



Sailor

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INSTRUKTIONSBOG FOR
SAILOR SCRAMBLER CRY2002

INSTRUCTION BOOK FOR
SAILOR SCRAMBLER CRY2002

INSTRUKTIONSBUCH FÜR
SAILOR SCRAMBLER CRY2002

INSTRUCTIONS POUR
SAILOR SCRAMBLER CRY2002

INSTRUCCIONES PARA
SAILOR SCRAMBLER CRY2002



A/S S. P. RADIO · AALBORG · DENMARK

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1.0. INTRODUCTION

The SAILOR Scrambler CRY2002 has been designed to be used with the SAILOR Compact 2000 module programme.

The SAILOR CRY2002 is a remote-controlled version of SAILOR Scrambler CRY2001. The CRY2001 and CRY2002 are able to communicate as they operate with the same code generator.

The SAILOR CRY2002 can be installed and operated either as an independent unit or in combination with the other elements of the Compact 2000 programme, as well as the public telephone network. The Compact 2000 programme includes a coast telephony station with a 400 Watt SSB transmitter, an SSB receiver with built-in FM and AM bands and a VHF radiotelephone.

The SAILOR CRY2002 has been designed to withstand the most extreme conditions experienced in small semi-open boats. Its compact weatherproof construction ensures a degree of resistance to sea spray. The printed circuits, which have made possible a combination of compactness and exceptional performance, are coated with a special moisture-repellent lacquer.

The SAILOR CRY2002 has also been designed to the mobile telephone network, open systems as well as closed systems.

In the design of this scrambler, S. P. Radio have taken into account all the circumstances it will be exposed to in day-to-day operating. However, even a product of this high quality requires regular servicing and maintenance, and we recommend a close observance of the directions contained in this instruction book.

S. P. Radio is one of Europe's leading producers of maritime radio communication equipment - a position which has been maintained by means of constant and extensive products development. We have a world-wide network of dealers with general agencies in fifty countries. All our dealers are well-trained and able to service all SAILOR products.

1.1. TECHNICAL DATA

<u>Principle:</u>	Rolling frequency domain scrambling combined with time delay sub-band signal processing. Ensures high security and negligible residual intelligibility.		
	Rolling frequency:	10 Hz	
	Time delay process:	177 mS	
<u>Code Capacity:</u>	Elementary keys:	16,777,216	
	Structures:	65,536	
<u>Automatic Auxiliary Key:</u>	Auxkey:	32	
	Automatically generated after each start and change of transmission direction.		
<u>Synchronization:</u>	Group call, start synch. time	=	1.12 sec.
	Selective call, start synch. time	=	3.01 sec.
	Start of transmission; synch.time	=	1.19 sec.
	End of transmission, synch. time	=	0.56 sec.
	Autom. resynchronization every 70 secs. with a resynch. time	=	280 msecs.
<u>Mode of Operation:</u>	Selective call with public selcall number. Group call with secret group call number. Semi-duplex/Simplex.		
<u>Number Register:</u>	8 quick select selcall numbers 8 quick select group call numbers		
<u>Pre-key of Transmitter:</u>	10 msecs to 2.4 secs.		
<u>Bandwidth:</u>	400 - 2600 Hz clear and scrambled signal		
<u>Line Input/Output:</u>	Handset selectable between two radio stations. 600 ohm balanced or unbalanced.		
	Transmit level	=	+4 dBm
	Receive level	=	0 dBm
<u>Connections:</u>	Two keying relays with break or make contacts:		
		1A-	110V AC
		2A-	24V DC
	Two optocoupled distress inputs:	8-30V or 3-15 mA	
<u>Temperature:</u>	-15°C to +55°C		
<u>Power:</u>	DC power supply 10V to 32V DC, 20W		
<u>Loudspeaker:</u>	Possibility for connection of external loudspeaker		
		3 Watt/4 ohm	

1.2. CONTROLS ON HANDSET



Turns the scrambler on or off.



Increases the volume progressively in 16 steps to maximum at the ext. loudspeaker.



Reduces the volume progressively in 16 steps to minimum at the ext. loudspeaker.



Selects station 1 (e.g. SSB station or public telephone) or station 2 (e.g. VHF station).



Digits from 1 to 8.



Function key



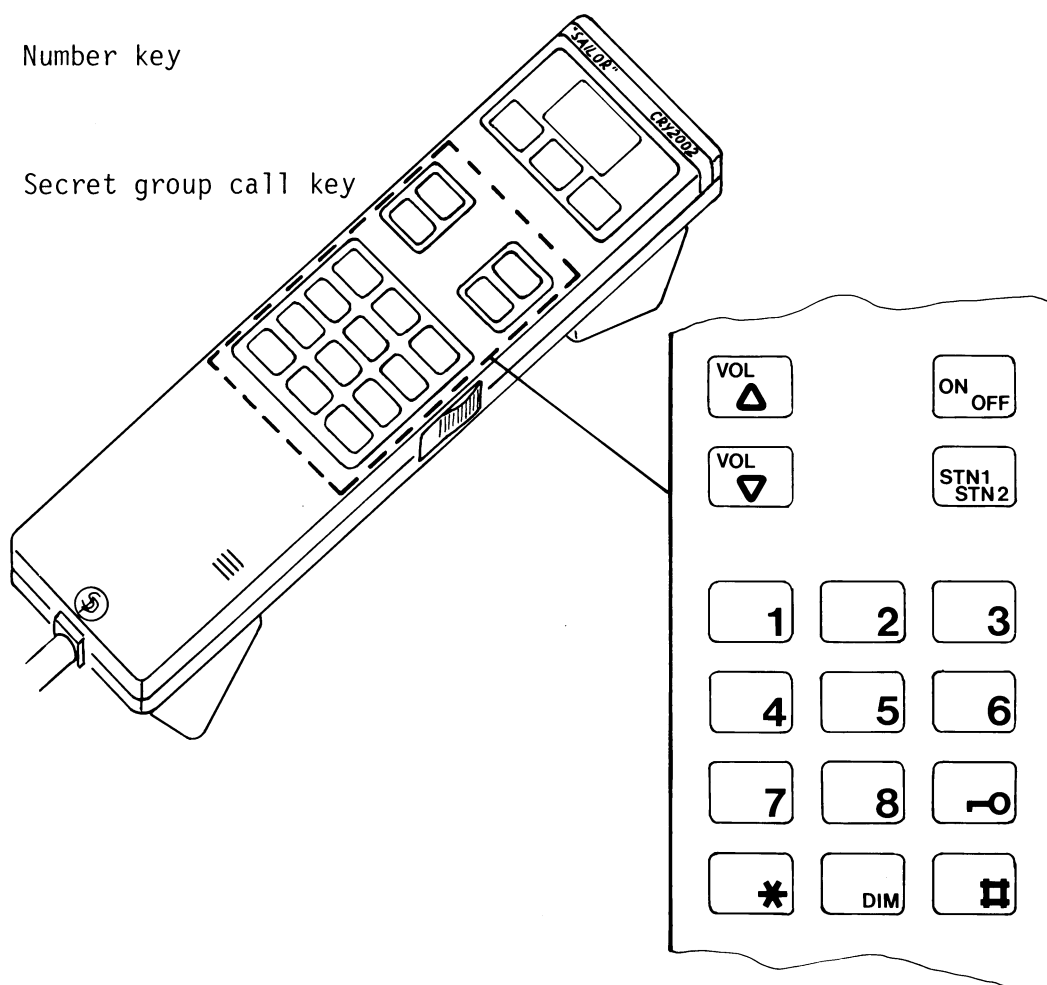
Turns the keyboard light on or off.



Number key



Secret group call key

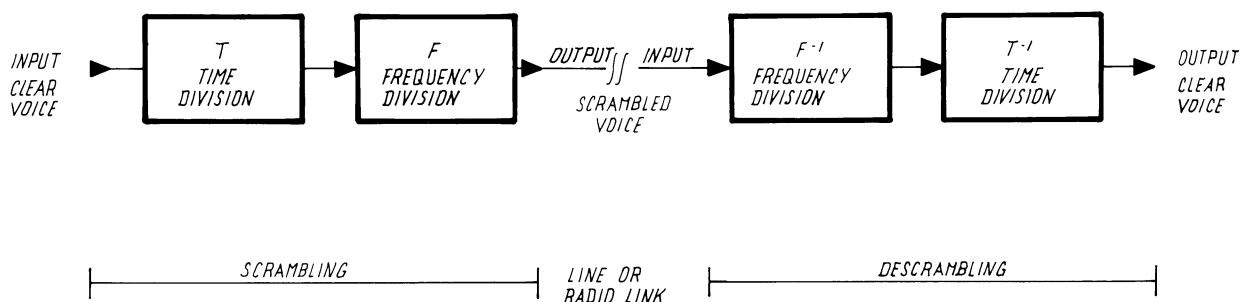


1.3. GENERAL DESCRIPTION

The CRY2002 voice scrambler is a microprocessor controlled double speech scrambler with a basic operation as shown in the simplified block diagram below. The F-scrambling process is accomplished by a cyclic band-shift and inversion of the incoming signal. The T-scrambling process is carried out by a summing of a low band time delayed and a high band signal. The combination of those two scrambling effects represents an optimum of security for many applications. It represents an effective and relative simple true diversity scrambling process.

Both T- and F-scrambling take place analogously and thus ensure a very high degree of voice recognizing.

BLOCK DIAGRAM: DOUBLE SPEECH SCRAMBLING



The subjectives of the double scrambling effect can be described as follows: The F-process employed, provides e.g. an effective scrambling of the sound characteristics, the short-time voiced sounds. The T-processor blurs the rhythm of speech, smooths the signal power in function of time.

Residual intelligibility tests for different speakers show for coherent text a negligible residual intelligibility throughout, and for separate pronounced figures, as numbers, a considerably lower residual intelligibility rate than with any other one-dimensional scrambling process. Furthermore, the unscrambled speech signal of the CRY2002 is considered very good.

In the second scrambled signal, both the frequency coordination and the distribution with respect to time, are modified. As the frequency scrambling is performed after the time scrambling, the dynamic frequency scrambling must be reversed first in a deciphering attempt. This is difficult to accomplish because in every segment portion, two time intervals of clear signal are present.

The CRY2002-chosen scrambling principle has further advantages in transmitting by RF radio systems. The key problem in a radio connection, of which the scrambling principle must be able to manage, is:

- restricted bandwidth
- frequency offset
- fading
- multipath
- varying propagation delays
- noise and interference

The F- and T-scrambling process has a high degree of tolerance for those parameters.

1.4. PRINCIPLE OF OPERATION

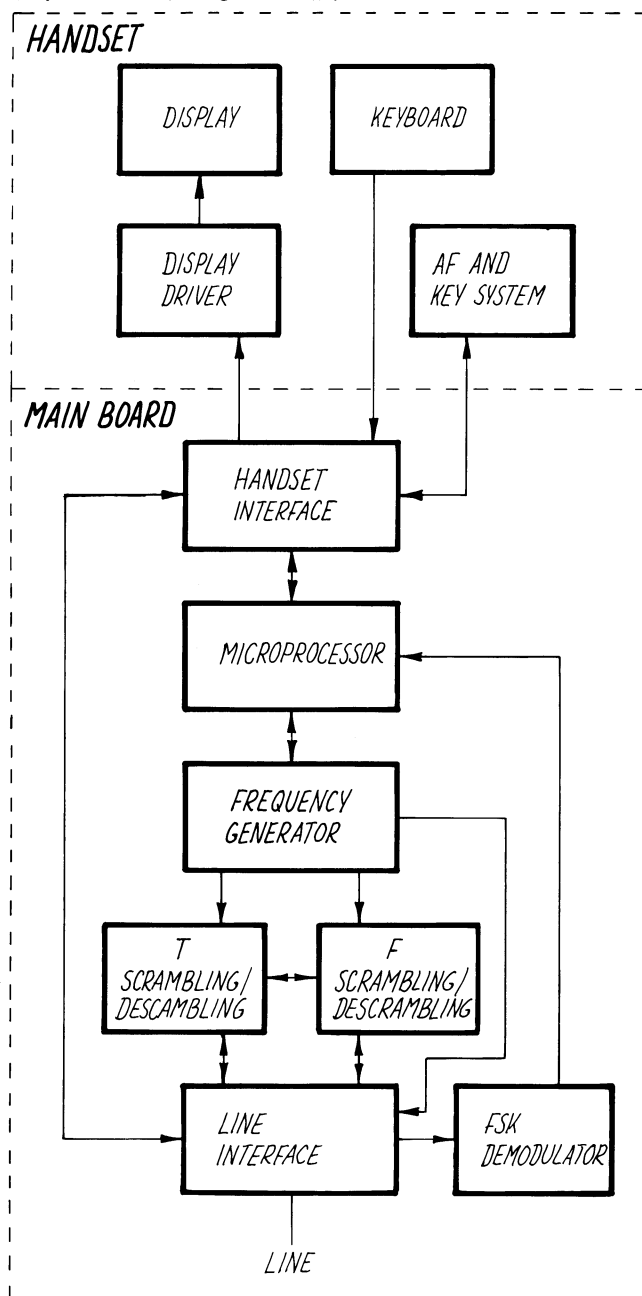
The BASIC BLOCK DIAGRAM shows the basic layout of CRY2002. It consists of a handset and a main board.

The handset consists of a keyboard unit with control switches, a display driver with display, and an AF & key system.

The main board consists of a microprocessor for handling of all the internal controls including the key-code generation, recognitions and control of information from the keyboard and to the display through the handset interface.

The frequency generator controls the F- and T-scramblers and sends out the FSK signals to the line interface. The FSK-demodulator is handling incoming data from line to microprocessor.

BASIC BLOCK DIAGRAM

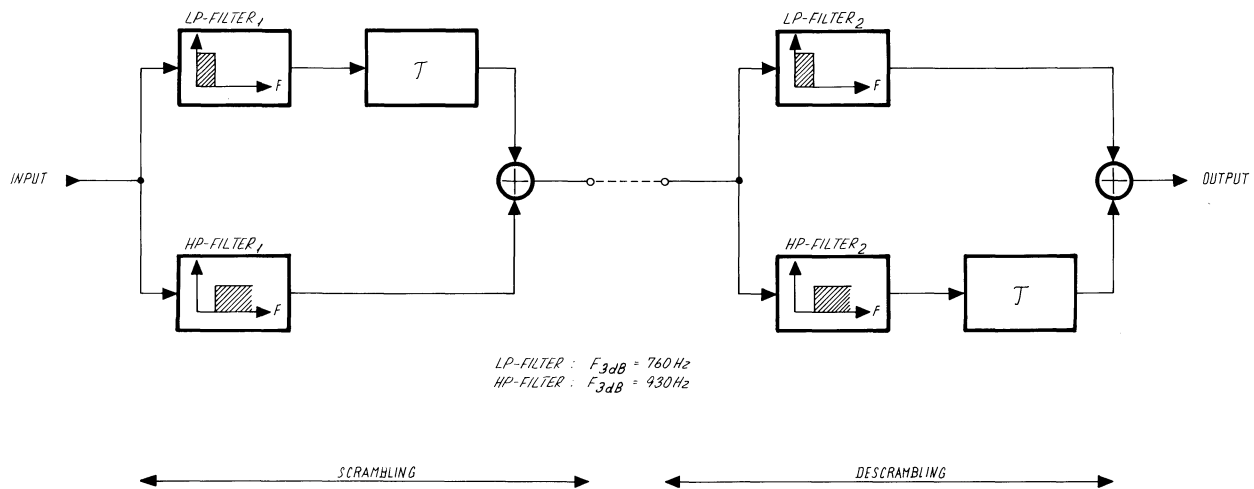


1.4. PRINCIPLE OF OPERATION cont.:

TIME SCRAMBLER (T-CSR)

The principle of the time scrambling and descrambling process is shown in the block diagram below:

TIME SCRAMBLING



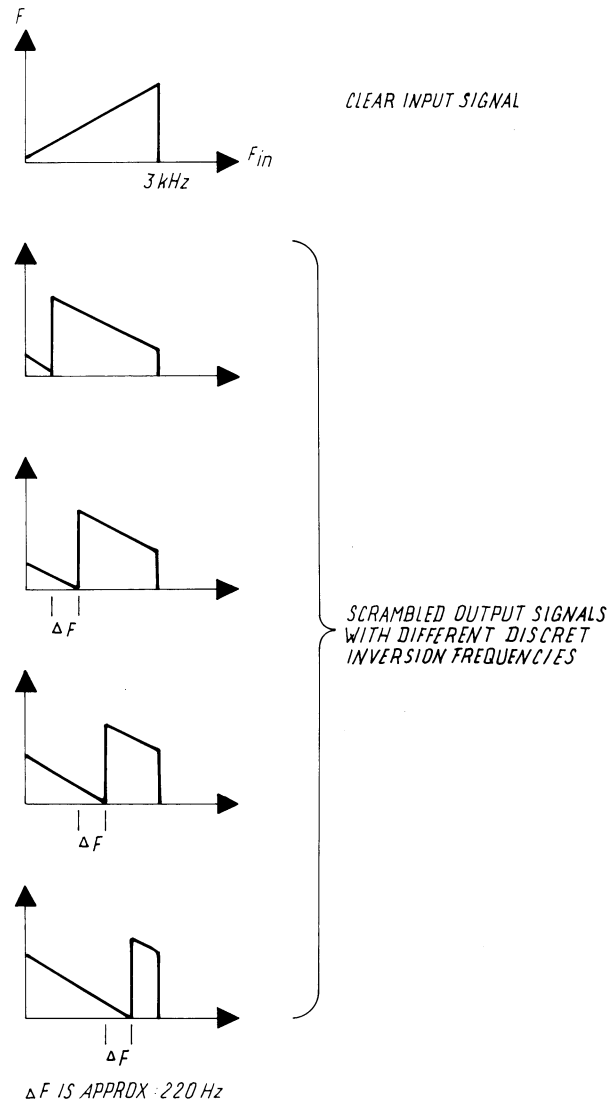
The clear signal is split-up into a lowpass and a highpass part. The cross-over frequency is chosen so that the average output power from the low and the high part is about the same, for a normal speaker ($F_c = 800 \text{ Hz}$). In the transmitting mode the lowpass filtered signal is fed to an analog delay-line with a delay of $T = 177 \text{ mS}$. The two signals are summed before further processing. In the receiving system (descrambler) the highpass filtered signal is delayed, so that after summation the original signal appears with a total delay of T .

1.4. PRINCIPLE OF OPERATION cont.:

FREQUENCY SCRAMBLING

Fig. 1 shows the principle in the frequency scrambler. The scrambling process consists of two steps; an inversion and a shift of inverted spectrum by the value F (approx. 220 Hz). The part of the inverted spectrum, which extends beyond the upper limit band is added to the lower end. The inversion frequency is varied within twelve discrete values in the range 435 - 2840 Hz. Fig. 1 shows output spectra with different inversion frequency.

FIG. 1 PRINCIPLE OF CYCLIC BANDSHIFT AND INVERSION



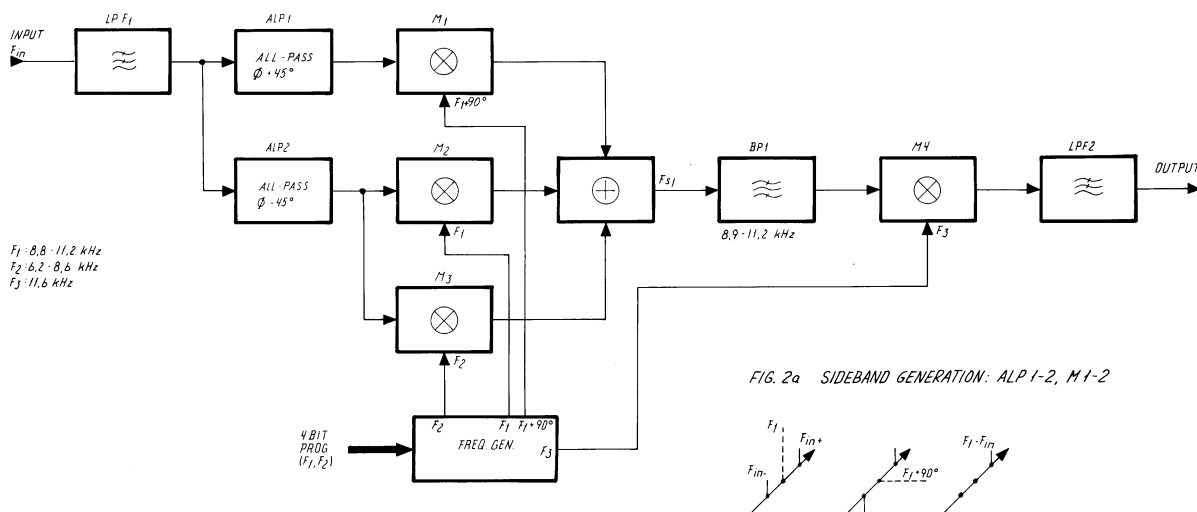
The microprocessor generates the scrambling code and controls a frequency generator to choose one of the twelve discrete inversion frequencies every 100 mS. When this process is combined with the previously explained T-scrambling, which has a 177 mS delay on the band splitted clear input signal, the 100 mS frequency shifted interval will shift the delayed and undelayed part in different ways. This ensures a 100 percent scrambling of all kind of messages.

1.4. PRINCIPLE OF OPERATION cont.:

A detailed block diagram is shown in fig. 2. The input is fed to a sharp cut-off lowpass filter at 2600 Hz. The signal is split-up into a wideband phase shifter, which keeps a 90 degree phase shift between its outputs, allpass filter ALP1, ALP2. Those 2 signals are fed to two mixers M1, M2. A combination of their outputs generates a single sideband signal, shifted to the upper sideband of F_1 . Summed to this output is the output from a third mixer M3, mixer frequency F_2 . The output spectrum can be seen in fig. 3. The frequency band of interest is filtered out in a sharp cut-off, delay controlled bandpass filter at 10 kHz. The mixer M4 converts the spectrum down to the audioband. F_3 is a fixed frequency on 11600 Hz. A lowpass filter rejects spurious and out of band products from this signal.

Fig. 2a shows a phasor diagram of the single sideband modulator (SSB), ALP1, ALP2, M1, M2 plus summation.

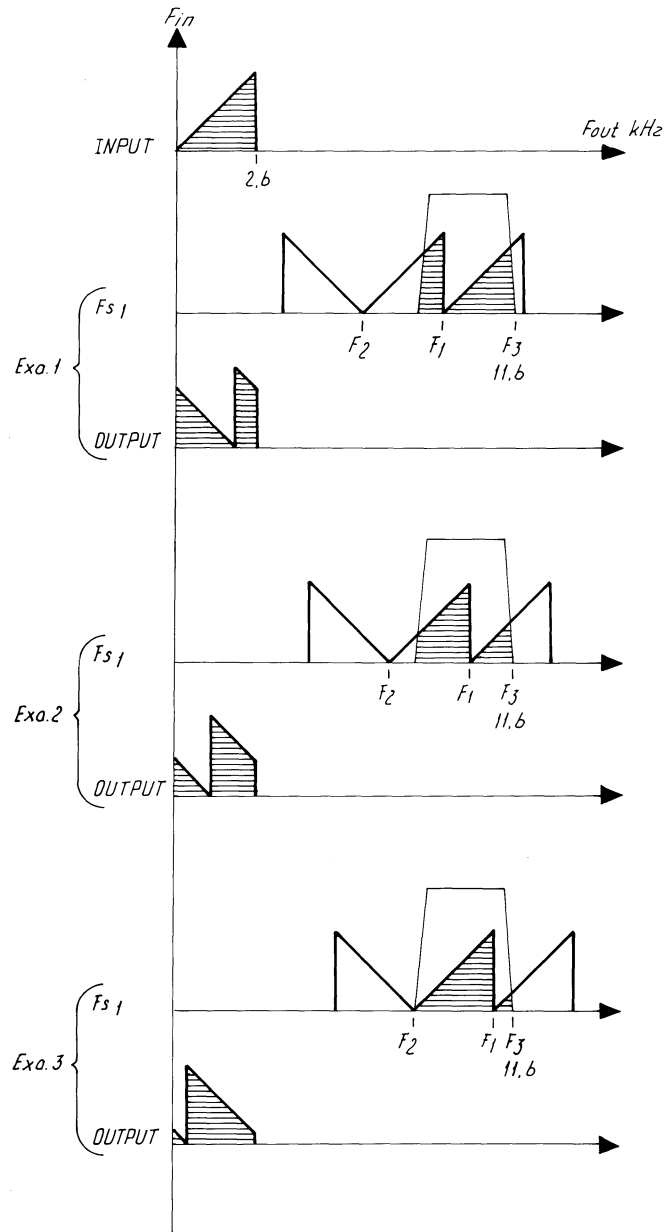
FIG. 2 FREQUENCY SCRAMBLING - ROLLING BANDSHIFT INVERTER



1.4. PRINCIPLE OF OPERATION cont.:

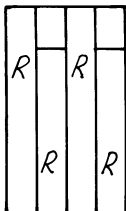
Fig. 3 shows three examples of frequency inversion. The frequency generator is controlled by the microprocessor and generates F_1 , F_2 , F_3 .

FIG. 3 3 EXAMPLES OF FREQUENCY INVERSION WITH DIFFERENT DISCRETE FREQUENCIES (F_1 , F_2)



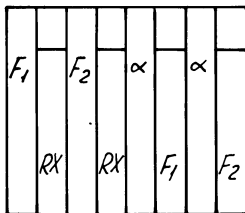
SIGNALLING CODES FOR CRY2001/CRY2002

RESYNCHRONIZATION 280ms

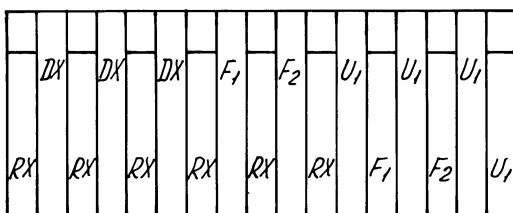


RX : PHASING SIGNAL 1
DX : PHASING SIGNAL 2
 α : IDLE SIGNAL α
F₁-F₂: CYCLING REDUNDANCE CHECK CODE
A₁-A₆: PUBLIC ADDRESS OF CALLED STATION
B₁-B₆: PUBLIC ADDRESS OF CALLING STATION
U₁ : AUXILIARY KEY

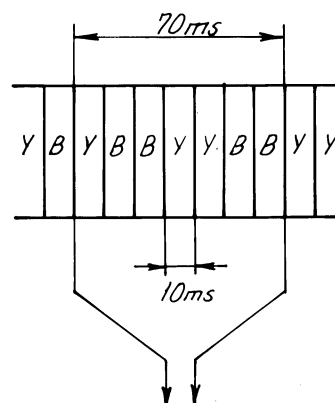
END-OF-TRANSMISSION 560ms



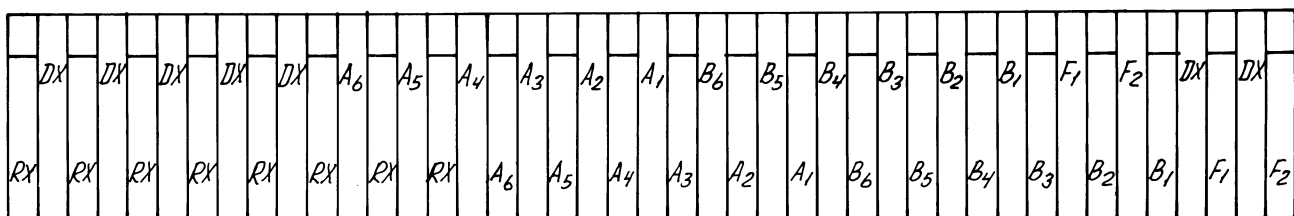
START-OF-TRANSMISSION 1190ms



NECESSARY FOR CORRECT SYNC.



PRIVATE CALL 3010ms



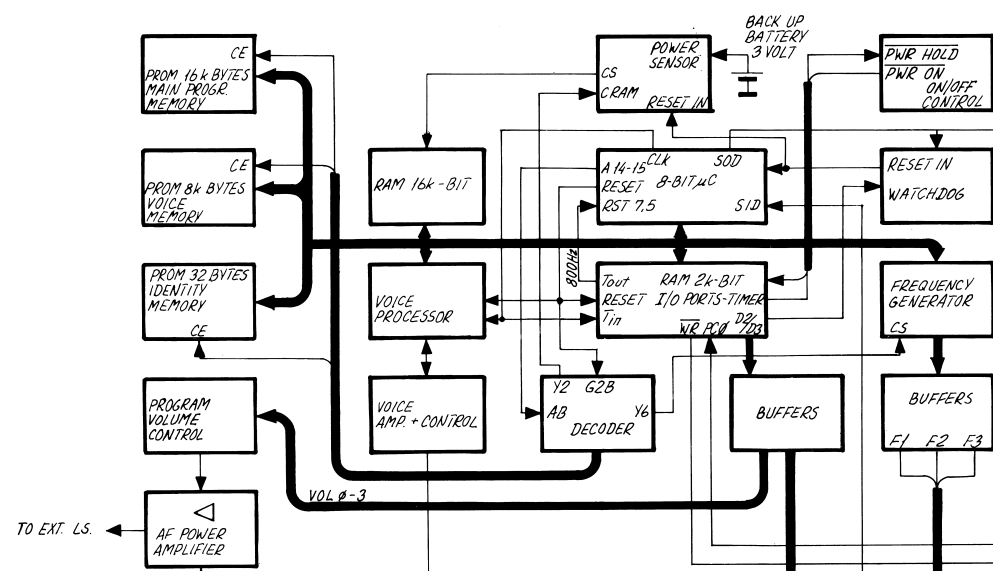
420ms

910ms

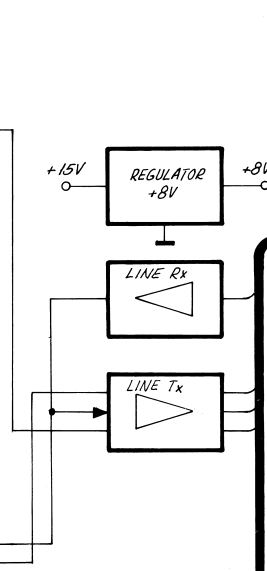
NECESSARY FOR
CORRECT SYNC.

STOP SCANNING WHEN
RECEIVING CALL.

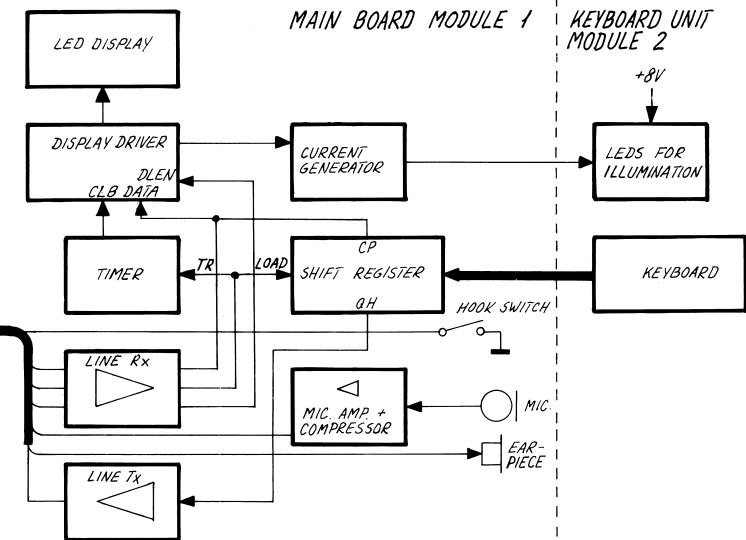
PROCESSOR UNIT MODULE 2



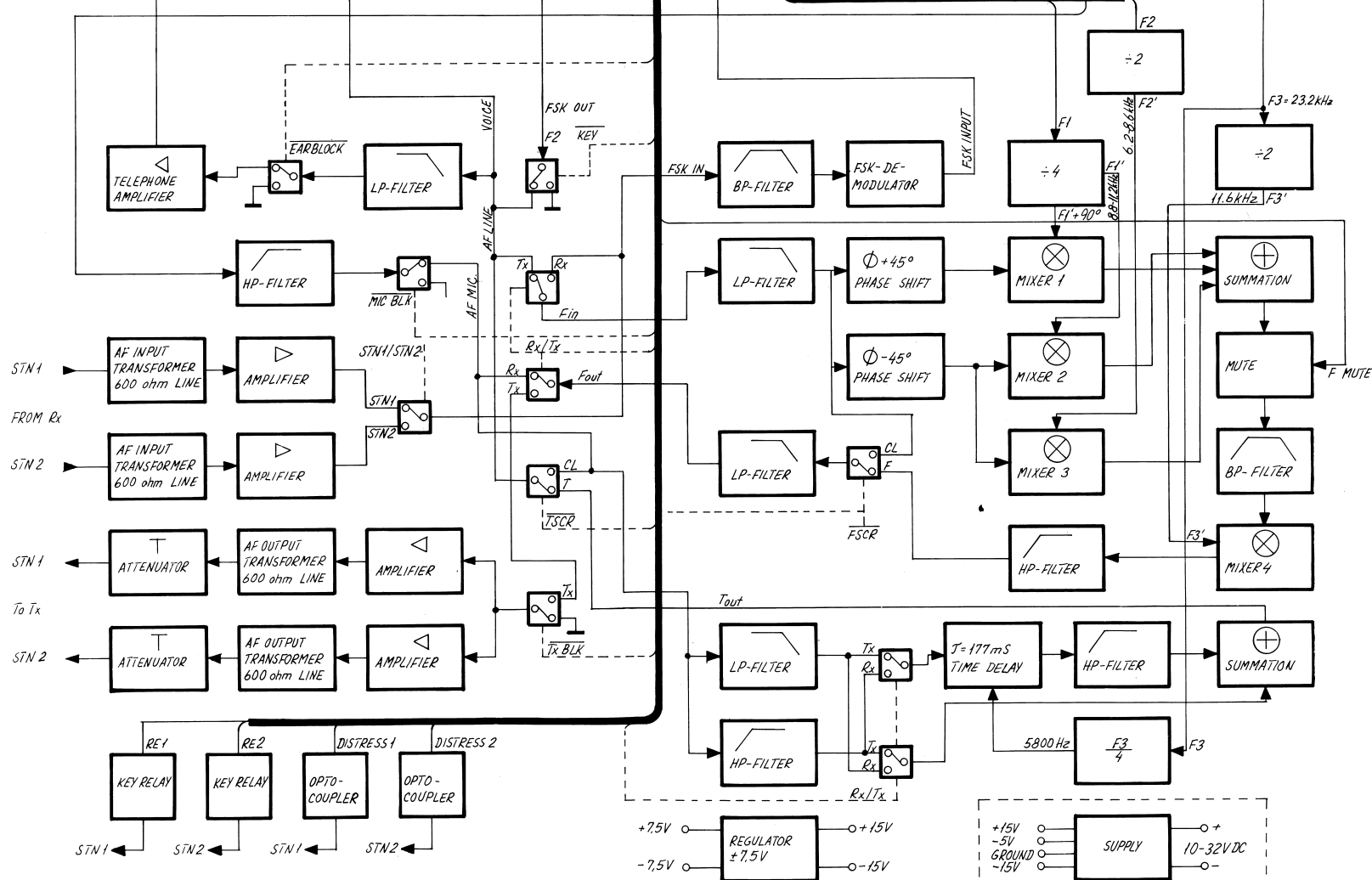
INTERFACE MODULE 7



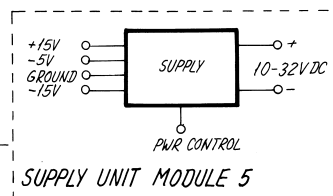
HANDSET



F+T UNIT MODUL 1



SUPPLY UNIT MODULE 5



2.0. INSTALLATION

Before installation of a SAILOR Scrambler CRY2002 the following points must be observed:

1. What equipment has the scrambler CRY2002 to operate with?

If the agent or serviceman has found out what equipment the scrambler CRY2002 has to operate together with, the "prekey time" and in some countries the "call name" must be programmed into the Identity Prom, (IC10 in the Processor Unit, module 2) see section 2.4. PROGRAMMING OF SERVICE PROM (PRE-KEY, CALL NAME).

When modifying the radio station so that CRY2002 can operate together with other transmitters, it is important that the scrambler CRY2002 goes into the "CLEAR VOICE" when distress and calling frequencies are used.

See section 3.0. INTERCONNECTION FOR SAILOR SCRAMBLER TO SAILOR EQUIPMENT and section 4.0. INTERFACE FOR SAILOR SCRAMBLER TO MISCELLANEOUS EQUIPMENT.

We want to underline that it is the responsibility of the agent that these features are functioning correctly.

2. How is the scrambler CRY2002 to be installed?

In section 2.1. MOUNTING POSSIBILITIES the installation of scrambler CRY2002 is described as an independent unit or in combination with the other elements of the Compact 2000 programme.

In conjunction with other SAILOR equipment see the INSTALLATION section for the SAILOR unit in question.

3. External loudspeaker:

An external loudspeaker 8 or 4 ohm can be connected to the power connector J4-6 pin 1 and 6, see section 2.3. ELECTRICAL CONNECTIONS.

4. The screw, GROUND FOR CHASSIS:

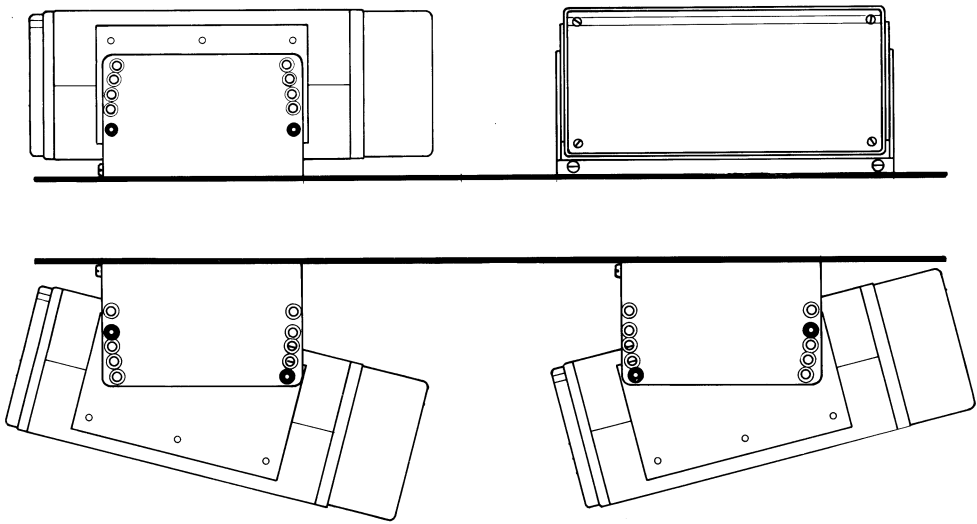
It can be an advantage to ground the scrambler CRY2002 through the screw, GROUND FOR CHASSIS on the rear plate, see section 2.3. ELECTRICAL CONNECTIONS. When installing CRY2002 together with coast telephony or short wave stations it is important that GROUND FOR CHASSIS is connected to the transmitter earth. The earth cable must be as short as possible and minimum 2.5 square mm.

We have developed a special connection box type SAILOR H2080, which makes possible several special installation combinations of SAILOR equipment as well as other types of equipment. See sections 3.0. and 4.0.

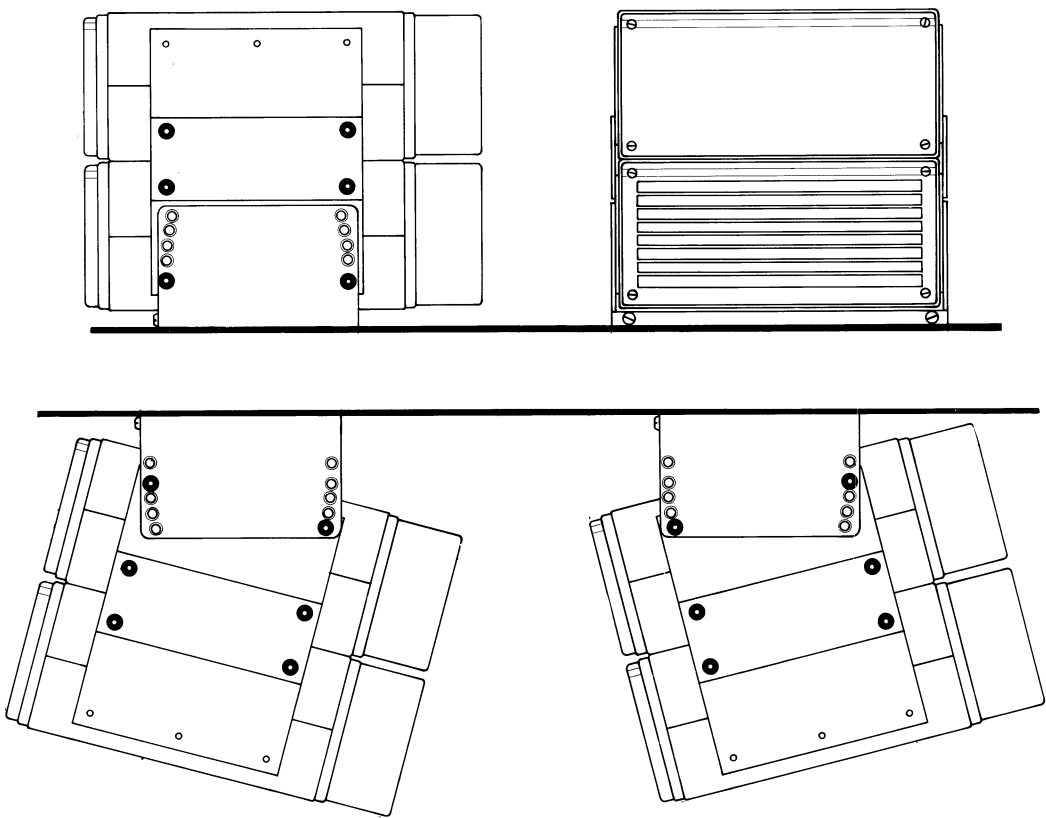
If you want any further information of connection box H2080 please see the instruction book for H2080.

2.1. MOUNTING POSSIBILITIES

TABLETOP AND DECKHEAD



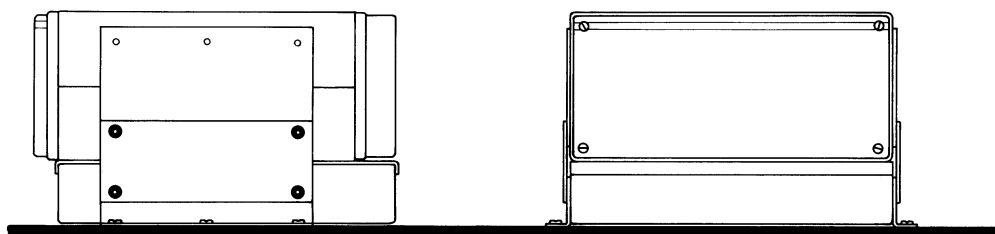
Mounting bracket H2055



Mounting kit H2068 and H2055

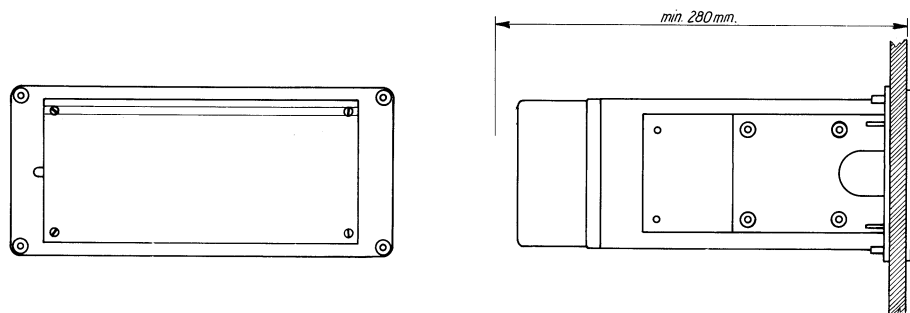
CRY2002 4-0-24766
4-0-24767 4-0-24764

2.1. MOUNTING POSSIBILITIES cont.:

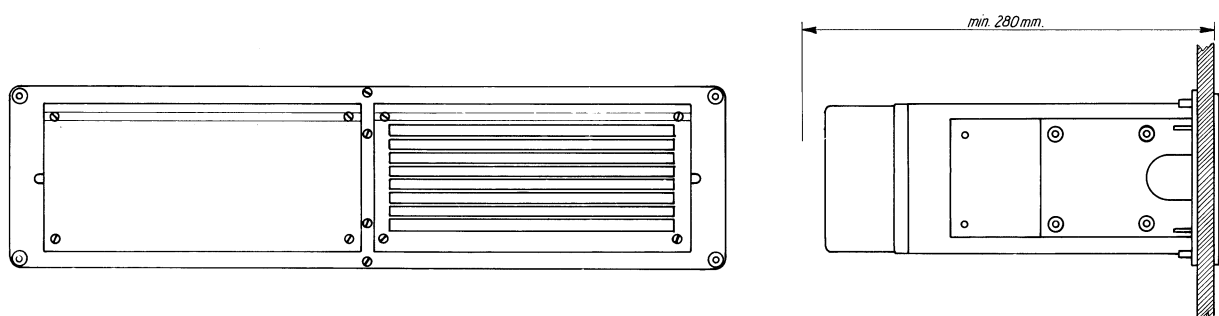


Connection Box SAILOR H2080 and Mounting Kit H2068

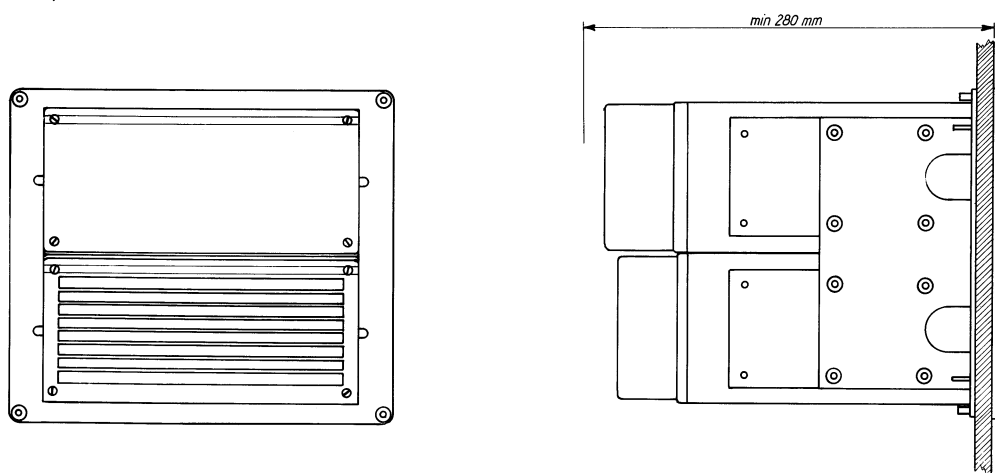
BULKHEAD AND CONSOLE



Mounting kit H2063



Mounting kit. H2062 or



Mounting kit H2064

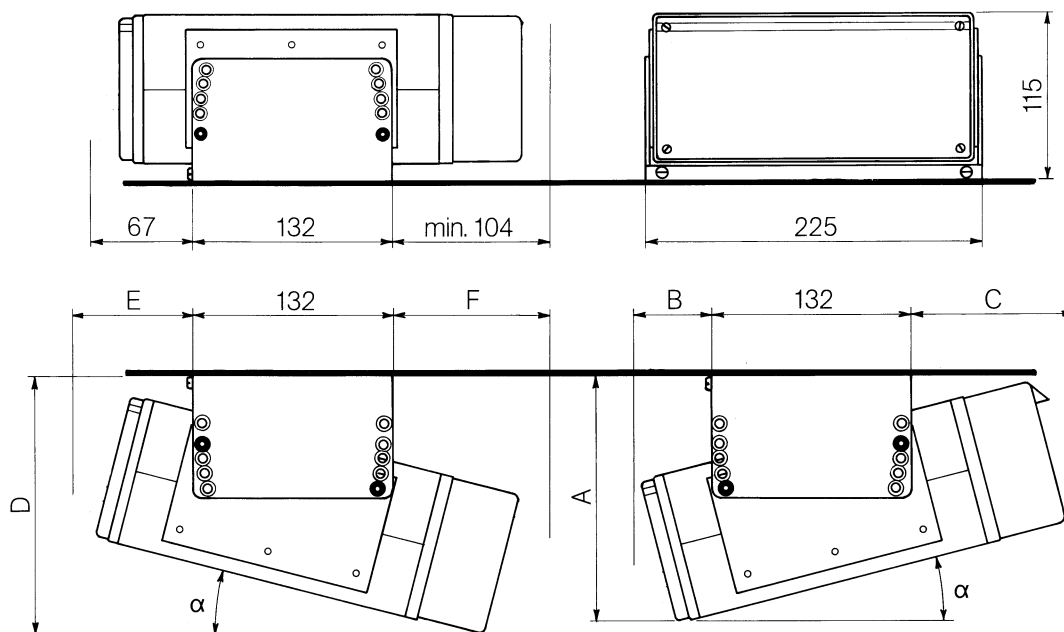
IN CONJUNCTION WITH OTHER SAILOR EQUIPMENT

Look-up the INSTALLATION section for the SAILOR unit in question.

2.2. DIMENSIONS AND DRILLING PLAN

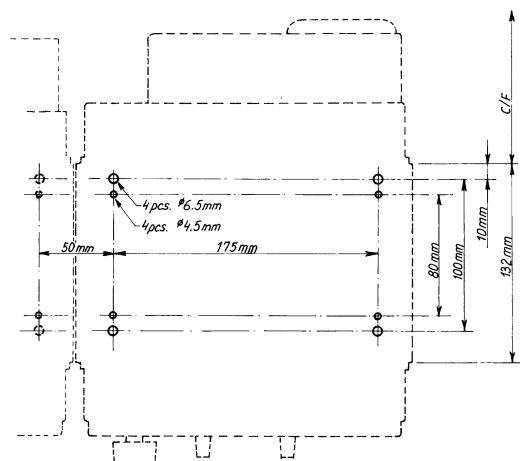
UNIVERSAL MOUNTING BRACKET H2055

permits a wide variety of installation possibilities, such as tabletop, bulkhead or deckhead. For other possibilities, such as console installation, the SAILOR 19" rack or all units in the Compact programme assembled on the bulkhead, see special information concerning installation of the Compact programme.



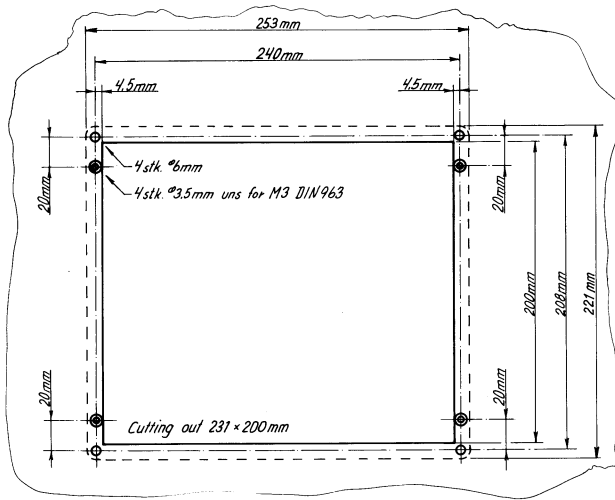
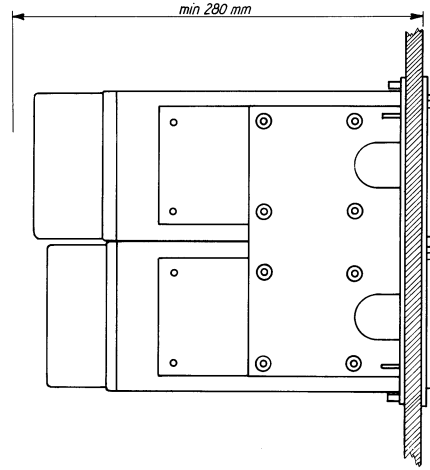
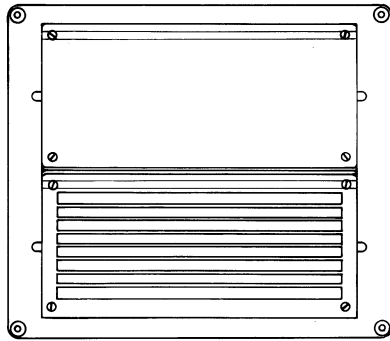
WEIGHT

Mounting kit H2055:	1.5 kg
R2022	: 4.5 kg
H2054	: 5.5 kg
H2074	: 4.0 kg
CRY2001	: 3.2 kg
RT2047	: 5.2 kg
CRY2002	: 2.9 kg
H2080	: 1.0 kg

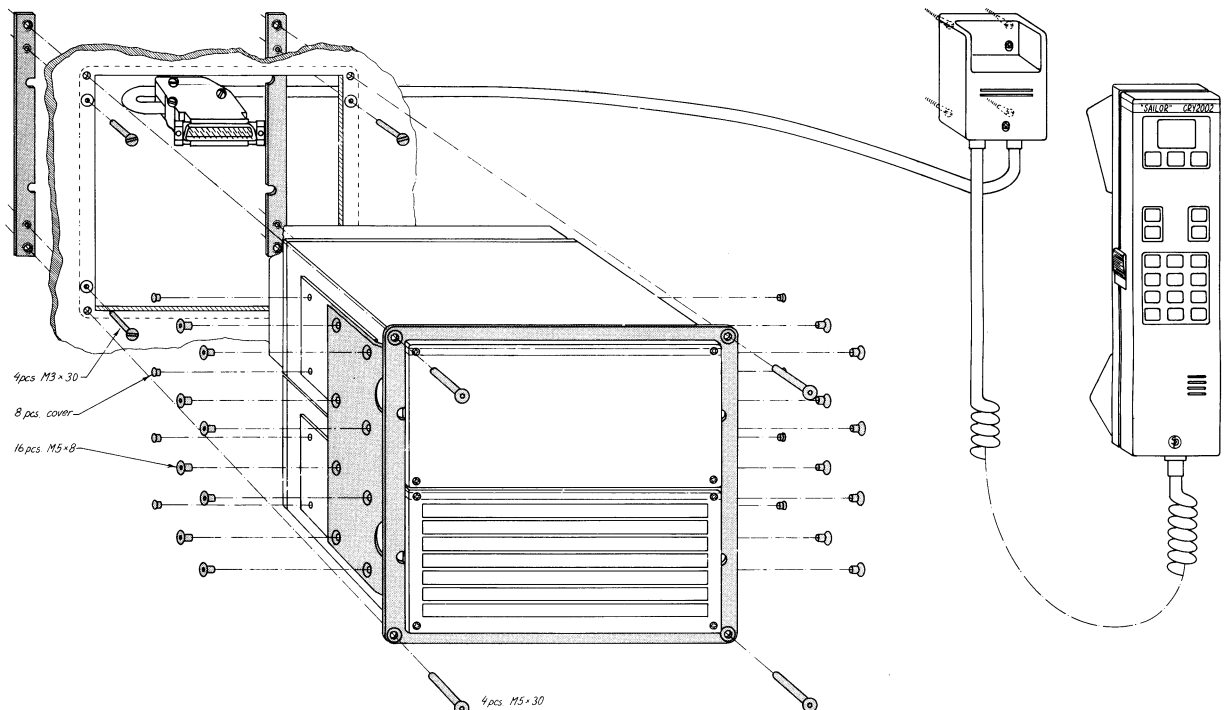


2.2. DIMENSIONS AND DRILLING PLAN cont.:

MOUNTING KIT H2064



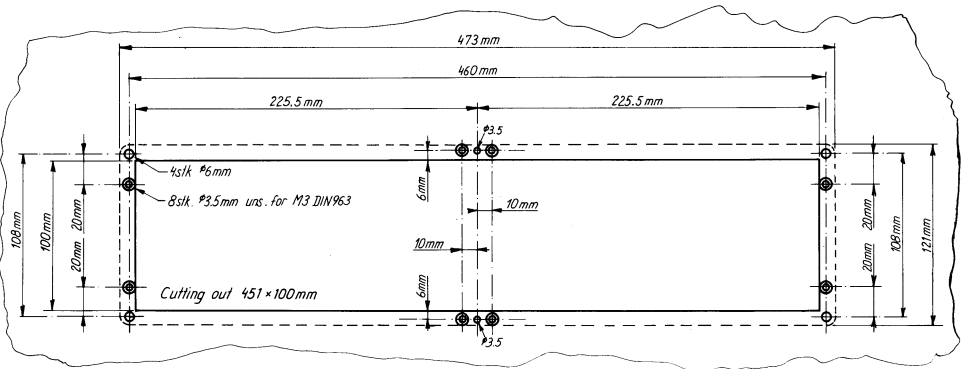
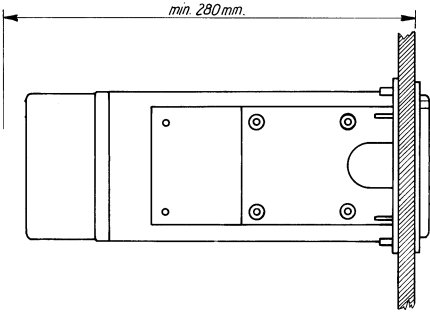
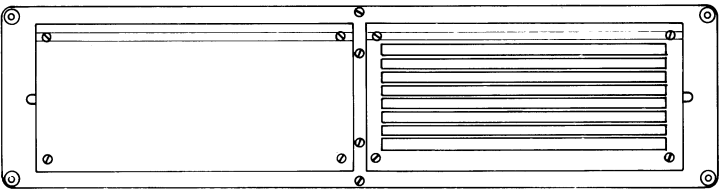
Free distance must be kept to allow free air circulation ambient temperature max. 40°C.



