radiotelefon

SERVICE MANUAL

Nordic Mobile Telephone

ap3733-02

Opdated version

Stock number: 296-319

Contents

GENERAL INFORMATION

CONFIGURATION AND INSTALLATION

SERVICE INSTRUCTIONS

ACCESSORIES

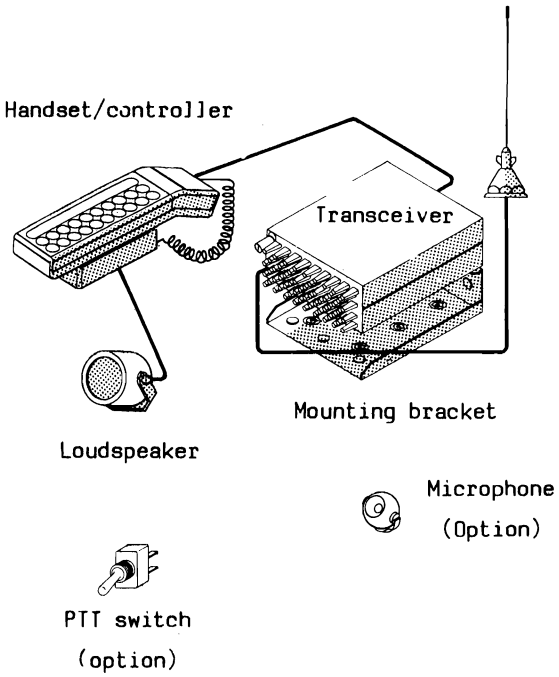
11/17/20 borelarke

List of figures

AP3733-02
(Updated version)
General information

1. Introduction

A. Mobile installation



B. Portaphone

Not yet issued

The mobile telephone AP3733-2 is designed for maximum operating convenience. Thereby the operator can concentrate on the driving. To increase driving safety further, the mobile installation can be provided with an optional microphone for hands-free operation.
Push-to-talk (PTT) is then done with an external switch mounted on e.g. the steering wheel.
When lifting the hand-set, the hands-free mode is automatically switched off. Going back to hands-free mode is done by pushing the appropriate button on the controller.
A portaphone kit, which contains the carrying case, NiCd battery and the antenna, is available. Switching from mobile to totally portable operation is easy as the transceiver is fixed to the mounting bracket with a snap-lock.
Connections are made with one multipin plug and a BNC connector for the antenna. In addition the handset can also be unplugged and moved to the portaphone.
The portaphone has a built-in battery.
If cordless operation is not requested, the battery can be omitted.

Despite the small size of the transceiver it has a built-in duplex filter. The transceiver is built up with modules, either directly plugged to a mother board or via plug terminated cables. Thereby service, if needed, is simplified.

It is possible to provide the mobile telephone with music muting and external calling indication. In addition, the ignition switch can be connected. Then the mobile telephone automatically switches off 10 hours after the ignition switch is turned off. Thereby starting problems caused by leaving the car with the mobile telephone "on" is avoided.

2. Technical data

A. General

Frequency range	: Transmitter	: 453.000MHz to 457.500MHz
	Receiver	: 463.000MHz to 467.500MHz
Principle		: Digital frequency synthesizer
RF - Bandwidth		: Max. 4.5MHz
Channel spacing		: 180 channels/25kHz spacing
Channel switching time		: 3.6s for 180 channels
Mode of operation		: Duplex, internal filter
Duplex separation		: 10MHz with 4.5MHz RF - bandwidth.
Operation temperature		: -25^{0}C to +55^{0}C -30^{0}C to +60^{0}C but specifications not guaranteed.
Frequency stability		: Better than ±5ppm for the specified temperature and supply voltage variations.
Vibration test		: According to the IEC publication 68-2-6.
Supply voltage		: 12V DC chassis neg. nom. 13.2V
Supply voltage variations		: 10.8 to 15.6V
Power consumption for NMT		: Standby: 13.2V 0.5A Tx 15W : 13.2V 7A
Antenna impedance		: 50ohms

B. For "hands free" operation

Loudspeaker	: external 4ohms
Audio output (regulated from control unit)	: Max. 3.5W at 5% distortion, 13.2V supply voltage.

Microphone	: 1kohm condenser microphone.
Input level	: 2mV RMS for ±3kHz dev. at 1kHz tone.

C. For "handset" operation

Output from handset receiver (25ohms with built-in amplifier and filter)	: Max. 115dB above $2x10^{-5}$ Pascal at 1kHz tone ±3kHz deviation. Nominal 90dB above $2x10^{-5}$. Pascal at 1kHz tone ±3kHz deviation.
Vol. regulated from handset (nominal level adjusted internally in radio)	: -10dB and +15dB from nominal level.
Line level from radio unit	: 200mV RMS at 1kHz tone ±3kHz deviation 560mV RMS at max. vol.

The De-emphasis is located in the radio unit.

Handset microphone sensitivity	: 94dB above $2x10^{-5}$
(1kHz condenser microphone with amplifier and filter)	: Pascal free field sound pressure at 1kHz will produce a Tx deviation between ±3 and ±4.5kHz.
Line level from handset	: 100mV RMS at 1kHz tone ±3kHz deviation on transmitter.

The pre-emphasis is located in the radio unit.
A 5ohm loudspeaker is located in the handset

D. Receiver

Sensitivity		: Typ 0.3uV (1/2 EMF) for 20dB sinad psophometric
Squelch level adjusted internally		: 0.4uV (1/2 EMF)
Co-channel rejection	: Cept method	: -7.5dB
	: NMT method	: -6.5dB
Adjacent channel rej.	: Cept method	: 72dB normal test conditions
	: NMT method	: 74dB normal test conditions

Spurious and image rej.	: Cept method	: >70dB in duplex. Image 90dB
	: NMT method	: >70dB in duplex. Image 90dB
Intermodulation rej.	: Cept method	: >70dB
	: NMT method	: >67dB
Blocking	: Cept method	: >100dB
	: NMT method	: >100dB
Spurious emissions	: Antenna	: <2nW
	: Cabinet	: <2nW
De-emphasis		: Following 6dB per octave curve from 0.3 to 3kHz within +1-3dB relative level at 1kHz
Harmonic distortion		: NMT method: 2%

Audio frequency

Intermodulation	: NMT method: -25dB
Hum and noise	: Cept method: -50dB RMS Psophometric NMT method: -50dB RMS Psophometric NMT method: -30dB Peak
AM suppression	: NMT method: 34dB
Function	: NMT method: <0.5dB

E. Transmitter

Power output		: 15W ±1dB from -25^{0}C to +55^{0}C between 10.8 and 15.6V
Power reduction for NMT		: Power reduced to 1.5W ±3dB Power reduced to 0.15W ±3dB
Carrier rise time		: <1ms
Carrier fall time		: <1ms
Spurious emissions	: Antenna	: <0.25uW
	Cabinet	: <2.5uW

Adjacent channel power		: 76dB below carrier power at ±25kHz
Frequency deviation		: Max. ±4.7kHz (supervisory ±300Hz)
Pre-emphasis		: Following 6dB per octave curve from 0.3 to 3kHz within +1-3dB relative level at 1kHz
Harmonic distortion		: 2% at ±3kHz deviation and 1kHz mod. frequency
Audio intermodulation	: NMT method	: -24dB
Hum and noise in "handset" operation		
(residual mod.)	: Cept method	: -48dB RMS Psophometric
	: NMT method	: -48dB RMS Psophometric
	: NMT method	: -24dB Peak

3. Description of the simplified block diagram

The radio contains a full duplex transmitter/receiver, a data modem and a CPU.
The CPU communicates with the base station via the modem which converts digital information to an FFSK (Fast Frequency Shift Keying) signal and the reverse. It also communicates with a uP in the handset and with circuits in the radio.
When a call has been established the base station transmits a 4kHz supervisory (pilot) signal together with the speech. The tone is looped back by the mobile radio. At the Base Station (BS) the received tone is evaluated. A poor signal/noise ratio gives automatic switching to a more close BS or in the worst case disconnection of the call.

References

1. Teleteknik, 1982, No. 1
2. NMT DOC. 1-4

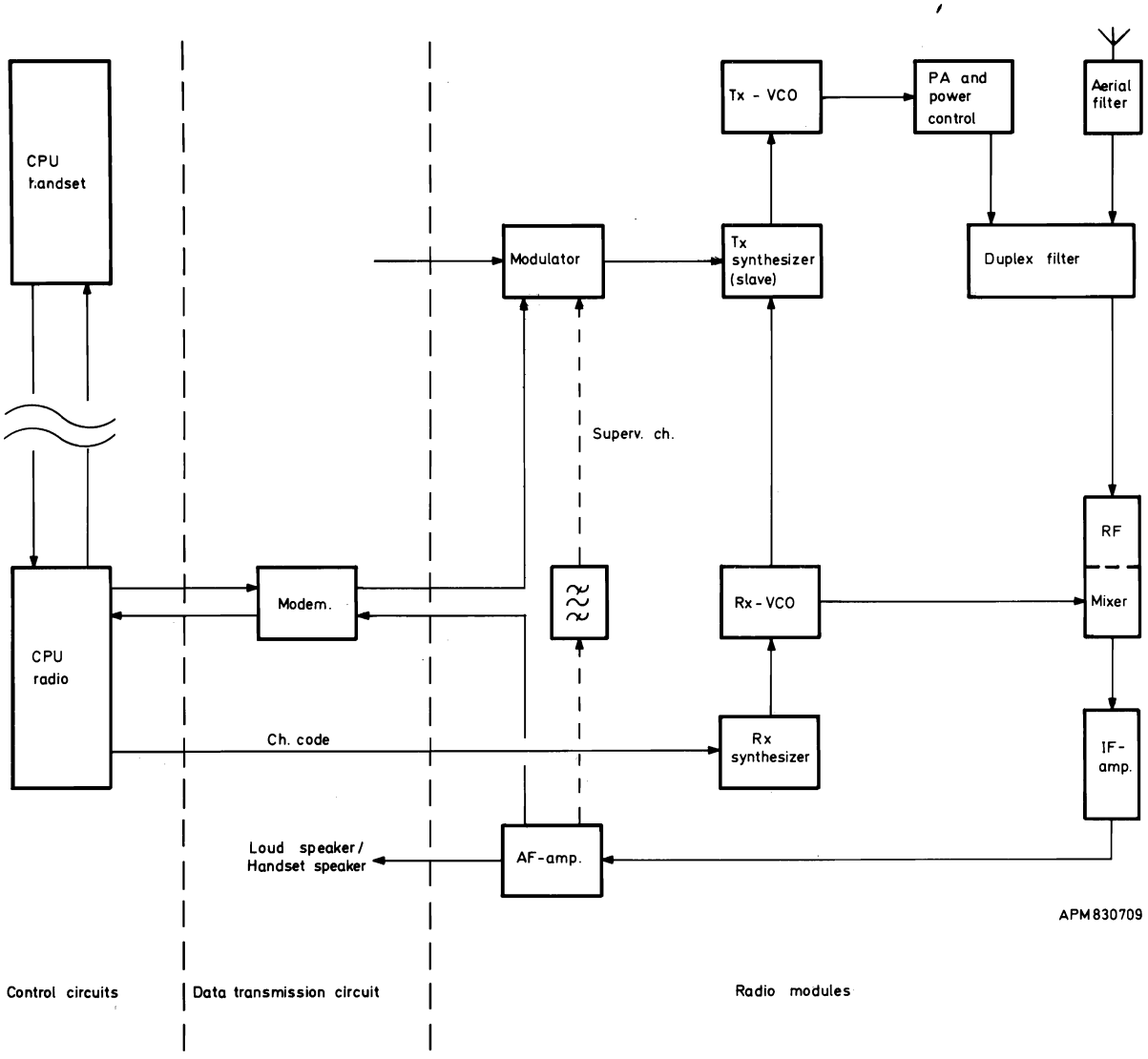


Fig. 3-1 Simplified block diagram

4. Directions for use

A. Basic operation

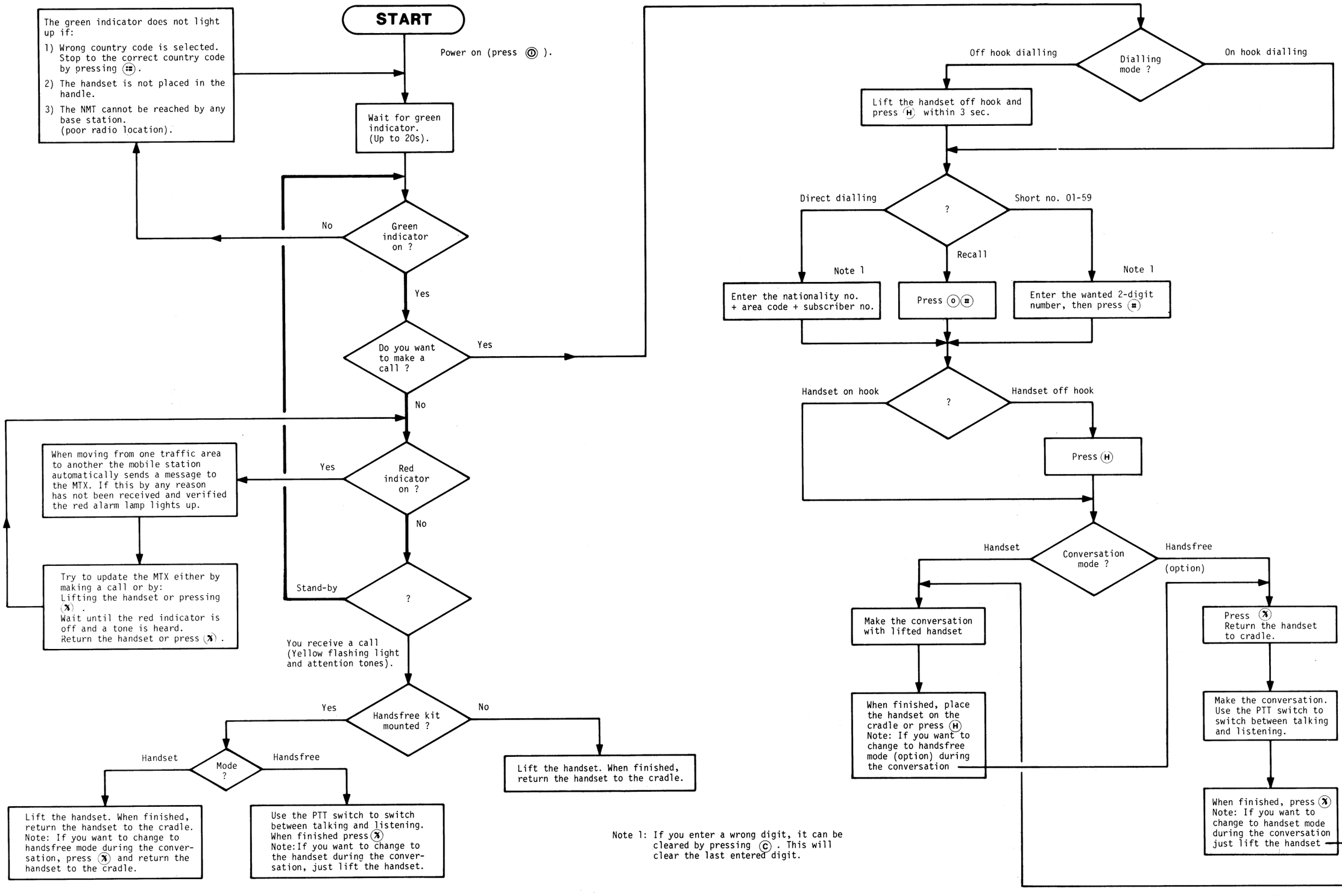


Fig. 4-1 Operation flow-chart

B. Storing short numbers

It is possible to store up to 59 telephone numbers. The stored numbers can be recalled by entering a short number (two digits 01-59). Each telephone number you want to store may contain a maximum of 15 digits.

⌗ is displayed as a □ while an ✳ is displayed as an H .

Storing of telephone numbers

- The display must be blank (unlocked condition).
- Press (✱). H is displayed.
- Enter the short number (01-59).
- Press (✱). H xx H is displayed.
- Enter the telephone number (including eventual prefixes).
- Press (⌗) and then (✱) (Blank display).

Deleting a stored telephone number

- The display must be blank (unlocked condition).
- Press (⌗).
- Enter the short number.
- Press (⌗) and then (✱).

Checking of which number is stored

- Enter the short number.
- Press (⌗). The corresponding telephone number is shown.
- Press (⌗). (Blank display).

AP3733-02

(Updated version)

Configuration and installation

5. Configuration

A. Telephone number coding

The coding is done by programming a PROM on the system board U8. For this purpose a programming box is used.
The telephone number is built up with 7 digits of which the 1st is the country code (Z).

Use the following procedure:

1) Turn the power on by the "ON" button.
   The display will show "E".

2) Insert the PROM into the socket.
   The socket is provided with a lever lock.
   Thereby the PROM can be inserted without using force.

3) Set the left rotary switch to position Z and the right rotary switch to the wanted country code: Denmark = 5
   Sweden = 6
   Norway = 7
   Finland = 8

Fig. 5-1 Front of the programming box

4) Check that an "F" is displayed. Press the "Program" button.

5) Check on the display that the correct digit has been programmed.

6) Turn the left switch to the X1 position and the right switch to the 1st digit of the subscriber no. Perform steps 4) and 5).

7) Continue using the described procedure until the complete subscriber no. is programmed.

NOTE 1: "E" on the display stands for "error".
An "E" will be obtained when the socket is empty and if the "Digit"-switch is set to unused positions.

NOTE 2: An empty PROM can be checked before the programming takes place.
Check that an "F" is displayed with all combinations of the switches.

B. Code lock

The code lock no. is stored in the handset memory.
When delivered all NMT's have been given the code 1,2,3,4.
This can be changed according to customer requirements with the following procedure:
Connect the handset to the test cradle and follow the flow-chart.

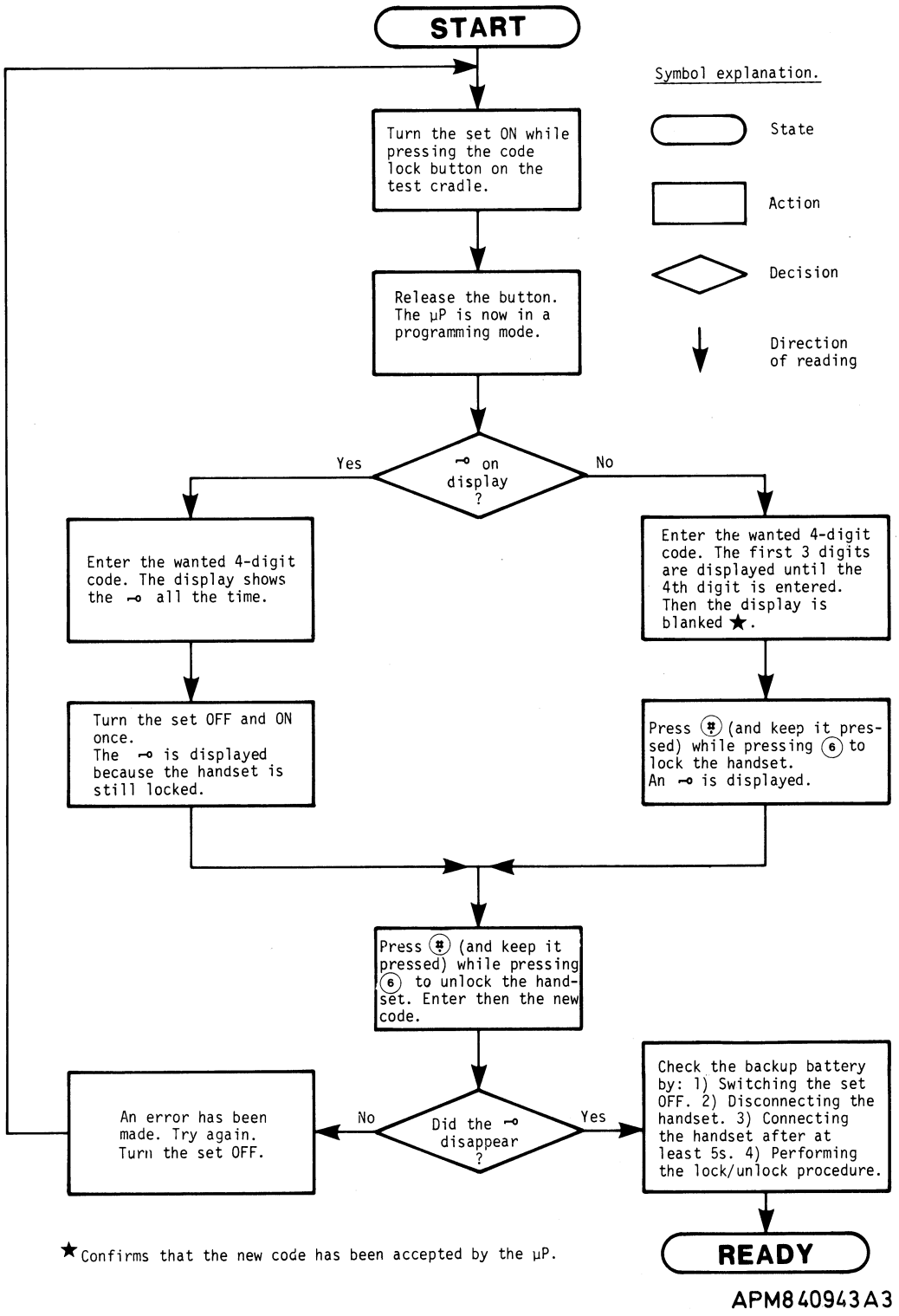


Fig. 5-2 Code lock programming

6. Installation instructions

For connection, see fig. 6-2

For fitting the mounting bracket, see fig. 6-3.

The handset can be turned 180^0 for left-handed people, see 9-6.

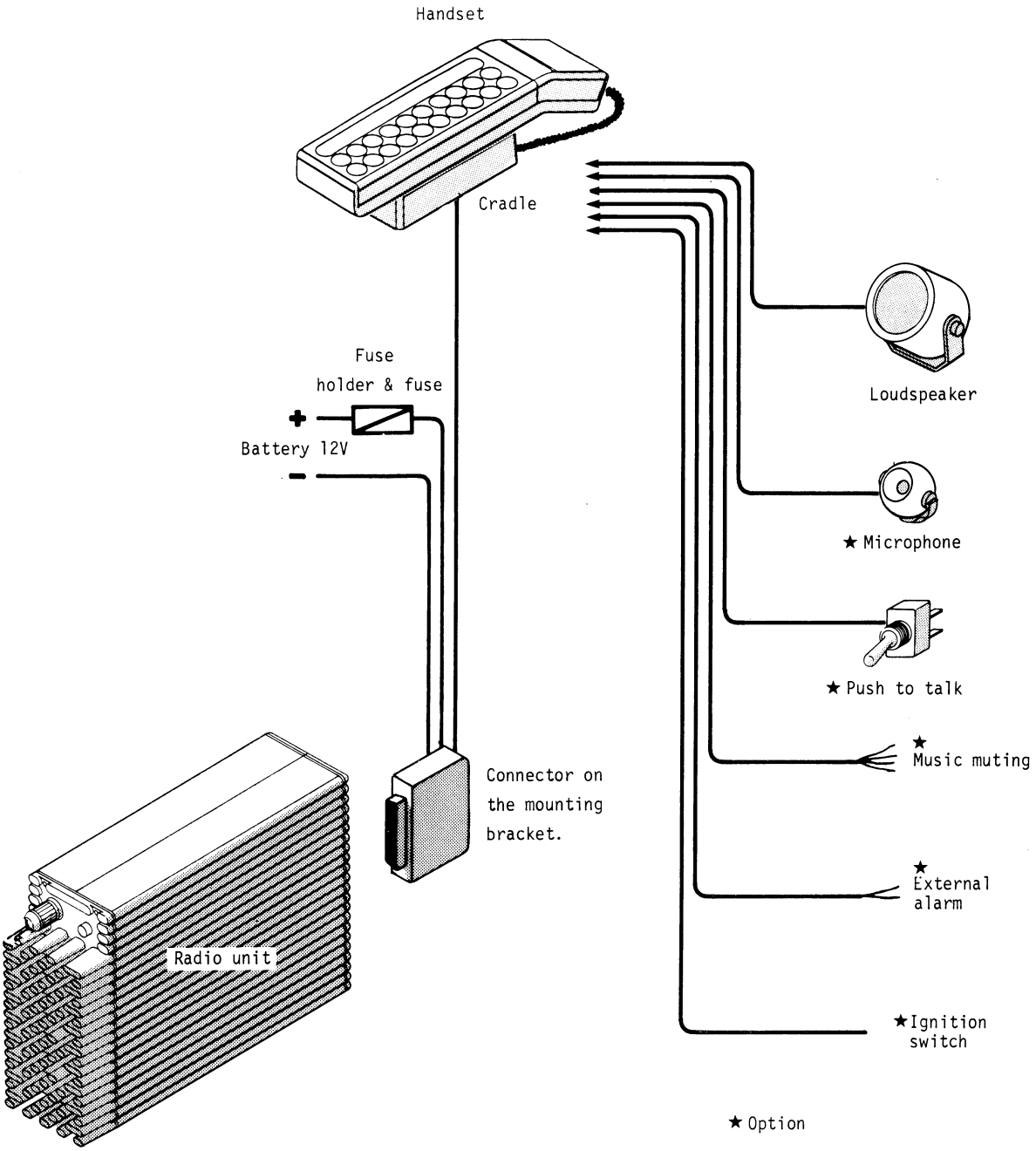


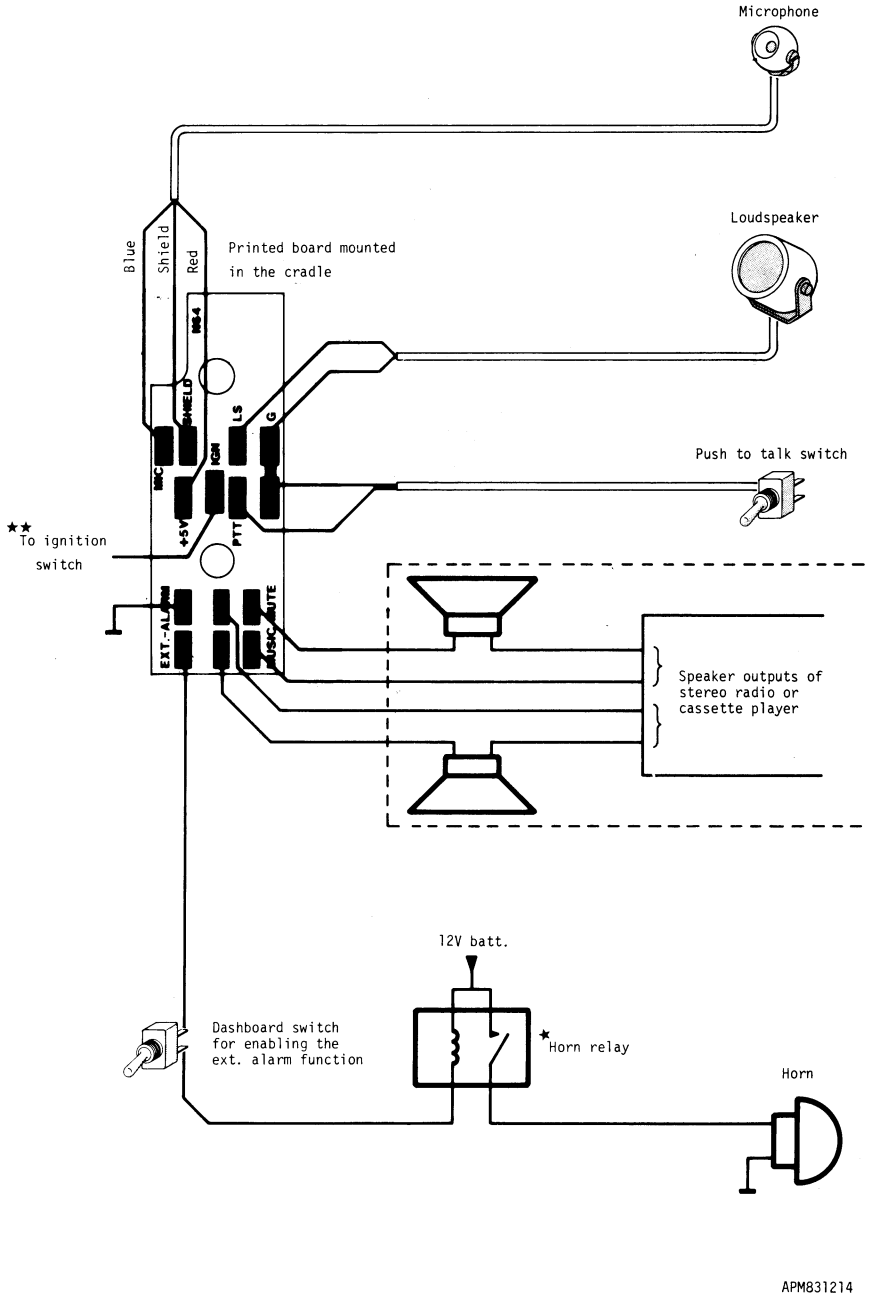
Fig. 6-1 Installation

See fig. 6-1.

IMPORTANT:

a. The music muting feature requires mounting of some components in the cradle. See the component location drawing (page 8-4).

b. When the 10h timer feature (ignition switch) is used, a strap on the cradle print must be removed. See the component location drawing (page 8-4).



★ The horn relay is necessary in most cases because the relay unit can only handle 2A.

★★ The cradle must be provided with +12V when the key is turned clock-wise. If the mobile telephone is left "on" and the key is removed, the mobile telephone is automatically switched off after 10 hours.

Fig. 6-2 Connection of accessories

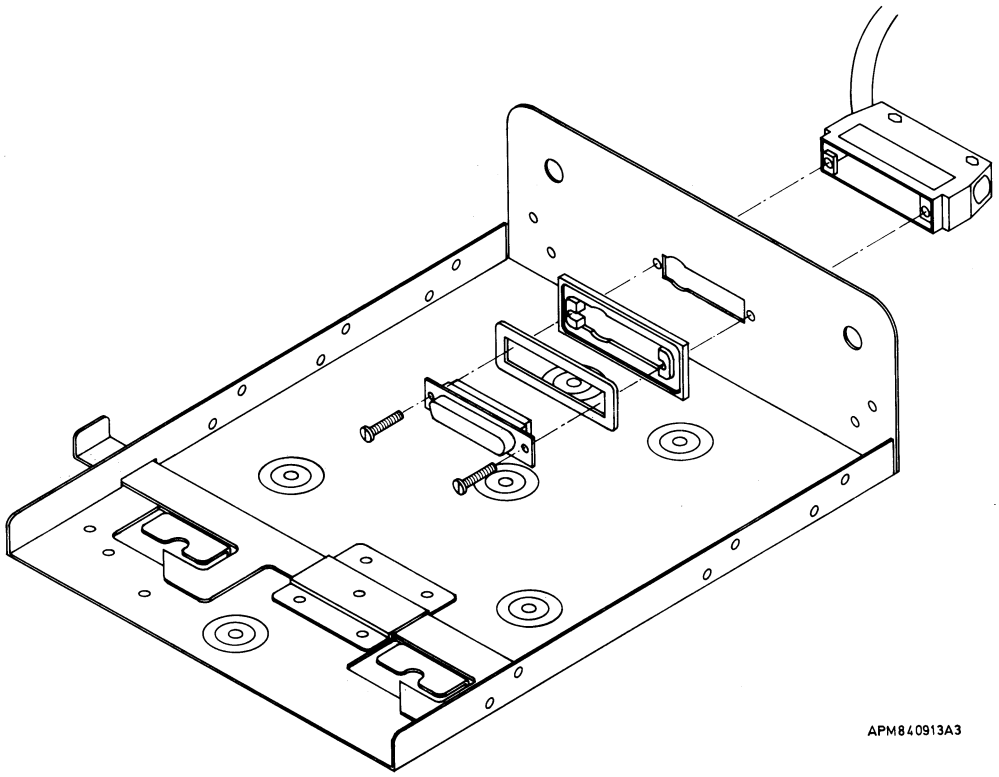


Fig. 6-3 Mounting bracket

AP3733-02

(Updated version)

Service instructions

7. Description of the radio unit

Introduction

In the following chapters the circuitry of the units will be explained.
The description of the handset and accessories and the tuning instructions are not included here as they have separate sections.
Please remember the following notes:

- The diagrams are provided with figures for reference; [2] in the diagram, for example, refers to oscillogram no. 2 (TP2) in the diagram, for example, refers to the test point 2 on the printed wiring board.
- The logic levels are indicated by the signal name $\overline{\text{TX on/off}}$ which means that a high level (+5V) gives the TX off condition while a low level gives the TX on condition.
- The battery voltage is shown as +13.2V.
  The reason is that this is the voltage used during checking and adjusting.
- The units have been given unit numbers U1, U2 etc.
  See the wiring diagrams for the location of the units.
- Most interconnections are made via the motherboard U1. These interconnections are shown in the wiring diagrams.

The block diagram is, to a large extent, self-explanatory. The following remarks are intended as a guide to the use of the diagram. The arrows in the block diagram indicate the signal paths through the circuits, and the main signal paths are indicated by heavy lines. The block diagram is divided into three main sections:
Transmitter, receiver, and common circuits.

The radio unit contains many functions of an ordinary mobile radio for a closed net. Examples: Channel selection, squelch and volume control. The difference is that this radio is fully remotely controlled. All these functions are controlled by a built-in microprocessor. This is mounted on the CPU. The CPU can be regarded as a "black box" which is fed with information from the handset, the radio and the MTX (telephone exchange for mobile telephones). The information is treated according to a program stored in a PROM. The result is commands to the handset, the radio and MTX. For communication with the MTX, the radio speech path is used. As this is of limited bandwidth it cannot be used directly for data transmission. Therefore the data stream is converted to audio type signals in a MODEM (modulator/demodulator).

Receiver

RF, mixer, IF and detector U3 & U2

The received signal is via the duplex filter fed to U3.01. The RF amplifier consists of two cascade coupled transistors Q1,Q2. Six tuned helical coils are tuned for a passband of about 463-468MHz. The mixer Q3 is fed by a local oscillator at 21.4MHz above the received frequency. The oscillator injection affects the DC level at TP2.
The 21.4MHz crystal filter has a bandwidth of about 25kHz. The 21.4MHz IF is converted to a 2nd IF of 455kHz. The 455kHz IF signal is fed to the quadrature detector IC1.
The detector phase shift is adjustable with L1. The 455kHz IF is also fed to the AGC amplifier on a daughter board. The output on U2.04 is a DC voltage in the range of 0-3V depending on the field strength. A high dynamic range is obtained by regulating IC2 with the output voltage.

AF amplifier (Part of system board U8)

The AF from U2 is fed to IC1/1 which removes very low frequencies. The output of IC1/1 is fed to the notch filter, the squelch circuit and to the supervisory signal circuit. The notch filter IC6 prevents the supervisory tone from being audible. IC7 is a variable attenuator controlled by the CPU. The attenuation is controlled by the voltage to IC7.9-11. The CPU controls blocking of either the complete speech path (IC7.06) or only the loudspeaker output IC28/2.05.
The outputs from a ringing signal oscillator and a malfunction oscillator are added to the speech path. The oscillators are enabled by commands from the CPU. The supervisory signal circuit picks out the 4kHz supervisory tone with two stagger tuned BP filters. These are tuned to 4149Hz and 3835Hz respectively. When the supervisory tone is received it will be re-transmitted by the radio, provided that IC28/1.13 is high. I.e. the supervisory tone is fed to the modulation amplifier. Q2,Q3 form an HP filter which picks out the noise obtained when the received signal (if any) is weak. The noise is detected and in IC3/2 the resulting DC is compared with the level set by R35 "Squelch adj.".

Receiver synthesizer loop U5 & U4

The receiver synthesizer loop contains the units U5 and U4. The circuit gives a signal in the range of 484.4 to 488.875MHz and in 25kHz steps. This corresponds to the received frequency +21.4MHz. The frequency is determined by a channel code from the CPU. The output is used as a receiver injection signal and as a control signal for the transmitter synthesizer loop. For the PLL the VCO signal at U4.03 is fed back to U5.03. IC1 and IC3 divide with a ratio determined by datawords from the CPU.

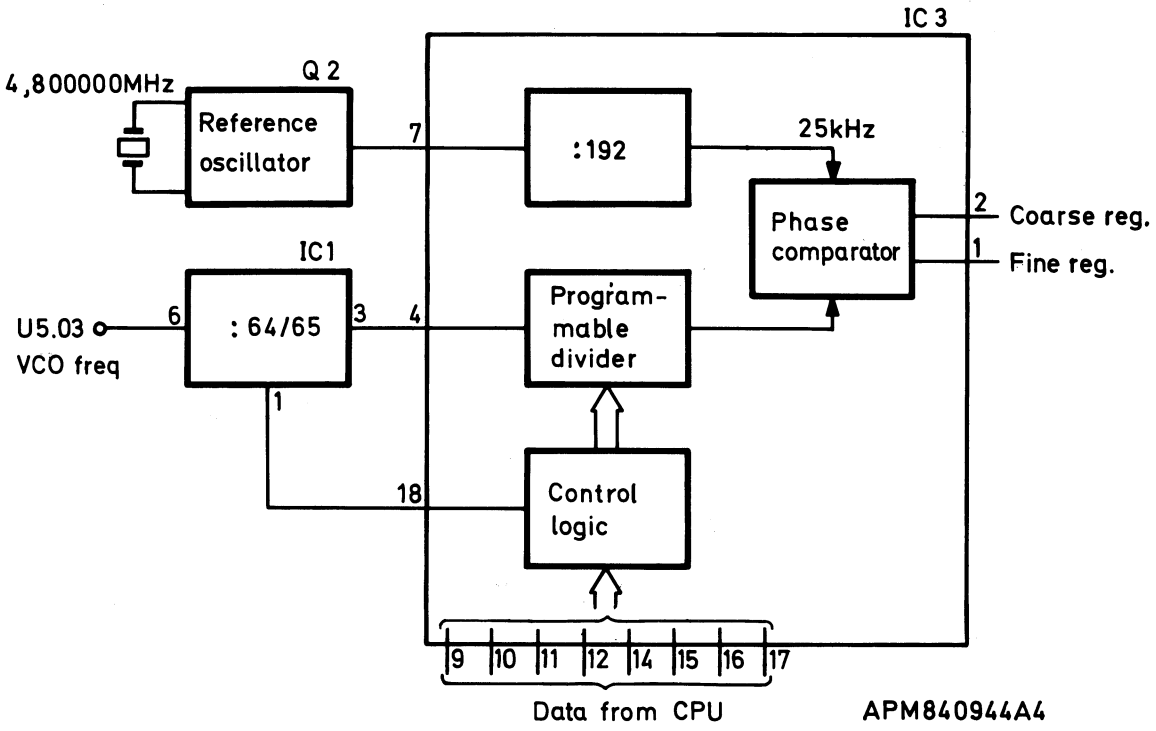


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Fig. 7-1 Principle block diagram IC3

Transmitter

Modulation amplifier (Part of system board U8)

The transmitter can be modulated with the handset microphone (mic. 2), the handsfree microphone (mic. 1), the modem and the supervisory tone. The CPU selects which source shall be connected. With the control signal to Mic. 2 (Handset)/Mic. 1 (Handsfree) either the handset or the handsfree microphone is selected. The pre-emphasis of the selected microphone signal is done with C62. Q8,9 and Q201,202 form an automatic level control which keeps the modulation constant. If the input level is too high IC4/1 starts limiting.
The microphone(s) can be disconnected by the CPU. This is done by disabling IC28/3.
NOTE: With the FAX TX input it is possible to connect an external source.

Transmitter synthesizer loop U6 & U7

The transmitter synthesizer loop contains the units U6 and U7. The VCO in U7 operates as a slave oscillator with an output of 31.4MHz below the RX VCO. This is the wanted transmitter frequency and corresponds to 10MHz duplex separation (31.4-21.4MHz = 10MHz). After the mixer U6/Q2 the difference frequency (RX VCO - TX VCO) is obtained. This frequency (31.4MHz when locked) divided by 4 in IC1 gives 7.85MHz.
IC1 also contains a phase comparator. It compares the down-divided difference frequency with 7.85MHz obtained from the VCXO (Voltage Controlled X-tal Oscillator) IC2.
The VCXO is modulated with the modulation signal from U8.20.
The modulation amplifier IC2 operates in push-pull mode. Thereby maximum voltage variation is obtained across the capacitance diode D2.

PA and power control U10

This unit contains four tuned amplifiers. The output power is blocked if either the TX or RX synthesizer pulls U10.02 low. This happens when the synthesizer loops are not locked. The settling time for the stabilizing loop is less than 3ms. The total bandwidth of the amplifier is about 10MHz. The PA (Power Amplifier) is by the CPU switched to either low, medium or high output power. All three levels are adjusted with trimpotentiometers.

Common circuits

CPU (Part of system board U8)

The CPU (Central Processing Unit) can be regarded as a "black box" which is fed with status information (high or low) to input ports, e.g. squelch condition.

One of the inputs, U8.03, is fed with an analog signal. This is the field strength signal from the IF amplifier. The analog signal is converted to a high or low level with the comparator IC26. The switch level is adjustable with the trimpotentiometer R163.
The uP (microprossesor) is fed with data from the modem. This serial data is arranged in frames so that the uP can separate different information, e.g. channel number, call etc. Via terminal BU1.14 the CPU receives information from the handset (abbreviated HS in some signal names). All information received is processed according to programmes stored in the PROM IC16. The resulting output information is fed to the output ports. The outputs D0,D1 and D2 have DC levels which can take one of 8 combinations (volume control). The volume can by the (🔊)/(🔉) buttons on the handset be stepped up or down. The selected volume is remembered. The volume is remembered independently for the handset and for the loudspeaker.
The CPU also has serial data outputs to the modem and to the handset. IC20-22 are expanders that make it possible for the uP IC10 to have more inputs and outputs than the number of pins otherwise would allow.
During checking and adjusting the function of the CPU is taken over by a test box which is connected to the CPU. When the power is switched on, the CPU is kept passive by a low level to BU1.07 from the handset. After a delay the handset uP releases the reset (i.e. BU1.07) goes high and the programme execution starts. The uP starts by setting the output of the unit to certain conditions. Then the telephone number which is set by the PROM IC19 is read and stored in the RAM. Now the uP starts channel scanning. In order to distribute call attempts evenly among all free marked traffic channels, the scanning starts from a channel selected at random. A random number is calculated by the uP and is converted to a channel number which is fed to the receiver synthesizer. The scanning stops when a base station with an FFSK signal is found with sufficient field strength. Checking of field strength is done with the "Field strength" input U8.03. If the field strength is too low the scanning continues, otherwise the FFSK is checked with the "FFSK carrier present" signal. If the received signal disappears during conversation (squelch off), the radio is switched off after 30s.
This can happen, e.g. when driving through a tunnel, into a garage etc. This function is called "Time out". IC11 contains two timers. One is clocked by 1200Hz and the other one with 4.032MHz. One of the timers is used for the "time out" function. If left by itself this timer will turn the radio off after 30s.
As long as all functions are as specified, time out is prohibited by the uP.
NOTE: Carrier bursts shorter than 1 second does not count as steady carrier.

Modem (Part of system board U8)

The modem (modulator/demodulator) is the interface between the CPU and the transmitter/receiver. Thereby full duplex data communication between the CPU and the base station/MTX is possible. The modem consists mainly of IC13.

Voltage regulators (Part of system board U8)

The power relay is controlled by an S/R flip-flop in the handset. The circuit with IC23 ensures that the relay is energized again after a momentary interruption of the battery supply voltage.
The maximum interrupt time is mainly determined by C108 which is charged through D13 during TX on. The switched voltage is regulated to +5V and +9V.

Transmitter

SYSTEM BOARD U8 (MODULATION AMPLIFIER)
BU1.12 "Mic.2 adj." R82
BU1.13
BU1.11 "Mic.1 adj." R81
IC1/2 D7,8 Pre-emph. Q201 Q8,9 IC28/3 IC4/1 Limi-ter R105 "Max. dev." IC1/4
Mic.2 (Handset)/ Mic.1 (Handsfree)
Mic. blocking
FFSK TX "FFSK level adj." R102
BU1.08
R113 "Superv. mod. adj."

U6 TX SYNTHESIZER
+9V (6) TX on/off (7)
7,85MHz L1 IC2 D2 Q5 TP1 IC1 Phase comp. IC1 Loop filter IC3
IC1 :4 IC1 Lock det.
Q3 Q2 Q1

U7 UHF TX VCO
+9V (2) TX on/off (3)
f_{RX} -31,4MHz VCO Q3,Q4 C4 Q7,Q8 Q5,Q6

U10 PA AND POWER CONTROL
+13,2V (6)
Q1 C9 Q2 C14 Q3 C25 Q4 C35 C36
Q6 IC1 +5V R13 "High power adj."
R26 "Medium power adj." +5V
R27 "Low power adj."
RF pick up RF recti-fier Det.

