STORNO RADIOKOMMUNIKATION

VHF MARITIME RADIOTELEPHONE
MODEL MARINEPHONE
TYPE CQF13-2
152 . . 174 Mc/s
SPEC.1164

Storno

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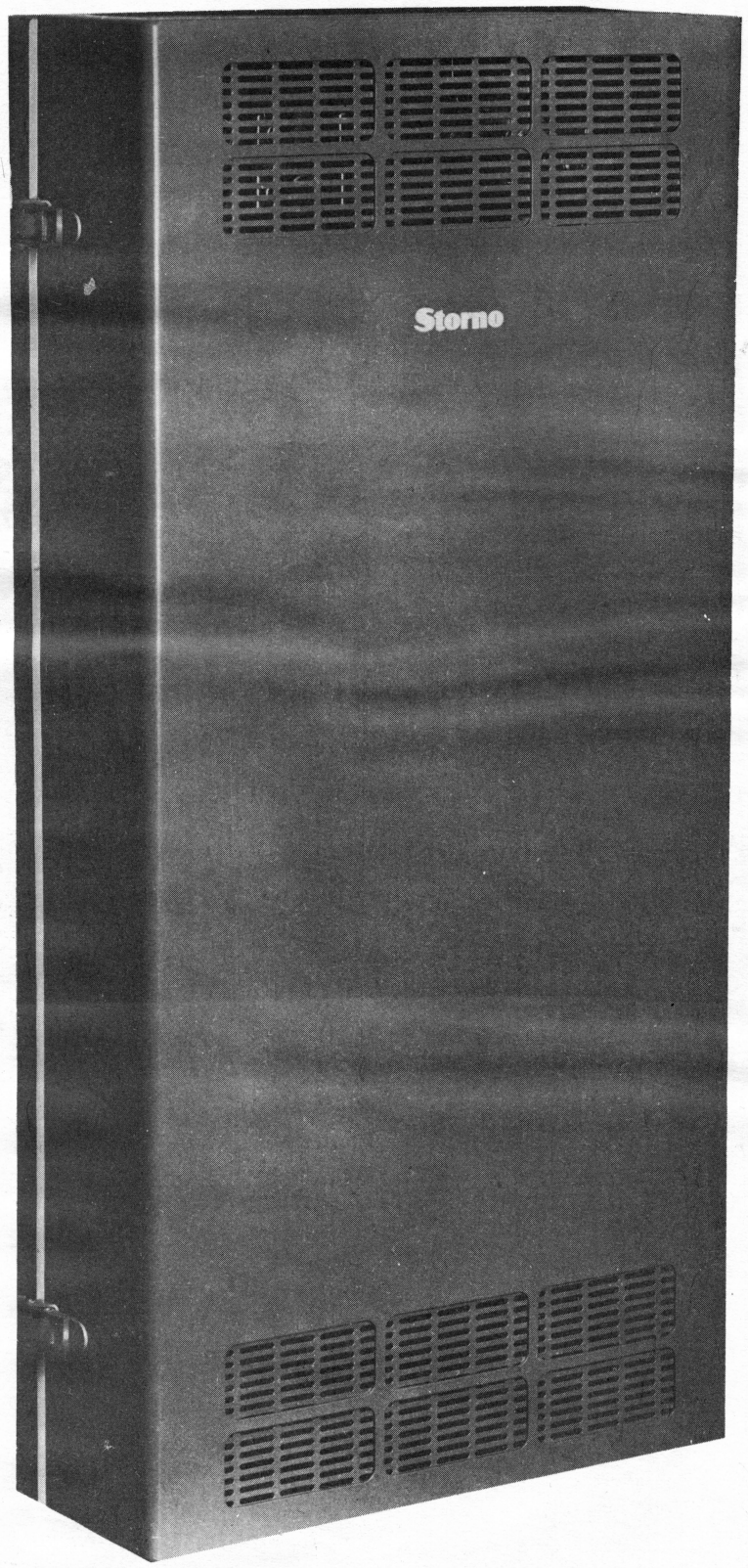
C o n t e n t s

Storno



VHF MARITIME RADIOTELEPHONE
MODEL MARINEPHONE
TYPE CQF13-2
152 . . 174 Mc/s

Danske Statsbaner

P2282

Introduktion.

Dette projekt omfatter 1: Parallelle kontrolbokse CB13-8 spec. til CQF13-2 og 2: CB13-8 spec. med tilslutning for symmetrisk firetråds 600Ω kredsløb med normalt telefonniveau.

1. Oversigt.

De to parallelle betjeningsbokse CB13-8 spec. er identiske og forbindes rent kablingsmæssigt som vist i standard beskrivelsen over CQF13-2 side 1-8 nederst.

1.1. Funktionsbeskrivelse

Når begge mikrotelefoner er anbragt i holderne på siden af boksene, står stationen altid på kanal 16, og dette indikeres ved at den blå kontrollampe "CALL & SAFETY CHANNEL ON" lyser på begge bokse. Endvidere er skalalyset tændt.

Et opkald på kanal 16 vises på begge bokse, ved at den hvide opkaldslampe lyser. Straks en af boksene fjerner sin mikrotelefon fra gummiholderen, overtager den pågældende boks alle funktioner. Dette indikeres i modsatte boks, ved at den røde TRANSM. lampe tændes og alle andre lamper slukkes. Modtagerens udgang er dog stadig forbundet til begge bokse, således at al indkommende kommunikation også høres i den blokerede boks (medhør). Lytter en af boksene på en kanal indstillet på kanalvælgeren, indikeres et opkald kun i den pågældende boks, ved at den grønne REC. lampe lyser, sålænge der modtages bærebølge. Se i øvrigt beskrivelsen af kontrolboksen CB13-8 i standard beskrivelsen, idet boksene funktionsmæssigt kun adskiller sig herfra på ovennævnte punkter.

1.2. Samleboks

I samleboksen JB13-1 spec. tilsluttes på skrueterminaler kablerne fra betjeningsboksene og fra stationen.

Desuden findes relæerne til omskiftning af funktionerne mellem boksene.

2. Oversigt

Kablingen for kontrolboksen fremgår af tegning D103786.

2.1. Funktionsbeskrivelse

Omsætningen fra normal tilslutning for mikrotelefon til symmetrisk firetråds 600Ω kredsløb med normal telefonniveau (-10dB) sker i en separat boks JB13-x. Boksens indhold fremgår af tegning D103784.

Tastfunktionen er ligeledes ført frem til denne boks, og der kræves fra tilslutningsskinnen en kontakt, som kortslutter terminalerne når senderen skal tastes.
Niveauskema for hele systemet findes på tegning D103785.
Ønsker man at boksen skal lytte på kanal 16 i stand-by kan man uden at indstille på kanalvælgeren kortvarigt trykke på gummitrykknappen i centrum af gummiophænget. Den blå "CALL & SAFETY CHANNEL ON" lampe vil lyse, og et opkald på kanalen vil få den hvide CALL lampe til at lyse, men i modsætning til normal boksen, kun sålænge modtageren modtager bærebølge.
Kanalvælgeren indkobles igen ved at påvirke PRESET CHANNEL IN knappen.
Ellers er boksens funktioner som angivet i beskrivelsen over CQF13-2.

JB13 - 1164

CB13-1164

KL1

LS/HT · Volume · a2 · Note 2

03 Function

Call · white · c4
Call and Safety chan. on · blue · b2
Transm. · red · a4
Receiv. · green · a3
Dial · Dimmer · b3
Micro switch · b1 · Re2 B · Re3 C · c1
b4

05 Tonecall

01 Channel preselector

Re1 A

NOTE 1.

MT13-1W · Monitor LS/HT · Hailing LS proje HT · Ext. LS/HT

KL1: 8 4 7 6 5 12 20 5 3 5 2

30 x 0,127 mm² Dätw. 1852/2

terminal 14 … 13
terminal 10 … 15 … 18 … 19 … 21 … 22 … 24 … 25 … 11
terminal 9 … 17 … 20 … 26 … 27 … 28 … 29 … 30 … 31 … 32 … 33 … 34 … 35 … 36 … 37 … 38

JB13-1164 KL III
JB13-1164 KL Ia
A
JB13-1164 KL II

CB13-1164

KL1

LS/HT · Volume · a2

03 Function

Call · white · c4
Call and safety Chann on · blue · b2
Transm. · red · a4
Receiv. · green · a3
Dial · Dimmer · b3
Micro switch · b1 · Re2 B · Re3 C · c1
b4

Preset channel in

05 Tonecall

01 Channel preselector

Re1 A

NOTE 1.

MT13-1W · Monitor LS/HT · Hailing LS proje HT · Ext. LS/HT

KL1: 8 4 7 6 5 12 20 5 3 5 2

30 x 0,127 mm² Datw. 1852/2

terminal 38 … 13
terminal 10 … 15 … 16 … 18 … 19 … 21 … 22 … 24 … 25 … 11
terminal 9 … 17 … 20 … 26 … 27 … 28 … 29 … 30 … 31 … 32 … 33 … 34 … 35 … 36 … 37 … 38

JB13-1164 KL III
JB13-1164 KL Ib
B
JB13-1164 KL II

Connection for CB13-1164 (B)
Connection for CB13-1164 (A)

KL I · KL II · KL III

CQF13-2

TB13-1

3	To AA13-4
5	To TX13-1
7	From IA13-1
9	Hail
10	"Hail" Relay
11	Group return
12	Chass
13	-12V
14	Stand-by/start
15	Duplex
16	Transm.
17	Low-power
18	To IA13-1
21	Squelch function
22	From AA13-4
19	AF-output
20	
24	To x-tal group relays
25	Channel 16
26	— " — 14
27	— " — 13 and 1
28	— " — 12 — " — 18
29	— " — 11 — " — 19
30	— " — 10 — " — 20
31	— " — 9 — " — 21
32	— " — 8 — " — 22
33	— " — 7 — " — 23
34	— " — 6 — " — 24
35	— " — 5 — " — 25
36	— " — 4 — " — 26
37	— " — 3 — " — 27
38	— " — 2 — " — 28
23	To XS13-1 and XS13-3

Front plate · ANT. · a3 · a4 · a1 · a2

BF13-1

TX13-1
RC13-1 (duplex)
RC13-1 (simplex)

PS13-1a

Ant relay · KL2 · c1

Ref A · Re3 C · Re2 B · Re4 D · a1

KL1

S1 · -12V

S4 · b4 · a3 · a1 · +430V · +250V · -30V
6 TX13-1
10 TX13-1
7 TX13-1
8 TX13-1

S2 · a1 · b1 · +150V · c4 · c3
5 RC13-1 (duplex)
4 RC13-1 (simplex)
3 IA13-1
2 6,3V~ filament

11 o
12 ~

S1 · 01 · 0 · ~ Mains

NOTE 1. If extended LS is not installed short circuit terminal 1 and 2
If hailing LS — " — " — " — " — " — 1 and 3
Hvis ekstra højttaler ikke er tilsluttet, kortslut da klemme 1 og 2
Hvis proje Højttaler — " — " — " — " — " — 1 og 3

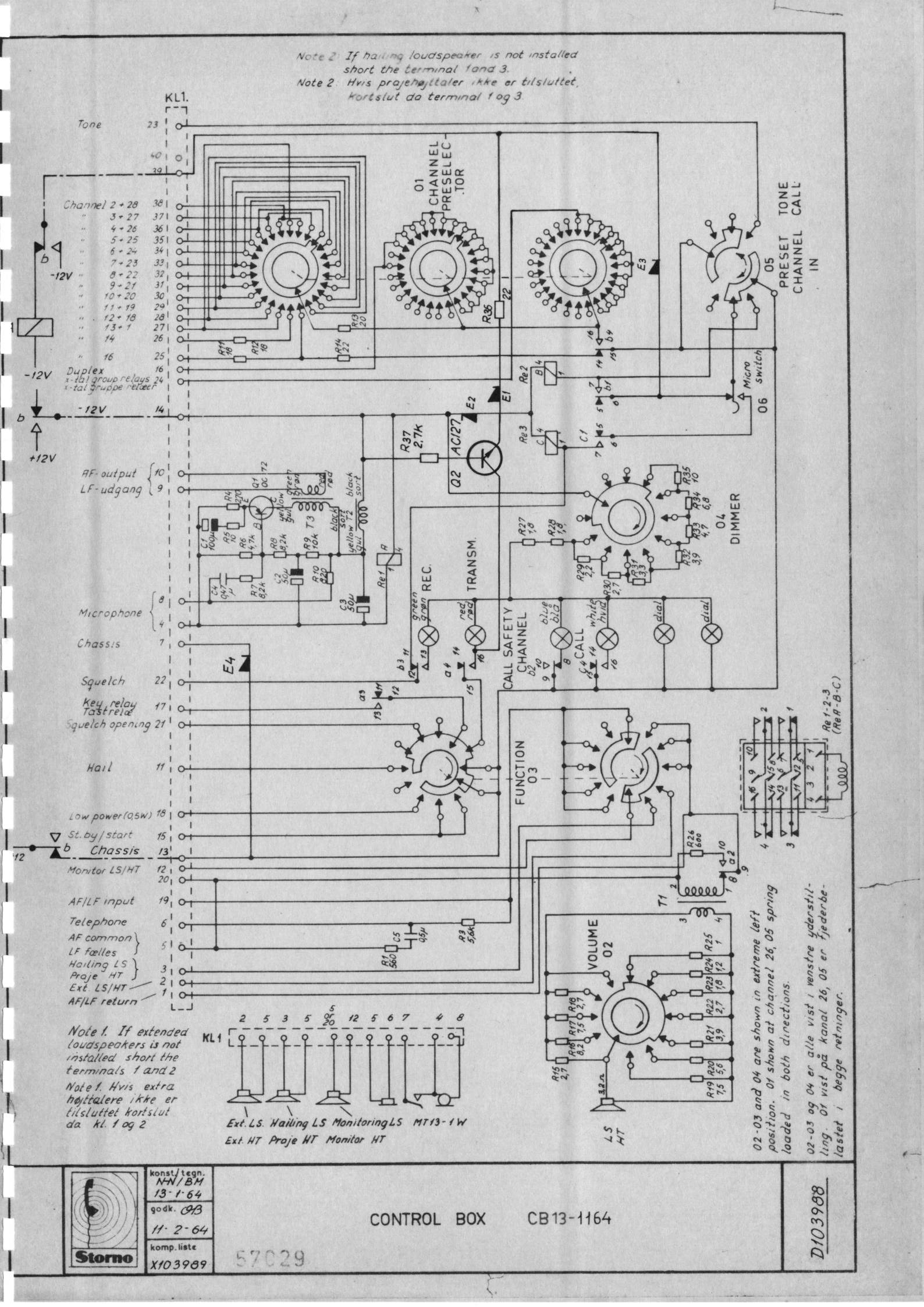
Storno

Konstr. Hegn	N-N/BM 20-1-64
godk	OB 11-2-64
Komp. liste	

MARITIME VHF RADIOTELEPHONE WITH TWO CONTROL BOXES CQF13-2

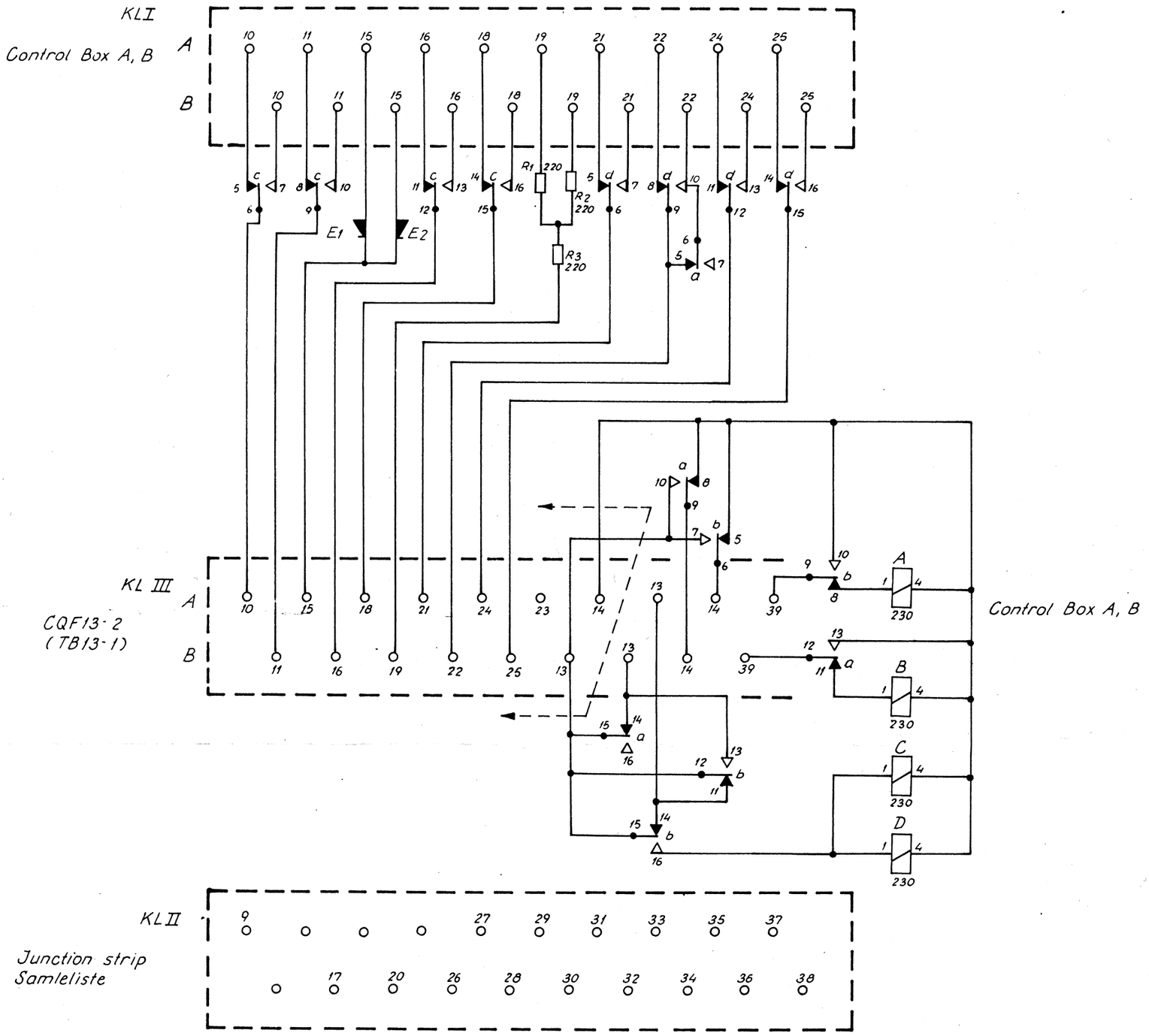
CB13-1164

D104010



Storno	konst./tegn. N-N/BM 13-1-64	CONTROL BOX CB13-1164
	godk. OB 11-2-64	
	komp.liste X103989	D103988

57029



R1-R2-R3: 220Ω Philips B8 305 07B/220E

E1-E2: I.R.E. 2E4.

ReA-B-C-D: Siemens Trls 154d 65418/93e.

Storno

konstr.sign. NN/BH 14.1.64

godk. 93 11.2.64

komp.liste

JUNCTION BOX
SAMLEBOX

JB13-1164

D103990

Storno

CHAPTER I. GENERAL DESCRIPTION

A. General

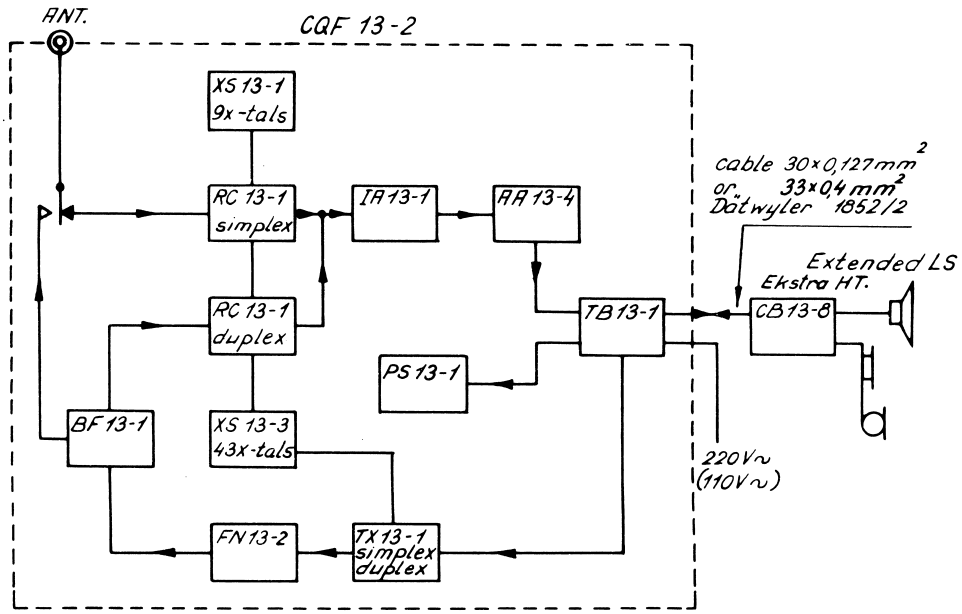
STORNO maritime VHF/FM radiotelephone equipment type CQF13-2 is especially designed for ship-to-ship and ship-to-shore communication within the frequency band 152 Mc/s to 174 Mc/s. It satisfies the requirements for maritime equipment as laid down by the Hague convention of 1957, and furthermore the STORNO MARINEPHONE possesses a number of special features that facilitates installation and operation.

The equipment is designed to provide dependable service under the most adverse climatic conditions. It is fully tropicalized and quality components are used throughout.

The radiotelephone may be used on all international frequency channels, for simplex and duplex operation as desired. Two receiver converter units that are partially independent of each other are used for these two types of operation.

A complete installation consists of the following items:

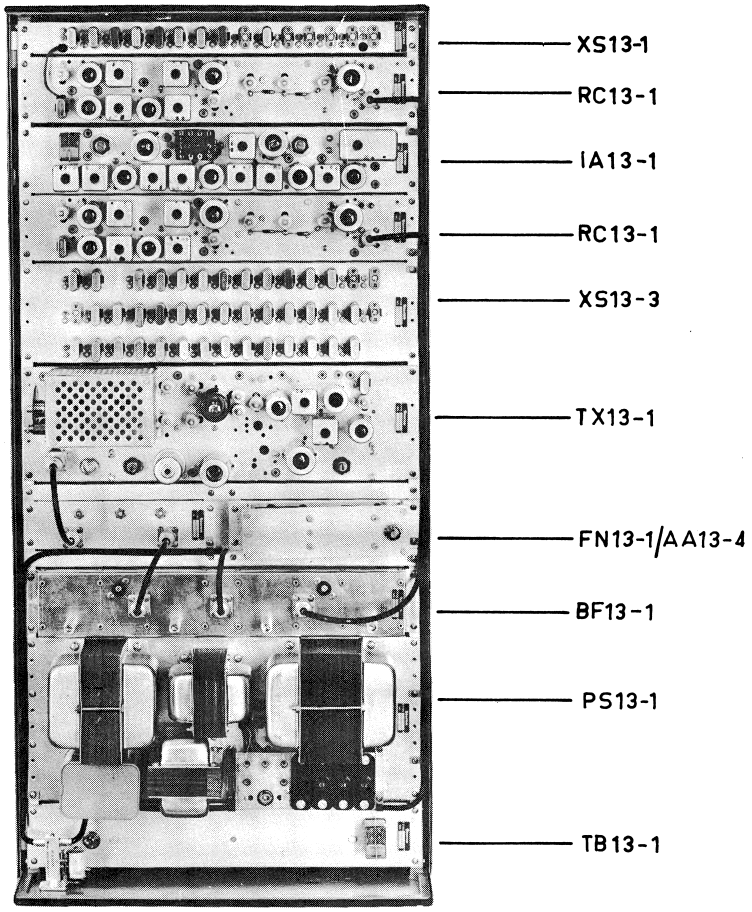
Wall-mounted cabinet containing transmitter/receiver
Remote control box with watertight handset
Omni-directional antenna
Possibly additional control box with handset and junction box
Installation accessories such as cables, connectors, etc.



Chapter I. General Description

Construction

The cabinet is designed for wall-mounting and can be fitted with shock absorbers if required. The cabinet is made up of a rear panel, which supports the common swinging frame for the radio subunits and it also provides a method of mounting the equipment to the wall. A dust cover is placed over the equipment and fixed to the rear panel with four quick release fasteners.



All modular subunits are mounted to the common swinging frame so that the valves lie horizontally at right angles to the front face. The rear of each modular unit is protected from dust and dirt by a plate, which is easily removed for servicing. In most cases the dust cover must be in place during alignment and operation as the frequency stability of the equipment otherwise may be affected.

The swinging frame construction leaves both sides of the equipment accessible - even during operation.

The main dust cover at the front has ventilation louvers at top and bottom to permit air circulation around the equipment.

The equipment is designed to be connected to 220 V or 110 V ac mains. However - only the main cabinet is connected to mains. The control boxes have supplied the necessary control voltages from the cabinet through the cabling.

Modifications

STORNO is constantly processing the experience gained during the production, testing, and operation of the company's radiotele-

phone installations. Minor modifications and changes will therefore appear from time to time. Information of this nature is listed on the last page in this Manual.

