With the exception of I as a band designator, alphas I & O will not be used in this scheme.
4. This scheme does not address coding for packed ensembles of radio, battery, charger, antenna and/or other accessories.
5. Lower-case alpha character-location designation can be used as a convenient shorthand when listing products or compliances such as TOP-B2xy0, where x = 1~3, y = 1 or 2.
6. 'V' identifies TEL badged products are for sale in Argentina, where the name 'Tait' is registered to another Company.
7. 'U' identifies accessories which are generally Tait-badged, but an unbadged version has been produced for use with radios carrying a non-Tait badge.
8. The Compliance Code underline addresses regulator concerns that the full (3-group) code appearing on the product is not the same as the 2-group code under which Compliance was obtained. It appears only on the product label and some regulatory declarations.

This also permits the same Compliances to apply regardless of badging or minor custom variations expressed in the 3rd group. However, note that the first 2 groups of the Product Code may not necessarily be the same as the Compliance Code.

### Operating instructions

A user's guide is available for each radio. Figure A-9 shows the naming convention for Tait Orca radio user's guides.

# 409-00ABC-DD

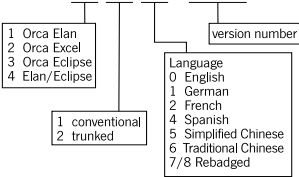


Figure A-9: Naming convention for Tait Orca handportable user's manuals

### Accessories

Table A-1 shows the accessories available for Tait Orca handportables. Of these accessories, only the chargers are serviceable.

For more information on chargers, see *Part E: Battery packs and chargers*. The six battery packs available for Tait Orca handportables are also described in Part E.

#### Fitting an accessory

To fit some accessories to the radio, you will need to remove the rear accessory cover. Remove the battery, then insert the end of a key underneath the bottom edge of the accessory cover. Lift to remove the cover.






When attaching or removing an accessory, ensure that the lever is in the upright position. Once the accessory is in position, rotate the lever 90 degrees counterclockwise to lock it in place.

Note: The D-clip used in Tait Orca 5000 series handportables is not compatible with Orca Elan/Excel/Eclipse handportables.

#### Fitting a non-Tait accessory

See *Part F: Interfacing non-Tait accessories* for information on using non-Tait accessories with Tait Orca handportables.

Table A-1: Tait Orca handportable accessories

Type of accessory	Product code	Description
Antennas	TOPA-AN-101	136-230 MHz 3" helical
	TOPA-AN-102	336-530 MHz 3" helical
	TOPA-AN-201	136-330 MHz 6" helical
	TOPA-AN-202	400-530 MHz 6" 1/4 wave whip
	TOPA-AN-204	806-870M 1/2 wave gain
	TOPA-AN-205	896-941M 1/2 wave gain
	TOPA-AN-301	66-88MHz 10" helical
Audio accessories	TOPA-AA-001	Speaker microphone -10°C, two function buttons
	TOPA-AA-002	Speaker microphone -30°C heavy duty, two function buttons
	TOPA-AA-003	Speaker microphone -30°C MIL spec
	TOPA-AA-004	Speaker microphone -30°C MIL spec RF
	TOPA-AA-005	7.5 mm accessory adaptor
	TOPA-AA-006	Tait Orca accessory connector kit
	TOPA-AA-007	Tait Orca RF accessory connector kit
	TOPA-AA-008	Speaker microphone, -30°C MIL spec, no function buttons, high/ * low volume
	TOPA-AA-009	2-wire palm microphone and earphone*
	TOPA-AA-010	3-wire lapel microphone and earphone*
	TOPA-AA-011	Light weight single speaker headset with in-line PTT*
	TOPA-AA-012	Over-the-head headset with noise cancelling boom microphone*
	TOPA-AA-013	Behind-the-head headset with noise cancelling boom microphone*
Batteries	T952-051	Earphone kit with coil cord and 2.5 mm plug†
	TOPB100	1100 mAh NiCd battery pack
	TOPB200	1500 mAh NiCd battery pack
	TOPB400	1500 mAh NiMH battery pack
	TOPB500	2000 mAh NiMH battery pack
	TOPB600	1100mAh NiCd battery pack (slim, no belt clip)
	TOPB700	1500 mAh NiMH battery pack (slim, no belt clip)
Battery chargers	TOPA-CH-100	Desktop trickle charger
	TOPA-CH-200	Desktop fast charger
	TOPA-CH-300	Six-way multi-charger
Plug packs (for TOPA-CH-200)	T952-012	Australia, New Zealand and China (230 V 50 Hz input; plug configuration:  )
	T952-022	Singapore and Middle East (230 V 50 Hz input; plug configuration:  )
	T952-032	Mainland Europe (230 V 50 Hz input; plug configuration:  )
	T952-042	USA and Canada (115 V 60 Hz input; plug configuration:  )
	T952-052	UK and Hong Kong (230 V 50 Hz input; plug configuration:  )
Carrying accessories	TOPA-CA-001	Heavy duty carry case
	TOPA-CA-002	Heavy duty holster
	TOPA-CA-007	38 mm belt clip x 1
	TOPA-CA-003	38 mm belt clip x 10
	TOPA-CA-004	Accessory port cover x 10
	TOPA-CA-005	55 mm belt clip
	TOPA-CA-006	55 mm belt clip x 10

\* For use with TOPA-AA-005

† For use with TOPA-AA-003, TOPA-AA-004 and TOPA-AA-008

---

# Important information

---

## Basic servicing precautions

Tait Orca handportables require specialised servicing techniques and should only be serviced at an approved Tait service centre equipped with the necessary facilities.

Standard anti-static procedures should be followed; a typical setup is shown in Figure A-1.

If in doubt, contact Tait Electronics Ltd or your nearest Tait dealer.

## Warning!!!

Repairs attempted with incorrect equipment or by untrained personnel may result in permanent damage.

## Caution: CMOS devices

This equipment contains CMOS devices, which are susceptible to damage from static charges. Care when handling these devices is essential. For correct handling procedures, refer to manufacturers' data books covering CMOS devices, such as *Philips Data Handbook Covering CMOS Devices* or *Motorola CMOS Data Book Section 5 (Handling Procedures)*.

## Screw head types

Torx recess head screws and Pozidriv recess head screws require the correct sized driver to achieve best performance. Most of the screws in Tait Orca handportables are Torx head screws, and so a Torx T6 driver bit is supplied as part of the service kit. Some earlier radios have Pozidriv screws.

Torx head 1.8\*5 mm screws should be removed using the supplied Torx T6 driver. When replacing these screws, set the driver to 2 inch pounds.

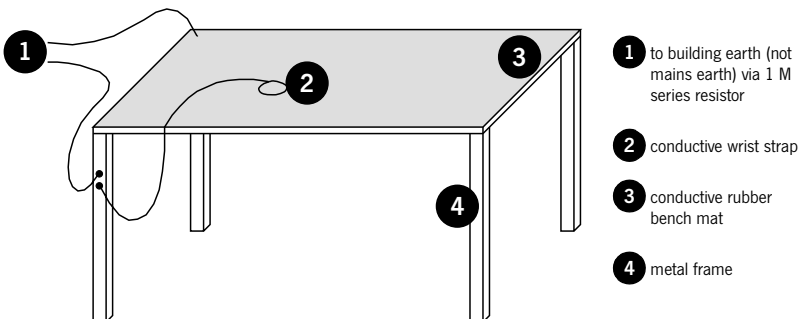
Pan Pozi M2\*8 mm and M2\*5 mm screws should be removed using a Pozi 1 driver. When replacing these screws, set the driver to 2 inch pounds.

## Programming

For information on programming Tait Orca handportables, refer to:

- the *Tait Orca Trunked Programming Application User's Manual* or the online help;
- the *Tait Orca Conventional Programming Application User's Manual* or the online help.

Figure A-1: Typical anti-static bench setup



The User's Manuals are on the Tait Programming Utilities (TPU) CD-ROM, which is included, together with this manual, as part of the calibration service kit.

## Calibrating

For information on calibrating Tait Orca handportables, refer to:

- the *Tait Orca Calibration Application User's Manual* or the online help.

The User's Manual is on the Tait Programming Utilities (TPU) CD-ROM, which is included, together with this manual, as part of the calibration service kit.

## Test facilities

Standard test facilities provide a way of testing the radio's functions independently of normal radio operation. See *Part C: Diagnostics and fault finding* for a description of the test facilities available for Tait Orca handportables.

## Basic maintenance

Your Tait Orca handportable requires no regular maintenance other than ensuring that the battery has sufficient charge, the battery contacts are kept clean and unobstructed, and that no damage has occurred to the antenna or the battery pack.

### General care

- Wipe the accessory connector contacts and radio display with a dry lint-free cloth to remove any dirt, oil or grease.
- Use a cloth dampened with clean water to clean the radio's case and display lens, but do not immerse the radio in fluids.
- Do not allow the radio to come into contact with detergents, alcohol, aerosol sprays or petroleum-based products as they may permanently damage the case.
- Avoid high temperatures. If the radio overheats, it will cease to function. You will hear two short high-pitched beeps.

## Troubleshooting

If you are experiencing difficulty operating your Tait Orca handportable check the following items:

- Is the battery firmly attached to the radio?
- Are the battery contacts clean and unobstructed?
- Is the battery sufficiently charged?
- Is the battery charger working properly?
- Is the antenna damaged?

For Fault Finding Charts see Figures C-1 to C-6 starting on page C-9. For further troubleshooting on batteries and chargers, see page E-15.

If all appears to be in order but your radio still fails to operate properly, consult your local Tait dealer for assistance.





# PART B Radio specifications and circuit descriptions

This part outlines the radio specifications and circuit descriptions for Tait Orca handportables.

---

## Contents

<b>Radio specifications .....</b>	<b>B-3</b>
General specifications .....	B-3
Receiver performance .....	B-4
Transmitter performance.....	B-5
<b>Circuit descriptions .....</b>	<b>B-6</b>
Transmitter .....	B-6
Transmit (Tx) audio .....	B-6
Receiver .....	B-6
Receive (Rx) audio .....	B-7
Synthesiser and VCO .....	B-7
Power supplies .....	B-7
Accessory connector interface .....	B-8
Universal band versus wideband IF filtering.....	B-8



# Radio specifications

The performance figures outlined in Tables B-1 to B-3 are typical figures, unless otherwise stated, for equipment operating at standard room temperature.

The test methods used to obtain these figures are those described in the European Telecommunication Standard ETS 300-086. Where applicable, the EIA figure is also given.

Table B-1: General specifications

Size W x H x D (including 1100 mAh NiCd battery)	62 mm x 153 mm x 44 mm (2.4 in x 6.0 in x 1.7 in)
Weight (including 1100 mAh NiCd battery)	
Orca Elan	495 g (17.5 oz)
Orca Excel	520 g (18.3 oz)
Orca Eclipse	520 g (18.2 oz)
Switching band	A 66-88 MHz B 136-174 MHz C 174-225 MHz G 336-400 MHz H* 400-470 MHz I 450-530 MHz J 806-870 MHz Tx 851-870 MHz Rx K 896-941 MHz Tx 935-941 MHz Rx
* Note that H band may be split into TOP-HxxxL (Rx 400-450 MHz, Tx 400-440 MHz) and TOP-HxxxH (440-470 MHz).	
Frequency increments	5, 6.25 kHz
IF bandwidth	
Narrowband	9 kHz
Medium/wideband	20 kHz
Universal bandwidth (UB)	10 kHz
Channel spacing	12.5/20/25 kHz

Details of test methods and the conditions that apply for type approval testing in all countries can be obtained from Tait Electronics Ltd.

Supply voltage	6.0-9.0 V
Standard test voltage	7.5 V
Battery capacity	
NiCd (TOPB100, 600)	1100 mAh
NiCd (TOPB200)	1500 mAh
NiMH (TOPB400, 700)	1500 mAh
NiMH (TOPB500)	2000 mAh
Current consumption*	
Transmitting (1 W)	1.0 A
Transmitting (4/5 W)	1.8 A
Receive (rated audio)	270 mA
Standby (conventional)	80 mA (no economy mode) 40 mA (economy mode high)
Standby (trunked)	100 mA (hardware version 00.xx) 90 mA (hardware version 02.xx)
Scanning (conventional)	75 mA (economy mode on)
Frequency stability	±2.5 ppm from -30 °C to +60 °C

\* Note that the figures for current are dependent upon the functions active in the radio and the operating frequency.

Table B-2: Receiver performance

Sensitivity		Spurious responses	
12 dB SINAD	-117 dBm (minimum) -120 dBm (typical) .25 $\mu$ V (EIA)		70 dB
20 dB psophometric	-114 dBm (minimum) .40 $\mu$ V (EIA)	Intermodulation	65 dB 70dB (EIA)
Ultimate signal to noise ratio		Blocking	-13 dBm
narrowband	40 dB	Spurious emissions	
wideband	45 dB	to 1 GHz	-57 dBm (conducted and radiated)
Audio		1 to 4 GHz (136-470 MHz)	-47 dBm (conducted and radiated)
Minimum load impedance	13 $\Omega$	1 to 12.75 GHz (>470 MHz)	-47 dBm (conducted only)
Rated power	500 mW (1kHz, 60% deviation into 16 $\Omega$ )	Group delay variation	
Distortion	<5% (1kHz, 60% deviation at rated power into 16 $\Omega$ )		$\pm$ 50 $\mu$ s (at detected audio output) bandwidth 300-3000 Hz
Response	-6 dB/oct +1, -3 dB (cf 1 kHz), 300-2550 Hz (narrowband) 300-3000 Hz (wideband)	Hum and noise	40 dB
Selectivity		RSSI	
to 225 MHz	70 dB (narrowband) 75 dB (mediumband) 75 dB (wideband)	range	-120 to -40 dBm
UHF	66 dB (narrowband) 72 dB (mediumband) 72 dB (wideband)	slope	28.65 mV/dB (typical)
		Squelch	
		city	16 dB <sub>SINAD</sub> fixed
		country	12 dB <sub>SINAD</sub> fixed

Table B-3: Transmitter performance

Power output		Trunking data deviation (as per MPT1327)	
136-174 MHz	1 W (low) 2.5 W (medium) 5 W (high)	narrowband	1.5 kHz
174-530 MHz	1 W (low) 2.5 W (medium) 4 W (high)	mediumband	2.4 kHz
806-941MHz	1 W (low) 2 W (medium) 3 W (high)	wideband	3 kHz
Duty cycle		FM hum and noise	
20% (1 minute Tx, 4 minutes Rx at maximum temperature and voltage)		narrowband	40 dB
Spurious emissions		wideband	45 dB
to 1 GHz	-36 dBm (conducted and radiated)	Audio response	
1 to 4 GHz (136-470 MHz)	-30 dBm (conducted and radiated)	below limiting	6 dB/oct +1, -3 dB (cf 1 kHz) 300-3000 Hz
1 to 12.75 GHz (470-870 MHz)	-30 dBm (conducted only)	in limiting	0 dB +0, -4 dB (cf maximum system deviation) 450-2550 Hz
Adjacent channel		above 3 kHz	-35 dB/oct min
narrowband	60 dBc	input for 60% deviation	5 mV <sub>rms</sub>
mediumband	70 dBc	distortion	<5% at 1 kHz
wideband	70 dBc	Ruggedness	
Group delay variation		2 minutes (into infinite SWR)	
bandwidth	±50 µs (at mod audio output) 300-3000 Hz	Stability	
Modulation type		5:1 SWR (all phase angles, <60 dBc)	
Deviation limiting			
narrowband	±5 kHz (adjustable up to) ±2.5 kHz		
mediumband	±4.0 kHz		
wideband	±5.0 kHz		

---

# Circuit descriptions

---

Figures B-1 and B-2 and show the circuit interface diagram for the Tait Orca handportable.

The Tait Orca handportable has been designed to be totally electronically tuned using the *Calibration System for Tait Orca Radios*. The titles of tests referred to below are tests available in the calibration system, e.g. **Power Level** test refers to the **Power Level** screen in the calibration system. Consult the calibration system *User's Manual* for more information on specific calibration tests.

## Transmitter

The RF power amplifier amplifies transmit RF from the VCO to the output power level (4W UHF/5W VHF). The PA output is fed to the PIN switch, which provides isolation between the transmit and receive paths.

An LPF follows the PIN switch and provides attenuation of unwanted high frequency signals.

Following the LPF, the signal is fed to the antenna.

The output power level is controlled by the microprocessor and associated circuitry, and is initially set by calibrating the radio (**Power Level** test).

## Transmit (Tx) audio

Tx audio from the microphone is processed by the DSP and associated circuitry into two modulation signals, one required by the TCXO in the synthesiser and the other by the VCO.

A digital pot is used to set the overall deviation and modulation balance; these are controlled by calibration (**Maximum Deviation** and **Modulation Balance** tests).

## Receiver

RF from the antenna is fed via the LPF and PIN switch into the receiver. The RF passes through the front end tuning circuit, which rejects unwanted frequencies. The front end is electronically tuned, and the front end tuning voltage that sets the centre of the bandpass filter is determined during calibration (**Front End Tuning** test).

The output of the front end tuning stage is fed to the first mixer, and the VCO provides the local oscillator input. The output of the mixer is at the first IF frequency (45.1 MHz UHF/ 21.4 MHz VHF).

The IF signal passes through two crystal filters, separated by the IF amplifier.

In the Demod IC, the signal passes through the second mixer, producing the second IF (455 kHz). The second IF passes through a ceramic band pass filter and IF amp, which are external to the IC. The second IF is then fed back into the Demod IC for another amplification stage, then through another ceramic band pass filter. The final stage is the phase lock loop (PLL) discriminator in the Demod IC, which produces detected audio.

A squelch detect circuit detects high frequency audio noise and compares it with a threshold, which is set up by the microprocessor and can be set during calibration (**Squelch Thresholds** test).

The RSSI output of the detector circuit provides an analogue indication of the received signal strength. RSSI thresholds are set during calibration (**RSSI Thresholds** test).

## Receive (Rx) audio

The detected audio is processed by the DSP, amplified and fed to an internal speaker, whose selection is controlled by a line from the microprocessor. The speaker output is always available on the accessory connector, to drive an external speaker.

The unprocessed audio from the output of the Demod IC (RX-DET-AF) is also available at the accessory connector.

All signalling, such as Selcall, CTCSS, DCS, DTMF and FFSK, and all confidence tones are generated by the DSP.

The DSP operates in half-duplex mode. That is, its CODEC input and output is switched between the Tx and Rx audio paths, according to whether the radio is transmitting or receiving.

## Synthesiser and VCO

The synthesiser receives channel frequency information from the microprocessor. It then sets the VCO to the required frequency and maintains its stability using a phase-locked loop. There are one or two VCOs, depending on the radio type. Some bands have one VCO that covers the whole tuning range of the radio plus the IF offset, with its output switched to Tx or Rx. Other bands have a dedicated Tx and Rx VCO.

A lock detect output from the synthesiser (LCK-DET) indicates whether the VCO is producing the correct frequency (the radio is in lock). If the frequency is incorrect, the lock detect status prevents the transmitter from operating, and informs the control microprocessor.

