Storno

CHANNEL FREQUENCY SYNTHESIZER

FS5111 and FS5112

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

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

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

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

CIRCUIT DESCRIPTION

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

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

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

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

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

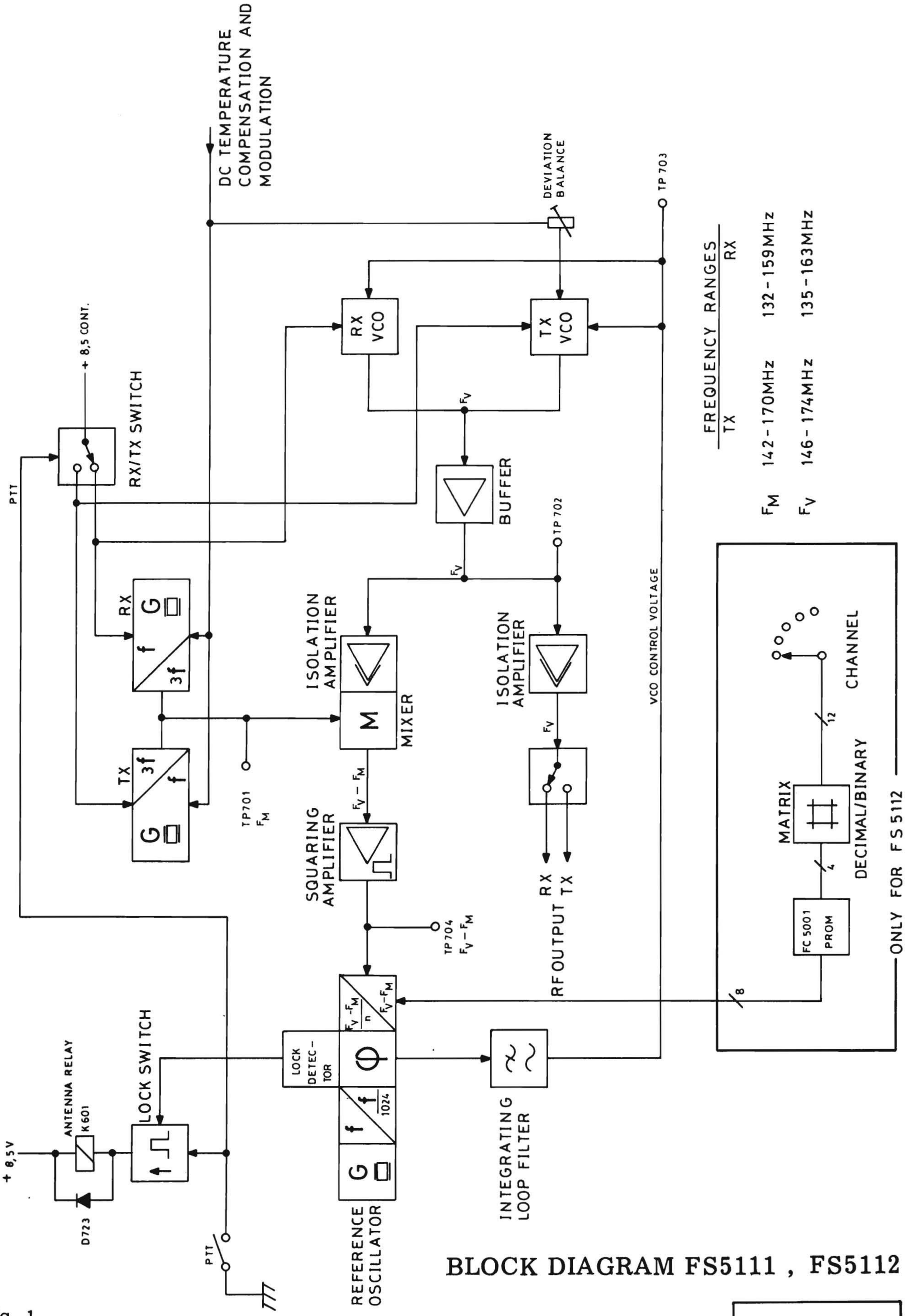

Fig. 1

BLOCK DIAGRAM FS5111 , FS5112

D402873

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

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

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

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

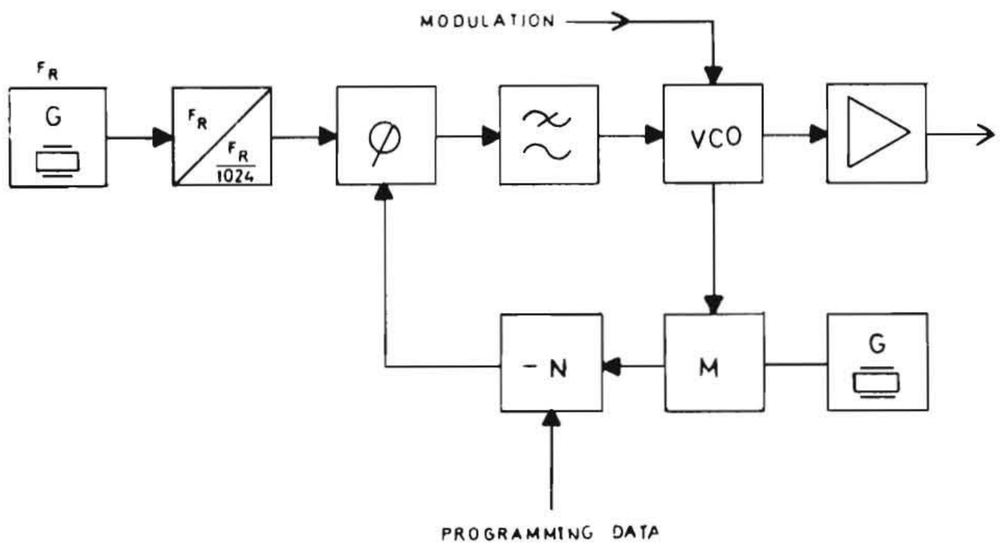

Fig. 2 Phase Locked loop Principle

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

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

