Digital Scrambler Type 9003B Handbook

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Codan Pty Ltd ACN 007 590 605 81 Graves Street Newton South Australia PO Box 96 Campbelltown South Australia 5074 Telephone National (08) 8305-0311 Internat'l +61 8 8305 0311 Facsimilie (08) 8305 0411 5

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Handbook Addendum

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"Digital Scrambler Type 9003 Handbook" - Part No. 15-03012 Issues 2 & 3 February 1996

9003B Digital Scrambler

The 9003B Digital Scrambler can be used with all Codan HF-SSB transceivers and Remote Control equipment.

The front panel of the 9003B is fitted with two different microphone connectors to cater for various equipment models; a smaller diameter microphone connector and a larger diameter microphone connector. The rear panel of the 9003B has two corresponding transceiver adaptor connectors.

The 9003B is internally configured so that only one corresponding pair of front and rear panel connectors is active at any time. The active pair is identified on the rear panel as "ENABLED", while the inactive pair is identified as "DISABLED".

The 9003B will be supplied from the factory pre-configured for your transceiver. However, if it should be necessary to alter the configuration, remove the top cover of the unit (by removing the four screws on the sides of the top cover) and follow the instructions contained inside.

Digital Scrambler circuit diagram 04-02727, (Issue 3) and VPD interface assembly 08-04132 (Issue 2) refer to the changes.

Using the 9003B Digital Scrambler with a 9323/9360/9390 Transceiver

- (a) Ensure that the small connector on the rear of the 9003B is "ENABLED".
- (b) Unplug the transceiver microphone.
- (c) Connect the Interface Cable (Part No. 08-05242) between the small plug at the rear of the 9003B and the transceiver microphone input.
- (d) Fit the microphone, removed in (b) above, to the small plug mounted on the front panel of the 9003B.
- (e) Refer to the Digital Scrambler Type 9003 Handbook for further instruction on operation of the unit.

NOTE: The 9323/9360 Transceiver supplies DC power to the 9003B through the interface cable; there is no need to provide a separate DC supply to the 9003B.

Using the 9003B Digital Scrambler with other Codan transceivers

- (a) Ensure that the large connector on the rear of the 9003B is "ENABLED".
- (b) Refer to the Digital Scrambler Type 9003 Handbook for further instruction on the installation and operation of the unit.

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1.1 Introduction

The 9003 Digital Scrambler is a voice security device designed for use with standard radio equipment. Digital processing of the audio speech signals almost eliminates the possibility of an unauthorised listener understanding your radio communications. The Scrambler operates within the standard audio bandwidth and does not degrade the transceiver's performance.

1.2 Operation

The speech from the microphone is connected via the Interface PCB to the Voice Privacy Device (VPD) module. Here it is digitised and stored in RAM prior to encryption.

Each half second of digitised audio is divided into 8, 16, or 32 segments and scrambled according to the programmed key code.

Synchronising information is added to the out of order segments prior to conversion back to an audio signal. The resulting scrambled speech is passed to the transceiver for transmission.

The received audio is again digitised stored in RAM and divided into 8, 16, or 32 segments using the synchronising information as a timing reference.

If the VPD module has the same key code, the segments are sorted into their original sequence. The digital information is converted to audio and passed to the loudspeaker via the audio amplifier.

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2.1 Location

- (a) The 9003 should be located where the Clear/Secure switch is easily accessible and near the transceiver associated with it.
- (b) If the unit is to be fitted to a vehicle, avoid areas where the equipment may be subjected to constant direct sunlight or high temperatures.
- (c) For marine installations, locate the 9003 away from areas that may be subjected to water or sea spray. It may be necessary to insulate the mounting bracket from the vessel structure.
 - NOTE: On some vessels, the DC supply is isolated from the antenna's earth to prevent corrosion (electrolysis effect).

Caution should be taken that the DC isolation is maintained when installing the 9003 Digital Scrambler.