B. Notes on Installation

Introduction

It is of vital importance that the installation is made properly and in strict accordance with the directions. The excellent qualities of the radio equipment may be seriously impaired due to a scamped or incorrect installation, and the risk of catastrophic failure of the equipment is increased. It is therefore strongly recommended to read and follow the instructions in this chapter.

Packing

Immediately after reception of each consignment from STORNO each item should be unpacked and checked with the packing lists and invoices. If the goods are not as described, damaged, or not as ordered, the fact should be reported to STORNO immediately.

When returning equipment to STORNO for any reason whatsoever, the original container should be used if possible, and the final test report for the complete equipment must always be returned with the equipment, too.

Main Parts

The following items are required for a correct installation:

1. Transmitter/receiver cabinet CQF13-2.
2. Remote control box CB13-8a ("Master box")
3. Possibly remote control box CB13-8 ("Slave box")
4. Omnidirectional antenna AN11-21
5. Coaxial antenna cable RG-8/U with connector UG-21B/U
6. Mains cable NKTP 12519 2x0,75 mm
7. Control multi-cable (see below)
8. Loudspeaker cable (see below)
9. Max. three extension and hailing loudspeakers (not supplied as standard)
10. Handset type MT13-1 W (included in Control box)

Lay-out

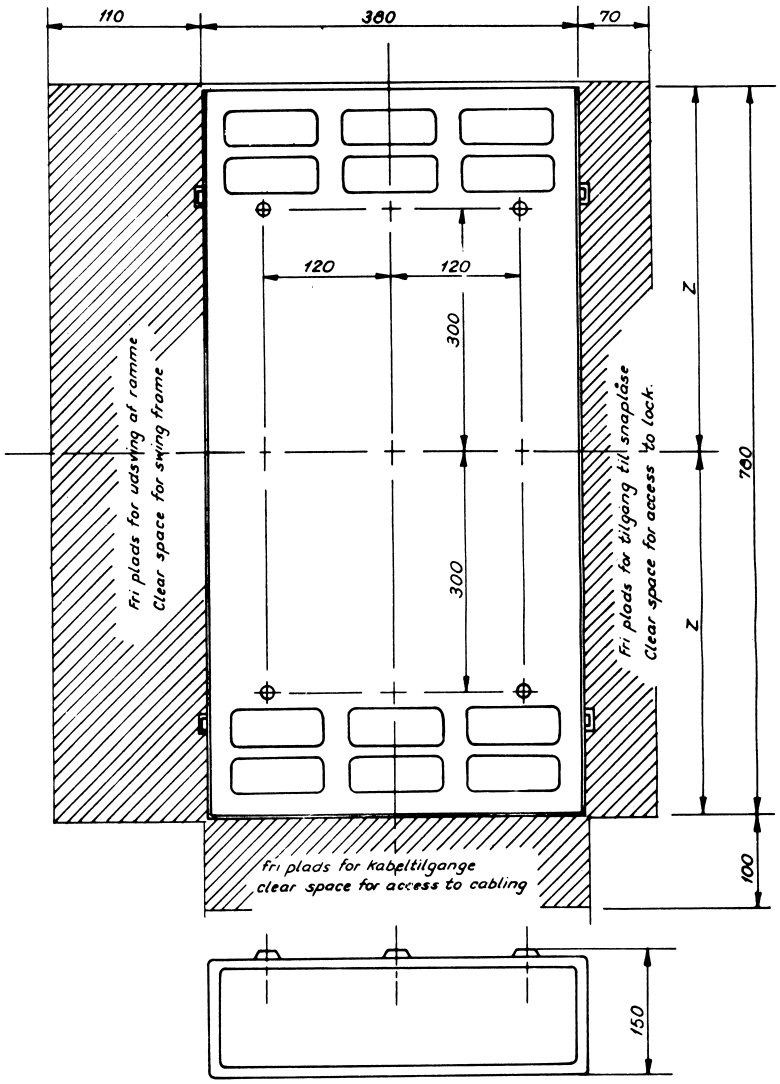
Before starting the installation work the cabling lay-out and the placing of cabinet and accessories must be decided. The cabinet must be mounted in a room, which is dry and well ventilated. The control box(es) must be placed at the ship's bridge or at any other convenient place within easy reach of the operator. The boxes and the handsets are watertight, but if possible they should be mounted at a site not directly exposed to rain or salt water. Depending of the cables used the boxes must not be placed more than 12 or 40 metres from the cabinet.

The loudspeakers may be placed at any convenient position as long as the loop resistance of the cabling does not become too high. The antenna can be mounted on top of a mast, but the coaxial feeder cable should be kept as short as possible.

The multi-cable must also be as short as possible. It should be kept absolutely clear of all movable parts and hot pipes. Furthermore the cable should be fastened by a sufficient number of cleats and relieved in all lead-in bushes and at sharp bendings.

Cabinet

The cabinet is designed for wall-mounting and can be fitted with shock absorbers if required. The cabinet is made up of a rear panel, which supports the swinging frame and also provides a method of mounting the equipment on the wall by 3/8" bolts or screws. The illustration below shows the overall dimensions of the cabinet.



Temperature

The ambient temperature of the room in question should not normally exceed 45°C. Occasionally it may rise to 60°C, but not for sustained periods. If the temperature remains above 60°C for more than an hour continuously, the equipment is considered to be operating under adverse conditions and damage may result.

The limits specified are based on continuous operation on standby/receive with intermittent operation of the transmitter 50 % of the time. A single transmitting period must not exceed one half hour. The equipment should not be operated at temperatures lower than -30°C.

The optimum operating range for an economic life of the components is between -10°C and +35°C. If necessary, an exhaust fan with thermostat control must be installed. In this case, dust filters at the fresh-air intake should be considered.

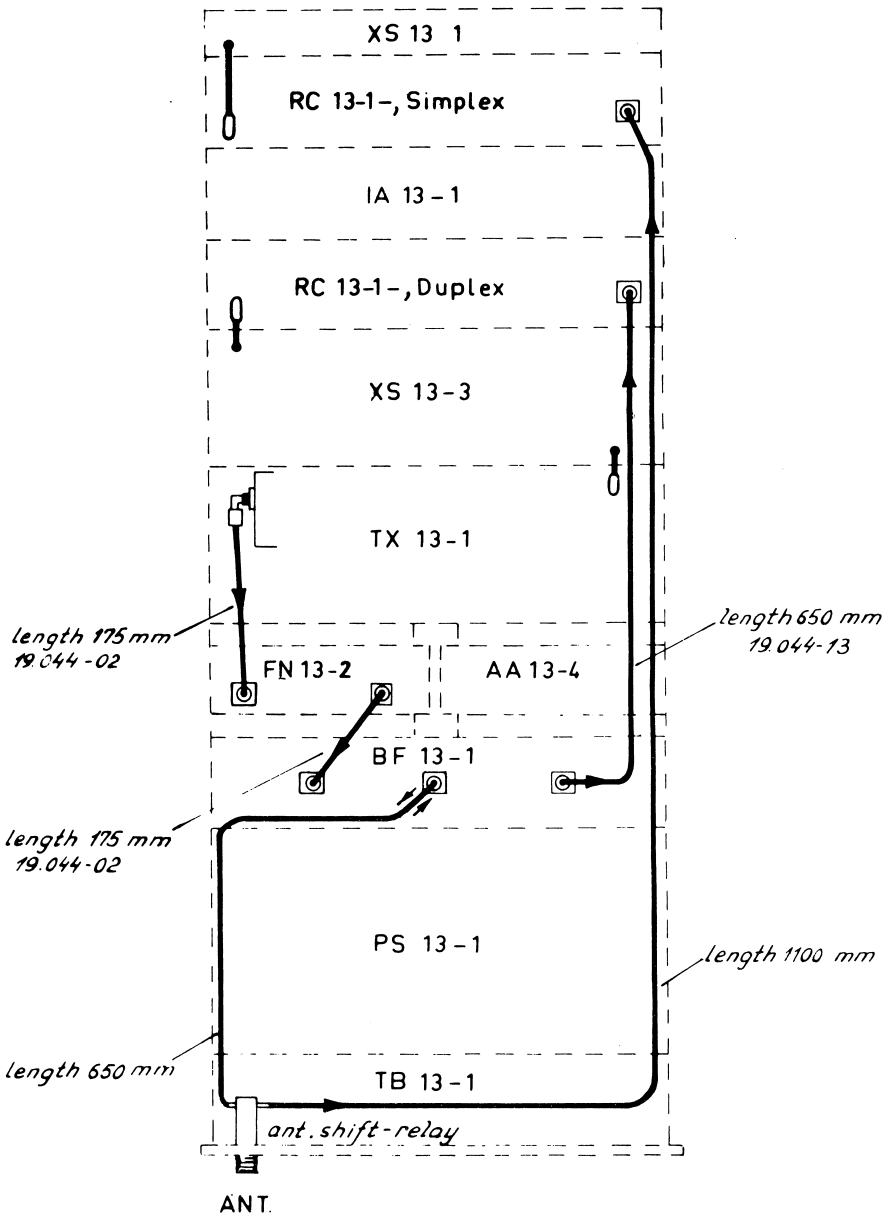
Mains Voltage

The supply voltage must be 110 V or 220 V ac, and in all other cases an autotransformer must be inserted. It is essential that the supply voltage be equal to the nominal value for the equipment. Random variations must never exceed 10 % - for best life of valves 5 %.

If necessary, voltage regulating transformers or other regulating devices must be provided. The equipment will - however - function with voltage variations up to ±20 %.

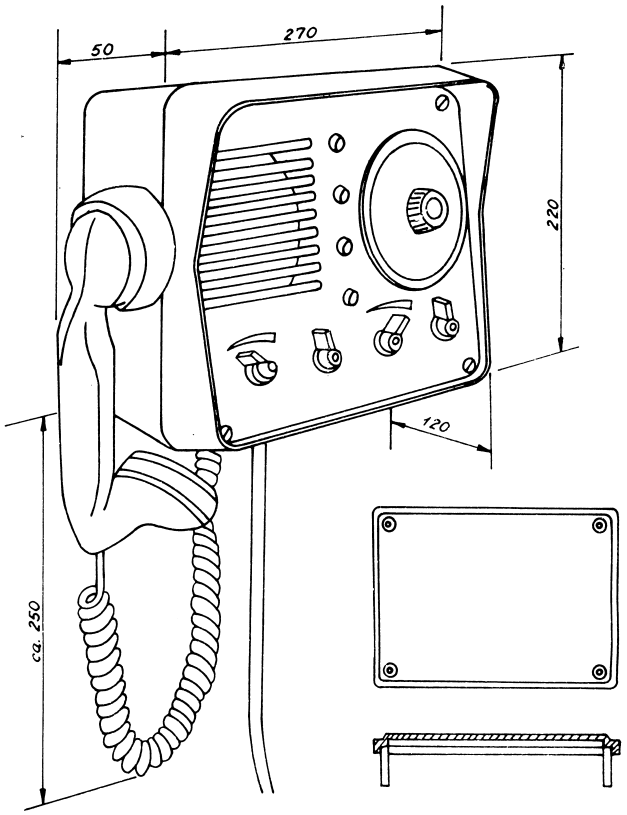
RF-connections

On the illustration is shown the RF-cabling between the modular subunits.



Control Boxes

The remote control box type CB13-8 contains all operating knobs and indicating devices necessary to operate the maritime radiotelephone equipment. The overall dimensions appear from the illustration.



For the suspension must be used screws or bolts the heads of which should not project more than 10 mm into the box. The suspension holes in the rear plate of the box may be drilled where desired, but it is recommended to use at least 4 suspension points.

In certain cases it is desirable to extend the control system with an additional control box. The priority box is then named "master box" and is of the type CB13-8a, while the "slave box" is of the type CB13-8.

Master Box

The "master box" should be mounted in such a position that the handset and controls are easily accessible for the operator. The control of the radio station lies entirely at the "master box", which at any time can interrupt the communication from the "slave box".

Slave Box

If a "slave box" is to be connected to the system a special junction box JB13-1 must be used to branch off the cable from the radio cabinet. Depending of the type of cable used the maximum total length from cabinet to each to the control boxes must not exceed 12 metres or 40 metres respectively.

A total of 17 wires are branched to either box, while the remaining wires are relay-branched. When the relays are de-energized, the control of the radio station lies at the "master box".

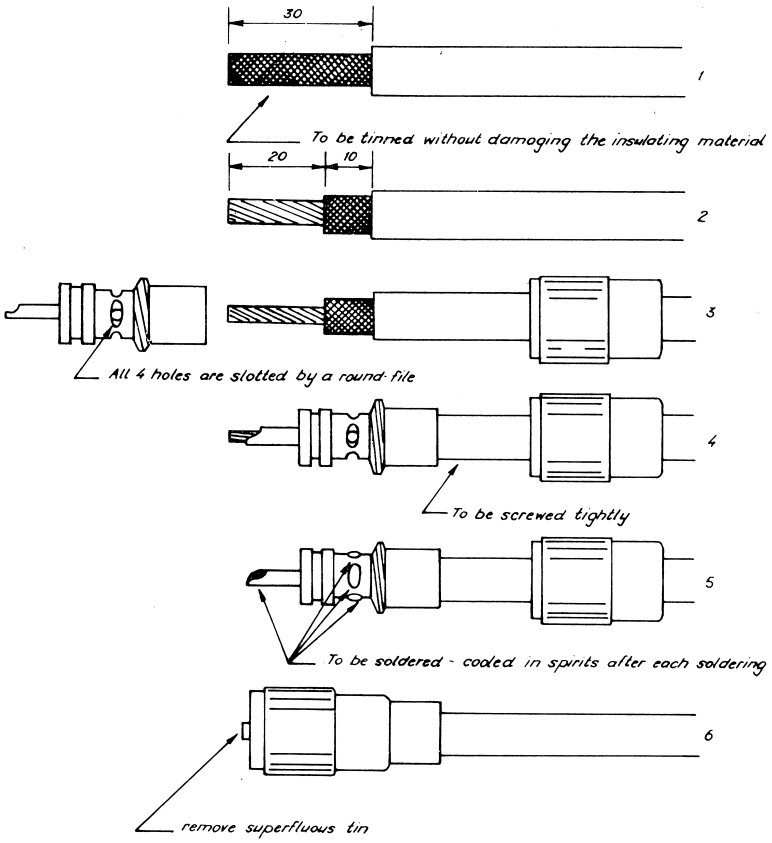
Take care that the start relay in the radio power supply PS13-1 has its contacts a1 and a2 shorted.

Mains Cabling

For the mains supply cabling should be used a 2 x 0.75mm^2 cable. Furthermore it is advisable to install a main circuit breaker next to the cabinet together with a main fuse (min. 2 Amp. at 220 V, min. 4 Amp. at 110 V).

Antenna Cabling

The suspension of the connector PL 259 to the coaxial antenna cable RG-8/U should be made according to the procedure shown in the illustration.



Antenna Mounting

The antenna should be placed as high and as clear as possible in order to obtain the best possible matching and radiation.

Erection of an antenna too close to an obstacle (e.g. the radar antenna reflector, the smoke-stack, etc.) may introduce an undesired directivity.

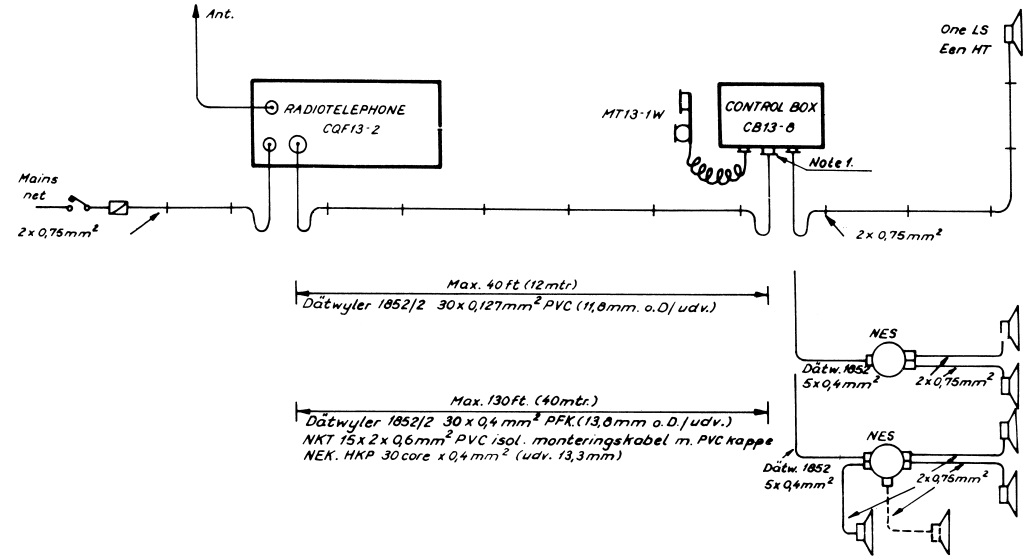
Main Cabling

For the cabling between cabinet and boxes the following cables are recommended:

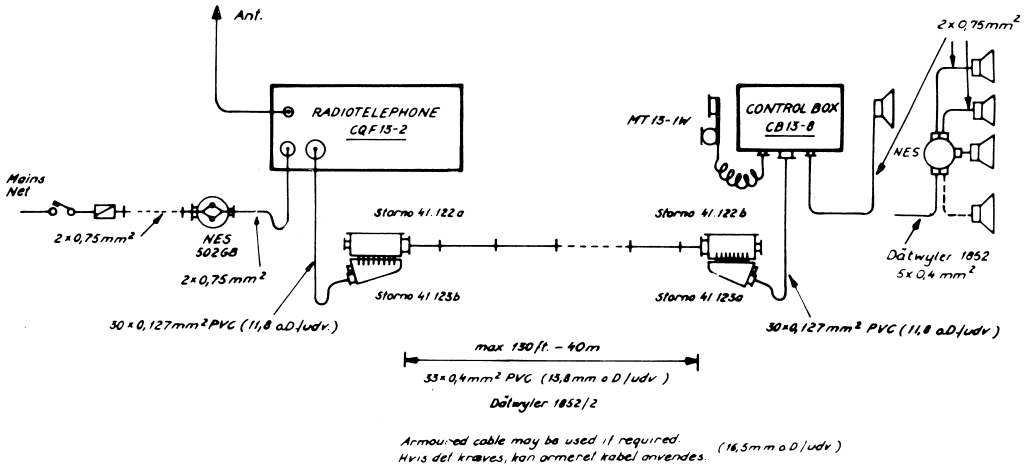
a) 30 x 0,127 mm^2 plastic covered with an external diameter of 11,8 mm (7/16"). Suitable for lengths up to 12 m (39 ft).

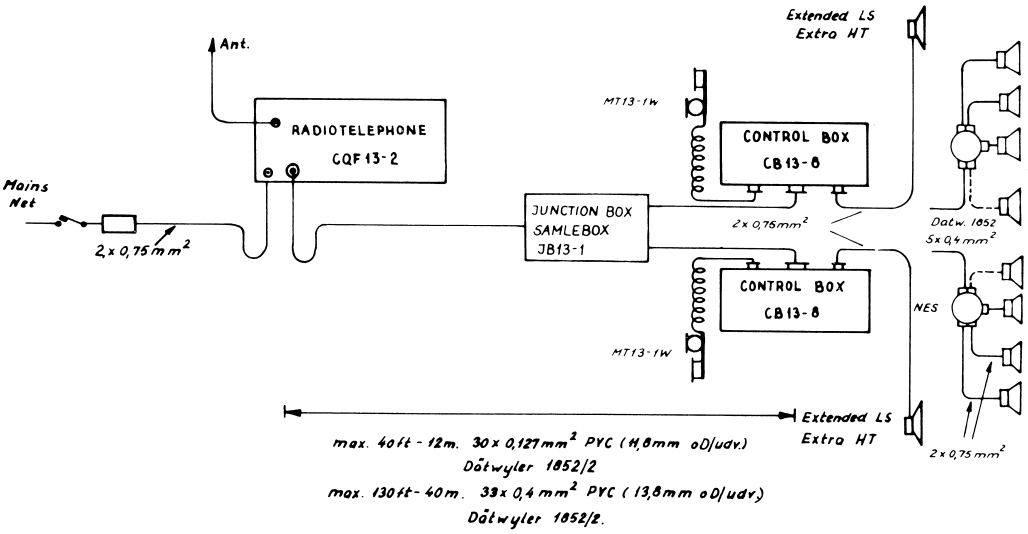
b) 33 x 0,4 mm^2 plastic covered with screen, external diameter 13,8 mm (17/32"). The screen is also used for chassis return purposes. Suitable for lengths up to 40m (125 ft) in connection either with special rubber gaskets in the watertight glands in cabinet and boxes or in connection with two short lengths of cable a) and two waterproof junction boxes.

Chapter I. General Description



Note 1. If necessary the cable from CQF13-2 is fitted to CB13-8 by means of rubber gaskets (code nr. 32.087)
Kablet fra CQF13-2 tilpasses om nødvendigt CB13-8 ved hjælp af gummipakninger (Kode nr. 32.087)





c) 33 x 0,4 mm^2 armoured, plastic covered with an external diameter of 16,5 mm (11/16") Diameter of cable is 13,8 mm (17/32"). The screen is also used for chassis return purposes. Suitable for lengths up to 40 m (125 ft) in connection with two short lengths of cable a) and two watertight junction boxes.

For lengths above 40 metres (125 ft.) must be used a special cable with either more wires or greater wire dimensions depending upon the total length required.

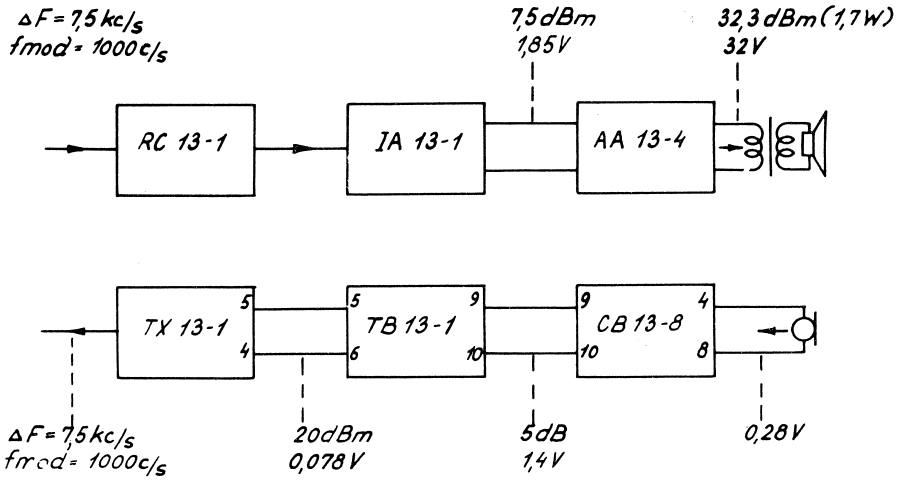
Loudspeakers

Up to three extra loudspeakers may be connected to the system. A hailing loudspeaker can be connected to terminals 2 and 3 and an external loudspeaker can be connector to terminals 1 and 3. Furthermore a monitoring loudspeaker can be connected to terminal 20 and 12. The hailing and the external loudspeaker should contain a 600 Ω matching transformer, while the monitoring loudspeaker should have a matching transformer of at least 6000 Ω and furthermore contain a volume control or an on/off switch.

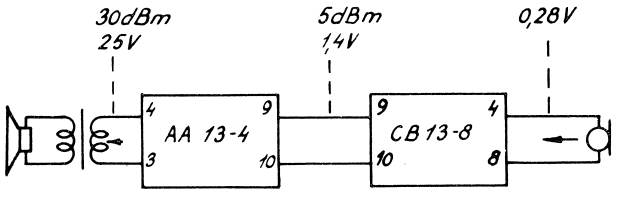
A junction box is used for branching off the different loudspeaker cables (2 x 0,75 mm^2). If a hailing loudspeaker is not used, terminals 2 and 3 must be shorted, and if an external loudspeaker is not used, terminals 1 and 3 must be shorted.

Initial Testing

Normally the equipment has crystals fitted and it is tuned and set for immediate operation, but if required the equipment may be supplied without crystals. Thus the station must be aligned in strict accordance with the alignment procedure given later in this manual.



Receiving and transmitting
Modtagning og sending



Hailing

However - it is recommended that the equipment has the crystals fitted at STORNO, as the initial setting up requires measurements of frequencies in the range 6 to 10 Mc/s with an accuracy of more than 2×10^{-6}.

Do not attemp any initial testing before carefully reading through the whole instruction manual. Switch on one group of units at a time and check operation by means of a service meter and the numbered testpoints. Comparison between figures in supplied test report and readings may prove valuable.

If operation is not successfull at first, check for installation faults, defective valves, etc. The equipment has been tested and operated at the factory before shipping, for which reason defects in workmanships can be said to be rather rare.

WARNING

Do not attemp to retune factory-set and locked circuits. This may necessitate extensive realignment work later on. This is particular important with respect to the branching filter. Do not remove the cover plate merely for inspection, but only when a fault is narrowed down to the filter itself. If the plate is removed and replaced, it is necessary to make a complete retuning of the branching filter.

Interference Suppression

If noise is present, such as noise produced by comutation, spark plugs, telegraph apparatus, etc. weak signals will be difficult to hear and therefore some suppression of the noise source will be necessary. The equipment itself has been designed to attenuate such interference by using ferrox beads, decoupling capacitors and coils wherever possible.

In all interference suppression problems, the cure is largely at matter of trial and error. Location of the interference and suppression of it with the aid of capacitors and chokes will reduce the interference to a practical minimum.

