STORNOPHONE 700

AUTOMATIC RADIOTELEPHONE

TYPE CQM713 P3

CONTENTS

9-77 Service Coordination

 Storno

CQM713 P3
TECHNICAL SPECIFICATIONS

Figures given in brackets are typical values.

GENERAL SPECIFICATIONS

Frequency Range

RX: 163.050 - 164.400 Hz
TX: 158.550 - 159.900 Hz

RF Bandwidth

1.35 MHz

Channel Separation

25 kHz

Channel Number

55 channels

Type of Modulation

Phase

Modulation Frequency Range

300 - 3000 Hz.

Maximum Frequency Deviation

± 5 kHz.

Nominal Frequency Deviation

± 3.5 kHz.

Antenna Impedance

50 Ω

Supply Voltage (minus on chassis)

13.6 V ± 10%

Temperature Range

-10°C - +40°C

Dimensions

180 x 210 x 70 mm

Weight

2.5 Kg.

RECEIVER SPECIFICATIONS

Sensitivity

2.5 μV e.m.f. for 20 dB S/N
20 μV e.m.f. for 40 dB S/N

Squelch open

1.8 μV e.m.f. (1.3 μV)

Squelch close

0.5 μV e.m.f. (0.65 μV)

Squelch hysteresis

0.5 μV e.m.f. (0.65 μV)

Squelch delay

open: 50 ms (45 ms)
close: 2000 ms (40 ms)

Crystal Frequency, RC712

136.275 MHz

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Frequency Stability (-10°C - +40°C)

1.5 kHz.

Modulation Pass Band (EIA)

5 kHz (7 kHz)

Adjacent Channel Selectivity

+15°C - +30°C: 10 mV
-10°C - +40°C: 3 mV

Blocking, fant > ± 150 kHz.

100 mV

Intermodulation

S/N 20 dB: 50 dB
+20 dB: 40 dB
+40 dB: 30 dB

Spurious Attenuation

3 mV

Radiation into an Artificial Load

20 nW

AF Load Impedance

Loudspeaker: 4 Ω
MT703 : 20 Ω in series with 470 Ω

AF Output to Loudspeaker

4 W (3 W)

AF Output to MT703

1 mW

Distortion

10% (3%)

AF Frequency Response

6 dB/octave de-emphasis + 1 dB/-5 dB (+0 dB/-1.5 dB).
1000 Hz - 3000 Hz

Hum and Noise

40 dB

Squelch Attenuation

50 dB

Current Consumption

Receive with MT703: 1.0 A
Receive with loudspeaker, AF output 2 W: 1.3 A

TRANSMITTER SPECIFICATIONS

RF Power Output

10 - 25 W

Crystal Frequency, EX712

142.475 MHz

Frequency Stability (-10°C - +40°C)

1.5 kHz.

Spurious Radiation from Antenna

Adjacent channel: 12 μW
Other : 2.5 μW

Modulation Input Impedance

510 Ω

Microphone Impedance

2700 Ω

Modulation Sensitivity

500 mV ± 2 dB e.m.f.

Modulation Distortion

10%

Modulation Frequency Response

6 dB/octave pre-emphasis +1 dB/-3 dB
300 Hz - 3000 Hz

FM Hum and Noise

40 dB

Current Consumption

Transmit: 5 A

TRANSMITTER TONE SIGNALLING

Tone Transmit	Duration -10°C - +40°C	750 ms ± 150 ms
	Distortion	10%
Respond	Modulation frequency -10°C - +40°C	2600 Hz ± 13 Hz
	Frequency deviation	3 kHz ± 300 Hz
Call and Acknowledge	Modulation frequency -10°C - +40°C	2400 Hz ± 12 Hz
	Frequency deviation	3 kHz ± 300 Hz
Clear	Modulation frequencies -10°C - +40°C	2400 Hz ± 12 Hz 2600 Hz ± 13 Hz
	Frequency deviation (Combined signal)	4.7 kHz ± 300 Hz

RECEIVER SEQUENTIAL TONE SIGNALLING

The equipment responds to a five-digit selective call from a Control Channel transmitter. The following specifications apply to the temperature range -10°C - +40°C.

Selective Calling Tones

Digit	Frequency (Hz)	Deviation (± kHz)
1	1060 ± 1%	3.03 ± 10%
2	1160 ± 1%	3.15 ± 10%
3	1270 ± 1%	3.24 ± 10%
4	1400 ± 1%	3.36 ± 10%
5	1530 ± 1%	3.45 ± 10%
6	1670 ± 1%	3.54 ± 10%
7	1830 ± 1%	3.66 ± 10%
8	2000 ± 1%	3.78 ± 10%
9	2200 ± 1%	3.90 ± 10%
0	2400 ± 1%	4.02 ± 10%
Repeat	2600 ± 1%	4.14 ± 10%

Tone Duration

70 ms ± 5 ms

Period separating two consecutive tones

< 15 ms

Period between successive calls

> 210 ms ± 15 ms

The receiver accepts +3 dB/-6 dB deflection in frequency deviation within temperature range +15°C - +30°C.

MARKING SIGNAL DETECTION

The equipment is capable of detecting any one of six Marking signals, which are transmitted according to the following specifications over Traffic channels (temperature range -10°C - +40°C):

Designation of Marking signal	Two tone frequencies	Individual tone peak deviation	Peak Vector-sum deviation
A	2200Hz ± 10Hz 2000Hz ± 10Hz	1.75kHz ± 0.25kHz	3.5kHz ± 0.5kHz
E	2200Hz ± 10Hz 1830Hz ± 10Hz		
I	2200Hz ± 10Hz 1670Hz ± 10Hz		
O	2000Hz ± 10Hz 1830Hz ± 10Hz		
U	2000Hz ± 10Hz 1670Hz ± 10Hz		
X	1830Hz ± 10Hz 1670Hz ± 10Hz		

TIMING CIRCUIT CHARACTERISTICS

ambient temperature range: -10°C - +40°C
supply voltage: 13.6 V ± 10%

Channel Search, 55 channels

7.5 seconds (<10s) carrier on all channels

Alerting Signal Tone

Duration 3.4 seconds (2 - 5 s)
Frequency 1650 Hz ± 30%

Call Indication

3.5 minutes (2 - 5 min.)

Squelch Clear Down

6.7 seconds (5 - 10 s)

Transmitter Inhibit on Channel 17

1.5 seconds (≤ 2 s)

Connection of Communication after Emitting Call/Respond

0.5 second ± 0.25 s

Measuring methods refer to Post Office Specification RC4402a and Home Office Specification W6601 unless otherwise stated.

CQM713 P3

GENERAL DESCRIPTION

Introduction

The Stornophone CQM713 P3 radiotelephone is a mobile transmitter/receiver with Automatic Channel Searching and Traffic Channel Signalling for The Public Land Radiotelephone.

The equipment is designed to operate in the simplex mode on 55 two-frequency channels in the 2 metre band using phase modulation and 25 kHz carrier frequency separation. (see Frequency Allocation Table).

The transmit and receive frequencies of each channel are separated 4.5 MHz.

The equipment is operated from a control unit (CB705) and a handmicrotelephone (MT703) connecting to the radio proper via a cable and multi-connector. A separate loudspeaker is optional and may be connected to the MT703 rest.

The CQM713 P3 is designed to connect directly to a 12 Volt vehicle storage battery and the equipment's negative potential is connecting to the chassis.

In order to avoid wrong voltage polarity being connected to the equipment the battery cable connector is so designed that it can be connected one way only. If a wrong voltage polarity (as may accidentally happen during tests) is applied a diode in the start relay circuit prevents the equipment from being turned ON.

The CQM713 P3 is built up as functional sub-units for ease in servicing and fault-finding. The unit consists of two panels hinged together (BA705 and RF716) and a chassis CL703.

The panel, designated RF716, contains all the circuits which are dependent on the channel frequencies.

These are:

- receiver input
- frequency synthesizer unit
- exciter
- transmitter power output amplifier
- antenna switch and antenna filter.

The panel, designated BA705, contains those units which are independent on the channel frequencies.

These are:

- intermediate frequency amplifier
- detector
- squelch
- audio amplifiers
- voltage regulators
- tone transmitter
- sequential tone receiver

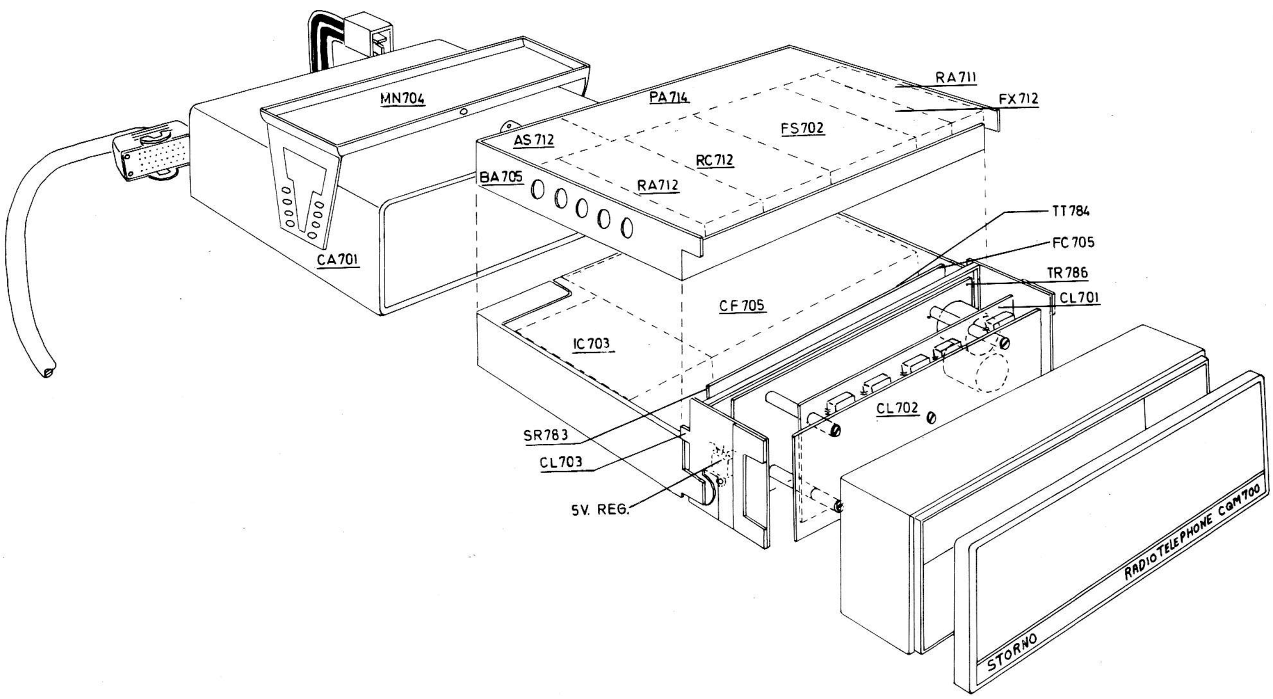
The chassis, designated CL703, contains the logic circuits controlling the Automatic Channel Selection, tone signalling and inhibiting of the transmitter and the receiver.

For mechanical construction see pictorial view page

Principle of Operation

The CQM713 P3 radiotelephone is designed for The Public Land Radiophone service-system 3.

The system, which is covering the entire country, is divided into Radiophone Areas comprising one or more base stations. Where several base stations are necessary to provide the requisite coverage within the Area their services may overlap. The number of channels allocated to individual base stations forming part of a radiophone Area are according to the traffic requirements of that Area.



At each base station there is a number of traffic channels, the frequencies of which is not reused elsewhere in that same Area. A common control channel (channel 17) is available at certain base stations to provide full coverage of the Area for calling purposes. No facilities for speach excists on the control channel.

Calls to mobile equipments are transmitted over the control channel as a sequential tone signal, first from one base station, then consecutive from the remaining stations.

A free channel in a Radiophone Area is marked modulating the carrier with one of six different marking signals. The same marking signal is used at all base stations within the area, and a marking Signal selection Control is provided on the Control unit allow the user to select any of the six Marking signals.

Calls to Mobile Equipments

When receiving a correct sequential tone signal on the control channel the mobile equipment automatic transmits the Acknowledge tone signal.

At the same time a tone generator is energised and the called lamp on the control unit is lit. The tonegenerator emits an Alerting tone to the receiver of the handmicrotelephone the duration being 3.5 seconds. The Called lamp extinguishes automatically after 3 1/2 minutes.

When the handmicrotelephone is removed from its rest the alerting signal stops and the Called lamp extinguishes. The Searching lamp is lit and the equipment automatically selects a free channel, transmits a Respond signal and reverts to the receive mode.

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If the handmicrotelephone is removed from its rest after the called lamp has extinguished the Respond signal is not transmitted.

Calls from Mobile Equipments

A call to the base station is initiated by removing the handmicrotelephone from its rest. The Searching lamp is lit and the equipment automatically selects a free channel and a Call tone signal is transmitted.

Conversation.

After having transmitted a Call signal or a Respond signal the equipment reverts to the receive mode and monitors the received signal. If the marking signal is removed from the base station carrier within approx. 1/2 second the call is succesful and connection is established.

The equipment then removes the inhibit from the transmitter and receiver audio output, and the Searching lamp extinguishes.

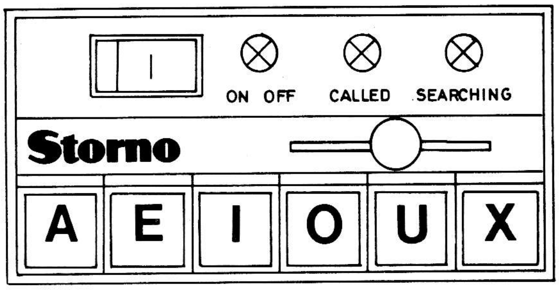
The conversation is performed in the simplex mode from the mobile and in the duplex mode at the base station.

Cleardown of Connection

At the completion of a call over the traffic channel, the connection will be cleared by either the user or the exchange operator.

User cleardown is performed by restoring the handmicrotelephone to its rest. The equipment immediately transmits a Clear signal over the traffic channel in use, reverts to the control channel, and inhibits the transmitter and the receiver audio output.

Operator cleardown is performed by removing the base station carrier thus closing the receiver squelch and after approx. 6.7 seconds the transmitter and the receiver output is inhibited. Restoring the handmicrotelephone to its rest thereafter causes the equipment to go to the control channel without transmission of the Clear signal.



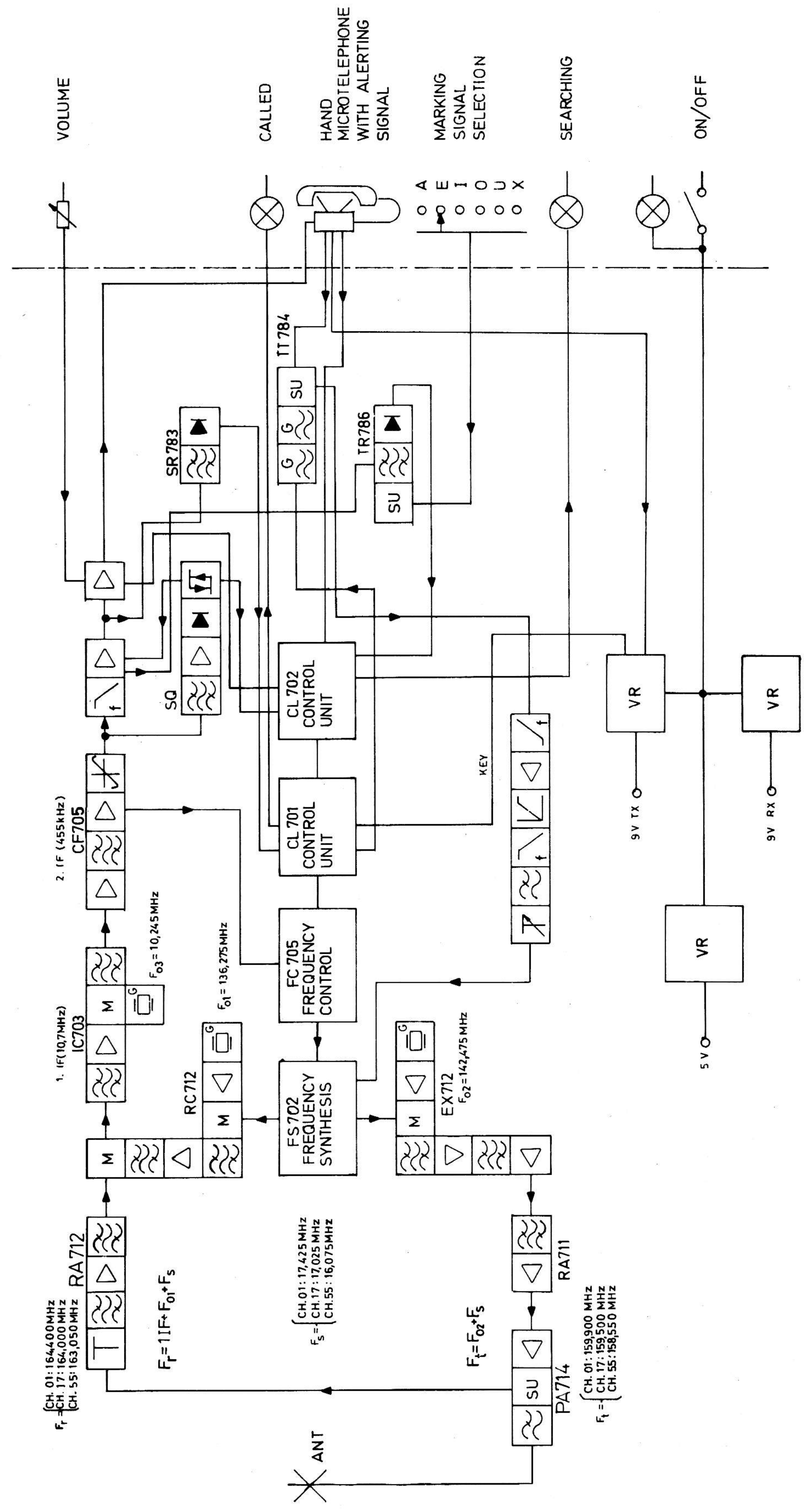
Automatic Channel Search

The channel search is initiated by removing the handmicrotelephone from its rest. First channel 1 is selected then consecutively all channels.
If a free channel is not available the search is repeated until either a suitable channel is selected or the user restores the handmicrotelephone to its rest.

During the search the receiver monitors each traffic channel carrier. If the r.f. signal strength at the input to the receiver is less than R (where R is between 2 µV and 4 µV) the equipment quickly (approx. 30 ms) switches to the next channel. If the r.f. signal strength is greater than R, a pause (approx. 130 ms) for detection of the marking signal is established. If the equipment during the search selects a free channel whose r.f. signal strength is greater than P (where P is between 40 µV and 80 µV) the search stops and the Call tone signal or the Respond tone signal is transmitted. If the connection is not established the channel search is resumed.

If, during the channel search, no channels with a signal strength greater than P is available, all channels are checked. Has free channels with signal strength greater than R been registered, the channel having the greatest is selected, and it is checked that the Marking signal is still present. If so, the Call tone signal or the Respond tone signal is transmitted. If the Marking signal is no longer present or the connection is not established, the channel search is repeated.

55 CHANNEL MOBILE EQUIPMENT FOR RADIOPHONE SYSTEM 3



RECEIVER CIRCUITS

Frequencies

The conversion of the frequencies can be expressed as follows:

Receiver: $f_{RX} = f_s + f_{XRX} + 10.7$ MHz

Transmitter: $f_{TX} = f_s + f_{FTX}$

f_s = frequency of the synthesizer signal, adjustable in steps of 25 kHz in the range 16.075 MHz to 17.425 MHz.

f_{XRX} = RC712 oscillator frequency 136.275 MHz.

f_{RX} = Receiver input frequency.

f_{XTX} = EX712 oscillator frequency 142.475 MHz.

f_{TX} = Transmitter output frequency.

Receiver

The CQM713 P3 receiver is a double conversion superheterodyne using intermediate frequencies of 10.7 MHz and 455 kHz. Adjacent channel selectivity is obtained by using two bandpass filters:

a 10.7 MHz crystal filter and a 455 kHz ceramic filter.

A maximum of 55 channels are available the corresponding injection frequencies being generated by digital frequency synthesis in the range 16.075 MHz to 17.425 MHz.

The receiver comprises the following subunits:

Antenna switch	AS713
RF amplifier	RA712
Receiver converter 1st mixer, local oscillator and synthesizer mixer	RC712
Intermediate frequency converter, 10.7 MHz crystal filter, 2nd mixer, 2nd local oscillator and 455 kHz ceramic filter	IC703
455 kHz intermediate frequency amplifier, discriminator, squelch, a.f. amplifier and voltage regulator	CF705
Frequency synthesizer	FS702

Signal Path

From the antenna switch the input signal passes to the RA712 amplifier via a 4.5 dB attenuation network which is to adjust the receiver sensitivity to the specified requirements. The r.f. amplifier RA712 is constructed as a 5-circuit filter with an amplifier between 2nd and 3rd filter. The configuration ensures good blocking, selectivity, and intermodulation characteristics. The input circuit is adjustable to the entire 2-metre band (146 - 174 MHz). The impedance translation to the mixer stage is achieved by a tuned circuit with a low Q-factor. The received signals and the injection signal are both applied to the gate of a field effect transistor (FET) and the IF signal at 10.7 MHz is taken from the drain circuit.

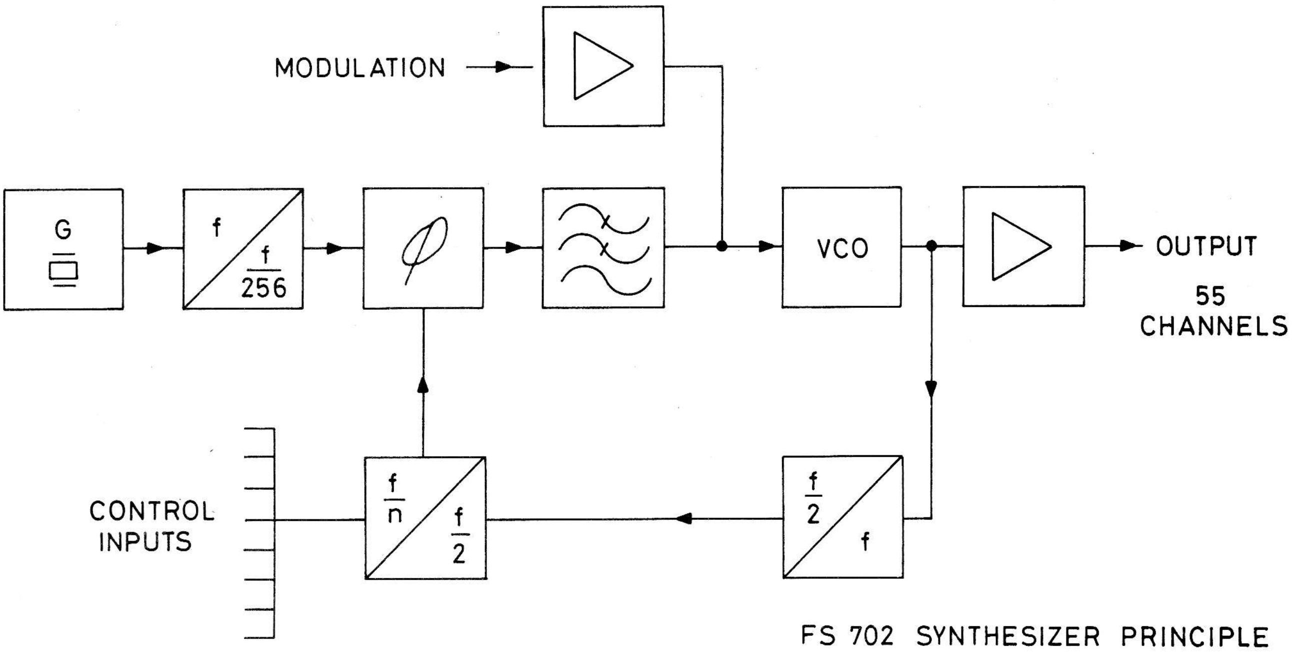
Injection Signal to 1st Mixer.

The mixer injection signal is 10.7 MHz below the input signal and is produced by mixing the signal from a crystal oscillator with the synthesizer signal. The crystal oscillator is a 7th overtone series resonance oscillator which is followed by a double-gate-FET buffer amplifier. The buffer output is mixed with the synthesizer signal in a second FET and the mixer output is filtered and amplified in order to obtain adequate drive for the r.f. mixer. The filter consists of 6 LC circuits in order to reject spurious signals, especially the oscillator frequency.

Frequency Synthesizer FS702

The FS702 generates the synthesizer signal by the digital frequency synthesis method. The signal is generated in a voltage controlled oscillator, VCO, the output of which is amplified. The VCO is forming part of a phase locked loop consisting of a buffer amplifier, a divide- by-two prescaler, a programable frequency divider, a detector, and a low pass filter.

The phase detector compares the divided VCO frequency to a 12.5 kHz reference frequency. Any difference in frequency will be opposed by the DC voltage at the low pass filter output ad-



FS 702 SYNTHESIZER PRINCIPLE

justing the VCO frequency up or down until it locks to the reference frequency.

The 12.5 kHz reference frequency is produced by dividing the output of a 3.2 MHz crystal controlled oscillator by 256.

Using the principles of a phase locked loop the long time stability of the reference oscillator is transfered to the VCO. The short time stability of the VCO (noise) is gennerally determined by the highest achievable Q-factor of the VCO tank circuit.

Reference crystal frequency, f_{ref} and VCO frequency relationship is given by:

$$\frac{f_s}{2 \cdot n} = \frac{f_{ref}}{256}$$

As $\frac{f_{ref}}{256} = 12.5$ kHz $\quad f_s = 25 \times n$ kHz

Changing the devisor n, produces f_s in steps of 25 kHz.

The RC oscillator frequency (and the EX) is so chosen that the lowest antenna frequency corresponds to dividing by 643 in the programable divider (f_s = 16.075 MHz). The three decades in the divider are controlled by the 9-complement of the divider expressed in the BCD code. Note that the third decade (x 100) is fixed programmed to divide by 6.

Intermediate Frequency Circuits

From the mixer in RC712 the 10.7 MHz signal passes to the intermediate frequency converter, type IC703 which provides the channel selectivity of the receiver. The i.f. signal passes a 10.7 MHz crystal filter and then a single amplifier stage before being applied to the base of the 2nd mixer and converted to 455 kHz. The injection signal to the mixer stage is generated by a crystal oscillator, the frequency of which is 455 kHz below 10.7 MHz, i.e. 10.245 MHz.

The second intermediate frequency, 455 kHz, proceeds through the ceramic filter in the IC703 and is then applied to the i.f. amplifier of subunit CF705.

The 455 kHz intermediate frequency amplifier consists of two RC coupled stages followed by a double tuned filter and a three stage integrated circuit amplifier. The last two stages provide the required limiting of the signal. The amplified and limited signal is then demodulated in a phase detector incorporated in the integrated circuit.

The balanced quadrature (or product) detector also provide efficient rejection of any amplitude modulated signals that may be present. The detector has only one tuned circuit and is simple to adjust.

AF Circuits

The demodulated signal is fed to a potentiometer preset to suit the a.f. signal level obtained from the detector. This level depends on the maximum frequency deviation in use as determined by the channel spacing of the receiver. The potentiometer also adjusts the level to the squelch circuit. The signal is then applied to an integrated two stage amplifier the first amplifier of which introduces deemphasis and amplification to a level of 110 mV. The signal is then fed to a tone receiver and, via an electronic switch, to the second half of the i.c. which constitutes a high-pass filter with strong attenuation of low frequencies (below 250 Hz). The electronic switch is controlled by the squelch circuit. From the amplifier output the signal is applied to a sequential tone receiver, SR783, and, via an inhibiting circuit and volume control in the control unit, CB705, to the a.f. power amplifier and loudspeaker. The loudspeaker amplifier consists of an integrated a.f. power module with a maximum output of approx. 4 W. The amplifier has a special input, which is independant on the setting of the volume control. This input is used for the Alerting signal. The amplifier is inhibited when transmitting.

Squelch Circuit

The squelch circuit is operated by noise components contained in the demodulated signal. The a.f. signal from the detector is passed through an amplitude selective amplifier (expander), rectified, and applied to a Schmitt trigger, which controls the electronic switch in the a.f. circuit.

When the noise level exceeds a certain value, i.e. when the signal to noise ratio falls below a certain value, the trigger circuit is activated and the a.f. output signal is switched off. The Schmitt trigger also controls a squelch signal circuit to indicate the function of the squelch.

The squelch sensitivity is adjusted by means of a potentiometer at the input of the amplitude selective amplifier.

TRANSMITTER CIRCUITS

The transmitter is phase modulated and the output frequency is produced by mixing the synthesizer signal with the signal from a crystal controlled oscillator. This principle transfers the number of channels and the modulation contained in the synthesizer signal to the output frequency. After the mixing the signal is amplified to an adequate power level at the output. Also a sharp selection is introduced in order to obtain sufficient attenuation of spurious side band frequencies, especially the crystal oscillator signal.

The transmitter comprises the following subunits:

Frequency synthesizer with modulator	FS702
Modulation amplifier, key circuit, and voltage regulator	CF705
Exciter with crystal oscillator and mixer for synthesizer signal	EX712
RF amplifier	RA711
RF power amplifier and antenna switch (AS713)	PA714

The FS702 and CF705 subunits are common to transmitter and receiver, and it should be noted that the frequency of the synthesizer signal for EX712 is the same as for RC712.

AF Circuits

The modulating signal from the microphone is fed, through the tone generator, to the modulation amplifier where it is differentiated, amplified, limited, integrated, and filtered. The modulation amplifier transforms the microphone output to a signal suitable for the modulator and limits the signal amplitude so that the maximum permissible frequency deviation is not exceeded.

For normal signals the deviation/modulation characteristic is a curve increasing at a rate of 6 dB/octave.

As the r.f. carrier is not to be deviated by more than ± 5 kHz a sharp cutting lowpass filter follows the modulation amplifier so that the carrier deviation at high modulating frequencies (above 3 kHz) decreases. For very strong modulation signals the amplitude characteristic, as measured at the output of the amplifier, is falling 6 dB/octave because of the limiter. Under these circumstances the deviation, Δ f, will, principally, be constant and equal to the maximum deviation, Δ f max.

A potentiometer at the output of the modulation amplifier is used to adjust the maximum frequency deviation.

Modulator

The modulating signal is applied to the VCO of FS702 in parallel to the internal control voltage in the phase locked loop. A preemphasis circuit produces phase modulation, i.e. Δ f increases 6 dB/octave for increasing frequency of the modulating signal. In order to keep the modulation sensitivity constant over the band (16 - 17.5 MHz), a compensating circuit is introduced, the gain of which varies with the VCO control voltage and hence the curving characteristic of the VCO control diode is compensated. The synthesizer is modulated to the full frequency deviation.

Exciter EX712

The r.f. signal is generated in a crystal controlled oscillator contained in EX712. The oscillator signal is applied to a buffer amplifier whose output is mixed with the synthesizer signal. The mixer output is filtered and amplified to obtain an adequate signal for the RA711.

RF Amplifier RA711

The output signal from the exciter is fed to an r.f. amplifier, RA711. Tuned input and output bandpass filters provide additional selectivity and attenuates undesired signals. The amplifier raises the signal to the level required by the r.f. power amplifier. The nominal output power is 100 mW into a 50 Ω load.

RF Power Amplifier PA714

The power amplifier contains three transistor stages the interconnection consisting of tuned matching networks with low loaded Q-factors. The r.f. amplifiers are high efficiency class C amplifiers.

An Automatic Drive Control, ADC, circuit regulates the supply voltage to the first stage and consequently the drive to the following stages. The regulation is controlled by the current of the output transistor, the supply voltage, and the temperature of the heat sink.

The purpose of the ADC circuit is to prevent overloading the power transistors, and to reduce the dependence of the output power of the r.f. power amplifier on supply voltage.

The transmitter output power is adjusted to the required level by means of a potentiometer provided in the ADC circuit.

Antenna Switch

The signal generated by the transmitter is passed through an electronic antenna switching unit and a lowpass filter to the antenna. The antenna switching unit consists of diodes which are forward biased during transmission and reverse biased during reception. The lowpass antenna filter is a 7-pole Chebishev filter having low insertion loss and ripple. The filter is not adjustable.

POWER SUPPLY AND SWITCHING CIRCUITS

The CQM713 P3 is powered directly from a 12 V storage battery. The negative battery terminal connects directly to the cabinet of the radiotelephone.

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A start relay connected across the battery input terminals protects the radiotelephone against damage caused by incorrect supply polarity. Incorrect battery connection will cause the relay series diode not to conduct and thus the relay refuses to operate.

The CQM713 P3 contains two identical voltage regulator circuits which deliver 9 V stabilized supply voltages for operating the transmitter and receiver sections of the radiotelephone. The supply to the loudspeaker amplifier, transmitter power amplifier, tone generator, and the 5 V regulator is taken from the battery and is unstabilized. The 5 V regulator for the logic circuits is mounted on the CL703 chassis. The voltage regulators are protected at the output against short circuit by limiting the maximum current to a safe value. In the receive mode (stand-by) the 9 V transmitter regulator is inhibited which is cancelled when energising the transmitter. In the transmit mode the receiver a.f. output amplifier is inhibited by the 9 V to the transmitter.

TONE SIGNALLING CIRCUITS

Tone Generator TT784

The tone generator is controlled by CL701 which submit control signals for the different tone combinations. Simultaneously the CL701 is supplying a signal to the transmitter voltage regulator which is then energized for approx. 750 ms. The TT784 modulates the transmitter of the equipment and, while activated, inhibits the modulating signal from the microtelephone by means of a gate circuit.

The TT784 generates supervisory signals as follows:

Acknowledge signal, 2400 Hz, is emitted over the control channel upon receipt of the correct selective calling signal.

Call signal, 2400 Hz, is emitted over a traffic channel to call a base station.

Respond signal, 2600 Hz, is emitted over a traffic channel to answer a call from the base station.

Clear signal, 2400 and 2600 Hz, is emitted over a traffic channel when a call is terminated.

Sequential Tone Receiver SR783

The input of the sequential tone receiver connects to the receiver's a.f. signal line after the squelch gate so that a sequential tone call can be received only when the received signal is sufficiently strong to open the receiver squelch (approx. 1 μV). SR783 is designed to receive a 5 tone sequential signal. The coding of the number to be received is made by connecting five leads to the tone coil. The 5 consecutive tones enable 100000 combinations to be coded.

Receipt of the correct selective calling signal causes the SR783 to emit a Call pulse of approx. 70 ms duration.

Two-tone Receiver TR786

The input of the TR786 connects to the receivers a.f. line ahead of the squelch gate in order to avoid time delay caused by the opening of the squelch. During channel searching the tone receiver registers free channels, i.e. the carrier is modulated with a correct Marking signal. In order to achieve a short searching time the response time is short (approx. 65 ms). The tone combination is selected by push-buttons on the control unit. When coding a marking signal a control lead is connected to V_{B+}, and by means of tone gates the tone coils are set to the combinations used.

When a correct Marking signal is accepted (after approx. 65 ms) a Call pulse is emitted. If the received signal strength is greater than R (where R is between 2 μV and 4 μV) a sample pulse is applied to CL702 where the signal strenght level is registered.

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The TR786 tone combinations are:

A - 2000 Hz and 2200 Hz.
E - 1830 Hz and 2200 Hz.
I - 1670 Hz and 2200 Hz.
O - 1830 Hz and 2000 Hz.
U - 1670 Hz and 2000 Hz.
X - 1670 Hz and 1830 Hz.

Control Logic CL701

The CL701 contains the following functions to be used in the call and channel searching procedures:

Tone generator control circuit.
Alerting signal circuit.
Squelch closing circuit.
Control channel decoder and inhibiting circuit.

Tone Generator Control Circuit

The circuit comprises three flip-flops all controlled by a common timer and a flip-flop that ensures the Respond tone to be transmitted after receipt of a sequential tone signal.

Activation of one of the three flip-flops triggers the timer, and after 750 ms the flip-flop is reset. The transmitter and the tone generator TT784 is energized during the activation of the timer. The tone combination to be emitted by TT784 is controlled by CL701 via two control leads. The tone signalling timer can, during service and tests, be inhibited from a test box in order to measure the tone signalling characteristics.

Alerting Signal Circuit

Receipt of a correct sequential tone signal first causes the Acknowledge tone to be transmitted, then a timer in CL701 to be triggered. The timer controls the Called lamp on the control unit and the tone generator which emits an Alerting signal. If the handmicrotelephone is removed from its rest causes automatically cessation of the Alerting signals.

Removing the handmicrotelephone from its rest the Alerting signals cease automatically; the Alerting tone persists for approx. 3.5 seconds and the called lamp for approx. 3 1/2 minutes. The receipt of another selective call before the visual time-out has expired will re-activate the timer, and the Alerting tone will be repeated. If the handmicrotelephone is removed from its rest during the persistence of the Called lamp the equipment transmits the Respond signal.

Squelch Closing Circuit

A timer on CL701 controls the receiver squelch when the equipment selects a traffic channel. In the receive mode the squelch, when closing, will activate the timer which clears the connection after approx. 6 - 7 seconds.

