SYNTHESIZER

MOBILE RADIOTELEPHONE

TYPE CQM5112 S12

TYPE CQM5113 S12

TYPE CQM5114 S12

146 - 174 MHz

Storno

SYNTHESIZER
MOBILE RADIOTELEPHONE
TYPE CQM5112 S12
TYPE CQM5113 S12
TYPE CQM5114 S12
146 - 174 MHz

CONTENS

Service Coordination
12 - 80
1st Edition

Storno

TECHNICAL SPECIFICATIONS

CQM5110 S12

Guaranteed performance specifications unless otherwise noted.

Typical values are given in brackets.

GENERAL

Frequency Range
146 - 174 MHz

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

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

Modulation Frequency Range
CQM5112: 300 - 3000 Hz
CQM5113: 300 - 3000 Hz
CQM5114: 300 - 2550 Hz

Maximum RF Bandwidth
RX: 1.5 MHz
TX: 2.5 MHz

Antenna Impedance
50 ohm

Maximum Number of Channels
12

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

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

Dimensions
B x D x H: 180 x 90 x 60 mm

Weight
1.8 Kg

RECEIVER

Sensitivity
12 dB SINAD (EIA), ½e.m.f.
0.3 uV (0.23 uV)
60% Δfmax; f_{mod} = 1 kHz

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

60% Δfmax; f_{mod} = 1 kHz.
Measured with psophometric filter.

Crystal Frequency Range
43 - 53 MHz

Receiver VCO Frequency Range
135 - 163 MHz

Frequency Stability
Conforms with governments regulations

Modulation Acceptance Bandwidth (EIA)
CQM5112: ±7 kHz (±7.5 kHz)

Adjacent Channel Selectivity
EIA
CQM5112: 75 dB (87 dB)
FTZ
CQM5113: 70 dB (87 dB)
CEPT
CQM5112: 75 dB (87 dB)
CQM5114: 65 dB (85 dB)

Spurious Rejection EIA
80 dB

Intermodulation Attennuation
EIA
CQM5112: 70 dB (72 dB)
CEPT
CQM5112: 70 dB (75 dB)
CQM5113: 70 dB (75 dB)
CQM5114: 70 dB (73 dB)
FTZ
CQM5113: 70 dB (72 dB)

Blocking
90 dB/uV (104 dB/uV)

Radiation
Conducted: max 0.8 nW
Radiated: max. 0.8 nW

AF Load Impedance (Loudspeaker)
4 ohm

AF Power Output
3 W

AF Distortion
5% (1.5%)
60% Δf max., 1 kHz, 1 W, RF 1 mW

Modulation Response
CQM5112
300 - 3000 Hz
+1/-3 dB (+0.5/-2 dB)
relative to 1000 Hz, 6 dB/octave

CQM5113
400 - 2700 Hz
+1/-1.5 dB (+0.5/-1 dB)
300 - 400 Hz
2700 - 3000 Hz
+1.5/-3 dB (+0.5/3 dB)
relative to 1000 Hz, 6 dB/octave

CQM5114
300 - 2550 Hz
+1/-3 dB (+0.5/-2 dB)
Relative to 1000 Hz, -6 dB/octave

Hum and Noise (EIA)
Squelched: 80 dB (better than 85 dB)
Unsquelched: 55 dB (57 dB)

Recovery Time
250 ms (200 ms)

Attack Time (EIA)
150 ms (110 ms)

Squelch Closing Time (EIA)
150 ms (50 ms)

Current Consumption
Squelched: 350 mA (330 mA)
Receive; AF 2 W: 750 mA (730 mA)
(without tone equipment, 13.2 V supply)

TRANSMITTER

RF Power Output
CQM5110-6/10 W: 6/10 W
CQM5110 25 W: 25 W
R_L = 50 ohm

Crystal Frequency Range
47 - 56 MHz

Crystal Frequency Multiplication
x3

Transmitter VCO Frequency Range
146 - 174 MHz

Frequency Stability
Conforms with government regulations

Undersired Radiation
max. 0.2 uW

Sideband Noise Power (CEPT)
Better than 70 dB

AF Input Impedance
560 ohm

Modulation Sensitivity
90 mV ±3 dB
(60% Δf max, 1 kHz)

Modulation Response
CQM5112
300 - 3000 Hz
+1/-3 dB (+0.5/-2 dB)
relative to 1000 Hz, 6 dB/octave

CQM5113
400 - 2700Hz
+1/-1.5 dB (+0.5/-2 dB)
300 - 400 Hz
2700 - 3000 Hz
+1.5/-3 dB (+0.5/-2 dB)
relative to 1000 Hz, 6 dB/octave

CQM5114
300 - 2550 Hz
+1/3 dB (+0.5/-2 dB)
relative to 1000 Hz, 6 dB/octave

Modulation Distortion
fm = 1000 Hz: max. 3%
60% Δf max.
fm = 300 Hz: max. 5%
5.5% Δf max.
measured with 750 us de-emphasis

FM Hum and Noise (CEPT)
55 dB (57 dB)
(measured with 750 us de-emphasis
and psophometric filter).

Current Consumption
CQM5110 -6/10 W: less than 3/3.5 A (2.5/3 A)
CQM5110 -25 W: less than 5.9 A (5 A)

Storno

GENERAL DESCRIPTION

CQM5110 S12

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

A comparison of the various models is 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 12 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	12		12		12	

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 coloumn.

SU702 Transmitter keying switch for mounting on the dashboard.

PS702 Power supply regulator for 24 V car battery installations.

PS5001 Power supply for 220 V 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 the Frequency Synthesizer Board located on the option side of the H-frame. A test connector is also located on the synthesizer board and is accessible from the rear of the radio.

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), the Frequency Synthesizer Board (FS), and the Frequency Control (FC) mount in the top section of the chassis. Their switches and push buttons mount directly to 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.

RECEIVER DESCRIPTION

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
455 kHz 2nd IF portion with demodulator.

(refer to functional block diagram)

FONT-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 mixer and part of the transmitter PA interconnections are designed in micro-stripline techniques on the mainboard.

1st IF

The first IF frequency is 10.7 MHz. 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 455 kHz IF signal. Two diodes, D501-502, limit the output from the mixer.

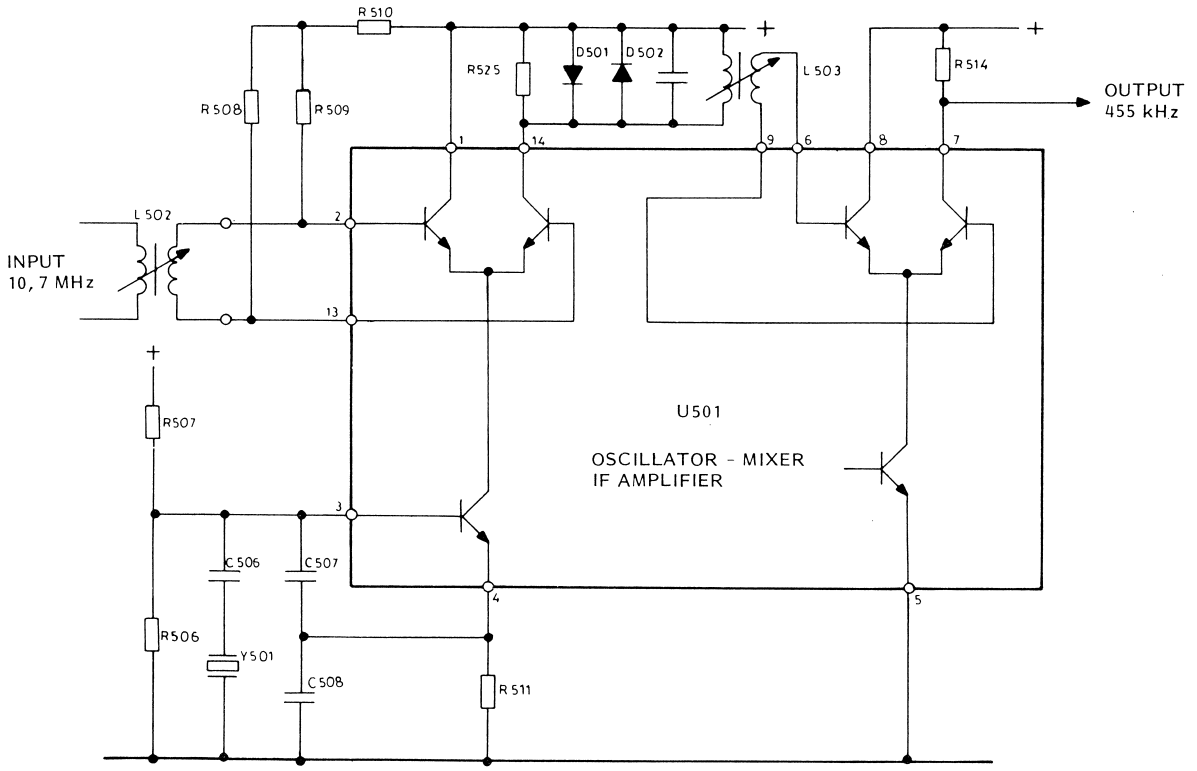


FIG. 1. SECOND OSCILLATOR , IF MIXER , AND IF AMPLIFIER

455 kHz IF/DEMODULATOR

The selectivity of the 455 kHz IF amplifier is formed by a ceramic filter fed from a 455 kHz amplifier/impedance transforming stage. The final 455 kHz 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.

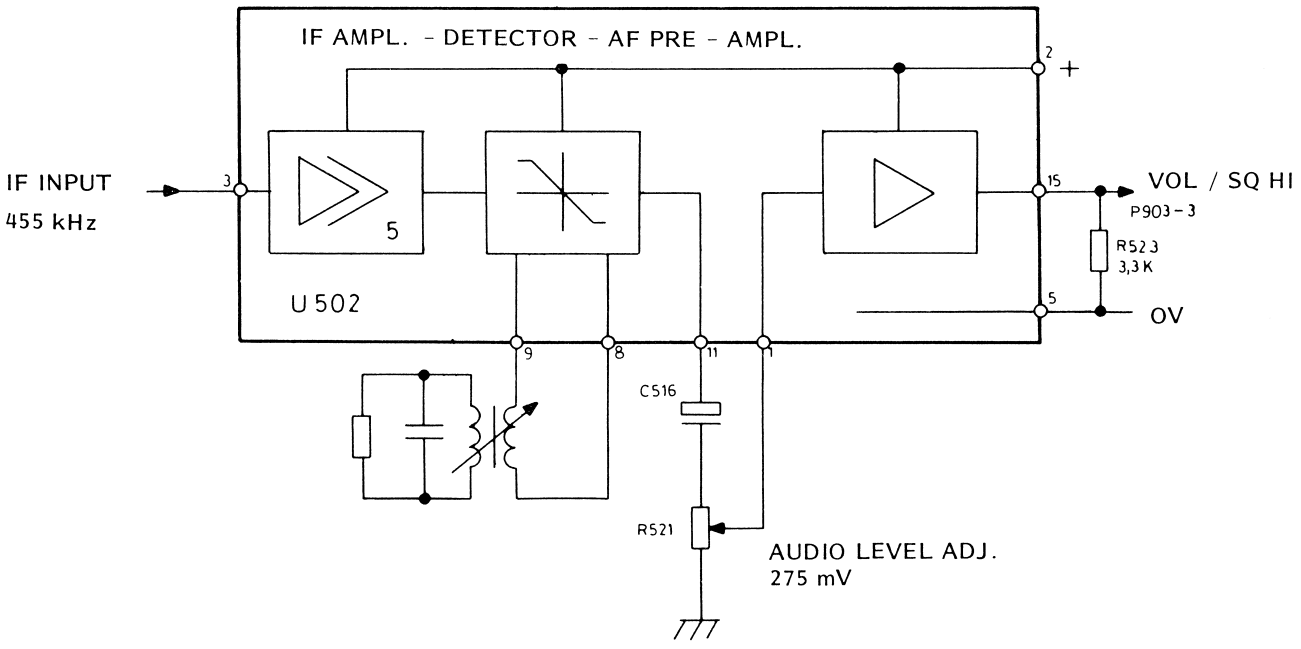


FIG. 2. IF AMPLIFIER , DETECTOR , AND AF PREAMPLIFIER

SQUELCH AND AUDIO CIRCUITS

The audio line signal (Vol/Sq - HI) is fed to a selective amplifier stage, where noise (frequencies around 8 kHz) 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 following buffer stage, Q605.
In the squelched condition and during transmissions this output is +1.5 V and mutes the audio power amplifier. The transmit indicater 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 (CG), 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.

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 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 FS 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 feed-

back network formed by D101, D102, R105, R106 and R107. The maximum permissible frequency deviation is set by a DEV.MAX. potentiometer on the RF board.
Amplifier U101A is operated as an active low-pass splatter filter feeding the modulating input of the VCO on the Frequency Synthesizer board.

EXCITER

The exciter takes the synthesized signal, 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 biased by a voltage generated by the feedback network C255, D201, Q201, Q209, Q208.

FREQUENCY SYNTHESIZER

The frequency synthesizer provides up to 12 Channels and is built on a printed wiring board which mounts in the top section of the radioset. There are two versions of the board, a single channel board, FS5111, and a multichannel board, FS5112.
The frequency of the single channel board is set by putting a binary code directly on the programmable divider input while the multichannel board uses a channel selector and a Frequency Control unit, FC5001. The channel selector is mounted directly on the synthesizer board and protrudes through the front panel.
The Frequency Control unit FC5001 fits into a shield which is placed over the main section of the synthesizer board.
The Frequency Synthesizer board also carries all interconnections between the tone modules and the RF module, and it has two connectors at the rear for accessories and the power supply cable.

SUPPLY VOLTAGE DISTRIBUTION SYSTEM

The battery voltage (A + BATT) enters the radio via two pins of the rear system connector to the synthesizer board. Both inputs are connected to reverse polarity protection diodes D741, D742. 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 synthesizer board via a feed-through capacitor and a connector P907 to the transmitter PA stages. The other input feeds through P903 - J903 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

V_B + to the voltage regulator U602 consisting of a monolitic regulator. The regulator output is fixed at 8.5 V by means of a factory adjusted resistor.

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

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

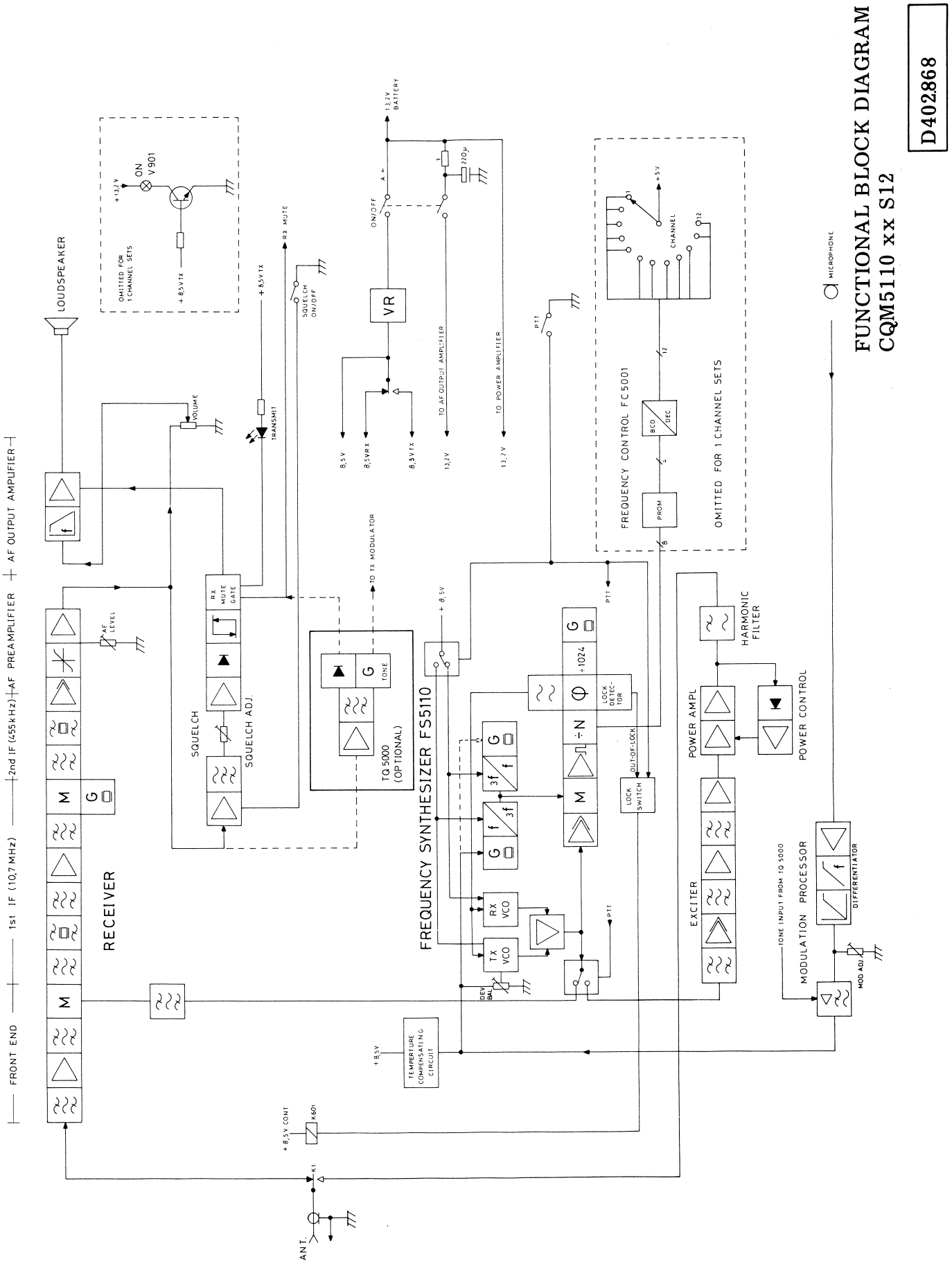
In sets with 5-tone sequential option or Pilot tone, the PTT (Push to talk) lead runs through the option board to provide for correct tone keying function.

WARNING

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

FUNCTIONAL BLOCK DIAGRAM CQM5110 xx S12

D402868



Storno

OPERATING INSTRUCTIONS

STORNOPHONE 5000

INSTRODUCTION

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

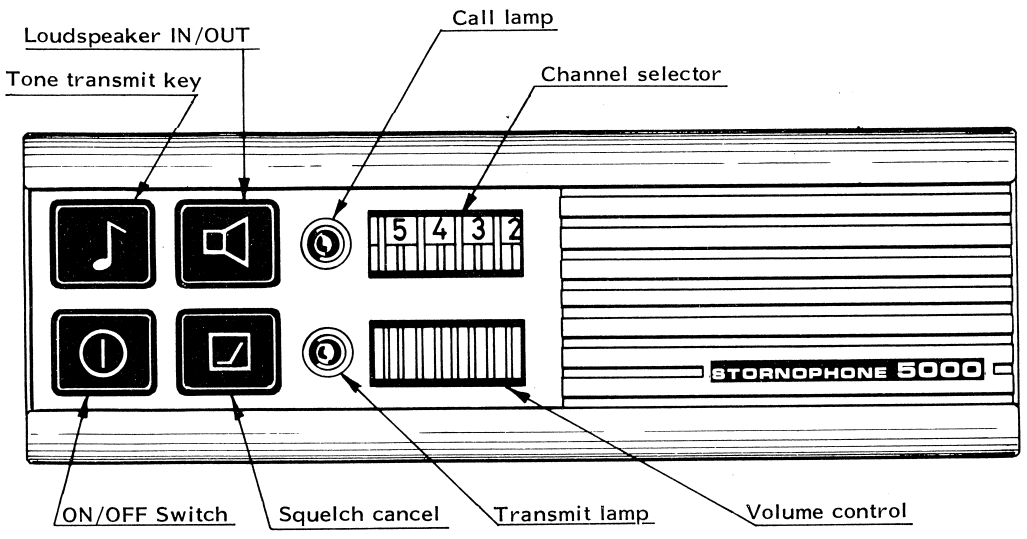
The radio is turned on by depressing the ON/OFF switch.
The thumb-wheel channel selector is accessible on the multichannel version and has the channel numbers on the rim. A lamp built into the channel selector illuminates the channel number from the inside. Single channel units have no 'power on' indicator.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

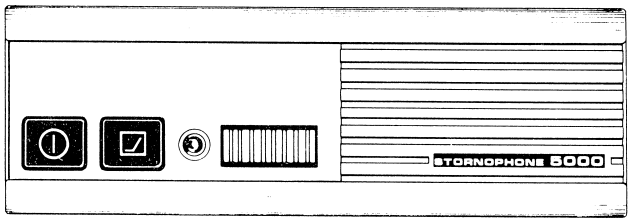
RECEIVE WITHOUT TONE EQUIPMENT

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.

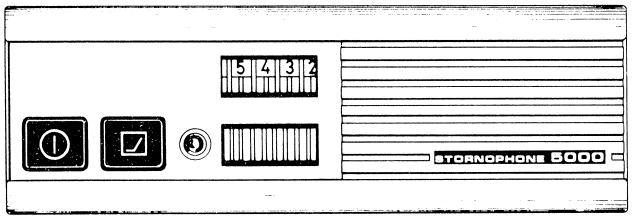
RECEIVE WITH TONE EQUIPMENT

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 green 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.





Version
One channel without tone equipment



Version
Six channel without tone equipment

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 green 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.

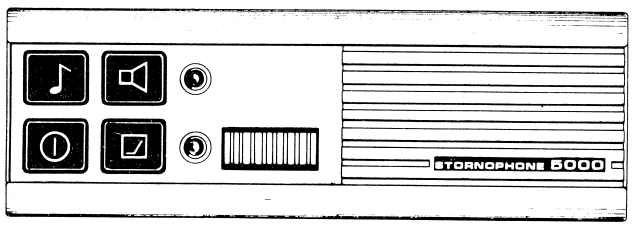
TRANSMIT WITHOUT TONE EQUIPMENT

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 green 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

Storno

CHANNEL FREQUENCY SYNTHESIZER

FS5111 and FS5112

The frequency synthesizer generates up to 12 channel frequencies for a STORNOPHONE 5000 operating in the 146 - 174 MHz band. It is built on a printed circuit board which mounts in the top section of the radio set. There are two versions of the board, a single channel board, FS5111 and a multichannel board FS5112. The frequency of the single channel board is set by putting a binary code directly on the programmable divider input while the multichannel board channels are selected with a channel selector and a Frequency Control unit, FC5001. The channel selector is mounted directly on the board and protrudes through the front panel, and the Frequency Control module FC5001, fits into the cast shield which is placed over the main section of the synthesizer board.
A metal shield is placed underneath the oscillator and mixer sections of the board.

All circuitry can be accessed and operated for repair and maintenance without the shields and with the FC5001 in its socket.

The Frequency Synthesizer board also carries all interconnections between the tone modules and the RF module and has two connectors at the rear for accessories and power supply cables.

The channel programming is contained in a 256 bit PROM placed in a socket on the Frequency Control module. The PROM can be field programmed if the necessary programming equipment is available. Programming equipment and procedures must be approved by STORNO and the PROM manufacturer, refer to the Channeling Instruction.

