MOBILE RADIOTELEPHONE

STORNOPHONE 5000

TYPE CQM5112

TYPE CQM5113

TYPE CQM5114

146 - 174 MHz

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TYPE CQM5112
TYPE CQM5113
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Contents

Service Coordination
9 - 79
3rd Edition

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TECHNICAL SPECIFICATIONS

CQM5110

Guaranteed performance specifications unless otherwise noted.
Typical values are given in brackets.

GENERAL

Frequency Range
146 - 174 MHz

Channel Separation
CQM5112: 30/25kHz
CQM5113: 20kHz
CQM5114: 12.5khz

Maximum Frequency Deviation
CQM5112: ±5kHz
CQM5113: ±4kHz
CQM5114: ±2.5kHz

Modulation Frequency Range
CQM5112: 300 - 3000Hz
CQM5113: 300 - 3000Hz
CQM5114: 300 - 2700Hz

Maximum RF Bandwidth
1.5MHz

Antenna Impedance
50Ω

Maximum Number of Channels
6

Supply Voltage
Minimum : 10.8V
Nominal : 13.2V
Maximum : 16.6V
Negative potential to chassis

Temperature Range
$-30^{o}C$ to $+ 60^{o}C$

Dimensions
B x D x H: 180 x 190 x 60mm

Weight
1.8 Kg

RECEIVER

Sensitivity
12dB SINAD (EIA), ½e.m.f.
0.3uV (0.23uV)

Measuring conditions:
Δf. ±2/3 x Δf max; f_{mod} = 1kHz

20dB SINAD (CEPT) e.m.f.
CQM5112: 0.75uV (0.55uV)
CQM5113: 0.75uV (0.55uV)
CQM5114: 1.0uV (0.75uV)

Δf 60% x Δf max; f_{mod} = 1kHz.
Measured with psophometric filter.

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Crystal Frequency Range

45.1 - 54.5MHz

Crystal Frequency Calculation (fx)

$$fx = \frac{Fs - 10.7}{3} MHz$$

Frequency Stability

Conforms with government regulations

Modulation Acceptance Bandwidth (EIA)

CQM5112: ±7KHz (±7.5KHz)

Adjacent Channel Selectivity

EIA

CQM5112: 75dB (90dB)

FTZ

CQM5113: 70dB (88dB)

CEPT

CQM5112: 75dB (90dB)

CQM5114: 65dB (88dB)

Spurious Rejection

EIA

80dB (85dB)

Intermodulation Attennuation

EIA

CQM5112: 70dB (72dB)

CQM5113: 70dB (72dB)

CEPT

CQM5112: 70dB (75dB)

CQM5113: 70dB (75dB)

CQM5114: 70dB (73dB)

Blocking

90dB/uV (104dB/uV)

Radiation

CQM5112:

Conducted: max 0.8nW

CQM5113:

Radiated: max. 0.8nW

CQM5114:

Radiated: max. 0.8nW

AF Load Impedance (Loudspeaker)

4Ω

AF Power Output

EIA: 3W (3.6W)

CEPT: 1.5W

AF Distortion

5% (1.5%)

Δf=60% Δf max., 1KHz, 1W, RF 1mV

Audio Frequency Response

+1/-3dB (+0/-1.5dB)

Relative to 1000Hz, -6dB/octave

fm: CQM5112: 300 - 3000Hz

CQM5113: 300 - 3000Hz

CQM5114: 300 - 2600Hz

Hum and Noise

Squelched : 80dB (better than 85dB)

Unsquelched : 55dB (60dB)

Squelch Recovery Time

100 ms (10 ms)

Squelch Attack Time

150 ms (110 ms)

Squelch Closing Time

150 ms (20 ms)

Current Consumption

Squelched: 150mA (130mA)

AF 2W : 500mA (450mA)

(1 channel, without tone equipment, 13.2V supply)

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TRANSMITTER

RF Power Output

CQM5110-6/10: 6 or 10W

CQM5110-25: 25W

RL = 50Ω

Crystal Frequency Range

48.6 - 58MHz

Crystal Frequency Calculation (fx)

$fx = \frac{Fs}{3}$

Frequency Stability

Conforms with government regulations

Undesired Radiation

max. 0.2uW

Sideband Noise Power, CEPT

less than 70db

AF Input Impedance

560 ohm

Modulation Sensitivity

70mV ± 2dB

(60% Δf max, 1kHz)

Modulation Response

300 - 3000 Hz

+1/-3.0dB (+0.5/-2dB)

relative to 1000Hz, 6dB/octave

400 - 2700Hz

+1/-1.5dB (+0.5/-1dB)

relative to 1000Hz, 6dB/octave

Modulation Distortion

fm = 1000Hz: max. 3%

Δf = ±3.0KHz

fm = 300Hz: max. 5%

Δf = ±0.9KHz

measured with 750 μ sec de-emphasis

FM Hum and Noise

70dB

CEPT (measured with 750 μsec de-emphasis)

and psophometric filter.

Current Consumption

6W: less than 3.5A (2.5A)

10W: less than 4.0A (3.0A)

25W: less than 6.0A (5.0A)

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GENERAL DESCRIPTION

CQM5110

The Stornophone 5000 is a mobile radiotelephone unit with self-contained controls and loudspeaker.

A comparison of the various models are presented in the table below.

Although compact in size, it contains a transmitter /receiver, optional 5-tone sequential encoder/decoder or Channel Guard, and up to 6 transmit and receive channels.

Type	CQM5112		CQM5113		CQM5114	
SPEC	6/10	25	6/10	25	6/10	25
Frequency Range MHz	146 - 174		146 - 174		146 - 174	
RF Power W	6/10	25	6/10	25	6/10	25
Channel Spacing kHz	30/25		20		12, 5	
Max. Number of Channels	6		6		6	

ACCESSORIES

Standard accessories include:
Mounting frame
Power cable
Fist microphone with retainer or
Fixed - mount microphone
External loudspeaker
External switches

MN5001
Mounting frame for mobile installations allowing the radio to be fixed in 36 positions. Includes a base plate with locking screw.

MN703
Desk stand for fixed installations.

MN704a
Mounting frame for mobile installations and direct attachment to the vehicle.

MC5001
Fist microphone with retractable spiral cable for mobile installation.
HS5001 Retainer for MC5001
HS5002 Retainer, with switches, for MC5001

MC704
Microphone with chockabsorbing mounting bracket for mobile installation.

MC703
Desk microphone with PTT switch for fixed installations.

MK5001
Installation kit containing connectors, power cable, fuses and fuseholders.

LS701
Loudspeaker enclosed in a plastic housing, complete with cable.

SU701
Transmitter keying switch for mounting on the steering coloum.

SU702
Transmitter keying switch for mounting on the dashboard.

PS702
Power supply regulator for 24V car battery installations.

PS5001
Power supply for 220V AC mains.

MECHANICAL AND ELECTRICAL DESCRIPTION

The internal construction of CQM5000 is on an H-frame chassis with a shelf separating the receiver/transmitter (RF) printed circuit board and the various option printed boards. Front panel controls are an integral part of the printed board assemblies.

The chassis is a die cast aluminium frame comprising the left and right sides, the back, and a shelf located midway between the top and bottom. The chassis front is open and looks like an "H" viewed from the front.

Interconnection to the package exterior and to internal options are made via a System Interconnect Board located on the option side of the H-frame. A test connector is also located on the system board and is accessible from the rear of the radio.

This board also serves as channel switch unit in sets with multichannel option.

The moulded plastic front is directly attached to the chassis and has the speaker mounted to it. A separate moulded speaker grill and aluminum nameplate are attached to the front.

The top and bottom covers slides under the edge of the front and are then secured by screws at the rear.

The tone signalling encoder/decoder board (TQ) and the multifrequency board (XS) mount in the top section of the chassis. Their switches and pushbutton mount directly on the boards and protrude through the front.

Thin casted shields with adjustment holes are placed over the transmitter and receiver oscillators and parts of the transmitter in order to reduce spurious radiation.

CIRCUIT DESCRIPTION

Receiver
The receiver circuitry is placed on the main board and can be divided into:

Receiver front end
1st IF section with first and second oscillator
455kHz 2nd IF portion with demodulator.

(refer to functional block diagram)

Front-End
The receiver front-end consists of a dual-resonator input filter, a transistor RF amplifier, Q401, a triple-resonator intermediate filter and a FET mixer, Q402. The drain of the FET is terminated in the first IF resonant circuit which adapts the output impedance to the crystal filter. The front-end, antenna relay, first

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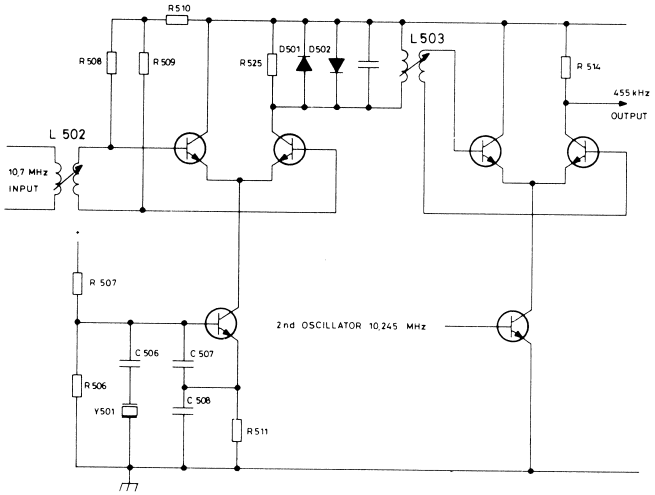
mixer and part of the transmitter PA inter-connections are design in micro-stripline techniques on the mainboard.

1st IF

The first IF frequency is 10.7MHz. The output from the crystal filter is fed to a dual-gate MOSFET amplifier, Q501, the output signal of which is fed to the second mixer, U501, a single balanced, self-oscillating, active mixer. Out of the second mixer comes the 455kHz IF signal. Two diodes, D501-502, limit the output from the mixer.



455kHz IF/Demodulator

The selectivity of the 455kHz IF amplifier is formed by a ceramic filter fed from a 455kHz amplifier/impedance transforming stage. The final 455kHz amplification and limiting is performed by an integrated circuit , U502, which also contains the guadrature FM detector and the AF amplifier/output emitter follower for the audio line signal.

SQUELCH AND AUDIO CIRCUITS

Squelch

The audio line signal (Vol/Sq - HI) is fed to a selective amplifier stage, where noise (frequencies around 8kHz) is extracted from the audio signal. Via the squelch potentiometer R607, this signal reaches an expander stage which improves the level discrimination charateristics of the circuit. A passive voltage doubler circuit (D603-D604) with high source impedance performs the action of an average value rectifier. A Schmitt Trigger gives the necessary hysteresis and a well-defined output from the fol-fowing buffer stage, Q605.
In the squelched condition and during transmissions this output is +1.5V and mutes the audio power amplifier.
The transmit indicator is part of the muting function.
A push button switch, S601, cancels the squelch function, when depressed, by grounding the base of Q601.

AUDIO

In sets with Pilot tone option, the audio line signal is fed to the Pilot tone board for filtering and back to the main board. In sets without CG this path is bypassed and the audio line signal is fed directly to the passive deemphasis network R629-C608 followed by the volume control. The volume control potentiometer R630 is mounted directly on the RF board and protrude through the front panel. The audio output amplifier U601 is a monolithic IC package capable of driving the loudspeaker at the desired power level. The output amplifier can be muted with a DC signal from the audio mute gate, which combines different logic signals to deside whether the amplifier should be active or not.
These inputs are:

- Regulated TX Voltage
- Squelch cancel
- Squelch signal

In sets equipped with Pilot tone and/or 5-tone sequential option, an RX mute function is routed from the option board to make the extra mute conditions possible.
The value of C610 in the feed back loop is chosen as the best compromise between battery ripple rejection and receiver squelch attack time.
The pilot lamp in the channel knob is supplied from A+, but controlled by the regulated 8.5 V via transistor Q968.

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TRANSMITTER

The transmitter consists of a modulation processor, an exciter, and a power amplifier, all assembled on the main board along with the receiver.

The exciter contains an FM oscillator, an audio processor, all frequency multiplier functions, and includes those stages operating at low enough power levels to avoid heat sinks. The exciter output is at the carrier frequency when applied to the power amplifier. The power amplifier boosts the signal to the proper level, and includes a low pass filter for suppressing harmonics and a circuitry which permits adjustment of the operating power level. The PA low pass filter connects to the antenna relay via a stripline on the board.

Modulation processor

The signal from the microphone load R901 on the XS board is applied to amplifier U101b. The transmitter audio frequency response is shaped by the feedback network R104-R103-C104.
The modulation limiting is obtained in the feedback network formed by D101, D102, R105, R106 and R107. The maximum permissible frequency deviation is set by R116 in single channel sets. In multichannel sets the potentiometer is turned to maximum and the diviation adjusted individually; refer to XS5111 and XS5112.
Amplifier U101A is operated as an active lowpass splatter filter feeding the modulating input of the FM oscillator.

Exciter

The exciter takes the third harmonic of the crystal oscillator, filters it to reduce spurious signals and amplifies it. Four amplifier stages (Q201-2-3-4) and four filters (L204-5-8-9) are used in a narrow band design which limits the maximum frequency spread of the transmitter.
The exciter has three test points (TP201-2-3) for measurements and alignment.

Power Amplifier

The PA is constructed on the main board and employs two broadband untuned amplifier stages Q205, Q206. Two amplifier configurations are available providing options of power levels of 10 watts or 25 watts. A power control circuit is included to sense the output RF level and keep it constant with variations in temperature and supply voltage. This circuit also limits the peak power to less than maximum, as specified by the authorities, while still maintaining the output as near maximum as possible.
The output power level can be set with a potentiometer, R215, over at least a 3:1 range. The transmitter delivers rated power into a 50-ohm load. A load SWR of 1.4:1 will result in more than 90% of the power being radiated. The transmitter will operate into a load with up to 3:1 SWR.

The power adjustment is achieved by controlling the supply voltage of power amplifier Q205 via transistor Q207. This series transistor is based by a voltage generated by the feedback network C255, D201, Q201, Q209, Q208.

OSCILLATORS

The oscillators are located on the main board for single frequency radio sets. All parts for the oscillators and compensation network are soldered to the board except the crystal which is a plug-in type.

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A multifrequency board is required for more than one frequency channel. This board is available is two versions; one (XS5111) has space for accomodating two transmit and two receive channels; one (XS5112) has space for up to six channels and an option for selecting the channels by a 3-digit BCD signal and a binary converter, U901-U902. The BCD signal is applied to three pins in J911. Separate active circuitry is used for each oscillator and all have their outputs connected to two buffer amplifiers Q927-Q967. The buffers' outputs are fed to their resonant circuit on the main board by a plug-in connection (J301-J151). The required oscillator is selected by switching the emitter of the oscillator transistor to the negative DC supply. The compensation voltage and audio for the oscillators is obtained from the same circuit on the main board via J902.

The maximum transmitter frequency deviation for the system is set by adjusting potentiometers, one for each channel, individualiy on each channel.

The oscillator uses a Colpitt's configuration with a bipolar transistor as the active element. The frequency is controlled by a third mode crystal which is operated at one third of the output frequency. This output frequency is selected by a tuned circuit in the transistor collector circuit. To provide modulation and compensation capability, the crystal, a variable inductor, and a varicap (variable capacitance diode) are connected in series. The inductor provides adjustment of the frequency to set the oscillator to the channel frequency. The varicap permits electrical adjustment of the frequency. Compensation voltage is generated by a resistor - thermistor network and applied to the varicap. A resistor in parallel with the crystal prevents oscillations with the crystal removed from the circuit.

Transmitter Oscillator

In the transmitter the circuit is used with the following additions. First, an inductor is placed across the crystal to resonate Co thus minimizing the audio distortion in the modulated output. Second, the audio voltage is superimposed on the compensating bias voltage to give the required deviation.

Receiver Oscillator

In the receiver the oscillator circuit has a buffer amplifier connected between the collector of the oscillator transistor and the tuned circuit, to provide the required power level.

SUPPLY VOLTAGE DISTRIBUTION SYSTEM

The battery voltage (A + BATT) enters the radio via two pins of the rear system connector to the interconnect board. Both inputs are connected to reverse polarity protection diodes D901, D902. The ground lead comes through the same connector and is connected to chassis ground through a fusable printed wiring path which will open in case of the ground wire being accidently connected to A +.

One battery input goes directly from the interconnect board via a feed-through capacitor and a connector P201 to the transmitter PA stages. The other input feeds through P903 to the main board for two functions. One branch for the audio amplifier passes through an RC-ripple filter R638 - C618 and one of the ON/OFF switch sections S602. The other section of the ON/OFF switch controls the VB + to the voltage regulator U602 consisting of a monolitic regulator. The regulator output is fixed at 8.5V by means of a factory adjusted resistor.

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Regulated 8.5V is switched to either the receiver or the transmitter by the antenna relay. The antenna relay is also supplied by the 8.5V regulated.

The squelch circuit, the modulation processor and parts of the IF amplifier U502 is supplied directly from the continuous 8.5 V.
The receiver front-end, the receiver oscillator, the 10.7 MHz IF stages and the second oscillator are supplied from 8.5V RX.
The transmitter oscillator and the exciter are supplied from 8.5V TX.

In sets with 5-tone sequential option or Pilot tone, the PTT (Push to talk) lead runs through the option board to provide for correct tone keying function.

WARNING

The transmitter PA transistors contain Beryllia which is poisonous when absorbed by the human body. Dissection, filing, or grinding of these transistor may be hazardous.

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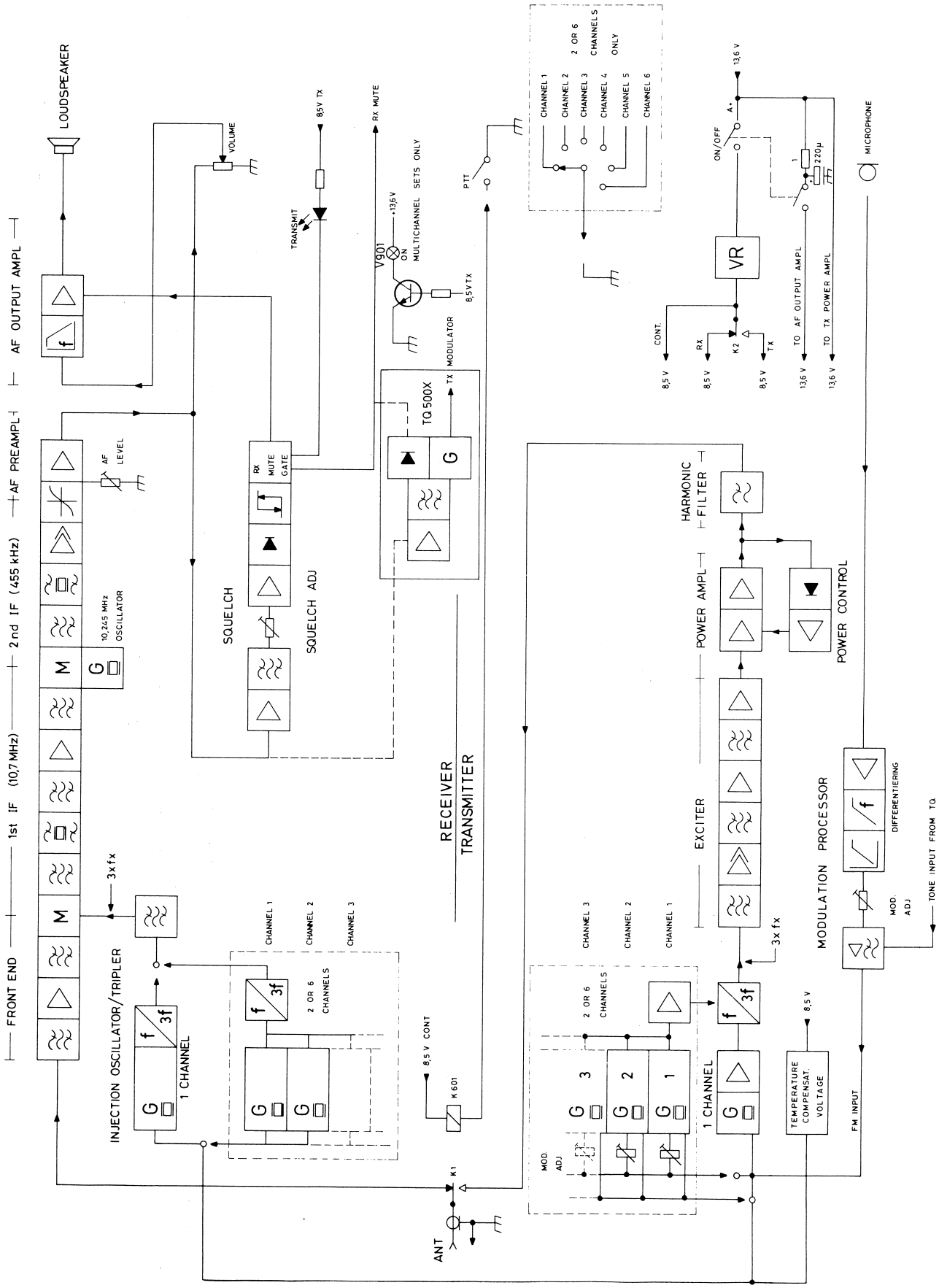


FUNCTIONAL BLOCK DIAGRAM
CQM 5110

SEQUENTIAL TONE UNIT

TQ5001 AND TQ5002

GENERAL

TQ5001 and TQ5002 are combined sequential tone transmitter-tone receiver units, the transmitter and receiver functions being independent of each other, and which can process 3, 4, or 5-tone signals. The units are designed to fit into CQM5000 radiotelephone equipment and the electrical design appears from the block diagram.
The unit is built on a single printed circuit board (p.c.b.) with plated through holes, and which connects to the radiotelephone circuits via plug-in sockets. The loudspeaker IN/OUT button, the TONE KEY button, and the green call indicator is mounted directly on the board and protrude through holes in the front plate. The unit is mechanical secured to the radiotelephone chassis by four screws and spacers.

For TQ5001 the tone frequencies are the STORNO series, 885 Hz to 2800 Hz; for TQ5002 the tone frequencies are the CCIR series, 960 Hz to 2110 Hz. The tone combinations for the tone receiver and the tone transmitter are selected by soldering colour coded wires to the tone coil, or by establishing the connections on the wiring side of the p.c.b.
In standby, when turning on the equipment, the unit is in the tone receive mode and set to the 1st tone of the combination. Receipt of a sequential tone signal, that matches this combination, will cause the following events to take place.

The key blocking is cancelled (Q127 ON).
The loudspeaker blocking is cancelled (Q130 OFF).
The LED call indicator D107 will start flashing.

When the tone unit is strapped for Auto-Receipt, a correct tone call will automatically trigger the sequential tone transmitter circuit and after having generated the last tone of the sequential tone signal the unit reverts to the condition described above, i.e. the loudspeaker is on.
Accordingly, when in the LS in mode, the tone transmitter can be manually triggered by pressing the Tone key button.
With 70 ms tone length, the time from depressing the Tone key to the generation of the 1st tone is approximate by 220 ms for TQ5001, and 320 ms for TQ5002.
ms = millisecond = 0.001 second.
When using 3 tones or 4 tones in the sequence this interval may by extended if the unused tone gate wires are left unconnected.
The transmitter remains keyed for approximately 640ms for TQ5001, and 920 ms for TQ5002 even if the Tone key button is pressed for a shorter or longer period. Simultanously with the keying of the transmitter, the microphone amplifier will be blocked. The blocking signal disappears after the last tone has ceased, that is when the unit reverts to standby.
The units can accomodate a Group Call unit, SU5001, when an extention of the call tone system is required, and the unit may also be used as a combined single tone transmitter and sequential tone receiver.

MODE OF OPERATION

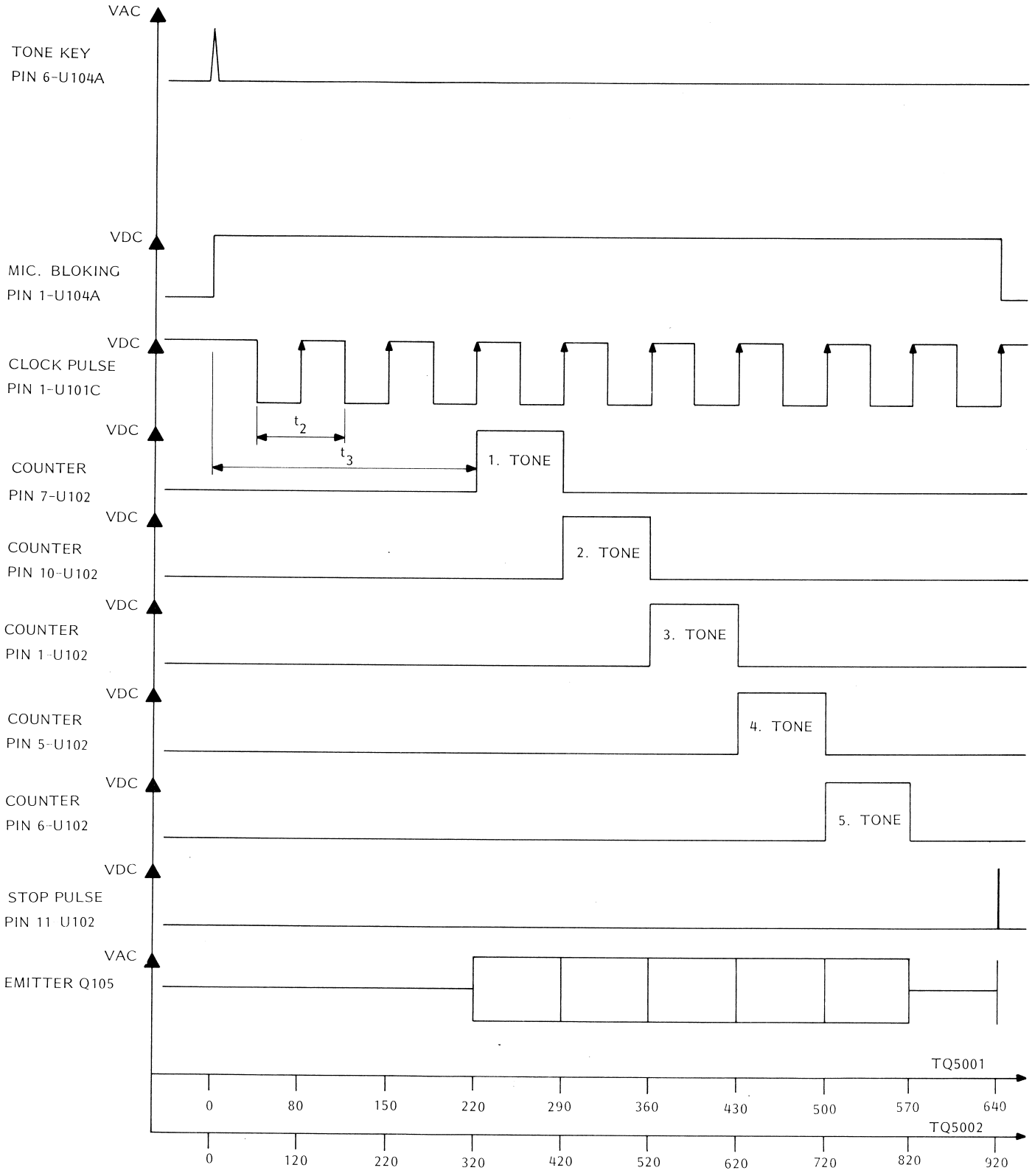
In standby the TQ5001/TQ5002 unit is set to the sequential tone receiver mode and when a tone signal having the proper code is applied to the input, the following events take place:
The 1st tone is amplified and limited in the input stage.
The signal is then, via a coupling link, applied to the selective circuit.
In standby the 1st tone gate, Q117, selects the 1st tone of the combination.

The active part of the selective circuit is a Q-multiplier, which also operates as oscillator when the selective circuit is part of the tone transmitter.
Owing to the high signal voltage across the selective circuit the gate transistors are biased in the nonconductive direction, and simultaneously the tone and oscillator signal amplitude is limited.
If the level of the 1st tone is within the sensitivity range of the tone receiver, the selected signal will switch the comparator output (U101A).
The schmitt-trigger (U101b) will go negative after approximately 17 ms which is generated by the Clock Delay circuit. At the same time the schmitt trigger rapidly charges the Clear Delay circuit in order to enable the counter.

At the end of the 1st tone the Schmitt trigger reverts to standby and the positive leading edge is fed to the counter's clock input. The counter steps forward and the next tone gate tunes the selective circuit to the 2nd tone.
Each gate transistor has its collector connected to one of the tone coil terminals. The sequential tone receiver is now set to receive the 2nd tone of the signal, and it remains in this state for approximately 120 ms, the time being determined by the Clear-Delay. Except for the requirement of a tone length of approximately 40 ms, the tone receiver is independent of the duration of the signal elements, because the counter switches to the next tone gate at the end of the preceeding tone. If the 2nd tone is not accepted within approximately 120 ms, the counter is reset to standby, i.e. ready for the 1st tone.
The 2nd, 3rd, 4th, and 5th tone of a sequential signal are received as described for the 1st. When the 5th tone has been accepted information of the counter is read out to Latch U104b, which cancels the key and loudspeaker blockings. At the same time the Call indicator is turned on, and the call may also cause an automatic transmission of receipt to take place, if used. The colour coded wires from the tone generator gates are soldered to the tone coil terminals, but if the same tone code is used for both tone transmitter and tone receiver, the code can be set by arranging the wires on the p.c.b. With the loudspeaker turned on depressing the Tone key button causes the following to take place:

A positive pulse from the Tone key button toggles the latch U104a whose Q and Q outputs control the internal switching from receive to transmit, and U104b controls the Transmitter Key switch and the Microphone Blocking.
When the clock generator U101c starts, the comparator U101a and the counter U103, are inhibited by the Q-output of U104a. The Q output enables the tone transmitter counter U102, inhibits the Clock Delay circuit, and turns on Q108 which increases the gain of the Q-multiplier Q107.
The clock generator pulses are applied to the counter U102, the repetition rate being 70 ms for TQ5001 and 100 ms for TQ5002.
Upon arrival of the 3rd clock pulse the 1st tone gate transistor is turned on and the tone oscillator generates the 1st tone of the signal code. The oscillator output is passing an emitter-follower before being applied to the output terminal. The output voltage is adjustable by means of R113.
The 4th, 5th, 6th, and the 7th clockpulse successively turn on the remaining gate transistors to accomplish the signal code. The 8th clock pulse is used to introduce an interval before the 9th clock pulse resets the latch, U104a, and the TQ-unit reverts to the tone receive mode with the loudspeaker turned on.

PULSE-TIME DIAGRAM FOR 5-TONE SEQUENTIAL CALL TRANSMITTING IN TQ5001 AND TQ5002



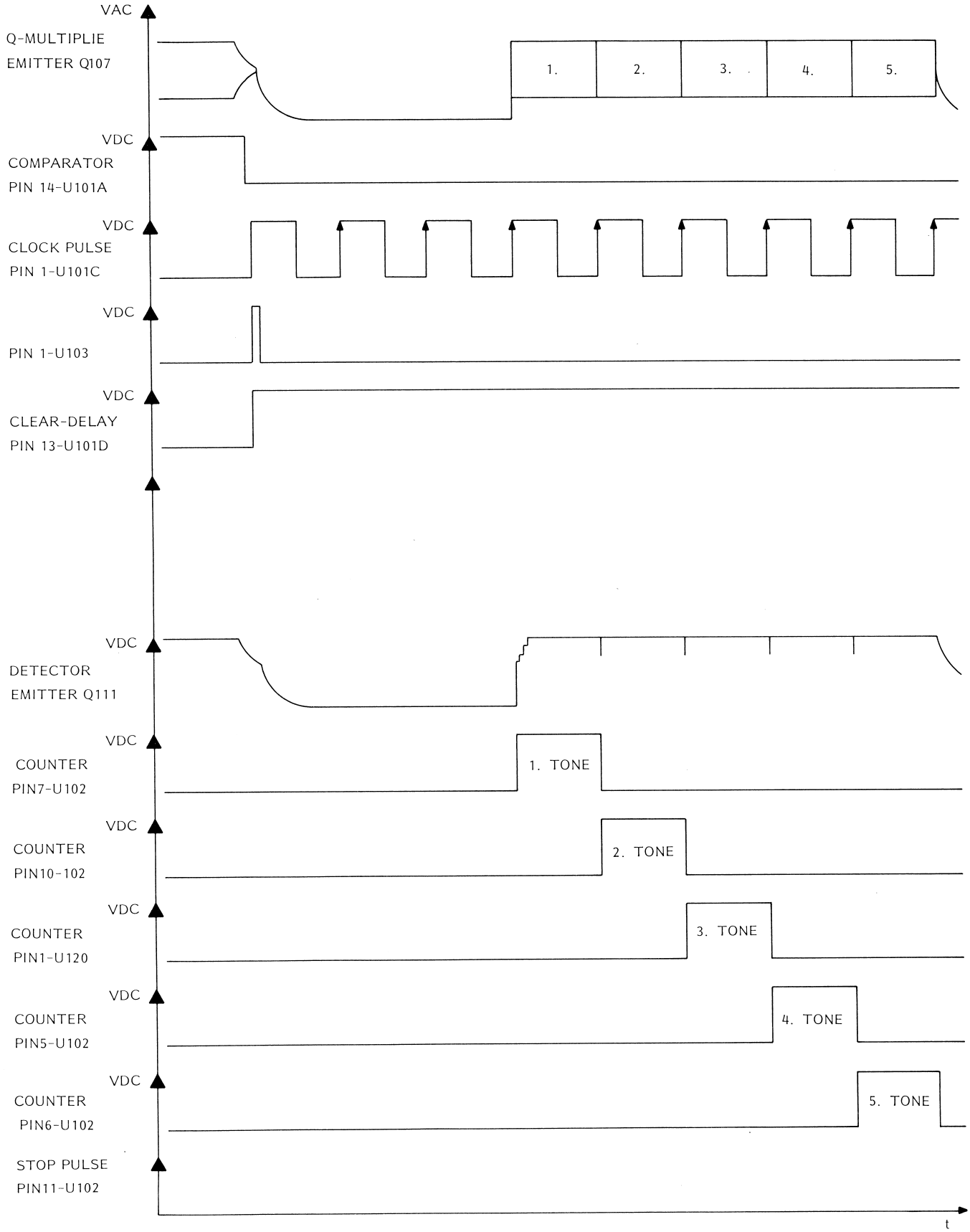
LOUDSPEAKER MANUALLY TURNED ON

t_1 CHARGING TIME FOR CLOCK GENERATOR

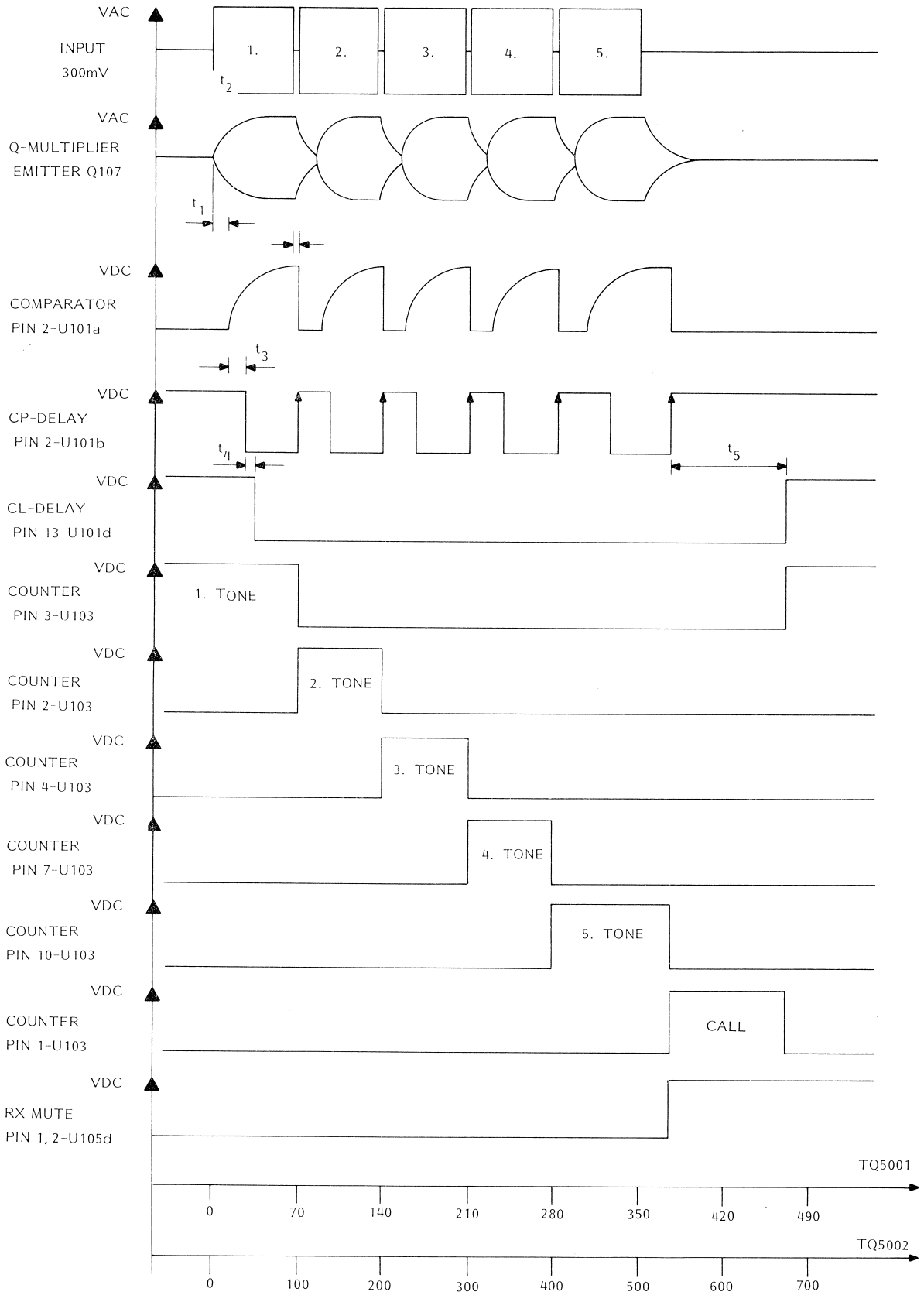
t_2 CLOCK PULSE PERIOD (TONE LENGHT)

t_3 UNMODULATED PULSES BEFORE THE 1 ST TONE

PULSE-TIME DIAGRAM FOR 5-TONE AUTOMATIC RECEIPT

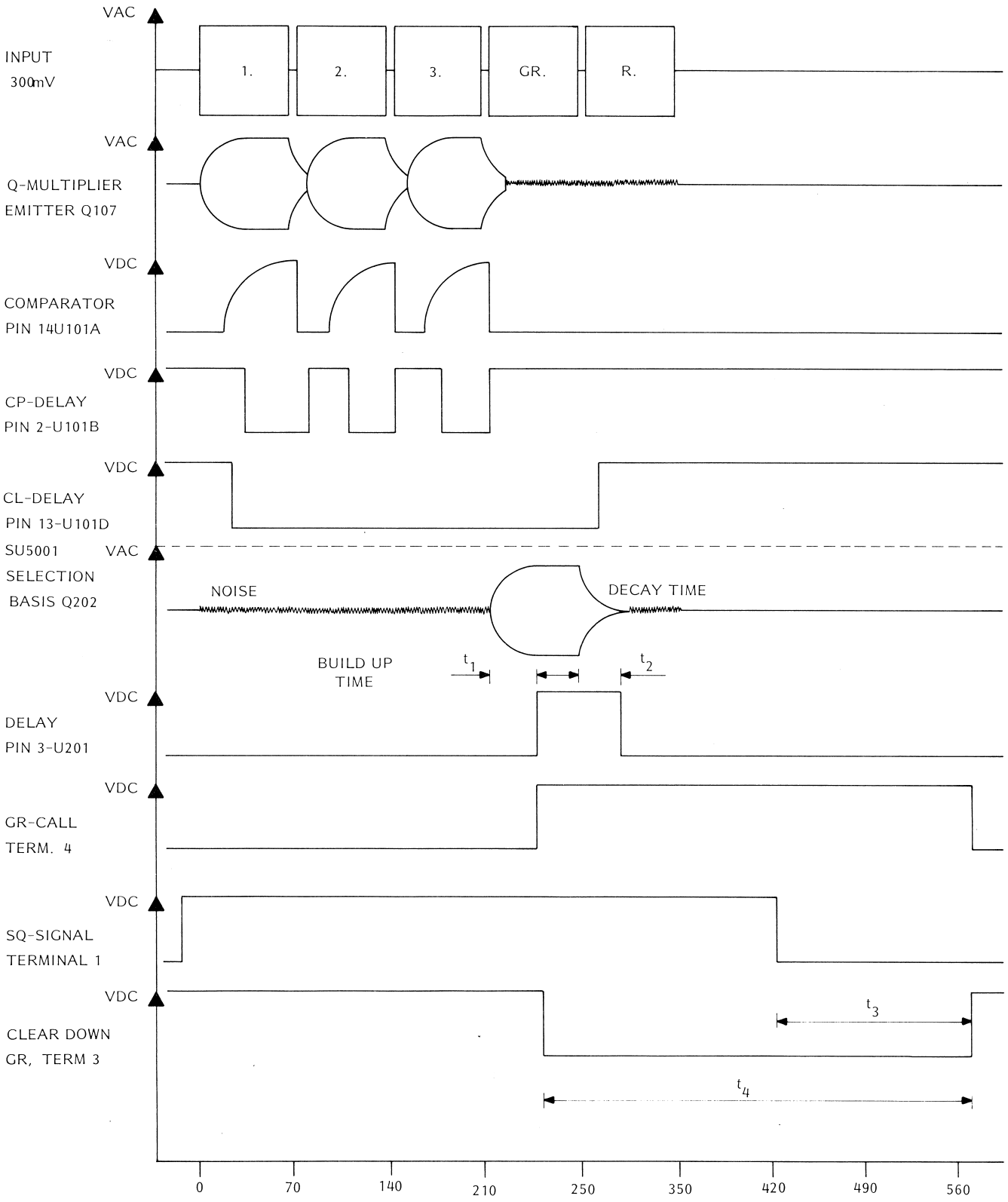


PULSE-TIME DIAGRAM FOR 5-TONE, SEQUENTIAL TONE RECEPTION IN TQ5001 AND TQ5002



t_1. SELECTIVE CIRCUIT BUILD-UP TIME
t_2. DELAYTIME
t_3. CLOCK-DELAY
t_4. DELAY CHARGING TIME
t_5. CLEAR-DELAY

PULSE-TIME DIAGRAM FOR 5-TONE SEQUENTIAL CALL WITH GROUP CALL



t_1 BUILD-UP TIME DELAY
t_2 DELAY TIME HANGE TIME
t_3 SQ-DELAY
IN PERIOD t_4 THE AUTOMATIC RECEIPT TONE KEY AND LS IN OUT ARE INHIBITED.