Control Channel Decoder and Inhibiting Circuit

A decoder supervises the control signals to FS702 and records whenever the equipment is set to the control channel (channel 17). When the equipment selects channel 17 CL701 submit an inhibiting signal to tone receiver TR786 in order to ensure that intermodulation products, if any present, may open the tone receiver and thus channel 17 cannot be recognized as a free channel during channel searching.

A fail-safe circuit becomes operative and inhibits the transmitter voltage regulator on CF705 when the equipment is set to the control channel and the transmitter is energized for a period exceeding approx. 1.5 seconds. This circuit prevents the control channel from being occupied in the event of equipment failure. The circuit does not interfere with the normal Acknowledge transmission. The inhibiting of the transmitter, caused by the fail-safe circuit, can only be cancelled by turning the equipment OFF and then again ON.

Frequency Control Subunit FC705

The FC705 controls the frequency synthesizer, FS702, by the 9 complement of the devisor expressed in BCD code.

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The FC705 contains three different circuits for controlling the programable divider in FS702 as follows:

1. A fixed coded circuit for the control channel (channel 17).
2. A BCD counter with addition network which adds two to the output signal from the BCD counter. When the channel selection is initiated the counter is reset and thereafter controlled by a clock pulse generator with a period time of approx. 30 ms and each channel is monitored in turn.

   The FC705 also contains a detector circuit the input of which is connected to the output of the IC703. For antenna signal inputs greater than R (where R is between 2 µV and 4µV) the clock generator pulse for controlling of the BCD counter is delayed approx. 130 ms. ensuring sufficient time for the TR786 to detect the Marking signal. At the completion of the channel search, i.e. when channel 56 is selected, the FC705 emits informations to CL702.

3. A register where a channel number can be stored. The register is controlled by a Sample and hold circuit on the CL702. A channel number will be stored in the register if the signal strength is greater than level R and appropriately marked. If an appropriately marked channel is selected later and the signal strength of that channel is greater than the former the number of that channel is stored in the register. At the end of the search the number stored in the register will be the channel having the greatest signal strength, and the register is switched to control the FS702.

The selection of the circuit to control the FS702 is by means of Bus Line drivers.

A test box connected to the multiconnector of the equipment enables the three circuits to be disabled and the FS702 to manually be set to any channel.

Control Logic CL702

The CL702 contains functions for controlling the automatic channel search as follows:

1. Reset Circuit

   The reset circuit is activated every time the channel search is repeated. Besides resetting circuits on CL702 the reset circuits emits a reset pulse to the BCD counter on the FC705 and, via the CL701, a reset pulse for the TR786.

2. Sample and Hold

   If, during the channel search, the equipment selects an appropriately marked channel and the signal strength is higher than R, a sample pulse is applied to the CL702. The detector on the FC705 connects to the input of the sample circuit. If the detector voltage is higher than the capacitor voltage in the sample circuit a charging commences, during which a read pulse is applied to the register on FC705 and the number of the selected channel is stored. If the detector voltage is less than the voltage of the capacitor, the sample pulse is not released.

3. Channel 1 Switch Delay

   The reset circuit triggers a timer which inhibits the clock pulse generator on the FC705 for approx. 300 ms. in order to stabilize the FS702 after a 1.4 MHz frequency switch.

4. Channel search cease for signal strength > P

   When the equipment selects a free channel with a signal strenght greater than P a flip-flop is toggled and the clock generator on the FC705 is inhibited. Simultaneously a trigger pulse to CL701 is emitted and the Call tone or Respond tone is transmitted.

5. Channel Search Cease for Signal Strength < P.

   If, at the end of a search, only free channels with signal strength levels between R and P are available, the CL702 switches the FC705 to the channel number stored in the register.

After a time delay of approx. 300 ms (to stabilize the FS702) the channel is checked for the presence of the Marking signal. If the Marking signal is no longer present (channel occupied) the channel search is repeated.

If the Marking signal is still present a trigger pulse is released to the CL701 and the Call tone or the Respond tone is transmitted.

6. Inhibiting Circuit

In the stand-by mode and during the search and select cycle the receiver audio output and the transmitter is inhibited.

After transmission of a Call or Respond tone a timer is activated and approx. 0.5 second later the channel is checked for the presence of the Marking signal. If the marking signal is not present the inhibit from the transmitter and the receiver audio output is removed, and the communication can be established over the traffic channel.

The channel search procedure is repeated if the marking signal is still present after 0.5 second.

7. Searching Lamp

When the channel search is initiated the Searching lamp on the control unit is lit. The lamp extinguishes when the receiver and transmitter inhibits are removed or the handmicrotelephone restored to its rest.

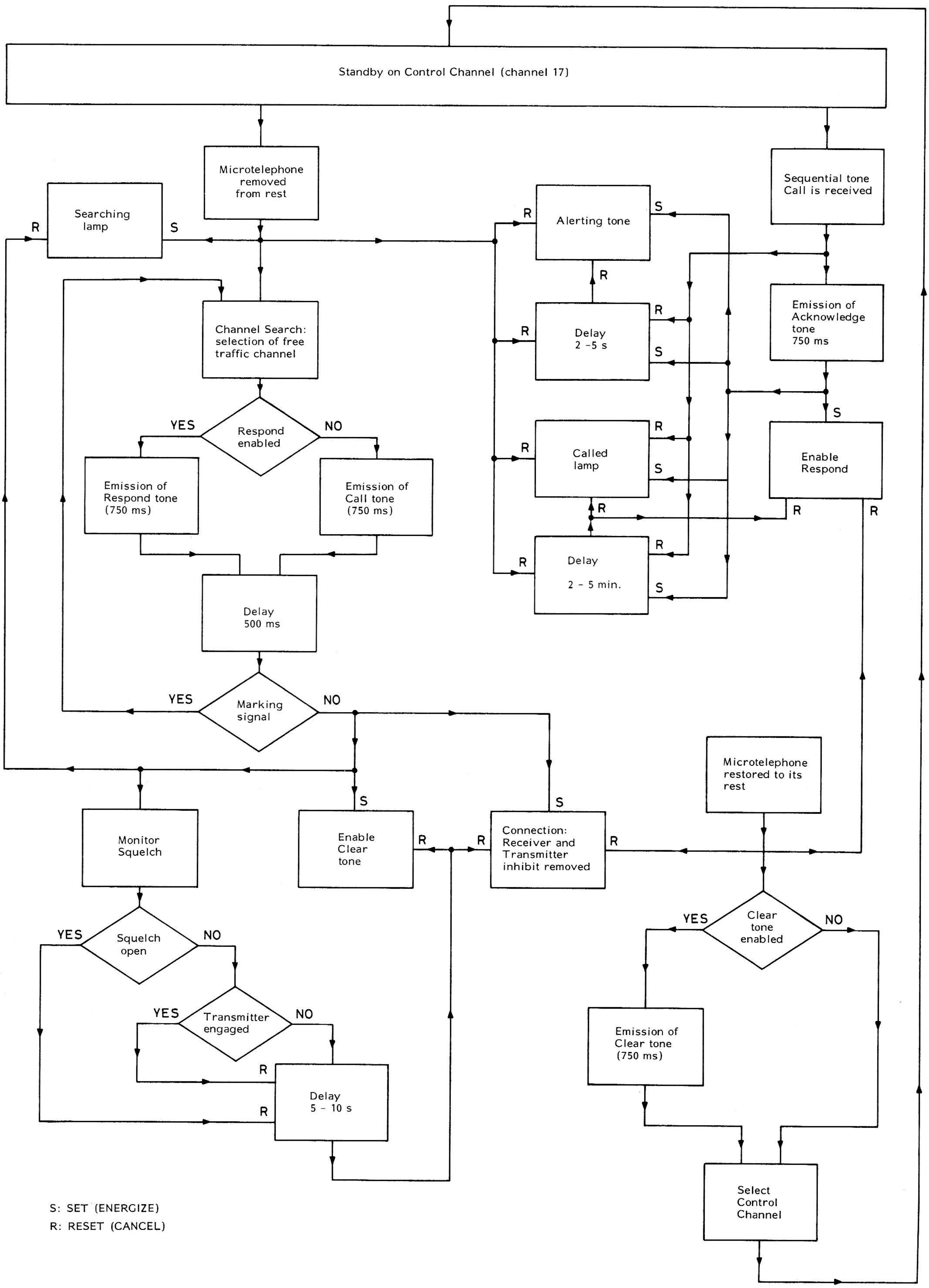
Storno

RADIO CHANNELS FOR THE PUBLIC RADIOPHONE SERVICE - SYSTEM 3

Xtal 142.475 xtal 136.275 MHz

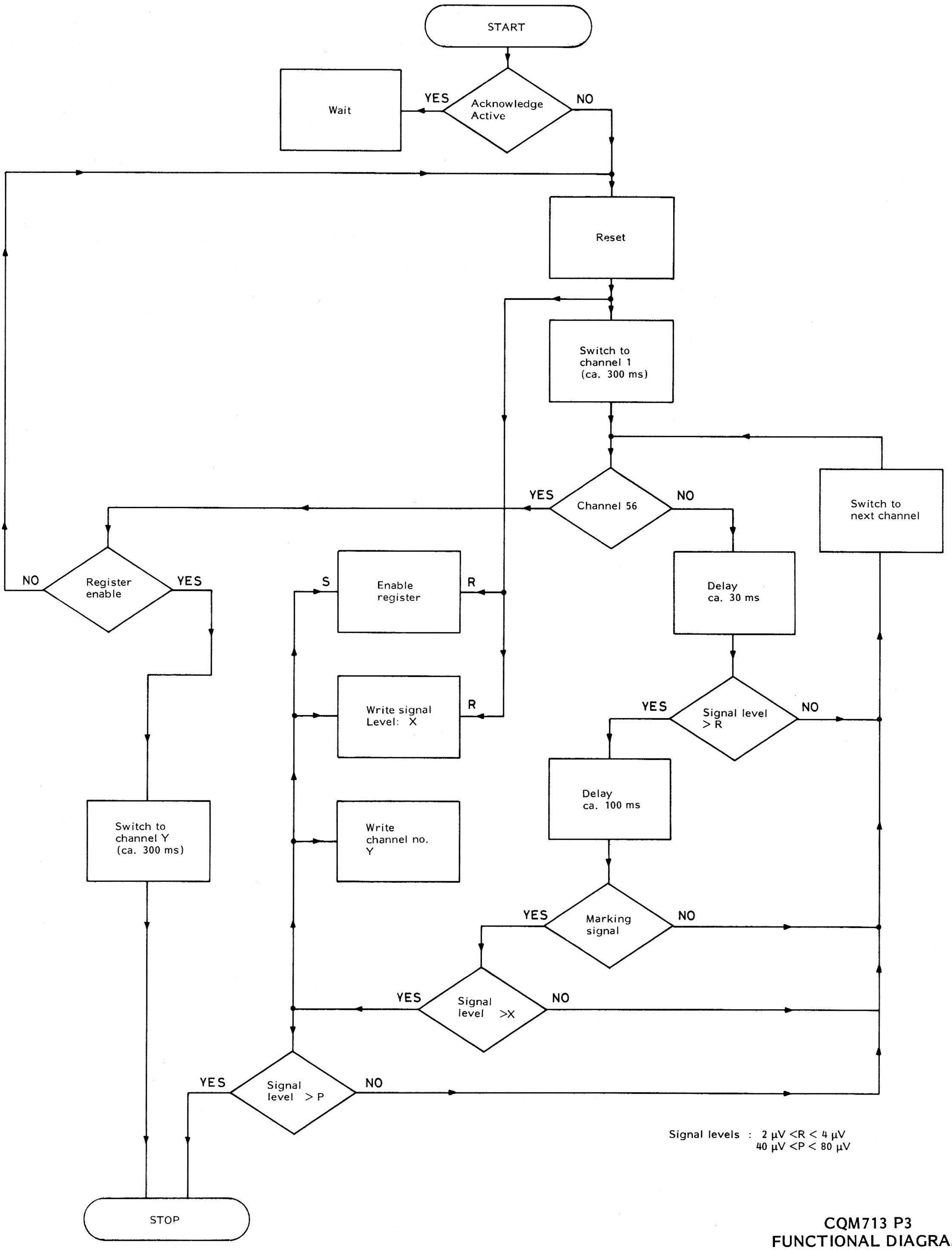
Chan. No.	Mobile Transmit	Mobile Receive	Chan. No.	Mobile Transmit	Mobile Receive
1	159.900 MHz	164.400 MHz	31	159.150 MHz	163.650 MHz
2	159.875 "	164.375 "	32	159.125 "	163.625 "
3	159.850 "	164.350 "	33	159.100 "	163.600 "
4	159.825 "	164.325 "	34	159.075 "	163.575 "
5	159.800 "	164.300 "	35	159.050 "	163.550 "
6	159.775 "	164.275 "	36	159.025 "	163.525 "
7	159.750 "	164.250 "	37	159.000 "	163.500 "
8	159.725 "	164.225 "	38	158.975 "	163.475 "
9	159.700 "	164.200 "	39	158.950 "	163.450 "
10	159.675 "	164.175 "	40	158.925 "	163.425 "
11	159.650 "	164.150 "	41	158.900 "	163.400 "
12	159.625 "	164.125 "	42	158.875 "	163.375 "
13	159.600 "	164.100 "	43	158.850 "	163.350 "
14	159.575 "	164.075 "	44	158.825 "	163.325 "
15	159.550 "	164.050 "	45	158.800 "	163.300 "
16	159.525 "	164.025 "	46	158.775 "	163.275 "
17	159.500 "	164.000 "	47	158.750 "	163.250 "
18	159.475 "	163.975 "	48	158.725 "	163.225 "
19	159.450 "	163.950 "	49	158.700 "	163.200 "
20	159.425 "	163.925 "	50	158.675 "	163.175 "
21	159.400 "	163.900 "	51	158.650 "	163.150 "
22	159.375 "	163.875 "	52	158.625 "	163.125 "
23	159.350 "	163.850 "	53	158.600 "	163.100 "
24	159.325 "	163.825 "	54	158.575 "	163.075 "
25	159.300 "	163.800 "	55	158.550 "	163.050 "
26	159.275 "	163.775 "			
27	159.250 "	163.750 "			
28	159.225 "	163.725 "			
29	159.200 "	163.700 "			
30	159.175 "	163.675 "			

The Control Channel is Chan. No. 17. All other channels are Traffic Channels.



CQM713 P3
FUNCTIONAL DIAGRAM

D402.558



Signal levels : 2 µV <R < 4 µV
40 µV <P < 80 µV

CQM713 P3
FUNCTIONAL DIAGRAM
(Channel search)

D402.559

COMMON FUNCTIONS UNIT

CF705

Description

The CF subunit contains all circuitry for the CQM713 P3 radiotelephone that is not dependent upon frequency or channel separation.

The unit includes the following functions:

- a 455 kHz intermediate frequency amplifier and discriminator.
- two 9 V voltage regulators and keying circuitry.
- an audio output amplifier.
- a de-emphasis network and an audio frequency preamplifier, including an electronic squelching circuit.
- a squelch circuit.
- a modulation amplifier.

The CF subunit is constructed on two printed circuit boards mounted in a sandwich assembly. The two p.c. boards are held in place with spacers, a small sewn cable taking care of the internal connections. The conductive sides of the p.c. boards face outwards, with the board containing the IF, the AF output amplifier, and the voltage regulators fastened to the chassis. External connections to the CF subunit are all solder connection with the exception of the battery connection, which is through a plug.

Operating Principle

To aid heat dissipation, the integrated AF output amplifier and the series regulator transistors in the voltage regulators on the lower board all have good thermal contact to the chassis.

The 455 kHz signal from IC700 passes through the IF stages to the integrated circuit discriminator, IC3. From there the audio signal divides between the squelch circuit input and the de-emphasis filter at the input to the audio preamplifier.

The squelch circuit opens and closes the signal path through the preamplifier according to the noise content in the demodulated signal. Also, control voltages for use with tone equipment are obtained from the squelch circuit.

The audio signal is taken from the 600 Ω output of the preamplifier to the AF output amplifier. When transmitting, the signal path through the output amplifier becomes automatically blocked. The tone equipment can also block the signal path here.

The signal from the microphone is amplified and limited in the modulation amplifier, which is designed around a dual, integrated operational amplifier. Both amplifiers, IC1a and IC1b, are contained in the same housing.

To avoid adjacent channel interference, the high-frequency component of the modulating signal is filtered out and the signal is also amplitude limited in order to keep the carrier frequency deviation within the established maximum excursions for whichever channel separation is employed.

As mentioned previously, the CF subunit also contains two voltage regulators; one supplies the receiver section and the other the transmitter. The AF output amplifier and the PA stage are supplied directly from the battery and are therefore unregulated.

Switching between transmit and receive is accomplished without relays. The transmitter key electronically switches one or the other of the voltage regulators on so that both do not function at the same time. Terminal 4 is grounded during transmission and otherwise floats when the key is not activated.

The 12 V supply voltage to the AF output amplifier and the TX power amplifier is always on whenever the on/off switch is turned on. Therefore the 9 V TX circuit is designed to inhibit the audio preamplifier and audio output amplifier

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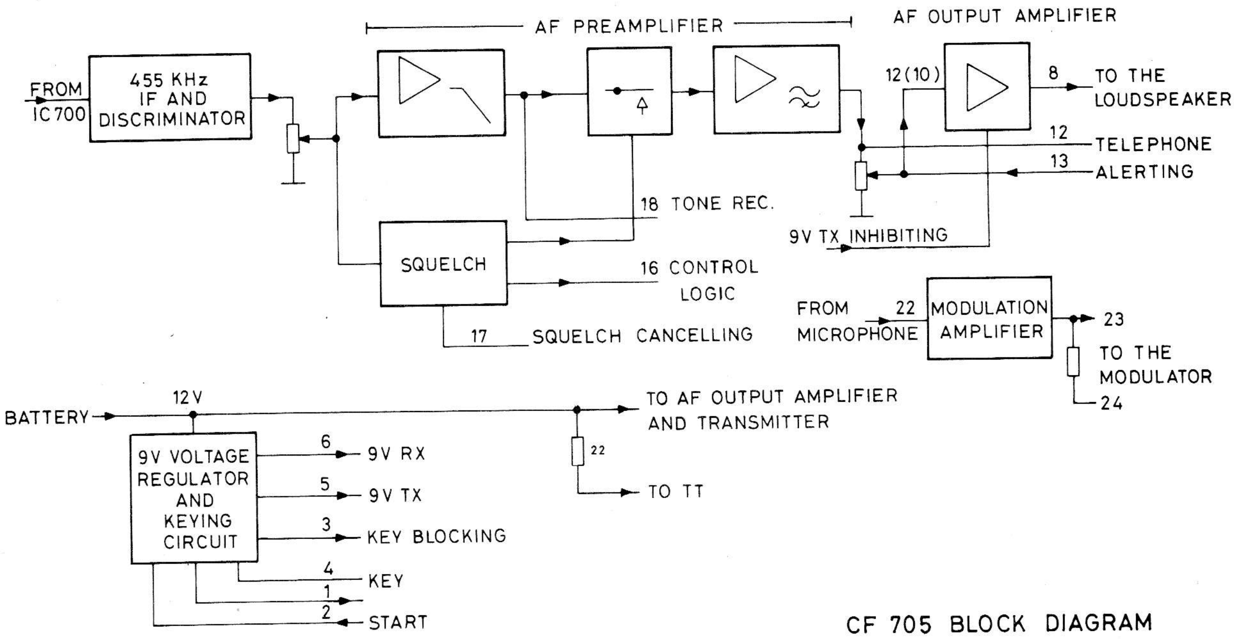
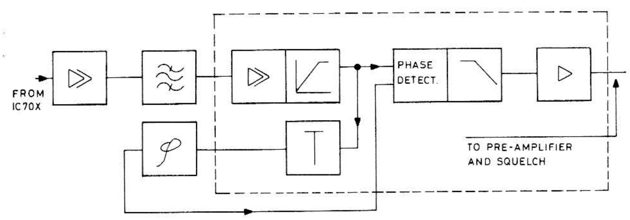


CF 705 BLOCK DIAGRAM

when the transmitter is keyed. This is a precaution against any transients in the squelch circuit that might be able to open the receiver output during transmission.

455 kHz IF Amplifier and Discriminator

This circuit amplifies, selects, limits, and detects the receiver's second IF signal of 455 kHz, allowing a deviation of up to ± 15 kHz from centre frequency.



The amplifier has five stages; the first two, Q30 and Q31, are made up of discrete components while the last three are a part of the integrated circuit, IC3, along with the phase detector.

The only resonant circuits employed in the 2nd IF stage are those between the collector of Q31 and the input to IC3. Resistors R111 and R114 load T1 and T2 enough to achieve sufficiently broad bandwidth.

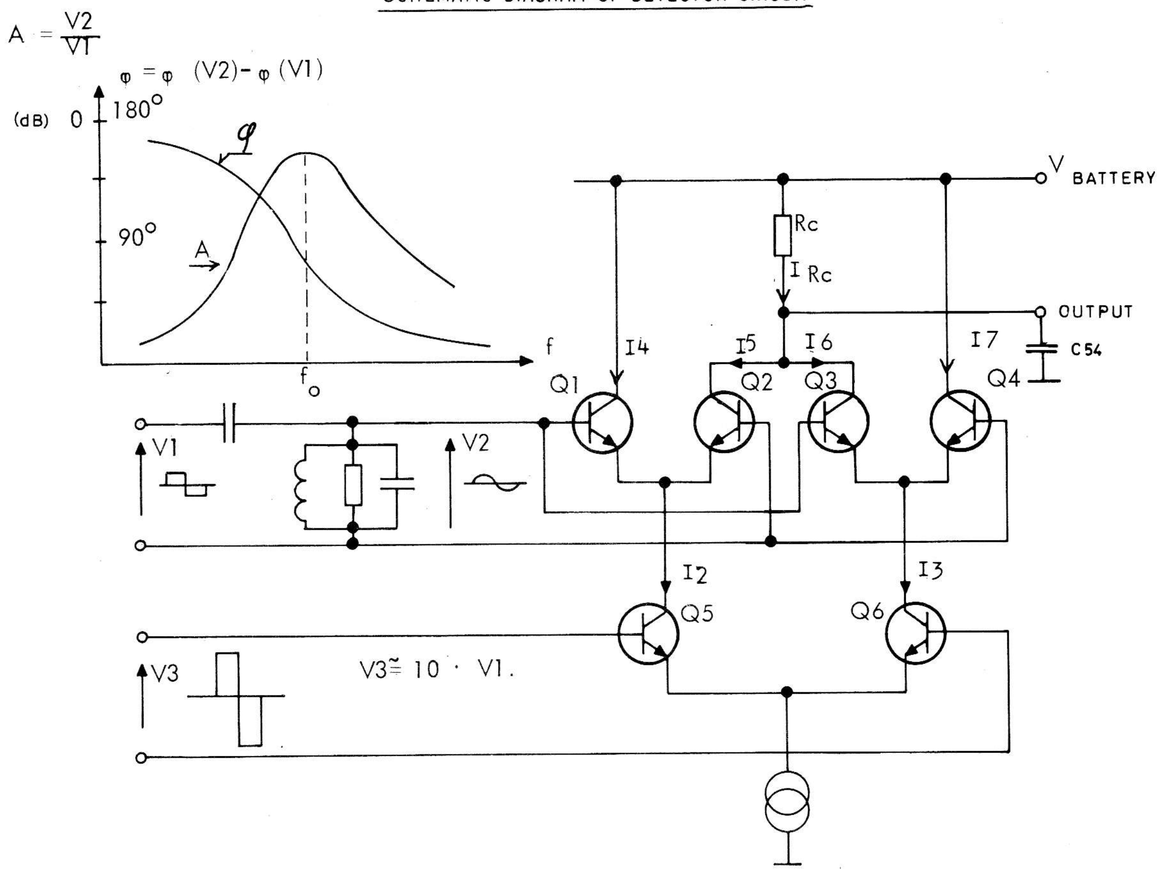
Inductive coupling between circuits is less than critical, R113 in the coupling link determining the coupling factor. Q31 operates with its collector-emitter voltage held low to prevent overdriving IC3.

The three amplifier stages in IC3 are differential amplifiers, which configuration approaches ideal symmetrical limiting. The stages are DC coupled and stability is assured through strong negative feedback. Capacitor C53 eliminates the feedback as far as AC voltages are concerned.

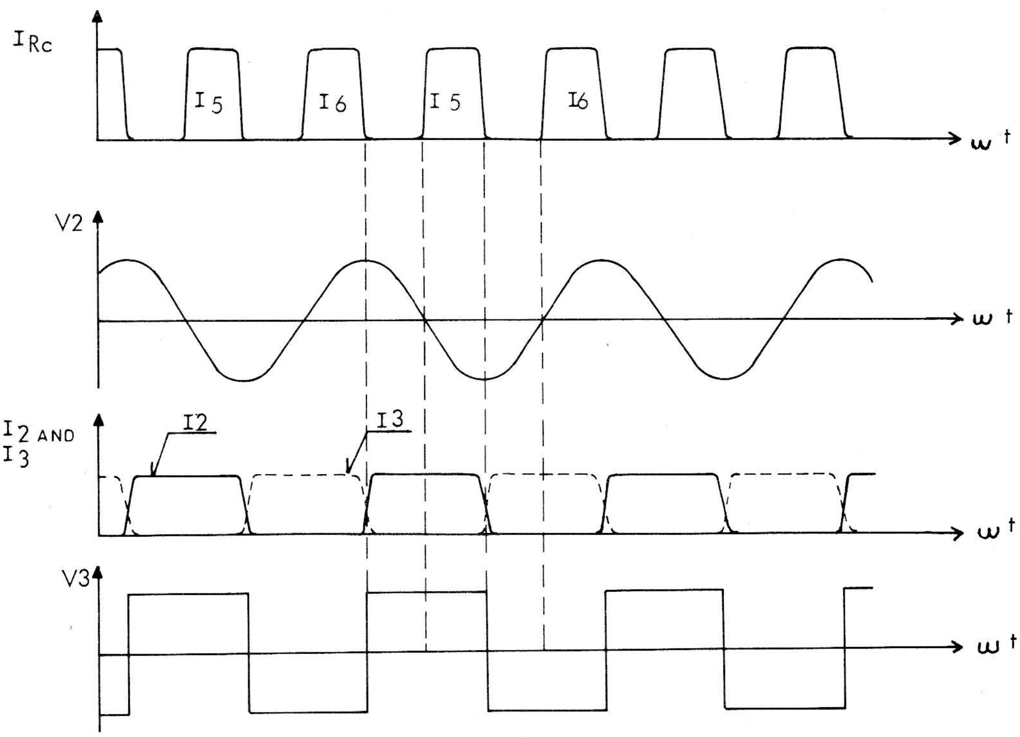
Via an emitter follower within the IC housing, the signal is fed to the phase detector. The IF signal, with its amplitude peaks clipped, is applied directly to one of the phase detector inputs.

The other input is fed the same signal, attenuated and approximately 90° out of phase (at f_0). Phase shift is accomplished with discrete components: C50, C51, L2 and R115. The following diagram shows the detector circuit schematic and the amplitude and phase characteristics of the phase shifting network. A graph of the de-

SCHEMATIC DIAGRAM OF DETECTOR CIRCUIT



GRAPH OF VOLTAGE AND CURRENT RELATIONSHIPS
IN THE PHASE DETECTOR WHEN f = f0



tector current and voltage relationships is also included here.

The phase detector is designed around three differential amplifiers, all supplied through a constant-current source. In addition to the components shown in the detector schematic, IC3 also contains an emitter follower after the detector output, another emitter follower between the phase shifting network and one of the detector inputs, and various biasing networks.

As long as voltage V 2 is high enough to drive the two differential stages - Q1 + Q2, and Q3 + Q4 - as switches, the collector current pulses, I5 and I6, will appear as a constant amplitude value and the average value of current through R_C remains independent of the amplitude of the input voltage.

As seen on the schematic, current pulses through R_C only appear when V2 and V3 are of opposite polarities and I5 appears only when V3 is positive while I6 appears when V3 is negative. Supposing that $f > f_0$, then the difference in phase (V2 - V1) is reduced (the V2 pulse a little to the right in relation to V3), causing the width of current pulses I5 and I6 to decrease. In other words, the average current through R_C will decrease. When $f < f_0$, the opposite will occur.

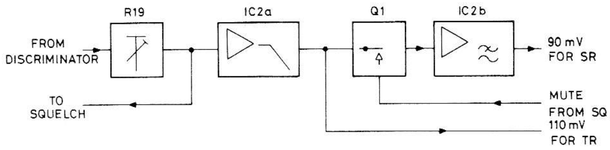
The width of I5 and I6 is therefore seen to be a measurement of the phase difference between V2 and V3. By integrating the output voltage (via R_C and C54) a voltage that is directly proportional to the phase shift is obtained.

Making use of both the negative and positive excursions of the signals, as in the detector configuration employed here, gives excellent suppression of noise and other undesired effects of inherent nonsymmetry in the clipped IF signal. For example, if the positive going half of V3 is wider than the negative half, I6 will be narrower and I5 wider with the result that the average current through R_C will remain unchanged.

An "S" curve similar to those known from conventional FM detectors will be present at the output (directly on pin 1 of IC3). However, the midpoint of this "S" curve will be around 3.5 V instead of 0 V. Circuit Q is designed low enough to enable the detector to handle frequency deviations of up to ± 15 kHz.

The De-emphasis Filter, AF Preamplifier and Electronic Squelching Switch

Network R14/C12 and IC2a take care of de-emphasing the demodulated signal at the rate of 6 dB/octave and the required gain of 8.5 dB at 1000 Hz.



The integrated preamplifier, IC2, amplifies the AF signal and match it to the nominal 600 Ω load. In addition Q1 is inserted between IC2a and IC2b. Transistor Q1 operates as an electronic switch, interrupting the signal path on command from the squelch circuit.

Potentiometer R19 adjusts the level to the preamplifier, and to the squelch as well.

The second half of the integrated amplifier, IC2b, and C14 - C15 - R29 - R28 constitute a filter, which strongly attenuates low frequencies (< 250 Hz).

R32 - C 16 introduce a suitable roll-off at high frequencies (> 6 kHz). Preamplifier IC2b is, like IC2a, biased via R28.

The signal path between the first and second amplifier stages is through a transistor, which acts like a switch controlled by the squelch.

The Squelch

The squelch circuit opens and closes the audio signal path through the AF preamplifier according to the noise content of the incomming signal. The squelch circuit also provides a signal voltage for use in tone signalling.

An internal adjustment, potentiometer R46, is provided for setting the squelch level. The squelch function can be cancelled altogether by grounding terminal 17 via the squelch cancelling button.

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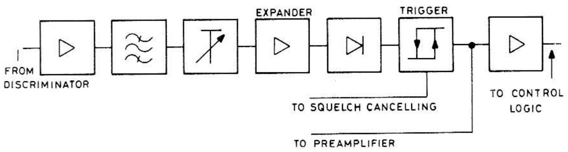
The squelch section includes a frequency selective noise amplifier, Q4 - Q5, an expander stage, Q6, a noise detector, a Schmitt trigger, Q7 and Q8, and an emitter follower amplifier, Q9.

The operating principle is as follows:

Some of the AF signal from the discriminator is fed to the noise amplifier whose collector load is made up of a parallel resonant circuit tuned to approximately 7.5 kHz. The selected noise is then fed to Q6 which is biased in such a way that only



positive going pulses of a certain minimum amplitude cause the transistor to conduct. Since only pulses of a certain amplitude can become amplified, the result is that a given relative change in noise amplitude at the base of Q6 appears as a larger relative change at the collector. The noise pulses are then rectified and filtered to a d.c. potential that, in turn, controls the Schmitt trigger, Q7 and Q8. The collector voltage on Q8 is used partly to drive the emitter follower, Q9, and partly to switch the transistor, Q1, in the AF preamplifier.

The 9 V Voltage Regulators and Keying Circuits

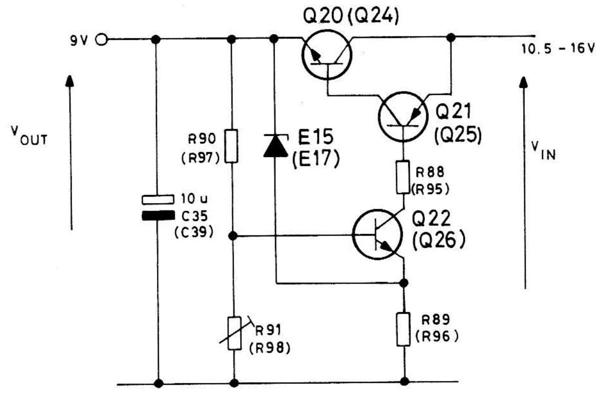
The two 9 V voltage regulators supply the receiver and the transmitter sections, respectively. They are intended for use with a 12 V storage battery.

The battery connects to the regulators through the start relay switches.

To protect the equipment against incorrect battery polarity a diode, E9, is placed in series with the start relay. If the power supply is connected wrong the diode will not conduct and the start relay thus refuses to operate.

The voltage regulators are protected against short circuits; with shorted output the current through Q20 will be less than 0.5 A and through Q24 less than 0.1 A. The power series transistors are mechanical mounted so as to be in good thermal contact with the chassis.

The two regulators are principally identical as shown on the simplified diagram as follows:



Q20 is driven by Q21, which is controlled by amplifier Q22. Transistor Q22 compares the zener reference voltage across E15 with a portion of the output voltage through dividing resistors R90 and R91. R91 sets the output voltage.

The operating principle is as follows:

If V_{out} drops (due to a decrease in input voltage or an increase in load current), V_{BE} for Q22 will increase, also increasing base current for Q21 and Q20. When base current to Q20 increases, more current flows through the output load, cancelling the original drop in output voltage.

If the load current increases to a certain value, Q22 goes into saturation. If the load current increases still more, the zener diode will act as an open circuit and V_{BE} for Q22 decreases whereby base current for Q22, Q21, and Q20 decreases, too. Finally, Q22 will be cut off and base current in Q20 and Q21 will be zero. Thus is Q20 protected against destruction by short circuits at its output. Resistors R88 - and R89 - determine the saturation current through Q22 and, of course, the short circuit current.

A regulator built exactly like the simplified diagram would not be self-starting, however. Therefore, the regulators are provided with starting circuits; 9 V RX employs R82, R83, and E13 in its starting circuit and 9 V TX employs R92 and

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E16. Since 9 V RX and 9 V TX must not operate simultaneously, the regulators are also mutually coupled through a keying circuit that blocks, or cuts off, one regulator while allowing the other to operate. This function is controlled via terminal 4.

Operation of Keying and Starting Circuits

When terminal 4 is floating and the power is turned on, 9 V RX will build up voltage since Q20 gets base current through R82, R83, and E13. When 9 V RX reaches its final value the starting circuit will have no effect on the regulator because diode E13 will then be nonconducting (the unloaded voltage at terminal 4 is approx. 8.2 V at nominal battery voltage).

Transistors Q23 and Q27 are both heavily saturated, so the 9 V RX regulator will operate undisturbed while 9 V TX will be blocked because Q26 is completely cut off by Q27.

Note that 9 V TX cannot begin to build up a voltage by itself after a short circuit. Since - as just explained - it is 9 V RX that starts 9 V TX, it is necessary to activate the transmitter key again.

When the transmit key grounds terminal 4, two things happen:

1. Q27 loses its forward bias and immediately cuts off. Now, instead of acting as a short circuit between the base of Q26 and ground, Q27 can now be considered a large resistance.
2. C36, which has been charging through diode E14, has accumulated a charge of about 6.4 V. With terminal 4 grounded the charge on C36 reverse biases E14. Now C36 will discharge.

There are two discharge paths available to C36, one through the bleeder resistor, R94, and one through R93 and E16 to the base of Q26. Remember that the base of Q26 is no longer grounded.

The discharge current to the base of Q26 drives this transistor on. Once Q26 turns on its base assumes a potential of approx. 5.1 V. By now C36 has discharged so much that E16 becomes reverse biased by the 5.1 V on the base of Q26, and C36 continues to discharge through its other path (R94).

As long as terminal 4 is kept at chassis potential by the transmit key the 9 V TX regulator continues to operate.

When the key is released and terminal 4 resumes its unloaded potential of approx. 7.0 V, Q27 is driven on and short circuits the base of Q26 again. The 9 V TX regulator then turns off.

C36 charges again through E14.

Diode E11 ensures effective keying even if terminal 4 is not brought all the way down to 0 V potential.

Note that 9 V TX cannot begin to build up a voltage by itself after a short circuit but must be started again by keying the transmitter.

The operations described above presume the key blocking terminal to be at approx. 0 V potential.

The AF Output Amplifier

The output amplifier amplifies the audio signal from the preamplifier and powers the loudspeaker.

The amplifier is built around an integrated AF power module mounted on stand-offs, which are fastened to the chassis and act as heat sink. The amplification factor is determined by a suitable amount of feedback. In order to compensate variations in gain the internal feedback resistor (approx. 4 kΩ) is shunted by R127. Besides the normal input, the amplifier has an input for an Alerting tone from the tone receiver, when called. As the Alerting tone is to be heard from the loudspeaker when the volume control is turned down an isolating resistor, R120 is inserted.

