

TM9300 DMR Mobile Radios TM9400 P25 Mobile Radios

Installation Guide

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Contact Information

Tait Communications Corporate Head Office

Tait International Limited
P.O. Box 1645
Christchurch
New Zealand

For the address and telephone number of regional offices, refer to our website: www.taitradio.com

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Tait International Limited also complies with the Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive in the European Union.

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Preface

Scope of Manual



Warning Incorrect installation of your mobile radio may cause damage to your vehicle which may result in death or serious injury. You must read this manual before starting the installation!

Mobile radios can be installed in many ways, using different combinations of components and accessories. While this manual focuses on the installation of the mobile radio using the U-cradle, the principles described also apply to other installation options.

For information on:

- radio body installation
- dual body installation
- remote control head installation
- dual control head installation
- hand-held control head installation
- desktop installation

refer to [“Installation Options” on page 13](#) and the installation instructions provided with the equipment.


Associated Documentation

The following associated documentation is available for this product:

- MTA-00011-xx Safety and Compliance Information
- MMB-00001-xx TM9300 User's Guide
- MMB-00003-xx TM9400 User's Guide

Dual Body specific documentation:

- MMB-00035-xx TM9356/TM9456 Getting Started Guide
- MMB-00037-xx TM9356/TM9456 Dual Body Users Guide
- 402-00032-xx GPS and External Interface Cable

 The characters **xx** represent the issue number of the documentation.

Updates to user documentation are published on the Tait support website:
tait.radio.com/support.

Technical notes are published from time to time to describe applications for Tait products, to provide technical details not included in manuals, and to offer solutions for any problems that arise.

Technical notes are available in PDF format from the Tait support website. For more information, contact your regional Tait office.

Publication Record

Issue	Publication Date	Description
08	March 2021	Minor updates throughout Added content addressing dual body and dual body installation - including accessories. Added new dual body icons to all dual body related content. Updated "Associated Documentation" to include all dual body documentation Updated safety section pg - correct EN reg.
06	October 2017	Minor changes to text throughout Added safety information regarding jump-starting without removing the fuses to "Radio Protection when Charging the Vehicle Battery" on page 11 Added information regarding the ribbon cable to "Mounting the Control Head" on page 28 Deleted all references to defunct product CD that used to be supplied with the service kit
05	December 2015	Remote head extender upgrade kits added. Component names to configure an external alert device changed.
04	May 2014	Information added about using an analog channel to check TM9300 forward and reflected power
03	November 2013	Hand-held control head added Caution about using Y-type breakout cable added
02	December 2012	TM9400 added.
01	September 2012	First release.

Document Conventions

Please follow exactly any instruction that appears in the text as an ‘alert’. An alert provides necessary safety information as well as instruction in the proper use of the product. This manual uses the following types of alert:



Warning This alert is used when there is a hazardous situation which, if not avoided, could result in death or serious injury.



Caution This alert is used when there is a hazardous situation which, if not avoided, could result in minor or moderate injury.

Notice This alert is used to highlight information that is required to ensure procedures are performed correctly. Incorrectly performed procedures could result in equipment damage or malfunction.



This alert is used to highlight significant information that may be required to ensure procedures are performed correctly, or draw your attention to ways of doing things that can improve your efficiency or effectiveness.

Within this manual, the following symbols are used to highlight differences between radios with a transmit power of more than 25 W, and radios with a transmit power of 25 W:



This symbol highlights information that is relevant to radios with a transmit power of 30-50 W.



This symbol highlights information that is relevant to radios with a transmit power of 25 W.



This symbol highlights information that is relevant to dual body radios.

1 Safety and Regulatory Warnings



Warning Incorrect installation of your mobile radio may cause damage to your vehicle which may result in death or serious injury. You must read this manual before starting the installation!

You must also read and observe the safety information on radio operation provided in the safety and compliance information and the user's guide!

1.1 RF Exposure Hazard

FCC RF Exposure Limits

To comply with FCC RF exposure limits:



For radios with a transmit power of 30-50 W:

- VHF radios must be installed using an antenna with a gain of up to 5.15 dBi.
- UHF and 800 MHz radios must be installed using an antenna with a gain of up to 5.65 dBi.



For radios with a transmit power of 25 W:

- The radio must be installed using an antenna with a gain of up to 5.15 dBi.

In all cases, the antenna must not be mounted at a location such that any person or persons can come closer than 35 inches (0.9m) to the antenna.

Health Canada Warning Statement

The installer of this radio equipment must ensure that the antenna is located or pointed such that it does not emit RF field in excess of Health Canada limits for the general population; consult Safety Code 6, obtainable from the Health Canada website <http://www.hc-sc.gc.ca>.

1.2 Vehicle Manufacturer's Installation Instructions

Installation of this product in a vehicle must be performed according to the instructions provided by the vehicle manufacturer. For more information, refer to the vehicle manufacturer's website or contact the vehicle manufacturer's dealer.

1.3 MPT 1362 Code of Practice

Mobile radios should be installed in accordance with the MPT 1362 Code of Practice.

1.4 Safe Radio Mounting

Notice When mounting dual body radios, the radio bodies must be less than 4.9ft (1.5m) apart.



Warning Mount the radio securely so that it will not break loose in the event of a collision. An unsecured radio is dangerous to the vehicle occupants.

- Mount the radio and the microphone where they will not interfere with the deployment of passenger airbags, the vehicle operator controls, the vehicle operator's view.
- Do not mount the radio vertically, with the control head facing down. This will violate compliance with the standards UL/CSA/EN 62368, Safety of Information Technology Equipment.



Caution The bottom surface of the radio and the heatsink fins can become hot during prolonged operation. When installing the radio, position the radio so that it is not possible for the radio user to touch the bottom surface of the radio and the heatsink fins.

1.5 Interference with Vehicular Electronics



Warning Some vehicular electronic devices may be prone to malfunction due to the lack of protection from RF energy when your radio is transmitting.

Examples of vehicular electronic devices that may be affected by RF energy are:

- electronic fuel injection systems
- electronic anti-skid braking systems
- electronic cruise control systems
- indicators

If the vehicle contains such equipment, consult the vehicle manufacturer or dealer to determine whether these electronic circuits will perform normally when the radio is transmitting.

1.6 Radio Protection when Charging the Vehicle Battery

Notice Always remove the fuses from the radio power cable before charging the vehicle battery, connecting a second battery, or using power from another vehicle (e.g when “jump-starting” the vehicle).

1.7 Preparation when Drilling Holes



Warning When drilling holes in the vehicle, check that drilling at the selected points will not damage existing wiring, airbags, petrol tanks, fuel and brake lines, or battery cables.

1.8 Radio Installation in Gas or Fuel Tankers

Special conditions must be observed when installing a radio on gas and fuel tankers. Consult your radio provider or Tait-accredited service center for more details.

1.9 Vehicles Powered by Liquefied Petroleum Gas



Warning Radio installation in vehicles powered by LPG (liquefied petroleum gas) with the LPG container in a sealed-off space within the interior of the vehicle must conform to the National Fire Protection Association Standard NFPA 58. This standard states that the radio equipment installation must meet the following requirements:

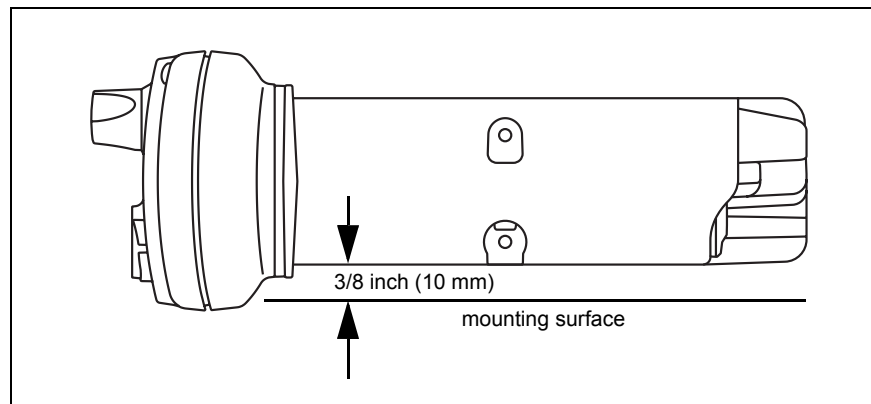
- The space containing the radio equipment shall be isolated by a seal from the space containing the LPG container and its fitting.
- Outside filling connections shall be used for the LPG container and its fittings.
- The LPG container space shall be vented to the outside of the vehicle.

1.10 Non-standard Radio Installations

The installation U-cradle described in this guide has been designed so that there is enough airflow around the radio to provide cooling.

If a non-standard installation method is used, care must be taken that sufficient heat can be dissipated from the heatsink fins and the ridged bottom surface of the radio.

There must be a gap of more than $\frac{3}{8}$ inch (10 mm) between the bottom surface of the radio chassis and the mounting surface. This is illustrated in the following diagram:



2 Installation Options

This section provides an overview of the main accessory kits that are currently available for installing the following components:

- radio body
- remote control head
- dual control heads
- hand-held control head
- desktop installation

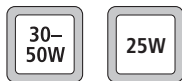
Some installation options may not be suitable for some models of radio. For more information, contact your regional Tait office.

2.1 Radio Body

U-Cradle Install Kits

The U-cradle install kits are supplied as standard for mounting a radio body fitted with either a local control head or a remote interface (for a remotely mounted control head).

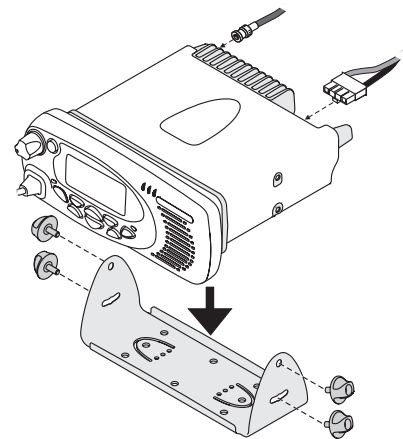
The following kits are available:



- TMAA03-22 (30-50 W radios with BNC antenna connector)
- TMAA03-17 (30-50 W radios with mini-UHF antenna connector)
- TMAA03-01 (25 W radios with BNC antenna connector)
- TMAA03-23 (25 W radios with mini-UHF antenna connector)

The kits contain the following items:

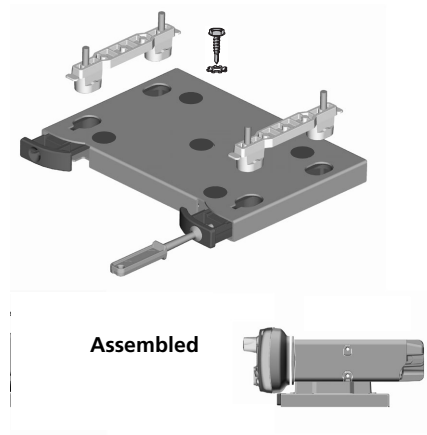
- U-cradle
- thumbscrews
- self-drilling screws and washers
- power cable with DC connector
- fuses with in-line fuse holders
- receptacles for a remote speaker (remote speaker not included)
- crimp terminals for a remote speaker
- antenna connector



For full details on mounting the U-cradle install kit and radio, refer to [“Mounting the U-Cradle” on page 35](#) and [“Installing the Radio” on page 46](#).

Security Bracket

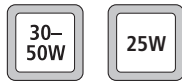
The TMAA03-02 security bracket can be used in place of the standard U-cradle in locations to prevent opportunistic removal of the radio by a third party, or where you want to have a quick release setup that allows you to swap over radios (e.g. leasing situation). The security bracket also provides electrical isolation to the radio. Refer to the installation instructions (402-00014-xx) provided with the security bracket for full details.



Re-install Kits

Re-install kits allow you to remove radios from one installation and re-install them at another location without having to remove the wiring from the old installation.

