

CODAN HF Transceivers

Part 1

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Year 2002 being "The Year of The Outback" provides an incentive to examine the extensive range of Eilco/Codan HF transceivers that over the last forty years have brought to the people of the outback improved communications and safety. Even when older Codan transceivers are discarded others find use for them, including amateur radio operators and four wheel drive club enthusiasts.

This article, in two parts, provides brief historical background information on Codan, an overview of their design and manufacturing philosophies and finally a summary of HF transceivers marketed.

Background of Codan

In the 1950s three young men attended the University of Adelaide, Ian Baker Wall, Alastair Edward Rose Wood and Irvine James (Jim) Bettison. During their first year Ian and Alastair were drawn together through common interests in engineering and particularly electronics and they became friends. On graduation in 1954 Alastair, with a Bachelors Degree in Mechanical Engineering, undertook part time lecturing in Mechanical Engineering while Ian, graduating in 1955 with a Bachelors Degree in Electrical Engineering, was employed by Philips at their factory Radio and TV Design Laboratories at Hendon, Adelaide. Over those years the two formed a working association that

designed and built electronic equipment. They both obtained amateur radio certificates of proficiency being allocated the call signs VK5IW and VK5ZAE respectively and together they built UHF mobile amateur radio equipment, perhaps their first joint venture into communications. Known everywhere as Wood and Wall, they initially operated out of Ian's home at Hampstead Gardens designing and building equipment for the University, repairing taxi receivers. Gradually their home business grew until with their normal day work there was no time for anything else. A decision needed to be made whether or not to go full time into their own engineering business.

Jim Bettison's interests were a little different from his University

engineering friends. There were common bonds such as a love of good cars (Ian having at the time an MG TC, Alastair a Triumph TR3A and Jim a Triumph TR2, both with electric overdrive). Jim's university fields of study were very different, yet complemented the two engineers, and included history, law and commerce. In 1961 he graduated with an Honours Degree of Bachelor of Arts in History. Having a love of theatre and the arts he secured for himself the agency for Strand Electric, UK, theatre lighting equipment manufacturers. When needed Wood and Wall were engaged to assist him designing variable reactors and such to control the lighting. From this situation it was but a small leap for the three to form a joint company, Ian and Alastair providing the engineering side and Jim the needed skills in commerce and law. The new company, The Electronic, Instrument and Lighting Company Limited was formed on the 1st July 1959. With the financial help of parents, adjacent house properties at 7 - 9 Osmond Terrace, Norwood were acquired, and early 1960 the company moved to this address.

In the beginning the company took on a wide range of work for it was a matter of survival. They applied their skills to redesign and manufacture medical instrumentation amplifiers for the company Both Equipment, the servicing of electronic instruments for government departments and other organisations, as well as the development of their own products such as theatre sound and lighting systems. Ian remained at Philips until the end of 1959 and even in later years used his TV knowledge and skills to do part time lecturing in TV at the SA Institute of Technology, School of



Figure 1. Type 6104 transceiver, Eilco's first set. Note the two whistles used to give the emergency tones

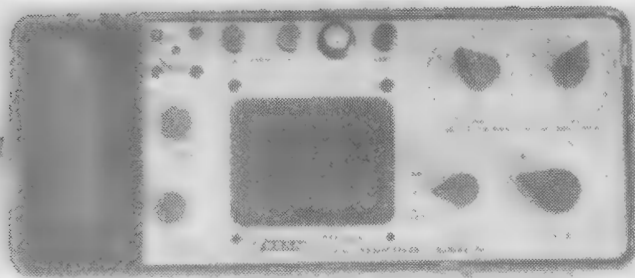


Figure 3a

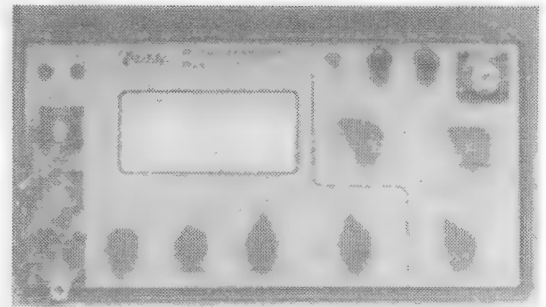


Figure 3d

Figure 3. Four versions of the portable type 6924 set. a) Original version, b) Mark two version having improved performance and used thick film modules, c) The new styling, having the same circuit as the Mark 2 and called the 6924B, d) Ruggedised water proof version called the type 6924C