In order to provide, optionally, a remote control for a locally controlled equipment, resistor R119 is serving to separate the two volume controls. Also note that the amplifier inputs (terminal 10

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or 12) must bave a d.c. path to chassis in order to bias the amplifier properly. C60/R125 increase the maximum achieveable output power (bootstrapping) and C58/C59 together with R126/C23 constitute the frequency compensation.

Supply voltage ripply is suppressed by C57, and R117/R118 reduce the current spike through the start relay switches when the equipment is turned on.

During transmit the amplifier is totally inhibited via Q32.

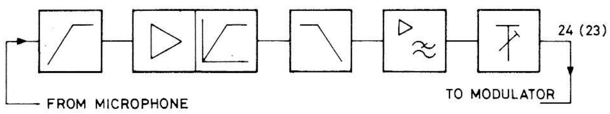
The Modulation Amplifier

General

The modulation amplifier differentiates, amplifies, limits and integrates the microphone signal. It also suppresses undesired high frequencies with an active filter designed for 25 kHz channel spacing.

Both amplifiers are contained in a single integrated circuit made up of dual operational amplifiers. The modulation amplifier contains additional passive differentiation and integrating circuits as well as diode clippers to prevent overmodulation.

The following block diagram shows the operating principle for the amplifier:



Input

The input circuit, which is also the collector return for the microphone amplifier output stage through resistor R2, is asymmetric.

The Differentiating Circuit

The differentiation network is made up of C1 and R3 (the input impedance of the operational amplifier is negligible due to the feedback through R8).

It differentiates at the rate of +6 dB pr. octave over the entire audio range of 300 - 3000 Hz.

The AF Amplifier - Clipper

The gain of the first amplifier stage, IC1a, is determined by the amount of feedback introduced.

Clipping action begins as soon as the amplifier is driven to where the collector excursions approximate the battery voltage. This level will be about 6.5 V peak-to-peak. The amplifier can be driven up to 25 dB above its nominal input level. Symmetry of the clipping is determined by bias network R5, R6, and R7 and therefore is fixed.

The Integration Circuit

Integrating takes place from 30 Hz at -6 dB pr. octave. The passive integrating network consists of R11 and C4. The lower limit for integration is determined solely by these two components as the previous amplifier's feedback makes its output impedance negligible, and because the loading of the network by the filter that follows is very light as long as the signal remains below the frequency limit of that filter.

The Splatter Filter

The purpose of this filter is to cut off frequencies that lie above the voice range in order to avoid undesirable sideband noise. It is an active filter consisting of the second operational amplifier and its associated components. Its response approaches that of a Chebishev filter. The circuit arrangement is the so-called voltage follower, where the voltage gain is very near unity (1).

Adjusting the Frequency Swing

The amount of signal to the modulator input, and thus the frequency swing, is set by the voltage divider formed by R18 and the input impedance of the modulator. If the frequency swing cannot be set sufficiently high, terminal 23 can be used instead of terminal 24.

TECHNICAL SPECIFICATIONS

Nominal Supply Voltage

13.6 V

Current Drain

(at nominal supply voltage)

Transmit: 120 mA
Receive : 100 mA

12 dB SINAD Sensitivity

(where 1.75 kHz deviation of the 455 kHz IF results in a 1 kHz audio signal)

1.2 μV input signal at antenna termination

AF Line Out (terminal 18)

-17 dBm/600Ω (110 mV)

AF Telephone Output (terminal 16)

90 mV

Regulated Voltages

Receiver (terminal 6):	9 V
Transmitter (terminal 5):	9 V

Unregulated Voltages

AF output amplifier:	13.6 V
PA stage (terminal 15):	13.6 V
Tone transmitter and microphone (terminal 7):	13.6 V

AF Output Power (terminal 8)

3 W

Modulation Amplifier Sensitivity

(for normal frequency swing of 1 kHz)

110 mV +1/-3 dB

TX Inhibit

Voltage/current: ≥ 6 V/2 mA

Temperature Range

Working range:	-25°C - +60°C
Function range:	-30°C - +75°C

The following, more detailed specifications for the several CF705 functions are all typical values measured at 25°C ambient temperature, unless otherwise stated.

455 kHz IF Amplifier and Discriminator

Current Drain (at nominal 9 V supply)

18 mA

Maximum Frequency Deviation

± 15 kHz

IF Bandwidth (3 dB attenuation)

± 17 kHz

Input Impedance

1 kΩ // 15 pF

Gain

from input (terminal 1) to pin 4 of IC3:	55 dB
from IC3 input (pin 4) to IC3 amplifier high output, pin 10:	55 dB

Discriminator Conversion Efficiency

50 mV / kHz

AF Output Voltage (f_m = 1 kHz, Δf = 3.5 kHz)

110 mV

Measured at test point [2] , terminated with 2.2 kΩ load.

Discriminator Linearity (relative to 1000 Hz)

Pass-Band 100 - 3500 Hz: +0/-1 dB

Measured at test point [2] , terminated with 2.2 kΩ load.

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Discriminator Output Resistance

200 Ω

Minimum Load Resistance

2 kΩ

Harmonic Distortion

Δf = 15 kHz : 4.5%

Δf = 3.5 kHz : 1.0%

AF PREAMPLIFIER and SQUELCH-CONTROLLED SWITCH

Current Drain (at nominal 9 V supply)

1.5 mA

Input Impedance (at 1 kHz)

2.2 kΩ

Output Impedance

R_{OUT} = ∿ 0 Ω

Gain (gain control at highest setting)

R_L = 1.8 kΩ, f = 1 kHz;

Terminal 19: 6.5 dB

Terminal 18: 8.5 dB

Harmonic Distortion (R_L = 1.8 kΩ, f = 1 kHz)

(terminal 18 and 19)

V_{OUT} = 110 mV (nominal): 0.2%

V_{OUT} = 500 mV : 0.5%

Required Turn-on Potential

(between R30 and R65)

To ensure normal signal path: $\geq$ 2.3 V

Deemphasis Cut-off Frequency

60 Hz

Frequency Response at Tone Receiver Output

(terminal 18)

(relative to -6 dB/octave characteristic)

Pass -Band linearity (300 - 3000 Hz): +0/-1 dB

Frequency Response at Output for AF Amplifier and Tone Receiver

(terminal 19)

(relative to -6 dB/octave characteristic)

Pass-Band linearity (300 - 3000 Hz) : +0/-1.5 dB

100 Hz rel. to 1000 Hz : +6 dB

6 kHz rel. to 1000 Hz : -17 dB

SQUELCH CIRCUIT

Current Drain (at nominal 9 V supply)

18 mA

Measured with unloaded Squelch Signalling (terminal 16)

Input Impedance

15 kΩ

Noise Filter Resonant Frequency

7.5 kHz

Output Voltage

Squelched condition: $\leq$ 100 mV

Un-squelched condition: > 5.6 V

measured at Q8's collector.

Squelch Signalling (terminal 16)

R_{LOAD} minimum = 680 Ω

V_{OUT} (with R_L = 680 Ω)

Squelched condition: $\leq$ 100 mV

Un-squelched condition: $\geq$ 4.0 V

AF OUTPUT AMPLIFIER

Nominal Supply Voltage

13.6 V

Operating Range

10.5 to 16 V

Current Drain (at nominal supply voltage)

no-signal condition: 12 mA

at 4 W output : 520 mA

inhibited : 6 mA

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Output Power (at nominal supply voltage)

Maximum 4 W

Loudspeaker Impedance

Nominal/minimum: 4 Ω

Input Impedance (at 1 kHz)

100 kΩ

Nominal Gain

32 dB (at 1 kHz)

Harmonic Distortion

P_{OUT} = 2 W: 1%

P_{OUT} = 0.2 W: 0.5%

Frequency Response (relative to 1 kHz)

80 Hz	-3 dB
300 Hz	0 dB
3000 Hz	-0.5 dB
15 kHz	-3 dB

Measured at 0.2 W output power.

Alerting Tone Input

Voltage gain:	1.5 dB
Input impedance:	270 kΩ

MODULATION AMPLIFIER

Current Drain, (at nominal 9 V supply)

1.5 mA

Input Impedance (at 1 kHz)

540 Ω

Limiting

Signal clipping begins to occur with an input signal (1000 Hz) of: 160 mV

Output signal level observed at pin 1 of IC1 when clipping occurs: 7.0 V p.p.

Output Voltage (1 kHz)

12 mV

Measured at modulation output (terminal 24) with potentiometer R18 fully up, and load impedance = 1 kΩ.
Input level = 160 mV.

Harmonic Distortion (at 1 kHz)

for 160 mV input signal: 0.8%

Frequency Response (relative to 1 kHz)

300 Hz	-	0 dB
3 kHz	-	0 dB
6 kHz	-	19 dB
10 kHz	-	32 dB

Measured for 15 mV input signal, and with a resistive output load.

9 V VOLTAGE REGULATORS and KEYING CIRCUITS

Nominal Supply Voltage

13.6 V

Operating Range

10.5 V to 16 V

Regulated Output Voltages

Receiver supply 9 V RX:	9.0 V ± 0.2 V
Transmitter supply 9 V TX:	9.0 V ± 0.2 V

V_{REG} vs. Temperature

3.6 mV / pr. °C

Suppression of $\Delta V_{BATTERY}$ in V_{REG}

(at nominal load)

DC	: 46 dB
1 kHz	: 50 dB

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Internal Resistance of Regulators

$R_I = 0.5\ \Omega$

Regulator Output Current

Maximum 250 mA

Maximum Load

on terminal 7 (MC-MT-TT)	:	100 mA
on terminal 15 (PA)	:	6 A
on terminal 11 (TX lamp)	:	100 mA

Keying Termination

Maximum allowable resistance of wiring	:	180 Ω
Alternatively, V_{MAX} at terminal 4	:	1.0 V

Regulator Switching Time

($V_{BATTERY}$ = 13.6 V)

9 V TX turn-on delay, $t_{0-90\%}$	:	0.1 ms
9 V TX turn-off delay, $t_{100-10\%}$	:	25 ms

Measured under normal load conditions.

TX Inhibit (terminal 3)

Voltage/current : $\geq$ 6 V / 2 mA

CQM713 P3

ADJUSTMENT PROCEDURE

The following measuring instruments are required for making adjustments to the CQM713 P3 radiotelephone:

Test box for CQM713 P3	Storno U95B0518
AF millivoltmeter,	Z in 2 MΩ//50 pF Accuracy better than 3% in the range 50 Hz - 100 kHz.
Multimeter	20 kΩ/V or better
Distortionmeter	
Electronic DC voltmeter	R in > 2 MΩ/ 1 V
Deviation meter	
DC Ampere meters	1.0/5.0A
Power supply	10.5 - 16V Preset current limiter 0.1 - 5.0 A
RF Watt meter	0 - 25 W
FM signal generator (s)	146 - 174 MHz
Tone generator	
Tone signalling generator	Storno G13
Crystal controlled generator 455 kHz/10.7 MHz	Storno G21
Frequency counter	
RF Test probe	Storno 95.0089
Signal splitter, 6 dB/160 MHz	Storno 95.2003
Attenuator	40 dB/25W 50Ω
Psophometric filter	
Variable Reactance Load	W52C

Connect a power supply with the correct polarity to the battery connector.

Set the supply voltage to 13.6 V and the current limiter to 1.0 A.

The station may now be turned on.

Check the 9 V RX at terminal 3 on the IF converter.

Requirement: 9 V ± 0.2 V

If necessary, adjust the RX voltage by means of potentiometer R91 in CF705. This potentiometer can be reached from the rear of the module chassis BA705.

Check the 5 V regulated supply.

Requirement: 5 V ± 0.2 V

ALIGNMENT OF 2nd IF AMPLIFIER

To protect the IF amplifier input stages, establish a good chassis connection between a 455 kHz generator and the station.

Apply a 455 kHz signal to the input of CF705. The IF generator STORNO G21 is well suited.

Connect a DC voltmeter with RF probe, STORNO 95.089, to test point [1] in CF705.

Adjust transformers T1 and T2 for maximum meter reading, attenuating the generator output before overloading the IF amplifier, causing limiting. The readings should be kept below approx. 10 μA if a multimeter is used, and below approx. 500 mV if an EVM (electronic voltmeter) is used, and in any case below the point where an increase in generator output voltage result in a constant or decreasing meter reading.

COARSE ADJUSTMENT OF L2 IN CF705

Disconnect the generator and disable the squelch by pushing the "Cancel Squelch" button on the control box.

Connect an AC EVM to terminal 35 LINE OUT (AF 17 dBm) on the terminal board.

Adjust coil L2 in CF705 for maximum meter reading. If two maxima are obtainable, adjust for the greater.

If no reading can be obtained, the potentiometer R19 (AFRX) may be turned up. This potentiometer can be reached from the rear of the module tray BA705, and turns up counterclockwise.

Storno

ADJUSTMENT OF OSCILLATOR FREQUENCY IN IC703

If a frequency counter is available, the frequency may be read at test point [5] , IC703. If the input of the frequency counter is DC-coupled a capacitor (approx. 1 nF) should be connected in series. The frequency will be 10.245 MHz. Refer to circuit description, "Intermediate Frequency Circuits".

Where no counter is at hand, proceed as follows:

Connect a 455 kHz generator to the IF input of CF705 and a 10.7 MHz generator to the input of IC703. A modified G21 may be used, i.e. the two oscillators, 455 kHz and 10.7 MHz, both in operation at the same time by activating two buttons. The 10.7 MHz output is fixed, and the 455 kHz variable by means of the attenuator. The accuracy of the generator signal should be checked to be 10.7 MHz ± 20 Hz.

Adjust the output level of the 455 kHz generator until a beat tone is produced in the speaker.

Adjust trimmer capacitor C12 in IC703 for zero beat.

The frequency difference may also be observed on an oscilloscope connected to the "Line out", 600 Ω audio output, which is accessible on the terminal board, terminal 35.

NOTE: The discriminator has no zero adjustment.

ALIGNMENT OF 1st IF AMPLIFIER (10.7 MHz)

Apply a 10.7 MHz signal to the input of IC703.

Connect a DC meter with an RF probe (95.089) to test point [1] in CF705.

Adjust coils L1, L2, and L3 in IC703 for maximum meter reading. The input level should be kept low enough to prevent limiting.

Gain of IC703: $\geq$ 20 dB

Alignment of the Frequency Synthesizer Reference Oscillator.

Select channel 01.

Connect a frequency counter to the TX output of the FS702.

Adjust C1 in FS702 for 17.425000 MHz ± 10 Hz.

Check all channels for correct synthesizer frequency according to the frequency allocation tables.

Alignment of Mixer Injection Signal to RC712.

Connect a DC voltmeter to test points (1) and (2) in RC712.

Adjust L3 in RC712 for maximum meter reading. Distance between the tuning slug and the top of the coil form should be approx. 2 mm.

The voltage with the oscillator stopped (short the crystal to chassis) will be approx. 0.25 V. Minimum increase, with the oscillator working, will be approx. 30 mV.

Connect the voltmeter to test point (4) in RC712.

Adjust L5 and L6, RC712, for maximum meter reading.

The voltage at test point (4) with the oscillator stopped will be approx. 0.7 V.

Start the oscillator.

Requirement: Minimum increase must be $\geq$ 0.25 V
Typical: 0.6 V

Adjustment of Crystal Oscillator Frequency, RC712.

Connect a frequency counter to test point [3] in RC712. Adjust L1, RC712, for correct frequency.

Requirement: 136.275000 MHz ± 150 Hz.

If the frequency cannot be pulled to the correct reading the strap in the oscillator circuit must be altered. Refer to RC712 diagram.

Storno

The frequency should be adjusted at 25°C ambient temperature.

Due to interaction between L1 and L3, the adjustment of L3 should be checked, and any readjustment requires the frequency to be readjusted.

Checking the FS702 Output Level.

Connect an RF probe 95.089 and a multimeter to terminal 5 in RC712.

Set the channel selector to channel 28.

f_{synt} = 16.750 MHz.

Stop the RC crystal oscillator and measure the RF level (approx. 0.4 V).

Select the channel having the highest frequency, and the lower frequency and measure the RF level.

Maximum deviation relative to centre channel.

2 dB ~ approx. ± 0.1 V.

If the level is low in one position, L6 in RF amplifier I in FS702 is adjusted for best symmetry.

Alignment of Filters and RF Amplifier, RC712.

Connect a voltmeter to test point (5) in RC712.

Stop the crystal oscillator in RC712 (short the crystal to chassis).

Coarse tuning

Connect an RF generator to the input of BP-filter I, and set the generator for 153 MHz.

Adjust L8, L9, L10, L14, L15, L16, and L17 for maximum reading on the voltmeter.

Fine tuning

Remove the RF generator and start the crystal oscillator.

Select channel 28.

Turn the tuning slug of L5 in RA712 flush with the outside of the coil can.

L8, L9, L10, L14, L15, L16, and L17 is adjusted for maximum meter reading in test point (5) .

Due to interaction the adjustments should be repeated until no further increase in meter reading can be obtained.

As the crystal oscillator frequency is only 10% below the desired frequency, care must be taken not to resonate the filter circuits at the wrong frequency.

The voltage at test point (5) with the oscillator stopped will be approx. 3 V.

Start the oscillator.

Requirement: Minimum increase at test point (5) , is 1.0 V.

Check the voltage at the higher frequency and the lower frequency.

If the voltage drops at higher or lower frequencies, small corrections of the filter alignment may be implemented.

FURTHER ALIGNMENT OF RC712, RF AMPLIFIER RA712, and FINE TUNING OF IC703.

Connect a DC EVM with an RF probe to test point [1] in CF705. A multimeter with 20 kΩ/V may be used, but the deflection will only be on the order of tens of microamperes.

Connect an unmodulated RF generator to the antenna input of the CQM700.

Select channel 28.

Set the generator to the receiver frequency.

Fine tuning of the generator frequency may be done by loosely coupling a 455 kHz signal to the IF input of CF705, or 10.7 MHz to the IC703 input. (First connect CQM700 chassis to generator earth.) Tune the RF generator for zero beat.

If the beat tone is to be monitored in the loudspeaker, the squelch and RX inhibit must be cancelled.

The RF generator output should be kept low enough to prevent limiting in CF705, i.e. a reading of approx. 500 mV on a DC EVM with an RF probe at test point [1] , CF705.

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The following coils are tuned for maximum meter reading in this order:

L1 , RA712
L2 , RA712
L3 , RA712
L4 , RA712
L5 , RA712
L17, RC712
L18, RC712
L1 , IC703
L2 , IC703
L3 , IC703

Due to interaction, the procedure should be repeated until no further increase in meter reading can be obtained.

By adjusting L17, RC712, the oscillator drive signal to the RF mixer will have decreased. L16, RC712, must be fine tuned for maximum reading on a DC voltmeter connected to test point (5) , RC712.

Now, when stopping the oscillator, the voltage at test point (5) should fall at least 0.5 V. L1, L2, and L3 in IC703, are now fine tuned for maximum reading at test point [1] , CF705. The circuits in IC703 should be aligned two or three times, as they influence each other.

FINE TUNING OF L2 IN CF705

Keep the RF generator connected as described and set its output attenuator for full limiting in the CQM713, approx. 1 mV EMF from the generator.

Modulate the generator with 1 kHz to a frequency swing of ± 3.5 kHz.

Connect an AF millivoltmeter to terminal 22 on BA705.

Adjust L2 in CF705 for maximum reading.

Adjust potentiometer R19 on CF705 for 110 mV +1/-0 dB.

Measure the AF voltage at terminal 35 on BA705.

Requirement: 90 mV ± 1.5 dB.

Connect a 4 Ω load resistor across the loudspeaker output terminals instead of the loudspeaker.

Connect an audio voltmeter and a distortion meter across the loudspeaker terminals. Set the volume control for 3.16 V (∿ 2.5 W) on the meter.

Check the distortion.

Requirement: k $\leq$ 7%.

CHECKING RECEIVER SENSITIVITY

Modulate the RF generator with 1 kHz, and a frequency deviation of ± 1.5 kHz.

Set the generator output to 1 mV e.m.f.

Connect an AF millivolt meter and a Psofometric filter across the loudspeaker terminals, substituting a 4Ω (4W) resistor for the speaker.

Set the volume control for 1 V across the load.

Reduce the calibrated RF voltage from the generator until a reading of 10 mV is obtained on the meter.

Requirement: $\leq$ 20 µV e.m.f.

This procedure should be repeated on all channels.

Reduce the RF voltage further until a reading of 0.1 V is obtained on the meter.

Requirement: $\leq$ 2.5 µV e.m.f.

This procedure should be repeated on all channels.

ADJUSTMENT AND CHECKING THE SQUELCH

Adjust the squelch by means of potentiometer R44 in CF705 to open the audio signal path for 1.3 µV e.m.f. antenna signal.

Reduce the antenna signal and check that the squelch closes and inhibits the audio output.

Requirement: 0.5 - 0.8 µV e.m.f.

CHECKING OVERALL RECEIVER CURRENT CONSUMPTION

Measure the current drain at 13.6 V supply voltage.

Requirement: $\leq$ 1.0 A (typical 750 mA).

TRANSMITTER ADJUSTMENT

Set the supply voltage to 13.6 V, and the current limiter to 5 A.

With the transmitter output loaded (antenna or dummy load connected), key the transmitter and check 9 V TX at terminal 19 on the terminal board.

NOTE: If 9 V RX was not present or was set too low before keying the transmitter, the 9 V TX series regulator will not start.

Requirement: 9 V TX = 9 V ± 0.2 V.

If necessary, adjust the TX voltage by means of potentiometer R98 on CF705. This potentiometer can be reached from the rear of module tray BA705.

Alignment of Mixer Injection Signal to EX712

Connect a DC voltmeter to test point (1) and (2) in EX712.

Adjust L3 in EX712 for maximum meter reading. Distance between the tuning slug and the top of the coil form should be approx. 2 mm.

The voltage with the oscillator stopped (short circuit the crystal to chassis) will be approx. 0.25 V. Minimum increase with the oscillator working will be approx. 30 mV.

Connect the voltmeter to test point (4) in EX712.

Adjust L5 and L6, EX712, for maximum meter reading.

The voltage at test point (4) with the oscillator stopped will be approx. 0.7 V.

Start the oscillator.

Requirement: Minimum increase at test point (4), EX712 = 0.25 V.

Adjustment of Crystal Oscillator Frequency, EX712.

Connect a frequency counter to test point [3].

Adjust L1, EX712, for correct frequency.

Requirement: 142.475 MHz ± 150 Hz

If the frequency cannot be pulled to the correct reading the strap in the oscillator circuit must be altered. Refer to EX712 diagram.

The frequency should be adjusted at 25°C ambient temperature.

Due to interaction between L1 and L3, the adjustment of L3 should be checked and any readjustment requires the frequency to be readjusted.

Checking the FS702 Output Level

Connect an RF probe 95.089 and a multimeter to terminal 5, EX712. Set the channel selector to the centre channel.

Select channel 28 (f_{synt} = 16.750 MHz)

Stop the RC crystal oscillator and measure the RF level (approx. 0.4 V).

Select the channel having the highest frequency, and the lowest frequency, and measure the RF level.

Maximum deviation relative to centre channel:

2 dB ∿ approx. ± 0.1 V.

If the level is low in one position, L7 in FS702 is adjusted for best symmetry.

Alignment of Filters and RF Amplifier, EX712.

Connect an RF probe 95.089 and a multimeter to test point [8] in EX712 (output terminal).

Stop the crystal oscillator in EX712 (short the crystal to chassis).

Coarse tuning

Connect an RF generator for the input of BP-filter I, and set the generator for 159,0 MHz. Adjust L8, L9, L10, L14, L15, and L16 for maximum reading on the multimeter.

Fine tuning

Remove the RF generator and start the crystal oscillator.

Select channel 28.

Adjust L8, L9, L10, L14, L15, and L16 for maximum meter reading, approx. 5.6 V.

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Due to interaction the adjustments should be repeated until no further increase in meter reading can be obtained.

As the crystal oscillator frequency is only 10% below the desired frequency, care must be taken not to resonate the filter circuits at the wrong frequency.

Alignment of RF Amplifier RA711.

Connect a voltmeter to test point (10) in RA711.

Adjust L16 in EX712 for minimum meter reading. Adjust L1, L2, L3, L4, and L5 in RA711 for minimum meter reading. approx. 4.0 V.

Remove the RF signal load between RA711 and PA714.

Connect an RF Watt meter 0 -0.3 W to the RA711 output.

Adjust L6, RA711 for maximum output.

Adjust L1, L2, L3, L4, L5, and L6 for maximum output.

Repeat the adjustment until no further increase in meter reading can be obtained.

Requirement: $P_{OUT} \geq 80$ mW.

The requirement should be fulfilled on all channels. The total variation in output power should be less than 1 dB within the bandwidth.

Alignment of RF Power Amplifier, PA714.

Reestablish the connection between RA711 and PA714.

Connect a wattmeter to the antenna output.

Select channel 28.

Set the supply voltage to 13.6 V.

Set all trimmer capacitors for half capacity.

Turn the ADC potentiometer, R11 in PA714 up until a current increase is obtained but do not exceed 5.0 A.

NOTE: Insulated trimming tools should be used.

Key the transmitter.

a. Adjust C2, C6, C8, C9, C13, and C15 in that order for maximum current drain until a deflection on the wattmeter is obtained. Then adjust for maximum output power.

b. During the following procedure keep the ADC potentiometer set to 20 W.

c. Connect a voltmeter to test point (1) in PA714. Adjust C2 for minimum deflection.

d. Adjust C6, C8, C9, C13, and C15 for maximum output power.

   Repeat steps a - d.

Increase the supply voltage to 16 V and set the ADC potentiometer to 22 W output power.

Remove shorting link designated "NOTE 1" and adjust potentiometer R12 for 4 W output power.

Insert "NOTE 1" and adjust potentiometer R11 for 22 W output power.

CHECKING THE RF OUTPUT, CURRENT CONSUMPTION, AND THE FUNCTION OF THE ADC CIRCUIT.

The current drain and output are measured as follows:

Supply voltage	P_{OUT}	Current drain
16.0 V	22 W	≤ 4.3 A
13.6 V	≥ 20 W	≤ 4.8 A
10.5 V	≥ 12 W	≤ 4.8 A

Correct values here also indicate that the ADC circuit is operating satisfactorily.

Checking the Transmitter Stability

Transmitter instability appears as AM modulation of the transmitted carrier by a modulating frequency which may vary between 0.5 - 40 MHz.

The existence of parametric oscillations can be determined by means of a detector followed by a filter, which removes the carrier, and an indicator, e.g. an oscilloscope, a millivoltmeter, or simply a multimeter with a diode detector. When using the latter, an amplifier is required, e.g. STORNO amplifier detector type TSF42A.

While varying the phase angle with W52C, check that no deflection appears on the AM indicator at any supply voltage between 10.5 V and 16 V.

For further details please refer to STORNO Service News No. 38 of May 1969.

Adjustment of Modulation and Frequency Deviation

Connect the deviationmeter to the transmitter output via an attenuation network (25 W capacity).

Connect a distortionmeter to the output of the deviationmeter.

Set the power supply to 13.6 V.

Connect a tone generator to the modulation input on the test box. Set the generator output to 1.1 V (110 mV + 20 dB).

Select channel number 1.

Find the audio generator frequency between 300 Hz and 3000 Hz giving the greatest frequency deviation as read on the deviation meter. At that audio frequency adjust potentiometer R18 on CF705 for ± 5 kHz deviation.

Reduce the audio generator output to 110 mV.

Set the frequency to 1 kHz.

Check the frequency deviation, ± 3.5 kHz, on all channels.

Requirement: V_{mod} = 110 mV ± 3 dB.

Check the distortion on the audio output of the deviation meter.

Requirement: K = ≤ 10% (without deemphasis).

CHECKING THE SEQUENTIAL TONE RECEIVER

Test Set Up

Connect an RF generator to the CQM713 P3 through Attenuators as shown.

Connect the tone signalling generator G13 to modulate the RF generator.

Adjust the RF generator output to 10 mV.

Set the G13 amplifier, A1, to FLAT RESPONSE and the output to HIGH and the Tone Burst Generator to HOLD TONE 1. Adjust the attenuator of A1 for ± 3.0 kHz frequency deviation.

Set the Tone Burst Generator to 70 ms bursts and 15 ms interval.

Set the Tone Generator to the tone code of SR783.

Switch the equipment to standby on the control channel.

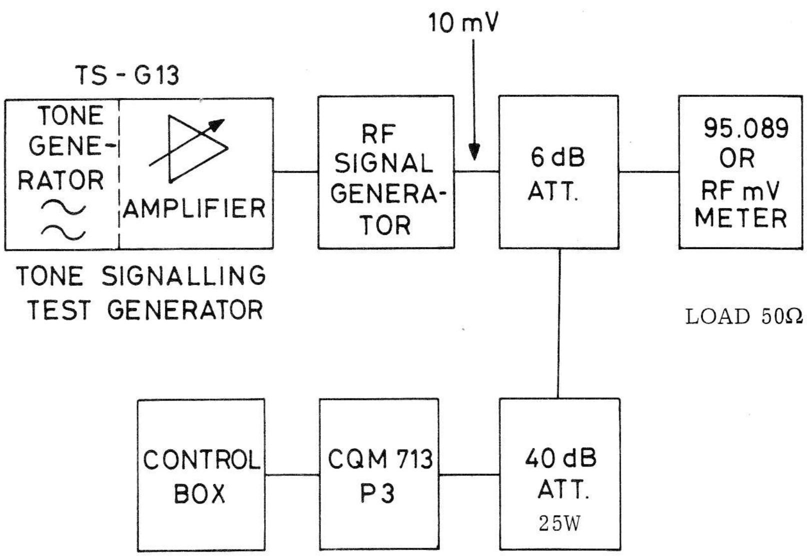

Fig. 1. Sequential Tone Receiver Test

Key the tone generator and check the following functions:

1. The Acknowledge tone is emitted.
   Measure the voltage, in stand-by, on the inhibit terminals of TT784, terminal 5 and 11.
   The voltage should be approx. 11 V.
   During transmission of Acknowledge tone the voltages change for approx. 750 ms as follows:
   terminal 5 = approx. 1.5 V
   terminal 11 = approx. 7.0 V

2. The Alerting tone is activated.
   The Alerting tone shall fullfil the following requirement:
   Duration 2 - 5 seconds (typical 3.4 s).
   Voltage: > 3.4 $V_{p.p}$ (typical 6 $V_{p.p}$)
   measured at the Loudspeaker output terminals.

3. The Called Lamp is turned on.
   Check the Called Lamp is ON for 2 - 5 minutes (typical 3.5 min.).

CHECKING THE TONE RECEIVER SENSITIVITY

Check the tone receiver for proper functioning with the tone signalling generator output reduced 6 dB, the procedure as described above.

CHECKING THE MARKING SIGNAL DETECTOR, TONE RECEIVER TR786

Test Set Up

See fig. 2.

Set the signal generator output to 10 mV.

Set the A1 amplifier to "Flat Response" and the output to "High".

Set the tone generator to 2000 Hz.

Adjust the attenuator of amplifier A1 for ± 1.5 kHz frequency deviation.

Select a traffic channel, f.ex. channel 16, by means of the manual channel selector on the control box.

Set the MT switch on the control box to "In rest".

Check by changing tones A and D that the marking signal detector TR786, generates call pulse and energize the transmitter for all of the following tone combinations.

Combination	Tone A, Hz	Tone D, Hz
A	2000	2200
E	1830	2200
I	1670	2200
O	1830	2000
U	1670	2000
X	1670	1830

Select channel 17.

Check that none of the tone combinations above causes the equipment to perform a call.

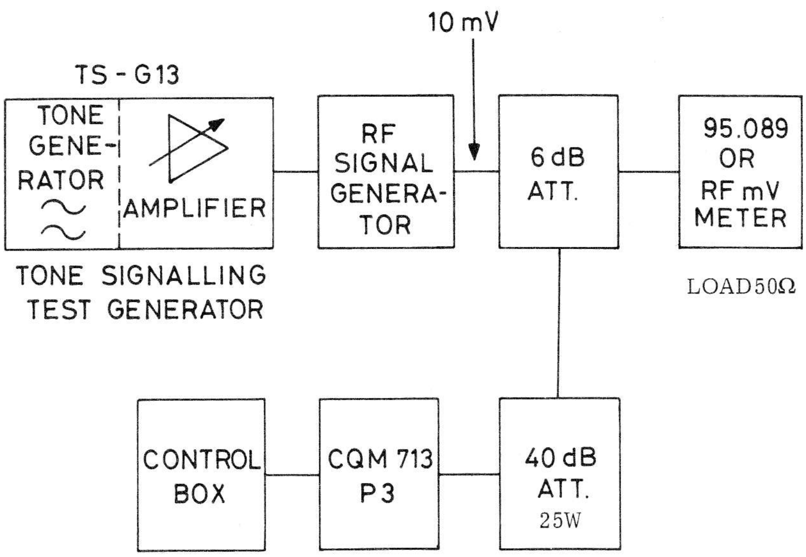

Fig. 2. Marking Signal Detector Test

Adjustment of the RF Level Detector.

Set the RF generator to the frequency of channel 28 and adjust the output for 10 mV e.m.f. corresponding to 50 μV input at the antenna connector. On the control box set the MT switch to Removed, and check that the automatic channel search is initiated.

Set the tone generator to correct combination as selected (A, E, I, O, U, X) on the control box.

Watch the channel searching on the channel display on the control box.

Adjust potentiometer R12 on FC705, P-level, so that the transmitter is energized during the channel search.

Adjust the generator output to 600 μV e.m.f. corresponding to 3 μV input at the antenna connector. Adjust potentiometer R30 on FC705, R-level, so that the equipment, after having searched all channels, switches to channel 28 and energizes the transmitter.

The R-level is to be checked on channel 1 and channel 55.

Requirement: nom. R-level + 2 dB / -0 dB.

Checking the Tone Transmitter TT784

Connect a deviation meter through an attenuator to the antenna connector.

Select channel 1.

Activate the tone transmitter, TT784, by means of the Tone Key switch on the control unit.

The frequency deviation should be ±3 kHz ±300Hz

By changing the value of resistor R15 in TT784 the frequency deviation may be adjusted to be within tolerance.

The resistor should be the closest lower standard value (E12 series) to the resistance giving a frequency deviation of ± 3 kHz.

Checking the Call, Respond, and Clear Functions

Test Set-Up
See fig. 3.

Call Tone

Set the signal generator to channel 28.

Modulate the signal generator with a marking signal as described under Checking of the Marking Signal Detector.

Set the control box to automatic channel search.

Depress "Hold Tone Key".

Set the "MT" switch to "Remove".

The equipment shall select channel 28 and transmit the call tone.

Read the Call Tone frequency on the counter; the frequency may be adjusted with the trimming slug of L1 on TT784.

Requirement: f = 2400 Hz ± 1 Hz.

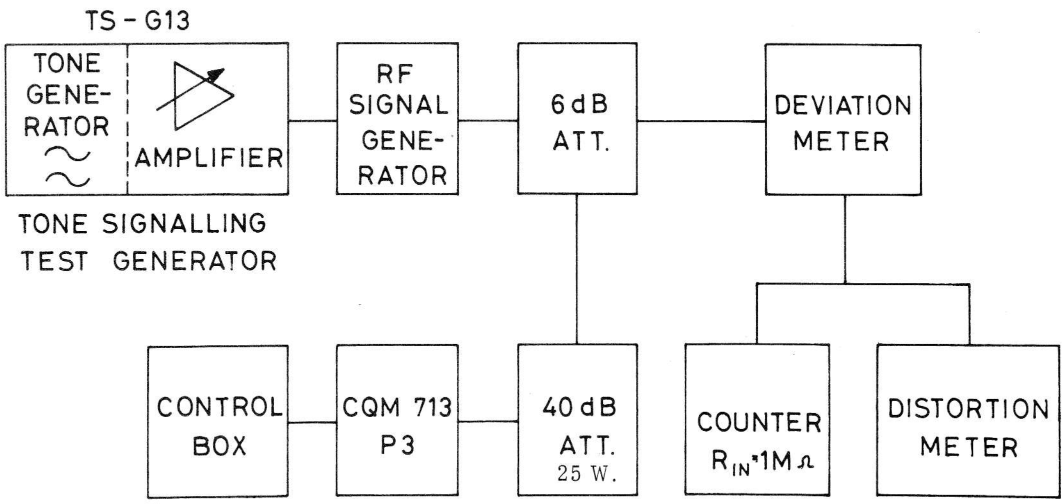

Fig. 3. Call, Respond, and Clear Function Test

Check the frequency deviation as read on the deviation meter.

Requirement: $\Delta f = \pm 3$ kHz ± 300 Hz.

Measure the distortion at the output of the deviation meter.

Requirement: THD < 10%
typical < 3%

Respond Tone

Set the signal generator to channel 17.

Modulate the signal generator with a signal as described under Checking of the Sequential Tone Receiver.

Set the MT switch to "In rest".
Release a sequentioal tone call to the station.

Perform measurements as described for the Call Tone.

Requirements:

Frequency, f = 2400 Hz
Frequency deviation, $\Delta f = \pm 3$ kHz ± 300Hz.
Distortion, THD < 10%, typical < 3%.

Repeat the measurements with the exception that the Called Lamp shall be extinguished before the MT switch is set to "Removed". The emitted tone shall be the Call tone (2400 Hz).