CIRCUIT DESCRIPTION

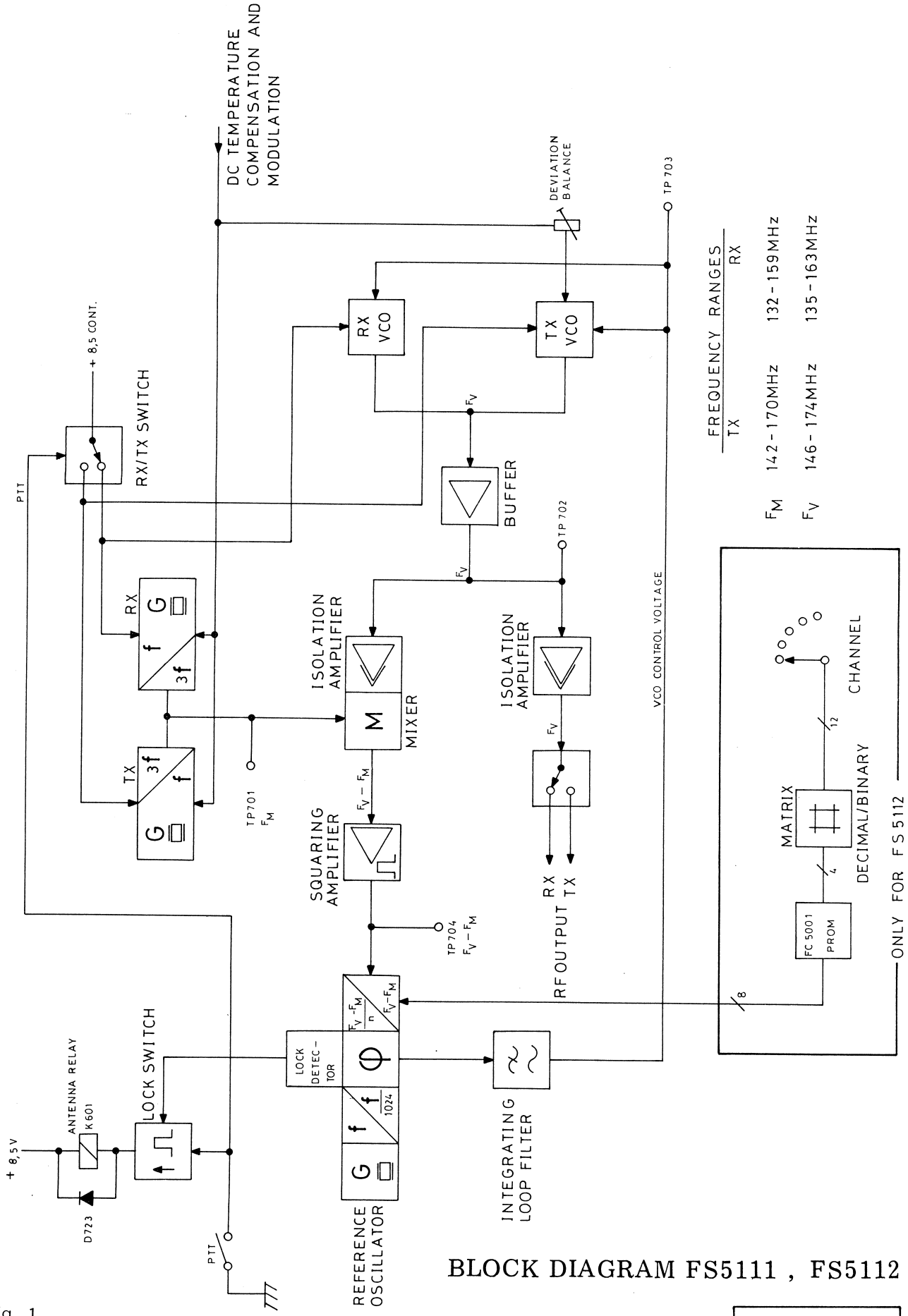
The Frequency Synthesizer generates the local oscillator injection for the receiver and a modulated exciter signal for the transmitter. The circuit is a single-loop phase-locked frequency generator.

The synthesizer frequency is controlled by three crystals, one reference crystal and two mixer crystals, and by a PROM.
The synthesizer can be reprogrammed for new frequencies if these are within the maximum frequency spread of the STORNOPHONE 5000.

Two voltage controlled oscillators (VCO) are generating the signals which are used as injection for the receiver mixer and excitation signal for the transmitter. The frequency of each VCO can be preset to any frequency within the band by a variable capacitor, and the fine adjustment is controlled by a variable capacitance diode, varicap, and the phase detector output. The control voltage for the varicaps is filtered in a loop integrating filter. The TX VCO has an additional varicap which is used to modulate the transmitter.

The Push-to-talk switch controls a transistor switch, which switches the supply voltage between the RX VCO and the TX VCO.

The output signal from the VCOs are fed into a buffer amplifier which protects the VCO from load changes.
The buffer amplifier's output is applied to an isolation amplifier and a diode switch before entering the RF board.



BLOCK DIAGRAM FS5111 , FS5112

Fig. 1

D402873

The buffer amplifier also connects to another isolation amplifier via a resistive attenuator and feeds the signal to the synthesizer mixer.

The synthesizer mixer mixes the VCO signal and the crystal oscillator signal to a frequency which is within the dividing capability of the programable divider.

Separate crystal oscillators are used in the receive and transmit mode, respectively, and they are both third mode oscillators.

A temperature compensating voltage is applied to the crystal oscillators only in the 5 p.p.m. version. This voltage is kept constant in the 10 p.p.m. version by cutting a diode on the RF board.

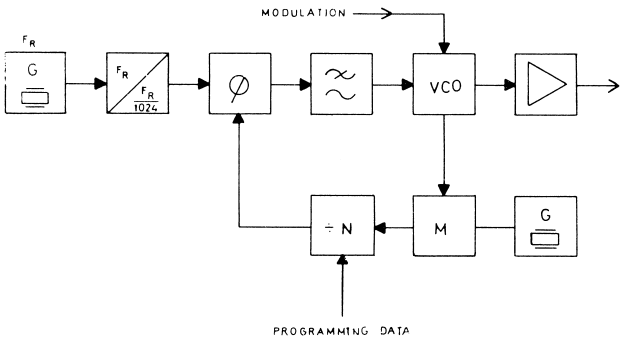


Fig. 2 Phase Locked loop Principle

The output from the synthesizer mixer is fed to a squaring amplifier which drives the programable divider and this divides the frequency by 211 to 511 depending on the logic levels on the 8-bit binary control input. The input frequency range for the divider differs according to the channel spacing and is shown in fig. 3.

The phase detector produces a waveform with variable duty cycle which depends on the phase and frequency difference between its two input signals. The operating frequency range of the phase detector is 4 kHz to 15 kHz and it depends on the channel spacing.

The reference frequency is generated in a crystal oscillator whose output is divided by 1024 and applied to the phase detector.

The output from the phase detector passes through a passive integrating filter which produces a DC voltage proportional to the duty cycle of the phase detector output. This voltage adjusts the frequency of the VCO.

An out-of-lock circuit inhibits the transmitter when the synthesizer loop is out of lock and hunting for the frequency.

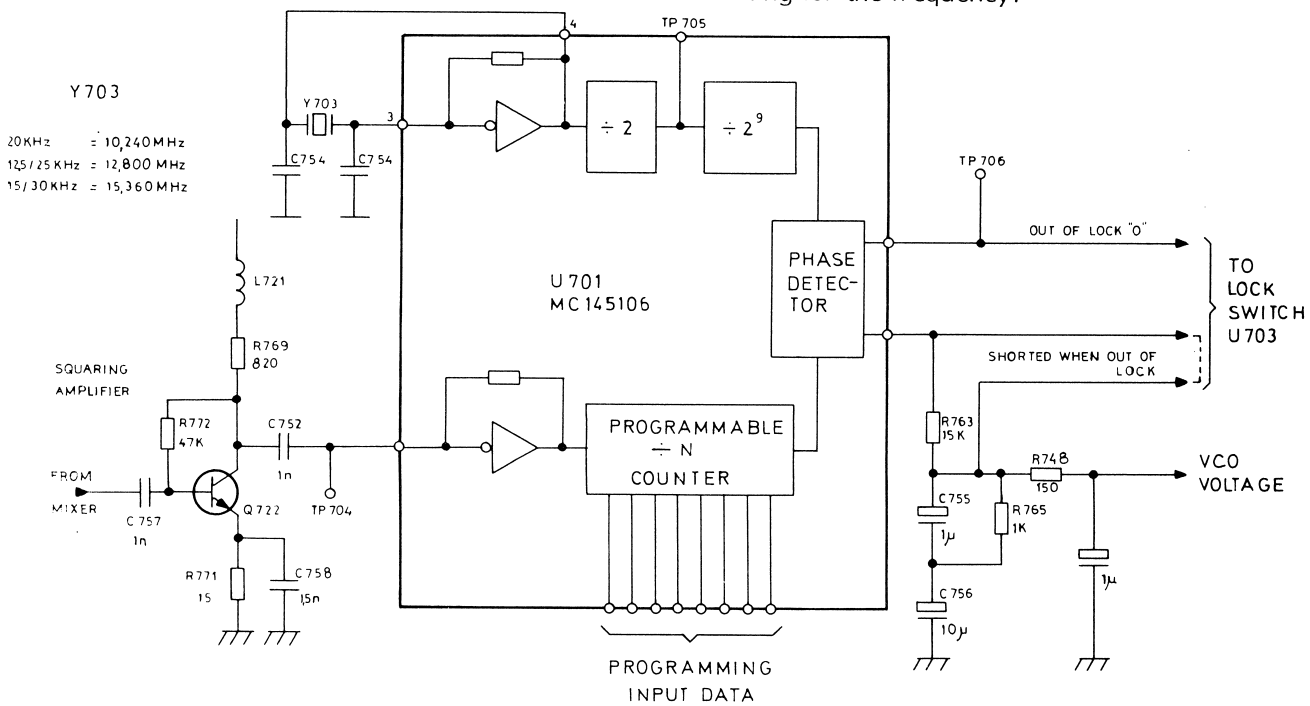


Fig. 3. REFERENCE OSCILLATOR, DIVIDER, AND PHASE DETECTOR

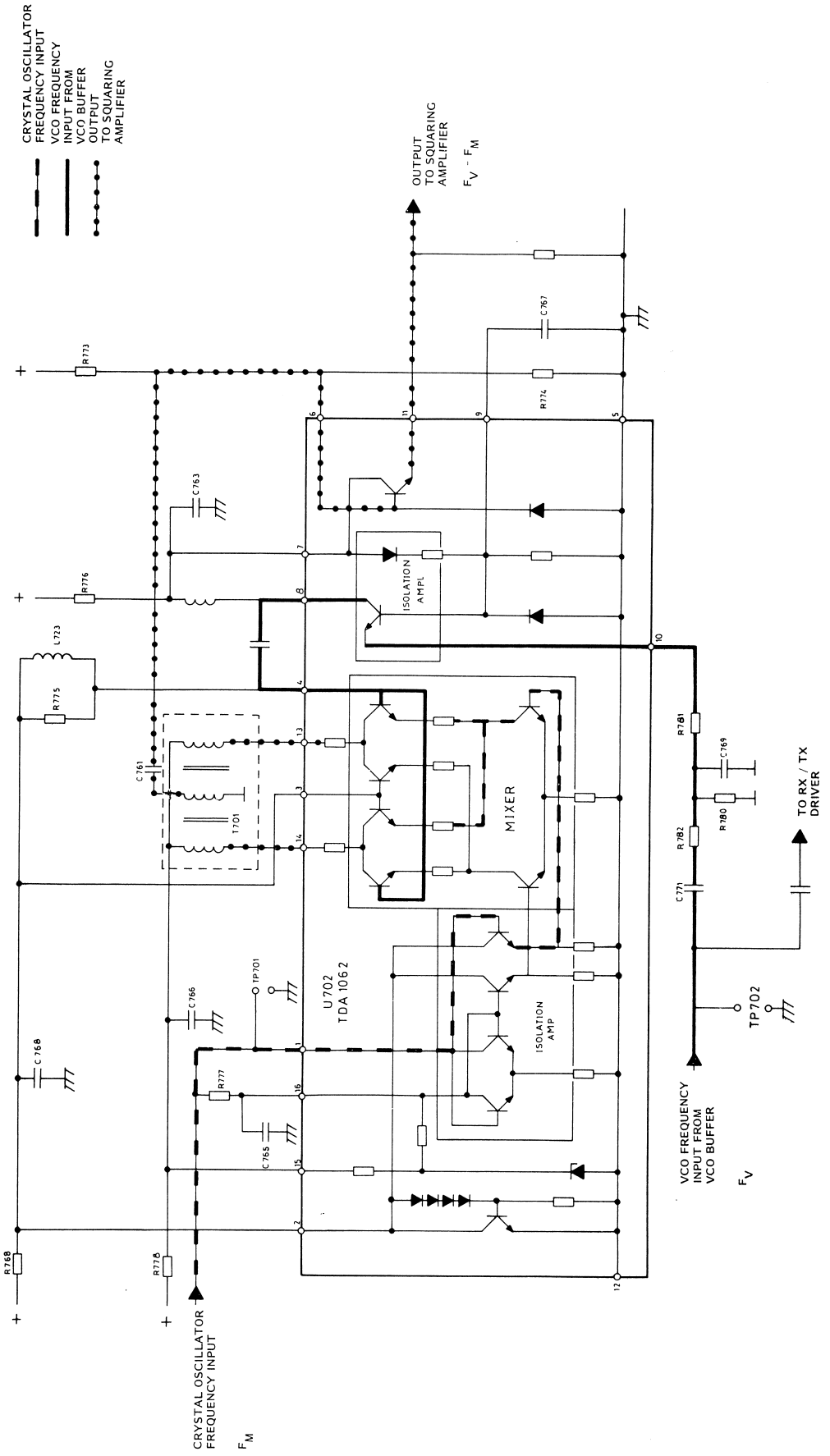


Fig 4. Synthesizer Mixer and Isolation Amplifiers, U702.

The transmitter modulation is applied simultaneously to the transmitter mixer-oscillator and the VCO. The modulation bandwidth also covers sub-audio frequencies used for channel guard (pilot tones). The frequency deviation balance adjustment equalizes the deviation on both oscillators to ascertain low distortion and low noise reference side bands during modulation of the synthesizer because it is operating with a relatively large loop bandwidth.

The frequency control module, FC5001, is built on a separate wiring board which mount on top of the synthesizer shield. This module converts the BCD-code (4 bits) from the channel selector to an 8-bit binary code for the programmable divides in the synthesizer loop. These 8-bit codes are programmed into a PROM (Programmable Read Only Memory) and are dividing factors expressed in hexadecimal codes.

On the FC5001 is a 5-Volt regulator which supply the voltage for the PROM. When the PTT button is pushed the transistor Q801 converts the PTT voltage level to TTL level and puts a logic "0" on the MSB (Most Significant Bit) on the address input of the PROM. This selects the PROM code for the corresponding transmitter channel. The PROM outputs have open collectors with external pull-up resistors.

TECHNICAL SPECIFICATIONS

Supply Voltage
+8.5 Volts regulated
+13.2 Volts unregulated

Current Consumption
max. 80 mA (+8.5 V)
max. 200 mA (+13.2 V)

Channel Spacing
20 kHz
12.5/25 kHz
15/30 kHz

Modulation Input
0.75 V r.m.s. ±2 dB
$\Delta f = 60\%\ f_{mod} = 1$ kHz

Modulation Bandwidth
70 - 3000 Hz

Modulation Distortion
70 - 300 Hz: <5%
1 kHz: <4%

DC Temperature Stabilization Voltage
25°C= 6 V ±10% (reference)
-30°C= +350 mV ±10%
-10°C= -50 mV ±10%
+60°C= +50 mV ±10%

The voltage characteristic is approximately linear between these points.

RF Output Level
4 mW ± 1 mW
(open collector output connected to tuned circuit)

TX Output Frequency Range
146 - 174 MHz (VCO)

RX Output Frequency Range
135 - 163 MHz (VCO)

Frequency Stability
5 p.p.m. or 10 p.p.m.

Reference Crystal Frequency
20 kHz: 10.240 MHz
12.5/25 kHz: 12.800 MHz

Signal-to-Noise Ratio (S/N)

>100 dB

Δf= 25 kHz, BN= 10 kHz

Spurious Attenuation

>85 dB

Lock Time

<30 m sec.

for 1 MHz step

Logic Control Level

LOW= <2 V

HIGH= >6 V

8 bit binary positive logic with built-in pull down resistors, I_{in} = 175 uA per bit.

Temperature range

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

Dimensions

135 x 190 x 45 mm (BxDxH)

Weight

PC board: 150 g

Shield: 75 g

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CHANNEL PROGRAMMING INSTRUCTIONS

CQM5110 S12

Programming of the PROM which contains the data for the channel frequencies will normally be part of the factory process, but it may also be field programmed.
The PROM programming unit must be approved by the PROM manufacturer, as for example (DATA I/O SYSTEM 17 or 19).

The programmer consists of the following items:

Programmer (DATA I/O SYSTEM 19)
Programming Pak, interchangeable
Socket adaptor
or universal programming pack.
DATA I/O UNIPAK (adaptable for more than 200 types of PROM devices).

To program a PROM the channel frequencies for all allocated channels and the channel spacing must be known.
It is recommended to complete a worksheet when calculating the prom data.
It is also possible to use a computer to calculate the prom data and Storno will be able to supply software programs for certain types of computers.

Operating instructions for the Programmer is supplied by the vendor.

WORKSHEET

For each PROM to be programmed a worksheet should be completed to calculate the input data for each channel.

The procedure for completing the worksheet is:

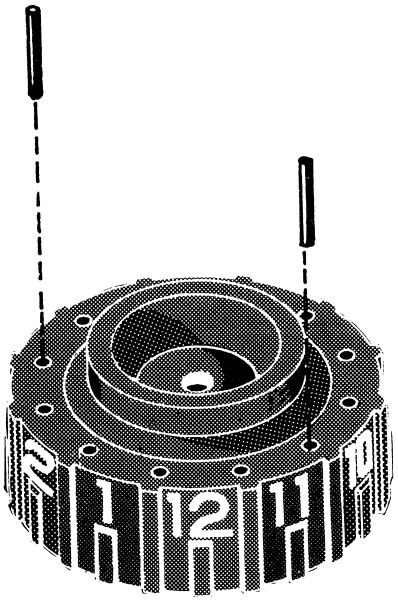
1. Complete list of receiver channel frequencies. (A).
2. Complete list of transmitter channel frequencies. (B).
3. Find highest (H) and lowest (L) receiving frequencies.
4. Find highest (H) and lowest (L) transmitting frequencies.
5. Select receiver mixer crystal frequency (C) from table 1. The highest and lowest receiver frequencies must be within the selected band.
6. Select transmitter mixer crystal frequency (D) from table 2. The highest and lowest transmitter frequencies must be within the selected band.
7. Note channel spacing and Reference frequency (F). See worksheet.
8. Use receiver formula to calculate "V_{DEC}" (divisor) for all receiver channels.
9. Use transmitter formula to calculate "V_{DEC}" (divisor) for all transmitter channels.
10. Check "V_{DEC}" for all channels to be between 256 and 511.
11. Use receiver crystal frequency and V_{DEC} to check for selfquieting frequencies, table 3.
12. In case of selfquieting select appropriate alternative and possibly recalculate "V".
13. Convert all "V_{DEC}" numbers to hexadecimal code. Refer to tabel 4.
14. Assign the hexadecimal codes to the corresponding channels and the PROM adresses.

After completing the worksheet the next steps are:

1. Enter correct Prom addresses and corresponding data (V_{HEX}) on the Programmer (DATA I/O), refer to Programmer Operating Instructions.
2. Insert the channel knob stop (if needed) if less than 9 channels, refer to fig. 1.
3. In case of more than 8, but less than 12 channels are used, transmission on unauthorized channels must be avoided. This is done by burning the unused channel locations in the PROM with the highest channel HEX CODE.

CHANNEL STOP

LOWEST CH.	INSERT PIN BETWEEN	HIGHEST CH.	INSERT PIN BETWEEN
1	10 and 11	1	3 and 4
2	11 and 12	2	4 and 5
3	12 and 1	3	5 and 6
4	1 and 2	4	6 and 7
5	2 and 3	5	7 and 8
6	3 and 4	6	8 and 9
7	4 and 5	7	9 and 10
8	5 and 6	8	10 and 11
9	6 and 7	9	11 and 12
10	7 and 8	10	12 and 1
11	8 and 9	11	1 and 2
12	9 and 10	12	2 and 3



Note: If 8 channels are used insert only one PIN.
If more than 8 channels are used stop is not possible and no PINs are inserted.

Fig. 1. SETTING OF CHANNEL KNOB STOP.