The reference frequency for the synthesiser is provided by the TCXO (temperature compensated crystal oscillator), which is initially set on frequency using a DC voltage at calibration (**TCXO Calibration** test).

## Power supplies

### +5V-DIG

The +5V-DIG supply provides regulated 5 V to the microprocessor and its associated circuitry. It is controlled by the on/off switch and a line from the microprocessor.

It provides 5 V to all circuitry that requires power when the radio is in economy mode.

### +5V-AN

The +5V-AN supply provides the power to all circuitry that requires 5 V when the radio is not in economy mode, mainly all analog circuitry in the receiver, synthesiser and audio modules. It is controlled by a line from the microprocessor and is a regulated supply.

### +5V-TX

The +5V TX supply provides power for the exciter stage of the transmitter when the radio is in transmit mode. It is controlled by a line from the microprocessor and is a regulated supply.

### +7V5-BATT

The +7V5-BATT supply is the unregulated voltage supplied to the radio from the battery.

### +7V5-ACC

The +7V5-ACC supply is supplied to the accessory connector from the battery through a switch and with some current limiting.

### +7V5-SW

The +7V5-SW switched supply is unregulated voltage supplied to the radio from the battery through a switch.

### +14V

The +14V regulated supply provides the 14 V required by the loop filter in the synthesiser.

A switch mode regulator produces this voltage from the +7V5-SW and +5V-AN supplies.

### **+4V3-DEC**

The +4V3-DEC supply is derived from the +5V-AN voltage. It is used to power the transmit and receive VCOs in conjunction with the transmit control line from the processor. It also provides the loop filter reference in the synthesiser.

### **Accessory connector interface**

The accessory connector interface is described in *Part F: Interfacing non-Tait accessories*.

### **Universal band versus wideband IF filtering**

The IF filtering for the universal band is designed in a way such that its functionally meets specifications for both narrowband as well as wideband systems.

The Deviation and Receive Audio Processing are selectable per channel, which enables the radio to inter-operate between narrowband and wideband channels.



# PART C Diagnostics and fault finding

This part provides information on diagnosing faults in Tait Orca handportables.

The information in the fault finding charts should be used in combination with the test facilities, and it may also be helpful to examine the radio programming software data using the programming system for Tait Orca conventional or trunked radios.

---

## Contents

<b>Test facilities .....</b>	<b>C-3</b>
Error codes .....	C-3
Test commands .....	C-5
Calculating the parameters required for test command 101 .....	C-7
<b>Fault finding charts .....</b>	<b>C-8</b>
Fault finding – Radio cannot be switched on .....	C-9
Fault finding – Cannot change channel (Orca Elan and Orca Excel) .....	C-10
Fault finding – No serial communication .....	C-11
Fault finding – Receive faults .....	C-12
Fault finding – Cannot transmit .....	C-13
Fault finding – No transmit audio .....	C-14



---

# Test facilities

---

Standard test facilities provide a way of testing the radio's functions independently of normal radio operation. A series of test commands can be sent to a radio in two ways:

- using the calibration system; or
- using a terminal program.

See the *User's Manual: Calibration System for Tait Orca Radios* for information on using the calibration system to send test commands to a radio.

When using a terminal program, use the following settings:

- baud rate: 9600
- number of data bits: 8
- number of stop bits: 1
- parity: none
- flow control: none.

To put the radio into computer-controlled test mode, send ^ (**Shift-6**), wait for a return prompt (v), then immediately send % (**Shift-5**). You can then begin sending test commands to the radio.

A full list of test commands is given in Table C-1. Table C-2 shows how to calculate the parameters necessary for test command 101.

If using the calibration system to send test commands to a radio, the parameters for command 101 are automatically calculated from the frequency value entered.

## Error codes

The errors you may receive while the radio is in test mode are outlined below. If the radio must be returned for repair (e.g. the DSP needs to be replaced), contact your Tait dealer for more information.

### {C01}

An invalid command code has been received. Try sending the command again.

### {C02}

A (valid) command code has been received but with invalid parameters. Check the parameters and try sending the command again.

### {C03}

A (valid) command code has been received but it cannot be processed at this time. Try sending the command again.

If the error persists, turn the radio off, then on again and put the radio into test mode. If the error still persists, contact your Tait dealer.

### {C04}

An error occurred during the initialisation of test mode. Turn the radio off, then on again and put the radio into test mode.

If the error persists, contact your Tait dealer.

### {X01}

EPROM checksum error. The software code in the flash has been corrupted. Re-download the radio software.

If the error persists, the flash needs to be replaced. Contact your Tait dealer.

### {X02}

Internal RAM failed. The RAM in the micro-processor is faulty and the microprocessor needs to be replaced. Contact your Tait dealer.

### {X03}

External RAM failed. The RAM in the ASIC is faulty and the ASIC needs to be replaced. Contact your Tait dealer.

**{X04}**

The DSP is not responding. Check the DSP for pin connections.

If the error persists, the DSP needs to be replaced. Contact your Tait dealer.

**{X05}**

The DSP version number is incorrect. The radio software and DSP software are incompatible. The DSP needs to be replaced with a later version. Contact your Tait dealer.

**{X06}**

The MCU internal configuration is incorrect. Contact your Tait dealer.

**{X09}**

The prototype timer has expired. This error will only occur on prototype software releases when the radio usage time has expired.

New radio software must be downloaded into the radio and the new software must have a different software version number.

**{X31}**

Model configuration checksum error. This error indicates that the radio's model configuration checksum is incorrect. Contact your Tait dealer.

**{X32}**

Database checksum error. This error indicates that the radio's database checksum is incorrect. Contact your Tait dealer.

**{X33}**

ESN error. The radio's electronic serial number is incorrect. Contact your Tait dealer.

**{X35}**

Temperature is above the T1 threshold and turn down of transmit power is impending. Allow the radio to cool down before continuing.

**{X36}**

Temperature is above the T2 threshold and turn off of the transmitter is impending. Allow the radio to cool down before continuing.

**{X37}**

Voltage is less than the V1 threshold; the radio will give a low battery warning. Replace the battery or use a DC service adaptor.

**{X38}**

Voltage is less than the V2 threshold. The radio turns itself off after indicating this error and so will be unable to respond to the reset command character.

Replace the battery or use a DC service adaptor.

Table C-1: Test commands

Function	Description	CCTM code	Parameters
Signalling	Set modem to send zeros	10	None
	Set modem to send ones	11	None
	Set modem to send preamble	12	None
	Disable modem signalling	13	None
	Read modem receive string (continuous)	14	None
	Disable all signalling	15	None
	Enable subaudible signalling	16	None
	Read subaudible signalling decode status	17	Returns: 0 = signal not detected, 1 = signal detected
Mute	Force Rx audio muted	20	None
	Force Rx audio unmuted	21	None
	Mute DSP input	22	None
	Unmute DSP input	23	None
	Let squelch control Rx audio	24	None
	Read RX_BUSY status	25	Returns: 0 = busy inactive, 1 = busy active
	Relax Rx mute control	26	None
Rx/Tx	Inhibit PA (transmit mode)	30	None
	Enable PA (transmit mode)	31	None
	Set radio to Rx	32	None
	Set radio to Tx	33	None
	Set transmit to low power	34	None
	Set transmit to mid power	135	None
	Set transmit to high power	35	None
	Set transmit to max power	36	None
	Set transmit to no power	137	None
	Activate economy mode	42	None
	Deactivate economy mode	43	None
	Read battery level	46	Returns: 0 to 255
	Read temperature level	47	Returns: 0 to 255
	Set keypad test on	50	None
	Set keypad test off	51	None
	Set display test on	52	IN: 0, 1, 2 or 3
	Set display test off	53	None
	Read averaged RSSI level	63	Returns: 0 to 255
	Read L1 threshold	64	Returns: 0 to 255
	Read L2 threshold	65	Returns: 0 to 255
Miscellaneous	Select normal micro clock	70	None
	Select birdie micro clock	71	None
	Read synth lock status	72	Returns: 0 = not in lock, 1 = in lock
	Disable internal speaker	74	
	Enable internal speaker	75	
	Stop the MCU clock	79	None
	Select wide band	84	None
	Select medium band	85	None
	Select narrow band	86	None
	Select city squelch	88	None
	Select country squelch	89	None
	(continued on next page)		

Table C-1: Test commands (continued)

Function	Description	CCTM code	Parameters
Radio info	Read radio serial number	94/131	Returns: 6 digit number (hex)
	Read DSP software version number	132	Returns: 4 digit number (hex)
	Read radio software version number	96	Returns: 4 digit number
	Read radio type	130	Returns: radio type (P or M), frequency band (B-J), channel spacing (1 or 2)
	Read radio hardware version number*	133	Returns: 4 digit number
Synth	Load absolute synth frequency	101	tttttt T rrrrrr R F (see Table C-2)
	Load synth reference divider	102	8 to 16383
	Load synth prescaler†	103	0 = 64/65 1 = 128/129
Config	Set volume pot	110	0 to 255
	Set transistor gate bias	111	0 to 255
	Set TCXO mod	112	0 to 255
	Set VCO mod	113	0 to 255
	Set Tx power level	114	0 to 255
	Set TCXO coarse frequency	115	0 to 255
	Set TCXO fine frequency	116	0 to 255
	Set Rx front end tuning	117	0 to 255
	Set squelch threshold	118	0 to 255
	Set CTCSS modulation	120	0 to 32767
	Set DCS modulation	121	0 to 32767
	Set FFSK modulation	122	0 to 32767
	Set Selcall modulation	123	0 to 32767
	Set DTMF modulation	124	0 to 32767
	Set voice modulation	125	0 to 32767
	Force DCS signalling (023 tone)	126	None
	Force CTCSS signalling (67.0 Hz)	127	None
	Force Selcall signalling (2000 Hz for 2 seconds)	128	None
	Force DTMF signalling (tone A)	129	IN: 1 = start encoding, 0 = stop encoding
	Read calibrated volume setting	136	Returns: 0 to 255
	Select bottom microphone*	138	None
	Select top microphone*	139	None
	Disable both microphones*	140	None
	Enable both microphones*	141	None

\* This test command is only supported in radios with hardware version greater than 0004 and radio software versions greater than:

Orca Elan conventional	v 1.07
Orca Excel conventional	v 1.07
Orca Eclipse conventional	v 1.05
Orca Elan trunked	v 3.03
Orca Excel trunked	v 3.03

† This test command is only supported in radios with radio software versions greater than:

Orca Elan conventional	v 1.09
Orca Excel conventional	v 1.09
Orca Eclipse conventional	v 1.07

Table C-2: Calculating the parameters required for test command 101

**Calculating parameters for test command 101**

Enter the parameters in the format ttttt T rrrrr R F

- ttttt represents the transmit frequency  
See Example 1
- T and R represent channel spacing  
0 = 5 kHz  
1 = 6.25 kHz
- rrrrr represents the receive frequency  
See Example 2
- F indicates whether the test command changes the calibration values  
0 = do not change calibrated values  
1 = recalculate the calibrated values based on new frequencies

Note: ttttt and rrrrr may be up to 6 digits long.

**Example 1: Calculating ttttt for an H band radio**

$$\begin{aligned} \text{ttttt} &= \frac{\text{transmit frequency (MHz)}}{\text{channel spacing (MHz)}} \\ &= \frac{461.025 \text{ MHz}}{6.25 \text{ kHz}} \\ &= \frac{461.025 \times 10^6 \text{ Hz}}{6.25 \times 10^3 \text{ Hz}} \\ &= 73764 \end{aligned}$$

**Example 2: Calculating rrrrr for an H band radio**

$$\begin{aligned} \text{rrrrr} &= \frac{\text{receive frequency (MHz)} - *IF \text{ (MHz)}}{\text{channel spacing (MHz)}} \\ &= \frac{461.025 \text{ MHz} - 45.1 \text{ MHz}}{6.25 \text{ kHz}} \\ &= \frac{415.925 \times 10^6 \text{ Hz}}{6.25 \times 10^3 \text{ Hz}} \\ &= 66548 \end{aligned}$$

Note: IF depends on the radio's switching band.

- For A, B, C and D bands radios, the IF is 21.4 MHz.  
\* For A band radios, add the IF (MHz) in the formula (Band A radios use high side injection).
- For E, F, G, H, I, J and K band radios, the IF is 45.1 MHz.

---

# Fault finding charts

---

The fault finding charts in Figures C-1 to C-6 address the faults you are most likely to find.

If you experience other faults that do not fall into these categories, contact your Tait dealer.

They are:

- radio cannot be switched on;
- cannot change channel (Orca Elan and Orca Excel);
- no serial communications;
- receive faults;
- cannot transmit; and
- no transmit audio.



Figure C-1: Fault finding – Radio cannot be switched on

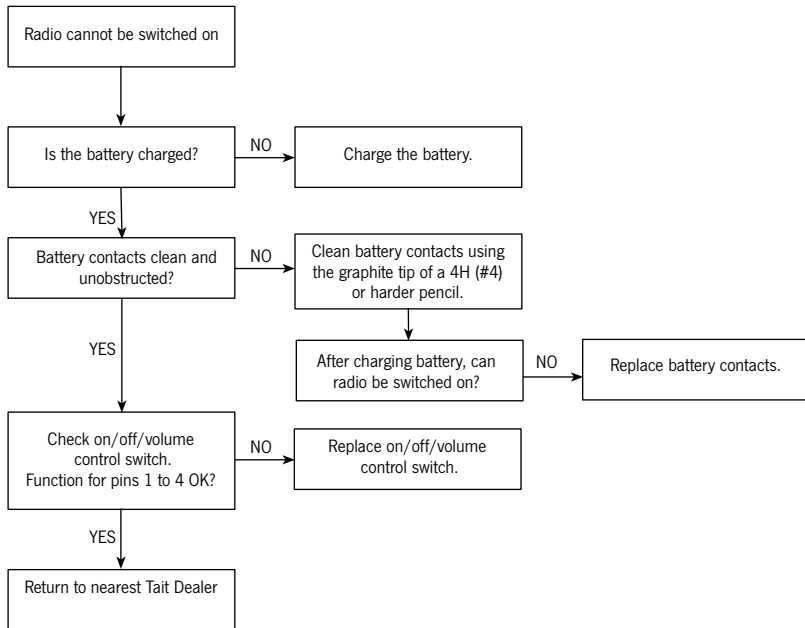


Figure C-2: Fault finding – Cannot change channel (Orca Elan and Orca Excel)

