Sailor

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INSTRUKTIONSBOG FOR
SAILOR SCRAMBLER CRY2001

INSTRUCTION BOOK FOR
SAILOR SCRAMBLER CRY2001

INSTRUKTIONSBUCH FÜR
SAILOR SCRAMBLER CRY2001

INSTRUCTIONS POUR
SAILOR SCRAMBLER CRY2001

INSTRUCCIONES PARA
SAILOR SCRAMBLER CRY2001

A/S S. P. RADIO · AALBORG · DENMARK

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1. INTRODUCTION

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1.4. PRINCIPLE OF OPERATION & BLOCK DIAGRAMS

1. INTRODUCTION

The SAILOR Scrambler CRY2001 has been designed to be used with the SAILOR Compact 2000 module programme.

The SAILOR CRY2001 can be installed and operated either as an independent unit or in combination with the other elements of the Compact 2000 programme. These include 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 CRY2001 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.

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 the 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 product development. We have a worldwide 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

Principle:	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
Code Capacity:	Elementary keys = 16,777,216 Structures = 65,536
Automatic Auxiliary Key:	Auxkey = 32 Automatically generated after each start and change of transmission direction.
Synchronization:	Group call; start synch. time = 1.12 sec. Selective call; start synch. time = 3.01 secs Start of tranmission; synch. time = 1.19 sec. End of transmission; synch. time = 0.56 sec. Autom. resynchronization every 70 secs. with a resynch. time = 280 msecs.
Mode of Operation:	Selective call with public selcall number. Group call with secret group call number. Semi-duplex/Simplex.
Number Register:	8 quick select selcall numbers 8 quick select group call numbers
Pre-key of Transmitter:	10 msecs to 2.5 secs.
Bandwidth:	400 - 2600 Hz clear and scrambled signal.
Line Input/Output:	Front panel selectable between two radiostations. 600 ohm balanced or unbalanced. Transmit level = +4 dBm Receive level = 0 to -30 dBm } adjustable
Connections:	Two keying relays with break or make contacts. Two optocoupled distress inputs; 6-30 V or 3-15 mA
Temperature:	$-15^{o}C$ to $+55^{o}C$
Power:	DC Power supply 10 V to 32 V DC, 15 W
Loudspeaker:	3 Watt/4 ohm

1.2. CONTROLS

Turns the scrambler ON or OFF.

Increases volume progressively in 16 steps to maximum.

Reduces volume progressively in 16 steps to minimum.

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

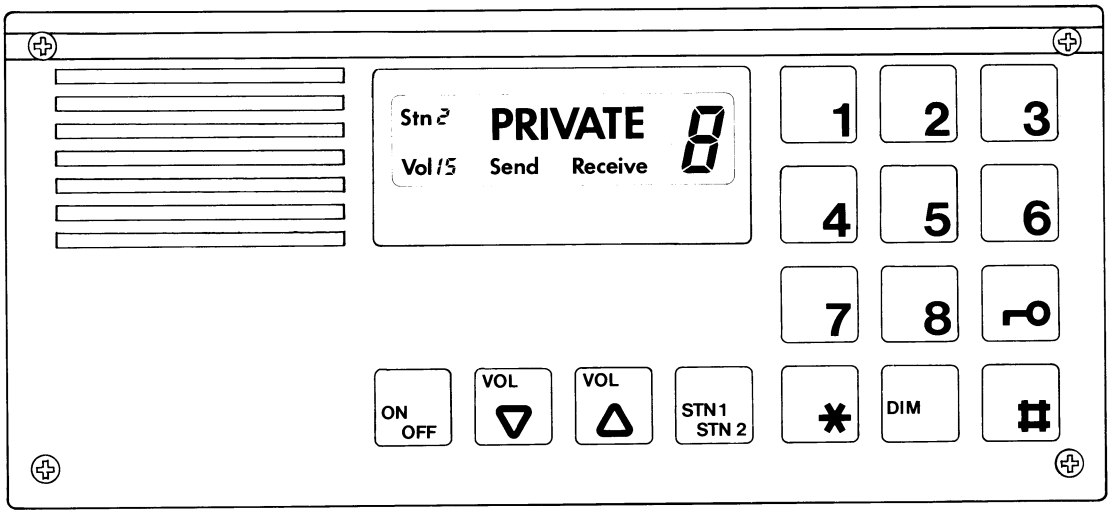
Digits from 1 to 8.

Function key.

Turns the front panel light ON or OFF.

Number key.

Secret group call key.

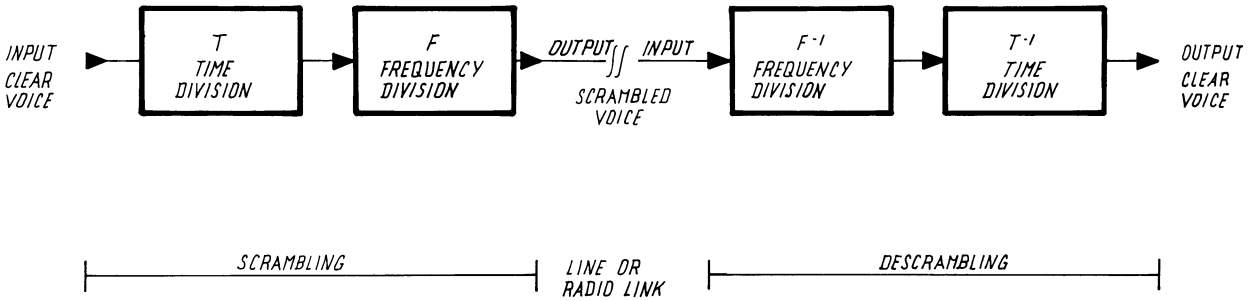


OPERATION: See the green covered Operating Manual for SAILOR SCRAMBLER CRY 2001.

1.3 GENERAL DESCRIPTION

The CRY2001 voice scrambler is a double microprocessor controlled 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.

BLOCK DIAGRAM : DOUBLE SPEECH SCRAMBLING



The subjectives of the double scrambling effect can be described as follows: The F-process employed, among other things, provides an effective scrambling of the sound characteristics, the short-time voiced sounds. The T-processor blurs the rhytm of speech, smooth 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 processes. Beyond that is CRY2001 unscrambled speech signal 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 portions, two time intervals of clear signal is present.
The CRY2001 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:

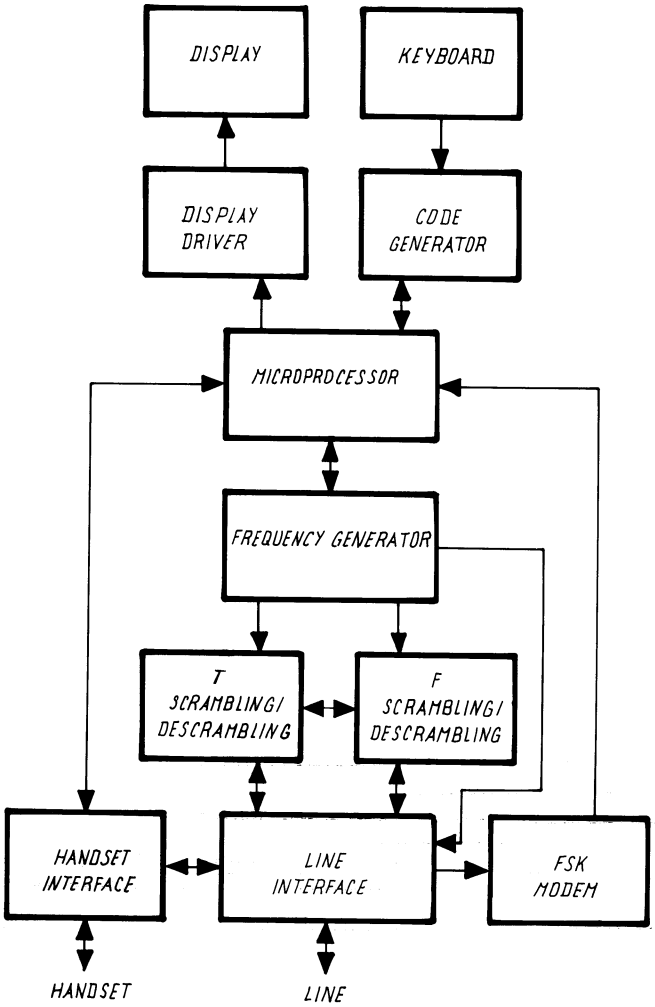
- Restricted bandwidth
- Frequency offset
- Fading
- Multipath
- Varying propagation delays
- Noise and interference

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

1.4 PRINCIPLE OF OPERATION

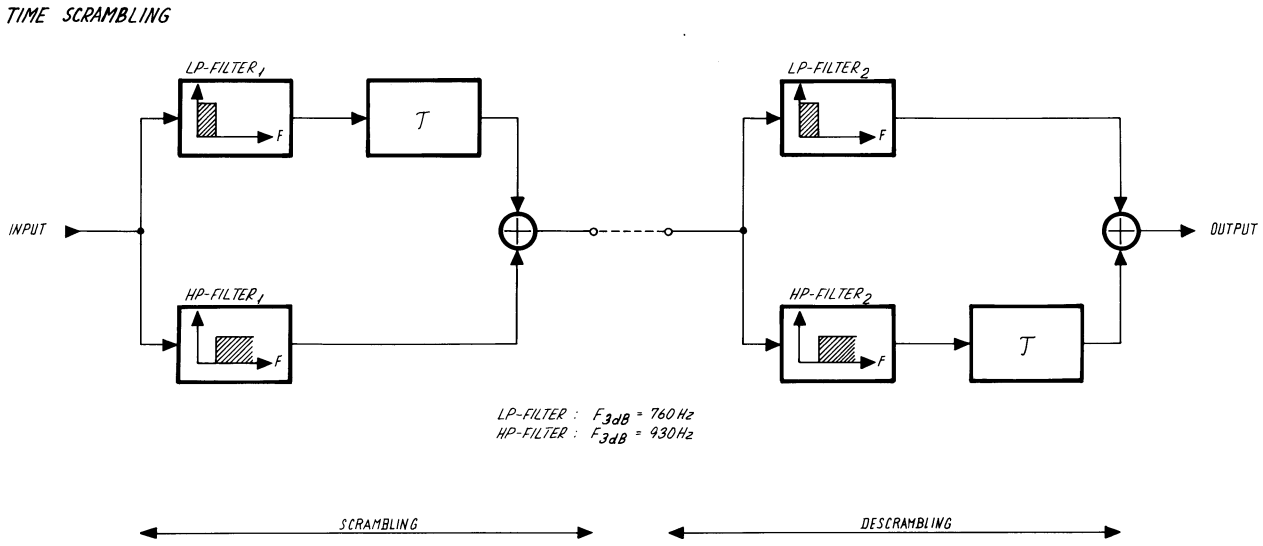
The BASIC BLOCK DIAGRAM shows the basic layout of CRY2001. It consists of a keyboard unit with control switches giving information to the code generator through shift registers. The microprocessor handles all the internal controls including the key-code generation, recognitions and control of information to the display driver. The frequency generator is controlling the F and T scrambler. The FSK modem is handling incoming data for the microprocessor and finally the handset and line interface are handling transmitting and receiving signals.

BASIC BLOCK DIAGRAM



Time Scrambler (T-CSR)

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

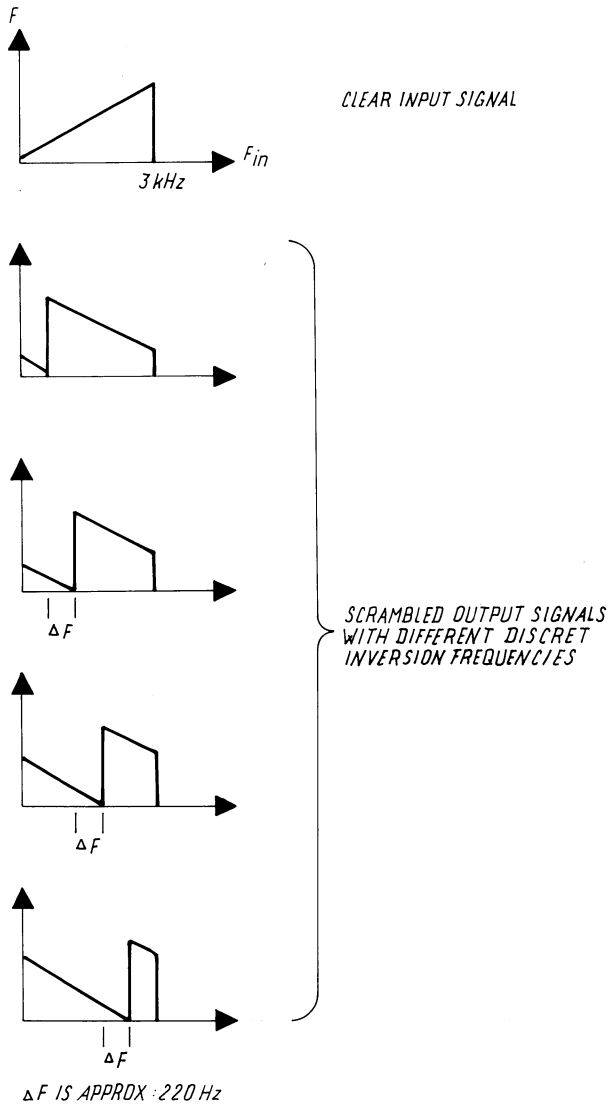


The clear signal is split up into a lowpass and a highpass part. The crossover frequency is chosen so that the average output power from the low and the high part is about the same, for a normal speaker. (Fc=800 Hz) In the transmitting mode the lowpass filtered signal is fed to an analog delay-line with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

Frequency Scrambling

Fig. 1 shows the principle in the frequency scrambler. The scrambling process consists of two steps an inversion and a shift of the inverted spectrum by the value Δ F (approx. 220 Hz). The part of the inverted spectrum, which extend 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, that 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 nearly 100 per cent scrambling of all kind of messages.

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 phaseshifter, that keeps a 90 degree phaseshift 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 F1. Summed to this output is the output from a third mixer M3, mixer frequency F2. 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. F3 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

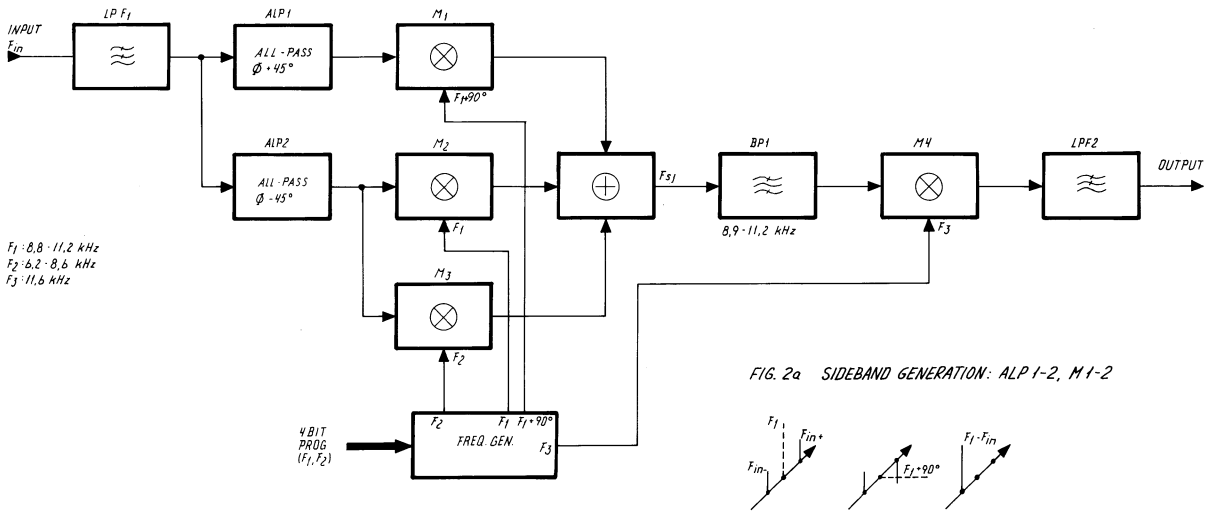
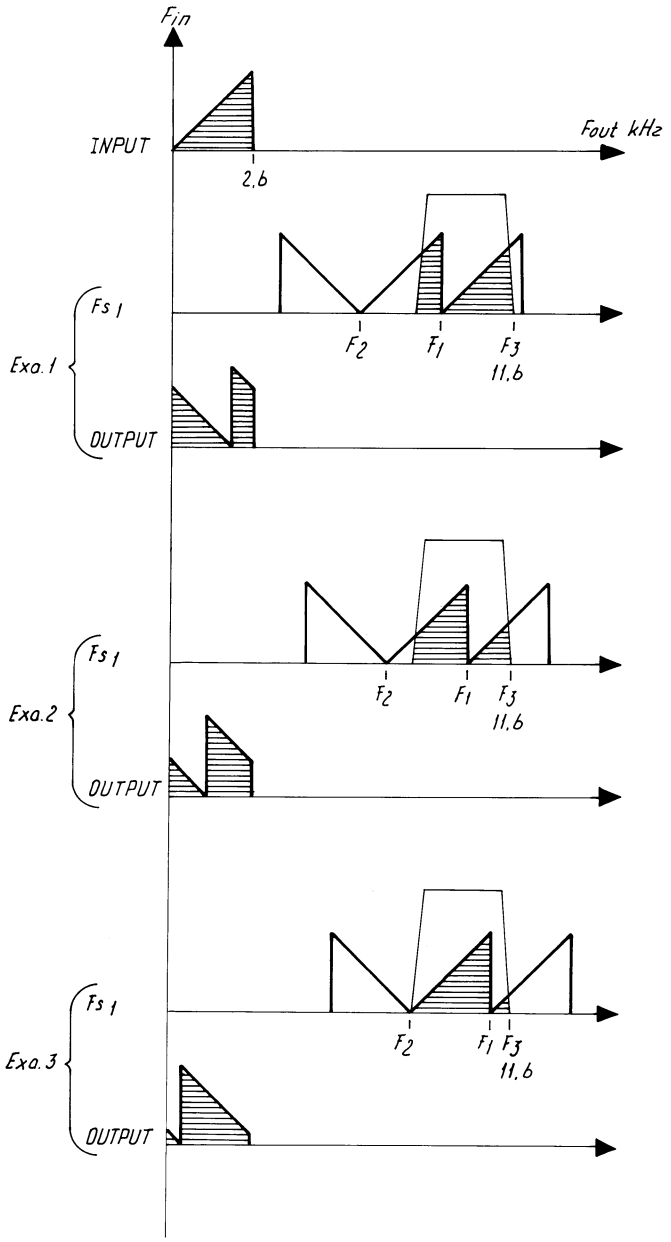


FIG. 2a SIDEBAND GENERATION: ALP 1-2, M 1-2

Principle of operation cont.

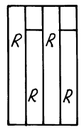
Fig. 3 shows three examples of frequency inversion. The frequency generator is controlled by the microprocessor and generates F1, F2, F3.

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



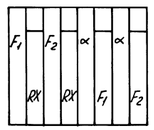
SIGNALLING CODES FOR CRY2001

RESYNCRONIZATION 280ms

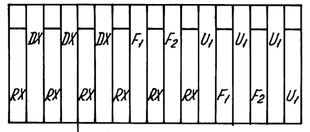


RX : PHASING SIGNAL 1
DX : PHASING SIGNAL 2
α : IDLE SIGNAL α
F_1-F_2 : CYCLING REDUNDANCE CHECK CODE
A_1-A_6 : PUBLIC ADDRESS OF CALLED STATION
B_1-B_6 : PUBLIC ADDRESS OF CALLING STATION
U_1 : AUXILIARY KEY

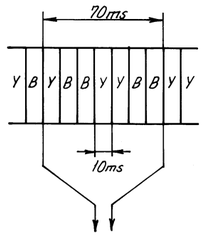
END-OF-TRANSMISSION 560ms



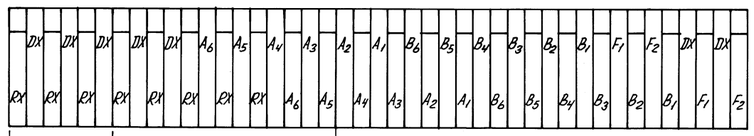
START-OF-TRANSMISSION 1190ms



NECESSARY FOR CORRECT SYNC.

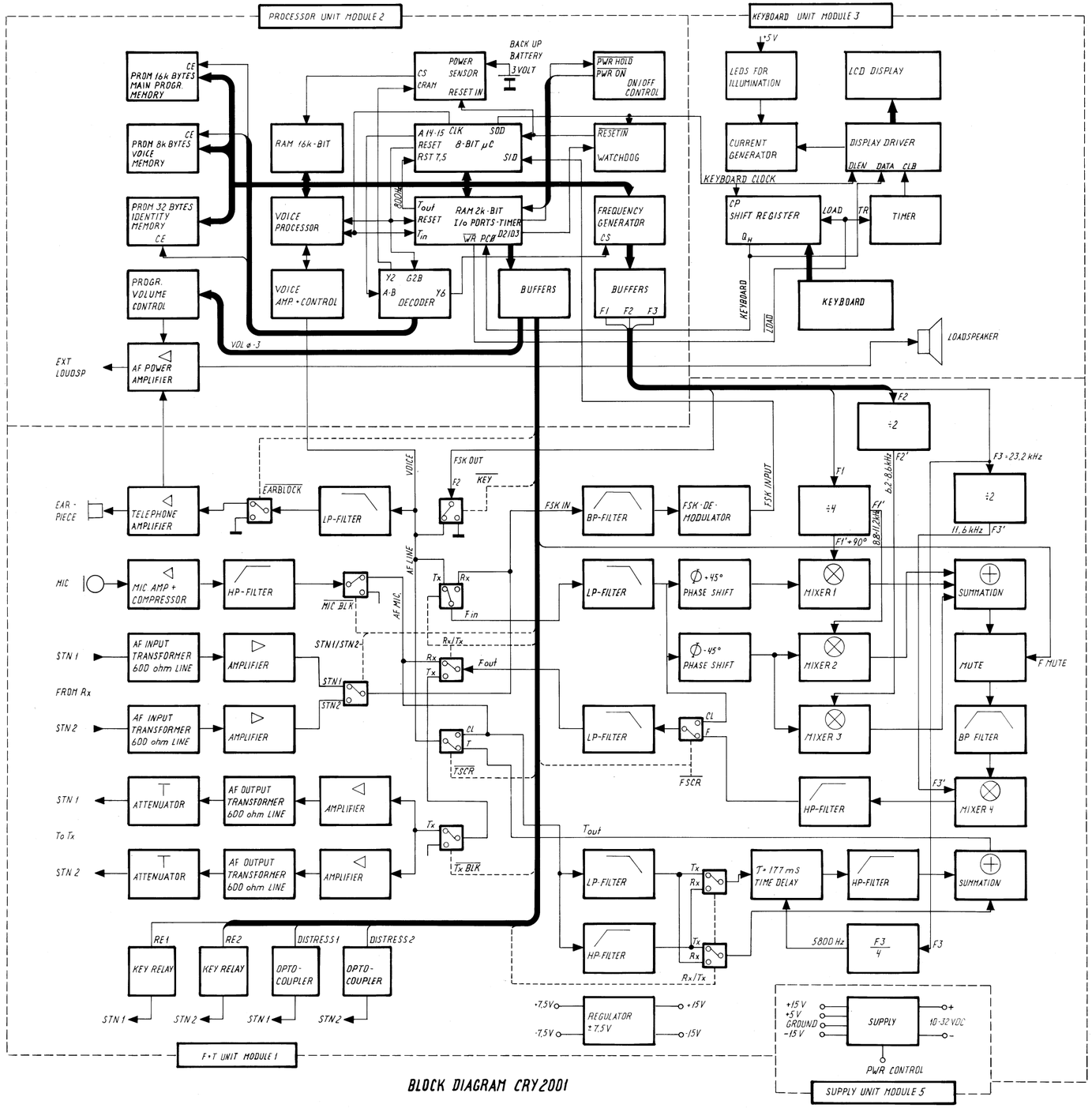


PRIVATE CALL 3010ms



NECESSARY FOR CORRECT SYNC.

STOP SCANNING WHEN RECEIVING CALL.



BLOCK DIAGRAM CRY2001

CRY2001 4-0-24761

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2.1. MOUNTING POSSIBILITIES

2.2. DIMENSIONS AND DRILLING PLAN

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

2.4. PROGRAMMING OF IDENTITY PROM (PRE-KEY, CALL NAME)

2.5. STRAPS (W1,W2,W3,W4 ON KEYBOARD AND W1,W2,W5,W6 ON PROCESSOR UNIT)

2.0. INSTALLATION

Before installation of a SAILOR SCRAMBLER CRY2001 the following points must be observed:

1. What equipment has the scrambler CRY2001 to operate with?

   If the agent or serviceman has found out what equipment the scrambler CRY2001 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 IDENTITY PROM (PRE-KEY, CALL NAME).

   Further a modification of the equipment, the scrambler CRY2001 has to operate together with, is necessary to get an information to the scrambler CRY2001 that the radio station is working on the Distress and Calling frequency, and the scrambler CRY2001 must then go into the "CLEAR VOICE" mode.
   See section 3, Interface for SAILOR Scrambler to SAILOR equipment and section 4, Interface for SAILOR Scrambler to miscellaneous equipment.

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

2. In what way the scrambler CRY2001 has to be installed?

   In section 2.1. MOUNTING POSSIBILITIES is described the installation of scrambler CRY2001 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 ohm can be connected to the POWER CONNECTOR J4-6 pin 1 and 6, see section 2.3. ELECTRICAL CONNECTIONS.

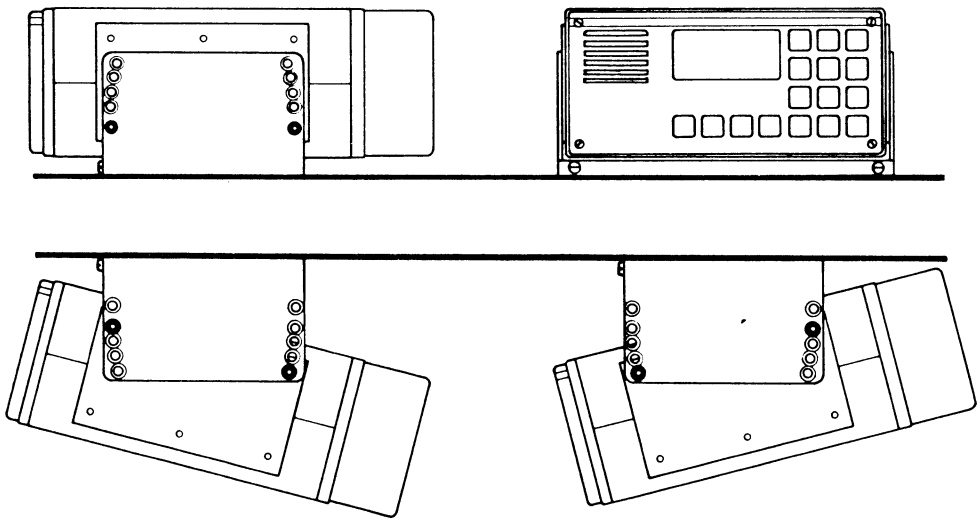
   If an external loudspeaker 4 ohm is installed we recommend to disconnect the internal loudspeaker.

4. The screw, GROUND FOR CHASSIS:

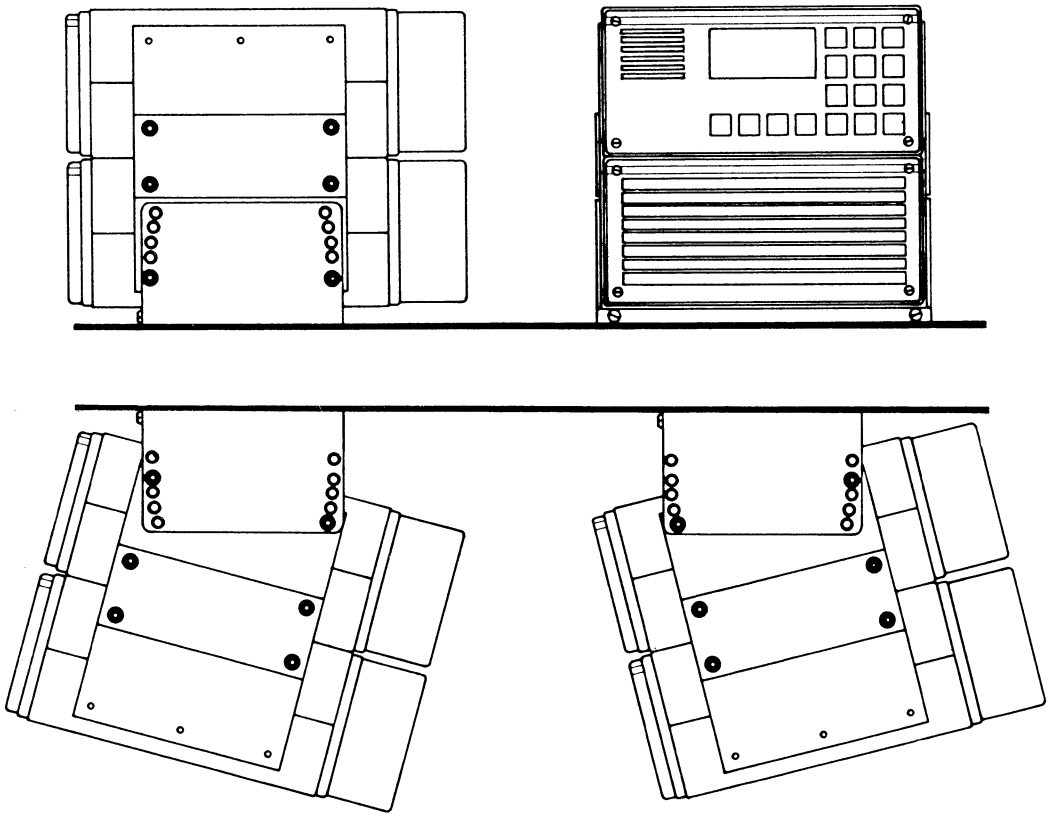
   It can be an advantage to ground the scrambler CRY2001 through the screw, GROUND FOR CHASSIS on the rear plate, see section 2.3. ELECTRICAL CONNECTIONS together with the Coast telephony - or SHORT WAVE station it is installed together with.

2.1 MOUNTING POSSIBILITIES

TABLETOP AND DECKHEAD

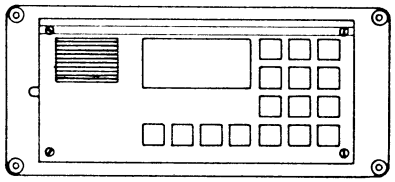


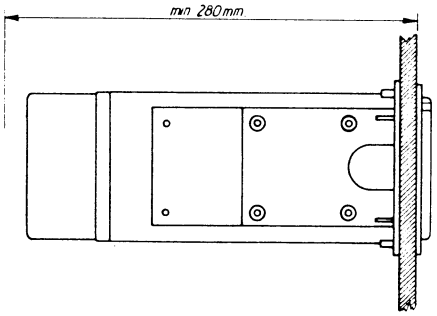
Mounting bracket H2055.



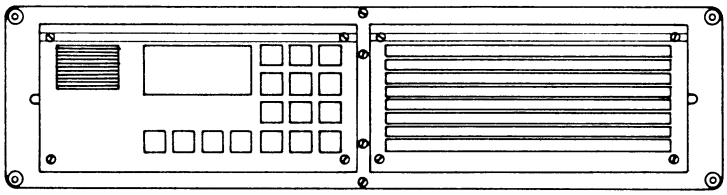
Mounting kit H2068 and H2055.

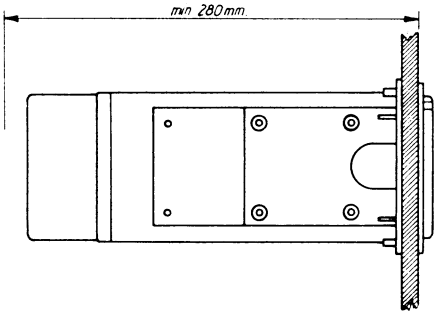
BULKHEAD AND CONSOLE



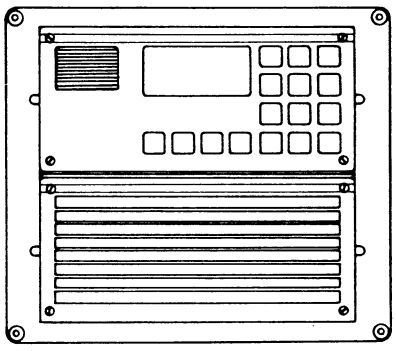


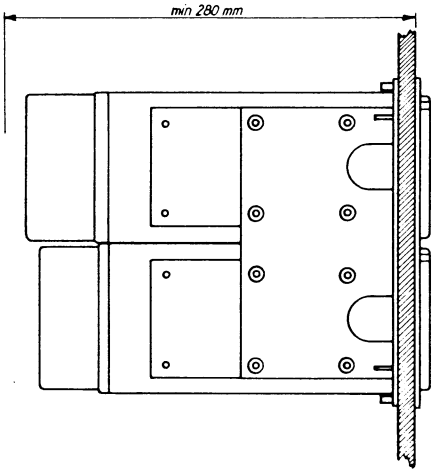
Mounting kit H2063.





Mounting kit H2062
or





Mounting kit H2064.

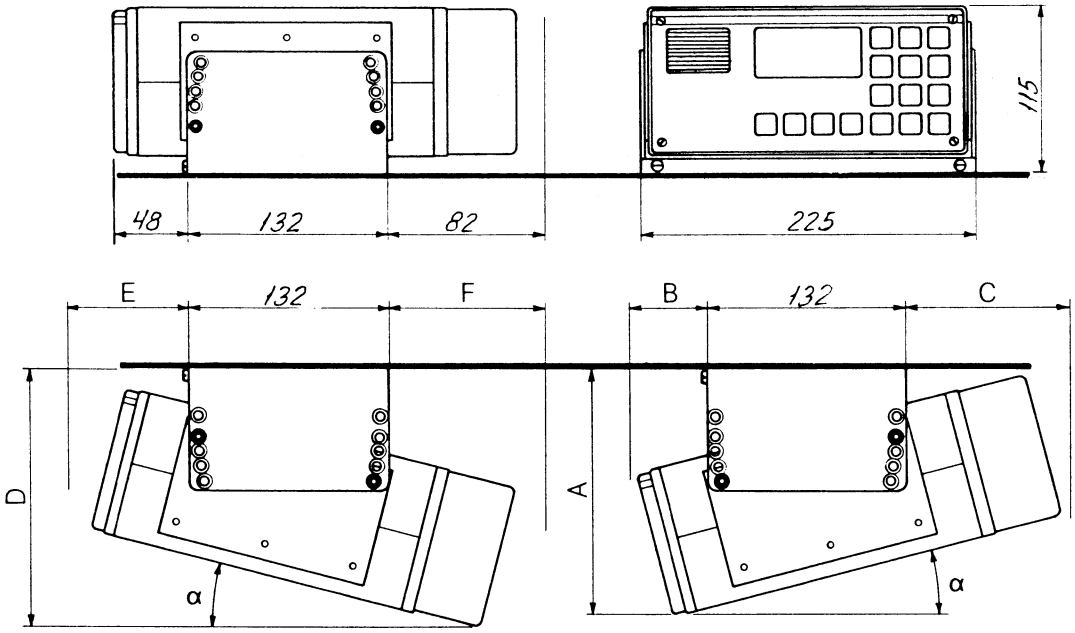
IN CONJUNCTION WITH OTHER "SAILOR" EQUIPMENT

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 on table top, 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.

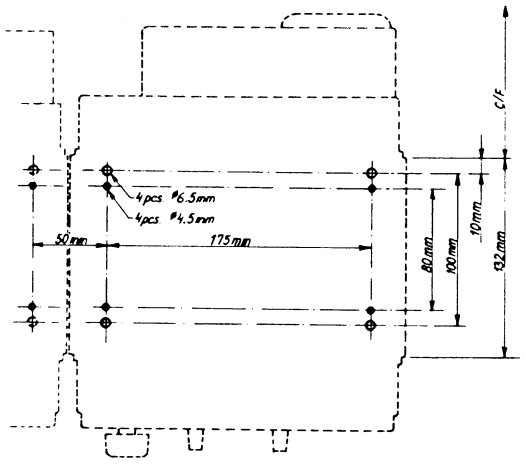


α	A	B	C	D	E	F
0°	130	48	82	130	48	82
4.8°	142	48	88	146	53	82
9.6°	155	48	83	163	59	81
14.4°	167	45	98	178	65	79

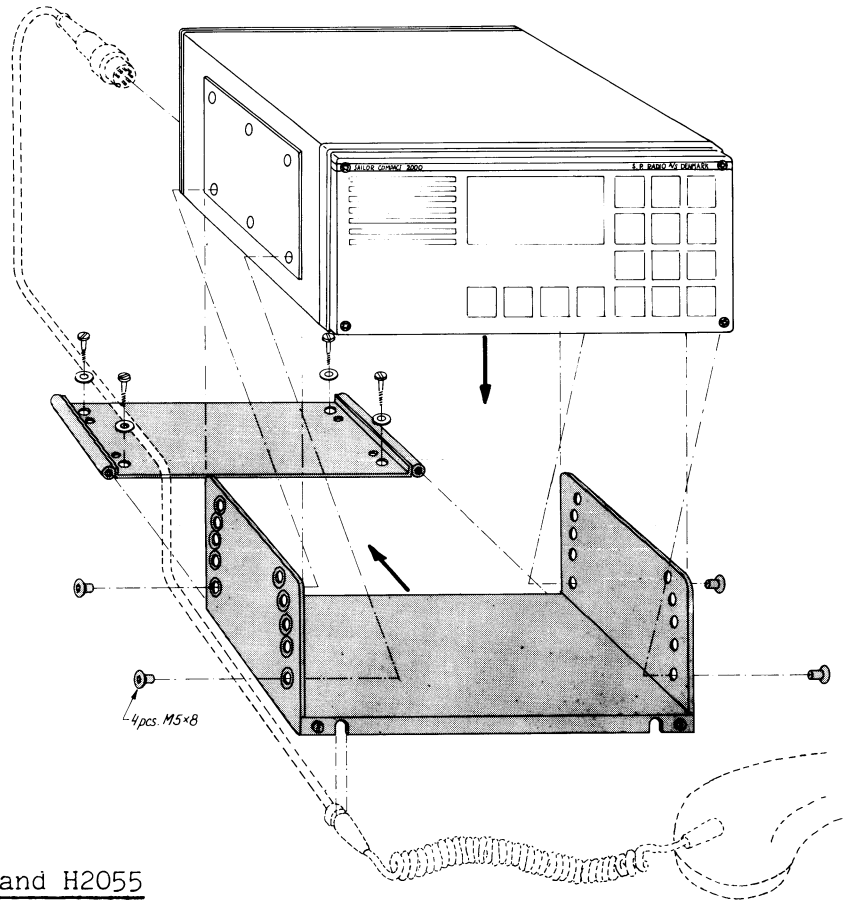
Dimensions in mm

WEIGHT

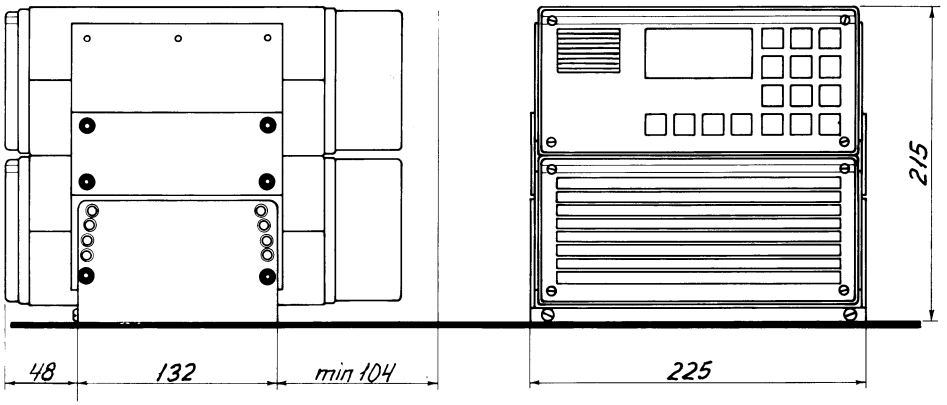
Mounting kit H2055	:	1.5 kg
R2022	:	4,5 kg
H2054	:	5,5 kg
H2074	:	4,0 kg
CRY2001	:	3,2 kg
RT2047	:	5,2 kg

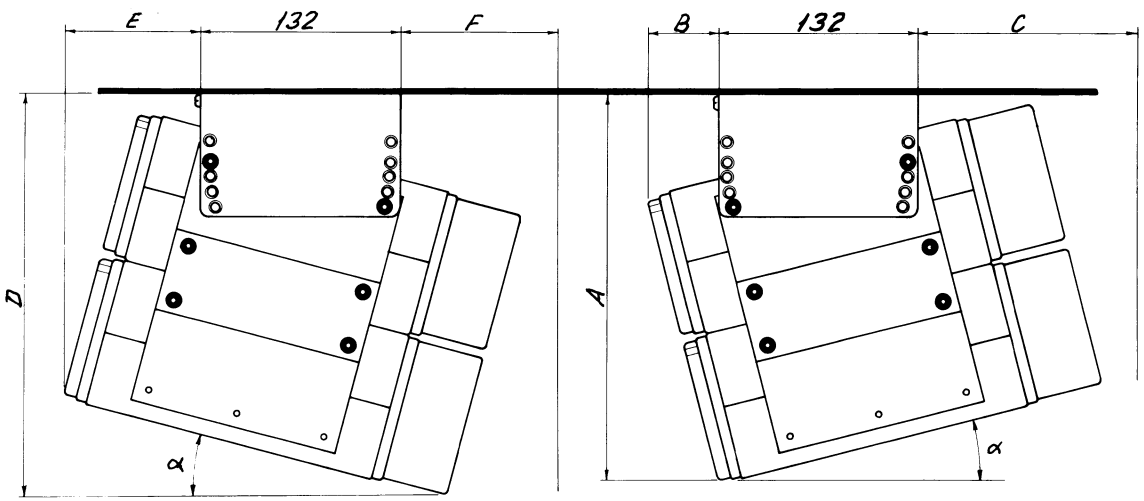


DIMENSIONS AND DRILLING PLAN cont.