CRY2002 4-0-24771
4-0-24704 4-0-25372

2.2. DIMENSIONS AND DRILLING PLAN cont.:

MOUNTING KIT H2062

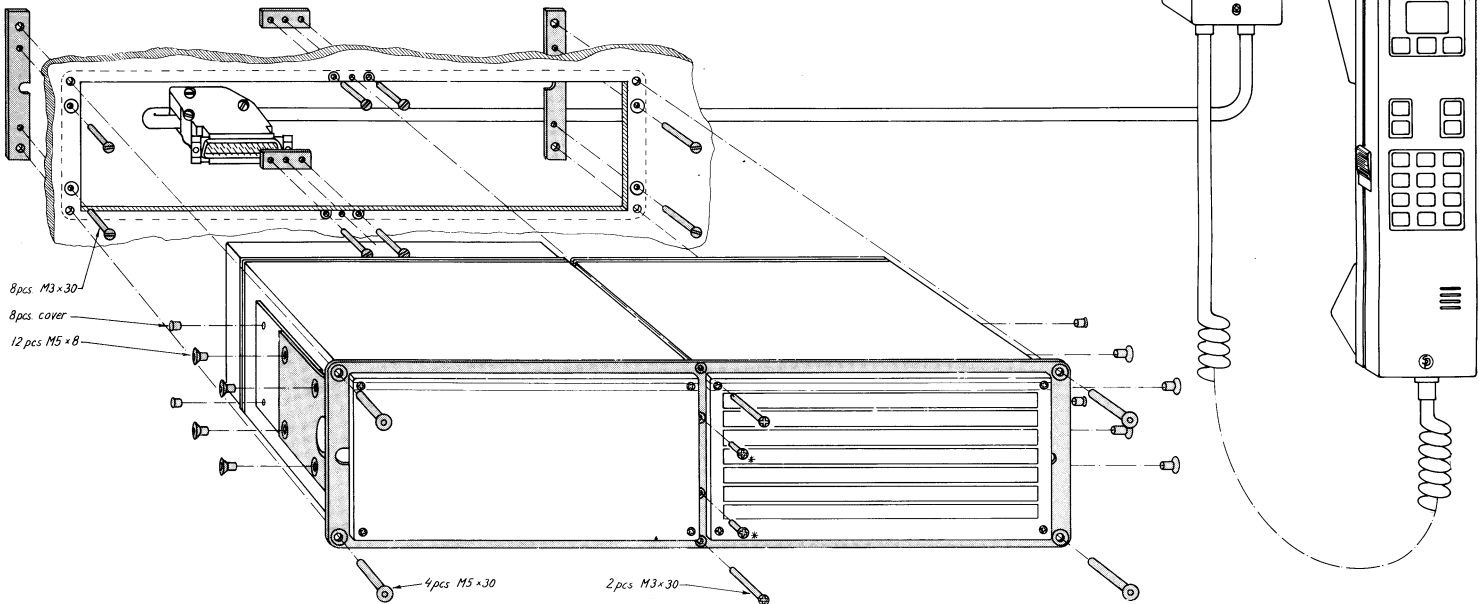
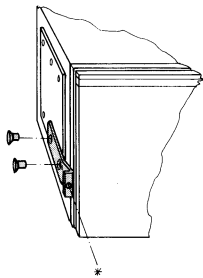
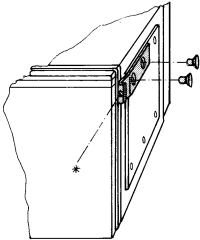


Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

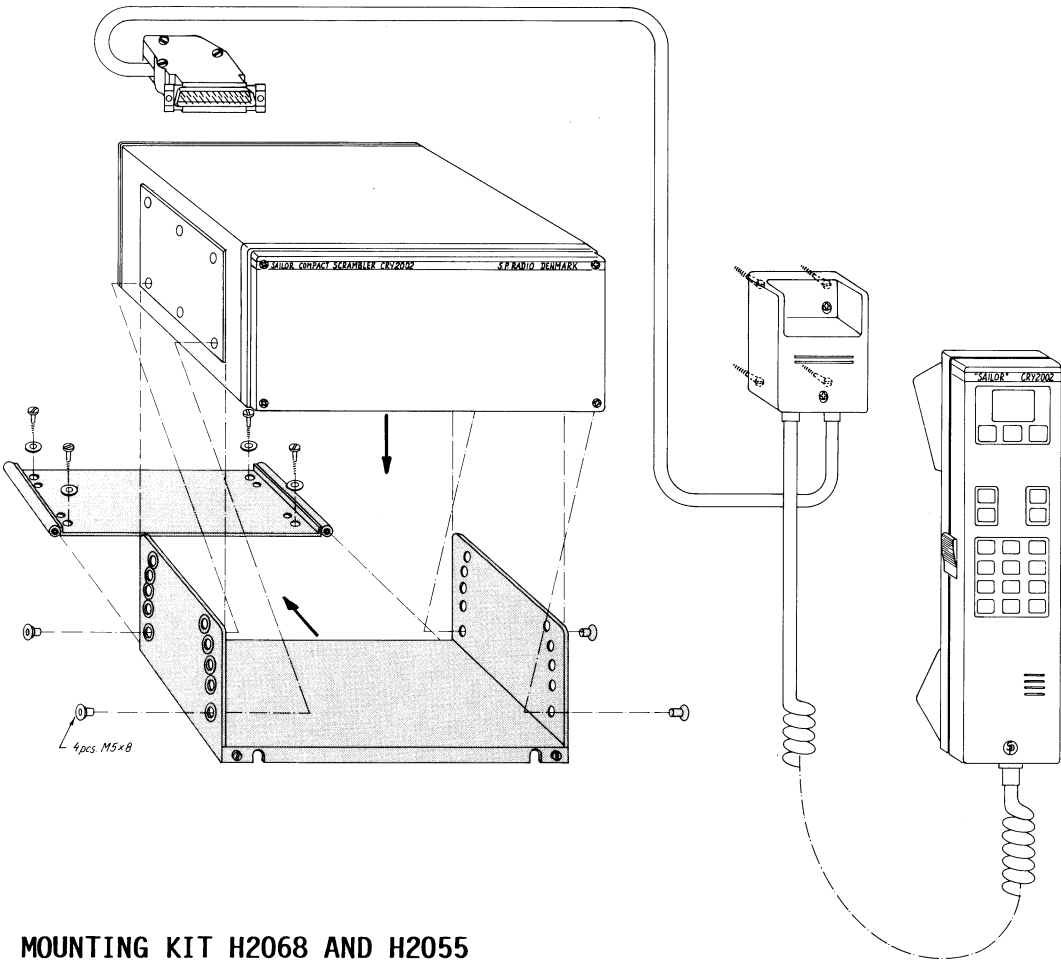
WEIGHT

Mounting kit H2062:	1.5 kg
R2022	: 4.5 kg
H2054	: 5.5 kg
H2074	: 4.0 kg
CRY2001	: 3.2 kg
RT2047	: 5.2 kg
CRY2002	: 2.9 kg
H2080	: 1.0 kg
Handset	: 0.5 kg

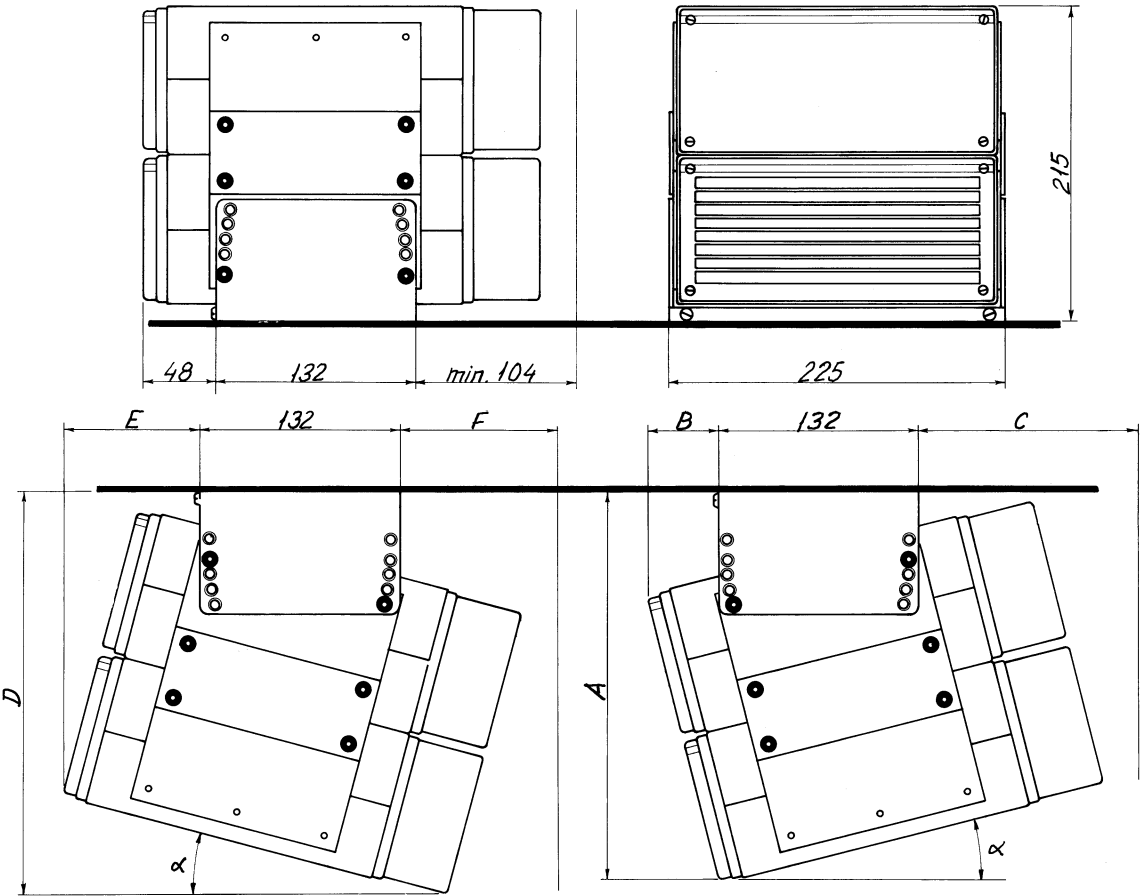
CRY2002 4-0-24732
4-0-25374 4-0-24769



2.2. DIMENSIONS AND DRILLING PLAN cont.:



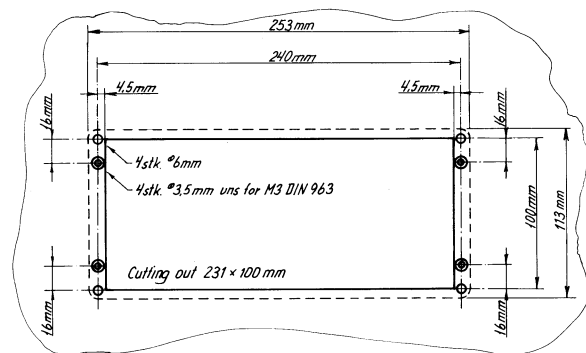
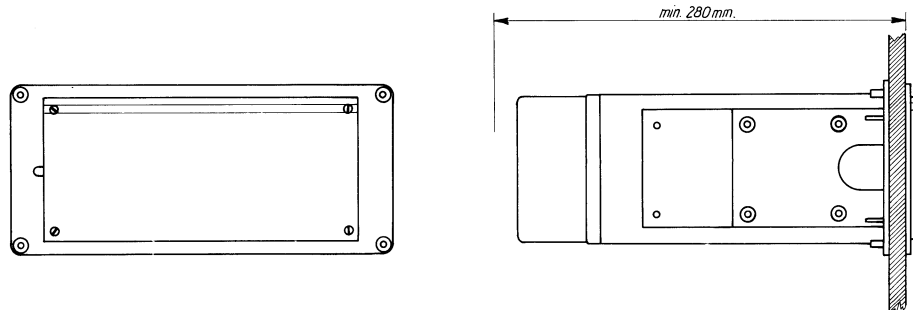
MOUNTING KIT H2068 AND H2055



CRY2002 4-0-24766
4-0-24767 4-0-25375

2.2. DIMENSIONS AND DRILLING PLAN cont.:

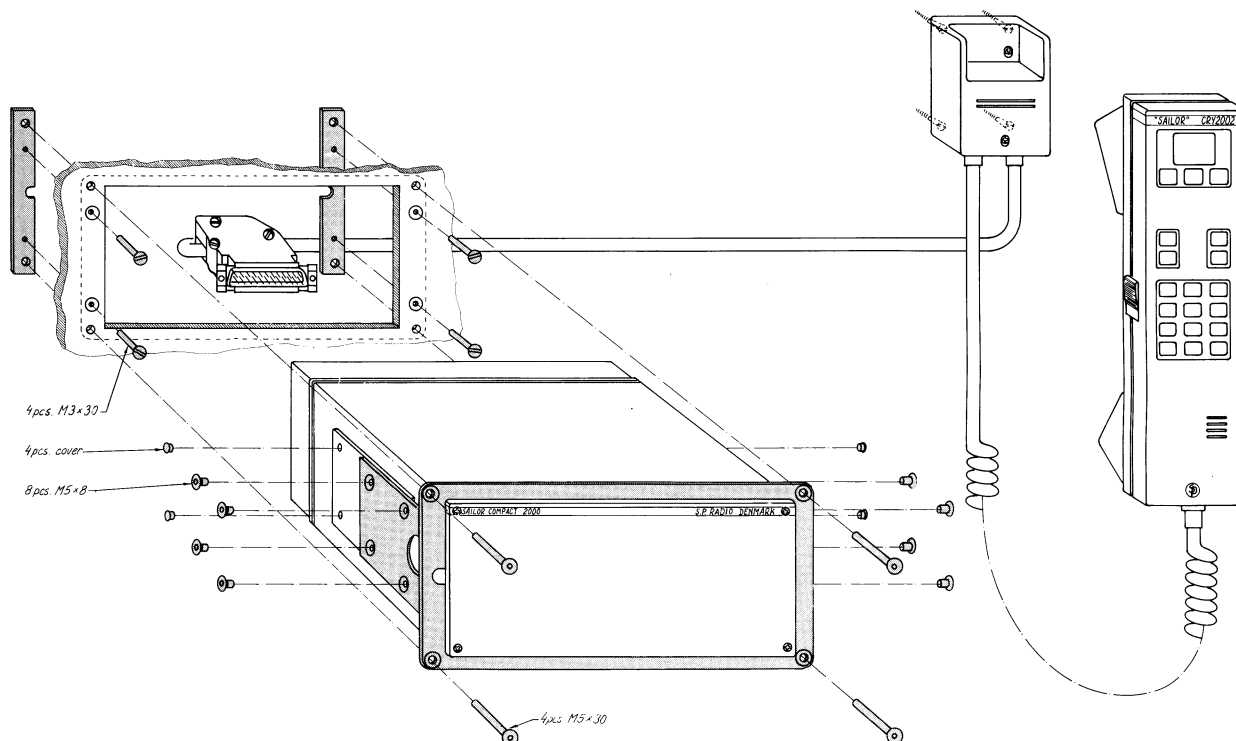
MOUNTING KIT H2063



Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

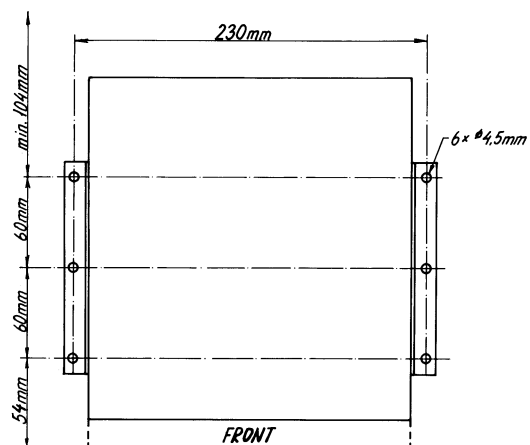
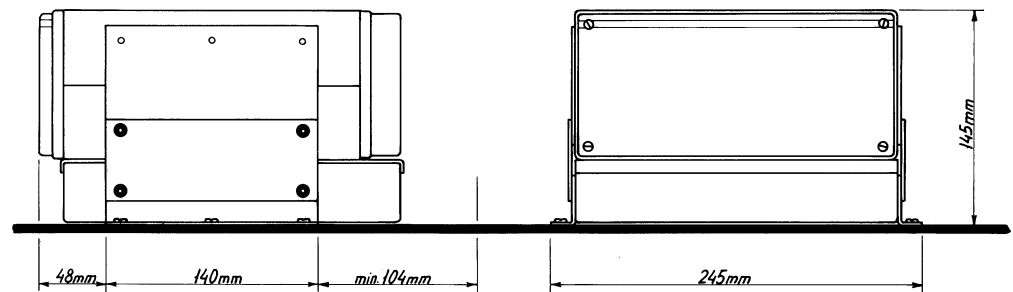
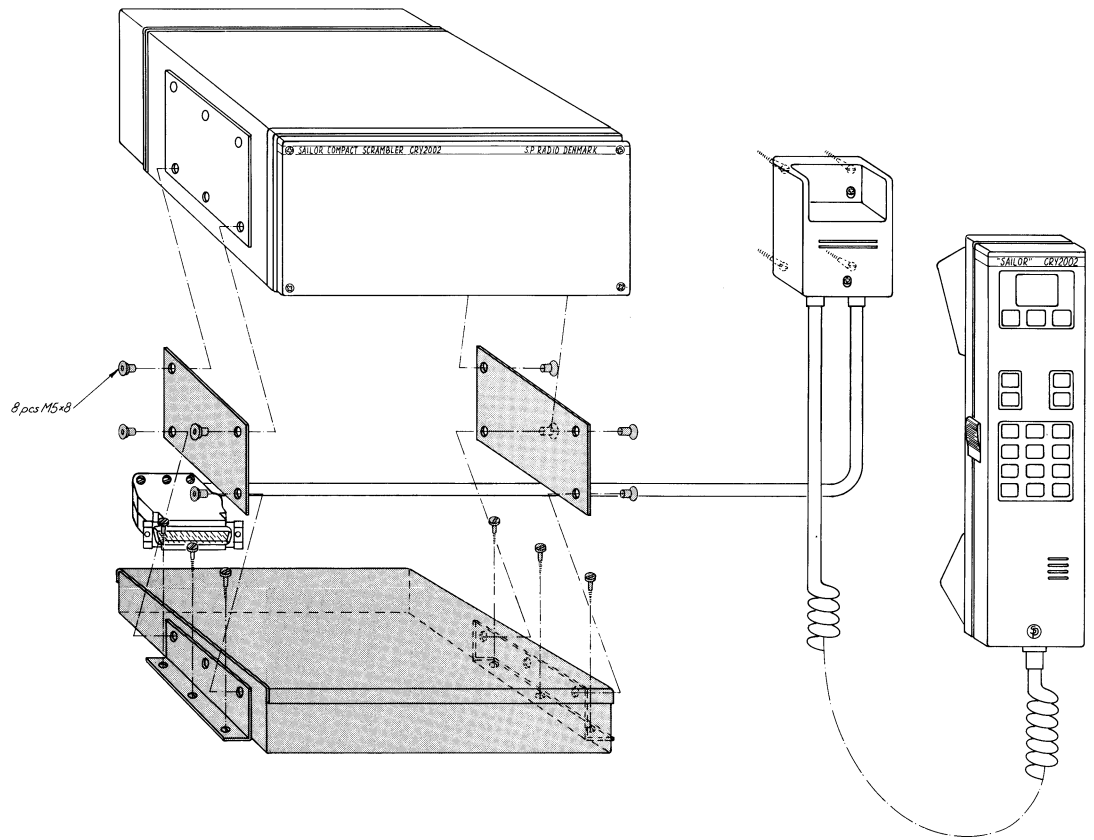
WEIGHT

Mounting kit H2063:	1.0 kg
R2022	: 4.5 kg
H2054	: 5.5 kg
H2074	: 4.0 kg
CRY2001	: 3.2 kg
RT2047	: 5.2 kg
CRY2002	: 2.9 kg
H2080	: 1.0 kg
Handset	: 0.5 kg



2.2. DIMENSIONS AND DRILLING PLAN cont.:

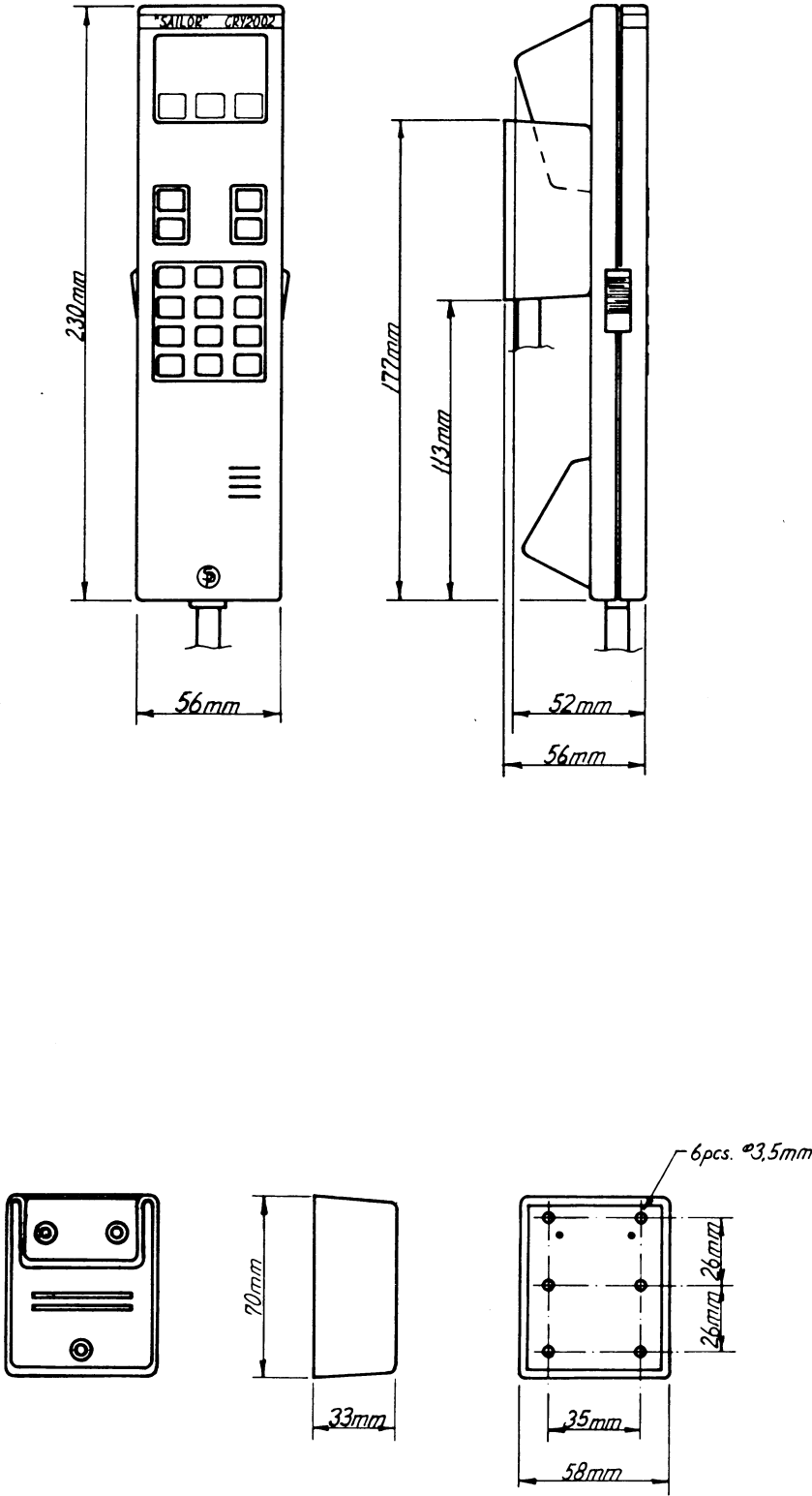
Connection Box SAILOR H2080 and Mounting Kit H2068



WEIGHT:

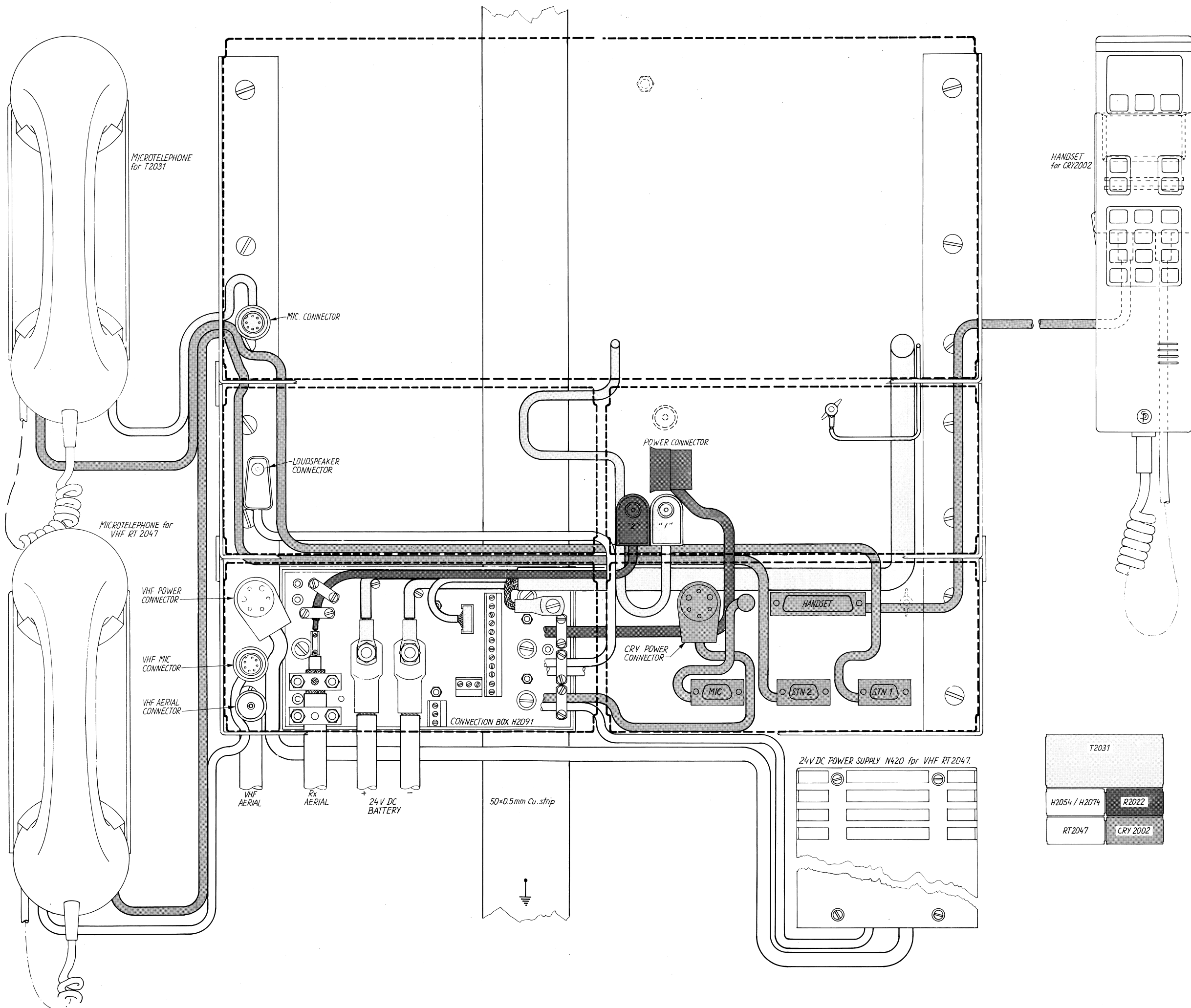
CRY2002:	2.9 kg
H2080:	1.0 kg
Handset:	0.5 kg

2.2. DIMENSIONS AND DRILLING PLAN cont.:



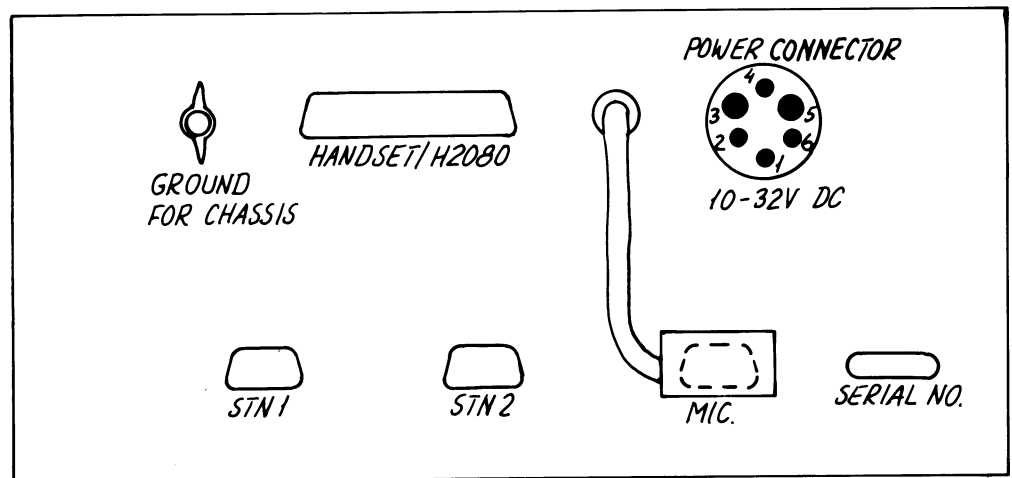
CRY2002 4-0-25360
4-0-25363

CRY2002
4-0-25405



T2031	
H2054 / H2074	R2022
RT2047	CRY 2002

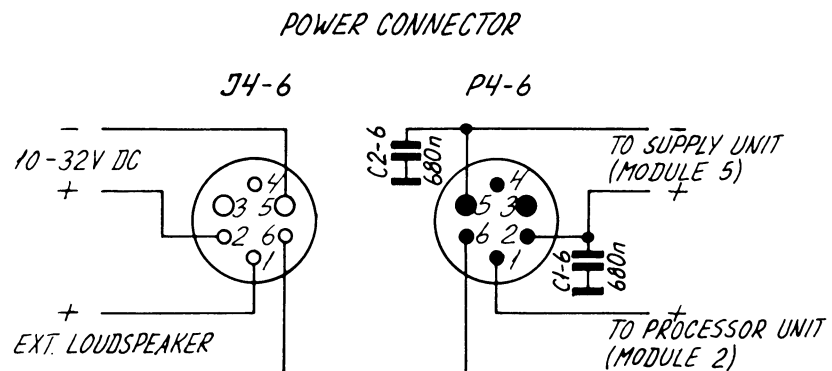
2.3. ELECTRICAL CONNECTIONS (EXT. LS, POWER PLUG)



rear view

THE CHASSIS IS GALVANIC SEPARATED FROM BATTERY.

THE CONNECTIONS FOR STN1, STN2, MIC. AND HANDSET/H2080 ARE SHOWN ON THE INTERCONNECTION CABLE DIAGRAM FOR CRY2002 (section 7.6.)

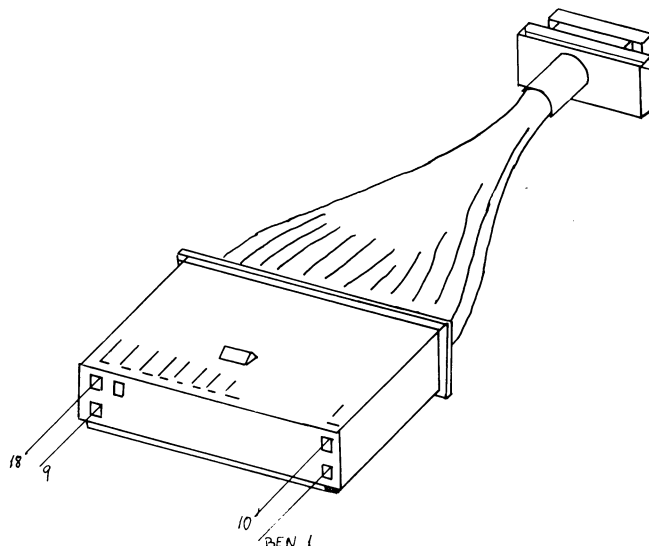


2.3. ELECTRICAL CONNECTIONS cont.:

Cabling between CRY2002/H2080 and handset.

Normal length 6 metres.

(Lengths of 4-8 and 10 metres can be ordered (see parts list).



For Handset or Hook

D-connector HANDSET/H2080

pin 1	brown/green	DIS.DATA+	pin 13
pin 2	orange/white	KYBD.CLK	pin 11
pin 3	white (screen)	EARPIECE+	pin 7
pin 4	screen (brown)	MIC.	pin 14
pin 5	brown (screen)	MIC.+	pin 15
pin 6	green/white	LOAD	pin 25
pin 7	violet	ON/OFF+	pin 20
pin 8	yellow	KYBD.DATA+	pin 9
pin 9	black	COMMEN	pin 3
pin 10	brown/yellow	DIS.DATA	pin 12
pin 11	orange	KYBD.CLK+	pin 10
pin 12	screen (white)	EARPIECE	pin 6
pin 13	blue/red	HOOK SWITCH	pin 16
pin 14	grey	HANDKEY	pin 4
pin 15	green	LOAD+	pin 24
pin 16	blue	ON/OFF	pin 21
pin 17	yellow/white	KEBD.DATA	pin 8
pin 18	red	+8V	pin 5

2.4. PROGRAMMING OF SERVICE PROM cont.:

GENERAL INFORMATION ABOUT THE PRE-KEY TIME:

If the SAILOR Scrambler CRY2002 has to operate with a radio station which is not manufactured by S. P. Radio A/S, the pre-key time must be measured by the sales agent before the service PROM can be programmed.

The procedure for measuring the pre-key time can be:

Use the push to talk (PTT) button as trigger information to an oscilloscope. Measure the time from the PTT button as activated until a 100% modulated signal is obtained from the transmitter. The modulated signal viewed on the oscilloscope can be taken from a receiver.

The code for pre-key time, programmed in service PROM can be read out at the display (see section 5.5.1.)

Table for miscellaneous sets:

Type	100% signal (msecs)	DATA		
		Value X x 10 mS	HEX	Binary
Skanti TRP6000	200	20	14	00010110

2.4. PROGRAMMING OF SERVICE PROM cont.:

PROGRAMMING OF CALL SIGN OF THE RADIO STATION FOR USE BY THE VOICE GENERATOR

The call sign may include up to 9 characters and must be terminated by a 00 Hex character.

The call sign is entered in ASCII format into the service PROM addresses 05 to 0D HEX (IC10) in the processor unit, module 2.

Table for ASCII to Hex:

ASCII	Hex	ASCII	Hex
A	41	0	30
B	42	1	31
C	43	2	32
D	44	3	33
E	45	4	34
F	46	5	35
G	47	6	36
H	48	7	37
I	49	8	38
J	4A	9	39
K	4B		
L	4C		
M	4D		
N	4E		
O	4F		
P	50		
Q	51		
R	52		
S	53		
T	54		
U	55		
V	56		
W	57		
X	58		
Y	59		
Z	5A		

Table for Value, Hex and Binary:

Value	Hex	Binary
1	1	0001
2	2	0010
3	3	0011
4	4	0100
5	5	0101
6	6	0110
7	7	0111
8	8	1000
9	9	1001
10	A	1010
11	B	1011
12	C	1100
13	D	1101
14	E	1110
15	F	1111

Example:

Call sign: SPR1

DATA

Addr.	Hex	Binary
05	53	01010011
06	50	01010000
07	52	01010010
08	31	00110001
09	00	00000000

2.4. PROGRAMMING OF SERVICE PROM (PRE-KEY, CALL NAME) (IC10 in Processor Unit, Module 2)

The service PROM IC10 is a 32x8 bit PROM into which a code for pre-key time must be programmed, and, if necessary, call sign for the radio station to which SAILOR CRY2002 has been connected.

The pre-key time is the period from the transmitter has been keyed and until 100% modulation has been obtained. If the pre-key time, which is programmed in IC10, is too short, the scrambler will start transmitting phase signal before the transmitter has obtained full power. This means that two scramblers may be able to communicate at a short distance but at a great distance synchronization problems will occur.

If the service PROM has not been installed, the pre-key time will be less than 1 mS. Therefore it is not necessary to install IC10, if SAILOR CRY2002 is to be connected to the public telephone system or systems with full duplex.

When ordering a scrambler CRY2002, the programming of the service PROM can be completed by S. P. Radio A/S if the sales agent can inform what type of radio stations the scrambler CRY2002 will be installed with, and the call sign of the radio station. If S. P. Radio is going to programme the service PROM IC10, the pre-key time for HF/SSB and VHF equipment will be in Stn1 and Stn2 respectively.

Otherwise the service and sales agents have to take out the service PROM and complete the programming before installation.

Type of PROM's used in the scrambler CRY2002:

Type	Manufact.	Memory size	Unprogrammed output level
82S123	Signetic	8x32	Low
6331-1J/N	MMI	8x32	High
63S080	MMI	8x32	Low

P.S. Only 6331-1J and 63S080 can be programmed by the PROM PROGRAMMER type H233 from S. P. Radio A/S.

RESERVED ADDRESSES IN SERVICE PROM (IC10 in Processor Unit, Module 2)

Addresses	Description
05-0E Hex	The call sign of the radio station for use by the voice generator. The call sign is entered in ASCII format, 9 characters long. A call sign must be terminated by 00 Hex character.
0F HEX	Contains the code for pre-key time in Stn1
10 HEX	Contains the code for pre-key time in Stn2

2.4. PROGRAMMING OF SERVICE PROM cont.:

The value (in decimal) of code x10 is the pre-key time in mS.

Example: the value 12 (0C HEX or 00001100B) gives a 120 mS pre-key time.
The max. value is 255 (FE HEX or 11111110B) gives a max. prekey time of 2.55 secs.

Check of programmed pre-key time, see section 5.5. ALIGNMENT PROCEDURE.

Addresses: 0F (Hex) Stn1. Normally for HF sets
10 (Hex) Stn2. Normally for VHF sets.

Always observe that the installation is adjusted for the programmed service PROM.

Table for SAILOR sets:

Type	100% signal(msecs)	Data in Addr.0F(Stn1)			Data in Addr.10(Stn2)		
		Value Xx10 mS	HEX	Binary	Value Xx10 mS	HEX	Binary
RT143	300				30	1E	00010100
RT144A/B/C	200				20	14	00010100
RT145	200				20	14	00010100
RT146	200				20	14	00010100
RT2047	200				20	14	00010100
T121	200	20	14	00010100			
T122	200	20	14	00010100			
T124	200	20	14	00010100			
T126	200	20	14	00010100			
T128	200	20	14	00010100			
T1127/N1400	500	50	32	00110010			
T1127/N1401	500	50	32	00110010			
T1130/N1407	500	50	32	00110010			
T1130/N1409	1100	110	6E	01101110			
T2031	900	90	5A	01011010			

Example: Installation with RT144C and T1127/N1400.

Type	Address (Hex)	Data (Hex)
T1127/N1400	0F	32
RT144C	10	14

2.5. STRAPS (W1, W2, W4, ON MAIN BOARD AND W1, W2, W5, W6 ON PROCESSOR UNIT)

The straps W1 - W4 on the main board unit (module 1) in the handset have the following function:

Strap	Description
-------	-------------

W1:	Check of pre-key time, call sign and F-scrambler (see section 5.5. ALIGNMENT PROCEDURE).
-----	--

W2:	If inserted (normal), T-scrambling is enabled.
-----	--

W4:	If inserted, the scrambler is locked to "Stn1". Normally used if only one station is connected to the scrambler.
-----	--

The straps W1 - W2 and W5 - W6 on the processor unit (module 2) have the following function.

Strap	Description
W1	Free running of microprocessor.
W2	Normal operation.
W5	If RAM, IC8 is changed to one with other data.
W6	Normal operation.

VHF RT2047

SSB T2031

CRV2002

H2082 Handset assembly

[0.8m]

[0.8m]

[6m]

[2m]

[2m]

HANDSET STN2

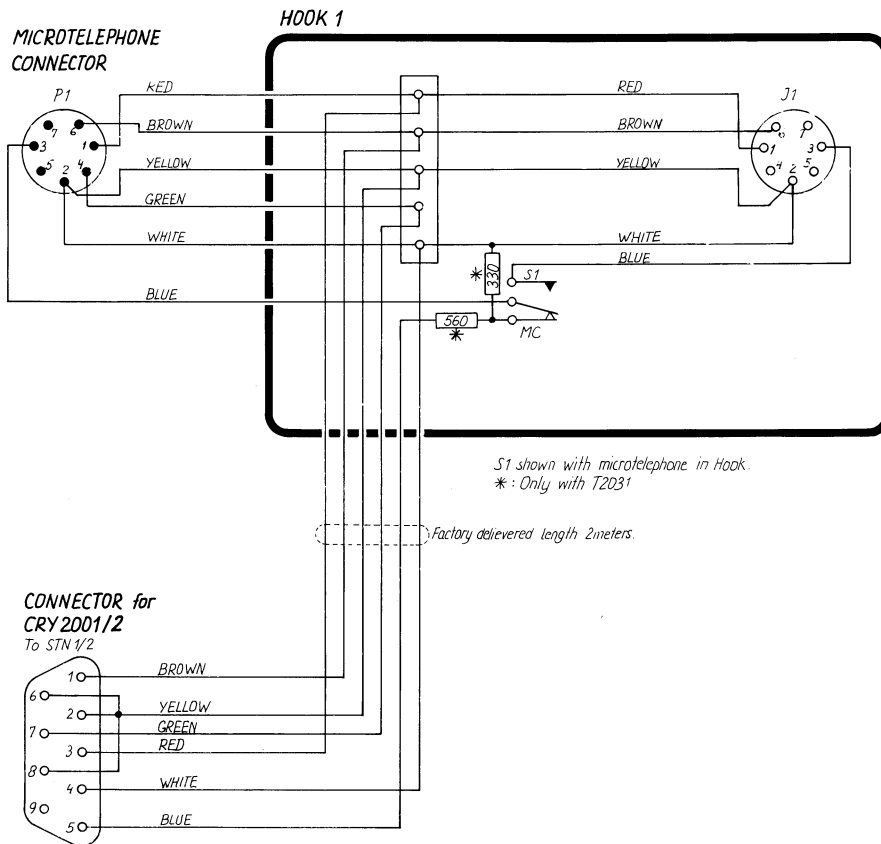
HANDSET STN1

[J: Distance in brackets is factory delivered length.

3.1. INTERCONNECTION TO SAILOR VHF RT2047 AND SSB T2031 WITH H2082 HANDSET ASSEMBLY cont.:

HANDSET ASSEMBLY H2082

INSTALLATION OF RT2047 or T2031 WITH CRY2001/2 and H2082 HANDSET ASSEMBLY.



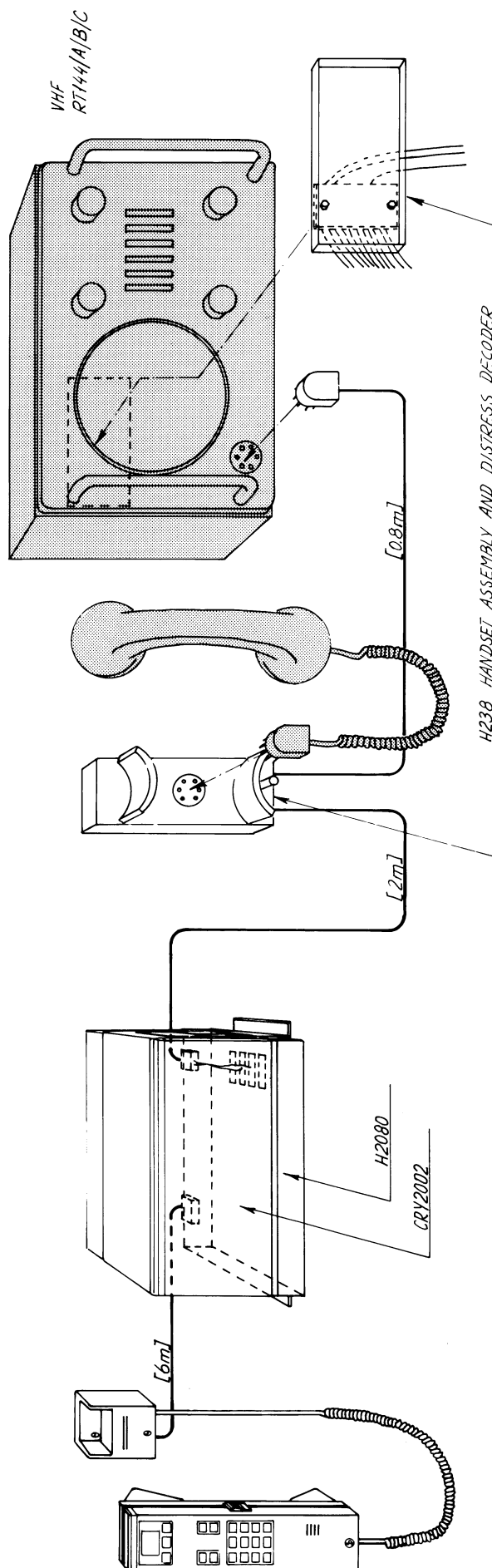
PROGRAMMING OF RT2047 FOR DISTRESS CHANNEL 16 OUTPUT:

Distress channel 16 output will be enabled by programming in identity code No. 1, service programme P5, addr. = 71:

AUX2 on preference channel, set bit No. 3 to "1".
If channel 16 is not preference channel set bit No. 2 to "1".

P.S.: Normally AUX2 for preference channel, bit No. 3 is set to "1" from factory

3.2. INTERCONNECTION TO VHF RT144A/B/C WITH H238 HANDSET ASSEMBLY AND DISTRESS DECODER AND H2080 CONNECTION BOX



[] : Distance in brackets is factory delivered length.

**3.2. INTERCONNECTION TO VHF RT144A/B/C
WITH H238 HANDSET ASSEMBLY AND DISTRESS DECODER
AND H2080 CONNECTION BOX cont.:**

INSTALLATION OF H238 HANDSET ASSEMBLY AND DISTRESS DECODER FOR CHANNEL 101316.

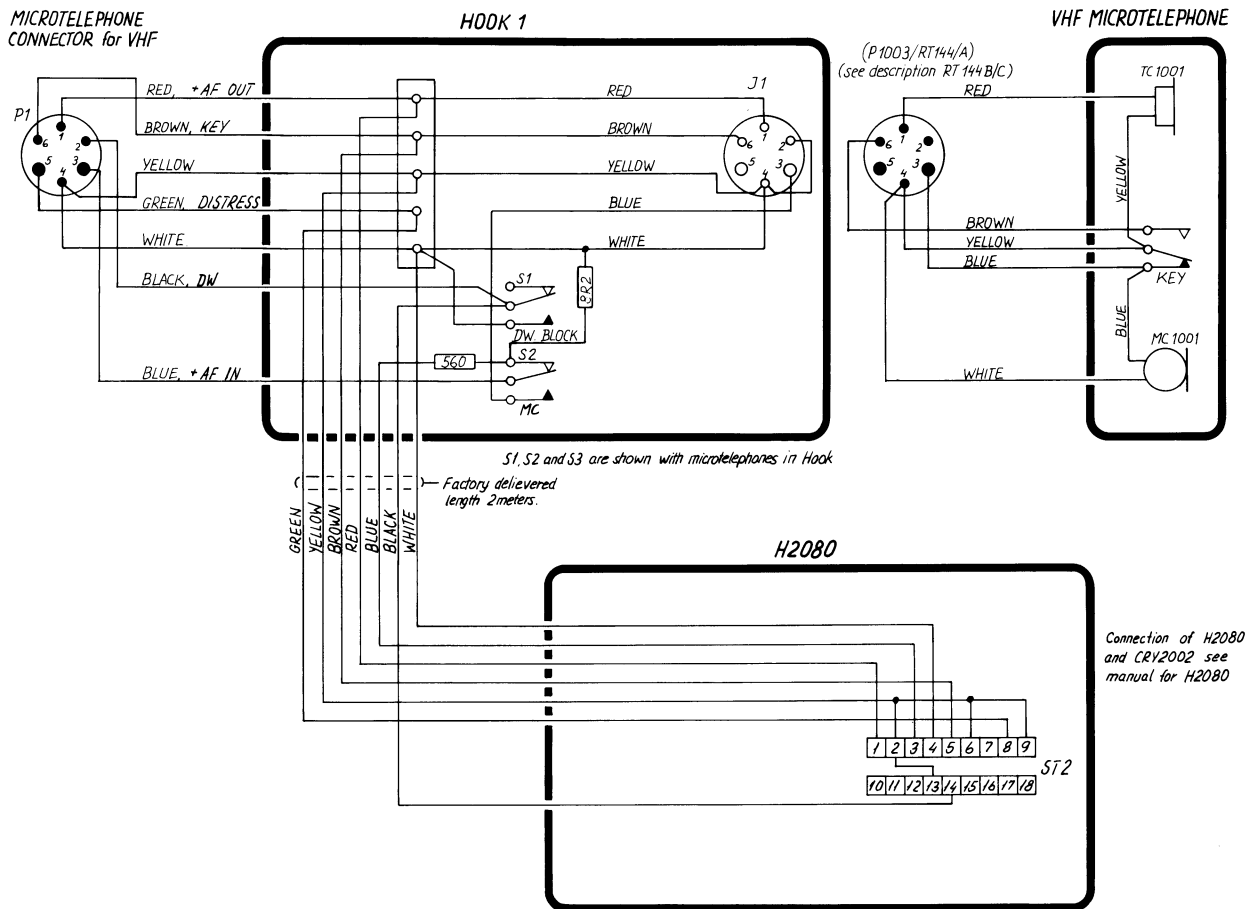
RT144/A

1. Remove the old hook for the VHF and replace it with Hook 1 from H238.
2. Cut-off the Hook 2 for CRY2001 handset and connect the cable from Hook 1 in H2080 as shown in the diagram.
3. Set the two switches SW1 and SW2 in the H2080. SW1-7 ON, SW2-6 and SW2-8 ON.
4. Install the distress decoder as shown on the next page.
5. Connect the microtelephone connector P1 to the microtelephone socket J1003 on the VHF and P1003 to J1 on Hook 1.

RT144/B/C

1. Remove the old hook for the VHF and replace it with Hook 1 from H238.
2. Cut-off the Hook 2 for CRY2001 handset and connect the cable in H2080 as shown in the diagram.
3. Set SW1 and SW2 in H2080 (the level for output and input of H2080). Set SW1-8, SW2-6 and SW2-8 ON.
4. SW1-1 to 4 and SW2-1 to 4. The location depends on the connection of Stn1.
5. Disconnect the handset with wire and the plug P1003 from the previous installation.
6. Solder the handset wire and connector P1003 as shown in the diagram of VHF microtelephone.
7. Connect microtelephone connector P1003 to J1 on Hook 1 and connector P1 to socket J1003 on the VHF.
8. Install the distress decoder as shown on the next page.

3.2. INTERCONNECTION TO VHF RT144/A/B/C WITH H238 HANDSET ASSEMBLY AND DISTRESS DECODER AND H2080 CONNECTION BOX cont.:



NB! The resistor in Hook 1 is for adjustment to the microphone input.

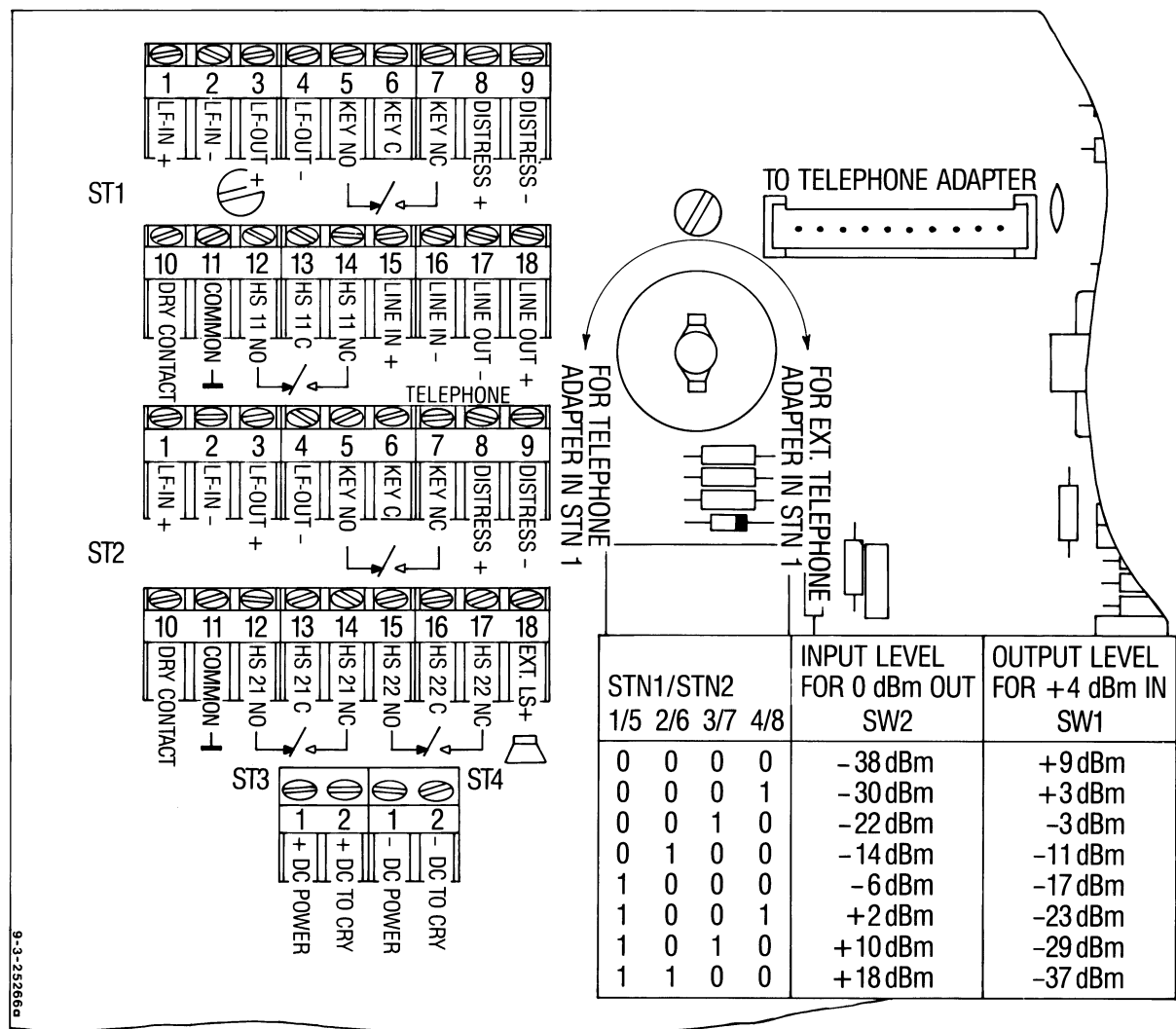
VHF sensitivity: $V_{in} = 4 \text{ mV RMS} \Rightarrow f \pm 3 \text{ kHz}, f_m = 1 \text{ kHz}$

At max. frequency deviation $V_{in, \text{max}} = 17 \text{ mV RMS}$.

If the level seems to high it may be suppressed 6 dB by setting SW1-7 on H2080 to ON instead of SW1-8.