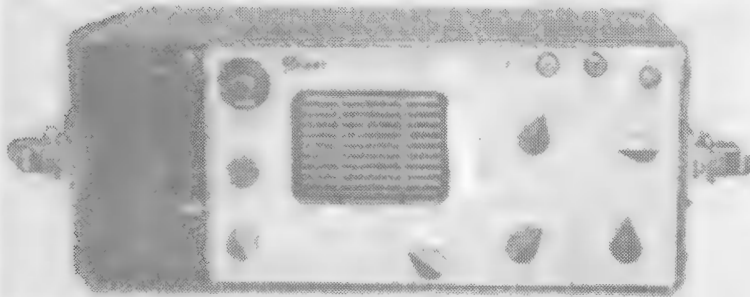


Figure 3b



Figure 3c

called Codan, an industry acronym for Carrier Operated Device (Delay (2)) Anti Noise, a squelch or muting system. Being a simple name, a word already known in the industry it was accepted. Codan Ltd business grew. About 1981 it was resolved that Codan and Eilco should amalgamate, AES remaining a separate entity, to concentrate on ticket machines and related products. This decision was quickly followed by a second move in 1983 when Eilco acquired all of the shares owned by the AES Director, Basil Reynolds, thus giving total control of Codan, including the name, to Eilco. With the growing market for SSB equipment the Codan name had now become better known than Eilco, so in 1983 a decision was taken to rationalise the whole activities of the company under the name of Codan Pty Ltd. The result was that the company became more focused and looked at ways of expanding its communication products. They did this by firstly, extending their HF range of equipment using recent technology advances, secondly moving up in frequency of operation to satellite and earth station equipment and finally placing even greater emphasis on the international market.

As part of the new Codan image, new styling for sets and a Codan logo were produced under contract with Chris Myers (product designer) and Lyndon Whaite (graphic designer)

respectively, both lecturers in the School of Design, Adelaide School of Art at the Underdale Campus of the SA College of Advanced Education. The early AM transceivers utilised armed service styled knobs and colours (blue grey) giving the impression these sets were equally rugged. The change to the standard grey and green colours with teardrop shaped knobs in 1968 conveyed the elegance seen on some American equipment of that era. The 1984 new image change was to black panels with black collet knobs, keeping products aesthetically pleasing, making touch up/restoration easier, as well as allowing older reliable sets to be "disguised" as if they were truly a new generation of products. The first of the new style sets released was the type 8525, a frequency synthesized transceiver allowing up to 99 channels which won the Electronics Association of South Australia's 1986 bi-annual Gold Cup, awarded for excellence in engineering and commercialisation.

Codan had an interest in the satellite communication field as far back as 1972 when the Australian Post Office published a study advocating Australians should enter it. In 1979 when the Hon A. A. Staley announced that a domestic system was envisaged for Australia, Codan responded. An area of unique need was identified, namely small earth terminals for two way communication and from 1980 Codan engineers, supported by the largest Industrial Research and Development Grant awarded hitherto by the Commonwealth, became involved in developing such a terminal for Ku-band using Australia's own Aussat satellites. In 1983 Codan received its first satellite equipment related order for five receive only earth terminals. Codan again diversified and moved into C-band equipment giving wider market opportunities. In 1984 a joint venture was commenced with M/A-Com Inc. of USA, called Microwave Associates Australia Pty Ltd and based in Sydney, to address the growing market for microwave communication systems, both for terrestrial and satellite communications. Early 1989 in conjunction with Sattel Technologies of California, they

were awarded an OTC contract to establish and operate a satellite based telephone service in the South Pacific Region. During 1991 Codan joined a new mobile satellite communications consortium which included Auspace Pty Ltd, CSIRO, Mitec Pty Ltd, Mosaic Electronics, Net-Comm and the Digital Communications Group at the University of South Australia. In 1998 Codan acquired Mitec, the Brisbane based company specialising in microwave RF design. All this allowed Codan to aggressively expand its existing range of satellite communications transceivers, to diversify into terrestrial microwave links, and to acquire specialist defence projects. While the initial growth in the satellite area had been slow it has currently reached the level where it is providing income at a level similar to the HF products.