Mounting kit H2068 and H2055





α	A	B	C	D	E	F
0°	230	67	105	230	67	105
4.8°	243	67	117	245	72	105
9.6°	255	65	130	262	78	103
14.4°	265	62	143	270	89	100

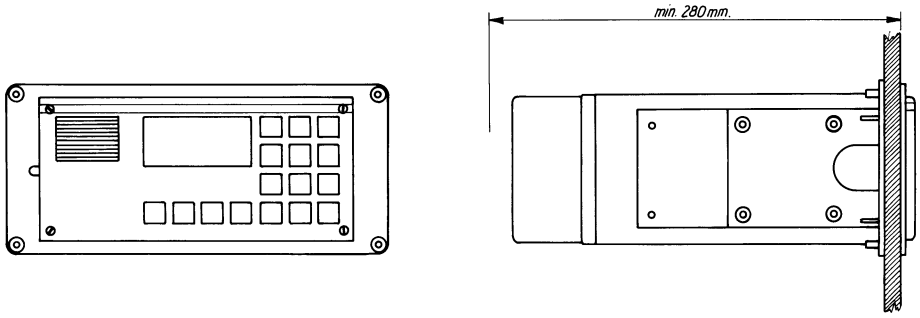
Dimensions in mm

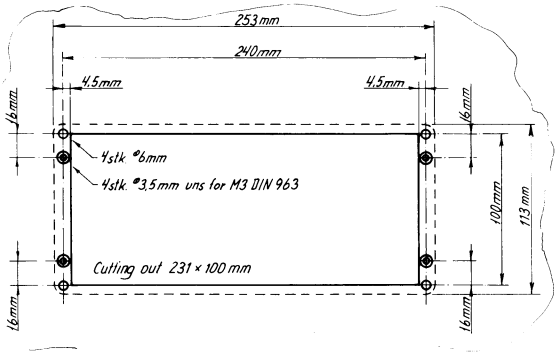
WEIGHT

Mounting kit H2068 and H2055	:	1,5 kg
R2022	:	4,5 kg
H2054	:	5,5 kg
H2074	:	4,0 kg
CRY2001	:	3,2 kg
RT2047	:	5,2 kg

DIMENSIONS AND DRILLING PLAN cont.

Mounting kit H2063

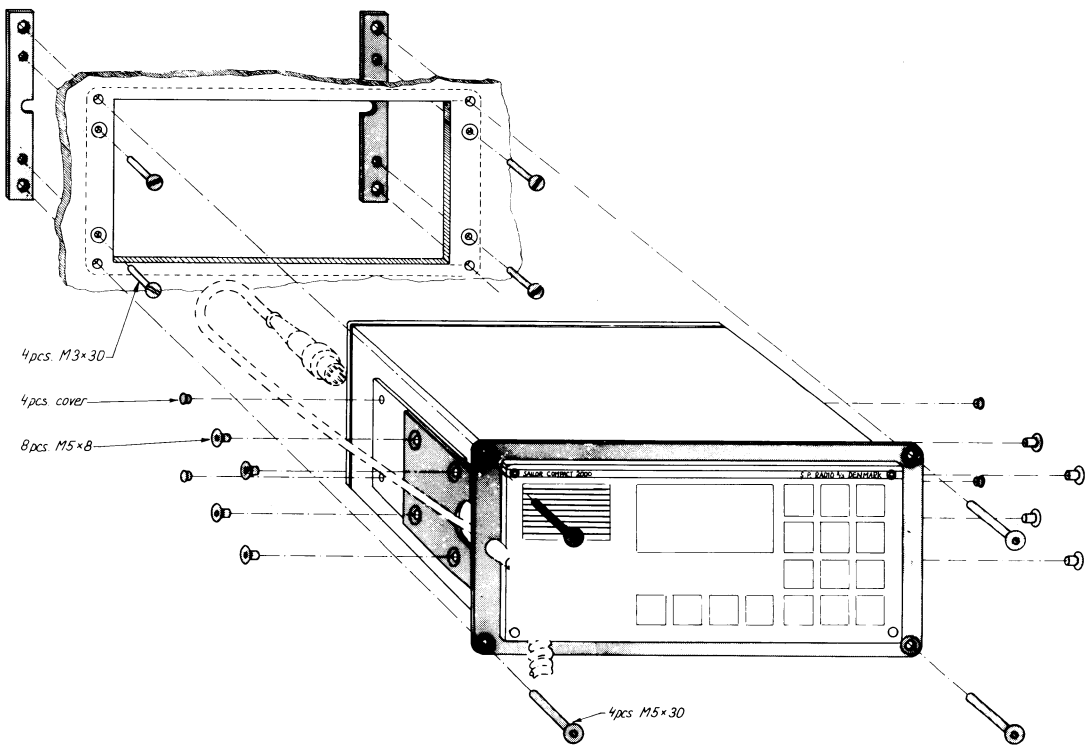




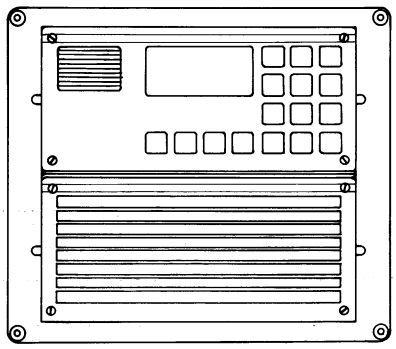
Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

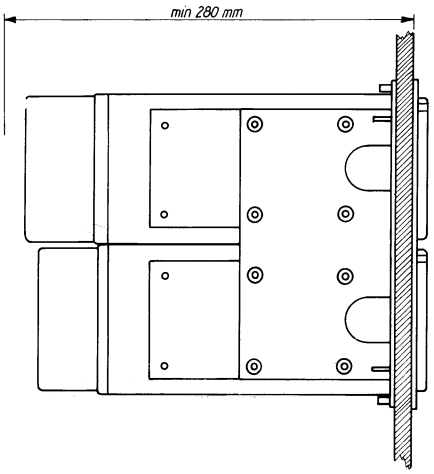
WEIGHT

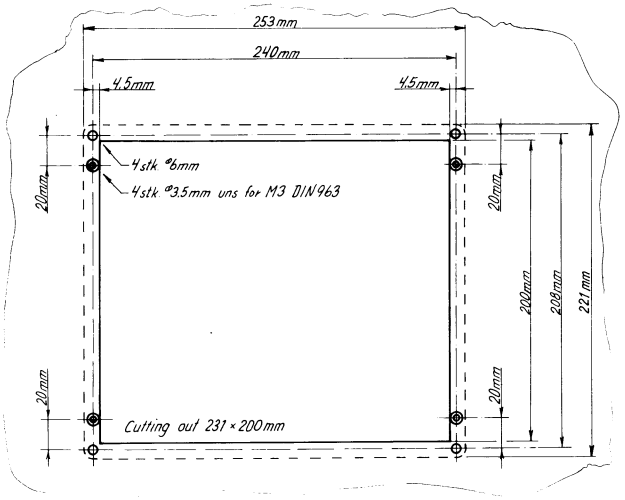
Mounting kit H2063	:	1,0 kg
R2022	:	4,5 kg
H2054	:	5,5 kg
H2074	:	4,0 kg
CRY2001	:	3,2 kg
RT2047	:	5,2 kg



Mounting kit H2064





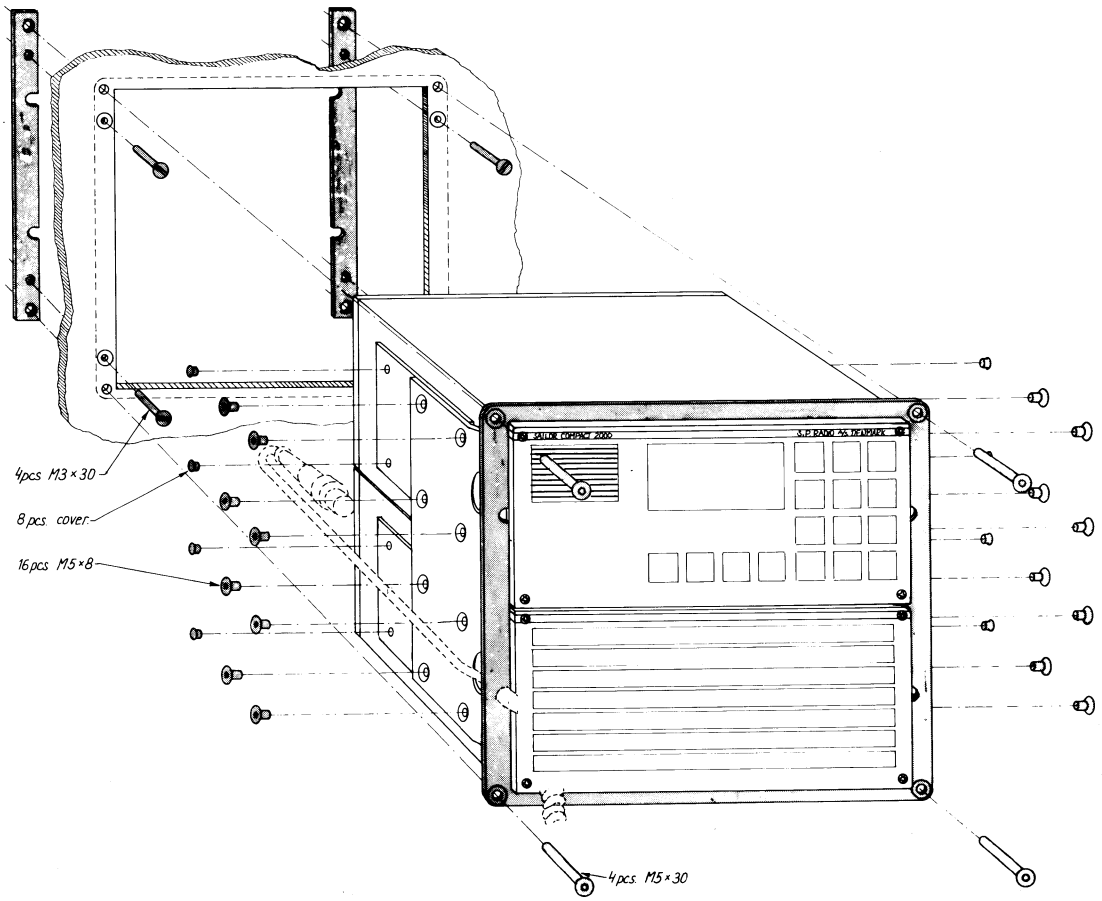


Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

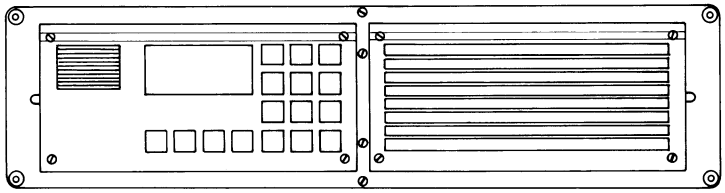
WEIGHT

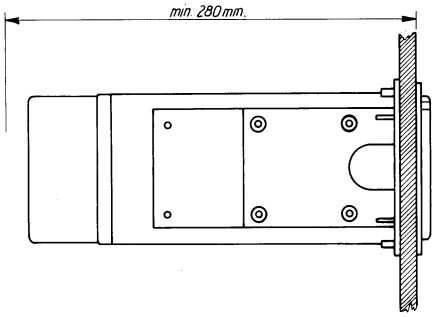
Mounting kit H2064	:	1,5 kg
R2022	:	4,5 kg
H2054	:	5,5 kg
H2074	:	4,0 kg
CRY2001	:	3,2 kg
RT2047	:	5,2 kg

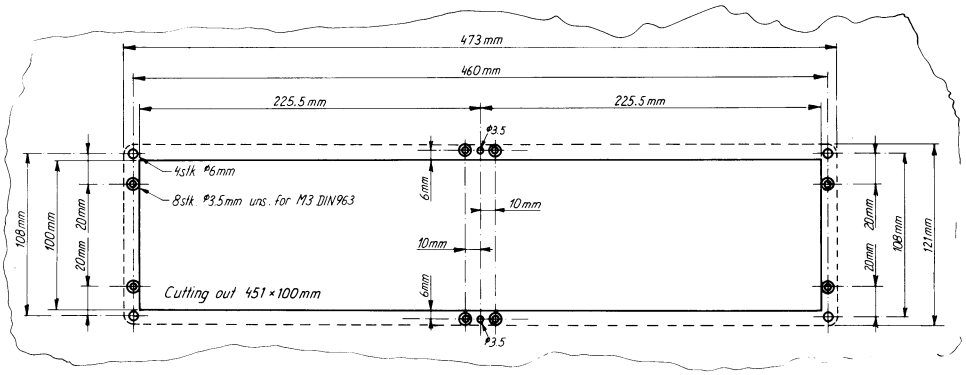
CRY2001



Mounting kit H2062



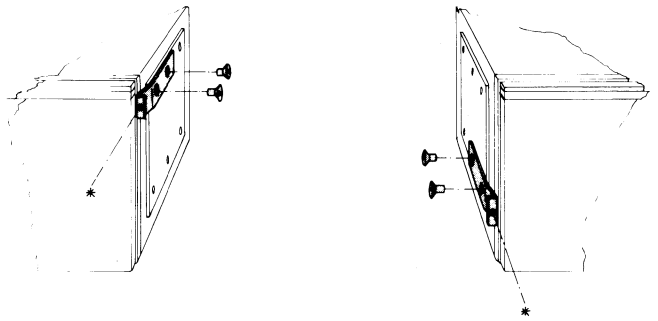


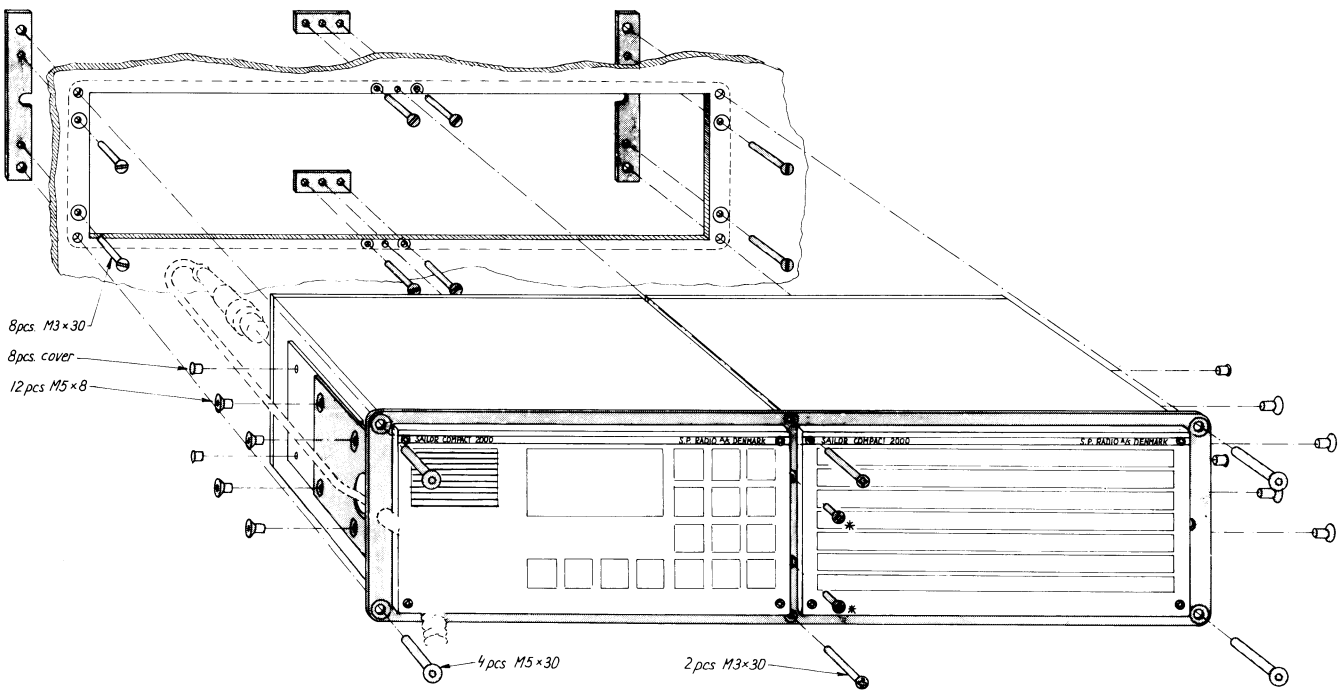


Free distance must be kept to allow free air circulation ambient temperature max. 40°C.

WEIGHT

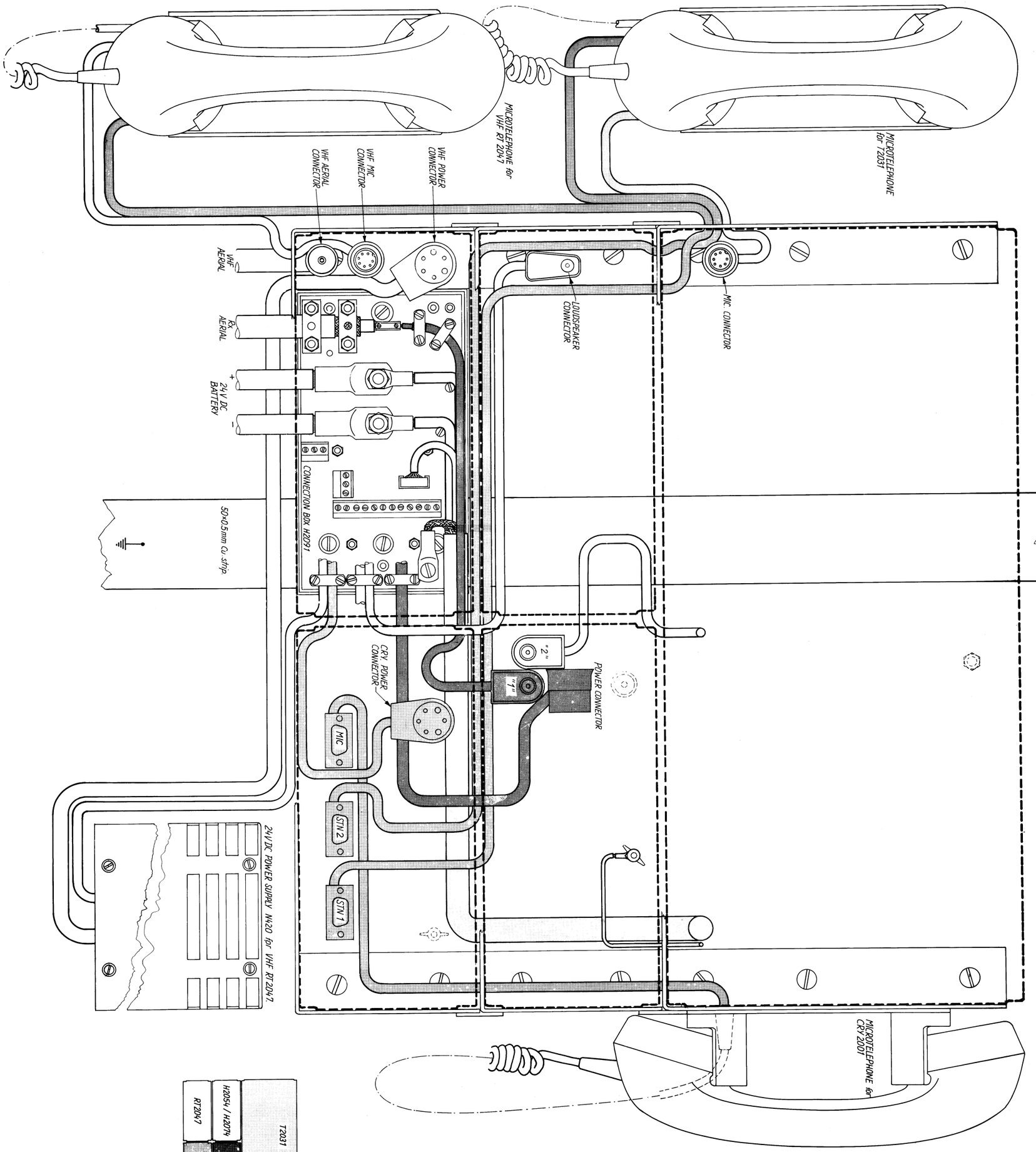
Mounting kit H2062	:	1,5 kg
R2022	:	4,5 kg
H2054	:	5,5 kg
H2074	:	4,0 kg
CRY2001	:	3,2 kg
RT2047	:	5,2 kg



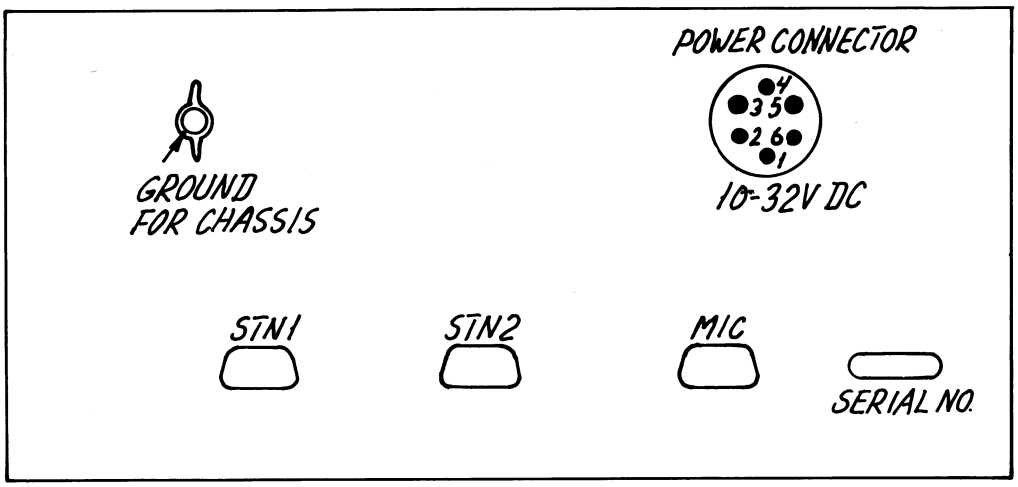


CRY2001

T2031/RT2047/CRY2001
4-0-24787



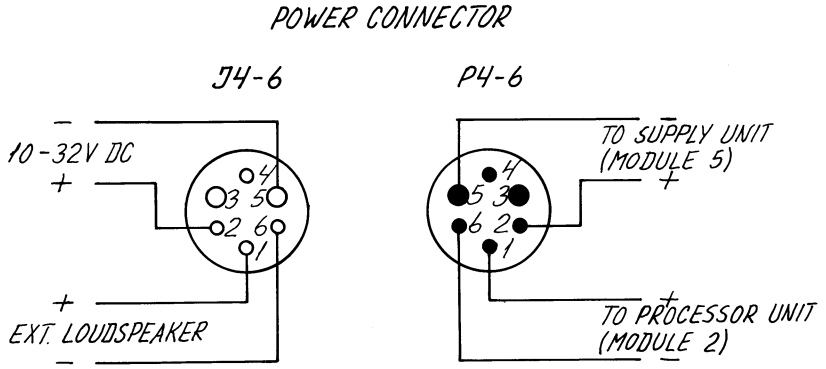
2.3 ELECTRICAL CONNECTIONS



REAR VIEW

THE CHASSIS IS GALVANIC SEPARATED FROM BATTERY

THE CONNECTIONS FOR STN1, STN2 AND MIC ARE SHOWN ON THE INTERCONNECTION CABLE DIAGRAM FOR CRY2001, (SECTION 7.6)



2.4 PROGRAMMING OF IDENTITY PROM (IC 10 in Processor Unit, Module 2)

From the factory the Scrambler CRY2001 normally has not been programmed with the call sign of the radiostation (only necessary in some countries) and the PRE-KEY time. By ordering a Scrambler CRY2001 the programming of the Identity PROM can be completed by S. P. Radio A/S if the sales agents can inform about what type of radio stations the Scrambler CRY2001 will be installed with and the call sign of the radiostation.
Otherwise service and sales agents have to take out the Identity PROM and complete the programming before installation.

Type of PROM's used in the Scrambler CRY2001:

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

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

RESERVED ADDRESSES IN IDENTITY PROM (IC 10 in Processor Unit, Module 2)

The Identity PROM contains data to give the Scrambler CRY2001 its identity.

The addresses 00-04 Hex contains data concerning the Scrambler CRY2001, in which the PROM is placed.
These addresses are programmed from the factory. If a new PROM is wanted we advise that a new PROM is ordered from S. P. Radio A/S. If sales or service agents are programming a new PROM it is important to enter the same data into the new PROM as in the old one.

Addresses	Description
05-0E Hex Programmed by sales agents.	The call sign of the radiostation 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 (Stn 1) 10 (Stn 2) Programmed by sales agents.	Contains the pre-key time in millisec. x 10. 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 254, i.e. a pre-key of 2.54 seconds.

PROGRAMMING OF PRE-KEY INTO IDENTITY PROM (IC 10) in Processor-Unit, Module 2).

Addresses: OF (Hex) stn 1 for HF sets
10 (Hex) stn 2 for VHF sets.

Table for SAILOR sets:

Type	100 % signal (msecs)	Data in Addrs. OF (Hex)	Data in Addrs. 10 (Hex)
RT143	300		1E
RT144A/B/C	200		14
RT145	200		14
RT146	200		14
RT2047	200		14
T121	200	14	
T122	200	14	
T124	200	14	
T126	200	14	
T128	200	14	
T1127/N1400	500	32	
T1127/N1401	500	32	
T1130/N1407	500	32	
T1130/N1409	1100	6E	
T2031	200	14	

Example: Installation with RT144C and T1127/N1400.

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

CRY2001

PROGRAMMING OF CALL SIGN OF THE RADIOSTATION FOR USE BY THE VOICE GENERATOR

The call sign can be up to 9 characters long and must be terminated by a 00 Hex character.
The call sign is entered in ASCII format into the Identity PROM (IC 10) in the Processor Unit, module 2.

Addresses: 05 - 0D Hex

Table for ASCII to Hex.

ASCII	Hex
0	30
1	31
2	32
3	33
4	34
5	35
6	36
7	37
8	38
9	39
A	41
B	42
C	43
D	44
E	45
F	46
G	47
H	48
I	49
J	4A
K	4B
L	4C
M	4D
N	4E
O	4F
P	50
Q	51

ASCII	Hex
R	52
S	53
T	54
U	55
V	56
W	57
X	58
Y	59
Z	5A

Example:

Call sign: SPR1

Addrs.	Data
05	53
06	50
07	52
08	31
09	00

CRY2001

2.5. STRAPS:

The straps W1 - W4 on the keyboard unit (module 3) behind the front panel have the following functions:

Strap	Description
W1	Used for service (see section 5.5. Alignment Procedure.)
W2	If inserted, T scrambling is enabled.
W3	If inserted, voice for call sign is enabled.
W4	If inserted, the scrambler is locked to "stn1".

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.

CONTENTS

3.0. INTERFACE FOR SAILOR SCRAMBLER TO SAILOR EQUIPMENT

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

3.2. H238 HANDSET ASSEMBLY AND DISTRESS DECODER FOR:
INTERCONNECTION TO VHF RT144/A/B/C
H240 HANDSET ASSEMBLY FOR:
INTERCONNECTION TO SSB T121/124/126/128

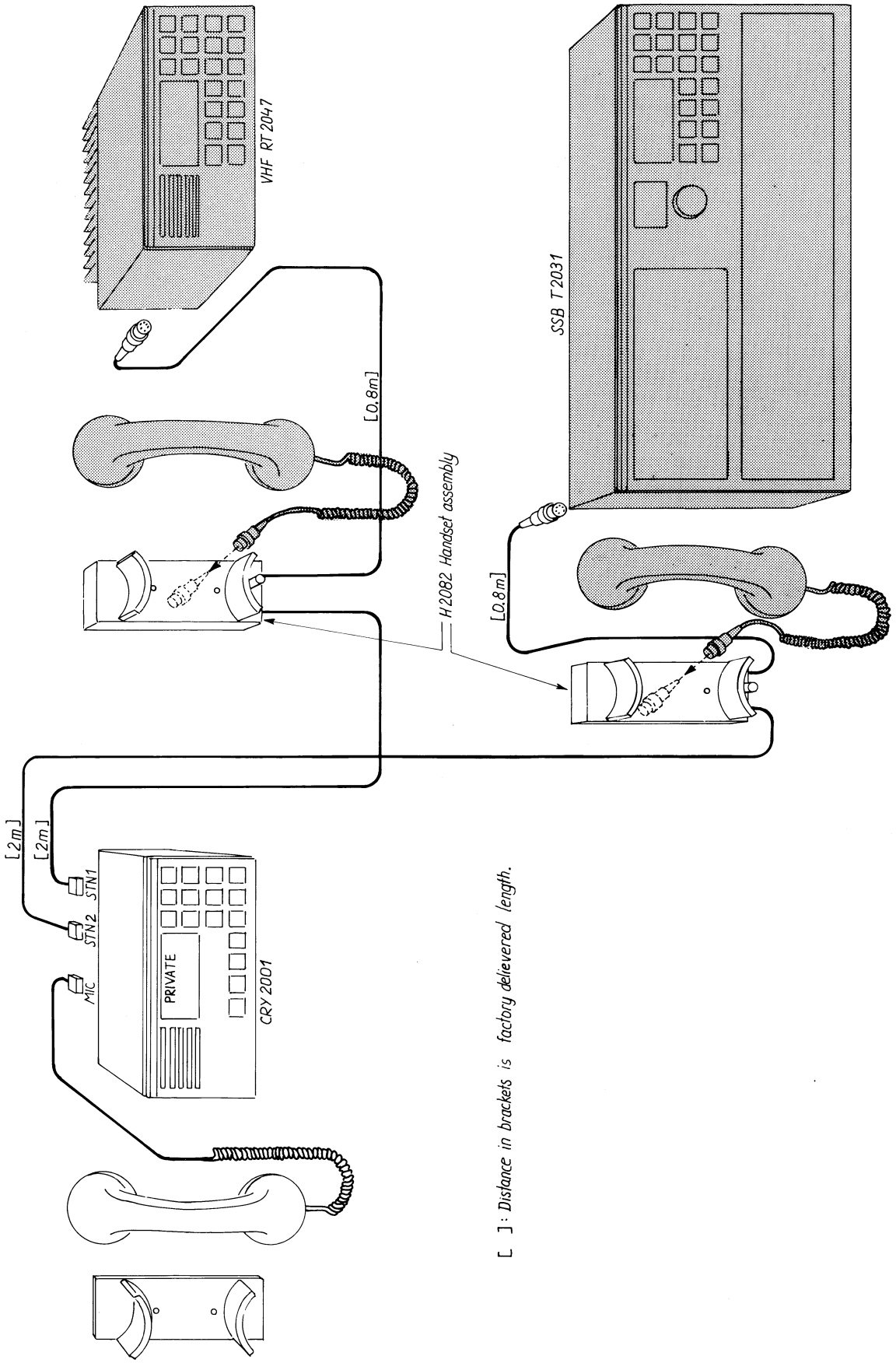
3.3. H242 HANDSET ASSEMBLY FOR:
INTERCONNECTION TO SSB T122

3.4. H421 HANDSET ASSEMBLY AND DISTRESS DECODER FOR:
INTERCONNECTION TO VHF CONTROL UNIT C401/2/3
H239 HANDSET ASSEMBLY AND DISTRESS DECODER FOR:
INTERCONNECTION TO VHF RT143

3.5. H1283 HANDSET ASSEMBLY AND DISTRESS DECODER FOR:
INTERCONNECTION TO SHORT WAVE PROGRAMME 1000/1000B

3.6. INSTALLATION WITH DIRECT INTERCONNECTION BETWEEN SAILOR SCRAMBLER CRY2001 AND SAILOR EQUIPMENT NOT ALLOWED BY AUTHORITIES IN DENMARK

H2082 HANDSET ASSEMBLY FOR:
INTERCONNECTION TO VHF RT2047 AND
INTERCONNECTION TO SSB T2031

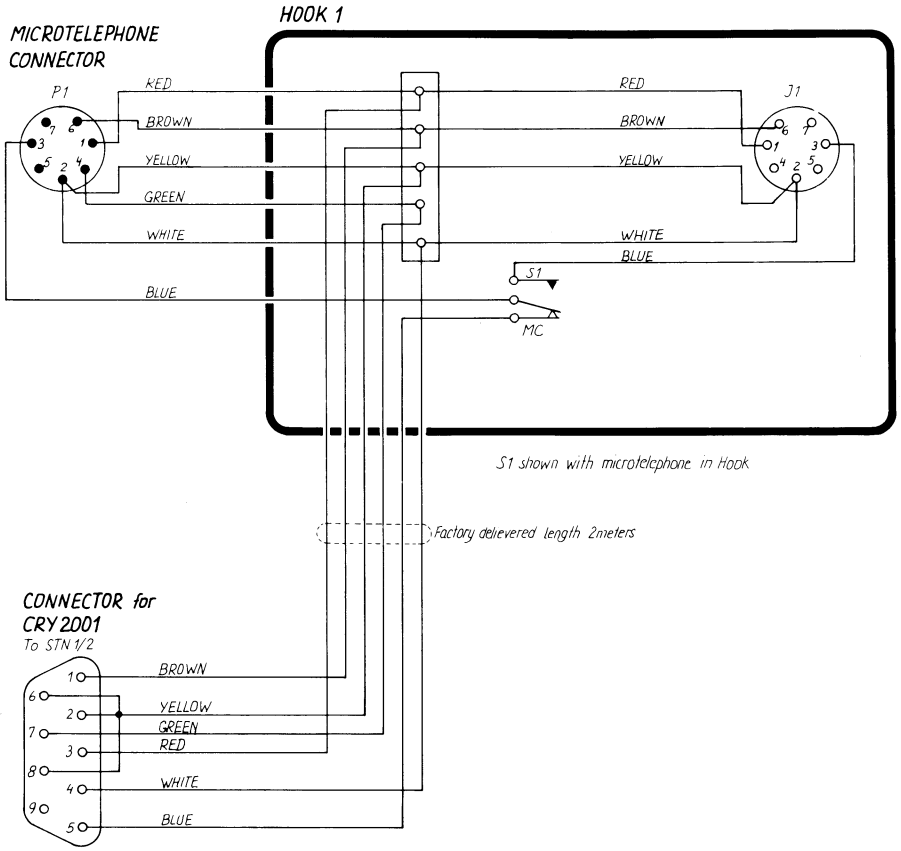


[ ]: Distance in brackets is factory delievered length.

CRY2001 INTERFACE A

H2082 HANDSET ASSEMBLY

INSTALLATION OF RT2047 or T2031 WITH CRY2001 and H2082 HANDSET ASSEMBLY



PROGRAMMING OF RT2047 FOR DISTRESS CH.16 OUTPUT:

Distress ch. 16 output will be enabled by programming in Identity code No. 1, Service Programme P5, addrs. = 71:

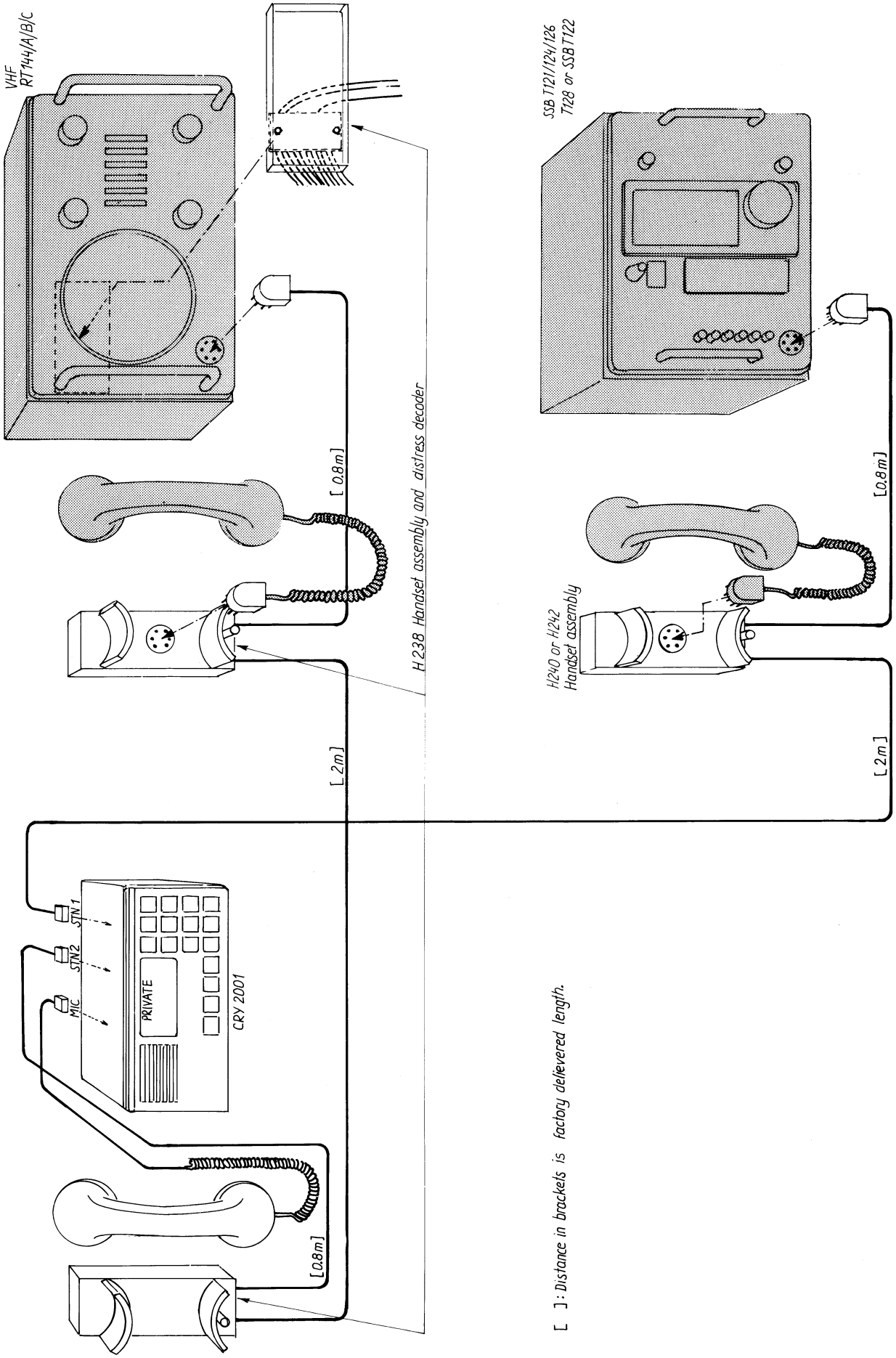
AUX2 on preference channel, set bit No. 3 to "1".
If ch. 16 is not preference channel set bit No. 2 to "1".

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

3.2. H238 HANDSET ASSEMBLY AND DISTRESS DECODER FOR: INTERCONNECTION TO VHF RT144A/B/C

H240 HANDSET ASSEMBLY FOR: INTERCONNECTION TO SSB T121/124/126/128

H242 HANDSET ASSEMBLY FOR: INTERCONNECTION TO SSB T122



[ ]: Distance in brackets is factory delievered length.

INSTALLATION OF H238 HANDSET ASSEMBLY AND DISTRESS DECODER

RT144/A

Remove the old hook for the VHF and place Hook 1 from H238 instead.

Place Hook 2 for CRY2001 handset near CRY2001.

Connect microtelephone connector (P1) to the microtelephone socket (J1003) on the VHF and (P1003) to (J1) on Hook 1.

The D-connector from Hook 2 must be connected to CRY2001 (stn 1 or stn 2).

RT144 B/C

Remove the old hook for the VHF and place Hook 1 from H238 instead.

Disconnect the handset with wire and the plug (P1003) from the earlier installation.

Connect the handset and connector (P1003) as shown in the diagram:

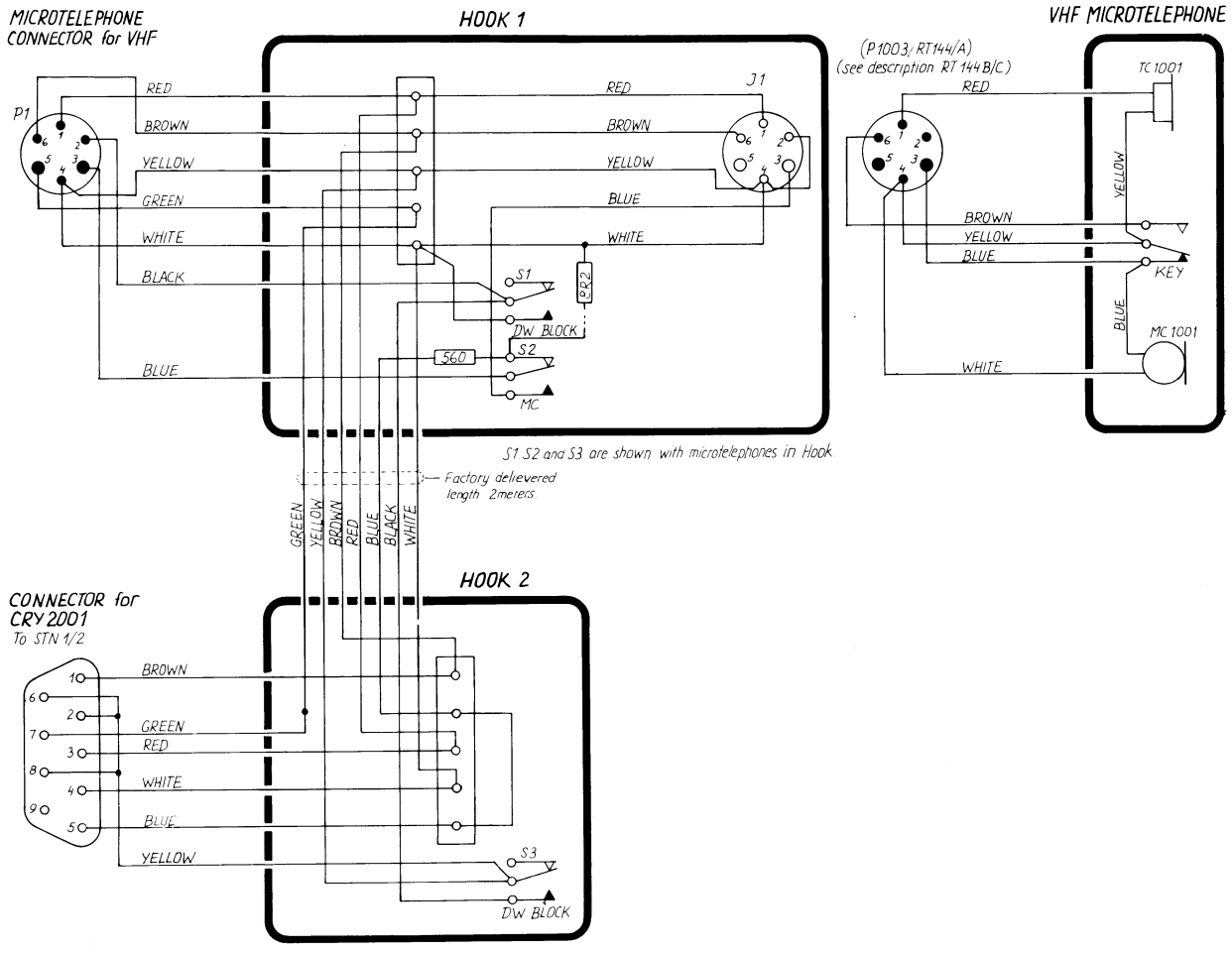
VHF microtelephone.

Connect microtelephone connector (P1) to socket (J1003) on VHF and the earlier (P1003) to (J1) on Hook 1.

The D-connector from Hook 2 must be connected to CRY2001 (stn 1 or stn 2).

NB! The resistors in hook 1 are selected, assuming the VHF set has the microphone sensitivity: V_{in} = 4 mV_{RMS} to give Δ f $\pm$3 kHz, fm 1 kHz.

INSTALLATION OF RT144/A/B/C WITH CRY2001 and H238 HANDSET ASSEMBLY AND DISTRESS DECODER.



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.