CIRCUIT DESCRIPTION

INPUT AMPLIFIER AND LIMITER

Transistors Q101, Q102, and Q103 form a differential input amplifier/limiter, and Q104 is the resonant circuit driver. The received tone signal is amplified the gain being constant and determined by the ratio of R106 to R107. Signal levels higher than the minimum sensitivity (approx. 85 mV) will cause limiting, and the tone signal is then applied to the Group Call Unit SU5001, if any, (terminal 9) and to driver Q104. Transistor Q104 operates as current generator with its collector connected to a separate winding on the tone coil. The sensitivity and thus the sequential tone receiver bandwidth is adjustable with R111.

The amplifier is inhibited when depressing the Tone Key (and the normal Key) causing the 8.5 V TX to be applied to the base of Q101 through D101. Less than 100 ms after reverting from the tone transmitting mode the unit is ready to receive a call.

RESONANT CIRCUIT

The band pass filter consists of tone coil L101 and capacitor C113.
The signal from the input amplifier is coupled to the parallel resonant circuit via the coupling link. The colour coded wires from the tone gates switch the tone coil taps into the circuit in parallel with capacitor C113.

Q-MULTIPLIER, LIMITER REFERENCE VOLTAGE AND DETECTOR

These circuits consist of Q107, Q108, Q109, Q110, Q111, and their accociated components. A part of the selected tone signal is fed via the Q-multiplier Q107 back to the coupling link and in phase with the input signal. This increases the bandpass filter Q-factor to approx. 30.

Resistors R123-R148 linearize this factor throughout the band, and the NTC resistor in the Q107 emitter compensates the Q-factor variations with ambient temperature.

The tone signal is rectified by transistor Q111 and the resultant d.c. voltage is applied to comparator U101a. Q108 is turned on by U104a when depressing the Tone Key, which increases the feedback so that the resonant circuit and Q107, which is the active component, form an oscillator. The signal voltage across the resonent circuit is amplitude limited by Q109 in order to obtain a constant signal output level from the oscillator and to reduce the decay time for strong signals. The gate transistor bias and the detector bias voltages are derived from Q110.

OUTPUT EMITTER FOLLOWER AND CLIPPER

The desired frequency characteristic is flat because the tone signal is connected directly to the splatter-filter. The output stage consists of the emitter follower Q105, and R113 is generator impedance for the OP-Amp of the splatterfilter. Due to the DC-shift in the oscillator a peak will appear at the start, and the end of the tone signal, but this peak will be limited by Q106.

COMPARATOR

The comparator is build around U101a, whose trigger reference level is determined by voltage divider R130-R131/R181 and controlled by the Q-output of latch U104a. The rectified tone signal increases the d.c. voltage to the non-inverting input of the comparator and when the level exceeds the reference voltage, the output of U101a will change from being a short to ground, to be the off state. This state persists for a time determined by the lenght of the tone. After the tone period the output will revert to form a ground path.

When depressing the Tone Key, U101a is inhibited in its standby state by the Q-output of U104a.

CLOCK-DELAY AND CLOCK GENERATOR

The Clock-delay is termined by R132 and C107. In standby the charge of capacitor C107 is neutral due to the discharge through the output of U104a, and the clock generator U101c is inhibited in its off position. The reference voltage, which is common to U101b and U101c, is, via voltage divider R133, R134, R135, applied to their non-inverting inputs. When the comparator U101a is activated, the voltage across Q107 will start to go positive. After 17 ms (Clock-delay) the Schmitt trigger U101b will be activated and the output voltage will drop to 0 V. At the end of the tone C107 again discharges via U101a.
This produces a positive going voltage edge at the U101b output which is applied to the clock inputs of counters U102 and U103 whose outputs switch the circuits to the next tone gate. If the comparator detects a new tone the procedure is repeated as previously described.

The comparator will, in its inhibited state (TONE KEY activated), keep U101b off. On the other hand, the clock generator U101c is released by biasing D104 off. C108 is charged through resistors R136, R137, and R138 until reaching the common reference voltage, and the output of U101c drops to 0V. This d.c. voltage transistion is via R134 fed back to the non-inverting input and thus causes a hysteresis. C108 is discharged to the lower voltage level and the positive edge so created is used as clock input to counter U102. The period time is adjusted by means of resistor, R137, to 70ms (TQ5001) or 100 ms for TQ5002.

CLEAR DELAY

Comparator U101d is controlled by the Schmitt trigger U101b. In standby the charge of C109 is neutral because D103 is reverse biased.

The output level of U101d corresponds to the supply voltage, 8.5 V, and counter U103 is cleared and set to the 1st tone gate. Triggering U101b enables C109 to be charged of via D103 and R140, and when the voltage of U109 has fallen to the reference level, U101d changes its output to 0 V and releases counter 103 which now is ready to receive the clock pulses.

The U101d references level is controlled by U104a's Q-output which in standby is approximately 8.5 V. Depressing the Tone Key button causes the reference level to fall to 0 V and U101d is blocked in its standby position, and hence counter U103 is blocked accordingly. As long as the Schmitt trigger, U101b, is active, D103 will maintain the charge of C109. When the last tone ceases, U101b reverts to standby and D103 is reverse biased. The discharge of C109 is determined by R139 and R140 which within approximately 120 ms reduces the charge of the capacitor until it corresponds to the reference level.
The U101d output voltage returns to 8.5 V and clears the counter, U103, after which the 1st tone gate is reengaged, and the tone receiver is ready to receive a new call. As the intervals between the individual tones in sequential tone call are far less than the above mentioned 120ms, the clear delay will retain its state for this period.

COUNTER AND TONE GATES

Two decimal counters are employed as tone generator pulse counter (U102) and tone receiver pulse counter, (U103). The counter outputs control the tone gates, Q112-121.

Determined by the clock generator period, counter U102's outputs will, consequently, open gate transistors Q112 to Q116 the collectors of which are tied to the tone coil taps and so producing the tones of the sequential tone signal. The first gate transistor is connected to the third counter output for which reason a period of 220 ms for TQ5001, and 320 ms for TQ5002 elapses -corresponding to the three first clock pulses- before generation of the 1st tone is started.

The time following the 9th clock pulse is utilized to discharge detector Q111, and the 10th clock pulse is fed, via R154, to latch U104a as a "stop" information. In order to hold the gate transistors effectively cut off their emitters are biased at 4.1 V.

The clear input of U102 is controlled by U104a's Q-output, and therefore the counter is inhibited in standby and is not released until the Tone Key button is depressed.
Counter U103 opens the tone receiver gate transistors, Q117-Q121.
The control signals for the counter is derived from U101b and the clear delay U101d, respectively.

In standby the counter is inhibited by U101d and the 1st tone gate is opened by the "0" output. The mode of operation for counter U103 is similar to that of U102 the clock pulse period corresponding to the received tone pulse lengths.

Approximately 120ms after the cessation of the last tone the counter is reset to standby by U101d. All counter outputs of U103 are accessible on the p.c.b. for setting the individual and the group call combinations (see instructions for coding and strapping).
Transistor Q122 is, together with the counter enable input, controlled by U104a's Q-output, which in standby is 0 V. Depressing the Tone Key button blocks the U103 clock input, and at the same time the 1st tone gate is blocked by Q122.

The elapse of time to transmit, or receive, a 5-tone sequential signal appears from the time-pulse deagrams.

LATCH, LS IN/OUT, TONE KEY AND FLASHING CIRCUIT

As latch for the tone receiver and tone transmitter functions, a dual-D-flip-flop U104 is employed of which U104a is directly controlled by U104b via diodes D105 and D106. An R-S flip-flop, U105a-U105b, prevents contact bounce in the LS in/out button from operating the latch.

After a tone call, or after having opened the loudspeaker manually the flashing circuit, U106 with its associated components will start flashing the yellow LED Call indicator (D107).

When applying the supply voltage, 8.5 V RX, U104b is forced into state "LS out" by the positive pulse fed to the latch reset input via C115. The call pulse is derived from one of counter U103's outputs and applied to U104b's set input and, according to note 6 on the diagram, to U104a as a receipt pulse. After a received tone call, U104b remains in state "LS in" until manually reset by depressing the LS in/out button. The tone transmitter latch, U104a, is inhibited in standby via diode D106 and, accordingly, the information from the Tone Key input terminal is short circuited via D105.
To perform a tone call U104b must be toggled manually to reverse bias D105 and D106.

MUTE AND ALARM

The mute function takes the information from the Q output of U104b and turns Q124 ON after a call or a manuel opening of the loudspeaker.
The Alarm (Q123) is ON for a short time (70 ms) immediately after the 5th tone.

PTT (TO RELAY) AND PTT (PUSH TO TALK)

When pressing the Tone Key, Q126 will go on and operate the transmitter relay. Q125 is controlled by the Q output of U104a which is triggered by U105c.
The normal keying of the RF transmitter is achieved by shorting terminal 3 to ground, but if the tone receiver is not opened, Q127 is off, and hence it prevents the transmitter from being keyed.

MICROPHONE BLOCKING AND RX MUTE

When the transmitter is keyed, the microphone amplifier supply comes via Q129.
When "Tone Key" is activated, U104a blocks Q129, the microphone is deprived of its supply, and the amplifier blocked.

After reception of a correct call, or manual opening, Q130 switches off and cancels the clamping of the RX mute lead, so that only the noise controlled squelch circuit decides whether the sets audio channel should be open or not.

TECHNICAL SPECIFICATIONS TQ5001.

Supply Voltage
8.5 V ±0.25 V (Cont. and TX)

Current Drain
Standby
<20 mA
Engaged
20 mA +25 mA peak when call indicator is on

Temperature Range
-30°C to +60°C

SEQUENTIAL TONE TRANSMITTER

Output Impedance
50 Kohm max.

Output Signal
3.4 or 5 tones in burst of 70 ms ±15 ms.
The interval between triggering and emission of the 1st tone is min. 200 ms.

Signal output level
600 mV emf. max.

Frequency response
Flat. ±1 dB

Distortion
max. 5%

Tone frequencies
885, 970, 1060, 1160, 1270, 1400, 1530, 1670, 1830, 2000, 2200, 2400, 2600, 2800 Hz.

Frequency accuracy
Typical deviation (2δ)
1%
Maximum deviation
1.4%
Relative frequency accuracy
0.3%
Adjustment accuracy
0.1%
Frequency stability
1%

CONTROL FUNCTIONS

Receipt
TQ5001 can be strapped to automatic transmission of receipt after a received sequential call.

Automatic Keying
TQ5001 energizes the transmitter for approx. 640 ms.

Microphone inhibit
The voltage supply to the microphone amplifier is inhibited during the tone key.

SEQUENTIAL TONE RECEIVER

Input impedance
>30 Kohm, DC isolation

Input Response
De-emphasis according to an RC-function with Fc= 2900 Hz.

Signalling code
3.4 or 5 tone burst of min
55 ms duration.

Activating Level
300 mV ±6 dB

Distortion
The TQ5001 can process tone signals having less than 20% distortion.

Tone Frequencies
885, 970, 1060, 1160, 1270, 1400, 1530, 1670, 1830, 2000, 2200, 2400, 2600, 2800 Hz.

Frequency Accuracy
±0.3%

Selectivity
The tone receiver responds to tones with a frequency deviation less than 1.4%. The tone receiver is not sensitive to adjacent tones or other tones of the same standard series.

Reset Time
minimum 90 ms
maximum 140 ms

Reaction Time
minimum 20 ms
maximum 45 ms

Signal to Noise Conditions
The tone receiver will accept a noise level corresponding to SINAD= 5 dB as measured in the speech channel of the CQM5000.

TECHNICAL SPECIFICATIONS TQ5002

Supply Voltage
8.5V ±0.25 V (Cont and TX)

Current Drain
Standby
<20 mA
Engaged
20 mA +25 mA peak when call indicator is on.

Temperature Range
$-30^{o}C$ to $+60^{o}C$

SEQUENTIAL TONE TRANSMITTER

Output Impedance
50 Kohm max.

Output Signal
3.4 or 5 tones in burst of 100 ms ±15 ms.
The interval between triggering and emission of the 1st tone is min 300 ms.

Signal output level
600 mV emf. max.

Frequency response
Flat. ±1 dB

Distortion
max. 5%

Tone frequencies
(960, 1022), 1124, 1197, 1275, 1358, 1446, 1540, 1640, 1747, 1860, 1981, 2110 Hz.

Frequency accuracy
Typical deviation (2δ)
1%
Maximum deviation
1.4%
Relative frequency accuracy
0.3%
Adjustment accuracy
0.1%
Frequency stability
1%

CONTROL FUNCTIONS

Receipt
TQ5002 can be strapped to automatic transmission of receipt after a received sequential call.

Automatic Keying
TQ5002 energizes the transmitter for approx. 900 ms.

Microphone inhibit
The voltage supply to the microphone amplifier is inhibited during the tone key.

SEQUENTIAL TONE RECEIVER

Input impedance
>30 Kohm, DC isolation

Input Response
De-emphasis according to an RC-function with Fc= 2900 Hz.

Signalling code
3.4 or 5 tone burst of min. 55 ms duration.

Activating Level
300 mV ±6 dB

Distortion
The TQ5002 can process tone signals having less than 20% distortion.

Tone Frequencies
(960, 1022), 1124, 1197, 1275, 1358, 1446, 1540, 1640, 1747, 1860, 1981, 2110 Hz.

Frequency Accuracy
±0.3%

Selectivity
The tone receiver responds to tones with a frequency deviation less than 1.4%. The tone receiver is not sensitive to adjacent tones or other tones of the same standard series.

Reset Time
minimum 90 ms
maximum 140 ms

Reaction Time
minimum 20 ms
maximum 45 ms

Signal to Noise Conditions
The tone receiver will accept a noise level corresponding to SINAD= 5 dB as measured in the speech channel of the CQM5000.

OUTPUT FUNCTIONS

A sequence call produces the following output signals.
Green L.E.D. will start flashing, cancel the short-cricuit of terminal 4, and short-circuit 2-3.

Manual activation of LS in/out
establishes the output functions as above.

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CODING AND STRAPPING OF TQ5001 AND TQ5002

The sequential tone transmitter and sequential tone receiver codes are independent of each other for which reason examples are given separately. See notes on the schematic diagram.

The sequential tone receiver is capable of receiving 3, 4 or 5 tones in a decadic system in which each digit is represented by a specific tone. Group call codings are described later, refer to SU5001 and SU5002.

Sequential Tone receiver, individual call.

Strapping for 3, 4 or 5 tone sequential call

For receiving and transmitting 3, 4 or 5 tones connect a wire from Note 4 to the terminal with the desired number. (Note 4 = INDV)
See fig. 1

The wire colors indicate the order of the tonegates, BN, RD, OR, YW, and GN for the sequential tone transmitter code, BL, VT, GY, WH and BK for the sequential tone receiver code. Each wire soldered to the tone coil represents one digit of the call number. If

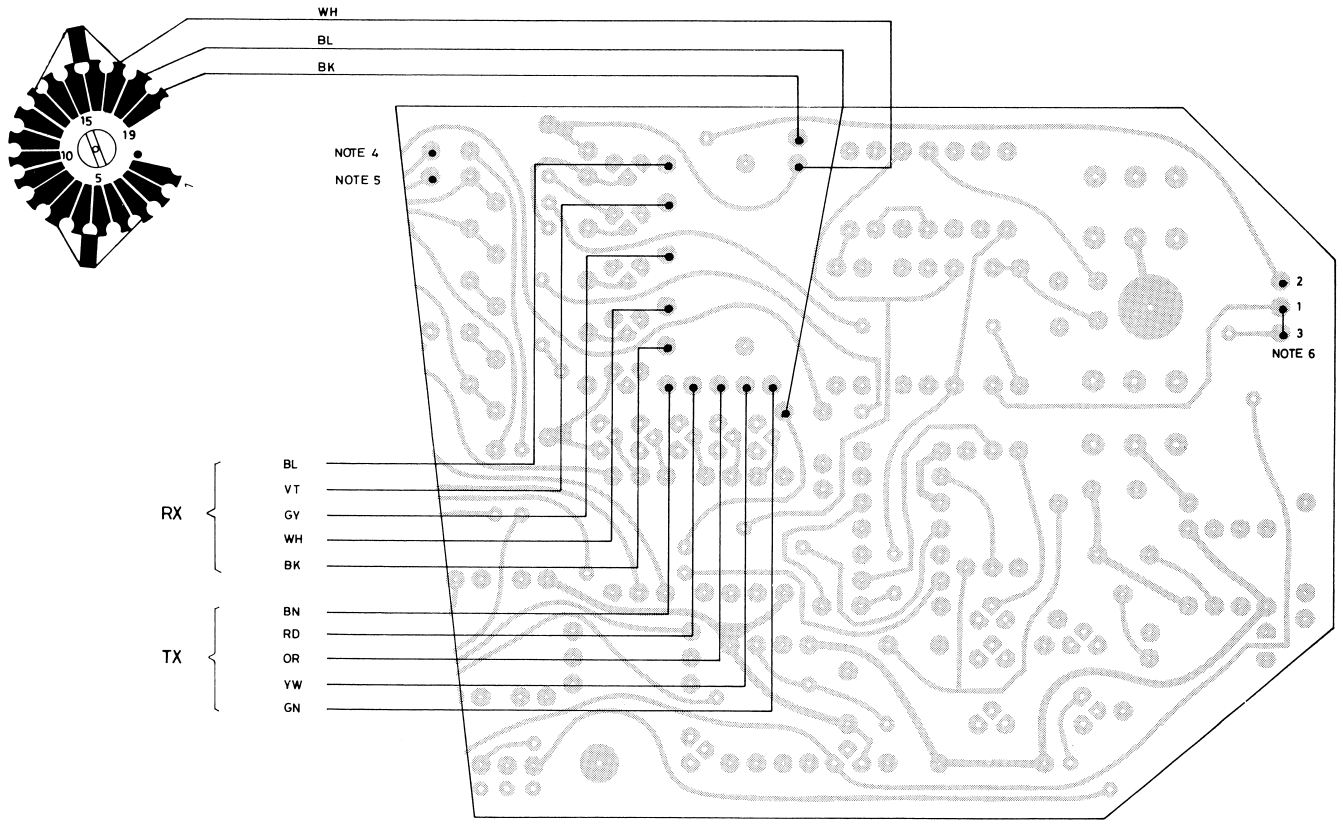

Fig. 1

Viewed from component side

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the actual call number contains two identical digits following each other, a repeat tone is used for the latter. The procedure is repeated if more than 2 identical digits are used.
As an example the number 33333 is coded 3R3R3.

		5-tone call	4-tone call	3-tone call
Blue wire	1 st tone	1st digit	1st digit	1st digit
Violet wire	2nd tone	2nd digit	2nd digit	2nd digit
Gray wire	3rd tone	3rd digit	3rd digit	3rd digit
White wire	4th tone	4th digit	4th digit	3rd digit
Black wire	5th tone	5th digit	4th digit	3rd digit

When coding 3-tone calls and 4-tone calls the remaining wires are, on the p.c.b, connected, to the last digit.

If the tone transmitter code and the tone receiver code are identical, the tone gate wires may be interconnected on the p.c.b. as shown:
Tone transmitter code: 23354 (23R54)
Tone receiver code: 23354

See Fig. 2.

Part of printed circuit

Coil on component side

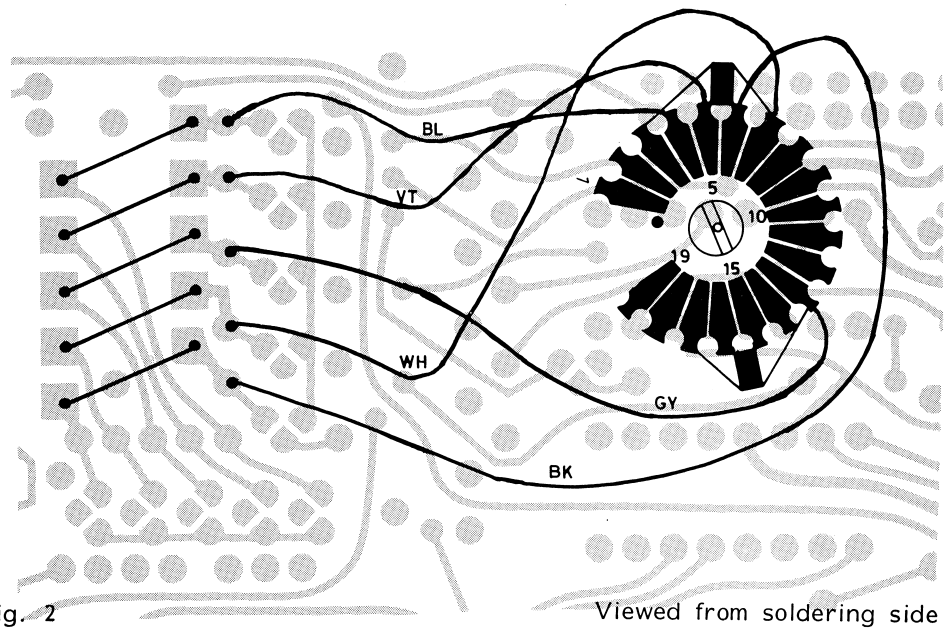

Fig. 2

Viewed from soldering side

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Group digit coding

The TQ-unit can be installed together with a group call unit SU5001 or an all-call unit SU5002, designed for group calls or all-calls with 1 digit. A connection between terminal GR (NOTES) and terminal 2, 3, or 4 are for group calls with 1 group call tone on the 3rd tone, the 4th tone, or the 5th tone.

A connection between terminal GR (NOTE5) and terminal 0 are for All-Call.

For code combinations and their limitations see coding of SU5001 and SU5002.

Auto Receipt

See NOTE 6 and Fig. 1.

Tone coil

Terminal numbers on the tone coil tags and their relating digits and frequencies appear from the table.

Terminal	Digit	STORNO. ZVEI Frequency, Hz	CCIR Frequency Hz
1	X	885	960
2	Y	970	1062
3	1	1060	1124
4	2	1160	1197
5	3	1270	1275
6	4	1400	1358
7	5	1530	1446
8	6	1670	1540
9	7	1830	1640
10	8	2000	1747
11	9	2200	1860
12	0	2400	1981
13	R	2600	2110
14	A	2800	

R =Repeat tone
A = Alarm tone
X and Y: Special tones, used for A and R in 12, 5kHz channel spacing equipment.

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GROUP CALL UNIT SU5001

ALL CALL UNIT SU5002

The All-Call unit, SU5002, and Group Call unit, SU5001, are identical expect for some few points. The following description will therefore apply to both SU5001 and SU5002, and their differences will be described in an appendix. All notes in this description refer to the schematic diagram.

General

The call unit is a single tone receiving module designed for application in TQ5001/2 and extend the selective calls to comprise group calls with one group tone. The module is a printed board with plug-in pins fitting sockets on the TQ5001/2. When fitted with a SU5000, TQ5001/2 is capable of receiving calls with a group call tone as the 3rd, 4th, or 5th tone of the sequential tone signal corresponding to the selected group division. Functionally the SU5000 is in parallel with the selection circuit of the individual call channel and the two circuits share the input amplifier/limiter. Two tones may be selected as the group tone, 2400Hz or 2800Hz, corresponding to individual digit 0 and alarm tone G, respectively.

A receiver group call is read out like an individual call with the following exceptions:

1: The audio channel can not be blocked with LS in/out.
2: The Automatic Receipt is blocked and Tone Keying is not possible.

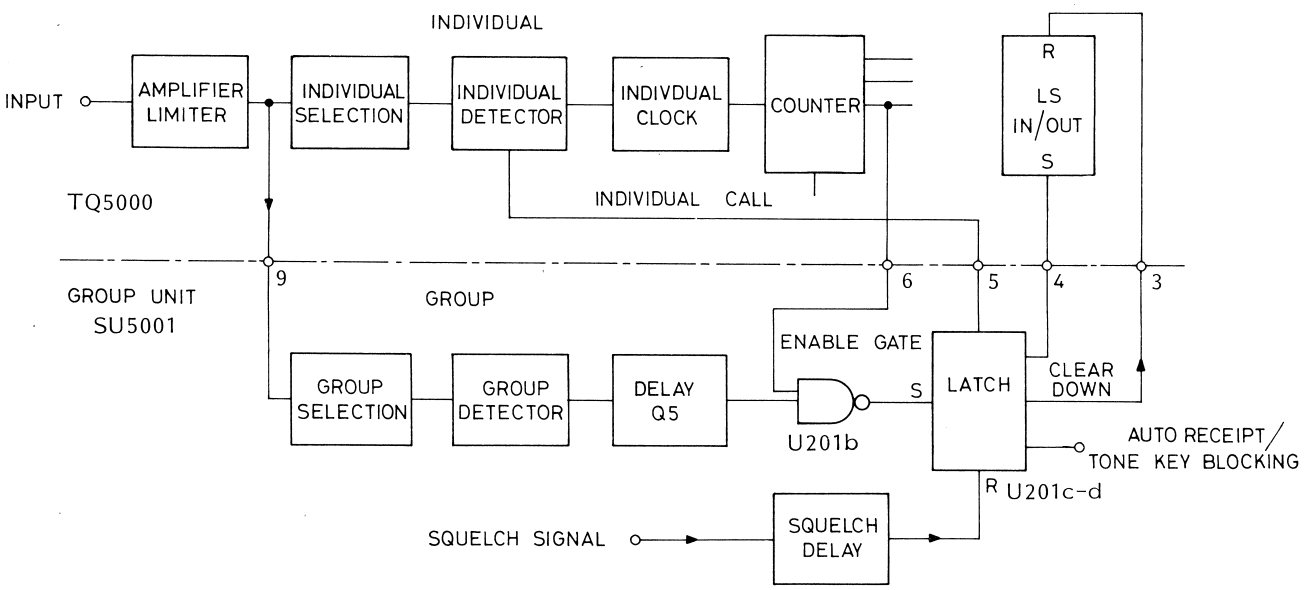
The blockings are all cancelled approximately 500 milliseconds (ms) after the group call is terminated. Also see notes on TQ5001/2 schematic.

Mode of Operation

Upon reception of a sequential tone signal matching the tone combinations of TQ5001/2 and SU5001 the operation is as follows:

The r.f. carrier opens the squelch circuit which energizes the SQ-delay.

The sequential tone signal is amplified and limited in the input stage after which the



signal is applied to the resonant circuits of TQ5001/2 and SU5000. When the individual counter of TQ5001/2 has registered the first tones of the signal it releases the SU5000 to read out the group digit. The group tone is selected by the bandpass filter and applied to the detector. If the group tone level is within the sensitivity range of SU5000 the signal activates the detector circuit. The rectified signal from the detector is delayed approx. 25ms before the latch read out the call to TQ5001/2 along with establishing the blocking functions. Approximately 15 to 20ms after the end of the group tone the detector and delay circuits revert to standby. Approximately 500ms after the squelch closes, all blocking signals are cancelled and the loudspeaker is turned off.

Circuit Description:

Resonant Circuit

Transistor Q201 operates as a current generator and drives the resonant circuit L201-C201. The sensitivity and thus the bandwidth of SU5000 can be adjusted with resistor R201. (Note 3). The resonant circuit is a bandpass configuration and drives the detector circuit directly. The unit can be set to one of two tones, 2400Hz and 2800Hz. (NOTE 1 and 2)

Detector

The transistors Q202 and Q203 are arranged to form a differential detector circuit. In standby transistor Q202 is off, Q203 is on, and C202 is charged up to the potential determined by voltage divider R206-207. If the peak value of the selected signal exceeds the bias of Q202 (Q203's base voltage) Q202 turns on and charges C202 to a higher potential by which Q203 is biased off. At the cessation of the group tone C202 discharges via R204 and after approximately 10-20ms Q203 again turns on and holds the voltage on C202.

Delay and Enable Gate

Transistor Q204 operates as a switch and is controlled directly by the detector. In standby Q204 is on and the charge of C203 is neutral. When the detector is energized by a call Q204 goes off and C203 charges through R208// R209. After approximately 25ms (adjustable with R209) the voltage across C203 reaches the trigger level of U201a which relays the call information (+ 8, 5V) to enable Gate U201b.

If U201b has received a signal indicating that the first tones of a signal is accepted and counted by the individual Counter the call is applied directly to the Latch.
At the end of the group tone C203 discharges through R210 and U210a-b reverts to standby.

Latch and Squelch Delay

The latch is constructed as an R-S flip-flop employing gates U201c and U201d.

The latch reads out the group call to the indivi-dual tone receiver TQ5001/2 and, simultaneously, establishes the blocking functions:

Pin 4: common terminal for individual and group call blocking of the LS in/ out. Diode D203 is forward biased.

Pin 7: Blocking of Automatic Receipt and Tone Key.
Diode D201 tied to chassis through U201d.

Pin 3: Tied to chassis through U201d.

The R-input of the Latch is controlled by the squelch via the Squelch Delay which cancels the blocking functions 500ms after the squelch closes. C205 charges through R214 and Q205 which is driven by the squelch buffer inverter of TQ5001/2. The voltage across the capacitor is maintained until the squelch closes after

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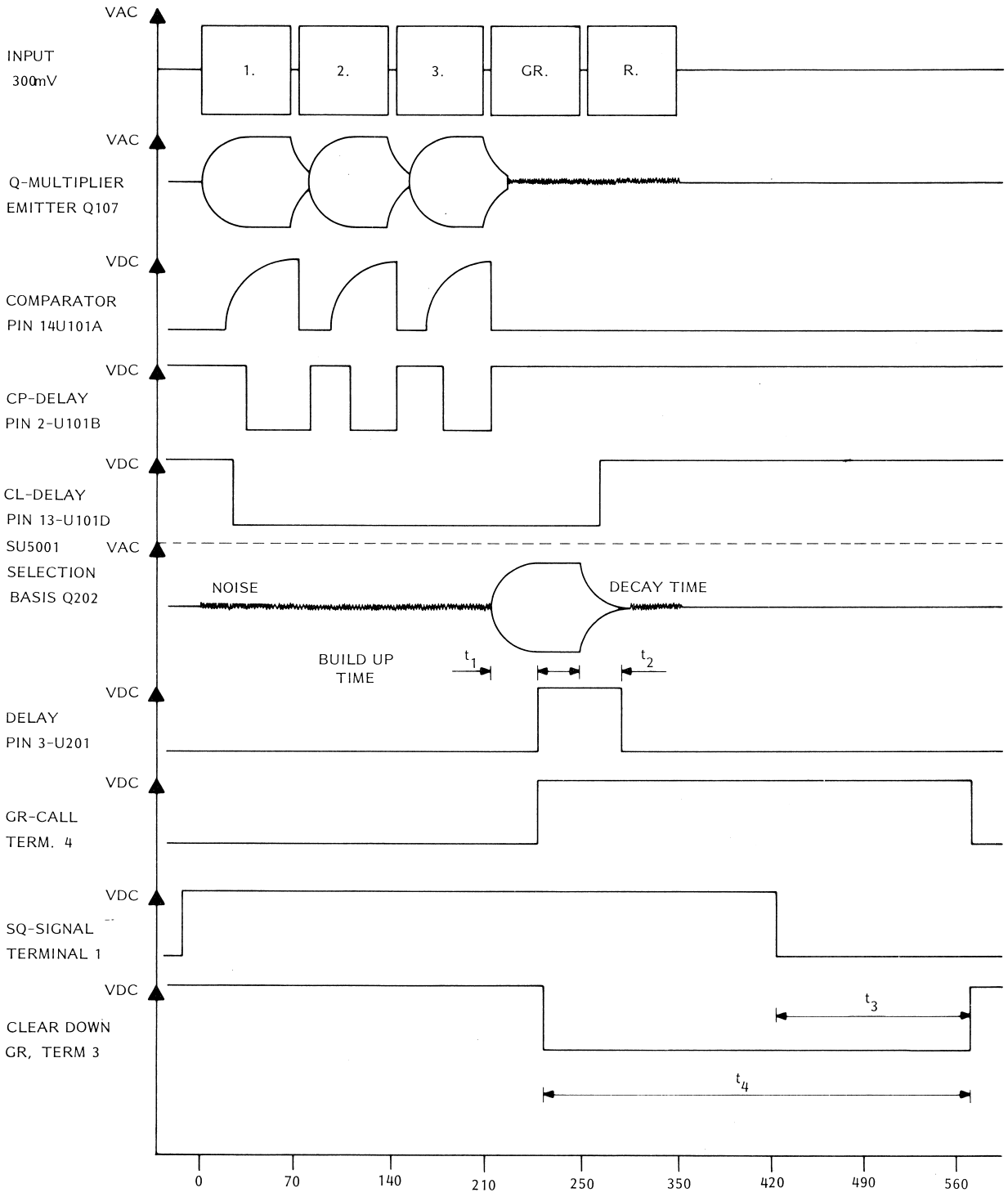

t_1 BUILD-UP TIME DELAY
t_2 DELAY TIME HANG TIME
t_3 SQ-DELAY
IN PERIOD t_4 THE AUTOMATIC RECEIPT TONE KEY AND LS IN OUT ARE INHIBITED.

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which C205 is discharged by R214 and R215. At the end of the group tone Enable Gate U201b reverts to standby.

The latch information is held by the Squelch Delay for approximately 500ms after the squelch has closed and then the blockings are cancelled.

Pin 4: 0V, R = R212
Pin 7: D201 submits a positive pulse to turn off the loudspeaker.

Coding Sequential Tone Call Signals

With One Group Tone

If digit 0 (2400Hz) is used (group call according to ZVEI), there are limitations to the number of individual call combinations, as the SU5001 responds to individual tone combinations containing the digit 0. Likewise a sequential tone signal must not contain two idential, consercutive tones for which reason digit 0 cannot be used as the last digit of a group number.

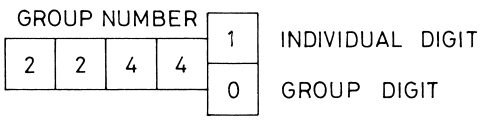
Note

The tone ahead of the group tone and the following tones must not be coded to 0. If tone G is used (2800Hz), which is outside the tone series employed (0-9), there are no limitations in the number of individual and group combinations.

The Group Digit Location

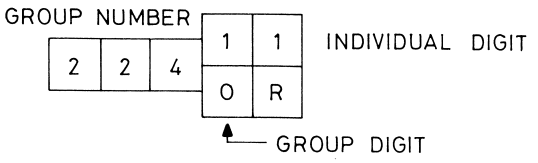
a: SU5001 strapped to 2400Hz (=digit 0).

5-digit sequential tone signal with group call on 5th digit



9 individual numbers from 22441 to 22449

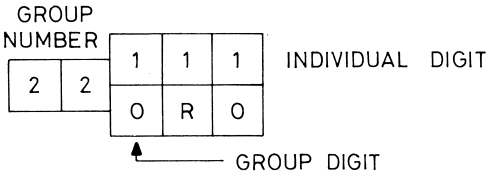
5-digit sequential tone signal with group call on 4th digit



81 individual numbers from 22411 to 22499.

5-digit sequential tone signal with group call on the 3rd digit

(non standard according to ZVEI)

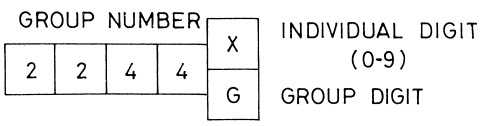


729 individual numbers from 22111 to 22999

The group call combination is emitted as shown above, but the digits following the group digit (0) have no functions in the call configuration.

b: SU5001 strapped to 2800Hz (=digit G)

5 digit sequential tone signal with group call on 5th digit



10 individual numbers from 22440 to 22449.

