TM9100 mobiles (40 W/50 W)

Installation Guide

Contact Information

Tait Radio Communications

Corporate Head Office New Zealand

Tait Electronics Ltd
P.O. Box 1645
Christchurch
New Zealand
E-mail: info@taitworld.com
Website: http://www.taitworld.com

Technical Support:
E-mail: support@taitworld.com
Website: http://support.taitworld.com

Tait North America

Regional Head Office -
United States of America
Tait North America Inc
E-mail: usa@taitworld.com

Canada
Tait North America Inc
E-mail: canada@taitworld.com

Tait Latin America

Tait Latin America
E-mail: latinamerica@taitworld.com

Tait Europe

Regional Head Office - United Kingdom
Tait Mobile Radio Ltd
E-mail: teusales@tait.co.uk

http://www.taitworld.com

Tait North Asia

Regional Head Office - Hong Kong
Tait Mobile Radio (Hong Kong) Ltd
E-mail: hongkong@taitworld.com

Beijing
Tait Mobile Radio (Hong Kong) Ltd
E-mail: beijing@taitworld.com

Tait South Asia

Regional Head Office - Singapore
Tait Electronics (Far East) Pte Ltd
E-mail: singapore@taitworld.com

Thailand
Tait Mobile Radio Ltd
E-mail: thailand@taitworld.com

Tait Oceania

New Zealand
Tait Communications Ltd
E-mail: headoffice@tcl.tait.co.nz

Australia
Tait Electronics (Aust) Pty Ltd
E-mail: australia@taitworld.com

Note: For the addresses and phone numbers of the above regional offices refer to the TaitWorld website.

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Contents

Preface

Scope of Manual

This manual describes the installation of the TM9100 mobile radios, microphones, antennas, emergency switches, and external alert devices.

The installation of accessories is described in the installation instructions provided with the accessories and the relevant section of the service manual.

Enquiries and Comments

If you have any enquiries regarding this manual, or any comments, suggestions and notifications of errors, please contact Technical Support, Tait Electronics Ltd, Christchurch, New Zealand (refer to "Contact Information" on page 2).

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Document Conventions

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

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

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

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

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

Safety Warnings

This chapter contains important information on the safe installation of the radio. You must read this information before starting the installation!

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

Warning!! **RF exposure hazard**

To comply with FCC RF exposure limits:

■ VHF radios must be installed using an antenna mounted centrally on the vehicle roof, with a gain of 2.15 dBi or 5.15 dBi.

■ UHF radios must be installed using an antenna mounted either centrally on the roof with a gain of 2.15 dBi or 5.65 dBi, or centrally mounted on the trunk with a gain of 5.65 dBi.

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

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 vehicle operator controls.

■ Mount the radio and the microphone where they will not interfere with the vehicle operator's view.

■ Mount the radio and the microphone where they will not interfere with air bag deployment.

Warning!! **Interference with vehicular electronics**

Some vehicular electronic devices may be prone to malfunction, due to the lack of protection from RF energy present 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.

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

Warning!! **Vehicles powered by liquefied petroleum gas**

Radio installation in vehicles powered by LP (liquefied petroleum) gas with the LP gas 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 LP gas container and its fitting.

■ Outside filling connections shall be used for the LP gas container and its fittings.

■ The LP gas container space shall be vented to the outside of the vehicle.

Caution **Negative earth supply**

The radios are designed to operate only in a negative earth system.

Caution **Insufficient heat dissipation with non-standard radio installations**

An unobstructed flow of air is required over the underside and rear of the radio to ensure adequate cooling. The installation U-bracket described in this guide has been designed to ensure such an airflow.

If a non-standard installation method is used, ensure that sufficient heat can be dissipated from the cooling fins at the rear of the radio as well as from the ridged underside of the radio. To achieve this, there must be a gap of more than 3/8 inch (10 mm) between the underside of the radio body and the mounting.