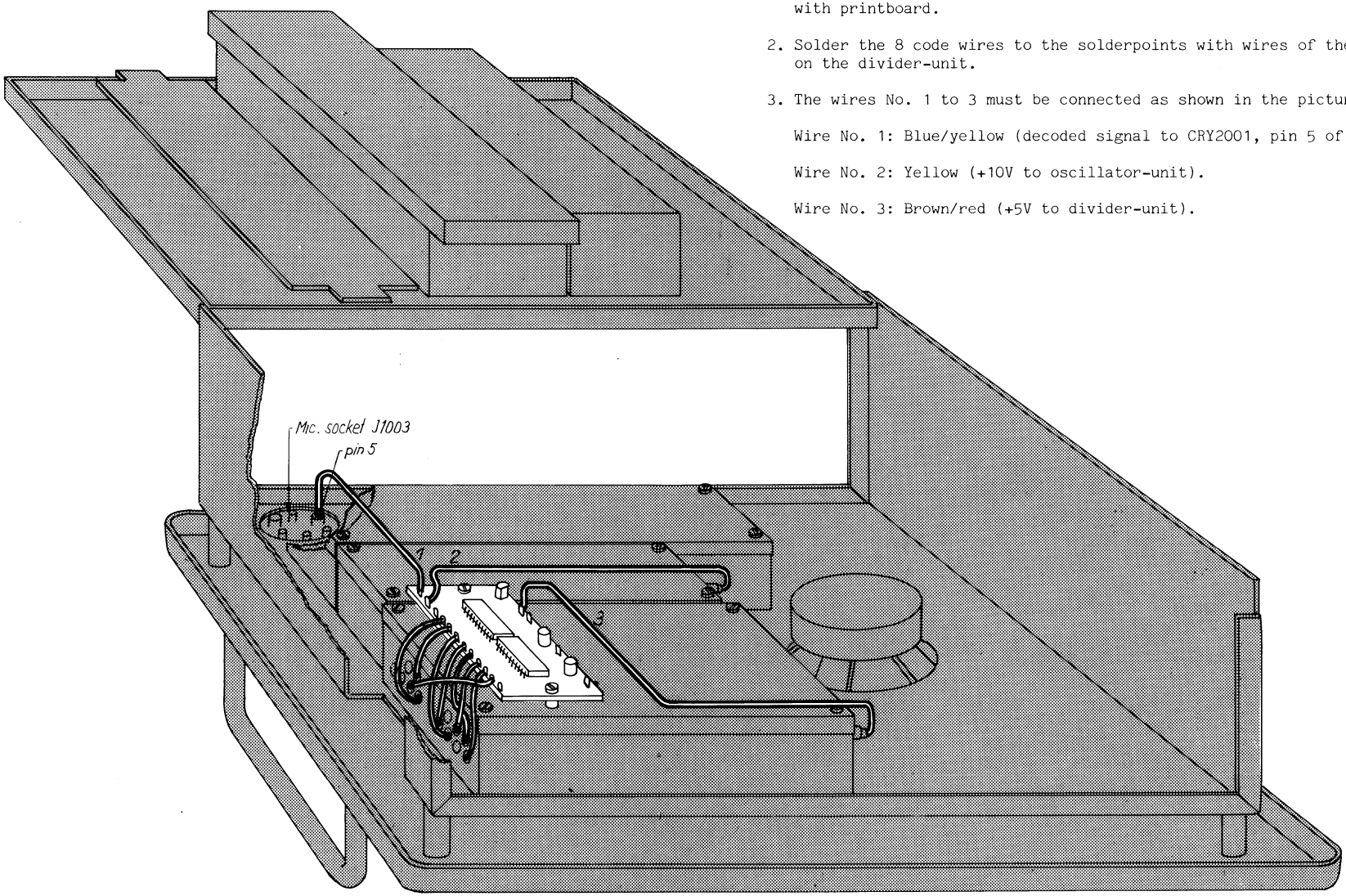
2. Solder the 8 code wires to the solderpoints with wires of the same colour on the divider-unit.

3. The wires No. 1 to 3 must be connected as shown in the picture:

   Wire No. 1: Blue/yellow (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).



INSTALLATION OF DISTRESS DECODER IN RT144B/C

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

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

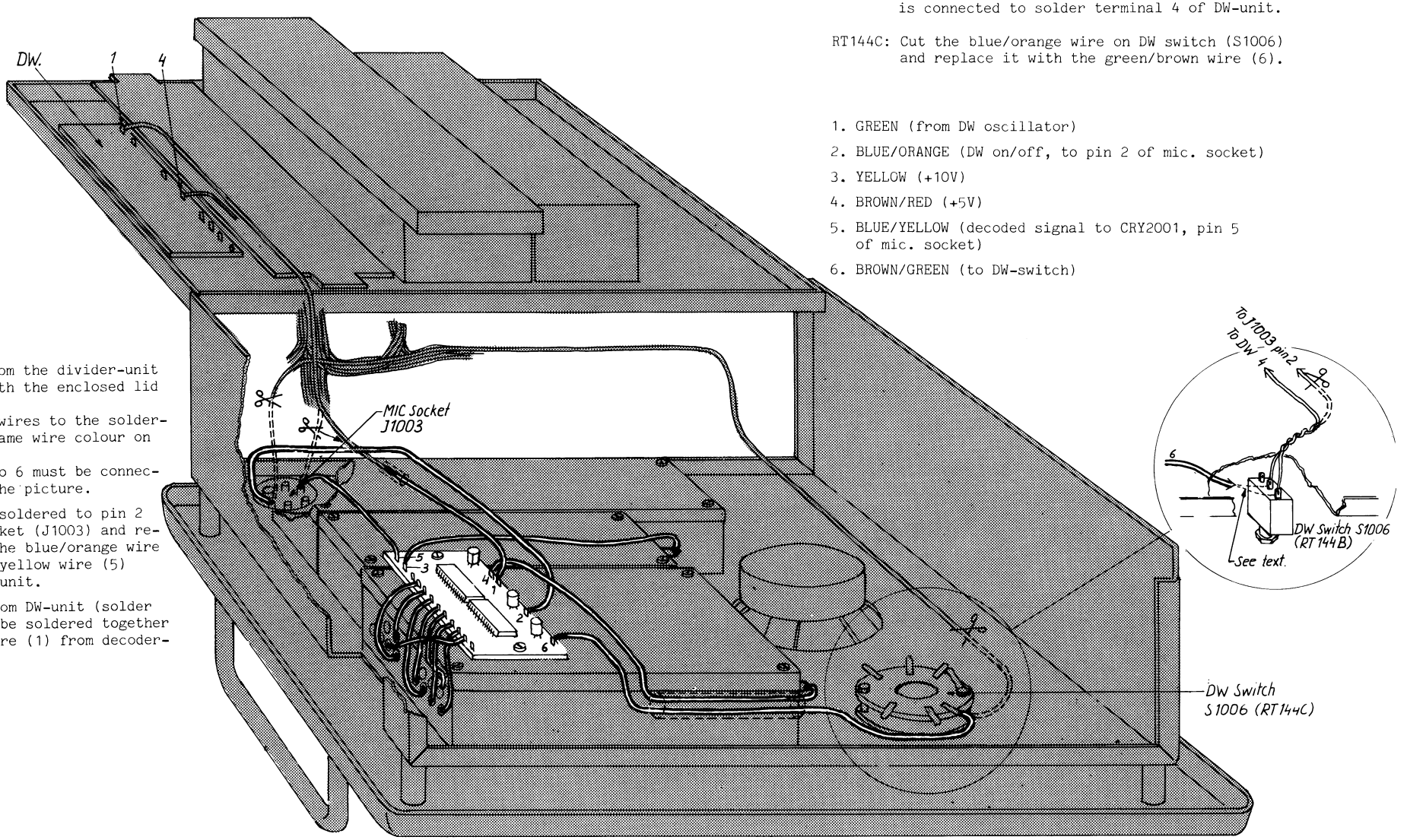
1. GREEN (from DW oscillator)
2. BLUE/ORANGE (DW on/off, to pin 2 of mic. socket)
3. YELLOW (+10V)
4. BROWN/RED (+5V)
5. BLUE/YELLOW (decoded signal to CRY2001, pin 5 of mic. socket)
6. BROWN/GREEN (to DW-switch)

MODIFICATION:

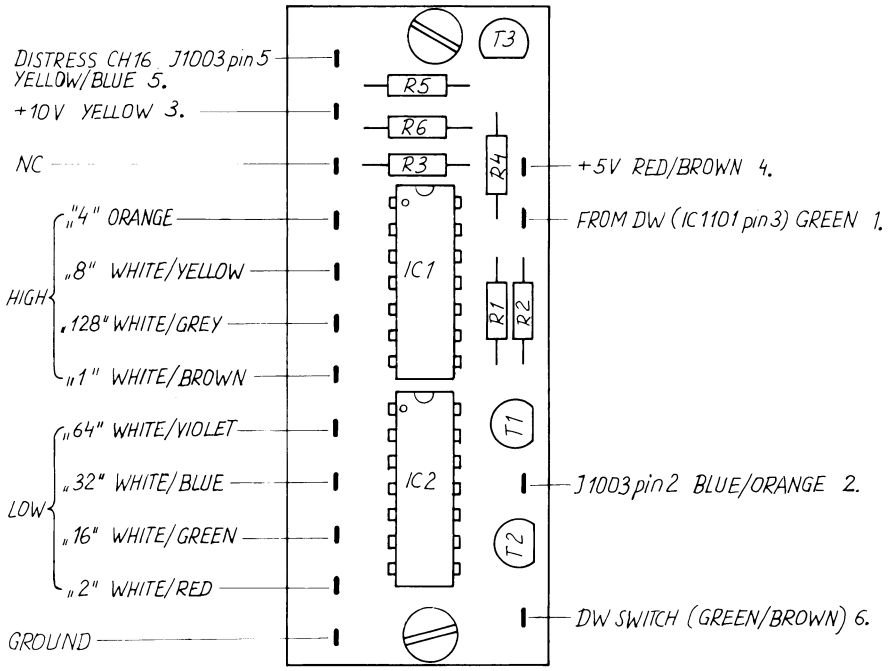
Remove the lid from the divider-unit and replace it with the enclosed lid with printboard.
Solder the 8 codewires to the solderpoints with the same wire colour on the divider-unit.
The wires Nos 1 to 6 must be connected as shown on the picture.

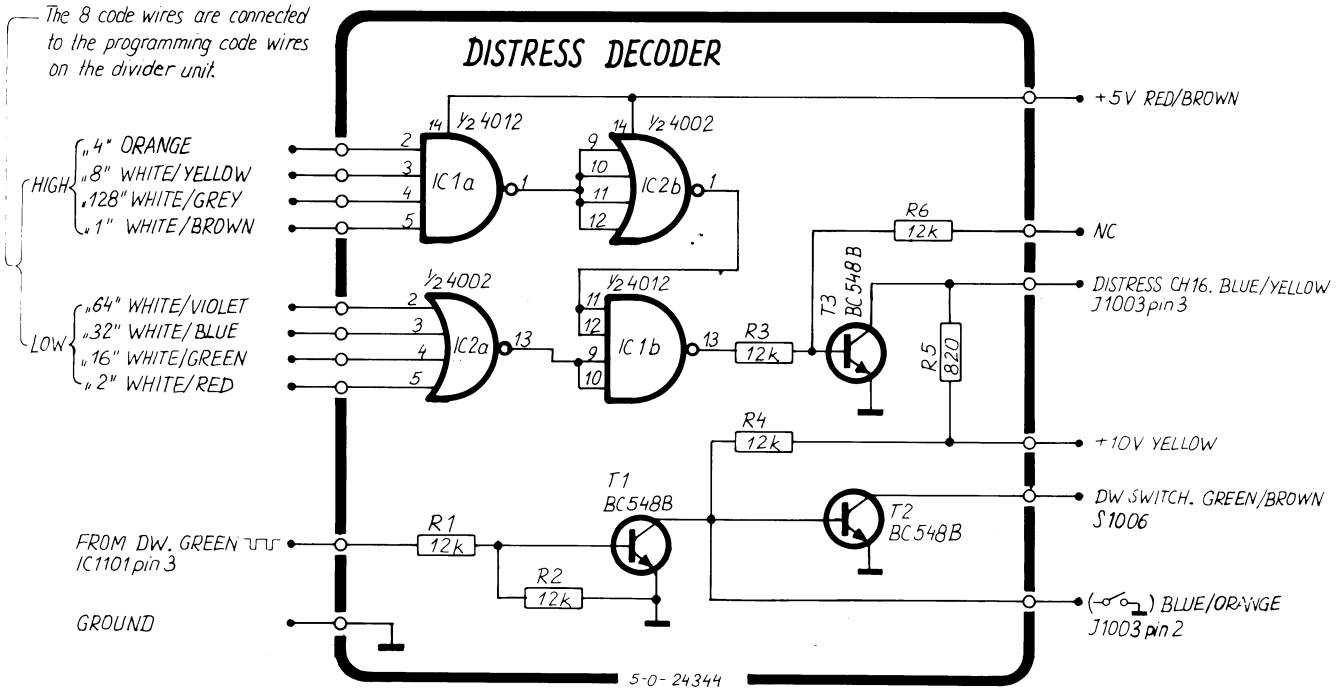
Remove the wires soldered to pin 2 and 5 on mic. socket (J1003) and replace them with the blue/orange wire (2) and the blue/yellow wire (5) from the decoder-unit.

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



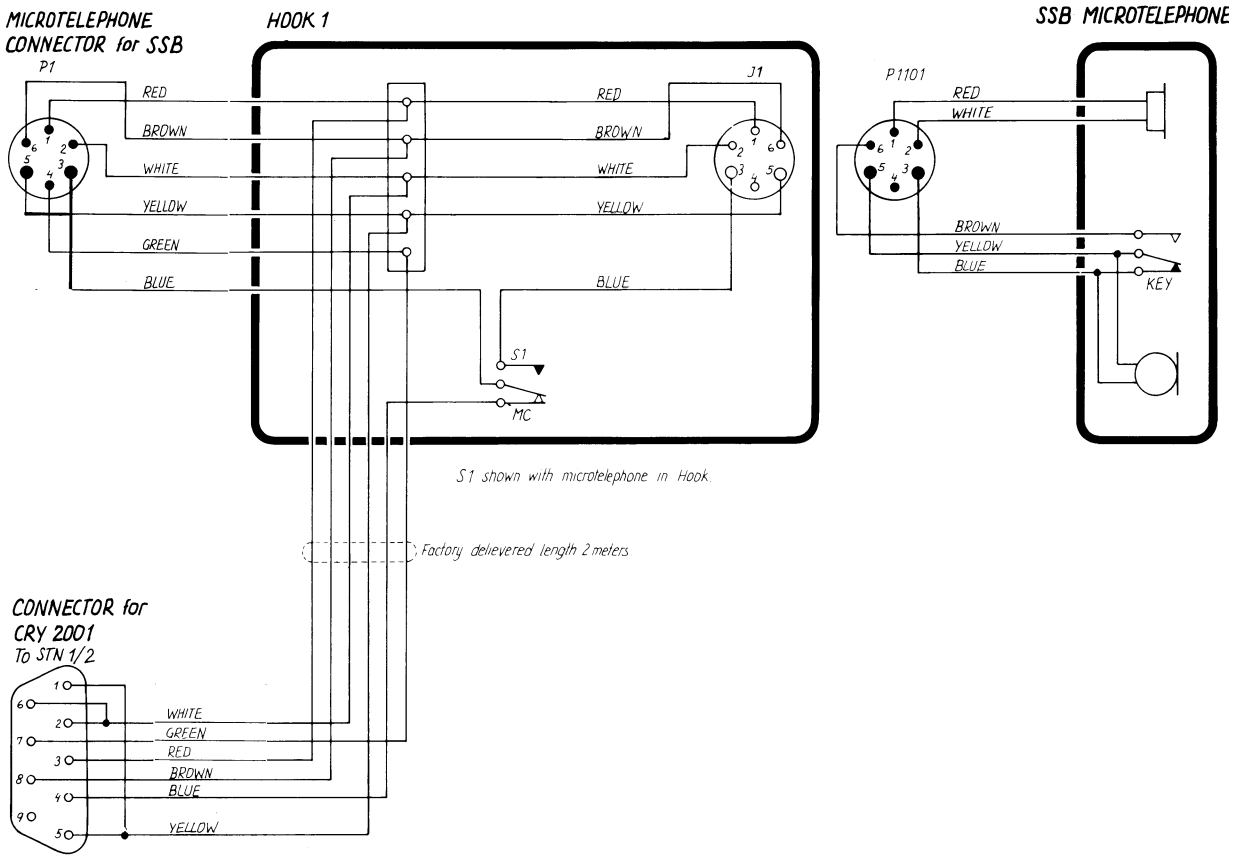
COMPONENT LOCATION AND DIAGRAM FOR H238 DISTRESS DECODER





H240 HANDSET ASSEMBLY

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



NOTE! If T121 is supplied with clipper microtelephone module H242 Handset Assembly must be used.

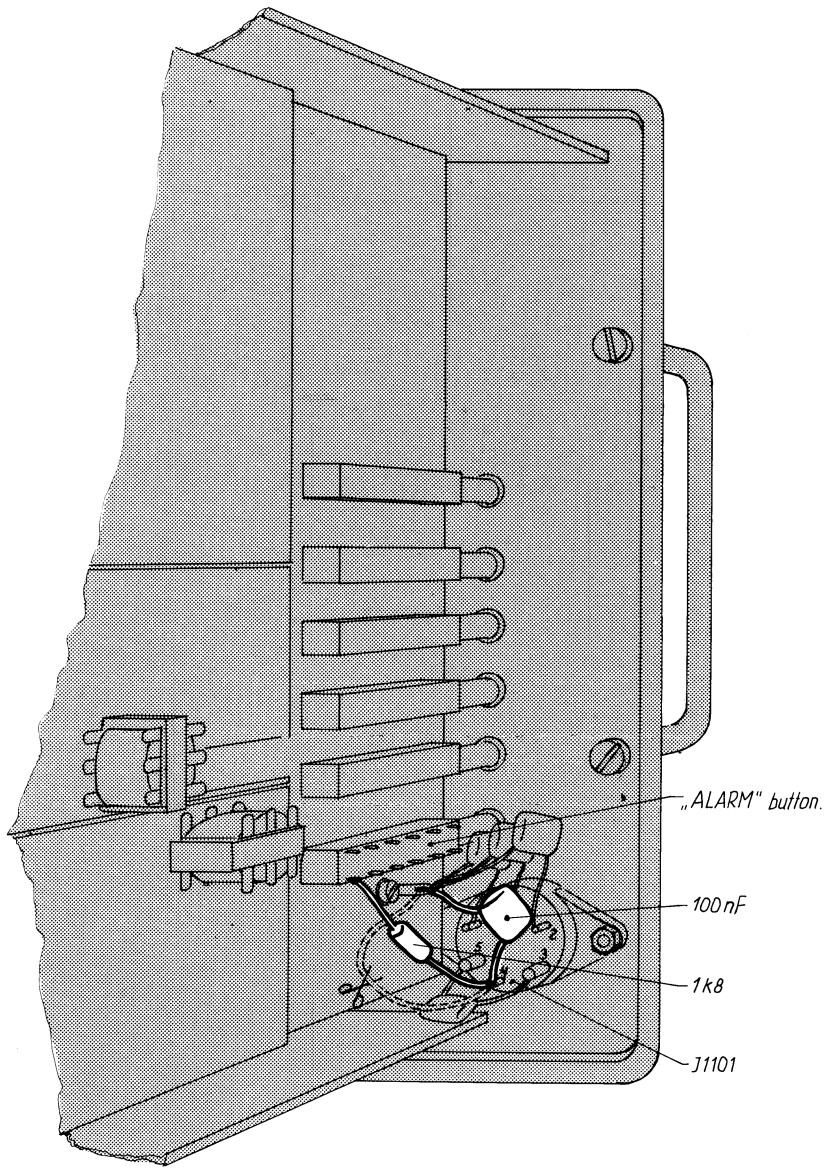
H240 HANDSET ASSEMBLY

DISTRESS OUTPUT IN T121/T124/T126/T128 FOR CRY2001/H240 HANDSET ASSEMBLY

MODIFICATION

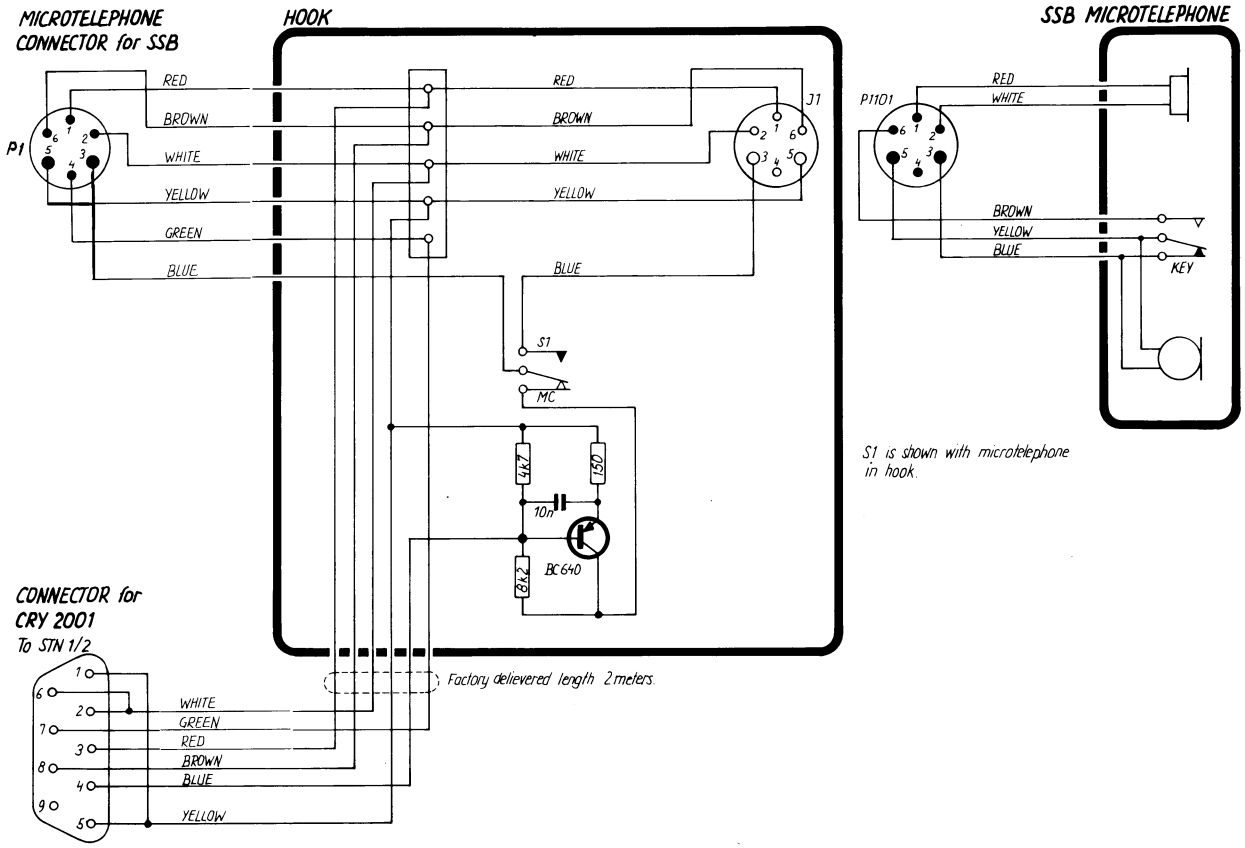
1. Remove the bypass capacitors together with the ground wire from pin No. 4 of J1101 and solder the capacitors to the ground point at chassis.

2. Solder a 1.8 kohm resistor from the push button "ALARM" to pin 4 of J1101 as shown. Solder also the 0.1 uF capacitor from pin 4 to the ground point.



3.3. H242 HANDSET ASSEMBLY

INSTALLATION OF T122 WITH CRY 2001 and H242 HANDSET ASSEMBLY



H242 HANDSET ASSEMBLY

DISTRESS OUTPUT IN T122 FOR CRY2001/H242 HANDSET ASSEMBLY

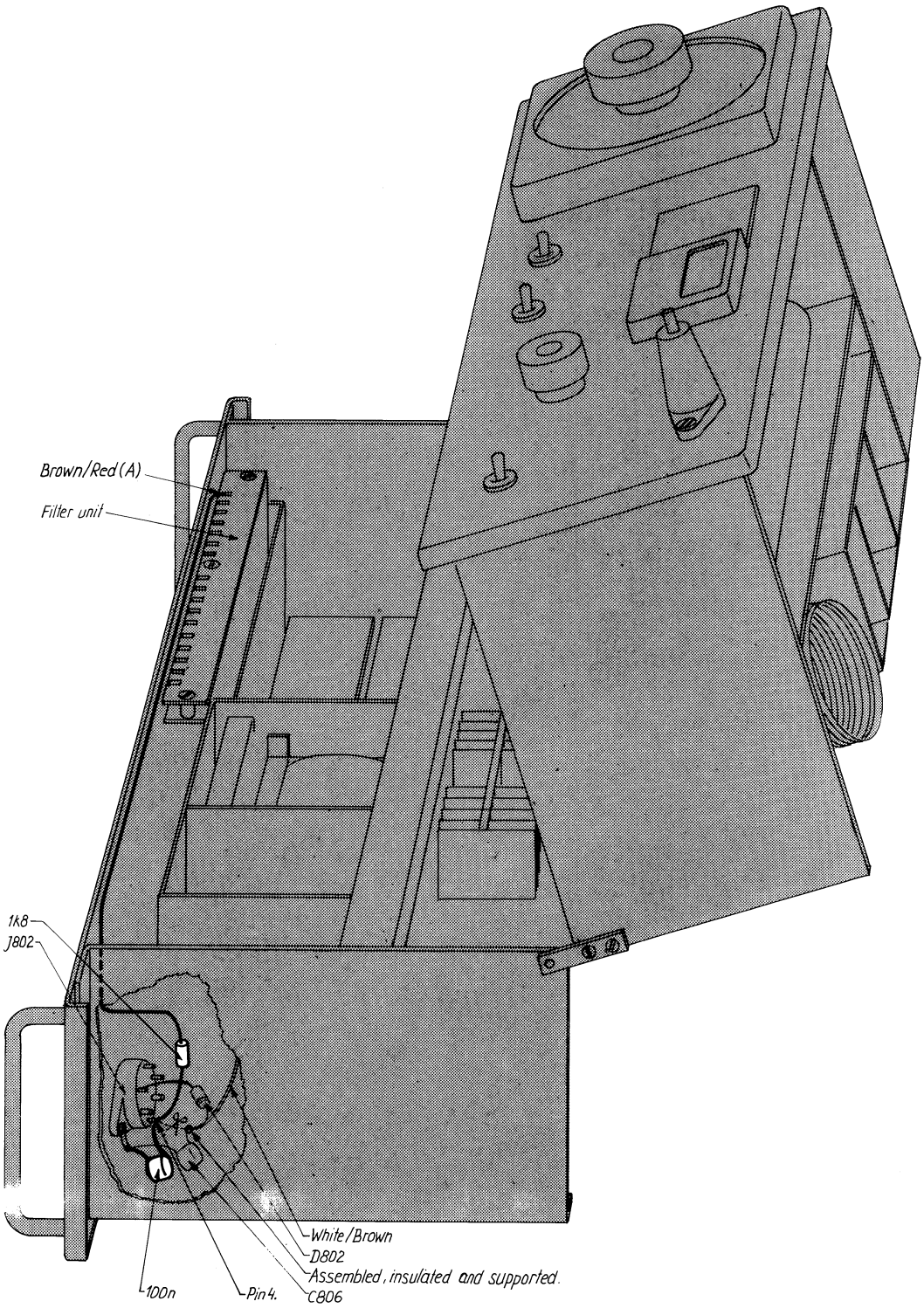
MODIFICATION

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.

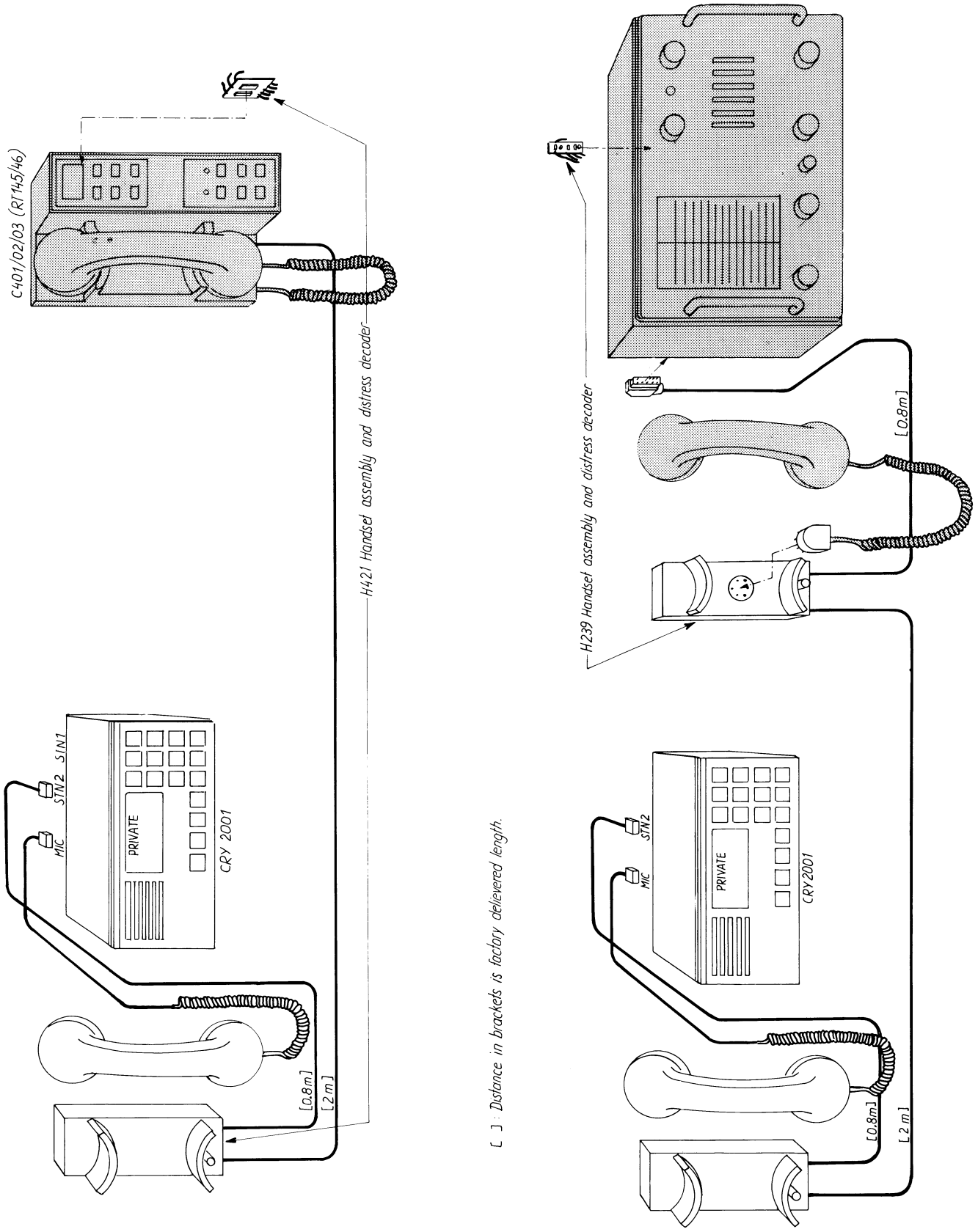
2. Solder a 1.8 kohm resistor between pin 4 of J802 and the soldering point A on the filter unit where 18V from the crystal selector (brown/red wire) is led to the crystal section as shown on the picture.

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



3.4. H421 HANDSET ASSEMBLY AND DISTRESS DECODER FOR: INTERCONNECTION TO VHF CONTROL UNIT C401/2/3

H239 HANDSET ASSEMBLY AND DISTRESS DECODER FOR: INTERCONNECTION TO VHF RT143



[ ] : Distance in brackets is factory delivered length.

INSTALLATION OF H421 HANDSET ASSEMBLY AND DISTRESS DECODER

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 points 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. 1) black to pin 7 of IC103.

2.3. Solder the +8V wire (No. 2) orange to pin 14 of IC103.

2.4. Solder the Distress out wire (No. 3) green together with the green wire in multicable from the hook for Scrambler CRY2001.

2.5. Solder the +13V wire (No. 4) grey to the + end of electrolytic capacitor C134.

3. Solder the enclosed microswitch S403 on the board for 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 and R2 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 the mic+ wire (No. 5) blue together with the blue wire from channel selector (100) which has to be removed from mounting panel (500).

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.

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.

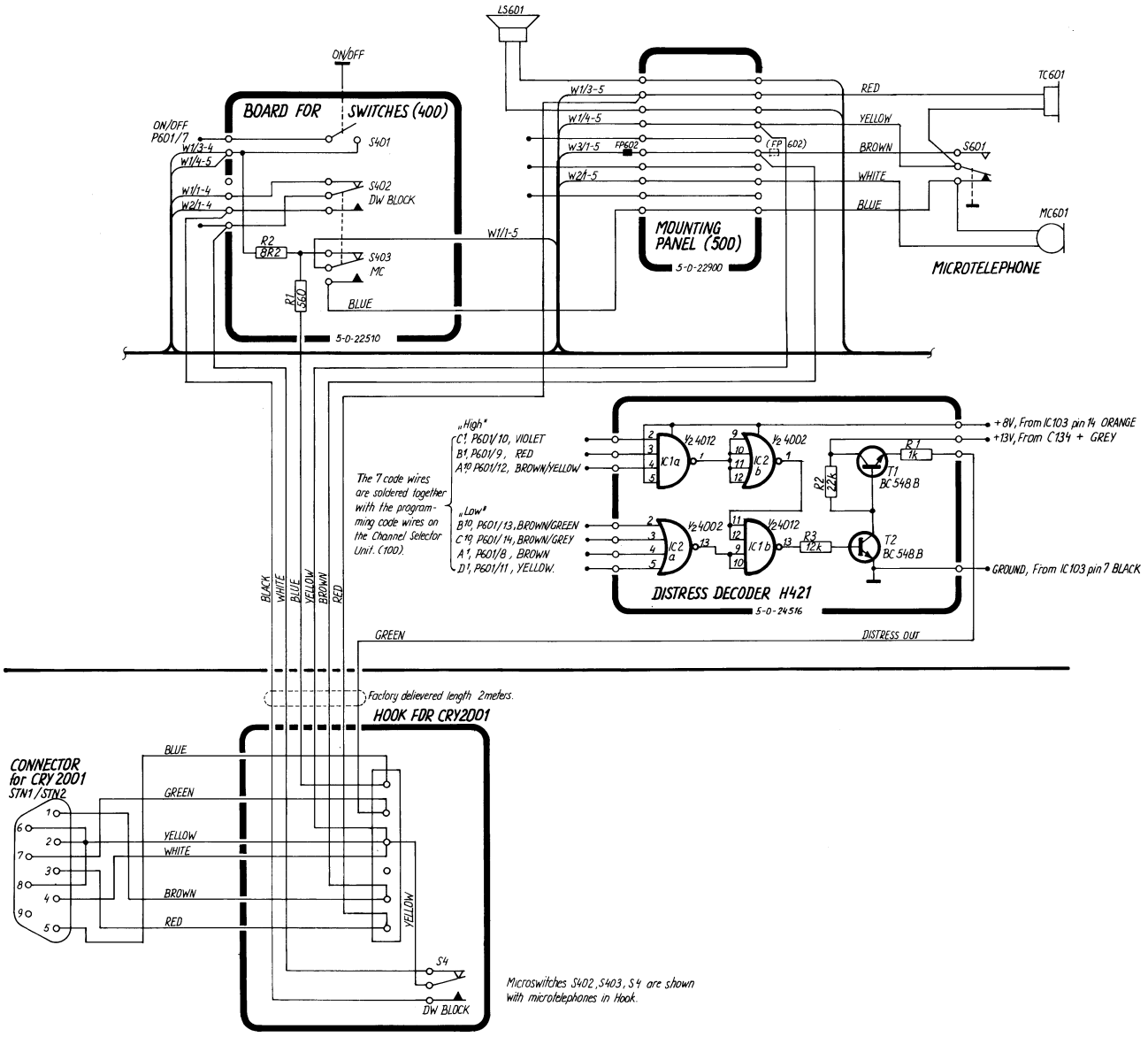
6.3. Solder the telephone wire (No. 11) red to the solder point with a red wire.

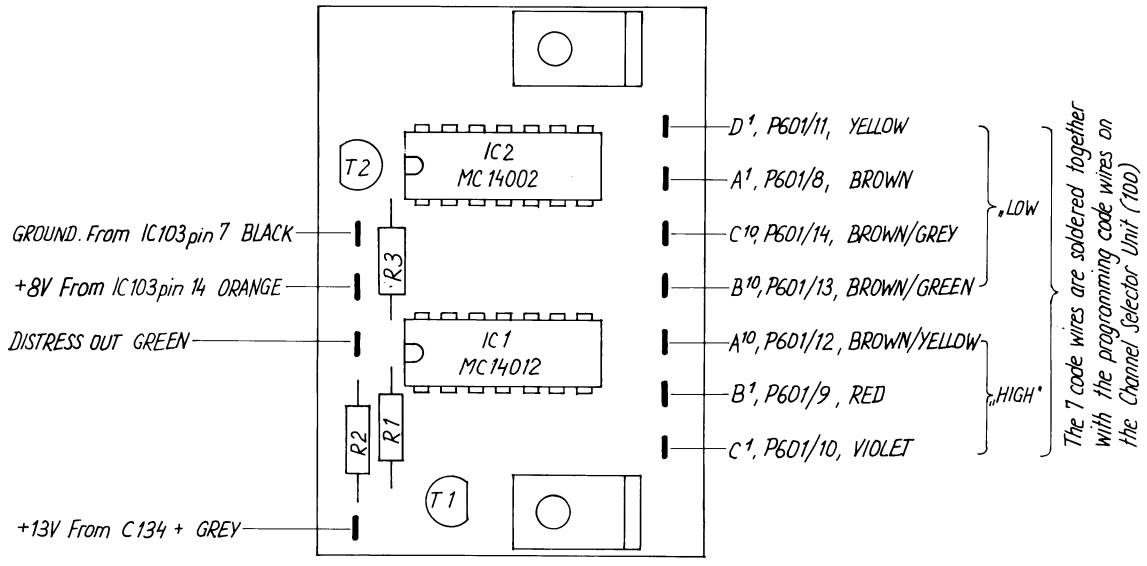
By assembling be careful and avoid wires being squeezed under print boards.

CRY2001 INTERFACE

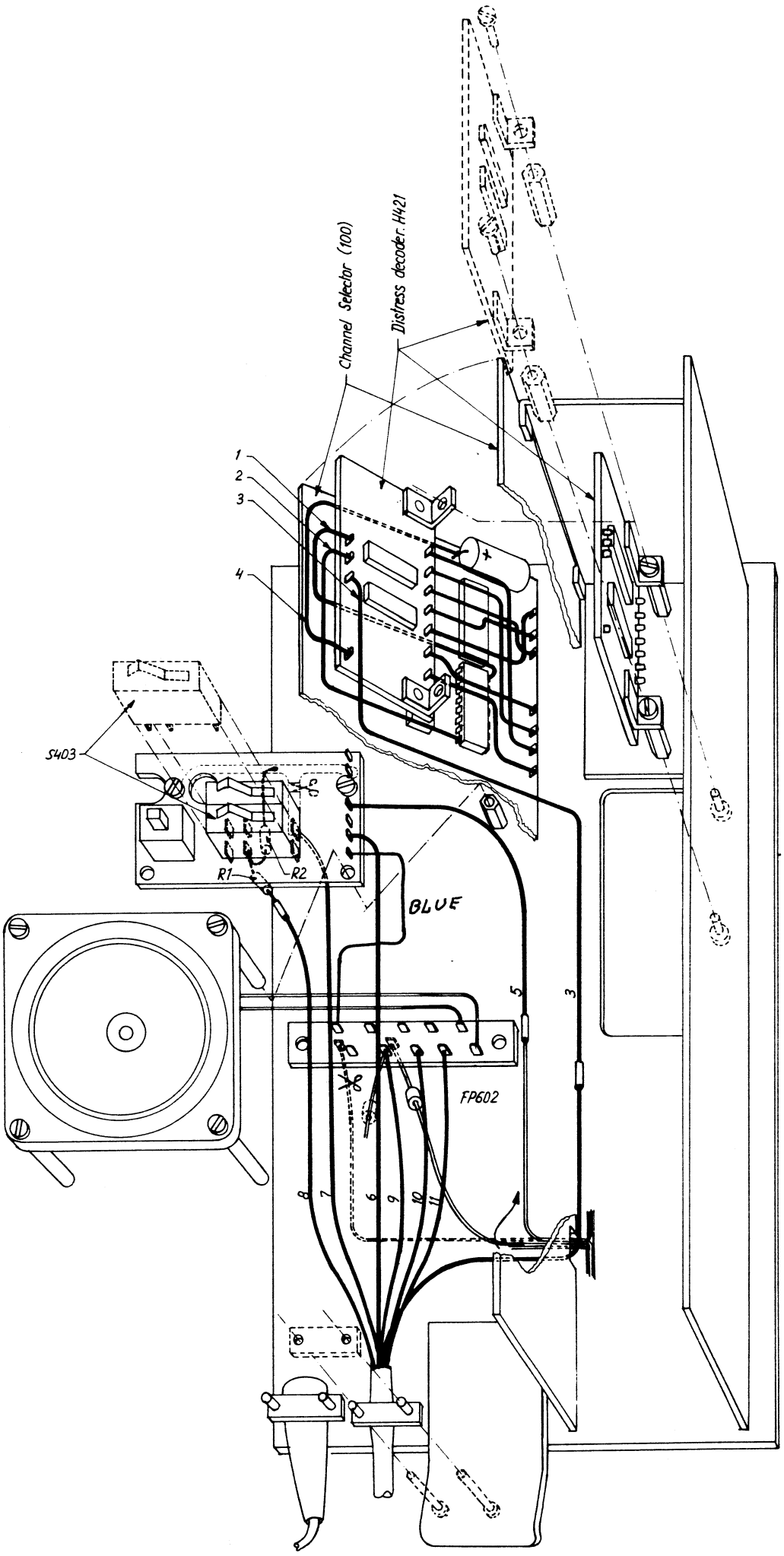
INSTALLATION, COMPONENT LOCATION AND DIAGRAM FOR H421 DISTRESS DECODER

INSTALLATION OF CONTROL UNIT C401/2/3 WITH CRY2001 and H421 HANDSET ASSEMBLY and DISTRESS DECODER





INSTALLATION OF DISTRESS DECODER IN C401/2/3

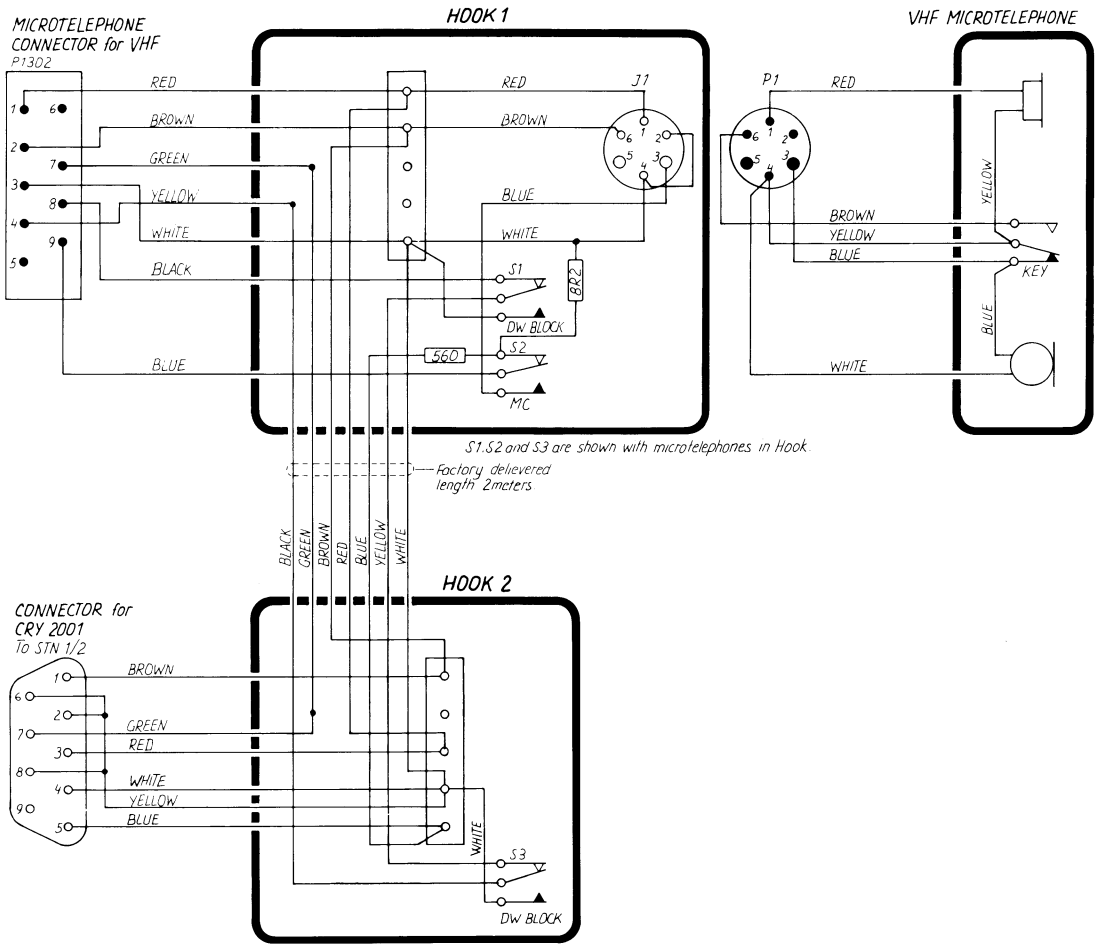


INSTALLATION OF H239 HANDSET ASSEMBLY AND DISTRESS DECODER

1. Remove the old hook for RT143 and place Hook 1 from H239 instead.
2. Disconnect the handset with wire from the earlier 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. Place Hook 2 for CRY2001 handset near CRY2001.
6. The D-connector from hook 2 must be connected to CRY2001 (Stn 1 or Stn 2).