RECOMMENDED CRYSTAL FREQUENCIES
CQM5110

CQM5112 - CQM5114 FREQUENCY RANGE	CQM5113 FREQUENCY RANGE	RX CRYSTAL
145.2 - 148.3875		43.766666
146.2 - 149.3875	145.56 - 148.11	44.1
147.2 - 150.3875	146.56 - 149.11	44.433333
148.2 - 151.3875	147.56 - 150.11	44.766666
149.2 - 152.3875	148.56 - 151.11	45.1
150.2 - 153.3875	149.56 - 152.11	45.433333
151.2 - 154.3875	150.56 - 153.11	45.766666
152.2 - 155.3875	151.56 - 154.11	46.1
153.2 - 156.3875	152.56 - 155.11	46.433333
154.2 - 157.3875	153.56 - 156.11	46.766666
155.2 - 158.3875	154.56 - 157.11	47.1
156.2 - 159.3875	155.56 - 158.11	47.433333
157.2 - 160.3875	156.56 - 159.11	47.766666
158.2 - 161.3875	157.56 - 160.11	48.1
159.2 - 162.3875	158.56 - 161.11	48.433333
160.2 - 163.3875	159.56 - 162.11	48.766666
161.2 - 164.3875	160.56 - 163.11	49.1
162.2 - 165.3875	161.56 - 164.11	49.433333
163.2 - 166.3875	162.56 - 165.11	49.766666
164.2 - 167.3875	163.56 - 166.11	50.1
165.2 - 168.3875	164.56 - 167.11	50.433333
166.2 - 169.3875	165.56 - 168.11	50.766666
167.2 - 170.3875	166.56 - 169.11	51.1
168.2 - 171.3875	167.56 - 170.11	51.433333
169.2 - 172.3875	168.56 - 171.11	51.766666
170.2 - 173.3875	169.56 - 172.11	52.1
171.2 - 174.3875	170.56 - 173.11	52.433333
172.2 - 175.3875	171.56 - 174.11	52.766666
173.2 - 176.3875	172.56 - 175.11	53.1
	173.56 - 176.11	53.433333

TABLE 1. RECEIVER MIXER CRYSTAL FREQUENCY

RECOMMENDED CRYSTAL FREQUENCIES

CQM5110

CQM5112 - CQM5114 FREQUENCY RANGE	CQM5113 FREQUENCY RANGE	TX CRYSTAL
145.5 - 148.6875	144.86 - 147.41	47.433333
146.5 - 149.6875	145.86 - 148.41	47.766666
147.5 - 150.6875	146.86 - 149.41	48.1
148.5 - 151.6875	147.86 - 150.41	48.433333
149.5 - 152.6875	148.86 - 151.41	48.766666
150.5 - 153.6875	149.86 - 152.41	49.1
151.5 - 154.6875	150.86 - 153.41	49.433333
152.5 - 155.6875	151.86 - 154.41	49.766666
153.5 - 156.6875	152.86 - 155.41	50.1
154.5 - 157.6875	153.86 - 156.41	50.433333
155.5 - 158.6875	154.86 - 157.41	50.766666
156.5 - 159.6875	155.86 - 158.41	51.1
157.5 - 160.6875	156.86 - 159.41	51.433333
158.5 - 161.6875	157.86 - 160.41	51.766666
159.5 - 162.6875	158.86 - 161.41	52.1
160.5 - 163.6875	159.86 - 162.41	52.433333
161.5 - 164.6875	160.86 - 163.41	52.766666
162.5 - 165.6875	161.86 - 164.41	53.1
163.5 - 166.6875	162.86 - 165.41	53.433333
164.5 - 167.6875	163.86 - 166.41	53.766666
165.5 - 168.6875	164.86 - 167.41	54.1
166.5 - 169.6875	165.86 - 168.41	54.433333
167.5 - 170.6875	166.86 - 169.41	54.766666
168.5 - 171.6875	167.86 - 170.41	55.1
169.5 - 172.6875	168.86 - 171.41	55.433333
170.5 - 173.6875	169.86 - 172.41	55.766666
171.5 - 174.6875	170.86 - 173.41	56.1
172.5 - 175.6875	171.86 - 174.41	56.433333
173.5 - 176.6875	172.86 - 175.41	56.766666
174.5 - 177.6875	173.86 - 176.41	57.1
175.5 - 178.6875	174.86 - 177.41	57.433333
176.5 - 179.6875	175.86 - 178.41	57.766666

TABLE 2. TRANSMITTER MIXER CRYSTAL FREQUENCY

SELFQUIETING FREQUENCIES

CQM5112, CQM5114

RECEIVER CRYSTAL FREQUENCY, MHz	V DEC	USE ALTERNATIVE+
43.766666	428	1
44.1	336	4
44.1	428	1
44.433333	256	4
44.433333	428	1
44.766666	428	1
45.1	428	1
45.433333	428	1
45.766666	428	1
45.766666	454	2
46.1	374	2
46.433333	294	2
46.766666	428	1
47.1	428	1
47.433333	428	1
47.766666	428	1
48.1	428	1
48.433333	428	1
48.766666	428	1
49.1	428	1
49.1	472	2
49.1	474	2
49.433333	393	2
49.433333	394	2
49.433333	428	1
49.766666	313	2
49.76666	314	2
49.766666	428	1
50.1	428	1
50.1	432	4

TABLE 3A. SELFQUIETING FREQUENCIES

+refer to worksheet

Continued on table 3B

SELFQUIETING FREQUENCIES
CQM5112, CQM5114

RECEIVER CRYSTAL FREQUENCY, MHz	V DEC	USE ALTERNATIVE+
50.433333	428	1
50.766666	272	3
50.766666	428	1
51.1	428	1
51.433333	428	1
51.766666	320	4
51.766666	428	1
52.1	344	4
52.1	428	1
52.433333	428	1
52.766666	304	4

TABLE 3B. SELFQUIETING FREQUENCIES +refer to worksheet

SELFQUIETING FREQUENCIES
CQM5113

RECEIVER CRYSTAL FREQUENCY, MHz	V DEC	USE ALTERNATIVE+
44.1	311	4
46.1	467	2
46.433333	367	2
46.766666	260	4
46.766666	267	2
49.433333	492	2
49.766666	392	2
50.1	292	2
50.433333	290	Avoid this frequency
53.1	390	4

TABLE 3C. SELFQUIETING FREQUENCIES +refer to worksheet

Least Significant Digit (LSD) of Hex Code

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271
1	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287
2	288	289	290	291	292	293	294	295	296	297	298	299	300	301	302	303
3	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319
4	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335
5	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351
6	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367
7	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383
8	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399
9	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415
A	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431
B	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447
C	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463
D	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479
E	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495
F	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511

Most Significant Digit of Hex Code.

"V_{DEC}" Numbers.

MSD
LSD

Example "V_{DEC}"= 345 equals to hex code 59.

"V_{DEC}"= 469 equals to hex code D5.

Table 4.

"V" Number to hex code conversion table.

Customer:

RECEIVER						TRANSMITTER				
CHAN-NEL	A FREQUENCY MHz	L H	V DEC	V HEX	PROM ADDRESS (HEX)	B FREQUENCY MHz	L H	V DEC	V HEX	PROM ADDRESS (HEX)
1					00					10
2					01					11
3					02					12
4					03					13
5					04					14
6					05					15
7					06					16
8					07					17
9					08					18
10					09					19
11					0A					1A
12					0B					1B

RECEIVER MIXER CRYSTAL FREQ. (Y702): C=_____

TRANSMITTER MIXER CRYSTAL FREQ. (Y701): D=_____

FORMULA: $V_{DEC} = \frac{(A - 10.7) - (C \times 3)}{F}$

FORMULA: $V_{DEC} = \frac{B - (D \times 3)}{F}$

CHANNEL SPACING:	REFERENCE CRYSTAL (Y703):	REFERENCE FREQUENCY:
20 kHz	10.240000 MHz	F= 0.01
12.5/25 kHz	12.800000 MHz	F= 0.0125

LIST OF REFERENCE CRYSTALS (Y703)

MODE	FREQUENCY, MHz	PART No.
Standard 5112/5114	12.800000	19J06361P1
Offset 5112	12.801000	19J06361P7
Offset 5114	12.000500	19J06361P6
Standard 5113	10.240000	19J06361P2
Offset 5113	10.240650	19J06361P9

ALTERNATIVE SOLUTIONS IF THE RECEIVER IS SELFQUIETING:

1. SELECT ANOTHER RX MIXER CRYSTAL FREQUENCY
2. SELECT HIGH SIDE INJECTION FREQUENCY FOR 2nd OSCILLATOR
   Y501= 11.15500 MHz INSTEAD OF 10.245000 MHz
3. USE SLIGHTLY OFFSET REFERENCE CRYSTAL
4. WEAK QUIETING; NO ALTERNATIVE REQUIRED

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PROGRAMMING WORKSHEET
FOR CQM5110 S12

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CONTROL HEAD

CP5003

DESCRIPTION

The control head CP5003 is a moulded plastic front with a 15-button keyboard cluster in the right side. Ten buttons are used for the digits 0-9 and five of them are spares for future options. The keyboard is illuminated by two lamps built into the upper ridge above the buttons. In the left side are 4 buttons, the ON/OFF , the SQUELCH, the TONE KEY, and the LOUDSPEAKER IN/OUT buttons. Two indicators, a green CALL and a red TRANSMIT, the CHANNEL SELECTOR and the VOLUME CONTROL are placed in the middle.

The control head is used in systems with tone switching facillities allowing up to four tones of the sequential tone transmitter combinations to be variable by entering the corresponding digits on the keyboard.

The front has no loudspeaker and therefore an external loudspeaker type LS701 must be connected to the rear connector, refer to the installation drawings.

OPERATING INSTRUCTIONS

STANDBY

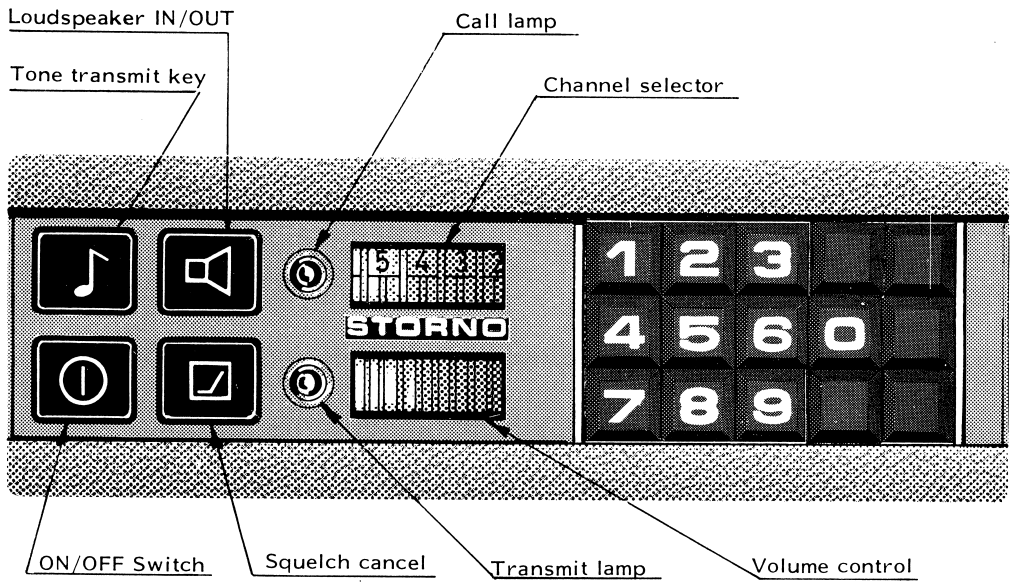
The radio is turned on by depressing the ON/OFF button. The standby condition is indicated by the keyboard being illuminated.

The thumb-wheel channel selector is accesible on multichannel radios and has the channel numbers on the rim. A lamp built into the selector illuminates the channel number from the inside.

When the channel selector is set to the desired channel the radio is ready for receive or transmit.

RECEIVE

Only calls whose number complies with the coding of the tone equipment will be heard in the loudspeaker. Reception of a call is indicated by the loudspeaker muting cancelled and a flashing green CALL indicator, until the conversation is terminated by pressing the loudspeaker in/out button. The loudspeaker will then again be muted and the CALL indicator goes off.



When receiving a group call or all call, the CALL indicator flashes during the message and stops when the RF carrier disappears.

TRANSMIT

Before transmitting the loudspeaker in/out button must be pressed to open the loudspeaker. The CALL indicator will then begin to flash, indicating that the loudspeaker in on.

Select the variable tones by entering the corresponding digits on the keyboard.
When the channel is clear the call is initiated by pressing the TONE TRANSMIT KEY button.

The tone combinations are now transmitted to the base station.

Wait for the base station to reply.

When contact is established the communication can continue by using the normal transmitter key button.

The communication is terminated by pressing the loudspeaker in/out button.

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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 $\pm$ 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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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:

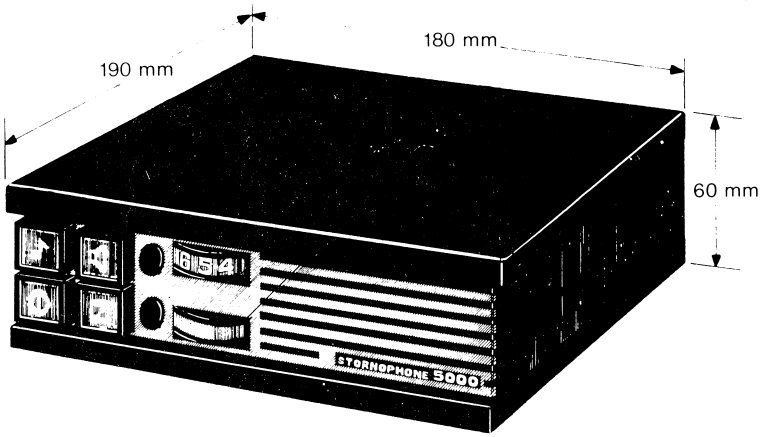
- the cables shall be as short as possible.
- the cables shall be kept away from moving parts as handbrake, shock absorbers etc.
- the cables shall not run near the engine, exhaust manifold, pipes, and other hot items.
- the cables should, whenever possible, be run in parallel with existing cables and 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.

Storno

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.

Storno

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.

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.

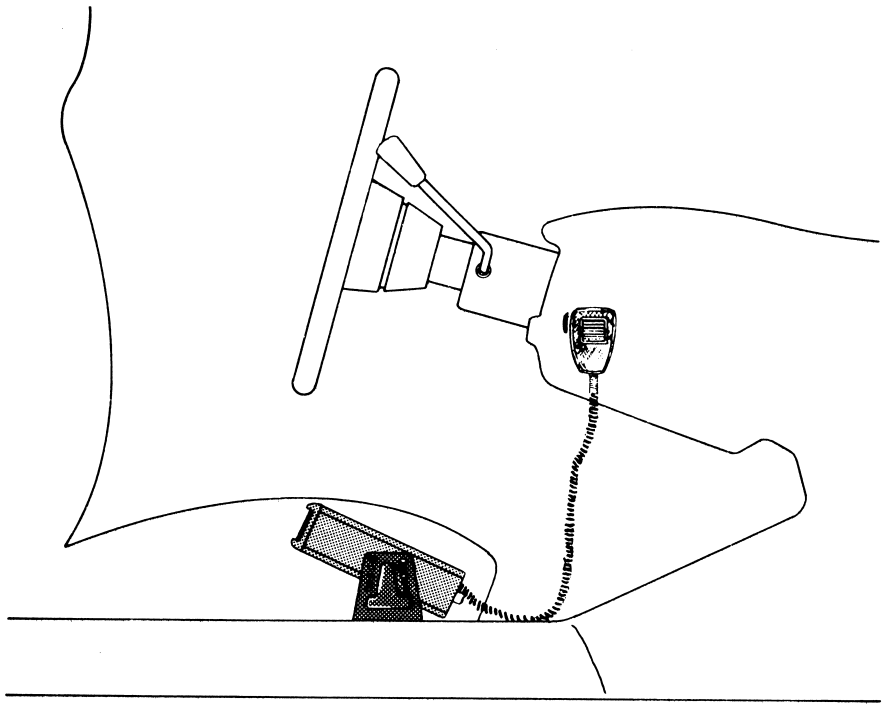


Fig. 1

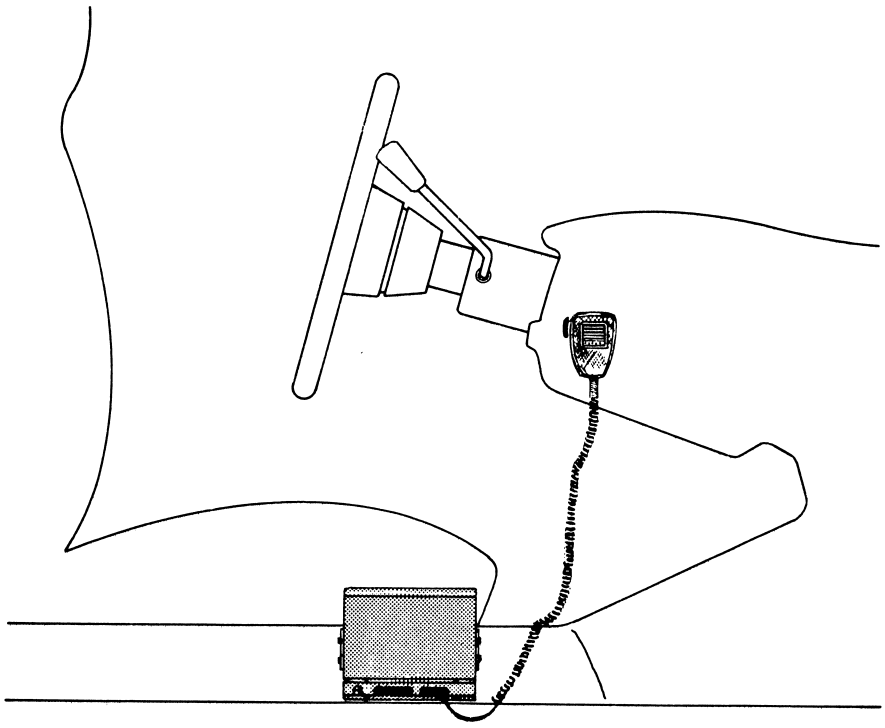


Fig. 2

Storno

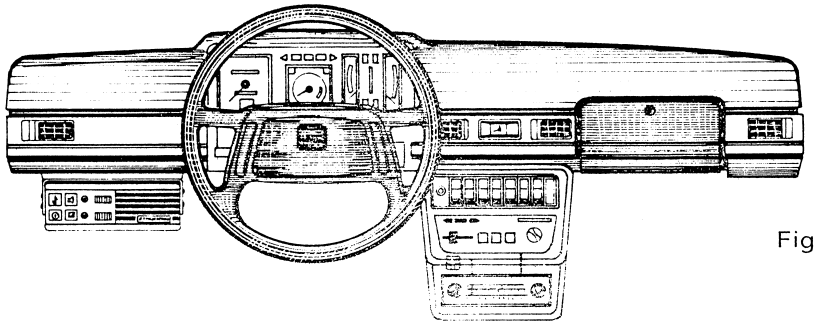


Fig. 3

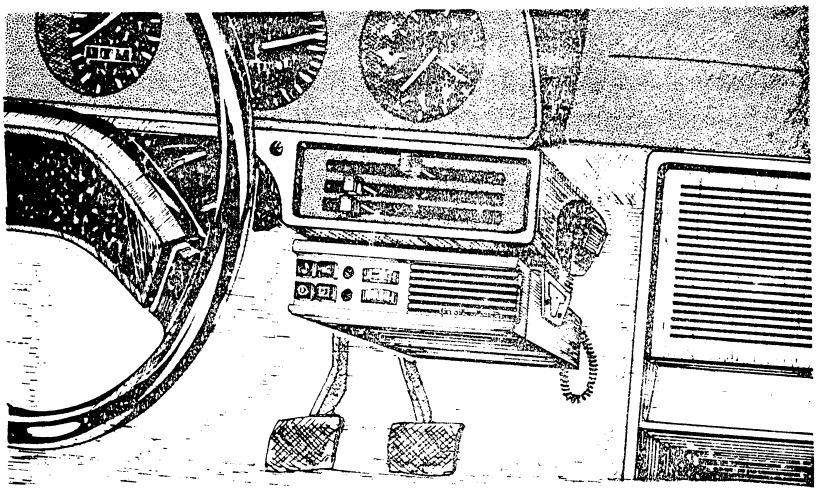


Fig. 4

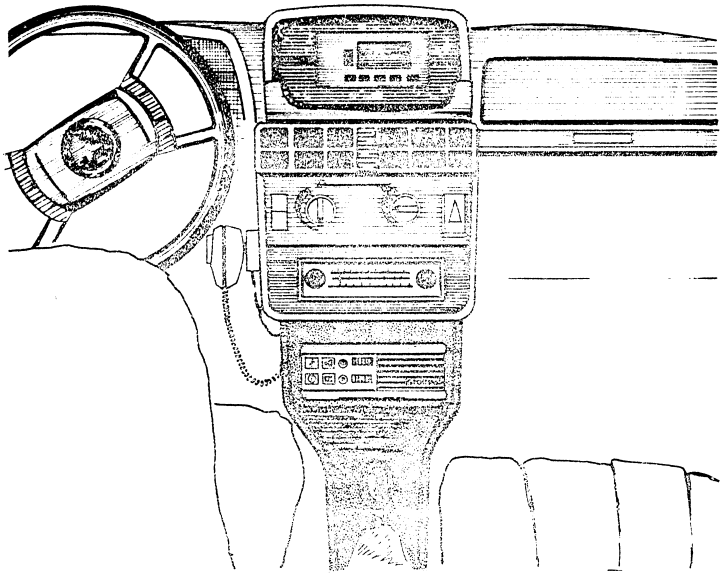


Fig. 5

60.380-E1

Storno

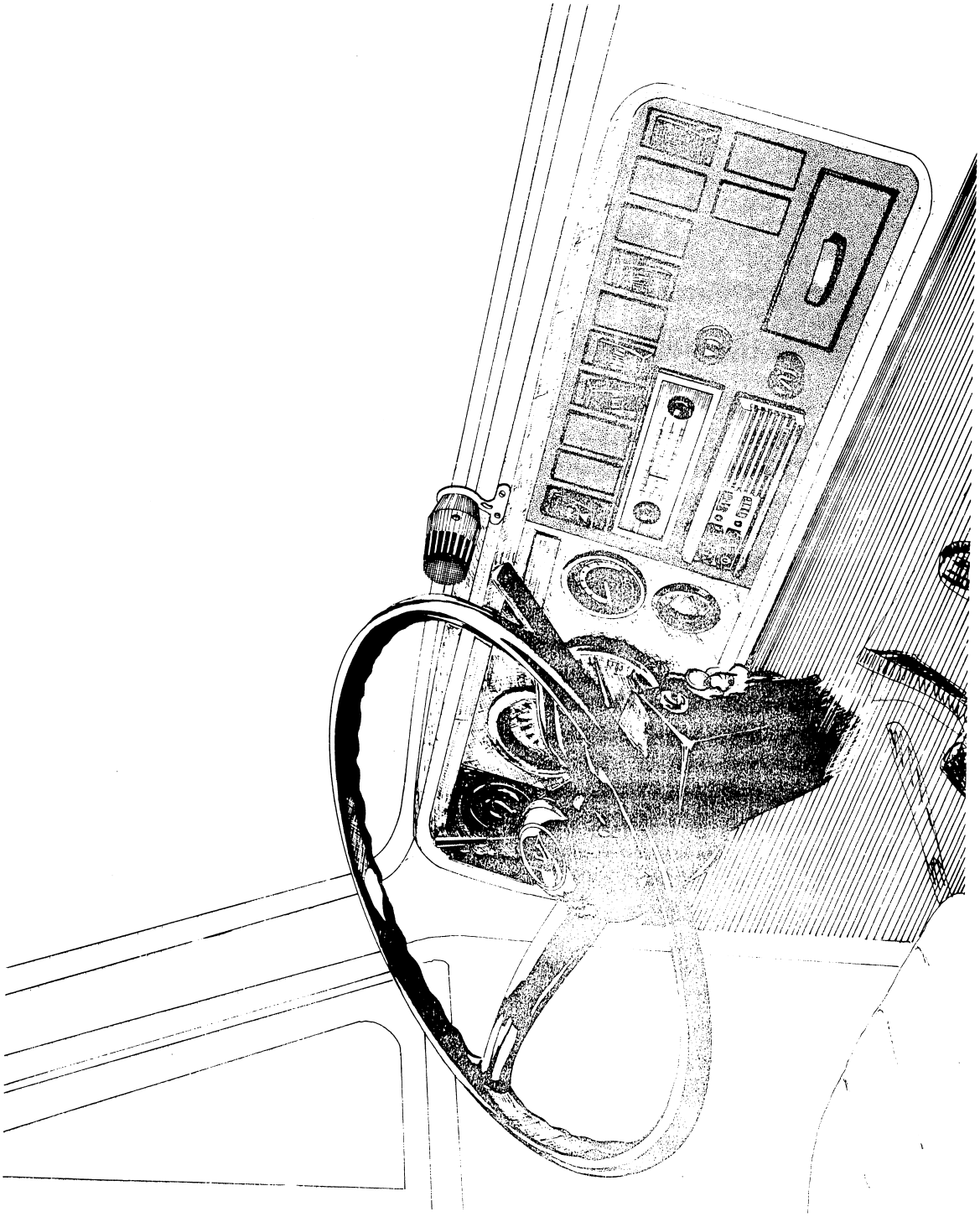
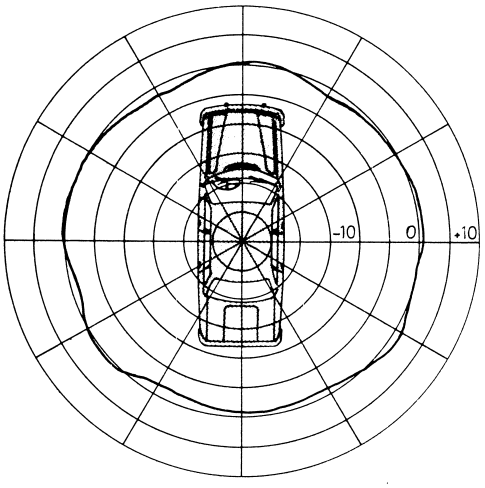


Fig. 6

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.

