Storno

MAINTENANCE
MANUAL

STORNOPHONE 700

MAINTENANCE MANUAL

VOLUME II

Volume II

Contents

Service Coordination

2 - 79

Storno

MICROPHONE AMPLIFIER AA701

Technical Specifications

Supply Voltage
9 V and 12 V

Output Impedance
600 Ω

Bandwidth
300 Hz to 3000 Hz

Nominal Output Level
–17 dBm

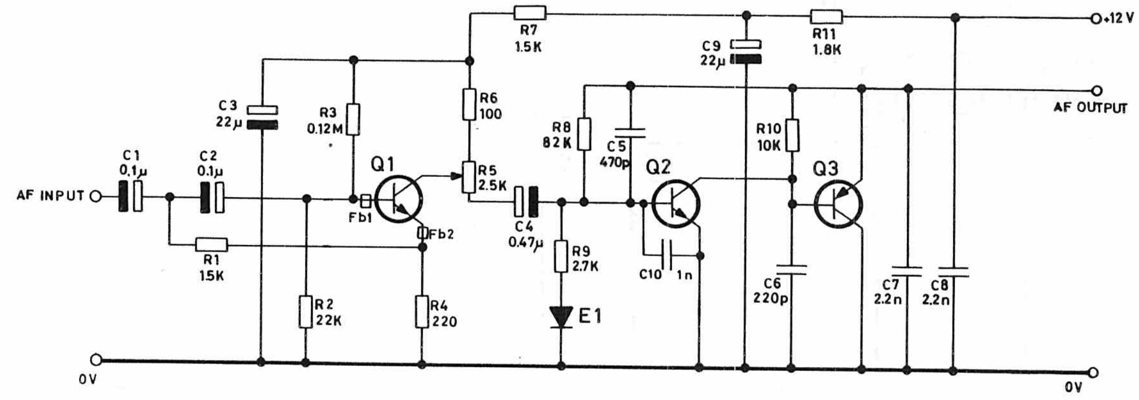
Maximum Output Level
+3 dBm

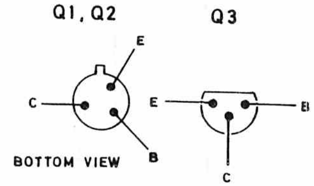
Distortion at –17 dBm
$\leq$ 3%

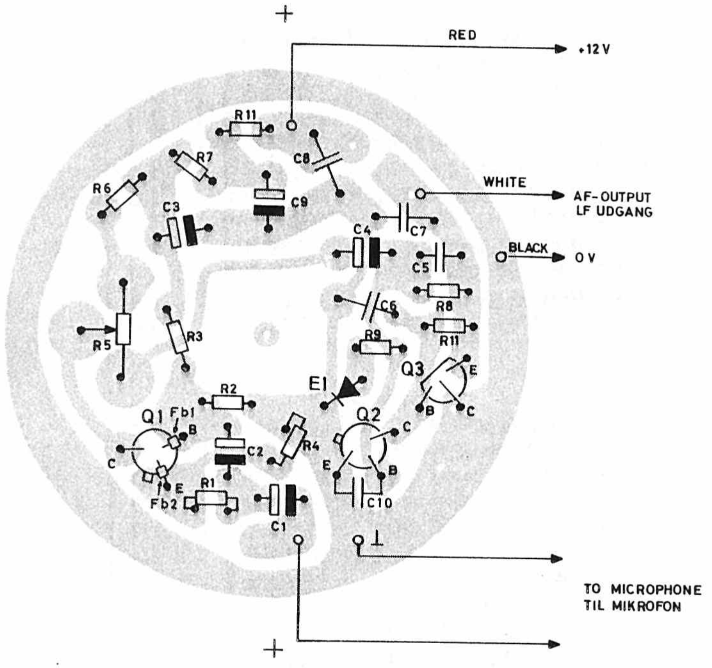
Gain (at 1000 Hz)
Maximum: 50 dB/– 3 dB
Minimum: 20 dB/ +3 dB

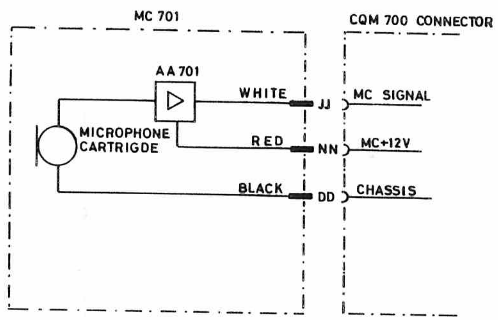
Temperature Range
–25° to +60°C

Current Drain
$\leq$12 mA









PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

AF AMPLIFIER
LF FORSTÆRKER

AA701

D 401.216/3

Storno

TYPE	NO.	CODE	DATA	
AA701		10.2488	Microphone Amplifier	
	C1	73.5130	0.1 μF -20 +60% tantal	20 V
	C2	73.5130	0.1 μF -20 +60% tantal	20 V
	C3	73.5127	22 μF 20% tantal	16 V
	C4	73.5134	0.47 μF -20 +60% tantal	20 V
	C5	76.5106	470 pF 5% polystyr TB	25 V
	C6	76.5104	220 pF 5% polystyr TB	25 V
	C7	76.5059	2.2 nF 10% polyest. FL	50 V
	C8	76.5059	2.2 nF 10% polyest. FL	50 V
	C9	73.5127	22 μF 20% tantal	16 V
	C10	74.5155	1 nF -20 +80% ceram PL	63 V
	R1	80.5251	1.5 KΩ 5% carbon film	1/8W
	R2	80.5265	22 KΩ 5% carbon film	1/8W
	R3	80.5274	0.12 MΩ 5% carbon film	1/8W
	R4	89.5241	220 Ω 5% carbon film	1/8W
	R5	86.5067	2.5 KΩ 20% potentiometer	0.1W
	R6	80.5237	100 Ω 5% carbon film	1/8W
	R7	80.5251	1.5 KΩ 5% carbon film	1/8W
	R8	80.5272	82 KΩ 5% carbon film	1/8W
	R9	80.5254	2.7 KΩ carbon film	1/8W
	R10	80.5261	10 KΩ 5% carbon film	1/8W
	R11	80.5252	1.8 KΩ carbon film	1/8W
	E1	99.5028	1N914 Diode	
	Q1	99.5121	BC107 Transistor	
	Q2	99.5121	BC107 Transistor	
	Q3	99.5144-02	BC214 L Transistor	
	Fb1	65.5102	Ferrit bead	
	Fb2	65.5102	Ferrit bead	

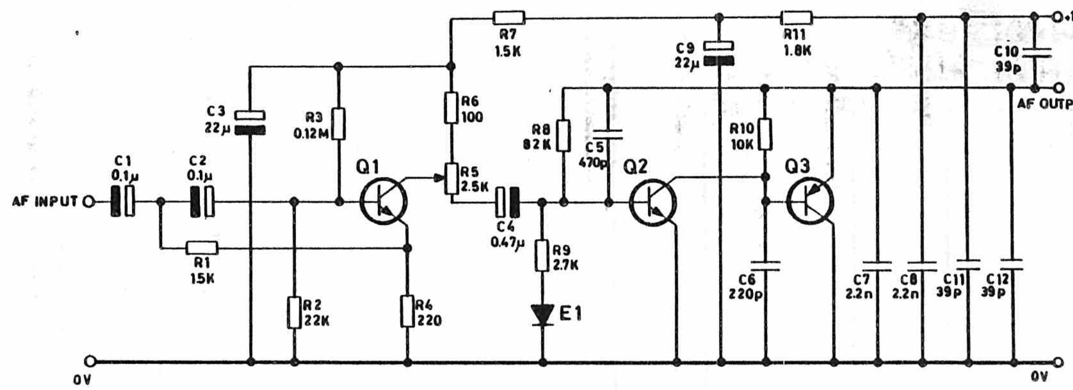
Storno

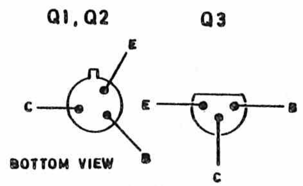
TYPE	NO.	CODE	DATA

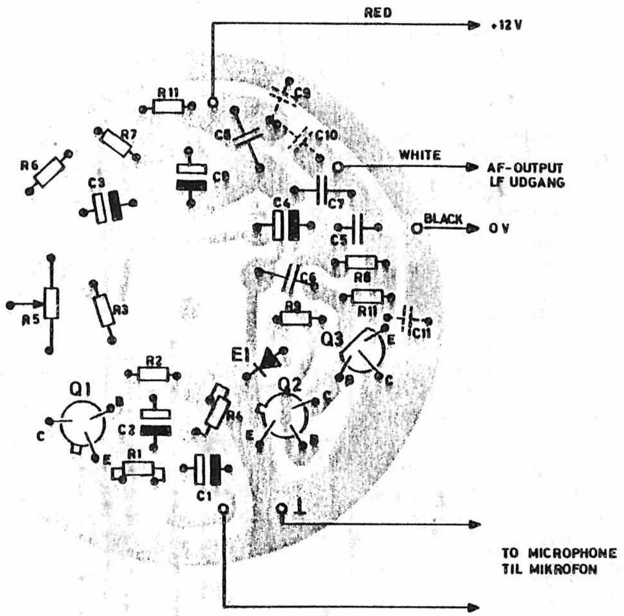
MICROPHONE AMPLIFIER
MIKROFONFORSTÆRKER

AA701

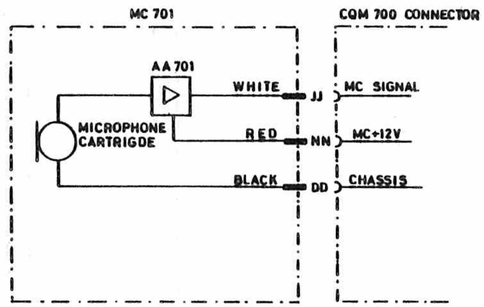
X401.318/3







PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.



AF AMPLIFIER AA701
LF FORSTÆRKER

D 401.216/2

Storno

TYPE	NO.	CODE	DATA	
AA701		10.2488	Microphone Amplifier	
	C1	73.5130	0.1 μF -20 +60% tantal	20 V
	C2	73.5130	0.1 μF -20 +60% tantal	20 V
	C3	73.5127	22 μF 20% tantal	16 V
	C4	73.5134	0.47 μF -20 +60% tantal	20 V
	C5	76.5106	470 pF 5% polystyr TB	25 V
	C6	76.5104	220 pF 5% polystyr TB	25 V
	C7	76.5059	2.2 nF 10% polyest. FL	50 V
	C8	76.5059	2.2 nF 10% polyest. FL	50 V
	C9	73.5127	22 μF 20% tantal	16 V
	C10	74.5187	39 pF 10% ceram PL	25 V
	C11	74.5187	39 pF 10% ceram PL	25 V
	C12	74.5187	39 pF 10% ceram PL	25 V
	R1	80.5251	1.5 KΩ 5% carbon film	1/8W
	R2	80.5265	22 KΩ 5% carbon film	1/8W
	R3	80.5274	0.12 MΩ 5% carbon film	1/8W
	R4	89.5241	220 Ω 5% carbon film	1/8W
	R5	86.5067	2.5 KΩ 20% potentiometer	0.1W
	R6	80.5237	100 Ω 5% carbon film	1/8W
	R7	80.5251	1.5 KΩ 5% carbon film	1/8W
	R8	80.5272	82 KΩ 5% carbon film	1/8W
	R9	80.5254	2.7 KΩ carbon film	1/8W
	R10	80.5261	10 KΩ 5% carbon film	1/8W
	E1	99.5028	1N914 Diode	
	Q1	99.5121	BC107 Transistor	
	Q2	99.5121	BC107 Transistor	
	Q3	99.5043	NS6063 Transistor	

Storno

TYPE	NO.	CODE	DATA

MICROPHONE AMPLIFIER
MIKROFONFORSTÆRKER

AA701

X401.318/2

MICROPHONE AMPLIFIER AA702

Technical Specifications

Supply Voltage

9 V

Input Impedance

600 Ω

Output Impedance

560 Ω

Bandwidth

300 Hz to 3000 Hz

Nominal Output Level

–17 dBm

Maximum Output Level

+ 3dBm

Distortion (–17 dBm to +3 dBm)

≤ 3%

Gain

Maximum: 44 dB ± 4 dB

Minimum: 26 dB ± 4 dB

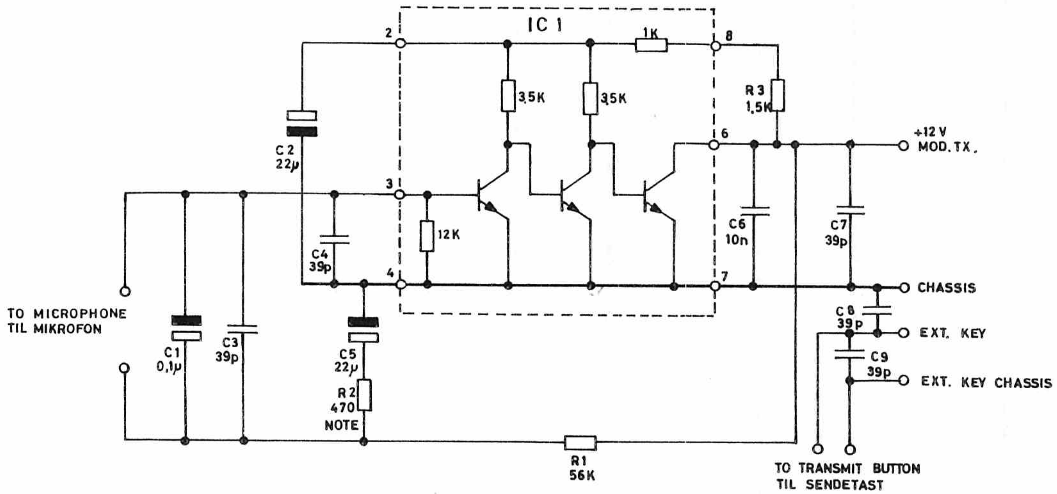
Temperature Range

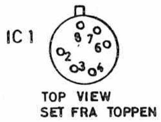
–25° to +60°C

Current Drain

10 mA ± 2 mA

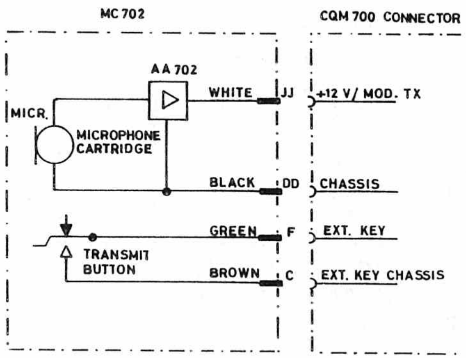
Storno

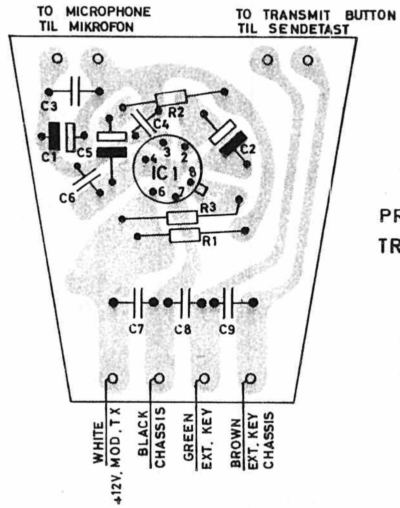




NOTE: HIGHER OR LOWER AMPLIFICATION
CAN BE ADJUSTED BY MEANS OF R2

C3, C4, C7, C8 AND C9 ON SOLDERING SIDE





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

AF AMPLIFIER
LF FORSTÆRKER

AA702

D401.713

Storno

TYPE	NO.	CODE	DATA
AA 702		10.2548	Microphone Preamplifier
	C1	73.5089	0.1μF 20% tantal 35V
	C2	73.5127	22μF 20% tantal 16V
	C3	74.5187	39pF 10% ceram PL 25V
	C4	74.5187	39pF 10% ceram PL 25V
	C5	73.5127	22μF 20% tantal 16V
	C6	76.5070	10nF 10% polyest FL 50V
	C7	74.5187	39pF 10% ceram PL 25V
	C8	74.5187	39pF 10% ceram PL 25V
	C9	74.5187	39pF 10% ceram PL 25V
	R1	80.5270	56kΩ 5% carbon film 1/8W
	R2	80.5245	470Ω 5% " 1/8W
	R3	80.5251	1.5kΩ 5% " 1/8W
	IC1	14.5001	Integrated AF Amplifier 65dB 40mW

Storno

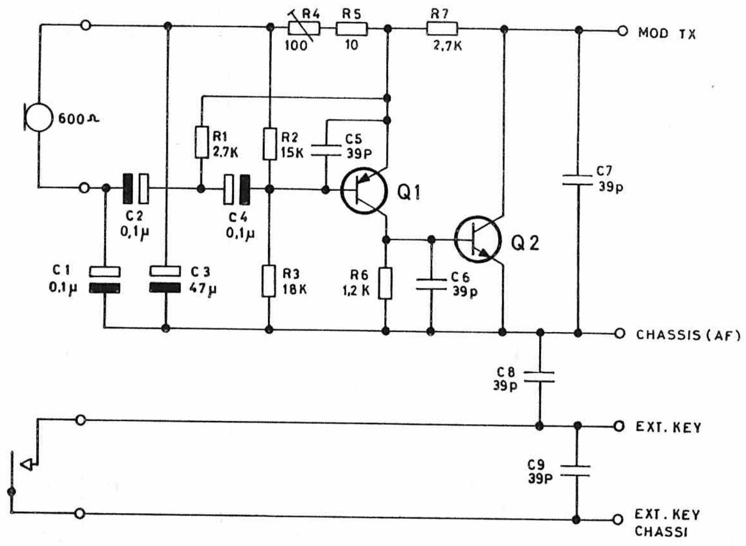
TYPE	NO.	CODE	DATA

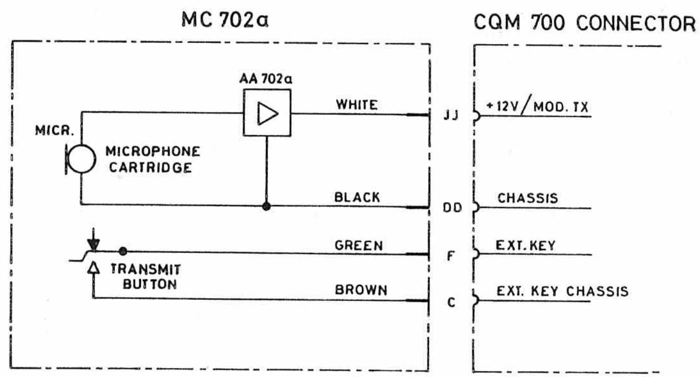
MICROPHONE PREAMPLIFIER
MIKROFONFORSTÆRKER

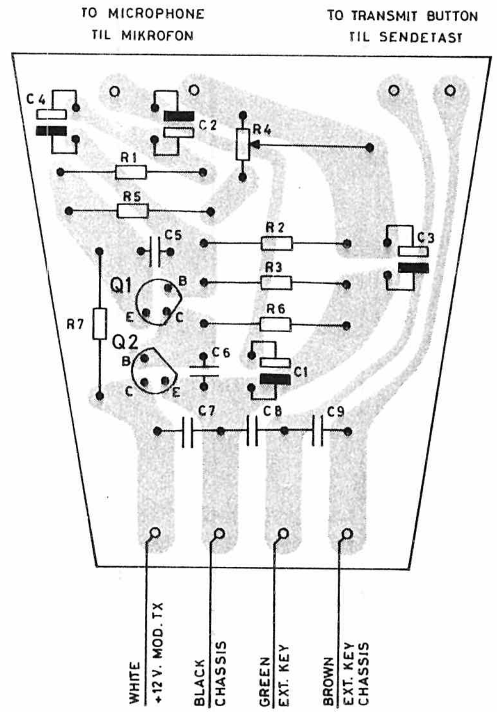
AA702

X401.938

Storno







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

Storno

MICROPHONE PREAMPLIFIER
MIKROFONFORSTÆRKER

AA702a

D 402.206

Storno

TYPE	NO.	CODE	DATA
MC702		96.0094-01	Fist Microphone
		96.5069	Microphone cartridge
		10.2548-01	AA702a Microphone Preamplifier
	O1	47.5040	Switch
AA702a		10.2548-01	Microphone Preamplifier
	C1	73.5089	0.1μF 20% tantal 35V
	C2	73.5089	0.1μF 20% tantal 35V
	C3	73.5124	47μF 20% tantal 6.3V
	C4	73.5089	0.1μF 20% tantal 30V
	C5	74.5137	39pF 10% ceram PL 25V
	C6	74.5137	39pF 10% ceram PL 25V
	C7	74.5137	39pF 10% ceram PL 25V
	C8	74.5137	39pF 10% ceram PL 25V
	C9	74.5137	39pF 10% ceram PL 25V
	R1	80.5254	2.7KΩ 5% carbon film 1/8W
	R2	80.5262	15KΩ 5% " 1/8W
	R3	80.5264	18KΩ 5% " 1/8W
	R4	86.5051	100Ω 20% potentiometer 1/10W
	R5	80.5225	10Ω 5% carbon film 1/8W
	R6	80.5254	2.7KΩ 5% " 1/8W
	R7	80.5254	2.7KΩ 5% " 1/8W
	Q1	99.5144	BC214L Transistor
	Q2	99.5117	2N2924 Transistor

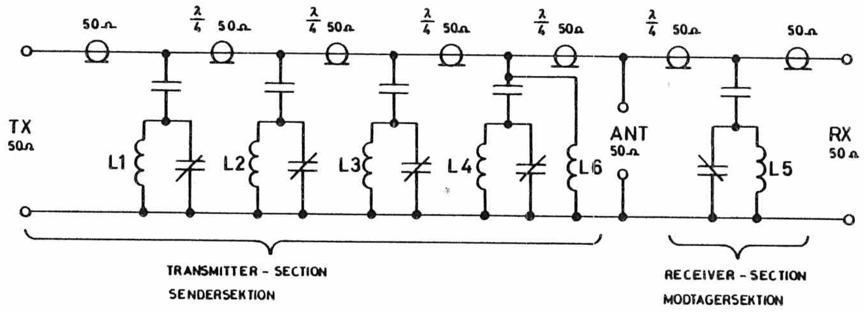
Storno

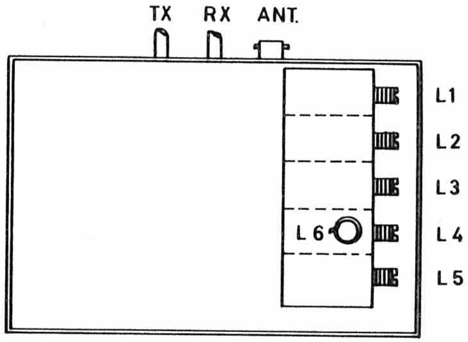
TYPE	NO.	CODE	DATA

FIST MICROPHONE
HÅNDMIKROFON

MC702

X401.939

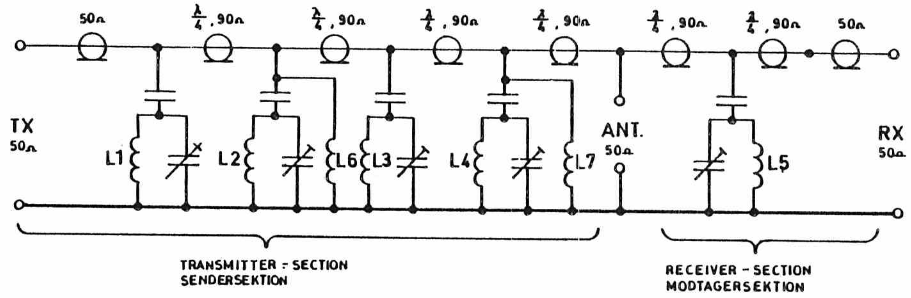


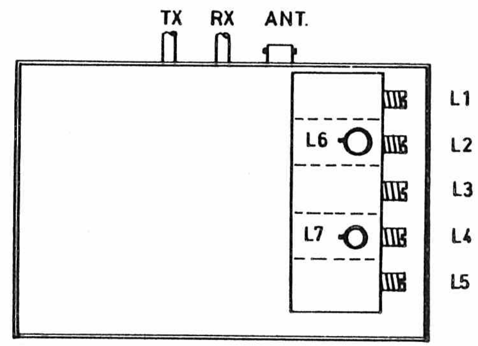


ANTENNA BRANCHING FILTER BF713

D401.990

Storno



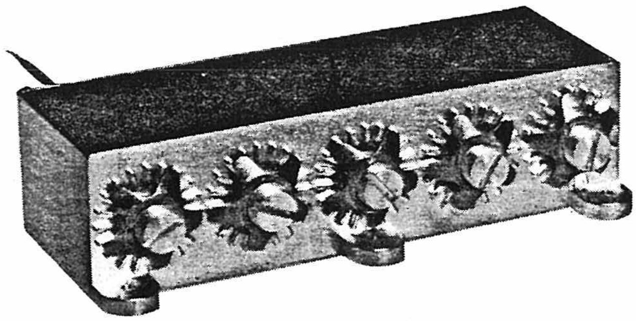


ANTENNA BRANCHING FILTER BF762

D401.989

 Storno

BAND-PASS FILTER BP711



Description

Band-pass filter BP711 is a highly selective, 5-element helix filter for the frequency band of 146 - 174 MHz.

BP711 is the preselector in CQM710, where the entire front-end selectivity is derived from this circuit.

The filter is built in a silver-plated metal box where each coil is placed in a separate compartment. Coupling between coils is accomplished through openings in the partitions between enclosures.

The input and output are inductively coupled to the first and last stages, respectively.

The coils are tuned by silver-plated slugs.

Technical Specifications

Frequency Range

146 - 174 MHz

Input Impedance

Nominal 50 Ω

Output Impedance

Nominal 50 Ω

Bandwidth

3 dB bandwidth: 3 MHz

40 dB bandwidth: 8 MHz

Insertion Loss

3.5 dB

Maximum Allowable Deviation from Centre Frequency

(between –30 and +75°C): ± 0.4 MHz

Temperature Range

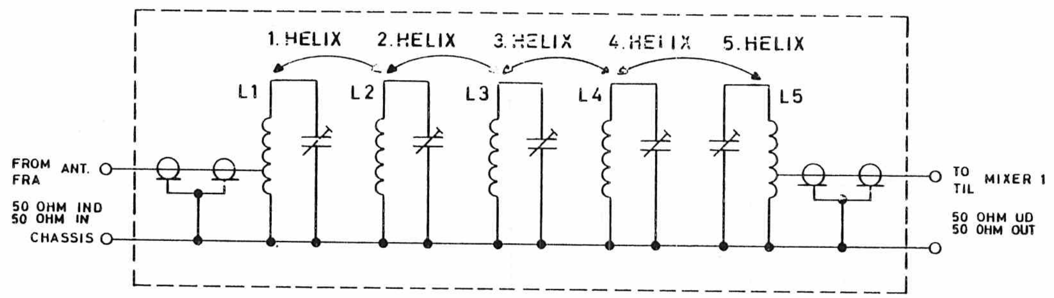
Operating range: –25° to +70°C

Functioning range: –30° to +75°C

Dimensions in mm:

h = 24, l = 91, b = 30 (without tuning slugs)

b = 43.5 (max. with tuning slugs)



BAND PASS FILTER
BÅNDPASFILTER

BP711

D 401.383

Storno

TYPE	NO.	CODE	DATA
BP711		10.2554	Band Pass Filter
	L1	62.0819	RF coil
	L2	62.0819	RF coil
	L3	62.0819	RF coil
	L4	62.0819	RF coil
	L5	62.0819	RF coil

Storno

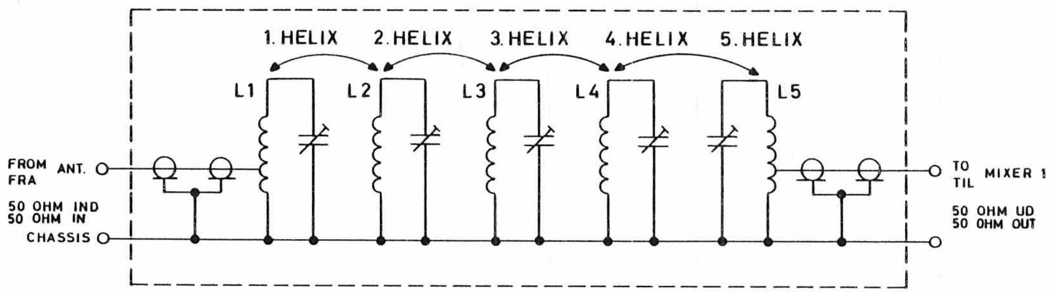
TYPE	NO.	CODE	DATA

BAND PASS FILTER
BÅNDPASFILTER

BP711

X401.381

Storno



BAND PASS FILTER BP712

D402.024

Storno

TYPE	Nº	CODE	DATA
BP712		10.3114-00	Band Pass Filter
	L1	62.0819	RF coil 146-174 MHz
	L2	62.0819	RF coil 146-174 MHz
	L3	62.0819	RF coil 146-174 MHz
	L4	62.0819	RF coil 146-174 MHz
	L5	62.0819	RF coil 146-174 MHz

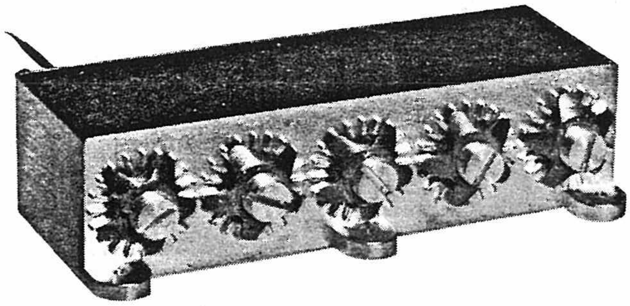
Storno

TYPE	Nº	CODE	DATA

BAND PASS FILTER BP712

X402.270

BAND-PASS FILTER BP731



Description

Band-pass filter BP731 is a highly selective, 5-element helix filter for the frequency band of 68 - 88 MHz.

BP731 is the preselector in CQM730, where the entire front-end selectivity is derived from this circuit.

The filter is built in a silver-plated metal box where each coil is placed in a separate compartment. Coupling between coils is accomplished through openings in the partitions between enclosures.

The input and output are inductively coupled to the first and last stages, respectively.

The coils are tuned by silver-plated slugs.

Technical Specifications

Frequency Range
68 - 88 Mhz

Input Impedance
Nominal 50 Ω

Output Impedance
Nominal 50 Ω

Bandwidth

3 dB bandwidth :	2.5 MHz
40 dB bandwidth :	6.5 MHz

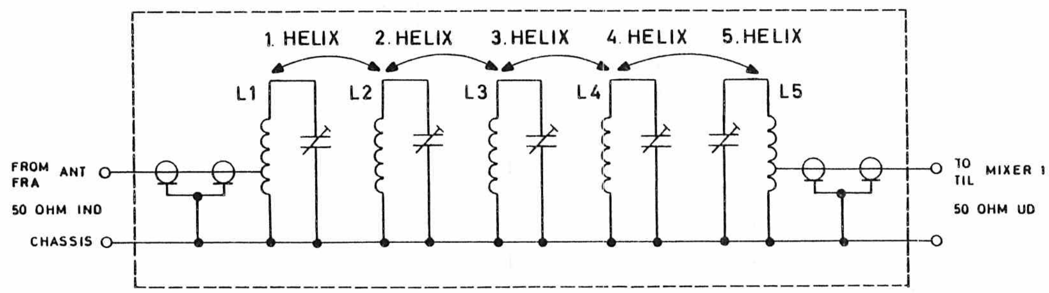
Insertion Loss
3.5 dB

Maximum Allowable Deviation from Centre Frequency
(between -30° and $+75^{\circ}$ C) ± 0.2 MHz

Temperature Range

Operating range	-25° to $+70^{\circ}$ C
Functioning range	-30° to $+75^{\circ}$ C

Dimensions in mm :
h = 24, l = 91, b = 30 (without tuning slugs)
b = 43.5 (max. with tuning slugs)



BAND PASS FILTER
BÅNDPASFILTER

BP731

D401.419

Storno

TYPE	NO.	CODE	DATA
BP731		10.2630-00	BAND PASS FILTER
	L1	62.0833	RF - coil
	L2	62.0834	RF - coil
	L3	62.0834	RF - coil
	L4	62.0834	RF - coil
	L5	62.0835	RF - coil

Storno

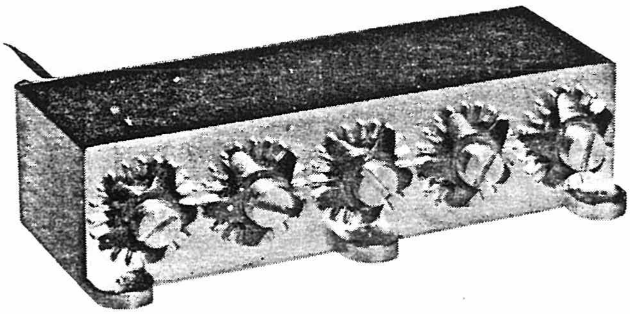
TYPE	NO.	CODE	DATA

BAND PASS FILTER
BÅNDPASFILTER

BP731

X401.536

BAND-PASS FILTER BP761



Description

Band-pass filter BP761 is a highly selective, 5-element helix filter for the frequency band of 420 - 470 MHz.

BP761 is the preselector in CQM760, where the entire front-end selectivity is derived from this circuit.

The filter is built in a silver-plated metal box where each coil is placed in a separate compartment. Coupling between coils is accomplished through openings in the partitions between enclosures.

The input and output are inductively coupled to the first and last stages, respectively.

The coils are tuned by silver-plated slugs.

Technical Specifications

Frequency Range

420 - 470 MHz

Input Impedance

Nominal 50 Ω

Output Impedance

Nominal 50 Ω

Bandwidth

3 dB bandwidth: 4 MHz

40 dB bandwidth: 12 MHz

Insertion Loss

3.5 dB

Maximum Allowable Deviation from Centre Frequency

(between –30° and +75°C): ± 0.6 MHz

Temperature Range

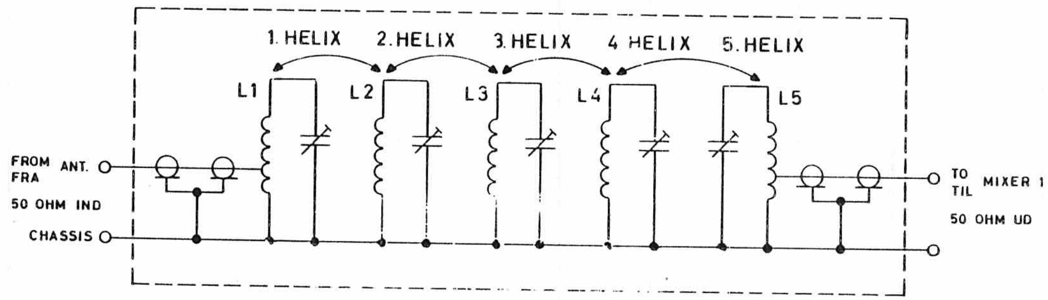
Operating range: –25° to +70°C

Functioning range: –30° to +80°C

Dimensions in mm

h = 24, l = 91, b = 30 (without tuning slugs)

b = 43.5 (max. with tuning slugs)



HELIXFILTER BP761

BAND PASS FILTER BP761

D401.325

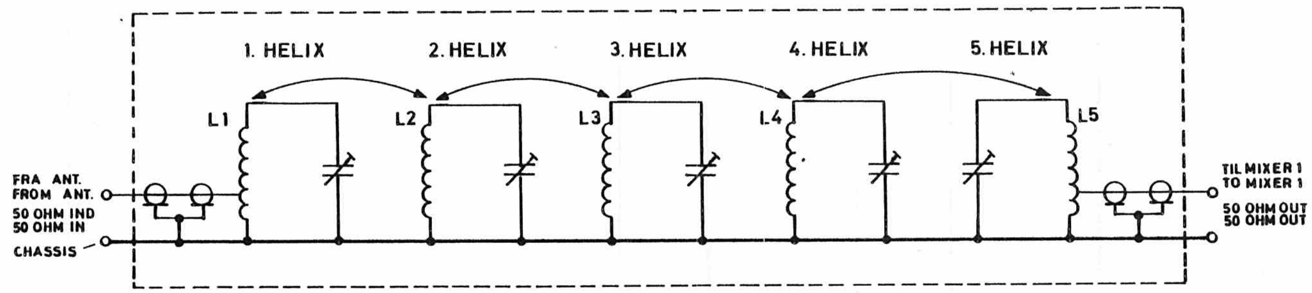
TYPE	NO.	CODE	DATA
BP761		10.2426	Helical Band Pass Filter
	L1	62.0793	Coil
	L2	62.0793	Coil
	L3	62.0793	Coil
	L4	62.0793	Coil
	L5	62.0793	Coil

Storno

TYPE	NO.	CODE	DATA

BAND PASS FILTER BP761

Storno



BAND PASS FILTER BP762

D402.010

Storno

TYPE	Nº	CODE	DATA
BP762		10.3115-00	Band Pass Filter
	L1	62.0793	Coil 420-470 MHz
	L2	62.0793	Coil 420-470 MHz
	L3	62.0793	Coil 420-470 MHz
	L4	62.0793	Coil 420-470 MHz
	L5	62.0793	Coil 420-470 MHz

Storno

TYPE	Nº	CODE	DATA

BAND PASS FILTER BP762

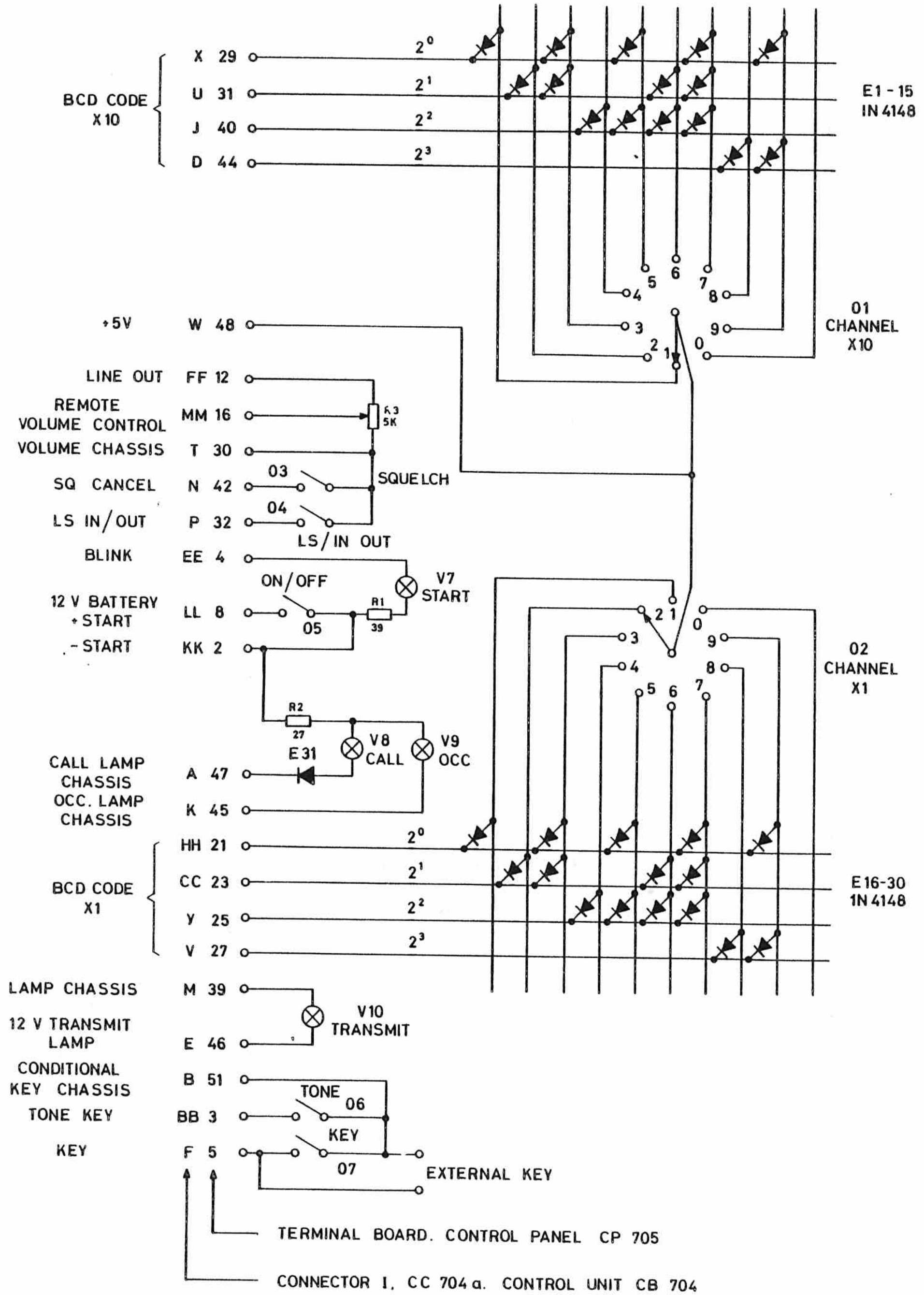
X402.268

STORNOPHONE 700
MAINTENANCE MANUAL
VOLUME II
Section 2

STORNOPHONE 700
MAINTENANCE MANUAL
VOLUME II
Section 2

CF705	Description	60.345-E2
	Schematic A3	D402.387/2
	Component Lay-out	D402.546
	Part List 1 - 3	X402.554
CL701	Schematic	D402.385
	Part List	X402.464
	Component Lay-out	D402.512
CL702	Schematic	D402.384
	Part List	X402.465
	Component Lay-out	D402.509

Storno



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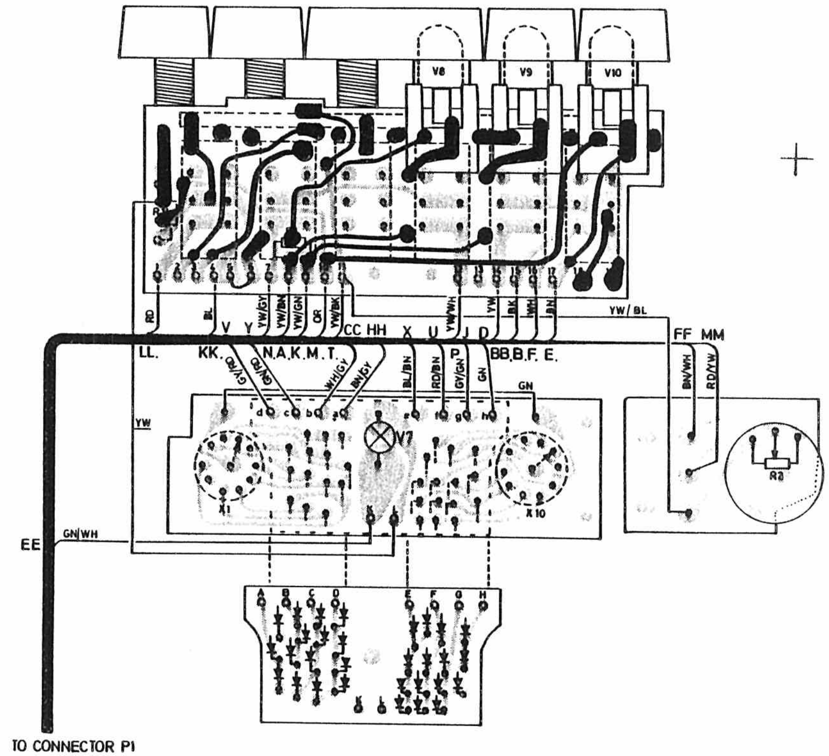


CONTROL PANEL CP 705
CONTROL UNIT CB 704

D 402.570

Storno

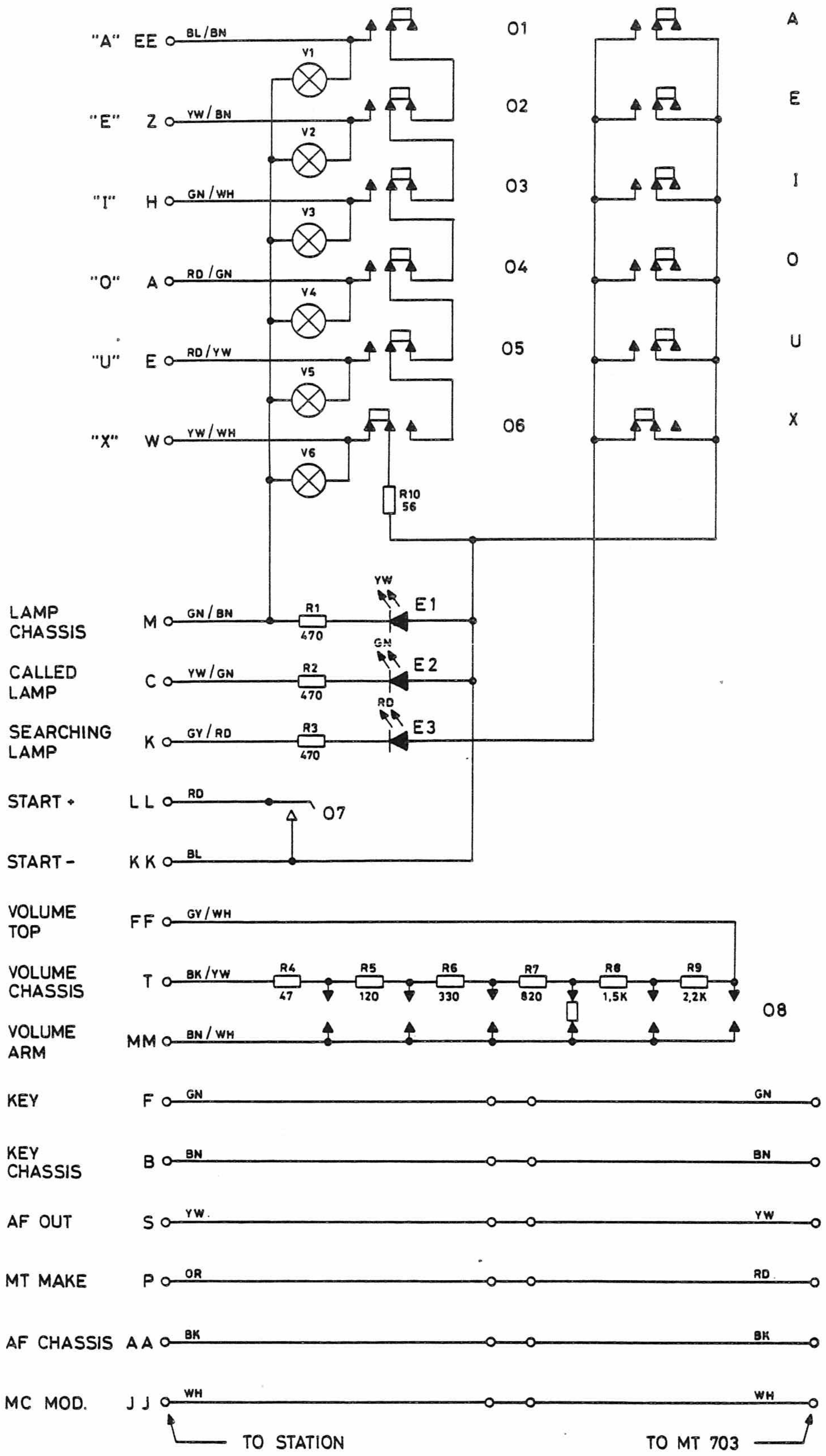
TYPE	Nº	CODE	DATA
CB704		10.2445	Control Unit
	R1	80.5432	39 ohm 5% carbon film 1/4W
	R2	80.5430	27 ohm 5% carbon film 1/4W
	R3	86.5069	5K ohm 20% potentiometer. log 0.8W
	E1- E30	99.5237	IN 4148 Diode
	V7	92.5098	Lamp 12V/60mA
	V8	92.5098	Lamp 12V/60mA
	V9	92.5098	Lamp 12V/60mA
	V10	92.5098	Lamp 12V/60mA
	01	47.5074	Channel Selector x 10
	02	47.5074	Channel Selector x 1
	03	49.0214	Puch button. Squelch
	04	49.0207	Push button, LS in/out
	05	49.0211	Push button. On/Off
	06	49.0220	Push button. Tone Key
	07	49.0219	Push button. Key

Storno

TYPE	Nº	CODE	DATA

CONTROL UNIT CB704

X402.560



CONTROL UNIT CB705

D402.386

Storno

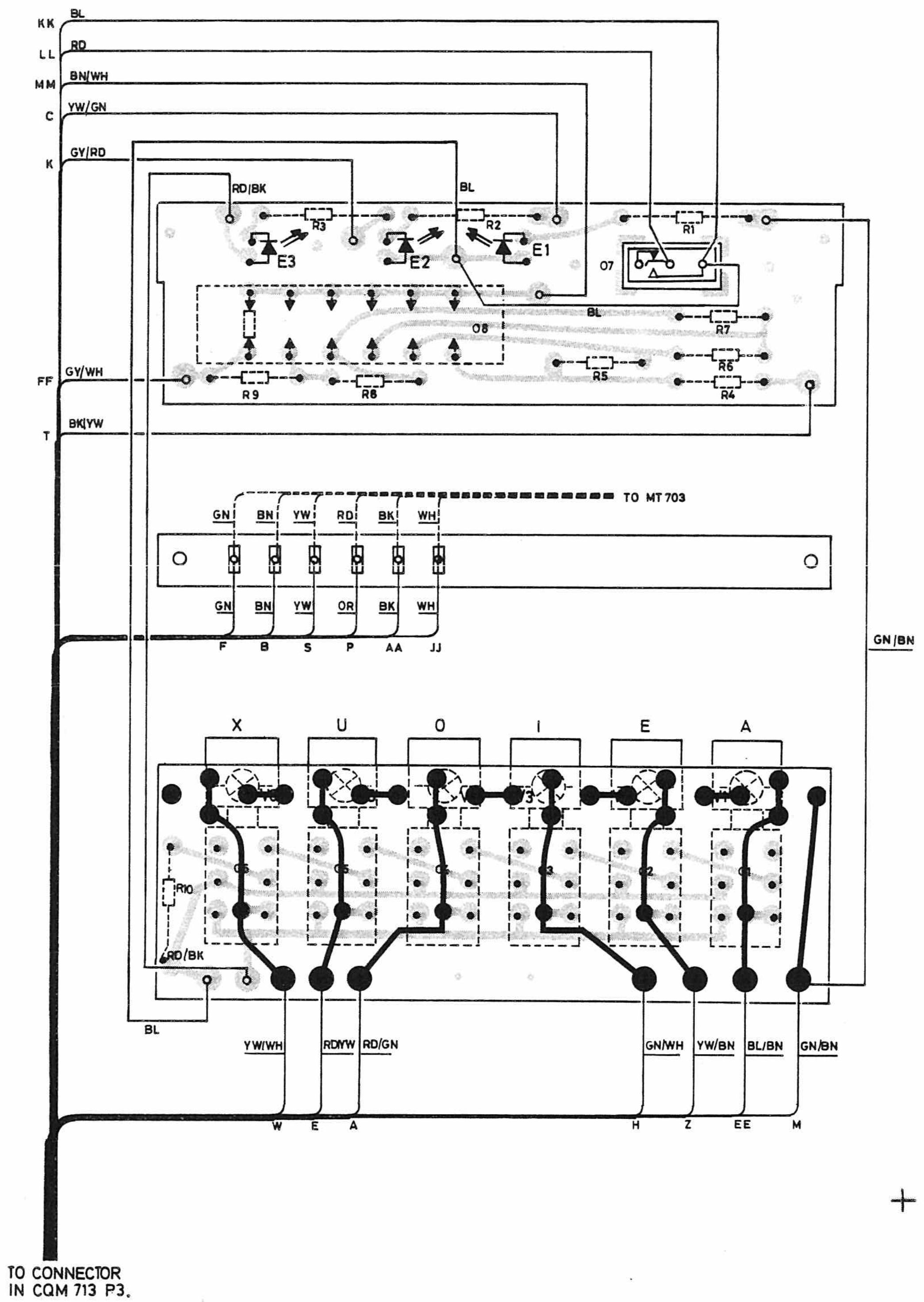
TYPE	Nº	CODE	DATA
		10.3427	Control Unit CB705
	R1	80.5445	470 Ω 5% carbon film 1/4 W
	R2	80.5445	470 Ω 5% " " 1/4 W
	R3	80.5445	470 Ω 5% " " 1/4 W
	R4	80.5233	47 Ω 5% " " 1/8 W
	R5	80.5238	120 Ω 5% " " 1/8 W
	R6	80.5243	330 Ω 5% " " 1/8 W
	R7	80.5248	820 Ω 5% " " 1/8 W
	R8	80.5251	1.5 kΩ 5% " " 1/8 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

