MOBILE RADIOTELEPHONE
TYPE CQM412
TYPE CQM413
142...174MHz

CONTENTS

Storno

GUARANTEED PERFORMANCE SPECIFICATIONS

General Specifications

Type	CQM412	CQM413
Frequency Range	142 - 174 MHz	
Min. Channel Separation	25 kHz	20 kHz
Max. Frequency Deviation	± 5 kHz	± 4 kHz
Frequency Stability	Meets government specifications	
Max. Bandwidth	800 kHz	
Antenna Impedance	50 ohms nominal	
Number of RF Channels	One	
Dimensions	159 x 49 x 211 mm	
Weight	1.8 kg	

Transmitter Specifications

RF Power Output	10 watts, Provision for reduced power
Modulation	Phase modulation 300 - 3000 Hz
FM Noise	40 dB below standard test modulation
Spurious Output	Less than 2×10^{-7} watts

Receiver Specifications

Sensitivity	0.5 μV EMF at 12 dB SINAD
Squelch	Electronic, adjustable
Adj. Channel Selectivity	Better than 70 dB (FTZ)
Undesired Radiation	Less than 2×10^{-9} watts
Intermodulation	Better than 60 dB (FTZ)
Spurious Response Att.	Better than 80 dB
Audio Output	1 watt; only 0.4 watts with built-in speaker

Power Supply Specifications

Battery Voltage	12.6 V/13.8 V
Battery Drain:	
Stand-by	0.15 amp
Transmission	2.5 amps

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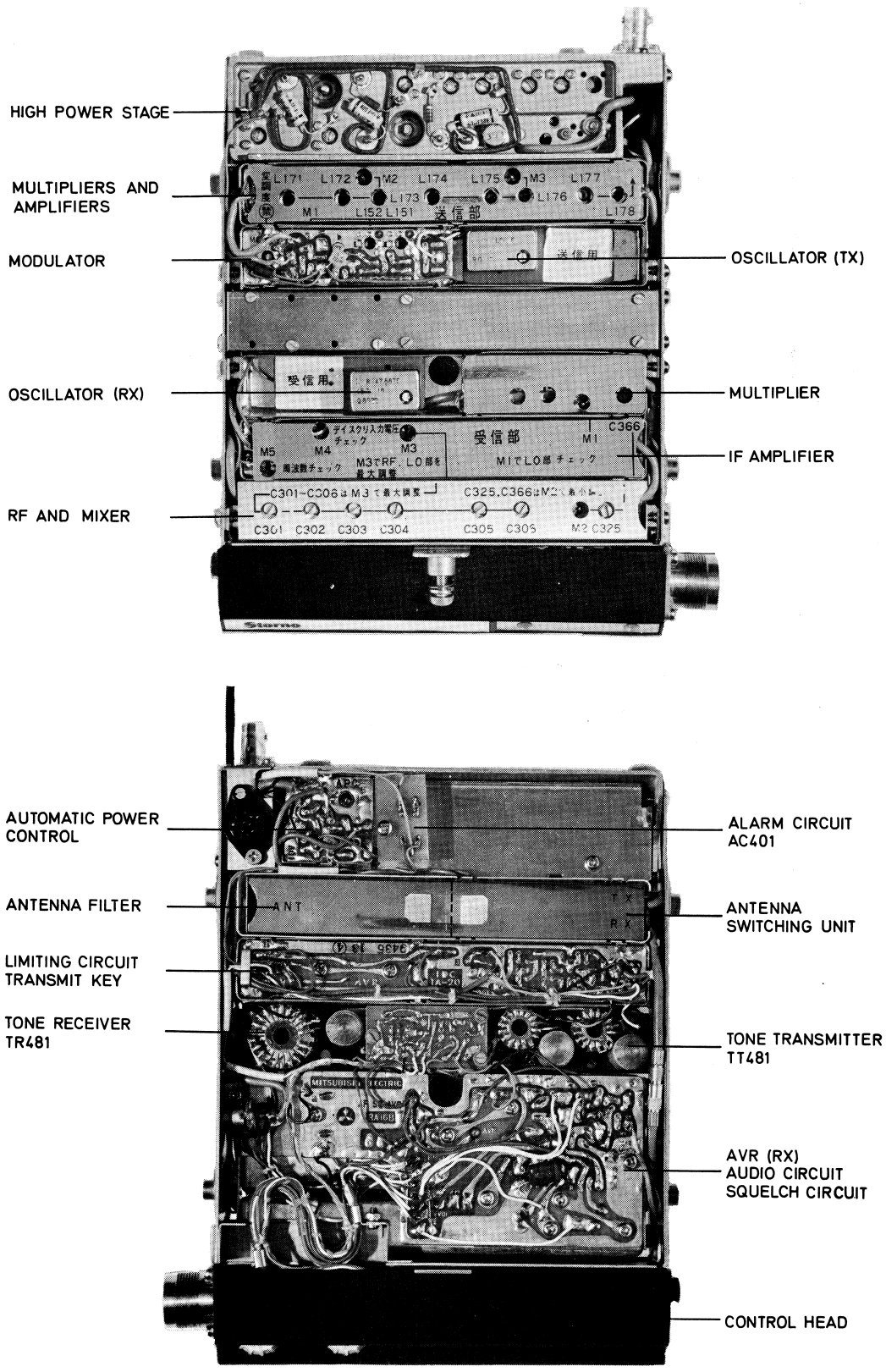

Mobile Radiotelephone CQM412, CQM413

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CHAPTER I. GENERAL DESCRIPTION

Introduction

The mobile radiotelephone CQM400 is a transmitter/receiver combination for simplex operated FM radio communication in the frequency range 142-174 MHz or 420-470 MHz.
The transmitter/receiver is developed and produced by the Japanese company Mitsubishi whereas the line of accessories available for the operation of the radiotelephone is mainly produced by Storno.

The complete radiotelephone comprises:

A cabinet housing the transmitter, the receiver, and a control head.

A microphone or handset.

An antenna.

Various installation kits.

This manual contains a description of the CQM400 and the standard accessories which are available. Because we are constantly processing the experience we gain during the production, testing, and operation of our radiotelephones, minor modifications and corrections will be made regularly. These will be listed on a separate sheet, which will be placed first in this manual.

Version

The CQM400 radiotelephones are available in the following versions:

TYPE	FREQ. RANGE	CHANN. SEPARATION
CQM412	142-174 MHz	±25 kHz
CQM413	142-174 MHz	±20 kHz
CQM462	420-470 MHz	±25 kHz
CQM463	420-470 MHz	±20 kHz

The CQM400 can be operated from a 12-volt DC power supply only, and when installed in a vehicle the negative potential of the battery must be connected to chassis.

The transmitter output for 2-metre radiotelephones is 10 watts, and for 0.7 metres radiotelephones 5 watts.

Space is provided in the transmitter/receiver cabinet for installation of tone equipment, and a line of tone calling units makes it possible to chose between various forms of selective calling systems.

Construction

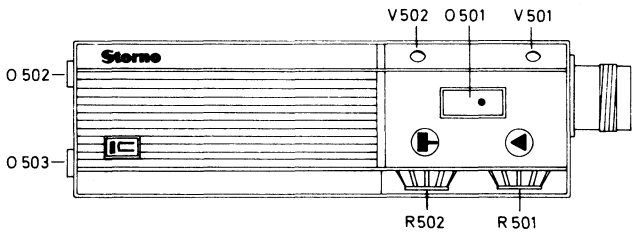
The transmitter/receiver equipment is housed in a metal-plate cabinet the interior of which is divided into a number of compartments each accomodating a number of receiver and transmitter units.
By leesening a screw located at the centre of the top cover of the cabinet, both the top and bottom cover will come off at the same time and most of the radio circuits become accessible.
Beside housing the transmitter and receiver the metal cabinet also serves as chassis for the radio circuits.
The control head forms the front section of the cabinet.

A multiwire connector located on the right side of the control head provides connection of handset or microphone and external transmit key.

A connector accessible through the bottom plate of the cabinet provides connection of external loudspeaker, if any, and of alarm device in case tone receiver and alarm circuit are built into the radio cabinet.

A BNC-type connector for connection of the antenna cable is located on the rear of the cabinet.
Through the rear of the cabinet are let two cables on which is mounted a combinet battery connector and fuseholder.

Operation



O501 Toggle switch.

On/off switch.

O502 Red self-releasing push-button.

Tone button (with built-in tone transmitter).
Transmit button (without built-in tone transmitter).

O503 Green self-releasing push-button.

In conjunction with built-in tone receiver this button cuts the loudspeaker in and out.

V501 Green pilot lamp.

Start lamp (without built-in tone receiver).
Indicates reception of tone calls (with built-in tone receiver).

V502 Red pilot lamp.

Transmit pilot lamp.

R501 Potentiometer.

Volume control.

R502 Potentiometer.

Squelch control.

On/off switch

The on/off function is operated by means of a toggle switch. By depressing the side of the switch marked with a red dot battery voltage is supplied to the radiotelephone.

Tone key

If a tone transmitter is used, a tone call can be transmitted only by pressing the button 0502, causing both the tone transmitter and the station transmitter to be operated.
If tone calls are not desired in subsequent traffic, the radiotelephone must be operated from an external transmit button such as a steering-wheel switch or microphone switch.

If a tone transmitter is not used in the radiotelephone, push-button 0502 may be used as a normal transmit key.

"Speaker in"/"Speaker out"

In conjunction with built-in tone receiver the loudspeaker will be operative during incoming calls. The loudspeaker can be cut out on termination of calls by depressing button 0503. Only calls intended for the operator will then turn the loudspeaker on.

If you want to monitor the channel for traffic, you turn the loudspeaker on by depressing the button. The channel should always be monitored before pressing the transmit button, and for this reason the tone receiver unit incorporates a circuit to prevent operation of the transmitter before the loudspeaker has been turned on.

Start lamp

In radiotelephones without built-in tone receiver lamp V501 shows light when the radiotelephone is turned on.
In stations with built-in tone receiver the lamp shows light when a tone call is received and the loudspeaker cuts in automatically. The lamp continues to show light until button 0503 is depressed thus cutting out the loudspeaker.

Transmit pilot lamp

When keying the transmitter lamp V502 illuminates.

Volume control

The volume is increased by turning potentiometer R501 to the right.

Squelch control

The setting of the electronic squelch in the receiver is performed by means of potentiometer R502 by turning the potentiometer to the right until you hear set noise (hiss); then turn it in the opposite direction until the noise disappears.

Control Equipment and Accessories

The list below covers the types of control equipment and accessories that are available for the CQM400 radiotelephones. Some of them, such as installation material, antenna and material, antenna and microphone, are necessary for installing and operating the equipment.

Control Equipment

LS401	High-efficiency loudspeaker. Supplied with mounting hardware and connector.
MC401	Fixed microphone with built-in amplifier. Supplied with mounting hardware, but less connector.
MC402	Fixed microphone for mounting on steering column. Supplied with mounting hardware, but less connector.
MC403	First microphone with built-in amplifier and transmit button, supplied with cable, connector, and hook suspension.
SU601 or SU602	Steering column transmit key with mounting hardware.

Antennas

The CQM400 radiotelephone is designed for operation with a 50-ohm antenna. Storno can supply the following standard types, all of which have bases designed to permit mounting from the outside without damaging the upholstery.

AN19-5	1/4 wavelength whip antenna for the frequency range 146-174 MHz.
AN69-3	1/4 wavelength whip antenna for the frequency range 420-470 MHz.
AN69-4	5/8 wavelength whip antenna for the frequency range 420-470 MHz.

Selective Tone Equipment

Tone equipment to permit operation in selective calling systems can easily be installed in the CQM400 radiotelephone, in which space has been left for tone transmitters, tone receivers, and alarm circuit.

TT481 Tone transmitter for transmission of single or double tone selective calls.

TR481 Tone receiver for reception of single or double tone selective calls.

AC401 Alarm circuit for operation of external alarm device (e. g. car horn or bell) in connection with tone receiver TR481.

Installation Kit

In addition to accessories listed above, the installation of CQM400 and the associated control equipment requires the following kits of parts:

MN401 Mounting kit comprising a mounting plate for the CQM400 cabinet and mounting hardware.

CC401 Kit consisting of battery and chassis cable.

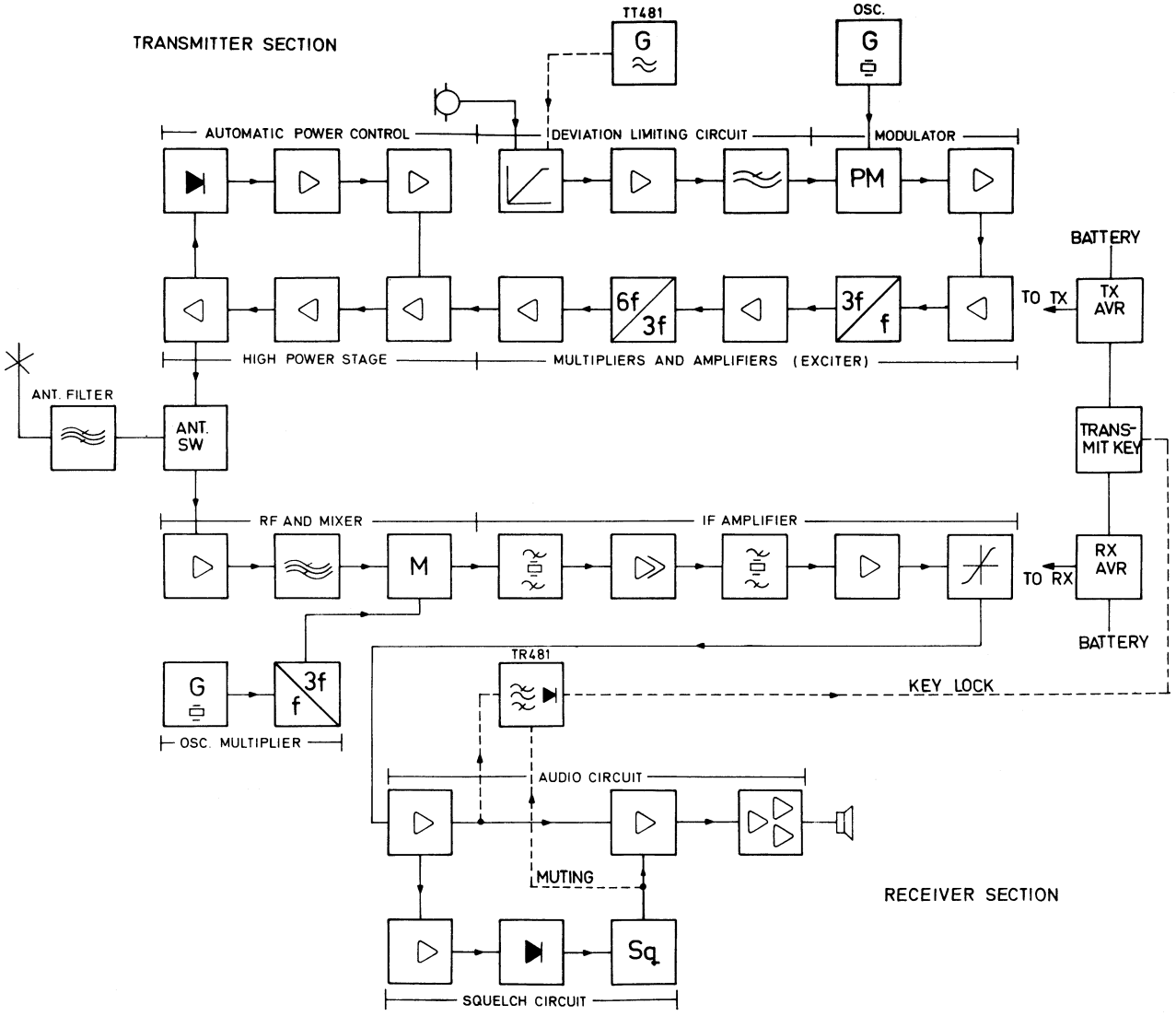
CC402 Kit consisting of antenna cable and antenna connector.

The above kits are delivered with the radiotelephone.

The following kit is required for installation of certain types of control equipment:

MK401 Hardware kit consisting of a connector for control equipment, such as fixed microphones MC401 and MC402, and Steering column transmit key SU601 or SU602.

CHAPTER II. THEORETICAL CIRCUIT ANALYSIS



General

Both the receiver and the transmitter are divided into a number of subunits each of which is built on printed wiring boards. This division has been made in order to make the equipment easily accessible for adjustment and repairs, and follows strictly logical lines.

The receiver and transmitter use silicon transistors throughout, resulting in less dependence on ambient temperature and in great reliability.

Functional Operation

The overall operation of the radiotelephone is illustrated in the above block diagram.

When the control head ON/OFF switch is turned on, the receiver is immediately operative, and battery voltage is applied to:

a) The receiver automatic voltage regulator input
b) The receiver audio amplifier stage
c) The transmitter automatic voltage regulator input

d) The transmitter power amplifier stage.

A regulated 9 volt supply voltage derived from the receiver AVR is applied to:

a) The receiver RF and Mixer stage, the crystal oscillator, the multiplier stage, the IF stage, and the squelch circuit.

When the transmitter is keyed, the following functions are performed:

a) The red lamp in the control head lights, indicating the transmitting condition.

b) The receiver AVR is inactivated.

c) The transmitter AVR is activated and a regulated 10 volt supply is applied to the transmitter crystal oscillator, the limiter stage, the modulator stage, the multiplier stage, the antenna switch, and the automatic power control stage.

When the transmit key is released the radiotelephone returns to its stand-by condition.

RECEIVER

The receiver is a completely transistorized single-conversion superheterodyne type using an immediate frequency of 10.7 MHz. It receives FM-signals on one fixed crystal controlled frequency within the frequency band 142-174 MHz.

RF and Mixer stage

The RF section of the receiver contains an RF preselector and a common emitter RF amplifier stage.
The RF preselector consists of six low loss, highly selective helical resonant cavities. The preselector has a bandwidth representing a flat acceptance bandwidth characteristic and a steep skirt response to provide rapid attenuation of signals outside the acceptance bandwidth.

RF carries signals received at the antenna are coupled to the base of the RF amplifier through the preselector cavity. The gain of this stage provides an optimum signal-to-noise ratio of the signals sent to the mixer.

Oscillator-Multiplier

The oscillator circuit is housed in a factory-sealed plug-in module. The oscillator uses an unheated crystal in an integrated circuit with the output at the third harmonic of the fundamental frequency. The output is applied to a transistor circuit which multiplies it three times. Consequently the injection signal to the mixer is nine times the fundamental frequency of the crystal.

Mixer

The mixer heterodynes the signal from the oscillator to produce the intermediate frequency of 10.7 MHz. These frequency relationships can be expressed as follows:

$$f_c - 3f_1 = 10.7 \text{ MHz}$$

where f_c is the RF carrier

f_1 is the crystal oscillator frequency.

IF Stage

The IF section consists of four transistor amplifiers in a common emitter coupling, two crystal filters, and a crystal discriminator. The IF frequency is 10.7 MHz.

The output from the mixer is coupled to the main crystal filter which is the major factor in determining the bandwidth and selectivity of the receiver. The IF signal is then amplified in the succeeding four amplifier stages whereupon it is coupled to the second crystal filter and from there it is passed to an integrated amplifier which has sufficient gain and limiting performance. The amplitude-limited signal is finally applied to the crystal discriminator, which recovers the audio from the 10.7 MHz IF signal.

Squelch circuit

The purpose of the squelch circuit is to eliminate disturbing noise which would otherwise be heard in the loudspeaker during intervals between received messages.

The noise operated squelch circuit consists of a noise amplifier, a noise detector, and a switching circuit. When the switching transistor is on, the dc-biasing voltage to the audio amplifier is connected to chassis.

Audio circuit

Audio signals from the discriminator are coupled to the first audio amplifier, and through the volume control, coupled to the second audio amplifier. The audio signals are amplified in the complimentary push-pull amplifier stage and further amplified in the push-pull power output stage without transformer.

The output stage provides 0.4 watt output to a 16 ohms speaker with less than 10% distortion. The response is between +1.0/-3 dB of the 6 dB/octave de-emphasis characteristic between 300 and 3000 Hz.

Automatic voltage regulator stage

The receiver automatic voltage regulator consists of one transistor and a zenerdiode. It converts 13.8 V dc into 9 V dc. When the transmit key is activated, the base of the transistor is connected to chassis.

TRANSMITTER

The fully transistorized transmitter is phase-modulated and operates on one crystal controlled frequency. The crystal oscillator frequency is modulated, multiplied by a factor of six, and applied to the high power RF stages. A transistor power amplifier provides a minimum of 10 watts output within the frequency range 142-174 MHz.

Deviation limiting circuit

In the incoming signal from the microphone, the waveform slope depends on both amplitude and frequency. The overall effect of the deviation limiting circuit is to place a barrier upon the maximum waveform slope which can pass into the modulator. The deviation limiting circuit consists of components for pre-emphasizing (dB/octave characteristic), amplifying, and limiting, and then de-emphasizing the modulation signal. Two diodes slip both positive and negative peaks when they exceed the pre-determined clipping level. Except for slope limiting, the output waveform of the deviation limiting circuit is identical to the input waveform. The amplifier and deviation limiting circuit limits deviation by controlling the maximum slope of the signal waveform which reaches the modulator. This controls the maximum frequency deviation of the transmitter, since the modulator frequency shift is proportional to the slope of the audio input.
A low-pass filter is provided between de-emphasizing stage and the modulator.

Oscillator

The oscillator circuit is housed in a factory-sealed plug-in module. The oscillator uses an unheated crystal in an integrated circuit with the output at the third harmonic of the fundamental frequency. The output is applied to the modulator.

Modulator

The audio output of the deviation limiting circuit is applied to the modulator which phase modulates the output of the oscillator. The tuning elements of the modulator tank circuits are varactors. The capacitance of these special back biased diodes is a function of the potential across them. The audio signal is applied to the varactors which changes this potential at an audio rate and varies the capacitance in the modulator tank circuit. This changes the phase angle of the RF signal producing modulation.

Multipliers and Amplifiers (Exciter)

From the modulator, the signal is first amplified, then applied to a tripler, amplified once more, doubled, and finally amplified again. This circuitry is contained on the exciter board. The output of the exciter board is normally 200-300 mW.

High power stage

The pre-driver, driver, and final stages are all working as common emitter amplifiers. The nominal power output of the final stage is 10 W.

However, it can be reduced by controlling the V_{be} of pre-driver, which is acted in the automatic power control stage. The signal is coupled to the highpass and lowpass filters through the antenna switch circuit.

Automatic power control stage

The automatic power control stage consists of two transistor dc amplifiers. The dc voltage, proportional to the output of the final stage, and detected in the directional coupler provided in the antenna switch board, is applied to the input of the first dc amplifier, which controls V_{ee} of the second transistor. When the reflected power from the antenna terminal is detected in the directional coupler, the dc voltage, proportional to it is applied to this stage, thereby reducing the power output to the power transistor.
The collector of the second transistor is directly coupled to the emitter of the pre-driver transistor of the high power stage. Thus the power output of the transmitter is controlled automatically.

ANTENNA SWITCHING UNIT

A solid state switching circuit connects the antenna to the proper circuitry for either transmission or reception. The switching operates by forward biasing high frequency diodes (low impedance) during transmission, and during reception these diodes are not biased. The receiver end forms 1/4 wavelength transmission line, which operates as short or open performance due to biasing diodes.

