FCC/MELLON MAR 1 2 1999

1 Handset control units C4900/C4901

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2 Transceiver units RT4800/-01/-22, and RT47xx duplex

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3 Service

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4 Accessories

How to use this manual

This workshop manual provides technicians with detailed information on all the products of the VHF series.

The first section deals with the handsets. In addition to the installation manual and the two operator's manuals - one for each handset - this section contains mechanical descriptions, diagrams, and parts lists.

Section two deals with the transceiver units. Like the previous section, it contains information on installation, operation, mechanical descriptions, diagrams, and parts lists.

The subject of the third section is service. Here you will find details on maintenance, test equipment, trouble shooting, how to check the system performance, adjustment procedures, the replacement of modules, and necessary adjustments after the repair or replacement of modules.

Finally, section four of the VHF workshop manual deals with accessories: Extra control units, an alarm panel unit, a PC program for the installation and test of the system, an options connector box, and a SPARC-bus splitter box.

Please note that in any PRELIMINARY edition made of this workshop manual, some of the above-mentioned chapters had not yet been completed at the time of printing, and were therefore not included. Please contact your dealer to get a copy of the final edition of the manual.

NB!

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PART 1
Handset control units C4900/C4901

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1 General information, CU description

In the VHF 4000 programme, there are two handsets for remote operation:

Handset for VHF telephony
- is a basic VHF handset with no DSC option. This handset is part of the A1 BASIC system. It can be connected to the other systems of the VHF 4000 programme performing VHF voice communication.

Handset for VHF telephony including DSC
- is similar to the VHF handset, but in addition it offers the possibility of transmitting and receiving DSC calls CLASS D, including PSTN (Public Switched Telephone Network) calls via a coast station. This handset is part of the A1 DSC system. It can be connected to the other DSC systems of the VHF 4000 programme, and can be used as an extra DSC terminal. In the hook there is a distress button and, in the US version, a 25W key.

2 Manuals

Installation manual C4900/C4901
A1 Basic VHF Operating Instructions
A1 VHF-DSC Operating Instructions

3 Service

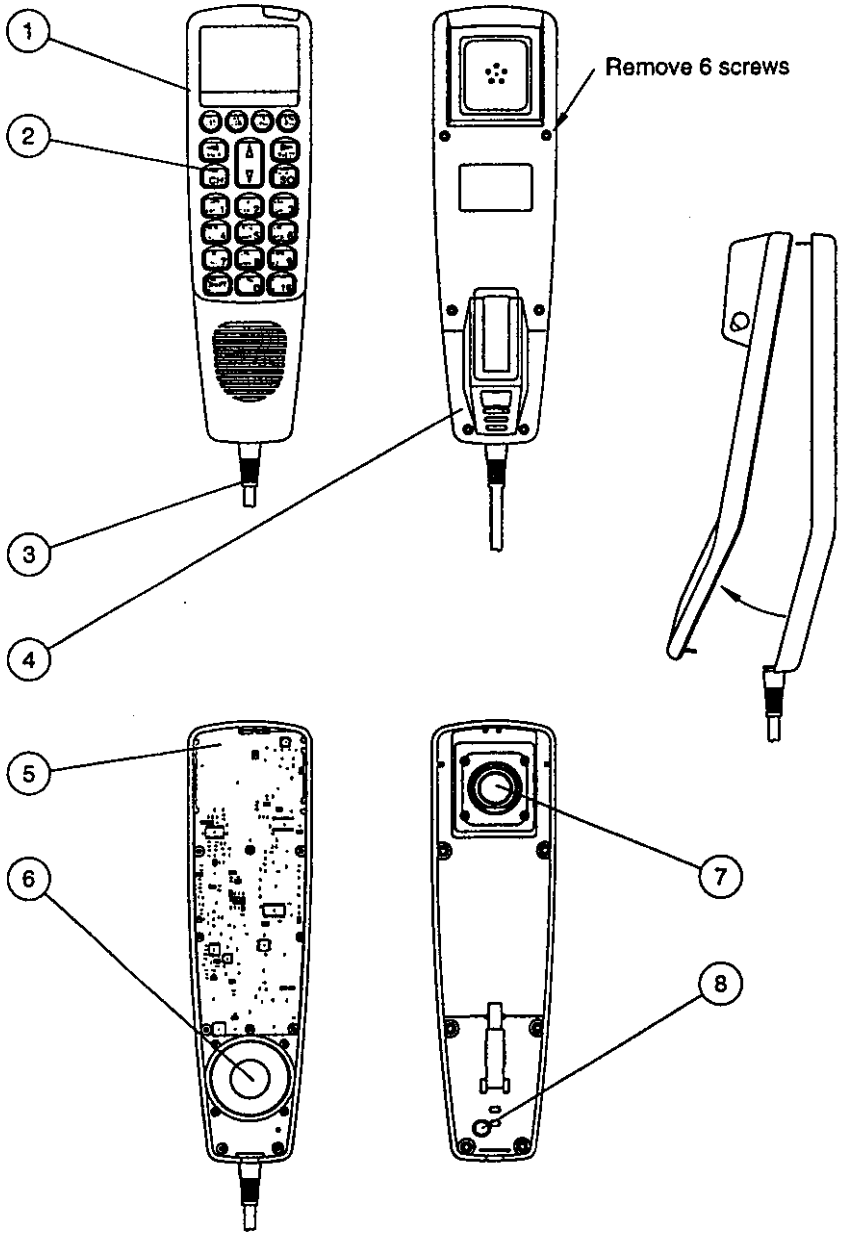
Please refer to part 3 of this manual: "Service".

4 Mechanical description

Mechanical parts lists

POS	NAME	PART NO.
1	Upper part assembly for handset C4900	730560
	Upper part assembly for handset C4901	730561
	Upper part assembly for handset C4900/BI	735670
	Upper part assembly for handset C4901/BI	735671
2	Keyboard buttons C4900	48.774
	Keyboard buttons C4901	48.754
	Keyboard buttons C4900/BI	48.883
	Keyboard buttons C4901/BI	48.884
3	Spiral cable	56.102
4	Handset lower part	48.761
5	HxC AF & MMI unit 32261	632261
6	Loudspeaker. 8 OHM 1.5W ø40mm	46.031
7	Transducer dynamic 150ohm	46.008
8	Microphone.electret ø6 x 2.9mm	46.015

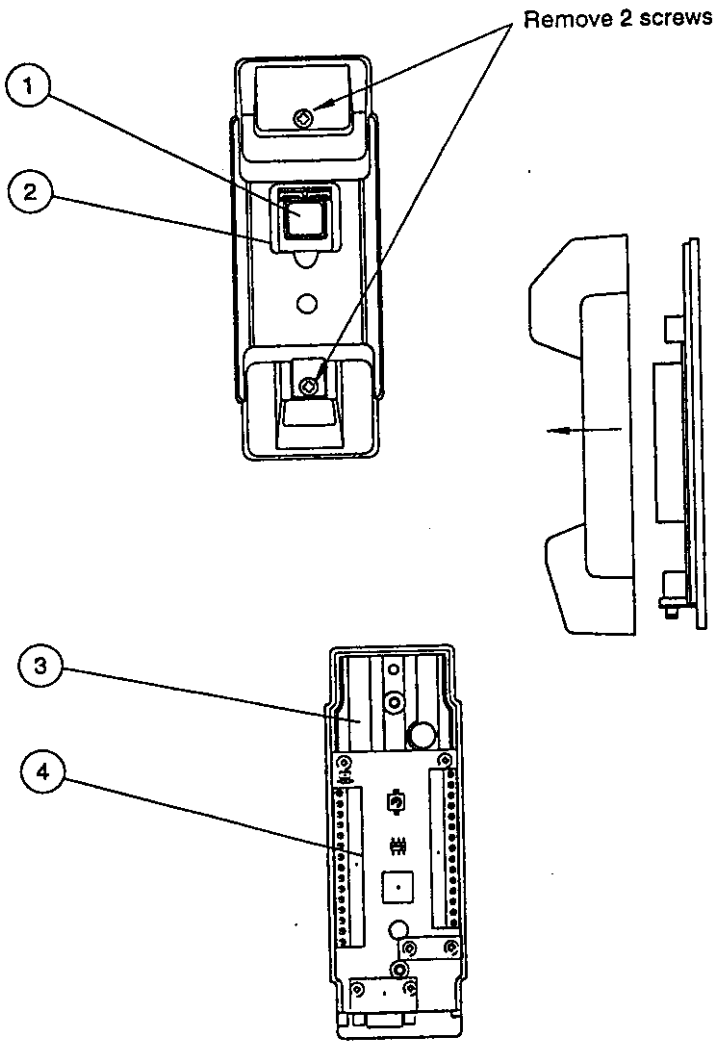
Exploded view C4900/C4901



Mechanical parts lists

POS	NAME	PART NO.
1	Light guide for hook (C4901)	48.759
2	Distress cover	48.771
3	Bottom plate for hook	48.801
4	Hook connection 32262	632262

Exploded view Hook connection



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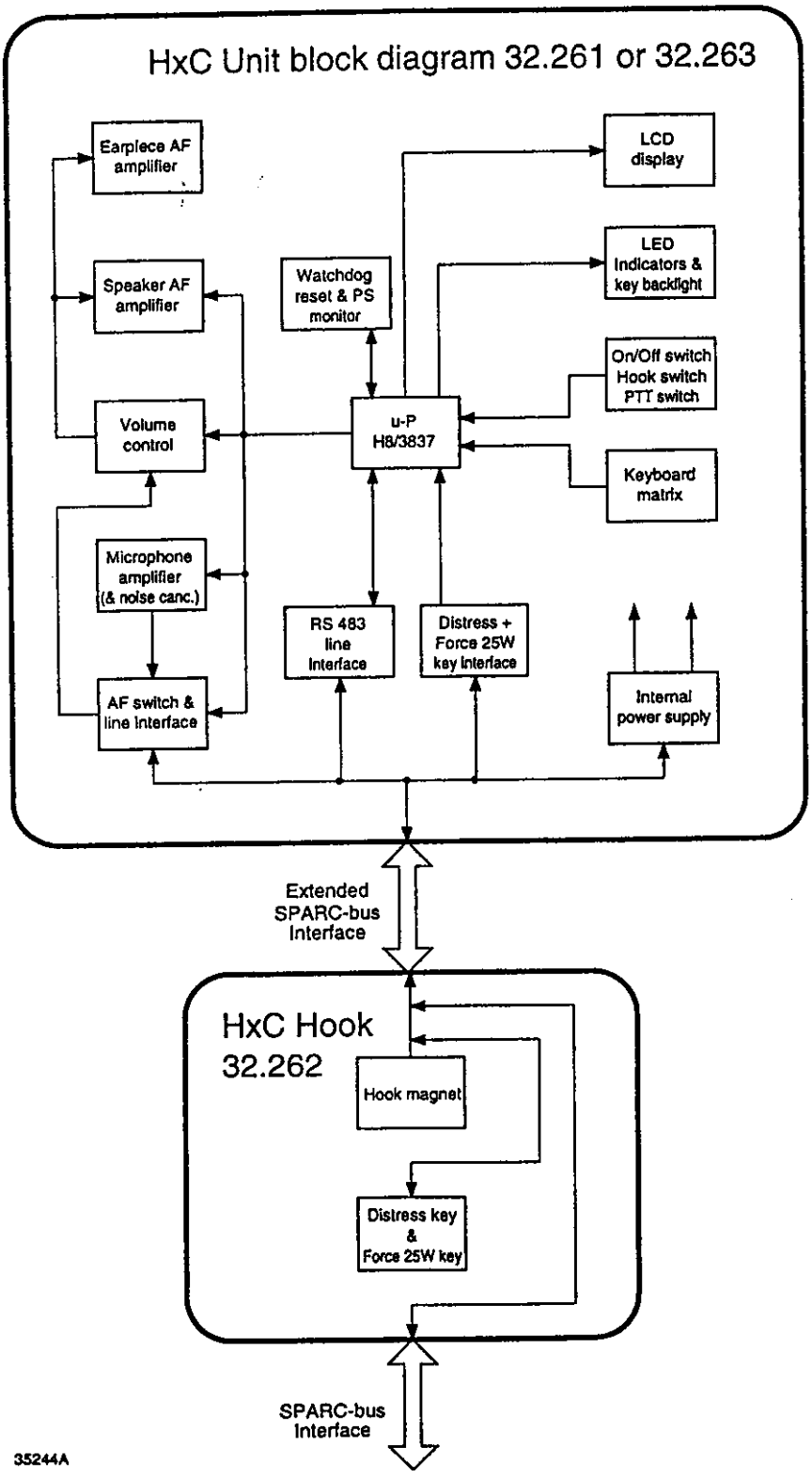
5 Circuit description and schematic diagrams

Block diagram for handset control unit includig hook:

Printed circuit boards 32261/32263 and 32262.