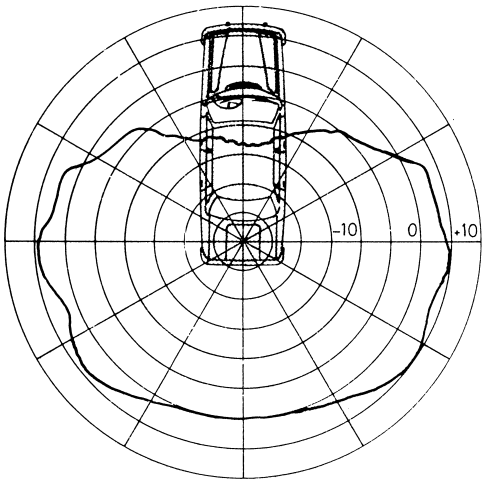
ATTENUATION RELATED TO λ/2 DIPOLE (0 dB)

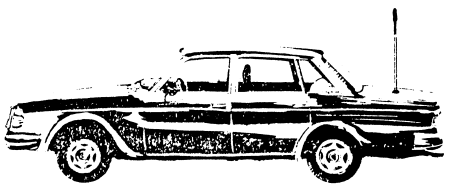
160 MHz



90°

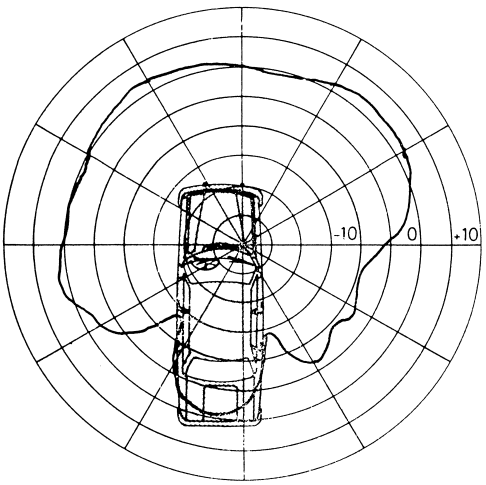
160 MHz

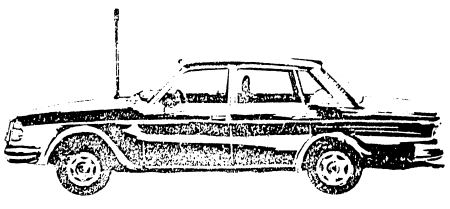




90°

160 MHz





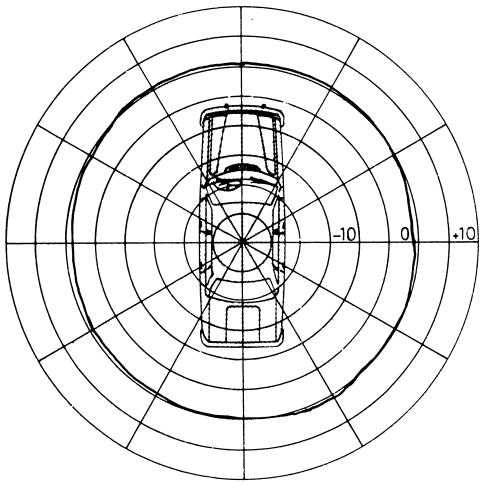
90°

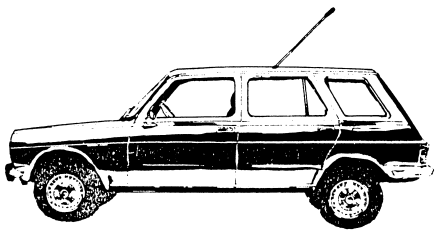
Fig. 7

Storno

ATTENUATION RELATED TO λ/2 DIPOLE (0 dB)

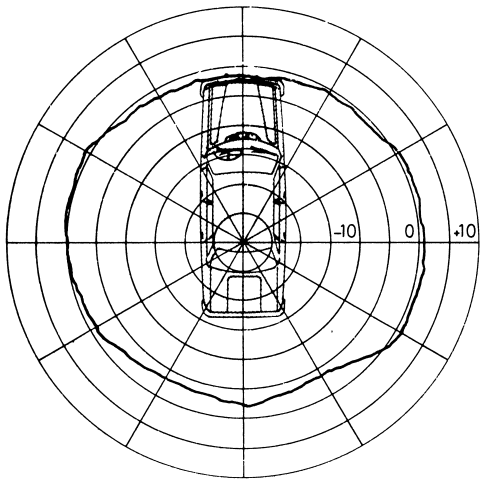
160 MHz

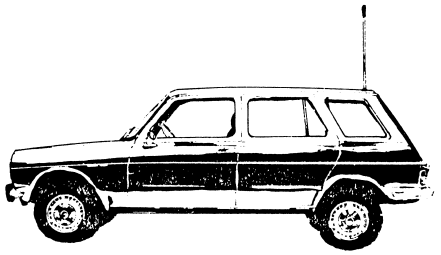




45°

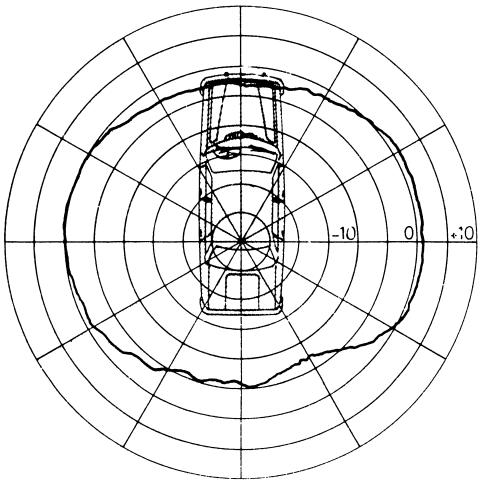
160 MHz

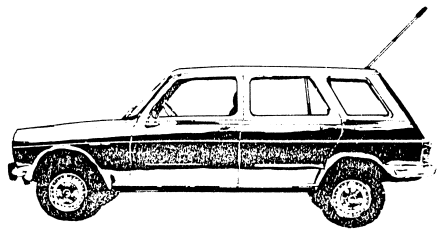




90°

160 MHz



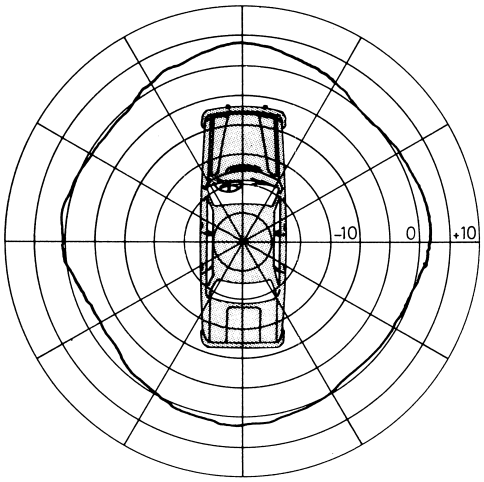


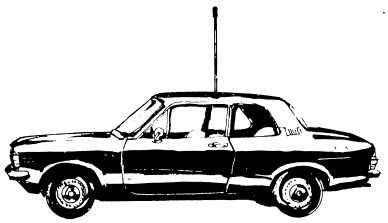
45°

Fig. 8

ATTENUATION RELATED TO λ/2 DIPOLE (0 dB)

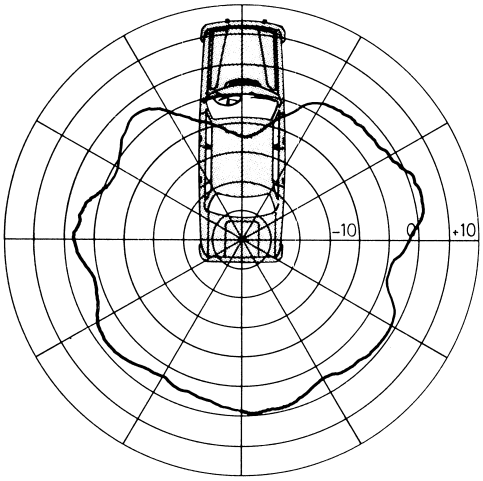
160 MHz

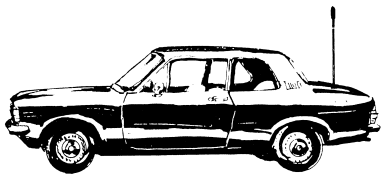




90°

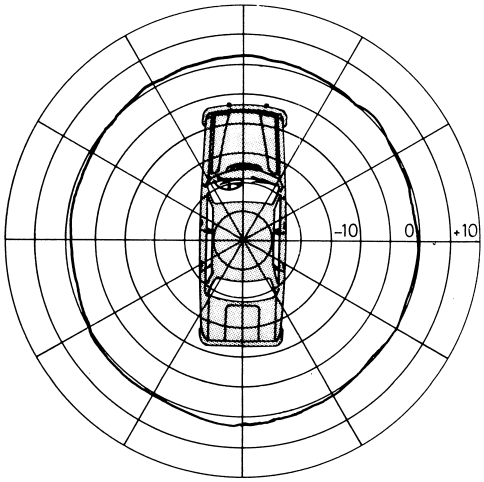
160 MHz





90°

160 MHz



90°

Fig. 9

ADJUSTMENT PROCEDURE

CQM5110 S12

This adjustment procedure applies to the following radiotelephone types:

CQM5112 S12	30/25 kHz Channel spacing
CQM5113 S12	20 kHz Channel spacing
CQM5114 S12	12.5 kHz Channel spacing

Before making adjustments to the radiotelephone transmitter/receiver, read the type tabel 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	$R_{in} \geq 1$ Mohm
AC Voltmeter	$Z_{in} > 1$ Mohm//50 pF
Multimeter	$R_i \geq 20$ Kohm/Volt
Distortion meter	e.g. Storno E11c
RF Watt meter	25 W/50 ohm/145-175 MHz
Deviation meter	145-175 MHz
RF generator	Z_{out}= 50 ohm; 145-175 MHz
10.7 MHz signal gen.	e.g. Storno TS-G21B
Frequency counter with attenuator	Z_{in}= 50 ohm; sensitivity 100 mV at 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; 6 A
Oscilloscope	0 - 5 MHz min.

MISCELLANEOUS

4 ohm/3 W 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

Trimming tools

The following tables show the frequency ranges of the CQM5110 S12 radiotelephone signals:

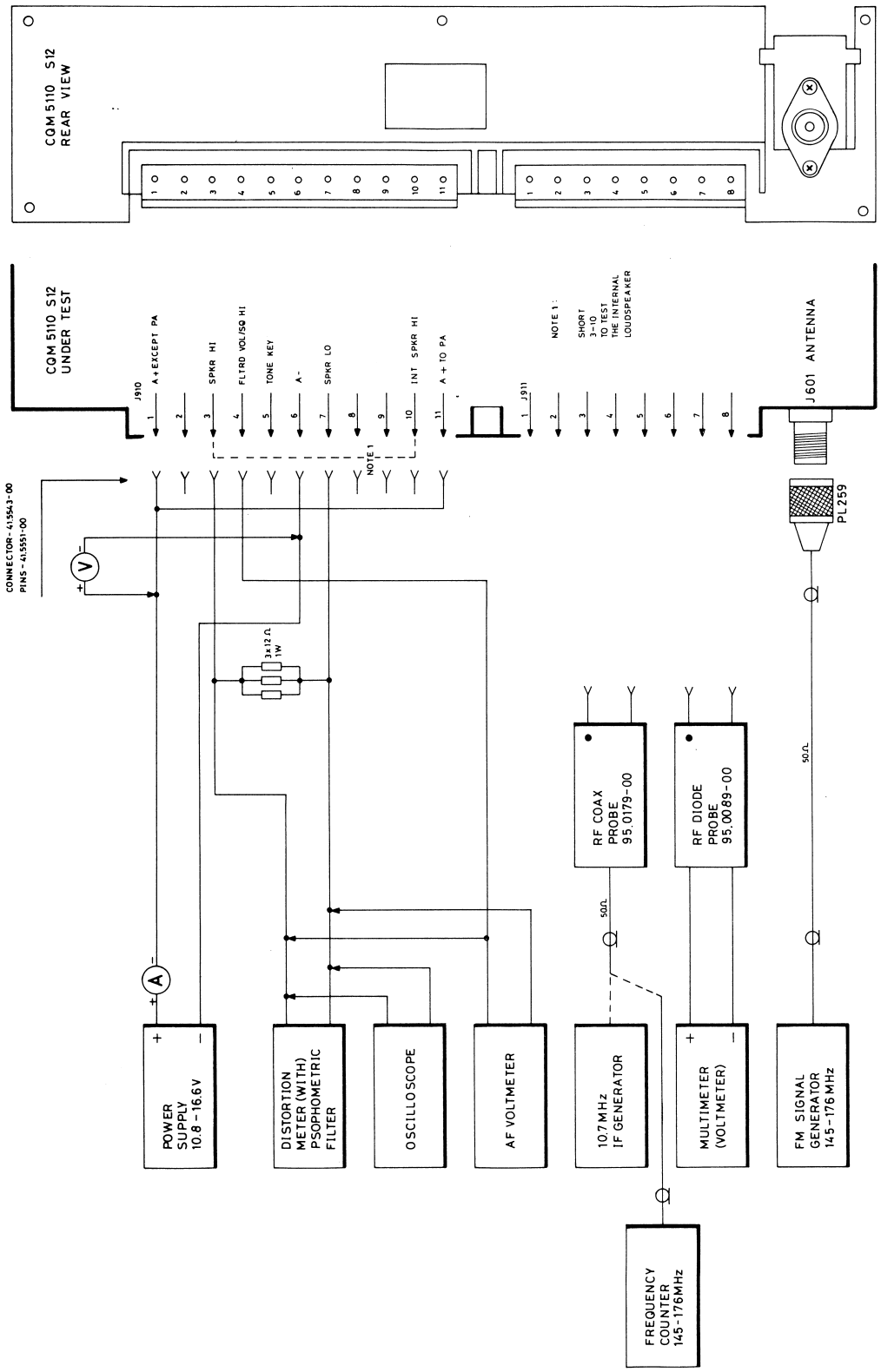
SIGNAL	Frequency, MHz
TX VCO	146 - 174
TX Crystal	47 - 56
TX Crystal multiplication	x3
RX VCO	135 - 163
RX Crystal	43 - 53
RX Crystal multiplication	x3

Table 1

Channel spacing kHz	Reference Crystal MHz	Min. Divider input frequency MHz	Max. Divider input frequency MHz	Reference frequency kHz
20	10.240	2.560	5.110	10
12.5 or 25[1)]	12.800	3.200	6.3875	12.5
15.0 or 30[1)]	15.360	3.840	7.665	15

Table 2 [1)] Two steps per channel

RECEIVER TEST SET-UP
CQM5110 S12
D402.876



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 1 A.
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 J901 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 mV
Repeat the procedure with the power supply adjusted for 10.8 V.

FREQUENCY SYNTHESIZER ALIGNMENT

Check the PROM U801, the TX mixer crystal, the RX mixer crystal, and the reference crystal and verify the frequencies and prom codes.

Mixer crystal output

Connect RF diode probe 95.0089-00 with multimeter to test point TP701. (1 V range).
Adjust L711 for maximum deflection on the multimeter.
Adjust L707 for maximum deflection on the multimeter.
Requirement: 250 mV ±125 mV (corresponding to -10 dBm to -4 dBm).

Note: Be careful not to resonate L707 to the false harmonics. If in doubt consult table 1 or check the crystal oscillator output with a spectrum analyzer.

Receiver VCO

Connect the multimeter, 10 V range, to test point TP706. The synthesizer's lock signal is accessible at TP706. +8 V DC with very narrow pulses (0.1 u sec) indicates normal locked condition. Unlocked condition is indicated by a variable duty signal or logic "Low".
Select the channel whose frequency is closest to the center frequency.
Await locked condition, constant voltage.
Adjust C745 for 8 Volts on the multimeter.
Connect the multimeter to test point TP703.
Adjust C745 for a voltage corresponding to the variable divider ratio (V) as indicated by the graph fig. 1.

Requirement: The voltage shall be in the range 1.5 V to 6.5 V and not deviate from the graph by more than 20%.

Mixer Crystal Frequency

Connect coax probe 95.0179-00 to test point TP701.
Connect the frequency counter to the probe and read the frequency.

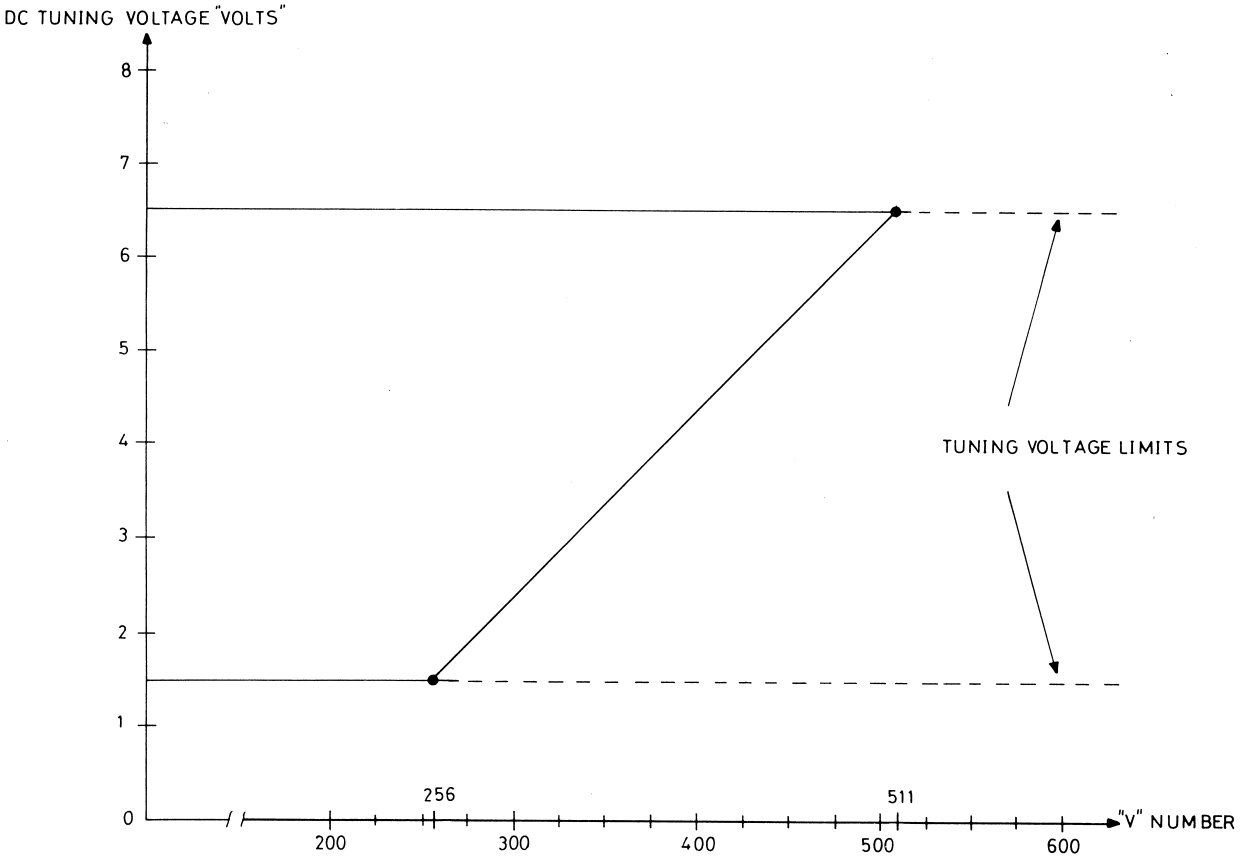


Fig. 1. Tuning voltage vs. V. number.

$f = f_x \times 3$ (f_x = crystal frequency)
Adjust L711 to the calculated frequency.
Requirement: f ±0.3 ppm at 25°C.
ppm= parts per million= 10^{-6}

Injection Frequency

Connect coax probe 95.0179-00 to test point TP401.
Connect the frequency counter to the probe.
Calculate the injection frequency for all channels.
$f_{inj} = f_{ant} - 10.7$ (MHz)
Select, one by one, the channels and read the injection frequency.
Requirement: F_{inj} ±0.4 ppm

IF AMPLIFIERS

Connect a 10.7 MHz signal generator to TP401 via coax probe 95.0179-00.
Connect RF diode probe 95.0089-00 with multimeter to test point TP501. (50 uA 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 50 uA 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 95.0089-00 and the multimeter to test point TP501. (50 uA 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 50 uA 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.

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 Δf max.

CQM5112 S12 ±3 kHz
CQM5113 S12 ±2.4 kHz
CQM5114 S12 ±1.5 kHz

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

IF DEMODULATOR

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

EIA or CEPT method may be used.

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 amplitide 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 20 dB below the first condition, as read on the distortion meter scale, This corresponds to a reading of 10%, 10 being 20 dB 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 60% 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.

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 20 dB ratio between signal + noise+ distortion and noise + distortion, i.e. 20 dB SINAD sensitivity.

EIA Method

EIA (Electronic Industrie's Association) Standard, definition:
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 12 dB signal + noise + distortion to noise + distortion.

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

ADJUSTING THE SENSITIVITY

Lower the RF generator output to obtain 20 dB 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 20 dB SINAD (CEPT)

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

MEASURING 12 dB SINAD (EIA)

Adjust the volume control for 2.45 V as measured with an AF voltmeter across the load. Adjust the RF generator to obtain 12 dB SINAD condition. Read the 12 dB SINAD sensitivity.
Requirement: $\leq$0.3 uV ($\frac{1}{2}$ e.m.f.)
The sensitivity should be measured on all channels, if more than one.