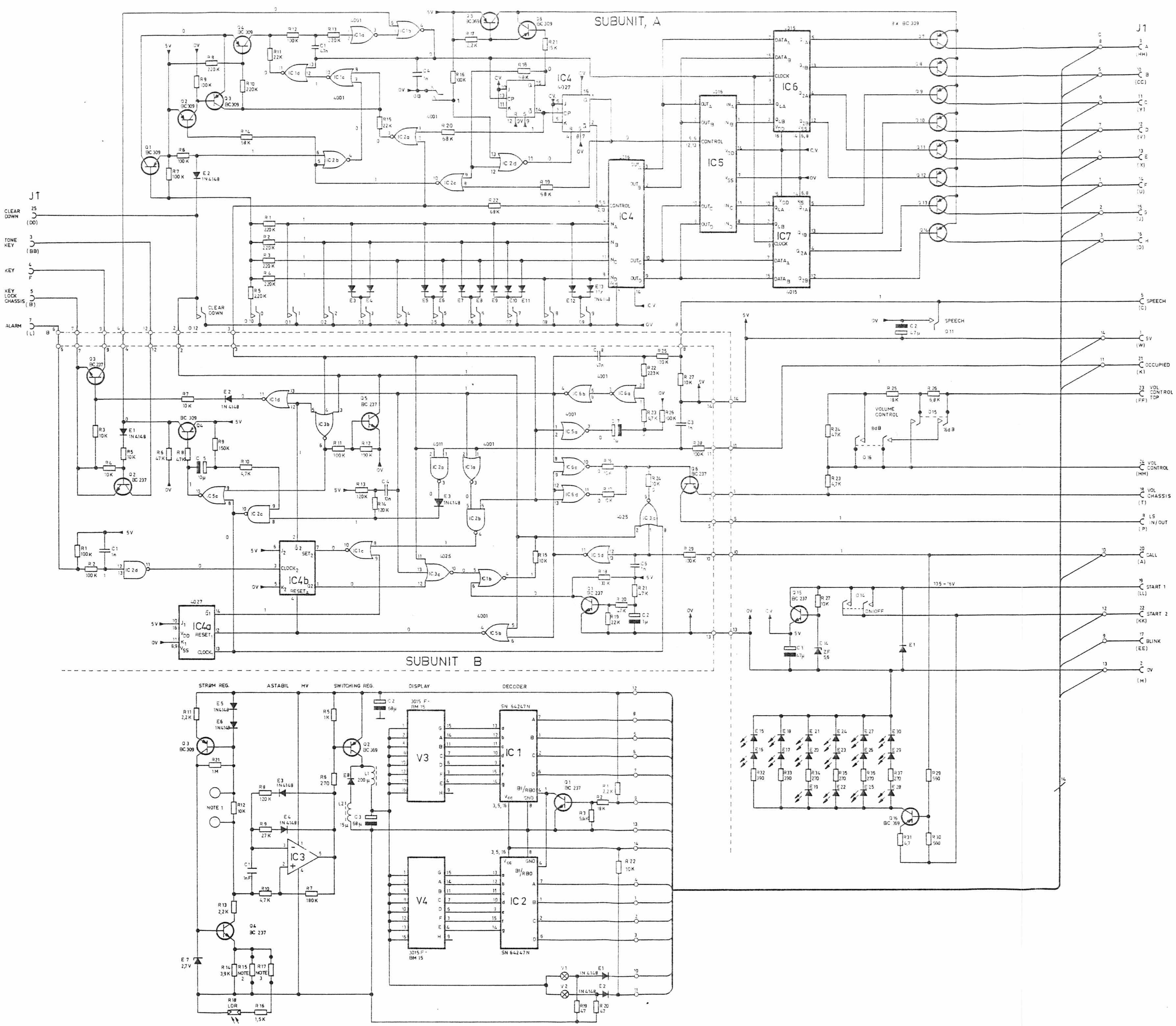
CONTROL UNIT CB705

X402.542



CONTROL UNIT CB705

D402.589



SUBUNIT, C

AUTOMATIC CONTROL UNIT CB706

Storno

TYPE	Nº	CODE	DATA
		10.3626-00	CB 706 Automatic Control Unit
		15.0349-00	Subassembly A
		15.0359-00	Subassembly B
		15.0360-00	Subassembly C
			Subassembly A
	C1	76.5072	47nF 10% polyest FL 50V
	C2	73.5124	47uF 20% tantal 6.3V
	C3	73.5124	47uF 20% tantal 6.3V
	C4	74.5155	1nF -20/+80% ceram PL 63V
	R1	80.5077	220Kohm 5% carbon film 0.1W
	R2	80.5077	220Kohm 5% " " 0.1W
	R3	80.5077	220Kohm 5% " " 0.1W
	R4	80.5077	220Kohm 5% " " 0.1W
	R5	80.5077	220Kohm 5% " " 0.1W
	R6	80.5073	100Kohm 5% " " 0.1W
	R7	80.5073	100Kohm 5% " " 0.1W
	R8	80.5077	220Kohm 5% " " 0.1W
	R9	80.5073	100Kohm 5% " " 0.1W
	R10	80.5077	220Kohm 5% " " 0.1W
	R11	80.5065	22Kohm 5% " " 0.1W
	R12	80.5073	100Kohm 5% " " 0.1W
	R13	80.5077	220Kohm 5% " " 0.1W
	R14	80.5071	68Kohm 5% " " 0.1W
	R15	80.5065	22Kohm 5% " " 0.1W
	R16	80.5073	100Kohm 5% " " 0.1W
	R17	80.5053	2.2Kohm 5% " " 0.1W
	R18	80.5071	68Kohm 5% " " 0.1W
	R19	80.5071	68Kohm 5% " " 0.1W
	R20	80.5071	68Kohm 5% " " 0.1W
	R21	80.5063	15Kohm 5% " " 0.1W
	R22	80.5071	68Kohm 5% " " 0.1W
	R23	80.5057	4.7Kohm 5% " " 0.1W
	R24	80.5069	47Kohm 5% " " 0.1W
	R25	80.5064	18Kohm 5% " " 0.1W
	R26	80.5059	6.8Kohm 5% " " 0.1W
	R27	80.5061	10Kohm 5% " " 0.1W
	R28		
	R29	80.5246	560ohm 5% " " 0.125W
	R30	80.5046	560ohm 5% " " 0.1W
	R31	80.5221	4.7ohm 5% " " 0.125W
	R32	80.5244	390ohm 5% " " 0.125W

Storno

TYPE	Nº	CODE	DATA
	R33	80.5244	390ohm 5% carbon film 0.125W
	R34	80.5242	270ohm 5% " " 0.125W
	R35	80.5242	270ohm 5% " " 0.125W
	R36	80.5242	270ohm 5% " " 0.125W
	R37	80.5242	270ohm 5% " " 0.125W
	E1	99.5020	IN4004 Diode
	E2	99.5237	IN4148 Diode
	E3	99.5237	IN4148 Diode
	E4	99.5237	IN4148 Diode
	E5	99.5237	IN4148 Diode
	E6	99.5237	IN4148 Diode
	E7	99.5237	IN4148 Diode
	E8	99.5237	IN4148 Diode
	E9	99.5237	IN4148 Diode
	E10	99.5237	IN4148 Diode
	E11	99.5237	IN4148 Diode
	E12	99.5237	IN4148 Diode
	E13	99.5237	IN4148 Diode
	E14	99.5114	5.6V Zenerdiode
	E15-E30	99.5338	2.4V Light Emitting Diode (LED) Green 20mA
	Q1	99.5115	BC179 (BC309) Transistor
	Q2	99.5115	BC179 (BC309) "
	Q3	99.5115	BC179 (BC309) "
	Q4	99.5115	BC179 (BC309) "
	Q5	99.5337	BC369 "
	Q6	99.5115	BC179 (BC309) "
	Q7	99.5115	BC179 (BC309) "
	Q8	99.5115	BC179 (BC309) "
	Q9	99.5115	BC179 (BC309) "
	Q10	99.5115	BC179 (BC309) "
	Q11	99.5115	BC179 (BC309) "
	Q12	99.5115	BC179 (BC309) "
	Q13	99.5115	BC179 (BC309) "
	Q14	99.5115	BC179 (BC309) "
	Q15	99.5121	BC107 (BC237) "
	Q16	99.5337	BC369 "
	IC1	14.5074-01	4001B Quad 2 input NAND
	IC2	14.5074-01	4001B Quad 2 input NAND

AUTOMATIC CONTROL UNIT CB706

X402.628

Storno

TYPE	NO	CODE	DATA
	IC3	14.5094-01	4027B Dual J-K master-slave FF
	IC4	14.5092	4016B Quad bilateral switch
	IC5	14.5092	4016B Quad bilateral switch
	IC6	14.5091	1415B Dual 4-stage Static shift regist.
	IC7	14.5091	4015B Dual 4-stage Static shift regist.
	O1	47.5088	Switch, type M-NO
	O2	47.5088	" " "
	O3	47.5088	" " "
	O4	47.5088	" " "
	O5	47.5088	" " "
	O6	47.5088	" " "
	O7	47.5088	" " "
	O8	47.5088	" " "
	O9	47.5088	" " "
	O10	47.5088	" " "
	O11	47.5088	" " "
	O12	47.5088	" " "
	O13	47.5088	" " "
	O14	47.5095	Switch, type A-OO
	O15	47.5095	" " "
	O16	47.5095	" " "
			Subassembly B
	C1	76.5069	1nF 10% polyest FL 35V
	C2	73.5114	1uF 20% tantal 35V
	C3	76.5069	1nF 10% polyest FL 50V
	C4	76.5070	10nF 10% polyest FL 50V
	C5	73.5109	10uF 20% tantal 35V
	C6	76.5069	1nF 10% polyest FL 50V
	C7	73.5114	1uF 20% tantal 35V
	C8	76.5072	47nF 10% polyest FL 50V
	R1	80.5073	100Kohm 5% carbon film 0.1W
	R2	80.5073	100Kohm 5% " " 0.1W
	R3	80.5061	10Kohm 5% " " 0.1W
	R4	80.5061	10Kohm 5% " " 0.1W
	R5	80.5061	10Kohm 5% " " 0.1W
	R6	80.5069	47Kohm 5% " " 0.1W
	R7	80.5061	10Kohm 5% " " 0.1W
	R8	80.5069	47Kohm 5% " " 0.1W
	R9	80.5075	150Kohm 5% " " 0.1W
	R10	80.5057	4.7Kohm 5% " " 0.1W
	R11	80.5073	100Kohm 5% " " 0.1W
	R12	80.5073	100Kohm 5% " " 0.1W

Storno

TYPE	NO	CODE	DATA
	R13	80.5074	120Kohm 5% carbon film 0.1W
	R14	80.5074	120Kohm 5% " " 0.1W
	R15	80.5061	10Kohm 5% " " 0.1W
	R16	80.5061	10Kohm 5% " " 0.1W
	R17	80.5061	10Kohm 5% " " 0.1W
	R18	80.5073	100Kohm 5% " " 0.1W
	R19	80.5065	22Kohm 5% " " 0.1W
	R20	80.5069	47Kohm 5% " " 0.1W
	R21	80.5069	47Kohm 5% " " 0.1W
	R22	80.5077	22Kohm 5% " " 0.1W
	R23	80.5057	4.7Kohm 5% " " 0.1W
	R24	80.5061	10Kohm 5% " " 0.1W
	R25	80.5073	100Kohm 5% " " 0.1W
	R26	80.5073	100Kohm 5% " " 0.1W
	R27	80.5061	10Kohm 5% " " 0.1W
	R28	80.5073	100Kohm 5% " " 0.1W
	R29	80.5073	100Kohm 5% " " 0.1W
	E1	99.5237	IN4148 Diode
	E2	99.5237	IN4148 Diode
	E3	99.5237	IN4148 Diode
	Q1	99.5121	BC107 Transistor
	Q2	99.5121	BC107 Transistor
	Q3	99.5121	BC107 Transistor
	Q4	99.5115	BC179 Transistor
	Q5	99.5121	BC107 Transistor
	Q6	99.5121	BC107 Transistor
			Subassembly C
	C1	765069	1nF 10% polyest. FL 50V
	C2	73.5106	68uF20% tantal. 16V
	C3	73.5106	68uF20% tantal 16V
	R1	80.5053	2.2Kohm 5% carbon film 0.1W
	R2	80.5064	18Kohm 5% " " 0.1W
	R3	80.5058	5.6Kohm 5% " " 0.1W
	R4		Not used
	R5	80.5049	1Kohm 5% " " 0.1W
	R6	80.5242	270 ohm 5% " " 0.125W
	R7	80.5076	180Kohm 5% " " 0.1W
	R8	80.5074	120Kohm 5% " " 0.1W

AUTOMATIC CONTROL UNIT CB706

X402.628

Storno

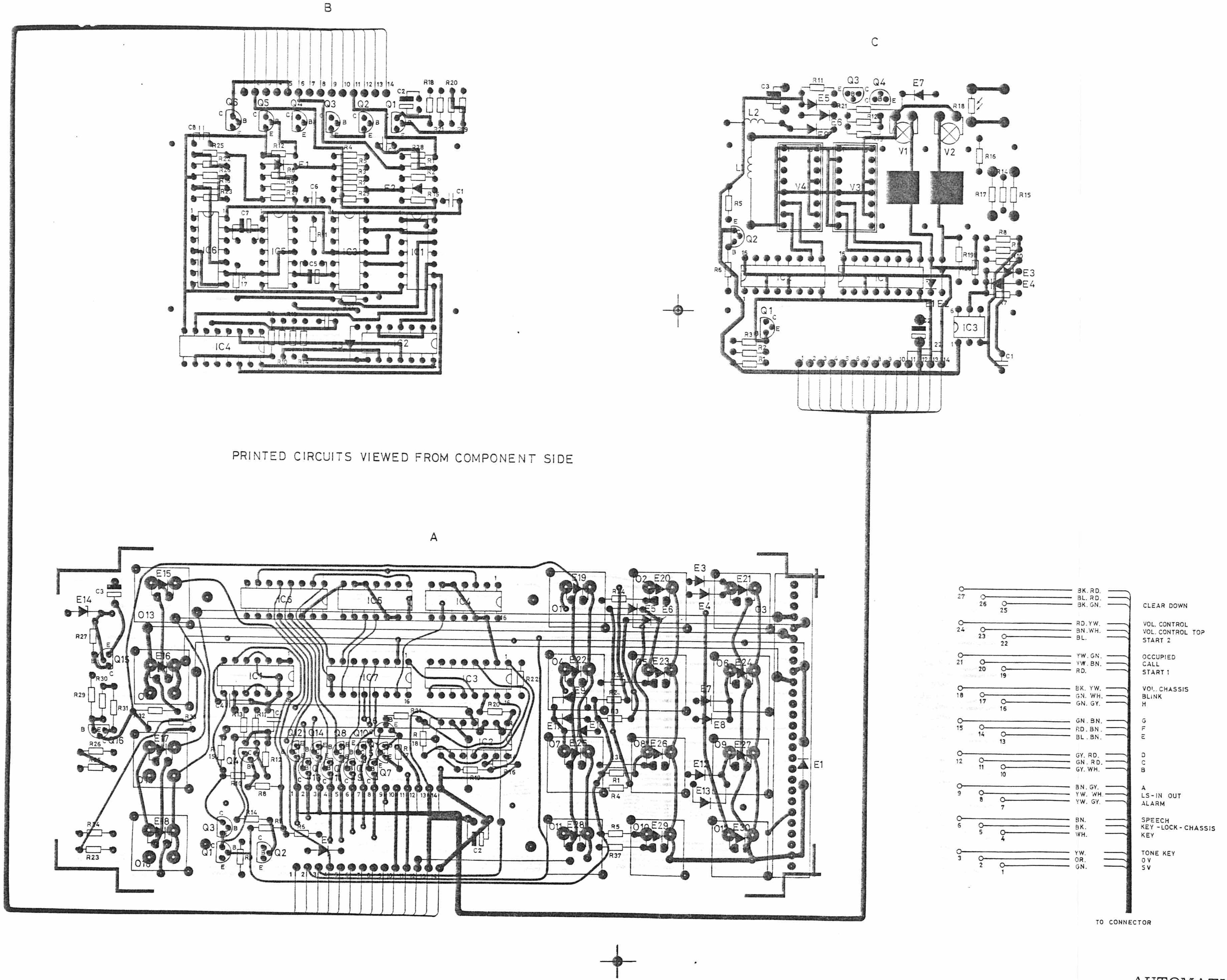
TYPE	Nº	CODE	DATA
	R9	80.5066	27Kohm 5% carbon film 0.1W
	R10	80.5057	4,7Kohm 5% " " 0.1W
	R11	80.5053	2.2Kohm 5% " " 0.1W
	R12	80.5061	10Kohm 5% " " 0.1W
	R13	80.5053	2.2Kohm 5% " " 0.1W
	R14	80.5056	3.9Kohm 5% " " 0.1W
	R15	80.50xx	ADJ 5% " " 0.1W
	R16	80.5051	1.5Kohm 5% " " 0.1W
	R17	80.50xx	ADJ 5% " " 0.1W
	R18	89.5081	Light Dependent Resistor (LDR) 0.1W
	R19	80.5233	47ohm 5% carbon film 0.125W
	R20	80.5233	47ohm 5% " " 0.125W
	R21	80.5085	1Mohm 10% " " 0.1W
	R22	80.5261	10Kohm 5% " " 0.1W
	L1	61.5024	180uH Chohe 500mA
	L2	63.5007	15uH Chohe
	E1	99.5237	IN4148 Diode
	E2	99.5237	IN4148 Diode
	E3	99.5237	IN4148 Diode
	E4	99.5237	IN4148 Diode
	E5	99.5237	IN4148 Diode
	E6	99.5237	IN4148 Diode
	E7	99.5227	2.7V Zenerdiode 0.25W
	E8	99.5296	BY201/2 Diode
	Q1	99.5121	BC107 Transistor
	Q2	99.5337	BC369 Transistor
	Q3	99.5115	BC179 Transistor
	Q4	99.5121	BC107 Transistor
	IC1	14.5095	SN64247 BCD 7-segment Decoder/driver
	IC2	14.5095	SN64247 BCD 7-segment Decoder/driver
	IC3	14.5017	TAA765A Operational amplifier.
	V1	92.5119	Lamp 6-7V
	V2	92.5119	Lamp 6-7V
	V3	92.5118	Display
	V4	92.5118	Display

Storno

TYPE	Nº	CODE	DATA

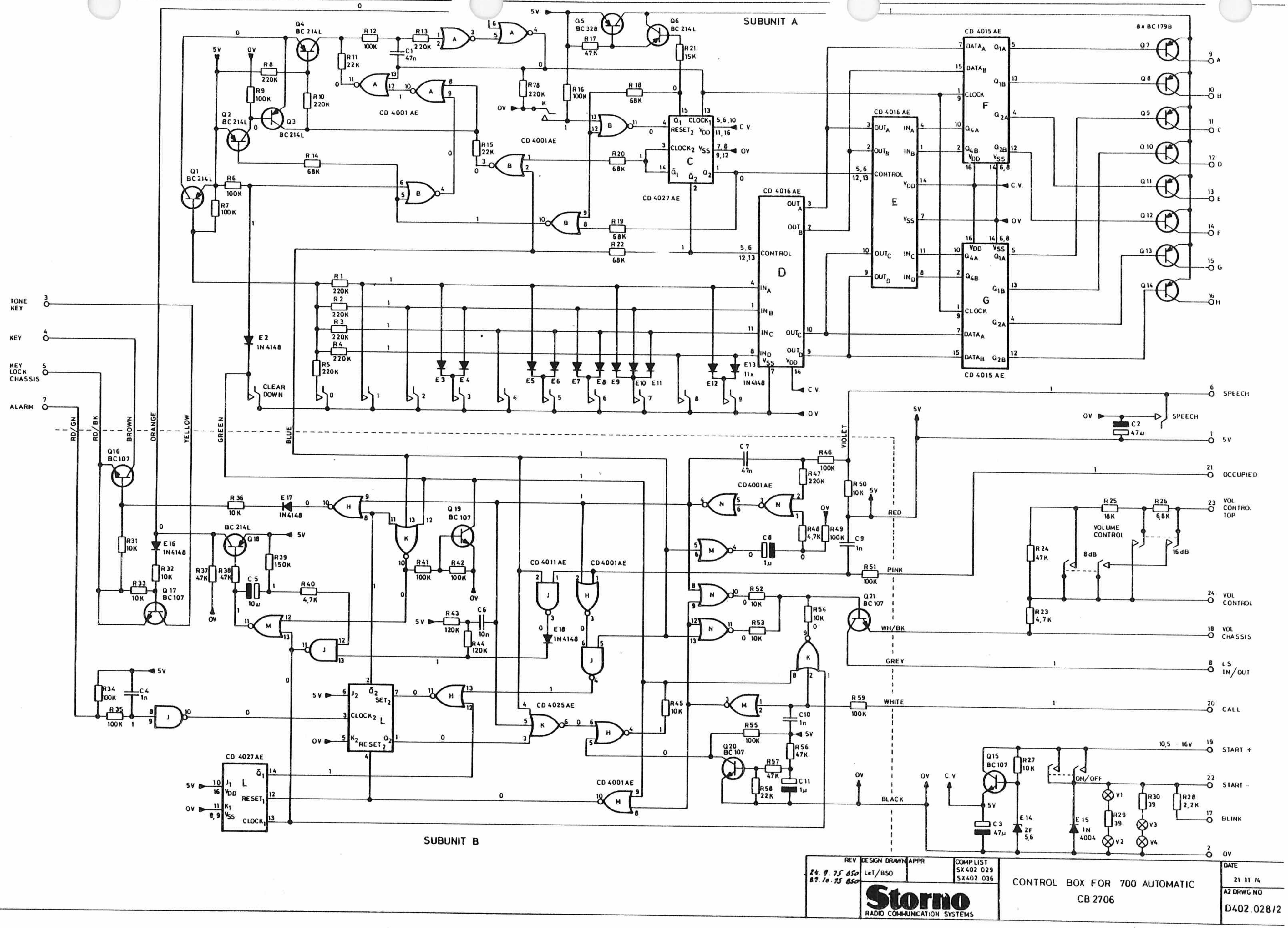
AUTOMATIC CONTROL UNIT CB706

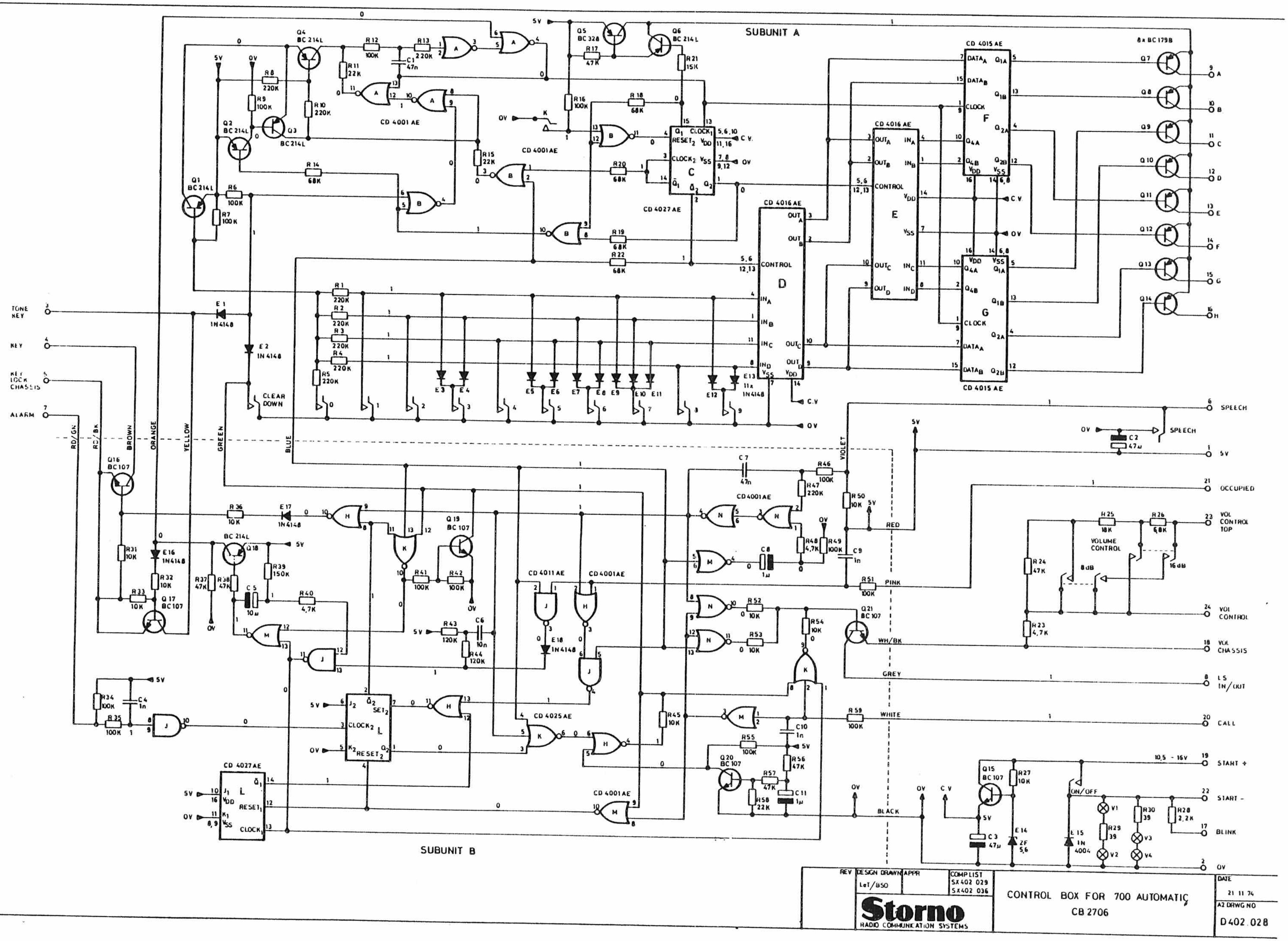
X402.628



AUTOMATIC CONTROL UNIT CB706

D402.609/2


SUBUNIT A
SUBUNIT B
3 TONE KEY
4 KEY
5 KEY LOCK CHASSIS
7 ALARM
6 SPEECH
1 5V
21 OCCUPIED
23 VOL CONTROL TOP
24 VOL CONTROL
18 VOL CHASSIS
8 LS IN/OUT
20 CALL
19 START +
22 START -
17 BLINK
2 0V
REV DESIGN DRAWN APPR
24. 9. 75 BSO
27. 10. 75 BSO
LeT/BSO
COMP LIST
SX402 029
SX402 036
Storno
RADIO COMMUNICATION SYSTEMS
CONTROL BOX FOR 700 AUTOMATIC
CB 2706
DATE
21 11 74
A2 DRWG NO
D402 028/2



SUBUNIT A
SUBUNIT B
CONTROL BOX FOR 700 AUTOMATIC
CB 2706
D402 028
21 11 74
COMP.LIST SX402 029 SX402 036
Storno
RADIO COMMUNICATION SYSTEMS
SPEECH
OCCUPIED
VOL CONTROL TOP
VOL CONTROL
VOL CHASSIS
LS IN/OUT
CALL
START +
START -
BLINK
TONE KEY
KEY
KEY LOCK CHASSIS
ALARM
CLEAR DOWN
VOLUME CONTROL

TYPE	NO.	CODE	DATA
		15.0232-00	Subunit A. Part of CB2706
	C1	76.5072-00	47 nF 10% Polyester FL 50 V
	C2	73.5124-00	47 µF 20% Tantalum 6,3 V
	C3	73.5124-00	47 µF 20% Tantalum 6,3 V
	R1	80.5277-00	220 KΩ 5% Carbon film 1/8 W
	R2	80.5277-00	220 KΩ 5% Carbon film 1/8 W
	R3	80.5277-00	220 KΩ 5% Carbon film 1/8 W
	R4	80.5277-00	220 KΩ 5% Carbon film 1/8 W
	R5	80.5277-00	220 KΩ 5% Carbon film 1/8 W
	R6	80.5273-00	100 KΩ 5% Carbon film 1/8 W
	R7	80.5273-00	100 KΩ 5% Carbon film 1/8 W
	R8	80.5277-00	220 KΩ 5% Carbon film 1/8 W
	R9	80.5273-00	100 KΩ 5% Carbon film 1/8 W
	R10	80.5277-00	220 KΩ 5% Carbon film 1/8 W
	R11	80.5265-00	22 KΩ 5% Carbon film 1/8 W
	R12	80.5273-00	100 KΩ 5% Carbon film 1/8 W
	R13	80.5277-00	220 KΩ 5% Carbon film 1/8 W
	R14	80.5271-00	68 KΩ 5% Carbon film 1/8 W
	R15	80.5265-00	22 KΩ 5% Carbon film 1/8 W
	R16	80.5273-00	100 KΩ 5% Carbon film 1/8 W
	R17	80.5269-00	47 KΩ 5% Carbon film 1/8 W
	R18	80.5271-00	68 KΩ 5% Carbon film 1/8 W
	R19	80.5271-00	68 KΩ 5% Carbon film 1/8 W
	R20	80.5271-00	68 KΩ 5% Carbon film 1/8 W
	R21	80.5263-00	15 KΩ 5% Carbon film 1/8 W
	R22	80.5271-00	68 KΩ 5% Carbon film 1/8 W
	R23	80.5257-00	4,7 KΩ 5% Carbon film 1/8 W
	R24	80.5269-00	47 KΩ 5% Carbon film 1/8 W
	R25	80.5264-00	18 KΩ 5% Carbon film 1/8 W
	R26	80.5259-00	6,8 KΩ 5% Carbon film 1/8 W
	R27	80.5261-00	10 KΩ 5% Carbon film 1/8 W
	R28	80.5253-00	2,2 KΩ 5% Carbon film 1/8 W
	R29	80.5232-00	39 Ω 5% Carbon film 1/8 W
	R30	80.5232-00	39 Ω 5% Carbon film 1/8 W
	E1	99.5237-00	1N4148 Diode
	E2	99.5237-00	1N4148 Diode
	E3	99.5237-00	1N4148 Diode
	E4	99.5237-00	1N4148 Diode
	E5	99.5237-00	1N4148 Diode
	E6	99.5237-00	1N4148 Diode
	E7	99.5237-00	1N4148 Diode
	E8	99.5237-00	1N4148 Diode
	E9	99.5237-00	1N4148 Diode
	E10	99.5237-00	1N4148 Diode
	E11	99.5237-00	1N4148 Diode

Storno

TYPE	NO.	CODE	DATA
	E12	99.5237-00	1N4148 Diode
	E13	99.5237-00	1N4148 Diode
	E14	99.5114-00	5,6 V 5% Zener diode 0,25 W
	E15	99.5020-00	1N4004 Diode
	IC A	14.5074-00	CD4001 AE Quad 2-input NOR
	IC B	14.5074-00	CD4001 AE Quad 2-input NOR
	IC C	14.5094-00	CD4027 AE Dual J-K Master-slave F-F
	IC D	14.5092-00	CD4016 AE Quad Bilateral switch
	IC E	14.5092-00	CD4016 AE Quad Bilateral switch
	IC F	14.5091-00	CD4015 AE Dual 4-stage static shift reg.
	IC G	14.5091-00	CD4015 AE Dual 4-stage static shift reg.
	Q1	99.5144-00	BC214L Transistor PNP
	Q2	99.5144-00	BC214L Transistor PNP
	Q3	99.5144-00	BC214L Transistor PNP
	Q4	99.5144-00	BC214L Transistor PNP
	Q5	99.5305-00	BC328 Transistor PNP
	Q6	99.5344-00	BC214L Transistor PNP
	Q7	99.5115-01	BC179 B Transistor PNP
	Q8	99.5115-01	BC179 B Transistor PNP
	Q9	99.5115-01	BC179 B Transistor PNP
	Q10	99.5115-01	BC179 B Transistor PNP
	Q11	99.5115-01	BC179 B Transistor PNP
	Q12	99.5115-01	BC179 B Transistor PNP
	Q13	99.5115-01	BC179 B Transistor PNP
	Q14	99.5115-01	BC179 B Transistor PNP
	Q15	99.5121-00	BC109 Transistor NPN
	O 1	47.5064-00	Push button 1
	O 2	47.5064-00	Push button 1
	O 3	47.5064-00	Push button 1
	O4	47.5064-00	Push button 1
	O 5	47.5064-00	Push button 1
	O 6	47.5064-00	Push button 1
	O 7	47.5064-00	Push button 1
	O 8	47.5064-00	Push button 1
	O 9	47.5064-00	Push button 1
	O 10	47.5064-00	Push button 1
	O 11	47.5064-00	Push button 1
	O 12	47.5064-00	Push button 1
	O 13	47.5064-00	Push button 1

CONTROL UNIT CB2706
Subunit A

TYPE	NO.	CODE	DATA
	O 14	47.5065-00	Push button 1-1
	O 15	47.5065-00	Push button 1-1
	O 16	47.5065-00	Push button 1-1
	V 1	92.5101-00	6 V 30mA Indicator lamp
	V 2	92.5101-00	6 V 30mA Indicator lamp
	V 3	92.5101-00	6V 30mA Indicator lamp
	V 4	92.5101-00	6 V 30mA Indicator lamp

Storno

TYPE	NO.	CODE	DATA

CONTROL UNIT CB2706
Subunit A

Storno

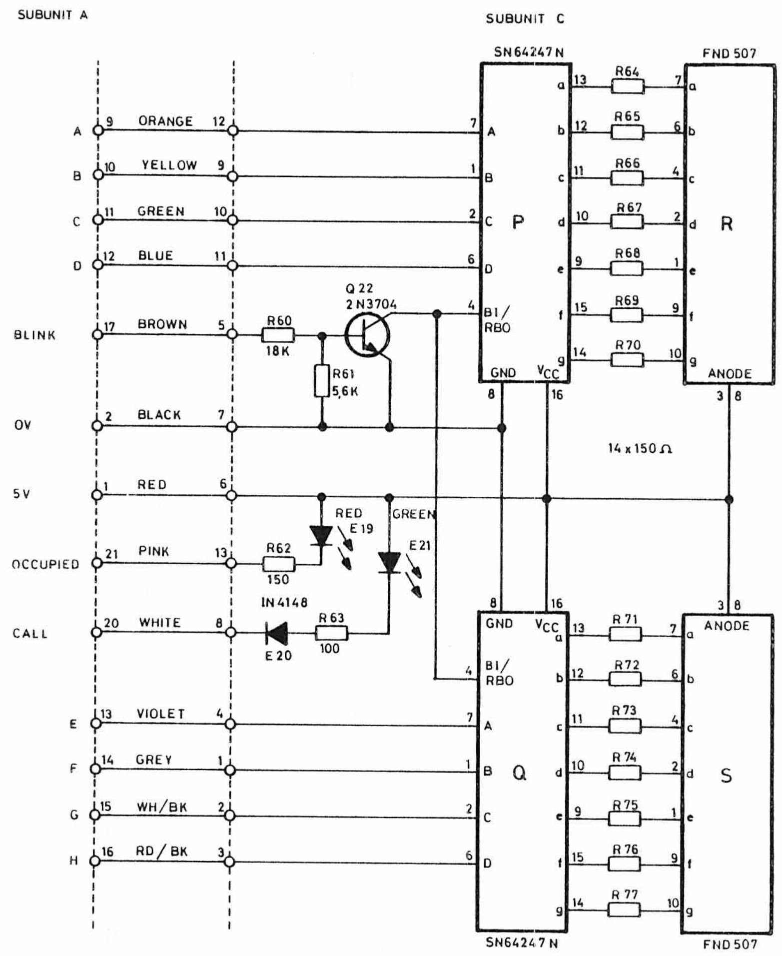
TYPE	NO.	CODE	DATA
		15. 0233-00	Subunit B. Part of CB2706
	C4	76. 5069-00	1 nF 10% Polyester FL 50 V
	C5	73. 5109-00	10 μF 20% Tantalum 16 V
	C6	76. 5070-00	10 nF 10% Polyester FL 50 V
	C7	76. 5072-00	47 nF 10% Polyester FL 50 V
	C8	73. 5114-00	1 μF 20% Tantalum 35 V
	C9	76. 5069-00	1 nF 10% Polyester FL 50 V
	C10	76. 5069-00	1 nF 10% Polyester FL 50 V
	C11	73. 5114-00	1 μF 20% Tantalum 35 V
	R31	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R32	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R33	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R34	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	R35	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	R36	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R37	80. 5269-00	47 KΩ 5% Carbon film 1/8 W
	R38	80. 5269-00	47 KΩ 5% Carbon film 1/8 W
	R39	80. 5275-00	150 KΩ 5% Carbon film 1/8 W
	R40	80. 5257-00	4,7 KΩ 5% Carbon film 1/8 W
	R41	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	R42	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	R43	80. 5274-00	120 KΩ 5% Carbon film 1/8 W
	R44	80. 5274-00	120 KΩ 5% Carbon film 1/8 W
	R45	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R46	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	R47	80. 5277-00	220 KΩ 5% Carbon film 1/8 W
	R48	80. 5257-00	4,7 KΩ 5% Carbon film 1/8 W
	R49	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	R50	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R51	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	R52	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R53	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R54	80. 5261-00	10 KΩ 5% Carbon film 1/8 W
	R55	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	R56	80. 5269-00	47 KΩ 5% Carbon film 1/8 W
	R57	80. 5269-00	47 KΩ 5% Carbon film 1/8 W
	R58	80. 5265-00	22 KΩ 5% Carbon film 1/8 W
	R59	80. 5273-00	100 KΩ 5% Carbon film 1/8 W
	E16	99. 5237-00	1N4148 Diode
	E17	99. 5237-00	1N4148 Diode
	E18	99. 5237-00	1N4148 Diode
	IC H	14. 5074-00	CD 4001 AE Quad 2-input NOR
	IC J	14. 5051-00	CD 4011 AE Quad 2-input NAND

Storno

TYPE	NO.	CODE	DATA
	IC K	14. 5093-00	CD 4025 AE Triple 3-input NOR-Gates
	IC L	14. 5094-00	CD 4027 AE Dual J-K Master-slave F-F
	IC M	14. 5074-00	CD 4001 AE Quad 2-input NOR
	IC N	14. 5074-00	CD 4001 AE Quad 2-input NOR
	Q16	99. 5121-00	BC 107 Transistor NPN
	Q17	99. 5121-00	BC 107 Transistor NPN
	Q18	99. 5144-00	BC 214 L Transistor PNP
	Q19	99. 5121-00	BC 107 Transistor NPN
	Q20	99. 5121-00	BC 107 Transistor NPN
	Q21	99. 5121-00	BC 107 Transistor NPN

X402. 036

CONTROL UNIT CB2706
Subunit B



CONTROL UNIT CB2706
Subunit C

D402.033/2

Storno

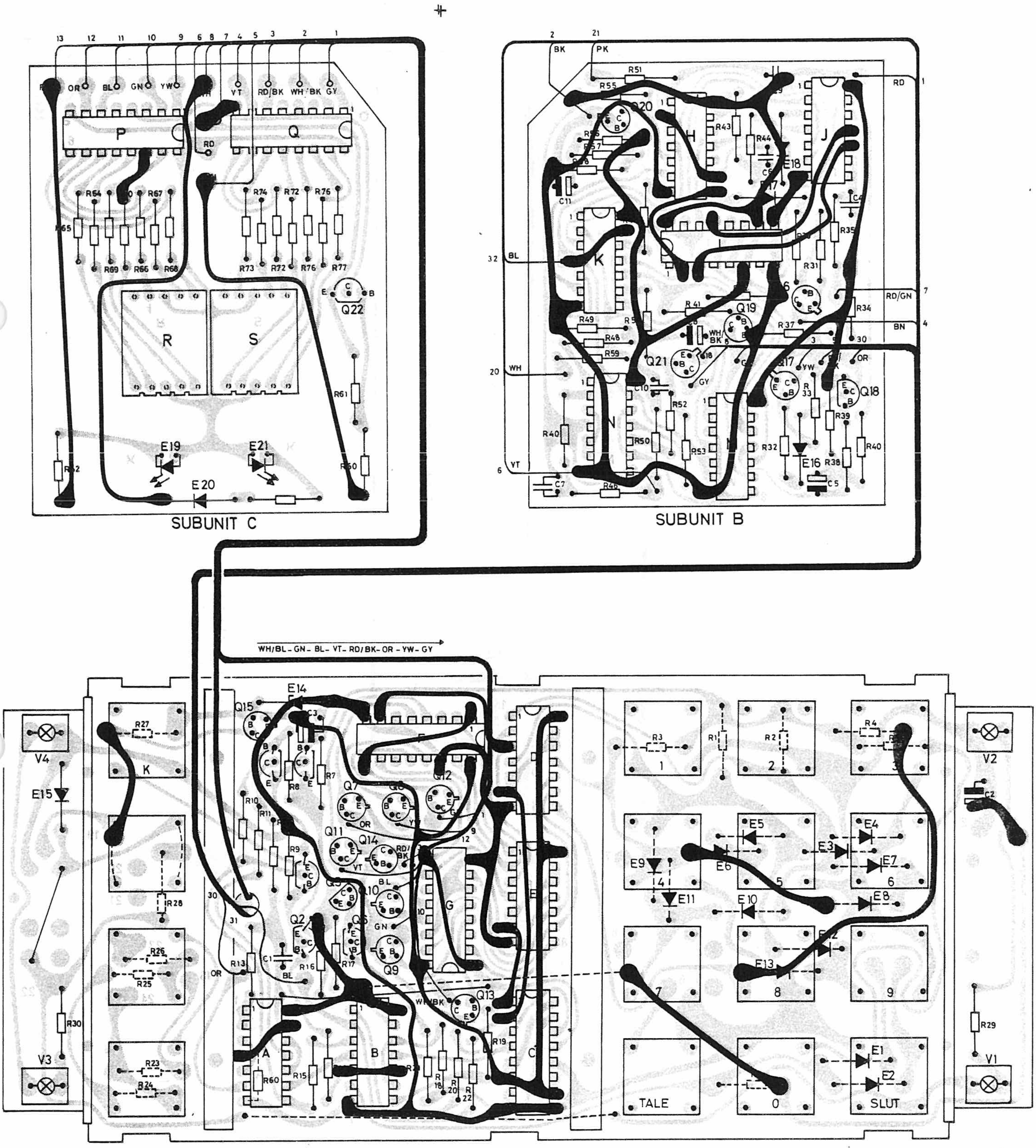
TYPE	NO.	CODE	DATA
		15.0234-00	Subunit C. Part of CB2706
	R60	80.5264-00	18 KΩ Carbon film 1/8 W
	R61	80.5258-00	5,6 KΩ Carbon film 1/8 W
	R62	80.5239-00	150 Ω Carbon film 1/8 W
	R63	80.5237-00	100 Ω Carbon film 1/8 W
	R64	80.5239-00	150 Ω Carbon film 1/8 W
	R65	80.5239-00	150 Ω Carbon film 1/8 W
	R66	80.5239-00	150 Ω Carbon film 1/8 W
	R67	80.5239-00	150 Ω Carbon film 1/8 W
	R68	80.5239-00	150 Ω Carbon film 1/8 W
	R69	80.5239-00	150 Ω Carbon film 1/8 W
	R70	80.5239-00	150 Ω Carbon film 1/8 W
	R71	80.5239-00	150 Ω Carbon film 1/8 W
	R72	80.5239-00	150 Ω Carbon film 1/8 W
	R73	80.5239-00	150 Ω Carbon film 1/8 W
	R74	80.5239-00	150 Ω Carbon film 1/8 W
	R75	80.5239-00	150 Ω Carbon film 1/8 W
	R76	80.5239-00	150 Ω Carbon film 1/8 W
	R77	80.5239-00	150 Ω Carbon film 1/8 W
	E19	99.5303-00	LED 1,9 V 10mA red
	E20	99.5237-00	1N4148 Diode
	E21	99.5304-00	LED 1,9 V 10mA green
	Q22	99.5181-00	2N3704 Transistor NPN
	IC P	14.5095-00	SN64 247 N BCD - Seven segment Decoder/Driver
	IC Q	14.5095-00	SN64 247 N BCD - Seven segment Decoder/Driver
	IC R	14.5096-00	FND507 Seven segment Display
	IC S	14.5096-00	FND507 Seven segment Display

Storno

TYPE	NO.	CODE	DATA

CONTROL UNIT CB2706
Subunit C

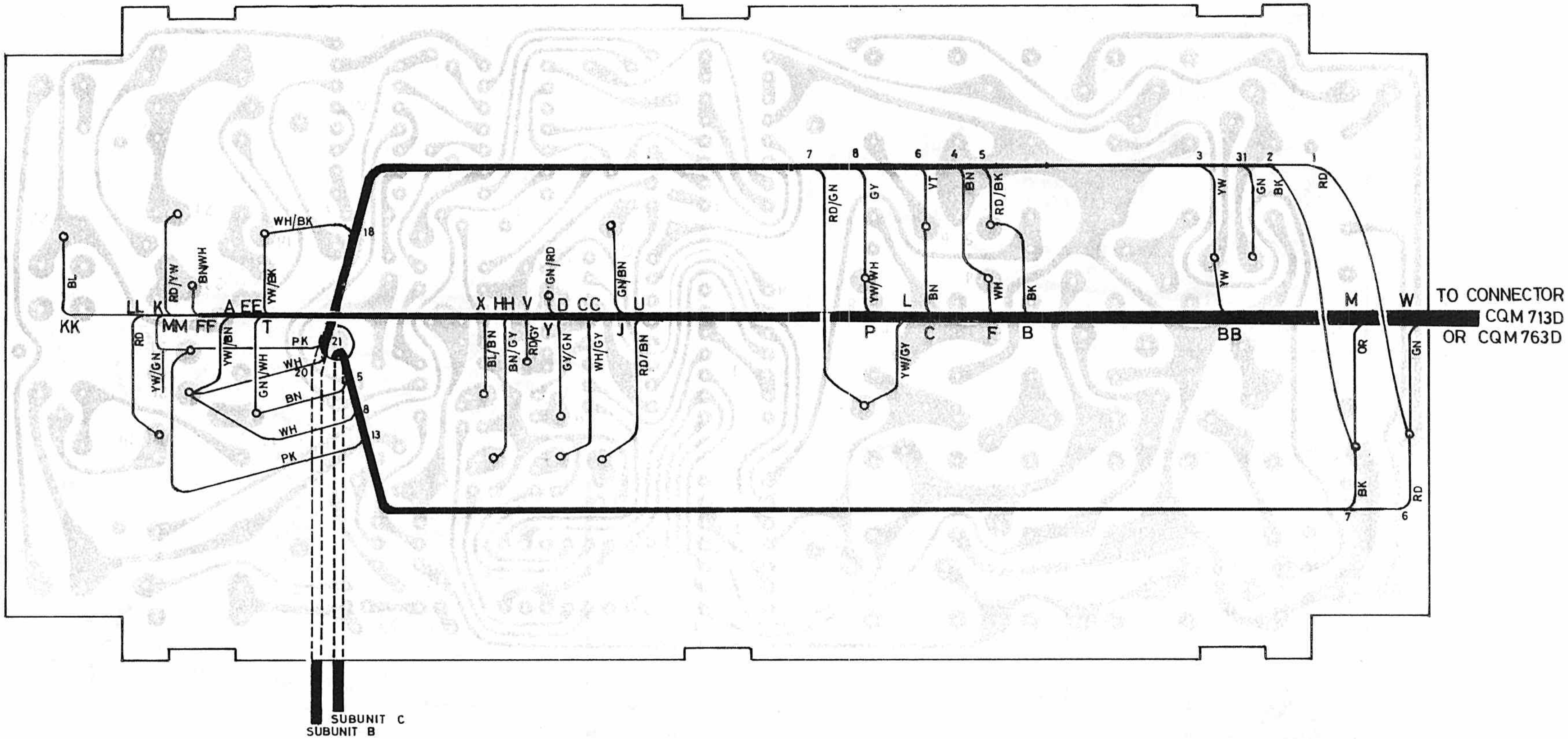
X402.034



CONTROL UNIT CB2706

D402.167

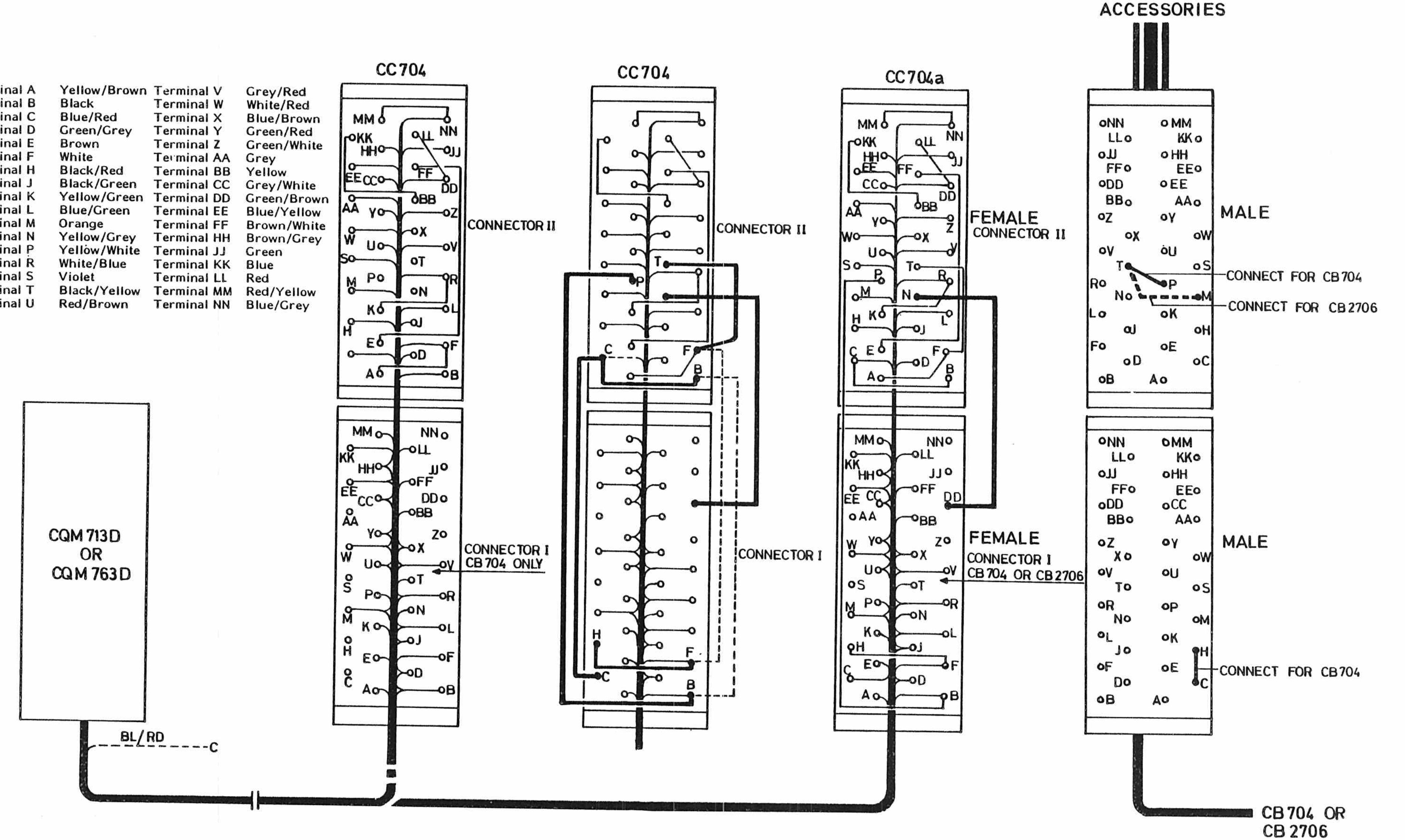
Storno



CONTROL UNIT CB2706
Wiring

D402.031/2

Terminal A	Yellow/Brown	Terminal V	Grey/Red
Terminal B	Black	Terminal W	White/Red
Terminal C	Blue/Red	Terminal X	Blue/Brown
Terminal D	Green/Grey	Terminal Y	Green/Red
Terminal E	Brown	Terminal Z	Green/White
Terminal F	White	Terminal AA	Grey
Terminal H	Black/Red	Terminal BB	Yellow
Terminal J	Black/Green	Terminal CC	Grey/White
Terminal K	Yellow/Green	Terminal DD	Green/Brown
Terminal L	Blue/Green	Terminal EE	Blue/Yellow
Terminal M	Orange	Terminal FF	Brown/White
Terminal N	Yellow/Grey	Terminal HH	Brown/Grey
Terminal P	Yellow/White	Terminal JJ	Green
Terminal R	White/Blue	Terminal KK	Blue
Terminal S	Violet	Terminal LL	Red
Terminal T	Black/Yellow	Terminal MM	Red/Yellow
Terminal U	Red/Brown	Terminal NN	Blue/Grey



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MODIFYING EXTENSION CABLE CC704 TO CC704a

D402.344/2

Storno

TYPE	Nº	CODE	DATA
	R124	80.5230	27 Ω 5% carbon film 1/8 W
	R125	80.5237	100 Ω 5% " 1/8 W
	R126	80.5213	1 Ω 5% " 1/8 W
	R127	80.5252	1.8 KΩ 5% " 1/8 W
	L1	61.1132	Squelch coil 75 mH
	L2	61.1131	IA coil 455 kHz
	E1	99.5237	1 N 4148 Diode
	E2	99.5237	1 N 4148 "
	E3	99.5042	Zenerdiode 9.1 V 5% 0.25 W
	E4	99.5209	Stabilizerdiode 1.5 V
	E5	99.5237	1 N 4148 Diode
	E6	99.5237	1 N 4148 "
	E7	99.5237	1 N 4148 "
	E8	99.5237	1 N 4148 "
	E9	99.5020	1 N 4004 "
	E10	99.5237	1 N 4148 "
	E11	99.5209	Stabilizerdiode 1.5 V
	E12	99.5237	1 N 4148 Diode
	E13 E14	99.5237	1 N 4148 "
	E15	99.5224	Zenerdiode 4.7 V 5% 0.25 W
	E16	99.5237	1 N 4148 Diode
	E17	99.5224	Zenerdiode 4.7 V 5% 0.25 W
	E18	99.5209	1.5 V Stab. diode
	Q1	99.5144	Transistor BC 214 L
	Q2	99.5143	" BC 238 (BC 108)
CF704	Q3	99.5143	" BC 238 (BC 108)
	Q4	99.5143	" BC 238 (BC 108)
	Q5	99.5143	" BC 238 (BC 108)
	Q6	99.5201	" BC 239 (BC 109)
	Q7	99.5115	" BC 309 (BC 179)
	Q8	99.5115	" BC 309 (BC 179)
	Q9	99.5143	" BC 238 (BC 108)
	Q20	99.5246	" TIP 31
	Q21	99.5144	" BC 214 L
	Q22	99.5143	" BC 238 (BC 108)
	Q23	99.5143	" BC 238 (BC 108)
	Q24	99.5246	" TIP 31
	Q25	99.5144	" BC 214 L
	Q26	99.5143	" BC 238 (BC 108)
	Q27	99.5143	" BC 238 (BC 108)
	Q28	99.5143	" BC 238 (BC 108)
	Q29	99.5115	" BC 309 (BC 179
	Q30	99.5326	" BF 198
	Q31	99.5326	" BF 198
	Q32	99.5143	BC238
	T1	61.1130	IA transformer 455 kHz