A handset unit contains two printed circuit boards: A board placed inside the handset (shown in the HXC unit block diagram above), and a board placed in the hook (shown in the HXC hook block diagram above). The handset hook board functions as an interface board between the handset extended SPARC-bus interface and the SPARC-bus interface.

Specific description of hardware blocks

Microprocessor H8/3837 and on-board SPI interface.
The microprocessor in the handset is the HITACHI H8/3837 which has 2 Kb RAM and 60 Kb ROM.
The processor runs at a clock of 4.9152 Mhz, from crystal Z1.
The processor connects to and controls the following items:
Controls the display, controls the display backlight intensity, reads the keyboard,
reads other user switches (ON/OFF, PTT, HOOK, DISTRESS and FORCE25W),
controls audio (AF) switches etc., generates alarm tones, communicates serially to the SPARC-bus,
controls the volume, keyboard and indicator LED light levels, and controls the on-board power supplies,
EEPROM and watchdog.

SPI data interface:
To control on-board peripherals N3 (attennuator), D2 (shift register) and D3 (EEPROM); a serial data interface of the SPI model is implemented by the microprocessor ports:
P3_3, p22: logic level output pin, data clock for serial communication.
P3_4, p23: logic level input pin; used for serial data input to the processor (from EEPROM).
P3_5, p24: logic level output pin; used for serial data output to the controlled devices.
Additionally also the following control pins are used for the SPI peripherals:
P3_0, p19: logic level output pin; enables the outputs of D2.
P3_1, p20: logic level output pin; latches in signal for D2 to set outputs according to last 8 data bits.
P3_7, p26: logic level output pin; chip selection for N3 to latch in serial data bits.
P3_2, p21: logic level output pin; chip selection for D3 to activate its latches.

RS 483 line interface
The RS 483 line interface is used as the communication channel by which the handset control unit receives and sends information to the transceiver unit or other control units placed at the SPARC-bus. The packet description is available in the document: SPARC-bus command specification. The line interface is a serial interface; the microprocessor uses its serial port 3 to receive and send data to the bus via the interface, which converts 0-5V levels to RS483 levels according to data sheet of Maxiim Max483 line interface driver.
Four microprocessor pins are used to complete the serial interface connecting to the SPARC-bus data line interface:
P1_6, p83: logic level, interrupt falling edge input pin for SPARC-bus packets interrupts.
P4_0, p85: logic level output pin; used to enable the TX part of the RS483 data line interface unit D5.
P4_1, p86: logic level input pin; used as serial data receiver pin for SPARC-bus data.
P4_2, p87: logic level output pin; used as serial data transmitter pin for SPARC-bus data.

LCD display & display backlight
The LCD display is a custom-built display consisting of 160 different segments forming symbols, VHF channel indication, and an information line of nine characters.
The display is controlled/driven directly from the microprocessor H8/3837.
Port A, p35-p32 : 4 display common pins
Port 5, p36-p43 : 8 display segment pins
Port 6, p44-p51 : 8 display segment pins
Port 7, p52-p59 : 8 display segment pins
Port 8, p60-p67 : 8 display segment pins
Port 9, p68-p75 : 8 display segment pins

The display backlight intensity is controlled directly from the microprocessor by a PWM output:
The PWM is used to set up 10 different display backlight levels including OFF. The PWM is controlled by the dimmer function. Each dimmer level (0-3) has a predefined setup intensity level (0-9) of the display backlight.
P1_4, p81 is used to output PWM signal to set the comparison level of N7-A op-amp which controls the current flow of the display backlight diodes (V1 and V28).

Indicator LEDs and keyboard backlight
The HxC unit has 3-5 indicator LEDs, placed right below the LCD display, to inform the user of the current operation state.
From left to right:
TX red. **1W** red. **US/BI** yellow. **CALL** green. **ALARM** red.
The intensity of the LEDs can be adjusted in four different steps. This feature is implemented as a 4 step constant voltage regulating circuit perfomed by the op-amp N7-b. N7-b gets V-set at IN+ and V-feedback at IN-, thus controlling the transistor V22 to output a constant voltage at its emitter pin. The five LEDs are fed by the transistor V22 and the serial shift register D2 controls the LEDs' on/off function and the V-set of the op-amp.
The keyboard backlight is controlled by the circuit of op-amp N7-c, transistor V20 and R54, performing a constant current generator for the keyboard backlight diodes V9-V13, V16, V21 and V23-V27.
P1_5, p82: logic level output pin. The light is turned on/off by the logic level signal KEYB_LIGHT_ON.
The on-board serial interface (SPI) is used to set up shift register D2.
The light intensity is set by shift register D2 through resistor divider of R22,R25 and R44,R50 feeding V-set to op-amp N7-c IN+.

ON/OFF switch, hook switch & PTT switch
1. **ON/OFF switch:** The switch S17 generates logic level signals according to pushed/not pushed informing the micro-processor (ON/OFF_DET): **PC_0**, p98 and the transceiver unit in the VHF4000 system (SUPPLY_ON) via the SPARC-bus.
2. **Hook switch**: The switch K1 (reed relay) generates logic level signal according to handset on hook or not, informing the microprocessor by the signal (HOOK): **PC_2**, p100.
3. **PTT switch**: The switch S15 generates logic level signal according to PTT pushed/not pushed informing the micro-processor by the signal (PTT): **PC_1**, p99:

DISTRESS + FORCE25W key interface
The DISTRESS key and the FORCE25W key are read from the extended SPARC-bus plug pin X3-1 via an analogue input pin at the microprocessor (D4 pin 1). The EXT-KEY_INPUT at the microprocessor is, by default, pulled to +5VA by R16 when no key is pushed. When a key is pushed (placed at the hook print) a resistor divider is performed by R16 and a key corresponding resistor in the hook print, changing the voltage level of the signal EXT-KEY_INPUT.
Voltage levels are determined by a key pushed as shown below. The minimum level is included in the specific window.
PC_3, p1: input of DISTRESS key and FORCE25W key, placed at the hook PCB (analogue level window).

Key according to	input threshold levels min/max [V]
no key	3.5/5.0
DISTRESS	2.8/3.5
FORCE25W	2.2/2.8
DISTRESS+FORCE25W	1.5/2.2

Keyboard matrix
To control the keyboard for the key scanning to function, 11 I/O pins are used forming an 3*8 keyboard matrix structure. The keyboard matrix covers the 22 keys forming the handset keyboard.
P2_0 - P2_2, p11-p13: are used as **level output** pins (logic level) for the 3 columns in the keyboard matrix. Each output is toggled in sequence.
Port B, p90-p97: are used as **level input** pins (logic level) for the 8 key rows in the keyboard matrix, detecting individual key states, pushed/not pushed for every P2_X output sequence.
The microprocessor toggles each column 0-5V at duty cycle 1/3, detecting key pushes at each row of input pins according to the exited column. The read key task runs every 10 milliseconds, so each key is read every 30 milliseconds.

Internal power supply
There are three different internal power supplies. Each supply is generated from the SPARC-bus supply line named V-BAT in the diagram. The incoming voltage V-BAT is fused on board by F1:
+5VA: This voltage is used to feed all digital circuits on the board. It is always present when +12V is present at the SPARC-bus and the handset is connected. IC N1 outputting +5V DC at pin_1

+5V: This voltage is used to feed the circuits generating audio and light. The supply is only active if any light or audio is turned on. The supply can be switched on/off by the transistor V15, which is controlled by the microprocessor port **P2_5**, p16 signal ON/OFF_FET.
+5V is generated by the IC N5 performing +5V DC.

+8V: This voltage is used to feed the circuits generating audio and light.
The supply is only active if any light or audio is turned on. The supply can be switched on/off by the transistor V15, which is controlled by the microprocessor port **P2_5**, p16 signal ON/OFF_FET.
+8V is generated by the IC N6 performing +8V DC at pin_1.

+2,5V: This voltage is used as virtual ground reference for the audio circuits on the board.
+2.5V DC is generated by the op-amp N7-D, setting the voltage according to the voltage +5V and the voltage dividing resistors R56-R60.

Also, an individual "power supply" is implemented for the microphone amplifier circuit.
D2_7 functions as power supply output pin to the microphone amplifier circuit, making it possible to switch the circuit on only when needed (the PTT key is pushed).

Watchdog reset & power supply monitor
To monitor the on-board power supplies and proper program execution of the microprocessor, the watchdog D1 is implemented. The watchdog is connected to the microprocessor D4 by 4 ports. The watchdog features are:

1. Watching the +12V supply from the SPARC-bus (PFI pin4). Informing the microprocessor if voltage fades (PFO pin 5)
   P4_3, p88: logic level interrupt input pin, power fade (not OK) or power rise (OK) indicating SPARC-bus power supply.
2. Watching the +5VA supply (VCC pin 2). Resetting microprocessor if fading.
   RESET, p9: logic level input pin, resets the microprocessor when logic low.
3. Watching proper program execution of the H8/3837. (WDI pin 6). Resetting the microprocessor (by WDO to MR input) if toggle signal at WDI stops.
   Microprocessor **P2_4**, p15: logic level output pin, ALIVE signal to the watchdog, indicating proper microprocessor performance, i.e. toggled either up or down at least once every 1.6 seconds.
4. Generating reset signal to the microprocessor when MR (pin 1 manual reset) is pulled logic low by the microprocessor. **P2_3**, p14: logic level output pin, ON/OFF_RESET signal to the watchdog, getting the watchdog to generate a reset sequence back to the microprocessor.

AF switch & line interface
Reception of signals:
RX_AF, audio from the receiver:
To route the received signal from the SPARC-bus to the speaker/earpiece, the signal first passes the RX/LF line interface circuit (an audio filter, SPARC-bus balanced to unbalanced converter and LF switch) implemented by the op-amp N9-A and the switch N8-A. N9-A realizes a filter function of 6 dB/oct for de-emphasis. It also converts the balanced SPARC-bus signal to single-ended on-board signal.
P3_6, p25: logic level; sets N8A switch, used to route the received signal to the handset loudspeaker and earpiece during VHF telephony.
AF, audio to/from the control units:
When control unit intercom is carried out, switch N8-B routes the audio signal through the AF line interface circuit implemented by N9-B, (an audio filter and SPARC-bus balanced to unbalanced converter).
P1_3, p80: logic level; sets N8-B switch. When an intercom between control units is carried out, this switch routes the TX audio from the SPARC-bus to the handset loudspeaker/earpiece.

