



CODAN



CODAN

www.codan.com.au

Head Office

Codan Limited
ABN 77 007 590 605
81 Graves Street
Newton SA 5074
AUSTRALIA
Telephone +61 8 8305 0311
Facsimile +61 8 8305 0411

asiasales@codan.com.au

Codan (UK) Ltd
Gostrey House
Union Road
Farnham Surrey GU9 7PT
UNITED KINGDOM
Telephone +44 1252 717 272
Facsimile +44 1252 717 337

uksales@codan.com.au

Codan US, Inc.
10660 Wakeman Ct
Manassas VA 20110
USA
Telephone +1 703 361 2721
Facsimile +1 703 361 3812

ussales@codan.com.au

Codan Limited
ABN 77 007 590 605
105 Factory Road
Oxley Qld 4075
AUSTRALIA
Telephone +61 7 3716 6333
Facsimile +61 7 3716 6350

Installation and
operation handbook

**Automatic Antenna Tuner
Type 9103**



CERTIFIED QUALITY
MANAGEMENT SYSTEM
ISO 9001

CONTENTS

- 1. INTRODUCTION 1
 - 1.1 General 1
 - 1.2 Specification 1
 - 1.3 Antenna Selection 2
 - 1.4 Accessories 2

- 2. INSTALLATION PROCEDURE 3
 - 2.1 General 3
 - 2.2 Weatherdeck Mounting 3
 - 2.3 Ground System 3
 - 2.3.1 Marine Earthing 4
 - 2.3.2 Base Station Earthing 4
 - 2.3.3 Corrosion 5
 - 2.4 Antenna Tuner Mounting 6
 - 2.5 Antenna Connection 6
 - 2.6 Antenna Installation 6
 - 2.7 Antenna Location 7
 - 2.8 Electrical Check 8
 - 2.9 Control Lead Connector 9

- 3. OPERATION 10
 - 3.1 General 10
 - 3.1 Scanning 10

1. INTRODUCTION

1.1 General

The Codan Type 9103 Automatic antenna tuner is designed primarily for use with end-fed, unbalanced, antennas such as long wire and whips matching the 50 ohm transceiver output to the impedance presented by the antenna. The radiating portion of the antenna connects directly to the tuner through a high voltage insulator. It is extremely important that the antenna type, site location and grounding technique be correctly chosen so that the system will radiate effectively.

1.2 Specification

Frequency range:	2.0 to 30.MHz
Power rating:	150 watts PEP (Speech only)
Input impedance range:	45 to 55 ohms
VSWR:	Typically less than 2:1
Power requirements:	12V DC (nominal) at 0.9 Amps (average)
DC operating range:	10 - 15V DC
Random set time:	Typically less than 2 seconds
Recurrent set time:	Typically less than 10 milliseconds
Antenna length:	Long Wire, 3 - 15m Marine Whip, 8.8m (recommended)
Size:	284mmW x 350mmH x 70mmD
Weight:	3.5 Kg

3. OPERATION

3.1 General

Once all channels have been tuned and memorised, the 9103 has no further controls that require setting during operation. Any slight variation in VSWR will be compensated for automatically by the tuner. Full instructions for the operation of a transceiver with the unit connected are given in the appropriate transceiver manual.

3.1 Scanning

Scanning is possible with the 9103 Automatic antenna tuner in conjunction with a transceiver (Codan Type 8525 and 8528 series) in the scan receiver mode. On early models of tuners where the control cable consists of a two core power lead, scanning can only be initiated by turning the transceiver off, then turning it back on and immediately pressing the scan keypad. On later models a separate scan lead is included in the control cable, overcoming the necessity for turning the transceiver off, momentarily.

9103 installation and set-up may be considered complete.

Note that, as despatched from the factory, the memory system in the 9103 will not contain any pre-stored data appropriate to your installation. To allow the 9103 to "learn" the antenna's tuning characteristic simply proceed from frequency to frequency, allowing the normal tune sequence to take place.

As more and more frequencies are "memorised" by the unit, it should be possible to return to a previously used frequency and note that the tuner immediately flashes the "ALL TUNED" flag.

It should be noted that the memory system is capable of storing hundreds of individual frequency/relay combinations and that most of these combinations are actually used for the lower operating frequencies. This provides better memory resolution at the lower frequencies where antenna systems are inherently narrowband.