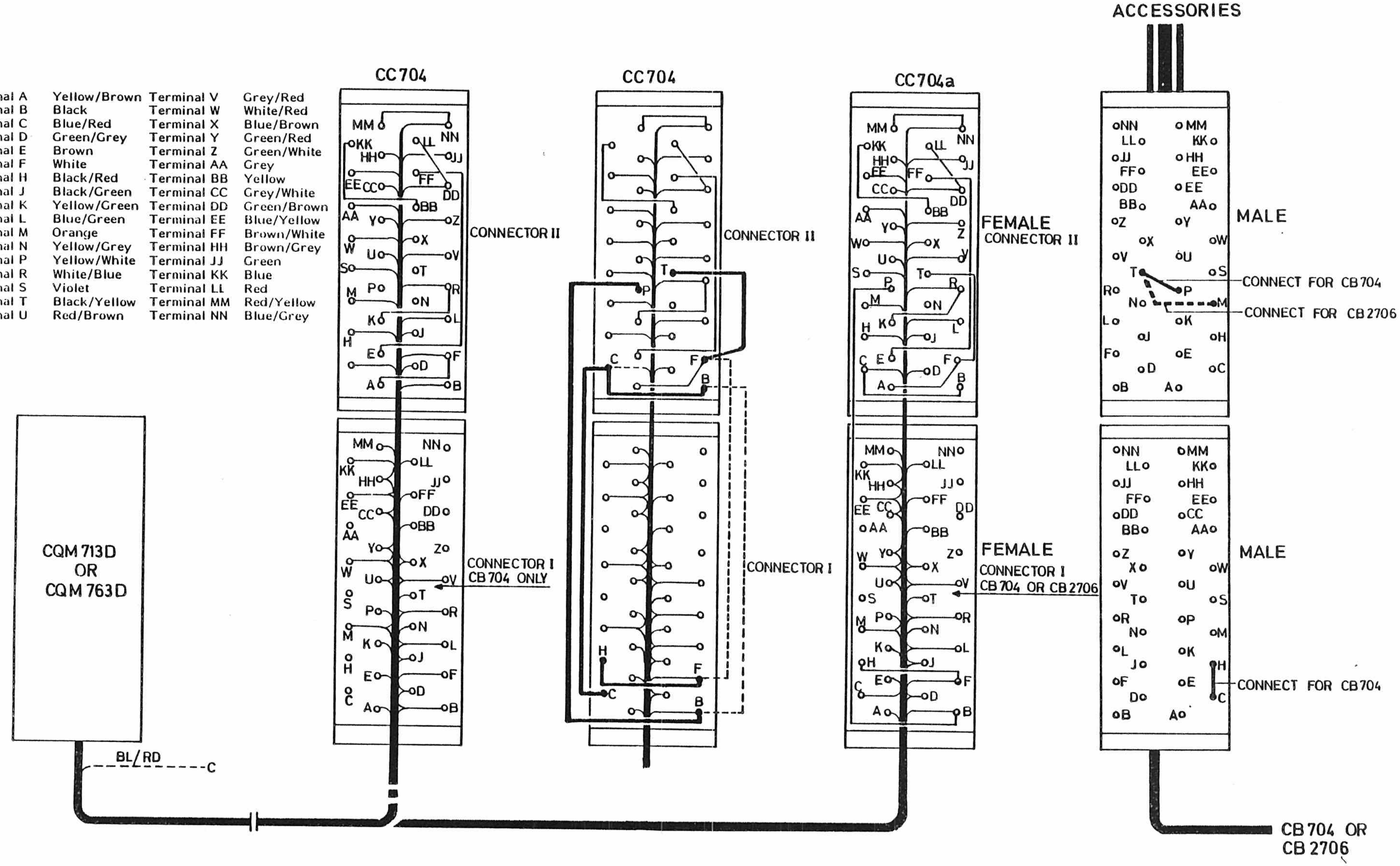
Storno

TYPE	Nº	CODE	DATA
	T2	61.1130	IA transformer 455 kHz
	IC1	14.5105	MC1458 Dual OP-amp.
	IC2	14.5105	MC1458 Dual OP-amp
	IC3	14.5010	IF Amplifier/Discr. ULN 2111 N
	IC4	14.5104	Audio Power Amplifier TBA 810 AS
	ReA	58.5084	Relay 330 Ω 12 V

COMMON FUNCTIONS CF703, CF704

Storno

Terminal A	Yellow/Brown	Terminal V	Grey/Red
Terminal B	Black	Terminal W	White/Red
Terminal C	Blue/Red	Terminal X	Blue/Brown
Terminal D	Green/Grey	Terminal Y	Green/Red
Terminal E	Brown	Terminal Z	Green/White
Terminal F	White	Terminal AA	Grey
Terminal H	Black/Red	Terminal BB	Yellow
Terminal J	Black/Green	Terminal CC	Grey/White
Terminal K	Yellow/Green	Terminal DD	Green/Brown
Terminal L	Blue/Green	Terminal EE	Blue/Yellow
Terminal M	Orange	Terminal FF	Brown/White
Terminal N	Yellow/Grey	Terminal HH	Brown/Grey
Terminal P	Yellow/White	Terminal JJ	Green
Terminal R	White/Blue	Terminal KK	Blue
Terminal S	Violet	Terminal LL	Red
Terminal T	Black/Yellow	Terminal MM	Red/Yellow
Terminal U	Red/Brown	Terminal NN	Blue/Grey



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MODIFYING EXTENSION CABLE CC704 TO CC704a

D402.344

Storno

TYPE	Nº	CODE	DATA			
CF703		10.3364-00	Common Functions			
CF704		10.3499	Common Functions			
	C1	76.5070	10 nF	10%	polyest FL	50 V
	C2	73.5127	22 µF	20%	tantal	16 V
	C3	73.5126	4.7 µF	20%	"	35 V
	C4	76.5072	47 nF	10%	polyest FL	50 V
	C5	76.5060	3.3 nF	10%	"	50 V
	C6	76.5063	220 pF	5%	polystyr TB	160 V
	C7	76.5070	10 nF	10%	polyest FL	50 V
	C8	76.5072	47 nF	10%	" 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 PL	63 V
	C18	73.5102	2.2 µF	20%	tantal	35 V
	C19	76.5070	10 nF	10%	polyest FL	50 V
	C20	76.5070	10 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	76.5072	47 nF	10%	" FL	50 V
	C24	73.5126	4.7 µF	20%	tantal	35 V
	C25	73.5127	22 µF	20%	"	16 V
	C26	73.5125	0.47 µF	20%	"	35 V
	C27	73.5125	0.47 µF	20%	"	35 V
	C28	74.5161	470 pF	-20 + 80%	ceram	63 V
	C31	73.5071	100 µF	-10 + 50%	elko	40 V
	C32	76.5072	47 nF	10%	polyest FL	50 V
CF704	C33	74.5187	39 pF	10%	ceram PL	25 V
	C34	73.5114	1 µF	20%	tantal	35 V
	C35	73.5011	10 µF	-10 + 100%	elko	16 V
CF704	C36	73.5114	1 µF	20%	tantal	35 V
	C37	74.5187	39 pF	10%	ceram PL	25 V
	C38	73.5114	1 µF	20%	tantal	35 V
	C39	73.5011	10 µF	-10 +50%	elko	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	73.5115	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		ceram PL	63 V
	C48	76.5067	1 nF	5%	polystyr TB	160 V

Storno

TYPE	Nº	CODE	DATA			
	C49	73.5114	1 µF	20%	tantal	35 V
	C50	74.5341	68 pF		ceram	63 V
	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%	elko	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%	elko	25 V
	C62	76.5072	47 nF	10%	polyest FL	50 V
	C63	76.5072	47 nF	10%	" FL	50 V
	C64	73.5137	470 µF	-10 + 50%	elko	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
	R6	80.5283	680 KΩ	5%	carbon film	1/8 W
	R7	80.5284	820 KΩ	5%	trim. carbon	0.1 W
	R8	80.5280	390 KΩ	5%	carbon film	1/8 W
	R9	80.5248	820 Ω	5%	"	1/8 W
	R10	80.5248	820 Ω	5%	"	1/8 W
	R11	80.5266	27 KΩ	5%	"	1/8 W
	R12	80.5267	33 KΩ	5%	"	1/8 W
	R13	80.5273	100 KΩ	5%	"	1/8 W
	R14	80.5278	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	1/8 W
	R19	86.5043	2.2 KΩ	20%	"	0.1 W
	R20	80.5250	1.2 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	80.5242	270 Ω	5%	"	1/8 W

COMMON FUNCTIONS CF703, CF704

X402.429

TYPE	NO	CODE	DATA			
CF703		10.3364-00	Common Functions			
	R25	80.5268	39 KΩ	5%	carbon film	1/8 W
	R26	80.5263	15 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
	R30	80.5264	18 KΩ	5%	"	1/8 W
	R31	80.5269	47 KΩ	5%	"	1/8 W
	R32	80.5258	5.6 KΩ	5%	"	1/8 W
CF704	R33	80.5261	10 KΩ	5%	"	1/8 W
CF704	R34	80.5264	18 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 Ω	5%	"	1/8 W
	R40	80.5269	47 KΩ	5%	"	1/8 W
	R41	80.5265	22 KΩ	5%	"	1/8 W
	R42	80.5264	18 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	5%	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 Ω	5%	"	1/8 W
	R62	80.5252	1.8 KΩ	5%	"	1/8 W
	R63	80.5243	330 Ω	5%	"	1/8 W
	R64	80.5258	5.6 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

Storno

TYPE	NO	CODE	DATA			
CF703		10.3364-00	Common Functions			
	R84	80.5257	4.7 KΩ	5%	carbon film	1/8 W
	R85	80.5265	22 KΩ	5%	"	1/8 W
	R86	80.5264	18 KΩ	5%	"	1/8 W
	R87	80.5262	12 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	1/8 W
	R92	80.5258	5.6 KΩ	5%	carbon film	1/8 W
CF704	R93	80.5258	5.6 KΩ	5%	"	1/8 W
CF704	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
	R98	86.5039	10 KΩ	20%	trim carbon	1/8 W
	R99	80.5268	39 KΩ	5%	carbon film	1/8 W
	R100	80.5266	27 KΩ	5%	"	1/8 W
	R101	80.5261	10 KΩ	5%	"	1/8 W
	R102	80.5256	3.9 KΩ	5%	"	1/8 W
	R103	80.5260	8.2 KΩ	5%	"	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	80.5273	100 KΩ	5%	"	1/8 W

COMMON FUNCTIONS CF703, CF704

Storno

TYPE	Nº	CODE	DATA
	R124	80.5230	27 Ω 5% carbon film 1/8 W
	R125	80.5237	100 Ω 5% " 1/8 W
	R126	80.5213	1 Ω 5% " 1/8 W
	R127	80.5252	1.8 KΩ 5% " 1/8 W
	L1	61.1132	Squelch coil 75 mH
	L2	61.1131	IA coil 455 kHz
	E1	99.5237	1 N 4148 Diode
	E2	99.5237	1 N 4148 "
	E3	99.5042	Zenerdiode 9.1 V 5% 0.25 W
	E4	99.5209	Stabilizerdiode 1.5 V
	E5	99.5237	1 N 4148 Diode
	E6	99.5237	1 N 4148 "
	E7	99.5237	1 N 4148 "
	E8	99.5237	1 N 4148 "
	E9	99.5020	1 N 4004 "
	E10	99.5237	1 N 4148 "
	E11	99.5209	Stabilizerdiode 1.5 V
	E12	99.5237	1 N 4148 Diode
	E13 E14	99.5237	1 N 4148 "
	E15	99.5224	Zenerdiode 4.7 V 5% 0.25 W
	E16	99.5237	1 N 4148 Diode
	E17	99.5224	Zenerdiode 4.7 V 5% 0.25 W
	E18	99.5209	1.5 V Stab. diode
	Q1	99.5144	Transistor BC 214 L
	Q2	99.5143	" BC 238 (BC 108)
CF704	Q3	99.5143	" BC 238 (BC 108)
	Q4	99.5143	" BC 238 (BC 108)
	Q5	99.5143	" BC 238 (BC 108)
	Q6	99.5201	" BC 239 (BC 109)
	Q7	99.5115	" BC 309 (BC 179)
	Q8	99.5115	" BC 309 (BC 179)
	Q9	99.5143	" BC 238 (BC 108)
	Q20	99.5246	" TIP 31
	Q21	99.5144	" BC 214 L
	Q22	99.5143	" BC 238 (BC 108)
	Q23	99.5143	" BC 238 (BC 108)
	Q24	99.5246	" TIP 31
	Q25	99.5144	" BC 214 L
	Q26	99.5143	" BC 238 (BC 108)
	Q27	99.5143	" BC 238 (BC 108)
	Q28	99.5143	" BC 238 (BC 108)
	Q29	99.5115	" BC 308 (BC 178)
	Q30	99.5326	" BF 198
	Q31	99.5326	" BF 198
	Q32	99.5143	BC238
	T1	61.1130	IA transformer 455 kHz

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TYPE	Nº	CODE	DATA
	T2	61.1130	IA transformer 455 kHz
	IC1	14.5105	MC1458 Dual OP-amp.
	IC2	14.5105	MC1458 Dual OP-amp
	IC3	14.5010	IF Amplifier/Discr. ULN 2111 N
	IC4	14.5104	Audio Power Amplifier TBA 810 AS
	ReA	58.5084	Relay 330 Ω 12 V

COMMON FUNCTIONS CF703, CF704

X402.429

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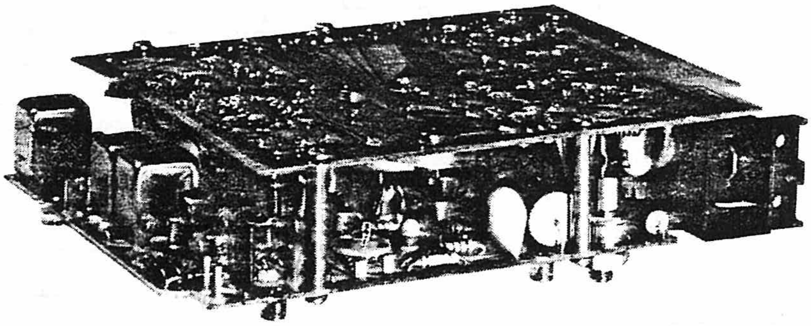
COMMON FUNCTIONS UNIT CF701



Description

The CF701 module contains all the circuitry for the CQM700 series radiotelephones that is not dependent upon frequency or channel separation. The unit includes the following functions:

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

CF701 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 internal connections. The conductive sides of the printed wiring boards face outwards, with the board containing the IF, the AF preamp, the squelch and the voltage regulators fastened to the chassis. External connections to the CF unit are all solder connections with the exception of the battery connection, which is through a plug.

Operating Principle

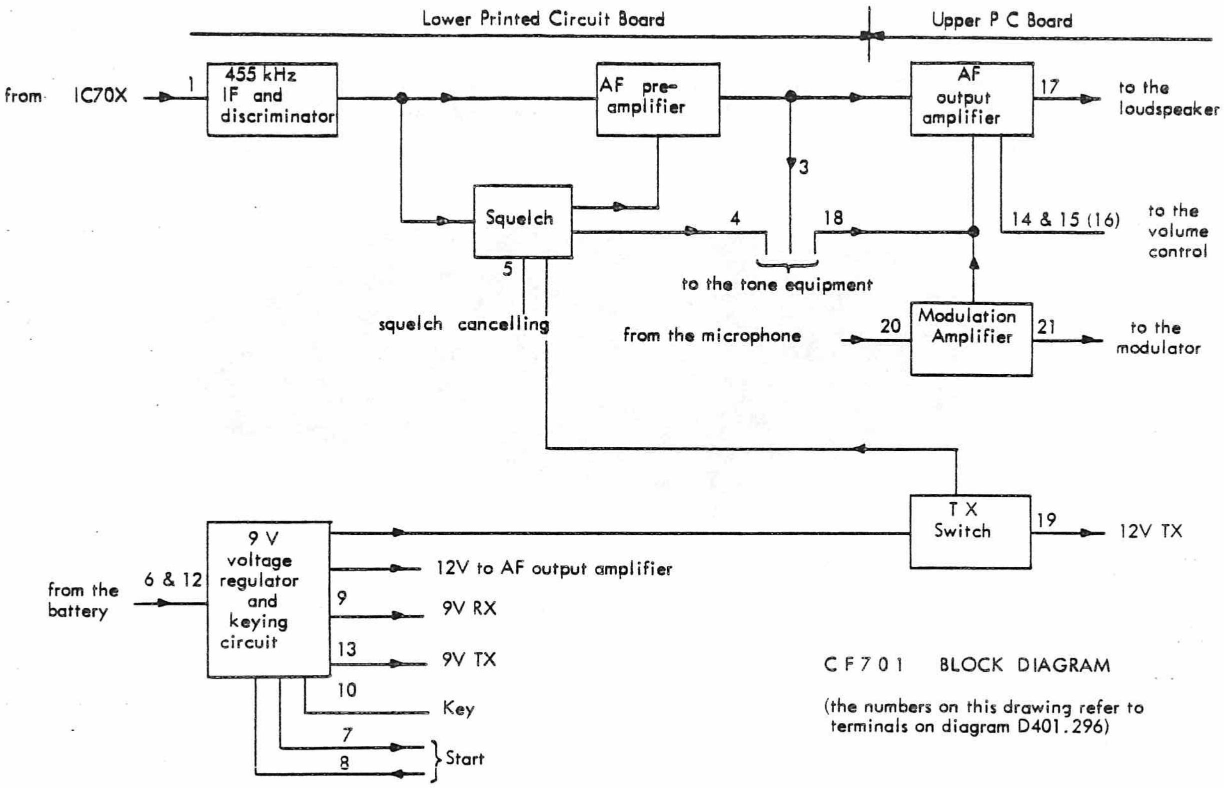
To aid heat dissipation, the AF amplifier output transistors and the drive resistor for Q29 in the TX switch, all on the upper p-c board, as well as the series regulator transistors in the voltage regulators on the lower board all have good thermal contact to the chassis.

The 455 kHz signal from IC700 passes through the IF stages to the integrated circuit discriminator, IC-1. 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 preamp 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 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, IC2a and IC2b, are contained in the same housing.



CF701 BLOCK DIAGRAM

(the numbers on this drawing refer to terminals on diagram D401.296)

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 swing within the established maximum excursions for whichever channel separation is employed.

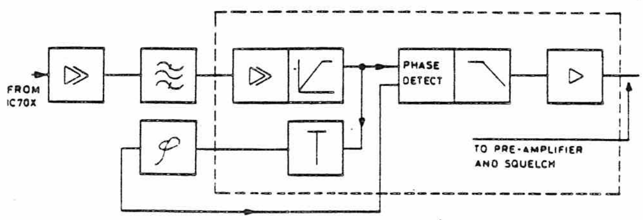
As mentioned previously, the CF unit also contains two voltage regulators; one supplies the receiver section and the other, the transmitter. The AF output amplifier and the PA stage are supplied through a filter choke directly from the battery and are therefore unregulated.

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 10 is grounded during transmission and otherwise floats when the key is not activated.

12 V TX is taken off before the on/off switch in order to avoid any voltage drop in the start cable when employing extended local control. 12 V TX is applied to the PA stage through a transistor switching arrangement, the TX switch, which is driven by the 9 V TX regulator. When the key is activated the TX switch blocks the audio preamplifier as a precaution against the possibility that any transients in the squelch circuit might open the receiver during transmission, since the supply voltage to the AF output amplifier is always on whenever the on/off switch is turned on.

The 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, Q1 and Q2, are made up of discrete components while the last three are a part of the integrated circuit, IC1, along with the phase detector.

The only resonant circuits employed in the 2nd IF stage are those between the collector of Q2 and the input to IC1. Resistors R9 and R12 load T1 and T2 enough to achieve sufficiently broad bandwidth.

Inductive coupling between circuits is less than critical, R11 in the coupling link determining the coupling factor. Q2 operates with its collector-emitter voltage held low to prevent overdriving IC1.

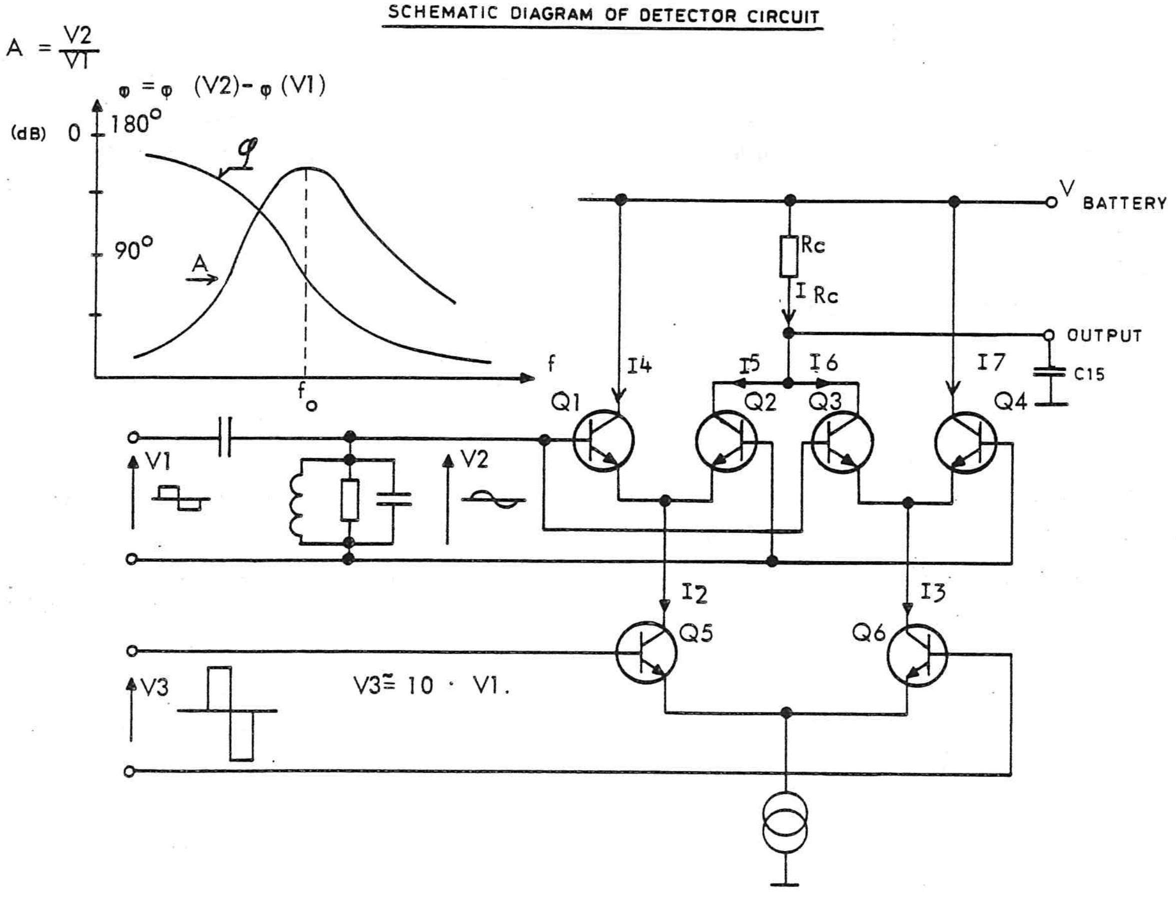
The three amplifier stages in IC1 are differential amplifiers, which configuration approaches ideal symmetrical limiting. The stages are DC coupled and stability is assured through strong negative feedback. Capacitor C12 eliminates the feedback as far as AC voltages are concerned.

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.

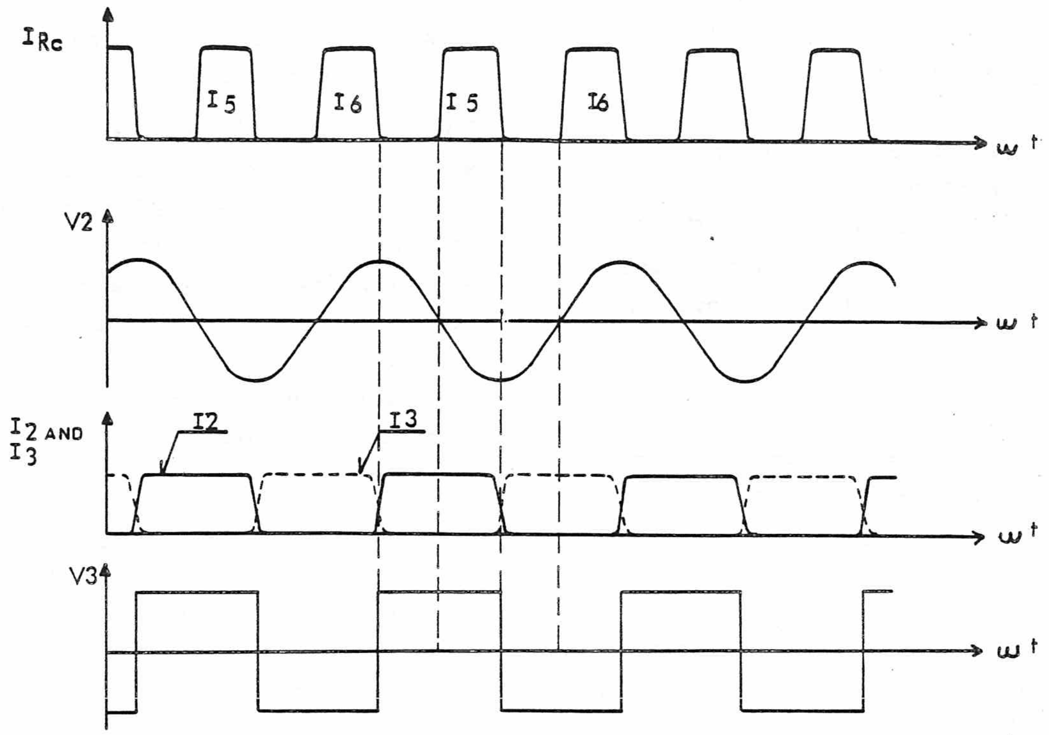
The other input is fed the same signal, attenuated and approximately 90^{o} out of phase (at f_0). Phase shift is accomplished with discrete components: C13, C14, L1 and R14. The following diagram shows the detector circuit schematic and the amplitude and phase characteristics of the phase shifting network. A graph of the detector 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, IC1 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.

SCHEMATIC DIAGRAM OF DETECTOR CIRCUIT



GRAPH OF VOLTAGE AND CURRENT RELATIONSHIPS
IN THE PHASE DETECTOR WHEN $f = f_0$



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 C15) 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 halv, 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 conventinal FM detectors will be present at the output (directly on pin 1 of IC1). However, the mid-point 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.

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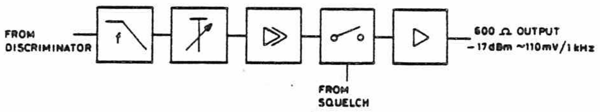
The De-emphasis Filter, AF Preamplifier and Electronic Squelching Switch



Network R15 and C19 take care of de-emphasising the demodulated signal at the rate of -6 dB pr. octave.

The three stages of the preamplifier, Q3, Q4 and Q6, must then amplify the AF signal and match it to the nominal 600 Ω load. In addition, Q5 is inserted between Q4 and Q6. Q5, which is a field-effect transistor, operates as an electronic switch, interrupting the signal path on command from the squelch circuit.

The nominal output voltage of the preamp is -17 dBm into the 600 Ω output line. R16 is the adjustment used for setting the correct output level.

The collector of Q3 is directly coupled to the base of Q4; resistors R21, R22 and R23 provide the feedback necessary to stabilise the two stages.

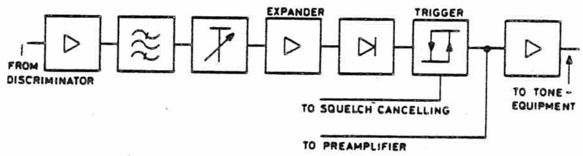
The signal path between the second and third amplifier stages is through the FET transistor, which acts like a relay contact, or switch. A gate-to-source potential of 4 V, at most, will "break" the path between source and drain. Since the collector of Q4 is at approx. 4.7 V, a gate voltage at Q5 under 0.7 V "breaks" the connection and "makes" the connection between Q4 and Q6 again when gate voltage rises above 4.7 V.

The Squelch

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

An internal adjustment, potentiometer R38, is provided for setting the squelch level. The squelch function can be cancelled altogether by grounding terminal 5 via the squelch cancelling button on the control panel.

By altering only a few passive component values, the squelch section can operate on any of the three channel bandwidths normally employed.



The squelch section includes a frequency selective noise amplifier, Q7, an expander stage, Q8, a noise detector, A Schmitt trigger, Q9 and Q10, and an emitter follower amplifier, Q11.

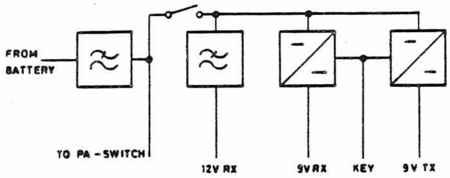
The operating principle is as follows:

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 some frequency well above the voice range, and depending upon the channel bandwidth employed. The selected noise is then fed to Q8 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 Q8 appears as a larger relative change at the collector. The noise pulses are then rectified and filtered to a DC potential that, in turn, controls the Schmitt trigger, Q9 and Q10. The collector voltage on Q10 is used partly to drive the emitter follower, Q11, and partly, through an R-C network, to switch the FET transistor in the AF preamplifier.

 Storno

Keying the transmitter interrupts the power to the receiver. At the same time, diodes E2 and E6 in the squelch are grounded through Q30 to prevent any false signals that might appear in the squelch circuitry from effecting the AF amplifier or Q11 during this condition.

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 volt auto battery.

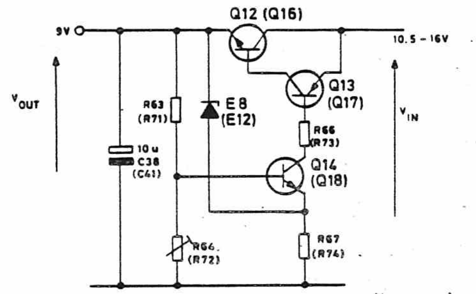
The battery connects to the regulators through the transient and ripple filter, L3a and C39, and through the vehicle's start switch via terminals 7 and 8. The AF output amplifier is supplied with unregulated, filtered battery power via the other filter winding, L3b, and C56 in the AF amplifier circuit.

To protect the equipment against incorrect battery polarity or excess voltage, a properly dimensioned zener diode is placed across the supply. If the power supply is connected wrong the zener diode will act as a short circuit at the input, blowing the fuses in the battery leads. In case of excess supply voltage, the zener diode will not allow more than about 20 volts to be present at the input to the regulators.

The voltage regulators are protected against short circuits; with shorted output the current through Q12 will be < 0.5 A and through Q16, < 0.1 A. The power transistors are mechanically 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:

Q12 is driven by Q13, which is controlled by amplifier Q14. Transistor Q14 compares the zener reference voltage across E8 with a portion of the output voltage through dividing resistors R63 and R64. R64 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 Q14 will increase, also increasing base current for Q13 and Q12. When base current to Q12 increases, more current flows through the output load, cancelling the original drop in output voltage.

If the load current increases to a certain value, Q14 goes into saturation. If the load current increases still more, the zener diode will act as an open circuit and V_{BE} for Q14 decreases whereby base current for Q14, Q13 and Q12 decreases, too. Finally, Q14 will be cut off and base current in Q12 and Q13 will be zero. Thus is Q12 protected against destruction by short circuits at its output. Resistors R66 and R67 determine the saturation current through Q14 and, of course, the short circuit current.

A regulator built exactly like the simplified diagram would not be self-starting, however. Therefore, the regulators in the CF701 are provided with starting circuits;

9 V RX employs R61, R62 and E9 in its starting circuit and 9 V TX employs R70 and E11. 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 10.

Operation of Keying and Starting Circuits

When terminal 10 is floating and the power is turned on, 9 V RX will build up voltage since Q12 gets base current through R58, E9, R61 and R62. When 9 V RX reaches its final value the starting circuit will have no effect on the regulator because diode E9 will then be nonconducting (the unloaded voltage at terminal 10 is approx. 8.2 V at nominal battery voltage).

Transistors Q15 and Q19 are both heavily saturated, so the 9 V RX regulator will operate undisturbed while 9 V TX will be blocked because Q18 is completely cut-off by Q19.

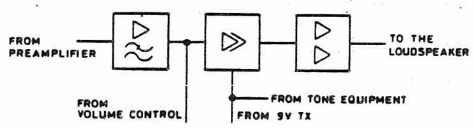
Grounding terminal 10 immediately cuts off Q15 and Q19. 9 V RX falls towards 0 V as there is now no base current to Q13. 9 V RX falls off at a rate determined by the time constant of R38 and the load on terminal 9. Under all operating conditions within factory specifications for the radiotelephone, the time constant will easily be long enough that the current through starting circuit R70 and E11 can turn on Q18, whereby a voltage builds up on 9 V TX that finally reaches a level where diode E11 becomes nonconducting.

Diode E10 and resistor R68 ensure that keying the transmitter cuts off base current to Q13 effectively, even at high temperatures. Diode E7 ensures effective keying even if terminal 10 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. Since - as just explained - it is 9 V RX that starts 9 V TX, it is necessary to activate the transmitter key again. Even with 9 V RX shorted, Q12 still gets its base current through the starting circuit where one of the resistors, R62, is a PTC resistor that will limit base current to the transistor at high ambient temperatures or when Q12 heats up.

The AF Output Amplifier

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



Frequencies below 250 Hz are very sharply cut off in the first amplifier stage, transistor Q20. Included in the collector of Q20 is a variable resistor which allows for adjustment of the amplifier gain above the nominal amount in order to compensate for weak modulation of the incoming signal.

The signal passes from the 1st stage to the volume control whose arm connects to terminal 15 in the case of local control or to terminal 16 in case of extended local control. An isolation resistor is placed between the two terminals, allowing for extended local control without necessitating the removal of the local control connections.

The 2nd amplifier stage, Q21, is an emitter follower whose base voltage is the essential factor in determining the symmetry of the drive signal to the loudspeaker output.

From Q21, the signal is fed via two R-C low-pass filter networks to the 3rd ampli-

Storno

fier stage, Q22. The primary purpose of the two low-pass networks is to stabilise the amplifier in regard to AC when empolying extended local control.

In Q22, which in principle is coupled in the grounded emitter configuration, the signal is amplified and passes directly to the next amplifier stage which, in turn, is coupled directly to the driver transistors, Q25 and Q26. Transistor Q23 and resistors R98, R99 and R100 provide temperature compensated biasing for the driver transistors. As far as AC is concerned, the circuit appears as a short circuit between the bases of the two driver transistors. The complementary output transistors operate in class AB push-pull. Strong negative DC feedback is introduced in order to stabilise the operating point for the output stages. The feedback network is from the output, over R106 to the emitter of Q22. The AC feedback network is formed by R106 in conjunction with R96.

The power transistors employ aluminium heat sinks fastened to the radio chassis for good thermal contact.

During transmission a "muting signal" grounds the base of Q24 via terminal 18 and an R-C network, blocking the output amplifier. This network also functions as the blocking gate for the tone equipment

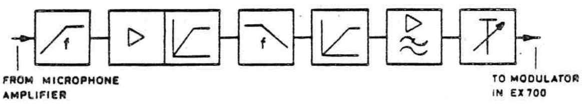
The Modulation Amplifier

General

The modulation amplifier differentiates, amplifies, limits and integrates the microphone signal. It also suppresses undesired high frequencies with an active filter designed for either 20, 25 or 50 kHz channel separation or, with a few resistor values changed, 12.5 kHz channel spacing.

Both amplifiers are contained in a single integrated circuit made up of dual operational amplifiers. The modulation amplifier contains additional passive differentiating 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 R112, is asymmetric.

The Differentiating Circuit

The differentiation network is made up of C64 and R113 (the input impedance of the op amp is negligible due to the feedback through R116). It differentiates at the rate of +6 dB pr. octave over the entire audio range of 300 to 3000 Hz.

The Amplifier - Clipper

The 1st amplifier stage has a very accurately determined gain due to its feedback. Clipping action begins as soon as the amplifier is driven to where the collector excursions approximate the battery voltage. This level will be about 6.8 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 R114 and R115 and therefore is fixed.

The Integration Circuit

Integrating takes place from 230 Hz at 6 dB pr. octave. The passive integrating network consists of R118 and C67. 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 2nd Clipper (or Phase Clipper)

This extra clipper is inserted to prevent strong input signals at low frequencies from overdriving the modulator stage. For signal levels corresponding to the nominal frequency swing, the clipper has no effect. Two 1.5 V diodes and capacitor C69 make up this circuit. The clipping level is only approx. 1.2 V at maximum due to the comparatively large impedance of R118.

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). The significant passive filter components are resistors R119, R120 and R121 and capacitors C70, C71, C72, C75, C76 and C77. The filter cannot be overdriven because the input signal level is subject to limiting by the diode clipper.

Adjusting the Frequency Swing

The amount of signal to the modulator input, and thus the frequency swing, is set by potentiometer R124 which forms a voltage divider with the modulator input impedance.

The TX Switch.

The PA keying circuit operates an electronic switch in the path of the 12 V TX supply voltage to the PA unit. The circuit consists of Q29 and Q30 along with the associated resistor networks at their bases. The transistors operate in saturation when transmitting and are cut-off during standby, or receive. The circuit is controlled from 9 V TX.

In addition, Q30 grounds out spurious squelch signals whenever the transmitter is activated.

TECHNICAL SPECIFICATIONS

Nominal Supply Voltage

13.6 V

Current Drain for CF701 (at nominal supply voltage)

Transmit: 220 mA
Receive : 65 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 3)
−17 dBm / 600 Ω

Regulated Voltages
Receiver (terminal 9) : 9 V
Transmitter (terminal 13): 9 V

Unregulated, Filtered Voltages
AF output amplifier : 13.6 V
PA stage (terminal 19): 13.6 V

AF Output Power (terminal 17)
2 W

Modulation Amplifier Sensitivity (for normal frequency swing of 1 kHz)

110 mV +1/ −0 dB

The following, more detailed specifications for the seven CF701 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 IC1: 55 dB
from IC1 input (pin 4) to IC1 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 $\boxed{2}$, terminated with 2.2 kΩ load.

Discriminator Linearity (relative to 1000 Hz)

Pass-Band 100 - 3500 Hz: +0 / −1 dB
Measured at test point $\boxed{2}$, terminated with 2.2 kΩ load.

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)

8 mA

Input Impedance (at 1 kHz)

2.2 kΩ

Output Impedance

R_{OUT} = 680 Ω

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Gain (gain control at highest setting)

R_L = 560 Ω, f = 1 kHz: 12.5 dB

Harmonic Distortion (R_L = 560 Ω, f = 1 kHz)

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

V_{OUT} = 500 mV : 0.5 %

Required Turn-on Potential (at gate of Q5)

To ensure normal signal path: ⩾4.7 V

Required Turn-off Potential (at gate of Q5)

To ensure 70 dB attenuation of signal: ⩽0.7 V
Measured with 110 mV, 1 kHz signal applied to circuit input, test point 2, and gain control set at max., V_{OUT} (terminal 3) = approx. 500 mV.

De-emphasis Cut-off Frequency

90 Hz

Frequency Response (relative to −6 dB/ octave characteristic)

Pass-Band linearity (300 - 3000 Hz): +0/−1 dB
50 - 100 Hz : +15 dB

SQUELCH CIRCUIT

Current Drain (at nominal 9 V supply)

12 mA
Measured with unloaded Squelch Signalling (terminal 4).

Input Impedance (at 1 kHz)

20 kΩ

Noise Filter Resonant Frequency

12.5 kHz channel spacing : 7.1 kHz
20/25 kHz channel spacing: 7.1 kHz
50 kHz channel spacing : 10 kHz

Output Voltage

Squelched condition : ⩽100 mV
Un-squelched condition: >5.7 V
Measured at test point 1. DC.

Squelch Signalling (terminal 4)

R_{LOAD} minimum: 680Ω

V_{OUT} (with R_L = 680 Ω)

Squelched condition ⩽100 mV
Un-squelched condition ⩾4.0 V

Transition Time (gain control set for nominal V_{OUT})

6 ms

Delay measured from the time that the voltage at test point 1 switches state until the AF signal at terminal 3 increases from 10% to 90% of its nominal amplitude.

Turn-off delay (signal decrease from 90% to 10%) is also 6 ms.

Overall Receiver Squelch Response

Turn-on delay: 30 ms
Turn-off delay: 25 ms
Measured with receiver adjusted for 12 dB SINAD.

9V VOLTAGE REGULATORS and KEYING CIRCUITS

Nominal Supply Voltage

13.6 V

Operating Range

10.5 V to 16 V

Regulated Output Voltages

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

Storno

Internal Resistance of Regulators

$R_I = 0.5\,\Omega$

Regulator Output Current

Maximum 250 mA

12 V RX to AF Output Amplifier (filtered, unregulated voltage)

ripple suppression at 1 kHz, no load condition:	36 dB
voltage drop over filter when P_{OUT} = 2 W:	0.25 V
maximum output current:	500 mA

Keying Termination

Maximum allowable resistance of wiring :	180 Ω
Alternatively, V_{MAX} at terminal 10:	1.0 V

Regulator Switching Time ($V_{BATT.}$ = 13.6 V)

9V RX turn-on delay, $t_{0-90\%}$:	0.4 ms
9V RX turn-off delay, $t_{100-10\%}$:	100 ms
9V TX turn-on delay, $t_{0-90\%}$:	0.1 ms
9V TX turn-off delay, $t_{100-10\%}$:	25 ms

Measured under normal load conditions.

AF OUTPUT AMPLIFIER

Nominal Supply Voltage

13.6 V

Operating Range

10.5 to 16.0 V

Current Drain (at nominal supply voltage)

no-signal condition :	20 mA
at 2 W output: :	300 mA
blocked :	20 mA

Output Power (at nominal supply voltage)

maximum 2 W

Loudspeaker Impedance

Nominal / minimum: 5 Ω

Input Impedance (at 1 kHz)

560 Ω

Nominal Gain

Input signal (1 kHz) required for 2 W output: 110 mV
Measured with volume control (5 kΩ potentiometer) connected to terminals 14, 15 and chassis ground, and turned fully up.

Where the connections are to terminals 14, 16 and chassis, as with extended local control, the gain increases by 2 dB.

Adjustment of R83 can increase sensitivity 12 dB.

Gain vs. $\Delta V_{BATT.}$

13.6 V +2.4 /−3.1 V: 0.2 dB

Harmonic Distortion

P_{OUT} = 2 W :	1 %
P_{OUT} = 0.2 W :	0.5 %

Frequency Response (relative to 1 kHz)

100 Hz	−22 dB
300 Hz	0 dB
2700 Hz	− 0.5 dB
6 Hz	− 2 dB

Measured at 0.2 W output power.

AF Muting

Required DC at terminal 18 to attenuate the output signal by 60 dB: 8.0 V

MODULATION AMPLIFIER

Current Drain (at nominal 9 V supply)

2 mA

Input Impedance (at 1 kHz)

560 Ω

Limiting

Signal clipping begins to occur with an input signal (1000 Hz) of: 110 mV

Output signal level observed at pin 2 of IC2 when clipping occurs: 7.0 V p.p.

60.178-E1

Phase Limiting

Phase clipping level (at 300 Hz): 2.1 V p.p.

Measured immediately after the integration network, with an input signal of 1.1 V (nominal 110 mV + 20 dB).

Output Voltage (1000 Hz)

560 mV

Measured at Modulation Output (terminal 21) with potentiometer R124 fully up, and load impedance = 1 kΩ.
Input level = 110 mV

Harmonic Distortion (at 1000 Hz)
for 110 mV input signal: 0.8 %

Frequency Response (relative to 1 kHz)

	channel spacing 20/25/50 kHz	channel spacing 12.5 kHz
300 Hz	– 0.5 dB	– 0.5 dB
3 kHz	– 1 dB	– 4 dB
6 kHz	– 19 dB	– 25 dB
10 kHz	– 32 dB	– 37 dB

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

PA KEYING CIRCUIT

Nominal Supply Voltage

13.6 V

Operating Range

10.5 to 16 V

Maximum Load Current

3 A

TX Switch

Voltage drop across transistor switch when ON, at 2 A load current: 0.2 V

Transistor collector current when OFF:

$T_{AMB} = 25^{o}C$: 0.2 mA

$T_{AMB} = 60^{o}C$: 10 mA

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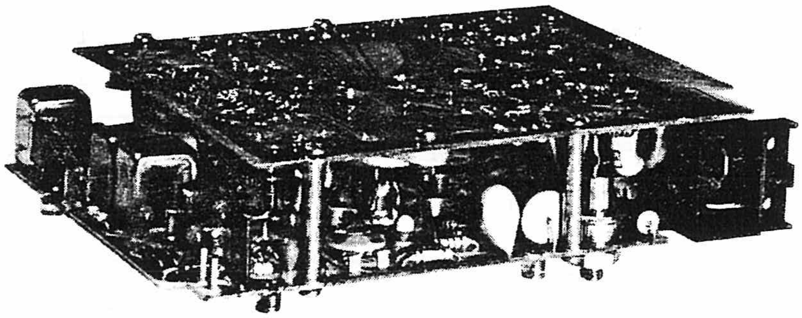
COMMON FUNCTIONS UNIT

CF701 & CF702



Description

The CF unit module contains all the circuitry for the CQM700 series radiotelephones that is not dependent upon frequency or channel separation. CF701 is designed for simplex operation and CF702 for duplex. The unit includes the following functions:

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

The CF unit 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 internal connections. The conductive sides of the printed wiring boards face outwards, with the board containing the IF, the AF preamp, the squelch and the voltage regulators fastened to the chassis. External connections to the CF unit are all solder connections with the exception of the battery connection, which is through a plug.

Operating Principle

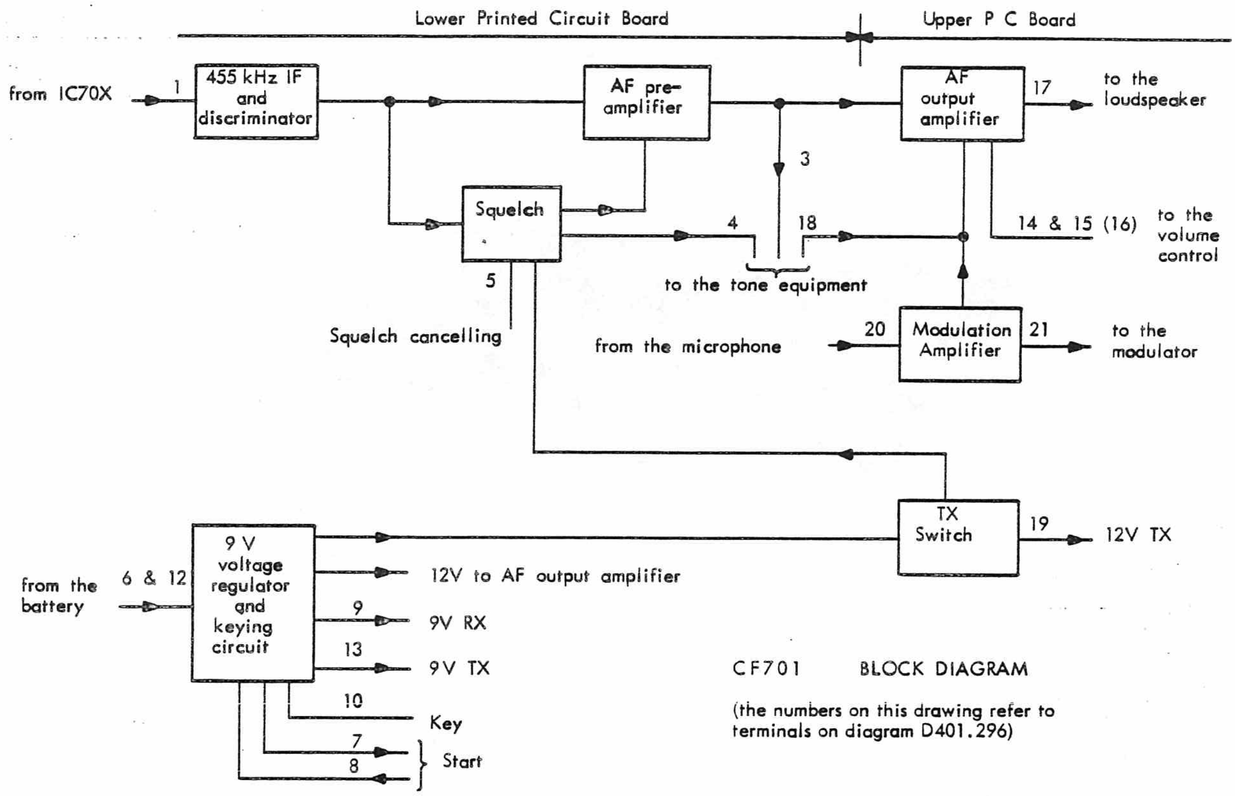
To aid heat dissipation, the AF amplifier output transistors and the drive resistor for Q29 in the TX switch, all on the upper p-c board, as well as the series regulator transistors in the voltage regulators on the lower board all have good thermal contact to the chassis.

The 455 kHz signal from IC700 passes through the IF stages to the integrated circuit discriminator, IC-1. 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 preamp according to the noise content in the demodulated signal. Also, control voltages for use with tone equipment are obtained from the squelch circuit.

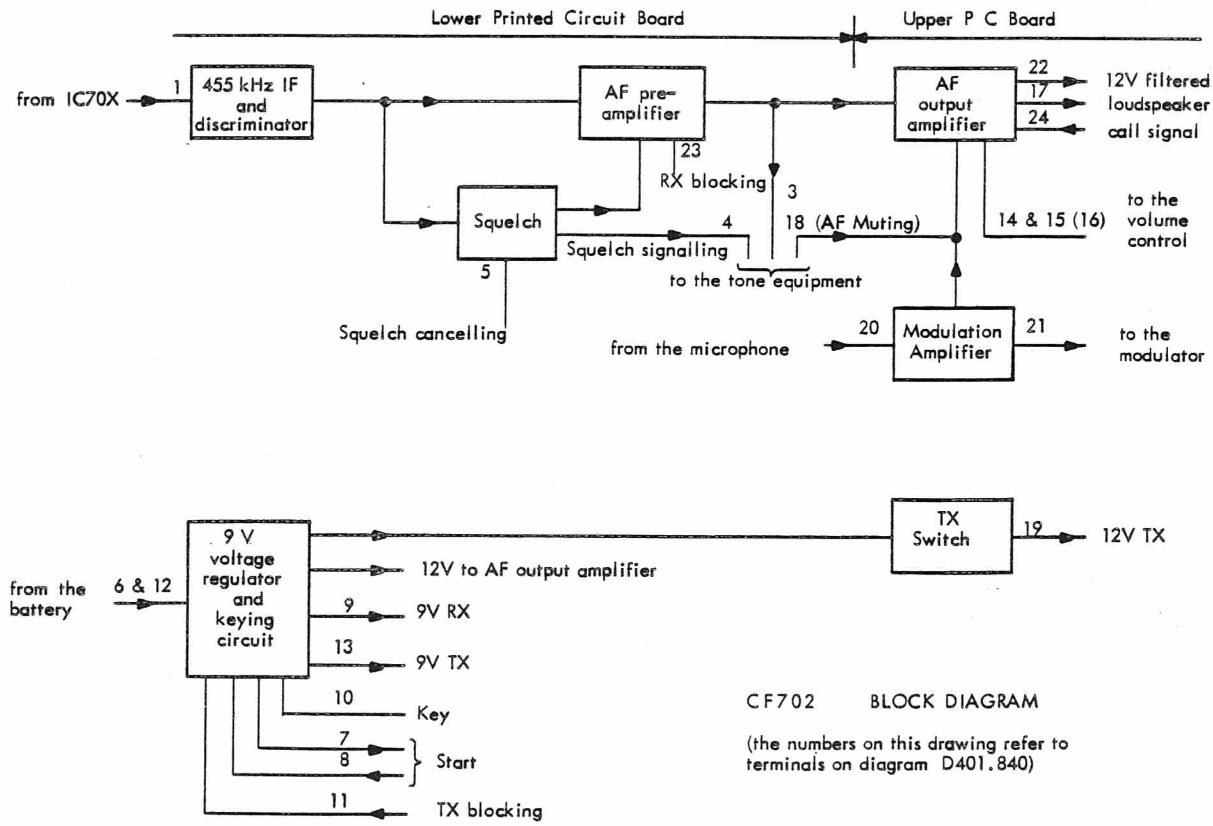
The audio signal is taken from the 600 Ω output of the preamplifier to the AF amplifier. When transmitting in the simplex mode (CF701), the signal path through the output amplifier becomes automatically blocked. The tone equipment can also block the signal path here.

The signal from the microphone is amplified and limited in the modulation amplifier, which is designed around a dual, integrated operation-



CF701 BLOCK DIAGRAM

(the numbers on this drawing refer to terminals on diagram D401.296)



CF702 BLOCK DIAGRAM

(the numbers on this drawing refer to terminals on diagram D401.840)

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al amplifier. Both amplifiers, IC2a and IC2b, 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 swing within the established maximum excursions for whichever channel separation is employed.

As mentioned previously, the CF unit 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 through a filter choke directly from the battery and are therefore unregulated.

Switching between transmit and receive is accomplished without relays. In CF701 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 10 is grounded during transmission and otherwise floats when the key is not activated.

Likewise, in the case of CF702, switching between the duplex and the receive conditions is accomplished without relays. Whenever the equipment is turned on the 9 V RX voltage regulator will always be on.