NB The resistors in hook 1 are selected, assuming the VHF has the microphone sensitivity: Vin = $4mV_{RMS}$ to give $\Delta f = \pm 3$ kHz, fm = 1 kHz.

INSTALLATION OF RT143 WITH CRY2001 and H239 HANDSET ASSEMBLY AND DISTRESS DECODER.

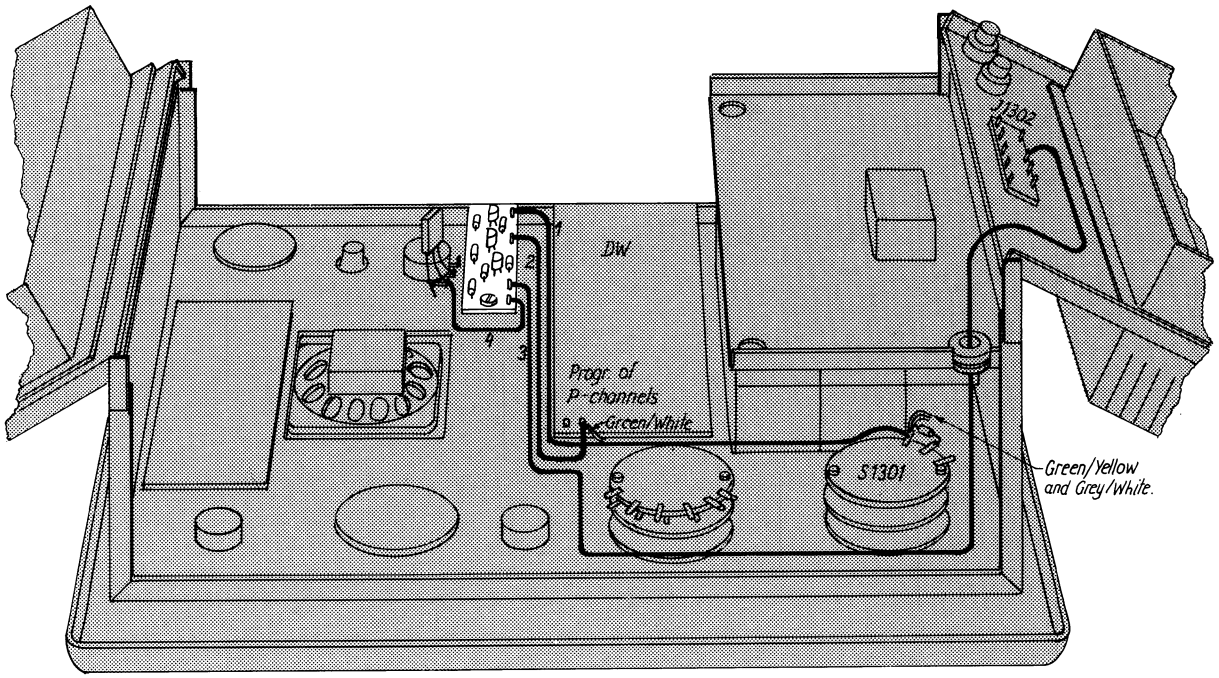


H239 HANDSET ASSEMBLY AND DISTRESS DECODER

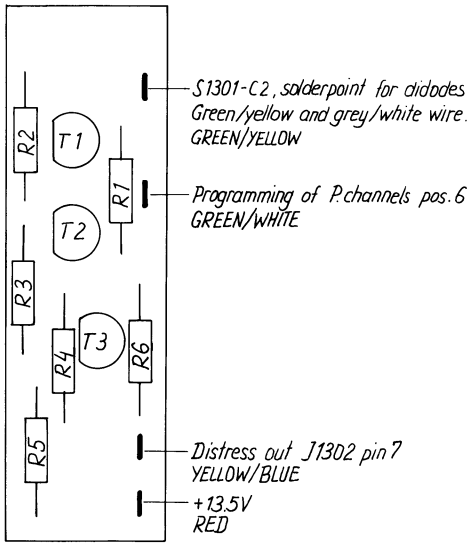
INSTALLATION OF DISTRESS DECODER IN RT143 FOR CRY2001/H239 HANDSET ASSEMBLY

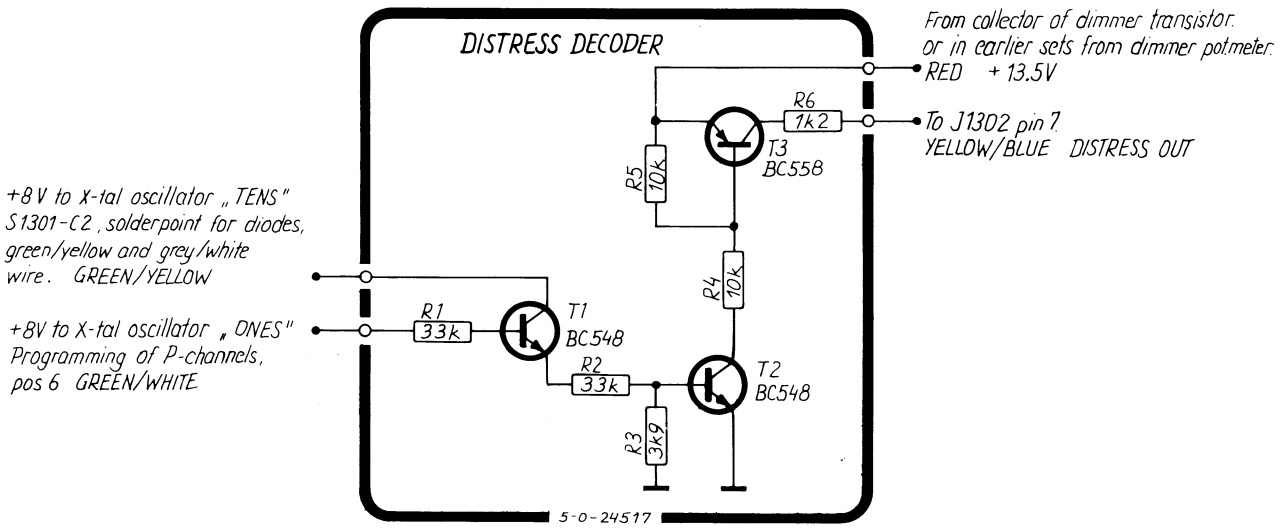
MODIFICATION

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 to either the collector of the dimmer transistor together with the blue/grey wire or in earlier sets to the dimmer potentiometer R1307 where the 13,5V wire is soldered to.

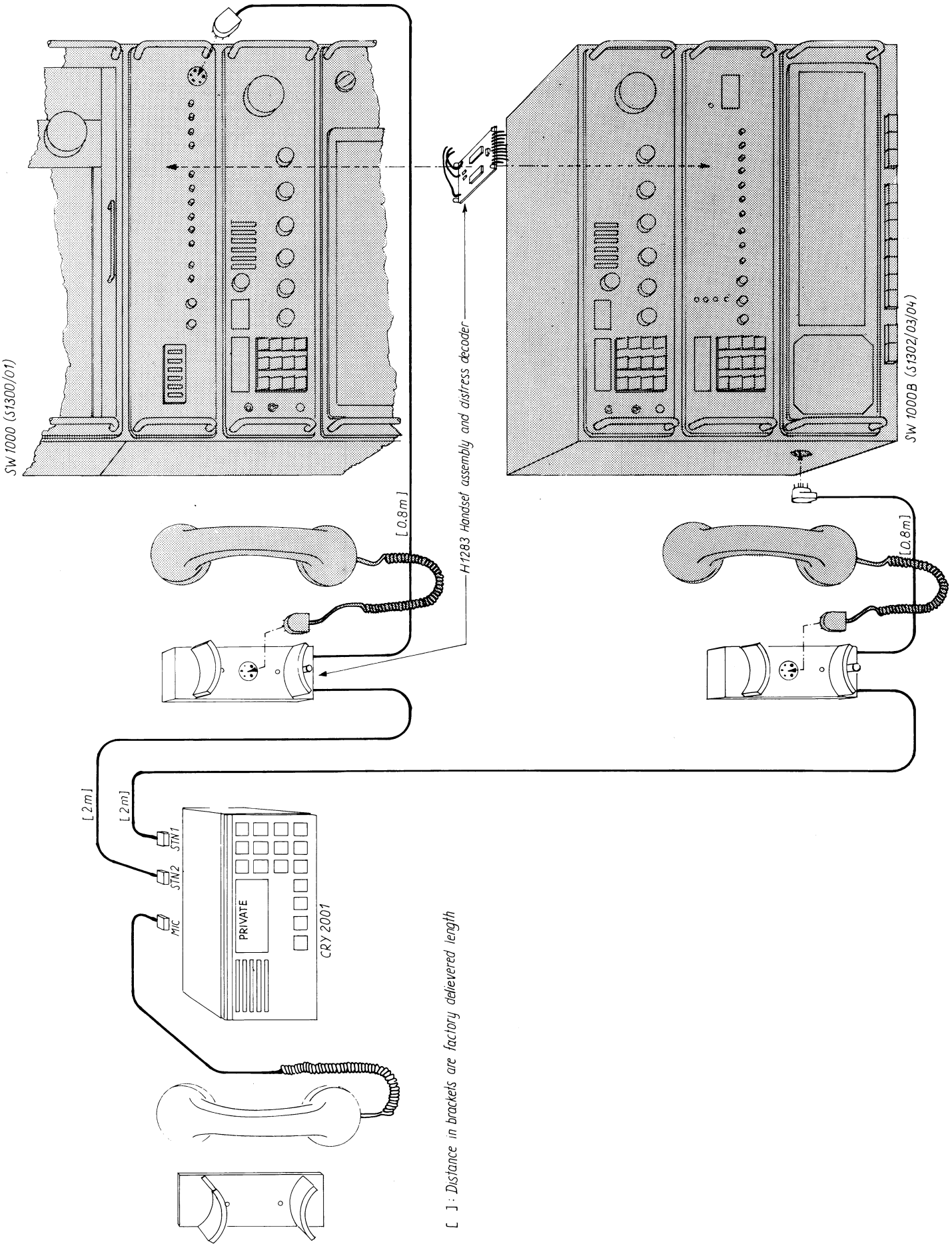


COMPONENT LOCATION AND DIAGRAM FOR H239 DISTRESS DECODER





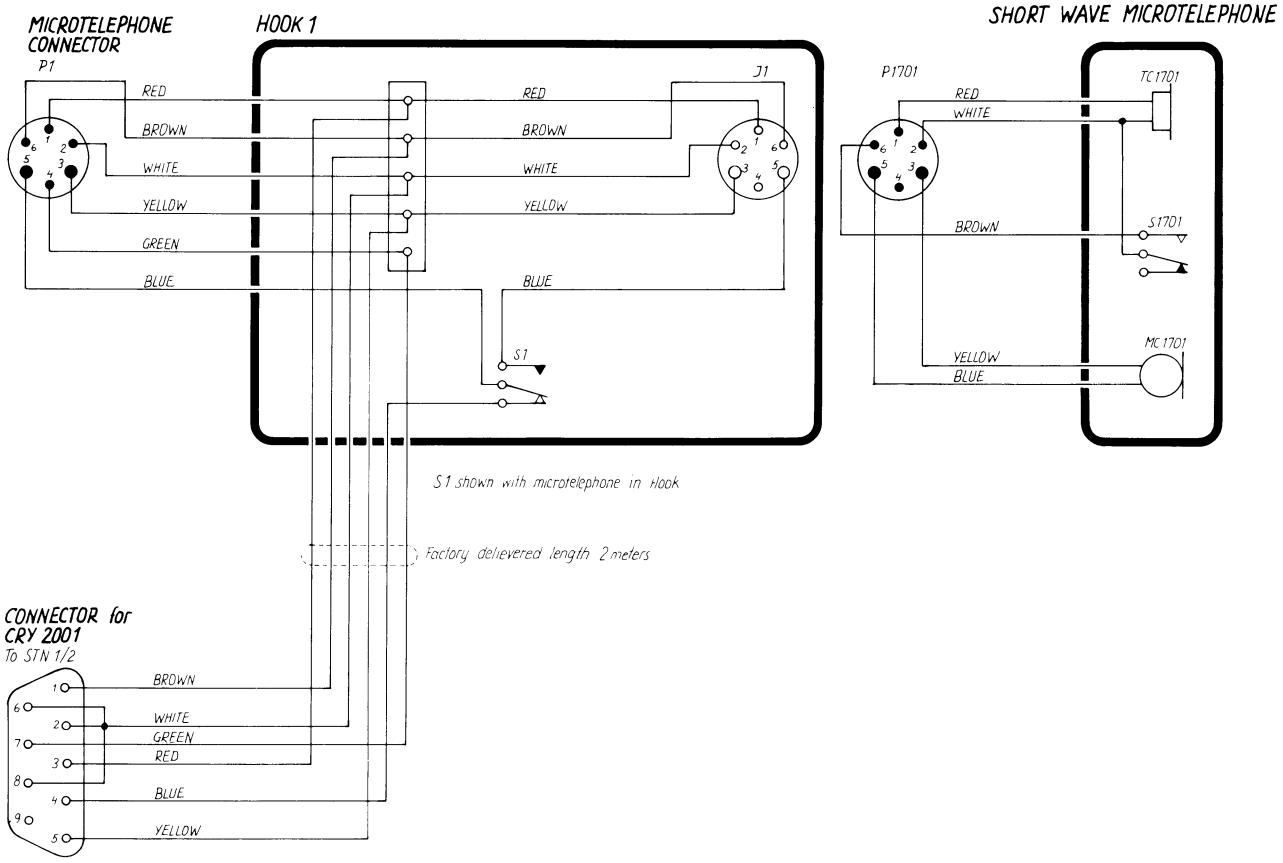
3.5. H1283 HANDSET ASSEMBLY AND DISTRESS DECODER FOR: INTERCONNECTION TO SHORT WAVE PROGRAMME 1000/1000/B



[ ] : Distance in brackets are factory delievered length

H1283 HANDSET ASSEMBLY AND DISTRESS DECODER

INSTALLATION OF S1300/01/02/03/04/ WITH CRY2001 and H1283 HANDSET ASSEMBLY



CRY2001 INTERFACE A

H1283 HANDSET ASSEMBLY AND DISTRESS DECODER

INSTALLATION OF DISTRESS DECODER IN S1300/01 FOR CRY2001/H1283 HANDSET ASSEMBLY

MODIFICATION

1. The pcb with the distress decoder has to be soldered into the DIVIDER UNIT (100).

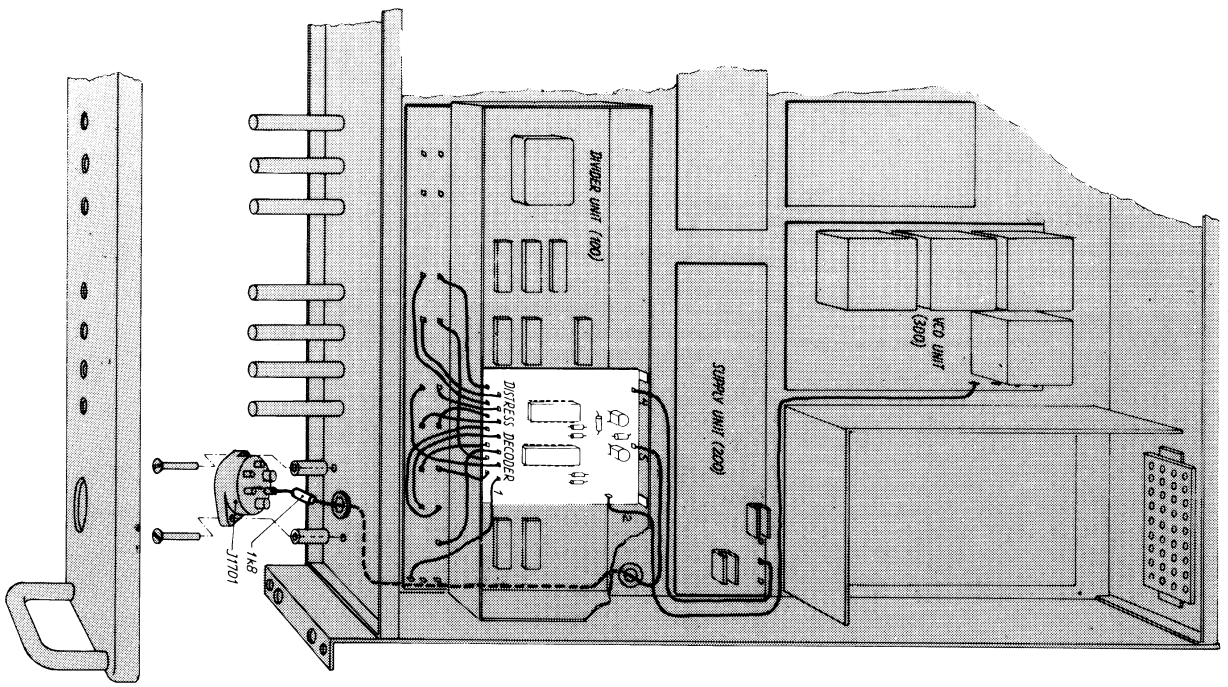
2. Solder the 13 code wires to the solder points on the divider pcb (same colour to the same colour).

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 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.



H1283 HANDSET ASSEMBLY AND DISTRESS DECODER

INSTALLATION OF DISTRESS DECODER IN S1302/03/04 FOR CRY2001/H1283 HANDSET ASSEMBLY

MODIFICATION

1. The pcb with the distress decoder has to be soldered into the DIVIDER UNIT (100).

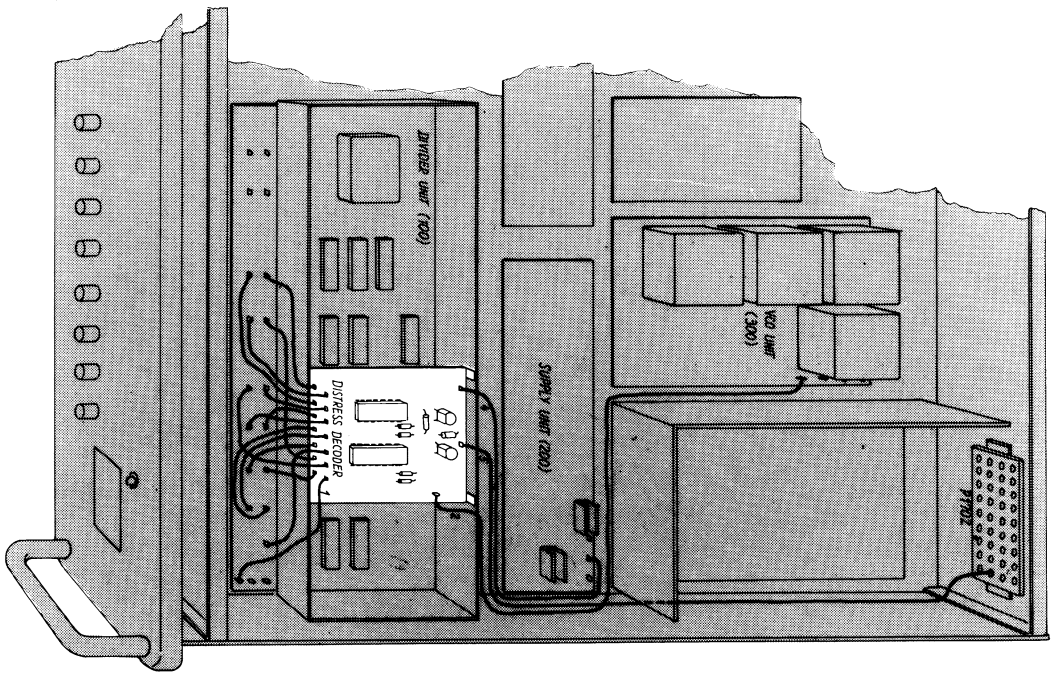
2. Solder the 13 code wires to the solder points on the divider pcb (same colour to the same colour).

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.



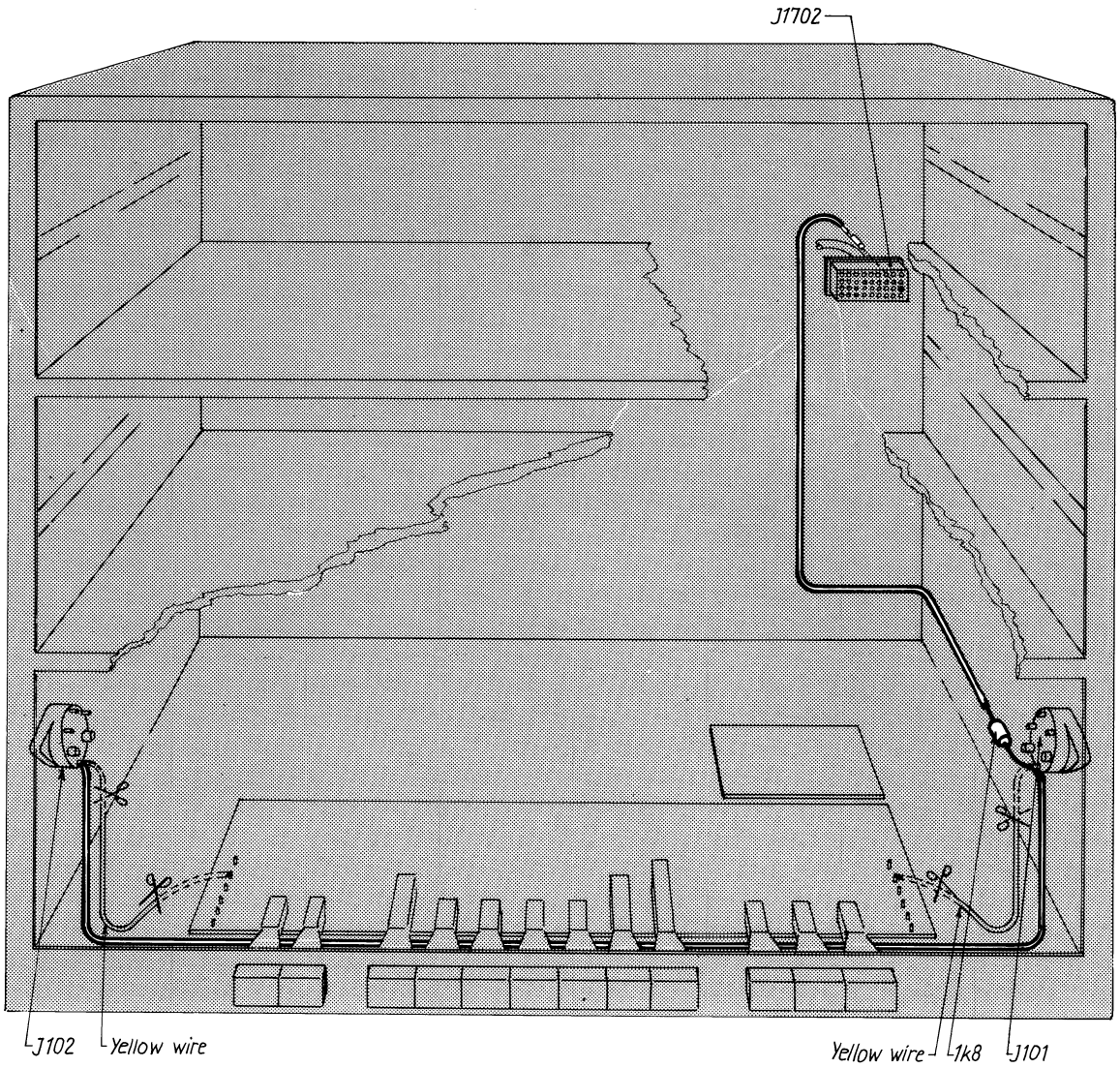
7 and 8 Modification in Rack H1235: see next page.

7. In rack H1235:

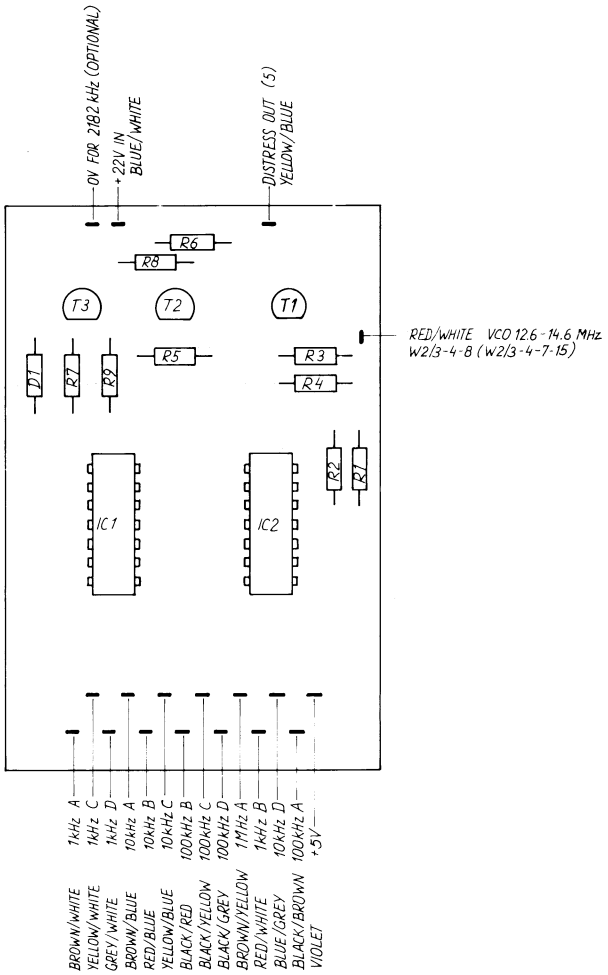
   Insert a yellow/blue wire in jack J1702 pin No. 35 and quide the wire into the microtelephone jack J101 pin No. 4 with 1.8 kohm on pin No. 4. Remove the yellow wire (22V) from both the jack J101 and the aerial switch pcb.

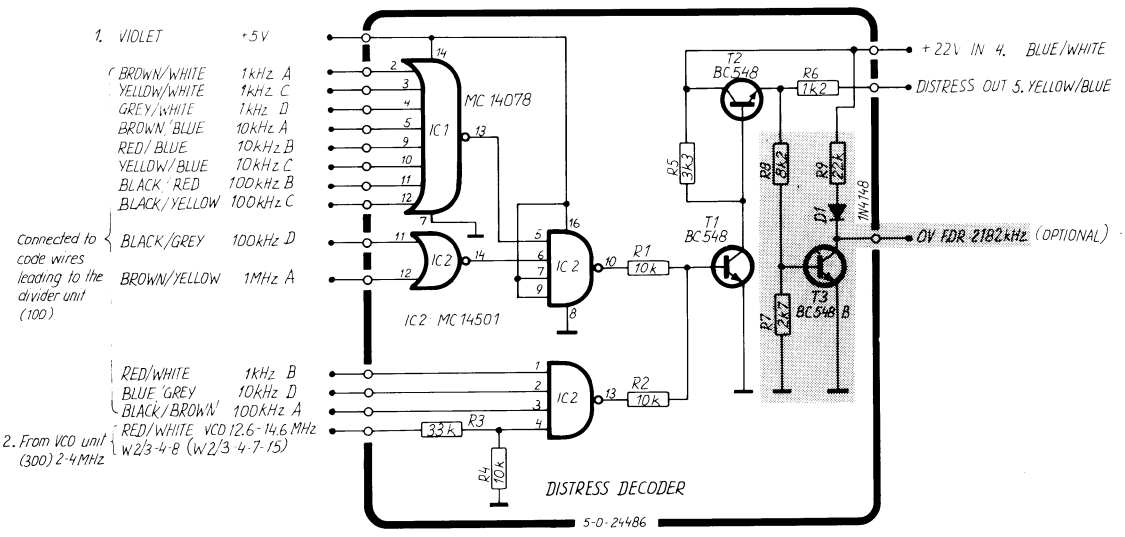
8. In rack H1235:

   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.

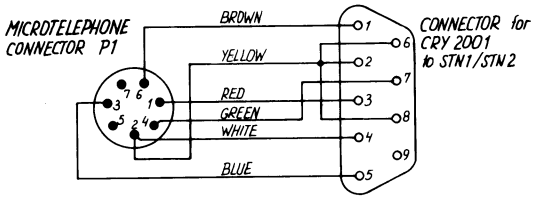


COMPONENT LOCATION AND DIAGRAM FOR H1283 DISTRESS DECODER





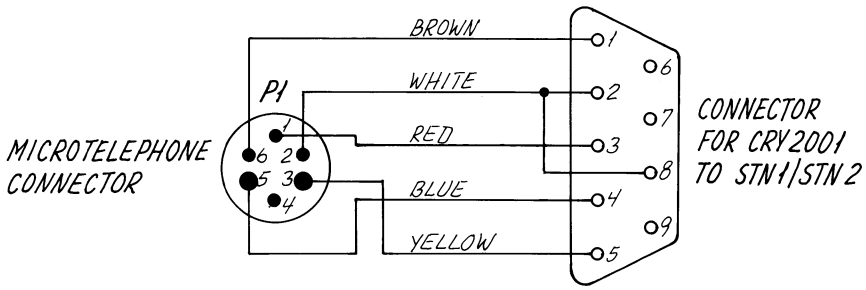
3.6 DIAGRAM OF DIRECT INTERCONNECTION BETWEEN RT2047/T2031 AND CRY2001 WITHOUT HANDSET ASSEMBLY H2082



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.

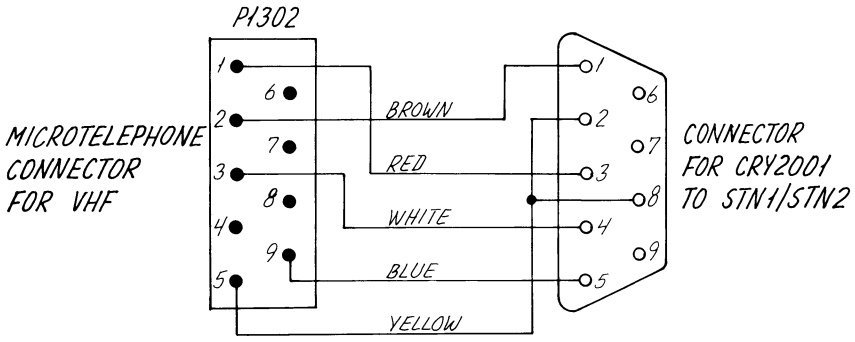
DIAGRAM OF DIRECT INTERCONNECTION BETWEEN RT144A/B/C AND CRY2001 WITHOUT HANDSET ASSEMBLY H238



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 frontplate.

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

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

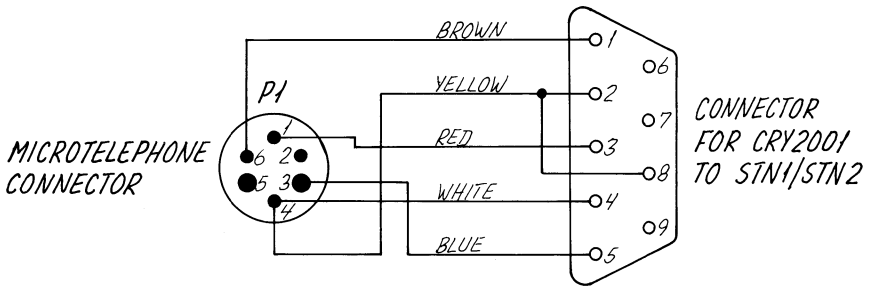


Note 1. This installation disables the Dual Watch and the Distress facilities in RT143. The Dual Watch can be enabled with a short-circuit between pin 4 and 8 of P1302, but that means the Dual Watch facility is controlled only from the switch on the frontplate.

Note 2. This installation gives only possibility for simplex operation of the station.

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

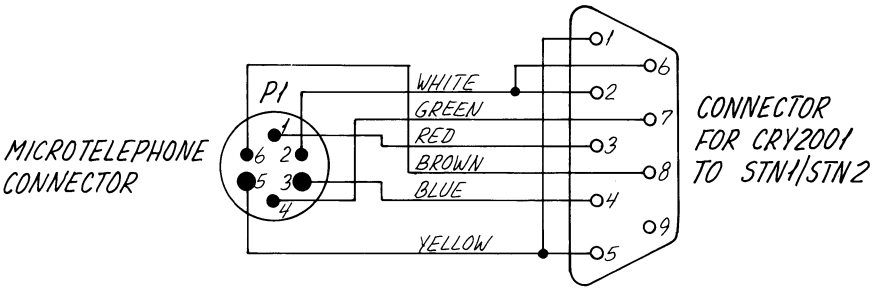
DIAGRAM OF DIRECT INTERCONNECTION BETWEEN SHORT WAVE PROGRAMME 1000/ 1000B AND CRY2001 WITHOUT HANDSET ASSEMBLY H1283



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.

DIAGRAM OF DIRECT INTERCONNECTION BETWEEN T121, T124, T126 OR T128 AND CRY2001 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.

NB! Direct interconnection between T122 and CRY2001 is not recommended because it is necessary with a buffer/amp. in the microphone as shown in the diagram of H242 Handset Assembly.

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

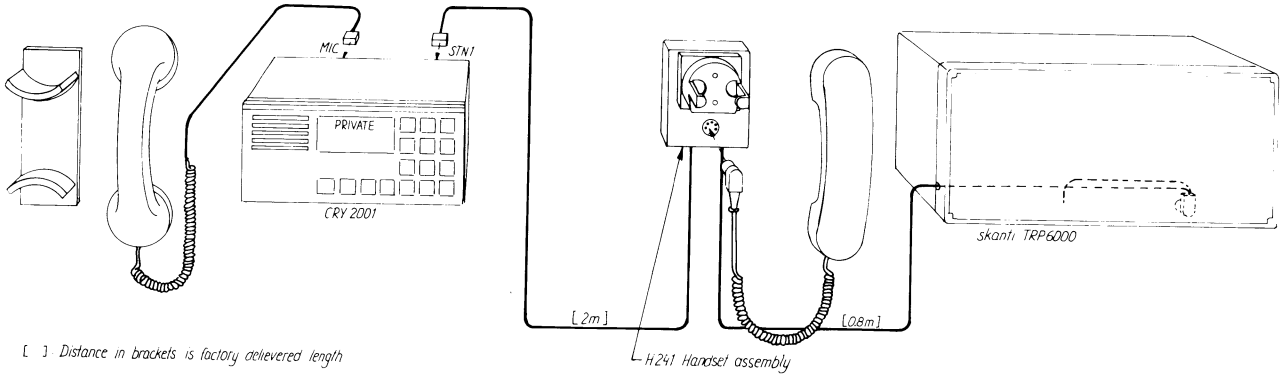
CONTENTS

4.0. INTERFACE FOR SAILOR SCRAMBLER TO MISCELLANEOUS EQUIPMENT

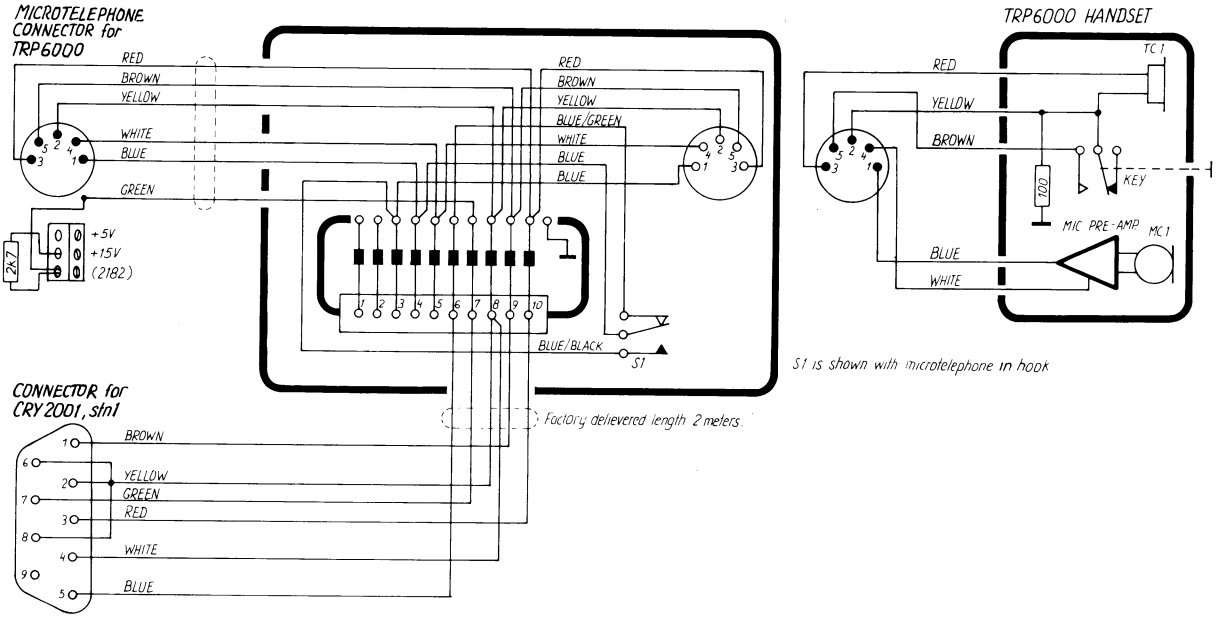
4.1. H241 HANDSET ASSEMBLY FOR:
INTERCONNECTION TO SKANTI TRP6000

4.2. H2090 TELEPHONE MODEM FOR:
INTERCONNECTION TO LOCAL AND PUBLIC TELEPHONE SYSTEMS

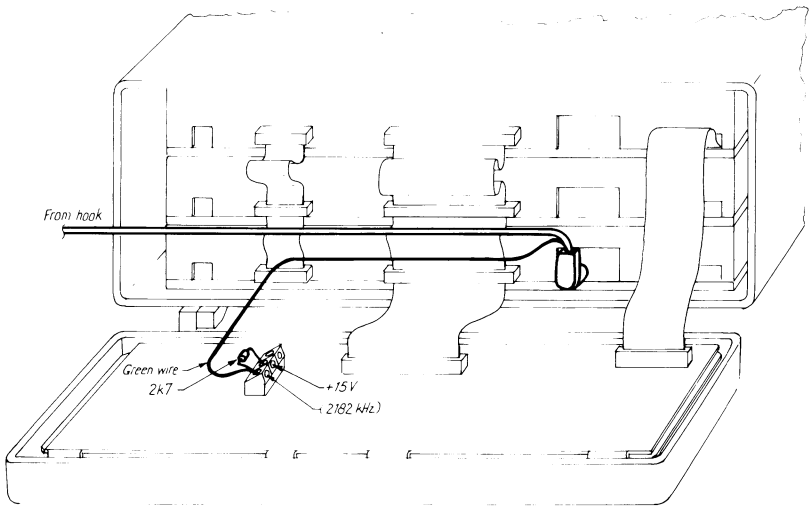
4.1. H241 HANDSET ASSEMBLY FOR INTERCONNECTION TO SKANTI SSB TRP6000



INSTALLATION OF SKANTI TRP6000 WITH SAILOR CRY2001 AND H241 HANDSET ASSEMBLY



DISTRESS OUTPUT IN TRP6000 FOR CRY2001/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. SAILOR TELEPHONE MODEM H2090

GENERAL

SAILOR telephone modem H2090 is used when the scrambler CRY2001 is to be connected to the public telephone line.

TECHNICAL DATA

Supply Voltage:	10.8 - 31.2V DC
Power Consumption:	0.5W/24V DC
Temperature Range:	-15 to +60°C
AF Output to CRY2001:	0 dBm/600 ohm
AF Input Range from Line:	-36 to -10 dBm/600 ohm
AF Output to Line: (talk and music)	Max. -10 dBm/600 ohm integration time 3s.
AF Output to Line: (code signals)	Max. -10 dBm/600 ohm integration time 0.2s.
AF Line Input Impedance:	600 ohm
DC-Line Input Impedance:	<400 ohm (Line current 16-80 mA).

DIRECTIONS FOR USE

CRY2001

TELEPHONE CALL

By means of the parallel telephone a call is made as usual. When a call has been set-up it is possible to continue by means of the scrambler. The scrambler handset is lifted off the hook and the parallel telephone handset can be put down again.

For further information see the operating manual for the scrambler CRY2001. Notice that the conversation from now on is made in simplex.

TELEPHONE ANSWER

A call can either be answered by means of the parallel 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.

The volume control on the modem H2090 is to be adjusted so that the red LED just flashes. This is done while listening.