AUDIO FREQUENCY RESPONSE (EIA)

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

	Frequency	Level	Tol.
Type CQM5112 S12	300 Hz	+9 dB	+1 dB/-3 dB
	1000 Hz	0 dB	
	3000 Hz	-9.5 dB	+1 dB/-3 dB
Type CQM5113 S12	300 Hz	+10.5 dB	+1.5 dB/-3 dB
	400 Hz	+8 dB	+1.5 dB/-1.5 dB
	1000 Hz	0 dB	
	2700 Hz	-8.6 dB	+1.5 dB/-1.5 dB
	3000 Hz	-9.5 dB	+1.5 dB/-3 dB
	6000 Hz	<-20 dB	
Type CQM5114 S12	300 Hz	+9 dB	+1 dB/-3 dB
	1000 Hz	0 dB	
	2550 Hz	-8 dB	+1 dB/-3 dB

SELF QUIETING CHECK

Internal oscillators, dividers and the harmonic frequencies hereof, may cause self quieting of the receiver if a mixer product falls in the RF or IF pass band.

For proper operation of the squelch all channels must be checked for the self quieting phenomenon.

Connect the RF generator to the antenna connector. Reduce the RF output to 0.
Set the frequency outside the 145 - 175 MHz band.
Alternatively, an attenuator (50 ohm) may be connected to the antenna connector.

Connect an AF voltmeter across the 4 ohm speaker load.

Adjust the volume control for 774 mV (0 dBm) as read on the AF voltmeter.

Select, in turn, all allocated channels.

The reading on the AF voltmeter shall not on any selected channel decline more than 6 dB.

Requirement: Quieting $\leq$6 dB.

AF POWER OUTPUT

Adjust the RF signal generator to Standard Test Condition.
Set the supply voltage to 13.2 V.
Adjust the volume control for 3 W output (3.46 V across the 4 ohm 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 8-10 dB SINAD.

The final squelch adjustment must not be set on a channel that has shown a minor degree of self quieting.

CURRENT CONSUMPTION

Measure the current consumption at 13.2V.

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

Requirements

Condition	Current consumption
Standby	≤400 mA
Receive 2 W AF ~2.83 V r.m.s. across 4 ohm.	≤750 mA

TRANSMITTER ADJUSTMENT

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

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

Refer to Receiver Alignment for measuring 8.5 V regulated supply.
Preset all transmitter tuning slugs, L153, L204, L205, L208, and L209, to be flush with the coil form top.

Turn the power control potentiometer, R215, to minimum, anticlockwise (CCW).
Connect a Wattmeter, (25 W) to the antenna connector, J601.

FREQUENCY SYNTHESIZER ALIGNMENT

Check the PROM U801, the TX mixer crystal, the RX mixer crystal, and the reference crystal and verify the frequencies and the prom codes.

Mixer crystal output

Connect RF probe 95.0089-00 with multimeter to test point TP701 (1 V range).
Key the transmitter.

Adjust L701 for maximum deflection on the multimeter.

Adjust L704 for maximum deflection on the multimeter.

Requirement:
250 mV ± 125 mV
(corresponding to -10 dBm to -4 dBm)

Note: Be careful not to resonate L704 to the false harmonics. If in doubt consult table 1 or check the crystal oscillator output with a spectrum analyzer.

Transmitter VCO

Connect the multimeter, 10 V range, to test point TP706.

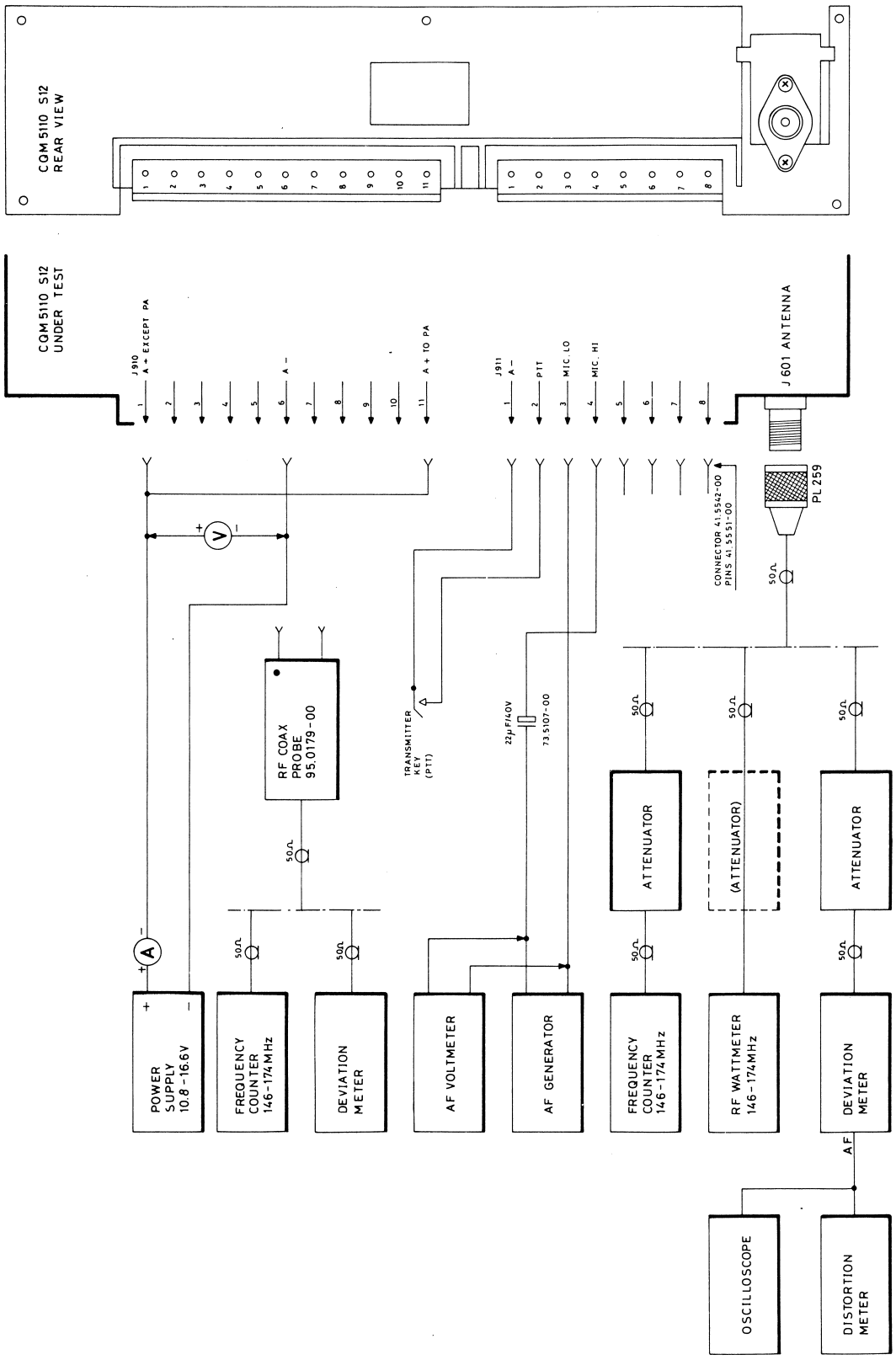
The synthesizer's lock signal is accessible at TP706 and +8 V DC with very narrow pulses (0.1 u sec.) indicate normal locked condition. Unlocked condition is indicated by a variable duty signal or logic "LOW".

Select the channel whose frequency is closest to the center frequency. Key the transmitter. Await locked condition.
Adjust C737 for 8 Volts on the multimeter.
Connect the voltmeter to test point TP703.
Adjust C737 for a voltage corresponding to the variable divider ratio (V) as indicated by the graph fig. 1.

Requirement: The voltage shall be in the range 1.5 V to 6.5 V and not deviate from the graph by more than 20%.

TRANSMITTER TEST SET-UP CQM5110 S12

D402.877



Mixer Crystal Frequency

Connect coax probe 95.0179-00 to test point TP702.
Connect the frequency counter to the probe, key the transmitter and read the frequency.
$f = f_x \times 3$ (f_x = crystal frequency).
Adjust L701 to the calculated frequency.
Requirement: f ±0.3 ppm at 25°C.
ppm= parts per million= 10^{-6}.

Synthesizer Output Level

Connect a multimeter, 2.5 V range, to test point TP201. Key the transmitter.

Adjust L153 for maximum deflection on the multimeter, typical more than 0.75 V.

EXCITER

Coarse adjustment

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

Adjust L204 for minimum deflection. The dip is small and careful tuning is required.
Connect the multimeter (1 V range) to test point TP202.
Adjust L205 for maximum deflection on the multimeter, typical 0.4 V.
Adjust L208 for minimum reading. The dip is small and careful tuning is required.
Connect diode probe 95.0089-00 and the multimeter to test point TP203.
Adjust L209 for maximum reading on the multimeter, typical 10 V.
Adjust the PA power control, R215, for rated transmitter power, 6/10 W or 25 W.

Fine adjustment

Connect the multimeter to test point TP201.
Key the transmitter.
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.
Key the transmitter.
Select, one by one, the channels and read their frequencies.
Adjust L701 for best frequency tracking on all channels.
Requirement: $F = F_{ant} \pm 0.4$ ppm.
ppm= parts per million= 10^{-6}.

RF POWER OUTPUT, CURRENT CONSUMPTION AND POWER CONTROL

Connect the Watt meter to the antenna connector, J601.
Increase the supply voltage to 16 V. The voltage is measured directly at the input connector J910.
Readjust the PA power control, R215, for rated transmitter power (P), 6/10 or 25 W.
Requirement: $P_{nom} \pm 0.1$ dB.
Measure the RF power output at 16 V, 13.2 V and 10.8 V.

Requirements (25 W):

Voltage	Power	Current
16.6 V	25 W (ref)	≤5.8 A
13.2 V	≥23 W	≤5.8 A
10.8 V	≥16 W	≤5.8 A

Requirements (10 W):

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

Requirements (6 W):

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

MODULATION ADJUSTMENT

Set the power supply voltage to 13.2 V.
Select the channel having the highest frequency. Set R116 to mid-position.
Connect coax probe 95.0179-00 to test point TP701.
Connect a deviation meter to the coax probe.
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 22 uF capacitor; refer to test setup.
Set the AF generator to 1000 Hz.
Adjust the AF generator output to 1 V r.m.s. This voltage is approx. 20 dB above the nominal modulation input level (60% Δf max) to ensure full limiting in the modulation processor.
Note the deviation read at TP701.
Connect the deviation meter to test point TP702.
Adjust R752 (Dev. Bal.) for same deviation as measured at TP701.
Connect the 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 22 uF capacitor; refer to test setup.
Set the AF generator to 1000 Hz.
Adjust the AF generator output to 1 V r.m.s. This voltage is approx. 20 dB above the nominal modulation input level (60% Δf max) to ensure full limiting in the modulation processor.
Find the AF frequency between 200 Hz and 3000 Hz 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 S12	30/25 kHz	±5 kHz
CQM5113 S12	20 kHz	±4 kHz
CQM5114 S12	12.5 kHz	±2.5 kHz

Requirement
Difference between + and - deviation: ≤10%

MODULATION SENSITIVITY AND MODULATION DISTORTION

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

CQM5112 S12 : ±3.0 kHz
CQM5113 S12 : ±2.4 kHz
CQM5114 S12 : ±1.5 kHz

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

Requirements:
Modulating signal: 75 mV ±3 dB
Distortion: ≤7%
(measured without deemphasis)

MODULATION FREQUENCY RESPONSE

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

CQM5112 S12 : ±1.0 kHz
CQM5113 S12 : ±0.8 kHz
CQM5114 S12 : ±0.5 kHz

Vary the frequency of the generator and note the deviation changes as refered to the 1000 Hz value.
Requirement :
Within the frequency range 400-2700 Hz the frequency characteristic shall lie within

+1 dB/-1.5 dB related to a 6 dB/octave characteristic.
With 6 kHz modulation frequency the deviation shall be attenuated at least 6 dB below the 1 kHz value.

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/TQ5004/TQ5005 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/TQ5004/TQ5005 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.

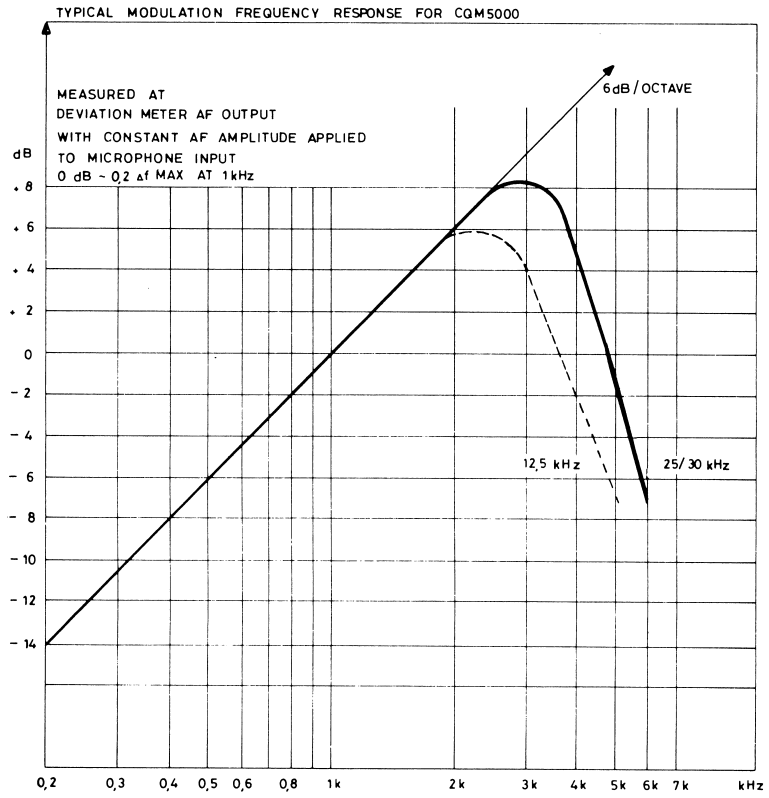
Checking the Tone Receiver

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 TQ unit responds to a released tone call.



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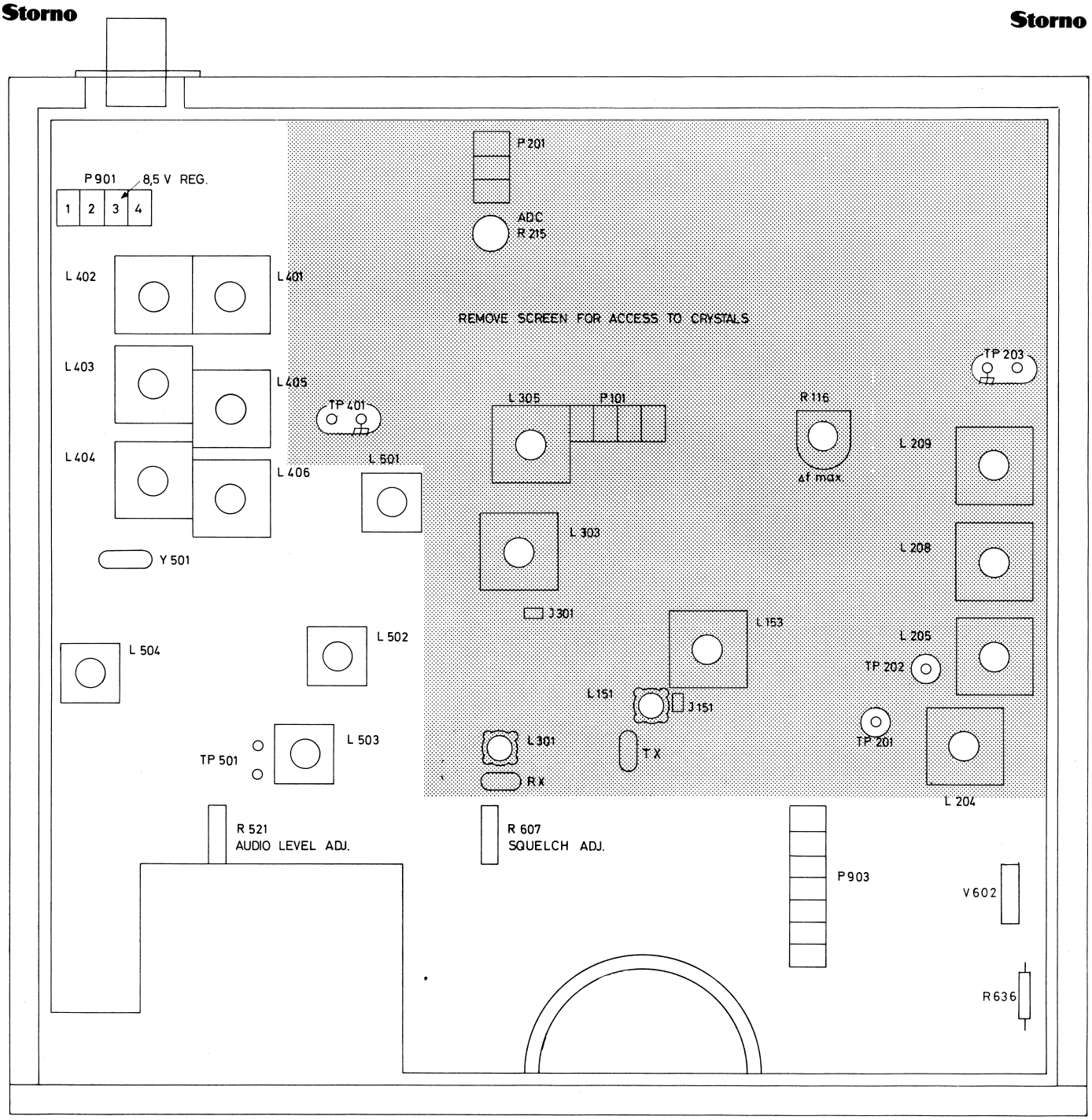
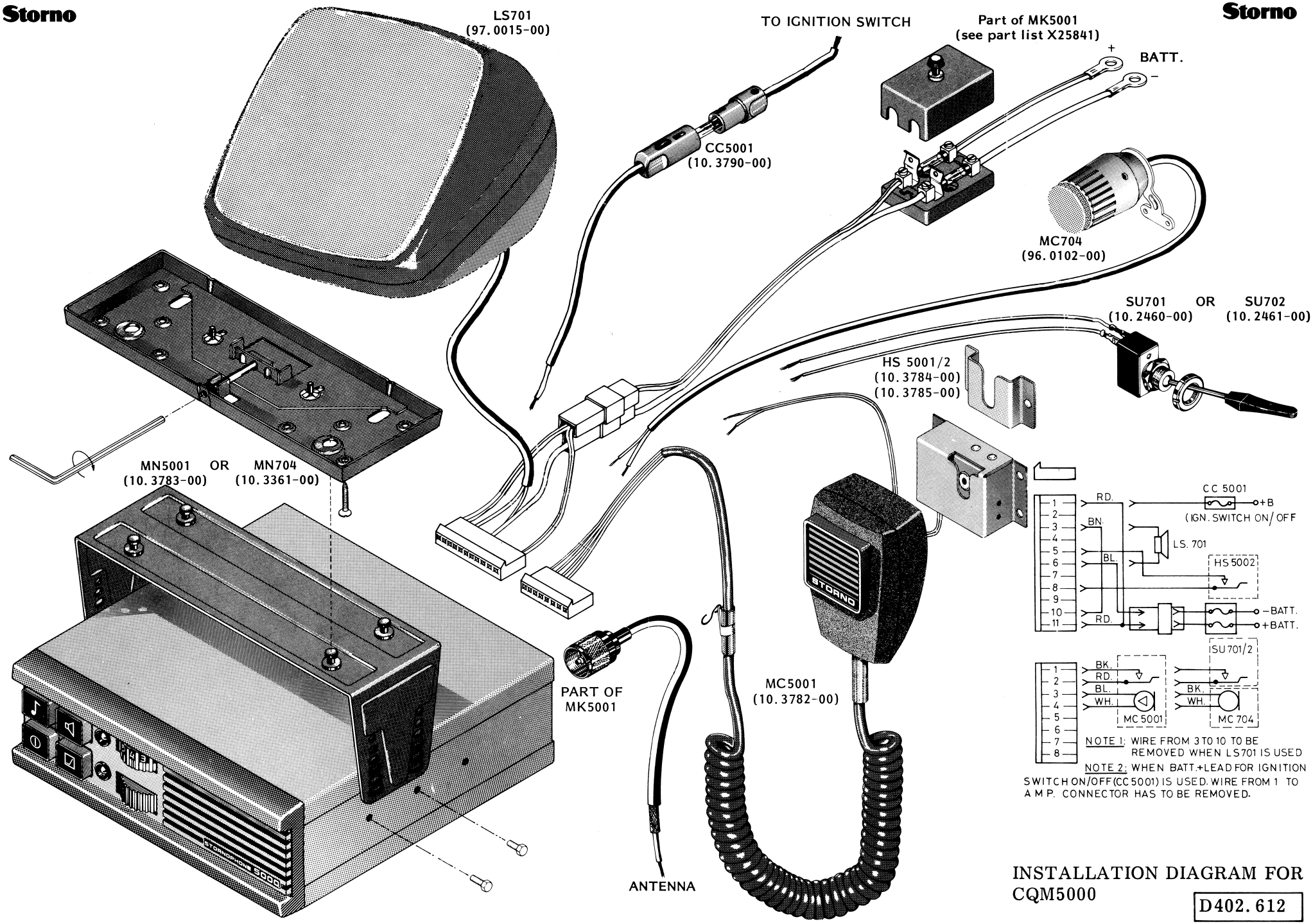


ADJUSTABLE COMPONENTS AND TEST POINTS ON RF 5110

D402.623

Storno



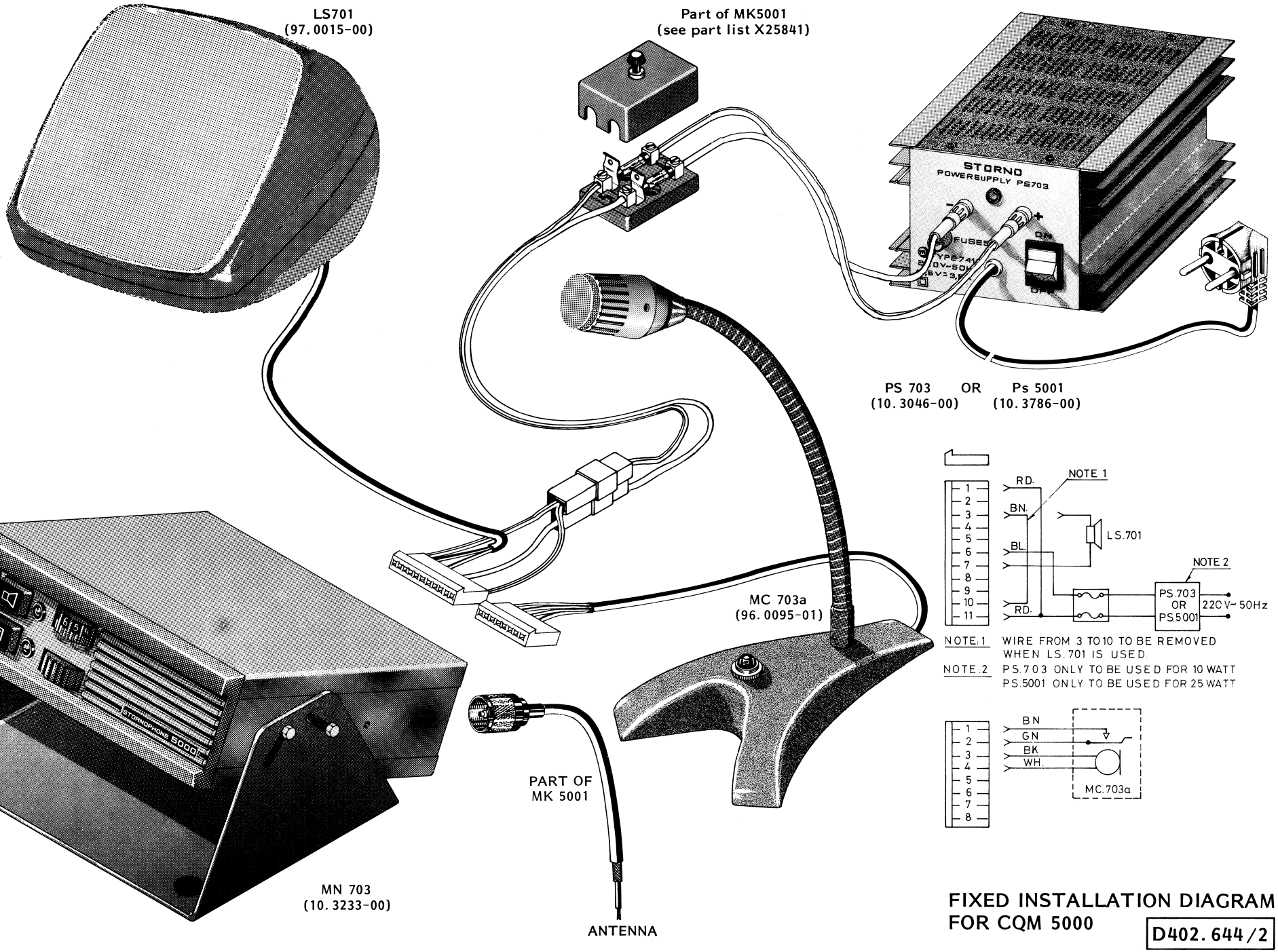
NOTE 1: WIRE FROM 3 TO 10 TO BE REMOVED WHEN LS701 IS USED

NOTE 2: WHEN BATT.+LEAD FOR IGNITION SWITCH ON/OFF (CC5001) IS USED. WIRE FROM 1 TO A M P. CONNECTOR HAS TO BE REMOVED.