The following kits are available:



- TMAA03-20 (30-50 W radios with BNC antenna connector)
- TMAA03-10 (30-50 W radios with mini-UHF antenna connector)
- TMAA03-11 (25 W radios with BNC antenna connector)
- TMAA03-15 (25 W radios with mini-UHF antenna connector)

Re-install kits contain the parts left behind after removing the radio:

- power cable with DC connector
- fuses with in-line fuse holders
- receptacles for a remote speaker (remote speaker not included)
- crimp terminals for a remote speaker
- antenna connector

2.2 Remote Control Head

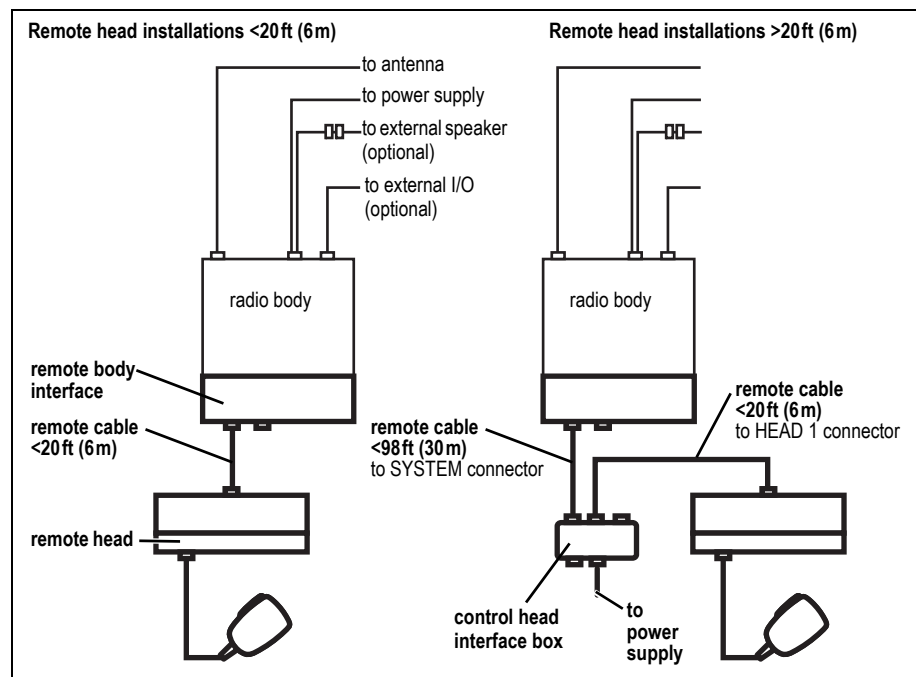
The T02-00061-1xxx remote head kits and the T02-00061-2xxx remote head upgrade kits can be used to install the graphical control head remotely from the radio body.

The remote head kits provide a complete remote head whereas the remote upgrade kits provide a remote control head interface which is fitted to an existing local control head.



Kits for remote head installations < 20 ft (6m) contain one remote cable and no control head interface box. Kits for remote head installations > 20 ft (6m) contain two remote cables and one control head interface box.

The following diagram summarizes how the components are installed.



Refer to the installation instructions (402-00088-xx) provided with these kits for full details.

Remote Head Extender Upgrade Kits

The T02-00064-2xxx remote head extender upgrade kits can be used when extended distances are required between a TM9300 or TM9400 radio body and the control head interface box or graphical-display control head (up to a maximum of 750m).


Refer to the T02-00062-2xxx Remote Head Extender Upgrade Kits Installation Instructions (402-00102-xx) for full details.

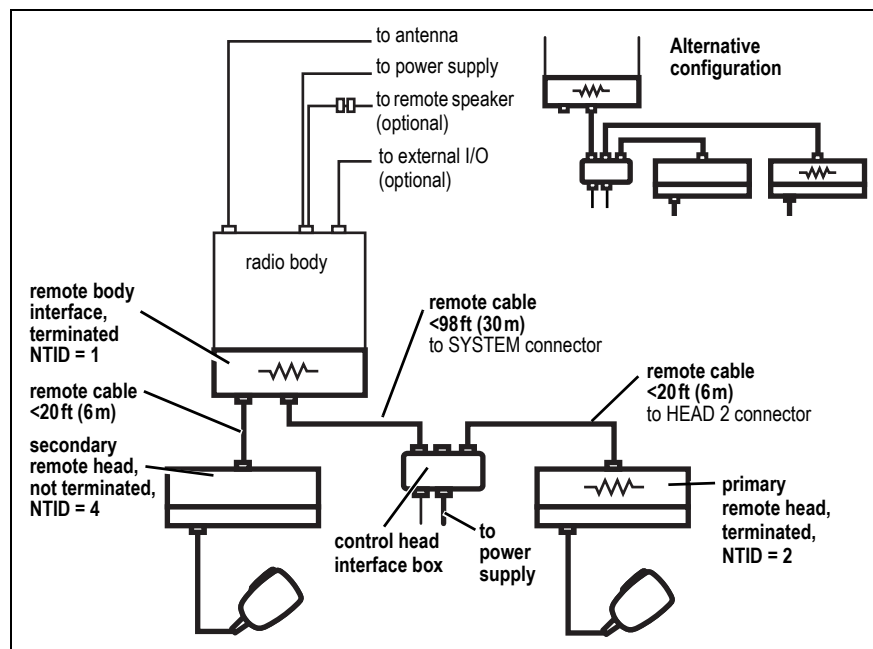
2.3 Dual Control Heads

The T02-00062-1xxx dual-head kits and the T02-00062-2xxx dual-head upgrade kits can be used to install two control heads remotely from the radio body.

The dual-head kits provide two complete remote heads whereas the dual-head upgrade kits provide one complete remote head and one remote control head interface which is fitted to an existing local control head.



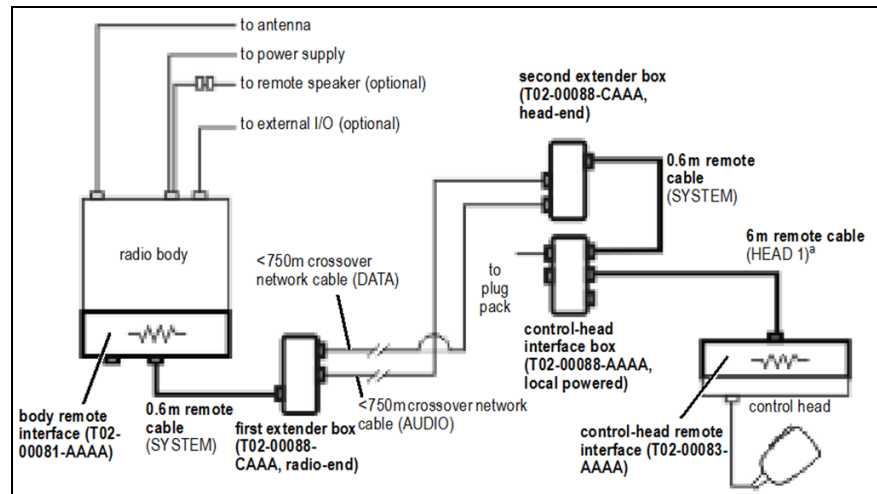
The following diagram summarizes how the components are installed. A  symbol means an RS-485 terminating resistor is fitted.



Refer to the installation instructions (402-00087-xx) provided with these kits for full details.

Remote Head Extender Upgrade Kits

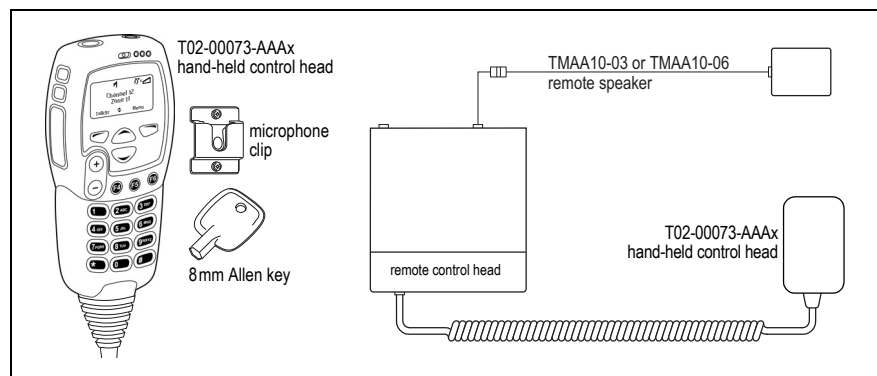
The T02-00064-2xxx remote head extender upgrade kits can be used when extended distances are required between a TM9300 or TM9400 radio body and the control head interface box or graphical-display control head (up to a maximum of 750m). Refer to the T02-00062-2xxx Remote Head Extender Upgrade Kits Installation Instructions (402-00102-xx) for full details.



2.4 Hand-Held Control Head

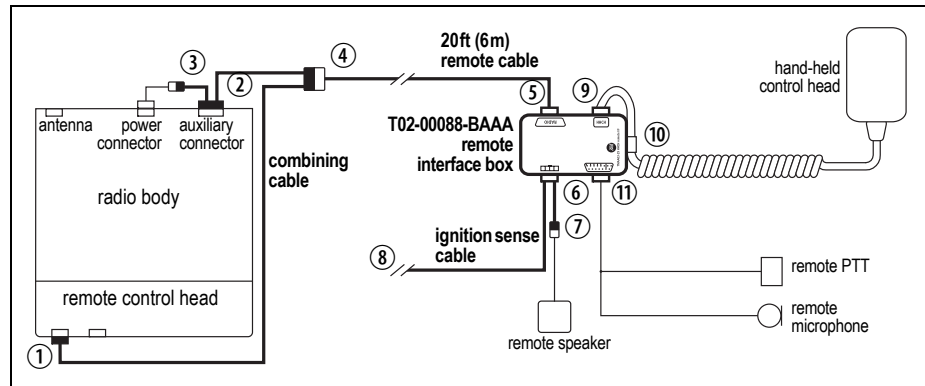
Hand-Held Control Head

The T02-00073-AAAx is a hand-held control head for mobile radios that enables the user to operate the radio at a distance from the radio body. The hand-held control head plugs into one of the RJ45 sockets on the appropriate remote control head. A remote speaker is required when a hand-held control head is installed. Refer to the T02-00073-AAAx Hand-Held Control Head Installation Instructions (402-00101-xx) for full details.



Hand-Held Control Head Remote Interface Kit

The T02-00063-2001 is an installation kit for remotely mounting the T02-00073-AAAx hand-held control head. The following diagram summarizes how the components are installed. The items named in **bold** are part of the T02-00063-2001 kit. Refer to the TMAA03-32 Hand-Held Control Head Remote Interface Kit Installation Instructions (402-00093-xx) for full details.



Hand-Held Control Head Extension Kits

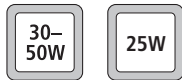
The T02-00009-0201/0202/0203/0204 kits can be used to extend the distance between a hand-held control head and the radio body or a remote interface box. Cables are provided in lengths of

- 5ft/1.6m (T02-00009-0201)
- 10ft/3m (T02-00009-0202)
- 20ft/6m (T02-00009-0203)
- 30ft/9m (T02-00009-0204)

A housing unit and gasket encloses the extension cable socket, and provides additional strain relief and some protection from water and dust ingress.

Refer to the T02-00009-0201/0202/0203/0204 Hand-Held Control Head Extension Kits Installation Instructions (402-00095-xx) for full details.

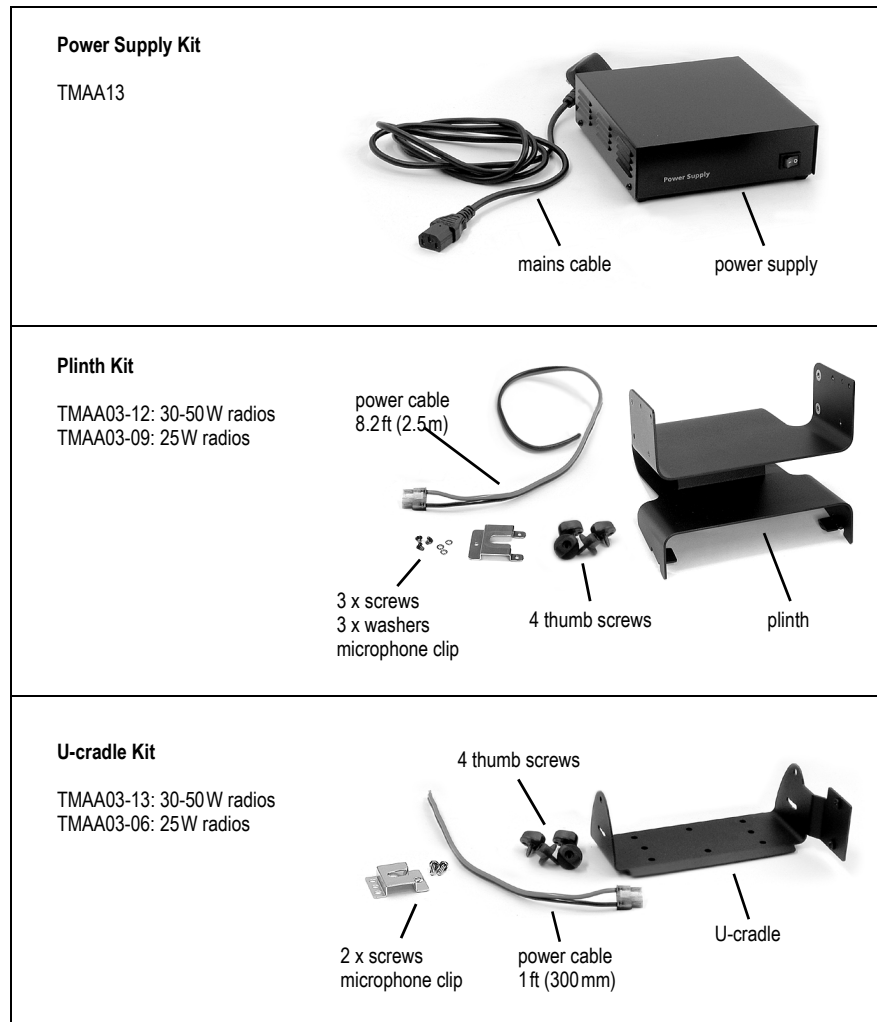
2.5 Desktop Installation



The TMAA13 power supply enables you to use a mobile radio as a desktop radio. The TMAA13 operates on an input voltage of 100–130 VAC or 200–250 VAC, depending on the model, and can be used with both 30–50 W and 25 W radios. The mobile radio can be installed at a distance from the power supply, or it can be mounted on top of the power supply using a plinth. The following diagram shows the components included in each kit. Refer to the TMAA13 Power Supplies User's Guide (MMZ-00002-xx) for full details.