END A CALL

When the conversation is finished the scrambler handset must be placed in the hook again. Also the parallel telephone handset must be put down 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

The microswitch SW1 switches automatically the scrambler handset on to the telephone line when the hook is lifted. This also means that as long as it is in the hook, 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.

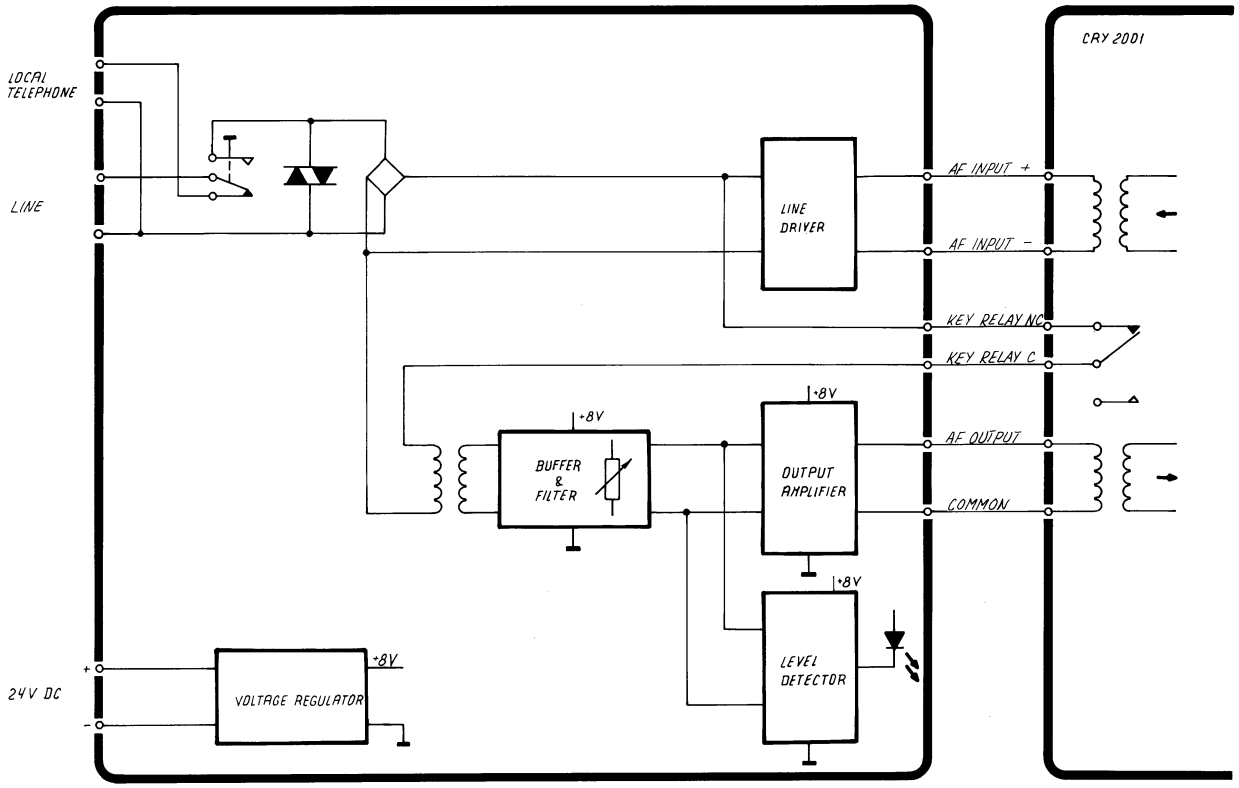
The line current is determined by the potential on the basis of T2 and R20. T2 is also line output amplifier for the AF output from the scrambler. The signal from the output transformer in the scrambler is first attenuated by the resistors R23 and R19 and then it is amplified by T2.

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

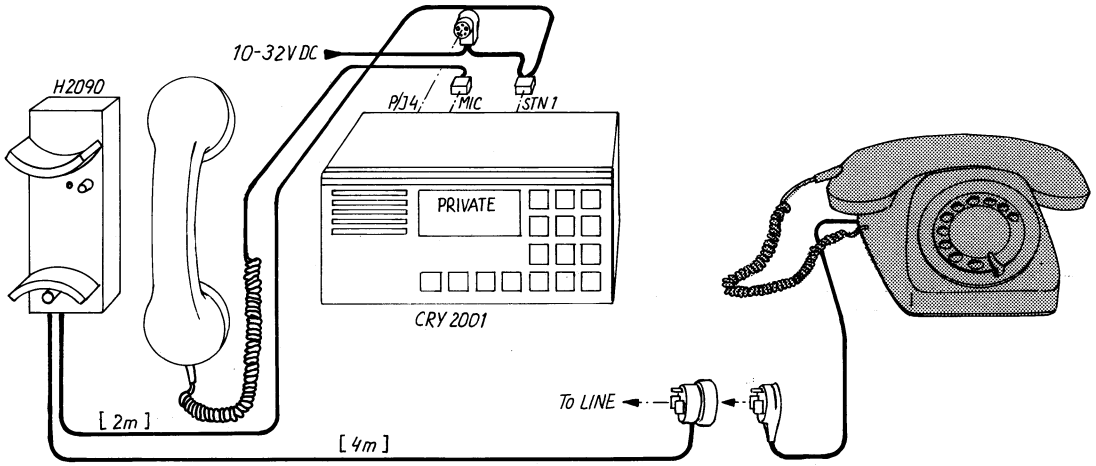
The input signal is first led through a relay in the scrambler so that the signal is disconnected when the scrambler is keyed. Then a 1:1 transformer is placed to give galvanic isolation. In the first amplifier the signal can be adjusted to nominal level by means of R3. The next two operational amplifiers form a 4. order highpass filter with a corner frequency of 300 Hz. The gain in the pass band is unity. This filter removes hum and noise which would else 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.

BLOCK DIAGRAM FOR H2090 TELEPHONE MODEM



INSTALLATION OF CRY2001 WITH TELEPHONE-MODEM H2090



[ ] : Distance in brackets is factory delievered length.

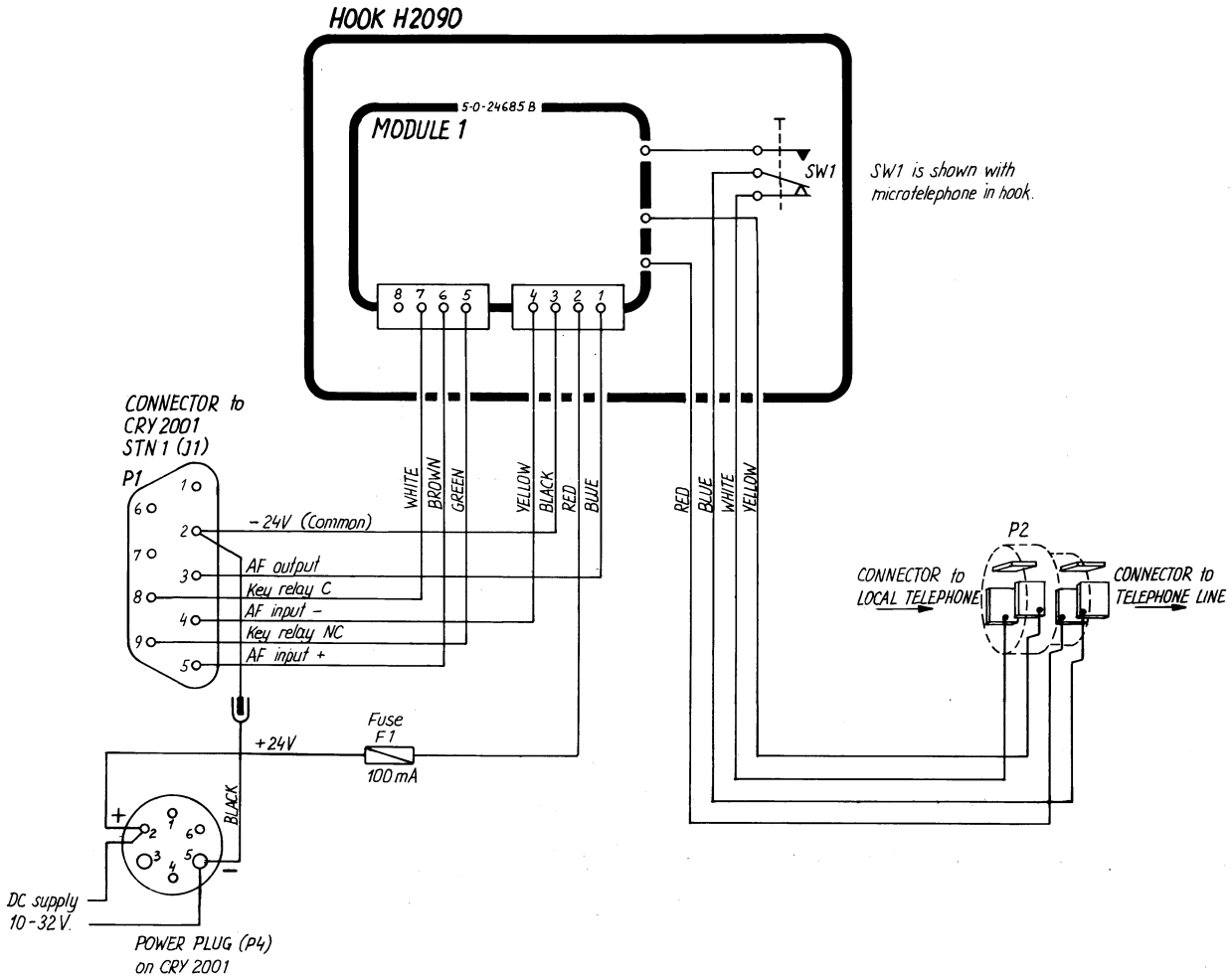
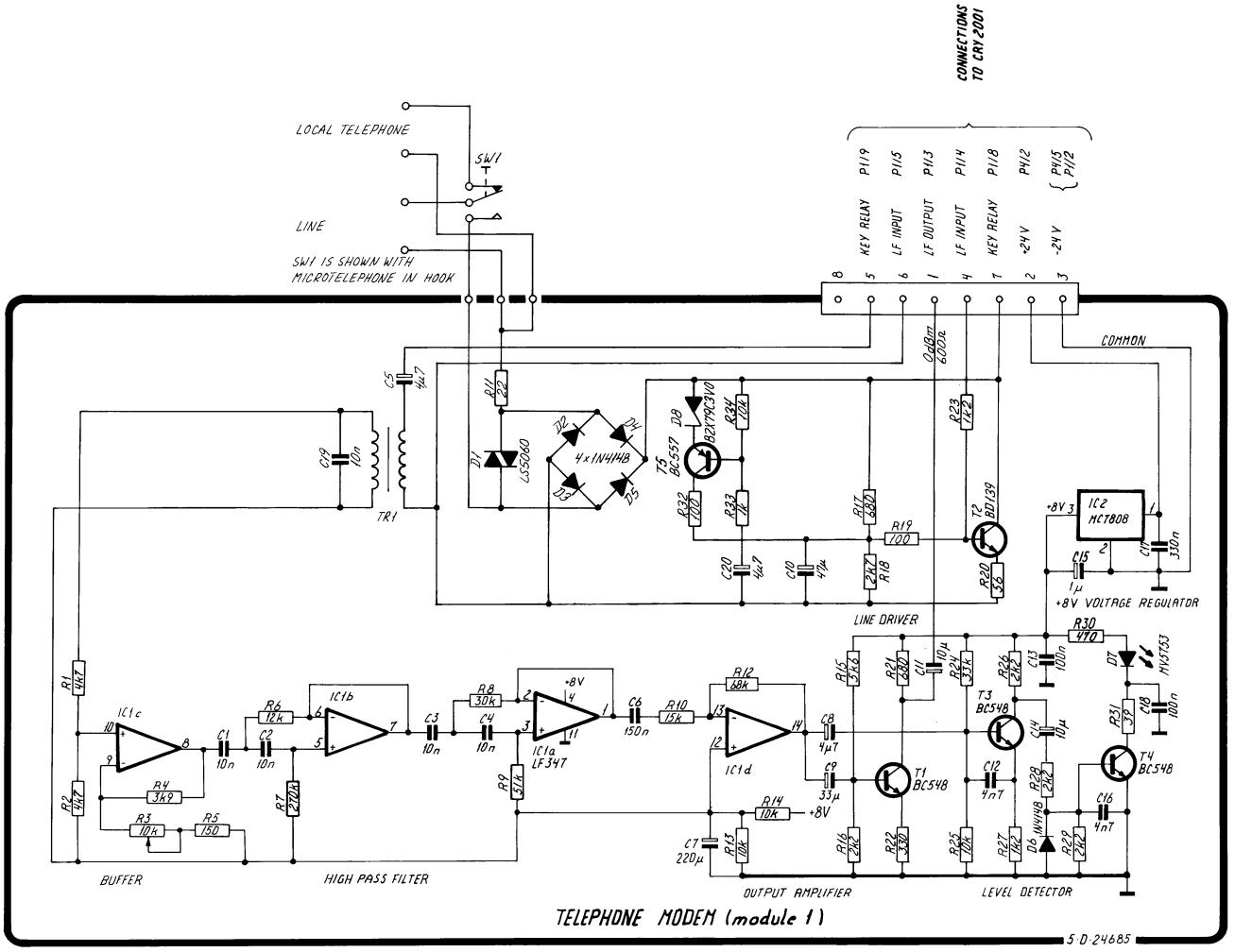
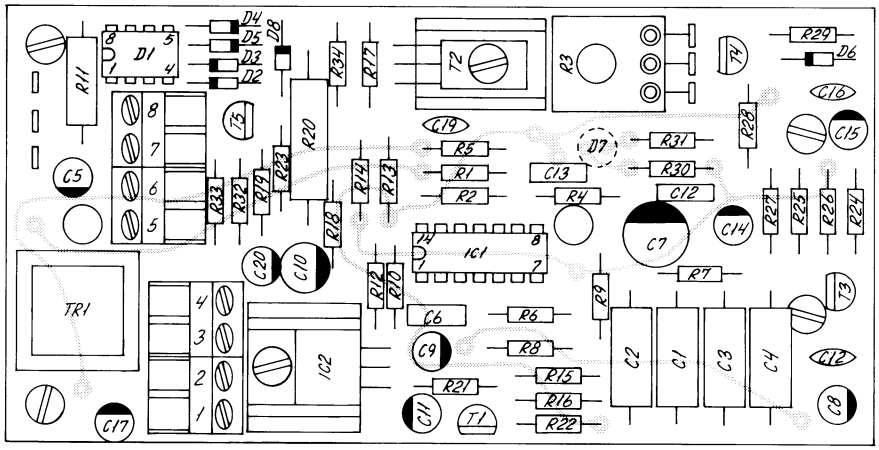


DIAGRAM FOR H2090 TELEPHONE MODEM



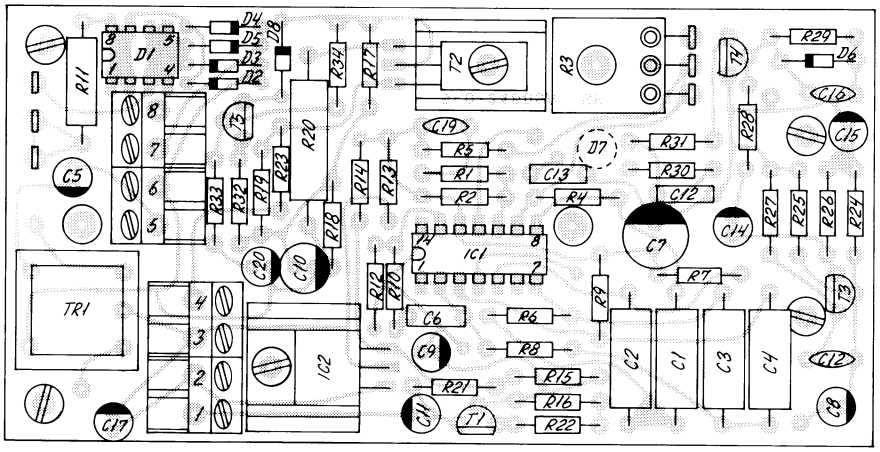
TO SW1
FROM LINE
TO TELEPHONE



1 LF OUTPUT
2 +24V
3 -24V
4 LF INPUT
5 KEY RELAY
6 LF INPUT
7 KEY RELAY
8 SPARE

Seen from component side with upper side tracks

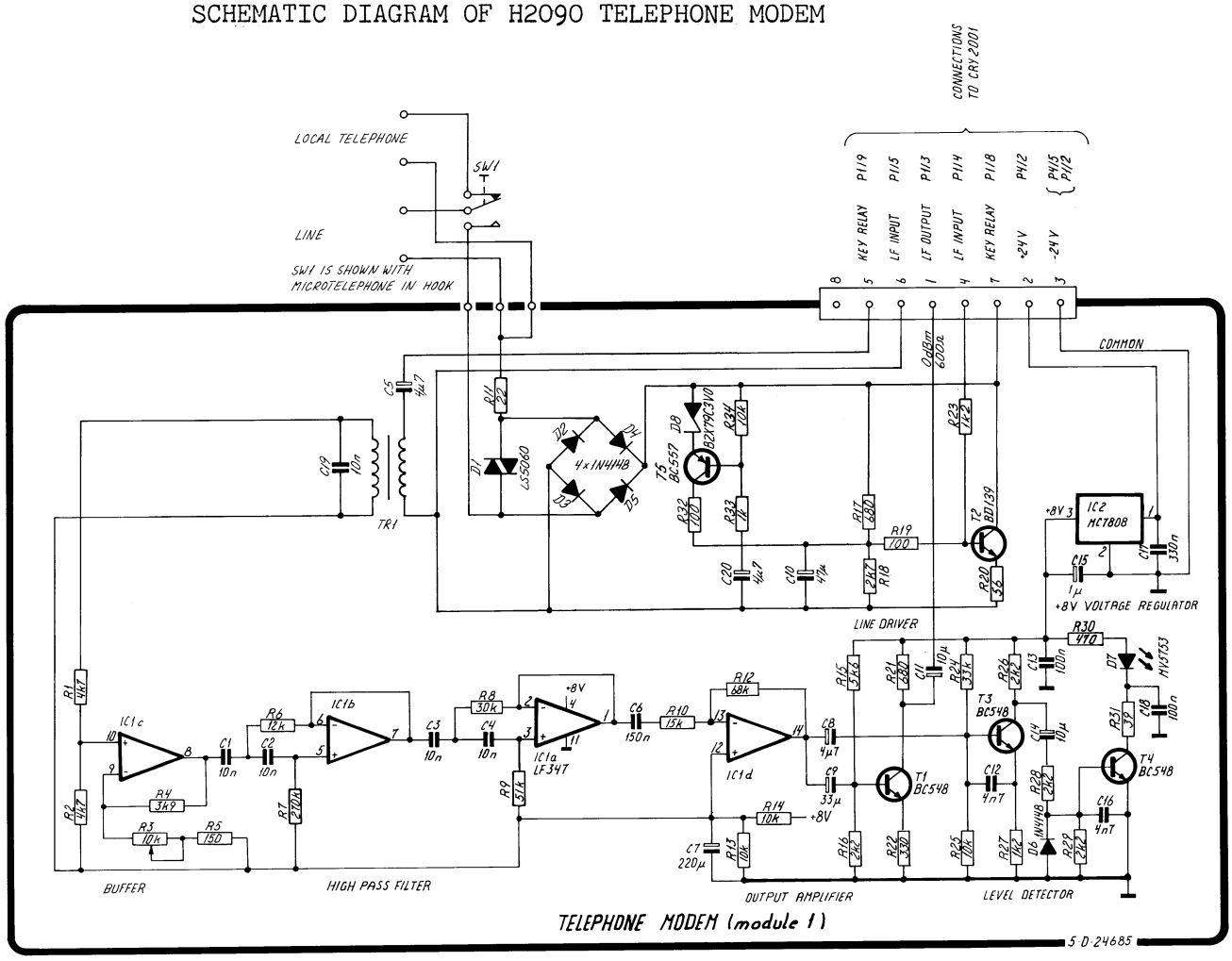
TO SW1
FROM LINE
TO TELEPHONE



1 LF OUTPUT
2 +24V
3 -24V
4 LF INPUT
5 KEY RELAY
6 LF INPUT
7 KEY RELAY
8 SPARE

Seen from component side with lower side tracks

SCHEMATIC DIAGRAM OF H2090 TELEPHONE MODEM



POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	TELEPHONE MODEM	H2090	ESPERA	PRINT NR.5-0-24685A	600568
C1	CAPACITOR POLYSTYRENE	10nF 1% 160V	PHILIPS	2222 425 41003	10.300
C2	CAPACITOR POLYSTYRENE	10nF 1% 160V	PHILIPS	2222 425 41003	10.300
C3	CAPACITOR POLYSTYRENE	10nF 1% 160V	PHILIPS	2222 425 41003	10.300
C4	CAPACITOR POLYSTYRENE	10nF 1% 160V	PHILIPS	2222 425 41003	10.300
C5	CAPACITOR ELECTROLYTIC	4.7uF 50V	ERO	EK000AA147H	14.509
C6	CAPACITOR MKT	150nF 10% 100V	SIEMENS	B32510-D1154-K000	11.222
C7	CAPACITOR ELECTROLYTIC	220uF 10V	ERO	EKI00CC322C	14.631
C8	CAPACITOR ELECTROLYTIC	4.7uF 50V	ERO	EK000AA147H	14.509
C9	CAPACITOR ELECTROLYTIC	33uF 20% 16V	* ERO	EKI00AA233D	14.518
C10	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI00BB247E	14.524
C11	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C12	CAPACITOR CERAMIC	4.7nF -20/+80% 32V	FERROPERM	9/0145/9	15.895
C13	CAPACITOR MKT	100nF 10% 100V	*SIEMENS	B32510-D1104-K000	11.219
C14	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C15	CAPACITOR ELECTROLYTIC	1uF 50V	ERO	EK000AA110H	14.505
C16	CAPACITOR CERAMIC	4.7nF -20/+80% 32V	FERROPERM	9/0145/9	15.895
C17	CAPACITOR ELECTROLYTIC	0.47uF 20% 50V	ERO	EKI00AA047H	14.504
C18	CAPACITOR MKT	100nF 10% 100V	*SIEMENS	B32510-D1104-K000	11.219
C19	CAPACITOR CERAMIC	10nF -20/+80% 32V	FERROPERM	9/0145/9	15.900
C20	CAPACITOR ELECTROLYTIC	4.7uF 50V	ERO	EK000AA147H	14.509
D1	TRANSIENT SUPPRESSOR	LS5060	SGS	LS 5060	31.371
D2	DIODE	1N4148	* ITT	1N4148	25.131
D3	DIODE	1N4148	* ITT	1N4148	25.131
D4	DIODE	1N4148	* ITT	1N4148	25.131
D5	DIODE	1N4148	* ITT	1N4148	25.131
D6	DIODE	1N4148	* ITT	1N4148	25.131
D7	DIODE	MV5753	GI	MV5753 RØD	25.545
D8	DIODE ZENER	3V	PHILIPS	BZX79C3V0	26.509
IC1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC2	INTEGRATED CIRCUIT	MC7808CT	MOTOROLA	MC7808CT	31.255
R1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R2	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R3	POTENTIOMETER	10 KOHM LIN	ESPERA	2-0-24850 *	200621
R4	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 13392	01.214
R5	RESISTOR	150 OHM 5% 0.33W	PHILIPS	2322 181 13151	01.179
R6	RESISTOR	12 KOHM 1% 0.4W	PHILIPS	2322 151 51203	03.461
R7	RESISTOR	270 KOHM 1% 0.4W	PHILIPS	2322 151 52704	03.465
R8	RESISTOR	30 KOHM 1% 0.4W	PHILIPS	2322 151 53003	03.460
R9	RESISTOR	51 KOHM 1% 0.4W	PHILIPS	2322 151 55103	03.462
R10	RESISTOR	15 KOHM 5% 0.33W	PHILIPS	2322 181 13153	01.229
R11	RESISTOR	22 OHM 1% 1W	VITROHM	253-0	05.145

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R12	RESISTOR	68 KOHM 5% 0.33W	PHILIPS	2322 181 13683	01.245
R13	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R14	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R15	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 13562	01.218
R16	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 13222	01.208
R17	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 13681	01.195
R18	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 13272	01.210
R19	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R20	RESISTOR	56 OHM 5% 2.5W	PHILIPS	2322 192 35609	04.667
R21	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 13681	01.195
R22	RESISTOR	330 OHM 5% 0.33W	PHILIPS	2322 181 13331	01.187
R23	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 13122	01.202
R24	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 13333	01.237
R25	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R26	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 13222	01.208
R27	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 13122	01.202
R28	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 13222	01.208
R29	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 13222	01.208
R30	RESISTOR	470 OHM 5% 0.33W	PHILIPS	2322 181 13471	01.191
R31	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 13399	01.164
R32	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R33	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R34	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
T1	TRANSISTOR	BC548	* PHILIPS	BC548	28.070
T2	TRANSISTOR	BD139	* MOTOROLA	BD139	29.060
T3	TRANSISTOR	BC548	* PHILIPS	BC548	28.070
T4	TRANSISTOR	BC548	* PHILIPS	BC548	28.070
T5	TRANSISTOR	BC557	* PHILIPS	BC557	28.087
TR1	TRANSFORMER	EE16-6982	SCANELECTRIC	EE16-6982	22.505

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5. SERVICE

5.1. MAINTENANCE

Preventive Maintenance

If SAILOR SCRAMBLER CRY2001 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 CRY2001 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.
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 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

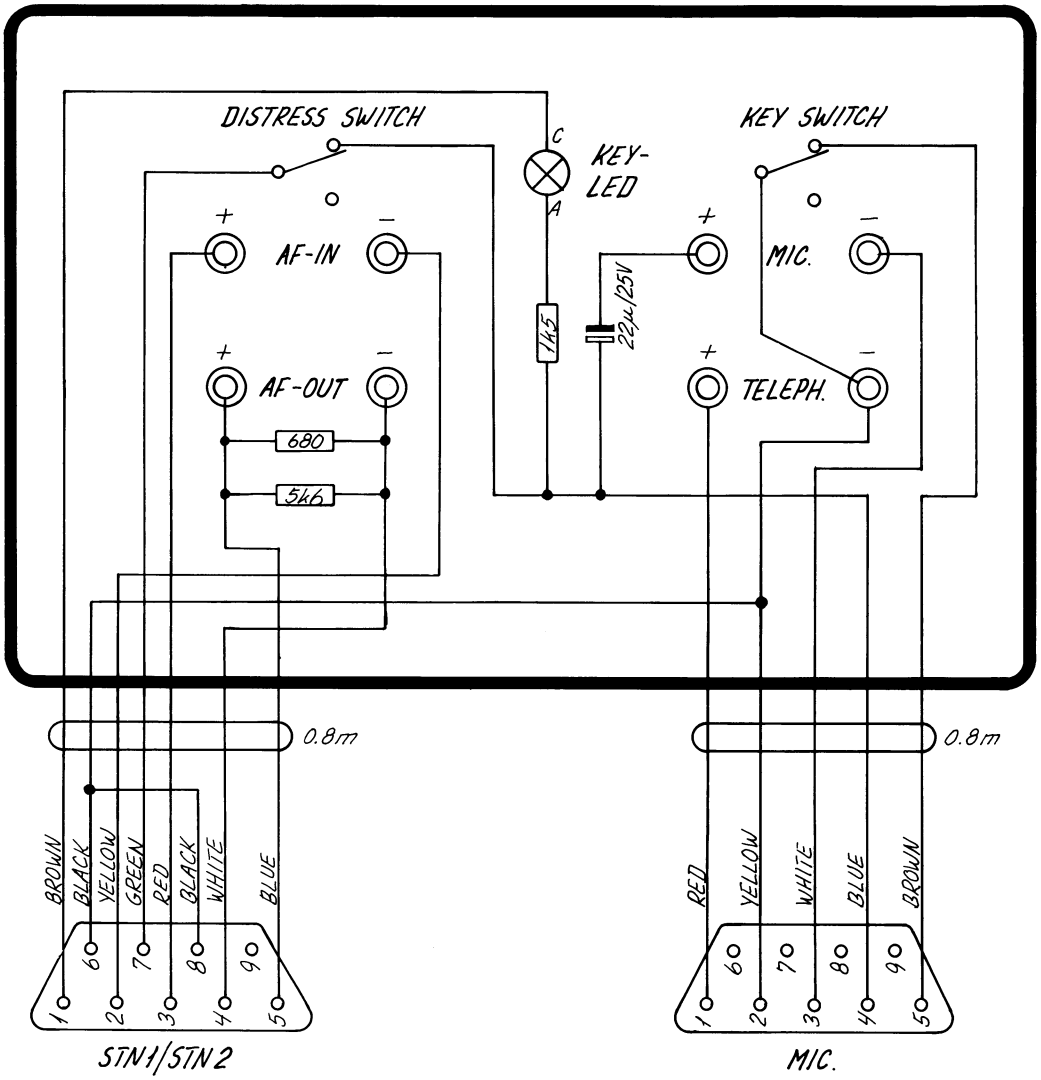
Oscilloscope type PM3216 0-35 MHz ..... PHILIPS

Frequency Counter

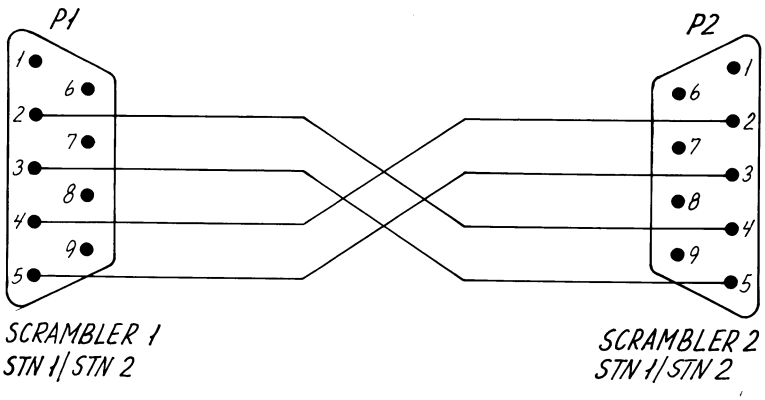
Frequency range	$\geq$ 10 MHz
Sensitivity	$\leq$ 100 mV
Impedance	$\geq$ 1 Mohm
Accuracy	$\leq 1 \cdot 10^{-6}$

Selfmade testbox for CRY2001 (see diagram next page)

DIAGRAM FOR SELFMADE TESTBOX, WHICH IS USEFUL FOR PERFORMANCE CHECK AND ALIGNMENT OF CRY2001



DIRECT CONNECTION CABLE BETWEEN TWO SCRAMBLERS, CRY2001



5.4. PERFORMANCE CHECK

By the performance check we recommend to use a testbox with possibility for connecting measuring instruments and plugs for the scrambler CRY2001. 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 on the testbox and see the LED on the testbox be 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}) $\pm$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 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}) $\pm$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 on the keyboard unit.
19. If * 4 is pressed on the front panel the voice processor will read out the call name programmed into the IDENTITY PROM IC10 on processor unit (module 2) every 5 secs.
20. 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 5 Volt with multimeter on top of thyristor T12 to be 5.1 Volt ±0.1V otherwise adjust potentiometer R39 to 5.1 Volt.
3. Check the voltage of the back-up battery B1 to be between 3.0 to 3.5 Volt.

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 $3.6V_{RMS}$ ±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 ±0.4V.
3. Check the voltage on TP35 to be -7.5V ±0.4V.
4. Control of frequency response 300 Hz to 3 kHz from AF IN to telephone output in "clear voice".
   Adjust tone generator until telephone output level is 0 dBm, fm = 1 kHz. Input level must be -7 dBm (340 V_{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	+0.5 dB
2500 Hz	0 dB
2600 Hz	-3 dB
2800 Hz	-30 dB
2850 Hz	-40 dB

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 1540 Hz.

6. Switch "OFF" the tone generator and measure DC-level on pin 8 of IC10 to be 6.5V ±0.2V. 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.
7. 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) otherwise adjust R101 to the right value.
8. Control that the DC value of TP16 will change ±2.5V when the frequency of tone generator is changed 1500 Hz ±85 Hz.
9. Control the DC value on pin 10 of IC10 to be 6.9V ±0.3V.

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} 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:

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

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 $3V_{RMS}$ ± 2 dB
   TP7: + 12 dBm $3V_{RMS}$ ± 2 dB
9. Measure AF OUT in stn1 pin 4 and 5 in P1 with 600 ohm load:
   + 4 dBm ~ $1.2V_{RMS}$ ±3 dB.
10. Measure AF OUT in stn2 pin 4 and 5 in P2 with 600 ohm load:
    +4 dBm ~ $1.2V_{RMS}$ ±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"):

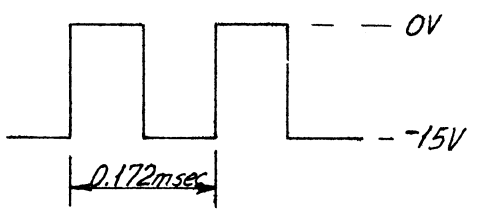
Frequency	level	
500 Hz	0 dB	
730 Hz	-0.3 dB	
760 Hz	-3 dB	
795 Hz	-10 dB	
840 Hz	-20 dB	
880 Hz	-30 dB	
900 Hz	-40 dB	
920 Hz	→ ∞	(-52 dB)
1020 Hz	-34 dB	
1250 Hz	-50 dB	

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	

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 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

11. Control of RX frequency response for T-SCRAMBLER from AFIN (stn1) to TP33:

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

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

Check on F-SCRAMBLER.

1. Connect tone generator to AFIN 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 on the keyboard until (module 3) behind the front panel.
7. Press ✱1, Display shows PRIVATE 1
   RECEIVE

   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
8. Reduction of spurious signals from mixers:

   Connect AC-Voltmeter to TP22.

   Adjust the potentiometers R148, R170 and R179 (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 ±2 dB.
11. Control of MUTE circuit:

    Measure with AC voltmeter in TP24.

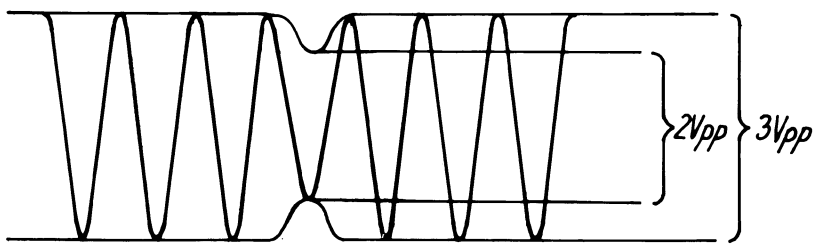
    Adjust potentiometer R187 max. counter clockwise signal level: -1 dBm ±2 dB.

    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



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 ≧ 11200 Hz

    -30 dB ≦ 12000 Hz

    Min. level about 12200 Hz (-36 dB), L20-L22

    Max. level about 12700 Hz (-28 dB)

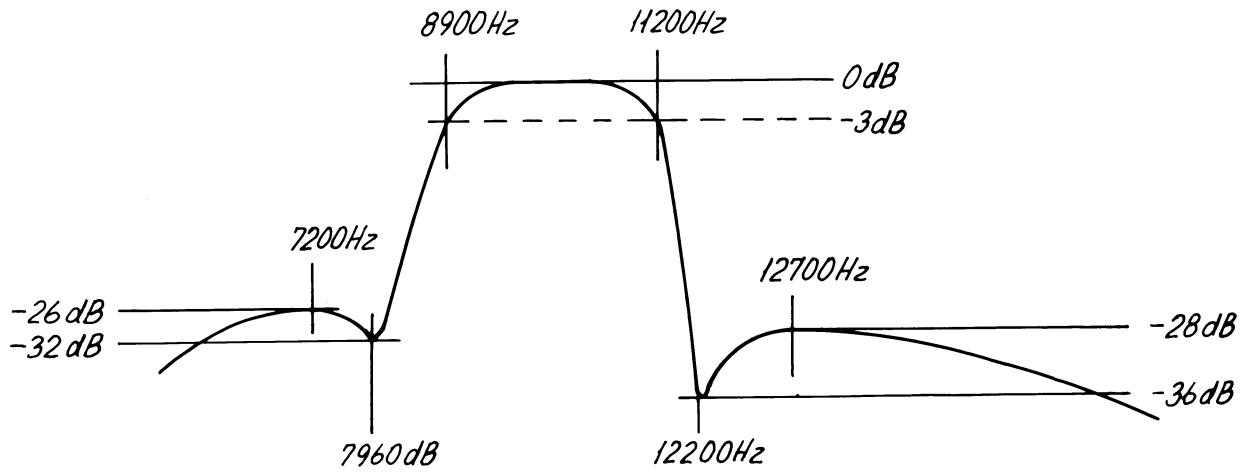
    Low cut-off:

    -3 dB: 8900 Hz ±70 Hz

    -26 dB: ≧ 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)

    typical -50 dBm (2.5 mVeff).

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.

ALIGNMENT PROCEDURE CONT.

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' + Fm) = 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 msec.

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

5.5.1 Service Facilities with Strap W1 Inserted:

With strap W1 inserted on the keyboard unit (module 3) or a jumper is used to short-circuit the two pins for W1 some service facilities are enabled.

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 loudspeaker and repeated after 5 secs.
Normally the call sign is transmitted in "clear voice" every 5 minute.

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

The strap W1 must be removed after the test is finished.

5.6. NECESSARY ADJUSTMENT 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 Keyboard Unit (module 3):

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.

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. Control the counter for volume:

Press vol ∇ until the display shows vol = 0
Press vol Δ until the display shows vol = 15

(also check that no segments are missing in the digits in the display).

3.2. Press the buttons 1 to 8 and check the digits coming correct into the display.

3.3. Press the number key # and see a square in the display. Press the number key # one time more and the square must disappear.

3.4. Press the DIM button and see the light be switched on or off.

3.5. Press the function key * and see an F in the display.

3.6. Press the number key # two times. After the first press F will change to E and after the second press E will disappear.

3.7. Press the key ⊏O and see a ⊏ in the display.

3.8. Press the number key # two times and the key wil disappear.

After the first press the key ⊏ will change to a square □ and after the second press the □ will disappear.

3.9. 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 the direct cable is connected to and set the volume position to 8. With higher volume level the scramblers will start howling, because they are too near each other.

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" a flashing "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.

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 synchronising 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 on both stations: stn1 and stn2.

After some experience an audible test will indicate whether a scrambler is operating normal or not.

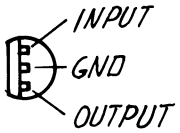
Check of call name is described in section 5.4., (Performance Check).

5.8 PIN CONFIGURATIONS AND SCHEMATIC DIAGRAMS OF IC's

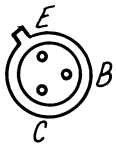
BOTTOM VIEW

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

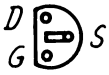
BC640



LM78L05A

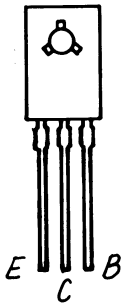


2N2369A

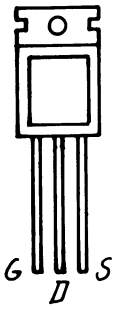


BF245

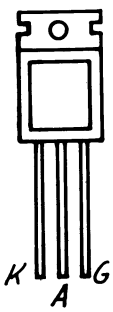
FRONTSIDE VIEW



BD139

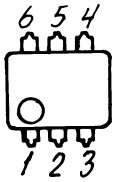


RFP12N10



BT151-500R

TOP VIEW



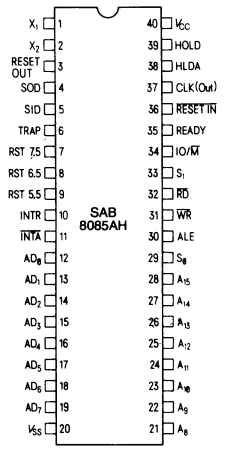
4N27
4N32

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

CRY2001

8085A-2 8-BIT MICROPROCESSOR

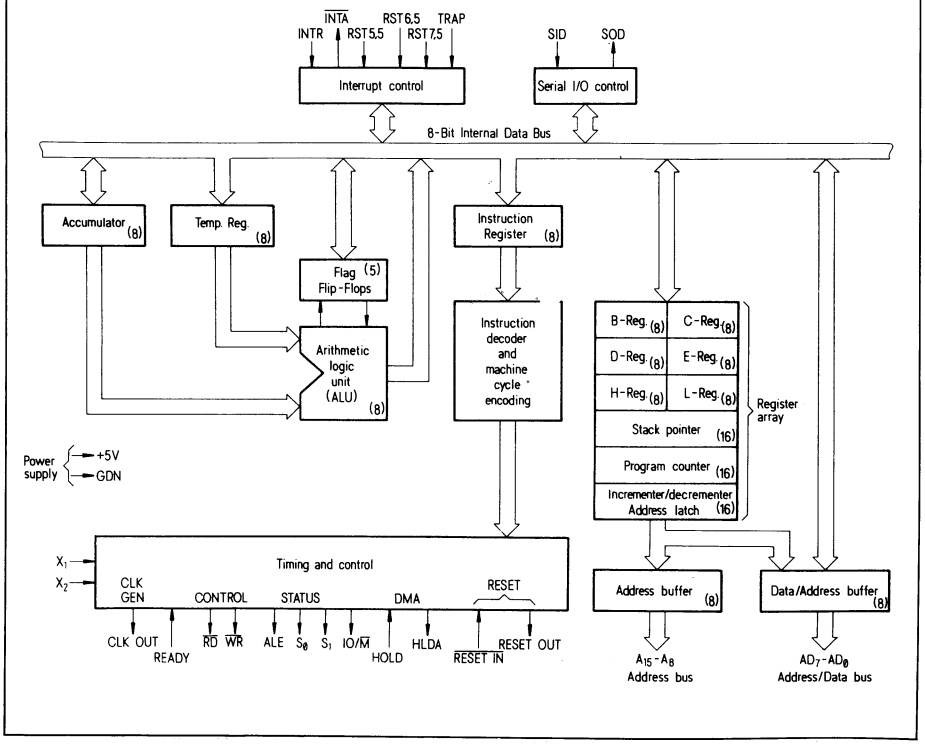
Pin Diagram



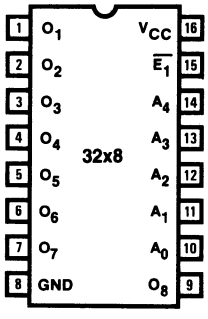
Pin Names

A_8-A_{15}	Address Bus	$\overline{INTA}$	Interrupt Acknowledge
AD_0-AD_7	Mux. Address/ Data Bus	RST 5.5, 6.5, 7.5	Restart Interrupts
ALE	Address Latch Enable	TRAP	Trap
S_0, S_1, IO/$\overline{M}$	Machine Cycle Status	$\overline{RESET\ IN}$	Reset in
$\overline{RD}$	Read Control	RESET OUT	Reset out
$\overline{WR}$	Write Control	X_1, X_2	Crystal/Clock Input
READY	Ready	CLK	Clock Output
HOLD	Hold	SID	Serial Input Data
HLDA	Hold Acknowledge	SOD	Serial Output Data
INTR	Interrupt Request	V_{CC}	+5V
		V_{SS}	Ground (OV)

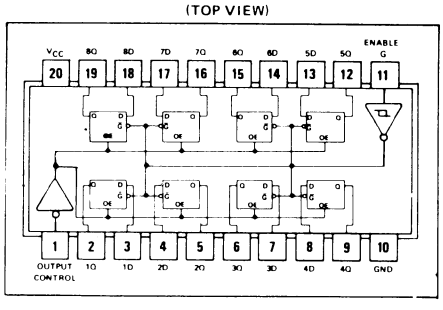
Functional Block Diagram



6331-1
256 BIT PROM



SN74LS373
OCTAL D-TYPE LATCHES

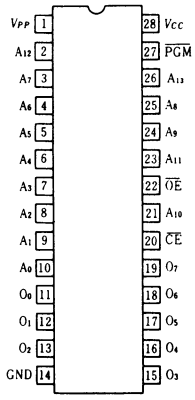


PIN CONFIGURATIONS CONT.