U9 DUPLEX FILTER
U03.01
U11 ANTENNA FILTER
π filter
BU2 Antenna

Low/Medium/High power
Low/Medium/High power
PA blocking
RF detect

Common circuits

SYSTEM BOARD U8 (CPU)
FFSK Modu-lator
CPU
Mic.2 (Handset)/ Mic.1 (Handsfree)
Mic. blocking
TX on/off
BU1.07 BU1.04 BU1.14 BU1.15
BU1.05 BU1.06 BU1.03 BU1.02 BU1.01
U06.07 U07.03
+9V R163 "Comp level adj." Com-para-tor
FFSK Demodu-lator
(12) A2 (13) A1 (14) A0 (15) LE (16) D3 (17) D2 (18) D1 (19) D0
Channel code

U5 RECEIEVER SYNTHESIZER
+9V (5)
Channel code A2 A1 A0 LE D3 D2 D1 D0 (15)(14)(13)(12)(11)(10)(9)(8)
4,800000 MHz Q2 C22 "TXCO adj."
Reference divider IC3 Coarse reg. Fine reg. Q3 Loop ampl. IC4 Loop filter 25kHz notch filter IC1 :64/65

U4 UHF RX VCO
+9V (2)
C5 f_{RX} +21,4MHz Q7 Q5 Q6

SYSTEM BOARD U8 (POWER CONTROL)
10A
BU1.18 BU1.19 BU1.21 BU1.22 BU1.23 BU1.24 BU1.25
BU1.17 U10.06 BU1.16
+9V +9V for RX VCO (2) U04.02
+9V
+5V
(4) U02.02 U03.03 U05.05 U06.06 U07.02

SYSTEM BOARD U8 (AF AMPLIFIER)
Supervisory signal circuit
TP1 IC2/1,4 IC2/2,3 IC28/1 TP2
R5 "4149Hz adj." R12 "3835 Hz adj."
Supervisory tone off/on
Squelch circuit IC3/1 Det. IC3/2 Q4 Squelch on/off
+9V R35 "Squelch"
Malfunction alarm
IC5/4 Malfunc.
IC5/2,3 Q5 Ring
Ring
Volume control
FFSK
AF
IC1/1 IC6 De-emph. IC7 IC7 IC28/2 IC9 BU1.10
R41 "Handset adj." IC4/2 BU1.09
Speech mute
Loudspeaker blocking

BU1
Clock to HS
Data from HS
Data to HS
Clock from HS
Time out
+13,2V for HS
Push to talk
+13,2V cont.
Music muting
+12V battery
External alarm
+12V battery
µP reset
FAX RX
FAX TX
On/off
Handset receiver
Loudspeaker
Mic.1 (Handsfree)
Ground
Mic.2 (Handset)
Mic. ground
1 14 25 13

Note: +13,2V is the nominal voltage used during checking and adjusting.

Receiver

Field strength
U2 IF AMPLIFIER
+9V (2)
21,4MHz X-tal filter C1 Q1,Q2 Q3 455kHz cer. filter Q4 AGC IC1,Q5 Det./ ampl. L1
Q6 20,945MHz
U3 RF AND MIXER
+9V (3)
U9 L1 L2 Q1,Q2 L3 L4 L5 L6 TP3 TP2 TP1 C11 C10 Q3 L11

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Fig. 7-2 Block diagram, radio unit

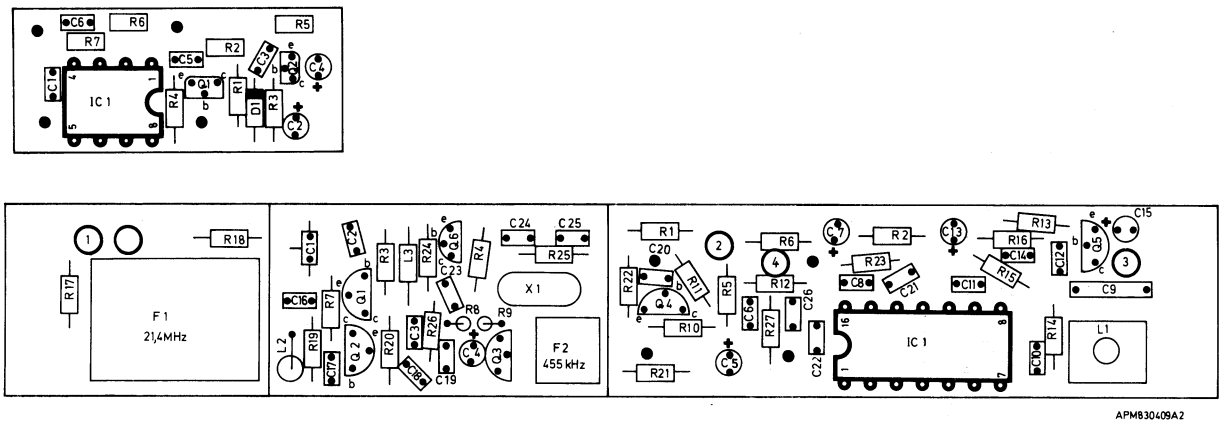
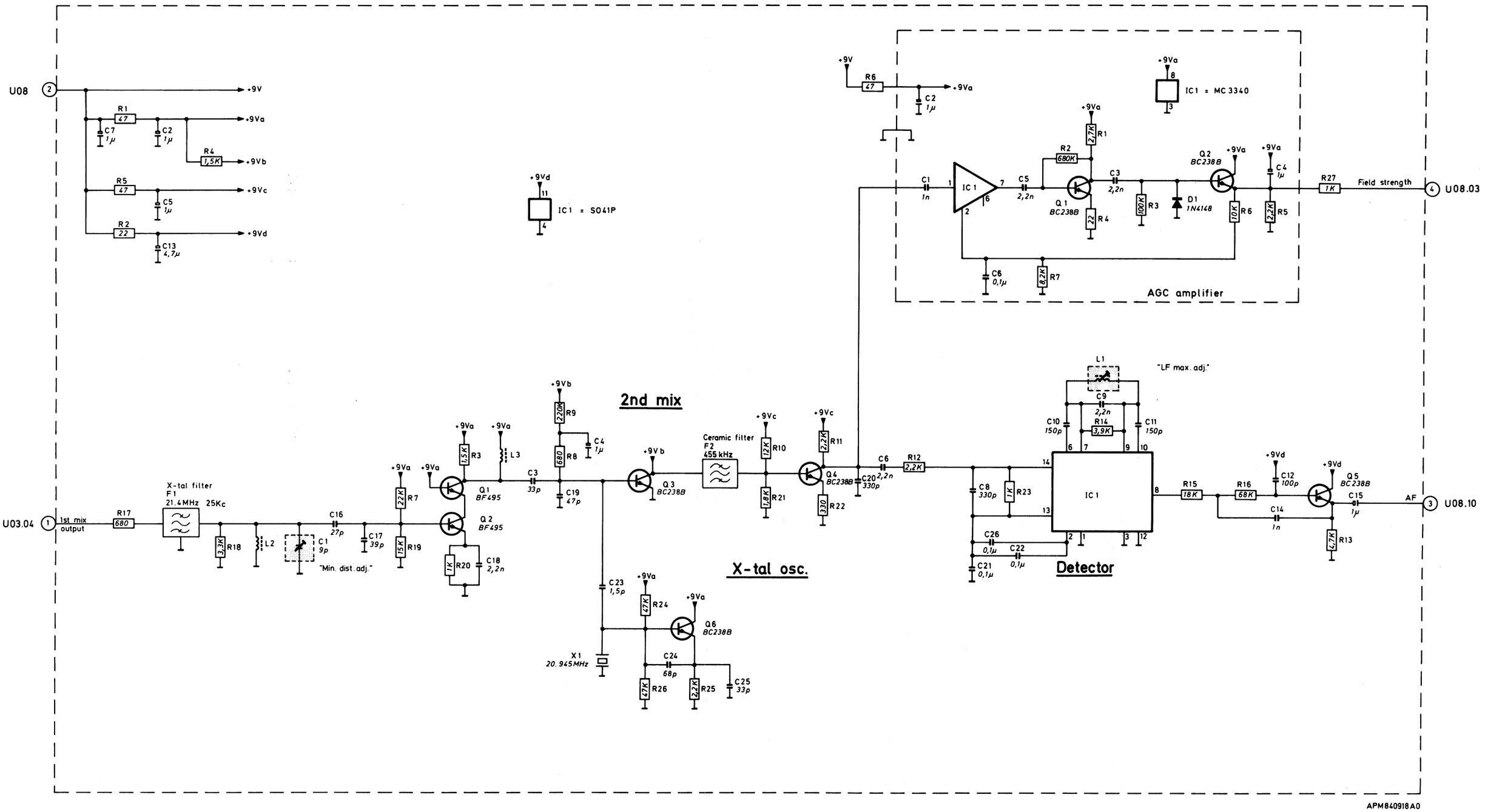


Fig. 7-3 Component location, IF amplifier, unit 2



85.08

Fig. 7-4 Circuit diagram, IF amplifier, unit 2

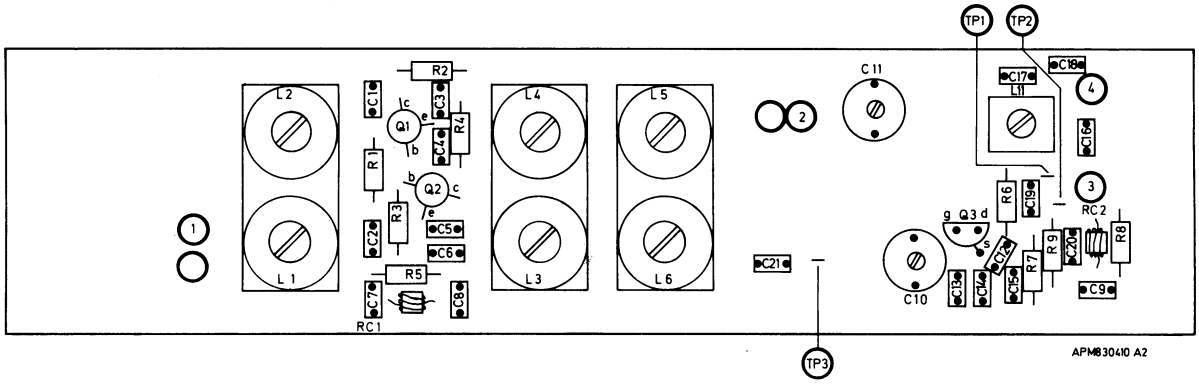


Fig. 7-5 Component location, RF and mixer, unit 3

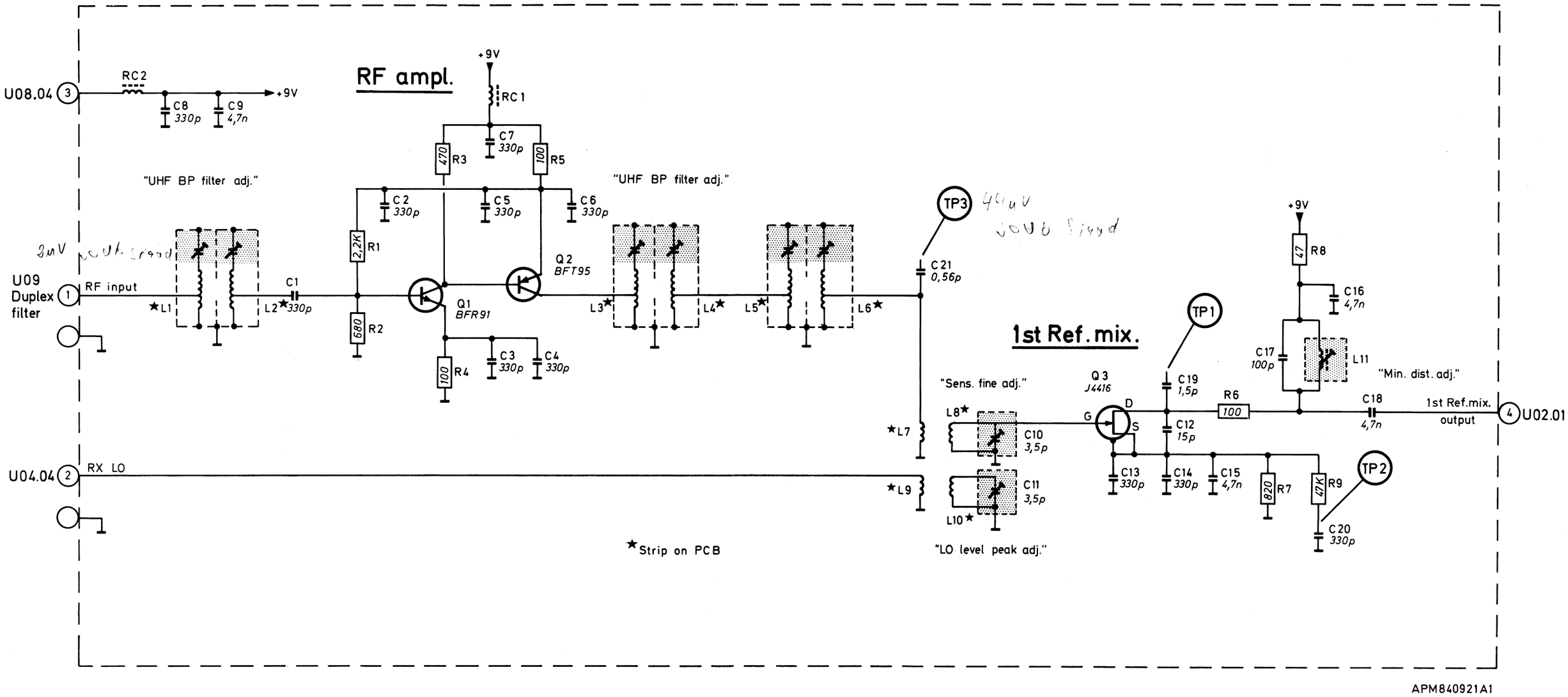


Fig. 7-6 Circuit diagram, RF and mixer, unit 3

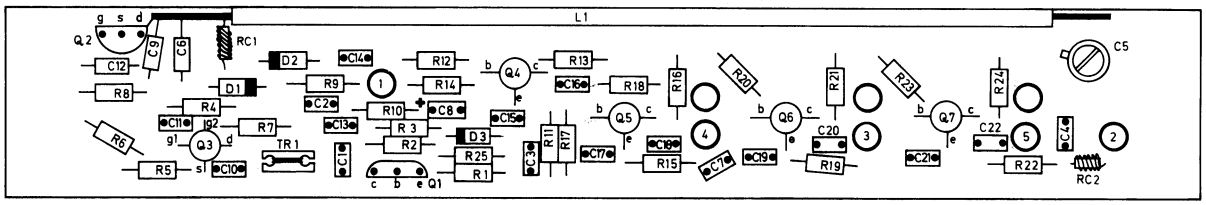
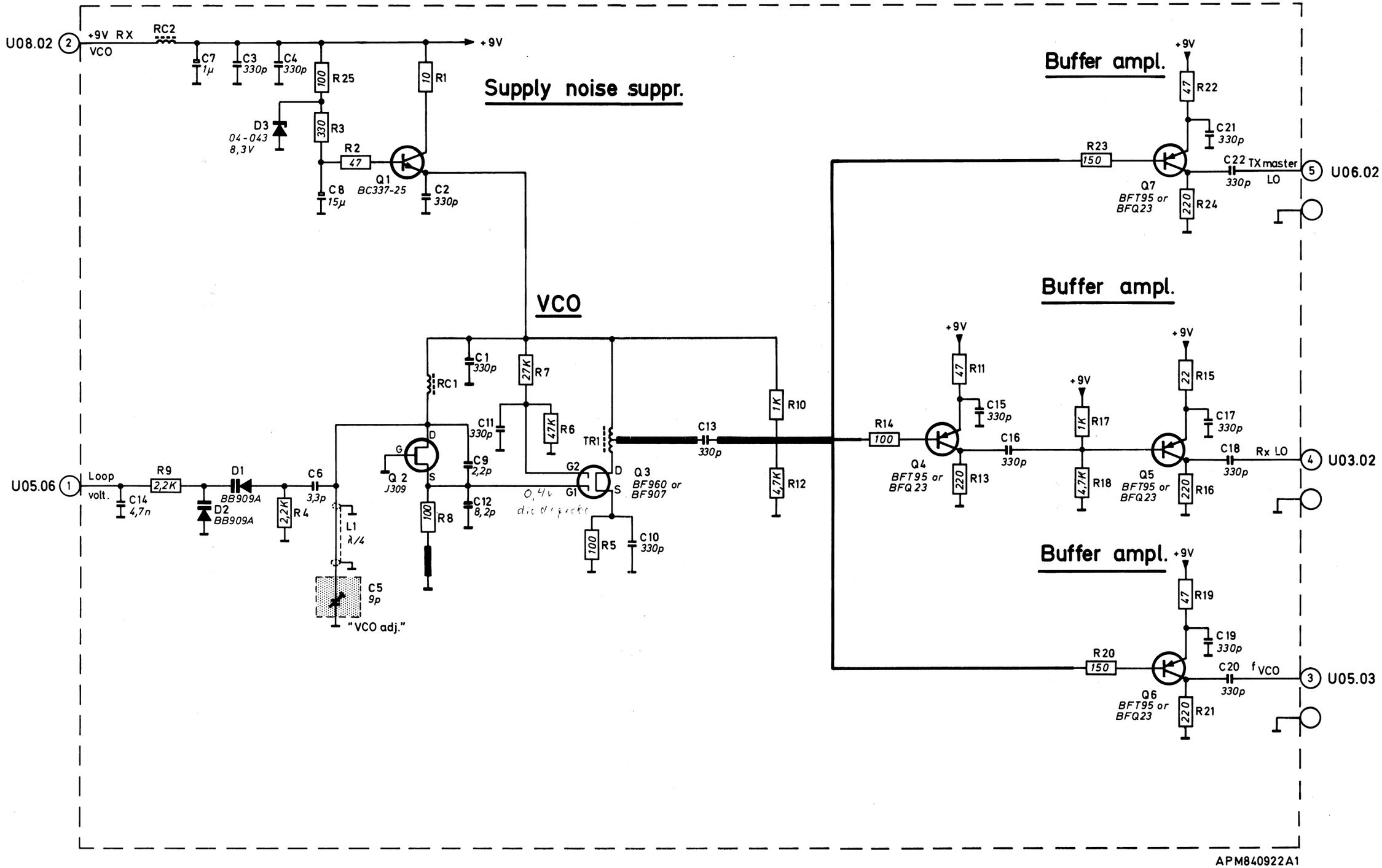


Fig. 7-7 Component location, UHF RX VCO, unit 4



85.08

Fig. 7-8 Circuit diagram, UHF RX VCO, unit 4

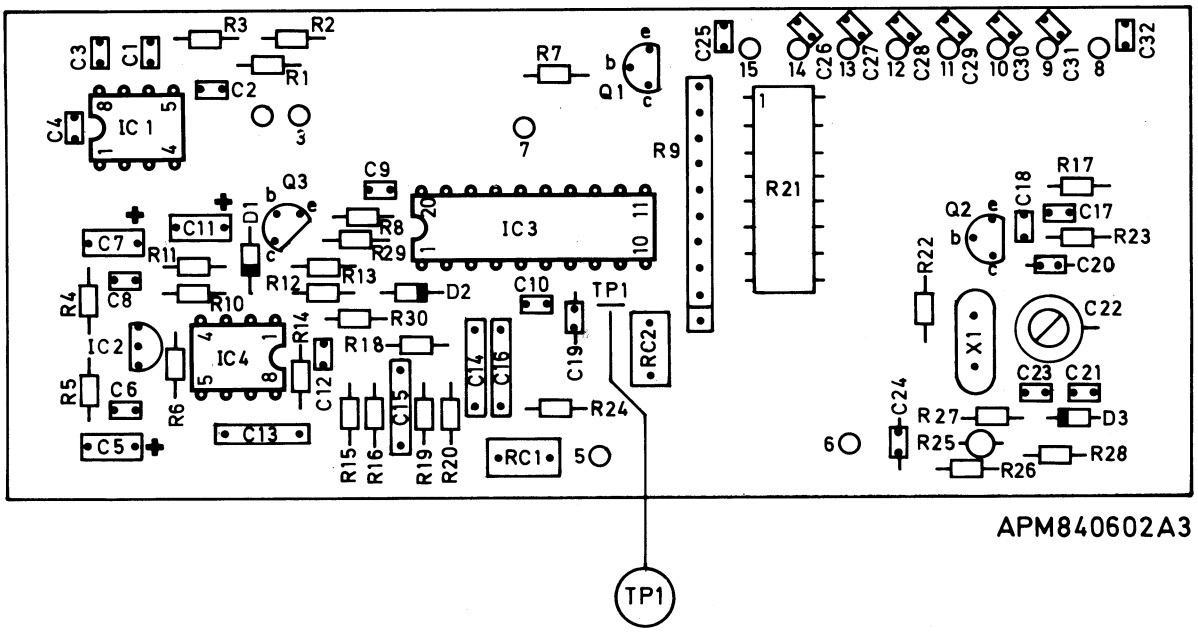


Fig. 7-9 Component location, RX synthesizer, unit 5

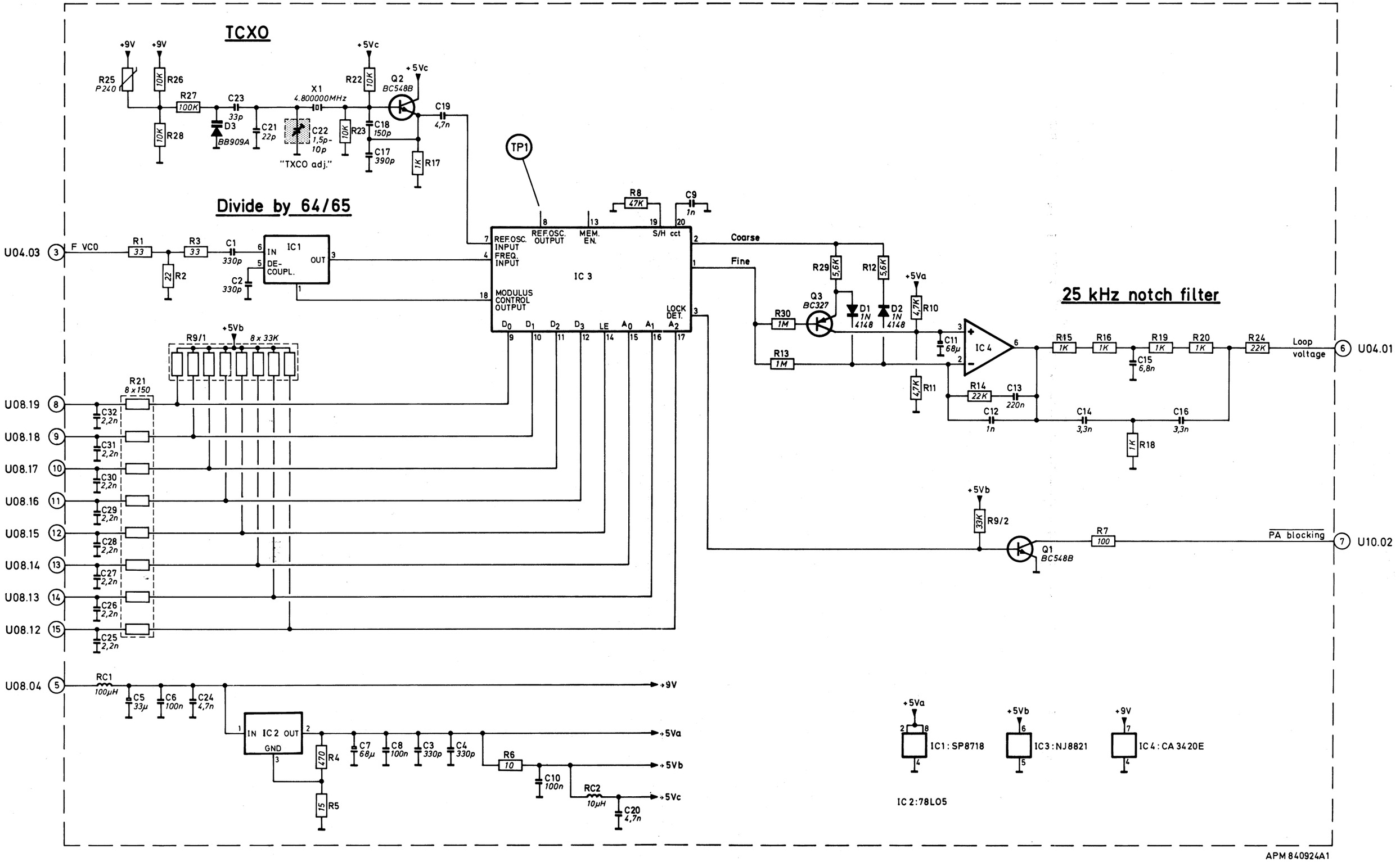


Fig. 7-10 Circuit diagram, RX synthesizer, unit 5

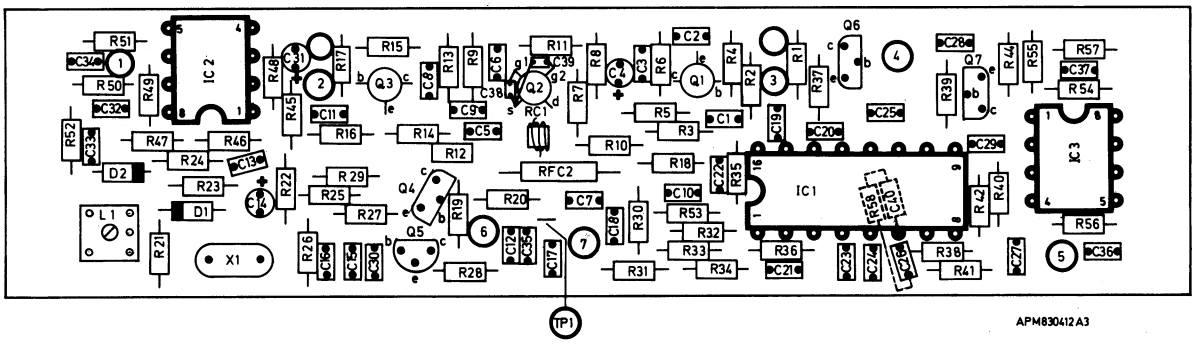


Fig. 7-11 Component location, TX synthesizer, unit 6

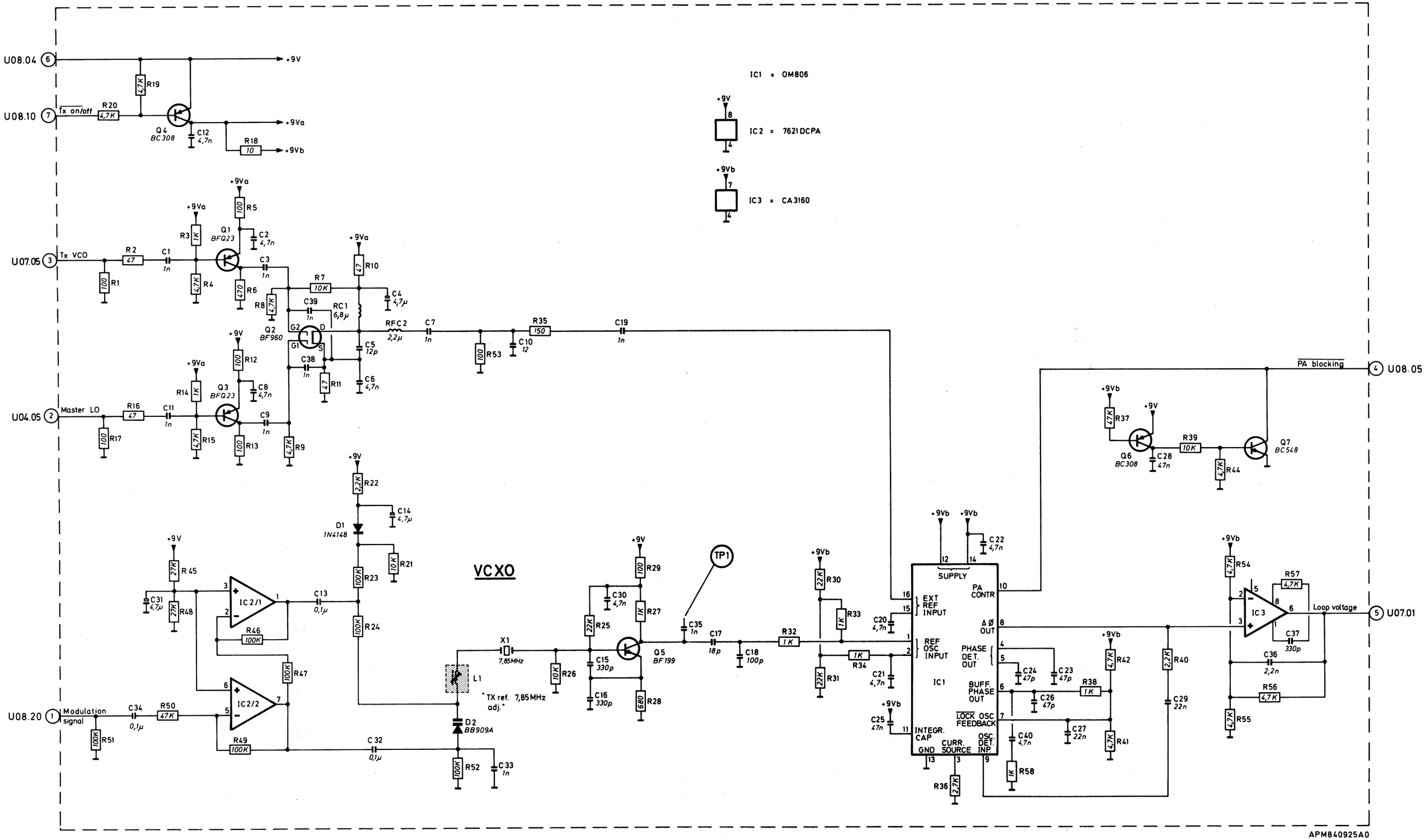


Fig. 7-12 Circuit diagram, TX synthesizer, unit 6

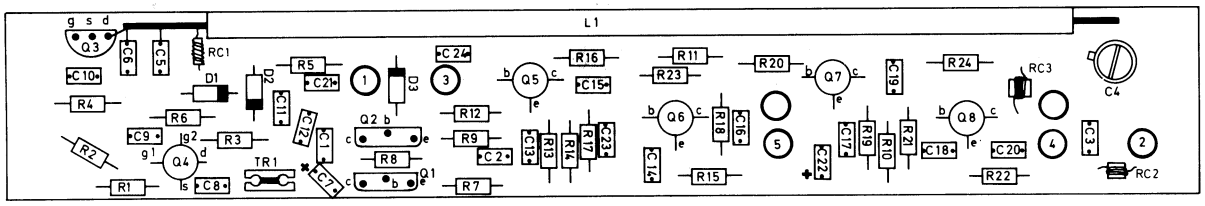


Fig. 7-13 Component location, UHF TX VCO, unit 7

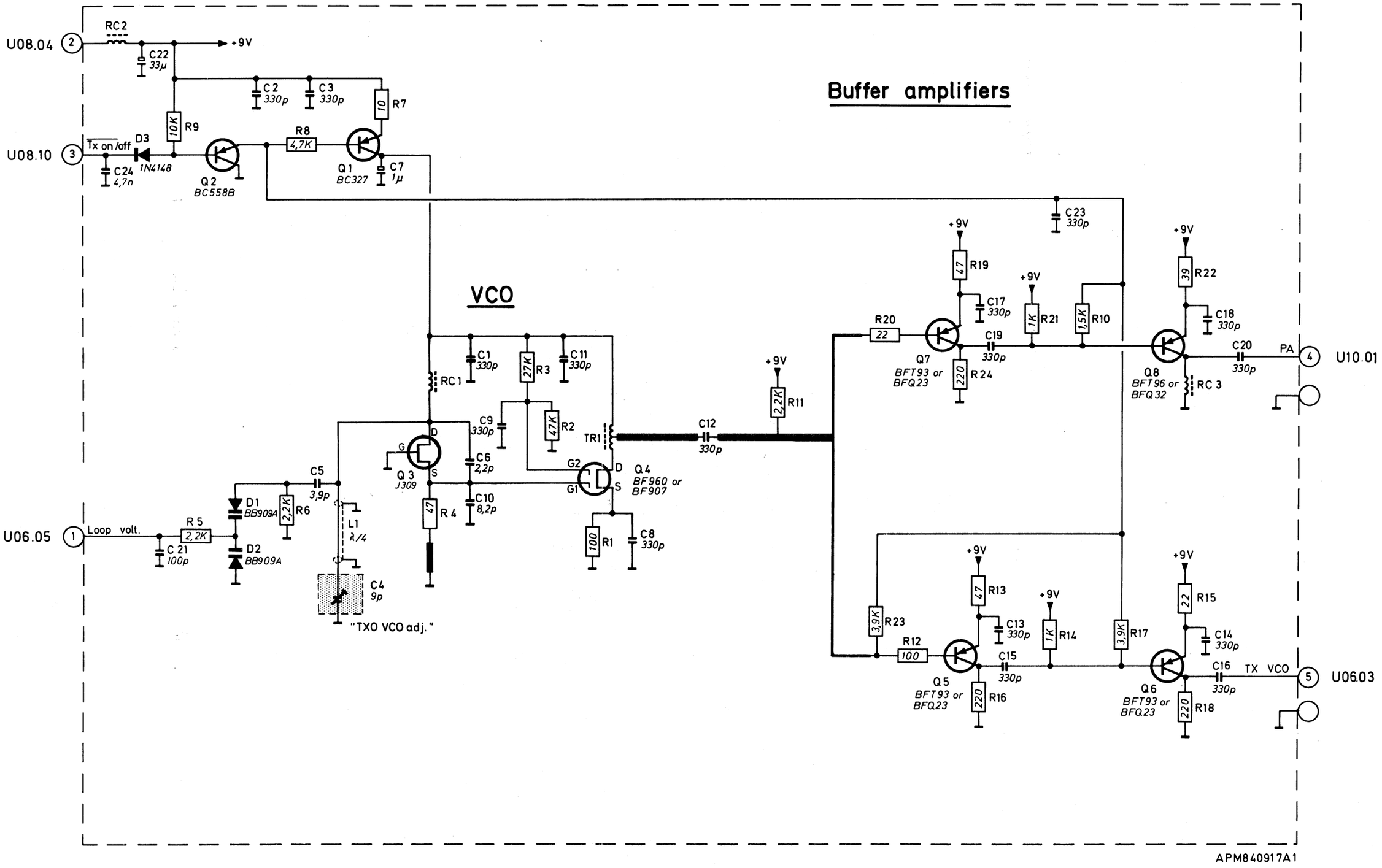


Fig. 7-14 Circuit diagram, UHF TX VCO, unit 7

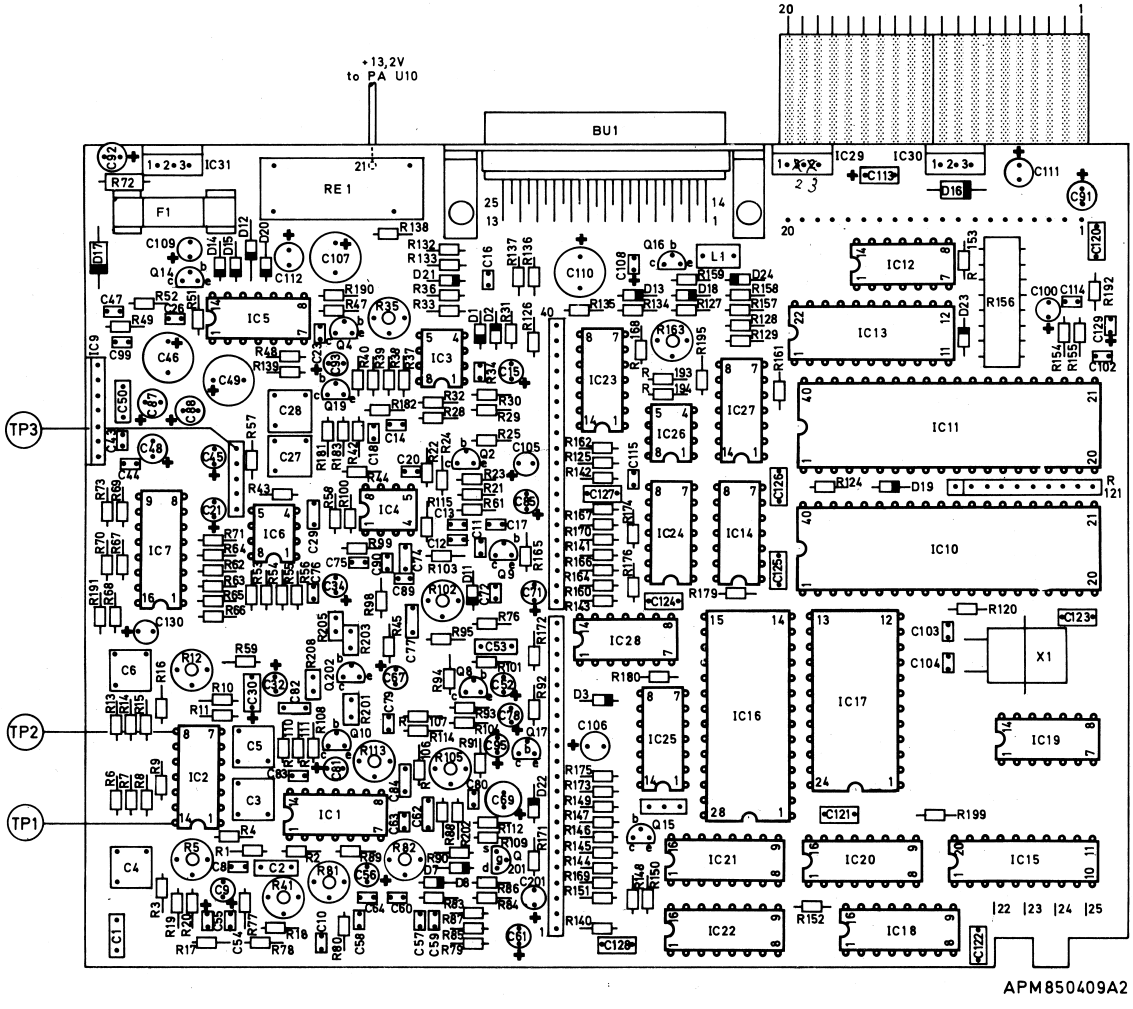


Fig. 7-15 Component location, system board, unit 8 sect. 1

Automatic level control

Limiter

Low voltage det.

IC 1 : 4741
IC4 : ICL7621DCP
IC 28 : 4066
IC 29 LM2931
IC30,31:L4885
IC 23 : 4093

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Fig. 7-16 Circuit diagram, system board, unit 8 sect. 1

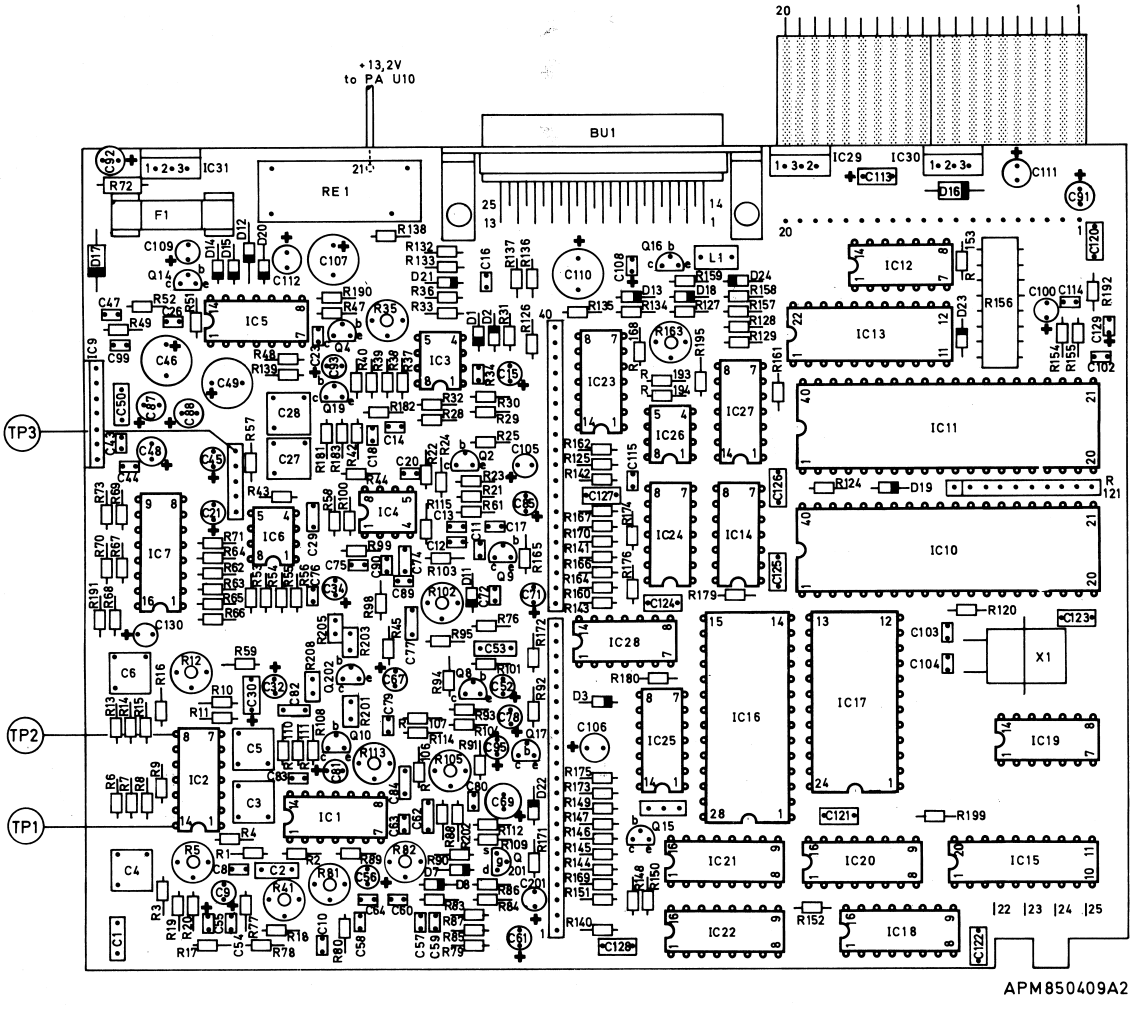

Fig. 7-17 Component location, system board, unit 8 sect. 2

Supervisory signal (4kHz) circuit

Supervisory on/off switch

Squelch circuit

Malfunction oscillator

Ringing tone oscillator

Notch filter (4kHz)

LS block switch

LS amplifier

HS amplifier

Var. attenuator

IC 1 : HA4741
IC 2 : µA3403
IC3: TL082CP
IC 4 : ICL7621DCP
IC6: MC1458
IC5 : HEF 4093
IC9: TA7252
IC7 : HEF4051

R147 U8sec3 Supervisory tone off/on
R173 U8sec3 Malfunction alarm
R146 U8sec3 Ring
R141 U8sec3 Vol. D0 (LSB)
R142 U8sec3 Vol. D1
R143 U8sec3 Vol. D2 (MSB)
R144 U8sec3 Speech mute
U8sec1 +12V, +9V, +5V, +4,5V, +2,5V
U 2.03 (10) AF
R145 U8sec3 Loudspeaker blocking

Superv. mod. C84 U8sec1
C18 100n FFSK RX IC13.15 U8sec 3
Squelch on/off R165 U8sec3
BU1.10
BU1.09

APM 850416A0

Fig. 7-18 Circuit diagram, system board, unit 8 sect. 2

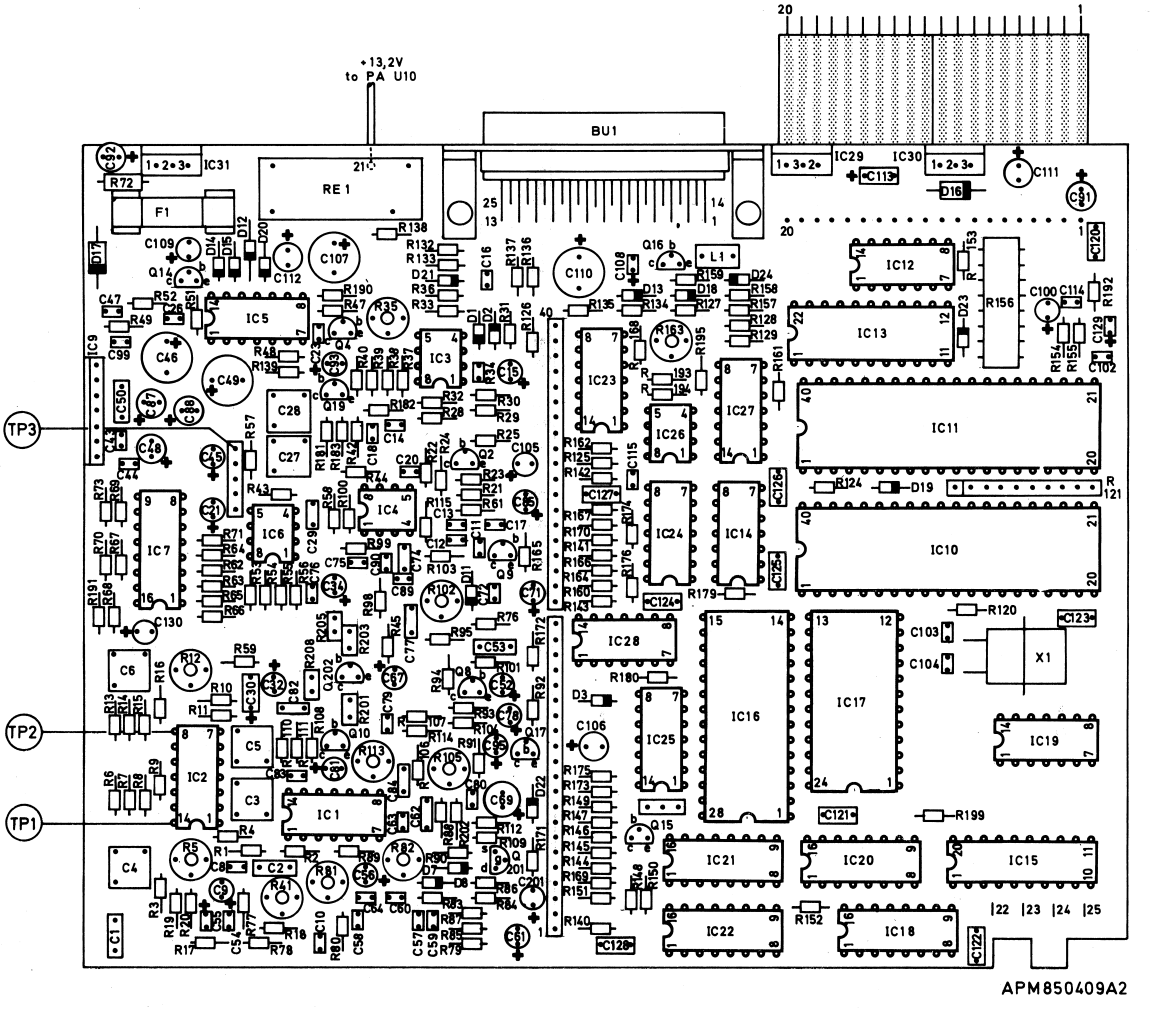

Fig. 7-19 Component location, system board, unit 8 sect. 3

Modem

Timer/expander

μP

Address latch

PROM

RAM

Phone no. PROM

Exp.