Generally the addition of capacitors across the brushes of a commutator will suffice. With high voltage systems (spark plugs on an internal combustion engine) a high resistance in series with the plug and capacitors on coils and distributors will be sufficient.

Much of this interference is picked up by the antenna so the antenna must be mounted as high and as far as possible from the offending equipment.

C. Fault Finding and Maintenance

When the maritime radiostation CQF13-2 has been correctly installed and checked for satisfactory operation it should not thereafter be left to itself until breakdowns occur. Every equipment should be inspected at regular intervals and readjusted if necessary. The frequency of such routine inspections will depend on the conditions under which the equipment is operated and on the total number of operating hours, but one year is the maximum time that should be permitted to elapse from one preventive service to the next.

Through conservative dimensionning of the circuits employed in the radio station the STORNO company has created a piece of radio equipment that may be expected to have long life.

Testpoints

All significant currents and voltages are specified in the circuit diagrams. All modular units moreover have marked metering testpoints to permit rapid checking of the operational condition of the equipment. These DC testpoints are shown on the units as a circle with a figure, thus ①. All measurements are taken with respect to ground with a ammeter with an internal resistance of 1000 Ω and a 50-0-50 uA scale. The STORNO service instruments types SI05, SI06 and SI07 have been designed for such applications.

Test Report

Each radio station shipped from the factory is accompanied by a final test report giving the testpoint readings for that equipment as read by the Final Testing Department. This test report will provide a useful standard of comparison when future checks are being made. On the whole, it is a good plan to keep a sort of "log" of the check readings, seeing that comparison of readings made over a certain period of time will provide the radio technician with a good picture of the general condition of the station. Also, such comparisons will clearly show when readjustments and valve replacements should be made.

Routine Inspections

A normal routine inspection should comprise a complete check of all testpoints in the equipment, and in addition to this the following operations should be made:

1) Remove dust and dirt from the equipment by means of a soft brush or through cautious use of compressed air.
2) Inspect visually valves, transistors, diodes, etc. Fasten any component that may have worked loose.
3) Check the supply voltage
4) Check cable connections for corroded joints and broken leads.
5) Measure the output power delivered by the transmitter and readjust the PA-circuit and the antenna link if necessary.
6) Measure the receiver sensitivities and readjust the receiver input circuits if necessary.
7) Check locks, surfaces, etc. for incipient rust or corrosion. Be careful when cleaning the surfaces so that rust and particles of enamel will not get into the station cabinet.
8) Clean relay pins and contact surfaces.
9) Check the antenna mounting, the feeder cable and measure if possible the standing wave ratio of the antenna.

Fault-Finding

Fault-finding should be performed only by skilled personnel, who have the necessary measuring instruments at their disposal and have acquainted themselves with the functioning of the equipment.

Simple Faults

Simple faults may be divided into these groups:

a) Faults due to causes outside the cabinet.
Such faults can be supply voltage failures, absence of modulating signal, faulty connections in cable connectors, defective antenna, etc. The recognition of such faults are easy.
b) Faulty adjustment of the signal circuits.
Such faults arise gradually, which is clearly seen when

comparing the "log" figures over a certain period of time. The proper realignment of the circuits around the said test-point will restore the equipment.

c) Defective valves, transistors, or diodes, and faulty connections in valve sockets or relay sockets.
Such faults can be traced partly by measuring the voltages and currents given on the diagrams with a 20.000 Ω/V multimeter and partly by a complete test of the functioning of the equipment.

d) Burned-out resistors, broken wires, shorted capacitors, etc. Such defective components or broken wires can be found visually. However - great care should be displayed when replacing a component that the wiring and placing is exactly as before.

However, repairing a fault that has been located is not always enough. Especially in the case of fault of the type described under c) and d) it is important that the cause of the fault be found and steps be taken that will prevent the fault from occuring again.

Complicated Faults

If a fault cannot be classified as a "simple fault", a more methodical approach will have to be employed. General rules cannot be laid down, but since the equipment is composed of modular units the best plan is usually to try to locate the defective modular unit, thereafter proceeding to inspect and check that unit in detail.

Spare Parts

When ordering spare parts reference should be made to the code number given in the parts lists. Also the type and serial number of the particular subunit should be quoted.

D. Technical Specifications

For detailed technical specifications of the subunits are referred to the section E. Additional Technical Specifications in chapter II.

Frequency Range

152 Mc/s to 174 Mc/s.

Frequency Deviation

Maximum ±15 kc/s.

Frequency Stability

Better than $\pm 15 \times 10^{-6}$ within the ambient temperature range $-10^{\circ}C$ to $+40^{\circ}C$.

Antenna Impedance

50 Ω nominal.

Maximum Frequency Separation between Extreme Channels

1,4 Mc/s at 3 dB points.

Transmitter

Output Power

20/0.5 watt.

CHAPTER II. DESCRIPTION OF SUBUNITS

A. General

Module Units

The MARINEPHONE radiotelephone equipment CQF13-2 contains the following subunits as a minimum:

TX13-1	20/0.5 watt transmitter unit with 7 valves
FN13-2	Antenna filter subunit
RC13-1	Simplex receiver converter with 5 valves
RC13-1	Duplex receiver converter with 5 valves
IA13-1	IF-amplifier for 50 kc/s spacing with 6 valves
PS13-1/1a	Common power supply for all subunits
XS13-1	Crystal shift unit for simplex receiver converter crystals
XS13-3	Crystal shift unit for simplex/duplex transmitter crystals and duplex receiver converter crystals
AA13-4	Audio amplifier
TB13-1	Terminal panel
BF13-1	Duplex antenna branching filter

The module subunits mentioned above are detailed described on the pages following. Diagrams and parts list are found in chapter IV.

B. Transmitter Section

The transmitter section comprises description of the transmitter subunit TX13-1 and the antenna filter subunit FN13-2.

TX13-1

TX13-1 is a FM transmitter designed for communication within the frequency range 152-174 Mc/s. It is phase modulated and supplied with two modulation inputs, a speech channel with modulation limiter, which operates in the range 300 to 3000 c/s together with a tone channel which has a range of 300 to 8000 c/s. The maximum frequency deviation is 15 kc/s up to 3000 c/s. The transmitter is crystal controlled with a frequency stability better than $\pm 15 \times 10^{-6}$ within normal temperature range.

Mechanical

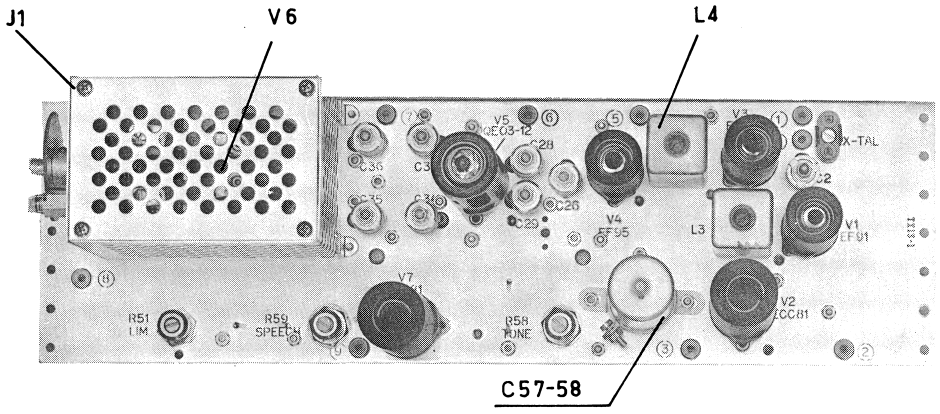
The transmitter, which occupies 4" of rack space, is built on the module principle and fits into a swinging frame. The swinging frame is mounted on a back plate, which in turn may be mounted in a standard 19" rack.

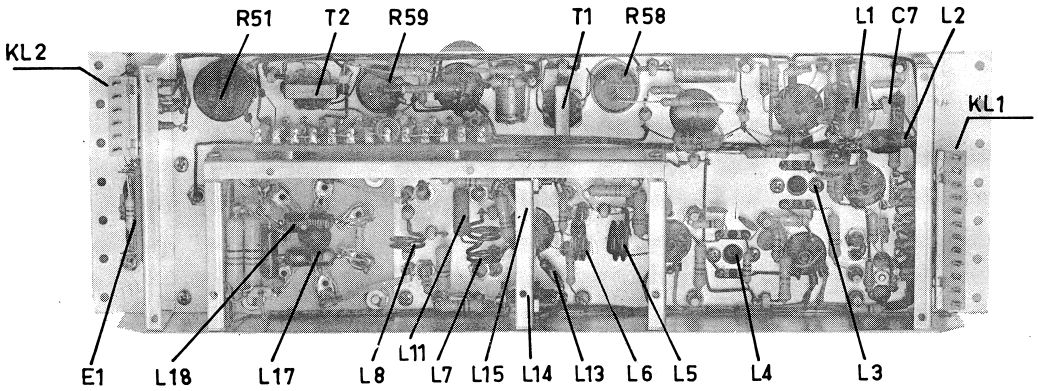
All power leads and signal carrying leads out or into the unit are fed through capacitors and ferrox beads. The chassis is screened with a backplate which helps to stabilize the transmitter and to prevent dust and dirt from entering.

Electrical

The crystal oscillator and phase modulator is followed by a frequency multiplier chain which has a factor of 24. The output is a push-pull amplifier, capable of giving approximately 25 watts.

The crystal oscillator (V1) is a Pierce-Colpitts circuit and the crystal is connected across the screen and control grid. This arrangement gives a reasonably good stability against voltage variations. When a separate crystal shift unit is used the connection is made to the crystal socket on the transmitter chassis as the twin-lead output from the crystal unit terminates in a crystal holder. Because this connecting lead is to be as short as possible, the crystal unit must be mounted immediately above the transmitter unit.





Phase Modulator

The oscillator output is fed via the phase shifting network L1-C7, L2 and the coupling capacitor C8 to the phase modulator PM (V2a) which is half an ECC81. The outputs from the speech limiter and the tone input circuits are also fed into the phase modulator. The principle of phase modulation produces a large deviation for a low input level. The output voltage of the phase modulator may be measured at testpoint 3.

Doubler and Quadrupler

The phase modulator is followed by a doubler stage DB (V2b) which is one half of an ECC81. The plate circuit L3, a double filter, is tuned to the second harmonic of the crystal frequency and the output is directly coupled to the quadrupler V3. L4 is tuned to the 8th harmonic and resonance may be indicated on a meter connected to testpoint 5.

Tripler

From the quadrupler the signal is fed to a tripler stage V4 which is an EF95. The tuned plate circuit is adjusted by C26 to

resonate at the 24th harmonic of the crystal fundamental, which is the output frequency. The input to the driver stage is directly coupled to the push-pull driver stage through L5 and L6 and it is balanced by the trimmers C28 and C29. The grid voltage may be checked at testpoint 6.

Driver

The driver stage DR (QQE03/12) is a tetrode operating in push-pull which amplifies the signal and feeds it to the power stage. The correct frequency is filtered out by L7 and L8. The output valve is a QQE03/20 and also operating in push-pull, and it delivers approximately 25 watts of power to the antenna connector J1. C38 is a butterfly capacitor used for tuning the last circuit. A small probe in the proximity of the antenna coupling coil L10 picks up a signal, which is rectified by E1 and fed to testpoint 8 and to an external connection. This DC voltage is proportional to the output power and therefore used as a monitor.

Monitor

All valves in the transmitter are protected from damage if the drive should fail. This is achieved by a fixed negative bias and the use of cathode resistors.

Modulators

The transmitter modulator stage has two balanced inputs, one for tones and the other for speech. The tone circuit is a simple matching transformer circuit and the amplitude of the signal is controlled by R58. The range for the tone channel is from 300 to 8000 c/s, but by connecting in the 48 uS circuit, the band is from 300 c/s to 3400 c/s.

Speech Limiter

The speech channel consists of a speech limiter and an amplifier with pre-emphasis and de-emphasis circuits, which correct the modulation before feeding it to the modulator stage.

From the transformer and the level setting potentiometer, the signal is fed via the differentiating circuit C68-R57 to the grid of the speech limiter valve V7a. The amplified signal is then fed via the clipper diodes E2 and E3 and the integrating circuit consisting of R48-C63, to the AF valve V7b. Negative feedback is supplied to the valve by C60-R46, C61-R45, which gives the stage a low-pass characteristic with a cut-off at about 3000 c/s. Thus the harmonic distortion products due to the speech limiter are attenuated so they do not pass to the modulator and the danger of modulation splatter in neighbouring channels is greatly reduced.
The clipping level potentiometer R51 is normally set to give a frequency deviation of ±15 kc/s. The output from V7b is fed via the terminal strip to the grid of the modulation valve.

The filament circuit may be used with 12.6 or 6.3 V and is not grounded. If 6.3 V is used, then terminals 2 and 4 must be joined.

FN13-2

The filter FN13-2 is a low-pass filter designed to attenuate the spurious radiation from a transmitter working in the range 152-174 Mc/s.

The filter consists of four T-sections, combined to form a constant K filter with an impedance of 52 Ω.

Properly loaded with 52 Ω the filter has a band-pass range of 0 - 220 Mc/s. However, some rippling above 174 Mc/s may reduce the use of the filter above this frequency.

C. Receiver Section

The receiver section comprises description of the receiver converter subunit RC13-1 and the intermediate amplifier subunit IA13-1.

RC13-1

The receiver converter amplifies the received antenna signal and converts it to the second intermediate frequency of 455 kc/s. One crystal is used together with a frequency multiplier chain to produce the sixteenth harmonic, which is mixed with the incoming signal to produce the first intermediate frequency of approximately 10 Mc/s. The fundamental frequency of the same crystal is mixed with the first intermediate frequency to produce the second intermediate frequency. The converter is used in connection with a 455 kc/s IF-amplifier, which is a separate subunit.

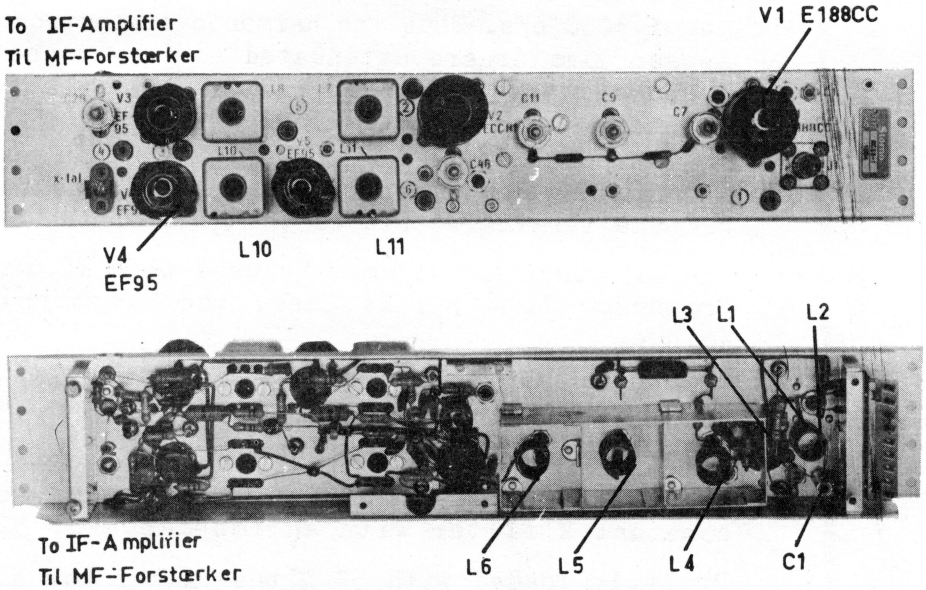
R.F. Circuits

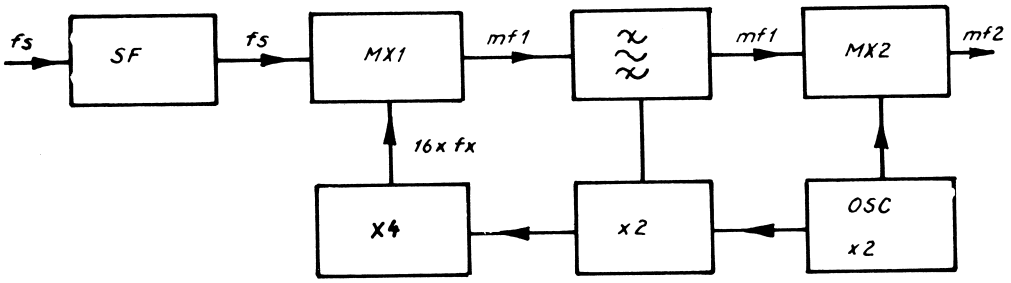
The antenna signal is fed via the antenna connector J1 to the antenna link L1, which is inductively coupled to the circuit C1-L2 in the RF-amplifier V1. V1 is a double triode type E188CC, connected in cascode. The cascode stage is followed by a triple band-pass filter C7-L4, C9-L5 and C11-L6 which gives the receiver a large input selectivity.

The signal is then fed to the control grid of the first mixer stage MX1 (V2a) together with the local oscillator frequency, which is the 16th harmonic of the fundamental crystal frequency. V2a is one half of a double triode ECC81, the other half forms part of the crystal multiplier circuit.

The plate circuit of the first mixer contains a two-circuit filter L7, followed by a similar filter L8, which selects the resultant frequency and feeds it to the grid of the second mixer valve MX2 (V3) which is a pentode M8100/5654.

The crystal fundamental is also fed to the grid of the mixer valve MX2 (V3).





Mixing

From the diagram it can be seen that double superhetrodyne reception with only one crystal is used and that the first intermediate frequency is dependent on the signal frequency.

$$f_s = 16\, f_x + If_1 \qquad (1)$$

$$IF_1 = f_x + 0.455 \text{ Mc/s} \qquad (2)$$

Solving for f_x'

$$f_x = \frac{f_s - 0.455}{17} \text{ Mc/s} \qquad (3)$$

where f_s is the input frequency in Mc/s.

Solving for If_1'

$$If_1 = \frac{f_s + 7.28}{17} \text{ Mc/s} \qquad (4)$$

From (4) it is seen that the change of the 1st intermediate frequency for a given change in signal frequency is:

$$\Delta If_1 = \frac{\Delta f_s}{17}$$

Multiplier Circuits

The oscillator and 1st doubler, which is a pentode of the type M8100/5654 is a Pierce-Colpitts oscillator with the crystal inserted between the control and screen grids. This arrangement allows the crystal to operate at a very low level and the frequency is independent of normal variations of plate and filament voltages. The oscillator plate circuit L10 is tuned to the second harmonic and the signal is fed to the second doubler stage via C37. The oscillator frequency is also fed to the grid of the 2nd mixer from the screen grid.

The second doubler is also M8100/5654 whose plate circuit is tuned to the fourth harmonic of the fundamental by the two-stage filter L11. Oscillator and 2nd doubler grid currents can be measured at test points 4 and 5. The secondary of L11 is coupled to the quadrupler QD, which is the half of an ECC81 (V2b). The quadrupler grid current can be measured at test point 6. In the plate of V2b, the 16th harmonic is filtered out by C46-L12 and fed to the first mixer valve.

Crystal Shift

A separate crystal shift unit must be employed and placed in a position next to the converter unit. The normal method of mounting is side by side in a rack or cabinet. Connection from the crystal unit to the converter is via a short piece of twin-lead cable which is terminated in a crystal holder. The crystal holder is then plugged into the socket on the converter.

The IF output of 455 kc/s is fed to the IF-amplifiers via a hole in side of the chassis.

Power Supply

The power for the unit is supplied by a separate supply and is connected to the converter via feed-through capacitors and ferrox beads. A screening plate protects the unit from dust and dirt and also tends to stabilise the receiver.
The heaters may be connected for 6.3 or 12.6 volts operation, but when using 6.3 volts, terminals 6 and 7 on K1.1 are shorted together.

IA13-1

The I.F. amplifier subunit amplifies the 455 kc/s signal from the second mixer stage in the receiver converter subunit, and after having passed limiting and demodulating circuits the signal is amplified to a suitable level in a line amplifier stage. The subunit also provides a noise operated squelch circuit with facilities for extension of alarm circuits.

I.F. stages

The 455 kc/s I.F.-signal is amplified in two stages comprising a total of 3 filters each containing 4 double-tuned circuits (L1/L2 = V1 - L3/L4 - V2 - L5/L6). The amplifier stages are provided with a special AVC-circuitry by which each stage generates a control voltage of its own by grid rectification.

Limiter

The I.F. amplifier is followed by two limiter stages (V3 and V4) having different time constants in order to reach the best possible static and dynamic limiter characteristics. A coupling circuit L7 forms the connection between the two limiter valves. The bandwidth of this circuit is large, and it contributes practically nothing to the total selectivity of the receiver.

Discriminator

The de-emphasis network gives a -6 dB/octave de-emphasis within the range 0.3 to 3.0 kc/s and a flat characteristic above 3 kc/s. A -6 dB/octave response covering the whole range 0.3 to 8.0 kc/s may be obtained by short-circuiting R53 and a flat response may be obtained by open-circuiting the network C43-R35.

Line amplifier

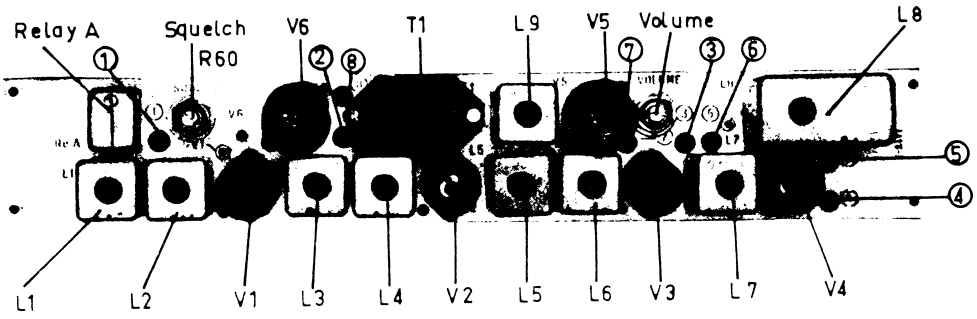
The line amplifier (V5a) amplifies the de-modulated signal to the desired output level.

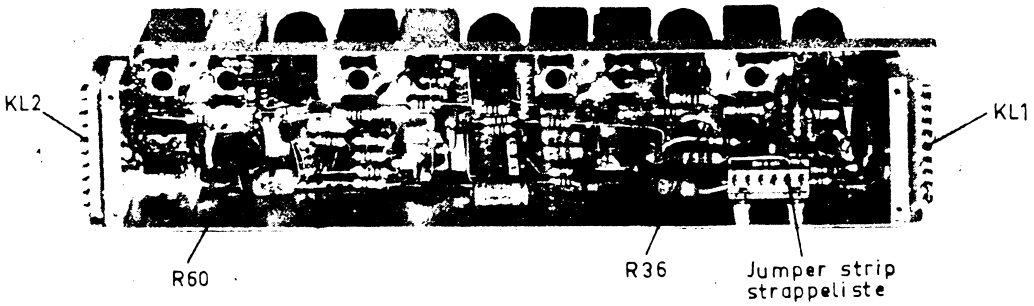
Current feedback in the cathode of the line amplifier valve (V5a) via R38 provides for low distortion and correct output impedance (600Ω). The output level is adjusted by potentiometer R36.

Squelch

The squelch circuit consists of a noise amplifier valve (V5b) a combined filter and detector network (L9), and a squelch valve (V6).

The signal which controls the operation of the squelch circuitry is taken from the discriminator. The signal is amplified in V5b, and all frequencies below approx. 20 kc/s are strongly attenua-





ted in L9. The noise signals are rectified and applied to the grid of the squelch valve (V6a). The rectified noise voltage is positive with respect to ground and to this voltage is added a negative bias voltage, which is taken from the grid of the second limiter valve across R59 - R60. This bias voltage is adjusted by potentiometer R60, and therefore this potentiometer is used for adjustment of the receiver squelch sensitivity. The relay (A) is energized, when a signal is received. If the signal disappears, the rectified noise voltage increases, V6a conducts, the squelch relay (A) is de-energized, and contact a2 breaks the current flow through the line amplifier valve (V5a), and the signal path through the receiver is interrupted.

Alarm

Contact a1 on the squelch relay is brought out to terminal strip kl.2 and may be used for external alarm purpóses.

Filaments

The filament circuits are connected in such a way that the valves may be operated on 6.3 V or 12.6 V which ever is most convenient.

Test points

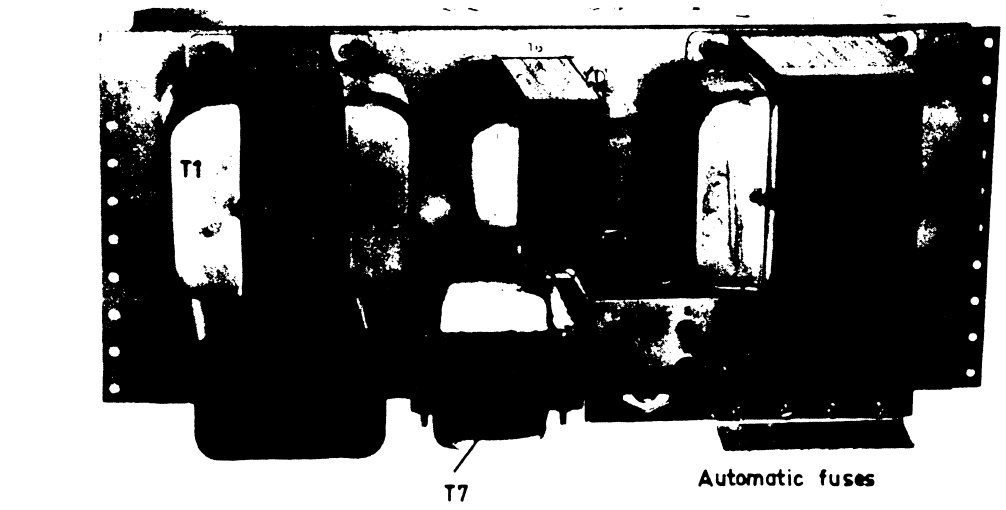
The unit is provided with numbered test points at which the most important currents and voltages can be measured. The grid current in limiter 1 and the discriminator output voltage may also be measured at terminal strip kl.2.