Clear Tone

Perform the Call tone test as described.

Disconnect the modulating signal to the RF signal generator.

Depress "Hold Tone Key" for more than 1 second and then release.

Set the MT switch to "In rest".

Check the frequency deviation.

Requirement: $\Delta f = \pm 4.7$ kHz ± 300 Hz.

Checking the Channel Searching Circuit

Test Set-up
See fig. 4.

Checking The Channel Selection

Set the frequencies of the two signal generators to two individual traffic channels.

Set the signal generator outputs to 2 mV e.m.f. corresponding to 10 µV input at the antenna connector.

Set the equipment for automatic channel control on the control box.

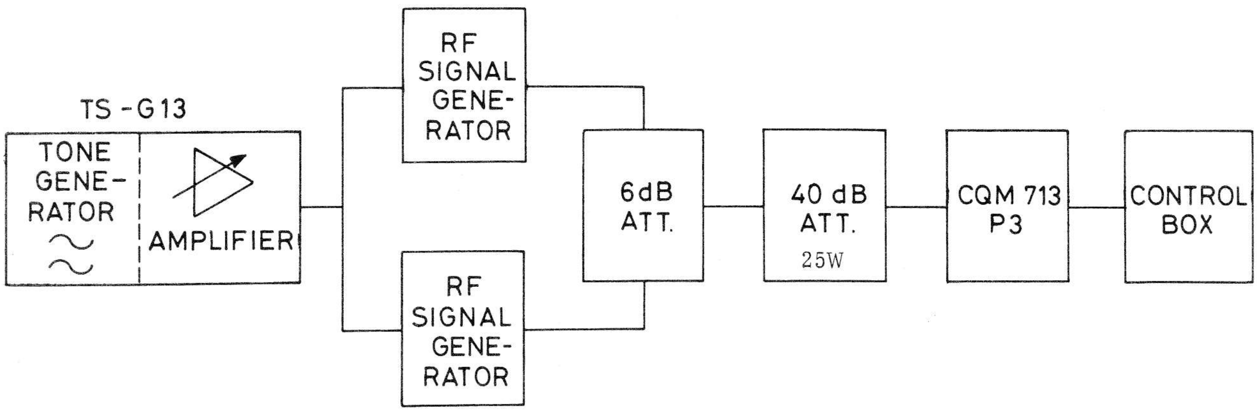

Fig. 4. Channel Searching Circuit Test

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Alternately, increase the RF signal generator outputs 4 dB.

Check that the equipment selects the channel having the greater signal.

Checking the Network Connection

Test Set-Up

See fig. 4.

Set the RF signal generator to channel 28.

Set the RF signal generator output to 2 mV e.m.f.

Modulate the RF signal generator as described under Checking the Marking Signal Detector.

The equipment shall search all channels, revert to channel 28, emit the Call tone, and repeat the channel search starting at channel 1.

Removing the marking signal while searching channel 29 - 55 (after channel 28 has been registered) shall cause the equipment to revert to channel 28 without the transmitter being energized and then the channel search shall be repeated starting at channel 1.

Removing the marking signal while the Call tone emission is in progress the equipment shall stop the channel search, the Searching Lamp shall extinguish and the receiver and the transmitter inhibit shall be removed.

Decreasing the RF signal until the squelch closes and then again increased, or energizing the transmitter for less than 5 seconds shall not cause the receiver to be inhibited.

Closing the squelch for more than 10 seconds shall cause the receiver and transmitter to be inhibited.

Setting the MT switch to "In rest", the equipment shall select channel 17 without emitting the Clear tone.

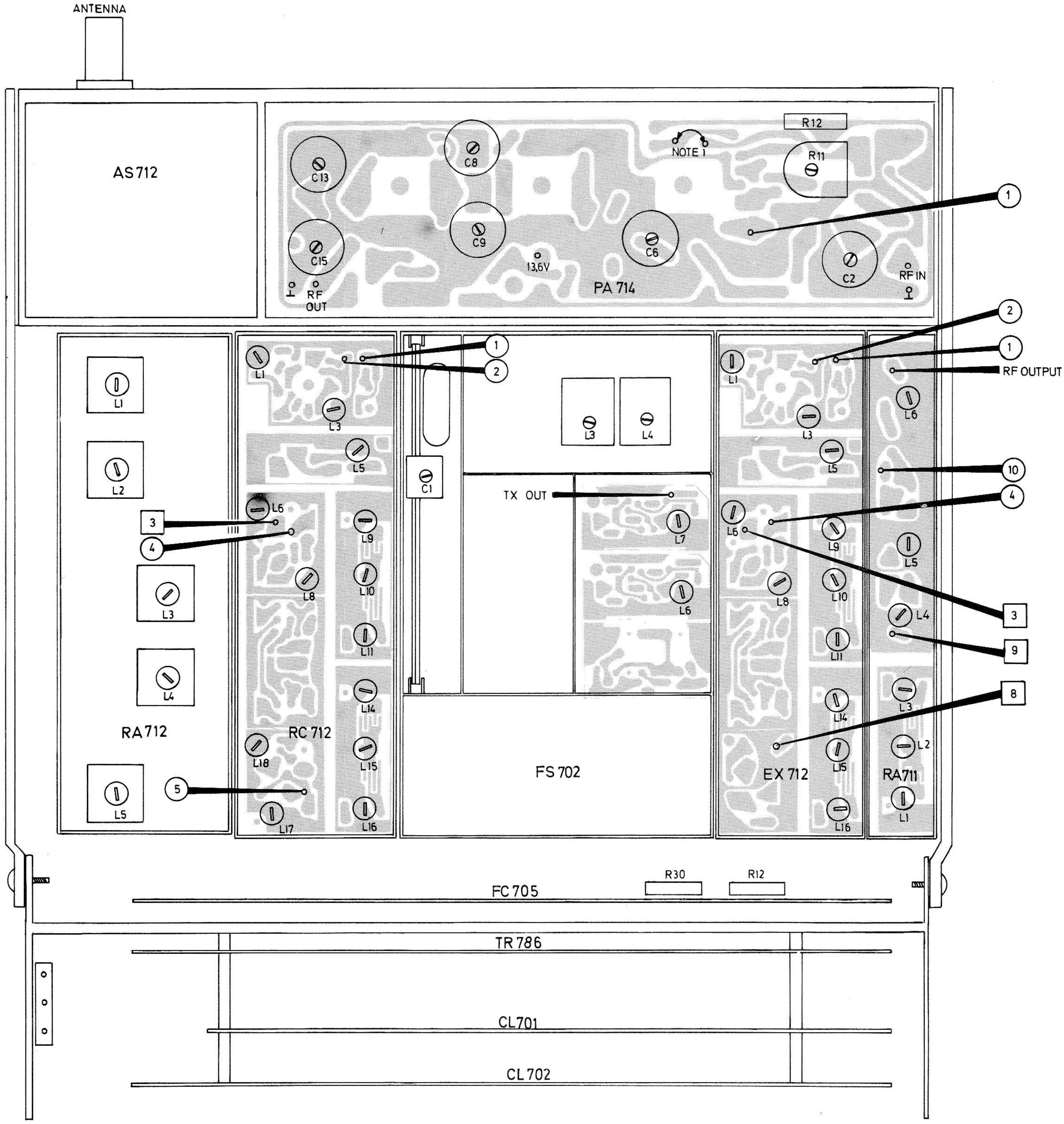
Checking the Control Channel Time-out

Select channel 17 and key the transmitter.

Activate the "Cancel TX Block" switch.

The transmitter shall be energized for 1 - 2 seconds and the equipment shall then revert to the receive mode.

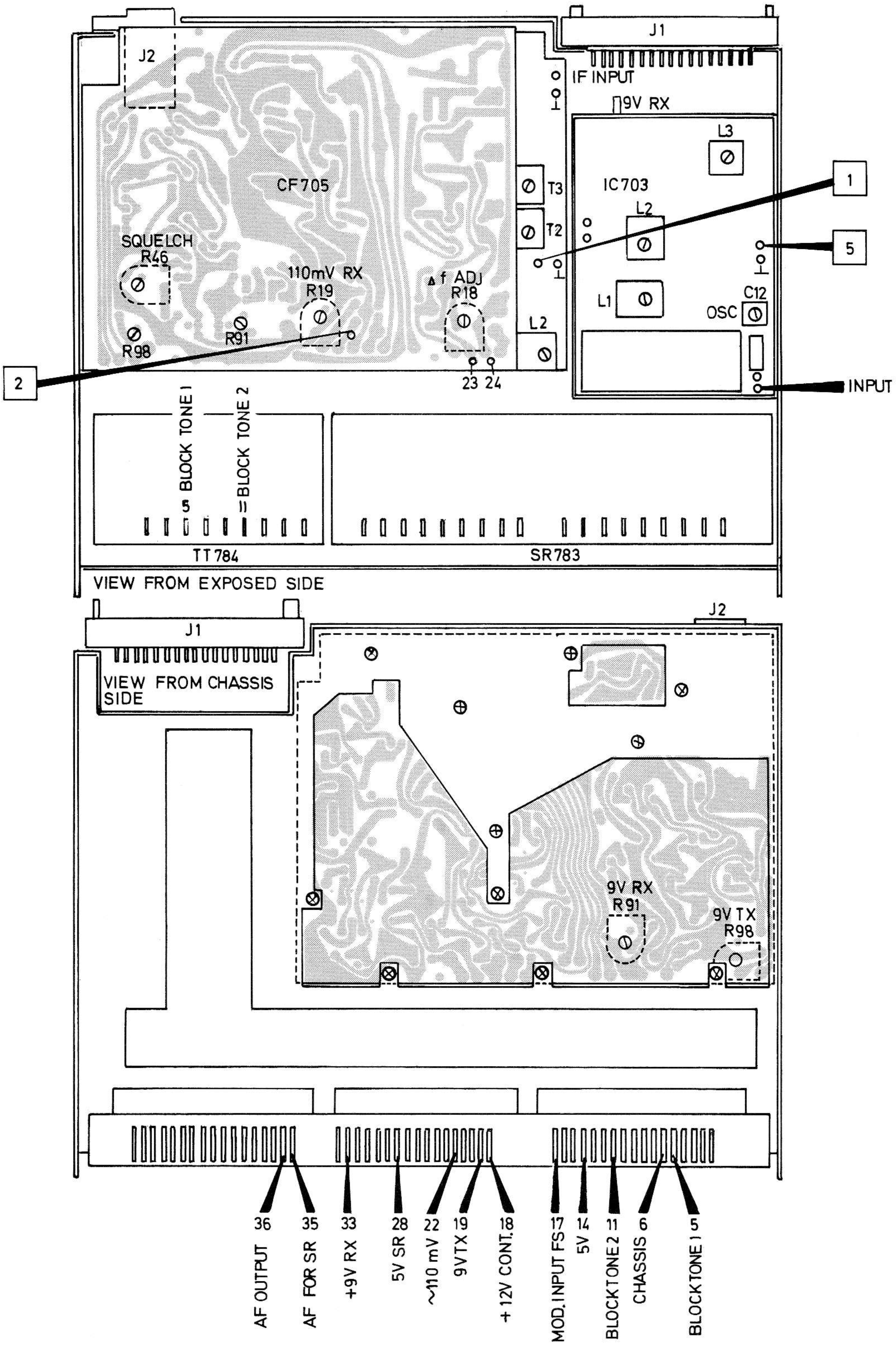
Storno



TEST POINTS AND ADJUSTABLE COMPONENTS

CQM713 P3

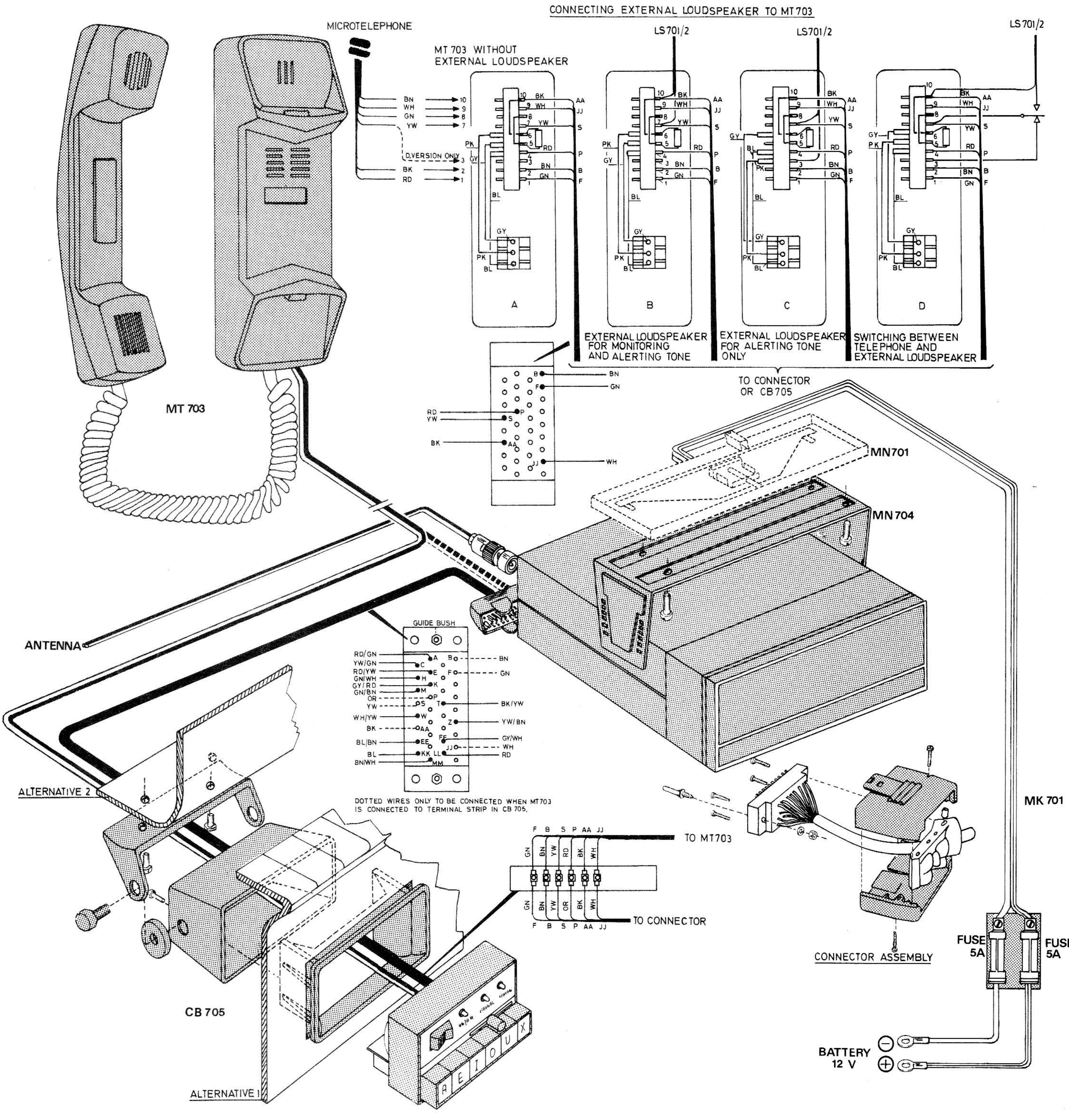
D402.524



TEST POINTS AND ADJUSTABLE COMPONENTS

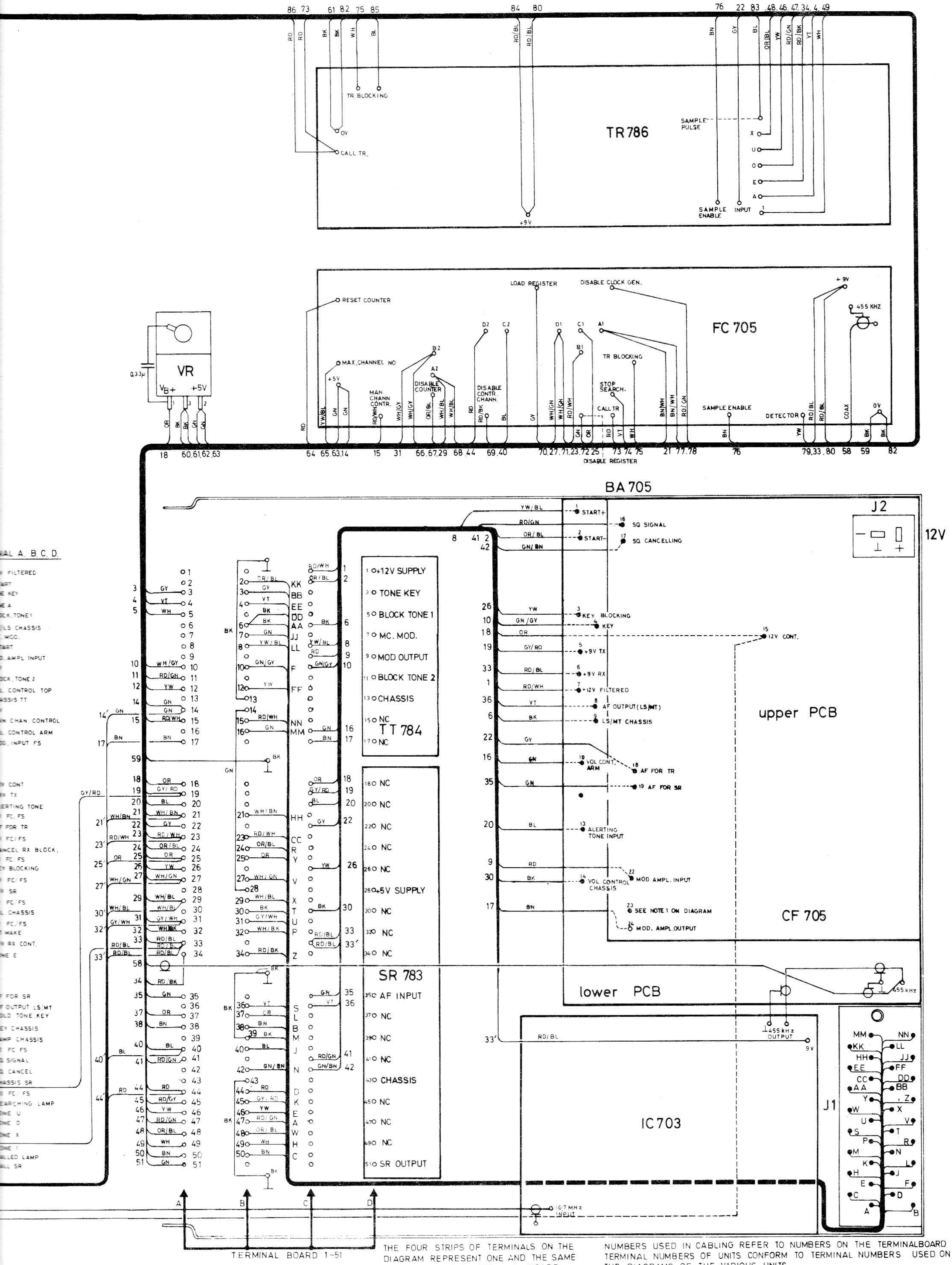
CQM713 P3

D402.525



INSTALLATION DIAGRAM CQM713 P3

D402.494

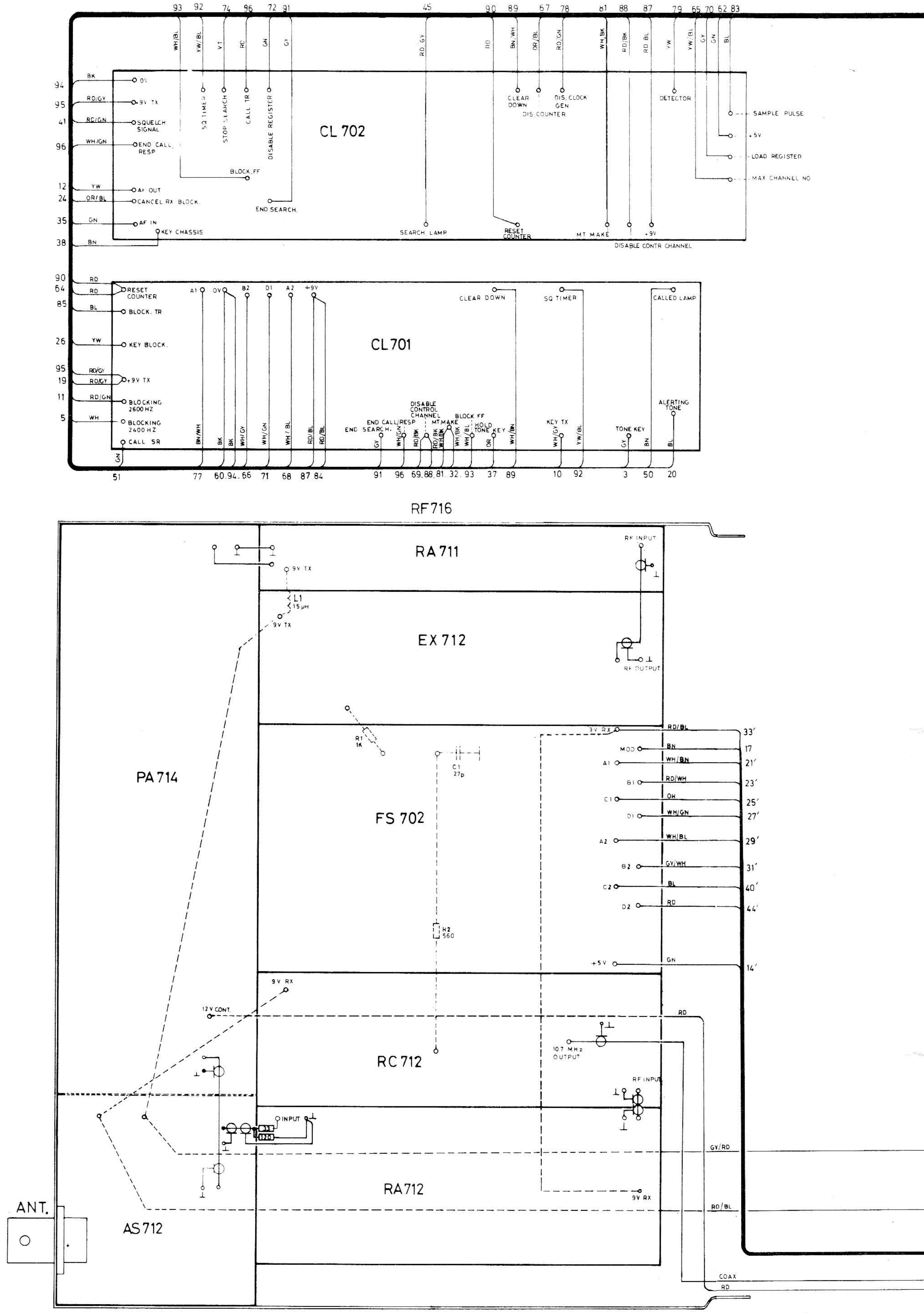


THE FOUR STRIPS OF TERMINALS ON THE DIAGRAM REPRESENT ONE AND THE SAME TERMINAL STRIP ON TERMINAL BOARD.

NUMBERS USED IN CABLING REFER TO NUMBERS ON THE TERMINALBOARD TERMINAL NUMBERS OF UNITS CONFORM TO TERMINAL NUMBERS USED ON THE DIAGRAMS OF THE VARIOUS UNITS.

CABLE FORM CQM713-P3

D402.452

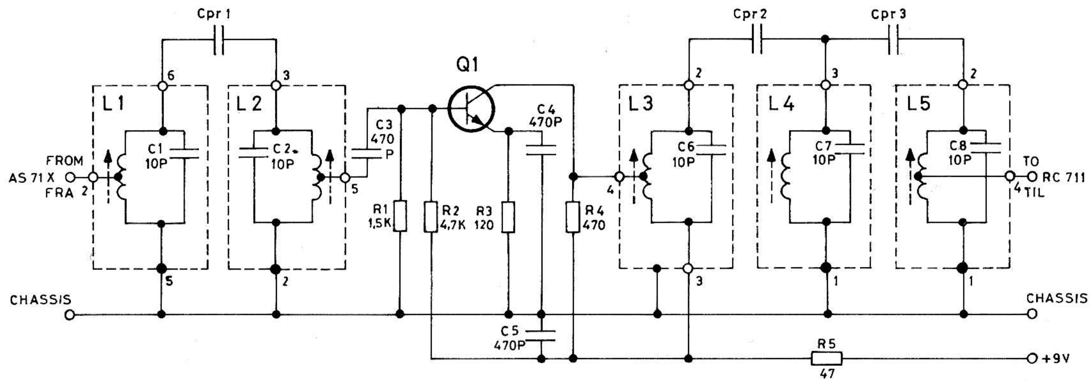


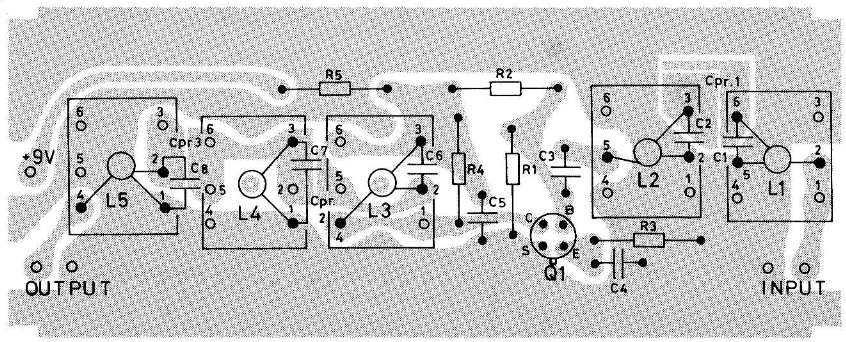
TERMINAL A, B, C, D.

1	+12V FILTERED
2	-START
3	TONE KEY
4	TONE A
5	BLOCK, TONE 1
6	MT/LS CHASSIS
7	MC. MOD.
8	+START
9	MOD. AMPL. INPUT
10	KEY
11	BLOCK, TONE 2
12	VOL. CONTROL TOP
13	CHASSIS TT
14	+5V
15	MAN. CHAN. CONTROL
16	VOL. CONTROL ARM
17	MOD. INPUT FS
18	+12V CONT
19	+ 9V TX
20	ALERTING TONE
21	A1 FC/FS
22	AF FOR TR
23	B1 FC/FS
24	CANCEL RX BLOCK.
25	C1 FC/FS
26	KEY BLOCKING
27	D1 FC/FS
28	+5V SR
29	A2 FC/FS
30	VOL. CHASSIS
31	B2 FC/FS
32	MT MAKE
33	+9V RX CONT.
34	TONE E
35	AF FOR SR
36	AF OUTPUT LS/MT
37	HOLD TONE KEY
38	KEY CHASSIS
39	LAMP CHASSIS
40	C2 FC/FS
41	SQ SIGNAL
42	SQ CANCEL
43	CHASSIS SR
44	D2 FC/FS
45	SEARCHING LAMP
46	TONE U
47	TONE O
48	TONE X
49	TONE I
50	CALLED LAMP
51	CALL SR

Storno

Storno





PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

RF-AMPLIFIER RA712

D402.183

Storno

TYPE	Nº	CODE	DATA
RA712		10. 3256-00	RF Amplifier
	C1	74. 5135	10 pF 5% ceram 125 V
	C2	74. 5135	10 pF 5% " 125 V
	C3	74. 5161	470 pF -20 + 80% " 63 V
	C4	74. 5161	470 pF -20 + 80% " 63 V
	C5	74. 5161	470 pF -20 + 80% " 63 V
	C6	74. 5135	10 pF 5% " 125 V
	C7	74. 5135	10 pF 5% " 125 V
	C8	74. 5135	10 pF 5% " 125 V
	R1	80. 5251	1. 5 KΩ 5% carbon film 1/8 W
	R2	80. 5257	4. 7 KΩ 5% " 1/8 W
	R3	80. 5238	120 KΩ 5% " 1/8 W
	R4	80. 5245	470 Ω 5% " 1/8 W
	R5	80. 5233	47 Ω 5% " 1/8 W
	L1	61. 1315	RF coil 146 - 174 MHz
	L2	61. 1319	RF coil 146 - 174 MHz
	L3	61. 1316	RF coil 146 - 174 MHz
	L4	61. 1318	RF coil 146 - 174 MHz
	L5	61. 1317	RF coil 146 - 174 MHz
	Q1	99. 5240	Transistor BFX89

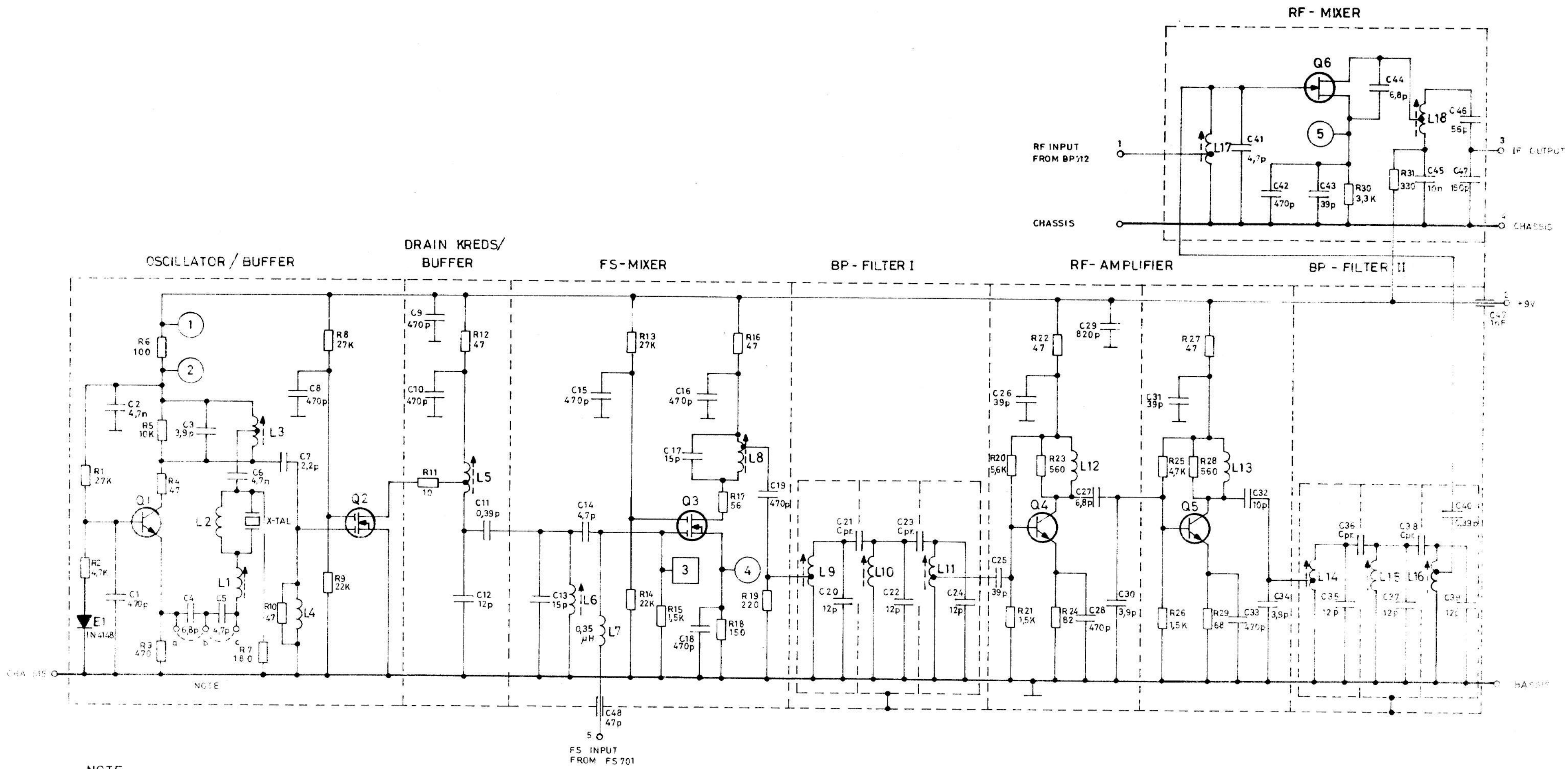
Storno

TYPE	Nº	CODE	DATA

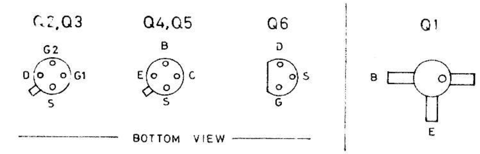
RF-AMPLIFIER RA712

X402. 367

Storno **Storno**



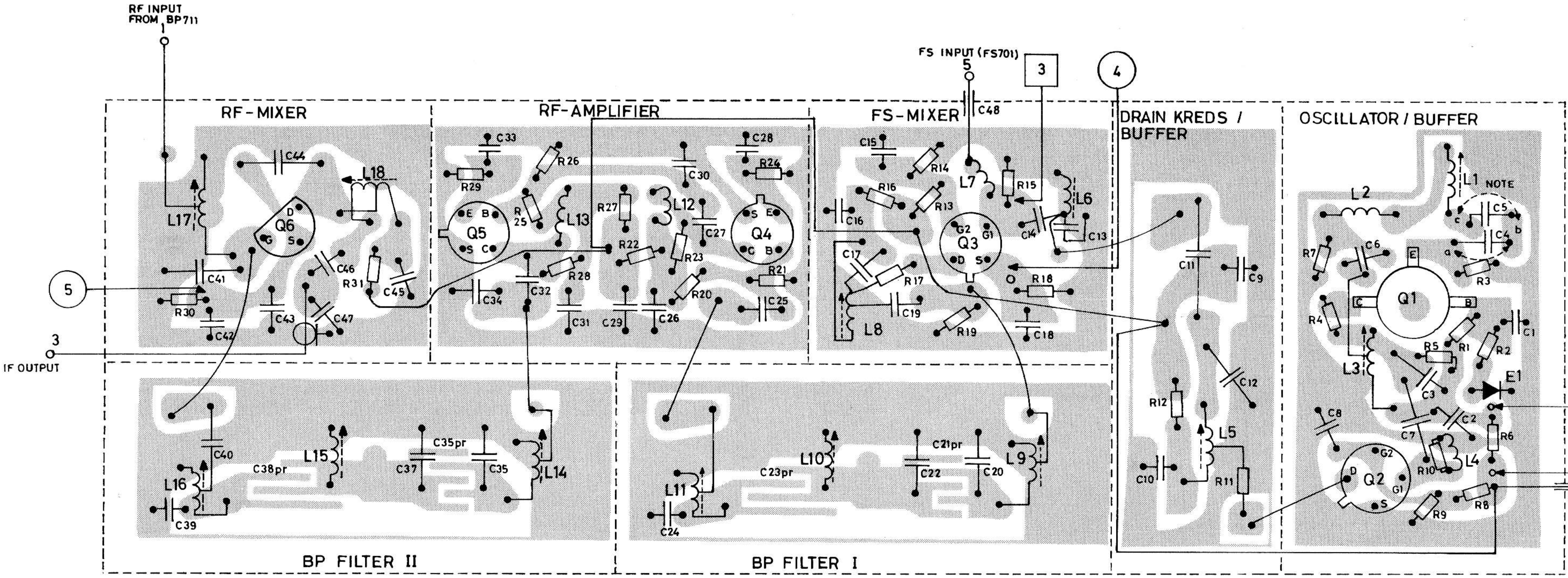
NOTE: FREQUENCY FREKVENS	STRAP STRAPNING
UP / [illegible]	NONE / INGEN
NORMAL	a - b
DOWN / NED	b - c



RECEIVER CONVERTER
MODTAGERKONVERTER

RC712

D401.84F/2



RECEIVER CONVERTER
MODTAGERKONVERTER

RC712

D401.976

Storno

TYPE	NO.	CODE	DATA		
RC712		10.2935	Receiver Converter		
	C1	74.5162	470pF -20/+50%	ceram DI	400V
	C2	74.5108	4.7nF -20/+80%	ceram PL	20V
	C3	74.5302	3.9pF ±0.25pF	ceram PL	63V
	C4	74.5321	6.8pF ±0.25pF	ceram PL	100V
	C5	74.5318	4.7pF ±0.25pF	ceram PL	100V
	C6	74.5108	4.7nF -20/+80%	ceram PL	20V
	C7	74.5299	2.2pF ±0.25pF	ceram PL	63V
	C8	74.5161	470pF -20/+80%	ceram PL	63V
	C9	74.5162	470pF -20/+50%	ceram DI	400V
	C10	74.5162	470pF -20/+50%	ceram DI	400V
	C11	74.5120	0.39pF±0.1pF	ceram BD	250V
	C12	74.5136	12pF 5%	ceram DI	250V
	C13	74.5137	15pF 5%	ceram DI	250V
	C14	74.5131	4.7pF±0.25pF	ceram DI	25oV
	C15	74.5162	470pF-20/+50%	ceram DI	400V
	C16	74.5162	470pF-20/+50%	ceram DI	400V
	C17	74.5137	15pF 5%	ceram DI	250V
	C18	74.5162	470pF-20/+50%	ceram DI	400V
	C19	74.5161	470pF-20/+80%	ceram PL	63 V
	C20	74.5308	12pF 5%	ceram PL	63 V
	C21		Printed Capacitor		
	C22	74.5308	12pF 5%	ceram PL	63V
	C23		Printed Capacitor		
	C24	74.5308	12pF 5%	ceram PL	63V
	C25	74.5316	39pF 5%	ceram PL	63V
	C26	74.5316	39pF 5%	ceram PL	63V
	C27	74.5305	6.8pF ± o.25pF	ceram PL	63V
	C28	74.5162	470pF -20/+50%	ceram DI	400V
	C29	74.5314	820pF -20/+80%	ceram PL	63V
	C30	74.5302	3.9pF ± 0.25pF	ceram PL	63V
	C31	74.5316	39pF 5%	ceram PL	63V
	C32	74.5307	10pF 5%	ceram PL	63V
	C33	74.5162	470pF -20/+50%	ceram DI	400V
	C34	74.5302	3.9pF ± 0.25 pF	ceram PL	63V
	C35	74.5308	12pF 5%	ceram PL	63V
	C36		Printed Capacitor		
	C37	74.5308	12pF 5%	ceram PL	63V
	C38		Printed Capacitor		
	C39	74.5308	12pF 5%	ceram PL	63V
	C40	74.5120	0.39pF ± 0.1pF	ceram BD	250V
	C41	74.5131	4.7pF ± 0.25pF	ceram BD	250V
	C42	74.5162	470pF -20/+50%	ceram DI	400 V
	C43	74.5117	39pF 5%	ceram TB	160 V
	C44	74.5133	6.8pF ± 0.25pF	ceram BD	250 V
	C45	74.5109	10nF -20/+80%	ceram PL	20 V