The PA stage is controlled by the 9 V TX regulator which turns on when terminal 10 is grounded (via the transmit key). Thus when transmitting, both the 9 V TX and the 9 V RX regulators are on.

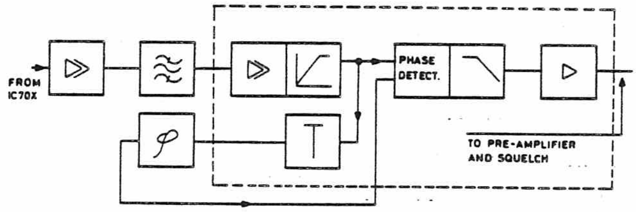
12 V TX is taken off before the on/off switch in order to avoid any voltage drop in the start cable when employing extended local control. 12 V TX is applied to the PA stage through a transistor switching arrangement, the TX switch, which is driven by 9 V TX regulator.

The 12 V supply voltage to the AF output amplifier is always on whenever the on/off switch is turned on. Therefore, in simplex equipment (CF701), the TX switch is designed to block the audio preamplifier 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.

As just explained, the receiver section in duplex equipment (CF702) is always on whenever power is applied to the set.

The 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, Q1 and Q2, are made up of discrete components while the last three are a part of the integrated circuit, IC1, along with the phase detector.

The only resonant circuits employed in the 2nd IF stage are those between the collector of Q2 and the input to IC1. Resistors R9 and R12 load T1 and T2 enough to achieve sufficiently broad bandwidth.

Inductive coupling between circuits is less than critical, R11 in the coupling link determining the coupling factor. Q2 operates with its collector-emitter voltage held low to prevent overdriving IC1.

The three amplifier stages in IC1 are differential amplifiers, which configuration approaches ideal symmetrical limiting. The stages are DC coupled and stability is assured through strong negative feedback. Capacitor C12 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.

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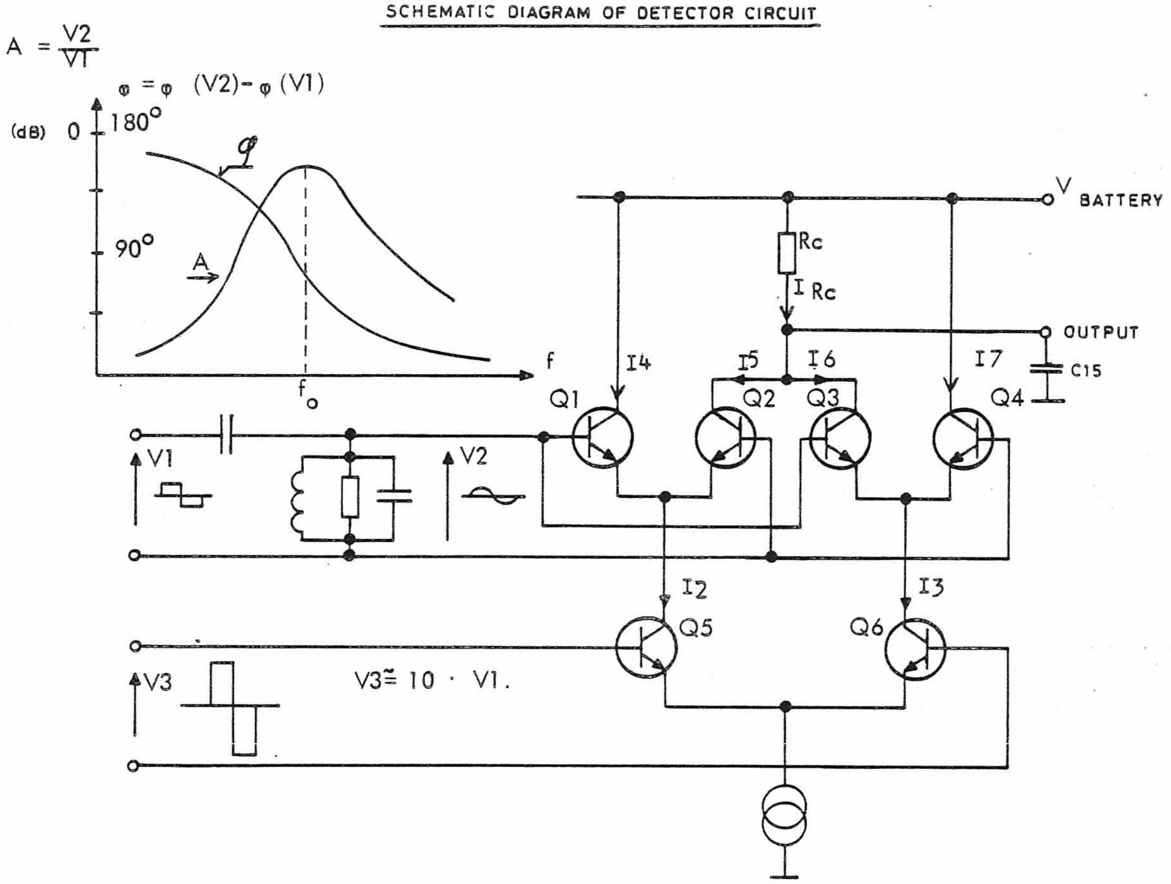
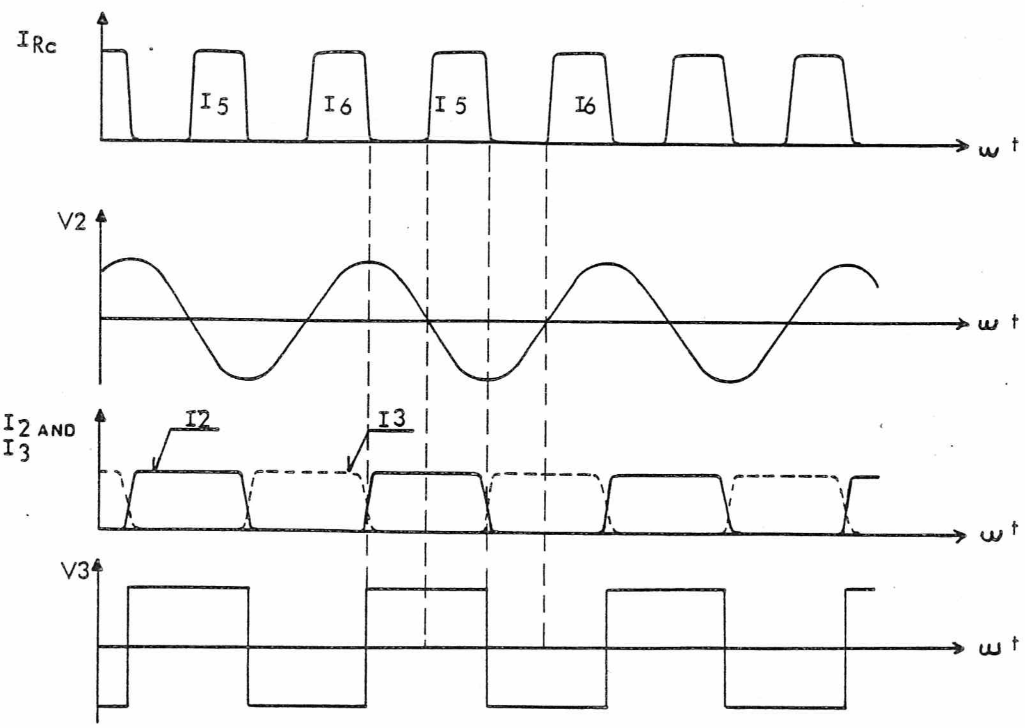
SCHEMATIC DIAGRAM OF DETECTOR CIRCUIT



GRAPH OF VOLTAGE AND CURRENT RELATIONSHIPS
IN THE PHASE DETECTOR WHEN $f = f_0$



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The other input is fed the same signal, attenuated and aproximately 90° out of phase (at f_0). Phase shift is accomplished with discrete components: C13, C14, L1 and R14. The following diagram shows the detector circuit schematic and the amplitude and phase characteristics of the phase shifting network. A graph of the detector 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, IC1 also contains an emitter follower after the detector output, another emitter follower between the phase shifing 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.

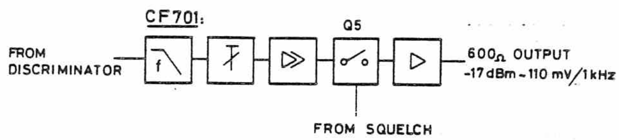
As seen on the schematic, current pulses through R_C only appear when V2 and V3 are of opposite polarities and I 5 appears only when V3 is positive while I 6 appears when V3 is negative. Supposing that $f > f_0$, then the difference in phase (V2 - V1) is reduced (the V2 pulse a little to the right in 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.

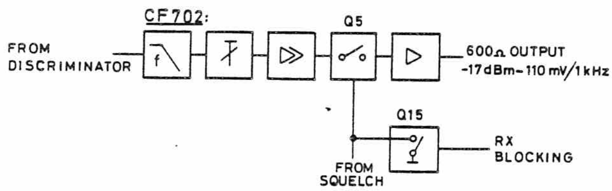
The width of I5 and I6 is therefore seen to be a measurement of the phase difference between V2 and V3. By integrating the output voltage (via R_C and C15) a voltage that is directly proportional to the phase shift is obtained.

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 IC1). 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 R15 and C19 take care of de-emphasising the demodulated signal at the rate of -6 dB pr. octave.

The three stages of the preamplifier, Q3, Q4 and Q6, must then amplify the AF signal and match it to the nominal 600 Ω load. In addition, Q5 is inserted between Q4 and Q6. Q5, which is a field-effect transistor, operates as an electronic switch, interrupting the signal path on command from the squelch circuit.

CF702 includes an additional transistor, Q15. With a DC potential of ≥ 3 V at terminal 23 (RX Blocking) Q15 will be driven on, turning the AF switch, Q5, off. With the gate of Q5 held at ground by Q15, the condition of the squelch circuit will have no effect on the preamplifier.

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The nominal output voltage of the preamplifier is -17 dBm into the 600 Ω output line. R16 is the adjustment used for setting the correct output level.

The collector of Q3 is directly coupled to the base of Q4; resistors R21, R22 and R23 provide the feedback necessary to stabilize the two stages.

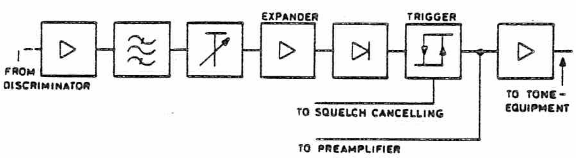
The signal path between the second and third amplifier stages is through the FET transistor, which acts like a relay contact, or switch. A gate-to-source potential of 4 V, at most, will "break" the path between source and drain. Since the collector of Q4 is at approx. 4.7 V, a gate voltage at Q5 under 0.7 V "breaks" the connection and " makes" the connection between Q4 and Q6 again when gate voltage rises above 4.7 V.

The Squelch

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

An internal adjustment, potentiometer R38, is provided for setting the squelch level. The squelch function can be cancelled altogether by grounding terminal 5 via the squelch cancelling button on the control panel.

By altering only a few passive component values, the squelch section can operate on any of the three channel bandwidths normally employed.



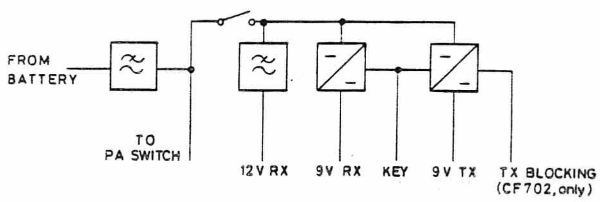
The squelch section includes a frequency selective noise amplifier, Q7, an expander stage, Q8, a noise detector, A Schmitt trigger, Q9 and Q10, and an emitter follower amplifier, Q11.

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 some frequency well above the voice range, and depending upon the channel bandwidth employed. The selected noise is then fed to Q8 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 Q8 appears as a larger relative change at the collector. The noise pulses are then rectified and filtered to a DC potential that, in turn, controls the Schmitt trigger, Q9 and Q10. The collector voltage on Q10 is used partly to drive the emitter follower, Q11, and partly, through an R-C network, to switch the FET transistor in the AF preamplifier.

Where CF701 is used, keying the transmitter also interrupts the power to the receiver. At the same time, diodes E2 and E6 in the squelch are grounded through Q30 to prevent any false signals that might appear in the squelch circuitry from affecting the AF amplifier or Q11 during this condition. This does not apply to CF702.

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 volt auto battery.

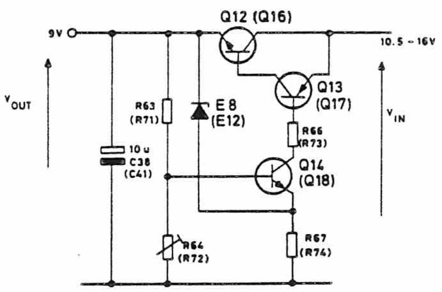
The battery connects to the regulators through the transient and ripple filter, L3a and C39, and through the vehicle's start switch via terminals 7 and 8. The AF output amplifier is supplied with unregulated, filtered battery power via the other filter winding, L3b, and C56 in the AF amplifier circuit.

To protect the equipment against incorrect battery polarity or excess voltage, a properly dimensioned zener diode is placed across the supply. If the power supply is connected wrong the zener diode will act as a short circuit at the input, blowing the fuses in the battery leads. In case of excess supply voltage, the zener diode will not allow more than about 20 volts to be present at the input to the regulators.

The voltage regulators are protected against short circuits; with shorted output the current through Q12 will be < 0.5 A and through Q16, < 0.1 A. The power transistors are mechanically 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:

Q12 is driven by Q13, which is controlled by amplifier Q14. Transistor Q14 compares the zener reference voltage across E8 with a portion of the output voltage through dividing resistors R63 and R64. R64 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 Q14 will increase, also increasing base current for Q13 and Q12. When base current to Q12 increases, more current flows through the output load, cancelling the original drop in output voltage.

If the load current increases to a certain value, Q14 goes into saturation. If the load current increases still more, the zener diode will act as an open circuit and V_{BE} for Q14 decreases whereby base current for Q14, Q13 and Q12 decreases, too. Finally, Q14 will be cut off and base current in Q12 and Q13 will be zero. Thus is Q12 protected against destruction by short circuits at its output. Resistors R66 - and R67 - determine the saturation current through Q14 and, of course, the short circuit current.

A regulator built exactly like the simplified diagram would not be self-starting, however. Therefore, the regulators in the CF701 are provided with starting circuits;

9 V RX employs R61, R62 and E9 in its starting circuit and 9 V TX employs R70 and E11. 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 10.

CF702 is arranged in a slightly different manner since 9 V RX must always operate when the equipment is turned on. While the 9 V RX and 9 V TX regulators employ the same starting circuits as just explained for CF701, the difference here is that keying the transmitter (which grounds terminal 10) does not turn the CF702 9 V RX regulator off.

Operation of Keying and Starting Circuits

For CF701:

When terminal 10 is floating and the power is turned on, 9 V RX will build up voltage since Q12 gets base current through R58, E9, R61 and R62. When 9 V RX reaches its final value the starting circuit will have no effect on the regulator because diode E9 will then be nonconducting (the unloaded voltage at terminal 10 is approx. 8.2 V at nominal battery voltage).

Transistors Q15 and Q19 are both heavily saturated, so the 9 V RX regulator will operate undisturbed while 9 V TX will be blocked because Q18 is completely cut off by Q19.

Grounding terminal 10 immediately cuts off Q15 and Q19. 9 V RX falls towards 0 V as there is now no base current to Q13. 9 V RX falls off at a rate determined by the time constant of C38 and the load on terminal 9. Under all operating conditions within factory specifications for the radiotelephone, the time constant will easily be long enough that the current through starting circuit R70 and E11 can turn on Q18, whereby a voltage builds up on 9 V TX that finally reaches a level where diode E11 becomes nonconducting.

Diode E10 and resistor R68 ensure that keying the transmitter cuts off base current to Q13 effectively, even at high temperatures. Diode E7 ensures effective keying even if terminal 10 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. Since - as just explained - it is 9 V RX that starts 9 V TX, it is necessary to activate the transmitter key again. Even with 9 V RX shorted, Q12 still gets its base current through the starting circuit where one of the resistors, R62, is a PTC resistor that will limit base current to the transistor at high ambient temperatures or when Q12 heats up.

For CF702

When terminal 10 is floating and the power is turned on, 9 V RX will build up voltage since Q12 gets base current through R58, E9, R61 and R62. When 9 V RX reaches its final value the starting circuit will have no effect on the regulator because diode E9 will then be nonconducting (the unloaded voltage at terminal 10 is approx. 8.2 V at nominal battery voltage).

Transistor Q19 is heavily saturated, completely cutting off Q18 and thus blocking the 9 V TX voltage regulator.

When the transmit key grounds terminal 10, two things happen:

1.) Q19 loses its forward bias and immediately cuts off. Now, instead of acting as a short circuit between the base of Q18 and ground, Q19 can now be considered a large resistance.

2.) C45, which has been charging through diode E10, has accumulated a charge of about 6.6 V. With terminal 10 grounded the charge on C45 reverse biases E10. Now C45 will discharge.

There are two discharge paths available to C45, one through the bleeder resistor, R59, and one through R70 and E11 to the base of Q18. Remember that the base of Q18 is no longer grounded by Q19.

The discharge current to the base of Q18 drives this transistor on. Once Q18 turns on its base assumes a potential of approx. 5 V. By now C45 has discharged so much that E11 becomes reverse biased by the 5 V on the base of Q18, and C45 continues to discharge through its other path (R59).

As long as terminal 10 is kept at chassis potential by the transmit key the 9 V TX regulator continues to operate.

When the key is released and terminal 10 resumes its unloaded potential of approx. 7.3 V, Q19 is driven on and short circuits the base of Q18 again. The 9 V TX regulator then turns off.

C45 charges again through E10.

Diode E7 ensures effective keying even if terminal 10 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.

Even with 9 V RX shorted, Q12 still gets its base current through the starting circuit where one of the resistors, R62, is a PTC resistor

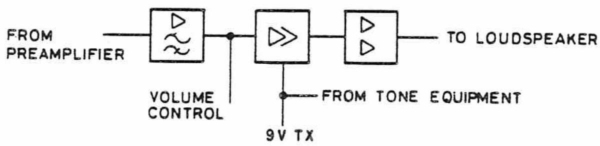
Storno

that will limit base current to the transistor at high ambient temperatures or when Q12 heats up.

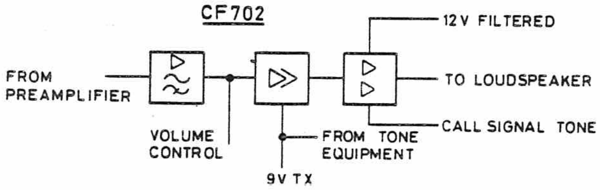
The AF Output Amplifier

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

CF701



CF702



Frequencies below 250 Hz are very sharply cut off in the first amplifier stage, transistor Q20. Included in the collector of Q20 is a variable resistor which allows for adjustment of the amplifier gain above the nominal amount in order to compensate for weak modulation of the incoming signal.

The signal passes from the 1st stage to the volume control whose arm connects to terminal 15 in the case of local control or to terminal 16 in case of extended local control. An isolation resistor is placed between the two terminals, allowing for extended local control without necessitating the removal of the local control connections.

The 2nd amplifier stage, Q21, is an emitter follower whose base voltage is the essential factor in determining the symmetry of the drive signal to the loudspeaker output.

From Q21, the signal is fed via two R-C low-pass filter networks to the 3rd amplifier stage, Q22. The primary purpose of the two low-pass networks is to stabilize the amplifier in regard to AC when employing extended local control.

In Q22, which in principle is coupled in the grounded emitter configuration, the signal is amplified and passes directly to the next amplifier stage which, in turn, is coupled directly to the driver transistors, Q25 and Q26. Transistor Q23 and resistors R98, R99 and R100 provide temperature compensated biasing for the driver transistors. As far as AC is concerned, the circuit appears as a short circuit between the bases of the two driver transistors. The complementary output transistors operate in class AB push-pull. Strong negative DC feedback is introduced in order to stabilize the operating point for the output stages. The feedback network is from the output, over R106 to the emitter of Q22. The AC feedback network is formed by R106 in conjunction with R96.

The power transistors employ aluminium heat sinks fastened to the radio chassis for good thermal contact.

During transmission a "muting signal" grounds the base of Q24 via terminal 18 and an R-C network, blocking the output amplifier. This network also functions as the blocking gate for the tone equipment.

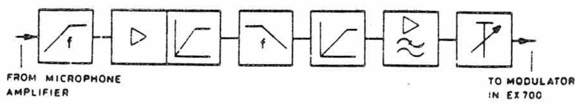
The Modulation Amplifier

General

The modulation amplifier differentiates, amplifies, limits and integrates the microphone signal. It also suppresses undesired high frequencies with an active filter designed for either 20, 25 or 50 kHz channel separation or, with a few resistor values changed, 12.5 kHz channel spacing.

Both amplifiers are contained in a single integrated circuit made up of dual operational amplifiers. The modulation amplifier contains additional passive differentiating 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 R112, is asymmetric.

The Differentiating Circuit

The differentiation network is made up of C64 and R113 (the input impedance of the op amp is negligible due to the feedback through R116). It differentiates at the rate of +6 dB pr. octave over the entire audio range of 300 to 3000 Hz.

The Amplifier - Clipper

The gain of the first amplifier stage, IC2a, is determined by the amount of feedback introduced. Circuit gain can be varied by about 10 dB by adjusting potentiometer R133.

Clipping action begins as soon as the amplifier is driven to where the collector excursions approximate the battery voltage. This level will be about 6.8 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 R114 and R115 and therefore is fixed.

The Integration Circuit

Integrating takes place from 230 Hz at 6 dB pr. octave. The passive integrating network consists of R118 and C67. 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 2nd Clipper (or Phase Clipper)

This extra clipper is inserted to prevent strong input signals at low frequencies from overdriving the modulator stage. For signal levels corresponding to the nominal frequency swing, the clipper has no effect. Two 1.5 V diodes and capacitor C69 make up this circuit. These two diodes are connected to the junction of voltage divider R131 and R132 in order to have the same potential on both sides of C69, thus avoiding the time constant R118 x C69 when keying the transmitter. The clipping level is only approx. 1.2 V at maximum due to the comparatively large impedance of R118.

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). The significant passive filter components are resistors R119, R120 and R121 and capacitors C70, C71, C72, C75, C76 and C77. The filter cannot be overdriven because the input signal level is subject to limiting by the diode clipper.

Adjusting the Frequency Swing

The amount of signal to the modulator input, and thus the frequency swing, is set by potentiometer R124. R133 sets the modulation sensitivity.

The TX Switch.

The PA keying circuit operates an electronic switch in the path of the 12 V TX supply voltage to the PA unit. The circuit consists of Q29 and Q30 along with the associated resistor networks at their bases. The transistors operate in saturation when transmitting and are cut-off during standby, or receive. The circuit is controlled from 9 V TX.

For CF701, Q30 has the additional function of grounding out any spurious squelch signals whenever the transmitter is activated.

TECHNICAL SPECIFICATIONS

Nominal Supply Voltage

13.6 V

Current Drain for CF701 (at nominal supply voltage)

Transmit: 220 mA
Receive : 65 mA

Current Drain for CF702 (at nominal supply voltage)

Transmit: 285 mA
Receive : 65 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 3)

-17 dBm/ 600 Ω

Regulated Voltages

Receiver (terminal 9) : 9 V
Transmitter (terminal 13): 9 V

Unregulated, Filtered Voltages

AF output amplifier : 13.6 V
PA stage (terminal 19) : 13.6 V

AF Output Power (terminal 17)

2 W

Modulation Amplifier Sensitivity (for normal frequency swing of 1 kHz)

110 mV +1/ -0 dB

The following, more detailed specifications for the several CF701 and CF702 functions are all typical values measured at 25^{o} 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 IC1: 55 dB
from IC1 input (pin 4) to IC1 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 $\boxed{2}$, terminated with 2.2 kΩ load.

Discriminator Linearity (relative to 1000 Hz)

Pass-Band 100 - 3500 Hz: +0/ -1 dB
Measured at test point $\boxed{2}$, terminated with 2.2 kΩ load.

Discriminator Output Resistance

200 Ω

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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)

8 mA

Input Impedance (at 1 kHz)

2.2 kΩ

Output Impedance

R_{OUT} = 680 Ω

Gain (gain control at highest setting)

R_L = 560 Ω, f = 1 kHz: 12.5 dB

Harmonic Distortion (R_L = 560 Ω, f = 1 kHz)

V_{OUT} = 110 mV (nominal) : 0.2 %
V_{OUT} = 500 mV : 0.5 %

Required Turn-on Potential for CF701
(at gate of Q5)

To ensure normal signal path: $\geq$ 4.7 V

Required Turn-off Potential for CF701
(at gate of Q5)

To ensure 70 dB attenuation of signal: $\leq$ 0.7 V
Measured with 110 mV, 1 kHz signal applied to circuit input, test point $\boxed{2}$, and gain control set at max., V_{OUT} (terminal 3) = approx. 500 mV.

Required Turn-on Potential for CF702

a. at gate of Q5, to ensure normal signal path: $\geq$ 4.7 V

b. at terminal 23 (RX Blocking), to allow normal operation of squelch command : $\leq$ 0.8 V

Required Turn-off Potential for CF702

a. at gate of Q5, to ensure 70 dB attenuation of signal: $\leq$ 0.7 V

b. at terminal 23 (RX Blocking), for same result : $\geq$ 3 V

Measured with 110 mV, 1 kHz signal applied to circuit input, test point $\boxed{2}$, and gain control set at max., V_{OUT} (at terminal 3) = approx. 500 mV.

De-emphasis Cut-off Frequency

90 Hz

Frequency Response (relative to -6 dB/ octave characteristic)

Pass-Band linearity (300 - 3000 Hz): +0/-1 dB
50 - 100 Hz : +15 dB

SQUELCH CIRCUIT

Current Drain (at nominal 9 V supply)

12 mA
Measured with unloaded Squelch Signalling (terminal 4).

Input Impedance (at 1 kHz)

20 kΩ

Noise Filter Resonant Frequency

12.5 kHz channel spacing : 7.1 kHz
20/25 kHz channel spacing : 7.1 kHz
50 kHz channel spacing : 10 kHz

Output Voltage

Squelched condition : $\leq$ 100 mV
Un-squelched condition: > 5.7 V
Measured at test point 1 . DC.

Squelch Signalling (terminal 4)

R_{LOAD} minimum: 680Ω
V_{OUT}(with R_L = 680Ω)

Squelched condition $\leq$ 100 mV
Un-squelched condition $\geq$ 4.0 V

Storno

Transition Time (gain control set for nominal V_{OUT})

6 ms

Delay measured from the time that the voltage at test point 1 switches state until the AF signal at terminal 3 increases from 10% to 90 % of its nominal amplitude.

Turn-off delay (signal decrease from 90% to 10%) is also 6 ms.

Overall Receiver Squelch Response

Turn-on delay: 30 ms
Turn-off delay: 25 ms
Measured with receiver adjusted for 12 dB SINAD.

AF OUTPUT AMPLIFIER

Nominal Supply Voltage

13.6 V

Operating Range

10.5 to 16.0 V

Current Drain (at nominal supply voltage)

no-signal condition	:	20 mA
at 2 W output	:	300 mA
blocked	:	20 mA

Output Power (at nominal supply voltage)

maximum 2 W

Loudspeaker Impedance

Nominal / minimum: 5 Ω

Input Impedance (at 1 kHz)

560 Ω

Nominal Gain

Input signal (1 kHz) required for 2 W output: 110 mV
Measured with volume control (5 kΩ potentiometer) connected to terminals 14, 15 and chassis ground, and turned fully up.

Where the connections are to terminals 14, 16 and chassis, as with extended local control, the gain increases by 2 dB.

Adjustment of R83 can increase sensitivity 12 dB.

Gain vs. $\Delta V_{BATT.}$

13.6 V +2.4 / -3.1 V: 0.2 dB

Harmonic Distortion

P_{OUT} = 2 W : 1%
P_{OUT} = 0.2 W : 0.5%

Frequency Response (relative to 1 kHz)

100	Hz	-22 dB
300	Hz	0 dB
2700	Hz	-0.5 dB
6	Hz	-2 dB

Measured at 0.2 W output power.

AF Muting

Required DC at terminal 18 to attenuate the output signal by 60 dB: 8.0 V

MODULATION AMPLIFIER

Current Drain, CF701 (at nominal 9 V supply)

2 mA

Current Drain, CF702 (at nominal 9 V supply)

5 mA

Input Impedance (at 1 kHz)

560 Ω

Limiting

Signal clipping begins to occur with an input signal (1000 Hz) of: 110 mV

Output signal level observed at pin 2 of IC2 when clipping occurs: 7.0 V p.p.

Phase Limiting, CF701

Phase clipping level (at 300 Hz): 2.1 V p.p.

Measured immediately after the integration network, with an input signal of 1.1 V (nominal 110 mV + 20 dB).

Storno

Phase Limiting, CF702

Phase clipping level (at 300 Hz): 2.5 V p.p.

Measured immediately after the integration network, with an input signal of 1.1 V (nominal 110 mV + 20 dB).

Output Voltage (1000 Hz)

560 mV

Measured at Modulation Output (terminal 21) with potentiometer R124 fully up, and load impedance = 1 kΩ.
Input level = 110 mV

Harmonic Distortion (at 1000 Hz)

for 110 mV input signal : 0.8%

Frequency Response (relative to 1 kHz)

	channel spacing 20/25/50 kHz	channel spacing 12.5 kHz
300 Hz	-0.5 dB	-0.5 dB
3 kHz	-1 dB	-4 dB
6 kHz	-19 dB	-25 dB
10 kHz	-32 dB	-37 dB

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

12 V RX to AF Output Amplifier (filtered, unregulated voltage)

ripple suppression at 1 kHz, no load condition:	36 dB
voltage drop over filter when P_{OUT} = 2 W	0.25 V
maximum output current:	500 mA

Keying Termination

Maximum allowable resistance of wiring : 180 Ω
Alternatively, V_{MAX} at terminal 10 : 1.0 V

Regulator Switching Time ($V_{BATT.}$ = 13.6 V)

9V RX turn-on delay, $t_{0-90\%}$:	0.4 ms
9V RX turn-off delay, $t_{100-10\%}$:	100 ms
9V TX turn-on delay, $t_{0-90\%}$:	0.1 ms
9V TX turn-off delay, $t_{100-10\%}$:	25 ms

Measured under normal load conditions.

Regulator Output Current

Maximum 150 mA

Internal Resistance of Regulators

R_I = 0.5 Ω

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

(at nominal load)

DC : 46 dB
1 kHz : 50 dB

9V VOLTAGE REGULATORS and KEYING CIRCUITS

Nominal Supply Voltage

13.6 V

Operating Range

10.5 V to 16 V

Regulated Output Voltages

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

V_{REG} vs. Temperature

3.6 mV / pr. °C

PA KEYING CIRCUIT

Nominal Supply Voltage

13.6 V

Operating Range

10.5 to 16 V

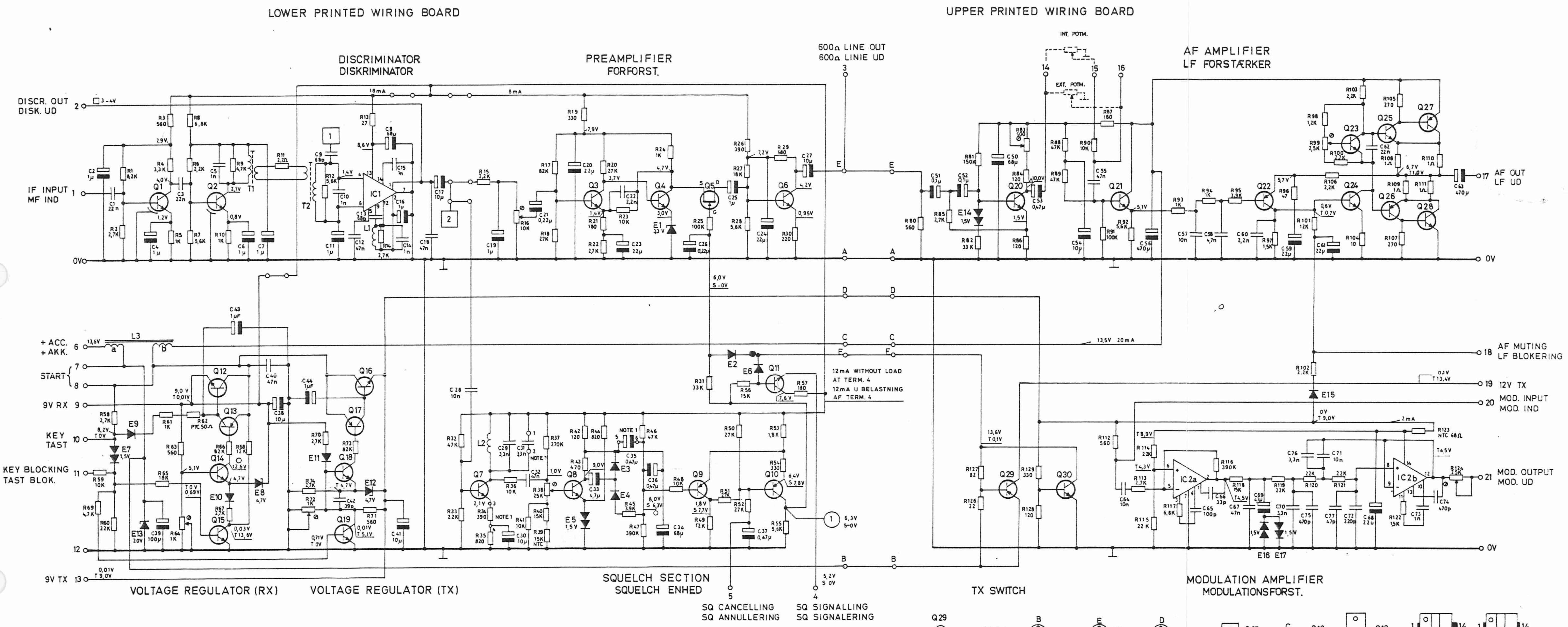
Maximum Load Current

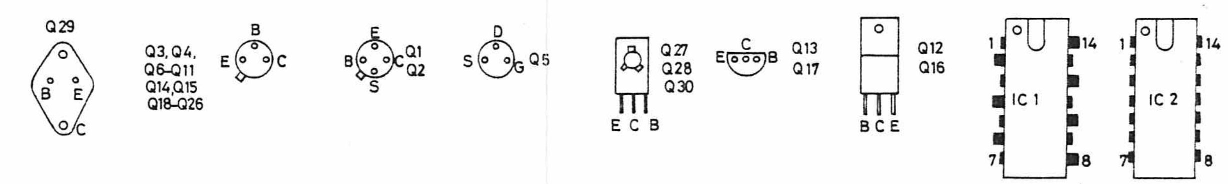
3 A

TX Switch

Voltage drop across transistor switch when ON, at 2 A load current: 0.2 V

Transistor collector current when OFF:
T_{AMB} = 25°C : 0.2 mA
T_{AMB} = 60°C : 10 mA





DEPENDING ON THE CHANNEL SEPARATION EMPLOYED
MAKE THE FOLLOWING ALTERATIONS:

CH. SEP. / POINTS	1-2	3-4	5-6	
12.5 kHz	3.3nF	150Ω	0.47μF	REPLACE R119, R120, R121, BY 27KΩ
20/25 kHz	3.3nF	390Ω	0.47μF	
50 kHz	OPEN	820Ω	OPEN	

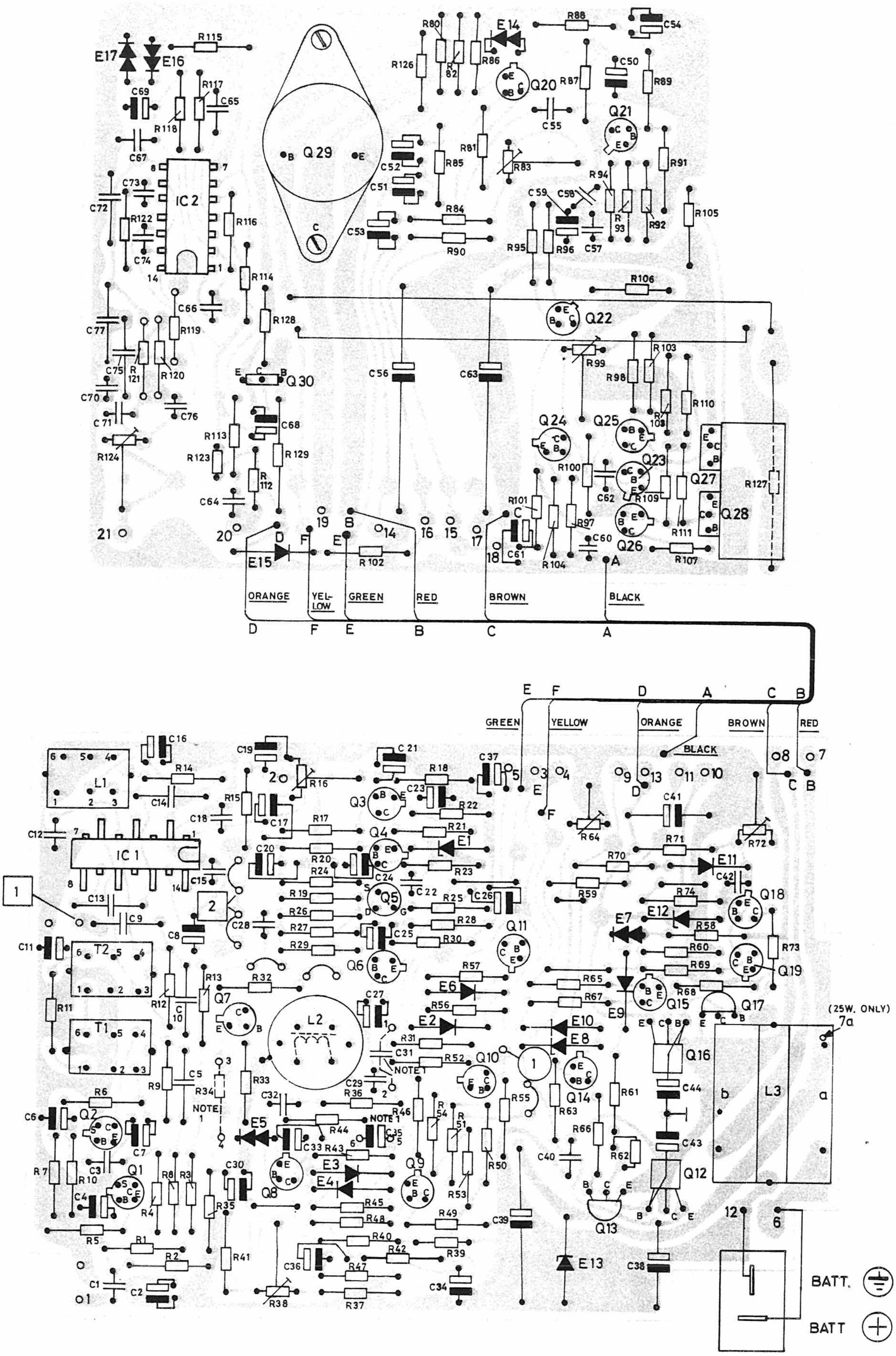
CONDITIONS OF MEASUREMENTS

- □ MEASURED AT Δf = 0 kHz
- Δ RESISTOR R83 SHORT-CIRCUITED
- S SQUELCHED CONDITION
- T TRANSMITTER KEYED CONDITION
- ○ USE A HIGH-RESISTANCE VOLTMETER (2MΩ)

COMMON FUNCTION UNIT
FÆLLESENHED

CF701

D401.296/2



COMMON FUNCTION UNIT CF701

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TYPE	NO.	CODE	DATA	
CF701		10.2433	Common Functions Unit	
	C1	76.5071	22 nF 10% polyest. FL	50V
	C2	73.5114	1 μF 20% tantal	35V
	C3	76.5071	22 nF 10% polyest. FL	50V
	C4	73.5114	1 μF 20% tantal	35V
	C5	76.5109	1 nF 2.5% polyest. TB	25V
	C6	73.5114	1 μF 20% tantal	35V
	C7	73.5114	1 μF 20% tantal	35V
	C8	73.5106	68 μF 20% tantal	16V
	C9	76.5101	68 pF 2.5% polystyr TB	25V
	C10	76.5109	1 nF 2.5% polystyr TB	25V
	C11	73.5114	1 μF 20% tantal	35V
	C12	76.5072	47 nF 10% polyest. FL	50V
	C13	76.5101	68 pF 2.5% polystyr TB	25V
	C14	76.5109	1 nF 2.5% polystyr TB	25V
	C15	76.5069	1 nF 10% polyest FL	50V
	C16	73.5114	1 μF 20% tantal	35V
	C17	73.5109	10 μF 20% tantal	16V
	C18	76.5072	47 nF 10% polyest FL	50V
	C19	73.5114	1 μF 20% tantal	35V
	C20	73.5127	22 μF 20% tantal	16V
	C21	73.5118	0.22 μF 20% tantal	35V
	C22	76.5059	2.2 nF 10% polyest FL	50V
	C23	73.5127	22 μF 20% tantal	16V
	C24	73.5127	22 μF 20% tantal	16V
	C25	73.5114	1 μF 20% tantal	35V
	C26	73.5118	0.22 μF 20% tantal	35V
	C27	73.5109	10 μF 20% tantal	16V
	C28	76.5070	10 nF 10% polyest FL	50V
	C29	76.5060	3.3 nF 10% polyest. FL	50V
	C30	73.5109	10 μF 20% tantal	16V
	C31	76.5060	3.3 nF 10% polyest. FL	50V
	C32	76.5072	47 nF 10% polyest FL	50V
	C33	73.5126	4.7 μF 20% tantal	35V
	C34	73.5106	68 μF 20% tantal	16V
	C35	73.5125	0.47 μF 20% tantal	35V
	C36	73.5125	0.47 μF 20% tantal	35V
	C37	73.5125	0.47 μF 20% tantal	35V
	C38	73.5011	10 μF -10/+100% elco	16V
	C39	73.5071	100 μF -10/+100% elco	35V
	C40	76.5072	47nF 10% polyest FL	50V
	C41	73.5011	10 μF -10+100% elco	16V
	C42	74.5187	39pF 10% ceram N750 PL	25V
	C43	73.5114	1 μF 20% tantal	35V
	C44	73.5114	1 μF 20% tantal	35V
	C50	73.5106	68 μF 20% tantal	16V
	C51	73.5089	0.1 μF 20% tantal	35V

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TYPE	NO.	CODE	DATA	
	C52	73.5089	0.1 μF 20% tantal	35V
	C53	73.5125	0.47 μF 20% tantal	35V
	C54	73.5109	10 μF 20% tantal	16V
	C55	76.5072	47 nF 10% polyest FL	50V
	C56	73.5138	470 μF -10/+50% elco	25V
	C57	76.5070	10 nF 10% polyest. FL	50V
	C58	76.5061	4.7 nF 10% polyest FL	50V
	C59	73.5127	22 μF 20% tantal	16V
	C60	76.5059	2.2 nF 10% polyest FL	50V
	C61	73.5127	22 μF 20% tantal	16V
	C62	76.5071	22 nF 10% polyest FL	50V
	C63	73.5137	470 μF -10/+50% elco	16V
	C64	76.5070	10 nF 10% polyest FL	50V
	C65	74.5165	100 pF 10% ceram PL	63V
	C66	74.5116	33 pF 5% ceram TB	160V
	C67	76.5072	47 nF 10% polyest FL	50V
	C68	73.5127	22 μF 20% tantal	16V
	C69	73.5126	4.7 μF 20% tantal	35V
	C70	76.5060	3.3 nF 10% polyest. FL	50V
	C71	76.5070	10 nF 10% polyest FL	50V
	C72	76.5104	220 pF 5% polystyr TB	25V
	C73	76.5069	1 nF 10% polyest FL	50V
	C74	74.5161	470 pF -20/+80% ceram PL	63V
	C75	76.5106	470 pF 5% polystyr TB	25V
	C76	76.5060	3.3 nF 10% polyest FL	50V
	C77	76.5090	47 pF 5% polystyr	63V
	R1	80.5260	8.2 kΩ 5% carbon film	1/8W
	R2	80.5254	2.7 kΩ 5% " "	1/8W
	R3	80.5246	560 Ω 5% " "	1/8W
	R4	80.5255	3.3 kΩ 5% " "	1/8W
	R5	80.5249	1 kΩ 5% " "	1/8W
	R6	80.5253	2.2 kΩ 5% " "	1/8W
	R7	80.5258	5.6 kΩ 5% " "	1/8W
	R8	80.5259	6.8 kΩ 5% " "	1/8W
	R9	80.5257	4.7 kΩ 5% " "	1/8W
	R10	80.5249	1 kΩ 5% " "	1/8W
	R11	80.5218	2.7 Ω 5% " "	1/8W
	R12	80.5258	5.6 kΩ 5% " "	1/8W
	R13	80.5230	27 Ω 5% " "	1/8W
	R14	80.5254	2.7 kΩ 5% " "	1/8W
	R15	80.5253	2.2 kΩ 5% " "	1/8W

TYPE	NO.	CODE	DATA	
	R16	86.5039	10 kΩ 20% potentiometer	0.1W
	R17	80.5272	82 kΩ 5% carbon film	1/8W
	R18	80.5266	27 kΩ 5% " "	1/8W
	R19	80.5243	330 Ω 5% " "	1/8W
	R20	80.5266	27 kΩ 5% " "	1/8W
	R21	80.5240	180 Ω 5% " "	1/8W
	R22	80.5254	2.7 kΩ 5% " "	1/8W
	R23	80.5261	10 kΩ 5% " "	1/8W
	R24	80.5249	1 kΩ 5% " "	1/8W
	R25	80.5273	0.1 MΩ 5% " "	1/8W
	R26	80.5244	390 Ω 5% " "	1/8W
	R27	80.5264	18 kΩ 5% " "	1/8W
	R28	80.5258	5.6 kΩ 5% " "	1/8W
	R29	80.5247	680 Ω 5% " "	1/8W
	R30	80.5241	220 Ω 5% " "	1/8W
	R31	80.5267	33 kΩ 5% " "	1/8W
	R32	80.5269	47 kΩ 5% " "	1/8W
	R33	80.5265	22 kΩ 5% " "	1/8W
	R34	80.5244	390 Ω 5% " "	1/8W
	R35	80.5248	820 Ω 5% " "	1/8W
	R36	80.5261	10 kΩ 5% " "	1/8W
	R37	80.5278	0.27 MΩ 5%" "	1/8W
	R38	86.5044	25 kΩ 20% potentiometer	0.1W
	R39	89.5010	15 kΩ 2% NTC	0.6W
	R40	80.5263	15 kΩ 5% carbon film	1/8W
	R41	80.5261	10 kΩ 5% " "	1/8W
	R42	80.5238	120 Ω 5% " "	1/8W
	R43	80.5245	470 Ω 5% " "	1/8W
	R44	80.5248	820 Ω 5% " "	1/8W
	R45	80.5256	3.9 kΩ 5% " "	1/8W
	R46	80.5269	47 kΩ 5% " "	1/8W
	R47	80.5280	0.39 MΩ 5%" "	1/8W
	R48	80.5261	10 kΩ 5% " "	1/8W
	R49	80.5262	12 kΩ 5% " "	1/8W
	R50	80.5266	27 kΩ 5% " "	1/8W
	R51	80.5266	27 kΩ 5% " "	1/8W
	R52	80.5266	27 kΩ 5% " "	1/8W
	R53	80.5252	1.8 kΩ 5% " "	1/8W
	R54	80.5243	330 Ω 5% " "	1/8W
	R55	80.5258	5.6 kΩ 5% " "	1/8W
	R56	80.5263	15kΩ 5% " "	1/8W
	R57	80.5240	180 Ω 5% " "	1/8W
	R58	80.5254	2.7 kΩ 5% " "	1/8W
	R59	80.5261	10 kΩ 5% " "	1/8W
	R60	80.5265	22 kΩ 5% " "	1/8W
	R61	80.5249	1 kΩ 5% " "	1/8W
	R62	89.5046	50 Ω PTC	
	R63	80.5246	560 Ω 5% " "	1/8W

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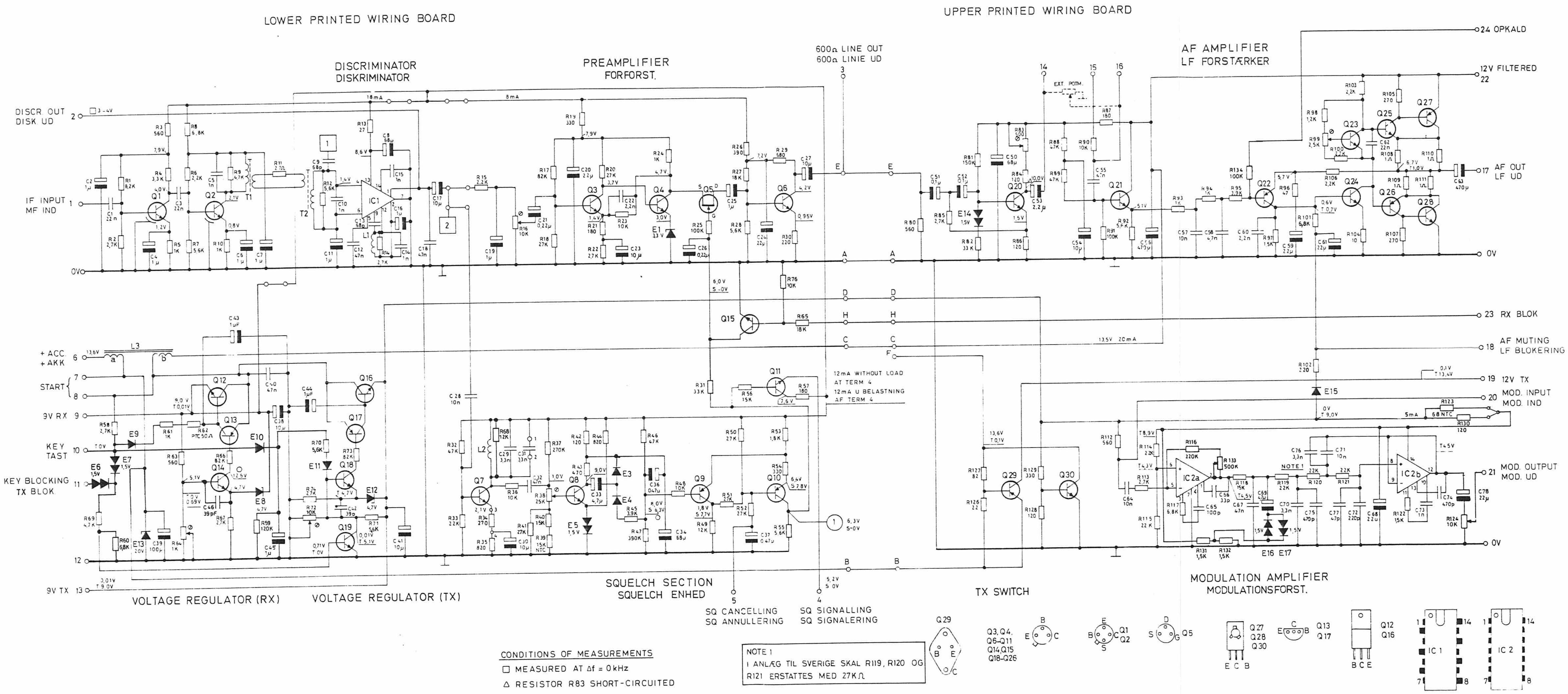
TYPE	NO.	CODE	DATA	
	R64	86.5068	1 kΩ 20% potentiometer	0.1W
	R65	80.5264	18 kΩ 5% carbon film	1/8W
	R66	80.5272	82 kΩ 5% " "	1/8W
	R67	80.5254	2.7 kΩ 5% " "	1/8W
	R68	80.5262	12 kΩ 5% " "	1/8W
	R69	80.5257	4.7 kΩ 5% " "	1/8W
	R70	80.5254	2.7 kΩ 5% " "	1/8W
	R71	80.5246	560 Ω 5% " "	1/8W
	R72	86.5058	1 kΩ 20% potentiometer	0.1W
	R73	80.5272	82 kΩ 5% carbon film	1/8W
	R74	80.5254	2.7 kΩ 5% " "	1/8W
	R80	80.5246	560 Ω 5% " "	1/8W
	R81	80.5275	0.15 MΩ 5%" "	1/8W
	R82	80.5267	33 kΩ 5% " "	1/8W
	R83	86.5042	500 Ω 20% potentiometer	0.1W
	R84	80.5238	120 Ω 5% carbon film	1/8W
	R85	80.5254	2.7 kΩ 5% " "	1/8W
	R86	80.5238	120 Ω 5% " "	1/8W
	R87	80.5240	180 Ω 5% " "	1/8W
	R88	80.5269	47 kΩ 5% " "	1/8W
	R89	80.5269	47 kΩ 5% " "	1/8W
	R90	80.5261	10 kΩ 5% " "	1/8W
	R91	80.5273	0.1 MΩ 5% " "	1/8W
	R92	80.5258	5.6 kΩ 5% " "	1/8W
	R93	80.5249	1 kΩ 5% " "	1/8W
	R94	80.5249	1 kΩ 5% " "	1/8W
	R95	80.5256	3.9 kΩ 5% " "	1/8W
	R96	80.5233	47 Ω 5% " "	1/8W
	R97	80.5251	1.5 kΩ 5% " "	1/8W
	R98	80.5250	1.2 kΩ 5% " "	1/8W
	R99	86.5043	2.5 kΩ 20% potentiometer	0.1W
	R100	80.5254	2.7 kΩ 5% carbon film	1/8W
	R101	80.5262	12 kΩ 5% " "	1/8W
	R102	80.5253	2.2kΩ 5% " "	1/8W
	R103	80.5253	2.2 kΩ 5% " "	1/8W
	R104	80.5225	10 Ω 5% " "	1/8W
	R105	80.5242	270 Ω 5% " "	1/8W
	R106	80.5253	2.2 kΩ 5% " "	1/8W
	R107	80.5242	270 Ω 5% " "	1/8W
	R108	80.5213	1 Ω 5% " "	1/8W
	R109	80.5213	1 Ω 5% " "	1/8W
	R110	80.5213	1 Ω 5% " "	1/8W

COMMON FUNCTIONS UNIT CF701

TYPE	NO.	CODE	DATA	
	R111	80.5213	1 Ω 5% carbon film	1/8W
	R112	80.5246	560 Ω 5% " "	1/8W
	R113	80.5254	2.7 kΩ 5% " "	1/8W
	R114	89.5062	22 kΩ 1% metal film	1/8W
	R115	89.5062	22 kΩ 1% metal film	1/8W
	R116	80.5280	0.39 MΩ 5% carbon film	1/8W
	R117	80.5259	6.8 kΩ 5% " "	1/8W
	R118	80.5263	15 kΩ 5% " "	1/8W
	R119	89.5062	22 kΩ 1% metal film	1/8W
	R120	89.5062	22 kΩ 1% metal film	1/8W
	R121	89.5062	22 kΩ 1% metal film	1/8W
	R122	80.5251	1.5 kΩ 5% carbon film	1/8W
	R123	89.5061	68 Ω 20% NTC	0.5W
	R124	86.5044	25 kΩ 20% potentiometer	0.1W
	R126	80.5229	22 Ω 5% carbon film	1/8W
	R127	84.5224	82 Ω 5% wire wound	4W
	R128	80.5238	120 Ω 5% carbon film	1/8W
	R129	80.5443	330 Ω 5% " "	1/4W
	L1	61.1131	IF coil 455 kHz	
	L2	61.1132	Coil 75 mH	
	L3	60.5158	Cnoke	
	T1	61.1130	IF Transformer 455 kHz	
	T2	61.1130	IF Transformer 455 kHz	
	E1	99.5210	Zenerdiode 3.3V 5%	1/4W
	E2	99.5237	1N4148 Diode	
	E3	99.5237	1N4148 Diode	
	E4	99.5237	1N4148 Diode	
	E5	99.5209	Stab. diode 1.5V	
	E6	99.5237	1N4148 Diode	
	E7	99.5209	Stab. diode 1.5V	
	E8	99.5224	Zenerdiode 4.7V 5%	1/4W
	E9	99.5237	1N4148 Diode	
	E10	99.5237	1N4148 Diode	
	E11	99.5237	1N4148 Diode	
	E12	99.5224	Zenerdiode 4.7V 5%	1/4W
	E13	99.5249	Zenerdiode BZY93/C20R	
	E14	99.5209	Stab. diode 1.5V	
	E15	99.5237	1N4148 Diode	
	E16	99.5209	Stab. diode 1.5V	
	E17	99.5209	Stab. diode 1.5V	
	Q1	99.5166	BF167 Transistor	
	Q2	99.5166	BF167 Transistor	
	Q3	99.5143	BC108 Transistor	
	Q4	99.5143	BC108 Transistor	

Storno

TYPE	NO.	CODE	DATA
	Q5	99.5247	2N4302 Transistor FET
	Q6	99.5143	BC108 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5115	BC179 Transistor
	Q10	99.5115	BC179 Transistor
	Q11	99.5143	BC108 Transistor
	Q12	99.5246	TIP 31 Transistor
	Q13	99.5144-01	BC214L Transistor
	Q14	99.5243	BC108 Transistor
	Q15	99.5243	BC108 Transistor
	Q16	99.5246	TIP 31 Transistor
	Q17	99.5144-01	BC214L Transistor
	Q18	99.5143	BC108 Transistor
	Q19	99.5143	BC108 Transistor
	Q20	99.5201	BC109 Transistor
	Q21	99.5201	BC109 Transistor
	Q22	99.5115	BC179 Transistor
	Q23	99.5143	BC108 Transistor
	Q24	99.5143	BC108 Transistor
	Q25	99.5143	BC108 Transistor
	Q26	99.5115	BC179 Transistor
	Q27	99.5236	BD136 Transistor
	Q28	99.5235	BD135 Transistor
	Q29	99.5248	SP2629 Transistor
	Q30	99.5235	BD135 Transistor
	IC1	14.5010	IF ampl./discr.
	IC2	14.5006	MC1437P dual OP amp.