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

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

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

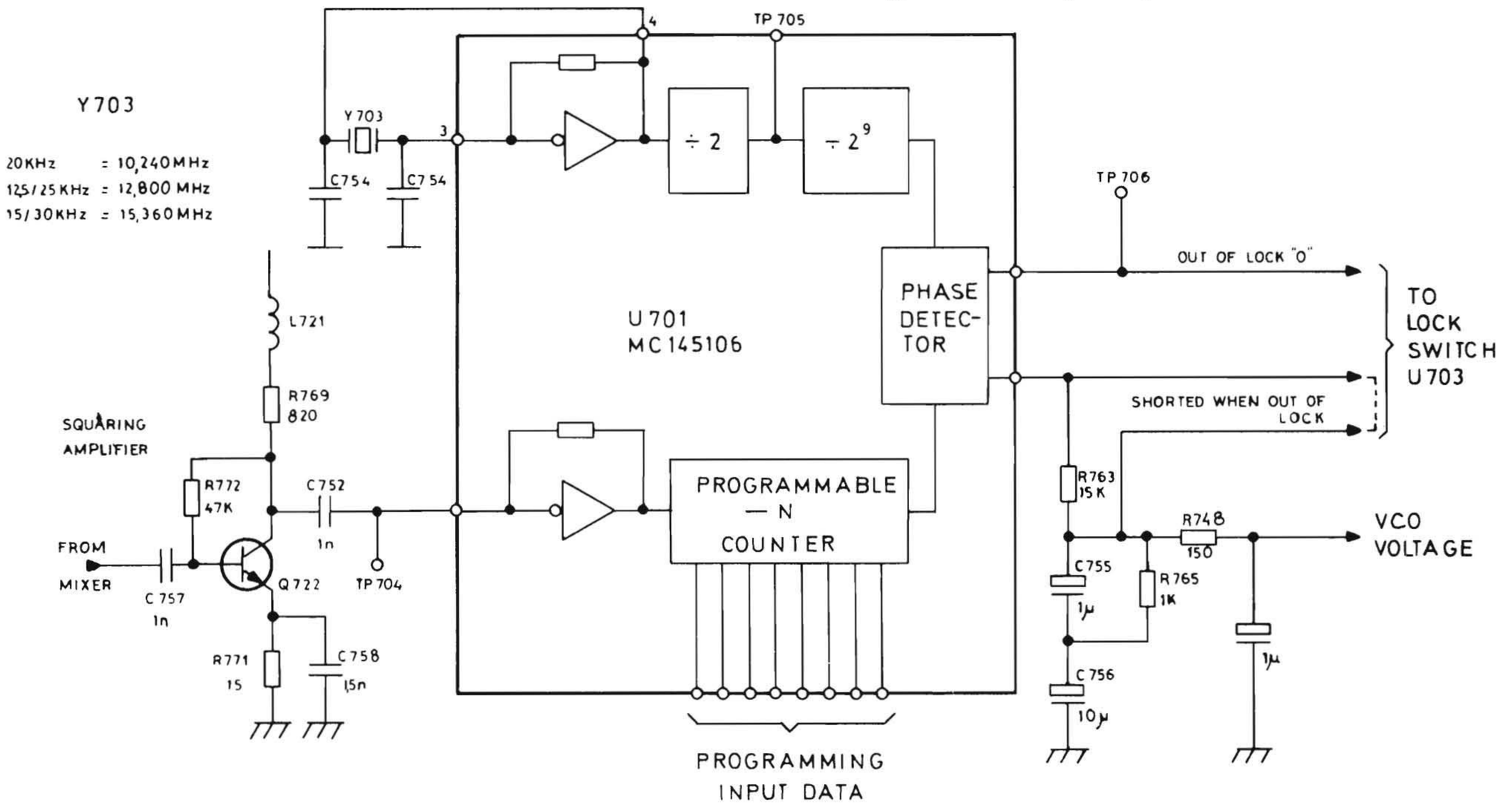

Fig. 3. REFERENCE OSCILLATOR, DIVIDER, AND PHASE DETECTOR

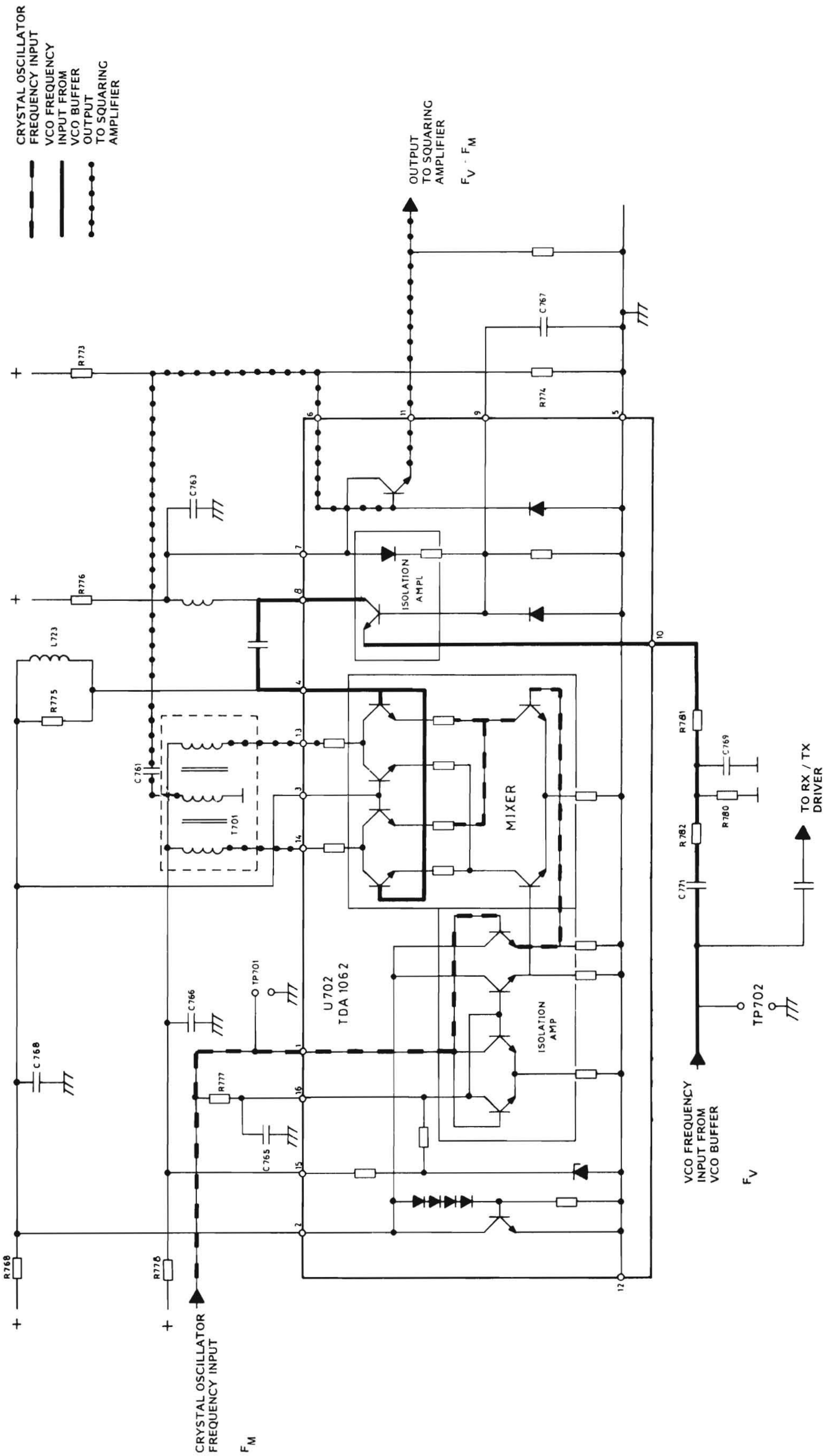

Fig 4. Synthesizer Mixer and Isolation Amplifiers, U702.

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

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

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

TECHNICAL SPECIFICATIONS

Supply Voltage
+8.5 Volts regulated
+13.2 Volts unregulated

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

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

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

Modulation Bandwidth
70 - 3000 Hz

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

DC Temperature Stabilization Voltage
$25^{o}C$= 6 V ±10% (reference)
$-30^{o}C$= +350 mV ±10%
$-10^{o}C$= -50 mV ±10%
$+60^{o}C$= +50 mV ±10%

The voltage characteristic is approximately linear between these points.