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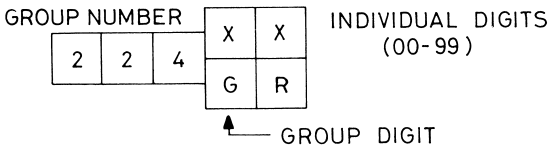
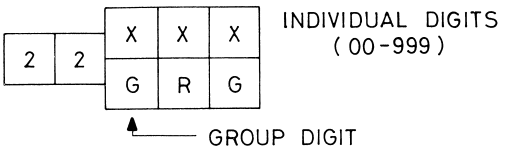
5-digit sequential tone call with group call on the 4th digit

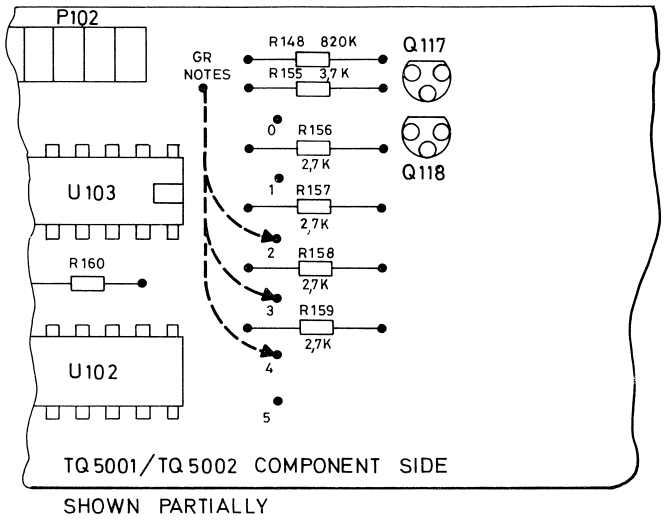


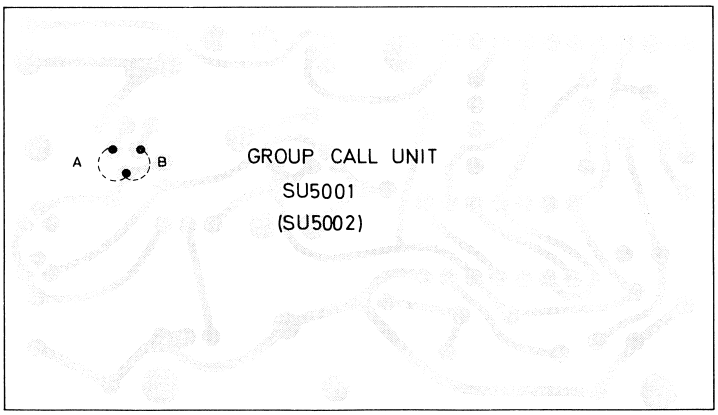
100 individual numbers from 22400 to 22499

5-digit sequential tone call with group call on the 3rd digit



1000 individual numbers from 22000 to 22999





A = 2800 Hz (DIGIT G)
B = 2400 Hz (DIGIT 0)

Part of component side TQ5001/2. See drawing and notes on the TQ diagram.

NOTE 5 → 2: Group-Call on 3rd tone
NOTE 5 → 3: Group-Call on 4th tone.
NOTE 5 → 4: Group-Call on 5th tone.

Installation

The SU5000 is equipped with plug-in pins and can be inserted directly in the TQ5001/2. When inserted the straps in the connector P102 (on TQ5001/2) must be removed. See drawing and notes on the TQ diagram.

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GROUP CALL UNIT
SU5001
Technical Specifications

Supply Voltage
8.5V ± 0.25V

Current Drain
Standby: 0,5 mA (no external load)
Engaged: approx. 0,65 mA (with SQ signal)

Temperature Range
30^{o}C to $+60^{o}$C

Input Specifications
See input specifications of TQ5001/TQ5002.

Activating Signal
Single tone signal of 55 ms duration. The location of the group tone is coded on the TQ5001/TQ5002.

Tone Frequencies
2400Hz, 2800Hz.

Frequency Accuracy
± 0.3%

Selectivity
SU5001 responds to frequency deviations ± 1.4%. SU5001 is insensitive to adjacent tones of the same standard series.

Reaction Time
30ms ± 5ms (adjustable).

Signal to Noise Conditions
SU5001 can, in conjunction with TQ5001/TQ5002, process signals having a noise level corresponding to SINAD = 5dB as measured in the speech channel of the CQM5000.

Clear Down Time
< 30ms.

Output Functions
The TQ5001/TQ5002 output functions corresponds to an individual call with the following exceptions:

LS in/out Latch Blocking:	After a group call the loudspeaker cannot be turned off manually.
Auto Receipt Blocking:	After a group call the automatic receipt function is inhibited.
Tone Key Blocking:	After a group call the tone key function is blocked.
Group Call Clear Down:	Approx. 500ms after the receiver squelch closes, the blocked functions are released and the loudspeaker is turned off.

Dimensions
Width: 41 mm
Length: 72.5 mm

Weight
20 g

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GROUP CALL UNIT
SU5002
Technical Specifications

Supply Voltage
8.5V ± 0.25V

Current Drain
Standby: 0.5 mA (no external load)
Engaged: approx. 0.65 mA (with SQ signal)

Temperature Range
-30^{O}C to $+60^{O}$C.

Input Specifications
See input specifications of TQ5001/TQ5002.

Activating Signal
Single tone signal of minimum 2 seconds duration.
The location of the 'all call tone' is coded on the TQ5001/TQ5002.

Tone Frequencies
2400Hz, 2800Hz

Frequency Accuracy
± 0.3%

Selectivity
SU5002 responds to frequency deviations ± 1.4%.
SU5002 is insensitive to adjacent tones of the same standard series.

Reaction Time
2 seconds ± 0.25 sec. (adjustable).

Signal to Noise Conditions
SU5002 can, in conjunction with TQ5001/5002, process signals having a noise level corresponding to SINAD = 5 dB as measured in the speech channel of CQM5000.

Clear Down Time
< 30ms.

Output Functions
The TQ5001/TQ5002 output functions corresponds to an individual call with the following exceptions:

LS in/out Latch Blocking:	After an all-call the loudspeaker cannot be turned off manually.
Auto Receipt Blocking:	After an all-call the automatic receipt function is inhibited.
Tone Key Blocking:	After an all-call the tone key function is blocked.
All Call Clear Down:	Approx. 500ms after the receiver squelch closes, the blocked functions are released and the loudspeaker is turned off.

Dimensions
Width: 41 mm
Length: 72.5 mm

Weight
20 g

Storno

Appendix

SU5002

An "All-Call" is emitted as a single tone of more than two seconds duration. In SU5002 both tones, 2400Hz or 2800Hz, may be used (digit 0 or digit G) The only difference between SU5001 and SU5002 is the time delay that determines the reaction time (C203, R208, R209). With a reaction time of two seconds it is possible to transmit a normal sequence call including the All-Call tone without activating the unit.

Coding

For Coding TQ5001/2 to correspond with SU5002:
Strap NOTE5 O.
See coding for Group Call.

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SWITCHING UNIT
SU5003

The SU5003 switching unit is used as driver for an alarm device, horn, buzzer, bell, etc., or as a broadcast radio muting switch. The unit comprises a timer circuit and a relay with one changeover contact set. The unit is triggered by the CQM5000, either the tone receiver, or the squelch circuit and the monostable multivibrator timer sounds the alarm device for a preset time, approximately 1 second.

Alarm.

A horn or bell is connected to the relay and the SU5003 is controlled by the alarm output of the CQM5000 (pin 2 on J910). The alarm will be on for approximately 1 second.

Broadcast Radio Muting

The unit is connected to the muting output on the CQM5000 (pin 9 on J910) which actuates the relay when the TQ5001/TQ5002 opens the AF output. In radiotelephones without toneequipment the relay will be activated whenever the squelch circuit is opened or the transmitter is keyed. The broadcast radio supply voltage is applied via the relay contacts that are normally closed, or its loudspeaker is disconnected.

Technical Specifications

Supply Voltage
10.8V to 16.6V

Current Drain, 13.2V
Standby: approximately 0 mA
Engaged: 140 mA

Relay Contact Current
Max. 16A (t less than 3 seconds)
5A continuously
One change over contact set

Input
Alarm: A short pulse grounding the input terminal will actuate the relay for approx. 1 second.

Mute: A ground connection will actuate the relay.

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PS5001
POWER SUPPLY UNIT

General

The PS5001 is a mains operated power supply for the Stornophone 5000 radiotelephone when used as base station. The unit consists of a mains transformer, a rectifier, a smothing filter, a switching regulator, and an output filter. The unit will supply 13.6 Volt stabilized DC when connected to a 220V/240V AC outlet.
A LED (light emitting diode) on the front panel is lit when the unit is on.

Circuit Description

Power Transformer

The power transformer is wound on a toroide core and has two windings, a 220/240Volt primary and a 24 Volt secondary. A 4 Amp slow blow fuse in series with the secondary winding protects those parts of the circuitry which are not protected by the electronic current limiter in the switching regulator.

Switching Regulator

The switching circuit is built as a normal switching mode regulator with constant switching frequency, approximately 32KHz, and variable duty cycle. The actual switching function is performed by the transistor configuration Q2, Q3, Q4 and the fly-back diode D4, which clamps the input of L-C filter L2-C8 to ground potential in that portion of the cycle where the switching transistors are off and D4 is forced to conduct by the energy from the collapsing field of L2.

The output voltage across C8 is sensed by IC1a and compared to the reference voltage across D2-D3. The resulting signal is amplified by IC1b which is driving Q2 and in turn Q3 and Q4.

Output current limiting is achieved by monitoring the voltage drop across R17 and feed this voltage to IC1d. The IC1d output is 'OR-ed' with the voltage control signal at the IC1a output and therefore overrides the control voltage when the output current goes excessively high.

The two filters, C2-L1-C3, and C8-L3-C9, are ripple-transient filters on the input and output and their function is to ensure that the inherent switching noise does not exceed acceptable limits on the input and output terminals, and the cables as well.

Technical Specifications

Mains Voltage
220/240V AC + 10/-15%; 50-60Hz

Power Consumption
Approx. 6mA; 0 Amp load
Approx. 450mA; 6 Amp load

Output Voltage
13,6V DC ± 1,0V

Output Current
Maximum 6 Ampere (short circuit protected)

Output Voltage Ripple
Less than 100mV pp (peak to peak)

Switching Frequency
approx. 32KHz

Temperature Range
$-10^{o}C$ to $+50^{o}C$

Duty Cycle
as specified for CQM5000

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OPERATING INSTRUCTIONS

STORNOPHONE 5000

Introduction

The CQM5000 is available with local control only and four different control heads cover the various versions.

No unnecessary controls are accessible at the front, e.g. radios without tone equipment don't have any loudspeaker IN/OUT nor tone transmitter key on the control head.

The transmitter key button is on the microphone MC5001 or mounted separately, SU701, SU702.

Control heads for the four versions are shown below:

Stand-by

The radio is turned on by depressing the ON/OFF switch.

The thumb-wheel channel selector is accessible on the multichannel version and has the channel numbers on the rim. A lamp built into the channel selector illuminates the channel number from the inside. Single channel units have no 'power on' indicator. The radio is now ready to receive or transmit.

Receive without tone equipment

With the radio in standby the volume control is adjusted to an appropriate level.

If no signals are received the volume may be set by depressing the squelch button and monitor the noise from the loudspeaker. Received calls will now be heard in the loudspeaker.

By pressing the squelch cancel button, the intelligibility may be improved, even if the signal is very noisy. The squelch cancel button is self locking.

Receive with tone equipment

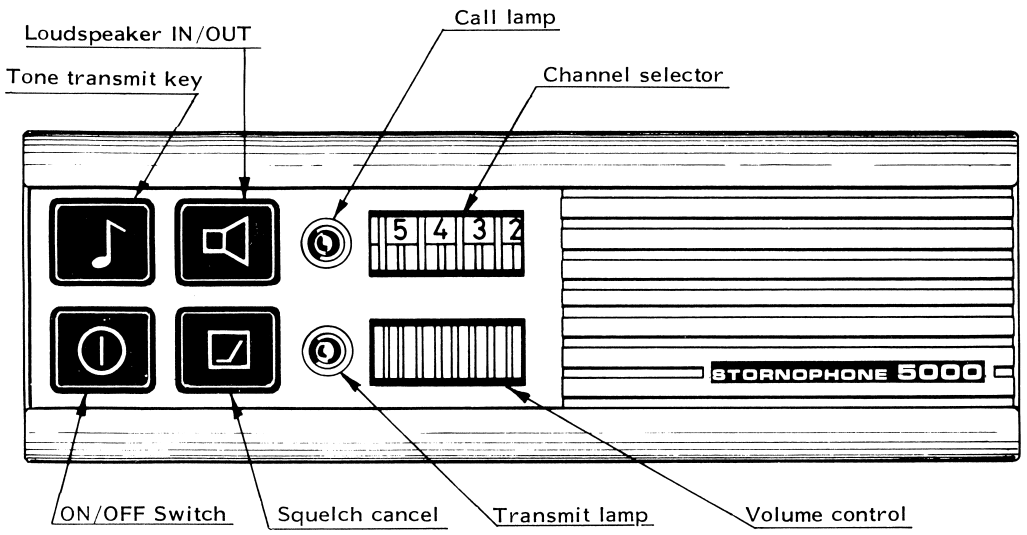
In radios with tone equipment only calls where the number complies with the coding of the tone equipment will be heard in the loudspeaker. Reception of a call that matches the call number will cause the tone equipment to cancel the loudspeaker blocking so that the call can be heard. Simultaneously, the yellow call indicator will start flashing until the conversation is terminated by pressing the loudspeaker IN/OUT button.

The loudspeaker will now again be blocked, and the call indicator will stop flashing.

Group Call - All Call

The tone unit TQ5001 function can be expanded with a group call unit SU5001 or All Call unit SU5002.

When receiving a group call or an all call, the yellow call indicator will only flash during the message. The call indicator will stop flashing when the received carrier disappears, or when the loudspeaker IN/OUT button is depressed.



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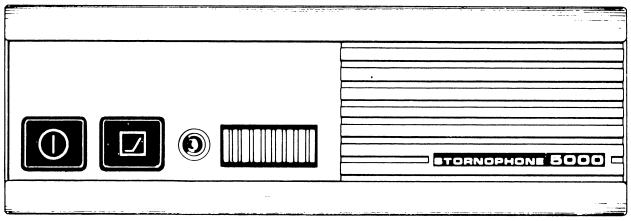
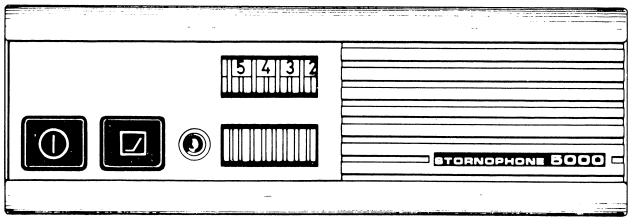


Version
One channel without tone equipment



Version
Six channel without tone equipment

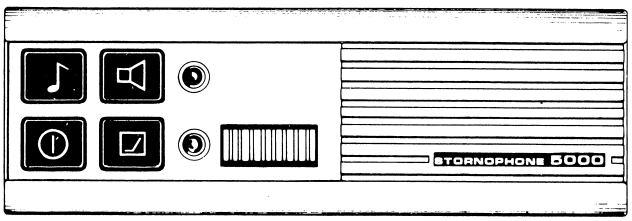
TRANSMIT without tone equipment

Before keying the transmitter the channel must be clear. In radios without tone equipment the operator can always hear when conversation takes place on the channel.
When the channel is clear, the transmitter is keyed by using the key button. The red transmit indicator will light up when the transmitter is keyed.

PRESS TO TALK-RELEASE TO LISTEN

TRANSMIT with tone equipment

When the radio is equipped with sequential tone equipment, the loudspeaker IN/OUT button must be pressed to open the loudspeaker. The yellow call indicator will then start flashing, indicating that the loudspeaker is open.
When the channel is clear, the call can be initiated by pressing the tone transmit key, for transmitting a tone call to the base station, in order to open the base station loudspeaker. When contact with the base station is established, the conversation can continue by using the normal transmitter key button on the microphone.



Version
One channel with tone equipment

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INSTALLATION

STORNOPHONE 5000

General

Proper installation of the Stornophone 5000 radiotelephone is most important as its performance can be seriously impaired if the installation work is done without due care The instructions should be read carefully and followed by the person installing the equipment.
As precise instructions for all types and models of vehicles are impossible to give and customer requirements may differ, all instructions, illustrations and examples in this chapter must be adapted to the actual installation.

Unpacking

Each shipment should be checked against the packing list or invoice when arriving, and Storno must be notified immediately of any damage or shortage.

MOBILE INSTALLATION

Before the installation commences the cable run should be desired. The following hints should be noted:

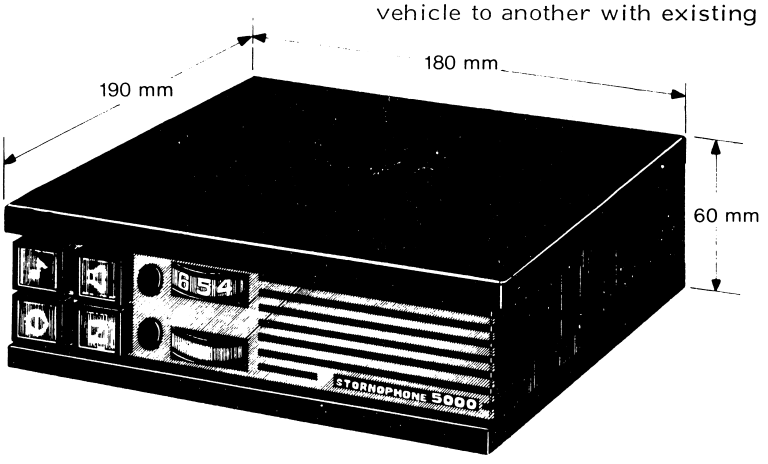
- the cables shall be as short as possible.
- the cables shall be kept away from moving parts as handbrake, shock absorbers etc.
- the cables shall not run near the engine, exhaust manifold, pipes, and other hot items.
- the cables should, whenever possible, be run in parallel with existing cables and through the same holes in the chassis and car body. Suitable grommets must always be used if special holes are drilled in the metal work.
- the cables shall not be run externally underneath vehicles and cable clamps shall be used whereever the cable is likely to sag.
- to ensure that cables are not strained sharp bends should be avoided.
- the fuse in the battery cable should be placed as close to the battery as possible.

Positioning

When selecting a position in the vehicle to install the transmitter/receiver unit several important points should be noted:

- the unit must be allowed to dissipate heat.
- the unit must be within convenient reach of the operator.
- the unit must not be liable to cause damage to the operator or passengers in case of an accident.
- demand for a possible transfer from one vehicle to another with existing installation.

Volume: 2.0 litre
Weight: 1,8 kg



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Temperature

The Stornophone 5000 circuitry is designed to operate over a wide range of temperature and the case is designed to provide maximum heat dissipation without vents. The ambient temperature during operation should normally not exceed $-30^{o}C$ to $+60^{o}C$. In cases of operation in hot climates adequate ventilation must be provided.
The equipment can be stored at higher or lower temperatures without damage.

Sufficient space must be left to enable a service engineer to remove the equipment and the cables shall be left free for the unit to be removed from its cradle.

Installation Material

Mobile operation of the Stornophone 5000 requires the following accessories:

MK5001	Installation kit containing:
	8-position connector housing with crimp terminals
	2-position connector housing with crimp terminals
	UHF antenna connector
	Power Supply cable
	Fuse holder
	2 fuses, 8A
	Cable eyes
MN5001	Cradle for the transmitter/receiver unit consisting of two parts locked together by a screw.
or	
MN704a	Cradle for direct attachment to the vehicle.

Both cradles allow the radio to be fixed in 36 different angles and positions.

MC704	Microphone for fixed mounting. A bracket with rubber shock mounts are included.
MC5001	Fist microphone with PTT button and hook.
HS5001	Retainer for MC5001
Antenna	Various types are available, refer to Storno Antenna Sales Programme.

Mobile antennas are normally supplied with adequate lengths of coaxial cable.

Options

HS5002	Retainer for MC5001 with switches.
SU701	Keying switch, long lever
SU702	Keying switch, short lever
LS701	External loudspeaker
CC5001	Cable with fuse for installations using the ignition switch for turning the radio on and off.
PS702	Voltage regulator for 24 V DC installations (busses, vessels, heavy trucks, etc.).

Assemble and install the equipment as outlined on the installation diagram, refer to D402.612.

Placing the antenna

The antenna should be placed as high and as much in the clear as possible in order to ensure the best matching and radiation pattern. On a vehicle, the roof must be considered the best place for the antenna. If the roof is non-metalic, a sheet of aluminium foil, at least 1 square metre in size, shall be glued to the roof below the antenna provided that the vehicle fittings make it possible. On passenger

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cars, the boot cover is an alternative place for the antenna although this will impair its efficiency and introduce an unfavourable directivity. Hence the latter solution should be chosen only if these factors are of secondary importance, i.e. where maximum operating range is not a significant requirement.

All Storno standard antennas can be installed from the outside without need for drilling through the upholstery, if any.

Antennas supplied by Storno have an installation instruction packed with each unit.

The coxial antenna cable, after having been routed to the radio unit, should be cut to length and fitted with the antenna connector, type PL259. The connector is a crimp-on type and hence soldering is not necessary.

If the antenna whip length must be cut to operating frequency, the transmitter frequency is the diterminant. Refer to enclosed instructions.
For multichannel operation the mean frequency is calculated.

FIXED INSTALLATIONS

Fixed operations (base station) of the Stornophone 5000 requires the following accessories:

MK5001	Refer to mobile installation for specification of contents.
MN703	Desk Stand
PS703	220V AC Power Supply unit 10W
PS5001	220V AC Power Supply unit 25W
MC703a	Desk microphone with PTT button
Antenna	Various types are available, refer to Storno Antenna Sales Programme. Storno can also supply masts, towers, and special installation material on request.

The equipment should be assembled and installed as outlined on the installation diagram, refer to D402.---.

FUNCTIONAL TEST

When the Stornophone 5000 radiotelephone has been properly installed the following points should be checked:

- that the multiway connector is strapped according to the instructions and inserted in its socket.
- that the battery cable is connected.
- that the battery polarity is correct.
- that the fuses is inserted in their holders and are of correct value.
- that the antenna and the antenna connector are properly connected.
- that the channel selector, if any, is set to the operating channel.

Test Calls

Turn the radiotelephone on and perform test calls with the associated base(mobile) station to ascertain that transmission quality is good and that reception is good.
In systems with selective calling the loudspeaker on/off button must be pressed to check if the channel is free before transmitting commences. When the channel is clear, the tone signal is transmitted, whereupon the base (mobile) station should reply, reporting the strength and quality of the signal. The station is then requested to call, and the loudspeaker on/off button is pressed to turn the loudspeaker off.

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On reception of the call from the base station (mobile) the loudspeaker will be switch on and subsequent messages are transmitted without use of the selective calling.

Modulation Sensitivity Adjustment

The microphone gain of MC704 is ajusted by means of a potentiometer so that the speech level is set for correct modulation of the transmitter. This is best achieved by using the operator's voice.

The potentiometer must not be set so that the ambient background noise is able to modulate the transmitter. If the speech/ noise level is too low, then the microphone must be brought closer to the operator. Fist microphone MC5001 need not be adjusted.
Too high sensitivity will cause the message to be broken up and if it is too low, the message will be clear but weak. The optimum adjustment is found when loud shouting into the microphone just causes the message to break up.

NOISE SUPPRESSION

Noise interference in mobile radio communication equipment can either be caused by the vehicle's or vessel's own noise sources such as other vehicles, electrical generators, electrical wires, X-ray apparatus, etc.

The external noise cannot be avoided, but care has been taken in the design of STORNO radiotelephones to reduce the effect as much as possible. Such noisy periods can be an annoyance, but will normally be of short duration if the vehicle is on the move.

The electrical noise generated by the vehicle's or vessel's own electrical system can often be suppressed sufficiently by simple means. It should be noted that as long as the radiotelephone is being operated close to the base station the noise will normally not be noticed. The noise will only be heard in the loudspeaker, when the equipment moves away from the base station, where the received signal is somewhat weaker.

Complete noise suppression of an electrical system can be very difficult in certain cases, but normally it is possible to achieve satisfactory results if the simple advice given below is followed.

Moreover, recommendations about noise-suppression published by manufacturers of electrical automobile accessories and noise suppression components (such as Bosch, Lucas, etc.) should be studied.

Ignition Noise

The most common noise source is the ignition system of an engine, and this noise is characterized by a regular ticking sound, which is syncronized with the motor revolutions. In case the vehicle is not sufficiently noise suppressed from the factory it is necessary to insert suppression resistors in series with each spark plug or replace the spark plugs with types having builtin resistors. If suppression resistors are used wirewound resistors (5 Kohm) are recommended as these resistors suppress the noise better than the carbon types (10 - 15 kohm). Suppressor resistors in the spark plug leads must be placed as close as possible to the spark plugs and the spark gap should be increased. Consult the car instruction manual for the exact width.

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Further noise suppression may be obtained by inserting a suppressor resistor in the cable between the ignition coil and the distributor as close to the latter as possible. The best solution is to replace the distributor rotor with a special rotor having a built-in resistor.

Screening of noisy components is expensive, but may be necessary in certain cases. Metal components, or metal coated components, such as distributor lids are used to incapsulate the noise source.

If the steps mentioned do not result in a satisfactory noise suppression, a 0, 1uF coaxial capacitor must be mounted between the primary of the ignition coil and chassis. The capacitor should be fitted near the coil with the chassis wire as short as possible.

Finally, it should be born in mind that dirty or pitted distributor contacts may cause noise similar to ignition noise.

Dynamo Noise

The dynamo noise is characterized by a whine, where the frequency and pitch is syncronized with the motor revolutions.
Normally this noise is due to arching between dirty or worn brushes and the commutator. Cleaning, or possibly, replacement of the carbon brushes will normally remove the noise.

In some cases it may be necessary to insert a noise filter in the dynamo circuit. A noise suppressor capacitor may be inserted in the lead from the ignition coil (connection to ignition switch) and in the battery lead from the dynamo terminal. Do not remove more insulating material than absolutely necessary in order to minimize the risk of shorting the circuit.

Other Noise Sources

Noise from the voltage regulator can be identefied by a rasping noise in the loudspeaker. This noise can normally be removed by mounting a coaxial capacitor in the dynamo lead, as close to the regulator housing as possible. The other end of the capacitor should be connected to chassis.

All electrical instruments and motors may introduce noise into the radiotelephone. The windscreen wiper motor can for example be suppressed by a conventional noise suppressor capacitor.

The different noise sources can easily be detected by switching on and off the suspected noise sources one by one. Other noise sources are the electric clock, the petrol gauge, the oil lamp, etc., and in all cases the noise can be sufficiently suppressed by correct use of capacitors.

The ventilator fan belt may be the cause of static noise. The cure is to replace the belt with one containing a graphite compound.

Tyre statics can sometimes produce interference and in such cases improvement may be obtained by mounting special shorting springs on each wheel.

Static noise may also be due to a nonmetalic suspension of the engine. Metal braids mounted between the engine and the chassis, or the firewall, will remove the noise. Corroded joints of existing braids may also cause static noise.

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Different proposals for placing the radio telephone.

These are recommended, but other may be used depending on the type of vehicle. However, if a transfer from one vehicle to another is demanded, without using tools, installations must be fitted in both cars and the positioning in Fig. 1, Fig. 2, or Fig. 4 be used.

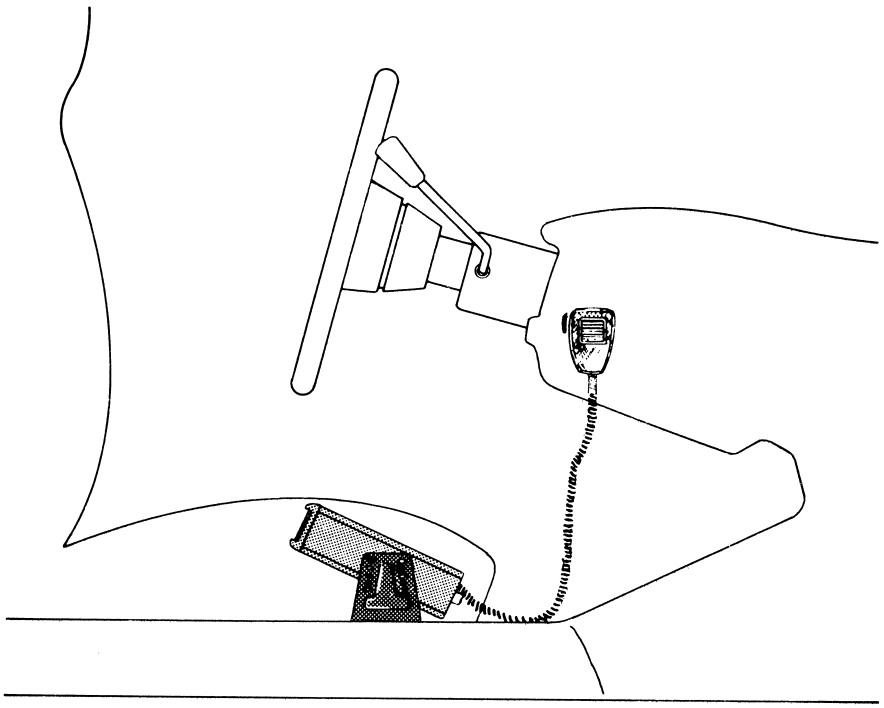

Fig. 1

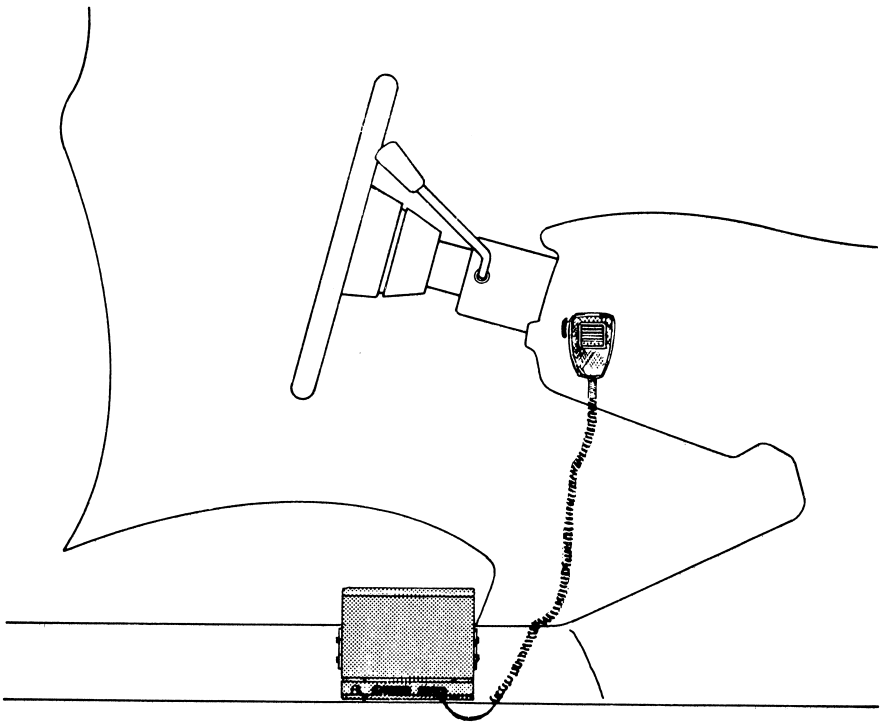

Fig. 2

Storno

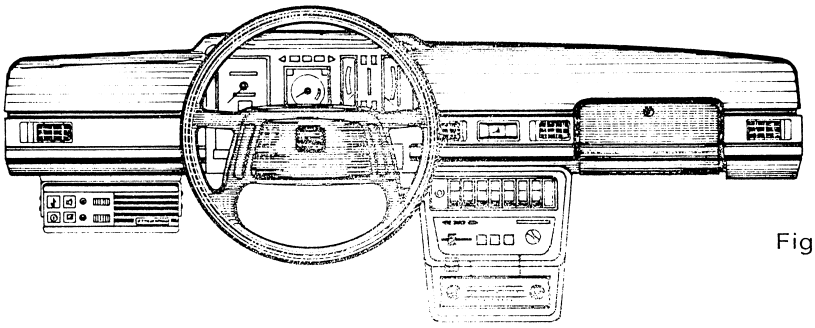

Fig. 3

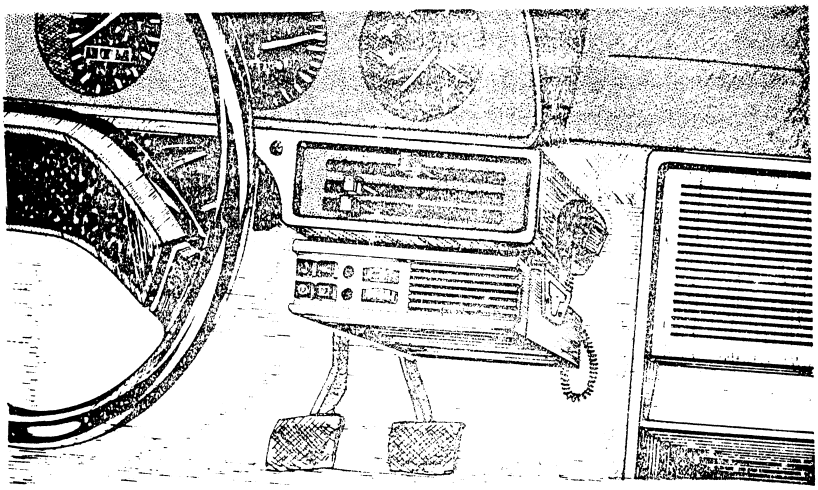

Fig. 4

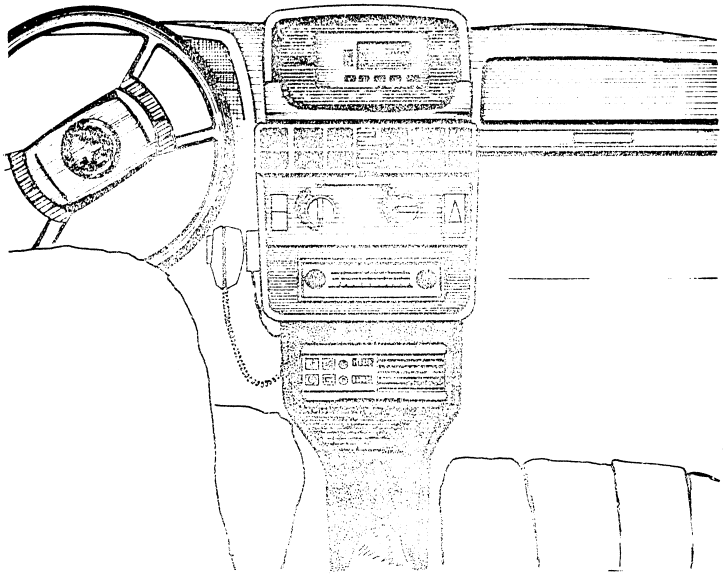

Fig. 5

60.380-E1

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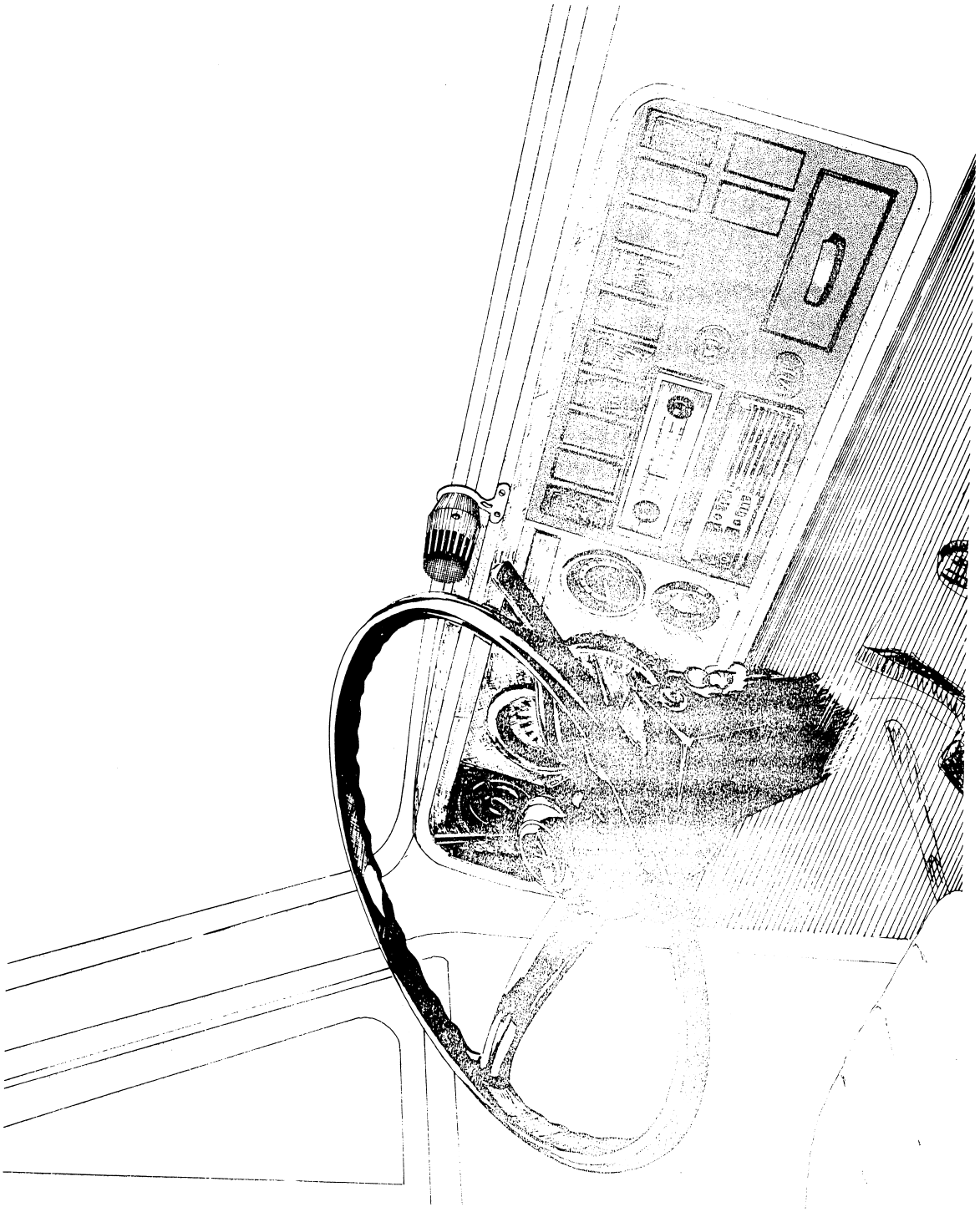
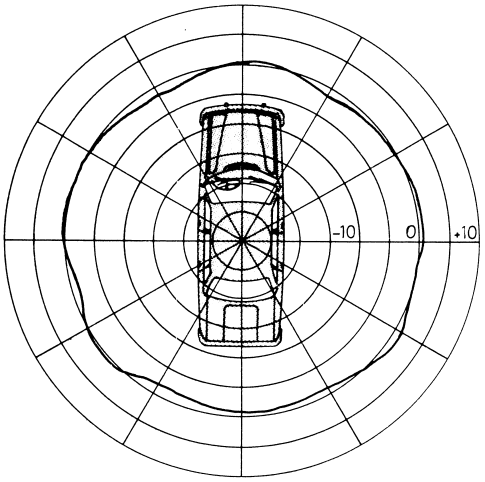


Fig. 6

If the antenna is mounted on the boot cover, or near the edge of the roof, the radiation pattern will change considerably. Fig. 7, Fig. 8, and Fig. 9 show the attenuation for different mountings, related to a λ/2 dipole. Reduction in coverage occurs as a result, but it is possible to compensate for higher losses by using 5/8 λ antennas which have approx. 2dB gain. Especially in the case of boot cover mounting, antennas with gain should be used if the operating range is a significant requirement.