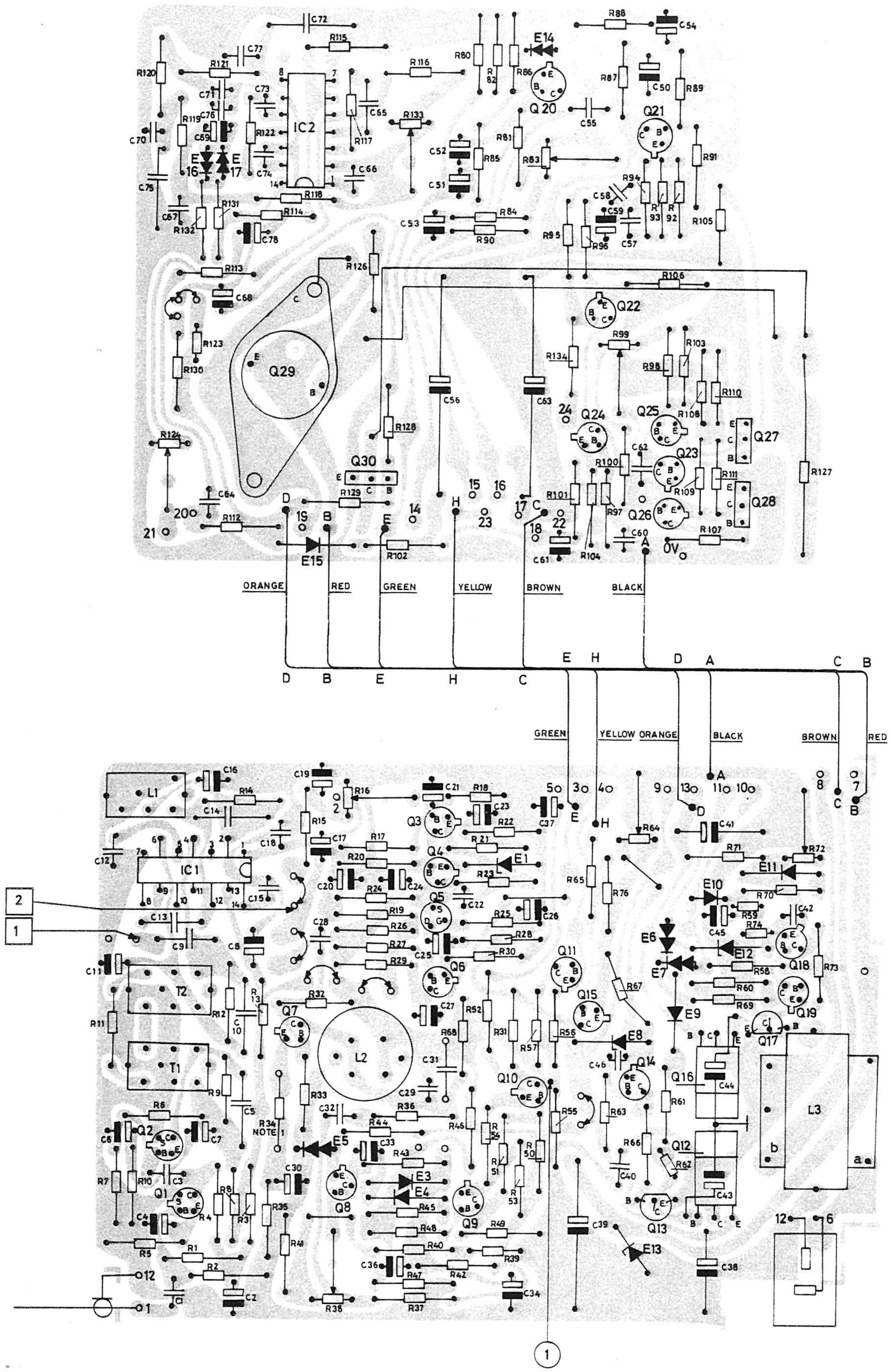
CONDITIONS OF MEASUREMENTS

- □ MEASURED AT Δf = 0 kHz
- Δ RESISTOR R83 SHORT-CIRCUITED
- S SQUELCHED CONDITION
- T TRANSMITTER KEYED CONDITION
- ○ USE A HIGH-RESISTANCE VOLTMETER (2MΩ)

NOTE 1
I ANLÆG TIL SVERIGE SKAL R119, R120 OG R121 ERSTATTES MED 27KΩ

COMMON FUNCTION UNIT
FÆLLESENHED
D401.840

CF702



COMMON FUNCTIONS UNIT CF702

D401.975

Storno

TYPE	NO.	CODE	DATA	
		10.2433	Common Functions Unit	
	C1	76.5071	22 nF 10% polyest. FL	50 V
	C2	73.5114	1 μF 20% tantal	35 V
	C3	76.5071	22 nF 10% polyest. FL	50 V
	C4	73.5114	1 μF 20% tantal	35 V
	C5	76.5067	1 nF 5% polystyr TB	160 V
	C6	73.5114	1 μF 20% tantal	35 V
	C7	73.5114	1 μF 20% tantal	35 V
	C8	73.5106	68 μF 20% tantal	16 V
	C9	74.5144	68 pF 5% ceram TB	160 V
	C10	76.5067	1 nF 5% polystyr TB	160 V
	C11	73.5114	1 μF 20% tantal	35 V
	C12	76.5072	47 nF 10% polyest. FL	50 V
	C13	74.5144	68 pF 5% ceram TB	160 V
	C14	76.5067	1 nF 5% polystyr TB	160 V
	C15	76.5069	1 nF 10% polyest. FL	50 V
	C16	73.5114	1 μF 20% tantal	35 V
	C17	73.5109	10 μF 20% tantal	16 V
	C18	76.5072	47 nF 10% polyest. FL	50 V
	C19	73.5114	1 μF 20% tantal	35 V
	C20	73.5127	22 μF 20% tantal	16 V
	C21	73.5118	0.22 μF 20% tantal	35 V
	C22	76.5059	2.2 nF 10% polyest. FL	50 V
	C23	73.5109	10 μF 20% tantal	16 V
	C24	73.5127	22 μF 20% tantal	16 V
	C25	73.5114	1 μF 20% tantal	35 V
	C26	73.5118	0.22 μF 20% tantal	35 V
	C27	73.5109	10 μF 20% tantal	16 V
	C28	76.5070	10 nF 10% polyest. FL	50 V
	C29	76.5060	3.3 nF 10% polyest. FL	50 V
	C30	73.5109	10 μF 20% tantal	16 V
	C31	76.5060	3.3 nF 10% polyest. FL	50 V
	C32	76.5072	47 nF 10% polyest. FL	50 V
	C33	73.5126	4.7 μF 20% tantal	35 V
	C34	73.5106	68 μF 20% tantal	16 V
	C35	73.5125	0.47 μF 20% tantal	35 V
	C36	73.5125	0.47 μF 20% tantal	35 V
	C37	73.5125	0.47 μF 20% tantal	35 V
	C38	73.5011	10 μF -10/+100% elco	16 V
	C39	73.5071	100 μF -10/+100 elco	35 V
	C40	76.5072	47 nF 10% polyest. FL	50 V
	C41	73.5011	10 μF -10/+100% elco	16 V
	C42	74.5187	39 pF 10% ceram N750 PL	25 V
	C43	73.5114	1 μF 20% tantal	35 V
	C44	73.5114	1 μF 20% tantal	35 V
	C45	73.5114	1 μF 20% tantal	35 V
	C46	74.5187	39 pF 10% ceram PL	25 V

Storno

TYPE	NO.	CODE	DATA	
	C50	73.5106	68 μF 20% tantal	16 V
	C51	73.5089	0.1 μF 20% tantal	35 V
	C52	73.5089	0.1 μF 20% tantal	35 V
	C53	73.5102	2.2 μF 20% tantal	35 V
	C54	73.5109	10 μF 20% tantal	16 V
	C55	76.5072	47 nF 10% polyest. FL	50 V
	C56	73.5138	470 μF -10/+50% elco	25 V
	C57	76.5070	10 nF 10% polyest. FL	50 V
	C58	76.5061	4.7 nF 10% polyest. FL	50 V
	C59	73.5127	22 μF 20% tantal	16 V
	C60	76.5059	2.2 nF 10% polyest. FL	50 V
	C61	73.5127	22 μF 20% tantal	16 V
	C62	76.5071	22 nF 10% polyest. FL	50 V
	C63	73.5137	470 μF -10/+50% elco	16 V
	C64	76.5070	10 nF 10% polyest. FL	50 V
	C65	74.5165	100 pF 10% ceram PL	63 V
	C66	74.5116	33 pF 5% ceram TB	160 V
	C67	76.5072	47 nF 10% polyest. FL	50 V
	C68	73.5127	22 μF 20% tantal	16 V
	C69	73.5126	4.7 μF 20% tantal	35 V
	C70	76.6050	3.3 nF 10% polyest. FL	50 V
	C71	76.5070	10 nF 10% polyest. FL	50 V
	C72	76.5063	22 pF 5% polystyr TB	160 V
	C73	76.5069	1 nF 10% polyest. FL	50 V
	C74	74.5161	470 pF -20/+80% ceram PL	63 V
	C75	76.5065	470 pF 5% polystyr TB	160 V
	C76	76.5060	3.3 nF 10% polyest. FL	50 V
	C77	74.5118	47 pF 5% ceram TB	160 V
	C78	73.5127	22 μF 20% tantal	16 V
	R1	80.5260	8.2 KΩ 5% carbon film	1/8W
	R2	80.5254	2.7 KΩ " "	1/8W
	R3	80.5246	560 Ω 5% " "	1/8W
	R4	80.5255	3.3 KΩ 5% " "	1/8W
	R5	80.5249	1KΩ 5% " "	1/8W
	R6	80.5253	2.2 KΩ 5% " "	1/8W
	R7	80.5258	5.6 KΩ 5% " "	1/8W
	R8	80.5259	6.8 KΩ 5% " "	1/8W
	R9	80.5257	4.7 KΩ 5% " "	1/8W
	R10	80.5249	1 KΩ 5% " "	1/8W
	R11	80.5218	2.7 Ω 5% " "	1/8W
	R12	80.5258	5.6 KΩ 5% " "	1/8W

COMMON FUNCTIONS UNIT CF702

X401.868

TYPE	NO.	CODE	DATA	
	R13	80.5230	27 Ω 5% carbon film	1/8W
	R14	80.5254	2.7 KΩ 5% "	1/8W
	R15	80.5253	2.2 KΩ 5% "	1/8W
	R16	86.5039	10 KΩ 20% potentiometer	0.1W
	R17	80.5272	82 KΩ 5% carbon film	1/8W
	R18	80.5266	27 KΩ 5% "	1/8W
	R19	80.5243	330 Ω 5% "	1/8W
	R20	80.5266	27 KΩ 5% "	1/8W
	R21	80.5240	180 Ω 5% "	1/8W
	R22	80.5254	2.7 KΩ 5% "	1/8W
	R23	80.5261	10 KΩ 5% "	1/8W
	R24	80.5249	1 KΩ 5% "	1/8W
	R25	80.5273	0.1 MΩ 5% "	1/8W
	R26	80.5244	390 Ω 5% "	1/8W
	R27	80.5264	18 KΩ 5% "	1/8W
	R28	80.5258	5.6 KΩ 5% "	1/8W
	R29	80.5247	680 Ω 5% "	1/8W
	R30	80.5241	220 Ω 5% "	1/8W
	R31	80.5267	33 KΩ 5% "	1/8W
	R32	80.5269	47 KΩ 5% "	1/8W
	R33	80.5265	22 KΩ 5% "	1/8W
	R34	80.5244	390 Ω 5% "	1/8W
	R35	80.5248	820 Ω 5% "	1/8W
	R36	80.5261	10 KΩ 5% "	1/8W
	R37	80.5278	0.27 MΩ 5% "	1/8W
	R38	86.5044	25 KΩ 20% potentiometer	0.1W
	R39	89.5010	15 KΩ 2% NTC	0.6W
	R40	80.5263	15 KΩ 5% carbon film	1/8W
	R41	80.5266	27 KΩ 5% "	1/8W
	R42	80.5238	120 Ω 5% "	1/8W
	R43	80.5245	470 Ω 5% "	1/8W
	R44	80.5248	820 Ω 5% "	1/8W
	R45	80.5256	3.9 KΩ 5% "	1/8W
	R46	80.5269	47 KΩ 5% "	1/8W
	R47	80.5280	0.39 MΩ 5% "	1/8W
	R48	80.5261	10 KΩ 5% "	1/8W
	R49	80.5262	12 KΩ 5% "	1/8W
	R50	80.5266	27 KΩ 5% "	1/8W
	R51	80.5266	27 KΩ 5% "	1/8W
	R52	80.5266	27 KΩ 5% "	1/8W
	R53	80.5252	1.8 KΩ "	1/8W
	R54	80.5243	330 Ω 5% "	1/8W
	R55	80.5258	5.6 KΩ 5% "	1/8W
	R56	80.5263	15 KΩ 5% "	1/8W
	R57	80.5240	180 Ω 5% "	1/8W
	R58	80.5254	2.7 KΩ 5% "	1/8W
	R59	80.5274	120 KΩ 5% "	1/8W
	R60	80.5259	6.8 KΩ 5% "	1/8W

Storno

TYPE	NO.	CODE	DATA	
	R61	80.5249	1 KΩ 5% carbon film	1/8W
	R62	89.5046	50Ω PTC	
	R63	80.5246	560 Ω 5% "	1/8W
	R64	86.5068	1 KΩ 20% potentiometer	0.1W
	R65	80.5264	18 KΩ 5% carbon film	1/8W
	R66	80.5272	82 KΩ 5% "	1/8W
	R67	80.5254	2.7 KΩ 5% "	1/8W
	R68	80.5262	12 KΩ 5% "	1/8W
	R69	80.5257	4.7 KΩ 5% "	1/8W
	R70	80.5258	5.6 KΩ 5% "	1/8W
	R71	80.5258	5.6 KΩ 5% "	1/8W
	R72	86.5039	10 KΩ 20% potentiometer	0.1W
	R73	80.5272	82 KΩ 5% carbon film	1/8W
	R74	80.5254	2.7 KΩ 5% "	1/8W
	R76	80.5261	10 KΩ 5% "	1/8W
	R80	80.5246	560 Ω 5% "	1/8W
	R81	80.5275	0.15 MΩ 5% "	1/8W
	R82	80.5267	33 KΩ 5% "	1/8W
	R83	86.5042	500 Ω 20% potentiometer	0.1W
	R84	80.5238	120 Ω 5% carbon film	1/8W
	R85	80.5254	2.7 KΩ 5% "	1/8W
	R86	80.5238	120 Ω 5% "	1/8W
	R87	80.5240	180 Ω 5% "	1/8W
	R88	80.5269	47 KΩ 5% "	1/8W
	R89	80.5269	47 KΩ 5% "	1/8W
	R90	80.5261	10 KΩ 5% "	1/8W
	R91	80.5273	0.1 MΩ 5% "	1/8W
	R92	80.5258	5.6 KΩ 5% "	1/8W
	R93	80.5249	1 KΩ 5% "	1/8W
	R94	80.5249	1 KΩ 5% "	1/8W
	R95	80.5256	3.9 KΩ 5% "	1/8W
	R96	80.5233	47 Ω 5% "	1/8W
	R97	80.5251	1.5 KΩ 5% "	1/8W
	R98	80.5250	1.2 KΩ 5% "	1/8W
	R99	86.5043	2.5 KΩ 20% potentiometer	0.1W
	R100	80.5254	2.7 KΩ 5% carbon film	1/8W
	R101	80.5259	6.8 KΩ 5% "	1/8W
	R102	80.5253	2.2 KΩ 5% "	1/8W
	R103	80.5253	2.2 KΩ 5% "	1/8W
	R104	80.5225	10 Ω 5% "	1/8W
	R105	80.5242	270 Ω 5% "	1/8W
	R106	80.5253	2.2 KΩ 5% "	1/8W

TYPE	NO.	CODE	DATA
	R107	80.5242	270 Ω 5% carbon film 1/8W
	R108	80.5213	1 Ω 5% " 1/8W
	R109	80.5213	1 Ω 5% " 1/8W
	R110	80.5213	1 Ω 5% " 1/8W
	R111	80.5213	1 Ω 5% " 1/8W
	R112	80.5246	560 Ω 5% " 1/8W
	R113	80.5254	2.7 KΩ 5% " 1/8W
	R114	89.5062	22 KΩ 1% metal film 1/8W
	R115	89.5062	22 KΩ 1% metal film 1/8W
	R116	80.5277	0.22 MΩ 5% carbon film 1/8W
	R117	80.5259	6.8 KΩ 5% " 1/8W
	R118	80.5263	15 KΩ 5% " 1/8W
	R119	89.5062	22 KΩ 1% metal film 1/8W
	R120	89.5062	22 KΩ 1% metal film 1/8W
	R121	89.5062	22 KΩ 1% metal film 1/8W
	R122	80.5251	1.5 KΩ 5% carbon film 1/8W
	R123	89.5061	68 Ω 20% NTC 0.5W
	R124	86.5053	10 KΩ 20% potentiometer 0.1W
	R126	80.5229	22 Ω 5% carbon film 1/8W
	R127	84.5224	82 Ω 5% wire wound 4 W
	R128	80.5238	120 Ω 5% carbon film 1/8W
	R129	80.5443	330 Ω 5% " 1/4W
	R130	80.5238	120 Ω 5% " 1/8W
	R131	80.5251	1.5 KΩ 5% " 1/8W
	R132	80.5251	1.5 KΩ 5% " 1/8W
	R133	86.5038	500 KΩ 20% potentiometer 0.05W
	R134	80.5273	100 KΩ 5% carbon film 1/8W
	L1	61.1131	IF coil 455 kHz
	L2	61.1132	Coil 75 mH
	L3	60.5158	Choke
	T1	61.1130	IF Transformer 455 kHz
	T2	61.1130	IF Transformer 455 kHz
	E1	99.5210	Zenerdiode 3.3 V 5% 1/4W
	E3	99.5237	1N4148 Diode
	E4	99.5237	1N4148 Diode
	E5	99.5209	Stab. diode 1.5 V
	E6	99.5209	Stab. diode 1.5 V
	E7	99.5209	Stab. diode 1.5 V
	E8	99.5224	Zenerdiode 4.7 V 5% 1/4W
	E9	99.5237	1N4148 Diode
	E10	99.5237	1N4148 Diode
	E11	99.5237	1 N4148 Diode
	E12	99.5224	Zenerdiode 4.7 V 5% 1/4W
	E13	99.5249	Zenerdiode BZY93/C20R
	E14	99.5209	Stab. diode 1.5 V
	E15		

TYPE	NO.	CODE	DATA
	E15	99.5237	1N4148 Diode
	E16	99.5209	Stab. diode 1.5 V
	E17	99.5209	Stab. diode 1.5 V
	Q1	99.5166	BF167 Transistor
	Q2	99.5166	BF167 Transistor
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5247	2N4302 Transistor FET
	Q6	99.5143	BC108 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5115	BC179 Transistor
	Q10	99.5115	BC179 Transistor
	Q11	99.5143	BC108 Transistor
	Q12	99.5246	TIP 31 Transistor
	Q13	99.5144-01	BC214L Transistor
	Q14	99.5243	BC108 Transistor
	Q15	99.5243	BC108 Transistor
	Q16	99.5246	TIP 31 Transistor
	Q17	99.5144-01	BC214L Transistor
	Q18	99.5143	BC108 Transistor
	Q19	99.5143	BC108 Transistor
	Q20	99.5201	BC109 Transistor
	Q21	99.5201	BC109 Transistor
	Q22	99.5115	BC179 Transistor
	Q23	99.5143	BC108 Transistor
	Q24	99.5143	BC108 Transistor
	Q25	99.5143	BC108 Transistor
	Q26	99.5115	BC179 Transistor
	Q27	99.5236	BD136 Transistor
	Q28	99.5235	BD135 Transistor
	Q29	99.5248	SP2629 Transistor
	Q30	99.5235	BD135 Transistor
	IC1	14.5010	IF ampl./discr.
	IC2	14.5006	MC1437P dual OP amp.

COMMON FUNCTIONS UNIT CF702

X 401.868

 Storno

COMMON FUNCTION UNIT
CF703 - CF704

Description

The CF subunit contains all circuitry for the CQM700 radiotelephone that is not dependent upon frequency or channel separation.

CF703 is designed for simplex operation and CF704 for duplex.

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 in the simplex mode (CF703), the signal path through the output amplifier becomes automatically blocked. The tone equipment can also block the signal path here.

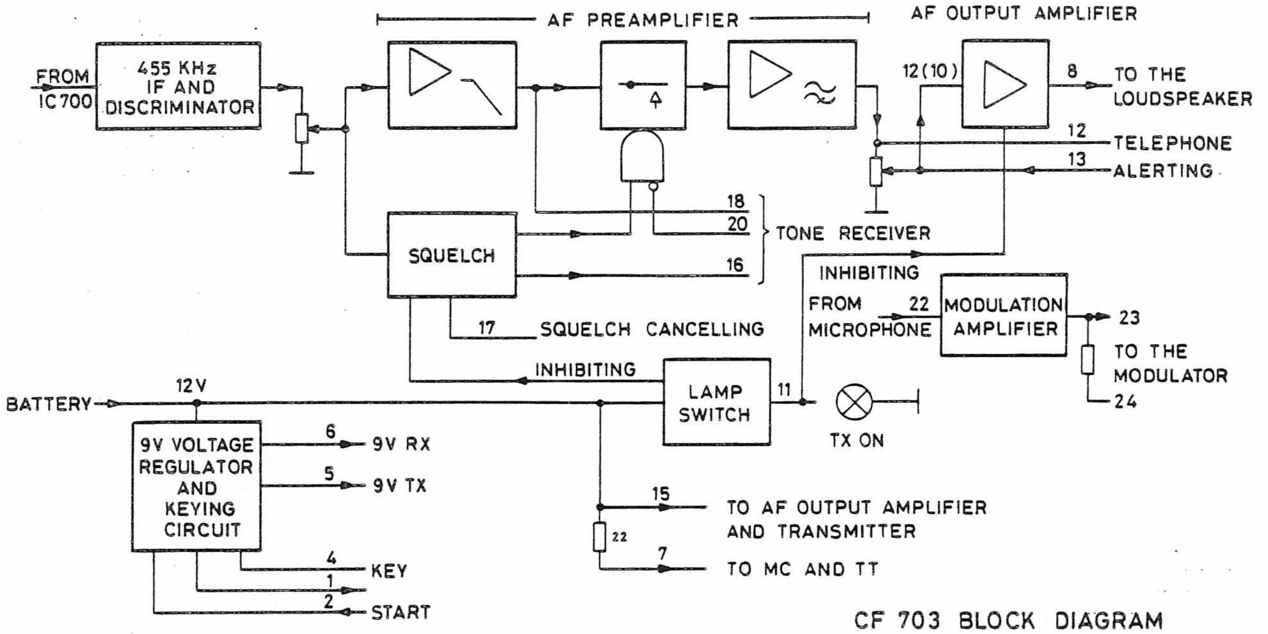
The signal from the microphone is amplified and limited in the modulation amplifier, which is designed around a dual, integrated operational amplifier. Both amplifiers, IC1a and IC1b, are contained in the same housing.

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.

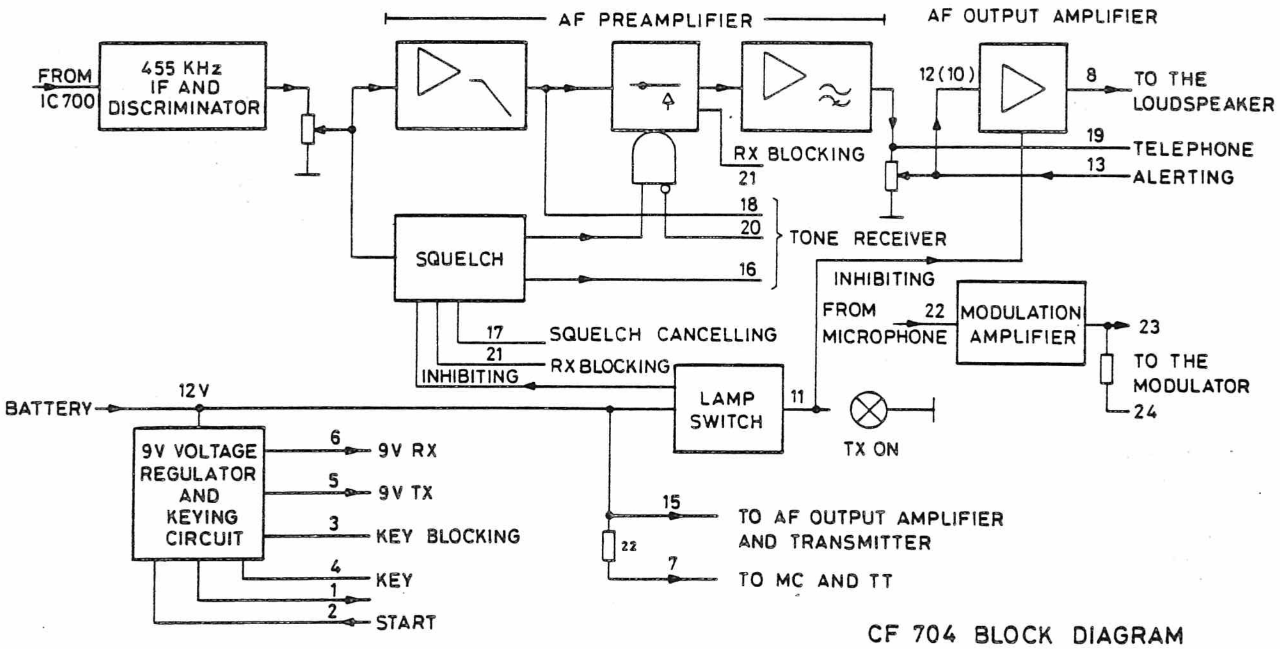
As mentioned previously, the CF subunit also contains two voltage regulators; one supplies the receiver section and the other the transmitter. The AF output amplifier and the PA stage are supplied directly from the battery and are therefore unregulated.

Switching between transmit and receive is accomplished without relays. In CF703 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.

Likewise, in the case of CF704, switching between the duplex and the receive conditions is accomplished without relays. Whenever the equipment is turned on the 9 V RX voltage regulator will always be on.



CF 703 BLOCK DIAGRAM



CF 704 BLOCK DIAGRAM

 Storno

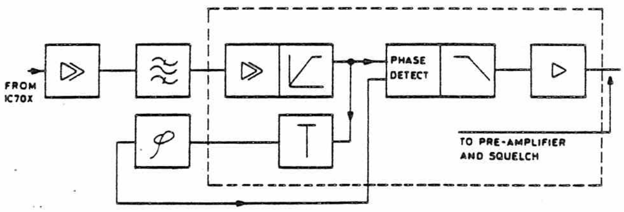
The 12 V supply voltage to the AF output amplifier and the TX power amplifier is always on whenever the on/off switch is turned on. Therefore the TX lamp switch circuit is designed to inhibit the audio preamplifier and audio output amplifier when the transmitter is keyed. This is a precaution against any transients in the squelch circuit that might be able to open the receiver output during transmission.

As explained, the receiver section in duplex equipment (CF704) is always on whenever the power is applied to the set.

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 detector 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.

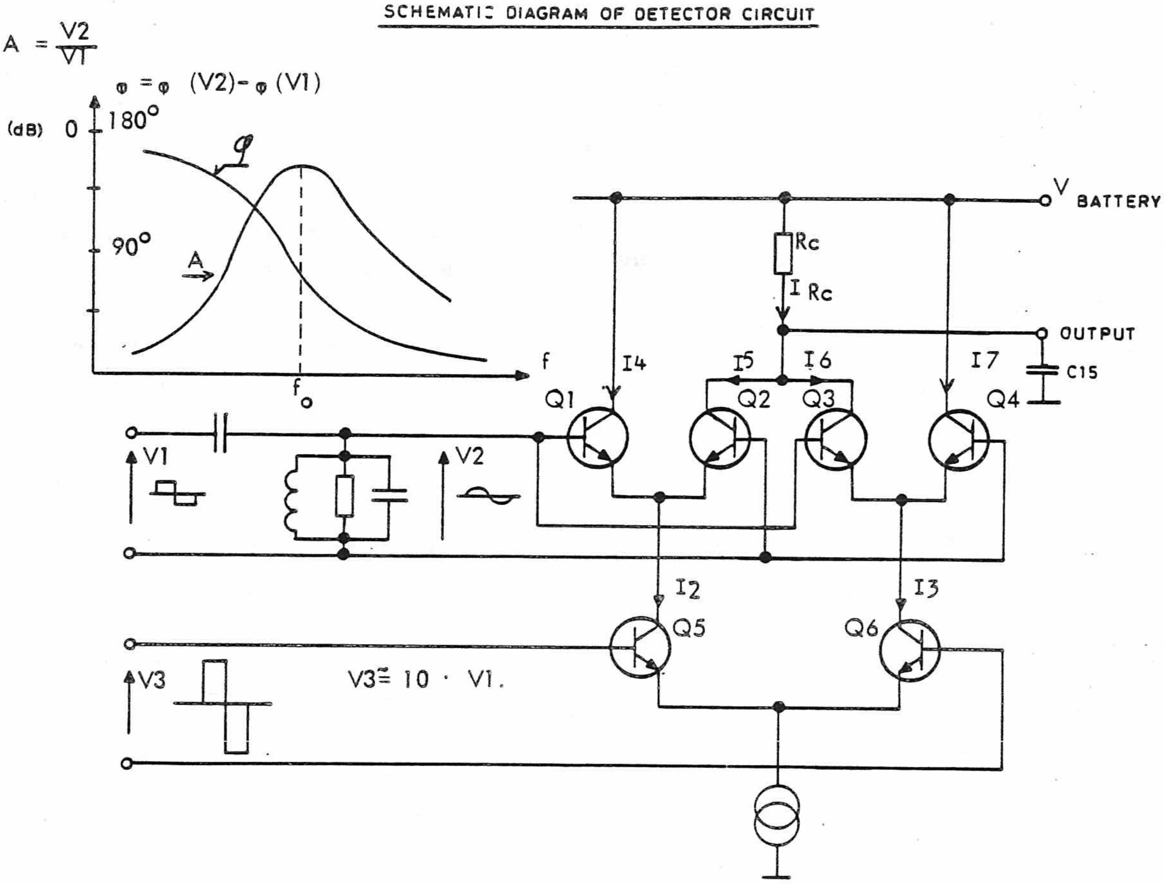
As long as voltage V 2 is high enough to drive the two differential stages - Q1 + Q2, and Q3 + Q4 - as switches, the collector current pulses, I5 and I6, will appear as a constant amplitude value and the average value of current through R_C remains independent of the amplitude of the input voltage.

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.

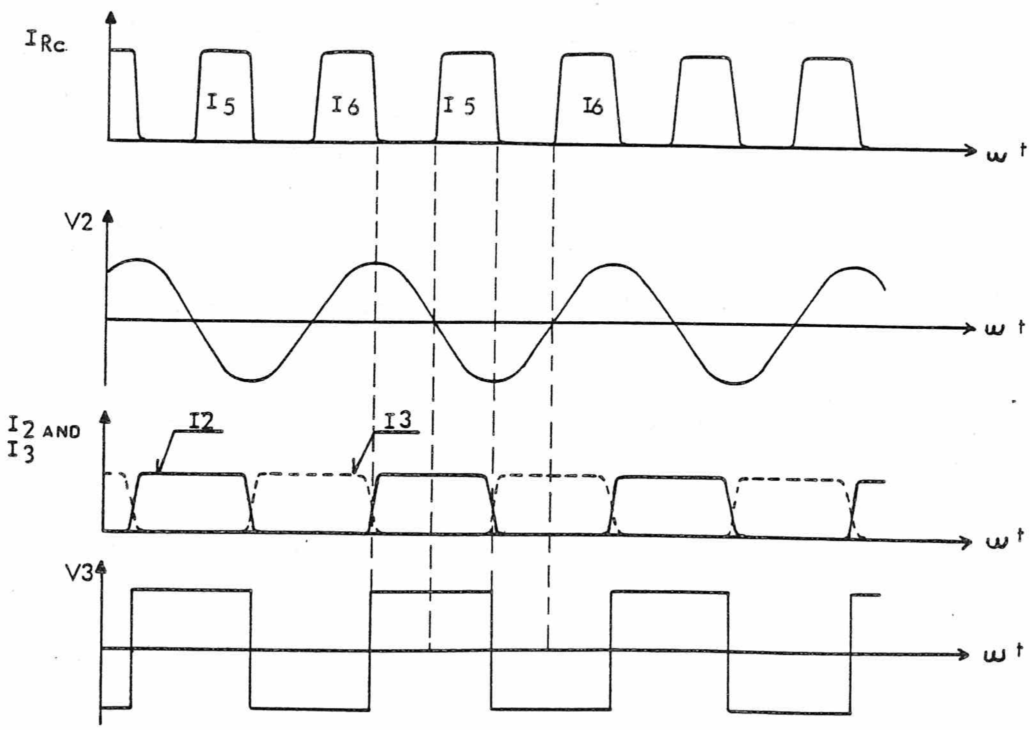
The width of I5 and I6 is therefore seen to be a measurement of the phase difference between V2 and V3. By integrating the output voltage (via R_C and C54) a voltage that is directly proportional to the phase shift is obtained.

Making use of both the negative and positive excursions of the signals, as in the detector con-

SCHEMATIC DIAGRAM OF DETECTOR CIRCUIT



GRAPH OF VOLTAGE AND CURRENT RELATIONSHIPS IN THE PHASE DETECTOR WHEN $f = f_0$



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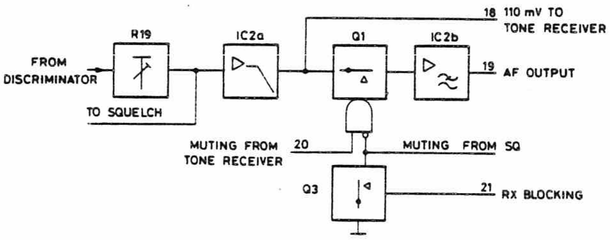
figuration employed here, gives excellent suppression of noise and other undesired effects of inherent nonsymmetry in the clipped IF signal. For example, if the positive going half of V3 is wider than the negative half, I6 will be narrower and I5 wider with the result that the average current through 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 15 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.

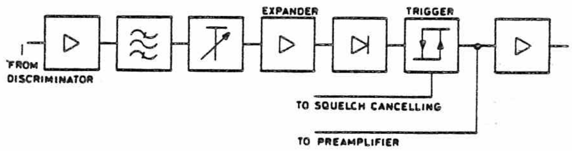
CF704 includes an additional transistor, Q3. With a d.c. potential of ≥ 2.5 V at terminal 21 (RX Blocking)· Q3 will be driven on, turning the AF switch, Q1, off. With the base of Q2 held at ground by Q3, the condition of the squelch circuit will have no effect on the preamplifier. Potentiometer R19 adjusts 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 both the squelch and the tone receiver.

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 on the control panel.

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 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.

Where CF703 is used, keying the transmitter also interrupts the power to the receiver. At the same time, diodes E7 and E8 in the squelch are grounded through Q28 to prevent any false signals that might appear in the squelch circuitry from affecting the AF amplifier or Q9 during this condition.

This does not apply to CF704.

The 9 V Voltage Regulators and Keying Circuits

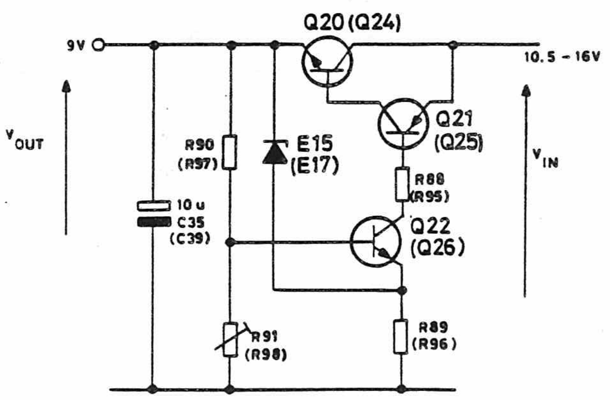
The two 9 V voltage regulators supply the receiver and the transmitter sections, respectively. They are intended for use with a 12 V storage battery.

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 in the CF703 are provided with starting circuits; 9 V RX employs R82, R83, and E13 in its starting circuit and 9 V TX employs R92 and 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.

CF704 is arranged in a slightly different manner since 9 V RX must always operate when the equipment is turned on. While the 9 V RX and 9 V TX regulators employ the same starting circuit as just explained for CF703, the difference here is that keying the transmitter (which grounds terminal 4) does not turn the CF704 9 V RX regulator off.

Operation of Keying and Starting Circuits

For CF703:

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. 8.1 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.

Grounding terminal 4 immediately cuts off Q23 and Q27. 9 V RX falls towards 0 V as there is now no base current to Q21. 9 V RX falls off at a rate determined by the time constant of C35 and the load on terminal 6. Under all operating conditions within factory specifications for the radiotelephone, the time constant will easily be long enough that the current through starting circuit R92 and E16 can turn on Q26, whereby a voltage builds up on 9 V TX that finally reaches a level where diode E16 becomes nonconducting.

Diode E12 and resistor R87 ensures that keying the transmitter cuts off base current to Q21 effectively, even at high temperatures. 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. Since - as just explained - it is 9 V RX that starts 9 V TX, it is necessary to activate the transmitter key again.

For CF704:

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. 7.0 V at nominal battery voltage).

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. 4.6 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 TX Lamp Switch

The TX lamp switch supplies 12 V to the transmit lamp, when transmitting, and also submit inhibit voltages to the squelch (CF703 only) and to the AF output amplifier. The lamp switch includes Q28/Q29 and is controlled by 9 V TX.

The AF Output Amplifier

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

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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 or 12) must have 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.

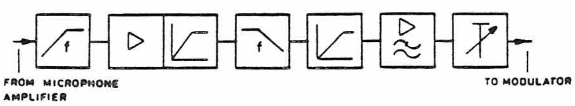
The Modulation Amplifier

General

The modulation amplifier differentiates, amplifies, limits and integrates the microphone signal. It also suppresses undesired high frequencies with an active filter designed for either 20, 25 or 50 kHz channel separation or, with a few resistor values changed, 12.5 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 R6 and R7 and therefore is fixed.

The Integration Circuit

Integrating takes place from 150 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 2nd Clipper (or Phase Clipper)

This extra clipper is inserted to prevent strong input signals at low frequencies from overdriving the modulator stage. For signal levels corresponding to the nominal frequency swing, the clipper has no effect. Two 1.5 V diodes and capacitor C3 make up this circuit.

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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).

The filter cannot be overdriven because the input signal level is subject to limiting by the diode clipper.

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 reduced sufficiently an additional resistor can be inserted by using terminal 24 instead of terminal 23.

TECHNICAL SPECIFICATIONS

Nominal Supply Voltage

13.6 V

Current Drain for CF703

(at nominal supply voltage)

Transmit: 22 mA
Receive : 100 mA

Current Drain for CF704

(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 CF704

Voltage/current: ≥ 6 V/2 mA

RX Inhibit CF703

Voltage/current: ≥ 2.5 V/0.1 mA

Temperature Range

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

The following, more detailed specifications for the several CF703 and CF704 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 $\boxed{2}$, terminated with 2.2 kΩ load.

Discriminator Linearity (relative to 1000 Hz)

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

Measured at test point $\boxed{2}$, terminated with 2.2 kΩ load.

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

$R_{OUT} = \sim 0\ \Omega$

Gain (gain control at highest setting)

R_L = 1.8 kΩ, f = 1 kHz;

Tone output: 15 dB
Telephone output: 13 dB

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

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: ≥ 2.3 V
Terminal 20 must float.

Deemphasis Cut-off Frequency

60 Hz

Frequency Response at Tone Receiver Output

(relative to -6 dB/octave characteristic)

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

Frequency Response at Telephone Output

(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)

16 mA

Measured with unloaded Squelch Signalling (terminal 16)

Input Impedance

15 kΩ

Noise Filter Resonant Frequency

12.5 kHz channel spacing:	7.2 kHz
20/25 kHz " " :	7.2 kHz
(50 kHz " " :	10 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

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:	3.5 dB
Input impedance:	100 kΩ

MODULATION AMPLIFIER

Current Drain, (at nominal 9 V supply)

7 mA

Input Impedance (at 1 kHz)

540 Ω

Limiting

Signal clipping begins to occur with an input signal (1000 Hz) of: 110 mV

Output signal level observed at pin 2 of IC1 when clipping occurs: 7.0 V p.p.

Phase Limiting

Phase clipping level (at 300 Hz): 2.1 V p.p.

Measured immediately after the integration network, with an input signal of 1.1 V (nominal 110 mV + 20 dB).

Output Voltage (1 kHz)

560 mV

Measured at modulation output (terminal 23) with potentiometer R18 fully up, and load impedance = 1 kΩ.
Input level = 110 mV.

Harmonic Distortion (at 1 kHz)

for 110 mV input signal: 0.8%

Frequency Response (relative to 1 kHz)

	Channel spacing	
	20/25/50 kHz	12.5 kHz
300 Hz	-1.5 dB	-1.5 dB
3 kHz	0 dB	-4 dB
6 kHz	-19 dB	-25 dB
10 kHz	-32 dB	-37 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

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

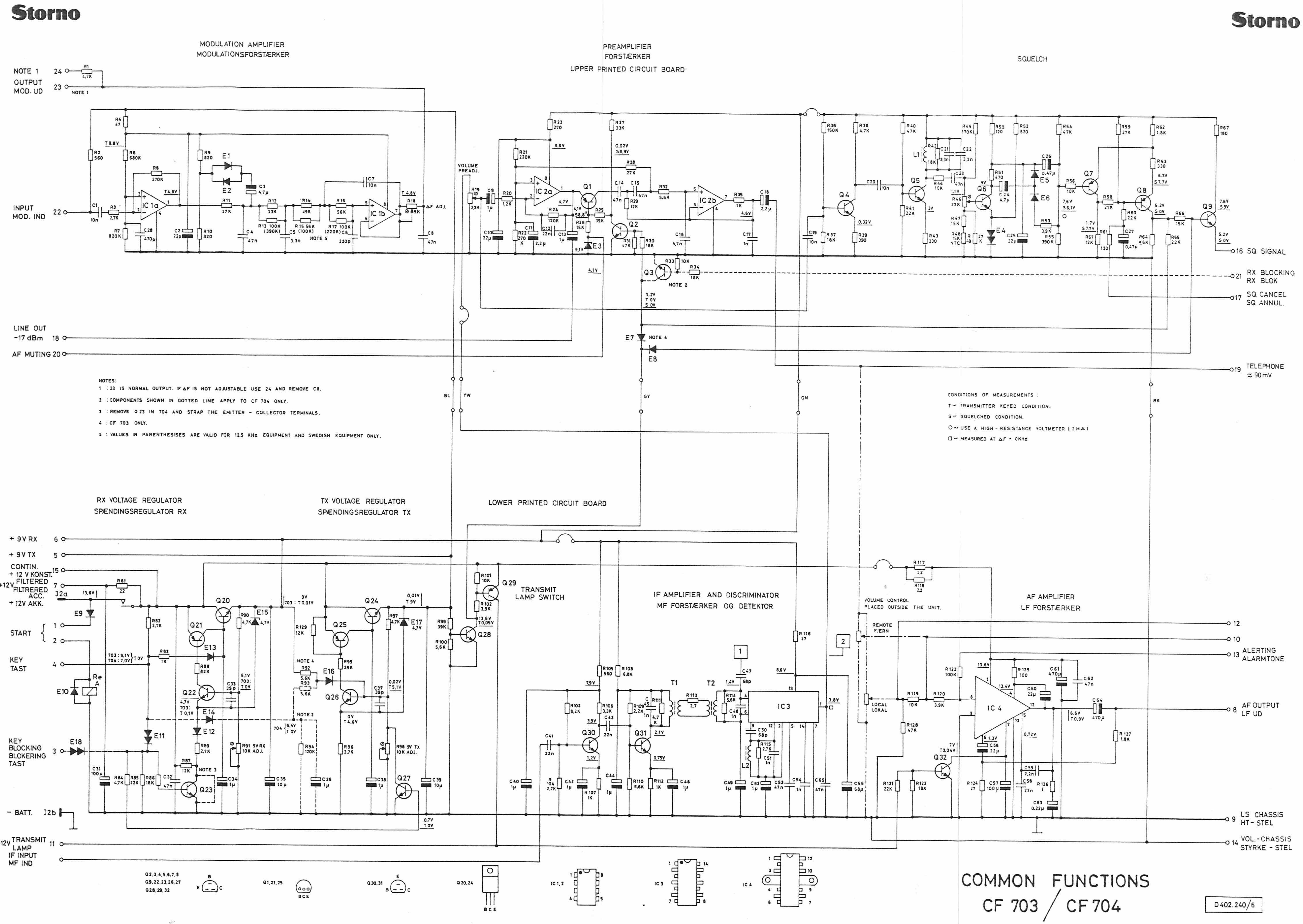
($V_{BATTERY}$ = 13.6 V)

9 V RX turn-on delay, $t_{0-90\%}$: 0.4 ms
9 V RX turn-off delay, $t_{100-10\%}$: 100 ms
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



COMMON FUNCTIONS
CF 703 / CF 704

D402.240/6

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TYPE	Nº	CODE	DATA			
CF703		10.3364-00	Common Functions			
CF704		10.3499	Common Functions			
	C1	76.5070	10 nF	10%	polyest FL	50 V
	C2	73.5127	22 µF	20%	tantal	16 V
	C3	73.5126	4.7 µF	20%	"	35 V
	C4	76.5072	47 nF	10%	polyest FL	50 V
	C5	76.5060	3.3 nF	10%	"	50 V
	C6	76.5063	220 pF	5%	polystyr TB	160 V
	C7	76.5070	10 nF	10%	polyest FL	50 V
	C8	76.5072	47 nF	10%	" 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 PL	63 V
	C18	73.5102	2.2 µF	20%	tantal	35 V
	C19	76.5070	10 nF	10%	polyest FL	50 V
	C20	76.5070	10 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	76.5072	47 nF	10%	" FL	50 V
	C24	73.5126	4.7 µF	20%	tantal	35 V
	C25	73.5127	22 µF	20%	"	16 V
	C26	73.5125	0.47 µF	20%	"	35 V
	C27	73.5125	0.47 µF	20%	"	35 V
	C28	74.5161	470 pF	-20 + 80%	ceram	63 V
	C31	73.5071	100 µF	-10 + 50%	elko	40 V
	C32	76.5072	47 nF	10%	polyest FL	50 V
CF704	C33	74.5187	39 pF	10%	ceram PL	25 V
	C34	73.5114	1 µF	20%	tantal	35 V
	C35	73.5011	10 µF	-10 + 100%	elko	16 V
CF704	C36	73.5114	1 µF	20%	tantal	35 V
	C37	74.5187	39 pF	10%	ceram PL	25 V
	C38	73.5114	1 µF	20%	tantal	35 V
	C39	73.5011	10 µF	-10 +50%	elko	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	73.5115	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		ceram PL	63 V
	C48	76.5067	1 nF	5%	polystyr TB	160 V

Storno

TYPE	Nº	CODE	DATA			
	C49	73.5114	1 µF	20%	tantal	35 V
	C50	74.5341	68 pF		ceram	63 V
	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%	elko	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%	elko	25 V
	C62	76.5072	47 nF	10%	polyest FL	50 V
	C63	76.5072	47 nF	10%	" FL	50 V
	C64	73.5137	470 µF	-10 + 50%	elko	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
	R6	80.5283	680 KΩ	5%	carbon film	1/8 W
	R7	80.5284	820 KΩ	5%	trim. carbon	0.1 W
	R8	80.5280	390 KΩ	5%	carbon film	1/8 W
	R9	80.5248	820 Ω	5%	"	1/8 W
	R10	80.5248	820 Ω	5%	"	1/8 W
	R11	80.5266	27 KΩ	5%	"	1/8 W
	R12	80.5267	33 KΩ	5%	"	1/8 W
	R13	80.5273	100 KΩ	5%	"	1/8 W
	R14	80.5278	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	1/8 W
	R19	86.5043	2.2 KΩ	20%	"	0.1 W
	R20	80.5250	1.2 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	80.5242	270 Ω	5%	"	1/8 W

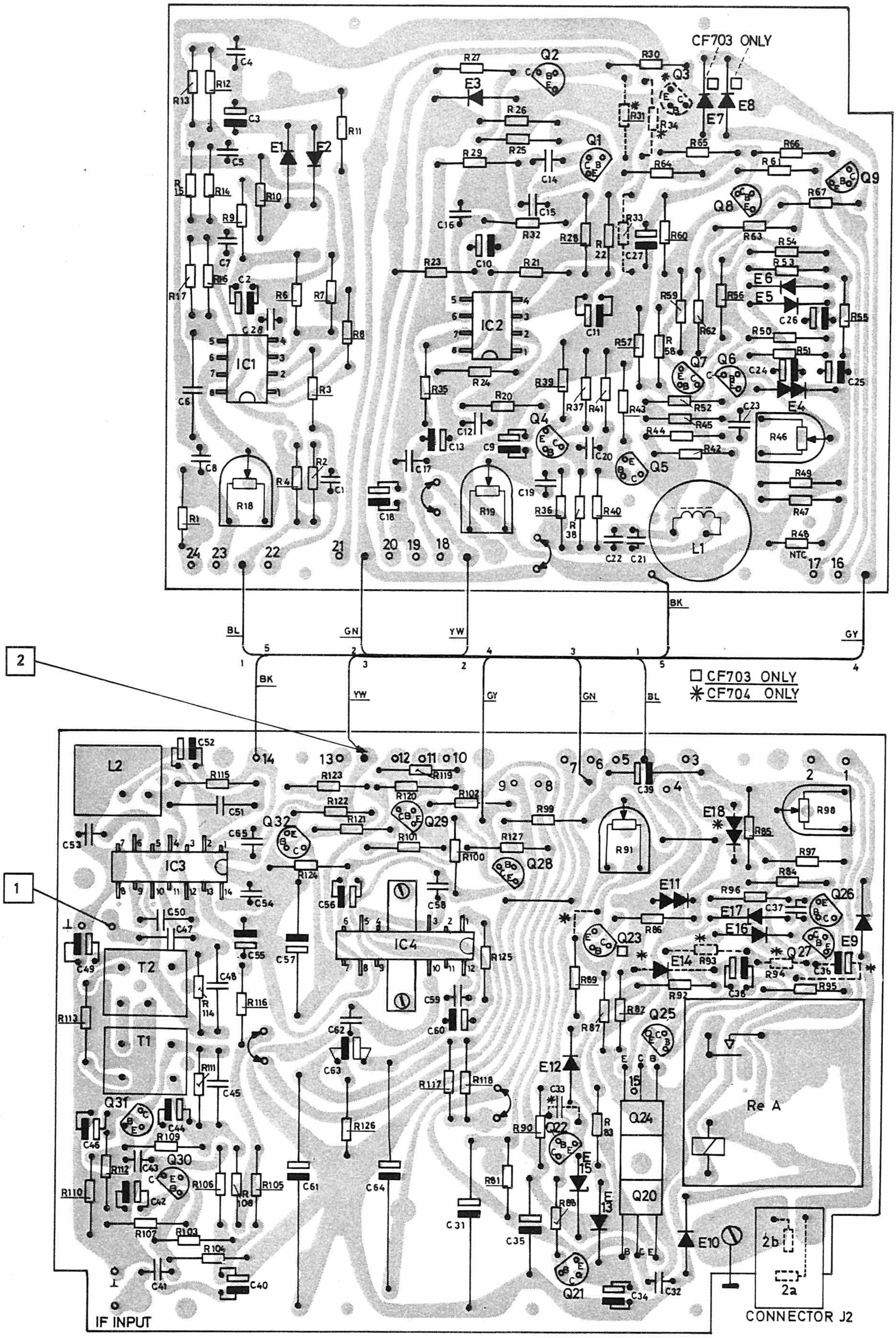
COMMON FUNCTIONS CF703, CF704

TYPE	Nº	CODE	DATA
	R124	80.5230	27 Ω 5% carbon film 1/8 W
	R125	80.5237	100 Ω 5% " 1/8 W
	R126	80.5213	1 Ω 5% " 1/8 W
	R127	80.5252	1.8 KΩ 5% " 1/8 W
	L1	61.1132	Squelch coil 75 mH
	L2	61.1131	IA coil 455 kHz
	E1	99.5237	1 N 4148 Diode
	E2	99.5237	1 N 4148 "
	E3	99.5042	Zenerdiode 9.1 V 5% 0.25 W
	E4	99.5209	Stabilizerdiode 1.5 V
	E5	99.5237	1 N 4148 Diode
	E6	99.5237	1 N 4148 "
	E7	99.5237	1 N 4148 "
	E8	99.5237	1 N 4148 "
	E9	99.5020	1 N 4004 "
	E10	99.5237	1 N 4148 "
	E11	99.5209	Stabilizerdiode 1.5 V
	E12	99.5237	1 N 4148 Diode
	E13 E14	99.5237	1 N 4148 "
	E15	99.5224	Zenerdiode 4.7 V 5% 0.25 W
	E16	99.5237	1 N 4148 Diode
	E17	99.5224	Zenerdiode 4.7 V 5% 0.25 W
	E18	99.5209	1.5 V Stab. diode
	Q1	99.5144	Transistor BC 214 L
	Q2	99.5143	" BC 238 (BC 108)
CF704	Q3	99.5143	" BC 238 (BC 108)
	Q4	99.5143	" BC 238 (BC 108)
	Q5	99.5143	" BC 238 (BC 108)
	Q6	99.5201	" BC 239 (BC 109)
	Q7	99.5115	" BC 309 (BC 179)
	Q8	99.5115	" BC 309 (BC 179)
	Q9	99.5143	" BC 238 (BC 108)
	Q20	99.5246	" TIP 31
	Q21	99.5144	" BC 214 L
	Q22	99.5143	" BC 238 (BC 108)
	Q23	99.5143	" BC 238 (BC 108)
	Q24	99.5246	" TIP 31
	Q25	99.5144	" BC 214 L
	Q26	99.5143	" BC 238 (BC 108)
	Q27	99.5143	" BC 238 (BC 108)
	Q28	99.5143	" BC 238 (BC 108)
	Q29	99.5115	" BC 309 (BC 179
	Q30	99.5326	" BF 198
	Q31	99.5326	" BF 198
	Q32	99.5143	BC238
	T1	61.1130	IA transformer 455 kHz

TYPE	Nº	CODE	DATA
	T2	61.1130	IA transformer 455 kHz
	IC1	14.5105	MC1458 Dual OP-amp.
	IC2	14.5105	MC1458 Dual OP-amp
	IC3	14.5010	IF Amplifier/Discr. ULN 2111 N
	IC4	14.5104	Audio Power Amplifier TBA 810 AS
	ReA	58.5084	Relay 330 Ω 12 V

COMMON FUNCTIONS CF703, CF704

Storno



COMMON FUNCTIONS UNIT CF703, CF704

D402.354

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.