Storno

TYPE	NO.	CODE	DATA		
	C46	74.5111	56pF 5%	ceram TB	160V
	C47	76.5103	150pF 2.5%	polyest TB	25V
	C48	74.5323	47pF 20%	ceram FT	400V
	C49	74.5198	1nF -20/+50%	ceram FT	30V
	R1	80.5066	27 KΩ 5%	carbon film	1/10W
	R2	80.5057	4.7 KΩ 5%	"	1/10W
	R3	80.5045	470 Ω 5%	"	1/10W
	R4	80.5033	47 Ω 5%	"	1/10W
	R5	80.5061	10 KΩ 5%	"	1/10W
	R6	80.5237	100 Ω 5%	"	1/8W
	R7	80.5041	220 Ω 5%	"	1/10W
	R8	80.5066	27 KΩ 5%	"	1/10W
	R9	80.5065	22 KΩ 5%	"	1/10W
	R10	80.5033	47 Ω 5%	" (L4)	1/10W
	R11	80.5025	10 Ω 5%	"	1/10W
	R12	80.5233	47 Ω 5%	"	1/8W
	R13	80.5066	27 Ω 5%	"	1/10 W
	R14	80.5065	22 KΩ 5%	"	1/10W
	R15	80.5051	1.5 KΩ 5%	"	1/10W
	R16	80.5033	47 Ω 5%	"	1/10W
	R17	80.5034	56 Ω 5%	"	1/10W
	R18	80.5039	150 Ω 5%	"	1/10W
	R19	80.5041	220 Ω 5%	"	1/10W
	R20	80.5058	5.6 KΩ 5%	"	1/10W
	R21	80.5051	1.5 KΩ 5%	"	1/10W
	R22	80.5033	47 Ω 5%	"	1/10W
	R23	80.5054	560 Ω 5%	"	1/10W
	R24	80.5036	82 Ω 5%	"	1/10W
	R25	80.5057	4.7 KΩ 5%	"	1/10W
	R26	80.5051	1.5 KΩ 5%	"	1/10W
	R27	80.5033	47 Ω 5%	"	1/10W
	R28	80.5046	560 Ω 5%	"	1/10W
	R29	80.5035	68 Ω 5%	"	1/10W
	R30	80.5243	330 Ω 5%	"	1/8W
	R31	80.5255	3.3 KΩ 5%	"	1/8W
	L1	61.1234	RF coil		
	L2	61.1230	RF coil		
	L3	61.1229	RF coil 119 - 159 MHz		
	L4	61.1231	RF choke (R10)		

RECEIVER CONVERTER
MODTAGERKONVERTER

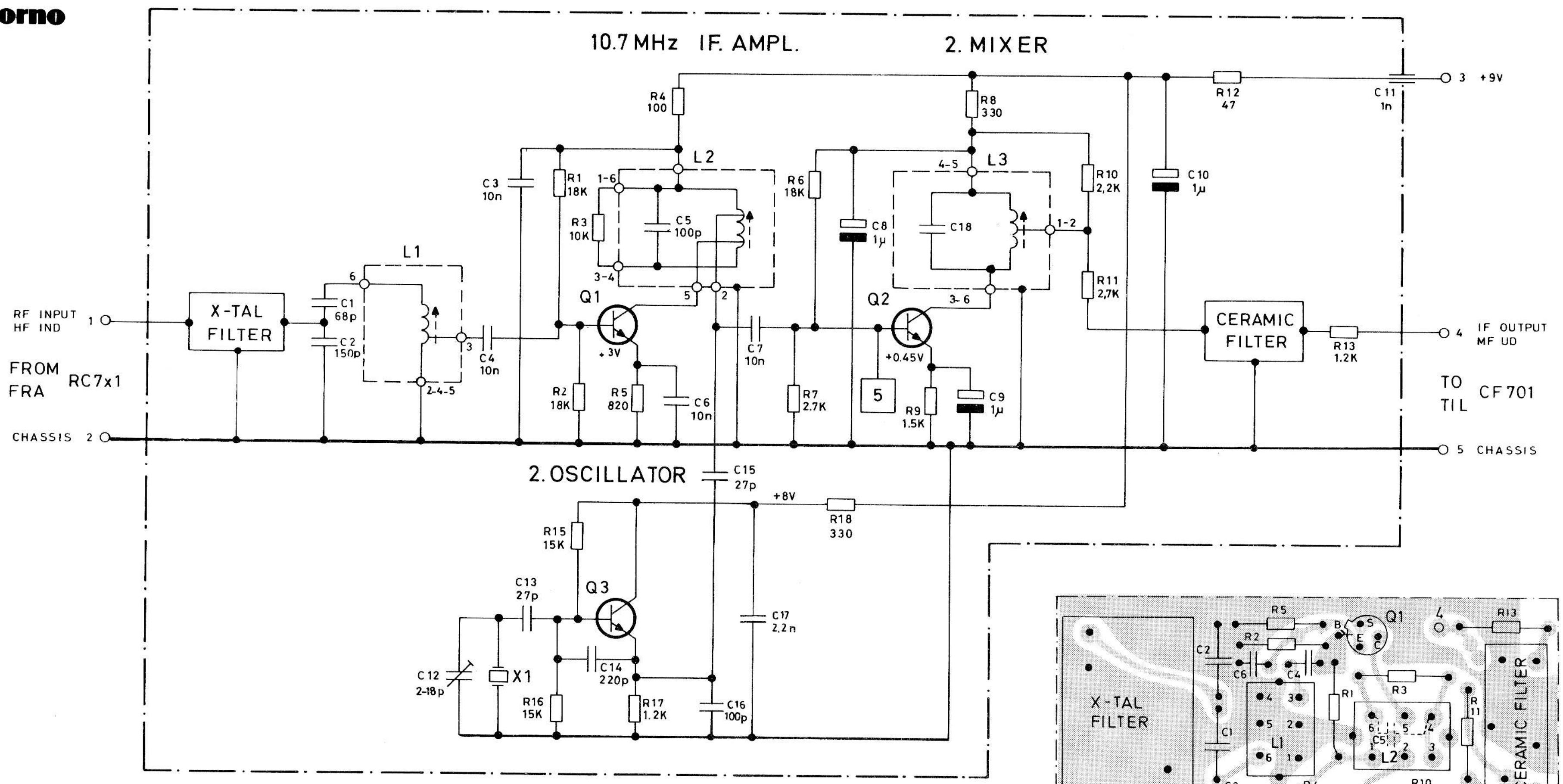
RC712

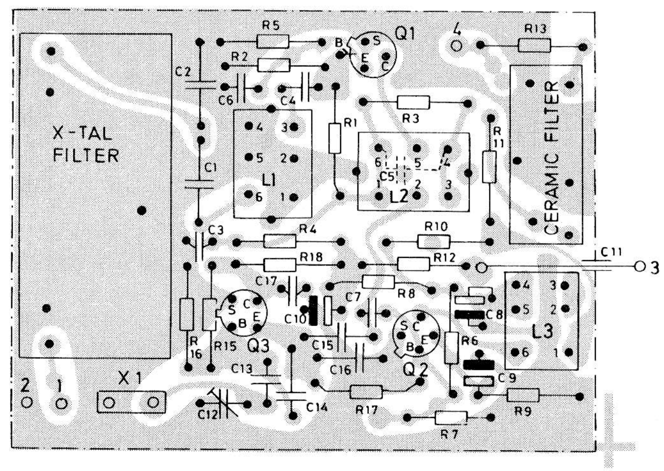
X401.942/2

TYPE	NO.	CODE	DATA
	L5	61.1253	RF coil
	L6	61.1252	RF coil
	L7	62.0659	0.35 μH RF choke
	L8	61.1251	RF coil
	L9	61.1250	RF coil
	L10	61.1249	RF coil
	L11	61.1248	RF coil
	L12	62.0651	0.08 μH RF choke
	L13	62.0651	0.08 μH RF choke
	L14	61.1250	RF coil
	L15	61.1249	RF coil
	L16	61.1247	RF coil
	L17	61.1246	RF coil 146-174 MHz
	L18	61.1117	IF coil 10.7 MHz
	E1	99.5237	1N4148 Diode
	Q1	99.5290	BFR90 Transistor
	Q2	99.5291	3N205 Transistor FET
	Q3	99.5291	3N205 Transistor FET
	Q4	99.5240	BFX89 Transistor
	Q5	99.5240	BFX89 Transistor
	Q6	99.5245	2N5245 Transistor J-FET

Storno

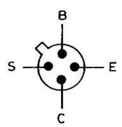
TYPE	NO.	CODE	DATA



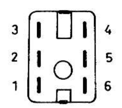


PRINTED CIRCUIT VIWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN.

Q1-Q3



L1-L2-L3



BOTTOM VIEW
SET FRA BUNDEN

IF CONVERTER
MF KONVERTER

IC703

D401.327/2

TYPE	NO.	CODE	DATA	
IC703		10.2432	IF Converter	
	C1	76.5101	68 pF 2.5% polystyr TB	25V
	C2	76.5103	150 pF 2.5% polystyr TB	25V
	C3	76.5070	10 nF 10% polyest. FL	50V
	C4	76.5070	10 nF 10% polyest. FL	50V
	C5	76.5102	100 pF 2.5% polystyr TB	25V
	C6	76.5070	10 nF 10% polyest. FL	50V
	C7	76.5070	10 nF 10% polyest. FL	50V
	C8	73.5114	1μF 20% tantal	35V
	C9	73.5114	1 μF 20% tantal	35V
	C10	73.5114	1 μF 20% tantal	35V
	C11	74.5167	1 nF -20 +80% ceram FT	300V
	C12	78.5044	2-18 pF trimmer	300V
	C13	74.5192	27 pF 5% ceram TB	160V
	C14	76.5104	220 pF 2.5% polystyr TB	25V
	C15	74.5107	27 pF 5% ceram TB	160V
	C16	76.5102	100 pF 2.5% polystyr TB	25V
	C17	76.5059	2.2 nF 10% polyest. FL	50V
	C18	76.5106	470 pF 2.5% polystyr	25V
	R1	80.5264	18 kΩ 5% carbon film	1/8W
	R2	80.5264	18 kΩ 5% " "	1/8W
	R3	80.5261	10 kΩ 5% " "	1/8W
	R4	80.5237	100 Ω 5% " "	1/8W
	R5	80.5248	820 Ω 5% " "	1/8W
	R6	80.5264	18 kΩ 5% " "	1/8W
	R7	80.5254	2.7 kΩ 5% " "	1/8W
	R8	80.5243	330 Ω 5% " "	1/8W
	R9	80.5254	2.7 kΩ 5% " "	1/8W
	R10	80.5234	56 Ω 5% " "	1/8W
	R11	80.5254	2.7KΩ 5% " "	1/8W
	R12	80.5233	47 Ω 5% " "	1/8W
	R13	80.5250	1.2 kΩ 5% " "	1/8W
	R15	80.5263	15 kΩ 5% " "	1/8W
	R16	80.5263	15 kΩ 5% " "	1/8W
	R17	80.5250	1.2 kΩ 5% " "	1/8W
	R18	80.5243	330 Ω 5% " "	1/8W
	L1	61.1122	IF coil 10.7 MHz	
	L2	61.1123	IF coil 10.7 MHz	
	L3	61.1302	IF coil 0.455 MHz	
	X1	98.5010	Crystal 10.2450 MHz Type 98-12	
	X1	98.5011	Crystal 11.1550 MHz Type 98-12	
		69.5016	Crystal Filter 10.7 MHz	
		69.5031	Ceramic Filter 455 kHz	

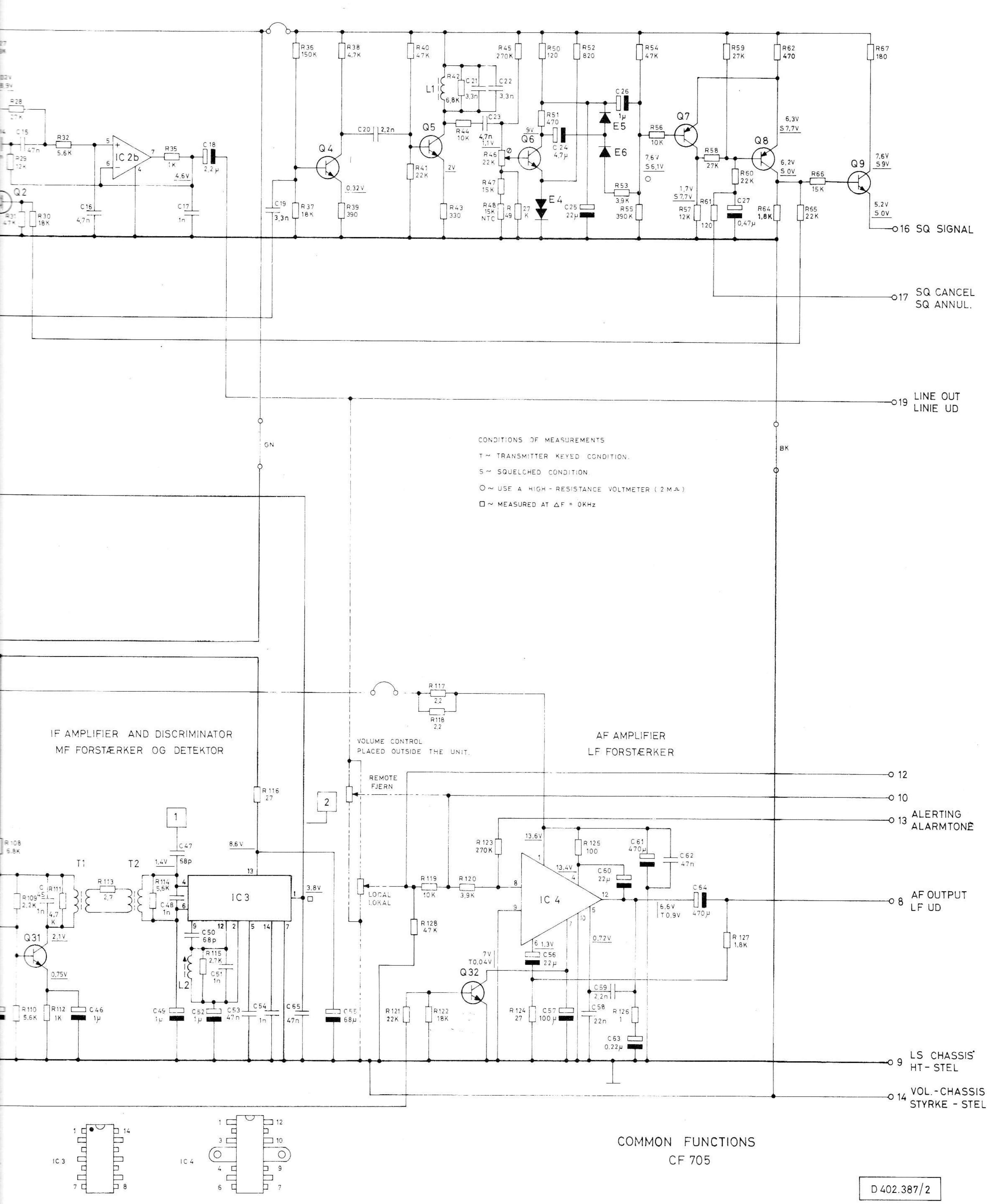
TYPE	NO.	CODE	DATA
	Q1	99.5168	BF173 Transistor
	Q2	99.5166	BF167 Transistor
	Q3	99.5168	BF173 Transistor

IF CONVERTER IC703

Storno

MPLIFIER
STÆRKER
D CIRCUIT BOARD

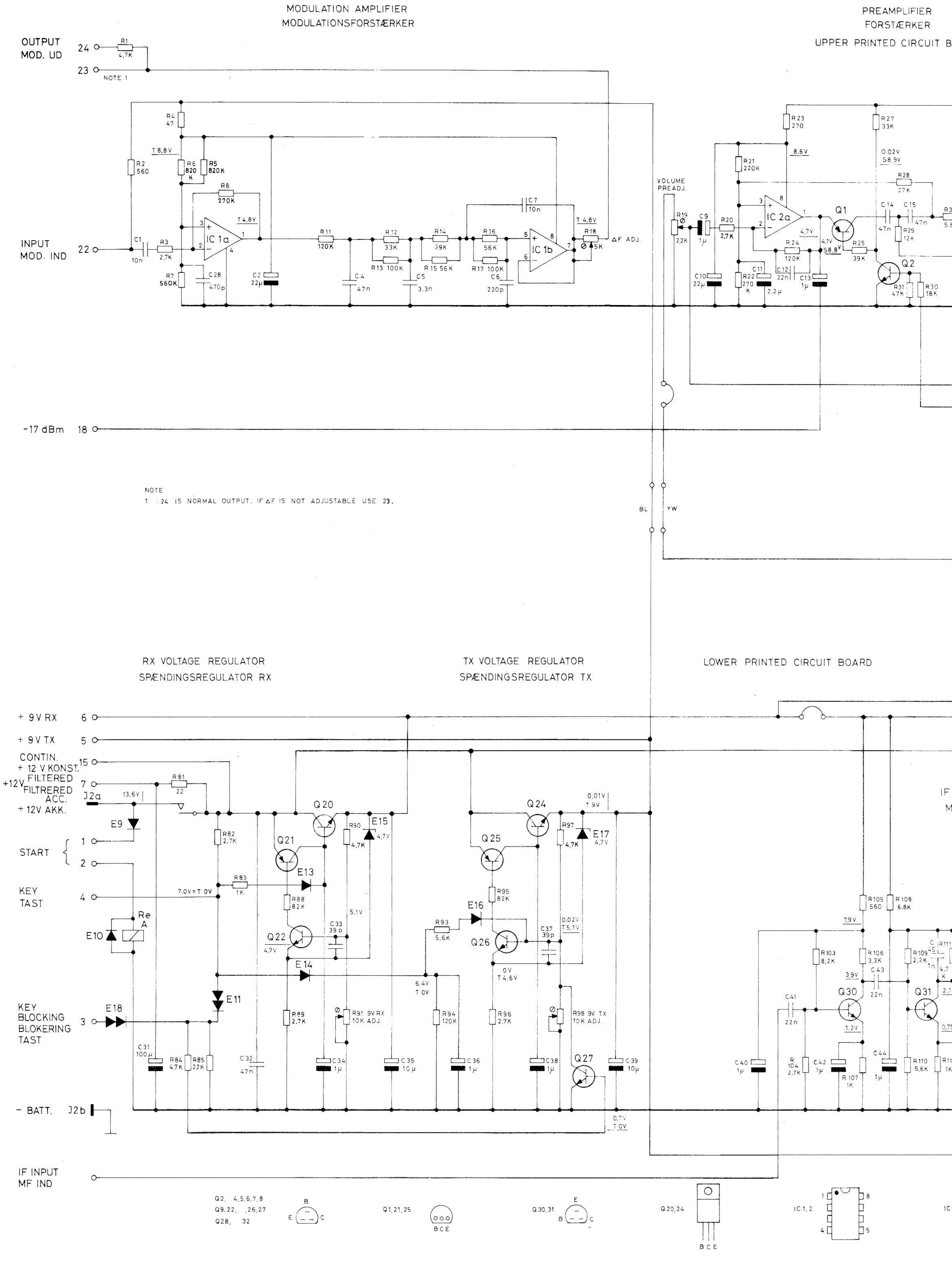
SQUELCH



COMMON FUNCTIONS
CF 705

D 402.387/2

Storno


MODULATION AMPLIFIER
MODULATIONSFORSTÆRKER
PREAMPLIFIER
FORSTÆRKER
UPPER PRINTED CIRCUIT B
OUTPUT
MOD. UD
24
23
NOTE 1
INPUT
MOD. IND
22
VOLUME
PREADJ.
ΔF ADJ.
-17 dBm
18
NOTE
1 : 24 IS NORMAL OUTPUT. IF ΔF IS NOT ADJUSTABLE USE 23.
BL
YW
RX VOLTAGE REGULATOR
SPÆNDINGSREGULATOR RX
TX VOLTAGE REGULATOR
SPÆNDINGSREGULATOR TX
LOWER PRINTED CIRCUIT BOARD
+ 9 V RX
6
+ 9 V TX
5
CONTIN.
+ 12 V KONST.
15
+12V FILTERED
FILTRERED
7
ACC.
+ 12V AKK.
J2a
START
1
2
KEY
TAST
4
KEY
BLOCKING
BLOKERING
TAST
3
- BATT.
J2b
IF INPUT
MF IND
R91 9V RX
10K ADJ.
R98 9V TX
10K ADJ.
Q2, 4,5,6,7,8
Q9,22, ,26,27
Q28, 32
Q1,21,25
Q30,31
Q20,24
IC1,2
BCE

Storno

TYPE	NO	CODE	DATA				
CF705		10.3502-00	Common Functions				
	C1	76.5070	10 nF	10%	polyest	FL	50 V
	C2	73.5127	22 µF	20%	tantal		16 V
	C4	76.5072	47 nF	10%	polyest	FL	50 V
	C5	76.5060	3,3 nF	10%	"	FL	50 V
	C6	76.5063	220 pF	5%	polystyr	TB	160 V
	C7	76.5070	10 nF	10%	polyest	FL	50 V
	C9	73.5114	1 µF	20%	tantal		35 V
	C10	73.5127	22 µF	20%	"		16 V
	C11	73.5102	2,2 µF	20%	"		35 V
	C12	76.5071	22 nF	10%	polyest	FL	50 V
	C13	73.5114	1 µF	20%	tantal		35 V
	C14	76.5072	47 nF	10%	polyest	FL	50 V
	C15	76.5072	47 nF	10%	"	FL	50 V
	C16	76.5061	4,7 nF	10%	"	FL	50 V
	C17	74.5155	1 nF	-20/+80%	ceram II	PL	63 V
	C18	73.5102	2,2 µF	20%	tantal		35 V
	C19	76.5060	3,3 nF	10%	polyest	FL	50 V
	C20	76.5059	2,2 nF	10%	"	FL	50 V
	C21	76.5060	3,3 nF	10%	"	FL	50 V
	C22	76.5060	3,3 nF	10%	"	FL	50 V
	C23	76.5061	4,7 nF	10%	"	FL	50 V
	C24	73.5126	4,7 µF	20%	tantal		35 V
	C25	73.5127	22 µF	20%	"		16 V
	C26	73.5114	1 µF	20%	"		35 V
	C27	73.5125	0,47 µF	20%	"		35 V
	C28	74.5161	470 pF	-20/+80%	ceram II	PL	63 V
	C31	73.5071	100 µF	-10/+50%	elco		40 V
	C32	76.5072	47 nF	10%	polyest	FL	50 V
	C33	74.5338	39 pF	2%	ceram N750	PL	63 V
	C34	73.5114	1 µF	20%	tantal		35 V
	C35	73.5011	10 µF	-10/+100%	elco		16 V
	C36	73.5114	1 µF	20%	tantal		35 V
	C37	74.5338	39 pF	2%	ceram N750	PL	63 V
	C38	73.5114	1 µF	20%	tantal		35 V
	C39	73.5011	10 µF	-10/+100%	elco		16 V
	C40	73.5114	1 µF	20%	tantal		35 V
	C41	76.5071	22 nF	10%	polyest	FL	50 V
	C42	73.5114	1 µF	20%	tantal		35 V
	C43	76.5071	22 nF	10%	polyest	FL	50 V
	C44	73.5114	1 µF	20%	tantal		35 V
	C45	76.5067	1 nF	5%	polystyr	TB	160 V
	C46	73.5114	1 µF	20%	tantal		35 V
	C47	74.5341	68 pF	2%	ceram N150	PL	63 V
	C48	76.5067	1 nF	5%	polystyr	TB	160 V
	C49	73.5114	1 µF	20%	tantal		35 V
	C50	74.5341	68 pF	2%	ceram N150	PL	63 V

Storno

TYPE	NO	CODE	DATA				
	C51	76.5067	1 nF	5%	polystyr	TB	160 V
	C52	73.5114	1 µF	20%	tantal		35 V
	C53	76.5072	47 nF	10%	polyest	FL	50 V
	C54	76.5069	1 nF	10%	"	FL	50 V
	C55	73.5106	68 µF	20%	tantal		16 V
	C56	73.5127	22 µF	20%	"		16 V
	C57	73.5151	100 µF	-10/+50%	elco		16 V
	C58	76.5071	22 nF	10%	polyest	FL	50 V
	C59	76.5059	2.2 nF	10%	"	FL	50 V
	C60	73.5127	22 µF	20%	tantal		16 V
	C61	73.5138	470 µF	-10/+100%	elco		25 V
	C62	76.5072	47 nF	10%	polyest	FL	50 V
	C63	73.5118	0.22 µF	20%	tantal		35 V
	C64	73.5137	470 µF	-10/+50%	elco		16 V
	C65	76.5072	47 nF	10%	polyest	FL	50 V
	R1	80.5257	4.7 kΩ	5%	carbon film		1/8 W
	R2	80.5246	560 Ω	5%	" "		1/8 W
	R3	80.5254	2,7 kΩ	5%	" "		1/8 W
	R4	80.5233	47 Ω	5%	" "		1/8 W
	R5	80.5284	820 kΩ	5%	" "		1/8 W
	R6	80.5284	820 kΩ	5%	" "		1/8 W
	R7	80.5282	560 kΩ	5%	" "		1/8 W
	R8	80.5278	270 kΩ	5%	" "		1/8 W
	R11	80.5274	120 kΩ	5%	" "		1/8 W
	R12	80.5267	33 kΩ	5%	" "		1/8 W
	R13	80.5273	100 kΩ	5%	" "		1/8 W
	R14	80.5268	39 kΩ	5%	" "		1/8 W
	R15	80.5270	56 kΩ	5%	" "		1/8 W
	R16	80.5270	56 kΩ	5%	" "		1/8 W
	R17	80.5273	100 kΩ	5%	" "		1/8 W
	R18	86.5050	5 kΩ	20%	trim carbon		0.1 W
	R19	86.5043	2,2 kΩ	20%	" "		0.1 W
	R20	80.5254	2,7 kΩ	5%	carbon film		1/8 W
	R21	80.5277	220 kΩ	5%	" "		1/8 W
	R22	80.5278	270 kΩ	5%	" "		1/8 W
	R23	80.5242	270 Ω	5%	" "		1/8 W
	R24	80.5274	120 kΩ	5%	" "		1/8 W
	R25	80.5268	39 kΩ	5%	" "		1/8 W
	R27	80.5267	33 kΩ	5%	" "		1/8 W
	R28	80.5266	27 kΩ	5%	" "		1/8 W
	R29	80.5262	12 kΩ	5%	" " "		1/8 W

COMMON FUNCTIONS CF705

X402.554

TYPE	Nº	CODE	DATA			
	R30	80.5264	18 kΩ	5%	carbon film	1/8 W
	R31	80.5269	47 kΩ	5%	" "	1/8 W
	R32	80.5258	5,6 kΩ	5%	" "	1/8 W
	R35	80.5249	1 kΩ	5%	" "	1/8 W
	R36	80.5275	150 kΩ	5%	" "	1/8 W
	R37	80.5264	18 kΩ	5%	" "	1/8 W
	R38	80.5257	4,7 kΩ	5%	" "	1/8 W
	R39	80.5244	390 kΩ	5%	" "	1/8 W
	R40	80.5269	47 kΩ	5%	" "	1/8 W
	R41	80.5265	22 kΩ	5%	" "	1/8 W
	R42	80.5259	6,8 kΩ	5%	" "	1/8 W
	R43	80.5243	330 Ω	5%	" "	1/8 W
	R44	80.5261	10 kΩ	5%	" "	1/8 W
	R45	80.5278	270 kΩ	5%	" "	1/8 W
	R46	86.5044	25 kΩ	20%	trim carbon	0.1 W
	R47	80.5263	15 kΩ	5%	carbon film	1/8 W
	R48	89.5010	15 kΩ	20%	NTC	0.6 W
	R49	80.5266	27 kΩ	5%	carbon film	1/8 W
	R50	80.5238	120 Ω	5%	" "	1/8 W
	R51	80.5245	470 Ω	5%	" "	1/8 W
	R52	80.5248	820 Ω	5%	" "	1/8 W
	R53	80.5256	3,9 kΩ	5%	" "	1/8 W
	R54	80.5269	47 kΩ	5%	" "	1/8 W
	R55	80.5280	390 kΩ	5%	" "	1/8 W
	R56	80.5261	10 kΩ	5%	" "	1/8 W
	R57	80.5262	12 kΩ	5%	" "	1/8 W
	R58	80.5266	27 kΩ	5%	" "	1/8 W
	R59	80.5266	27 kΩ	5%	" "	1/8 W
	R60	80.5265	22 kΩ	5%	" "	1/8 W
	R61	80.5238	120 kΩ	5%	" "	1/8 W
	R62	80.5245	470 Ω	5%	" "	1/8 W
	R64	80.5252	1,8 kΩ	5%	" "	1/8 W
	R65	80.5265	22 kΩ	5%	" "	1/8 W
	R66	80.5263	15 kΩ	5%	" "	1/8 W
	R67	80.5240	180 Ω	5%	" "	1/8 W
	R81	80.5229	22 Ω	5%	" "	1/8 W
	R82	80.5254	2,7 kΩ	5%	" "	1/8 W
	R83	80.5249	1 kΩ	5%	" "	1/8 W
	R84	80.5257	4,7 kΩ	5%	" "	1/8 W
	R85	80.5265	22 kΩ	5%	" "	1/8 W
	R88	80.5272	82 kΩ	5%	" "	1/8 W
	R89	80.5254	2,7 kΩ	5%	" "	1/8 W
	R90	80.5258	5,6 kΩ	5%	" "	1/8 W
	R91	86.5039	10 kΩ	20%	trim carbon	0.1 W
	R93	80.5258	5,6 kΩ	5%	carbon film	1/8 W
	R94	80.5274	120 kΩ	5%	" "	1/8 W
	R95	80.5272	82 kΩ	5%	" "	1/8 W
	R96	80.5254	2,7 kΩ	5%	" "	1/8 W
	R97	80.5258	5,6 kΩ	5%	" "	1/8 W

Storno

TYPE	Nº	CODE	DATA			
	R98	86.5039	10 kΩ	20%	trim carbon	0.1 W
	R103	80.5260	8,2 kΩ	5%	carbon film	1/8 W
	R104	80.5254	2,7 kΩ	5%	" "	1/8 W
	R105	80.5246	560 Ω	5%	" "	1/8 W
	R106	80.5255	3,3 kΩ	5%	" "	1/8 W
	R107	80.5249	1 kΩ	5%	" "	1/8 W
	R108	80.5259	6,8 kΩ	5%	" "	1/8 W
	R109	80.5253	2,2 kΩ	5%	" "	1/8 W
	R110	80.5258	5,6 kΩ	5%	" "	1/8 W
	R111	80.5257	4,7 kΩ	5%	" "	1/8 W
	R112	80.5249	1 kΩ	5%	" "	1/8 W
	R113	80.5218	2,7 Ω	5%	" "	1/8 W
	R114	80.5258	5,6 kΩ	5%	" "	1/8 W
	R115	80.5254	2,7 kΩ	5%	" "	1/8 W
	R116	80.5230	27 Ω	5%	" "	1/8 W
	R117	80.5217	2,2 Ω	5%	" "	1/8 W
	R118	80.5217	2,2 Ω	5%	" "	1/8 W
	R119	80.5261	10 kΩ	5%	" "	1/8 W
	R120	80.5256	3,9 kΩ	5%	" "	1/8 W
	R121	80.5265	22 kΩ	5%	" "	1/8 W
	R122	80.5264	18 kΩ	5%	" "	1/8 W
	R123	80.5278	270 kΩ	5%	" "	1/8 W
	R124	80.5230	27 Ω	5%	" "	1/8 W
	R125	80.5237	100 Ω	5%	" "	1/8 W
	R126	80.5213	1 Ω	5%	" "	1/8 W
	R129	80.5252	1,8 kΩ	5%	" "	1/8 W
	L1	61.5023	Squelch coil		75 mH	
	L2	61.1131	IA coil		455 kHz	
	E4	99.5209	Stabilizer diode			1,5 V
	E5	99.5237	1 N 4148 Diode			
	E6	99.5237	1 N 4148 "			
	E9	99.5020	1 N 4004 "			
	E10	99.5237	1 N 4148 "			
	E11	99.5209	Stabilizer diode			
	E13	99.5237	1 N 4148 Diode			
	E14	99.5237	1 N 4148 "			
	E15	99.5224	Zenerdiode		4,7 V 5%	0,25 W
	E16	99.5237	1 N 4158 Diode			
	E17	99.5224	Zenerdiode		4,7 V 5%	0,25 W
	E18	99.5209	Stabilizer diode			

COMMON FUNCTIONS CF705

Storno

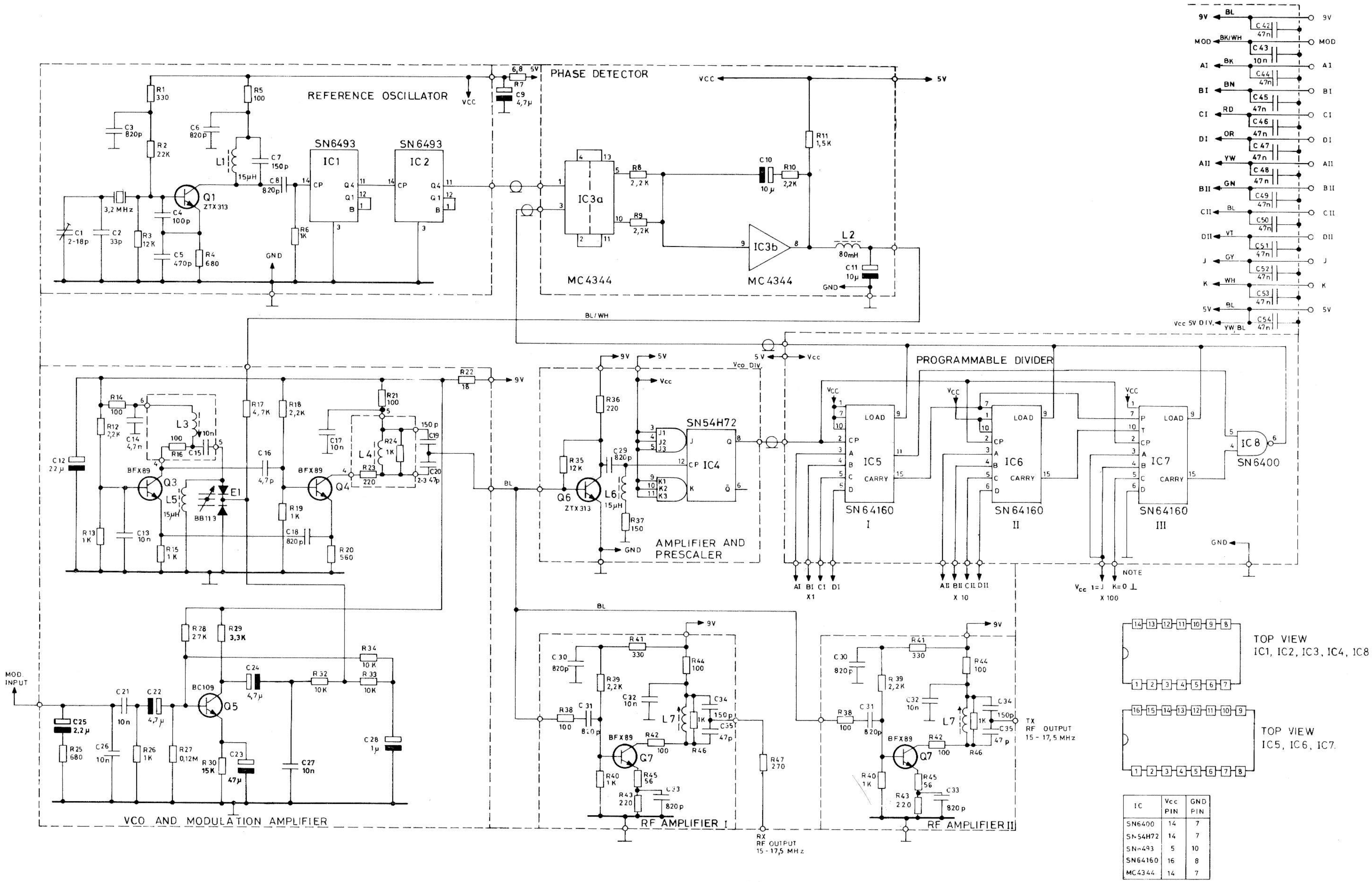
TYPE	Nº	CODE	DATA
	Q1	99.5144	BC 214 L Transistor
	Q2	99.5143	BC 238 "
	Q4	99.5143	BC 238 "
	Q5	99.5143	BC 238 "
	Q6	99.5201	BC 239 "
	Q7	99.5115	BC 309 "
	Q8	99.5115	BC 309 "
	Q9	99.5143	BC 238 "
	Q20	99.5246	TIP 31 "
	Q21	99.5144	BC 214 L "
	Q22	99.5143	BC 238 "
	Q24	99.5246	TIP 31 "
	Q25	99.5144	BC 214 L "
	Q26	99.5143	BC 238 "
	Q27	99.5143	BC 238 "
	Q30	99.5326	BF 198 "
	Q31	99.5326	BF 198 "
	Q32	99.5143	BC 238 "
	IC1	14.5105	MC 1458 Dual op. amplifier
	IC2	14.5105	MC 1458 " " "
	IC3	14.5010	ULN 211 N IF amplifier/discr.
	IC4	14.5104	TBA 810 AS Audio power amplifier
	ReA	58.5084	Relay 12 V 330 Ω