INSTALLATION DIAGRAM FOR CQM5000

D402.612

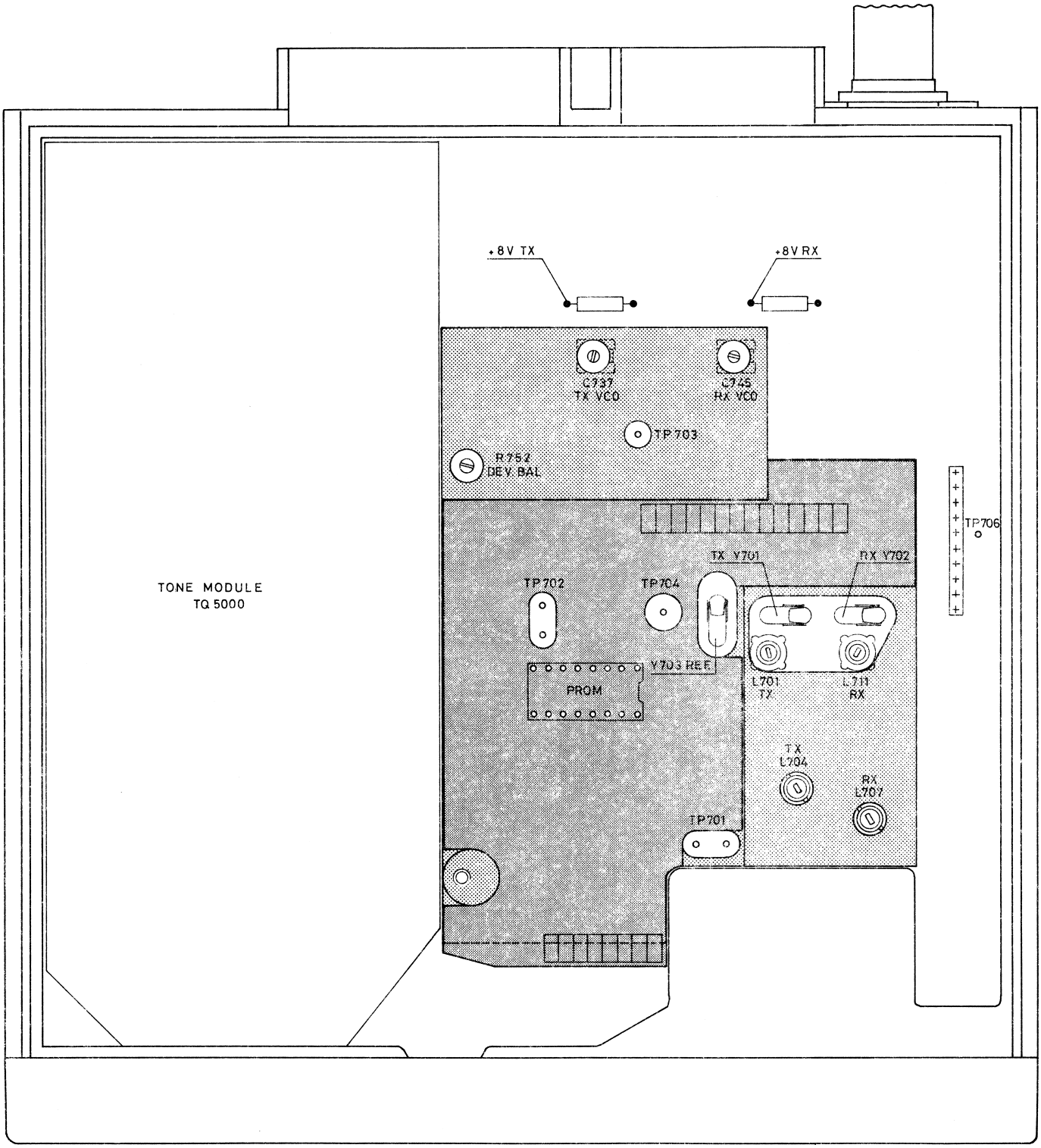
Storno



FIXED INSTALLATION DIAGRAM
FOR CQM 5000

D402.644/2

Storno



ADJUSTABLE COMPONENTS AND
TEST POINTS ON CQM5000XXS12

D402.875

Storno

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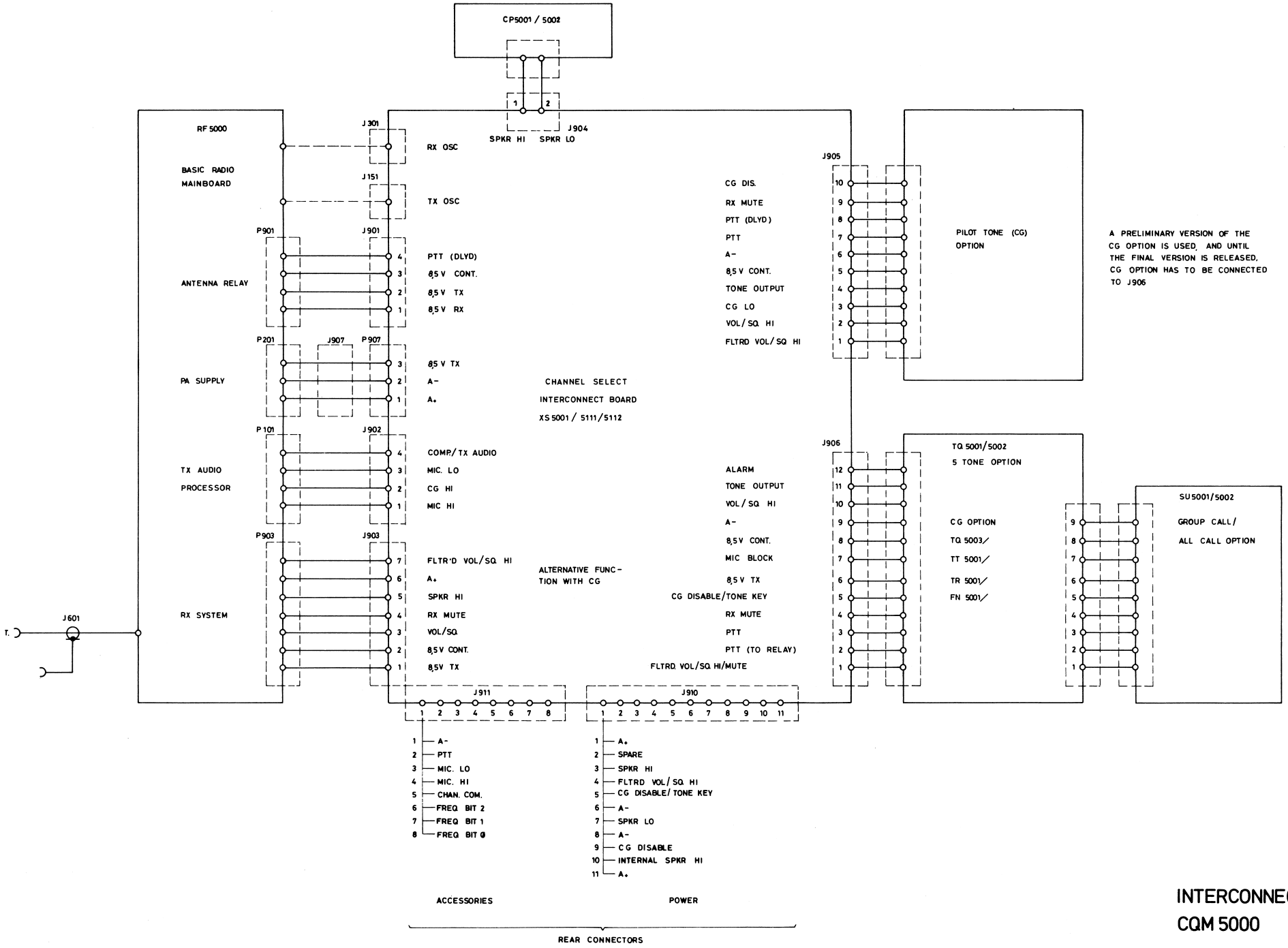


INTERCONNECT DIAGRAM

CQM 5000

D402.641/2

MIXER

RF AMPLIFIER

10,7 MHz AMPL.

U 501
2nd OSC + MIXER + IF AMPL

U 502
IF AMPL + DETECTOR + AF - PRE AMP

U 602
VOLTAGE REGULATOR

AF AMPLIFIER

AUDIO LEVEL ADJ

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

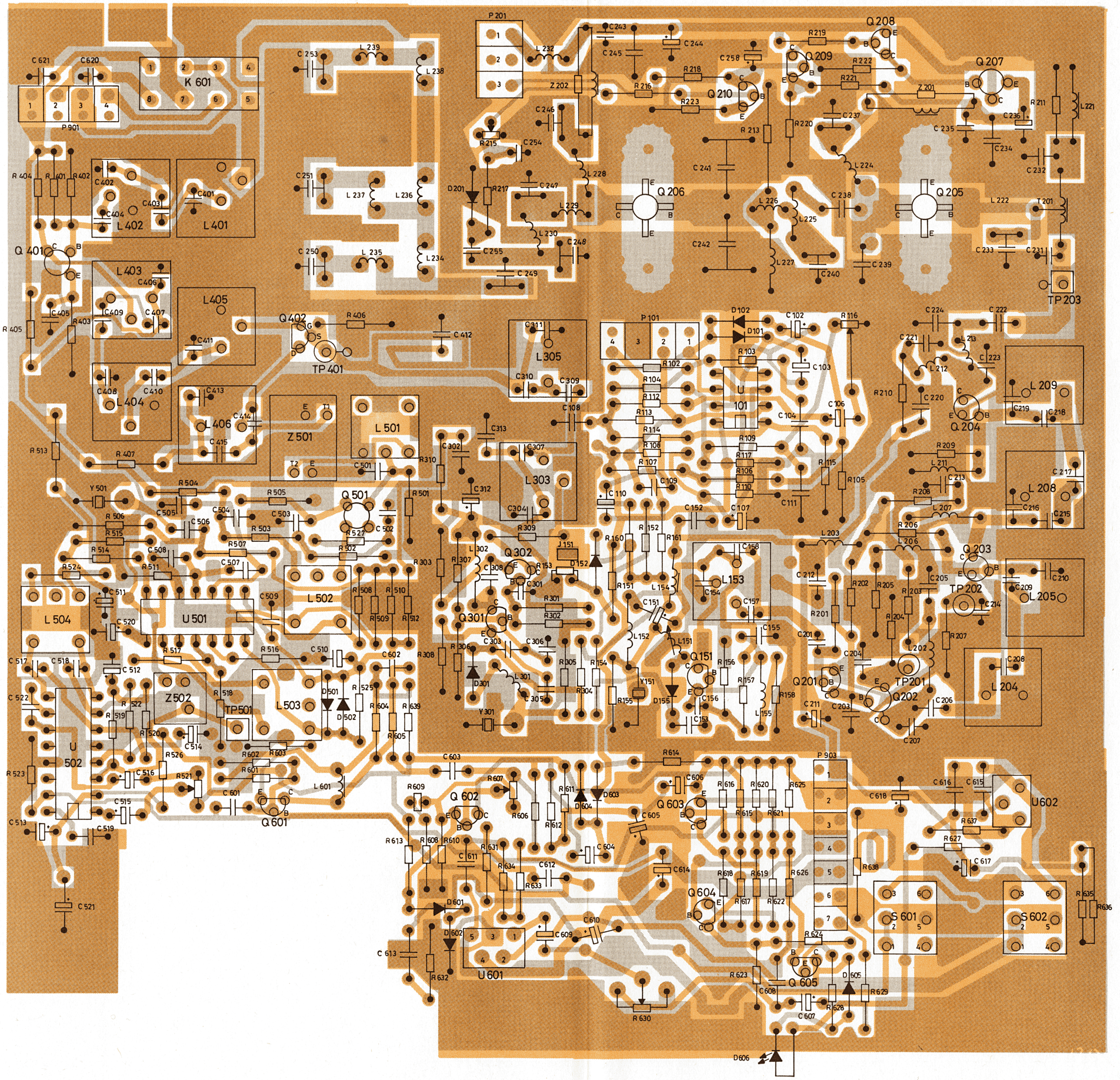
HARMONIC FILTER

TO ANTENNA RELAY

RF UNIT RF5110

D402.613/4

Storno



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	

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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

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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

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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

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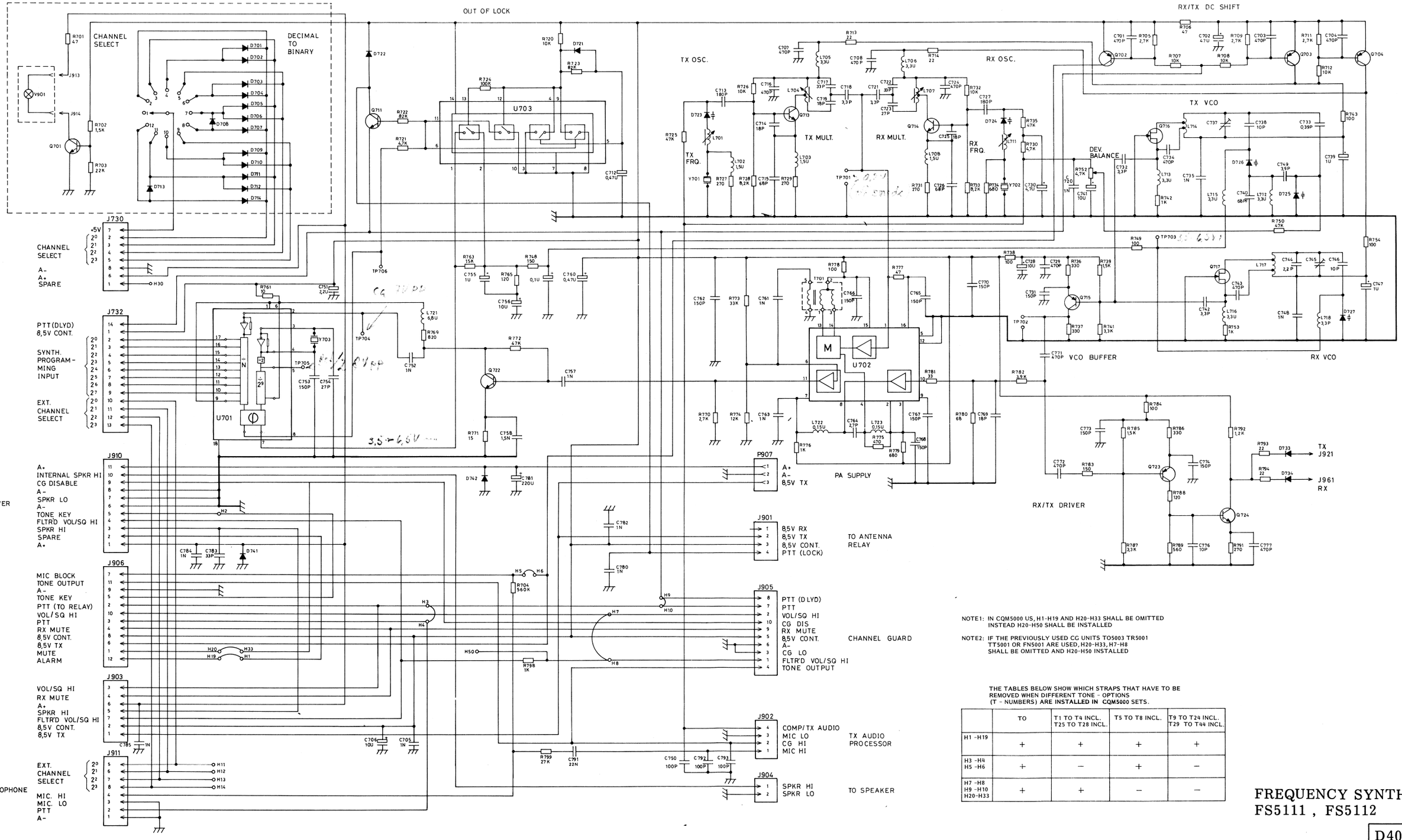
Storno

Storno



NOTE1: IN CQM5000 US, H1-H19 AND H20-H33 SHALL BE OMITTED INSTEAD H20-H50 SHALL BE INSTALLED

NOTE2: IF THE PREVIOUSLY USED CG UNITS TQ5003 TR5001 TT5001 OR FN5001 ARE USED, H20-H33, H7-H8 SHALL BE OMITTED AND H20-H50 INSTALLED

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

	TO	T1 TO T4 INCL. T25 TO T28 INCL.	T5 TO T8 INCL.	T9 TO T24 INCL. T29 TO T44 INCL.
H1 -H19	+	+	+	+
H3 -H4 H5 -H6	+	–	+	–
H7 -H8 H9 -H10 H20-H33	+	+	–	–

FREQUENCY SYNTHESIZER FS5111 , FS5112

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Nº	CODE	DATA	
C701	19A700233P5	470 pF Capacitor Ceramic	50 V
C702	19J706005P3	47 uF Capacitor Electrolytic	16 V
C703	19A700233P5	470 pF Capacitor Ceramic	50 V
C704	19A700233P5	470 pF Capacitor Ceramic	50 V
C705	19A700233P7	1 nF Capacitor Ceramic	50 V
C706	19A700003P7	10 uF Capacitor Tantalum	16 V
C707	19A700233P5	470 pF Capacitor Ceramic	50 V
C708	19A700233P5	470 pF Capacitor Ceramic	50 V
C711	19A700003P1	0.1 uF Capacitor Tantalum	35 V
C712	19A700003P5	2.2 uF Capacitor Tantalum	35 V
C713	19A700235P28	180 pF Capacitor Ceramic	50 V
C714	19J706256P202	18 pF N1500 Capacitor Ceramic	
C715	19J706256P205	68 pF N1500 Capacitor Ceramic	
C716	19A700233P5	470 pF Capacitor Ceramic	50 V
C717	19A700235P19	33 pF Capacitor Ceramic	50 V
C718	19A700235P7	3.3 pF Capacitor Ceramic	50 V
C719	19A700235P16	18 pF Capacitor Ceramic	50 V
C720	19A700233P7	1 nF Capacitor Ceramic	50 V
C721	19A700235P7	3.3 pF Capacitor Ceramic	50 V
C722	19A700235P19	33 pF Capacitor Ceramic	50 V
C723	19A700235P18	27 pF Capacitor Ceramic	50 V
C724	19A700233P5	470 pF Capacitor Ceramic	50 V
C725	19J706256P202	18 pF N1500 Capacitor Ceramic	50 V
C726	19J706256P205	68 pF N1500 Capacitor Ceramic	50 V
C727	19A700235P28	180 pF Capacitor Ceramic	50 V
C728	19A700003P7	10 uF Capacitor Tantalum	16 V
C729	19A700233P5	470 pF Capacitor Ceramic	50 V
C730	19A700003P6	4.7 uF Capacitor Tantalum	35 V
C731	19A700233P2	150 pF Capacitor Ceramic	50 V
C732	19A700235P7	3.3 pF Capacitor Ceramic	50 V
C733	19A700013P8	0.39 pF Capacitor Phenolic	500 V
C734	19A700233P5	470 pF Capacitor Ceramic	50 V
C735	19A700233P7	1 nF Capacitor Ceramic	50 V
C737	19J706003P1	1.8-10 pF Capacitor Variable	
C738	19A700235P13	10 pF Capacitor Ceramic	50 V
C739	19A700003P4	1 uF Capacitor Tantalum	35 V
C740	19A700235P23	68 pF Capacitor Ceramic	50 V
C741	19A700003P7	10 uF Capacitor Tantalum	16 V
C742	19A700235P7	3.3 pF Capacitor Ceramic	50 V
C743	19A700233P5	470 pF Capacitor Ceramic	50 V
C744	19A700235P5	2.2 pF Capacitor Ceramic	50 V
C745	19J706003P2	2-18 pF Capacitor Variable	
C746	19A700235P13	10 pF Capacitor Ceramic	50 V
C747	19A700003P4	1 uF Capacitor Tantalum	35 V
C748	19A700233P7	1 nF Capacitor Ceramic	50 V
C749	19A700235P8	3.9 pF Capacitor Ceramic	50 V