Codan directors were well aware that for survival they needed to look beyond the Australian market. Once the reliability of their products was established in Australia this gave opportunity to look elsewhere, using Australian case histories to further the cause. By 1975 they were selling HF equipment into African countries. About this time a license to manufacture selected Codan products was granted to a New Zealand company owned by W (Bill) E. Barlow, Electronic Products Ltd. In 1978 Codan acquired the major interest and renamed the company in 1979 Codan (NZ) Pty Ltd. All this was to get behind NZ import licenses and when such licenses between Australia and NZ were abolished Codan (NZ) was closed in 1989 and their operations transferred to Adelaide. In a similar way to get behind trade barriers and into Europe Codan established in 1980 a marketing office and some manufacturing facilities at Fleet, Hampshire, England. Again once barriers were abolished the manufacturing facilities closed, but a marketing office retained to cover Europe, Africa and the Middle East regions. An office, previously in Vancouver, Canada, but now in Manassas, USA covers Canada, USA and South American countries. At present Codan exports to over 150 countries, accounting for some 85% of their production. Truly a global service.

Design and manufacturing philosophies

An original aim of the company was to bring professionalism to the electronics industry and this was interpreted by the founders in several ways all evident in their HF products. Four ways that reflected their professionalism in technical and business matters will now be considered. Combined, these factors led to the development and marketing of reliable cost efficient products.

i) Utilising the latest advances in technology in products.

The original transceivers such as types 6104 and 6332 utilised semiconductors wherever possible. Initially this was germanium transistors in the receivers, modulators and DC to DC converters required to generate any voltage higher than the battery voltage. Vacuum tubes could only be used for the transmitter. However, as soon as RF power transistors became available they were utilised and resulted in new type 6801 and 6924 transceivers. Similarly to ensure good receiver selectivity narrow band IF filters were incorporated, right from the outset. Initially for AM work ceramic resonator filters were used in the first few sets, but from then on magnetostrictive resonator mechanical filters were employed. The advent of SSB operation immediately brought a change over to high quality narrow band crystal filters, raising the IF frequency from 455kHz to 1650kHz to give a marked improvement in image suppression at the higher frequencies of operation.

Sets were always crystal controlled, a procedure necessary to achieve good frequency stability no matter whether the sets were used in the outback, in vehicles or ships, locations where extremes in temperature frequently occur. Printed circuit cards, were introduced in 1964 when a new single board receiver was made, designated the type 6415 and employed in several transceiver types. In about 1978 a decision was made to introduce thick film daughter board modules, each coated

with a non transparent epoxy material. This not only simplified construction, but added a measure of security to their products, in that what was in the modules remained confidential. The type 8525 set saw the introduction of microprocessor control and frequency synthesis and from then onwards there were moves to employ software to provide improved performance and flexibility.

ii) Ensuring that products were appropriate for their application, both in terms of electronic, mechanical and ergonomic performance, including appearance, robustness, reliability and maintenance procedures.

While excellent electronic design was essential so too was the mechanical construction and appearance aspects. Cadmium plated sheet steel of 16 and 18 gauges was normally used for construction, providing strength, lightness and resistance to corrosive materials. Aluminium of 18 gauge was employed for the front panel escutcheon. Controls and operating procedures were kept to a minimum so that people of all ages had little difficulty in using them. Further, the company maintained a comprehensive in house manufacturing facility enabling it to maintain good quality control and quality assurance procedures on all products.

No matter how well a set is designed, failures and/or upgrades will occur, so sets had to be repaired or modified. Consequently the manuals made available with each product were very comprehensive. Placement of components on PCB drawings, step by step descriptions of operation, upgrades, tuning, etc. were all included. By and large there was easy access to boards and components with boards either having cable connectors between them or plug in card connectors used.

iii) Incorporating flexibility in products, that is, sufficient options given so all sectors of the market could be satisfied.

Even the original type 6104 set was offered in four variations. The standard was a 5 channel set, but

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If you have achieved these they all fit nicely along the full width of the internal border and are colored Dark Green on a smart gold background.

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This special reward is for those that achieve minus nine of the total DXCC entity list. Its shape is round and is colored smart gold on a Black

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VK9W Willis Islands.

VK9X Xmas Island.

Samples of these updates will be soon viewed on our National Website or alternatively by email.