U05.07 U06 04 (5) PA blocking

C18 U08 sec. 2 FFSK RX

PA blocking (23) U10.02

FFSK TX C76,C77 U08 sec. 1

BU1.15 Clock from HS (38)

BU1.07 μP reset (37)

U02.04 (3) Field strength

Q4 U08 sec. 2 Squelch on/off

BU1.04 Push to talk

BU1.14 Data from HS

1,008MHz

1200 Hz

4,032MHz

8,064MHz

"Comp. level adj."

IC 10 : NSC 800 / NSC 810

IC 12,14,27 : 4013BP

IC 25 : 74HC32

IC13 : FX409

IC15 : 74HC373

IC16 : 27128

IC26 : LM358

IC17 : μPD446

IC28 : 4066BP

IC19 : HM1-0168-5

IC18 : 74HC139

IC24 : 74HCU04

IC20, 21, 22 : HEF4724BP

Time out (36) BU1.03

Volume D0 control (LSB) (29) IC7.11 U08 sec.2

Volume D1 control (30) IC7.10 U08 sec.2

Volume D2 control (MSB) (23) IC7.09 U08 sec.2

RF detect (13) (22) U10.08

Ch. code A2 (14) U05.15

Ch. code A1 (15) U05.14

Ch. code A0 (16) U05.13

Ch. code LE (17) U05.12

Ch. code D3 (34) U05.11

Ch. code D2 (35) U05.10

Ch. code D1 (20) U05.09

Ch. code D0 (21) U05.08

Low/Medium High power (12) (24) U10.04

TX on/off (33) (11) U06.07 U07.03

Music muting (BU1.05)

TX on/off D13 U08 sec.1

Clock to HS (4) BU1.01

Data to HS (27) BU1.02

Mic. block. (1) IC28/3.06 U08 sec.1

Speech mute (5) IC7.06 U08 sec.2

Loudspeaker blocking (6) IC28/2.05 U08 sec.2

Ring (7) IC5/2.05 U08 sec.2

Ext. alarm (18) (BU1.06)

Mic. 2 (Handset) / Mic. 1 (Handsfree) (9) R85,C59 U08 sec.1

Malfunction alarm (10) IC5/4.12 U08 sec.2

Low/Medium High power (3) (25) U10.07

Supervisory tone off/on (8) IC28/1.13 U08 sec.2

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Fig. 7-20 Circuit diagram, system board, unit 8 sect. 3

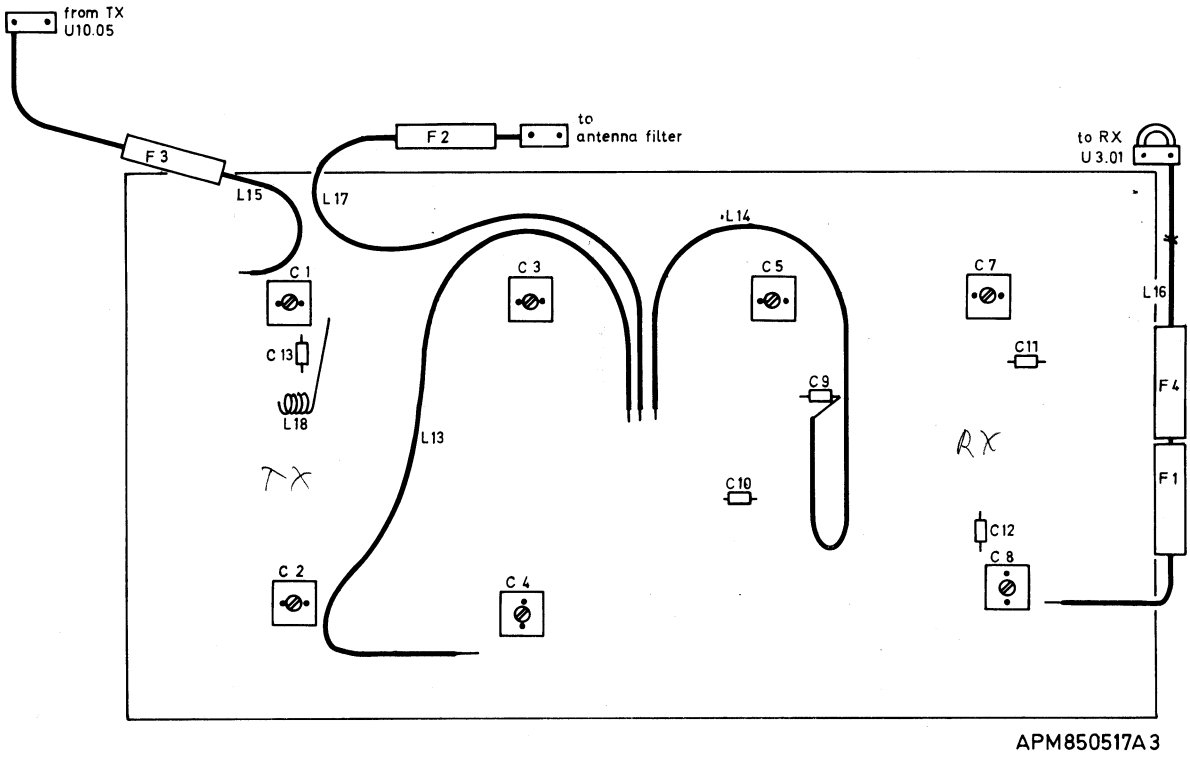

Fig. 7-21 Component location, duplex filter, unit 9

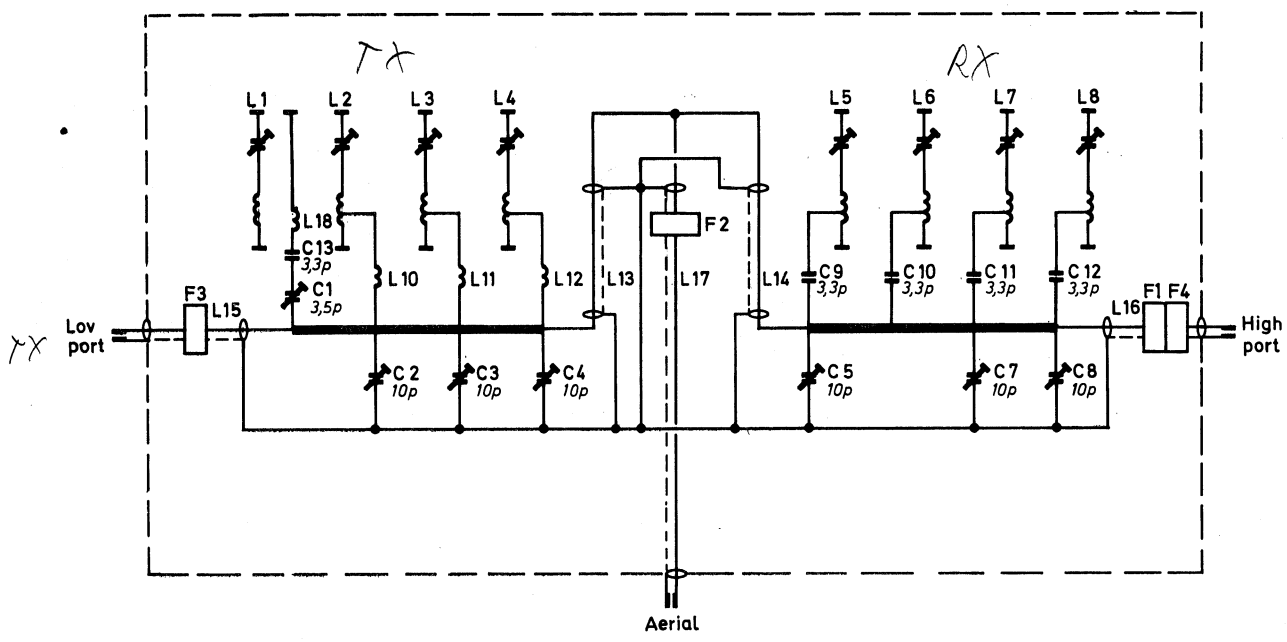

Fig. 7-22 Circuit diagram, duplex filter, unit 9

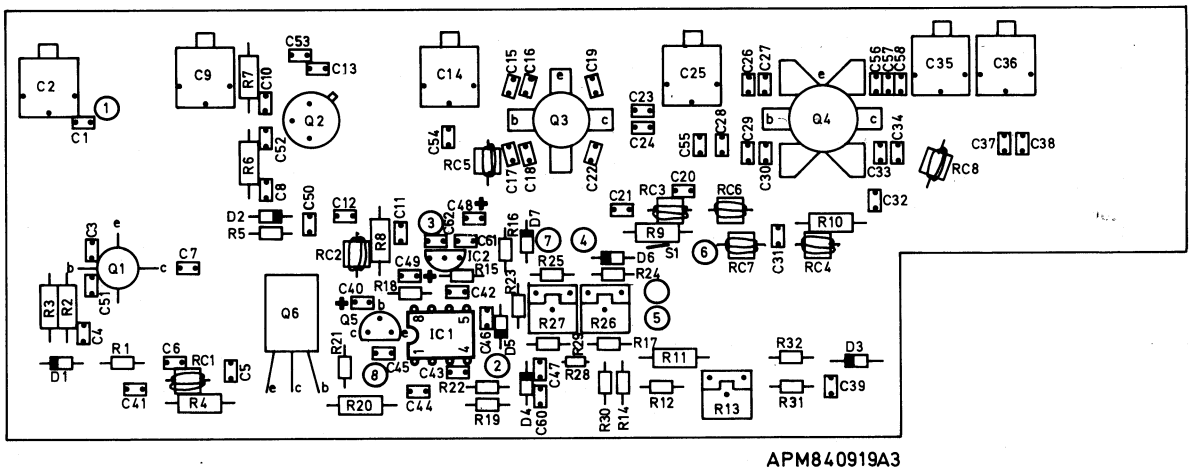

Fig. 7-23 Component location, PA and power control, unit 10

U08.21 (6) RC7 +13,2Va
S1
Not connec-ted. (3) +13,2Vb
C50 330p C41 330p
C49 10µ C62 330p IC2 C61 330p C48 4,7µ +5V

U08.23 (2) PA blocking D5 1N4148
U08.24 (4) Low/Medium/High power D6 1N4148 R24 6,8K R26 10K "Medium power adj."
U08.25 (7) Low/Medium/High power D7 1N4148 R25 1K R27 4,7K "Low power adj."
+5V R28 PTC R29 47K D4 1N4148 R30 15K C47 330p C60 330p C46 330p

+5V R16 47K R12 47K C42 47p IC1/2 R18 22K Q5 BC337 C45 330p R15 2,7K
RF detect (8) U08.22
R31 2,7K +5V R17 330K +13,2Vb R21 2,7K +13,2Vb Q6 2N4918
R13 "High power adj." 22K R14 47K C43 47p IC1/1 R20 390
R32 2,7K R19 47K C44 2,2n +5V R23 22K R22 47K

+13,2Vb IC1: LM358 (8, 4)
IC2: LM78L05

U07.04 (1) PA 1,5V C1 2,2p C2 9p C3 10p C51 10p
+13,2Vb R1 1,5K D1 1N 4148 R2 47 C4 330p R3 220
C5 100n RC1 C6 47p R4 10 Q1 MRF559 C7 10p C9 18p
+13,2Vb R5 1,5K D2 1N 4148 R6 47 C8 330p R7 220
C40 4,7µ C10 10p C52 10p
C11 100n RC2 C12 47p R8 10 C53 10p C13 47p Q2 MRF630
C54 10p C14 18p RC5 C15 10p C17 10p C16 10p C18 10p
+13,2Va C20 100n RC3 C21 47p R9 10 C19 10p C22 10p Q3 2N5946
C23 47p C24 47p C25 18p C55 10p C28 10p C26 10p C29 10p C27 10p C30 10p RC6
+13,2Va C31 100n RC4 R10 10 C32 330p RC8 C56 4,7p C33 4,7p Q4 MRF644
C57 4,7p C34 4,7p C58 4,7p C35 9p C37 47p C38 47p C36 18p
C39 330p D3 MBD 501 R11 100
(5) U09

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85.08

Fig. 7-24 Circuit diagram, PA and power control, unit 10

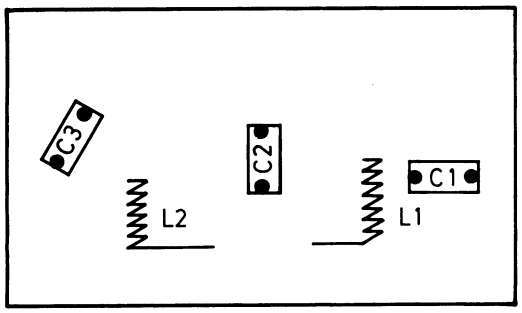


Fig. 7-25 Component location, antenna filter, unit 11

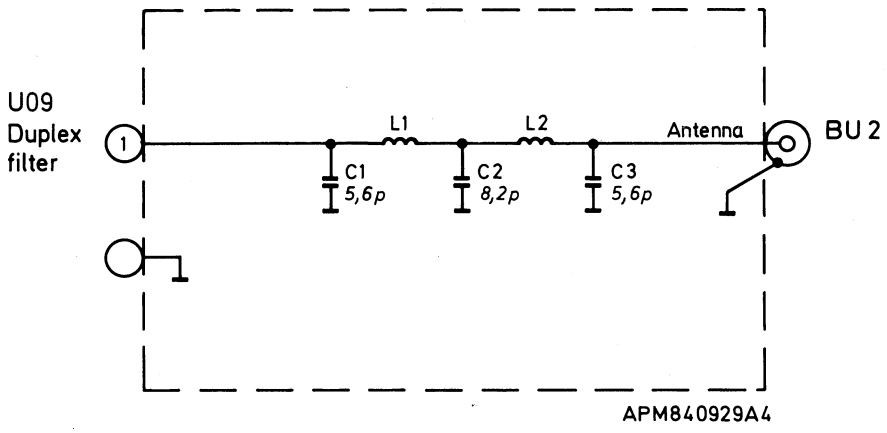


Fig. 7-26 Circuit diagram, antenna filter, unit 11

8. Description of the handset and cradle

Handset

The handset contains a microphone and receiver as well as a control part with keyboard and display. It also contains a reed switch which is operated by a permanent magnet in the cradle. Thereby "off hook" is detected.
The handset is built up with a main unit U13 and a keyboard/display unit U14.
The control part in U13 is provided with a microprocessor. The RAM IC11 stores among other things short nos. These are also kept when disconnecting the handset or power off, thanks to a back-up battery.
The microprocessor IC3 communicates with the CPU in the radio, the keyboard and with the display. This communication is done with the ports P10-P27 either directly or via the expander IC14. Some ports are devoted entirely to a specific purpose while others have a double function.

Power on/off circuit

The power on/off circuit consists of a power relay in the radio unit and control circuits in the handset.
One terminal of the relay coil is connected to the battery voltage while the other terminal is grounded in the handset during power on. This takes place in Q17 during the initial moment but is then taken over by Q18 in order to save power. Q18 is provided with an emitter resistor.
Q18 is directly controlled by IC9/1.
When the power is off and the ⏻-button is pressed IC9/2.13 goes high and IC9/2.12 goes low.
IC9/2.12 makes via IC7/1 and IC6/6 the transistor Q17 conducting.
This energizes the relay in the radio.
Q18 is also conducting when IC9/2.13 is high. When the switched +12V voltage is built up, Q17 is switched off by a high level at IC7/1.1.

Power off can be caused by several conditions:
1) When demanded by the uP IC3.31.
2) If the supply voltage is below 6.2V. Momentary interuption does not give power off.
   This is prohibited by a circuit in the system board U8.
3) If the supply voltage is above 16V.
4) If the temperature is above approx. 85^{0}C.
5) During system failure. Time out.

Pressing the ⏻-button in order to switch the power off is only a request which must be accepted by the uP.
Thereby a pressing of the ⏻-button during conversation (handset mode) or during BS-MS data exchange is ignored. In handsfree mode, a clearing message is sent before the pressing of the ⏻-button is accepted.
The voltage at the R60/61 connection is pulled low under conditions 1)3)4)5) and thus switching the power off. The condition 2) forces via C27 the power off.

Keyboard and display

The keyboard and display are via the expander IC14 communicating with the uP.
Repair of unit 14 is not considered practical, i.e. in case of failure the complete keyboard/display unit is replaced. However, replacement of the illumination lamps is possible.

Ignition switch

A 10 hour software timer prevents discharging of the car battery by the mobile telephone when being left with the power on. Terminal J shall be 12V when the key is turned. When the key is removed, the mobile telephone is switched off when 10 hours have elapsed.
If the mobile telephone is used during this period the timer starts again.

Illumination switch & LED dimmer

The illumination switch IC4/2 turns the illumination lamps on when there is not enough ambient light. The ambient light is detected by the photo transistor Q1 and converted to a proportional voltage at IC4/1.1. This voltage controls via Q5-9 the current through the LED's D1-4. In addition the voltage is fed to the illumination switch IC4/2 which is a comparator. When a certain darkness is reached (determined mainly by R22,23), the illumination lamps are turned on. The transistors Q2,3 form a constant current regulator which together with the zener diode D2 keeps the voltage across the lamps constant.

Reset

When the radio is switched on the microprocessor is reset (IC3.4) by a delayed (about 100ms) positive voltage coming from D9-Q12-Q13-IC6/3-IC6/1.

Even a very short supply voltage drop will reset both the handset processor IC3 and via IC6/2 the main microprocessor in the radio.

RAM protection

To prevent nonsense from the CPU to enter the RAM, during the switching ON/OFF process, the Q15 and Q16 are formed as a switchable buffer. If the "12V switched" becomes low, the reset voltage goes low and thereby cuts off the current in Q15 and Q16.

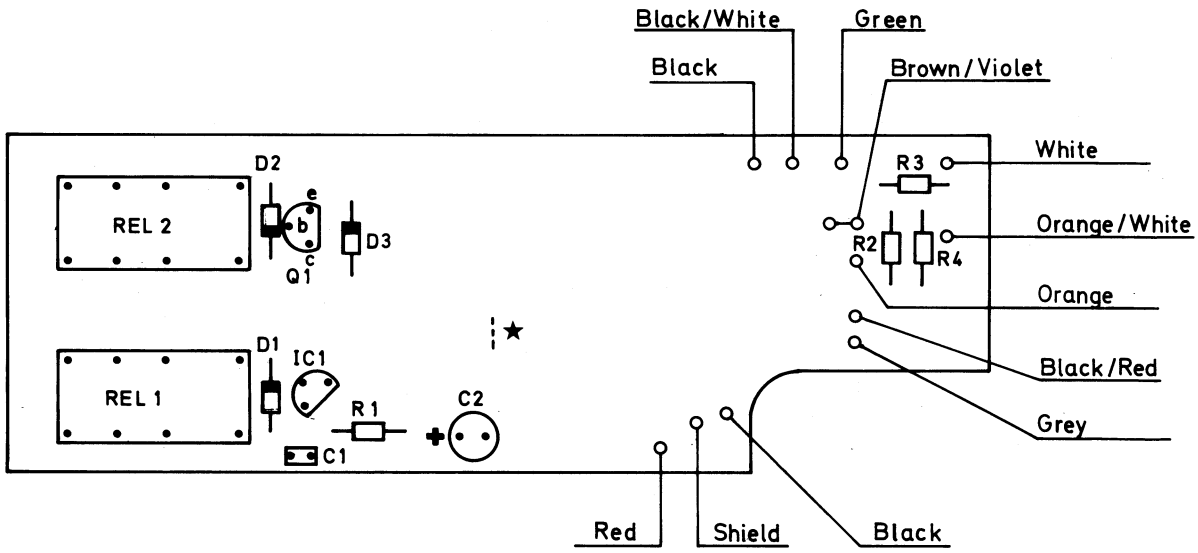
Touch-tone

Each time a push-button is pressed a signal is heard from the speaker. The uP IC3 gives a short burst of pulses (1200Hz) on IC3.33 which are amplified by Q11 and IC5.

Cradle U12

The cradle serves the following purposes:

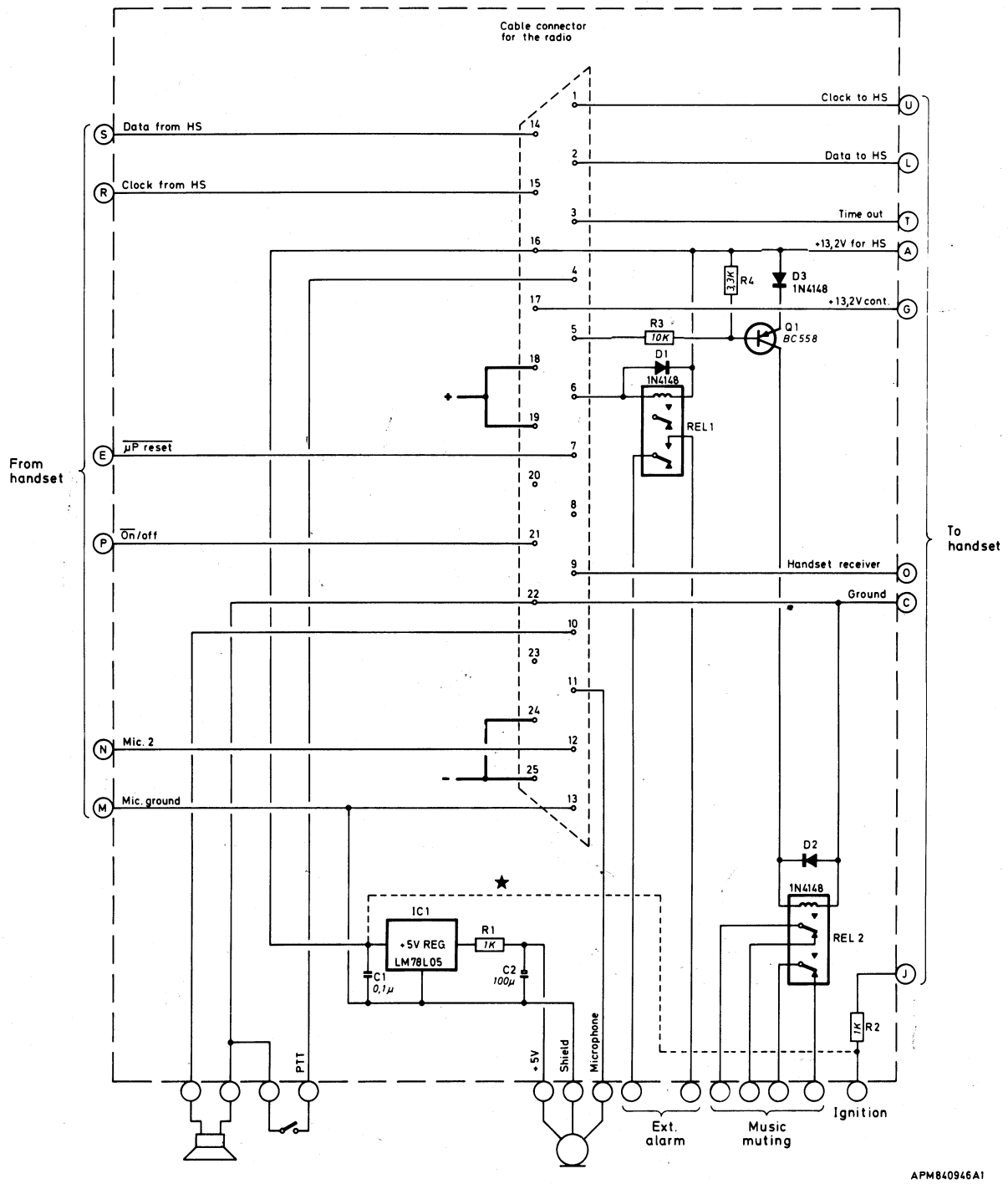
1) Holds the handset when not in use.
2) Provides connection of handset, loudspeaker, handsfree microphone, push to talk switch, music muting, external alarm and ignition switch.
3) Contains relays for the music muting and external alarm. The relays (and associated components) are mounted when these features are requested.



Note 1:
From the factory the cradle is delivered without REL2, D2, Q1, R3 - R5. These components must be mounted for the music muting feature.

Note 2:
When the 10h timer feature (ignition switch) is wanted, break the strap ★.

Fig. 8-1 Component location, cradle, unit 12



3733-02

★ See the notes for the fig. 8-1.

Hvis hora kun må tåde een gang
maxtens 1000 - 2000 uF i serie med
Helo 1 spole, parallel med ca. 1Ω

Fig. 8-2 Circuit diagram, cradle, unit 12

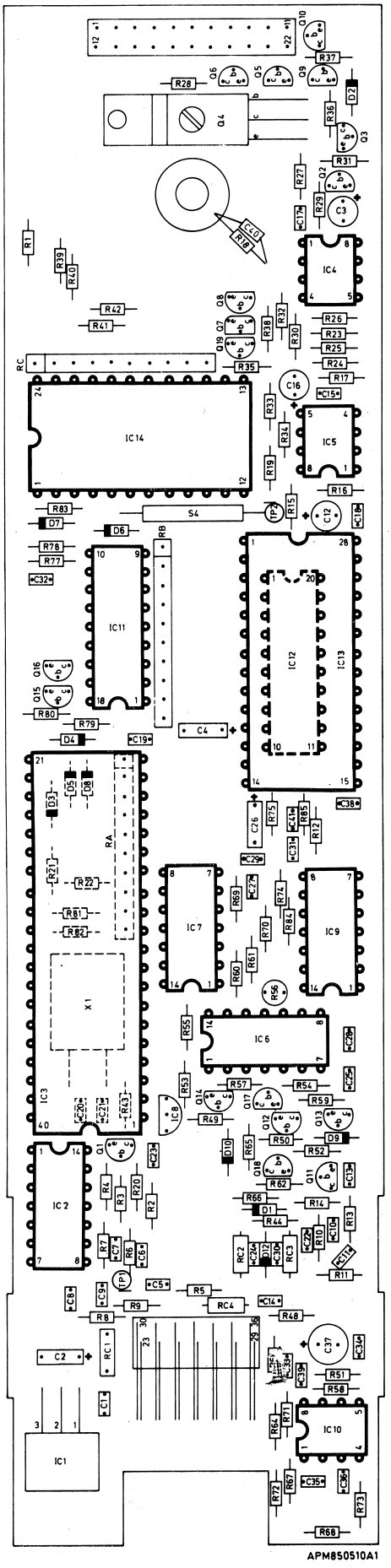


Fig. 8-3 Component location, handset, unit 13

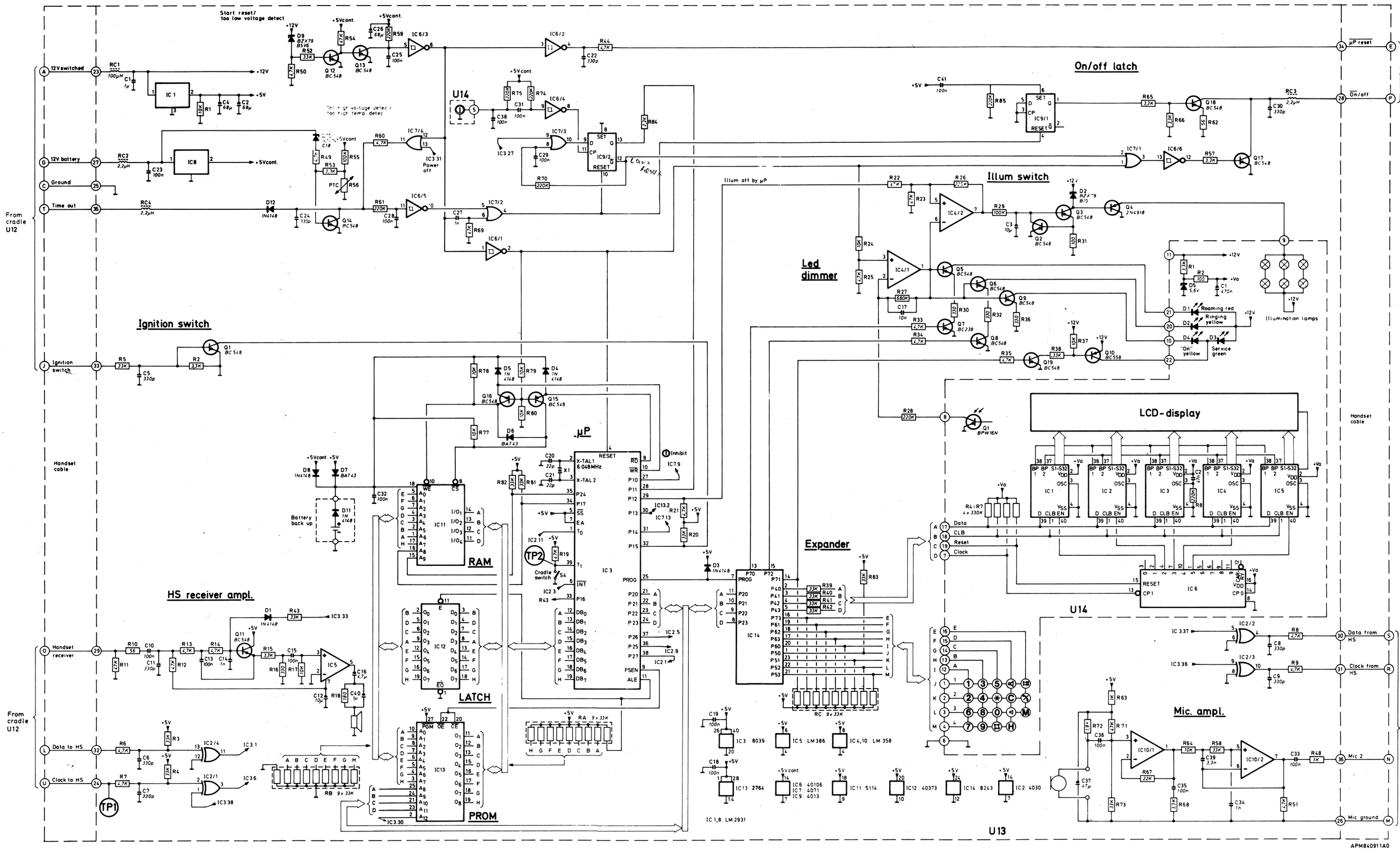


Fig. 8-4 Circuit diagram, handset, unit 13, unit 14

9. Disassembling and wiring diagram

A. Disassembling of the radio unit

1. Removing the cover

- Remove the screws (A) and remove the cover.

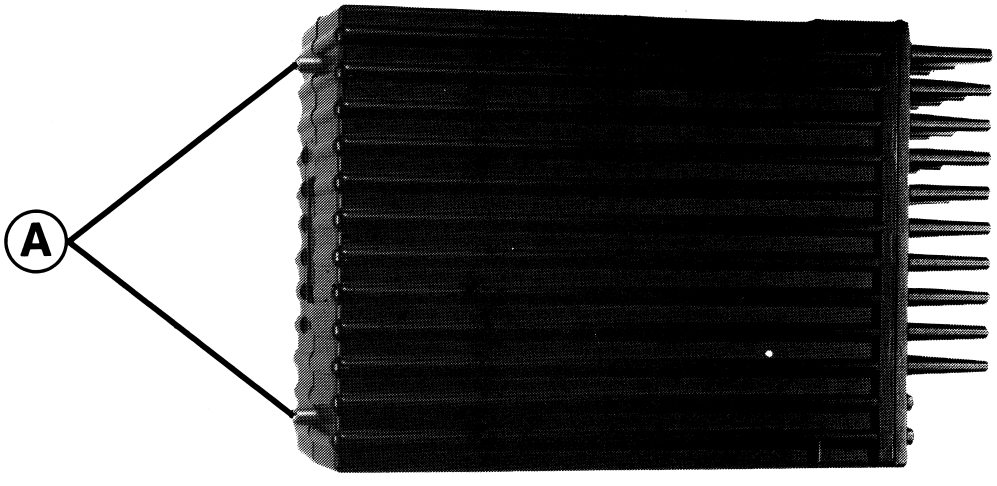


Fig. 9-1 Radio unit

2. Access to the units, RF side

Each unit is provided with a metal lid.
After removal of the lid the component side of the unit in question is accessible.

3. Replacement of the units, RF side

The units are provided with connector sockets for direct plug-in connection to the motherboard U1.
Each unit can be removed after removal of 4 screws (A).
Note 1: Before removing U7 and U3, remove the lid and the coaxial cables.
Note 2: Before mounting a unit, observe the location of the connector pins in order to turn the unit properly.

4. Removing the PA U10

- Remove the lid (see fig. 9-5) by lifting slighly at the edge (L) and, sliding the lid towards the heat sink. Now the lid can be removed.
- Remove the screws (B) .
- Now the PA can be pulled free for access to the component side.
- Remove the two nuts on the heat sink (between the cooling flanges).
- Unsolder the various cables.
- Remove the screws (D) .

5. Removing the antenna filter U11

- Remove the lid (E) .
- Remove the three screws inside the screened compartment.
- Unsolder the coaxial cable.
- Unsolder the antenna connector.

6. Removing the motherboard U1

- Unplug the flexstrip (G) .
- Remove the two metal bars by removing the screws (F) . Now U1 can be pulled out.

7. Removing the system board U8

- Unsolder the four wires (J) .
- Unsolder the wire (C) (see fig. 9-2).
- Unplug the flexstrip (G) to motherboard U1.
- Remove the screws (H) .
- Now U8 can be removed.

8. Removing the duplex filter U9

- Disconnect the coax cables at U10, U3 and U11.
- Remove the screws (K) .

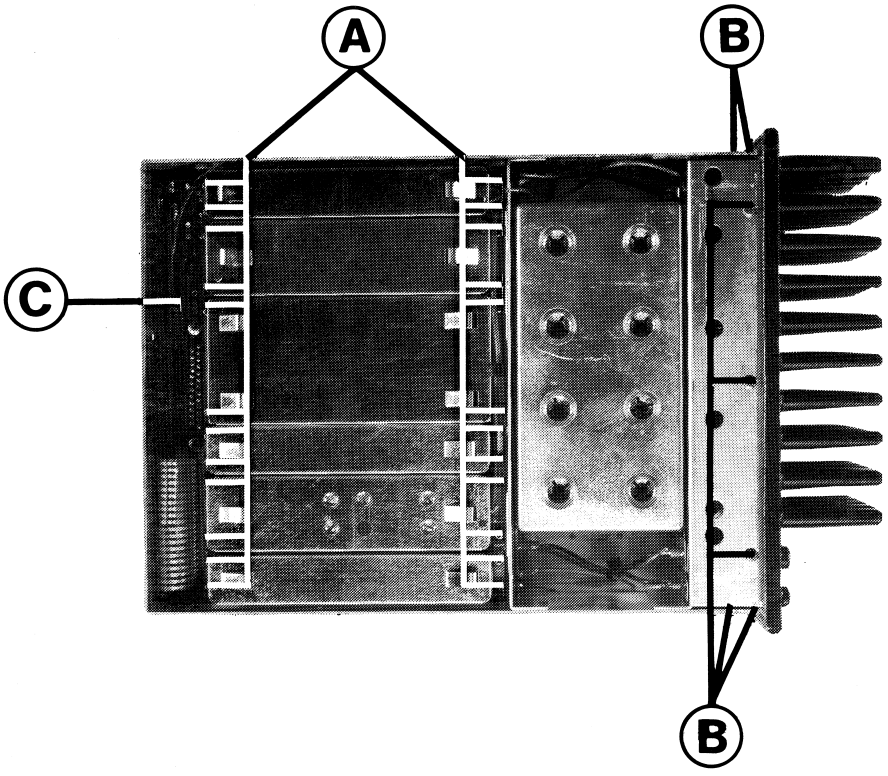


Fig. 9-2

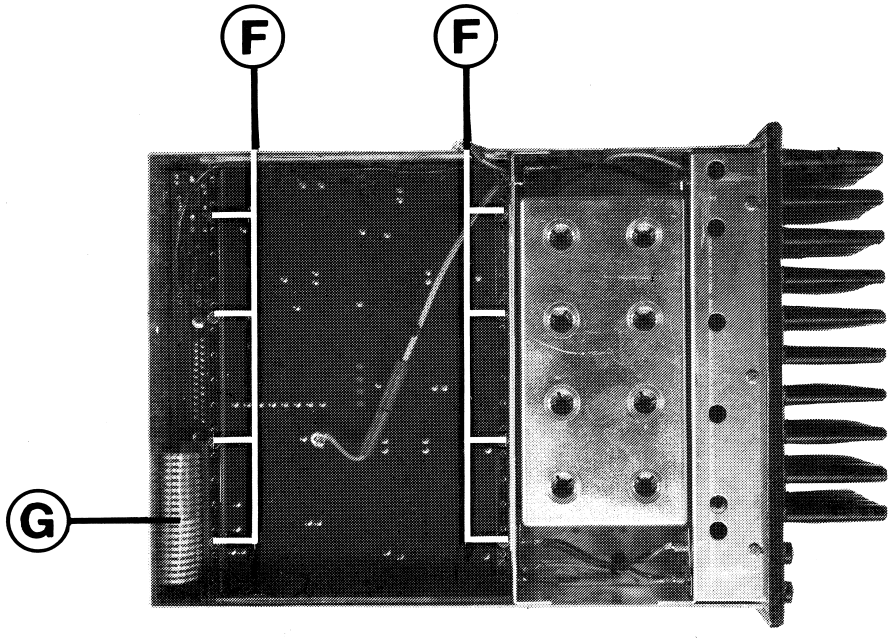


Fig. 9-4

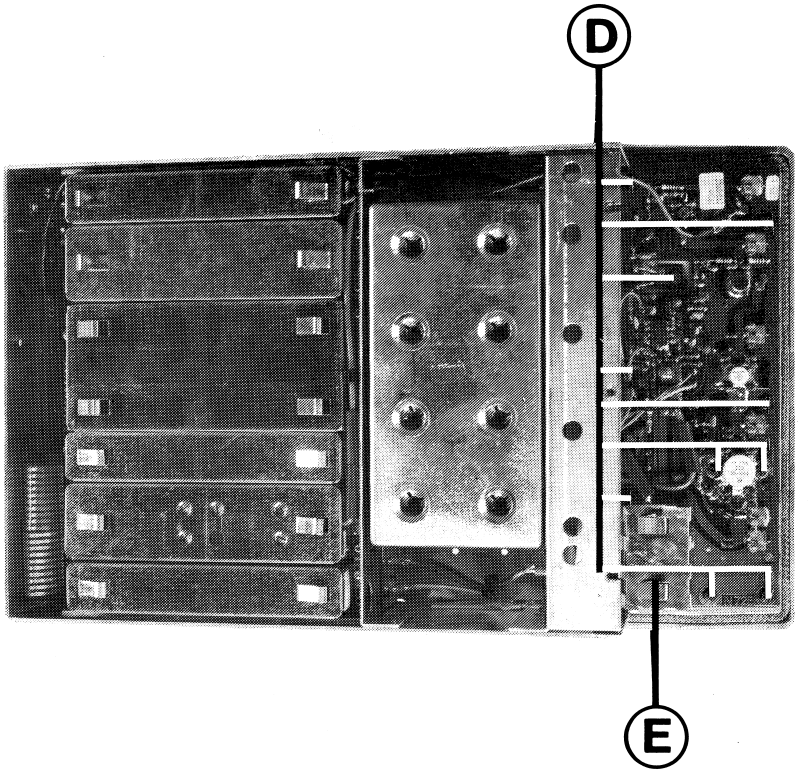


Fig. 9-3

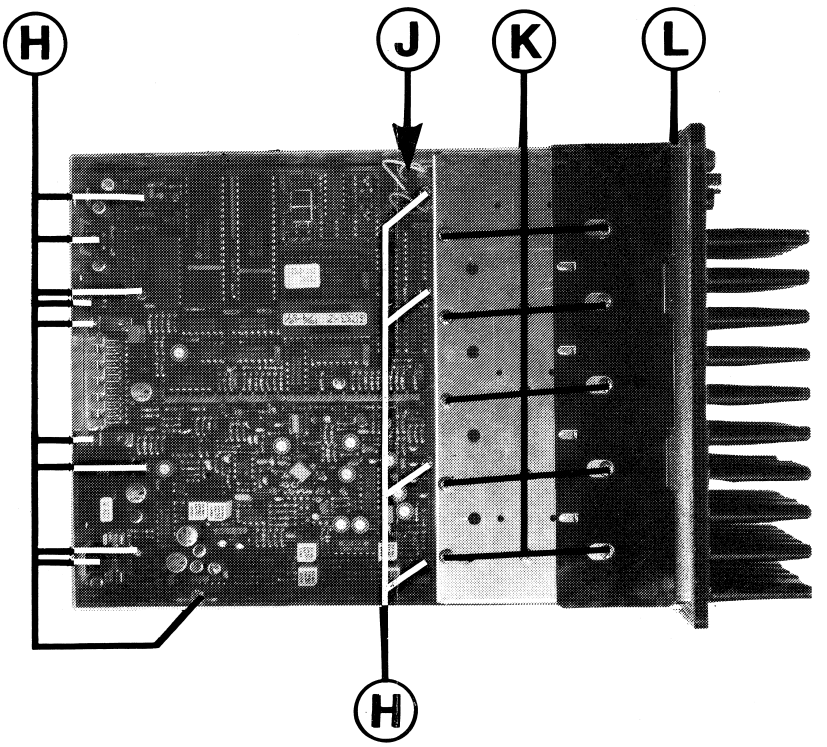


Fig. 9-5

B. Disassembling of the handset

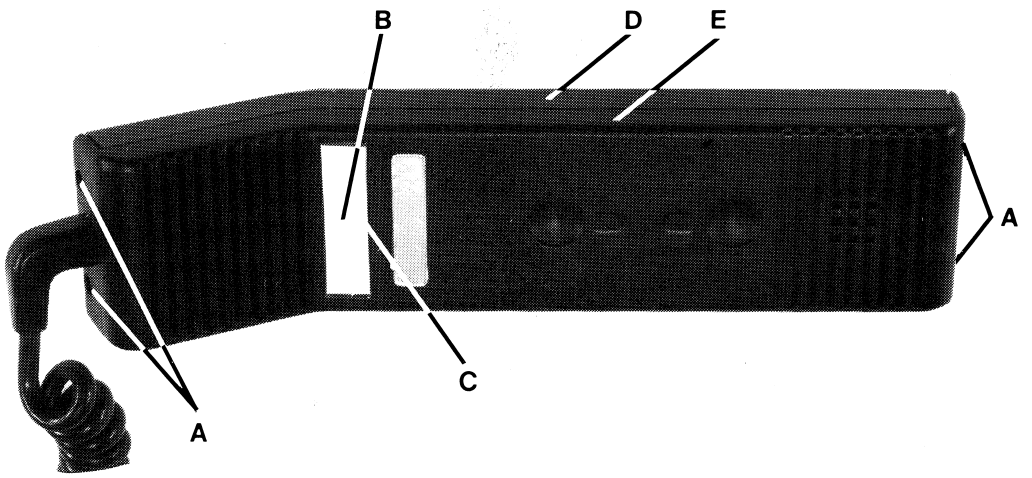


Fig. 9-6 Disassembling of the handset

1. Opening the handset

- Remove the four plastic plugs (A) and the screws hidden by these.
- With a pointer (e.g. small screwdriver or pincette) applied at point (B), remove the plastic screwcover.
- Remove the screw (C).
- Separate gently the two halves (D) and (E) (they are interconnected with a plug/socket).