Transmission signal:
The transmission signal is generated in the microphone, amplified by N11-A and converted to balanced SPARC-bus signal by the circuit around N10.
P2_6, p17: logic level; disables N10 which functions as buffer and single/balance signal converter for the microphone signal to the SPARC-bus audio signal.

Earpiece AF amplifier
N2-B amplifies/buffers the AF signal from the attenuator N3 to drive the earpiece unit.
The amplifier delivers approximately 4 mW of power into the earpiece unit.

Microphone amplifier (& noise canceller)
N11-A amplifies/filters the signal from the microphone unit to the level used at the SPARC-bus AF lines.
P1_0, p77: logic level; sets N8C switch
P1_2, p79: logic level; sets N8D switch
Used as attenuation feed through of microphone signal during intercom dB, and for monitoring during normal VHF telephony.

Volume control
Volume control is performed by the attenuator N3. Inside N3 there are two independent signal attenuators, one used for the speaker signal and one for the earpiece signal.
The microprocessor sets the attenuation levels by transmitting control codes to N3, using the on-board serial interface.

Speaker AF amplifier
The audio signal to the speaker is buffered/amplified by the circuit around N2-A and N4.
The output signal from the attenuator N3 is buffered by op-amp N2-A, feeding the speaker amplifier N4.
N4 delivers approximately 245 mW of power into the speaker unit.
P2_7, p18: logic level; disables N4 which is the handset loudspeaker amplifier.

Alarm tones
The microprocessor generates alarm tones to the handset loudspeaker and earpiece.
P1_1, p78: is used as alarm tone output pin. The output signal is a square wave logic level (0-5V) signal; the square wave frequency sets the output tone.

HXC hook connection 32262
The hook connection board functions as interface to/from extended SPARC-bus/SPARC-bus. It also contains the DISTRESS button for the handset unit and the FORCE25W button for handsets using the US channels.

Connection description:
X1 & X3: SPARC-bus connection, to/from system.

Pin 1:	SUPPLY_ON	ON/OFF pulled low when on
Pin 2:	SPARC+	RS483 data line
Pin 3:	SPARC-	RS483 data line
Pin 4:	AF+	Audio TX and intercom
Pin 5:	AF-	Audio TX and intercom
Pin 6:	GND	System supply ground, battery-
Pin 7:	+12V DC	System supply
Pin 8:	RX_AF+	Received audio
Pin 9:	RX_AF-	Received audio
Pin 10:	+12V DC	System supply
Pin 11:	LS_1+	Loudspeaker 1 audio
Pin 12:	LS_1-	Loudspeaker 1 audio
Pin 13:	GND	System supply ground, battery-
Pin 14:	LS_2+	Loudspeaker 2 audio
Pin 15:	LS_2-	Loudspeaker 2 audio

X2: Extended SPARC-bus connection (to/from handset unit).

Pin 1:	SUPPLY_ON	ON/OFF pulled low when on
Pin 2:	SPARC+	RS485 data line
Pin 3:	SPARC-	RS485 data line
Pin 4:	AF+	Audio TX and intercom
Pin 5:	AF-	Audio TX and intercom
Pin 6:	GND	System supply ground, battery-
Pin 7:	+12V DC	System supply
Pin 8:	RX_AF+	Received audio
Pin 9:	RX_AF-	Received audio
Pin 10:	KEY_LIGHT	To drive backlight in DISTRESS button from the handset
Pin 11:	EXT_KEYINPUT	Voltage level for handset to detect key pushes at hook
Pin 12:	EARTH	
Pin 13:	EARTH	
Pin 14:	EARTH	
Pin 15:	EARTH	

PART 2
Transceiver units RT4800/ -01/ -22, and RT47xx duplex

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1 General information: Transceiver and SCC unit description

The VHF 4000 programme consists of the following VHF transceivers:

Black box transceiver for VHF telephony
- is a basic VHF without DSC made for use in the A1 naval areas. It is primarily targeted at the leisure boat market. As an option, this transceiver can be equipped with an ATIS (Automatic Transmitter Identification System) module.

The transceiver consists of a black box to which one aerial can be connected, and a SPARC-bus interface for the connection of one or more remote handsets. The box contains the transceiver and the optional ATIS module.

The A1 BASIC system consists of this transceiver and the VHF handset.

Black box transceiver for VHF telephony and DSC
- is a transceiver similar to the VHF version, and also targeted at the leisure boat market.
In addition to the features of the basic VHF transceiver, it has an extra aerial connector and an extra receiver for the DSC watch facility. Furthermore, this transceiver contains a VHF-DSC modem which can be set up to work as an ATIS module besides the transmission/reception of DSC calls. Available are also an option box with an NMEA interface, among other things, and a SPARC-bus interface for the connection of more remote handsets.

The A1 VHF-DSC system consists of this transceiver and the VHF-DSC handset. Also, the system can be operated by the VHF BASIC handset, for VHF voice operation.

Transceiver with integrated control unit for VHF-DSC telephony
- is a VHF with DSC class A. The system consists of a transceiver with an integrated control unit, including a handset. The transceiver has the same external connections as the black box VHF-DSC transceiver, and in addition a printer interface. Also, it contains a VHF-DSC modem which can be set up to work as an ATIS module besides the transmission/reception of DSC calls.

This transceiver is provided with a handset that only contains wires for the loudspeaker, a microphone and a switch to indicate whether the handset is hooked off. It is only possible to use this handset when directly connected to the transceiver. In fact, to ensure proper function, the handset must be directly connected to the transceiver. The radio can either be operated from the front or by one of the remote VHF BASIC/VHF-DSC handsets.

The front panel is an operation panel for the transceiver with soft keys and a fully alpha-numeric LCD display for easy access and use.

Due to the large LCD display, the setup of calls through the SCC (System Combined Control) unit is performed in an easy and efficient way, no matter what type of call.

It is possible to connect up to seven control units to one VHF-DSC transceiver unit. This makes it possible to operate the transceiver from different locations. Also, when more control units are connected, it is possible to use the system for intercom between the various control units. The location assigned to each individual control unit determines both the address when using intercom, and the priority of the control units, i.e. which control unit controls the transceiver.

2 A1 VHF Basic & A1 VHF-DSC

2.1 Manuals

Installation A1 VHF-DSC/BASIC VHF
Henvisning til håndsæt installations- og betjeningsmanualer

2.2 Service

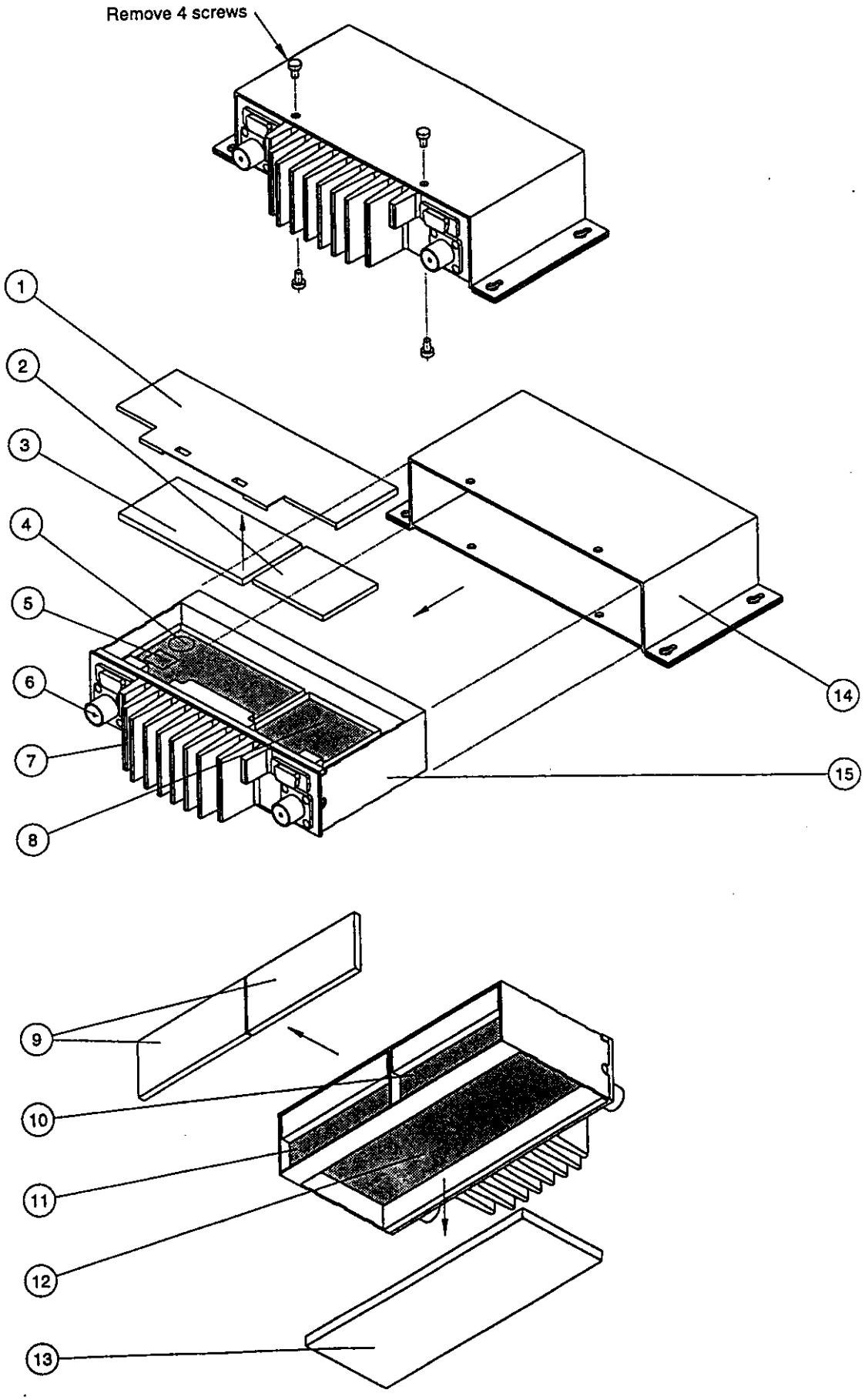
Please refer to part 3 of this manual: "Service".