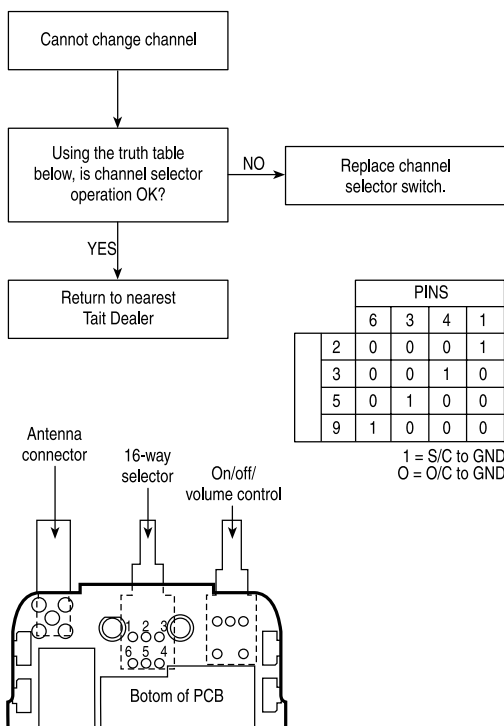


Figure C-3: Fault finding – No serial communication

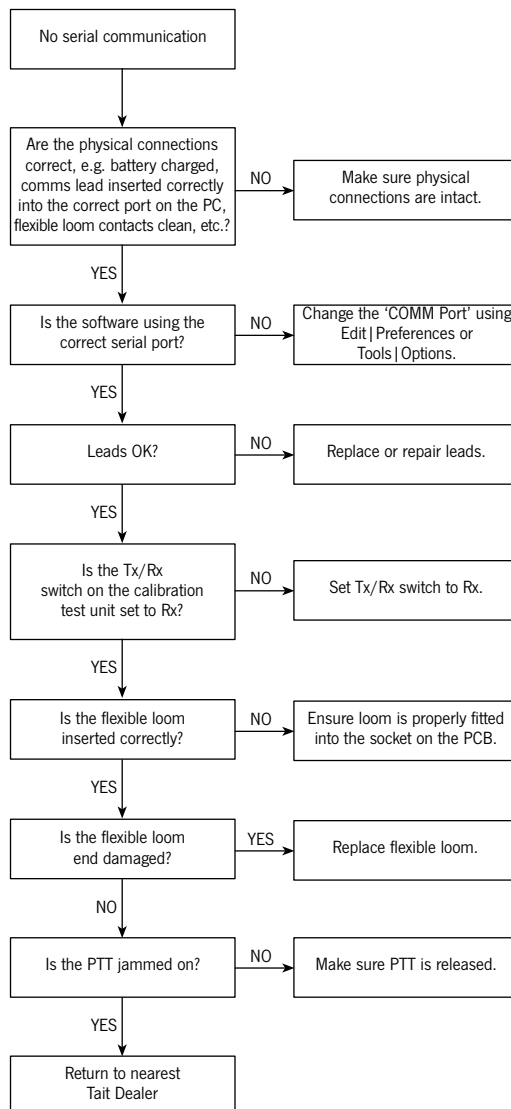


Figure C-4: Fault finding – Receive faults

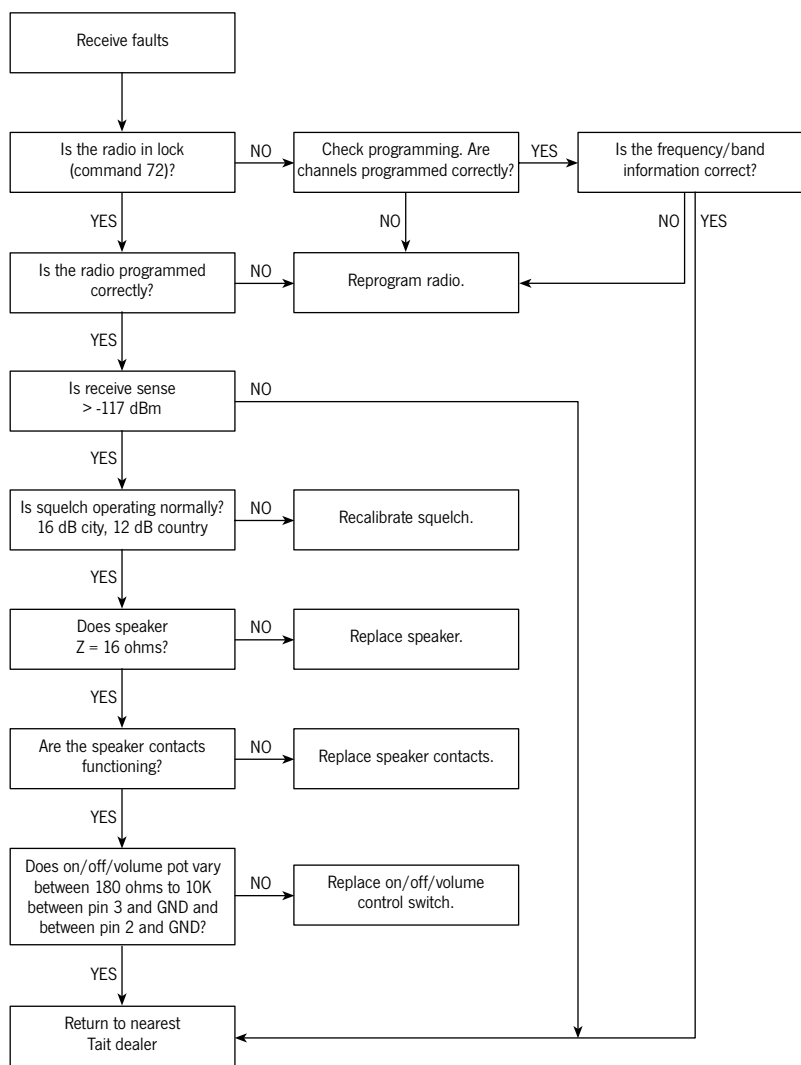


Figure C-5: Fault finding – Cannot transmit

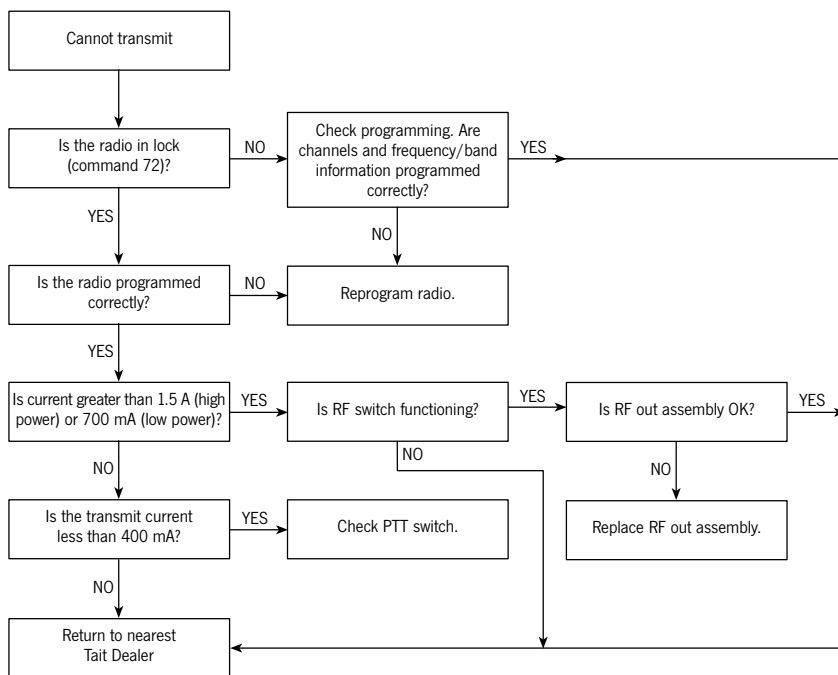
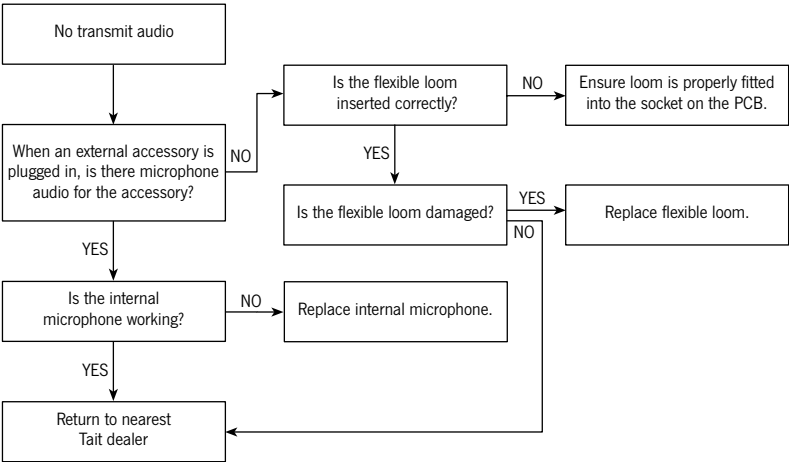


Figure C-6: Fault finding – No transmit audio



# PART D Servicing the radio

This part describes the disassembly and reassembly of Tait Orca handportables and the servicing of some key mechanical and ancillary devices.

Information is also provided on ordering spare parts for servicing handportables.

---

## Contents

<b>Servicing the radio .....</b>	<b>D-3</b>
Screw head types .....	D-3
<b>Disassembling the radio .....</b>	<b>D-4</b>
Removing the front panel from the chassis .....	D-4
Removing the shield from the chassis .....	D-5
Removing the PCB from the chassis .....	D-6
Removing the rear panel .....	D-7
<b>Replacing key mechanical and ancillary devices .....</b>	<b>D-8</b>
Replacing the lens (Orca Excel and Orca Eclipse) .....	D-8
Replacing the PTT keypad .....	D-8
Replacing the speaker .....	D-9
Replacing the LCD display (Orca Excel and Orca Eclipse) .....	D-9
Replacing the shield, user interface PCB assembly and polyester dome (Orca Excel and Orca Eclipse) .....	D-12
Replacing the antenna connector, channel selector switch (Orca Elan and Orca Excel) and volume control switch (Orca Elan and Orca Excel) .....	D-12
Replacing the microphone .....	D-12
Replacing the battery and speaker contacts .....	D-12
Replacing the tact switch .....	D-12
<b>Reassembling the radio .....</b>	<b>D-13</b>

Rear panel reassembly and replacing the auxiliary flexible PCB .....	D-13
Fitting the PCB to the chassis and replacing the RF out assembly .....	D-14
Fitting the shield to the chassis .....	D-14
Fitting the front panel to the chassis .....	D-15
<b>Spares kits .....</b>	<b>D-16</b>
Orca Elan spares kit (TOPA-SP-101) .....	D-17
Orca Excel spares kit (TOPA-SP-103) .....	D-18
Orca Eclipse spares kit (TOPA-SP-108) .....	D-19
Orca Elan re-skinning kit (TOPA-SP-102) .....	D-20
Orca Excel re-skinning kit (TOPA-SP-104) .....	D-20
Orca Eclipse re-skinning kit (TOPA-SP-109) .....	D-20



---

# Servicing the radio

---

The manufacturing process does not allow direct servicing access to components on the main PCB. Service repairs of Tait Orca handportables are therefore limited to key mechanical and ancillary devices associated with the main PCB. These include:

- front panel assembly;
- lens (Orca Excel and Orca Eclipse);
- PTT keypad;
- speaker;
- keypad (Orca Excel and Orca Eclipse);
- volume plate and keypad (Orca Eclipse);
- LCD display (Orca Excel and Orca Eclipse);
- shield, complete with user interface PCB assembly and polyester dome (Orca Excel and Orca Eclipse);
- main PCB assembly;\*
- antenna connector;
- channel selector switch (Orca Elan and Orca Excel);
- volume control switch (Orca Elan and Orca Excel);
- microphone;
- speaker contacts;
- battery contacts;
- PTT tact switch;
- RF out assembly; and
- auxiliary flexible PCB.

A list of spares kits available for servicing Tait Orca handportables is shown in Table D-1 on page D-16. These spares can be ordered from your local Tait dealer.

## Screw head types

Most of the screws in Tait Orca handportables are Torx head screws, and so a Torx T6 driver bit is supplied as part of the service kit. Some earlier radios have Pozidriv screws. When removing screws be sure to use the correct driver.

Torx head 1.8\*5 mm screws should be removed using the supplied Torx T6 driver. When replacing these screws, set the driver to 2 inch pounds.

Pan Pozi M2\*8 mm and M2\*5 mm screws should be removed using a Pozi 1 driver. When replacing these screws, set the driver to 2 inch pounds.

\* Refer to Table D-2 on page D-16 for details.

# Disassembling the radio

## Removing the front panel from the chassis

Unscrew the antenna and detach the battery pack.

On Orca Elan and Orca Excel radios, the channel selector and on/off/volume control knobs need to be removed before separating the front panel and the chassis.

To remove the knobs, insert a side cutter at the base of each knob, flat side down (Figure D-2), making sure not to damage the knob label and the switch shaft. Squeeze lightly; the knobs should pop off. Discard the knobs.

Some earlier Tait Orca radios have the knobs glued on. If so, the knob's metal insert will remain on the switch shaft. Remove the insert using a sharp scalpel blade.

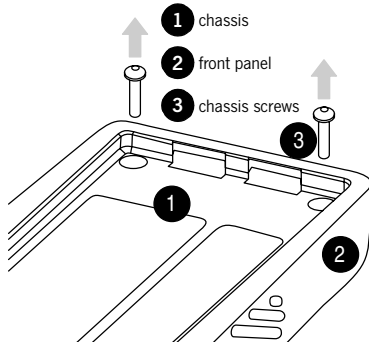
Remove the two chassis screws at the base of the radio (Figure D-1), then reattach the battery and hold the base of the radio in one hand. With the other hand, pull the chassis from the front panel using the base of the battery as leverage (Figure D-3).

At this point you can replace the following:

- the front panel assembly;
- the PTT keypad (PTT key and function keys);

- the speaker;
- the lens (Orca Excel and Orca Eclipse);
- the keypad (Orca Excel and Orca Eclipse); and
- the volume plate and volume keypad (Orca Eclipse).

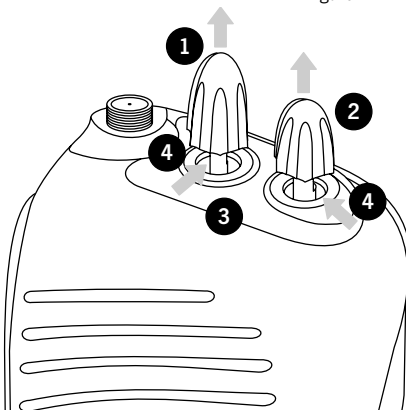
Figure D-1: Removing the chassis screws



Note that you should not attempt to remove the PTT keypad before removing the front panel from the chassis. See “Replacing the PTT keypad” on page D-8 for more information.

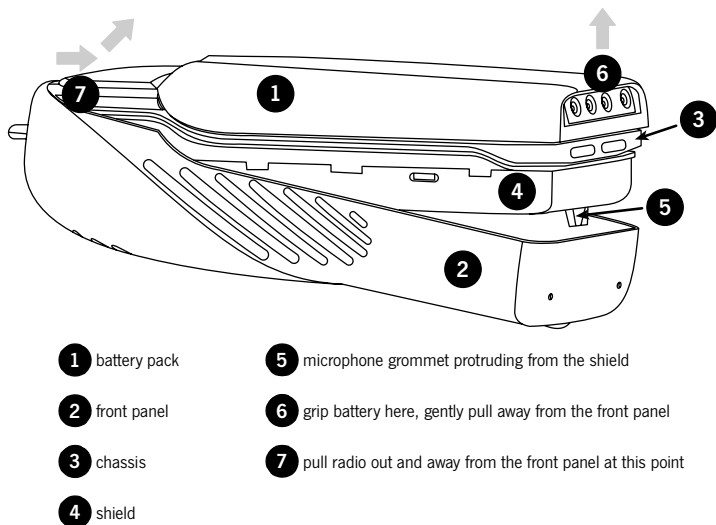
On Orca Eclipse radios, once the front panel has been removed from the chassis, the volume plate and keypad must be removed from the front panel before reassembly is attempted. Refer to Figure D-13 on page D-15.

Figure D-2: Removing the knobs (Orca Elan and Orca Eclipse)



- 1 channel selector
- 2 on/off/volume control
- 3 knob label
- 4 insert side cutters here

Figure D-3: Removing the front panel from the chassis, using the battery as leverage

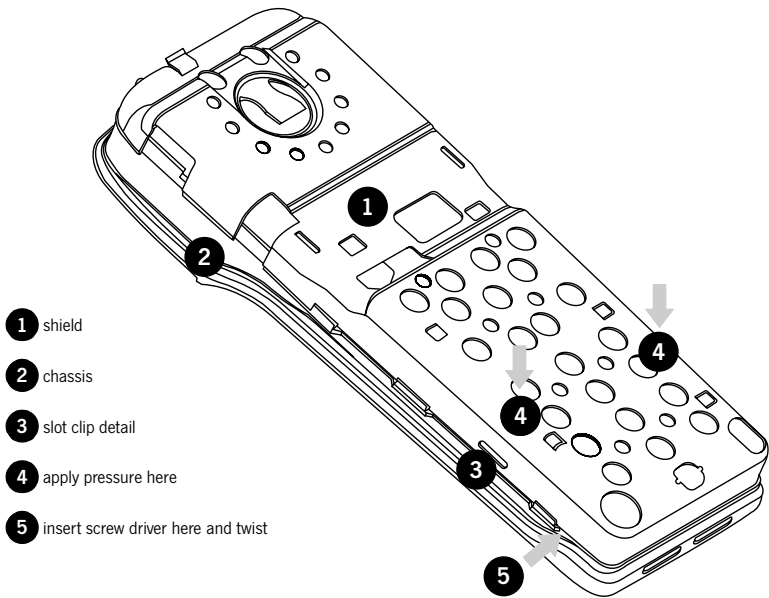


### Removing the shield from the chassis

To remove the shield, place the radio's internal assembly on a flat surface with the shield side facing up toward you. Press lightly down on the shield above the slot clip detail (shown in Figure D-4), which will slightly bow the shield away from the chassis.

Maintain pressure and insert a flat bladed screwdriver (approximately 4 mm) in the gap between the shield and the chassis. Twist the screwdriver and the shield should rise up over the clip.

Figure D-4: Removing the shield from the chassis



Repeat this on the other side. Remove the microphone grommet by pulling upward (Figure D-5).

You can now see the bottom surface of the PCB. The basic layout of the PCB is shown in Figures D-8 and D-9. Refer to these diagrams for the placement of parts.

Note that on Orca Excel and Orca Eclipse radios, the user interface loom must be detached from the main PCB before the shield can be separated from the main PCB and chassis.

At this point you can replace:

- the LCD display (Orca Excel and Orca Eclipse); and
- the shield, complete with user interface PCB assembly and polyester dome (Orca Excel and Orca Eclipse).

At this point you can replace:

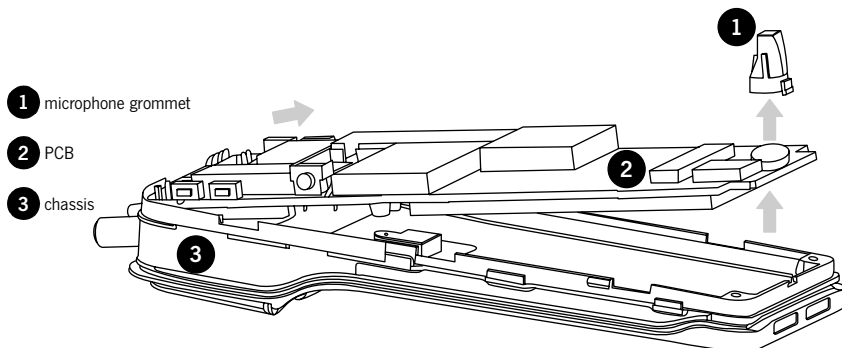
- the main PCB assembly;
- the antenna connector;
- the channel selector switch (Orca Elan and Orca Excel);
- the volume control switch (Orca Elan and Orca Excel);
- the microphone;
- the speaker contacts;
- the battery contacts;
- the PTT tact switch; and
- the RF out assembly.

## Removing the PCB from the chassis

Remove the knob seal, which covers the antenna connector, channel selector switch (Orca Elan and Orca Excel) and volume control switch (Orca Elan and Orca Excel).

Remove the screw through the PA shield. Remove the three nuts for the antenna connector and knobs using the supplied 8 mm long reach socket driver, then remove the three ribbed lock washers. Gently lift the PCB up to the angle shown in Figure D-5, then pull it away from the chassis.

Figure D-5: Removing the PCB from the chassis (Orca Elan or Orca Excel shown)



## Removing the rear panel

Follow the disassembly instructions and disassemble the radio to the PCB level. Refer to Figure D-10 for the details of the rear panel assembly.

Insert a small flat bladed screw driver under the auxiliary dummy rear cover and apply pressure to push the dummy rear cover lugs free of the holes in the rear panel. To remove the rear panel, either:

- slide the cover forward by pushing at the base with your thumbs; or
- insert a small flat-bladed screwdriver just under the notch in the base and twist.

Remove the rear panel seal. Note that the RF contact pin normally remains in the rear panel seal. Make sure that this is not lost during disassembly.

Using a calibration pin, lift the auxiliary flexible PCB contact area from the lower lefthand corner. Remove the flexible PCB with the seal from the chassis; they should come out as a unit.

You can now replace the auxiliary flexible PCB.

---

# Replacing key mechanical and ancillary devices

---

This section describes the replacement of key mechanical and ancillary devices associated with the main PCB. These include:

- lens (Orca Excel and Orca Eclipse);
- PTT keypad;
- speaker;
- LCD display (Orca Excel and Orca Eclipse);
- shield, complete with user interface PCB assembly and polyester dome (Orca Excel and Orca Eclipse);
- antenna connector;
- channel selector switch (Orca Elan and Orca Excel);
- volume control switch (Orca Elan and Orca Excel);
- microphone;
- speaker contacts;
- battery contacts; and
- PTT tact switch.

Note that instructions for replacing the RF out assembly, the auxiliary flexible PCB and the Orca Eclipse volume key pad and plate are included as part of the reassembly instructions.

Refer to Figures D-8 and D-9 for the placement of parts. Once the required devices have been replaced, refer to the reassembly instructions on pages D-13 to D-15.

## Replacing the lens (Orca Excel and Orca Eclipse)

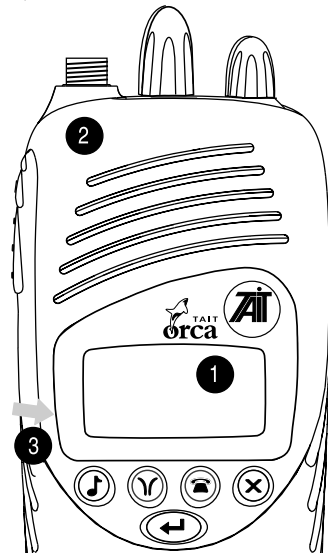
You must disassemble the radio before gently prising the lens away from the front panel of the radio. Remove any adhesive remaining on the front panel.

Peel the paper from the back of the new lens,

and place the lens in position on the front panel, so that the lugs on the back of the new lens fit into the holes in the front panel.

Press firmly into position, then remove the piece of clear plastic from the front of the lens.

Figure D-6: Replacing the lens (Orca Excel and Orca Eclipse)



- 1 lens
- 2 front panel (Orca Excel shown)
- 3 gently prise the lens away from the front panel

## Replacing the PTT keypad

Following the disassembly instructions, remove the front panel from the chassis.

To remove the PTT retaining plate, from the inside of the front panel, gently push the five latches that hold the retaining plate in place. Be careful not to lose the two pins that act as actuators for the function keys.