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

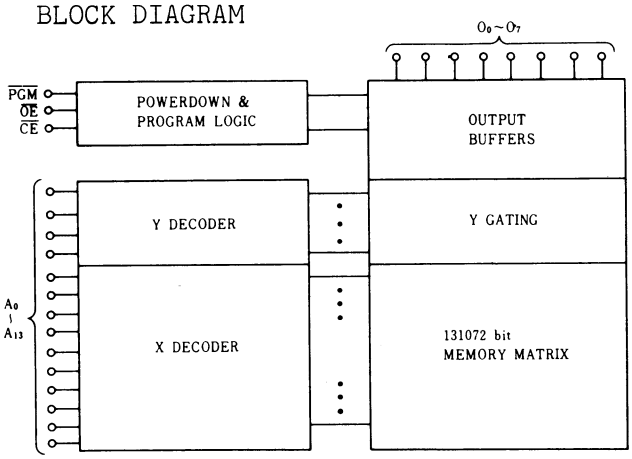
27128 16384-WORD X 8-BIT UV ERASABLE AND PROGRAMMABLE READ ONLY MEMORY

PIN ARRANGEMENT



(Top View)

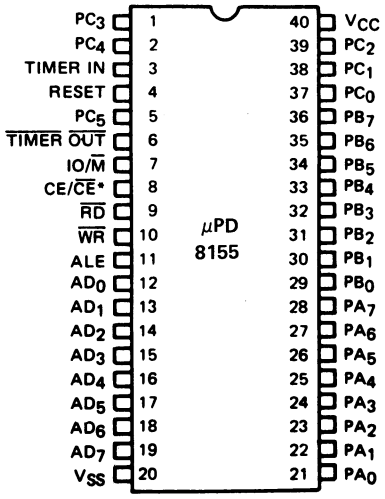
BLOCK DIAGRAM



μPD8155

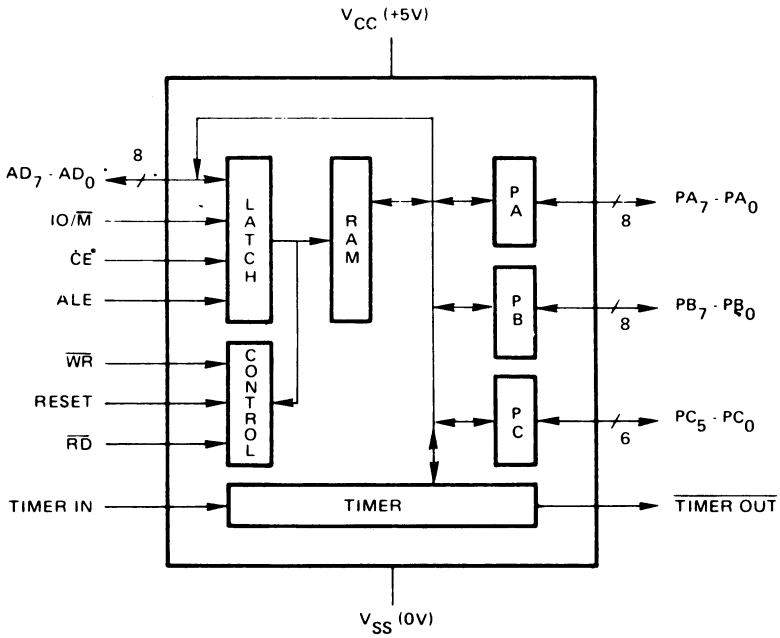
2048 BIT STATIC MOS RAM WITH I/O PORTS AND TIMER

PIN CONFIGURATION



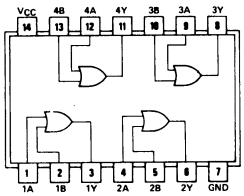
*μPD8155: $\overline{CE}$

BLOCK DIAGRAM



SN74LS32

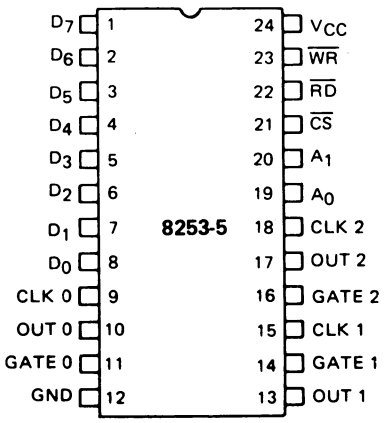
4x2-input or gates



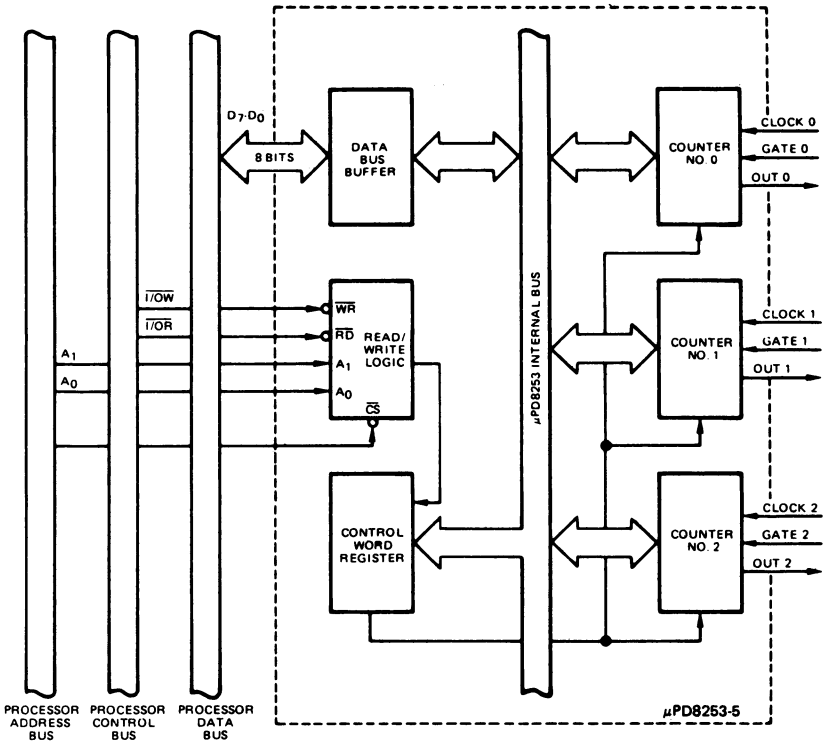
CRY2001

8253-5
PROGRAMMABLE INTERVAL TIMER

PIN CONFIGURATION

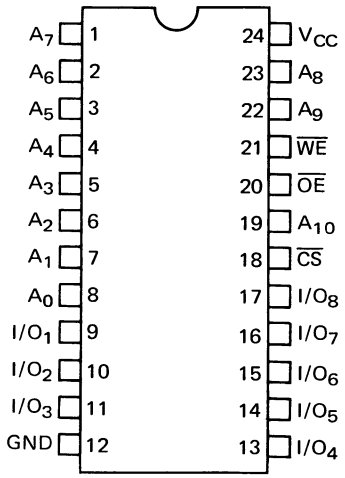


BLOCK DIAGRAM

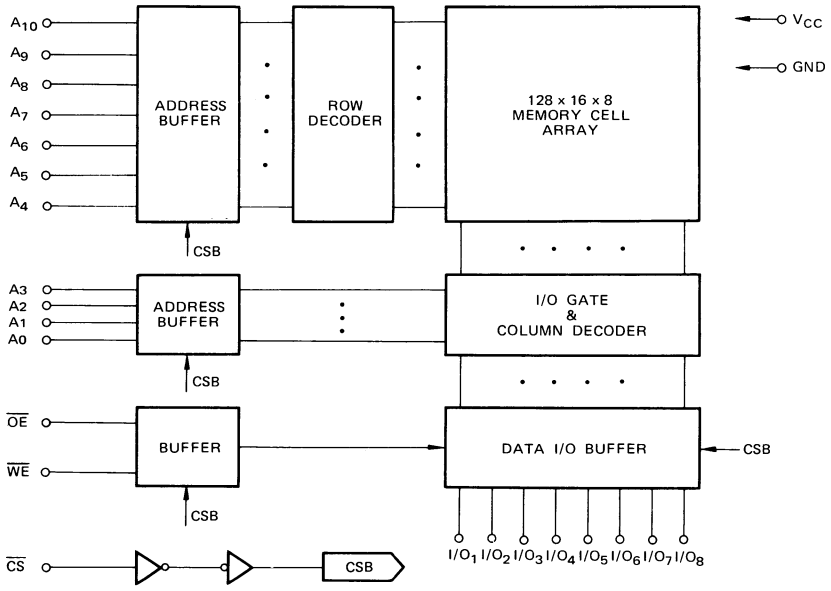


MB 8416A
LOW POWER 16K-BIT (2048 x 8) CMOS STATIC RAM

PIN ASSIGNMENT



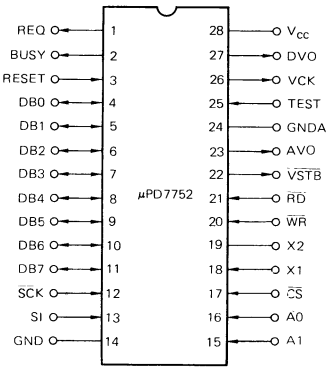
BLOCK DIAGRAM



TRUTH TABLE

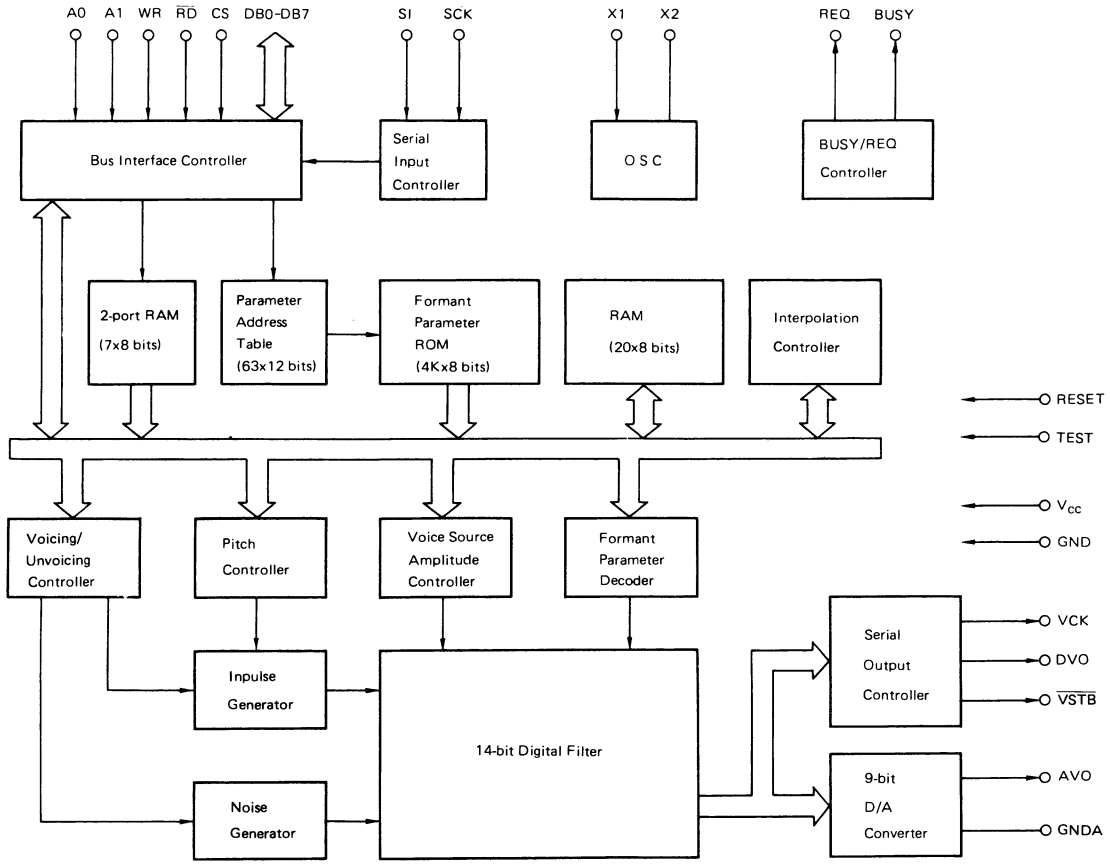
$\overline{CS}$	$\overline{OE}$	$\overline{WE}$	MODE	SUPPLY CURRENT	I/O PIN
H	X	X	NOT SELECTED	I_{SB}	HIGH-Z
L	H	H	D_{OUT} DISABLE	I_{CC}	HIGH-Z
L	L	H	READ	I_{CC}	D_{OUT}
L	X	L	WRITE	I_{CC}	D_{IN}

CONNECTION DIAGRAM



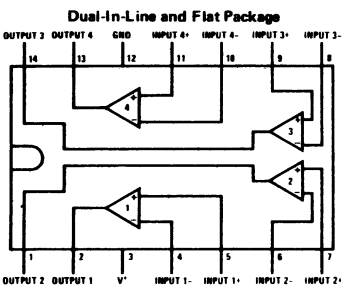
μPD7752C
VOICE SYNTHESIZING LSI ADOPTING FORMANT PARAMETER

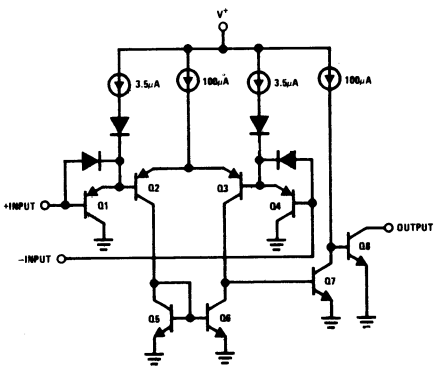
BLOCK DIAGRAM OF uPD7752



LM339N
4 x VOLTAGE COMPARATORS

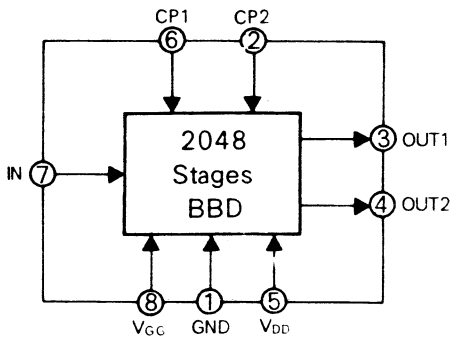
SCHEMATIC AND CONNECTION DIAGRAM



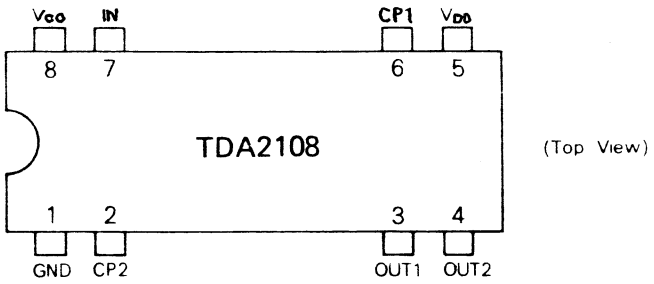


TDA2108 BUKET BRIGADE DELAY LINE

TERMINAL ASSIGNMENTS

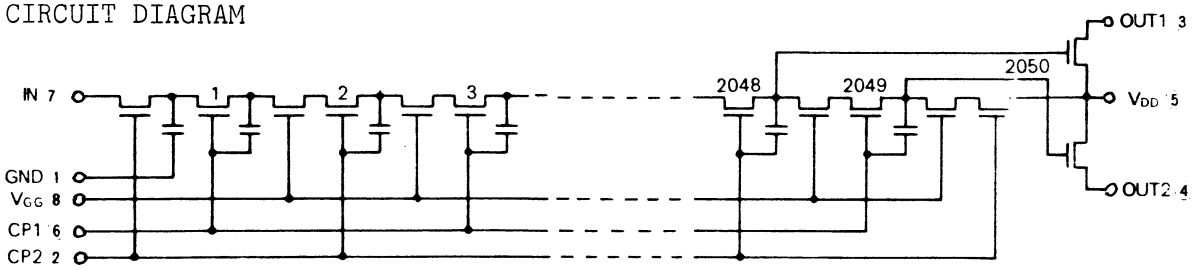


BLOCK DIAGRAM

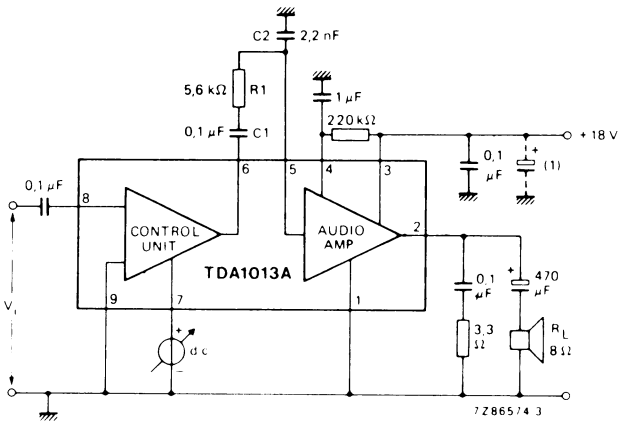


(Top View)

CIRCUIT DIAGRAM

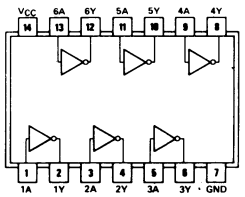


TDA1013A AF-POWER AMPLIFIER



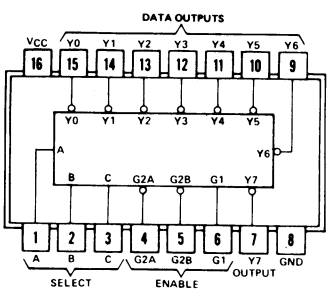
SN7406

HEX INVERTER BUFFERS

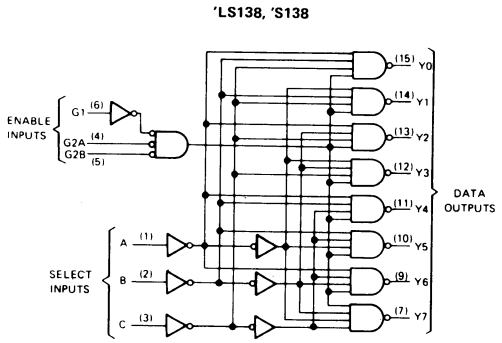


SN74LS138

DECODERS



FUNKTIONAL BLOCK DIAGRAM AND LOGIC

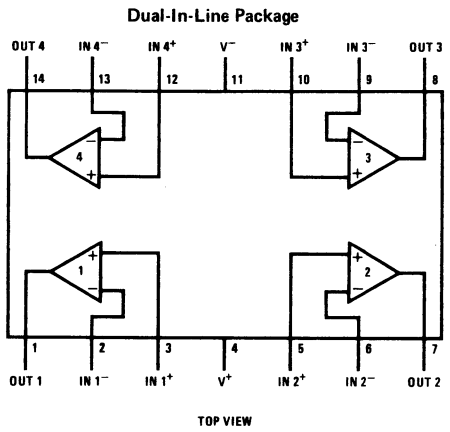


CRY2001

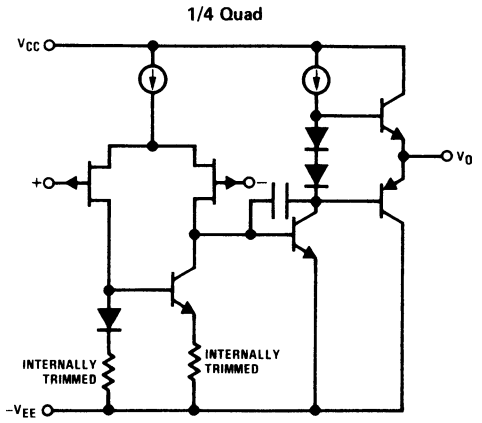
PIN CONFIGURATION CONT.

LF347 4 x JFET INPUT OP AMP

CONNECTION DIAGRAM

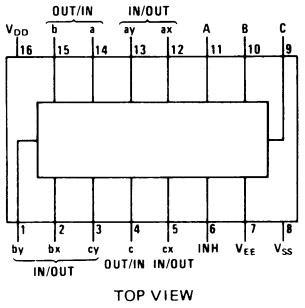


SIMPLIFIED SCHEMATIC



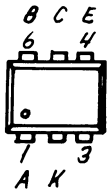
CD4053B

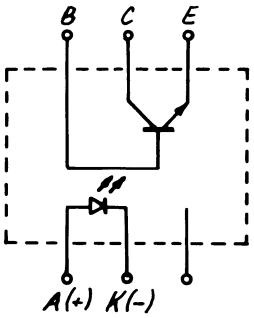
3 x 2-CHANNEL ANALOG MULTIPLEXER



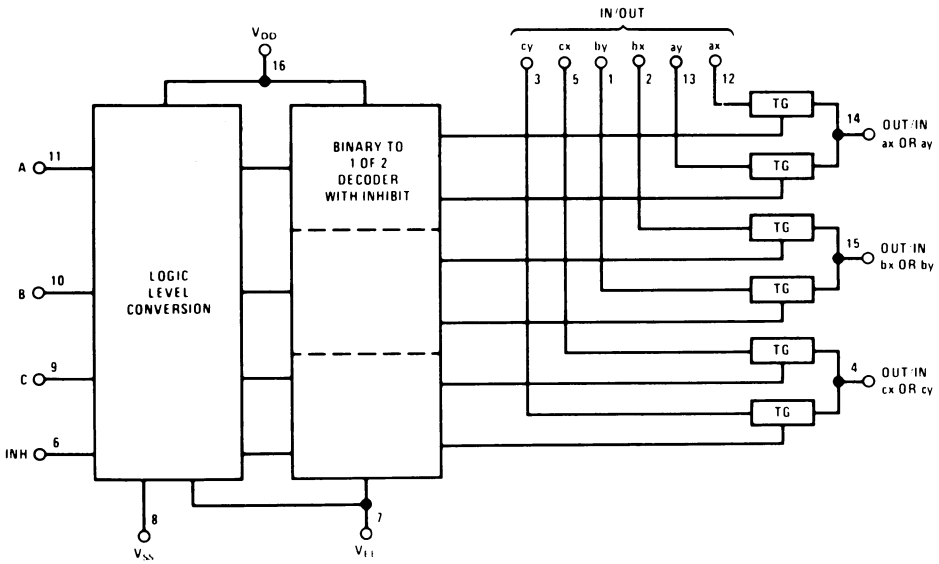
CNY 17

OPTO-COUPLER



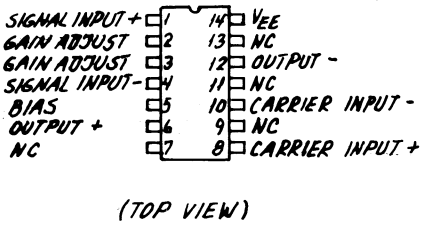


CD4053BC BLOCK DIAGRAM

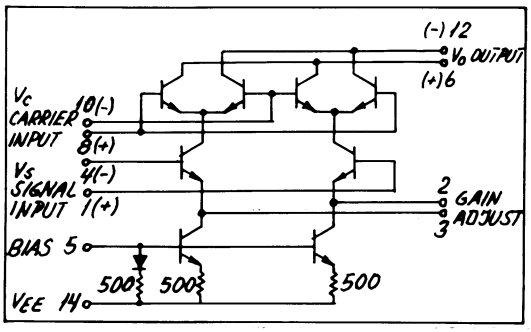


CRY2001

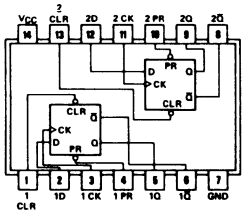
MC1496 BALANCED MODULATOR-DEMODULATOR



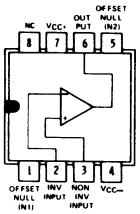
(TOP VIEW)



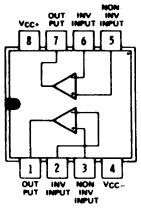
SN74LS74A (J,N)
DUAL D-TYPE FLIP FLOP



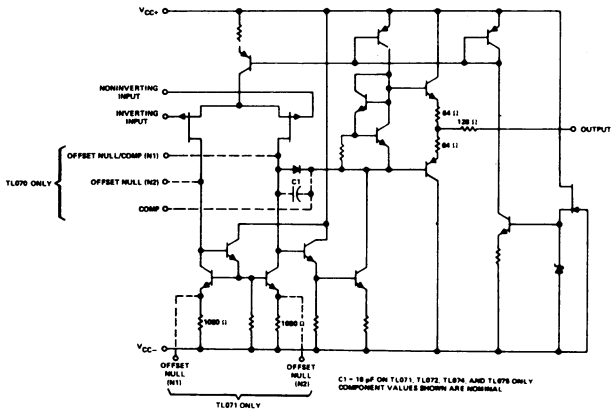
TLo7o
LOW-NOISE JFET-INPUT OP. AMP.



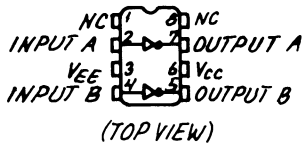
TLo72
LOW-NOISE JFET-INPUT OP. AMP.



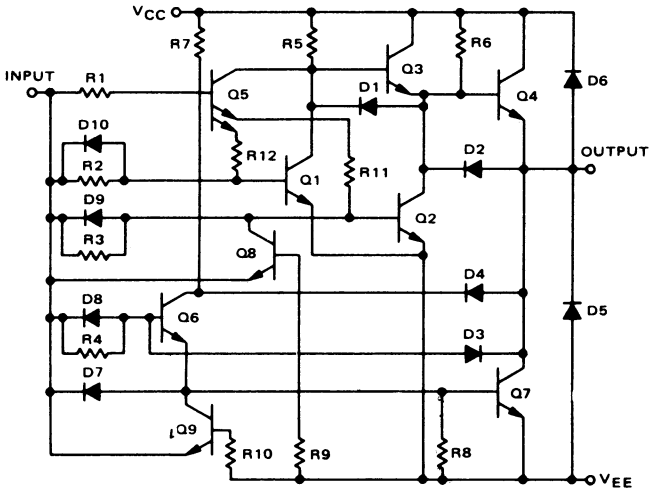
SCHEMATIC (EACH AMPLIFIER)



MMH0026C
DUAL MOS CLOCK DRIVER

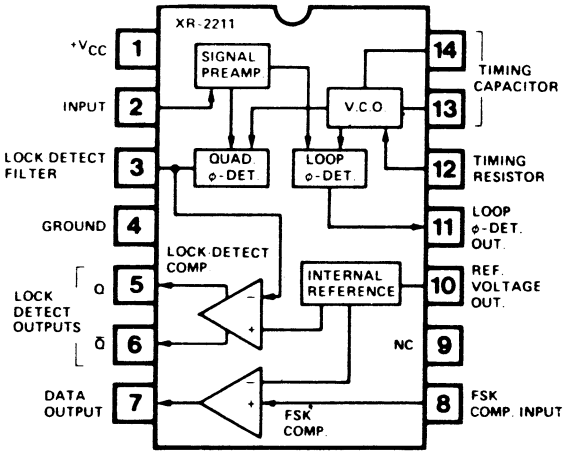


CIRCUIT SCHEMATIC
(1/2 CIRCUIT SHOWN)

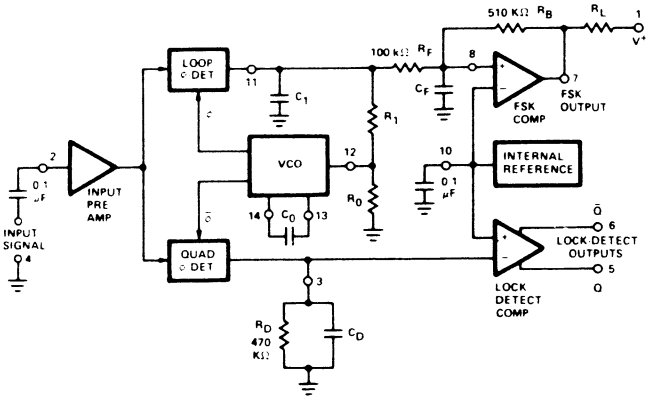


XR-2211 FSK DEMODULATOR

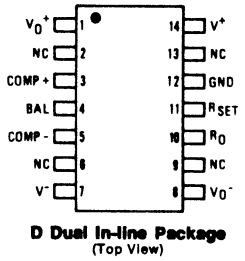
FUNCTIONAL BLOCK DIAGRAM



GENERALIZED CIRCUIT CONNECTION

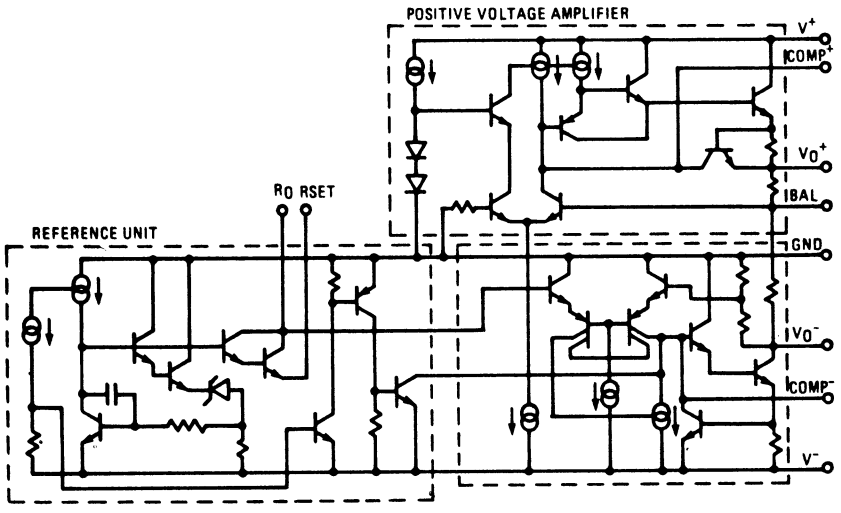


4194
DUAL TRACKING
VOLTAGE REGULATORS



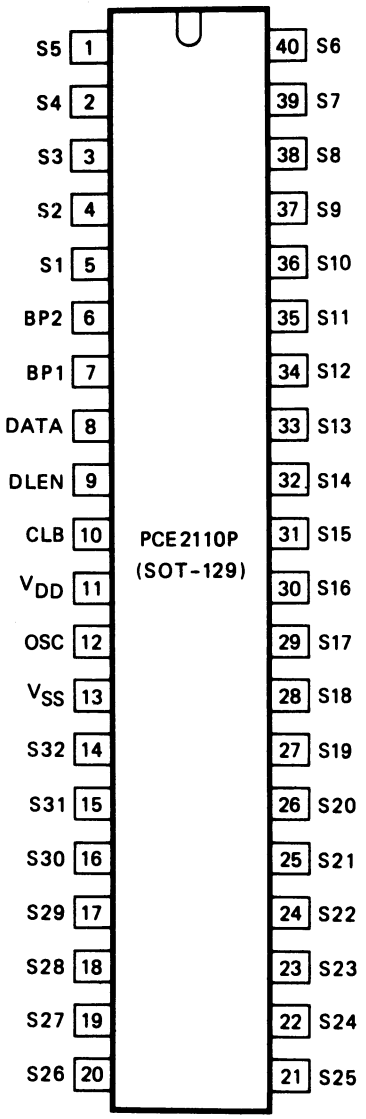
D Dual In-line Package
(Top View)

SCHEMATIC DIAGRAM

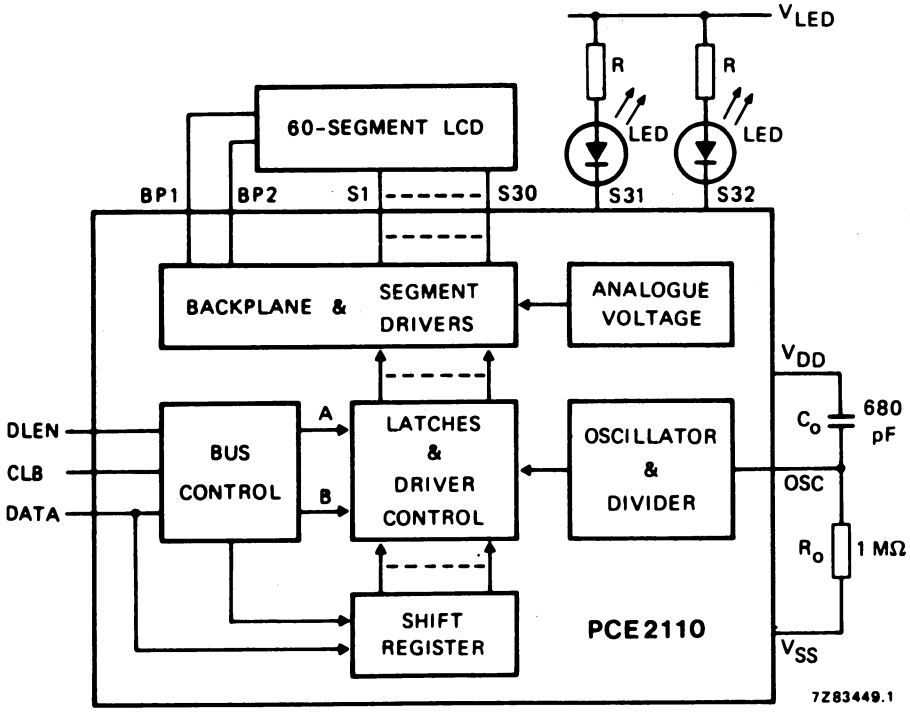


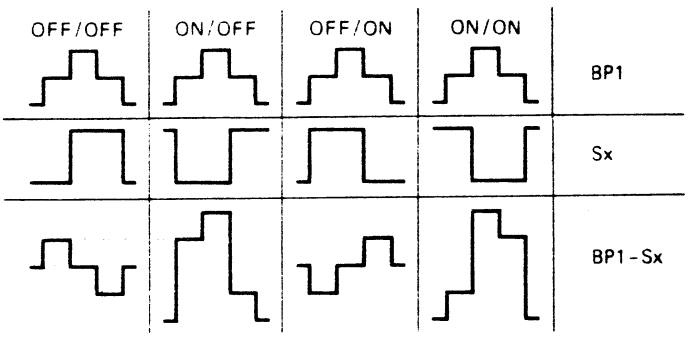
PCE2110 LCD DUPLEX DRIVER

PINNING DIAGRAM



BLOCK DIAGRAM





TIMING DIAGRAM

PINNING

Supply

11	V_{DD}	Positive supply
13	V_{SS}	Negative supply

Inputs

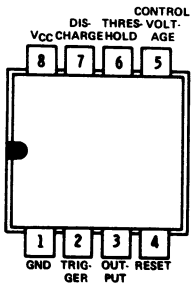
12	OSC	Oscillator input	
8	DATA	Data line	CBUS
9	DLEN	Data line enable	CBUS
10	CLB	Clock burst	CBUS

Outputs

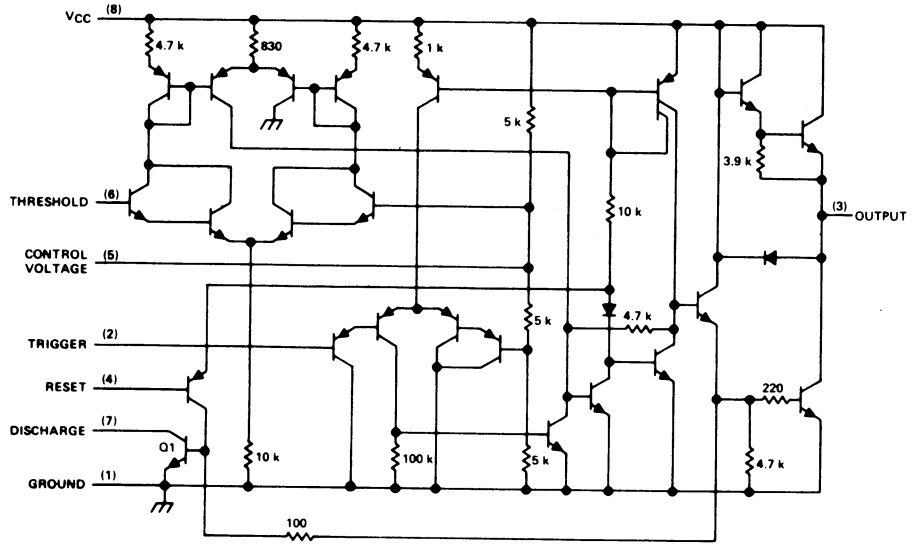
7	BP1	Back plane drivers (common of LCD)
6	BP2	Back plane drivers (common of LCD)
S1 to S30		LCD driver outputs
S31, S32		LED driver outputs

555 PRECISION TIMER

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



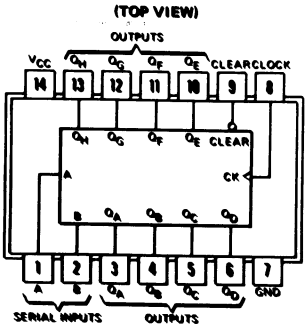
SCHEMATIC

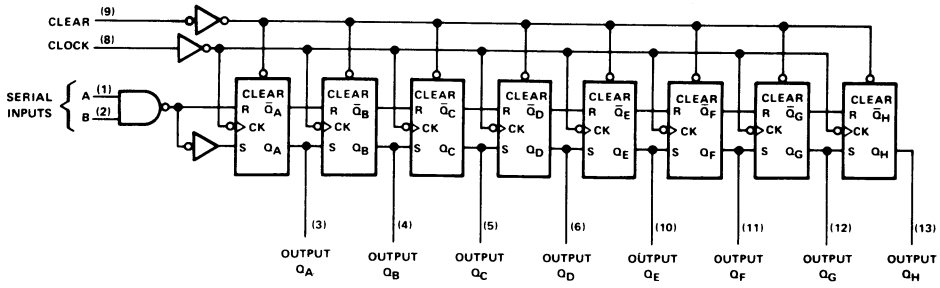


Resistor values shown are nominal and in ohms.

SN74LS164
8-BIT PARALLEL-OUT SERIAL SHIFT REGISTERS

(TOP VIEW)

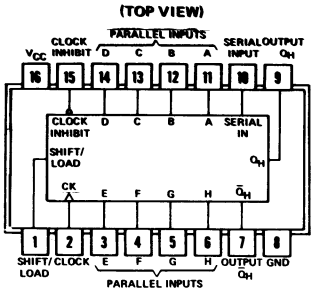


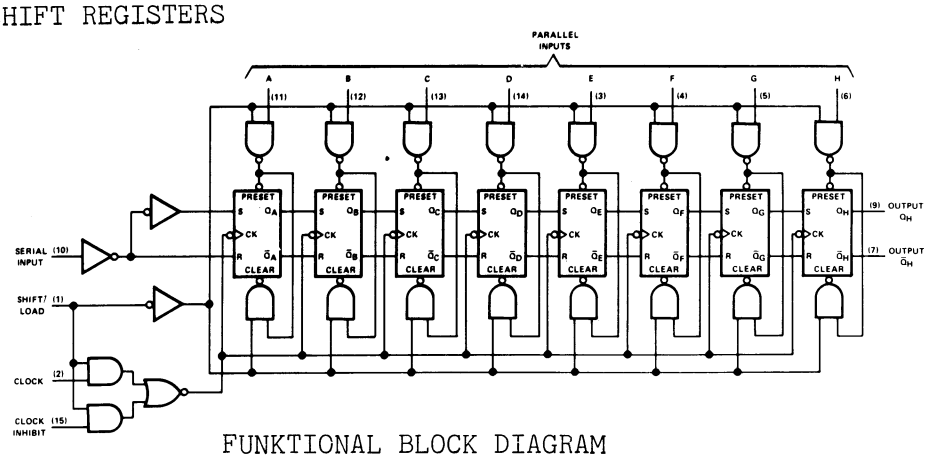


FUNCTIONAL BLOCK DIAGRAM

SN74LS165
PARALLEL-LOAD 8-BIT SHIFT REGISTERS

(TOP VIEW)





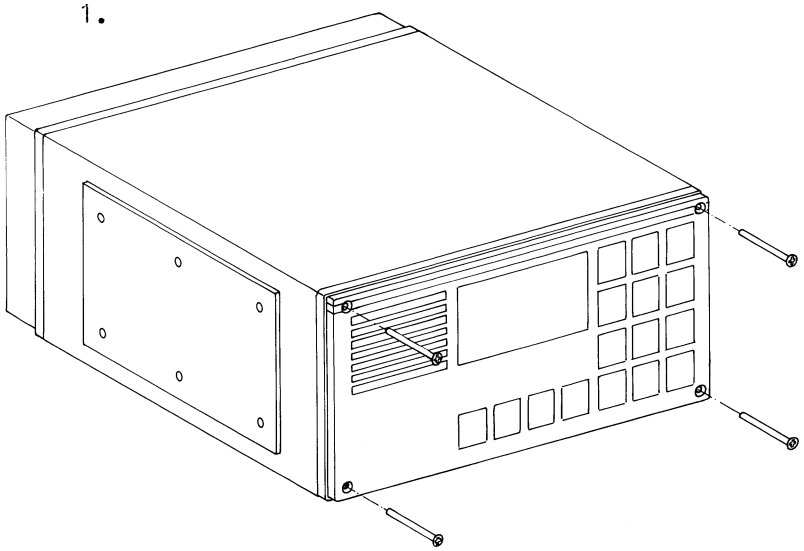
FUNKTIONAL BLOCK DIAGRAM

CONTENTS

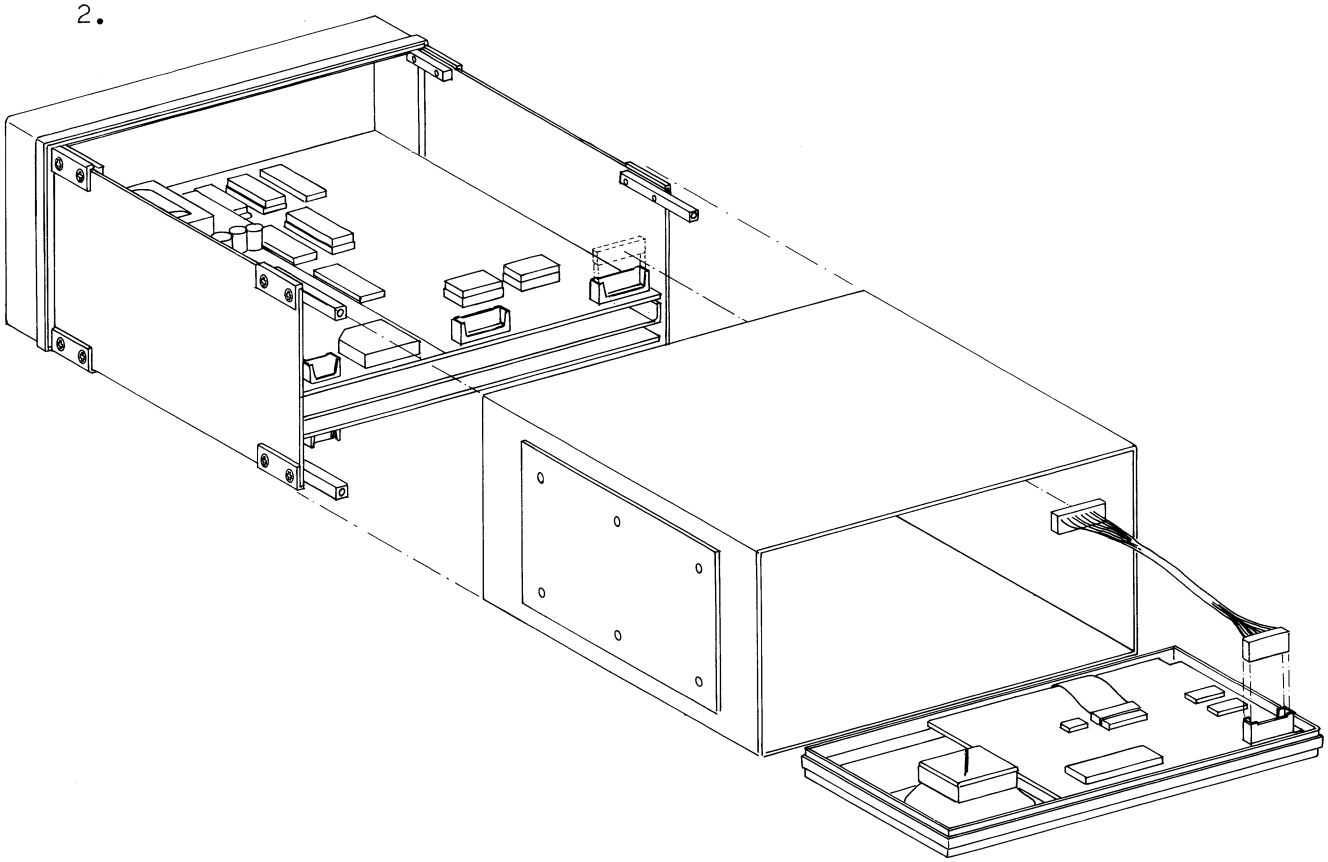
6.0. MECHANICAL DISASSEMBLING

6.0 MECHANICAL DISASSEMBLING CRY2001

1.