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

TX Output Frequency Range
146 - 174 MHz (VCO)

RX Output Frequency Range
135 - 163 MHz (VCO)

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

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

Signal-to-Noise Ratio (S/N)

>100 dB

Δf= 25 kHz, BN= 10 kHz

Spurious Attenuation

>85 dB

Lock Time

<30 m sec.

for 1 MHz step

Logic Control Level

LOW= <2 V

HIGH= >6 V

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

Temperature range

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

Dimensions

135 x 190 x 45 mm (BxDxH)

Weight

PC board: 150 g

Shield: 75 g

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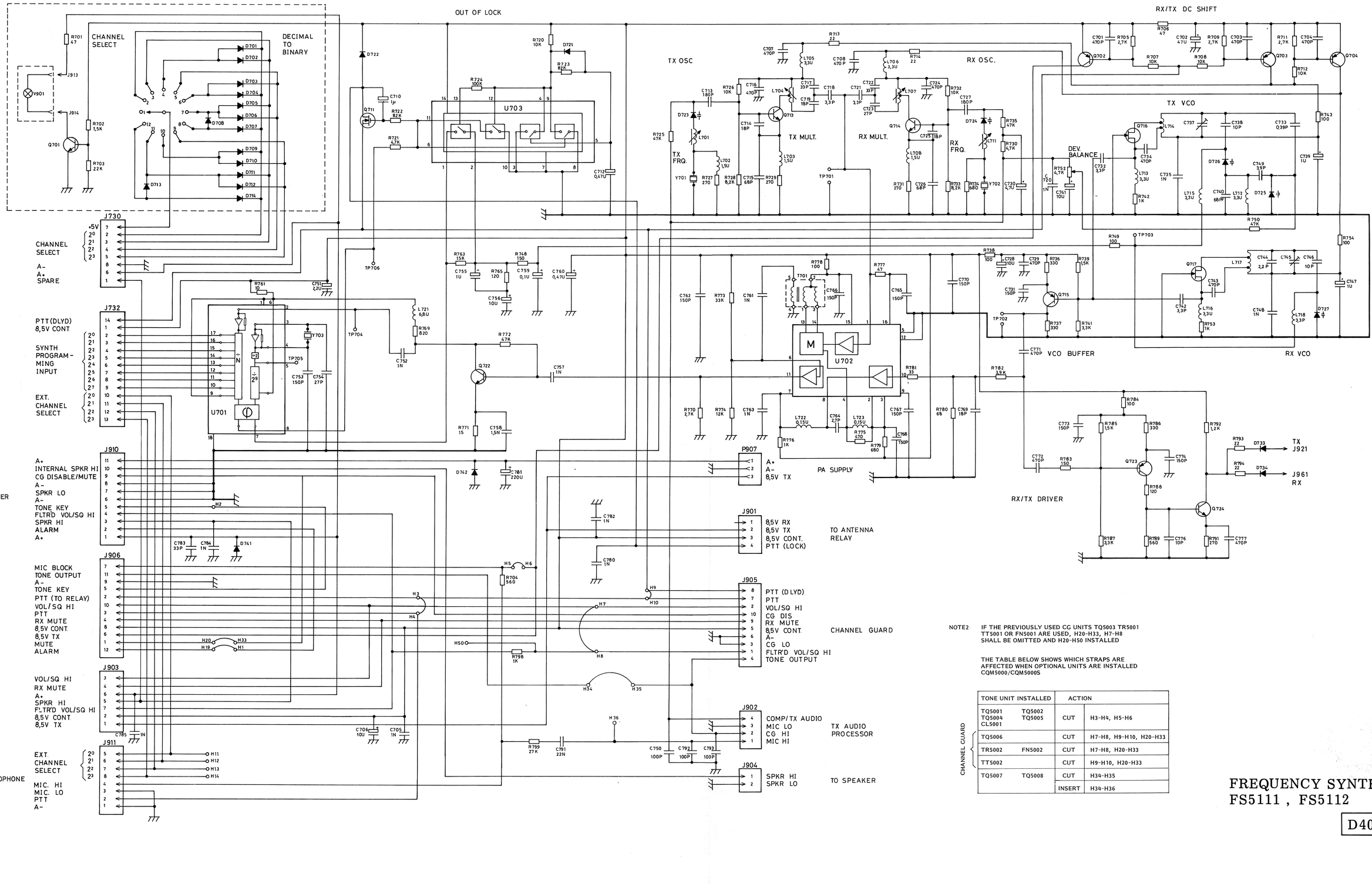

NOTE2 IF THE PREVIOUSLY USED CG UNITS TQ5003 TR5001 TT5001 OR FN5001 ARE USED, H20-H33, H7-H8 SHALL BE OMITTED AND H20-H50 INSTALLED

THE TABLE BELOW SHOWS WHICH STRAPS ARE AFFECTED WHEN OPTIONAL UNITS ARE INSTALLED CQM5000/CQM5000S

CHANNEL GUARD

TONE UNIT INSTALLED		ACTION	
TQ5001 TQ5004 CL5001	TQ5002 TQ5005	CUT	H3-H4, H5-H6
TQ5006		CUT	H7-H8, H9-H10, H20-H33
TR5002	FN5002	CUT	H7-H8, H20-H33
TT5002		CUT	H9-H10, H20-H33
TQ5007	TQ5008	CUT	H34-H35
		INSERT	H34-H36