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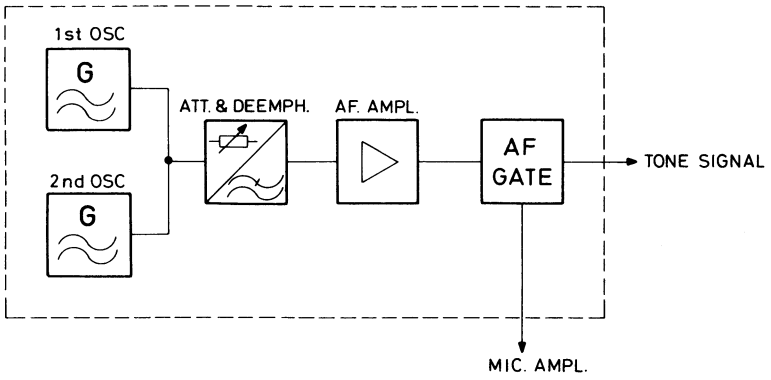
CHAPTER III. TONE EQUIPMENT

TONE TRANSMITTER TT481



Description

TT481 is a selective single- or double tone transmitter. The tone transmitter, which is built on a printed wiring board, is intended for installation in radiotelephones type CQM400.

The tone oscillator

Principally the tone oscillator is a Hartley circuit with Q1 and Q2 in a differential arrangement. The supply voltage is stabilized with a zener-diode to keep the oscillator output constant. The oscillator can be set for 12 different standard frequencies by switching a lead between the terminals of the tone coil. At single tone transmission, the feed back winding of one of the oscillator coils must be short circuited directly at the coil's terminal board.

Level adjustment and deemphasis

Between the oscillator and the output stage is inserted a combined deemphasis - and attenuator stage Q5.

The output stage

The emitter follower Q6 provides a low output impedance corresponding to the input impedance of the modulator. To obtain the best dynamic range, the emitter follower is connected directly to the regulated voltage. (AVR).

LF-gate

The LF-gate Q7 switches off the microphone signal during the tone transmission.

Transmission

As long as the external transmit key is depressed the transmitter AVR is activated via diode E3.

Technical Specifications

Supply voltage
10, 5V - 16V.

Battery Drain
14 mA (13, 6V).

Loading (terminal 2)
The current drain through 470 Ω from a 10V source amounts to 19 mA during tone transmission and 10 mA during speech transmission with the microphone amplifier AA401 connected to terminal 4.

Temperature range
Specified working range: -25°C - +60°C.
Unspecified operational range: -30°C - +80°C.

Tone Frequencies
1060, 1160, 1270, 1400, 1530, 1670, 1830, 2000, 2200, 2400, 2600, 2900 Hz.

Frequency Accuracy

Better than 0, 5%.

Frequency Stability

Better than ±1%.

Frequency Response

Falling according to a RC-function with cut-off frequency at 1060 Hz.

Output Level

Single tone: -4dBm ±0.5dB (134mV) at 1060 Hz.
Double tone: -4dBm ±0.5dB (134mV) at 1060 Hz.

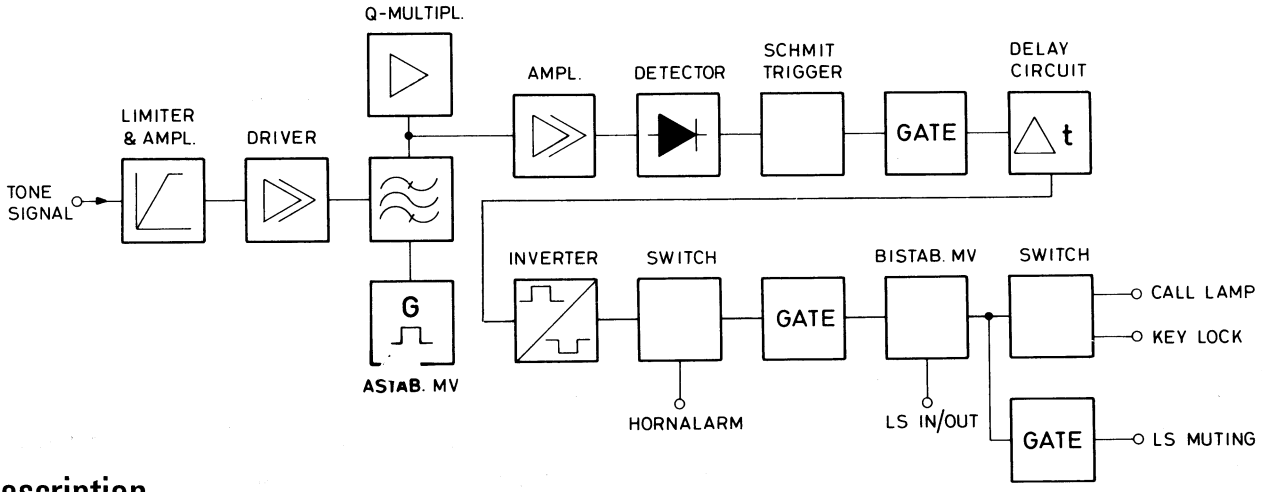
Distortion (Tone modulation)

Less than 3%.

AF-gate Attenuation

Better than 50 dB.

TONE RECEIVER TR681



Description

TR481 is a selective single- or double-tone receiver. The tone receiver, which is intended for installation in radiotelephones type CQM400, is built on two printed wiring boards which are bolted together with their tops (components) sides facing each other.

On reception for not less than 0.7 sec., of the particular call-tone - or call tones - to which the tone receiver is tuned, the radio receiver's audio output amplifier, normally muted, opens up automatically, the green pilot lamp on the control head of the radiotelephone shows light, and the key lock function is released, thereby allowing the transmitter to be keyed. Additional alarm functions (if desired) can be provided by connecting an alarm circuit AC401 to the tone receiver and the car horn, making it possible to sound the horn.

The audio output stage can be opened up manually by depressing the "Loudspeaker in" button on the control head, thereby allowing the receiver channel to be monitored for traffic. Monitoring the receiver channel - and hence also operation of the tone transmitter - is necessary every time the user wishes to switch on the transmitter, due to the fact that key lock function is controlled by the loudspeaker muting circuit.

Amplifier and Amplitude Limiter

Transistor Q1 amplifies the incoming signals until the diodes E1 and E2 commence to conduct. Full limitation occurs approx. 7 dB above min. trigger level for a double tone receiver, and approx. 3 dB above min. trigger level for a single tone receiver (i.e. either V_{in} = 50 mV or 100 mV RMS).

When limiting the amplitudes of all frequencies together with the band pass characteristic of the Q-multiplier, adjacent tones will not be able to trigger the tone receiver, providing their tone frequencies differ from the resonant frequency by at least 4.5%.

Driver

The transistors Q2 and Q3 operates in a configuration which provides a very low output impedance (approx. 1 ohm) and thus a negligible loading for the following Q-multiplier.

Q-multiplier

The Q-multiplier contains a parallel resonant circuit which is very loosely coupled to transistor Q8. C6 in the resonant circuit is grounded through

the output impedance of the driver and the relevant terminal(s) of the resonant coil L1 are alternatively grounded through the AF-gates Q6 and Q7. By means of a feedback winding in the collector circuit of Q8 part of the tone signal is again applied to L1 in phase, in order to give rise to the natural Q at L1 by a factor of approx. two. To neutralize the effect of temperature on the Q at L1 an NTC resistance (R20) is inserted in the emitter circuit of Q8.
This resistance will, in conjunction with R19 and R21 give an approximately flat temperature response from -30°C to +80°C.

Astable MV and AF-gates

The astable multivibrator consists of Q4 and Q5 which in turn drive the AF-gates Q6 and Q7. When the collector voltage of either Q4 or Q5 is LOW the basis of Q6 or Q7 is grounded respectively. This results in turning ON and OFF Q6 and Q7 alternatively.
The pulse repetition time is approx. 200 mS.

Amplifier, emitterfollower and detector

Q9 amplifies the tone signal after the Q-multiplier. To avoid loading of the Q-multiplier the input resistance is bootstrapped to a high value. Q9 is succeeded by an emitterfollower Q10 which in turn feeds the signal detector. The signal detector is a conventional voltage doubling circuit in which the DC output voltage for the following Schmitt-trigger can be adjusted by altering R31.

Schmitt-trigger and diode gate

The Schmitt-trigger (Q11, Q12) operates the succeeding diode gate (E5).

700 mS delay circuit

Q13 is part of a Miller-integrator circuit. When the Schmitt-trigger is not activated Q12 is ON and the basis of Q13 is grounded through E5 and Q12. By activating the Schmitt-trigger Q12 turns OFF and E5 ceases to conduct.

Horn alarm

As Q14 turns ON, Q15 will also turn ON and connect the terminal "Horn" to chassis. Q15 will remain ON as long as the correct tone signal is received.

Bistable MV and outlet switches

The bistable circuit consists of transistors Q16 and Q17. The bistable MV operates simultaneously TR481's outlet switches for "loudspeaker muting", "call lamp" and "key locking".
These three functions can be operated manually by connecting the terminal "LS IN/OUT" to ground by means of a push button switch. Each push will cause the MV to flip over
By reception of an adequate tone signal the transistor Q15 turns ON, which results in the basis of Q16 being grounded through the diode gate E7. This turns Q16 OFF. Thus, the voltage of Q16's collector rises turning Q18 OFF, Q21 ON and E10 OFF.
The loudspeaker muting is performed via E10, which is short circuited to ground through Q16 when this transistor is ON (i.e. the loudspeaker is cut off). Vice versa when Q16 is OFF the loudspeaker is in circuit again.
The transistor switches Q18 and Q19 control the ground path for the "call lamp" and the "key lock" respectively.

Technical Specifications

Power supply
10.5V - 16V, nom. 13.6V.

Current consumption
Without tone signal nom. 50 mA
With " " nom. 60 mA.

Temperature range
Specified working range -25°C - +60°C
Unspecified operational range -30°C - +80°C.

Input impedance
6 kΩ, assymmetrical.

Signal code
Double tonereceiver = 2 preset tonefrequencies, simultaneously received for min. 700 mS.
Single tonereceiver = 1 preset tonefrequency for min. 700 mS.

Input signal level
Double tonereceiver = nom. input voltage 100 mV ± 6 dB, each tone.
Single tonereceiver = nom. input voltage 200 mV ± 6 dB.

Frequency range (18 tones)

615, 675, 735, 805, 885, 970, 1060, 1160, 1270, 1400, 1530, 1670, 1830, 2000, 2200, 2400, 2900Hz

Frequency tolerance: 0.3%

Tolerance for the remaining tone frequencies, when the tone coil has been adjusted at 1060 Hz.

Frequency stability: 1%

Typically 0.5%.

Selectivity

Single LC resonant circuit, nom. Q = 28.

Max. loading of output switches

Horn switch: 100 mA.
Key lock: 50 mA.
Call lamp: 50 mA.
LS muting: 5 mA.

ALARM CIRCUIT AC401

Alarm Circuit AC401 is used in connection with tone receiver TR481 when an external alarm device, e.g. carhorn or bell, is required for indication of received tone calls.
The AC401 consists of a relay mounted on a printed wiring board. The unit is accomodated in the radiotelephone cabinet.
When a tone call is received, the tone receiver activates the alarm circuit relays, the contract set of which shortcircuits terminal 1 and 2 in connector J112 to which the external alarm circuit is connected.

CHAPTER IV. INSTALLATION

Introduction

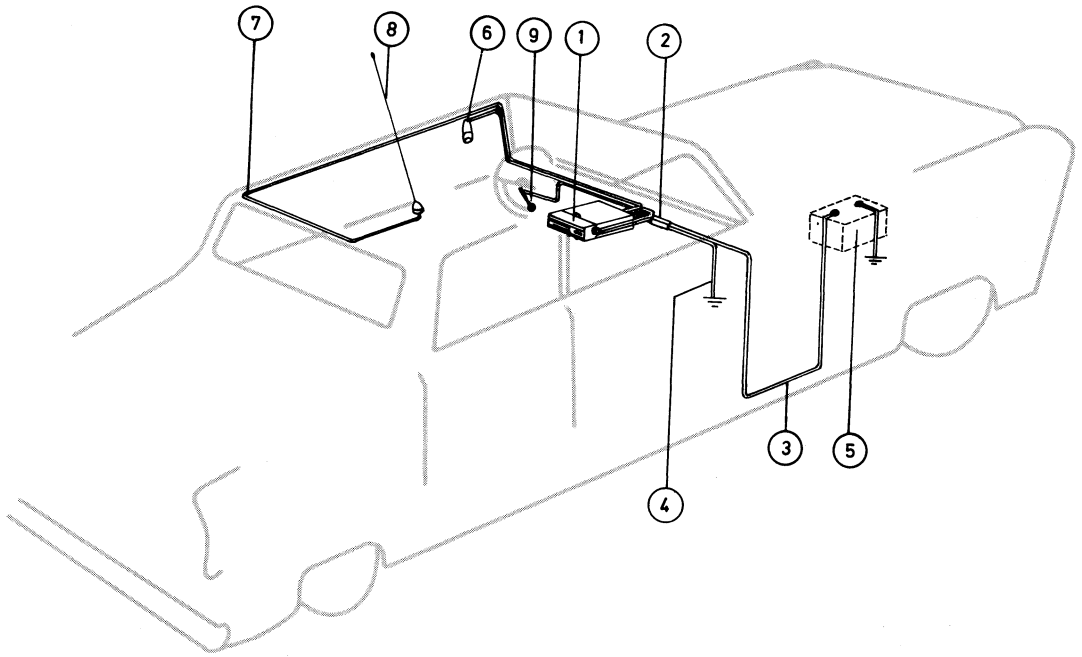
It is most important that the equipment is properly installed in accordance with the instructions in this chapter. The performance of the equipment can be seriously impaired if the installation is carried out without due care. The instructions given in this chapter should be read and followed carefully by the personnel installing the equipment.
It is not possible to give precise instructions for each particular vehicle, as there are so many different types and many customers who have different requirements.

If an installation job involves problems that cannot be solved through a study of this manual, please contact Storno.

Unpacking

On receipt of any consignment from Storno, all items should be unpacked and checked against the packing list and - if possible - the invoice. Also check for possible damage during transport. Storno should immediately be notified if goods are damaged or not as ordered.
When dispatching equipment to Storno in case of complaints, repairs, etc. the original packing should be used whenever possible.

Main Units



1. Station cabinet with mounting plate.
2. Combined battery connector and fuseholder.
3. Battery cable.
4. Chassis cable.
5. Vehicle battery.
6. Microphone.
7. Antenna cable.
8. Whip antenna.
9. Steering wheel switch.

A standard radiotelephone consists of these main units:

A station cabinet containing transmitter and receiver section, and provided with a control head, connectors for antenna cable and control equipment, and combined connector and fuseholder for connection of battery- and chassis cables.

A mounting kit type MN401 comprising a mounting plate and hardware.

A kit of installation cables type CC401 consisting of approx. 2.5 metres of battery cable and 1 meter of chassis cable with battery shoes.

A kit of installation cables type CC402 consisting of 4 metres of coaxial cable type RG58c/u and a BNC connector.

The following additional items are required for installing the radiotelephone and make it ready for operation:

A hardware kit type MK401 consisting of a connector for control equipment such as microphone and external transmit key.

Microphone. Several types are available.

Antenna. Several types are available.

Also available are various types of accessories such as: External loudspeaker, handset and steering wheel switch.

An instruction sheet or folder is supplied with each accessory and each large installation component.

Standard Directions

Before starting work, the siting of the radiotelephone and its cabling should be selected on a basis of the following factors:

Operation should be straightforward and easy. In vehicles, radiotelephones should be sited with a view to maximum safety for the driver.

The radiotelephone should be easily accessible for service, and its cabling should be placed so as to provide room for the connectors so that control equipment can easily be connected to or disconnected from the radiocabinet.

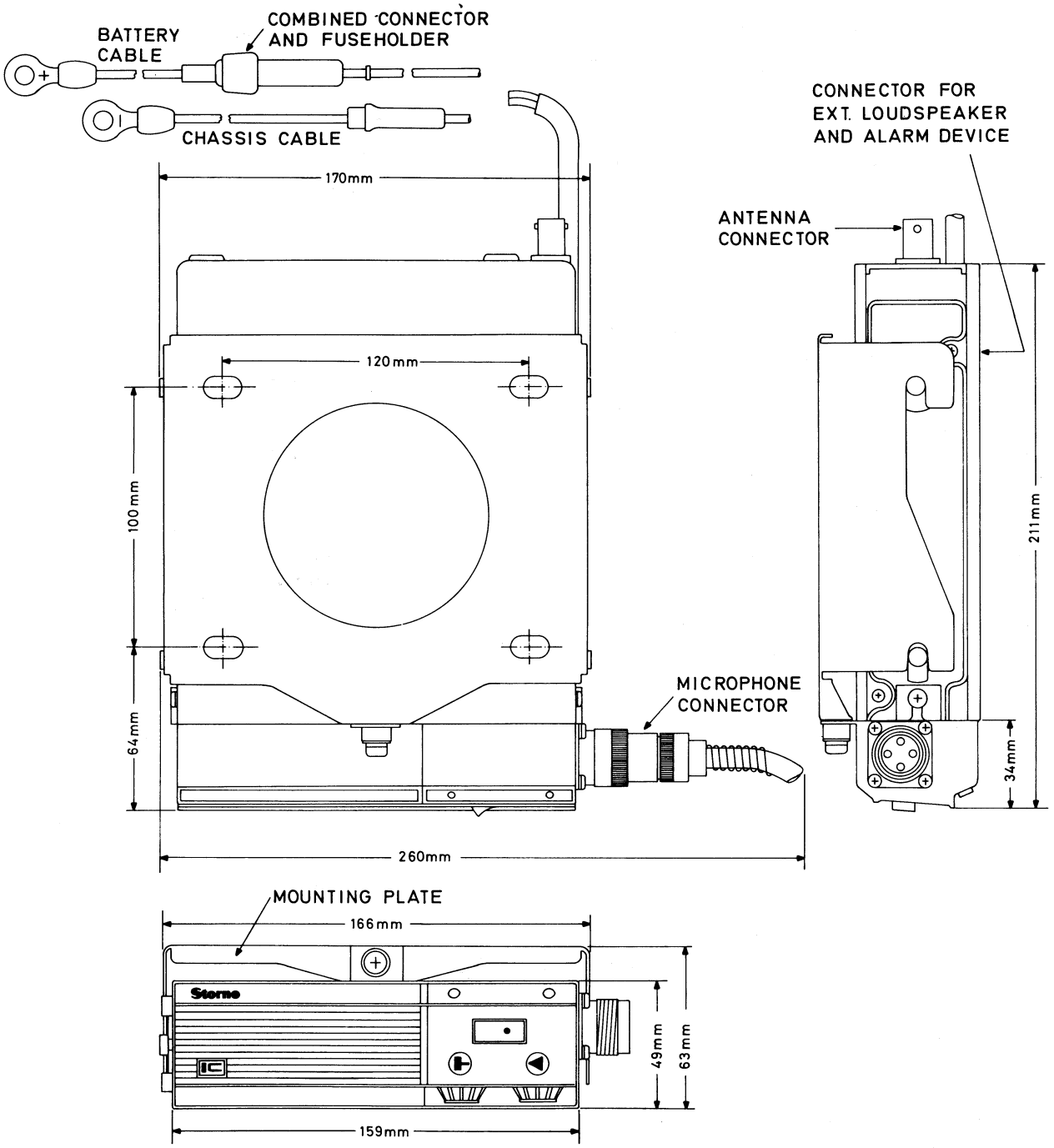
Cabling should be as short as practicable.
Cables should be placed well away from moveable, moist, and hot components. In vehicles, cables should be run through existing conduits or between the upholstery and the car body. Cables should not be mounted below the bottom of the car where this can be avoided.
Cables should be adequately relieved of stress - especially at critical points such as entries and sharp bends.

INSTALLING THE RADIO CABINET

The CQM400 radiotelephone is built for local operation and is consequently intended for installation near the operating position. In vehicles, the most convenient place will therefore be under the deshboard.

The cabinet is installed by means of the installation kit MN401, which comprises a mounting plate and associated hardware.
The mounting plate is fastened by a number of screws to the position chosen for the installation. The station cabinet is then attached to the mounting plate by putting the two studs located on each side of the cabinet in gear with the slots on the mounting plate.

Finally the cabinet is fastened by a screw which is placed on top of the cabinet.
Figure 2 shows the mounting of mounting plate and cabinet and their dimensions.



INSTALLING CABLES AND CONNECTORS

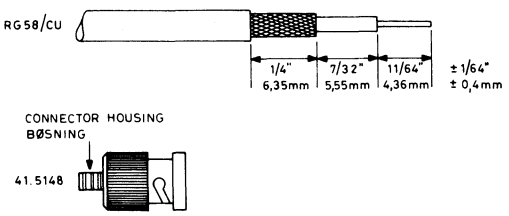
The installation kits required for connecting battery voltage and antenna to the equipment is delivered with the radiotelephone.

Connect the red battery cable to the positive battery terminal and the other end of the cable to the combined battery connector and fuseholder on the cabinet at the same time inserting a fuse (12V/5A) in the holder.
Connect the chassis connector on the cabinet to chassis on the vehicle by means of the black cable.

NOTICE The CQM400 radiotelephone is intended only for installation in vehicles having a battery voltage of 12 volts and minus to chassis.

Fit the antenna cable (coaxial cable RG58c/u) to the antenna (see subsection later in this chapter dealing with antennas). Run the cable down to the radiotelephone between the roof of the car and the upholstery and shorten it to the desired length.

Fit the antenna connector - which is a BNC "crimp type" connector, Storno code no. 41.5148-00 - to the cable.
The fitting operation requires a crimping tool (ERMA 29010) and associated accessories (29271).



Procedure

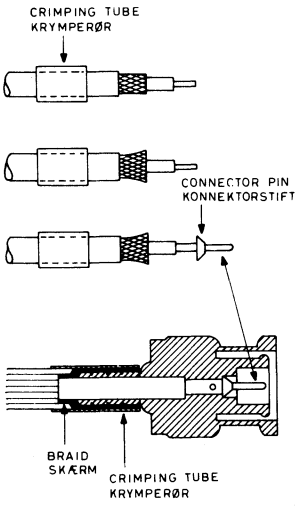
Strip cable as shown in sketch. Avoid nicking strands of braid and centre conductor.

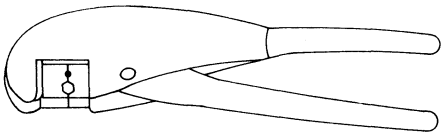
Slide crimping tube and connector housing on to cable in sequence shown.

Slide connector pin in over the centre conductor and secure it, using crimping tool.

Slide connector housing into place over the pin as shown.

Bring bared cable braid out over connector housing sleeve. Slide crimping tube up to connector housing and crimp it on to the sleeve and braid, using crimping tool.



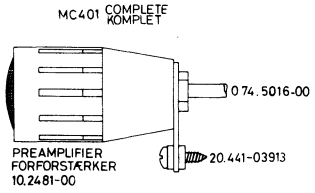


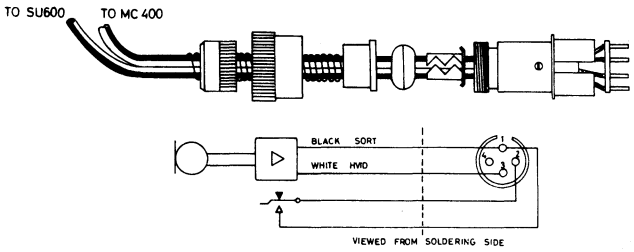
"ERMA" CRIMPING TOOL
NR. 29010/29271
"ERMA" KRYMPETANG
NR. 29010/29271

INSTALLING CONTROL EQUIPMENT

Fixed Microphone MC401

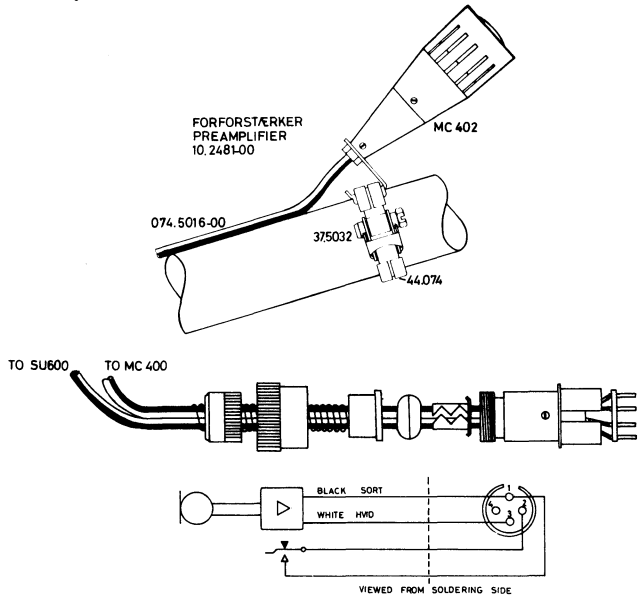
Mount the microphone in a suitable place so that normal speaking distance will be 30-40 cm.
In motor vehicles, the corner post will usually be found a good place for mounting the microphone.
The microphone-cable conductors should be soldered to the 4-contact connector as shown in the sketch below.