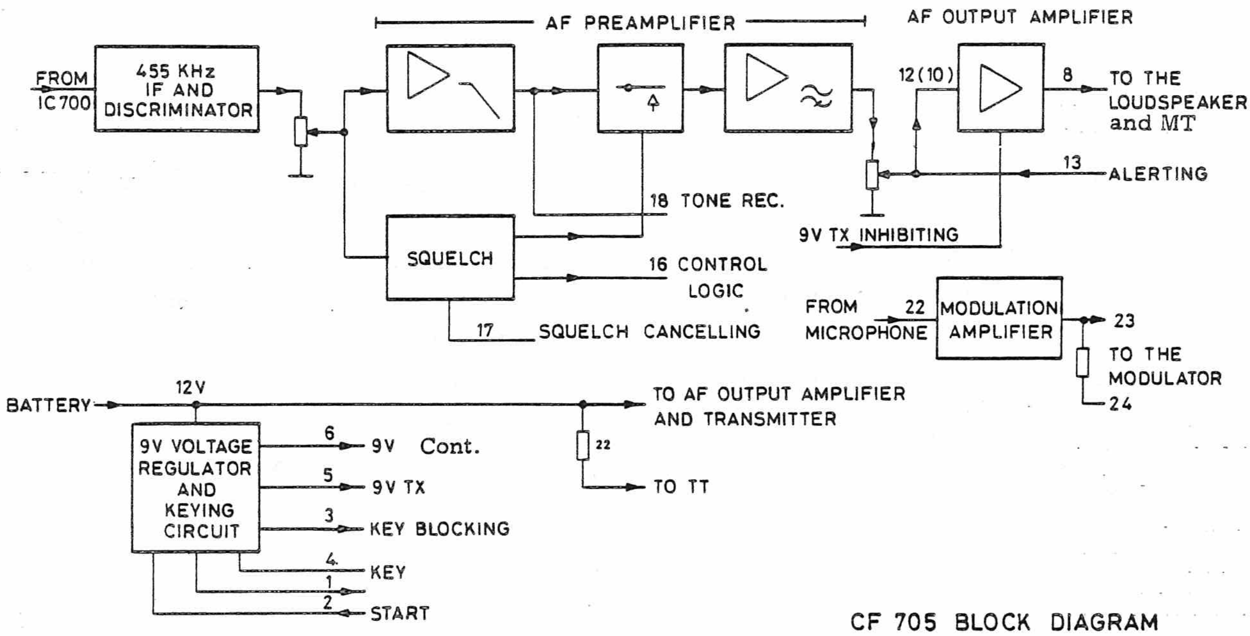
The signal from the microphone is amplified and limited in the modulation amplifier, which is designed around a dual, integrated operational amplifier. Both amplifiers, IC1a and IC1b, are contained in the same housing.

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 TX voltage regulator on. 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

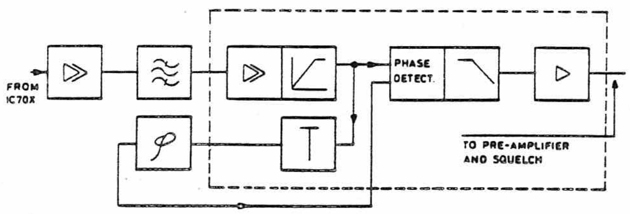


CF 705 BLOCK DIAGRAM

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.

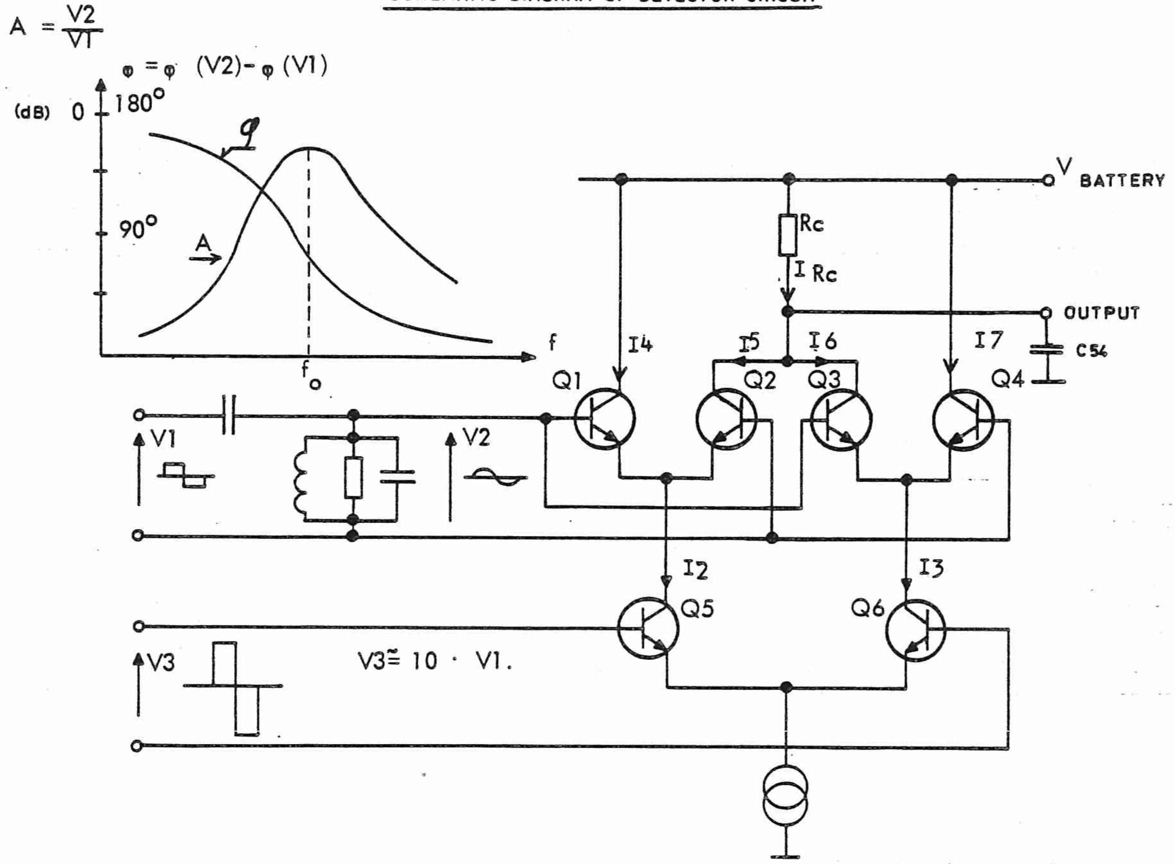
Inductive coupling between circuits is less than critical, R113 in the coupling link determining the coupling factor. Q31 operates with its collector-emitter voltage held low to prevent overdriving IC3.

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.

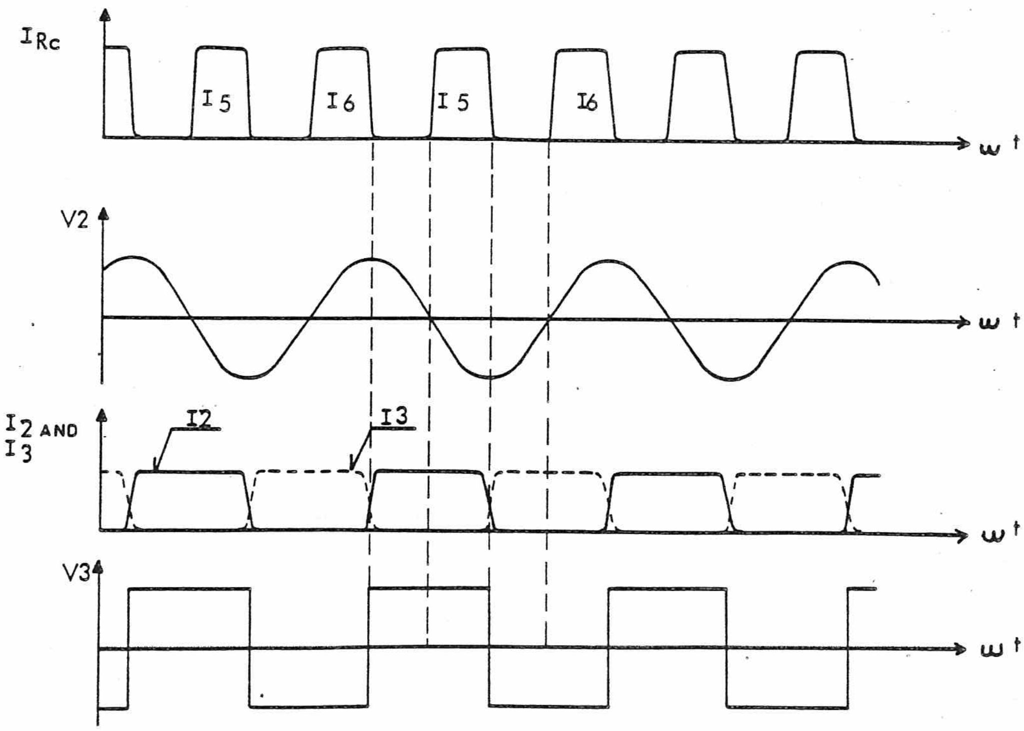
Via an emitter follower within the IC housing, the signal is fed to the phase detector. The IF signal, with its amplitude peaks clipped, is applied directly to one of the phase detector inputs.

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 $f = f_o$



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.

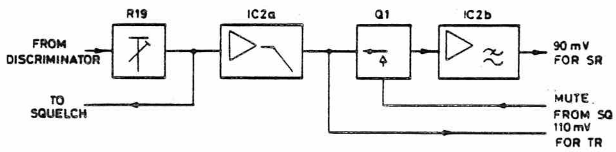
The width of I5 and I6 is therefore seen to be a measurement of the phase difference between V2 and V3. By integrating the output voltage (via R_C and C54) a voltage that is directly proportional to the phase shift is obtained.

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.

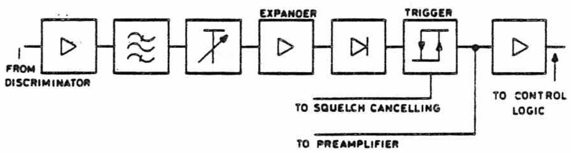
An internal adjustment, potentiometer R46, is provided for setting the squelch level. The squelch function can during test be cancelled altogether by grounding terminal 17 via squelch cancelling button.

Storno

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

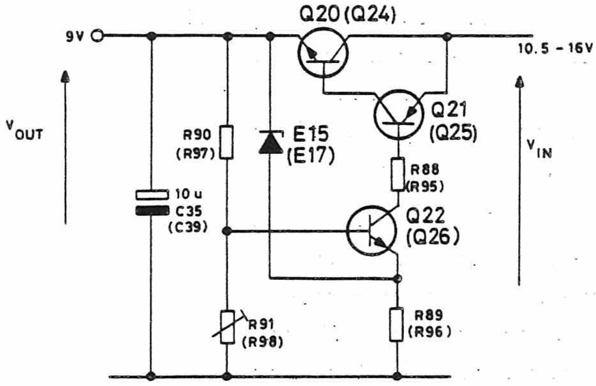
The two 9 V voltage regulators supply the receiver and the transmitter sections, respectively. They are intended for use with a 12 V storage battery.

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.

60.345-E2

Storno

A regulator built exactly like the simplified diagram would not be self-starting, however. Therefore, the regulators are provided with starting circuits; 9V RX employs R82, R83, and E13 in its starting circuit and 9V TX employs R93 and E16.

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 Q 20 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. 8.2V at nominal battery voltage).

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

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 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/C63 constitute the frequency compensation.

Supply voltage ripple 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.

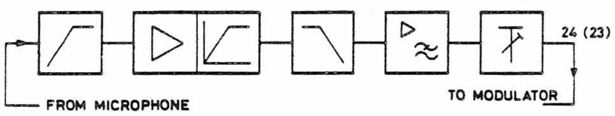
The Modulation Amplifier

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 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 output 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.

Storno

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 input termination

Line Output (terminal 19)

-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 filtered Voltages

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

AF Output Power (terminal 8)

3 W

Modulation Amplifier Sensitivity

(for normal frequency swing at 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.

Storno

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

$R_{OUT} = \sim 0\ \Omega$

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
To close signal path: $\leq$ 0.7 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)

21 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

Storno

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 (at 1kHz)

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 Δ $V_{BATTERY}$ in V_{REG}

(at nominal load)

DC	: 46 dB
1 kHz	: 50 dB

Internal Resistance of Regulators

$R_I = 0.5\ \Omega$

Regulator Output Current

Maximum 250 mA

Maximum Load

on terminal 7 (TT)	:	100 mA
on terminal 15 (PA)	:	6 A

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

Storno

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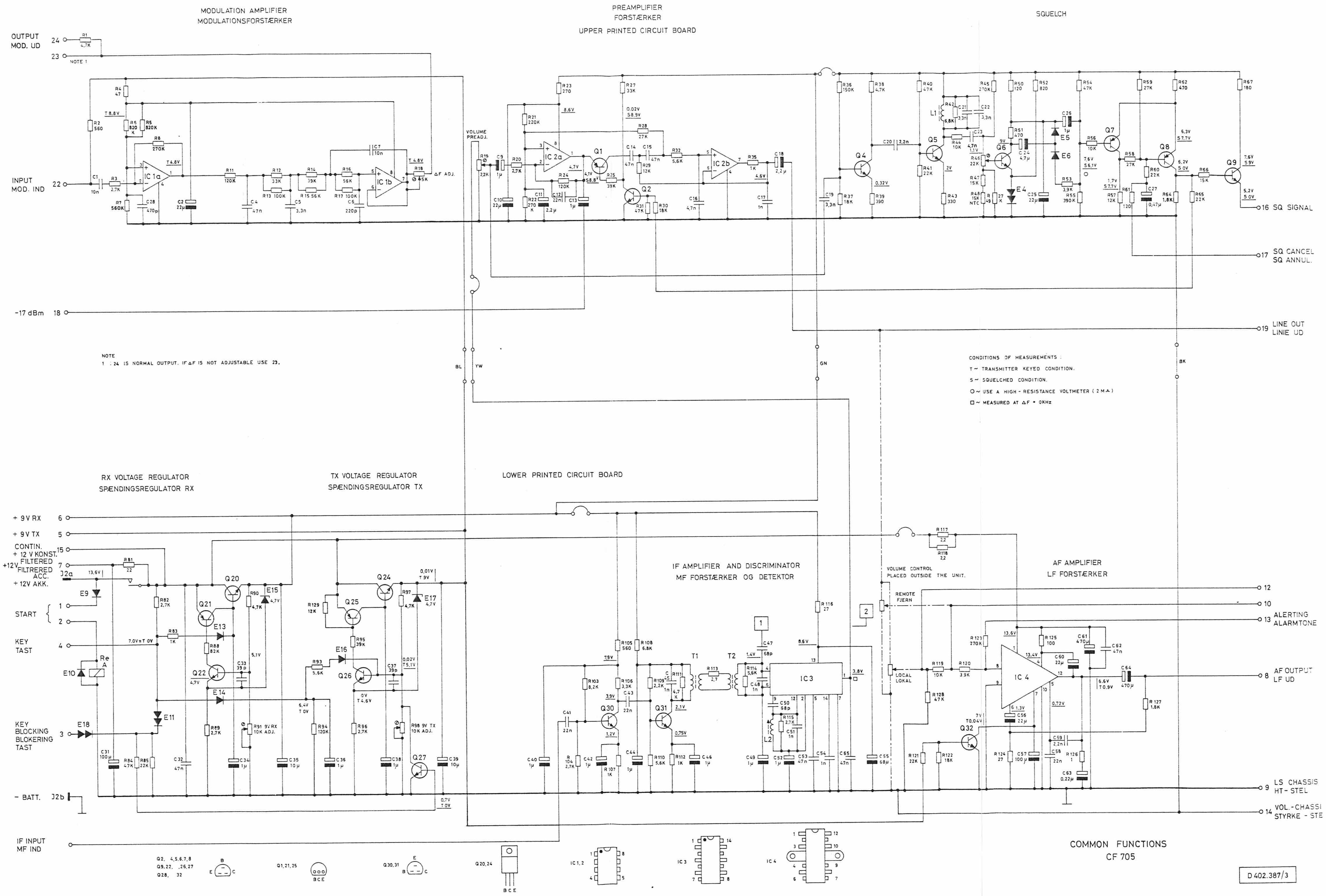
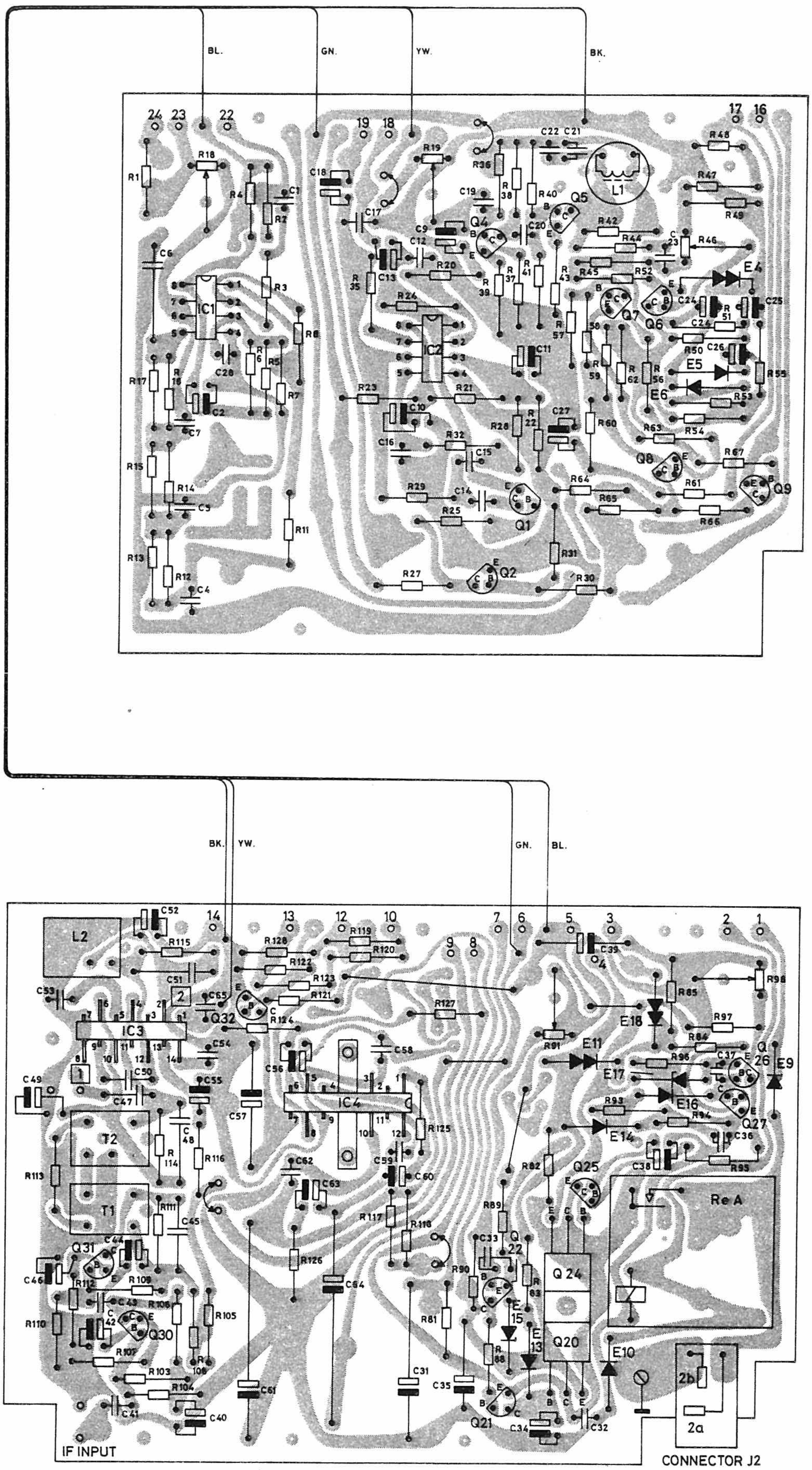


COMMON FUNCTIONS
CF 705

D 402.387/3

Storno



COMMON FUNCTIONS UNIT CF 705

D 402.546

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 k Ω	5%	carbon film		1/8 W
	R2	80. 5246	560 Ω	5%	" "		1/8 W
	R3	80. 5254	2, 7 k Ω	5%	" "		1/8 W
	R4	80. 5233	47 Ω	5%	" "		1/8 W
	R5	80. 5284	820 k Ω	5%	" "		1/8 W
	R6	80. 5284	820 k Ω	5%	" "		1/8 W
	R7	80. 5282	560 k Ω	5%	" "		1/8 W
	R8	80. 5278	270 k Ω	5%	" "		1/8 W
	R11	80. 5274	120 k Ω	5%	" "		1/8 W
	R12	80. 5267	33 k Ω	5%	" "		1/8 W
	R13	80. 5273	100 k Ω	5%	" "		1/8 W
	R14	80. 5268	39 k Ω	5%	" "		1/8 W
	R15	80. 5270	56 k Ω	5%	" "		1/8 W
	R16	80. 5270	56 k Ω	5%	" "		1/8 W
	R17	80. 5273	100 k Ω	5%	" "		1/8 W
	R18	86. 5050	5 k Ω	20%	trim carbon		0. 1 W
	R19	86. 5043	2, 2 k Ω	20%	" "		0. 1 W
	R20	80. 5254	2, 7 k Ω	5%	carbon film		1/8 W
	R21	80. 5277	220 k Ω	5%	" "		1/8 W
	R22	80. 5278	270 k Ω	5%	" "		1/8 W
	R23	80. 5242	270 Ω	5%	" "		1/8 W
	R24	80. 5274	120 k Ω	5%	" "		1/8 W
	R25	80. 5268	39 k Ω	5%	" "		1/8 W
	R27	80. 5267	33 k Ω	5%	" "		1/8 W
	R28	80. 5266	27 k Ω	5%	" "		1/8 W
	R29	80. 5262	12 k Ω	5%	" " "		1/8 W

X402. 554

COMMON FUNCTIONS CF705

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

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

X402. 554

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

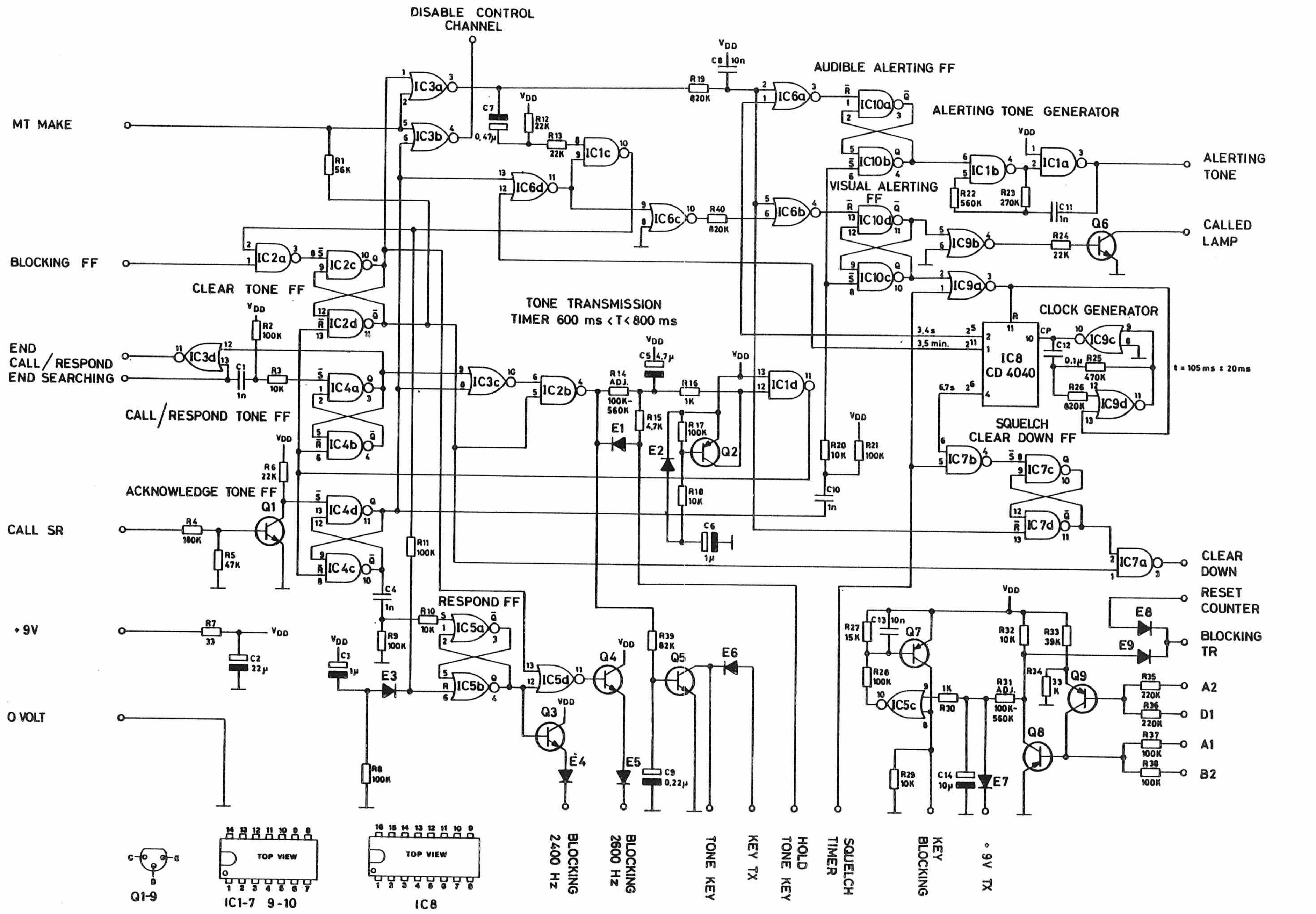
Storno

TYPE	Nº	CODE	DATA

COMMON FUNCTIONS CF705

X402.554

Storno



CONTROL LOGIC CL701

D 402.385

Storno

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

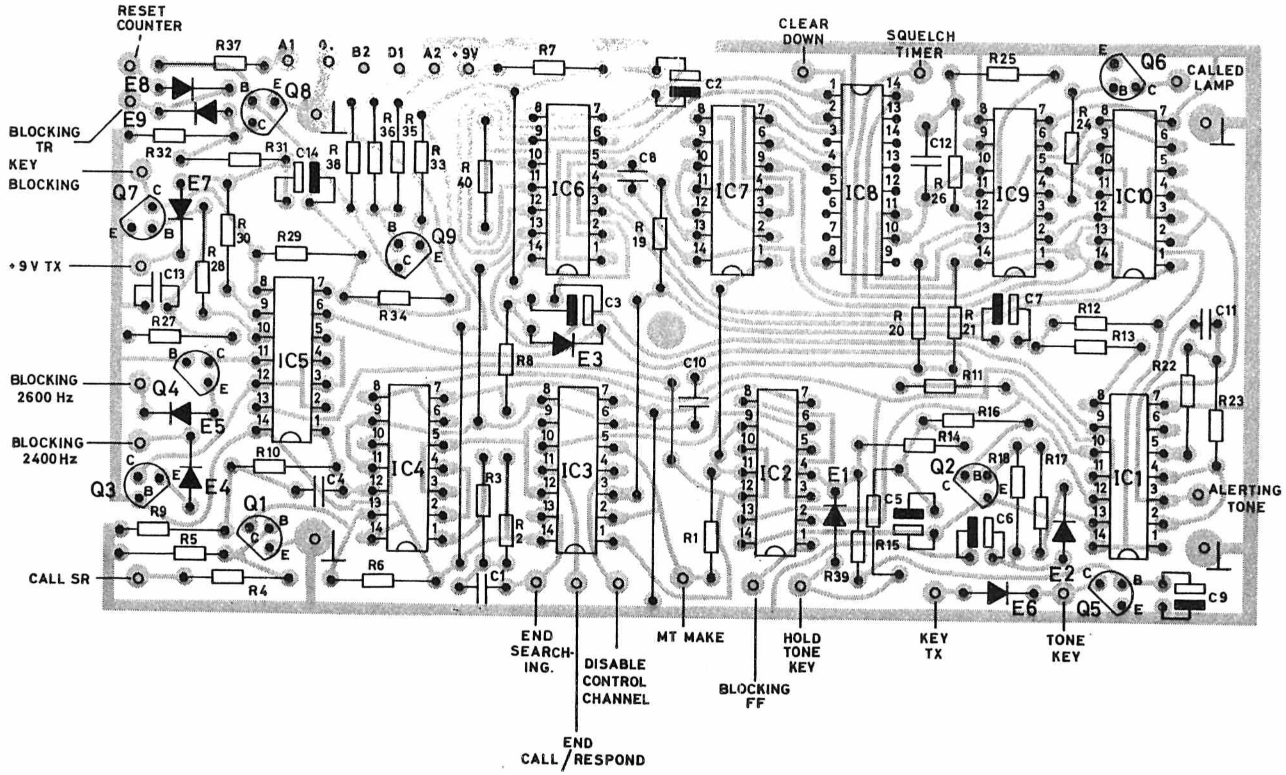
Storno

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

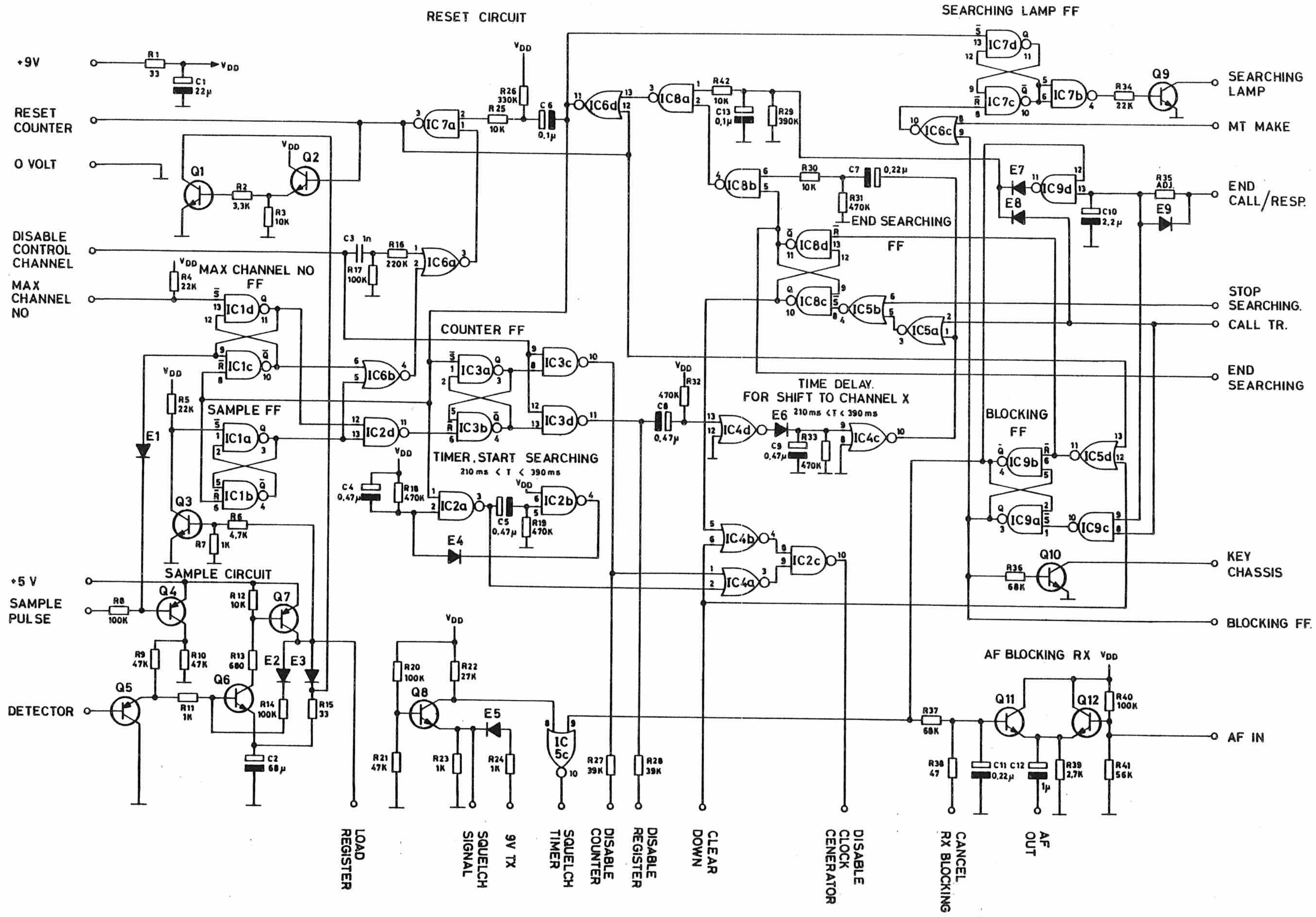
X402.464

Storno



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

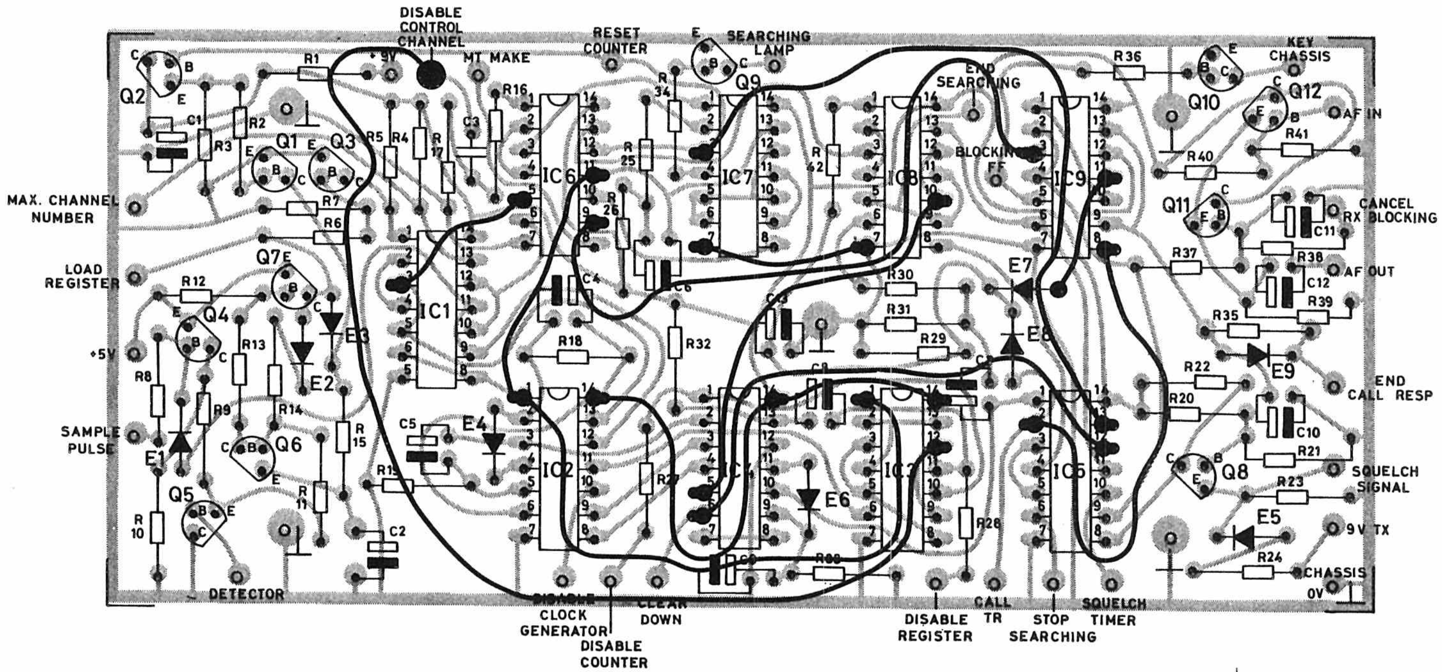
TYPE	Nº	CODE	DATA
	R33	80.5281	470 kΩ 5% carbon film 1/8 W
	R34	80.5265	22 kΩ 5% " " 1/8 W
	R35	80.52xx	ADJ 5% " " 1/8 W
	R36	80.5271	68 kΩ 5% " " 1/8 W
	R37	80.5271	68 kΩ 5% " " 1/8 W
	R38	80.5233	47 Ω 5% " " 1/8 W
	R39	80.5254	2.7 kΩ 5% " " 1/8 W
	R40	80.5273	100 kΩ 5% " " 1/8 W
	R41	80.5270	56 kΩ 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

Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

CONTROL LOGIC CL702

D402.509

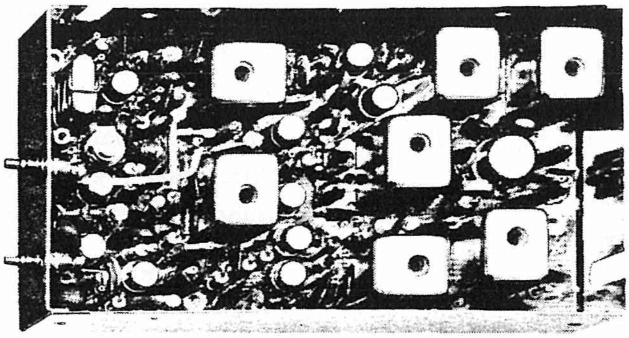
TITLE		Code
EX711	Description 1 - 3	60.179-E1
	Schematic	D401.361/2
	Component Lay-out	D401.521/2
	Part List 1 - 2	X401.371/2
EX712	Schematic	D401.847
	Part List 1 - 2	X401.945
EX731	Description 1 - 3	60.180-E1
	Schematic	D401.524/2
	Component Lay-out	D401.524/3
	Part List 1 - 3	X401.786
EX761	Description 1 - 3	60.181-E1
	Schematic	D401.312/2
	Component Lay-out	D401.519
	Part List 1 - 2	X401.321/2
EX762	Schematic	D401.805
	Component Lay-out	D401.892
	Part List 1 - 2	X401.867
FC701 & FC702	Schematic	D401.819/2
	Part List	X401.964
FC703	Schematic	D401.832
	Part List	X401.864
FC704	Schematic	D402.145
	Part List	X402.365
	Component Lay-out	D402.431
FC705	Schematic	D402.383/2
	Part List	X402.463/2
	Component Lay-out	D402.508

STORNOPHONE 700
MAINTENANCE MANUAL
VOLUME II
Section 3

FS701	Schematic	D401.714/3
	Component Lay-out	D401.891/3
	Part List	X401.863/2
FS702	Schematic	D402.406
	Component Lay-out	D402.550
	Part List	X402.467

Storno

EXCITER EX711



Description

General

The exciter must modulate and convert the signal from the transmitter oscillator so the frequency and amplitude are suitable for driving the power amplifier, PA711.

EX711 contains the following stages:

an oscillator (for single channel service)
a phase modulator with associated buffer stages
a frequency tripler
two frequency doublers
an amplifier

After passing through the buffer stage, the oscillator signal becomes phase modulated, goes through another buffer, then is multiplied 12 times, being first tripled then doubled and finally doubled once more. The result is a, signal at the transmitter antenna frequency (146 to 174 MHz.)

For multichannel service the built-in oscillator can be switched out and another oscillator (and frequency) switched in from the oscillator switching unit, XS701.

Oscillator

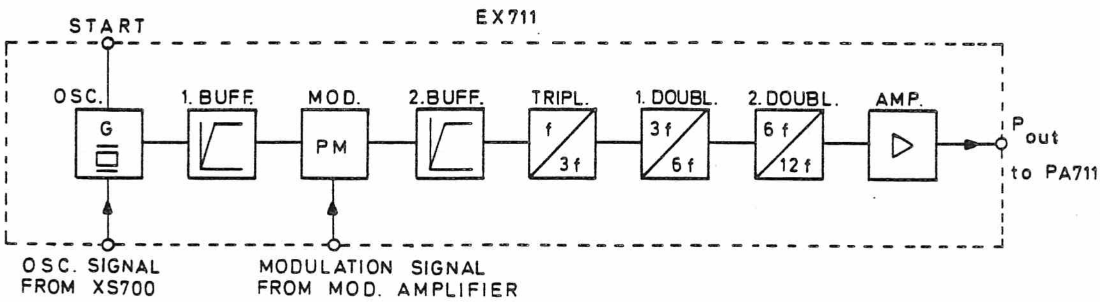
To start the oscillator, the emitter circuit of Q1 must be returned to ground via terminal 1. For single channel service the terminal is tied to ground right in the EX unit.

In the case of multichannel service the emitter of Q1 is grounded through the control panel. When one of the oscillators in the XS unit is functioning, the emitter connection to Q1 is open and the signal from XS is applied to the exciter at terminal 2. R5 in EX711 serves as a collector resistor common to all of the oscillators.

Buffer Stages

Buffer Q2 keeps the RF input signal to the modulator at a constant level while Q4 presents a constant load impedance to the modulator.

The output signals from the different oscillators can vary slightly and since the correct functioning of the modulator depends upon a constant input signal, Q2 is inserted between the oscillator output and the modulator input. The signal is led from the collector of Q2 via a low-pass filter, L1 and C14, which suppresses any har-



monics of the fundamental oscillator frequency. From there the signal is introduced to the base of the modulator, Q3.

Since proper functioning of the modulator likewise depends upon the load impedance, buffer Q4 is inserted between the modulator output and the multiplier chain. Q4 also limits any amplitude modulation present in the signal before it is applied to the first multiplier.

Modulator

The phase modulator stage is built around transistor Q3 and can be considered as a voltage divider consisting of the two identical capacitors, C13 and C15, and transistor Q3, over which the output signal is taken off.

Base voltage for Q3 is applied from the joint of C13 and C15, whereby Q3 appears as an inductance having the same reactance as one of the capacitors. In addition to the reactive current in the transistor there is also a resistive component which is determined by the transistor's operating point; this resistive component can be considered as a resistor in series with the inductance.

The phase shift between the modulator input signal applied to C13 and the modulator output signal taken off across Q3 is therefore dependent upon the transistor's operating point.

Applying a modulation signal to the emitter of Q3 will shift the operating point (transfer characteristic) coincident with the modulating signal, thus achieving the desired phase modulation.

Frequency Multiplication Stages

The frequency multiplier chain is composed of a tripler and two doublers, giving a multiplication factor of 12, resulting in the required antenna frequency of 146 to 174 MHz. The first multiplier, Q5 and Q6, is a balanced tripler configuration where the even-numbered harmonics of the fundamental frequency are suppressed. The signal from the second buffer stage, Q4, is applied to the base of Q5 through C20. The base of Q6 is grounded, as far as the signal is concerned, through C21 and C22. Since R23 is common to both transistor emitters, any signal through Q5 will also be across the emitter-base circuit of Q6 with the proper polarity to drive the stage in push-pull.

Two tuned LC circuits, L4 and C26, and L5 and C31, form a capacitive coupled band-pass filter tuned to the third harmonic of the frequency at the tripler input.

C32 and C33 pass the signal on to the succeeding multiplier, Q7 and Q8. This stage is a balanced doubler, suppressing the odd harmonics of the input signal frequency. Tuned circuits L6 and C36, and L7 and C39 in the collector path also make up a capacitive coupled band-pass filter, this time tuned to the second harmonic of the frequency at its input. The signal is fed on through C38 and C40 to the second doubler, Q9 and Q10, also operating as a balanced frequency doubler.

The collector circuit consisting of L8, C44 and C42 is, of course, tuned to the second harmonic of the input frequency. The collector circuit and the tuned circuit L9 and C46 in the base circuit of the following amplifier stage form another capacitive coupled band-pass filter. C45 is a coupling capacitor. L9 and C46 make up a series resonant circuit as seen from the base of Q11.

The output stage, Q11, amplifies the approx. 20 mW output signal from the final frequency multiplier to the required exciter output level of approx. 80 mW. Finally, the signal is fed from the collector of the transistor through the resonant circuit consisting of L10, C50, C52 and C53 to the output terminals. The output transistor collector impedance is transformed down to an output impedance of 50 Ω by capacitively tapping the resonant circuit.

The bandpass filters determine the over-all bandwidth of the exciter, just as they also suppress undesired harmonics generated during frequency multiplication. They all employ close-to-critical coupling.