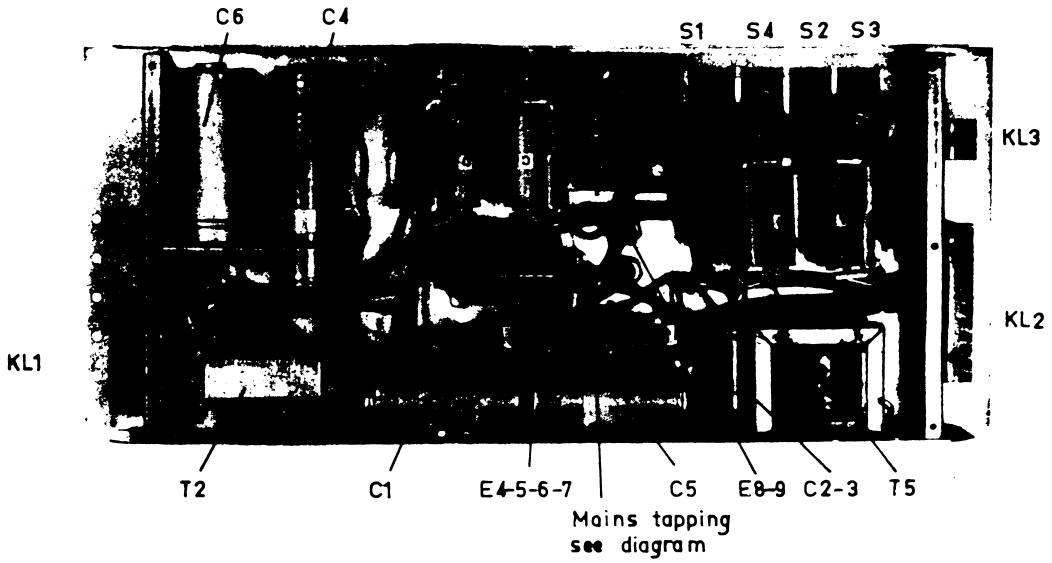
D. Common Subunits

The common subunit section comprises description of the power supply PS13-1/1a, the crystal shift units XS13-1 and XS13-3, the audio amplifier unit AA13-4, the terminal panel TB13-1 and the antenna branching filter BF13-1.

PS13-1, -1a

The PS13-1/1a is a mains driven power supply which provides the equipment with the necessary operating voltages. There are three separate transformers which are independently fused on the primary side to supply these voltages. The outputs may be measured at the appropriate test-points.





Conversion

The unit is designed to operate from 110 or 220 volts AC. Conversion of the unit from one input voltage to the other is achieved by connecting the appropriate terminals on the mains tapping strip as shown on the circuit diagram. It is also necessary to change the fuses in accordance with the parts list.

Fuses

The fuses may be used as mains on-off switches, as the mains is removed from the transformers when the fuses are tripped, but the mains is still applied to the equipment via a terminal panel.

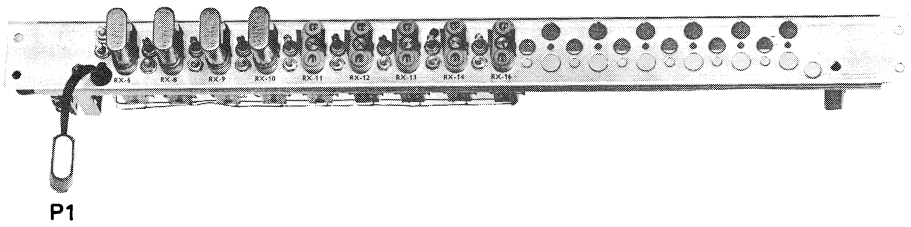
Fuse Panel

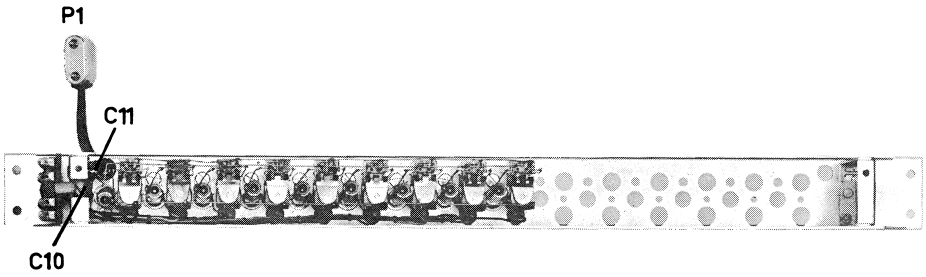
A small panel carries the automatic fuses, test-points and a pilot light which is lit when mains is applied to the equipment when the fuse S1 is closed.

XS13-1

The Crystal Shift Unit XS13-1 is designed for use with the receiver converter unit. The 9 crystals are switched by means of relays and both terminals are switched simultaneously. The crystals not in use are shorted. Each crystal has a trimmer capacitor of its own, which is part of the loading capacity and therefore the trimmer determines the exact frequency. The ca-

pacitor is adjusted to set the frequency but only when suitable frequency measuring equipment is available.



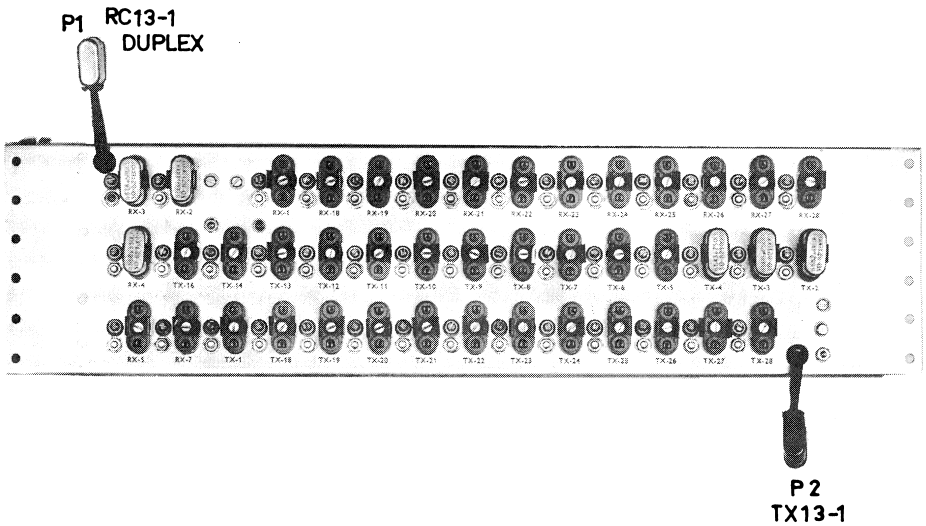


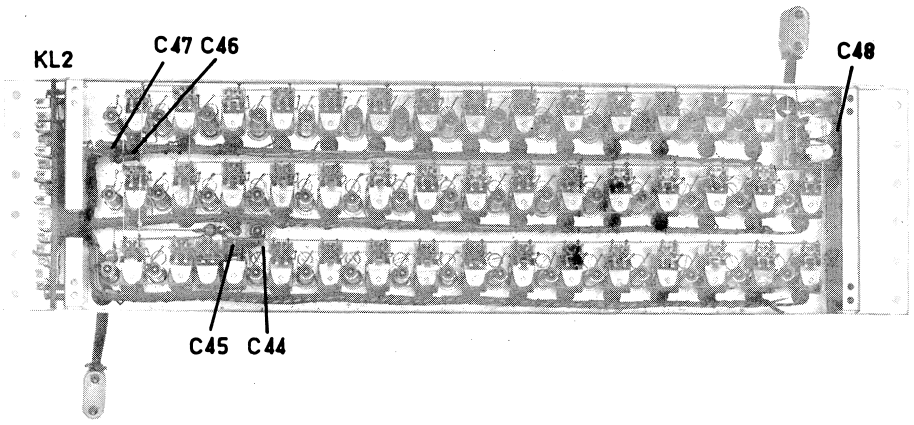
Connection

The unit is connected to the oscillator circuit in the transmitter or receiver module by a twin-lead connector which is terminated in a crystal holder. This holder is plugged into the crystal socket on the main unit. As the lead must be as short as possible, the crystal shift unit must be mounted next to and above the transmitter or receiver in the rack.

XS13-3

The Crystal Shift Unit XS13-3 is designed for use with a combined simplex/duplex system for maritime services. It has provision for all international maritime simplex/duplex transmitter frequencies, 26 in all, together with all duplex receiver frequencies, 17 in all, making a total of 43 channels on the chassis.





The crystals are switched by means of relays and both terminals are switched simultaneously and the crystals not in use are shorted out.

Adjustment

Each crystal has a trimmer capacitor, which is part of the loading capacity and therefore the trimmer determines the exact frequency.

The trimmer may be adjusted to set the frequency, but only when suitable frequency measuring equipment is available.

Group Relay

To reduce the wiring the crystals are divided into two groups and the output from any group is directed via its group relay to the receiver or transmitter.

Connection

The unit is connected to the oscillator circuit in the transmitter and receiver module by twin-lead connectors which is terminated in a crystal holder. This holder is plugged into the crystal socket on the main unit. As the leads must be as short as possible, the crystal shift unit must be mounted between the transmitter and receiver in the rack.

AA13-4

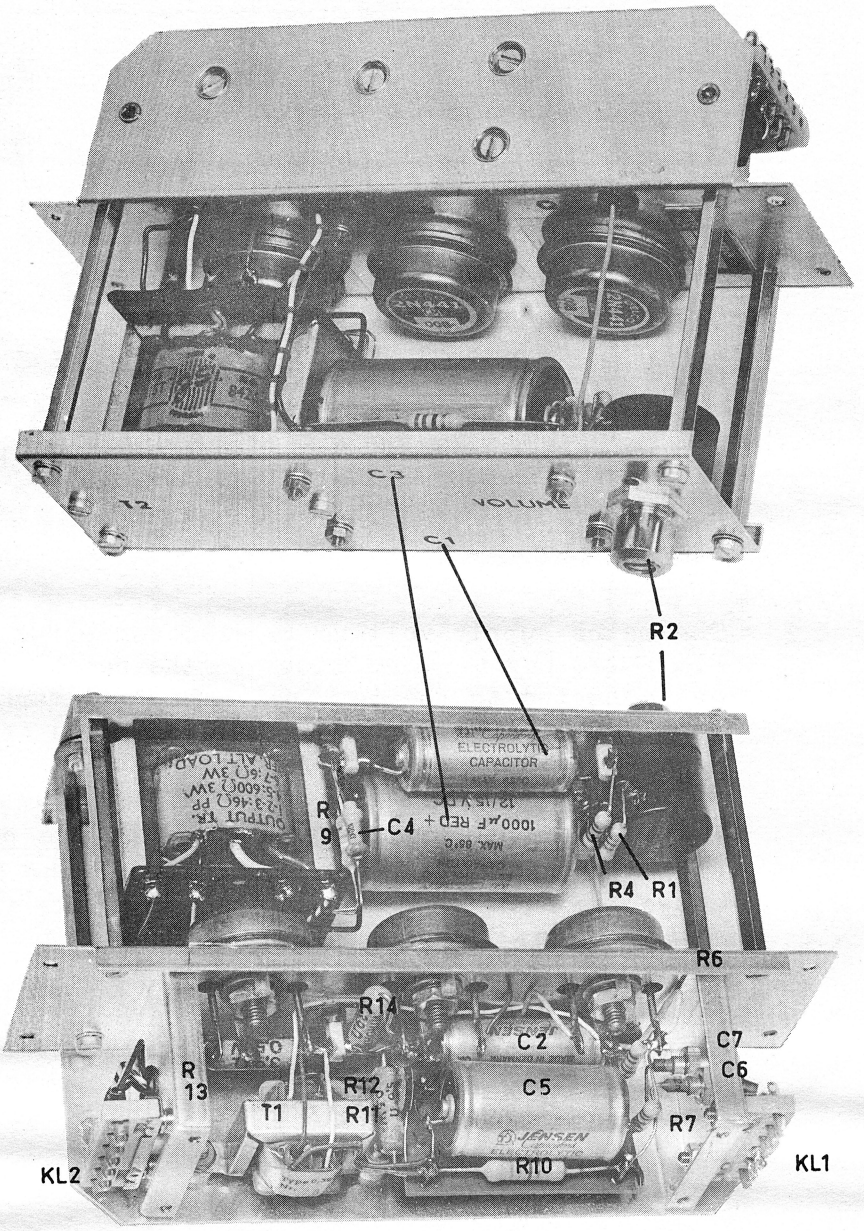
The amplifier AA13-4 is a transistorized amplifier with a push-pull output stage, capable of giving a maximum of three watts output. The amplifier is designed to be used in connection with a microphone or to amplify the output from a receiver. The amplifier covers the range 300 to 5000 c/s.

Construction

The amplifier is built as a module in two sections. It is mounted in a frame with the other modules by the section on which the transistors are mounted, thus the chassis and the large frame act as a heat sink for the transistors. The section carrying the output transformer and the level adjusting potentiometer stands off from the transistor section by approximately 6 cms.

Operation

The input signal is fed in across tags 1 and 2 on kl.2, and the output is taken from 4 and 5. The input is fed to the base of the first transistor (Q1) via the potentiometer R2 and C1. A phase inverter transformer T1 is placed in the collector circu-



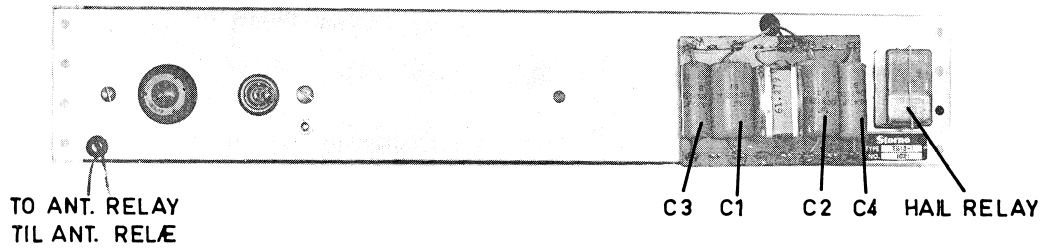
it and this is coupled to the push-pull output circuit consisting of Q2 and Q3. To ensure that the transistors are not destroyed by high temperatures, a NTC resistor is connected parallel with R11, in the base circuit. The output transformer has two output windings, one 600 Ω and the other 6Ω. Part of the 600Ω winding is used for negative feedback via R9 and C4.

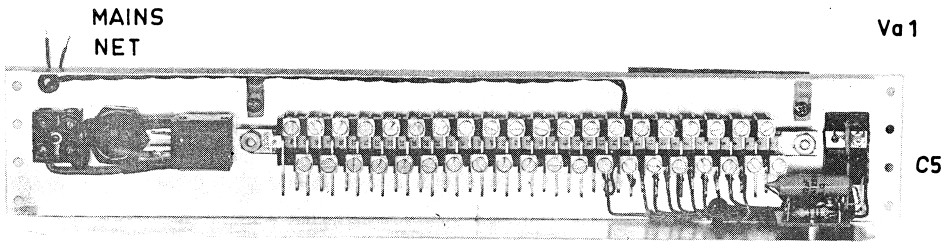
Power Supply

The amplifier is isolated from the chassis and normally only used in connection with a power unit giving -12 volts.

TB13-1

The terminal panel TB13-1 contains a terminal strip, a terminal block, a fuse, a hail relay, and a high-pass filter. The internal control wiring is connected at this point.





Mains

The mains supply voltage is also connected to the installation via a two-way terminal block on the panel. The phase lead should be connected to the terminal, which is marked with a red spot. The double pole switch isolates the mains from the equipment including the power supply section, thus the equipment may be serviced in complete safety. The 2 Amp. fuse protects the rack wiring up to the reset type fuses on the power supply unit.

Hail Relay

When the loudhailer is in operation, the HAIL relay is energised, switching the microphone voltages from the transmitter modulator to the AF-amplifier.

Filter

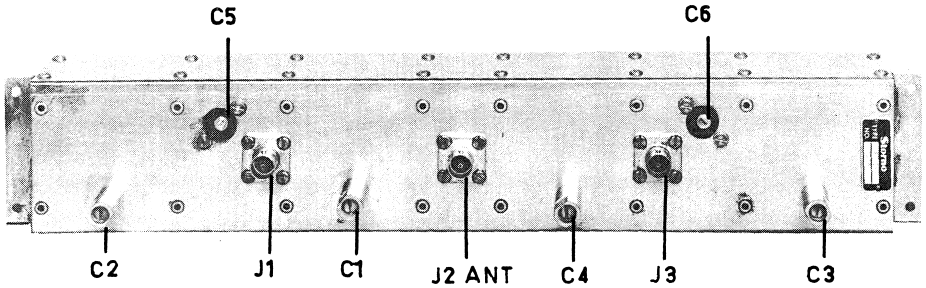
The high-pass T-network consisting of C1,C2,C3,C4, and L1 act as a bass-cut filter on the speech before it is fed to the AF amplifier. The output from the discriminator in the receiver is also fed through the filter. The microphone voltage is attenuated by an attenuator pad before it is fed to the transmitter modulator unit.

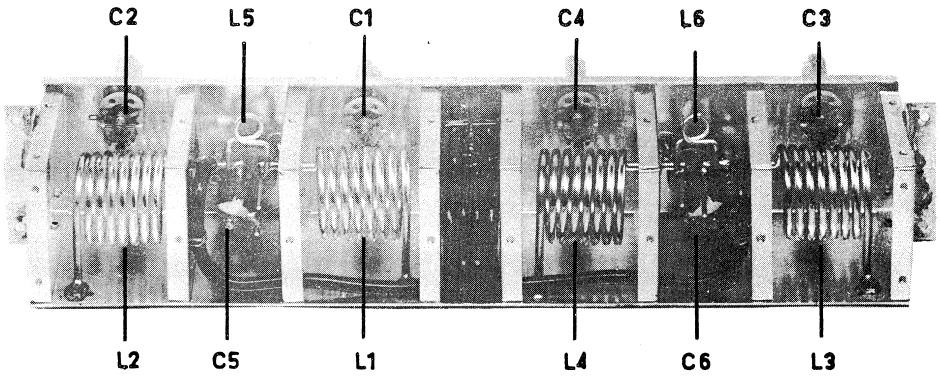
BF13-1

The branching filter BF13-1 connects one transmitter and one receiver to the same antenna. The frequency spacing is from 4.6 - 12 Mc/s in the frequency band 144 - 174 Mc/s.

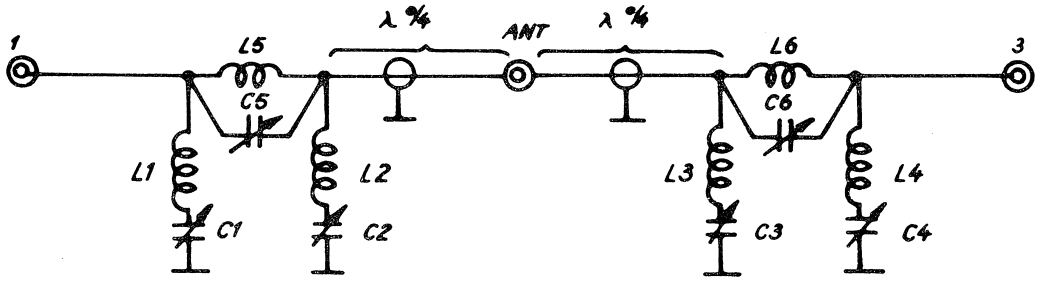
Construction

The filter is mounted on a silver plated chassis, divided into compartments, which contain the filter elements.





All controls are mounted on the front face of the chassis, together with the connectors to connect the filter to the antenna and to the receiver and transmitter for duplex operation. The connectors are standard type UG290/U. The whole chassis is screened by a cover plate which is attached by twenty self-cutting screws.



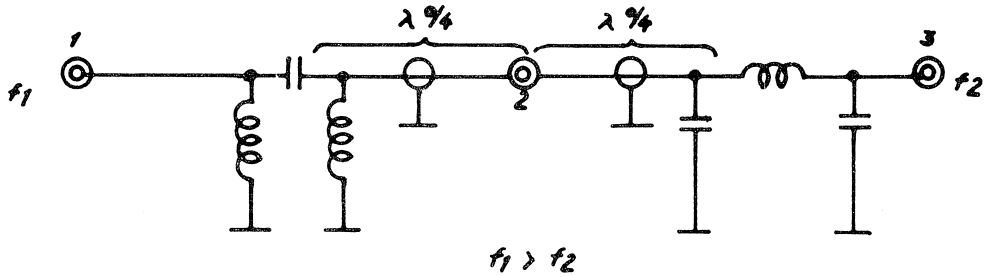
Circuit analysis

The illustration shows a simplified diagram of BF13-1. The two identical sections of lumped constants are connected to the common connector (ANT) by means of λo/4 coaxial cables. λo = electrical wavelength at 165 Mc/s.

Band stop function

The isolation between terminal 1 and terminal 3 is achieved by series resonance of L1, C1 - L2, C2 with respect to f2 and L3, C3 - L4, C4 with respect to f1, thus effectively shortening the line for the unwanted signal. This short circuits are transformed by means of the λo/4 coaxial cable to a high impedance at the antenna terminal. An incoming signal from the antenna f.inst. f1 is thus directed to terminal 1 and a signal f2 is directed to terminal 3.

Band pass function



The illustration shows an equivalent diagram of BF13-1 in the band pass case. The series resonance circuits as mentioned above, will act as reactive shunts on the line, positive or negative, depending on which frequency is the highest. To compensate these shunt reactances for the pass band frequencies, a tunable reactance is added in series to form a π-section with an impedance equal of that of the characteristic impedance of the coaxial cable used.

E. Additional Technical Specifications

See also Technical Specifications in Chapter I.

General

Frequency Range

152 to 174 Mc/s.

Max. Frequency Deviation

±15 kc/s adjustable.

Frequency Stability

Better than $\pm 15 \times 10^{-6}$ in the temperature range -10 to $+70^{\circ}C$ in the cabinet.

Antenna Impedance

50 Ω.

Maximum Frequency Separation

Maximum frequency separation between extreme channels is 1.4 Mc/s. Reduction of 3 dB in output power with this separation.

No. of channels

With crystal shift units: maximum 26.

Frequency Adjustment

With a trimmer $\pm 25 \times 10^{-6}$ from the crystal frequency with 30 pF loading.

Crystal Specifications

Holder HC G/U or Nato type 1, or DEF 5271 style D.
Loading 30 pF.
Frequency Tolerance $\pm 25 \times 10^{-6}$ from -20 to $+70^{\circ}C$.
Cutting Tolerance Less than 20×10^{-6} at $25^{\circ}C$.
Storno number: Storno type 1.
The crystals, RC-18/U (American). DEF 5271 style D (English) or NATO type 1 are suitable for the equipment.

TX13-1

Output Power

Full power: Minimum 20 watts.
Reduced power: Approx. 0.5 watt.

Frequency Multiplication

2x4x3 = 24.

Spurious Radiation

With filter FN13-2. Harmonics attenuated more than 70 dB. Crystal frequency harmonics attenuated more than 85 dB.

FM-Hum and Noise Level

Attenuated more than 40 dB relative to Δf = 7.5 kc/s at 1000 c/s. (EIA standard RS-152 pt. 7).

AM-Hum and Noise

Attenuated more than 34 dB (EIA standard RS-152 pt. 16).

Sideband Noise Level

Attenuated more than 75 dB. (EIA standard RS-152 pt. 17).

Modulation Splatter

Less than 1 µW. (G.P.O. Spec. TSC 53 (d) pt. 4.3.2.).

Modulation

a. Speech Channel

Input impedance: Approx. 600 Ω balanced.
Sensitivity: -20 dBm for Δf = 7.5 kc/s at 1000 c/s with 5% harmonic distortion.
Frequency Characteristic: 6 dB/octave, +0.5 dB to -2 dB in the range 300 to 3000 c/s relative to 1000 c/s Sharply cut off above 3000 c/s.

b. Tone Channel

Input impedance: Approx. 600 Ω balanced.
Sensitivity: -10 dBm for Δf = 10 kc/s at 1000 c/s with 3% harmonic distortion.

Frequency Characteristic: 6 dB/octave, +0.5 to -1.5 dB. Flat above 3000 c/s if required.

Modulation Limiting

The maximum deviation, normally ±15 kc/s are not exceeded with an AF-signal of 20 dB above that which gives 2/3 of rated deviation.

Power Supplies

3.7A at 6.3V or 2.0A at 12.6V AC
75 mA at 250V
110 mA at 430V
-30V Bias supply.