"This is another Federal Awards update, working to keep pace for our members in 2003".

CODAN HF Transceivers continued

there was also a single channel set, a 12 channel set in a larger case, plus a 5 channel version for light aircraft. Later sets had even greater range of options, examples being, number of channels, single and two frequency simplex; modes offered AM (H3E), CW, LSB, USB or combinations; clarifier - narrow or wide range, two tone call encoder, noise blanker, mute facility; battery pack; vehicle installation kit; whip antenna. Marine versions were available and these had an added option of output power level.

iv) Using the process of incremental product design to gradually improve the overall performance of products. The original 6104 set was constructed using valve techniques. Transistors were held in rubber grommets in the chassis with other circuit components mounted on tag strips. Both valves and transistor circuits could now be assembled in the same way. Once the 6415, a single PCB receiver was developed, it became the receiver section of the 6104 set, which was now called the 6104 Mark 2. This same combination

was then used in the type 6332 transceiver, a self contained set having a screw-on portable battery pack, whip antenna and carry bag. This idea of utilising modules developed in a range of products became even more common when SSB sets were made. The company developed a modular system of generation and reception of SSB signals, shown in Figure 2, and it became their standard. Improved blocks or modules developed for next generation sets could then be utilised in older type sets, resulting in a upgraded type number. A good example is the type 6924 set and illustrated in Figure 3. After thick film modules were developed and improved RF power transistors became available a new version the type 6924 Mark 2 was released. Next there was a cosmetic change from the green/grey/teardrop knobs styling to the black/silver grey/black knobs version which was renumbered 6924B. The 6924C version is a ruggedised, waterproof version of the 6924 Mk 2. Similar circuits, concepts and flow can be seen in the sister sets

type 6801 and 6801 Mk 2, that is, these sets match the 6924 to 6924 Mk 2 upgrade, but have a higher power RF amplifier with 50 ohm output impedance. Some sets were so similar that the one manual covered a series of transceivers. Naturally this process makes good engineering sense for it allows a steady progress in updating products, shares and minimises design and production costs as well as making life easier for those undertaking set maintenance.

(To be continued)

Notes

1. For a more detailed history of Codan see, Haskard, M R (2002) Radio Waves, "Codan - the era after Traeger Part 1", No. 81, July 2002, Historical Radio Society of Australia, Melbourne, Australia.
2. The CODAN acronym - According to F E Terman in "Radio Engineers' Handbook", McGraw-Hill, NY, 1943, page 653 the D stood for Device, yet Rob Gurr (VK5RG) maintains that in the local Australian industry it stood for Delay.

CODAN HF Transceivers

Part 2

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Codan HF transceiver types (3)

As with most electronic products, where new models are needed every two years or so, a surprising range of transceivers was produced, emphasis always being placed on compactness and performance. Popular types came out as series, later improved versions either a Mark 2 or with a letter added after the four digit type number to signify a

change. Significant upgrades included the use of thick film daughter boards, separate control heads, eventually all essential controls truncated to fit on the back of the microphone, frequency synthesis, microprocessor/software control, double conversion receivers, and remote interrogation from another location to ascertain the condition of a set. At least two attempts were made to produce "homestead" style sets (types 7303 and X-2), that is, sets whose

appearance fitted in with modern home styling, while the new generation transceivers (NGT) begin to appear a little like a "mobile" phone in styling. In the last decade the transceivers allow attachments, so that facsimile, data transmission, email and such can be sent over the HF link. Table 1 provides a listing of known transceiver sets, while Figure 4 gives examples of several different set styling.