FREQUENCY SYNTHESIZER FS5111 , FS5112

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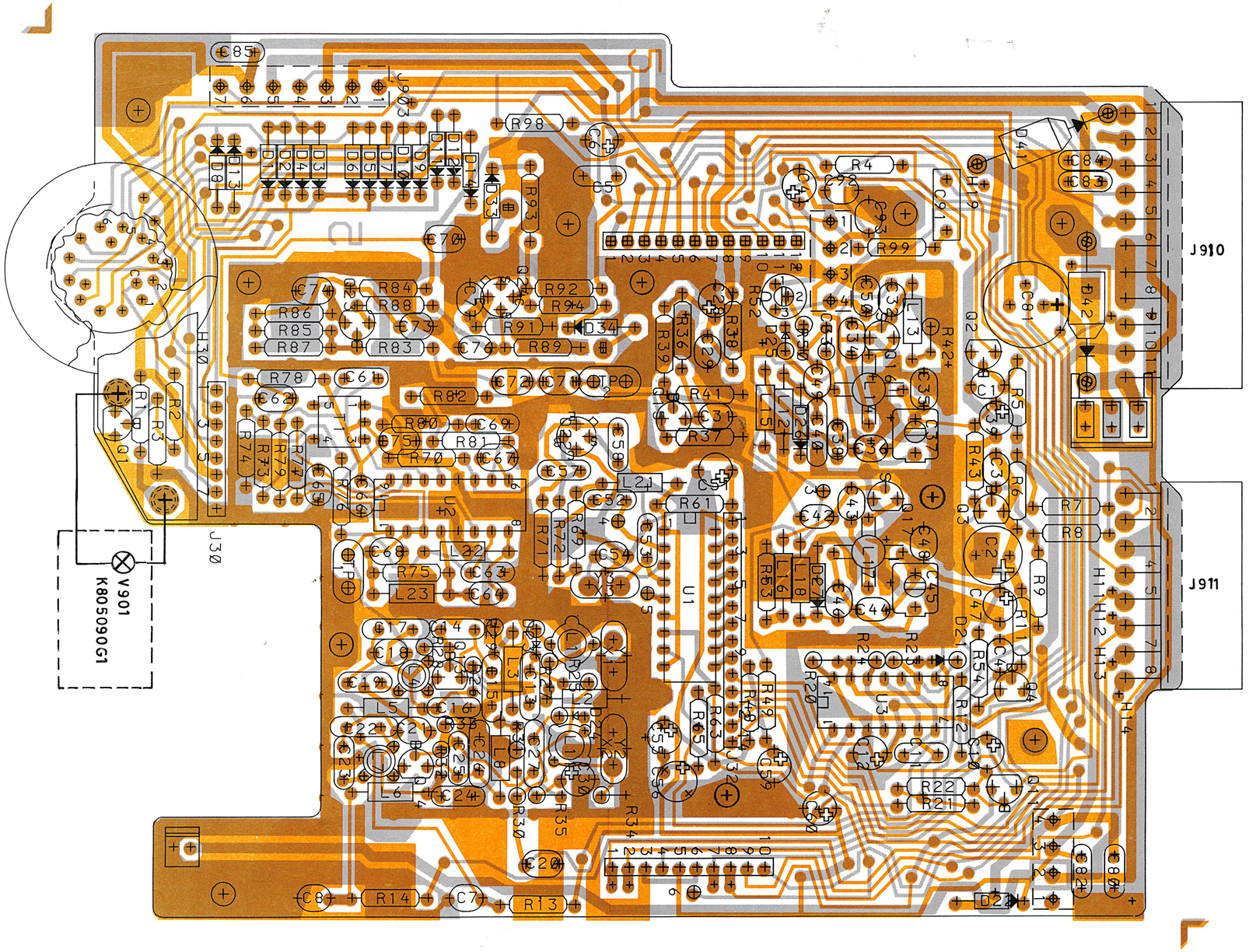

TYPE	CODE NO.
FS5331	M905054G1
FS5332	M905054G2
FS5111	M905054G3
FS5112	M905054G4
FS5661	M905054G5
FS5662	M905054G6
FS5551	M905054G7
FS5552	M905054G8

FREQUENCY SYNTHESIZER
FS5X1, FS5XX2

COMPONENT LAYOUT D402.886/3

Nº	CODE	DATA	
C701	A700233P5	470 pF Capacitor Ceramic	50 V
C702	J706005P3	47 uF Capacitor Electrolytic	16 V
C703	A700233P5	470 pF Capacitor Ceramic	50 V
C704	A700233P5	470 pF Capacitor Ceramic	50 V
C705	A700233P7	1 nF Capacitor Ceramic	50 V
C706	A701534P7	10 uF Capacitor Tantalum	16 V
C707	A700233P5	470 pF Capacitor Ceramic	50 V
C708	A700233P5	470 pF Capacitor Ceramic	50 V
C710	A701534P1	0.1 uF Capacitor tantal	35 V
C711	A700234P9	22 nF Capacitor Pol	50 V
C712	A701534P3	0.47 uF Capacitor Tantal	35 V
C713	A700235P28	180 pF Capacitor Ceramic	50 V
C714	J706256P202	18 pF N1500 Capacitor Ceramic	
C715	J706256P205	68 pF N1500 Capacitor Ceramic	
C716	A700233P5	470 pF Capacitor Ceramic	50 V
C717	A700235P19	33 pF Capacitor Ceramic	50 V
C718	A700235P7	3.3 pF Capacitor Ceramic	50 V
C719	A700235P16	18 pF Capacitor Ceramic	50 V
C720	A700233P7	1 nF Capacitor Ceramic	50 V
C721	A700235P7	3.3 pF Capacitor Ceramic	50 V
C722	A700235P19	33 pF Capacitor Ceramic	50 V
C723	A700235P18	27 pF Capacitor Ceramic	50 V
C724	A700233P5	470 pF Capacitor Ceramic	50 V
C725	J706256P202	18 pF N1500 Capacitor Ceramic	50 V
C726	J706256P205	68 pF N1500 Capacitor Ceramic	50 V
C727	A700235P28	180 pF Capacitor Ceramic	50 V
C728	A701534P7	10 uF Capacitor Tantalum	16 V
C729	A700233P5	470 pF Capacitor Ceramic	50 V
C730	A701534P6	4.7 uF Capacitor Tantalum	35 V
C731	A700233P2	150 pF Capacitor Ceramic	50 V
C732	A700235P7	3.3 pF Capacitor Ceramic	50 V
C733	A700013P8	0.39 pF Capacitor Phenolic	500 V
C734	A700233P5	470 pF Capacitor Ceramic	50 V
C735	A700233P7	1 nF Capacitor Ceramic	50 V
C737	J706003P1	1.8-10 pF Capacitor Variable	
C738	A700235P13	10 pF Capacitor Ceramic	50 V
C739	A701534P4	1 uF Capacitor Tantalum	35 V
C740	A700235P23	68 pF Capacitor Ceramic	50 V
C741	A701534P7	10 uF Capacitor Tantalum	16 V
C742	A700235P7	3.3 pF Capacitor Ceramic	50 V
C743	A700233P5	470 pF Capacitor Ceramic	50 V
C744	A700235P5	2.2 pF Capacitor Ceramic	50 V