Tait strongly recommends to use one TMAA13 power supply for each radio. This prevents any issues caused by simultaneous transmissions.



2.6 External Speakers

Remote Speaker



TMAA10-06 remote speaker (for 30-50W radios) and the TMAA10-03 remote speaker (for 25W radios) are connected to the radio's speaker out terminals. The remote speaker can then be installed at some distance from the radio, or it can be used to increase the volume of the audio from the radio's existing internal speaker.

Refer to the installation instructions (402-00010-xx) provided with the speaker for full details.



Horn Speaker

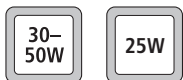


The T02-00004-0202 horn speaker (for 30-50W radios) and the T02-00004-0201 horn speaker (for 25W radios) are connected to the radio's speaker out terminals. The horn speaker can be mounted externally on the vehicle so that radio traffic can be heard when personnel are outside the vehicle.

Refer to the installation instructions (402-00090-xx) provided with the speaker for full details.



Rugged External Speaker



The T02-00004-0206 Rugged External Speaker (for 25W radios) and the T02-00004-0207 Rugged External Speaker (for 30-50W radios) are connected, in parallel, to the radio's existing external speaker. The speaker can be installed at some distance from the radio, or it can be used to increase the volume of the audio from the radio's existing external speaker.

Refer to the installation instructions (402-31432-02) provided with the speaker for full details.



3 Power Sense and Connector Power Supply Options

The mobile radio allows the configuration of different power-sense options to control how the radio is powered up and down, and connector power supply options to control how power is switched to the connectors of the mobile radio.

Before starting the installation it is important to understand these options in order to make the right decision on how to best connect your mobile radio.

3.1 Power Sense Options

The radio allows the configuration of different power-sense options to control how the mobile radio is powered up and down:

- battery power sense
- auxiliary power sense (ignition sense)
- internal-options power sense
- no power sense
- emergency power sense.

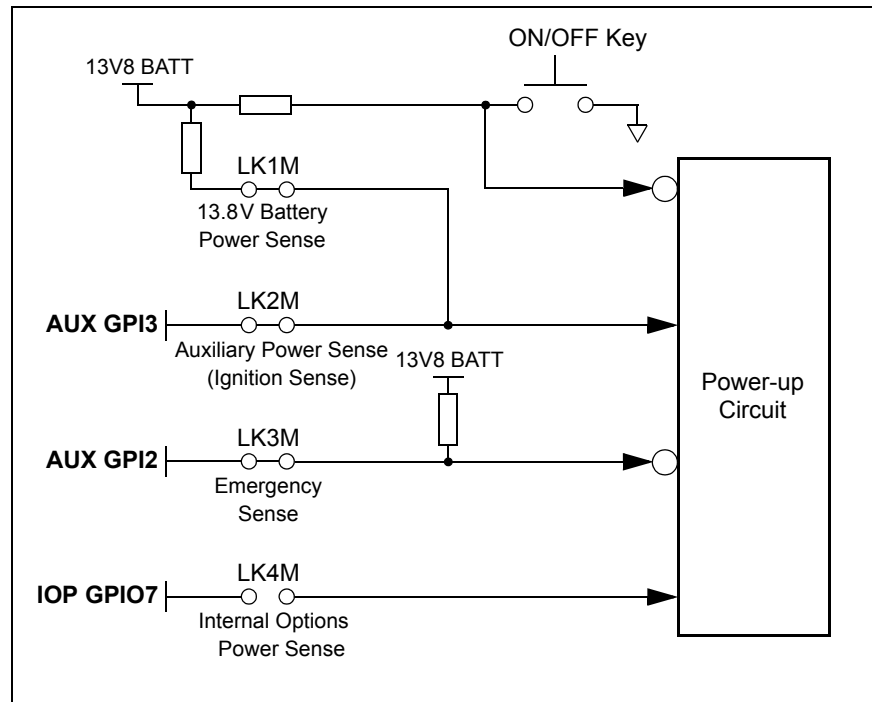
The emergency power-sense option can be used in conjunction with any of the other four options.

The different power-sense options have to be facilitated by hardware means, as the software cannot act before it is powered up. The radio provides four hardware links (marked LK1M to LK4M) on the top-side of the main board which can be configured to attain the power-sense option desired.

Notice The hardware links are SMT components. Do not replace SMT components unless you are trained and equipped to do so. Attempting to replace SMT components without the necessary training, tools, and equipment can cause permanent damage to the radio.

Figure 3.1 shows a block diagram of the hardware links LK1M to LK4M.

Figure 3.1 Block diagram of hardware links LK1M to LK4M



The factory defaults are:

- hardware link LK1M (+13.8V battery power sense): fitted
- hardware link LK2M (ignition sense): fitted
- hardware link LK3M (emergency sense): fitted

The radio can be programmed to be either on, or to return to its previous state when the power sense signal is removed. For information on programming the power-on mode refer to the online help of the programming software.

The ON/OFF key can be used with any of the of the power-sense options to turn the radio on and off.

[Table 3.1](#) shows the configuration of the hardware links LK1M, LK2M and LK4M for the individual power-sense options. It also lists the dependence of the power-sense options with respect to the GPI lines, which can or cannot be used.

Table 3.1 Configuration of hardware links and GPI lines for power-sense options

Power-sense option	Links required	Configuration of remaining links and use of AUX GPI3 and IOP GPIO7	Voltages required
13.8V battery power sense	LK1M in LK4M out	LK2M in: AUX GPI3 must be left floating. LK2M out: AUX GPI3 can be used as GPI ^a . IOP GPIO7 can be used as GPIO.	10.8V ≤ supply ≤ 16V
auxiliary power sense (ignition sense)	LK2M in LK4M out	LK1M in: Input line must sink > 1 mA from AUX GPI3 (which is pulled to 13.8V by a 33kΩ resistor). The impedance between the vehicle ignition signal and ground must be ≤ 1kΩ. LK1M out: Input line must be active high ^b . IOP GPIO7 can be used as GPIO.	AUX GPI3 ≤ 0.7V off AUX GPI3 ≥ 2.6V high (active) ignition-sense tolerant to 3.3V, 5V and 12V
internal power sense	LK1M out LK2M out LK4M in	AUX GPI3 can be used as GPI. With LK4M in, the input line must be active high ^c .	IOP GPIO7 ≤ 0.7V off IOP GPIO7 ≥ 2.6V high (active) ignition-sense tolerant to 3.3V and 5V only
no power sense	LK1M out LK2M out LK4M out	AUX GPI3 can be used as GPI. IOP GPIO7 can be used as GPIO.	10.8V ≤ supply ≤ 16V

a. If LK2M is out and AUX GPIO is not used, R775 (33k) should be placed to ensure that AUX GPI3 does not float (R775 is not placed by factory default).

b. If LK1M is out and R775 is placed, AUX GPI3 should be driven low as well.

c. If LK 4 is in and R723 is placed, IOP GPIO7 should be driven low as well. (R723 is placed by factory default.)

[Table 3.2](#) shows the configuration of ‘emergency power sense’.

‘Emergency power sense’ can be configured with any of the above power sense options.

Table 3.2 Configuration of hardware link LK3M and AUX GPI2 for ‘emergency power sense’

External push-button or toggle switch required to enter emergency mode	Links required	Implications on AUX GPI2	Voltages required
Yes	LK3M in	AUX GPI2 must be connected to an external (hidden) push-button or toggle switch, which connects it to ground.	≤ 0.7V active, floating inactive
No	LK3M in LK3M out	AUX GPI2 must be left floating AUX GPI2 can be used as GPI.	

Battery Power Sense

With this option, link LK1M connects +13V8 BATT of the power connector to the power-up circuitry. With this option, when a 13.8 V supply is connected to the radio, the radio enters the programmed power-on mode. The ON/OFF key can then be used to switch the radio on and off. This option has the disadvantage that the radio still draws about 50mA after being switched off using the ON/OFF key. The reason is that the radio enters the stand-by mode and does not shut down completely.

Auxiliary Power Sense (Ignition Sense)

This option uses the digital input line AUX GPI3 of the auxiliary connector to power the radio up and down. Link LK2M is required to connect the line to the power-up circuitry. The line is active high; it is on when the level exceeds 2.6V and off when the level falls below 0.7V; the line tolerates maximum inputs equal to the radio supply voltage. When the line becomes active, the radio enters the programmed power-on mode. The ON/OFF key can then be used to switch the radio on and off. With the radio off and the line active, the radio draws about 50mA. When the line becomes inactive, the radio is shut down completely regardless of whether it was on or in stand-by mode. With the line inactive the radio draws less than 3 mA. In a vehicle installation this avoids flattening the battery when the ignition key is off.



Caution If the radio is configured for auxiliary power sense, i.e. +13.8V from the ignition is supplied to pin AUX GPI3, and a Y-type breakout cable (such as T02-00009-0301/0302 or TA3101-01) is used, +13.8V will also be present at AUX_GPI3 of the free connector and therefore must be left unconnected.

Internal-Options Power Sense

This option is similar to the auxiliary power-sense option, except that the IOP GPIO7 line of the internal options connector is used. Link LK4M is required to connect the line to the power-up circuitry. This line is active high; it is on when the level exceeds 2.6V and off when the level falls below 0.7V; the line tolerates maximum inputs of 5V. The behavior of the ON/OFF key is the same as with the auxiliary power-sense option.

No Power Sense

If no power-sense option is selected, the radio can only be powered up and powered down by means of the ON/OFF key. For this option, the links LK1M, LK2M and LK4M must be removed. The advantage of this option over the battery power-sense option is that the radio draws less than 1 mA when it is switched off.

Emergency Power Sense

This option uses the AUX GPI2 line of the auxiliary connector. Externally, this line is typically connected to a hidden switch. Internally, link LK3M is required to connect the line to the power-up circuitry. The line is active low and has an internal pull-up resistor to the external supply voltage. The line is on when the level falls below 0.7V. When the line becomes active (when the hidden switch is pressed for two seconds) the radio enters the emergency mode. This mode can also be activated by making an emergency call or by pressing a key that has been programmed

appropriately. The concealed microphone is typically fitted when the emergency power-sense option is selected.

Operation in Emergency Mode

If the radio is off when the emergency mode is activated, the radio is powered up but the display on the control head is not switched on. If the radio is on when the mode is activated, the display is frozen. In the latter case, if the ON/OFF key is pressed, the display is switched off but the radio remains in the emergency mode. While in this mode the radio cycles between transmit and receive. To exit the emergency mode, the ON/OFF key needs to be pressed again.

3.2 Connector Power Supply Options

Power from the radio's primary power source is fed to the auxiliary, internal options, control head and microphone connectors. Whether power to these connectors is un-switched, switched or not supplied is determined by hardware links FLK1N to FLK4N on the top side of the main board, as shown in [Figure 3.2](#) and [Table 3.3](#).

Notice The hardware links are SMT components. Do not replace SMT components unless you are trained and equipped to do so. Attempting to replace SMT components without the necessary training, tools, and equipment can cause permanent damage to the radio.

Unswitched power means that power will always be supplied to the connector while the primary power source is connected to the radio and is alive. The supply to the connector is not affected by the state of the radio.

Switched power means that when the radio is off or in standby mode, the power to the connector is switched off. The power will also be switched off if the primary power source voltage is outside the radio's operating range. The combined switched current drawn by the internal options connector, the auxiliary connector and the control-head connector must not exceed 2A.