Valve Complement

		European	U.S.	Spec.Qual.
Oscillator	V1	EF91	6AM6	6064
Modulator and doubler	V2	ECC81	12AT7	6201
Quadrupler	V3	EF91	6AM6	6064
Tripler	V4	M8100/5654	6AK5	5654
Driver	V5	QQE03/12	6360	
Power Amplifier	V6	QQE03/20	6252	
Modulation amplifier	V7	ECC81	12AT7	6201

FN13-2

Insertion Loss

Max. 1 dB in the range 152-174 Mc/s.

Band-pass Attenuation

Above 300 Mc/s, better than 50 dB down.

Maximum Power

60 Watts.

Nominal Impedance

52 Ω.

Filter Impedance

VSWR Less than 1.7 in the range 152-174 Mc/s.

Connectors

BNC UG-290/U.

RC13-1

Noise Figure

Approx. 6 dB.

Rejection of Spurious Frequencies

Better than 85 dB (EIA standard RS-204).

Sensitivity

Better than 0.8 µV emf at 12 dB signal/noise ratio with Δf = 10 kc/s and fm = 1000 c/s.

Overall Gain

Approx. 30 dB (from antenna input to MX2 grid).

Heater Consumption

1.27 A at 6.3 V or 0.635 A at 12.6 V.

Crystal

Crystal Multiplication

2 x 2 x 4 = 16.

Calculation of Crystal Frequency

$$\text{Crystal frequency} = \frac{\text{Receiver frequency in Mc/s} - 0.455}{17} \text{ Mc/s.}$$

Crystal Frequency Range

8.9 to 10.2 Mc/s.

IF

Calculation of 1st IF

$$IF_1 = \frac{\text{Receiver frequency in Mc/s} + 7{,}28}{17} \text{ Mc/s.}$$

Or if the crystal frequency is known,

IF_1 = Crystal Frequency in Mc/s + 0.455 Mc/s.

1st Intermediate Frequency Range

9.3 to 10.7 Mc/s.

Valves

Valve Complement

		European	U.S.	Spec.Qual.
RF-Amplifier	V1	E188CC	7308	E188CC
1st. Mix.	V2	ECC81	12AT7	6201
Oscillator	V4	M8100/5654	6AK5	5654
2nd. Doubler	V5	M8100/5654	6AK5	5654
2nd. Mixer	V3	M8100/5654	6AK5	5654

IA13-1

2nd Intermediate Frequency

455 kc/s.

Attenuation

ΔF_o = ±15 kc/s, attenuation maximum 6 dB.
ΔF_o = ±35 kc/s, attenuation minimum 70 dB.

Gain

Voltage Amplification

At 455 kc/s from grid of 2nd mixer in receiver converter to grid of 1st limiter in 2nd I.F. amplifier: approx. 108 dB. In one I.F. stage incl. filter losses: approx. 36 dB.

Discriminator

Discriminator Curve

ΔF_o = ±5 kc/s, I = approx. ±18 µA
(Measured at test point no.5 or external meter).

Demodulation

Demodulation Characteristic Curve

3.0 to 8.0 kc/s: flat. 0.3 to 3.0 kc/s: -6 dB/octave. 0.3 to 8.0 kc/s: flat.

Tolerances

0.3 - 1.0 kc/s: +1/-3 dB, relative to 1 kc/s.
1.0 - 8.0 kc/s: ±1.5 dB, relative to 1 kc/s.

Output

Output Impedance

0.3 - 8.0 kc/s: 600 Ω ±20%, balanced.

Output Level

With F_m = 1.0 kc/s, ΔF = ±7.5 kc/s (50%) (test level) is obtained max. 7.5 dBm.

Distortion

Distortion

F_m = 1.0 kc/s, ΔF = ±5 kc/s: max. 2%.
F_m = 1.0 kc/s, ΔF = ±10 kc/s: max. 5%.

Consumption

Total Plate Current

At 150 V DC: approx. 40 mA.

Total Filament Current

At 6.3 V: 1.4 Amp.

Valves

Valve Complement

		European	U.S.	Spec.Qual.
Amplifier 1	V1	M8100/5654	6AK5	5654
Amplifier 2	V2	M8100/5654	6AK5	5654
Limiter 1	V3	M8100/5654	6AK5	5654
Limiter 2	V4	M8100/5654	6AK5	5654
AF/Noise Ampl.	V5	E188CC	7308	E188CC
Squelch	V6	E188CC	7308	E188CC

PS13-1

Nominal Supply Voltage

110 Vac or 220 V ac.

Filament Voltage

7.58 Amp at 6.35 ac.

Bias Voltage

Approx. -30 V dc.

Plate Voltages

Supply to	150 V dc	250 V dc	420 V dc
IA13-1	40 mA		
RC13-1 simplex	25 mA		
RC13-1 duplex	25 mA		
TX13-1, full power			110 mA
TX13-1, low power		75 mA	

Supply to control box

12.6 nominal, depending on the load.
Max. Supply. approx. 2A, measured at C6.

Power Consumption

Receiver/Standby: 82 watts approx.
Transmit. (simplex): 142 watts. approx.
Transmit. (duplex): 182 watts. approx.

The power supply is designed for continious operation at stand-by and intermittent operation of the transmitter up to 50% of the time. A single transmitting period must not be more than 1/2 hour.

XS13-1

No. of channels

Maximum 9.

Relay

Relay Voltage

6.3 V.

Relay Current

Approx. 70 mA.

Crystal

Crystal

HC-6/U, Nato type 1, DEF 5271 style D, or Storno Type 1.

XS13-3

No. of channels

Maximum: 17 duplex receiver
: 26 simplex/duplex transmitter.

Relay

Relay Voltage

6.3 V.

Relay Current

Approx. 70 mA.

Crystals

Crystal

HC-6/U, Nato type 1, DEF 5271 style D, or Storno type 1.

AA13-4

Output Power

3 watts with less than 10% distortion at 1000 c/s.

Frequency Characteristics

+0 -1 dB within the range 300 - 5000 c/s relative to 1000 c/s at an output power of 1.5 watts.

Input Power

10 mW for 3 W output.

Impedances

Input Impedance

600 ohms ±20% in the range 300 to 5000 c/s.

Output Impedance

a) Approx. 280 ohms unbalanced between terminals 1 and 4 on Kl. 2.
b) Approx. 2.8 ohms balanced between terminals 5 and 6 on Kl. 2.

Load Impedance

a) Nominal 600 ohms between terminals 1 and 4 on Kl. 2.
b) Nominal 6 ohms between terminals 5 and 6 on Kl. 2.

Temperature Range

-20°C to +80°C. At -30°C the low frequency characteristic falls.

Consumption

Power Supply

Approximately 90 mA at 12.6 volts with no signal.
Approximately 600 mA at 12.6 volts with max. signal.

TB13-1

Filter Impedance

600 Ω.

Filter Attenuation

Less than 1.0 dB at 300 c/s.
More than 10 dB at 100 c/s.
More than 25 dB at 50 c/s.

Attenuator Impedance

600 Ω.

Attenuator Loss

Approx. 24-28 dB at 1000 c/s.

BF13-1

Frequency Range

144 - 175 Mc/s.

Duplex Spacing

4.6 - 12.0 Mc/s.

Isolation

Max. Isolation between Units

70 - 75 dB.

Isolation

36 - 40 dB at a band width of ±0.7 Mc/s.

Losses

Insertion Losses

At a frequency spacing of 4.6 Mc/s: 0.7 - 1.2 dB (depending on the band width).

At a frequency spacing of 9.0 Mc/s: 0.3 dB.

Nominal Impedance

50 Ω.

Max. Standing Wave Ratio

1.5 for 4.6 Mc/s ±0.7 Mc/s.

Power

Power Handling Capacity

70 watts at 4.6 Mc/s duplex spacing.

CHAPTER III. REMOTE CONTROL BOX CB13-8

A. General Description

Introduction

The maritime VHF/FM radio station CQF13-2 can be completely controlled from the remote control box CB13-8. Up to two parallel connected control boxes may be used, one of which is a "priority" box or "master box", as this box at any time may be used to interrupt and take over the control from the "slave" box.

The "priority" box is normally mounted on the ship's bridge within easy reach of the operator. The possibly "slave" box may be mounted at any other convenient place on the ship, the only limitation of installation being the cable length as mentioned in chapter I under the description of the installation.

Construction

The control box consists of a cast box with watertight cable entries. A rest for a handset, in which the watertight handset is kept when not in use is mounted on the left hand side of the box. All control knobs and indicator lights are placed on the front face of the control box, and the functions of each control are clearly marked. The control box requires no connection to mains as all necessary control voltages and pilot lamp voltages are fed to the box from the main cabinet through the multi-cable.

The front face of the box also has slots for the loudspeaker, and in order to keep the box watertight the slots are covered by a PVC sheet.

Mounting

The rear plate of the control box is attached to the wall by four screws, which are screwed up from the front face. The complete box is rendered watertight by a rubber gasket.

Handset

The watertight handset contains a built-in pressel switch for keying the transmitter. Furthermore the rubber holder on the side of the box incorporates a micro-switch, which returns the equipment automatically to the calling and safety channel (channel no. 16).

Amplifier

The carbon microphone cartridge in the handset is connected to the input of a transistorized one stage amplifier (in control box), which gives approximately 20 dB gain from an OC72 transistor operating under grounded emitter conditions. The amplified AF-output is either routed to the transmitter input terminals or to the AF-amplifier, depending upon the position of the FUNCTION switch. The filter T2-C3 is common for microphone and transistor stage, and the filter R9-C2 is for the base voltage of the transistor.

Channels

If the output from the microphone is too high or too low, R7 is used for adjusting to the correct level. To save the number of control leads, only channel number 16 and channel number 14 are taken to separate contacts on the CHANNEL PRESELECTOR switch, while the remainder of the contacts are connected in pairs. In the main radio equipment channels 2 to 16 are in one group and channels 18 to 28 in another group. The groups are controlled by their respective group relay.

The box is set for duplex operation by grounding terminal 16 and thus changing over the antenna relay and the power supply.

PRESET CHANNEL

The PRESET CHANNEL IN switch (05) is spring loaded in both directions. In the TONE CALL position ground is put on contact 23, and this facility is used if a selective calling system is built into the equipment. In the left spring loaded position IN the "master" box takes over the control from a "slave" box. By keeping the switch on the left the "master" box may control the radiostation irrespectively of the setting of the controls on the "slave" box. The pilot lamps in the "slave" box are extinquished, and the normal procedure will therefore be to switch the PRESET CHANNEL to the left position a couple of times whereby the blinking of the pilot lamps on the "slave" box indicates for the operator there that the "master" box operator wishes to take over. The "slave" box operator then turns the FUNCTION switch to OFF, and the "master" box has full control of the radio station.

In either the TONE CALL or the PRESET CHANNEL IN position, relay B will operate, and if the handset is off the rest, the relay is held in by its holding contact b1.

Thus: Contact b2 extinguishes the blue pilot lamp (CHANNEL 16 ON).

Contact b3 transfers the squelch indication from relay C to the green lamp (REC.).

Contact b4 removes the ground contact from the channel number 16 line and puts it to the selector wiper.

CALLING AND SAFETY CHANNEL

When the handset is replaced at its rest after use, the microswitch 06 breaks the circuit to relay B and it falls out. Then the equipment will return to the CALL and SAFETY CHANNEL number 16, and the blue pilot lamp lights. If a call is now received, the squelch operates relay C, which will be held by its own contact c1 over the microswitch 06.

Contact c4 lights the white (CALL) lamp.

These conditions prevail until the handset is removed from the rest or the CHANNEL PRESELECTOR switch is operated.

DIMMER

The DIMMER switch 04 switches resistors in series with the pilot lamps in order to adjust the intensity of the lamps.

Transmitting

When the pressel switch in the handset is closed, relay A operates.

Contact set a2 disconnects the internal loudspeaker and couples in a suitable loading resistor.

Contact set a3 connects the keying lead to ground, thus providing a current path through the transmitter high voltage (keying) relay.

Contact set a4 lights the red (TRANSMIT) pilot lamp.

The circuits through contact sets a3 and a4 are broken, when FUNCTION switch is thrown into position HAIL.

FUNCTION

The FUNCTION switch 03 is shown in in the extreme left position on all diagrams. In the position OPEN the terminals 15 (start) and 21 (squelch opening) are connected to ground, and thus the receiver is open for both noise and signal.

In the third position NORMAL the ground connection of terminal 21 is broken and the audio amplifier will only operate on reception of a signal.

The fourth position LOW POWER connects terminal 18 to ground, causing a relay in the power supply PS13-1/1a to operate so that the transmitter output falls to approximately 0,5 watts.

The last two positions of the FUNCTION switch can only be used if extension loudspeakers are connected to the control box. In position EXTENSION the receiver output is fed to an extension loudspeaker, which may be installed in the wireless operator's room, next to the "slave" box, or in any other convenient place. In position HAIL, the output from the microphone amplifier is fed to a separate loudspeaker, which may be used for hailing purposes, e.q. by using a high efficient re-entrant horn loudspeaker.

The HAIL position is spring loaded so that the equipment may not be inadvertently left in the hail position. The receiver is cut off in this position.

VOLUME

The VOLUME control for the built-in loudspeaker is correctly matched to the output transformer in all positions.

JB13-1

A junction box type JB13-1 is used when two control boxes are installed. Besides a terminal strip for all multicable leads the box contains three relays. A total of 17 wires are branched off to either box, while the relays perform the branching of the remaining leads. When no -12 volts are supplied to lug no. 14 in the "slave" box the control of the radio station lies at the "master" box and the three relays are de-energized.

When the FUNCTION switch in the "slave" box is turned away from its OFF position, the relays in the junction box energized and -12 volts are applied to the "slave" box, while the ground return is removed from the "master" or "priority" box.

The "master" box gains complete control of the radio equipment, when the "slave" box operator switches the FUNCTION switch to OFF.

B. Control Box

Switches

The remote maritime control box CB13-8(a) contains the following controls on the front face:

CHANNEL PRESELECTOR

Indicates selected channels, where the hour-glass symbols covers the following system: Both triangles filled out indicates duplex channel, one triangle filled out indicates simplex channel and both triangles empty indicates that the equipment is not supplied with crystals for that channel.

VOLUME

This knob controls the volume of the built-in loudspeaker.

FUNCTION

The FUNCTION switch has 6 positions:

OFF	This position is blocked in a "master" box.
OPEN	Reception of both signals and noise.
NORMAL	Reception of signals controlled by the squelch system.
LOW POWER	Output power reduced to 0.5 watt for port operations.
EXTERNAL	The received signals are reproduced by the external loudspeaker.
HAIL	In this spring loaded position the receiver/transmitter is interrupted and the microphone signals are amplified and fed to a second external loudspeaker (e.g. a re-trant horn hailing loudspeaker).

PRESET CHANNEL — This switch has three positions, where the two extreme positions are spring loaded. Position TONE CALL (right) is used in connection with possible selective calling equipment, while position IN (left) releases the equipment from channel no. 16 (Calling and Safety) and switches it to the preset channel.

DIMMER — Control knob for regulation of the control lamp intensity.

Handset Rest — The microswitch incorporated in the rest releases the CALL lamp and switches the equipment to channel no. 16 when the handset is placed on the rest.

Pilot Lamps — The maritime control box furthermore contains the following pilot lamps:

CHANNEL 16 ON — This blue pilot lamp indicates when this channel automatically is switched into operation.

TRANSMIT — This red pilot lamp indicates that the transmitter is keyed.

RECEPTION — This green pilot lamp indicates a received signal on a preselected channel only.

CALL — This white pilot lamp indicates a received call on the automatically selected CALL and SAFETY channel (No. 16). The light stays on until it is "released" either by lifting the handset from the rest (microswitch) or by turning the PRESET CHANNEL switch to position IN.

Transmitting — The transmitter is keyed by pressing the pressel switch on the handset. When operating in duplex the switch may be pressed the whole time.

C. Operation Instructions

Initial — The equipment is started by switching the FUNCTION switch to position OPEN, and after approximately 30 seconds for warm up the receiver hiss should be heard in the loudspeaker. The FUNCTION switch should then be switched to position NORMAL thus removing the noise.

Stand-by — With the handset in its rest on the side of the box and with the blue pilot lamp (CALLING and SAFETY CHANNEL ON) on, the equipment is automatically operating on the calling and safety channel (No. 16). On reception of a call the white pilot lamp (CALL) will light, and any message will be heard in the loudspeaker.

Answering a Call — In order to reply a call, the handset is lifted from the rest and the pressel switch is pressed while speaking. The red lamp (TRANSM.) lights thus indicating that the transmitter is operating.

Having decided that further conversation should be carried out on another channel, then the channel should be selected by the CHANNEL PRESELECTOR switch.

Channels — The CHANNEL PRESELECTOR switch is turned to the required channel and the PRESET CHANNEL switch is flicked to the spring loaded position IN. The blue lamp will be extinguished, when the selection has been made.

Duplex/Simplex

The selected channel may be either duplex or simplex, which is indicated on the CHANNEL PRESELECTOR scale by having two or only one black triangles respectively.

During simplex operation the receiver is cut off during transmission, while both transmitter and receiver are operating during duplex operation. Thus on simplex, the pressel switch in the handset must be released to hear a reply, while on duplex it may be pressed the whole time.

Return to CALLING AND SAFETY

At the end of the conversation, the handset is replaced in the rest and the microswitch operates. The equipment returns automatically to channel no. 16 (CALLING AND SAFETY). Therefore if a further call is required on the channel just used, and the handset has been hung up, the PRESET CHANNEL must be operated again so that the equipment selects the preset channel.

If it is desired that the equipment is to remain on a selected channel for some time, then the handset should not be hung up in the rest.

Call Indication

When the handset is lifted from the rest, a received call is indicated by the green pilot lamp (REC), while a received call on channel no. 16 (CALLING and SAFETY) is indicated by the white pilot lamp (CALL).

Low Power

The FUNCTION switch, when in the LOW POWER position, reduces the transmitter output from 20 watts to one half watt. This is used in the vicinity of harbours and when the distances from ship-to-ship or ship-to-shore are in the order of 1 mile or less.

EXTENSION

In the position EXTENSION, the built-in loudspeaker is disconnected, and the output from the receiver is switched to an extension loudspeaker. However, any received signals will still be fed to the earpiece of the handset. If no extension loudspeaker is connected and the switch is turned to this position, a strap wire in the box will keep the built-in loudspeaker operative.

HAIL

With the FUNCTION switch in position HAIL, the equipment may be used as a loud hailer. In this position the transmitter is not operated so that there is no danger of the hailer message to be fed to the transmitter.

Operating Instruction

A shortend version of the operating instructions are also supplied with the equipment. It is protected in a plastic cover and intended to be mounted in a place next to the control box for quick reference. The instructions also include a list of available channels and their frequency and intended use, as set out by the 1957 International Maritime Conference at the Hague.

Two Boxes

In order to prevent any incoming calls being lost, neither of the two boxes are able to switch off the equipment. Switching off the equipment must be carried out by the main switch, which is installed next to the cabinet.

In the "master" or "priority" box (CB13-8a) position OFF is mechanically blocked, and in the "slave" box (CB13-8) position OFF is used to transfer the controllability to the "master" box.

Master Box

When the "master" box want to take over the traffic from the "slave" box, the PRESET CHANNEL switch must be flicked to its left spring loaded position, whereby the pilot lamps in the control box light, while at the same time the pilot lights in the "slave" box go out.

The "master" box can secure complete control of the equipment irrespectively of the positions of the controls in the "slave" box by keeping the PRESET CHANNEL switch in the spring loaded position IN.

Slave Box

Operation of the Preset channel switch at the "master" box is indicated at the slave box by the extinguishing of all pilot lights. This indicates that the "master" wishes to take control and the function switch at the slave box must be turned to the position OFF.

D. Technical Specifications

Amplifier

Gain

Approx. 20 dB.

Output Power

+10 dBm (2,5 V in 600 Ω) with approx. 2 % distortion.

Frequency Characteristic

Flat from 300 c/s to 2400 c/s (-2 dB at 300 c/s relative to 1000 c/s).

Current Consumption

Approx. 8 mA (excl. microphone current) at 12,6 V.

Loudspeakers

Input Impedances

Monitor loudspeakers: At least 6000 Ω.
Extension and hailing loudspeakers: 600 Ω.

Volume control

8 positions, approx. 3 dB per step.

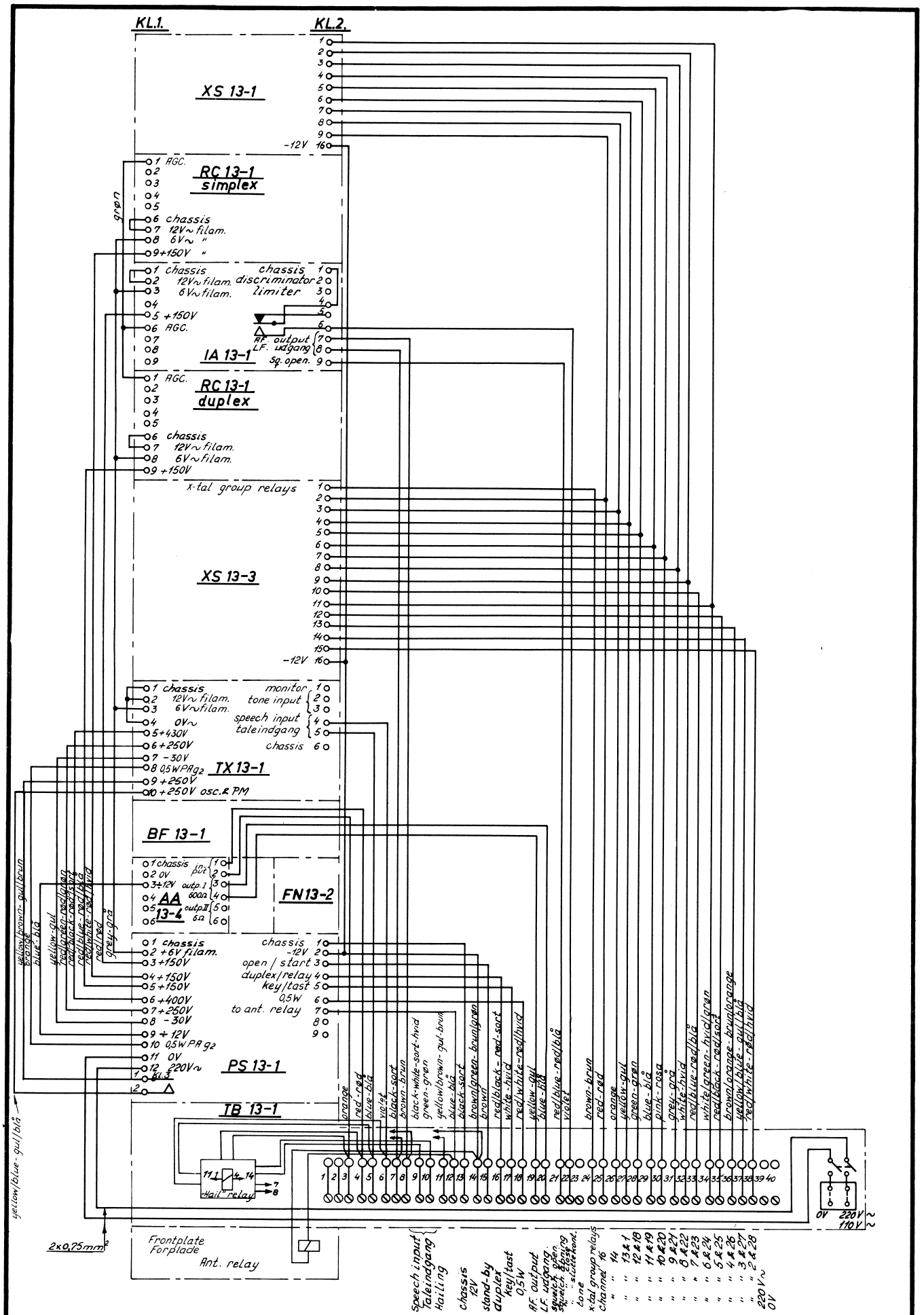
DIAGRAMS AND PARTS LISTS

Introduction

The diagrams and the function schematics of the modular units in the radiotelephone equipment model MARINEPHONE can be found on the following pages. Each modular diagram is accompanied by an electrical part list with component specifications and STORNO stock numbers.

Spare Parts

When ordering spare parts from STORNO please state STORNO stock numbers together with component position number and type designation of modular unit. Position designation is not sufficient information as the components in each modular units is numbered from 1. As an example more than ten resistors have been designed R5 in this radiotelephone station.