Storno

TYPE	Nº	CODE	DATA

COMMON FUNCTIONS CF705

X402.554



IC	Vcc PIN	GND PIN
SN6400	14	7
SN54H72	14	7
SN6493	5	10
SN64160	16	8
MC4344	14	7

FREQUENCY SYNTESIZER
FREKVENSSYNTESEENHED

FS702

D 402.406

Storno

TYPE	Nº	CODE	DATA
FS702		10.3503-00	Frequency Synthesizer
	C1	78.5044	2/18 pF teflon N350 norm. 300 V
	C2	74.5116	33 pF 5% ceram NO 75 TB 160 V
	C3	74.5314	820 pF -20/+80% " II PL 63 V
	C4	76.5102	100 pF 2.5% polystyr TB 25 V
	C5	76.5065	470 pF 5% " TB 160 V
	C6	74.5314	820 pF -20/+80% ceram II PL 63 V
	C7	76.5103	150 pF 2.5% polystyr TB 25 V
	C8	74.5314	820 pF -20/+80% ceram II PL 63 V
	C9	73.5126	4.7 µF 20% tantal 35 V
	C10	73.5109	10 µF 20% " 16 V
	C11	73.5109	10 µF 20% " 16 V
	C12	73.5127	22 µF 20% " 16 V
	C13	76.5070	10 nF 10% polyest FL 50 V
	C14	76.5061	4.7 nF 10% " FL
	C15	76.5070	10 nF 10% " FL 50 V
	C16	74.5318	4.7 pF 0.25 pF ceram NPO PL 100 V
	C17	76.5070	10 nF 10% polyest FL 50 V
	C18	74.5314	820 pF -20/+80% ceram II PL 63 V
	C19	76.5103	150 pF 2.5% polystyr TB 25 V
	C20	74.5319	47 pF 2% ceram N 750 PL 100 V
	C21	76.5070	10 nF 10% polyest FL 50 V
	C22	73.5126	4.7 µF 20% tantal 35 V
	C23	73.5124	47 µF 20% " 6 V
	C24	73.5126	4.7 µF 20% " 35 V
	C25	73.5102	2.2 µF 20% " 35 V
	C26	76.5070	10 nF 10% polyest FL 50 V
	C27	76.5070	10 nF 10% " FL 50 V
	C28	73.5135	1 µF -20/+50% tantal 16 V
	C29	74.5314	820 pF -20/+80% ceram II PL 63 V
	C30	74.5314	820 pF -20/+80% " II PL 63 V
	C31	74.5314	820 pF -20/+80% " II PL 63 V
	C32	76.5070	10 nF 10% polyest FL 50 V
	C33	74.5314	820 pF -20/+80% ceram II PL 63 V
	C34	76.5103	150 pF 2.5% polystyren TB 25 V
	C35	74.5319	47 pF 2% ceram N 750 PL 100 V
	C42	74.5283	47 nF 20% " 2C1 CP 50 V
	C43	74.5281	10 nF 20% " 2C1 CP 50 V
	C44-C54	74.5283	47 nF 20% " 2C1 CP 50 V
	C55	74.5320	1 nF -20/+80% " FT 400 V
	C56	74.5320	1 nF -20/+80% " FT 400 V
	R1	80.5043	330 Ω 5% carbon film 1/10W
	R2	80.5065	22 kΩ 5% " " 1/10W
	R3	80.5062	12 kΩ 5% " " 1/10W
	R4	80.5047	680 Ω 5% " " 1/10W
	R5	80.5037	100 Ω 5% " " 1/10W

Storno

TYPE	Nº	CODE	DATA
	R6	80.5049	1 kΩ 5% carbon film 1/10W
	R7	80.5223	6.8 Ω 5% " " 1/10W
	R8-R10	80.5053	2.2 kΩ 5% " " 1/10W
	R11	80.5051	1.5 kΩ 5% " " 1/10W
	R12	80.5053	2.2 kΩ 5% " " 1/10W
	R13	80.5049	1 kΩ 5% " " 1/10W
	R14	80.5037	100 Ω 5% " " 1/10W
	R15	80.5049	1 kΩ 5% " " 1/10W
	R16	80.5037	100 Ω 5% " " 1/10W
	R17	80.5057	4.7 kΩ 5% " " 1/10W
	R18	80.5053	2.2 kΩ 5% " " 1/10W
	R19	80.5049	1 kΩ 5% " " 1/10W
	R20	80.5046	560 Ω 5% " " 1/10W
	R21	80.5037	100 Ω 5% " " 1/10W
	R22	80.5028	18 Ω 5% " " 1/10W
	R23	80.5041	220 Ω 5% " " 1/10W
	R24	80.5049	1 kΩ 5% " " 1/10W
	R25	80.5047	680 Ω 5% " " 1/10W
	R26	80.5049	1 kΩ 5% " " 1/10W
	R27	80.5074	120 kΩ 5% " " 1/10W
	R28	80.5066	27 kΩ 5% " " 1/10W
	R29	80.5055	3.3 kΩ 5% " " 1/10W
	R30	80.5063	15 kΩ 5% " " 1/10W
	R32-R34	80.5061	10 kΩ 5% " " 1/10W
	R35	80.5062	12 kΩ 5% " " 1/10W
	R36	80.5241	220 Ω 5% " " 1/10W
	R37	80.5039	150 Ω 5% " " 1/10W
	R38	80.5037	100 Ω 5% " " 1/10W
	R39	80.5053	2.2 kΩ 5% " " 1/10W
	R40	80.5049	1 kΩ 5% " " 1/10W
	R41	80.5043	330 Ω 5% " " 1/10W
	R42	80.5037	100 Ω 5% " " 1/10W
	R43	80.5041	220 Ω 5% " " 1/10W
	R44	80.5037	100 Ω 5% " " 1/10W
	R45	80.5034	56 Ω 5% " " 1/10W
	R46	80.5049	1 kΩ 5% " " 1/10W
	R47	80.5042	270 Ω 5% " " 1/10W
	L1	63.5007	15 µH 20% choke 200mA
	L2	61.1222	80 mH coil
	L3	61.1220	RF coil
	L4	61.1221	RF coil
	L5	63.5007	15 µH 20% choke 200mA

FREQUENCY SYNTHESIZER FS702

X402.467

Storno

TYPE	Nº	CODE	DATA
	L6	63.5007	15 µH 20% choke 200mA
	L7	61.1233	RF coil
	E1	99.5292	BB 113 Triple cap. diode
	Q1	99.5293	ZTX 313 Transistor
	Q3	99.5240	BFX 89 Transistor
	Q4	99.5240	BFX 89 Transistor
	Q5	99.5201	BC 109 Transistor
	Q6	99.5293	ZTX 313 Transistor
	Q7	99.5240	BFX 89 Transistor
	IC1	14.5043	SN 6493 4-bit binary counter
	IC2	14.5043	SN 6493 4-bit binary counter
	IC3	14.5060	MC 4344 Phase-frequency detector
	IC4	14.5062	SN 54 H 72 Gated J-K flip-flop
	IC5-7	14.5061	SN 64160 Syncronous decade counter
	IC8	14.5024	SN 6400 Quadr. 2-input NAND gates

Storno

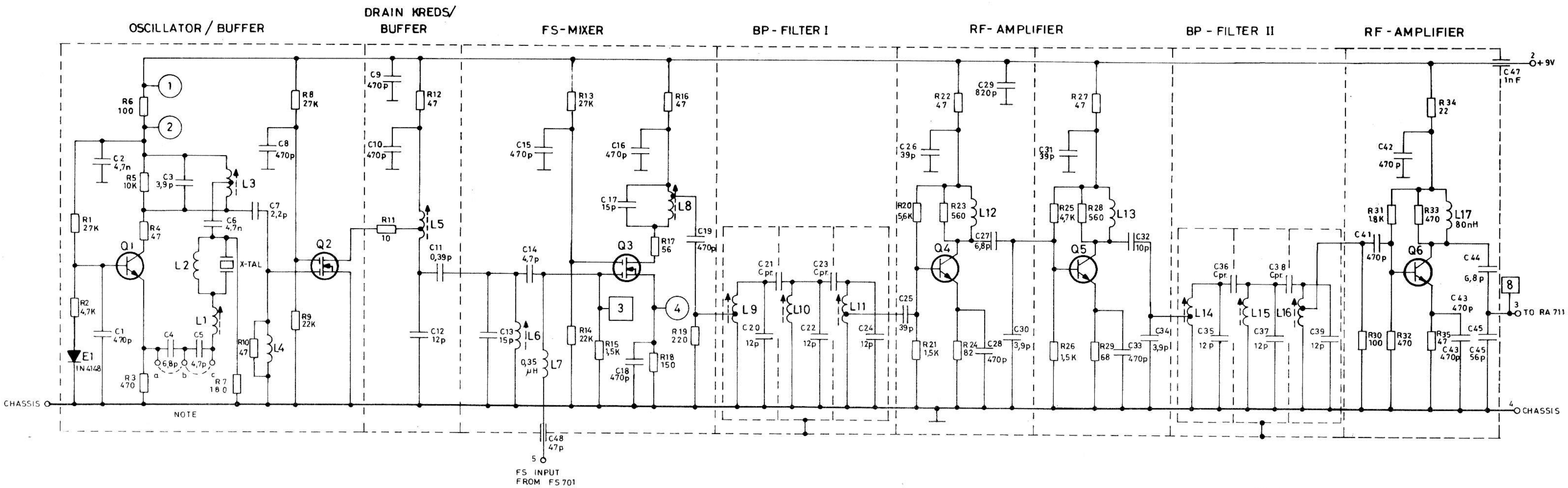
TYPE	Nº	CODE	DATA

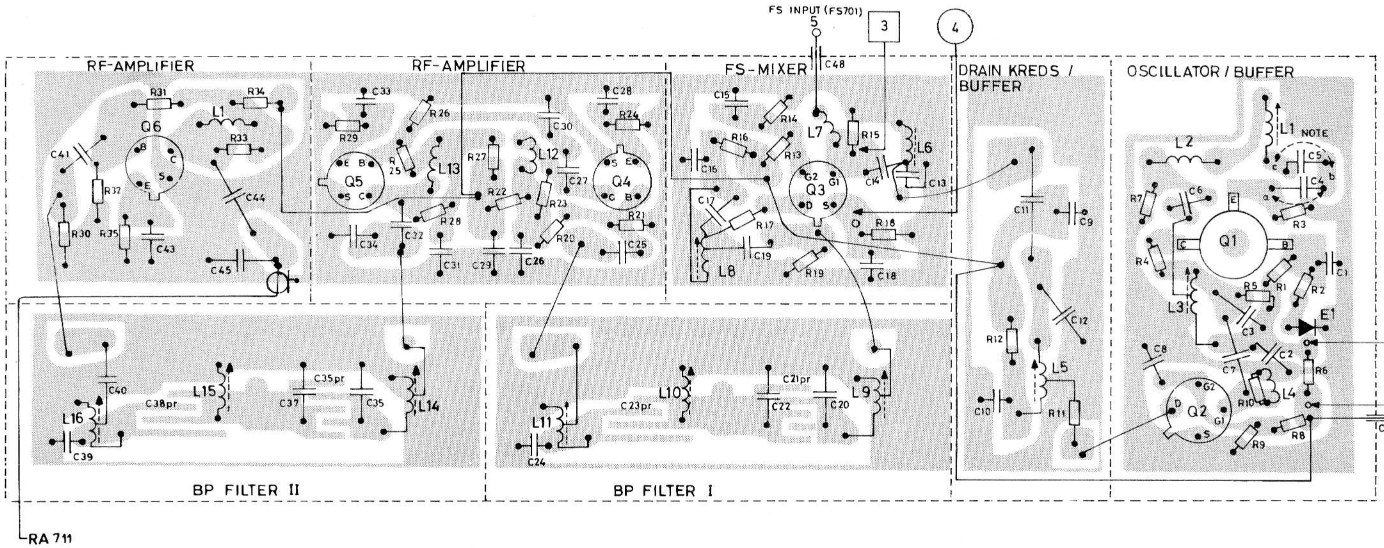
FREQUENCY SYNTHESIZER FS702

X402.467

Storno

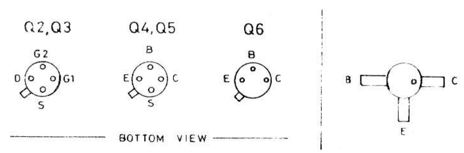
Storno





NOTE:

FREQUENCY FREKVENS	STRAP STRAPNING
UP/OP	NONE/INGEN
NORMAL	a - b
DOWN/NED	b - c

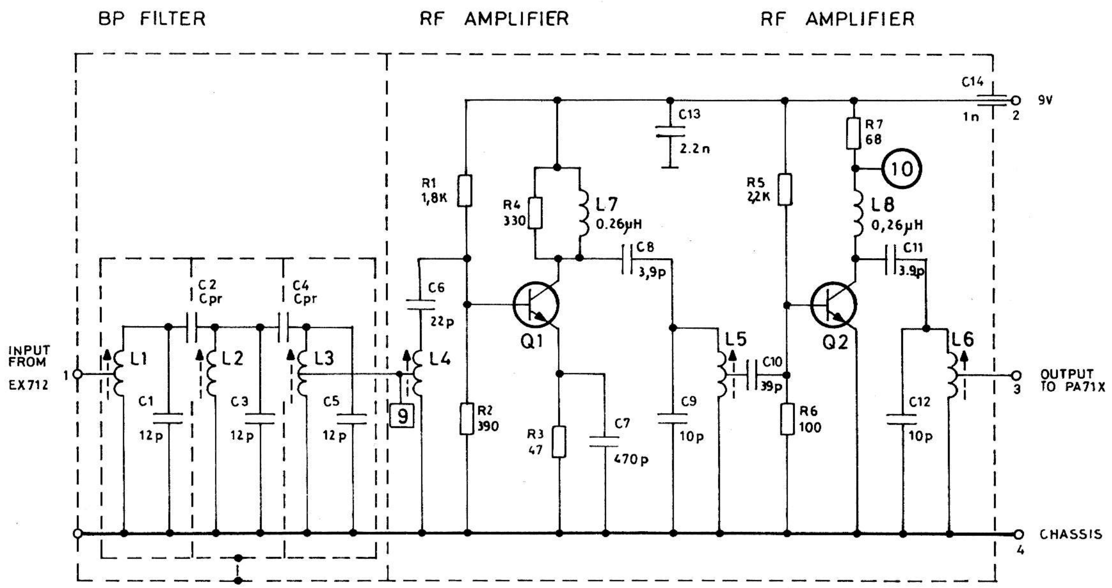


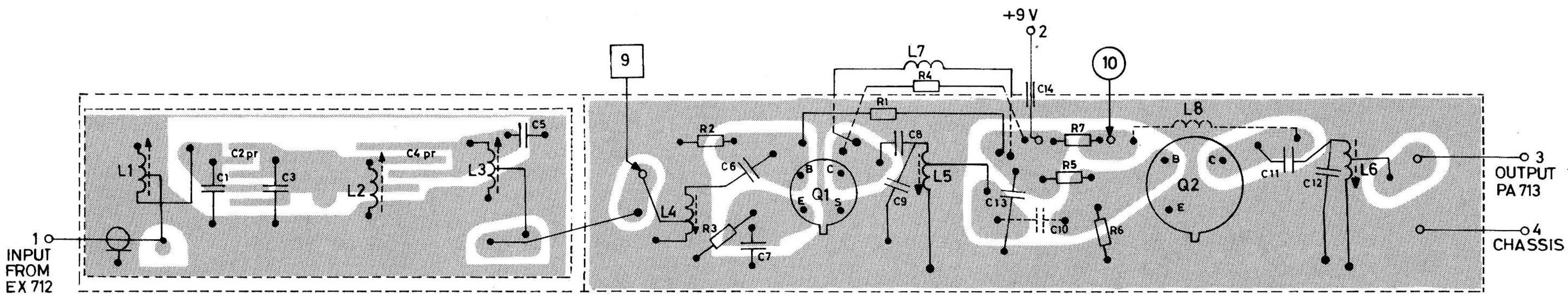
EXCITER
STYRESENDER

EX712

D 401.847

Storno





RF AMPLIFIER
HF FORSTÆRKER

RA711

D401.848/2

TYPE	NO.	CODE	DATA
RA 711		10.2937	RF Amplifier
	C1	74.5308	12pF 5% ceram PL 63V
	C2		Printed Capacitor
	C3	74.5308	12pF 5% ceram PL 63V
	C4		Printed capacitor
	C5	74.5308	12pF 5% ceram Pl 63V
	C6	74.5106	22pF 5% ceram TB 160V
	C7	74.5162	470pF -20/+50% ceram DI 400V
	C8	74.5130	3.9pF ± 0.25pF ceram DI 250V
	C9	74.5135	10pF 5% ceram DI 125V
	C10	74.5117	39pF 5% ceram TB 160V
	C11	74.5130	3.9pF ± 0.25pF ceram DI 250V
	C12	74.5135	10pF 5% ceram DI 125V
	C13	74.5163	2.2nF -20/+80% ceram PL 63V
	C14	74.5198	1nF -20/+50% ceram FT 30V
	R1	80.5052	1.8KΩ 5% carbon film 1/10W
	R2	80.5044	390 Ω 5% " 1/10W
	R3	80.5033	47 Ω 5% " 1/10W
	R4	80.5043	330 Ω 5% " 1/10W
	R5	80.5053	2.2 KΩ 5% " 1/10W
	R6	80.5037	100 Ω 5% " 1/10W
	R7	80.5236	82 Ω 5% " 1/8W
	L1	61.1256	RF coil 146-174 MHz
	L2	61.1257	RF coil 146-174 MHz
	L3	61.1258	RF coil 146-174 MHz
	L4	61.1254	RF coil 146-174 MHz
	L5	61.1255	RF coil 146-174 MHz
	L6	61.1255	RF coil 146-174 MHz
	L7	62.0614	0.26 μH RF choke
	L8	62.0614	0.26 μH RF choke
	Q1	99.5240	BFX89 Transistor
	Q2	99.5229	2N4427 Transistor

Storno

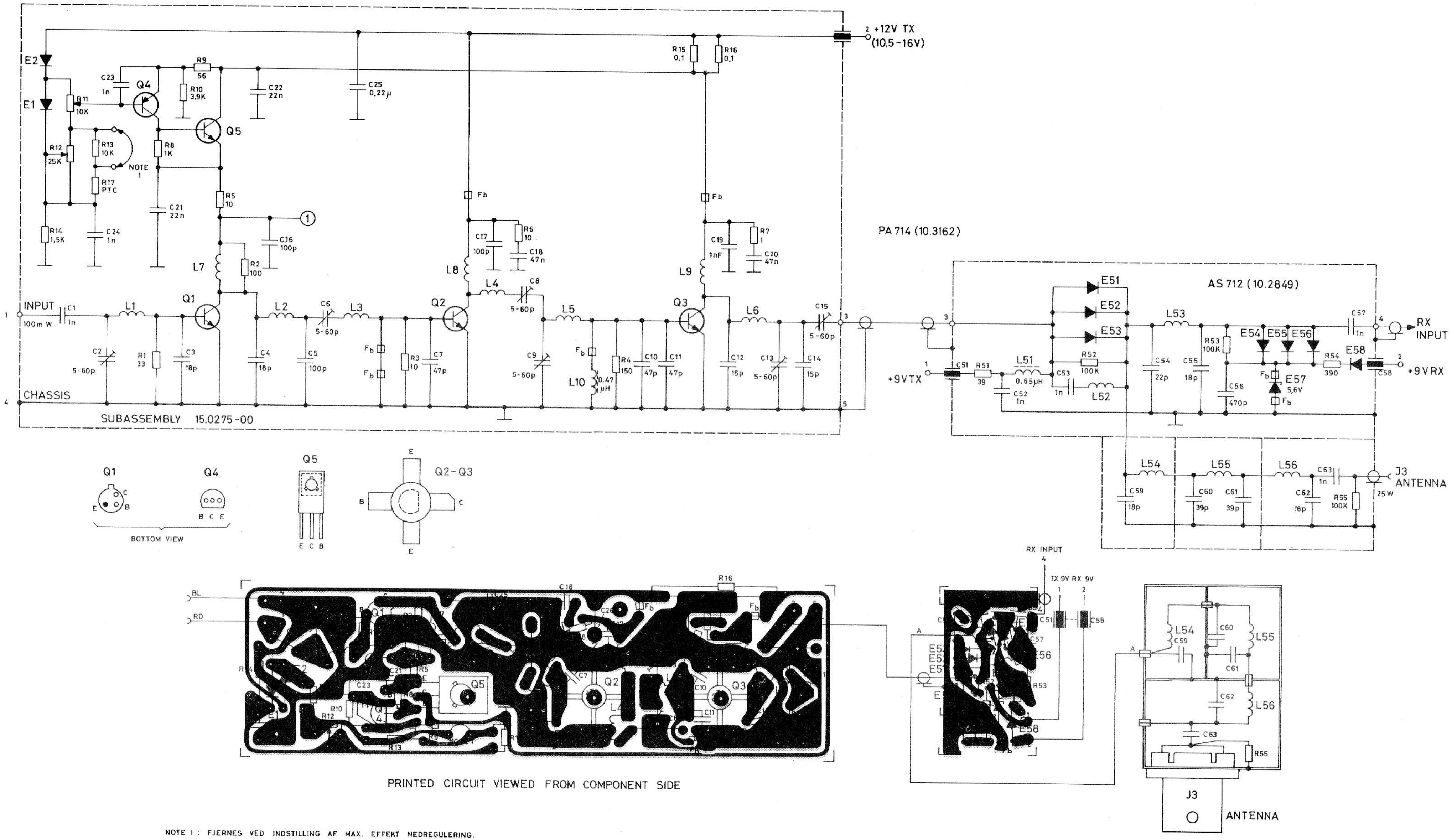
TYPE	NO.	CODE	DATA

RF AMPLIFIER
HF FORSTÆRKER

RA711

X401.941

Storno



NOTE 1 : FJERNES VED INDSTILLING AF MAX. EFFEKT NEDREGULERING.
TO BE REMOVED WHEN SETTING THE MAXIMUM POWER DECLINE.

RF POWER AMPLIFIER PA714

D402.250/2

Storno

TYPE	Nº	CODE	DATA
PA714		10.3162-00	Power Amplifier (AS712 incl.)
	C1	74.5155	1 nF -20 +80% ceram 63 V
	C2	78.5061	5/60 pF teflon trimmer 300 V
	C3	74.5138	18 pF 5% ceram 125 V
	C4	74.5138	18 pF 5% " 125 V
	C5	74.5342	100 pF 2% " 63 V
	C6	78,5061	5/60 pF teflon trimmer 300 V
	C7	74.5343	47 pF 2% ceram 63 V
	C8	78,5062	5/60 pF teflon trimmer 300 V
	C9	78.5062	5/60 pF " " 300 V
	C10	74.5343	47 pF 2% ceram 63 V
	C11	74.5343	47 pF 2% " 63 V
	C12	74.5046	15 pF 5% " 400 V
	C13	78.5062	5/60 pF teflon trimmer 300 V
	C14	74.5046	15 pF 5% ceram 400 V
	C15	78.5062	5/60 pF teflon trimmer 300 V
	C16	74.5013	100 pF 20% ceram 400 V
	C17	74.5013	100 pF 20% " 400 V
	C18	76.5072	47 nF 10% polyester 50 V
	C19	74.5013	100 pF 20% ceram 400 V
	C20	76.5072	47 nF 10% polyester 50 V
	C21	76.5071	22 nF 10% " 50 V
	C22	76.5071	22 nF 10% " 50 V
	C23	74.5155	1 nF -20 +80% ceram 63 V
	C24	74.5155	1 nF -20 +80% " 63 V
	C25	76.5074	0.22 µF 10% polyester 100 V
	C26	69.5023	Filter feed-through
	R1	80.5231	33 Ω 5% carbon film 1/8 W
	R2	80.5237	100 Ω 5% " " 1/8 W
	R3	80.5225	10 Ω 5% " " 1/8 W
	R4	80.5239	150 Ω 5% " " 1/8 W
	R5	80.5225	10 Ω 5% " " 1/8 W
	R6	80.5225	10 Ω 5% " " 1/8 W
	R7	80.5213	1 Ω 5% " " 1/8 W
	R8	80.5249	1 KΩ 5% " " 1/8 W
	R9	80.5234	56 Ω 5% " " 1/8 W
	R10	80.5256	3.9 KΩ 5% " " 1/8 W
	R11	86.5039	10 KΩ 20% trim. carbon film 0.1 W
	R12	86.5060	25 KΩ 20% " " " 0.1 W
	R13	80.5261	10 KΩ 5% carbon film 1/8 W
	R14	80.5251	1.5 KΩ 5% " " 1/8 W
	R15	82.5208	0.1 Ω 10% wire wound 1 W
	R16	82.5208	0.1 Ω 10% " " 1 W
	R17	89.5071	60 Ω - 50 KΩ PTC 30 V

Storno

TYPE	Nº	CODE	DATA
	L1	62.0930	RF coil 146 - 174 MHz
	L2	62.0930	RF coil 146 - 174 MHz
	L3	62.0930	RF coil 146 - 174 MHz
	L4	62.0932	RF coil 146 - 174 MHz
	L5	62.0932	RF coil 146 - 174 MHz
	L6	62.0931	RF coil 146 - 174 MHz
	L7	62.0651	RF coil 146 - 174 MHz
	L8	62.0933	RF coil 146 - 174 MHz
	L9	62.0934	RF coil 146 - 174 MHz
	E1	99.5028	1 N 914 Diode
	E2	99.5028	1 N 914 Diode
	Q1	99.5321	Transistor MRF 237
	Q2	99.5322	Transistor MRF 212
	Q3	99.5323	Transistor 2 N 6082
	Q4	99.5144-01	Transistor BC 214 L
	Q5	99.5235	Transistor BD 135
	Fc1-6	65.5060	Ferrite bead 60 MHz
AS712		10.2849-00	Antenna Switching Unit
	C51	69.5007	VHF feed-through filter
	C52	74.5155	1 nF -20 +80% ceram 63 V
	C53	74.5155	1 nF -20 +80% " 63 V
	C54	74.5008	22 pF 5% " 400 V
	C55	74.5196	18 pF 5% " 400 V
	C56	74.5162	470 pF -20 +50% no lead 400 V
	C57	74.5155	1 nF -20 +80% ceram 63 V
	C58	69.5007	VHF feed-through filter
	C59	74.5196	18 pF 5% ceram 400 V
	C60	74.5197	39 pF 5% " 400 V
	C61	74.5197	39 pF 5% " 400 V
	C62	74.5196	18 pF 5% " 400 V
	C63	74.5015	1 nF 20% " 400 V
	R51	80.5232	39 Ω 5% carbon film 1/8 W
	R52	80.5073	100 KΩ 5% " " 1/8 W
	R53	80.5073	100 KΩ 5% " " 1/8 W
	R54	80.5044	390 Ω 5% " " 1/8 W
	R55	80.5273	100 KΩ 5% " " 1/8 W

POWER AMPLIFIER PA714

X402.374/2

Storno

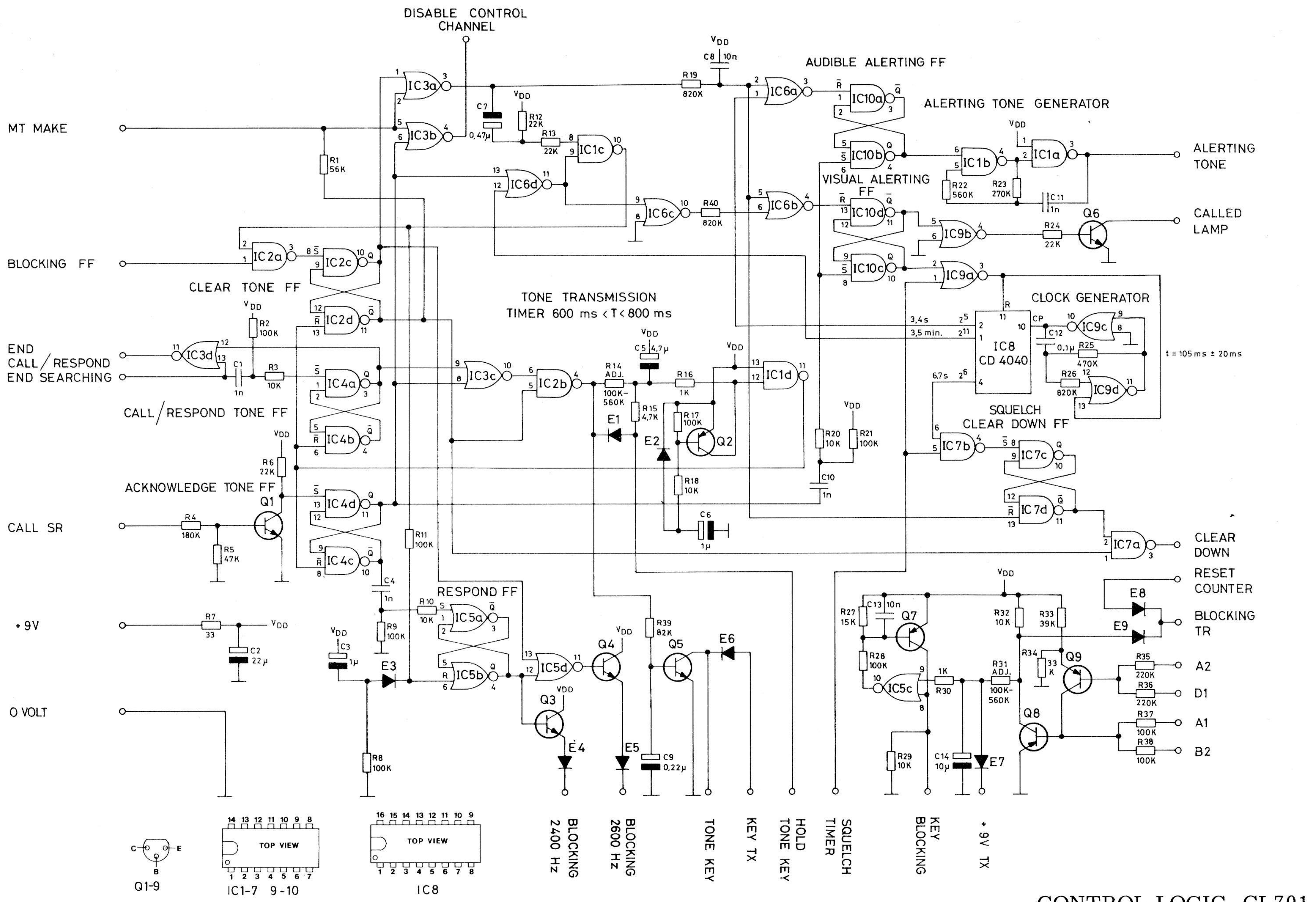
TYPE	Nº	CODE	DATA
	L51	62.0662-01	0.65 µH RF choke
	L52	62.0818	RF coil
	L53	62.0817	RF coil
	L54-L56	62.0816	RF coil
	E51	99.5187-01	BA244 Diode
	E52	99.5187-01	BA244 Diode
	E53	99.5187-01	BA244 Diode
	E54	99.5187-01	BA244 Diode
	E55	99.5187-01	BA244 Diode
	E56	99.5187-01	BA244 Diode
	E57	99.5282	Zenerdiode 5% 5.6 V 1 W
	E58	99.5237	1 N 4148 Diode
		15.0138	AS712 PC-assembly
	J	41.0166	BNC - connector
	Fb	65.5061	Ferrite bead 60 MHz

Storno

TYPE	Nº	CODE	DATA

POWER AMPLIFIER PA714

X402.374/2



CONTROL LOGIC CL701

D 402.385

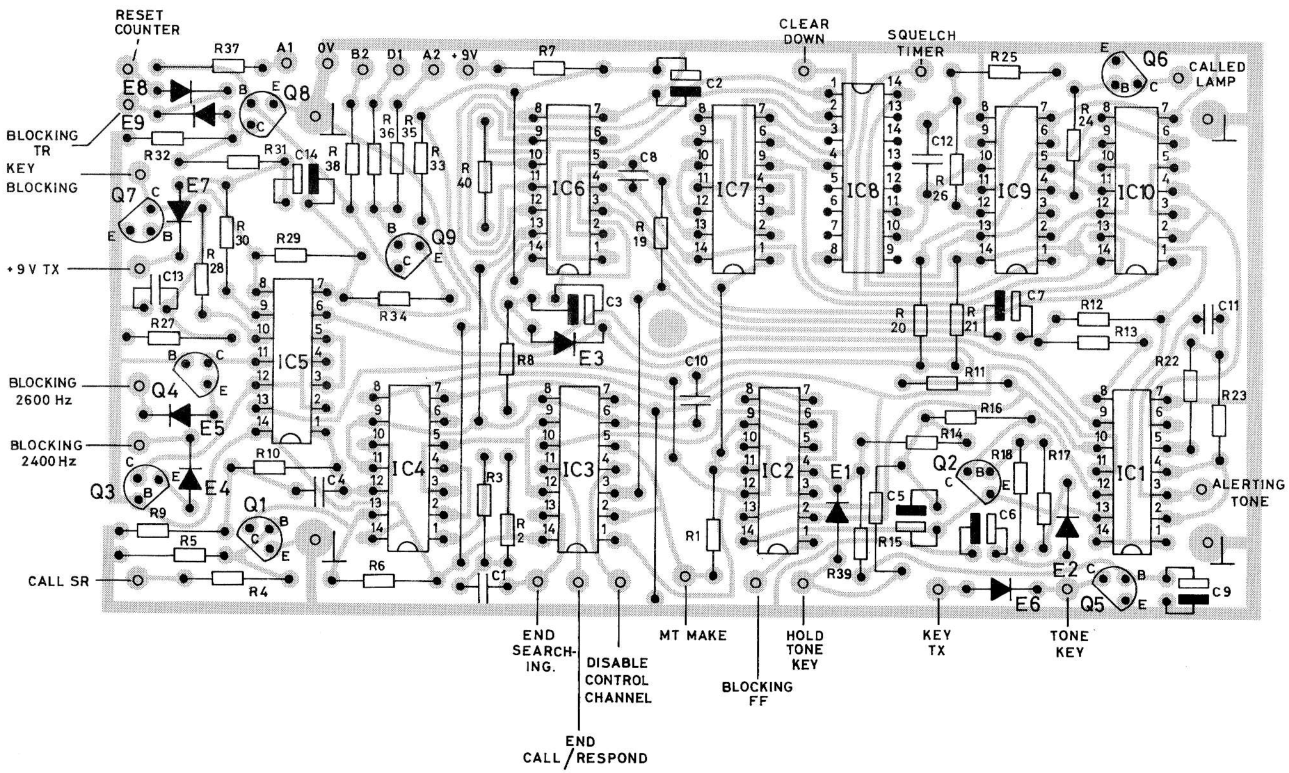
TYPE	Nº	CODE	DATA
CL701		10.3369-00	Control Logic
	C1	74.5155	1 nF -20/+80% ceram PL 63 V
	C2	73.5127	22 µF 20% tantal 16 V
	C3	73.5114	1 µF 20% " 35 V
	C4	74.5155	1 nF -20/+80% ceram PL 63 V
	C5	73.5126	4.7 µF 20% tantal 35 V
	C6	73.5114	1 µF 20% " 35 V
	C7	73.5125	0.47 µF 20% " 35 V
	C8	76.5070	10 nF 10% polyest FL 50 V
	C9	73.5118	0.22 µF 20% tantal 35 V
	C10	74.5155	1 nF -20/+80% ceram PL 63 V
	C11	76.5069	1 nF 10% polyest FL 50 V
	C12	76.5125	0.1 µF 5% " " 100 V
	C13	76.5070	10 nF 10% " " 50 V
	C14	73.5109	10 µF 20% tantal 16 V
	R1	80.5270	56 kΩ 5% carbon film 1/8 W
	R2	80.5273	100 kΩ 5% " " 1/8 W
	R3	80.5261	10 kΩ 5% " " 1/8 W
	R4	80.5276	180 kΩ 5% " " 1/8 W
	R5	80.5269	47 kΩ 5% " " 1/8 W
	R6	80.5265	22 kΩ 5% " " 1/8 W
	R7	80.5231	33 Ω 5% " " 1/8 W
	R8	80.5273	100 kΩ 5% " " 1/8 W
	R9	80.5273	100 kΩ 5% " " 1/8 W
	R10	80.5261	10 kΩ 5% " " 1/8 W
	R11	80.5273	100 kΩ 5% " " 1/8 W
	R12	80.5265	22 kΩ 5% " " 1/8 W
	R13	80.5265	22 kΩ 5% " " 1/8 W
	R14	80.52xx	ADJ 5% " " 1/8 W
	R15	80.5257	4.7 kΩ 5% " " 1/8 W
	R16	80.5249	1 kΩ 5% " " 1/8 W
	R17	80.5273	100 kΩ 5% " " 1/8 W
	R18	80.5261	10 kΩ 5% " " 1/8 W
	R19	80.5284	820 kΩ 5% " " 1/8 W
	R20	80.5261	10 kΩ 5% " " 1/8 W
	R21	80.5273	100 kΩ 5% " " 1/8 W
	R22	80.5282	560 kΩ 5% " " 1/8 W
	R23	80.5278	270 kΩ 5% " " 1/8 W
	R24	80.5265	22 kΩ 5% " " 1/8 W
	R25	80.5281	470 kΩ 5% " " 1/8 W
	R26	80.5284	820 kΩ 5% " " 1/8 W
	R27	80.5263	15 kΩ 5% " " 1/8 W
	R28	80.5273	100 kΩ 5% " " 1/8 W
	R29	80.5261	10 kΩ 5% " " 1/8 W
	R30	80.5249	1 kΩ 5% " " 1/8 W
	R31	80.52xx	ADJ 5% " " 1/8 W