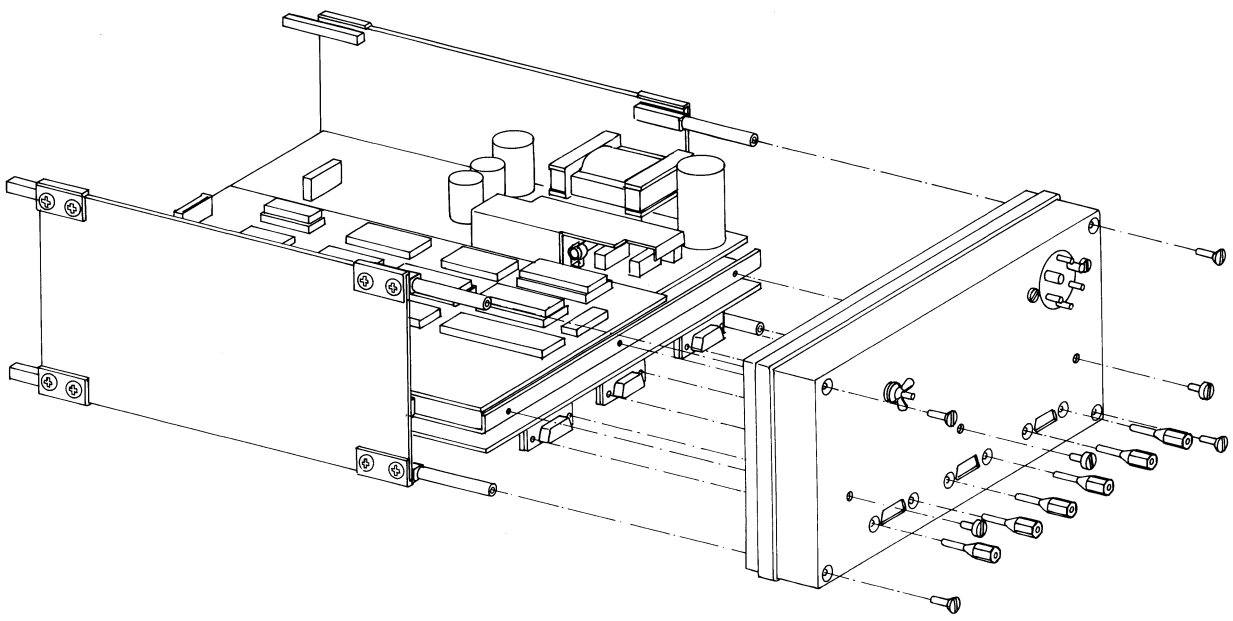


2.



CRY2001,4-0-24826,4-0-24827,
4-0-24828

3. HOW TO DISASSEMBLE THE REAR PLATE



CONTENTS:

7.0. CIRCUIT DESCRIPTION

7.1. F AND T UNIT (MODULE 1)

7.2. PROCESSOR UNIT (MODULE 2)

7.3. KEYBOARD UNIT (MODULE 3)

7.4. NOT USED (MODULE 4)

7.5. POWER SUPPLY (MODULE 5)

7.6. INTERCONNECTION CABLE DIAGRAM/MAIN CHASSIS (MODULE 6)

7.7. MICROTELEPHONE INSTALLATION

7.8. SPECIAL INSTALLATION WITH 2 MICROTELEPHONES

7.9. SPECIAL INSTALLATION WITH 3 MICROTELEPHONES

7.0 CIRCUIT DESCRIPTION

7.1 THE 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 CRY2001 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 trancient 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 is the outputs DC isolated for bipolare voltage up to +/- 30V.

Distress

Separate Distress optocoupled inputs are accomplished for STN1, STN2, IC4, IC5. The distress inputs are working from 8-40V and protected for reversed bias. D5, D6, R20-25.

Keying

Keying out is performed by RE1, RE2. 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 preamplifier, 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.

To reduce spurious in the F-scrambler the Microphone amplified signal is filtered in a 4 order High-pass 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 5. order elliptical low-pass filter. It has a sharp cut-off at 2550 Hz, and removed 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 5. order elliptical low-pass 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 depended 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 5. order elliptical LP filter is used 5 expensive coils. 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, R120 are DC load resistors. The F.D.N.R. element IC12,a,d and IC12b,c. IC14 is a buffer amplifier.

All-pass Filter

IC15a,b,c,d performs a 6 pole all-pass function. It gives a flat amplitude response in the outputs TP20,21, but the phase relationship between TP20,21, is constant 90 degrees within 280-3200 Hz. These outputs are necessary for the single sideband generation by IC16,17. The pole frequencies in the all-pass 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 I. F1 is divided by four. The output from IC20,a,b are two square waves with a 90 degree relationship, and their related inverted signals are used in IC16,17 together with the all-pass 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 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. All the three mixers have suppressed carriers and

the carrier suppression adjustments are very important in IC16, R148 and IC17, R170, because of audiobile 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 arised 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 translater 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. By R182 is the muting reduced to approx. 12 dB.

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 width enough to cover the baseband. A sharp cut-off gives high delay distortion, which gives the special sound effect "Phasing". The bandpass filter in CRY2001 is a socalled LERNER filter (pole residue). It has a linear phase and with possible transmission zeros.

It is an 8. 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 F3=23.2 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 5. 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 cross-over filter system. It consists of a 5. 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 5. order elliptic filter where the coils are realized by gyrotors 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.
This 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 is buffer amplifiers with 6 dB gain. The output in TP28 and TP29 is the same as the input TP27 and nominal 0 dBm.

Delay Line

In the transmitting mode is the analog switch IC23,a,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 require 1A peak 0, -15V clock driver IC29 MMH0026. The delay is dependent on the clock-frequency which is F3=23.2 kHz divided in IC30a,b by four to 5.8 kHz. The delay is = 2048/2x5.8 kHz = 176.55 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 Fo = 3.7 kHz and a Q = 1.4 to compensate for the sinx/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 is the high- and lowpass filter 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 Δ F = +/-85 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 contents 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, 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 +/-7.5V supply voltage. IC31 is a dual tracking, current limited, voltage regulator, adjusted to +/-7.5V by R263.

SP 9-0-23833A

CRT2001 A

CRY 2001 B

F and T UNIT (module 1) (b)

5-0-21833

F AND T UNIT MODULE 1

7.2 PROCESSOR UNIT (MODULE 2)

This unit contains the following parts:

- Microprocessor
- Watch dog
- C-MOS RAM
- Programme Memory
- Identity Memory
- Timer Input/Output
- Frequency Generator
- Speech Processor
- Audio Power Amplifier-Volume Control
- Power ON-OFF

Microprocessor

All functions in the CRY2001 are controlled by a 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 functions. 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 is a lithium battery back-up for the C-MOS RAM switched in, by T3 and T4. 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 feed-back 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 ensures that the voltage on C3 never will 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 each 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 2K byte (2000 words) C-MOS RAM. It is used for all temporary data. Further it stores all the contents in the user 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 k bit UV PROM IC6.

Identity Memory

The identity memory, IC10 is a 256 bit fuseable PROM and contains data to give the scrambler CRY2001 its identity.
The addresses 00-04 Hex contains data concerning the scrambler CRY2001, in which the PROM is placed.
These addresses are programmed from the factory. If a new PROM is wanted we advise that a new PROM is ordered from S. P. Radio A/S. If sales or service agents are programming a new PROM it is important to enter the same data into the new PROM as in the old one.

Addresses	Description
05-0E Hex Programmed by sales agents	The call sign of the radiostation 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 (Stn 1) 10 (Stn 2) Programmed by sales agents	Contains the pre-key time in mS x 10. 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 254, i.e. a pre-key of 2.54 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 drives 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. IC11, 8253-5 is organized as 3 independent 16-bit programmable counters, each with a count rate up to 5 MHz.

Speech Processor

The teleadministrations from different countries recommend a clear voice ship's identification, when voice scrambling is used. Built in the CRY2001 is a FORMANT VOICE SYNTHESIZER NEC7752, IC9.

The whole phonetic alphabet and the numbers from zero to ten are stored in a digisized way. A tape recording is first taken and digisized with 200 k BIT/sec. A phonetic analyzer reduces this to approx. 1.8k BIT/sec. without seriously intelligibility reduction. IC7 is a 64 k BIT PROM with the content of total of approx. 30 sec. speech. The vocabulary instructions are taken from the identity 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.

Audio Power Amplifier-Volume Control

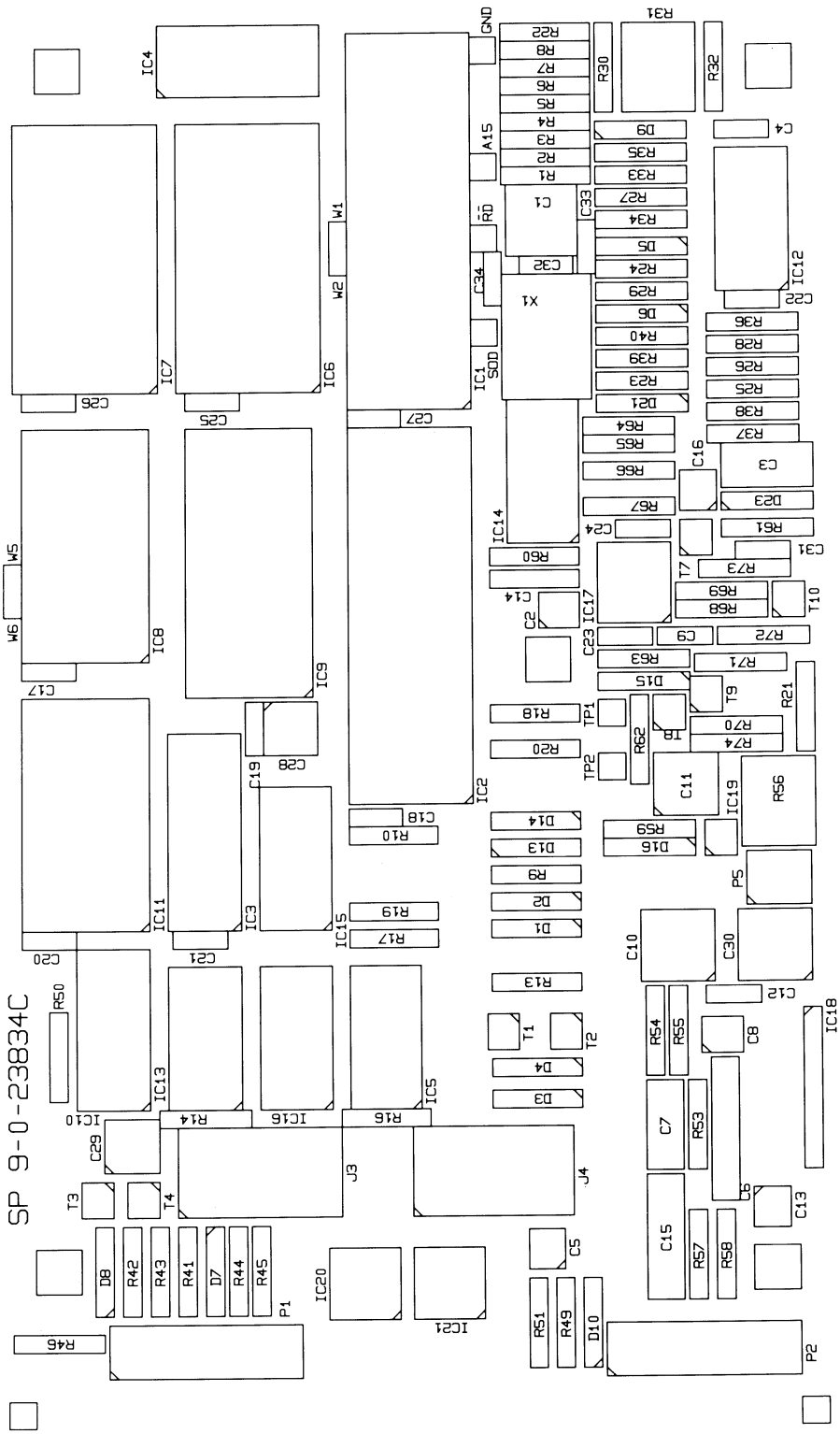
The output power amplifier IC18 contains two sections. A DC controlled pre-amplifier and a 4W power amplifier. The volume control is digital controlled in four bits. IC14, 7406 open collector output drives a discrete digital to analog converter, performed by IC17, T7 and T8. T7 and D23 generate a reference voltage to pin 5 IC17. R64,65,66,67 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 maximum output level, when no current flows in R62. The voltage in TP2 is nom. 6.2V. The volume control has 15 steps with an incriment 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 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



CRY2001

CRY2001B

CLK 3.572.800kHz ±10Hz
V.SYN
ROM1
ROMØ
RD
WR
RESET
CLK
V.SYN
RD
WR
ROM1
ROMØ
FRERUN
RESET IN
REQ
SDD
GND
+5V
-15V
+15V
PWRON
PWRHLD
BUSY
CRAM
RESETIN
IDROM
LOAD
KYBD
DIST1
HNDKEY
PWRON
DIST2
VOL Ø
VOL 1
VOL 2
VOL 3

IC6 27128
IC7 2764-25
IC8 MB8416
IC9 7752
IC10 6331-1
IC11 8253-5
IC1 8085 AH-2
IC2 8155 H
IC3 74 LS 373
IC4 74LS 138
IC5 74 LS 32
IC12 b
IC12 c
IC12 d
IC12 a
IC13 74 LS 74
IC14/15/16 = 7406
IC16 1/6 7406
IC17
IC18 TDA 1013A
IC19 78L05
IC20 3N27
IC21 3N32

WATCH DOG
VOICE CONTROL
POWER SENSOR
ON/OFF CONTROL
PROGR. VOLUME CONTROL

PROCESSOR UNIT (module 2) (b)

5-0-23834A

P1
TO P1 ON POWER SUPPLY (5)
- BATT
-15V
+15V
+BATT
PWR CONTROL
GND
GND
+5V
V.BATT

P2
TO P1 ON KEYBOARD UNIT (3)
ON/OFF
SPEAKER GND
SPEAKER
KBD CLK
KYBD
LOAD
GND
+5V to FRONT PANEL
ON/OFF

J3
TO J5 ON F and T UNIT (1)
DIST2
F.MUTE
FSCR
F3
F2
F1

J4
TO J4 ON F and T UNIT (1)
HNDKEY
DIST1
FSKINP
GND
RE2
RE1
STN1/STN2
FSKKEY
TSCR
Rx/Tx
TXBLK
MIC BLK
EAR BLK
VOICE
AF
GND

P5
TO P4 POWER CONNECTOR.
SPEAKER
GND

7.3 KEYBOARD UNIT (MODULE 3)

Keyboard encoding
Display

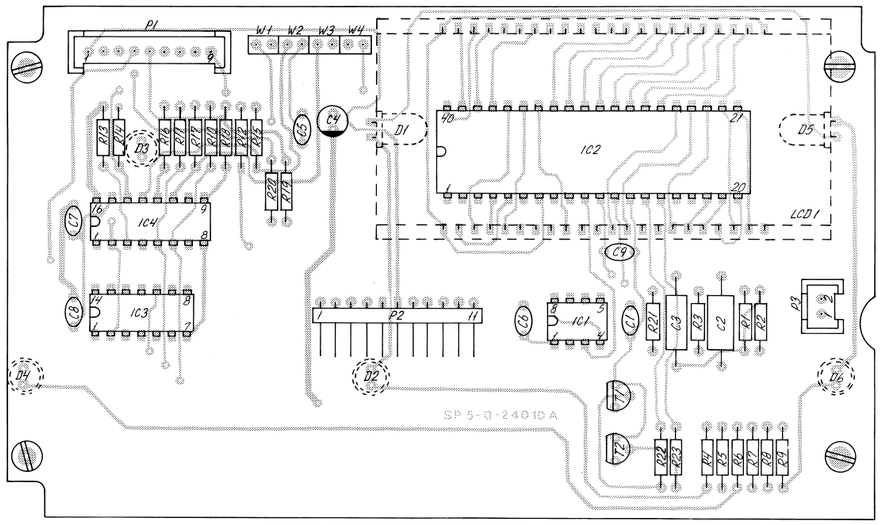
Keyboard Encoding

The front panel is operated in a serial mode. Only 3 leads are used, KYBD, KYBDCLK and LOAD. The keyboard switches are organized in a matrix 4x5. Each 10 mS is serial data shifted into IC3 an 8 bit serial to parallel shift register. A parallel in-serial-out shift register IC4 responds on the KYBD line with information about which contact is depressed. For eliminating debounce all keys are tested 5 times each 10 mS, and a depression is only valid if the results are the same in all the cases.

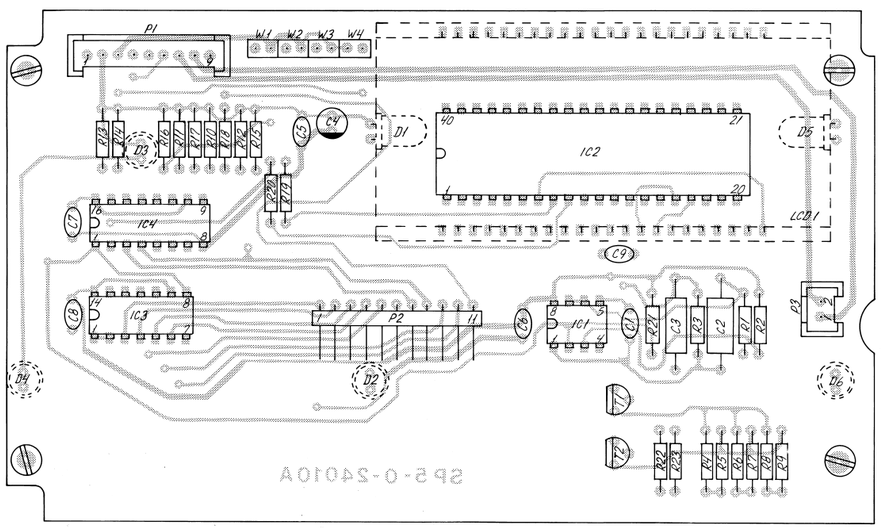
Display

The display is a 32 segments LCD display LCD1. IC2 is an LCD driver with a built-in backplane oscillator and a serial input 32 segments register. Each 100 mS is this register updated.

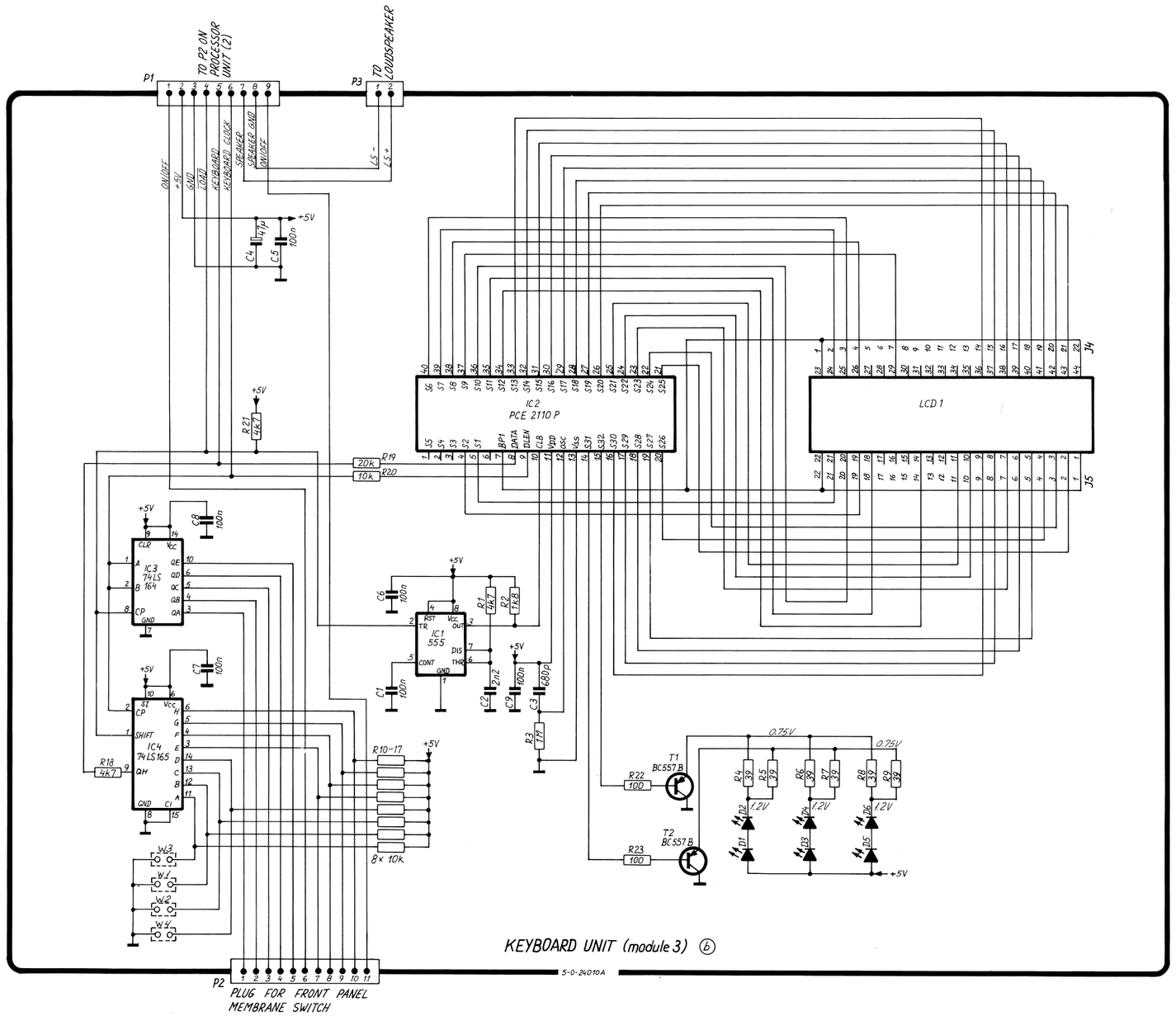
The illumination LEDs. D1 - D6 are controlled from the LCD driver, IC2 through the transistors T1 and T2.



SEEN FROM COMPONENT SIDE WITH UPPER SIDE TRACKS



SEEN FROM COMPONENT SIDE WITH LOWER SIDE TRACKS



STRAPS:
W1 : For service use
W2 : If inserted, T-scrambling is enabled
W3 : If inserted, voice for call sign is enabled
W4 : If inserted, the scrambler is locked to STN1

KEYBOARD UNIT MODULE 3

7.5. POWER SUPPLY UNIT (MODULE 5)

General Description

The power supply unit is constructed for supplying the SAILOR scrambler CRY2001 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

Input Voltage:	10 - 32V DC
Power Consumption:	approx. 15 W
Output Voltage:	+5V
	+15V
	-15V
Back-up battery	3.0 - 3.5V
Switch Frequency:	approx. 45 kHz
Operating Temperature Range:	$-15^{o}C$ to $+55^{o}C$

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-snubbers, 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.

7.5. POWER SUPPLY UNIT (MODULE 5)

General Description

The power supply unit is constructed for supplying the SAILOR scrambler CRY2001 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

Input Voltage:	10 - 32V DC
Power Consumption:	approx. 15 W
Output Voltage:	+5V
	+15V
	-15V
Back-up battery	3.0 - 3.5V
Switch Frequency:	approx. 45 kHz
Operating Temperature Range:	$-15^{o}C$ to $+55^{o}C$

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.

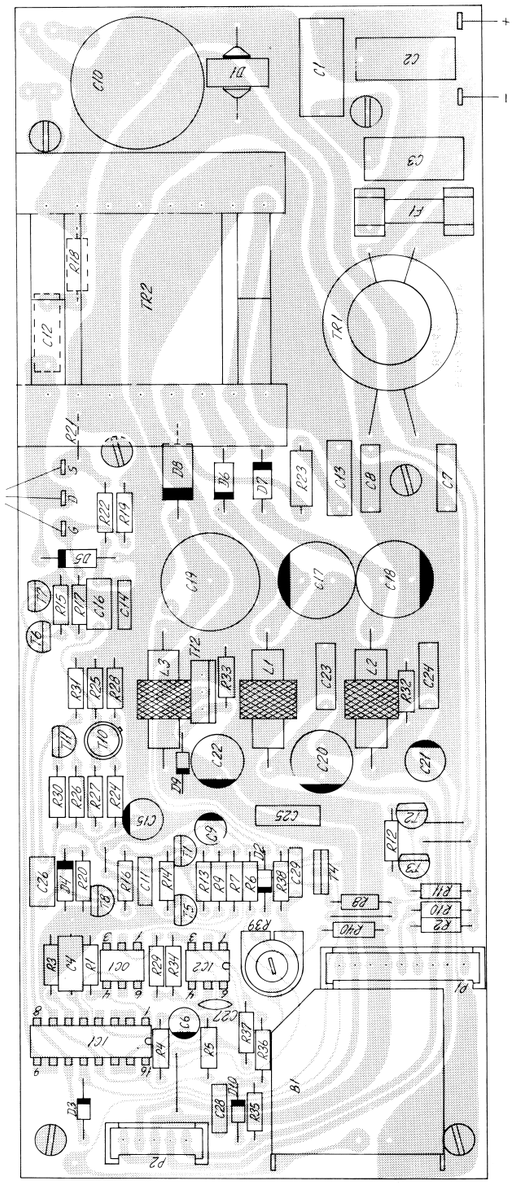
The windings of the transformer TR2 are connected in such a way that the output diodes are reverse-biased when the transistor T9 is conducting. Because of this a current is established in the primary windings, which increases linearly in relation to time, and energy is stored in the primary inductance.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

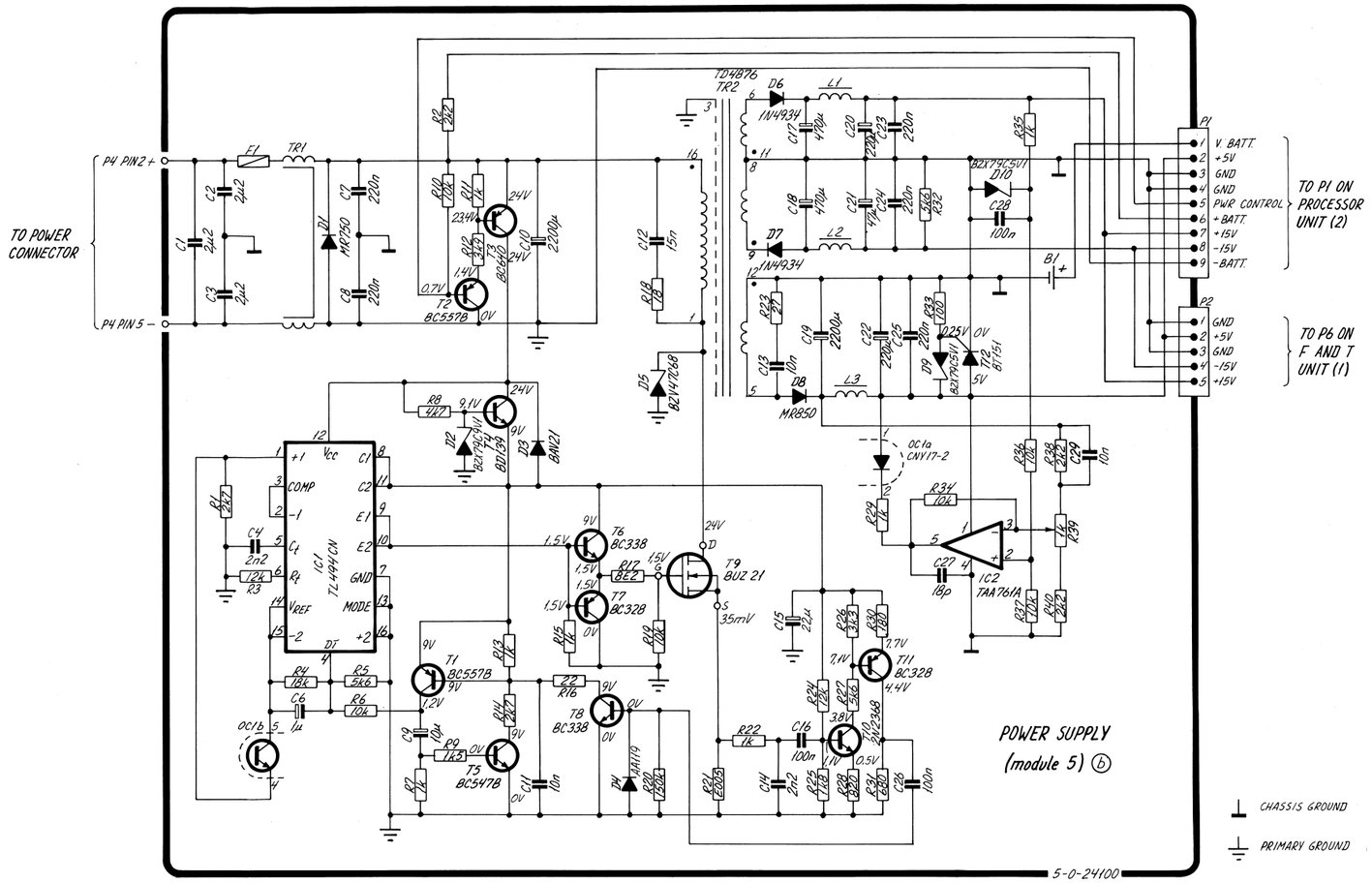
The switch off of the transistor T9 produces polarity inversion of the voltage across the secondary windings. The output diodes conduct and the energy stored in the transformer TR2 is fed to the output capacitors and through the filters to the load.

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-snubbers, 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.

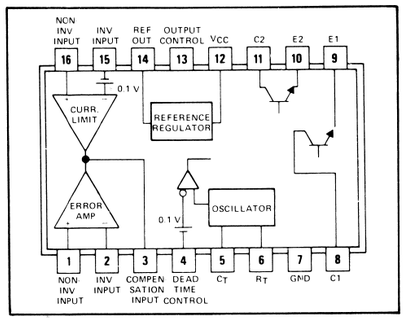




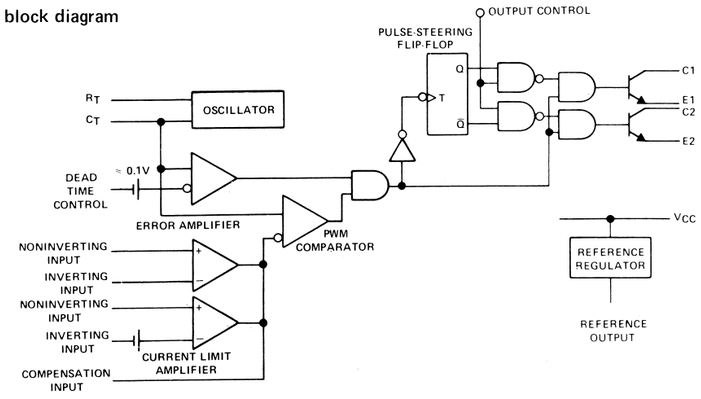
TL494C

PULSE-WIDTH-MODULATION CONTROL CIRCUIT

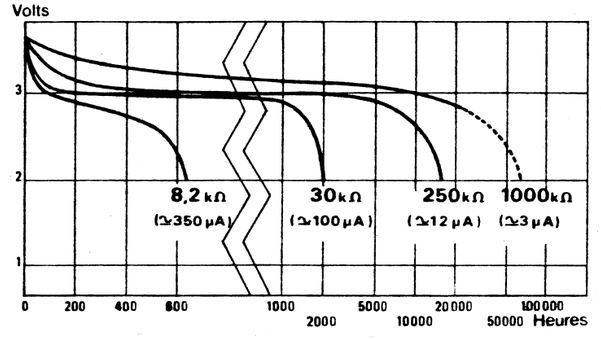
TL494M . . . J
TL494I, TL494C . . . J OR N
DUAL-IN-LINE PACKAGE
(TOP VIEW)



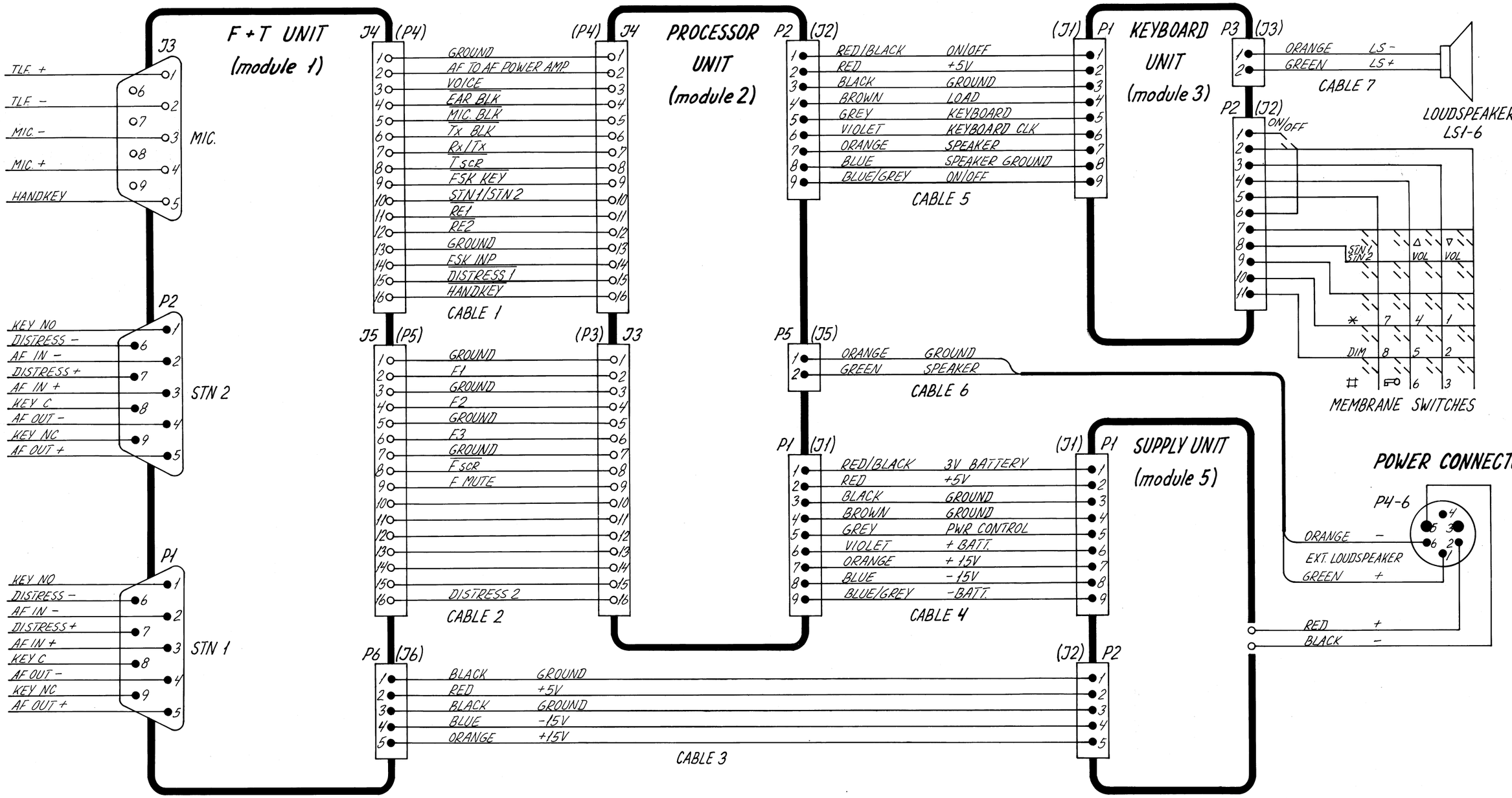
functional block diagram



Discharge curves
for
Back up battery, B1.



7.6 INTERCONNECTION CABLE DIAGRAM FOR CRY2001

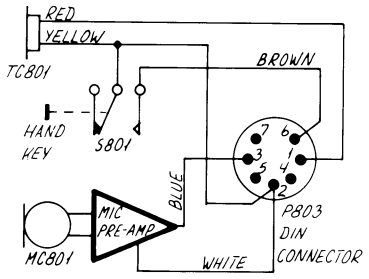


P AND J IN BRACKETS ARE CABLE MOUNTED

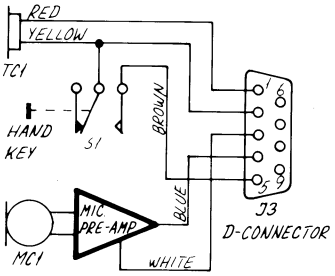
INTERCONNECTION CABLE DIAGRAM FOR CRY2001

MICROTELEPHONE INSTALLATION.