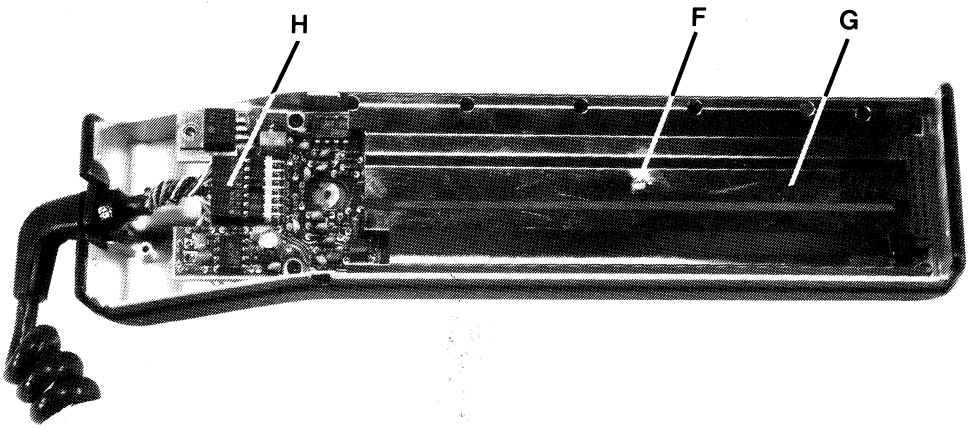


Fig. 9-7 Disassembling of the handset

2. Access to and replacement of U13

- Perform step 1.
- Remove the screw (F) .
- Remove gently the metal cover (G) . There is now access to the component side.
- Remove the plug (H) . The multiwire cable can now be removed.
- Unsolder the two wires for the microphone.
- Remove the 8 screws (I) .

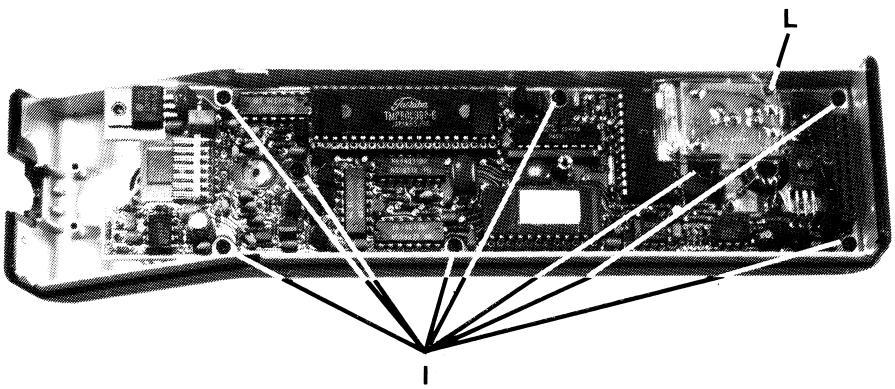


Fig. 9-8 Disassembling of the handset

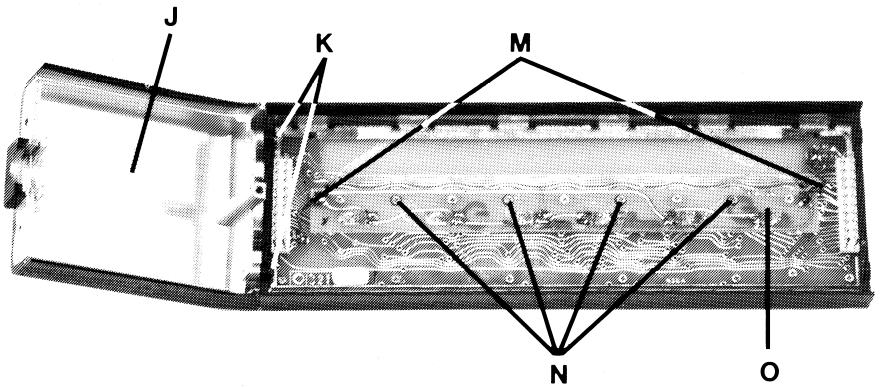


Fig. 9-9 Disassembling of the handset

3. Turning the U14 (for left-handed people)

- Perform step 1.
- Remove the two screws (K). The plastic cover part called (J), can now be moved to the other end of U14, where holes are fit for the screws (K).
- Turn the multicable so that it fits with the new position in the holder.

4. Replacement of memory backup battery

- Perform step 1.
- Remove the screw (F) (see fig. 9-7).
- Remove gently the metal cover (G). There is now access to the component side of U13.
- By removing the screw (L) (see fig. 9-8), the battery can be replaced.

During battery replacement it is recommended to have the handset connected to the radio (or handset test box) with power on. Other-wise all stored numbers and the code lock number must be entered again.

5. Replacement of the illumination lamps

- Perform step 1.
- Unsolder the two wires (M) (see fig. 9-9).
- Remove the screws (N).
- Lift gently the printboard (O).

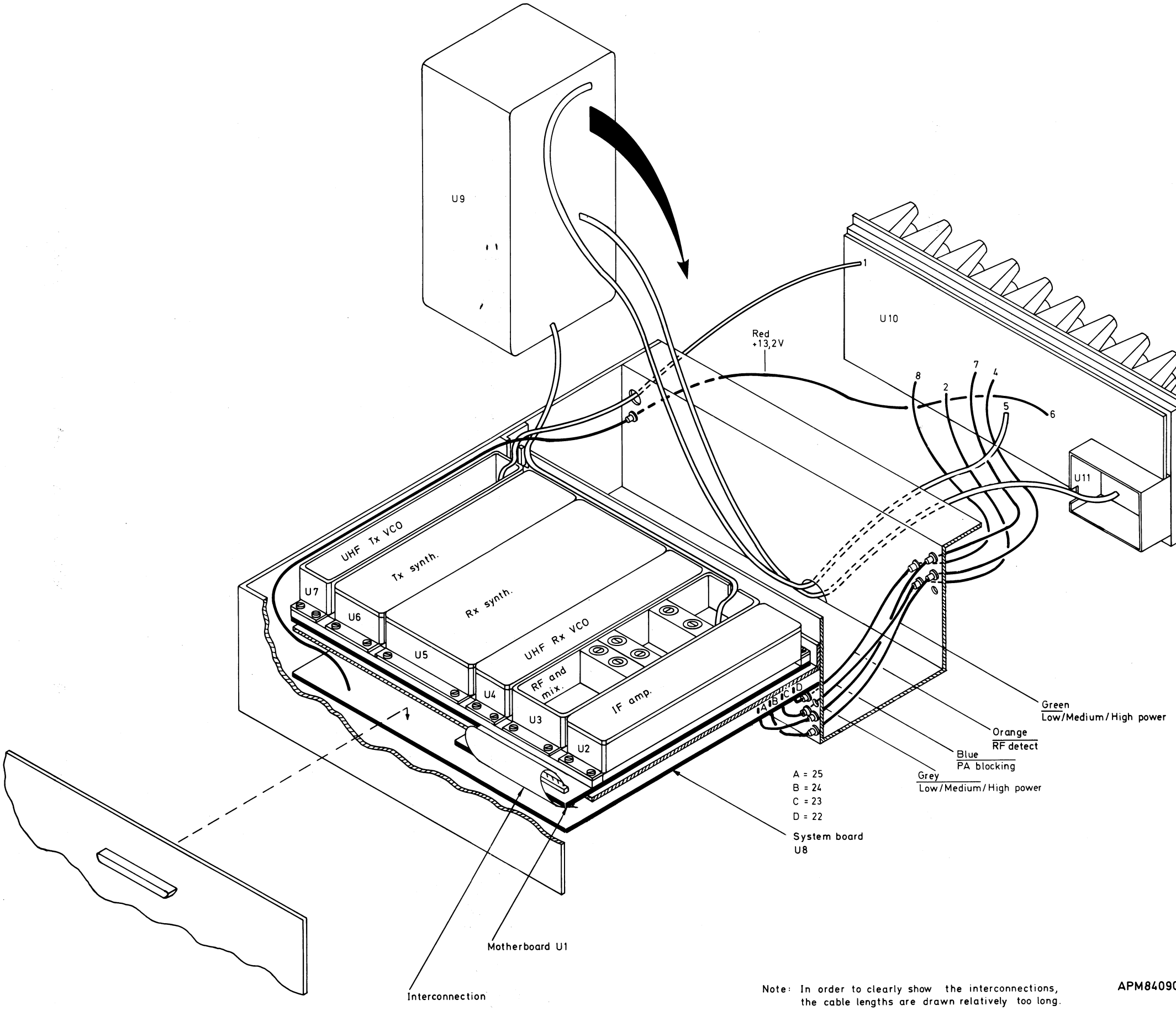


Fig. 9-10 Wiring survey of the radio unit

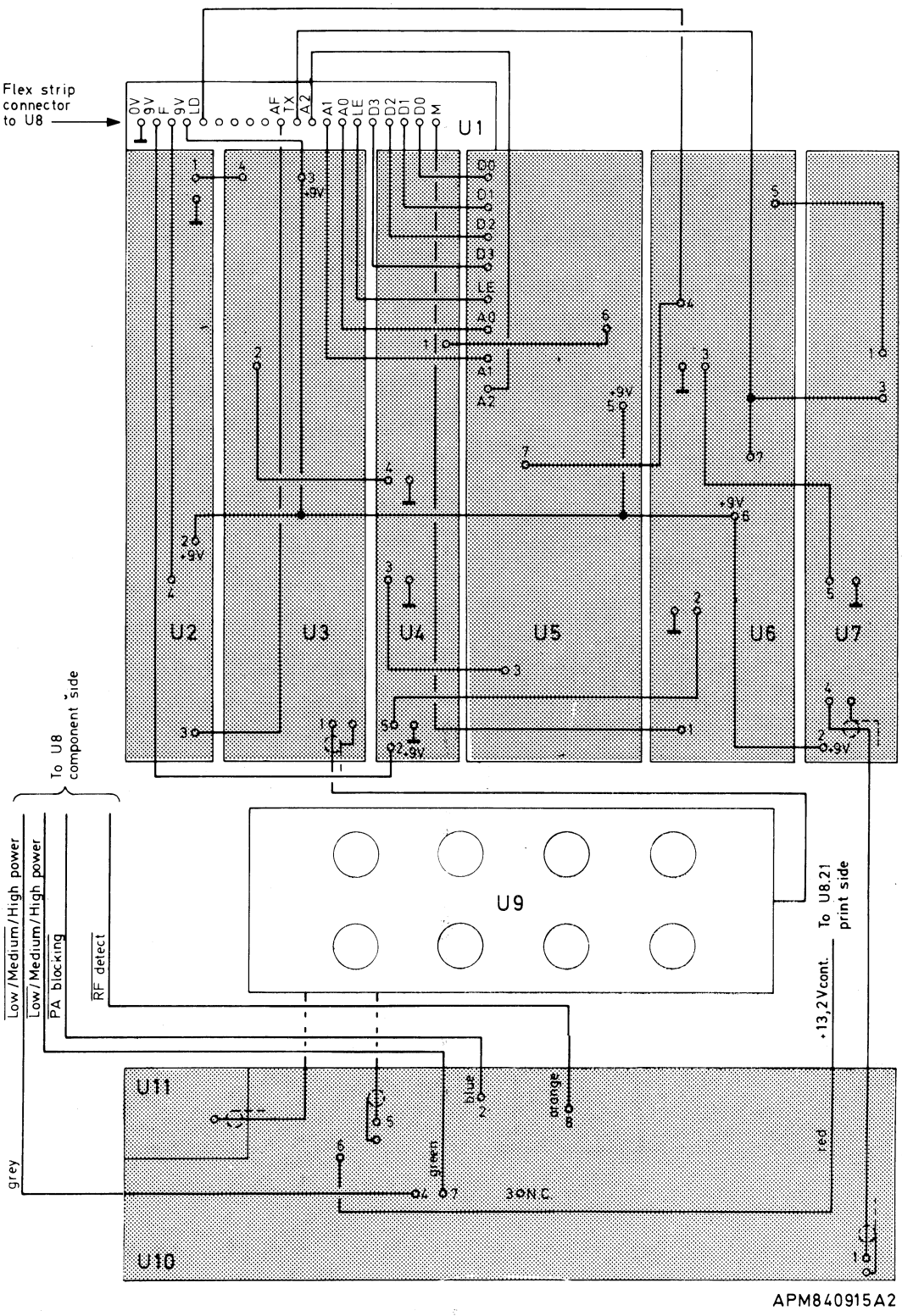


Fig. 9-11 Wiring diagram, radio unit ("RF side")

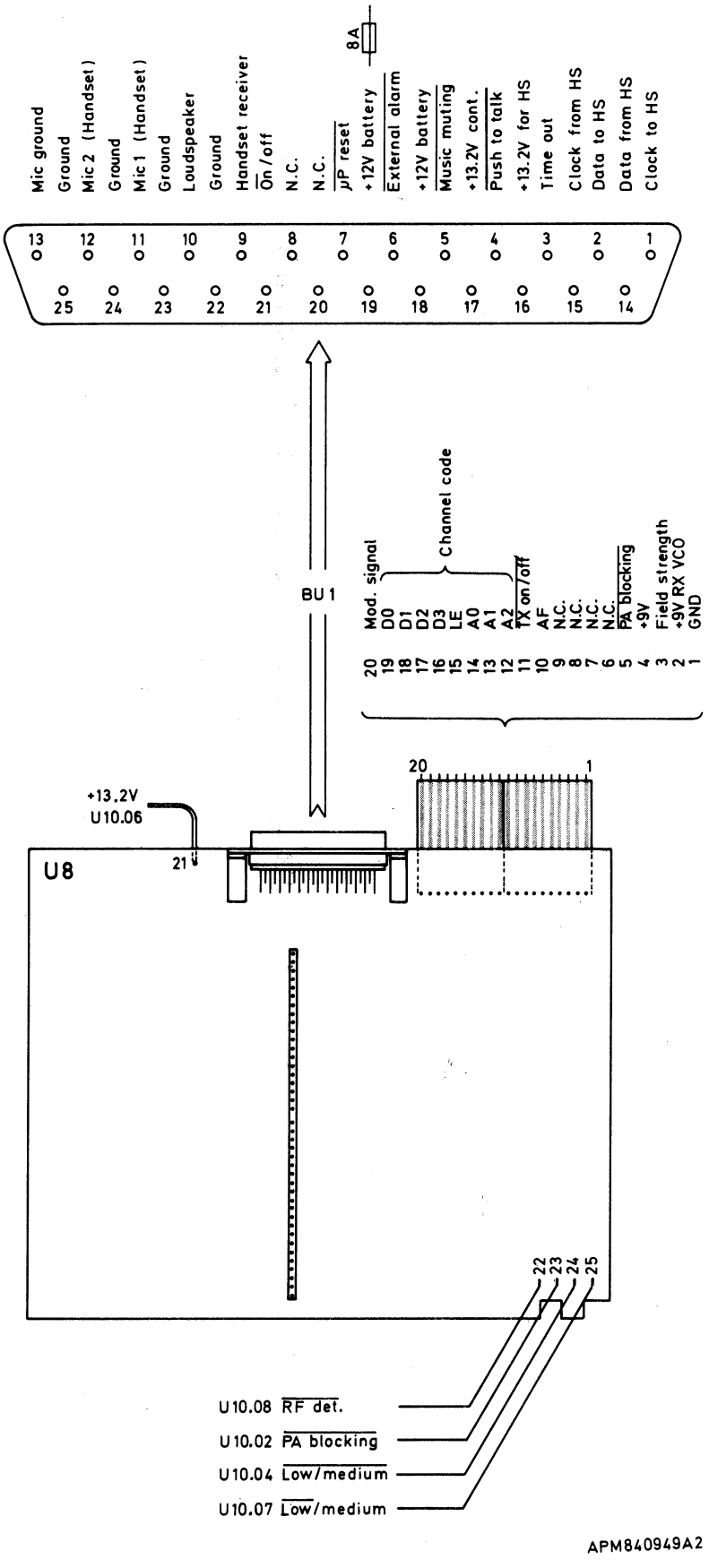
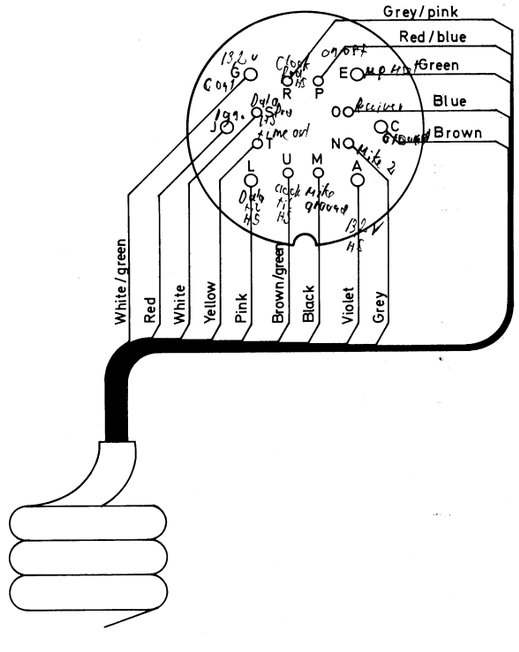
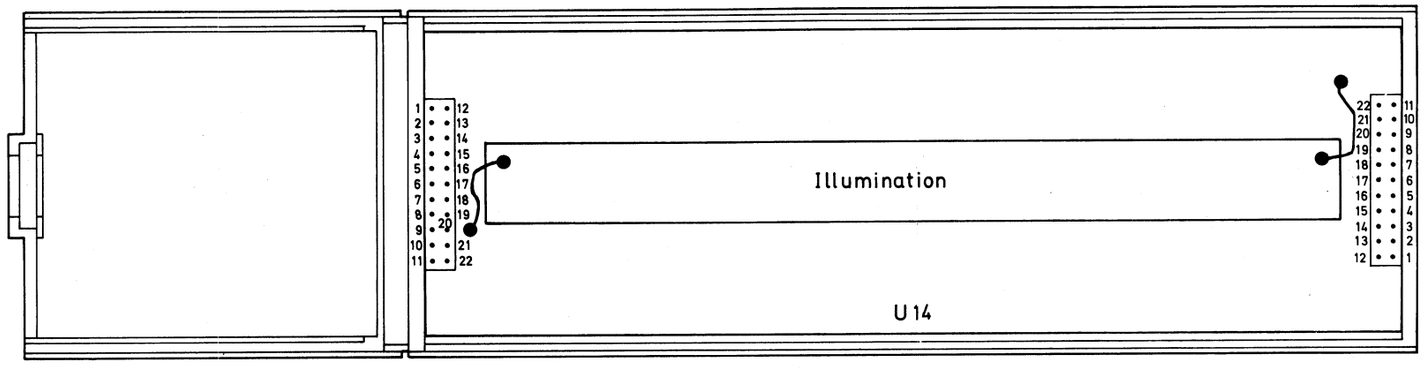
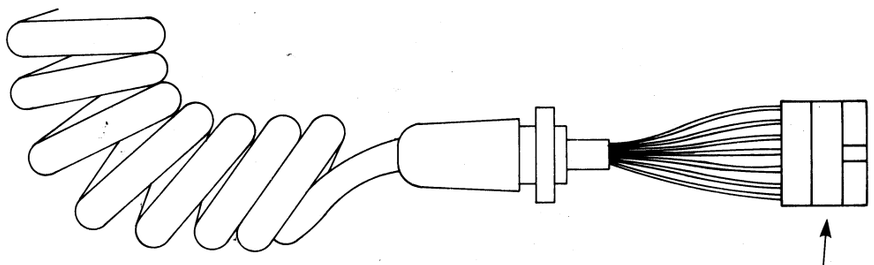


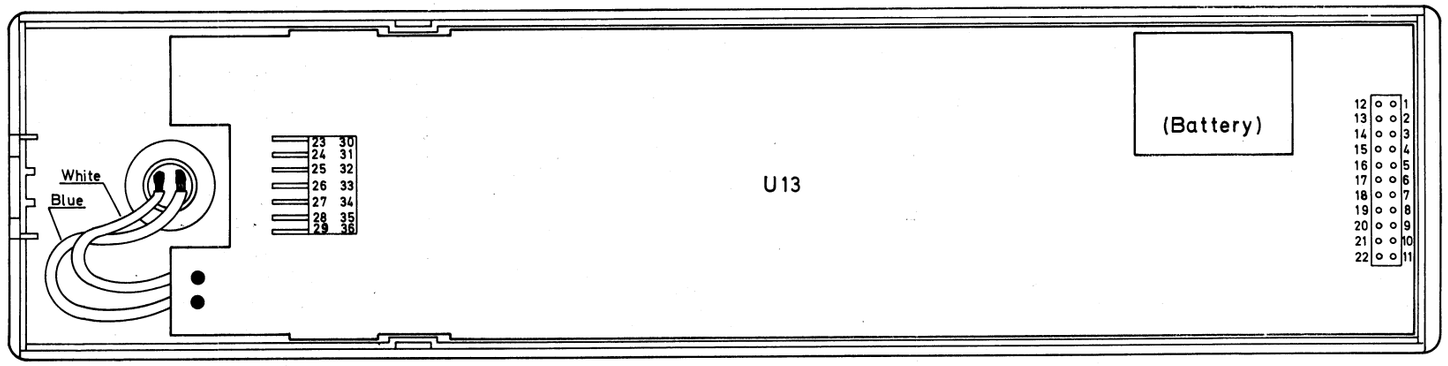
Fig. 9-12 Wiring diagram, radio unit ("CPU side")

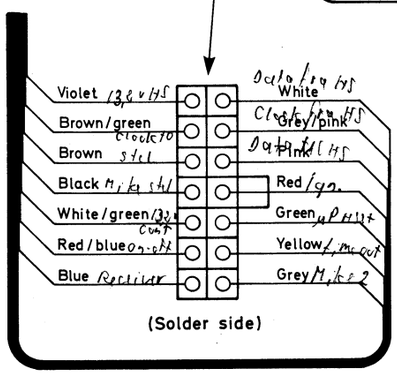
Handset
connector
(Solder side)











APM840916A1

Fig. 9-13 Wiring diagram, handset

10. Checking and adjusting

1. General information

Measuring instruments:

Test box	: AP accessory
Handset test box	: AP accessory
Power meter	
Dummy load 50ohm/25W	
Attenuator 30-40dB/50ohm/20W	
Attenuator 20dB/50ohm/20W	
Deviation meter	
Tone generator	
RF signal generator with attenuator	
Distortion meter	
Oscilloscope	
Modulation meter	
Frequency counter	
Power supply 13.2V/6A	

In the following instructions adjusting elements are indicated with the unit no. and the component no. e.g. U10/R10. The same principle is also used for indication of test points, e.g. U08/TP5 indicates unit U08 test point 5. U08.04 indicates unit U08 terminal 4. The location of test points, adjusting elements etc. is shown in fig. 10-6 and fig. 10-7.

We presume that the technician performing the adjusting is familiar with the test box and the test cradle.

2. Connecting the box and handset test box

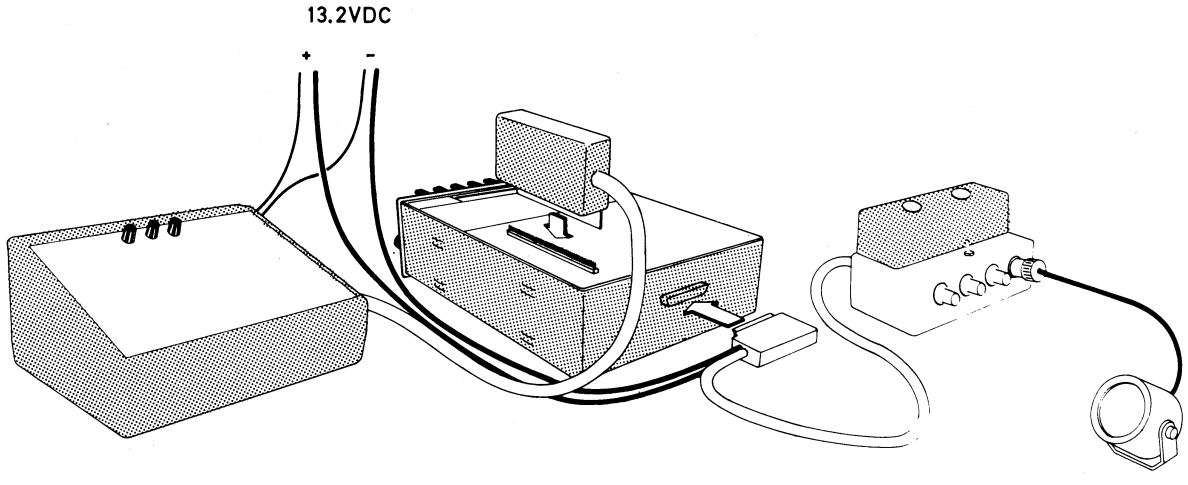


Fig. 10-1 Connection of the test box and the handset box

START-UP PROCEDURE FOR THE TEST SET

A. Switches:
Handset connected and resting on its cradle.

ON/OFF switch in position OFF. (page 11-4).
Put switch S5 in position "CPU-CONTROL". (page 11-1).
Put switch S12 in position "manual". (page 11-1).
Put all other switches in middle position. (page 11-1).

B: Turn ON the radio by pressing the ON/OFF button ⏻ of the handset.

C: Now S5 can be used to select manual (overriding the radio microprocessor) control or monitoring mode "CPU-CONTROL".
The wanted mode of operation can now be selected by the appropriate switches.

WARNING: When the equipment is used for measurements.
If S9 (microprocessor operate) has been used to stop the radio processor, the start-up procedure must be applied again. This is to avoid that the radio microprocessor (which is normally reset/restarted by the handset) ends up in an unknown mode of operation, where it can introduce noise in the measurements.

COMMENTS: For modulation measurements:
Disconnect the handset, as the microphone signal must be disconnected.

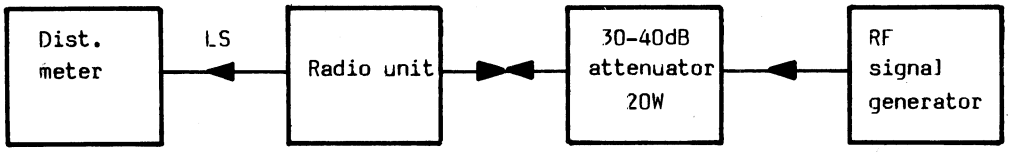
How to disconnect the handset:

After start-up procedure.
1. Put ON/OFF switch on test cradle in position ON.
2. Now the handset can be removed and the set is still switched on.

3. Quick functional test

The following test is not complete, but it gives an indication of the transmitter/receiver performance.

- By using e.g. the set-up in fig. 10-2, check the receiver sensitivity at the channels 1, 91 and 180 while transmitting with high power.
  Requirement: < 1uV EMF for 20dB SINAD, psophometric
  <1.2V EMF for 20dB SINAD, linear.



TX ON, HI power

f = 463.000MHz for ch. 1
f = 465.250MHz for ch. 91
f = 467.475MHz for ch. 180

Note: The exact value of the attenuator is not important but must be known in order to determine the sensitivity.

Fig. 10-2 Test set-up for quick functional test

4. Adjusting the TX and RX synthesizer

- Set the test box rotary switches to channel 91.
- No modulation (MIC BLOCK, SUPERVISORY OFF and TX DATA RESET).
- With a dummy load/wattmeter connected, activate the transmitter (TX ON).
- Check that 7.850MHz ±100Hz is obtained at U6/TP1.
- If not, adjust U6/L1.
- Check that 5.0V is obtained at U5.06.
- If not, adjust U4/C5.
- Check that 4.5V is obtained at U7.01.
- If not, adjust U7/C4.
- Connect the frequency counter to the wattmeter. Check that 455.250MHz ±1kHz is obtained.
- If not, adjust U5/C22.

NOTE: When U6/L1 has been adjusted, the modulation amplifier must also be adjusted.
See para 6.

5. Adjusting the PA and power control

- Connect a 50ohm/25W dummy load via a power meter to the antenna connector.
- As it is important that the PA is terminated with 50ohms, it is assumed that the duplex filter is OK.
- Still using channel 91, enable a high power transmission without modulation with the test box.
- Adjust all the trim capacitors in unit U10 for maximum output (critical adjustment).
- Adjust U10/R13 for 15W output power.
- Check that the output power at channels 1 and 180 is minimum 12W.
- If not, suspect the duplex filter.
- Enable a medium power transmission on channel 91.
- Adjust U10/R26 for 1.5W output power.
- Enable a low power transmission on channel 91.
- Check that pin U10.08 is low during transmission.

6. Adjusting the modulation amplifier

- Connect a deviation meter to U7.04 or via a power attenuator to the antenna connector.
- Connect a tone generator to the "MIC 1" connector at the test cradle.
- Connect an oscilloscope to the AF output of the modulation meter for checking of the modulation.
- Set S17 to "MIC 1" position, S10 to "OPEN" position, S20 to "SUPERVISORY OFF" and S6 in "RESET" position. time-out på AF
- With 1000Hz/10mV RMS from the tone generator check that ±4.1kHz deviation is obtained.
- If not, adjust U8/R105.
- With an output 20dB less (1mV output), check that ±3kHz deviation is obtained.
- If not, adjust U8/R81.
- Repeat the procedure once.
- Connect the tone generator to the "MIC 2" connector at the test cradle.
- Set S17 to "MIC 2" position.
- With 1000Hz/100mV RMS from the tone generator, check that ±3kHz deviation is obtained.
- If not, adjust U8/R82.

7. Adjusting the modem modulation level

- With the switch S10 in "MIC BLOCK" position and S6 in "TRANS" position, check that ±4.2kHz deviation is obtained.
- If not, adjust U8/R102.

8. Adjusting the IF amplifier

- If the RF and mixer unit is working you can connect the signal generator (10uV EMF) to the antenna connector. Then perform the measurement at 465.250MHz. You can "by-pass" the RF and mixer unit by connecting the signal generator to U3/TP1 instead. In this case the measurement is performed at 21.4MHz.
- Connect the distortion meter to the handset speaker output on the test cradle.
- Modulate the signal generator with 1kHz to ±3kHz deviation.
- Adjust U2/L1 for maximum LF output and U3/L11 and U2/C1 for minimum distortion.

9. Adjusting the RF amplifier

The adjustment of U3/L11 is described together with the IF amplifier.

- Set the radio to channel 91.
- Adjust U3/C10,11 for max. DC voltage at U2.04. You can measure at the flex strip terminal 3.
- For fault-finding U3/TP2 can be used to check that the injection signal is present (approx. 1.5 to 2.5VDC).
- Adjustment of the RF filter should be avoided unless e.g. a sweep generator provided with a logarithmic horizontal amplifier (min. 50dB dynamic range) is available.
- If the required instrument is available the specifications in fig. 10-3 can be checked. The generator is connected directly to U3.01 input and the RF probe to U3/TP3.
- With U3/C10 and U9/C7,8 the sensitivity can be fine-tuned (on ch. 91).
- Perform step 3.

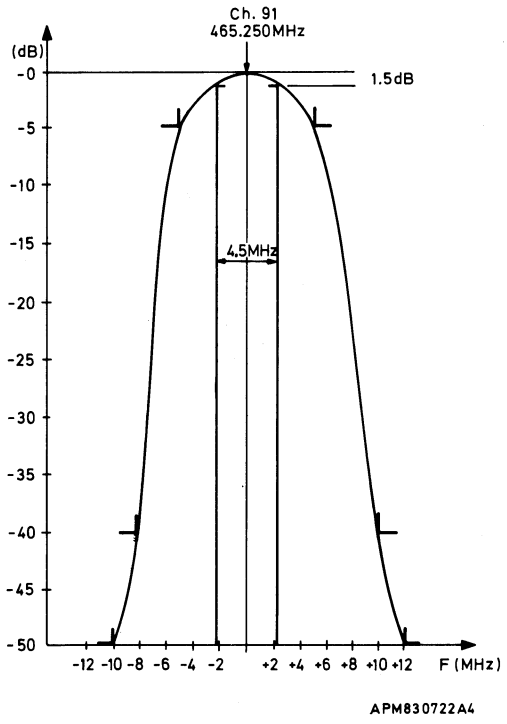


Fig. 10-3 Receiver RF filter (without duplex filter)

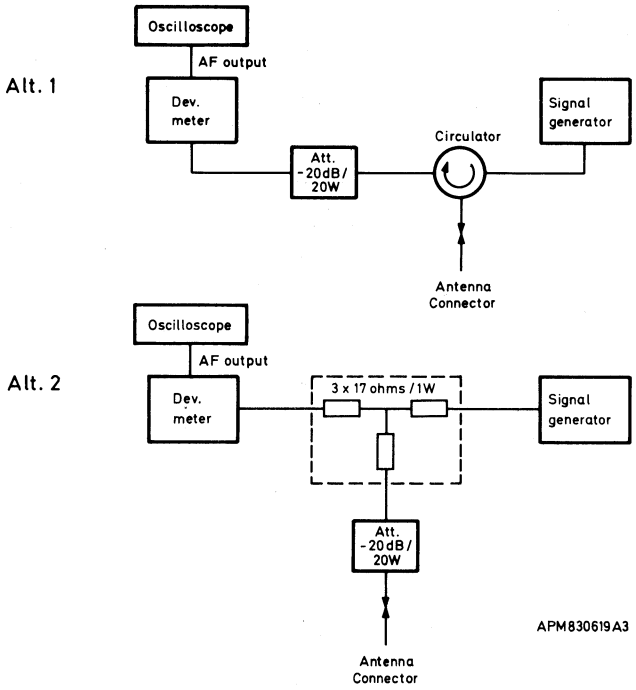
10. Adjusting squelch, handset output and field strength controls

- Disable the transmitter by setting S13 in position "OFF".
- Disable the loudspeaker with S15 in position "LSPK OFF".
- Connect the RF signal generator to the antenna input (10uV EMF) and an oscilloscope to the handset connector of the test cradle.
- Set the RF signal generator to 465.250MHz, modulation 1000Hz tone / ±3kHz deviation and the output level for 20dB SINAD measured with a psophometric filter (=14dB SINAD measured without psophometric filter). This level is approx. 0.8uV EMF.
- Adjust U8/R35 until the "SQUELCH" lamp D19 just lights up.
- Reduce the RF signal generator output with 4dB.
- Check that the "SQUELCH" lamp is off.
- Readjust the RF signal generator to 3.2uV EMF ±4dB.
- Adjust U8/R163 so that the "FIELD STRENGTH" lamp D20 just lights up.
- Set the receiver volume by setting the volume switch to position 4 and S12 to position man.
- LSPK OFF.
- Check that 190mV RMS is obtained at the handset output.
- If not, adjust U8/R41.
- Set the volume switch in position 7.
- Check that 560-580mV RMS without limiting/distortion is obtained at the handset output.

11. Adjusting the supervisory filters

- Connect an RF signal generator to the antenna input (10uV EMF).
- Modulate the RF generator with 4149Hz (±0.1%), ±500Hz deviation.
- Adjust U8/R5 for max. AC voltage at U8/TP1.
- Modulate with 3845Hz (±0.1%), ±500Hz deviation.
- Adjust U8/R12 for max. AC voltage at U8/TP2.

12. Adjusting the supervisory modulation level



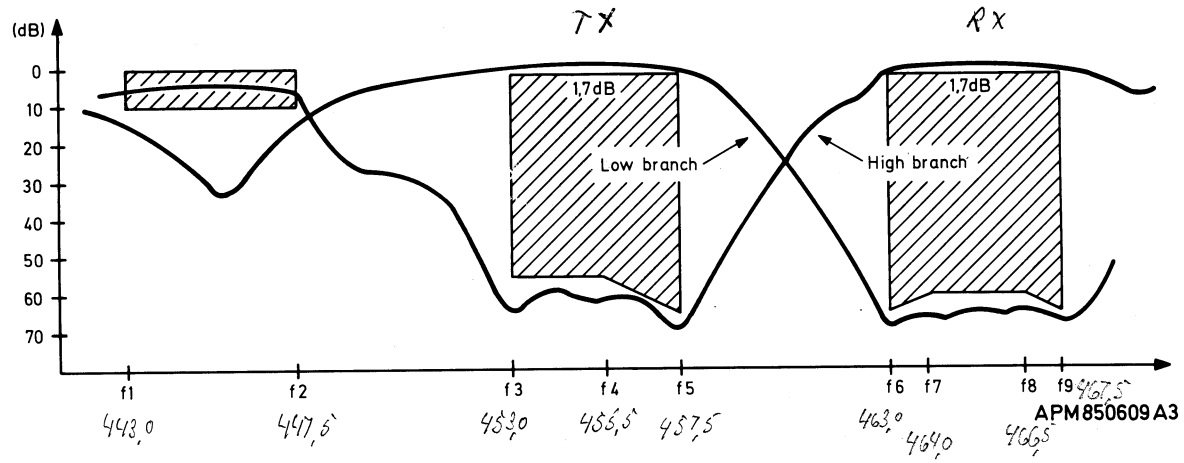
NOTE: The oscilloscope is used for visual checking of the signal.

Fig. 10-4 Test set-up. Supervisory modulation level

- Set the RF signal generator to the receiver frequency.
- Modulate the RF signal generator with 4000Hz to ±500Hz deviation (10uV EMF).
- Open the supervisory path (S20) and reset the TX data (S6).
- Enable the transmitter with S13.
- Check that the transmitter deviation is ±550Hz.
- If not, adjust U8/R113.

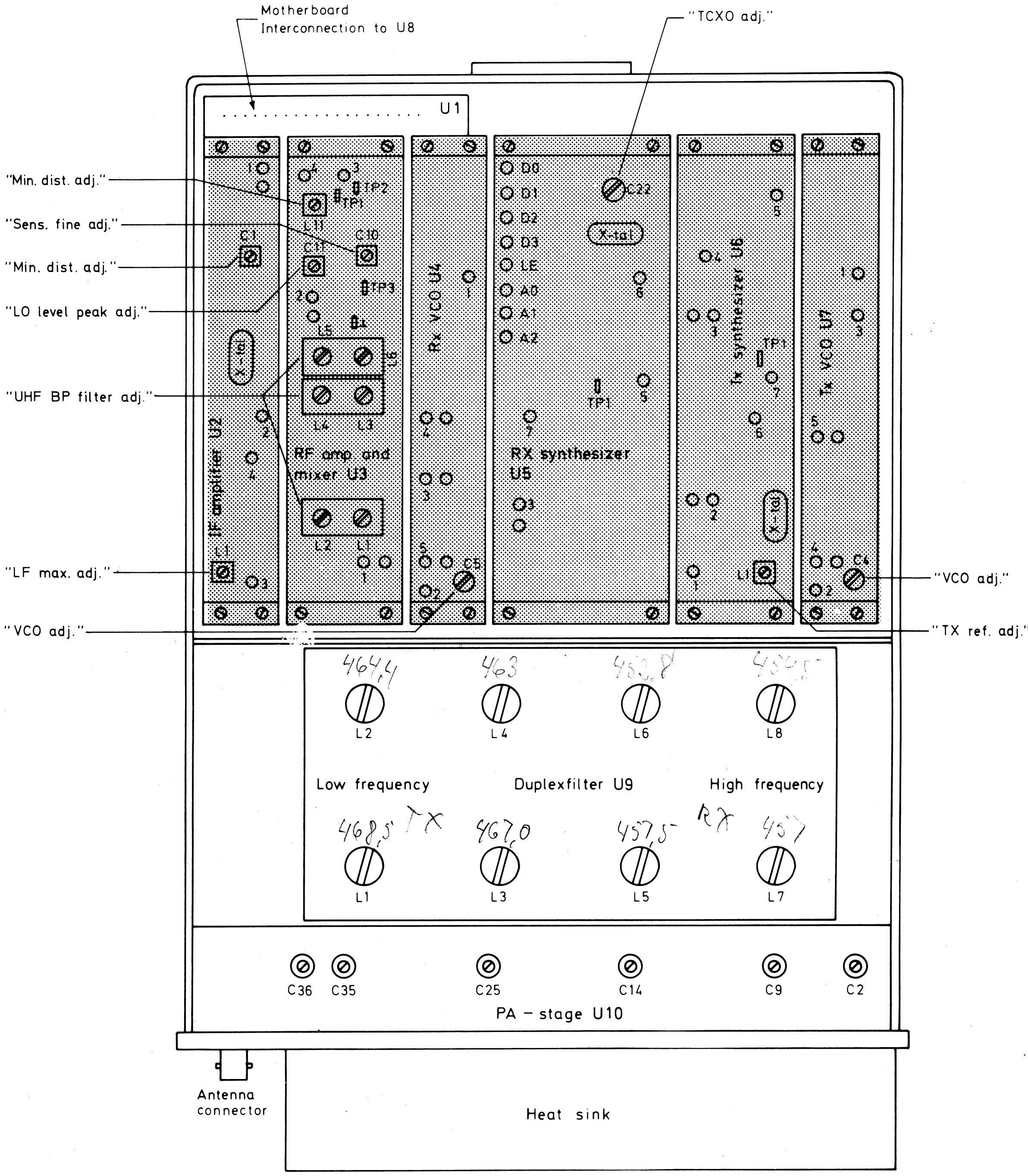
13. Adjusting of the duplex filter

NOTE: We recommend that adjustment of the duplex filter is made in the factory only. Not only are expensive instruments necessary but the test set-up is also critical. For fault-isolation we recommend that a duplex filter is kept in the work-shop. For adjustment a network analyser or a "Polyskop" with minimum 65dB dynamic range is required.



f1:	443.0MHz	f6:	463.0MHz
f2:	447.5MHz	f7:	464.0MHz
f3:	453.0MHz	f8:	466.5MHz
f4:	455.5MHz	f9:	467.5MHz
f5:	457.5MHz		

Fig. 10-5 Duplex filter characteristics



Styrkediagrammets placering kan have betydning for udg. effekt.
Skal være lagt væk fra udg. transistor.
Evt. afkobles ben 4 og 7 med 100 pF til stel.

Fig. 10-6 Location of adjusting elements, test points and terminals, ("RF side")

CONNECTOR FOR TEST BOX

1. $\overline{\text{Mic. blocking}}$
2. TX data
3. $\overline{\text{Low}}$/Medium/High power
4. Clock to HS
5. Speech mute
6. $\overline{\text{Loudspeaker blocking}}$
7. Ring
8. $\overline{\text{Supervisory tone off}}$/on
9. $\overline{\text{Mic. 2 (Handset)}}$/Mic. 1 (Handsfree)
10. Malfunction alarm
11. N.C
12. $\overline{\text{Low/Medium}}$/High power
13. $\overline{\text{RF detect}}$
14. Ch. code A2
15. Ch. code A1
16. Ch. code AØ
17. LE
18. $\overline{\text{External alarm}}$
19. Test input
20. Ch. code D1
21. Ch. code DØ
22. Volume D2
23. FS Low/High
24. $\overline{\text{Squelch on}}$/off
25. $\overline{\text{Push to talk}}$
26. Volume DØ
27. Data to HS
28. Data from HS
29. 1200Hz
30. Volume control D1
31. RX data
32. FFSK carrier present
33. $\overline{\text{FFSK TX enable}}$
34. Ch. code D3
35. Ch. code DØ
36. Time out
37. $\overline{\text{uP reset}}$
38. Clock from HS
39. $\overline{\text{TX on}}$/off
40. FFSK TX sync.