3/8 inch (10 mm)
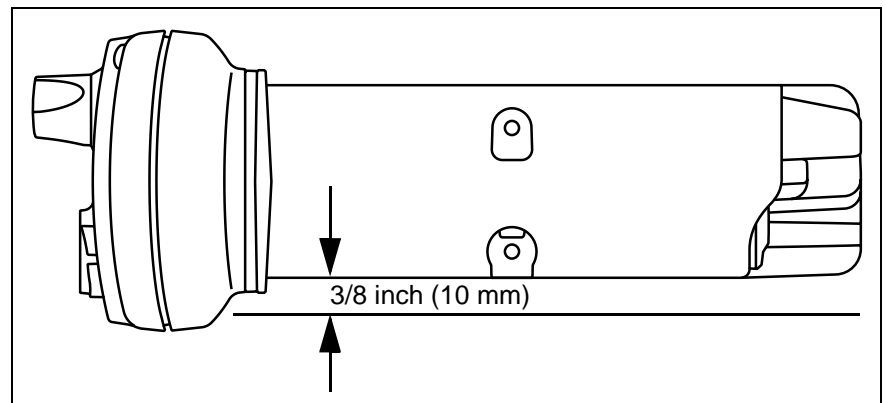
1 Preparing the Installation

Overview

This chapter provides you with the information required to:

- know the regulations regarding the installation of mobile radios
- provide the tools required for installation
- choose the appropriate installation configuration

1.1 Regulations

MPT 1362 Code of Practice

Tait Electronics recommend that mobile radios be installed in accordance with the MPT 1362 Code of Practice.

Vehicle Manufacturer's Installation Instructions

Follow your vehicle manufacturer's instructions on the installation of mobile radios. For more information refer to the vehicle manufacturer's website or contact the vehicle manufacturer's dealer.

1.2 Installation Tools

The following tools are required for the installation of the radio:

- drill and drill bits
- Pozidriv screwdriver
- 5/16 inch (8 mm) socket (or Pozidriv screwdriver)
- 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

1.3   Choosing an Installation Configuration

Introduction

The radio allows for different installation configurations for vehicles with respect to ignition signal and standby current. For special configurations for desktop and remote site installations, refer to the service manual.

The installation configurations described below are based on the following hardware link configuration:

■ hardware link 1 (+13.8V battery power sense): fitted

■ hardware link 2 (ignition sense): fitted

For more information on the hardware links, refer to the service manual.

Direct Connection to the Power Source

The radio's power cable must always be connected directly to the power source (battery).

Important   Although it is possible to connect the radio in line with the vehicle ignition, this installation method is not recommended, as it may draw too much current, resulting in damage to 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.

The radio can always be turned on and off using the on/off button, independent of the ignition signal.

Installation without Ignition Signal

Connect the power cable directly to the power source as described in "Connecting the Power Cable" on page 19.

Note   If hardware link 1 is fitted and the ignition signal is not used, the standby current is 28mA. To reduce the standby current to 1mA:
– remove hardware link 1, or
– connect pin 4 (AUX_GPIO3) to pin 15 (GND) of the auxiliary connector, and program the AUX_GPIO3 line as described below.

Installation with Ignition Signal

Connect the power cable directly to the power source as described in "Connecting the Power Cable" on page 19.

Connect pin 4 (AUX_GPIO3) of the auxiliary connector to the ignition signal as described in "Connecting to the Auxiliary Connector" on page 21.

Note   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 application software.

2   Installing the Radio

This chapter provides the information required to:

- mount and remove the control head
- select a safe and convenient mounting position
- mount the radio
- install the microphone and microphone clip
- install the antenna
- connect the power cable
- connect a remote speaker
- connect to the auxiliary connector
- carry out installation checks

2.1   Mounting and Removing the Control Head
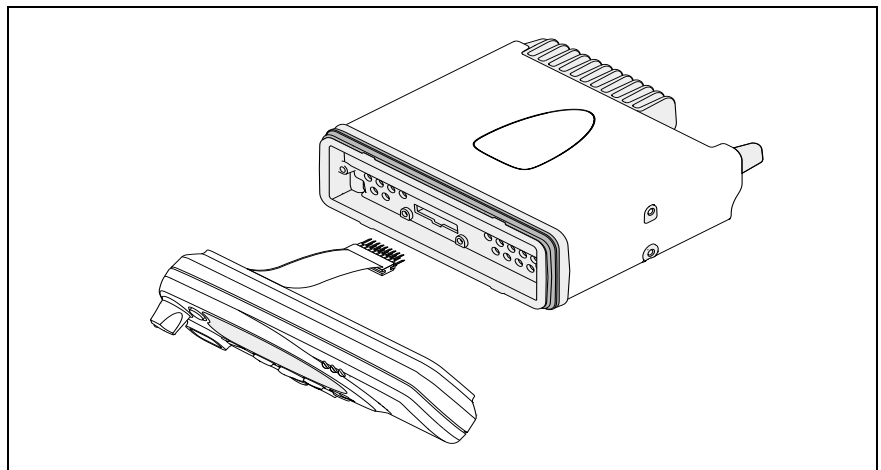
Mounting the Control Head

The radio body and the control head and its connection loom are delivered separately. 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.