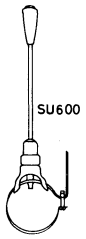
Steering-wheel Microphone MC402

The steering-wheel microphone should be mounted and wired as shown in the sketch below, using the 4-contact connector contained in installation kit MK401.



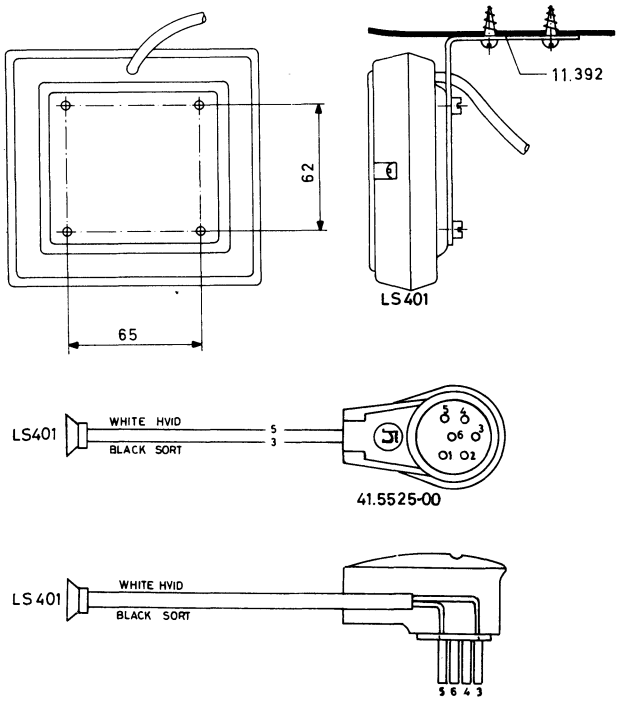
Steering-wheel Transmit Button SU601 or SU602

The steering-wheel transmit button may be used with fixed microphones MC401 and MC402.
The transmit button should be mounted on the steering-wheel and the wire ends soldered to the 4-contact connector as shown in the sketch below.



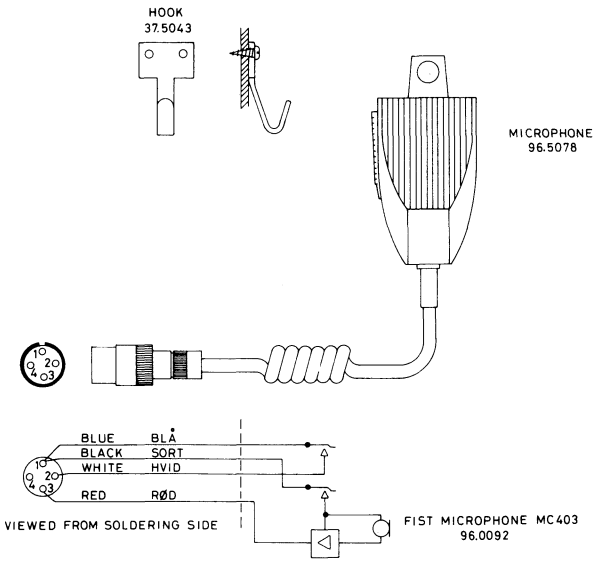
Loudspeaker LS401

The loudspeaker should be mounted by means of the hardware and screws supplied.
The enclosed 5-contact connector should be connected to the loudspeaker cable as shown in the sketch below.



Fist Microphone with Transmit Button MC403

The microphone is provided with cable, connector and hook suspension. Mounting of the suspension is shown in the sketch below.



STANDARD ANTENNAS

The antenna should be placed as high as possible and well out in the clear as this will make it easier to obtain optimum matching and maximum radiation. On a vehicle, the roof must be considered the best place for the antenna. If the roof is not a metal one, one square metre of aluminium foil should be glued to it immediately below the antenna (it may be placed on the inside of the roof). In the case of passenger cars, the antenna may also be mounted on the lid of the luggage compartment. However, this will impair the efficiency of the antenna and produce undesirable directively

effects, for which reason this solution should be restored to only where these factors are of minor importance - that is, in cases where maximum range is not an important requirement.
All of the standard antennas described here can be installed from outside; it is not necessary to make a hole in the car upholstery.

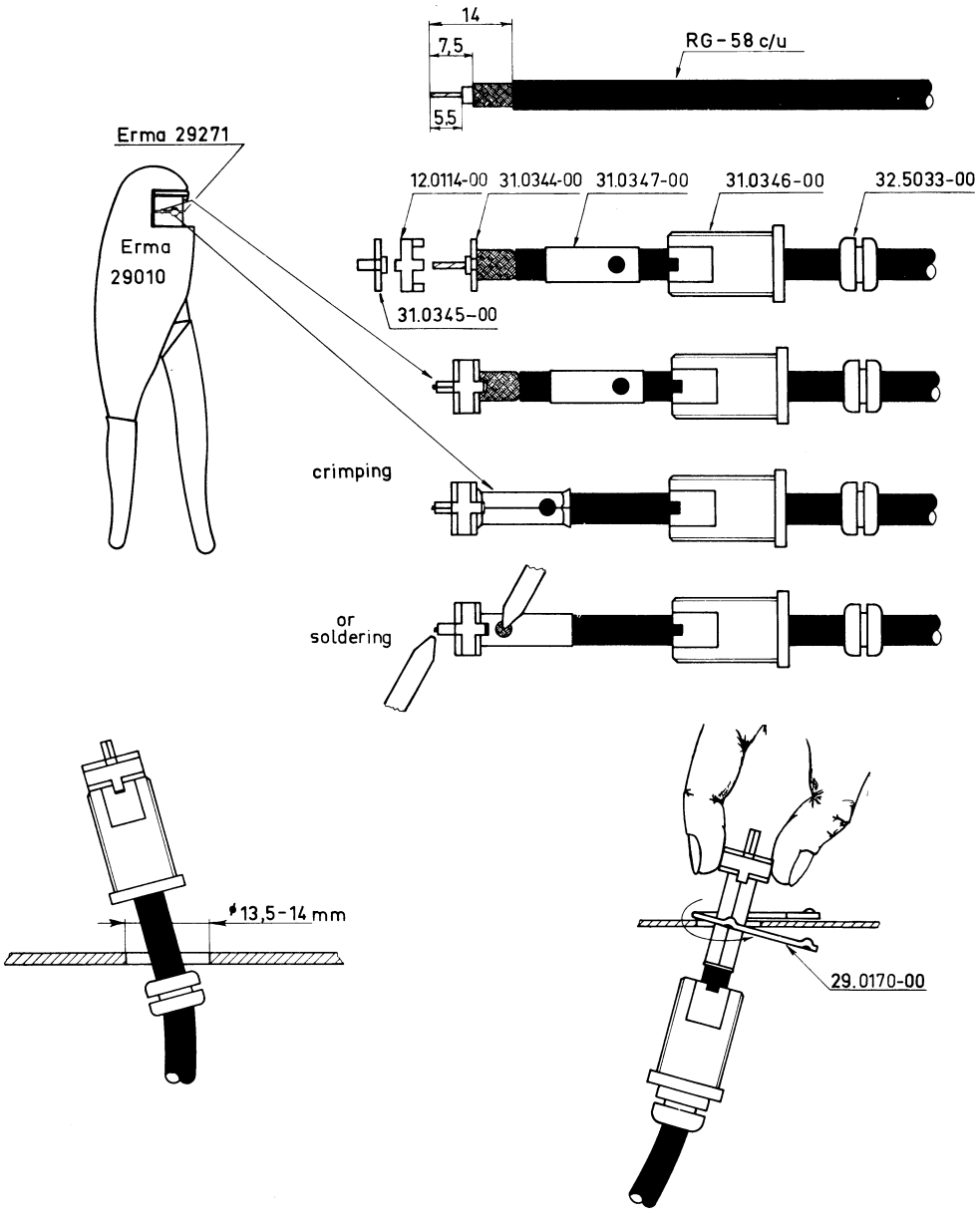
Antenna Mount

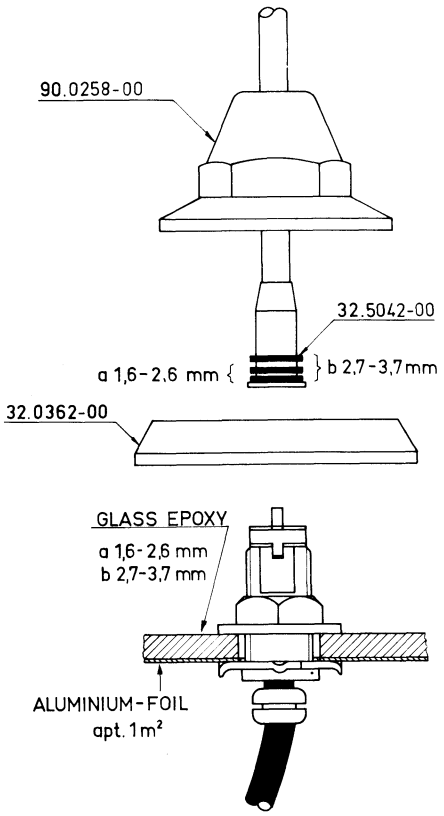
The antenna cable may be connected to the antenna in two different ways, either by means of a crimping tool (ERMA 29010) and associated accessories (29271) or by means of conventional tin soldering.

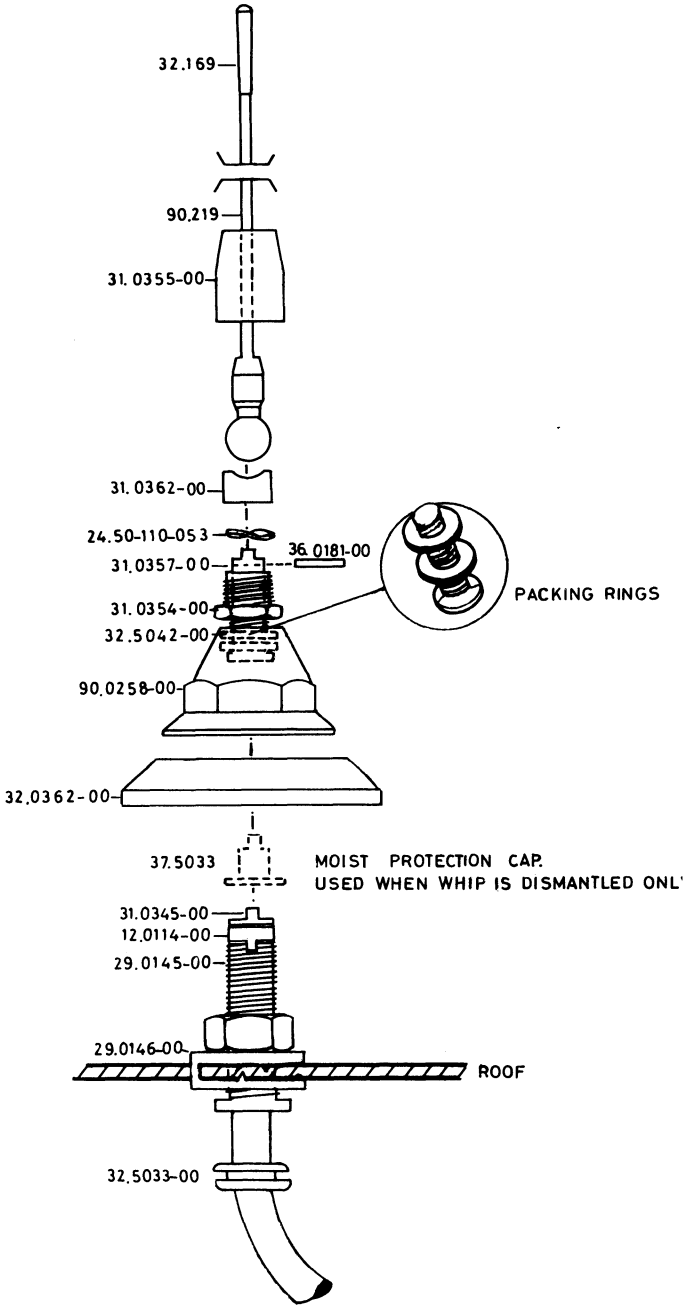
Procedure

Strip the jacket and dielectric from the end of the coaxial cable as shown, avoiding to nick the strands of the braid and centre conductor.
Slide the grommet (32.5033), threaded sleeve (31.346) and crimping tube (31.347) in on the cable in the sequence shown. Thereafter insert the sleeve (31.344) between the cable dielectric and the braid, and lastly place the insulating washer (12.114) and sleeve (31.345) as shown.

Thereafter secure the antenna to the cable, either using a crimping tool to make the crimping tube fit tightly around the cable braid and the sleeve (31.345) fit tightly around the centre conductor, or by soldering. Both procedures are illustrated in the sketches below.







Drill a hole 13.5 - 14 mm at the point selected. Push the free end of the coaxial cable through the hole, and run it between the roof and the headlining to the transmitter/receiver unit.

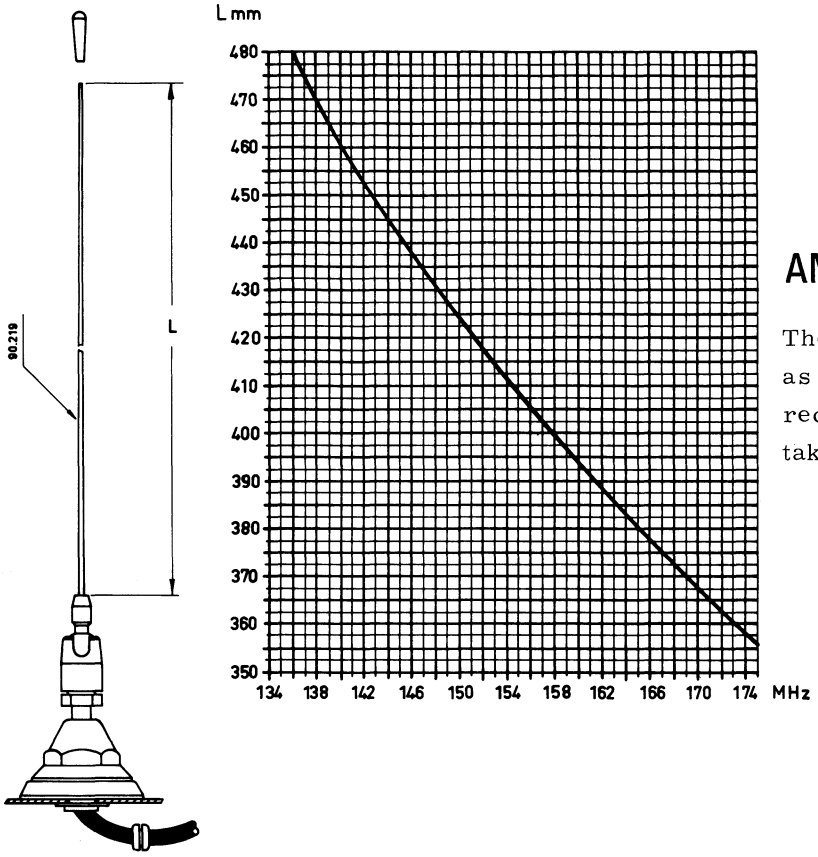
Insert the antenna base half way into the hole as shown in the diagram. Thread the large spiral washer through the hole so that it is under the roof material.

Pull the base back through the hole until the spiral washer is held up against the roof material, add the washer 29.0146-00 and tighten down the nut 29.0145-00.

There are two versions of whip section which may be added to the base, the AN69-3 and AN69-4 (UHF) and the AN19-5 (VHF) which may be folded down. These are attached by placing the sealing washer 32.0362-00 over the base assembly and screwing down the plastic hood 90.0258-00.

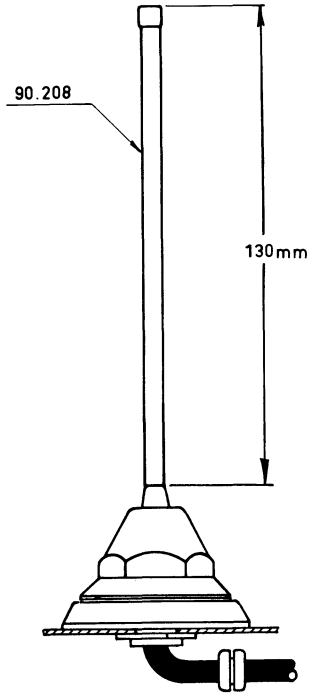
The AN69-3 and AN69-4 is supplied with a number of packing rings which are threaded over the antenna as shown to compensate for the varying roof thicknesses.

For 1.6 - 2.6 mm two washers are used, whilst for fibre glass which is between 2.7 - 3.7 mm (7/64" - 9/64") three washers should be used.



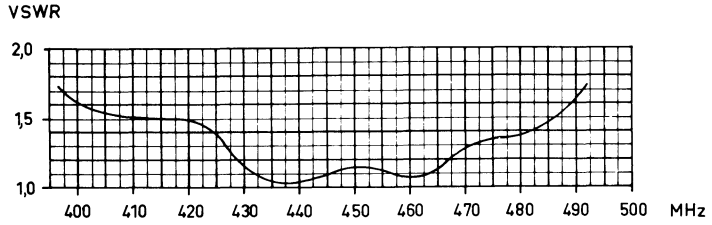
AN19-5

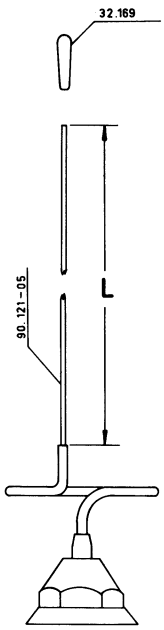
The antenna whip should be cut to frequency as shown on the chart. If the transmitter and receiver frequency differ then the mean is taken.

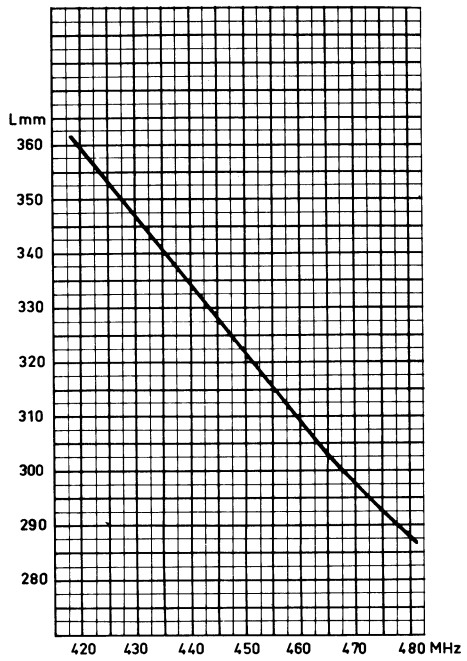


AN69-3

The antenna whip is a fixed 1/4 λ antenna. The standing wave ratio at various frequencies within the 450 MHz band is shown on the chart.

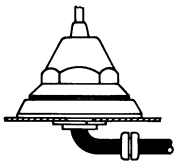


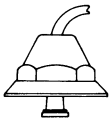




AN69-4

The antenna whip should be cut to frequency as shown on the chart. If the transmitter and receiver frequency differ then the mean is taken.





INSTALLATION OF TONE EQUIPMENT

Room has been left in the radiotelephone for installation of selective calling equipment. Furthermore the radiotelephone is provided with the tone equipment cabling on delivery.

The installation of tone equipment requires an installation kit type MK402 consisting of:

A mounting plate
4 screws with associated spring washers.

The tone transmitter and tone receiver are fastened to the mounting plate by means of screws and spacers, and the mounting plate is then installed in the empty room of the cabinet, and fastened with two screws in each side of the cabinet.

Installation of Tone Transmitter TT481

Fasten the TT481 to the mounting plate and screw-mount it in the radio cabinet.

Connecting

(See the sketch).

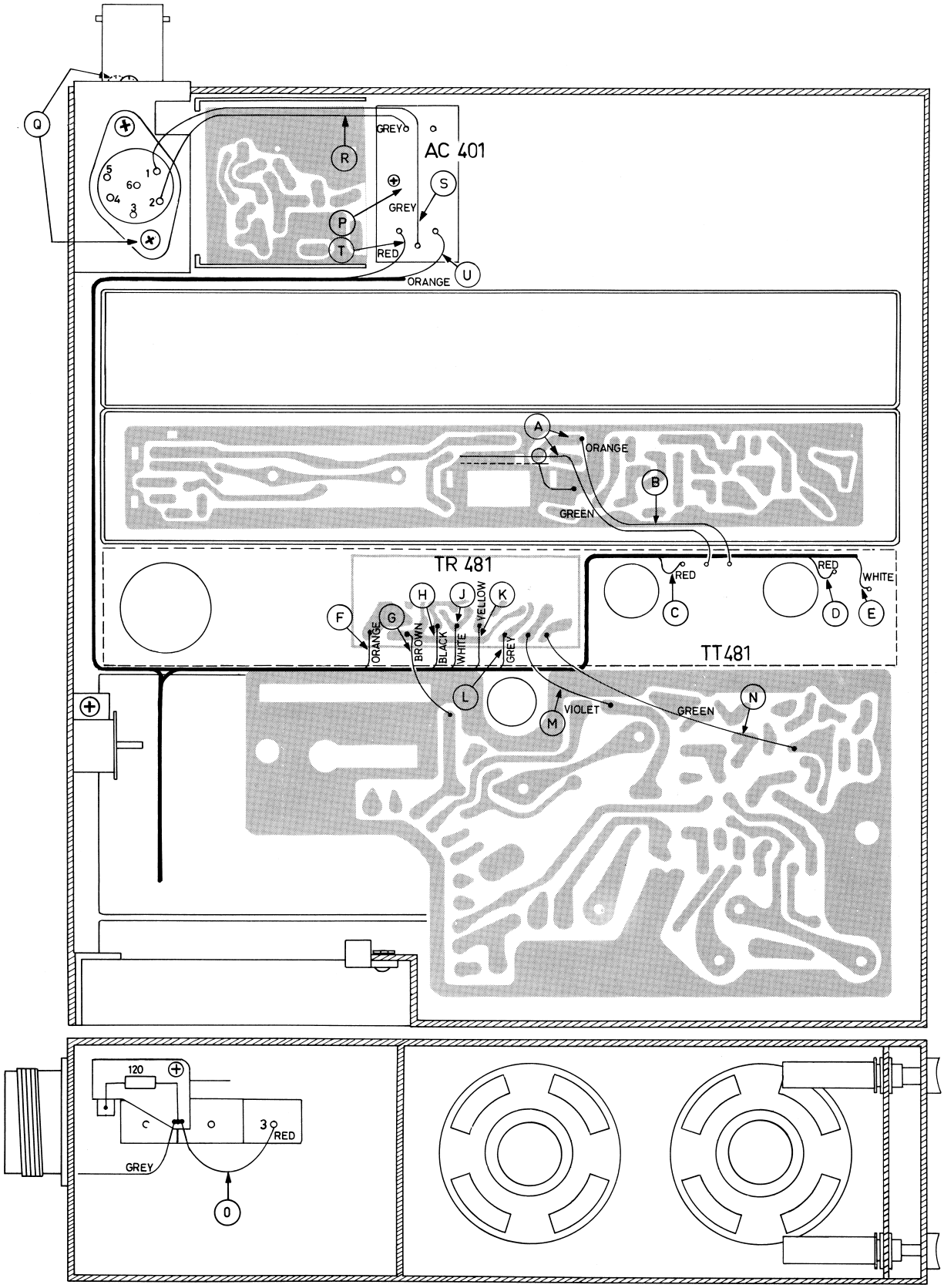
(A) Unsolder the inner conductor of the screened AF lead from its position on the printed wiring board and extend it with a green lead. Insulate the junction of the two leads by a piece of flex, and connect the lead to TT481.