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2.2 Power Supply

- (a) The 3 core cable fitted with a 4 way connector is used to supply the DC power to the unit.
- (b) As a precaution, isolate the battery supply during the installation of the equipment.
- (c) Plug the cable into the connector marked **Power** located on the rear panel of the 9003.
- (d) The unterminated wires should be connected to the nearest convenient DC Supply and wired as follows:

Black wire	negative supply	Connect to -ve ground See Note 1
Red wire	Use for 12 V operation	Connect to +ve 12 V Supply - See note 2
Orange Wire	Use for 24 V operation	Connect to +ve 24 V Supply - See note 2

- NOTE: 1. The case of the 9003 is internally connected to the negative rail. Installation is <u>not</u> recommended for vehicles with positive chassis/ground connection.
 - 2. <u>Warning</u>: Connect only one +ve wire (red or orange). Insulate or cut off unused wire.
- (e) In the Clear mode, the current consumption of the 9003 is extremely low (≈ 20 mA). Therefore, when not in use, it is not necessary to switch or disconnect from the battery supply, unless the battery is not charged for long periods.

Installation

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2.3 Connecting to a 7 pin microphone socket

To interface the 9003 Digital Scrambler to a 7 pin microphone socket on a Transceiver or Remote Control:

- (a) Unplug the transceiver microphone.
- (b) Connect the Interface Cable (Pt No. 08-04292-001) between the 8 way plug at the rear of the 9003 and the transceiver or remote control microphone input.
- (c) Fit the microphone, removed in (a) above, to the 7 pin plug mounted on the front panel of the 9003.

2.4 Connecting to a 6 pin microphone socket

NOTE: To be used with code 656 accessory kit. (Pt No. 15-00656 Interface Kit-6 pin, 9003).

To interface the 9003 Digital Scrambler to a 6 pin microphone socket on a Transceiver or Remote Control:

- (a) Unplug the transceiver microphone and discard.
- (b) Connect the Interface Cable (Pt No. 08-04291-001) between the 8 way plug at the rear of the 9003 and the transceiver or remote control microphone input.
- (c) Fit the new microphone (supplied with the 15-00656 Interface Kit) to the 7 pin plug mounted on the front panel of the 9003.

3.1 Clear Mode

(a) With Clear selected on the 9003, the VPD unit is bypassed and the transceiver functions as normal.

NOTE: DC power to the 9003 is still required when operating in the Clear mode.

(b) On reception of a scrambled message, it will remain scrambled and not understood as long as the Clear mode remains selected.

3.2 Secure Mode

In the Secure Mode the Mute function on your Transceiver (if fitted) must be disabled for satisfactory operation. The receiving station must be programmed with the same security key code, for your transmissions to be understood.

To operate in the Secure mode proceed as follows:

- (a) Switch Mute off
- (b) Select Secure
- (c) Operate PTT and pause for approximately half second before speaking. Check the Lock indicator is lit, indicating secured transmission.
- (d) At the end of the transmission, release the PTT to return to the receive mode.
- (e) At the beginning of a received scrambled message the Lock indicator will commence flashing, indicating the 9003 has synchronised with the 9003 at the transmitting end. Providing the same key code is used, the message will be received unscrambled and intelligible.

Operation

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- (f) The Lock indicator will continue to flash for five seconds after the end of the received transmission. However, should communications be continued with breaks of less than five seconds between transmitting and receiving, synchronisation will be maintained resulting in no loss of speech content.
- (g) If the sender's speech is transmitted in the Clear mode (or without a Digital Scrambler fitted) and the receiver is still in Secure mode, the speech will be understood, but the Lock indicator will not flash, indicating normal unscrambled transmission (unsecured).
- (h) During a Secure transmission, any other person within the network, with the same key code, may monitor the transmission, simply by selecting the Secure mode & waiting for approximately one second for the scrambler to synchronise (Lock LED flashing). Once synchronised, the third party's transmission will also be understood by others within the operating network.

3.3 Transceiver Frequency/Clarifiers

The scrambler is sensitive to frequency differences between the Transmitter and the Receiver. When this difference is 30Hz, or greater, the scrambler may not lock. If your transceiver is fitted with a clarifier, it's use will introduce some frequency difference, and the following will apply:

a) If your transceiver is equipped with a digital clarifier, such as the 8525/8528 transceiver, then

the clarifier should NOT be adjusted.

- b) If your transceiver is equipped with a clarifier knob it is recommended that:
 - 1) The clarifier knob is returned to the the central position for zero frequency off-set, or
 - 2) The clarifier is removed entirely.

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4.1 Description

With the switch S1 in the **Secure** mode, contacts S1A complete the DC path to energise relay K1. With relay K1 energised, contacts K1/a connect the microphone to the VPD module pin 10 (mic. in). In transmit, the scrambled speech from the VPD module pin 12, is attenuated by R9/R10 and connected to the transceiver microphone input via relay contacts K1/b and isolating transformer T1.