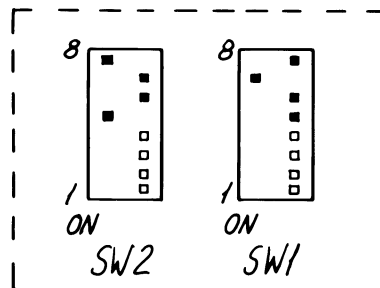
3.2. INTERCONNECTION TO VHF RT144A/B/C
WITH H238 HANDSET ASSEMBLY AND DISTRESS DECODER
AND H2080 CONNECTION BOX cont.:

CONNECTION OF H2080 TO HOOK 1



H2080 Cable from Hook 1

- ST2- 1 Red
- ST2- 2
- ST2- 6 Yellow
- ST2- 9
- ST2-13
- ST2- 3 Blue
- ST2- 4 White
- ST2- 8 Green
- ST2-14 Black



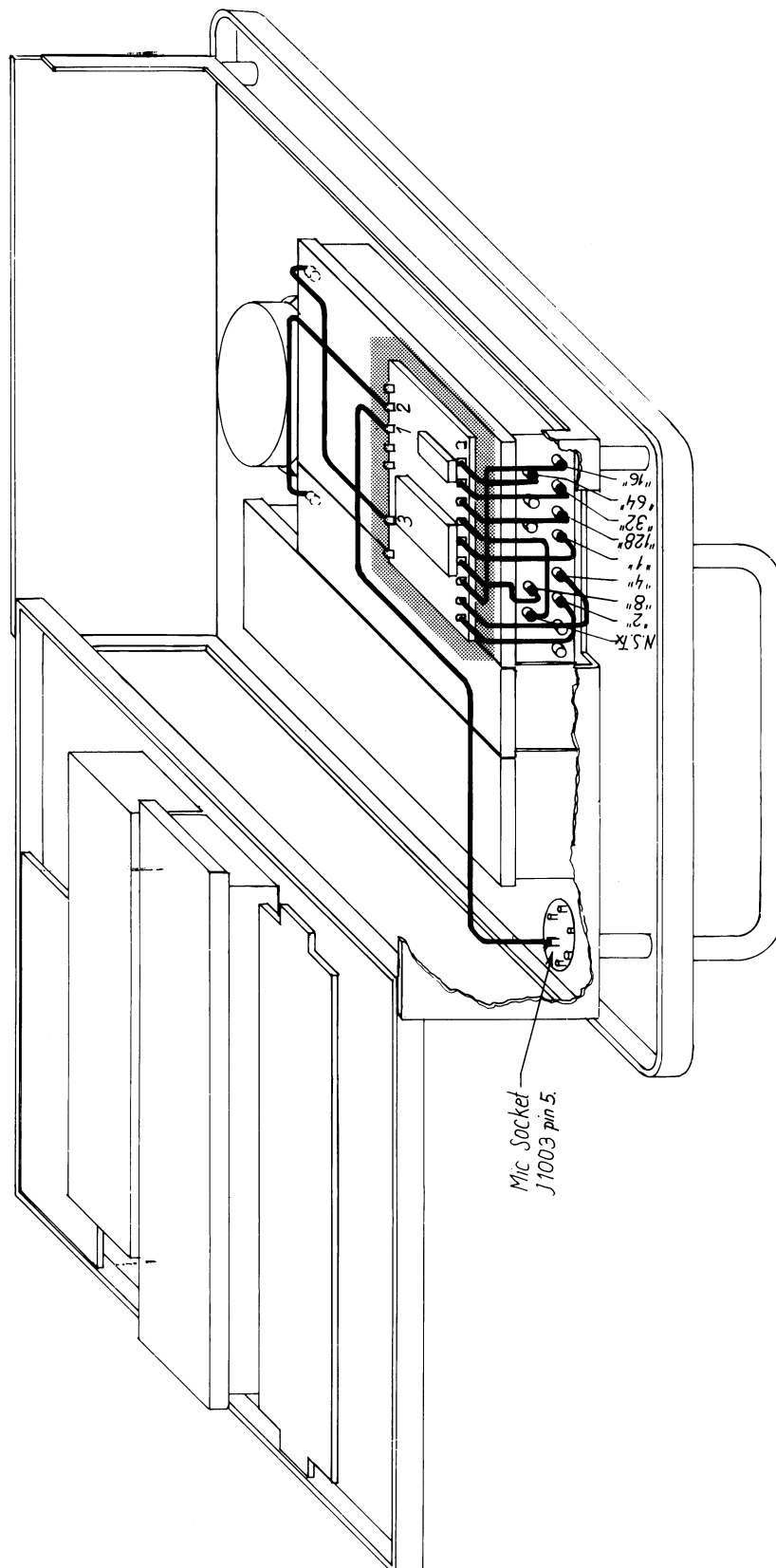
- The location is dependent on what is connected to Stn1.
- Adjustment of SW1 and SW2 for installation of RT144A/B/C to Stn2.

3.2. INTERCONNECTION TO VHF RT144A/B/C WITH H238 HANDSET ASSEMBLY WITH DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

INSTALLATION OF DISTRESS DECODER IN RT144/A

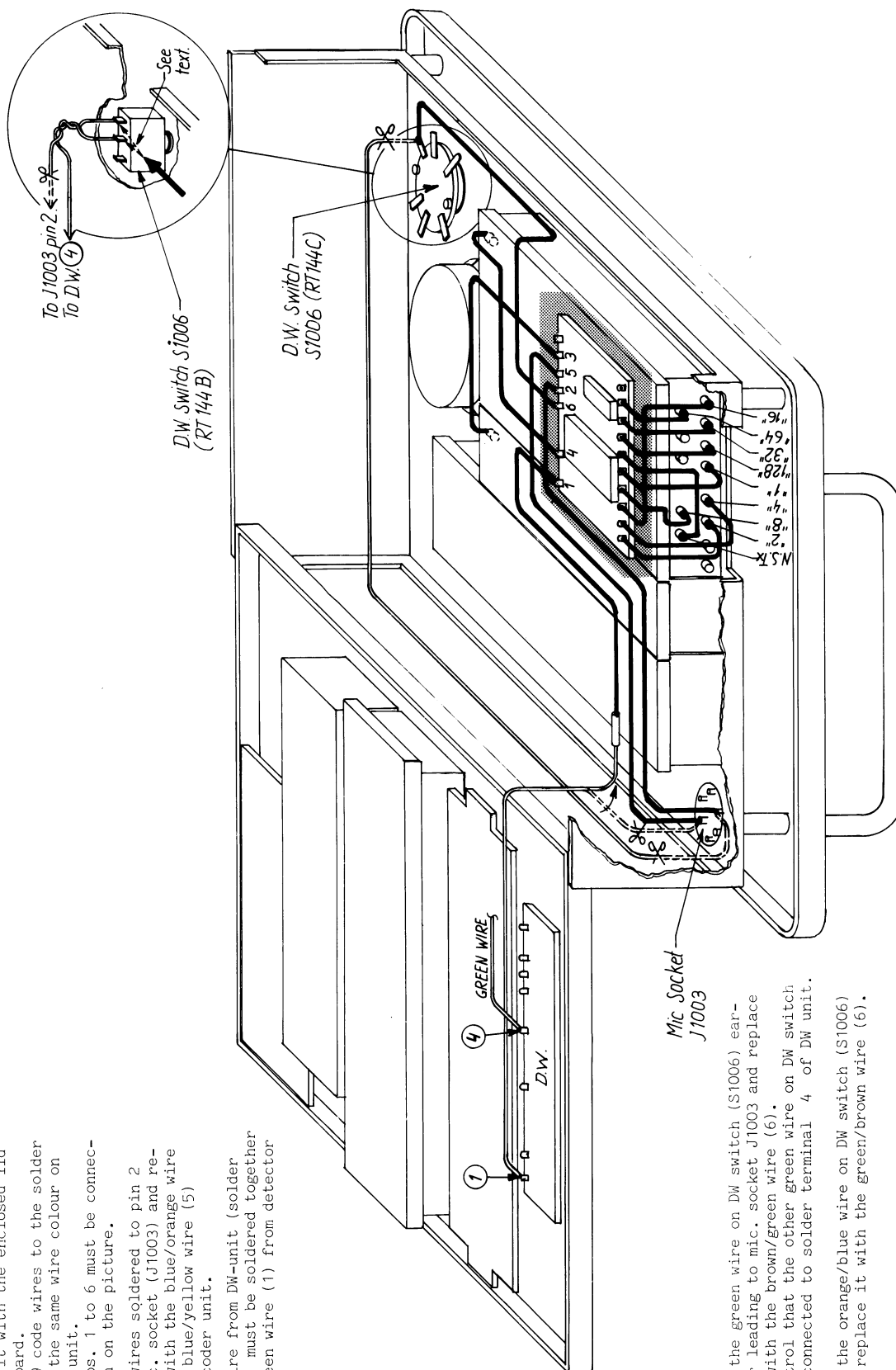
MODIFICATION

1. Remove the lid from the divider-unit and replace it with the enclosed lid with printboard.
2. Solder the 9 code wires to the solder points with wires of the same colour on the divider unit.
3. The wires No. 1 to 3 must be connected as shown in the picture:
 - Wire No. 1: Yellow/blue (decoded signal to CRY2001, pin 5 of mic. socket J1003).
 - Wire No. 2: Yellow (+10V to oscillator-unit).
 - Wire No. 3: Brown/red (+5V to divider-unit).



3.2. INTERCONNECTION TO VHF RT144A/B/C WITH H238 HANDSET ASSEMBLY WITH DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

INSTALLATION OF DISTRESS DECODER IN RT144B/C



MODIFICATION:

Remove the lid from the divider unit and replace it with the enclosed lid with printboard. Solder the 9 code wires to the solder points with the same wire colour on the divider unit. The wires Nos. 1 to 6 must be connected as shown on the picture.

Remove the wires soldered to pin 2 and 5 on mic. socket (J1003) and replace them with the blue/orange wire (2) and the blue/yellow wire (5) from the decoder unit.

The green wire from DW-unit (solder terminal 1 must be soldered together with the green wire (1) from detector unit.

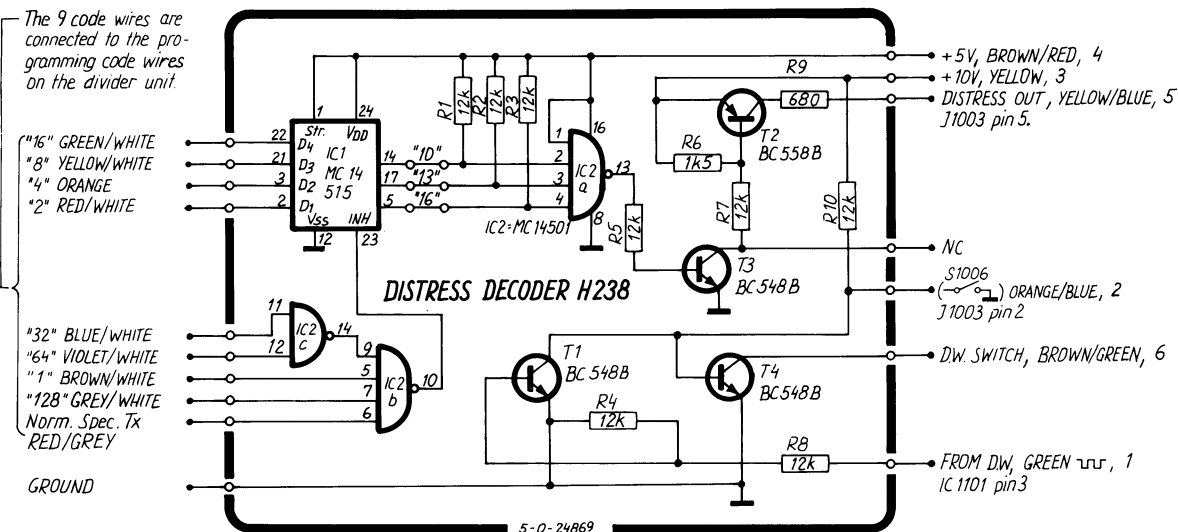
RT144B: Cut the green wire on DW switch (S1006) ear-lier leading to mic. socket J1003 and replace it with the brown/green wire (6). Control that the other green wire on DW switch is connected to solder terminal 4 of DW unit.

RT144C: Cut the orange/blue wire on DW switch (S1006) and replace it with the green/brown wire (6).

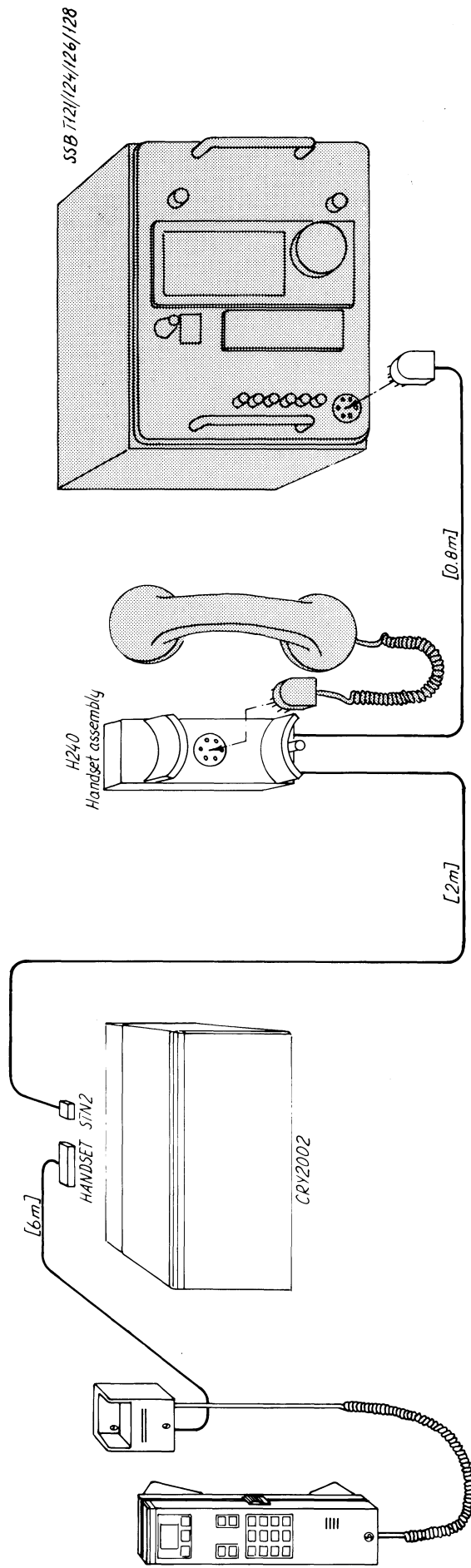
1. GREEN (from DW oscillator)
2. ORANGE/BLUE (DW on/off, to pin 2 of mic. socket, J1003)
3. YELLOW (+10V)
4. BROWN/RED (+5V)
5. YELLOW/BLUE (decoded signal to CRY2001, pin 5 of mic. socket)
6. BROWN/GREEN (to DW switch)

CRY2001/2, H2080
4-0-24869
4-6-24869

The 9 code wires are connected to the programming code wires on the divider unit.



3.3. INTERCONNECTION TO SAILOR SSB T121/124/126/128
WITH H240 HANDSET ASSEMBLY



[]: Distance in brackets is factory delivered length.

3.3. INTERCONNECTION TO SAILOR SSB T121/124/126/128 WITH H240 HANDSET ASSEMBLY cont.:

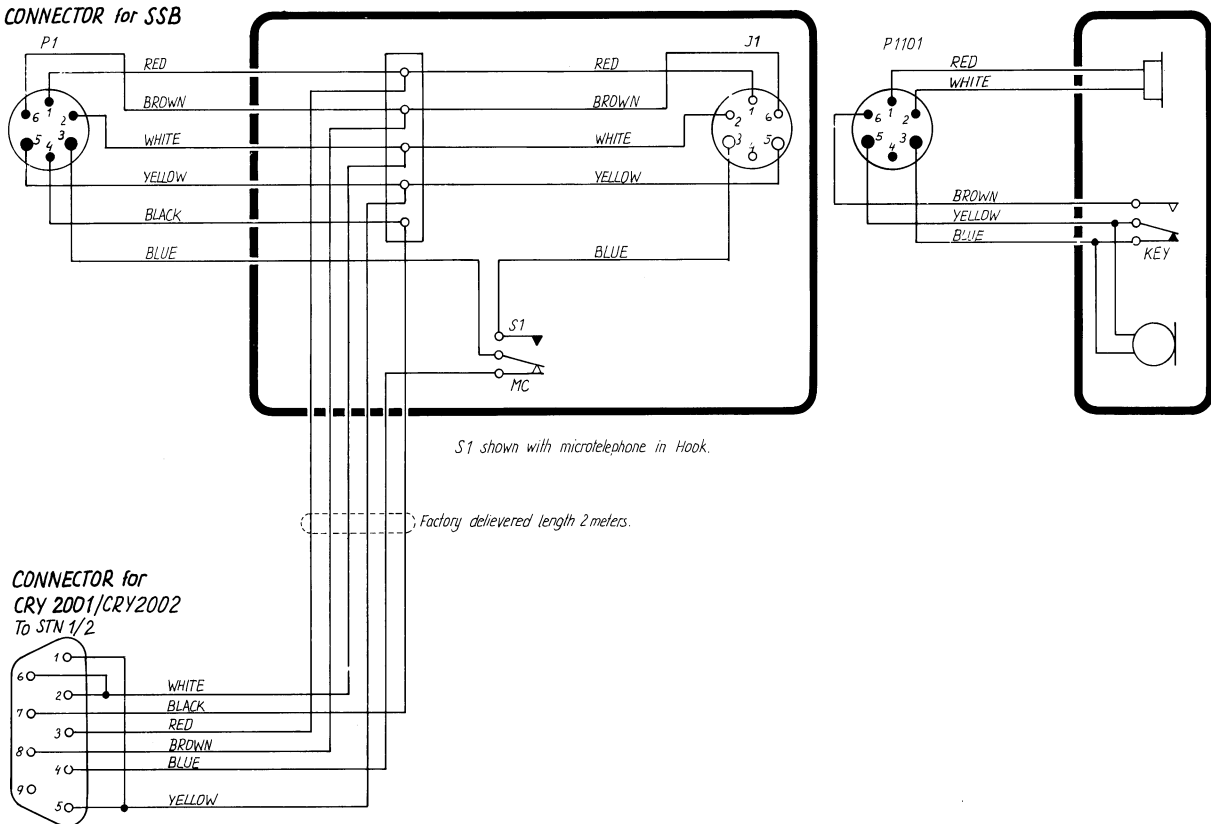
H240 HANDSET ASSEMBLY

INSTALLATION OF T121, T124, T126 or T128 WITH CRY2001/CRY2002 and H240 HANDSET ASSEMBLY

MICROTELEPHONE
CONNECTOR for SSB

HOOK 1

SSB MICROTELEPHONE



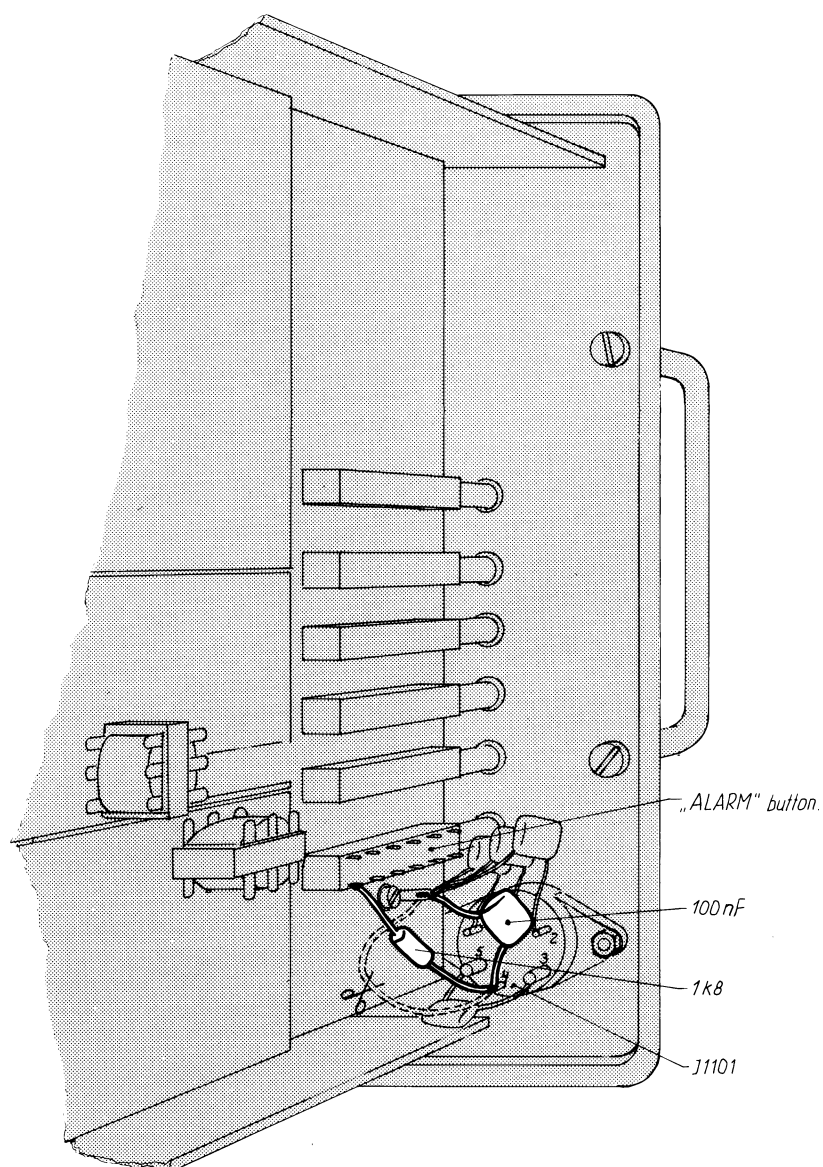
Note! If T121 is supplied with clipper microtelephone module, handset assembly H242 must be used.

3.3. INTERCONNECTION TO SAILOR SSB T121/124/126/128 WITH H240 HANDSET ASSEMBLY cont.:

HANDSET ASSEMBLY H240

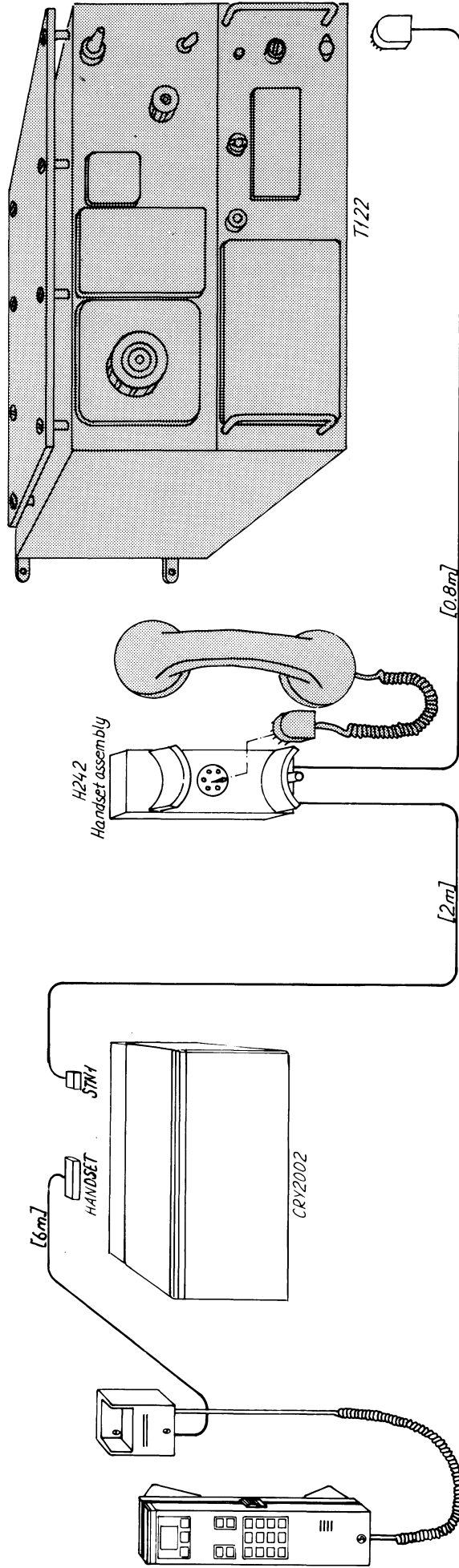
Modification for Distress Output in T121/124/126/128 to CRY2001/2

1. Remove the bypass capacitors together with the ground wire from pin No. 4 of J1101 and solder the capacitors to the ground point at chassis.
2. Solder a 1.8 kohm resistor from the push button ALARM to pin 4 of J1101 as shown below. Solder also the 0.1 uF capacitor from pin 4 to the ground point.
3. Remember to use loudspeaker on/off switch.



3.4. INTERCONNECTION TO SAILOR SSB T122
WITH H242 HANDSET ASSEMBLY

CRY2002
4-0-25420

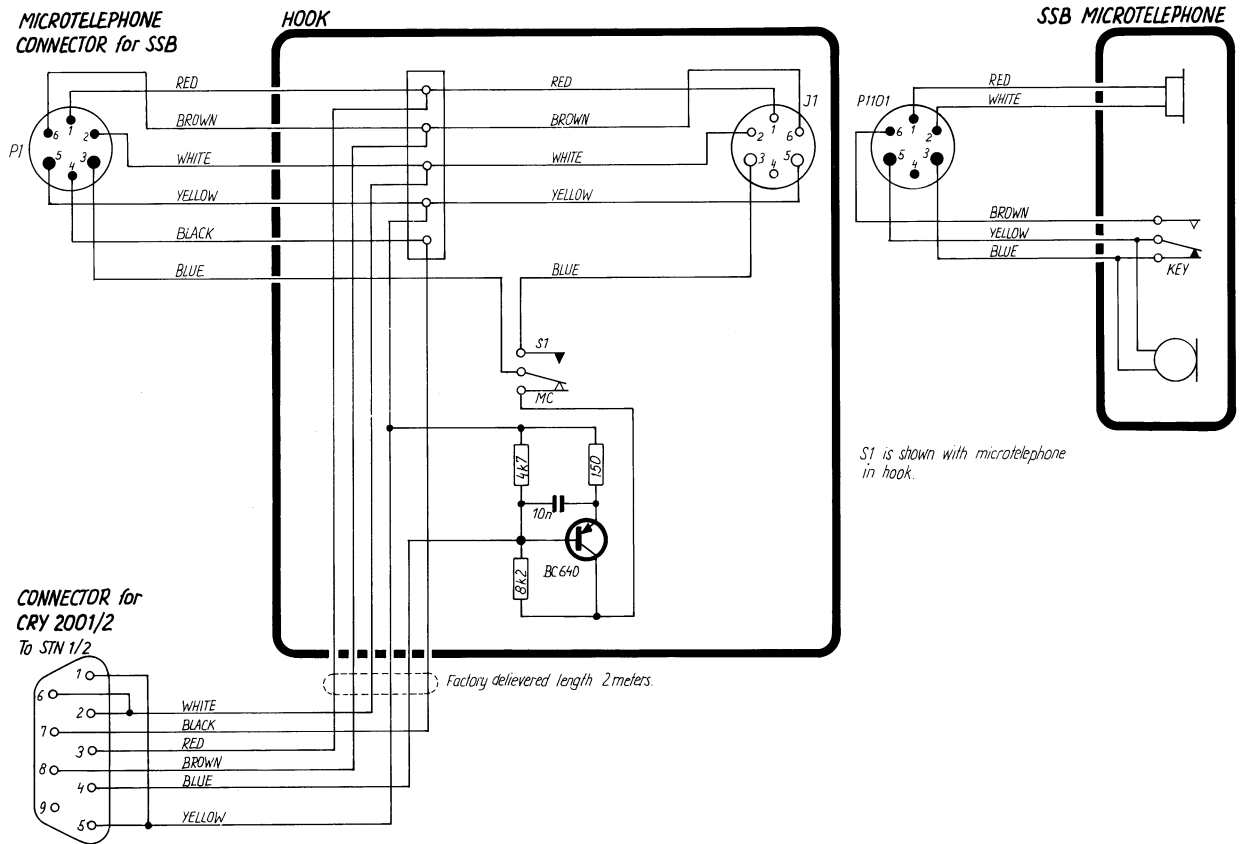


[] : Distance in brackets is factory delivered length.

3.4. INTERCONNECTION TO SAILOR SSB T122 WITH H242 HANDSET ASSEMBLY cont.:

HANDSET ASSEMBLY H242

INSTALLATION OF T122 WITH CRY2001/2 and H242 HANDSET ASSEMBLY



CRY2001/2,
4-0-25421

3.4. INTERCONNECTION TO SAILOR SSB T122 WITH H242 HANDSET ASSEMBLY cont.:

HANDSET ASSEMBLY H242

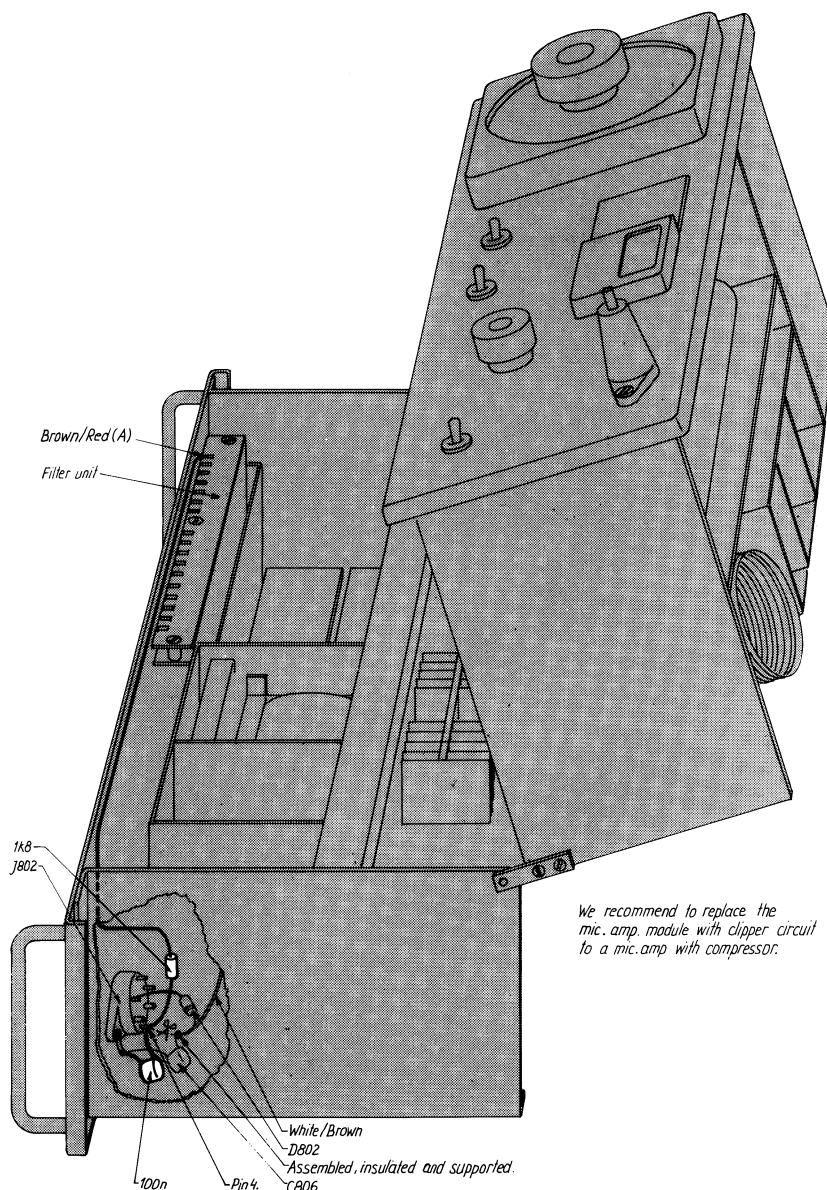
Modification for Distress Output in T122 to CRY2001/2

1. Remove the capacitor C806, the diode D802 and the brown/white wire from pin 4 of microtelephone socket J802.

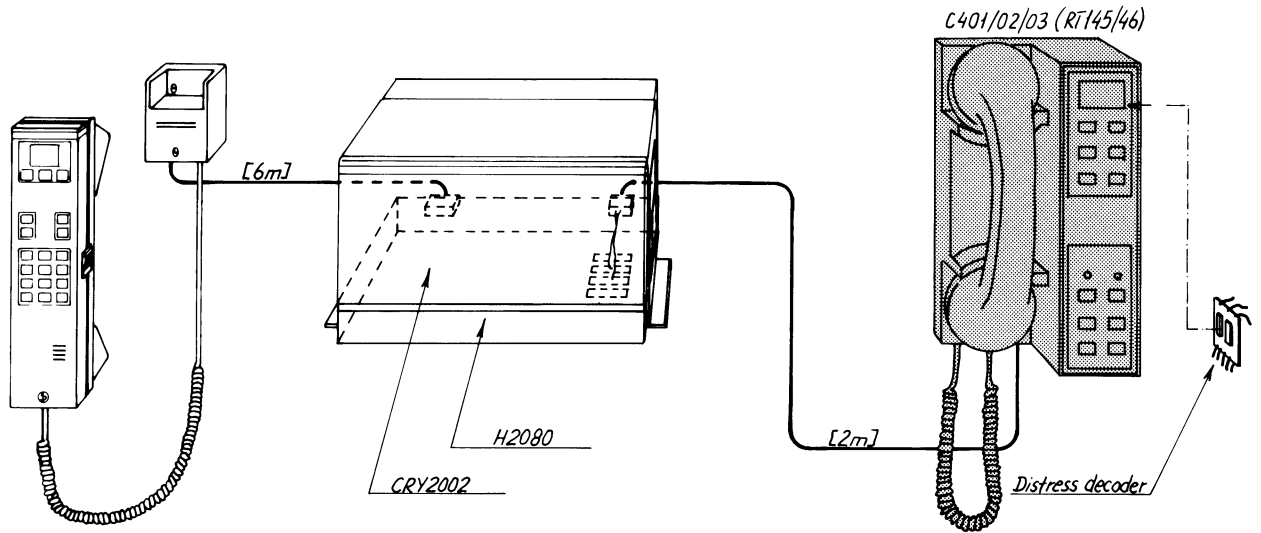
The connection must be kept assembled, insulated and supported.

2. Solder a 1.8 kohm resistor between pin 4 of J802 and the soldering point A on the filter unit where 18V from the crystal selector (brown/red wire) is led to the crystal section as shown on the picture.

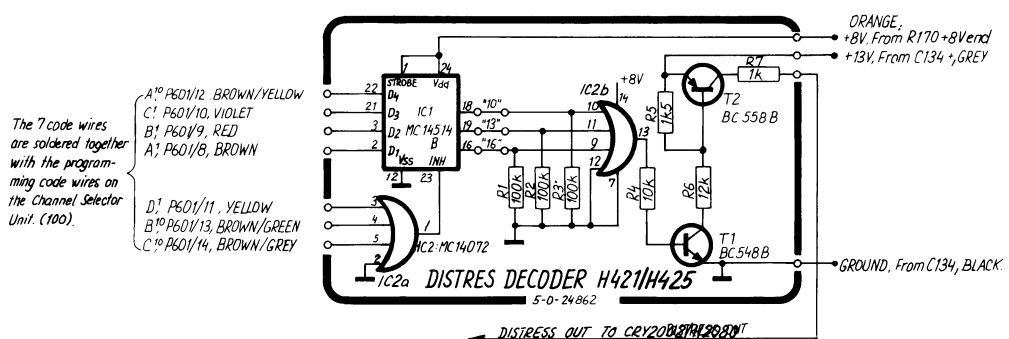
The capacitor 0.1 uF is connected between pin 4 of J802 and ground.



3.5. INTERCONNECTION TO SAILOR VHF CONTROL UNIT C401/2/3 WITH H425 CONNECTION KIT AND DISTRESS DECODER AND H2080 CONNECTION BOX.



[]: Distance in brackets is factory delivered length.



The function of the straps "10" - "13" - "16" is to enable the distress information to the scrambler CRY2002 on the channels: 10 - 13 - 16. Normally the distress information is only enabled on channel 16, the distress and calling channel.

To enable the distress information on channel 10 and 13 insert straps "10" and "13".

3.5. INTERCONNECTION TO SAILOR VHF CONTROL UNIT C401/2/3 WITH H425 CONNECTION KIT AND DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

INSTALLATION OF DISTRESS DECODER FOR CHANNEL 10 - 13 - 16

Modification in VHF Control Unit C401/2/3:

1. Remove the cabinet and disassemble the pcb's as described in the instruction book for SAILOR Multi-Remote VHF-System Part III, section 3 and 4.
The channel selector (100), board for switches (400), and mounting panel (500) also have to be disassembled.
2. Solder the wires from the distress decoder pcb to the solder point on the channel selector (100) as shown on the drawing: Installation of Distress Decoder in Control Unit C401/2/3.
 - 2.1. The 7 code wires must be soldered to the solder points with corresponding colour except the violet wire must be soldered to the solder point with a pink wire.
 - 2.2. Solder the ground wire (No. 4) black to the -end of electrolytic capacitor C134.
 - 2.3. Solder the +8V wire (No. 3) orange to the +8V end of resistor R170.
 - 2.4. Solder the distress out wire (No. 2) green together with the green wire in the multicable from the connector box H2080.
 - 2.5. Solder the +13V wire (No. 1) grey to the +end of electrolytic capacitor C134.
3. Solder the enclosed microswitch S403 on the board from switches and cut the line (ground) under the printboard between the switches S401 and S402. Cut the line near the microswitch S402.
4. Connect the enclosed resistors R1 (560 ohm) and R2 (8.2 ohm) to the microswitch S403 under the board for switches as shown on the drawing: Installation of Distress Decoder in Control Unit C401/2/3.
5. Solder the wires from the multicable to the board for switches (400) as shown on the drawing: Installation of Distress Decoder in Control Unit C401/2/3.
 - 5.1. Solder one of the enclosed blue wires (5 cm) No. 5 for mic+ from the solder point on the board for switches (400) together with the blue wire from channel selector (100) which has to be removed from the mounting panel (500).
The other enclosed blue wire (11 cm) No. 12 must be soldered to the mounting panel (500) together with the blue wire from the green multicable for the handset and led to the solder point on the board for switches (400) connected to S403, see the drawing and diagram.
 - 5.2. Solder the wire for selected channel (No. 6) black to the solder point together with the blue/black wire.
 - 5.3. Solder the DW block wire (No. 7) white to the microswitch S402.
 - 5.4. Solder the mic+ wire (No. 8) blue to resistor R1.
6. Solder the wires from the multicable to the mounting panel (500) as shown on the drawing: Installation of Distress Decoder in Control Unit C401/2/3.

3.5. INTERCONNECTION TO SAILOR VHF CONTROL UNIT C401/2/3 WITH H425 CONNECTION KIT AND DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

- 6.1. Solder the key wire (No. 9) brown to the solder point with a brown wire. The ferrite bead FP602 must be moved to the other brown wire soldered to the solder point under the mounting panel.
- 6.2. Solder the ground wire (No. 10) yellow to the solder point with a yellow wire.
- 6.3. Solder the telephone wire (No. 11) red to the solder point with a red wire.

When assembling be careful and avoid wires being squeezed under printed boards.

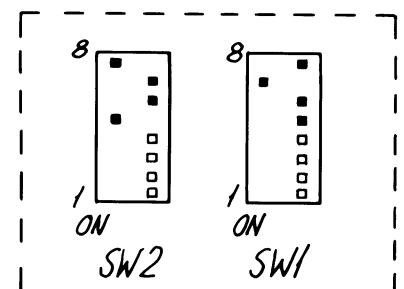
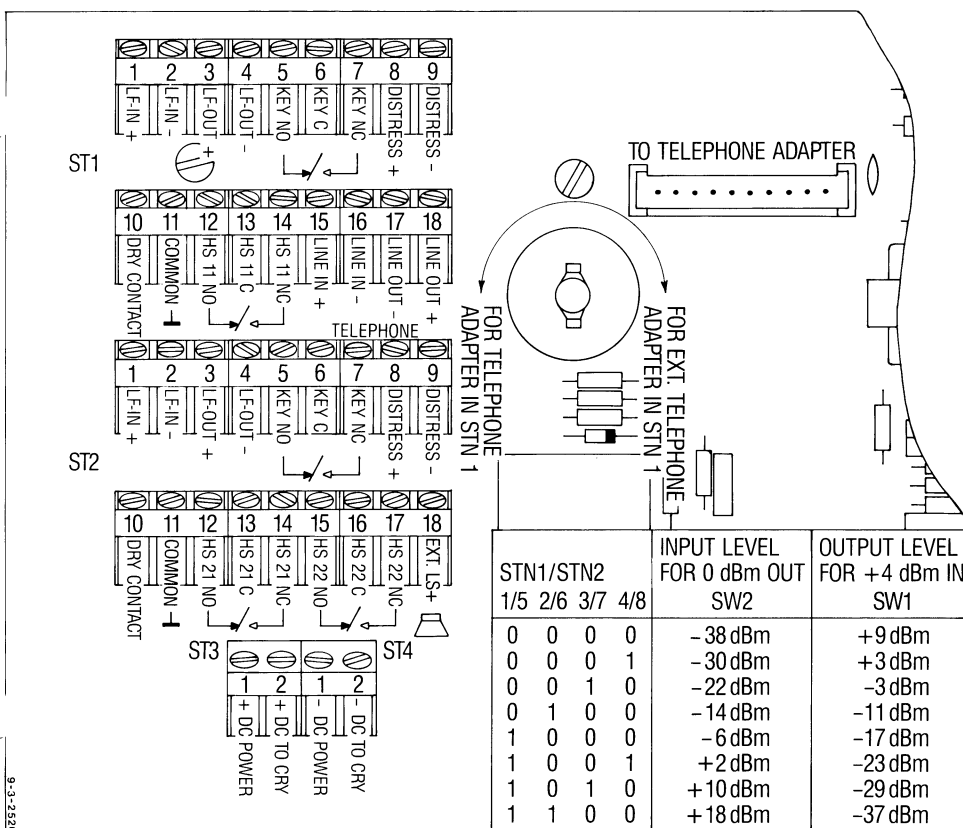
7. Connect multicable to H2080 ST2 terminal block (for installation to STN2) as shown in the diagram.

Green	ST2- 8
Red	ST2- 1
Brown	ST2- 5
Yellow	ST2-2-4-9-13
Blue	ST2- 3
White	ST2-12
Black	ST2-14

- 7.1. Set SW1 and SW2 into H2080 as shown in the drawing.

- 7.2. Cabling between H2080 and CRY2002 is mentioned in manual for H2080.

CRY2002/H2080
9-3-25266A

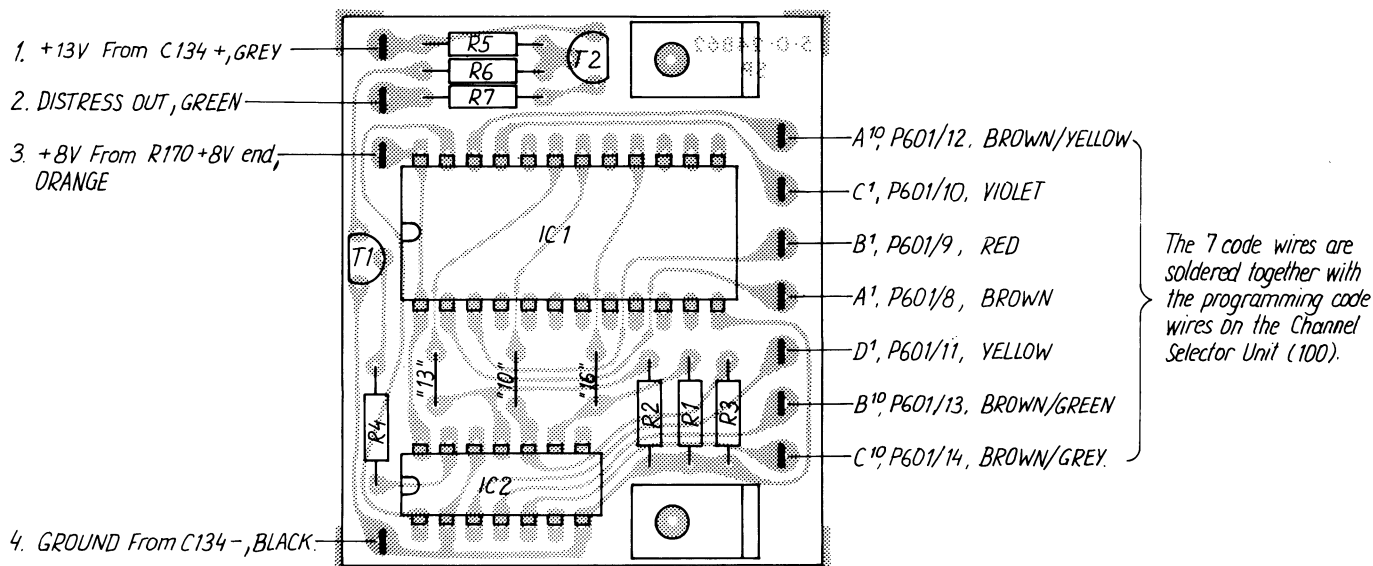
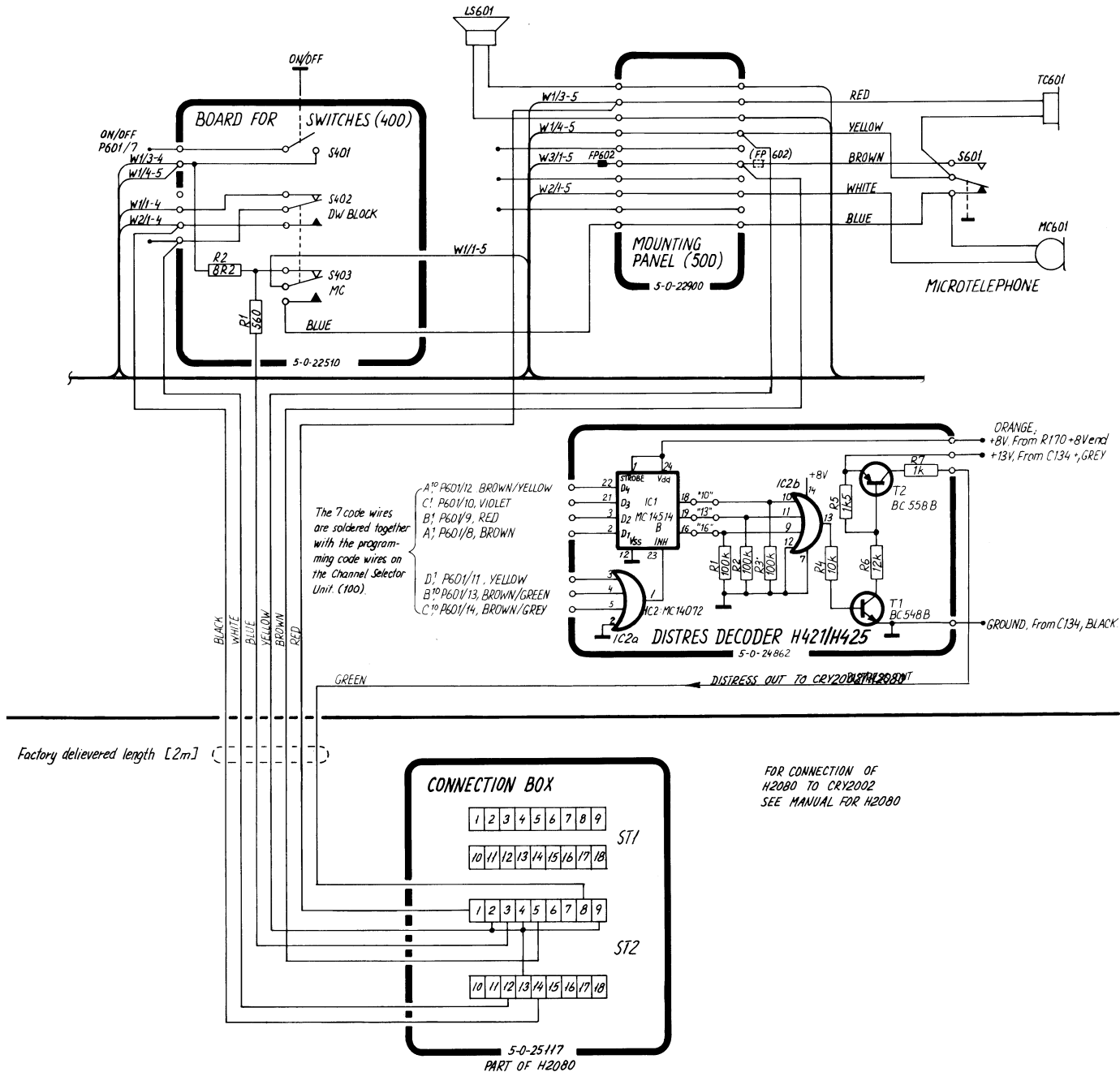


- Adjustment of SW1 and SW2 for installation of RT145 and RT146 to STN2.
- Location dependent on what is connected to STN1.

3.5. INTERCONNECTION TO SAILOR VHF CONTROL C401/2/3 WITH H425 CONNECTION KIT AND DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

INSTALLATION, COMPONENT LOCATION AND DIAGRAM FOR DISTRESS DECODER

INSTALLATION OF CONTROL UNIT C401/2/3 WITH CRY2002 and HANDSET ASSEMBLY and DISTRESS DECODER

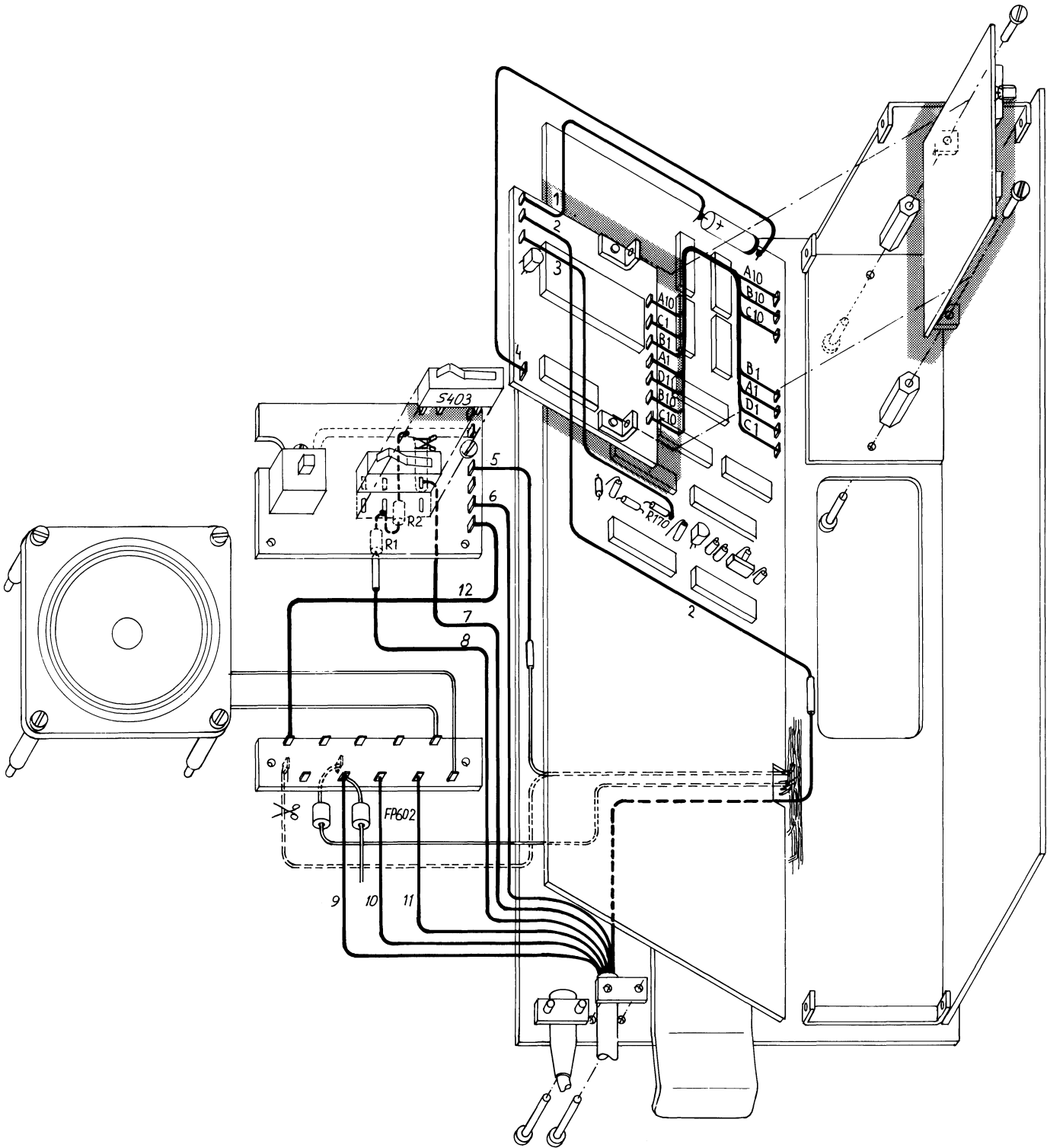


CRY2002 / H2080
4-0-25425
4-6-24862

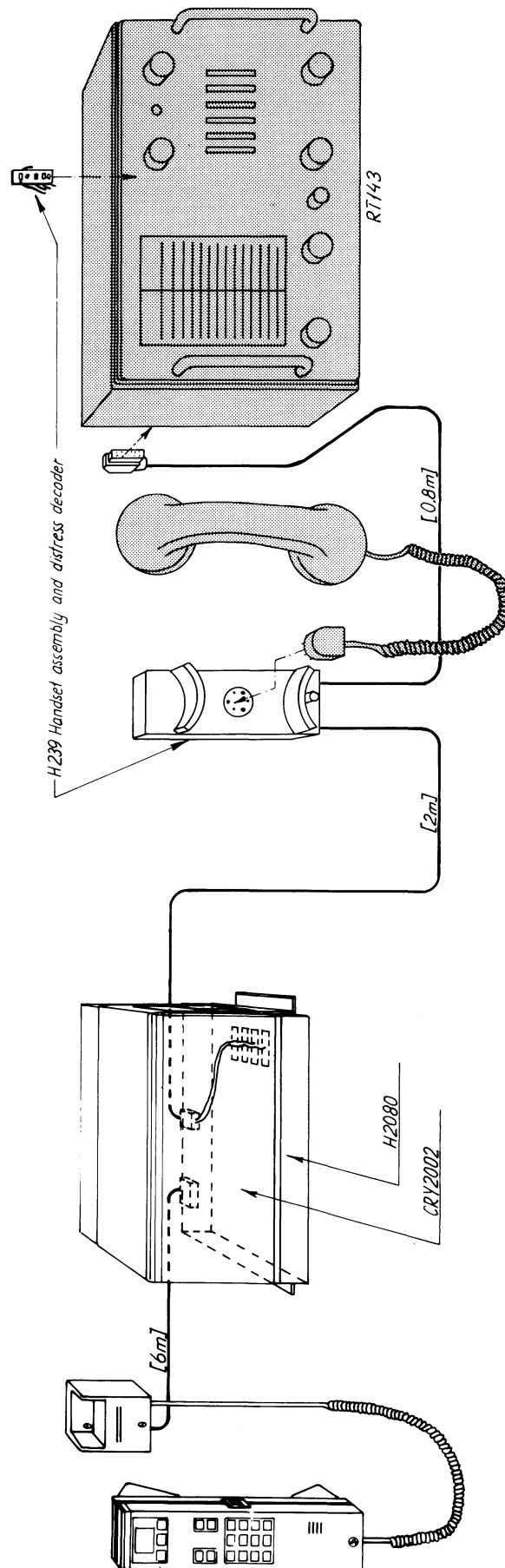
3.5. INTERCONNECTION TO SAILOR VHF CONTROL C401/2/3 WITH H425 CONNECTION KIT AND DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

INSTALLATION OF DISTRESS DECODER IN C401/2/3

CRY2002/H2080
4-0-24880



3.6. INTERCONNECTION TO SAILOR VHF RT143
WITH H239 HANDSET ASSEMBLY AND DISTRESS DECODER
AND H2080 CONNECTION BOX.



[J : Distance in brackets is factory delivered length.

3.6. INTERCONNECTION TO SAILOR VHF RT143 WITH H239 HANDSET ASSEMBLY AND DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

INSTALLATION OF H239 HANDSET ASSEMBLY AND DISTRESS DECODER

1. Remove the old hook for RT143 and replace it with Hook 1 from H239.
2. Disconnect the handset with wire from the previous installation.
3. Connect the handset and connector P1 as shown on the diagram for VHF microtelephone.
4. Connect microtelephone connector P1302 to socket J1302 on VHF.
5. Cut-off the Hook 2 for CRY2001 handset and connect the cable from Hook 1 in H2080 as shown in the diagram.
6. Set the two switches SW1 and SW2 on the PCB in the H2080. SW1-7 on, SW2-6 and SW2-8 on. SW1-1 to 4 and SW2-1 to 4 location depends on connection of Stn1.
7. Install distress decoder as shown in the next page (modification).