Storno

TYPE	Nº	CODE	DATA
	R32	80.5261	10 kΩ 5% carbon film 1/8 W
	R33	80.5268	39 kΩ 5% " " 1/8 W
	R34	80.5267	33 kΩ 5% " " 1/8 W
	R35	80.5277	220 kΩ 5% " " 1/8 W
	R36	80.5277	220 kΩ 5% " " 1/8 W
	R37	80.5273	100 kΩ 5% " " 1/8 W
	R38	80.5273	100 kΩ 5% " " 1/8 W
	R39	80.5272	82 kΩ 5% " " 1/8 W
	R40	80.5284	820 kΩ 5% " " 1/8 W
	E1-E9	99.5237	1 N 4148 Diode
	Q1	99.5143	BC 238 Transistor
	Q2	99.5230	BC 308 Transistor
	Q3-Q6	99.5143	BC 238 Transistor
	Q7	99.5230	BC 308 Transistor
	Q8	99.5143	BC 238 Transistor
	Q9	99.5230	BC 308 Transistor
	IC1-2	14.5051	CD 4011 AE quadr. 2 input NAND
	IC3	14.5074	SD 4001 AE quadr. 2 input NOR
	IC4	14.5051	CD 4011 AE quadr. 2 input NAND
	IC5-6	14.5074	SD 4001 AE quadr. 2 input NOR
	IC7	14.5051	CD 4011 AE quadr. 2 input NAND
	IC8	14.5111	CD 4040 AE 12 stage binary counter
	IC9	14.5074	CD 4001 AE quadr. 2 input NOR
	IC10	14.5051	CD 4011 AE quadr. 2 input NAND

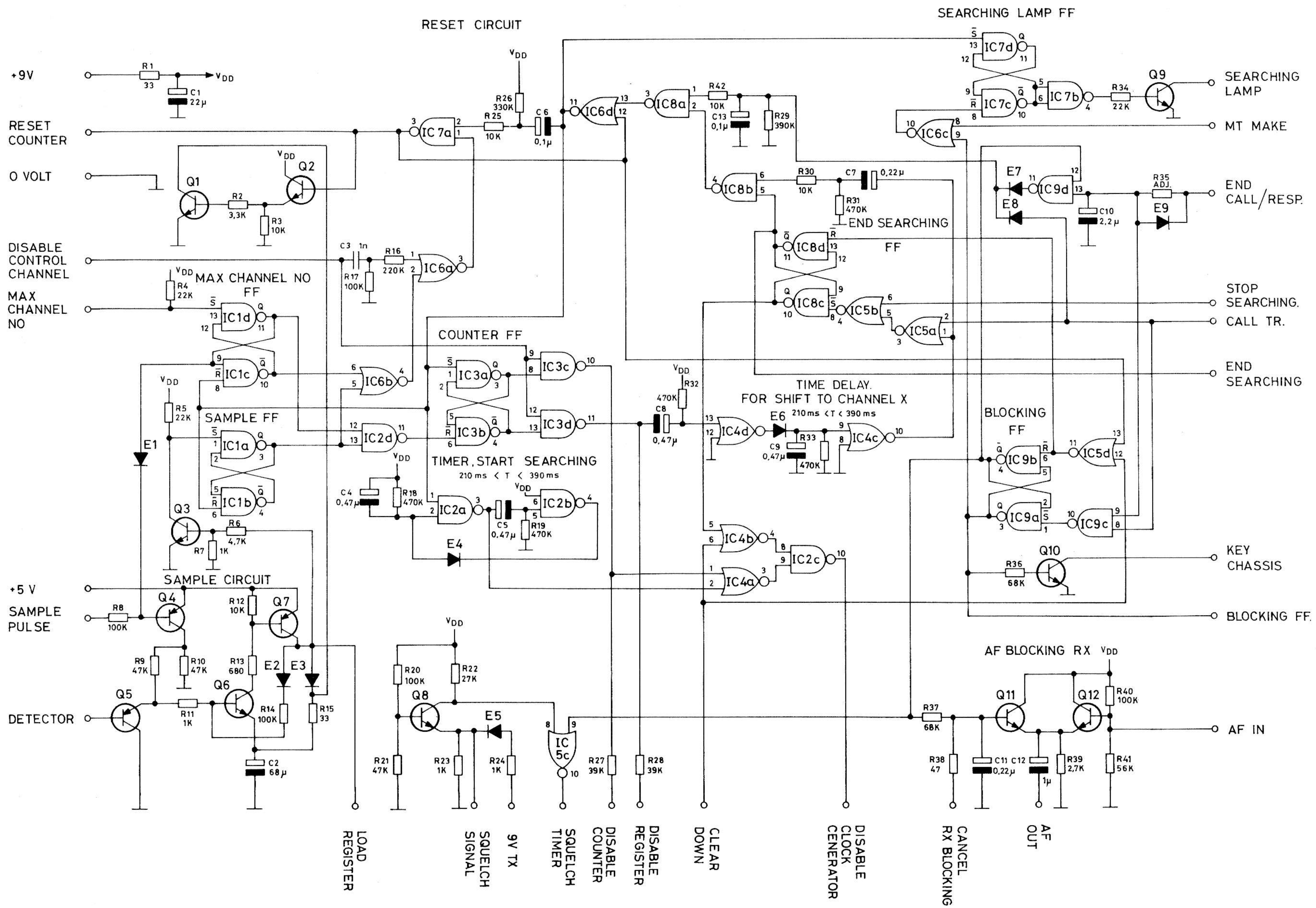
CONTROL LOGIC UNIT CL701

X402.464



CONTROL LOGIC CL701

D402.512



CONTROL LOGIC CL702

D402.384

Storno

TYPE	Nº	CODE	DATA
CL702		10.3370-00	Control Logic
	C1	73.5127	22 µF 20% tantal 16 V
	C2	73.5106	68 µF 20% " 16 V
	C3	74.5155	1 nF -20/+80% ceram PL 63 V
	C4	73.5125	0.47 µF 20% tantal 35 V
	C5	73.5125	0.47 µF 20% " 35 V
	C6	73.5089	0.1 µF 20% " 35 V
	C7	73.5118	0.22 µF 20% " 35 V
	C8	73.5125	0.47 µF 20% " 35 V
	C9	73.5125	0.47 µF 20% " 35 V
	C10	73.5102	2.2 µF 20% " 35 V
	C11	73.5118	0.22 µF 20% " 35 V
	C12	73.5114	1 µF 20% " 35 V
	C13	73.5089	0.1 µF 20% " 35 V
	R1	80.5231	33 Ω 5% carbon film 1/8 W
	R2	80.5255	3.3 kΩ 5% " " 1/8 W
	R3	80.5261	10 kΩ 5% " " 1/8 W
	R4	80.5265	22 kΩ 5% " " 1/8 W
	R5	80.5265	22 kΩ 5% " " 1/8 W
	R6	80.5257	4.7 kΩ 5% " " 1/8 W
	R7	80.5249	1 kΩ 5% " " 1/8 W
	R8	80.5273	100 kΩ 5% " " 1/8 W
	R9	80.5269	47 kΩ 5% " " 1/8 W
	R10	80.5269	47 kΩ 5% " " 1/8 W
	R11	80.5249	1 kΩ 5% " " 1/8 W
	R12	80.5261	10 kΩ 5% " " 1/8 W
	R13	80.5247	680 Ω 5% " " 1/8 W
	R14	80.5273	100 kΩ 5% " " 1/8 W
	R15	80.5231	33 Ω 5% " " 1/8 W
	R16	80.5277	220 kΩ 5% " " 1/8 W
	R17	80.5273	100 kΩ 5% " " 1/8 W
	R18	80.5281	470 kΩ 5% " " 1/8 W
	R19	80.5281	470 kΩ 5% " " 1/8 W
	R20	80.5273	100 kΩ 5% " " 1/8 W
	R21	80.5269	47 kΩ 5% " " 1/8 W
	R22	80.5266	27 kΩ 5% " " 1/8 W
	R23	80.5249	1 kΩ 5% " " 1/8 W
	R34	80.5249	1 kΩ 5% " " 1/8 W
	R25	80.5261	10 kΩ 5% " " 1/8 W
	R26	80.5279	330 kΩ 5% " " 1/8 W
	R27	80.5268	39 kΩ 5% " " 1/8 W
	R28	80.5268	39 kΩ 5% " " 1/8 W
	R29	80.5280	390 kΩ 5% " " 1/8 W
	R30	80.5261	10 kΩ 5% " " 1/8 W
	R31	80.5281	470 kΩ 5% " " 1/8 W
	R32	80.5281	470 kΩ 5% " " 1/8 W

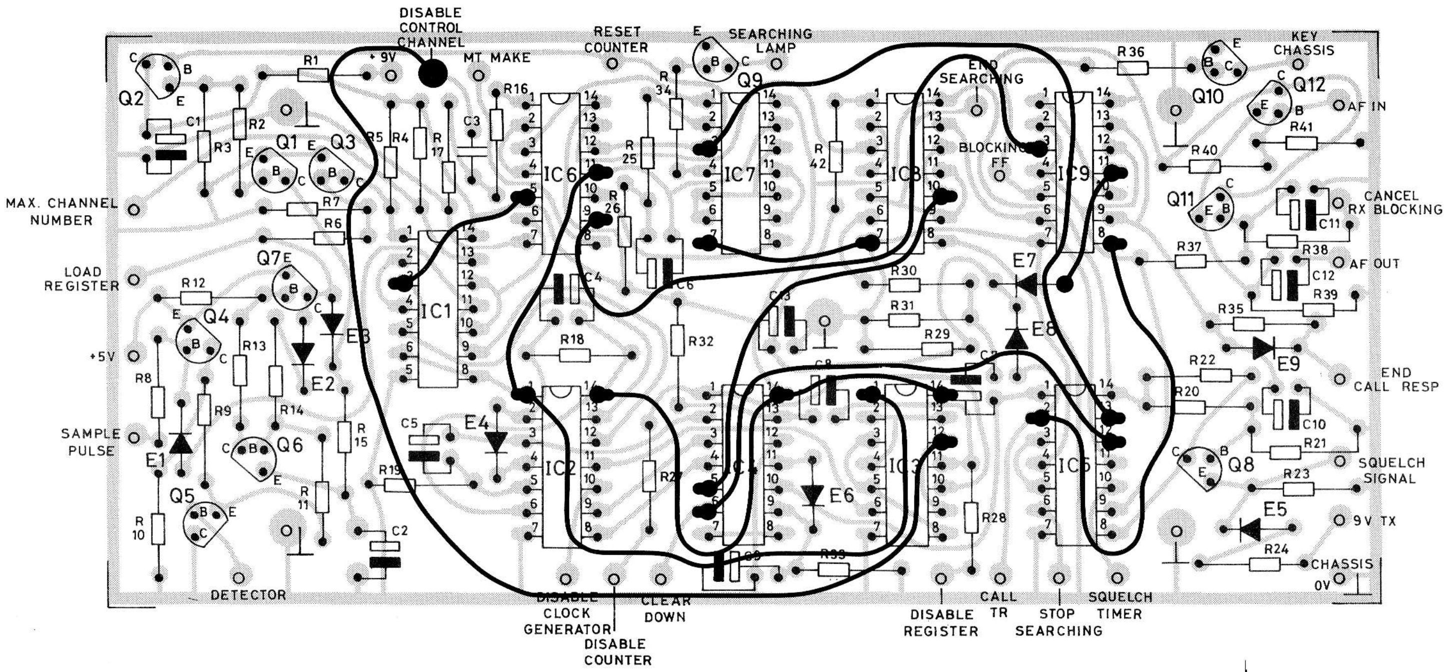
Storno

TYPE	Nº	CODE	DATA
	R33	80.5281	470 kΩ 5% carbon film 1/8 W
	R34	80.5265	22 kΩ 5% " " 1/8 W
	R35	80.52xx	ADJ 5% " " 1/8 W
	R36	80.5271	68 kΩ 5% " " 1/8 W
	R37	80.5271	68 kΩ 5% " " 1/8 W
	R38	80.5233	47 Ω 5% " " 1/8 W
	R39	80.5254	2.7 kΩ 5% " " 1/8 W
	R40	80.5273	100 kΩ 5% " " 1/8 W
	R41	80.5270	56 kΩ 5% " " 1/8 W
	R42	80.5261	10 kΩ 5% " " 1/8 W
	E1-E9	99.5237	1 N 4148 Diode
	Q1-Q3	99.5143	BC 238 Transistor
	Q4-Q5	99.5230	BC 308 Transistor
	Q6	99.5143	BC 238 Transistor
	Q7	99.5230	BC 308 Transistor
	Q8-Q12	99.5143	BC 238 Transistor
	IC1-3	14.5051	CD 4011 AE quadr. 2 input NAND
	IC4-6	14.5074	CD 4001 AE quadr. 2 input NOR
	IC7-9	14.5051	CD 4011 AE quadr. 2 input NAND

CONTROL LOGIC UNIT CL702

X402.465

Storno

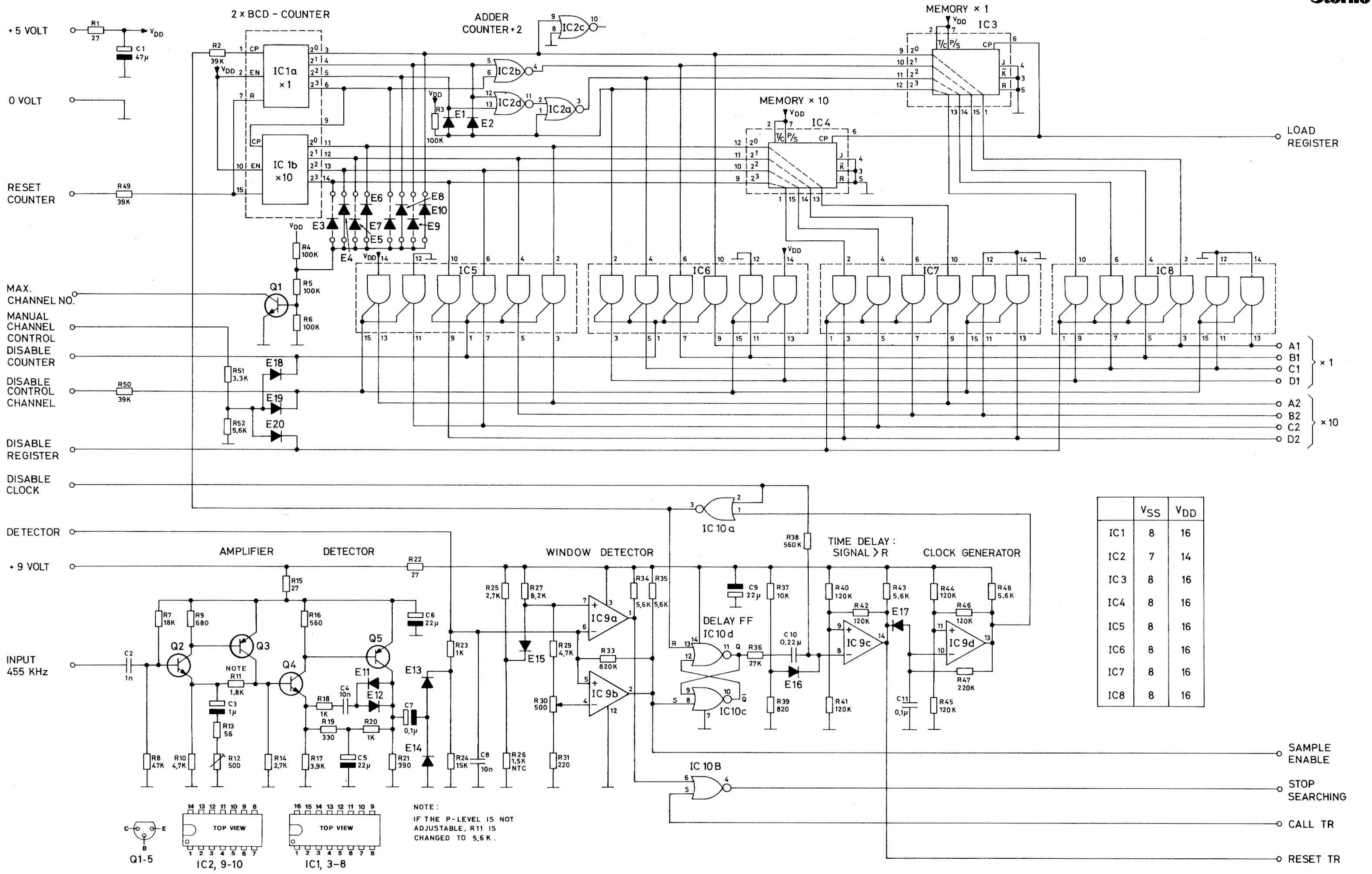


PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

CONTROL LOGIC CL702

D402.509

Storno



	V_{SS}	V_{DD}
IC1	8	16
IC2	7	14
IC3	8	16
IC4	8	16
IC5	8	16
IC6	8	16
IC7	8	16
IC8	8	16

FREQUENCY CONTROL UNIT FC705

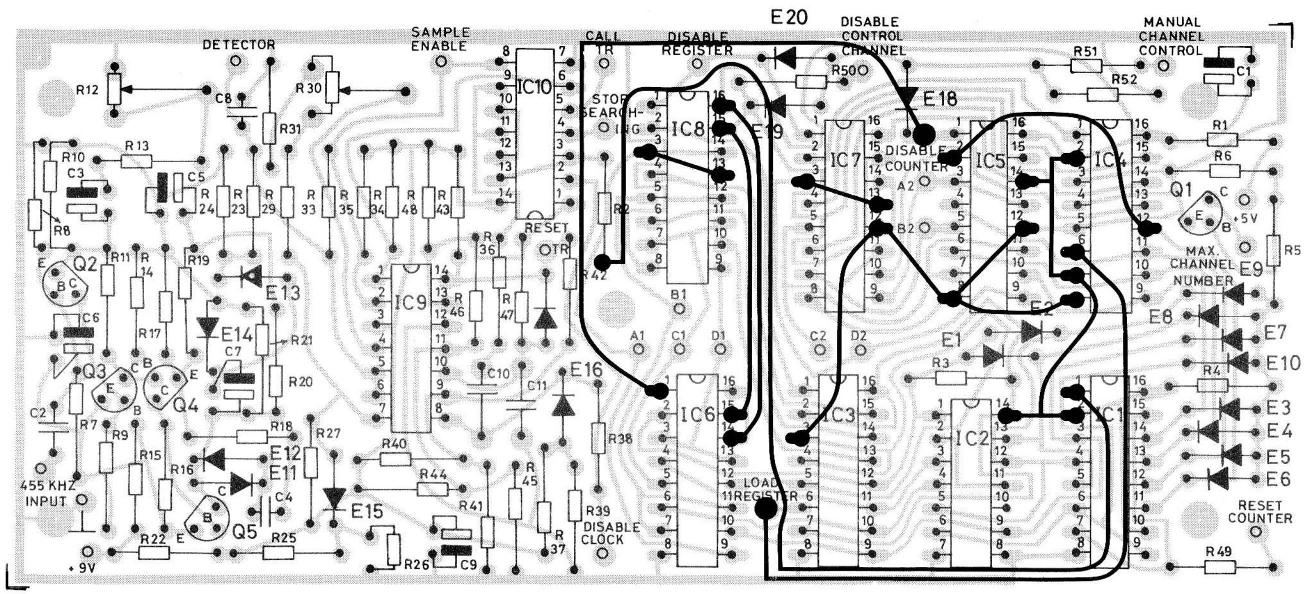
D 402.383

TYPE	Nº	CODE	DATA
FC705		10.3374-00	Frequency Control Unit
	C1	73.5124	47 µF 20% tantal 6.3 V
	C2	74.5155	1 nF -20/+80% ceram PL 63 V
	C3	73.5114	1 µF 20% tantal 35 V
	C4	76.5070	10 nF 10% polyester FL 50 V
	C5	73.5127	22 µF 20% tantal 16 V
	C6	73.5127	22 µF 20% " 16 V
	C7	73.5089	0.1 µF 20% " 35 V
	C8	76.5070	10 nF 10% polyester FL 50 V
	C9	73.5127	22 µF 20% tantal 16 V
	C10	76.5126	0.22 µF 5% polyester FL 100 V
	C11	76.5125	0.1 µF 5% " FL 100 V
	R1	80.5230	22 Ω 5% carbon film 1/8 W
	R2	80.5268	39 kΩ 5% " " 1/8 W
	R3-R6	80.5273	100 kΩ 5% " " 1/8 W
	R7	80.5264	18 kΩ 5% " " 1/8 W
	R8	80.5269	47 kΩ 5% " " 1/8 W
	R9	80.5247	680 Ω 5% " " 1/8 W
	R10	80.5257	4.7 kΩ 5% " " 1/8 W
	R11	80.5252	1.8 kΩ 5% " " 1/8 W
	R12	86.5042	500 Ω 20% " " pot. lin. 0.1 W
	R13	80.5234	56 Ω 5% " " 1/8 W
	R14	80.5254	2.7 kΩ 5% " " 1/8 W
	R15	80.5230	27 Ω 5% " " 1/8 W
	R16	80.5246	560 Ω 5% " " 1/8 W
	R17	80.5256	3.9 kΩ 5% " " 1/8 W
	R18	80.5249	1 kΩ 5% " " 1/8 W
	R19	80.5243	330 Ω 5% " " 1/8 W
	R20	80.5249	1 kΩ 5% " " 1/8 W
	R21	80.5244	390 Ω 5% " " 1/8 W
	R22	80.5230	27 Ω 5% " " 1/8 W
	R23	80.5249	1 kΩ 5% " " 1/8 W
	R24	80.5263	15 kΩ 5% " " 1/8 W
	R25	80.5254	2.7 kΩ 5% " " 1/8 W
	R26	89.5008	1.5 kΩ 20% NTC 0.5 W
	R27	80.5260	8.2 kΩ 5% carbon film 1/8 W
	R29	80.5257	4.7 kΩ 5% " " 1/8 W
	R30	86.5042	500 Ω 20% " " pot. lin. 0.1 W
	R31	80.5241	220 Ω 5% " " 1/8 W
	R33	80.5284	820 kΩ 5% " " 1/8 W
	R34	80.5258	5.6 kΩ 5% " " 1/8 W
	R35	80.5258	5.6 kΩ 5% " " 1/8 W
	R36	80.5266	27 kΩ 5% " " 1/8 W
	R37	80.5261	10 kΩ 5% " " 1/8 W
	R38	80.5282	560 kΩ 5% " " 1/8 W
	R39	80.5248	820 Ω 5% " " 1/8 W

TYPE	Nº	CODE	DATA
	R40-R42	80.5274	120 kΩ 5% carbon film 1/8 W
	R43	80.5258	5.6 kΩ 5% " " 1/8 W
	R44-R46	80.5274	120 kΩ 5% " " 1/8 W
	R47	80.5277	220 kΩ 5% " " 1/8 W
	R48	80.5258	5.6 kΩ 5% " " 1/8 W
	R49-R50	80.5268	39 kΩ 5% " " 1/8 W
	R51	80.5255	3.3 kΩ 5% " " 1/8 W
	R52	80.5258	5.6 kΩ 5% " " 1/8 W
	E1-E2	99.5237	1 N 4148 Diode
	E4	99.5237	1 N 4148 Diode
	E6	99.5237	1 N 4148 Diode
	E8	99.5237	1 N 4148 Diode
	E10-E20	99.5237	1 N 4148 Diode
	Q1-Q2	99.5143	BC 238 Transistor
	Q3	99.5230	BC 308 Transistor
	Q4	99.5143	BC 238 Transistor
	Q5	99.5230	BC 308 Transistor
	IC1	14.5118	CD 4518 AE dual BCD counter
	IC2	14.5074	CD 4001 AE quadr. 2 input NOR
	IC3-4	14.5115	CD 4035 AE 4 bit universal shift register
	IC5-8	14.5117	MC 14503 CP hex, tri-state buffer
	IC9	14.5019	MC 3302 P quadr. comparator
	IC10	14.5074	CD 4001 AE quadr. 2 input NOR

FREQUENCY CONTROL UNIT FC705

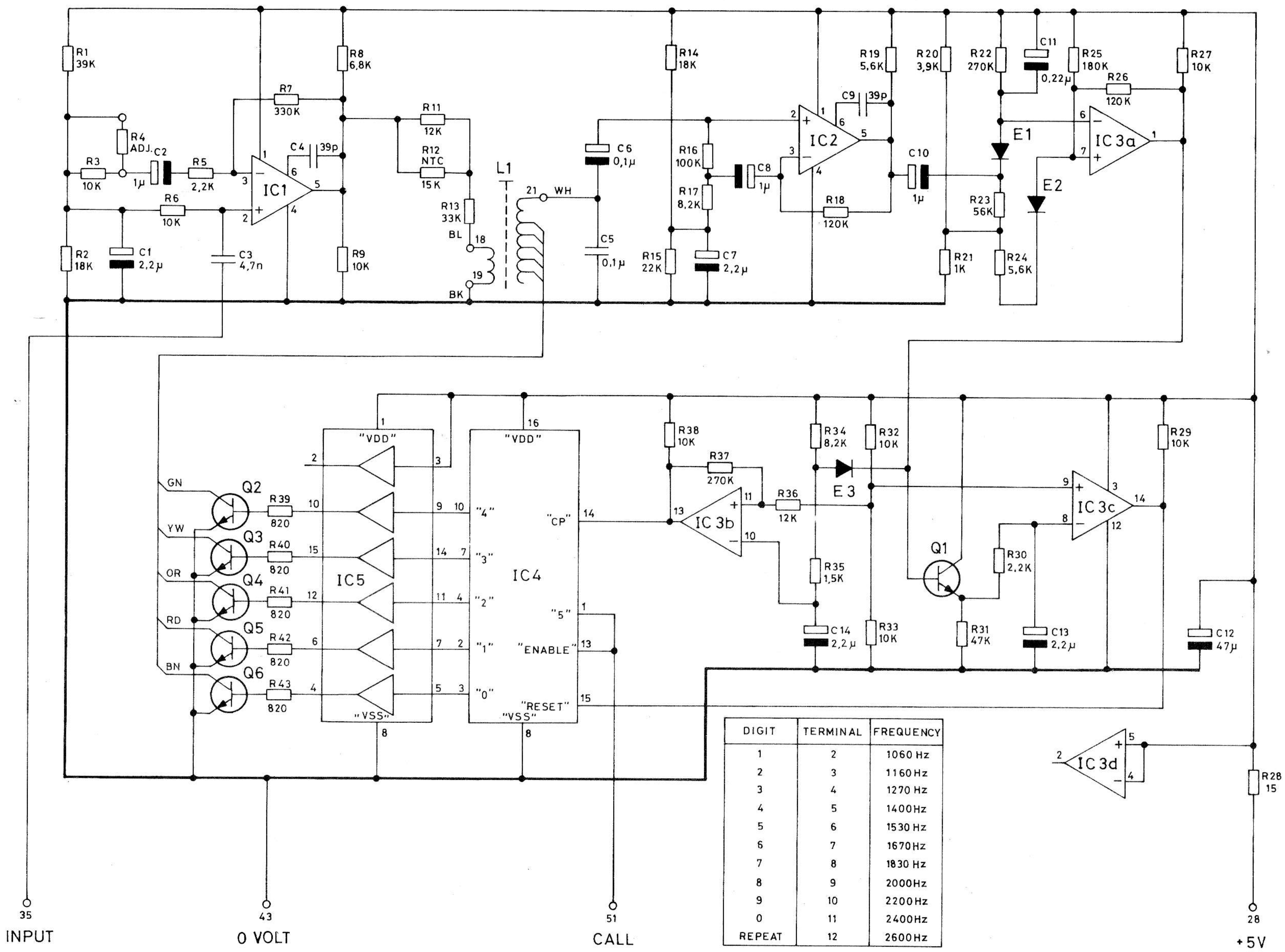
X402.463



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

FREQUENCY CONTROL UNIT FC705

D 402.508



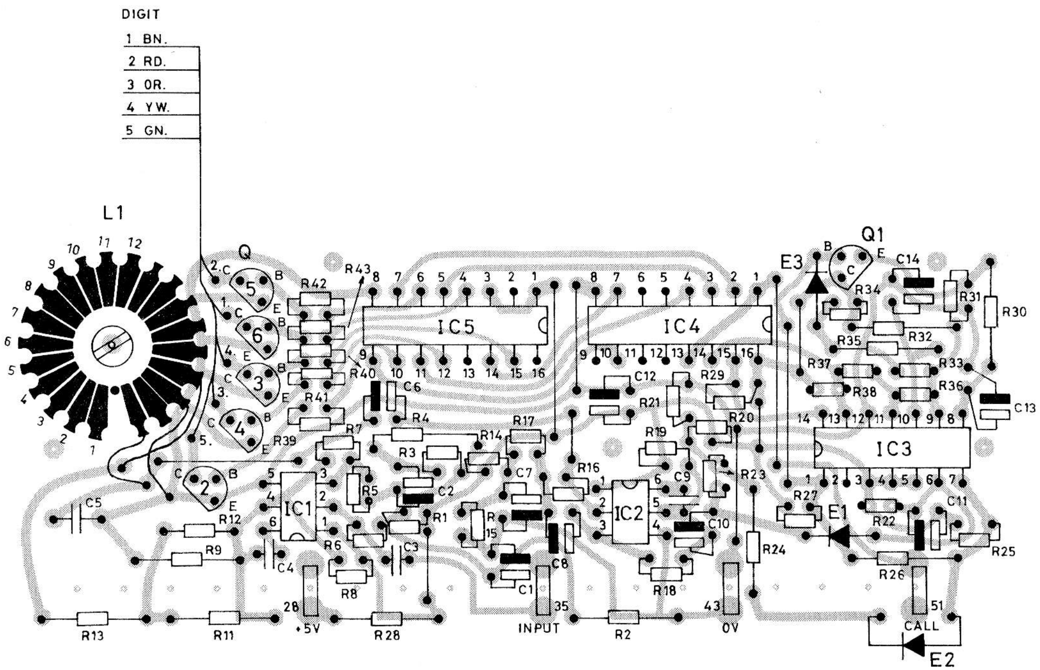
DIGIT	TERMINAL	FREQUENCY
1	2	1060 Hz
2	3	1160 Hz
3	4	1270 Hz
4	5	1400Hz
5	6	1530 Hz
6	7	1670Hz
7	8	1830 Hz
8	9	2000Hz
9	10	2200Hz
0	11	2400Hz
REPEAT	12	2600Hz

SEQUENTIAL TONE RECEIVER SR783

D402.372

Storno

Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

SEQUENTIAL TONE RECEIVER SR783

D402.511

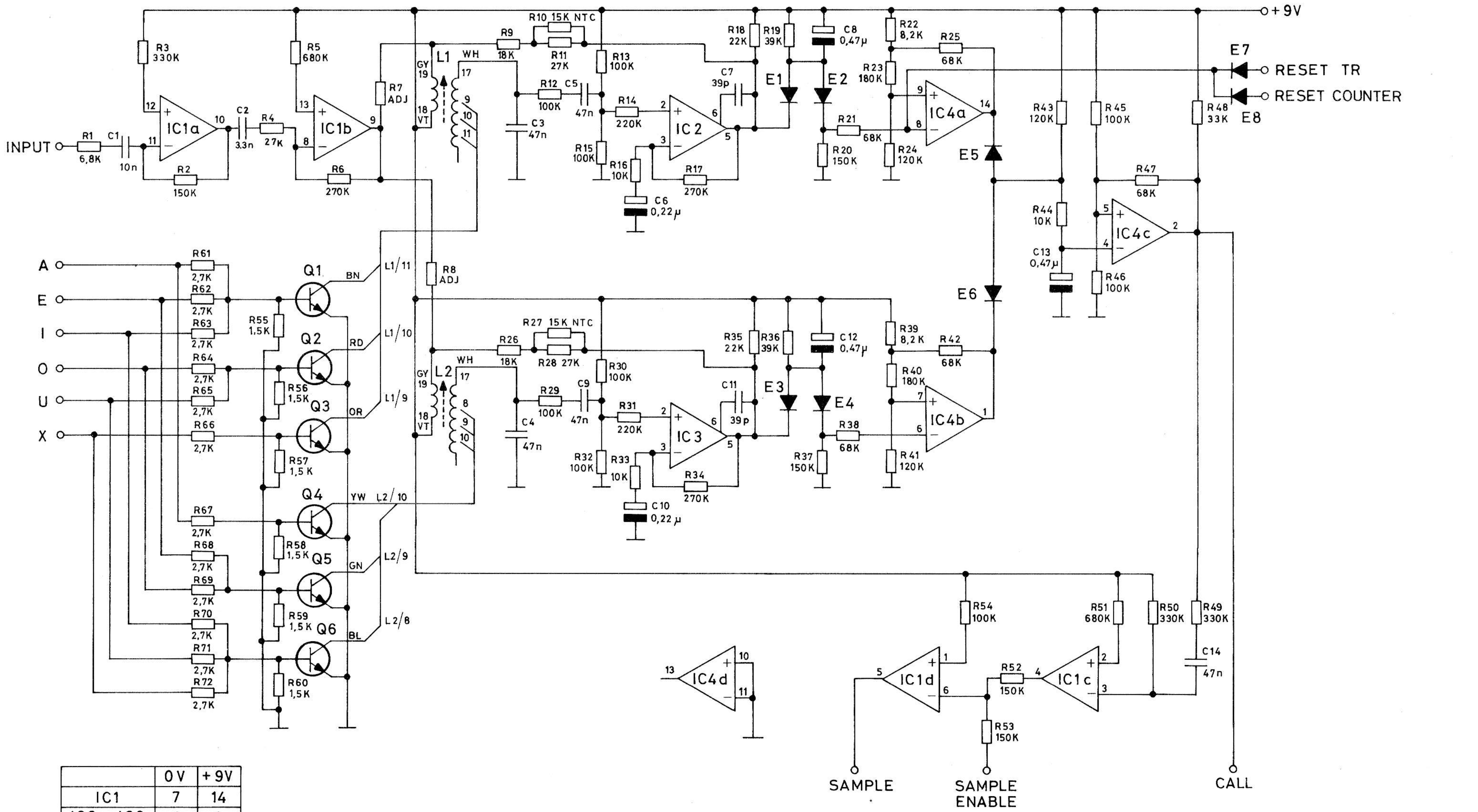
TYPE	Nº	CODE	DATA		
SR783		10.3373-00	Sequential Tone Receiver		
	C1	73.5102	2.2 µF 20%	tantal	35 V
	C2	73.5114	1 µF 20%	"	35 V
	C3	76.5061	4.7 nF 10%	polyester FL	50 V
	C4	74.5338	39 pF 2%	ceram PL	63 V
	C5	76.5068	0.1 µF 1%	polyester TB	63 V
	C6	73.5089	0.1 µF 20%	tantal	35 V
	C7	73.5102	2.2 µF 20%	"	35 V
	C8	73.5114	1 µF 20%	"	35 V
	C9	74.5338	39 pF 2%	ceram PL	63 V
	C10	73.5114	1 µF 20%	tantal	35 V
	C11	73.5118	0.22 µF 20%	"	35 V
	C12	73.5124	47 µF 20%	"	6.3 V
	C13	73.5102	2.2 µF 20%	"	35 V
	C14	73.5102	2.2 µF 20%	"	35 V
	R1	80.5268	39 kΩ 5%	carbon film	1/8 W
	R2	80.5264	18 kΩ 5%	" "	1/8 W
	R3	80.5261	10 kΩ 5%	" "	1/8 W
	R4	80.52xx	ADJ 5%	" "	1/8 W
	R5	80.5253	2.2 kΩ 5%	" "	1/8 W
	R6	80.5261	10 kΩ 5%	" "	1/8 W
	R7	80.5279	330 kΩ 5%	" "	1/8 W
	R8	80.5259	6.8 kΩ 5%	" "	1/8 W
	R9	80.5261	10 kΩ 5%	" "	1/8 W
	R11	80.5262	12 kΩ 5%	" "	1/8 W
	R12	89.5010	15 kΩ 20%	NTC	0.6 W
	R13	80.5267	33 kΩ 5%	carbon film	1/8 W
	R14	80.5264	18 kΩ 5%	" "	1/8 W
	R15	80.5265	22 kΩ 5%	" "	1/8 W
	R16	80.5273	100 kΩ 5%	" "	1/8 W
	R17	80.5260	8.2 kΩ 5%	" "	1/8 W
	R18	80.5274	120 kΩ 5%	" "	1/8 W
	R19	80.5258	5.6 kΩ 5%	" "	1/8 W
	R20	80.5256	3.9 kΩ 5%	" "	1/8 W
	R21	80.5249	1 kΩ 5%	" "	1/8 W
	R22	80.5278	270 kΩ 5%	" "	1/8 W
	R23	80.5270	56 kΩ 5%	" "	1/8 W
	R24	80.5258	5.6 kΩ 5%	" "	1/8 W
	R25	80.5276	180 kΩ 5%	" "	1/8 W
	R26	80.5274	120 kΩ 5%	" "	1/8 W
	R27	80.5261	10 kΩ 5%	" "	1/8 W
	R28	80.5227	15 Ω 5%	" "	1/8 W
	R29	80.5261	10 kΩ 5%	" "	1/8 W
	R30	80.5253	2.2 kΩ 5%	" "	1/8 W
	R31	80.5269	47 kΩ 5%	" "	1/8 W
	R32	80.5261	10 kΩ 5%	" "	1/8 W