When PTT is operated, the low that is applied to pin 8 of the VPD module results in a low appearing at pin 9. This switches off transistor V1 causing V3 to conduct and relay K2 to energise. Contacts K2/a operate the transceiver PTT and K2/b isolate the loudspeaker from the audio amplifier. When the PTT is released, a delay of approximately 0.25 seconds occurs in the VPD module before pin 9 goes high. A further delay is achieved by the time constant of R6/C1 (V2 conducting in the Secure mode) causing V3 to remain conducting for a further 0.25 seconds, before releasing relay K2. This overall delay of approximately half a second permits the remaining speech delayed by the VPD module to be transmitted before returning to the receive mode.

The receiver audio is applied to the VPD module pin 14 via attenuator R11/R12, normally in a scrambled format. The unscrambled output (if the key code is correct) from pin 15 is connected to an audio amplifier IC1 incorporating a low pass filter. The output of IC1 is connected to the loudspeaker via contacts K2/b, switch S1B and link (pins 5 to 7) fitted in the microphone plug.

When the toggle switch S1 is in the Clear mode, the microphone is connected via T1 direct to the transceiver. PTT still operates via the VPD module but with no delay. Receiver output is connected direct to the loudspeaker via contacts S1B and link in the microphone plug.

The unit can be operated from either 12 or 24 volts DC supply.

The 12 volt input supply is protected against over voltage (>15 volts) and reverse polarity by a 1 Amp fuse F1 and a 15 volt zener diode V1.

The 24 volt input supply is protected against reverse polarity by series diode D3.

VPD Interface PCB

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C1 10u 20x 25V TA Cap AVX	4800000000	Description		Manufacturer	manuracturer's P/I	I Codan P/N Remarks	
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100	C1	10u 20% 25V	TA Cap	AVX	TAP106M025ccs	47-11002-510	
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D2 Diode, Si small sig GP	01	Diede Cierallei-OD					
D3 Diode, Si 400V 1A D4 Diode, Si 400V 1A D5 Diode, Si small sig GP D6 Diode, Si small sig GP D7 Diode, Si small sig GP D8 Diode, Si small sig GP D8 Diode, Si small sig GP D9 Diode, Si small sig GP D9 Diode, Si small sig GP D1 D1 D2 Diode, Si small sig GP D1 D1 D2 D2 Sig D1 D2 D2 Sig D1 D2 Sig D1 D2 D2		•					
D4 Diode, Si 400V TA 114004 D5 Diode, Si small sig GP 23-10005 D6 Diode, Si small sig GP 23-10005 D6 Diode, Si 400V TA 114004 IC1 Amplifier, Power 12W IC Philips TDA1020 TDA1020 K1 Relay, 2C Bif 12V 720 Ohm Matsushita DS2Y-S-DC12 64-21223-272 K2 Relay, 2C Bif 12V 720 Ohm Matsushita DS2Y-S-DC12 64-21223-272 L1 Inductor, Toroid 44-80044 L2 Inductor, 1mH Taiyo Yuden FL 5H 102K 43-83100-095 L3 Inductor, 1mH Taiyo Yuden FL 5H 102K 43-83100-095 L4 Inductor, Toroid 44-80044 L5 Inductor, Toroid 17 Taiyo Yuden FL 5H 101K 43-82100-095 L6 Inductor, 100uH Taiyo Yuden FL 5H 101K 43-82100-095 P1 Header (P) 15way 1Row 2mm Pitch Molex 39-26-9156 60-00150-101 P2 Header (P) 8way 1row Molex 22-03-2081 60-00081-100 P3 Header (P) 8way 1row Molex 22-03-2081 60-00081-100 P4 Header (P) 6way 1row Molex 22-03-2061 60-00061-100 P5 Header (P) 6way 1row Molex 22-03-2041 60-00061-100 P5 Header (P) 4way 1row Molex 22-03-2041 60-00041-100							
D5 Diode, Si small sig GP D6 Diode, Si 400V 1A IC1 Amplifier, Power 12W IC2 Philips IDA1020 IC2 Philips IDA1020 IDA10		•					
D6 Diode, Si 400V 1A 1N4004 IC1 AmpLifier, Power 12W IC Philips TDA1020 TDA1020 K1 Relay, 2C Bif 12V 720 Ohm Matsushita DS2Y-S-DC12 64-21223-272							
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P5 Header (P) 4way 1row Molex 22-03-2041 60-00041-100	P4						
R1 33 Ohm 5% 0.334 CF non Philipp	P5						
R1 33 Ohm 5% 0,33W CF Res Philips 2322 211 13339 40-13300-020		·		-		23 00041 100	
ארט 55 Unm כל 0,33W CF Res Philips 2322 211 13339 40-13300-020	D4	77 AL 54 - 5-		4	•		
	ΚI	33 Unm 5% 0,33₩	CF Res	Philips	2322 211 13339	40-13300-020	