It is possible for circumstances to arise where a particular channel frequency may not tune. Should this occur the parameters which effect tuning ie. length of antenna (in the case of the long wire), length of antenna feed wire, and the conductivity of grounding system should be checked and varied slightly in an attempt to achieve better tuning.

2.9 Control Lead Connector

For some installations it may be necessary to disconnect the D-connector from the control lead to allow the lead to pass through small apertures. To assist re-connection the following shows the connector pin wiring and function.

Pin	Colour	Function
12	Red	+ 12V
15	Green	0V
5	Yellow	Scan (Reset)
3	Blue	RMT IND

1.3 Antenna Selection

The automatic antenna tuner will operate into almost any end fed antenna with a length of 3 metres or more, provided an effective ground system is used. The antenna efficiency will be proportional to length and in most applications will be maximum at 1/4 wavelength. Therefore, the longest possible antenna should be selected for each installation. The performance of short whip antennas is usually poor, particularly at the lower channel frequencies, and radiation efficiency will be only a few percent.

Whip antenna - 3.65 metres

This antenna is the minimum length recommended for marine installations on small vessels. It may also be used in base stations if it is impracticable to use a longer antenna.

Whip antenna - 8.8 metres

This is the preferred antenna for marine installations except when there is sufficient space for a long wire antenna. It will also provide reasonable efficiency for base station use and is the smallest recommended base antenna.

Long wire antenna - 3 metres minimum : 15 metres maximum

For most applications the long wire antenna will give the best results and is recommended where practicable.

1.4 Accessories

The unit is normally supplied with 10 metres of coaxial cable terminated on a UHF connector, and 10 metres of control cable terminated into 15 way D-type plug to connect directly to the transceiver.

2. INSTALLATION PROCEDURE

2.1 General

The 9103 requires a power source of 12V DC (available from the transceiver via the control cable), an RF transmission line and a suitable ground system. No bandswitch information or handshake is required since the coupler tunes on RF power only. Power consumption is normally less than 1 amp, allowing for a light 2 conductor cable. The power terminal is clearly marked inside the unit, and the PCB is protected against power reversal.

2.2 Weatherdeck Mounting

Weatherdeck mounting can be used with a fibreglass enclosure. Experience has shown that internal mounting or even just splashproof mounting is preferable, particularly in cold, damp environments.

The base of the antenna should be connected to the high voltage feed-through insulator. Note that this insulator is not designed to support heavy mechanical loads. If such a loading is encountered, the use of a strain insulator is recommended.

2.3 Ground System

The ground system is a key part of the overall antenna system and is the primary cause of poor performance and difficulty in adjusting the tuner.

The ground system should be connected to the 4mm stainless steel stud protruding from the bottom right side of the housing.

Connection to the ground system is of extreme importance for a successful installation.

Ground runs of more than 0.5 metre should be made from 100mm wide copper strap, or larger.

- (i) The connection from the tuner to the ground must be a small percentage of the total length of the antenna. Do not let the length of the ground strap exceed 1 ~ 1.5 metres. Use heavy wire or braid for the ground connection.
- (j) Whip antennas should be connected with the minimum length of wire.
- (k) Do not locate the tuner further from the transceiver than necessary. If the distance exceeds 20 metres, it is recommended that low loss coaxial cable such as RG213 is used.

2.8 Electrical Check

After mechanical installation is complete, the highest operating frequency in the transceiver should be selected, a directional Watt meter such as the Bird model 43 inserted into the transmission line and the "TUNE" control selected to energise the transceiver.

The tuner should begin to tune indicated by a general chattering of the PC mounted relays. If the antenna length and ground parameters are within satisfactory operating range, the tuner relay noise will cease and the reflected power on the Watt meter will drop to a value consistent with an RF output better than 2:1 VSWR. The internal 'TUNED' LED will light but this can only be viewed with the 9103 cover removed.

The transceiver should now be adjusted to the lowest operating frequency and the TUNE test repeated. Again, the 9103 will sense the mismatch, switch into the tune mode and retune the antenna system.

The tune cycle will take somewhat longer at the lower frequencies since the controlling algorithm must search through more possible values of L and C to find an appropriate combination.