2.3 Mechanical description

Mechanical parts lists

POS	NAME	PART NO.
1	Cover for proc.	230462
2	Cover for shield	235507 (RT4800)
	Cover for shield	233564 (RT4801)
3	Cover for shield	235508 (RT4800)
	Cover for shield	233566 (RT4801)
4	Battery Lithium 3V/0.22Ah ø20x3.2	47.007
5	EEPROM 8k Bit serial	356.323
6	Chassis FATNING SO239	78.504
7	Cooling fin	59.045
8	RTU AF & Processor	63225001 (RT4800)
	RTU AF & Processor	63225002 (RT4801)
9	Cover for receiver	230461
10	RTU Receiver	632252
11	RTU Receiver	632252 (only for RT4801)
12	RTU Transmitter	632251
13	Cover for transmitter	233868
14	Cover for VHF	23355010
15	Chassis	59.047

Exploded view A1 basic VHF/A1 VHF-DSC



2.4 Block diagram & circuit description

Please refer to chapter 4: Circuit description and schematic diagrams

3 RT4822 VHF-DSC

3.1 Manuals

Installation manual RT4822 VHF-DSC
RT 4822 VHF-DSC Operating Instructions

3.2 Service

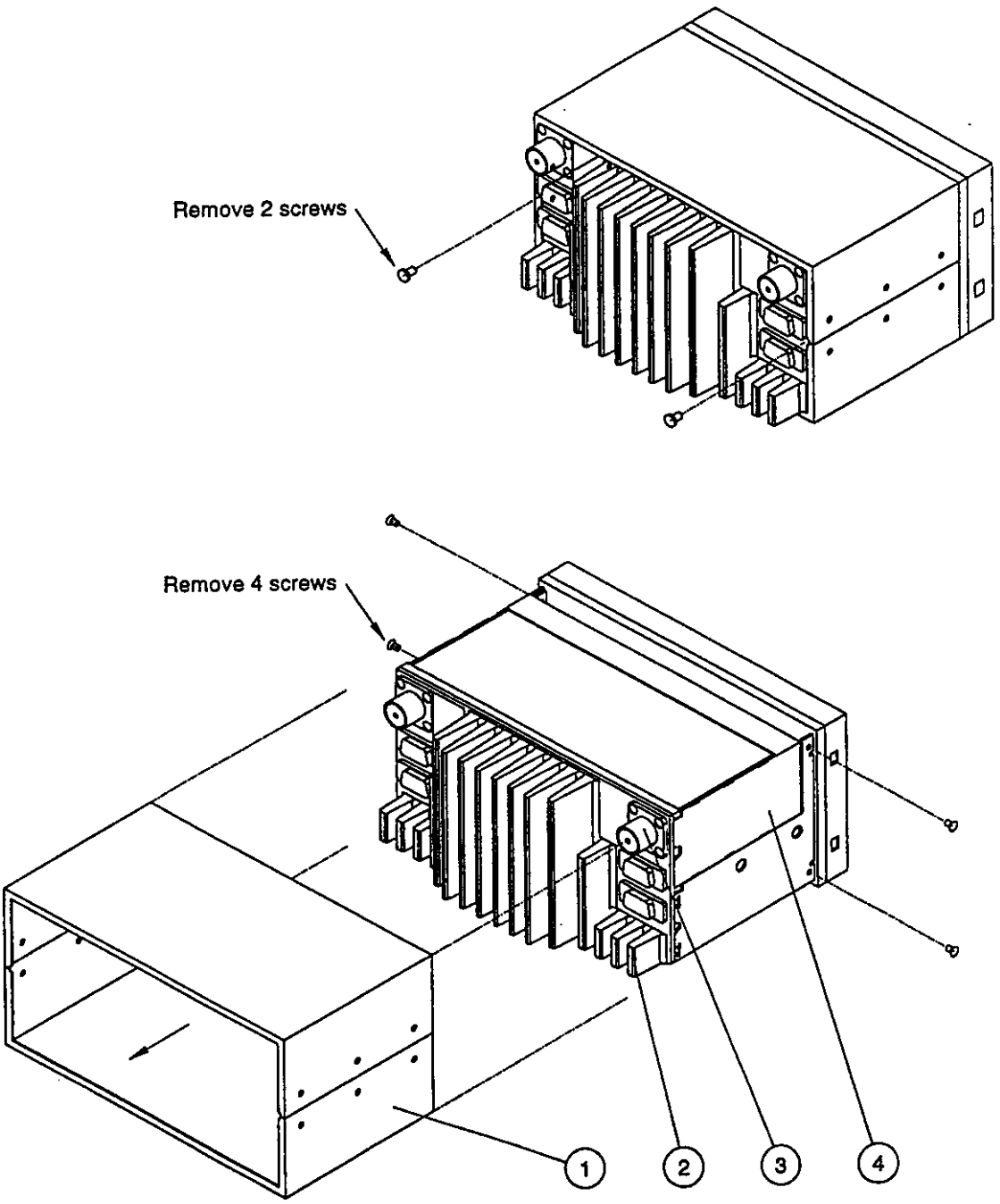
Please refer to part 3 of this manual: "Service".

3.3 Mechanical description

Mechanical parts lists

POS	NAME	PART NO.	
1	Cover	230553xx	
2	Cooling fin	59.046	
3	Antenna jack (female) SO239	78.504	
4	Chassis	59.047	
5	RTU Transmitter	632251	
6	RTU Receiver	632252	
7	Cover for receiver	230461	
8	Loudspeaker 4 OHM 5W 50x90mm	46.046	
9	Display LCD	25.718	
10	SCC Indicator	632255	
11	Display window	48.776	(sailor)
12	Air filter	51.008	
13	Left side chassis	230478	
14	RTU Transmitter	632251	
15	Battery Li 3V/0.22Ah ø20x3.2	47.007	
16	EEPROM 8k Bit serial	356.323	
17	Handset conv. 32257	632257	
18	Interface 32253	632253	
19	Housing for front chassis	164.073	
20	SCC Keyboard	632254	
21	Light guide	48.811	
22	Frontfoil	51.484	
23	Frontal plane	230400xx	
24	Distress cover	48.813	
25	Distress frame	48.814	
26	Knop "VOL" ø21x12.3mm	84.156	
27	Knop "SQ" ø10x11.0mm	84.151	
28	Driving mechanism	84.154	
29	Right side chassis	230477	
30	Printer conv. 32270	632270	

Exploded view RT4822



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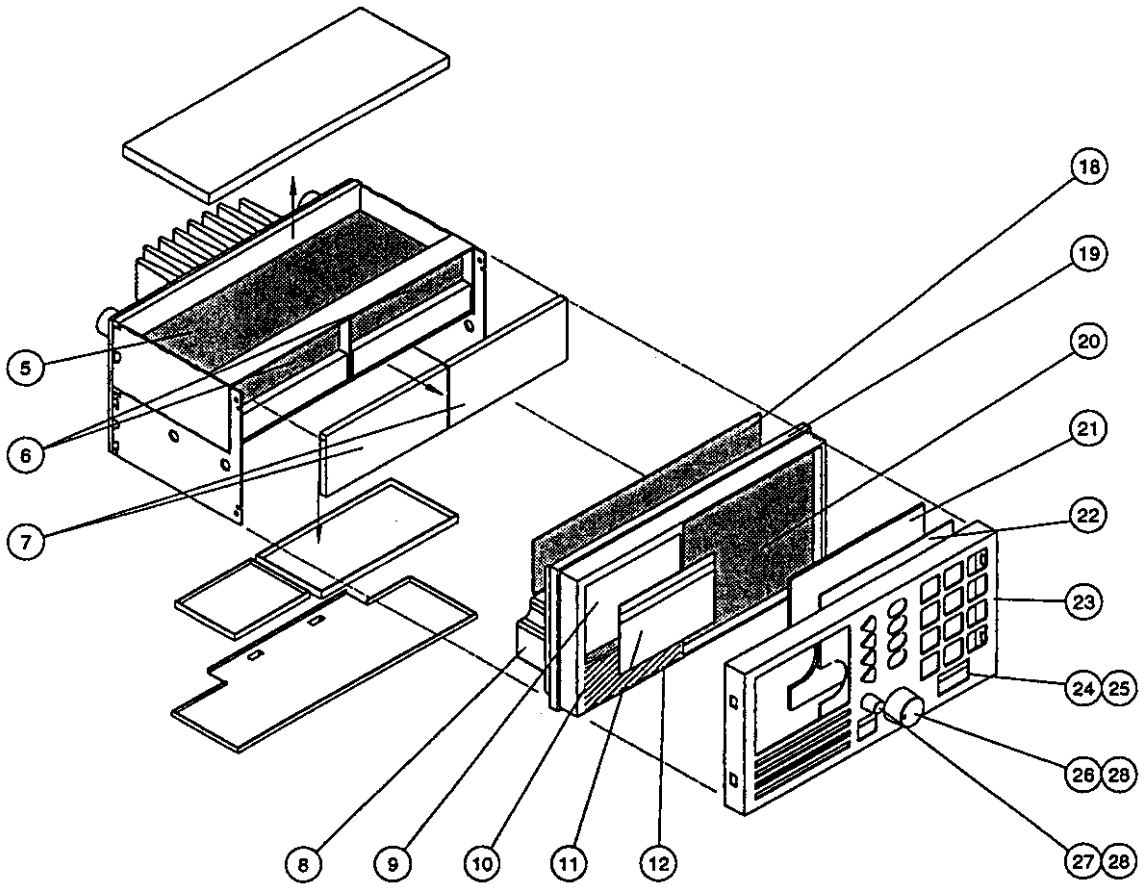
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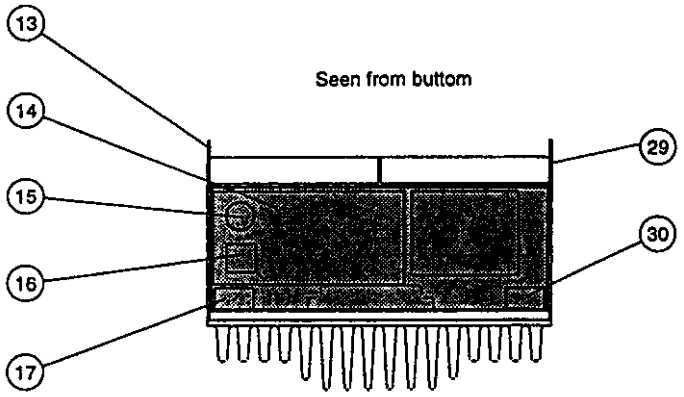
13
14
15
16
17
Seen from buttom
29
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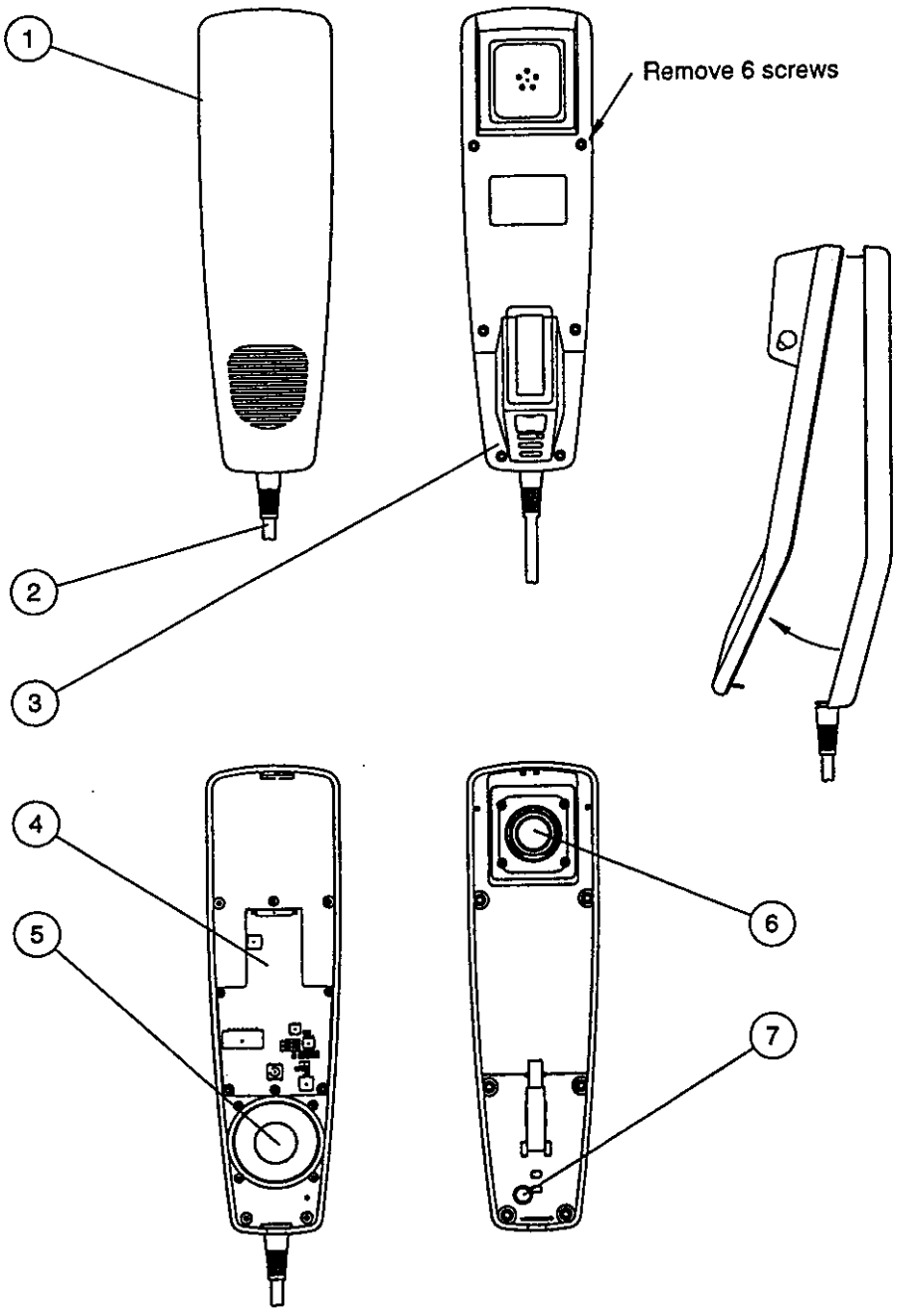
36867