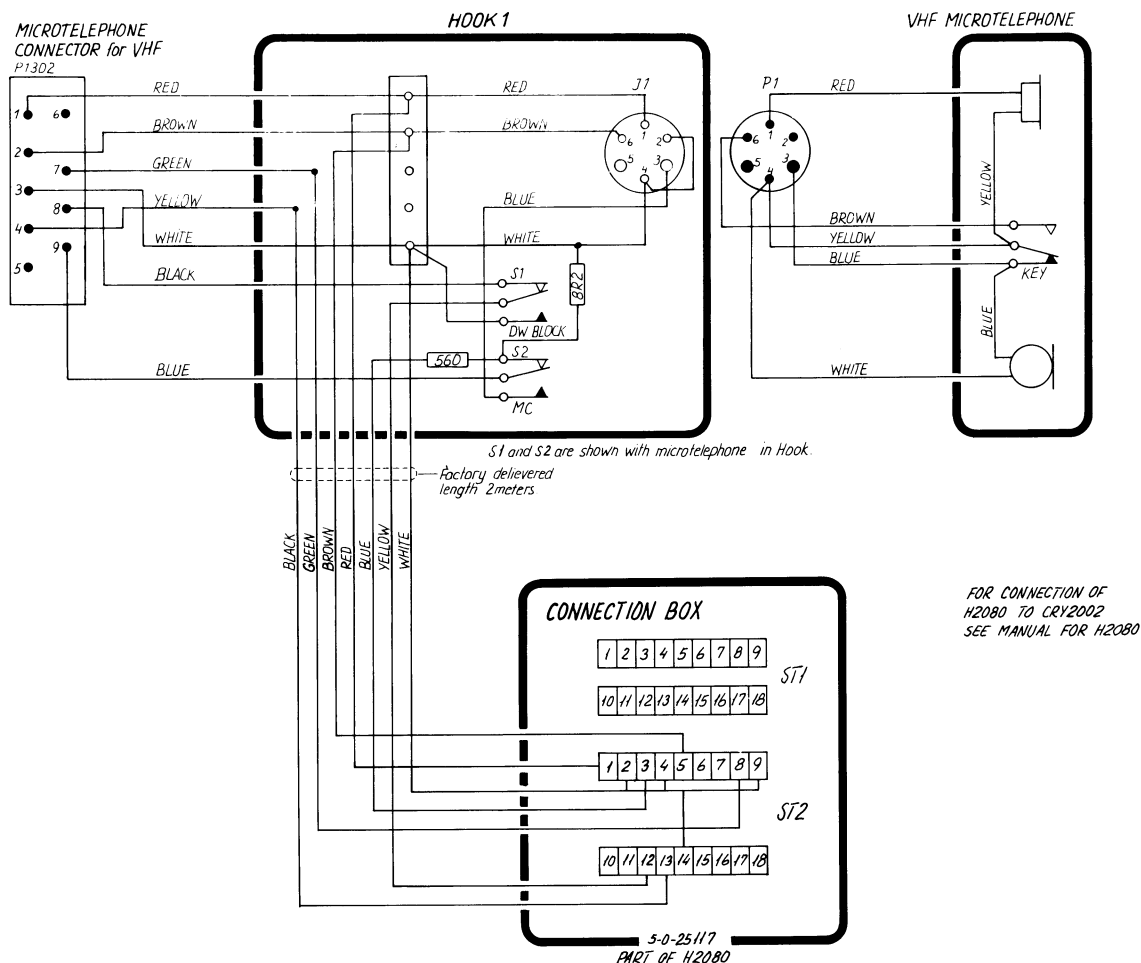
Note! The resistors in Hook 1 are for adjustment to the microphone input.

VHF sensitivity: $V_{in} = 4 \text{ mV RMS} \Rightarrow \Delta f \pm 3 \text{ kHz}$, for $f_m = 1 \text{ kHz}$

At max. frequency deviation $V_{in} = 17 \text{ mV RMS}$.

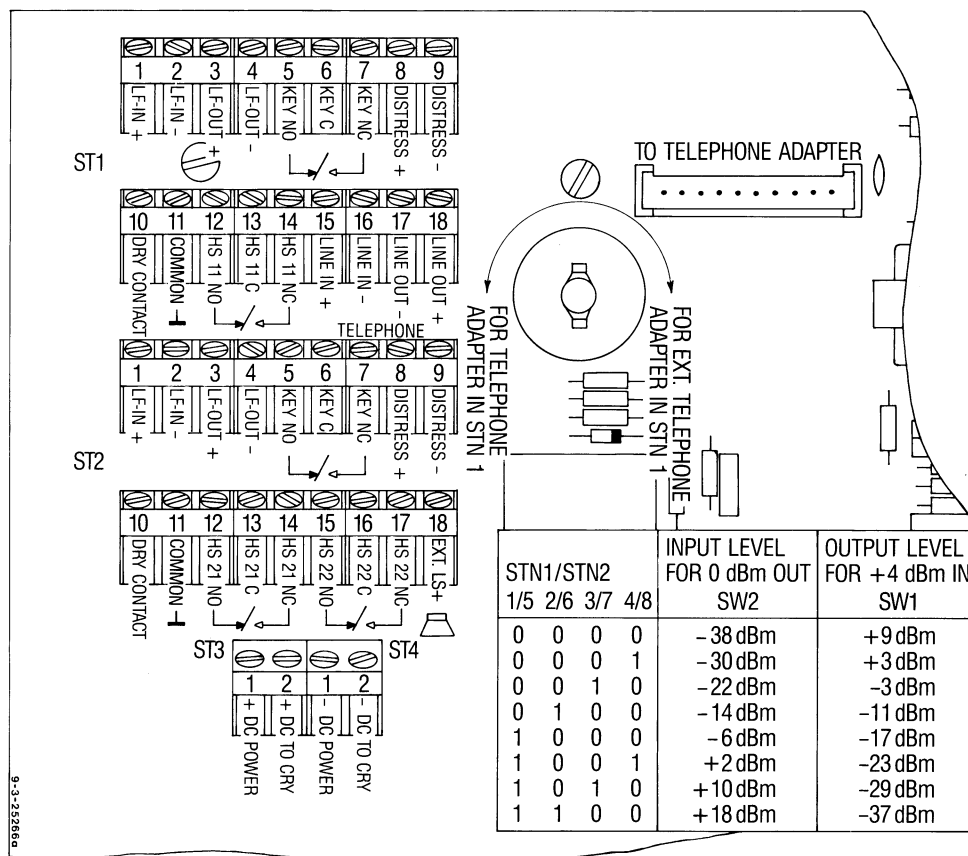
If the level seems too high it can be suppressed 6 dB by setting SW1-7 in H2080 to on instead of SW1-8.

INSTALLATION OF RT143 TO CRY2002 WITH H2080 and HANDSET ASSEMBLY and DISTRESS DECODER

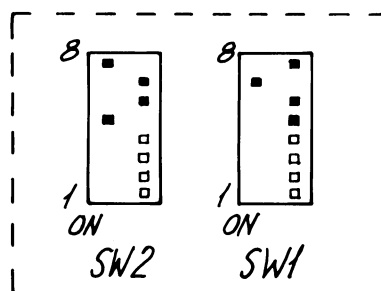


3.6. INTERCONNECTION TO SAILOR VHF RT143 WITH H239 HANDSET ASSEMBLY AND DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

H239 HANDSET ASSEMBLY AND DISTRESS DECODER



- Adjustment of SW1 and SW2 for installation of VHF RT143 to Stn2.
- Location dependent on what is connected to Stn1.



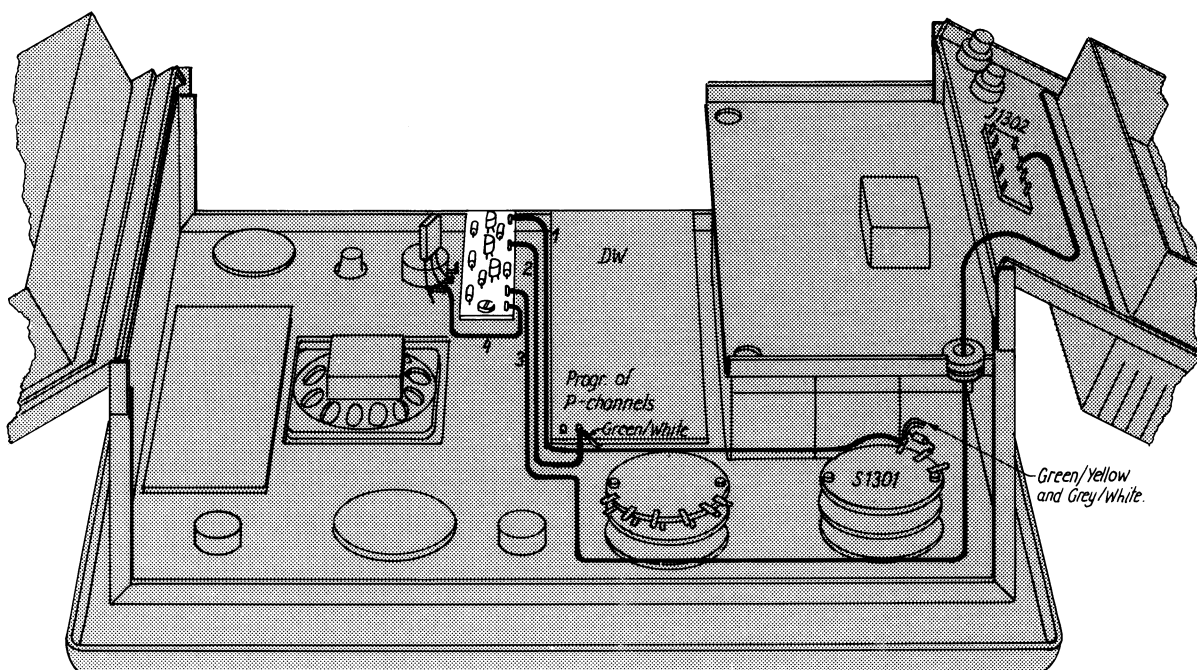
**3.6. INTERCONNECTION TO SAILOR VHF RT143
WITH H239 HANDSET ASSEMBLY AND DISTRESS DECODER
AND H2080 CONNECTION BOX cont.:**

H239 HANDSET ASSEMBLY AND DISTRESS DECODER

Installation of Distress Decoder in RT143 for CRY2002/H239 Handset Assembly

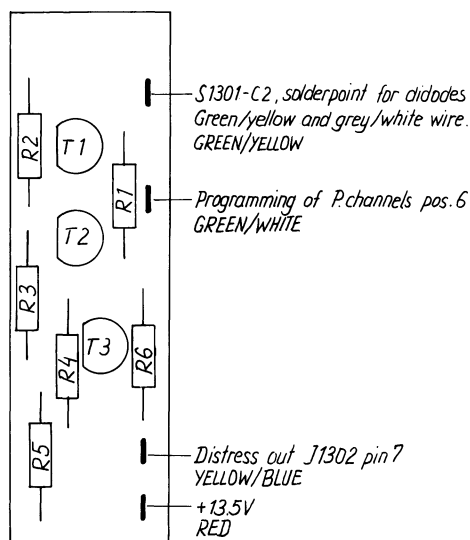
MODIFICATION

1. The PCB with the distress decoder has to be placed to the left side of the dual watch module, see picture. If the place is used, the PCB with the distress decoder can be placed on the other PCB by using the long screws and 2 distance pieces in both ends.
2. Solder the green/yellow wire (No. 1) to the soldering point on S1301-C2, where two diodes are soldered together with a green/yellow and a grey/white wire.
3. Solder the green/white wire (No. 2) to the PCB with programming of P-channels pos. 6.
4. Solder the distress out wire (No. 3) yellow/blue to microtelephone socket J1302 pin 7.
5. Solder the 13.5V wire (No. 4) red either to the collector of the dimmer transistor together with the blue/grey wire or in previous sets to the dimmer potentiometer R1307 to which the 13.5V wire is soldered.



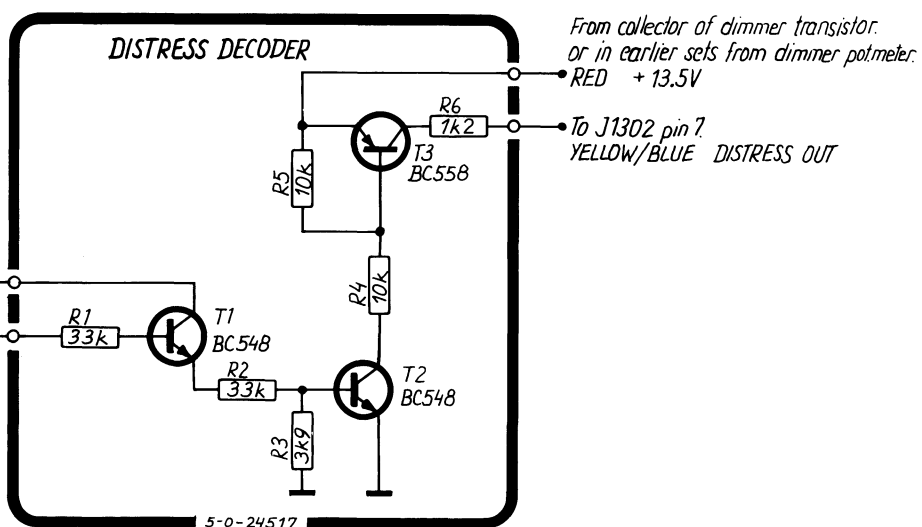
3.6. INTERCONNECTION TO SAILOR VHF RT143 WITH H239 HANDSET ASSEMBLY AND DISTRESS DECODER AND H2080 CONNECTION BOX cont.:

COMPONENT LOCATION AND DIAGRAM FOR H239 DISTRESS DECODER



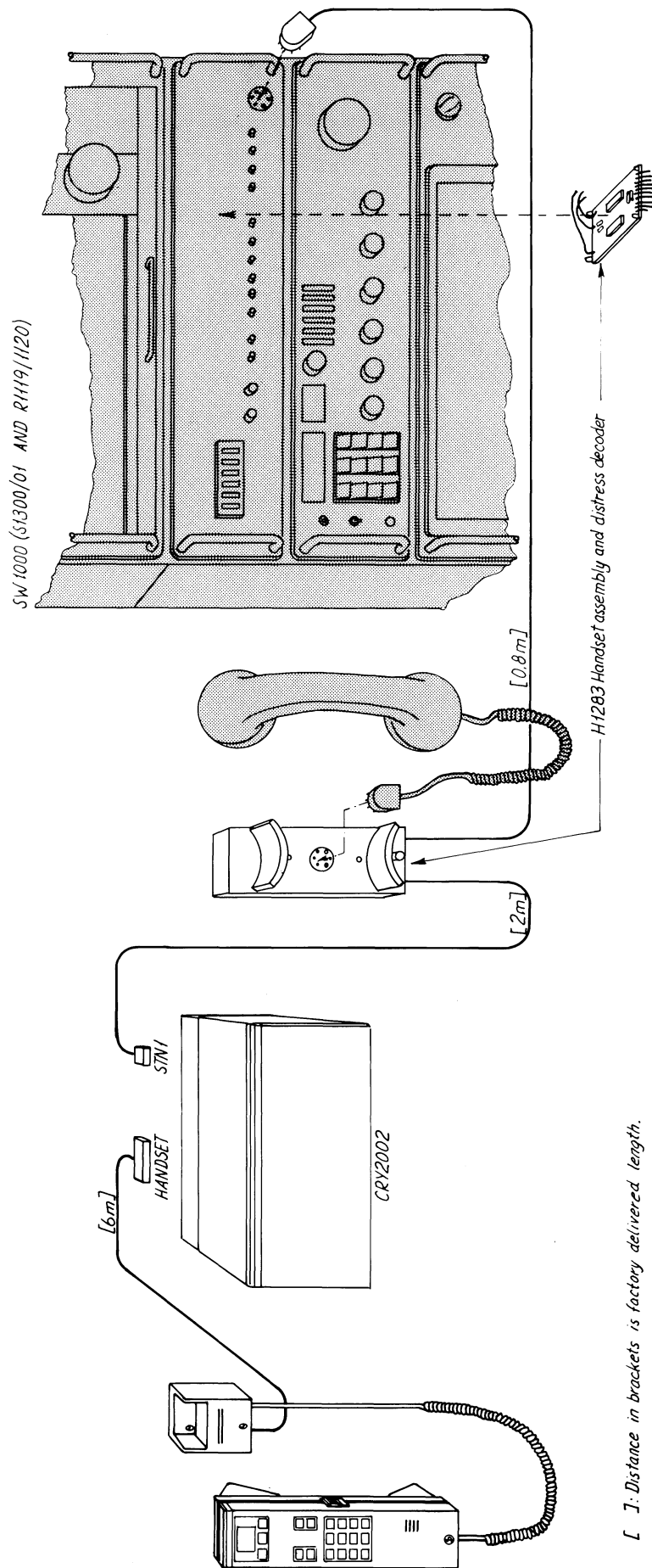
+8V to X-tal oscillator „TENS“
S1301-C2, solderpoint for diodes,
green/yellow and grey/white
wire. GREEN/YELLOW

+8V to X-tal oscillator „ONES“
Programming of P-channels,
pos 6 GREEN/WHITE



3.7. INTERCONNECTION TO SAILOR SHORT WAVE PROGRAMME 1000 WITH H1283 HANDSET ASSEMBLY AND DISTRESS DECODER.

SAILOR CRY2002 INTERCONNECTION to SHORT WAVE 1000 (SI300/01 and RH19/20)



[]: Distance in brackets is factory delivered length.

CRY2001/2
4-0-25430
4-0-24486A
4-6-24486

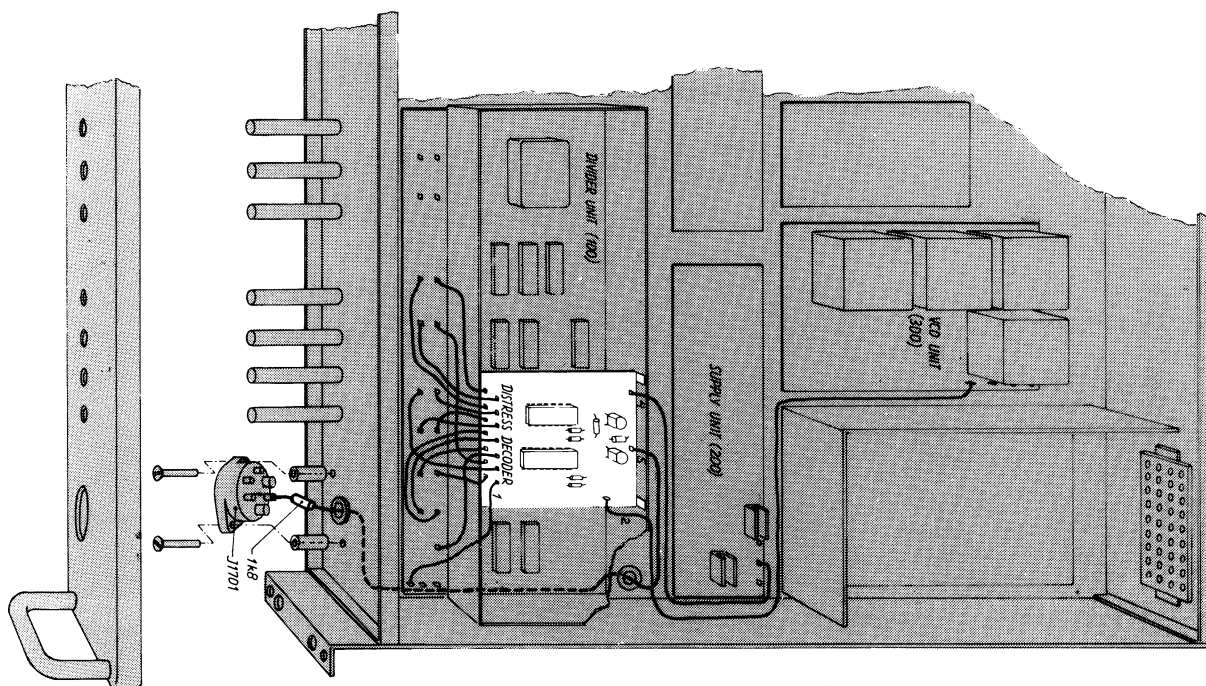
3.7. INTERCONNECTION TO SAILOR SHORT WAVE PROGRAMME 1000 WITH H1283 HANDSET ASSEMBLY AND DISTRESS DECODER cont.:

H1283 HANDSET ASSEMBLY AND DISTRESS DECODER

Installation of Distress Decoder in S1300/01 for CRY2002/H1283 Handset Assembly

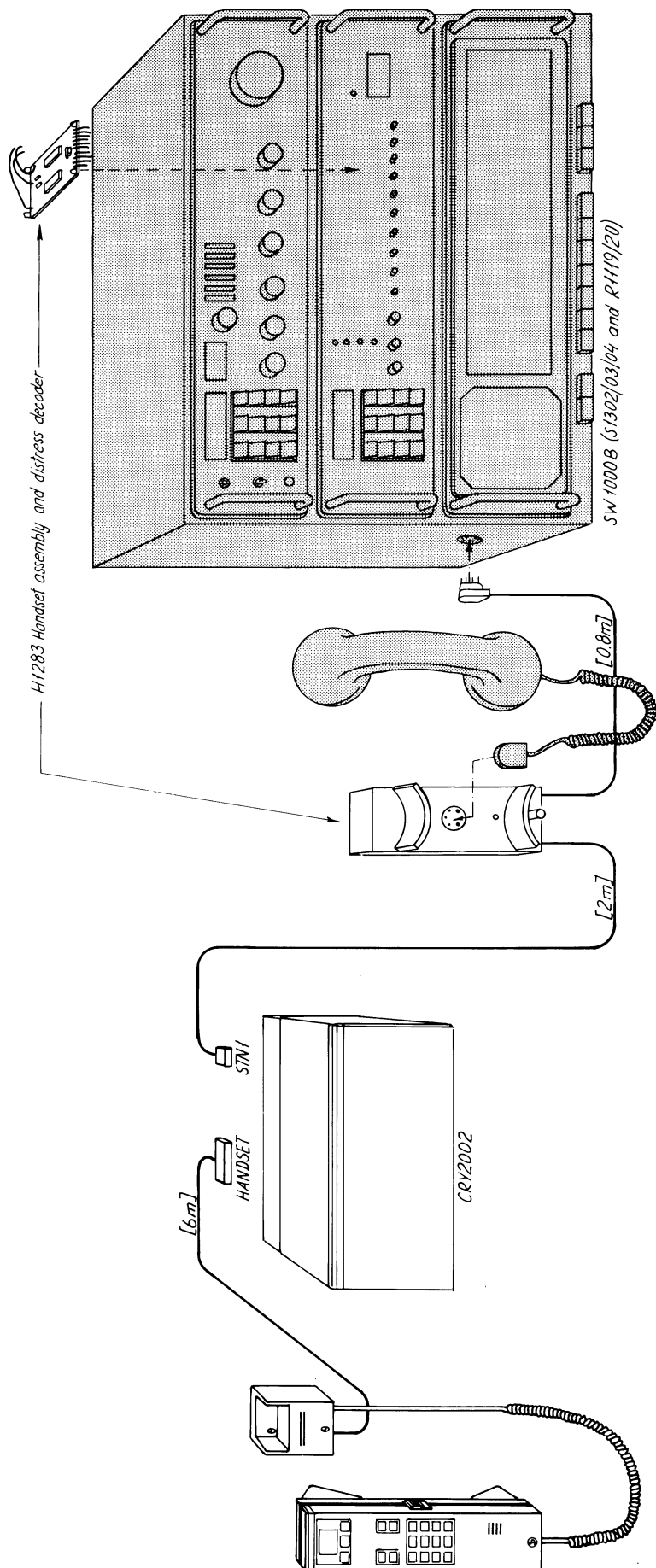
MODIFICATION

1. The PCB with the distress decoder has to be soldered into the divider unit (1001).
2. Solder the 13 code wires to the solder points on the divider PCB (same colour to the same colour).
3. Solder 5V wire No. 1 (violet) to the violet wire on the divider PCB.
4. Solder the VCO 2-4 MHz wire No. 2 (red/white) to the red/white wire at the VCO 2-4 MHz (300).
5. Solder the 22V wire No. 4 (blue/white) to the blue/white wire on the +18V supply unit (200).
6. Solder the distress wire No. 5 (yellow/blue) to microtelephone jack J1701 pin No. 4 with 1.8 kohm on pin No. 4.



3.7.1. INTERCONNECTION TO SAILOR SHORT WAVE PROGRAMME 1000/B WITH H1283 HANDSET ASSEMBLY AND DISTRESS DECODER

SAILOR CRY2002 INTERCONNECTION to SHORT WAVE 1000B (S1302/03/04 and RH19/20)



[]: Distance in brackets is factory delivered length.

CRY2001/2
4-0-25430
4-0-24486A
4-6-24486

CRY2001/2
4-0-25430
4-0-24486A
4-6-24486

CRY2001/2
4-0-25430
4-0-24486A
4-6-24486



CRY2001/2
4-0-25430
4-0-24486A
4-6-24486



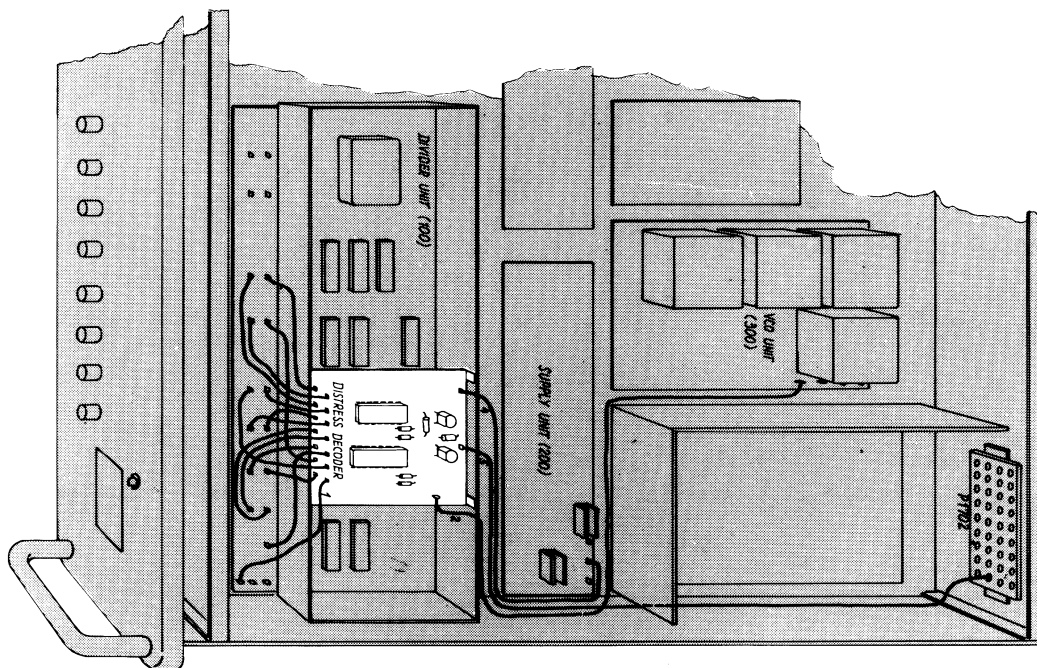
3.7.1. INTERCONNECTION TO SAILOR SHORT WAVE PROGRAMME 1000/B
WITH H1283 HANDSET ASSEMBLY AND DISTRESS DECODER cont.:

H1283 HANDSET ASSEMBLY AND DISTRESS DECODER

Installation of Distress Decoder in S1302/03/04 for CRY2001/2 and H1283 Handset Assembly

MODIFICATION

1. The PCB with the distress decoder has to be soldered into the divider unit (100).
2. Solder the 13 code wires to the solder points on the divider PCB (same colour to the same colour).
3. Solder 5V wire No. 1 (violet) to the violet wire on the divider PCB.
4. Solder the VCO 2-4 MHz wire No. 2 (red/white) to the red/white at the VCO 2-4 MHz (300).
5. Solder the 22V wire No. 4 (blue/white) to the blue/white wire on the +18V supply unit (200).
6. Insert the distress wire No. 5 (yellow/blue) in plug No. P1702 pin No. 35.

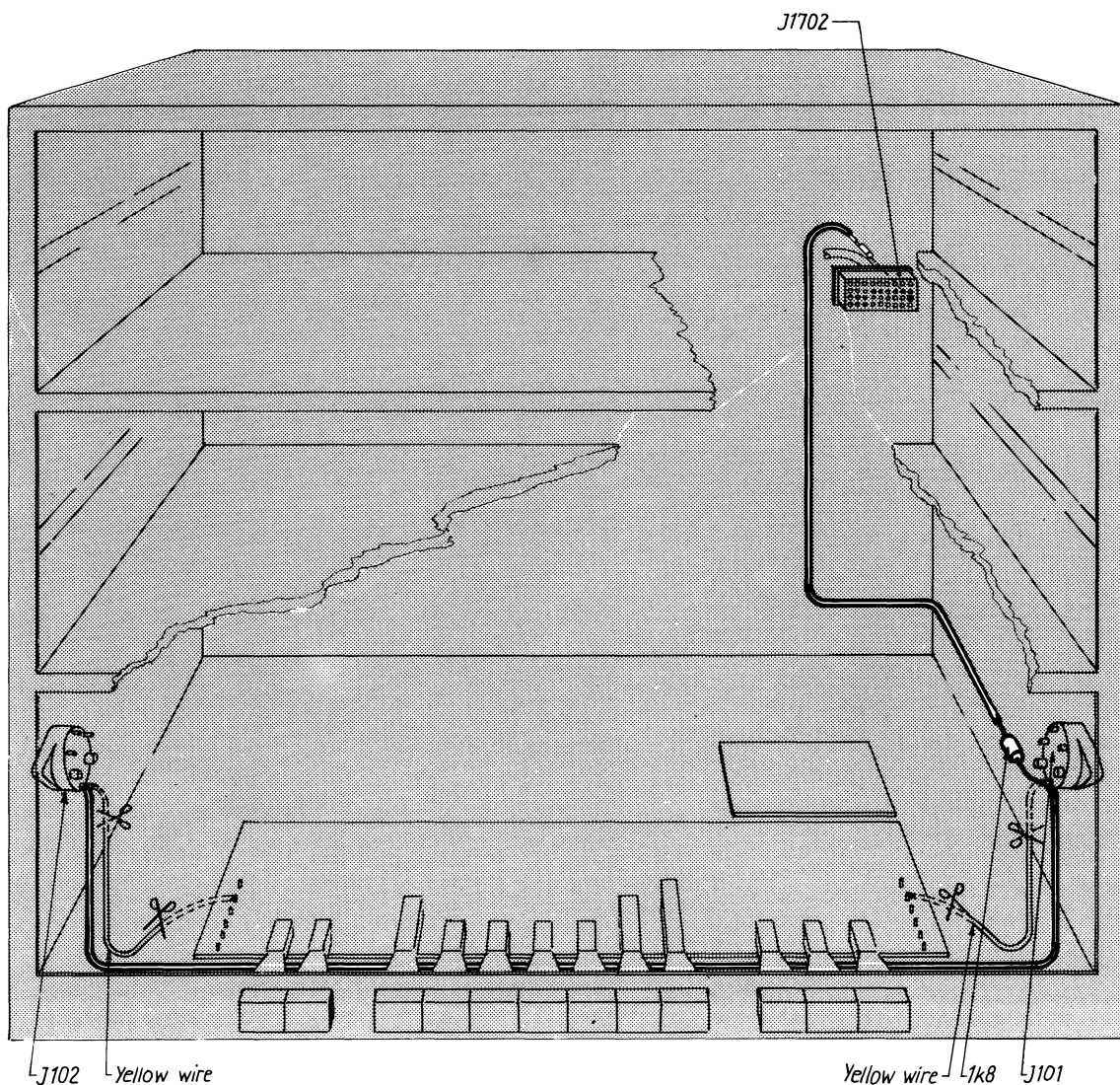


3.7.1. INTERCONNECTION TO SAILOR SHORT WAVE PROGRAMME 1000/B
WITH H1283 HANDSET ASSEMBLY AND DISTRESS DECODER cont.:

MODIFICATION cont.:

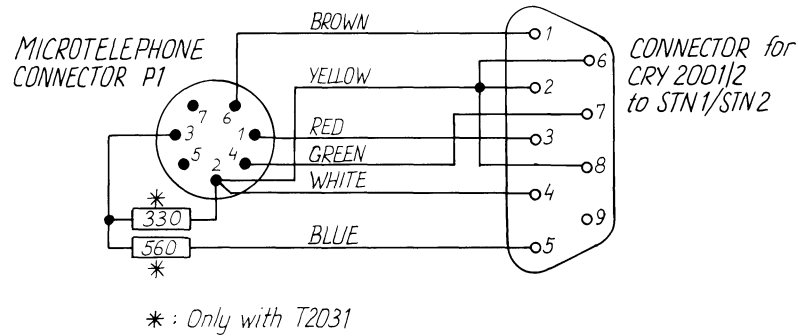
RACK H1235

7. Insert a yellow/blue wire in jack H1702 pin No. 35 and guide the wire into the microtelephone jack J101 pin No. 4 with 1.8 kohm on pin No. 4. Remove the yellow wire (22V) from both the jack J101 and the aerial switch PCB.
8. Solder a yellow/blue wire between jack J101 pin No. 4 and jack J102 pin No. 4. Remove the yellow wire (22) from both the jack J101 and the aerial switch PCB.



3.8. INSTALLATION WITH DIRECT INTERCONNECTION BETWEEN SAILOR SCRAMBLER CRY2001/2 AND SAILOR EQUIPMENT. NOT ALLOWED BY THE AUTHORITIES IN DENMARK

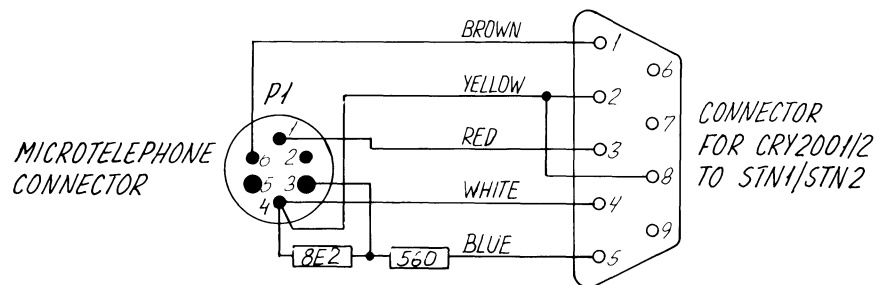
DIAGRAM OF DIRECT INTERCONNECTION BETWEEN RT2047/T2031 AND CRY2001/2 WITHOUT HANDSET ASSEMBLY H2082



Note 1. This installation gives only possibility for simplex operation of the station.

Note 2. This installation is not allowed by the authorities in Denmark.

DIAGRAM OF DIRECT INTERCONNECTION BETWEEN RT144A/B/C AND CRY2001/2 WITHOUT HANDSET ASSEMBLY H238.



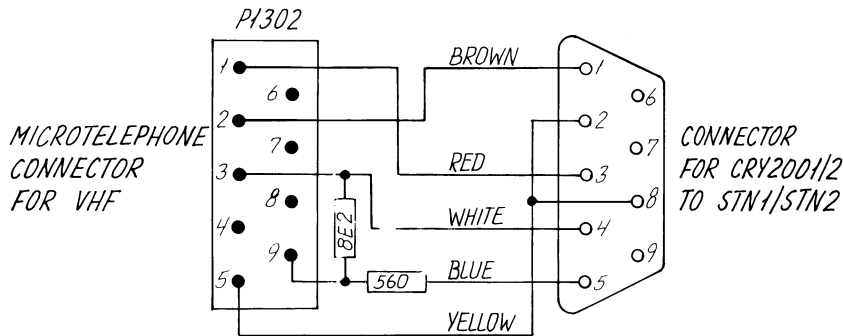
Note 1. This installation disables the dual watch and the distress facilities in RT144B/C. The dual watch can be enabled with a short-circuit between pin 2 and 5 in P1, but that means the dual watch is controlled only from the switch on the front plate.

Note 2. The microphone signal from the scrambler pin 4 and 5 to the VHF RT144A/B/C must be attenuated about 36 dB as shown on the diagrams. With a proper assembling the attenuator can be placed in the microtelephone connector P1 for RT144A/B/C.

Note 3. This installation is not allowed by the authorities in Denmark.

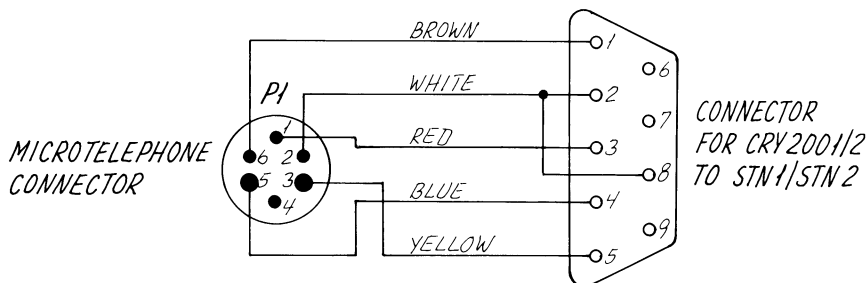
3.8. INSTALLATION WITH DIRECT INTERCONNECTION BETWEEN SAILOR SCRAMBLER CRY2001/2 AND SAILOR EQUIPMENT.

DIAGRAM OF DIRECT INTERCONNECTION BETWEEN RT143 AND CRY2001/2 WITHOUT HANDSET ASSEMBLY H239.



- Note 1. This installation disables the dual watch and the distress facilities in RT143. The dual watch can be enabled with a short-circuit between pin 4 and 8 of P1302, but that means the dual watch facility is controlled only from the switch on the front plate.
- Note 2. The microphone signal from the scrambler pin 4 and 5 to the VHF RT143 must be attenuated about 36 dB shown in the diagrams. With a proper assembling the attenuator can be placed in the microtelephone connector P1302 for RT143.
- Note 3. This installation is not allowed by the authorities in Denmark.

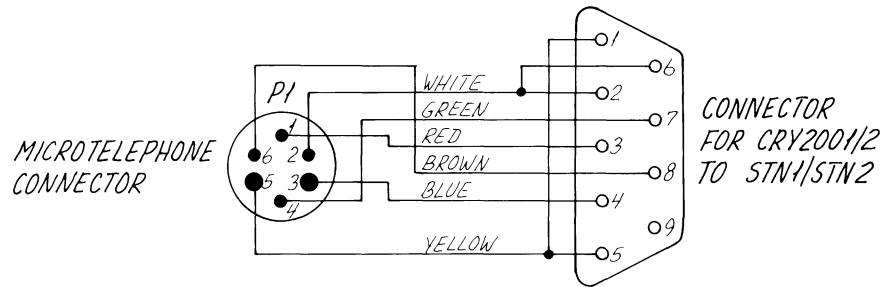
DIAGRAM OF DIRECT INTERCONNECTION BETWEEN SHORT WAVE PROGRAMME 1000, 1000/B AND CRY2001/2 WITHOUT HANDSET ASSEMBLY H1283.



- Note 1. This installation disables the distress facility and gives only possibility for simplex operation of the station.
- Note 2. This installation is not allowed by the authorities in Denmark.

3.8. INSTALLATION WITH DIRECT INTERCONNECTION BETWEEN SAILOR SCRAMBLER CRY2001/2 AND SAILOR EQUIPMENT.

DIAGRAM OF DIRECT INTERCONNECTION BETWEEN T121, T124, T126, T128 AND CRY2001/2 WITHOUT HANDSET ASSEMBLY H240.



Note 1. This installation gives only possibility for simplex operation of the station.

Note 2. Modification of the station for distress decoding is described under H240 handset assembly.

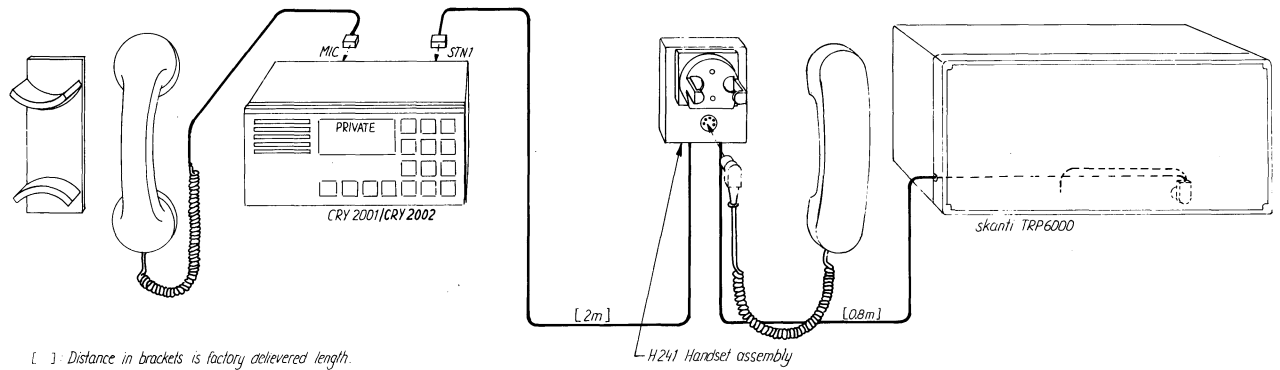
Note 3. This installation is not allowed by the authorities in Denmark.

NOTE! Direct interconnection between T122 and CRY2001/2 is not recommended because it is necessary with a buffer/amp. in the microphone as shown in the diagram of H242 handset assembly.

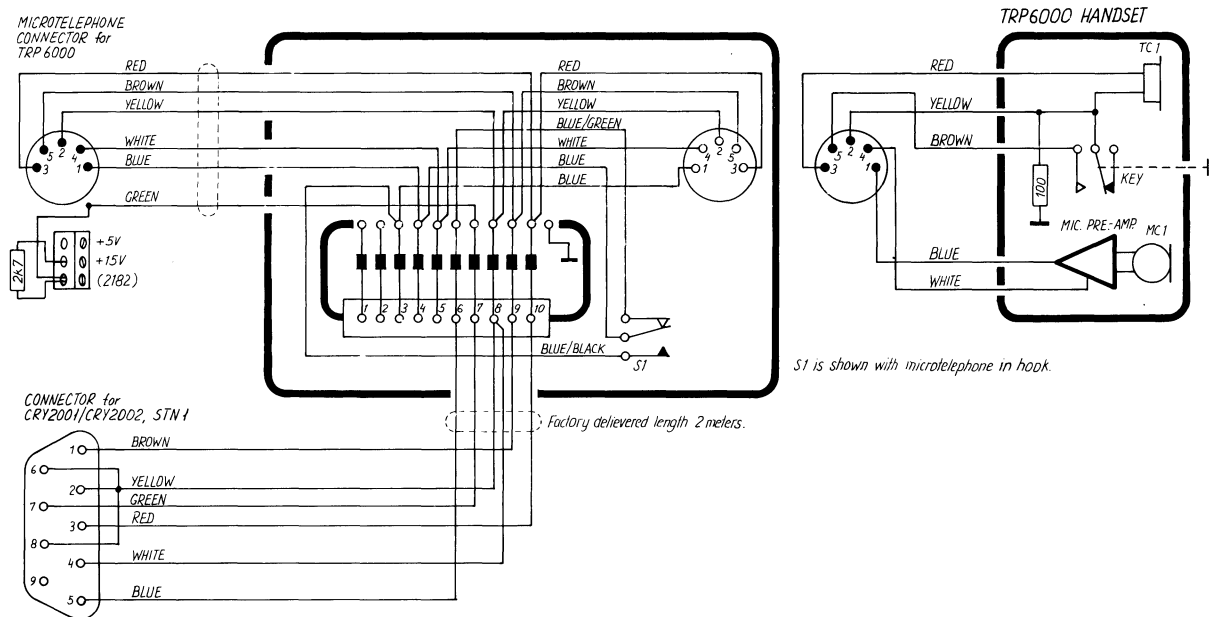
NOTE! DIRECT INTERCONNECTION BETWEEN CONTROL UNIT C401/2/3 AND CRY2001/2 IS NOT RECOMMENDED.

4.0. INTERFACE FOR SAILOR SCRAMBLER TO MISCELLANEOUS EQUIPMENT

4.1. H241 HANDSET ASSEMBLY FOR INTERCONNECTION TO SKANTI TRP6000

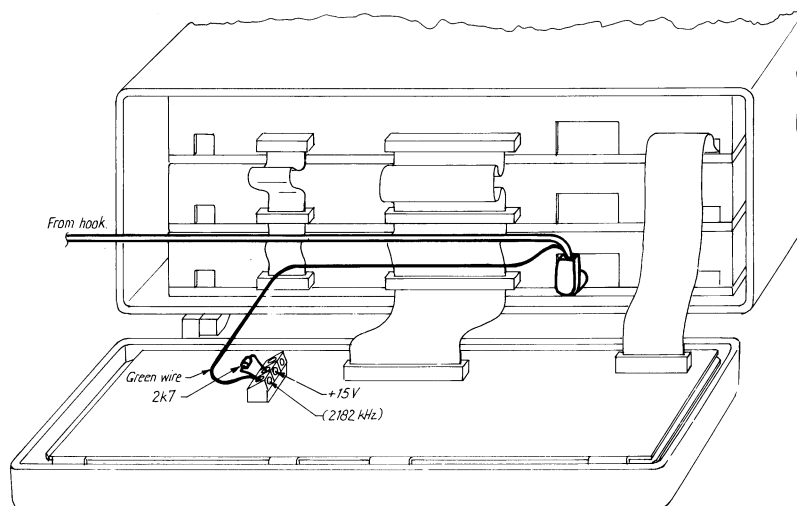


INSTALLATION OF SKANTI TRP6000 WITH SAILOR CRY2001/2 AND H241 HANDSET ASSEMBLY.



4.1. H241 HANDSET ASSEMBLY FOR INTERCONNECTION TO SKANTI TRP6000 cont.:

DISTRESS OUTPUT IN TRP6000 FOR CRY2001/CRY2002 AND H241 HANDSET ASSEMBLY



MODIFICATION

1. Connect the green wire from the microtelephone plug for TRP6000 to the terminal strip, output 2182 kHz on rear side of the front panel.
2. Connect a 2.7 kohm resistor on the terminal strip from +15V to 2182 kHz terminal.

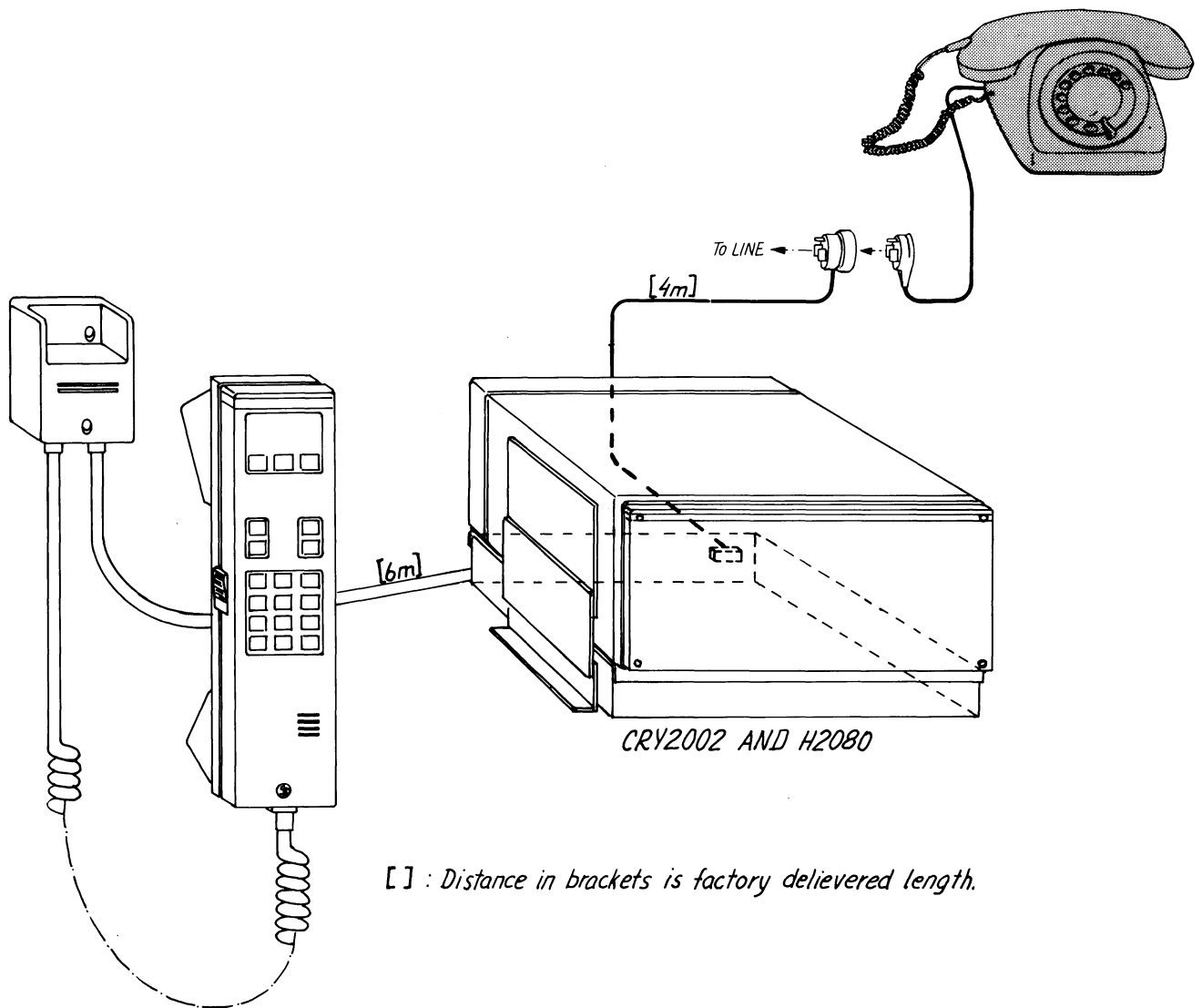
4.2. H2080 CONNECTION BOX WITH TELEPHONE LINE ADAPTOR 702090 FOR INTERCONNECTION TO LOCAL AND PUBLIC TELEPHONE SYSTEM

GENERAL

As option for the SAILOR Connection Box H2080 a Telephone Line Adaptor 702090 can be installed.

The installation of telephone line adaptor is described in the manual for SAILOR Connection Box H2080.

When a telephone line adaptor pcb has been installed, Stn1 will be reserved for communication on public telephone. In Stn2 it will still be possible to install e.g. VHF or SSB-sets.



DIRECTIONS FOR USE

Telephone Call

By means of the public telephone a call is made as usual. When a call has been set-up it is possible to continue the speech by means of the scrambler. When the handset of the scrambler is lifted out of the hook the public telephone line will switch over to the telephone line adaptor and the public telephone handset can be hung up again.

Note that the conversation from now on is in simplex*) mode.

4.2. H2080 CONNECTION BOX WITH TELEPHONE LINE ADAPTOR 702090 FOR INTERCONNECTION TO LOCAL AND PUBLIC TELEPHONE SYSTEM cont.:

Secret Conversation

When a connection in clear voice is established through the scrambler, you can make a private call, selective or group (look-up the operating manual for SAILOR scrambler).

Normally it is the caller who also makes the private call.

Telephone Answer

A call can either be answered by means of the public telephone or with the scrambler handset. If the scrambler handset is used, the conversation is in simplex*), regardless of plain language or scrambled talk is used.

End a Call

When the conversation is finished the scrambler handset must be placed in the hook again. Also the public telephone handset must be hung up again, if it has not been done already.

*)Simplex

All conversations on the scrambler handset, whether in plain language or code, are in simplex. The handset key is depressed, the message is sent and can be completed with the word "OVER". The handset key is released and the other station can answer.

When operating in code it is necessary to wait until synchronization has been effected. The ready tone (Apollo tone) must be heard in the handset and "SEND" must appear in the display before beginning to speak.

CIRCUIT DESCRIPTION OF TELEPHONE LINE ADAPTOR 702090

The hook switch relay switches automatically the scrambler handset on to the telephone line when the hook is lifted and the scrambler is in Stn1. This also means that as long as it is in the hook or in Stn2, the parallel telephone is working.

On the input lines to the modem a transient absorber is mounted and a diode bridge securing correct polarity to the circuit, regardless of the polarity of the telephone line. Then a transmitting circuit and a receiving circuit are mounted in parallel over the line.

When the modem is switched on the line, T5 will conduct until C20 is charged. By this C10 is rapidly given a big charge, so that the settle time for the line current is minimized.

The line current is determined by the potential on the basis of T2 and R20. T2 is also line output amplifier for the AF output from the scrambler. The signal from the output transformer in the scrambler is first attenuated by the resistors R23 and R19 and then it is amplified by T2.

The line impedance is mainly determined by R17 both in transmit and receive position.

The input signal is first led through a relay in the scrambler so that the signal is disconnected when the scrambler is keyed. Then a 1:1 transformer is placed to give galvanic isolation. In the first amplifier the signal can

4.2. H2080 CONNECTOR BOX WITH TELEPHONE LINE ADAPTOR 702090 FOR INTERCONNECTION TO LOCAL AND PUBLIC TELEPHONE SYSTEM cont.:

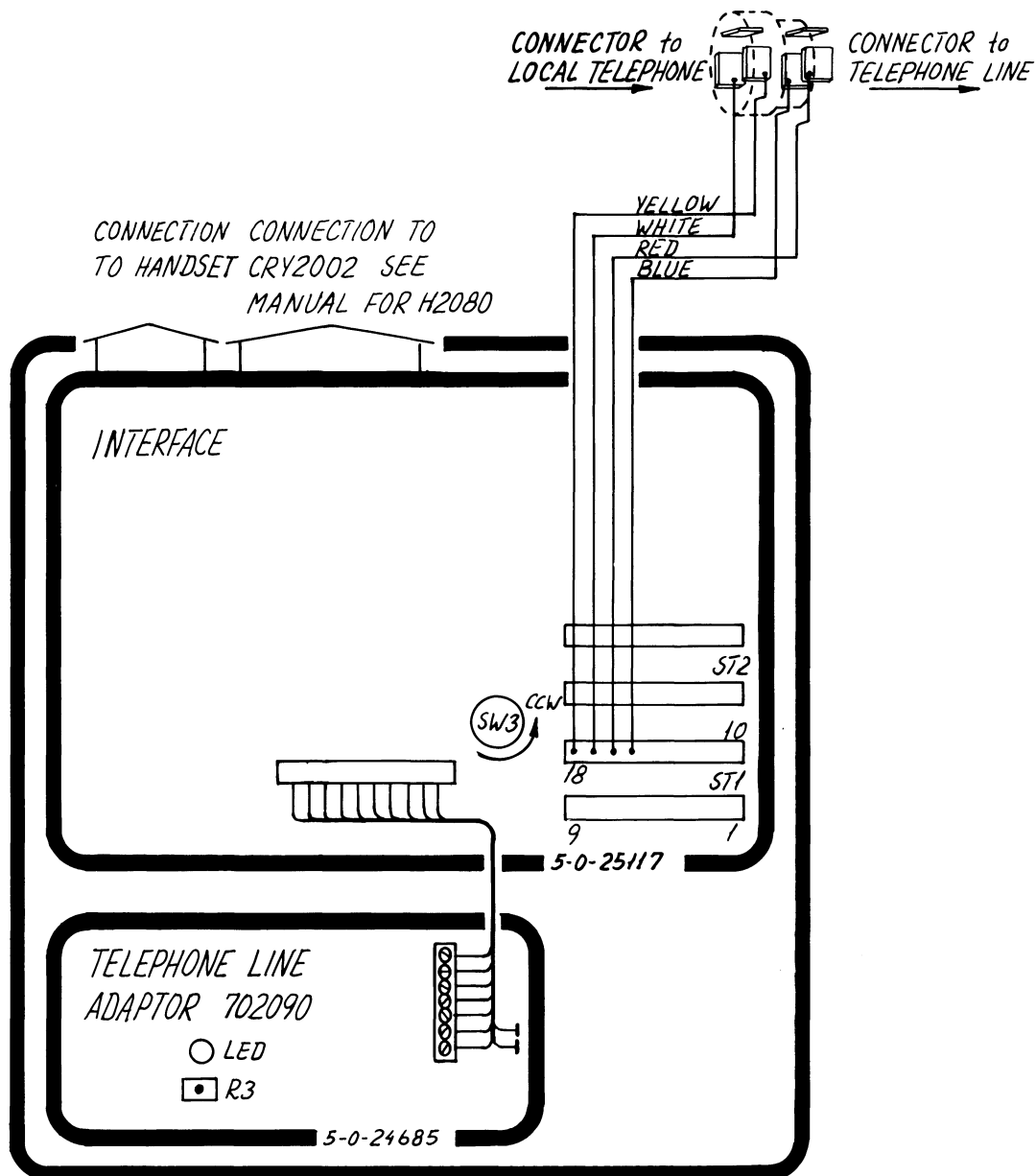
be adjusted to nominal level by means of R3. The next two operational amplifiers form a 4th order highpass filter with a corner frequency of 300 Hz. The gain in the passband is unity. This filter removes hum and noise which would otherwise cause disturbance of a scrambled signal. The output amplifier delivers 0 dBm to the scrambler.

T4 in the level detector is not conducting when no signal is supplied. When the signal over R29 exceeds 0.5V, T4 will be conducting and D7 will be turned on.