(B) Connect an orange lead from the former position of the inner conductor to the TT481.

(C) Connect the short red lead in the tone equipment cabling to TT481.

(D) Connect the long red lead in the tone equipment cabling to TT481.

(E) Connect the white lead in the tone equipment cabling to TT481.


AC 401
TR 481
TT481
GREY
GREY
RED
ORANGE
ORANGE
GREEN
RED
RED
WHITE
ORANGE
BROWN
BLACK
WHITE
YELLOW
GREY
VIOLET
GREEN
120
3
RED
GREY
0

Installation of Tone Receiver TR481

Fasten the TR481 to the mounting plate and screw-mount it in the radio cabinet.

Connections

(See the sketch).

(F) Connect the orange lead in the tone equipment cabling to TR481.

(G) Connect a brown lead between the tone receiver and the radiotelephone circuits as shown.

(H) Connect the black lead in the tone equipment cabling to TR481.

(J) Connect the white lead in the tone equipment cabling to TR481.

(K) Connect the yellow lead in the tone equipment cabling to TR481.

(L) Connect the grey lead in the tone equipment cabling to TR481.

(M) Insert a violet lead between the TR481 and the radiotelephone circuits as shown.

(N) Insert a green lead between TR481 and the radiotelephone circuits as shown.

(O) Disconnect and insulate the red lead in the control head as shown.

Installation of Alarm Circuit AC401

(P) Mount the AC401 in the radio cabinet by means of a screw and a spacer with the relay downwards.

(Q) Loosen the L-piece which carries the multiconnector and antennaconnector. To do this remove the screw in front of the multiconnector and the screw above the antennaconnector (see sketch). After that the L-piece can be liftet carefully from the cabinet whereby the multiconnector pins become accessible.

(R) (S) Connect two grey leads from pin 1 and 2 of the multiconnector to AC401.

(T) Connect the red lead in the tone equipment cabling to AC401.

(U) Connect the orange lead in the tone equipment cabling to AC401.

Storno

CHAPTER V. SERVICE

MAINTENANCE

When a CQM400 radiotelephone has been properly installed and checked for satisfactory operation it should not thereafter be left to itself until breakdown begin to occur. Every equipment should be inspected at regular intervals and readjusted if necessary. The frequency of such routin inspections will depend on the conditions under which the equipment is operated and on the total number of operating hours, but twelve months is the maximum time that should be permitted to elapse from one preventive service inspection to the next. All modules have easily accessible test points to permit rapid check of the operational condition of the equipment.

Routine Inspection

A normal routine inspection should cover checks of all test points in the equipment, and the readings taken should thereafter be checked against readings obtained in previous routine inspections. However, each routine inspection should also comprise the operations specified below:

1) Inspect (visually) transistors, diodes etc. Fasten any components that may have worked loose.
2) Check the supply voltage.
3) Check cable connections, fuse holder, battery (look for corroded joints; top up with distilled water (if necessary). Also check the current drain.
4) Measure the carrier power delivered by the transmitter.
5) Measure the receiver sensitivity and readjust the receiver input circuit if necessary.
6) Call the base station and perform speech test.
7) Check the antenna mounting, especially for rust.

Replacement of Modules

In certain situations time can be saved by replacing a probably defective module with a new module of the same type. Even if it is known to be fully aligned, such a newly inserted module may require a few minor readjustments.

FAULT-FINDING AND REPAIR

Fault-finding

Fault-finding should be performed only by skilled personnel who have the necessary measuring instruments at their disposal and have previously studied the operating principles of the Mitsubishi radiotelephone. Before starting work, find out whether the fault is located in the accessories, in the outside power source, in the installation cabling, or in the transmitter/receiver equipment itself. It is important that the directions given in next section (Alignment procedure) be followed closely in each individual case if a satisfactory result is to be obtained.

Resistance Measurements

Two precautionary measures are necessary when making resistance measurements on transistor circuits. Firstly, it is necessary to make sure that the ohmmeter current does not exceed one milliampere, which may very well be the case with certain types of vacuum-tube voltmeters. Secondly, the ohmmeter voltage may cause the transistors to become conductive, with incorrect readings as the obvious result. Since most faults are either short circuits or open circuits, accurate measurements of resistance are not normally required.

Soldering on Semiconductors

Never forget, when soldering on semiconductors, that the soldering operation should be performed quickly and as a general rule it is not advisable to solder closer to semiconductors than approximately 5 mm. However a transistor should not be replaced until it has been determined with reasonable certainty that it is defective. Even transistors of the same type and make may show fairly wide variations in their data. For this reason it is usually necessary, in the case of replacements, to check the transistor circuits and readjust them if necessary.

Wiring Boards

The wiring boards used in the Mitsubishi radiotelephone are very rugged, but in unfortunate cases it is possible for the printed wiring to break or detach itself from the board. This usually happens when excessive heat is applied when soldering or when a soldering operation lasts longer than it should. Fine cracks in the wiring or in the wiring board itself are mostly difficult to spot with the nacked eye, in which cases a magnifying glass will be a good help. This type of fault can also be the cause of trouble of an intermittent nature. Such faults are easily corrected by soldering a short end of wire across the broken place on the board. The wiring boards also carry some fixed capacitances. Here, repairs must be made with some caution in order to avoid changes in capacitance.

Replacement of Components

Replacement of resistors, capacitors and similar components on printed wiring boards require the use of a small pencil-type soldering iron of 30- to 75-watt rating so as to permit rapid soldering. The use of a tin sucker to drain away melted solder is also advisable. Do not attempt to pull any component off the wiring board until the solder flows smoothly as there is otherwise a risk of pulling some of the printed wiring off the board. As a general rule the soldering iron should not be applied to the board for a longer time than strictly necessary. Care should be taken, when soldering a new component to the wiring board, that no short circuits are caused by excess solder. Do not use more solder than necessary. Large blobs of solder can reduce the spacing between the printed wires, which can produce undesirable effects in RF circuits even if no actual short circuit exists.

ADJUSTMENT PROCEDURE

General

The directions given in this section are intended as an aid in aligning a CQM400 radiotelephone and consequently must not be considered the only correct adjustment procedure. However, departures from the directions given here should be made only in cases where the technician can foresee with certainty that modified alignment methods will neither degrade the specifications stipulated nor complicate subsequent alignment procedures. Only such skilled radio technicians as have already acquainted themselves with the operation of the CQM400 radiotelephone should perform adjustments and repairs. Each individual radiotelephone is checked and tested before being dispatched from the factory. In the absence of any special agreements, the testing department has:

1) Inserted oscillator units with quartz crystals for the channel ordered.
2) Aligned the complete radiotelephone so that the accuracy of the transmitting and receiving frequencies is better than 1×10^{-6}.
3) Adjusted the receiver audio output and the speech limiter clipping level according to specification.

Test instrument

The following instruments are required:

a) A power supply rated at 5-20V/5A.
b) A watt meter, 50 ohms, 0-10 watts/0-20 watts.
c) A signal generator, for 142 - 174 and 420 - 450 MHz.

d) An audio voltmeter.
e) A distortion meter.
f) An FM detector.
g) A dummy load, 20 watts, 50 ohms.
h) A tone generator.
i) A circuit tester, 50 μA with 2 kilo ohms internal resistance.

With these instruments available, the equipment can always be restored to operating conditions.

TRANSMITTER ALIGNMENT

Adjust coils L151 and L152 in the modulator for max. reading at test point (1).

Adjust coils L171, L172, and L173 in the Exciter for max. reading at test point (2).

Adjust coils L174, L175, and L176 in the Exciter for max. reading at test point (3).

Adjust coils L177 and L178 in the Exciter for max reading at test point (5) (in the Power Amplifier Unit).

Adjust capacitors C202 and C203 in the Power Amplifier Unit for max. reading at test point (5).

Make sure that potentiometer R131 is turned fully clockwise.

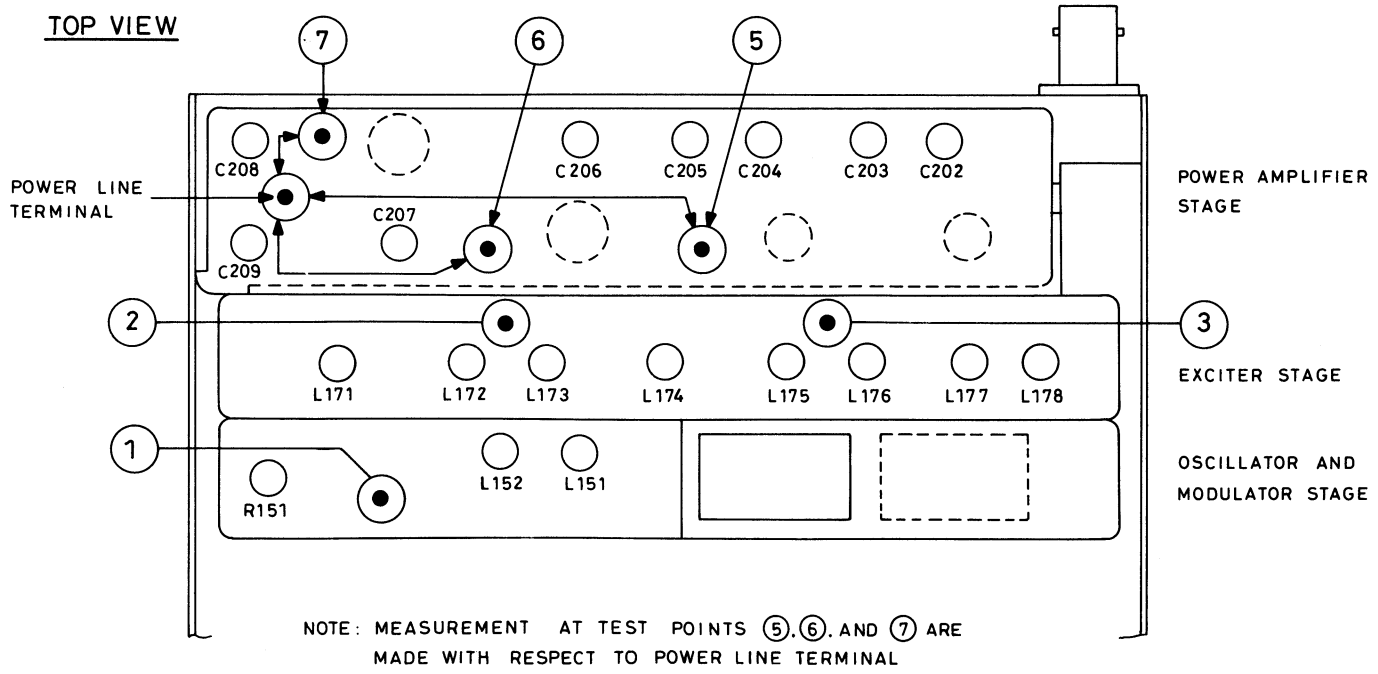
Adjust capacitors C204 and C205 in the Power Amplifier Unit for max. reading at test point (6).

Adjust capacitors C206 and C207 in the Power Amplifier Unit for max. reading at test point (7).

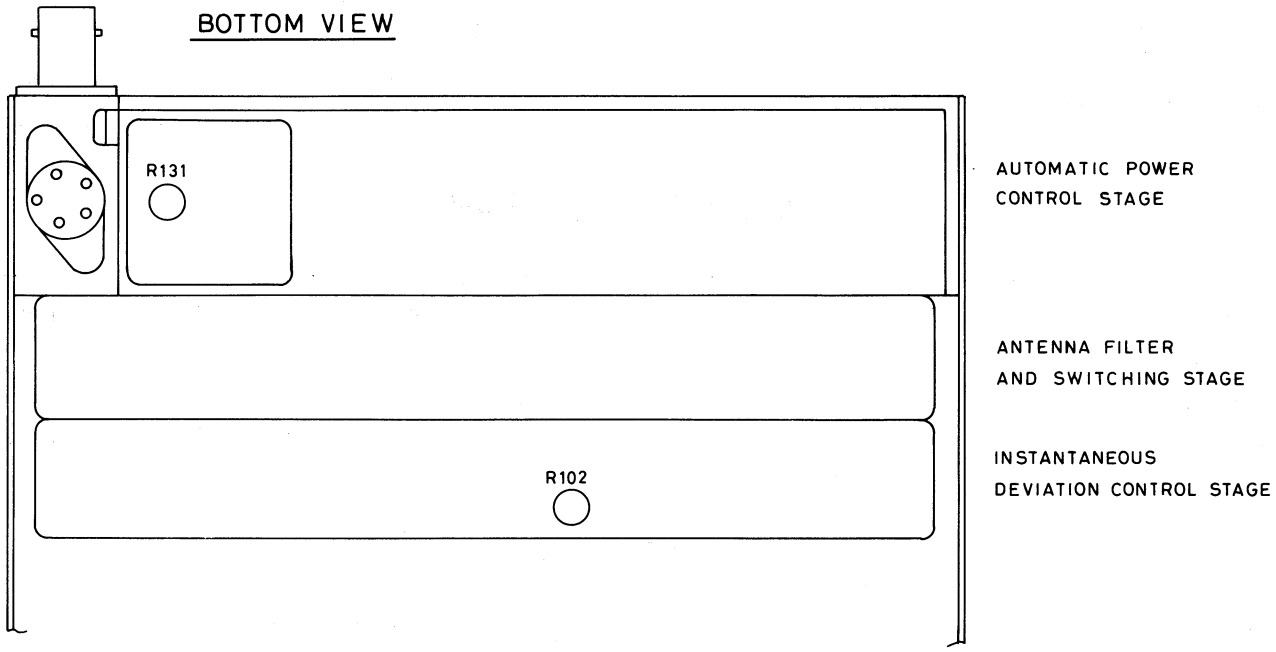
Repeat the alignment in order to obtain maximum output.

NOTE: Until the transmitter has been properly tuned it should only be turned on for short periods while making the adjustments, otherwise the transistors may be damaged from overloading.

Set potentiometer R131 for the specified power output.



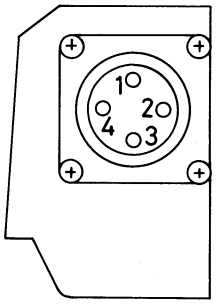
TEST POINTS AND ALIGNMENT POSITIONS IN THE TRANSMITTER



ALIGNMENT POSITION IN THE TRANSMITTER

Adjustment of Modulator

Disconnect the microphone and connect a tone generator (-4 dBm, 40 ohms) across terminal 1 and 3 of the microphone recepstacle. Terminal 1 is connected to chassis.



Turn on the transmitter by connecting terminal 2 to terminal 1.

Connect an FM detector through a coupler and measure the deviation and distortion.

Adjustment of modulation sensitivity is performed by means of potentiometer R102.

Adjustment of frequency deviation is performed by means of potentiometer R151.

If the distortion is too high, readjust L151 and L152 carefully.

RECEIVER ALIGNMENT

Check at test point (1) that the oscillator operates normally.

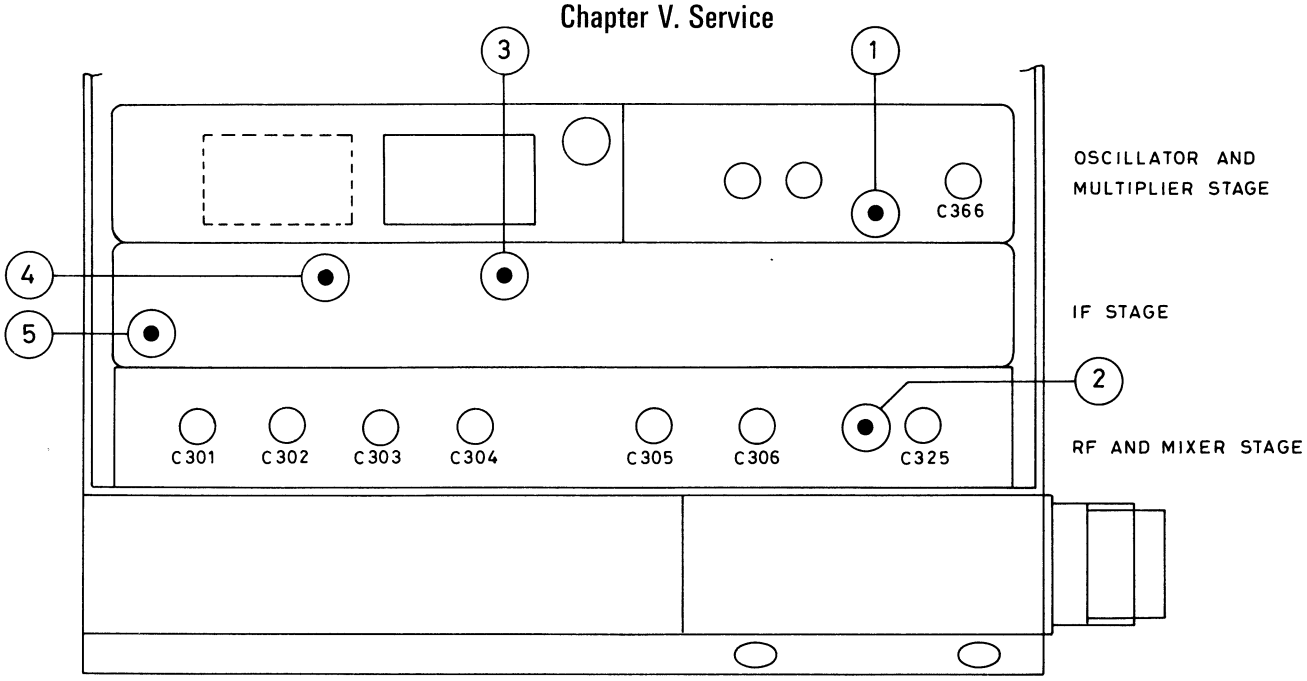
Adjust capacitors C325 and C366 in the Mixer Unit for minimum reading at test point (2).

Adjust capacitors C301 to C306 in the RF Stage for maximum reading at test point (3).

The output level from the signal generator, connected to the antenna input, should be so low that limiting does not occur.

Check for deflection at test point (4) in the IF Stage.

Set the signal generator precisely at the receiving frequency and adjust the variable capacitor in the Oscillator Unit for zero reading at test point (5) (discriminator zero).



TEST POINTS AND ALIGNMENT POSITIONS IN THE RECEIVER

Readings at Test Points

The list below specifies all test points in the equipment and the respective readings. Readings are intended only as a guide.

Transmitter

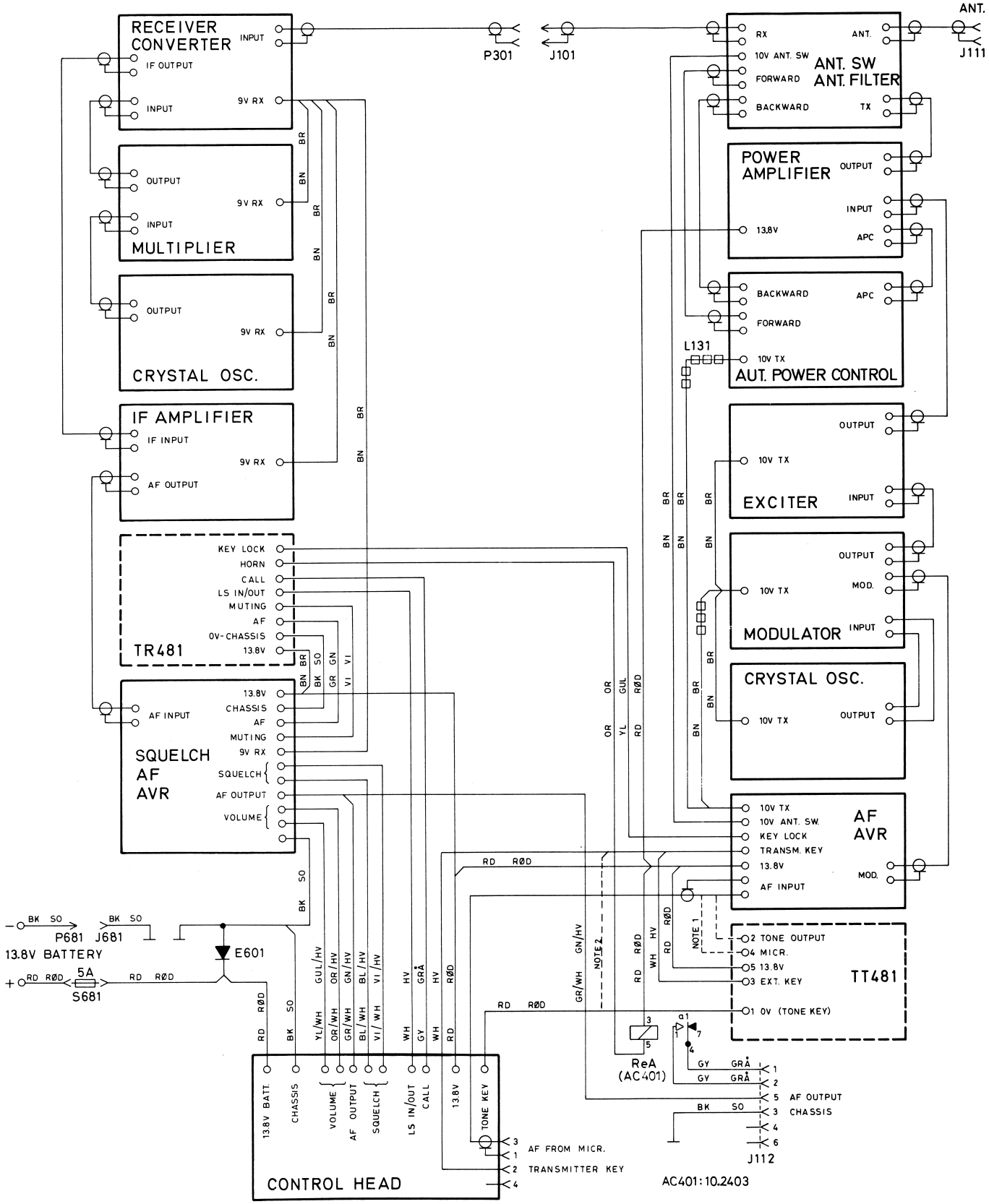
Test Points	Measuring Stage	Standard Current
1	Modulator output	15
2	Tripler output	25
3	Doubler output	25
5	Q 202 collector current	15
6	Q 203 collector current	20
7	Q 204 collector current	30

Receiver

Test Points	Measuring Stage	Standard Current	
		No Carrier	Carrier 20 dBμV
1	Tripler emitter current	25	25
2	Mixer base voltage	19	19
3	4th stage of IF	1	3
4	IF final stage output	35	25
5	Discriminator output	±5	0

Measurement should be made with ammeter having an internal resistance of 2 kilo-ohms.