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Nº	CODE	DATA	
C745	J706003P2	2-18 pF Capacitor Variable	
C746	A700235P13	10 pF Capacitor Ceramic	50 V
C747	A701534P4	1 uF Capacitor Tantalum	35 V
C748	A700233P7	1 nF Capacitor Ceramic	50 V
C749	A700235P8	3.9 pF Capacitor Ceramic	50 V
C750	A700233P1	100 pF Capacitor Ceramic	50 V
C751	A701534P5	2.2 uF Capacitor Tantalum	35 V
C752	A700233P7	1 nF Capacitor Ceramic	50 V
C753	A700233P2	150 pF Capacitor Ceramic	50 V
C754	A700235P18	27 pF Capacitor Ceramic	50 V
C755	A701534P4	1 uF Capacitor Tantalum	35 V
C756	A701534P7	10 uF Capacitor Tantalum	35 V
C757	A700233P7	1 nF Capacitor Ceramic	50 V
C758	A700233P8	1.5 nF Capacitor Ceramic	50 V
C759	A701534P1	0.1 uF Capacitor Tantalum	35 V
C760	A701534P3	0.47 uF Capacitor Tantalum	35 V
C761	A700233P7	1 nF Capacitor Ceramic	50 V
C762	A700233P2	150 pF Capacitor Ceramic	50 V
C763	A700233P7	1 nF Capacitor Ceramic	50 V
C764	A700235P6	2.7 pF Capacitor Ceramic	50 V
C765	A700233P2	150 pF Capacitor Ceramic	50 V
C766	A700233P2	150 pF Capacitor Ceramic	50 V
C767	A700233P2	150 pF Capacitor Ceramic	50 V
C768	A700233P2	150 pF Capacitor Ceramic	50 V
C769	A700235P16	18 pF Capacitor Ceramic	50 V
C770	A700233P2	150 pF Capacitor Ceramic	50 V
C771	A700233P5	470 pF Capacitor Ceramic	50 V
C772	A700233P5	470 pF Capacitor Ceramic	50 V
C773	A700233P2	150 pF Capacitor Ceramic	50 V
C774	A700233P2	150 pF Capacitor Ceramic	50 V
C776	A700235P13	10 pF Capacitor Ceramic	50 V
C777	A700233P5	470 pF Capacitor Ceramic	50 V
C780	A700233P7	1 nF Capacitor Ceramic	50 V
C781	J706005P10	220 uF Capacitor Electrolytic	25 V
C782	A700233P7	1 nF Capacitor Ceramic	50 V
C783	A700235P19	33 pF Capacitor Ceramic	50 V
C784	A700233P7	1 nF Capacitor Ceramic	50 V
C785	A700233P7	1 nF Capacitor Ceramic	50 V
C791	J706261P1	22 nF Capacitor Polyester	100 V
C792	A700233P1	100 pF Capacitor Ceramic	50 V
C793	A700233P1	100 pF Capacitor Ceramic	50 V
D721	A700028P1	1N4148 Diode Silicon	

FREQUENCY SYNTHESIZER FS5111

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Nº	CODE	DATA	
D722	A700028P1	1N4148 Diode Silicon	
D723	A706262P1	Variable Cap. Diode	
D724	J706262P1	Variable Cap. Diode	
D725	A700073P1	BB409 Variable Cap. Diode	
D726	A700073P1	BB409 Variable Cap. Diode	
D727	A700073P1	BB409 Variable Cap. Diode	
D733	J706006P2	BA282 Diode	
D734	J706006P2	BA282 Diode	
D741	J706026P1	1N5401 Diode Silicon	
D742	J706026P1	1N5401 Diode Silicon	
J730	J706215P108	Male Connector	8 pin
J732	J706215P114	Male Connector	14 pin
J901	J706214P4	Male Connector	4 pin
J902	J706214P4	Male Connector	4 pin
J903	J706214P7	Male Connector	7 pin
J904	A700072P28	Male Connector	2 pin
J905	A700072P9	Male Connector	10 pin
J906	A700072P11	Male Connector	12 pin
J907	A700102P10	Female Connector	3 pin
J910	J706223P11	Male Connector	11 pos
J911	J706223P8	Male Connector	8 pos
J921	J706219P1		pin
J961	J706219P1		pin
L701	J706029P4	Variable Coil	
L702	J708091P1	1.5 uH Coil	
L703	A708091P1	1.5 uH Coil	
L704	J706083P1	Variable Coil	
L705	A700024P19	3.3 uH Coil	
L706	A700024P19	3.3 uH Coil	
L707	J706083P1	Variable Coil	
L708	A700024P15	1.5 uH Coil	
L711	J706029P4	Variable Coil	
L712	A700024P19	3.3 uH Coil	
L713	A700024P19	3.3 uH Coil	
L714	J706258P1	Coil	
L715	A700024P19	3.3 uH Coil	
L716	A700024P19	3.3 uH Coil	
L717	J706258P1	Coil	
L718	A700024P19	3.3 uH Coil	
L721	A700024P23	6.8 uH Coil	
L722	A700024P3	0.15 uH Coil	
L723	A700024P3	0.15 uH Coil	

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Nº	CODE	DATA	
Q702	A700020P1	BC558 Transistor	
Q703	A700020P1	BC558 Transistor	
Q704	A700020P1	BC558 Transistor	
Q711	A707834P1	VN0610L Transistor	
Q713	J706283P1	BFR54 Transistor	
Q714	J706283P1	BFR54 Transistor	
Q715	J706264P1	BF414 Transistor	
Q716	J706038P1	2N5245 Transistor	
Q717	J706038P1	2N5245 Transistor	
Q722	J707515P1	BFX89 Transistor	
Q723	J706264P1	BF414 Transistor	
Q724	J707515P1	BFX89 Transistor	
R704	A700019P34	560 ohm Resistor Depos.	0.25 W
R705	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R706	A700019P21	47 ohm Resistor Depos.	0.25 W
R707	A700019P49	10 Kohm Resistor Depos.	0.25 W
R708	A700019P49	10 Kohm Resistor Depos.	0.25 W
R709	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R711	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R712	A700019P49	10 Kohm Resistor Depos.	0.25 W
R713	A700019P17	22 ohm Resistor Depos.	0.25 W
R714	A700019P17	22 ohm Resistor Depos.	0.25 W
R720	A700019P49	10 Kohm Resistor Depos.	0.25 W
R721	A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R722	A700019P60	82 Kohm Resistor Depos.	0.25 W
R723	A700019P60	82 Kohm Resistor Depos.	0.25 W
R724	A700019P61	100 Kohm Resistor Depos.	0.25 W
R725	A700019P57	47 Kohm Resistor Depos.	0.25 W
R726	A700019P49	10 Kohm Resistor Depos.	0.25 W
R727	A700019P30	270 ohm Resistor Depos.	0.25 W
R728	A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R729	A700019P30	270 ohm Resistor Depos.	0.25 W
R730	A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R731	A700019P30	270 ohm Resistor Depos.	0.25 W
R732	A700019P49	10 Kohm Resistor Depos.	0.25 W
R733	A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R734	A700019P35	680 ohm Resistor Depos.	0.25 W
R735	A700029P57	47 Kohm Resistor Depos.	0.25 W
R736	A700029P31	330 ohm Resistor Depos.	0.25 W
R737	A700019P31	330 ohm Resistor Depos.	0.25 W
R738	A700019P25	100 ohm Resistor Depos.	0.25 W
R739	A700019P39	1.5 Kohm Resistor Depos.	0.25 W

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Nº	CODE	DATA	
D722	A700028P1	1N4148 Diode Silicon	
D723	A706262P1	Variable Cap. Diode	
D724	J706262P1	Variable Cap. Diode	
D725	A700073P1	BB409 Variable Cap. Diode	
D726	A700073P1	BB409 Variable Cap. Diode	
D727	A700073P1	BB409 Variable Cap. Diode	
D733	J706006P2	BA282 Diode	
D734	J706006P2	BA282 Diode	
D741	J706026P1	1N5401 Diode Silicon	
D742	J706026P1	1N5401 Diode Silicon	
J730	J706215P108	Male Connector	8 pin
J732	J706215P114	Male Connector	14 pin
J901	J706214P4	Male Connector	4 pin
J902	J706214P4	Male Connector	4 pin
J903	J706214P7	Male Connector	7 pin
J904	A700072P28	Male Connector	2 pin
J905	A700072P9	Male Connector	10 pin
J906	A700072P11	Male Connector	12 pin
J907	A700102P10	Female Connector	3 pin
J910	J706223P11	Male Connector	11 pos
J911	J706223P8	Male Connector	8 pos
J921	J706219P1		pin
J961	J706219P1		pin
L701	J706029P4	Variable Coil	
L702	J708091P1	1.5 uH Coil	
L703	A708091P1	1.5 uH Coil	
L704	J706083P1	Variable Coil	
L705	A700024P19	3.3 uH Coil	
L706	A700024P19	3.3 uH Coil	
L707	J706083P1	Variable Coil	
L708	A700024P15	1.5 uH Coil	
L711	J706029P4	Variable Coil	
L712	A700024P19	3.3 uH Coil	
L713	A700024P19	3.3 uH Coil	
L714	J706258P1	Coil	
L715	A700024P19	3.3 uH Coil	
L716	A700024P19	3.3 uH Coil	
L717	J706258P1	Coil	
L718	A700024P19	3.3 uH Coil	
L721	A700024P23	6.8 uH Coil	
L722	A700024P3	0.15 uH Coil	
L723	A700024P3	0.15 uH Coil	