The switched output is protected. Short-circuiting the switched power on any connector will not damage the radio. In the event of a short circuit, the current folds back to protect the switch device and connectors.

Figure 3.2 Connector power supply options

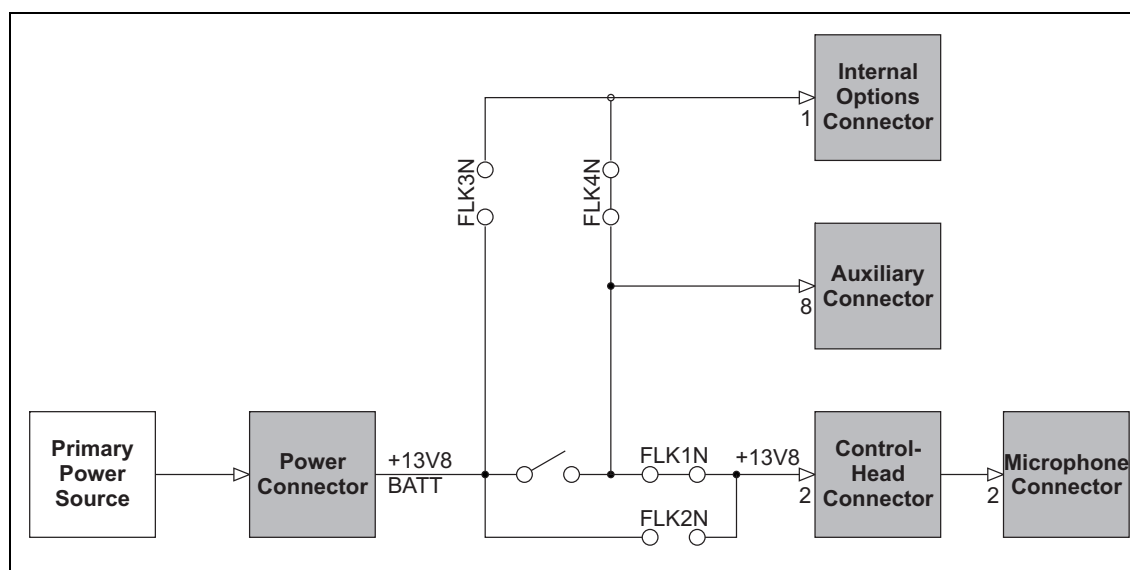


Table 3.3 Connector power supply options

Link state				Connector power state			
FLK1N	FLK2N	FLK3N	FLK4N	Auxiliary	Internal options	Control head	Microphone
out	out	out	out	switched	no power	no power	no power
in	out	out	in	switched	switched	switched	switched
out	in	out	in	switched	switched	unswitched	unswitched
in	out	in	out	switched	unswitched	switched	switched
out	in	in	out	switched	unswitched	unswitched	unswitched
in	in/out	in	in	unswitched	unswitched	unswitched	unswitched

4 Installing the Radio

This section describes the installation of the mobile radio using the U-cradle. However, the principles described in this manual also apply to other installation options.

For information on other types of installation, refer to [“Installation Options” on page 13](#) and the installation instructions provided with the equipment.

Notice TM9300 only

Ensure that the radio has an analog conventional channel programmed and available to the installer so that the installation testing can be completed correctly (see [“Checking the Installation” on page 48](#)). TM9300 TDMA digital channels do not give a true power level reading on an in-line power meter.

4.1 Installation Tools

The following tools are required to install the radio:

- drill and drill bits
- Pozidriv screwdriver
- 5/16 inch (8mm) socket
- RF connector crimp tool
- fuse crimp tool
- in-line RF power meter capable of measuring forward and reflected power at the operating frequency of the radio

4.2 Checking the Vehicle Before Installation

Complete a pre-installation check of all vehicular functions.

4.3 Mounting and Removing the Control Head

Notice The control head contains devices which can be damaged by static discharges. Always install or remove the control head in a static-safe environment. For information on antistatic precautions, go to the Electrostatic Discharge Association (ESD) website, <http://www.esda.org>.

Mounting the Control Head

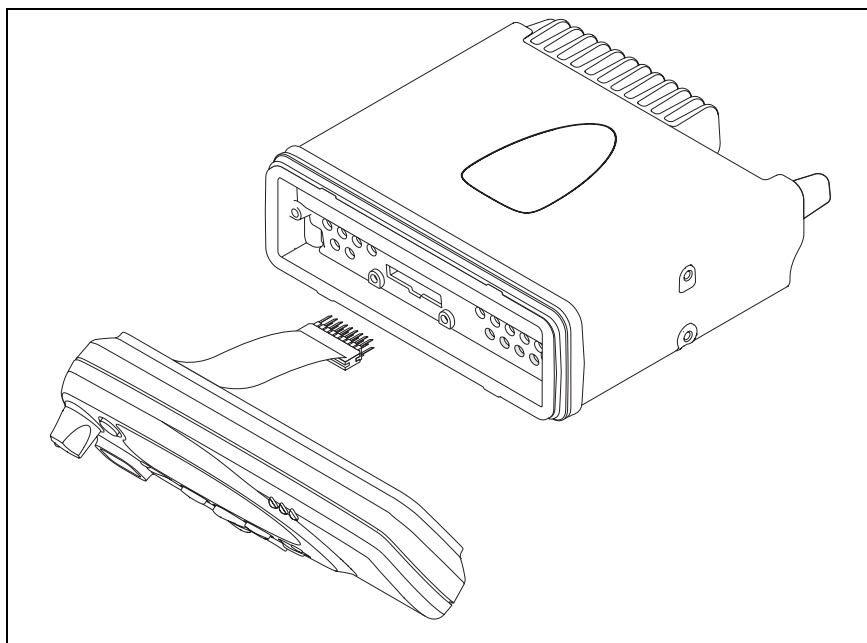
The control head and its connection ribbon cable are delivered separately from the radio body. Before installing the radio, the control head should be mounted on the radio body.

The orientation of the radio body determines which way up the control head is mounted on the radio body.

Notice It may be necessary to mount the radio upside down to maintain a gap of more than 3/8 inch (10 mm) for air circulation between the underside of the radio body and the mounting surface.

Notice When fitting the control head to the torso, be careful not to pinch or squash the control-head ribbon cable.

Figure 4.1 Mounting the control head

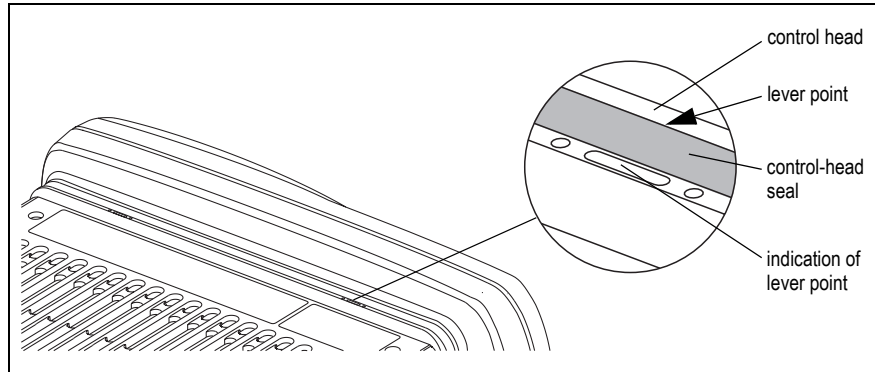


1. Plug the control-head ribbon cable onto the control-head connector.
2. Place one edge of the control head on either the top or bottom pair of snap features on the front of the radio body, then rotate to snap the opposite edge into place.

Removing the Control Head

Notice During this procedure, take care that the control-head seal is not damaged. Damage to this seal reduces environmental protection.

Figure 4.2 Removing the control head



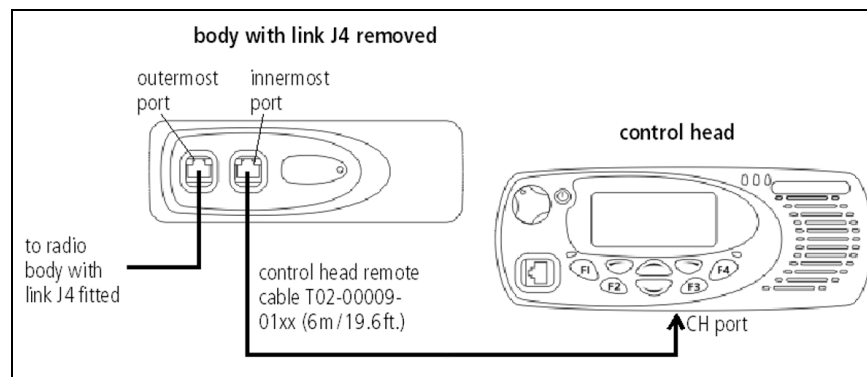
On the underside of the radio, two lever points are indicated on the radio body by a dot-dash-dot pattern (○ — ○). The lever point is between the control-head seal and the control head.

1. At either of the lever points, insert a 3/16 inch (5 mm) flat-bladed screwdriver between the control head and the control-head seal.
2. Use the screwdriver to lift the control head off the snap feature, then repeat in the other position. The control head can now be removed from the radio body.

The figure below contains an overview of the connection between the radio bodies and the control head.



Figure 4.3 Connecting radio bodies to control head with graphical-display



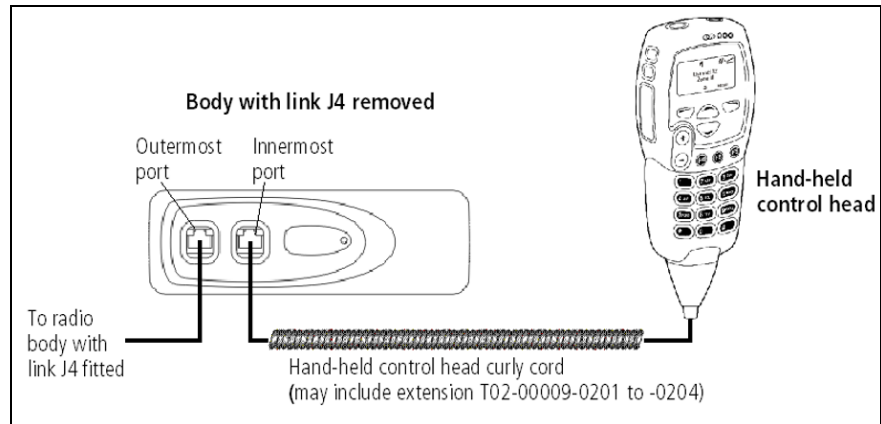
- i** If a radio body does not have link J4 removed, or you cannot identify the correct radio body to use, you will need to disassemble one or both interfaces.
1. Attach one end of the control-head remote cable to the innermost port of the radio body with link J4 removed.
- i** The outermost port of this radio body connects to the other radio body.
2. Attach the other end of the control-head remote cable to the rear port of the control head remote interface.

4.4 Installing a Hand-Held Control Head



The figure below contains an overview of the connection between the radio bodies and a hand-held control head.

Figure 4.4 Connecting radio bodies to hand-held control head



- i** If a radio body does not have link J4 removed, or you cannot identify the correct radio body to use, you will need to disassemble one or both interfaces.

Attach the hand-held control head cord to the innermost port of the radio body with link J4 removed.

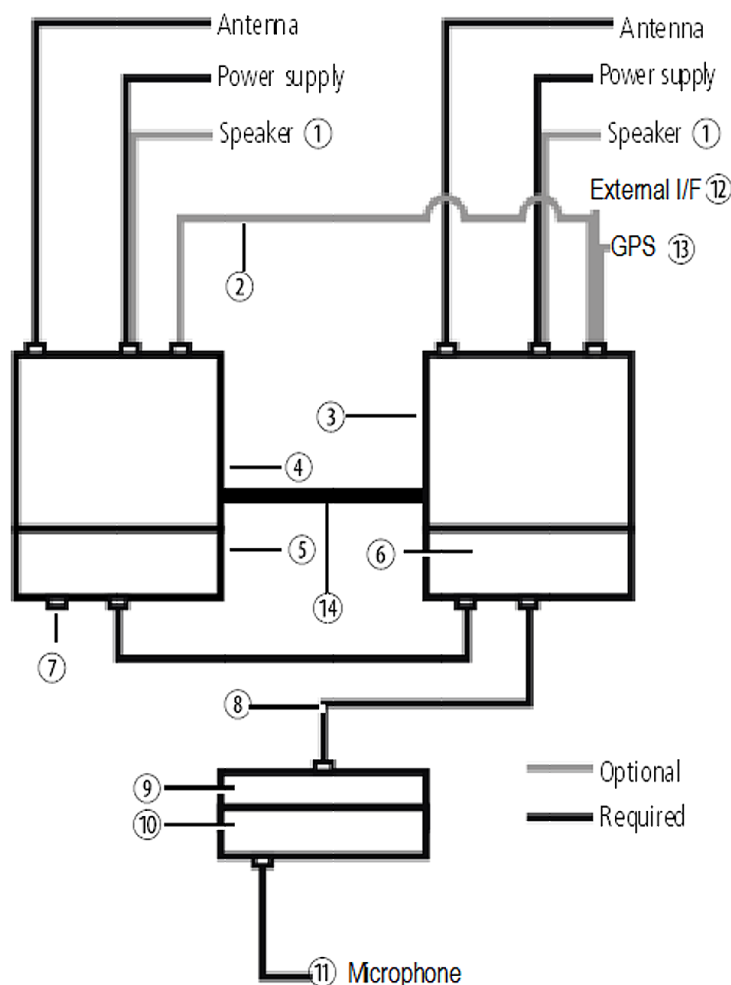
- i** The outermost port of this radio body connects to the other radio body.

