CODAN

Automatic antenna tuner Type 4203

Technical service manual

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1 GENERAL INFORMATION

1.1 INTRODUCTION

The Codan type 4203 Automatic Antenna Tuner is for use with a variety of single or dual antenna installations and is particularly suitable for operation with Codan HF4000 and 8525/8 series transceivers.

The unit is designed to select the appropriate antenna and match it to the 50Ω output of the transmitter at any of the frequencies covered by the transceiver. Once initiated by controls on the transceiver the tuning sequence is fully automatic until the unit indicates to the transceiver that a satisfactory match has been obtained. If a satisfactory match cannot be obtained this is indicated to the transceiver while transmission is still permitted.

1.2 SPECIFICATIONS

Frequency Range:	2 to 23MHz.
Channel Capacity:	Unlimited.
Power Rating:	400W PEP, 200W CW.
Power Requirements:	12V (nominal) DC at 1.2A max (supplied from transceiver).
Antenna:	
Single Antenna Installation:	2 to 23MHz: 8.5 metres (min) to 13 metres (max) wire, or 8.5 metre whip.
Dual Antenna Installation:	Antenna 1: 2 to 5MHz: 5.5 or 6.7 metre whip loaded to 4.6 MHz Antenna 2: 5 to 23MHz: 5.5 or 6.7 metre whip unloaded.
Grounding Requirements:	
With transmitters up to 125W (e.g. 8525S):	At least 0.25 square metres of grounding plate, in contact with the water, connected to the unit via 50mm wide copper strip or 20mm diameter copper tube.
With transmitters up to 400W (e.g. HF4000):	At least 2 square metres of grounding plate, in contact with the water, connected to the unit via 100mm wide copper strip or 25mm diameter copper tube.
RF Input/Output Impedances:	50Ω (nominal).
Environmental:	Temperature: -10°C to +55°C (60°C with no damage) Relative humidity: up to 95%.
Dimensions:	320mm(W) x 210mm(D) x 270mm(H) over terminals.
Weight:	5.5kg.
Case:	Ruggedised PVC, splashproof.
Finish:	Black enamel.

1.3 ACCESSORIES

The unit is supplied with 10 metres of coaxial cable and 10 metres of multi-core control cable. The control cable is normally terminated with a 15-way plug. The cable/termination assembly depends upon the transceiver with which the unit is to be used, as follows:

HF4000:	Assembly No. 08-03016-010 (applies to 8528S-H also)
8525/8:	Assembly No. 08-03236-010

1.4 ABBREVIATIONS

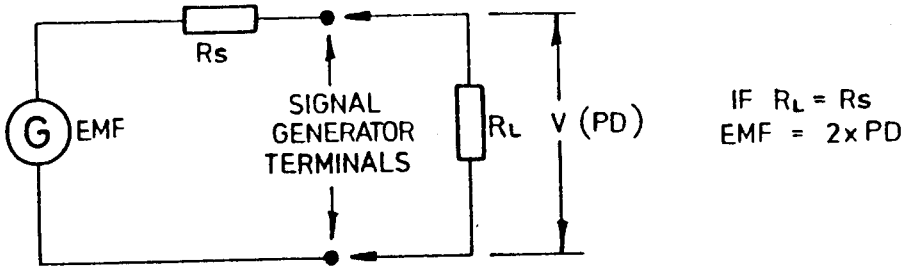
A/D	Analog to Digital
A/F	Across flats (hexagon)
AC	Alternating Current
ACIA	Asynchronous Communications Interface Adapter
ADJ	Adjust
AF	Audio Frequency
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
ALC	Automatic Level Control
ALF	Absorption Limited Frequency
AM	Amplitude Modulation
ASCII	American Standard Code for Information Interchange
ASSY	Assembly
ATU	Antenna Tuning Unit
AUX	Auxiliary
AV	Average
BAL	Balance
BALUN	Balanced to Unbalanced Transformer
BCD	Binary Coded Decimal
BPF	Band Pass Filter
BW	Bandwidth
C/O	Change-over
CAL	Calibrate
CCT	Circuit
CCW	Counterclockwise, Anticlockwise
CH	Channel
CMOS	Complementary Metal Oxide Semiconductor
COAX	Coaxial
COM	Common
CPU	Central Processor Unit
CRO	Cathode Ray Oscilloscope
CRT	Cathode Ray Tube
CSK	Countersink
CW	Continuous Wave, Carrier Wave, Clockwise
D/A	Digital to Analog
DC	Direct Current
DEMUX	Demultiplexer
DMA	Direct Memory Access
DPDT	Double-Pole, Double-Throw
DPST	Double-Pole, Single-Throw
DRG	Drawing
DSB	Double Sideband
DTL	Diode Transistor Logic
DVM	Digital Voltmeter
dB	Decibel
dBm	Decibel relative to 1 mW
EAPROM	Electrically Alterable Programmable Read Only Memory
ECL	Emitter Coupled Logic
EDP	Electronic Data Processing
EEPROM	Electrically Erasable Programmable Read Only Memory
EMF	Electro-motive Force
EMI	Electromagnetic Interference
EPROM	Erasable Programmable Read Only Memory
EXT	External
F/V	Frequency to Voltage
FAX	Facsimile
FET	Field Effect Transistor

FM	Frequency Modulation
FREQ	Frequency
FSK	Frequency Shift Keying
FTTL	Fast Transistor Transistor Logic
GND	Ground
GPIB	General Purpose Interface Bus
HCMOS	High Speed Complementary Metal Oxide Semiconductor
HEX	Hexadecimal, Hexagon
HF	High Frequency
HMOS	High Speed Metal Oxide Semiconductor
HORIZ	Horizontal
HPF	High Pass Filter
I/COM	Intercom
I/F	Interface
I/O	Input Output
I/P	Input
IF	Intermediate Frequency
IMD	Intermodulaton Distortion
INT	Internal
ISB	Independent Sideband
JFET	Junction Field Effect Transistor
J3E	Single Sideband, Suppressed Carrier, Telephony Emission
LC	Inductance - Capacitance
LDR	Light Dependent Resistor
LED	Light Emitting Diode
LF	Low Frequency
LIN	Linear Law
LO	Local Oscillator
LOG	Logarithmic Law
LPF	Low Pass Filter
LS	Loudspeaker, Low Power Schottky
LSB	Lower Sideband, Least Significant Bit
LSI	Large Scale Integration
LSTTL	Low Power Schottky Transistor Transistor Logic
LTU	Line Terminating Unit
MAX	Maximum
MF	Medium Frequency
MIN	Minimum
MODEM	Modulator-Demodulator
MOL	Maximum Operating Level
MOS	Metal Oxide Semiconductor
MPU	Microprocessor
MSB	Most Significant Bit
MSI	Medium Scale Integration
MUF	Maximum Usable Frequency
MUX	Multiplex
N/C	Normally Closed
N/O	Normally Open
NC	Not Connected
NMOS	N Type Metal Oxide Semiconductor
NOL	Normal Operating Level
NOM	Nominal
NORM	Normal
NPO	Zero Temperature Coefficient
NTC	Negative Temperature Coefficient
O/C	Open Circuit
O/P	Output
OPR	Operator