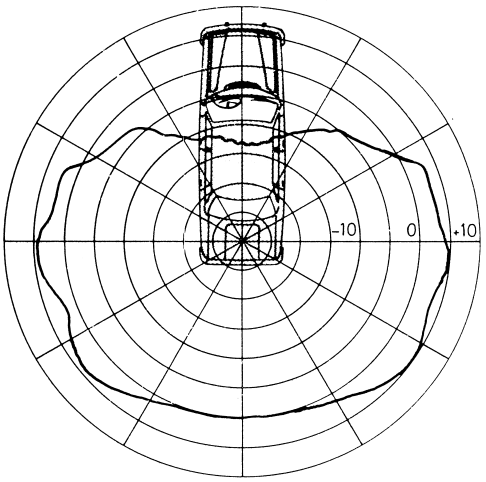
ATTENUATION RELATED TO λ/2 DIPOLE (0 dB)

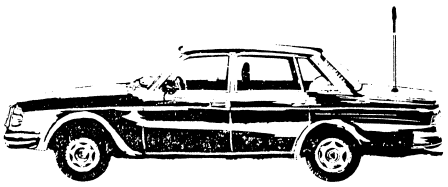
160 MHz



90°

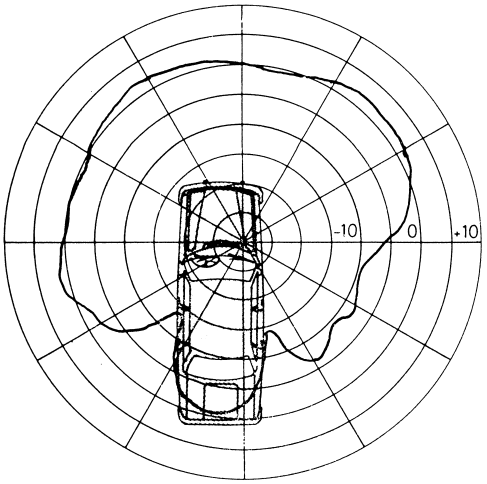
160 MHz

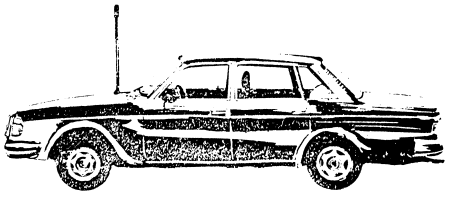




90°

160 MHz





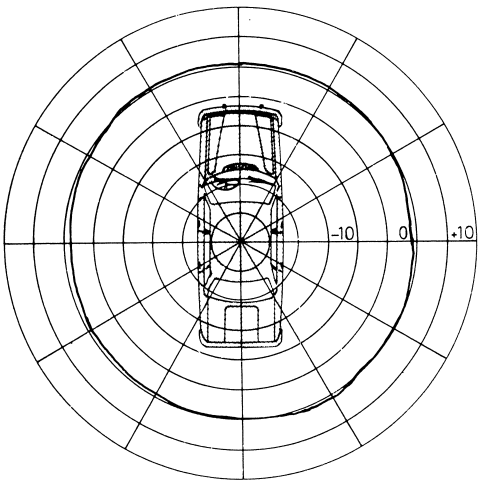
90°

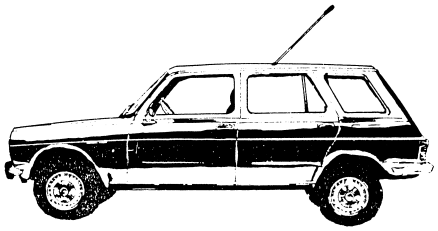
Fig. 7

Storno

ATTENUATION RELATED TO λ/2 DIPOLE (0 dB)

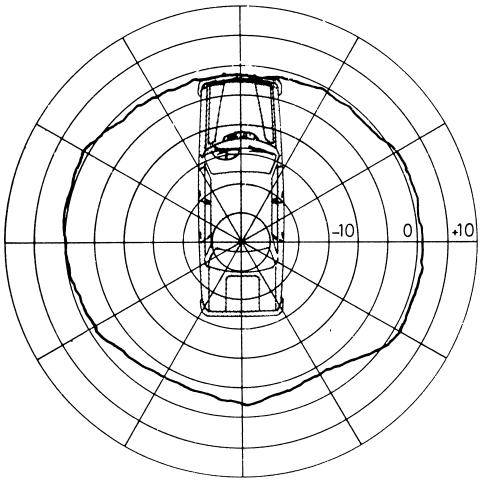
160 MHz

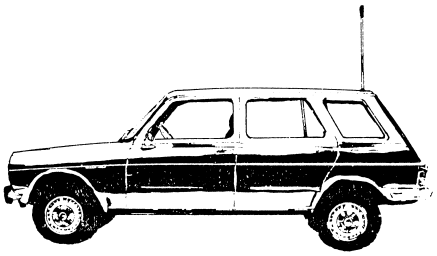




45°

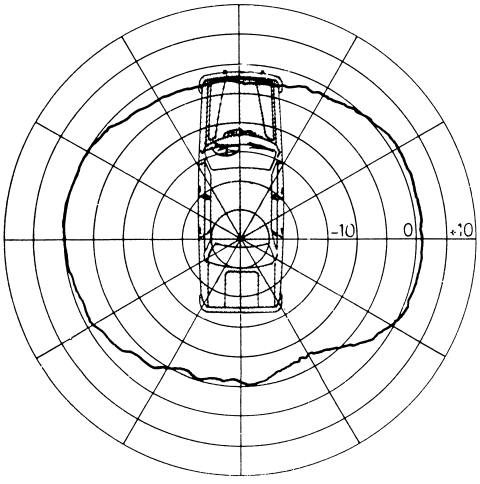
160 MHz

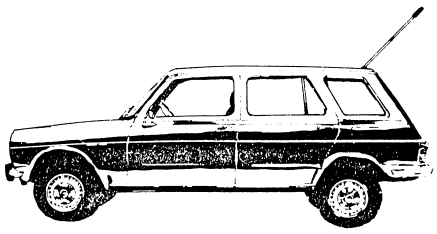




90°

160 MHz



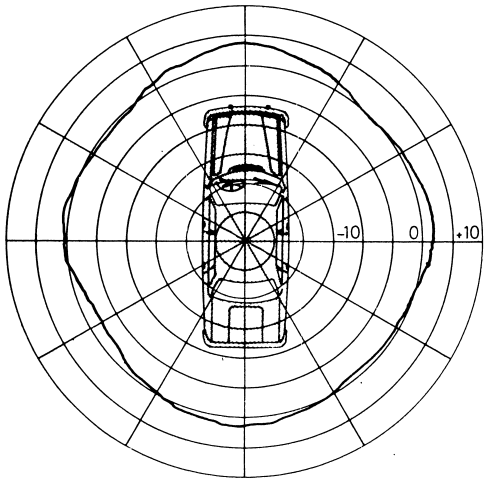


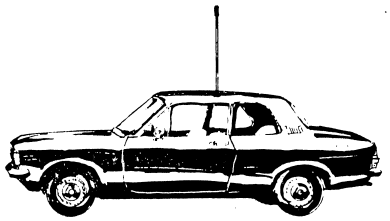
45°

Fig. 8

ATTENUATION RELATED TO λ/2 DIPOLE (0 dB)

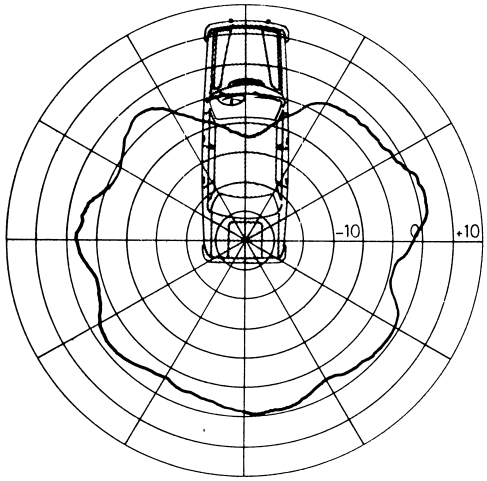
160 MHz

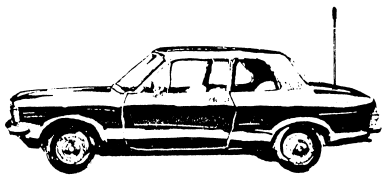




90°

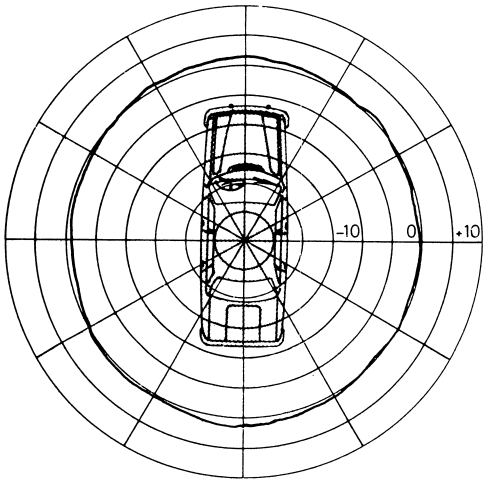
160 MHz

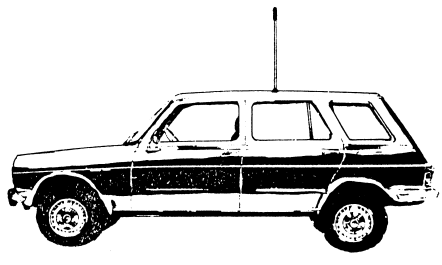




90°

160 MHz





90°

Fig. 9

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CQM5110
ADJUSTMENT PROCEDURE

General

This adjustment procedure applies to the following radiotelephone types:

CQM5112	30/25 kHz Channel spacing
CQM5113	20 kHz Channel spacing
CQM5114	12.5 kHz Channel spacing

Before making adjustments to the radiotelephone transmitter/receiver, read the type label and note the channel frequencies. Check all straps according to the notes on the diagrams. Also check the selective calling tone equipment, if any, against the coding instructions; refer to description of tone equipment.
All screens must be in place and properly secured during the adjustments.

Measuring Instruments

The following list contains instruments necessary for adjusting the radiotelephone and checking its performance characteristics:

DC Voltmeter	$R_{in} \geq$ 1Mohm
AC Voltmeter	Z_{in} >1Mohm//50pF
Multimeter	$R_i \geq$ 20Kohm/Volt
Distortion meter	e.g. Storno E11c
RF Watt meter	25 W/50 ohm/145-175MHz
RF generator	Z_{out} = 50 ohm; 145-175 MHz
10.7 MHz signal generator	e.g. Storno TS-G21B
Frequency counter with attenuator	Z_{in} = 50ohm; sensitivity 100mV af 175 MHz
RF diode probe	Storno 95.0089-00
RF coaxial probe	Storno 95.0179-00
DC power supply	10.8 V - 16.6 V; 6A
Oscilloscope	0 - 5 MHz min.

Miscellaneous

4 ohm/3W resistor	3 x Storno code 82.5026
22 uF/40 V electrolytic capacitor	Storno code 73.5107-00
Connector, 11-pin house	Storno code 41.5543-00
Connector, 8-pin house	Storno code 41.5542-00
Pins for connectors	Storno code 41.5551-00

RECEIVER ADJUSTMENT

Checking 8.5 V regulated supply

Turn the power supply ON and set the voltage to 13.2 V. Set the power supply current limiter to 1A.
Turn the radiotelephone ON by depressing the ON/OFF button. Note the light in the Channel selector, if any, is on.
Depress the Squelch button.
Set the volume control to minimum.
Connect the DC voltmeter to J 901 pin 3 and read the voltage.
Requirement: 8.5 V ± 0.15 V
If the requirement is not fulfilled check resistor R636 against the colour code of U602.

U602 colour code	R636 Value
Brown	omit
Red	270
Orange	100
Yellow	47
Green	22
Blue	6.8

Adjust the power supply voltage to 16.6 V and read the 8.5 V regulated. Compare the change in the 8.5 volt regulated to the value obtained at 13.2 V.

Requirement: $\leq$ 50 m V

Repeat the procedure with the power supply adjusted for 10.8 V

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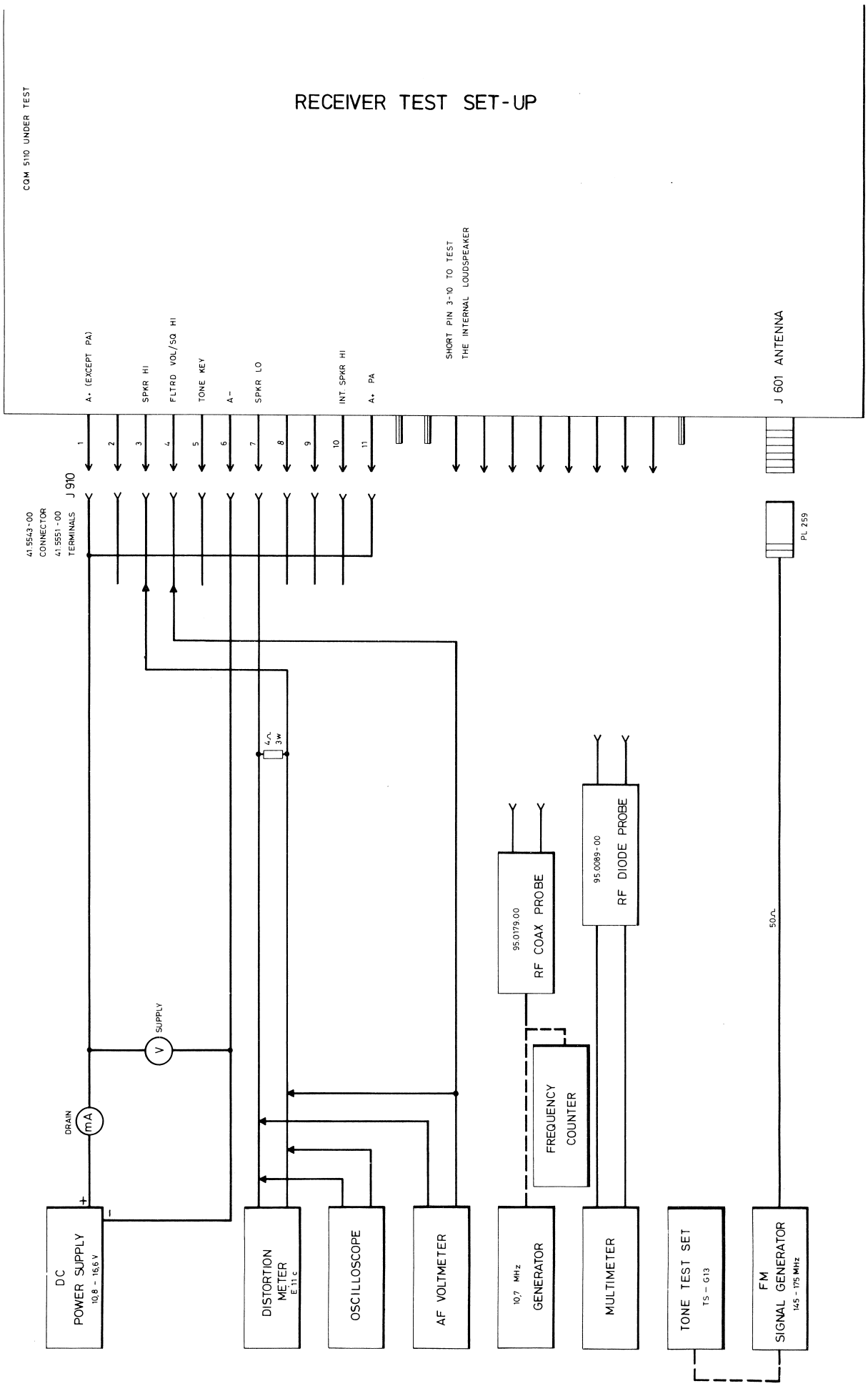
RECEIVER TEST SET-UP



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Oscillator(s) and Frequency Multiplier

In single channel sets the receiver oscillator is located on the RF5110 board. In multichannel sets all oscillators are on the XS5111 board (2 Channels) or XS5112 (6 Channels).

Select the channel whose frequency is closest to center frequency. If not otherwise indicated adjustments should be performed on that channel.

Connect RF diode probe 95.0089-00 leads to the multimeter and select the most sensitive voltage range.
Connect the probe to TP401 with the dot to the live terminal.

Single channel sets

Adjust L301 for maximum deflection

Multichannel sets

Adjust the following coils for maximum deflection:

L961,	Channel 1
L962,	Channel 2
L963,	Channel 3
L964,	Channel 4
L965,	Channel 5
L966,	Channel 6

Adjust L303 and L305 for maximum deflection; Typical 2 to 3 volts
Requirement: $\geq$ 1 V

Receiver frequency adjustment

Connect coax probe 95.017900 to testpoint TP401.
Connect the frequency counter to the probe, and read the frequency. The frequency is measured after the tripler and shall be
$F_{antenna}$ 10,7 MHz

Single channel sets

Adjust L301 for the specified frequency ($3xf_x$)
This adjustment shall be performed at 25°C
Requirement: F_{nom} ± 0.4ppm (±60 Hz at 150 MHz)

Multichannel sets

Adjust the following coils on the XS board to the specified receiver frequencies ($3xf_x$)

L961,	Channel 1
L962,	Channel 2
L963,	Channel 3
L964,	Channel 4
L965,	Channel 5
L966,	Channel 6

Requirement:
F_{nom} ± 0.4 ppm (± 60 Hz at 150 MHz)
ppm = parts per million = x 10^{-6}

IF Amplifiers

Connect a 10.7 MHz signal generator to TP401 via coax probe 95.017900.
Connect RF diode probe 95.008900 with multimeter to test point TP501. (50uA range).
During adjustment the RF generator output must be kept low enough to prevent limiting in the IF stages, i.e. a maximum reading of 50uA on the multimeter.
Adjust coils L503, L502, L501, and L406, in that order, for maximum deflection on the multimeter.

Front-end

Connect the RF probe 95.008900 and the multimeter to test point TP501. (50uA range).
Connect an unmodulated RF generator to the antenna connector, J601.
Set the generator frequency to the receiver frequency.
Adjust the generator output to produce a deflection on the multimeter, i.e. a maximum reading of 50uA on the multimeter.
Adjust L401 and L402 for maximum deflection.
Detune L403 and 405 as much as possible.

Adjust L404 for maximum deflection on the multimeter. This is the only adjustment of L404 and it must not be touched during the rest of the procedure.
Adjust L403 and L405 for maximum deflection on the multimeter.
Readjust L401 and L402 for maximum deflection.
Remove the RF diode probe.

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IF demodulator

Standard Test condition:

Connect the RF generator to antenna connector and adjust the output to 1 mV e.m.f.
Modulate the RF generator with 1000 Hz to 60% of DF max.

CQM5112 = ± 3 KHz
CQM5113 = ± 2.4 KHz
CQM5114 = ± 1.5 KHz

Connect a 4 ohm/3W resistor load to connector J910/37 (SPKR HI-SPKR LO).
Connect an AF voltmeter to J910/47 (FLTD VOL SPKR LO).

Turn R521 halfway up.
Adjust L504 for maximum reading on the AF voltmeter.

Connect a distortion meter and AF voltmeter and Distortion meter across the 4 ohm resistor (if Storno E11c distortion meter is used switch the function to AF voltmeter).
Adjust the volume control for approx. 2 V across the load.
Adjust L501 and L406 for minimum distortion.
The demodulated signal may be monitored on an oscilloscope connected in parallel with the distortion meter.

Connect the AF voltmeter and distortion meter to J910/47 (FLTD VOL - SPKR LO).
Adjust R521 for a reading of 275 mV on the AF voltmeter.
Requirement: 275 mV ± 5 mV.
Read the distortion.
Typical Total Harmonic Distortion (THD) will be less than 5%.

Receiver Sensitivity, SINAD

EIA or CEPT method may be used.

Receiver sensitivity measurement EIA.

The SINAD sensitivity of a receiver is the minimum input signal that will provide at least 50% of the receivers's rated audio power with 12dB signal +noise +distortion to noise + distortion.

Method of measurement. CEPT

The purpose of the measurement is to define the ratio of one condition to another.
The first condition is the one where a modulated RF-signal drives the receiver into full limiting. The audio output is measured with the distortion meter (in the CAL position) and, disregarding the amplitude of the audio, this is adjusted to read 100% on the meter scale; this is our reference condition consisting of signal +noise +distortion, where 'signal' is the modulation of the RF, 'noise' is the lowest possible amount achieved from that particular receiver, when receiving a strong carrier, and 'distortion' is the modulation being slightly distorted in passing through the receiver.

The second condition is the one where the signal (modulation) is removed with a notch filter and the RF-signal is lowered in amplitude until the remaining noise and distortion increases to 20dB below the first condition, as read on the distortion meter scale, This corresponds to a reading of 10%, 10 being 20dB below 100, which was our reference condition.

In practice our first condition is achieved by feeding a minimum of 1000 uV of RF signal modulated with 1000 Hz at 2/3 Δf max. to the receiver.
The audio output (which must be at least 100% of the receiver's audio rating) is measured through the psophometric filter, with the distortion meter in position CAL and adjusted with potentiometer ADJ. FSD. to a reading of 100.

The notch filter is then inserted in series with the audio by pressing one of the buttons marked in %. The meter needle immeadiately drops to indicate a low value, this being the receiver's inherent audio distortion.

By backing off the attenuator of the RF-generator thereby lowering the RF-input to the receiver, the noise will eventually increase; the attenuator is now adjusted for a 10% reading on the distortion meter scale.

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At this stage it must be ensured that the increased noise and the signal (with the notch filter switched out while checking) still equals 100 on the meter scale.

The RF-generator's calibrated attenuator now shows the value of RF-signal required to achieve a 20dB ratio between signal + noise + distortion and noise + distortion, i.e. 20dB SINAD sensitivity.

EIA Method

The EIA method differs from CEPT by omitting the psophometric filter, adjusting the RF generator for 2/3xΔfmax, and measure at 50% of the receiver's rated AF power. The SINAD sensitivity is measured as a 12dB ratio between signal + noise + distortion and noise + distortion, which corresponds to a reading of 25% noise + distortion.

Adjusting the sensitivity

Lower the RF generator output to obtain 20dB SINAD (10% THD as measured with the distortion meter). Readjust L402 for the best SINAD value, e.i. lowest generator output for 25% THD.

Measuring 20dB SINAD

Adjust the volume control for 2.45V as measured with an AF voltmeter across the load.
Adjust the RF generator output to obtain 20dB SINAD condition.
Read the 20dB SINAD sensitivity
Requirement: ≤0.75uV (e.m.f.)
The sensitivity should be measured on all channels, if more than one.

Measuring 12dB SINAD

Adjust the volume control for 2.45V as measured with an AF voltmeter across the load.
Adjust the RF generator to obtain 12dB SINAD condition.

Read the 12dB SINAD sensitivity.
Requirement: ≤0.3uV (½ e.m.f.)
The sensitivity should be measured on all channels, if more than one.

Audio Frequency Response

Set the signal generator to Standard Test Condition.
Adjust the volume control for 0.82V across the load. (4ohm across SPKR HI - LO).
At 13.2V supply, ΔF = 60% ΔF max and 1000Hz measure the output voltage according to the following table:

	Frequency	Level	Tol.
Type CQM5112	300Hz	+9dB	+1dB/-3dB
	1000Hz	0dB	
	3000Hz	-9.5dB	+1dB/-3dB
Type CQM5113	300Hz	+10.5dB	+1.5dB/-3dB
	400Hz	+8dB	+1.5dB/-1.5dB
	1000Hz	0dB	
	2700Hz	-8.6dB	+1.5dB/-1.5dB
	3000Hz	-9.5dB	+1.5dB/-3dB
	6000Hz	<-20dB	

AF Power Output

Adjust the RF signal generator to Standard Test Condition.
Set the supply voltage to 13.2V.
Adjust the volume control for 3W output (3.46V across the 4ohm load).
Measure the distortion (THD).
Requirement: THD $\leq$ 5%.

Squelch

Release the squelch cancel button.
Adjust potentiometer R607 squelch adj. to open the receiver for an RF input signal corresponding to 8-10dB SINAD.

Current consumption

Measure the current consumption at 13.2V.

Requirements

Condition	1 channel	2 channels	6 channels
Standby	$\leq$150mA	$\leq$160mA	$\leq$200mA
Receive	$\leq$500mA	$\leq$510mA	$\leq$550mA
2W AF ~2,83V r.m.s. across 4ohm.			

For sets with selective calling facilities add current consumption of the tone unit to the figures above.

TRANSMITTER ADJUSTMENT

Adjust the power supply voltage to 13.2V and set current limiter as follows:

25W transmitter:	6A
10W transmitter:	4A

Refer to Receiver Alignment for measuring 8.5V regulated supply.
Preset all transmitter tuning slugs, L151, L204, L205, L208, and L209, to be flush with the coil form top.

Connect a multimeter (2.5 volt range) to test point TP201.
Turn the power control potentiometer, R215, to minimum, anticlockwise (CCW).
Connect a Wattmeter, (25W) to the antenna connector, J601.

Oscillator adjustment

In single channel sets the transmitter oscillator is located on the RF5110 board. In multichannel sets all oscillators are on the XS5111 board (2 channels) or XS5112 (6 channels).
Select the channel whose frequency is closest to the center frequency. If not otherwise indicated adjustments should be performed on that channel.

Key the Transmitter.

Single channel sets

Adjust L153 for maximum deflection on the multimeter. The incriase defelection is small and gently tuning si required. If the frequency is in the low end of the band is may be necessary to turn the slug of L151 (L921 - L926) partly into the coil form to obtain a multimeter deflection.
Adjust L151 for maximum meter reading, typical 1.2V.

Multichannel sets

Adjust the following coils for maximum deflection on the multimeter, typical 1.2V.

L921,	channel 1
L922,	channel 2
L923,	channel 3
L924,	channel 4
L925,	channel 5
L926,	channel 6

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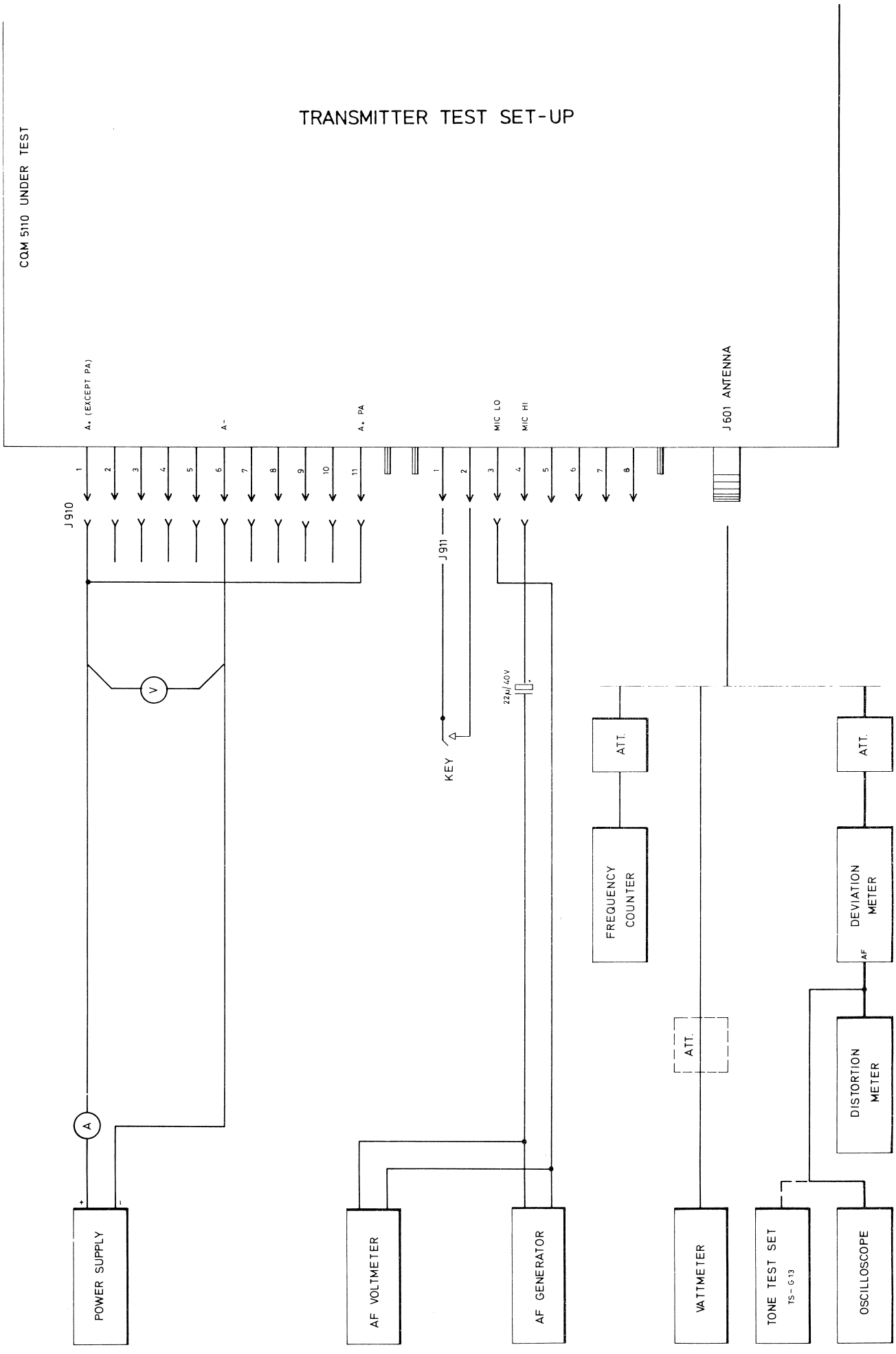
TRANSMITTER TEST SET-UP



Exciter, coarse adjustment

Connect a multimeter (2.5V range) to test point TP201. Adjust L153 for maximum deflection.

Adjust L204 for minimum deflection. The dip is small and careful tuning is required. Connect the multimeter (1V range) to test point TP202.

Adjust L205 for maximum deflection on the multimeter, typical 0.4V.

Adjust L208 for minimum reading. The dip is small and careful tuning is required.

Connect diode probe 95.008900 and the multimeter to test point TP203.

Adjust L209 for maximum reading on the multimeter, typical 10V.

Adjust the PA power control, R215, for rated transmitter power, 6/10W or 25W.

Exciter, fine adjustment

Connect the multimeter to test point TP201. Readjust L153 for maximum reading. Connect the multimeter to test point TP202. Peak L204 and L205 for maximum reading. If the maximum is not well defined detune L153 slightly, adjust L204 and L205, and repeat the adjustment of L153. Connect the 95.0089-00 RF probe and multimeter to test point TP203. Peak L208 and L209 for maximum reading.

Transmitter frequency adjustment

Connect a frequency counter through a suitable attenuator to the antenna connector J601.

Single channel sets

Adjust L151 to specified transmitter frequency.

Multichannel sets

Adjust the following coils on the XS board to the specified transmitter frequencies:

L921,	channel 1
L922,	channel 2
L923,	channel 3
L924,	channel 4
L925,	channel 5
L926,	channel 6

The frequency adjustment shall be performed af 25°C.

Requirement: F_{nom} ±0.4 ppm.

RF power output, current consumption, and power control

Connect the Watt meter to the antenna connector, J601.

Increase the supply voltage to 16V. The voltage is measured directly at the input connector J910.

Readjust the PA power control, R215, for rated transmitter power (P), 6/10 or 25W.

Requirement: P_{nom} ±0.1dB.

Measure the RF power output at 16V, 13.2V and 10.8V.

Requirements (25W):

Voltage	Power	Current
16.6V	25W (ref)	≤5.8A
13.2V	≥24W	≤5.8A
10.8V	≥20W	≤5.8A

Requirements (10 W):

Voltage	Power	Current
16V	10W (ref)	≤3.2A
13.2V	≥9W	≤3.2A
10.8V	≥8W	≤3.2A

Requirements (6W):

Voltage	Power	Current
16V	6W (ref)	≤2.6A
13.2V	≥5.5W	≤2.6A
10.8V	≥5.2W	≤2.6A

MODULATION ADJUSTMENT

Set the power supply voltage to 13.2V.
Connect a deviation meter through an attenuator to the antenna connector, J601.
Connect a distortion meter and oscilloscope to the deviation meter output.
Connect an AF generator and an AF voltmeter to the microphone input via a 22uF capacitor; refer to test setup.
Adjust the AF generator output to 1V r.m.s. This voltage is approx. 20dB above the nominal modulation input level (60% Δf max) to ensure full limiting in the modulation processor.
Find the AF frequency between 200Hz and 3000Hz giving the greatest frequency deviation as read on the deviation meter with the transmitter keyed.
Check the maximum deviation for both positive and negative deviation polarity. At that audio frequency set the maximum frequency deviation Δf max with R116.

Type	Channel spacing	Δf max
CQM5112	30/25kHz	±5kHz
CQM5113	20kHz	±4kHz
CQM5114	12.5kHz	±2.5kHz

Requirement
Difference between + and - deviation: ≤10%

Multichannel sets
In multichannel sets R116 is turned 2/3 clockwise and the modulation adjustment is adjusted individually for each channel using the Δf max potentiometers on the XS board.

R956 = channel 1
R957 = channel 2
R958 = channel 3
R959 = channel 4
R960 = channel 5
R961 = channel 6

Modulation sensitivity and modulation distortion
Set the AF generator frequency to 1000Hz
Adjust the generator output until 60% of Δf max is obtained on the deviation meter.

CQM5112 : ±3.0kHz
CQM5113 : ±2.4kHz
CQM5114 : ±1.5kHz

Read the AF generator output and measure the modulation distortion on the audio output of the deviation meter.

Requirements:
Modulating signal: 75mV ±2dB
Distortion: ≤7%
(measured without deemphasis)

Modulation frequency response
Set the AF generator to 1000Hz.
Reduce the AF generator output until a deviation of 0.2 x Δf max is obtained on the deviation meter.

CQM5112 : ±1.0kHz
CQM5113 : ±0.8kHz
CQM5114 : ±0.5kHz

Vary the frequency of the generator and note the deviation changes as refered to the 1000Hz value.
Requirement :
Within the frequency range 400-2700Hz the frequency characteristic shall lie within +1dB/-1.5dB related to a 6dB/octave characteristic.
With 6kHz modulation frequency the deviation shall be attenuated at least 6dB below the 1kHz value.

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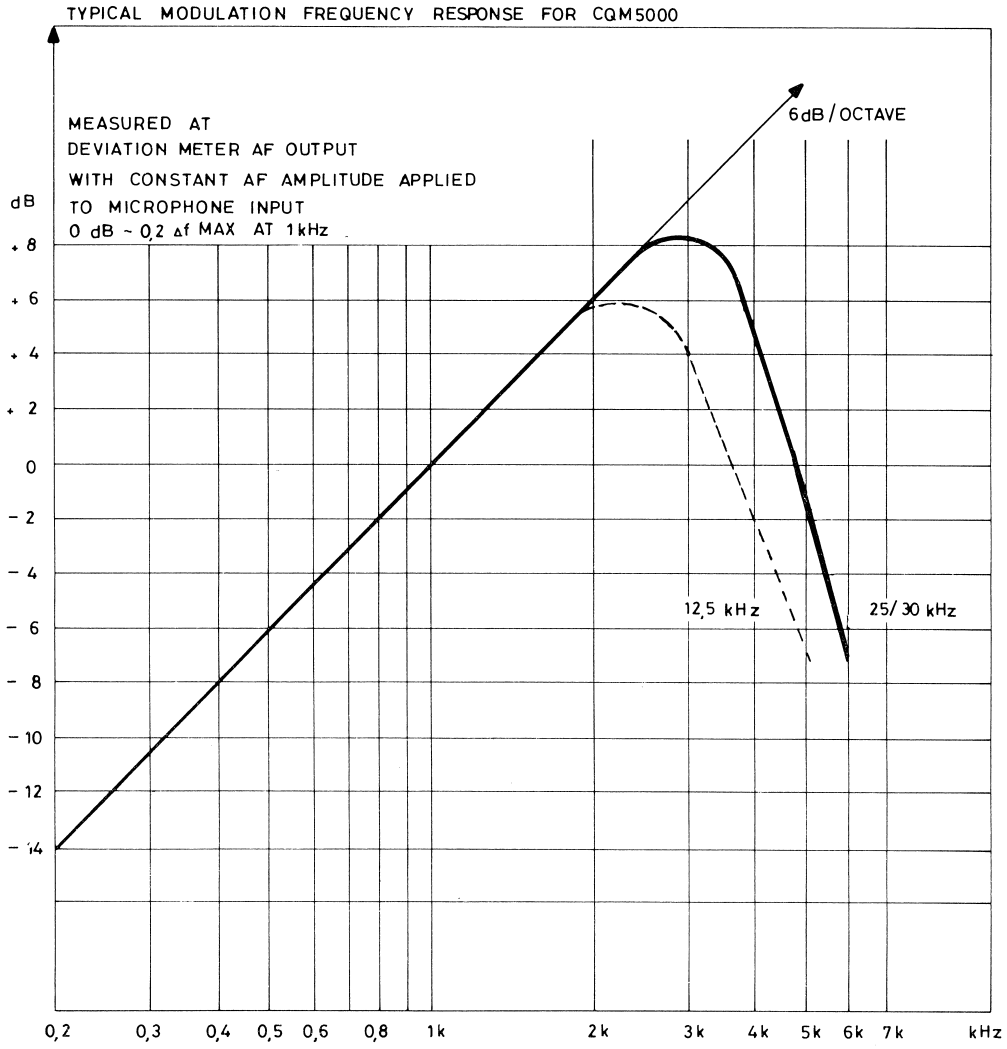

TYPICAL MODULATION FREQUENCY RESPONSE FOR CQM5000
MEASURED AT
DEVIATION METER AF OUTPUT
WITH CONSTANT AF AMPLITUDE APPLIED
TO MICROPHONE INPUT
0 dB ~ 0,2 Δf MAX AT 1kHz
6dB / OCTAVE
12,5 kHz
25/30 kHz
dB
+ 8
+ 6
+ 4
+ 2
0
- 2
- 4
- 6
- 8
- 10
- 12
- 14
0,2
0,3
0,4
0,5
0,6
0,8
1k
2k
3k
4k
5k
6k
7k
kHz

ADJUSTMENT OF TONE EQUIPMENT

Measuring equipment

Tone Test Generator Storno TS-G13
95B0251-00

Check the connections and the tone combination of the TQ5001/TQ5002 and SU/5002; refer to description and diagrams.