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VPD Interface PCB (cont'd)

Ref	Descr	iptio	n			Manufacturer	Manufacturer's P/N	Codan P/N Remarks
R2	10k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13103	40-41000-020
R3	10k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13103	40-41000-020
R4	10k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13103	40-41000-020
R5	1k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13102	40-31000-020
R6	47k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13473	40-44700-020
R7	22k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13223	40-42200-020
R8	10k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13103	40-41000-020
R9	1k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13102	40-31000-020
R10	100	Ohm	5%	0,33W	CF Res	Philips	2322 211 13101	40-21000-020
R11	1k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13102	40-31000-020
R12	4,7k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13472	40-34700-020
R13	6,8k	Ohm		0,33W	CF Res	Philips	2322 211 13682	40-36800-020
R14	270	Ohm		0,33W	CF Res	Philips	2322 211 13271	40-22700-020
R15	4,7k	Ohm		0,33W	CF Res	Philips	2322 211 13472	40-34700-020
R16	4,7k	Ohm		0,33W	CF Res	Philips	2322 211 13472	40-34700-020
R17	330k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13334	40-53300-020
R18	22k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13223	40-42200-020
R19	4,7	Ohm	5%	0,33W	CF Res	Philips	2322 211 13478	40-04700-020
R20	1k	Ohm	5%	0,33W	CF Res	Philips	2322 211 13102	40-31000-020
т1	Trans	sforme	er					44-30821
V1	Trans	sistor	·, NF	PN Si		Philips	BC548	BC548
V2	Trans	sisto	, NF	N Si		Philips	BC548	BC548
V3	Trans	sisto	·, NF	N Si		Philips	BC548	BC548
1	PCB.	VPD ;	Inte	rface				07-01458

Digital Scrambler, 9003B

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Ref	Description		Manufacturer	Manufacturer's P/N	Codan P/N Remarks
	VPD Interface		CIRCUIT DIAGRAM	FOR REFERENCE ONLY	04-02727
в1	Loudspeaker, 105x70	8 Ohm	Foster	C101K20S0050	65-21000-805
F1	Fuse, STD	1 Amp	Australux	3AG	63-00000-100
н1	LED, Red HE T-1 3/4 Di	ffused	Liton	LTL-4223	65-61110-207
IC2	Regulator, Voltage +15V 1,	5A IC	National	LM340T-15	XB-07815-400
P6	Plug, 8way	Fixed	Marushin	MI-753-8S	60-00083-320
₽7	Plug, 7way	Fixed	Marushin	MI-7528	60-00073-320
Р8	Plug, 4way	Fixed	Marushin	MI-721S	60-00040-320
s1	Switch, Toggle DPDT on-on		C&K	7201-P3-Y-Z-Q-E	62-02220-000
V1	Diode, Zener 15V 5% 5W				1N5352B
9	Loom, Mic Input A				08-04294-001
10	Loom, Power			· ·	08-04401-001
11	Loom, Interface A				08-04293-001
12	Loom, Switch				08-04402-001
29	Loom, MIC I/P B				08-05234-001
30	Loom, Interface B				08-05233-001
	Cable, Interface 7pin A				08-04292-001
	Cable, Power 12/24V				08-04404-001
	Cable, Interface B				08-05242-001

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5 TRANSCEIVER SPEAKER FACILITY

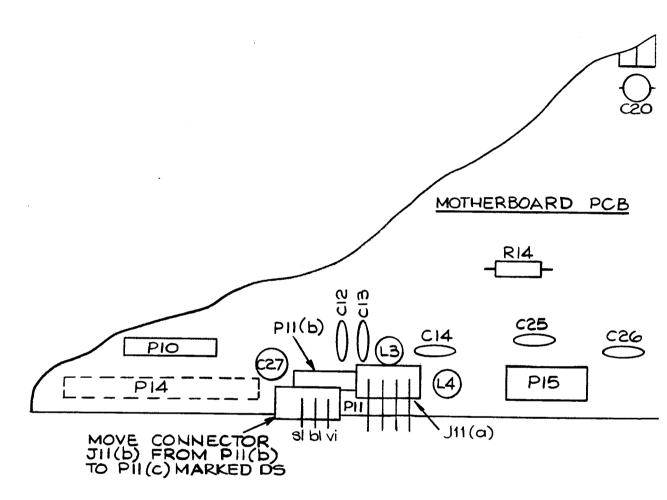
5.1 Introduction

<u>NOTE</u>: The following modification should only be carried out by a Codan agent or qualified technician.