Storno	konstr./tegn. KN-GM. 2-11-60.	CABLEFORM
	godk.	KABLING
	komp.liste	CQF 13-2
		D10949

Storno

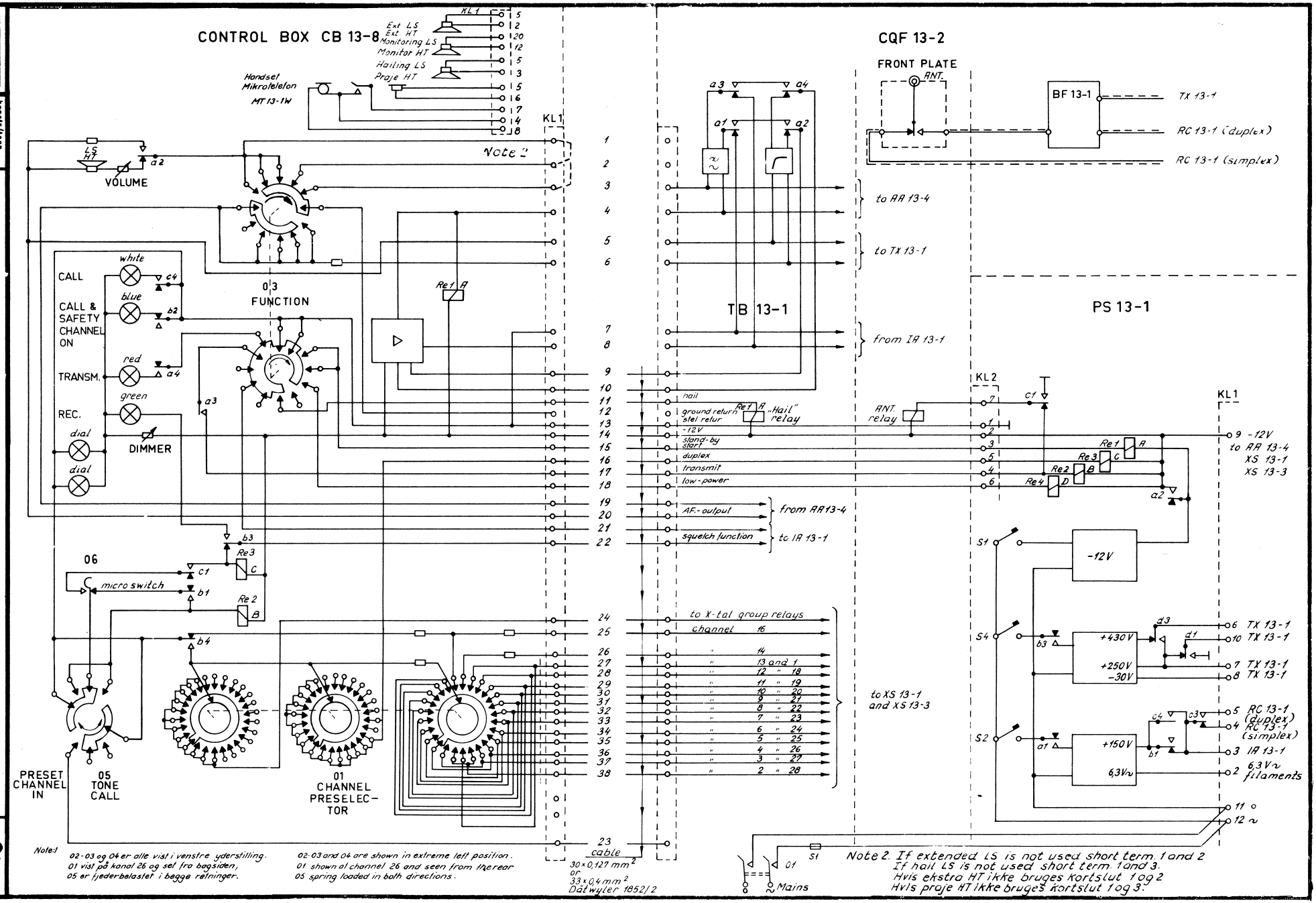
konstr/tegn. MH. GM. 8-5-61

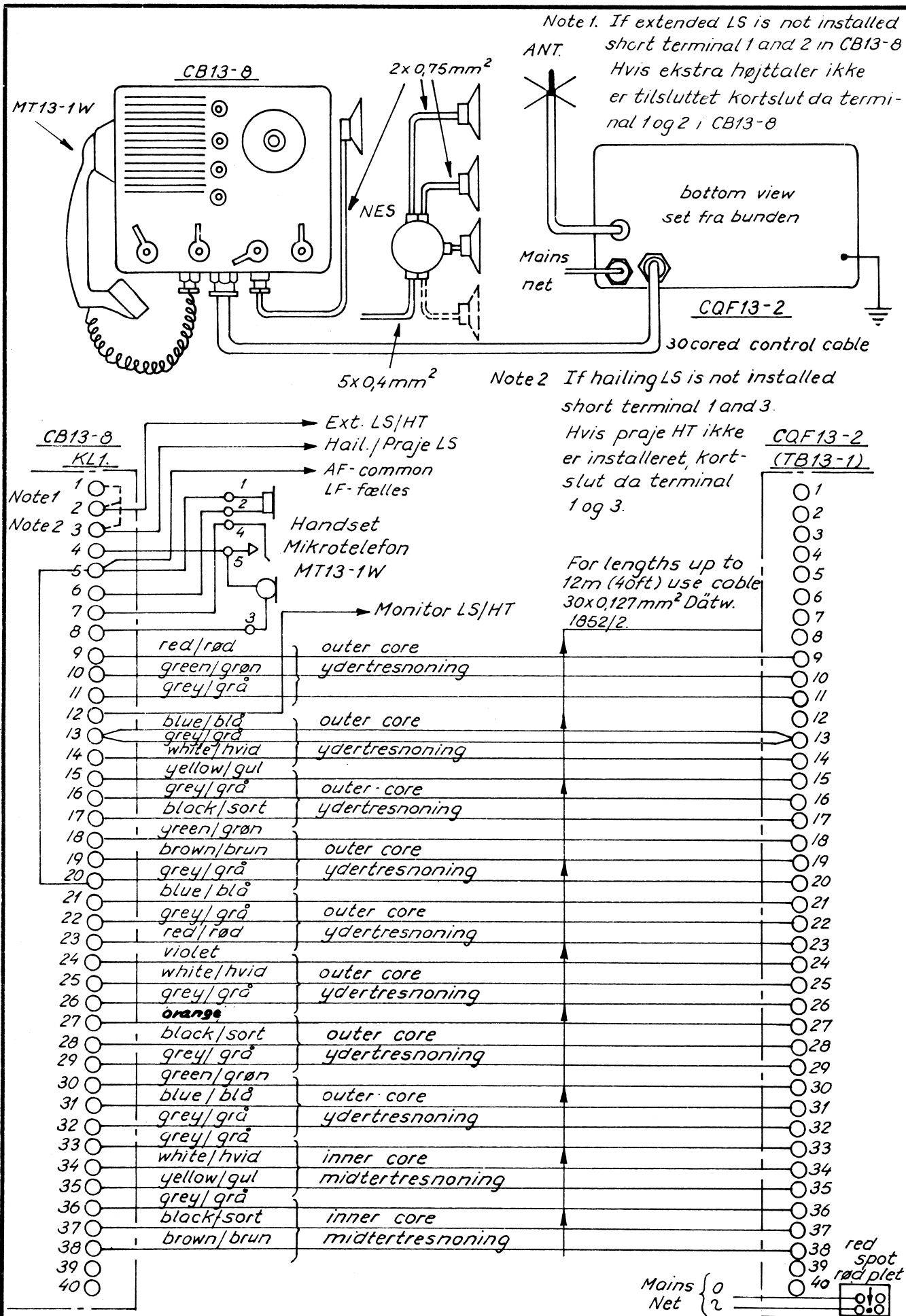
godk. KH 8-5-61

komp.liste

FUNCTION DIAGRAM
FUNKTIONSDIAGRAM
CQF 13-2

D 10907/2





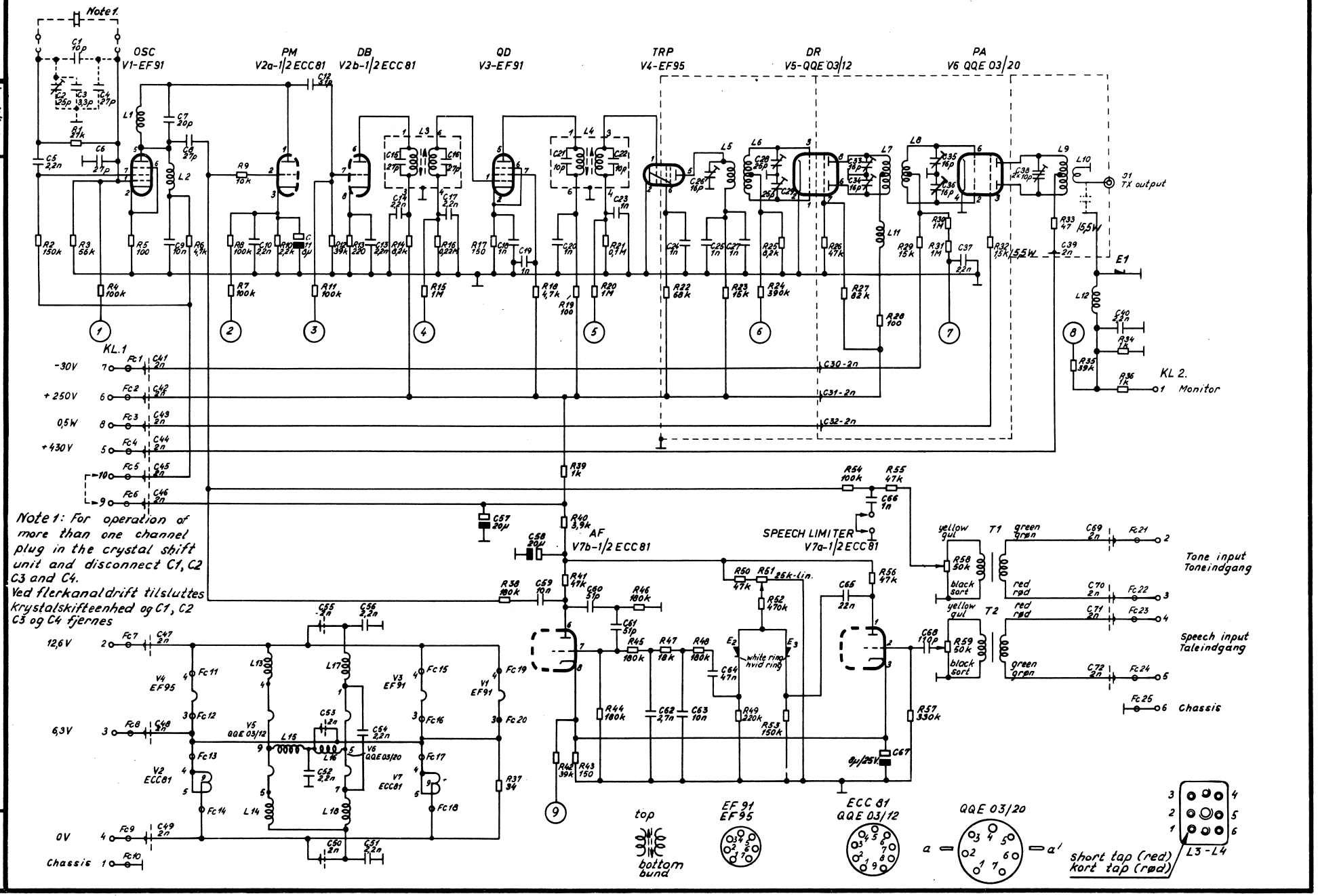
Storno	konstr./tegn. KN/BM 23-10-62 godk. komp.liste	MARINE EQUIPMENT MARINESTATION Installation diagram	CQF13-2	D10977

Sterno

konstr/tegn. SM-G.M 12-4-60.
godk. SH/MN
komp.liste X10771

TRANSMITTER SENDER TX 13-1

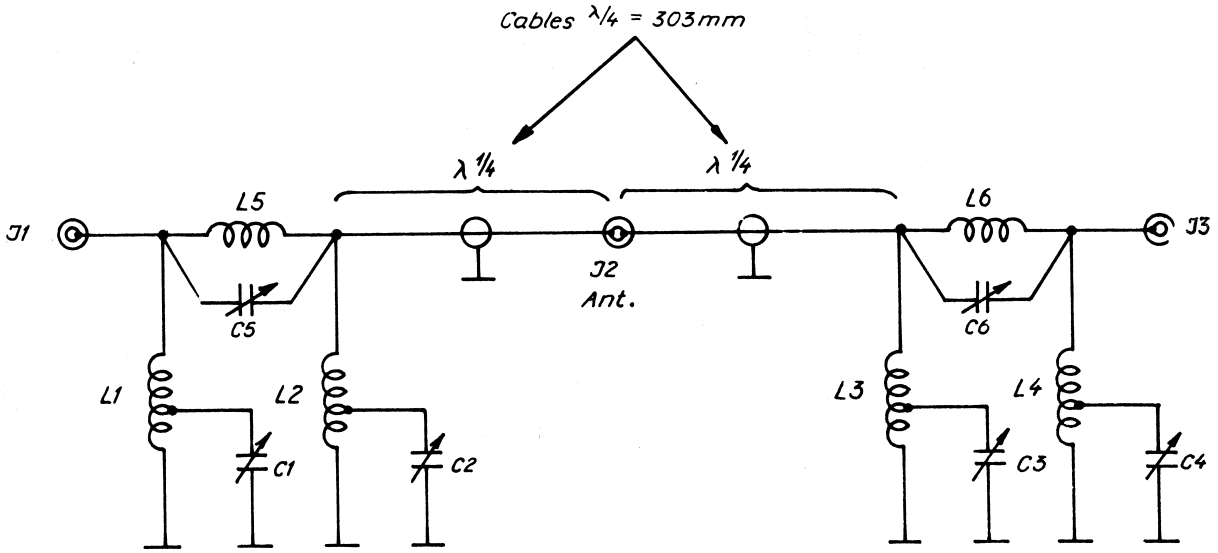
D10770



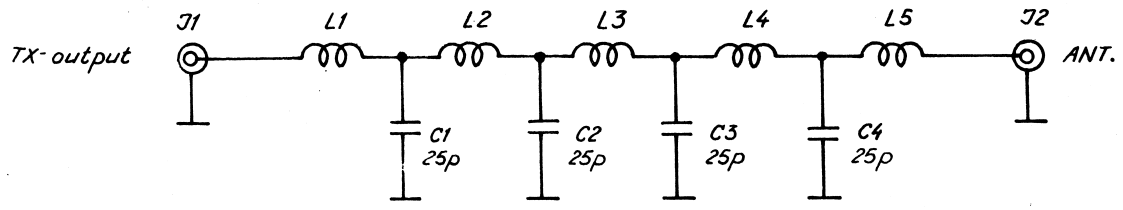
type	no	code	data	type	no	code	data
	C1	74.5042	10 pF ±5% 500 V		R34	80.5449	1 kΩ 1/4 W
	C2	78.5005	25 pF trimmer		R35	80.5468	39 kΩ 1/4 W
	C3	74.5095	3,3 pF 500 V		R36	80.5449	1 kΩ 1/4 W
	C4	74.5056	27 pF ±5% 500 V		R37	82.5035	34 Ω (2x68Ω) 1 W
	C5	74.5017	2,2 nF 350 V		R38	80.5476	0,18 MΩ 1/4 W
	C6	74.5056	27 pF ±5% 500 V		R39	81.5049	1 kΩ 1/2 W
	C7	74.5052	20 pF ±5% 500 V		R40	81.5056	3,9 kΩ 1/2 W
	C8	74.5056	27 pF ±5% 500 V		R41	80.5469	47 kΩ 1/4 W
	C9	76.5030	10 nF ±10% 400 V		R42	80.5468	39 kΩ 1/4 W
	C10	74.5017	2,2 nF 350 V		R43	80.5439	150 Ω 1/4 W
	C11	73.5008	8 µF 25 V		R44..R46	80.5476	0,18 MΩ 1/4 W
	C12	74.5061	51 pF ±5% 500 V		R47	80.5464	18 kΩ 1/4 W
	C13..C14	74.5017	2,2 nF 350 V		R48	80.5476	0,18 MΩ 1/4 W
	C15..C16	74.5056	27 pF ±5%		R49	80.5477	0,22 MΩ 1/4 W
	C17	74.5017	2,2 nF 350 V		R50	81.5069	47 kΩ 1/2 W
	C18..C20	74.5016	1 nF 500 V		R51	86.5012	25 kΩ potentiom. lin.
	C21..C22	74.5042	10 nF ±5%		R52	80.5481	0,47 MΩ 1/4 W
	C23..C25	74.5016	1 nF 500 V		R53	80.5475	0,15 MΩ 1/4 W
	C26	78.5016	16 pF trimmer		R54	80.5473	0,1 MΩ 1/4 W
	C27	74.5016	1 nF 500 V		R55..R56	80.5469	47 kΩ 1/4 W
	C28..C29	78.5004	25 pF trimmer		R57	80.5479	0,33 MΩ 1/4 W
	C30..C32	74.5081	2 nF 500 V		R58..R59	86.5014	50 kΩ potentiom. log.
	C33..C36	78.5016	16 pF trimmer				
	C37	74.5017	2,2 nF 350 V		E1	99.5046	diode
	C38	78.5013	2x10 pF		E2..E3	99.5028	diode
	C39	74.5081	2 nF 500 V				
	C40	74.5017	2,2 nF 350 V		Fc1..Fc25	65.	Ferroxcube beads perler
	C41..C50	74.5081	2 nF 500 V				
	C51..C52	74.5017	2,2 nF 350 V		J1	41.5101	Ant. connector
	C53	74.5081	2 nF 500 V				
	C54	74.5017	2,2 nF 350 V		L1..L2	62.099	
	C55	74.5081	2 nF 500 V		L3	61.447	12,6-14,5 Mc/s (C15-C16)
	C56	74.5017	2,2 nF 350 V		L4	61.448	50,6-58 Mc/s (C21-C22)
	C57..C58	73.5018	20+20 µF 450/500 V		L5	62.532	152 - 174 Mc/s
	C59	76.5030	10 nF ±10% 400 V		L6	62.531	152 - 174 Mc/s
	C60..C61	74.5061	51 pF ±5% 500 V		L7	62.506	152 - 174 Mc/s
	C62	76.5023	2,7 nF ±10% 400 V		L8	62.507	152 - 174 Mc/s
	C63	76.5011	10 nF ±5% 400 V		L9	62.505	152 - 174 Mc/s
	C64	76.5033	47 nF ±10% 125 V		L10	62.508	152 - 174 Mc/s
	C65	76.5031	22 nF ±10% 400 V		L11..L12	63.5004	2,2 µH
	C66	76.	1 nF ±5% 600 V		L13..L15	62.474	
	C67	73.5008	8 µF 25 V		L16..L18	62.504	
	C68	74.5072	110 pF ±5% 500 V				
	C69..C72	74.5081	2 nF 500 V		T1..T2	60.5003	50 kΩ-600 Ω
	R1	80.5466	27 kΩ 1/4 W		V1	99.5057	pentode EF91
	R2	80.5475	0,15 MΩ 1/4 W		V2	99.5054	duotriode ECC81
	R3	80.5470	56 kΩ 1/4 W		V3	99.5057	pentode EF91
	R4	80.5473	0,1 MΩ 1/4 W		V4	99.5002	pentode M8100/5654
	R5	80.5437	100 Ω 1/4 W		V5	99.5004	duotetrode QQE03/12
	R6	81.5057	4,7 kΩ 1/2 W		V6	99.5056	duotetrode QQE03/20
	R7..R8	80.5473	0,1 MΩ 1/4 W		V7	99.5054	duotriode ECC81
	R9	80.5461	10 kΩ 1/4 W				
	R10	80.5453	2,2 kΩ 1/4 W		X1	98.	Crystal
	R11	80.5473	0,1 MΩ 1/4 W				
	R12	80.5468	39 kΩ 1/4 W				
	R13	80.5441	220 Ω 1/4 W				
	R14	81.5060	8,2 kΩ 1/2 W				
	R15	81.5085	1 MΩ 1/2 W				
	R16	80.5477	0,22 MΩ 1/4 W				
	R17	80.5439	150 Ω 1/4 W				
	R18	81.5057	4,7 kΩ 1/2 W				
	R19	80.5437	100 Ω 1/4 W				
	R20	81.5085	1 MΩ 1/2 W				
	R21	80.5473	0,1 MΩ 1/4 W				
	R22	81.5071	68 kΩ 1/2 W				
	R23	81.5063	15 kΩ 1/2 W				
	R24	80.5480	0,39 MΩ 1/4 W				
	R25	80.5460	8,2 kΩ 1/4 W				
	R26	80.5469	47 kΩ 1/4 W				
	R27	81.5072	82 kΩ 1/2 W				
	R28	81.5037	100 Ω 1/2 W				
	R29	81.5063	15 kΩ 1/2 W				
	R30..R31	81.5085	1 MΩ 1/2 W				
	R32	84.5007	1,5 kΩ 5,5 W				
	R33	84.5003	47 Ω 5,5 W				

X 10.771

BF13-1



FN13-2



Storno	konstr./tegn. EBN/BM 5-12-62 godk. komp.liste	BRANCHING FILTER/DELEFILTER BF13-1 ANTENNA FILTER FN13-2

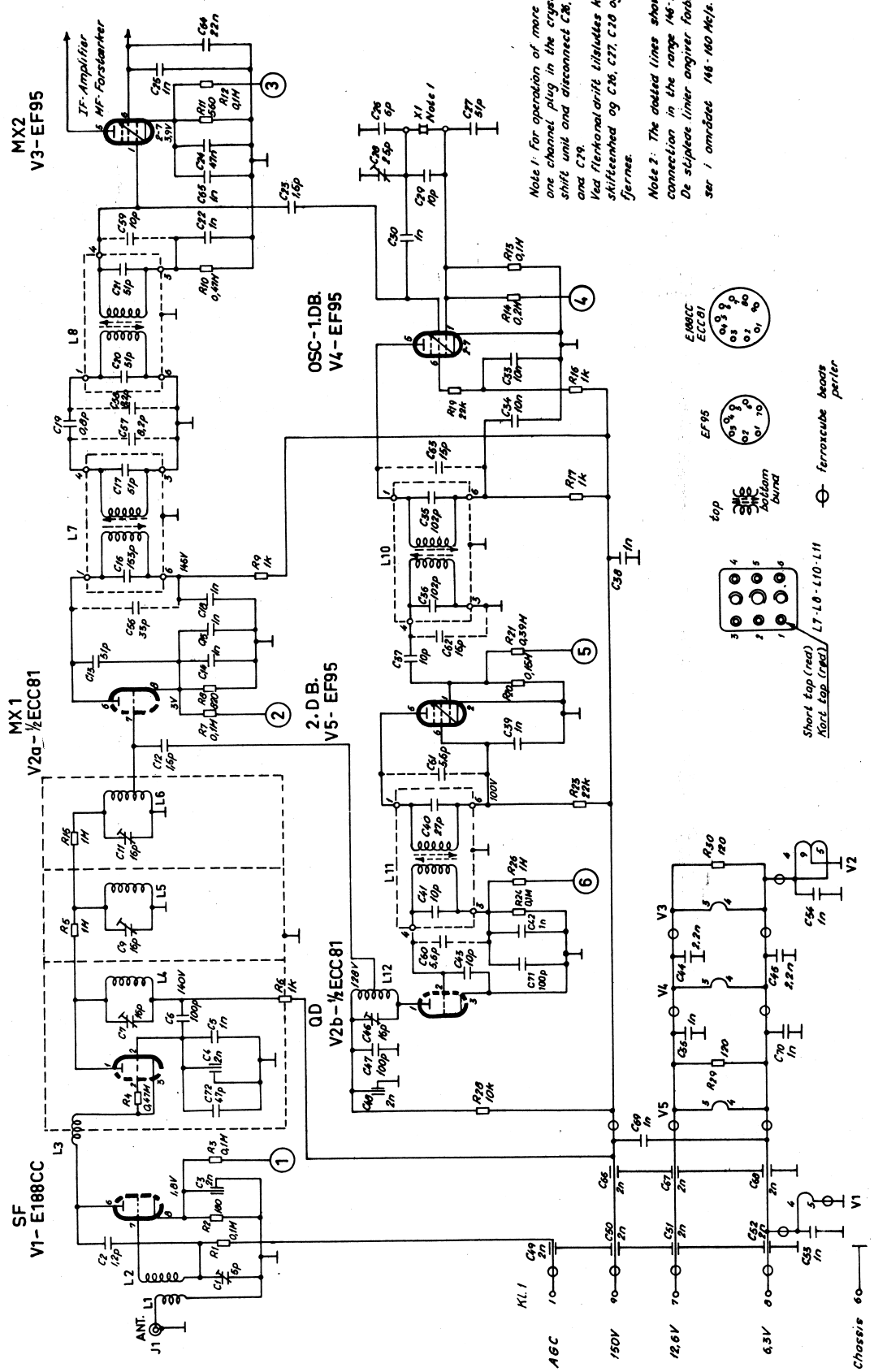
D 10.735
D 10.921

BF13-1

type	no	code	data	type	no	code	data
	C1..C4	78.005	trimmer 500 V		L4	62.501	Filter coil
	C5..C6	78.006	3-40 pF 700 V		L5..L6	62.503	"
	L1	62.502	Filter coil		J1..J3	41.5131	Connector
	L2	62.501	"				
	L3	62.502	"				

FN13-2

type	no	code	data	type	no	code	data
	C1..C4	74.5054	25 pF ±5% 500V		L4	62.548	filter coil
					L5	62.546	filter coil
	L1	62.547	filter coil				
	L2	62.549	filter coil		J1..J2	41.5131	connector
	L3	62.549	filter coil				



Storno	konstr./tegn. EBN/BM 19-9-63	RECEIVER CONVERTER RC13-1 MODTAGER KONVERTER RC13-1L
	godk.	
	komp.liste	D10.244