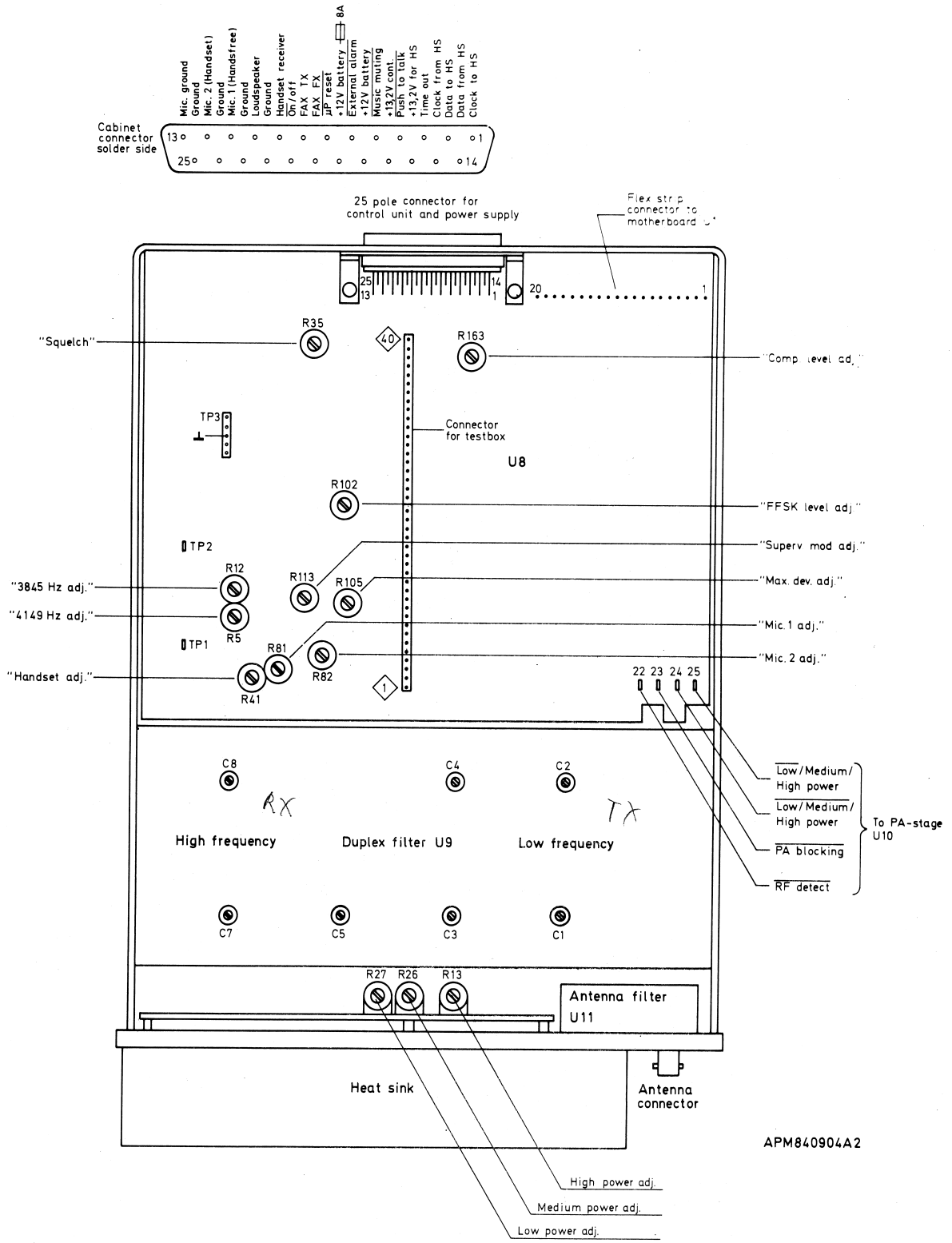


Fig. 10-7 Location of adjusting elements, test points and terminals, ("CPU side")

Channel	1	463.000MHz	Channel	46	464.125MHz	Channel	91	465.250MHz
"	2	463.025 "	"	47	464.150 "	"	92	465.275 "
"	3	463.050 "	"	48	464.175 "	"	93	465.300 "
"	4	463.075 "	"	49	464.200 "	"	94	465.325 "
"	5	463.100 "	"	50	464.225 "	"	95	465.350 "
"	6	463.125 "	"	51	464.250 "	"	96	465.375 "
"	7	463.150 "	"	52	464.275 "	"	97	465.400 "
"	8	463.175 "	"	53	464.300 "	"	98	465.425 "
"	9	463.200 "	"	54	464.325 "	"	99	465.450 "
"	10	463.225 "	"	55	464.350 "	"	100	465.475 "
"	11	463.250 "	"	56	464.375 "	"	101	465.500 "
"	12	463.275 "	"	57	464.400 "	"	102	465.525 "
"	13	463.300 "	"	58	464.425 "	"	103	465.550 "
"	14	463.325 "	"	59	464.450 "	"	104	465.575 "
"	15	463.350 "	"	60	464.475 "	"	105	465.600 "
"	16	463.375 "	"	61	464.500 "	"	106	465.625 "
"	17	463.400 "	"	62	464.525 "	"	107	465.650 "
"	18	463.425 "	"	63	464.550 "	"	108	465.675 "
"	19	463.450 "	"	64	464.575 "	"	109	465.700 "
"	20	463.475 "	"	65	464.600 "	"	110	465.725 "
"	21	463.500 "	"	66	464.625 "	"	111	465.750 "
"	22	463.525 "	"	67	464.650 "	"	112	465.775 "
"	23	463.550 "	"	68	464.675 "	"	113	465.800 "
"	24	463.575 "	"	69	464.700 "	"	114	465.825 "
"	25	463.600 "	"	70	464.725 "	"	115	465.850 "
"	26	463.625 "	"	71	464.750 "	"	116	465.875 "
"	27	463.650 "	"	72	464.775 "	"	117	465.900 "
"	28	463.675 "	"	73	464.800 "	"	118	465.925 "
"	29	463.700 "	"	74	464.825 "	"	119	465.950 "
"	30	463.725 "	"	75	464.850 "	"	120	465.975 "
"	31	463.750 "	"	76	464.875 "	"	121	466.000 "
"	32	463.775 "	"	77	464.900 "	"	122	466.025 "
"	33	463.800 "	"	78	464.925 "	"	123	466.050 "
"	34	463.825 "	"	79	464.950 "	"	124	466.075 "
"	35	463.850 "	"	80	464.975 "	"	125	466.100 "
"	36	463.875 "	"	81	465.000 "	"	126	466.125 "
"	37	463.900 "	"	82	465.025 "	"	127	466.150 "
"	38	463.925 "	"	83	465.050 "	"	128	466.175 "
"	39	463.950 "	"	84	465.075 "	"	129	466.200 "
"	40	463.975 "	"	85	465.100 "	"	130	466.225 "
"	41	464.000 "	"	86	465.125 "	"	131	466.250 "
"	42	464.025 "	"	87	465.150 "	"	132	466.275 "
"	43	464.050 "	"	88	465.175 "	"	133	466.300 "
"	44	464.075 "	"	89	465.200 "	"	134	466.325 "
"	45	464.100 "	"	90	465.225 "	"	135	466.350 "

Fig. 10-8 RX frequency list (1 of 2)

Channel	136	466.375MHz
"	137	466.400 "
"	138	466.425 "
"	139	466.450 "
"	140	466.475 "
"	141	466.500 "
"	142	466.525 "
"	143	466.550 "
"	144	466.575 "
"	145	466.600 "
"	146	466.625 "
"	147	466.650 "
"	148	466.675 "
"	149	466.700 "
"	150	466.725 "
"	151	466.750 "
"	152	466.775 "
"	153	466.800 "
"	154	466.825 "
"	155	466.850 "
"	156	466.875 "
"	157	466.900 "
"	158	466.925 "
"	159	466.950 "
"	160	467.975 "
"	161	467.000 "
"	162	467.025 "
"	163	467.050 "
"	164	467.075 "
"	165	467.100 "
"	166	467.125 "
"	167	467.150 "
"	168	467.175 "
"	169	467.200 "
"	170	467.225 "
"	171	467.250 "
"	172	467.275 "
"	173	467.300 "
"	174	467.325 "
"	175	467.350 "
"	176	467.375 "
"	177	467.400 "
"	178	467.425 "
"	179	467.450 "
"	180	467.475 "

Fig. 10-8 RX frequency list (2 of 2)

AP3733-02
(Updated version)
Accessories

ap radiotelefon a/s

1984-11-13 LT/IHS/FK/AO

ap 3733 -02

1. Opstart procedure for testset

(Referencerne er til servicemanualen)

A. Knapper

Handset monteret og hvilende på ophænget.

ON/OFF knap (SK2 side 11-4) i position OFF.
Stil knap S1 (se side 11-1) i position 3733-02.
Stil knap S5 (se side 11-1) i position "CPU-CONTROL".
Stil knap S12(se side 11-1) i position "manuel".
Stil alle andre knapper i midter position.

B.

Tænd for radioen ved at trykke på handsettets ON/OFF-knap ⏻.

C.

Nu kan S5 (se side 11-1) anvendes til at vælge manuel (udkobler radio-mikroprocessoren) styring eller "CPU-CONTROL". Den ønskede operationsmåde kan nu vælges ved hjælp af de beskrevne knapper.

ADVARSEL: Når apparatet anvendes til målinger.

Hvis S9 (mikroprocessor-styret) har været anvendt til at standse radioprocessoren, skal opstart proceduren gentages. Dette for at undgå, at radio-mikroprocessoren (der normalt resettes/genopstartes af handsettet) ender med en ukendt operationsmåde, hvor den kan indføre støj i målingerne.

Kommentarer

For modulationsmålinger: Afmonter handset.
Årsag: Mikrofonsignal skal afbrydes.

Måde at udføre det på

Efter opstart proceduren.

1. Flyt ON/OFF knap på testophæng til position ON.
2. Nu kan handset afmonteres medens radioen forbliver tændt.

Lars Tuxen

Modification of the test box ap3733-01 to ap3733-01/02.

This is a supplement to the service manual for ap3733-01 (stock no. 296-303).

The supplement deals with the modification of the test box 319-055. After the modification the test box can be used both for ap3733-01 and for ap3733-02.

Enclosed with this supplement:
Fig. 2 Modifications on the component side.
Fig. 3 Modifications on the print side.
Fig. 4 Circuit diagram, test box.

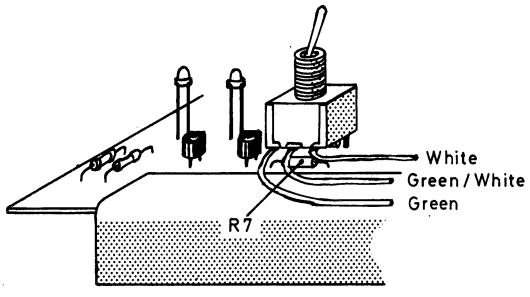
In the later case an interface board must be used.

We recommend that this supplement is filed in the section ADDITIONS AND ALTERATIONS for future reference.
The operation of the modified test box is described in the manual for ap3733-02.

Perform the following steps:
1) Remove and discard the front plate. (marked 319-055).
2) Remove the bottom plate.

MODIFICATIONS ON THE COMPONENT SIDE

See fig. 2. The figure is provided with ref. to the corresponding step nos.
3) Mount the following components:
   R4(560ohms), R5(560ohms), R6(10K), R7(10K), D2(red LED), D3(green LED), Q1 & Q2(BC337-25).
4) Replace the microprocessor IC1.
5) Mount the toggle switch S1 to the board as shown in fig. 1. Three pins are shortened because of R7. Connect the three wires from the toggle switch.
6) Replace R36 with 82ohm/1/4W



CAUTION! Assure that sufficent clearence is provided in order to avoid accidental shortcircuiting.

Fig. 1 Mounting the toggle switch S1

MODIFICATIONS ON THE PRINT SIDE

See fig. 3. The figure is provided with ref. to the corresponding step nos.

7) Cut a copper track.
8) Connect the diode D43(1N4148) between IC8 pin 6 and Q2/c.
   NOTE: For this purpose the kit is provided with a brown wire and a cotton sleeve.
9) Cut a trace and mount R86(100K).

FINAL ASSEMBLY

10) Mount the new front plate (marked 9506 100 10290).
    NOTE: adjust the nuts on the switch S1.
11) Mount the bottom plate.

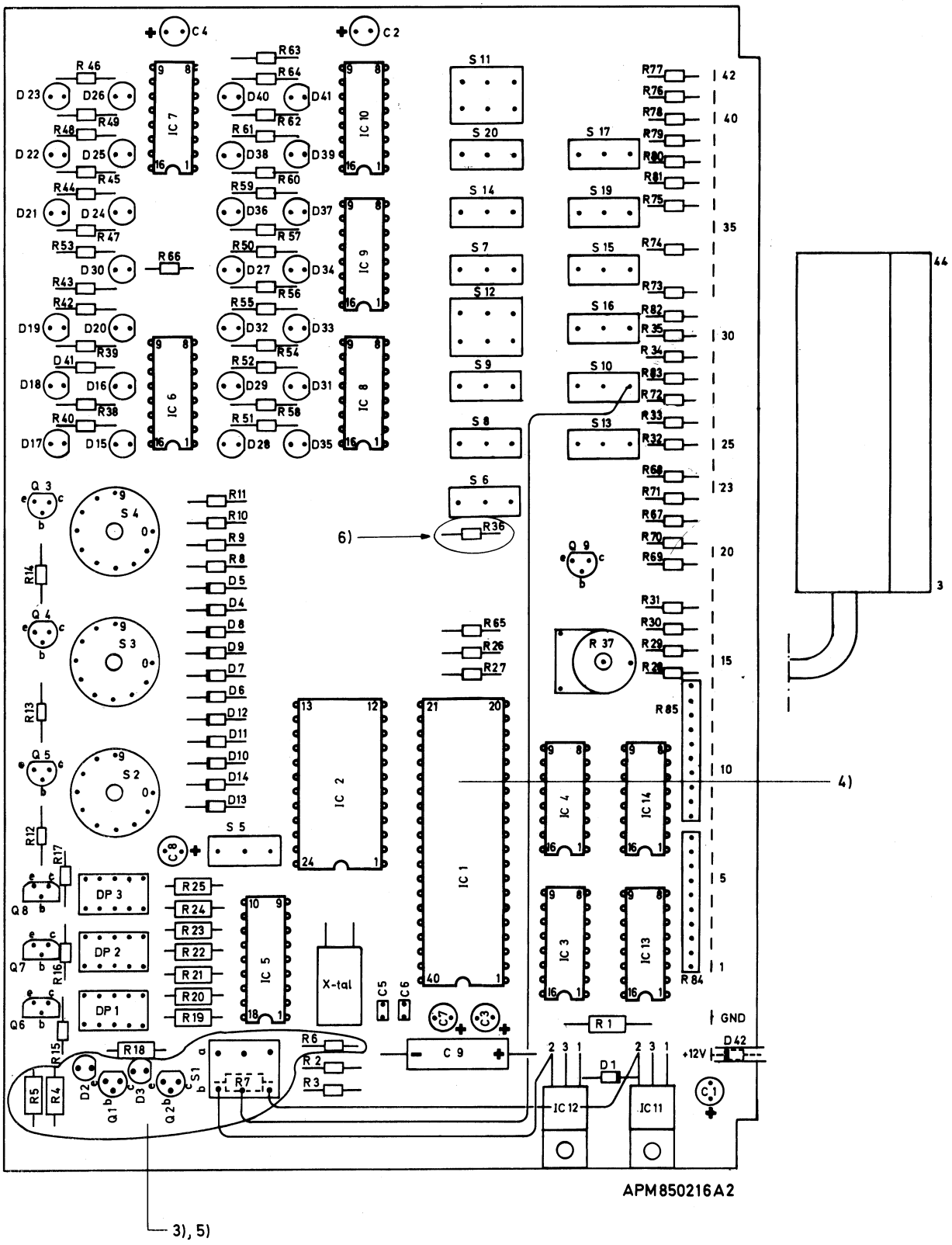


Fig. 2 Modifications on the component side

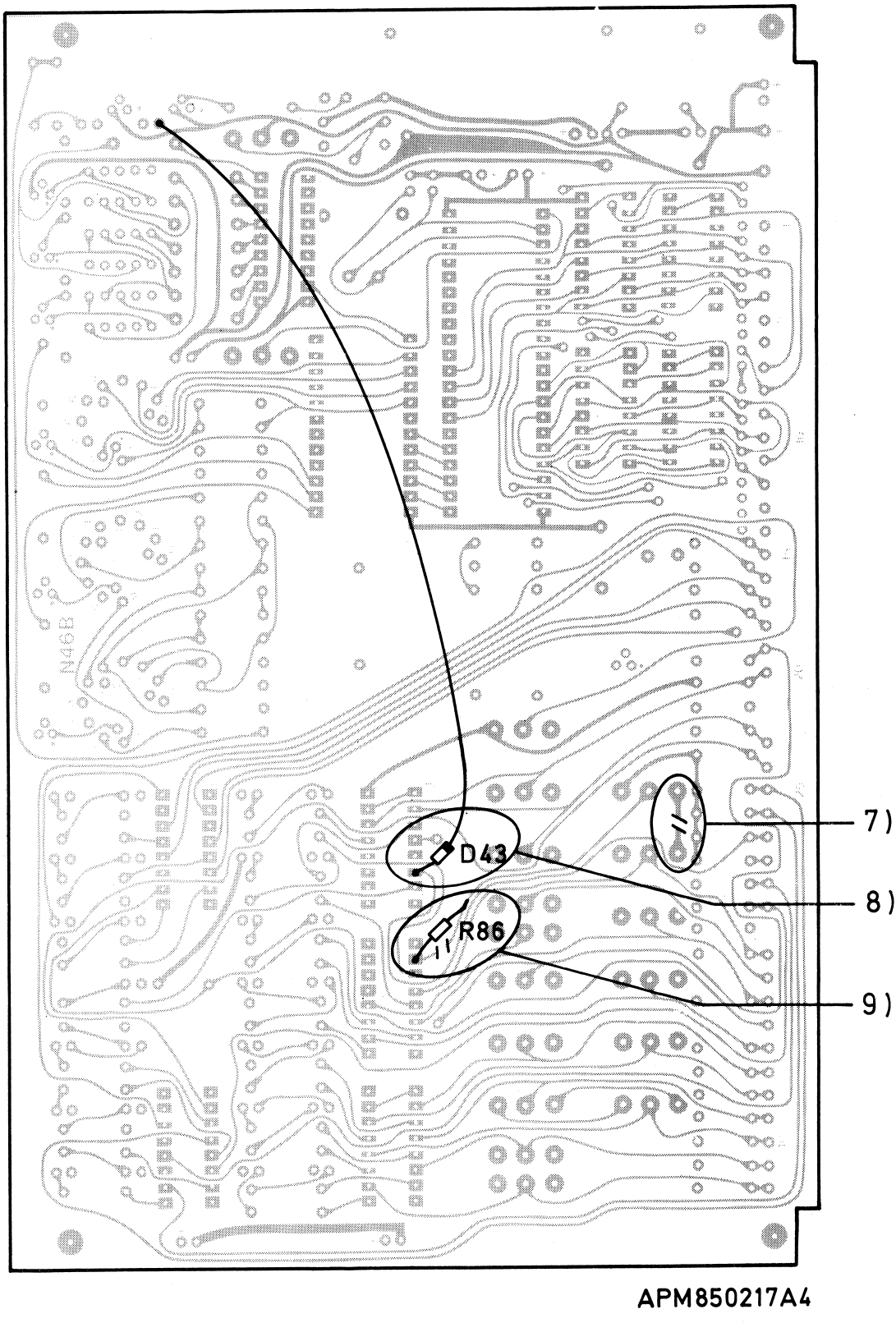


Fig. 3 Modifications on the print side

Cable connector

Data from HS/CU

IC 6 IC 7 IC 8 IC 9 IC 10

HAND-SET

D15 Red TX CLK
D16 Green TX DATA
D17 Red RX CLK
D18 Green RX DATA
D19 Yellow SQUELCH
D20 Yellow FIELD STRENGTH

MODEM

D21 Yellow RX FFSK PRESENT
D22 Green RX DATA
D23 Red RX CLOCK
D24 Yellow TX RESET
D25 Green TX DATA
D26 Red TX CLK

D27 Red TIME-OUT
D28 Red PTT
D29 Red RESET
D30 Red RX MODEM RESET
D31 Red MIC BLOCK
D32 Red VOL MAN
D33 Red SPEECH PATH
D34 Red LSPK BLOCK
D35 Red TX ON
D36 Red ALARM
D37 Red RINGING
D38 Red SUP ON
D39 Red MIC 1
D40 Red LOW POWER
D41 Red MEDIUM POWER

S6 RESET / TX DATA TRANS
S9 µP OPERATE / RESET
S7 RADIO OFF / TIME OUT DISABLE
S16 BLOCK / SPEECH PATH OPEN
S8 ON / PTT OFF
S15 OPEN / LSPK BLOCK
S10 OPEN / MIC BLOCK
S13 OFF / TX ON
S14 MAL FCT OFF / ALARM
S19 OFF / RINGING
S20 ON / SUPER VISORY OFF
S17 MIC 2 / MIC 1
S11 MEDIUM / HIGH / LOW
S12 VOL CPU / MAN

R37 4,7K "VOLUME"

MANUAL CONTROL S5

IC 1 X-TAL X-TAL SS EA T0 T1 INT RESET DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7 RD WR P10 P11 P12 P13 P14 P15 P16 P17 PROG P20 P21 P22 P23 P24 P25 P26 P27 PSEN ALE

AP3733-2 AP3733-1 S1a S1b

IC 3 IC 13 IC 4 IC 14

term.8 R85 7x33K

term.7,5,4,2,3 R84 4x33K

Cable connector

Q 9 BC337 R26 10K R65 22K

IC 2 PROG P20 P21 P22 P23 CS P40 P41 P42 P43 P50 P51 P52 P53 P60 P61 P62 P63 P70 P71 P72 P73

IC 5 R18 390 R25 390

DP 1 DP 2 DP 3

Q 6 BCX38B Q 7 BCX38B Q 8 BCX38B R15 4,7K R16 4,7K R17 4,7K

Q 3 BC337 R14 10K
Q 4 BC337 R13 10K
Q 5 BC337 R12 10K

S 2 "100" S 3 "10" S 4 "1"

D4 D5 D6 D7 D8 D9 D10 D11 D12 D13 D14 BAT43

IC8.6 AP3733-2 D3 Green R5 560 R7 10K Q 2 BC 337

D2 Red R4 560 AP3733-1 R6 10K Q 1 BC337

IC 1 - 8748
IC 2 - 8243
IC3,4,6-10,13,14 - 40097BP
IC 5 2981
IC11,12 - 7805CT
DP1-3 - HDSP7303

IC 11 IC 12 D42 3051 D1 BZX83 7C4V3 R1 3,3 C1 33µ C2 33µ C3 100µ C4 100µ C8 10 33µ C9 470µ

+12V +9V +5V GND

APM 840938A0

Fig. 4 Circuit diagram, test box

11. Test box and test cradle

A. Introduction

The test box is used in conjunction with a test cradle during checking and adjusting (see chapter 10). The box is provided with a cable which is plugged into a test connector on the U8. With the switches and the potentiometer, many functions can now be manually controlled. Note that the test box can be used both for ap3733-01 and ap3733-02. In the first case the test box is connected directly to the CPU U11 (see ap3733-01 manual). In the latter case the connection is done via an interface board. The interface board contains a switch for volume control. Therefore R37 must be turned completely counter clockwise.

B. Survey of controls

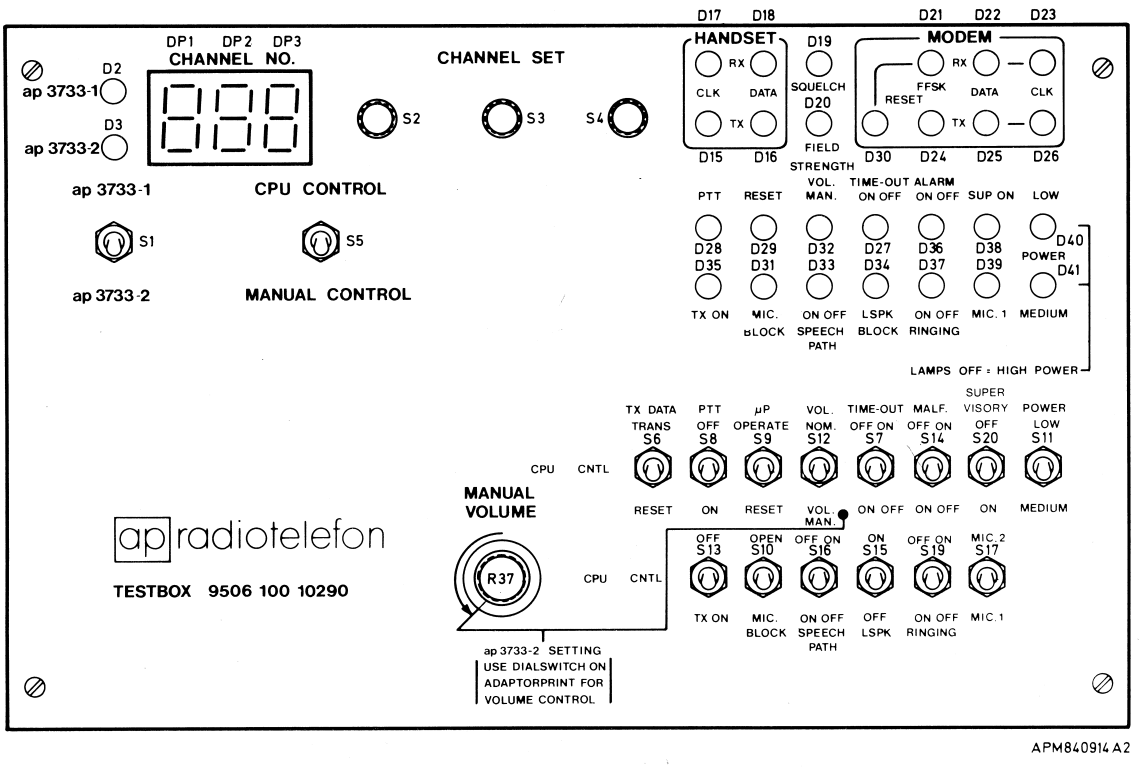


Fig. 11-1 Test box

D2,3 LED's indicating which NMT version the test box is set to (by the switch S1). The colour of the LED's also indicates that in some cases the LED/switch text corresponds to the D2, D3 colour.

DP1,2,3	"CHANNEL NO." LED display which indicates the channel number chosen with S2-3 in the manual mode or the channel set by the CPU. An irrelevant channel code is indicated with "E" (error) on the display.
D17-D41	LED's indicating status on the CPU terminals:

SIGNAL NAME ON DIAGRAMS

D17	Clock to HS
D18	Data to HS
D19	$\overline{\text{Squelch on/off}}$
D20	$\overline{\text{FS low/high}}$
D21	RX data present
D22	RX data
D23	RX clock
D24	TX data reset
D25	TX data
D26	TX clock
D27	Time out
D28	$\overline{\text{Push to talk}}$
D29	$\overline{\text{uP reset}}$
D30	Modem reset
D31	$\overline{\text{Mic. blocking}}$
D32	(When on, the LED indicates that the volume is controlled by R37 "VOLUME" i.e. the switch S12 in pos. "MAN".
D33	Speech mute
D34	$\overline{\text{Loudspeaker blocking}}$
D35	$\overline{\text{TX on}}$/off
D36	Malfunction alarm
D37	Ring
D38	$\overline{\text{Supervisory tone off}}$/on
D39	$\overline{\text{Mic. 2 (Handset)}}$/Mic. 1 (Handsfree)
D40	$\overline{\text{Low/Medium}}$/High power
D41	$\overline{\text{Low}}$/Medium/High power

S1	Switch for setting the test box to either ap3733-01 or -02.
S2-S4	"CHANNEL SET" Switches for controlling the channel selection manually (if the switch S5 is in position "MANUAL").

NOTE: By means of the switch S2 (hundreds), it is possible to select the frequently used channels 1,91,180 and 2,90 and 179.
With this facility the turning of knobs is minimized as S3 and S4 are disabled in this case. When this facility is used, the channel number is displayed with a dot after each digit.

S5 "MANUAL"

When the switch is set in the upper position the CPU controls the radio. When in the "MANUAL" position, the control is taken over by the control box switches and volume control.

S6-S17 The switches (except S12) have three positions. In mid-position the corresponding CPU control line is controlled by the CPU.
In the other two positions the switches override the CPU according to the front labelling.
NOTES: When the switch S11 is in mid-position, the PA is set to high power.

R37 "VOLUME"

The potentiometer must be turned completely clockwise because the volume is controlled by means of a switch on the interface board. S12 must be set to position "MAN".

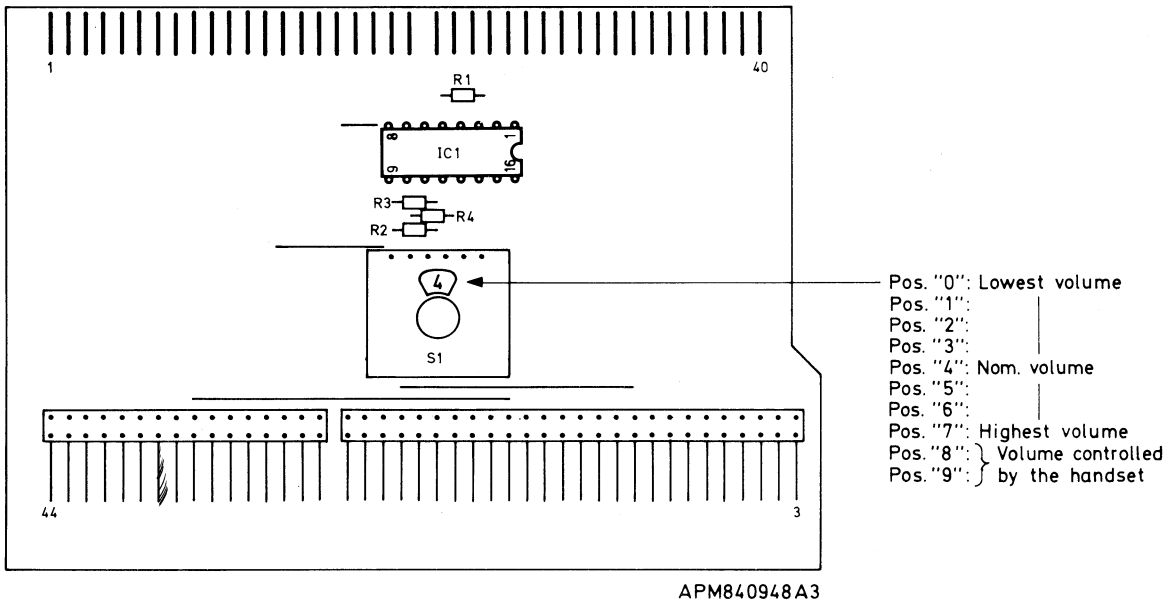
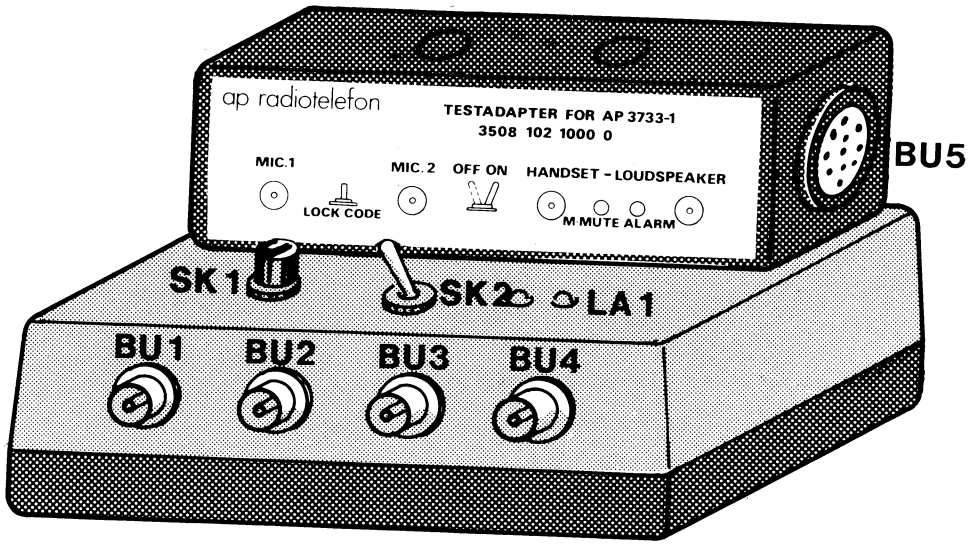


Fig. 11-2 Interface board for ap3733-2



APM831216

Fig. 11-3 Test cradle

SK1 "LOCK CODE"
The push button switch is used for programming of the code lock number.
See page 5-3.

SK2 "OFF/ON"
With this switch the radio unit and the handset can be switched on. This switch is useful if the power-on circuit in the handset is defect.

LA1 "ALARM"
Yellow LED which corresponds to the calling indicator on the handset.

BU1 "MIC. 1"
BNC connector for connecting an AF generator to the external microphone input.

BU2 "MIC. 2"
BNC connector for connecting an AF generator to the handset microphone input.

BU3 "HANDSET"
BNC connector which is connected across the handset receiver.

BU4 "LOUDSPEAKER"
BNC connector for connecting an external loudspeaker.

BU5 Handset connector.

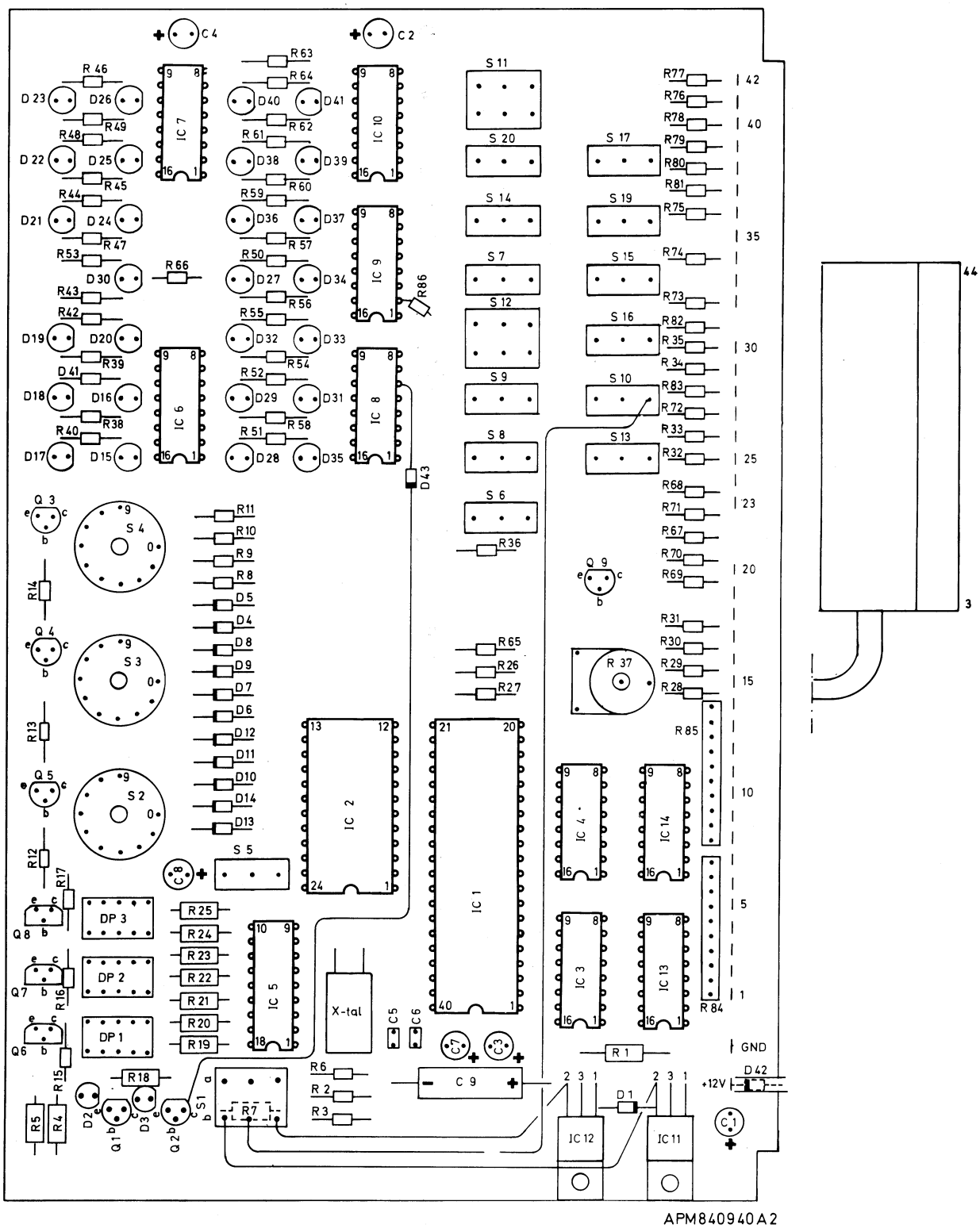


Fig. 11-4 Component location, test box

Cable connector

Data from HS/CU

TX DATA TRANS

RADIO OFF

TIME OUT DISABLE

BLOCK

SPEECH PATH OPEN

LSPK BLOCK

MIC BLOCK

MAL FCT OFF

ALARM

RINGING

SUPER VISORY OFF

MIC 2

MIC 1

MEDIUM HIGH LOW

VOL CPU MAN

"VOLUME"

HAND-SET

MANUAL CONTROL

MODEM

D15	Red	TX CLK	HAND-SET
D16	Green	TX DATA	HAND-SET
D17	Red	RX CLK	HAND-SET
D18	Red	RX DATA	HAND-SET
D19	Yellow	SQUELCH	HAND-SET
D20	Yellow	FIELD STRENGTH	HAND-SET
D21	Yellow	RX FFSK PRESENT	MODEM
D22	Green	RX DATA	MODEM
D23	Red	RX CLOCK	MODEM
D24	Yellow	TX RESET	MODEM
D25	Green	TX DATA	MODEM
D26	Red	TX CLK	MODEM
D27	Red	TIME-OUT	
D28	Red	PTT	
D29	Red	RESET	
D30	Red	RX MODEM RESET	
D31	Red	MIC BLOCK	
D32	Red	VOL MAN	
D33	Red	SPEECH PATH	
D34	Red	LSPK BLOCK	
D35	Red	TX ON	
D36	Red	ALARM	
D37	Red	RINGING	
D38	Red	SUP ON	
D39	Red	MIC 1	
D40	Red	LOW POWER	
D41	Red	MEDIUM POWER	

IC 1 - 8749

IC 2 - 8243

IC3,4,6-10,13,14 - 40097 BP

IC 5 2981

IC11,12 - 7805CT

DP1-3 - HDSP 7303

Cable connector

term. 7,5,4,2,3

term. 8

APM 840938A0

Fig. 11-5 Circuit diagram, test box

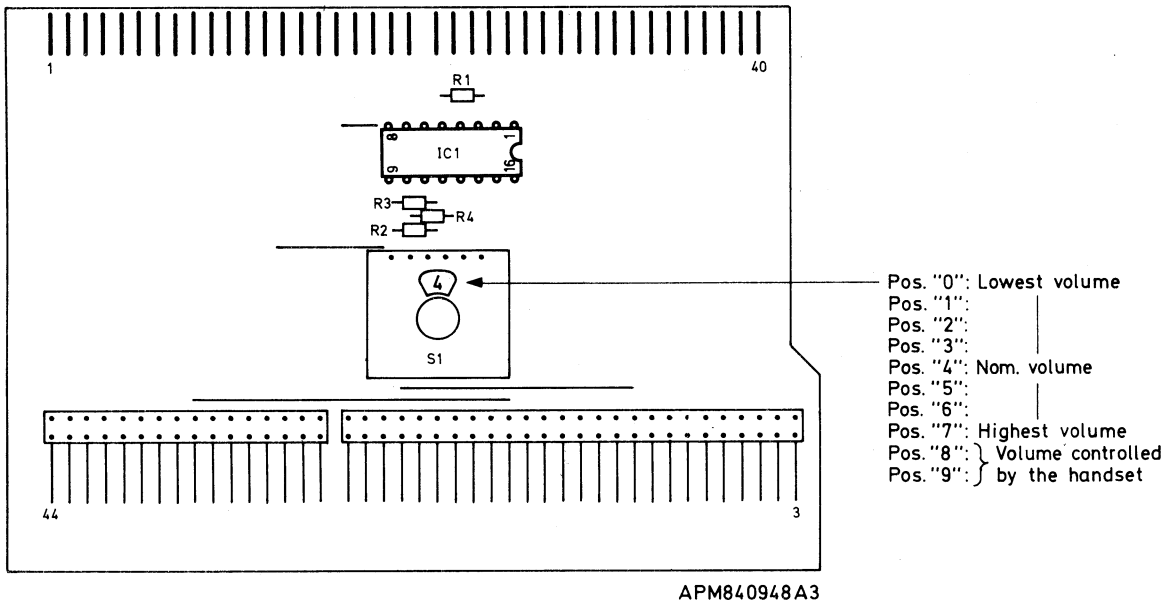


Fig. 11-6 Component location, interface board

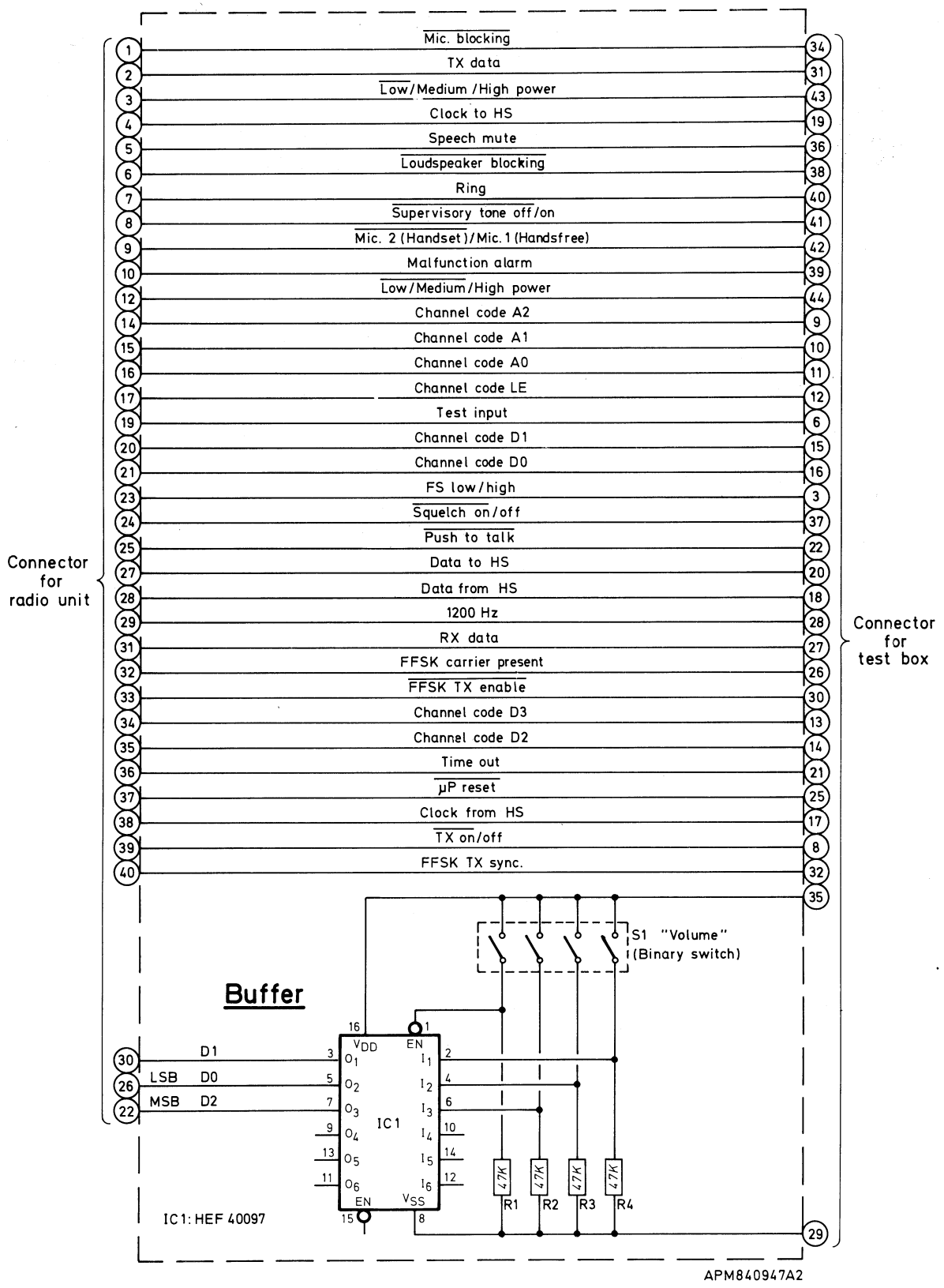


Fig. 11-7 Circuit diagram, interface board

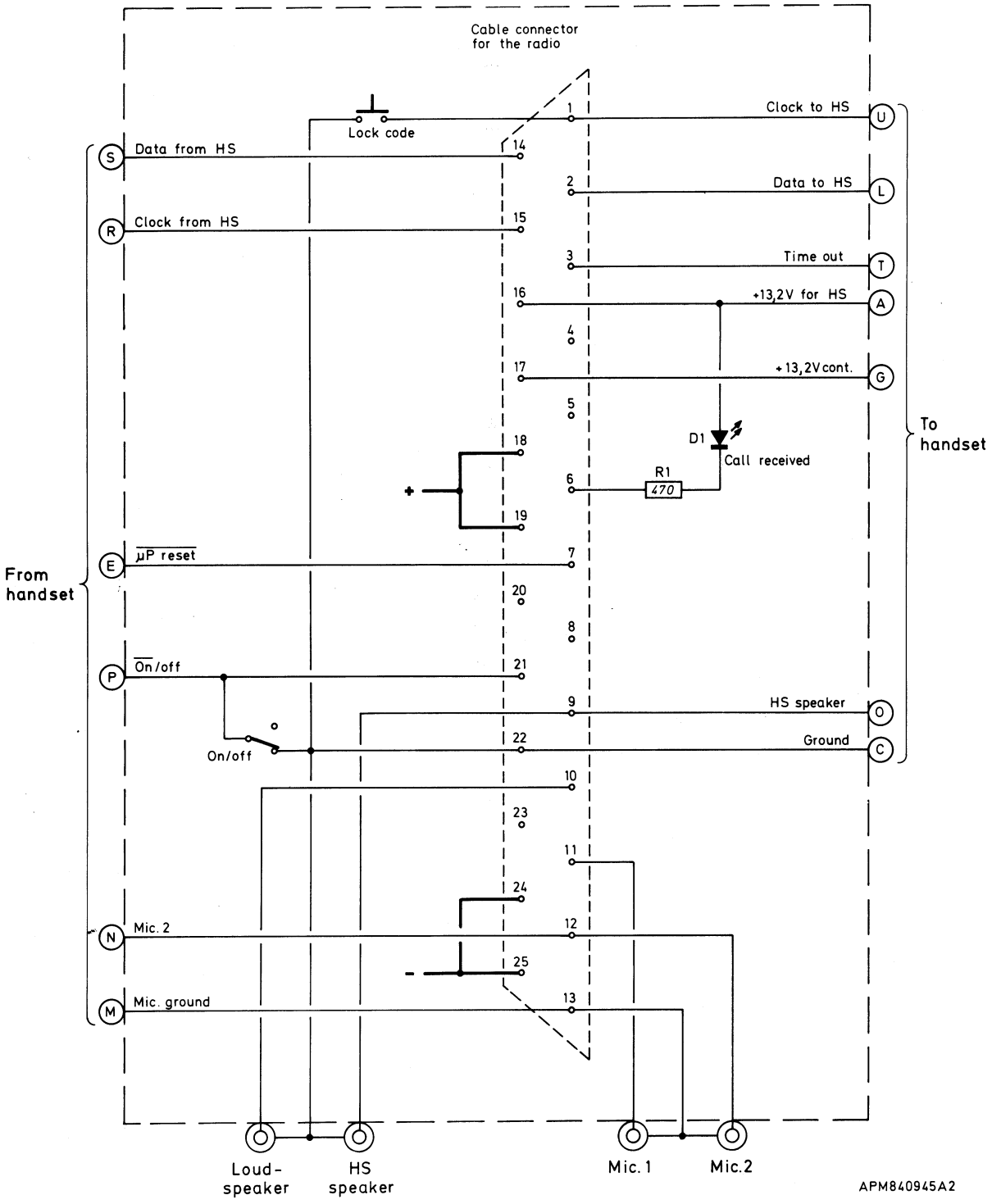


Fig. 11-8 Circuit diagram, test cradle

11. Test box and test cradle

A. Introduction

The test box is used in conjunction with a test cradle during checking and adjusting (see chapter 10). The box is provided with a cable which is plugged into a test connector on the U8. With the switches, many functions can now be manually controlled.