With minor modifications, it is possible to use the internally fitted speaker of the 8525/8528 Transceiver or the 8570 Remote Control Unit, when operating the 9003 digital scrambler. With these changes, the DC to power the 9003 is supplied via the interface cable, therefore eliminating the necessity of an external DC power cable.

The modifications to the transceiver and the rewiring of the interface cable are detailed in sections 5.2 to 5.4.

- 5.2 Modifications to Transceiver 8525/8528
 - (a) Front Panel Control (PCB Issue 2)
 (with Motherboard PCB issue 2 onwards)



<u>Wiring Details</u>

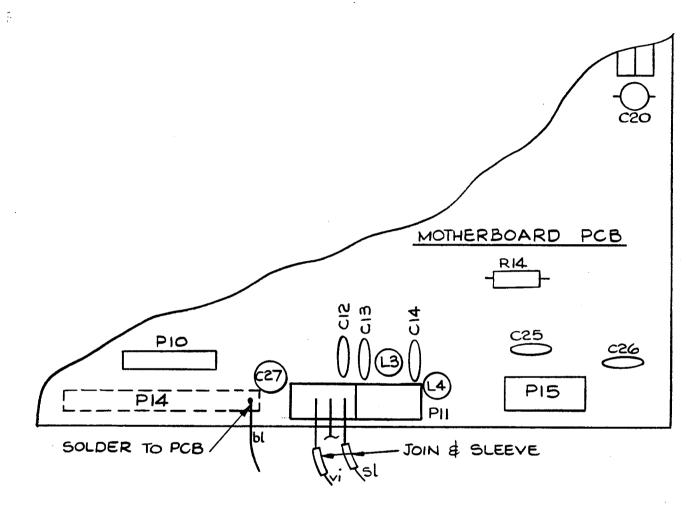
i. Reposition J11 (b) as shown

Transceiver Speaker Facility

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(b) Front Panel Control (PCB Issue 1)
 (with Motherboard PCB issue 1)



<u>Wiring Details</u>

- i. Cut wires blue, violet & slate on connector J11 (b)
- ii. Connect slate to pin 5 and sleeve join
- iii. Connect violet to pin 7 and sleeve join
 - iv. Solder blue to track as detailed above

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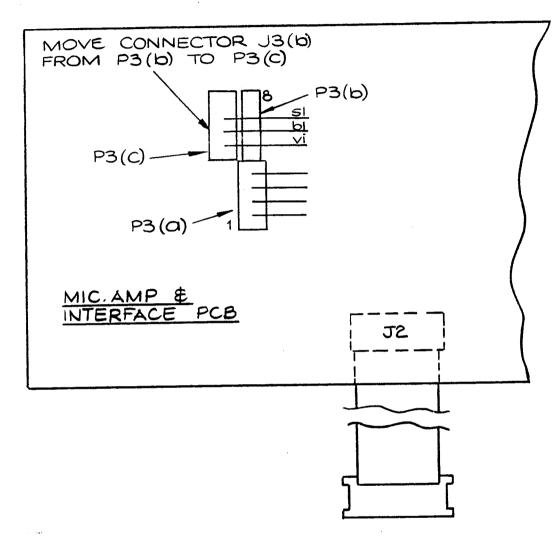
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(c) Control Head 8530/8531 (PCB Issue 3)
 (with Mic, Amp & Interface PCB issue 3 Onwards)