-10-64
-5-64

type	no	code	data	type	no	code	data
	C1	78.5014	5pF trimmer		R1	80.5473	0,1 MΩ 1/4W
	C2	74.5002	1,2pF ±0,1pF		R2	80.5440	180 Ω 1/4W
	C3-C4	74.5081	2 nF 500V		R3	80.5473	0,1 MΩ 1/4W
	C5	74.5016	1 nF 500V		R4	80.5481	0,47MΩ 1/4W
	C6	74.5069	100 pF 500V		R5	81.5085	1 MΩ 1/2W
	C7	78.5015	16pF trimmer		R6	80.5449	1 kΩ 1/4W
	C9-C11	78.5016	16pF trimmer		R7	80.5473	0,1 MΩ 1/4W
	C12	74.5003	1,5pF ±20%		R8	80.5448	820 Ω 1/4W
	C13	74.5061	51pF ±5%		R9	80.5449	1 kΩ 1/4W
	C14-C15	74.5016	1nF 500V		R10	80.5481	0,47 MΩ 1/4W
	C16	74.5061	3 x 51 pF ±5%		R11	80.5446	560 Ω 1/4W
	C17	74.5061	51pF ±5%		R12-R13	80.5473	0,1 MΩ 1/4W
	C18	74.5016	1nF 500V		R14	80.5473	0,2MΩ (2x0,1MΩ) 1/4W
	C19	74.5023	0,8pF ±0,1pF		R15	81.5085	1 MΩ 1/2W
	C20-C21	74.5061	51pF ±5%		R16-R17	80.5449	1 kΩ 1/4W
	C22	74.5016	1 nF 500V		R19	80.5465	22 kΩ 1/4W
	C23	74.5003	1,5pF ±20%		R20	80.5475	0,15 MΩ 1/4W
	C24	76.5033	47nF 125V		R21	80.5480	0,39MΩ 1/4W
	C25	74.5016	1 nF 500V		R23	80.5465	22 kΩ 1/4W
	C26	74.5035	6pF only used		R24	80.5473	0,1 MΩ 1/4W
	C27	74.5061	51pF ±5% on one channel		R26	81.5085	1 MΩ 1/4W
	C28	78.5005	25pF trim. benyttes kun ved 1 kanal		R28	80.5461	10 kΩ 1/4W
	C29	74.5042	10pF ±0,5pF 500V		R29-R30	80.5438	120 Ω 1/4W
	C30	74.5016	1nF 500V		Fc	65.	ferroxcube beads/perler
	C33-C34	76.5030	10nF 400V		J1	41.5131	ant. coax connector
	C35-C36	74.5061	2 x 51pF ±5%		L1	62.446	
	C37	74.	10pF ±0,5 pF 500V		L2	62.447	152-174 Mc/s
	C38-C39	74.5016	1nF 500V		L3	62.236	152-174 Mc/s
	C40	74.5056	27pF ±5%		L4	62.438	152-174 Mc/s
	C41	74.5042	10pF ±5%		L5	62.440	152-174 Mc/s
	C42	74.5016	1nF 500V		L6	62.438	152-174 Mc/s
	C43	74.5042	10pF ±5%		L7	61.389	9,4-10,7 Mc/s, C16, C17
	C44	74.5017	2,2nF		L8	61.391	9,4-10,7 Mc/s, C20, C21
	C45	74.5017	2,2nF		L10	61.445	18,4-20,4 Mc/s, C35, C36
	C46	78.5015	16pF trimmer		L11	61.428	36-41 Mc/s, C40,C41
	C47	74.5069	100pF		L12	62.439	144-164 Mc/s
	C48-C52	74.5081	2nF 500V		V1	99.5052	duotriode E188CC
	C53-C55	74.5016	1nF 500V		V2	99.5054	duotriode ECC81
13L	C56	74.5085	33pF ±5%(13L only) 500V		V3-V5	99.5002	pentode 5654
13L	C57-C58	74.5036	8,2pF±0,25pF(13L only) 500V				
13L	C59	74.5042	10pF ±5%(13L only) 500V				
13L	C60-C61	74.5005	5,6pF ±0,25pF (13L only) 500V				
13L	C62-C63	74.5046	15pF ±5%(13L only) 500V				
	C64	76.5031	22nF ±10% 400V				
	C65	74.5016	1 nF 500V				
	C66-C68	74.5081	2 nF 500V				
	C69	74.5015	1nF -20/+50% 500V				
	C70	74.5015	1nF -20/+50% 500V				
	C71	74.5013	100pF ±20% 500V				
	C72	74.5088	47 pF ±5% 500V				

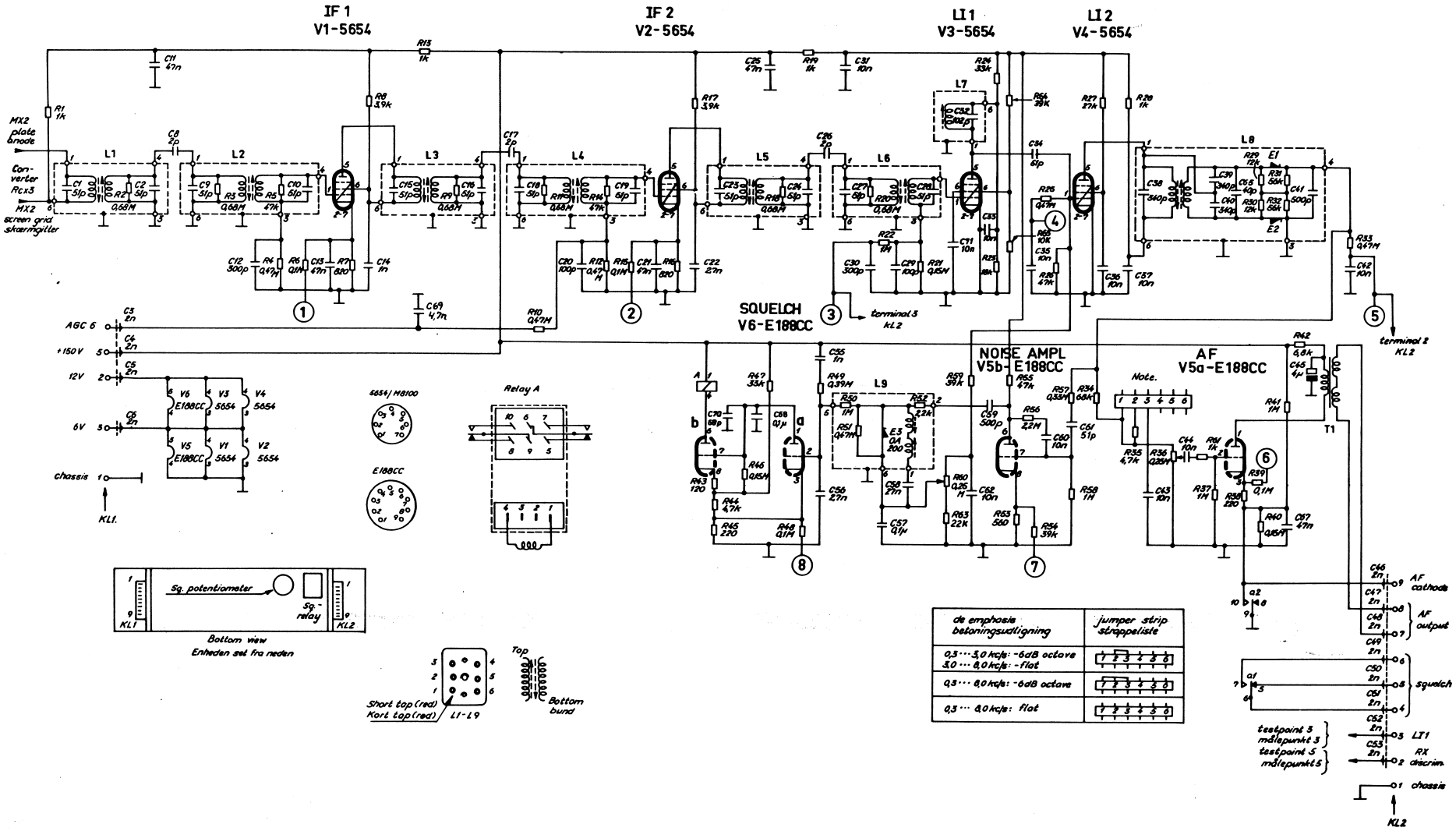
Storno

konstr./tegn. FH / JEK
3 - 5 - 60
godk.

komp.liste x10.027/2

IF-AMPLIFIER
MF-FORSTÆRKER IA13-1

D10.026/2



type	no	code	data	type	no	code	data
	C1..C2	74.5061	51 pF ±5% TC: -100		R33	80.5481	0.47 MΩ 1/4W
	C3..C6	74.5081	2 nF 500V		R34	80.5471	68 kΩ 1/4W
	C8	74.5028	2 pF ±0,1pF		R35	80.5457	4.7 kΩ 1/4W
	C9..C10	74.5061	51 pF ±5% TC: -100		R36	86.5020	0.25 MΩ potentiom. (log)
	C11	76.5035	47 nF ±10% 400V		R37	80.5485	1 MΩ 1/4W
	C12	74.5077	300 pF		R38	80.5441	220 Ω 1/4W
	C13	76.5033	47 nF ±10% 125V		R39	80.5473	0.1 MΩ 1/4W
	C14	74.5016	1 nF 500V		R40	80.5475	0,15 MΩ 1/4W
	C15-C16	74.5061	51 pF ±5% TC: -100		R41	80.5485	1 MΩ 1/4W
	C17	74.5028	2 pF		R42	81.5059	6.8 kΩ 1/2W
	C18-C19	74.5061	51 pF ±5% TC: -100		R43	80.5438	120 Ω 1/4W
	C20	74.5070	100 pF		R44	80.5457	4.7 kΩ 1/4W
	C21	76.5033	47 nF ±10% 125V		R45	80.5441	220 Ω 1/4W
	C22	76.5023	2,7 nF ±10% 400V		R46	80.5475	0,15 MΩ 1/4W
	C23-C24	74.5061	51 pF ±5% TC: -100		R47	81.5067	33 kΩ 1/2W
	C25	76.5035	47 nF ±10% 400V		R48	80.5473	0.1 MΩ 1/4W
	C26	74.5028	2 pF ±0,1 pF		R49	80.5456	0.39 MΩ 1/4W
	C27-C28	74.5061	51 pF ±5% TC: -100		R50	80.5485	1 MΩ 1/4W
	C29	74.5070	100 pF		R51	80.5481	0.47 MΩ 1/4W
	C30	74.5077	300 pF		R52	80.5453	2.2 kΩ 1/4W
	C31	76.5030	10 nF ±10% 400V		R53	80.5446	560 Ω 1/4W
	C32	74.5061	2x51 pF ±5% TC: -100		R54	80.5458	39 kΩ 1/4W
	C33	76.5030	10 nF ±10% 400V		R55	80.5469	47 kΩ 1/4W
	C34	74.5063	51 pF		R56	80.5489	2.2 MΩ 1/4W
	C35-C36	76.5028	10 nF ±10% 125V		R57	80.5479	0.33 MΩ 1/4W
	C37	76.5030	10 nF ±10% 400V		R58	80.5485	1 MΩ 1/4W
	C38-C40	74.5075	2x170 pF ±5%		R59	80.5468	39 kΩ 1/4W
	C41	74.5079	500 pF 500V		R60	86.5019	0.25 MΩ lin. potentiom.
	C42	76.5030	10 nF ±10% 400V		R61	80.5449	1 kΩ 1/4W
	C43	76.5011	10 nF ±5% 400V		R62-R63	80.5465	22 kΩ 1/4W
	C44	76.5030	10 nF ±10% 400V		R64	81.5068	39 kΩ 1/2W
	C45	73.5004	4 uF 85° 250V		R65	81.5061	10 kΩ 1/2W
	C46-C53	74.5081	2 nF 500V				
	C55	74.5016	1 nF 500V		E1...E3	99.5028	OA200
	C56	76.5023	2,7 nF ±10% 400V				
	C57	76.5036	0,1 uF ±10% 125V		L1	61.435	0,455 Mc/s, C1, C2, R2
	C58	76.5032	27 nF ±10% 125V		L2	61.438	0,455 Mc/s, C9, C10, R3, R5
	C59	74.5079	500 pF ±5% 350V		L3	61.437	0,455 Mc/s, C15, C16, R9
	C60	76.5030	10 nF ±10% 400V		L4	61.438	0,455 Mc/s, C18, C19, R11, R14
	C61	74.5061	51 pF ±5% 500V				
	C62	76.5030	10 nF ±10% 400V				
	C65	74.5057	40 pF ±5% TC: -750		L5	61.437	0,455 Mc/s, C23, C24, R18
	C67	76.5033	47 nF ±10% 125V		L6	61.439	0,455 Mc/s, C27, C28, R20
	C68	76.5036	0,1 uF ±10% 125V		L7	61.395	0,455 Mc/s, C32
	C69	74.5020	4,7 nF -20/+50% 500V		L8	61.440	0,455 Mc/s, C38, C39, C40, C41, C65, R29, R30, R31, R32, E1, E2
	C70	74.5018	68 pF ±5% 500V				
	C71	76.5030	10 nF ±10% 400V				
	R1	80.5449	1 kΩ 1/4W		L9	61.427	High pass filter R50, R51, R52, E3
	R2..R3	80.5483	0.68 MΩ 1/4W				
	R4	80.5481	0.47 MΩ 1/4W				
	R5	80.5469	47 kΩ 1/4W				
	R6	80.5473	0.1 MΩ 1/4W				
	R7	80.5448	820 Ω 1/4W		ReA	58.5019	Squelch relay
	R8	80.5456	3.9 kΩ 1/4W				
	R9	80.5483	0.68 MΩ 1/4W		T1	60.5022	25 kΩ/1200 Ω
	R10	80.5481	0.47 MΩ 1/4W				
	R11	80.5483	0.68 MΩ 1/4W		V1...V4	99.5002	pentode EF95/5654/M8100
	R12	80.5481	0.47 MΩ 1/4W		V5...V6	99.5052	duo triode E188CC
	R13	81.5049	1 kΩ 1/2W				
	R14	80.5469	47 kΩ 1/4W				
	R15	80.5473	0.1 MΩ 1/4W				
	R16	80.5448	820 Ω 1/4W				
	R17	80.5456	3,9 kΩ 1/4W				
	R18	80.5483	0.68 MΩ 1/4W				
	R19	80.5449	1 kΩ 1/4W				
	R20	80.5483	0.68 MΩ 1/4W				
	R21	80.5475	0.15 MΩ 1/4W				
	R22	80.5485	1 MΩ 1/4W				
	R23	81.5064	18 kΩ 1/2W				
	R24	81.5067	33 kΩ 1/2W				
	R25	80.5481	0.47 MΩ 1/4W				
	R26	80.5469	47 kΩ 1/4W				
	R27	80.5466	27 kΩ 1/4W				
	R28	80.5449	1 kΩ 1/4W				
	R29-R30	80.5462	12 kΩ 1/4W				
	R31-R32	80.5470	56 kΩ 1/4W				

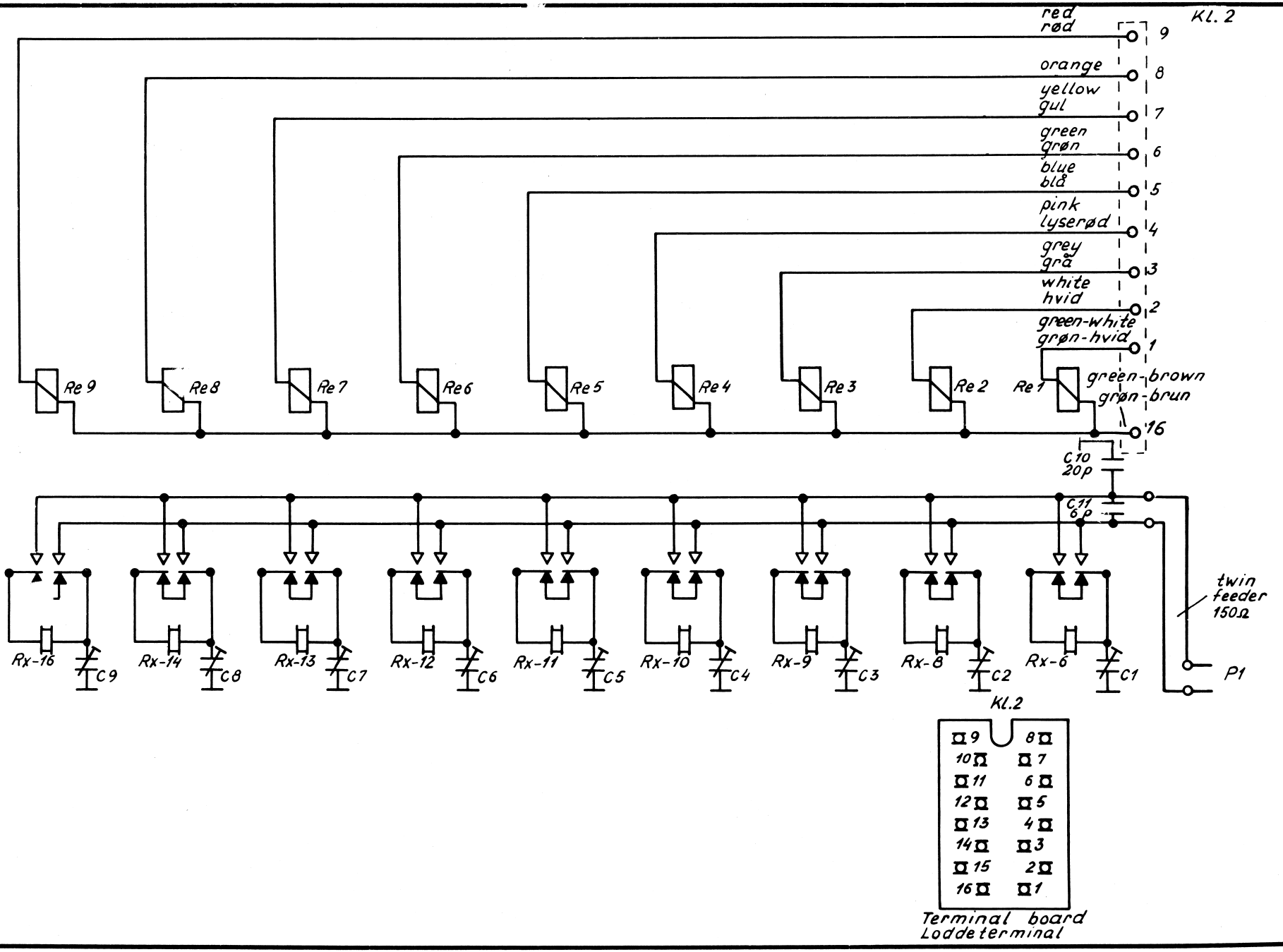
X10.027/2

Storno

konstr./tegn. KN-GM. 28-3-60.
godk. [illegible] 4-4-60
komp.liste X10749.

X-TAL SHIFT UNIT
X-TAL SKIFTEENHED
XS 13-1

D10748



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X10.749

X10.749

Stern

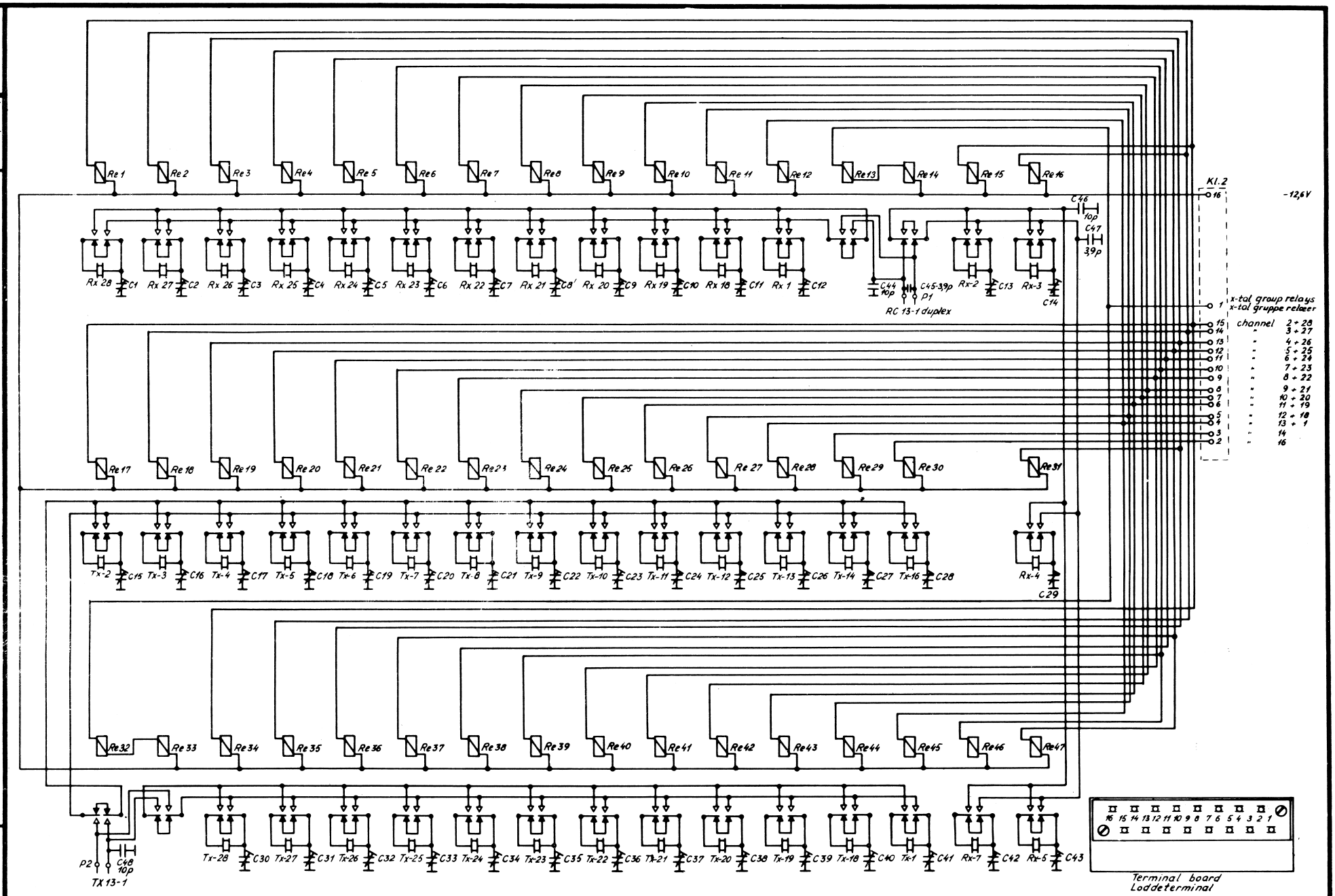
konstr/tegn. KN-GM. 22-4-60
godk. KN 22-4-60
komplikte
X 10751

X TAL SHIFT UNIT

X TAL SKIFTEENHED

XS 13-3

D10750



type	no	code	data	type	no	code	data
	C1 ..C43	78.5009	22 pF trimmer		C47	74.5031	3,9 pF ±0,5 pF 500V
	C44	74.	10 pF ±5% 500V		C48	74.	10 pF ±5% 500V
	C45	74.5031	39 pF ±0,5 pF 500V				
	C46	74	10 pF ±5% 500V		Rel-47	58.5004	Relays 6V