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Nº	CODE	DATA	
Q702	A700020P1	BC558 Transistor	
Q703	A700020P1	BC558 Transistor	
Q704	A700020P1	BC558 Transistor	
Q711	A707834P1	VN0610L Transistor	
Q713	J706283P1	BFR54 Transistor	
Q714	J706283P1	BFR54 Transistor	
Q715	J706264P1	BF414 Transistor	
Q716	J706038P1	2N5245 Transistor	
Q717	J706038P1	2N5245 Transistor	
Q722	J707515P1	BFX89 Transistor	
Q723	J706264P1	BF414 Transistor	
Q724	J707515P1	BFX89 Transistor	
R704	A700019P34	560 ohm Resistor Depos.	0.25 W
R705	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R706	A700019P21	47 ohm Resistor Depos.	0.25 W
R707	A700019P49	10 Kohm Resistor Depos.	0.25 W
R708	A700019P49	10 Kohm Resistor Depos.	0.25 W
R709	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R711	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R712	A700019P49	10 Kohm Resistor Depos.	0.25 W
R713	A700019P17	22 ohm Resistor Depos.	0.25 W
R714	A700019P17	22 ohm Resistor Depos.	0.25 W
R720	A700019P49	10 Kohm Resistor Depos.	0.25 W
R721	A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R722	A700019P60	82 Kohm Resistor Depos.	0.25 W
R723	A700019P60	82 Kohm Resistor Depos.	0.25 W
R724	A700019P61	100 Kohm Resistor Depos.	0.25 W
R725	A700019P57	47 Kohm Resistor Depos.	0.25 W
R726	A700019P49	10 Kohm Resistor Depos.	0.25 W
R727	A700019P30	270 ohm Resistor Depos.	0.25 W
R728	A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R729	A700019P30	270 ohm Resistor Depos.	0.25 W
R730	A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R731	A700019P30	270 ohm Resistor Depos.	0.25 W
R732	A700019P49	10 Kohm Resistor Depos.	0.25 W
R733	A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R734	A700019P35	680 ohm Resistor Depos.	0.25 W
R735	A700029P57	47 Kohm Resistor Depos.	0.25 W
R736	A700029P31	330 ohm Resistor Depos.	0.25 W
R737	A700019P31	330 ohm Resistor Depos.	0.25 W
R738	A700019P25	100 ohm Resistor Depos.	0.25 W
R739	A700019P39	1.5 Kohm Resistor Depos.	0.25 W

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Nº	CODE	DATA	
R741	A700019P43	3.3 Kohm Resistor Depos.	0.25 W
R742	A700019P37	1 Kohm Resistor Depos.	0.25 W
R743	A700019P25	100 ohm Resistor Depos.	0.25 W
R748	A700019P27	150 ohm Resistor Depos.	0.25 W
R749	A700019P25	100 ohm Resistor Depos.	0.25 W
R750	A700019P57	47 Kohm Resistor Depos.	0.25 W
R752	A700016P3	4.7 Kohm Resistor Variable	
R753	A700019P37	1 Kohm Resistor Depos.	0.25 W
R754	A700019P25	100 ohm Resistor Depos.	0.25 W
R761	A700019P13	10 ohm Resistor Depos.	0.25 W
R763	A700019P51	15 Kohm Resistor Depos.	0.25 W
R765	A700019P26	120 ohm Resistor Depos.	0.25 W
R769	A700019P36	820 ohm Resistor Depos.	0.25 W
R770	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R771	A700019P15	15 ohm Resistor Depos.	0.25 W
R772	A700019P57	47 Kohm Resistor Depos.	0.25 W
R773	A700019P55	33 Kohm Resistor Depos.	0.25 W
R774	A700019P50	12 Kohm Resistor Depos.	0.25 W
R775	A700019P33	470 ohm Resistor Depos.	0.25 W
R776	A700010P37	1 Kohm Resistor Depos.	0.25 W
R777	A700019P21	47 ohm Resistor Depos.	0.25 W
R778	A700019P25	100 ohm Resistor Depos.	0.25 W
R779	A700019P34	560 ohm Resistor Depos.	0.25 W
R780	A700019P23	68 ohm Resistor Depos.	0.25 W
R781	A700019P19	33 ohm Resistor Depos.	0.25 W
R782	A700019P44	3.9 Kohm Resistor Depos.	0.25 W
R783	A700019P27	150 ohm Resistor Depos.	0.25 W
R784	A700019P25	100 ohm Resistor Depos.	0.25 W
R785	A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R786	A700019P31	330 ohm Resistor Depos.	0.25 W
R787	A700019P43	3.3 Kohm Resistor Depos.	0.25 W
R788	A700019P26	120 ohm Resistor Depos.	0.25 W
R789	A700019P34	560 ohm Resistor Depos.	0.25 W
R791	A700019P30	270 ohm Resistor Depos.	0.25 W
R792	A700019P38	1.2 Kohm Resistor Depos.	0.25 W
R793	A700019P17	22 ohm Resistor Depos.	0.25 W
R794	A700019P17	22 ohm Resistor Depos.	0.25 W
R798	A700019P37	1 Kohm Resistor Depos.	0.25 W
R799	A700019P54	27 Kohm Resistor Depos.	0.25 W
T701	J706284G1	Transformer	
U701	J706263P1	MC145106	
U702	J706238P1	TDA1062S IC	