CHAPTER VI. DIAGRAMS AND PARTS LISTS



NOTE 1: IN EQUIPMENT WITH BUILD-IN TONETRANSMITTER THE INNER CORE OF THE SCREENED WIRE IS EXTENDED TO TERMINAL 4 ON TT481 AND THE TONE OUTPUT TERMINAL IS CONNECTED TO THE TRANSMITTER AF INPUT TERMINAL.

I ANLÆG MED INDBYGGET TONESENDER FORLÆNGES SKÆRMLEDNINGENS INDERLEDER TIL TERMINAL 4 PÅ TT481 OG TONEUDGANGSTERMINALEN FORBINDES TIL SENDERENS LF INDGANG.

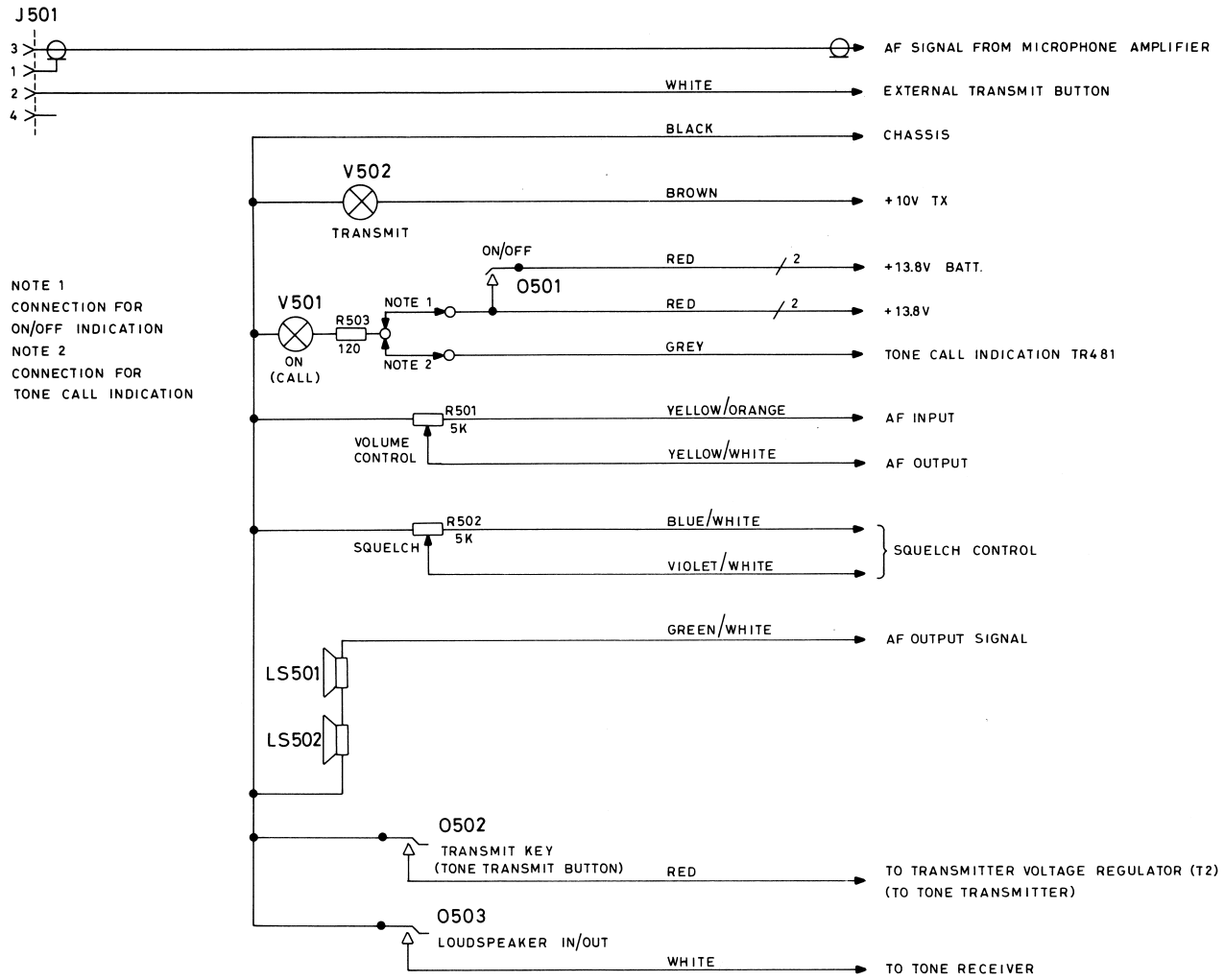
NOTE 2: IN EQUIPMENT WITHOUT TONE TRANSMITTER THE TONE KEY BUTTON MAY BE USED AS TRANSMITTER KEY IF THE RED WIRE IS CONNECTED TO THE TRANSMITTER KEY TERMINAL

I ANLÆG UDEN TONESENDER KAN TONETASTKNAPPEN ANVENDES SOM SENDETAST HVIS DEN RØDE LEDNING FORBINDES TIL TRANSMIT KEY TERMINALEN.

CABLE FORM CQM412, CQM413

D401.203

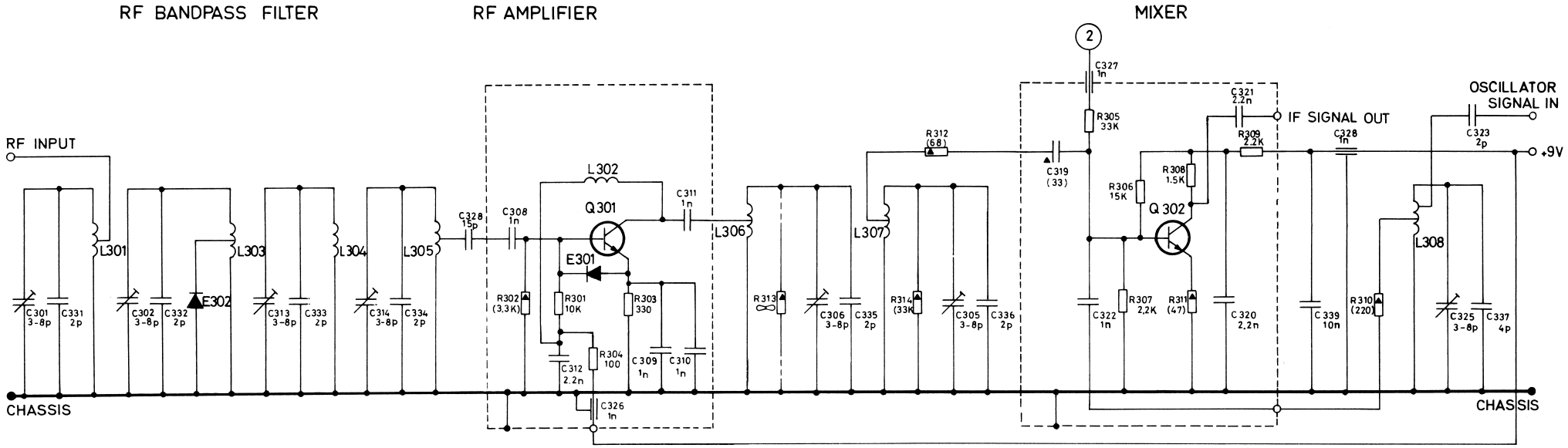
Storno



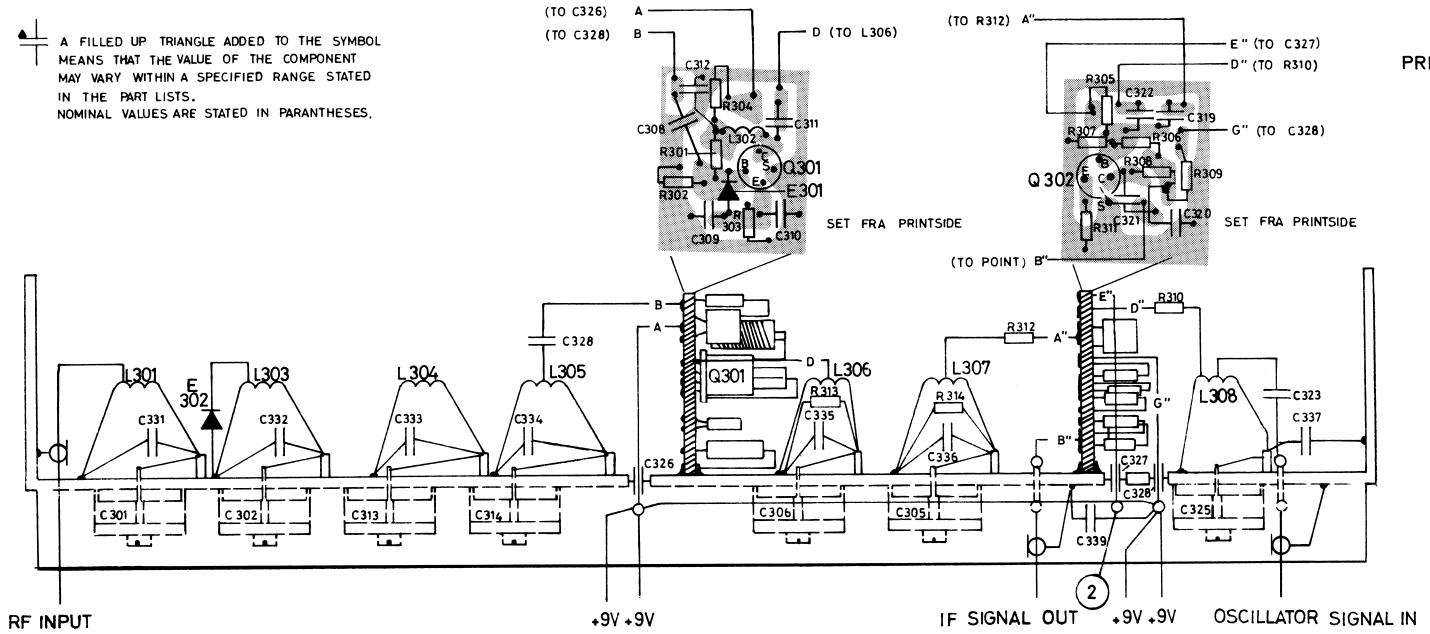
CONTROL HEAD

D401.204

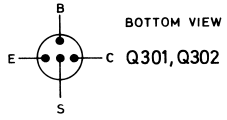
Storno



A FILLED UP TRIANGLE ADDED TO THE SYMBOL MEANS THAT THE VALUE OF THE COMPONENT MAY VARY WITHIN A SPECIFIED RANGE STATED IN THE PART LISTS.
NOMINAL VALUES ARE STATED IN PARANTHESES.



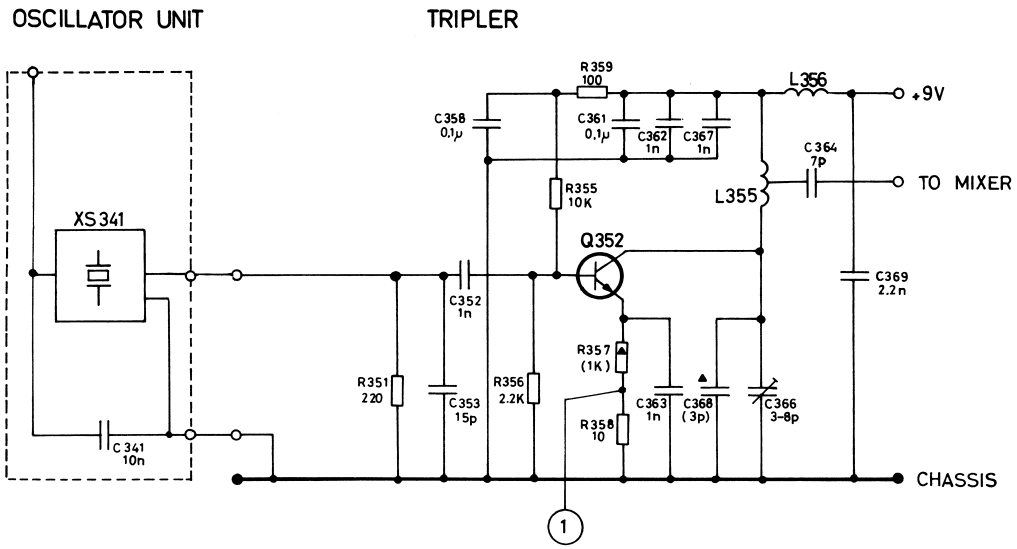
PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE

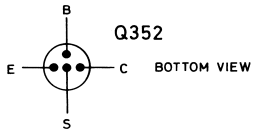


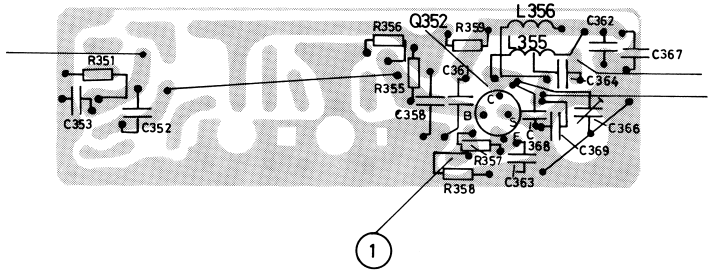
RECEIVER SECTION
RF Circuits and Mixer

D401.191

Storno







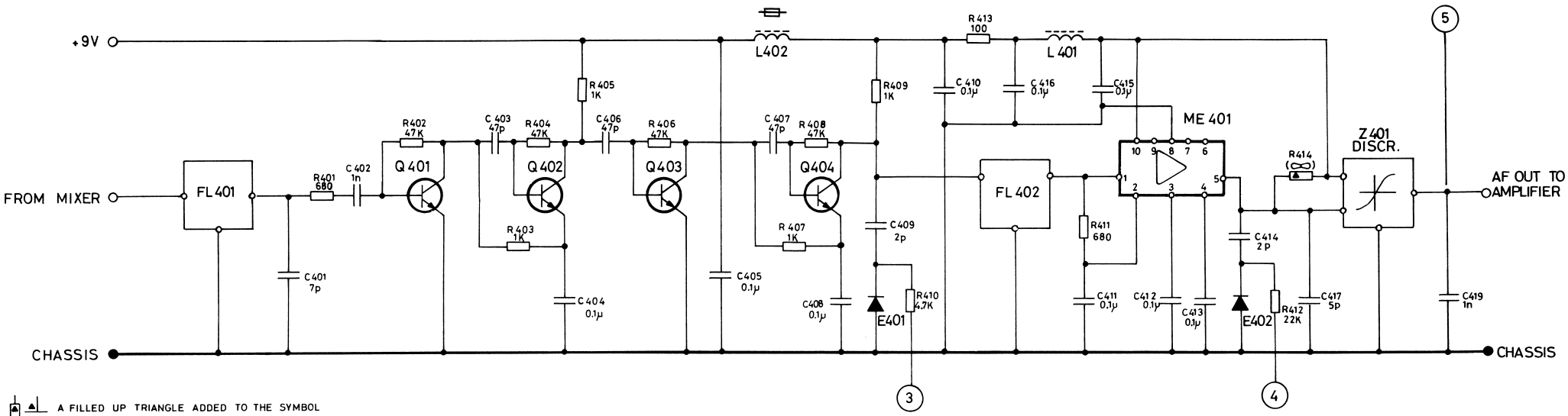
PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE

A FILLED UP TRIANGLE ADDED TO THE SYMBOL MEANS THAT THE VALUE OF THE COMPONENT MAY VARY WITHIN A SPECIFIED RANGE STATED IN THE PART LISTS
NOMINAL VALUES ARE STATED IN PARANTHESES.

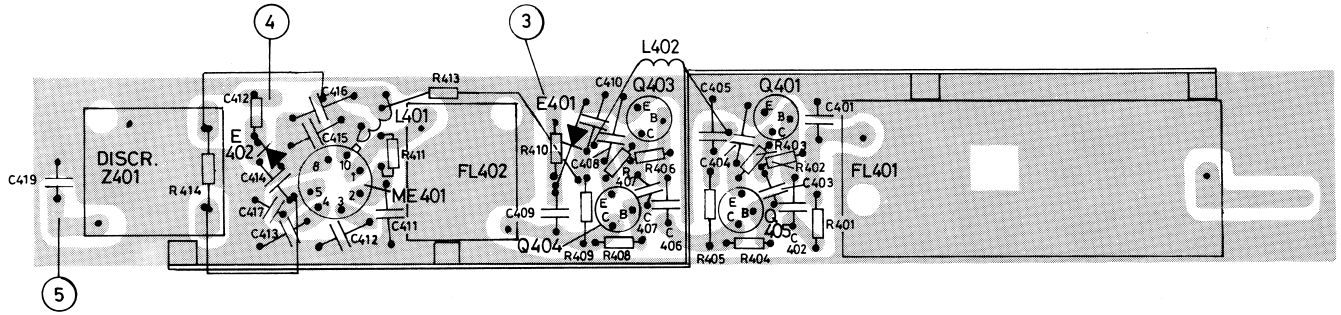
RECEIVER SECTION
Multiplier Unit

D401.197

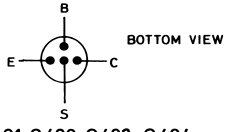
Storno



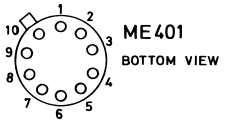
A FILLED UP TRIANGLE ADDED TO THE SYMBOL MEANS THAT THE VALUE OF THE COMPONENT MAY VARY WITHIN A SPECIFIED RANGE STATED IN THE PART LISTS.
NOMINAL VALUES ARE STATED IN PARANTHESES



PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE



Q401, Q402, Q403, Q404



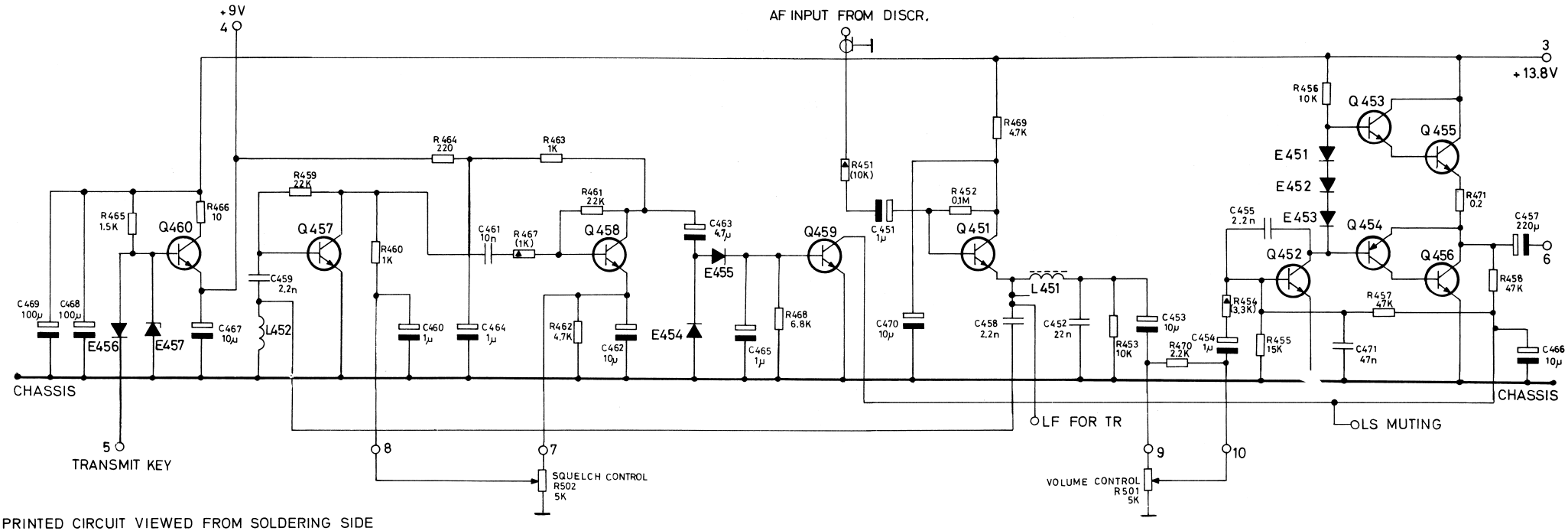
RECEIVER SECTION
IF Amplifier

D401.187

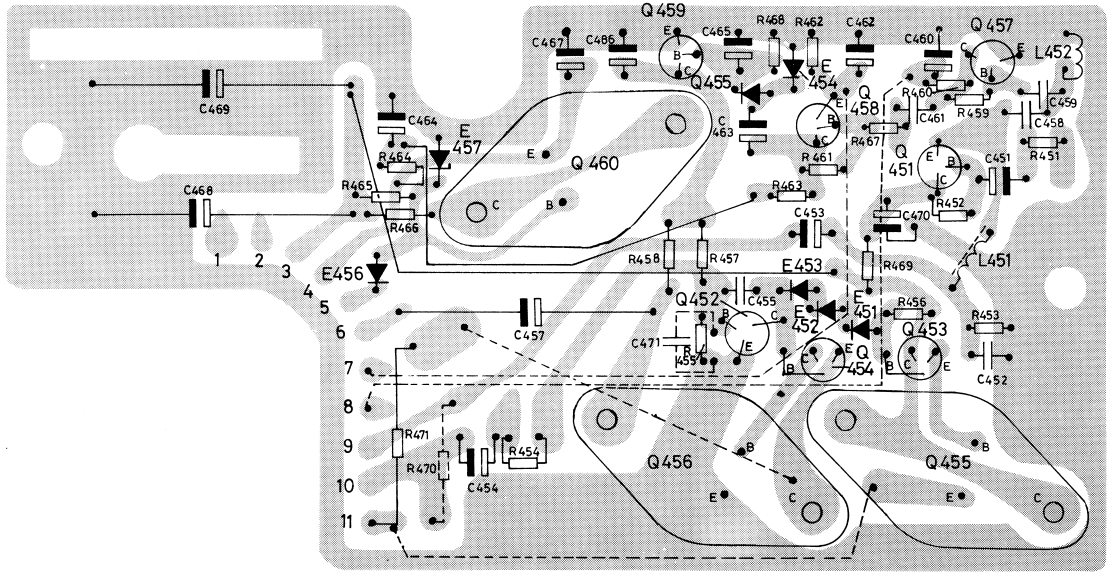
Storno

AVR. 1. NOISE AMPL. 2. NOISE AMPL. SQ. SWITCH 1. AF. AMPL. 2. AF. AMPL.