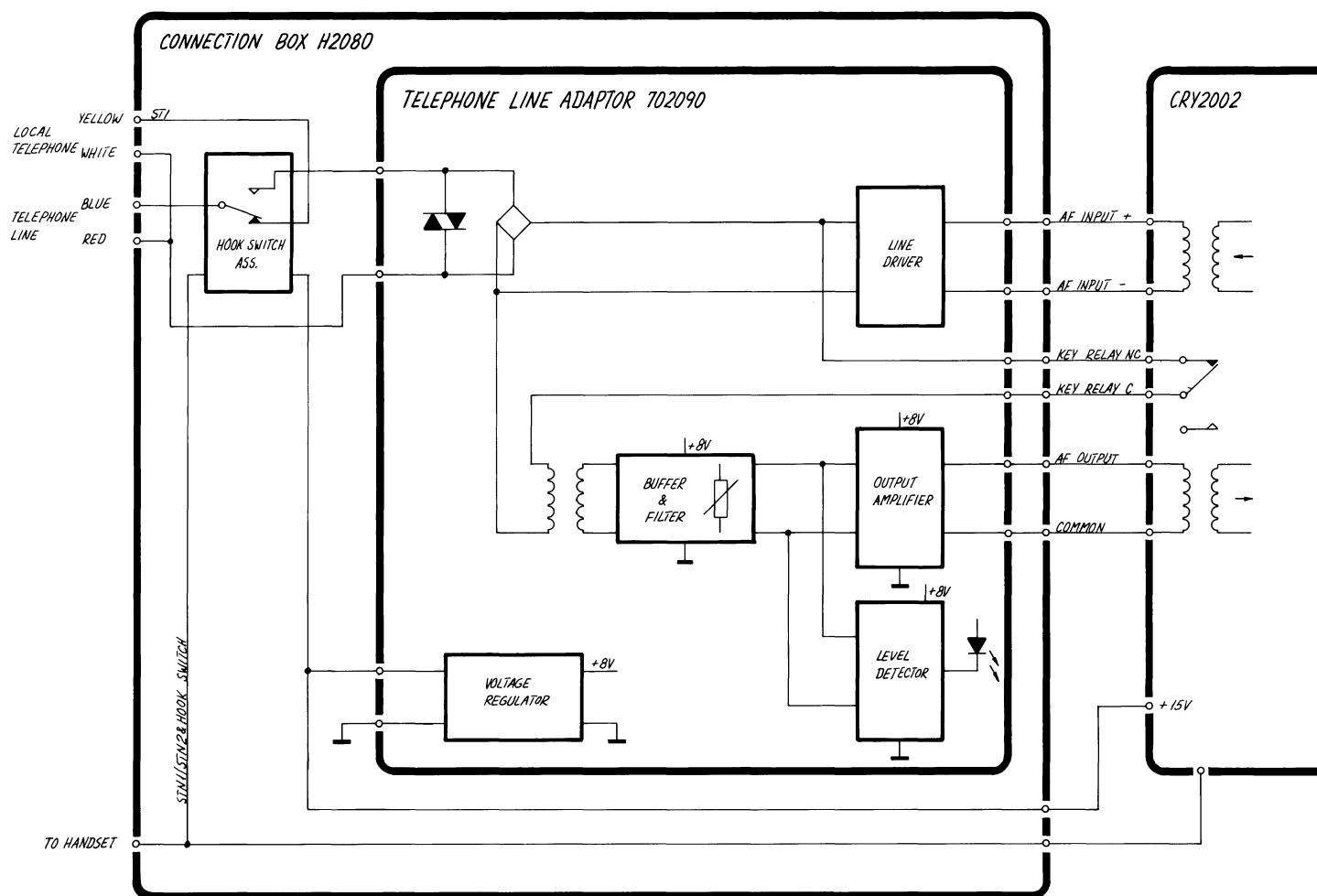
TECHNICAL DATA

<u>Supply Voltage:</u>	10.8 - 31.2V DC
<u>Power Consumption:</u>	0.5W/24V DC
<u>Temperature Range:</u>	-15°C to +60°C
<u>AF Output to Scrambler:</u>	0 dBm/600 ohm
<u>AF Input Range from Line:</u>	-36 to -10 dBm/600 ohm
<u>AF Output to Line:</u> (talk and music)	Max. -10 dBm/600 ohm integration time 3 S.
<u>AF Output to Line:</u> (code signals)	Max. -10 dBm/600 ohm integration time 0.2 S
<u>AF Line Input Impedance:</u>	600 ohm
<u>DC-Line Input Impedance:</u>	<400 ohm (line current 16-80 mA)

4.2. H2080 CONNECTION BOX WITH TELEPHONE LINE ADAPTOR 702090 FOR INTERCONNECTION TO LOCAL AND PUBLIC TELEPHONE SYSTEM cont.:



4.2. H2080 CONNECTION BOX WITH TELEPHONE LINE ADAPTOR 702090 FOR INTERCONNECTION TO LOCAL AND PUBLIC TELEPHONE SYSTEM cont.:

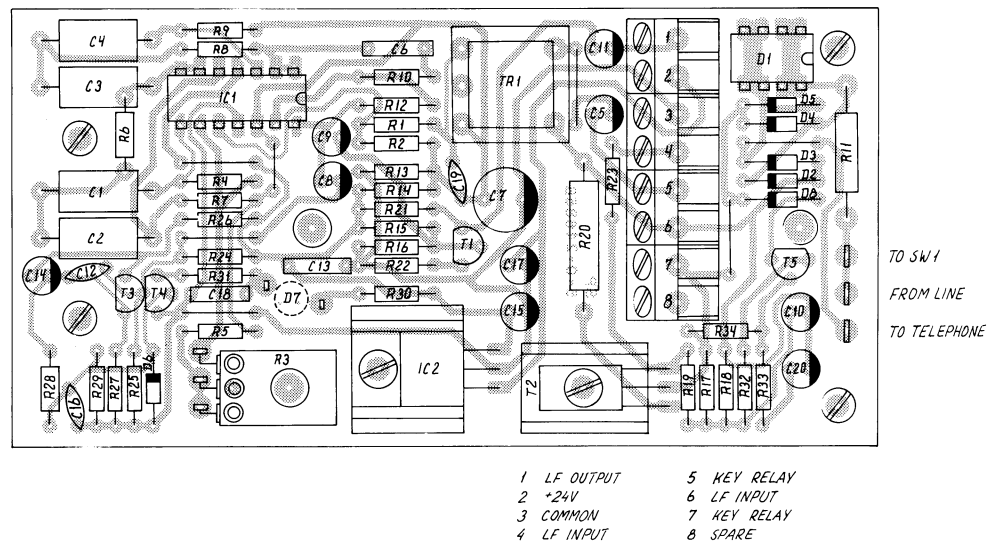


BLOCK DIAGRAM FOR H2080 WITH 702090 TELEPHONE LINE ADAPTER

CRY2002 4-0-24685



4.2. H2080 CONNECTION BOX WITH TELEPHONE LINE ADAPTOR 702090 FOR INTERCONNECTION TO LOCAL AND PUBLIC TELEPHONE SYSTEM cont.:



COMPONENT LOCATION FOR TELEPHONE LINE ADAPTER

4.2. H2080 CONNECTION BOX WITH TELEPHONE LINE ADAPTOR 702090 FOR INTERCONNECTION TO LOCAL AND PUBLIC TELEPHONE SYSTEM cont.:

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMB
	TELEPHONE LINE ADAPTOR	H2090/702090	ESPERA	PRINT NR.5-0-24685B
				600568
C1	CAPACITOR POLYSTYRENE	10nF 1% 160V	*PHILIPS	2222 429 81003
C2	CAPACITOR POLYSTYRENE	10nF 1% 160V	*PHILIPS	2222 425 41003
C3	CAPACITOR POLYSTYRENE	10nF 1% 160V	*PHILIPS	2222 429 81003
C4	CAPACITOR POLYSTYRENE	10nF 1% 160V	*PHILIPS	2222 425 41003
C5	CAPACITOR ELECTROLYTIC	4.7uF 50V	ERO	EK000AA147H
C6	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000
C7	CAPACITOR ELECTROLYTIC	220uF 20% 10V	ERO	EKI 00 CC 322 C
C8	CAPACITOR ELECTROLYTIC	4.7uF 50V	ERO	EK000AA147H
C9	CAPACITOR ELECTROLYTIC	33uF 20% 16V	* ERO	EKI 00 AA 233 D
C10	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI 00 BB 247 E
C11	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F
C12	CAPACITOR CERAMIC	4.7nF -20/+80% 32V	FERROPERM	9/0145,9
C13	CAPACITOR MKT	100nF 10% 100V	*SIEMENS	B32520-A1104-K
C14	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F
C15	CAPACITOR ELECTROLYTIC	1uF 50V	ERO	EK000AA110H
C16	CAPACITOR CERAMIC	4.7nF -20/+80% 32V	FERROPERM	9/0145,9
C17	CAPACITOR ELECTROLYTIC	0.47uF 20% 50V	ERO	EKI 00 AA 047 H
C18	CAPACITOR MKT	100nF 10% 100V	*SIEMENS	B32520-A1104-K
C19	CAPACITOR CERAMIC	10nF -20/+80% 32V	FERROPERM	9/0145,9
C20	CAPACITOR ELECTROLYTIC	4.7uF 50V	ERO	EK000AA147H
D1	TRANSIENT SUPPRESSOR	LS5060	SGS	LS 5060
D2	DIODE	1N4148	* ITT	1N4148
D3	DIODE	1N4148	* ITT	1N4148
D4	DIODE	1N4148	* ITT	1N4148
D5	DIODE	1N4148	* ITT	1N4148
D6	DIODE	1N4148	* ITT	1N4148
D7	DIODE	MV5753	GI	MV5753 R0D
D8	DIODE ZENER	3.0V 5% 0.4W BZX79C3V0	PHILIPS	BZX79C3V0
IC1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N
IC2	INTEGRATED CIRCUIT	MC7808CT	MOTOROLA	MC7808CT
R1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472
R2	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472
R3	POTENTIOMETER	10 KOHM LIN	ESPERA	2-0-24850 *
R4	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 53392
R5	RESISTOR	150 OHM 5% 0.33W	PHILIPS	2322 181 53151
R6	RESISTOR	12 KOHM 1% 0.4W	PHILIPS	2322 151 51203
R7	RESISTOR	270 KOHM 1% 0.4W	PHILIPS	2322 151 52704

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMB
R8	RESISTOR	30 KOHM 1% 0.4W	PHILIPS	2322 151 53003
R9	RESISTOR	51 KOHM 1% 0.4W	PHILIPS	2322 151 55103
R10	RESISTOR	15 KOHM 5% 0.33W	PHILIPS	2322 181 53153
R11	RESISTOR	22 OHM 5% 1.6W	PHILIPS	2322 191 32209
R12	RESISTOR	68 KOHM 5% 0.33W	PHILIPS	2322 181 53683
R13	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103
R14	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103
R15	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 53562
R16	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222
R17	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 53681
R18	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 53272
R19	RESISTOR	56 OHM 5% 0.33W	PHILIPS	2322 181 53569
R20	RESISTOR	56 OHM 5% 2.5W	PHILIPS	2322 192 35609
R21	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 53681
R22	RESISTOR	330 OHM 5% 0.33W	PHILIPS	2322 181 53331
R23	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 53122
R24	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 53333
R25	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103
R26	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222
R27	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 53122
R28	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222
R29	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222
R30	RESISTOR	470 OHM 5% 0.33W	PHILIPS	2322 181 53471
R31	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 53399
R32	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101
R33	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102
R34	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103
T1	TRANSISTOR	BC548	* PHILIPS	BC548
T2	TRANSISTOR	BD139	* MOTOROLA	BD139
T3	TRANSISTOR	BC548	* PHILIPS	BC548
T4	TRANSISTOR	BC548	* PHILIPS	BC548
T5	TRANSISTOR	BC557	* PHILIPS	BC557
TR1	TRANSFORMER	EE16-6982	SCANELECTRIC	EE16-6982

4.3. INSTALLATION WITH MISCELLANEOUS EQUIPMENT

The following points must be observed:

1. Adaption of input level, AF IN and output level, AF OUT for scrambler CRY2002.
2. Control of key function from scrambler CRY2002.
3. Distress function on certain frequencies.
4. Programming of PRE-KEY time.
5. Programming of CALL SIGN.

To complete the first three points mentioned above, it may be necessary to use SAILOR Connection Box H2080 and a decoder as described in section 3.0. INTERFACE FOR SAILOR SCRAMBLER TO SAILOR EQUIPMENT.

The interface unit consists of a hook for the handset belonging to the radio station. In the hook the multi cables from the radio station, the scrambler CRY2002 of connection box H2080 and the handset must be connected in a proper way.

The microphone is connected to give preference to the handset belonging to the radio station through a microswitch or the hook in connection box H2080, which is activated when the handset is placed in the hook.

- 1.1. The level from the scrambler CRY2002, AF OUT, must be adapted to the modulation circuit in the radio station in question, and the level from the earpiece output of the radio station must be adapted to the scrambler AF-input, otherwise the quality of the scrambling communication will be reduced.

Recommended input level to CRY2002:

AF IN: -6 dBm to 0 dBm corresponding to $0.4V_{RMS}$ to $0.8V_{RMS}$ in 600 ohm.

Standard output level from CRY2002:

AF OUT: +4 dBm ± 3 dB corresponding to $1.2V_{RMS}$ in 600 ohm.

Therefore it is necessary to have the data for the radio station involved in order to see whether the levels have to be attenuated or amplified for adaption to the scrambler CRY2002.

The levels can be attenuated by the 4 attenuators in SAILOR Connection Box H2080.

For AF to the radio station the levels can be adjusted from -37 dBm to +9 dBm in steps of 6 dB. (11 mV to $2.2 V_{RMS}$ in 600 ohm load).

For AF from the radio station, the level can be adjusted to 0 dBm for CRY2002 in the range from -38 dBm to +18 dBm (9.8 mV to $6.2 V_{RMS}$ in 600 ohm load).

4.3. INSTALLATION WITH MISCELLANEOUS EQUIPMENT cont.:

- 2.1. The key function on the radio station must be connected to the scrambler CRY2002 in the manner that it can be controlled from the handset belonging to the scrambler.

The key function can be controlled through the relays (RE1 or RE2) on the F and T unit, pin 1-8-9 in the sockets P1 (Stn1) or P2 (Stn2), see diagram of F and T unit, section 7.1.

If the SAILOR Connection Box H2080 is used, the key function can be connected to the terminal block (see manual for H2080).

- 3.1. In some countries the scrambler must be kept in "clear voice" on certain frequencies. Therefore it may be necessary to build a decoder and connect it in the radio station to inform the scrambler to go into "clear voice". If the distress input has an 8-30V or 3-15mA the scrambler will go in "clear voice".
- 4.1. It is important for correct function that the pre-key time for the radio station involved is programmed into the service PROM as described in section 2.4. PROGRAMMING OF SERVICE PROM (otherwise some data will be missed and the scrambler will not go into synchronization. If the pre-key time is not available for the station it must be measured by the sales agent before the service PROM can be programmed.

The procedure for measuring the pre-key time can be:

Use the PTT (push to talk) button for the radio station as trigger information to an oscilloscope. Measure the time from the PTT button is activated until a 100 % modulated signal is obtained from the transmitter. The modulated signal viewed on the oscilloscope can be taken from a receiver.

- 5.1. In some countries the "call sign" of the ship must be sent out every 5 minutes for identification.

The procedure for programming the "call sign" into the service PROM is described in section 2.4. PROGRAMMING OF SERVICE PROM.

5. SERVICE

5.1. MAINTENANCE

PREVENTIVE MAINTENANCE

If SAILOR Scrambler CRY2002 has been installed in a proper way the maintenance can be reduced to an overhaul at each visit of the service staff.

Then inspect the set, cables and plugs for mechanical damages, salt deposits, corrosion and any foreign material.

Owing to its traditional structure the SAILOR Scrambler CRY2002 has a long lifetime but always depending upon the circumstances under which the set is working - it should be carefully controlled at intervals of no more than 12 months. The set must be taken to the service workshop to be tested.

5 years after the date of production (see at the back of the scrambler) the back-up batteries must be replaced (see section 7.5.)

By control measurings made in the set follow the procedure specified under Alignment Instructions.

5.2. ALIGNMENT INSTRUCTIONS

INTRODUCTION

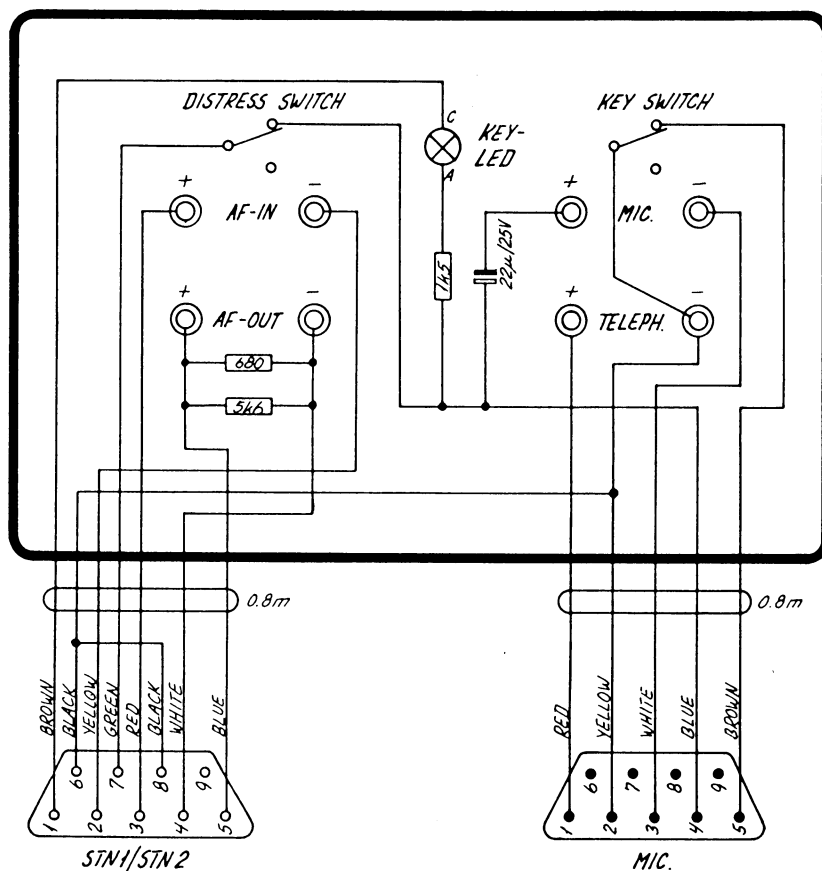
The measuring values indicated in the schematic diagrams are typical values and we recommend you to use instruments in absolute conformity with the below list:

5.3. RECOMMENDED MEASURING INSTRUMENTS

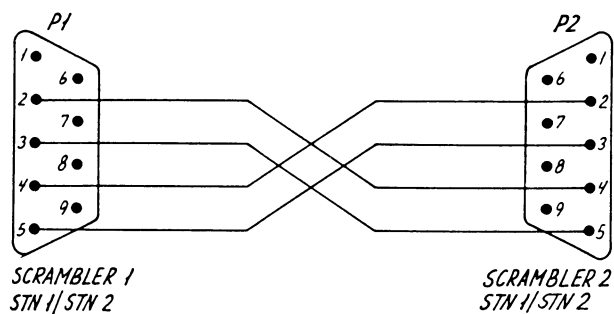
Tone generator type PM5107	: PHILIPS
Electronic Multimeter type 2517X	: PHILIPS
AF Voltmeter type VT-121	: TRIO
Oscilloscope type PM3216 0-35 MHz	: PHILIPS
Frequency Counter	
Frequency range	: ≥ 10 MHz
Sensitivity	: ≤ 100 mV
Impedance	: ≥ 1 Mohm
Accuracy	: $\leq 1 \cdot 10^{-6}$
Selfmade testbox for CRY2001/2 (see diagram next page)	

5.3. RECOMMENDED MEASURING INSTRUMENTS cont.:

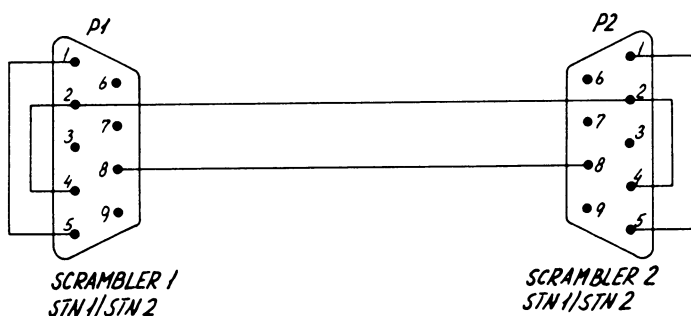
DIAGRAM FOR SELFMAD TESTBOX, WHICH IS USEFUL FOR PERFORMANCE CHECK AND ALIGNMENT CRY2001/2



DIRECT CONNECTION CABLE (4 WIRES) BETWEEN TWO SCRAMBLERS



DIRECT CONNECTION CABLE (2 WIRES) BETWEEN TWO SCRAMBLERS



5.4. PERFORMANCE CHECK

By the performance check we recommend you to use a testbox with possibility for connecting measuring instruments and plugs for the scrambler CRY2001/2. See the enclosed diagram of the testbox.

1. Connect supply plug and plugs from testbox for mic. and Stn1 or Stn2.
2. Switch on the set.
3. Connect a cable from the tone generator to the mic. input on the testbox.
4. Connect a cable from the AF voltmeter to AF-OUT on the testbox.
5. Set frequency of tone generator to 1000 Hz and level 0 dBm ($0.77V_{RMS}$ 600 ohm).
6. Key the scrambler with the switch in the testbox and see that the LED on the testbox is lit ("SEND" indication in the display must be flashing).
7. Measure the level from AF-OUT on the testbox to be +4 dBm ($1.2V_{RMS}$) ± 3 dB in 600 ohm.
8. Change over to the other station with the cable from the testbox and press the station selection button to get the other station. Measuring result as mentioned in point 7.
9. Control of selecting a distress channel:

By switching on the distress switch on the testbox the distress function is enabled. A "d" in the display will indicate that a distress channel is selected and the scrambler is functioning only in "clear voice".
10. Also check the distress function in the other station, Stn1 or Stn2.
11. Control of telephone and AF power output to ext. loudspeaker:
12. Connect the tone generator to the sockets for AF-IN and the AF voltmeter to telephone output.
13. Frequency and level of tone generator:

1000 Hz and 0 dBm ($0.77V_{RMS}/600$ ohm).
14. Measure the telephone output to be +7 dBm ($1.7V_{RMS}$) ± 2 dB.
15. Also check the other station.
16. Connect a 4 ohm/4W resistor to the external loudspeaker output and measure the level over the resistor on volume position 14 to be $3.6V_{RMS}$, otherwise adjust potentiometer R56 (100 ohm) on the process unit (module 2).
17. By stepping down the volume control the level will fall about 4 dB/step.
18. The voice processor (if mounted) can be activated by inserting the straps W1 and W3 in the handset.

5.4. PERFORMANCE CHECK cont.:

19. If * 4 is pressed on the front panel the voice processor will read out the call name programmed into the service PROM IC10 on processor unit (module 2) every 5 sec.
20. By inserting at straps W1 in the handset (service straps) and if *6 or *7 is pressed, the pre-key time in code will be read out at the display (see section 5.5.1.).
21. Further checks on the scrambler, see point 5.7. FUNCTION CHECK.

5.5. ALIGNMENT PROCEDURE

ALIGNMENT OF POWER SUPPLY, MODULE 5

1. Switch on the scrambler.
2. Check the 5V with multimeter on top of thyristor T12 to be $5.1V \pm 0.1V$, otherwise adjust potentiometer R39 to 5.1V.
3. Check the voltage of the back-up battery B1 to be between 3.0 to 3.5V. The back-up battery has to be replaced after 5 years (see date at the back of the scrambler).

ALIGNMENT OF PROCESSOR UNIT, MODULE 2

1. Switch on the scrambler.
2. Check with multimeter the voltage on the center pin of potentiometer R31 to be in the range 540 mV to 560 mV, otherwise adjust potentiometer R31.
3. Control of clock frequency to be 3572.800 kHz ± 10 Hz, which is half of the crystal frequency 7145.600 kHz.
The frequency is measured on pin 3 of IC13 (74LS74) or resistor R20 (10K) not on pin 1 or 2 of the microprocessor (IC1), because the test probe will load the oscillator frequency.
The frequency can be adjusted by means of trimming capacitor C1.
4. Control of AF POWER-AMP. output: $3.6V_{RMS}/4$ ohm with volume position in pos. 14.
Input to AF IN Stn1 or Stn2 (pin 2 and 3) on F + T unit must be fm = 1 kHz, level 0 dBm ($0.77V_{RMS}/600$ ohm).
Output from IC18 loaded with 4 ohm and volume position 14 must be $3.6V_{RMS} \pm 0.2V$, otherwise adjust potentiometer R56.

ALIGNMENT OF F + T UNIT, MODULE 1

1. Switch on the scrambler.
2. Check the voltage on TP34 to be $+7.5V \pm 0.4V$.
3. Check the voltage on TP35 to be $-7.5V \pm 0.4V$.
4. Control of frequency response 300 Hz to 3 kHz from AF IN in telephone output in "clear voice".
Adjust tone generator until telephone output level is 0 dBm, fm = 1 kHz.
Input level must be -7 dBm ($340mV_{RMS}$) ± 2 dB.

Table 1.

Frequency	level
300 Hz	0 dB
500 Hz	0 dB
1000 Hz	0 dB
1500 Hz	+1 dB
2000 Hz	+0.5dB
2500 Hz	0 dB
2600 Hz	-3 dB
2800 Hz	-30 dB
2850 Hz	-40 dB

5.5. ALIGNMENT PROCEDURE cont.:

ALIGNMENT OF FSK MODEM

1. Connect tone generator to AF IN, pin 2 and 3 of Stn1.
2. Switch on the set and select Stn1.
3. Set level of tone generator to give 0 dBm in TP13, frequency 1500 Hz.
4. Adjust potentiometer R92 until max. deflection on the AF-meter in TP14 (+5.5 dBm, 1.5V_{RMS}).
5. Control the 3 dB points in the BP-filter to be 1370 Hz and 1640 Hz.
6. Control the DC value on pin 10 of IC10 to be 6.9V \pm 0.3V.
7. Switch off the tone generator and measure DC-level on pin 8 of IC10 to be 6.5V \pm 0.5V. The level of pin 7, the data output must be "low" (<0.5V).
If the level of pin 7 is "high" (5V) the level of pin 8 is approx. 7.3V, the hysteresis is about 0.8V.
8. Switch on the tone generator, same level and frequency 1500 Hz as mentioned above. Measure the DC-level of TP16 to be the level on pin 8 of IC10 plus 0.4V (nominal value 6.5V +0.4V = 6.9V DC for "low" level of pin 7), otherwise adjust R101 to the right value.
9. Control that the DC value of TP16 will change \pm 2.5V when the frequency of tone generator is changed 1500 Hz \pm 85 Hz.

ALIGNMENT OF MIC AMPLIFIER

1. Connect tone generator to mic. input, pin 3 and 4 of J3 (remember DC voltage on pin 4 to supply the mic. pre-amp. in handset). (Insert capacitor 22 uF/25V in the line).
2. Switch on the set and set level of tone generator to 500 mV_{RMS} (-4 dBm) and frequency to 1000 Hz.
3. Measure on TP10 the level to be 0 dBm, when the mic. amp. is in compression (adjust level of tone generator until the level in TP10 is constant).
4. The nominal compression level is 500 mV_{RMS}. With 500 mV_{RMS} from tone generator the level in TP10 must be constant, otherwise adjust potentiometer R68 coming from a lower level just until the level is constant approx. 0 dBm.
5. For controlling the HP filter the mic. amp. must be out of compression and it is necessary to remove the rear plate to measure in TP12. Adjust level on tone generator until level in TP12 is -10 dBm (250 mV_{RMS}).
6. Frequency response TP12 (pin 4 IC6):

Frequency	Level
375 Hz	-3 dB
312 Hz	-10 dB
250 Hz	-20 dB
195 Hz	-30 dB

5.5. ALIGNMENT PROCEDURE cont.:

7. Check mic. signal in TP1 (key ON)
Input level from tone generator: 0 dBm, fm = 1000 Hz.
Measure in TP1: 0 dBm ± 2 dB.
With key "OFF" the attenuation in TP1: min. 55 dB.
8. Check mic. signal in TP6 and 7 (key ON)
TP6: +12 dBm $3V_{RMS} \pm 2$ dB
TP7: +12 dBm $3V_{RMS} \pm 2$ dB
9. Measure AF OUT in Stn1 pin 4 and 5 in P1 with 600 ohm load:
+4 dBm $1.2V_{RMS} \pm 3$ dB.
10. Measure AF OUT in Stn2 pin 4 and 5 in P2 with 600 ohm load:
+4 dBm $1.2V_{RMS} \pm 3$ dB.

CHECK ON T-SCRAMBLER

1. Connect tone generator to mic. input pin 3 and 4 of J3 (remember DC voltage on pin 4).
2. Switch on the set and set level of tone generator to 0 dBm ($0.77 V_{RMS}$) and the frequency to 1000 Hz.
3. Measure in TP27 with key "ON": 0 dBm ± 2 dB.
4. Frequency response of LP filter in TP28 (key "ON"):

Frequency	Level
500 Hz	0 dB
730 Hz	-0.3 dB
760 Hz	-3 dB
795 Hz	-10 dB
840 Hz	-20 dB
880 Hz	-30 dB
900 Hz	-40 dB
920 Hz	-> (-52 dB)
1020 Hz	-34 dB
1250 Hz	50 dB

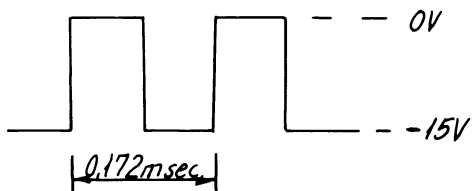
5. Frequency response of HP FILTER in TP29 (key "ON"):

Frequency	Level
1000 Hz	0 dB
970 Hz	-0.3 dB
930 Hz	-3 dB
882 Hz	-10 dB
835 Hz	-20 dB
800 Hz	-30 dB
780 Hz	-40 dB
768 Hz	-> (-50 dB)
690 Hz	-34 dB

5.5. ALIGNMENT PROCEDURE cont.:

6. Clock signals to delay line, IC28.

TP30
TP31



Frequency: 5800 Hz

7. Control of level for clock signals in TP32:

Switch off the tone generator, connect AF-voltmeter to TP32 and measure all remains from clock signals: Less than -40 dBm, otherwise adjust potentiometer R241 to minimum, typical value -43 dBm.

8. Control of AF level in TP32 (key "ON"):

Switch on the tone generator connected to mic. input, level 0 dBm (0.77V_{RMS}), frequency 500 Hz.
Level in TP32: 0 dBm \pm 2 dB.

9. Control of delay in TP32 (key "ON"):

A quick check control can be done by changing the frequency from the tone generator in a quick way around the frequency 500 Hz and see the delay on a scope.

By correct measuring the time delay T is $\frac{2048}{2 \times 5800} = 176.5 \text{ mS}$.

10. Control of level and response in TP33 (key "ON"):

Input level to mic. input: 0 dBm (0.77 V_{RMS}).

Response:	Frequency	Level
	500 Hz	+1 dBm \pm 2 dB
	1500 Hz	0 dBm \pm 2 dB
	2500 Hz	0 dBm \pm 2 dB

5.5. ALIGNMENT PROCEDURE cont.:

11. Control of RX frequency response for T-scrambler from AF IN (Stn1) to TP33:

Level from tone generator: -4 dBm (500 mV_{RMS})

Frequency	Level
300 Hz	-0.5 dB +2 dB
500 Hz	0 dB +2 dB
755 Hz	-3 dB +2 dB
794 Hz	-10 dB +2 dB
840 Hz	min. level (-30 dB)
880 Hz	-10 dB +2 dB
923 Hz	-3 dB +2 dB
1000 Hz	+0.5 dB +2 dB
1500 Hz	+1.5 dB +2 dB
2000 Hz	+1 dB +2 dB
2500 Hz	+1 dB +2 dB
2654 Hz	-3 dB +2 dB
2735 Hz	-10 dB +2 dB
2825 Hz	-20 dB +2 dB
2905 Hz	-30 dB +2 dB
3005 Hz	-40 dB +2 dB

CHECK ON F-SCRAMBLER

1. Connect tone generator to AF IN pin 2 and 3 of P1 (Stn1).
2. Switch on the set and set level of tone generator to 0 dBm (0.77V_{RMS}) and the frequency 1000 Hz.
3. Adjust level from tone generator until level on AF-voltmeter is -6 dBm (0.39V_{RMS}) in TP18 (IC14 pin 1).
4. Control of level in TP20 and TP21 through all pass filters:
Measure in TP20: -14.5 dBm (150 mV_{RMS})
Measure in TP21: -15.0 dBm (140 mV_{RMS})
5. Switch off the tone generator.
6. Insert strap W1 in the handset (module 1).
7. Press *1, display shows P1 and R will be illuminated.

The F-scrambling process is enabled, and the frequency generator is generating the frequencies:

F1 44660 Hz (J5 pin 2)
F2 17177 Hz (J5 pin 4)
F3 23200 Hz (J5 pin 6)
F1' to mixer 1-2: 11165 Hz
F2' to mixer 3 : 8588.5 Hz
F3' to mixer 4 : 11600 Hz

5.5. ALIGNMENT PROCEDURE cont.:

8. Reduction of spurious signals from mixers:

Connect AC-voltmeter to TP22.

Adjust the potentiometers R148, R170 and T179 (DC offset of mixer 1,2,3) to reduce level as much as possible, repeat the adjustment a few times.

The signals in TP22 must be max. -50 dBm (typ. -52 dBm). (Also see the page about STRAPS).

9. Switch on the tone generator, level 0 dBm and frequency 1000 Hz.

10. Measure the summation signal in TP22 to be +1 dBm \pm 2 dB.

11. Control of MUTE circuit:

Measure with AC-voltmeter in TP24.

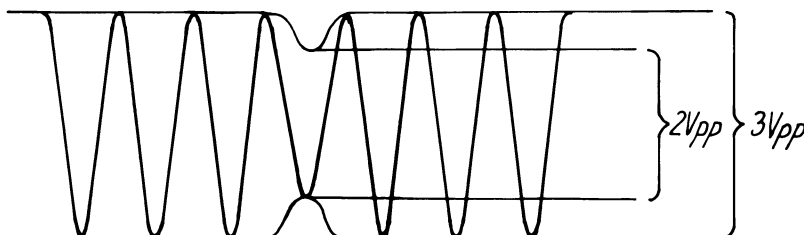
Adjust potentiometer R187 max. counter clockwise signal level:
-1 dBm \pm 2 dB.

Adjust potentiometer R187 max. clockwise signal level:
approx. -15 dBm.

Adjust potentiometer R187 until the signal is attenuated 0.1 dB.

See muting signal on oscilloscope:

Time/Div. 10 mS, Amp/Div. 0.5V.



5.5. ALIGNMENT PROCEDURE cont.:

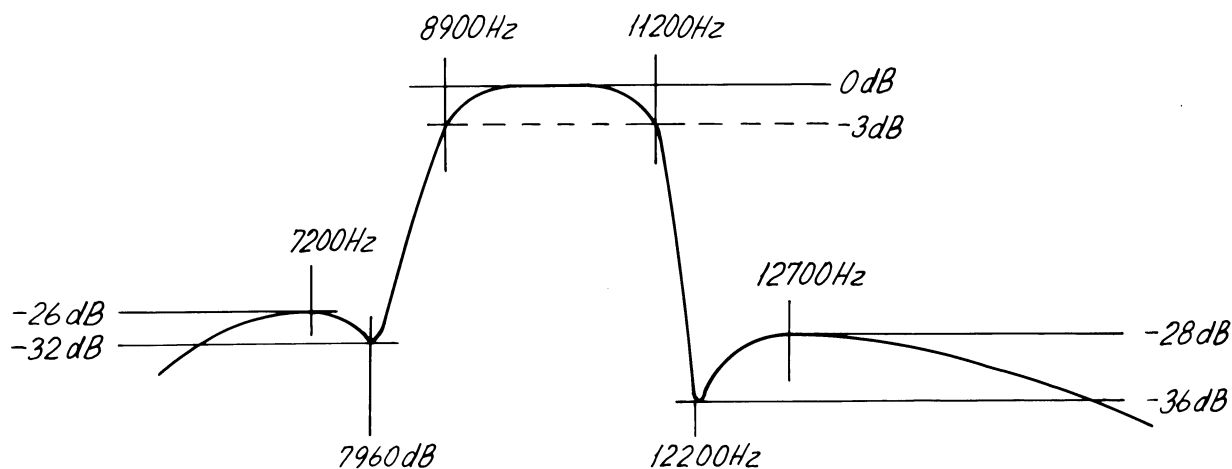
12. Control of 10 kHz BP-filter between TP23 and TP25. The filter cannot be adjusted because the cores are locked in the coils.

Connect tone generator and counter to TP23, level from tone generator -5 dBm.

Control of the filter response with AF-voltmeter in TP25:

High cut-off: -3 dB \geq 11200 Hz
 -30 dB \leq 12000 Hz
 Min. level about 12200 Hz (-36 dB), L20-L22
 Max. level about 12700 Hz (-28 dB)

Low cut-off: -3 dB 8900 Hz \pm 70 Hz
 -26 dB \geq 8200 Hz
 Min. level about 7960 Hz (-32 dB), L23-L21
 Max. level about 7200 Hz (-26 dB)



13. Reduction of spurious signals from mixer 4:

Connect AC voltmeter to TP26.

Insert strap W1 and press *1.

Adjust potentiometer R206 until AC voltmeter shows minimum level (tone generator switched off).

Level: max. -45 dBm (4.5 mVeff)
 typ. -50 dBm (2.5 mVeff)

5.5. ALIGNMENT PROCEDURE cont.:

14. Total check on F-scrambler:

Connect tone generator to AF IN pin 2 and 3 of P1 (Stn1).

Switch on the set and set level of tone generator to -7 dBm (0.35V_{RMS}) and the frequency to 1000 Hz.

Insert strap W1 and press *1.

Connect AC voltmeter and counter to TP8.

Measure in TP8:

Output level: 0 dBm (0.77 V_{RMS}) \pm 3 dB.

Frequency: 2012 Hz

$F_{out} = F3' - (F2' + F_m) = 11600 - (8588.5 + 1000) = 2011.5$ Hz

See frequency table 2.

Table 2. Frequency table for F-scrambling process:

The frequencies can be measured in cable connector J5 on F + T unit.

F1: J5 - 2, see table

F2: J5 - 4, see table

F3: J5 - 6, 23.200 kHz $F3' = \frac{F3}{2} = 11600$ Hz

No.	Divider N1	F1 (Hz)	$F1' = \frac{F1}{4}$ (Hz)	Divider N2	F2 (Hz)	$F2' = \frac{F2}{2}$ (Hz)	W1
1	40	44660	11165	104	17177	8588	*1
2	41	43571	10893	107	16695	8348	
3	42	42533	10587	111	16094	8047	
4	43	41544	10386	114	15670	7835	
5	44	40600	10150	118	15139	7569	
6	45	39698	9924	121	14764	7382	*2
7	46	38835	9709	125	14291	7146	
8	47	38009	9502	128	13956	6978	
9	48	37217	9304	132	13533	6767	
10	49	36457	9114	136	13135	6568	
11	50	35728	8932	140	12760	6380	
12	51	35027	8756	144	12406	6203	*3

X-tal oscillator: 7.1456 MHz

Clock frequency: $\frac{F_{osc.}}{4}$ 1.7864 MHz

The frequencies F1 and F2 are changed every 100 mS.

For service use with strap W1 inserted and e.g. *1 pressed, the frequencies in No. 1 for F1 and F2 will be generated constantly, and e.g. with *2 pressed it is the frequencies in No. 6.

5.5.1. SERVICE FACILITIES WITH STRAP W1 INSERTED

When strap W1 is inserted in the handset (module 1) or a jumper is used to short-circuit the two pins for W1, some service facilities are activated.

Press *1: Set volume to position 15.

Adjust potentiometer R179 (DC-offset of MIXER 3) until min. noise is heard in the loudspeaker.

Normally adjusted to the middle of the range of the potentiometer.

Press *2: Set volume to position 15.

For elimination of spurious, adjust potentiometers R148 and R170 (DC-offset of MIXER 1 and 2) to reduce level of high tone heard in the loudspeaker as much as possible.

Set volume to position 10 or a suitable level.

Connect tone generator to AF IN (tone 1 kHz, level 0 dBm) and adjust potentiometer R155 to min. distortion.

Normally adjusted to the middle of the range of the potentiometer. By this adjustment the balance between MIXER 1 and 2 is controlled.

Press *3: Tone No. 12 for F1 and F2 (see table 2).

Press *4: Set volume to position 14.

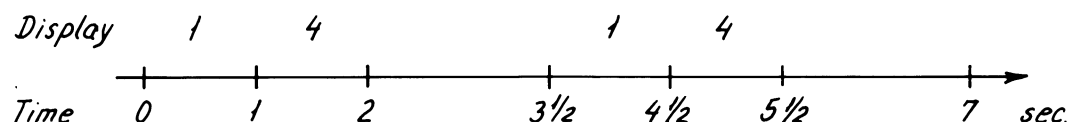
If the voice generator is enabled, the programmed call sign will be heard in the earpiece and repeated after 5 secs.

Normally the call sign is transmitted in "clear voice" every 5 minute.

Press *6: The programmed pre-key time in Stn1 (HEX code) will be read out at the display.

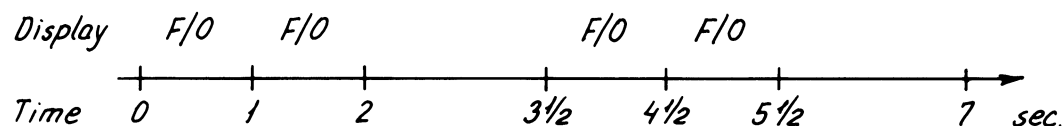
Ex.: Pre-key time 200 msec = 14 HEX.

Read-out sequence for display:



Press *7: The programmed pre-key time in Stn2 (HEX code) will be read out at the display.

Note: If the service PROM is not installed (or programmed), the pre-key time will be 0 secs and the read-out sequence will be:



Remember to press # # if you want to change to another test mode.

The strap W1 must be removed after the test has been finished.

5.6. NECESSARY ADJUSTMENTS AFTER REPLACEMENT OF MODULES

Replacement of power supply (module 5):

Alignment of POWER SUPPLY, MODULE 5, points 1 to 3.

Replacement of processor unit (module 2):

Alignment of PROCESSOR UNIT, MODULE 2, points 1 to 4.

Replacement of interface (module 6):

No alignments.

Replacement of F and T unit (module 1):

No alignments, the module is adjusted from the factory.






When the scrambler is assembled again, go through the following checks:

1. Point 5.4. PERFORMANCE CHECK
2. Point 5.7. FUNCTION CHECK
3. Point 5.5. ALIGNMENT PROCEDURE.
Check service facilities with strap W1 inserted.

Replacement of handset:

No alignments.

5.7. FUNCTION CHECK

1. Connect plugs for supply, handset and Stn1 or Stn2.
2. Switch on the set.
3. Keyboard and display test.
 - 3.1. Press the buttons 1 to 8 and check the digits coming correctly into the display.
 - 3.2. Press the number key # and see a square in the display. Press the number key # once more and the square must disappear.
 - 3.3. Press the DIM button and see the light be switched on or off.
 - 3.4. Press the function key * and see an F in the display.
 - 3.5. Press the number key # twice. After the first press, F will change to E and after the second press, E will disappear.
 - 3.6. Press the key  and see a  in the display.
 - 3.7. Press the number key # twice and the key will disappear.
After the first press, the key  will change to a square  and after the second press, the  will disappear.
 - 3.8. Press the station selection Stn1/Stn2 and see the station number change in the display.
4. A judgement of the scrambling and the "clear voice" quality of the scrambler can be done with another scrambler and a direct connection cable between the two scramblers.
A diagram of the cable is shown in section 5.4. PERFORMANCE CHECK.
 - 4.1. After the plugs are connected, switch on the 2 sets, select the station to which the direct cable is connected.
 - 4.2. The sets can now be operated in simplex mode from the two handsets by one person holding a handset in each hand on both sides of the head. Then talk into the microphone of the transmitting scrambler and listen to the other scrambler through its belonging earpiece and reversed. If the call is in "clear voice", the "SEND" information is shown in the display of the transmitting scrambler.
 - 4.3. After the 2 scramblers have been tested both ways in "clear voice" and the operator has got an impression of the sound quality, change over to scrambling operation by following the procedure in the green operation manual about selective calling and group calling.
In scrambling mode the sound will be delayed.

5.7. FUNCTION CHECK cont.:

- 4.4. Also check that a "SEND" is lit in the display of the transmitting scrambler and a "RECEIVE" in the receiving scrambler.

Remember that every transmission starts with a synchronizing signal and conversation cannot be started until the ready tone (Apollo tone) is heard in the handset and "SEND" is lit.


When the key is released, the transmitting scrambler will transmit an EOT (end of transmission) signal and the "RECEIVE" indication must disappear from the display of the receiving scrambler before it is ready for transmission.

- 4.5. This audible test must be carried out in both stations: Stn1 and Stn2. After some experience an audible test will indicate whether a scrambler is operating normally or not.


Check of call name and pre-key time is described in section 5.4. PERFORMANCE CHECK.

5.8 PIN CONFIGURATIONS AND SCHEMATIC DIAGRAMS OF IC's

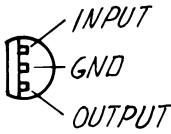
BOTTOM VIEW


BC328-25, BC338-25
BC547B, BC557B, BC560

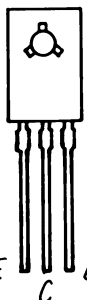

BC640

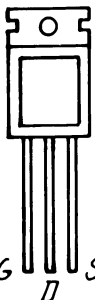

2N2369A

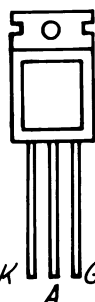

BF245


LM78L05A

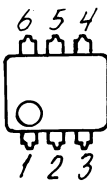
FRONTSIDE VIEW


BD139


RFP12N10


BT151-500R

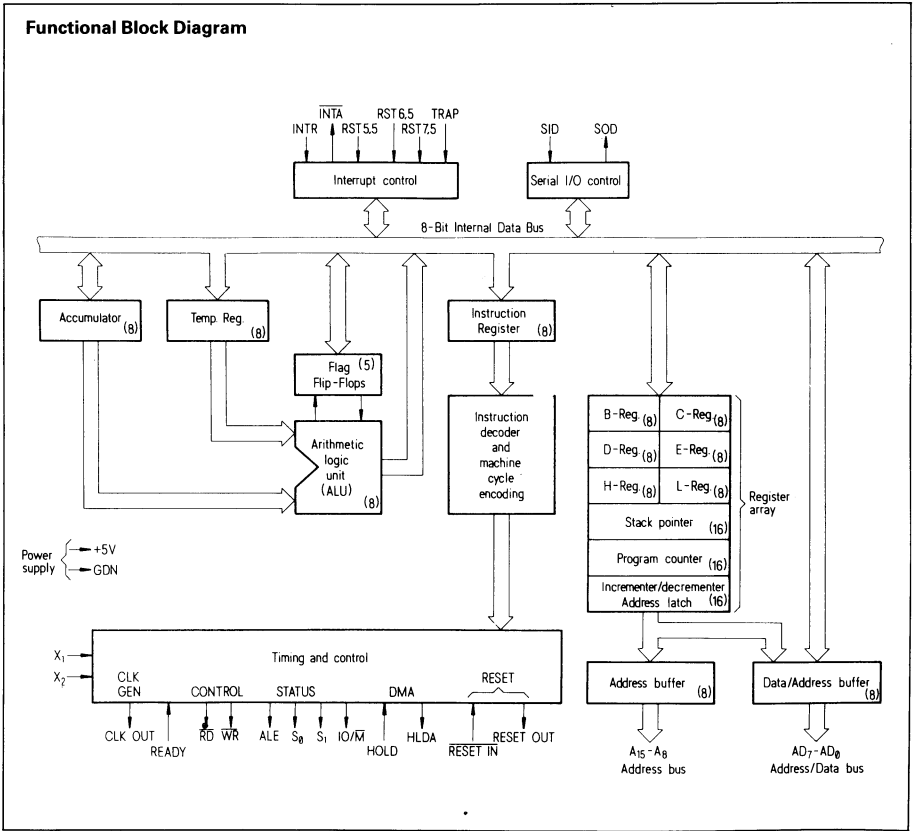
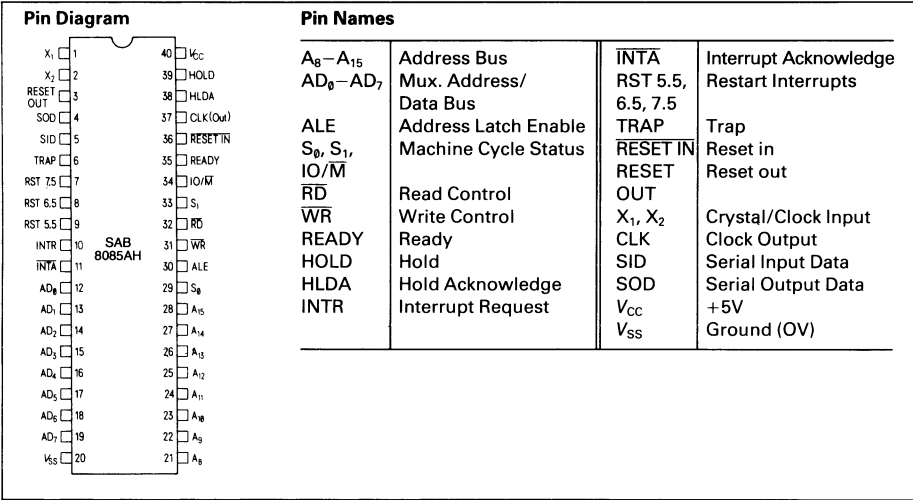
TOP VIEW


4N27
4N32
MOC8020

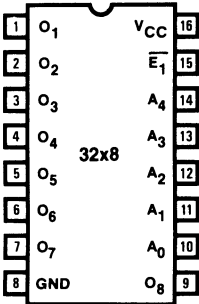
1 ANODE *4 EMITTER*
2 CATHODE *5 COLLECTOR*
3 NC *6 BASE*

NB! MOC8020 is with out base connection

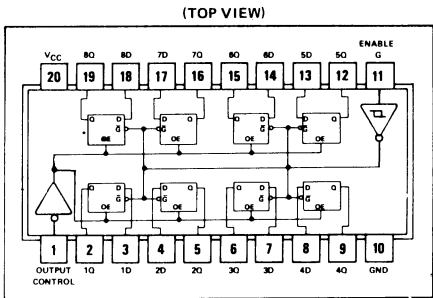
8085A-2 8-BIT MICROPROCESSOR



6331-1
256 BIT PROM



SN74LS373
OCTAL D-TYPE LATCHES

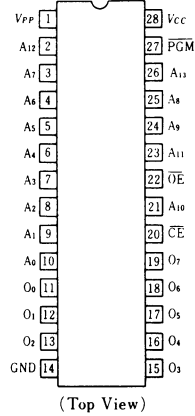


PIN CONFIGURATIONS CONT.