Storno

Nº	CODE	DATA	
C750	19A700233P1	100 pF Capacitor Ceramic	50 V
C751	19A700003P5	2.2 uF Capacitor Tantalum	35 V
C752	19A700233P7	1 nF Capacitor Ceramic	50 V
C753	19A700233P2	150 pF Capacitor Ceramic	50 V
C754	19A700235P18	27 pF Capacitor Ceramic	50 V
C755	19A700003P4	1 uF Capacitor Tantalum	35 V
C756	19A700003P7	10 uF Capacitor Tantalum	35 V
C757	19A700233P7	1 nF Capacitor Ceramic	50 V
C758	19A700233P8	1.5 nF Capacitor Ceramic	50 V
C759	19A700003P4	1 uF Capacitor Tantalum	35 V
C760	19A700003P3	0.47 uF Capacitor Tantalum	35 V
C761	19A700233P7	1 nF Capacitor Ceramic	50 V
C762	19A700233P2	150 pF Capacitor Ceramic	50 V
C763	19A700233P7	1 nF Capacitor Ceramic	50 V
C764	19A700235P6	2.7 pF Capacitor Ceramic	50 V
C765	19A700233P2	150 pF Capacitor Ceramic	50 V
C766	19A700233P2	150 pF Capacitor Ceramic	50 V
C767	19A700233P2	150 pF Capacitor Ceramic	50 V
C768	19A700233P2	150 pF Capacitor Ceramic	50 V
C769	19A700235P16	18 pF Capacitor Ceramic	50 V
C770	19A700233P2	150 pF Capacitor Ceramic	50 V
C771	19A700233P5	470 pF Capacitor Ceramic	50 V
C772	19A700233P5	470 pF Capacitor Ceramic	50 V
C773	19A700233P2	150 pF Capacitor Ceramic	50 V
C774	19A700233P2	150 pF Capacitor Ceramic	50 V
C776	19A700235P13	10 pF Capacitor Ceramic	50 V
C777	19A700233P5	470 pF Capacitor Ceramic	50 V
C780	19A700233P7	1 nF Capacitor Ceramic	50 V
C781	19J706005P5	220 uF Capacitor Electrolytic	16 V
C782	19A700233P7	1 nF Capacitor Ceramic	50 V
C783	19A700235P19	33 pF Capacitor Ceramic	50 V
C784	19A700233P7	1 nF Capacitor Ceramic	50 V
C785	19A700233P7	1 nF Capacitor Ceramic	50 V
C791	19J706261P1	22 nF Capacitor Polyester	100 V
C792	19A700233P1	100 pF Capacitor Ceramic	50 V
C793	19A700233P1	100 pF Capacitor Ceramic	50 V
D721	19A700028P1	1N4148 Diode Silicon	
D722	19A700028P1	1N4148 Diode Silicon	
D723	19A706262P1	Variable Cap. Diode	
D724	19J706262P1	Variable Cap. Diode	

FREQUENCY SYNTHESIZER FS5111

X402.895

Nº	CODE	DATA	
D725	19A700073P1	BB409 Variable Cap. Diode	
D726	19A700073P1	BB409 Variable Cap. Diode	
D727	19A700073P1	BB409 Variable Cap. Diode	
D733	19J706006P2	BA282 Diode	
D734	19J706006P2	BA282 Diode	
D741	19J706026P1	1N5401 Diode Silicon	
D742	19J706026P1	1N5401 Diode Silicon	
J730	19J706215P108	Male Connector	8 pin
J732	19J706215P114	Male Connector	14 pin
J901	19J706214P4	Male Connector	4 pin
J902	19J706214P4	Male Connector	4 pin
J903	19J706214P7	Male Connector	7 pin
J904	19A700072P28	Male Connector	2 pin
J905	19A700072P9	Male Connector	10 pin
J906	19A700072P11	Male Connector	12 pin
J907	19A700102P21	Female Connector	3 pin
J910	19J706223P11	Male Connector	11 pos
J911	19J706223P8	Male Connector	8 pos
J921	19J706219P1		pin
J961	19J706219P1		pin
L701	19J706029P4	Variable Coil	
L702	19A700024P15	1.5 uH Coil	
L703	19A700024P15	1.5 uH Coil	
L704	19J706083P1	Coil	
L705	19A700024P19	3.3 uH Coil	
L706	19A700024P19	3.3 uH Coil	
L707	19J706083P1	Variable Coil	
L708	19A700024P15	1.5 uH Coil	
L711	19J706029P4	Variable Coil	
L712	19A700024P19	3.3 uH Coil	
L713	19A700024P19	3.3 uH Coil	
L714	19J706258P1	Coil	
L715	19A700024P19	3.3 uH Coil	
L716	19A700024P19	3.3 uH Coil	
L717	19J706258P1	Coil	
L718	19A700024P19	3.3 uH Coil	
L721	19A700024P23	6.8 uH Coil	
L722	19A700024P3	0.15 uH Coil	
L723	19A700024P3	0.15 uH Coil	
Q702	19A700020P1	BC558 Transistor	
Q703	19A700020P1	BC558 Transistor	
Q704	19A700020P1	BC558 Transistor	
Q711	19A700017P2	BC548 Transistor	
Q713	19J706283P1	BFR54 Transistor	
Q714	19J706283P1	BFR54 Transistor	
Q715	19J706264P1	BF414 Transistor	

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Nº	CODE	DATA	
Q716	19J706038P1	2N5245 Transistor	
Q717	19J706038P1	2N5245 Transistor	
Q722	19J706146P1	BF357S Transistor	
Q723	19J706164P1	BF414 Transistor	
Q724	19J706146P1	BF357S Transistor	
R704	19A700019P34	560 ohm Resistor Depos.	0.25 W
R705	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R706	19A700019P21	47 ohm Resistor Depos.	0.25 W
R707	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R708	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R709	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R711	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R712	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R713	19A700019P17	22 ohm Resistor Depos.	0.25 W
R714	19A700019P17	22 ohm Resistor Depos.	0.25 W
R720	19A700019P37	1 Kohm Resistor Depos.	0.25 W
R721	19A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R722	19A700019P60	82 Kohm Resistor Depos.	0.25 W
R723	19A700019P58	56 Kohm Resistor Depos.	0.25 W
R724	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R725	19A700019P57	47 Kohm Resistor Depos.	0.25 W
R726	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R727	19A700019P30	270 ohm Resistor Depos.	0.25 W
R728	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R729	19A700019P30	270 ohm Resistor Depos.	0.25 W
R730	19A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R731	19A700019P30	270 ohm Resistor Depos.	0.25 W
R732	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R733	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R734	19A700019P35	680 ohm Resistor Depos.	0.25 W
R735	19A700029P57	47 Kohm Resistor Depos.	0.25 W
R736	19A700029P31	330 ohm Resistor Depos.	0.25 W
R737	19A700019P31	330 ohm Resistor Depos.	0.25 W
R738	19A700019P25	100 ohm Resistor Depos.	0.25 W
R739	19A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R741	19A700019P43	3.3 Kohm Resistor Depos.	0.25 W
R742	19A700019P37	1 Kohm Resistor Depos.	0.25 W
R743	19A700019P25	100 ohm Resistor Depos.	0.25 W
R748	19A700019P27	150 ohm Resistor Depos.	0.25 W
R749	19A700019P25	100 ohm Resistor Depos.	0.25 W

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Nº	CODE	DATA	
R750	19A700019P57	47 Kohm Resistor Depos.	0.25 W
R752	19A700016P3	4.7 Kohm Resistor Variable	
R753	19A700019P37	1 Kohm Resistor Depos.	0.25 W
R754	19A700019P25	100 ohm Resistor Depos.	0.25 W
R761	19A700019P13	10 ohm Resistor Depos.	0.25 W
R763	19A700019P51	15 Kohm Resistor Depos.	0.25 W
R765	19A700019P26	120 ohm Resistor Depos.	0.25 W
R769	19A700019P35	820 ohm Resistor Depos.	0.25 W
R770	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R771	19A700019P15	15 ohm Resistor Depos.	0.25 W
R772	19A700019P57	47 Kohm Resistor Depos.	0.25 W
R773	19A700019P55	33 Kohm Resistor Depos.	0.25 W
R774	19A700019P50	12 Kohm Resistor Depos.	0.25 W
R775	19A700019P33	470 ohm Resistor Depos.	0.25 W
R776	19A700010P37	1 Kohm Resistor Depos.	0.25 W
R777	19A700019P21	47 ohm Resistor Depos.	0.25 W
R778	19A700019P25	100 ohm Resistor Depos.	0.25 W
R779	19A700019P35	680 ohm Resistor Depos.	0.25 W
R780	19A700019P23	68 ohm Resistor Depos.	0.25 W
R781	19A700019P19	33 ohm Resistor Depos.	0.25 W
R782	19A700019P44	3.9 Kohm Resistor Depos.	0.25 W
R783	19A700019P27	150 ohm Resistor Depos.	0.25 W
R784	19A700019P25	100 ohm Resistor Depos.	0.25 W
R785	19A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R786	19A700019P31	330 ohm Resistor Depos.	0.25 W
R787	19A700019P43	3.3 Kohm Resistor Depos.	0.25 W
R788	19A700019P26	120 ohm Resistor Depos.	0.25 W
R789	19A700019P34	560 ohm Resistor Depos.	0.25 W
R791	19A700019P30	270 ohm Resistor Depos.	0.25 W
R792	19A700019P38	1.2 Kohm Resistor Depos.	0.25 W
R793	19A700019P17	22 ohm Resistor Depos.	0.25 W
R794	19A700019P17	22 ohm Resistor Depos.	0.25 W
R798	19A700019P37	1 Kohm Resistor Depos.	0.25 W
R799	19A700019P54	27 Kohm Resistor Depos.	0.25 W
T701	19J706284G1	Transformer	
U701	19J706263P1	MC145106	
U702	19J706238P1	TDA1062 IC	
U703	19A700029P44	4066B IC	

Nº	CODE	DATA

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Nº	CODE	DATA	
C701	19A700233P5	470 pF Capacitor Ceramic	50 V
C702	19J706005P3	47 uF Capacitor Electrolytic	16 V
C703	19A700233P5	470 pF Capacitor Ceramic	50 V
C704	19A700233P5	470 pF Capacitor Ceramic	50 V
C705	19A700233P7	1 nF Capacitor Ceramic	50 V
C706	19A700003P7	10 uF Capacitor Tantalum	16 V
C707	19A700233P5	470 pF Capacitor Ceramic	50 V
C708	19A700233P5	470 pF Capacitor Ceramic	50 V
C711	19A700003P1	0.1 uF Capacitor Tantalum	35 V
C712	19A700003P5	2.2 uF Capacitor Tantalum	35 V
C713	19A700235P28	180 pF Capacitor Ceramic	50 V
C714	19J706256P202	18 pF N1500 Capacitor Ceramic	
C715	19J706256P205	68 pF N1500 Capacitor Ceramic	
C716	19A700233P5	470 pF Capacitor Ceramic	50 V
C717	19A700235P19	33 pF Capacitor Ceramic	50 V
C718	19A700235P7	3.3 pF Capacitor Ceramic	50 V
C719	19A700235P16	18 pF Capacitor Ceramic	50 V
C720	19A700233P7	1 nF Capacitor Ceramic	50 V
C721	19A700235P7	3.3 pF Capacitor Ceramic	50 V
C722	19A700235P19	33 pF Capacitor Ceramic	50 V
C723	19A700235P18	27 pF Capacitor Ceramic	50 V
C724	19A700233P5	470 pF Capacitor Ceramic	50 V
C725	19J706256P202	18 pF N1500 Capacitor Ceramic	50 V
C726	19J706256P205	68 pF N1500 Capacitor Ceramic	50 V
C727	19A700235P28	180 pF Capacitor Ceramic	50 V
C728	19A700003P7	10 uF Capacitor Tantalum	16 V
C729	19A700233P5	470 pF Capacitor Ceramic	50 V
C730	19A700003P6	4.7 uF Capacitor Tantalum	35 V
C731	19A700233P2	150 pF Capacitor Ceramic	50 V
C732	19A700235P7	3.3 pF Capacitor Ceramic	50 V
C733	19A700013P8	0.39 pF Capacitor Phenolic	500 V
C734	19A700233P5	470 pF Capacitor Ceramic	50 V
C735	19A700233P7	1 nF Capacitor Ceramic	50 V
C737	19J706003P1	1.8-10 pF Capacitor Variable	
C738	19A700235P13	10 pF Capacitor Ceramic	50 V
C739	19A700003P4	1 uF Capacitor Tantalum	35 V
C740	19A700235P23	68 pF Capacitor Ceramic	50 V
C741	19A700003P7	10 uF Capacitor Tantalum	16 V
C742	19A700235P7	3.3 pF Capacitor Ceramic	50 V
C743	19A700233P5	470 pF Capacitor Ceramic	50 V
C744	19A700235P5	2.2 pF Capacitor Ceramic	50 V
C745	19J706003P2	2-18 pF Capacitor Variable	
C746	19A700235P13	10 pF Capacitor Ceramic	50 V
C747	19A700003P4	1 uF Capacitor Tantalum	35 V
C748	19A700233P7	1 nF Capacitor Ceramic	50 V
C749	19A700235P8	3.9 pF Capacitor Ceramic	50 V
C750	19A700233P1	100 pF Capacitor Ceramic	50 V

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Nº	CODE	DATA	
C751	19A700003P5	2.2 uF Capacitor Tantalum	35 V
C752	19A700233P7	1 nF Capacitor Ceramic	50 V
C753	19A700233P2	150 pF Capacitor Ceramic	50 V
C754	19A700235P18	27 pF Capacitor Ceramic	50 V
C755	19A700003P4	1 uF Capacitor Tantalum	35 V
C756	19A700003P7	10 uF Capacitor Tantalum	35 V
C757	19A700233P7	1 nF Capacitor Ceramic	50 V
C758	19A700233P8	1.5 nF Capacitor Ceramic	50 V
C759	19A700003P4	1 uF Capacitor Tantalum	35 V
C760	19A700003P3	0.47 uF Capacitor Tantalum	35 V
C761	19A700233P7	1 nF Capacitor Ceramic	50 V
C762	19A700233P2	150 pF Capacitor Ceramic	50 V
C763	19A700233P7	1 nF Capacitor Ceramic	50 V
C764	19A700235P6	2.7 pF Capacitor Ceramic	50 V
C765	19A700233P2	150 pF Capacitor Ceramic	50 V
C766	19A700233P2	150 pF Capacitor Ceramic	50 V
C767	19A700233P2	150 pF Capacitor Ceramic	50 V
C768	19A700233P2	150 pF Capacitor Ceramic	50 V
C769	19A700235P16	18 pF Capacitor Ceramic	50 V
C770	19A700233P2	150 pF Capacitor Ceramic	50 V
C771	19A700233P5	470 pF Capacitor Ceramic	50 V
C772	19A700233P5	470 pF Capacitor Ceramic	50 V
C773	19A700233P2	150 pF Capacitor Ceramic	50 V
C774	19A700233P2	150 pF Capacitor Ceramic	50 V
C776	19A700235P13	10 pF Capacitor Ceramic	50 V
C777	19A700233P5	470 pF Capacitor Ceramic	50 V
C780	19A700233P7	1 nF Capacitor Ceramic	50 V
C781	19J706005P5	220 uF Capacitor Electrolytic	16 V
C782	19A700233P7	1 nF Capacitor Ceramic	50 V
C783	19A700235P19	33 pF Capacitor Ceramic	50 V
C784	19A700233P7	1 nF Capacitor Ceramic	50 V
C785	19A700233P7	1 nF Capacitor Ceramic	50 V
C791	19J706261P1	22 nF Capacitor Polyester	100 V
C792	19A700233P1	100 pF Capacitor Ceramic	50 V
C793	19A700233P1	100 pF Capacitor Ceramic	50 V
D701	19A700028P1	1N4148 Diode Silicon	
D702	19A700028P1	1N4148 Diode Silicon	
D703	19A700028P1	1N4148 Diode Silicon	
D704	19A700028P1	1N4148 Diode Silicon	
D705	19A700028P1	1N4148 Diode Silicon	

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Nº	CODE	DATA	
D706	19A700028P1	1N4148 Diode Silicon	
D707	19A700028P1	1N4148 Diode Silicon	
D708	19A700028P1	1N4148 Diode Silicon	
D709	19A700028P1	1N4148 Diode Silicon	
D710	19A700028P1	1N4148 Diode Silicon	
D711	19A700028P1	1N4148 Diode Silicon	
D712	19A700028P1	1N4148 Diode Silicon	
D713	19A700028P1	1N4148 Diode Silicon	
D714	19A700028P1	1N4148 Diode Silicon	
D721	19A700028P1	1N4148 Diode Silicon	
D722	19A700028P1	1N4148 Diode Silicon	
D723	19A706262P1	Variable Cap. Diode	
D724	19J706262P1	Variable Cap. Diode	
D725	19A700073P1	BB409 Variable Cap. Diode	
D726	19A700073P1	BB409 Variable Cap. Diode	
D727	19A700073P1	BB409 Variable Cap. Diode	
D733	19J706006P2	BA282 Diode	
D734	19J706006P2	BA282 Diode	
D741	19J706026P1	1N5401 Diode Silicon	
D742	19J706026P1	1N5401 Diode Silicon	
J730	19J706215P108	Male Connector	8 pin
J732	19J706215P114	Male Connector	14 pin
J901	19J706214P4	Male Connector	4 pin
J902	19J706214P4	Male Connector	4 pin
J903	19J706214P7	Male Connector	7 pin
J904	19A700072P28	Male Connector	2 pin
J905	19A700072P9	Male Connector	10 pin
J906	19A700072P11	Male Connector	12 pin
J907	19A700102P21	Female Connector	3 pin
J910	19J706223P11	Male Connector	11 pos
J911	19J706223P8	Male Connector	8 pos
J921	19J706219P1		pin
J961	19J706219P1		pin
L701	19J706029P4	Variable Coil	
L702	19A700024P15	1.5 uH Coil	
L703	19A700024P15	1.5 uH Coil	
L704	19J706083P1	Coil	
L705	19A700024P19	3.3 uH Coil	
L706	19A700024P19	3.3 uH Coil	
L707	19J706083P1	Variable Coil	
L708	19A700024P15	1.5 uH Coil	
L711	19J706029P4	Variable Coil	
L712	19A700024P19	3.3 uH Coil	
L713	19A700024P19	3.3 uH Coil	
L714	19J706258P1	Coil	
L715	19A700024P19	3.3 uH Coil	

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Nº	CODE	DATA	
L716	19A700024P19	3.3 uH Coil	
L717	19J706258P1	Coil	
L718	19A700024P19	3.3 uH Coil	
L721	19A700024P23	6.8 uH Coil	
L722	19A700024P3	0.15 uH Coil	
L723	19A700024P3	0.15 uH Coil	
Q701	19A700017P1	BC548 Transistor	
Q702	19A700020P1	BC558 Transistor	
Q703	19A700020P1	BC558 Transistor	
Q704	19A700020P1	BC558 Transistor	
Q711	19A700017P2	BC548 Transistor	
Q713	19J706283P1	BFR54 Transistor	
Q714	19J706283P1	BFR54 Transistor	
Q715	19J706264P1	BF414 Transistor	
Q716	19J706038P1	2N5245 Transistor	
Q717	19J706038P1	2N5245 Transistor	
Q722	19J706146P1	BF357S Transistor	
Q723	19J706164P1	BF414 Transistor	
Q724	19J706146P1	BF357S Transistor	
R701	19A700019P21	47 ohm Resistor Depos.	0.25 W
R702	19A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R703	19A700019P53	22 Kohm Resistor Depos.	0.25 W
R704	19A700019P34	560 ohm Resistor Depos.	0.25 W
R705	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R706	19A700019P21	47 ohm Resistor Depos.	0.25 W
R707	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R708	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R709	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R711	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R712	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R713	19A700019P17	22 ohm Resistor Depos.	0.25 W
R714	19A700019P17	22 ohm Resistor Depos.	0.25 W
R720	19A700019P37	1 Kohm Resistor Depos.	0.25 W
R721	19A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R722	19A700019P60	82 Kohm Resistor Depos.	0.25 W
R723	19A700019P58	56 Kohm Resistor Depos.	0.25 W
R724	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R725	19A700019P57	47 Kohm Resistor Depos.	0.25 W
R726	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R727	19A700019P30	270 ohm Resistor Depos.	0.25 W

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Nº	CODE	DATA	
R728	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R729	19A700019P30	270 ohm Resistor Depos.	0.25 W
R730	19A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R731	19A700019P30	270 ohm Resistor Depos.	0.25 W
R732	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R733	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R734	19A700019P35	680 ohm Resistor Depos.	0.25 W
R735	19A700029P57	47 Kohm Resistor Depos.	0.25 W
R736	19A700029P31	330 ohm Resistor Depos.	0.25 W
R737	19A700019P31	330 ohm Resistor Depos.	0.25 W
R738	19A700019P25	100 ohm Resistor Depos.	0.25 W
R739	19A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R741	19A700019P43	3.3 Kohm Resistor Depos.	0.25 W
R742	19A700019P37	1 Kohm Resistor Depos.	0.25 W
R743	19A700019P25	100 ohm Resistor Depos.	0.25 W
R748	19A700019P27	150 ohm Resistor Depos.	0.25 W
R749	19A700019P25	100 ohm Resistor Depos.	0.25 W
R750	19A700019P57	47 Kohm Resistor Depos.	0.25 W
R752	19A700016P3	4.7 Kohm Resistor Variable	
R753	19A700019P37	1 Kohm Resistor Depos.	0.25 W
R754	19A700019P25	100 ohm Resistor Depos.	0.25 W
R761	19A700019P13	10 ohm Resistor Depos.	0.25 W
R763	19A700019P51	15 Kohm Resistor Depos.	0.25 W
R765	19A700019P26	120 ohm Resistor Depos.	0.25 W
R769	19A700019P35	820 ohm Resistor Depos.	0.25 W
R770	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R771	19A700019P15	15 ohm Resistor Depos.	0.25 W
R772	19A700019P57	47 Kohm Resistor Depos.	0.25 W
R773	19A700019P55	33 Kohm Resistor Depos.	0.25 W
R774	19A700019P50	12 Kohm Resistor Depos.	0.25 W
R775	19A700019P33	470 ohm Resistor Depos.	0.25 W
R776	19A700010P37	1 Kohm Resistor Depos.	0.25 W
R777	19A700019P21	47 ohm Resistor Depos.	0.25 W
R778	19A700019P25	100 ohm Resistor Depos.	0.25 W
R779	19A700019P35	680 ohm Resistor Depos.	0.25 W
R780	19A700019P23	68 ohm Resistor Depos.	0.25 W
R781	19A700019P19	33 ohm Resistor Depos.	0.25 W
R782	19A700019P44	3.9 Kohm Resistor Depos.	0.25 W
R783	19A700019P27	150 ohm Resistor Depos.	0.25 W
R784	19A700019P25	100 ohm Resistor Depos.	0.25 W
R785	19A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R786	19A700019P31	330 ohm Resistor Depos.	0.25 W
R787	19A700019P43	3.3 Kohm Resistor Depos.	0.25 W
R788	19A700019P26	120 ohm Resistor Depos.	0.25 W
R789	19A700019P34	560 ohm Resistor Depos.	0.25 W
R791	19A700019P30	270 ohm Resistor Depos.	0.25 W