OPT	Option
OSC	Oscillator
OWF	Optimum Working Frequency
PA	Power Amplifier
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PD	Potential Difference
PEP	Peak Envelope Power
PH	Phase
PIA	Peripheral Interface Adapter
PIV	Peak Inverse Voltage
PKG	Package
PLL	Phase Locked Loop
PMOS	P Type Metal Oxide Semiconductor
POL	Peak Operating Level
POT	Potentiometer
PP	Peak to Peak
PPM	Parts per Million
PROM	Programmable Read Only Memory
PSU	Power Supply Unit
PTC	Positive Temperature Coefficient (Resistor)
PTT	Push-to-talk
PUT	Programmable Unijunction Transistor
PWM	Pulse Width Modulation
RAM	Random Access Memory
R/C	Remote Control
RC	Resistance-Capacitance
RCU	Remote Control Unit
REF	Reference
REG	Regulated, Register
RF	Radio Frequency
RFI	Radio Frequency Interference
RMS	Root Mean Square
ROL	Reference Operating Level
ROM	Read Only Memory
RTL	Resistor Transistor Logic
RTTY	Radio Teletype
RX	Receive or Receiver
S/C	Short Circuit
S/N	Signal to Noise Ratio
(S+N)/N	Signal plus Noise to Noise Ratio
SCF	Suppressed Carrier Frequency
SCR	Silicon Controlled Rectifier
SINAD	Signal+Noise+Distortion to Noise+Distortion Ratio
SMPS	Switching Mode Power Supply
SOT	Select-on-test
SPDT	Single-Pole, Double-Throw
SPST	Single-Pole, Single-Throw
SSB	Single Sideband
STTL	Schottky Transistor Transistor Logic
SWR	Standing Wave Ratio
SYNC	Synchronisation
SYNTH	Synthesizer
T/R	Transmit - Receive
TC	Temperature Coefficient
TCVR	Transceiver
TCW	Tinned Copper Wire
TCXO	Temperature Compensated Crystal Oscillator
TDM	Time Division Multiplex

THD	Total Harmonic Distortion
TRIG	Trigger
TS	Tag Strip
TSM	Technical Service Manual
TTL	Transistor Transistor Logic
TYP	Typical
TX	Transmit or Transmitter
UART	Universal Asynchronous Receiver Transmitter
UJT	Unijunction Transistor
USART	Universal Synchronous/Asynchronous Receiver Transmitter
USB	Upper Sideband
UT	Universal Time
UTC	Universal Coordinated Time
V/F	Voltage to Frequency
VA	Voltampere
VCO	Voltage Controlled Oscillator
VDR	Voltage Dependent Resistor
VERT	Vertical
VFO	Variable Frequency Oscillator
VOX	Voice Operated Switch
VSWR	Voltage Standing Wave Ratio
VU	Volume Unit
WRT	With respect to
WT	Weight
XTN	Extension
XTND	Extend
λ	Wavelength
+ve	Positive
-ve	Negative
Ø	Phase, Diameter in mm

EMF is the source voltage behind the output resistance (Rs) and is independent of the signal generator loading. Many signal generators are calibrated in PD (across the load) assuming a load resistance equal to the generator source resistance; for these the EMF is twice the attenuator scale reading.



1.5 CIRCUIT REFERENCE DESIGNATIONS

A	Assembly
B	Transducer, Microphone, Loudspeaker etc.
C	Capacitor
D	Diode small signal and power
E	Heating Device
F	Protection Device, Fuse etc.
G	Generator, Battery etc.
H	Signalling & Indicating Device Lamp, LED, Buzzer etc.
IC	Integrated Circuit, Thick Film Hybrid
J	Jack, Socket
K	Relay, Key Switch
L	Inductor
M	Indicating Device, Meter etc.
P	Plug
R	Resistor
S	Switch
T	Transformer & common mode choke
TP	Test Point
U	Modem, Modulator
V	Semiconductor not including small signal & power diodes
X	Terminals
Z	Quartz Crystal, Crystal Filter, Frequency Network

1.6 UNITS

A	Ampere	min	Minute
C	Celsius (degrees), Coulomb	N	Newton
F	Farad	Pa	Pascal
g	Gram	S	Siemen
h	Hour	s	Second
H	Henry	T	Tesla
Hz	Hertz	V	Volt
J	Joule	W	Watt
K	Kelvin (degrees)	Wb	Weber
l	Litre	Ω	Ohms
m	Metre		

1.7 UNIT MULTIPLIERS

T	tera	one million million	10^{+12}
G	giga	one thousand million	10^{+9}
M	mega	one million	10^{+6}
k	kilo	one thousand	10^{+3}
h	hecto	one hundred	10^{+2}
da	deca	ten	10
d	deci	one tenth	10^{-1}
c	centi	one hundredth	10^{-2}
m	milli	one thousandth	10^{-3}
u	micro	one millionth	10^{-6}
n	nano	one thousand millionth	10^{-9}
p	pico	one million millionth	10^{-12}

2 PRINCIPLE OF OPERATION

2.1 TUNE SEQUENCE

The type 4203 provides for the independent tuning and matching of the selected antenna to the 50 ohm transceiver output. Antenna selection, reactive tuning, and resistive matching is fully automatic. Each time a tune sequence is initiated, the microprocessor-based control board drives relays on the RF board until a minimum VSWR is achieved, typically better than 1.3:1.

The following sequence of events occurs each time the operator wishes to tune the antenna:

1. The operator selects a channel and momentarily presses the **Antenna** (HF4000) or **Tune** (8525/8 series) button.

2. Carrier is fed to the tuner, the control board is activated and the microprocessor clock starts.

3. The 'Tune Switch' line is held low (to hold carrier on after the operator releases the button), and the **Tune** LED is illuminated (HF4000) or one-second pips will be heard (8525/8 series).

4. The microprocessor measures the carrier frequency (via a divide by 256 prescaler on the RF board), and selects the appropriate antenna according to the antenna option link (ref. para. 4.4).

5. The microprocessor then tunes the antenna according to phase and VSWR information.

6. When the VSWR is optimised the control board de-activates, turning off carrier and the **Tune** lamp (HF4000). Two high-frequency tones are heard (8525/8 series).

7. If a VSWR better than 2:1 cannot be found, the other antenna (if there is one) is selected, and the tune sequence continues until VSWR is optimised on this antenna.