Mechanical parts lists

POS	NAME	PART NO.
1	Handset upper part	48.769
2	Spiral cable	56.102
3	Handset lower part	48.761
4	Handset unit 32264	632264
5	Loudspeaker. 8 OHM 1.5W ø40mm	46.031
6	Transducer dynamic 150ohm	46.008
7	Microphone.electret ø6 x 2.9mm	46.015

Exploded view Handset for RT4822



3.4 Block diagram & circuit description

Please refer to chapter 4: Circuit description and schematic diagrams

4.4 Duplex filter

NB! This chapter is relevant to duplex transceiver versions only.

4.5 Interface unit 632253

Power supply
+5V, +8V, and +12V are applied from the transceiver unit 632250.
Negative supply for the contrast voltage to the display is generated by the circuit around N1-D including temperature compensation.

On/off circuit
The on/off circuit is used for the detection of the on/off condition. Hardware turn on and software turn off.
The on/off key is separately read by the microprocessor input pin_25.
The circuit around V6-V7 enables the microprocessor to watch the state of the on/off key, together with the hardware turn-on function by pulling the line signal ON_OFF logic low.

Reset
A reset circuit (D2) keeps the microprocessor reset for at least 100 milliseconds after power on, waiting for voltage settling before program execution starts up.

Microprocesser, memories and chip selection
The microprocessor used is an H83003 (D4), and with a 512 kbyte PROM, a 128 kbyte RAM, and a 128 kbyte Flash PROM, it makes the microcomputer part of the control unit. The processor has a built-in watchdog, which will reset the system if program failure occurs.
The EEPROM (256 bytes) D3 is used to read/store setup parameters used in the control unit.

Backlight
There are three different circuits for regulating indicators (N1-A), display (N1-C) and keyboard (N1-B). The microprocessor makes a voltage by means of a PWM output. This voltage is used as a reference input for the regulation.

Contrast control
The microprocessor makes a voltage by means of a PWM output. This voltage is amplified (N1-D) and used as the contrast voltage for the display.

SPARC-bus interface
The RS483 driver (D11) is used as a SPARC-bus interface to communicate with the transceiver and other control units.

Centronics interface
The Centronics interface is used to print out received DSC calls. The latches (D8,D9) are the hardware interface.

MIC amplifier
The microphone amplifier signal (MIC) is converted from unbalanced to balanced in the circuit around N7. The AF signal is the input to the transmitter.

RX AF
The RX AF is converted from balanced to unbalanced in the circuit around N6-D.

Intercom
When an intercom between control units is performed, the SPARC-bus AF signal is switched by N5-A and converted (balanced/unbalanced) by the circuit around N6-C.

Summation amplifier and attenuator
The summation point of the AF is made in N3-D. The audio attenuator (N2) is used to control the output level to the earpiece.

Earpiece amplifier
The earpiece amplifier N4-A amplifies the signal from the volume control to the earpiece in the handset. (TLF).

PART 3
Service

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1.3 Change of software 1

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1 System maintenance

1.1 Preventive maintenance

If the VHF system has been installed in a proper way, the maintenance can, dependent on the environments and working hours, be reduced to a performance check at the service workshop at intervals not exceeding 12 months. A complete performance check list is enclosed in this manual, chapter: System performance check.
The inspection of the aerial, cables, and plugs for mechanical defects, salt deposits, corrosion, and any foreign bodies should be done at regular intervals not exceeding 12 months.

Along with each VHF system, a test sheet is delivered listing all the measurements made in the test department of the factory. If the control measuring made in the service workshop does not show the same values as those listed in the test sheet, the set must be adjusted as specified in chapter: Adjustment procedures.

1.2 Change of battery for back-up

The VHF system is constructed with a real-time clock which uses a lithium battery for power back-up. By means of this battery, it is possible to maintain track of time and date even though the VHF system has been turned off.
The capacitance of the battery is 220 mAh (milli Ampere hours), and if the real-time clock consumes a current of about 12.5µA, the battery should last for a period of app. 2 years. However, in practice this period will be longer because the battery is only used when the VHF system is turned off.
The battery is located at the AF & processor module (632250) and is soldered to the PCB to obtain mechanical stability.
If you need to order a new battery, please note that the spare part number is: 47.007.

IMPORTANT!
To avoid environmental damages caused by the lithium, the old battery must be handed over to the authorities for proper destruction.

1.3 Change of software

The AF & processor module includes the PROM D9, which contains the software. To locate this PROM, please see the component location of the module described in this manual, part 1 and 2, chapter: Circuit Description and schematic diagrams.

2 Necessary test equipment

OSCILLOSCOPE:

Bandwidth	DC-35 MHz
Sensitivity	2mV/div
Input impedance	1 Mohm//20 pF
E.g. Philips type	PM3050

PASSIVE PROBE:

Attenuation	20 dB
Input impedance	10 Mohm//15 pF
Compensation range	10-30 pF
E.g. Philips type	PM8936/091

MULTIMETER:

Sensitivity DC (f.s.d.)	100 mV
Input impedance	10 Mohm
Accuracy DC (f.s.d.)	1.5%
E.g. Philips type	PM2505

FREQUENCY COUNTER:

Frequency range	100 Hz - 165 MHz
Resolution	1 Hz at f = 100 MHz
Accuracy	1×10^{-7}
Sensitivity	100 mV RMS
Input impedance	1 Mohm/30 pF
E.g. Philips type	PM 6674

RF SIGNAL GENERATOR:

Frequency range	155 MHz - 165 MHz
Output level:	-124dBm - +7dBm (EMF: 0.25 μV_{RMS} - 1 V_{RMS})
Output impedance	50 ohm
Type of modulation	FM
Modulation frequency	External: 1.3kHz, 2.1kHz / Internal: 1kHz
E.g. Rohde & Schwarz	CMT

RF MODULATION METER:

Frequency range	155 MHz - 165 MHz
Input impedance	50 ohm
E.g. Rohde & Schwarz	CMT

LF SIGNAL GENERATOR:

Frequency range	100 Hz - 3 kHz
Output level	10 mV - 1V
Output impedance	50 ohm
E.g. Hewlett-Packard	HP 8903B

LF DISTORTION METER:

Frequency range	1000 Hz, 1300 Hz, 2100 Hz
Distortion range (f.s.d.)	0.1-10%
Input impedance	100 kohm
Accuracy (f.s.d.)	5% of reading
E.g. Hewlett-Packard	HP 8903B

3 Service / Test program including dongle & testbox

(OLE FOLDAGER) (MIR)

4 System trouble shooting

Trouble shooting should only be performed by persons with sufficient technical knowledge who have the necessary measuring instruments at their disposal, and who have carefully studied the operation principles and structure of the VHF series.

The first thing to check is whether the fault is somewhere in the aerial circuit, the power source, the handset, or inside the VHF system itself.

In order to help you during trouble shooting, part 1 and 2, chapter: Circuit Description and schematic diagrams contains diagrams, principal descriptions, and component location of the individual components.

The VHF system has a number of trimming cores and trimmers which must not be touched unless adjustments can be made as specified in chapter: Adjustment procedures.
When measuring inside the unit, short circuits must be avoided as they would damage the transistor

5 System Performance check

5.1 Check of system performance

The primary purpose of this test is to control the function of all system units. The test procedures require no test equipment.

The test procedures are described in the installation manuals in the sections "System function test".

5.2 Check of receiver sensitivity

The receiver sensitivity is controlled by applying a modulated RF test signal to the aerial terminal and then measuring the output signal-noise-distortion-to-noise-distortion ratio (SINAD) by means of an audio analyser.

1. Connect an RF signal generator to the aerial input, and adjust the RF signal level to -107 dBm (EM. 6 dB/µV). Modulate the RF signal with 1 kHz to a peak frequency deviation of 3 kHz.

2. Connect the AF_out (receiver output) signal from the test box to the audio analyser and measure SINAD ratio.

3. The level of the test signal is to be adjusted until the SINAD ratio of 20 dB is obtained, using the psophometric network (CCITT).

4. The level of the test signal at the input is the value of the maximum usable sensitivity, and it is not to exceed -119 dBm.

5.3 Check of receiver distortion

The receiver distortion is controlled by applying an RF signal to the aerial terminal and then measuring the output distortion by means of the distortion meter of the audio analyser.

1. Connect an RF signal generator to the aerial input, and adjust the signal level to -30 dBm (EMF: 83 dB/µV). Modulate the carrier frequency with 1 kHz to a peak frequency deviation of 3 kHz.
2. Connect the AF_out (receiver output) signal from the test box to the audio analyser, and measure the audio frequency distortion.
3. The measured distortion is not to exceed 3%.

5.4 Check of TX AF Level

The TX AF level is controlled by checking that the peak nominal deviation of the transmitted RF signal is correct.

1. Reduce the output RF power from the VHF transceiver to 1W.
2. Connect a modulation meter through an attenuator to the aerial terminal at the VHF transceiver. **Please note:** To protect the modulation meter from damages caused by the large input voltage, it is necessary to use an attenuator of about 30dB.
3. Connect the output of an LF signal generator to the AF_in of the test box. Adjust the frequency of the LF signal to 1kHz and the level to 100mVrms.
4. Start the transmission by turning on the PTT switch of the test box.
5. The measured nominal deviation is to be in the interval ±2.8kHz- ±3.2kHz .

5.5 Check of TX AF distortion

The TX AF distortion is controlled by checking that the distortion of the transmitted RF signal is correct.

1. Reduce the output RF power from the VHF transceiver to 1W.
2. Connect a distortion meter through an attenuator to the aerial terminal at the VHF transceiver. **Please note:** To protect the modulation meter from damages caused by the large input voltage, it is necessary to use an attenuator of about 30dB.
3. Connect the output of an LF signal generator to the AF_in of the test box. Adjust the frequency of the LF signal to 1kHz and the level to 100mVrms.
4. Start the transmission by turning on the PTT switch of the test box.
5. The measured distortion is not to exceed 3% .

6 Adjustment procedures

This section contains the adjustment procedures for all adjustable components in the VHF system.

6.1 Adjustment of AF & Processor Unit (632250)

In the AF & processor unit there are two hardware adjustments to be made: Power Low Level and DSP clock adjustment. The adjustment of the TX_AF level and TX_AF modulation level is made by adjusting their respective amplifiers, which are integrated in the ASIC. These adjustments can be made only by means of software (see section ???????????).