X 10.751

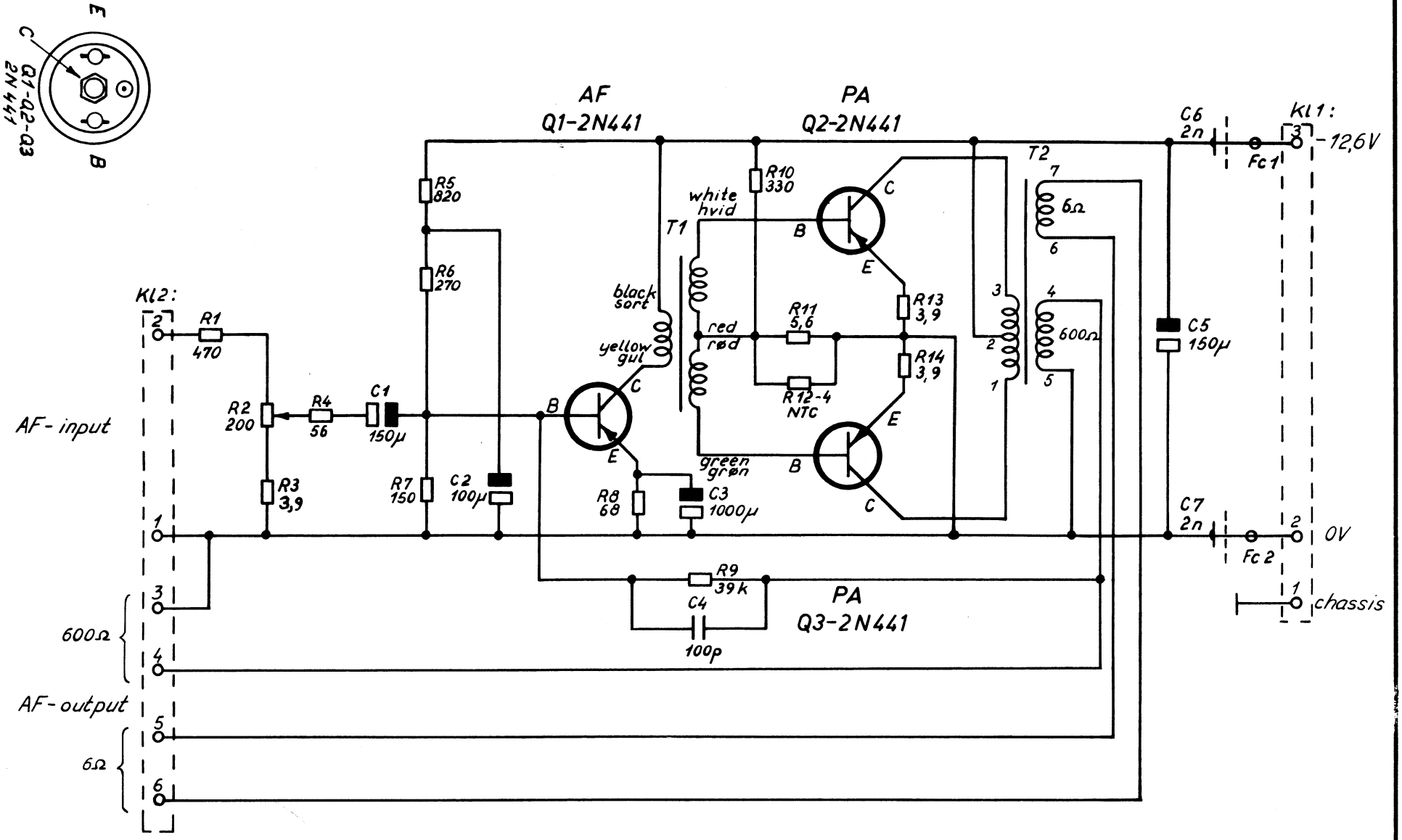
X 10.751

Storno

konstr./tegn. SM/GM 6-10-52
godk. SM/ 6-11-52
komp.liste
X10353

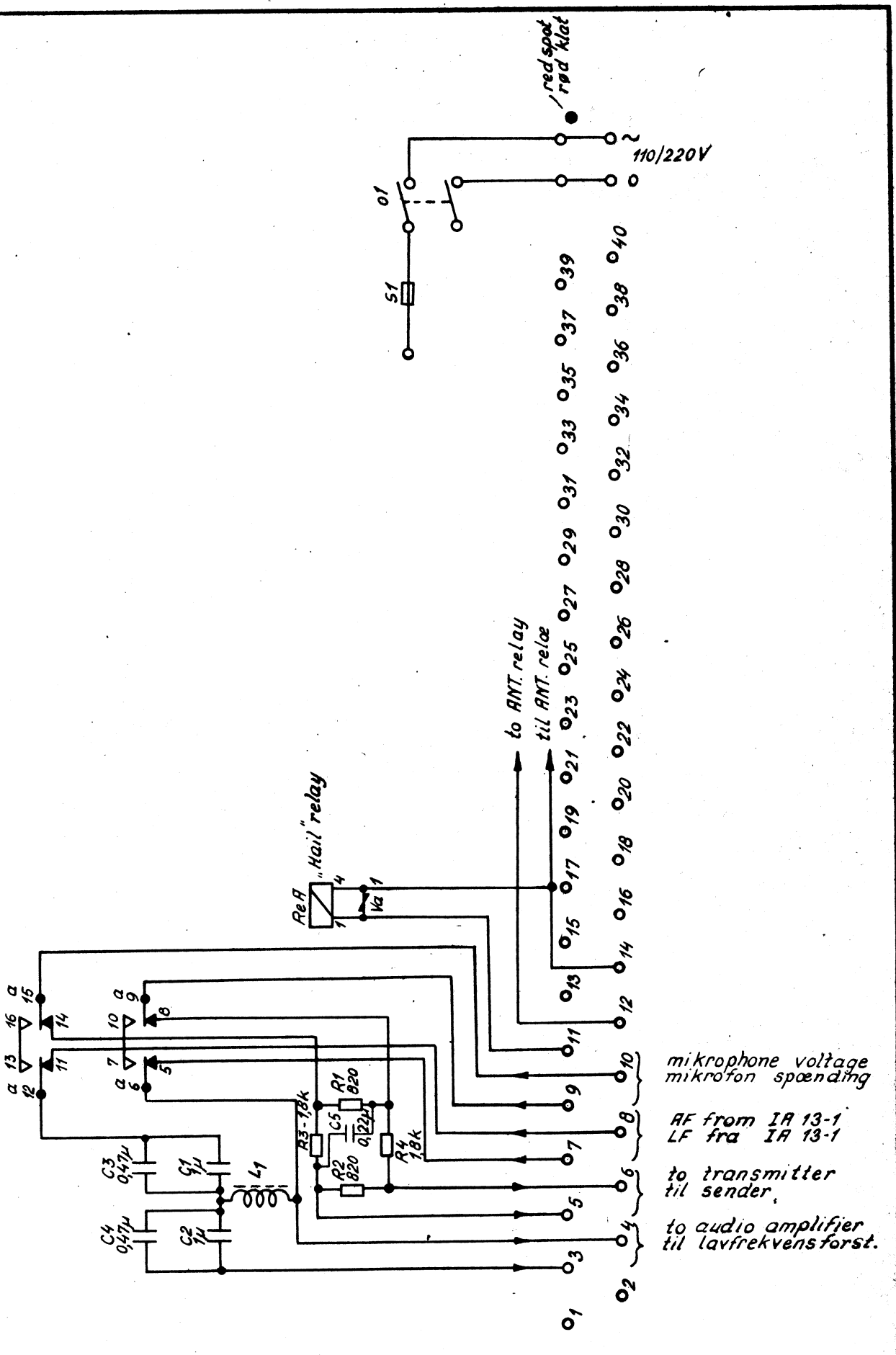
AUDIO AMPLIFIER
LAVFREKVENSFORSTÆRKER
AA 13-4

D10352



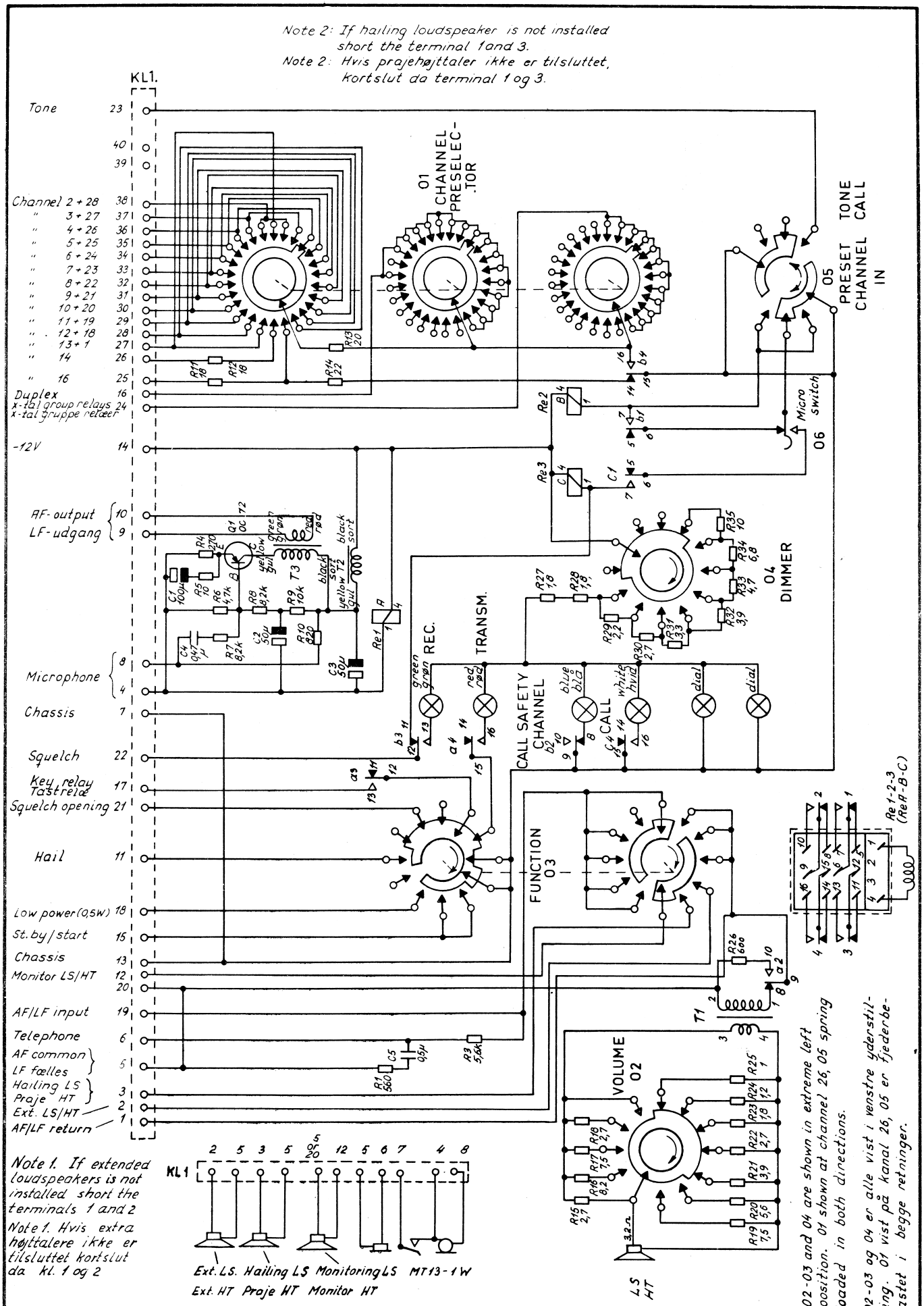
type	no	code	data	type	no	code	data
	C1	73.5039	150 µF 12/15V		R4	80.5434	56 Ω 1/4 W
	C2	73.5044	100 µF 12/15V		R5	80.5448	820 Ω 1/4 W
	C3	73.5067	1000 µF 12/15V		R6	80.5442	270 Ω 1/4 W
	C4	74.5069	100 pF		R7	80.5439	150 Ω 1/4 W
	C5	73.5040	150 µF 25/30V		R8	80.5435	68 Ω 1/4 W
	C6..C7	74.5080	2 nF 500 V		R9	80.5468	39 kΩ 1/4 W
					R10	81.5043	330 Ω 1/2 W
	Fc1	65.	1 Ferroxcube pearl		R11	82.	5,6 Ω 1/2 W
	Fc2	65.	4 Ferroxcube pearl		R12	89.5001	4 Ω NTC
					R13	81.	3,9 Ω 1/2 W
	Q1..Q3	99.5016	Transistor 2N441		R14	81.	3,9 Ω 1/2 W
	R1	80.5445	470 Ω 1/4 W		T1	60.5016	600/1200 Ω
	R2	87.5002	200 Ω pot. 1/2 W		T2	60.5037	46/600 Ω/6Ω
	R3	81.	3,9 Ω 1/2 W				

X10.353



Storno	konstr./tegn. KN-GM. 31-3-60	TERMINAL PANEL TERMINALENHED	TB 13-1
	godk. KN 4-4-60		
	komp.liste X10705		D10754

42203

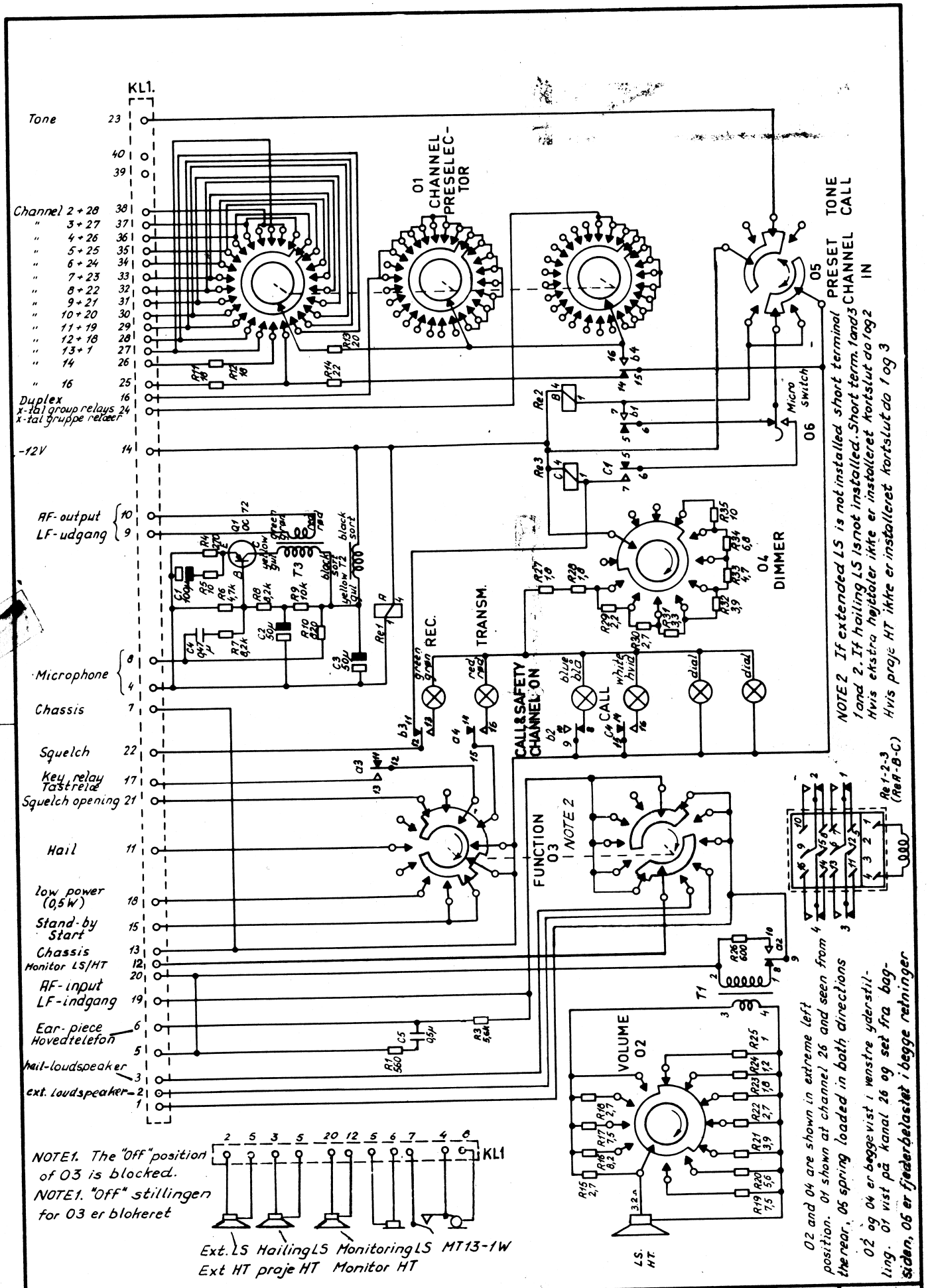


Storno	konst/tegn. KH - GM. 11-5-60 godk. komp. liste X 10796	CONTROL BOX CB13-8

D 10.795/2

type	no	code	data	type	no	code	data
	C1	73.5034	100uF 3 V		R29	82.	2,2Ω 1 W
	C2..C3	73.5032	50uF 25 V		R30	82.	2,7Ω 1 W
	C4..C5	76.5027	0,47uF 125V		R31	82.	3,3Ω 1 W
					R32	82.	3,9Ω 1 W
	R1	82.5046	560Ω 1 W		R33	82.	4,7Ω 1 W
	R3	82.5058	5,6kΩ 1 W		R34	82.	6,8Ω 1 W
	R4	81.5042	270Ω 1/2W		R35	82.	10Ω 1 W
	R5	80.5425	10Ω 1/4W				
	R6	80.5457	4,7kΩ 1/4W		LS	97.5010	Loudspeaker Højttaler 3,2Ω
	R7..R8	80.5460	8,2kΩ 1/4W				
	R9	80.5461	10kΩ 1/4W				
	R10	82.5048	820Ω 1 W		MT	MT13-1W	Microtelephone
	R11..R12	83.5028	18Ω 2 W				
	R13	83.5025	2x10Ω 2 W		01	47.196	Channel preselector
	R14	83.5029	22Ω 2 W		02	47.190	Volume
	R15	82.	2,7Ω 1 W		03	47.197	Function
	R16	81.	8,2Ω 1/2W		04	47.188	Dimmer
	R17	81.	7,5Ω 1/2W		05	47.189	Channel IN-Tone Call
	R18	81.	2,7Ω 1/2W		06	47.5008	Micro Switch
	R19	81.	7,5Ω 1/2W				
	R20	81.	5,6Ω 1/2W		Q1	99.5012	Transistor OC72
	R21	81.	3,9Ω 1/2W				
	R22	81.	2,7Ω 1/2W		Rel..Re3	58.5022	Relay
	R23	81.	1,8Ω 1/2W				
	R24	81.	1,2Ω 1/2W		T1	60.5036	600/3,5Ω 4 W
	R25	81.	1Ω 1/2W		T2	60.5008	0,8H 20mA 25Ω
	R26	83.5204	600Ω 3 W		T3	60.5017	1200Ω/600Ω
	R27	82.	1,8Ω 1 W				
	R28	82.	1,8Ω 1 W		V1..V6	92.5001	12 V 2 W

X10.796



Storno	konst/tegn. KH - GM. 11-5-60	CONTROL BOX Master box Fortrinsbox	CB 13-8a
	godk. KH 14-9-62		
	komp. liste X 10796		D 400.334

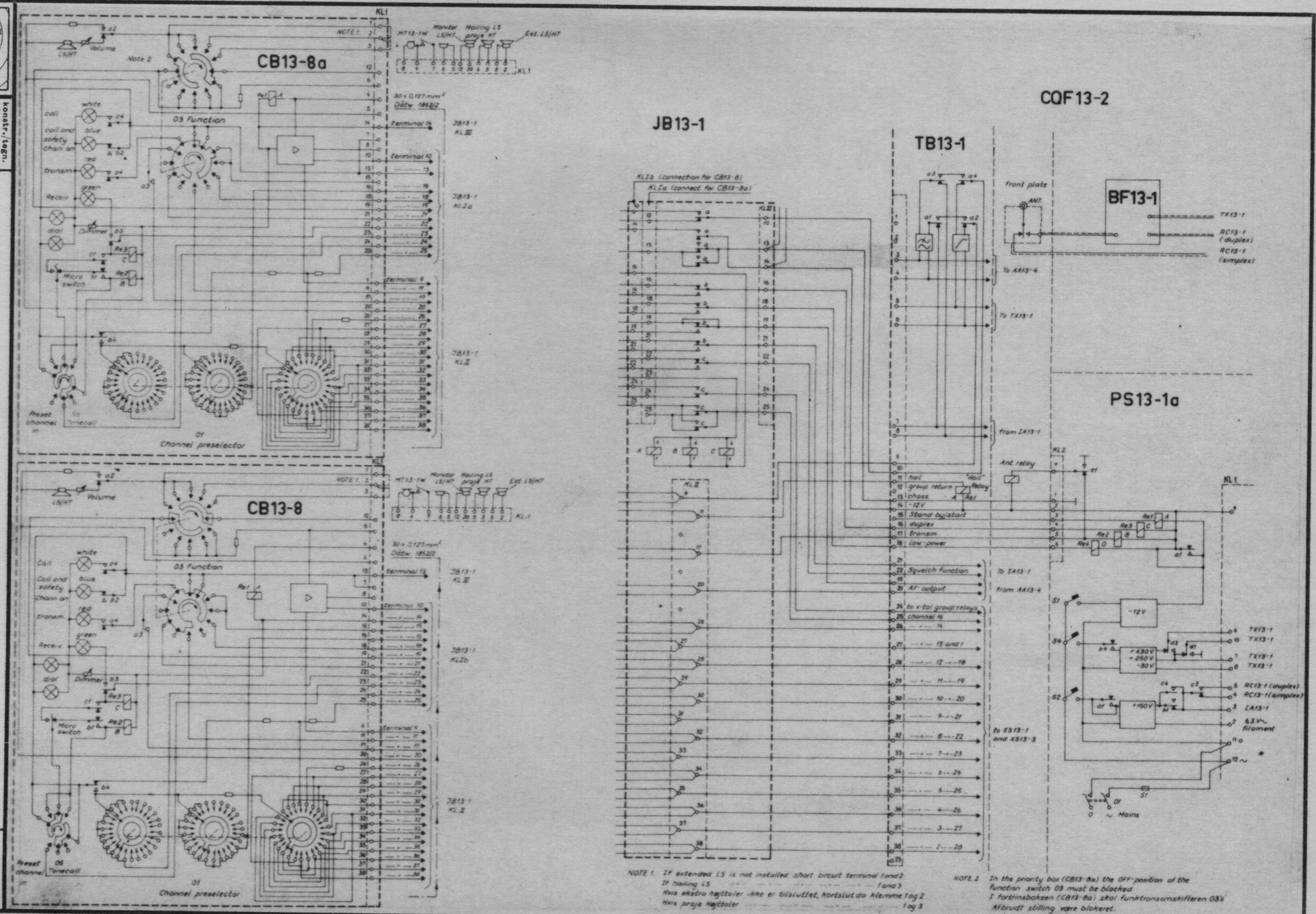
43123

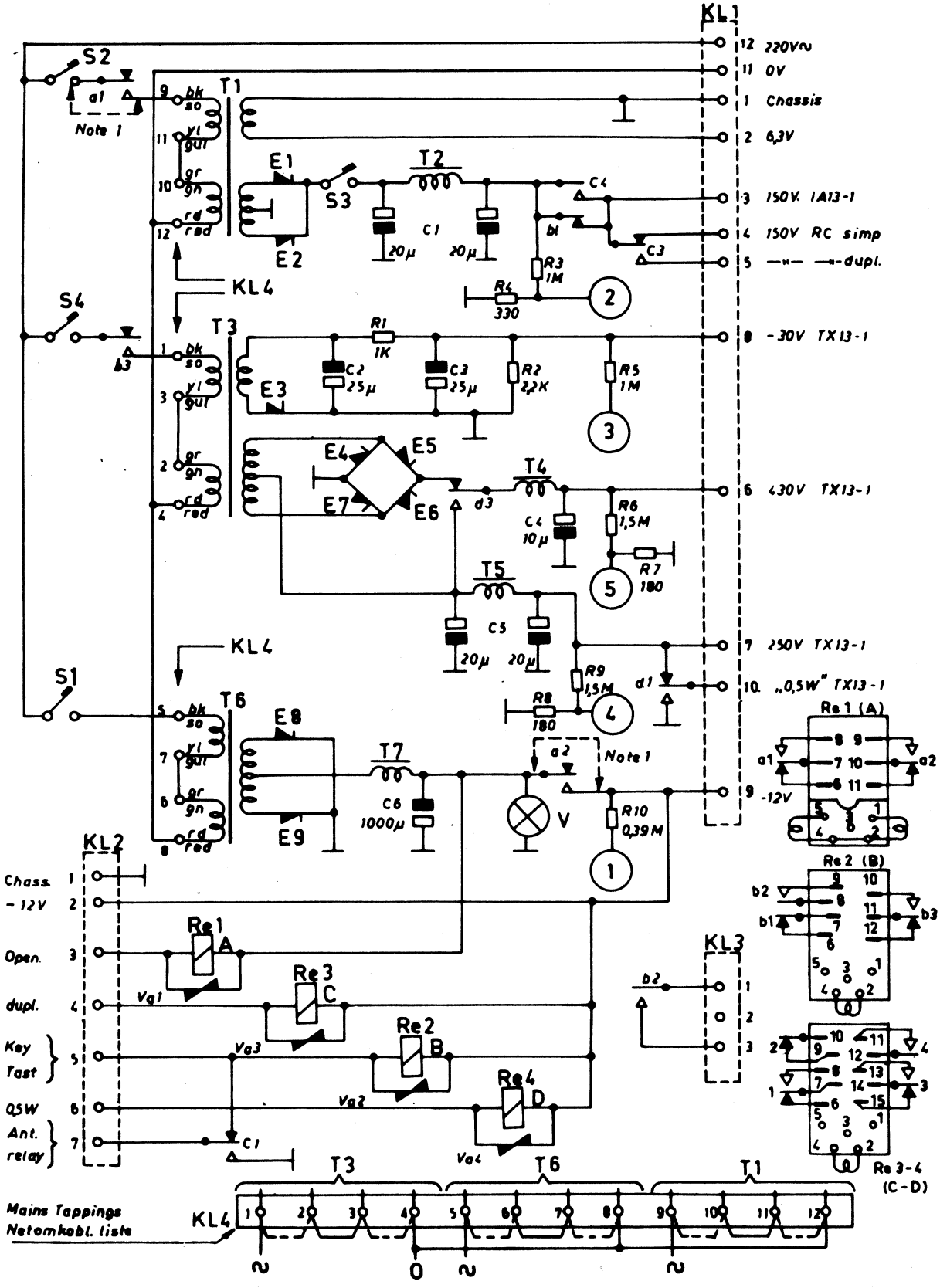
Storno

Konstr./tegn. EBN/BM 12-10-62
godk. KH
komp.liste

MARITIME VHF RADIOTELEPHONE with two Control Boxes CB13-8/8a CQF13-2

D 400.189





Note 1: Shorting links to be laid in PS13-1a.

Kortslutninger der lægges i PS13-1a.

——— { Connections at 220V / Forbindelser ved 220V

---- - " - " 110V

Storno	konstr./tegn. EBN/JEK 29-1-64 godk. komp.liste X10.795	POWER SUPPLY STRØMFORSYNING	PS 13-1/1a	D10.762/2