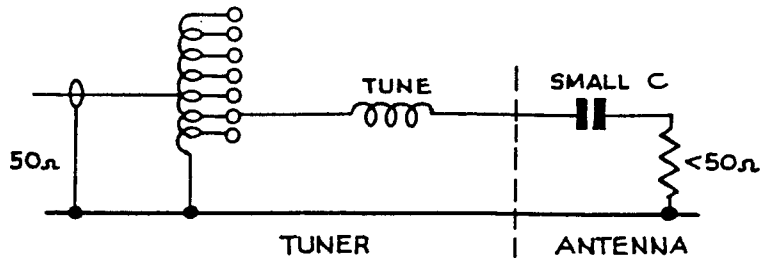
8. If a VSWR better than 2:1 still cannot be found, the best tuning point is selected, carrier turned off, and the **Tune** lamp flashes for 5 seconds (HF4000) or the error message **ut** is displayed and two short, low-frequency tones are heard (8525/8 series). This alerts the operator to a possible failure in the antenna system, such as a broken or corroded feeder, or an antenna out of specification for the frequency chosen.

In addition, a 'VSWR >3' detector on the RF board will cause the **Tune** lamp to flash during voice transmissions (HF4000) or low-frequency tones to be heard (8525/8 series) if VSWR deteriorates beyond this limit, or if the operator commences a transmission without tuning.

2.2 EQUIVALENT CIRCUITS

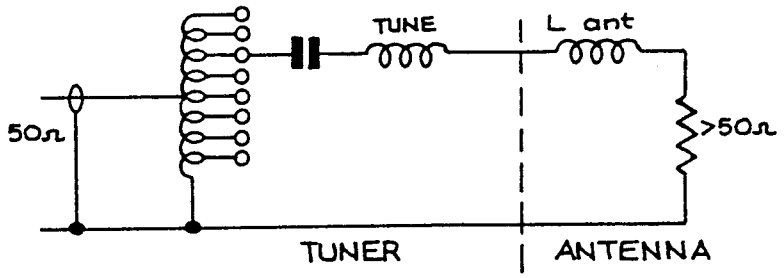
The equivalent circuits of the RF section of the tuner and the antenna for different electrical lengths are given below. The figures in brackets refer to approximate frequencies for a typical single-antenna installation.

(a) Antennas shorter than λ/4 (up to 7MHz for typical 9m whip).



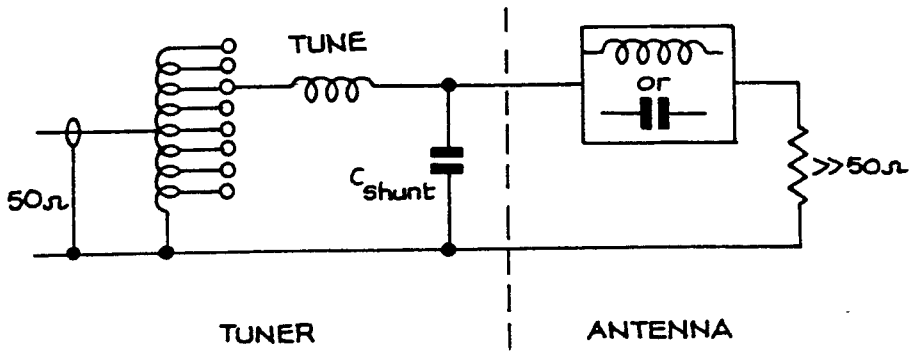
The series inductor in the tuner resonates with the series capacity of the antenna, and the RF auto-transformer matches the antenna resistance to 50 ohms.

(b) Antennas between λ/4 and 3λ/8 (7MHz to 10MHz for typical 9m whip).



A fixed series capacitor in the tuner together with some small additional series inductance resonates with the series L of the antenna, and the RF auto-transformer matches the antenna resistance to 50 ohms.

(c) Antennas between 3λ/8 and 7λ/8 (10MHz to 23MHz for typical 9m whip).



These antennas appear as a high resistance (which may be too high to be matched by the auto-transformer) in series with an inductance for lengths below λ/2 or above 3λ/4, and a capacitance for lengths between λ/2 and 3λ/4.

The shunt capacitance is made up of:

(i) stray capacitance (approximately 60 pF)
(ii) relay-switched shunt C.

Because of the stray capacitance, it is not always necessary to add extra shunt C for correct tuning in this region.

2.3 IMPEDANCE PARAMETERS

The auto-transformers can match a range of loads from 5.6 ohms to 270 ohms, in twelve increments.

Series and shunt capacitors are selectable at 33 pF, 68 pF, or 101 pF.

Series inductance is selectable in 62 nH steps to 89 µH. Two large air coils provide coarse 11 µH steps to 66 µH, the remaining 23 µH being achievable by nine binary-weighted inductors.

3 TECHNICAL DESCRIPTION

3.1 RF CIRCUITRY (Refer to Dwg 04-02038)

As described in the Principle of Operation (Section 2) the tuner allows for independent resonating and matching of the antenna. The RF from the transmitter enters J1 and passes through the VSWR bridge formed by T1, T2 and associated components. DC voltages proportional to forward and reflected power are fed to P3, from where a ribbon cable goes to the control board.

After the VSWR bridge, the RF signal passes through the two auto-transformers T3 and T4. Relays select one of four taps on T3, then two further relays determine whether T4 acts as a 1:1, 1:4, or 4:1 impedance transformer. In total, twelve different resistances between 5.6 ohms and 270 ohms can be selected.

Next in the RF path is a small inductor, L7, and capacitor, C79, which are switched in during normal operation. In the 'tune' mode, RF is diverted through the phase detector's current transformer, T5.

The series components which follow, each with an associated relay, are the series capacitors and eight binary-weighted inductors.

Relays K22 and K23 enable selection of shunt capacitance, and K21 is the antenna change-over relay.

Resistors R14 to R16 are static discharge resistors.

Lastly, there are three air inductors mounted in a shielded compartment. L1 is the ninth binary-weighted inductor; L2 and L3 provide additional coarse inductance steps.

Tuners built for New Zealand include an antenna current monitoring facility. This requires the addition of two antenna current transformers. Their outputs are rectified on a small PCB adjacent to the control board. This enables relative measurements of antenna current to be made with a DC voltmeter.

Also on the RF board is the phase detector, frequency divider, and 'VSWR>3' detector.

The phase detector consists of a voltage feed from T2, the current transformer T5, and after rectification, comparator IC2a.

The 'VSWR>3' detector is comparator IC2b, fed from divided forward and reflected voltages. When VSWR exceeds 3:1, reflected voltage is more than half the forward voltage, forcing the comparator high. V2 turns on, lighting the **Tune** lamp (HF4000) or causing the untuned indications (8525/8 series). When no RF signal is present, a small bias voltage from R8/R9 ensures the comparator is held low.

Frequency measurement is performed by the microprocessor, but first the RF is squared up and divided by 256 on the RF board. This is done by IC1, which samples the RF via R3 and C6. The resultant square wave is fed to the control board via P2 and a coaxial cable.

All relay coils on the RF board are connected to the +12V common line, and are energised by the microcontroller on the Control Board grounding the other end of the coil. These DC lines come from the control board via P1. The high voltage relay, K17, has a 6 V coil, so is grounded via a 27Ω resistor on the Control Board. Capacitor C30 on the Control Board supplies this relay with 12V momentarily to ensure rapid closure.