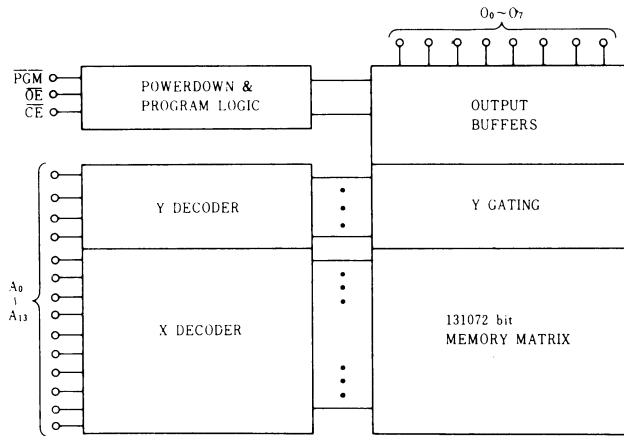
2764 8192-WORD X 8-BIT U.V.ERASABLE AND PROGRAMMABLE READ ONLY MEMORY

27128 16384-WORD X 8-BIT UV ERASABLE AND PROGRAMMABLE READ ONLY MEMORY

PIN ARRANGEMENT



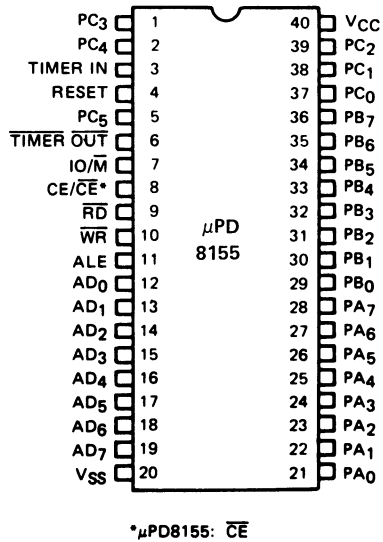
BLOCK DIAGRAM



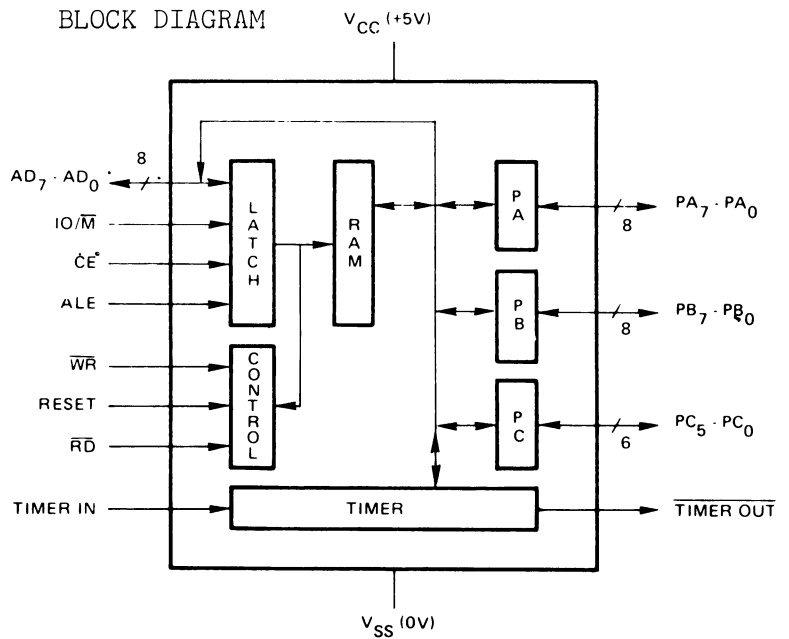
μPD8155

2048 BIT STATIC MOS RAM WITH I/O PORTS AND TIMER

PIN CONFIGURATION

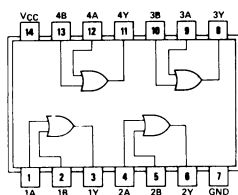


BLOCK DIAGRAM



SN74LS32

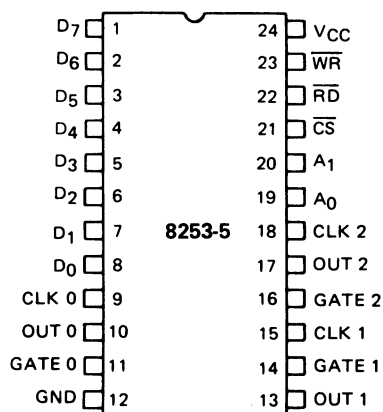
4x2-input or gates



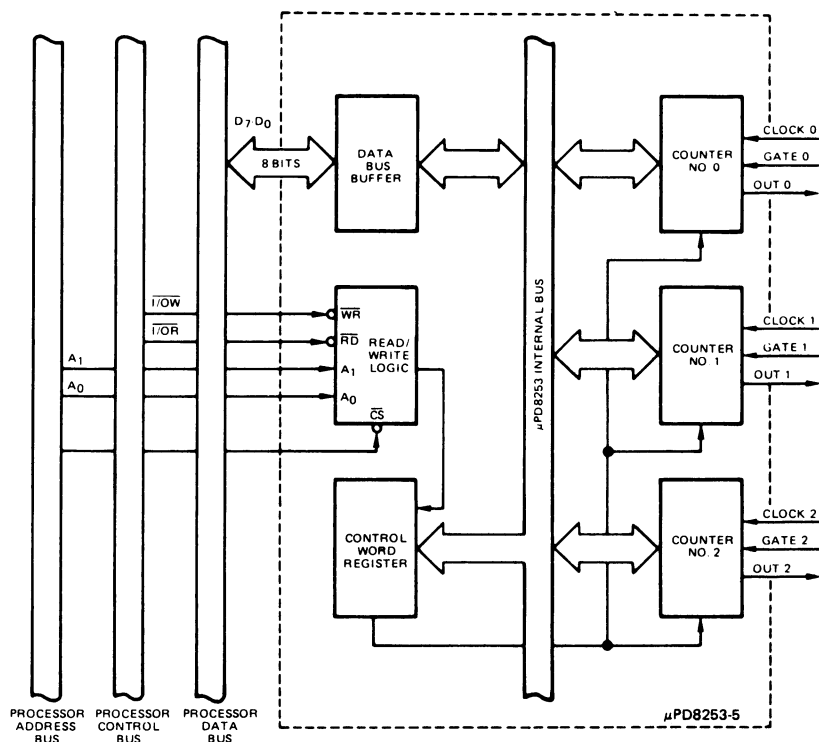
8253-5

PROGRAMMABLE INTERVAL TIMER

PIN CONFIGURATION



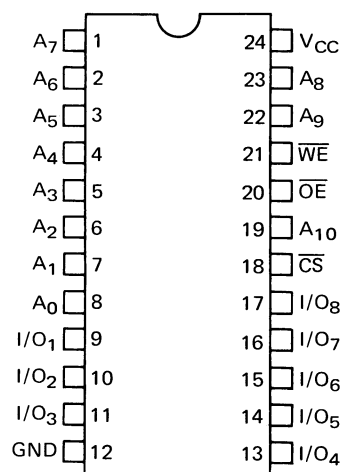
BLOCK DIAGRAM



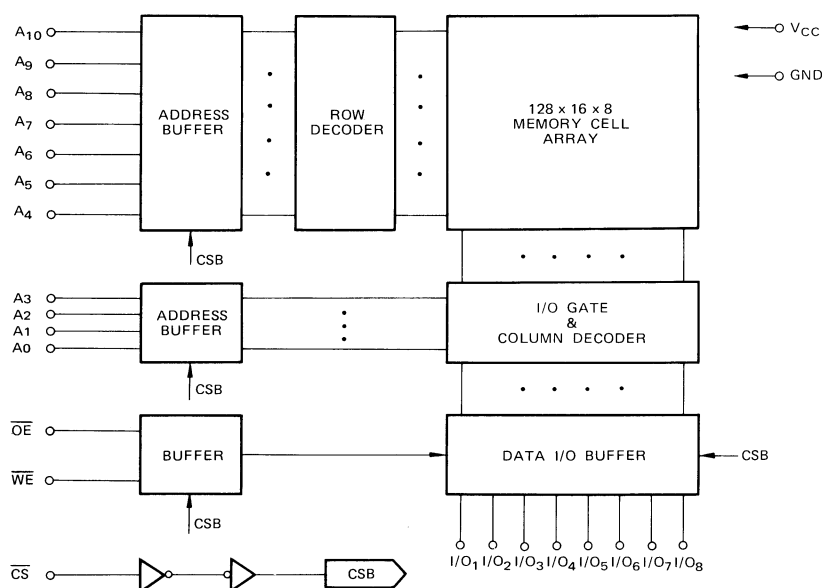
MB 8416A

LOW POWER 16K-BIT (2048 x 8) CMOS STATIC RAM

PIN ASSIGNMENT



BLOCK DIAGRAM

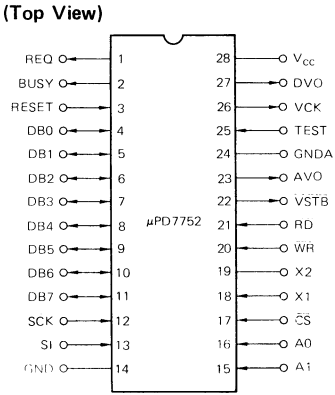


TRUTH TABLE

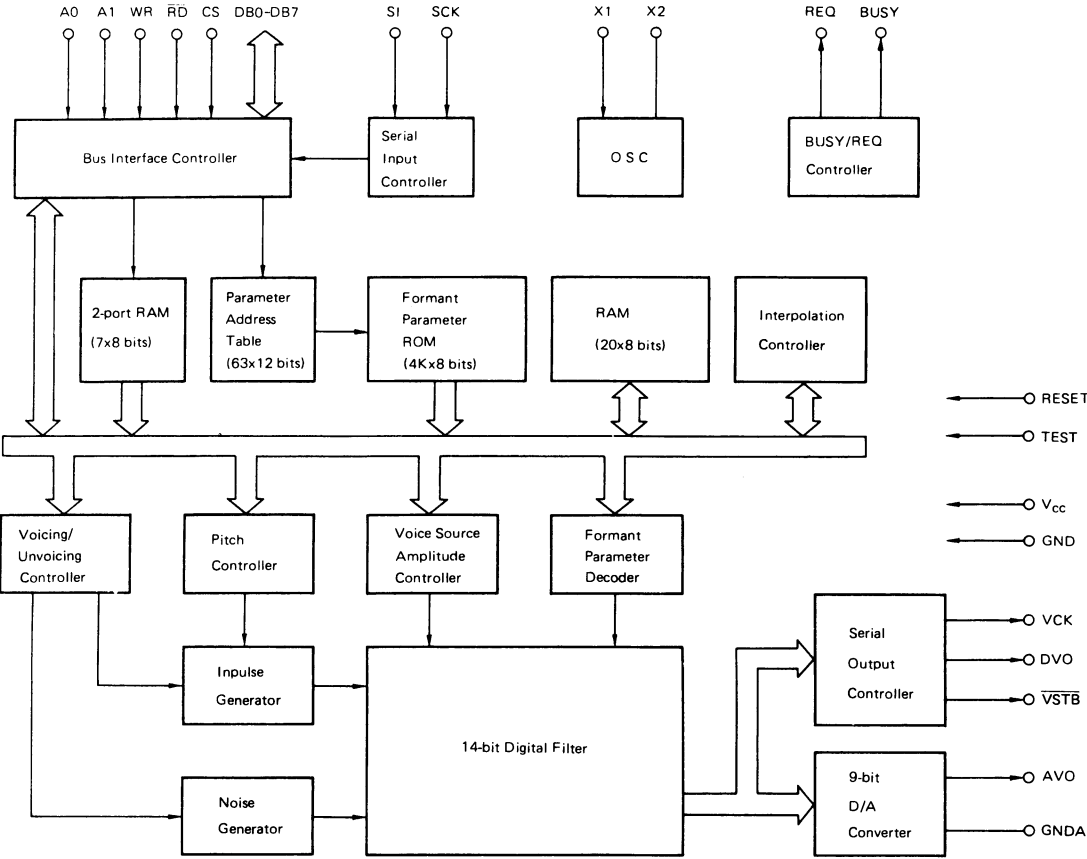
CS	OE	WE	MODE	SUPPLY CURRENT	I/O PIN
H	X	X	NOT SELECTED	I_{SB}	HIGH-Z
L	H	H	D_{OUT} DISABLE	I_{CC}	HIGH-Z
L	L	H	READ	I_{CC}	D_{OUT}
L	X	L	WRITE	I_{CC}	D_{IN}

CONNECTION DIAGRAM

μPD7752C
VOICE SYNTHESIZING LSI ADOPTING
FORMANT PARAMETER

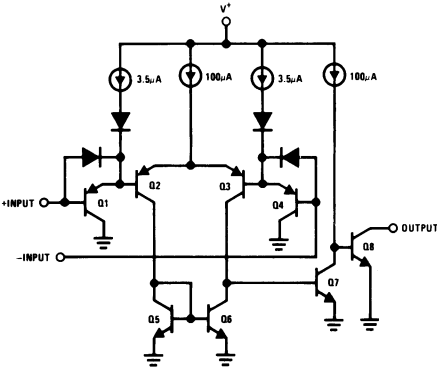
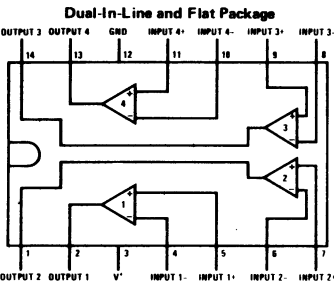


BLOCK DIAGRAM OF μPD7752



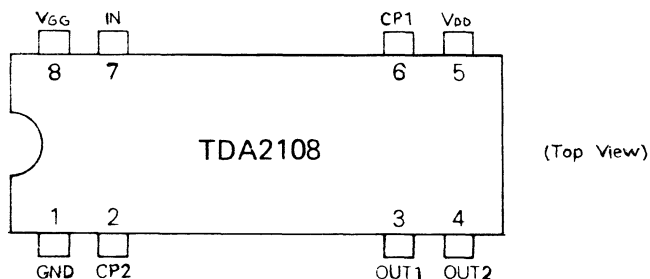
LM339N
4 x VOLTAGE COMPARATORS

SCHEMATIC AND CONNECTION DIAGRAM

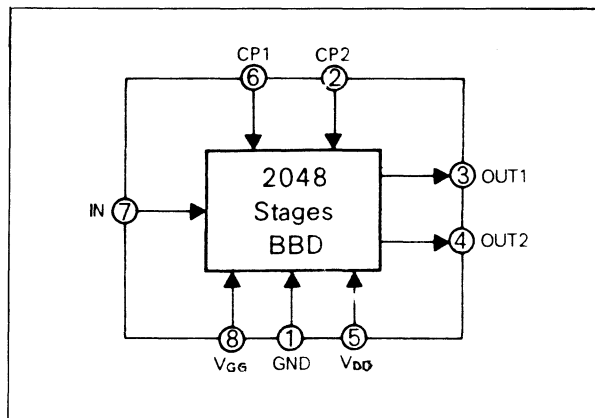


TDA2108 BUKET BRIGADE DELAY LINE

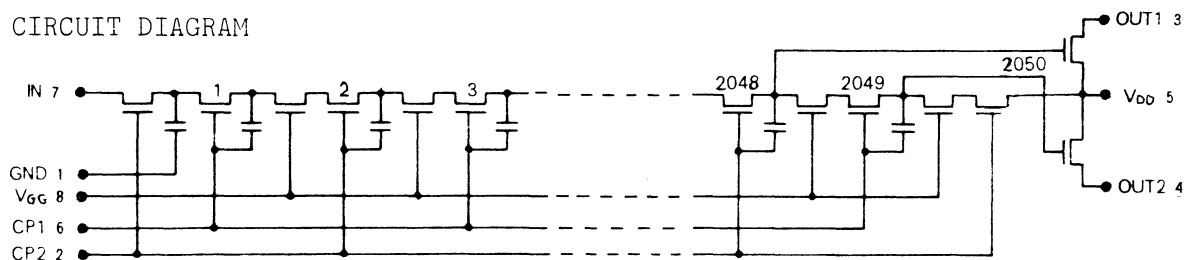
TERMINAL ASSIGNMENTS



BLOCK DIAGRAM



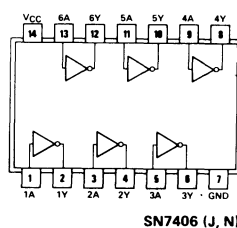
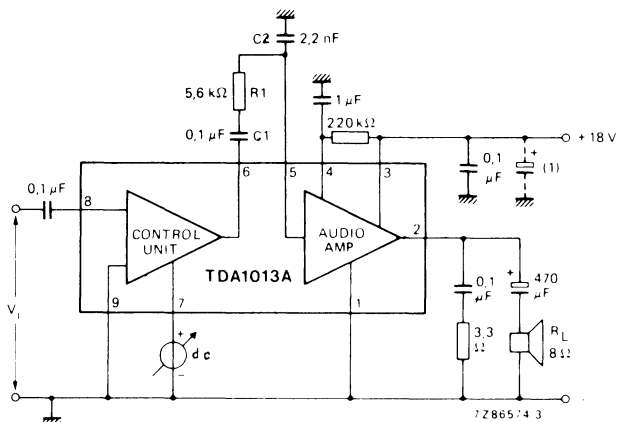
CIRCUIT DIAGRAM



TDA1013A AF-POWER AMPLIFIER

SN7406

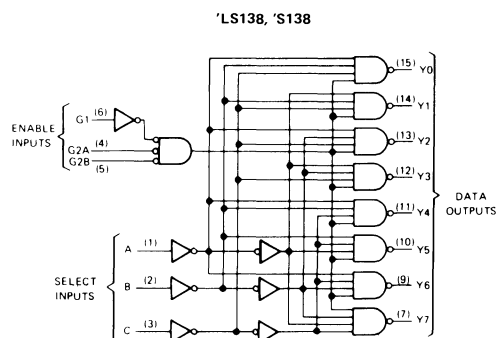
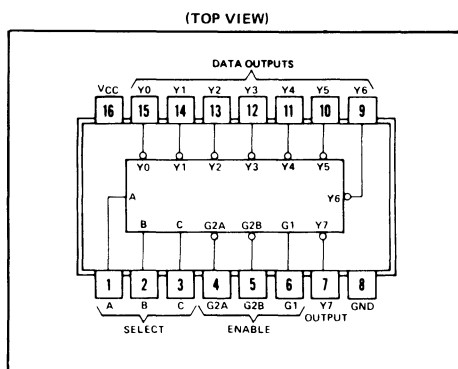
HEX INVERTER BUFFERS



SN74LS138

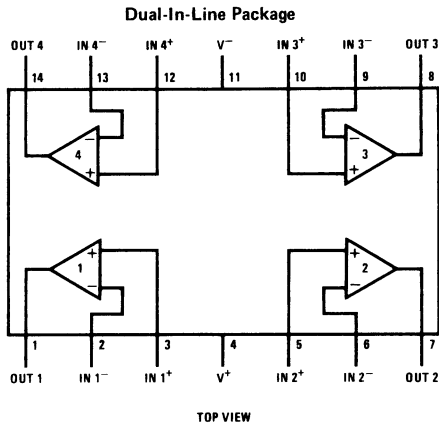
DECODERS

FUNKTIONAL BLOCK DIAGRAM AND LOGIC

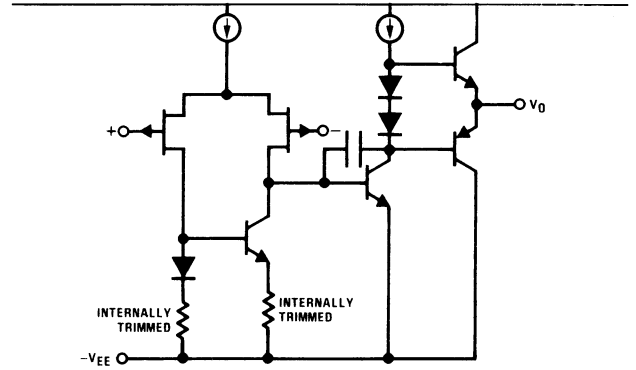


LF347 4 X JFET INPUT OP AMP

CONNECTION DIAGRAM

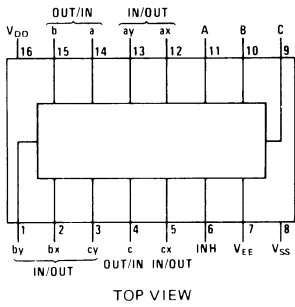


SIMPLIFIED SCHEMATIC



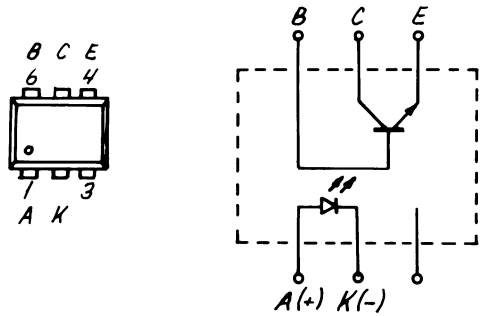
CD4053B

3 x 2-CHANNEL ANALOG MULTIPLEXER

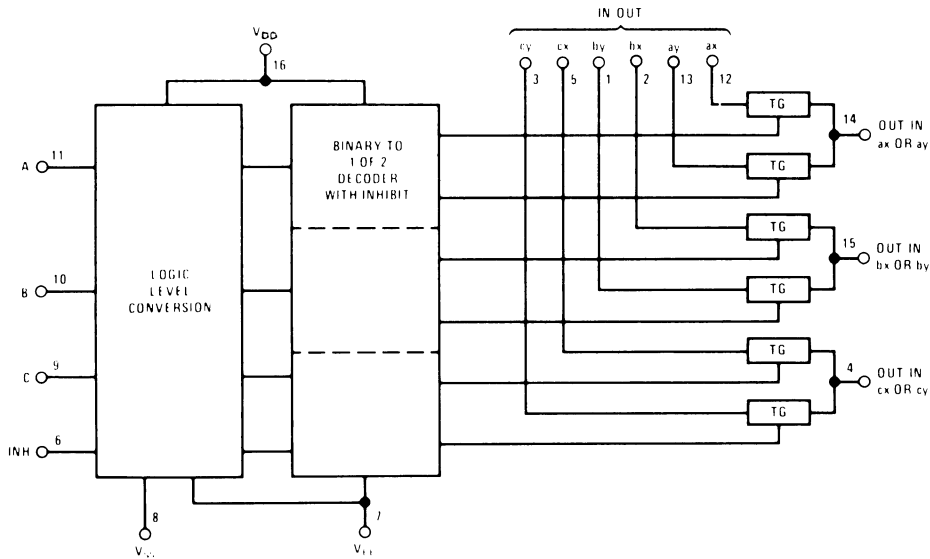


CNY 17

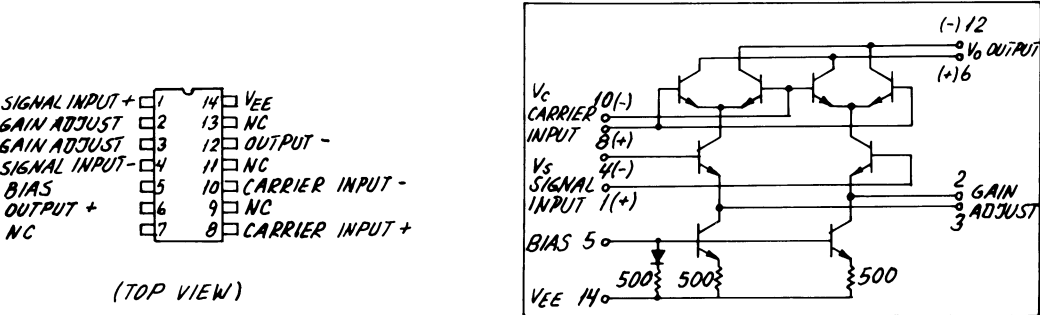
OPTO-COUPLER



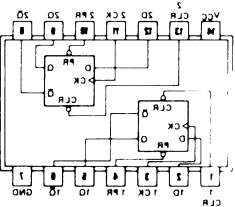
CD4053BC BLOCK DIAGRAM



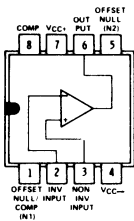
MC1496 BALANCED MODULATOR-DEMODULATOR



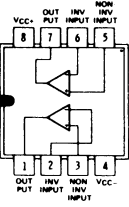
SN74LS74A (J,N)
DUAL D-TYPE FLIP FLOP



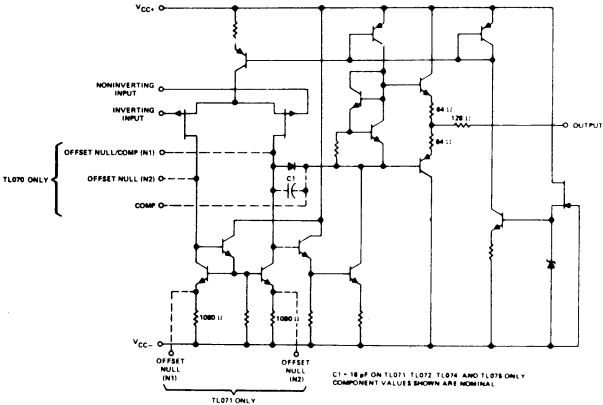
TL070
LOW-NOISE JFET-INPUT OP. AMP.



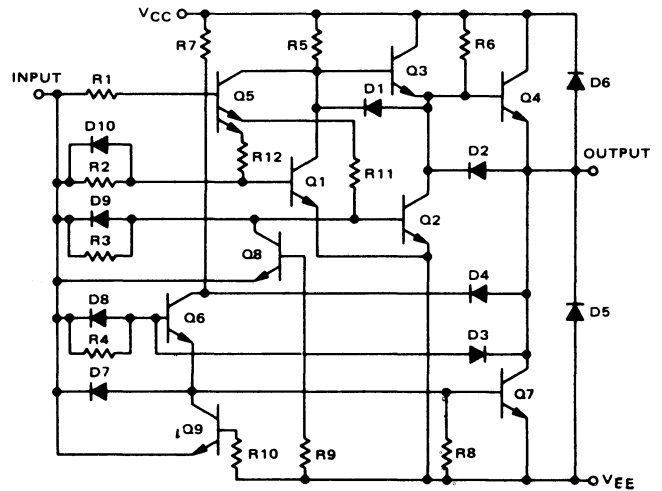
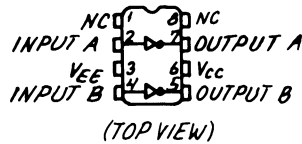
TL072
LOW-NOISE JFET-INPUT OP. AMP.



SCHEMATIC (EACH AMPLIFIER)

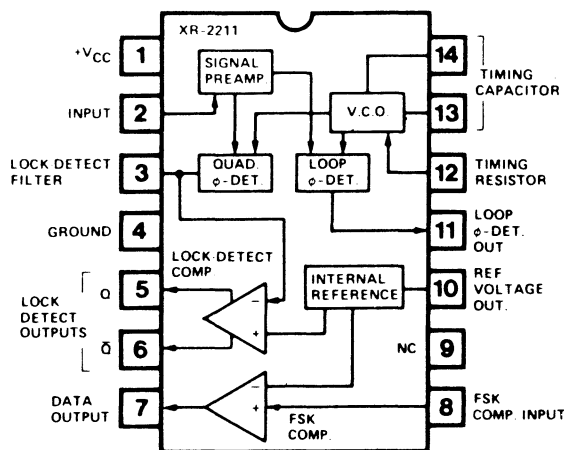


CIRCUIT SCHEMATIC
(1/2 CIRCUIT SHOWN)

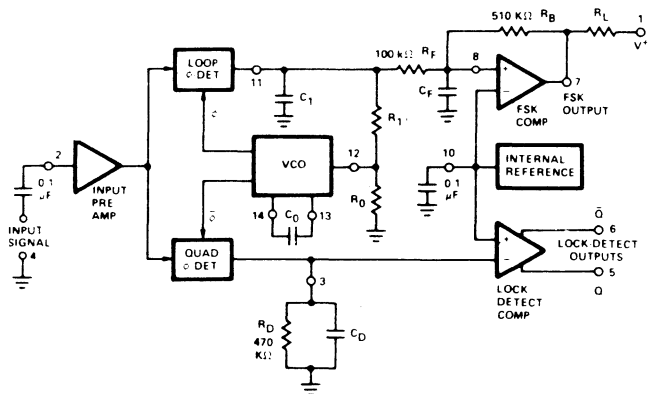


XR-2211 FSK DEMODULATOR

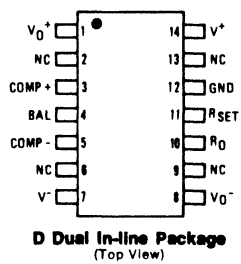
FUNCTIONAL BLOCK DIAGRAM



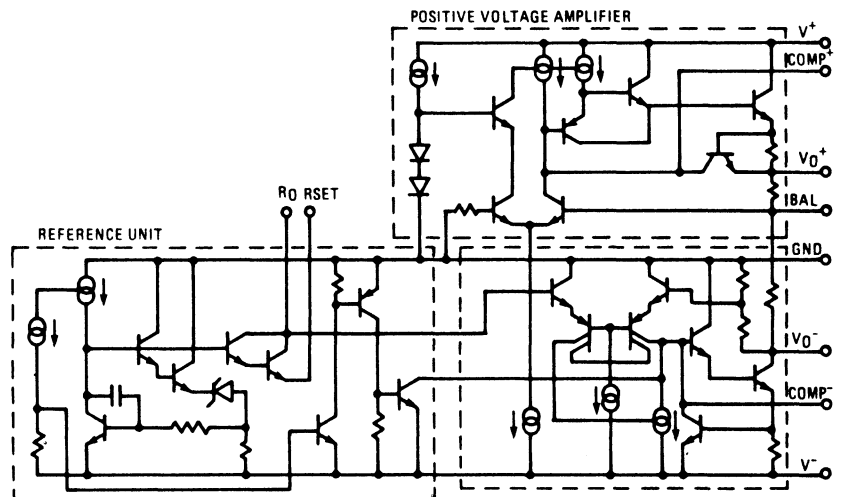
GENERALIZED CIRCUIT CONNECTION



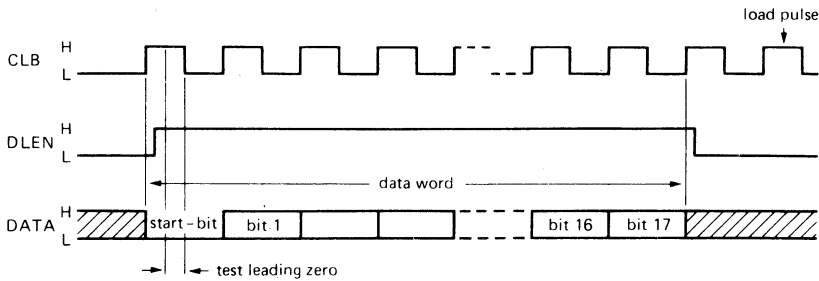
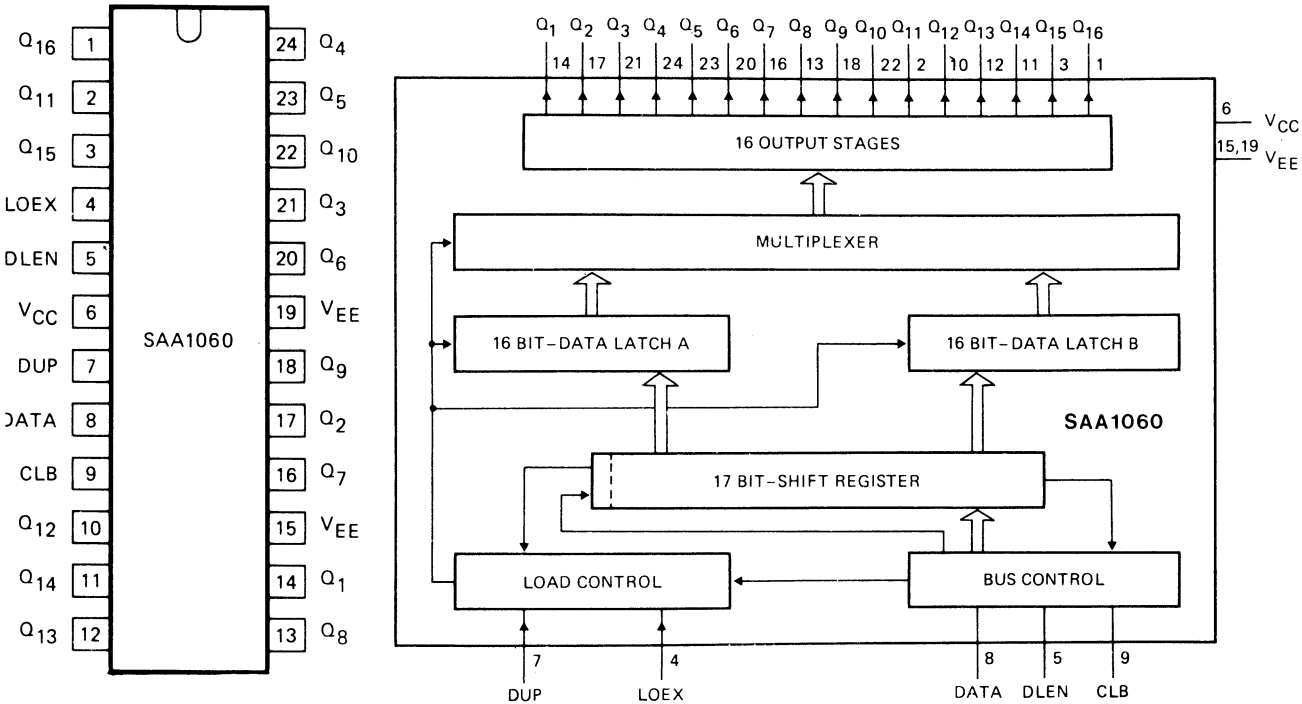
4194
DUAL TRACKING
VOLTAGE REGULATORS



SCHEMATIC DIAGRAM



SAA1060 LED DISPLAY/INTERFACE CIRCUIT (ONLY CRY 2002)

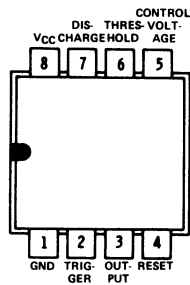


QUICK REFERENCE DATA

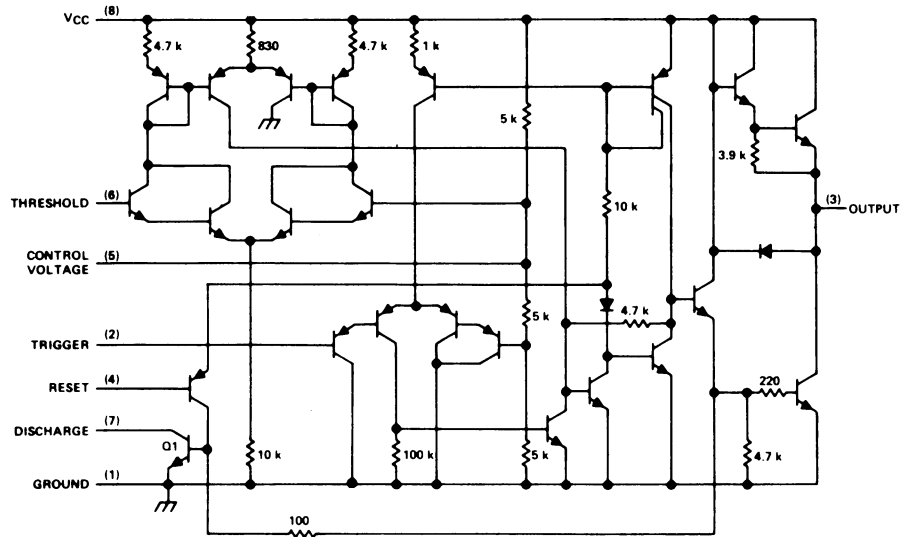
Supply voltage range	V_{CC}	4 to 6 V
Operating ambient temperature range	T_{amb}	-20 to +80 °C
Maximum input frequency	f_I	typ. 50 kHz
Supply current	I_{CC}	typ. 60 mA
Output current	I_Q	< 40 mA
Output current (Q_8 and Q_{16} only)	I_Q	< 80 mA

555 PRECISION TIMER

JG OR P DUAL-IN-LINE PACKAGE
(TOP VIEW)



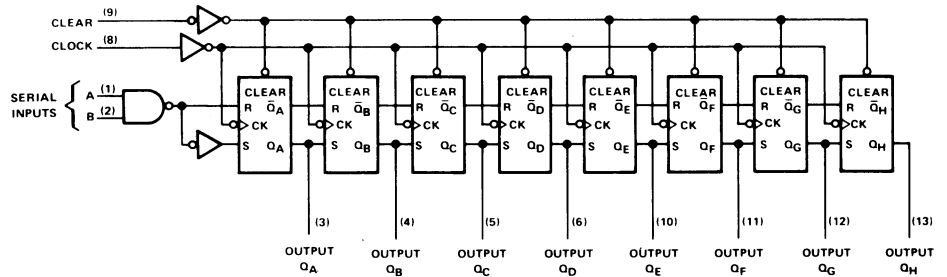
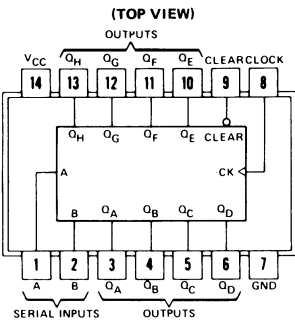
SCHEMATIC



Resistor values shown are nominal and in ohms.

SN74LS164

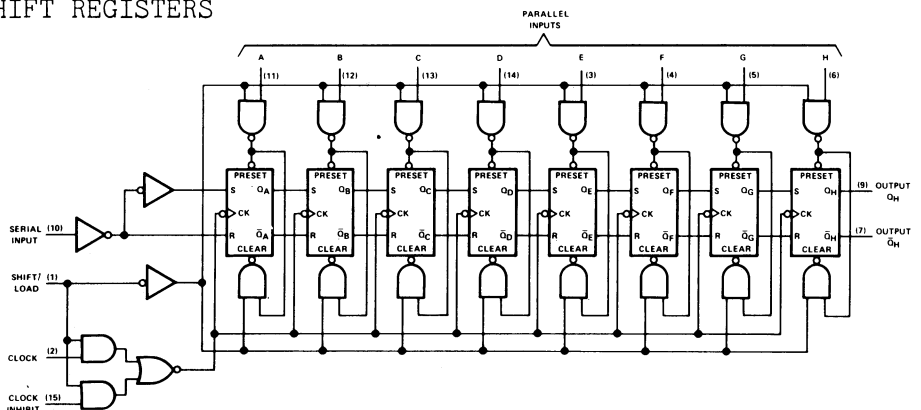
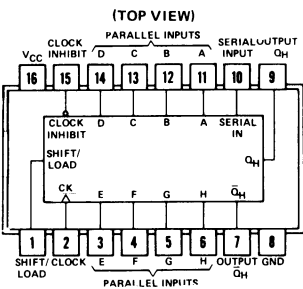
8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS



FUNCTIONAL BLOCK DIAGRAM

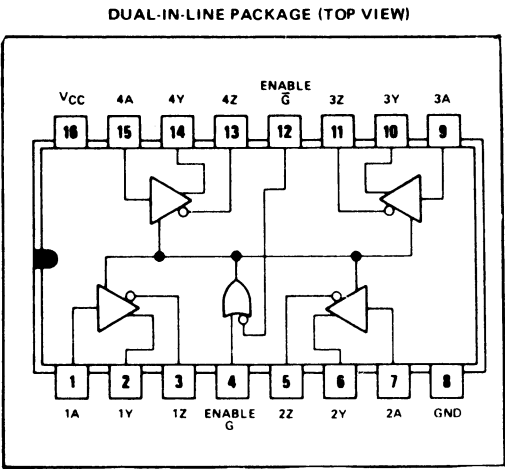
SN74LS165

PARALLEL-LOAD 8-BIT SHIFT REGISTERS



FUNKTIONAL BLOCK DIAGRAM

AM26LS31M, AM26LS31C
QUADRUPLE DIFFERENTIAL LINE DRIVERS (ONLY CRY 2002)



FUNCTION TABLE (EACH DRIVER)

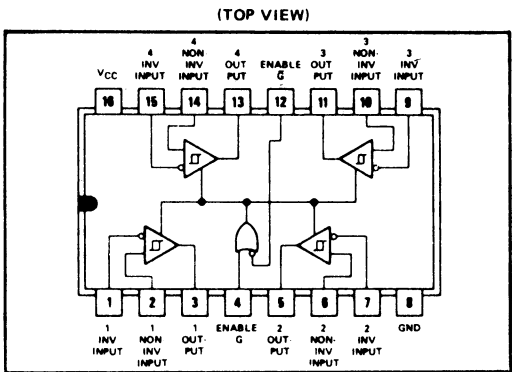
INPUT A	ENABLES		OUTPUTS	
	G	\bar{G}	Y	Z
H	H	X	H	L
L	H	X	L	H
H	X	L	H	L
L	X	L	L	H
X	L	H	Z	Z

H = high level
L = low level
X = irrelevant
Z = high impedance (off)

recommended operating conditions

	AM26LS31M			AM26LS31C			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			-20			-20	mA
Low-level output current, I_{OL}			20			20	mA
Operating free-air temperature, T_A	-55		125	0		70	°C

AM26LS32AC
QUADRUPLE DIFFERENTIAL LINE RECEIVERS (ONLY CRY 2002)



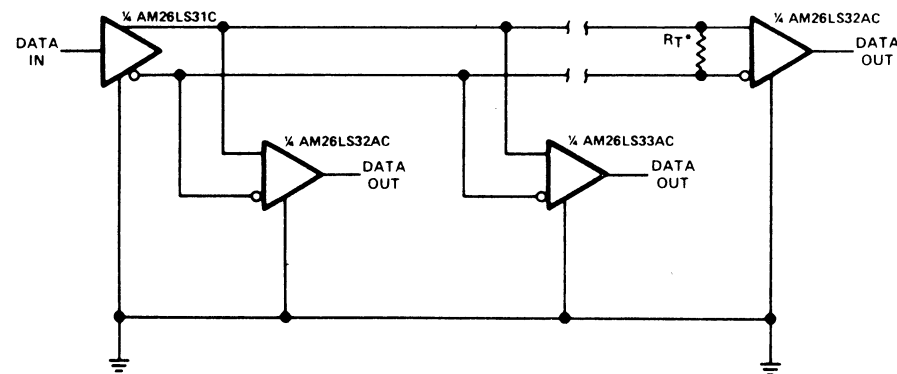
FUNCTION TABLE (EACH RECEIVER)

DIFFERENTIAL INPUT	ENABLES		OUTPUT
	G	\bar{G}	
$V_{ID} > V_{TH}$	H	X	H
	X	L	H
$V_{TL} < V_{ID} < V_{TH}$	H	X	?
	X	L	?
$V_{ID} < V_{TL}$	H	X	L
	X	L	L
X	L	H	Z

H = high level, L = low level, X = irrelevant
Z = high impedance (off), ? = indeterminate

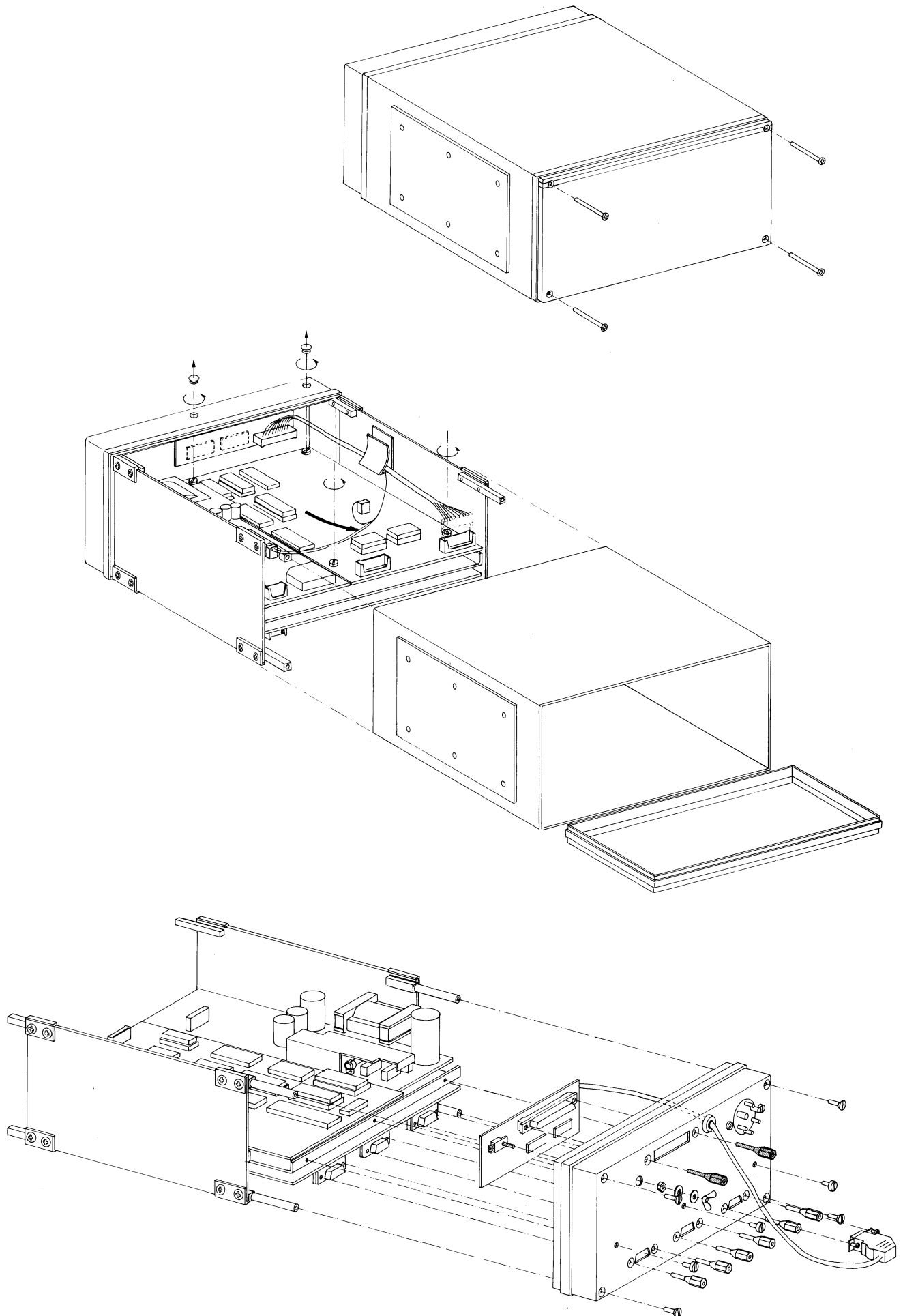
recommended operating conditions

	AM26LS32AC			AM26LS33AC			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.75	5	5.25	4.75	5	5.25	V
Common-mode input voltage, V_{IC}			± 7			± 15	V
High-level output current, I_{OH}			-440			-440	μ A
Low-level output current, I_{OL}			8			8	mA
Operating free-air temperature, T_A	0		70	0		70	°C



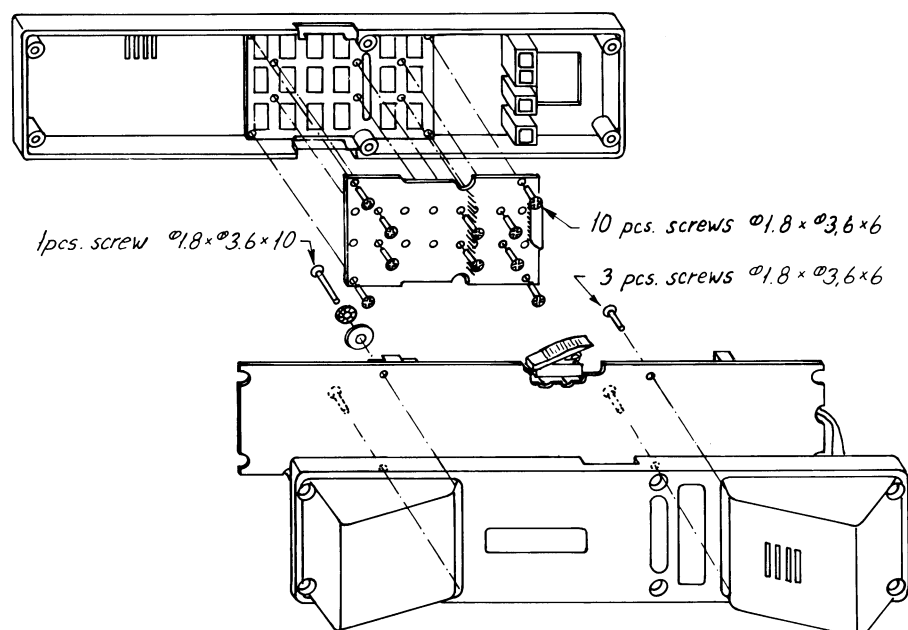
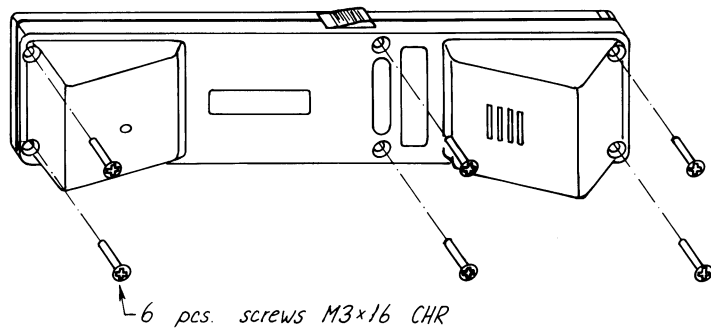
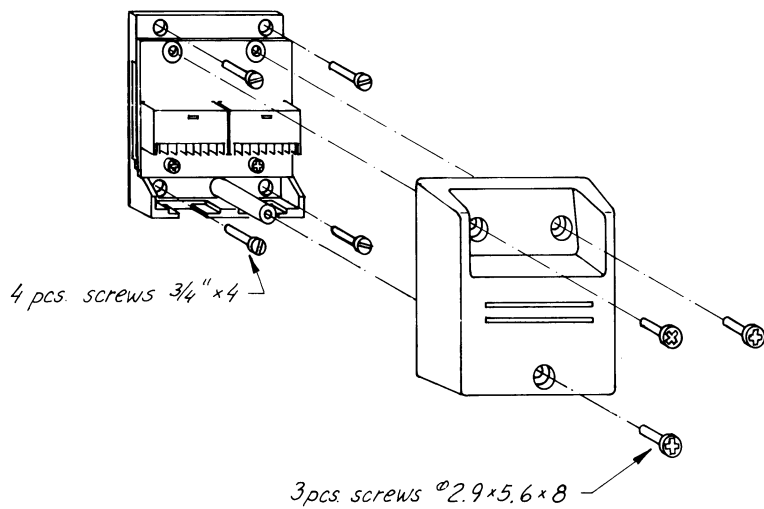
*RT equals the characteristic impedance of the line.

6.0. MECHANICAL DISASSEMBLING CRY2002



CRY2002, 4-0-25498
4-0-25499 4-0-25500

6.1. MECHANICAL DISASSEMBLING CRY2002 HANDSET



7.0. CIRCUIT DESCRIPTION

7.1. F AND T UNIT (MODULE 1)

This unit contains the following parts.

- line interface - distress - keying relays
- mode switching logic
- microphone - telephone amplifier
- F-scrambler
- T-scrambler
- modem (FSK)
- on board power supply

LINE INTERFACE

The scrambler has balanced input and output connections. The AF in Stn1 and Stn2 is fed to an RF-filter L12, L13, C13, C14 (L14, L15, C15, C16) and from there to a balancing transformer T1 (T2). The input impedance is controlled by R8 (R11) and is 600 ohm. The transient protected (D1, D2, D3, D4) amplifier IC2a (IC2d) gives a single ended output, adjusted to the necessary gain by R5 (R9).

The output is in the same way RF protected and balanced. For Stn1, IC2b, R30-35, TR4 and for Stn2, IC2c, R13-17, TR3.

The outputs have a fixed selected 3 dB, 600 ohm attenuator. Further the outputs are DC isolated for bipolar voltage up to $\pm 30V$.

DISTRESS

Separate distress optocoupled inputs for Stn1 and Stn2 of IC4 and IC5 are accomplished. The distress inputs are working from 8-30V and protected for reversed bias with D5 and D6.

KEYING

Keying-out is performed by RE1 and RE2 for Stn1 and Stn2 respectively. Both outputs can either be made or break for 1A-110V.

MODE SWITCHING LOGIC

All the internal audio switching is performed by the analog C-MOS switch CD4053. ICI,3,6,23. The switch arrangement can be followed on the block diagram. The switches are controlled by the microprocessor.

MICROPHONE TELEPHONE AMPLIFIER

The microphone amplifier consists of a gain controlled pre-amplifier and a peak limiting post section. T4 and T5 are a low gain (open loop gain 20x) amplifier with a shunt feed-back consisting of R67,68,69,72. The shunt feed-back gives an increasing dynamic range at increasing gain, adjusted by R68. This means a fixed maximum input voltage independent of gain adjustments. The gain regulating device is a transistor T3. The regulating distortion is kept below 1% because of a maximum AC voltage at T4 basis on 0.5mV eff. The rectifier for the control voltage to T3 is T1, T2. The attack time is determined by R110 and C44, and the recovery time by C44, R64 (R65). The regulated RMS voltage at TP10 is approx. 775mV. An active limiter D7,8,9,10 takes care of a maximum peak voltage at approx. 1.5V. The amplifier is IC9a.

7.1. THE F AND T UNIT (MODULE 1) cont.:

To reduce spurious in the F-scrambler, the microphone amplified signal is filtered in a 4th order highpass filter with a 3 dB cut-off frequency at 425 Hz. This high cut-off frequency is chosen for reducing the influence of the high group delay distortion at low (and high) frequencies in an SSB RF equipment.

TELEPHONE AMPLIFIER

To drive the earpiece in the handset is a fixed gained amplifier IC8. The amplifier is disconnected in the TX mode by the EAR BLK switch IC6b. The output from this amplifier is also fed to the power amplifier on the processor unit, module 2.

In the front of the telephone amplifier is a 5th order elliptical lowpass filter. It has a sharp cut-off at 2550 Hz and removes the out of band spurious from the F and T-scrambling. This filter is also used in the F-scrambler and will be described there.

F-SCRAMBLER

Input Filter

The input is fed from the mode switch IC1a to a 5th order elliptical lowpass filter IC12,a,d,b,c. It has a 0.28 dB bandpass ripple and a 0.28 dB cut-off frequency at 2550 Hz. The stopband attenuation is 34 dB, activated at 3100 Hz. The filter is of the F.D.N.R. type (frequency dependant negative resistor). This means a transformed LC filter: resistors transformed to capacitors, inductors to resistors, and capacitors to F.D.N.R. elements, which is a kind of super capacitors. $Z = K/s^2C$.

In a conventional 5th order elliptical LP-filter, 5 expensive coils are used. In the actual circuit they are converted to 5 resistors R112,113,117,119,121. The generator and load resistors are converted to C71,78. R111,120 are DC load resistors. The F.D.N.R. element IC12a,d and IC12b,c. IC14 is a buffer amplifier.

Allpass Filter

IC15a,b,c perform a 6-pole allpass function. It gives a flat amplitude response in the outputs TP20,21 but the phase relationship between TP20,21 is constantly 90 degrees within 280-3200 Hz. These outputs are necessary for the single sideband generation by IC16,17. The pole frequencies in the allpass filter is

C88, R139	=	90.6 Hz
C35, C89, R142	=	666 Hz
C90, C91, R144	=	2875 Hz
C96, C97, C98, R161	=	310 Hz
C99, R164	=	1340 Hz
C100, C101, R167	=	9852 Hz

Mixer System

The main frequency translation frequencies in the F-scrambler is F1, F2. They are generated in the CPU unit and control the frequency inversion and shifting process. The scrambling code generator shifts between one set of twelve possible sets each 100 mS.

The frequency list can be seen in table 2 in section 5.5. F1 is divided by 4. The output from IC20a,b are two square waves with a 90 degrees relationship, and their related inverted signals are used in IC16,17 together with the allpass signals to perform a single sideband generator with the high sideband used. The mixer output current is summed over R153 and R154. R155 adjusts the amplitude balance and is adjusted to minimum for

7.1. THE F AND T UNIT (MODULE 1) cont.:

the unwanted sideband. F2 is divided by two in IC21a and used for a third mixer IC18. This output is a double sideband signal and summed to the other R153, R154. This mixer is used to complete the inverted frequency band. A picture of the composed spectrum can be seen on fig. 3 in section 1.4. All the three mixers have suppressed carriers and the carrier suppression adjustments are very important in IC16, R148 and IC17, R170, because of audible spurious. IC19a translates the balanced mixer output to a single ended output.

Muting

The translated output spectrum IC19a is fed to a muting circuit T6 before it is bandpass filtered. Muting is introduced to reduce click noise in the audio arising from the frequency shift. Therefore it is only performed each 100 ms, when the inversion frequencies are changed and only for approx. 5 ms, and after a smoothed curve. The muting pulse J5/9 F Mute is fed to level translator T7 a little before each frequency shift. The smoothed gate control is performed by R186, C103, C104. R187 is adjusted so that the FET T6 is only just off. The muting is reduced to approx. 12 dB by R182, see section 5.5. Check on F-scrambler, point 11.

Bandpass Filter

The bandpass filter is one of the critical parts in the frequency scrambler. It determines the overall bandwidth and spurious performance. It should have a very sharp cut-off to reduce spurious and wide enough to cover the baseband. A sharp cut-off gives high delay distortion, which gives the special sound effect "Phasing". The bandpass filter is a so-called LERNER filter (pole residual). It has a linear phase and possible transmission zeros.

It is an 8th order filter, which is a compromise between spurious and phasing. The filter is built around IC19c, with L20-23 and C105-C111. The filter is centered at 10 kHz and with a 3 dB bandwidth of 2.4 kHz.

Down Mixer

The bandpass filtered signal is mixed down to baseband with IC22. The converting frequency is $F_3 = 23.2 \text{ kHz}$ which divided by 2 in IC21b gives 11.6 kHz. It is on the high side, so the spectrum is inverted. The signal is highpass filtered, IC14c in a second order HP-filter to further remove low frequency spurious.

Output Lowpass Filter

By the analog switch IC23 used to bypass the F-scrambling, the signal is fed to a 5th order F.D.N.R. sharp cut-off lowpass filter similar to the input filter described earlier.

T-SCRAMBLER

Cross-over Filter System

In the T-scrambling processing, the baseband is splitted up into two equal power bands in a crossover filter system. It consists of a 5th order F.D.N.R. lowpass filter IC24a,b,c,d with a 0.3 dB cut-off at 725 Hz and a 34 dB at 794 Hz. The passband ripple is 0.3 dB. This filter is of the same type as used in the F-scrambler.

The highpass filter is a 5th order elliptical filter where the coils are realized by gyrators IC25a,b,c,d. It has a -0.3 dB passband ripple, a 0.3 dB cut-off at 970 Hz, and 34 dB at 794 Hz.

The cross-over system has an inband -3 dB hole from 755 - 930 = 175 Hz, but this gives a very little effect in the voice picture.

IC26a,d are buffer amplifiers with 6 dB gain. The output in TP28 and TP29 is the same as the input TP27 and nominal 0 dBm.

7.1. THE F AND T UNIT (MODULE 1) cont.:

Delay Line

In the transmitting mode is the analog switch IC23a,b selected so that the lowpass filtered portion is delayed. IC28 is a 2048 stages Bucket-brigade delay line. It is MOS device supplied with -15V and requires 2 clock signals from clock driver IC29 MMH=026. The delay is dependant on the clock frequency which is $F_3 = 23.2 \text{ kHz}$ divided in IC30a,b by four to 5.8 kHz . The delay is $= 2048/2 \times 5.8 \text{ kHz} = 176.55 \text{ mS}$.

The output from IC28 is taken from the last two stages by R241. By this potentiometer the clock feed-through can be adjusted to a minimum. IC27a,b is a second order lowpass filter with a $F_o = 3.7 \text{ kHz}$ and a $Q = 1.4$ to compensate for the $\sin x/x$ roll-off out of sampling device IC28.

Summing of the delayed signal and the highpass filtered signal is accomplished in IC26b. The T-scrambler output is in TP33 and the overall gain is 0 dB.

In the receiving mode the high and lowpass filter is interchanged by IC23a,b.

Modem

The code and synchronizing information is transmitted between scramblers by 100 BAUD FSK (frequency shift key) centered at 1500 Hz with a $F = \pm 85 \text{ Hz}$. From the input selector switch IC1b, the signal is fed to a bandpass filter. IC11a,d is a gyrator and acts as a coil and the tuning capacitor is C58. The output at pin 14 is the input for an integrated phase-locked loop circuit IC10 XR2211. It contains a limiting amplifier, a phase detector, a voltage controlled oscillator, a comparator, and a lock detector.

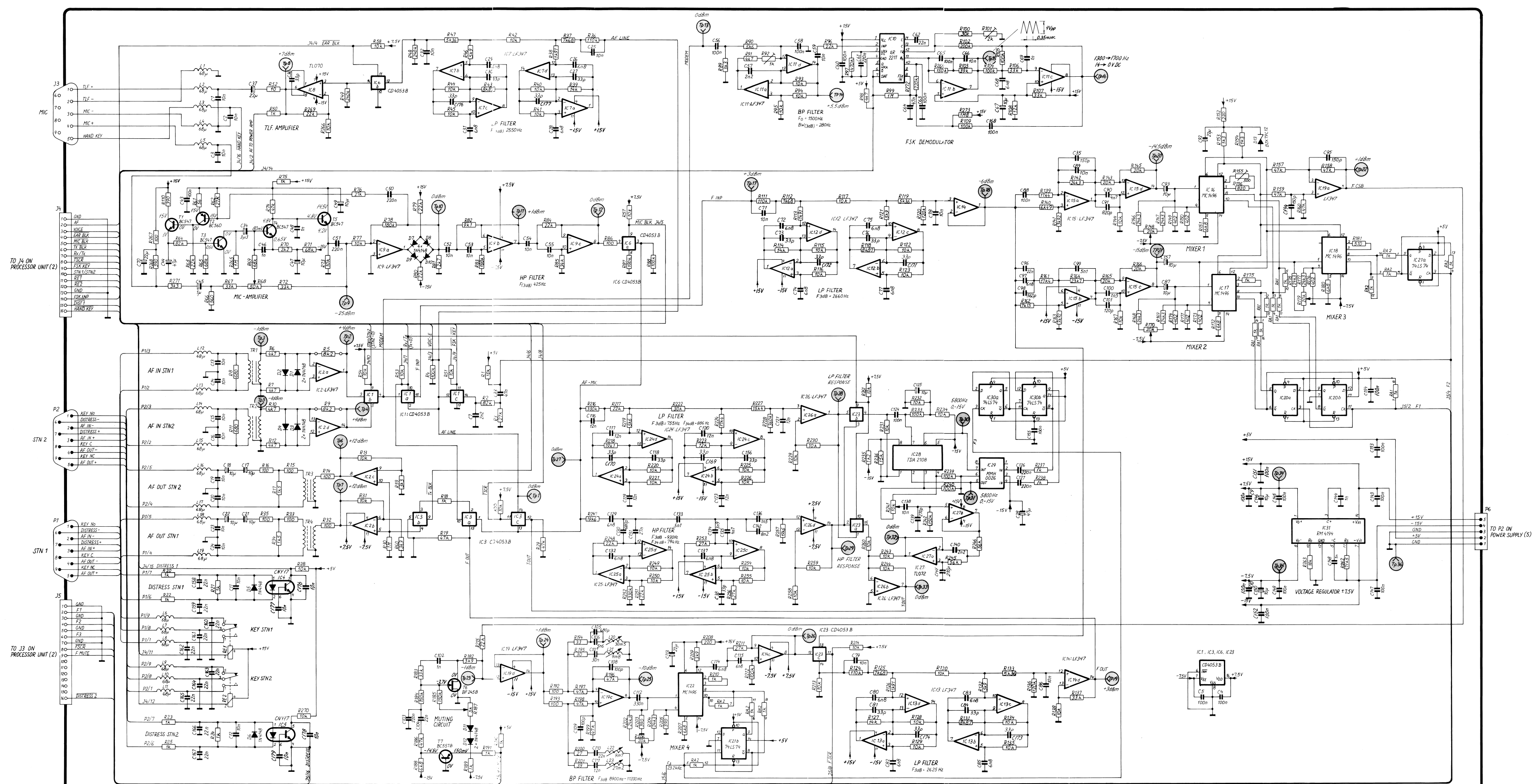
The loop filter is performed by IC11b,c. IC11b is a first order function and IC11c is a second order lowpass filter. The output is fed to the VCO by R102. The center frequency adjustment is made by R101. The demodulated signal appears in TP16 and is fed to the internal comparator by C168 and R109. R99, R172, R273 ensure hysteresis and bias for the comparator. The AC-coupling to the comparator eliminates a frequency offset from an SSB radio connection.