4.5 Dual Body Overview



The figure below summarizes how the components in a dual body system are installed.

TM9356/TM9456 dual body installation overview



- ① Supported speaker (x2)
(T02-00004-020x)
- ② Torso linking cable
(TMAA04-06)
- ③ Primary TM9300 radio body
- ④ Secondary TM9300 radio body
- ⑤ Body remote interface
(T02-00081-BAAA)
- ⑥ Body remote interface with link J4 removed
(T02-00081-BBAA)
- ⑦ Connector seal (302-50002-0x)
- ⑧ Radio/control head connecting cable, maximum length 6m
(T02-00009-01xx)
(T02-00009-01xx)
- ⑨ Control head and remote ⑩ Interface
(T02-00083-Axxx)
- ⑪ Any supported microphone (e.g. keypad microphone)
(T02-00005-Axxx)
(T02-00005-Axxx)
- ⑫ External auxiliary interface (e.g. external alert)
- ⑬ GPS antenna/receiver with plate mount or magnetic mount
(TMAA05-0x)
- ⑭ Inter-body grounding strap
(219-03736-00)

Inter-body Grounding Strap



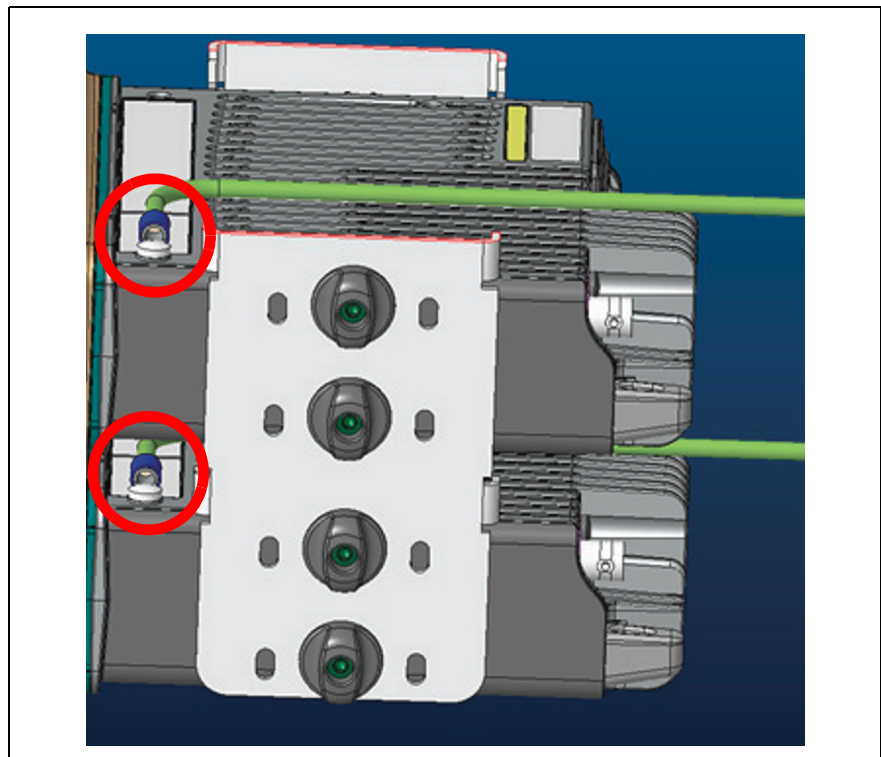
Grounding is required between the two radio bodies to decrease TDMA interference. When installing and mounting the radio bodies, make sure you ground your radio equipment using the inter-body grounding strap (219-03736-00). See the figure below.

Figure 4.5 Inter-Body Grounding Strap



The grounding strap is attached to each radio body by either a bottom mounting boss, or a side mounting boss. See the figure below.

Figure 4.6 Inter-Body Grounding Strap Between the Radio Bodies



4.6 Selecting the Mounting Position

Requirements for Safe and Convenient Installation

Ensure the mounting position complies with the following safety warnings:



Warning Safe radio mounting!

- Mount the radio securely so that it will not break loose in the event of a collision. An unsecured radio is dangerous to the vehicle occupants.
- Mount the radio and the microphone where they will not interfere with the deployment of airbags, the vehicle operator controls, the vehicle operator's view.



Caution The bottom surface of the radio and the heatsink fins can become hot during prolonged operation. When installing the radio, position the radio so that it is not possible for the radio user to touch the bottom surface of the radio and the heatsink fins.

Gap Between Radio Body and Mounting Surface

Notice It may be necessary to mount the radio upside down to maintain a gap of more than 3/8 inch (10 mm) between the bottom surface of the radio body and the mounting surface.

Inspect the vehicle and determine the safest and most convenient position for mounting the radio. Make sure that there is sufficient clearance behind the radio for the heatsink and cables.

IP54 Protection Class Considerations

The radio fulfils the requirements of the IP54 protection class.

Notice Do not mount the radio in areas where it can be temporarily submerged from an accumulation of water or other liquids (e.g. when using a high-pressure cleaning device).

The IP54 protection class does not apply when:

- the control head is removed from the radio body
- the bungs are removed from the auxiliary connector or the cavity for the external options connector (fitting an auxiliary connector or external options connector will not restore the IP54 protection class)
- the grommet of the microphone or hand-held control head is not installed
- an accessory is added which is not rated to IP54 (e.g. control-head interface box or hand-held control head remote interface box)

4.7 Mounting the U-Cradle

The U-cradle can be used to install the radio on the dashboard or on any sufficiently flat surface (e.g. cabin floor or trunk). The U-cradle can be mounted using the self-drilling screws and washers provided in the installation kit, or nuts and bolts (not included).



Caution Although an industrial-strength recloseable fastening system can be used to support the installation, for safety reasons Tait does not recommend this as a mounting option.

Notice When mounting the radio on a surface, check whether the mounting screws will screw into material providing sufficient strength. Reinforce the mounting surface, if required.

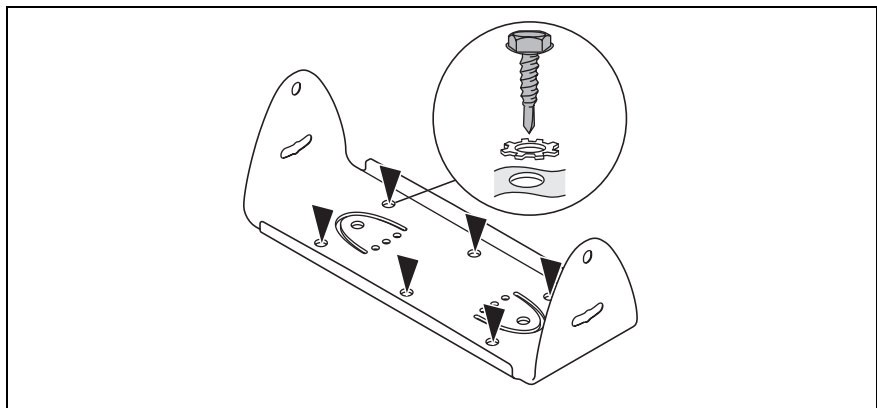
1. If the U-cradle is being mounted over a curved surface, bend the tabs at the bottom of the U-cradle slightly to match the surface shape.
2. Hold the U-cradle in the position chosen for the radio and use the mounting holes as a template to mark the mounting locations. Use at least four screws to install the U-cradle.

Notice Ensure that drilling at the selected points will not damage existing wiring.

The screws provided are self-drilling. For more precise positioning, predrill $\varnothing 1/8$ inch (3 mm) pilot holes for self-drilling screws. Reduce the hole size in metal that is less than $1/32$ inch (1 mm) thick.

3. Drill any holes required for cables and install suitable grommets or bushings in the holes.
4. Screw the U-cradle in the chosen mounting position using the self-drilling screws and washers provided. When tightening the screws, ensure that this does not distort the U-cradle.

Figure 4.7 Mounting the U-cradle



4.8 Installing the Antenna

This section provides information on installing an external antenna within the RF exposure limits.



Warning RF exposure hazard!

To comply with FCC RF exposure limits, mount the antenna at a location such that no person or persons can come closer than 35 inches (0.9m) to the antenna.



For 30-50 W radios:

- VHF radios must be installed using an antenna mounted centrally on the vehicle roof, with a gain of 2.15dBi or 5.15dBi.
- UHF and 800MHz radios must be installed using an antenna mounted either centrally on the roof with a gain of 2.15dBi or 5.65dBi, or centrally mounted on the trunk with a gain of 5.65dBi.



For 25 W radios:

- The radio must be installed using an externally mounted antenna with a gain of either 2.15dBi or 5.15dBi.

Install the external antenna according to the antenna manufacturer's instructions. Good quality 50 Ω coaxial cable must be used, such as RG58 or UR76.

Notice Route the antenna cable in a manner that minimizes:

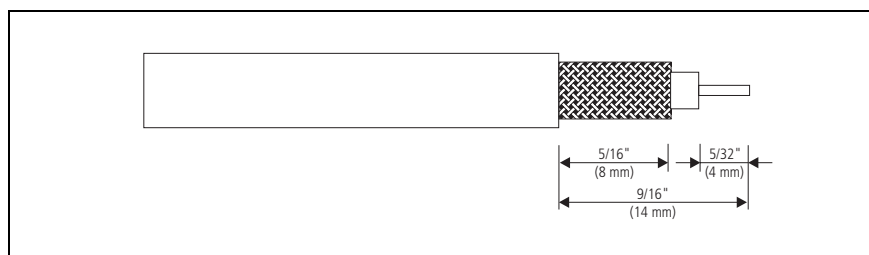
- coupling into the electronic control systems of the vehicle
- coupling of electric vehicle systems, such as alternators, into the radio
- coupling into the radio's DC power cable, the cable to a remote control head, or an external speaker cable

Avoid sharp bends in the cable. These distort the cable and alter its electrical characteristics.

Terminating the Antenna Cable

1. Run the free end of the coaxial cable to the radio's mounting position and cut it to length, allowing approximately 8 inches (200mm) excess at the radio end.
2. Terminate the free end of the antenna cable with the mini-UHF plug or BNC plug (supplied) as shown in [Figure 4.8](#).

Figure 4.8 Terminating the antenna cable



4.8.1 Installing Antennas - Dual Body Considerations



A separate antenna for each radio is recommended, rather than a single antenna configuration (such as a multi-band antenna with a duplexer or splitter). Use ground-independent antennas if no suitable ground plane is available.

It is important that the antennas are separated as far as possible from each other, such as opposite corners of the vehicle, to reduce interference. FCS1362:2016 UK Code of Practice recommends a separation of at least $\frac{1}{4}$ wavelength for transmit frequencies below 600 MHz and one wavelength for transmit frequencies above 600MHz. Use the largest separation requirement of the two radio bodies. See [Table 4.1](#) below.

Notice You may need to install additional equipment such as filters if:

- your installation environment does not allow for proper separation,
- the channel frequencies of the two radios are similar, or
- after testing you experience poor performance or interference.

If the above cases apply to your installation, or you are unsure of the equipment to install, contact an antenna specialist for further advice.

Table 4.1 Approximate frequency to wavelength conversion

Band Name	Frequency (MHz)	Wavelength (cm)	1/4 Wavelength (cm)
B1 (lower range)	136	220	55
B1 (upper range)	174	172	43
H7 (lower range)	450	67	17
H7 (upper range)	520	57	14

4.9 Connecting the Power Cable to the Power Source

This section provides information on connecting the power cable to the power source.