*Note*   It may be required to mount the radio upside down in order 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.

Figure 2.1   Mounting the control head

1.   Plug the control-head loom onto the control-head connector.

2.   Insert the bottom edge of the control head onto the two clips in the front of the radio body, then snap into place.

Figure 2.2   **Disconnecting the control head from the radio body**
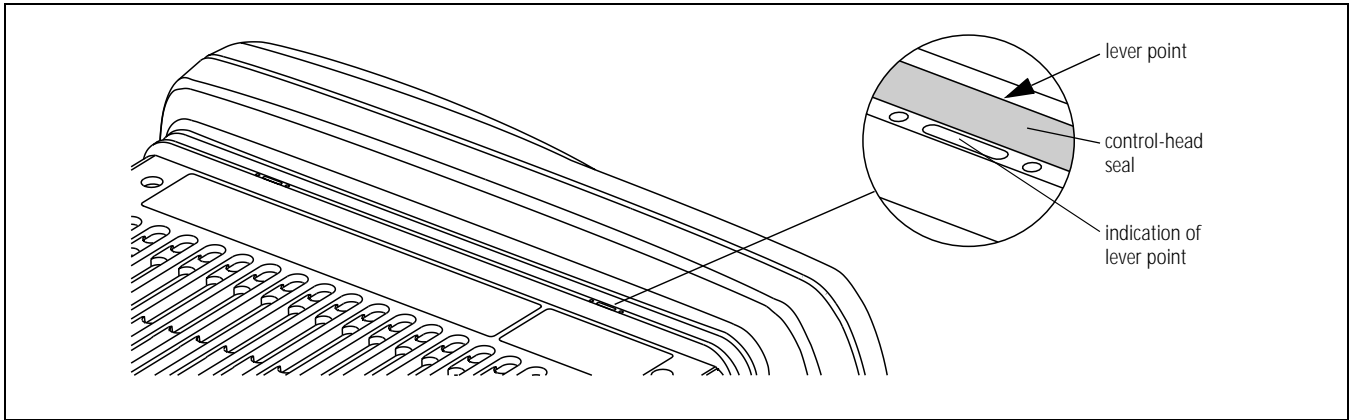
Removing the Control Head

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

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

Important   When inserting the screwdriver, take care not to damage the control-head seal.

2. 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.

3. Use the screwdriver to lift the control head off the clip, then repeat in the other position. The control head can now be removed.

2.2 Selecting the Mounting Position

Requirements for Safe and Convenient Installation

Make sure the mounting position complies with the requirements of 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 vehicle operator controls.

■ Mount the radio and the microphone where they will not interfere with the vehicle operator's view.

■ Mount the radio and the microphone where they will not interfere with air bag deployment.

Gap between Radio Body and Mounting Surface

Note   It may be required to mount the radio upside down in order 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 sufficient clearance behind the radio for the heatsink and cables.

IP54 Protection Class Considerations

Important   The radio is specified to fulfil the requirements of the IP54 protection class. However, the following must be considered:

The radio must not be mounted in areas, where an accumulation of water or other liquids can result in the temporary submersion of the radio (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 aperture for the external options connector (fitting an auxiliary connector or external options connector will not restore the IP54 protection class)

■ the microphone grommet is not installed

2.3   Mounting the Radio

Introduction

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

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

Installation

Important 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-bracket is being mounted over a curved surface, the tabs at the bottom of the U-bracket can be bent slightly to match the surface shape.

2. Hold the U-bracket in the position chosen for the radio and use the mounting holes as a template to mark the mounting locations.
    The U-bracket must be installed using at least four screws.

Tip The screws provided are self-drilling. For precise positioning, pilot holes of ∅1/8 inch (3 mm) may be predrilled. Reduce the hole size in metal that is less than 1/32 inch (1 mm) thick.