The transmitting FSK signalling is performed in the frequency generator in the processor unit and is the F2 line coupled via the switch IC1c to the F-scrambler lowpass filter. This removes the harmonic contents in the square wave from F2.

On Board Power Supply

The analog CMOS switches and the mixers need a $\pm 7.5\text{V}$ supply voltage. IC31 is a dual tracking, current limited, voltage regulator, adjusted to $\pm 7.5\text{V}$ by R263.

CRY2001/2
4-0-23833C



F and T UNIT (module 1)

5-0-23833

7.2. PROCESSOR UNIT (MODULE 2)

This unit contains the following parts:

- microprocessor
- watch dog
- C-MOS RAM
- programme memory
- service PROM
- timer input/output
- frequency generator
- speech processor
- audio power amplifier-volume control
- power on/off

MICROPROCESSOR

All functions in the scrambler are controlled by an 8 bit microprocessor 8085AH-2, IC1. It is a high speed unit and is working on a 7,1456 MHz x-tal. The frequency is chosen so that all the frequency generation and timing are matched. 8085 has multiplexed data and addresses at the lowest 8 bit. An 8 bit address latch IC3 keeps A0-07 controlled by the ALE. IC4 performs a decoding logic for the hardware address arrangement.

WATCH DOG

The watch dog has different function. It watches that the microprocessor programme is running correctly. It watches the +5V supply. If something is wrong, the processor is reset each 60 mS.

A low threshold voltage sensor is adjusted so that the open collector output in IC12c is off (1) at a supply voltage about 4.5V. Set by R31. Below 4.5V Pin 14 is low and IC12a pin 2 goes low. The CPU is reset. At the same time a lithium battery back-up for the C-MOS RAM is switched in by T3, T4 and T5. This ensures that the data information in the RAM is stored.

Serial data for the keyboard, SOD terminal on the CPU is used to stimulate the watch dog. Each 10 mS is a block of data transmitted to the keyboard. Those pulses bring IC12 pin 13 output into high condition. The positive feedback by R29 increases the voltage at pin 11 and C3 is charged by R36.

When the level at pin 11 is reached, pin 13 goes low and C3 starts to discharge by R36. The positive pulses on the keyboard clock ensure that the voltage on C3 will never drop below the threshold on pin 4, IC12a set by R37 and R38. If the programme is not working correctly and the SOD signal comes less frequently, C3 will discharge and IC12d starts to oscillate, which gives an output reset from IC12a every 60 mS. If the programme stops with IC16 pin 4 in a high condition, IC12d pin 13 is high and C3 is charged by R36, R28, R26 until the threshold voltage at pin 7 IC12b is reached. Pin 1 goes low and oscillation will occur around IC12b.

When the voltage on C3 becomes lower than pin 4, a low RESET IN signal is generated.

C-MOS RAM

IC8 is a 2 kbyte (2000 words) C-MOS RAM. It is used for all temporary data. Further it stores all the contents in the used registers. When the power is off, a 3V lithium battery takes over the supply for this circuit. The battery lifetime is about 5 years.

PROGRAMME MEMORY

All the programmes for communication, key and code generations, front panel processing are contained in a 128 kbyte UV PROM IC6.

7.2. PROCESSOR UNIT (MODULE 2) cont.:

SERVICE PROM

The service PROM, IC10 is a 256 bit fuseable PROM, which contains data to give the scrambler its identity.

The service PROM must be programmed by the sales agent so that it fits the radio station to which the scrambler is to be connected (see section 2.4.)

Addresses		Description
05-0E	Hex	The call sign of the radio station for use by the voice generator. The call sign is entered in ASCII format, 9 characters. A sales agent call sign must be terminated by 00 Hex character.
0F	Hex	Contains the pre-key time in mS x 10 for Stn1.
10	Hex	Contains the pre-key time in mS x 10 for Stn2. Pre-key time is the time from the transmitter is keyed until 100% modulated signal is obtained. Example: the value 12 gives a 120 mS pre-key. The max. value is 240, i.e. a prekey of 2.4 seconds.

TIMER INPUT/OUTPUT

IC2, 8155H is a powerful support circuit for the MPU 8085. It contains a 256 word RAM, 2 programmable 8 bit input/output ports, 1 programmable 6 bit I/O port and a 14 bit binary counter/timer. The timer is used to generate a 1.25 mS interrupt control signal to the CPU for the real time programme operation. The input-output ports drive the volume control and all the controls on the F and T board.

FREQUENCY GENERATOR

The F and T unit uses one fixed and two programmable frequencies for the scrambling process. The F1 output can be one of the twelve discrete frequencies from 35-45 kHz. F2 is from 12.4 to 17.2 kHz, and F3 on 23.2 kHz (see section 5.5. table 2). IC11, 8253-5 is organized as 3 independent 16 bit programmable counters, each with a count rate up to 5 MHz.

SPEECH PROCESSOR

The tele administrations from different countries recommend a clear voice ship's identification, when voice scrambling is used. Built into the scrambler is a FORMANT VOICE SYNTHESIZER NEC7752, IC9.

The whole phonetic alphabet and the numbers from zero to ten are stored in a digitised way. A tape recording is first taken and digitised with 200 kbyte/sec. A phonetic analyzer reduces this to approx. 1.8 kbyte/sec. without seriously intelligibility reduction. IC7 is a 64 kbyte PROM with a total content of approx. 30 sec. speech. The vocabulary instructions are taken from the service PROM IC10. The voice output from IC9 is amplified in IC17. An audio switch, T10, disconnects this output from the AF line in the F and T unit, when it should not speak. The switch driver T9 is controlled by the BUSY line IC9.

7.2. PROCESSOR UNIT (MODULE 2) cont.:

AUDIO POWER AMPLIFIER-VOLUME CONTROL

The output power amplifier IC18 contains two sections. A DC controlled pre-amplifier and a 4W power amplifier. The volume control is digital controlled in four bits. IC14, 7406 open collector output drives a discrete digital to analog converter, performed by IC17, T7 and T8. T7 and D23 generate a reference voltage to pin 5 IC17. R64, R65, R66, R67 are binary weighed resistors and generate in connection with IC17, T8 a steeped changed output current flowing in R62.

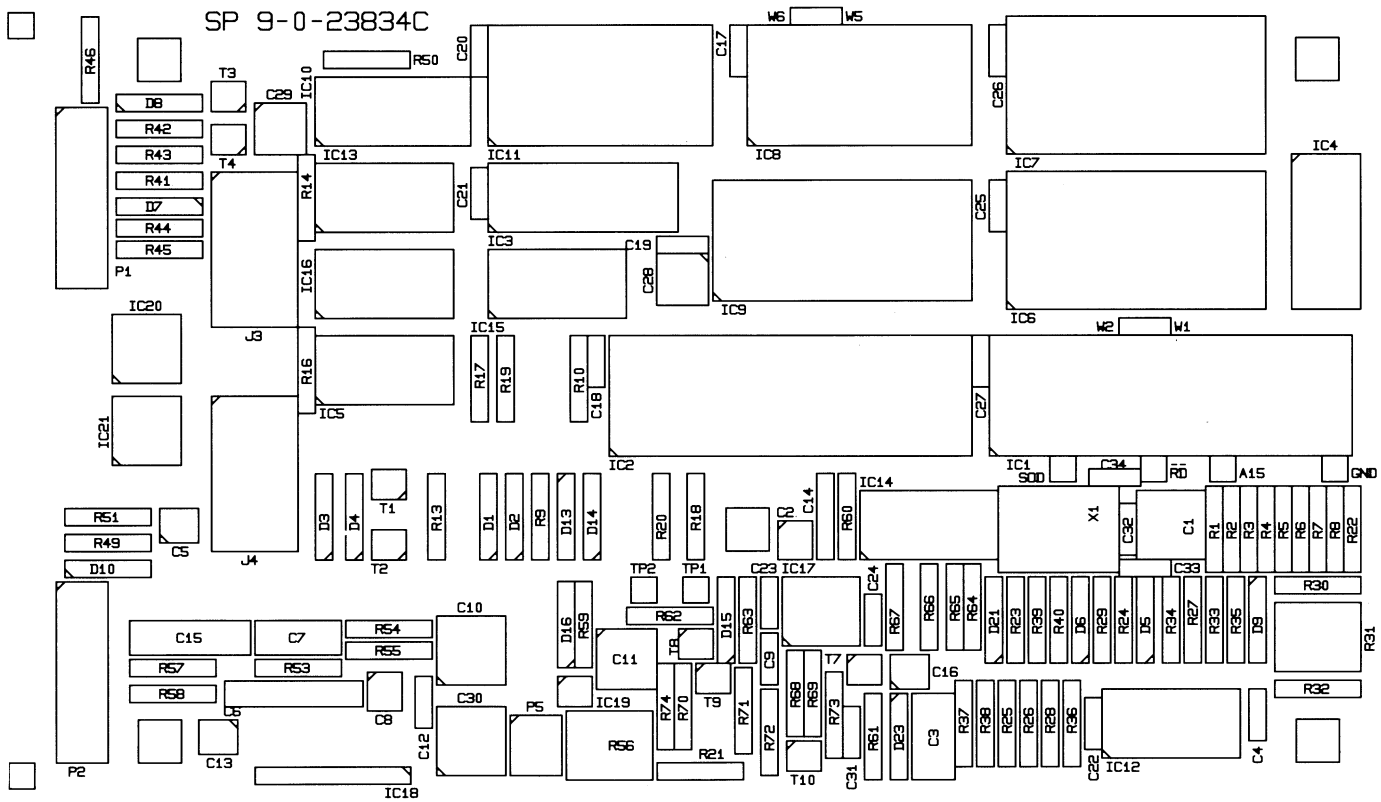
A temperature controlled voltage reference IC19 sets the minimum output level, when no current flows in R62. The voltage in TP2 is nom. 6.2V. The volume control has 15 steps with an increment scaled to approx. 4 dB which gives a total regulating range of approx. 60 dB.

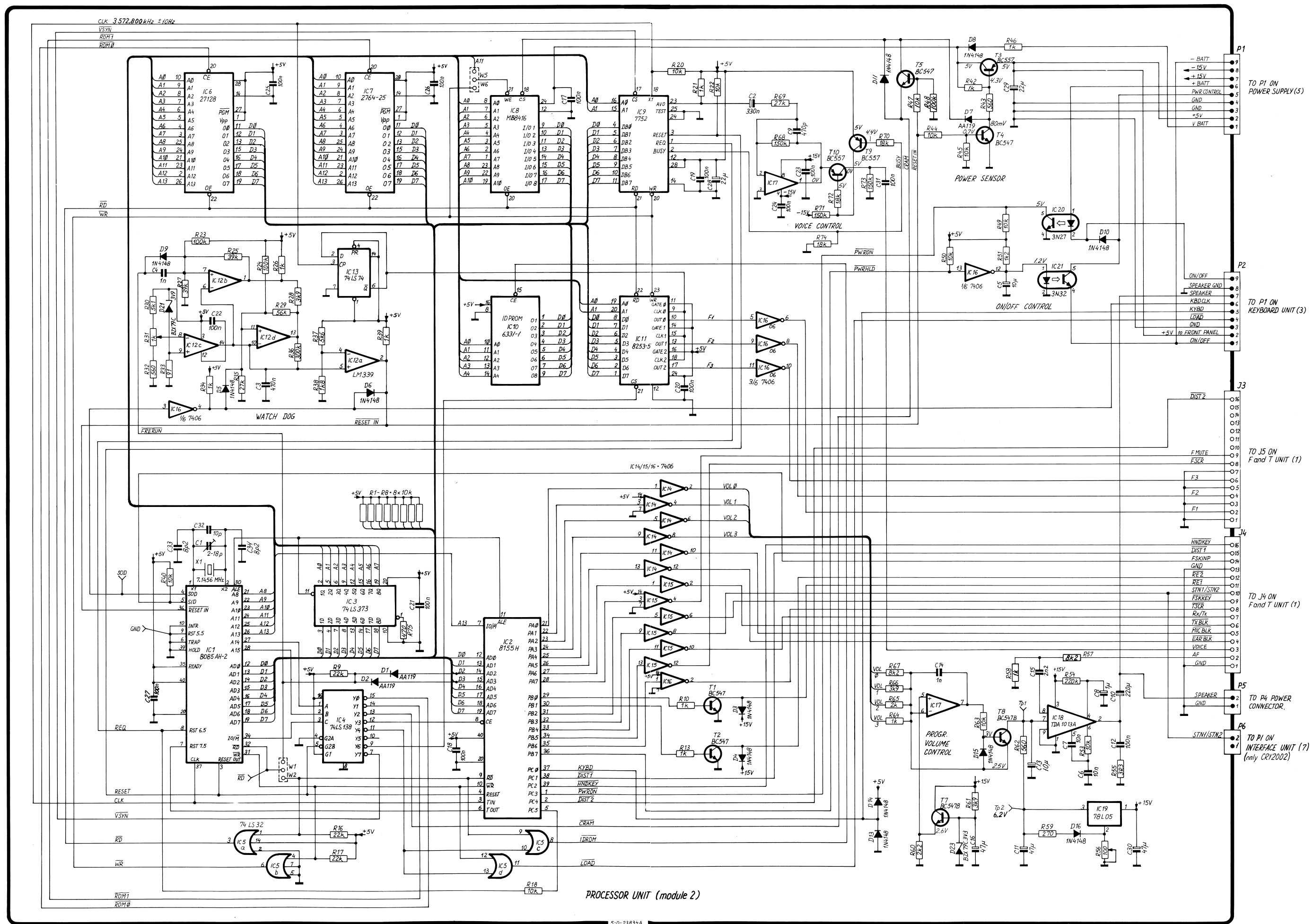
POWER ON-OFF

The scrambler on/off switch is controlled by the microprocessor. The on/off switch on the front panel or handset activates the switch mode power supply and sends a current to the optocoupler IC20. The MPU answers with a hold signal to IC21, which keeps the power supply on.

STRAPS:

W1 : Free running for uC
W2 : Normal operation
W5 : For RAM with other data
W6 : Normal operation





7.5. POWER SUPPLY UNIT (MODULE 5)

GENERAL DESCRIPTION

The power supply unit is constructed for supplying the SAILOR scrambler from a 12V DC or a 24V DC supply without change-over. In order to obtain high efficiency the power supply is a fly-back switch mode converter.

TECHNICAL DATA

<u>Input voltage:</u>	10 - 32V DC
<u>Power Consumption:</u>	
for CRY2001	approx. 15W
for CRY2002	approx. 18W
for CRY2002 and H2080	approx. 20W
<u>Output Voltage:</u>	+5V
	+15V
	-15V
back-up battery	3.0 - 3.5V
<u>Switch Frequency:</u>	approx. 45 kHz
<u>Operating Temperature Range:</u>	-15°C to +55°C

CIRCUIT DESCRIPTION

The power regulation is functioning after the Pulse Width Modulation principle. The switch transistor T9 is controlled by IC1, which produces a square wave signal.

The "ON-time" (duty-cycle) mainly depends upon the input voltage.

The windings of the transformer TR2 are connected in such a way that the output diodes are reverse biased when the transistor T9 is conducting. Because of this a current is established in the primary windings, which increases linearly in relation to time, and energy is stored in the primary inductance. When T9 is "ON", the load current is supplied from the output capacitors.

The switch-off of the transistor T9 produces polarity inversion of the voltage across the secondary windings. The output diodes conduct and the energy stored in the transformer TR2 is fed to the output capacitors and through the filters to the load.

The switch transistor T9 is a power mosfet and for protecting it against electrostatic discharge and transient overvoltage a zener diode D5 is placed across the transistor T9.

The resistors R18 and R23 and the capacitors C12 and C13 form two RC-snuffers, which reduce the overvoltage transients and unwanted oscillations on the primary and secondary windings.

Transistor T4 is producing a regulated voltage for the drivers T6 and T7 and for the current limiting circuit.

If regulation fails and the output voltage rises above approx. 5.7V a crowbar consisting of D9 and T12 pulls down the output voltage. This and a short-circuit at the outputs cause a high current through transistor T9 and sense resistor R21. The sense voltage across R21 is amplified in the

7.5. POWER SUPPLY UNIT (MODULE 5) cont.:

transistors T10 and T11 and turn on the transistors T8 and T1. IC1 pin 4 is pulled up to the regulated voltage from T4 and the pulse width modulator IC1 will be stopped. Capacitor C9 will be charged and turn on transistor T5, which keeps on the transistor T1. When C9 is charged the transistors T1 and T5 turn off and C9 will be discharged through the resistors R6 and R5. The voltage at IC1 pin 4 decays and provides a softstart facility. When the power supply is turned on the capacitor C6 also provides a softstart.

When the 5V output has been pulled down below 4.5V a "watchdog" in the processor unit, module 2, detects the voltage drop and the microprocessor then turns off the power supply.

The converter output voltage is controlled by the error amplifier IC2. Reference voltage is taken from diode D10, and the output voltage is adjusted by means of resistor R39. The feed-back regulation signal is via OC1 led back to IC1 pin 1 in order to regulate the duty-cycle.

When the on/off button on the front panel is pressed the base of T2 will go low through the PWR control line and turn on T2, T3 and IC1. The converter will start and supply the microprocessor which will control the on/off control circuit on the processor unit, module 2.

This starting-up procedure is the reason why it is necessary to keep the on/off button pressed for a short moment.

If the on/off button is pressed, when the set is switched on, the microprocessor will control through the on/off control circuit, (processor unit, module 2), that T1, T2 and IC1 are turned off and switch off the set when the on/off button is released.

The lithium back-up battery, B1 supplies the memory on the processor unit, when the power supply is switched off.

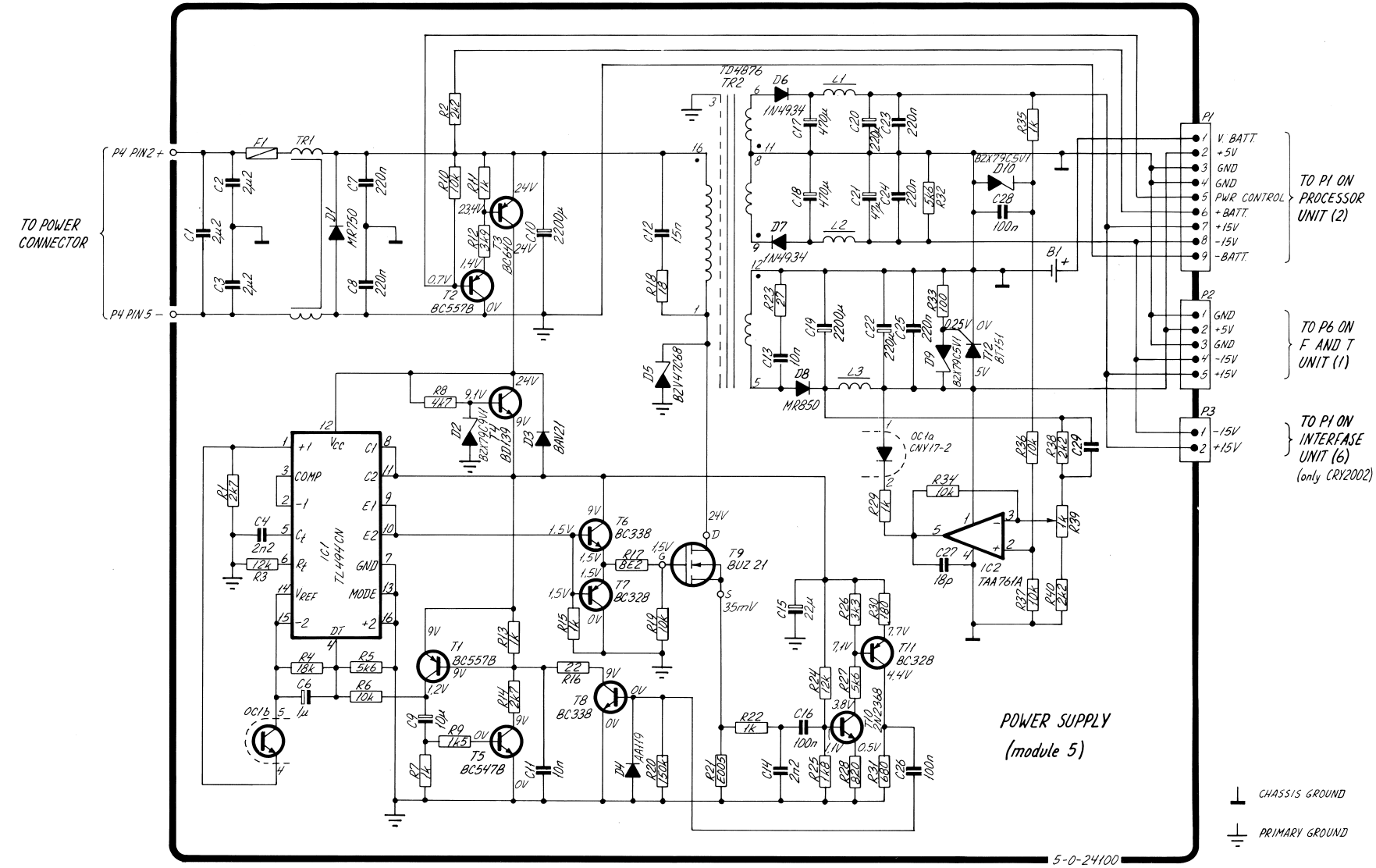
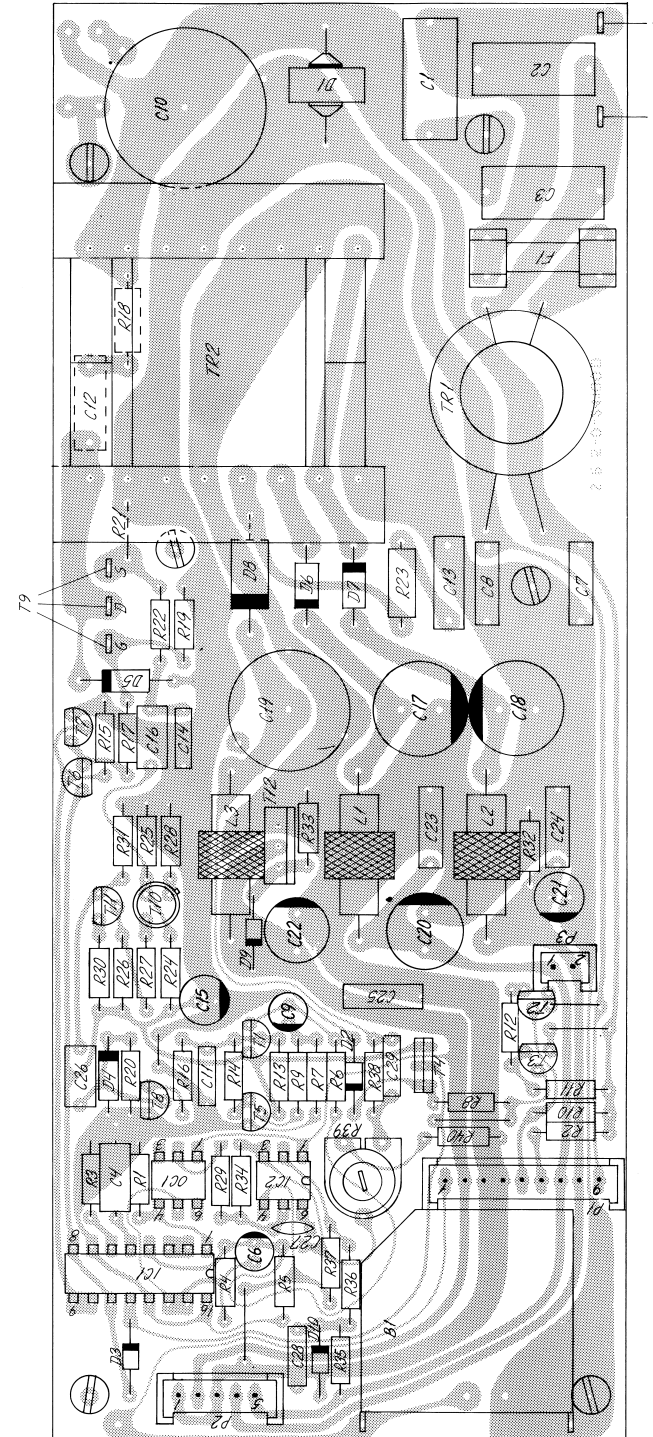
The lifetime of the battery is approx. 5 years.

The diode D1 is a protection for reverse polarity.

The function of the capacitors and TR1 placed at the input of the power supply is to suppress the switching noise so that the power supply fulfils the CISPR noise regulation.

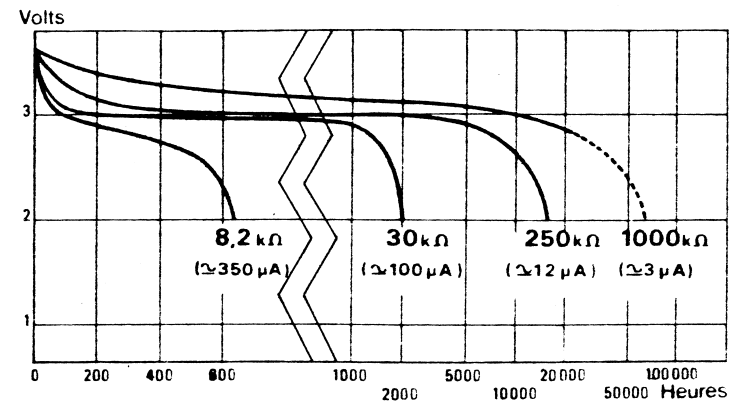
Remember by control measuring on the power supply that the circuits are galvanic separated in a primary ground (BATT.) and chassis ground.

CRY2001B
4-0-24100C

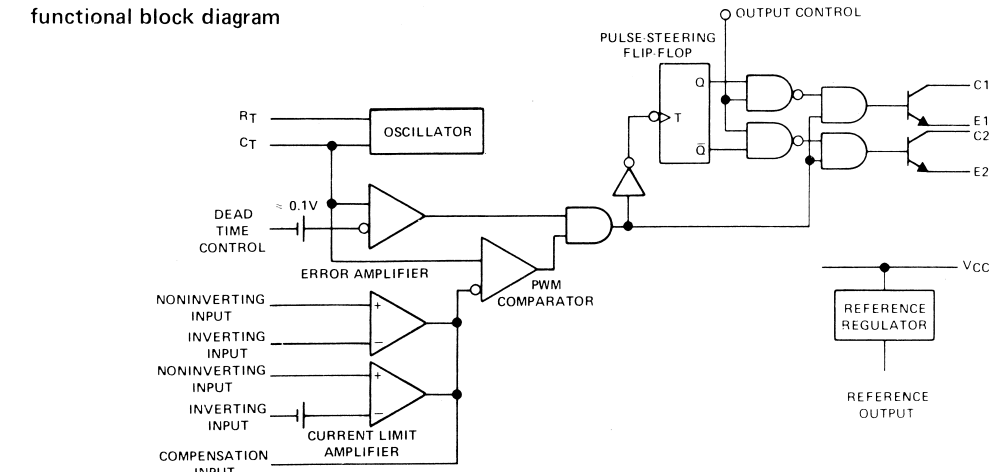
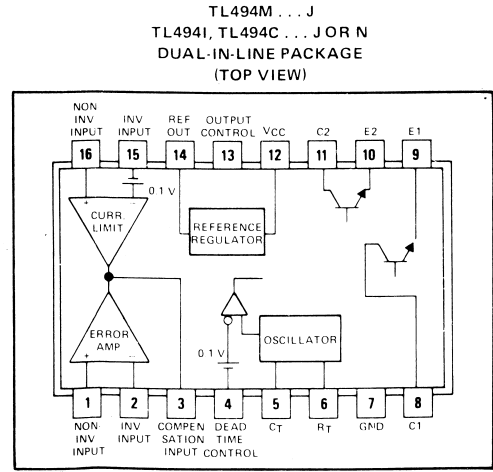


PULSE-WIDTH-MODULATION CONTROL CIRCUIT

TL494C



Discharge curves
for
Back up battery, B1.



7.6. INTERFACE UNIT (MODULE 7)

This unit contains the following parts:

- line drivers/receiver for data
- on board power supply

LINE DRIVERS/RECEIVER FOR DATA

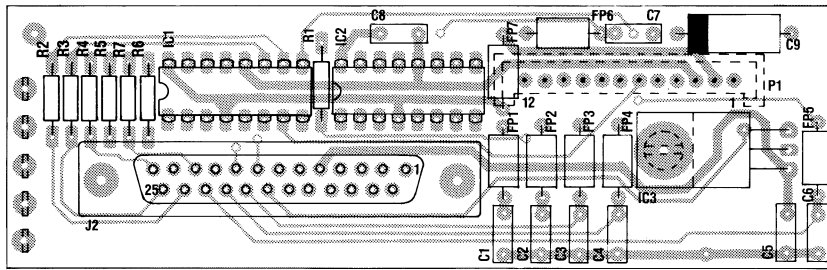
In order that CRY2002 and handset may communicate over long distances and during HF radiation it is necessary to transfer data by means of line drivers/receiver.

As keyboard scan, driver IC1b-c is used for transmission of LOAD and KEYBOARD CLOCK. The input from keyboard scan takes place via KYBD/SND, which is connected to receiver IC2.

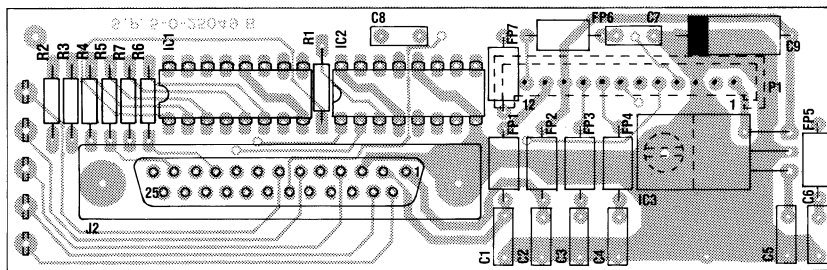
For input of data for the display driver in the handset, 3 pcs. line drivers IC1a-b-c are used for KYBD/SND - KYBD CLK - LOAD respectively.

ON BOARD POWER SUPPLY

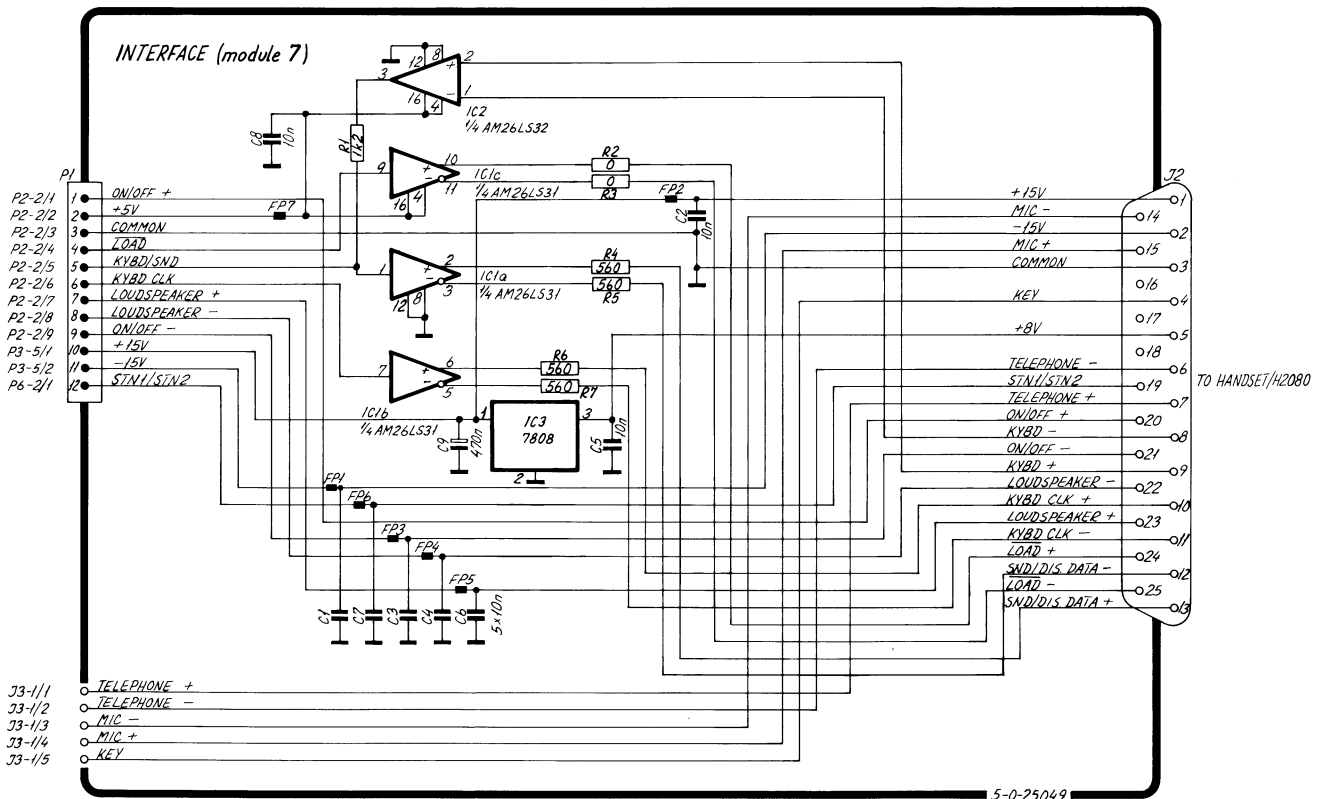
IC2 7809 is a +8V voltage regulator, which supplies 8V for the handset and connection box H2080.



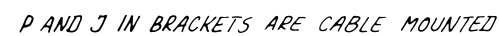
View from component side with upper side tracks.



View from component side with lower side tracks.



CRY2002
4-0-25403



INTERCONNECTION CABLE DIAGRAM
FOR CRY2002

8.0. CIRCUIT DESCRIPTION HANDSET

GENERAL

CRY2002 handset is an extension of CRY2001 front panel. The handset is connected to the back plate of CRY2002 or SAILOR Connector Box H2080 if this is being used in the installation.

The cable between CRY2002/H2080 and the handset will normally have a length of 6 metres but may be extended up to 10 metres. Lengths of 4, 8 and 10 metres can be ordered (see parts list).

The handset contains earpiece, mic. with pre-amplifier, keyboard, display, buzzer, handkey and hook switch. All data information to and from the handset is sent in serial mode by means of 4 lines (3 in, 1 out). By means of 5 straps it is possible to change the condition of the scrambler.

8.1. MAIN BOARD (MODULE 1)

This unit contains the following parts:

- data line interface
- keyboard scan
- display/buzzer
- mic. amplifier
- hook switch
- handkey
- on board power supply

DATA LINE INTERFACE

IC1 (AM26LS31) and IC2 (AM26LS32) are balanced data line transmitter and data line receiver respectively. They are transmit and receive data from INTERFACE UNIT (MODULE 6), which are used for the keyboard scan and display driver.

KEYBOARD SCAN

The keyboard is organized as a 4 x 4 Matrix. Every 10 mS a serial code is sensed into IC7, an 8 bit serial to parallel shift register. IC6, parallel to serial shift register, tracks whether some of the keys have been depressed and status of the 5 straps W1 - W5. The output from IC6 to the microprocessor unit (module 2) takes place via KYBD DATA.

In order to eliminate rebound all keys are tested 5 times for every 10 mS.

DISPLAY

The display consists of 2 pcs. 7 segment LED (low current type) IC8 and IC9. Furthermore 4 pcs. LED (D1 - D4) have been used for indication of SEND, RECEIVE, STN1 and STN2.

In order to indicate a call acoustically, an acoustic alarm (AA1) has been used.

IC3 (SAA1060) is a 16 bit LED driver for serial input, which is up-dated every 100 mS).

The display data appear on the line DIS.DATA.

IC4 (NE555) converts the LOAD pulse to a pulse of approx. 50% duty-cycle, which is necessary in order to secure the correct clock for the display driver.

IC5 (4011) detectors "P" and "C" from the the display driver so that acoustic alarm will appear.

Q4 (IC3 pin 4) controls the DIM function.

By means of T1 and T5 the light intensity in the display will be reduced when keyboard light is switched on.

T2 is the driver for the keyboard light.

MIC. AMPLIFIER

The microphone pre-amplifier is a separate circuit which is being supplied with 5.5V from Mic+ (P1-5). The power consumption is approx. 20 mA.

The amplifier consists of 3 pcs. common emitter cable NPN transistors with a total amplification of approx. 27 dB. With a sound pressure of 94 dB at a distance of 20 cm from the microphone, there will be approx. 150 mV at 1 kHz in P1-5.

8.1. MAIN BOARD (MODULE 1) cont.:

HOOK SWITCH

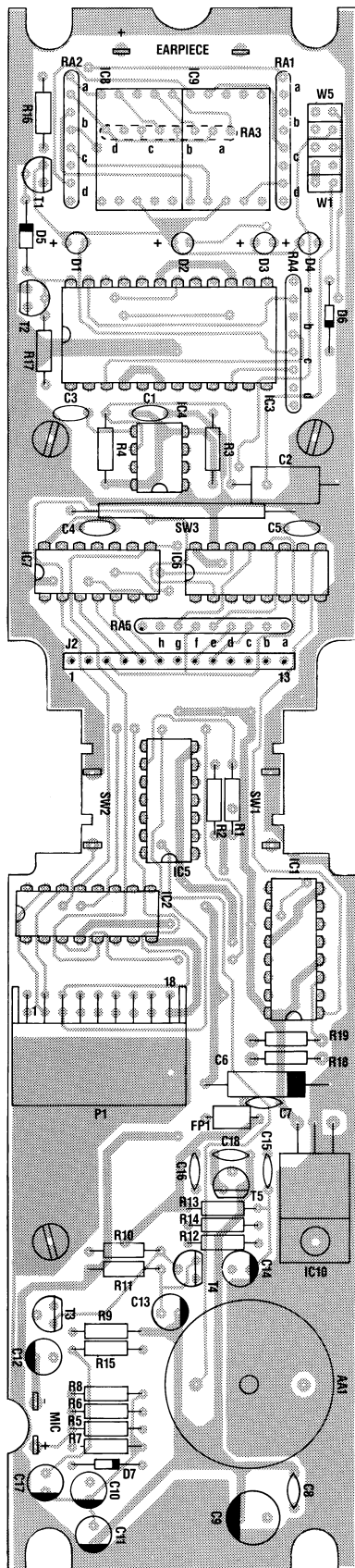
The hook switch SW3 is a reed tube, which is being activated when the handset is placed in the hook. The information is only used when SAILOR Connection Box H2080 has been connected between the handset and CRY2002.

HANDKEY

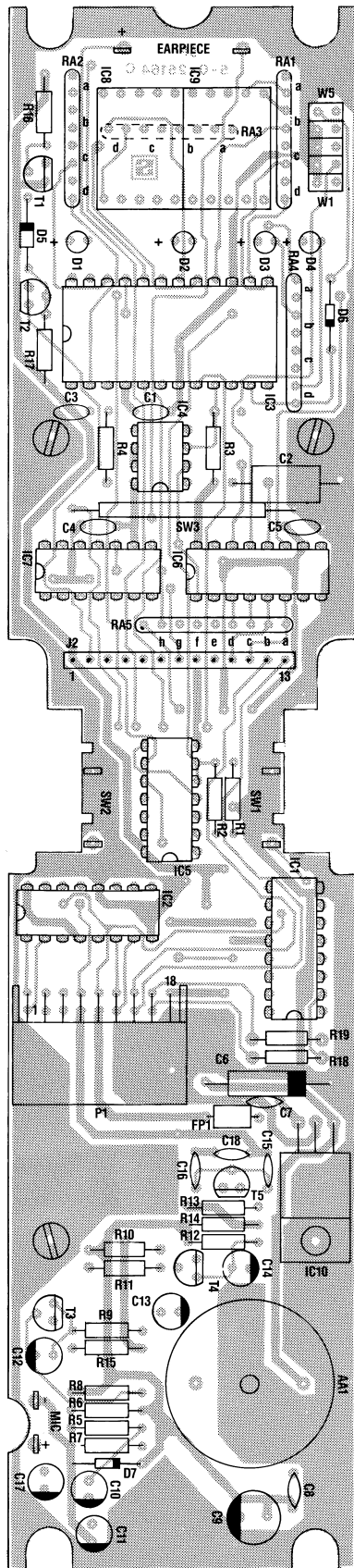
SW1 and SW2 are double parallel operating handkeys, which can be activated from the right or left side of the handset.

ON BOARD POWER SUPPLY

IC10 (7805) is a +5V regulator for the supply of IC1, IC2, IC3, IC4, IC6 and IC7. The remaining circuits will be supplied with +8V.

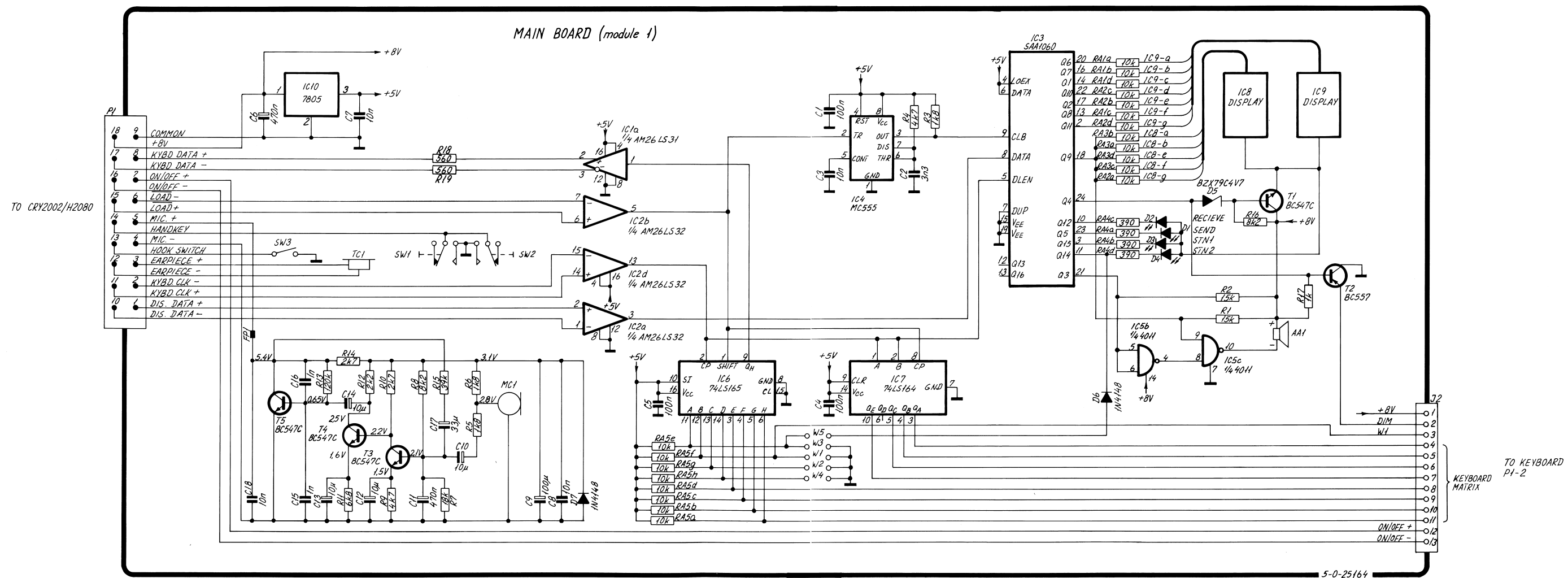


View from component side
with upper side tracks.



View from component side
with lower side tracks.

COMPONENT LOCATION FOR MAIN BOARD (MODULE 1)

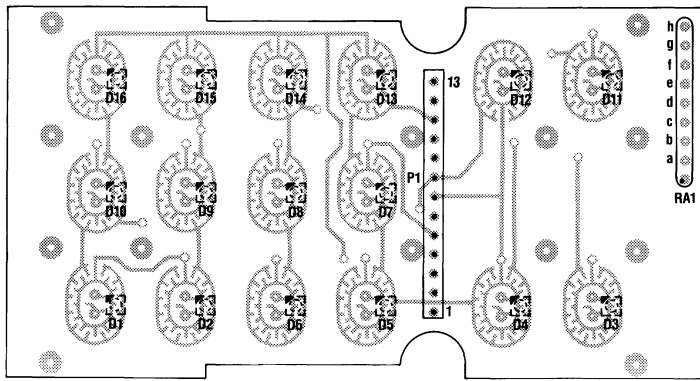


SW3 is shown with handset out of hook.

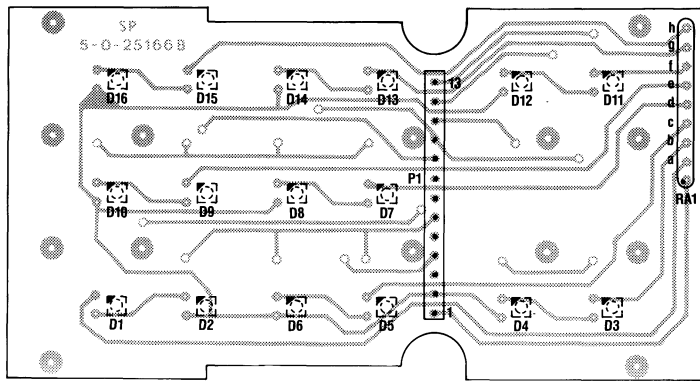
8.2. KEYBOARD (MODULE 2)

The keyboard unit consists of a circuit designed 4 x 4 Matrix where the 15 keys have been used as well as a separate key for on/off. For each key a LED has been used for illumination of the keyboard. The light intensity is determined by the resistor array RA1 (560 ohm).

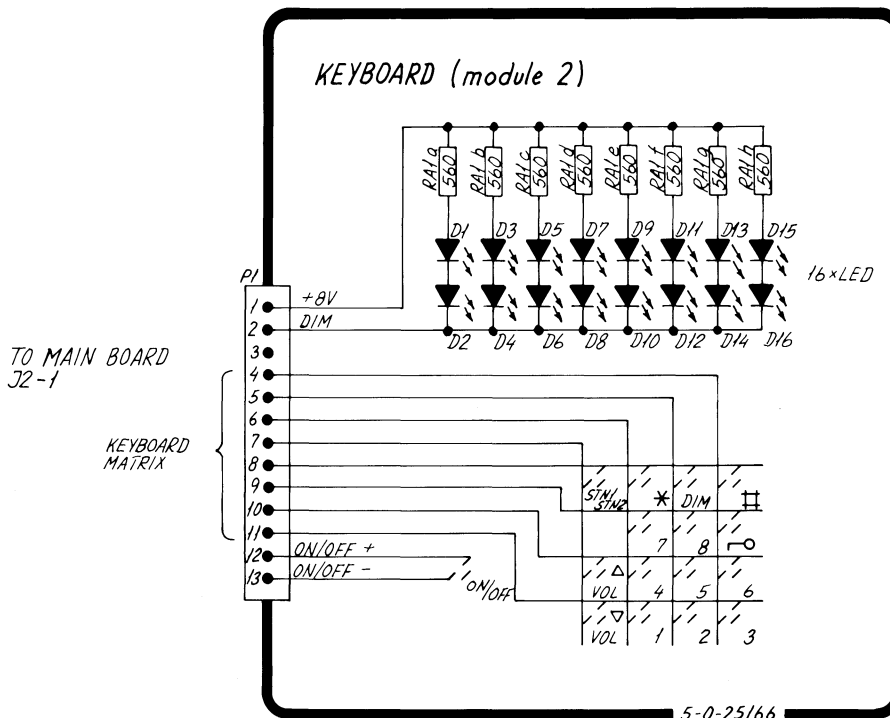
When repairing or replacing the keyboard unit be careful to avoid touching the carbon brushes in the PCB as well as the Silicone contact system, as this will increase the contact resistance. The contact resistance will typical be 50 - 100 ohm when the unit is new, however the system is able to operate with a contact resistance up to 800 ohm.



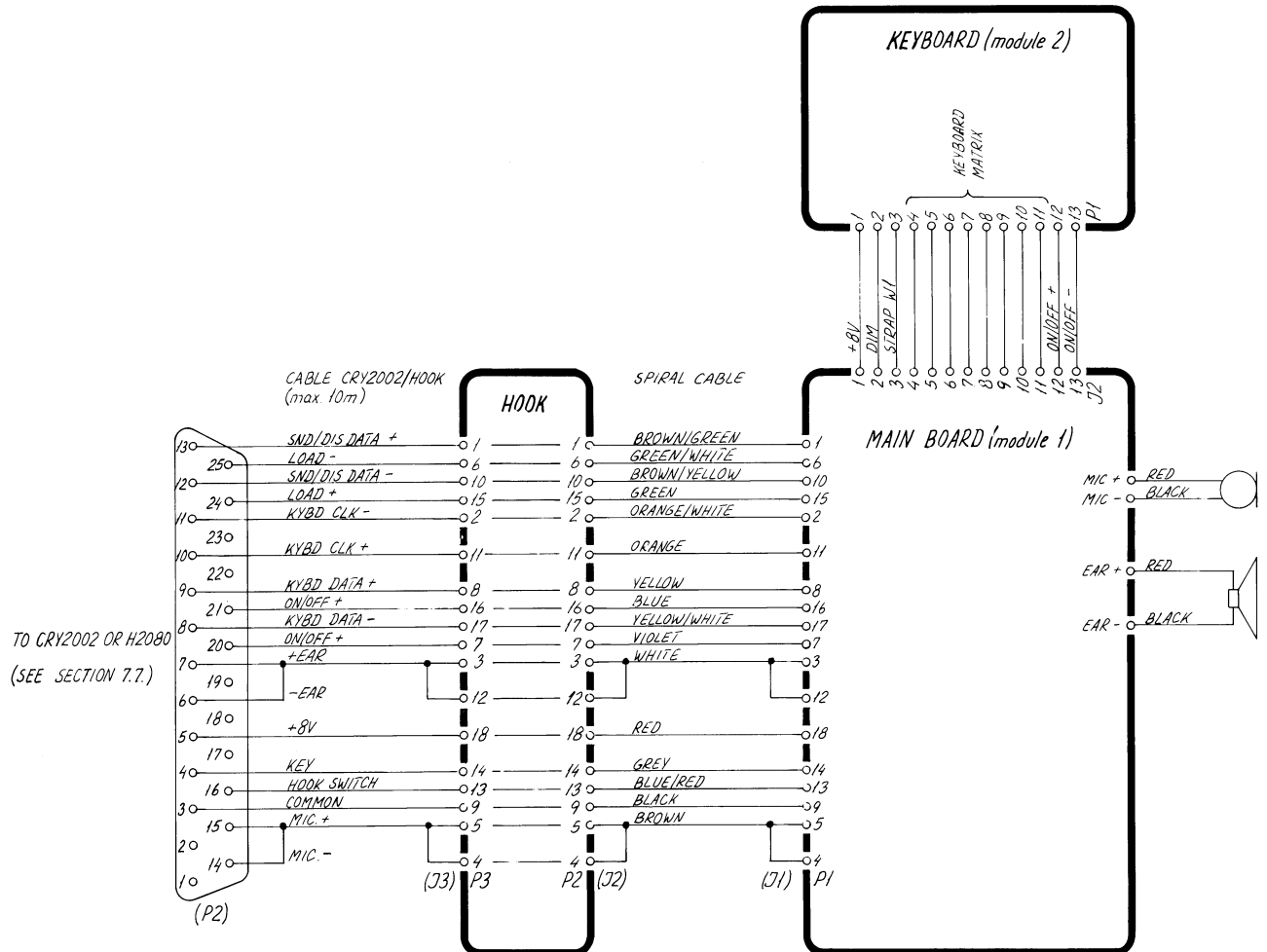
View with upper side tracks.



View with lower side tracks.