4.9.2 Applying Power to a Radio System

The radio allows the configuration of different power-sense and power supply options to control how the radio is powered up and down. For more information, refer to [“Power Sense and Connector Power Supply Options” on page 21](#).

The installation configurations described below are based on the following hardware link configuration (factory default):

- hardware link LK1M (+13.8V battery power sense): fitted
- hardware link LK2M (ignition sense): fitted

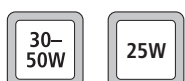
4.9.3 Applying Power - Dual Body Considerations



To provide power to dual body systems, you must connect each radio body separately to a power source or sources. Dual body systems do not currently support a single lead-to-battery connection.

It is important to ensure that both radio bodies have a solid and secure power supply. Unexpected behavior can arise if the power supply to one body operates at a lower voltage than the other, or is momentarily interrupted, as might occur with a poorly formed or intermittent wiring termination.

Power Connector



The power connector is the interface to the vehicle battery and an optional external remote speaker. Connecting a remote speaker is described in [“Connecting an External Speaker” on page 42](#).

Table 4.2 Power connector (radio) - pins and signals

Pinout	Pin	Signal name	Description	Signal type
30-50W radio rear view 25W radio rear view	1	AGND	Earth return for radio body power source	Ground
	2	SPK-	External speaker output. Balanced load configuration	Analog
	3	SPK+	External speaker output. Balanced load configuration	Analog
	4	13V8 BATT	DC power input for radio body and control head	Power

Notice This radio is designed to operate from a nominal 12V negative ground supply and may draw up to 15 A of current. The radio will tolerate a supply voltage range of 10.8V to 16.0V at the radio.

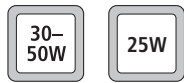
Selecting the Power Source

In passenger vehicles, the radio is always connected directly to the battery using the power cable provided.

Notice Do not connect the radio to the centre tap of two 12V batteries! This may result in damage to the radio due to earth loops, in particular when the negative lead is disconnected from the vehicle battery. It may also result in overcharging or undercharging of the batteries, reducing their service life.

In trucks, where direct connection to the battery is often not possible, the radio can be connected to a suitable terminal inside the fuse box that is connected directly to the battery.

24V-to-12V Converter



In vehicles with a supply voltage larger than 16.0V, such as many trucks, it is essential to provide a 24V-to-12V converter with a minimum rating of 15A for radios 30-50W and 10A for the 25W radio. This will isolate the radio from excessive battery voltage and provide the correct DC operating conditions. Note that most 24V-to-12V converters already fitted are not rated sufficiently.

Ignition Signal and Standby Current

When connecting the radio to the battery without using the ignition signal as described [on page 45](#), the standby current is approximately 50mA per radio.

When using the ignition signal to turn off the radio, the standby current is reduced to <3mA per radio.

To reduce the standby current from 50mA to <3mA without using the ignition signal, connect pin 4 (AUX GPI3) and pin 15 (GND) of the auxiliary connector.

Connecting the Power Cable

Notice Although it is possible to connect the radio in line with the vehicle ignition, this is not recommended, as it may draw too much current and damage the vehicle wiring and steering column or ignition switch. This may also cause the supply voltage of the radio to drop below the specified level.

Notice Disconnecting the vehicle's battery may cause problems with some electronic equipment, such as vehicle alarms, engine management systems, and in-vehicle entertainment systems. Check that the vehicle owner has the necessary information to make all electronic equipment function correctly after battery reconnection.

Notice If the battery is not disconnected, exercise extreme caution during the installation and install the fuses only when the installation is ready to be checked. For more information, refer to [“Checking the Installation” on page 48](#).

1. Disconnect the vehicle's battery unless specifically prohibited from doing so by the customer, vehicle manufacturer, agent, or supplier.

Notice Route the cable in a manner that minimizes coupling of electric vehicle systems such as alternators into the radio.

Notice Protect the power cable from engine heat, sharp edges and from being pinched or crushed.

2. Run the power cable between the radio's mounting position and the power source and cut it to length, allowing approximately 8 inches (200 mm) excess at the radio end.
3. Plug the power cable into the power connector of the radio.



Warning Danger of fire! The radio's protection mechanisms rely on the correct fuses on both the negative and positive power supply leads being present. Failure to fit the correct fuses may result in fire or damage to the radio.

The correct fuse types are:



- 30-50 W radios: 20 A fuses (Tait IPN 265-00010-81)
- 25 W radios: 10 A fuses (Tait IPN 265-00010-80)

4. Cut the negative and the positive wires where the in-line fuse holders will be placed (as close to the power source as possible).

Notice Do not install the fuses until the installation is ready to be checked. For more information, refer to [“Checking the Installation” on page 48](#).

5. Insert each end of the negative wire into each of the fuse crimp-terminals and crimp them to force the metal contacts onto the wires.
6. Push the two crimp-terminals into the clear plastic fuse cover. Close the cover while the next steps are completed.
7. Repeat steps 5 and 6 for the positive wire.
8. Connect the negative wire to the battery ground terminal.
9. Connect the positive wire to the battery positive terminal.

Notice Do not install the fuses until the installation is ready to be checked. For more information, refer to [“Checking the Installation” on page 48](#).

4.10 Connecting an External Speaker

An external speaker is connected to the speaker pins of the radio's power connector and operates in addition to the radio's existing internal speaker. For information about Tait external speakers refer to [“External Speakers” on page 20](#).

If a different speaker is used, receptacles for the speaker pins of the power connector are provided with the radio's installation kit.

- Connect the speaker to pins 2 (SPK–) and 3 (SPK+) of the power connector described [on page 38](#).



The external speaker will only sound audio from the radio that it is connected to. Audio is never fed to an external speaker from the other radio body. If a radio is at the background and dual receive is activated, the attached external speaker will sound received audio from that radio at a reduced volume. If a radio is at the foreground, the attached external speaker will sound received audio from that radio at normal volume. Audible indicators will be heard on the control head speaker and the external speaker attached to the primary radio body with the lowest MAC address.

For more information, refer to the installation instructions provided with the speaker.

4.11 Connecting to the Auxiliary Connector (Ignition Signal, Emergency Switch, External Alert Devices)

The auxiliary connector can be used to connect external devices and signals that are typically connected to a radio. These devices and signals include:

- the ignition signal to power up and power down the radio
- an emergency switch to power up the radio (if required) and then enter emergency mode
- external alert devices

Auxiliary Connector The radio's auxiliary connector is a 15-way standard-density D-range socket.



The space for a mating plug is limited to 1 5/8 inch (41 mm) in width and 11/16 inch (18 mm) in height. Although most plugs will fit this space, it is recommended that you test the plug to be used before manufacturing a cable.

Some input levels of the auxiliary connector depend on how the internal hardware links are fitted (refer to [Table 4.4](#)). For more information on hardware links refer to “Power Sense Options” on page 21.

Table 4.3 Auxiliary connector (radio) - pins and signals

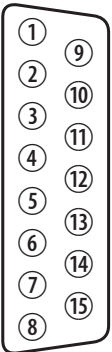
Pinout	Pin	Signal name	Description	Signal type
 rear view	12	AUX GPI1	General purpose digital input. Programmable function	Digital, 3.3V CMOS.
	5	AUX GPI2		
	4	AUX GPI3	General purpose input (ignition sense)	3.3V levels. Protected for +13.8V (refer to Table 4.4).
	10	AUX GPIO4	Programmable function and direction Pads available to fit a higher power driver transistor on GPIO4 line	Digital, 3.3V CMOS input; open collector output with pullup
	2	AUX GPIO5		
	9	AUX GPIO6		
	1	AUX GPIO7		
	11	AUX TXD	Asynchronous serial port - Transmit data	Digital, 3.3V CMOS
	3	AUX RXD	Asynchronous serial port - Receive data	Digital, 3.3V CMOS
	7	AUD TAP IN	Programmable tap point into the Rx or Tx audio chain. DC-coupled	Analog
	13	AUD TAP OUT	Programmable tap point out of the Rx or Tx audio chain. DC-coupled	Analog
	14	AUX MIC AUD	Auxiliary microphone input. Electret microphone biasing provided. Dynamic microphones are not supported	Analog
	6	RSSI	Analog RSSI output	Analog
	8	+13V8 SW	Switched 13.8V supply. Supply is switched off when radio body is switched off	Power
	15	AGND	Analog ground	Ground

Table 4.4 Auxiliary connector - input levels

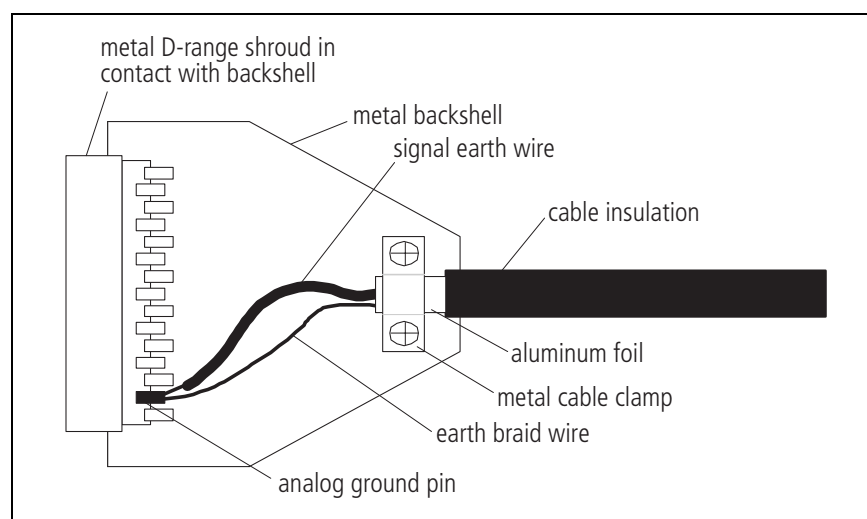
Parameter	Voltage ^a			Test method and conditions	Comments
	min.	max.	units		
Input low level: All inputs AUX_GPI2		0.7 V _S -4	V V	No hardware links fitted ^b . LK3M fitted.	Includes AUX_GPI3 with LK1M/2 fitted. Configured as emergency power sense input.
Input high level: All inputs AUX_GPI2	1.7 V _S -1.5		V V	No hardware links fitted ^b . LK3M fitted.	Configured as emergency power sense input.
AUX_GPI3	2.6		V	LK1M and/or 2 fitted.	Configured as power sense input (see "Ignition Signal" on page 45).
Safe DC input limits: AUX_GPI1-3 AUX_GPIO4-7 AUX_RXD AUX_TXD ^c	-0.5 -0.5 -25V -10	V _S +0.5 V _S +0.5 V _S +0.5 V _S +0.5	V V V V		The input current must not exceed $\pm 50\text{mA}$. This is the rating of the clamping diodes.

- a. The radio will tolerate a supply voltage range of 10.8V to 16.0V at the radio.
b. For more information on hardware links refer to Table 3.1 on page 23.
c. This output is protected against accidental input to the limits specified.

Shielding

If the auxiliary cable is longer than 4 feet (1 m) it is recommended that the cable and connector backshell are shielded. [Figure 4.9](#) shows the recommended shielding arrangement. The earth braid wire (bare copper) and aluminum foil should only be earthed at the radio end of the cable.

Figure 4.9 Auxiliary cable and connector shielding



No Ignition Signal

If hardware link LK1M is fitted (factory default) and the ignition signal is not used, the standby current is approximately 50 mA. To reduce the standby current to <3 mA either:

- remove hardware link LK1M, or
- connect pin 4 (AUX GPI3) to pin 15 (AGND) of the auxiliary connector

Notice The hardware links are SMT components. Do not replace SMT components unless you are trained and equipped to do so.

Attempting to replace SMT components without the necessary training, tools, and equipment can cause permanent damage to the radio.

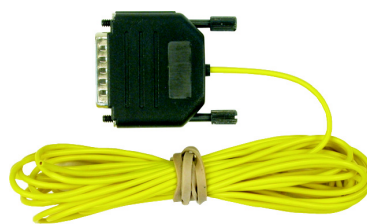
With the above two options, the radio always stays off when power is first applied. The radio can only be turned on with the on/off button.

Ignition Signal

The ignition signal can be used to power up and power down the radio. This will turn the radio off when the ignition key is off to avoid flattening the battery, and will turn the radio on or return to its previous state (as programmed) when the ignition key is on.



A TMAA04-05 ignition sense kit is available. The kit comprises a mating plug for the radio's auxiliary connector and a 13 foot (4m) length of cable to connect to the vehicle's ignition signal. Refer to the installation instructions supplied in the kit for full details.



Notice The AUX GPI3 line **must** be programmed to 'Power Sense (Ignition)' and active to 'High'. For more information, refer to the online help of the programming application.