3.2 CONTROL CIRCUITRY (Refer to Dwg 04-02039)

At the heart of the control circuit is the microprocessor, IC6, whose internal memory contains the control program. Peripheral devices include the reset monostable (IC5), the reset gates and flip-flop (IC1), the clock switch (IC4a, IC4c), and the relay drivers (IC7, IC8).

Three control lines, an indicator line and the 12V supply lines interface with the transceiver at the terminal block X1. Each line immediately passes through RF chokes (L1 to L5) and is bypassed to ground or chassis. The 12V supply is fused and goes to the 10V and 5V regulators.

Another input to the control board is the square-wave 'f divided by 256' from the RF board, which goes to the microprocessor via buffer IC4b. Also going to the microprocessor are the phase and VSWR lines from the RF board, entering at P6 and limited to 5V by zener diodes V2 to V4.

Operation of the control board is most clearly explained by following a normal power-up and tune sequence, which is summarised below:

1. At switch-on, the reset monostable (IC5) provides a reset pulse to the microprocessor.

2. At the conclusion of the reset pulse, the microprocessor begins program execution as if a 'Tune' command had been received because this also would generate a reset pulse. However, because RF is not immediately transmitted (as determined by low voltage on the 'Forward' input), the program will execute a 'Fail' routine, causing the **Tune** lamp on the HF4000 control unit to flash for 5 seconds. This reminds the operator that the antenna must be re-tuned every time the radio is turned on. No corresponding indication is given in the 8525 series transceiver.

3. At the end of the 5 second indication of the **Tune** lamp, pin 32 of the processor goes low, toggling the flip-flop and turning off the clock. The system is now in a 'rest' state, waiting for a 'Tune' command to generate another reset pulse. When this 'rest' state is initiated by a 'Fail' routine detecting no RF from the transmitter the microcontroller sets the relays on the RF Board to the 'default' state. This arranges the switched inductance and capacitance to the optimum configuration for reception.

4. When the operator presses the **Antenna** (HF4000) or **Tune** (8525/8 series) button, a short pulse via IC1b triggers both the flip-flop and the monostable, starting the clock and initiating the program. Provided the carrier rises within 800 mS, the program will continue to run and V1 will be turned on, holding the tune command line low.

5. A tune sequence is initiated. The processor writes to the driver IC's to turn on the **Tune** LED, measures the carrier frequency, and selects the appropriate antenna as determined by the position of the antenna option link.

6. The processor then executes its antenna tuning routines, based on information from the phase detector and VSWR detectors.

7. When an optimum VSWR is achieved, the **Tune** LED and carrier are turned off, as is the clock. The system is now tuned.

8. Should the tuner not be able to reduce VSWR below 2:1, it selects the other antenna (unless the single antenna option is selected), and attempts to tune this in the same way. If VSWR still cannot be reduced below 2:1, the carrier will stop but a 'Fail' condition will be indicated by flashing of the **Tune** LED for 5 seconds (HF4000) or the untuned indication is given (8525/8 series). The LED and clock will then turn off. (During the flashing sequence it is permissible to press the **Antenna** or **Tune** button again to try a second time.)

   This 'Fail' condition will usually indicate a broken or corroded antenna or feeder, or an antenna out of specification for the frequency selected.

   Selection of the Scan function on an 8525/8 series transceiver initiates a 'default' state the same as that caused by a fail routine detecting no RF from the transmitter. This sets the capacitors and inductors to the optimum state for reception.

4 INSTALLATION

4.1 GROUNDING REQUIREMENTS

4.1.1 General

Because the unit is used with high-power transceivers working over a wide frequency range adequate grounding is absolutely essential. A very low impedance path must be provided to the vessel's hull (if steel), keel, or grounding plate. For wooden or fibreglass vessels a copper sheet must be fixed to the hull in such a position that it will remain immersed under all sea conditions. Proprietary marine radio grounding plates are available for this purpose. One or more bonding straps should be run from the ATU to the grounding plate. Since the RF current flows only on the surface of the conductor a thin (0.5mm) strap, of adequate width, is sufficient. Alternatively copper tubes may be used. The grounding straps or tubes should be secured under the mounting bolts of the grounding plate or copper sheet.

4.1.2. HF4000/8528S-H Series

Because of the high power (up to 400W) of these transmitters it is recommended that as a MINIMUM 100mm wide copper strip or 25mm (or two 12.5mm) diameter copper tubes be run directly between the tuner's two grounding bolts and the hull or other grounding point. For wooden or fibreglass vessels the copper sheets should have an area of at least two square metres. If proprietary grounding plates are used at least two should be installed.

A ground strap to the power amplifier and the control unit may be required for stability in some installations.

4.1.3 8525/8

The following grounding requirements are recommended for the 8525/8 and other transmitters up to 125W.

The straps from the tuner's two grounding bolts should be at least 25mm (but preferably 50mm) wide and proportionately wider (or multiple straps) for longer runs. Alternatively 20mm diameter copper tube may be used. Copper sheet or grounding plates must have an area of at least 0.25 square metres.

THE IMPORTANCE OF A GOOD GROUND CANNOT BE OVERSTRESSED.

4.2 MECHANICAL

The 4203 tuner is housed in a splashproof PVC case. It should not be exposed directly to the weather, but mounted so as to allow the minimum possible length of antenna lead-in. If two antennas are to be used, as recommended, the unit should be mounted nearest the higher frequency one (antenna 2).

Additionally, the tuner must be oriented so that the installation technician can readily remove the lid for access to the cable terminal block and antenna option link plug. It should be remembered that, as very high voltages (up to 8kV) appear at the base of antenna 1 on the 2MHz and 4MHz bands, several centimetres clearance around the antenna 1 terminal must be allowed.

Firmly mount the tuner with four stainless steel bolts or screws through the mounting holes provided.

4.3 INTERWIRING

The two 10 metre length cables normally supplied run from the antenna tuner to the power amplifier (PA) (when used with HF4000) or transceiver (when used with 8525/8 series). One is the coaxial cable with UHF type connectors fitted to each end; the other is multi-core control cable terminated at one end with a 15-way plug to connect to the PA or transceiver and the other end free for connection to the tuner.

NOTE: The connector used to terminate the multi-core control cable in the 8525/8 series installation is different to that used in the HF4000. The cable/connector assemblies are:

(a) HF4000 Assembly No. 08-03016-010 (applies also to 8528S-H series)
(b) 8525/8 Assembly No. 08-03236-010

Control cable preparation and termination should be carried out as follows:

1. Run both cables from the PA or transceiver to the tuner.

2. Screw the coaxial connector firmly to the socket on the tuner.

3. Trim excess length from the control cable allowing sufficient for connection inside the tuner.

4. Remove the lid from the tuner (six captive screws). Note the 5-way orange coloured terminal block in line with the cable entry point.

5. Strip about 10cm of outer sheath from the control cable, and push the cable through the locking bush into the tuner until the outer sheath enters it and is held firmly.

6. Tighten the bush locking ring to lock and seal the control cable in place.

7. Remove insulation as appropriate and connect the wires to the terminals as shown in Table 1 or 2, below. Note that terminal number 5 is not used in HF4000 installations.