Storno



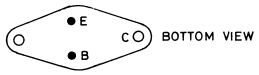
PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE



BOTTOM VIEW

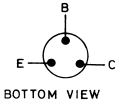
Q453, Q454

A FILLED UP TRIANGLE ADDED TO THE SYMBO
MEANS THAT THE VALUE OF THE COMPONEI
MAY VARY WITHIN A SPECIFIED RANGE STATE
IN THE PART LISTS.
NOMINAL VALUES ARE STATED IN PARANTHESE



BOTTOM VIEW

Q455, Q456, Q460



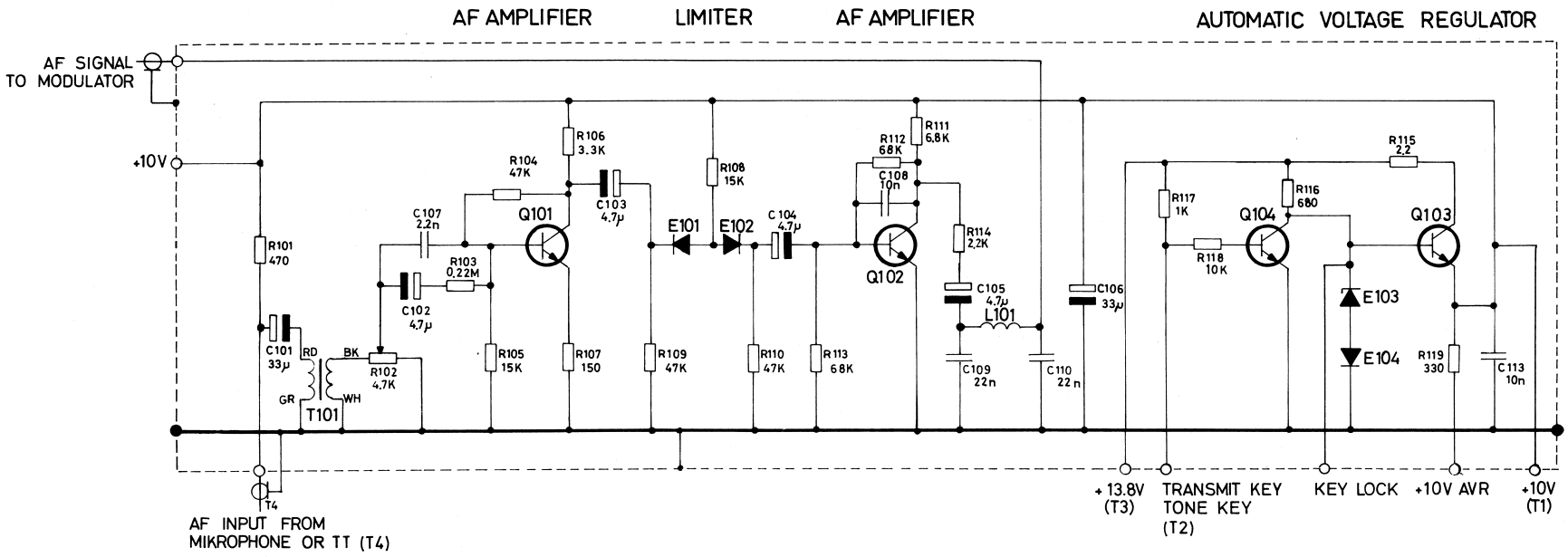
BOTTOM VIEW

Q451, Q452, Q457, Q458, Q459

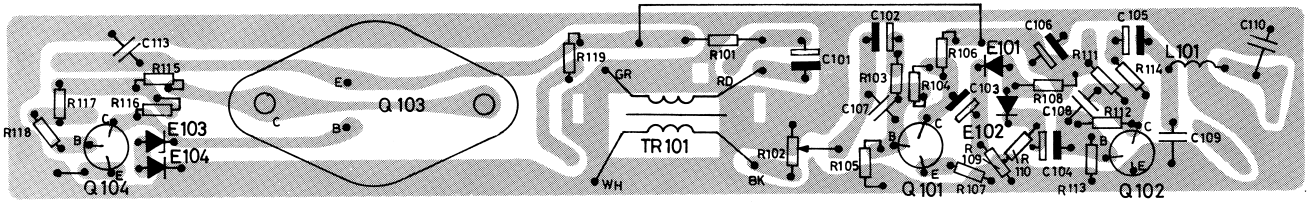
RECEIVER SECTION
Squelch Circuits and AF Amplifiers

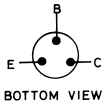
D401.189

Storno



PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE





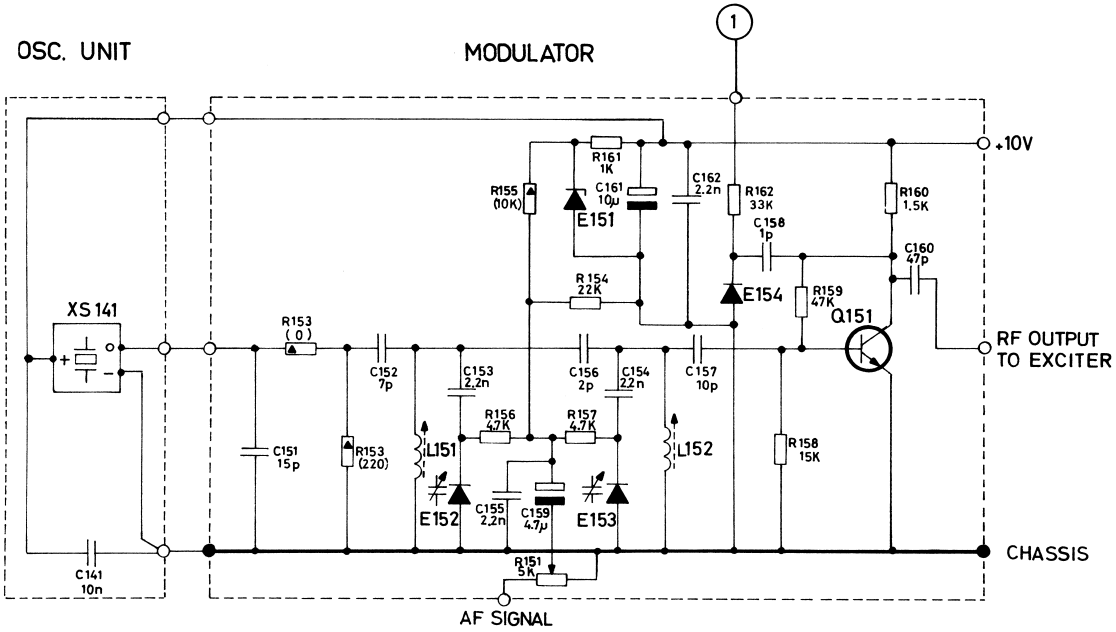
Q101, Q102, Q104

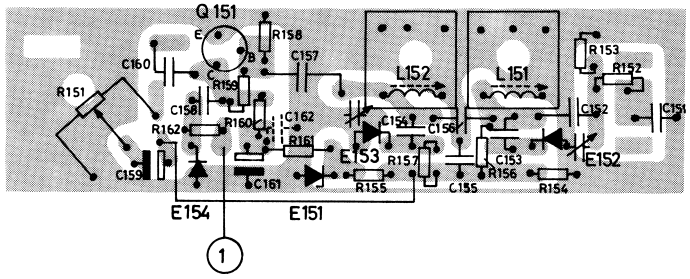
BOTTOM VIEW

TRANSMITTER SECTION
AF Amplifier, Limiter, and Automatic Voltage Regulator

D401.192

Storno





PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE

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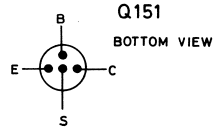
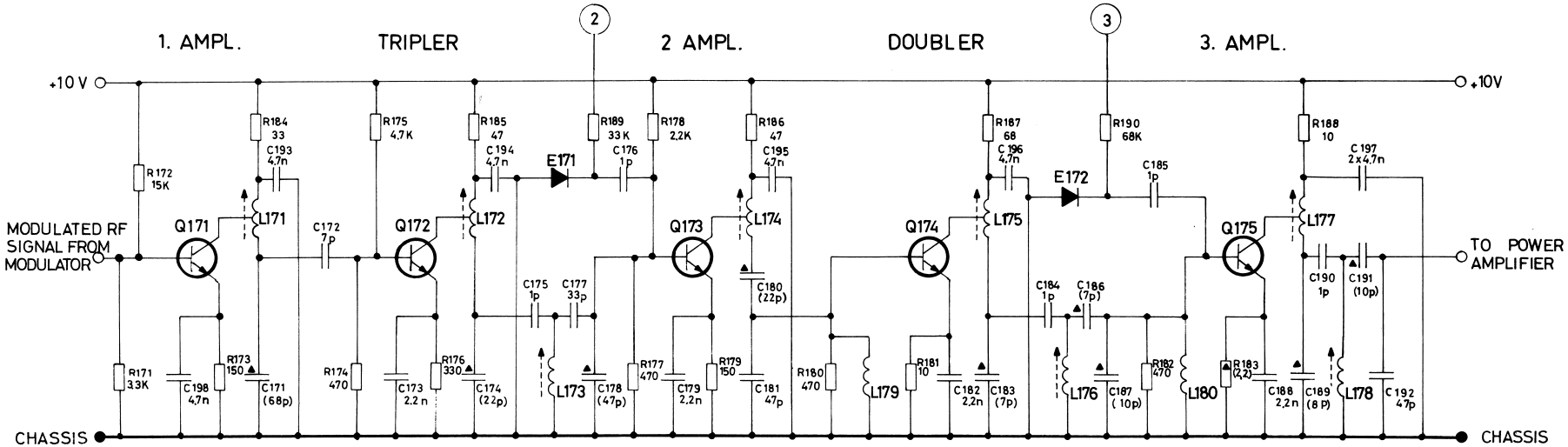


TRANSMITTER SECTION
Modulator

D401.188

Storno



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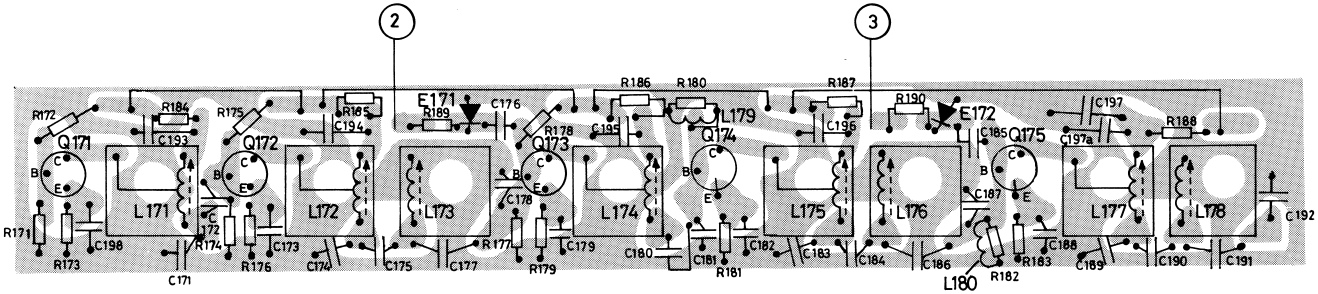
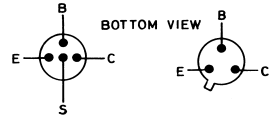


PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE



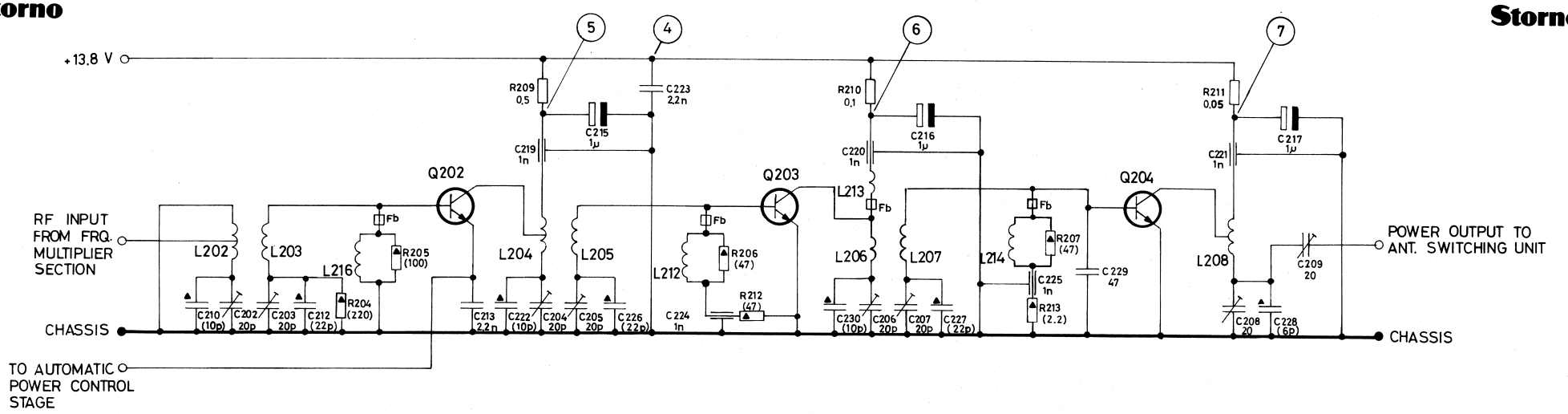
Q171, Q172, Q173 Q174, Q175

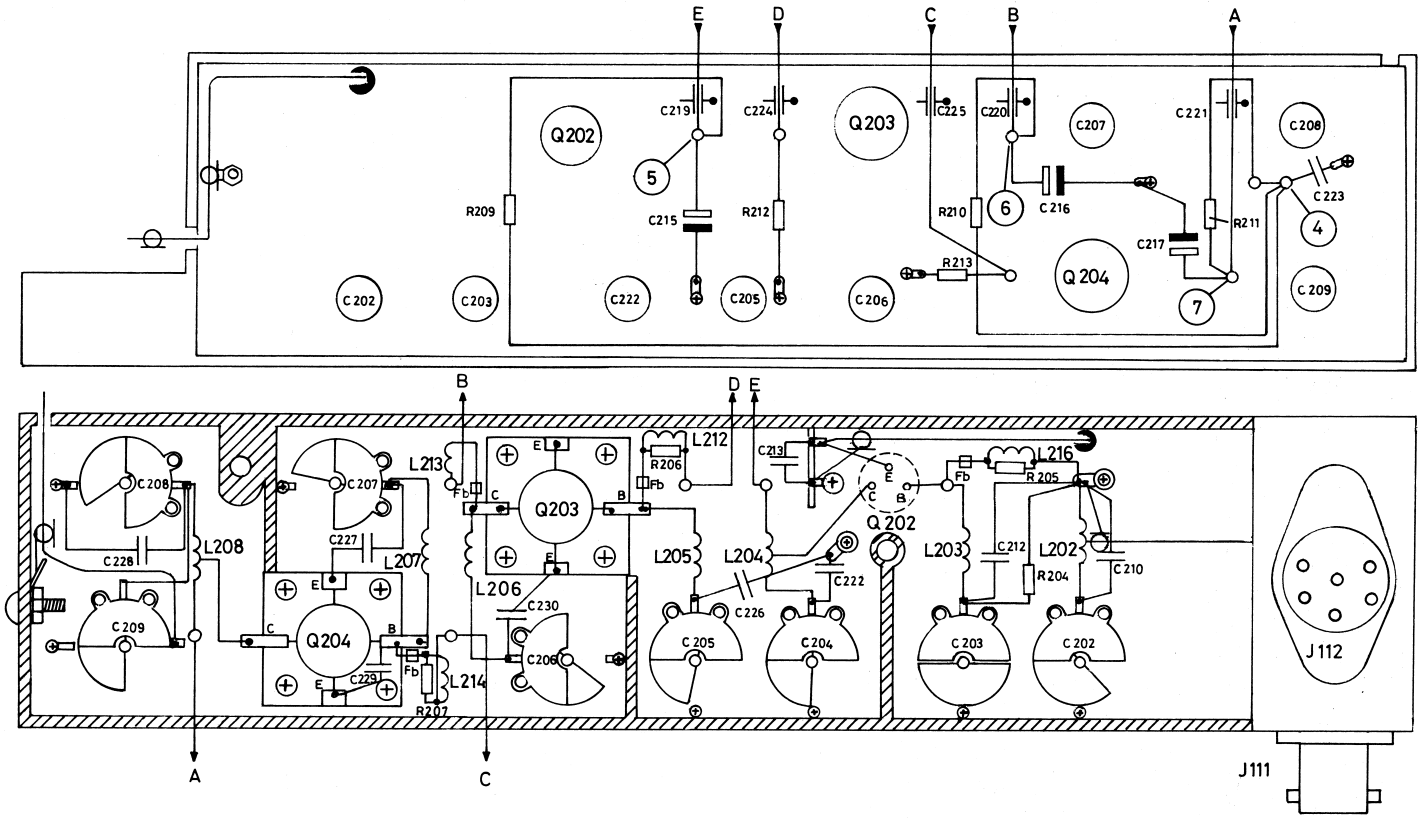
TRANSMITTER SECTION
Exciter

D401.195

Storno

Storno





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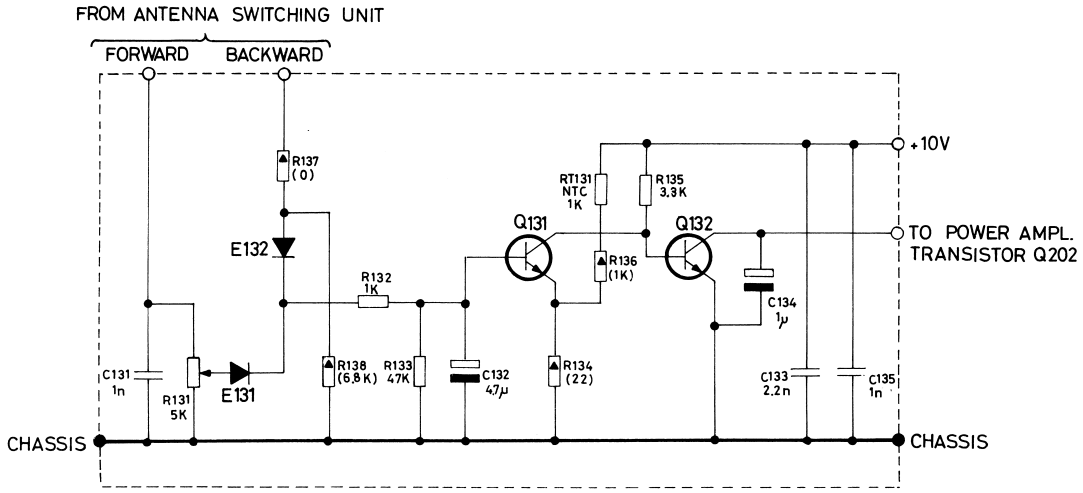
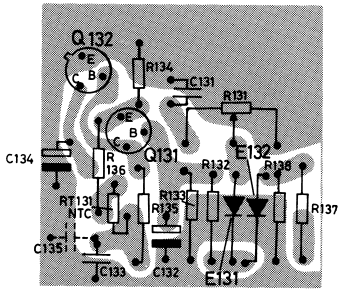
TRANSMITTER SECTION
RF Power Output Stages

D401.196

Storno



PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE



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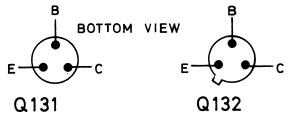
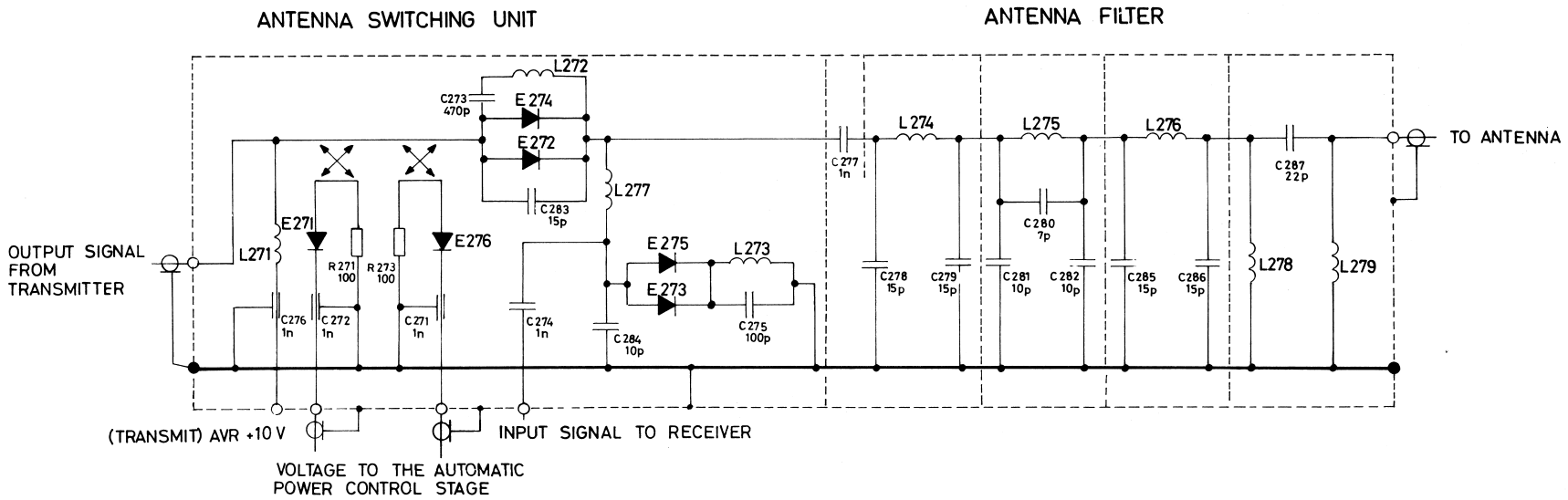
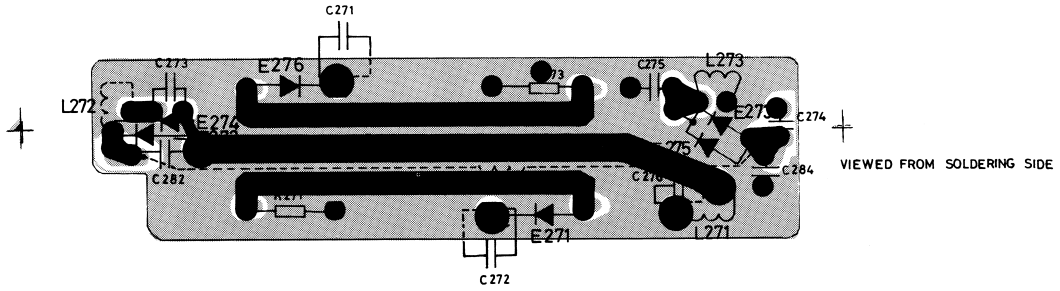


TRANSMITTER SECTION
Automatic Power Control Unit

D401.194

Storno





TRANSMITTER SECTION
Antenna filter and Switching Unit

D401.193

POS.	CODE	DATA	
C101	ECEA16V33H	33 µF +100/-10% elco	16V
C102	ECEA25V4R7H	4.7 µF +100/-10% "	25V
C103	ECEA25V4R7H	4.7 µF +100/-10% "	25V
C104	ECEA25V4R7H	4.7 µF +100/-10% "	25V
C105	ECEA25V4R7H	4.7 µF +100/-10% "	25V
C106	ECEA16V33H	33 µF +100/-10% "	16V
C107	CQ92M1H222K	2.2 nF 10% plastic film	50V
C108	CQ92M1H103K	10 nF 10% " "	50V
C109	CQ92M1H223K	22 nF 10% " "	50V
C110	CQ92M1H223K	22 nF 10% " "	50V
C113	CQ92M1H103K	10 nF 10% " "	50V
C131	RD204YW102M	1 nF 20% ceram	50V
C132	ECEA25V4R7N	4.7 µF +100/-10% elco	25V
C133	RD204YW222M	2.2 nF 20% ceram	50V
C134	ECEA50V1N	1 µF +150/-10% elco	50V
C135	RD204YW102M	1 nF 20% ceram	50V
C141	CQ92M1H103K	10 nF 10% plastic film	50V
C151	RD200CH150J	15 pF 5% ceram	50V
C152	RD200CH070C	7 pF ±0.25 pF ceram	50V
C153	RD204YW222M	2.2 nF 20% ceram	50V
C154	RD204YW222M	2.2 nF 20% "	50V
C155	RD204YW222M	2.2 nF 20% "	50V
C156	RD200CK020C	2 pF ±0.25 pF "	50V
C157	RD200CH100D	10 pF ±0.5 pF "	50V
C158	RD200CK010C	1 pF ±0.25 pF "	50V
C159	ECEA25V4R7N	4.7 µF +100/-10% elco	25V
C160	RD205CH470J	47 pF 5% ceram	50V
C161 1)	ECEA25V10N	10 µF +100/-10%	25V
C171 1)	RD204UJ680J	68 pF 5% ceram	50V
C172	RD200CH070C	7 pF ±0.25 pF ceram	50V
C173	RD204YW222M	2.2 nF 20% "	50V
C174 1)	RD200UJ220J	22 pF 5% "	50V
C175	RD200CK010C	1 pF ±0.25 pF "	50V
C176	RD200CK010C	1 pF ±0.25 pF "	50V
C177	RD200UJ330J	33 pF 5% ceram	50V
C178 1)	RD204UJ470J	47 pF 5% "	50V
C179	RD204YW222M	2.2 nF 20% "	50V
C180a	RD200UJ220J	22 pF 5% "	50V
C180b	RD200CH050C	5 pF ±0.25 pF ceram	50V
C181	RD204UJ470J	47 pF 5% ceram	50V
C182	RD204YW222M	2.2 nF 20% "	50V
C183 1)	RD200CH070C	7 pF ±0.25 pF ceram	50V
C184	RD200CK010C	1 pF ±0.25 pF "	50V
C185	RD200CK010C	1 pF ±0.25 pF "	50V
C186 1)	RD200PH070D	7 pF ±0.25 pF "	50V
C187 1)	RD200PH100D	10 pF ±0.5 pF "	50V
C188	RD204YW222M	2.2 nF 20% ceram	50V
C189 1)	RD200CH080D	8 pF ±0.25 pF "	50V