B. Survey of controls

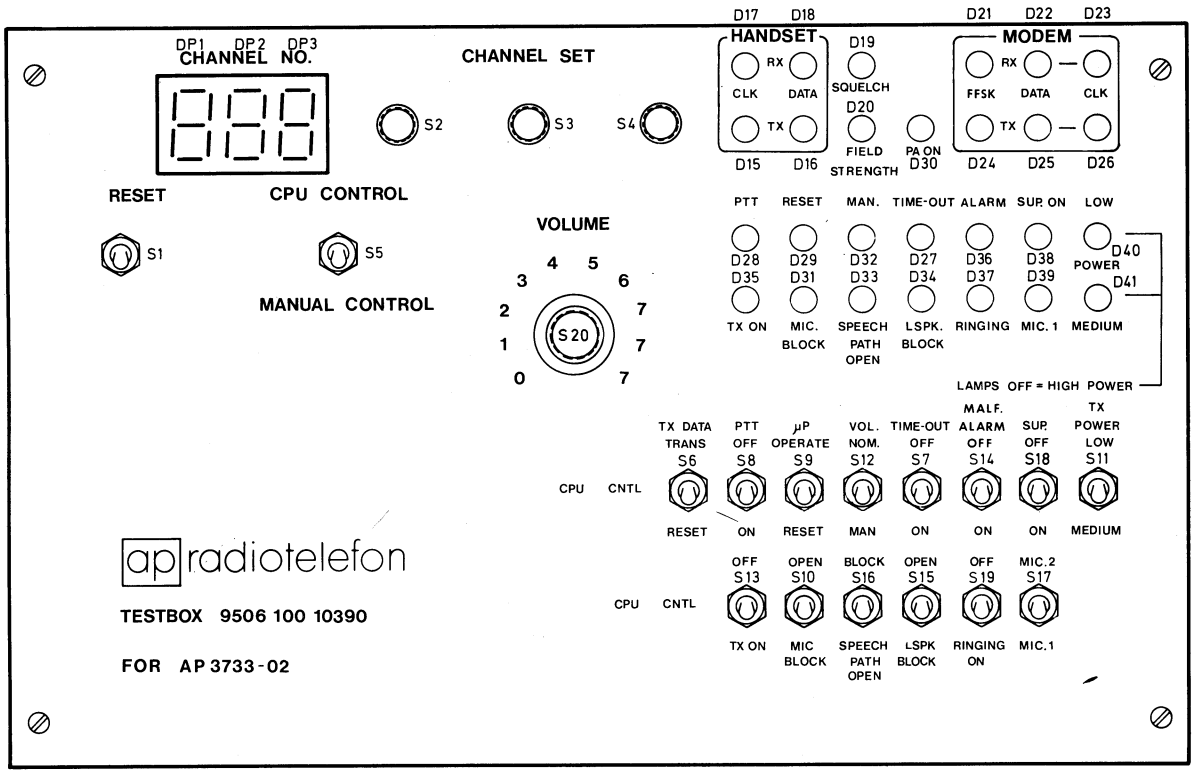


Fig. 11-1 Test box

DP1,2,3 "CHANNEL NO."
LED display which indicates the channel number chosen with S2-3 in the manual mode or the channel set by the CPU.
An irrelevant channel code is indicated with "E" (error) on the display.

D17-D41 LED's indicating status on the CPU terminals:

	SIGNAL NAME ON DIAGRAMS
D17	Clock to HS
D18	Data to HS
D19	$\overline{\text{Squelch on/off}}$
D20	$\overline{\text{FS low/high}}$
D21	RX data present
D22	RX data
D23	RX clock
D24	TX data present
D25	TX data
D26	TX clock
D27	Time out
D28	$\overline{\text{Push to talk}}$
D29	$\overline{\text{uP reset}}$
D30	TX power present
D31	$\overline{\text{Mic. blocking}}$
D32	(When on, the LED indicates that the volume is controlled by S20 "VOLUME" i.e. the switch S12 in pos. "MAN" (or "NOM").
D33	Speech path
D34	$\overline{\text{Loudspeaker blocking}}$
D35	$\overline{\text{TX on/off}}$
D36	Malfunction alarm
D37	Ring
D38	$\overline{\text{Supervisory tone off/on}}$
D39	$\overline{\text{Mic. 2 (Handset)}}$/Mic. 1 (Handsfree)
D40	$\overline{\text{Low/Medium}}$/High power
D41	$\overline{\text{Low}}$/Medium/High power

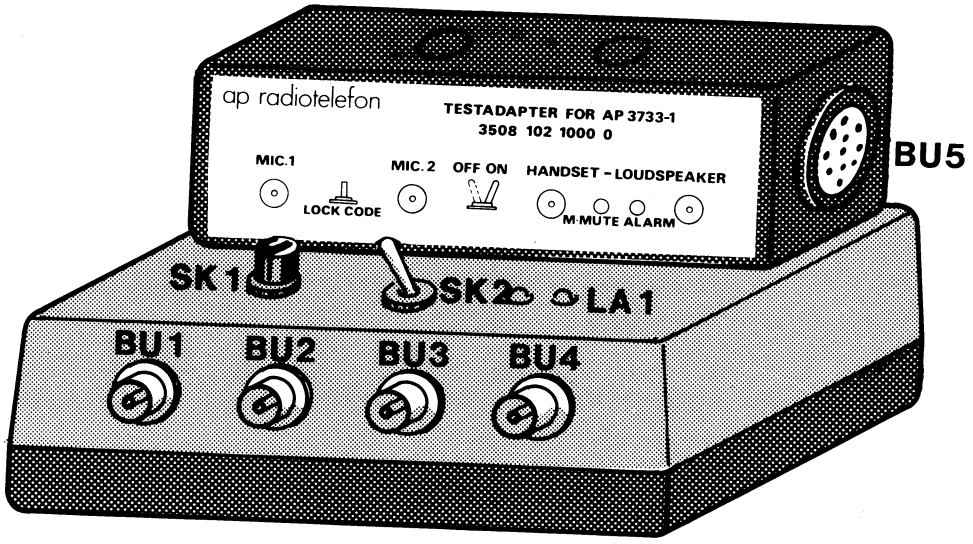
S1 Switch is resetting the test box.

S2-S4 "CHANNEL SET"
Switches for controlling the channel selection manually (if the switch S5 is in position "MANUAL").

NOTE: By means of the switch S2 (hundreds), it is possible to select the frequently used channels 1,91,180 and 2,90 and 179.
With this facility the turning of knobs is minimized as S3 and S4 are disabled in this case. When this facility is used, the channel number is displayed with a dot after each digit.

S5 "MANUAL"
When the switch is set in the upper position the CPU controls the radio.
When in the "MANUAL" position, the control is taken over by the control box switches and volume control.

S6-S19 The switches have three positions. In mid-position the corresponding CPU control line is controlled by the CPU.
In the other two positions the switches override the CPU according to the front labelling.
NOTES: When the switch S11 is in mid-position, the PA is set to high power.



APM831216

Fig. 11-3 Test cradle

SK1 "LOCK CODE"
The push button switch is used for programming of the code lock number.
See page 5-3.

SK2 "OFF/ON"
With this switch the radio unit and the handset can be switched on. This switch is useful if the power-on circuit in the handset is defect.

LA1 "ALARM"
Yellow LED which corresponds to the calling indicator on the handset.

BU1 "MIC. 1"
BNC connector for connecting an AF generator to the external microphone input.

BU2 "MIC. 2"
BNC connector for connecting an AF generator to the handset microphone input.

BU3 "HANDSET"
BNC connector which is connected across the handset receiver.

BU4 "LOUDSPEAKER"
BNC connector for connecting an external loudspeaker.

BU5 Handset connector.

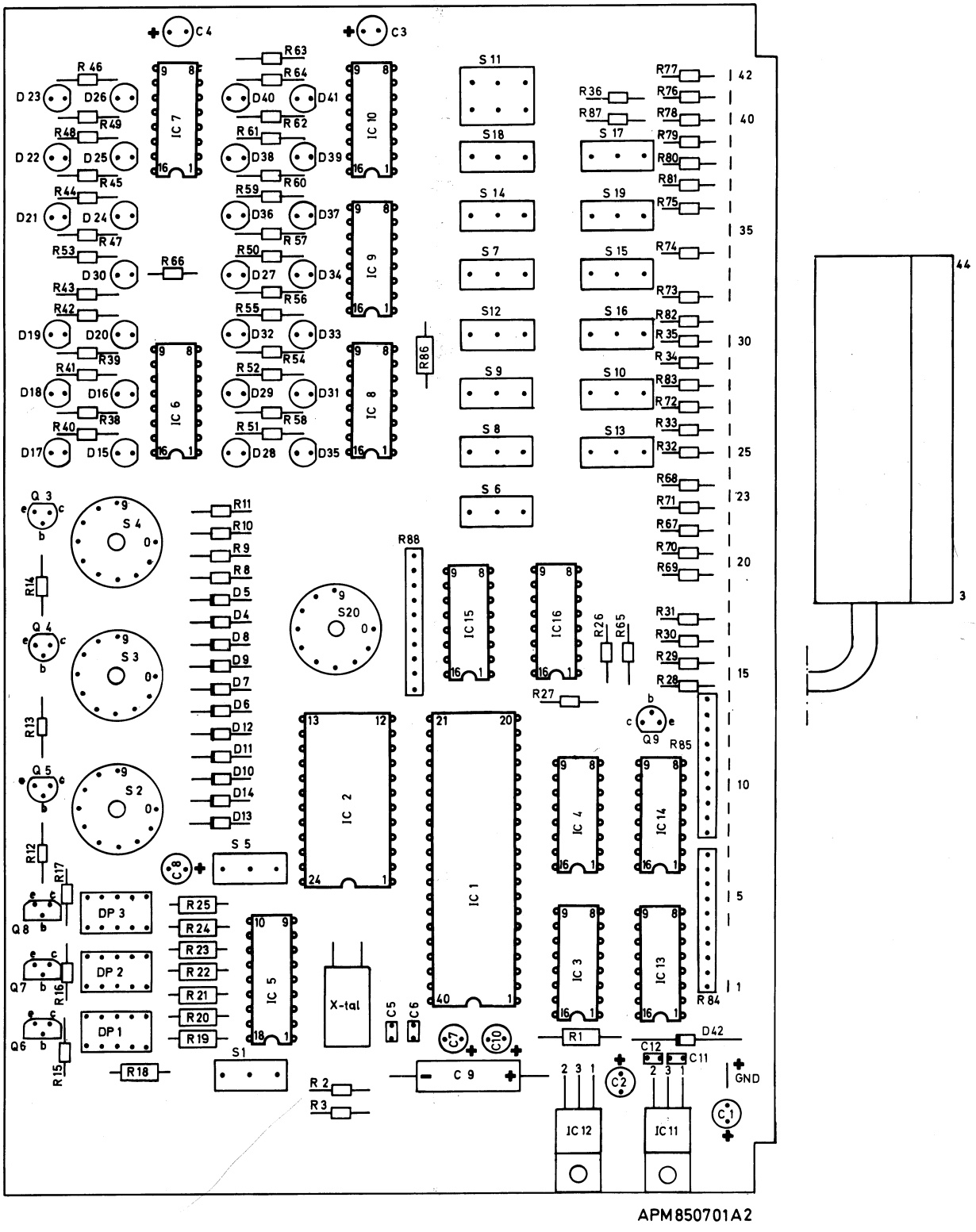


Fig. 11-4 Component location, test box

Cable connector

Data from HS/CU

S6 RESET
TX DATA TRANS

S9 µP OPERATE / RESET
S7 TIME OUT OFF / ON
S16 BLOCK / SPEECH PATH OPEN
S8 PTT OFF / ON
S15 OPEN / LSPK BLOCK
S10 OPEN / MIC BLOCK
S13 OFF / TX ON
S14 MAL FCT OFF / ALARM
S19 OFF / RINGING ON
S18 ON / SUPER VISORY OFF
S17 MIC 2 / MIC 1
S11 MEDIUM / HIGH / LOW
S20 VOL.
S12 VOL NOM. / MAN.

HAND-SET
MANUAL CONTROL
CPU CONTROL
MODEM

D15 Red TX CLK
D16 Green TX DATA
D17 Red RX CLK
D18 Green RX DATA
D19 Yellow SQUELCH
D20 Yellow FIELD STRENGTH
D21 Yellow RX FFSK PRESENT
D22 Green RX DATA
D23 Red RX CLOCK
D24 Yellow TX FFSK PRESENT
D25 Green TX DATA
D26 Red TX CLK
D27 Red TIME-OUT
D28 Red PTT
D29 Red RESET
D30 Red PA ON
D31 Red MIC BLOCK
D32 Red VOL MAN
D 33 Red SPEECH PATH
D34 Red LSPK BLOCK
D35 Red TX ON
D36 Red ALARM
D37 Red RINGING
D38 Red SUP ON
D39 Red MIC 1
D40 Red LOW POWER
D41 Red MEDIUM POWER

6.048MHz
S5
S1 RESET
S 2 "100"
S 3 "10"
S 4 "1"

term.8
B,C,D,E,F
Cable connector

IC 1 IC 2 IC 3 IC 4 IC 5 IC 6 IC 7 IC 8 IC 9 IC 10 IC 11 IC 12 IC 13 IC 14 IC 15 IC 16
DP 1 DP 2 DP 3

APM850312A0

IC1 : 8748
IC2 : 8243
IC3,4,6-10,13,14,16 : 40097BP
IC15 : 74LS148
IC5 : 2981
IC11: L4785 IC12: LM7805
DP1-3 : HDSP7303

85.08

Fig. 11-5 Circuit diagram, test box

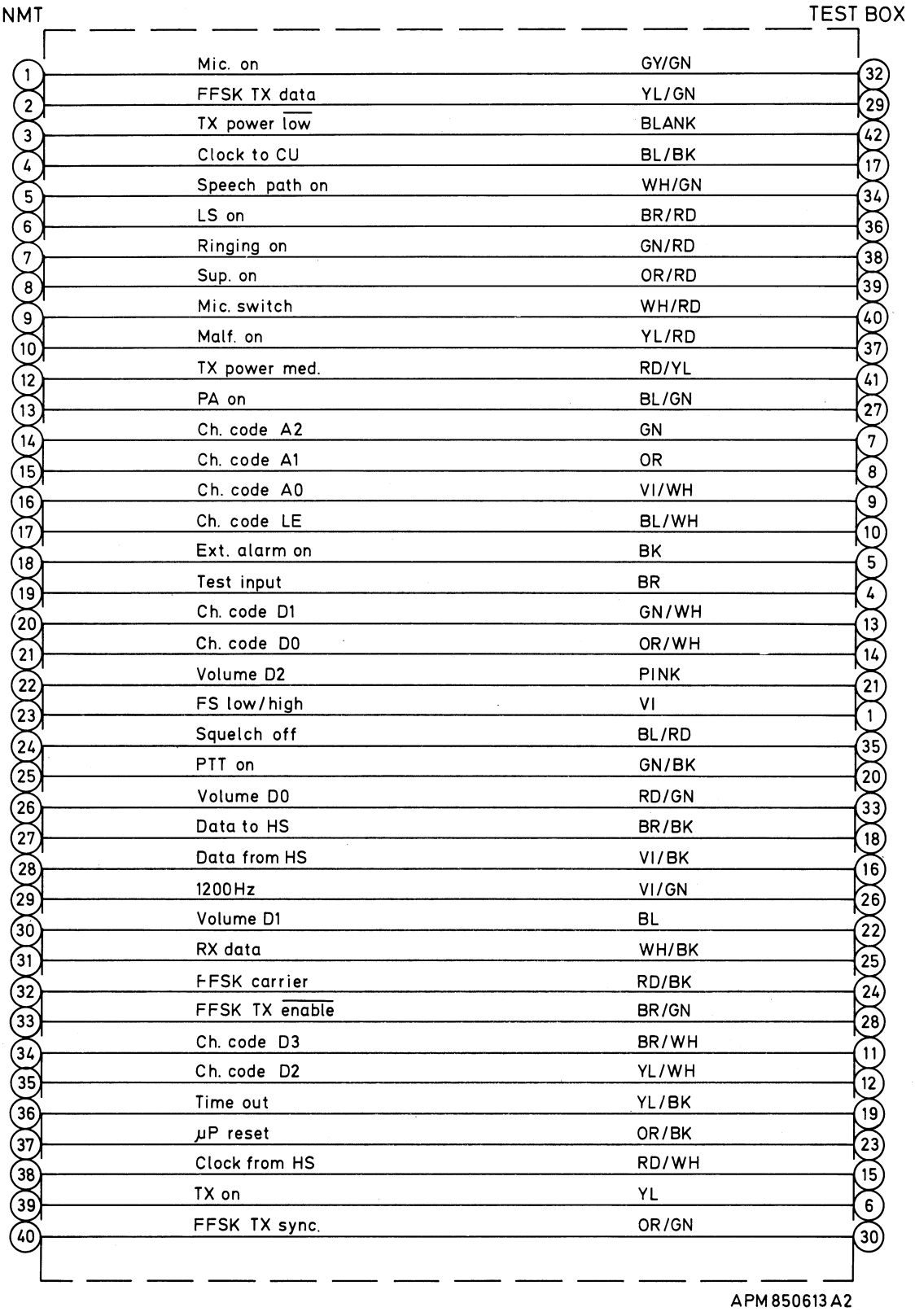


Fig. 11-7 Cable for test box

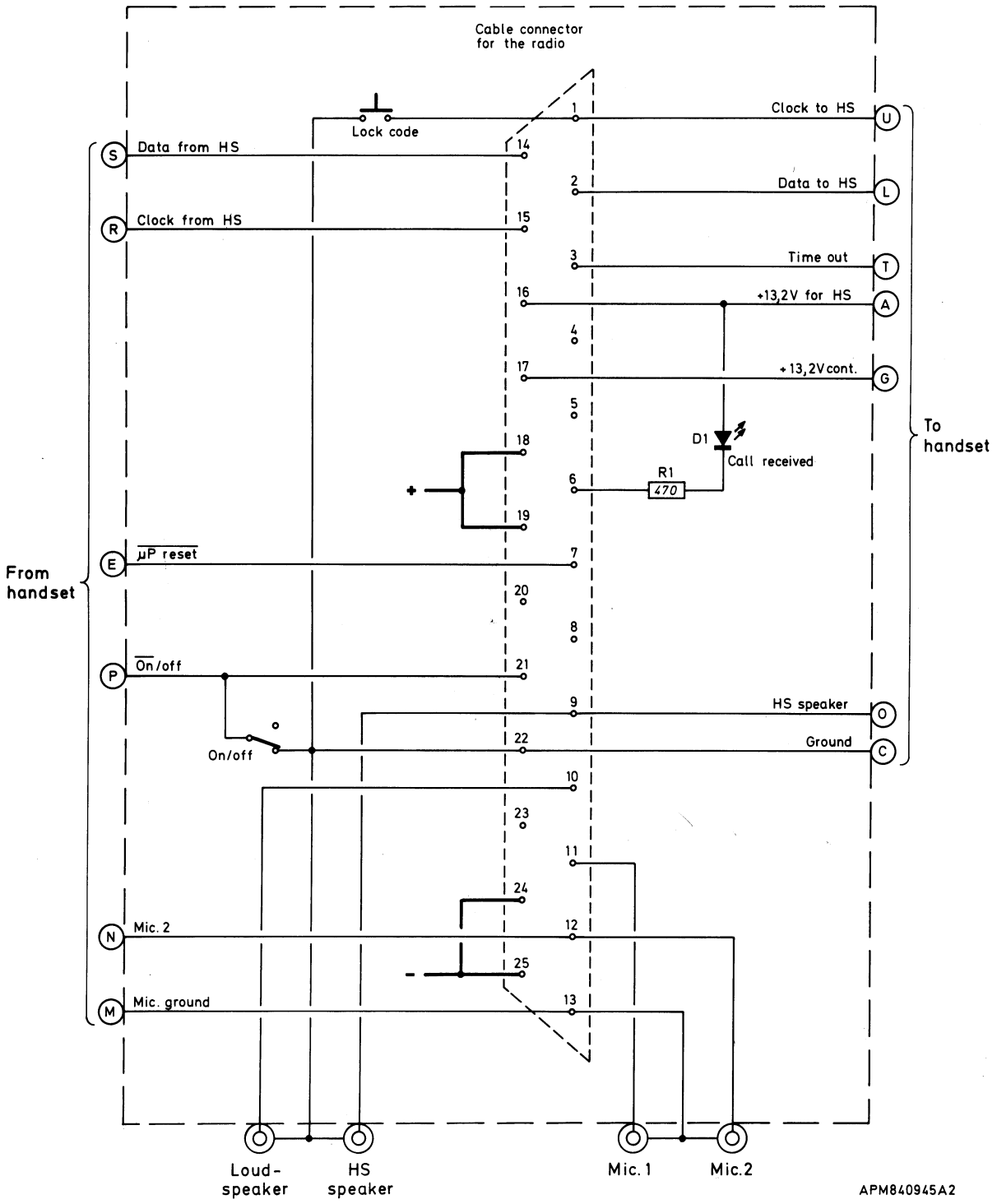


Fig. 11-8 Circuit diagram, test cradle

Carrying case 31

A. Introduction

Fig. 11-9

With the carrying case, a fully portable installation is obtained with the same features as mobile installation.
The carrying case is supplyed either from a NiCd battery, from a main power source or from a DC power source.
For charging of the NiCd battery, various rechargers are available.
Battery and recharger can be plased in a special extra case, designed to snap onto the carrying case.

CAUTION: A recharger should never be placed in the case while charging.

B. Instruction for use

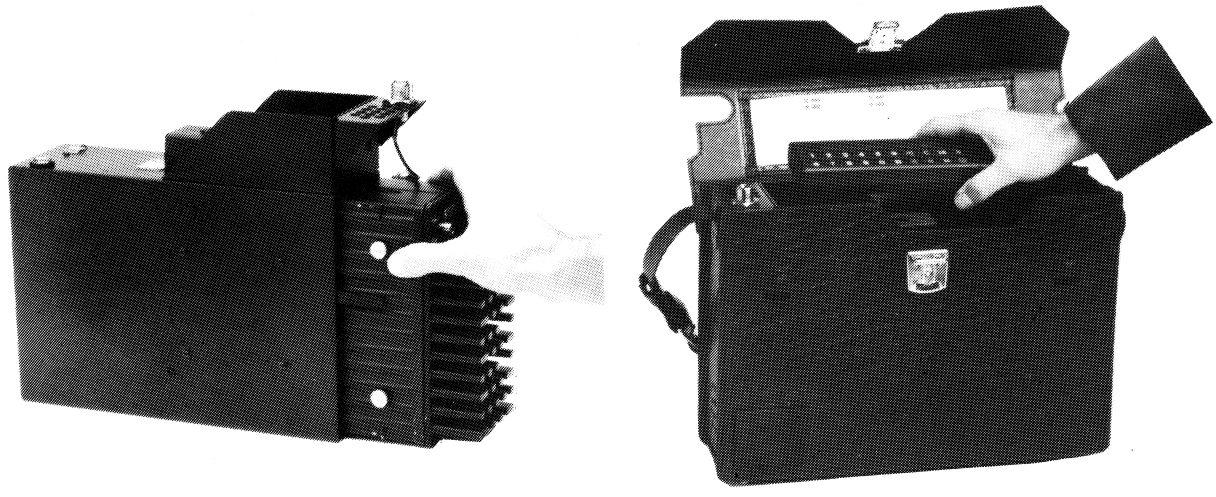


Fig. 11-10

SETTING UP

The carrying case contains a cassette designed to hold the radio, telephone and antenna. Lift the cassette out of the carrying case and insert the radio.

It is important that the radio is inserted so that the multiplug in the radio matches the female socket in the cassette.

Pressing the locl-lever down enables the radio to slide easily into place.

When the cassette, with radio, is placed in the case, the antenna socket must be at the front left-hand corner.

The antenna, or the antenna cable, is then plugged into the socket.

The telephone plug is inserted in the socket in the cassette and secured with the screw-cap.

Fig. 11-11

POWER SUPPLY

ap nordic operates on a 12V power supply.

12V from car or boat. Car or boat must operate on 12V and they must be earthed. In a car, ap nordic can be connected to the cigarette lighter socket. A DC cable connects the socket to the 3 pole socket on the cassette.

24V from car or boat. On 24V operations, a transformer must be used between the current outlet on a truck, for example, and the current intake on ap nordic.
220V mains voltage. Stationary use of ap nordic in houses with ordinary mains voltage is possible if a transformer is used. Its 12V outlet is connected to the cassette's 3 pole intake socket. The transformer is then plugged into the house mains and power is turned on.
Battery operation. A rechargeable Ni-Cd battery is used.

Fig. 11-12

THE BATTERY

A new battery is not always charged upon delivery, so it must be charged before use. Charging time for a full charge is approx. 14 hours. With ap chargers, the battery can take charging for unlimited periods. So, even if a battery is forgotten it will not be damaged.
Avoid charging at temperatures below 0°C, as this can reduce battery life.
Battery voltage is 12V and the capacity is 7 amphours.
The battery comes with cable and plug for connecting directly to the cassette's 3 pole current intake socket.
Calling time. A fully charged battery transmitting 5% of the time has enough capacity for 8 hours of radio operation.
Recharging. When the battery needs recharging (when voltage drops to a predetermined minimum), the radio turns off automatically.
A battery with low voltage can, however, keep the radio on as long as there is no transmission. Disconnection will occur when a call is received or sent.
External power should be connected whenever possible to help extend the life of the battery charge.

Important. The battery should always be used until the radio turns off automatically. Then it should be given a maximum charge.This is because this type of battery retains its capacity best when charges and discharges are utilised fully.
If the battery yields too little power for no apparent reason, repeated charging and discharging can restore full capacity.

N.B. A recharger should never be placed in the case while charging.

CARRYING CASE MAINTENANCE
The carrying case is made of genuine leather. It can be washed with water and mild soap.

Fig. 11-13

ACCESSORIES
220V home recharger and stationary power source. Transformer No. 318-012 has socket for 220V AC and cable and plug for 12V opration, plus a cable for simultaneous battery charging. Light diodes indicate whether power is connected.
If 12V current is connected to both radio and battery at the same time, a conversation should not last more than 1/2 hour.
Charging time for a depleted battery is approx. 14 hours.

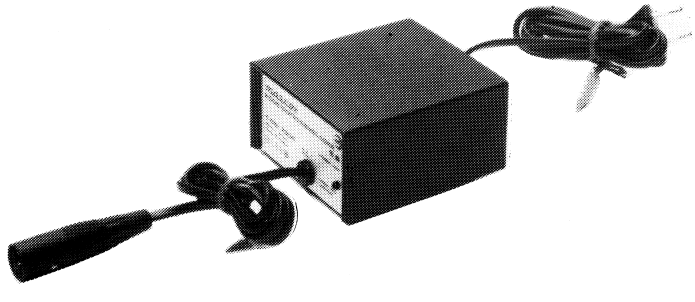


Fig. 11-14

220V home recharger. Recharger No. 318-010 has socket for 220V mains and cable with plug for recharging the battery. It cannot provide power for the transceiver. The recharger can be taken in the carrying case which has special compartment for it.
Charging time for a depleted battery is approx. 14 hours.

Fig. 11-15

12/12V recharger for car and boat. Transformer/recharger No. 318-011 can be connected to cigarette lighter socket or wiring in a car or boat.
With permanent connection, an on/off switch should also be installed in order to cut off the recharger's low power consumption (when not in use). This reduces unnecessary battery strain. Charging time for a depleted battery is approx. 14 hours.

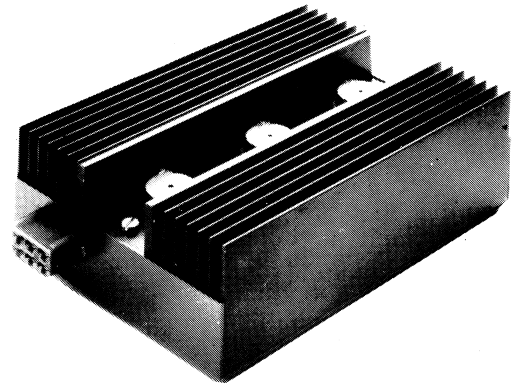


Fig. 11-16

24/12V converter No. 203-003. On 24V oprations, a transformer must be used between the current outlet on a truck, f.ex. and the current intake on ap nordic.

Fig. 11-17

Cigarette lighter cable. Cable No. 311-014 is used to connect ap nordic to the car's cigarette lighter socket.

ANTENNAS

Magnet-base antenna for the car. When ap nordic operates in a car, an antenna which sticks magnetically to the car roof should be used. The cable is put through the ventilator window or the side window.

Do not put the cable between the door and the pillar. This will damage the cable through pressure and stretching.

An adaptor for BNC-plug must be used between the antenna cable and the carrying case.

The adaptor have stock No. 291-11600000.

Antenna for boat or house. The antenna should be placed as high and as free of obstruction as possible. To choose the best antenna for your needs, contact the ap dealer.

Antenna for the carrying case. The antenna is into the socket at the front lefthand corner of the cassette and fastened with the screw-cap.

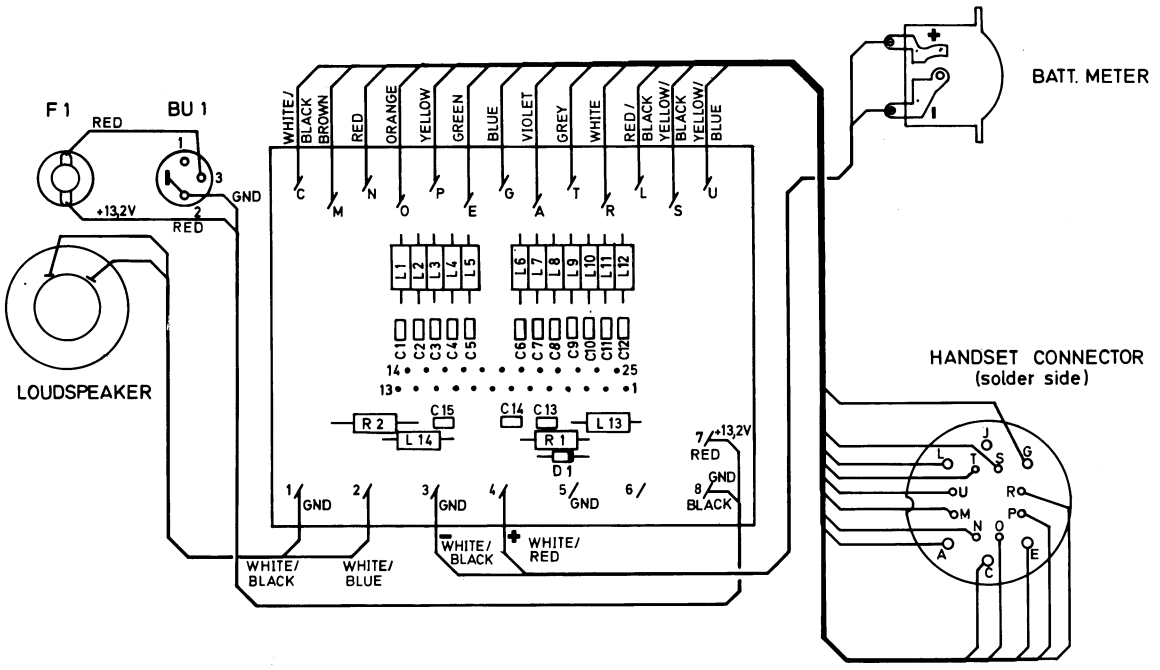


Fig. 11-18 Component lay out, portaphone

APM841008A3

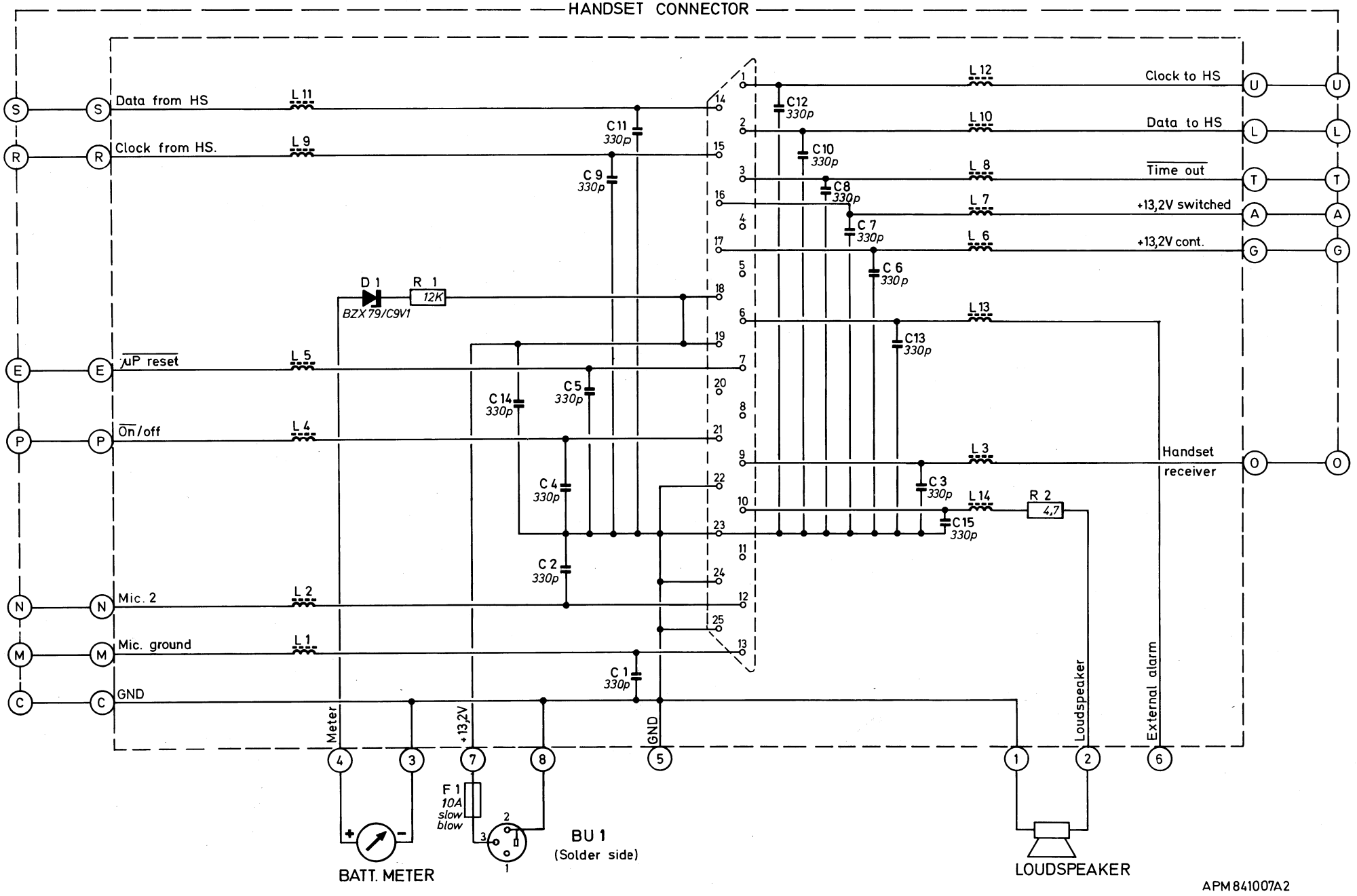


Fig. 11-19 Circuit diagram, portaphone

Mechanical parts

ITEM	DESCRIPTION	QUANTITY	ORDERING NUMBER
1.	Antenna socket complete	1	3508 100 55080
2.	Connector socket 14 pole	1	3508 100 55020
3.	Battery indicator	1	8208 130 07000
4.	Fuseholder	1	3508 101 50470
5.	Fuse, 10A	1	2422 086 01161
6.	Supply socket 3 pole	1	3508 101 01470
7.	D-connector 25 pole	1	2422 606 72501
8.	Loudspeaker 4 ohm	1	3508 100 80010
9.	Interconnectionprint N73	1	3508 102 20190
10.	Screw M3x6mm black	10	8208 130 00150
11.	Washer 3mm	10	3508 100 00850

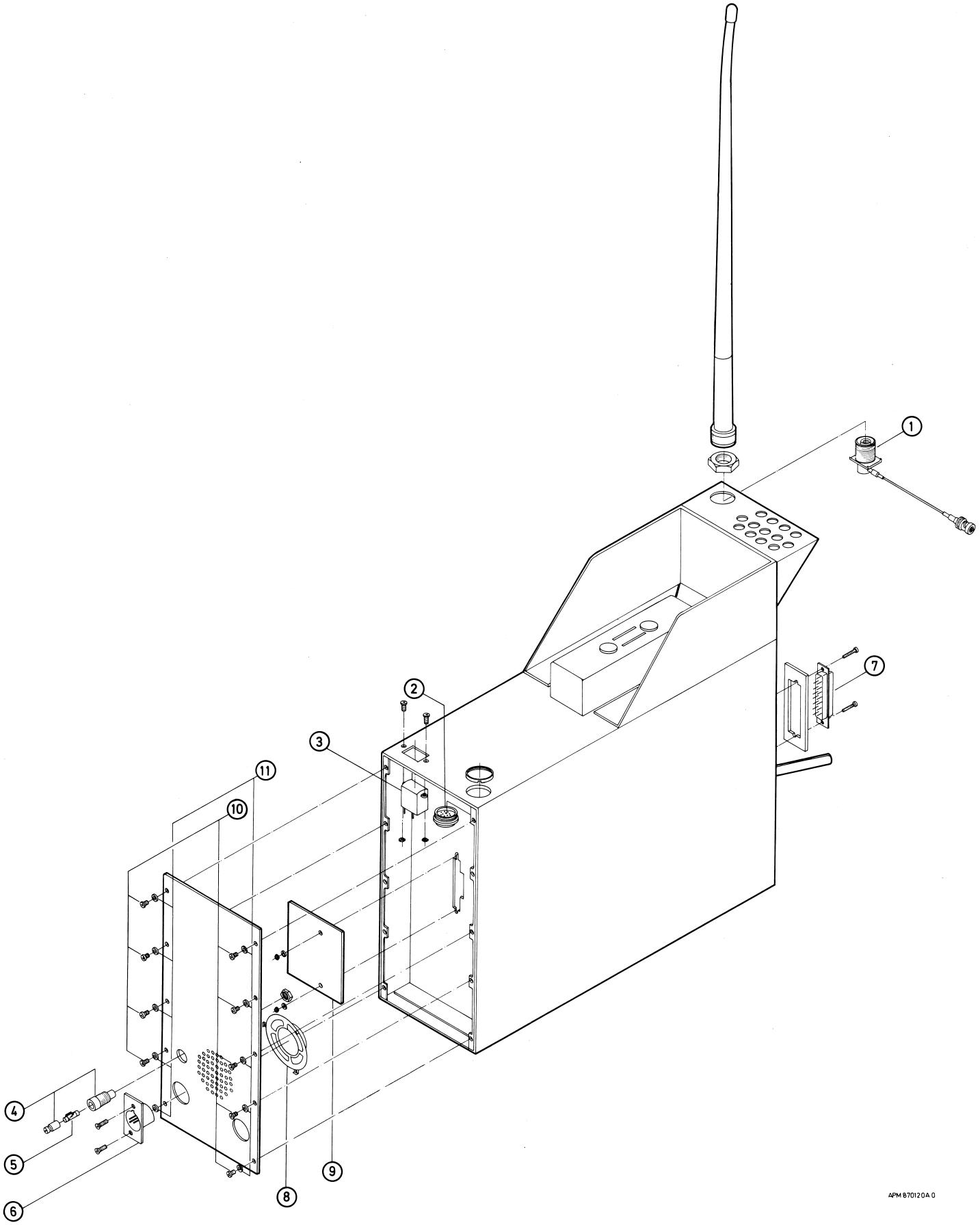


Fig. 11-20 Exploded view, carrying case

PHILIPS

SUPPLEMENT

PRCS-Service

Philips Radio Communication Systems (Copenhagen)

CONCERNING **ap3733-02** **87.05**

This is a supplement to the service manuals for the mobile telephone ap3733-02. (Manual ordering number 296-308 and opdated manual 296-319).

The supplement deals with the ap3706 which is an optional Telephone Answering Unit.