1. **The power low level is** adjusted by trimpot R6. The trigger level is 10V DC.
   - Set supply voltage to 10V DC.
   - Turn R6 clockwise all the way.
   - Turn R6 anticlockwise until the control units indicate POWER LOW on the display.

2. **The DSP clock** is adjusted by C60. The DSP clock is supplied by a 19.6608MHz crystal oscillator which will be divided by 4 in the DSP (D18) to form a clock frequency of 4.9152MHz, which can be adjusted by C60 as follows:
   - Connect a frequency counter by means of a passive probe to the SCLK pin in the AD-convert. (D7pin-18).
   - Adjust the trimmer capacitor C60 until the frequency is 4.9152MHz ± 10Hz

6.2 Adjustment of transmitter Unit (632251)

In the transmitter unit there are 5 adjustable components. These are adjusted as shown below. (The adjustment of the RF output power 1W and 25W can be made by means of software).

1. **The +5V and +8V voltage regulators** can be adjusted by trimpot R15 and R32 respectively.
   - Switch the transceiver on.
   - Measure the DC voltage of the output pin the +5V regulator N2.
   - Adjust R15 until the +5 volt is reached.
   - Measure the DC voltage of the output pin the +8V regulator N3.
   - Adjust R32 until the +8 volt is reached.

2. **The 14.85MHz reference oscillator** is built around V19 and Z3, and its frequency is adjusted by the trimming capacitor C48 as shown below:
   - Connect a frequency counter by means of a passive probe to the input of the PLL (D3-pin-20)
   - Adjust C48 until the frequency is 14.85 MHz ± 10Hz.

3. **The VCO voltage** is adjusted by L14:
   - Set the transceiver on channel 88 (157.425 MHz), and get it to activate the VCO.
   - Measure the DC voltage of the output pin of the PLL(D3-pin-6) on the other side of R40.
   - Adjust L14 until the VCO voltage is 3.7V DC ± 50mV DC.

4. **The nominal deviation** of the transmitter is adjusted by R90. The adjustment is made as follows:
   - Select reduced output RF power (1W) from the VHF transceiver.
   - Connect a modulation meter through an attenuator to the aerial terminal at the VHF transceiver.
   - **Please note:** To protect the modulation meter from damages caused by the large input voltage, it is necessary to use an attenuator of about 30dB.
   - Connect the output of an LF signal generator to the AF_in of the test box. Adjust the frequency of the LF signal to 1kHz and the level to 100mVrms.
   - Start the transmission by turning on the PTT switch of the test box.
   - Adjust R90 until the nominal deviation is 3kHz ± 40Hz.

6.3 Adjustment of receiver unit (632252)

The receiver unit there are 8 adjustable components. The adjustment of these components is made as follows:

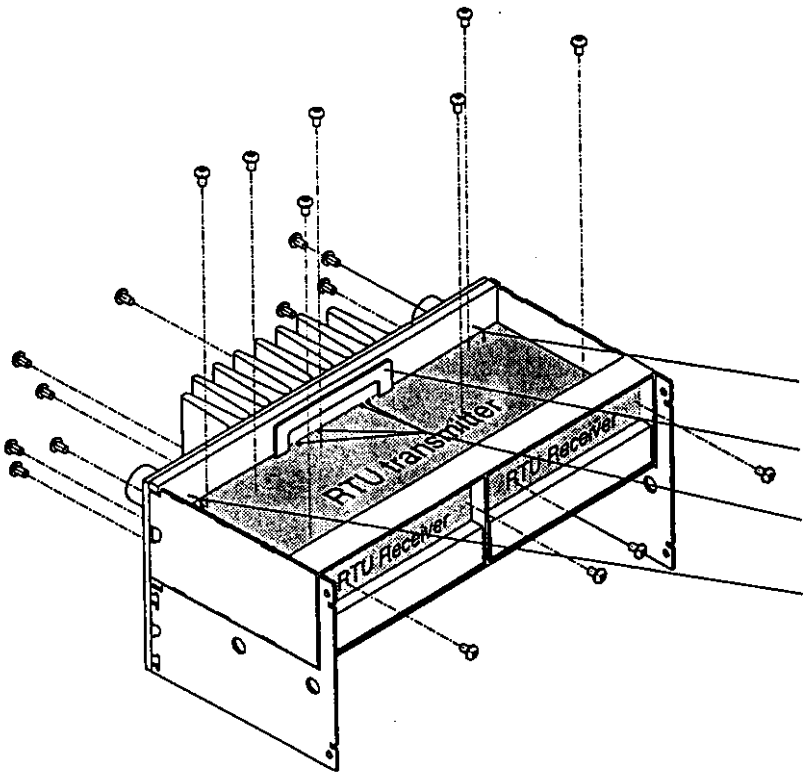
1. **The VCO voltage** is adjusted by C54 as shown below:
   - Set the transceiver on channel 17 (156.850MHz).
   - Measure the DC voltage of the output pin of the PLL(D4-pin-6) on the other side of R46.
   - Adjust C54 until the VCO voltage is 3.04V DC ± 10mV DC.

2. **The front-end filters and mixer transformers** are adjusted by L7, L8, L13, L14, TR1 and TR2. All components are adjusted to maximum RSSI output (Received Signal Strength Indicator) of N1 at pin-13. The adjustment is made as follows:
   - Apply an unmodulated carrier with the frequency 157.425 MHz to the aerial terminal, and adjust the signal level to -90 dBm (EMF: 23 dB/µV).
   - Set the transceiver on channel 88 (157.425 MHz).
   - Measure the DC voltage of pin-13 of the N1.
   - Adjust in succession L7, L8, L13, L14, TR1 and TR2 until the DC voltage is 2V DC± 0.2V DC.

3. **The AF output level** is adjusted by trimpot R25. The adjustment is made as follows:
   - Apply an RF signal to the aerial terminal, and adjust the signal level to -50dBm (EMF: 63 dB/µV).
   - Modulate the RF signal with 1kHz to a peak frequency deviation of 3kHz.
   - Measure the AC voltage of the AF output of the demodulator N1 pin-11.
   - Adjust the trimpot R25 until the output level is 150mVrms ± 5mV.

7 Removal / installation of units

If a fault has been located to a single unit, it may often be worth-while to replace it and then repair it later on. The following schematic figures illustrate the removal of the units of the VHF system.



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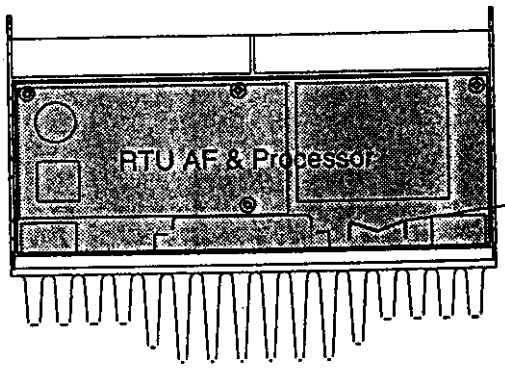

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7.3 Removal / installation of receiver unit (632252)

› removal of the receiver unit is very simple and is done as follows:
- Disconnect all coax cables.
- Unscrew and remove the unit from the chassis.

Install the new receiver unit by doing the opposite of the above steps in reverse order.

7.4 Removal / installation of interface unit (632253)

After disassembling the front control unit from the RTU, the removal of the interface unit can be done as follows:
- Disconnect the speaker cable.
- Unscrew and remove the unit from the housing for the front chassis.
  Install the new interface unit by doing the opposite of the above steps in reverse order.
  Please note: Place the unit gently in the housing for the front chassis so that the pins of the male connector of the display will enter the place on the female connector of the unit that matches.

7.5 Removal / installation of keyboard unit (632256)

›r the removal of the frontal plane, the keyboard unit can be removed as follows:
- Remove the display window
- Unscrew and remove the indicator module.
- Unscrew and remove the unit from the housing for the front chassis.

Install the new keyboard unit by doing the opposite of the above steps in reverse order.

8 Necessary adjustments after repair or replacement of units

8.1 Repair/replacement of AF & Processor unit (632250)

If this unit is replaced by a new one which is factory adjusted, it is only necessary to:
Perform chapter: System performance check.
If this unit is repaired, it is necessary to:
Perform chapter: Adjustment of AF & Processor unit.
Perform chapter: System performance check.

8.2 Repair/replacement of transmitter unit (632251)

If this unit is replaced by a new one which is factory adjusted, it is only necessary to:
Perform chapter: System performance check.
If this unit is repaired, it is necessary to:
Perform chapter: Adjustment of transmitter unit.
Perform chapter: System performance check.

8.3 Repair/replacement of receiver unit (632252)

If this unit is replaced by a new one which is factory adjusted, it is only necessary to:
Perform chapter: System performance check.
If this unit is repaired, it is necessary to:
Perform chapter: Adjustment of receiver unit.
Perform chapter: System performance check.

8.4 Repair/replacement of interface unit (632253)

If this unit is replaced by one that is new or has been repaired, it is only necessary to:
Perform chapter: System performance check.

Accessories

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2 Alarm panel unit (for GMDSS installation) 2

3 Using the PCV4xxx for system setup 3

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1 Handset control units (for use of extra control units)

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2 Alarm panel unit (for GMDSS installation)

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3 Using the PCV4xxx for system setup

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1 Installation

1.1 System requirements

CPU 80386 or more
Memory 4Mb or more
Disk pace 2Mb recommended

1.2 Hardware

1.3 Software

The software is delivered on a 1.44Mb 3.5" disk. The program can be run from the disk directly, but it is recommended to make a copy to a hard drive.

2 Using the program

When using the program, turn on all units to be set up. While running, the program will attempt to find all the known units on the SPARC-bus. When the program is started, the main window will appear. To highlight the various views, use the "tab" key and Shift + tab. To select a highlighted button, use the space bar. Enter will always select the last button in the menu.

For internal LAB use, it is possible to enable a file log feature. This feature is only used for LAB system debugging.

2.1 Main menu

This is the first menu. Before doing anything, make sure that all cabling is connected correctly, and all devices are turned on. After checking, press the "System setup" button.

Internal LAB software will contain the button "Custom". The menu behind this button is purely user defined in the file "CALLS.TXT". The file must be placed in the working directory of the program. Lines starting with ["."] are considered as remarks. The file is built up as follows: Name in menu, transmitter address, receiver address, op-code, data.

2.2 System menu

This menu attempts to align the devices which are turned on at the SPARC-bus. On the left, there is a window with the list of units responding. The information in the window is to be read as follows: Device address, unit type, serial number, software revision. The program will recognise the following types:

- SCC System combined control
- HTC Handset telephony control
- HCC Handset combined control
- RTU Receiver transmitter unit (transceiver)
- VDM VHF DSC modem
- PC Personal computer
- MOT Motor control unit, LAB use only

To set up the system, it is important that no control unit has the same location number at the SPARC-bus. The transceiver software 32451 is designed for 7 control units. The transceiver software 32450 is designed for only five control units, which must be given the locations 1-5.

Notes:
- The HTC and HCC units are programmed from the same window.
- The VHF DSC modem has no separate serial number; the listed number is the MMSI number.
- A PC operating the system with this program is not recognised as a control unit.

2.3 System combined control

SCC name
The system combined control name, which is used for intercom, contains seven characters.

Serial number
This is only provided for the user's information; changes made in this field are not stored.

Backlight level 0
The following table shows the possible settings of the different levels.

	Level 0	Level 1	Level 2	Level 3
Backlight	0	1 to 4	3 to 6	4 to 7
Keyboard light	Off	On/off	On	On/off

Contrast level
The contrast level used on the display can be changed by the user.

Earpiece level
The initial level of the earpiece.

Speaker alarm level
The alarm level of the internal loud speaker.