8. Insulate and tie back the remaining wires in the cable.

Table 1 HF4000 Connections/8528S-H series*

	Terminal number	Function	Wire	PA Connector Pin No.
DO	1	Supply -ve	Black & Blue 14/0.2	9,10
	2	Supply +ve	Red & Orange 14/0.2	3,4
	3	'Tune' lamp	Green 7/0.2	12
	4	'Tune' button	Blue 7/0.2	15
	*5	Scan	Slate	14

Table 2 8525S Connections

Terminal number	Function	Wire	Transceiver J201 Pin No.
1	Supply -ve	Black & Blue 14/0.2	14 & 15
2	Supply +ve	Red & Orange 14/0.2	12 & 13
3	Tune Indicator	Green 7/0.2	11
4	PTT/Tune	Blue 7/0.2	4
5	Scan	Slate 7.0.2	5

4.4 ANTENNAS

For maximum efficiency it is recommended that two whip antennas be installed as specified in para 1.2 of this manual.

A moveable antenna option link plug inside the tuner, adjacent to the fuse on the control board, must be correctly positioned during installation to ensure the tuner automatically selects the appropriate antenna for each operating frequency. The four option positions are shown in Table 3, below. The unit normally leaves the factory with option 2 selected.

CAUTION

THE LINK MUST BE SET FOR OPTION 4 BEFORE ANY ATTEMPT IS MADE TO TUNE OR TRANSMIT WITH ONLY ONE ANTENNA CONNECTED. FAILURE TO DO THIS MAY RESULT IN DAMAGE TO THE UNIT.

Table 3 Antenna Selection

Antenna option link position	Antenna 1 selected	Antenna 2 selected
1	2-3MHz	3-23MHz
2 (ex factory)	2-5MHz	5-23MHz
3	2-7MHz	7-23MHz
4	2-23MHz	

Antenna lead-ins should be kept as short as possible and be well clear of metal structures and other wiring. As very high voltages are generated during transmission below 4MHz at least 100mm clearance to other conducting surfaces is recommended. The lead-ins should also be positioned to minimise the chance of accidental contact by crew members otherwise painful burns may be incurred.

5 OPERATION

The unit has no controls that require setting during operation. Full instructions for the operating of a transceiver with the unit connected are given in the appropriate transceiver manual.

6 MAINTENANCE

6.1 FAULT DIAGNOSIS

6.1.1 General

Because antenna tuner operation is critically dependent on the antennas and grounding, it is essential to thoroughly check these before attributing tuning problems to the Type 4203.

Repeated failure of the tuner to find a satisfactory tuning point will almost invariably indicate a broken, corroded, or altered antenna or grounding system.

6.1.2 Tuner Completely Dead

If the radio is on but the tuner is dead, ensure the control cable is firmly plugged into the PA or transmitter. Check the control cable connections at the tuner. Test for 12V input and outputs from 5V and 10V regulators. Check the 2A fuse.

6.1.3 Tunes On Some Frequencies Only

If the tuner has previously operated on all frequenices but now gives a 'Fail' indication on some, check first for any variations to the antennas. If unchanged, there may be a relay failure in the RF section, preventing selection of a particular reactance. Note that the armature of a faulty relay may still operate without its contacts making or breaking properly.

6.1.4 Tuner Live But Fails To Tune

If a 'fail' indication occurs immediately the **Antenna** or **Tune** buttons are pressed there is probably no RF reaching the VSWR detectors. Ascertain if there is an RF output from the PA or transceiver. If there is, check for a faulty coaxial cable or connection. If the RF is reaching the tuner unit monitor pin 8 of the microcontroller IC6 where there should be square waves at the carrier frequency divided by 256 while the RF is applied.

If the tuner appears to be live but nothing happens on pressing the **Antenna** or **Tune** button, monitor terminal 4 of the orange terminal block on the Control Board. The voltage on this terminal should go to 0V when the button is operated.

6.2 DISMANTLING THE TUNER

To remove the Control Board, loosen the wiring to it and undo the six posi-drive screws holding it to the septum panel.

The septum panel may now be taken out by removal of seven posi-drive screws.

The RF section is now more accessible, but to remove it completely unsolder the two antenna connections and the RF input socket. Then remove the six screws on the tuner base, taking care that the RF and chassis sections do not fall out as the last screw is removed.

7 PARTS LISTS

7.1 GENERAL INFORMATION

The parts lists for each assembly contain the following information:

(a) Circuit Reference Number.
(b) Description giving the value and type of component.
(c) Manufacturer and Manufacturer's Part Number.
(d) CODAN Part Number.

NOTE: Items having numeric references identifying specific components or subassemblies may be encountered in the parts lists included in this handbook. These items, selected from master manufacturing information, identify parts which either are useful for maintenance purposes or relate to other items as cross referenced in the remarks column.

The following abbreviations are used for resistor and capacitor types.

Resistors	Capacitors
CC - carbon composition	AS - solid aluminium electrolytic
CF - carbon film	CC - ceramic multilayer chip
MF - metal film	CE - ceramic
MG - metal glaze	EL - wet aluminium electrolytic
MO - metal oxide	M - stacked mica
WW - wire wound	PC - polycarbonate
	PE - polyester
	PP - polypropylene
	PS - polystyrene
	PT - PTFE
	TA - solid tantalum

7.1.1 Ordering Information

When ordering replacement components, all the following information should be quoted to minimise the risk of obtaining the wrong part and to expedite despatch.

(a) Equipment type (i.e. Type 4203 Automatic Antenna Tuner)
(b) Component location (e.g. control PCB 08-02918)
(c) Component circuit reference number (e.g. R3)
(d) Full component description (e.g. Resistor 47 kΩ 5% 0,33 W CF)
(e) Manufacturer and Manufacturer's Part Number
(f) CODAN Part Number

7.1.2 Component Substitution

Due to continuous process of updating equipment and changes in component availability, minor variations in components may be noted from those listed. Equipment performance is in no way adversely affected by their substitution.

When replacing general purpose components (resistors, capacitors etc.), equivalent parts of other manufacture may be used provided that they have similar tolerances, voltage/power rating and temperature coefficients as those of the specified part.