To replace the PTT retaining plate, fit the keypad to the retaining plate, making sure not to split or otherwise damage it. Place the three clips on the long edge of the retaining plate into place, then make sure the actuators for the function keys and PTT key fit into the holes on the front panel. Clip the retaining plate into place.

## Replacing the speaker

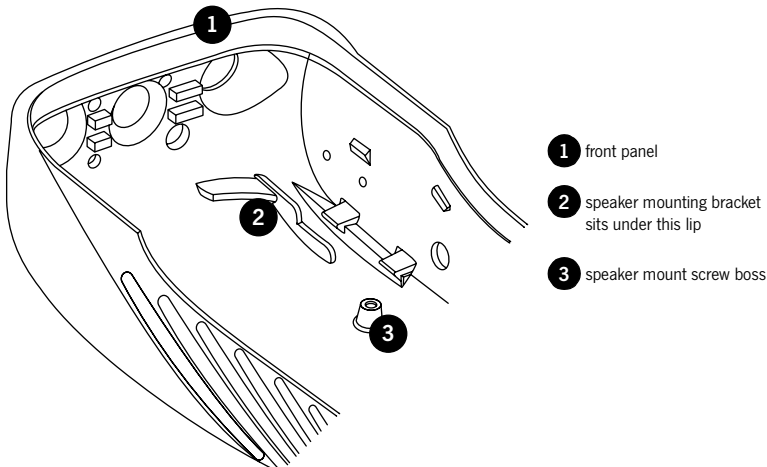
Following the disassembly instructions, remove the front panel from the chassis. The speakers sit in the mounting bracket on the inside of the front panel (see Figure D-7).

If the mounting bracket is damaged, remove the two screws at the base of the mounting bracket. Lift the speaker and mounting bracket out and discard.

Insert the new speaker and mounting bracket in the front panel, making sure the top edge of the mounting bracket goes under the lip in the front panel (Figure D-7). Replace the two screws to secure the speaker in place, gently tightening them to 1.5 inch pounds.

If the mounting bracket is not damaged, remove the speaker from the mounting bracket. Replace the adhesive ring and secure a new speaker in place.

Figure D-7: Mounting the speaker in the front panel (Orca Elan or Orca Excel shown)



## Replacing the LCD display (Orca Excel and Orca Eclipse)

Following the disassembly instructions, remove the shield from the front panel and unplug the user interface loom from the main PCB.

Unplug the LCD display loom from the user interface PCB, remove the LCD display from the shield and discard the LCD display. Remove any adhesive remaining on the shield.

Position the new LCD display on the shield, pass the LCD loom through the gap in the shield and plug into the connector on the user interface PCB. Push down the two connector lugs to secure the loom.

Plug the user interface PCB loom onto the connector on the main PCB and push down the connector lugs to secure.

Refit the shield onto the chassis (refer to page D-14 for detailed instructions).

Position a piece of foam tape on the shield, in the centre of the LCD area. Position the LCD display on the foam tape in such a way that the top left corner of the LCD does not interfere with the PTT switch. Place the LCD holder over the LCD, fitting the LCD holder locating blocks into the holes in the shield.

Refit the front panel to the chassis (refer to page D-15 for detailed instructions).

Figure D-8: Bottom surface of the PCB, which is visible when the shield has been removed from the chassis (Orca Elan or Orca Excel shown)

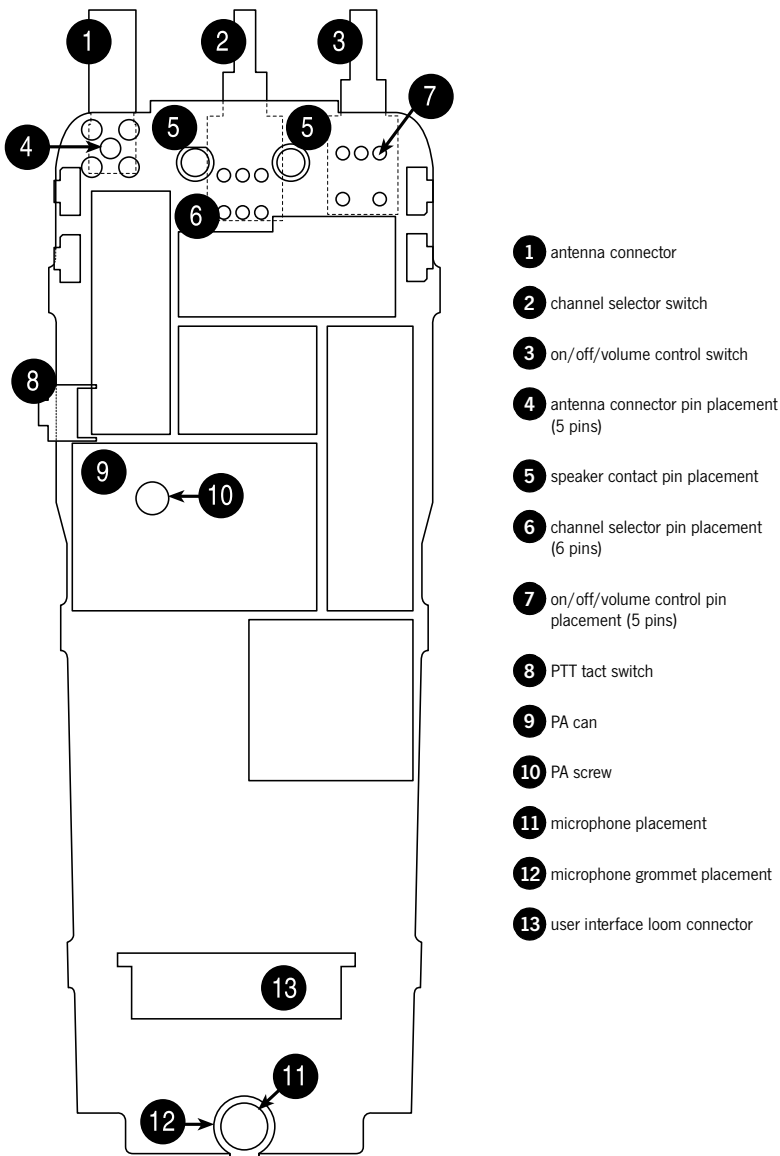
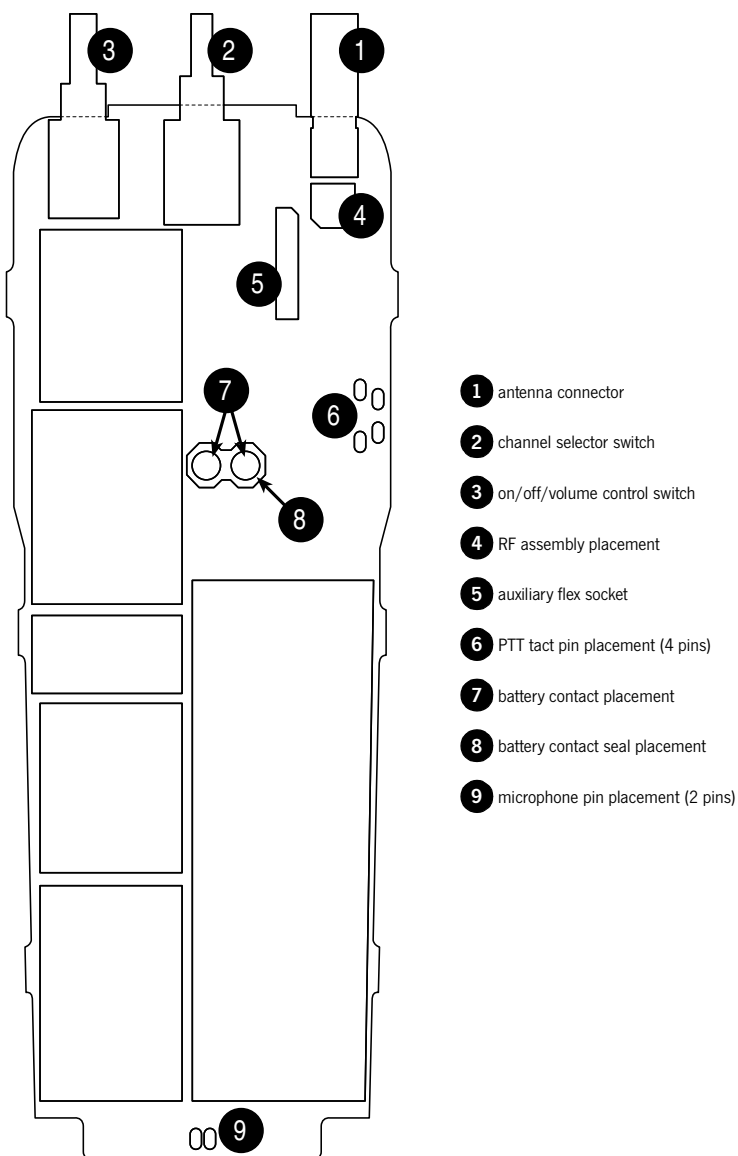




Figure D-9: Top surface of PCB, which is visible only when the PCB has been removed from the chassis (Orca Elan or Orca Excel shown)



## **Replacing the shield, user interface PCB assembly and polyester dome (Orca Excel and Orca Eclipse)**

On Orca Excel and Orca Eclipse radios the shield, user interface PCB and polyester dome are replaced as one complete assembly.

Following the disassembly instructions, remove the shield from the front panel and unplug the user interface loom from the user interface PCB.

Remove the LCD display assembly from the discarded shield, and fit to the replacement shield according to the instructions on page D-9.

Plug the user interface loom into the connector on the new user interface PCB, and reassemble the shield onto the chassis according to the instructions on page D-14.

Note that the light pipe in the discarded shield will need to be repositioned in the new shield.

## **Replacing the antenna connector, channel selector switch (Orca Elan and Orca Excel) and volume control switch (Orca Elan and Orca Excel)**

Following the disassembly instructions, disassemble the radio to the PCB level. Remove the PCB from the chassis.

If any of the antenna connector, channel selector switch or volume control switch need to be replaced, remove them using a vacuum-operated solder station. Replace them according to the reassembly instructions on pages D-13 to D-15.

## **Replacing the microphone**

Following the disassembly instructions, disassemble the radio to the PCB level. Remove the PCB from the chassis.

Use a desoldering station to remove the microphone. Discard the microphone.

When replacing the microphone, make sure it

is aligned with the marks on the PCB, since it is polarised. Refer to Figures D-8 and D-9 for the placement of the microphone.

The microphone should not hang over the edge of the PCB. Solder it in place using a light-tip soldering iron (e.g. Weller PTR7 tip).

## **Replacing the battery and speaker contacts**

Following the disassembly instructions, disassemble the radio to the PCB level. Remove the PCB from the chassis.

When replacing one of the battery or speaker contacts, replace the other contact, even if only one is faulty. If available, use solder paste to replace the contacts.

Note that the contacts are heat-sensitive and will fail if they are overheated. Low temperature solder must be used and the contacts must not be heated above 260°C.

Remove the contact with a soldering iron and discard. Refer to Figures D-7 and D-8 for the placement of the battery and speaker contacts.

Solder the replacement contact in place using a heavy-tip soldering iron (e.g. Weller 2PTCC8 tip). Hold onto the contact with a pair of pliers and apply large amounts of solder to the PCB, rather than to the contact, to avoid damaging the contact.

## **Replacing the tact switch**

Following the disassembly instructions, disassemble the radio to the PCB level. Remove the PCB from the chassis.

Remove the PTT tact switch using a desoldering station or solderwick. Note that there is a lot of solder on both sides of the board, so be sure to remove it all.

Refer to Figures D-8 and D-9 for the placement of the PTT tact switch.

Place the new PTT on the board and solder it in place using a heavy-tip soldering iron (e.g. Weller 2PTCC8 tip).

---

# Reassembling the radio

---

This section describes the reassembly of the radio once the required units have been serviced. Additional instructions for replacing the following mechanical and ancillary devices are also included:

- auxiliary flexible PCB;
- RF out assembly;
- volume plate and volume keypad (Orca Eclipse);
- antenna connector;
- channel selector switch (Orca Elan and Orca Excel); and
- volume control switch (Orca Elan and Orca Excel).

## Rear panel reassembly and replacing the auxiliary flexible PCB

Follow the instructions on page D-7 to access the auxiliary flexible PCB, and replace. Push the flexible PCB with seal firmly into the

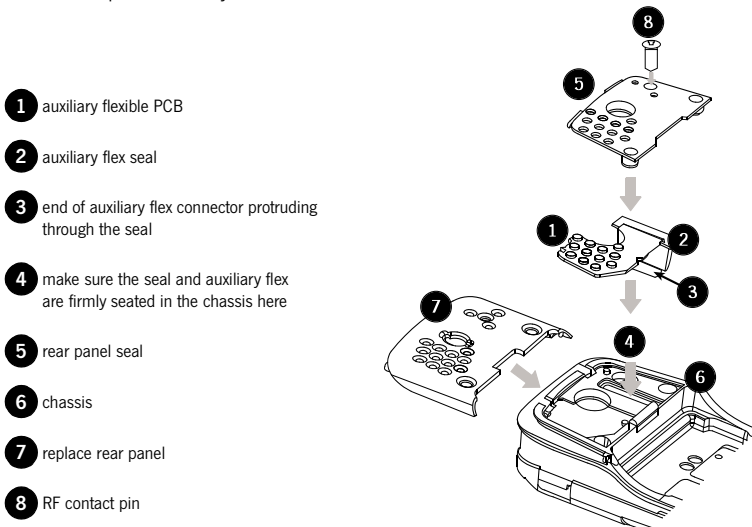
chassis, aligning the notch in the seal with the locating pin on the chassis (see Figure D-10). The rubber must sit flush with the back of the chassis or the rear panel will not sit properly and the battery will not fit correctly.

Fold the flexible PCB over and fit the contact area on the chassis; it should fit snugly in place.

Replace the rear panel seal by tucking the two tags at the top of the seal under the lip on the chassis and folding it over the flexible PCB. Check that the RF contact pin is positioned correctly in the rear panel seal, and that the seal is flush with the chassis.

Slide the rear panel on from the top of the radio (Figure D-10). Force it into place by pressing the top edge of the cover against the edge of a table; it will clip home. Make sure the gap between the cover and the chassis is as small as possible. Refit the auxiliary dummy cover by pushing the lugs into the holes on the rear panel.

Figure D-10: Rear panel assembly



## Fitting the PCB to the chassis and replacing the RF out assembly

Put the battery contact seal over the battery contacts rather than into the chassis. If you put the seal on the chassis, the contacts will squash the seal.

Fit the replacement RF out assembly as shown in Figure D-11.

If you have removed the antenna connector or either of the switches (Orca Elan or Orca Excel radios only), fit them on the PCB (refer to Figures D-8 and D-9), but do not yet solder them in place. Align them with the holes in the chassis, and as you lower the PCB onto the chassis, make sure the accessory flex protruding from the chassis fits into the socket on the PCB. Lower the PCB onto the chassis, making sure it is firmly seated.

Fit the PA screw loosely in place. Align the switches so they are centred (Orca Elan or Orca Excel only), referring to Figures D-8 and D-9 for placement.

Figure D-12 shows the reassembly of the antenna and switches. Replace the washers, making sure the cone faces up. The nuts for the two switches are black.

Replace the nuts, making sure they are threaded correctly before using an 8 mm long reach socket driver set to 10 inch pounds. Then tighten the PA screw to 2 inch pounds.

Using a heavy-tip soldering iron (e.g. Weller 2PTCC8 tip), solder the antenna connector and two switches in place, if required, taking care not to damage the surrounding components.

Replace the knob seal over the antenna connector and the two switches (see Figure D-12).

## Fitting the shield to the chassis

Replace the microphone grommet over the microphone.

Replace the shield from the top of the radio, ensuring that the two pins on the chassis go into the two holes at the top of the shield.

Should the main seal need replacing, place the new seal so that the notch at the top of the chassis (behind the channel selector switch on the Orca Elan and Orca Excel radios) matches that on the seal and the profile matches the chassis.

Run your finger around the seal to ensure that it fits properly into the seal retaining well.

Figure D-11: Placing the RF out assembly (Orca Elan or Orca Excel shown)

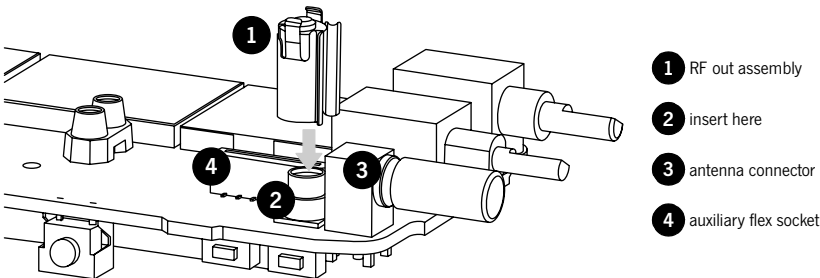
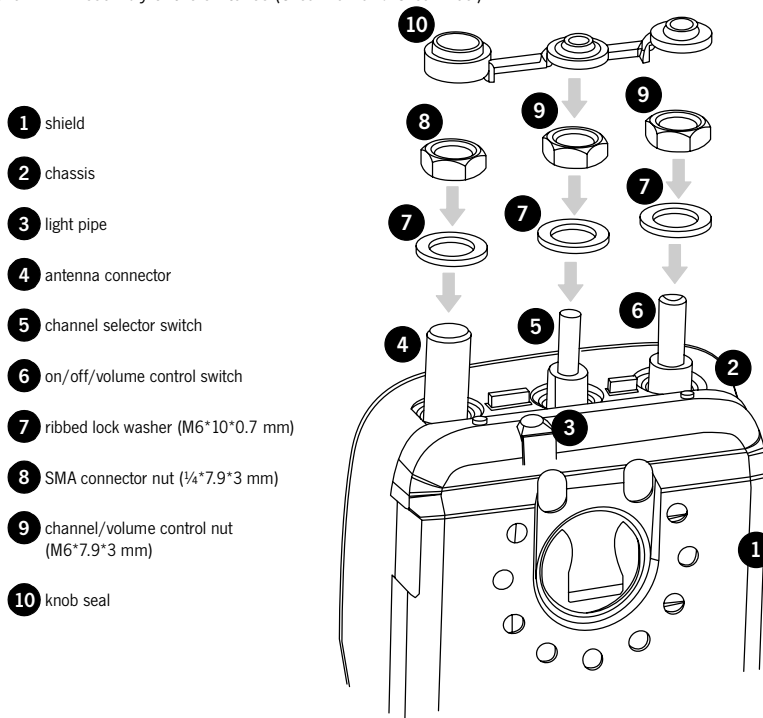


Figure D-12: Assembly of the switches (Orca Elan and Orca Excel)



## Fitting the front panel to the chassis

Place the radio into the front panel top first, inserting the antenna connector and knob switches through the holes. Gently ease the radio into the front panel until the edge of the chassis is flush with the edge of the front panel, while making sure that the seal is not pinched; using the battery as leverage as in radio disassembly may be helpful. Replace the two chassis screws at the base of the radio, tightening them to 2 inch pounds.