Adjustment of frequency deviation

Apply Standard test condition to the transmitter; refer to transmitter test setup. Establish a shortcircuit between emitter and collector of Q108, on the solderside of the TQ unit, which will produce a continuous tone to the modulator.

Key the transmitter using the tone button.

Adjust R113, TQ5001/TQ5002 for 70% of maximum frequency deviation.

Remove the short circuit.

Connect the G13 Tone Test set to the AF output on the Deviation Meter.

Check that the tone call is properly received when the tone button is depressed.

Checking the Tone Receiver

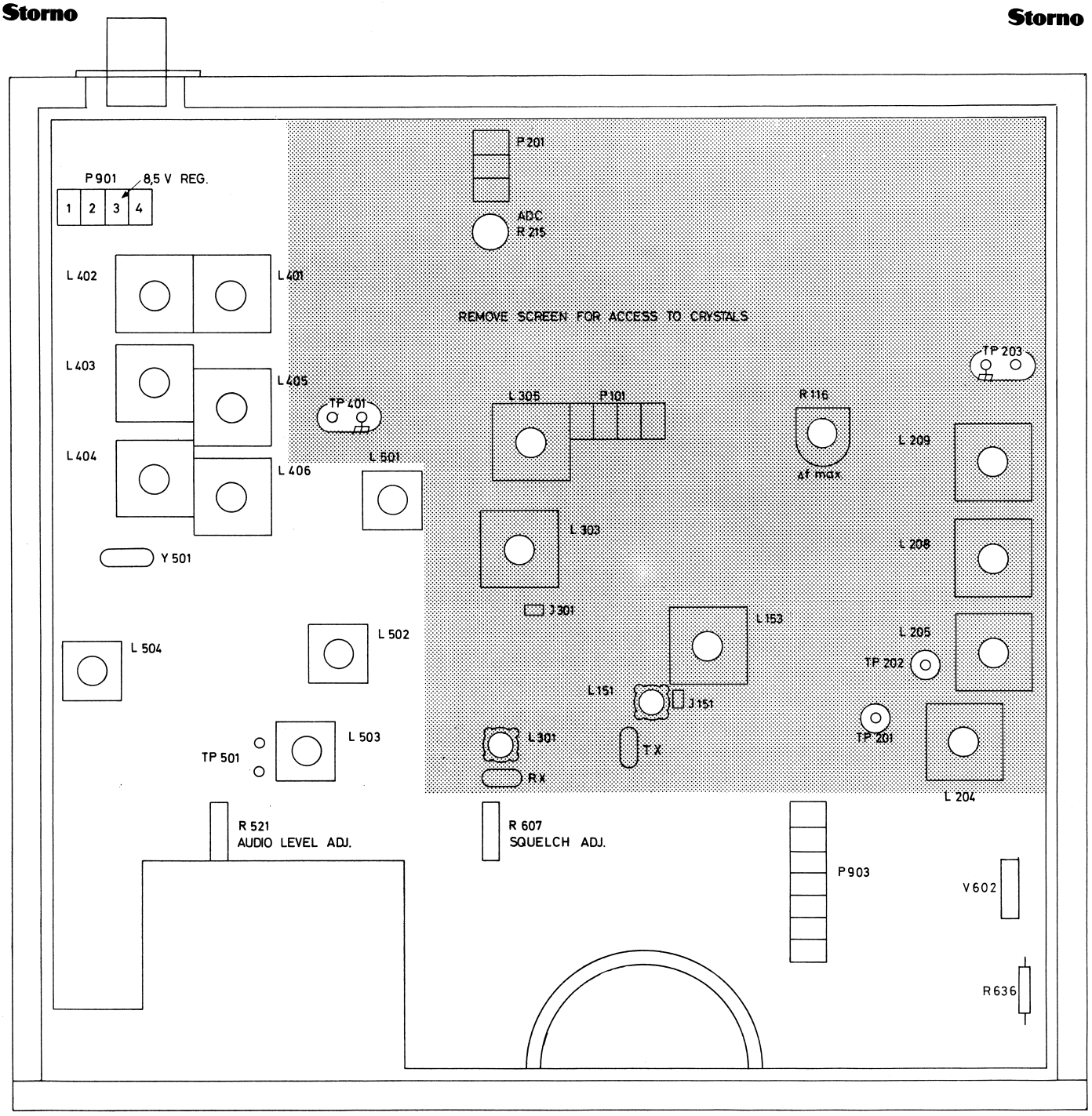
Apply Standard test condition to the receiver; refer to receiver test setup.

Modulate the signal generator with the G13 Tone Test Set.

Set the G13 to the proper tone combination.

Check that the TQ5001/TQ5002 responds to a released tone call.

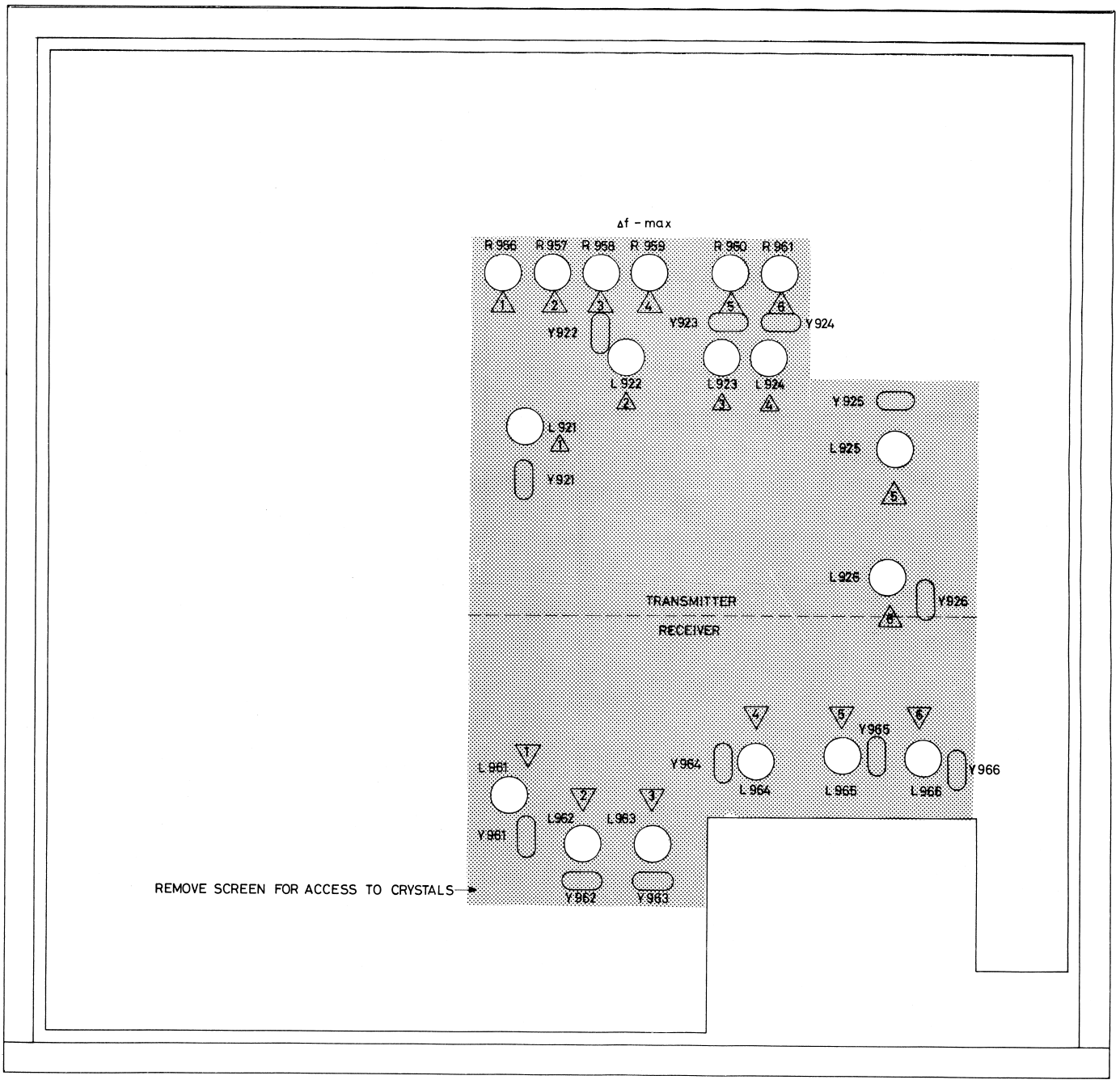
Storno



ADJUSTABLE COMPONENTS AND
TEST POINTS ON RF 5110

D402.623

Storno



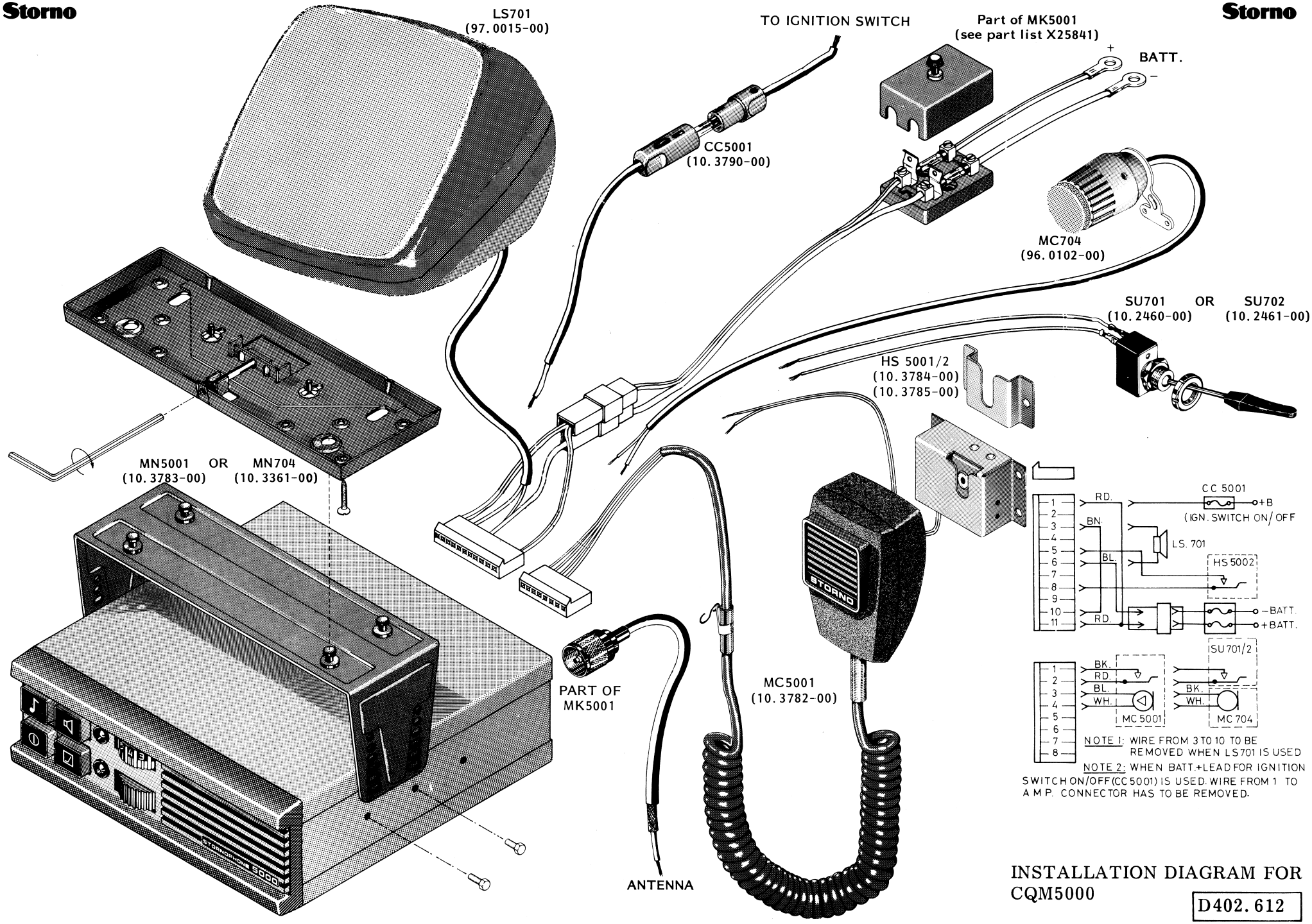
▽ = RECEIVER CHANNEL

△ = TRANSMITTER CHANNEL

ADJUSTABLE COMPONENTS AND TEST POINTS ON XS5111 / XS5112 AND XS5331 / XS5332

D402.624/2

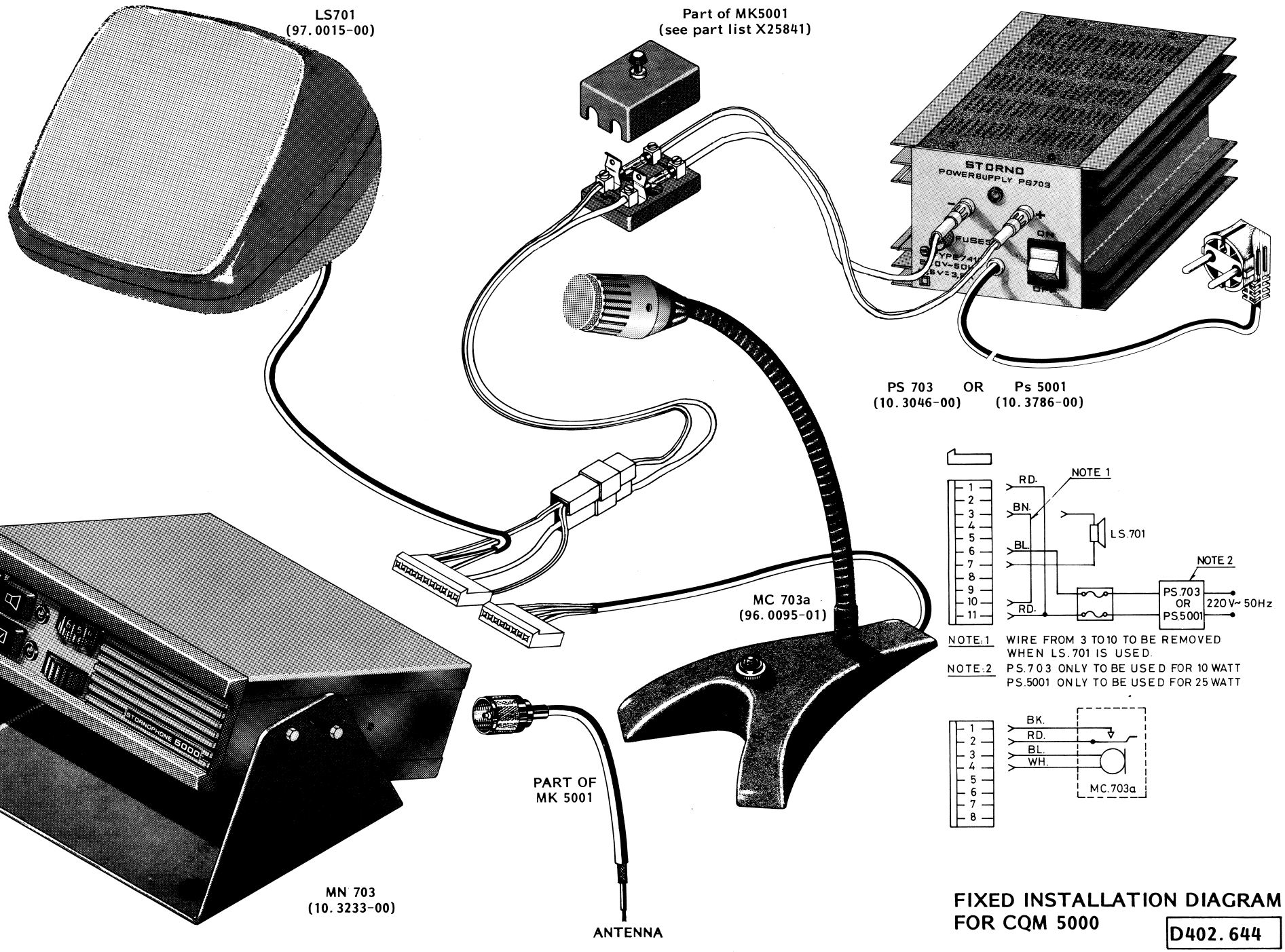
Storno



INSTALLATION DIAGRAM FOR
CQM5000

D402.612

Storno

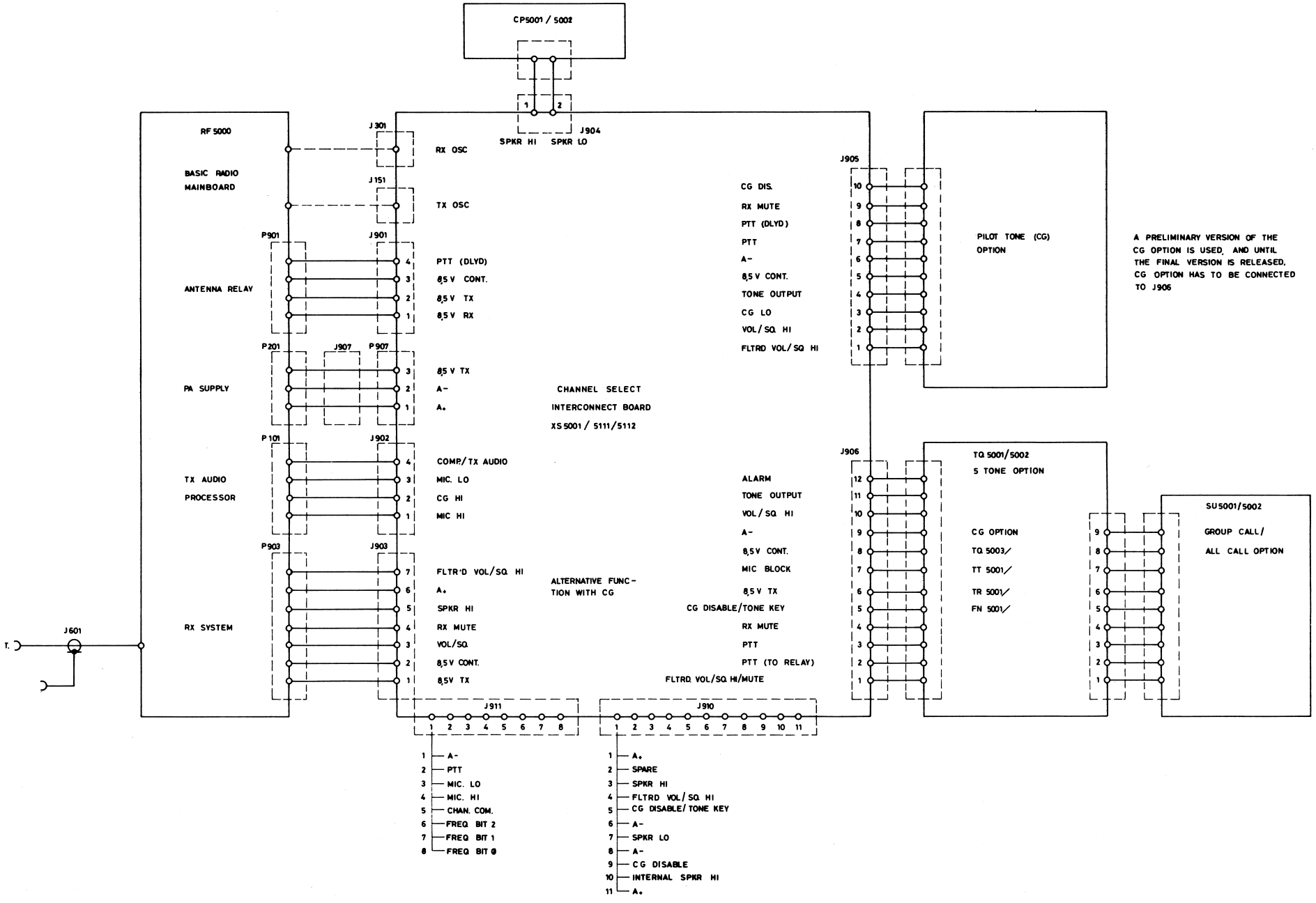


FIXED INSTALLATION DIAGRAM FOR CQM 5000

D402.644

Storno

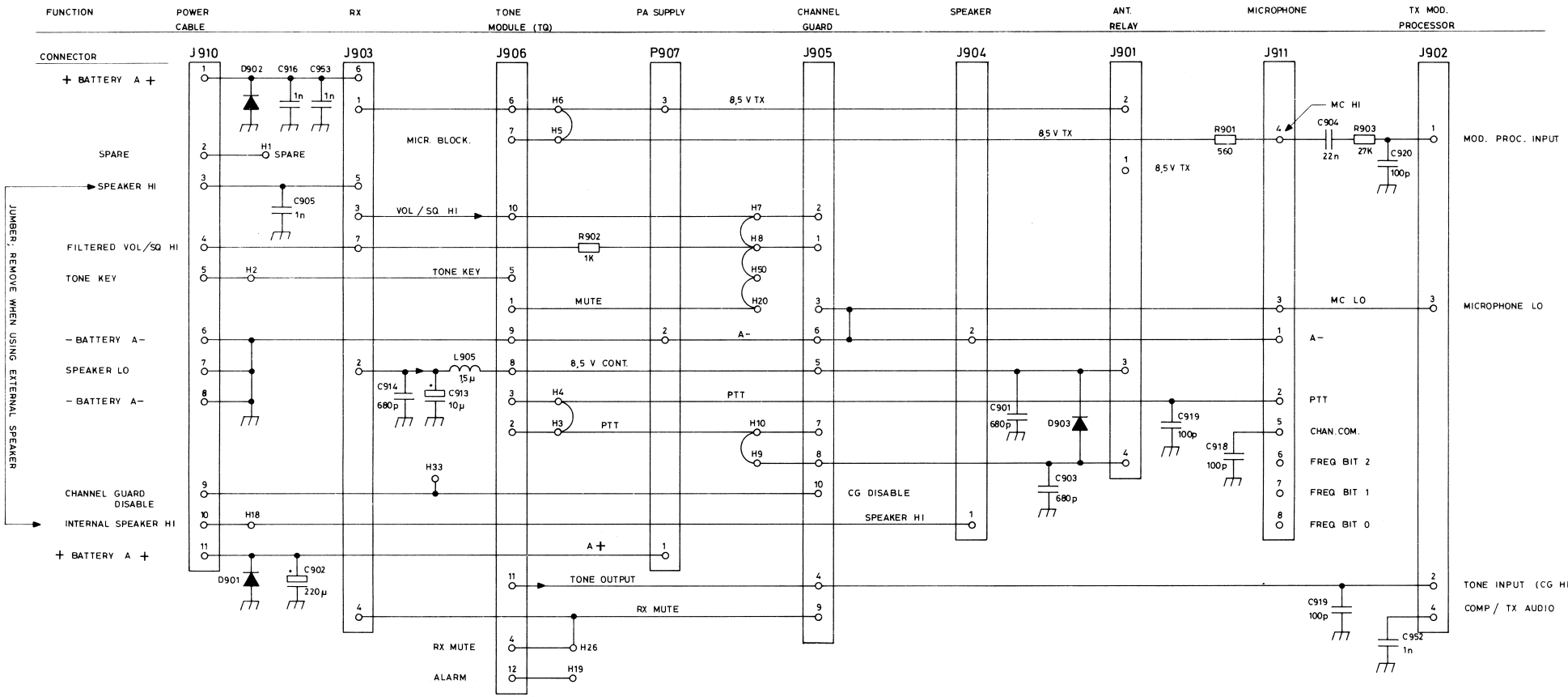
Storno

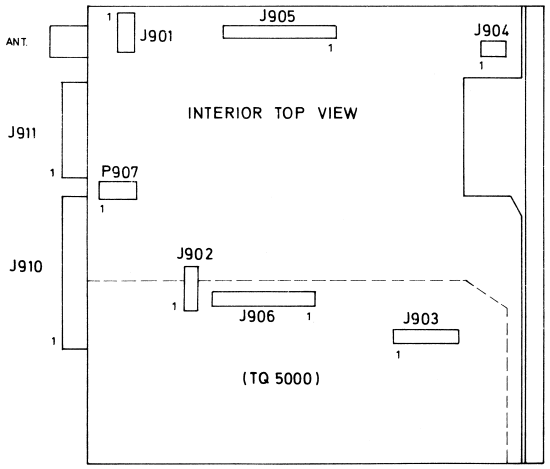


INTERCONNECT DIAGRAM

CQM 5000

D402.641/2





NOTES

ALL CONNECTORS SHOWN ARE ON THE XS 5000 BOARD

COMPONENTS SHOWN ARE PARTS OF THE XS BOARD

TONE OPTIONS	STRAPS				
	H3 - H4	H5 - H6	H7 - H8	H9 - H10	H20 - H50
T0 - NONE	+	+	+	+	+
T1 - TQ 5001	—	—	+	+	—
T2 - TQ 5002	—	—	+	+	—
T3 - TQ 5001 + SU 5001	—	—	+	+	—
T4 - TQ 5001 + SU 5002	—	—	+	+	—
T5 - TQ 5003	+	+	—	+	+
T6 - TR 5001	+	+	—	+	+
T7 - TT 5001	+	+	+	+	+
T8 - FN 5001	+	+	—	+	+

INSERT = +
REMOVE = —

INTERCONNECTION DIAGRAM CQM 5000

D402.695

RF AMPLIFIER

MIXER

10,7 MHz AMPL.

AUDIO LEVEL ADJ

AF AMPLIFIER

SQUELCH

FROM TRANSMITTER OUTPUT

OSCILLATOR

TRIPLER

NOTES: 1. ▲ PART OF PRINTED CIRCUIT
2. TO MODIFY FOR MULTIFREQUENCY, REMOVE R157 TO DISABLE TX OSCILLATOR ON RF5110 AND/OR REMOVE R309 TO DISABLE RX OSCILLATOR ON RF5110.
3. • VALUE OF R636 DEPENDS ON COLOUR MARK ON U602.

U602	R636 VALUE ^
BROWN	OM IT
RED	270
ORANGE	100
YELLOW	47
GREEN	22
BLUE	6,8

5. 12,5 kHz CHANNEL SPACING
C108 : 10n
R109 : 1,8K

NOTE 4: STRAP 4-5 IN ALL RADIOS EXCEPT US VERSIONS.

MODULATION PROCESSOR

OSCILLATOR

BUFFER

TRIPLER

EXCITER

POWER CONTROL

POWER AMPLIFIER

HARMONIC FILTER

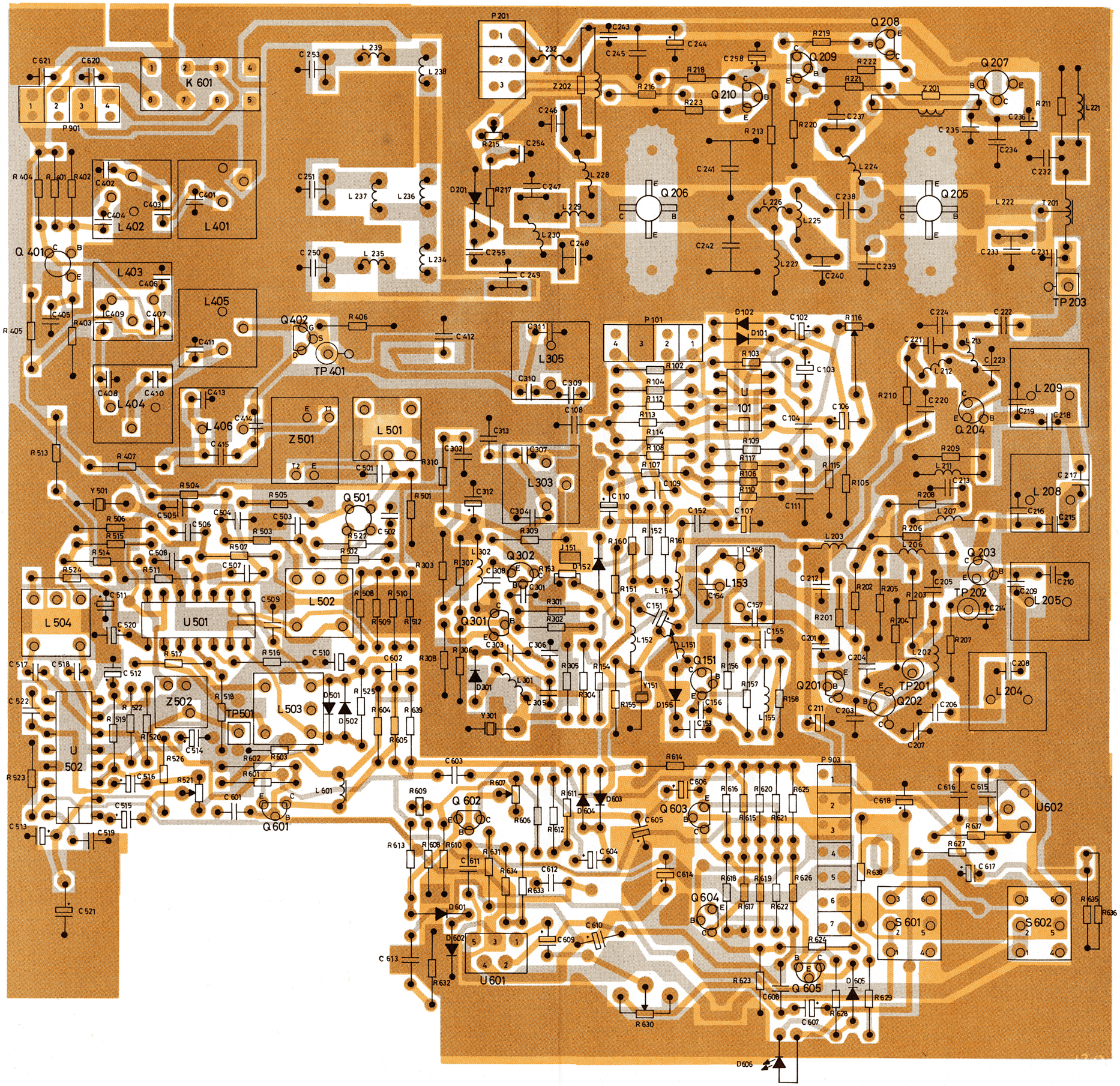
TO ANTENNA RELAY

RF UNIT RF5110

D402.613/4

Storno

Storno



RF UNIT RF5110

D402.640

TYPE	Nº	CODE	DATA	
	C102	73.5172	4.7 uF 20% Tantal	35V
	C103	73.5172	4.7 uF 20% Tantal	35V
	C104	76.5142	47 nF 5% Polyest FL	63V
	C106	73.5170	1.0 uF 20% Tantal	35 V
	C107	73.5172	4.7 uF 20% Tantal	35V
SWE	C108	76.5135	10nF 10% Polyester FL	50V
RF5114	C108	76.5135	10 nF 10% Polyester FL	50V
+	C109	76.5156	1 nF 5% Polyester FL	50 V
	C110	73.5172	4.7 uF 20% Tantal	35V
	C111	76.5151	68 nF 5% Polyest FL	63 V
	C112	74.5392	150 pF 20% Ceram DI	50 V
+	C113	74.5374	18 pF 5% Ceram DI	50 V
+	C114	74.5395	470 pF 20% Ceram DI	50V
	C151	73.5173	10 uF 20% Tantal	16V
	C152	76.5135	10 nF 10% Polyest FL	50 V
	C153	74.5386	180 pF 5% Ceram DI	50 V
	C154	74.5396	680 pF 20% Ceram DI	50 V
	C155	74.5405	68 pF 5% Ceram DI	50 V
	C156	74.5403	18 pF 5% Ceram DI	50 V
+	C157	74.5370	8.2 pF 0.25 pF Ceram DI	50 V
	C158	74.5378	39 pF 5% Ceram DI	50 V
+	C201	74.5392	150 pF 20% Ceram DI	50 V
	C203	74.5377	33 pF 5% Ceram DI	50 V
	C204	74.5397	1 nF 20% Ceram DI	50 V
	C205	74.5397	1 nF 20% Ceram DI	50 V
	C206	74.5374	18 pF 5% Ceram DI	50 V
	C207	74.5377	33 pF 5% Ceram DI	50 V
	C208	79.5003	0.39 pF 5% Phenolic TB	500V
	C209	74.5373	15 pF 5% Ceram DI	50 V
	C210	74.5377	33 pF 5% Ceram DI	50V
	C211	73.5171	2.2 uF 20% Tantal	35V
	C212	74.5397	1 nF 20% Ceram DI	50 V
	C213	74.5397	1 nF 20% Ceram DI	50 V
	C214	74.5395	470 pF 20% Ceram DI	50 V
	C215	74.5374	18 pF 5% Ceram DI	50 V
	C216	74.5379	47 pF 5% Ceram DI	50 V
	C217	79.5005	0.56 pF 5% Phenolic TB	500 V
	C218	74.5372	12 pF 5% Ceram DI	50 V
	C219	74.5378	39 pF 5% Ceram DI	50 V
	C220	74.5397	1 nF 20% Ceram DI	50 V
	C221	74.5397	1 nF 20% Ceram DI	50 V
	C222	74.5397	1 nF 20% Ceram DI	50 V
	C223	74.5374	18 pF 5% Ceram DI	50V
	C224	74.5374	18 pF 5% Ceram DI	50V
	C225	74.5397	1 nF 20% Ceram DI	50 V
	C231	74.5371	10 pF 5% Ceram DI	50 V
	C232	74.5380	56 pF 5% Ceram DI	50V

Storno

TYPE	Nº	CODE	DATA	
	C233	75.5026	110 pF 5% Mica	250 V
	C234	76.5144	0.1 uF 10% Polyest FL	63 V
	C235	74.5392	150 pF 20% Ceram DI	50 V
	C236	73.5173	10 uF 20% Tantal	16V
	C237	75.5028	220 pF 5% Mica	250 V
10W +	C238	75.5030	68 pF 5% Mica	250V
25W	C238	75.5020	100 pF 5% Mica	250V
+	C239	75.5019	10 pF 5% Silv. Mica	250 V
	C240	75.5026	110 pF 5% Mica	250 V
10W	C241	75.5031	150 pF 5% Mica	250V
25W	C241	75.5022	240 pF 5% Mica	250V
10W	C242	75.5031	150 pF 5% Mica	250V
25W	C242	75.5022	240 pF 5% Mica	250V
	C243	76.5144	0.1 uF 10% Polyest FL	63 V
	C244	73.5172	4.7 uF 20% Tantal	35V
	C245	74.5392	150 pF 20% Ceram DI	50 V
	C246	75.5028	220 pF 5% Mica	250 V
25 W	C247	75.5027	130 pF 5% Mica	250 V
10W	C247	75.5032	82 pF 5% Mica	250V
	C248	75.5025	30 pF 5% Teflon	250 V
	C249	75.5028	220 pF 5% Mica	250 V
	C250	75.5023	8.0 pF 0.5 pF Teflon	250 V
	C251	75.5024	22 pF 5% Teflon	250V
	C252	75.5021	29 pF 2% Teflon	250 V
	C253	75.5023	8.0 pF 0.5 pF Teflon	250 V
	C254	74.5392	150 pF 20% Ceram DI	50 V
	C255	74.5361	1.5 pF 0.25 pF Ceram DI	50 V
	C258	73.5173	10 uF 20% Tantal	16V
	C301	74.5396	680 pF 20% Ceram DI	50 V
	C302	76.5135	10 nF 10% Polyest FL	50 V
	C303	74.5386	180 pF 5% Ceram DI	50 V
	C304	74.5396	680 pF 20% Ceram DI	50 V
	C305	74.5405	68 pF 5% Ceram DI	50 V
	C306	74.5403	18 pF 5% Ceram DI	50 V
	C307	74.5369	6.8 pF 0.25 pF Ceram	50 V
	C308	74.5386	180 pF 5% Ceram DI	50 V
	C309	79.5005	0.56 pF 5% Phenolic TB	500 V
	C310	74.5373	15 pF 5% Ceram DI	50V
	C311	74.5379	47 pF 5% Ceram DI	50 V
	C312	73.5172	4.7 uF 20% Tantal	35V
+	C313	74.5375	22 pF 5% Ceram DI	50V

RF UNIT RF5110

X402.653/2

TYPE	Nº	CODE	DATA	
	C401	74.5370	8.2 pF 0.25 pF Ceram DI	50 V
	C402	74.5370	8.2 pF 0.25 pF Ceram DI	50 V
	C403	79.5006	0.68 pF 5% Phenolic TB	500 V
	C404	74.5395	470 pF 20% Ceram DI	50V
	C405	74.5395	470 pF 20% Ceram DI	50 V
	C406	74.5395	470 pF 20% Ceram DI	50 V
	C407	74.5370	8.2 pF 0.25 pF Ceram DI	50 V
	C408	74.5370	8.2 pF 0.25 pF Ceram DI	50 V
	C409	79.5001	0.22 pF 5% Phenolic TB	500 V
	C410	74.5361	1.5 pF 0.25 pF Ceram DI	50 V
	C411	74.5368	5.6 pF 0.25 pF Ceram	50 V
	C412	76.5132	3.3 nF 10% Polyest FL	50 V
	C413	76.5135	10 nF 10% Polyest FL	50 V
	C414	19J706280P1	2.2 nF 10% Ceramic 2DI	125 V
+	C415	74.5389	330 pF 5% Ceram DI	50 V
	C501	74.5375	22 pF 5% Ceram DI	50 V
	C502	74.5395	470 pF 20% Ceram DI	50 V
	C503	76.5135	10 nF 10% Polyest FL	50 V
	C504	76.5135	10 nF 10% Polyest FL	50 V
	C505	76.5135	10 nF 10% Polyest FL	50 V
	C506	74.5379	47 pF 5% Ceram DI	50 V
	C507	74.5383	100 pF 5% Ceramic DI	50V
	C508	74.5387	220 pF 5% Ceram DI	50 V
	C509	76.5133	4.7 nF 10% Polyest FL	50 V
	C510	73.5170	1.0 uF 20% Tantal	35 V
	C511	73.5168	0.22 uF 20% Tantal	35 V
	C512	73.5170	1.0 uF 20% Tantal	35 V
	C513	73.5170	1.0 uF 20% Tantal	35 V
	C514	73.5170	1.0 uF 20% Tantal	35 V
	C515	73.5168	0.22 uF 20% Tantal	35 V
	C516	73.5168	0.22 uF 20% Tantal	35 V
	C517	74.5393	220 pF 20% Ceram DI	50V
	C518	74.5393	220 pF 20% Ceram DI	50V
	C519	74.5397	1 nF 20% Ceram DI	50 V
	C520	73.5170	1.0 uF 20% Tantal	35 V
	C521	73.5166	470 uF -10+100% Elco	16V
	C522	76.5132	3.3 nF 10% Polyest FL	50 V
	C601	76.5133	4.7 nF 10% Polyest FL	50 V
	C602	76.5134	6.8 nF 10% Polyest FL	50 V
	C603	76.5139	47 nF 10% Polyest FL	50 V
	C604	73.5172	4.7 uF 20% Tantal	35V
	C605	73.5164	47 uF -10+100% Elco	16V
	C606	73.5170	1.0 uF 20% Tantal	35 V
	C607	73.5169	0.47 uF 20% Tantal	35 V
	C608	76.5144	0.1 uF 10% Polyest FL	63 V
	C609	73.5172	4.7 uF 20% Tantal	35V
	C610	73.5175	47 uF 20% Tantal	6.3 V
	C611	76.5144	0.1 uF 10% Polyest FL	63 V