Storno

POS.	CODE	DATA	
C190	RD200CK010C	1 pF ±0.25 pF ceram	50V
C191 1)	RD200PH100D	10 pF ±0.5 pF "	50V
C192	RD204UJ470J	47 pF 5% ceram	50V
C193	RD208YW472M	4.7 nF 20% "	50V
C194	RD208YW472M	4.7 nF 20% "	50V
C195	RD208YW472M	4.7 nF 20% "	50V
C196	RD208YW472M	4.7 nF 20% "	50V
C197a	RD208YW472M	4.7 nF 20% "	50V
C197b	RD208YW472M	4.7 nF 20% "	50V
C198	RD208YW472M	4.7 nF 20% "	50V
C202	RPS 170036	20 pF trimmer	
C203	RPS 170036	20 pF "	
C204	RPS 170036	20 pF "	
C205	RPS 170036	20 pF "	
C206	RPS 170036	20 pF "	
C207	RPS 170036	20 pF "	
C208	RPS 170036	20 pF "	
C209 1)	RPS 170037	20 pF "	
C210 1)	RD200CH100D	10 pF ±0.5 pF ceram	50V
C212 1)	RD204CH220J	22 pF ±5% ceram	50V
C213	RD204YW222M	2.2 nF 20% "	50V
C215	ECEB50V1N	1 µF +150/-10% elco	50V
C216	ECEB50V1N	1 µF +150/-10% "	50V
C217	ECEB50V1N	1 µF +150/-10% "	50V
C219	DF514-2YZ102P	1 nF +100/-0% ceram	500V
C220	DF514-2YZ102P	1 nF +100/-0% "	500V
C221	DF514-2YZ102P	1 nF +100/-0% "	500V
C222	RD204CH100D	10 pF ±0.5 pF "	50V
C223	RD204YW222M	2.2 nF 20% ceram	50V
C224	DF516-2YM102Z	1 nF +80/-20% ceram	500V
C225 1)	DF516-2YM102Z	1 nF +80/-20% "	500V
C226 1)	RD200CH150J	15 pF 5% ceram	50V
C227 1)	CC22CH220JZ500	22 pF 5% "	500V
C228 1)	CC22CH050CZ500	5 pF ±0.5 pF ceram	500V
C229 1)	RD205CH470J	47 pF 5% ceram	50V
C230 1)	RD200CH100D	10 pF 5% "	50V
C271	DF516-YM102Z	1 nF +80/-20% ceram	500V
C272	DF516-YM102Z	1 nF +80/-20% "	500V
C273	RD200YW471M	470 pF 20% ceram	50V
C274	RD204YW102M	1 nF 20% "	50V
C275	RD208CH101J	100 pF 5% "	50V
C276	DF516-YW102Z	1 nF +80/-20% "	500V

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X401.198

POS.	CODE	DATA	
C277 [1]	RD204YW102M	1 nF 20% ceram	50V
C278	CC22CH150JZ500	15 pF 5% "	500V
C279	CC22CH150JZ500	15 pF 5% "	500V
C280	CC22CH070CZ500	7 pF ± 0.25 pF ceram	500V
C281	CC22CH100DZ500	10 pF ± 0.5 pF "	500V
C282	CC22CH100DZ500	10 pF ± 0.5 pF "	500V
C283	RD200CH150J	15 pF 5% ceram	50V
C284	RD200CH100D	10 pF ± 0.5 pF ceram	50V
C285	CC22CH150JZ500	15 pF 5% ceram	500V
C286	CC22CH150JZ500	15 pF 5% "	500V
C287	CC22CH220J	22 pF 5% "	500V
C301	CV03A080Y	3-8 pF trimmer	350V
C302	CV03A080Y	3-8 pF "	350V
C303	CV03A080Y	3-8 pF "	350V
C304	CV03A080Y	3-8 pF "	350V
C305	CV03A080Y	3-8 pF "	350V
C306	CV03A080Y	3-8 pF "	350V
C307	CV03A080Y	3-8 pF "	350V
C308	RD204YW102M	1 nF 20% ceram	50V
C309	RD204YW102M	1 nF 20% "	50V
C310	RD204YW102M	1 nF 20% "	50V
C311	RD204YW102M	1 nF 20% "	50V
C312	RD204YW222M	2.2 nF 20% "	50V
C319 [1]	RD204CH330J	33 pF 5% "	50V
C320	RD204YW222M	2.2 nF 20% "	50V
C321	RD204YW222M	2.2 nF 20% "	50V
C322	RD204YW102M	1 nF 20% "	50V
C323	RD200CK020C	2 pF ± 0.25 pF ceram	50V
C325	CV03A080Y	3-8 pF trimmer	350V
C326	DF516YM-102Z	1 nF +80/-20% ceram	500V
C327	DF516YM-102Z	1 nF +80/-20% "	500V
C328	DF516YM-102Z	1 nF +80/-20% "	500V
C331	RD200CK020C	2 pF ± 0.25 pF "	50V
C332	RD200CK020C	2 pF ± 0.25 pF "	50V
C333	RD200CK020C	2 pF ± 0.25 pF "	50V
C334	RD200CK020C	2 pF ± 0.25 pF "	50V
C335	RD200CK020C	2 pF ± 0.25 pF "	50V
C336	RD200CK020C	2 pF ± 0.25 pF "	50V
C337	RD200CH040C	4 pF ± 0.25 pF "	50V
C338	RD200CH150J	15 pF 5% ceram	50V
C339	RD208YZ103p	10 nF +100/-0% "	50V
C341	CQ92M1H103K	10 nF 10% plastic film	50V
C352	RD204YW102M	1 nF 20% ceram	50V
C353	RD200CH150J	15 pF 5% "	50V
C358	DD600BC104Z	0.1 µF +80/-20% ceram	12V
C361	DD600BC104Z	0.1 µF +80/-20% "	12V
C362	RD204YW102M	1 nF 20% ceram	50V
C363	RD204YW102M	1 nF 20% "	50V

Storno

POS.	CODE	DATA	
C364 [1]	RD200CK070C	7 pF ± 0.25 pF ceram	50V
C366	CV03-7A080Y	3-8 pF trimmer	350V
C367	RD204YW102M	1 nF 20% ceram	50V
C368 [1]	RD200CJ030C	3 pF ± 0.25 pF ceram	50V
C369	RD204YW22M	2.2 nF 20% ceram	50V
C401	RD200CH070C	7 pF ± 0.25 pF "	50V
C402	RD204YW102M	1 nF 20% ceram	50V
C403	RD205CH470J	47 pF 5% "	50V
C404	DD600BC104Z	0.1 µF +80/-20% ceram	12V
C405	DD600BC104Z	0.1 µF +80/-20% "	12V
C406	RD205CH470J	47 pF 5% ceram	50V
C407	RD205CH470J	47 pF 5% "	50V
C408	DD600BC104Z	0.1 µF +80/-20% ceram	12V
C409	RD200CK020C	2 pF ± 0.25 pF "	50V
C410	DD600BC104Z	0.1 µF +80/-20% "	12V
C411	DD600BC104Z	0.1 µF +80/-20% "	12V
C412	DD600BC104Z	0.1 µF +80/-20% "	12V
C413	DD600BC104Z	0.1 µF +80/-20% "	12V
C414	RD200CK020C	2 pF ± 0.25 pF "	50V
C415	DD600BC104Z	0.1 µF +80/-20% "	12V
C416	DD600BC104Z	0.1 µF +80/-20% "	12V
C417	RD200CH050C	5 pF ± 0.25 pF "	50V
C419	RD204YW102M	1 nF 20% ceram	50V
C451	ECEA50V1N	1 µF +150/-10% elco	50V
C452	CQ92M1H223K	22 nF 10% plastic film	50V
C453	ECEA50V10N	10 µF +150/-10% elco	50V
C454	ECEA50V1N	1 µF +150/-15% "	50V
C455	CQ92M1H222K	2.2 nF 10% plastic film	50V
C457	CE02C16V220 µF	220 µF +100/-10% elco	16V
C458	CQ92M1H222K	2.2 nF 10% plastic film	50V
C459	CQ92M1H222K	2.2 nF 10% " "	50V
C460	ECEA50V1N	1 µF +150/-10% elco	50V
C461	CQ92M1H103K	10 nF 10% plastic film	50V
C462	ECEA25V10N	10 µF +100/-10% elco	25V
C463	ECEA25V4R7N	4.7 µF +100/-10% "	25V
C464	ECEA50V1N	1 µF +150/-10% "	50V
C466	ECEA25V10N	10 µF +100/-10% "	25V
C467	ECEA25V10N	10 µF +100/-10% "	25V
C468	ECEB25V100N	100 µF +100/-10% "	25V
C469	ECEB25V100N	100 µF +100/-10% "	25V
C470	ECEA25V10N	10 µF +100/-10% "	25V
C471	CQ92M1H473K	47 nF 10% plastic film	50V

POS.	CODE	DATA	
R101	RNC20B471J	470 Ω 5% carbon film	1/2W
R102	SV10KR4.7kΩJ	4.7 kΩ potentiometer	
R103	RC1/4GF220KΩJ	0,22 MΩ 5%	1/4W
R104	RC1/4GF47kΩ	47 kΩ 5%	1/4W
R105	RC1/4GF15kΩJ	15 kΩ 5%	1/4W
R106	RC1/4GF3.3kΩJ	3.3 kΩ 5%	1/4W
R107	RC1/4GF150ΩJ	150 Ω 5%	1/4W
R108	RC1/4GF15kΩJ	15 kΩ 5%	1/4W
R109	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R110	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R111	RC1/4GF6.8kΩJ	6.8 kΩ 5%	1/4W
R112	RC1/4GF68kΩJ	68 kΩ 5%	1/4W
R113	RC1/4GF68KΩJ	68 kΩ 5%	1/4W
R114	RC1/4GF2.2kΩJ	2.2 kΩ 5%	1/4W
R115	RC1/4GF2.2ΩJ	2.2 Ω 5%	1/4W
R116	RC1/4GF680ΩJ	680 Ω 5%	1/4W
R117	RC1/4GF1KΩJ	1 kΩ 5%	1/4W
R118	RC1/4GF10kΩJ	10 kΩ 5%	1/4W
R119	RNC20B331J	330 kΩ 5% carbon film	1/4W
R131	V168-1-1(PVB)N-B5kΩ	5 kΩ 20% potentiometer	0.1W
R132	RC1/4GF1kΩJ	1 kΩ 5%	1/4W
R133	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R134 [1)]	RC1/4GF22ΩJ	4.7 Ω - 100 Ω 5%	1/4W
R135	RC1/4GF3.3kΩJ	3.3 kΩ 5%	1/4W
R136 [1)]	RC1/4GF1kΩJ	470 Ω - 10 kΩ 5%	1/4W
R137 [1)]	RC1/4GF0ΩJ	0 Ω - 10 kΩ 5%	1/4W
R138 [1)]	RC1/4GF68kΩJ	0 Ω - 10 kΩ 5%	1/4W
R151	V168-1-1(PVB)N-B5kΩ	5 kΩ 20% potentiometer	0.1W
R152 [1)]	RC1/4GF0ΩJ	0 Ω - 100 Ω 5%	1/4W
R153 [1)]	RC1/4GF220 ΩJ	47 Ω - 470 Ω 5%	1/4W
R154	RC1/4GF22kΩJ	22 kΩ 5%	1/4W
R155 [1)]	RC1/4GF10kΩJ	4.7 kΩ - 22 kΩ 5%	1/4W
R156	RC1/4GF4.7kΩJ	4.7 kΩ 5%	1/4W
R157	RC1/4GF4.7kΩJ	4.7 kΩ 5%	1/4W
R158	RC1/4GF15kΩJ	15 kΩ 5%	1/4W
R159	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R160	RC1/4GF1.5kΩJ	1.5kΩ 5%	1/4W
R161	RC1/4GF1kΩJ	1 kΩ 5%	1/4W
R162	RC1/4GF33kΩJ	33 kΩ 5%	1/4W
R171	RC1/4GF3.3kΩJ	3.3 kΩ 5%	1/4W
R172	RC1/4GF15kΩJ	15 kΩ 5%	1/4W
R173	RC1/4GF150ΩJ	150 Ω 5%	1/4W
R174	RC1/4GF470 ΩJ	470 Ω 5%	1/4W
R175	RC1/4GF4.7kΩJ	4.7 kΩ 5%	1/4W
R176	RC1/4GF330ΩJ	330 Ω 5%	1/4W
R177	RC1/4GF470ΩJ	470 Ω 5%	1/4W

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POS.	CODE	DATA	
R178	RC1/4GF2.2kΩJ	2.2 kΩ 5%	1/4W
R179	RC1/4GF150ΩJ	150 Ω 5%	1/4W
R180	RC1/4GF470ΩJ	470 Ω 5%	1/4W
R181	RC1/4GF10ΩJ	10 Ω 5%	1/4W
R182 [1)]	RC1/4GF470ΩJ	470 Ω 5%	1/4W
R183 [1)]	RC1/4GF2.2ΩJ	0 Ω - 10 Ω 5%	1/4W
R184	RC1/4GF33ΩJ	33 Ω 5%	1/4W
R185	RC1/4GF47ΩJ	47 Ω 5%	1/4W
R186	RC1/4GF47ΩJ	47 Ω 5%	1/4W
R187	RC1/4GF68ΩJ	68 Ω 5%	1/4W
R188	RC1/4GF10ΩJ	10 Ω 5%	1/4W
R189	RC1/4GF33kΩJ	33 kΩ 5%	1/4W
R190 [1)]	RC1/4GF68kΩJ	68 kΩ 5%	1/4W
R204 [1)]	RC1/4GF220ΩJ	47 Ω - Ω 5%	1/4W
R205 [1)]	RC1/4GF100ΩJ	22 Ω - 1 kΩ 5%	1/4W
R206 [1)]	RNC20B470J	10 Ω - 1 kΩ 5% carbon film	1/4W
R207 [1)]	RNC20B470J	10 Ω - 1 kΩ 5% " "	1/4W
R209		0.5 Ω wire	
R210		0.1 Ω "	
R211		0.05 Ω "	
R212 [1)]	RC1/4GF4.7ΩJ	0 Ω - 100 Ω 5%	1/4W
R213 [1)]	RC1/4GF2.2ΩJ	0 Ω - 100 Ω 5%	1/4W
R271	RC1/4GF100ΩJ	100 Ω 5%	1/4W
R272	RC1/4GF100kΩJ	0.1 MΩ 5%	1/4W
R273	RC1/4GF100ΩJ	100 Ω 5%	1/4W
R301 [1)]	RC1/4GF10kΩJ	10 kΩ 5%	1/4W
R302 [1)]	RC1/4GF3.3kΩJ	1 kΩ - 10 kΩ 5%	1/4W
R303	RC1/4GF330ΩJ	330 Ω 5%	1/4W
R304	RC1/4GF100ΩJ	100 Ω 5%	1/4W
R305	RC1/4GF33kΩJ	33 kΩ 5%	1/4W
R306	RC1/4GF15kΩJ	15 kΩ 5%	1/4W
R307	RC1/4GF2.2kΩJ	2.2 kΩ 5%	1/4W
R308	RC1/4GF1.5kΩJ	1.5 kΩ 5%	1/4W
R309 [1)]	RC1/4GF2.2kΩJ	2.2 kΩ 5%	1/4W
R310 [1)]	RC1/4GF220ΩJ	0 Ω - 1 kΩ 5%	1/4W
R311 [1)]	RC1/4GF47ΩJ	0 Ω - 220 Ω 5%	1/4W
R312 [1)]	RC1/4GF68ΩJ	0 Ω - 1 kΩ 5%	1/4W
R313 [1)]	RC1/4GF∞ΩJ	1 kΩ - ∞Ω 5%	1/4W
R314 [1)]	RC1/4GF33kΩJ	1 kΩ - 33 kΩ 5%	1/4W
R351	RC1/4GF220ΩJ	220 Ω 5%	1/4W
R355	RC1/4GF10kΩJ	10 kΩ 5%	1/4W
R356	RC1/4GF2.2kΩJ	2.2 kΩ 5%	1/4W

POS.	CODE	DATA	
R357 1)	RC1/4GF1kΩJ	100 Ω - 4.7 kΩ 5%	1/4W
R358	RC1/4GF10ΩJ	10 Ω 5%	1/4W
R359	RC1/4GF100ΩJ	100 Ω 5%	1/4W
R401	RC1/4GF680ΩJ	680 Ω 5%	1/4W
R402	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R403	RC1/4GF1kΩJ	1 kΩ 5%	1/4W
R404	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R405	RC1/4GF1kΩJ	1 kΩ 5%	1/4W
R406	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R407	RC1/4GF1kΩJ	1 kΩ 5%	1/4W
R408	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R409	RC1/4GF1kΩJ	1 kΩ 5%	1/4W
R410	RC1/4GF4.7kΩJ	4.7 kΩ 5%	1/4W
R411	RC1/4GF680ΩJ	680 Ω 5%	1/4W
R412	RC1/4GF22kΩJ	22 kΩ 5%	1/4W
R413	RC1/4GF100ΩJ	100 Ω 5%	1/4W
R414 1)	RC1/4GF∞ΩJ	1 kΩ - ∞ Ω 5%	1/4W
R451 1)	RC1/4GF10kΩJ	0 Ω - 33 kΩ 5%	1/4W
R452	RC1/4GF100kΩJ	0.1 MΩ 5%	1/4W
R453	RC1/4GF10kΩJ	10 kΩ 5%	1/4W
R454 1)	RC1/4GF3.3kΩJ	1.5 kΩ - 6.8 kΩ 5%	1/4W
R455	RC1/4GF1.5kΩJ	1.5 kΩ 5%	1/4W
R456	RC1/4GF10kΩJ	10 kΩ 5%	1/4W
R457	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R458	RC1/4GF47kΩJ	47 kΩ 5%	1/4W
R459	RC1/4GF22kΩJ	22 kΩ 5%	1/4W
R460	RC1/4GF1kΩJ	1 kΩ 5%	1/4W
R461	RC1/4GF22kΩJ	22 kΩ 5%	1/4W
R462	RC1/4GF4.7kΩJ	4.7 kΩ 5%	1/4W
R463	RC1/4GF1kΩJ	1 kΩ 5%	1/4W
R464	RC1/4GF220ΩJ	220 Ω 5%	1/4W
R465	RC1/4GF1.5kΩJ	1.5 kΩ 5%	1/4W
R466	RC1/4GF10ΩJ	10 Ω 5%	1/4W
R467 1)	RC1/4GF1kΩJ	0 Ω - 4.7 kΩ 5%	1/4W
R468	RC1/4GF6.8kΩJ	6.8 kΩ 5%	1/4W
R469	RC1/4GF4.7kΩJ	4.7 kΩ 5%	1/4W
R470	RC1/4GF2.2kΩJ	2.2 kΩ 5%	1/4W
R471	M-2 0.2 Ω J	0.2 Ω 5%	2 W
R501	V16M5-3N7TB5kΩ	5kΩ potentiometer	
R502	V16M5-3N7TB5kΩ	5kΩ potentiometer	
R503	RNC20B121J	120Ω 5% carbon film	1/2W
L101	RPS350742	180 mH 5% choke FL-11H/84J	
L131	RPS370020	3 Ferrite Beads	
L151	RPS360555	RF coil	
L152	RPS360555	RF coil	
L153	RPS370020	3 Ferrite Beads	
L171	RPS360555	RF coil	

Storno

POS.	CODE	DATA
L172	RPS360556	RF coil
L173	RPS360556	RF coil
L174	RPS360556	RF coil
L175	RPS360557	RF coil
L176	RPS360557	RF coil
L177	RPS360557	RF coil
L178	RPS360557	RF coil
L179		RF choke
L180		RF choke
L202		RF coil
L203		RF coil
L204		RF coil
L205		RF coil
L206		RF coil
L207		RF coil
L208		RF coil
L212		RF choke
L213		RF coil
L214		RF choke
L216		Choke
L271		Choke 5.6H 200 mA
L272		RF coil
L273		Choke
L274		RF coil
L275		RF coil
L276		RF coil
L277		RF coil
L278		RF coil
L301		RF coil
L302		Choke
L303		RF coil
L304		RF coil
L305		RF coil
L306		RF coil
L307		RF coil
L308		RF coil
L355		RF coil
L356	RPS370020	3 Ferrite Beads
L401	LF1-680K	Choke
L402	RPS370020	5 Ferrite Beads
L403	RPS370020	8 Ferrite Beads
L451	FL-11H823J	Choke

RADIOTELEPHONE CQM412, CQM413

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POS.	CODE	DATA
L452	FL-7H222J	Choke
RT131	31D26	1 kΩ 5% NTC
T1	RPS350615	AF Transformer 45Ω/5kΩ
J101	UM-QJ-1.5	
J111	RPS410145	Connector type N
J112		
Z401	RPS460369	Discriminator 10.7 MHz
FL401	RPS460367	Crystal Filter
FL402	RPS460368	Crystal Filter
E101	MD134	MD134 Diode
E102	MD134	MD134 Diode
E103	RPS330257	MZ1010(M) Zenerdiode
E104	MD134	MD134 Diode
E131	MD134	MD134 Diode
E132	MD134	MD134 Diode
E151	RPS330257	MZ1006(M) Zenerdiode
E152	RPS330535	MV3047 Cap. diode
E153	RPS330535	MV3047 Cap. diode
E154	SD82A	SD82A Diode
E171	SD82A	SD82A Diode
E172	SD82A	SD82A Diode
E271	MC5321	MC5321 Diode
E272	RPS330533	MI-101 Diode
E273	RPS330533	MI-101 Diode
E274	RPS330533	MI-101 Diode
E275	RPS330533	MI-101 Diode
E276	MC5321	MC5321 Diode
E401	SD82A	SD82A Diode
E401	SD82A	SD82A Diode
E451	RPS330593	MC5321 (red) Diode
E452	RPS330593	MC5321 (red) Diode
E453	RPS330593	MC5321 (red) Diode
E454	MD134	MD134 Diode
E455	MD134	MD134 Diode
E456	MD134	MD134 Diode
E457	RPS330257	MZ1010 (L)
E601	SR10K-2R	SR10K-2R Diode
Q101	2SC912E	2SC912E Transistor
Q102	2SC912E	2SC912E Transistor
Q103	RPS330528	2SD130 - BL Transistor

Storno

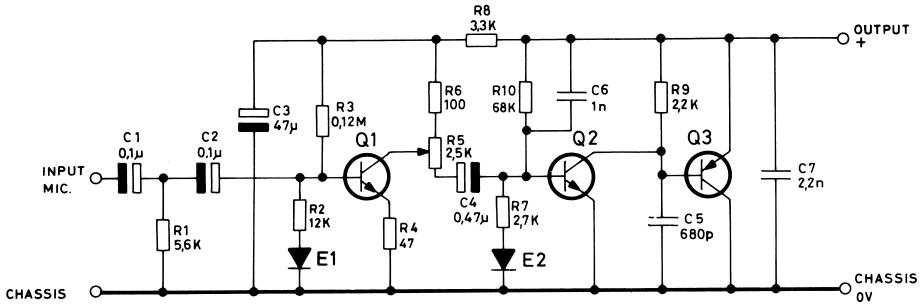
POS.	CODE	DATA
Q104	2SC912C	2SC912C Transistor
Q131	2SC912C	2SC912C Transistor
Q131	2SC816C	2SC816C Transistor
Q151	2SC663C	2SC663C Transistor
Q171	2SC663C	2SC663C Transistor
Q172	2SC663C	2SC663C Transistor
Q173	2SC663C	2SC663C Transistor
Q174	RPS330395	2SC730 Transistor
Q175	RPS330395	2SC730 Transistor
Q202	RPS330395	2SC730 Transistor
Q203	RPS330397	2SC703 Transistor
Q204	RPS330421	2SC704 Transistor
Q301	RPS330562	2SC817 Transistor
Q302	RPS330562	2SC817 Transistor
Q352	2SC663D	2SC663D Transistor
Q401	2SC663D	2SC663D Transistor
Q402	2SC663D	2SC663D Transistor
Q403	2SC663D	2SC663D Transistor
Q404	2SC663D	2SC663D Transistor
Q451	2SC912D	2SC912D Transistor
Q452	2SC912E	2SC912E Transistor
Q453	RPS330531	2SC372G-Y Transistor
Q454	RPS330531	2SA495G-Y Transistor
Q455	RPS330528	2SD130-Y (green) Transistor
Q456	RPS330528	2SD130-Y (green) Transistor
Q457	2SC912D	2SC912D Transistor
Q458	2SC912D	2SC912D Transistor
Q460	RPS330528	2SD130-Y Transistor
ME401	M5113T	M5113T Integrated Circuit

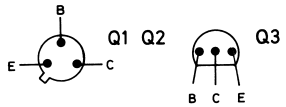
1) The stated values are nominal and subject to changes without notice.