Please place the enclosed chapter in the section "Accessories" in the service manuals.

9506 100 80040 Printed in Denmark

ap3706 Digital telephone answering unit

CONTENTS **PAGE**

General information

INTRODUCTION

This telephone answering unit is for use in connection with the ap3733/02 mobile telephones. The ap3706 consists of a Display which is to be mounted on the dash board and a Control unit which is to be mounted near the radio unit.
The ap3706 is used for displaying incoming telephone numbers, recording and replaying speech. The ap3706 digital telephone answering unit differs from conventional answering machines by using digital memory instead of magnetic tape which requires many mechanical parts.
The use of digital circuitry only gives a very high reliability since there are no moving parts; besides, it is sealed against moisture and works within large temperature ranges.
Another major difference is that this telephone answering unit will store the telephone number given by the caller. The requirement is that the caller uses a Dual Tone Multi Frequency telephone (i.e. a pushbutton telephone). The ap3706 stores 8 numbers of 16 characters each.
The ap3706 will take over and "play" the recorded message if the subscriber does not react on the first two ringings. The maximum recording time for messages is 16 seconds.

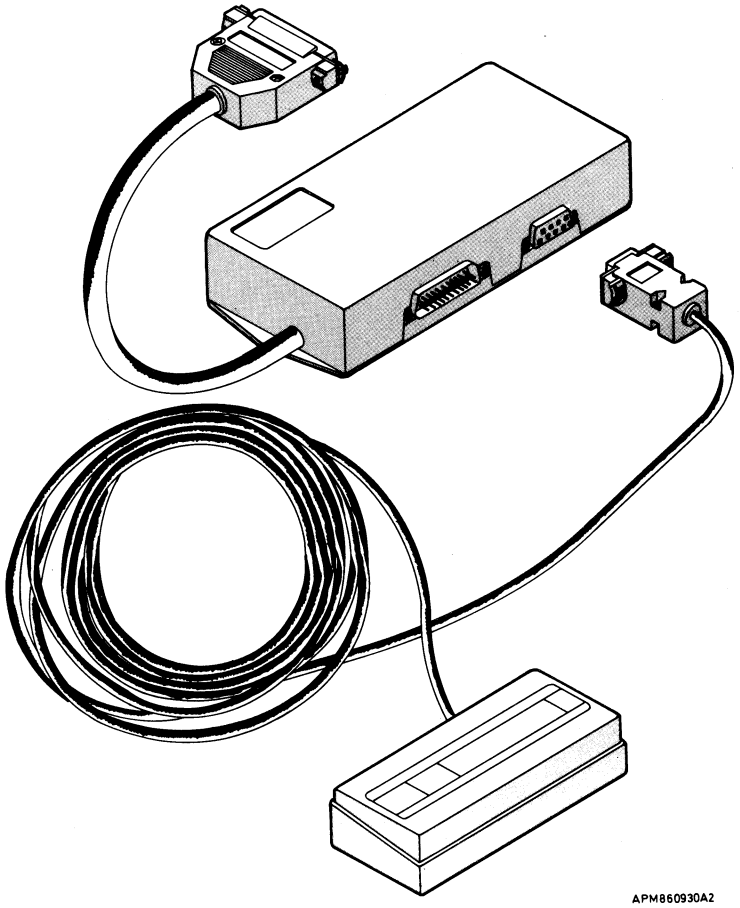


Fig. 1 ap3706

TECHNICAL DATA

Current consumption	: Stand-by (ap3733 off)*	35mA
	Active (ap3733 on)	100mA
	Background illumination	150mA
Voltage	: 10.8V to 15.0V	
Line level from ap3706 nom.	: 100mV RMS	
Line level from ap3706 max.	: 250mV RMS	
Line level to handset max.	: 600mV RMS	
DTMF decoder max. input level	: 880mV RMS	
**DTMF input dynamic range	: 30dB min.	
Dynamic range for recorded speech	: 40dB min.	
Harmonic distortion : 300Hz	: 2% max.	
: 1kHz	: 2% max.	
: 3.2kHz	: 6% max.	
Frequency range for speech	: 100-3200Hz	
Temperature range : Display unit	: -10 to +55°C	
: Control unit	: -25 to +55°C	
Limit range for storage and transport	: -55 to +75°C	

* The ap3706 has a built-in time-out circuit which automatically switches off the ap3706 after 8 days. This results in loss of recorded speech.

** For further information as to DTMF technical data please refer to Plessey MV8870EXP or Mitel MT8870 specifications.

DESCRIPTION OF THE BLOCK DIAGRAM

The following block diagram shows the set-up for the ap3706 connected to the ap3733 mobile telephone.
The CPU controls the complete answering unit: The DRAM refresh, read, write, the A/D convertion, the data communication with the transceiver, receiving and storing of telephone numbers.

The communication can be separated into four different signals:

1. Analog signals to and from transceiver/handset.
2. Digital signals to and from transceiver/handset consisting of synchronous data communication from handset to transceiver, and detection of activity on the synchronous data clock from the transceiver to the handset. It also detects the signal to the call relay for a call to the mobile telephone.
3. Serial synchronous data communication at 2K BAUD to and from the ap3706 display and control unit.
4. Voltage supply from the mobile telephone.

The analog part is built up around a 7th order elliptic filter. This is used during recording and replaying. It serves two different purposes, one during recording as an anti-aliasing filter and another during replaying as protection for the 4kHz supervisory tone.

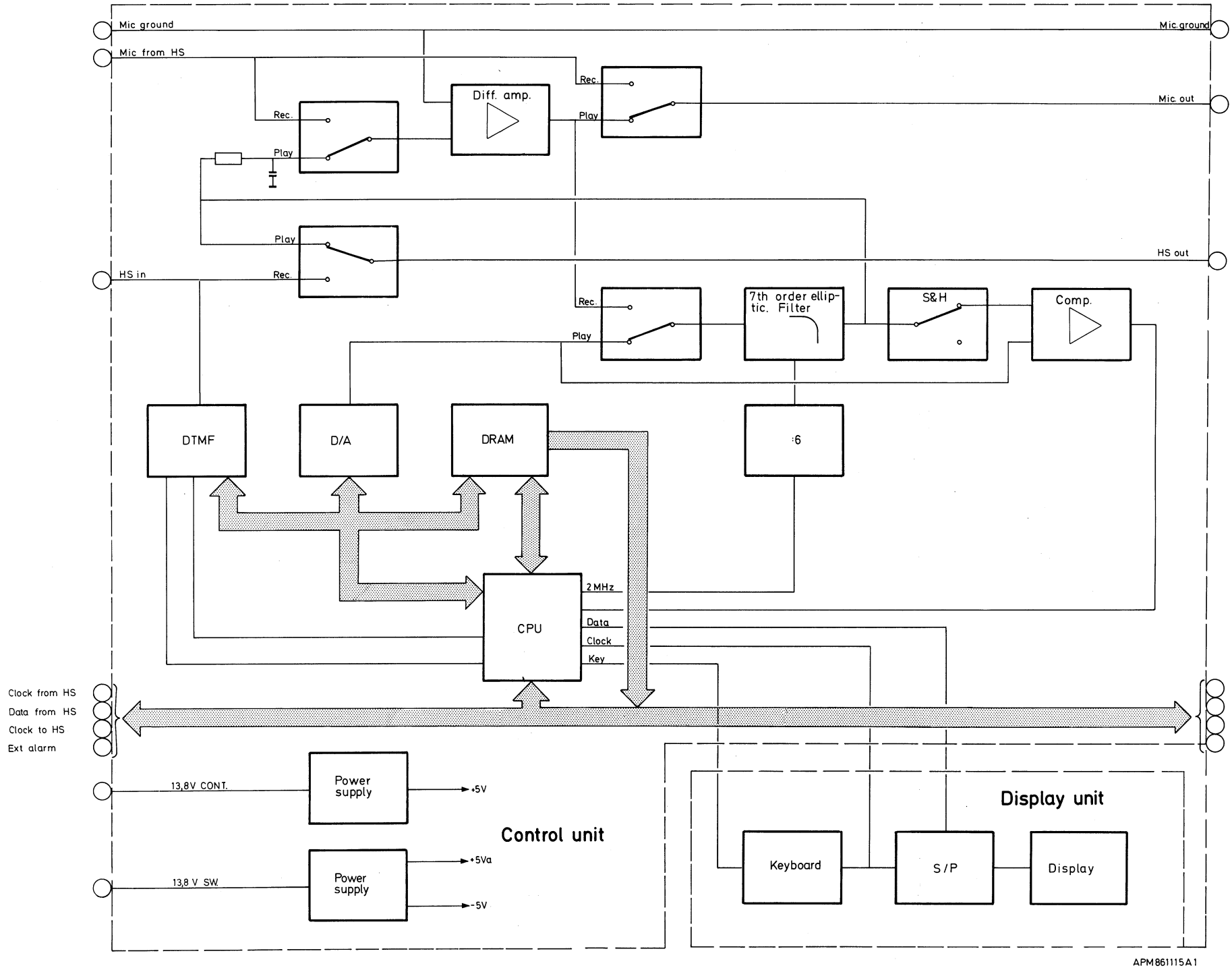


Fig. 2 Block diagram, digianswer

Installations

1. Remove the multicable plug from the ap3733 Mounting bracket. Exchange the cover from the ap3733 25 pole D-connector with the cover from the ap3706 25 pole D-connector. This is necessary in order to mount the D-connector from the ap3706 on the mounting bracket for the ap3733 and to mount the 25 pole connector on the ap3706 control unit.
   After this exchange connect the multicable from the cradle/handset to the 25 pole connector on the ap3706 Control unit.

2. Mount the 25 pole plug from the ap3706 Control unit on the ap3733 Mounting bracket.

3. Connect the 9 pole plug from the ap3706 Display unit to the 9 pole socket on the Control unit.

This is the set-up for the installation.

4. Disconnect the plugs attached to the ap3706 Control unit and find a convenient location where this unit can be mounted. Make sure that all cables can still be fitted into the corresponding connectors.

5. Find a convenient location for the ap3706 Display unit, e.g. on the dashboard, but avoid locations where it is exposed to direct sunlight.

6. Route the cable to the Control unit.

7. Connect the cables and make a final inspection and test.

Operating instructions

Replay speech.
Scrolling through incoming telephone numbers.

Recording speech.
Erasing telephone numbers.

The ap3706 will display "DIGIANSWER OFF" when out of action.
To activate the answering device press one of the two push-buttons, the display then shows one of two messages: "NO SPEAK STORED" or "SYSTEM READY".

"NO SPEAK STORED" indicates that there are no messages stored in the memory and the ap3706 will not answer calls.

"SYSTEM READY" indicates that the memory contains a message and the ap3706 will answer incoming calls.

The answering device can be deactivated by pressing both push-buttons at the same time. When doing so the display will respond with "DIGIANSWER OFF".

RECORDING A MESSAGE

When you want to record a message and the display shows "NO SPEAK STORED" or "SYSTEM READY" use the following procedure:

1. Take the mobile telephone handset.
2. Press and when the display respond with "RECORDING" you leave the message by speaking into the handset microphone for maximum 16 seconds.
3. If the message is shorter than 16 seconds the recording can be terminated by pressing  . If the button is not pressed the recording will automatically be terminated after 16 seconds. If you try to record for less than 1 second the display will respond with "NO SPEAK STORED".
4. When the recording is stopped "PLAYING" will be shown on the display and the recorded message can be heard on the handset loudspeaker.

REPLAYING A RECORDED MESSAGE

When "SYSTEM READY" is shown on the display, you can check the recorded message by pressing  . The display will respond with "PLAYING" and the message can be heard on the handset loudspeaker. The replay can be terminated by pressing once again.

CALL TO A MOBILE TELEPHONE

1. When a subscriber calls a mobile telephone with an ap3706, the answering unit will respond if the call is not handled in the normal way after the first two ringings.
   The ap3706 will not respond if:
   a. It has already stored 8 numbers.
   b. The display shows "NO SPEAK STORED".
   c. The display shows "DIGIANSWER OFF".
   If the ap3706 is in any of these conditions a call can only be recognized by looking at the flashing yellow light on the handset as in normal ap3733 operation.

2. When the ap3706 is answering a call, the display shows "ON LINE".
   After this the message in the memory will be replayed and the end of the message is recognized as a short beep.

3. The subscriber calling the mobile telephone can now enter a telephone number so that you can call back when you check the incoming calls.
   The subscriber calling the mobile telephone leaves the number or any code message that can be keyed in on a DTMF (Push button telephone).
   The system works like the public paging system. The * allows the calling party to restart the message and # breaks down the line.

CHECKING INCOMING CALLS

When the ap3706 receives one or more calls the last incoming code or number will be shown on the display.
Pressing allows you to scroll through the stored numbers, and pressing will erase the number shown on the display from the memory.
When all incoming numbers have been erased, the display will show "SYSTEM READY" and the two push-buttons are available for the setting-up of a new recording and replay.
The ap3706 has a priority system for filing incoming numbers, so that the first number received and stored will have number 1, the second number number 2, etc. up to number 8.
When scrolling through the numbers the priority number will be shown on the display for one second before the number.

There is a background illumination for the display and it will illuminate for approximately 2 minutes after the last activation of the ap3706.

Detailed description of the ap3706

The ap3706 can be divided into 10 modules:

1. IC14 is a maskprogrammed u-processor type 80C51. It is provided with a 12MHz clockpulse which gives a total instruction cycle of 1 u-second.

2. IC15-18 is a dynamic RAM speech memory with a total of 256 x 4 bits.
   This memory is refreshed by the u-processor. The complete refresh cycle is 4ms and happens with 8 RAS per 125 usecond. During recording and replay the RAS, A8 and WE are used. The A8 has a double function because it is also used as sample/hold control for the A/D conversion. The inputs/outputs on the RAM are sharing the same u-processor ports as the D/A converter and the interface.

3. IC13 and IC10 are D/A and A/D converters. The D/A conversion are made by IC13 via port 2 on IC14. The A/D conversion is made by software using successive approximation at IC13 via the comparator IC10. In connection with A/D conversion C24 is used as sample-and-hold capacitor and IC17 pin 12,14 as sample switch.

4. IC5 and IC12 form a digitalized 7th order elliptic filter. This filter has a very steep characteristic (approximately 90dB per octave) and it is used as an anti-aliasing filter during recording and as an protection for the 4kHz supervisory tone during replay. The cutting frequency is determined by the signal on pin 3. This signal is 100 times the cutting frequency which is 333kHz and origins from IC12 which divides the 2MHz ALE signal by 6. IC5 will by use of this signal cut the signal by -3dB at 3.3kHz.
   The post-filtering is made by R12, 13 and C23.

5. IC9 is the DTMF decoder. The u-processor uses this circuit to pick-up the incoming telephone number from the transceiver. Before the u-processor starts the decoding it increases the audio level to max. via the interface and after this the decoding can take place. Right after DTMF decoding the audio level has no influence on the dynamic range and the DTMF decoding.

6. IC11 is the digital interface. It makes the IC14 (u-processor) listen to the conversation between the handset and the transceiver and listens for UP/DOWN or ON/OFF Hook commands. IC11 pin 11 and 13 can be tri-stated leaving the processor in control of the communication instead of the handset. During recording and replay the data communication will be blocked to prevent accidental ON/OFF Hook signal to cause an error beep from the transceiver. The clock from the transceiver is used for detection of a conversation break down by the MTX, while no data communication takes place between handset and transceiver in conversation mode.

The ringing signal taken from the horn alarm relay is used for indicating initiation of a call to the mobile telephone. After the first ringing the clock from the transceiver is deactivated until the handset is picked up by the subscriber or the ringing is terminated. This is used by ap3706 because the clock from the transceiver must be inactive for 10s after the start of the first ringing before the ap3706 answers the call.

7. IC8 and IC6 form an analog interface. This interface is mainly a microphone differential amplifier, consisting of IC8 pins 1, 2, and 3. This amplifier takes care of the analog speech signal so that this signal is in reference with its correct ground (MIC GND) during recording and replay.
   Under normal conditions the Mic. and audio signals are looped-through the ap3706 via IC6. Only during replay is the speech signal enabled from ap3706 to the transceiver and handset.

8. IC's 1 to 4 and IC19 are continuously supplying +5V DC to the u-processor and RAM circuit while the RAM must be refreshed every 4ms even when the mobile telephone is OFF.
   To prevent too much discharge on the car battery an automatic timeout circuit is provided consisting of IC19 and Q1. This circuit will disconnect the power to the u-processor and RAM if the mobile telephone has not been used for 8 days, and this means that the RAM information will be lost.
   IC2 converts the switched 12V DC from the transceiver to +5V DC and this voltage is only available when the ap3733 is ON. IC3 and IC4 are used to form a stabilised -5V DC used by IC5 while this IC must have +/-5V DC to function. For practical reasons the -5V DC is supplied to other IC's.

9. C17,D8,D9,R25 and C14 is the Reset circuit.
   This circuit creates two reset functions: One short pulse, less than 4ms, generated via C14,R25 and D7 during transceiver switch ON. This reset is to ensure that the u-processor will work correctly or it will do so after the next switch ON operation of the transceiver. The reason for this reset to less than 4ms is that the RAM has to be refreshed by the u-processor by 4ms interval. The other pulse only occurs during power-up of the ap3706 (when the ap3706 is connected to the battery of the car).

10. The Display circuit.
    IC4 is a 16 character x 1 line LCD. The display has a built-in controller and receives only a 7/8 bits ASCII code. The ASCII code is applied to the display from the CPU unit in serial data and will be converted into parallel information by IC2. The information will be latched into IC4 on the falling edge of the signal on pin 6 (ENABLE). The clock signal from the Control unit is used for shifting data into IC2 on the raising edge of the signal and it controls the enable signal via IC3 on the falling edge.
    The key output (B1.1) is low if the REC switch is pressed when the clock pulse is in the high stage and (B1.1) is low if PLAY is pressed when the clock pulse is in the low stage.
    IC4 has a temperature compensated contrast regulation via R6 and NTC resistor R7. It also has a background illumination whereas D2 is a back light surface consisting of 20 LED's mounted under the LCD.

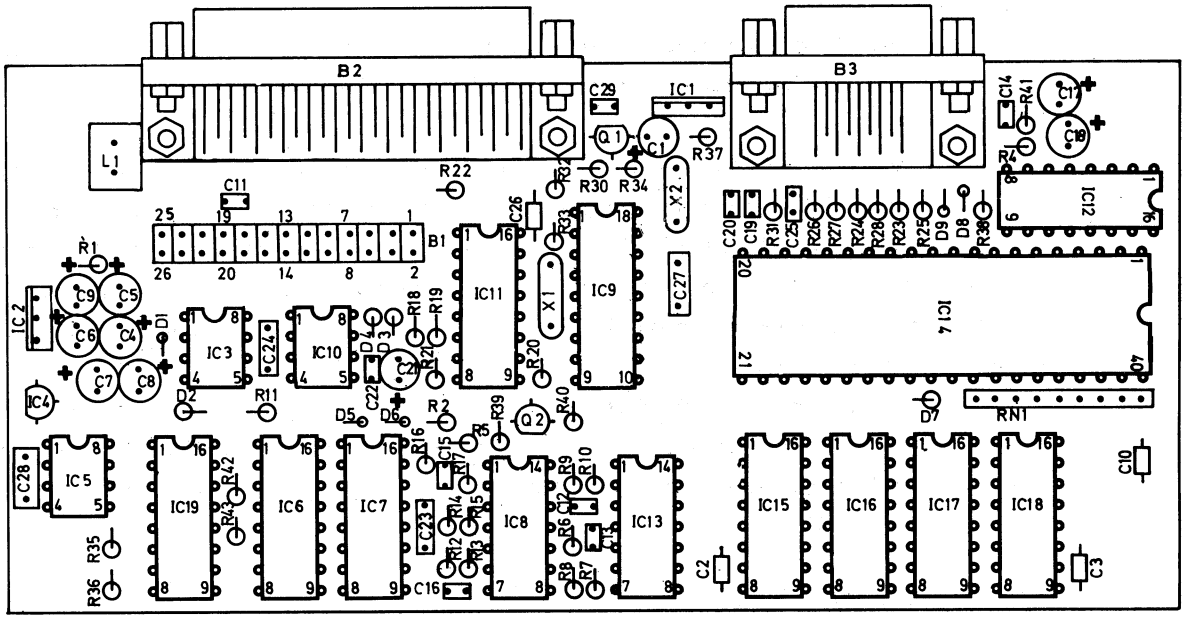
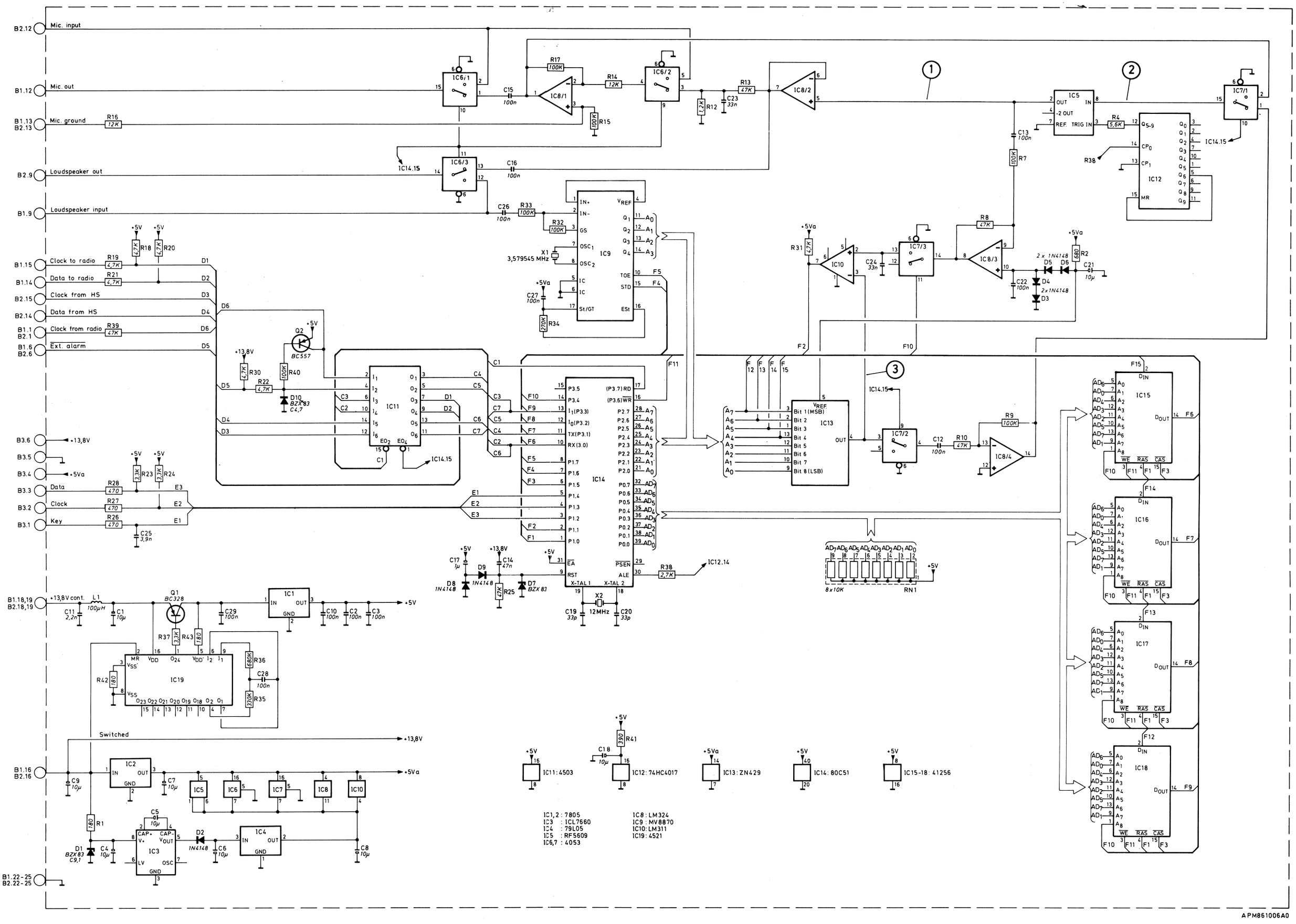


Fig. 3 Component location, control unit

CPH861101/0



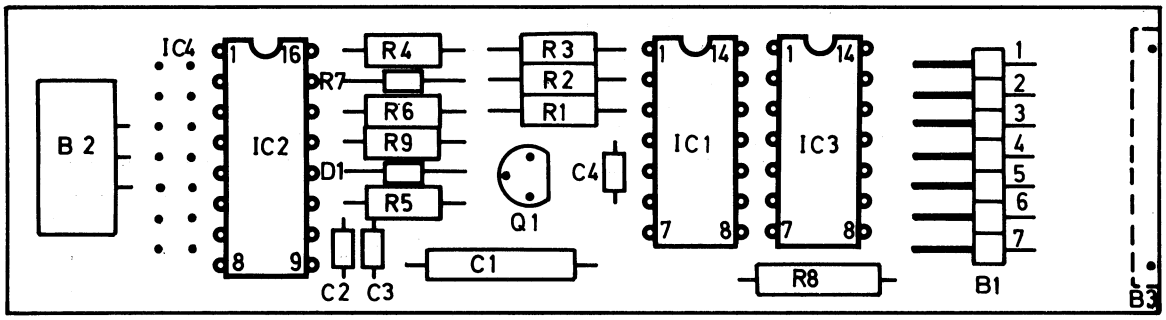
IC1,2 : 7805
IC3 : ICL7660
IC4 : 79L05
IC5 : RF5609
IC6,7 : 4053

IC8 : LM324
IC9 : MV8870
IC10: LM311
IC19: 4521

IC11: 4503 — IC12: 74HC4017 — IC13: ZN429 — IC14: 80C51 — IC15-18: 41256

CPH861101/0

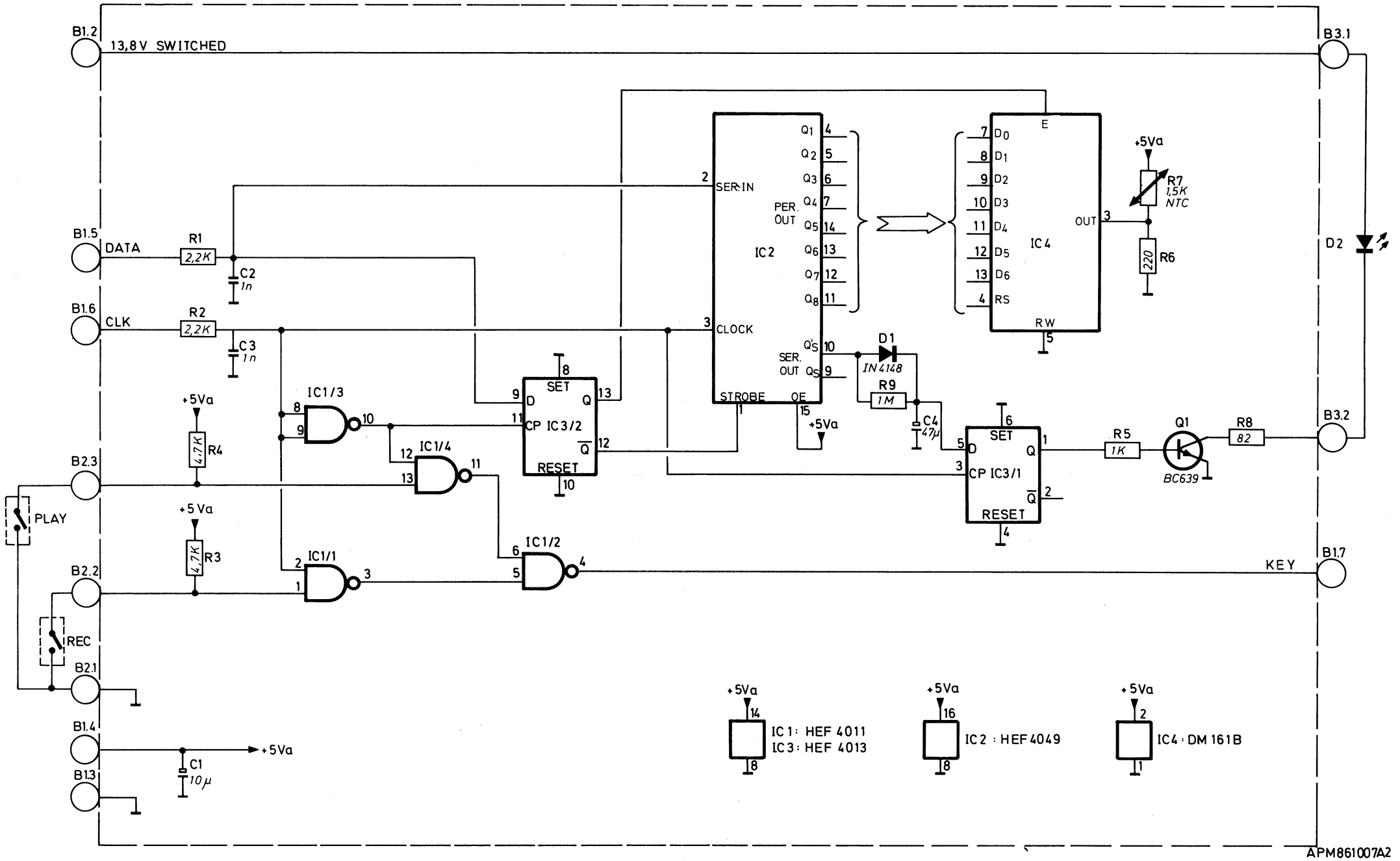
Fig. 4 Circuit diagram, control unit



APM861009A3

Fig. 5 Component location, display unit

CPH861101/0



CPH861101/0

Fig. 6 Circuit diagram, display unit

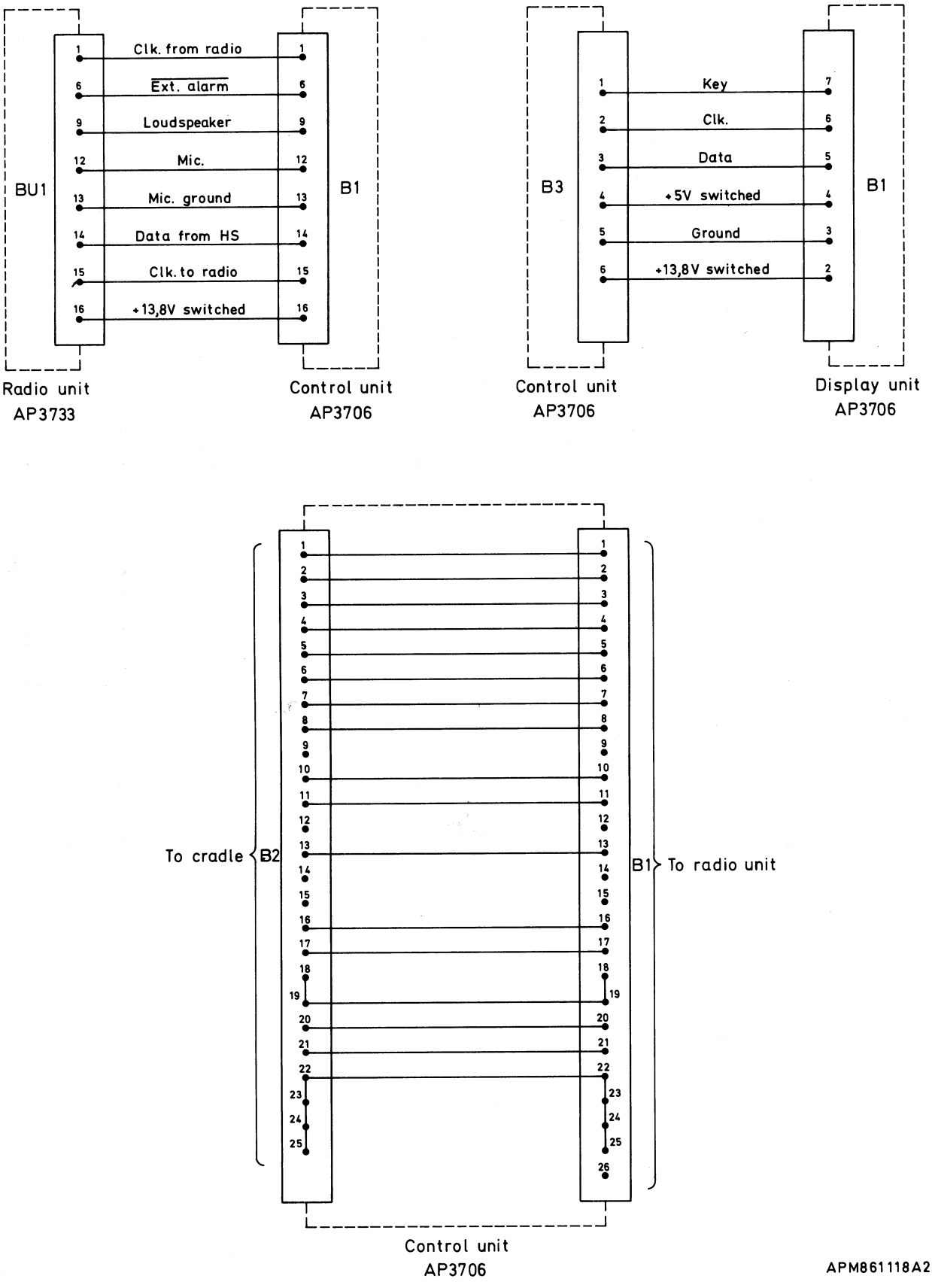


Fig. 7 Wiring diagram

CPH861101/0

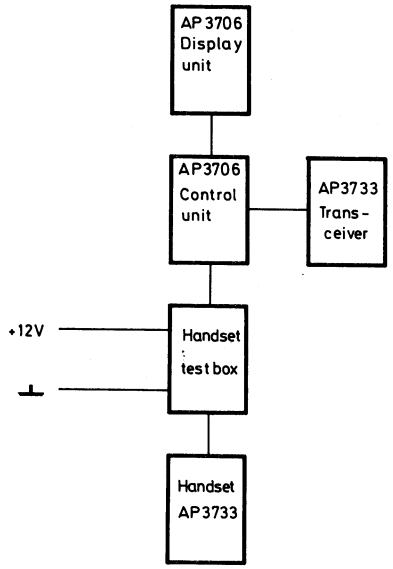
Service instructions

Recommended test equipment for service on ap3706:

- Handset testbox for ap3733-01 or -02.
- Distortion meter.
- Low impedance tone generator.
- RMS millivoltmeter.
- ap3733 transceiver and handset.

Set-up

Connect the ap3706 plug to the transceiver, the handset testbox to the ap3706 Control unit, and connect the handset to the testbox. Then connect the ap3706 Display unit to the ap3706 Control unit.



PERFORMANCE CHECK

Software testmodes

The ap3706 software has 4 built-in test modes. Any one of these 4 modes are able to provide the technician with valuable information during testing. The four modes are named TEST 1 to TEST 4 and they will be initiated by shorting one of four pins on the u-processor (IC14) to ground for a moment.

TEST 1: IC14 pin 39 to GND
TEST 2: IC14 pin 38 to GND
TEST 3: IC14 pin 37 to GND
TEST 4: IC14 pin 36 to GND

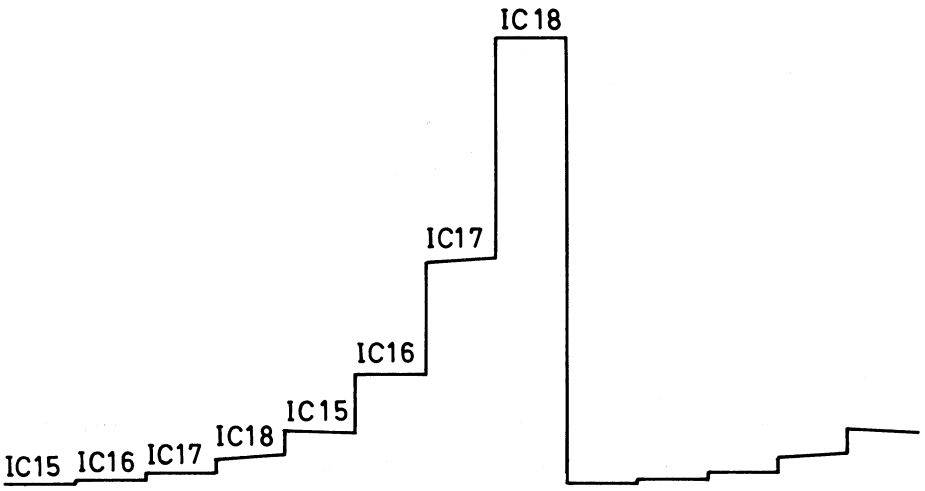
The ap3706 is returned into normal operation by switching the ap3733 OFF and ON again.

TEST 1. A 1kHz tone in replay mode.

In this mode the processor generates a 1kHz tone at max. level. This 1kHz must occur on IC13 pin 4 with a sampling rate of 125 microseconds and approximately 2.5Vpp. The tone should be detectable throughout the signal path IC7.4, IC8.14, IC7.15, IC5.2, IC8.7, IC6.4, IC8.1, IC6.15, and IC6.14. The distortion of this signal after IC5.2 is not allowed to exceed 2%.

TEST 2. Walking bit pattern.

This mode is primarily used for testing the dynamic RAM.
When pin 38 on IC14 is shorted to ground the processor will store a pattern byte per byte consisting of 1 bit High and 7 bit Low. The high bit changes position in the byte for each sampling period so that the value of the pattern changes in this way: 1, 2, 4, 16, 32, 64, 128, 1, 2, ...etc. This pattern is stored in the dynamic RAM (Speech memory).
During recording the display will show "DRAM/REC"; after recording approximately 16 seconds the display will show "DRAM PLAY" and the pattern will be replayed. This will be done repeatedly until the ap3733 is switched OFF.
During the replay a pattern like the one shown in the figure below should be found on IC13.4. If the signal is different from the one shown below change the IC failing according to the IC numbers in the figure.



IC13 BEN 4 UNDER DRAM TEST

APM861126A4

TEST 3. A/D catch.

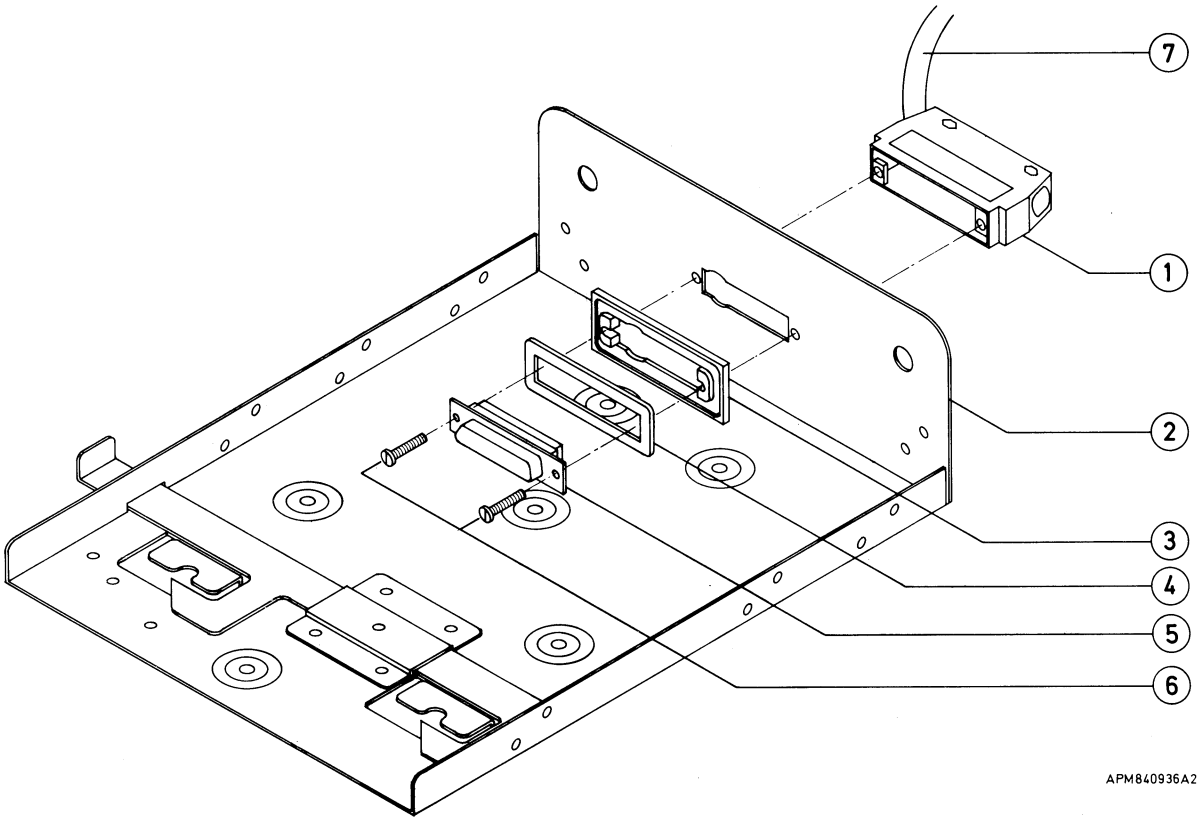
This test is used for testing the analog circuit. The ap3706 will be in constant recording mode and by applying a signal of 1kHz, 220mV RMS the A/D circuit reaches maximum capability. The signal on IC13.4 should look like the input signal but chopped every 125 microseconds. If not, the signal path must be followed through IC6.4, IC8.1, IC7.15, IC5.2, IC8.8, and IC7.13. If the signal is available on all these locations, and the D/A converter is working (TEST 1), and an error still exists, IC10 is the one causing the problem.

TEST 4. Display write.

This test enables the technician to check the serial to parallel communication on the display print. A pattern changes on the display from 10101010B to 01010101B so that the signals can be checked accordingly.