Storno

TYPE	Nº	CODE	DATA	
	C612	73.5168	0.22 uF 20% Tantal	35 V
	C613	76.5148	0.47 uF 10% Polyest FL	63V
	C614	73.5166	470 uF -10+100% Elco	16V
	C615	76.5143	68 nF 10% Polyest FL	63V
	C616	76.5143	68 nF 10% Polyest FL	63V
	C617	73.5164	47 uF -10+100% Elco	16V
	C618	73.5165	220 uF -10+100% Elco	25V
	C620	74.5395	470 pF 20% Ceram DI	50 V
	C621	74.5395	470 pF 20% Ceram DI	50 V
+	D101	99.5374	1N458A Diode, selected	
+	D102	99.5374	1N458A Diode, selected	
	D151	99.5341	Cap. Diode	
	D152	99.5237	1N4148 Diode	
	D201	99.5237	1N4148 Diode	
	D301	99.5341	Cap. Diode	
	D501	99.5237	1N4148 Diode	
	D502	99.5237	1N4148 Diode	
	D601	99.5237	1N4148 Diode	
	D602	99.5237	1N4148 Diode	
	D603	99.5237	1N4148 Diode	
	D604	99.5237	1N4148 Diode	
	D605	99.5237	1N4148 Diode	
	D606	99.5303	1.6 V LED	20 mA
+	D607	99.5237	1N4148 Diode	
	J151	41.5529	Socket	
	J301	41.5529	Socket	
	J601	41.5165	UHF connector	
	K601	58.5085	21-21 Relay	12V
	L151	61.5032	48-58 MHz RF coil	
	L152	61.5030	1.5 uH 10% RF choke	0.8 A
	L153	61.5041	146-174 MHz RF coil	
	L154	61.5031	10 uH 10% RF choke	0.3 A
	L155	61.5030	1.5 uH 10% RF choke	0.8 A
	L202	61.5028	0.1 uH 10% RF choke	1.3 A
	L203	61.1383	RF choke	
	L204	61.5036	146-174 MHz RF coil	
	L205	61.5036	146-174 MHz RF coil	
	L206	61.5029	1.0 uH 10% RF choke	0.65 A
	L207	61.5028	0.1 uH 10% RF choke	1.3 A
	L208	61.5036	146-174 MHz RF coil	
	L209	61.5036	146-174 MHz RF coil	

RF UNIT RF5110

X402.653/2

TYPE		Nº	CODE	DATA	
		L211	61.5029	1.0 uH 10% RF choke	0.65 A
		L212	62.0982	146-174 MHz RF coil	
		L213	62.0982	146-174 MHz RF coil	
		L221	61.5031	10 uH 10% RF choke	0.3 A
		L224	62.0987	146-174 MHz RF coil	
25 W		L225	62.0985	146-174 MHz RF coil	
10 W		L225	62.0988	146-174 MHz RF coil	
		L226	62.0979	146-174 MHz RF coil	
		L227	61.1383	RF choke	
10W		L228	62.0986	146-174 MHz RF coil	
25W	+	L228	62.1030	AIR RF coil	
25 W		L229	62.0979	146-174 MHz RF coil	
10 W		L229	62.0983	146-174 MHz RF coil	
25 W		L230	62.0984-01	146-174 MHz RF coil	
10 W		L230	62.0986	146-174 MHz RF coil	
	+	L232	62.1031	146-174 MHz RF coil	
		L234	62.0981	146-174 MHz RF coil	
		L235	62.0980	146-174 MHz RF coil	
		L236	62.0981	146-174 MHz RF coil	
		L237	62.0979	146-174 MHz RF coil	
		L238	62.0981	146-174 MHz RF coil	
		L239	62.0980	146-174 MHz RF coil	
		L301	61.5034	45-55 MHz RF coil	
		L302	61.5015	3.3 uH 10% RF choke	0.7 A
		L303	61.5041	146-174 MHz RF coil	
		L305	61.5035	135-164 MHz RF coil	
		L401	61.5037	146-174 MHz RF coil	
		L402	61.5037	146-174 MHz RF coil	
		L403	61.5037	146-174 MHz RF coil	
		L404	61.5037	146-174 MHz RF coil	
		L405	61.5039	146-174 MHz RF coil	
	+	L406	61.5050	10.7-21.4 MHz RF coil	
		L501	61.5026	10.7 MHz IF transformer	
		L502	61.5026	10.7 MHz IF transformer	
		L503	61.5025	455 kHz IF transformer	
		L504	61.5025	455 kHz IF transformer	
		L601	61.5023	75 uH 10% RF choke	0.01 A
		P101	41.5541	Fem. connector	4 PIN
		P201	41.5545	Fem. connector	3 PIN
		P901	41.5541	Fem. connector	4 PIN
		P903	41.0230	Fem. connector	7 PIN
		Q151	99.5347	PN2369 Transistor	
		Q201	99.5363	2N3904 Transistor	
		Q202	99.5348	Transistor	
		Q203	99.5348	Transistor	
		Q204	99.5349	RF transistor	
		Q205	99.5342	PA Transistor	

Storno

TYPE		Nº	CODE	DATA	
25 W		Q206	99.5343	PA Transistor	
10 W		Q206	99.5344	PA Transistor	
		Q207	99.5345	BD201 Transistor	
		Q208	99.5251	BC307 Transistor	
		Q209	99.5121	BC237 Transistor	
		Q210	99.5121	BC237 Transistor	
		Q301	99.5347	PN2369 Transistor	
		Q302	99.5347	PN2369 Transistor	
		Q401	99.5240	BFX89 Transistor	
		Q402	99.5245	2N5245 J-FET	
		Q501	99.5291	3N205 Mos-FET	
		Q601	99.5143	BC238 Transistor	
		Q602	99.5201	BC239 Transistor	
		Q603	99.5115	BC309 Transistor	
		Q604	99.5115	BC309 Transistor	
		Q605	99.5115	BC309 Transistor	
		R102	80.5265	22 Kohm 5% Carbon film	0.125 W
		R103	80.5243	330 ohm 5% Carbon film	0.125 W
		R104	89.5095	51 Kohm 5% Carbon film	0.125 W
		R105	89.5083	10.5Kohm 1% Metal film	0.25W
		R106	89.5085	12.7Kohm 1% Metal film	0.25W
		R107	89.5083	10.5 kohm 1% Metal film	0.25 W
		R108	89.5082	5.11 Kohm 1% Metal film	0.25 W
		R109	89.5091	1.3 Kohm 5% Carbon film	0.125 W
SWE		R109	80.5252	1.8Kohm 10% Carbon film	0.125W
RF5114		R109	80.5252	1.8 Kohm 5% Carbon film	0.125W
		R110	89.5082	5.11 Kohm 1% Metal film	0.25 W
		R112	89.5086	20 Kohm 1% Metal film	0.25 W
		R113	89.5084	12.4 kohm 1% Metal film	0.25 W
	+	R114	80.5267	3 3 Kohm 1% Metal Film	0.25 W
	+	R115	80.5253	2.2 Kohm 5% Carbon film	0.125W
		R116	86.5050	5 Kohm 20% Carbon pot.	0.1 W
		R117	80.5254	2.7 Kohm 5% Carbon film	0.125 W
		R151	80.5259	6.8 Kohm 5% Carbon film	0.125 W
		R152	80.5259	6.8 Kohm 5% Carbon film	0.125 W
		R153	89.5088	33 Kohm 1% Metal film	0.5 W
		R154	80.5269	47 Kohm 5% Carbon film	0.125 W
		R155	80.5247	680 ohm 5% Carbon film	0.125 W
		R156	80.5260	8.2 Kohm 5% Carbon film	0.125 W
	+	R157	80.5259	6.8 Kohm 5% Carbon film	0.125 W
		R158	80.5242	270 ohm 5% Carbon film	0.125 W

RF UNIT RF5110

X402.653/2

TYPE	Nº	CODE	DATA	
	R160	80.5263	15 Kohm 5% Carbon film	0.125 W
	R161	80.5257	4.7 Kohm 5% Carbon film	0.125 W
	R201	80.5255	3.3 Kohm 5% Carbon film	0.125 W
	R202	80.5244	390 ohm 5% Carbon film	0.125 W
	R203	80.5233	47 ohm 5% Carbon film	0.125 W
	R204	80.5229	22 ohm 5% Carbon film	0.125 W
	R205	80.5241	220 ohm 5% Carbon film	0.125 W
	R206	89.5092	2.4 Kohm 5% Carbon film	0.125 W
	R207	80.5225	10 ohm 5% Carbon film	0.125 W
	R208	80.5230	27 ohm 5% Carbon film	0.125 W
	R209	80.5237	100 ohm 5% Carbon film	0.125 W
	R210	80.5230	27 ohm 5% Carbon film	0.125 W
	R211	89.5090	51 ohm 5% Carbon comp.	0.5 W
	R213	89.5089	10 ohm 5% Carbon comp.	0.5 W
	R215	86.5078	5 Kohm 10% Cerm. pot.	0.5 W
	R216	80.5253	2.2 Kohm 5% Carbon film	0.125 W
	R217	80.5257	4.7 Kohm 5% Carbon film	0.125 W
	R218	80.5259	6.8 Kohm 5% Carbon film	0.125 W
	R219	80.5252	1.8 Kohm 5% Carbon film	0.125 W
	R220	80.5241	220 ohm 5% Carbon film	0.125 W
	R221	80.5245	470 ohm 5% Carbon film	0.125 W
	R222	80.5246	560 ohm 5% Carbon film	0.125 W
	R223	80.5249	1 Kohm 5% Carbon film	0.125 W
+	R224	89.5089	10 ohm 5% Carbon comp.	0.5W
	R301	80.5259	6.8 Kohm 5% Carbon film	0.125 W
	R302	80.5255	3.3 Kohm 5% Carbon film	0.125 W
	R303	80.5242	270 ohm 5% Carbon film	0.125 W
	R304	80.5269	47 Kohm 5% Carbon film	0.125 W
	R305	80.5247	680 ohm 5% Carbon film	0.125 W
	R306	80.5260	8.2 Kohm 5% Carbon film	0.125 W
+	R307	80.5259	6.8 Kohm 5% Carbon film	0.125 W
	R308	80.5242	270 ohm 5% Carbon film	0.125 W
	R309	80.5229	22 ohm 5% Carbon film	0.125 W
	R310	80.5225	10 ohm 5% Carbon film	0.125 W
	R401	80.5257	4.7 Kohm 5% Carbon film	0.125 W
	R402	80.5251	1.5 Kohm 5% Carbon film	0.125 W
	R403	80.5237	100 ohm 5% Carbon film	0.125 W
	R404	80.5245	470 ohm 5% Carbon film	0.125 W
	R405	80.5233	47 ohm 5% Carbon film	0.125 W
	R406	80.5252	1.8 Kohm 5% Carbon film	0.125 W
	R407	80.5237	100 ohm 5% Carbon film	0.125 W
	R501	80.5249	1 Kohm 5% Carbon film	0.125 W
	R502	80.5266	27 Kohm 5% Carbon film	0.125 W
	R503	80.5266	27 Kohm 5% Carbon film	0.125 W
	R504	80.5243	330 ohm 5% Carbon film	0.125 W
	R505	80.5242	270 ohm 5% Carbon film	0.125 W
	R506	80.5260	8.2 Kohm 5% Carbon film	0.125 W

Storno

TYPE	Nº	CODE	DATA	
	R507	80.5259	6.8 Kohm 5% Carbon film	0.125 W
	R508	80.5253	2.2 Kohm 5% Carbon filter	0.125 W
	R509	80.5253	2.2 Kohm 5% Carbon film	0.125 W
	R510	80.5262	12 Kohm 5% Carbon film	0.125 W
	R511	80.5247	680 ohm 5% Carbon film	0.125 W
	R512	80.5243	330 ohm 5% Carbon film	0.125 W
	R513	80.5243	330 ohm 5% Carbon film	0.125 W
	R514	80.5252	1.8 Kohm 5% Carbon film	0.125 W
	R515	80.5262	12 Kohm 5% Carbon film	0.125 W
	R516	80.5247	680 ohm 5% Carbon film	0.125 W
	R517	80.5259	6.8 Kohm 5% Carbon film	0.125 W
	R518	80.5260	8.2 Kohm 5% Carbon film	0.125 W
	R519	80.5252	1.8 Kohm 5% Carbon film	0.125 W
	R520	80.5261	10 Kohm 5% Carbon film	0.125 W
	R521	86.5060	25 Kohm 20% Carbon pot.	0.1W
	R522	80.5261	10 Kohm 5% Carbon film	0.125 W
	R523	80.5255	3.3 Kohm 5% Carbon film	0.125 W
	R524	80.5268	39 Kohm 5% Carbon film	0.125W
	R525	80.5268	39 Kohm 5% Carbon film	0.125 W
	R526	80.5221	4.7 ohm 5% Carbon film	0.125 W
	R527	80.5237	100 ohm 5% Carbon film	0.125 W
	R601	80.5269	47 Kohm 5% Carbon film	0.125 W
	R602	80.5265	22 Kohm 5% Carbon film	0.125 W
	R603	80.5243	330 ohm 5% Carbon film	0.125 W
	R604	80.5264	18 Kohm 5% Carbon film	0.125 W
	R605	80.5261	10 Kohm 5% Carbon film	0.125 W
	R606	80.5278	270 Kohm 5% Carbon film	0.125 W
	R607	86.5080	10 Kohm 20% Carbon pot.	0.1W
	R608	80.5259	6.8 Kohm 5% Carbon film	0.125 W
	R609	89.5053	470 ohm 20% NTC	0.6 W
	R610	80.5260	8.2 Kohm 5% Carbon film	0.125 W
	R611	80.5238	120 ohm 5% Carbon film	0.125 W
	R612	80.5245	470 ohm 5% Carbon film	0.125 W
	R613	80.5248	820 ohm 5% Carbon film	0.125 W
	R614	80.5256	3.9 Kohm 5% Carbon film	0.125 W
	R615	80.5269	47 Kohm 5% Carbon film	0.125 W
	R616	80.5261	10 Kohm 5% Carbon film	0.125 W
	R617	80.5280	390 Kohm 5% Carbon film	0.125 W
	R618	80.5262	12 Kohm 5% Carbon film	0.125 W
	R619	80.5266	27 Kohm 5% Carbon film	0.125 W
	R620	80.5266	27 Kohm 5% Carbon film	0.125 W

RF UNIT RF5110

X402.653/2

TYPE		Nº	CODE	DATA	
		R621	80.5252	1.8 Kohm 5% Carbon film	0.125 W
		R622	80.5243	330 ohm 5% Carbon film	0.125 W
		R623	80.5259	6.8 Kohm 5% Carbon film	0.125 W
		R624	80.5261	10 Kohm 5% Carbon film	0.125 W
	+	R625	89.5093	3 Kohm 5% Carbon film	0.125 W
		R626	80.5249	1 Kohm 5% Carbon film	0.125 W
	+	R627	80.5240	180 ohm 5% Carbon film	0.125 W
	+	R628	80.5239	150 ohm 5% Carbon film	0.125 W
		R629	80.5260	8.2 Kohm 5% Carbon film	0.125W
		R630	86.5077	47 Kohm 20% Carbon pot.	0.15 W
		R631	80.5229	22 ohm 5% Carbon film	0.125 W
		R632	80.5213	1 ohm 5% Carbon film	0.125 W
		R633	80.5238	120 ohm 5% Carbon film	0.125 W
		R634	80.5213	1 ohm 5% Carbon film	0.125 W
		R635	80.5234	56 ohm 5% Carbon film	0.125W
		R636	80.52XX	6.8-270 ohm 5% Carbon film	0.125W
		R637	80.5247	680 ohm 5% Carbon film	0.125 W
		R638	80.5413	1 ohm 5% Carbon film	0.25 W
		R639	80.5237	100 ohm 5% Carbon film	0.125 W
		S601	47.0641	Switch	
		T201	61.1385	RF transformer	
	+	U101	14.5141	4558 Dual OP amp.	
		U501	14.5128	CA3054 IF amplifier	
		U502	14.5129	TBA750 IF amp/detec.	
		U601	14.5130	TDA2002 AF amplifier	
		U602	14.0133	Voltage reg.	
		Y501	98.5010	10.245 MHz Crystal	98-12
		Z201	61.1384	Damping choke	
		Z202	61.1384	Damping choke	
5112		Z501	69.5037	10.7 MHz Crystal filter	25/30 kHz
5113		Z501	69.5038	10.7 MHz Crystal filter	20 kHz
5114		Z501	69.5039	10.7 MHz Crystal filter	12.5 kHz
		Z502	69.5045	455 kHz Ceram. filter	20/25/30 kHz
5114		Z502	69.5046	455 kHz Ceram. filter	12.5 kHz

Storno

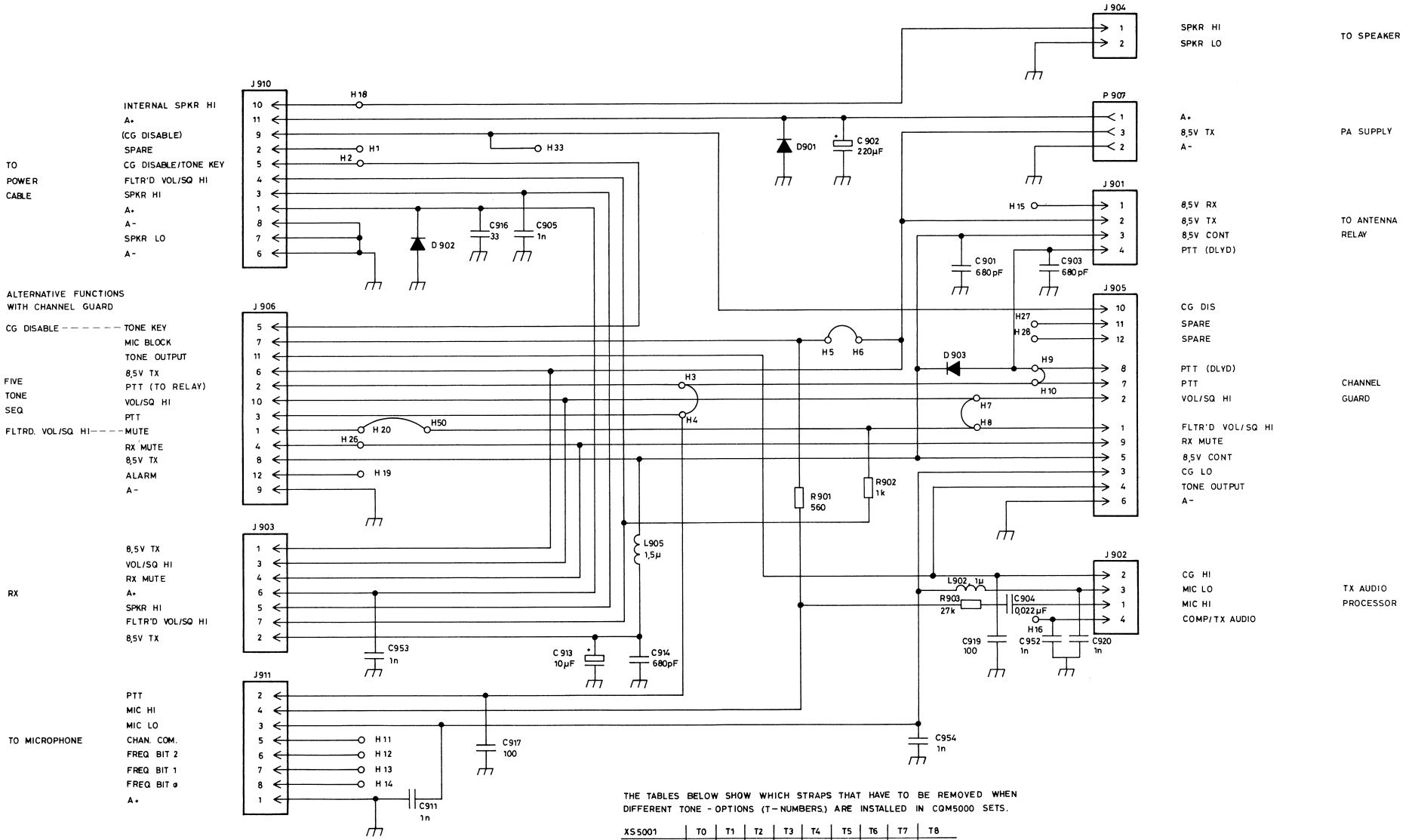
TYPE	Nº	CODE	DATA

RF UNIT RF5110

X402.653/2

Storno

Storno



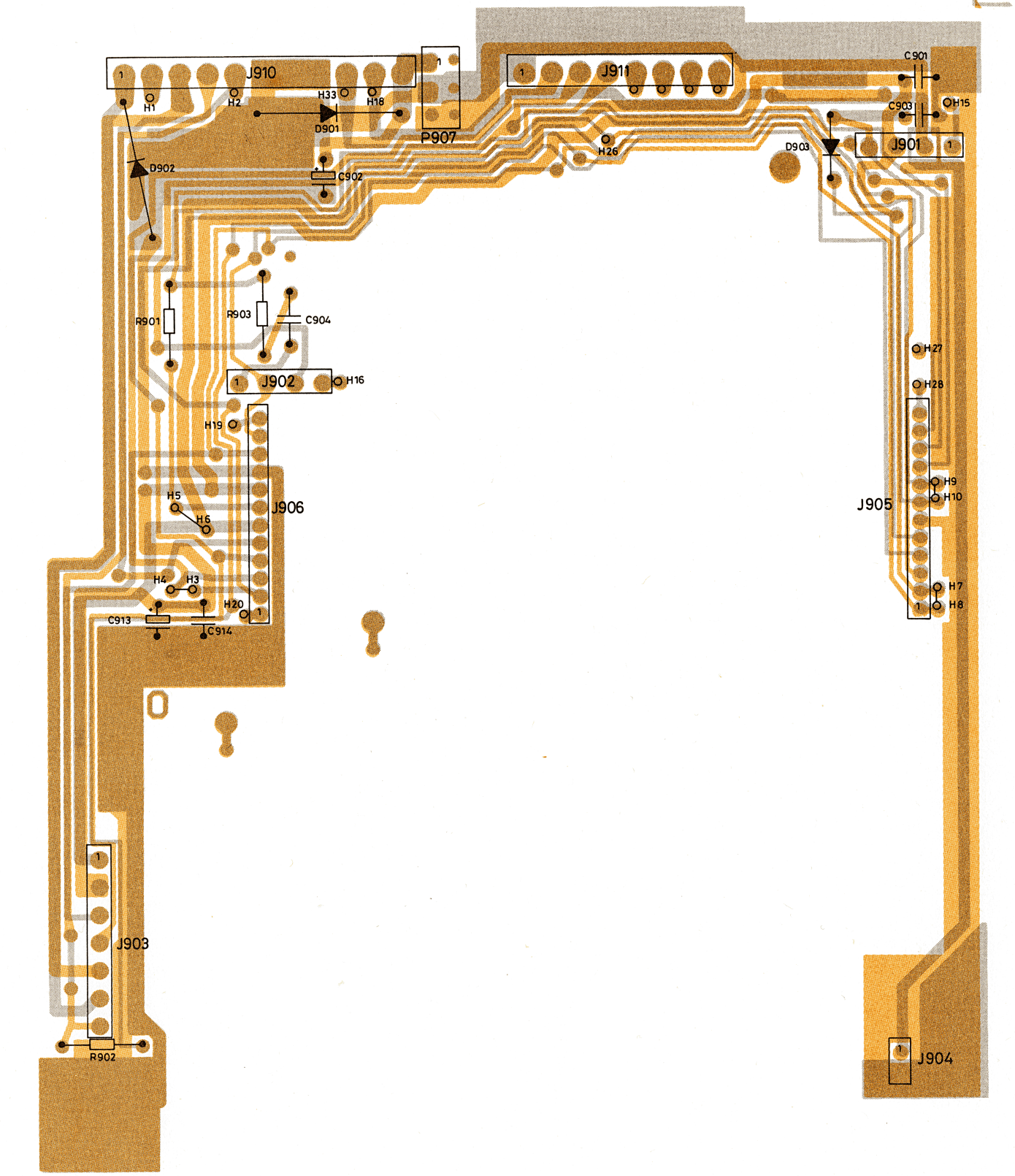
THE TABLES BELOW SHOW WHICH STRAPS THAT HAVE TO BE REMOVED WHEN DIFFERENT TONE - OPTIONS (T-NUMBERS.) ARE INSTALLED IN CQM5000 SETS.

XS 5001	T0	T1	T2	T3	T4	T5	T6	T7	T8
H3 - H4	+	-	-	-	-	+	+	+	+
H5 - H6	+	-	-	-	-	+	+	+	+
H7 - H8	+	+	+	+	+	-	-	+	-
H9 - H10	+	+	+	+	+	+	+	+	+
H20 - H50	+	-	-	-	-	+	+	+	+

INTERCONNECT UNIT XS 5001

D402.615/2

Storno



INTERCONNECT UNIT
XS 5001

D402.637

Storno

TYPE	Nº	CODE	DATA	
	C901	74.5396	680pF 20% Ceram DI	50V
	C902	73.5165	220uF -10/+100% Elco	25V
	C903	74.5396	680pF 20% Ceram DI	50V
	C904	74.5141	22nF 5% Polyest FL	50V
	C905	74.5397	1 nF 20% Ceram	50V
	C911	74.5397	1 nF 20% Ceram	50V
	C913	73.5173	10 uF 20% Tantal	25V
	C914	74.5396	680 pF 20% Ceram	50V
	C916	76.5141	22 nF 20% Polyest. Fl.	50V
	C917	74.5391	100 pF 20% Ceram	50V
	C919	74.5391	100 pF 20% Ceram	50V
	C920	74.5397	1 nF 20% Ceram	50V
	C952	74.5397	1 nF 20% Ceram	50V
	C953	74.5397	1 nF 20% Ceram	50V
	C954	74.5397	1 nF 20% Ceram	50V
	D901	99.5220	1N5401 Diode	
	D902	99.5220	1N5401 Diode	
	D903	99.5237	1N4148 Diode	
	J901	41.0228	Male connector	4 pin
	J902	41.0228	Male connector	4 pin
	J903	41.0229	Male connector	4 pin
	J904	41.0225	Male connector	2 pin
	J905	41.0227	Male connector	12 pin
	J906	41.0227	Male connector	12 pin
	J907	41.5544	Fem. connector	3 pin
	J910	41.0232	Male connector	11 pin
	L902	61.5029	1.0 uH 10% RF choke	0.65 A
	L905	61.5030	1.5 uH 10% RF choke	0.8 A
	R901	80.5246	560 ohm 5% Carbon film	0.125W
	R902	80.5249	1 Kohm 5% Carbon film	0.125W
	R903	80.5265	27 Kohm 5% Carbon film	0.125W

Storno

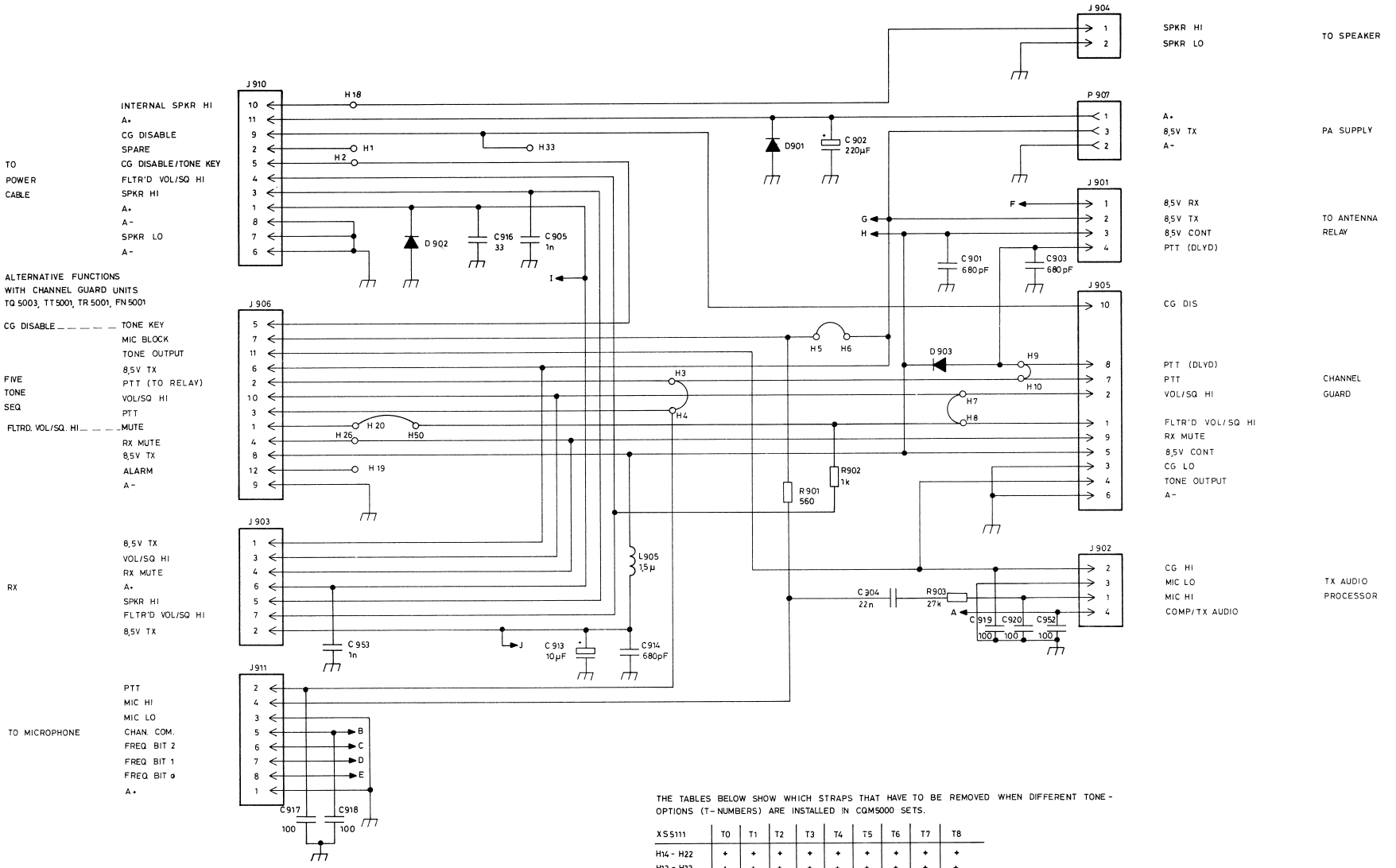
TYPE	Nº	CODE	DATA

INTERCONNECT UNIT XS5001

X402.648

Storno

Storno



THE TABLES BELOW SHOW WHICH STRAPS THAT HAVE TO BE REMOVED WHEN DIFFERENT TONE-OPTIONS (T-NUMBERS) ARE INSTALLED IN CQM5000 SETS.

XS5111	T0	T1	T2	T3	T4	T5	T6	T7	T8
H14 - H22	+	+	+	+	+	+	+	+	+
H13 - H23	+	+	+	+	+	+	+	+	+
H11 - H25	+	+	+	+	+	+	+	+	+
H32 - H29	+	+	+	+	+	+	+	+	+
H31 - H30	+	+	+	+	+	+	+	+	+
H3 - H4	+	–	–	–	–	+	+	+	+
H5 - H6	+	–	–	–	–	+	+	+	+
H7 - H8	+	+	+	+	+	–	–	+	–
H9 - H10	+	+	+	+	+	+	+	+	+
H20 - H50	+	–	–	–	–	+	+	+	+

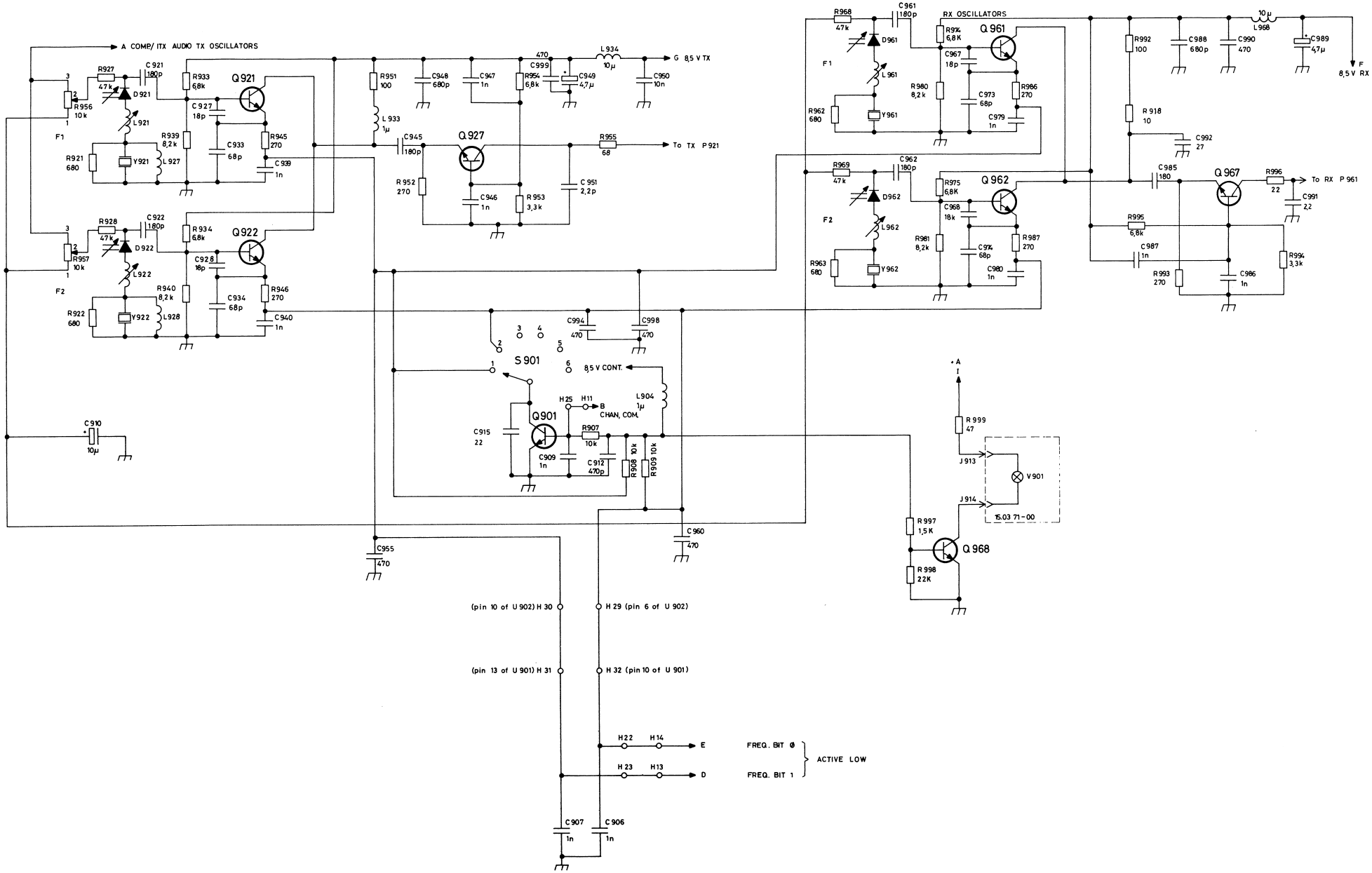
CHANNEL SELECTOR UNIT

XS 5111

D402.635

Storno

Storno

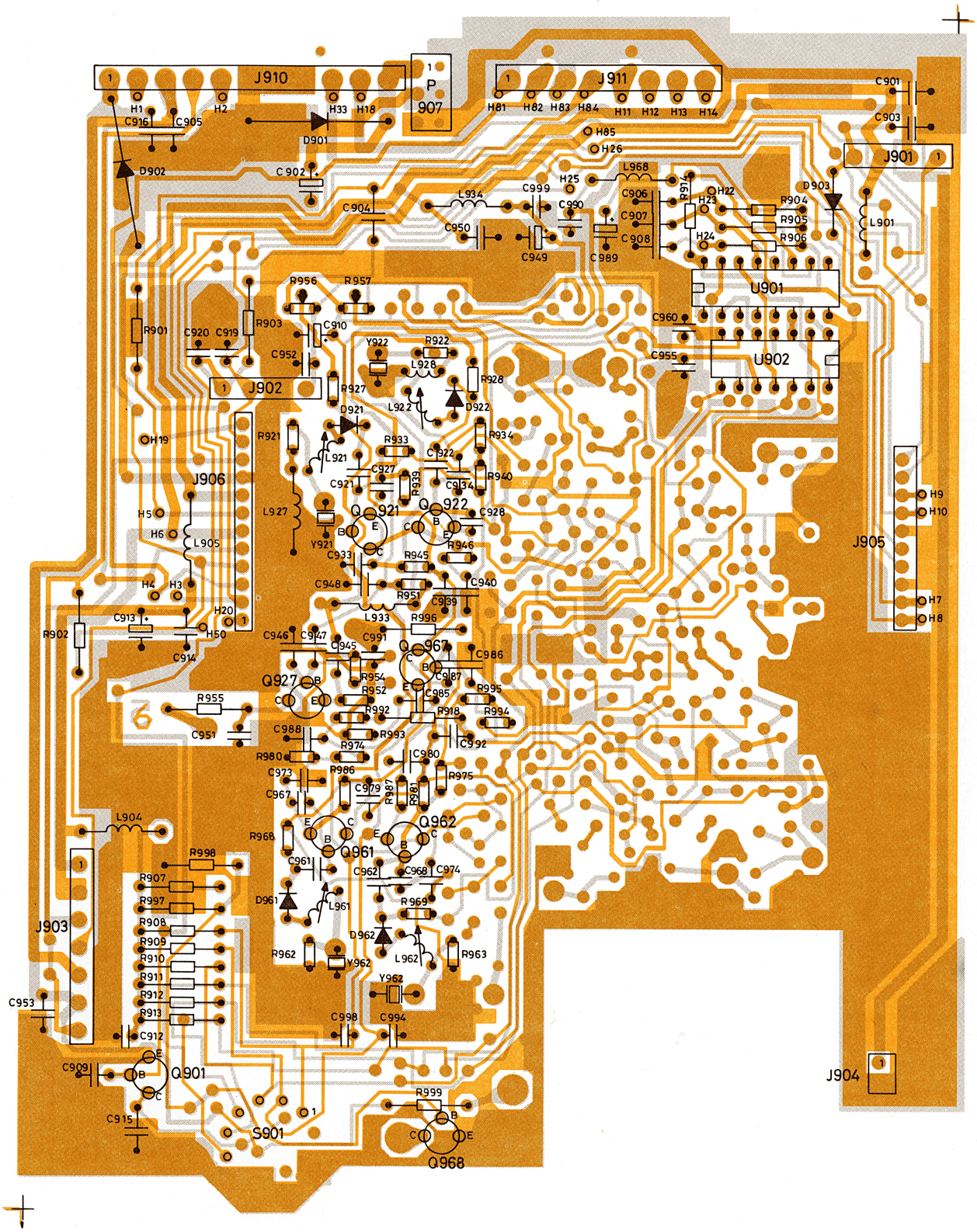


CHANNEL SELECTOR UNIT XS 5111
OSCILLATOR SECTION

D402.616

Storno

Storno



CHANNEL SELECTOR UNIT XS 5111
INTERCONNECTION SECTION

D402.617/3

TYPE	Nº	CODE	DATA	
	C612	74.5395	470pF 5% Ceram DI	50V
	C901	74.5396	680pF 20% Ceram DI	50V
	C902	73.5165	220uF -10/+100% Elco	25V
	C903	74.5396	680pF 20% Ceram DI	50V
	C904	74.5141	22nF 5% Polyest FL	50V
	C905	74.5397	1nF 20% Ceram DI	50V
	C906	74.5397	1nF 20% Ceram DI	50V
	C907	74.5397	1nF 20% Ceram DI	50V
	C909	74.5397	1nF 20% Ceram DI	50V
	C910	73.5173	10uF 20% Tantal	16V
	C911	74.5397	1nF 20% Ceram DI	50V
	C913	73.5173	10uF 20% Tantal	16V
	C914	74.5396	680pF 20% Ceram DI	50V
	C915	74.5375	22pF 5% Ceram DI	50V
	C917	74.5391	100 pF 20% Ceramic DI	50V
	C918	74.5391	100 pF 20% Ceramic DI	50V
	C921	74.5386	180pF 5% Ceram DI	50V
	C922	74.5386	180pF 5% Ceram DI	50V
	C927	74.5403	18pF 5% Ceram DI	50V
	C928	74.5403	18pF 5% Ceram DI	50V
	C933	74.5405	68pF 5% Ceram DI	50V
	C934	74.5405	68pF 5% Ceram DI	50V
	C939	74.5397	1nF 20% Ceram DI	50V
	C940	74.5397	1nF 20% Ceram DI	50V
	C945	74.5386	180pF 5% Ceram DI	50V
	C946	74.5397	1nF 20% Ceram DI	50V
	C947	74.5397	1nF 20% Ceram DI	50V
	C948	74.5396	680pF 20% Ceram DI	50V
	C949	73.5172	4.7uF 20% Tantal	35V
	C950	76.5135	10nF 10% Polyest FL	50V
	C951	74.5363	2.2 pF 0.25 pF Ceramic DI	50V
	C961	74.5386	180pF 5% Ceram DI	50V
	C962	74.5386	180pF 5% Ceram DI	50V
	C967	74.5403	18pF 5% Ceram DI	50V
	C968	74.5403	18pF 5% Ceram DI	50V
	C973	74.5405	68pF 5% Ceram DI	50V
	C974	74.5405	68 pF 5% Ceramic DI	50V
	C979	74.5397	1nF 20% Ceram DI	50V
	C980	74.5397	1 nF 20% Ceramic DI	50V
	C985	74.5386	180pF 5% Ceram DI	50V
	C986	74.5377	33 pF 5% Ceramic DI	50V
	C987	74.5397	1nF 20% Ceram DI	50V
	C988	74.5396	680pF 20% Ceram DI	50V
	C989	73.5172	4.7 20% Tantal	35V
	C990	76.5135	10nF 10% Polyest FL	50V
	D901	99.5520	1N5401 Diode	
	D902	99.5220	1N5401 Diode	
	D903	99.5237	1N4148 Diode	