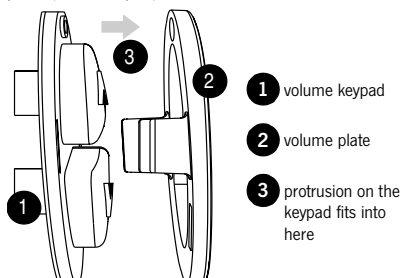
On Orca Elan and Orca Excel radios, replace the two knobs with new knobs, after placing a spot of Loctite™ 680 on each switch shaft. Make sure there is no gap between the base of each knob and the knob label by firmly pressing the top of each knob against a firm surface. Choose a surface that will not damage the top of the knob.

On Orca Eclipse radios, once the front panel

has been fitted to the chassis, the volume keypad and volume plate can now be fitted in place. Figure D-13 shows the assembly of the volume keypad onto the volume plate.

Fit the keypad to the plate, aligning the round protrusion on the keypad with the hole in the plate. Clip the volume plate into position on the Orca Eclipse front panel, orientated so that the hole end is closest to the top of the radio.

Figure D-13: Assembly of the volume keypad and plate (Orca Eclipse)



# Spares kits

The following table shows a list of spares kits which are currently available for servicing Tait Orca handportables. Spares kits are designed to service 100 radios, and can be ordered from your local Tait dealer.

Table D-1: Spares kits

Product code	Description
TOPA-SP-101	Orca Elan radio spares kit
TOPA-SP-102	Orca Elan re-skinning kit
TOPA-SP-103	Orca Excel radio spares kit
TOPA-SP-104	Orca Excel re-skinning assembly kit
TOPA-SP-105	Orca Elan front panel assembly kit
TOPA-SP-106	Orca Excel front panel assembly kit
TOPA-SP-107	Orca Eclipse/Excel interface PCB complete with mechanical shield
TOPA-SP-108	Orca Eclipse spares kit
TOPA-SP-109	Orca Eclipse re-skinning kit
TOPA-SP-501	Volume knobs x 10
TOPA-SP-502	Channel knobs x 10
TOPA-SP-504	Battery clip x 10
TOPA-SP-505	Orca dummy cover (universal) x 10

The contents of the Orca Elan and Orca Excel spares kits (TOPA-SP-101 and TOPA-SP-103) are shown in Tables D-3 and D-4. The contents of the Orca Elan and Orca Excel re-skinning kits are shown in Tables D-6 and D-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 'Reference' column are Figure numbers in which the spares item is shown, and the number in brackets refers to the numbered legend within each figure.

Tait Orca main PCBs are available on a replacement basis from Tait Electronics Ltd. Quote the product code shown in Table D-2 when using this service.

Table D-2: Replacement Boards

Product code	Description
TOP-A2110-KS	66-88MHz Elan Conventional
TOP-A2210-KS	66-88MHz Excel Conventional
TOP-A2310-KS	66-88MHz Eclipse Conventional
TOP-B2110-KS	136-174MHz Elan Conventional
TOP-B2120-KS	136-174MHz Elan Trunked
TOP-B2210-KS	136-174MHz Excel Conventional
TOP-B2220-KS	136-174MHz Excel Trunked
TOP-B2310-KS	136-174MHz Eclipse Conventional
TOP-C2210-KS	174-225MHz Excel Conventional
TOP-G2110-KS	336-400MHz Elan Conventional
TOP-G2120-KS	336-400MHz Elan Trunked
TOP-G2210-KS	336-400MHz Excel Conventional
TOP-G2220-KS	336-400MHz Excel Trunked
TOP-G2310-KS	336-400MHz Eclipse Conventional
TOP-H2110-KS	400-470MHz Elan Conventional
TOP-H2120-KS	400-470MHz Elan Trunked
TOP-H2210-KS	400-470MHz Excel Conventional
TOP-H2220-KS	400-470MHz Excel Trunked
TOP-H2310-KS	400-470MHz Eclipse Conventional
TOP-I2110-KS	450-530MHz Elan Conventional
TOP-I2120 -KS	450-530MHz Elan Trunked
TOP-I2210-KS	450-530MHz Excel Conventional
TOP-I2220-KS	450-530MHz Excel Trunked
TOP-I2310-KS	450-530MHz Eclipse Conventional
TOP-J2110-KS	806-870MHz Elan Conventional
TOP-J2120-KS	806-870MHz Elan Trunked
TOP-J2220-KS	806-870MHz Excel Trunked
TOP-K2110-KS	896-941MHz Elan Conventional
TOP-K2210-KS	896-941MHz Excel Conventional
TOP-K2220-KS	896-941MHz Excel Trunked

Table D-3: Orca Elan spares kit (TOPA-SP-101)

IPN	Description	Quantity supplied	Reference
345-00020-11	Chassis screw (M2*8 mm PanTorx)	10	D-1 (3)
311-01044-02	Channel selector knob	20	D-2 (1)
311-01043-02	Volume control knob	20	D-2 (2)
316-06633-01	Knob label	5	D-2 (3)
316-06634-01	Front panel logo plate	1	–
319-01203-01	Shield	5	D-4 (1)
362-01092-02	Main seal	20	–
303-11194-02	Handportable chassis	5	D-4 (2), D-5 (3)
360-02015-00	Microphone grommet/seal	10	D-5 (1)
311-03099-01	PTT keypad	20	–
316-85124-00	PTT retaining plate	10	–
360-01060-00	PTT/function key actuator	40	–
349-00030-02	Speaker screw (1.8*5 mm Torx)	10	D-7 (3)
252-00010-55	Speaker 0.5 W 16 $\Omega$	5	–
302-05231-01	Speaker mounting bracket	5	–
369-01039-00	Speaker cloth	5	–
231-00010-45	Channel selector switch	10	D-8 (2), D-9 (2)
040-05500-08	Volume control switch	10	D-8 (3), D-9 (3)
232-00010-37	PTT tact switch	5	D-8 (8), D-9 (6)
345-00020-09	PA screw (M2*5 mm Pan Pozi)	10	D-8 (10)
252-00010-56	Microphone	5	D-8 (11)
356-01077-00	Battery contact probe	10	D-9 (7)
362-01087-00	Battery contact seal	10	D-9 (8)
308-01057-01	Aux dummy rear cover	20	–
220-01414-03	Aux flex connector PCB	5	D-10 (1)
362-01089-01	Auxiliary flex seal	10	D-10 (2)
362-01088-00	Rear panel seal	10	D-10 (5)
316-06632-01	Rear panel	5	D-10 (7)
219-50029-01	RF out assembly	5	D-11 (1)
240-02156-01	Antenna SMA connector 1/4 x 36	10	D-12 (4)
353-00010-42	Ribbed lock washer (M6*10*0.7 mm)	30	D-12 (7)
352-01053-00	Antenna SMA connector nut	10	D-12 (8)
352-00010-52	Channel/volume control nut (M6*7.9*3 mm)	20	D-12 (9)
362-01091-01	Knob seal	10	D-12 (10)
303-30071-02	Battery catch	20	–
303-50091-00	Belt clip	20	–
OPP100:	Orca Elan front panel assembly. This comprises the following parts:	1	–
	252-00010-55 Speaker 0.5 W 16 $\Omega$	1	
	302-05231-01 Speaker mounting bracket	1	
	307-01021-00 Speaker grill	1	
	316-06629-00 Orca Elan front panel	1	
	316-06633-00 Knob label	1	
	316-06634-01 Front panel logo plate	1	
	349-00030-00 Speaker screw (1.8*5 mm Torx)	2	
	354-01044-00 Bush M2 threaded brass	2	
	369-01039-00 Speaker cloth	1	

Table D-4: Orca Excel spares kit (TOPA-SP-103)

IPN	Description	Quantity supplied	Reference
345-00020-11	Chassis screw (M2*8 mm PanTorx)	10	D-1 (3)
311-01044-02	Channel selector knob	20	D-2 (1)
311-01043-02	Volume control knob	20	D-2 (2)
316-06633-01	Knob label	5	D-2 (3)
362-01092-02	Main seal	20	–
303-11194-02	Handportable chassis	5	D-4 (2), D-5 (3)
360-02015-00	Microphone grommet/seal	10	D-5 (1)
311-03099-01	PTT keypad	20	–
316-85124-01	PTT retaining plate	10	–
360-01060-00	PTT/function key actuator	40	–
312-01071-00	Lens	2	D-6 (1)
349-00030-02	Speaker screw (1.8*5 mm Torx)	10	D-7 (3)
252-00010-55	Speaker 0.5 W 16 $\Omega$	5	–
302-05231-01	Speaker mounting bracket	5	–
369-01039-00	Speaker cloth	5	–
231-00010-45	Channel selector switch	10	D-8 (2), D-9 (2)
040-05500-08	Volume control switch	10	D-8 (3), D-9 (3)
232-00010-37	PTT tact switch	5	D-8 (8), D-9 (6)
345-00020-09	PA screw (M2*5 mm Pan Pozl)	10	D-8 (10)
252-00010-56	Microphone	5	D-8 (11)
356-01077-00	Battery contact probe	10	D-9 (7)
362-01087-00	Battery contact seal	10	D-9 (8)
308-01057-01	Aux dummy rear cover	20	–
220-01414-03	Aux flex connector PCB	5	D-10 (1)
362-01089-01	Auxiliary flex seal	10	D-10 (2)
362-01088-00	Rear panel seal	10	D-10 (5)
316-06632-01	Rear panel	5	D-10 (7)
219-50029-01	RF out assembly	5	D-11 (1)
240-02156-01	Antenna SMA connector	10	D-12 (4)
353-00010-42	Ribbed lock washer (M6*10*0.7 mm)	30	D-12 (7)
352-01053-00	Antenna SMA connector nut	10	D-12 (8)
352-00010-52	Channel/volume control nut (M6*7.9*3 mm)	20	D-12 (9)
362-01091-01	Knob seal	10	D-12 (10)
303-30071-02	Battery catch	20	–
303-50091-00	Belt clip	20	–
008-36671-80	LCD display	1	–
304-07042-00	LCD holder	1	–
311-03101-01	Orca Excel keypad	5	–
220-01501-00	User interface loom PCB	5	–
OPP200:	Orca Excel front panel assembly. This comprises the following parts:	1	–
	252-00010-55 Speaker 0.5 W 16 $\Omega$	1	
	302-05231-01 Speaker mounting bracket	1	
	307-01021-00 Speaker grill	1	
	312-01071-00 Lens	1	
	316-06633-00 Knob label	1	
	316-06636-00 Orca Excel front panel	1	
	349-00030-00 Speaker screw (1.8*5 mm Torx)	2	
	354-01044-00 Bush M2 threaded brass	2	
	369-01039-00 Speaker cloth	1	
	Orca Excel user interface PCB and polyester dome, assembled on the shield. This comprises the following parts:	5	–
	OPF200-A User interface PCB assembly	5	
	311-04004-00 Polyester dome	5	
	319-01203-01 Shield	5	



Table D-5: Orca Eclipse spares kit (TOPA-SP-108)

IPN	Description	Quantity supplied	Reference
345-00020-11	Chassis screw (M2*8 mm PanTorx)	10	D-1 (3)
311-03102-01	TOP High Tier Keypad	5	–
316-85123-00	Eclipse volume plate	20	–
365-00011-38	Yellow Static Warning Label	3	–
362-01092-02	Main seal	20	–
303-11194-02	Handportable chassis	5	D-4 (2), D-5 (3)
360-02015-00	Microphone grommet/seal	10	D-5 (1)
311-03099-01	PTT keypad	20	–
316-85124-01	PTT retaining plate	10	–
360-01060-00	PTT/function key actuator	40	–
312-01071-00	Lens	2	D-6 (1)
349-00030-02	Speaker screw (1.8*5 mm Torx)	10	D-7 (3)
252-00010-55	Speaker 0.5 W 16 $\Omega$	5	–
302-05231-01	Speaker mounting bracket	5	–
369-01039-00	Speaker cloth	5	–
231-00010-45	Channel selector switch	10	D-8 (2), D-9 (2)
040-05500-08	Volume control switch	10	D-8 (3), D-9 (3)
232-00010-37	PTT tact switch	5	D-8 (8), D-9 (6)
345-00020-09	PA screw (M2*5 mm Pan Pozi)	10	D-8 (10)
252-00010-56	Microphone	5	D-8 (11)
356-01077-00	Battery contact probe	10	D-9 (7)
362-01087-00	Battery contact seal	10	D-9 (8)
308-01057-01	Aux dummy rear cover	20	–
220-01414-03	Aux flex connector PCB	5	D-10 (1)
362-01089-01	Auxiliary flex seal	10	D-10 (2)
362-01088-00	Rear panel seal	10	D-10 (5)
316-06632-01	Rear panel	5	D-10 (7)
219-50029-01	RF out assembly	5	D-11 (1)
240-02156-01	Antenna SMA connector	10	D-12 (4)
353-00010-42	Ribbed lock washer (M6*10*0.7 mm)	10	D-12 (7)
352-01053-00	Antenna SMA connector nut	10	D-12 (8)
362-01091-01	Knob seal	10	D-12 (10)
303-30071-02	Battery catch	20	–
303-50091-00	Belt clip	20	–
008-36671-80	LCD display	1	–
304-07042-00	LCD holder	1	–
311-03100-01	Eclipse keypad	5	–
220-01501-00	User interface loom PCB	5	–
OPP300:	Orca Eclipse front panel assembly. This comprises the following parts:	1	–
252-00010-55	Speaker 0.5 W 16 $\Omega$	1	
302-05231-01	Speaker mounting bracket	1	
307-01021-00	Speaker grill	1	
312-01071-00	Lens	1	
316-05104-01	Orca Eclipse front panel	1	
349-00030-00	Speaker screw (1.8*5 mm Torx)	2	
354-01044-00	Bush M2 threaded brass	2	
369-01039-00	Speaker cloth	1	
	Orca Eclipse user interface PCB and polyester dome, assembled on the shield. This comprises the following parts:	5	–
OPF200-A	User interface PCB assembly	5	
311-04004-00	Polyester dome	5	
319-01203-01	Shield	5	

Table D-6: Orca Elan re-skinning kit (TOPA-SP-102)

IPN	Description	Quantity supplied
311-01043-02	Volume control knob	1
311-01044-02	Channel selector knob	1
311-03099-01	PTT keypad	1
316-06632-01	Rear panel	1
316-85124-01	PTT retaining plate	1
345-00020-11	Chassis screw (M2*8 Pan Torx)	2
360-01060-00	PTT/function key actuator	2
362-01088-00	Rear panel seal	1
362-01091-01	Auxiliary flex seal	1
362-01092-02	Main seal	1
OPP100	Elan front panel assembly	1

Table D-7: Orca Excel re-skinning kit (TOPA-SP-104)

IPN	Description	Quantity supplied
311-01043-02	Volume control knob	1
311-01044-02	Channel selector knob	1
311-03099-01	PTT keypad	1
316-06632-01	Rear panel	1
316-85124-01	PTT retaining plate	1
345-00020-11	Chassis screw (M2*8 Pan Torx)	2
360-01060-00	PTT/function key actuator	2
362-01088-00	Rear panel seal	1
362-01091-01	Auxiliary flex seal	1
362-01092-02	Main seal	1
OPP200	Excel front panel assembly	1

Table D-8: Orca Eclipse re-skinning kit (TOPA-SP-109)

IPN	Description	Quantity supplied
311-03100-01	Eclipse keypad	1
316-85123-00	Eclipse volume plate	1
311-03099-01	PTT keypad	1
316-06632-01	Rear panel	1
316-85124-01	PTT retaining plate	1
345-00020-11	Chassis screw (M2*8 Pan Torx)	2
360-01060-00	PTT/function key actuator	2
362-01088-00	Rear panel seal	1
362-01091-01	Auxiliary flex seal	1
362-01092-02	Main seal	1
OPP300	Eclipse front panel assembly	1

# PART E Battery packs and chargers

This part provides information on the battery packs and chargers available for Tait Orca handportables.

The battery packs are not serviceable, and repair of chargers is limited to replacement of the spring contacts, the discharge tact switch and the DC jack.

---

## Contents

<b>Battery packs .....</b>	<b>E-3</b>
Battery shift life .....	E-3
Disposing of used nickel-cadmium batteries .....	E-4
<b>Battery chargers .....</b>	<b>E-5</b>
<b>Desktop fast charger .....</b>	<b>E-6</b>
Fast charger operation .....	E-6
Using the fast charger .....	E-9
Repairing the fast charger .....	E-10
<b>Desktop trickle charger .....</b>	<b>E-12</b>
Trickle charger operation .....	E-12
Using the trickle charger .....	E-13
Repairing the trickle charger .....	E-13
Troubleshooting .....	E-13
<b>Multi-charger .....</b>	<b>E-15</b>
Multi-charger operation .....	E-15
Repairing the multi-charger .....	E-15
Fuse replacement .....	E-16



---

# Battery packs

---

Six battery packs are available for Tait Orca handportables. These battery packs are not serviceable, but their construction and expected life are described below.

The battery packs available are:

- TOPB100 NiCD battery pack;
- TOPB600 NiCD battery pack (slim, no belt clip);
- TOPB200 NiCD battery pack;
- TOPB400 NiMH battery pack;
- TOPB700 NiMH battery pack (slim, no belt clip); and
- TOPB500 NiMH battery pack.

The battery casing is constructed using a rugged resin material, and includes two pieces that are ultrasonically welded together.

## Battery shift life

Battery shift life is outlined in Table E-1.

Battery shift life for other models can be calculated from the typical drain rates on page E-4.

## Preserving battery shift life

It is important that you follow the steps below to preserve the shift life of the battery:

- Charge or change the battery as soon as the radio gives the 'Low Battery' warning.
- Short condition the battery weekly.
- Long condition the battery only for the following reasons: on first use of new battery, if performance is poor, and after more than two weeks of storage.
- Avoid leaving charged batteries in the charger for more than a day.
- Clean electrical contacts of the battery using a fibre glass pencil, or the graphite tip of a type 4H (#4) or harder pencil.
- Always store the battery detached from the radio when storing for more than a few days.
- Turn the radio off when it is unattended for long periods.
- Use only a Tait-recommended charger.
- Maintain an ambient temperature of between 5°C and 40°C during recharging. Optimum battery performance will be obtained between 15°C and 25°C.
- Do not allow the battery pack contacts to become short-circuited.

Table E-1: Typical battery shift life (in hours) based on a 5:5:90 duty cycle for a new conditioned battery pack\*.

Battery type	Radio type		
	Conventional - Medium Economy	Conventional - No Economy	Trunked
TOPB100/600 NiCD	8.5	7	6.5
TOPB400/700 NiMH	10.5	8.5	8
TOPB200 NiCD	11.5	9	8.5
TOPB500 NiMH	15	12	11

\* Users should aim to have one hour spare capacity at the end of their shift to allow for battery ageing.

## Extending battery shift life

Battery shift life can be extended by activating economy mode (conventional radios) or by using dynamic power control (trunked radios).

During economy mode, the radio cycles between the normal receive state and a standby state in which some of the radio's circuitry is switched off or placed on standby mode. Dynamic power control optimises the radio's power use by reducing the transmit power in high signal strength areas.