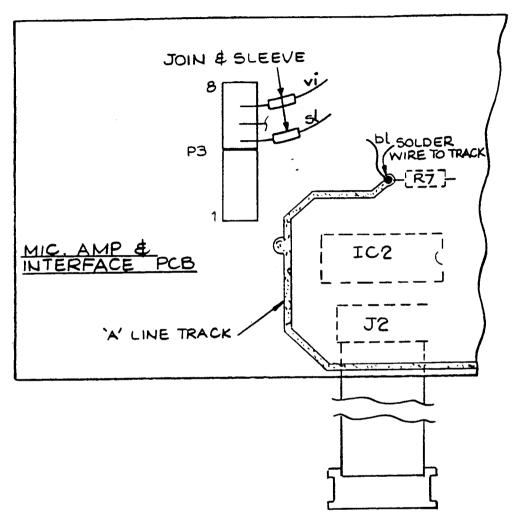


Wiring Details

i. Reposition J3 (b) as shown

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(d) Control Head 8530/8531 (PCB Before Issue 3) (with Mic Amp & Interface PCB before Issue 3)



Wiring Details

i. Cut the Blue, Violet & Slate wires to connector P3 and rewire as shown.

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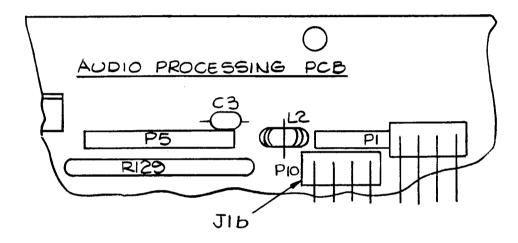
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5.3 Modifications to Remote Control type 8570



<u>Wiring Details</u>

i. Move connector J1 (b) to P10 as detailed

Transceiver Speaker Facility

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5.4 Modification to the Interface Cable 08-04292

- (a) Cut off the 7 way connector, remove existing wires and reterminate as detailed in table 1 below.
- (b) Trim back to outer sheath all unused wires.
- (c) Ensure the connector's cable clamp securely clamps the outer sheath (including rubber sleeve).

Wire Colour	Connector Pin No.	Function
Brown Slate Red	1 1 2	Ground (PTT) Ground (Supply) PTT
Orange Yellow	3	Microphone Microphone
Green Blue Violet	5 6 7	Speaker DC Supply +ve Rx Audio

6.1 Specifications

Supply Volts

10 to 15 V DC Fuse protected for over voltage and reverse

polarity

15 to 30 V DC Protected against

reverse polarity

Power Consumption

(no audio)

Clear - 20 mA (nom) Secure - 90 mA (nom)

AF Power

2.5 W (nom) into 8 a

Extension Speaker

4 $\mathfrak o$ to 16 $\mathfrak o$

Operating Temperature

-30° to +60°C

Receiver Input/Output Level

2 to 12 volts PP

Transmit Input/Output Level

20 mV PP (nom)

8 Element Scrambler

Scrambling technique:

Disjoint frame, sliding window 8 time element scrambling of 64 ms speech

segments with reverse read out

Permutation Space:

40,320

16 Element Scrambler

Scrambling technique:

Disjoint frame, sliding window 16 time element scrambling of 32 ms speech

segments with reverse read out

Permutation Space:

 2.09×10^{13}

32 Element Scrambler

Scrambling technique:

Disjoint frame, sliding window 32 time element scrambling of 16 ms speech

segments with reverse read out

Permutation Space:

 2.63×10^{35}

General

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Total Allowable System Propagation Delay 10 ms A/D, D/A. Internally fully digital Voice Processing **Key Format** 10 decimal digits Key Entry Cryptofil hand held programmer Key to Permutation Via pseudo-random sequence mapping generates algorithm System delay 512 ms total end to end delay Synchronisation Fully automatic continuous re-sync every 0.5 seconds Late Entry approx 1 second Size and Weight 165 mm W x 58 mm H x 200 mm D; 800 g (less mounting bracket. Depth includes rear connectors)

6.2 Connectors

(a) Interface to transceiver - 8 pin (rear panel)

Pin No.		Function
1 2 3 4 5)))	PTT " Mic. " Speaker Connection*
6 7 8		+12 V I/P Receiver Audio Ground

Audio return to transceiver speaker when modified see section 6

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(b) External DC Supply Input - 4 pin (rear panel)

Pin No.	Function
1 2	+12 V Input +24 V Input
3 4	No Connection Ground

(c) Microphone Input - 7 pin (front panel)

Pin No.	Function
1	PTT Ground
2	PTT
3	Mic. Ground
4	Mic.
5	Speaker Connection*
6	Audio Ground
7	Audio Output

^{*} Linked to pin 7 for internal speaker operation

6.3 Accessories

Code 656

Interface cable, 6 pin and microphone P/N 15-00656 Interface Cable, 6 pin & Mic.