Type No	Use (4)	Style (5)	Comments	Type No	Use (4)	Style (5)	Comments
6104	P	A	First set. Valve type construction. SS receiver, 455kHz IF, 5 channels, ceramic filters. Two valve transmitter, 8 watt RF. AM only.	6803	B	B	As 6802 above, but with remote control facilities
6104A	L		As above but 12 channels and in a larger case	6924	P	G	2-10MHz, 10 channel. Fully solid state. 1650kHz IF, 25 watt PEP, SSB (normally USB) and AM (H3E)
6104B	A		Special light weight version of above for light aircraft	6924 Mk2	P	G	2-13MHz, 10 channel. Fully solid state. 1650 kHz IF, 30 watt PEP, SSB (normally USB) and AM (H3E), output impedance 50 ohms (as well as in-built antenna tuner)
6104C	P		Single channel version of above	6924B	P	B	Same as 6924 Mk2 but new styling
6104 Mk2	P	A	As 6104 except PCB receiver type 6415 used, 455kHz IF mechanical filter	6924C	P	G	2-13 MHz, 25 watt PEP, 10 channel, ruggedised waterproof transceiver
6201	S		200kHz -18MHz receiver, transmitter 2-9MHz, marine AM set, 455kHz IF, 50 watt RF, Receiver DF loop	7005	B	G	10 channel, AM and SSB, similar to 6801 Mk 2
6319	M		1.6 - 10 MHz, 1 channel, AM set, 455 kHz IF, 25 watt RF.	7007	B	G	3 channel, AM only transceiver, styling similar 6801
6319A	M		As 6319. Minor modifications to the transmitter valve output stage.	7303	B	G	2-11 MHz, 5 channel, Fully solid state, 1650 kHz IF, 50 watt PEP, SSB (normally USB, and AM (H3E), output impedance 50 ohms, push button operation
6332	P	A	Battery pack. Whip antenna. Type 6415 single PCB SS receiver, 455kHz IF, mechanical filter. Two valve transmitter, 8 watt RF. AM only, 5 channels.	7307	B	P	Same as 7515, but in a special plastic case for "Homestead" use - School of the Air and RFDS. Emergency call fitted as standard.
6332A	P	A	As 6332 but 10 channels	7515	L	G	2-11 MHz, 6 channel initially then increased to 10, fully solid state, 1650kHz IF, 50watt PEP, SSB (normally USB and AM (H3E), output impedance 50 ohms
6605	B		Base station for EFS (CFS).	7727	L	G	Same as 7515 but increased RF power - 100 watt PEP
6619	P	A	1.6-10 MHz, AM set, 10 channel, 455kHz IF, mechanical filter, Valve output stage, 25 watt RF. B/C receiver built in.	7727-C	L	G	As 7727 above but cosmetically upgraded. Also available with remote control box and speaker
6717	H		1.6 - 10 MHz, Single channel, AM, hand held, 455 kHz IF, mechanical filter, 1 watt RF, internal battery	7727-T	L	G	As 7727 but with remote control
6801	L	G	Fully solid state. 1650 kHz IF, Output impedance 50 ohm. SSB (normally USB) and AM (H3E). 80 watt RF.	7727-TB	L	B	As above, but cosmetically different again having a digital channel display. Remote control box and separate speaker.
6801-P	B	G	As 6801 but made especially for PNG P & T	7924-B	P	G	2-13 MHz, 10 channels, solid state, 1650 kHz IF, 25 watt PEP output, SSB (Normally USB) and AM (H3E), ruggedised, water proofed, carry bag, sealed internal battery.
6801 Mk2	L, S	G	2-16 MHz. 10 channel. Fully solid state. Thick film modules used. 1650kHz IF. Output impedance 50 ohm. SSB (normally USB) and AM (H3E), 100 watt RF.				
6801-S Mk2C	S	B	Marine version 6801 Mk2				
6802	B	B	As above, 6801 Mk 2 receiver and exciter, modified transmitter output, 100watt PEP. RTTY and Fax operation				