Code and Data MUST be specified when ordering diodes and transistors.

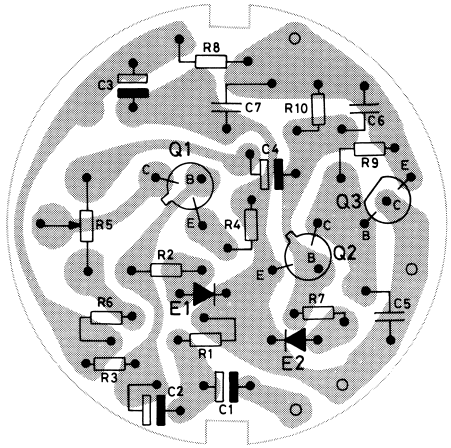
RADIOTELEPHONE CQM412, CQM413

Storno





BOTTOM VIEW



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

MICROPHONE AMPLIFIER AA401

D401.149/2

TYPE	NO.	CODE	DATA	
AA401		10.2481	Microphone Amplifier	
	C1	73.5089	0,1 µF ±20% tantal	35V
	C2	73.5089	0,1 µF ±20% "	35V
	C3	73.5124	47 µF ±20% "	6,3V
	C4	73.5125	0.47 µF ±20% "	35V
	C5	76.5107	680 pF polystyr.	
	C6	76.5069	1 nF polyest.	
	C7	76.5059	2.2 nF "	
	R1	80.5058	5.6 kΩ 5% carb. film	1/10W
	R2	80.5062	12 kΩ 5% " "	1/10W
	R3	80.5074	0.12 MΩ 5% " "	1/10W
	R4	80.5033	47 Ω 5% " "	1/10W
	R5	86.5067	2.5 kΩ 20% carb. potm. lin.	0,1W
	R6	80.5037	100 Ω 5% carb. film	1/10W
	R7	80.5054	2.7 kΩ 5% " "	1/10W
	R8	80.5055	3.3 kΩ 5% " "	1/10W
	R9	80.5053	2.2 kΩ 5% " "	1/10W
	R10	80.5071	68 kΩ 5% " "	1/10W
	E1	99.5028	Diode 1N914	
	E2	99.5028	Diode 1N914	
	Q1	99.5121	Transistor BC107	
	Q2	99.5121	Transistor BC107	
	Q3	99.5144	Transistor BC214L	

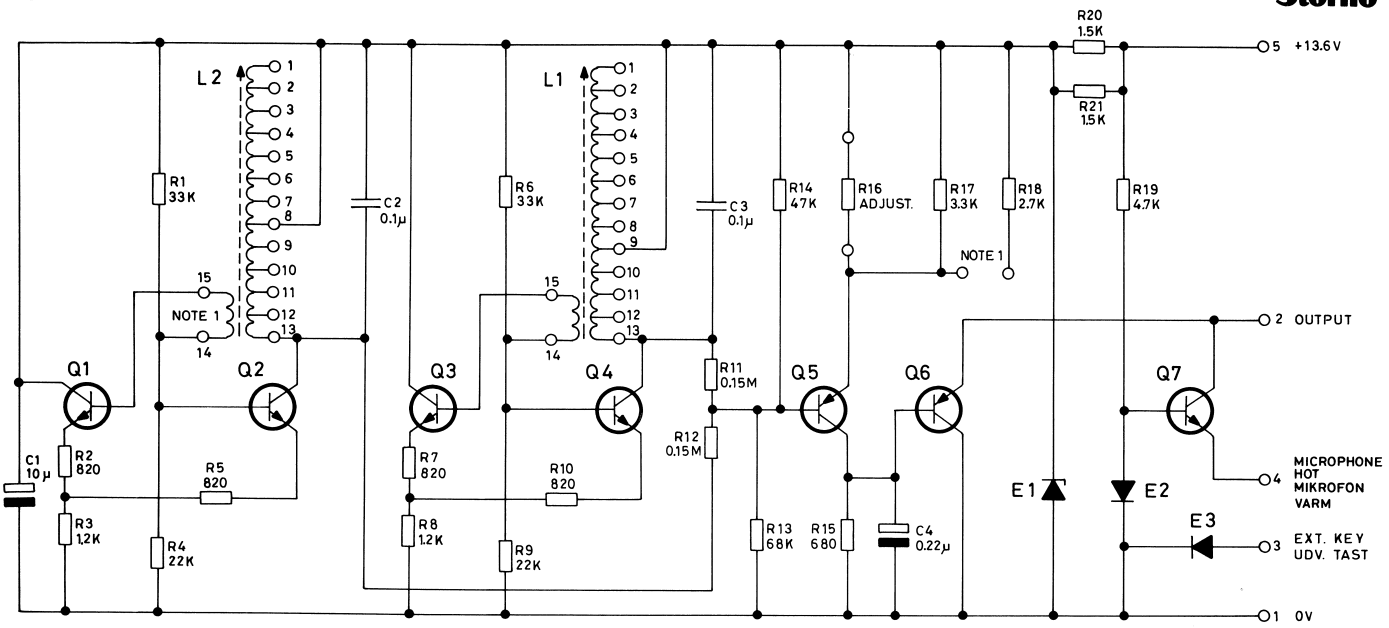
Storno

TYPE	NO.	CODE	DATA

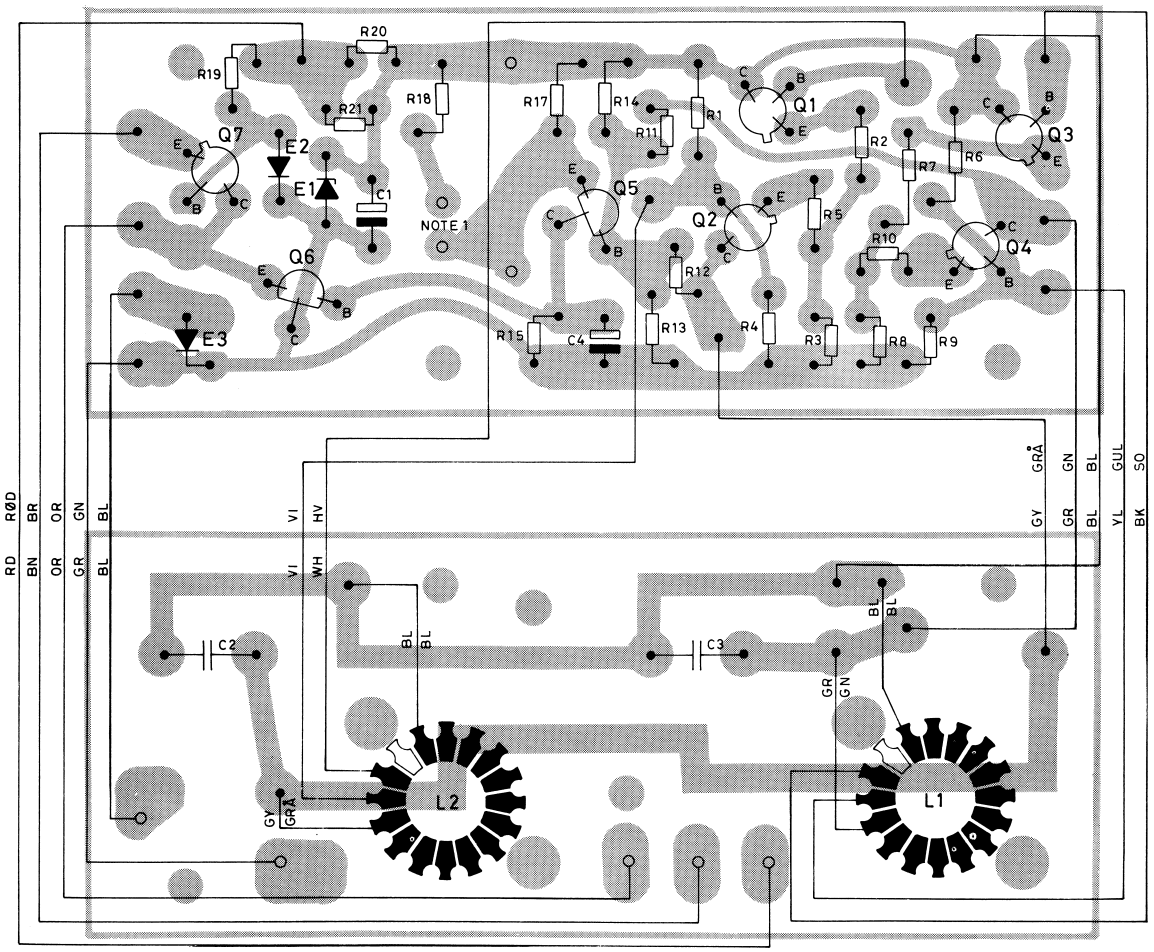
MICROPHONE AMPLIFIER AA401

X401.199

Storno



NOTE 1: FOR SINGLE TONE TRANSMISSION INSERT STRAP
FOR ENKELTTONESENDING INDSÆTTES STRAPNING



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

Q1.Q2.Q3.Q4.Q7

Q5.Q6

BOTTOM VIEW
SET FRA BUNDEN

TONE TRANSMITTER
TONESENDER

TT481

D401.164

TYPE	NO.	CODE	DATA	
	C1	73.5109	10 µF 20% tantal	16V
	C2	76.5068	0.1 µF 1% polystyr TB	63V
	C3	76.5068	0.1 µF 1% " TB	63V
	C4	73.5118	0.22 µF 20% tantal	35V
	R1	80.5267	33 kΩ 5% carbon film	1/8W
	R2	80.5248	820 Ω 5% " "	1/8W
	R3	80.5250	1.2 kΩ 5% " "	1/8W
	R4	80.5265	22 kΩ 5% " "	1/8W
	R5	80.5248	820 Ω 5% " "	1/8W
	R6	80.5267	33 kΩ 5% " "	1/8W
	R7	80.5248	820 Ω 5% " "	1/8W
	R8	80.5250	1.2 kΩ 5% " "	1/8W
	R9	80.5265	22 kΩ 5% " "	1/8W
	R10	80.5248	820 Ω 5% " "	1/8W
	R11	80.5275	0.15 MΩ 5% " "	1/8W
	R12	80.5275	0.15 MΩ 5% " "	1/8W
	R13	80.5271	68 kΩ 5% " "	1/8W
	R14	80.5269	47 kΩ 5% " "	1/8W
	R15	80.5247	680 Ω 5% " "	1/8W
	R16	80.52xx	Adjusted/udvalgt carbon film	1/8W
	R17	80.5255	3.3 kΩ 5% carbon film	1/8W
	R18	80.5254	2.7 kΩ 5% " "	1/8W
	R19	80.5257	4.7 kΩ 5% " "	1/8W
	R20	80.5251	1.5 kΩ 5% " "	1/8W
	R21	80.5251	1.5 kΩ 5% " "	1/8W
	L1	61.1102	Tone coil/tonespole	
	L2	61.1102	" " "	
	E1	99.5114	Zenerdiode 5.6V 5%	0.25W
	E2	99.5028	Diode 1N914	
	E3	99.5219	Diode AAZ15	
	Q1	99.5143	Transistor BC108	
	Q2	99.5143	Transistor BC108	
	Q3	99.5143	Transistor BC108	
	Q4	99.5143	Transistor BC108	
	Q5	99.5144	Transistor BC214L	
	Q6	99.5144	Transistor BC214L	
	Q7	99.5143	Transistor BC108	

Storno

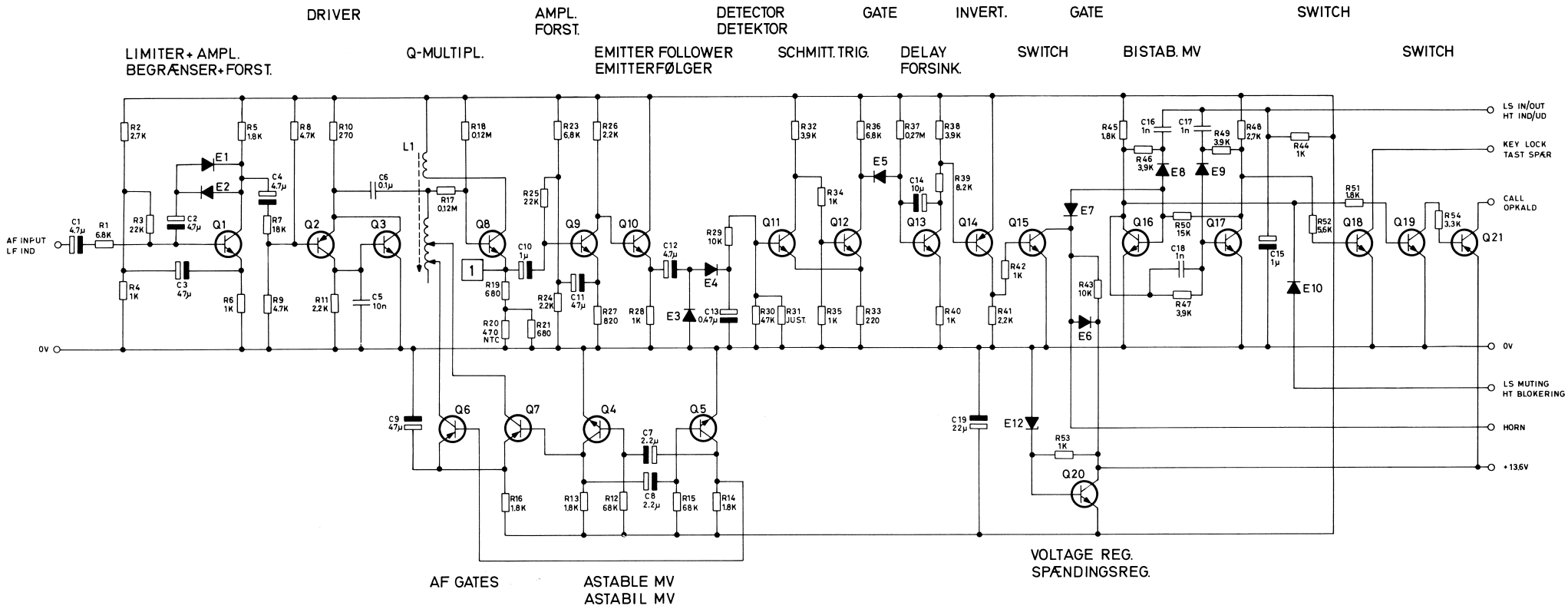
TYPE	NO.	CODE	DATA

TONE TRANSMITTER
TONESENDER

TT481

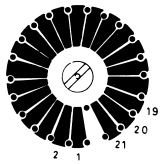
X401.180

Storno



TERM	FREQ Hz
1	615
2	675
3	735
4	805
5	885
6	970
7	1060
8	1160
9	1270
10	1400
11	1530
12	1670
13	1830
14	2000
15	2200
16	2400
17	2600
18	2900

L1

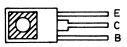


Q1, Q3, Q4, Q5, Q8, Q9, Q10, Q11, Q12, Q13, Q15, Q16, Q17, Q18, Q19

Q2, Q6, Q7, Q14, Q21

BOTTOM VIEW
SET FRA BUNDEN

Q20



TONE RECEIVER
TONEMODTAGER

TR481

D401.151

TYPE	NO.	CODE	DATA
TR481		10.2399	Tone receiver/tonemodtager
	C1	73.5126	4.7 µF 20% tantal 35V
	C2	73.5126	4.7 µF 20% " 35V
	C3	73.5124	47 µF 20% " 6,3V
	C4	73.5126	4.7 µF 20% " 35V
	C5	76.5070	10 nF 10% polyest. FL 50V
	C6	76.5068	0.1 µF 1% polystyr TB 63V
	C7	73.5102	2.2 µF 20% tantal 35V
	C8	73.5102	2.2 µF 20% " 35V
	C9	73.5124	47 µF 20% " 6.3V
	C10	73.5114	1 µF 20% " 35V
	C11	73.5124	47 µF 20% " 6.3V
	C12	73.2126	4.7 µF 20% " 35V
	C13	73.2126	4.7 µF 20% " 35V
	C14	73.5109	10 µF 20% " 16V
	C15	73.5114	1 µF 20% " 35V
	C16	76.5069	1 nF 10% polyest. FL 50V
	C17	76.5069	1 nF 10% " FL 50V
	C18	76.5069	1 nF 10% " FL 50V
	C19	73.5127	22 µF 20% " 16V
	R1	80.5259	6.8 kΩ 5% carbon film 1/8W
	R2	80.5254	2.7 kΩ 5% " " 1/8W
	R3	80.5265	22 kΩ 5% " " 1/8W
	R4	80.5249	1 kΩ 5% " " 1/8W
	R5	80.5255	3.3 kΩ 5% " " 1/8W
	R6	80.5249	1 kΩ 5% " " 1/8W
	R7	80.5264	18 kΩ 5% " " 1/8W
	R8	80.5257	4.7 kΩ 5% " " 1/8W
	R9	80.5257	4.7 kΩ 5% " " 1/8W
	R10	80.5242	270 Ω 5% " " 1/8W
	R11	80.5253	2.2 kΩ 5% " " 1/8W
	R12	80.5271	68 kΩ 5% " " 1/8W
	R13	80.5252	1.8 kΩ 5% " " 1/8W
	R14	80.5252	1.8 kΩ 5% " " 1/8W
	R15	80.5271	68 kΩ 5% " " 1/8W
	R16	80.5252	1.8 kΩ 5% " " 1/8W
	R17	80.5274	0.12 MΩ 5% " " 1/8W
	R18	80.5274	0.12 MΩ 5% " " 1/8W
	R19	80.5247	680 Ω 5% " " 1/8W
	R20	89.5053	470 Ω NTC 0.6W
	R21	80.5247	680 Ω 5% carbon film 1/8W
	R22		
	R23	80.5259	6.8 kΩ 5% " " 1/8W
	R24	80.5253	2.2 kΩ 5% " " 1/8W
	R25	80.5265	22 kΩ 5% " " 1/8W
	R26	80.5253	2.2 kΩ 5% " " 1/8W

Storno

TYPE	NO.	CODE	DATA
	R27	80.5253	2.2 kΩ 5% carbon film 1/8W
	R28	80.5249	1 kΩ 5% " " 1/8W
	R29	80.5261	10 kΩ 5% " " 1/8W
	R30	80.5269	47 kΩ 5% " " 1/8W
	R31	80.52xx	Adjusted/Tilpasset " 1/8W
	R32	80.5256	3.9 kΩ 5% " " 1/8W
	R33	80.5241	220 Ω 5% " " 1/8W
	R34	80.5249	1 kΩ 5% " " 1/8W
	R35	80.5249	1 kΩ 5% " " 1/8W
	R36	80.5259	6.8 kΩ 5% " " 1/8W
	R37	80.5278	0.27 MΩ 5% " " 1/8W
	R38	80.5256	3.9 kΩ 5% " " 1/8W
	R39	80.5260	8.2 kΩ 5% " " 1/8W
	R40	80.5249	1 kΩ 5% " " 1/8W
	R41	80.5253	2.2 kΩ 5% " " 1/8W
	R42	80.5249	1 kΩ 5% " " 1/8W
	R43	80.5261	10 kΩ 5% " " 1/8W
	R44	80.5249	1 kΩ 5% " " 1/8W
	R45	80.5252	1.8 kΩ 5% " " 1/8W
	R46	80.5256	3.9 kΩ 5% " " 1/8W
	R47	80.5256	3.9 kΩ 5% " " 1/8W
	R48	80.5254	2.7 kΩ 5% " " 1/8W
	R49	80.5256	3.9 kΩ 5% " " 1/8W
	R50	80.5263	15 kΩ 5% " " 1/8W
	R51	80.5252	1.8 kΩ 5% " " 1/8W
	R52	80.5258	5.6 kΩ 5% " " 1/8W
	R53	80.5249	1 kΩ 5% " " 1/8W
	R54	80.5255	3.3 kΩ 5% " " 1/8W
	L1	61.1101	Tone coil/Tonespole
	E1	99.5211	Stab. diode 0.8V 1/4W
	E2	99.5211	Stab. diode 0.8V 1/4W
	E3	99.5219	Diode AAZ15
	E4	99.5219	Diode AAZ15
	E5	99.5219	Diode AAZ15
	E6	99.5020	Diode 1N4004
	E7	99.5219	Diode AAZ15
	E8	99.5028	Diode 1N914
	E9	99.5028	Diode 1N914
	E10	99.5219	Diode AAZ15
	E12	99.5042	Zenerdiode 9,1V 5% 1/4W

TONE RECEIVER
TONEMODTAGER

TR481

X401.186

TYPE	NO.	CODE	DATA
	Q1	99.5143	Transistor BC108
	Q2	99.5144	Transistor BC214L
	Q3	99.5143	Transistor BC108
	Q4	99.5143	Transistor BC108
	Q5	99.5143	Transistor BC108
	Q6	99.5144	Transistor BC214L
	Q7	99.5144	Transistor BC214L
	Q8	99.5143	Transistor BC108
	Q9	99.5143	Transistor BC108
	Q10	99.5143	Transistor BC108
	Q11	99.5143	Transistor BC108
	Q12	99.5143	Transistor BC108
	Q13	99.5143	Transistor BC108
	Q14	99.5144	Transistor BC214L
	Q15	99.5143	Transistor BC108
	Q16	99.5143	Transistor BC108
	Q17	99.5143	Transistor BC108
	Q18	99.5143	Transistor BC108
	Q19	99.5143	Transistor BC108
	Q20	99.5235	Transistor BD135
	Q21	99.5144	Transistor BC214L

Storno

TYPE	NO.	CODE	DATA

TONE RECEIVER
TONEMODTAGER

TR481

X401.186