- Connect the ignition signal to pin 4 (AUX GPI3) of the auxiliary connector.

Notice The logic thresholds for AUX GPI3 are based on 3V3 levels. However, AUX GPI3 can be connected directly to a +13.8V ignition signal (for input levels, refer to [Table 4.4 on page 44](#)).

Emergency Switch

The radio allows for connection of an emergency switch to any input line to enter the emergency mode. If connected to the AUX GPI2 input line, the radio can also use 'emergency power sense' to power up the radio to enter the emergency mode.

The selected input line must be programmed to 'Enter Emergency Mode' and active to 'Low'. To use 'emergency power sense', hardware link LK3M must be fitted (factory default), and AUX GPI2 must be used. For more information, refer to ["Power Sense Options" on page 21](#) and the online help of the programming application.

- Connect a normally open switch between the pin of the input line (pin 5 for AUX GPI2) and pin 15 (AGND) of the auxiliary connector.

External Alert Device

The radio allows for output to external alert devices using the digital GPIO lines of the auxiliary connector and the internal options connector.

AUX GPIO4 can be fitted with a power MOSFET (Q10N) to directly connect external alert devices (e.g. flashing light, buzzer, horn relay) to the radio. Also, resistor R75N must be removed.

Notice While the MOSFET is rated at 12 A (with heat sink), the maximum allowable current of the connector and radio's earthing system is 2 A. Therefore, a horn must not be connected directly to the radio. A horn relay must be used.

The selected output line must be programmed to 'External Alert 1 or 2', active to 'Low', and signal state to 'Momentary'.

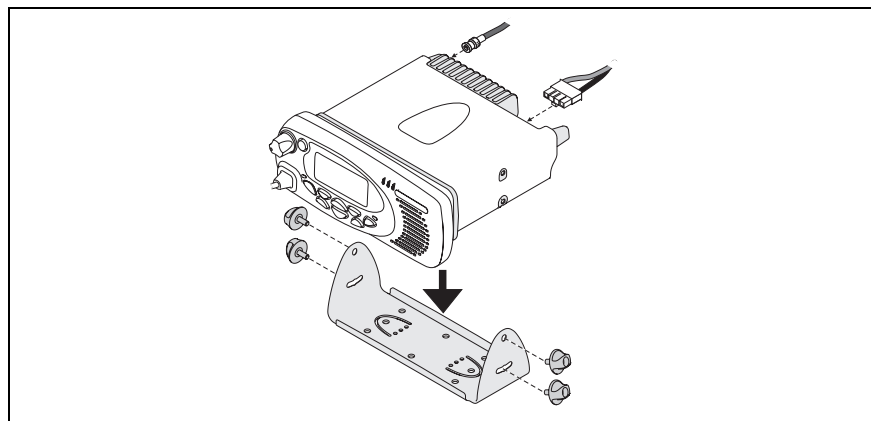
- Connect the external alert device to the pin of the output line (pin 10 for AUX GPIO4) and pin 8 (+13V8 SW) of the auxiliary connector (or a different positive battery connection).

This means that the negative side of the alert device must be connected to AUX GPIO4 and the positive side to pin 8 (+13V8 SW). The external alert device must be capable of accepting a voltage of between 10V and 18V.

4.12 Installing the Radio

1. Connect the antenna cable, power cable, and (if applicable) the auxiliary cable to the rear of the radio.
2. Position the radio in the U-cradle so that the holes in the U-cradle line up with the holes in the radio chassis.
3. Screw the radio into position using the four thumb screws provided, but without fully tightening the screws.
4. Adjust the position of the radio in the U-cradle for the best viewing angle, then tighten the thumb screws.

Figure 4.10 Installing the radio in the U-cradle



4.13 Installing the Microphone

This section describes the radio's microphone connector and the information required to connect the microphone and install the microphone clip.

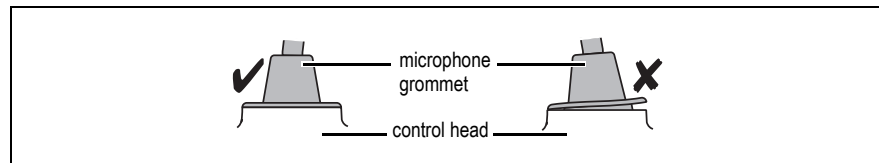
Notice The microphone grommet must be installed whenever the microphone is plugged into the microphone socket:

- to prevent damage to the microphone socket when there is movement of the microphone cord, and
- to ensure that the control head is sealed against water, dust and other environmental hazards

Connecting the Microphone

1. Plug the microphone into the microphone socket.
2. Slide the grommet along the microphone cord and push two adjacent corners of the grommet into the microphone socket cavity.
3. Squeeze the grommet and push the remaining corners into position.
4. Check that the grommet is seated correctly in the cavity.

Figure 4.11 Correct remote cable grommet seating



Installing the Microphone Clip



Warning Safe radio mounting! Mount the microphone where it will not interfere with:

- the deployment of passenger airbags
- the vehicle operator controls
- the vehicle operator's view

Notice Only install the microphone clip provided. If a non-standard microphone clip is used, the correct operation of the microphone hook-switch cannot be guaranteed.

Install the microphone clip in the most convenient location using the screws provided. The microphone must be within reach of the user but in such a position that the PTT (press-to-talk) key cannot be inadvertently activated or jammed.

4.14 Checking the Installation



Warning Danger of fire! The radio's protection mechanisms rely on the correct fuses on both the negative and positive power supply leads being present. Failure to fit the correct fuses may result in fire or damage to the radio.

The correct fuse types are:



- 30-50 W radios: 20 A fuses (Tait part number 265-00010-81)
- 25 W radios: 10 A fuses (Tait part number 265-00010-80)

1. Insert the fuses into the power leads.
2. Switch on the radio to confirm that it is operational, but do not transmit.
3. Connect an in-line power meter between the radio and the antenna.
4. **TM9300 only:** TM9300 TDMA digital channels do not give a true power level reading on an in-line power meter. Change to conventional mode and select an analog channel. For example, select Change Mode from the radio's main menu, or Change Mode may have been programmed to a function key.
5. Transmit and measure the forward and reflected power levels.
Less than 4% of the forward power should be reflected. If this is not achieved, check the installation, including the antenna length.
6. If **not** using a **pre-tuned** antenna (**should not be cut**), start reducing the length of the antenna in steps of 0.1 inches to 0.2 inches (2 to 5 mm). Measure the power levels at each step.
7. Once the reflected power levels are within tolerance, return the radio to the required operational mode, then make a call to another party on the radio.

Testing Dual Body Functions



The availability of the following features varies depending on firmware version.



- Compare the receive functions (such as sensitivity) of one radio, while the other radio is and is not transmitting. Ensure there is no significant difference.
- Compare the transmit functions (such as coverage) of one radio, while the other radio is and is not transmitting.
- Test all other functions, such as dual-receive and repeater cable and repeater operation. Check that those functions operate as expected.

If issues are found, move the radio bodies and/or antennas further apart and re-test.

4.15 Negative Earth Supply

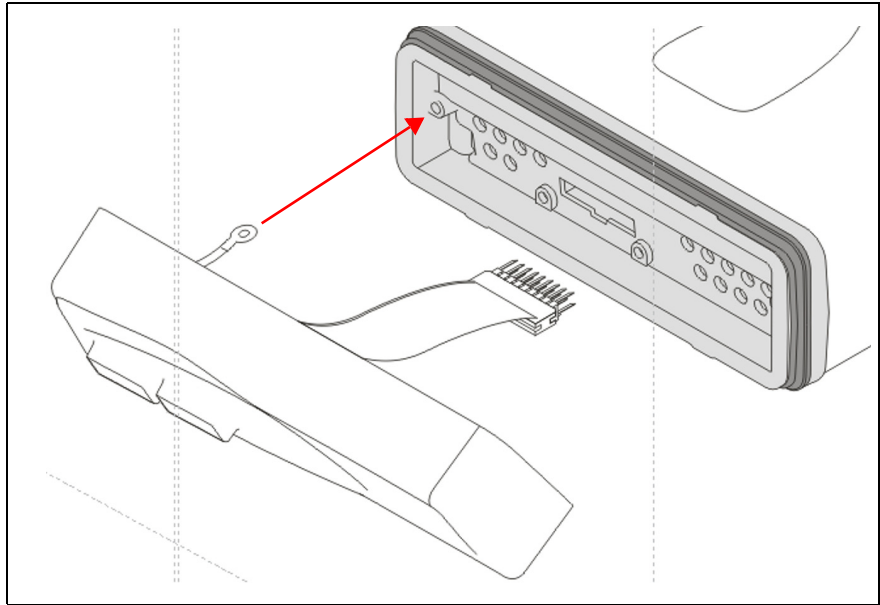
Radios are designed to operate only in a negative earth system.

Remote Interfaces Earthing Tag

Earthing is achieved by attaching an earthing tag to the radio chassis.

Before installing the remote body interface to the radio body, screw the earthing tag onto one of the screw bosses on the radio chassis, as seen in the figure below.

Figure 4.12 Earthing Tag

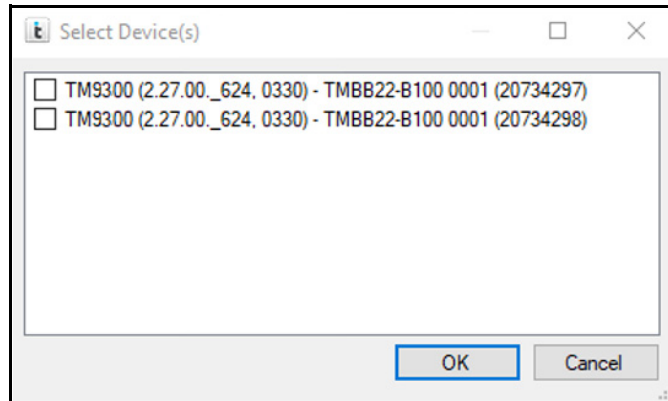


4.16 Checking the Vehicle After Installation

Complete a post-installation check of all vehicular functions.


5 Appendix - Dual Body Programming Instructions

After you have downloaded MACs and assembled the system, you can program or read individual devices in the system. Each time you attempt to communicate with the radio system, the Select Device(s) dialog appears:



This section contains the following information:

- Connecting a Dual Body System to a PC
- Programming a Dual Body System
- Recommended Dual Body Settings
- Troubleshooting

 For required programming application and firmware versions for your radio system, see the “TM9356/TM9456 Getting Started Guide” (MMB-00035-01)

5.1 Connecting a Dual Body System to a PC

A dual body system connects to a PC via the control head. The exact connector to use depends on the control head solution.

Notice Do not attempt to connect the programming lead to an RJ45 socket on a radio body. This can cause damage to the connector and the radio.

- Single graphical-display control head: Unplug the standard or keypad microphone, and connect a PC to the microphone port.
- Hand-held control head: Use the tool provided in the T02-00073-xxxx kit or an 8mm AF Allen key to remove the rear programming connector cover, and connect a PC to the programming connector. For more information, refer to the instructions provided with the hand-held control head (see [“Associated Documentation” on page 6](#)).
- Dual graphical-display control heads: As with the single graphical-display control head, but using the microphone port of the primary control head. To identify the primary control head, select Menu > Radio settings > Radio info > Multi head info. For more information, refer to the instructions provided with the upgrade kit (see [“Associated Documentation” on page 6](#)).



The dual graphical-display control head may or may not be supported depending on firmware version.

5.2 Programming a Dual Body System

The following steps for programming a dual body system assume:

- all the devices in the system have been loaded with the same firmware package version, and you have installed supported versions of programming and calibration software.
- all the devices in the system have unique MACs assigned.
- all radio bodies in the system have the required software features enabled.

Step 1: Create a template file

1. Using the Programming Application, enter the information into the fields that are common between the radios. See [“Recommended Dual Body Settings” on page 53](#).
2. Click File > Save.
3. Enter a descriptive name for the template, for example: **“Tait_DualRadio_Master_File”**.

Step 2: Program each device in the system

1. Using the Programming Application, open the template file created for the radio system.
2. Set the radio’s **Band** (Global > Specification form).
3. Enter a **Radio Name** (recommended).



The length of the radio name restricts the length of all channel and group labels. Therefore a three-character radio name such as “UHF” or “VHF” is recommended, as it will allow group and channel labels up to 10 characters (such as “Channel 99”).

4. Add all information relating to the band selected in step 2, including channels (Conventional > Channel Setup > Channels form) and groups (Scan Groups form).
5. Click File > Save As to save the device’s file to disk as a new file.
6. Click Radio > Program.
7. In the Select Device(s) dialog, select the radio body that matches the Band selected in step 2, and optionally, both may be the same band.