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

3. Drill any holes required for cables and fit the holes with suitable grommets or bushings.

4. Fasten the U-bracket to the mounting points using the self-drilling screws provided. Ensure that tightening the screws does not distort the U-bracket.

5. Mount the radio to the U-bracket using the four thumb screws provided. The radio can be tilted for the best viewing angle.

2.4   Installing the Microphone

Introduction

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

Connecting the Microphone

1. Plug the microphone into the microphone socket.

Important   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.

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 2.3   Inserting the microphone grommet
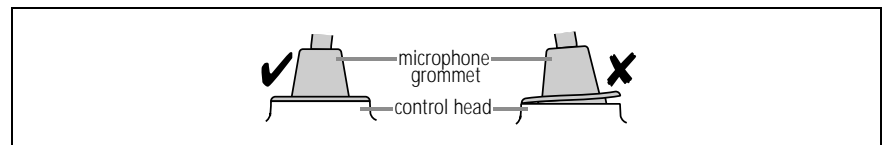
Installing the Microphone Clip

Warning!! **Safe radio mounting**

■ Mount the microphone where it will not interfere with the vehicle operator controls.

■ Mount the microphone where it will not interfere with the vehicle operator's view.

■ Mount the microphone where it will not interfere with air bag deployment.

Important   Only install the microphone clip provided. If a non-standard microphone clip is used, the correct operation of the microphone hookswitch 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.

2.5   Installing the Antenna

Introduction

This section provides the information required for the installation of an external antenna within the RF exposure limits. For further information refer to the antenna manufacturer's instructions.

***Warning!!* RF exposure hazard**

To comply with FCC RF exposure limits:

■ VHF radios must be installed using an antenna mounted centrally on the vehicle roof, with a gain of 2.15 dBi or 5.15 dBi.

■ UHF radios must be installed using an antenna mounted either centrally on the roof with a gain of 2.15 dBi or 5.65 dBi, or centrally mounted on the trunk with a gain of 5.65 dBi.

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

Installing the Antenna

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.

Connecting the Antenna Cable

Important   The cable must be routed in a manner that minimizes coupling into the electronic control systems of the vehicle.

Important   The cable must be routed in a manner that minimizes coupling of electric vehicle systems such as alternators into the radio.

Important   Protect the antenna cable from engine heat, sharp edges and from being pinched or crushed.

1.   Run the free end of the coaxial cable to the radio's mounting position and cut it to length, allowing approximately 8 inches (20 cm) excess at the radio end.

2.   Terminate the free end of the cable with the mini-UHF plug supplied.
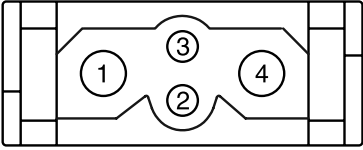
2.6   Connecting the Power Cable

Introduction   This section provides the information required for the connection of power cable to the power source.

Power Connector   The power connector is the interface to the vehicle battery and an optional external remote speaker. Connection of a remote speaker is discussed in the next section.

Table 2.1   Power connector (radio) - pins and signals

Pinout	Pin	Signal name	Description	Signal type
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

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

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

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 16.0 V, such as many trucks, it is essential to provide a suitably rated 24V-to-12V converter. 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.

Standby Current   When connecting the radio to the battery without using the ignition signal as described , the standby current is approximately 28 mA.

When using the ignition signal to turn off the radio, the standby current is reduced to <1 mA.

Tip   To reduce the standby current from 20 mA to approximately 1 mA without using the ignition signal, connect pin 4 of the auxiliary connector to ground.

Connecting the Power Cable

Important   Although it is possible to connect the radio in line with the vehicle ignition, this installation method is not recommended, as it may draw too much current resulting in damage to 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.

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

Important   If the battery is not disconnected, exercise extreme caution throughout the installation and install the fuses only when the installation is ready to be checked (refer to "Checking the Installation" on page 24).

1.   Disconnect the vehicle's battery unless specifically prohibited from doing so by the customer, vehicle manufacturer, agent, or supplier due to the type of electrical equipment fitted to the vehicle.

Important   The cable must be routed in a manner that minimizes coupling of electric vehicle systems such as alternators into the radio.

Important   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 (20 cm) excess at the radio end.

3.   Plug the power cable into the power connector of the radio.

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).