7.2 PARTS LIST INDEX

RF PCB

Ref	Description				Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
C1	470p	10%	100V	CE Cap	Philips	2222 630 03471	46-24700-200	
C2	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C3	470n	20%	50V BX	2321 AgPd	Vitramon	VJ2321X474MFA	46-54700-280	
C4	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C5	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C6	2,2p	10%	4kV N150	CE Cap	Erie	Style 858	46-02200-090	
C7	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C8	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C9	1n	5%	250V	PS Cap	Philips	2222 426 21002	46-31000-320	
C10	1n	5%	250V	PS Cap	Philips	2222 426 21002	46-31000-320	
C11	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C12	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C13	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C14	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C15	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C16	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C17	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C18	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C19	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C20	33p	10%	4kV N750	CE Cap	Erie	Style 848	46-13300-092	
C21	68p	10%	3kV N750	CE Cap	Erie	Style 848	46-16800-091	
C22	2,2u	20%	35V	TA Cap	AVX	TAP225M035CCS	47-02203-510	
C23	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C24	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C25	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C26	2,2u	20%	35V	TA Cap	AVX	TAP225M035CCS	47-02203-510	
C27A	33p	10%	4kV N750	CE Cap	Erie	Style 848	46-13300-092	
C27B	33p	10%	4kV N750	CE Cap	Erie	Style 848	46-13300-092	
C28A	18p	10%	6kV NPO	CE Cap	Erie	Style 848	46-11800-090	
C28B	18p	10%	6kV NPO	CE Cap	Erie	Style 848	46-11800-090	
C29	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C30	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C31	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C32	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C33	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C34	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C35	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C36	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C37	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C38	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C39	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C40	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C41	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C42	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C43	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C44	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C45	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C46	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C47	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C48	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C49	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C50	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C51	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C52	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C53	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C54	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C55	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C56	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C58	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C59	47n		63V	CE Cap	Samwha	TL	46-44700-210	

RF PCB (cont'd)

Ref	Description				Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
C60	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C61	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C62	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C63	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C64	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C65	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C66	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C67	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C68	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C69	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C70	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C71	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C72	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C73	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C74	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C75	47n		63V	CE Cap	Samwha	TL	46-44700-210	
C76	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C77	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C78	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C79A	3,3n	5%	160V	PS Cap	Philips	2222 425 23302	46-33300-310	
C79B	3,3n	5%	160V	PS Cap	Philips	2222 425 23302	46-33300-310	
C79C	3,3n	5%	160V	PS Cap	Philips	2222 425 23302	46-33300-310	
C79D	3,3n	5%	160V	PS Cap	Philips	2222 425 23302	46-33300-310	
C79E	3,3n	5%	160V	PS Cap	Philips	2222 425 23302	46-33300-310	
C79F	3,3n	5%	160V	PS Cap	Philips	2222 425 23302	46-33300-310	
C80	1n	10%	100V	CE Cap	Philips	2222 630 03102	46-31000-200	

D1	Diode, Si fast low cap high cond	23-10001
D2	Diode, Si fast low cap high cond	23-10001
D3	Diode, Si fast low cap high cond	23-10001
D4	Diode, Si fast low cap high cond	23-10001
D5	Diode, Si fast low cap high cond	23-10001
D6	Diode, Si fast low cap high cond	23-10001
D7	Diode, Si fast low cap high cond	23-10001
D8	Diode, Si fast low cap high cond	23-10001
D9	Diode, Si fast low cap high cond	23-10001
D10	Diode, Si fast low cap high cond	23-10001
D11	Diode, Si fast low cap high cond	23-10001
D12	Diode, Si fast low cap high cond	23-10001
D13	Diode, Si fast low cap high cond	23-10001
D14	Diode, Si fast low cap high cond	23-10001
D15	Diode, Si fast low cap high cond	23-10001
D16	Diode, Si fast low cap high cond	23-10001
D17	Diode, Si fast low cap high cond	23-10001
D18	Diode, Si fast low cap high cond	23-10001
D19	Diode, Si fast low cap high cond	23-10001
D20	Diode, Si fast low cap high cond	23-10001
D21	Diode, Si fast low cap high cond	23-10001
D22	Diode, Si fast low cap high cond	23-10001
D23	Diode, Si fast low cap high cond	23-10001
D24	Diode, Si fast low cap high cond	23-10001
D25	Diode, Si fast low cap high cond	23-10001
D26	Diode, Si fast low cap high cond	23-10001
D27	Diode, Si fast low cap high cond	23-10001
D28	Diode, Si fast low cap high cond	23-10001
D29	Diode, Si fast low cap high cond	23-10001
D30	Diode, Si fast low cap high cond	23-10001
D31	Diode, Si fast low cap high cond	23-10001
D32	Diode, Si fast low cap high cond	23-10001

RF PCB (cont'd)

Ref	Description		Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
D33	Diode, Si fast low cap high cond				23-10001	
D34	Diode, Si fast low cap high cond				23-10001	
D35	Diode, Si fast low cap high cond				23-10001	
IC1	Counter, Dual Binary	IC	Texas Inst	SN74LS393N	YB-74393-000	
IC2	Amplifier, Operational Dual	IC	National	LM358N	XA-00358-100	
IC3	Regulator, Voltage +5V 0,1A	IC	National	LM340LAZ-5.0	XB-07805-501	
K1	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K2	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K3	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K4	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K5	Relay, 1C 12V 10A	280 Ohm	Eichoff-Werke	E3201 Coil No10	64-10501-121	
K6	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K7	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K8	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K9	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K10	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K11	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K12	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K13	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K14	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K15	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K16	Relay, Vert 1C 12V 8A	306 Ohm	Omron	G2L-113P-V 12V	64-31120-232	
K17	Relay, HV				08-02986	
K18	Relay, 1M 12V 10A	280 Ohm	Eichoff-Werke	E3201 BV18 PrV15 12V	64-10501-120	
K19	Relay, 1C 12V 10A	280 Ohm	Eichoff-Werke	E3201 Coil No10	64-10501-121	
K20	Relay, 1C 12V 10A	280 Ohm	Eichoff-Werke	E3201 Coil No10	64-10501-121	
K21	Relay, 1C 12V 10A	280 Ohm	Eichoff-Werke	E3201 Coil No10	64-10501-121	
K22	Relay, 1M 12V 10A	280 Ohm	Eichoff-Werke	E3201 BV18 PrV15 12V	64-10501-120	
K23	Relay, 1M 12V 10A	280 Ohm	Eichoff-Werke	E3201 BV18 PrV15 12V	64-10501-120	
L1	Inductor, 10uH		Sigma	30-10-2525-10	43-81100-061	
L2	Inductor, Fixed Tor 0.50uH bl/sl				44-70237	
L3	Inductor, Fixed 1.00uH bl/bl/ye				44-70283	
L4	Inductor, Fixed 1.42uH bl/bl/bk				44-70284	
L5	Inductor, Fixed 5.70uH bl/bl/gn				44-70286	
L6	Inductor, 10uH		Sigma	30-10-2525-10	43-81100-061	
L7	Inductor, Path Length				44-70349	
L8	Inductor, Fixed Tor 0.06uH bl/bk				44-70234	
L9	Inductor, Fixed 2.85uH bl/bl/rd				44-70285	
L10	Inductor, Fixed Tor 0.12uH bl/bn				44-70235	
L11	Inductor, Fixed 0.25uH bl/bl/bl				44-70281	
P1	Header (P) 26way 2row 90deg		JAE	PS-26PE-D4LT1-PN1	60-00260-261	
P2	Header (P) 2way 1row Latch		JAE	IL-2P-S3EN2	60-00020-260	
P3	Header (P) 10way 2row		JAE	PS-10PE-D4T1-PN1	60-00100-260	
R1	100 Ohm 5% 2,5W	MF Res	Philips	2322 192 31001	40-21000-605	
R2	100 Ohm 5% 2,5W	MF Res	Philips	2322 192 31001	40-21000-605	
R3	47k Ohm 5% 0,33W	CF Res	Philips	2322 211 13473	40-44700-020	
R4	1k Ohm 5% 0,33W	CF Res	Philips	2322 211 13102	40-31000-020	
R5	1k Ohm 5% 0,33W	CF Res	Philips	2322 211 13102	40-31000-020	
R6	15k Ohm 5% 0,33W	CF Res	Philips	2322 211 13153	40-41500-020	
R7	10k Ohm 5% 0,33W	CF Res	Philips	2322 211 13103	40-41000-020	