You cannot select more than one of the same device type (for example, two radio bodies).

8. Repeat steps 1 to 7 and program the other radio body and the control head.

5.3 Recommended Dual Body Settings

The programming configuration of all devices must be as similar as possible, with the exception of the operating band, radio name, channels and groups. If features relating to the user interface (such as function keys, radio menus, and backlighting), and other features like the security lock are different, there may be unexpected behavior when powering on or switching between the radios.

The following settings are recommended for a dual body system. Use this table when setting up a template file, before programming the system (see [“Programming a Dual Body System” on page 52](#)).



The availability of some of the following features depends on which version of firmware is being used.

Table 5.1 Recommended dual body settings

Field/Feature	Location	Comments
Radio Name	Global > Specifications form	The radio name, if used, should be different for both radio bodies in the system.
Power On Mode	Global > Start-up form	The power on mode must be the same for all devices in the system.
Power-up on Last Active Body	Global > Start-up form	This check box must be the same for all devices in the system.
Reset on Error	Global > Start-up form	The Reset on Error check box must be the same for all devices in the system.
Security Lock on Power Up and Security PIN	Global > Start-up form	If the security PIN is enabled, it must be enabled (and have the same PIN) for all devices in the system.
PTT fields	Global > PTT form	PTT settings for both radio bodies are used when in dual-transmit mode and the radio user presses the PTT. Care should be taken if programming PTT behavior differently between the radio bodies. PTT settings are typically set the same for all devices in the system.
Startup (Channel or Group)	Conventional > Conventional UI form	You can program this option for the foreground radio (the radio body with the lowest MAC address) to start on a specific channel or group each time the radio system is turned on. You can also program this option for the background radio to default to a specific channel or group after the radio system is turned on, and the radio user subsequently switches the active radio or enables dual receive.
Selcall Stun and Revive	Conventional > Selcall > Control Status form	Selcall stun and revive functionality is currently not supported for TM9356/TM9456 radio systems. If the stun and revive control status types are used, set the equivalent Rx Processing fields to No for all devices.

Conv Key Settings	Conventional > Conv Key Settings form	Dual body functionality such as dual transmit and receive, and changing the foreground radio, can only be accessed via function keys. Add the Dual Body Mode and Single Body Mode actions to separate keys, or Dual/Single Body Mode to a single key. Add the Switch Active Radio action to a different function key.
Other Function Key Settings and the Radio Menu	Conventional > Conventional Menu form	The radio's function key settings and menu must be the same for all devices in the system.
Left Selection Key and Scroll Keys	Conventional > Conv Key Settings form	If options are programmed for the left selection key and/or scroll keys, they must be the same for all devices in the system.
UI Preferences and Conventional UI	Global > UI Preferences form, and Conventional > Conventional UI form	UI preferences must be configured identically for all devices in the system. For example, backlighting, keypress tones, the RSSI icon, and the default dialling type.
Programmable I/O	Programmable I/O form	All radio body I/O pins are supported, and all actions are supported except the output F1 to F4 Key Status. The control head I/O pin (CH_GPIO1) is limited to outputs only, and those outputs will always reflect the foreground radio. The following actions are dependant on the current mode, and state of the active radio body. External PTT 1 and 2: The radio body that the PTT is connected to will transmit, unless transmission is invalid (for example, that radio is the background radio in single-body mode). Toggle F1 and F4 Key LED: The function key LED will reflect the state of the relevant I/O pin on the foreground radio. Radio Ready: The radio at the background in single-body mode is not considered ready, so will not activate the output pin. Note: A repeater cable requires specific programmable I/O settings for both radio bodies. For more information, see "Troubleshooting" on page 55 .
Trunked MPT ^a		Trunked MPT settings are currently not supported with TM9356 radio systems. Do not attempt to program these fields or enable the optional feature for MPT 1327 Trunking.
Trunked DMR Tier-3 ^b		Trunked DMR Tier-3 settings are currently not supported with TM9356 radio systems. Do not attempt to program these fields or enable the optional feature for DMR Tier-3 Trunking.

a. Trunked MPT only applies to DMR radios.


b. Trunked DMR Tier-3 only applies to DMR radios.

5.4 Troubleshooting

If reporting the configuration shows only two devices when three are expected, or the Select Device(s) dialog does not appear when reading or programming the radio system:

- Make sure all cables are connected correctly, and securely.
- Make sure power is applied to both radio bodies.
- One or more devices may not have the correct system configuration table of MACs.

If duplicate MAC addresses are suspected, dismantle the system and verify that the MAC addresses are unique across all three devices.

-  MAC addresses need to be unique in each device. If they are not, the system will not operate correctly.

If an “incorrect band” message appears in the programming application (XPA) when attempting to program a radio body, the band of the selected device to program is different to the band selected in the programming application. Either change the **Band** field on the Specifications form, or select the matching radio body in the Select Device(s) dialog.

If an “unlicensed feature” message appears in the programming application, or the LEDs on one or both radio bodies flash on and off when powering up the system, optional features (for example, Multi-Body Support) may not be enabled.

For more information, please contact your local Tait dealer.

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7.5. If Licensee, as a contractor or subcontractor (integrator), is purchasing Tait Designated Products and licensing Software not for its own internal use but for end use only by a Customer, the Licensee may transfer such Software, but only if a) Licensee transfers all copies of such Software and the related Documentation to the transferee and b) Licensee has first obtained from its Customer (and, if Licensee is acting as a subcontractor, from the interim transferee(s) and from the ultimate end user sub license) an enforceable sublicense agreement that prohibits any other transfer and that contains restrictions substantially identical to the terms set forth in this Software License Agreement. Except as stated in the foregoing, Licensee and any transferee(s) authorised by this Section may not otherwise transfer or make available any Tait Software to any third party nor permit any party to do so. Licensee will, on request, make available evidence reasonably satisfactory to Tait demonstrating compliance with all the foregoing.

Section 8 TERM AND TERMINATION

8.1. Licensee's right to use the Software and Documentation will commence when the Designated Products are supplied by Tait to Licensee and will continue for the life of the Designated Products with which or for which the Software and Documentation are supplied, unless Licensee breaches this Agreement, in which case this Agreement and Licensee's right to use the Software and Documentation may be terminated immediately upon notice by Tait.

8.2. Within thirty (30) days after termination of this Agreement, Licensee must certify in writing to Tait that all copies of the Software have been removed or deleted from the Designated Products and that all copies of the Software and Documentation have been returned to Tait or destroyed by Licensee and are no longer in use by Licensee.

8.3. Licensee acknowledges that Tait made a considerable investment of resources in the development, marketing, and distribution of the Software and Documentation and that Licensee's breach of this Agreement will result in irreparable harm to Tait for which monetary damages would be inadequate. If Licensee breaches this Agreement, Tait may terminate this Agreement

and be entitled to all available remedies at law or in equity including immediate injunctive relief and repossession of all non-embedded Software and associated Documentation. Licensee shall pay all Tait costs (on an indemnity basis) for the enforcement of the terms of this Agreement.

Section 9 CONFIDENTIALITY

Licensee acknowledges that the Software and Documentation contain proprietary and Confidential Information valuable to Tait and are Tait trade secrets, and Licensee agrees to respect the confidentiality of the information contained in the Software and Documentation.

Section 10 LIMITATION OF LIABILITY

10.1. In no circumstances shall Tait be under any liability to Licensee, or any other person whatsoever, whether in Tort (including negligence), Contract (except as expressly provided in this Agreement), Equity, under any Statute, or otherwise at law for any losses or damages whether general, special, exemplary, punitive, direct, indirect, or consequential arising out of or in connection with any use or inability of using the Software.

10.2. Licensee's sole remedy against Tait will be limited to breach of contract and Tait sole and total liability for any such claim shall be limited at the option of Tait to the repair or replacement of the Software or the refund of the purchase price of the Software.

Section 11 GENERAL

11.1. COPYRIGHT NOTICES. The existence of a copyright notice on the Software will not be construed as an admission or presumption of publication of the Software or public disclosure of any trade secrets associated with the Software.

11.2. COMPLIANCE WITH LAWS. Licensee acknowledges that the Software may be subject to the laws and regulations of the jurisdiction covering the supply of the Designated Products and will comply with all applicable laws and regulations, including export laws and regulations, of that country.

11.3. ASSIGNMENTS AND SUBCONTRACTING. Tait may assign its rights or subcontract its obligations under this Agreement, or encumber or sell its rights in any Software, without prior notice to, or consent of, Licensee.

11.4. GOVERNING LAW. 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 judgment 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.

11.5. THIRD-PARTY BENEFICIARIES. This Agreement is entered into solely for the benefit of Tait and Licensee. No third party has the right to make any claim or assert any right under this Agreement, and no third party is deemed a beneficiary of this Agreement. Not-

withstanding the foregoing, any licensor or supplier of third-party software included in the Software will be a direct and intended third-party beneficiary of this Agreement.

11.6. SURVIVAL. Sections 4, 5, 6.3, 7, 8, 9, 10, and 11 survive the termination of this Agreement.

11.7. ORDER OF PRECEDENCE. In the event of inconsistencies between this Agreement and any other Agreement between the parties, the parties agree that, with respect to the specific subject matter of this Agreement, this Agreement prevails.

11.8 SECURITY. Tait uses reasonable means in the design and writing of its own Software and the acquisition of third-party Software in order to limit Security Vulnerabilities. While no software can be guaranteed to be free from Security Vulnerabilities, if a Security Vulnerability is discovered, Tait will take the steps specified in Section 6 of this Agreement.

11.9 EXPORT. Licensee will not transfer, directly or indirectly, any Designated Product, Documentation or Software furnished hereunder or the direct product of such Documentation or Software to any country for which New Zealand or any other applicable country requires an export license or other governmental approval without first obtaining such license or approval.

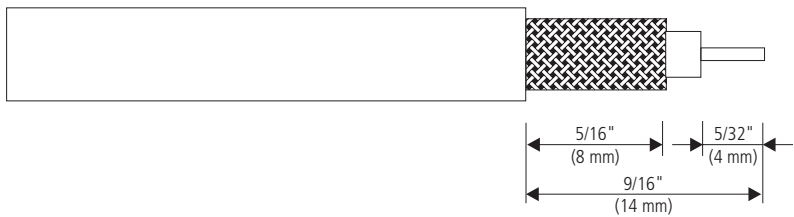
11.10 SEVERABILITY. In the event that any part or parts of this Agreement shall be held illegal or null and void by any court or administrative body of competent jurisdiction, such determination shall not affect the remaining terms which shall remain in full force and effect as if such part or parts held to be illegal or void had not been included in this Agreement. Tait may replace the invalid or unenforceable provision with a valid and enforceable provision that achieves the original intent and economic effect of this Agreement.

11.11 CONSUMER GUARANTEES. Licensee acknowledges that the licenses supplied in terms of this agreement are supplied to Licensee in business, and that the guarantees and other provisions of prevailing consumer protection legislation shall not apply.

11.12 WHOLE AGREEMENT. Licensee acknowledges that it has read this Agreement, understands it and agrees to be bound by its terms and conditions. Licensee also agrees that, subject only to the express terms of any other agreement between Tait and Licensee to the contrary, this is the complete and exclusive statement of the Agreement between it and Tait in relation to the Software. This Agreement supersedes any proposal or prior agreement, oral or written, and any other communications between Licensee and Tait relating to the Software and the Designated Products.

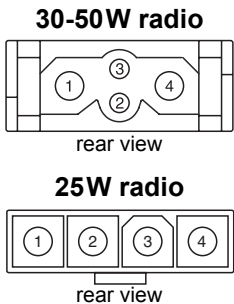
Cable Connections

Terminating the Antenna Cable



For more information, refer to [“Installing the Antenna” on page 36](#).

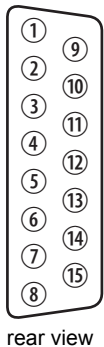
Power and Remote Speaker Connections



Pin	Signal	Function
1	AGND	Earth return
2	SPK–	External speaker –
3	SPK+	External speaker +
4	+13V8 BATT	DC power input (10.8V to 16.0V)

For more information, refer to [“” on page 37](#) and [“Connecting an External Speaker” on page 42](#).

Ignition Sense, Emergency Switch, and External Alert Device Connections



Pin	Signal	Function
4	AUX GPI3	Ignition sense (see “Ignition Signal” on page 45)
5	AUX GPI2	Emergency switch +
8	+13V8 SW	External alert device +
10	AUX GPIO4	External alert device –
15	AGND	Emergency switch –

For more information, refer to [“Connecting to the Auxiliary Connector \(Ignition Signal, Emergency Switch, External Alert Devices\)” on page 42](#).