Storno

Technical Specifications

Supply Voltage
9 V

Current Consumption
80 mA

Frequency Range
146 to 174 MHz

Frequency Multiplication Factor
3 x 2 x 2 = 12

Crystal Frequency Band
12.166 - 14.500 MHz

Bandwidth (3 dB)
5 MHz

Output Power
100 mW

Load Impedance
50 Ω

AF Input Impedance
1 kΩ

Modulation Sensitivity
Required e.m.f. from a 600 Ω generator:
(for Δf = 3.5 kHz at 1 kHz) : 210 mV

Modulation Distortion
Measured without de-emphasis,
at f = 3.5 kHz / 1 kHz : 2.5 %

Oscillator Frequency Adjustable by

$$\frac{\Delta f}{f} \geq \pm 30 \times 10^{-6}$$

Frequency Stability
for voltage variations of 2.5 %

$$\frac{\Delta f}{f} \leq \pm 0.1 \times 10^{-6}$$

for temperatures between -25° and $+75^{\circ}$ C

$$\frac{\Delta f}{f} \leq \pm 2 \times 10^{-6}$$

Input Impedance for External Oscillators
470 Ω // 22 pF

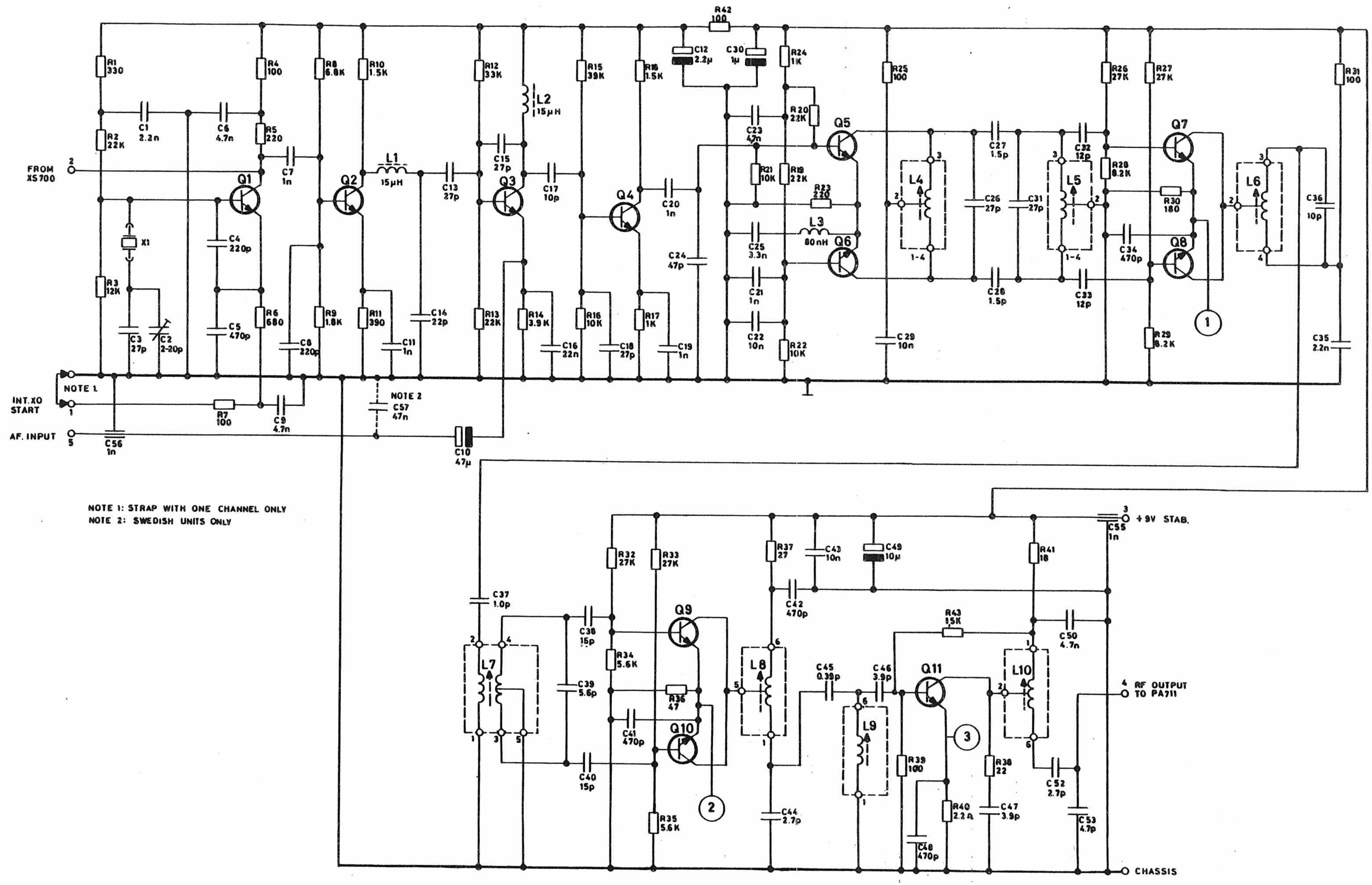
Sensitivity at Input for External Oscillators
(required input voltage) : 100 mV

Crystal Types
98-12, 98-20, 98-26

Temperature Range
operating range -25° to $+70^{\circ}$ C
functioning range -30° to $+80^{\circ}$ C

Mechanical Dimensions
Metal enclosure: 24.7 x 50.8 x 91.5 mm
Printed circuit board: 48.3 x 88.9 mm

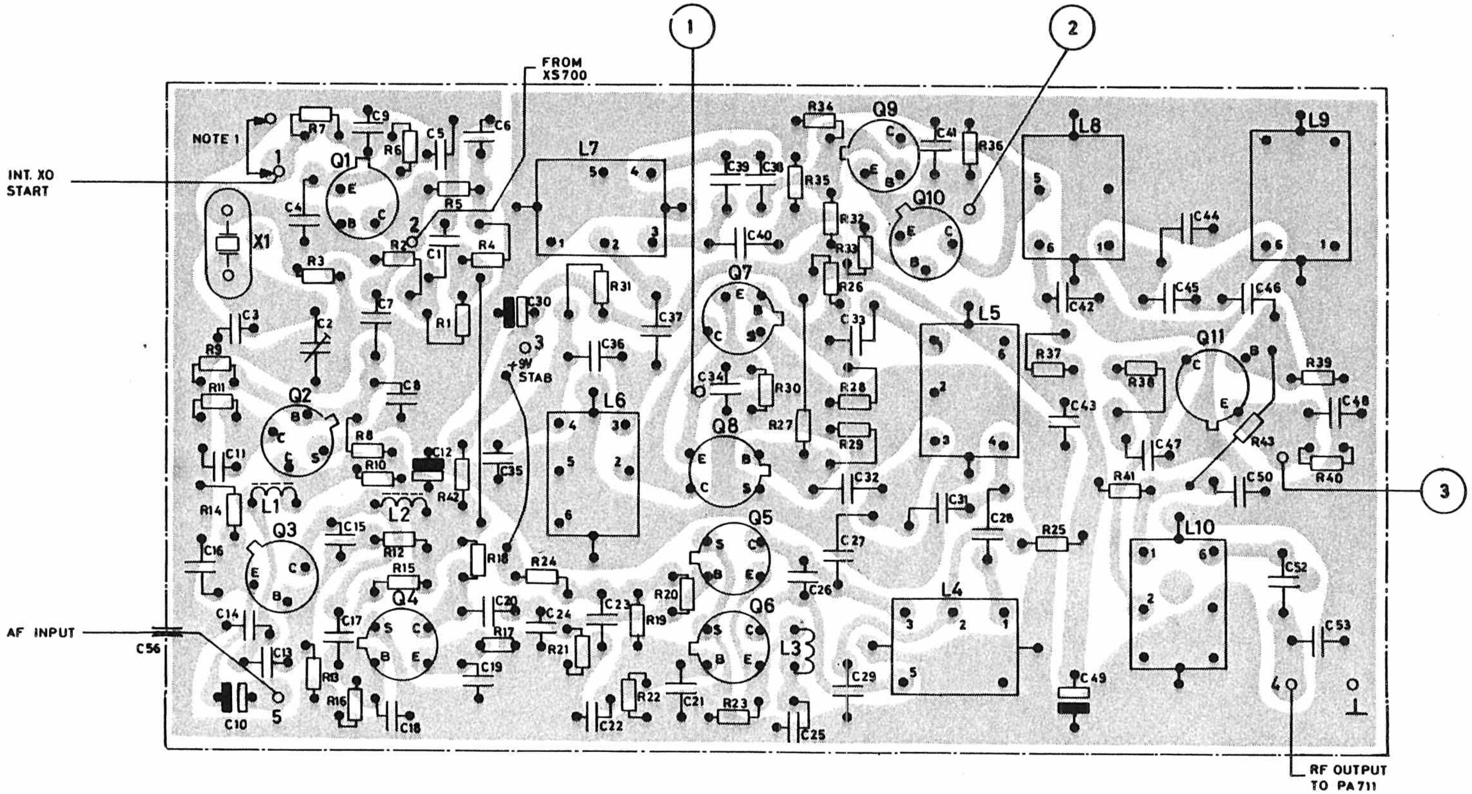
Storno



NOTE 1: STRAP WITH ONE CHANNEL ONLY
NOTE 2: SWEDISH UNITS ONLY

EXCITER EX711

D401.361/2



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

EXCITER EX711

D401.521/2

Storno

TYPE	NO.	CODE	DATA	
EX711		10.2570	Exciter Unit	
	C1	76.5059	2.2 nF 10% polyest. FL	50V
	C2	78.5046	2-20 pF trimmer	
	C3	74.5192	27 pF 5% ceram TB	160V
	C4	76.5104	220 pF 2.5% polystyr TB	25V
	C5	76.5106	470 pF 2.5% polystyr TB	25V
	C6	76.5061	4.7 nF 10% polyest FL	50V
	C7	74.5155	1 nF -20 +80% ceram PL	63V
	C8	76.5104	220 pF 2.5% polystyr TB	25V
	C9	76.5061	4.7 nF 10% polyest. FL	50V
	C10	73.5124	47 µF 20% tantal	6.3V
	C11	76.5069	1 nF 10% polyest. FL	50V
	C12	73.5129	2.2 µF -20 +50% tantal	10V
	C13	74.5107	27 pF 5% ceram	160V
	C14	74.5106	22 pF 5% ceram	160V
	C15	74.5107	27 pF 5% ceram	160V
	C16	76.5071	22 nF 10% polyest. FL	50V
	C17	74.5135	10 pF 5% ceram DI	250V
	C18	74.5107	27 pF 5% ceram	160V
	C19	76.5069	1 nF 10% polyest. FL	50V
	C20	74.5155	1 nF -20 +80% ceram PL	63V
	C21	74.5155	1 nF -20 +80% ceram PL	63V
	C22	76.5070	10 nF 10% polyest FL	50V
	C23	76.5061	4.7 nF 10% polyest. FL	50V
	C24	74.5186	47 pF 10% ceram PL	25V
	C25	76.5060	3.3 nF 10% polyest. FL	50V
	C26	74.5107	27 pF 5% ceram	160V
	C27	74.5125	1.5 pF ±0.25 pF ceram BD	250V
	C28	74.5125	1.5 pF ±0.25 pF ceram BD	250V
	C29	76.5070	10 nF 10% polyest. FL	50V
	C30	73.5135	1 µF -20 +50% tantal	16V
	C31	74.5107	27 pF 5% ceram	160V
	C32	74.5136	12 pF 5% ceram DI	250V
	C33	74.5136	12 pF 5% ceram DI	250V
	C34	74.5161	470 pF -20 +80% ceram PL	63V
	C35	76.5059	2.2 nF 10% polyest FL	50V
	C36	74.5135	10 pF 5% ceram DI	250V
	C37	74.5123	1.0 pF ±0.25 pF ceram BD	250V
	C38	74.5137	15 pF 5% ceram DI	125V
	C39	74.5132	5.6 pF ±0.25 pF ceram DI	250V
	C40	74.5137	15 pF 5% ceram DI	125V
	C41	74.5161	470 pF -20 +80% ceram PL	63V
	C42	74.5161	470 pF -20 +80% ceram PL	63V
	C43	76.5070	10 nF 10% polyest. PL	50V
	C44	74.5128	2.7 pF ±0.25 pF ceram DI	250V
	C45	74.5120	0.39 pF ±0.1 pF ceram BD	250V
	C46	74.5130	3.9 ±0.25 pF ceram DI	250V

Storno

TYPE	NO.	CODE	DATA	
	C47	74.5130	3.9 pF ±0.25 pF ceram DI	250V
	C48	74.5161	470 pF -20 +80% ceram PL	63V
	C49	73.5109	10 µF 20% tantal	16V
	C50	76.5061	4.7 nF 10% polyest. FL	50V
	C51			
	C52	74.5128	2.7 pF ±0.25 pF ceram DI	250V
	C53	74.5131	4.7 pF ±0.25 pF ceram DI	250V
	C54			
	C55	74.5167	1 nF -20 +80% ceram FT	300V
	C56	74.5167	1 nF -20 +80% ceram FT	300V
	C57	76.5072	47nF 10% Polyest. FL(Swedish units only)	50V
	R1	80.5243	330 Ω 5% carbon film	1/8W
	R2	80.5265	22 kΩ 5% " "	1/8W
	R3	80.5262	12 kΩ 5% " "	1/8W
	R4	80.5237	100 Ω 5% " "	1/8W
	R5	80.5241	220 Ω 5% " "	1/8W
	R6	80.5247	680 Ω 5% " "	1/8W
	R7	80.5237	100 Ω 5% " "	1/8W
	R8	80.5259	6.8 kΩ 5% " "	1/8W
	R9	80.5252	1.8 kΩ 5% " "	1/8W
	R10	80.5251	1.5 kΩ 5% " "	1/8W
	R11	80.5244	390 Ω 5% " "	1/8W
	R12	80.5267	33 kΩ 5% " "	1/8W
	R13	80.5265	22 kΩ 5% " "	1/8W
	R14	80.5256	3.9 kΩ 5% " "	1/8W
	R15	80.5268	39 kΩ 5% " "	1/8W
	R16	80.5261	10 kΩ 5% " "	1/8W
	R17	80.5249	1 kΩ 5% " "	1/8W
	R18	80.5251	1.5 kΩ 5% " "	1/8W
	R19	80.5265	22 kΩ 5% " "	1/8W
	R20	80.5265	22 kΩ 5% " "	1/8W
	R21	80.5261	10 kΩ 5% " "	1/8W
	R22	80.5261	10 kΩ 5% " "	1/8W
	R23	80.5241	220 Ω 5% " "	1/8W
	R24	80.5249	1 kΩ 5% " "	1/8W
	R25	80.5237	100 Ω 5% " "	1/8W
	R26	80.5266	27 kΩ 5% " "	1/8W
	R27	80.5266	27 kΩ 5% " "	1/8W
	R28	80.5260	8.2 kΩ 5% " "	1/8W
	R29	80.5260	8.2 kΩ 5% " "	1/8W
	R30	80.5240	180 Ω 5% " "	1/8W
	R31	80.5237	100 Ω 5% " "	1/8W
	R32	80.5266	27 kΩ 5% " "	1/8W

EXCITER UNIT
STYRESENDER

EX711

X401.371/2

Storno

TYPE	NO.	CODE	DATA	
	R33	80.5266	27 kΩ 5% carbon film	1/8W
	R34	80.5258	5.6 kΩ 5% " "	1/8W
	R35	80.5258	5.6 kΩ 5% " "	1/8W
	R36	80.5233	47 Ω 5% " "	1/8W
	R37	80.5230	27 Ω 5% " "	1/8W
	R38	80.5229	22 Ω 5% " "	1/8W
	R39	80.5237	100 Ω 5% " "	1/8W
	R40	80.5217	2.2 Ω 5% " "	1/8W
	R41	80.5228	18 Ω 5% " "	1/8W
	R42	80.5237	100 Ω 5% " "	1/8W
	R43	80.5051	1.5KΩ 5% " "	1/10W
	L1	63.5007	15 µA 10% RF choke	0.5A
	L2	63.5007	15 µH 10% " "	0.5A
	L3	62.065101	0.08 µH 20% RF choke	
	L4	61.1113	RF coil 37 MHz	
	L5	61.1113	RF coil 37 MHz	
	L6	61.1150	RF coil 74 MHz	
	L7	61.1151	RF coil 74 MHz	
	L8	61.1152-01	RF coil 148 MHz	
	L9	61.1153	RF coil 148 MHz	
	L10	61.1154	RF coil 148 MHz	
	Q1	99.5139	BSX19 Transistor	
	Q2	99.5168	BF173 Transistor	
	Q3	99.5121	BC107 Transistor	
	Q4	99.5175	BF185 Transistor	
	Q5	99.5175	BF185 Transistor	
	Q6	99.5175	BF185 Transistor	
	Q7	99.5175	BF185 Transistor	
	Q8	99.5175	BF185 Transistor	
	Q9	99.5139	BSX19 Transistor	
	Q10	99.5139	BSX19 Transistor	
	Q11	99.5229	2N4427 Transistor	
	C57	76.5072	47nF 10% polyest. FL (Swedish units only)	50V

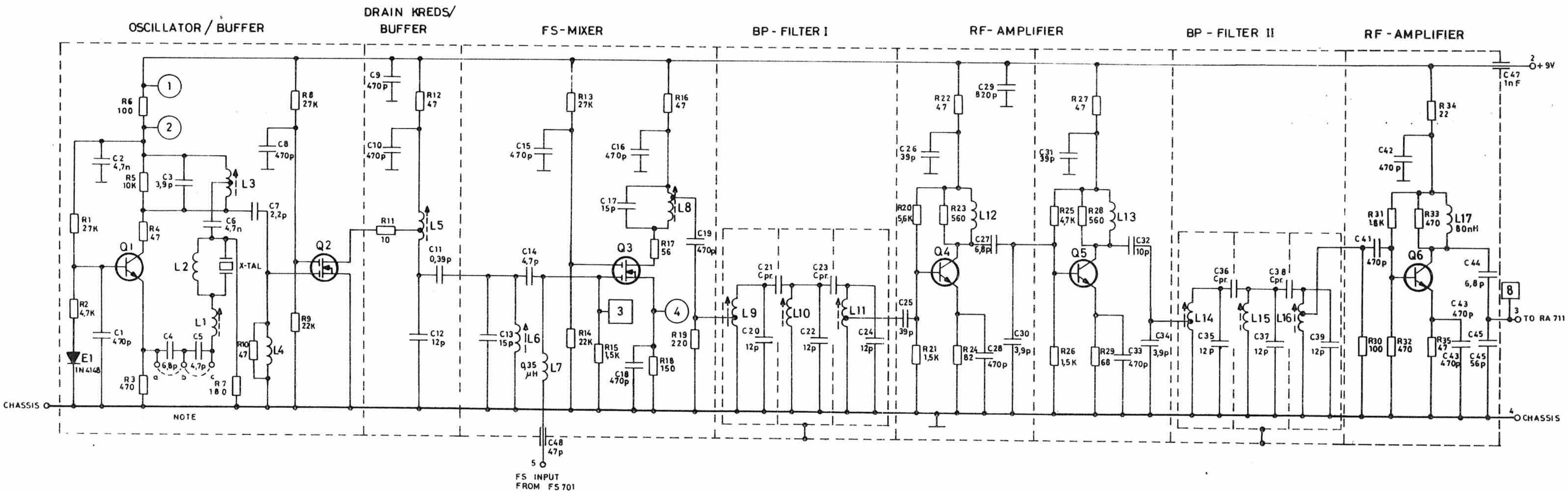
Storno

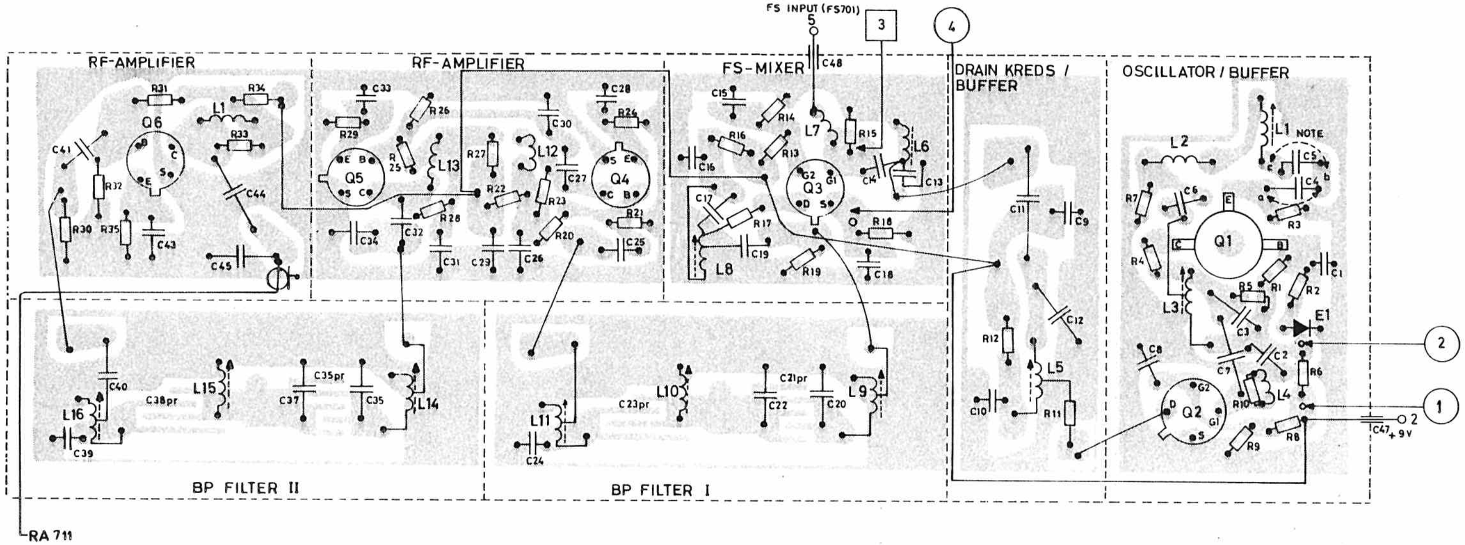
TYPE	NO.	CODE	DATA

EXCITER UNIT
STYRESENDER

EX711

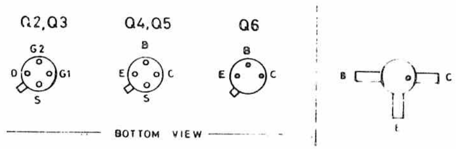
X401.371/2





NOTE:

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



EXCITER
STYRESENDER

EX712

D 401.847

Storno

TYPE	NO.	CODE	DATA	
EX712		10.2936	Exciter	
	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	74.5135	10pF 5%	ceram DI 125V
	C13	74.5136	12pF 5%	ceram DI 125V
	C14	74.5131	4.7pF ± 0.25pF	ceram DI 250V
	C15	74.5162	470pF -20/+50%	ceram DI 400V
	C16	74.5162	470pF -20/+50%	ceram DI 400V
	C17	74.5136	12pF 5%	ceram DI 125V
	C18	74.5162	470pF -20/+50%	ceram DI 400V
	C19	74.5161	470pF -20/+80%	ceram PL 63V
	C20	74.5308	12pF 5%	ceram PL 63V
	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 ± 0.25pF	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 ±0.25pF	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		Not used	
	C41	74.5161	470pF -20/+80%	ceram PL 63V
	C42	74.5161	470pF -20/+80%	ceram PL 63V
	C43	74.5162	470pF -20/+50%	ceram DI 400V
	C44	74.5133	6.8pF ± 0.25pF	ceram DI 250V
	C45	74.5132	5.6pF ± 0.25pF	ceram DI 250V

Storno

TYPE	NO.	CODE	DATA			
	C46		Not used			
	C47	74.5198	1nF -20/+80%	ceram FT		30V
	C48	74.5323	47pF 20%	ceram FT		400V
	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	100Ω 5%	"		1/8 W
	R7	80.5040	180 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 KΩ 5%	"		1/10W
	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	80.5037	100 Ω 5%	"		1/10W
	R31	80.5052	1.8 KΩ 5%	"		1/10W
	R32	80.5045	470 Ω 5%	"		1/10W
	R33	80.5045	470 Ω 5%	"		1/10W
	R34	80.5029	22 Ω 5%	"		1/10W
	R35	80.5033	47 Ω 5%	"		1/10W
	L1	61.1234	RF coil			

EXCITER
STYRESENDER

EX712

X401.945

Storno

TYPE	NO.	CODE	DATA
	L2	61.1230	RF coil
	L3	61.1229	RF coil 119 - 159 MHz
	L4	61.1231	RF choke (R 10)
	L5	61.1253	RF coil
	L6	61.1252	RF coil
	L7	62.0659	0.35 μH RF choke
	L8	61.1251	RF coil
	L9	61.1256	RF coil
	L10	61.1257	RF coil
	L11	61.1258	RF coil
	L12	62.0651	0.08 μH RF choke
	L13	62.0651	0.08 μH RF choke
	L14	61.1256	RF coil
	L15	61.1257	RF coil
	L16	61.1258	RF coil
	L17	62.0561	0.08 μH RF choke
	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	99.5240	BFX89 Transistor

Storno

TYPE	NO.	CODE	DATA

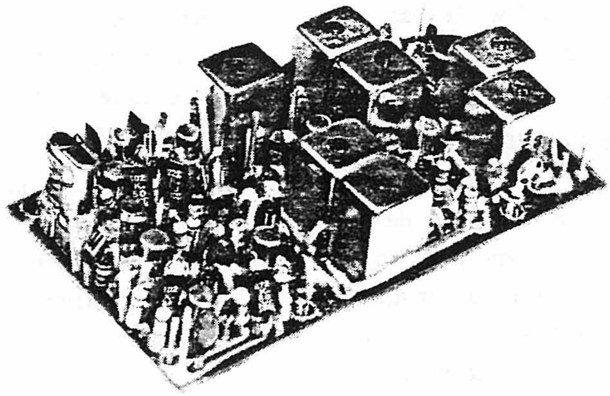
EXCITER
STYRESENDER

EX712

X401.945

Storno

EXCITER EX731



Description

General

The exciter must modulate and convert the signal from the transmitter oscillator so the frequency and amplitude are suitable for driving the power amplifier, PA731.

EX731 contains the following stages:

an oscillator (for single channel service)
a phase modulator with associated buffer stages
a frequency tripler
a frequency doubler
an amplifier.

The oscillator signal is sent through the modulators and buffers and is next tripled and finally doubled. The result is a signal at the transmitter antenna frequency (68 to 88 MHz).

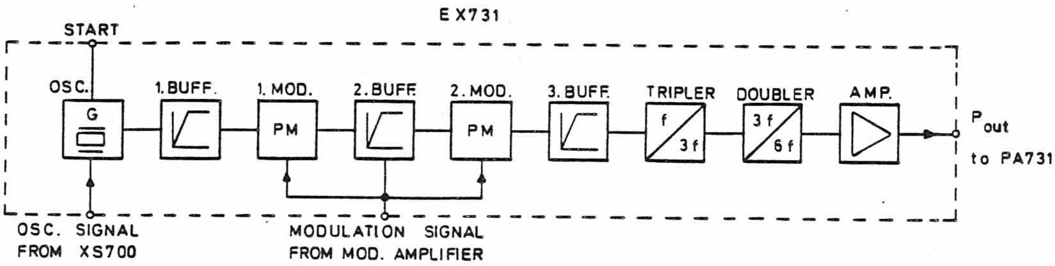
The amplifier stage in the output of the exciter raises the signal to the level required to drive the power amplifier (80 mW). While in the phase modulators the oscillator signal, still at its fundamental frequency, is phase modulated with the audio frequency signal from the modulation amplifier in CF701.

For multichannel service the built-in oscillator can be switched out and another oscillator (and frequency) switched in from the oscillator switching unit, XS701.

Oscillator.

To start the oscillator, the emitter circuit of Q1 must be returned to ground via terminal 1. For single channel service the terminal is tied to ground right in the EX unit.

In the case of multichannel service the emitter of Q1 is grounded through the control panel. When one of the oscillators in the XS unit is functioning, the emitter connection to Q1 is open and the signal from XS is applied to the exciter at terminal 2. R5 in EX731 serves as a collector resistor common to all of the oscillators.



Modulator and Buffer Stages

Buffer amplifiers Q2, Q4 and Q6 are required to keep the RF input signal to the modulators at a constant level while, at the same time, presenting a constant load impedance to the modulators.

The output signals from the different oscillators can vary slightly and since the correct functioning of the modulators depends upon a constant input signal, Q2 is inserted between the oscillator output and the modulators. The signal is led from the collector of Q2 via a low-pass filter, L1 and C11, which suppresses any harmonics of the fundamental oscillator frequency. From there the signal is introduced to the base of the modulator, Q3.

Buffer amplifier stage Q4 is identical to Q2. Its purpose is to isolate the two modulators from each other.

Since proper functioning of the modulator likewise depends upon the load impedance, buffer Q6 is inserted between the modulator output and the multiplier chain. Q6 also limits any amplitude modulation present in the signal before it is applied to the first multiplier.

In order to achieve sufficient phase deviation with minimum distortion the phase modulator is designed as two identical modulator stages (Q3 and Q5) in series. The modulation signal is fed to both transistor emitters at the same time.

Since the two modulators are identical we will consider only Q3 here.
The phase modulator can be considered as a voltage divider consisting of the two identical capacitors, C12 and C13, and transistor Q3, over which the output signal is taken off.
Base voltage for Q3 is applied from the joint of C12 and C13, whereby Q3 appears as an inductance having the same reactance as one of the capacitors. In addition to the reactive current in the transistor there is also a resistive component which is determined by the transistor's operating point; this resistive component can be considered as a resistor in series with the inductance.

The phase shift between the modulator input signal applied to C12 and the modulator output signal taken off across Q3 is therefore dependent upon the transistor's operating point.

Applying a modulation singal to the emitter of Q3 will shift the operating point (transfer characteristic) coincident with the modulating signal, thus achieving the desired phase modulation.

Frequency Multiplication Stages

The frequency multiplier chain is composed of a tripler and a doubler, giving a multiplication factor of 6, resulting in the required antenna frequency of 68- to 88 MHz. The first multiplier, Q5 and Q6, is a balanced tripler figuration where the even-numbered harmonics of the fundamental frequency are suppressed. The signal from the third buffer stage, Q6, is applied to the balanced tripler, Q7 and Q8, through transformer L5.

Two tuned LC circuits, L6 and C35, and L7 and C38, form a capacitive coupled band-pass filter tuned to the third harmonic of the frequency at the tripler input.

C39 and C40 pass the signal on to the succeeding multiplier, Q9 and Q10. This stage is a balanced doubler, suppressing the odd harmonics of the input signal frequency. Tuned circuits L8, C43 and L9, and C45 and C46 in the collector path also make up a capacitive coupled band-pass filter, this time tuned to the second harmonic of the frequency at its input. The signal has now reached the final antenna frequency of 68 to 88 MHz and is applied to the output transistor, Q11.

The output stage, Q11, amplifies the approx. 15 mW output signal from the final frequency multiplier to the required exciter output level of approx. 80 mW. Finally, the signal is fed from the collector of the transistor through the resonant circuit consisting of

L10 and C49, and L11 and C51 and C52 to the output terminals. The output transistor collector impedance is transformed down to an output impedance of 50 Ω by capacitively tapping the resonant circuit.

The band-pass filters determine the over-all bandwidth of the exciter, and they also suppress undesired harmonics generated during frequency multiplication. All of the band-pass filters employ close-to-critical coupling.

Technical Specifications

Supply Voltage
+9 V

Current Consumption
60 mA

Frequency Range
68 to 88 MHz

Frequency Multiplication Factor
6

Crystal Frequency Band
11.33 to 14.67

Band Width (3 dB)
3 MHz

Output Power
80 mW

Load Impedance
50 Ω

AF Input Impedance
1 kΩ

Modulation Sensitivity
Required EMF from a 600 Ω generator
(for Δf = 3.5 kHz at 1 kHz): 350 mV

Modulation Distortion
Measured without de-emphasis,
at f = 3.5 kHz / 1 kHz : 2.5%.
Oscillator frequency adjustable by:
$\frac{\Delta f}{f} \geq \pm 30 \times 10^{-6}$

Frequency Stability
for voltage variations of 2.5%:
$\frac{\Delta f}{f} \leq \pm 0.1 \times 10^{-6}$

for temperatures between -25° and +75°C:
$\frac{\Delta f}{f} \leq \pm 2 \times 10^{-6}$

Input Impedance for External Oscillators
470 Ω// 22 pF

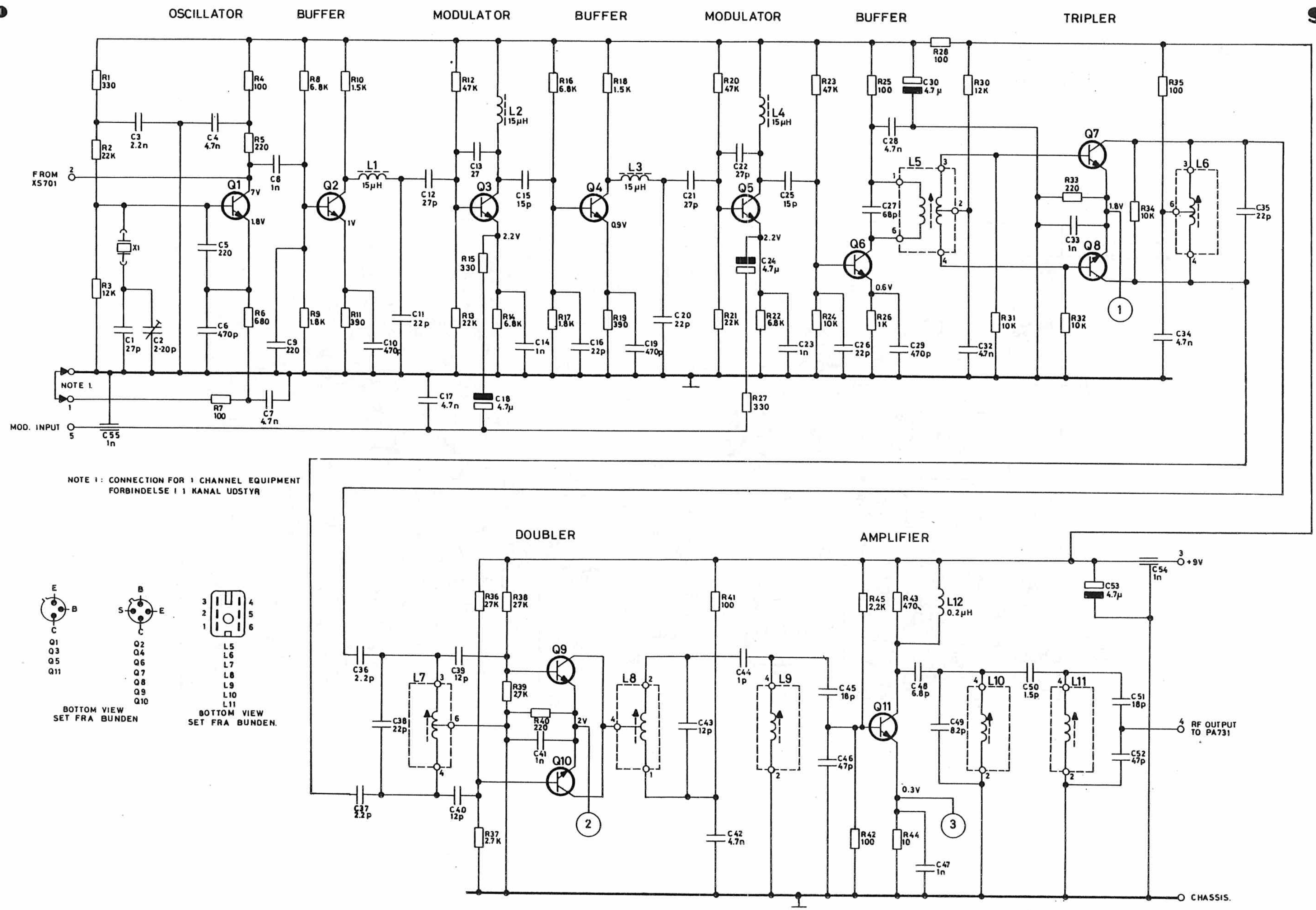
Sensitivity at Input for Ext. Oscillators
(required input voltage) : 100 mV

Crystal Types
98-12, 98-20, 98-26

Temperature Range
Operating range: -25° to + 70°C
Functioning range: -30° to +80°C

Mechanical Dimensions
Metal enclosure: 24.7 x 50.8 x 91.5 mm
Printed circuit board: 48.3 x 88.9 mm

Storno



EXCITER
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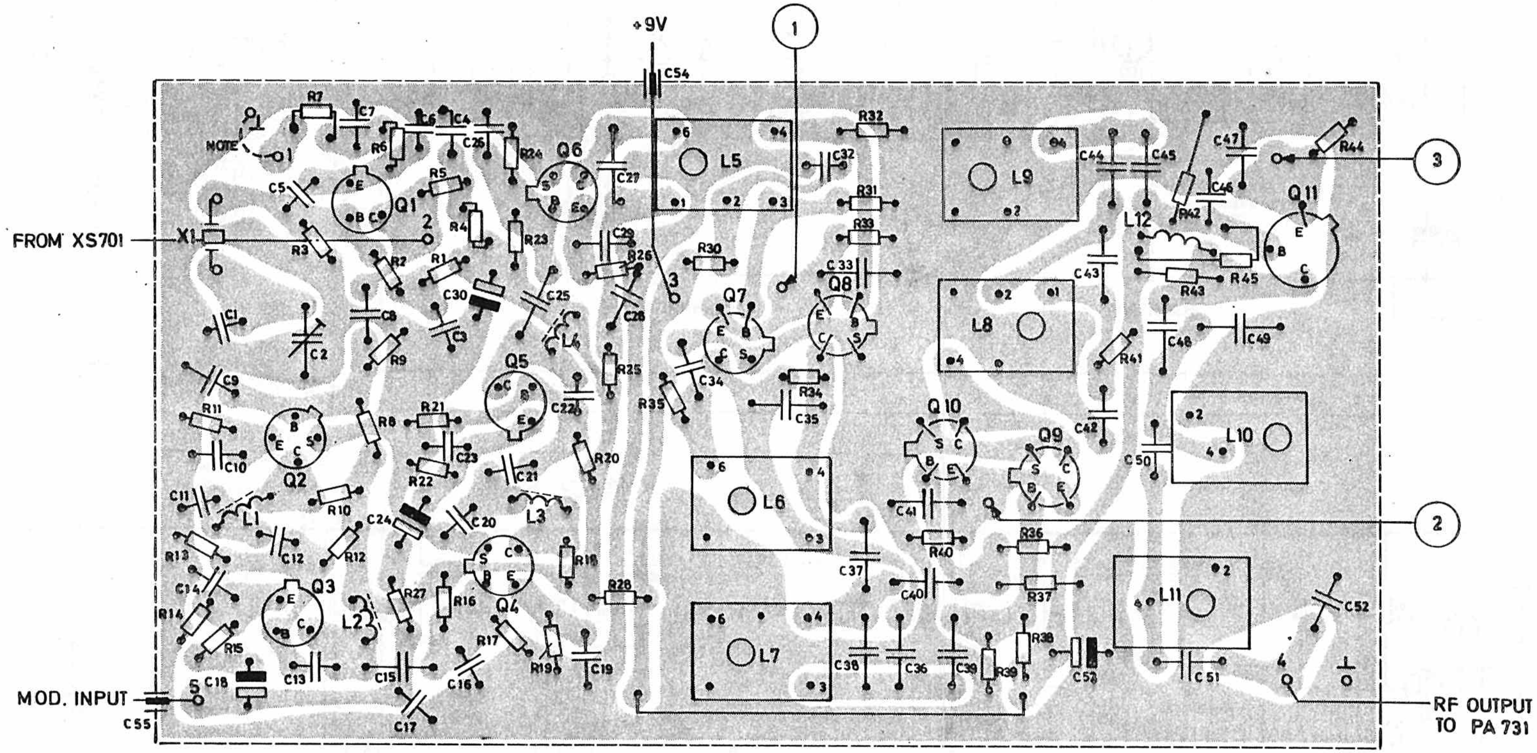
EX731

D401.524/3



EXCITER
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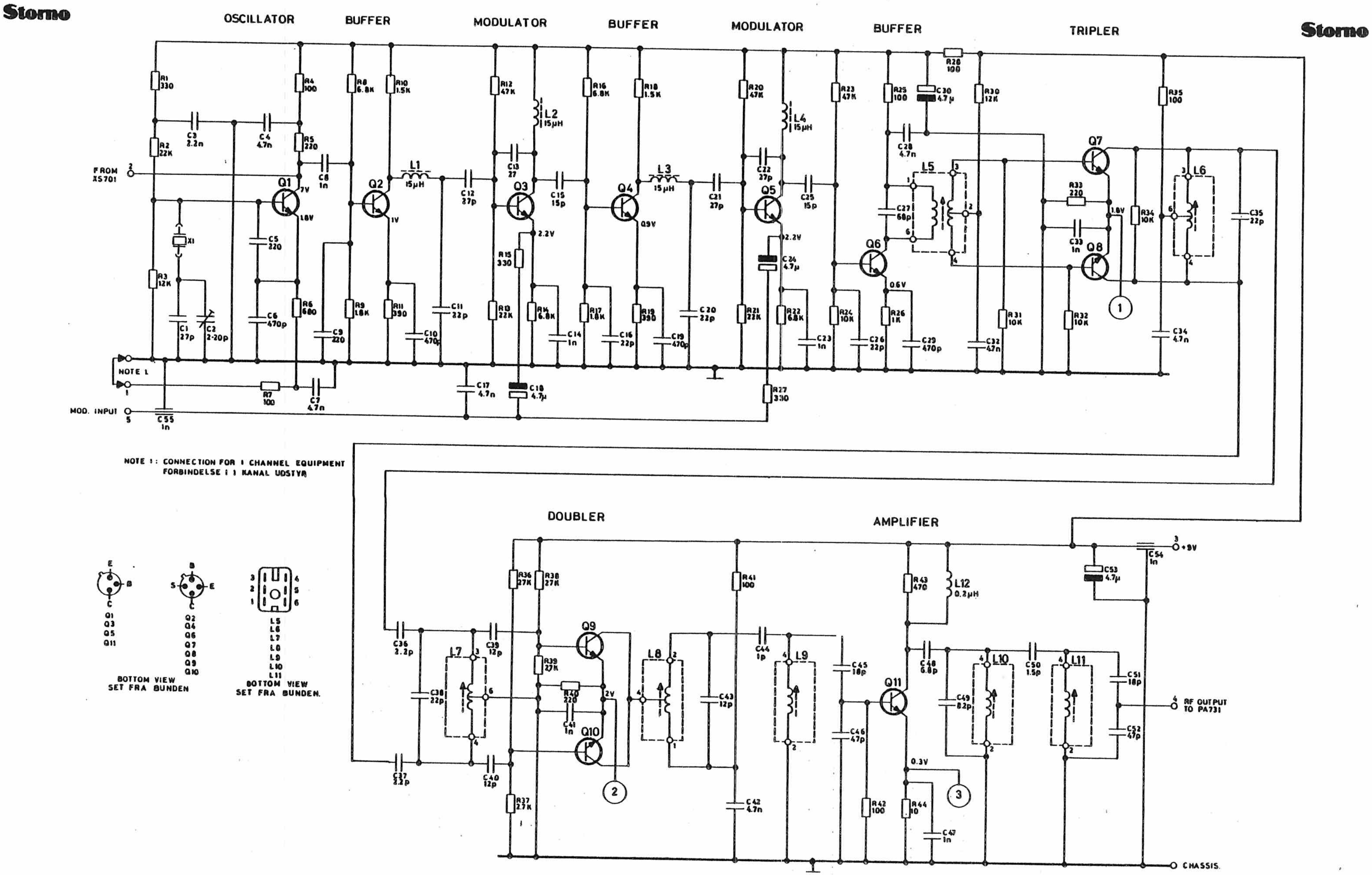
EX731

D 401.524/3



EXCITER
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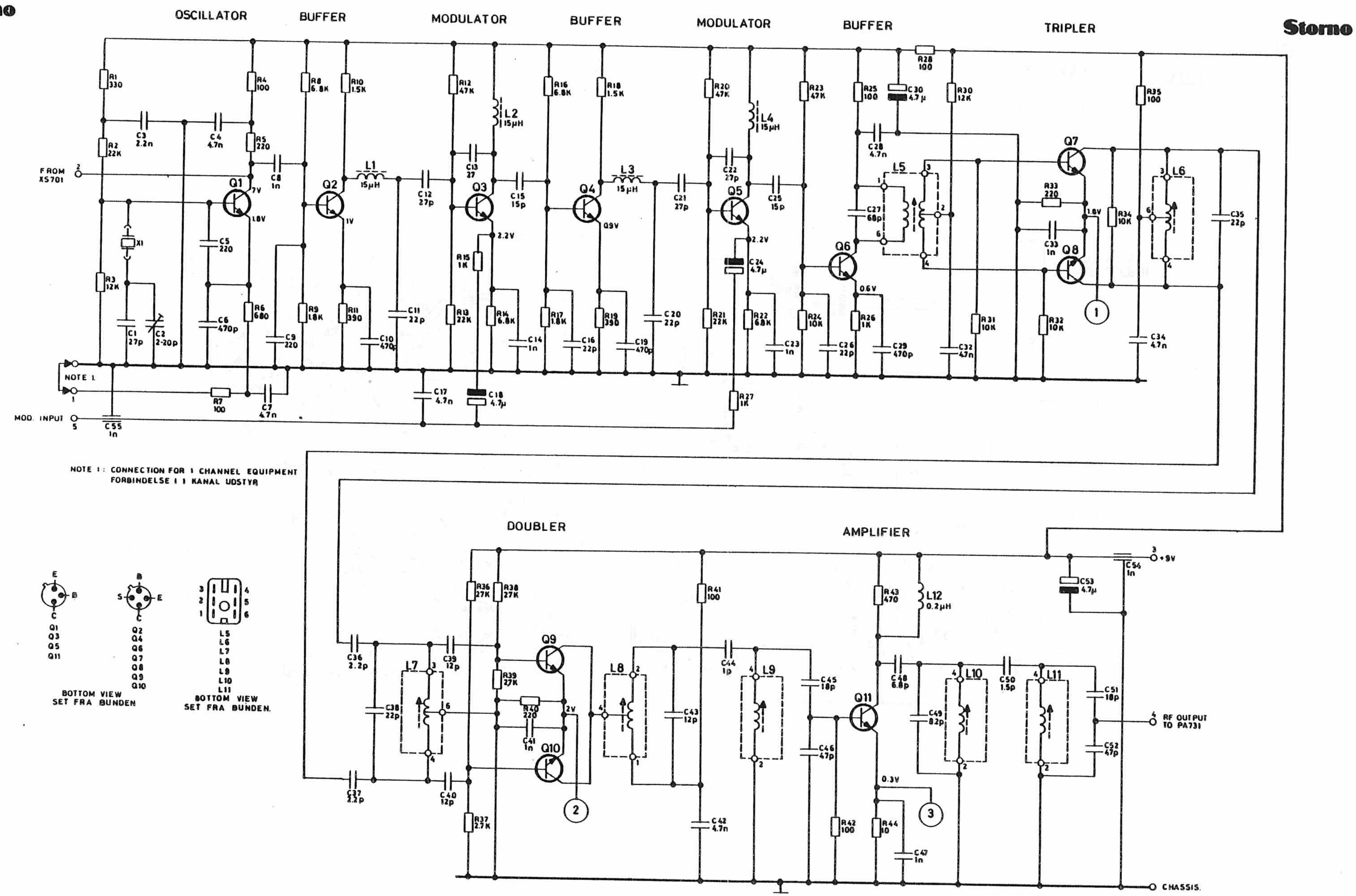
EX731

D401.524/2

Storno



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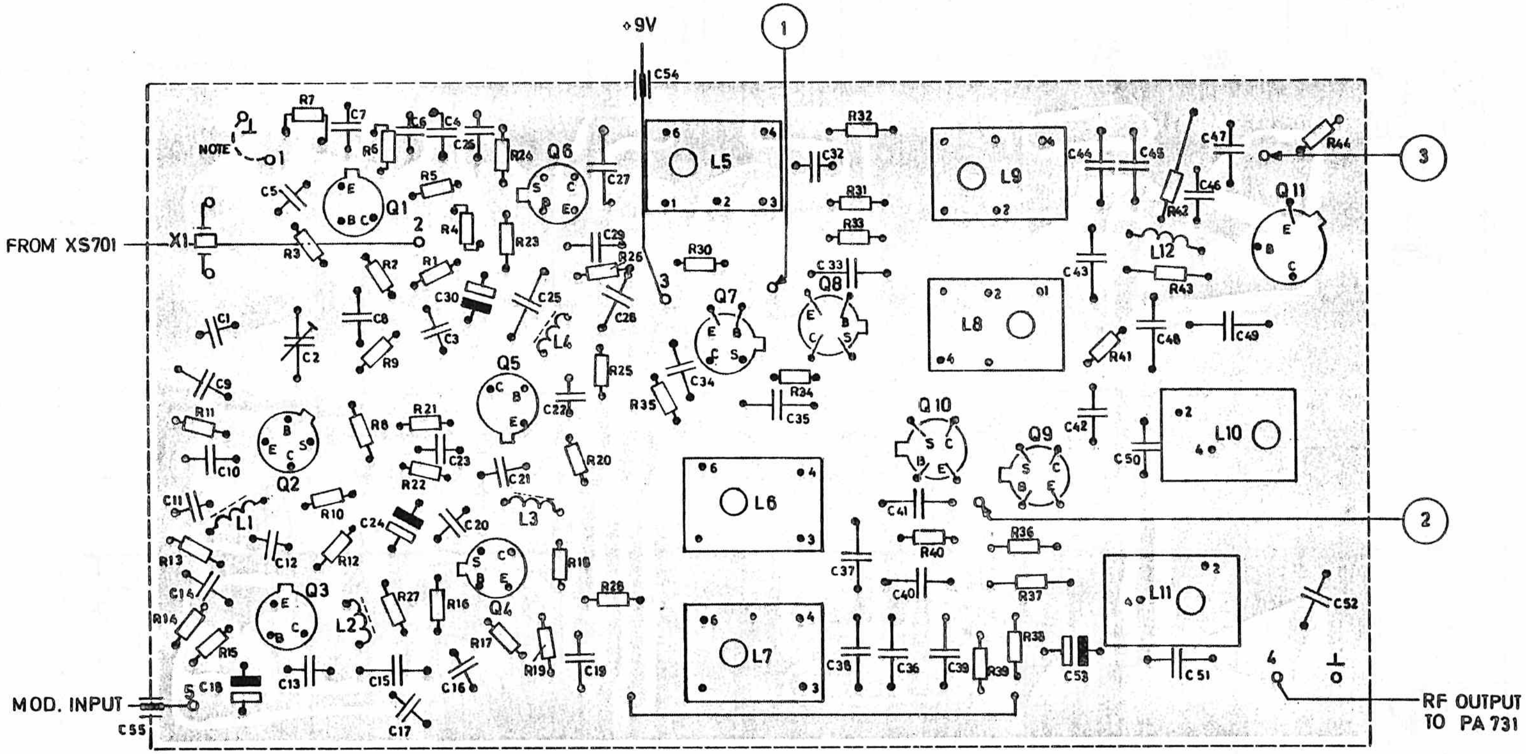
EX731

D401.524

Storno



EXCITER
STYRESENDER

EX 731

D 401.524/2

Storno

TYPE	NO.	CODE	DATA	
EX731		10.2673	Exciter Unit	
	C1	74.5192	27pF 5% ceram TB	160V
	C2	78.5040	2-2pF trimmer	300V
	C3	76.5059	2,2nF 10% polyest. FL	50V
	C4	76.5061	4.7 nF 10% polyest	50V
	C5	76.5104	220 pF 2.5% polystyr TB	25V
	C6	76.5106	470pF 2,5% polystyr TB	25V
	C7	76.5061	4.7nF 10% polyest. FL	50V
	C8	76.5069	1nF 10% polyest.	50V
	C9	76.5104	220 pF 2.5% polystyr TB	25V
	C10	74.5161	470pF - 20+ 80% ceram PL	63V
	C11	74.5106	22pF 5% ceram TB	160V
	C12	74.5107	27pF 5% ceram TB	160V
	C13	74.5107	27pF 5% ceram TB	160V
	C14	76.5069	1nF 10% polyest. FL	50V
	C15	74.5137	15pF 5% ceram DI	125V
	C16	74.5106	22pF 5% ceram TB	160V
	C17	76.5061	4,7nF 10% polyest. FL	50V
	C18	73.5126	4,7µF 20% tantal	35V
	C19	74.5161	470pF - 20+80% ceram PL	63V
	C20	74.5106	22pF 5% ceram TB	160V
	C21	74.5107	27pF 5% ceram TB	160V
	C22	74.5107	27pF 5% ceram TB	160V
	C23	76.5069	1nF 10% polyest. FL	50V
	C24	73.5126	4,7µF 20% tantal	35V
	C25	74.5137	15pF 5% ceram DI	125V
	C26	74.5106	22pF 5% ceram TB	160V
	C27	76.5101	68pF 2,5% polystyr TB	30V
	C28	76.5061	4,7nF 10% polyest FL	50V

Storno

TYPE	NO.	CODE	DATA	
	C29	74.5161	470pF - 20+80% ceram PL	63V
	C30	73.5126	4,7µF 20% tantal	35V
	C31			
	C32	76.5061	4,7nF 10% polyest	35V
	C33	74.5155	1nF - 20+80% ceram PL	63V
	C34	76.5061	4,7nF 10% polyest FL	50V
	C35	74.5106	22pF 5% ceram TB	160V
	C36	74.5127	2,2pF± 0,25pF ceram DI	250V
	C37	74.5127	2,2pF± 0,25pF ceram DI	250V
	C38	74.5106	22pF 5% ceram TB	160V
	C39	74.5136	12pF 5% ceram DI	250V
	C40	74.5136	12pF 5% ceram DI	250V
	C41	74.5155	1nF - 20+80% ceram PL	63V
	C42	76.5061	4,7nF 10% polyest. FL	50V
	C43	74.5136	12pF 5% ceram DI	250V
	C44	74.5123	1.0pF± 0.25pF ceram BD	250V
	C45	74.5138	18pF 5% ceram DI	125V
	C46	76.5090	47pF 2.5% polyest TB	63V
	C47	74.5155	1nF - 20+ 80% ceram PL	63V
	C48	74.5133	6.8pF ± 0.25pF ceram DI	250V
	C49	74.5134	8.2pF ± 0.25pF ceram DI	250V
	C50	74.5125	1.5pF ± 0.25pF ceram BD	250V
	C51	74.5138	18pF 5% ceram DI	125V
	C52	76.5090	47pF 2.5% polystyr TB	63V
	C53	73.5126	4.7µF 20% tantal	35V
	C54	74.5167	1nF - 20+80% ceram FT	300V

EXCITER
STYRESENDER

EX731

X 401.786

TYPE	NO.	CODE	DATA	
	C55	74.5167	1nF - 20+80% ceram FT	300V
	R1	80.5243	330Ω 5% carbon film	1/8W
	R2	80.5265	22kΩ 5% carbon film	1/8W
	R3	80.5262	12kΩ 5% carbon film	1/8W
	R4	80.5237	100Ω 5% carbon film	1/8W
	R5	80.5241	220Ω 5% carbon film	1/8W
	R6	80.5247	680Ω 5% carbon film	1/8W
	R7	80.5237	100Ω 5% carbon film	1/8W
	R8	80.5259	6.8kΩ 5% carbon film	1/8W
	R9	80.5252	1.8Ω 5% carbon film	1/8W
	R10	80.5251	1.5kΩ 5% carbon film	1/8W
	R11	80.5244	390Ω 5% carbon film	1/8W
	R12	80.5269	47kΩ 5% carbon film	1/8W
	R13	80.5265	22kΩ 5% carbon film	1/8W
	R14	80.5259	6.8kΩ 5% carbon film	1/8W
	R15	80.5249	1kΩ 5% carbon film	1/8W
	R16	80.5259	6.8kΩ 5% carbon film	1/8W
	R17	80.5252	1.8kΩ 5% carbon film	1/8W
	R18	80.5251	1.5kΩ 5% carbon film	1/8W
	R19	80.5244	390Ω 5% carbob film	1/8W
	R20	80.5269	47kΩ 5% carbon film	1/8W
	R21	80.5265	22kΩ 5%carbon film	1/8W
	R22	80.5259	6.8kΩ 5% carbon film	1/8W
	R23	80.5269	47kΩ 5% carbon film	1/8W
	R24	80.5261	10kΩ 5% carbon film	1/8W
	R25	80.5237	100Ω 5% carbon film	1/8W
	R26	80.5249	1kΩ 5% carbon film	1/8W
	R27	80.5249	1kΩ 5% carbon film	1/8W
	R28	80.5237	100Ω 5% carbon film	1/8W

Storno

TYPE	NO.	CODE	DATA	
	R29			
	R30	80.5262	12kΩ 5% carbon film	1/8W
	R31	80.5261	10kΩ 5% carbon film	1/8W
	R32	80.5261	10kΩ 5% carbon film	1/8W
	R33	80.5241	220Ω 5% carbon film	1/8W
	R34	80.5261	10kΩ 5% carbon film	1/8W
	R35	80.5237	100Ω 5% carbon film	1/8W
	R36	80.5266	27Ω 5% carbon film	1/8W
	R37	80.5254	2.7kΩ 5% carbon film	1/8W
	R38	80.5266	27kΩ 5% carbon film	1/8W
	R39	80.5254	2.7kΩ 5% carbon film	1/8W
	R40	80.5241	220Ω 5% carbon film	1/8W
	R41	80.5237	100Ω 5% carbon film	1/8W
	R42	80.5237	100Ω 5% carbon film	1/8W
	R43	80.5245	470Ω 5% carbon film	1/8W
	R44	80.5225	10Ω 5% carbon film	1/8W
	L1	63.5007	15μH 10% RF choke	0.5A
	L2	63.5007	15μH 10% RF choke	0.5A
	L3	63.5007	15μH 10% RF choke	0.5A
	L4	63.5007	15μH 10% RF choke	0.5A
	L5	61.1169	RF coil 11.3 - 14.7MHz	
	L6	61.1168	RF coil 34 - 44MHz	
	L7	61.1168	RF coil 34 - 44 MHz	
	L8	61.1167	RF coil 68 -88 MHz	
	L9	61.1166	RF coil 68 - 88MHz	

EXCITER
STYRESENDER

EX731

X401.786

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TYPE	NO.	CODE	DATA
	L10	61.1166	RF coil 68 - 88MHz
	L11	61.1166	RF coil 68 - 88MHz
	L12	63.5006	2,2μH 20% RF choke 0.6A
	Q1	99.5139	BSX19 transistor
	Q2	99.5168	BF173 transistor
	Q3	99.5121	BC107 transistor
	Q4	99.5168	BF173 transistor
	Q5	99.5121	BC107 transistor
	Q6	99.5175	BF185 transistor
	Q7	99.5175	BF185 transistor
	Q8	99.5175	BF185 transistor
	Q9	99.5175	BF185 transistor
	Q10	99.5175	BF185 transistor
	Q11	99.5229	2 N 4427 transistor

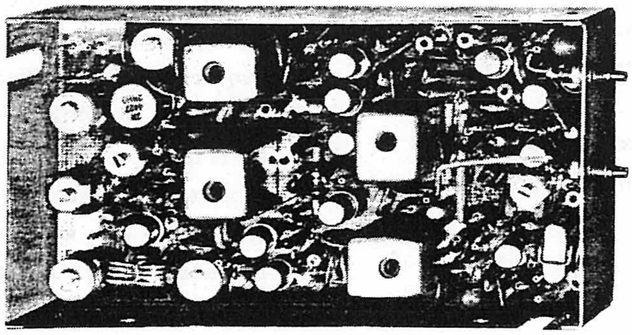
TYPE	NO.	CODE	DATA

EXCITER
STYRESENDER

EX731

X401.786

EXCITER EX761



Description

General

The exciter must modulate and convert the signal from the transmitter oscillator so the frequency and amplitude are suitable for driving the power amplifier, PA761.