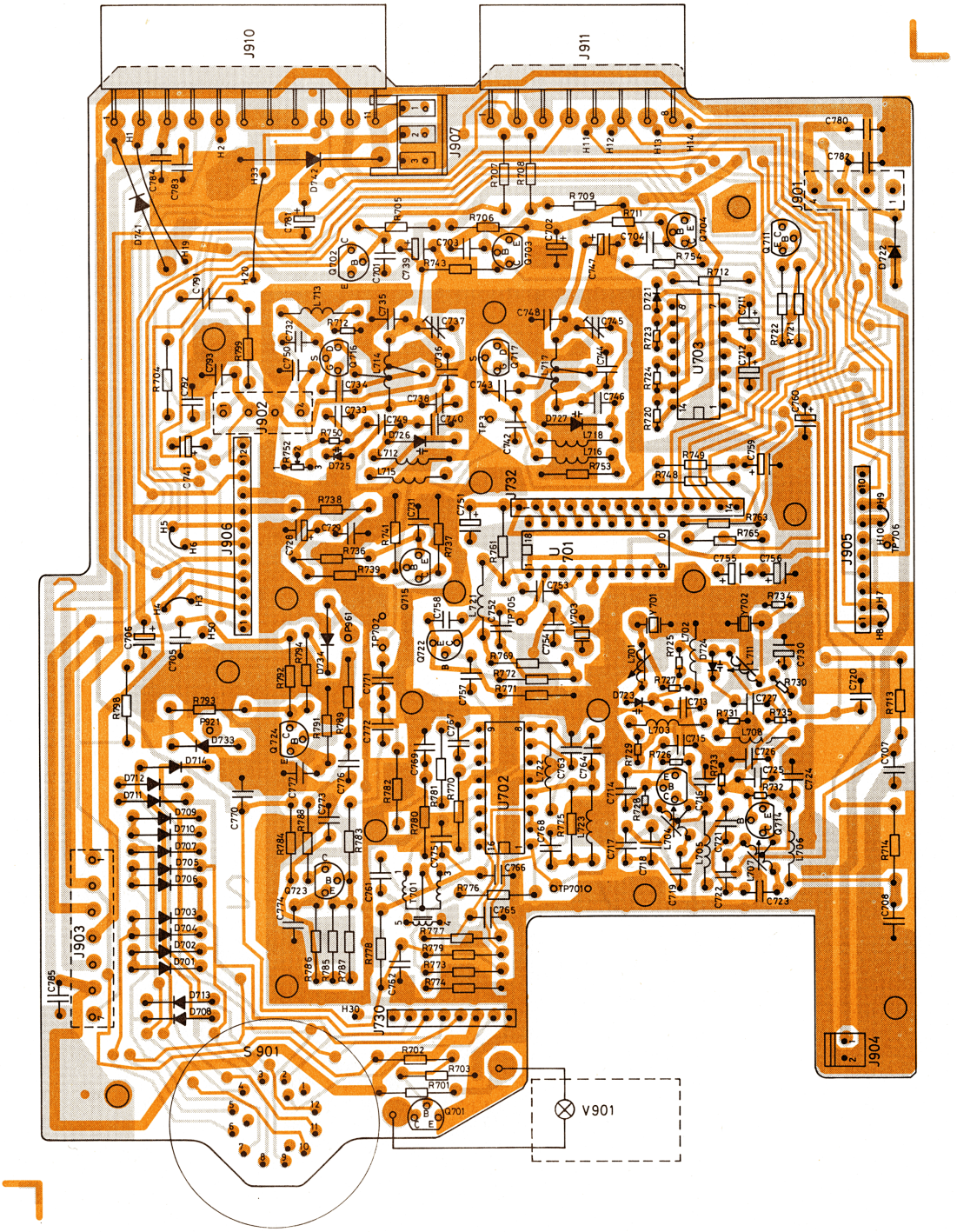
Storno

Nº	CODE	DATA	
R792	19A700019P38	1.2 Kohm Resistor Depos.	0.25 W
R793	19A700019P17	22 ohm Resistor Depos.	0.25 W
R794	19A700019P17	22 ohm Resistor Depos.	0.25 W
R798	19A700019P37	1 Kohm Resistor Depos.	0.25 W
R799	19A700019P54	27 Kohm Resistor Depos.	0.25 W
S901	19J706322G1	Channel Switch	
T701	19J706284G1	Transformer	
U701	19J706263P1	MC145106	
U702	19J706238P1	TDA1062 IC	
U703	19A700029P44	4066B IC	

FREQUENCY SYNTHESIZER FS5112

X402.896

Storno

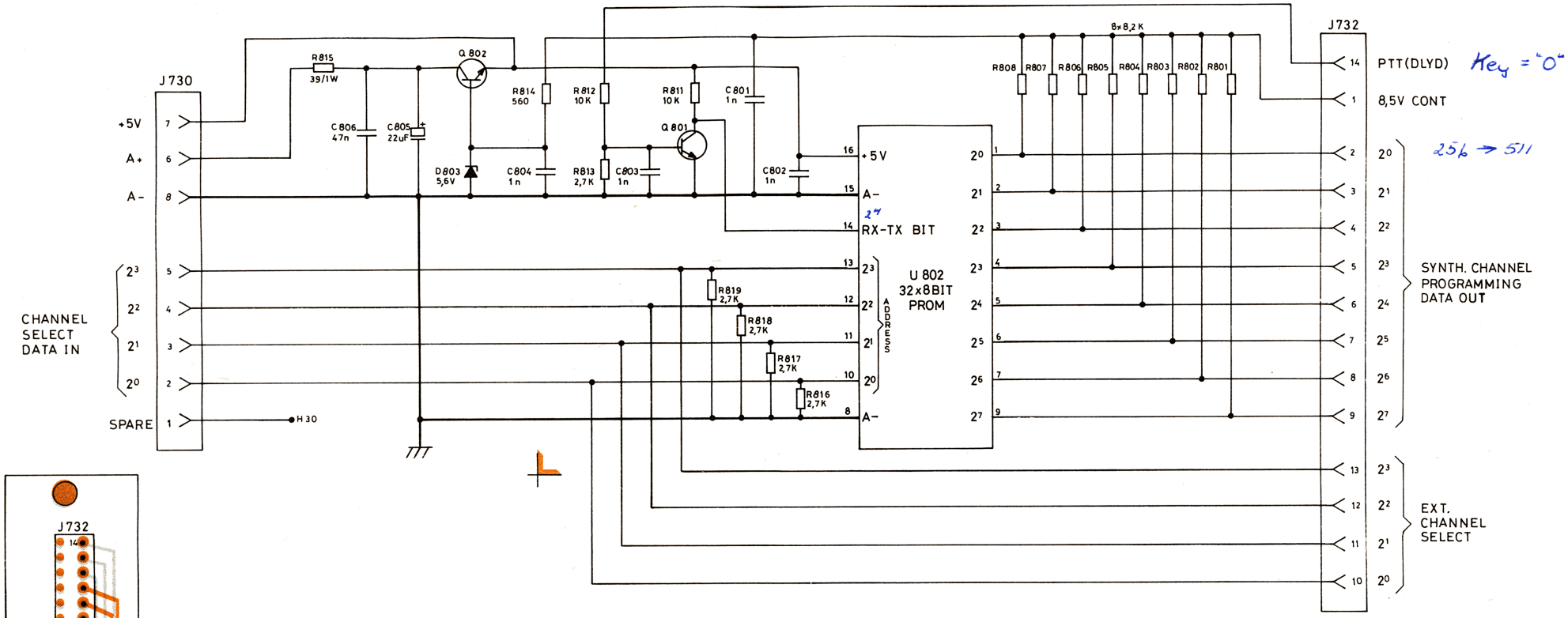


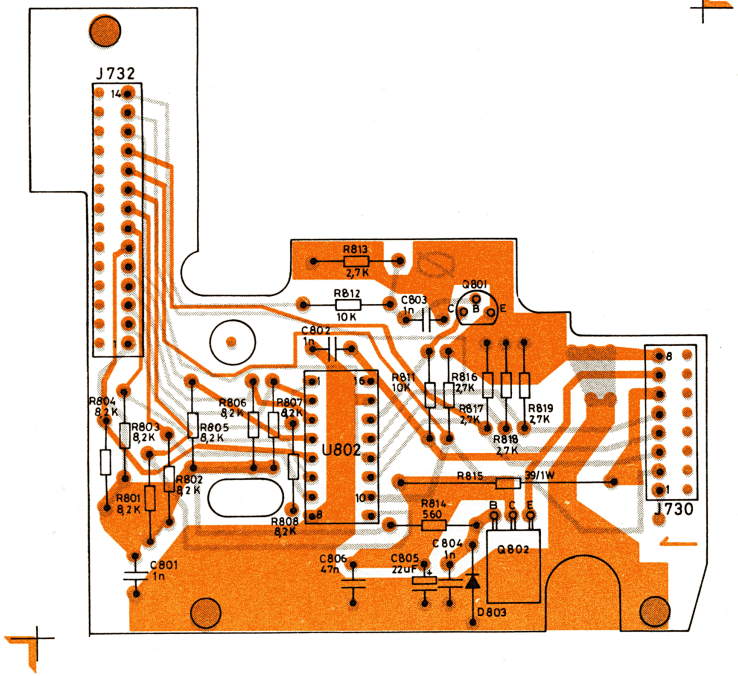
FREQUENCY SYNTHESIZER
FS5111 , FS5112

D402. 886

Storno

Storno





CHAN-NEL	J730 2^3	2^2	2^1	2^0
1	0	0	0	0
2	0	0	0	1
3	0	0	1	0
4	0	0	1	1
5	0	1	0	1
6	0	1	1	0
7	0	1	1	0
8	0	1	1	0
9	1	1	0	0
10	1	0	0	1
11	1	0	1	0
12	1	0	1	1

FREQUENCY CONTROL FC5001

D402. 885

Nº	CODE	DATA	
C801	19A700233P7	1 nF Ceramic	50 V
C802	19A700233P7	Ceramic	50 V
C803	19A700233P7	Ceramic	50 V
C804	19A700233P7	Ceramic	50 V
C805	19A700003P8	Tantal	16 V
C806	19A700005P11	Polyester	50 V
D803	19J706270P1	Zener Diode	5.6 V
J731	19A700041P7	Connector	8 pos
J732	19A700041P13	Connector	14 pos
Q801	19A700017P1	BC548 Transistor	
Q802	19J706250P1	BD135 Transistor	
R801	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R802	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R803	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R804	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R805	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R806	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R807	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R808	19A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R811	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R812	19A700019P49	10 Kohm Resistor Depos.	0.25 W
R813	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R814	19A700019P34	560 ohm Resistor Depos.	0.25 W
R815	19J06251P20	39 ohm Resistor Depos.	1 W
R816	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R817	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R818	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R819	19A700019P42	2.7 Kohm Resistor Depos.	0.25 W

Storno

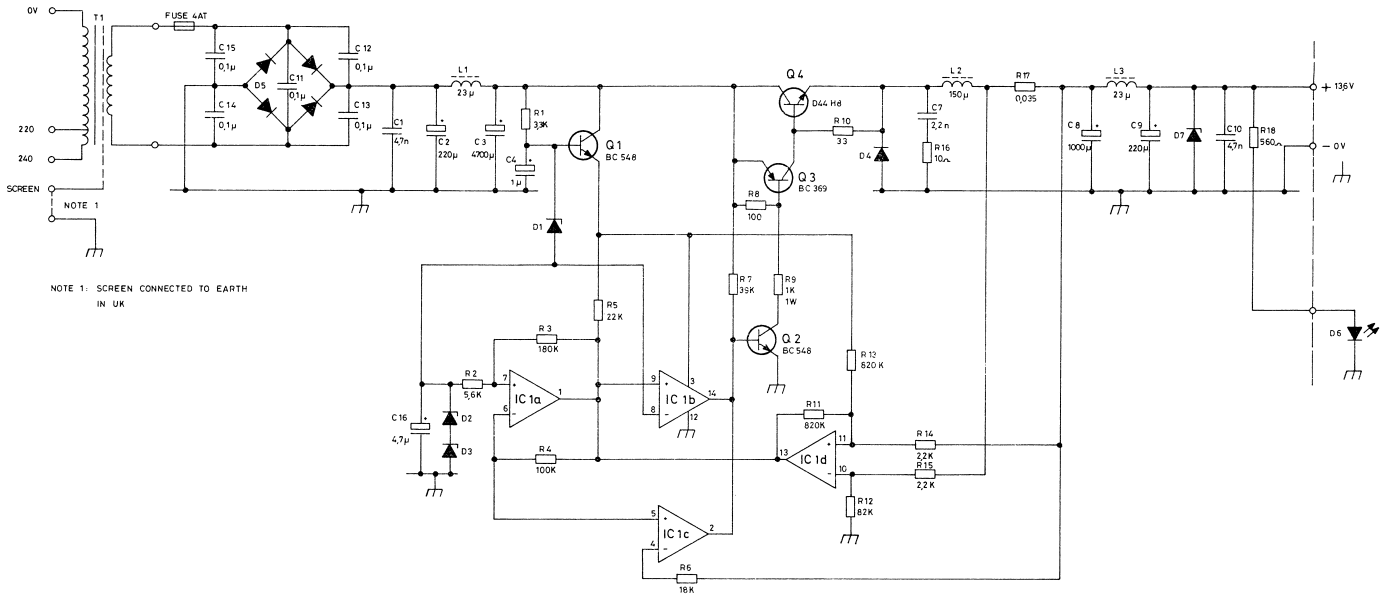
Nº	CODE	DATA

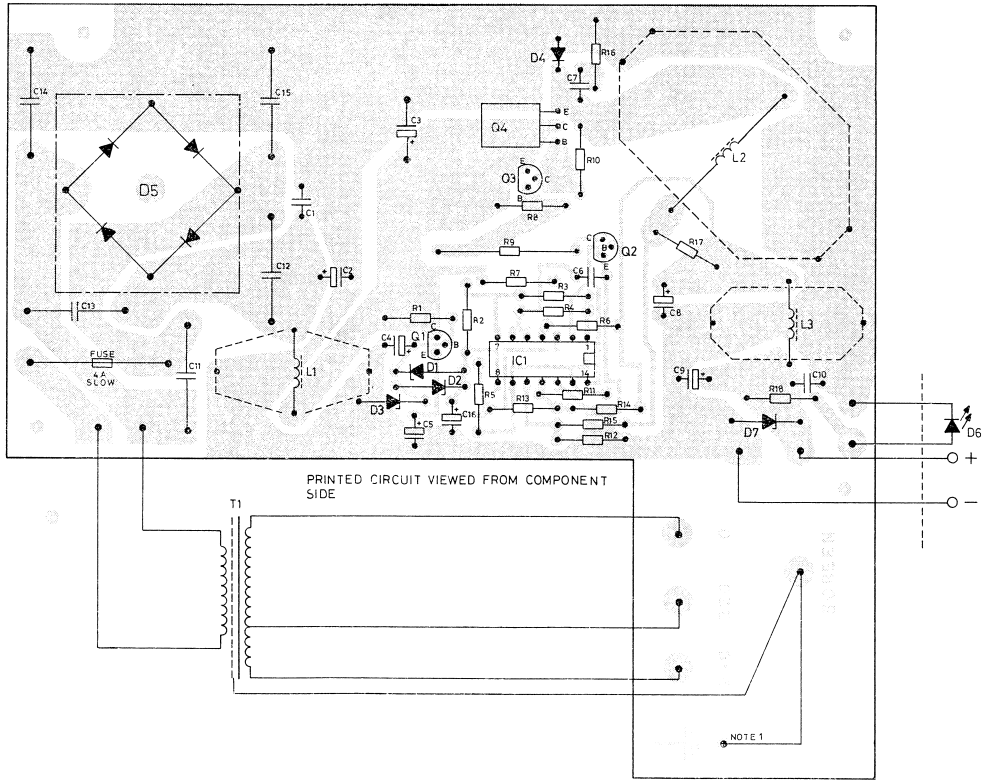
FREQUENCY CONTROL FC5001

X402.899

Storno

Storno





POWER SUPPLY PS5001

D402.713/2

TYPE	Nº	CODE	DATA	
	C 1	74.5401	4700pF 10% Ceram DI	50V
	C 2	73.5178	220uF -10 +100% Elco	40V
	C 3	73.5155	4700uF -10 +50% Elco	40V
	C 4	73.5126	4.7uF 20% Tantal	35V
	C 5	73.5126	4.7uF 20% Tantal	35V
	C 6	76.5130	1.5nF 10% Polyester FL	50V
	C 7	74.5399	2200pF 20% Ceram DI	50V
	C 8	73.5179	1000uF -10 +100% Elco	16V
	C 9	73.5151	100uF -10 +50% Elco	16V
	C 10	74.5401	4700pF 10% Ceram DI	50V
	C 11	76.5073	0.1uF 10% Polyest TB	100V
	C 12	76.5073	0.1uF 10% Polyest TB	100V
	C 13	76.5073	0.1uF 10% Polyest TB	100V
	C 14	76.5073	0.1uF 10% Polyest TB	100V
	C 15	76.5073	0.1uF 10% Polyest TB	100V
	C 16	73.5126	4.7uF 20% Tantal	35V
	D 1	99.5224	4.7V 5% Zenerdiode	0.4W
	D 2	99.5146	6.8V 5% Zenerdiode	0.4W
	D 3	99.5146	6.8V 5% Zenerdiode	0.4W
	D 4	99.5371	BYW29-150 Diode	
	D 5	99.5174	10A Rectifier bridge	100V
	D 6	99.5303	LED red	1.6 V/20 mA
	D 7	99.5334	16V 5% Zenerdiode	1W
	F1	92.5094	4A Fuse, slow	
	L 1	61.1419	Choke	
	L 2	61.1420	Choke	
	L 3	61.1419	Choke	
	Q 1	99.5143	BC548 Transistor	
	Q 2	99.5143	BC548 Transistor	
	Q 3	99.5337	BC369 Transistor	
	Q 4	99.5372	D44H.8 Transistor	
	R 1	80.5265	22Kohm 5% Carbon film	1/8W
	R 2	80.5258	5.6Kohm 5% Carbon film	1/8W
	R 3	80.5276	180Kohm 5% Carbon film	1/8W
	R 4	80.5272	82Kohm 5% Carbon film	1/8W
	R 5	80.5265	22Kohm 5% Carbon film	1/8W
	R 6	80.5264	18Kohm 5% Carbon film	1/8W
	R 7	80.5268	39Kohm 5% Carbon film	1/8W
	R 8	80.5237	100ohm 5% Carbon film	1/8W
	R 9	82.5049	1Kohm 5% Carbon film	1W
	R 10	80.5231	33ohm 5% Carbon film	1/8W
	R 11	80.5284	820Kohm 5% Carbon film	1/8W
	R 12	80.5272	82Kohm 5% Carbon film	1/8W
	R 13	80.5284	820Kohm 5% Carbon film	1/8W
	R 14	80.5253	2.2Kohm 5% Carbon film	1/8W
	R 15	80.5253	2.2Kohm 5% Carbon film	1/8W
	R 16	80.5225	10ohm 5% Carbon film	1/8W

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TYPE	Nº	CODE	DATA	
	R 17	178.5005	0.035ohm Resistor Constantan	
	R 18	80.5246	560ohm 5% Carbon film	1/8W
	T 1	60.5170	Main transformer	
	U 1	14.5019	MC3302P Quad comparator	

POWER SUPPLY PS5001

X402.821

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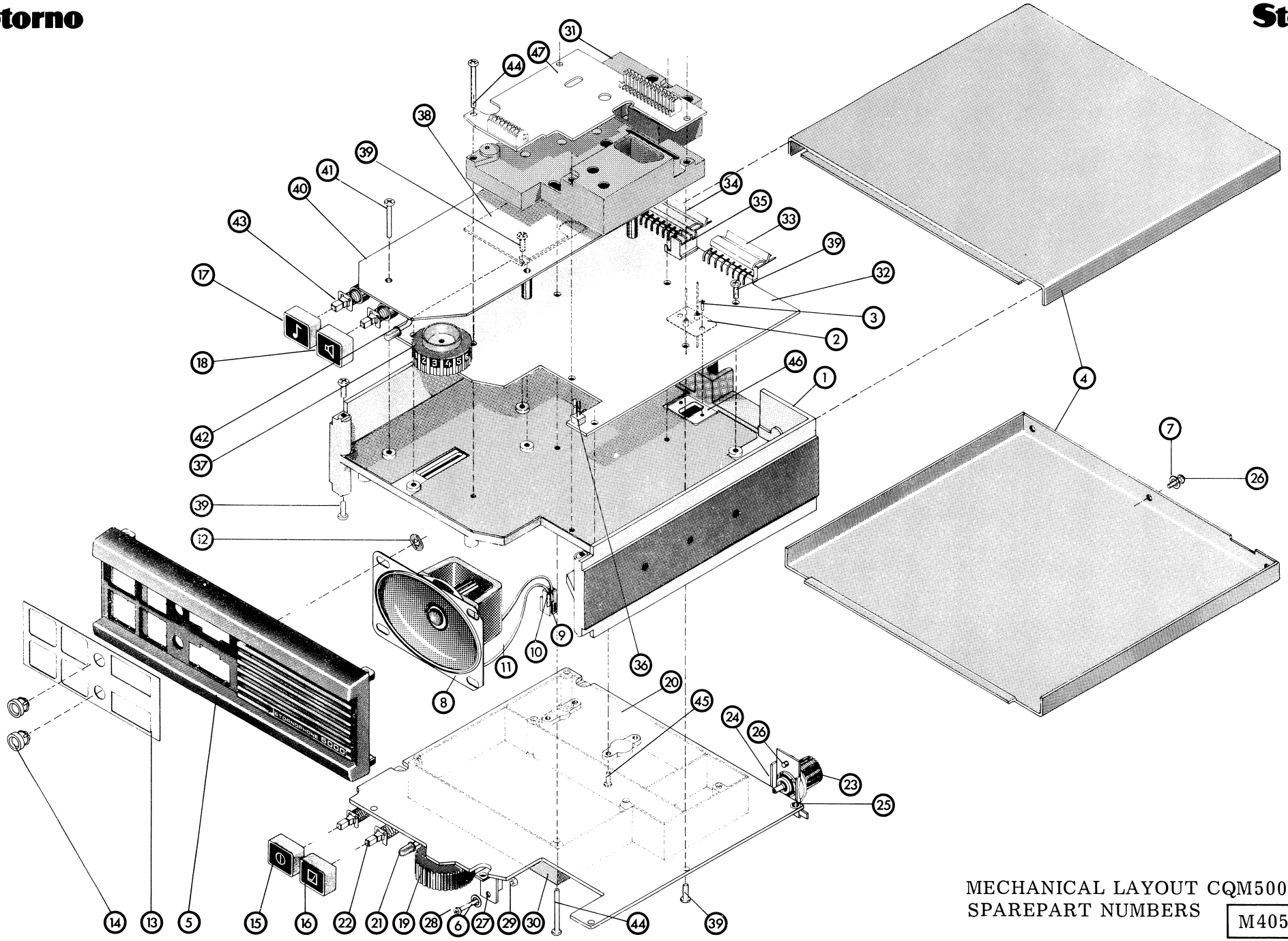

MECHANICAL LAYOUT CQM5000XXS12
SPAREPART NUMBERS

M405. 103

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 Américain
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 (américain.)
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 américain.
	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 américain.
16	490272-00	Push button (SQ) Eur. Bouton de squelch europ.
	49.0276-00	Push button (SQ) U.S. Bouton de squelch américain.

ITEM	CODE	DESCRIPTION
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.
30	12.0357-01	Shield Eur. Ecran europ.
	12.0400-00	Shield U.S. Ecran américain.

ITEM	CODE	DESCRIPTION
31	19M905080	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
47	19M905067	Frequency control 5001 Commande de fréquence 5001