Storno

TYPE	Nº	CODE	DATA	
	D921	99.5341	Varicap	
	D922	99.5341	Varicap	
	D961	99.5341	Varicap	
	D962	99.5341	Varicap	
	J901	41.0228	Male connector	4 pin
	J902	41.0228	Male connector	4 pin
	J903	41.0229	Male connector	7 pin
	J904	41.0225	Male connector	2 PIN
	J905	41.0227	Male connector	12 pin
	J906	41.0227	Male connector	12 pin
	J907	41.5545	Fem. connector	3 pin
	J910	41.0232	Male connector	11 pin
	J911	41.0231	Male connector	8 PIN
	L902	61.5029	1.0 uH RF choke	
	L904	61.5029	1.0 uH RF choke	
	L921	61.5032	48-58 MHz RF coil	
	L922	61.5032	48-58 MHz RF coil	
	L927	61.5030	1.5 uH RF choke	
	L928	61.5030	1.5 uH RF choke	
	L933	61.5029	1.0 uH RF choke	
	L934	61.5031	10 uH RF choke	
	L961	61.5034	45-55 MHz RF coil	
	L962	61.5034	45-55 MHz RF coil	
	L967	61.5029	1.0 uH RF choke	
	L968	61.5031	10 uH RF choke	
	P921	41.5550	Male connector	1 pin
	P961	41.5550	Male connector	1 pin
	Q901	99.5121	BC237 Transistor	
	Q921	99.5294	PN2369 Transistor	
	Q922	99.5294	PN2369 Transistor	
	Q927	995294	PN2369 Transistor	
	Q961	99.5294	PN2369 Transistor	
	Q962	99.5347	PN2369 Transistor	
	Q967	99.5347	PN2369 Transistor	
	Q968	99.5121	BC237 Transistor	
	R901	80.5246	560 ohm 5% Carbon film	0.125W
	R902	80.5249	1 Kohm 5% Carbon film	0.125W
	R903	80.5266	27 Kohm 5% Carbon film	0.125W
	R907	80.5261	10 Kohm 5% Carbon film	0.125W
	R908	80.5261	10 Kohm 5% Carbon film	0.125W
	R909	80.5261	10 Kohm 5% Carbon film	0.125W
	R918	80.8225	10 ohm 5% Carbon film	0.125W

CHANNEL SWITCH XS5111

X402.647

TYPE	Nº	CODE	DATA
	R921	80.5247	680 ohm 5% Carbon film 0.125W
	R922	80.5247	680 ohm 5% Carbon film 0.125W
	R923	80.5247	680 ohm 5% Carbon film 0.125W
	R927	80.5269	27 Kohm 5% Carbon film 0.125W
	R928	80.5269	47 Kohm 5% Carbon film 0.125W
	R933	80.5261	10 Kohm 5% Carbon film 0.125W
	R934	80.5261	10 Kohm 5% Carbon film 0.125W
	R939	80.5260	8.2 Kohm 5% Carbon film 0.125W
	R940	80.5260	8.2 Kohm 5% Carbon film 0.125W
	R945	80.5242	270 ohm 5% Carbon film 0.125W
	R946	80.5242	270 ohm 5% Carbon film 0.125W
	R951	80.5237	100 ohm 5% Carbon film 0.125W
	R952	80.5242	270 ohm 5% Carbon film 0.125W
	R953	80.5255	3.3 Kohm 5% Carbon film 0.125W
	R954	80.5259	6.8 Kohm 5% Carbon film 0.125W
	R955	80.5235	68 ohm 5% Carbon film 0.125W
	R956	86.5079	10 Kohm 10% Potentiometer 0.5W
	R957	86.5079	10 Kohm 10% Potentiometer 0.5W
	R962	80.5247	680 ohm 5% Carbon film 0.125W
	R963	80.5247	680 ohm 5% Carbon film 0.125W
	R968	80.5269	47 Kohm 5% Carbon film 0.125W
	R969	80.5269	47 Kohm 5% Carbon film 0.125W
	R974	80.5261	10 Kohm 5% Carbon film 0.125W
	R975	80.5261	10 Kohm 5% Carbon film 0.125W
	R980	80.5260	8.2 Kohm 5% Carbon film 0.125W
	R981	80.5260	8.2 Kohm 5% Carbon film 0.125W
	R986	80.5242	270 ohm 5% Carbon film 0.125W
	R987	80.5242	270 ohm 5% Carbon film 0.125W
	R992	80.5237	100 ohm 5% Carbon film 0.125W
	R993	80.5242	270 ohm 5% Carbon film 0.125W
	R994	80.5255	3.3 Kohm 5% Carbon film 0.125W
	R995	80.5259	6.8 Kohm 5% Carbon film 0.125W
	R996	80.5229	22 ohm 5% Carbon film 0.125W
	R997	80.5251	1.5 Kohm 5% Carbon film 0.125W
	R998	80.5265	22 Kohm 5% Carbon film 0.125W
	R999	80.5233	47 ohm 5% Carbon film 0.125W
	S901	47.0643	Channel switch

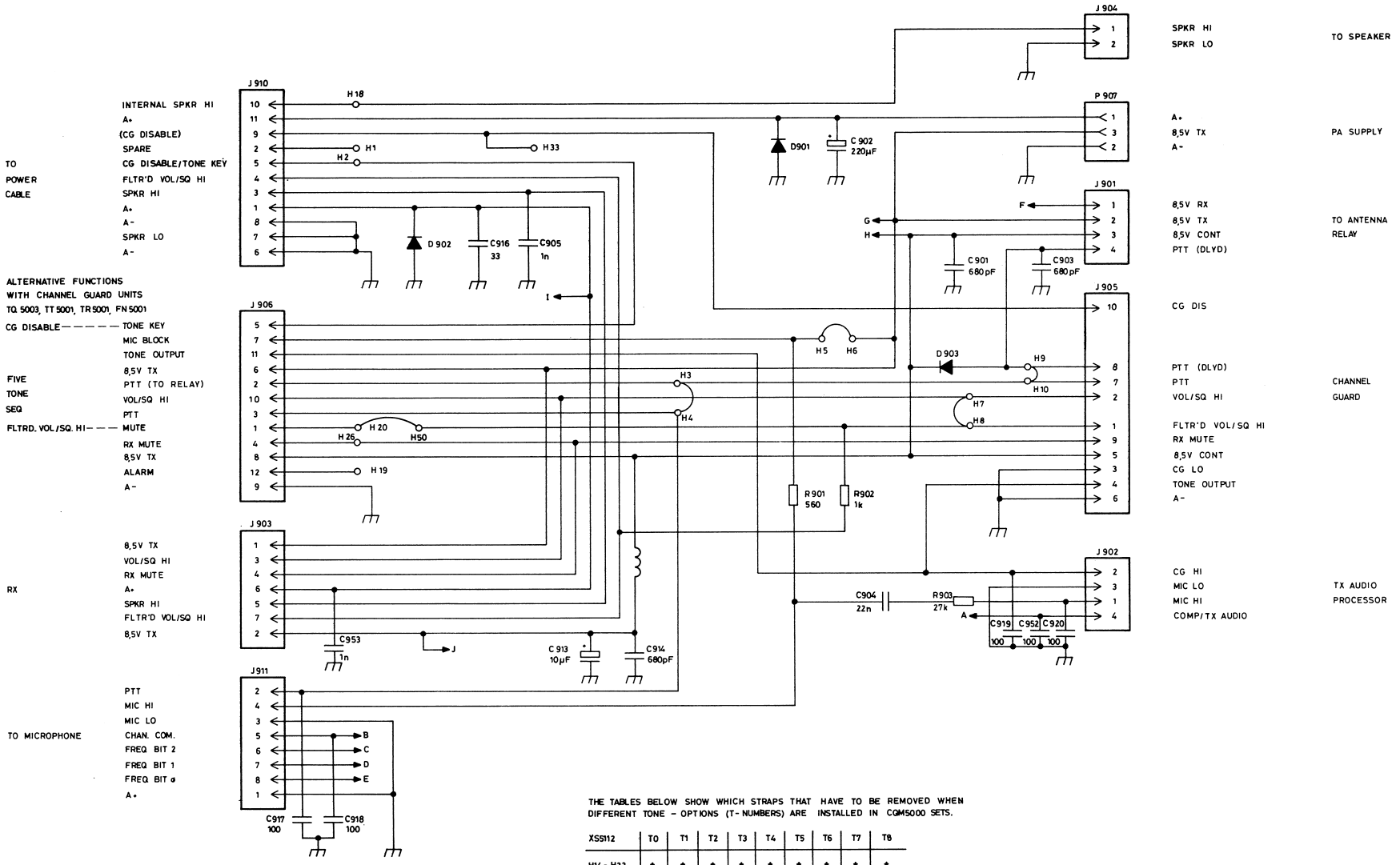
Storno

TYPE	Nº	CODE	DATA

CHANNEL SWITCH XS5111

X402.647

Storno



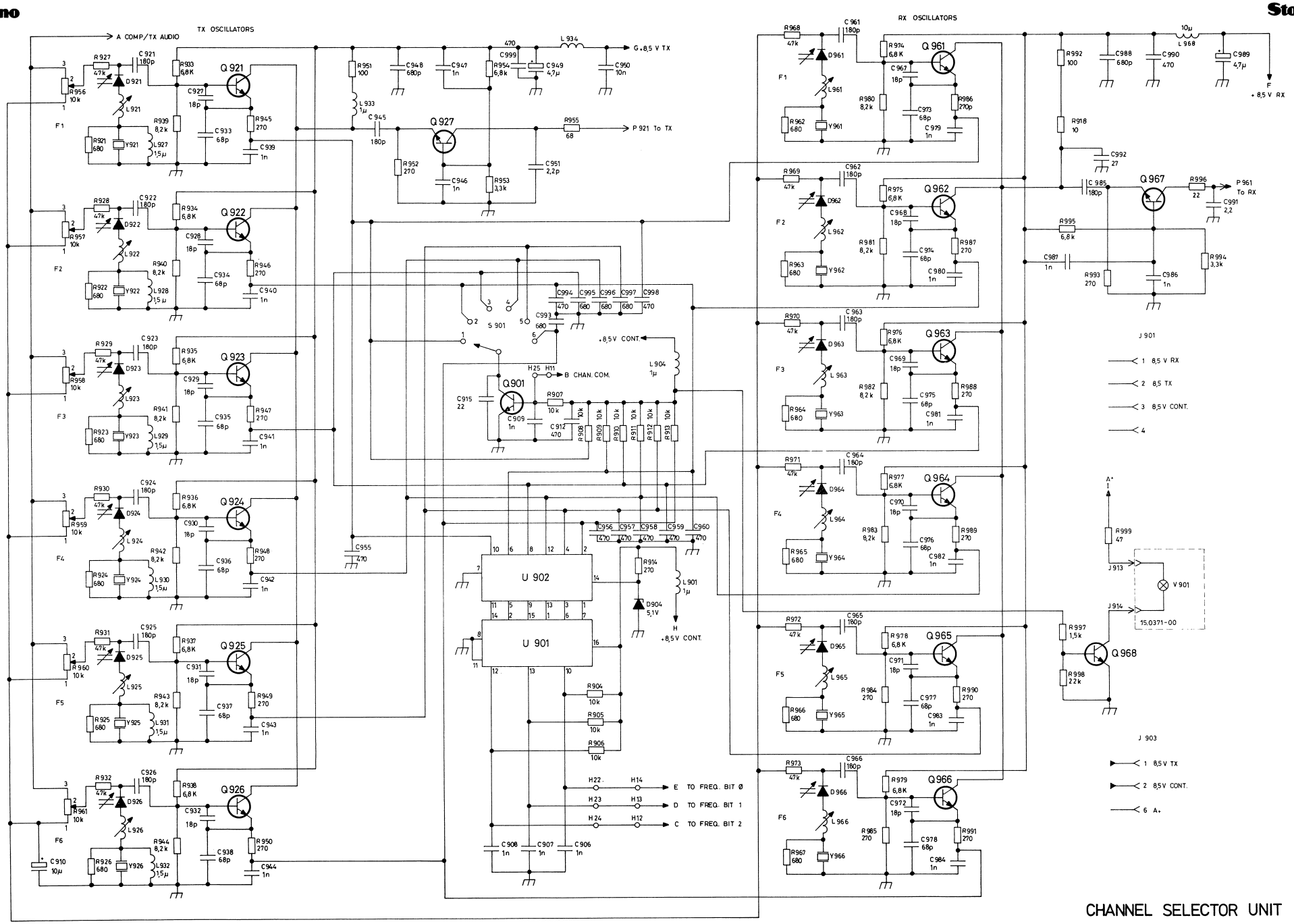
THE TABLES BELOW SHOW WHICH STRAPS THAT HAVE TO BE REMOVED WHEN DIFFERENT TONE - OPTIONS (T-NUMBERS) ARE INSTALLED IN CQM5000 SETS.

XS5112	T0	T1	T2	T3	T4	T5	T6	T7	T8
H14 - H22	+	+	+	+	+	+	+	+	+
H13 - H23	+	+	+	+	+	+	+	+	+
H12 - H24	+	+	+	+	+	+	+	+	+
H11 - H25	+	+	+	+	+	+	+	+	+
H3 - H4	+	–	–	–	–	+	+	+	+
H5 - H6	+	–	–	–	–	+	+	+	+
H7 - H8	+	+	+	+	+	–	–	+	–
H9 - H10	+	+	+	+	+	+	+	+	+
H20 - H50	+	–	–	–	–	+	+	+	+

CHANNEL SELECTOR UNIT
XS 5112

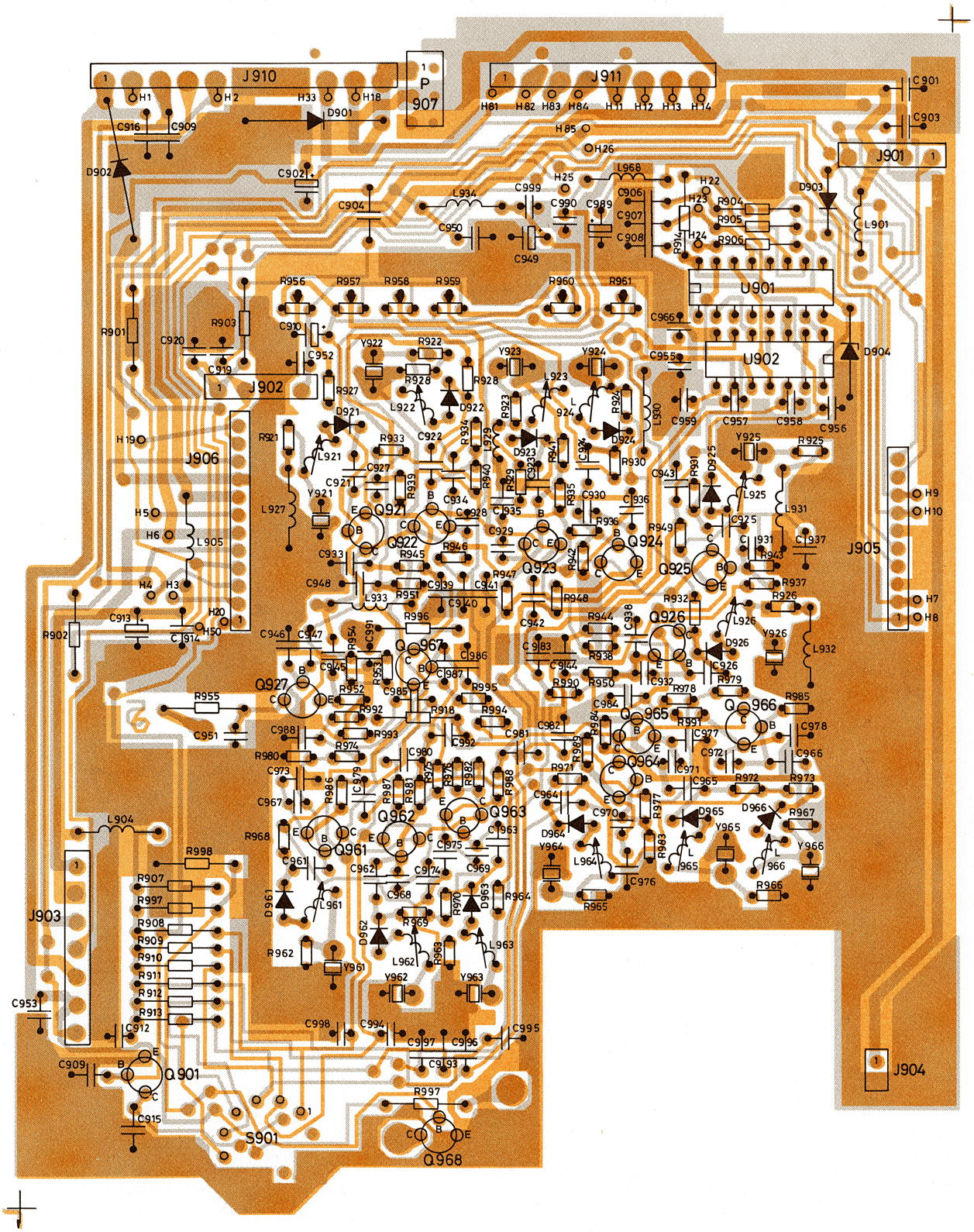
D402.636

Storno



CHANNEL SELECTOR UNIT XS 5112
OSCILLATOR SECTION

D402.618



CHANNEL SELECTOR UNIT XS5112
INTERCONNECTION SECTION

D402.619/3

TYPE	Nº	CODE	DATA	
	C901	74.5396	680pF 20% Ceram DI	50V
	C902	73.5165	220uF -10/+100% Elco	25V
	C903	74.5396	680pF 20% Ceram DI	50V
	C904	74.5141	22nF 5% Polyest FL	50V
	C905	74.5397	1nF 20% Ceram DI	50V
	C906	74.5397	1nF 20% Ceram DI	50V
	C907	74.5397	1nF 20% Ceram DI	50V
	C908	74.5397	1nF 20% Ceram DI	50V
	C909	74.5397	1nF 20% Ceram DI	50V
	C910	73.5173	10uF 20% Tantal	16V
	C911	74.5397	1nF 20% Ceram DI	50V
	C912	74.5395	470pF 5% Ceram DI	50V
	C913	73.5173	10 pF 20% Tantal	16V
	C914	74.5396	680 pF 20% Ceramic DI	50V
	C915	74.5375	22 pF 5% Ceramic DI	50V
	C915	74.5363	2.2 pF 0.25 pF Ceramic DI	50V
	C916	74.5377	33 pF 5% Ceramic DI	50V
	C916	74.5377	33 pF 5% Ceramic DI	50V
	C917	74.5391	100 pF 20% Ceramic DI	50V
	C918	74.5391	100 pF 20% Ceramic DI	50V
	C921	74.5405	180pF 5% Ceram DI	50V
	C922	74.5386	180pF 5% Ceram DI	50V
	C923	74.5386	180pF 5% Ceram DI	50V
	C924	74.5386	180pF 5% Ceram DI	50V
	C925	74.5386	180pF 5% Ceram DI	50V
	C926	74.5386	180pF 5% Ceram DI	50V
	C927	74.5403	18pF 5% Ceram DI	50V
	C928	74.5403	18pF 5% Ceram DI	50V
	C929	74.5403	18pF 5% Ceram DI	50V
	C930	74.5403	18pF 5% Ceram DI	50V
	C931	74.5403	18pF 5% Ceram DI	50V
	C932	74.5403	18pF 5% Ceram DI	50V
	C933	74.5405	68pF 5% Ceram DI	50V
	C934	74.5405	68pF 5% Ceram DI	50V
	C935	74.5405	68pF 5% Ceram DI	50V
	C936	74.5405	68pF 5% Ceram DI	50V
	C937	74.5405	68pF 5% Ceram DI	50V
	C939	74.5397	1nF 20% Ceram DI	50V
	C940	74.5397	1nF 20% Ceram DI	50V
	C941	74.5397	1nF 20% Ceram DI	50V
	C942	74,5397	1nF 20% Ceram DI	50V
	C943	74.5397	1nF 20% Ceram DI	50V
	C944	74.5397	1nF 20% Ceram DI	50V
	C945	74.5386	180pF 5% Ceram DI	50V
	C946	74.5397	1nF 20% Ceram DI	50V
	C947	74.5397	1nF 20% Ceram DI	50V
	C948	74.5396	680pF 20% Ceram DI	50V
	C949	73.5172	4.7uF 20% Tantal	35V

Storno

TYPE	Nº	CODE	DATA	
	C950	76.5135	10nF 10% Polyest FL	50V
	C961	74.5386	180pF 5% Ceram DI	50V
	C962	74.5386	180pF 5% Ceram DI	50V
	C963	74.5386	180pF 5% Ceram DI	50V
	C964	74.5386	180pF 5% Ceram DI	50V
	C965	74.5386	180pF 5% Ceram DI	50V
	C966	74.5386	180pF 5% Ceram DI	50V
	C967	74.5403	18pF 5% Ceram DI	50V
	C968	74.5403	18pF 5% Ceram DI	50V
	C969	74.5403	18pF 5% Ceram DI	50V
	C970	74.5403	18pF 5% Ceram DI	50V
	C971	74.5403	18pF 5% Ceram DI	50V
	C972	74.5403	18pF 5% Ceram DI	50V
	C973	74.5405	68pF 5% Ceram DI	50V
	C974	74.5405	68 pF 5% Ceramic DI	50V
	C975	74.5405	68pF 5% Ceram DI	50V
	C976	74.5405	68pF 5% Ceram DI	50V
	C977	74.5405	68pF 5% Ceram DI	50V
	C978	74.5405	68pF 5% Ceram DI	50V
	C979	74.5397	1nF 20% Ceram DI	50V
	C980	74.5397	1nF 20% Ceram DI	50V
	C981	74.5397	1nF 20% Ceram DI	50V
	C982	74.5397	1nF 20% Ceram DI	50V
	C983	74.5397	1nF 20% Ceram DI	50V
	C984	74.5397	1nF 20% Ceram DI	50V
	C985	74.5386	180pF 5% Ceram DI	50V
	C986	74.5377	33 pF 5% Ceramic DI	50V
	C987	74.5397	1nF 20% Ceram DI	50V
	C988	74.5396	680pF 20% Ceram DI	50V
	C989	73.5172	4.7 20% Tantal	35V
	C990	76.5135	10nF 10% Polyest FL	50V
	D901	99.5520	1N5401 Diode	
	D902	99.5220	1N5401 Diode	
	D903	99.5237	1N4148 Diode	
	D921	99.5341	Varicap	
	D922	99.5341	Varicap	
	D923	99.5341	Varicap	
	D924	99.5341	Varicap	
	D925	99.5341	Varicap	
	D926	99.5341	Varicap	
	D961	99.5341	Varicap	
	D962	99.5341	Varicap	

CHANNEL SWITCH XS5112

X402.646

TYPE	Nº	CODE	DATA	
	D963	99.5341	Varicap	
	D964	99.5341	Varicap	
	D965	99.5341	Varicap	
	J901	41.0228	Male connector	4 pin
	J902	41.0228	Male connector	4 pin
	J903	41.0229	Male connector	7 pin
	J904	41.0225	Male connector	2 pin
	J905	41.0227	Male connector	12 pin
	J906	41.0227	Male connector	12 pin
	J907	41.5545	Fem. connector	3 pin
	J910	41.0232	Male connector	11 pin
	J911	41.0231	Male connector	8 PIN
	L901	61.5029	1.0 uH RF choke	
	L902	61.5029	1.0 uH RF choke	
	L904	61.5029	1.0 uH RF choke	
	L921	61.5032	48-58 MHz RF coil	
	L922	61.5032	48-58 MHz RF coil	
	L923	61.5032	48-58 MHz RF coil	
	L924	61.5032	48-58 MHz RF coil	
	L925	61.5032	48-58 MHz RF coil	
	L926	61.5032	48-58 MHz RF coil	
	L927	61.5030	1.5 uH RF choke	
	L928	61.5030	1.5 uH RF choke	
	L929	61.5030	1.5 uH RF choke	
	L930	61.5030	1.5 uH RF choke	
	L931	61.5030	1.5 uH RF choke	
	L932	61.5030	1.5 uH RF choke	
	L933	61.5029	1.0 uH RF choke	
	L934	61.5031	10 uH RF choke	
	L961	61.5034	45-55 MHz RF coil	
	L962	61.5034	45-55 MHz RF coil	
	L963	61.5034	45-55 MHz RF coil	
	L964	61.5034	45-55 MHz RF coil	
	L965	61.5034	45-55 MHz RF coil	
	L966	61.5034	45-55 MHz RF coil	
	L968	61.5031	10 uH RF choke	
	P921	41.5550	Male connector	1 pin
	P961	41.5550	Male connector	1 pin
	Q901	99.5121	BC237 Transistor	
	Q921	99.5294	PN2369 Transistor	
	Q922	99.5294	PN2369 Transistor	
	Q923	99.5294	PN2369 Transistor	
	Q924	99.5294	PN2369 Transistor	
	Q925	99.5294	PN2369 Transistor	
	Q925	99.5294	PN2369 Transistor	
	Q926	99.5294	PN2369 Transistor	
	Q927	995294	PN2369 Transistor	
	Q961	99.5294	PN2369 Transistor	

TYPE	Nº	CODE	DATA	
	Q962	99.5294	PN2369 Transistor	
	Q963	99.5347	PN2369 Transistor	
	Q964	99.5294	PN2369 Tranisitor	
	Q965	99.5294	PN2369 Transistor	
	Q966	99.5294	2N2369A Transistor	
	Q966	99.5347	PN2369 Transistor	
	Q967	99.5347	PN2369 Transistor	
	Q968	99.5121	BC237 Transistor	
	R901	80.5246	560 ohm 5% Carbon film	0.125W
	R902	80.5249	1 Kohm 5% Carbon film	0.125W
	R903	80.5266	27 Kohm 5% Carbon film	0.125W
	R904	80.5261	10 Kohm 5% Carbon film	0.125W
	R905	80.5261	10 Kohm 5% Carbon film	0.125W
	R906	80.5261	10 Kohm 5% Carbon film	0.125W
	R907	80.5261	10 Kohm 5% Carbon film	0.125W
	R908	80.5261	10 Kohm 5% Carbon film	0.125W
	R909	80.5261	10 Kohm 5% Carbon film	0.125W
	R910	80.5261	10 Kohm 5% Carbon film	0.125W
	R911	80.5261	10 Kohm 5% Carbon film	0.125W
	R912	80.5261	10 Kohm 5% Carbon film	0.125W
	R913	80.5261	10 Kohm 5% Carbon film	0.125W
	R914	80.5242	270 ohm 5% Carbon film	0.125W
	R918	80.8225	10 ohm 5% Carbon film	0.125W
	R921	80.5247	680 ohm 5% Carbon film	0.125W
	R922	80.5247	680 ohm 5% Carbon film	0.125W
	R923	80.5247	680 ohm 5% Carbon film	0.125W
	R924	80.5247	680 ohm 5% Carbon film	0.125W
	R925	80.5247	680 ohm 5% Carbon film	0.125W
	R926	80.5247	680 ohm 5% Carbon film	0.125W
	R927	80.5269	47 Kohm 5% Carbon film	0.125W
	R928	80.5269	47 Kohm 5% Carbon film	0.125W
	R929	80.5269	47 Kohm 5% Carbon film	0.125W
	R930	80.5269	47 Kohm 5% Carbon film	0.125W
	R931	80.5269	47 Kohm 5% Carbon film	0.125W
	R932	80.5269	47 Kohm 5% Carbon film	0.125W
	R933	80.5261	10 Kohm 5% Carbon film	0.125W
	R934	80.5261	10 Kohm 5% Carbon film	0.125W
	R935	80.5261	10 Kohm 5% Carbon film	0.125W
	R936	80.5261	10 Kohm 5% Carbon film	0.125W
	R937	80.5261	10 Kohm 5% Carbon film	0.125W
	R938	80.5261	10 Kohm 5% Carbon film	0.125W
	R939	80.5260	8.2 Kohm 5% Carbon film	0.125W

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TYPE	Nº	CODE	DATA	
	R940	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R941	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R942	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R943	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R944	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R945	80.5242	270 ohm 5% Carbon film	0.125W
	R946	80.5242	270 ohm 5% Carbon film	0.125W
	R947	80.5242	270 ohm 5% Carbon film	0.125W
	R948	80.5242	270 ohm 5% Carbon film	0.125W
	R949	80.5242	270 ohm 5% Carbon film	0.125W
	R950	80.5242	270 ohm 5% Carbon film	0.125W
	R951	80.5237	100 ohm 5% Carbon film	0.125W
	R952	80.5242	270 ohm 5% Carbon film	0.125W
	R953	80.5255	3.3 Kohm 5% Carbon film	0.125W
	R954	80.5259	6.8 Kohm 5% Carbon film	0.125W
	R955	80.5235	68 ohm 5% Carbon film	0.125W
	R956	86.5079	10 Kohm 10% Potentiometer	0.5W
	R957	86.5079	10 Kohm 10% Potentiometer	0.5W
	R958	86.5079	10 Kohm 10% Potentiometer	0.5W
	R959	86.5079	10 Kohm 10% Potentiometer	0.5W
	R960	86.5079	10 Kohm 10% Potentiometer	0.5W
	R961	86.5079	10 Kohm 10% Potentiometer	0.5W
	R962	80.5247	680 ohm 5% Carbon film	0.125W
	R963	80.5247	680 ohm 5% Carbon film	0.125W
	R964	80.5247	680 ohm 5% Carbon film	0.125W
	R965	80.5247	680 ohm 5% Carbon film	0.125W
	R966	80.5247	680 ohm 5% Carbon film	0.125W
	R967	80.5247	680 ohm 5% Carbon film	0.125W
	R968	80.5269	47 Kohm 5% Carbon film	0.125W
	R969	80.5269	47 Kohm 5% Carbon film	0.125W
	R970	80.5269	47 Kohm 5% Carbon film	0.125W
	R971	80.5269	47 Kohm 5% Carbon film	0.125W
	R972	80.5269	47 Kohm 5% Carbon film	0.125W
	R973	80.5269	47 Kohm 5% Carbon film	0.125W
	R974	80.5261	10 Kohm 5% Carbon film	0.125W
	R975	80.5261	10 Kohm 5% Carbon film	0.125W
	R976	80.5261	10 Kohm 5% Carbon film	0.125W
	R977	80.5261	10 Kohm 5% Carbon film	0.125W
	R978	80.5261	10 Kohm 5% Carbon film	0.125W
	R979	80.5261	10 Kohm 5% Carbon film	0.125W
	R980	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R981	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R982	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R983	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R984	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R985	80.5260	8.2 Kohm 5% Carbon film	0.125W
	R986	80.5242	270 ohm 5% Carbon film	0.125W
	R987	80.5242	270 ohm 5% Carbon film	0.125W

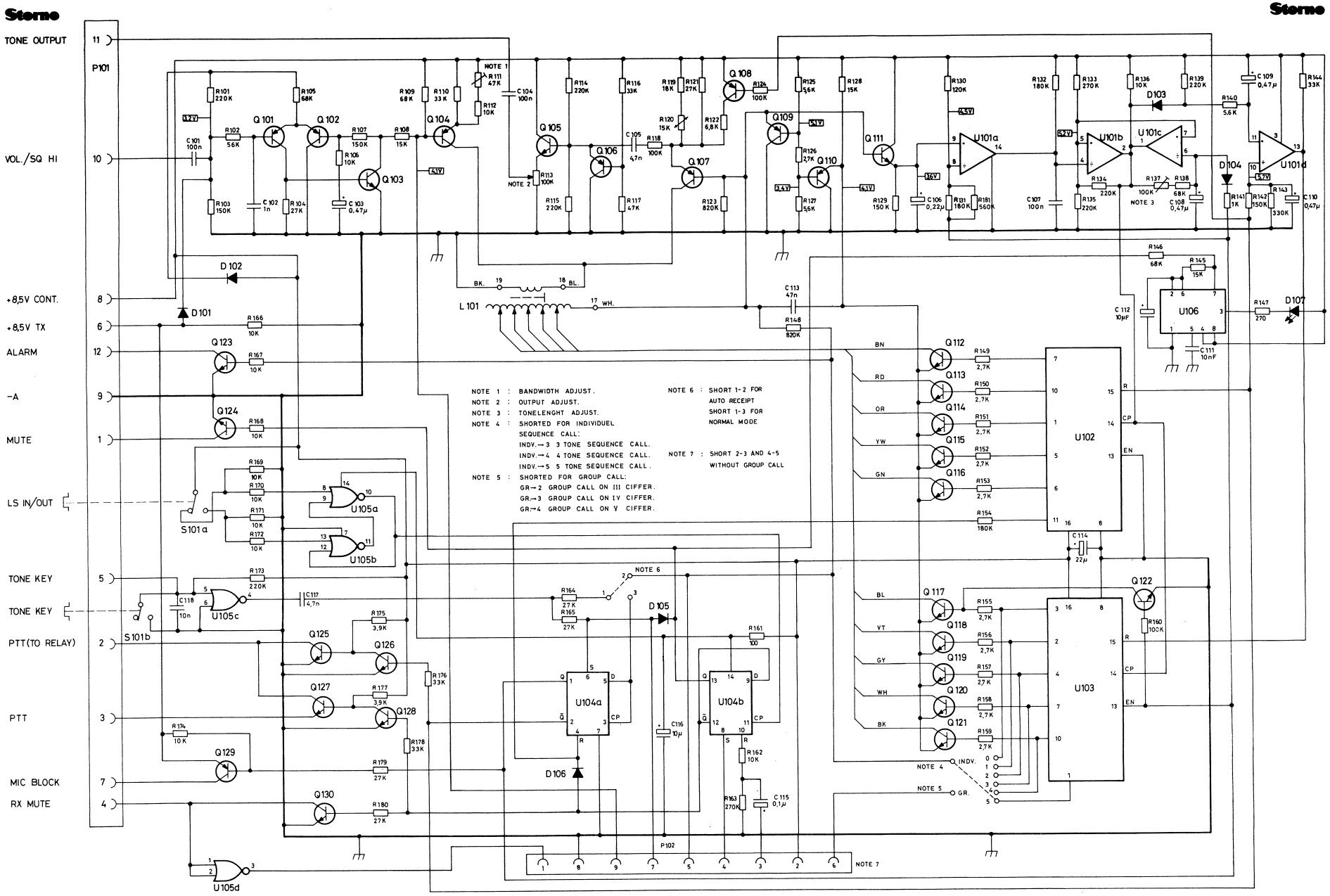
Storno

TYPE	Nº	CODE	DATA	
	R988	80.5242	270 ohm 5% Carbon film	0.125W
	R989	80.5242	270 ohm 5% Carbon film	0.125W
	R990	80.5242	270 ohm 5% Carbon film	0.125W
	R991	80.5242	270 ohm 5% Carbon film	0.125W
	R992	80.5237	100 ohm 5% Carbon film	0.125W
	R993	80.5242	270 ohm 5% Carbon film	0.125W
	R994	80.5255	3.3 Kohm 5% Carbon film	0.125W
	R995	80.5259	6.8 Kohm 5% Carbon film	0.125W
	R996	80.5229	22 ohm 5% Carbon film	0.125W
	R997	80.5251	1.5 Kohm 5% Carbon film	0.125W
	R998	80.5265	22 Kohm 5% Carbon film	0.125W
	R999	80.5233	47 ohm 5% Carbon film	0.125W
	S901	47.0643	Channel switch	
	U901	14.5133	4028 BCD/DEC. decoder	
	U902	14.5025	6405N Hex. inverter O.C	