Storno

Nº	CODE	DATA
U703	A700029P44	4066B IC
W1	A700184P1	Jumper
W2	A700184P1	Jumper

FREQUENCY SYNTHESIZER FS5111

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Nº	CODE	DATA	
C701	A700233P5	470 pF Capacitor Ceramic	50 V
C702	J706005P3	47 uF Capacitor Electrolytic	16 V
C703	A700233P5	470 pF Capacitor Ceramic	50 V
C704	A700233P5	470 pF Capacitor Ceramic	50 V
C705	A700233P7	1 nF Capacitor Ceramic	50 V
C706	A701534P7	10 uF Capacitor Tantalum	16 V
C707	A700233P5	470 pF Capacitor Ceramic	50 V
C708	A700233P5	470 pF Capacitor Ceramic	50 V
C710	A701534P1	0.1 uF Capacitor tantal	35 V
C711	A700234P9	22 nF Capacitor Pol	50 V
C712	A701534P3	0.47 uF Capacitor Tantal	35 V
C713	A700235P28	180 pF Capacitor Ceramic	50 V
C714	J706256P202	18 pF N1500 Capacitor Ceramic	
C715	J706256P205	68 pF N1500 Capacitor Ceramic	
C716	A700233P5	470 pF Capacitor Ceramic	50 V
C717	A700235P19	33 pF Capacitor Ceramic	50 V
C718	A700235P7	3.3 pF Capacitor Ceramic	50 V
C719	A700235P16	18 pF Capacitor Ceramic	50 V
C720	A700233P7	1 nF Capacitor Ceramic	50 V
C721	A700235P7	3.3 pF Capacitor Ceramic	50 V
C722	A700235P19	33 pF Capacitor Ceramic	50 V
C723	A700235P18	27 pF Capacitor Ceramic	50 V
C724	A700233P5	470 pF Capacitor Ceramic	50 V
C725	J706256P202	18 pF N1500 Capacitor Ceramic	50 V
C726	J706256P205	68 pF N1500 Capacitor Ceramic	50 V
C727	A700235P28	180 pF Capacitor Ceramic	50 V
C728	A701534P7	10 uF Capacitor Tantalum	16 V
C729	A700233P5	470 pF Capacitor Ceramic	50 V
C730	A701534P6	4.7 uF Capacitor Tantalum	35 V
C731	A700233P2	150 pF Capacitor Ceramic	50 V
C732	A700235P7	3.3 pF Capacitor Ceramic	50 V
C733	A700013P8	0.39 pF Capacitor Phenolic	500 V
C734	A700233P5	470 pF Capacitor Ceramic	50 V
C735	A700233P7	1 nF Capacitor Ceramic	50 V
C737	J706003P1	1.8-10 pF Capacitor Variable	
C738	A700235P13	10 pF Capacitor Ceramic	50 V
C739	A701534P4	1 uF Capacitor Tantalum	35 V
C740	A700235P23	68 pF Capacitor Ceramic	50 V
C741	A701534P7	10 uF Capacitor Tantalum	16 V
C742	A700235P7	3.3 pF Capacitor Ceramic	50 V
C743	A700233P5	470 pF Capacitor Ceramic	50 V
C744	A700235P5	2.2 pF Capacitor Ceramic	50 V

Storno

Nº	CODE	DATA	
C745	J706003P2	2-18 pF Capacitor Variable	
C746	A700235P13	10 pF Capacitor Ceramic	50 V
C747	A701534P4	1 uF Capacitor Tantalum	35 V
C748	A700233P7	1 nF Capacitor Ceramic	50 V
C749	A700235P8	3.9 pF Capacitor Ceramic	50 V
C750	A700233P1	100 pF Capacitor Ceramic	50 V
C751	A701534P5	2.2 uF Capacitor Tantalum	35 V
C752	A700233P7	1 nF Capacitor Ceramic	50 V
C753	A700233P2	150 pF Capacitor Ceramic	50 V
C754	A700235P18	27 pF Capacitor Ceramic	50 V
C755	A701534P4	1 uF Capacitor Tantalum	35 V
C756	A701534P7	10 uF Capacitor Tantalum	35 V
C757	A700233P7	1 nF Capacitor Ceramic	50 V
C758	A700233P8	1.5 nF Capacitor Ceramic	50 V
C759	A701534P1	0.1 uF Capacitor Tantalum	35 V
C760	A701534P3	0.47 uF Capacitor Tantalum	35 V
C761	A700233P7	1 nF Capacitor Ceramic	50 V
C762	A700233P2	150 pF Capacitor Ceramic	50 V
C763	A700233P7	1 nF Capacitor Ceramic	50 V
C764	A700235P6	2.7 pF Capacitor Ceramic	50 V
C765	A700233P2	150 pF Capacitor Ceramic	50 V
C766	A700233P2	150 pF Capacitor Ceramic	50 V
C767	A700233P2	150 pF Capacitor Ceramic	50 V
C768	A700233P2	150 pF Capacitor Ceramic	50 V
C769	A700235P16	18 pF Capacitor Ceramic	50 V
C770	A700233P2	150 pF Capacitor Ceramic	50 V
C771	A700233P5	470 pF Capacitor Ceramic	50 V
C772	A700233P5	470 pF Capacitor Ceramic	50 V
C773	A700233P2	150 pF Capacitor Ceramic	50 V
C774	A700233P2	150 pF Capacitor Ceramic	50 V
C776	A700235P13	10 pF Capacitor Ceramic	50 V
C777	A700233P5	470 pF Capacitor Ceramic	50 V
C780	A700233P7	1 nF Capacitor Ceramic	50 V
C781	J706005P10	220 uF Capacitor Electrolytic	25 V
C782	A700233P7	1 nF Capacitor Ceramic	50 V
C783	A700235P19	33 pF Capacitor Ceramic	50 V
C784	A700233P7	1 nF Capacitor Ceramic	50 V
C785	A700233P7	1 nF Capacitor Ceramic	50 V
C791	J706261P1	22 nF Capacitor Polyester	100 V
C792	A700233P1	100 pF Capacitor Ceramic	50 V
C793	A700233P1	100 pF Capacitor Ceramic	50 V
D701	A700028P1	1N4148 Diode Silicon	

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Nº	CODE	DATA	
D702	A700028P1	1N4148 Diode Silicon	
D703	A700028P1	1N4148 Diode Silicon	
D704	A700028P1	1N4148 Diode Silicon	
D705	A700028P1	1N4148 Diode Silicon	
D706	A700028P1	1N4148 Diode Silicon	
D707	A700028P1	1N4148 Diode Silicon	
D708	A700028P1	1N4148 Diode Silicon	
D709	A700028P1	1N4148 Diode Silicon	
D710	A700028P1	1N4148 Diode Silicon	
D711	A700028P1	1N4148 Diode Silicon	
D712	A700028P1	1N4148 Diode Silicon	
D713	A700028P1	1N4148 Diode Silicon	
D714	A700028P1	1N4148 Diode Silicon	
D721	A700028P1	1N4148 Diode Silicon	
D722	A700028P1	1N4148 Diode Silicon	
D723	A706262P1	Variable Cap. Diode	
D724	J706262P1	Variable Cap. Diode	
D725	A700073P1	BB409 Variable Cap. Diode	
D726	A700073P1	BB409 Variable Cap. Diode	
D727	A700073P1	BB409 Variable Cap. Diode	
D733	J706006P2	BA282 Diode	
D734	J706006P2	BA282 Diode	
D741	J706026P1	1N5401 Diode Silicon	
D742	J706026P1	1N5401 Diode Silicon	
J730	J706215P108	Male Connector	8 pin
J732	J706215P114	Male Connector	14 pin
J901	J706214P4	Male Connector	4 pin
J902	J706214P4	Male Connector	4 pin
J903	J706214P7	Male Connector	7 pin
J904	A700072P28	Male Connector	2 pin
J905	A700072P9	Male Connector	10 pin
J906	A700072P11	Male Connector	12 pin
J907	A700102P10	Female Connector	3 pin
J910	J706223P11	Male Connector	11 pos
J911	J706223P8	Male Connector	8 pos
J921	J706219P1		pin
J961	J706219P1		pin
L701	J706029P4	Variable Coil	
L702	J708091P1	1.5 uH Coil	
L703	A708091P1	1.5 uH Coil	
L704	J706083P1	Variable Coil	
L705	A700024P19	3.3 uH Coil	