Display type
To use channel numbers higher than 99, three digits are needed. This is not necessary to support P10 to P54.

Dimmer direction
- To centre: At steps 0 and 1 the direction is up; at steps 2 and 3 it is down.
- Up: The step is increased, stepping from 3 to 0.
- Down: The step is decreased, stepping from 0 to 3.

Active speaker
It is possible to select which speaker is to be controlled by the unit. The internal speaker at the front is connected to speaker output 1. If an external speaker is required, it can be connected to speaker 2. It is possible to control both speakers from one control unit. Care should be taken that only one control unit controls a speaker at a time.

Printer width
If using a printer in connection with the SCC, the printer width is set to either 24 or 80 characters.

Language
If multiple languages are supported, a second and third language can be selected here. Currently no other language than English is implemented. If this setting is not carried out correctly, the device will malfunction until the setting has been corrected.

Printer type
- Off The printer is off.
- Text The printer prints in text mode.
- Code The printer prints out the codes in the call, normally only for test.

Allow language
The user may allow for a different language to be selected. However, as this is not implemented in the current SCC code, this function should not be enabled.

HO_SKP_ACT
Hooked off speaker active; when set, the external speaker is not muted in hook-off mode.

Inland mode
This mode is used to define the text on the display in local mode. If selected, "B!" is displayed instead of "US".

Distress call [ ] DISABLE
When selecting this option, all distress and urgency calls are disabled. The option is used for commercial land stations.

2.4 Handset telephony control / Handset combined control

Handset name
This is the handset user name, which is used for intercom. The name contains seven characters.

Serial number
This is only provided for the user's information; changes made in this field are not stored.

Display backlight level 0
Level 0 is restricted to 0, and cannot be changed.

Display backlight level x
Each of the levels 1, 2 and 3 can be set to 0-9.

Led level 0
This is always set to 0, at which level the indicator lamps (LEDs) are off.

Led levels 1, 2 and 3
Each of these indicator lamp levels can be set to 0-3.

Type
This has to be set in accordance with the control keyboard of the unit.
- HTC
- HCC without DSC
- HCC with DSC

HTC:
Is selected when the keyboard upper left button is PWR. This setting will operate correctly with the software 32450 and 32451, but the DSC facility in the software 32451 is not supported.

HCC without DSC:
Is selected when the keyboard upper left button is TEL/DSC, and the DSC function is disabled. This will operate with the software 32450 and 32451.

HCC with DSC:
Is selected when the keyboard upper left button is TEL/DSC, and the DSC function is enabled. This will operate with the software 32451 only. If the HxC is sold as an HTC, no attempt to enable the DSC function should be made; it has not been tested, and currently there are known errors when doing so.

DSC call action:
- Pleasure 1 sys
- GMDSS A sys
- Pleasure 2 sys

Distress call [ ] DISABLE
When selecting this option, all distress and urgency calls are disabled. This is used for commercial land stations.

Display type
To use channel numbers higher than 99, 3 digits are needed. This is not necessary to support P10 to P54.

Active speaker
It is possible to select which speaker is to be controlled by the unit. The internal speaker at the front is connected to speaker output 1. If an external speaker is required, it can be connected to speaker 2. It is possible to control both speakers from one control unit. Care should be taken that only one control unit controls a speaker at a time.

Dimmer direction
- To centre: At steps 0 and 1, the direction is up; at steps 2 and 3, it is down.
- Up: The step is increased, stepping from 3 to 0.
- Down: The step is decreased, stepping from 0 to 3.

Earpiece start level:
This is the volume level in the earpiece when the device is turned on. Default 10, interval 0 to 15.

Speaker start level:
This is the initial level of the speaker in the handset, and if selected, the level of the external speaker. Default 8, interval 0 to 15.

Earpiece alarm level:
This is the alarm level in the earpiece. Default 10, interval 0 to 15.

Speaker alarm level:
This is the alarm level of the speaker in the handset, and if selected, the level of the external speaker. Default 10, interval 0 to 15.

Side tone ATT:
In intercom mode a part of the microphone signal is fed back to the earpiece. Default 0, interval 0 to 3.

Dimmer start level:
This is the dimmer level where the unit starts when turned on. Default 2, interval 0 to 3.

Key light level
Default 2, interval 0 to 3.

Key light time
Default 5, interval 0 to 20.

2.5 Transceiver menu

This menu is split in several subwindows, each covering a part of the transceiver setup. When a window is opened, data is loaded from the transceiver. After changing any data in a window, use the "Save" button to save data from the view in the PC memory. To transfer the changed data use the "Send to unit" button. When opening a view, data is loaded from the transceiver to the PC memory.

2.5.1 Enabling code setup

This window is for enabling different things and basic setup.
Enabling codes:
- Invert RX / TX
- Local mode
- Duplex / simplex
- ATIS module
- VDM ATIS
- ATIS suppress
- Pri. Edit
- Pri. Delete

Invert RX / TX: This allows the control unit to select inverted RX / TX frequency. The current selection is saved when the device is turned off. This means that all control units are turned off, so the system powers down.

Local mode: When selected, it is allowed to select local mode from the control unit. In the USA this will be the US mode; in the Netherlands it will be the BI mode.

Duplex / simplex: If set, the control unit may select duplex or simplex. Currently this has not been implemented in any control unit.

ATIS module: This is maintained from the software, and should not be changed. If set, the transceiver contains an ATIS module, which is checked every time the system is booted.

VDM ATIS: When this bit is set, the VHF DSC modem is used for transmitting ATIS information every time the talk button (PTT) is released.

ATIS suppress: When set, the information: True FSK (frequency shift key) on the receiver is used to mute the LF signal. This function will not be operational during reception of DSC information on DSC channel (70).

Pri. Edit: When set, the control unit can change the priority channel attached to each scan table.

Pri. Delete: When set, the control unit can set a scan table to be an ordinary one, i.e. not a priority scan table.

Base frq. KHz: The frequency entered in this window is the lowest frequency that the transceiver can use.

Transceiver address in hex: When there is only one transceiver in the system, a duplex transceiver address is 31 hex, and a simplex transceiver address is 39 hex.

2.5.2 Scanning setup

All scan tables have the following parameters:

- Table name
- Pri CH
- US
- INT
- Max length

Table name:
This is the scan table name. It must contain 8 digits, and upper-case letters and numbers may be used.

Pri. CH:
This is the scan table priority channel. This channel number is assigned for the "16" key on the control unit. Default = channel 16.

US:
This is the safety channel used in local mode (normally in US territorial waters). Default = channel 13.

INT:
This is the safety channel used in international mode. Default = channel 6.

MAX length:
This is the maximum number of channels in the scan table. MEM no 7 will always contain all channels in the transceiver when deleting during scanning, the channel will bee added when scanning is stopped.

Nor.SC:
This indicates that the scanning to take place will be an ordinary one, if allowed. Can be edited by the user.

Additionally the following times are to be set. NB! When changing the following parameters, the transceiver may not be cable to scan correctly.

DW time:
This is the time the receiver monitors a channel without a carrier before skipping to the next channel. Value 0 to 255, default 10, interval 0 to 2.55 sec., step 10 mS.

Pause time:
This is the time the scanning stops on a channel with a carrier. This is overruled by the "Pri. Rep. Time". Value 0 and 2 to 255, default **200**, interval 40 mS to 5.1 sec., step 20 mS, 0 = forever.

Hang time:
This is the time the receiver stays on a channel where a carrier has been detected. Value 0 to 255, default 3, interval 0 to 2.55 sec., step 10 mS.

Pri. Dw time:
This is the time the receiver stays on the priority channel before returning to the next channel in the scan table. Value 0 to 255, default 10, interval 0 to 2.55 sec., step 10 mS.

Pri. Hang time:
This is the time the receiver stays on the priority channel after a carrier has faded. Value 0 to 255, default 3 interval 0 to 2.55 sec., step 10 mS.

Pri. Rep. Time:
Value 0 to 255, default **255**, interval 0 to 5.1 sec., step 20 mS. This is the maximum time it takes before the priority channel is monitored the next time.

Pri. Open time:
This is the time the receiver stays on the priority channel when a carrier has been detected. Value 0 and 2 to 255, default 0, interval 40 mS to 5.1 sec., step 20 mS. 0 = forever.

2.5.3 Transmitter setup

This menu contains the constants to control the transmitter.

ASIC TX preamp.:
Value 0 to 31, typically 13. This is used to compensate for deviations in the transmitter preamplifier stage, before the AGC. Tuned in module test.

ASIC_TX_MOD_LEVEL:
Value 0 to 31, typically 17. This is used to fine tune the deviation to +-3 KHz at 100 mVrms 1KHz on the SPARC-bus AF lines. Tuned and verified in final test.

TEMP_FAN_ON:
Value 0 to 255. If the "fan on" option is used, the value for turning the fan on is entered here; 144 is about 25 deg. C.

TEMP_FAN_OFF:
Value 0 to 255. If the "fan on" option is used, the value for turning the fan off is entered here; 144 is about 25 deg. C.

MAX_REV_POWER_HIGH:
Value 0 to 255, default 110. When transmitting at 25W, the SWR (standing wave ratio) bridge return level must be below this. The level is set to allow transmission at an SWR of 1:3. If the level is exceeded, the transmitter is reduced to 1W. The error code "ANTENNA FAIL" is transmitted.

MAX_REV_POWER_LOW:
Value 0 to 255, default 14. During transmission the SWR is continuously monitored. When exceeding this limit, "ANTENNA FAIL" is transmitted. The transmitter continues transmitting.

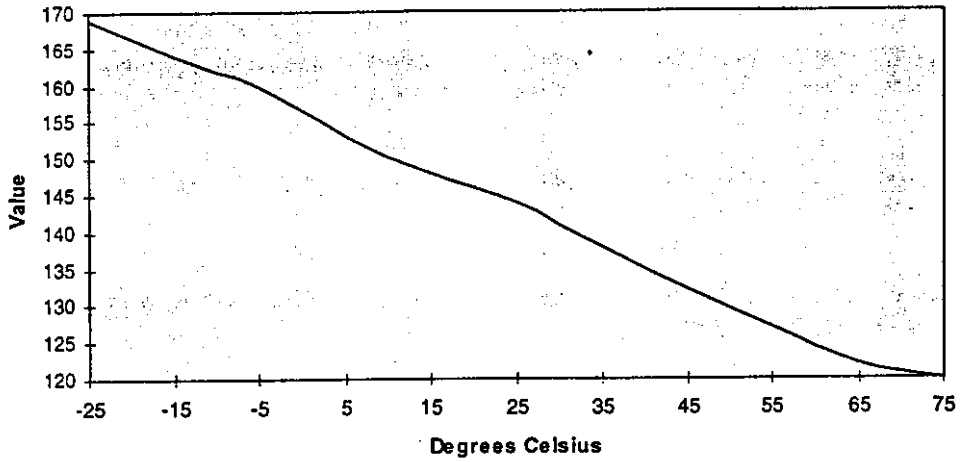
TX_MAX_HIGH_TEMP:
Value 0 to 255, typically 120. When this level is reached, the transmitter switches to 1W and transmits an TX_OWER_TEMP.

TX_POWER_HIGH:
Value 0 to 255, typically 110. This value is used to tune the transmission power to 22.5W in the final test.

TX_POWER_RED:
Value 0 to 255, default 84. This value is NOT used currently.

TX_POWER_LOW:
Value 0 to 255, typically 85. This value is used to tune the transmission low power output to 0.9W in the final test.