Type No	Use (4)	Style (5)	Comments	Type No	Use (4)	Style (5)	Comments
7924-C	L	G	As 7924-B above. Option of a hand crank generator.	9323	L	B	As for type 9360 except transmitter 100watt PEP and on Australian 27 MHz CB band 10 watt PEP. Control head option is type 9330.
8121	S		2-13.2 MHz, 10 channels, 60W PEP, AM compatible only on 2182 kHz	9360	L	S	Synthesised, 400 channels, 10Hz resolution, microprocessor control, SSB, 50 ohm impedance. Receiver 0.25 - 30 MHz, 45MHz and 455 kHz IFs. Transmitter 2-26.5 MHz, 125watt PEP, CW or single tone approx 60% PEP. Control front panel or microphone keypad. Available with control head type 9366. In-built remote diagnostic facility.
8332	H	Y	1.6 - 6 MHz, 2 channel, 1watt PEP. Hand held set.	9390	S	S	Marine version of the 9360. With Type 4404 power amplifier increase PEP to 400 watt (Type 9390-H). Control head available type 9391.
8525	L	B	2-18 MHz, 99 channels, 20 standard, dual conversion receiver (IFs 45MHz and 1650kHz), frequency synthesised, digital display, SSB, 100 watt PEP	9480	L	S	Cut down version of 8528 for international market. Synthesised 15 channels with voice scanning, SSB, 2-24 MHz transmit, 100 watt PEP, optional control head type 9482, comprehensive LCD display, new automatic emergency digital calling
8525-B	L	S	2-24 MHz transmit, receive 250 kHz to 30 MHz, scanning up to 15 channels, SSB, 125 watt PEP, up to 99 channels with 20 standard, 50 ohm impedance, touch membrane controls, available with separate control head type 8530	9780	L	S	As for type 9360. Supports non-voice applications.
8525-S	S	S	A marine version above, 2-18 MHz transmit, receive 1.6 - 18 MHz, SSB but AM (H3E) on 2182 kHz.	HF1000	A	B	2-14MHz, SSB, 10 channels, 1650 kHz IF, 100W PEP, aviation transceiver, control head panel or rack mounting, digital channel readout
8528	L	S	2-24 MHz transmit, receiver 250 kHz - 30 MHz, up to 600 channels, receiver scanning up to 15 channels, SSB, transmit power variable 25 to 125 watt PEP, 50 ohm impedance, touch controls back lit liquid crystal display, available also with separate control head type 8531	HF2000	A	B	2-16MHz, SSB with AM (H3E) option, 28 channels, 1650 kHz, 100W PEP, aviation transceiver, control head panel or rack mounting, digital channel readout
8528-S	S	S	As above but marine version. Can have separate control head type 8531S, PEP of 125, 200 or 400 watt	HF4000	M	B	2-23MHz, 256 channels, marine transceiver, SSB with AM (H3E) on 2182 kHz, digital frequency readout, 150, 200 and 400 watt PEP
8528-I	L	S	International version of the 8528, having improvements in performance through new software. Identification plate carries a "K" prefix on the serial number.	2010	L		1.6-30 MHz, 125 watt PEP, SSB and AM (H3E) up to 400 (NGT xx) channels, operated from a remote desk console, supports non voice operations, receiver will tune down to 250 kHz. As a mobile unit needs junction box type 2030 Note: If the xx letters are - AR = Australia (100 watt), SR = System Radio, VR = Voice Radio (15 channels).
8727	L	S	2-16 MHz, 10 channels, SSB, 125 watt PEP. Also available separate control head type 8730.	NGT	R		2-30 MHz, 500 or 1000 watt PEP, NGT SR remote control, SSB, AM, external control, up to 400 channels
X-2	L	K	2-18 MHz, 10 programmable channels, LSB and USB, speech (Also 9105) processing, audio tones indicate important operating conditions/faults, output variable 25 to 125 watt PEP, dual RF output to match whip or dipole antennas.				
9313	L	S	Cut down version of the 8528 for the local market. Synthesised 15 channels, SSB, 100 watt PEP, 2-24MHz transmit, 0.25 - 30 MHz receive, control head type 9320, membrane switches, liquid crystal display				

Table 1 Codan transceiver set types and a brief description of them

Notes

3. For detail on other Codan HF products see, Haekard, M R (2002) Radio Waves, "Codan - the era after Traeger Part 2", No. 82, October 2002, Historical Radio Society of Australia, Melbourne, Australia.

4. Use—

- B = Fixed base use
- H = Hand held
- L = Land use both fixed and mobile
- M = Mobile vehicle operation
- P = Portable. Has in-built antenna tuning unit
- S = Marine use

5. Style—

- A = Grey with military style knobs
- B = Black painted with white lettering and black knobs
- G = Green painted (light front panel and dark case) and tear drop knobs. Some of the later sets were painted a very dark blue
- K = Polycarbonate case, khaki grey front panel, blue top cover
- PCB = Printed circuit card

R = Rack mounted

S = Case silver-grey with black or blue panel

P = Plastic case with push button switches and tear drop knobs

Y = Yellow polycarbonate case/Black panel with white lettering

continued page 17

Conclusions

The growth of Codan from the original three who founded the organisation to a staff of over 350 in a period of forty years is a remarkable achievement. Annual turnover now exceeds one hundred million dollars and the Codan name has become a household name, as much as

Traeger. Much of this success has been due to hard work in ensuring that products produced were reliable no matter what environment or circumstances. In a small way their contribution to the Australian outback and the electronics industry in general has been recognised by the winning of the Electronic Industries Association

Gold Cup and in 1990 Austrade's International Business Achievers Award.