Nº	CODE	DATA	
L706	A700024P19	3.3 uH Coil	
L707	J706083P1	Variable Coil	
L708	A700024P15	1.5 uH Coil	
L711	J706029P4	Variable Coil	
L712	A700024P19	3.3 uH Coil	
L713	A700024P19	3.3 uH Coil	
L714	J706258P1	Coil	
L715	A700024P19	3.3 uH Coil	
L716	A700024P19	3.3 uH Coil	
L717	J706258P1	Coil	
L718	A700024P19	3.3 uH Coil	
L721	A700024P23	6.8 uH Coil	
L722	A700024P3	0.15 uH Coil	
L723	A700024P3	0.15 uH Coil	
Q701	A700017P1	BC548 Transistor	
Q702	A700020P1	BC558 Transistor	
Q703	A700020P1	BC558 Transistor	
Q704	A700020P1	BC558 Transistor	
Q711	A707834P1	VN0610L Transistor	
Q713	J706283P1	BFR54 Transistor	
Q714	J706283P1	BFR54 Transistor	
Q715	J706264P1	BF414 Transistor	
Q716	J706038P1	2N5245 Transistor	
Q717	J706038P1	2N5245 Transistor	
Q722	J707515P1	BFX89 Transistor	
Q723	J706264P1	BF414 Transistor	
Q724	J707515P1	BFX89 Transistor	
R701	A700019P21	47 ohm Resistor Depos.	0.25 W
R702	A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R703	A700019P53	22 Kohm Resistor Depos.	0.25 W
R704	A700019P34	560 ohm Resistor Depos.	0.25 W
R705	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R706	A700019P21	47 ohm Resistor Depos.	0.25 W
R707	A700019P49	10 Kohm Resistor Depos.	0.25 W
R708	A700019P49	10 Kohm Resistor Depos.	0.25 W
R709	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R711	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R712	A700019P49	10 Kohm Resistor Depos.	0.25 W
R713	A700019P17	22 ohm Resistor Depos.	0.25 W
R714	A700019P17	22 ohm Resistor Depos.	0.25 W
R720	A700019P49	10 Kohm Resistor Depos.	0.25 W
R721	A700019P45	4.7 Kohm Resistor Depos.	0.25 W

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Nº	CODE	DATA	
R722	A700019P60	82 Kohm Resistor Depos.	0.25 W
R723	A700019P60	82 Kohm Resistor Depos.	0.25 W
R724	A700019P61	100 Kohm Resistor Depos.	0.25 W
R725	A700019P57	47 Kohm Resistor Depos.	0.25 W
R726	A700019P49	10 Kohm Resistor Depos.	0.25 W
R727	A700019P30	270 ohm Resistor Depos.	0.25 W
R728	A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R729	A700019P30	270 ohm Resistor Depos.	0.25 W
R730	A700019P45	4.7 Kohm Resistor Depos.	0.25 W
R731	A700019P30	270 ohm Resistor Depos.	0.25 W
R732	A700019P49	10 Kohm Resistor Depos.	0.25 W
R733	A700019P48	8.2 Kohm Resistor Depos.	0.25 W
R734	A700019P35	680 ohm Resistor Depos.	0.25 W
R735	A700029P57	47 Kohm Resistor Depos.	0.25 W
R736	A700029P31	330 ohm Resistor Depos.	0.25 W
R737	A700019P31	330 ohm Resistor Depos.	0.25 W
R738	A700019P25	100 ohm Resistor Depos.	0.25 W
R739	A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R741	A700019P43	3.3 Kohm Resistor Depos.	0.25 W
R742	A700019P37	1 Kohm Resistor Depos.	0.25 W
R743	A700019P25	100 ohm Resistor Depos.	0.25 W
R748	A700019P27	150 ohm Resistor Depos.	0.25 W
R749	A700019P25	100 ohm Resistor Depos.	0.25 W
R750	A700019P57	47 Kohm Resistor Depos.	0.25 W
R752	A700016P3	4.7 Kohm Resistor Variable	
R753	A700019P37	1 Kohm Resistor Depos.	0.25 W
R754	A700019P25	100 ohm Resistor Depos.	0.25 W
R761	A700019P13	10 ohm Resistor Depos.	0.25 W
R763	A700019P51	15 Kohm Resistor Depos.	0.25 W
R765	A700019P26	120 ohm Resistor Depos.	0.25 W
R769	A700019P36	820 ohm Resistor Depos.	0.25 W
R770	A700019P42	2.7 Kohm Resistor Depos.	0.25 W
R771	A700019P15	15 ohm Resistor Depos.	0.25 W
R772	A700019P57	47 Kohm Resistor Depos.	0.25 W
R773	A700019P55	33 Kohm Resistor Depos.	0.25 W
R774	A700019P50	12 Kohm Resistor Depos.	0.25 W
R775	A700019P33	470 ohm Resistor Depos.	0.25 W
R776	A700010P37	1 Kohm Resistor Depos.	0.25 W
R777	A700019P21	47 ohm Resistor Depos.	0.25 W
R778	A700019P25	100 ohm Resistor Depos.	0.25 W
R779	A700019P34	560 ohm Resistor Depos.	0.25 W
R780	A700019P23	68 ohm Resistor Depos.	0.25 W

Storno

Nº	CODE	DATA	
R781	A700019P19	33 ohm Resistor Depos.	0.25 W
R782	A700019P44	3.9 Kohm Resistor Depos.	0.25 W
R783	A700019P27	150 ohm Resistor Depos.	0.25 W
R784	A700019P25	100 ohm Resistor Depos.	0.25 W
R785	A700019P39	1.5 Kohm Resistor Depos.	0.25 W
R786	A700019P31	330 ohm Resistor Depos.	0.25 W
R787	A700019P43	3.3 Kohm Resistor Depos.	0.25 W
R788	A700019P26	120 ohm Resistor Depos.	0.25 W
R789	A700019P34	560 ohm Resistor Depos.	0.25 W
R791	A700019P30	270 ohm Resistor Depos.	0.25 W
R792	A700019P38	1.2 Kohm Resistor Depos.	0.25 W
R793	A700019P17	22 ohm Resistor Depos.	0.25 W
R794	A700019P17	22 ohm Resistor Depos.	0.25 W
R798	A700019P37	1 Kohm Resistor Depos.	0.25 W
R799	A700019P54	27 Kohm Resistor Depos.	0.25 W
S901	J706322G1	Channel Switch	
T701	J706284G1	Transformer	
U701	J706263P1	MC145106	
U702	J706238P1	TDA1062S IC	
U703	A700029P44	4066B IC	
V901	K805090G1	LMP	
W1	A700184P1	Jumper	
W2	A700184P1	Jumper	

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