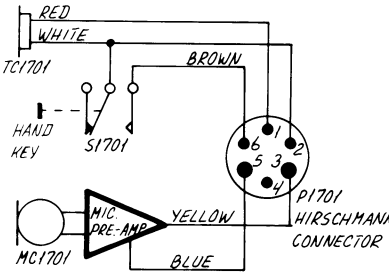
VHF RT2047

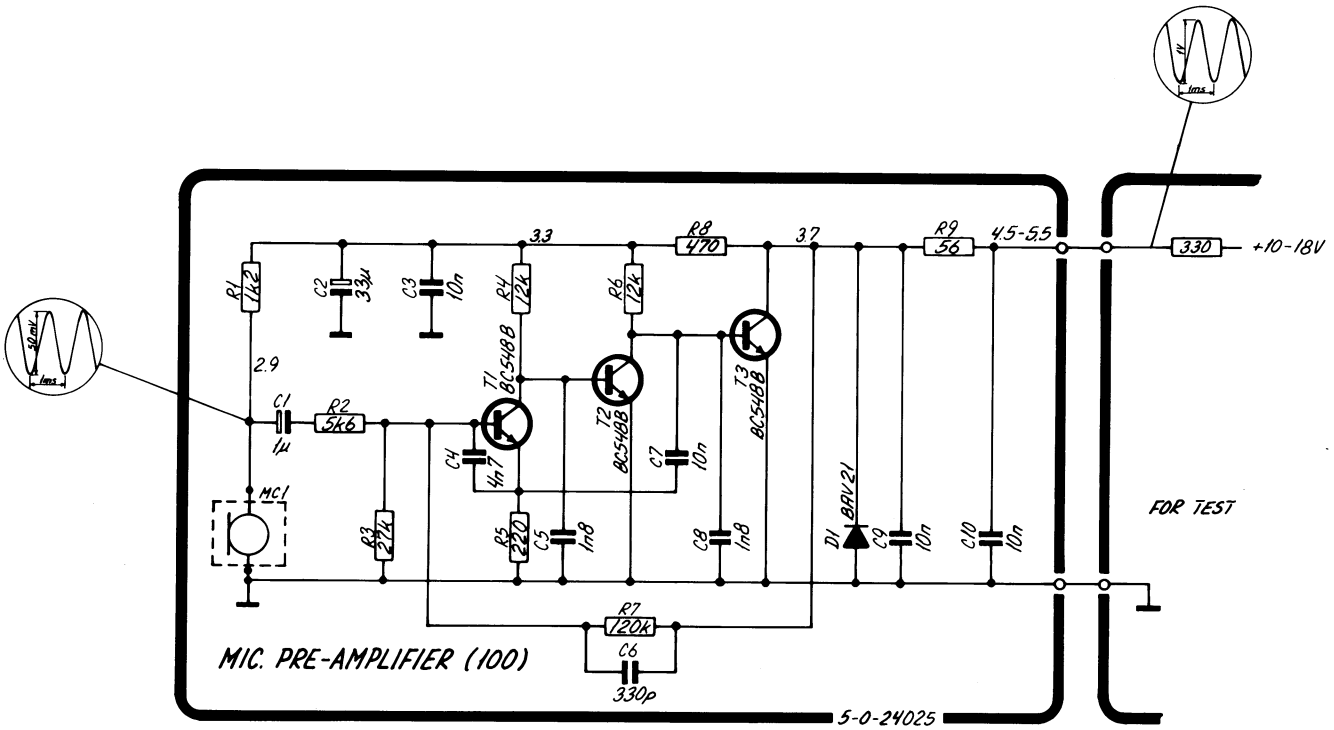


SCRAMBLER CRY2001



SHORTWAVE S130X

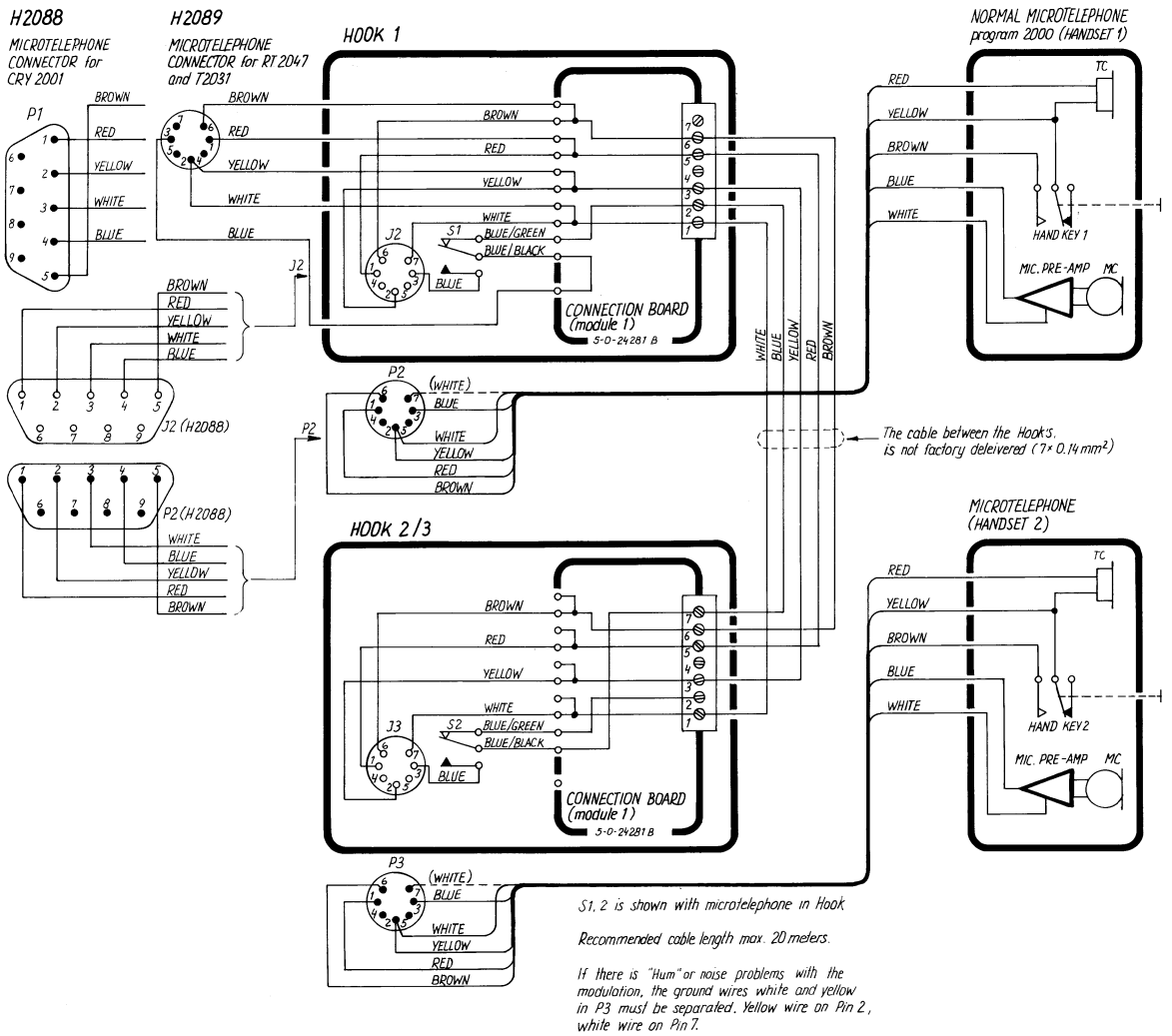




POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	MICROTELEPHONE	with ELEKTRET MIC.AMP.	ESPERA	PRINT NR.5-0-24025A	600108
C1	CAPACITOR ELECTROLYTIC	1uF 20% 50V	* ERO	EK100AA110H	14.506
C2	CAPACITOR ELECTROLYTIC	33uF 20% 16V	* ERO	EK100AA233D	14.518
C3	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C4	CAPACITOR CERAMIC	4.7nF 20% 50V	KCK	HE80SJYD472M	15.165
C5	CAPACITOR CERAMIC	1.8nF -20/+80% 400V	FERROPERM	9/0141/9	15.735
C6	CAPACITOR CERAMIC	330pF 20% 400V	FERROPERM	9/0129/9	16.093
C7	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C8	CAPACITOR CERAMIC	1.8nF -20/+80% 400V	FERROPERM	9/0141/9	15.735
C9	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C10	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
D1	DIODE	BAV21	PHILIPS	BAV21	25.340
MC1	MICROPHONE ELEKTRET		KUC	2123	46.011
R1	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 13122	01.202
R2	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 33562	01.718
R3	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 33273	01.735
R4	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 33123	01.727
R5	RESISTOR	220 OHM 5% 0.33W	PHILIPS	2322 181 33221	01.683
R6	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 33123	01.727
R7	RESISTOR	120 KOHM 5% 0.33W	PHILIPS	2322 181 13124	01.252
R8	RESISTOR	470 OHM 5% 0.33W	PHILIPS	2322 181 33471	01.691
R9	RESISTOR	56 OHM 5% 0.33W	PHILIPS	2322 181 33569	01.668
S1	MICROSWITCH	E62-10H PDT	CHERRY	E62-10H PDT	44.025
T1	TRANSISTOR	BC548B	* PHILIPS	BC548B	28.076
T2	TRANSISTOR	BC548B	* PHILIPS	BC548B	28.076
T3	TRANSISTOR	BC548B	* PHILIPS	BC548B	28.076
TC1	TELEPHONE CARTRIDGE	200 OHM	KIRK	01132518	46.010

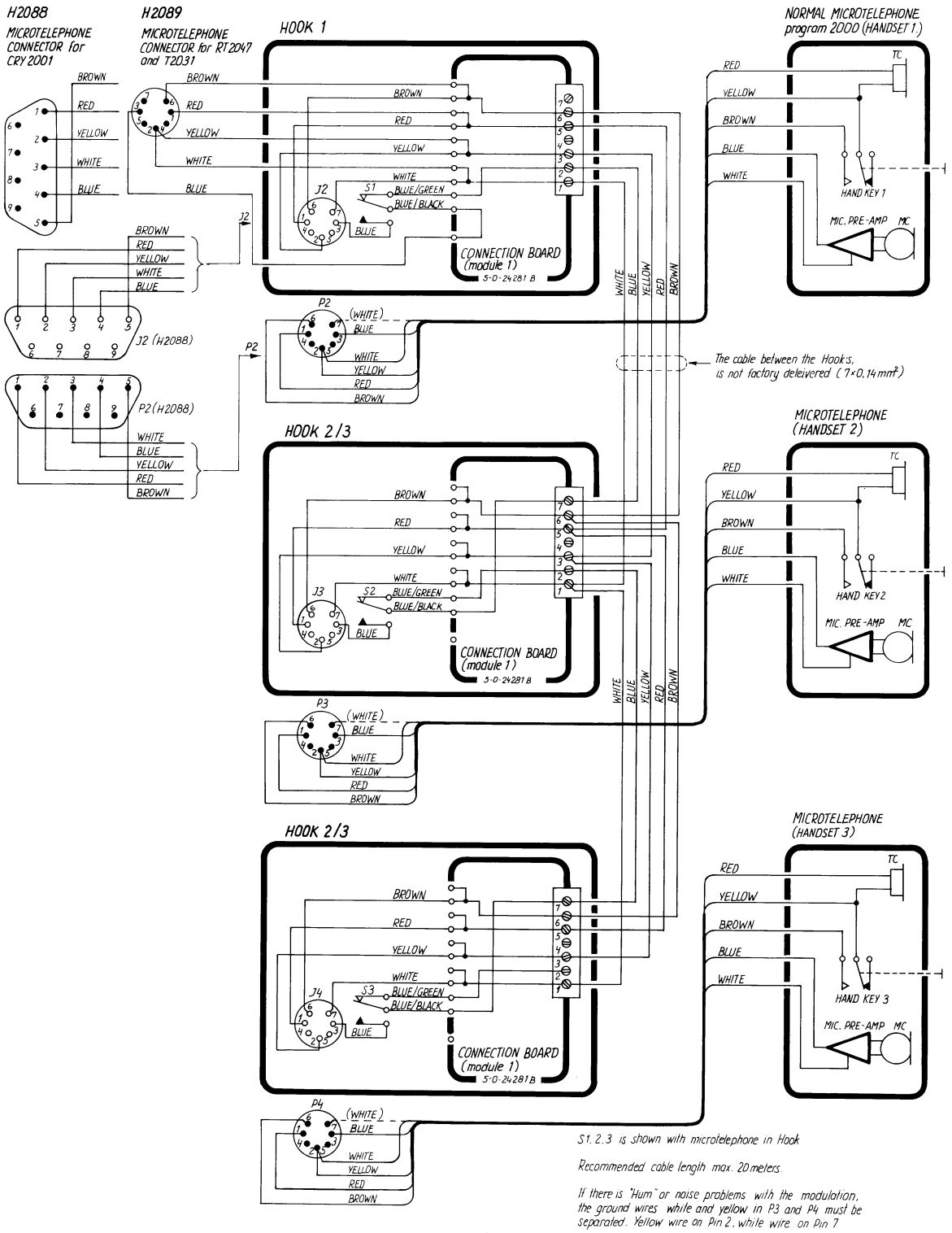
SPECIAL INSTALLATION WITH 2 MICROTELEPHONES:
H2086 FOR SCRAMBLER CRY2001
H2087 FOR VHF RT2047 AND SSB T2031

MICROTELEPHONE ONE WITH PREFERENCE



SPECIAL INSTALLATION WITH 3 MICROTELEPHONES
H2088 FOR SCRAMBLER CRY2001
H2089 FOR VHF2047 AND SSB T2031

MICROTELEPHONE ONE WITH PREFERENCE



CRY2001, VHF2047, T2031,
4-0-24804

CONTENTS

8.0. PARTS LIST

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	MAIN CHASSIS CRY2001	MODULE 6	ESPERA	CRYPTO	802001
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 5	CABLE 4&5 CRY2001		ESPERA	500210 CABLE 4&5 CRY2001	500210
CABLE 6	CABLE 6 CRY2001		ESPERA	500257 CABLE 6 CRY2001	500257
CABLE 7	CABLE 7/CRY2001-8/RT2047		ESPERA	CABLE 7/CRY2001-8/RT2047	500110
-1	F & T UNIT	MODULE 1	ESPERA	PRINT NR 5-0-23833A	600102
-2	PROCESSOR UNIT	MODULE 2	ESPERA	PRINT NR.5-0-23834C	600103
-3	KEYBOARD UNIT	MODULE 3	ESPERA	PRINT NR 5-0-24010A	600104
-5	POWER SUPPLY	MODULE 5	ESPERA	PRINT NR.5-0-24100C	600106
MIC	MICROTELEPHONE	FOR CRY2001	ESPERA	700118 MICROTELEPHONE	700118
C1-6	CAPACITOR MKT	0.68uF 10% 100V	SIEMENS	B32510-D1684-K	11.391
C2-6	CAPACITOR MKT	0.68uF 10% 100V	SIEMENS	B32510-D1684-K	11.391
J6-1	RECEPTACLE (FEMALE)	5 POLE	AMP	0-826371-5	78.125
J1-2	RECEPTACLE (FEMALE)	9 POLE	AMP	0-826371-9	78.129
J2-2	RECEPTACLE (FEMALE)	9 POLE	AMP	0-826371-9	78.129
J5-2	RECEPTACLE (FEMALE)	2 POLE	AMP	0-826371-2	78.122
J1-3	RECEPTACLE (FEMALE)	9 POLE	AMP	0-826371-9	78.129
J2-3	MEMBRANESWITCH 5+6	11 POLE CONNECTOR	MELSEN	0-3-24077D BUK.TG.0-7-24395	44.500
J3-3	RECEPTACLE (FEMALE)	2 POLE	AMP	0-826371-2	78.122
J1-5	RECEPTACLE (FEMALE)	9 POLE	AMP	0-826371-9	78.129
J2-5	RECEPTACLE (FEMALE)	5 POLE	AMP	0-826371-5	78.125
J1-6	PLUG (FEMALE)	D-CONNECTOR 9 POLE	SOURIAU	DE9S-K78	78.757
J2-6	PLUG (FEMALE)	D-CONNECTOR 9 POLE	SOURIAU	DE9S-K78	78.757
J4-6	SUPPLY JACK (FEMALE)	MEK 60 BZ	HIRSCHMANN	973025-100 6 pole Female for Cable	78.309
LS1-6	LOUDSPEAKER	8 OHM	VIFA	S6 FB 8 OHM M/PAK.	46.040
P4-1	DIP SOCKET	16POLE	* AMP	641600-3	78.078
P5-1	DIP SOCKET	16POLE	* AMP	641600-3	78.078
P3-2	DIP SOCKET	16POLE	* AMP	641600-3	78.078
P4-2	DIP SOCKET	16POLE	* AMP	641600-3	78.078
P3-6	PLUG (MALE)	D-CONNECTOR 9 POLE	SOURIAU	DEU9P-FO	78.735
P4-6	SUPPLY PLUG (MALE)	MESEI 60F	HIRSCHMANN	973021-100 6 pole Male for Chassis	78.311
T9-5	TRANSISTOR	RFP 12N10	*RCA	RFP 12N10	29.410

CRY2001

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	F & T UNIT	MODULE 1	ESPERA	PRINT NR 5-0-23833A	600102
C1-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C2-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C3-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C4-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C5-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C7-1	CAPICITOR POLYSTYRENE	2.2nF 1% 63V	PHILIPS	2222 424 42202	10.209
C9-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C10-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C11-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C12-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C13-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C14-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C15-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C16-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C17-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C18-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C19-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C20-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C21-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C22-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C23-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C24-1	CAPACITOR CERAMIC	10nF -20/+80% 50V	KCK	HE70SJYF103Z	15.170
C25-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C26-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C27-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C28-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C29-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C30-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C31-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C32-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C33-1	CAPACITOR MKT	47nF 10% 250V	*ERO	MKT1822	11.101
C34-1	CAPACITOR ELECTROLYTIC	3.3uF 20% 50V	ERO	EKI00AA133H	14.508
C35-1	CAPACITOR CERAMIC	150pF 5% NPO 50V	KCK	HE90SJCH151J	15.147
C36-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C37-1	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI00AA222E	14.514
C38-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C43-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C44-1	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI00BB247E	14.524
C45-1	CAPACITOR ELECTROLYTIC	1uF 20% 50V	* ERO	EKI00AA110H	14.506
C46-1	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJYD102M	15.160
C47-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C48-1	CAPACITOR CERAMIC	1nF 10% 500V	PHILIPS	2222 655 03102	16.148
C49-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	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 424 41003	10.226
C53-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C54-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C55-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C56-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C57-1	CAPICITOR POLYSTYRENE	2.2nF 1% 63V	PHILIPS	2222 424 42202	10.209
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% 63V	AVX	SR215E104ZAA	15.250
C61-1	CAPACITOR MKT	220nF 10% 63V	*ERO	MKT1822	11.045
C62-1	CAPACITOR POLYSTERENE	22nF 1% 63V	PHILIPS	2222 424 42203	10.234
C63-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	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	EKI00AA210F	14.512
C68-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C69-1	CAPACITOR POLYSTYRENE	1nF 1% 250V	PHILIPS	2222 426 41002	10.350
C70-1	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI00AA222E	14.514
C71-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C72-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C73-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C74-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C75-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C76-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C77-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C78-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C79-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C80-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C81-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C82-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C83-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C84-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C85-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C86-1	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
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 424 41003	10.226
C90-1	CAPACITOR POLYSTERENE	4.7nF 1% 63V	PHILIPS	2222 424 44702	10.217
C91-1	CAPACITOR POLYSTYRENE	820pF 1% 250V	PHILIPS	2222 426 48201	10.348

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C92-1	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI00AA222E	14.514
C93-1	CAPACITOR ELECTROLYTIC	10uF 25V	RUBYCON	25TWL10M LOW LEAKAGE	14.661
C94-1	CAPACITOR POLYSTERENE	150pF 1% 630V	PHILIPS	2222 427 41501	10.405
C95-1	CAPACITOR POLYSTERENE	150pF 1% 630V	PHILIPS	2222 427 41501	10.405
C96-1	CAPACITOR POLYSTERENE	22nF 1% 63V	PHILIPS	2222 424 42203	10.234
C97-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C98-1	CAPACITOR POLYSTERENE	560pF 1% 250V	PHILIPS	2222 426 45601	10.344
C99-1	CAPACITOR POLYSTERENE	5.1nF 1% 63V	PHILIPS	2222 424 45102	10.218
C100-1	CAPACITOR POLYSTYRENE	1.5nF 1% 160V	PHILIPS	2222 425 41502	10.280
C101-1	CAPACITOR POLYSTERENE	120pF 1% 630V	PHILIPS	2222 427 41201	10.403
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 426 46801	10.346
C106-1	CAPACITOR POLYSTYRENE	5.6nF 1% 63V	PHILIPS	2222 424 45602	10.219
C107-1	CAPACITOR POLYSTERENE	30nF 1% 63V	PHILIPS	2222 424 43003	10.237
C108-1	CAPACITOR POLYSTYRENE	100pF 1% 630V	PHILIPS	2222 427 41001	10.400
C109-1	CAPACITOR POLYSTYRENE	100pF 1% 630V	PHILIPS	2222 427 41001	10.400
C110-1	CAPACITOR POLYSTERENE	22nF 1% 63V	PHILIPS	2222 424 42203	10.234
C111-1	CAPACITOR POLYSTERENE	12nF 1% 63V	PHILIPS	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	EKI00AA222E	14.514
C114-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C115-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C116-1	CAPACITOR POLYSTERENE	12nF 1% 63V	PHILIPS	2222 424 41203	10.228
C117-1	CAPACITOR POLYSTERENE	12nF 1% 63V	PHILIPS	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 424 41203	10.228
C120-1	CAPACITOR POLYSTERENE	12nF 1% 63V	PHILIPS	2222 424 41203	10.228
C121-1	CAPACITOR POLYSTERENE	12nF 1% 63V	PHILIPS	2222 424 41203	10.228
C122-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C123-1	CAPACITOR POLYSTERENE	12nF 1% 63V	PHILIPS	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	EKI00AA210F	14.512
C126-1	CAPACITOR CERAMIC	220nF 20% 63V	AVX	SR305C224MAA	15.255
C127-1	CAPACITOR CERAMIC	220nF 20% 63V	AVX	SR305C224MAA	15.255
C128-1	CAPACITOR ELECTROLYTIC	47uF 35V	* ERO	EKI00CC247F	14.525
C129-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C130-1	CAPACITOR POLYSTERENE	680pF 1% 250V	PHILIPS	2222 426 46801	10.346
C131-1	CAPACITOR POLYSTERENE	27nF 1% 63V	PHILIPS	2222 424 42703	10.236
C132-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C133-1	CAPACITOR POLYSTERENE	5.1nF 1% 63V	PHILIPS	2222 424 45102	10.218
C134-1	CAPACITOR POLYSTERENE	3.9nF 1% 63V	PHILIPS	2222 424 43902	10.215
C135-1	CAPACITOR POLYSTERENE	4.7nF 1% 63V	PHILIPS	2222 424 44702	10.217

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
C136-1	CAPACITOR POLYSTYRENE	1.5nF 1% 160V	PHILIPS	2222 425 41502	10.280
C137-1	CAPACITOR POLYSTYRENE	6.8nF 1% 63V	PHILIPS	2222 424 46802	10.221
C138-1	CAPACITOR MKT	10nF 10% 400V	* ERO	MKT1822-310/405	12.212
C139-1	CAPACITOR POLYSTYRENE	270pF 1% 630V	PHILIPS	2222 427 42701	10.411
C140-1	CAPICITOR POLYSTYRENE	2.2nF 1% 63V	PHILIPS	2222 424 42202	10.209
C141-1	CAPACITOR POLYSTYRENE	270pF 1% 630V	PHILIPS	2222 427 42701	10.411
C142-1	CAPACITOR POLYSTYRENE	8.2nF 1% 63V	PHILIPS	2222 424 48202	10.224
C143-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C144-1	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJYD102M	15.160
C145-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C146-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C147-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C148-1	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJYD102M	15.160
C149-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C150-1	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C151-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C152-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C153-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C154-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C155-1	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C156-1	CAPACITOR CERAMIC	33pF 5% NPO 100V	KCK	HE50SJCH330J	15.084
C157-1	CAPACITOR ELECTROLYTIC	10uF 25V	RUBYCON	25TWL10M 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
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
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

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POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
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	* MOTOROLA	BZX79C12	26.554
IC1-1	INTEGRATED CIRCUIT	MC14053BCP	MOTOROLA	MC14053BCP	33.201
IC2-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC3-1	INTEGRATED CIRCUIT	MC14053BCP	MOTOROLA	MC14053BCP	33.201
IC4-1	OPTO-COUPLER	CNY17-2	*SIEMENS	Q62703-N0001-S002	32.530
IC5-1	OPTO-COUPLER	CNY17-2	*SIEMENS	Q62703-N0001-S002	32.530
IC6-1	INTEGRATED CIRCUIT	MC14053BCP	MOTOROLA	MC14053BCP	33.201
IC7-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC8-1	INTEGRATED CIRCUIT	TL070	TEXAS	TL070	31.708
IC9-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC10-1	INTEGRATED CIRCUIT	XR2211	EXAR	XR2211	31.496
IC11-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC12-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC13-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC14-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC15-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	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	* NATIONAL	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	INTEGRATED CIRCUIT	MC14053BCP	MOTOROLA	MC14053BCP	33.201
IC24-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC25-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC26-1	INTEGRATED CIRCUIT	LF347N	* NATIONAL	LF347N	31.530
IC27-1	INTEGRATED CIRCUIT	TL072CP	TEXAS	TL072CP	31.710
IC28-1	INTEGRATED CIRCUIT	TDA2108	*PHILIPS	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	RM4194	* RAYTHEON	RC4194	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

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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
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 13103	01.225
R2-1	RESISTOR	82 KOHM 5% 0.33W	PHILIPS	2322 181 13823	01.247
R3-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 13273	01.235
R4-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R5-1	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 13822	01.222
R6-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R7-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R8-1	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 13681	01.195
R9-1	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 13822	01.222
R10-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R11-1	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 13681	01.195
R12-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R13-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R14-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R15-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R16-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R17-1	RESISTOR	1.5 KOHM 5% 0.33W	PHILIPS	2322 181 13152	01.204
R18-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R19-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 13473	01.241

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R20-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R21-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R22-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R23-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R24-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R25-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R26-1	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 13105	01.275
R27-1	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 13105	01.275
R28-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R29-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 13473	01.241
R30-1	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 13105	01.275
R31-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R32-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R33-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R34-1	RESISTOR	1.5 KOHM 5% 0.33W	PHILIPS	2322 181 13152	01.204
R35-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R36-1	RESISTOR	110 KOHM 5% 0.33W	PHILIPS	2322 181 13114	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 13103	01.225
R41-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	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 13103	01.225
R45-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	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 13244	01.259
R49-1	RESISTOR	240 KOHM 5% 0.33W	PHILIPS	2322 181 13244	01.259
R50-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R51-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R52-1	RESISTOR	10 OHM 5% 0.33W	PHILIPS	2322 181 13109	01.150
R53-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R54-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R55-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R56-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R57-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R58-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R59-1	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 13332	01.212
R60-1	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 13332	01.212
R61-1	RESISTOR	56 OHM 5% 0.33W	PHILIPS	2322 181 13569	01.168
R62-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 13273	01.235
R63-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R64-1	RESISTOR	82 KOHM 5% 0.33W	PHILIPS	2322 181 13823	01.247
R65-1	RESISTOR	68 KOHM 5% 0.33W	PHILIPS	2322 181 13683	01.245
R66-1	RESISTOR	560 OHM 5% 0.33W	PHILIPS	2322 181 13561	01.193
R67-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 13333	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 13683	01.245
R70-1	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 13222	01.208
R71-1	RESISTOR	68 KOHM 5% 0.33W	PHILIPS	2322 181 13683	01.245
R72-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 13333	01.237
R73-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R74-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 13473	01.241
R75-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R76-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 13273	01.235
R77-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R78-1	RESISTOR	180 KOHM 5% 0.33W	PHILIPS	2322 181 13184	01.256
R79-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233
R80-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233
R81-1	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 13272	01.210
R82-1	RESISTOR	9.1 KOHM 5% 0.33W	PHILIPS	2322 181 13912	01.224
R83-1	RESISTOR	180 KOHM 5% 0.33W	PHILIPS	2322 181 13184	01.256
R84-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	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 13101	01.175
R87-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R88-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R89-1	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 13332	01.212
R90-1	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 13562	01.218
R91-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	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 13103	01.225
R94-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R95-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R96-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233
R97-1	RESISTOR	470 KOHM 5% 0.33W	PHILIPS	2322 181 13474	01.266
R98-1	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R99-1	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 13105	01.275
R100-1	RESISTOR	29.4 KOHM 1% 0.4W	PHILIPS	2322 151 52943	03.464
R101-1	POTENTIOMETER TRIMMNING	2.2 KOHM 10% 0.5W	PHILIPS	2322 482 22222	07.665
R102-1	RESISTOR	200 KOHM 5% 0.33W	PHILIPS	2322 181 13204	01.257
R103-1	RESISTOR	39 KOHM 5% 0.33W	PHILIPS	2322 181 13393	01.239
R104-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R105-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R106-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 13333	01.237
R107-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 13333	01.237

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POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R108-1	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 13123	01.227
R109-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R110-1	RESISTOR	390 OHM 5% 0.33W	PHILIPS	2322 181 13391	01.189
R111-1	RESISTOR	110 KOHM 5% 0.33W	PHILIPS	2322 181 13114	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 13103	01.225
R116-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	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 13124	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 13103	01.225
R123-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R124-1	RESISTOR	110 KOHM 5% 0.33W	PHILIPS	2322 181 13114	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 13103	01.225
R129-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	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
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 13103	01.225
R135-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R136-1	RESISTOR	120 KOHM 5% 0.33W	PHILIPS	2322 181 13124	01.252
R137-1	RESISTOR	33 KOHM 5% 0.33W	PHILIPS	2322 181 13333	01.237
R138-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	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 13682	01.220

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R152-1	RESISTOR	220 OHM 5% 0.33W	PHILIPS	2322 181 13221	01.183
R153-1	RESISTOR	1.3 KOHM 5% 0.33W	PHILIPS	2322 181 13132	01.203
R154-1	RESISTOR	1.3 KOHM 5% 0.33W	PHILIPS	2322 181 13132	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 13821	01.197
R157-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 13473	01.241
R158-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 13473	01.241
R159-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 13473	01.241
R160-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 13473	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 13682	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 13102	01.200
R176-1	RESISTOR	403 OHM 1% 0,4W	PHILIPS	2322 151 54021	03.390
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 TRIMMNING	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 13511	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 13333	01.237
R184-1	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 13154	01.254
R185-1	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 13154	01.254
R186-1	RESISTOR	47 KOHM 5% 0.33W	PHILIPS	2322 181 13473	01.241
R187-1	POTENTIOMETER TRIMMING	4.7 KOHM 0.75W	AB ELECTRONIC	HC-10	07.714
R188-1	RESISTOR	6.8 KOHM 5% 0.33W	PHILIPS	2322 181 13682	01.220
R189-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R190-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R191-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R192-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R193-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R194-1	RESISTOR	33 OHM 5% 0.33W	PHILIPS	2322 181 13339	01.162
R195-1	RESISTOR	30 OHM 5% 0.33W	PHILIPS	2322 181 13309	01.161

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
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 13279	01.160
R201-1	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 13399	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 13391	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 13391	01.189
R206-1	POTENTIOMETER TRIMMNING	22 KOHM 10% 0.5W	PHILIPS	2322 482 22223	07.675
R207-1	RESISTOR	6.8 KOHM 5% 0.33W	PHILIPS	2322 181 13682	01.220
R208-1	RESISTOR	220 OHM 5% 0.33W	PHILIPS	2322 181 13221	01.183
R209-1	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 13392	01.214
R210-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R211-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 13273	01.235
R212-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R213-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R214-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R215-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233
R216-1	RESISTOR	330 KOHM 5% 0.33W	PHILIPS	2322 181 13334	01.262
R217-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	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 13562	01.218
R220-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R221-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R222-1	RESISTOR	30 KOHM 5% 0.33W	PHILIPS	2322 181 13303	01.236
R223-1	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 13123	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 13103	01.225
R226-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	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 13364	01.263
R229-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R230-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R231-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R232-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R233-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R234-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R235-1	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 13122	01.202
R236-1	RESISTOR	15 KOHM 5% 0.33W	PHILIPS	2322 181 13153	01.229
R237-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R238-1	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R239-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R240-1	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	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 13154	01.254
R243-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R244-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R245-1	RESISTOR	56 KOHM 5% 0.33W	PHILIPS	2322 181 13563	01.243
R246-1	RESISTOR	56 KOHM 5% 0.33W	PHILIPS	2322 181 13563	01.243
R247-1	RESISTOR	19.6 KOHM 1% 0.4W	PHILIPS	2322 151 51963	03.457
R248-1	RESISTOR	22.1 KOHM 1% 0.4W	PHILIPS	2322 151 52213	03.433
R249-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R250-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R251-1	RESISTOR	22.1 KOHM 1% 0.4W	PHILIPS	2322 151 52213	03.433
R252-1	RESISTOR	330 KOHM 5% 0.33W	PHILIPS	2322 181 13334	01.262
R253-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 13273	01.235
R254-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R255-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R256-1	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 13273	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 13103	01.225
R259-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R260-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R261-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R262-1	RESISTOR	71.5 KOHM 1% 0.4W	PHILIPS	2322 151 57153	03.446
R263-1	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 13183	01.231
R264-1	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 13154	01.254
R265-1	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 13105	01.275
R266-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R267-1	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R268-1	RESISTOR	390 OHM 5% 0.33W	PHILIPS	2322 181 13391	01.189
R269-1	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233
R270-1	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R271-1	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 13332	01.212
R272-1	RESISTOR	220 KOHM 5% 0.33W	PHILIPS	2322 181 13224	01.258
R273-1	RESISTOR	1.8 MOHM 5% 0.33W	PHILIPS	2322 181 13185	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	12V 1 SK	OUC	OUC-S-112D	21.300
RE2-1	RELAY	12V 1 SK	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

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POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
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.NUMBER
	PROCESSOR UNIT	MODULE 2	ESPERA	PRINT NR.5-0-23834C	600103
C1-2	CAPACITOR TRIMMING	2-18pF PTFE	DAU	107.2901.018	17.100
C2-2	CAPACITOR ELECTROLYTIC	0.33uF 50V	ERO	EKI00AA033H	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	EKI00AA210F	14.512
C6-2	CAPACITOR POLYSTYRENE	10nF 1% 63V	PHILIPS	2222 424 41003	10.226
C7-2	CAPACITOR MKT	10nF 10% 400V	* ERO	MKT1822-310/405	12.212
C8-2	CAPACITOR ELECTROLYTIC	1uF 20% 50V	* ERO	EKI00AA110H	14.506
C9-2	CAPACITOR CERAMIC	470pF 10% 400V	FERROPERM	9/0129,9	16.096
C10-2	CAPACITOR ELECTROLYTIC	220uF 25V	*ERO	EKM00DD322E	14.647
C11-2	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI00BB247E	14.524
C12-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C13-2	CAPACITOR ELECTROLYTIC	10uF 20% 35V	* ERO	EKI00AA210F	14.512
C14-2	CAPACITOR CERAMIC	1nF 20% 500V	*KCK	HM60SJYD102M	15.160
C15-2	CAPICITOR POLYSTYRENE	2.2nF 1% 63V	PHILIPS	2222 424 42202	10.209
C16-2	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI00BB247E	14.524
C17-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C18-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C19-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C20-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C21-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C22-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C23-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C24-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C25-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C26-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C27-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C28-2	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI00AA222E	14.514
C29-2	CAPACITOR ELECTROLYTIC	22uF 20% 25V	* ERO	EKI00AA222E	14.514
C30-2	CAPACITOR ELECTROLYTIC	220uF 25V	*ERO	EKM00DD322E	14.647
C31-2	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	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
D6-2	DIODE	1N4148	* ITT	1N4148	25.131
D7-2	DIODE	AA119	PHILIPS	AA119	25.250

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
D8-2	DIODE	1N4148	* ITT	1N4148	25.131
D9-2	DIODE	1N4148	* ITT	1N4148	25.131
D10-2	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	BZX79C3V9	PHILIPS	BZX79C3V9	26.512
D23-2	DIODE ZENER	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	MB8416-25M	32.765
IC9-2	INTEGRATED CIRCUIT	SPEACH PROCESSOR	N.E.C.	uPD7752	31.521
IC10-2	INTEGRATED CIRCUIT	PROM 32 x 8	ESPERA	32 BYTE	700214
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 BATCH 4172 ELLER DEROVER	31.455
IC19-2	VOLTAGE REGULATOR	LM78L05ACZ	NATIONAL	LM78L05ACZ 5% PL.HUS	31.135
IC20-2	OPTO COUPLER	4N27	MOTOROLA	4N27	32.512
IC21-2	OPTO COUPLER	4N32	MOTOROLA	4N32	32.510
J3-2	DIP SOCKET	16POLE	* AMP	641600-3	78.078
J4-2	DIP SOCKET	16POLE	* AMP	641600-3	78.078
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 13103	01.225
R2-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R3-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R4-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R5-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R6-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R7-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R8-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R9-2	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233
R10-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R13-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R14-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R16-2	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233
R17-2	RESISTOR	22 KOHM 5% 0.33W	PHILIPS	2322 181 13223	01.233
R18-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R19-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R20-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R21-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R22-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R23-2	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R24-2	RESISTOR	100 KOHM 5% 0.33W	PHILIPS	2322 181 13104	01.250
R25-2	RESISTOR	39 KOHM 5% 0.33W	PHILIPS	2322 181 13393	01.239
R26-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R27-2	RESISTOR	39 KOHM 5% 0.33W	PHILIPS	2322 181 13393	01.239
R28-2	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 13392	01.214
R29-2	RESISTOR	56 KOHM 5% 0.33W	PHILIPS	2322 181 13563	01.243
R30-2	RESISTOR	5.1 KOHM 5% 0.33W	PHILIPS	2322 181 13512	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 13561	01.193
R33-2	RESISTOR	91 OHM 5% 0.33W	PHILIPS	2322 181 13919	01.174
R34-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R35-2	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 13273	01.235
R36-2	RESISTOR	300 KOHM 5% 0.33W	PHILIPS	2322 181 13304	01.261
R37-2	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 13562	01.218
R38-2	RESISTOR	1.8 KOHM 5% 0.33W	PHILIPS	2322 181 13182	01.206
R39-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R40-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R41-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R42-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R43-2	RESISTOR	560 OHM 5% 0.33W	PHILIPS	2322 181 13561	01.193
R44-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R45-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R46-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R49-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R50-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R51-2	RESISTOR	1.2 KOHM 5% 0.33W	PHILIPS	2322 181 13122	01.202
R53-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R54-2	RESISTOR	220 KOHM 5% 0.33W	PHILIPS	2322 181 13224	01.258
R55-2	RESISTOR	3.3 OHM 5% 0.33W	PHILIPS	2322 181 13338	01.137
R56-2	POTENTIOMETER TRIMMING	100 OHM 0.75W	*AB ELECTRONIC	HC-10	07.708
R57-2	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R58-2	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216

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POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R59-2	RESISTOR	270 OHM 5% 0.33W	PHILIPS	2322 181 13271	01.185
R60-2	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 13222	01.208
R61-2	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 13392	01.214
R62-2	RESISTOR	560 OHM 5% 0.33W	PHILIPS	2322 181 13561	01.193
R63-2	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R64-2	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R65-2	RESISTOR	2.0 KOHM 5% 0.33W	PHILIPS	2322 181 13202	01.207
R66-2	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 13392	01.214
R67-2	RESISTOR	8.2 KOHM 5% 0.33W	PHILIPS	2322 181 13822	01.222
R68-2	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 13154	01.254
R69-2	RESISTOR	27 KOHM 5% 0.33W	PHILIPS	2322 181 13273	01.235
R70-2	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 13183	01.231
R71-2	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 13154	01.254
R72-2	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 13183	01.231
R73-2	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 13154	01.254
R74-2	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 13183	01.231
R75-2	RESISTOR	470 OHM 5% 0.33W	PHILIPS	2322 181 13471	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
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.NUMBER
	KEYBOARD UNIT	MODULE 3	ESPERA	PRINT NR 5-0-24010A	600104
C1-3	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C2-3	CAPACITOR POLYSTYRENE	2,2nF 1% 250V	PHILIPS	2222 426 42202	10.362
C3-3	CAPACITOR POLYSTERENE	680pF 1% 250V	PHILIPS	2222 426 46801	10.346
C4-3	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI00BB247E	14.524
C5-3	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C6-3	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C7-3	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C8-3	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
C9-3	CAPACITOR CERAMIC	100nF -20/+80% 63V	AVX	SR215E104ZAA	15.250
D1-3	DIODE LIGHT EMITTING	YELLOW 5mm	SANKEN	SEL1910D	25.630
D2-3	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D3-3	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D4-3	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
D5-3	DIODE LIGHT EMITTING	YELLOW 5mm	SANKEN	SEL1910D	25.630
D6-3	DIODE LIGHT EMITTING	ORANGE 5mm	SANKEN	SEL 1913K	25.631
IC1-3	INTEGRATED CIRCUIT	MC1455P1	* MOTOROLA	MC1455P1	31.205
IC2-3	INTEGRATED CIRCUIT	PCE 2110P	PHILIPS	PCE 2110P	31.535
IC3-3	INTEGRATED CIRCUIT	74LS164N	* TEXAS	SN74LS164N	33.960
IC4-3	INTEGRATED CIRCUIT	74LS165N	TEXAS	SN74LS165N	33.961
LCD 1-3	LIQUID CRYSTAL DISPLAY	LCD 3556-365-923/CRY2001	HAMLIN	SP TG.0-3-23887A HAMLIN TG.3556-365-923	25.706
P1-3	PLUG (MALE)	9 POLE	AMP	0-826375-9	78.109
P2-3	PLUG (MALE)		BERG	75168-301-36	78.380
P3-3	PLUG (MALE)	2 POLE	AMP	0-826375-2	78.102
R1-3	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R2-3	RESISTOR	1.8 KOHM 5% 0.33W	PHILIPS	2322 181 13182	01.206
R3-3	RESISTOR	1 MOHM 5% 0.33W	PHILIPS	2322 181 13105	01.275
R4-3	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 13399	01.164
R5-3	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 13399	01.164
R6-3	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 13399	01.164
R7-3	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 13399	01.164
R8-3	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 13399	01.164
R9-3	RESISTOR	39 OHM 5% 0.33W	PHILIPS	2322 181 13399	01.164
R10-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R11-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R12-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R13-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R14-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R15-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R16-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R17-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
R18-3	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R19-3	RESISTOR	20 KOHM 5% 0.33W	PHILIPS	2322 181 13203	01.232
R20-3	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R21-3	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R22-3	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R23-3	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
T1-3	TRANSISTOR	BC557B	* ITT	BC557B	28.091
T2-3	TRANSISTOR	BC557B	* ITT	BC557B	28.091

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
	POWER SUPPLY	MODULE 5	ESPERA	PRINT NR.5-0-24100C	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 425 42202	10.284
C6-5	CAPACITOR ELECTROLYTIC	1uF 20% 50V	* ERO	EKI00AA110H	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	EKI00AA210F	14.512
C10-5	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 40V	* ERO	EGD EG 03 MG 422 G	14.730
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	EKI00BB222F	14.516
C16-5	CAPACITOR MKT	100nF 10% 250V	SIEMENS	B32510-D3104-K000	11.309
C17-5	CAPACITOR ELECTROLYTIC	470uF 40V	*ERO	EKM00FG347G	14.650
C18-5	CAPACITOR ELECTROLYTIC	470uF 40V	*ERO	EKM00FG347G	14.650
C19-5	CAPACITOR ELECTROLYTIC	2200uF -10/+50% 16V	ERO	EG03KE422D	14.714
C20-5	CAPACITOR ELECTROLYTIC	220uF 25V	*ERO	EKM00DD322E	14.647
C21-5	CAPACITOR ELECTROLYTIC	47uF 20% 25V	* ERO	EKI00BB247E	14.524
C22-5	CAPACITOR ELECTROLYTIC	220uF -10/+50% 10V	ERO	EKM00CC322C	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	PHILIPS	BZX79C9V1	26.546
D3-5	DIODE	BAV21	PHILIPS	BAV21	25.340
D4-5	DIODE	AA119	PHILIPS	AA119	25.250
D5-5	DIODE ZENER	68V	THOMSON-CSF	BZV47C68	26.790
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	* PHILIPS	BZX79C5V1	26.527
D10-5	DIODE ZENER	5.1V	* PHILIPS	BZX79C5V1	26.527
F1-5	FUSE	3.15A M Ø5x20mm	WICKMANN	919201	45.552

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POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
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-N0001-S002	32.530
R1-5	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 13272	01.210
R2-5	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 13222	01.208
R3-5	RESISTOR	12 KOHM 5% 0.33W	PHILIPS	2322 181 13123	01.227
R4-5	RESISTOR	18 KOHM 5% 0.33W	PHILIPS	2322 181 13183	01.231
R5-5	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 13562	01.218
R6-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R7-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R8-5	RESISTOR	4.7 KOHM 5% 0.33W	PHILIPS	2322 181 13472	01.216
R9-5	RESISTOR	1.5 KOHM 5% 0.33W	PHILIPS	2322 181 13152	01.204
R10-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R11-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R12-5	RESISTOR	3.9 KOHM 5% 0.33W	PHILIPS	2322 181 13392	01.214
R13-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R14-5	RESISTOR	2.7 KOHM 5% 0.33W	PHILIPS	2322 181 13272	01.210
R15-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R16-5	RESISTOR	22 OHM 5% 0.33W	PHILIPS	2322 181 13229	01.158
R17-5	RESISTOR	8.2 OHM 5% 0.33W	PHILIPS	2322 181 13828	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 13103	01.225
R20-5	RESISTOR	150 KOHM 5% 0.33W	PHILIPS	2322 181 13154	01.254
R21-5	SHUNT	TL381	S.P.RADIO	6-0-23857	400381
R22-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	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 13123	01.227
R25-5	RESISTOR	1.8 KOHM 5% 0.33W	PHILIPS	2322 181 13182	01.206
R26-5	RESISTOR	3.3 KOHM 5% 0.33W	PHILIPS	2322 181 13332	01.212
R27-5	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 13562	01.218
R28-5	RESISTOR	820 OHM 5% 0.33W	PHILIPS	2322 181 13821	01.197
R29-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R30-5	RESISTOR	180 OHM 5% 0.33W	PHILIPS	2322 181 13181	01.181
R31-5	RESISTOR	680 OHM 5% 0.33W	PHILIPS	2322 181 13681	01.195
R32-5	RESISTOR	5.6 KOHM 5% 0.33W	PHILIPS	2322 181 13562	01.218
R33-5	RESISTOR	100 OHM 5% 0.33W	PHILIPS	2322 181 13101	01.175
R34-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R35-5	RESISTOR	1 KOHM 5% 0.33W	PHILIPS	2322 181 13102	01.200
R36-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R37-5	RESISTOR	10 KOHM 5% 0.33W	PHILIPS	2322 181 13103	01.225
R38-5	RESISTOR	2.2 KOHM 5% 0.33W	PHILIPS	2322 181 13222	01.208

POSITION	DESCRIPTION		MANUFACTOR	TYPE	S.P.NUMBER
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 13222	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	22.168