Acknowledgements

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BT

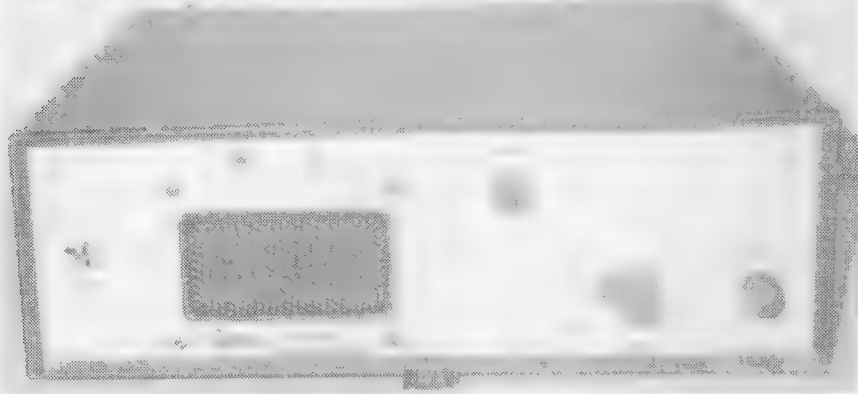


figure 4a

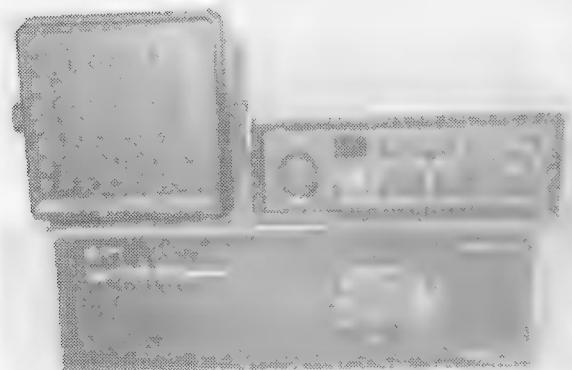


figure 4b



figure 4c

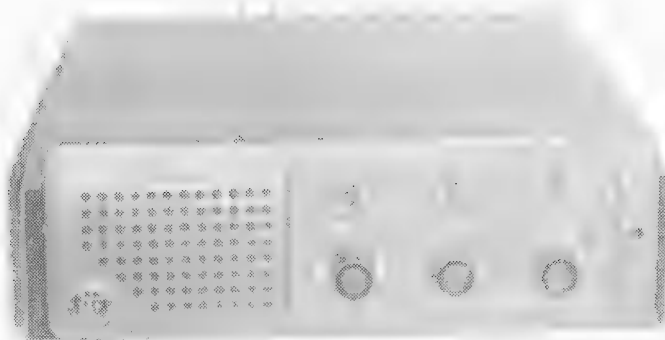


figure 4d

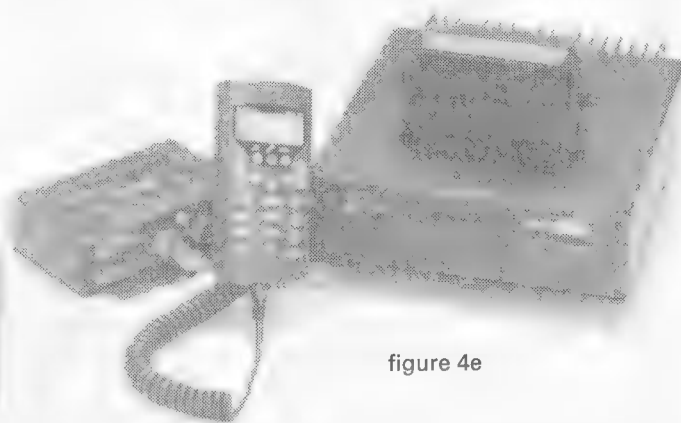


figure 4e

Figure 4. Models showing changes in transceiver styles. Types a) 6801, b) 7727-TB having separate control head, c) 8525 with separate control head, d) the X-2 or 9105 and e) 2010 (NGT) mobile version with junction box