CHANNEL SWITCH XS5112

X402, 646

Storno



SEQUENTIAL TONE UNIT
TQ 5001, TQ 5002

D402.610/2

TYPE	Nº	CODE	DATA
		10.3651	SI804 Battery Tester.
	R1	80.5443	330 ohm 5% carbon film 0.25 W
	R2	80.5261	10 Kohm 5% carbon film 0.125W
	R3	84.5228	47 ohm wirewound 4 W
	R4	84.5227	27 ohm wirewound 7 W
	R5	84.5224	82 ohm wirewound 4 W
	R6	86.5039	10 Kohm carbon potentiom 0.1 W
	R7	86.5044	25 Kohm carbon potentiom 0.1 W
	R8	86.5039	10 Kohm carbon potentiom 0.1 W
	01-5	47.0645	Switch assembly
	E1	99.5226	8.2V Zenerdiode 0.25 W
	M1	95.5021	400 uA meter

Storno

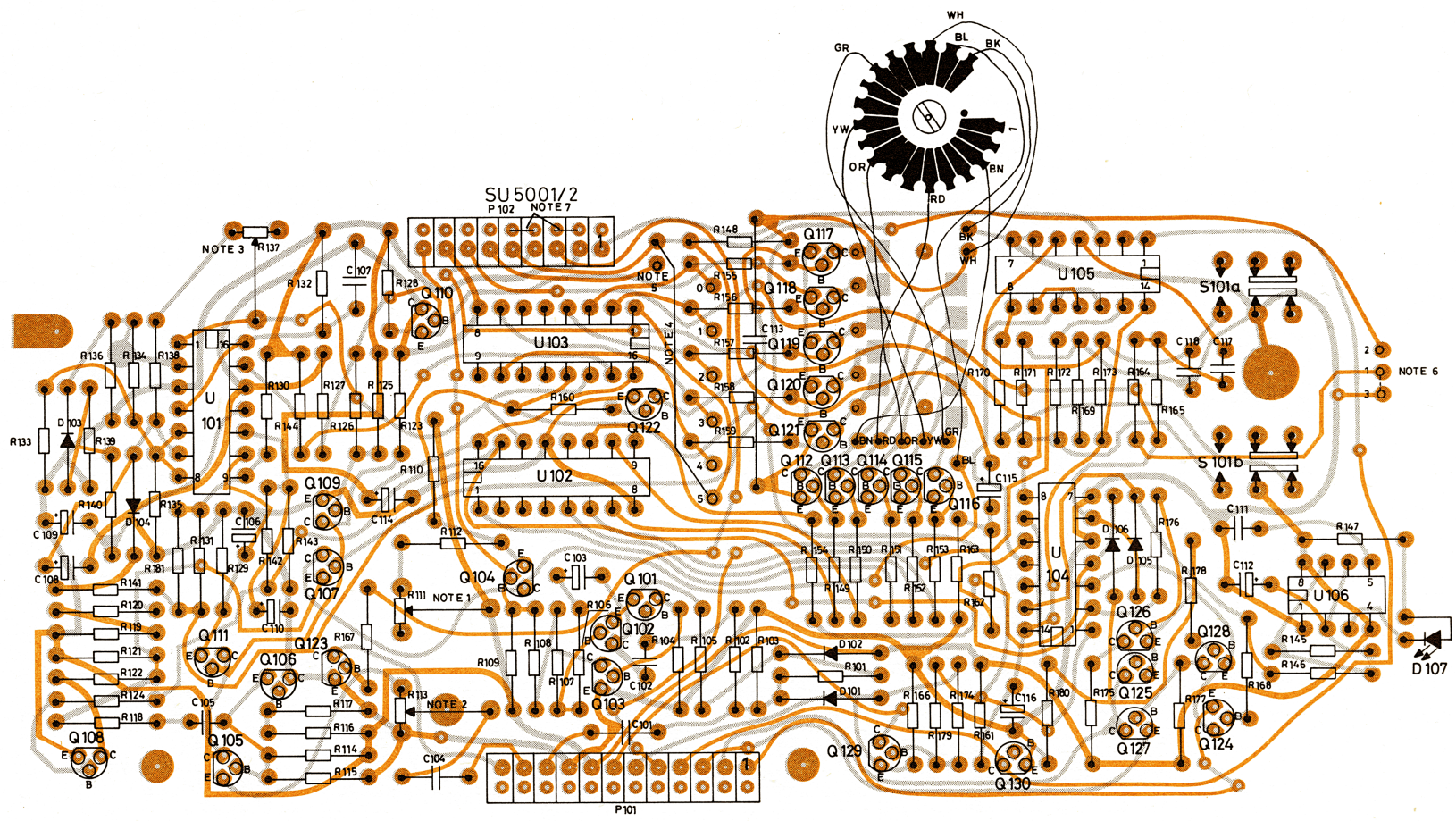
TYPE	Nº	CODE	DATA

BATTERY TESTER SI804

X402.800

Storno

COIL TERM	DIGIT	TQ5001 STORNO FREQ	TQ5002 CCIR FREQ
1	X	885 Hz	960 Hz
2	Y	970 Hz	1062 Hz
3	1	1060 Hz	1124 Hz
4	2	1160 Hz	1197 Hz
5	3	1270 Hz	1275 Hz
6	4	1400 Hz	1358 Hz
7	5	1530 Hz	1446 Hz
8	6	1670 Hz	1540 Hz
9	7	1830 Hz	1640 Hz
10	8	2000 Hz	1747 Hz
11	9	2200 Hz	1860 Hz
12	0	2400 Hz	1981 Hz
13	R	2600 Hz	2110 Hz
14	A	2800 Hz	-



SEQUENTIAL TONE UNIT
COMPONENT LAYOUT
TQ 5001 , TQ 5002

D402.622/2

Storno

TYPE	Nº	CODE	DATA	
	C101	76.5144	0.1 uF 10% Polyest. FL	63 V
	C102	76.5129	1 nF 10% Polyest. FL	50 V
	C103	73.5169	0.47 uF 20% Tantal	35 V
	C104	76.5144	0.1 uF 10% Polyest. FL	63V
	C105	76.5133	4.7 nF 10% Polyest. FL	50 V
	C106	73.5168	0.22 uF 20% Tantal	35 V
	C107	76.5144	0.1 uF 10% Polyest. FL	63 V
	C108	73.5169	0.47 uF 20% Tantal	35 V
	C109	73.5169	0.47 uF 20% Tantal	35 V
	C110	73.5169	0.47 uF 20% Tantal	35 V
	C111	76.5135	10 nF 10% Polyest. FL	50 V
	C112	73.5173	10 uF 20% Tantal	16 V
	C113	76.5123	47 nF 25% Polyest. TB	63 V
	C114	73.5174	22 uF 20% Tantal	16 V
	C115	73.5167	0.1 uF 20% Tantal	35 V
	C116	73.5173	10 uF 20% Tantal	16 V
	C117	76.5133	4.7 nF 10% Polyest. FL	50 V
	C118	76.5135	10 nF 10% Polyest. FL	50 V
	D101	99.5237	1N4148 Diode	
	D102	99.5237	1N4148 Diode	
	D103	99.5237	1N4148 Diode	
	D104	99.5237	1N4148 Diode	
	D105	99.5237	1N4148 Diode	
	D106	99.5237	1N4148 Diode	
	D107	99.5325	LED Yellow	
TQ5001	L1	61.1337	Tone coil	
TQ5002	L1	61.1366	Tone coil	
	P101	41.5549	Fem. Connector	2 PIN
	P102	41.5548	Fem. Connector	9 PIN
	Q101	99.5230	BC308 Transistor	
	Q102	99.5230	BC308 Transistor	
	Q103	99.5230	BC308 Transistor	
	Q103	99.5143	BC238 Transistor	
	Q104	99.5230	BC308 Transistor	
	Q105	99.5143	BC238 Transistor	
	Q106	99.5230	BC308 Transistor	
	Q107	99.5115	BC309 Transistor	
	Q108	99.5230	BC308 Transistor	
	Q109	99.5230	BC308 Transistor	
	Q110	99.5230	BC308 Transistor	
	Q111	99.5143	BC238 Transistor	
	Q112	99.5324	BC338-25 Transistor	
	Q113	99.5324	BC338-25 Transistor	
	Q114	99.5324	BC338-25 Transistor	
	Q115	99.5324	BC338-25 Transistor	
	Q116	99.5324	BC338-25 Transistor	
	Q117	99.5324	BC338-25 Transistor	

Storno

TYPE	Nº	CODE	DATA	
	Q118	99.5324	BC338-25 Transistor	
	Q119	99.5324	BC338-25 Transistor	
	Q120	99.5324	BC338-25 Transistor	
	Q121	99.5324	BC338-25 Transistor	
	Q122	99.5143	BC238 Transistor	
	Q123	99.5143	BC238 Transistor	
	Q124	99.5143	BC238 Transistor	
	Q125	99.5143	BC238 Transistor	
	Q126	99.5143	BC238 Transistor	
	Q127	99.5143	BC238 Transistor	
	Q128	99.5143	BC238 Transistor	
	Q129	99.5230	BC308 Transistor	
	Q130	99.5143	BC238 Transistor	
	R101	80.5277	220 Kohm 5% Carbon film	0.125 W
	R102	80.5270	56 Kohm 5% Carbon film	0.125 W
	R103	80.5275	150 Kohm 5% Carbon film	0.125 W
	R104	80.5266	27 Kohm 5% Carbon film	0.125 W
	R105	80.5271	68 Kohm 5% Carbon film	0.125 W
	R106	80.5261	10Kohm 5% Carbon film	0.125W
	R107	80.5275	150 Kohm 5% Carbon film	0.125 W
	R108	82.5263	15 Kohm 5% Carbon film	0.125 W
	R109	80.5271	68 Kohm 5% Carbon film	0.125 W
	R110	80.5267	33 Kohm 5% Carbon film	0.125 W
	R111	86.5036	47 Kohm 20% Carbon pot.	0.05 W
	R112	80.5261	10 Kohm 5% Carbon film	0.125 W
	R113	86.5074	100 Kohm 20% Carbon pot.	0.1 W
	R114	80.5277	220 Kohm 5% Carbon film	0.125 W
	R115	80.5277	220 Kohm 5% Carbon film	0.125W
	R116	80.5267	33 Kohm 5% Carbon film	0.125 W
	R117	80.5269	47 Kohm 5% Carbon film	0.125 W
	R118	80.5273	100 Kohm 5% Carbon film	0.125 W
	R119	80.5264	18 Kohm 5% Carbon film	0.125 W
	R120	89.5010	15 Kohm 20% NTC	0.5 W
	R121	80.5266	27 Kohm 5% Carbon film	0.125 W
	R122	80.5259	6.8 Kohm 5% Carbon film	0.125 W
	R123	80.5284	820 Kohm 5% Carbon film	0.125 W
	R124	80.5273	100 Kohm 5% Carbon film	0.125 W
	R125	80.5258	5.6 Kohm 5% Carbon film	0.125 W
	R126	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R127	80.5258	5.6 Kohm 5% Carbon film	0.125 W
	R128	80.5263	15 Kohm 5% Carbon film	0.125 W
	R129	80.5275	150 Kohm 5% Carbon film	0.125 W

SEQUENTIAL TONE UNIT TQ5001
SEQUENTIAL TONE UNIT TQ5002

X402.645/2

TYPE	Nº	CODE	DATA	
	R130	80.5274	120 Kohm 5% Carbon film	0.125 W
	R131	80.5276	180 Kohm 5% Carbon film	0.125 W
	R132	80.5276	180 Kohm 5% Carbon film	0.125 W
	R133	80.5278	270 Kohm 5% Carbon film	0.125 W
	R134	80.5277	220 Kohm 5% Carbon film	0.125 W
	R135	80.5277	220 Kohm 5% Carbon film	0.125 W
	R136	80.5261	10 Kohm 5% Carbon film	0.125 W
	R137	86.5074	100 Kohm 20% Carbon pot.	0.1 W
	R138	80.5271	68 Kohm 5% Carbon film	0.125 W
	R139	80.5277	220 Kohm 5% Carbon film	0.125 W
	R140	80.5258	5.6 Kohm 5% Carbon film	0.125 W
	R141	80.5249	1 Kohm 5% Carbon film	0.125 W
	R142	80.5275	150 Kohm 5% Carbon film	0.125 W
	R143	80.5279	330 Kohm 5% Carbon film	0.125 W
	R144	80.5267	33 Kohm 5% Carbon film	0.125 W
	R145	82.5263	15 Kohm 5% Carbon film	0.125 W
	R146	80.5271	68 Kohm 5% Carbon film	0.125 W
	R147	80.5243	270 ohm 5% Carbon film	0.125 W
	R148	80.5284	820 Kohm 5% Carbon film	0.125 W
	R149	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R150	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R151	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R152	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R153	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R154	80.5276	180 Kohm 5% Carbon film	0.125 W
	R155	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R156	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R157	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R158	80.5254	2.7 Kohm 5% Carbon film	0.125 W
	R159	80,5254	2.7 Kohm 5% Carbon film	0.125 W
	R160	80.5273	100 Kohm 5% Carbon film	0.125 W
	R161	80.5237	10 ohm 5% Carbon film	0.125 W
	R162	80.5261	10 Kohm 5% Carbon film	0.125 W
	R163	80.5278	270 Kohm 5% Carbon film	0.125 W
	R164	80.5266	27 Kohm 5% Carbon film	0.125 W
	R165	80.5266	27 Kohm 5% Carbon film	0.125 W
	R166	80.5261	10 Kohm 5% Carbon film	0.125 W
	R167	80.5261	10 Kohm 5% Carbon film	0.125 W
	R168	80.5261	10 Kohm 5% Carbon film	0.125 W
	R169	80.5261	10 Kohm 5% Carbon film	0.125 W
	R170	80.5261	10 Kohm 5% Carbon film	0.125 W
	R171	80.5261	10 Kohm 5% Carbon film	0.125 W
	R172	80.5261	10 Kohm 5% Carbon film	0.125 W
	R173	80.5277	220 Kohm 5% Carbon film	0.125 W
	R174	80.5261	10 Kohm 5% Carbon film	0.125 W
	R175	80.5256	3.9 Kohm 5% Carbon film	0.125 W
	R176	80.5267	33 Kohm 5% Carbon film	0.125 W

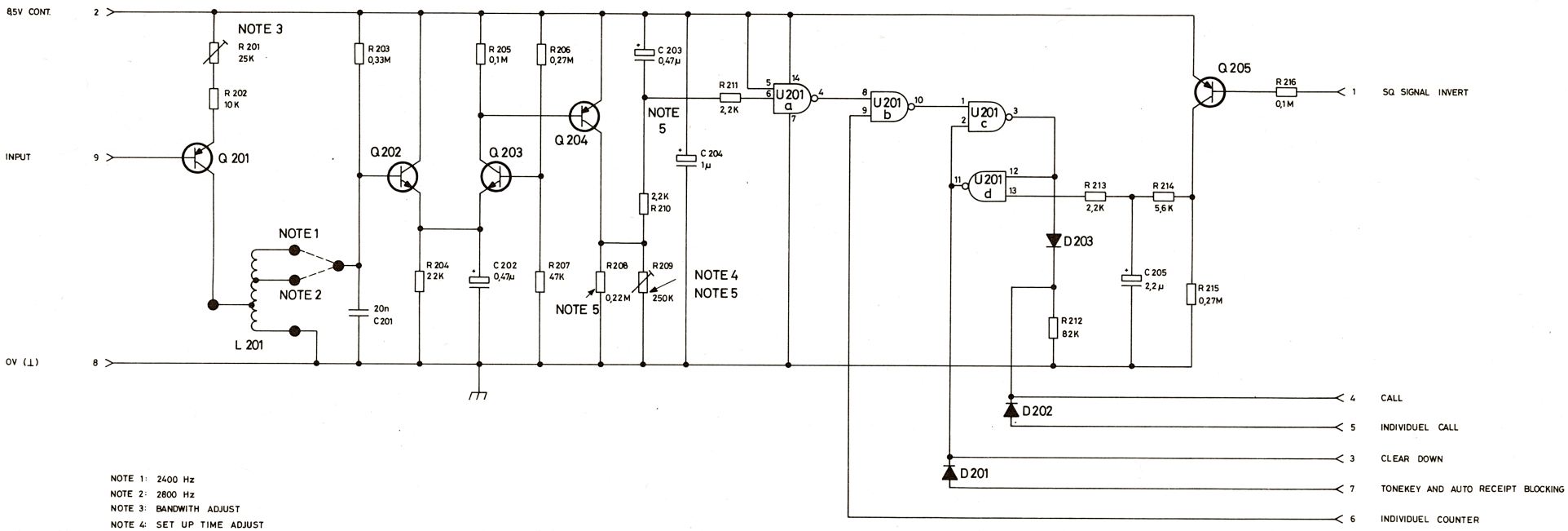
Storno

TYPE	Nº	CODE	DATA	
	R177	80.5256	3.9 Kohm 5% Carbon film	0.125 W
	R178	80.5267	33 Kohm 5% Carbon film	0.125 W
	R179	80.5266	27 Kohm 5% Carbon film	0.125 W
	R180	80.5266	27 Kobm 5% Carbon film	0.125 W
	R181	80.5281	560 Kohm 5% Carbon film	0.125 W
	S101	47.0642	Switch	
	U101	14.5019	MC3302 Quad. Comparat.	
	U102	14.5052	4017 Johnson Counter	
	U103	14.5052	4017 Johnson Counter	
	U104	14.5098	4013 Dual D-FF	
	U105	14.5074	4001 Quad. 2-inp. NAND	
	U106	14.5134	555 Timer	

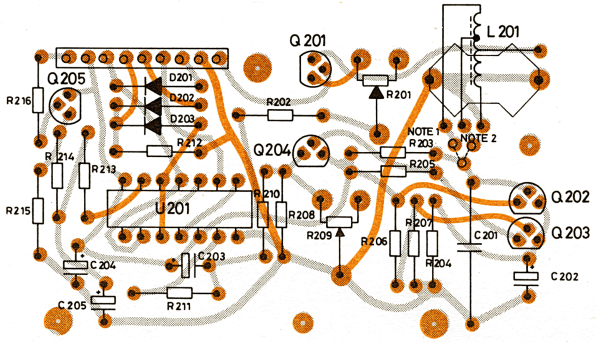
SEQUENTIAL TONE UNIT TQ5001
SEQUENTIAL TONE UNIT TQ5002

X402 645/2

Storno



NOTE 1: 2400 Hz
NOTE 2: 2800 Hz
NOTE 3: BANDWITH ADJUST
NOTE 4: SET UP TIME ADJUST
NOTE 5: FOR SU 5002
R 208 = 0,56 M
R 209 = 500 K
C 203 = 10uF/16V



GROUP CALL - ALL CALL UNIT
SU 5001, SU 5002

D402.620

Storno

TYPE	Nº	CODE	DATA	
	C202	73.5125	0.47 uF 20% Tantal	35 V
SU5002	C203	73.5109	10 uF 20% Tantal	16 V
	C204	73.5114	1 uF 20% Tantal	35 V
	C205	73.5102	2.2 uF 20% Tantal	35 V
	C210	76.5127	20 nF 2% Polystyr. TB	63 V
	D201	99.5237	1N4148 Diode	
	D202	99.5237	1N4148 Diode	
	D203	99.5237	1N4148 Diode	
	L1	61.1358	Tone coil	
	Q201	99.5237	BC308 Transistor	
	Q202	99.5143	BC238 Transistor	
	Q203	99.5143	BC238 Transistor	
	Q204	99.5237	BC308 Transistor	
	Q205	99.5237	BC308 Transistor	
	R201	86.5054	25 Kohm 20% Carbon pot.	0.05 W
	R202	80.5260	10 Kohm 5% Carbon film	0.125 W
SU5002	R203	80.5282	560 Kohm 5% Carbon film	0.125 W
	R204	80.5265	22 Kohm 5% Carbon film	0.125 W
	R205	80.5273	100 Kohm 5% Carbon film	0.125 W
	R206	80.5278	270 Kohm 5% Carbon film	0.125 W
	R207	80.5269	47 Kohm 5% Carbon film	0.125 W
	R208	80.5277	220 Kohm 5% Carbon film	0.125 W
SU5002	R209	86.5038	500 Kohm 20% Carbon pot.	0.05 W
	R210	80.5253	2.2 Kohm 5% Carbon film	0.125 W
	R211	80.5253	2.2 Kohm 5% Carbon film	0.125 W
	R212	80.5272	82 Kohm 5% Carbon film	0.125 W
	R213	80.5253	2.2 Kohm 5% Carbon film	0.125 W
	R214	80.5258	5.6 Kohm 5% Carbon film	0.125 W
	R215	80.5278	270 Kohm 5% Carbon film	0.125 W
	R216	80.5273	100 Kohm 5% Carbon film	0.125 W
	U201	14.5051	4011 Quad-2-inp. NAND	

Storno

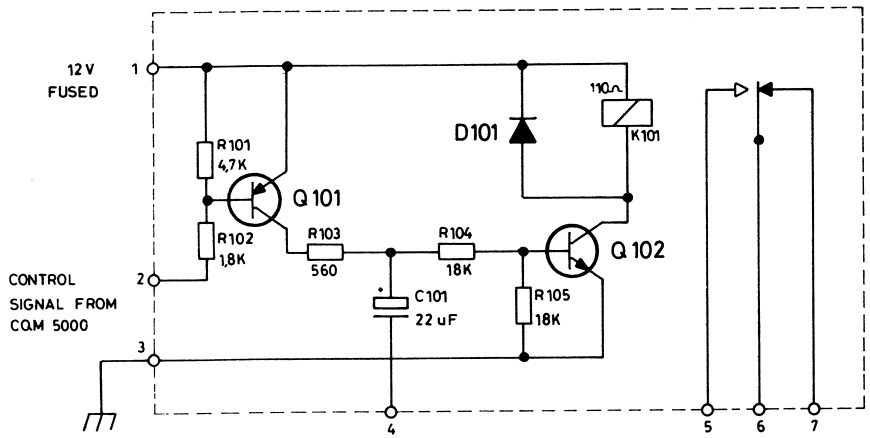
TYPE	Nº	CODE	DATA

GROUP CALL UNIT SU5001

ALL CALL UNIT SU5002

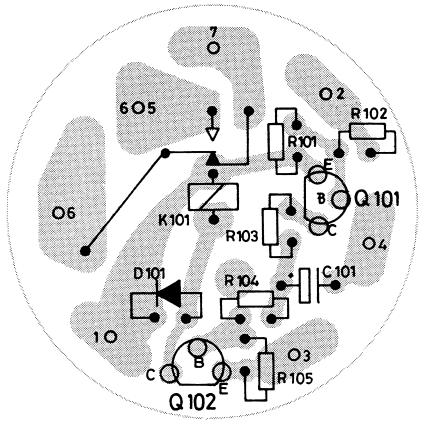
X402.649

Storno



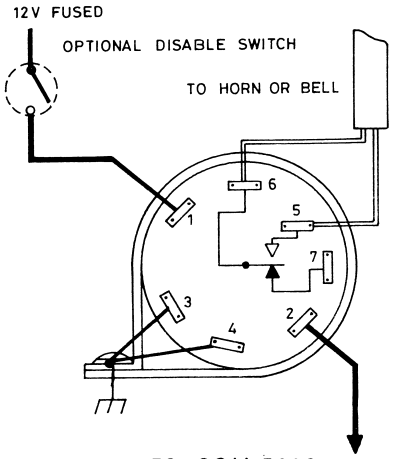
GROUND FOR DELAY

BOTTOM VIEW



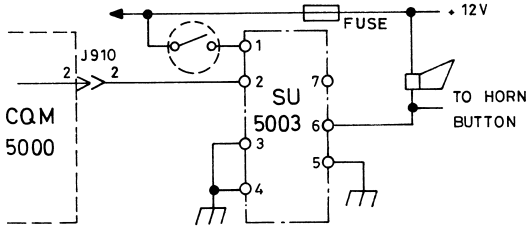
PRINTED CIRCUIT VIEWED FROM
SOLDER SIDE

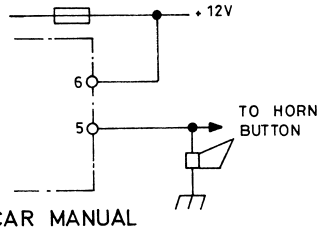
ALARM (HORN, BELL)



TO CQM 5000
CONNECTOR J910 - PIN 2

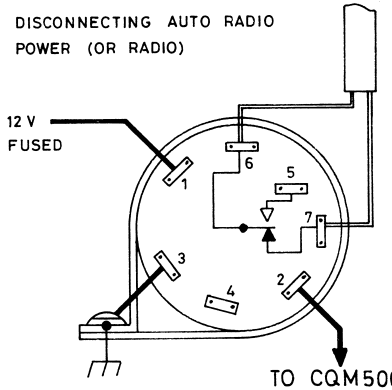
NOTES: STRAP H1 - H19 ON XS 5000.
THE HORN ALARM MAY BE
SWITCHED OFF BY A SWITCH
IN SERIES WITH 12V FUSED





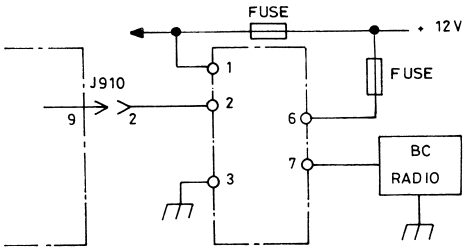
CONSULT CAR MANUAL
FOR HORN SCHEMATIC

DISCONNECTING AUTO BROADCAST RADIO



TO CQM5000
CONNECTOR J910
PIN 9

NOTES: STRAP H20 - H33 ON XS5000.
J910 - PIN 9 IS NOT FREE IF
A CHANNEL GUARD / PILOT TONE
UNIT IS CONNECTED TO J905.
J911 PIN 6 MAY BE USED IN
THESE CASES (REMOVE STRAP
H12 - H24 IF ANY) AND STRAP
H20 - H12.



SWITCHING UNIT SU5003

D402.725

Storno

TYPE	Nº	CODE	DATA	
	C101	73.5174	22uF, 20%, Tantal	16 V
	D101	99.5237	1N4148, Diode	
	FB102	65.5102	Ferrite bead	
	FB103	65.5102	Ferrite bead	
	FB103	65.5102	Ferrite bead	
	K101	58.5083	12 V Relay, 110 ohm,	
	Q101	99.5365	MPS-A13, Transistor	
	Q102	99.5251	BC307, Transistor	
	R101	80.5249	1 Kohm, 5%, Carbon film	0.125 W
	R102	80.5252	1.8 Kohm, 5%, Carbon film	0.125 W
	R103	80.5246	560 ohm, 5%, Carbon film	0.125 W
	R104	80.5264	18 Kohm, 5%, Carbon film	0.125 W
	R105	80.5264	18 Kohm, 5%, Carbon film	0.125 W

Storno

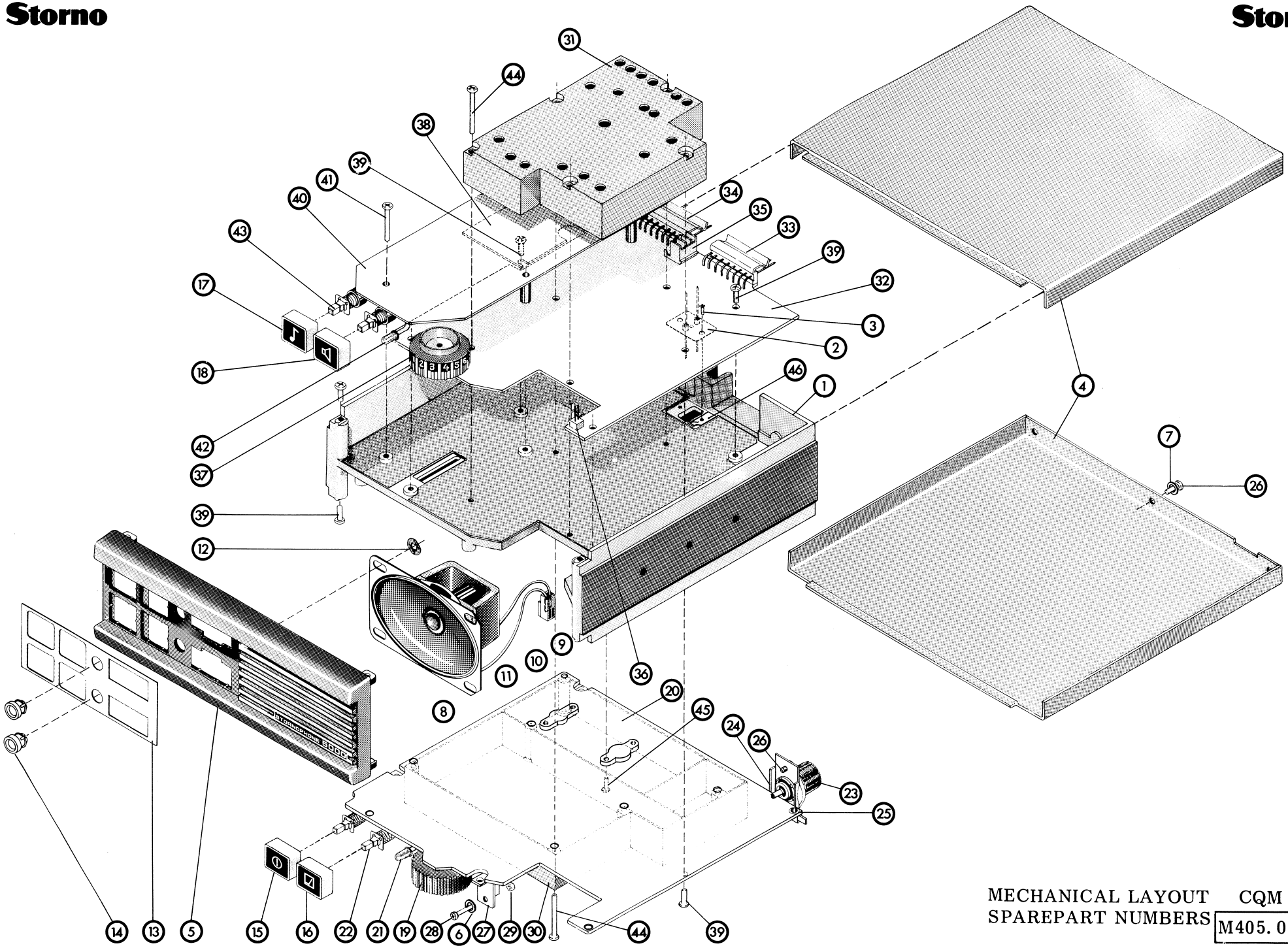
TYPE	Nº	CODE	DATA

SWITCHING UNIT SU5003

X402.710/2

Storno

Storno



MECHANICAL LAYOUT CQM 5000
SPAREPART NUMBERS M405. 096/1

ITEM	CODE	DESCRIPTION
1	10.3742-00	Cabinet Coffret
2	69.0016-00	Feed through connector Connecteur d'alimentation
3	20022-02003	Screw M2x3mm Vis M2x3mm
4	11.1177-00	Cover Couvercle
5	15.0379-00	Front cap Eur. Avant Europ.
	15.0380-00	Front cap U.S. Avant Américc
6	2450-048027	Spring washer Rondelle grower
7	2450-06032	Spring washer Rondelle grower
8	97.0018-00	Loudspeaker modified Haut-parleur modifié
9	41.5546-00	Connector housing female Prise femelle pour connecteur
10	41.5547-00	Crimp terminal for connector Embout pour connecteur
11	173.5203-00	Wire for loudspeaker Fil du H.P.
12	2432-095040	Speed nut Ecrou
		Item No. 5 to 12 are assembled under one code No. 10.3740-00 for Eur. and 10.3741 for U.S. l'ensemble des pièces 5 à 12 a le numéro 10.3740-00 (europ.) l'ensemble des pièces 5 à 12 a le numero 10.3741 (américc.)
13	51.1160-01	Nameplate } Eur. Version Plaque europ.
	51.1161-01	Nameplate
	51.1164-01	Nameplate
	51.1165-01	Nameplate
	51.1169-01	Nameplate } U.S. version Plaque américc.
	51.1170-01	Nameplate
	51.1173-01	Nameplate
	51.1174-01	Nameplate
14	32.0512-00	Bushing for led indicator Voyant pour diode lumineuse
15	490271-00	Push button(on/off) Eur. Bouton marche/arrêt europ.
	49.0275-00	Push button(on/off) U.S. Bouton marche/arrêt américc.

ITEM	CODE	DESCRIPTION
16	490272-00	Push button (SQ) Eur. Bouton de squelch europ.
	49.0276-00	Push button (SQ) U.S. Bouton de squelch américain.
17	49.0273-00	Push button (tone key) Eur. Bouton de tonalité europ.
	49.0277-00	Push button (tone key) U.S. Bouton de tonalité américain.
18	49.0274-00	Push button (LS. in/out) Eur. Bouton de H.P. europ.
	49.0278-00	Push button (LS. in/out) U.S. Bouton de H.P. américain.
19	49.0267-00	Knob volume control Eur. Bouton de volume europ.
	49.0281-00	Knob volume control U.S. Bouton de volume américain. Item No. 13 to 19 are available as a Kit for name plate. At ordering of Kit or single item see choice sheet No. M405.096-4 Les pièces 13 à 19 peuvent être commandées ensemble. Voir choice sheet M405.096-4
20	10.3732-00	RF 5112-6/10 WATT
	10.3733-00	RF 5112-25 WATT
	10.3734-00	RF 5113-6/10 WATT
	10.3776-00	RF 5113-25 WATT
	10.3735-00	RF 5114-6/10 WATT
	10.3736-00	RF 5114-25 WATT
21	99.5303-00	Light emitt. diode red Diode lumineuse rouge
22	470641-00	Switch Commutateur
23	41.5165-00	Connector UHF Connecteur UHF
24	33.0406-00	Braket Applique
25	305023-00	Tubular rivet Rivet tubulaire
26	20022-03005	Screw M3x5 Vis M3x5
27	59.0049-00	Heat sink Radiateur
28	20022.02508	Screw M2,5x8 Vis M2,5x8
29	2202-025050	Nut M2,5 Ecrou M2,5 Item No. 20 is fully assembled circuit including item No. 21 to 29. 20 complétement assemblé contient les pièces 21 à 29.

ITEM	CODE	DESCRIPTION
30	12.0357-01	Shield Eur. Ecran europ.
	12.0400-00	Shield U.S. Ecran américc.
31	12.0361-00	Shield Multifreq. Ecran multifreq.
32	10.3737-00 10.3738-00 10.3739-00	Channel selector unit XS5001 Channel selector unit XS5002 Channel selector unit XS5003 Sélecteur de canal XS5001, XS5002, XS5003
33	41.0231-00	Connector 8 pos. male Connecteur mâle 8 pos.
34	41.0232-00	Connector 11 pos. male Connecteur mâle 11 pos.
35	41.5545-00	Connector 3 pos. female Connecteur femelle 3 pos.
36	41.0225-00	Connector 2 pos. male Connecteur mâle 2 pos.
37	49.0268-00	Knob channel switch (only XS5002 and XS5003) Bouton de sélecteur de canal (pour XS5002 et XS5003 seul) Item No. 32 is fully assembled circuit including item No. 33 to 37. 32 complètement assemblé contient les pièces 33 à 37.
38	10.3745-00 10.3746-00	Switching unit SU5001 Switching unit SU5002
39	20562-03008	Screw M3x8 mm Vis M3x8 mm
40	10.3743-00 10.3744-00	Tone transmitter/receiver TQ5001 Emetteur-récepteur de tonalité TQ5001 Tone transmitter/receiver TQ5002 Emetteur-récepteur de tonalité TQ5002
41	20562-03022	Screw M3x22 mm Vis M3x22 mm
42	99.5325-00	L.E.D. Yellow Diode lumineuse jaune
43	47.0642-00	Switch Commutateur Item No. 40 is fully assembled circuit including item No. 41 to 43. 40 complètement assemblé contient les pièces 41 à 43.
44	20562-03028	Screw M3x28 mm Vis M3x28 mm
45	20022-02508	Screw M2,5x8 mm Vis M2,5x8 mm
46	36.0298-00	Plate, grounding spring Plaque à ressort de mise à la terre

Storno

Storno

* ONE CHANNEL ** MORE THAN ONE CHANNEL

CQM 5000 TONE EQUIPMENT T. No.	KIT WITH NAMEPLATE AND BUTTON				NAME PLATE Eur.				NAME PLATE US.				BUSHING Eur. & US. 32.0512-00	KNOB VOL. 49.0267-00Eur. 49.0281-00 US.	PUSH BUTTON			
	ONE CHANNEL		MORE THAN ONE CHANNEL												ON/OFF	SQ.	TONE KEY	LS. IN/OUT
	17.0116-00Eur. 17.0122-00 US.	17.0120-00Eur. 17.0126-00 US.	17.0117-00Eur 17.0123-00 US.	17.0121-00Eur. 17.0127-00 US.	* 51.1160-00	* 51.1164-00	** 51.1161-00	** 51.1165-00	* 51.1169-00	* 51.1173-00	** 51.1170-00	** 51.1174-00			49.0271-00Eur. 49.0275-00 US.	49.0272-00Eur 49.0276-00 US.	49.0273-00Eur. 49.0277-00 US.	49.0274-00Eur 49.0278-00 US.
T 0	1		1		1		1		1		1		1	1	1	1		
T 1		1		1		1		1		1		1	2	1	1	1	1	1
T 2		1		1		1		1		1		1	2	1	1	1	1	1
T 3		1		1		1		1		1		1	2	1	1	1	1	1
T 4		1		1		1		1		1		1	2	1	1	1	1	1
T 5	1		1		1		1		1		1		1	1	1	1		
T 6	1		1		1		1		1		1		1	1	1	1		
T 7	1		1		1		1		1		1		1	1	1	1		
T 8	1		1		1		1		1		1		1	1	1	1		
T 9		1		1		1		1		1		1	2	1	1	1	1	1
T 10		1		1		1		1		1		1	2	1	1	1	1	1
T 11		1		1		1		1		1		1	2	1	1	1	1	1
T 12		1		1		1		1		1		1	2	1	1	1	1	1
T 13		1		1		1		1		1		1	2	1	1	1	1	1
T 14		1		1		1		1		1		1	2	1	1	1	1	1
T 15		1		1		1		1		1		1	2	1	1	1	1	1
T 16		1		1		1		1		1		1	2	1	1	1	1	1
T 17		1		1		1		1		1		1	2	1	1	1	1	1
T 18		1		1		1		1		1		1	2	1	1	1	1	1
T 19		1		1		1		1		1		1	2	1	1	1	1	1
T 20		1		1		1		1		1		1	2	1	1	1	1	1
T 21		1		1		1		1		1		1	2	1	1	1	1	1
T 22		1		1		1		1		1		1	2	1	1	1	1	1
T 23		1		1		1		1		1		1	2	1	1	1	1	1
T 24		1		1		1		1		1		1	2	1	1	1	1	1

The versions T9 – T24 incl. are not available until further notice is given.

EXAMPLE: CQM 5112 Spec. 25x6 T21 → COMBINATIONS OF TONE EQUIPMENT
WATT ↙ ↘ NUMBER OF CHANNELS

CHOICE OF NAMEPLATE KIT AND PUSH BUTTON

M40 5.096-4