Typical drain rates for a conventional UHF radio are:

- 1.5 A at high power transmit;
- 300 mA in receive at rated audio;
- 80 mA on standby (no audio);
- 55 mA with low economy cycling enabled;
- 45 mA with medium economy cycling enabled; and
- 40 mA with high economy cycling enabled.

Economy cycling in conventional radios is programmed in the **Power Save Features** screen of the *Tait Orca Portable Conventional Programming Application (TOPCPA)*. Dynamic power control in trunked radios is enabled in the **User Selectable Parameters** screen of the *Tait Orca Portable Trunked Programming Application (TOPTPA)*.

## Disposing of used nickel-cadmium batteries

NiCd batteries contain a small amount of the metal cadmium, which can produce potentially toxic waste if not disposed of properly. When no longer in use, contact your Tait dealer for recycling details.

# Battery chargers

**Important Note:** In order to charge TOPB700 NiMH batteries, the charger must have firmware version 2.07 or greater. TOPB500 NiMH batteries can be charged on chargers with firmware version 2.05 or greater.

Three battery chargers are available for Tait Orca handportables:

- desktop fast charger;
- desktop trickle charger; and
- six-way multi-charger.

The fast charger charges, conditions and analyses the battery. The trickle charger only charges the battery, and does not have a conditioning button but is otherwise identical in appearance to the fast charger. The multi-charger is made up of six fast chargers, and charging instructions for the fast charger also

apply to the multi-charger.

Note that the trickle charger should not be used for NiMH battery packs as they can take up to 24 hours to charge fully and the overall lifetime of the battery may be reduced. NiMH battery packs should be charged using a fast charger.

Repair of chargers is limited to replacement of the spring contacts, the discharge tact switch and the DC jack.

The repair information provided for the fast charger also applies to repair of the trickle charger and multi-charger.

A spares kit is available for Tait Orca chargers (TOPA-SP-202). The contents of the spares kit is shown in Table E-2, and the assembly of these parts is shown in Figure E-3.

Table E-2: Contents of the Tait Orca chargers spares kit (TOPA-SP-202)

IPN	Description	Quantity	For charger
240-02020-07	Skt DC jack	10	All
232-00010-28	Tact switch	10	Desktop fast charger Multi-charger
302-40054-01	Conditioning button	10	Desktop fast charger Multi-charger
262-00001-00	Charger light pipe	10	Desktop fast charger Multi-charger
312-01069-02	Charger top	10	All
312-01070-01	Charger base	10	All
365-01549-01	Charger logo label	10	All
365-01598-01	Charger labels	10	Desktop fast charger Multi-charger
365-01601-00	Charger labels	5	Desktop trickle charger
365-01597-00	Charger labels	5	Desktop trickle charger
369-00010-11	Rubber charger foot	40	All
360-01059-00	Trickle charger blanking label	10	Desktop trickle charger
356-01079-00	Spring probe charger bias-ball	40	All

---

# Desktop fast charger

---

The Tait Orca desktop fast charger (Figure E-1) is an intelligent charger that can charge, condition and analyse both NiCd and NiMH batteries of varying capacities.

## Fast charger operation

A circuit diagram of the fast charger is shown in Figure E-2. The fast charger operates using constant current charging and multiple criteria for end-of-charge detection. When a battery is inserted, the charger detects the type of battery, checks to see if it is working correctly, and then charges the battery.

If the conditioning button is pressed after inserting the battery, the charger will discharge the battery before charging. If the conditioning button is held down while the battery is being inserted, the charger will enter a long condition cycle that will charge and discharge the battery a number of times and, on the last cycle, check its capacity before recharging.

Multiple protection methods are employed to ensure safe operation.

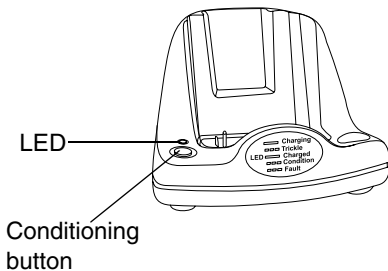


Figure E-1: Tait Orca fast charger

## Hardware operation

Power to the unit is provided from a 12 volt, 1 amp (nominal) wall-mounted AC to DC adaptor, through SK1. Reverse polarity protection is provided by the 22 V transient suppress-

or, D1, in conjunction with poly-switch PS1. Under reverse polarity conditions, D1 conducts, drawing the available short circuit current until PS1 trips. D1 also protects against any voltage spikes that may come through the AC to DC adaptor. The unit is designed for 10.5 - 14 V operation.

The +5V supply is produced by the regulator, IC1. A feature of this regulator is that it provides a RESET output to the microprocessor. This RESET output is used to delay startup of the microprocessor until the power supply has stabilised after turn-on. It also puts the microprocessor into reset if the input voltage falls too low. D2 sets this low voltage threshold to approximately 9.2 V.

The intelligence of the fast charger is provided by the microprocessor, IC2, which interfaces with the current source, the discharge circuit and the expanded battery voltage interface. The user can interact with the fast charger by pressing the conditioning button, SW1, and can observe the operational state on the tri-colour LED, D5.

The current source is based on a ground-sensing linear topology. R1 and R2 are the current sense resistors. The power device is a P-channel MOSFET, Q4, which is controlled by an operational amplifier, IC3:A. The feedback path that controls the op amp, and hence the current, is through transistor Q5 and its resistor network. The grounding on R23 includes the ground sense resistors in the feedback path. The nominal output current is 800 mA.



The schematic diagram illustrates a 12-channel, 16-bit, 100-Sps ADC system. The system is powered by a DC-DC converter (DC-DC1) and a 12-channel multiplexer (IC1). The ADC (IC2) is configured for 16-bit resolution and 100-Sps sampling rate. The DAC (IC3) is configured for 100-Sps output rate. The system includes various components such as resistors, capacitors, and integrated circuits, along with their pin connections and power supply rails.

**Power Supply and Grounding:**

- VCC:** 4.1V4
- IC3:** LM324D
- IC2:** 11V-
- IC1:** AD7295S
- IC4:** AD7295S
- IC5:** AD7295S
- IC6:** AD7295S
- IC7:** AD7295S
- IC8:** AD7295S
- IC9:** AD7295S
- IC10:** AD7295S
- IC11:** AD7295S
- IC12:** AD7295S
- IC13:** AD7295S
- IC14:** AD7295S
- IC15:** AD7295S
- IC16:** AD7295S
- IC17:** AD7295S
- IC18:** AD7295S
- IC19:** AD7295S
- IC20:** AD7295S
- IC21:** AD7295S
- IC22:** AD7295S
- IC23:** AD7295S
- IC24:** AD7295S
- IC25:** AD7295S
- IC26:** AD7295S
- IC27:** AD7295S
- IC28:** AD7295S
- IC29:** AD7295S
- IC30:** AD7295S
- IC31:** AD7295S
- IC32:** AD7295S
- IC33:** AD7295S
- IC34:** AD7295S
- IC35:** AD7295S
- IC36:** AD7295S
- IC37:** AD7295S
- IC38:** AD7295S
- IC39:** AD7295S
- IC40:** AD7295S
- IC41:** AD7295S
- IC42:** AD7295S
- IC43:** AD7295S
- IC44:** AD7295S
- IC45:** AD7295S
- IC46:** AD7295S
- IC47:** AD7295S
- IC48:** AD7295S
- IC49:** AD7295S
- IC50:** AD7295S
- IC51:** AD7295S
- IC52:** AD7295S
- IC53:** AD7295S
- IC54:** AD7295S
- IC55:** AD7295S
- IC56:** AD7295S
- IC57:** AD7295S
- IC58:** AD7295S
- IC59:** AD7295S
- IC60:** AD7295S
- IC61:** AD7295S
- IC62:** AD7295S
- IC63:** AD7295S
- IC64:** AD7295S
- IC65:** AD7295S
- IC66:** AD7295S
- IC67:** AD7295S
- IC68:** AD7295S
- IC69:** AD7295S
- IC70:** AD7295S
- IC71:** AD7295S
- IC72:** AD7295S
- IC73:** AD7295S
- IC74:** AD7295S
- IC75:** AD7295S
- IC76:** AD7295S
- IC77:** AD7295S
- IC78:** AD7295S
- IC79:** AD7295S
- IC80:** AD7295S
- IC81:** AD7295S
- IC82:** AD7295S
- IC83:** AD7295S
- IC84:** AD7295S
- IC85:** AD7295S
- IC86:** AD7295S
- IC87:** AD7295S
- IC88:** AD7295S
- IC89:** AD7295S
- IC90:** AD7295S
- IC91:** AD7295S
- IC92:** AD7295S
- IC93:** AD7295S
- IC94:** AD7295S
- IC95:** AD7295S
- IC96:** AD7295S
- IC97:** AD7295S
- IC98:** AD7295S
- IC99:** AD7295S
- IC100:** AD7295S

The discharge circuit is based around a constant current sink. This uses an N-channel MOSFET, Q6, controlled by an operational amplifier, IC3:B. R41 and R42 are the current sense resistors that allow the op amp to set the current. The nominal discharge current is 400 mA.

The microprocessor needs to be able to monitor the battery voltage. A coarse voltage is provided by the voltage divider R48, R49 and R50. This voltage divider brings the range of battery voltage into the same range as the microprocessor A/D input (0-5 V). This enables the microprocessor to monitor the general battery voltage. An expanded battery voltage interface is based around operational amplifier IC3:C. It expands a small window of battery voltage over the range of the microprocessor A/D input. This enables the microprocessor to detect small changes in battery voltage and accurately pick when the battery voltage drops below peak.

The interface to the battery is through four contacts, positive (+BATT), temperature (TEMP), capacity (CAP) and ground (GND). The positive and ground contacts are the main connections for charging. In the battery pack, the temperature contact is connected to ground via a thermistor. This allows the charger to monitor the temperature of the battery and if the battery temperature is outside the range +5°C to +40°C, the charger will not charge the battery. The charger also uses the temperature line for detecting the presence of a battery; for example, detecting whether the battery has been inserted or removed from the charger. In the battery pack, the capacity contact is connected to ground via a resistor. If there is a capacitor in parallel with the capacity resistor, then the resulting time constant indicates to the charger that the battery pack is NiMH. Consequently, battery packs that do not have a capacitor in parallel with the capacity resistor are considered to be NiCd.

## Software operation

The charging sequence is as follows.

- battery flat check;
- battery type detection;
- battery open circuit test;
- battery short circuit test;
- battery temperature test;
- battery discharge (optional);
- fast charge;
- Multiple EOC detection methods;
- trickle charge;
- standby charge.

If during trickle or standby charge the battery voltage falls to the discharged battery threshold, the charger restarts the charge cycle as if the battery has just been inserted.

Using the fast charger

Fast charger indicators are described in Table E-3.

Table E-3: Fast charger indicators

Indicator	Meaning
steady red	battery charging
steady green	battery charged
steady amber	charge suspended until battery temperature is within correct range
flashing red	battery not seated properly in the charger, contacts dirty or battery faulty
flashing green	battery trickle charging
flashing amber	battery being long or short conditioned. If flashing amber as soon as radio is seated in charger, may indicate a fault such as dirty or obstructed contacts

Charging the battery using the fast charger

Charging using the fast charger involves three stages.

- The fast charge stage quickly brings the battery up to near its full capacity. The charger LED will glow red.
- The trickle stage slowly tops up the battery until it is at its full capacity, which is typically 1 1/2 hours. The charger LED will flash green.
- The standby charge stage keeps the battery at its full capacity, as long as the radio is turned off. The charger LED will glow green.

The battery can be charged separately or attached to the radio. The radio must be turned off to ensure a full charge.

Turn off the radio and insert the battery/radio into the charger. If the indicator does not glow red, make sure the battery/radio is seated properly, the charger is plugged in correctly, and the battery contacts are clean and not obstructed. If the battery is too hot or too cold,

the indicator will remain amber until the battery temperature is within the safe range for recharging (5°C to 40°C).

Approximate charge times are:

- up to 1½ hours for TOPB100 and TOPB600;
- up to 2 hours for TOPB200, TOPB400 and TOPB700; and
- up to 2 ½ hours for TOPB500.

Once the battery has reached approximately 90% capacity, the indicator will flash green. At this point, it is recommended the battery be left in the charger for a further 1 to 2 hours, to ensure maximum battery charge. Once the battery is fully charged, the indicator will glow green. Avoid leaving charged batteries in the charger for more than a day.

Conditioning the battery with the fast charger

Two conditioning functions are available on the fast charger, a short conditioning cycle and a long conditioning cycle. The short cycle discharges the battery then charges it. Regularly recharging a battery that has not been completely discharged will eventually affect its ability to hold a full charge.

For best performance, the battery should be conditioned weekly using the fast charger. Conditioning the battery takes about four to eight hours, depending on how much use it has had.

**Note:** Do not use the short conditioning cycle on a new battery without first fully charging it using a long conditioning cycle.

The long conditioning cycle is necessary:

- before the battery is used for the first time;
- if the battery performance has deteriorated; or
- after the battery has been stored for longer than two weeks.

To short condition the battery

Turn off the radio and insert the battery/radio into the fast charger. When the charger LED glows red, press the conditioning button until the indicator flashes amber. Release the conditioning button. The LED will flash amber while the battery is being discharged. Once the battery is discharged, it will charge normally. The battery is ready to be used again when the charger LED glows green.

To long condition the battery

Long conditioning the battery with the fast charger will put the battery through a number of conditioning cycles and will check the battery's capacity on the last cycle.

To long condition the battery, turn off the radio. Press and hold the conditioning button while inserting the battery/radio. Continue holding the conditioning button until the indicator flashes amber. When the indicator flashes amber, release the conditioning

button.

The long condition cycle will take approximately 24 hours.

Once charged, the charger's indicator will glow green if the battery is in good condition. The indicator will flash red if the battery is well below optimum capacity; consult your Tait dealer.

### Repairing the fast charger

The assembly of the fast charger is shown in Figure E-3.

Depress the release tab in the base of the charger using the end of a flat-bladed screwdriver. Holding the lever in, gently pull the body away from the base. Lift out the PCB.

Replace the battery contacts, the tact switch and the DC jack, if necessary.

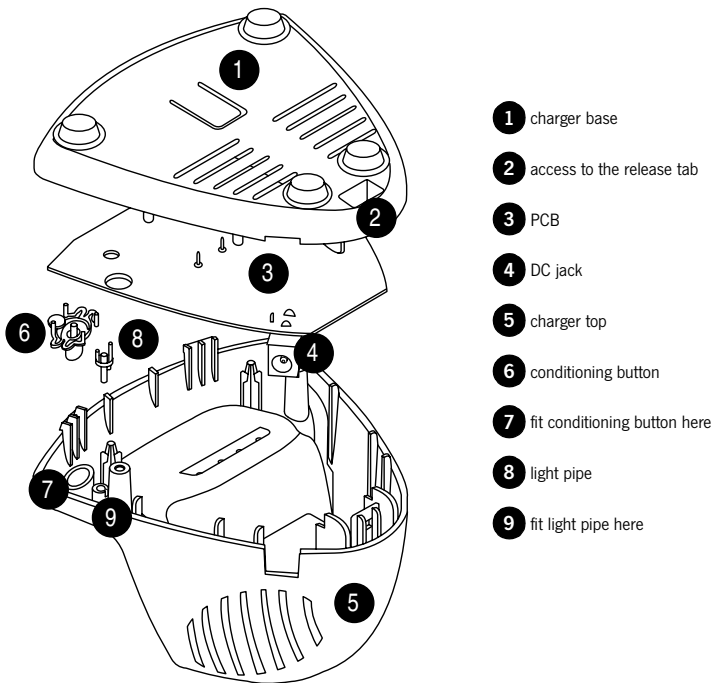


Figure E-3: Assembly of the desktop fast charger

Replacing the spring contacts

If the two outer contacts are the same type as the two inner contacts, the two outer holes must be drilled out to 2.2 mm to accommodate the larger new positive and negative spring contacts. Figure E-4 shows the charger PCB with the location of the different spring contacts indicated.

Remove the faulty contacts with a soldering iron and discard. When placing the replacement contact, it must not be bent or otherwise damaged. Solder the replacement contact in place using a heavy-tip soldering iron (e.g. Weller 2PTCC8 tip). Hold onto the contact with a pair of pliers and apply solder to the PCB, rather than to the contact, to avoid contact damage.

Replacing the discharge tact switch

Remove the tact switch using a desoldering station or solderwick. Place the new part on the board and solder it in place using a medium-tip soldering iron (e.g. Weller PTA7 tip).

Replacing the DC jack

Remove the DC jack using a desoldering station or solderwick. There is a lot of solder on both sides of the board, so be sure to remove it all.

Place the new part on the board and solder it in place using a heavy-tip soldering iron (e.g. Weller 2PTCC8 tip).

Reassembling the charger

Refer to Figure E-3.

Hold the body of the charger upside down and insert the conditioning button and the light pipe; both parts self-orient. Place the PCB so it rests on the location pins. Attach the base at the front edge, and clip it down at the back.

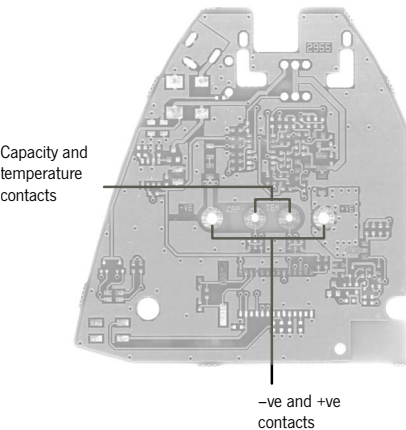


Figure E-4: The fast charger PCB, showing the location of the different spring contacts

Table E-4: Charger Spares and Upgrade Kits:

Product code	Description
TOPA-SP-202	Charger Spares Kit
TOPA-SP-203	Charger Upgrade Kit
TOPA-SP-205	Charger Software Upgrade Kit

---

# Desktop trickle charger

---

The Tait Orca desktop trickle charger can charge a 1100 mAh or 1500 mAh NiCd battery overnight. It is designed to provide approximately 1450 mAh of charge in a 16 hour period. Thus both 1100 mAh or 1500 mAh NiCd batteries can be charged. Simple protection of the radio is provided in the form of an open circuit voltage limit as well as short circuit protection.

Figure E-5 shows the charger current profile. Figure E-6 shows the circuit diagram for the trickle charger.

## Trickle charger operation

When the battery voltage is above approximately 8 V, the charge current is inversely proportional to the battery voltage. This characteristic is produced by Q100, Q101 and Q102. The charge current is determined by the current through R104, which is set by Q102, its emitter resistors and the reference voltage. The slope of the curve is determined by Q101 and R106. The reference voltage is provided by an 8.2 V Zener diode (D100).

When the battery voltage is below approximately 8 V, the charge current is proportional to the battery voltage. This is accomplished by using Q103 to change the reference voltage in proportion to the battery voltage. This changes the current through R104, which changes the charge current, as desired.