Storno

TYPE	Nº	CODE	DATA		
	R33	80.5261	10 kΩ 5%	carbon film	1/8 W
	R34	80.5260	8.2 kΩ 5%	" "	1/8 W
	R35	80.5251	1.5 kΩ 5%	" "	1/8 W
	R36	80.5262	12 kΩ 5%	" "	1/8 W
	R37	80.5278	270 kΩ 5%	" "	1/8 W
	R38	80.5261	10 kΩ 5%	" "	1/8 W
	R39	80.5248	820 Ω 5%	" "	1/8 W
	R40	80.5248	820 Ω 5%	" "	1/8 W
	R41	80.5248	820 Ω 5%	" "	1/8 W
	R42	80.5248	820 Ω 5%	" "	1/8 W
	R43	80.5248	820 Ω 5%	" "	1/8 W
	L1	61.1259	Tone coil		
	E1	99.5237	1 N 4148 Diode		
	E2	99.5237	1 N 4148 Diode		
	E3	99.5237	1 N 4148 Diode		
	Q1	99.5201	BC 239 Transistor		
	Q2	99.5201	BC 239 Transistor		
	Q3	99.5201	BC 239 Transistor		
	Q4	99.5201	BC 239 Transistor		
	Q5	99.5201	BC 239 Transistor		
	Q6	99.5201	BC 239 Transistor		
	IC1	14.5017	TAA 865 0p amp.		
	IC2	14.5017	TAA 865 0p amp.		
	IC3	14.5019	MC 3302 p quad comparator		
	IC4	14.5052	CD 4017 AE decimal counter		
	IC5	14.5116	CD 4050 AE hex buffer		

SEQUENTIAL TONE RECEIVER SR783

X402.453



	0 V	+ 9V
IC1	7	14
IC2 , IC3	4	1
IC4	12	3

TONE RECEIVER TR786

D402.251

Storno

TYPE	Nº	CODE	DATA				
TR786		10.3371-00	Tone Receiver				
	C1	76.5070	10 nF	10%	polyester		50 V
	C2	76.5060	3.3 nF	10%	"		50 V
	C3	76.5122	47 nF	2%	polystyren		20 V
	C4	76.5122	47 nF	2%	"		20 V
	C5	76.5072	47 nF	10%	polyester		50 V
	C6	73.5118	0.22 µF	20%	tantal		35 V
	C7	74.5338	39 pF	2%	ceram N 150 PL		63 V
	C8	73.5125	0.47 µF	20%	tantal		35 V
	C9	76.5072	47 nF	10%	polyester		50 V
	C10	73.5118	0.22 µF	20%	tantal		35 V
	C11	74.5338	39 pF	2%	ceram N 150 PL		63 V
	C12	73.5125	0.47 µF	20%	tantal		35 V
	C13	73.5125	0.47 µF	20%	"		35 V
	C14	76.5072	47 nF	10%	polyester		50 V
	R1	80.5259	6.8 kΩ	5%	carbon	film	1/8 W
	R2	80.5275	150 kΩ	5%	"	"	1/8 W
	R3	80.5279	330 kΩ	5%	"	"	1/8 W
	R4	80.5266	27 kΩ	5%	"	"	1/8 W
	R5	80.5283	680 kΩ	5%	"	"	1/8 W
	R6	80.5278	270 kΩ	5%	"	"	1/8 W
	R7	80.52xx	ADJ	5%	"	"	1/8 W
	R8	80.52xx	ADJ	5%	"	"	1/8 W
	R9	80.5264	18 kΩ	5%	"	"	1/8 W
	R10	89.5010	15 kΩ	20%	NTC		0.6 W
	R11	80.5266	27 kΩ	5%	carbon	film	1/8 W
	R12	80.5273	100 kΩ	5%	"	"	1/8 W
	R13	80.5273	100 kΩ	5%	"	"	1/8 W
	R14	80.5277	220 kΩ	5%	"	"	1/8 W
	R15	80.5273	100 kΩ	5%	"	"	1/8 W
	R16	80.5261	10 kΩ	5%	"	"	1/8 W
	R17	80.5278	270 kΩ	5%	"	"	1/8 W
	R18	80.5265	22 kΩ	5%	"	"	1/8 W
	R19	80.5268	39 kΩ	5%	"	"	1/8 W
	R20	80.5275	150 kΩ	5%	"	"	1/8 W
	R21	80.5271	68 kΩ	5%	"	"	1/8 W
	R22	80.5260	8.2 kΩ	5%	"	"	1/8 W
	R23	80.5276	180 kΩ	5%	"	"	1/8 W
	R24	80.5274	120 kΩ	5%	"	"	1/8 W
	R25	80.5271	68 kΩ	5%	"	"	1/8 W
	R26	80.5264	18 kΩ	5%	"	"	1/8 W
	R27	89.5010	15 kΩ	20%	NTC		0.6 W
	R28	80.5266	27 kΩ	5%	carbon	film	1/8 W
	R29	80.5273	100 kΩ	5%	"	"	1/8 W
	R30	80.5273	100 kΩ	5%	"	"	1/8 W
	R31	80.5277	220 kΩ	5%	"	"	1/8 W

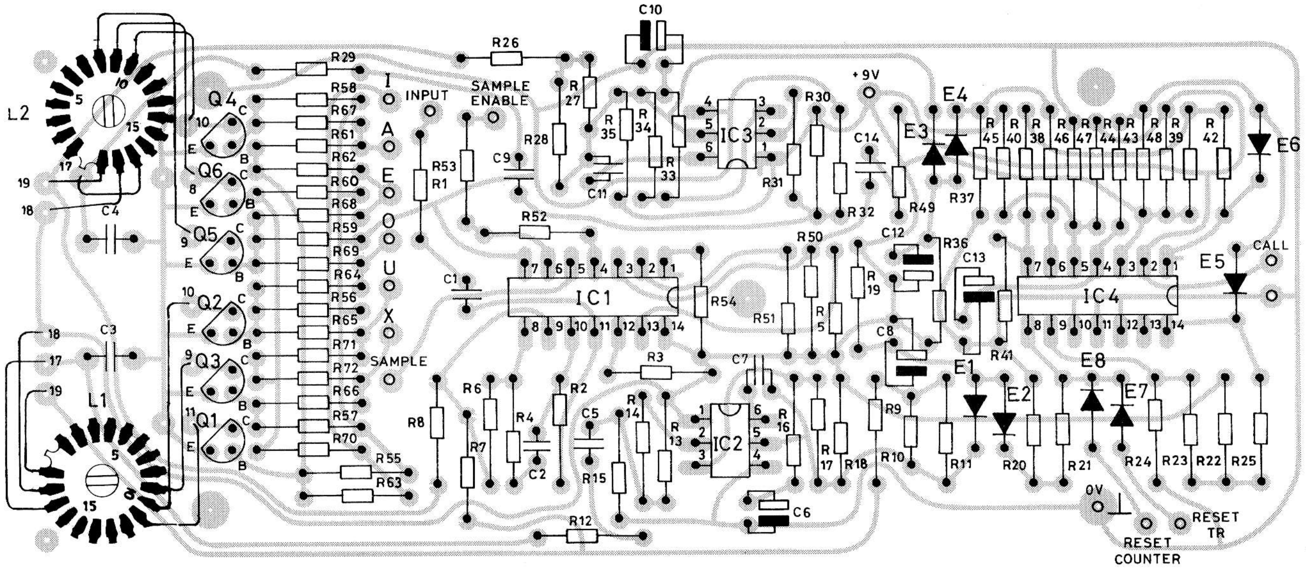
Storno

TYPE	Nº	CODE	DATA				
	R32	80.5273	100 kΩ	5%	carbon	film	1/8 W
	R33	80.5261	10 kΩ	5%	"	"	1/8 W
	R34	80.5278	270 kΩ	5%	"	"	1/8 W
	R35	80.5265	22 kΩ	5%	"	"	1/8 W
	R36	80.5268	39 kΩ	5%	"	"	1/8 W
	R37	80.5275	150 kΩ	5%	"	"	1/8 W
	R38	80.5271	68 kΩ	5%	"	"	1/8 W
	R39	80.5260	8.2 kΩ	5%	"	"	1/8 W
	R40	80.5276	180 kΩ	5%	"	"	1/8 W
	R41	80.5274	120 kΩ	5%	"	"	1/8 W
	R42	80.5271	68 kΩ	5%	"	"	1/8 W
	R43	80.5274	120 kΩ	5%	"	"	1/8 W
	R44	80.5261	10 kΩ	5%	"	"	1/8 W
	R45	80.5273	100 kΩ	5%	"	"	1/8 W
	R46	80.5273	100 kΩ	5%	"	"	1/8 W
	R47	80.5271	68 kΩ	5%	"	"	1/8 W
	R48	80.5267	33 kΩ	5%	"	"	1/8 W
	R49	80.5279	330 kΩ	5%	"	"	1/8 W
	R50	80.5279	330 kΩ	5%	"	"	1/8 W
	R51	80.5283	680 kΩ	5%	"	"	1/8 W
	R52	80.5275	150 kΩ	5%	"	"	1/8 W
	R53	80.5275	150 kΩ	5%	"	"	1/8 W
	R54	80.5273	100 kΩ	5%	"	"	1/8 W
	R55-R60	80.5251	1.5 kΩ	5%	"	"	1/8 W
	R61-R72	80.5254	2.7 kΩ	5%	"	"	1/8 W
	L1-L2	61.1292	Tone coil				
	E1-E8	99.5237	1 N 4148 Diode				
	Q1-Q6	99.5143	BC 238 Transistor				
	IC1	14.5100	LM 2900 Integrated Circuit				
	IC2	14.5017	TAA 865 Integrated Circuit				
	IC3	14.5017	TAA 865 Integrated Circuit				
	IC4	14.5019	MC 3302 Integrated Circuit				

TONE RECEIVER TR786

X402.466

Storno Storno

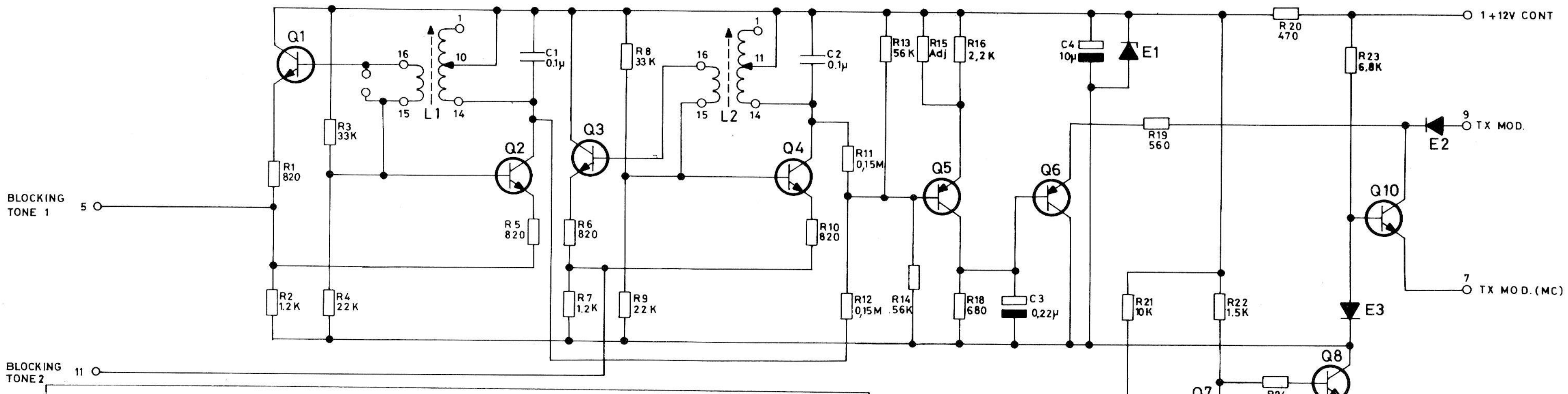


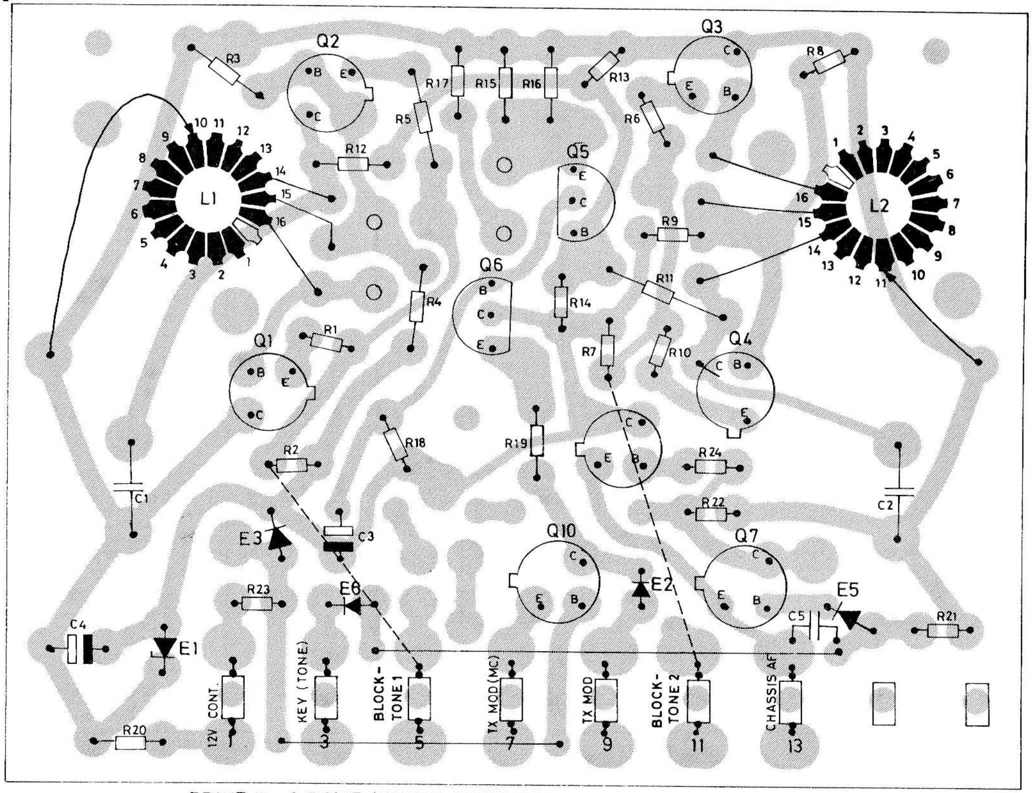
PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

TONE RECEIVER TR786

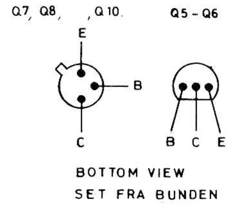
D402.510

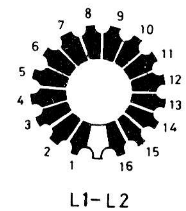
Storno





PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN





TERM.	FREQ.
1	1060 Hz
2	1160 –
3	1270 –
4	1400 –
5	1530 –
6	1670 –
7	1830 –
8	2000 –
9	2200 –
10	2400 –
11	2600 –
12	2900 –

TONE TRANSMITTER TONESENDER TT784

D402.242

Storno

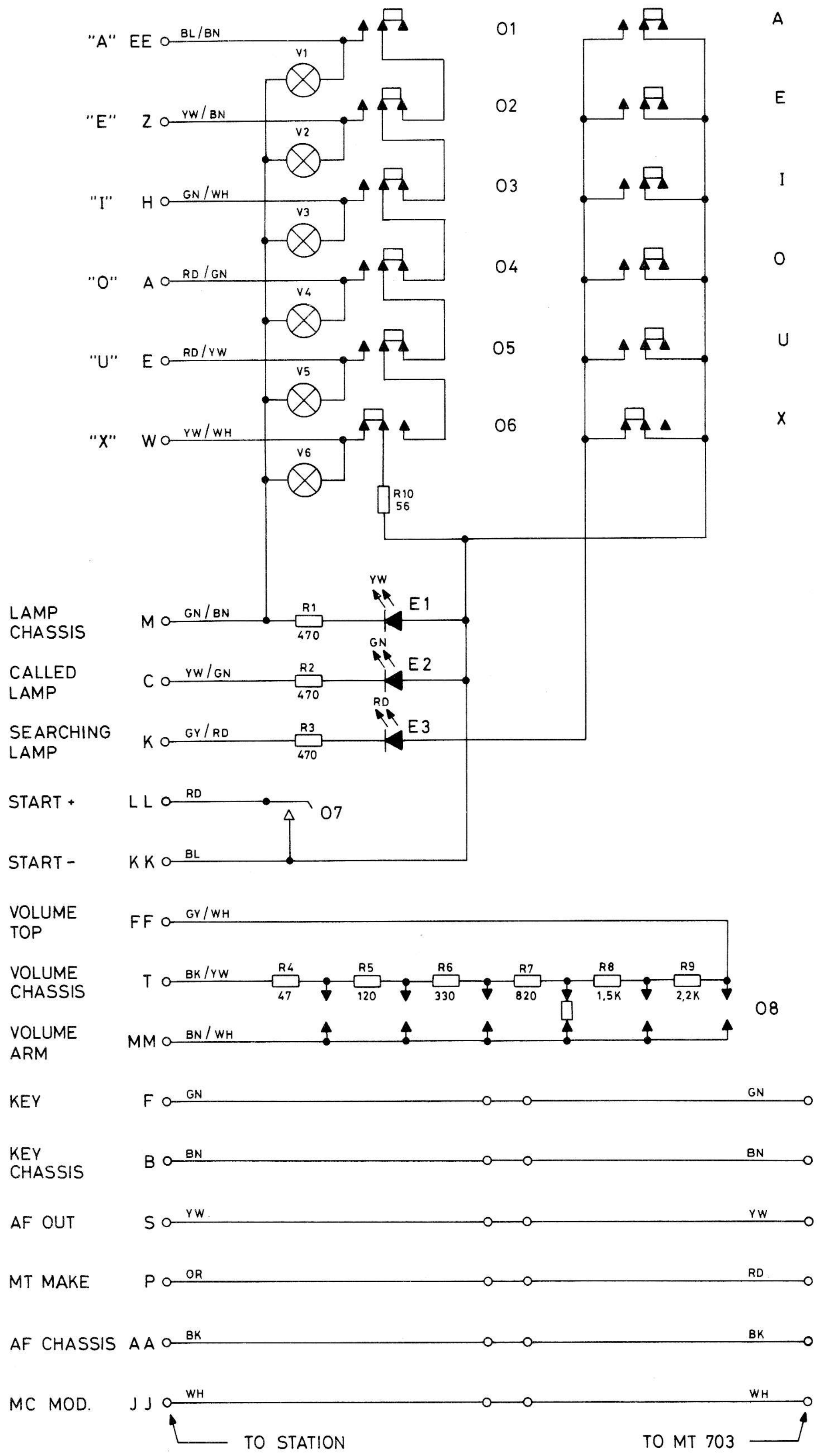
TYPE	Nº	CODE	DATA
		10.3372	Tone Transmitter TT784
	C1	76.5068	0.1 µF 1% polystyr TB 63 V
	C2	76.5068	0.1 µF 1% " TB 63 V
	C3	73.5118	0.22 µF 20% tantal 35 V
	C4	73.5109	10 µF 20% " 16 V
	C5	74.5155	1 nF -20/+80% ceram PL 63 V
	R1	80.5248	820 Ω 5% carbon film 1/8 W
	R2	80.5250	1.2 kΩ 5% " " 1/8 W
	R3	80.5267	33 kΩ 5% " " 1/8 W
	R4	80.5265	22 kΩ 5% " " 1/8 W
	R5	80.5248	820 Ω 5% " " 1/8 W
	R6	80.5248	820 Ω 5% " " 1/8 W
	R7	80.5250	1.2 kΩ 5% " " 1/8 W
	R8	80.5267	33 kΩ 5% " " 1/8 W
	R9	80.5265	22 kΩ 5% " " 1/8 W
	R10	80.5248	820 Ω 5% " " 1/8 W
	R11	80.5275	150 kΩ 5% " " 1/8 W
	R12	80.5275	150 kΩ 5% " " 1/8 W
	R13	80.5270	56 kΩ 5% " " 1/8 W
	R14	80.5270	56 kΩ 5% " " 1/8 W
	R15	80.52xx	ADJ 5% " " 1/8 W
	R16	80.5253	2.2 kΩ 5% " " 1/8 W
	R18	80.5247	680 Ω 5% " " 1/8 W
	R19	80.5246	560 Ω 5% " " 1/8 W
	R20	80.5445	470 Ω 5% " " 1/4 W
	R21	80.5261	10 kΩ 5% " " 1/8 W
	R22	80.5251	1.5 kΩ 5% " " 1/8 W
	R23	80.5259	6.8 kΩ 5% " " 1/8 W
	R24	80.5050	1.2 kΩ 5% " " 1/8 W
	L1	61.1157	Tone Coil
	L2	61.1157	" "
	E1	99.5114	Zenerdiode 5.6 V 5% 0.25 W
	E2	99.5219	AAZ 15 Diode
	E3	99.5219	AAZ 15 "
	E5	99.5028	1 N 914 "
	E6	99.5028	1 N 914 "
	Q1	99.5143	BC 108 Transistor
	Q2	99.5143	BC 108 Transistor
	Q3	99.5143	BC 108 Transistor
	Q4	99.5143	BC 108 Transistor
	Q5	99.5144	BC 214 L Transistor
	Q6	99.5144	BC 214 L Transistor

Storno

TYPE	Nº	CODE	DATA
	Q7	99.5143	BC 108 Transistor
	Q8	99.5143	BC 108 Transistor
	Q10	99.5143	BC 108 Transistor

TONE TRANSMITTER TT784

X402.543



CONTROL UNIT CB705

D402.386

Storno

TYPE	Nº	CODE	DATA
		10.3427	Control Unit CB705
	R1	80.5445	470 Ω 5% carbon film 1/4 W
	R2	80.5445	470 Ω 5% " " 1/4 W
	R3	80.5445	470 Ω 5% " " 1/4 W
	R4	80.5233	47 Ω 5% " " 1/8 W
	R5	80.5238	120 Ω 5% " " 1/8 W
	R6	80.5243	330 Ω 5% " " 1/8 W
	R7	80.5248	820 Ω 5% " " 1/8 W
	R8	80.5251	1.5 kΩ 5% " " 1/8 W
	R9	80.5253	2.2 kΩ 5% " " 1/8 W
	R10	80.5434	56 Ω 5% " " 1/4 W
	E1	99.5325	Yellow LED
	E2	99.5304	Green LED
	E3	99.5303	Red LED
	V1	92.5098	Lamp 12 V 60 mA
	V2	92.5098	Lamp 12 V 60 mA
	V3	92.5098	Lamp 12 V 60 mA
	V4	92.5098	Lamp 12 V 60 mA
	V5	92.5098	Lamp 12 V 60 mA
	V6	92.5098	Lamp 12 V 60 mA
	O1	49.0252	"A" Push button
	O2	49.0253	"O" Push button
	O3	49.0254	"E" Push button
	O4	49.0255	"U" Push button
	O5	49.0256	"I" Push button
	O6	49.0257	"X" Push button
	O7	47.5084	ON/OFF switch
	O8	47.0622	Volume switch

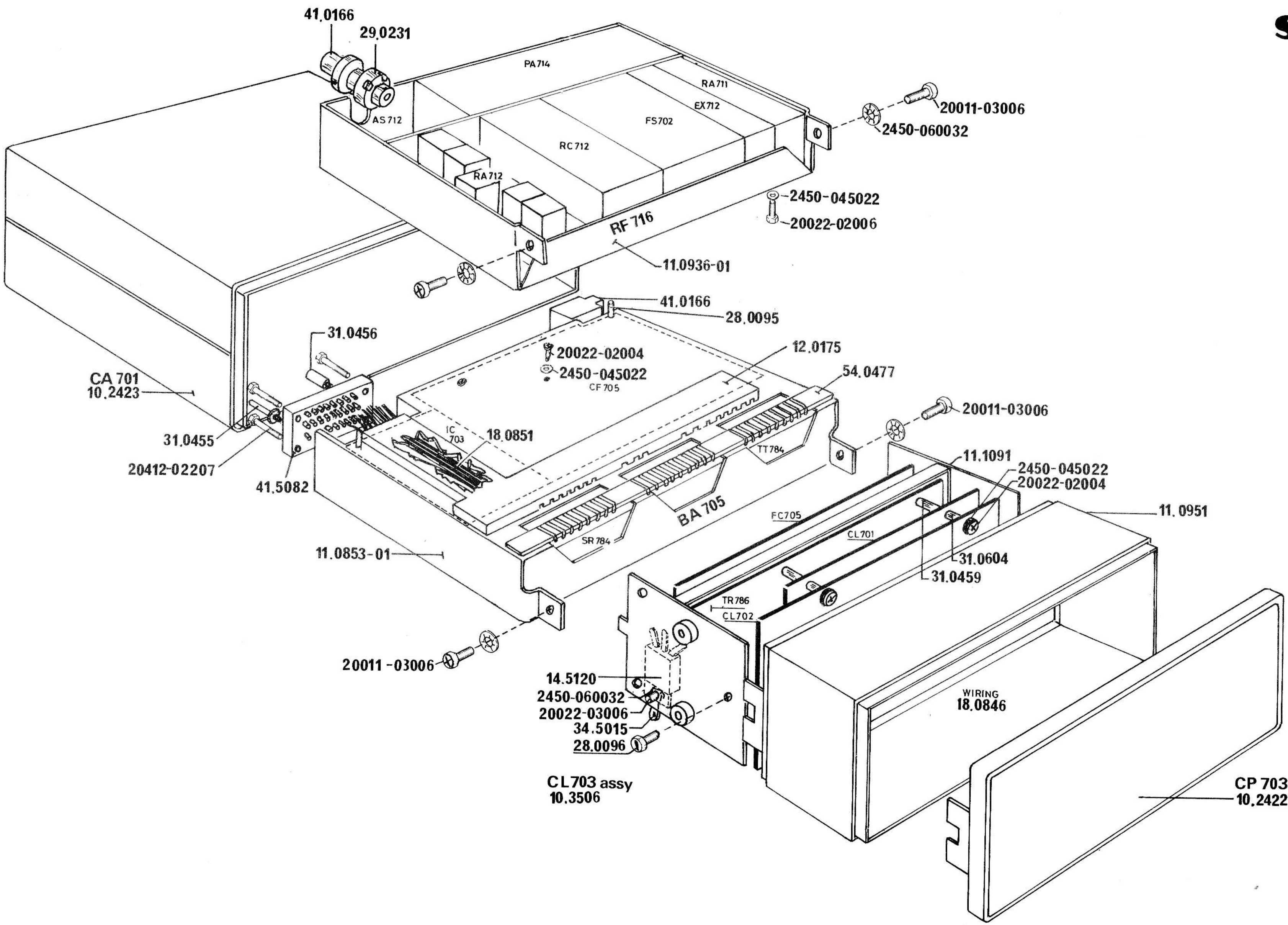
Storno

TYPE	Nº	CODE	DATA

CONTROL UNIT CB705

X402.542

Storno



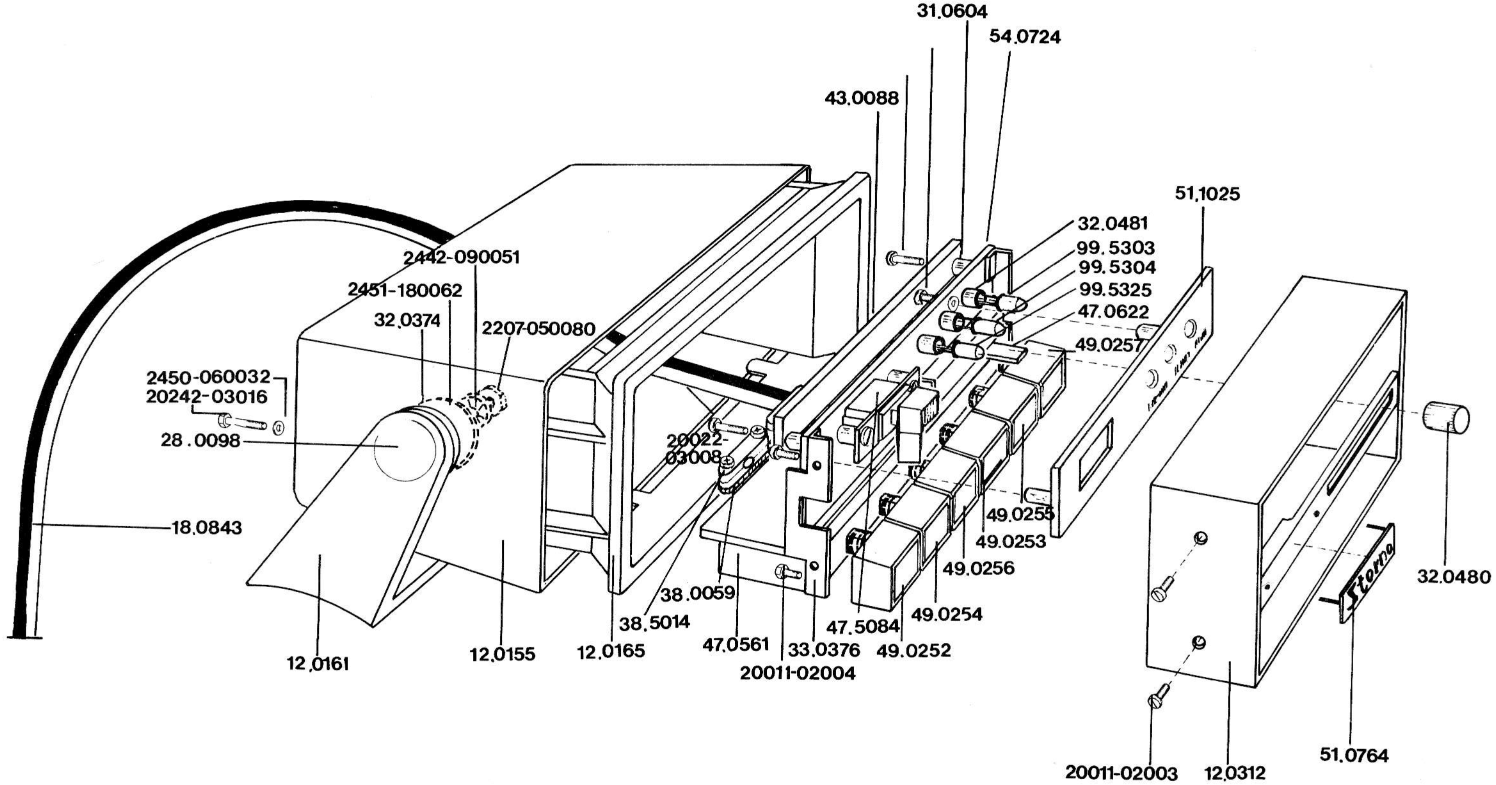
RADIOTELEPHONE

MECHANICAL LAY OUT

CQM713 P3

M405080

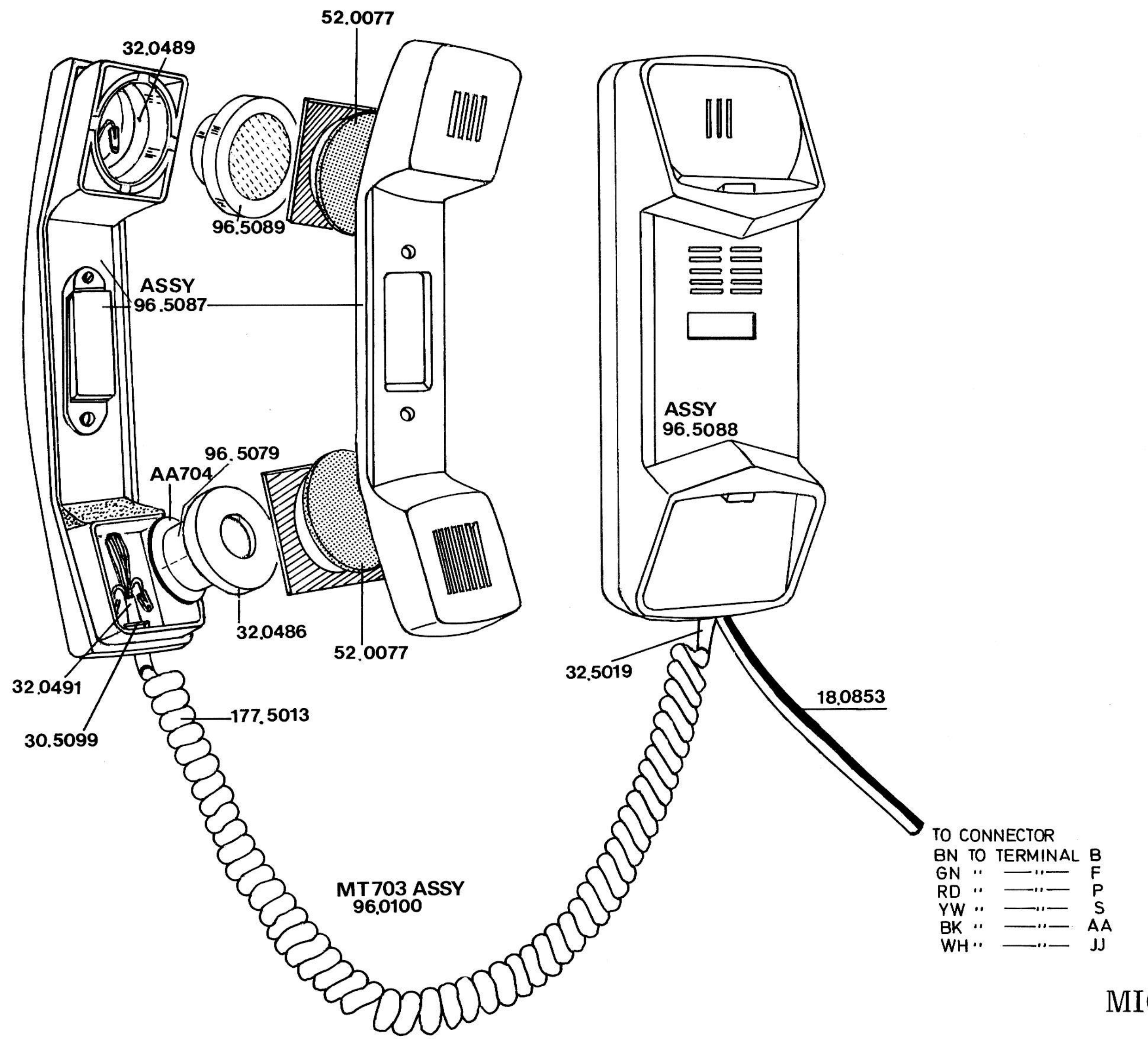
 Storno



CONTROL UNIT CB705

M405.078

Storno



MICROTELEPHONE MT703

M405.081