Important   Do not install the fuses until the installation is ready to be checked.

5.   Insert each end of the negative wire into one of the in-line fuse holders and crimp them to force the metal contacts onto the wires.

6.   Connect the negative wire to the battery ground.

7.   Repeat step 4 for the positive wire and connect it to the positive terminal of the power source.

2.7 Connecting a Remote Speaker

If a high-power remote speaker is required, the Tait TMAA10-03 speaker is recommended. Connect the speaker to pins 2 (SPK−) and 3 (SPK+) of the power connector described . For more information refer to the fitting instructions provided with the speaker, or to the accessories manual.

2.8 Connecting to the Auxiliary Connector

Introduction

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 down the radio

■ an emergency switch to power up the radio (if required) and the enter emergency mode
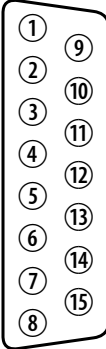
■ external alert devices

Auxiliary Connector

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

Note The space for a mating plug is limited to 1 5/8 inches (41 mm) in width and 11/16 inches (18 mm) in height. It is recommended to test the plug to be used before manufacturing a cable. Tait uses IPN 240-00020-55 for the plug.

Table 2.2   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, 3V3 CMOS.
	5	AUX_GPI2		
	4	AUX_GPI3		
	10	AUX_GPIO4	Programmable function and direction. Pads available to fit a higher power driver transistor on GPIO4 line.	Digital, 3V3 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, 3V3 CMOS
	3	AUX_RXD	Asynchronous serial port - Receive data	Digital, 3V3 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

Shielding

If the auxiliary cable is longer than 4 feet (1 m) it is recommended to shield the cable and connector backshell. Figure 2.4 shows the recommended shielding arrangement. The earth braid wire (bare copper) and aluminium foil should only be earthed at the radio end of the cable.

Figure 2.4   Auxiliary cable and connector shielding
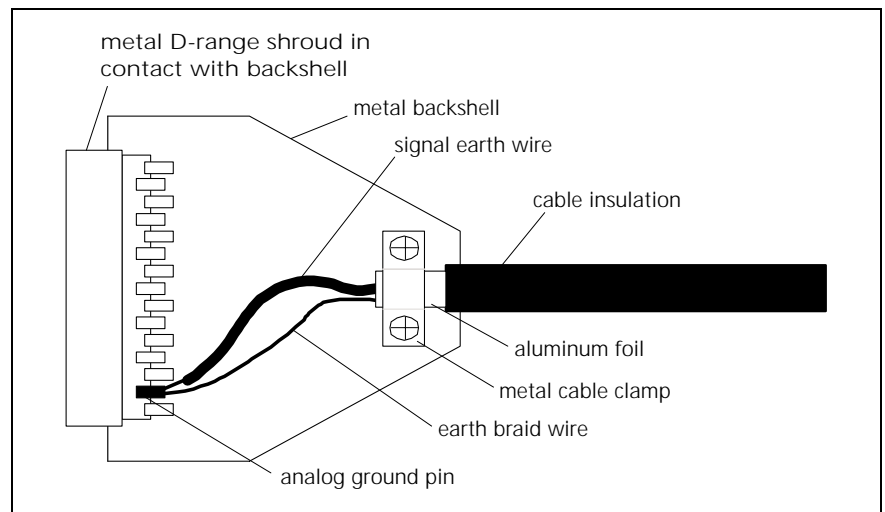
Ignition Signal

The radio can use the ignition signal to be powered up and down. 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.

Note   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 application software.

Connect the ignition signal to pin 4 (AUX_GPI3) of the auxiliary connector.

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 in order to enter the emergency mode.

Note   The selected input line must be programmed to 'Enter Emergency Mode' and active to 'Low'. To use 'emergency power sense', hardware link LK3 must be fitted (factory default), and AUX_GPI2 must be used. For more information, refer to the service manual and the online help of the application software.

Connect a normally closed 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 (Q707) in order to directly connect external alert devices (e.g. flashing light, buzzer, horn relay) to the radio. Also, resistor R768 must be removed.

Important   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.

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

2.9   Checking the Installation

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.   Place the radio in transmit mode and measure the forward and reflected power levels.

5.   Less than 4% of the forward power should be reflected. If this is not achieved, check the installation, including the antenna length.

6.   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, make a call to another party on the radio.