RF PCB (cont'd)

Ref	Description	Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
R8	1,5k Ohm 5% 0,33W CF Res	Philips	2322 211 13152	40-31500-020	
R9	390 Ohm 5% 0,33W CF Res	Philips	2322 211 13391	40-23900-020	
R10	4,7k Ohm 5% 0,33W CF Res	Philips	2322 211 13472	40-34700-020	
R11	18k Ohm 5% 0,33W CF Res	Philips	2322 211 13183	40-41800-020	
R12	4,7k Ohm 5% 0,33W CF Res	Philips	2322 211 13472	40-34700-020	
R13	10k Ohm 5% 0,33W CF Res	Philips	2322 211 13103	40-41000-020	
R14	1,8M Ohm 5% 0,5W MG Res	Philips	2322 242 13185	40-61800-554	
R15	1,8M Ohm 5% 0,5W MG Res	Philips	2322 242 13185	40-61800-554	
R16	1,8M Ohm 5% 0,5W MG Res	Philips	2322 242 13185	40-61800-554	
R17	47 Ohm 5% 0,33W CF Res	Philips	2322 211 13479	40-14700-020	
T1	Transformer, Current bk/bk/bl			44-80166	
T2	Transformer, Voltage			44-80199	
T3	Transformer, Load			44-80197	
T4	Transformer, Load			44-80196	
T5	Transformer, Phase			44-80198	
V1	Diode, Zener 4,7V 5% 0,4W	Philips	BZX79-C4V7	BZX79C4V7	
V2	Transistor, NPN Si	Philips	BC548	BC548	
3	Relay, Contact			05-02816	
4	Washer, Rubber 36mm			06-00663	
5	Washer, Rubber 25mm			06-00465	
6	Washer, Rubber 20mm			06-00466	
7	Plate, Inductor Mounting 22mm			06-00467	
8	Plate, Inductor Mounting 16mm			06-00468	
9	Washer, Fibreglass 36mm			06-00637	
15	Spacer, Teflon 13mm			06-00473	
16	Spacer, Teflon 20mm			06-00474	

Control PCB

Ref	Description				Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
C1	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C2	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C3	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C4	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C5	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C6	100n	10%	250V	PE Cap	Philips	2222 368 45104	46-51000-500	
C7	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C8	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C9	2,2u	20%	35V	TA Cap	AVX	TAP225M035CCS	47-02203-510	
C10	1u	20%	35V	TA Cap	AVX	TAP105M035CCS	47-01003-510	
C11	1u	20%	35V	TA Cap	AVX	TAP105M035CCS	47-01003-510	
C12	2,2u	20%	35V	TA Cap	AVX	TAP225M035CCS	47-02203-510	
C13	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C14	2,2u	20%	35V	TA Cap	AVX	TAP225M035CCS	47-02203-510	
C15	1u	20%	35V	TA Cap	AVX	TAP105M035CCS	47-01003-510	
C16	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C17	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C18	2,2u	20%	35V	TA Cap	AVX	TAP225M035CCS	47-02203-510	
C19	22p	2%	100V NPO	CE Cap	Philips	2222 680 10229	46-12200-011	
C20	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C21	1u	20%	35V	TA Cap	AVX	TAP105M035CCS	47-01003-510	
C22	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C23	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C24	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C25	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C26	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C27	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C28	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C29	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C30	1000u	16V		EL Cap	Elna	RT	48-31001-650	
C31	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C32	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C33	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C34	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C35	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C36	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C37	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C38	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C39	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C40	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C41	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C42	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C43	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C44	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C45	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C46	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C47	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C48	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C49	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C50	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C51	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C52	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C53	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C54	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C55	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C56	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	
C57	100n	10%	250V	PE Cap	Philips	2222 368 45104	46-51000-500	
C58	100n	20%	50V X7R	CE Cap	Vitramon	VP41BY104MA	46-51000-261	

Control PCB (cont'd)

Ref	Description	Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
D1	Diode, Si fast low cap high cond			23-10001	
D2	Diode, Si fast low cap high cond			23-10001	
D3	Diode, Si fast low cap high cond			23-10001	
D4	Diode, Si fast low cap high cond			23-10001	
D5	Diode, Si fast low cap high cond			23-10001	
D6	Diode, Si fast low cap high cond			23-10001	
D7	Diode, Si fast low cap high cond			23-10001	
F1	Fuse, STD 2 Amp	Australux	3AG	63-00000-200	
H1	LED, Red HE T-1 3/4 Diffused	Liton	LTL-4223	65-61110-207	
H2	LED, Red HE T-1 3/4 Diffused	Liton	LTL-4223	65-61110-207	
H3	LED, Red HE T-1 3/4 Diffused	Liton	LTL-4223	65-61110-207	
H4	LED, Red HE T-1 3/4 Diffused	Liton	LTL-4223	65-61110-207	
H5	LED, Red HE T-1 3/4 Diffused	Liton	LTL-4223	65-61110-207	
H6	LED, Red HE T-1 3/4 Diffused	Liton	LTL-4223	65-61110-207	
H7	LED, Red HE T-1 3/4 Diffused	Liton	LTL-4223	65-61110-207	
H8	LED, Red HE T-1 3/4 Diffused	Liton	LTL-4223	65-61110-207	
IC1	Gate, NAND 2 Input Quad Schmt IC	Texas Inst	SN74LS132N	YB-74132-000	
IC2	Regulator, Voltage +5V 1,5A IC	National	LM340T-5	XB-07805-400	
IC3	Regulator, Voltage +10V IC	National	LM2940T-10	XB-02940-402	
IC4	Gate, NAND 2 Input Quad O/C IC	Texas Inst	SN74LS38N	YB-74038-000	
IC5	Monostable IC	Texas Inst	SN74LS123N	YB-74123-000	
IC6	Micro prgmd, 4203	Codan	HF4203	90-20113	
IC7	CBUS, 16Bit parallel 40mA O/P IC	Philips	SAA1060	YK-01060-000	
IC8	CBUS, 16Bit parallel 40mA O/P IC	Philips	SAA1060	YK-01060-000	
L1	Inductor, 100uH	Taiyo Yuden	FL 5H 101K	43-82100-095	
L2	Inductor, 100uH	Taiyo Yuden	FL 5H 101K	43-82100-095	
L3	Inductor, Toroid			44-80044	
L4	Inductor, Toroid			44-80044	
L5	Inductor, 100uH	Taiyo Yuden	FL 5H 101K	43-82100-095	
P1	Header (P) 2way 1row Latch	JAE	IL-2P-S3EN2	60-00020-260	
P2	Header (P) 6way 1row	Molex	22-03-2061	60-00061-100	
P3	Header (P) 2way 1row	Molex	22-03-2021	60-00021-100	
P4	Header (P) 4way 1row	Molex	22-03-2041	60-00041-100	
P5	Header (P) 4way 1row	Molex	22-03-2041	60-00041-100	
P6	Header (P) 10way 2row	JAE	PS-10PE-D4T1-PN1	60-00100-260	
P7	Header (P) 26way 2row	JAE	PS-26PE-D4T1-PN1	60-00260-260	
R1	2,2k Ohm 5% 0,33W CF Res	Philips	2322 211 13222	40-32200-020	
R2	47k Ohm 5% 0,33W CF Res	Philips	2322 211 13473	40-44700-020	
R3	33k Ohm 5% 0,33W CF Res	Philips	2322 211 13333	40-43300-020	
R4	47k Ohm 5% 0,33W CF Res	Philips	2322 211 13473	40-44700-020	
R5	10k Ohm 5% 0,33W CF Res	Philips	2322 211 13103	40-41000-020	
R6	2,2k Ohm 5% 0,33W CF Res	Philips	2322 211 13222	40-32200-020	
R7	100k Ohm 5% 0,33W CF Res	Philips	2322 211 13104	40-51000-020	
R8	100k Ohm 5% 0,33W CF Res	Philips	2322 211 13104	40-51000-020	
R9	33k Ohm 20% 0,1W Com SIL x5Res	Murata	RGSD5X333M	40-84330-500	
R10	4,7k Ohm 5% 0,33W CF Res	Philips	2322 211 13472	40-34700-020	
R11	5,6k Ohm 5% 0,33W CF Res	Philips	2322 211 13562	40-35600-020	
R12	22k Ohm 5% 0,33W CF Res	Philips	2322 211 13223	40-42200-020	