8.3. CABLE CONNECTION HANDSET



POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMB
	MAIN CHASSIS CRY2002	MODULE 6	ESPERA	REMOTE CRYPTO
				802002
CABLE 1	CABLE 1&2 CRY2001	ESPERA	500209 CABLE 1 CRY2001	500209
CABLE 2	CABLE 1&2 CRY2001	ESPERA	500209 CABLE 1 CRY2001	500209
CABLE 3	CABLE 3 CRY2001	ESPERA	500211 CABLE 3 CRY2001	500211
CABLE 4	CABLE 4&5 CRY2001	ESPERA	500210 CABLE 4&5 CRY2001	500210
CABLE 6	CABLE 6 CRY2001	ESPERA	500257 CABLE 6 CRY2001	500257
CABLE 8		AFD.32	3-0-25257	500911
-1	F & T UNIT	MODULE 1	ESPERA	PRINT NR 5-0-23833A
-2	PROCESSOR UNIT	MODULE 2	ESPERA	PRINT NR.5-0-23834D
-5	POWER SUPPLY	MODULE 5	ESPERA	PRINT NR. 5-0-24100D
-7			ESPERA	PRINT NR 5-0-25049A
HANDSET	HANDSET FOR CRY2002		ESPERA	HANDSET FOR CRY2002
C1-6	CAPACITOR MKT	0.68uF 10% 100V	SIEMENS	B32510-D1684-K
C2-6	CAPACITOR MKT	0.68uF 10% 100V	SIEMENS	B32510-D1684-K
J6-1	RECEPTACLE (FEMALE)	5 POLE	AMP	0-826371-5
J1-2	RECEPTACLE (FEMALE)	9 POLE	AMP	0-826371-9
J5-2	RECEPTACLE (FEMALE)	2 POLE	AMP	0-826371-2
J3-3	RECEPTACLE (FEMALE)	2 POLE	AMP	0-826371-2
J1-5	RECEPTACLE (FEMALE)	9 POLE	AMP	0-826371-9
J2-5	RECEPTACLE (FEMALE)	5 POLE	AMP	0-826371-5
J1-6	PLUG (FEMALE)	D-CONNECTOR 9 POLE	SOURIAU	DE9S-K91
J2-6	PLUG (FEMALE)	D-CONNECTOR 9 POLE	SOURIAU	DE9S-K91
J4-6	SUPPLY JACK (FEMALE)	MEK 60 BZ	HIRSCHMANN	973025-100
P4-1	DIP SOCKET	16POLE	* AMP	641600-3
P5-1	DIP SOCKET	16POLE	* AMP	641600-3
P3-2	DIP SOCKET	16POLE	* AMP	641600-3
P4-2	DIP SOCKET	16POLE	* AMP	641600-3
P3-6	PLUG (MALE)	D-CONNECTOR 9 POLE	SOURIAU	DEU9P-F0
P4-6	SUPPLY PLUG (MALE)	MESEI 60F	HIRSCHMANN	973021-100
T9-5	TRANSISTOR	RFP 12N10	*RCA	6 pole Male for Chassis RFP 12N10

POSITION	DESCRIPTION	MANUFACTOR	TYPE	S.P.NUMB
	F & T UNIT	MODULE 1	ESPERA	PRINT NR 5-0-23833A
				600102
C1-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C2-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C3-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C4-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA
C5-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA
C7-1	CAPACITOR POLYSTYRENE	2.2nF 1% 63V	*PHILIPS	2222 428 82202
				2222 424 42202
C9-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA
C10-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA
C11-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C12-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C13-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C14-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C15-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C16-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z
C17-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F
C18-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F
C21-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F
C22-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F
C25-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003
				2222 424 41003
C26-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802
				2222 424 46802
C27-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J
C28-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802
				2222 424 46802
C29-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802
				2222 424 46802
C30-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J
C31-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802
				2222 424 46802
C32-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003
				2222 424 41003
C33-1	CAPACITOR MKT	47nF 10% 250V	*ERO	MKT1822
C34-1	CAPACITOR ELECTROLYTIC	3.3uF 20% 50V	ERO	EKI 00 AA 133 H
C35-1	CAPACITOR CERAMIC	150pF 5% NPO 50V	KCK	HE90SJCH151J
C36-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J
C37-1	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI 00 AA 222 E
C38-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J
C43-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA
C44-1	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI 00 BB 247 E

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
C45-1	CAPACITOR ELECTROLYTIC	1uF 20% 50V	* ERO	EKI 00 AA 110 H	14.506
C46-1	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJYD102M	15.160
C47-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C48-1	CAPACITOR CERAMIC	1nF 10% 500V	PHILIPS	2222 655 03102	16.148
C49-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C50-1	CAPACITOR MKT	220nF 10% 63V	*ERO	MKT1822	11.045
C51-1	CAPACITOR MKT	220nF 10% 63V	*ERO	MKT1822	11.045
C52-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C53-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C54-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C55-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C56-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C57-1	CAPACITOR POLYSTYRENE	2.2nF 1% 63V	*PHILIPS	2222 428 82202	10.209
				2222 424 42202	
C58-1	CAPACITOR POLYSTYRENE	100nF 1% 63V	PHILIPS	2222 444 41004	10.200
C59-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z	15.170
C60-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C61-1	CAPACITOR MKT	220nF 10% 63V	*ERO	MKT1822	11.045
C62-1	CAPACITOR POLYSTERENE		*PHILIPS	2222 428 82203	10.234
				2222 424 42203	
C63-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C64-1	CAPACITOR MKT	47nF 10% 250V	*ERO	MKT1822	11.101
C65-1	CAPACITOR POLYESTER	0.1uF 10% 100V	*ERO	MKT1822	11.073
C66-1	CAPACITOR MKT	10nF 10% 400V	* ERO	MKT1822-310/405	12.212
C67-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C68-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C69-1	CAPACITOR POLYSTYRENE	1nF 1% 250V	*PHILIPS	2222 430 81002	10.350
				2222 426 41002	
C70-1	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI 00 AA 222 E	14.514
C71-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C72-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C73-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C74-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C75-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C76-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
C77-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C78-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C79-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C80-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C81-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C82-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C83-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C84-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C85-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C86-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C87-1	CAPACITOR ELECTROLYTIC	10uF 25V	*RUBYCON	25TWL10M LOW LEAKAGE	14.661
C88-1	CAPACITOR POLYSTYRENE	100nF 1% 63V	PHILIPS	2222 444 41004	10.200
C89-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C90-1	CAPACITOR POLYSTERENE	4.7nF 1% 63V	*PHILIPS	2222 428 84702	10.217
				2222 424 44702	
C91-1	CAPACITOR POLYSTYRENE	820pF 1% 250V	*PHILIPS	2222 430 88201	10.348
				2222 426 48201	
C92-1	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI 00 AA 222 E	14.514
C93-1	CAPACITOR ELECTROLYTIC	10uF 25V	*RUBYCON	25TWL10M LOW LEAKAGE	14.661
C94-1	CAPACITOR POLYSTERENE	150pF 1% 630V	*PHILIPS	2222 431 81501	10.405
				2222 427 41501	
C95-1	CAPACITOR POLYSTERENE	150pF 1% 630V	*PHILIPS	2222 431 81501	10.405
				2222 427 41501	
C96-1	CAPACITOR POLYSTERENE		*PHILIPS	2222 428 82203	10.234
				2222 424 42203	
C97-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802	10.221
				2222 424 46802	
C98-1	CAPACITOR POLYSTERENE	560pF 1% 250V	*PHILIPS	2222 430 85601	10.344
				2222 426 45601	
C99-1	CAPACITOR POLYSTERENE	5.1nF 1% 63V	*PHILIPS	2222 428 85102	10.218
				2222 424 45102	
C100-1	CAPACITOR POLYSTYRENE	1.5nF 1% 160V	*PHILIPS	2222 429 81502	10.280
				2222 425 41502	
C101-1	CAPACITOR POLYSTERENE	120pF 1% 630V	*PHILIPS	2222 431 81201	10.403
				2222 427 41201	

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
C102-1	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJYD102M	15.160
C103-1	CAPACITOR MKT	220nF 10% 63V	*ERO	MKT1822	11.045
C104-1	CAPACITOR MKT	22nF 10% 400V	*ERO	MKT1822	11.130
C105-1	CAPACITOR POLYSTERENE	680pF 1% 250V	*PHILIPS	2222 430 86801 2222 426 46801	10.346
C106-1	CAPACITOR POLYSTYRENE	5.6nF 1% 63V	*PHILIPS	2222 428 85602 2222 424 45602	10.219
C107-1	CAPACITOR POLYSTERENE	30nF 1% 63V	*PHILIPS	2222 428 83003 2222 424 43003	10.237
C108-1	CAPACITOR POLYSTYRENE	100pF 1% 630V	*PHILIPS	2222 431 81001 2222 427 41001	10.400
C109-1	CAPACITOR POLYSTYRENE	100pF 1% 630V	*PHILIPS	2222 431 81001 2222 427 41001	10.400
C110-1	CAPACITOR POLYSTERENE		*PHILIPS	2222 428 82203 2222 424 42203	10.234
C111-1	CAPACITOR POLYSTERENE	12nF 1% 63V	*PHILIPS	2222 428 81203 2222 424 41203	10.228
C112-1	CAPACITOR POLYESTER	0.33uF 5% 63V	*ERO	MKT1822	11.121
C113-1	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI 00 AA 222 E	14.514
C114-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802 2222 424 46802	10.221
C115-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802 2222 424 46802	10.221
C116-1	CAPACITOR POLYSTERENE	12nF 1% 63V	*PHILIPS	2222 428 81203 2222 424 41203	10.228
C117-1	CAPACITOR POLYSTERENE	12nF 1% 63V	*PHILIPS	2222 428 81203 2222 424 41203	10.228
C118-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C119-1	CAPACITOR POLYSTERENE	12nF 1% 63V	*PHILIPS	2222 428 81203 2222 424 41203	10.228
C120-1	CAPACITOR POLYSTERENE	12nF 1% 63V	*PHILIPS	2222 428 81203 2222 424 41203	10.228
C121-1	CAPACITOR POLYSTERENE	12nF 1% 63V	*PHILIPS	2222 428 81203 2222 424 41203	10.228
C123-1	CAPACITOR POLYSTERENE	12nF 1% 63V	*PHILIPS	2222 428 81203 2222 424 41203	10.228
C124-1	CAPACITOR POLYESTER	0.1uF 10% 100V	*ERO	MKT1822	11.073
C125-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C126-1	CAPACITOR CERAMIC	220nF 20% 50V	AVX	SR30 5C 224 MAA	15.255
C127-1	CAPACITOR CERAMIC	220nF 20% 50V	AVX	SR30 5C 224 MAA	15.255
C128-1	CAPACITOR ELECTROLYTIC	47uF 20% 35V	* ERO	EKI 00 CC 247 F	14.525
C129-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 428 86802 2222 424 46802	10.221
C130-1	CAPACITOR POLYSTERENE	680pF 1% 250V	*PHILIPS	2222 430 86801	10.346

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
C131-1	CAPACITOR POLYSTERENE	47nF 1% 63V	*PHILIPS	2222 426 46801 2222 428 82703	10.236
C132-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 424 42703 2222 428 86802	10.221
C133-1	CAPACITOR POLYSTERENE	5.1nF 1% 63V	*PHILIPS	2222 424 46802 2222 428 85102	10.218
C134-1	CAPACITOR POLYSTYRENE	3.9nF 1% 63V	*PHILIPS	2222 424 45102 2222 428 83902	10.215
C135-1	CAPACITOR POLYSTERENE	4.7nF 1% 63V	*PHILIPS	2222 424 43902 2222 428 84702	10.217
C136-1	CAPACITOR POLYSTYRENE	1.5nF 1% 160V	*PHILIPS	2222 424 44702 2222 429 81502	10.280
C137-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	*PHILIPS	2222 425 41502 2222 428 86802	10.221
C138-1	CAPACITOR MKT	10nF 10% 400V	* ERO	2222 424 46802 MKT1822-310/405	12.212
C139-1	CAPACITOR POLYSTYRENE	270pF 1% 630V	*PHILIPS	2222 431 82701 2222 427 42701	10.411
C140-1	CAPACITOR POLYSTYRENE	2.2nF 1% 63V	*PHILIPS	2222 428 82202 2222 424 42202	10.209
C141-1	CAPACITOR POLYSTYRENE	270pF 1% 630V	*PHILIPS	2222 431 82701 2222 427 42701	10.411
C142-1	CAPACITOR POLYSTYRENE	8.2nF 1% 63V	*PHILIPS	2222 428 88202 2222 424 48202	10.224
C143-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C144-1	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJYD102M	15.160
C145-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C146-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C147-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C148-1	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJYD102M	15.160
C149-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C150-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C151-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C152-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C153-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C154-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C155-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C156-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C157-1	CAPACITOR ELECTROLYTIC	10uF 25V	*RUBYCON	25TUL10M LOW LEAKAGE	14.661
C158-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C159-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C160-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C161-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C162-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
C163-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C164-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C165-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C166-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C167-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C168-1	CAPACITOR POLYESTER	0.1uF 10% 63V	ERO	MKT1817	11.136
C169-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C170-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C171-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C172-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C173-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C174-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C175-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C176-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C177-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C178-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
C179-1	CAPACITOR POLYESTER	22nF 10% 100V	ERO	MKT 1817	11.175
D1-1	DIODE	1N4148	* ITT	1N4148	25.131
D2-1	DIODE	1N4148	* ITT	1N4148	25.131
D3-1	DIODE	1N4148	* ITT	1N4148	25.131
D4-1	DIODE	1N4148	* ITT	1N4148	25.131
D5-1	DIODE	1N4148	* ITT	1N4148	25.131
D6-1	DIODE	1N4148	* ITT	1N4148	25.131
D7-1	DIODE	1N4148	* ITT	1N4148	25.131
D8-1	DIODE	1N4148	* ITT	1N4148	25.131
D9-1	DIODE	1N4148	* ITT	1N4148	25.131
D10-1	DIODE	1N4148	* ITT	1N4148	25.131
D11-1	DIODE	1N4148	* ITT	1N4148	25.131
D12-1	DIODE	1N4148	* ITT	1N4148	25.131
D13-1	DIODE ZENER	12V 5% 0.4W BZX79C12	* MOTOROLA	BZX79C12	26.554
IC1-1	ANALOG MULTIPLEXER	MC14053BCP	*MOTOROLA	MC 14053 BCP	31.201
IC2-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC3-1	ANALOG MULTIPLEXER	MC14053BCP	*MOTOROLA	MC 14053 BCP	31.201
IC4-1	OPTO-COUPLER	CNY17-2	*SIEMENS	Q62703-N87	32.530
IC5-1	OPTO-COUPLER	CNY17-2	*SIEMENS	Q62703-N87	32.530
IC6-1	ANALOG MULTIPLEXER	MC14053BCP	*MOTOROLA	MC 14053 BCP	31.201
IC7-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC8-1	INTEGRATED CIRCUIT	TL070	TEXAS	TL070	31.708
IC9-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC10-1	INTEGRATED CIRCUIT	XR2211	EXAR	XR2211	31.496
IC11-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC12-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC13-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC14-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
IC15-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC16-1	INTEGRATED CIRCUIT	MC1496P	* MOTOROLA	MC1496P	31.221
IC17-1	INTEGRATED CIRCUIT	MC1496P	* MOTOROLA	MC1496P	31.221
IC18-1	INTEGRATED CIRCUIT	MC1496P	* MOTOROLA	MC1496P	31.221
IC19-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC20-1	INTEGRATED CIRCUIT	74LS74N	* TEXAS	74LS74N	33.727
IC21-1	INTEGRATED CIRCUIT	74LS74N	* TEXAS	74LS74N	33.727
IC22-1	INTEGRATED CIRCUIT	MC1496P	* MOTOROLA	MC1496P	31.221
IC23-1	ANALOG MULTIPLEXER	MC14053BCP	*MOTOROLA	MC 14053 BCP	31.201
IC24-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC25-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC26-1	INTEGRATED CIRCUIT	LF347N	*NATIOPNAL	LF347N	31.530
IC27-1	INTEGRATED CIRCUIT	TL072CP	TEXAS	TL072CP	31.710
IC28-1	INTEGRATED CIRCUIT	TDA2108	*MATUSHITA	TDA2108	31.485
IC29-1	INTEGRATED CIRCUIT	MMH026CP1	* MOTOROLA	MMH026CP1	33.499
IC30-1	INTEGRATED CIRCUIT	74LS74N	* TEXAS	74LS74N	33.727
IC31-1	VOLTAGE REGULATOR	RC4194DB	* RAYTHEON	RC4194DB	31.570
J3-1	PLUG (FEMALE)	9 POLE D-CONNECTOR f.PCB	AMP	0-164800-1	78.146
J4-1	DIP SOCKET	16POLE	* AMP	641600-3	78.078
J5-1	DIP SOCKET	16POLE	* AMP	641600-3	78.078
L1-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L2-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L3-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L4-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L5-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L6-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L7-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L8-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L9-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L10-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L11-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L12-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L13-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L14-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L15-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L16-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L17-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L18-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L19-1	CHOKE	68uH 10%	* AIRCO	1326-5K	20.164
L20-1	COIL	TL403	S.P.RADIO	6-0-24109	400403
L21-1	COIL	TL404	S.P.RADIO	6-0-24110	400404
L22-1	COIL	TL404	S.P.RADIO	6-0-24110	400404
L23-1	COIL	TL405	S.P.RADIO	6-0-24111	400405
P1-1	PLUG (MALE)	9 POLE D-CONNECTOR f.PCB	AMP	0-164492-1	78.145

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
P2-1	PLUG (MALE)	9 POLE D-CONNECTOR f.PCB	AMP	0-164492-1	78.145
P6-1	PLUG (MALE)	5 POLE	AMP	0-826375-5	78.105
R1-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R2-1	RESISTOR	82 KOHM 5% 0.33W	PHILIPS	2322 181 53823	01.247
R3-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 53273	01.235
R4-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R5-1	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 53822	01.222
R6-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R7-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R8-1	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 53681	01.195
R9-1	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 53822	01.222
R10-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R11-1	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 53681	01.195
R12-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R13-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R14-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R15-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R16-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R17-1	RESISTOR	1.5 KOHM 5% 0.33W	PHILIPS	2322 181 53152	01.204
R18-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R19-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 53473	01.241
R20-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R21-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R22-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R23-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R24-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R25-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R28-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R29-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 53473	01.241
R30-1	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 53105	01.275
R31-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R32-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R33-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R34-1	RESISTOR	1.5 KOHM 5% 0.33W	PHILIPS	2322 181 53152	01.204
R35-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R36-1	RESISTOR	110 KOHM 5% 0.33W	PHILIPS	2322 181 53114	01.251
R37-1	RESISTOR	7.68 KOHM 1% 0.4W	PHILIPS	2322 151 57682	03.421
R38-1	RESISTOR	1.91 KOHM 1% 0.4W	PHILIPS	2322 151 51912	03.408
R39-1	RESISTOR	14 KOHM 1% 0.4W	PHILIPS	2322 151 51403	03.432
R40-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R41-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R42-1	RESISTOR	10 KOHM 1% 0.4W	PHILIPS	2322 151 51003	03.427
R43-1	RESISTOR	8.87 KOHM 1% 0.4W	PHILIPS	2322 151 58872	03.420
R44-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R45-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R46-1	RESISTOR	5.9 KOHM 1% 0.4W	PHILIPS	2322 151 55902	03.410
R47-1	RESISTOR	5.36 KOHM 1% 0.4W	PHILIPS	2322 151 55362	03.418
R48-1	RESISTOR	240 KOHM 5% 0.33W	PHILIPS	2322 181 53244	01.259
R49-1	RESISTOR	240 KOHM 5% 0.33W	PHILIPS	2322 181 53244	01.259
R50-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R51-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R52-1	RESISTOR	10 OHM 5% 0.33W	PHILIPS	2322 181 53109	01.150
R53-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R54-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R55-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R56-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R57-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R58-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R59-1	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 53332	01.212
R60-1	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 53332	01.212
R61-1	RESISTOR	56 OHM 5% 0.33W	PHILIPS	2322 181 53569	01.168
R62-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 53273	01.235
R63-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R64-1	RESISTOR	82 KOHM 5% 0.33W	PHILIPS	2322 181 53823	01.247
R65-1	RESISTOR	68 KOHM 5% 0.33W	PHILIPS	2322 181 53683	01.245
R66-1	RESISTOR	560 OHM 5% 0.33W	PHILIPS	2322 181 53561	01.193
R67-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 53333	01.237
R68-1	POTENTIOMETER TRIMMING	47 KOHM 10% 0.5W	PHILIPS	2322 482 22473	07.678
R69-1	RESISTOR	68 KOHM 5% 0.33W	PHILIPS	2322 181 53683	01.245
R70-1	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222	01.208
R71-1	RESISTOR	68 KOHM 5% 0.33W	PHILIPS	2322 181 53683	01.245
R72-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 53333	01.237
R73-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R74-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 53473	01.241
R75-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R76-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 53273	01.235
R77-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R78-1	RESISTOR	180 KOHM 5% 0.33W	PHILIPS	2322 181 53184	01.256
R79-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R80-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R81-1	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 53272	01.210
R82-1	RESISTOR	9.1 KOHM 5% 0.33W	PHILIPS	2322 181 53912	01.224
R83-1	RESISTOR	180 KOHM 5% 0.33W	PHILIPS	2322 181 53184	01.256
R84-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R85-1	RESISTOR	34 KOHM 1% 0.4W	PHILIPS	2322 151 53403	03.437
R86-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R87-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R88-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R89-1	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 53332	01.212
R90-1	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 53562	01.218
R91-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R92-1	POTENTIOMETER TRIMMING	1 KOHM 10% 0.5W	* PHILIPS	2322 482 22102	07.660
R93-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R94-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R95-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R96-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R97-1	RESISTOR	470 KOHM 5% 0.33W	PHILIPS	2322 181 53474	01.266
R98-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R99-1	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 53105	01.275
R100-1	RESISTOR	30 KOHM 1% 0.4W	PHILIPS	2322 151 53003	03.460
R101-1	POTENTIOMETER TRIMMING	2.2 KOHM 10% 0.5W	PHILIPS	2322 482 22222	07.665
R102-1	RESISTOR	200 KOHM 5% 0.33W	PHILIPS	2322 181 53204	01.257
R103-1	RESISTOR	39 KOHM 5% 0.33W	PHILIPS	2322 181 53393	01.239
R104-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R105-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R106-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 53333	01.237
R107-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 53333	01.237
R108-1	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 53123	01.227
R109-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R110-1	RESISTOR	390 OHM 5% 0.33W	PHILIPS	2322 181 53391	01.189
R111-1	RESISTOR	110 KOHM 5% 0.33W	PHILIPS	2322 181 53114	01.251
R112-1	RESISTOR	7.68 KOHM 1% 0.4W	PHILIPS	2322 151 57682	03.421
R113-1	RESISTOR	1.91 KOHM 1% 0.4W	PHILIPS	2322 151 51912	03.408
R114-1	RESISTOR	14 KOHM 1% 0.4W	PHILIPS	2322 151 51403	03.432
R115-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R116-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R117-1	RESISTOR	10 KOHM 1% 0.4W	PHILIPS	2322 151 51003	03.427
R118-1	RESISTOR	8.87 KOHM 1% 0.4W	PHILIPS	2322 151 58872	03.420
R119-1	RESISTOR	5.36 KOHM 1% 0.4W	PHILIPS	2322 151 55362	03.418
R120-1	RESISTOR	120 KOHM 5% 0.33W	PHILIPS	2322 181 53124	01.252
R121-1	RESISTOR	5.9 KOHM 1% 0.4W	PHILIPS	2322 151 55902	03.410
R122-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R123-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R124-1	RESISTOR	110 KOHM 5% 0.33W	PHILIPS	2322 181 53114	01.251
R125-1	RESISTOR	7.68 KOHM 1% 0.4W	PHILIPS	2322 151 57682	03.421
R126-1	RESISTOR	1.91 KOHM 1% 0.4W	PHILIPS	2322 151 51912	03.408
R127-1	RESISTOR	14 KOHM 1% 0.4W	PHILIPS	2322 151 51403	03.432
R128-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R129-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R130-1	RESISTOR	10 KOHM 1% 0.4W	PHILIPS	2322 151 51003	03.427
R131-1	RESISTOR	8.87 KOHM 1% 0.4W	PHILIPS	2322 151 58872	03.420
R132-1	RESISTOR	5.9 KOHM 1% 0.4W	PHILIPS	2322 151 55902	03.410

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R133-1	RESISTOR	5.36 KOHM 1% 0.4W	PHILIPS	2322 151 55362	03.418
R134-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R135-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R136-1	RESISTOR	120 KOHM 5% 0.33W	PHILIPS	2322 181 53124	01.252
R137-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 53333	01.237
R138-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R139-1	RESISTOR	17.4 KOHM 1% 0.4W	PHILIPS	2322 151 51743	03.450
R140-1	RESISTOR	6.49 KOHM 1% 0.4W	PHILIPS	2322 151 56492	03.412
R141-1	RESISTOR	3.92 KOHM 1% 0.4W	PHILIPS	2322 151 53922	03.409
R142-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R143-1	RESISTOR	20 KOHM 1% 0.4W	PHILIPS	2322 151 52003	03.452
R144-1	RESISTOR	10 KOHM 1% 0.4W	PHILIPS	2322 151 51003	03.427
R145-1	RESISTOR	20 KOHM 1% 0.4W	PHILIPS	2322 151 52003	03.452
R146-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R147-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R148-1	POTENTIOMETER MULTITURN	20 KOHM	BOURNS	3296W-1-203	07.852
R149-1	RESISTOR	403 OHM 1% 0.4W	PHILIPS	2322 151 54021	03.390
R150-1	RESISTOR	403 OHM 1% 0.4W	PHILIPS	2322 151 54021	03.390
R151-1	RESISTOR	6.8 KOHM 5% 0.33W	PHILIPS	2322 181 53682	01.220
R152-1	RESISTOR	220 OHM 5% 0.33W	PHILIPS	2322 181 53221	01.183
R153-1	RESISTOR	1.3 KOHM 5% 0.33W	PHILIPS	2322 181 53132	01.203
R154-1	RESISTOR	1.3 KOHM 5% 0.33W	PHILIPS	2322 181 53132	01.203
R155-1	POTENTIOMETER TRIMMING	470 OHM 10% 0.5W	* PHILIPS	2322 482 22471	07.651
R156-1	RESISTOR	820 OHM 5% 0.33W	PHILIPS	2322 181 53821	01.197
R157-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 53473	01.241
R158-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 53473	01.241
R159-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 53473	01.241
R160-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 53473	01.241
R161-1	RESISTOR	17.4 KOHM 1% 0.4W	PHILIPS	2322 151 51743	03.450
R162-1	RESISTOR	7.15 KOHM 1% 0.4W	PHILIPS	2322 151 57152	03.453
R163-1	RESISTOR	3.92 KOHM 1% 0.4W	PHILIPS	2322 151 53922	03.409
R164-1	RESISTOR	23.7 KOHM 1% 0.4W	PHILIPS	2322 151 52373	03.454
R165-1	RESISTOR	20 KOHM 1% 0.4W	PHILIPS	2322 151 52003	03.452
R166-1	RESISTOR	20 KOHM 1% 0.4W	PHILIPS	2322 151 52003	03.452
R167-1	RESISTOR	10 KOHM 1% 0.4W	PHILIPS	2322 151 51003	03.427
R168-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R169-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R170-1	POTENTIOMETER MULTITURN	20 KOHM	BOURNS	3296W-1-203	07.852
R171-1	RESISTOR	403 OHM 1% 0.4W	PHILIPS	2322 151 54021	03.390
R172-1	RESISTOR	6.8 KOHM 5% 0.33W	PHILIPS	2322 181 53682	01.220
R173-1	RESISTOR	403 OHM 1% 0.4W	PHILIPS	2322 151 54021	03.390
R174-1	RESISTOR	403 OHM 1% 0.4W	PHILIPS	2322 151 54021	03.390
R175-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R176-1	RESISTOR	403 OHM 1% 0.4W	PHILIPS	2322 151 54021	03.390

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R177-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R178-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R179-1	POTENTIOMETER TRIMMING	22 KOHM 10% 0.5W	PHILIPS	2322 482 22223	07.675
R180-1	RESISTOR	6.81 KOHM 1% 0.4W	PHILIPS	2322 151 56812	03.419
R181-1	RESISTOR	510 OHM 5% 0.33W	PHILIPS	2322 181 53511	01.192
R182-1	RESISTOR	3.92 KOHM 1% 0.4W	PHILIPS	2322 151 53922	03.409
R183-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 53333	01.237
R184-1	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 53154	01.254
R185-1	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 53154	01.254
R186-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 53473	01.241
R187-1	POTENTIOMETER TRIMMING	4.7 KOHM 10% 0.75W	AB ELECTRONIC	HC-10	07.714
R188-1	RESISTOR	6.8 KOHM 5% 0.33W	PHILIPS	2322 181 53682	01.220
R189-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R190-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R191-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R192-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R193-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R194-1	RESISTOR	33 OHM 5% 0.33W	PHILIPS	2322 181 53339	01.162
R195-1	RESISTOR	30 OHM 5% 0.33W	PHILIPS	2322 181 53309	01.161
R196-1	RESISTOR	47 KOHM 1% 0.4W	PHILIPS	2322 151 54703	03.442
R197-1	RESISTOR	47 KOHM 1% 0.4W	PHILIPS	2322 151 54703	03.442
R198-1	RESISTOR	47 KOHM 1% 0.4W	PHILIPS	2322 151 54703	03.442
R199-1	RESISTOR	47 KOHM 1% 0.4W	PHILIPS	2322 151 54703	03.442
R200-1	RESISTOR	27 OHM 5% 0.33W	PHILIPS	2322 181 53279	01.160
R201-1	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 53399	01.164
R202-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R203-1	RESISTOR	390 OHM 5% 0.33W	PHILIPS	2322 181 53391	01.189
R204-1	RESISTOR	24.3 KOHM 1% 0.4W	PHILIPS	2322 151 52433	03.451
R205-1	RESISTOR	390 OHM 5% 0.33W	PHILIPS	2322 181 53391	01.189
R206-1	POTENTIOMETER TRIMMING	22 KOHM 10% 0.5W	PHILIPS	2322 482 22223	07.675
R207-1	RESISTOR	6.8 KOHM 5% 0.33W	PHILIPS	2322 181 53682	01.220
R208-1	RESISTOR	220 OHM 5% 0.33W	PHILIPS	2322 181 53221	01.183
R209-1	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 53392	01.214
R210-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R211-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 53273	01.235
R212-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R213-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R214-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R215-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R216-1	RESISTOR	330 KOHM 5% 0.33W	PHILIPS	2322 181 53334	01.262
R217-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R218-1	RESISTOR	19.1 KOHM 1% 0.4W	PHILIPS	2322 151 51913	03.455
R219-1	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 53562	01.218
R220-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R221-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R222-1	RESISTOR	30 KOHM 5% 0.33W	PHILIPS	2322 181 53303	01.236
R223-1	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 53123	01.227
R224-1	RESISTOR	17.4 KOHM 1% 0.4W	PHILIPS	2322 151 51743	03.450
R225-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R226-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R227-1	RESISTOR	15.4 KOHM 1% 0.4W	PHILIPS	2322 151 51543	03.456
R228-1	RESISTOR	360 KOHM 5% 0.33W	PHILIPS	2322 181 53364	01.263
R229-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R230-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R231-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R232-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R233-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R234-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R235-1	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 53122	01.202
R236-1	RESISTOR	15 KOHM 5% 0.33W	PHILIPS	2322 181 53153	01.229
R237-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R238-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R239-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R240-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R241-1	POTENTIOMETER TRIMMING	10 KOHM 10% 0.5W	PHILIPS	2322 482 22103	07.669
R242-1	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 53154	01.254
R243-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R244-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R245-1	RESISTOR	56 KOHM 5% 0.33W	PHILIPS	2322 181 53563	01.243
R246-1	RESISTOR	56 KOHM 5% 0.33W	PHILIPS	2322 181 53563	01.243
R247-1	RESISTOR	19.6 KOHM 1% 0.4W	PHILIPS	2322 151 51963	03.457
R248-1	RESISTOR	22 KOHM 1% 0.4W	*PHILIPS	2322 151 52213	03.441
R249-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R250-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R251-1	RESISTOR	22 KOHM 1% 0.4W	*PHILIPS	2322 151 52213	03.441
R252-1	RESISTOR	330 KOHM 5% 0.33W	PHILIPS	2322 181 53334	01.262
R253-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 53273	01.235
R254-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R255-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R256-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 53273	01.235
R257-1	RESISTOR	19.6 KOHM 1% 0.4W	PHILIPS	2322 151 51963	03.457
R258-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R259-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R260-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R261-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R262-1	RESISTOR	71.5 KOHM 1% 0.4W	PHILIPS	2322 151 51753	03.446
R263-1	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 53183	01.231
R264-1	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 53154	01.254

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R265-1	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 53105	01.275
R266-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R267-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R268-1	RESISTOR	390 OHM 5% 0.33W	PHILIPS	2322 181 53391	01.189
R269-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R270-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R271-1	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 53332	01.212
R272-1	RESISTOR	220 KOHM 5% 0.33W	PHILIPS	2322 181 53224	01.258
R273-1	RESISTOR	1.8 MOHM 5% 0.33W	PHILIPS	2322 181 53185	01.281
RA1-1	RESISTOR ARRAY	8x1 KOHM 2%	DALE	MDP1603 102-G	08.675
RA2-1	RESISTOR ARRAY	8x1 KOHM 2%	DALE	MDP1603 102-G	08.675
RE1-1	RELAY	12VDC 1SH. 2A.	OUC	OUC-S-112D	21.300
RE2-1	RELAY	12VDC 1SH. 2A.	OUC	OUC-S-112D	21.300
T1-1	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T2-1	TRANSISTOR	BC557B	* ITT	BC557B	28.091
T3-1	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T4-1	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T5-1	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T6-1	TRANSISTOR	BF245B	PHILIPS	BF245B	29.715
T7-1	TRANSISTOR	BC557B	* ITT	BC557B	28.091
TR1-1	TRANSFORMER	6579	SCANELECTRIC	EI 19/6,7-6579	22.502
TR2-1	TRANSFORMER	6579	SCANELECTRIC	EI 19/6,7-6579	22.502
TR3-1	TRANSFORMER	6579	SCANELECTRIC	EI 19/6,7-6579	22.502
TR4-1	TRANSFORMER	6579	SCANELECTRIC	EI 19/6,7-6579	22.502

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
	PROCESSOR UNIT	MODULE 2	ESPERA	PRINT NR.5-0-23834D	600103
C1-2	CAPACITOR TRIMMING	2-18pF PTFE	DAU	107.2901.018	17.100
C2-2	CAPACITOR ELECTROLYTIC	0.33uF 50V	ERO	EK1 00 AA 033 H	14.521
C3-2	CAPACITOR MKT	470nF 10% 63V	*ERO	MKT1822-447/065	11.048
C4-2	CAPACITOR CERAMIC	1nF 10% 500V	PHILIPS	2222 655 03102	16.148
C5-2	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EK1 00 AA 210 F	14.512
C6-2	CAPACITOR POLYSTYRENE	10nF 1% 63V	*PHILIPS	2222 428 81003	10.226
				2222 424 41003	
C7-2	CAPACITOR MKT	10nF 10% 400V	* ERO	MKT1822-310/405	12.212
C8-2	CAPACITOR ELECTROLYTIC	1uF 20% 50V	* ERO	EK1 00 AA 110 H	14.506
C9-2	CAPACITOR CERAMIC	470pF 10% 400V	FERROPERM	9/0129,9	16.096
C10-2	CAPACITOR ELECTROLYTIC	220uF -10/+50% 25V	*ERO	EKM 00 DD 322 E	14.647
C11-2	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EK1 00 BB 247 E	14.524
C12-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C13-2	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EK1 00 AA 210 F	14.512
C14-2	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJD102M	15.160
C15-2	CAPACITOR POLYSTYRENE	2.2nF 1% 63V	*PHILIPS	2222 428 82202	10.209
				2222 424 42202	
C16-2	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EK1 00 BB 247 E	14.524
C17-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C18-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C19-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C20-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C21-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C22-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C23-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C24-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C25-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C26-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C27-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C28-2	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EK1 00 AA 222 E	14.514
C29-2	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EK1 00 AA 222 E	14.514
C30-2	CAPACITOR ELECTROLYTIC	220uF -10/+50% 25V	*ERO	EKM 00 DD 322 E	14.647
C31-2	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C32-2	CAPACITOR CERAMIC	10pF 5% NPO 400V	FERROPERM	9/0112,9	15.565
C33-2	CAPACITOR CERAMIC	8.2pF +-0.5pF NPO 400V	FERROPERM	9/0112,9	15.563
C34-2	CAPACITOR CERAMIC	8.2pF +-0.5pF NPO 400V	FERROPERM	9/0112,9	15.563
D1-2	DIODE	AA119	PHILIPS	AA119	25.250
D2-2	DIODE	AA119	PHILIPS	AA119	25.250
D3-2	DIODE	1N4148	* ITT	1N4148	25.131
D4-2	DIODE	1N4148	* ITT	1N4148	25.131
D5-2	DIODE	1N4148	* ITT	1N4148	25.131

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
D6-2	DIODE	1N4148	* ITT	1N4148	25.131
D7-2	DIODE	AA119	PHILIPS	AA119	25.250
D8-2	DIODE	1N4148	* ITT	1N4148	25.131
D9-2	DIODE	1N4148	* ITT	1N4148	25.131
D10-2	DIODE	1N4148	* ITT	1N4148	25.131
D11-2	DIODE	1N4148	* ITT	1N4148	25.131
D13-2	DIODE	1N4148	* ITT	1N4148	25.131
D14-2	DIODE	1N4148	* ITT	1N4148	25.131
D15-2	DIODE	1N4148	* ITT	1N4148	25.131
D16-2	DIODE	1N4148	* ITT	1N4148	25.131
D21-2	DIODE ZENER	3.9V 5% 0.4W BZX79C3V9	PHILIPS	BZX79C3V9	26.512
D23-2	DIODE ZENER	3.3V 5% 0.4W BZX79C3V3	PHILIPS	BZX79C3V3	26.510
IC1-2	INTEGRATED CIRCUIT	8085 AH-2	*SIEMENS	SAB 8085 A2P	32.565
IC2-2	INTEGRATED CIRCUIT	8155H	*INTEL	8155H	32.755
IC3-2	INTEGRATED CIRCUIT	74LS373N	*TEXAS	SN74LS373N	34.263
IC4-2	INTEGRATED CIRCUIT	74LS138	TEXAS	74LS138	33.919
IC5-2	INTEGRATED CIRCUIT	74LS32N	*TEXAS	74LS32N	33.599
IC6-2	INTEGRATED CIRCUIT	EPROM 16K X 8-300ns	ESPERA	16K x 8	700212
IC7-2	INTEGRATED CIRCUIT	EPROM 8K x 8-300ns	ESPERA	8K x 8	700213
IC8-2	INTEGRATED CIRCUIT	MB8416	**FUJITSU	MB 8416-20LP	32.765
IC9-2	INTEGRATED CIRCUIT	SPEACH PROCESSOR	N.E.C.	uPD7752	31.521
IC10-2			*MMI	63S081	32.750
IC11-2	INTEGRATED CIRCUIT	8253-5	*INTEL	8253-5	32.756
IC12-2	INTEGRATED CIRCUIT	QUAD VOLTAGE COMPERATOR	* NATIONAL	LM339N	31.075
IC13-2	INTEGRATED CIRCUIT	74LS74N	* TEXAS	74LS74N	33.727
IC14-2	INTEGRATED CIRCUIT	7406N	TEXAS	7406N	33.521
IC15-2	INTEGRATED CIRCUIT	7406N	TEXAS	7406N	33.521
IC16-2	INTEGRATED CIRCUIT	7406N	TEXAS	7406N	33.521
IC17-2	INTEGRATED CIRCUIT	TL072CP	TEXAS	TL072CP	31.710
IC18-2	POWER AUDIO AMPLIFIER	TDA1013A	PHILIPS	TDA1013A	31.455
				BATCH 4172 ELLER DEROVER	
IC19-2	VOLTAGE REGULATOR	5V - 0.1A	*NATIONAL	LM78L05ACZ	31.135
IC20-2	OPTO COUPLER	4N27	MOTOROLA	4N27	32.512
IC21-2	OPTO COUPLER DARLINGTON	MOC 8020	*MOTOROLA	MOC 8020	32.535
J3-2	DIP SOCKET	16POLE	* AMP	641600-3	78.078
J4-2	DIP SOCKET	16POLE	* AMP	641600-3	78.078
P6-2	PLUG (MALE)	2 POLE	AMP	0-826375-2	78.102
P1-2	PLUG (MALE)	9 POLE	AMP	0-826375-9	78.109
P2-2	PLUG (MALE)	9 POLE	AMP	0-826375-9	78.109
P5-2	PLUG (MALE)	2 POLE	AMP	0-826375-2	78.102
R1-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R2-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R3-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R4-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R5-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R6-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R7-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R8-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R9-2	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R10-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R13-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R14-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R16-2	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R17-2	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 53223	01.233
R18-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R19-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R20-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R21-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R22-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R23-2	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R24-2	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R25-2	RESISTOR	39 KOHM 5% 0.33W	PHILIPS	2322 181 53393	01.239
R26-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R27-2	RESISTOR	39 KOHM 5% 0.33W	PHILIPS	2322 181 53393	01.239
R28-2	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 53392	01.214
R29-2	RESISTOR	56 KOHM 5% 0.33W	PHILIPS	2322 181 53563	01.243
R30-2	RESISTOR	5.1 KOHM 5% 0.33W	PHILIPS	2322 181 53512	01.217
R31-2	POTENTIOMETER TRIMMING	1 KOHM 20% 0.3W	NOBLE	TM8-KV2-1S	07.784
R32-2	RESISTOR	560 OHM 5% 0.33W	PHILIPS	2322 181 53561	01.193
R33-2	RESISTOR	91 OHM 5% 0.33W	PHILIPS	2322 181 53919	01.174
R34-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R35-2	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 53273	01.235
R36-2	RESISTOR	300 KOHM 5% 0.33W	PHILIPS	2322 181 53304	01.261
R37-2	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 53562	01.218
R38-2	RESISTOR	1.8 KOHM 5% 0.33W	PHILIPS	2322 181 53182	01.206
R39-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R40-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R42-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R43-2	RESISTOR	560 OHM 5% 0.33W	PHILIPS	2322 181 53561	01.193
R44-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R45-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R46-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R47-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R48-2	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 53104	01.250
R49-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R50-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R51-2	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 53122	01.202
R53-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R54-2	RESISTOR	220 KOHM 5% 0.33W	PHILIPS	2322 181 53224	01.258
R55-2	RESISTOR	3.3 OHM 5% 0.33W	PHILIPS	2322 181 53338	01.137
R56-2	POTENTIOMETER TRIMMING	100 OHM 10% 0.75W	*AB ELECTRONIC	HC-10	07.708
R57-2	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 53822	01.222
R58-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R59-2	RESISTOR	270 OHM 5% 0.33W	PHILIPS	2322 181 53271	01.185
R60-2	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222	01.208
R61-2	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 53392	01.214
R62-2	RESISTOR	560 OHM 5% 0.33W	PHILIPS	2322 181 53561	01.193
R63-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R64-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R65-2	RESISTOR	2.0 KOHM 5% 0.33W	PHILIPS	2322 181 53202	01.207
R66-2	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 53392	01.214
R67-2	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 53822	01.222
R68-2	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 53154	01.254
R69-2	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 53273	01.235
R70-2	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 53183	01.231
R71-2	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 53154	01.254
R72-2	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 53183	01.231
R73-2	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 53154	01.254
R74-2	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 53183	01.231
R75-2	RESISTOR	470 OHM 5% 0.33W	PHILIPS	2322 181 53471	01.191
T1-2	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T2-2	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T3-2	TRANSISTOR	BC557B	* ITT	BC557B	28.091
T4-2	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T5-2	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T7-2	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T8-2	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T9-2	TRANSISTOR	BC557B	* ITT	BC557B	28.091
T10-2	TRANSISTOR	BC557B	* ITT	BC557B	28.091
X1-2	CRYSTAL	7.1456 MHz	DANTRONIC	SP C1048	39.950

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
	POWER SUPPLY	MODULE 5	ESPERA	PRINT NR. 5-0-24100D	600106
B1-5	BATTERY LITHIUM	3V	SAFT	40LH220	47.000
C1-5	CAPACITOR MKT	2.2uF 10% 100V	SIEMENS	B32512-E1225-K000	11.406
C2-5	CAPACITOR MKT	2.2uF 10% 100V	SIEMENS	B32512-E1225-K000	11.406
C3-5	CAPACITOR MKT	2.2uF 10% 100V	SIEMENS	B32512-E1225-K000	11.406
C4-5	CAPACITOR POLYSTYRENE	2.2nF 1% 160V	*PHILIPS	2222 429 82202	10.284
				2222 425 42202	
C6-5	CAPACITOR ELECTROLYTIC	1uF 20% 50V	* ERO	EKI 00 AA 110 H	14.506
C7-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C8-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C9-5	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI 00 AA 210 F	14.512
C10-5	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	* ERO	EGD	14.730
				EG 03 MG 422 G	
C11-5	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
C12-5	CAPACITOR MKT	15nF 10% 400V	PHILIPS	2222 344 55153	11.732
C13-5	CAPACITOR MKT	10nF 10% 400V	PHILIPS	2222 344 55103	11.731
C14-5	CAPACITOR MKT	2.2nF 10% 400V	SIEMENS	B32510-D6222-K000	11.165
C15-5	CAPACITOR ELECTROLYTIC	22uF 35V	* ERO	EKI 00 BB 222 F	14.516
C16-5	CAPACITOR MKT	100nF 10% 250V	SIEMENS	B32510-D3104-K000	11.309
C17-5	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40V	*ERO	EKM 00 FG 347 G	14.650
C18-5	CAPACITOR ELECTROLYTIC	470uF -10/+50% 40V	*ERO	EKM 00 FG 347 G	14.650
C19-5	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 16V	**ERO	EG03KE422D	14.714
C20-5	CAPACITOR ELECTROLYTIC	220uF -10/+50% 25V	*ERO	EKM 00 DD 322 E	14.647
C21-5	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI 00 BB 247 E	14.524
C22-5	CAPACITOR ELECTROLYTIC	220uF -10/+50% 10V	ERO	EKM 00 CC 322 C	14.630
C23-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C24-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C25-5	CAPACITOR MKT	220nF 10% 100V	SIEMENS	B32511-D1224-K000	11.227
C26-5	CAPACITOR MKT	100nF 10% 250V	SIEMENS	B32510-D3104-K000	11.309
C27-5	CAPACITOR CERAMIC	18 pF 10% NPO 400V	FERROPERM	9/0112,9	15.593
C28-5	CAPACITOR MKT	100nF 10% 100V	*SIEMENS	B32510-D1104-K000	11.219
C29-5	CAPACITOR MKT	10nF 10% 250V	SIEMENS	B32510-D3103-K000	11.290
D1-5	DIODE	MR750	MOTOROLA	MR750	25.219
D2-5	DIODE ZENER	9.1V 5% 0.4W BZX79C9V1	PHILIPS	BZX79C9V1	26.546
D3-5	DIODE	BAV21	PHILIPS	BAV21	25.340
D4-5	DIODE	AA119	PHILIPS	AA119	25.250
D5-5	DIODE ZENER	51V	THOMSON	BZW06-44	26.995
D6-5	DIODE	1N4934	MOTOROLA	1N4934	25.155
D7-5	DIODE	1N4934	MOTOROLA	1N4934	25.155
D8-5	DIODE F.REC	3A/50V	* MOTOROLA	MR850	25.225
D9-5	DIODE ZENER	5.1V 5% 0.4W BZX79C5V1	* PHILIPS	BZX79C5V1	26.527
D10-5	DIODE ZENER	5.1V 5% 0.4W BZX79C5V1	* PHILIPS	BZX79C5V1	26.527

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
F1-5	FUSE	3.15A M Ø5x20mm	WICKMANN	919201	45.552
IC1-5	PWM REGULATOR	TL494CN	TEXAS	TL494CN	31.487
IC2-5	OP AMP	TAA761A	*SIEMENS	TAA761A	31.300
L2-5	CHOKE	TL079	ESPERA	TL079	400079
L3-5	CHOKE	TL079	ESPERA	TL079	400079
L4-5	CHOKE	TL079	ESPERA	TL079	400079
OC1-5	OPTO-COUPLER	CNY17-2	*SIEMENS	Q62703-N87	32.530
P1-5	PLUG (MALE)	9 POLE	AMP	0-826375-9	78.109
P2-5	PLUG (MALE)	5 POLE	AMP	0-826375-5	78.105
P3-5	PLUG (MALE)	2 POLE	AMP	0-826375-2	78.102
R1-5	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 53272	01.210
R2-5	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222	01.208
R3-5	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 53123	01.227
R4-5	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 53183	01.231
R5-5	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 53562	01.218
R6-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R7-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R8-5	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R9-5	RESISTOR	1.5 KOHM 5% 0.33W	PHILIPS	2322 181 53152	01.204
R10-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R11-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R12-5	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 53392	01.214
R13-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R14-5	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 53272	01.210
R15-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R16-5	RESISTOR	22 OHM 5% 0.33W	PHILIPS	2322 181 53229	01.158
R17-5	RESISTOR	8.2 OHM 5% 0.33W	PHILIPS	2322 181 53828	01.147
R18-5	RESISTOR	18 OHM 5% 0.5W	PHILIPS	2322 182 13189	01.357
R19-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R20-5	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 53154	01.254
R21-5	SHUNT	TL381	S.P.RADIO	6-0-23857	400381
R22-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R23-5	RESISTOR	22 OHM 5% 0.5W	PHILIPS	2322 182 13279	03.160
R24-5	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 53123	01.227
R25-5	RESISTOR	1.8 KOHM 5% 0.33W	PHILIPS	2322 181 53182	01.206
R26-5	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 53332	01.212
R27-5	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 53562	01.218
R28-5	RESISTOR	820 OHM 5% 0.33W	PHILIPS	2322 181 53821	01.197
R29-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R30-5	RESISTOR	180 OHM 5% 0.33W	PHILIPS	2322 181 53181	01.181
R31-5	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 53681	01.195
R32-5	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 53562	01.218
R33-5	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 53101	01.175
R34-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R35-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
R36-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R37-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 53103	01.225
R38-5	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222	01.208
R39-5	POTENTIOMETER TRIMMING	1 KOHM 10% 0.5W	* PHILIPS	2322 482 22102	07.660
R40-5	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222	01.208
T1-5	TRANSISTOR	BC557B	* ITT	BC557B	28.091
T2-5	TRANSISTOR	BC557B	* ITT	BC557B	28.091
T3-5	TRANSISTOR	BC640	PHILIPS	BC640	28.124
T4-5	TRANSISTOR	BD139	* MOTOROLA	BD139	29.060
T5-5	TRANSISTOR	BC547B	* ITT	BC547B	28.067
T6-5	TRANSISTOR	BC338-25	* PHILIPS	BC338-25	28.058
T7-5	TRANSISTOR	BC328-25	* PHILIPS	BC328-25	28.052
T8-5	TRANSISTOR	BC338-25	* PHILIPS	BC338-25	28.058
T9-5	TRANSISTOR	RFP 12N10	*RCA	RFP 12N10	29.410
T10-5	TRANSISTOR	2N2369A	*MOTOROLA	2N2369A	28.315
T11-5	TRANSISTOR	BC328-25	* PHILIPS	BC328-25	28.052
T12-5	THYRISTOR	BT151-500R	PHILIPS	BT151-500R	29.912
TR1-5	CHOKE	TL412	TRANS-ELECTRO	6-0-24232	400412
TR2-5	TRANSFORMER	TD 4876	TRADANIA	TD4876.1	22.168

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
INTERFACE CRY2002		MODULE 7	ESPERA	PRINT NR 5-0-25049A	600901
C1-7	CAPACITOR MKT	10nF 20% 100V	ERO	MKT1817	11.168
C2-7	CAPACITOR MKT	10nF 20% 100V	ERO	MKT1817	11.168
C3-7	CAPACITOR MKT	10nF 20% 100V	ERO	MKT1817	11.168
C4-7	CAPACITOR MKT	10nF 20% 100V	ERO	MKT1817	11.168
C5-7	CAPACITOR MKT	10nF 20% 100V	ERO	MKT1817	11.168
C6-7	CAPACITOR MKT	10nF 20% 100V	ERO	MKT1817	11.168
C7-7	CAPACITOR MKT	10nF 20% 100V	ERO	MKT1817	11.168
C8-7	CAPACITOR MKT	10nF 20% 100V	ERO	MKT1817	11.168
C9-7	CAPACITOR ELECTROLYTIC	0.47uF -10/+50% 63V	**ERO	EL 00 BA 047 J	14.501
FP1-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011
FP2-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011
FP3-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011
FP4-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011
FP5-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011
FP6-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011
FP7-7	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011
IC1-7	4xDIFF.LINE DRIVER	DS26LS31CN	*NATIONAL	DS26LS31CN	34.350
IC2-7	4xDIFF.LINE REC.	DS26LS32CN	*NATIONAL	DS26LS32CN	34.351
IC3-7	INTEGRATED CIRCUIT	MC7808CT	MOTOROLA	MC7808CT	31.255
P1-7	PLUG (MALE)	12 POLE	*AMP	1-826375-2	78.112
P2-7	SOCKET	25 POLES	**AMP	207828-4	78.021
R1-7	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 53122	01.202

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
	HANDSET FOR CRY2002		ESPERA	HANDSET FOR CRY2002	702002
-1	MAIN BOARD HANDSET	CRY2002 MODULE 1	ESPERA	PRINT NR.5-0-25164A	625164
-2	KEYBOARD HANDSET CRY2002	MODULE 2	ESPERA	PRINT NR.5-0-25166	625166
MC1-1	MICROPHONE ELECTRET	WM-034BY	MATUSHITA	WM-034BY	46.012
TC1-1	TELEPHONE CARTRIDGE	200 OHM	S.E.K. (KIRK)	0113.2518 (0113.2510)	46.010

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
	MAIN BOARD HANDSET	CRY2002 MODULE 1	ESPERA	PRINT NR.5-0-25164A	625164
AA1-1	BUZZER	EEB-CD37C11	*PANASONIC	EEB-CD37C11	46.019
C1-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C2-1	CAPACITOR POLYSTYRENE	3.3nF 1% 63V	*PHILIPS	2222 428 83302	10.213
				2222 424 43302	
C3-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C4-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C5-1	CAPACITOR CERAMIC	100nF -20/+80% 50V	AVX	SR21 5E 104 ZAA	15.250
C6-1	CAPACITOR ELECTROLYTIC	0.47uF -10/+50% 63V	**ERO	EL 00 BA 047 J	14.501
C7-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z	15.170
C8-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z	15.170
C9-1	CAPACITOR ELECTROLYTIC	100uF 20% 10V	*ERO	EKI 00 BB 310 C	14.607
C10-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	*ERO	EKI 00 AA 210 F	14.512
C11-1	CAPACITOR ELECTROLYTIC	0.47uF 20% 50V	ERO	EKI 00 AA 047 H	14.504
C12-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	*ERO	EKI 00 AA 210 F	14.512
C13-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	*ERO	EKI 00 AA 210 F	14.512
C14-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	*ERO	EKI 00 AA 210 F	14.512
C15-1	CAPACITOR CERAMIC	1nF 10% 100V	*PHILIPS	2222 630 03102	16.149
C16-1	CAPACITOR CERAMIC	1nF 10% 100V	*PHILIPS	2222 630 03102	16.149
C17-1	CAPACITOR ELECTROLYTIC	33uF 20% 16V	*ERO	EKI 00 AA 233 D	14.518
C18-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	*KCK	HE70SJYF103Z	15.170
D1-1	DIODE LIGHT EMITTING	ORANGE SQUARE 5x5mm	*TFK	TLS0 5301	25.538
D2-1	DIODE LIGHT EMITTING	ORANGE SQUARE 5x5mm	*TFK	TLS0 5301	25.538
D3-1	DIODE LIGHT EMITTING	ORANGE SQUARE 5x5mm	*TFK	TLS0 5301	25.538
D4-1	DIODE LIGHT EMITTING	ORANGE SQUARE 5x5mm	*TFK	TLS0 5301	25.538
D5-1	DIODE ZENER	4.7V 5% 0.4W BZX79C4V7	*PHILIPS	BZX79C4V7	26.524
D6-1	DIODE	1N4148	*ITT	1N4148	25.131
D7-1	DIODE	1N4148	*ITT	1N4148	25.131
FP1-1	FERRITE BEAD	HZ 4.2/2.1/7 G K1201	KASCHKE	HZ 4.2/2.1/7 G K1201	35.011
				405 442 075 021	
IC1-1	4xDIFF.LINE DRIVER	DS26LS31CN	*NATIONAL	DS26LS31CN	34.350
IC2-1	4xDIFF.LINE REC.	DS26LS32CN	*NATIONAL	DS26LS32CN	34.351
IC3-1	LED DISPLAY INTERFACE	SAA1060	SIGNETICS	SAA1060	32.825
IC4-1	INTEGRATED CIRCUIT	MC1455P1	*MOTOROLA	MC1455P1	31.205
IC5-1	INTEGRATED CIRCUIT	MC14011BCP	*MOTOROLA	MC14011BCP	33.041
IC6-1	INTEGRATED CIRCUIT	74LS165N	TEXAS	SN74LS165N	33.961
IC7-1	INTEGRATED CIRCUIT	74LS164N	*TEXAS	SN74LS164N	33.960
IC8-1	DISPLAY 7 SEGMENT LED	TD5L 5150 RED	*TELEFUNKEN	TD5L 5150	25.735
IC9-1	DISPLAY 7 SEGMENT LED	TD5L 5150 RED	*TELEFUNKEN	TD5L 5150	25.735
IC10-1	VOLTAGE REGULATOR	MC7805CT	*MOTOROLA	MC7805CT	31.250
J1-1	SOCKET 13 POLES	1-167910-3	AMP	1-167910-3	78.800
P1-1	PLUG 2x9 POLES	AMP 28510-2	AMP	MODU II 280510-2	78.162

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
R1-1	RESISTOR	15 KOHM 5% 0.33W	PHILIPS	2322 181 53153	01.229
R2-1	RESISTOR	15 KOHM 5% 0.33W	PHILIPS	2322 181 53153	01.229
R3-1	RESISTOR	1.8 KOHM 5% 0.33W	PHILIPS	2322 181 53182	01.206
R4-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R5-1	RESISTOR	1.8 KOHM 5% 0.33W	PHILIPS	2322 181 53182	01.206
R6-1	RESISTOR	1.8 KOHM 5% 0.33W	PHILIPS	2322 181 53182	01.206
R7-1	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 53183	01.231
R8-1	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 53822	01.222
R9-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 53472	01.216
R10-1	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 53272	01.210
R11-1	RESISTOR	6.8 KOHM 5% 0.33W	PHILIPS	2322 181 53682	01.220
R12-1	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 53222	01.208
R13-1	RESISTOR	120 KOHM 5% 0.33W	PHILIPS	2322 181 53124	01.252
R14-1	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 53272	01.210
R15-1	RESISTOR	39 KOHM 5% 0.33W	PHILIPS	2322 181 53393	01.239
R16-1	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 53822	01.222
R17-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 53102	01.200
RA1-1	RESISTOR ARRAY	4x1 KOHM 5%	*MATUSHITA	C44	08.603
RA2-1	RESISTOR ARRAY	4x1 KOHM 5%	*MATUSHITA	C44	08.603
RA3-1	RESISTOR ARRAY	4x1 KOHM 5%	*MATUSHITA	C44	08.603
RA4-1	RESISTOR NETWORK	4x390 ohms 5% 1/8W	*PANASONIC	EXB-F8V-391-J	08.660
RA5-1	RESISTOR ARRAY	8x10 KOHM 10% 0.125W	*MATUSHITA	R88 103J	08.630
SW1-1	MICROSWITCH	E62-10H PDT	CHERRY	E62-10H PDT	44.025
SW2-1	MICROSWITCH	E62-10H PDT	CHERRY	E62-10H PDT	44.025
SW3-1	REED SWITCH 12VA	2206-2725-020	GUNTHER	2206-2725-020	44.035
T1-1	TRANSISTOR	BC547C	SGS	BC547C	28.068
T2-1	TRANSISTOR	BC557	*PHILIPS	BC557	28.087
T3-1	TRANSISTOR	BC547C	SGS	BC547C	28.068
T4-1	TRANSISTOR	BC547C	SGS	BC547C	28.068
T5-1	TRANSISTOR	BC547C	SGS	BC547C	28.068
W1-W5-1			SAMTEC	TSW-136-07-S-D	78.327

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMB
	KEYBOARD HANDSET CRY2002	MODULE 2	ESPERA	PRINT NR.5-0-25166	625166
D1-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D2-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D3-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D4-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D5-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D6-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D7-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D8-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D9-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D10-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D11-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D12-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D13-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D14-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D15-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
D16-2	DIODE LIGHT EMITTING	HLMP-7040 GREEN	H.P.	HLMP-7040	25.650
P1-2	PLUG 13 POLES	927 974-1	AMP	927 974-1	78.801
RA1-2	RESISTOR NETWORK	8x560 ohms 5% 1/8W	**PANASONIC	EXB-F9E-561-J	08.622