The maximum voltage available from the trickle charger is limited to less than 10.5 V by R111, in conjunction with Q101, so that the radio can not be damaged if the battery goes open circuit. If the battery goes short circuit, then Q102 is held off by Q103 and thus Q100 is off, and there is negligible charge current.

On startup, the state of the charger is similar to that when the charger output is shorted. When power is applied,  $V_{IN}$  starts to rise and the

emitter voltage of Q103 rises. However, the base of Q103 is still at zero volts, so Q103 starts to turn on. When Q103 is on, it will maintain Q102 off and hence Q100 will also stay off. Thus when  $V_{IN}$  has risen to its final value, the circuit is in an off state, giving negligible output voltage and charge current.

In order to activate the circuit, a minimum voltage of approximately 2.6 V (a battery) must be connected to the circuit to charge C101 and turn Q103 off, thus turning on the charger.

The LED is on whenever there is sufficient charge current. Its brightness is proportional to the charge current profile, and its turn-on and turn-off thresholds are determined by R105. Thus the LED is on under normal charging, dims when the battery approaches full charge and is off under fault/no charge conditions.

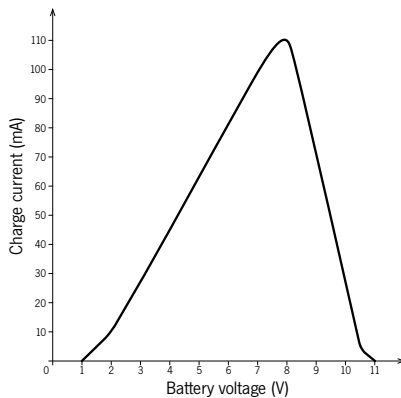
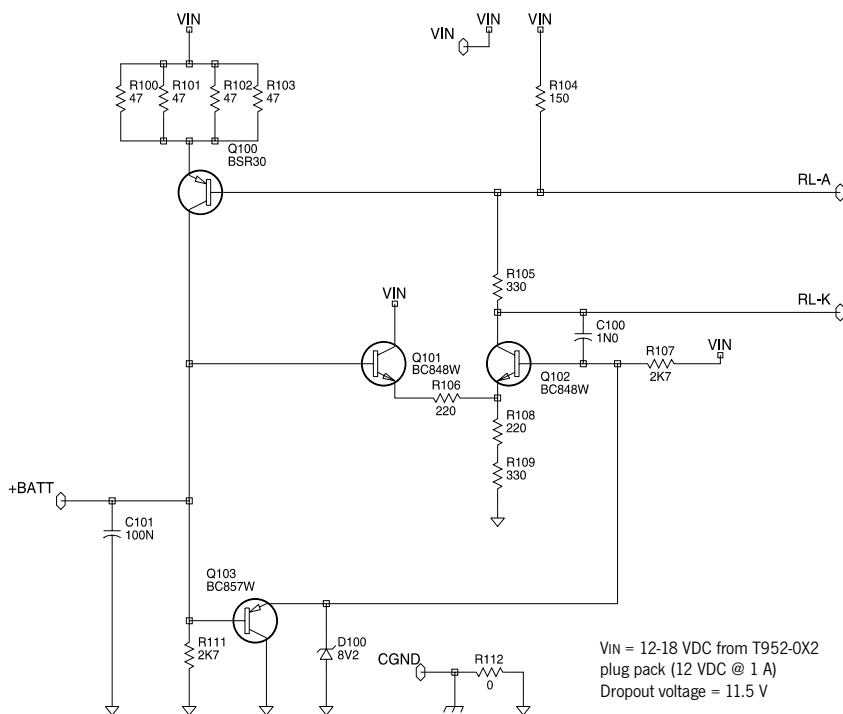


Figure E-5: Tait Orca desktop trickle charger current charge profile

Figure E-6: Circuit diagram of the Tait Orca desktop trickle charger



## Using the trickle charger

The trickle charger is not recommended for NiMH battery packs, as they can take up to 24 hours to charge fully and the overall lifetime of your battery may be reduced. Use a fast charger instead.

The battery can be recharged attached to the radio or as a separate unit. To charge the battery pack using the trickle charger, make sure the radio is turned off. Insert the battery/radio into the charger. Make sure the indicator on the charger glows red. If the indicator does not glow red, check that the battery/radio is seated properly and the charger is plugged in correctly. The indicator will remain red until the radio is removed from the charger.

The battery will be fully charged in about 16 hours. You can leave the battery in the charger

until you next need to use the radio. However, leaving the battery in the charger for longer than 24 hours is not recommended.

## Repairing the trickle charger

For instructions on repairing the trickle charger, refer to those for repairing the desktop fast charger.

## Troubleshooting

*When inserting the battery/radio in the charger, there is no indication on the charger LED.*

- Check that the battery/radio is seated properly in the charger.
- Check that the charger is properly plugged in and the correct plug pack is being used.
- Check that the battery and charger contacts are clean and not obstructed.

Clean the electrical contacts of the battery and charger using a fibre glass pencil, or the graphite tip of a type 4H (#4) or harder pencil.

- May indicate a faulty plug pack or cable. Contact your Tait dealer.

*The charger LED flashes amber as soon as the radio is seated in the charger.*

- Check that the battery and charger contacts are clean and not obstructed.

*The charger LED glows amber.*

- Safe range for charging is 5°C to 40°C, and optimum battery performance will be obtained between 15°C and 25°C. The charger will start charging when the battery temperature is within the range 5°C to 40°C.

*The charger LED flashes red.*

- Check that the battery and charger contacts are clean and not obstructed.
- May indicate a more serious fault such as a faulty battery. Contact your Tait dealer.

*The battery contacts show corrosion.*

- Contact corrosion may start to be noticed later in life, and will reduce battery cell capacity. If early signs of corrosion appear, then clean back and end contacts of the battery using a fibre glass pencil, or the graphite tip of a type 4H (#4) or harder pencil.



---

# Multi-charger

---

The multi-charger (TOPA-CH-300) is made up of six desktop fast chargers that operate independently of one another. Each multi-charger PCB has an additional diode.

## Multi-charger operation

The operation of the multi-charger is the same as that of the desktop fast charger.



Figure E-7: The Tait Orca six-way multi-charger

## Repairing the multi-charger

Should one of the charger units be faulty, you can repair it according to the instructions for the desktop fast charger, or replace the faulty PCB with a fast charger PCB to which the diode (1N4001 or similar) has been added (refer to Figure E-8).

To remove a faulty charger from the multi-charger:

- Unplug the power cord.
- Undo the 10 screws at the base of the radio using a Pozi 1 driver.
- **Do not** pull the top off the charger using the housing of the individual chargers. Instead, from the side of the charger, lift the top cover up and gently fold back.
- Unplug the red and black wires leading to the faulty charger.
- Remove the three screws holding the faulty charger to the top of the multi-charger.
- Gently pull the faulty charger away from the multi-charger top. Turn the charger upside down so that the release tab is at the top.
- Depress the release tab using the end of a flat-bladed screwdriver and gently pull the base away from the body.
- Desolder both wires.
- Repair the board or replace it with a new one to which the required diode has been added.
- Pass the wires through the charger base.
- Solder the red wire to the positive terminal on the PCB and the black wire to the negative terminal on the PCB.
- Place the charger upside down and make sure the conditioning button, the light pipe and the PCB are seated properly.
- Attach the base at the front edge, and clip it down at the back.

- Gently pull the wires through the multi-charger top while aligning the charger with the three screw holes.
- Fasten the charger to the multi-charger top using the three screws.
- Reconnect the red and black wire to the fuse connector. Ensure that the polarity is correct.
- Close up the multi-charger, replacing the 10 screws using a Pozi 1 driver.

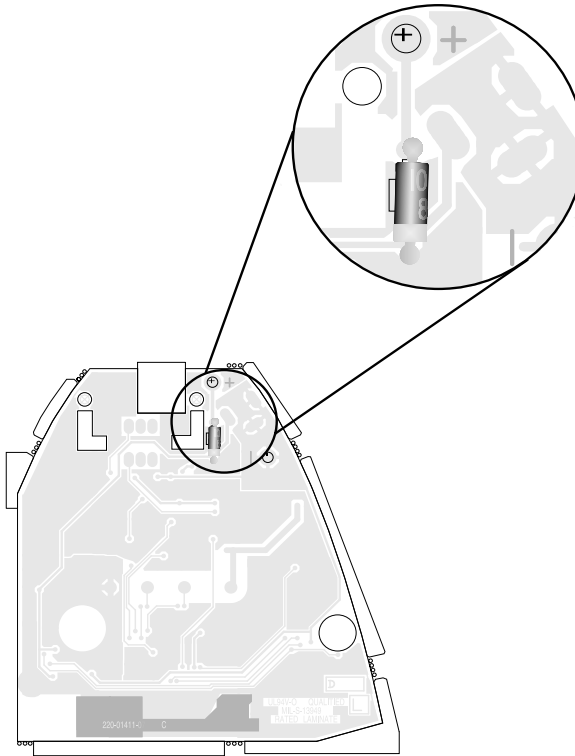


Figure E-8: The Tait Orca Fast Charger PCB. The inset shows where to place the diode (1N4001 or similar) for using the PCB in a multi-charger

A suitable fuse can be ordered directly from Customer Services, Tait Electronics (IPN 265-00010-64).

## Fuse replacement

Each charger is protected by a 3A fuse. To replace a fuse, open the multi-charger as described previously. The fuse must be replaced with a 12V 3A secondary fuse made from material with a Class V-2 flammability rating.

# PART F Accessories

This part describes how to interface accessories with Tait Orca radios, using the Tait Orca accessory connector and the 7.5 mm accessory adaptor.

Detailed servicing information about the Tait Orca vehicle kit is also provided on page F-10.

A list of audio accessories currently available for use with Tait Orca handportables is found in Table A-1, on page A-7.

---

## 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-8</b>
<b>Tait Orca vehicle kit .....</b>	<b>F-10</b>
Product codes .....	F-10
Installing a vehicle kit .....	F-10
Vehicle kit operation .....	F-10
Vehicle kit specifications .....	F-12
Servicing the vehicle kit .....	F-13
Spares kits .....	F-14
Vehicle kit spares kit (TOPA-SP-301).....	F-15
Vehicle kit reskinning kit (TOPA-SP-302).....	F-15
Custom modifications .....	F-16
Vehicle kit circuit descriptions .....	F-18



# Tait Orca accessory connector

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

There are two Tait accessory connector kits available for Tait Orca handportables:

- Accessory Connector Kit (TOPA-AA-006); and
- RF Accessory Connector Kit (TOPA-AA-007).

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-3.

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-6.

## 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-5. If connecting a headset, refer to “Connecting a headset” on page F-5 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).

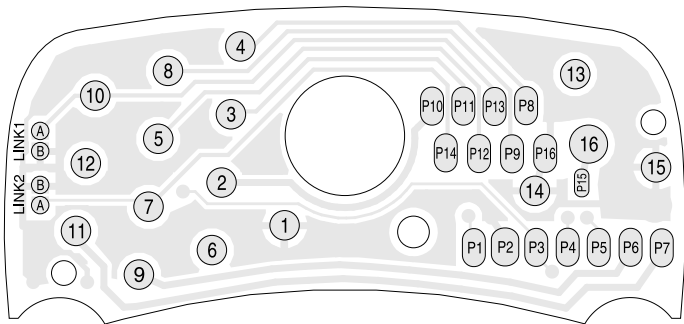
If an external switch is to be used to control the EXT-PTT line, for example in a handsfree vehicle kit, short link 2 (‘LINK2’, shown in Figure F-1).

## 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 as shown in Figure F-3.

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 needle-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

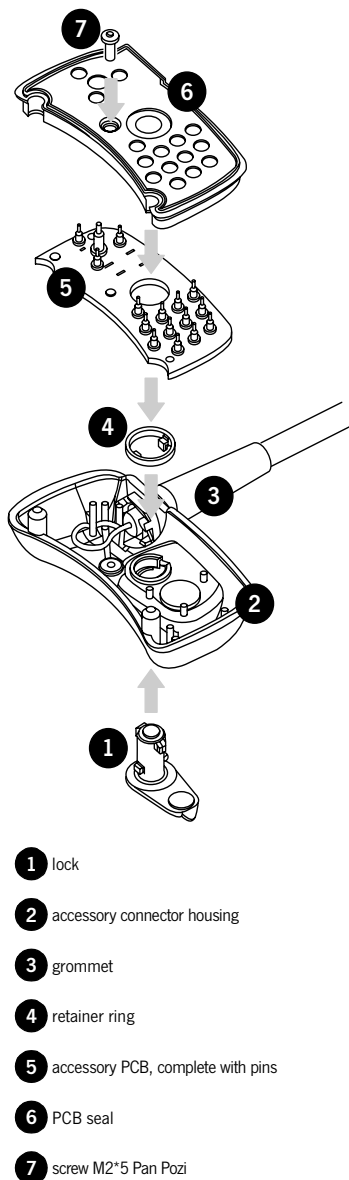


Table F-1: Accessory connector signal specifications

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-8 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.

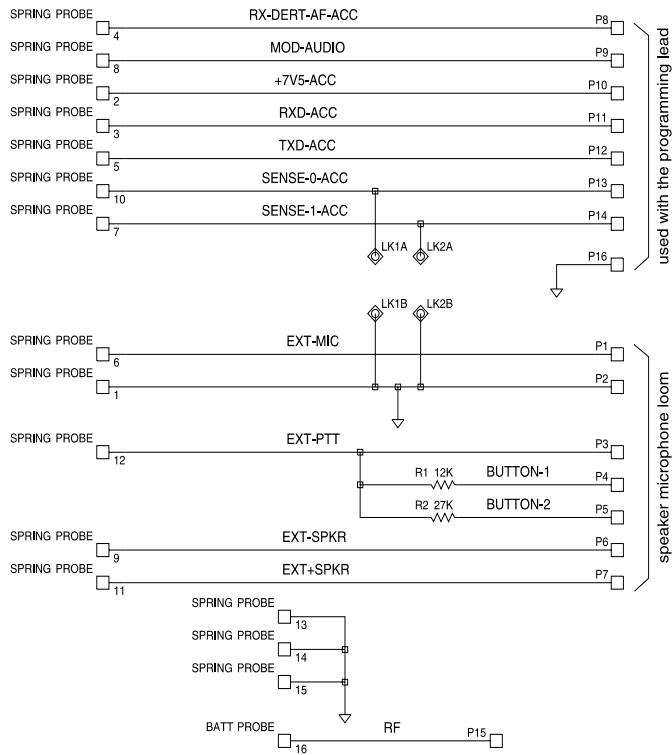


RF

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-3: Tait Orca accessory connector circuit diagram



---

## 7.5 mm accessory adaptor

---

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).

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-4.

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-4.

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-5 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-5). 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-4: Plugs for the 7.5 mm accessory adaptor

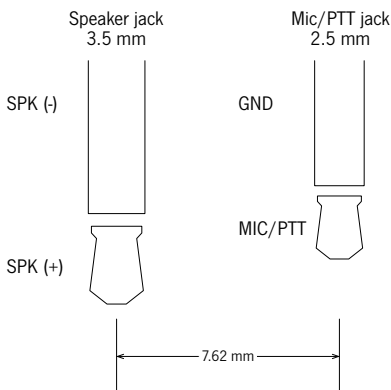
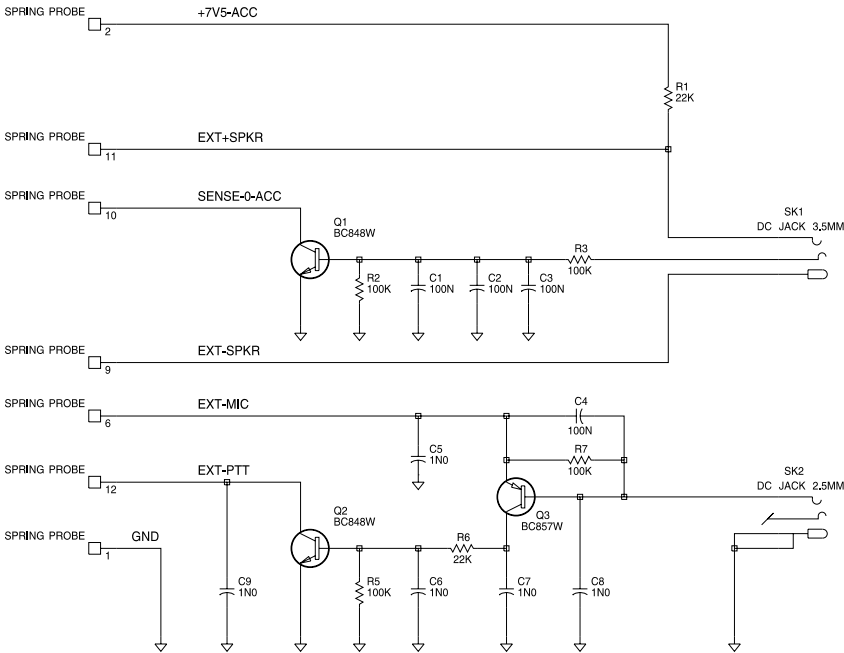


Figure F-5: Tait Orca 7.5 mm accessory adaptor circuit diagram



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

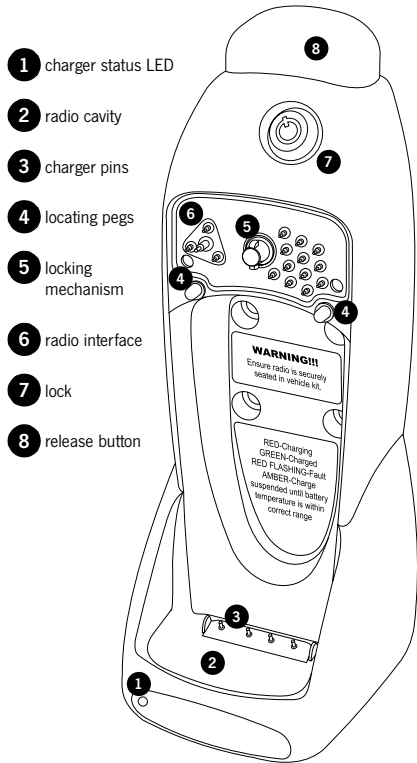


Figure F-6: Vehicle kit assembly

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)
Products 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-7: 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.

### Replacing 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-12
OPA-VK-020	TOP vehicle kit options PCB	1	F-13
OPA-VK-030	TOP vehicle kit accessory probe PCB	5	F-10
OPA-VK-040	TOP vehicle kit charger probe PCB	10	F-11
219-02665-00	Cable - RF (MCX to BNC connectors)	5	F-9
219-02666-00	Cable - charger to charger probe PCBs	5	F-9
219-02667-00	Cable - options to accessory PCBs	5	F-9
240-04021-74	Mobile microphone socket (6-way vertical phone jack)	5	F-8 (3)
240-04021-82	External speaker & remote PTT sockets (3. 5 mm DC jack)	10	F-8 (4), F-8 (5)
240-04021-83	Visor microphone socket (2.5 mm DC jack)	5	F-8 (6)
240-04021-85	Power/ignition sense socket (4-way right angle PCB mounting)	5	F-8 (7)
303-11204-00	Chassis moulding	10	—
305-00007-00	Trigger moulding	10	—
305-00008-00	Quarter turn moulding	10	F-6 (5)
305-00009-00	Peg moulding	10	F-6 (4)
305-00010-00	Trigger cap moulding	10	F-6 (8)
305-00021-00	Trigger spring	10	—
305-00022-00	Peg spring	20	—
305-00023-00	Lock	5	F-6 (7)
353-05006-00	Washer 7/16 beryllium	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-6 (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	—

# 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 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-6 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.