Control PCB (cont'd)

Ref	Description	Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
R13	10k Ohm 5% 0,33W CF Res	Philips	2322 211 13103	40-41000-020	
R14	22k Ohm 5% 0,33W CF Res	Philips	2322 211 13223	40-42200-020	
R15	10k Ohm 5% 0,33W CF Res	Philips	2322 211 13103	40-41000-020	
R16	27k Ohm 5% 0,33W CF Res	Philips	2322 211 13273	40-42700-020	
R17	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R18	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R19	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R20	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R21	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R22	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R23	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R24	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R25	27k Ohm 5% 0,33W CF Res	Philips	2322 211 13273	40-42700-020	
R26	2,7k Ohm 5% 0,33W CF Res	Philips	2322 211 13272	40-32700-020	
R27	27 Ohm 10% 5,0W WW Res	IRH	PW5	40-12700-700	
R28	2,2k Ohm 5% 0,33W CF Res	Philips	2322 211 13222	40-32200-020	
R29	47k Ohm 5% 0,33W CF Res	Philips	2322 211 13473	40-44700-020	
R30	100k Ohm 5% 0,33W CF Res	Philips	2322 211 13104	40-51000-020	
R31	100k Ohm 5% 0,33W CF Res	Philips	2322 211 13104	40-51000-020	
R32	100k Ohm 5% 0,33W CF Res	Philips	2322 211 13104	40-51000-020	
V1	Transistor, NPN Si	Philips	BC548	BC548	
V2	Diode, Zener 4,7V 5% 0,4W	Philips	BZX79-C4V7	BZX79C4V7	
V3	Diode, Zener 4,7V 5% 0,4W	Philips	BZX79-C4V7	BZX79C4V7	
V4	Diode, Zener 4,7V 5% 0,4W	Philips	BZX79-C4V7	BZX79C4V7	
V5	Transistor, PNP Si	Philips	BC558	BC558	
V6	Transistor, NPN Si	Philips	BC338	BC338	
X1	Terminal block 5 way	Utilux	H17003	61-10200-501	
Z1	Crystal, 4000 kHz uP Grade	Hy-Q	M/P QC49	65-90008-000	

Rectifier, Meter PCB

Ref	Description	Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
C1	2,2u 20% 35V TA Cap	AVX	TAP225M035CCS	47-02203-510	
C2	100n 50V Z5U CE Cap	Centralab	CZ20C104M244	46-51000-260	
D1	Diode, Si fast low cap high cond			23-10001	
D2	Diode, Si fast low cap high cond			23-10001	
P1	Header (P) 4way 1row Latch 90deg	JAE	IL-4P-S3FP2	60-00040-260	
R1	1k Ohm 5% 0,33W CF Res	Philips	2322 211 13102	40-31000-020	
R2	56 Ohm 5% 1,15W CF Res	Philips	2322 214 13569	40-15600-050	
R3	68k Ohm 5% 0,33W CF Res	Philips	2322 211 13683	40-46800-020	
R4	56 Ohm 5% 1,15W CF Res	Philips	2322 214 13569	40-15600-050	

Tuner, 4203

Ref	Description	Manufacturer	Manufacturer's P/N	Codan P/N	Remarks
J1	Socket, UHF Single Hole Fixed	Acme	C32-28	60-11363-228	
L1	Inductor			44-70267	
L2	Inductor, Fixed Air wound 11uH			44-70218	
L3	Inductor, Fixed Air wound 55uH			44-70219	
1	Bracket, Mounting			05-02820	
2	Bracket, Mounting Left			05-02872	
3	Spacer, M3x5.5A/Fx40mm Long			05-03312-400	
6	Washer, 1/4ID x 1/20D x 1/16		Nylon Black	31-40801-029	
7	Pad, Self Adhesive			06-00325	
8	Bracket, Coil Support			06-00623	
9	Bracket, Coil Support			06-00624	
10	Bracket, Coil Support			06-00625	
11	Case			06-00636	
12	Envelope, Installation Instruct.			06-00698	
22	Gland, Cable C/W Locknut	Alco	MG20	30-13200-001	
23	Insulator, Cup (Top)	Nilsen	FT300 2150940	30-17010-003	
24	Insulator, Bush (Bottom)	Nilsen	FT200 2160916	30-17010-005	
36	Washer, M5 Normal		Nylon Black	31-25001-029	
37	Lug, Solder M6	Tucker	T540 Code 127	61-30200-001	
38	Lug, Solder M12 6,0 sq mm ET	Utilux	H3139	61-30200-019	
40	Wire, EHT 25kV 16/0,2	Radio Spares	354-206	66-31072-500	

8 DRAWINGS

RF Board and Chassis	Circuit Diagram	04-02038
RF Board	Assembly	08-02917 Sht 1
RF Board		08-02917 Sht 2
Control Board	Circuit Diagram	04-02039
Control Board	Assembly	08-02918
Chassis Layout		16-00007-010
Tuner Dimensions		16-00007-002