Temperature sensor characterization



tx_on_time_out:
Value 0 and 2 to 255, default 0, interval 20 to 2550 sec. (42.5 min) step 10 sec. This is the maximum time the transmitter may be keyed. 0 = no time out.

tx_inhibit:
Value 0 and 2 to 255, default 0, interval 2 to 255 sec. The time the transmitter must be off the air. After a TX time out.

tx_early_warning:
Value 0 to 255, default 0, interval 0 to 255 sec. Time before TX time out occurs. The transmitter will warn the system. This is not used in any control unit at this point.

2.5.4 Read file

When entering this "Open a file" menu, the file dialogue will allow the user to load a part or a complete setup of the transceiver. The only numbers that cannot be altered are the serial number and the test serial number. The format of the file is as follows: Address, data, data ... Up to 8 data bytes may be placed on each line. All the numbers must be entered in hex. The address contains 4 digits and data only 2. Information placed after the mark [;] is considered as a remark, and has no effect on the reading of the file. The file extension is supposed to be DAT. A file may look like this:

```
;ADR  DATA
0008 22 ;ENABLE_CODE
000c 08 ;BASE_FREQUENCY
000d F0 ;
000e D1 ;
000f 80 ;
0042 00 ;TX_ON_TIME_OUT
0043 00 ;TX_INHIBIT
0044 00 ;TX_EARLY_WARNING
0100 01 03 54 01 e4 04 33 80 ;CHANNELS
0108 02 03 58 01 e8 0c 33 80 ;
0110 03 03 5c 01 ec 0c 33 80 ;
```

2.5.5 Save file

This function is very much like Read file. The only difference is that the data known by the PC is saved to a file. Data placed in a "system defined" spot in the EEPROM gets the defined name as a remark.

2.5.6 Data to / from transceiver

For all these transfer functions, the transfer must be verified before it is started.

2.5.6.1Send all

This function will write all data from the PC to the unit. Information not stored in the PC is deleted in the transceiver EEPROM. Designed for LAB use only, Send all *must be used with extreme care.*

2.5.6.2Send transceiver setup

This function is used to overwrite unit information / setup parameters. This includes the base frequency of the channel setup. Designed for LAB use only, the function must be used with extreme care.

2.5.6.3Send channel setup

This function will overwrite the channel information in the transceiver. This excludes the base frequency. Designed for LAB use only, the function must be used with extreme care.

2.5.6.4Read all

This function is used to read all information in the transceiver EEPROM. To get a complete data file on the transceiver, use this function, followed by "Save file". All information about the transceiver is stored. Note that information from the VHF DSC modem is NOT included.

2.5.6.5Read transceiver setup

This function reads the setup information from the transceiver EEPROM to the PC memory.

2.5.6.6Read transceiver channel setup

This function reads the channel information from the transceiver.

2.5.7 ATIS number

This dialogue is for changing and displaying the ATIS number. The program will automatically find the right place to read and write the number. This includes the software 32450 with an optional ATIS module. After changing the number the transceiver must be powered down and restarted.

To view or edit the ATIS number, press "ATIS number".
The current number is viewed in the window. The number is built up as follows:
CCCLNNNN, CCC being the country code, L being the second letter of the ship call sign, and NNNN being the ship number. This means that eg. the number of SP4000 in Denmark is: 219P4000.

Press "Save" to save the number in the RTU / ATIS module or "Cancel" to leave the number unchanged.

2.5.8 Service

This menu is for authorised service only. It is possible to read out different values from the transceiver. For the transmitter there are the following values:

DRV_DET: Not used.
PA_TEMP: The temperature of the device, see above.
ANT_DET: The power reflected from the aerial.
TX_LD: Lock detector in TX PLL; a level above 128 is "in lock".
DRV_VOLT: A fraction (one fifth) of the voltage across the first stage of the power amplifier.
PA_CHECK: The forward power to the aerial.
IF_DET:

RX1 LD: Lock detector in primary receiver PLL; a level above 128 is "in lock".
RX1 level: The RSSI level in the primary receiver.
RX1 IF:
RX2 LD: Lock detector in channel 70 receiver PLL; a level above 128 is "in lock".
RX2 level: The RSSI level in the channel 70 receiver.
RX2 IF:

TX latch:
In order to carry out service on the transmitter, different settings in the transmitter can be set up. The three lower bits are maintained by the transceiver software, the rest are free to alter. The information is transferred to the transmitter when pressing the button "Send".

Auto read:
When selected, the information in the view is updated every second.

Power set:
This value is sent to the DAC controlling the power amplifier output level. The information is transferred to the transmitter when pressing the button "Send".

Read:
When the view is opened, all fields are blank. To read the information from the unit, press "Read", and a single read is performed.

Send:
When pressing this button, data from TX latch and Power set is read, and transmitted to the transceiver.

OK:
To leave this view, press "OK"; since there is no saved data, this is the same as cancel.

2.5.9 Send to unit

After changing data in the different views, it is possible to transmit the changed data to the transceiver. The program will only send data changed by the user. If a channel has been added in the middle of the row, channels are sorted by their number, and must be replaced in the transceiver.

2.5.10 Channel setup

This window is used for changing channel information in the transceiver. When entering the menu, the PC loads all channel information from the transceiver. By using PageUp and PageDown on the keyboard, it is possible to look at the current channels.

2.5.10.1 Deleting a channel

To delete a channel:
1. Find the channel to be deleted.
2. Press F for FREE in the channel number field.
3. Press ctrl+S to save the information.

The channel is now deleted in the PC memory. To get the information to the transceiver:
1. Go to the "special menu" by using F5.
2. Press the button "send to unit".
3. Confirm the transfer.

2.5.10.2 Adding a channel

To add a channel in the transceiver:
1. Press ctrl+W for New CH.
2. Enter the channel number 0..100 200..299 P0..P54.
3. Fill in the rest of the information.
4. Press ctrl+S to save.

The channel is now deleted in the PC memory. To get the information to the transceiver:
1. Go to the "special menu" by using F5.
2. Press the button "send to unit".
3. Confirm the transfer.

2.5.11 Control

This menu is for servicing the transceiver without a control unit. It is possible to key and un-key the transmitter, switch channels, change the power level, invert receiver frequency and transmitter frequency, select local mode and international mode, generate a system reset, and power down the transceiver.

Channel:
The current channel for the transceiver is displayed. To change the channel, type in the selected channel number, followed by enter (send). If the channel is present in the transceiver, the channel is switched; otherwise the first channel is kept, and the display will be updated to the correct value.

Squelch:
The following information about the transceiver status is only provided for the user's information; changes will not affect the transceiver.

- Duplex
- Local
- 1W
- TX on

- No scan
- Dual watch
- Normal scan
- pri. Scan

2.6 VHF DSC modem

This menu is used to set up the VHF DSC modem. Please note that it is not possible to change the numbers or digits in the MMSI number.

MMSI number	The MMSI number of the system. If 9 digits, the tenth digit is 0, or not entered.
Group 0 number	Group number. The first number must be 0. If only 9 digits, the last number is 0.
Group 1 number	Group number. The first number must be 0. If only 9 digits, the last number is 0.
DSC channel number	The channel used for digital selective calling. Default = channel 70.
Number of digits	Number of digits in MMSI number. Default = 9.
Auto pos insert	Sets position in auto acknowledgment, if requested.
Auto acknowledge	Sends acknowledgment automatically.
RX 2 SQ level	Squelch level of receiver 2 (DSC receiver)
Time zone	The current time zone used in the VHF DSC modem.
Date	The current data used in the VHF DSC modem.
UTC time	The time from the VHF DSC modem at last reload time. Not updated continuously.

Set time
When changing the time, date or time zone, use "SET time" to save the changes in the unit.

Save
This button will send the MMSI number, group number, DSC channel number, auto position insert and auto acknowledgment information to the VHF DSC modem.

Auto SQ: This button is used to set the RX2 squelch.

Cancel **Quits the view.**
Reload Reloads data from the VHF DSC modem.

2.7 PC

For this device, it is only possible to change the location of the unit. This is done so that it is possible to use up to 7 PCs in the same system. The serial number and software revision code is the number stored in the H4990A.

2.8 Motor control unit

This menu is only for internal LAB use. Unit one is used to elevate a measuring aerial on the roof. Unit two is used to rotate the device being measured. It is possible to connect up to 7 motor control units. There is no control unit for this type, currently it is only possible by using this program. The system allows multiple access to the type.

2.9 Revision history

Date	Rev.	Who	Section/page	Description
19.10.98	AA	JS	All	Document is under construction

4 Option connection box

For an explanation including illustrations, see the installation manuals:

- Front-operated transceiver unit with dumb handset: Chapter 2.7
- Transceiver unit operated by handset: Chapter 2.6

The following provides an explanation of the pins of the option connection box:

Pin no.	Pin name	Explanation
1	DSC_ALARM_ON	Indicates that there are one or more distress or urgency SC_calls in the buffer.
2	NMEA_OUT+	Optional – not used.
3	NMEA_OUT-	Optional – not used.
4	NMEA_IN+	The positive side of a balanced input signal from an external instrument, i.e. a GPS.
5	NMEA_IN-	The negative side of a balanced input signal from an external instrument, i.e. a GPS.
6	-BAT.	Battery ground.
7	+12V DC	DC power supply.
8	FAN_ON	An output control signal to control an external FAN to cool the transceiver down.
9	RX_1_SQ	Squelch signal from receiver_1. Not enabled.
10	CH_AUX_1	Associated with every channel, there are 2 AUX bits, defined independently for each channel. These bits can be used e.g. to control an external instrument, or to get a certain action to take place in connection with the chosen channel.
11	CH_AUX_2	The same as CH_AUX_1.
12	RX_1_AF	Demodulated AF signal from receiver_1. The signal level is app. 150 mVrms

5 Sparc-bus splitter box

For an explanation including illustrations, see chapters 2.5 and 2.6 of the installation manual. The connection of one or more handsets to the transceiver can be done in two ways:

1. Directly between the transceiver and the handset hook.
2. By means of a SPARC-bus splitter box.

The second way has the advantage that if the handset installations are far away from each other and from the transceiver, there will be no degradation in the level of the data bus (SPARC+ and SPARC-) because the transceiver will just see the short stub (app. 90 cm) between the transceiver and the splitter box. The following provides an explanation of the pins of the splitter box:

Pin no.	Pin name	Explanation
1	Supply_ON	ON/OFF signal.
2	SPARC+	The positive side of the balanced signal of the data bus (SPARC-bus), which is derived by a line interface RS483.
3	SPARC-	The negative side of the balanced signal of the data bus (SPARC-bus), which is derived by a line interface RS483.
4	AF+	The positive side of the TX_AF, which will be modulated and transmitted in the transceiver.
5	AF-	The negative side of the TX_AF, which will be modulated and transmitted in the transceiver.
6	-BAT	Battery ground.
7	+12V DC	DC power supply.
8	RX_AF+	The positive side of the balanced AF received signal, which is demodulated but not de-emphasised.
9	RX_AF-	The positive side of the balanced AF received signal, which is demodulated but not de-emphasised.
10	+12V DC	DC power supply.
11	LS_1+	The positive side of the balanced AF received signal, which is demodulated and de-emphasised. This signal is fed to the positive side of an internal loudspeaker of 4 ohms to give 4W.
12	LS_1-	The negative side of the balanced AF received signal, which is demodulated and de-emphasised. This signal is fed to the positive side of an internal loudspeaker of 4 ohms to give 4W.
13	-BAT	Battery ground.
14	LS_2+	The positive side of the balanced AF received signal, which is demodulated and de-emphasised. This signal is fed to the positive side of an external loudspeaker of 4 ohms to give 6W.
15	LS_2-	The negative side of the balanced AF received signal, which is demodulated and de-emphasised. This signal is fed to the positive side of an external loudspeaker of 4 ohms to give 6W.