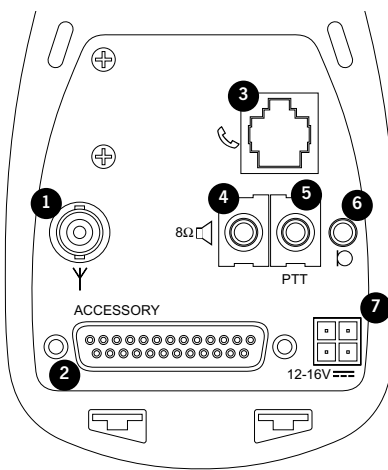
## Setting up 'Hookswitch' functionality for a trunked radio

'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-8: 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 pages F-17 to F-17 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 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)

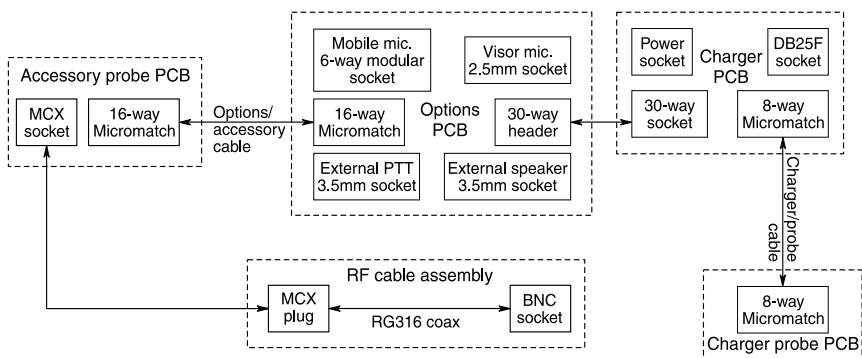
Pin	Signal	Description
1	+13V8LIM	Power out Zout = 10 $\Omega$ ; 100 mA maximum
2	N/C	–
3	EXT-PTT	External PTT and function buttons*
4	MOB-MIC	Dynamic microphone input impedance = 600 $\Omega$
5	GND	Ground
6	N/C	–

\* 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-9: 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-9.

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-10.

Figure F-10: Vehicle kit accessory probe PCB block diagram

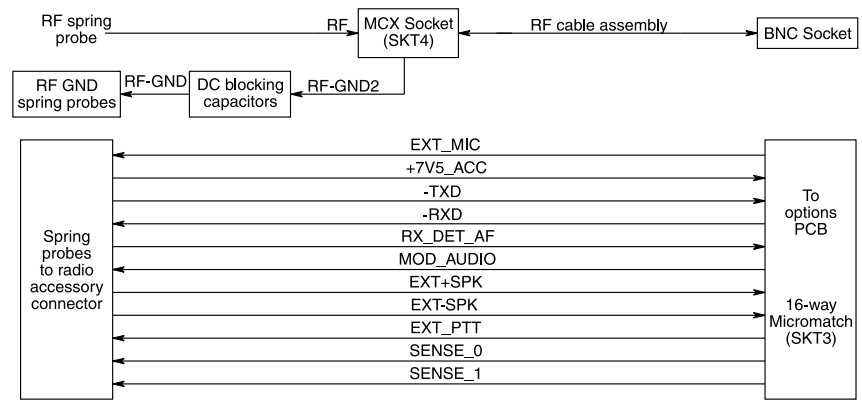
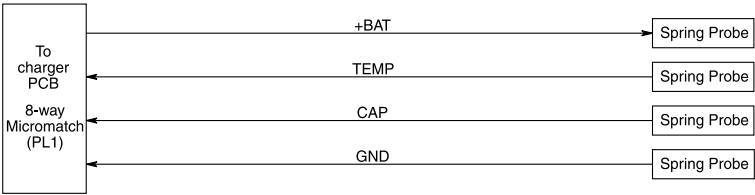


Figure F-11: Vehicle kit charger probe PCB block diagram



**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-11.

**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-12.

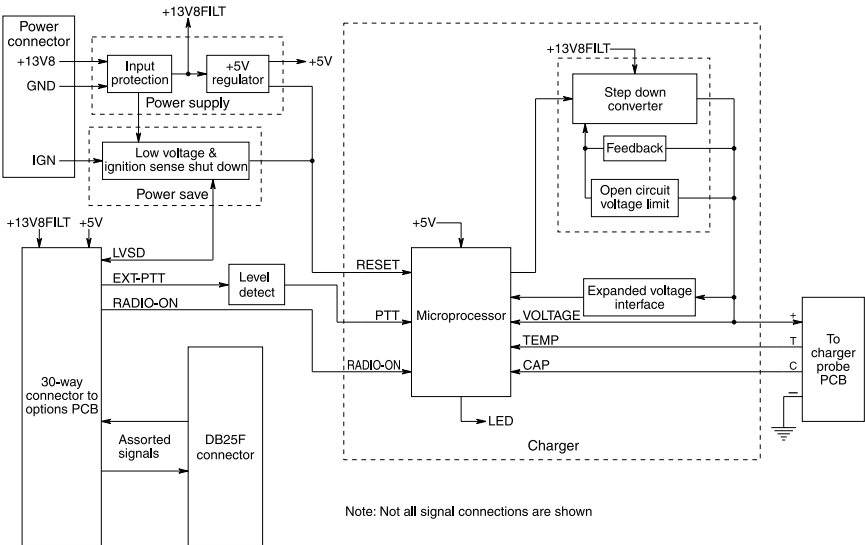
**Current Source**

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-12: 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.

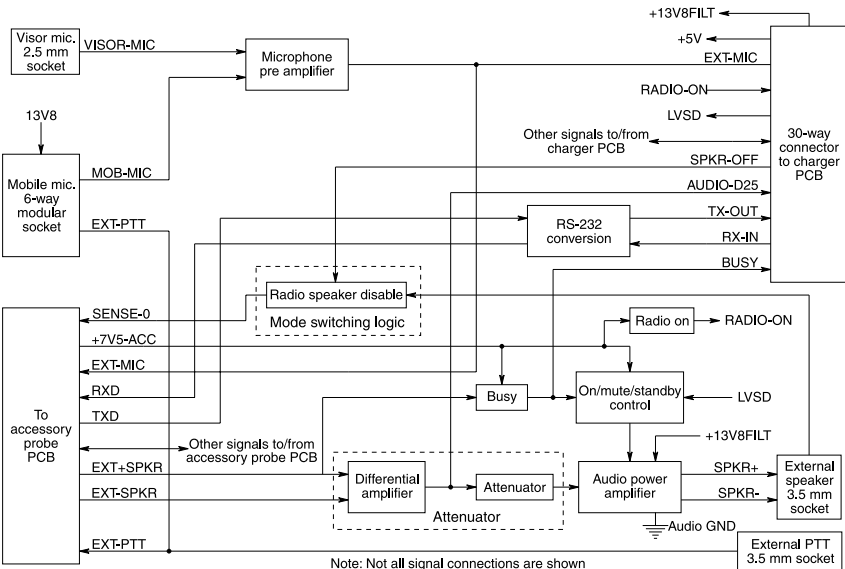
### Vehicle kit options PCB (IPN 220-01505-xx)

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-13.

#### 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-13: 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.



# **PART G** Additional information

This part provides reference information, including a glossary of terms.

---

## **Contents**

<b>Glossary .....</b>	<b>G-3</b>
<b>Tait Electronics Limited Software Licence Agreement .....</b>	<b>G-7</b>



---

# Glossary

---

## active

The 'on' (asserted) state of a signal or indicator.

## ADC

Analog to digital converter. An electronic device that outputs binary data dependant upon the magnitude of voltage input.

## brownout

A dip in the supply voltage sufficient to put the control section into hardware reset.

## calibration

The process of determining the **calibration data** for a radio. Calibration is normally only carried out during product manufacture or major service.

## calibration data

The set of coefficients for each of the electronic tuning variables, as a function of frequency, which allows the radio to calculate the **configuration data** for any frequency it operates on. The **calibration data** is unique for each radio.

## call

A complete exchange of information between two or more parties. In **trunked mode**, this may occur on the **control channel** or on a **traffic channel**.

## CCTM

Computer controlled test mode. The operating mode of the radio whereby computer equipment can control various radio functions by sending commands down a serial link to the radio.

## channel

A receive/transmit frequency pair.

## configuration

The determination and setup of the **configuration data** for a given frequency from the programmed **calibration data** (i.e. electronic tuning).

## configuration data

The data set corresponding to the value of the electronic tuning variables on a given channel. This is calculated for each frequency from the **calibration data**.

## control channel

The **channel** used by a **trunking system** to control the radio.

## conventional mode

The mode of operation whereby the radio behaves as a conventional two-way radio (i.e. non-trunked operation).

## CTCSS

Continuous Tone Controlled Squelch System. Continuous, subaudible coding on the channel for the purpose of segregating user groups.

## DAC

Digital to analog converter. An electronic device that outputs a voltage dependent upon the value of binary data input.

## database

The set of programmable data points that allows the product to be customised for a particular application or mode of operation.

Note: Terms that appear in **bold sans serif** font are also defined in this glossary.

## DC

Direct current.

## DCS

Digitally coded squelch. Continuous, subaudible coding (repeating digital code sequence) on the **channel** for the purpose of segregating user groups.

## delayed

Key action. The input is not actioned until it has been stable for the duration of the debounce interval.

## dialled string

A sequence of characters entered via the keypad. May contain **numbers**, **labels**, ‘\*’ or ‘#’. Used to initiate **calls** or invoke special functions.

## dialling

The act of entering a number or label by typing in successive characters on the keyboard.

## DSP

Digital signal processor.

## DTMF

Dual tone multiple frequency. Method of encoding digits (0 to 9) and characters (A to F), each as a pair of eight standard tones.

## economy mode

When the radio is cycling between the **receive mode** and **standby** state. Available on Tait Orca conventional handportables.

## ECR

External call request.

## EPROM

Erasable programmable read only memory.

## EPTT

External press-to-talk.

## ESN

The MPT1343 defined electronic serial number of the radio.

## FFSK

Fast frequency shift keying. The signalling method employed in trunked radios. Data is represented by 1 cycle of 1200 Hz (logic 1) or 1.5 cycles of 1800 Hz (logic 0) and is transmitted at 1200 baud.

## fixed (indicators)

Do not time out of their own accord. Generally indicate mode of operation or state.

## idle

The state of the radio in **trunked mode** when it is not engaged in a call or call setup, or in **conventional mode** when the radio is not transmitting.

## IF

Intermediate frequency.

## inactive (indicator)

The ‘off’ (unasserted) state of a signal or indicator.

## label

A plain language word (1 to 8 characters long) that is defined to represent a valid dialled string at radio programming time.

## LCD

Liquid crystal display.

## LED

Light emitting diode.

## LPF

Low pass filter.

## MCU

Micro control unit.

**mute**

The receive audio gating element. When active, receive audio is passed to the speaker. The decision to activate/deactivate the audio signal path is based on an evaluation of signaling codes (**CTCSS**, **DCS**, **Selcall**) contained in the audio information (contrast with **squelch**).

**number**

A simple **string** that corresponds to an MPT1343 defined called party identifier.

**PA**

Power amplifier.

**PABX**

Private automatic branch exchange.

**PCB**

Printed circuit board.

**PLL**

Phase locked loop.

**PLCC**

Plastic leaded chip carrier.

**PMR**

Private mobile radio.

**programming mode**

The mode of operation of the radio in which computer equipment can read from and write to the radio **database**.

**PSTN**

Public switched telephone network.

**RAM**

Random access memory.

**receive mode**

This is the state wherein the radio is producing a valid busy output, irrespective of whether any audio output is produced at the speaker

terminals. The +5V-ECON supply is on, and sufficient time has elapsed for various circuit blocks to settle.

**RF**

Radio frequency.

**RSN**

The radio's unique serial number.

**RSSI**

Received signal strength indicator.

**SCI**

Serial communications interface. This is the serial interface from the radio to an external device, normally utilising transmit and receive data, signal and ground lines.

**Selcall**

Selective calling. Sequential tone burst coding on the channel for the purpose of selecting an individual or group with which to communicate.

**selecting**

The act of picking a **label** from a displayed list using the arrow keys.

**signalling**

Non-voice coding on the channel for the purpose of identifying parties and/or segregating user groups, e.g. **CTCSS**, **DCS**, **Selcall**.

**SMD**

Surface mount device.

**SOIC**

Small outline integrated circuit.

**SOT**

Small outline transistor.

### **squelch**

The channel busy detection circuitry. The decision to activate/deactivate the audio signal path is based on a signal-to-noise measurement on the received **RF** signal (the squelch circuitry precedes the **mute** circuitry).

### **standby state**

This is essentially when the +5V-ECON line is off. That is, when the radio is drawing the minimum current, while still being switched on.

### **string (simple)**

A sequence of the characters 0 to 9, \*, #, which instructs the radio to initiate a call or perform some other function.

### **successful (call)**

A **call** for which a **traffic channel** is assigned.

### **system restart**

The action taken by the radio (e.g. in response to the '^' character received on the **SCI**) where it immediately ceases current operation, then behaves as though it has just been switched on.

### **TCXO**

Temperature compensated crystal oscillator (voltage controlled). The frequency reference for the **RF** part of the radio.

### **test mode**

The operating mode of the radio whereby computer (computer equipment can control various radio functions by sending controlled) commands down a serial link to the radio.

### **traffic channel**

The channel used by the radio for the duration of a **call**.

### **transmit mode**

The radio has validated a request and commenced or completed the sequence of switching out of **receive mode**. This does not necessarily imply that **RF** is being generated.

### **trunked mode**

The mode of operation of the radio whereby the radio obeys commands on the **control channel** and generally operates as proscribed in MPT1343.

### **trunking system**

The infrastructure comprising repeaters and radios required to support a number of **control channels** and **traffic channels**.

### **VCO**

Voltage controlled oscillator. The oscillator that generates either the on-channel signal to drive the transmitter, or the local oscillator to mix incoming **RF** signals to the **IF** of the radio. The instantaneous frequency of the VCO is determined by a combination of the synthesiser (**PLL**) and the modulation signals TCXO-MOD and VCO-MOD.

### **VOX**

Voice operated transmit.



---

# Tait Electronics Limited

## Software Licence Agreement

---

This legal document is an Agreement between you (the "Licencee") and Tait Electronics Limited ("Tait"). By opening this product package and/or using the product you agree to be bound by the terms of this Agreement. If you do not agree to the terms of this Agreement, do not open the product package and immediately return the unopened product package to Tait. If you open the product package, that will be deemed to be acceptance of the terms of this licence agreement.

### Licence

In consideration of the payment of the Licence Fee, which forms part of the price you paid for products you acquired from Tait or its subsidiary or agent (the "products") and our willingness to be bound by the terms of this agreement, Tait grants to you as Licencee the non-exclusive right to use the copy of a Tait software program included in the products (the "Software").

In particular, the Licencee may use the program on a single machine and if the software is supplied on a diskette, the licensee may:

- (a) Copy the program into any machine readable or printed form for backup purposes in support of your use of the program on the single machine (certain programs, however, may include mechanisms to limit or inhibit copying; they are marked "copy protected"), provided the copyright notice must be reproduced and included on any such copy of the Software.
- (b) Merge it into another program for your use on the single machine. (Any portion of this program merged into another program will continue to be subject to the terms and conditions of this Agreement.)

The Licencee may not duplicate, modify, reverse compile or reverse assemble the Software in whole or part.

### Title to software

This agreement does not constitute a contract of sale in relation to the Software supplied to the Licencee. Notwithstanding the Licencee may own the magnetic or other physical media on which the Software was originally supplied, or has subsequently been recorded or fixed, it is a fundamental term of this Agreement that at all times title and ownership of the Software, whether on the original media or otherwise, shall remain vested in Tait or third parties who have granted licences to Tait.

### Term and termination

This Licence shall be effective until terminated in accordance with the provisions of this Agreement. The Licencee may terminate this Licence at any time by destroying all copies of the Software and associated written materials. This Licence will be terminated automatically and without notice from Tait in the event that the Licencee fails to comply with any term or condition of this Agreement. The Licencee agrees to destroy all copies of the Software and associated written materials in the event of such termination.

### Limited warranty

The Software is supplied by Tait and accepted by the Licencee "as is" without warranty of any kind either expressed or implied, including but not being limited to any implied warranties as to merchantability or fitness for any particular purpose. The entire risk as to the quality and performance of the Software vests in the Licencee. Should the Software prove to be defective, the Licencee (and not Licensor or any subsidiary or agent of the Licensor) shall assume the entire cost of all necessary servicing, repair or correction. Tait does not warrant that the functions contained in the Software will meet the Licencee's requirements or that the operation of the Software will be uninterrupted or error free. However Tait warrants that the diskettes if any on which the Software is supplied to the Licencee shall be free from defects in material and workmanship under normal use and service for a period of ninety (90) days from the date of delivery to the Licencee.

## Exclusion of liability

Tait's entire liability and the Licencee's exclusive remedy shall be:

1. The replacement of any diskette not meeting Tait "limited warranty" and which is returned to Tait or an authorised agent or subsidiary of Tait with a copy of the Licencee's purchase receipt; or
2. If a diskette is supplied and if Tait is unable to deliver a replacement diskette that is free from defects in material or workmanship, the Licencee may terminate this Agreement by returning the Software to Tait.
3. In no circumstances shall Tait be under any liability to the Licencee, or any other person whatsoever, for any direct or consequential damage arising out of or in connection with any use or inability of using the Software.
4. Tait warrants the operation of the Software only with the operating system for which it was designed. Use of the Software with an operating system other than that for which it was designed may not be supported by Tait, unless otherwise expressly agreed by Tait.

## General

The Licencee confirms that it shall comply with the provisions of law in relation to the Software.

## Law and jurisdiction

This Agreement shall be subject to and construed in accordance with New Zealand law and disputes between the parties concerning the provisions hereof shall be determined by the New Zealand Courts of Law. Provided however Tait may at its election bring proceedings for breach of the terms hereof or for the enforcement of any judgement in relation to a breach of the terms hereof in any jurisdiction Tait considers fit for the purpose of ensuring compliance with the terms hereof or obtaining relief for breach of the terms hereof.

## No dealings

The Licencee may not sublicense, assign or transfer the licence or the program except as expressly provided in this Agreement. Any attempt otherwise to sublicense, assign or transfer any of the rights, duties or obligations hereunder is void.

## No other terms

The Licencee acknowledges that it has read this agreement, understand it and agree to be bound by its terms and conditions. The Licencee further agrees that this is the complete and exclusive statement of the agreement between it and Tait in relation to the Software which supersedes any proposal or prior agreement, oral or written and any other communications between the Licencee and Tait relating to the Software (LS-589).