AP3733-02
(Updated version)
Spare parts list

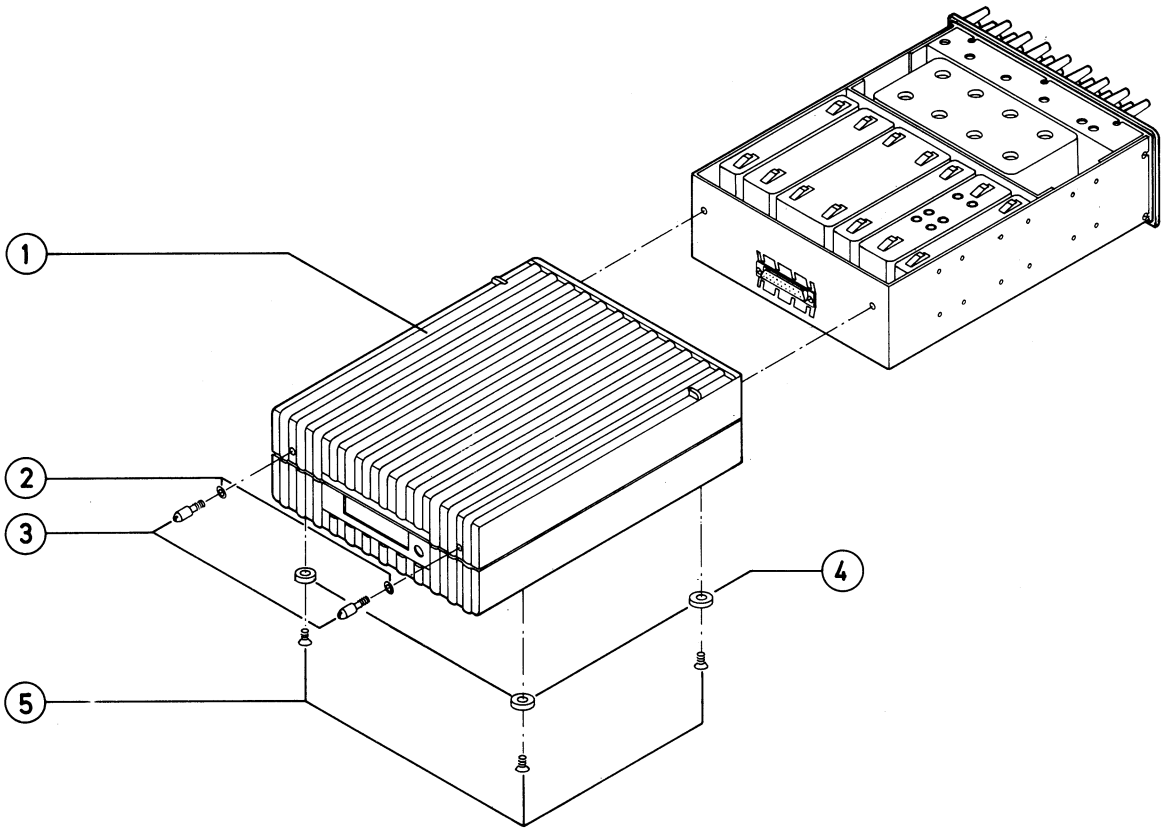
12. List of mechanical parts



AP 3733-02	Mounting bracket	**Date:** 1985.08.16
	ap radiotelefon a/s	**Page:** 12-2

List of mechanical parts

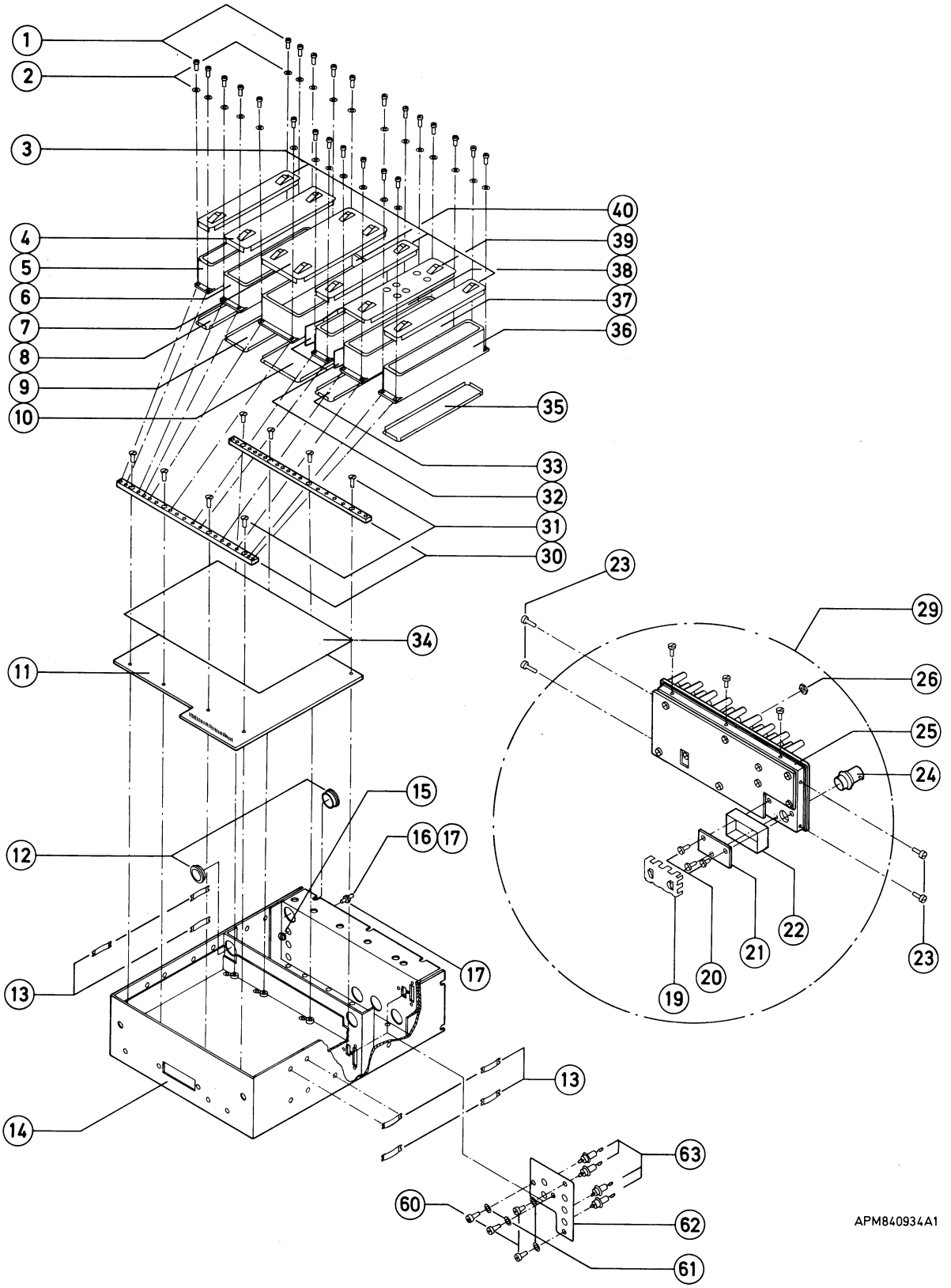
Item	Description	Ordering number
1	Connector housing 25 pol.	8208 213 22700
2	Mounting bracket for radio	3508 102 00010
3	Mounting plate	3508 101 50090
4	Washer	16-076
5	Socket 25 pol.	2422 034 10552
	Socket terminal (10 pcs)	2422 034 00051
	Socket terminal, crimped (12 pcs)	2422 034 16014
6	Topscrew 4x5/8" B.Panh.	8208 224 21800
7	Cable	8208 213 01200



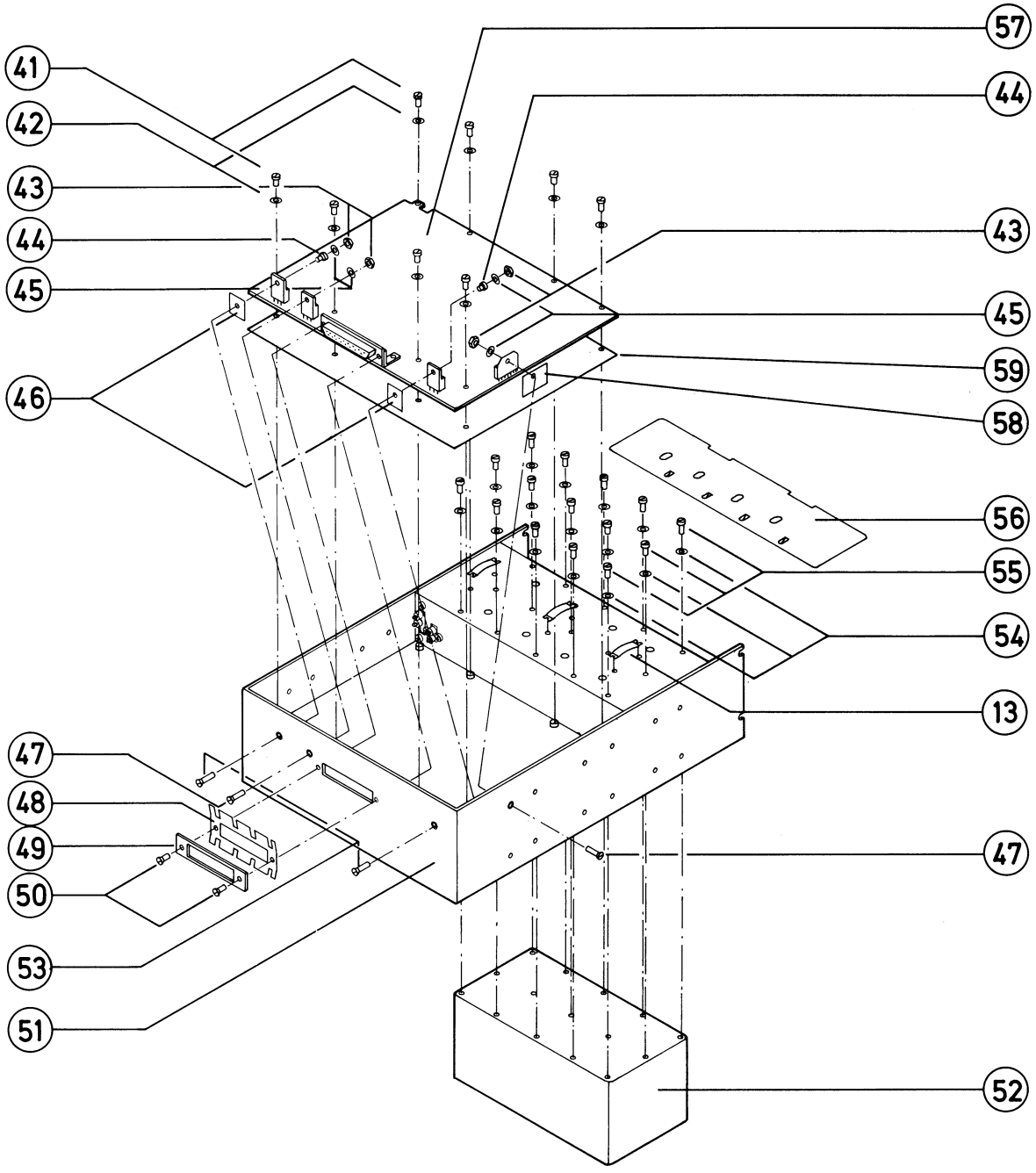
AP 3733-02	Cover	**Date:** 1985.08.16
	ap radiotelefon a/s	**Page:** 12-4

List of mechanical parts

Item	Description	Ordering number
1	Cover	3508 101 20130
2	Spring washer	2522 613 24013
3	Spacing screw	3508 101 20110
4	Spacer block	3508 101 50190
5	Screw M4x10mm UHJ	8208 130 00030



AP 3733-02	Radio unit	**Date:** 1985.08.16
	ap radiotelefon a/s	**Page:** 12-6



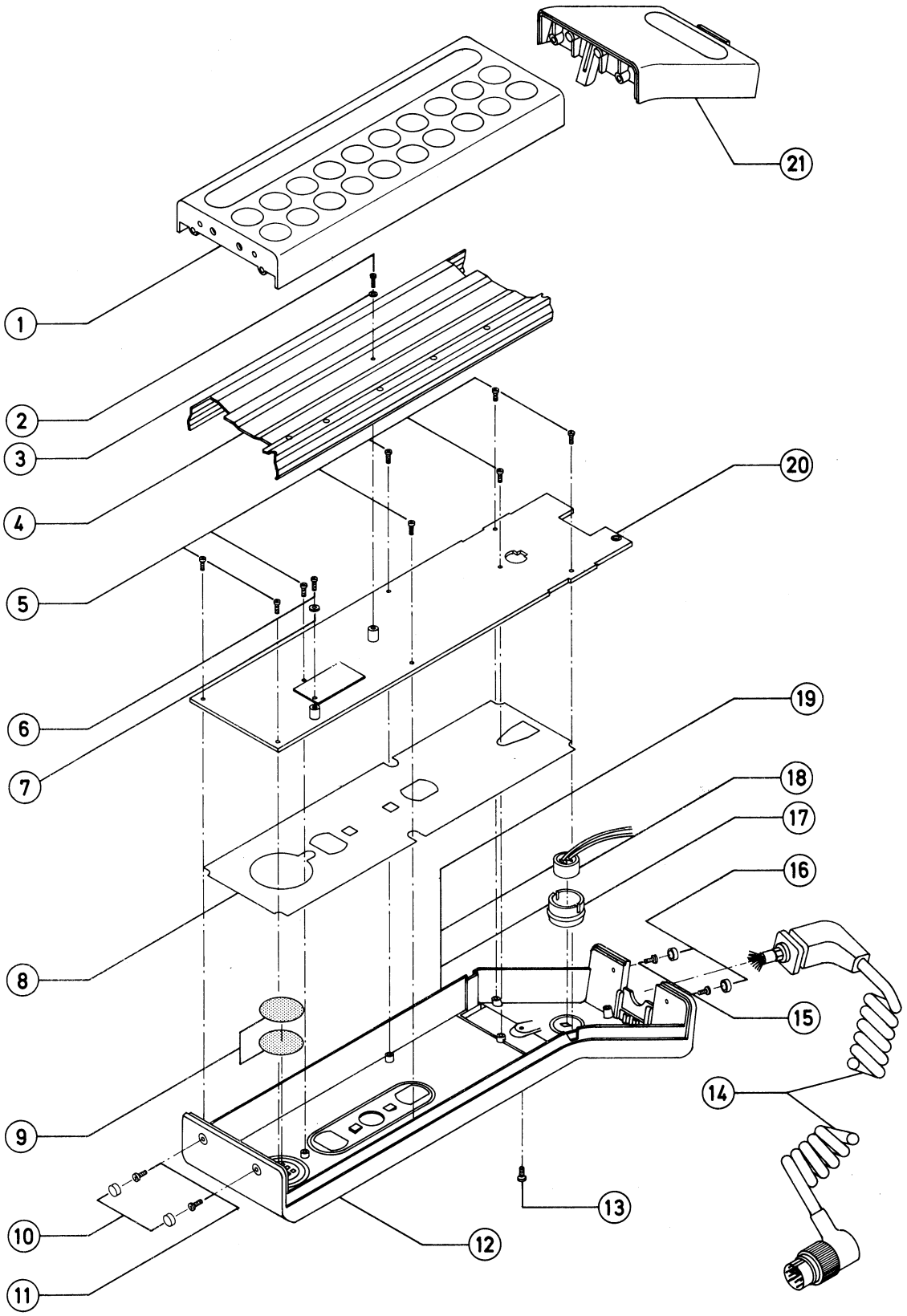
APM840935A1

AP 3733-02	Radio unit	**Date:** 1985.08.16
	ap radiotelefon a/s	**Page:** 12-7

List of mechanical parts

Item	Description	Ordering number
1	Screw M2x6mm PHJ swageform	8208 130 00020
2	Washer M2	18-141
3	Cover 18mm	22-737
4	Cover 28mm	22-738
5	Print (NO7C1)	NO7C1
6	Print	N18E1
7	Cover 48mm	22-739
8	Bottom shield 18mm	22-652
9	Bottom shield 28mm	22-650
10	Bottom shield 48mm	22-658
11	Print N69-2	3508-102 20180
12	Isolating bush	16-066
13	Spring	06-049
14	Chassis	3508 101 20010
15	C: Nut	24-327
16	A: Bush for feed-through	02-066
17	B: Feed-through 1.2nF	2012 551 01056
18	Screw M2,5x6mm CHJ	24-129
19	Cover for aerial filter	22-787
20	Screw M2,5x12mm UHJ	24-027
21	Print	N21A1
22	Screen for aerial filter	22-671
23	Screw M2,5x4mm PHJ	24-269
24	Coax socket	03-031
25	Heat sink	3508 101 01010
26	Nut for BLY-transistor	24-332
29	PA (complete)	3508 102 40160
30	Rail. RF-side	3508 101 20150
31	Screw M2,5x10mm UHJ	24-037
32	Spring	22-704
33	Bottom shield NO8 18mm	
34	Isolating plate	04-184
35	Bottom shield N12 18mm	
36	Print	N12C1
37	Print	N10B1
38	Print NO8	3508 102 20000
39	Cover 28mm	22-709
40	Print N56-2	3508 102 40100
41	Screw M2,5x5mm PHJ	24-128
42	Washer M2.5mm	18-142
43	Nut M2.5x5mm	24-303
44	Isolating plate	09-135
45	Spring washer M2.5mm	19-500
46	Siliconerubber SIL-EL33	09-137<
47	A: Screw M2,5x8mm UHJ	24-024
	B: Screw M2,5x10mm UHJ	24-037
48	Contactspring for connector	3508 101 20280
49	Bracing for contactspring	3508 101 00940

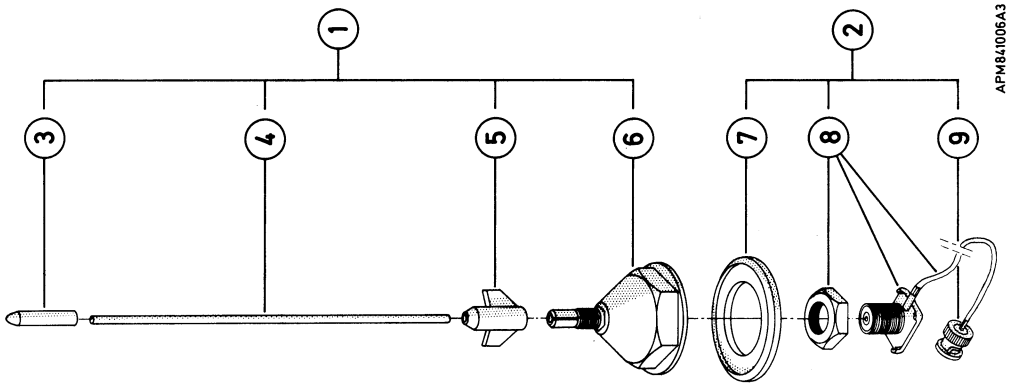
Item	Description	Ordering number
50	Screw M3x8mm UHJ	24-033
51	Chassis	3508 101 20010
52	Duplex filter	3508 102 10610
53	Screw M2,5x8mm UHJ	24-024 (som 47A)
54	Washer M2,5mm	18-142
55	Screw M2,5x4mm PHJ	24-269
56	Cover for aerial filter	22-914
57	Print N67	3508 102 20150
58	Bracing	3508 101 01450
59	Isolating plate	3508 101 50480
60	Screw 3/16" nr. 2	24-202
61	Washer M2	18-141
62	Mont. plate for feed-through	3508 101 2000
63	Feed-through 1nF	2012 551 01057



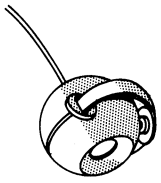
AP 3733-02	Handset	**Date:** 1985.08.16
	ap radiotelefon a/s	**Page:** 12-10

List of mechanical parts

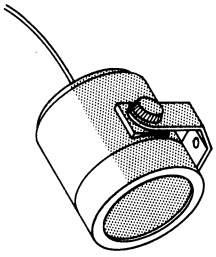
Item	Description		Ordering number
1	Key board complete		3508 102 10500
2	Screw M2x5mm CH		24-104
3	Washer 2,4x6,3x0,5mm		4008 108 02650
4	RF shield for microphone		22-879
5	Screw 3/16" nr. 2 Black		24-202
6	Screw M2x5mm CH		24-104
7	Washer M2		18-141
8	Isolating plate		09-140
9	Gloth for speaker		82-177
10	Dækprop sort		13-024
11	Screw, plate 3/16 inch.		24-202
12	Case	5322 466 82529	~~3508 101 50230~~
13	Screw, plate 1/4 inch.		24-216
14	Coiled cable		3508 102 60150
15	Screw, plate 3/16 inch.		24-202
16	Dækprop sort		13-024
17	Bush for microphone		13-058
18	Microphone		13-107
19	Mounted bottom part, complete		313-010
20	Print board (N74)		3508 102 20200
21	Microphone cover		13-031



APM841006A3

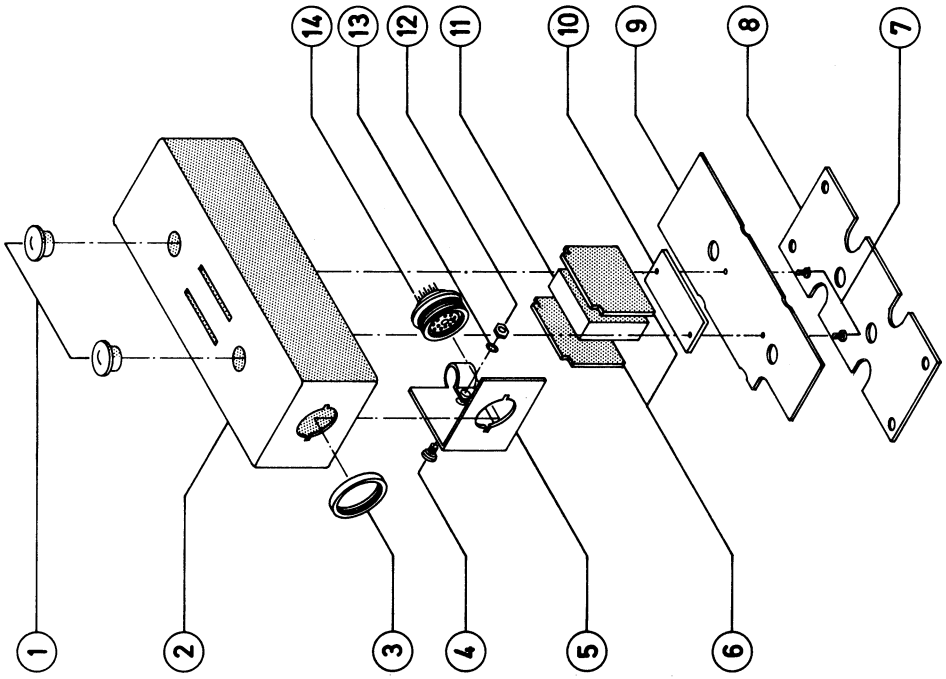


Microphone



Loud speaker

APM840509A3



Magnetic cradle for handset controller
incl. multiwire cable and connector.
Stock no. 3508 102 10170.

APM841004A2

AP 3733-02	Cradle, Microphone, Loudspeaker, Antenna	**Date:** 1985.08.16
	ap radiotelefon a/s	**Page:** 12-12

List of mechanical parts

Cradle complete

Item	Description	Ordering number
1	Holeplug for hangeup	13-128
2	Case with hole	13-116
3	Nut for multisocket	3508 100 00010
4	Screw 3x8mm	24-036
5	Bracket	22-852
6	Magnet plate	22-698
7	Screw 5/16" nr. 2	24-204
8	Base plate	22-695
9	Print board (N64)	3508 102 20010
10	Isolating plate	09-136
11	Magnetic catch	13-125
12	Nut 3x5x2mm	24-305
13	Washer 3,2mm	19-501
14	Multi socket 14 way	3508 100 55020

List of mechanical parts

Microphone complete	213-023
Loudspeaker complete	208-002

Antenna

Item	Description	Ordering number
1	Antenna complete without socket	301-102
2	Antenna socket, complete with cable	311-009
3	Rubber peake	07-115
4	Antenna whip 1/4 wave	81-119
5	Top screw	01-129
6	Antenna holder	01-127
7	Rubber ring	01-130
8	Cable complete	211-002
9	Connector for coax cable	03-010

13. List of electrical parts

Unit no.	Description	Ordering number
1	Mother board, RF side	3508 102 20180
2	IF amplifier	8208 243 01231
3	RF and mixer	8208 243 01021
4	UHF RX VCO	3508 102 20000
5	RX synthesizer	3508 102 40100
6	TX synthesizer	8208 243 01851
7	UHF TX VCO	8208 243 00731
8	System mother board	3508 102 20450
9	Duplex filter	3508 102 10920
10	PA and power control	3508 102 40160
11	Aerial filter	8208 243 02111
12	Handset, control boarde	3508 102 20200
13	Cable connection for cradle	3508 102 20010
	Cradle, black complete	3508 102 10170
	Display and key board, black	3508 102 10500

Item	Type	Ordering number
Printed board	IF amplifier	8208 243 01231
	IF amplifier	8208 243 00921

Note: In stock no. N12C1 is print board N09B1 included

Components mounted on the print board

N12C1

Integrated circuits

IC1	SO41P	8208-209-24800 ~~9336 340 10682~~

Transistors

Q1-2	BF495	9331 987 80112
Q3-6	BC238B E-line	19-117

Coils

L1	75279-4E2	25-001
L2-3	2.2uH	2422 535 98462

Crystal

X1	20.945MHz AP22	11-815

Crystal filters

F1	21.4MHz	11-854
F2	455kHz	11-870

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1	2.3-20P		Trim. Dau	19-336
C2,4-5,7,15	1uF	35V	Tantal	2022 019 00159
C3,25	33pF	100V	N150	2222 680 34339
C6,18	2.2nF	100V	Ceramic	2222 630 08222
C8,20	330P	100V	Ceramic	2222 630 08331
C9	2.2nF		MKC	11-486
C10-11	150P	100V	N750	2222 680 58151
C12	100P	100V	N150	2222 680 34101
C13	4.7uF	25V	Tantal	2022 019 00157

Item	Value	Volt/Watt	Description	Ordering number
C14	1nF		Ceramic	2222 630 07102
C16	27pF	100V	N150	2222 680 34279
C17	39pF	100V	N150	2222 680 34399
C19	47pF	100V	N150	2222 680 34479
C21,22,26	100nF	50V	Ceramic	2022 552 02334
C23	1.5pF	100V	P100	2222 631 03158
C24	68pF	100V	N150	2222 680 34689
C25	33pF	100V	N150	2222 680 34339

Components mounted on the print board

N09B1

Item	Type	Ordering number
Integrated circuit		
IC1	MC3340P	9335 482 70682
Transistors		
Q1-2	BC238B E-line	19-117
Diode		
D1	1N4148	9330 839 90113

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1	1nF	100V	Ceramic	2222 630 08102
C2	1uF	35V	Tantal	2022 019 00159
C3,5	2.2nF	100V	Ceramic	2222 630 08222
C4	1uF	35V	ELCO	05-038
C6	100nF	50V	Ceramic	2022 552 02334

Item	Type	Ordering number
Printed board	RF and mixer	8208 243 01021

Components mounted on the print board

Transistors

Q1	BFR91, Mot.	19-147
Q2	BFT95	19-138
Q3	J4416	19-089

Coils

L1-6	Helix coil 80089-4E2	25-083
L11	75293-4E2	25-012
RF1-2	75290-4E2	25-009

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1-8,13-14,20	330P	100V	Ceramic	2222 630 08331
C9,15-16,18	4.7nF	100V	Ceramic	2222 630 07472
C10-11	1P0-3P5		Trimmer	2222 809 05001
C12	15P	100V	N150	11-381
C17	100P	100V	N150	11-401
C19	1.5pF	100V	P100	2222 631 03158
C21	0.56pF	100V	P100	2222 680 03567

Item	Type	Ordering number
Printed board	UHF RX VCO	3508 102 20000

Components mounted on the print board

Transistors

Q1	BC337-25	3508 100 11010
Q2	J309	9335 361 60682
Q3	BF960	9335 105 20113
Q4-7	BFQ23/02	9335 219 80112

Diodes

D1-2	BB909A	9335 154 30113
D3	04-043/8.3V Zener	04-055

Coils

L1	80049-4E2	25-089
RFC1	2.2uH	04-108
RFC2	75290-4E2	25-009
TR1	80048-4E2	25-088

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1-4,10-11,13 15-22	330P	100V	Ceramic	2222 630 08331
C5	1.5pF-10.0pF	250V	Trim	2022 801 00059
C6	3.3pF	500V	N750	2222 650 57338
C7	1uF	50V	Elco	2020 002 90256
C8	15uF	16V	Elco	2222 122 55159
C9	2.2pF	400V	NP0	2008 554 00026
C12	8.2pF	400V	N750	2008 554 00022
C14	4.7nF	100V	Ceramic	2222 630 08472

Item	Type	Ordering number
Printed board	RX Synthesizer	3508 102 40100

Components mounted on the print board

Integrated circuits

IC1	SP8718B	9337 091 50682
IC2	LM78L05ACZ	9335 449 00682
IC3	NJ8821	8208 130 15010
IC4	CA3420E	8208 130 15330

Transistors

Q1-2	BC548B	9335 101 60682
Q3	BC327-25	9331 795 30112

Diodes

D1,2	1N4148	9330 839 90113
D3	BB909A	9335 154 30113

Coils

RFC1	100uH	2412 541 00195
RFC2	10uH	2412 541 00194

Crystal

X1	4.8MC AP38	11-805

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1-4	330P	100V	Ceramic	2222 630 08331
C5	33uF	10V	Electrolytic	2222 122 54339
C6,8,10	100nF	50V	Ceramic	2022 552 02334
C7,11	68uF	6.3V	Electrolytic	2222 122 53689
C9,12	1nF	100V	Ceramic	2222 630 08102
C13	220nF	100V	MKT	11-497
C14,16	3.3nF	400V	MKT	11-484
C15	6.8nF	400V	MKT	11-488
C17	390P	100V	N1500	2222 680 70391
C18	150P	100V	N150	2222 680 34151
C19,20,24	4.7nF	100V	Ceramic	2222 630 03472

Item	Value	Volt/Watt	Description	Ordering number
C21	22pF	100V	N750	2222 631 58229
C22	1P5-10P	250V	Trim air	2022 801 00059
C23	33pF	100V	N1500	2222 631 70339
C25-32	2.2nF	100V	Ceramic	2222 630 08222

Resistors

R9	33K		Network	13-684
R21	150		Network	13-709
R25	PTC		Q63100-P240-C11	2112 660 00004

Item	Type	Ordering number
Printed board	TX Synthesizer	8208 243 01851

Components mounted on the print board

Integrated circuits

IC1	OM806	9333 922 30112
IC2	ICL7621DCPA	9335 871 40682
IC3	CA3160A	9336 339 50682

Transistors

Q1,3	BFQ23/02	9335 219 80112
Q2	BF960	9335 105 20112
Q4,6	BC308B	19-084
Q5	BF199	9330 634 20112
Q7	BC548B	9335 101 60682

Diodes

D1	1N4148	04-062
D2	BB909A	9335 154 30113

Coils

L1	80052-4E3	25-091
RFC1	6.8uH	04-114
RFC2	2.2uH	04-111

Crystal

X1	7,85MHz AP37	11-821

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1,3,7,9,11,19,33, 35,38,39	1nF	100V	Ceramic	2222 630 08102
C2,21,40	4.7nF	100V	Ceramic	2222 630 08472
C4,14,31	4.7uF	35V	Electrolytic	2020 002 90261
C5,10	12pF	100V	Ceramic N150	2222 680 34129
C6,8,12,20,22,30	4.7nF	100V	Ceramic	2222 630 03472

Item	Value	Volt/Watt	Description	Ordering number
C13,32,34	100nF	50V	Ceramic	2022 552 02334
C15,16	33nF	100V	Ceramic N750	2222 680 58331
C17	18pF	100V	Ceramic N150	2222 631 34189
C18	100P	100V	Ceramic N150	2222 680 34101
C23,24	47pF	100V	Ceramic N150	2222 680 34479
C25,28	47nF	50V	Ceramic	2020 300 90179
C27,29	22nF	50V	Ceramic	2020 300 90251
C36	2.2nF	100V	Ceramic	2222 630 08222
C37	330P	100V	Ceramic	2222 630 08331

Item	Type	Ordering number
Printed board	UHF TX VCO	8208 243 00731

Components mounted on the print board

Transistors

Q1	BC327-25	9331 795 30112
Q2	BC558B	3508 100 11000
Q3	J309	9335 361 60682
Q4	BF960SI	9335 105 20113
Q5-7	BFQ23/02	9335 219 80112
Q8	BFQ32/2	9335 219 90112

Diodes

D1,2	BB909A	9335 154 30113
D3	1N4148	9330 839 90113

Coils

L1	80049-4E3	25-089
RFC1	2.2uH	04-108
RFC2,3	75290-4E2	25-009
TR1	80048-4E2	25-088

Item	Value	Volt/Watt	Description	Ordering number

Capacitors

C1-3,8,9,11-20,23	330P	100V	Ceramic	2222 630 08331
C4	1P5-10P	250V	Trim	2022 801 00059
C5	3.9pF	500V	Ceramic N750	2222 650 57398
C6	2.2pF	400V	Ceramic NP0	2008 554 00026
C7	1uF	50V	Electrolytic	2020 002 90256
C10	8.2pF	400V	Ceramic N750	2008 554 00022
C21	100P	100V	Ceramic N150	2222 680 34101
C22	33uF	16V	Electrolytic	2020 002 90568
C24	4.7nF	100V	Ceramic	2222 630 08472

Item	Type	Ordering number
Printed board	System board	3508 102 20450

Components mounted on the print board

Integrated circuits

IC1	XR-4741CP	9336 351 10682
IC2	UA3403PC	9335 101 20682
IC3	TL082CP	09-242
IC4	ICL7621DCPA	9335 871 40682
IC5,23	HEF4093BP	9333 242 90112
IC6	MC1458N	9332 911 80682
IC7	HEF4051BP	9332 824 20112
IC9	TA7252P	8208 130 15230
IC10	NSC800NI-4	8208 130 15220
IC11	NSC810NI-4	8208 130 15240
IC12,14,27	HEF4013BP	9332 776 10112
IC13	FX409	8208 130 15200
IC15	74HC373	3508 100 15020
IC16	27128 Coded	3508 102 70250
IC17	D446-C2	9336 403 60682
IC18	74HC139	3508 100 15010
IC19	HM1-0168-5 Nummerprom	9333 878 00682
IC20-22	HEF4724BP	9333 252 00112
IC24	74HC04	3508 100 16040
IC25	74HC32	3508 100 16030
IC26	LM358N	09-080
IC28	HEF4066BP	9332 966 50112
IC29	LM2931AT-5.0	9336 534 20682
IC30,31	L4785	8208 130 15290

Transistors

Q2,4,8-10,14-17,202	BC548B	9335 101 60682
Q19	BC558B	3508 100 11000
Q201	BF244A	19-106

Diodes

D1-2,7-8,11-12, 13-15,18,23	1N4148	9330 839 90113
D3	BAT43	9335 520 30682
D16-17	1N4001	9330 635 30113
D19	BZX79-C5V6	9331 177 30113
D20	BZX79-C15	9331 178 30113
D21	BZX79-C5V1	9331 177 20113
D22	BZX79-C24	9331 178 80113
D23	BZX79-B6V8	04-052

Item	Type	Ordering number
Coil		
L1	100uH	2412 541 00195
Relay		
RE1	12V	3508 100 60010
Crystal		
X1	8.064MHz	3508 100 50030

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1-2,53	10nF	100V	MKT	2222 370 21103
C3-6,27-28	4.64nF	63V	Polys	2222 443 44642
C8	4.7nF	100V	Ceramic	2222 630 18472
C9,52,55	10uF	16V	Electrolytic	2020 002 90262
C10-13,17,54,57-59,72,76,115	1nF	100V	Ceramic	2222 630 18102
C14	2.2nF	100V	Ceramic	2222 630 18222
C15,85	470nF	50V	Electrolytic	2020 002 90255
C16,18,23,26,43,47,60,64,74,80 102,114	100nF	50V	Ceramic	2022 552 00234
C20,44,63,75,89	330pF	100V	Ceramic	2222 630 18331
C21,22,61,93	4.7uF	35V	Electrolytic	2020 002 90261
C29	22nF	50V	Ceramic	2020 300 90251
C30	1.5uF	25V		2222 122 56158
C32,34,45,56,78,81,95,100,105,109,130	1uF	50V	Electrolytic	2020 002 90256
C46,110	220uF	25V	Electrolytic	2222 036 66221
C48,87,88,91,92,106,111-112	100uF	16V	Electrolytic	2222 036 85101
C49,107	330uF	16V	Electrolytic	2222 036 65331
C50	100nF	63V	MKT	2222 370 11104
C62,84,77	1.5nF	50V	Ceramic	2020 300 90245
C67,71,201	2.2uF	50V	Electrolytic	2020 002 90258
C69	47uF	16V	Electrolytic	8208 130 30080
C79	680pF	100V	Ceramic	2222 630 18681
C82	4.7nF	50V	Ceramic	8208 130 30030
C83	120pF	100V	NPO	2222 682 10121
C90	39pF	100V	NPO	2222 682 10399
C99	4.7nF	50V	Ceramic	2020 300 90247
C103	33pF	100V	Ceramic N150	2222 680 34339
C104	22pF	100V	Ceramic N150	2222 680 34229
C108	33uF	10V	Tantal	2222 122 54339
C113	68uF	6.3V	Tantal	22220122 53689
C120-128	47nF	63V	Ceramic	2012 572 10019
C129	22uF	16V	Tantal	2022 019 00156

Item	Value	Volt/Watt	Description	Ordering number
Resistors				
R3	150K	0.25W	490-0	2108 109 00257
R4	7.5K	0.25W	MR16	2322 150 57502
R5,12,41	1K	1/2W	TRIM	19-278
R6-7,13-14	20K	0.25W	MR16	2322 150 52003
R8,15	10K	0.25W	MR16	2322 150 51003
R9,16	8.2K	0.25W	MR16	2322 150 58202
R10	162K	0.25W	490-0	2108 109 00258
R11	9.1K	0.25W	MR16	2322 150 59102
R34	150		NTC	13-707
R35	4.7K	1/2W	TRIM	2111 369 00084
R53	3.3K	0.25W	MR16	2322 150 53302
R54	5.6K	0.25W	MR16	2322 150 55602
R55	11K	0.25W	MR16	2322 150 51103
R56	39K	0.25W	MR16	2322 150 53903
R57	33K	0.25W	MR16	2322 150 53303
R72	1	1/3W	SFR25	2322 181 13108
R81,102	100K	1/2W	TRIM	19-273
R82,105,113	22K	1/2W	TRIM	2111 369 00086
R121	10K	0.125W	Network	2120 108 90167
R156	1K		Network	13-710
R163	47K	1/2W	TRIM	2111 361 00087
R201	820	1/2W	RGU	2108 108 06821
R202	47K	1/3W	SFR25	2322 181 13473
R203	12K	0.5W	RGU	2108 108 06123
R205	2.7K	0.5W	RGU	2108 108 06272
R208	10	0.5W	RGU	2108 108 06109

Item	Type	Ordering number
Printed board	Duplex filter trimmet for NMT	3508 102 10920

Components mounted on the print board

Coils

L13-14	Coax cable	8017 6-4 E3
L15	Coax cable	8017 7-4 E3
L16	Coax cable	3508 102 60000
L17	Coax cable	8017 9-4 E3

Capacitors

Item	Value	Volt/Watt	Description	Ordering number
C2-5,7-8	1P8-10P		Trim air	2012 801 10024
C9-10	3.9pF	400V	NPO	2008 554 00027
C11-12	3.3pF	400V	NPO	2008 554 00023

Item	Type	Ordering number
Printed board	PA and power control	3508 102 40160

Components mounted on the print board

Integrated circuits

IC1	LM358N	09-080
IC2	LM78L05ACZ	9335 499 00682

Transistors

Q1	MRF559	8208 130 11020
Q2	MRF630	8208 130 11030
Q3	2N5946	9332 549 60682
Q4	MRF644	9337 091 20682
Q5	BC337-25	3508 100 11010
Q6	2N4918	9331 234 20682

Diodes

D1-2,4-7	1N4148		9330 839 90113
D3	MBD501	5322-130-34667 4108 -	~~9332-501-90682~~

Coils

RFC1-7	75290-4E2	25-009
RFC8	75297-4E2	25-015

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1	2.2pF	100V	NP0	2222 680 09228
C2,35	1P8-10P		Trim air	2012 801 10022
C3,7,10,15-19,22, 26-30,51-55	10pF	100V	N150	2222 680 34109
C4,8,32,39,41,45-47,50,60-62	33oP	100V	Ceramic	2222 630 08331
C5,20,31,11	100nF	50V	Ceramic	2022 552 02334
C6,12-13,21,23-24, 37-38,42-43	47pF	100V	N150	2222 680 34479
C9,14,25,36	2P5-18P		Trim air	2012 801 10023
C33-34,56-58	4.7pF	100V	N150	2222 663 33478
C40,48	4.7uF	25V	Tantal	2022 019 00157
C44	2.2nF	100V	Ceramic	2222 630 08222
C49	10uF	16V	Electrolytic	2020 002 90262

Item	Value	Volt/Watt	Description	Ordering number
Resistors				
R13,26	10K	1/2W	TRIM	2111 369 00107
R27	4.7K		PTC	8208 130 20020
R28	330		PTC	13-670

Item	Type	Ordering number
Printed board	Aerial filter	8208 243 02111

Components mounted on the print board

Coils

L1-2	80054-4E2	25-087

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1,3	5.6pF	400V	Ceramic N150	2008 554 00028
C2	8.2pF	400V	Ceramic N150	2008 554 00029

Item	Type	Ordering number
Printed board	Handset control board	3508 102 20200

Components mounted on the print board

Integrated circuits

IC1	LM2931AT	9336 534 20682
IC2	HEF4030BP	9332 827 40112
IC3	80C39	8208 130 15280
IC4,10	LM358N	09-080
IC5	LM386N	9330 838 90682
IC6	CD40106BE	9335 589 10682
IC7	HEF4071BP	9332 826 70112
IC8	LM2931AZ	09-280
IC9	HEF4013BP	9332 776 10112
IC11	5114	09-238
IC12	HEF40373BP	9335 672 10112
IC13	27C64	3508 102 70230
IC14	8243	09-234

Transistors

Q1-3,5-6,8-9,11-19	BC548B	9335 101 60682
Q4	2N4918	9331 234 20682
Q7	BC238B	19-117
Q10	BC558B	3508 100 11000

Diodes

D1,3-5,8,12	1N4148	9330 839 90113
D2	BZX79-B10	9331 668 70113
D6-7	BAT43	9335 520 30682
D9	BZX79-B5V6	9331 668 20113
D10	BZX79-C18	9331 178 50113

Coil

RC1	100uH	2412 541 00195
RC2,3,4	2.2uH	04-108

Crystal

X1	6.048MHz	11-822

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1,40	1uF	35V	Tantal	2022 019 00159
C2,4,26	68uF	6.3V	Electrolytic	2222 122 53689
C3,12	10uF	16V	Electrolytic	2020 002 90262
C5-9,11,22,24,30	330P	100V	Ceramic	2222 630 08331
C10,13,15,18-19, 23,25,28-29,31-33, 35-36,38	100nF	50V	Ceramic	2022 552 02334
C14,27,34	1nF	100V	Ceramic	2222 630 08102
C16	4.7uF	35V	Electrolytic	2020 002 90261
C17	10nF	50V	Ceramic	2012 557 02012
C20-21	22pF	100V	N150	2222 680 34229
C37	47uF	25V	Electrolytic	2020 002 90528
C39	3.3nF	100V	Ceramic	2222 630 08332
C41	100nF		Ceramic	3508 100 30170
Resistors				
RA-C	33K	0.125W	Network	2120 108 90168
R56	330P		PTC	13-670

Item	Type	Ordering number
Printed board	Battery back-up	3508 102 20030
Components mounted on the print board		
Diodes		
D1	1N4148	9330 839 90113
Battery	Cithiumcelle 3U 35mA	2422 526 00127

Item	Type	Ordering number
Printed board	Cable connection cradle N64	3508 102 20010

Components mounted on the print board

Integrated circuit

IC1	ICLM78L/5ACZ	9335 499 00682

Diode

D1	1N4148	9330 869 90113

Item	Value	Volt/Watt	Description	Ordering number
Capacitors				
C1	100nF		Ceramic	2022 552 02334
C2	100uF		Elco	2020 002 90567
Resistors				
R1-2	1K			2322 280 13102
Relay				
RE1	RD2-2	12VDC/50MA		17-065

AP3733-02

(Updated version)

Additions and alterations

PRCS-Service

Philips Radio Communication Systems (Copenhagen)

CONCERNING **AP 3000** **87.09**

Fault : Electrical noise in the receiver part caused by mechanical stress (e.g. when you press on the cover of the transceiver.

Troubleshooting:
1) The module top cover's punched part which provides contact to the transceiver cover may cause interference in the receiver.
2) The VCO module and synthesizer module bottom covers may have problems with the ground connection between bottom cover and module shielding cover.
3) Microphony in the Rx-Tx VCO's.

Repair :
1) Mount the isolating plate (3508 102 00090) in the transceiver cover or mount some flex across the top cover "clips" to prevent mechanical interference.
2) Mount the grounding plate (3508 101 01750) in the transceiver underneath the modules to improve the ground connection. A solder connection between the bottom cover and the module shielding cover will also improve the ground connection.
3) To prevent microphony in the VCO modules, silicone paste should be placed around the components as shown on figs 1 and 2.

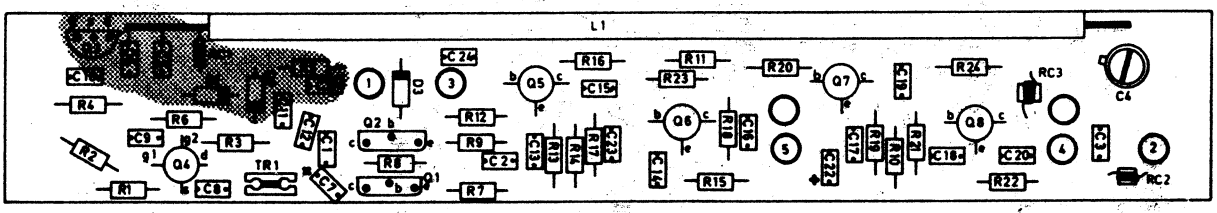


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Fig. 1 TX VCO

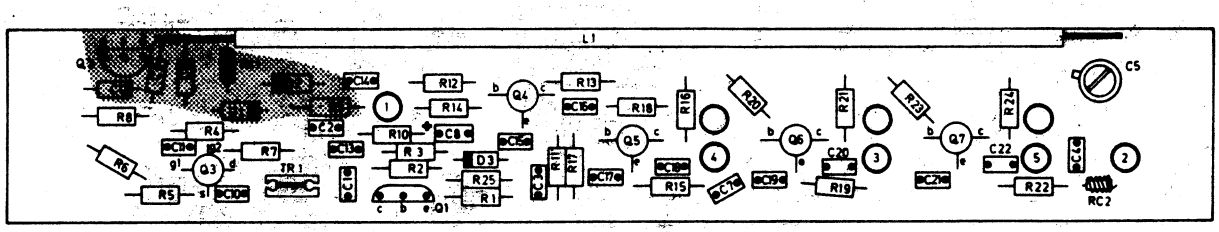

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Fig. 2 RX VCO