A few seconds of TUNE should result in an "ALL TUNED" indication. If the antenna parameters are within the operating range, and the above tests have been performed successfully, the

2.7 Antenna Location

- (a) The antenna should be located in a position free of obstructions, particularly in the desired direction of communication.
- (b) The antenna should be kept as far away as possible from buildings, trees and vegetation. If metallic masts or supports are used, arrange the insulators so that the antenna is spaced at least 2 metres from the mast.
- (c) Remember that the radiating part of the antenna starts at the tuner. The location of the bottom portion of the antenna is very important.
- (d) Vertical antennas have an omni-directional radiation pattern and generally provide a similar radiation pattern in all directions.
- (e) Horizontal wire antennas have maximum radiation broadside to the antenna direction when the frequency is less than 1/4 wavelength. As the frequency increases beyond 1/4 wavelength, lobes will appear in the radiation pattern with the principal lobes coming closer to the plane of the antenna as the length increases. At all times, radiation will be a minimum at the end of the antenna and it should be located so that the ends point in the direction where communications are least required.
- (f) As high voltages are present on the antenna (sometimes exceeding 5000 V) the tuner must be located, or protected, so that there is no possibility of accidental contact.
- (g) Do not locate the antenna close to any other antenna system.
- (h) Make sure that the antenna is rigidly supported. The antenna will detune if it sags or sways.

2.3.1 Marine Earthing

A metal hulled vessel in salt water provides an almost ideal ground. The tuner should be connected directly to the hull using the shortest possible ground strap. Make sure that the contact point is free from paint and dirt. Ensure a good contact area for minimum resistance.

Wooden or fibre glass hulled vessels present more of a grounding problem. It is normally necessary to bond all large metallic parts such as the engine propeller shaft, etc., and sometimes an external grounding plate should be bolted to the hull.

Proprietary marine radio grounding plates are available for this purpose and should be connected with one or more bonding straps run from the tuner to the grounding plate. Copper tubes (20mm diameter) may be used as strapping.

The grounding straps or tubes should be secured under the mounting bolts of the grounding plate or copper sheet. The plate must have an area of at least 0.25 square metres. The bonding and grounding plate should take into consideration the problems of electrolysis. Severe damage may result if dissimilar metals are connected together.

2.3.2 Base Station Earthing

In areas of good ground conductivity, an effective ground can be established with an earthing spike. The spike should be approximately 3 metres in length and should be installed as close as possible to the tuner. It may be necessary to use several earthing spikes bonded together to improve the ground contact. Copper (or steel) water pipes are sometimes recommended as suitable earths and may be used provided the following conditions are met:

- (a) Water pipe is close to the tuner.
- (b) The water pipe enters the ground very close to the tuner bonding point.
- (c) There are no joints or couplings in the pipe that may increase the resistance path to earth.
- (d) The water pipe enters soil with good conductivity.
- (e) A low resistance contact is made to the water pipe.

Frequently the ground conductivity will be insufficient to provide satisfactory operation of the tuner. This is almost certainly the case with well drained sandy, rocky or loamy soils where a counterpoise should be used as a ground system.

A counterpoise is also very important for rooftop installations where there is no existing ground plate. The ground should be a conducting surface extending several wavelengths in all directions around the antenna. On a rooftop, this situation may be approximated by placing a screen of wire mesh or similar material over the roof of the building.

More often, a counterpoise system of radially placed wires is used. The use of at least 8 - 10 radials bonded together is recommended. If the antenna is at ground level, the radials should be buried a few inches below the surface.

2.3.3 Corrosion

The ground connections are subject to corrosion and oxidation. All joints must be clean and the hardware adequately tightened. The joints may be protected by an application of silicon grease, and under severe conditions, covered with electrical tape and waterproof varnish.

2.4 Antenna Tuner Mounting

The 9103 tuner includes mounting brackets which should be used for all installations. Choose a location immediately adjacent to the antenna feed point. Note also that the antenna lead must pass through an insulated bushing. High voltage cable must be used to connect the antenna to the tuner.

2.5 Antenna Connection

The high voltage antenna lead wire should be connected to the high voltage terminal on the tuner. During installation it is advised that two wrenches are used when tightening the nut on the terminal to prevent the stud rotating.

As potentials of several thousand volts may be present at the antenna terminal ensure adequate protection is made against accidental contact. It is also necessary to ensure that the antenna is placed at least 30mm from a conducting surface. Kinks in the lead-in wire should be avoided.

2.6 Antenna Installation

The antenna system is a key part of the communication system: for satisfactory operation the system must be installed correctly. Unbalanced antennas used with the automatic antenna tuner use the ground as half of the antenna system. The ground forms an "Image" antenna and is a critical part of the system. It is essential to consider both the ground and the antenna when designing the system installation.