EX761 contains the following stages:

an oscillator (for single channel service)
a phase modulator with associated buffer stages
two frequency triplers
two frequency doublers
an amplifier.

After passing through the buffer stage, the oscillator signal becomes phase modulated, goes through another buffer, then is multiplied 36 times, being first tripled, then doubled then tripled again, and finally doubled once more. The result is a signal at the transmitter antenna frequency (420 to 470 MHz.)

While in the phase modulator the oscillator signal, still at its fundamental frequency, is phase modulated with the audio frequency signal from the modulation amplifier in CF701.

For multichannel service the built-in oscillator can be switched out and another oscillator (and frequency) switched in from the oscillator switching unit, XS701 or XS702.

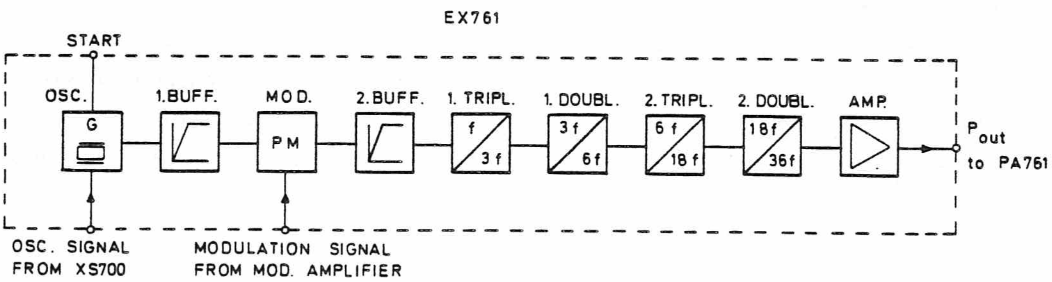
Oscillator

To start the oscillator, the emitter circuit of Q1 must be returned to ground via terminal 1. For single channel service the terminal is tied to ground right in the EX unit.

In the case of multichannel service the emitter of Q1 is grounded through the control panel. When one of the oscillators in the XS unit is functioning, the emitter connection to Q1 is open and the signal from XS is applied to the exciter at terminal 2. R5 in EX711 serves as a collector resistor common to all of the oscillators.

Buffer Stages

Buffer Q2 is required to keep the RF input signal to the modulator at a constant level while Q4 must present a constant load impedance to the modulator.



Storno

The output signals from the different oscillators can vary slightly and since the correct functioning of the modulator depends upon a constant input signal, Q2, is inserted between the oscillator output and the modulator input. The signal is led from the collector of Q2 via a low-pass filter, L1 and C11, which suppresses any harmonics of the fundamental oscillator frequency. From there the signal is introduced to the base of the modulator, Q3.

Since proper functioning of the modulator likewise depends upon the load impedance, buffer Q4 is inserted between the modulator output and the multiplier chain. Q4 also limits any amplitude modulation present in the signal before it is applied to the first multiplier.

Modulator

The phase modulator stage is built around transistor Q3 and can be considered as a voltage divider consisting of the two identical capacitors, C12 and C13, and transistor Q3, over which the output signal is taken off.

Base voltage for Q3 is applied from the joint of C12 and C13, whereby Q3 appears as an inductance having the same reactance as one of the capacitors. In addition to the reactive current in the transistor there is also a resistive component which is determined by the transistor's operating point; this resistive component can be considered as a resistor in series with the inductance.

The phase shift between the modulator input signal applied to C12 and the modulator output signal taken off across Q3 is therefore dependent upon the transistor's operating point.

Applying a modulation signal to emitter of Q3 will shift the operating point (transfer characteristic) coincident with the modulating signal, thus achieving the desired phase modulation.

Frequency Multiplication Stages

The frequency multiplier chain is composed of two triplers and two doublers, giving a multiplication factor of 36, resulting in the required antenna frequency of 420 to 470 MHz The first multiplier, Q5 and Q6, is a balanced tripler configuration where the even-numbered harmonics of the fundamental frequency are suppressed. The signal from the second buffer stage, Q4, is applied to the base of Q5 through C18. The base of Q6 is grounded, as far as the signal is concerned, through C23 and C24. Since R23 is common to both transistor emitters, any signal through Q5 will also be across the emitter-base circuit of Q6 with the proper polarity to drive the stage in push-pull.

Two tuned LC circuits, L3 and C26, and L4 and C31, form a capacitive coupled band-pass filter tuned to the third harmonic of the frequency at the tripler input.

C29 and C30 pass the signal on the multiplier, Q7 and Q8. This stage is a balanced doubler, suppressing the odd harmonics of the input signal frequency. Tuned circuits L5 and C34, and L6 and C36 in the collector paths also make up a capacitive coupled band-pass filter, this time tuned to the second harmonic of the frequency at its input. The signal is fed on through C37 and C38 to the second tripler, Q9 and Q10, also operating as a balanced frequency tripler.

The collector circuit consisting of L7 and C40 is, of course, tuned to the second harmonic of the input frequency. The collector circuit and the tuned circuit L8 and C41 in the base circuit of the following am-amplifier stage form an inductively coupled band-pass filter.

The final multiplier stage (Q11), operating as a doubler. is designed around a single transistor. The tuned circuit of L10 and C46 in its collector is tuned to the second harmonic of the frequency at the input to the doubler. The signal has now reached the antenna frequency (420 to 470 MHz) and is applied to the output transistor, Q12, via the series resonant circuit of L11 and C47.

The output stage, Q12, amplifies the approx. 20 mW signal from the second doubler to the output level required to drive the PA stage (approx. 80 mW). The signal from the collector of the output transistor passes through a band-pass filter consisting of L13 and C50, and L14 and C52 to the output terminals. The filter also transforms the collector impedance down to an output impedance of 50 Ω.

The band-pass filters determine the overall bandwidth of the exciter, and they also suppress undesired harmonics generated during frequency multiplication. All of the band-pass filters employ close-to-critical coupling.

Technical Specifications

Supply Voltage
9 V

Current Consumption
90 mA

Frequency Range
400 to 470 MHz

Frequency Multiplication Factor
36

Crystal Frequency Band
11.66 - 13.06 MHz

Band Width (3 dB)
15 MHz

Output Power
80 mW

Load Impedance
50 Ω

AF Input Impedance
1 kΩ

Modulation Sensitivity
Required EMF from a 600 generator: (for Δf = 10.5 kHz at 1 kHz): 210 mV

Modulation Distortion
Measured without de-emphasis, at f = 10.5 kHz / 1 kHz: 2.5 %

Oscillator Frequency adjustable by:
$\frac{\Delta f}{f} \geqslant \pm 30 \times 10^{-6}$

Frequency Stability
for voltage variations of ± 2.5%:
$\frac{\Delta f}{f} \leqslant \pm 0.1 \times 10^{-6}$

for temperatures between -25 and +75°C:
$\frac{\Delta f}{f} \leqslant \pm 2 \times 10^{-6}$

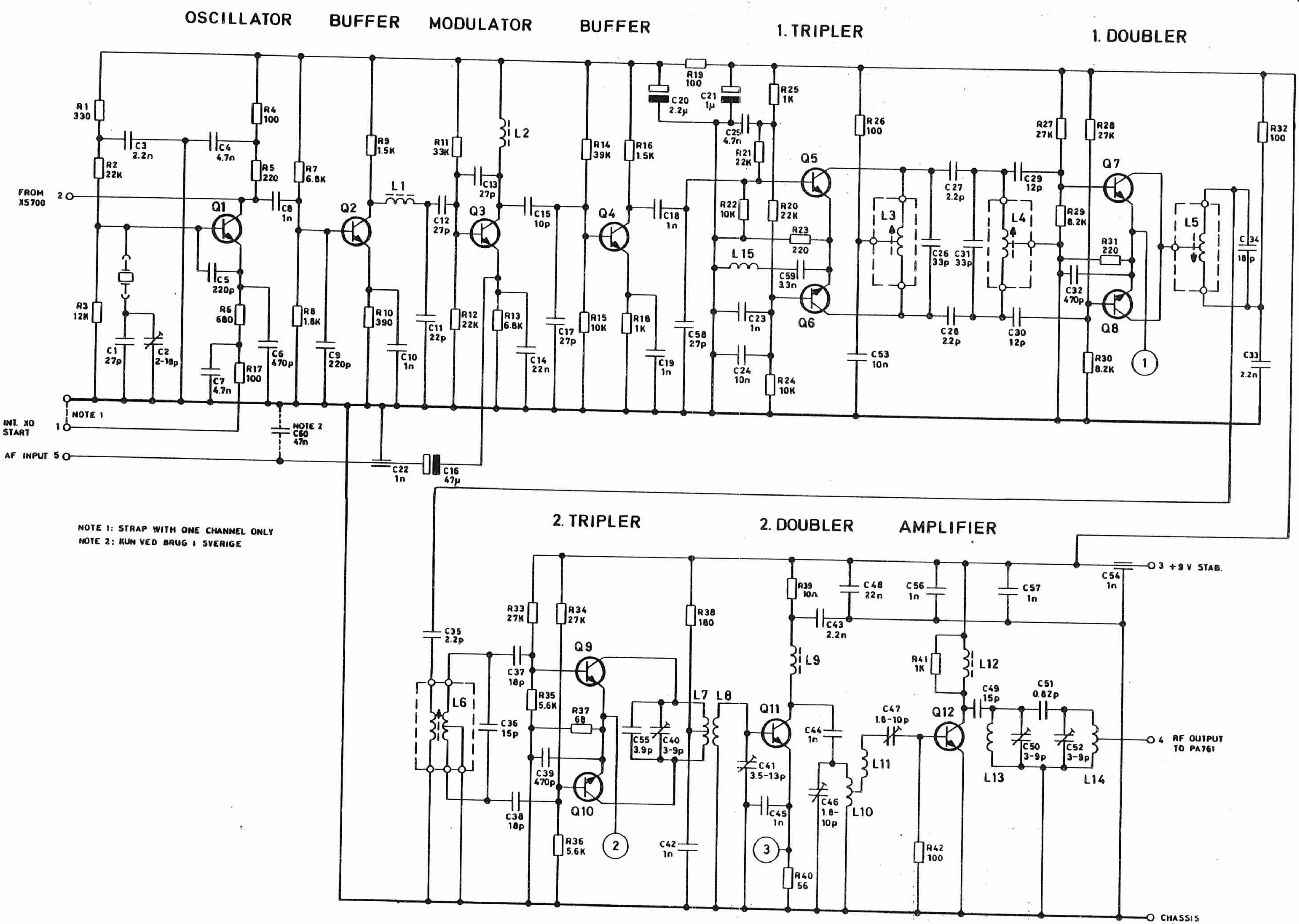
Input Impedance for External Oscillators
470 Ω / 22 pF

Sensitivity at Input for Ext. Oscillators
(required input voltage): 100 mV

Crystal Types
98-12, 98-20, 98-26

Temperature Range
Operating range: -25° to +70°C
Functioning range: -30° to + 80°C

Mechanical Dimensions
Metal enclosure: 24.7 x 50.8 x 91.5 mm
Printed circuit board: 48.3 x 88.9 mm

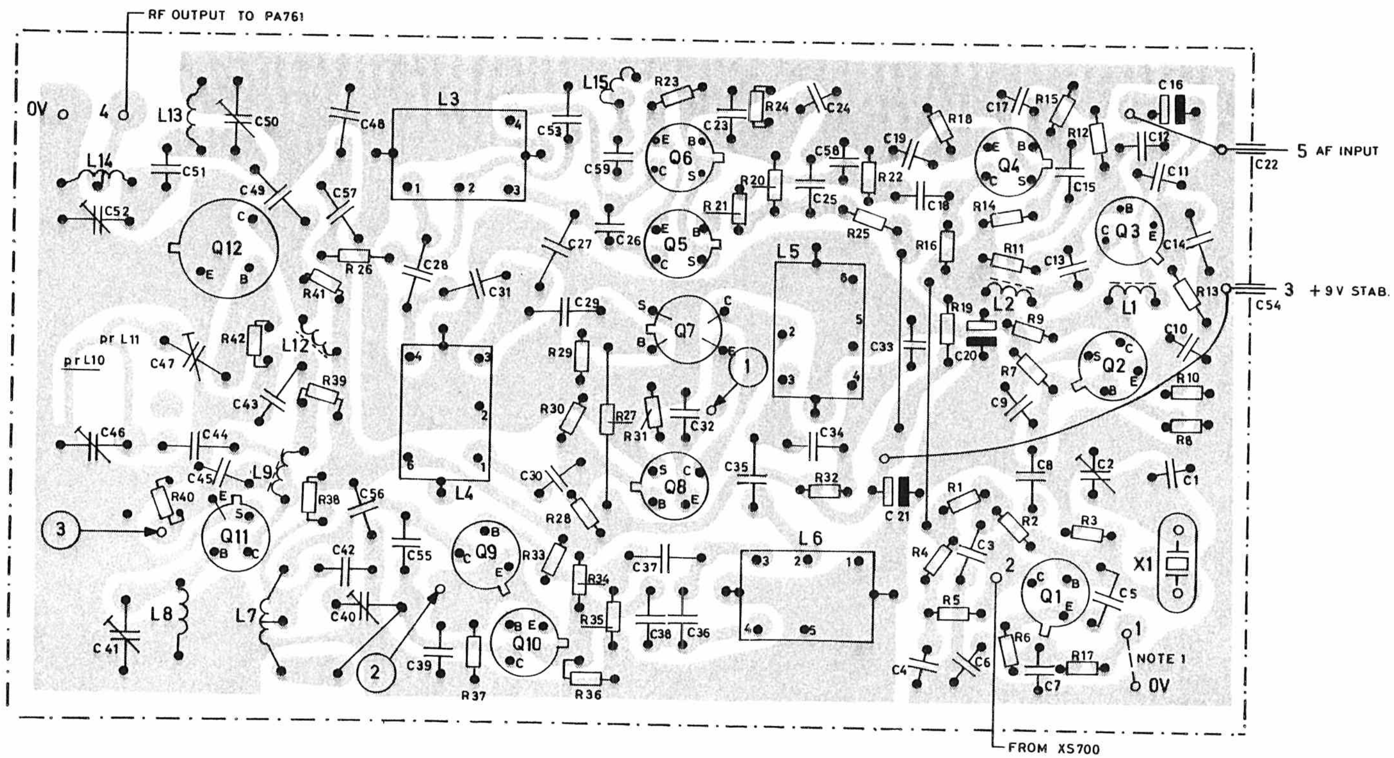


NOTE 1: STRAP WITH ONE CHANNEL ONLY
NOTE 2: KUN VED BRUG I SVERIGE

EXCITER EX761

D401.312/2

Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

EXCITER EX761

D401.519

TYPE	NO.	CODE	DATA	
EX761		10.2429	Exciter Unit	
	C1	74.5192	27 pF 5% ceram TB	160V
	C2	78.5044	2-18pF trimmer	300V
	C3	76.5059	2.2 nF 10% polyest FL	50V
	C4	76.5061	4.7 nF 10% polyest FL	50V
	C5	76.5104	220 pF 2.5% polystyr TB	25V
	C6	76.5106	470 pF 2.5% polyest TB	25V
	C7	76.5061	4.7 nF 10% polyest FL	50V
	C8	74.5155	1 nF -20/+50% ceram PL	63V
	C9	76.5104	220 pF 2.5% polystyr TB	25V
	C10	76.5069	1 nF 10% polyest FL	50V
	C11	74.5106	22 pF 5% ceram TB	160V
	C12	74.5107	27 pF 5% ceram TB	160V
	C13	74.5107	27 pF 5% ceram TB	160V
	C14	76.5071	22 pF 10% polyest FL	50V
	C15	74.5135	10 pF 5% ceram DI	125V
	C16	73.5124	47 µF 20% tantal	6.3V
	C17	74.5107	27 pF 5% ceram TB	160V
	C18	74.5155	1 nF -20/+50% ceram PL	63V
	C19	76.5069	1 nF 10% polyest FL	50V
	C20	73.5129	2.2 µF 20% tantal	10V
	C21	73.5135	1 µF 20% tantal	16V
	C22	74.5167	1 nF -20/+80% ceram FT	300V
	C23	74.5155	1 nF -20/+50% ceram PL	63V
	C24	76.5070	10 nF 10% polyest FL	50V
	C25	76.5061	4.7 nF 10% polyest FL	50V
	C26	74.5116	33 pF 5% ceram TB	160V
	C27	74.5127	2.2 pF ±0.25 pF ceram BD	250V
	C28	74.5127	2.2 pF ±0.25 pF ceram BD	250V
	C29	74.5136	12 pF 5% ceram DI	125V
	C30	74.5136	12 pF 5% ceram DI	125V
	C31	74.5116	33 pF 5% ceram TB	160V
	C32	74.5161	470 pF -20/+50% ceram PL	63V
	C33	76.5059	2.2 nF 10% polyest FL	50V
	C34	74.5138	18 pF 5% ceram DI	125V
	C35	74.5127	2.2 pF ±0.25pF ceram BD	250V
	C36	74.5137	15 pF 5% ceram DI	125V
	C37	74.5138	18 pF 5% ceram DI	125V
	C38	74.5138	18 pF 5% ceram DI	125V
	C39	74.5161	470 pF -20/+50% ceram PL	63V
	C40	78.5050	3-9 pF trimmer	160V
	C41	78.5025	3.5 - 13 pF trimmer	160V
	C42	74.5155	1 nF -20/+50% ceram PL	63V
	C43	74.5163	2.2 nF -20/+50% ceram PL	63V
	C44	74.5155	1 nF -20/+50% ceram PL	63V
	C45	74.5155	1 nF -20/+50% ceram PL	63V
	C46	78.5048	1.8 - 10 pF trimmer	300V

TYPE	NO.	CODE	DATA	
	C47	78.5048	1.8 - 10 pF trimmer	300V
	C48	76.5071	22 nF 10% polyest FL	50V
	C49	74.5137	15 pF 5% ceram DI	125V
	C50	78.5050	3-9 pF trimmer	160V
	C51	74.5122	0.82 pF ±0.1 pF ceram BD	
	C52	78.5050	3-9 pF trimmer	160V
	C53	76.5070	10 nF 10% polyest FL	50V
	C54	74.5167	1 nF -20/+80% ceram FT	300V
	C55	74.5130	3.9 pF ±0.25 pF ceram DI	125V
	C56	74.5155	1 nF -20/+50% ceram PL	63V
	C57	74.5155	1 nF -20/+50% ceram PL	63V
	C58	74.5107	27 pF 5% ceram TB	160V
	C59	76.5060	3.3 nF 10% polyest FL	50V
	R1	80.5243	330 Ω 5% carbon film	1/8W
	R2	80.5265	22 kΩ 5% " "	1/8W
	R3	80.5262	12 kΩ 5% " "	1/8W
	R4	80.5237	100 Ω 5% " "	1/8W
	R5	80.5241	220 Ω 5% " "	1/8W
	R6	80.5247	680 Ω 5% " "	1/8W
	R7	80.5259	6.8 kΩ 5% " "	1/8W
	R8	80.5252	1.8 kΩ 5% " "	1/8W
	R9	80.5251	1.5 kΩ 5% " "	1/8W
	R10	80.5244	390 Ω 5% " "	1/8W
	R11	80.5267	33 kΩ 5% " "	1/8W
	R12	80.5265	22 kΩ 5% " "	1/8W
	R13	80.5259	6.8 kΩ 5% " "	1/8W
	R14	80.5268	39 kΩ 5% " "	1/8W
	R15	80.5261	10 kΩ 5% " "	1/8W
	R16	80.5251	1.5 kΩ 5% " "	1/8W
	R17	80.5237	100 Ω 5% " "	1/8W
	R18	80.5249	1 kΩ 5% " "	1/8W
	R19	80.5237	100 Ω 5% " "	1/8W
	R20	80.5265	22 kΩ 5% " "	1/8W
	R21	80.5265	22 kΩ 5% " "	1/8W
	R22	80.5261	10 kΩ 5% " "	1/8W
	R23	80.5241	220 Ω 5% " "	1/8W
	R24	80.5261	10 kΩ 5% " "	1/8W
	R25	80.5249	1 kΩ 5% " "	1/8W
	R26	80.5237	100 Ω 5% " "	1/8W
	R27	80.5266	27 kΩ 5% " "	1/8W
	R28	80.5266	27 kΩ 5% " "	1/8W

EXCITER EX761

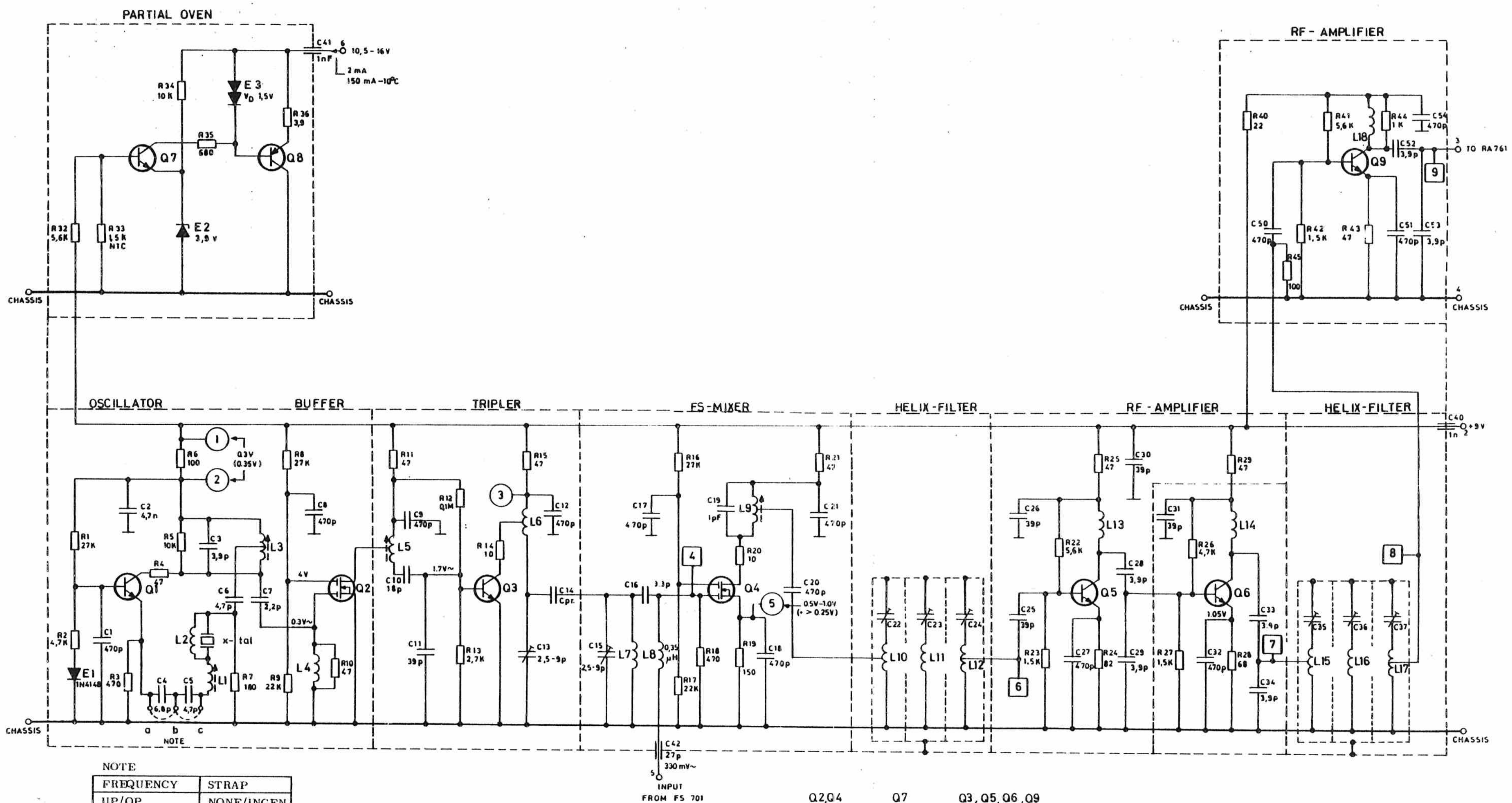
TYPE	NO.	CODE	DATA.
	R29	80.5260	8.2 kΩ 5% carbon film 1/8W
	R30	80.5260	8.2 kΩ 5% " " 1/8W
	R31	80.5241	220 Ω 5% " " 1/8W
	R32	80.5237	100 Ω 5% " " 1/8W
	R33	80.5266	27 kΩ 5% " " 1/8W
	R34	80.5266	27 kΩ 5% " " 1/8W
	R35	80.5258	5.6 kΩ 5% " " 1/8W
	R36	80.5258	5.6 kΩ 5% " " 1/8W
	R37	80.5235	68 Ω 5% " " 1/8W
	R38	80.5240	180 Ω 5% " " 1/8W
	R39	80.5225	10 Ω 5% " " 1/8W
	R40	80.5234	56 Ω 5% " " 1/8W
	R41	80.5249	1 kΩ 5% " " 1/8W
	R42	80.5237	100 Ω 5% " " 1/8W
	L1	63.5007	15 μH RF choke 0.5A
	L2	63.5007	15 μH RF choke 0.5A
	L3	61.1113	RF coil 37 MHz
	L4	61.1113	RF coil 37 MHz
	L5	61.1114	RF coil 75 MHz
	L6	61.1115	RF coil 75 MHz
	L7	62.0800	RF coil 210 - 235 MHz
	L8	62.0801	RF coil 210 - 235 MHz
	L9	63.5006	2.2 μH 20% RF choke 0.6A
	L10		Printed coil
	L11		Printed coil
	L12	63.5008	0.47 μH 20% RF choke 2.2A
	L13	62.0802	RF coil 420-470 MHz
	L14	62.0803	RF coil 420-470 MHz
	L15	62.0651	0.08 μH RF choke
	Q1	99.5139	BSX19 Transistor
	Q2	99.5168	BF173 Transistor
	Q3	99.5121	BC107 Transistor
	Q4	99.5175	BF185 Transistor
	Q5	99.5175	BF185 Transistor
	Q6	99.5175	BF185 Transistor
	Q7	99.5175	BF185 Transistor
	Q8	99.5175	BF185 Transistor
	Q9	99.5139	BSX19 Transistor
	Q10	99.5139	BSX19 Transistor
	Q11	99.5240	BFX89 Transistor
	Q12	99.5229	2N4427 Transistor

Storno

TYPE	NO.	CODE	DATA

EXCITER EX761

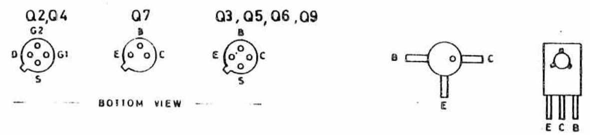
X401.321/2



NOTE

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

( ) MEASURED WITH DRIVE
MÅLT MED UDSTYRING



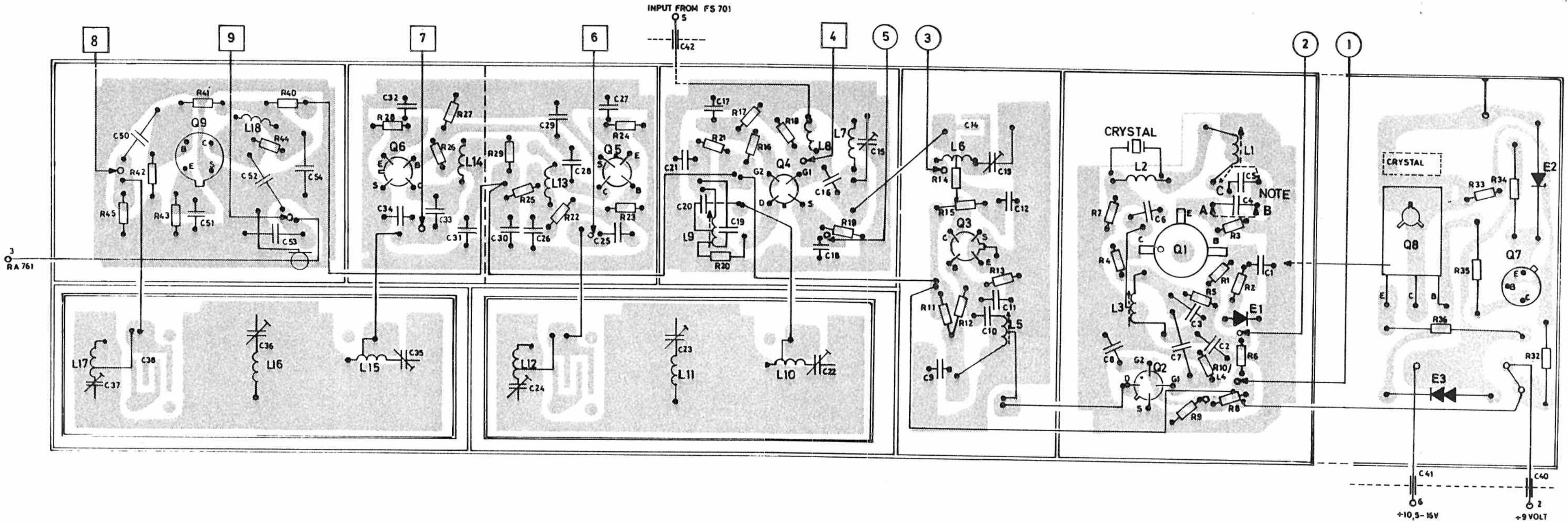
EXCITER
STYRESENDER

EX762

D 401. 805

Storno

Storno



EXCITER
STYRESENDER

EX 762

D401.892

Storno

TYPE	NO.	CODE	DATA	
EX762		10.2924		
	C1	74.5162	470 pF -20+50% ceram DI	400 V
	C2	74.5108	4.7 nF -20+80% ceram PL	20 V
	C3	74.5302	3.9 pF ±0.25 pF ceram PL	63 V
	C4	74.5321	6.8 pF ± 0.25 pF ceram PL	100 V
	C5	74.5318	4.7 pF ± 0.25 pF ceram PL	100 V
	C6	74.5108	4.7 nF -20+80% ceram PL	20 V
	C7	74.5299	2.2 pF ± 0.25 pF ceram PL	63 V
	C8	74.5161	470 pF -20+80% ceram PL	63 V
	C9	74.5162	470 pF -20+80% ceram DI	400 V
	C10	74.5310	18 pF 5% ceram PL	63 V
	C11	74.5316	39 pF 5% ceram PL	63 V
	C12	74.5162	470 pF -20+50% ceram DI	100 V
	C13	78.5055	2.5-9 pF trimmer DI	100 V
	C14		Printed Capacitor	
	C15	78.5055	2.5-9 pF trimmer DI	100 V
	C16	74.5301	3.3 pF± 0.25 pF ceram PL	63 V
	C17	74.5162	470 pF -20+50% ceram DI	400 V
	C18	74.5162	470 pF -20+50% ceram DI	400 V
	C19	74.5123	1.0 pF ±0.25 pF ceram DI	250 V
	C20	74.5161	480 pF -20+80% ceram PL	63 V
	C21	74.5162	470 pF -20+50% ceram DI	400 V
	C22		Helix Coil Adjustor	
	C23		Helix Coil Adjustor	
	C24		Helix Coil Adjustor	
	C25	74.5316	39pF 5% ceram PL	63 V
	C26	74.5316	39 pF 5% ceram PL	63 V
	C27	74.5162	470 pF -20+50% ceram DI	400 V
	C28	74.5302	3.9 pF ± 0.25 pF ceram PL	63 V
	C29	74.5302	3.9 pF ± 0.25 pF ceram PL	63 V
	C30	74.5316	39 pF 5% ceram PL	63 V
	C31	74.5316	39 pF 5% ceram PL	63 V
	C32	74.5162	470 pF -20+50% ceram DI	400 V
	C33	74.5302	3.9 pF ± 0.25 pF ceram PL	63 V
	C34	74.5302	3.9 pF ± 0.25 pF ceram PL	63 V
	C35		Helix Coil Adjustor	
	C36		Helix Coil Adjustor	
	C37		Helix Coil Adjustor	
	C40	74.5198	1 nF -20+50% ceram FT	30 V
	C41	74.5198	1 nF -20+50% ceram FT	30 V
	C42	74.5322	27 pF 20% ceram FT	400 V
	C50	74.5161	470 pF -20+80% ceram PL	63 V
	C51	74.5162	470 pF -20+50% ceram DI	400 V
	C52	74.5130	3.9 pF ± 0.25 pF ceram DI	250 V
	C53	74.5130	3.9 pF ±0.25 pF ceram DI	250 V
	C54	74.5161	470 pF -20+80% ceram PL	63 V

Storno

TYPE	NO.	CODE	DATA		
	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	80.5040	180 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%	-	1/10W
	R11	80.5033	47 Ω 5%	-	1/10W
	R12	80.5073	100 KΩ 5%	-	1/10W
	R13	80.5054	2.7 KΩ 5%	-	1/10W
	R14	80.5025	10 Ω 5%	-	1/10W
	R15	80.5033	47 Ω 5%	-	1/10W
	R16	80.5066	27 KΩ 5%	-	1/10W
	R17	80.5065	22 KΩ 5%	-	1/10W
	R18	80.5045	470 Ω 5%	-	1/10W
	R19	80.5239	150 Ω 5%	-	1/8 W
	R20	80.5025	10 Ω 5%	-	1/10W
	R21	80.5033	47 Ω 5%	-	1/10W
	R22	80.5058	5.6 KΩ 5%	-	1/10W
	R23	80.5051	1.5 KΩ 5%	-	1/10W
	R24	80.5036	82Ω 5%	-	1/10W
	R25	80.5033	47 Ω 5%	-	1/10W
	R26	80.5057	4.7 KΩ 5%	-	1/10W
	R27	80.5051	1.5 KΩ 5%	-	1/10W
	R28	80.5035	68 Ω 5%-	-	1/10W
	R29	80.5033	47 Ω 5%	1/10W	1/10W
	R32	80.5058	5.6 KΩ 5%	-	1/10W
	R33	89.5060	1.5 KΩ 5% NTC		1/2 W
	R34	80.5061	10 KΩ 5% carbon film		1/10W
	R35	80.5047	680Ω 5%	-	1/10W
	R40	80.5029	22 Ω 5%	-	1/10W
	R41	80.5058	5.6 KΩ 5%	-	1/10W
	R42	80.5051	1.5 KΩ 5%	-	1/10W
	R43	80.5033	47 Ω 5%	-	1/10W
	R44	80.5049	1 KΩ 5%	-	1/10W
	R45	80.5037	100 Ω 5%	-	1/10W
	L1	61.1234	RF Coil		
	L2	61.1230	RF Coil		

EXCITER
STYRESENDER

EX762

X 401.867

Storno

TYPE	NO.	CODE	DATA
	L3	61.1229	RF Coil 119-159 MHz
	L4	61.1231	RF Choke, R10 incl.
	L5	61.1227	RF Coil
	L6	62.0876	RF Coil
	L7	62.0877	RF Coil
	L8	62.0659-01	RF Choke 0.35 μH
	L9	61.1228	RF Coil
	L10	61.	Helix Coil 409.3-459.3 MHz
	L11	61.	Helix Coil 409.3-459.3 MHz
	L12	61.	Helix Coil 409.3-459.3 MHz
	L13	62.0875	RF Coil
	L14	62.0875	RF Coil
	L15	61.	Helix Coil 409.3-459.3 MHz
	L16	61.	Helix Coil 409.3-459.3 MHz
	L17	61.	Helix Coil 409.3-459.3 MHz
	L18	62.0875	RF Coil 420-470 MHz
	E1	99.5237	1N4148 Diode
	E2	99.5225	3.9 V Zenerdiode
	E3	99.5209	1.5 V Stab. diode
	Q1	99.5290	BFR90 Transistor
	Q2	99.5291	3N205 Transistor FET
	Q3	99.5240	BFX80 Transistor
	Q4	99.5291	3N205 Transistor FET
	Q5	99.5240	BFX89 Transistor
	Q6	99.5240	BFX89 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5236	BD136 Transistor
	Q9	99.5240	BFX89 Transistor

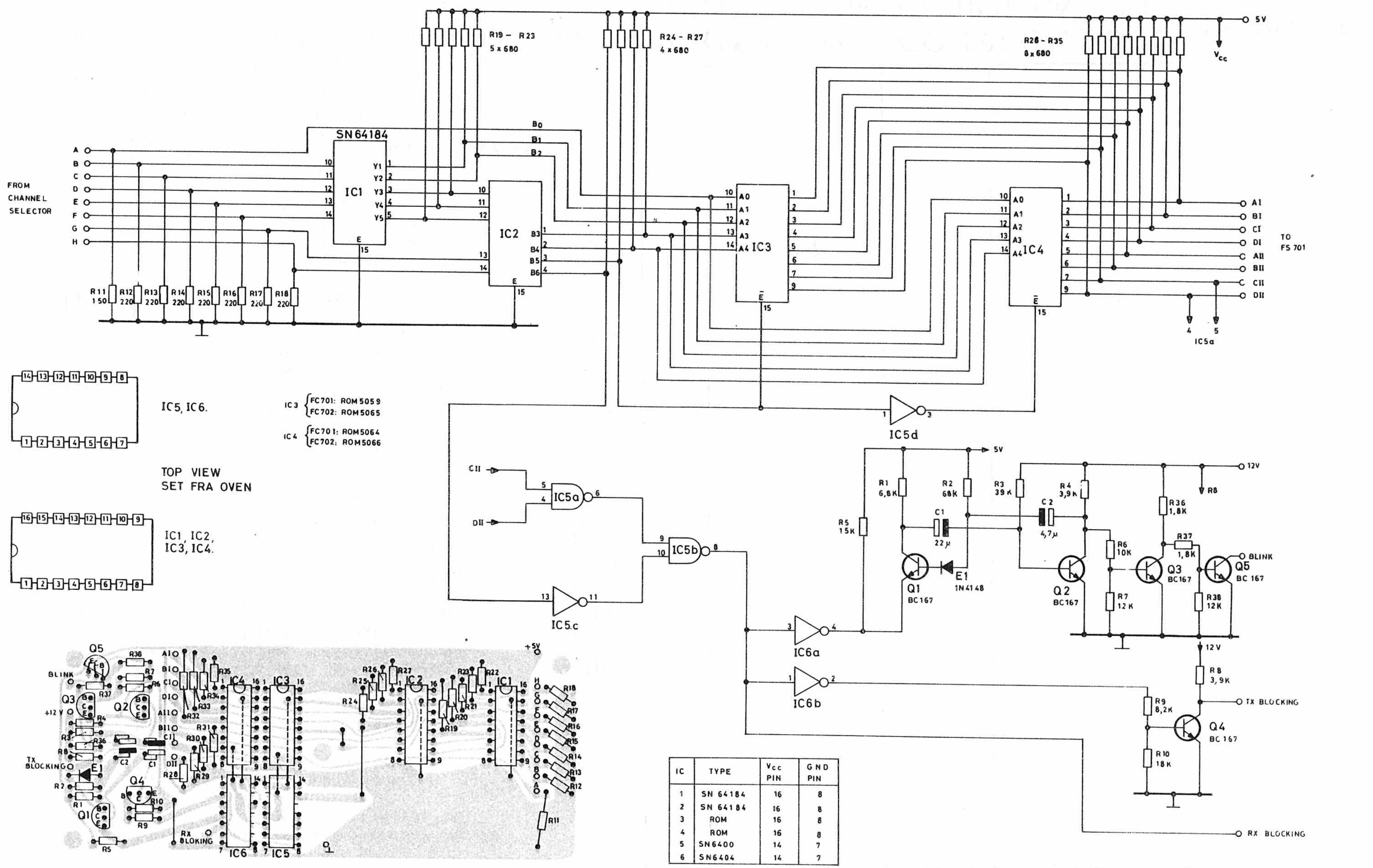
Storno

TYPE	NO.	CODE	DATA

EXCITER
STYRESENDER

EX762

X401.867



IC	TYPE	Vcc PIN	GND PIN
1	SN 64184	16	8
2	SN 64184	16	8
3	ROM	16	8
4	ROM	16	8
5	SN6400	14	7
6	SN6404	14	7

FREQUENCY CONTROL UNIT FC701, FC702
FREKVENSKONTROLENHED

D 401.819/2

Storno

TYPE	NO.	CODE	DATA
FC701		10.2939	Frequency Control Unit DK
FC702		10.2940	Frequency Control Unit N
	C1	73.5127	22μF 20% tantal 16V
	C2	73.5126	4.7μF 20% tantal 35V
	R1	80.5059	6.8kΩ 5% carbon film 1/10W
	R2	80.5071	68kΩ 5% carbon film 1/10W
	R3	80.5068	39kΩ 5% carbon film 1/10W
	R4	80.5056	3.9kΩ 5% carbon film 1/10W
	R5	80.5063	15kΩ 5% carbon film 1/10W
	R6	80.5061	10kΩ 5% carbon film 1/10W
	R7	80.5062	12kΩ 5% carbon film 1/10W
	R8	80.5056	3.9kΩ 5% carbon film 1/10W
	R9	80.5060	8.2kΩ 5% carbon film 1/10W
	R10	80.5064	18kΩ 5% carbon film 1/10W
	R11	80.5439	150Ω 5% carbon film 1/4W
	R12	80.5041	220Ω 5% carbon film 1/10W
	R13	80.5041	220Ω 5% carbon film 1/10W
	R14	80.5041	220Ω 5% carbon film 1/10W
	R15	80.5041	220Ω 5% carbon film 1/10W
	R16	80.5041	220Ω 5% carbon film 1/10W
	R17	80.5041	220Ω 5% carbon film 1/10W
	R18	80.5041	220Ω 5% carbon film 1/10W
	R19-35	80.5047	680Ω 5% carbon film 1/10W
	R36	80.5052	1.8kΩ 5% carbon film 1/10W
	R37	80.5052	1.8kΩ 5% carbon film 1/10W
	R38	80.5062	12kΩ 5% carbon film 1/10W
	E1	99.5237	1N4148 Diode
	Q1	99.5117	BC167 Transistor
	Q2	99.5117	BC167 Transistor
	Q3	99.5117	BC167 Transistor
	Q4	99.5117	BC167 Transistor
	Q5	99.5117	BC167 Transistor
	IC1	14.5063	SN64184 BCD to binary converter
	IC2	14.5063	SN64184 BCD to binary converter
FC701	IC3	14.5059	5059 DK ROM
FC702	IC3	14.5065	5065 N ROM
FC701	IC4	14.5064	5064 DK ROM
FC702	IC4	14.5066	5066 N ROM
	IC5	14.5024	SN6400 Quadruple 2-input NAND Gate
	IC6	14.5034	SN6404 Hex Inverter

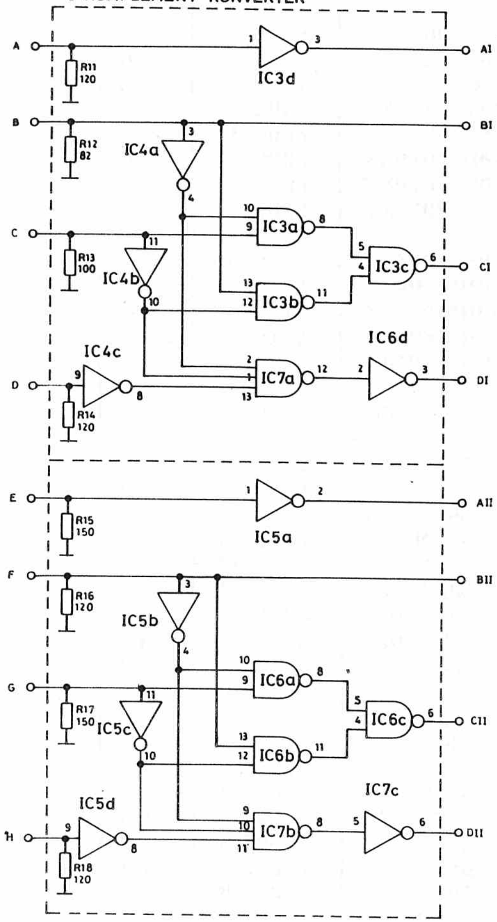
Storno

TYPE	NO.	CODE	DATA

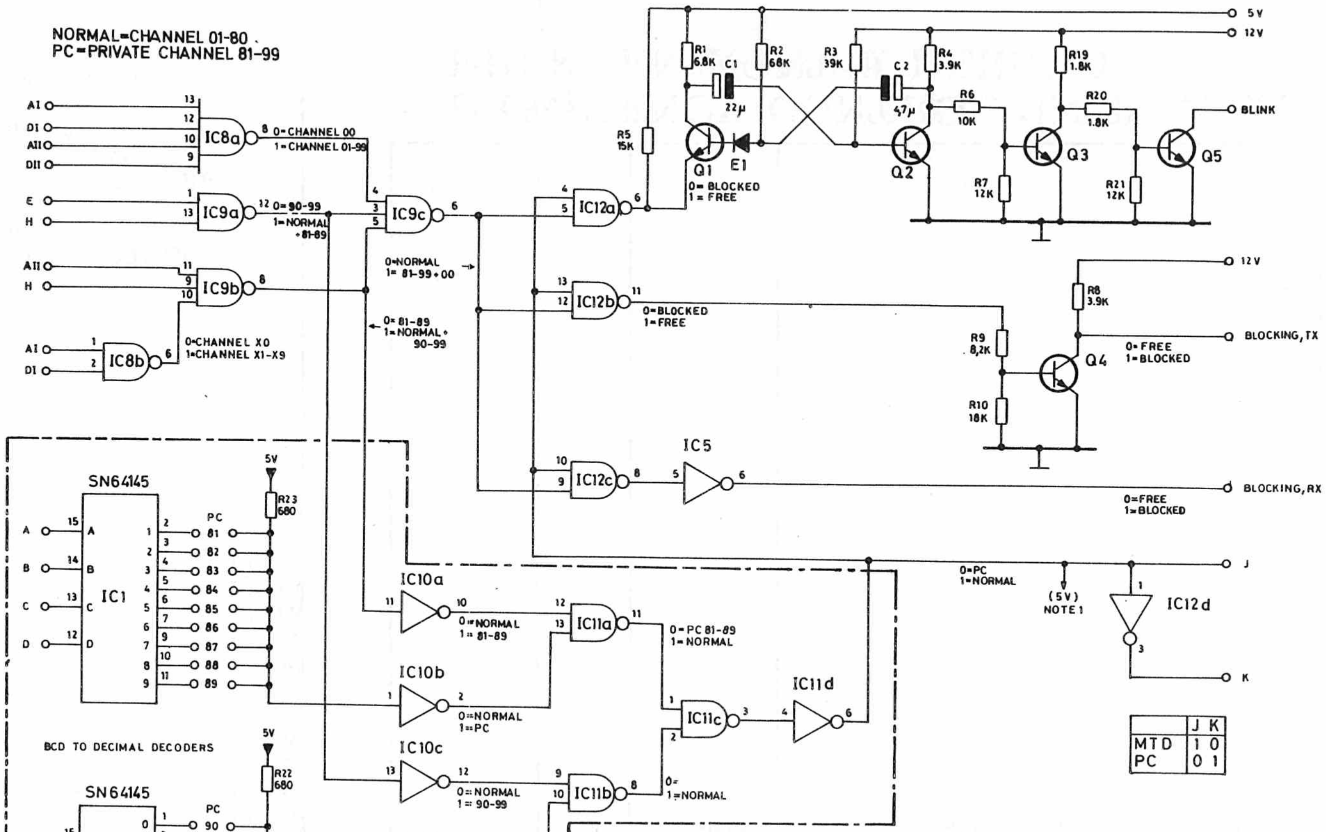
FREQUENCY CONTROL UNIT FC701, FC702
FREKVENSKONTROLENHED

X401.964

9-COMPLEMENTARY CONVERTER
9-KOMPLEMENT KONVERTER

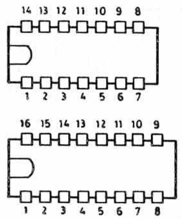


NORMAL=CHANNEL 01-80
PC=PRIVATE CHANNEL 81-99



	J	K
MTD	1	0
PC	0	1

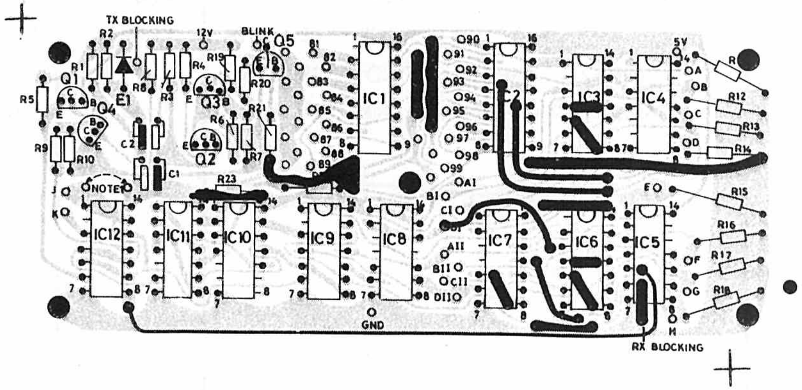
		Vcc PIN	GND PIN
IC1	SN64145	16	8
IC2	SN64145	16	8
IC3	SN6400	14	7
IC4	SN6404	14	7
IC5	SN6404	14	7
IC6	SN6400	14	7
IC7	SN6410	14	7
IC8	SN6420	14	7
IC9	SN6410	14	7
IC10	SN6404	14	7
IC11	SN6400	14	7
IC12	SN6400	14	7



TOP WIEW
IC3-IC12

TOP WIEW
IC1, IC2

NOTE 1. TERMINAL J IS CONNECTED TO 5V IN UNITS WITHOUT PRIVATE CHANNEL CIRCUIT.



FREQUENCY CONTROL UNIT
FREKVENSKONTROLENHED

FC703

D401.832

TYPE	NO.	CODE	DATA	
FC703		10.2927	Frequency Control Unit	
	C1	73.5127	22 μF 20% tantal	16 V
	C2	73.5103	4.7 μF 20% tantal	35 V
	R1	80.5059	6.8 KΩ 5% carbon film	1/10W
	R2	80.5071	68 KΩ 5% -	1/10W
	R3	80.5068	39 KΩ 5% -	1/10W
	R4	80.5056	3.9 KΩ 5% -	1/10W
	R5	80.5063	15 KΩ 5% -	1/10W
	R6	80.5061	10 KΩ 5% -	1/10W
	R7	80.5062	12 KΩ 5% -	1/10W
	R8	80.5056	3.9 KΩ 5% -	1/10W
	R9	80.5060	8.2 KΩ 5% -	1/10W
	R10	80.5064	18 KΩ 5% -	1/10W
	R11	80.5438	120 Ω 5% -	1/4 W
	R12	80.5436	82 Ω 5% -	1/4 W
	R13	80.5437	100 Ω 5% -	1/4 W
	R14	80.5438	120 Ω 5% -	1/4 W
	R15	80.5439	150 Ω 5% -	1/4 W
	R16	80.5438	120 Ω 5% -	1/4 W
	R17	80.5439	150 Ω 5% -	1/4 W
	R18	80.5438	120 Ω 5% -	1/4 W
	R19	80.5052	1.8 KΩ 5% -	1/10W
	R20	80.5052	1.8 KΩ 5% -	1/10W
	R21	80.5062	12 KΩ 5% -	1/10W
	R22	80.5247	680 Ω 5% -	1/8 W
	R23	80.5247	680 Ω 5% -	1/8 W
	E1	99.5237	Diode 1N4148	
	Q1	99.5117	Transistor BC167	
	Q2	99.5117	Transistor BC167	
	Q3	99.5117	Transistor BC167	
	Q4	99.5117	Transistor BC167	
	Q5	99.5117	Transistor BC167	
	IC3	14.5024	SN6400 Quadr. 2-input NAND gate	
	IC4	14.5034	SN6404 Hex Inverter	
	IC5	14.5034	SN6404 Hex Inverter	
	IC6	14.5024	SN6400 Quadr. 2-input NAND gate	
	IC7	14.5004	SN6410 Triple 3-input NAND gate	
	IC8	14.5031	SN6420 Dual 4-input NAND gate	
	IC9	14.5004	SN6410 Triple 3-input NAND gate	
	IC12	14.5024	SN6400 Quadr. 2-input NAND gate	

Storno

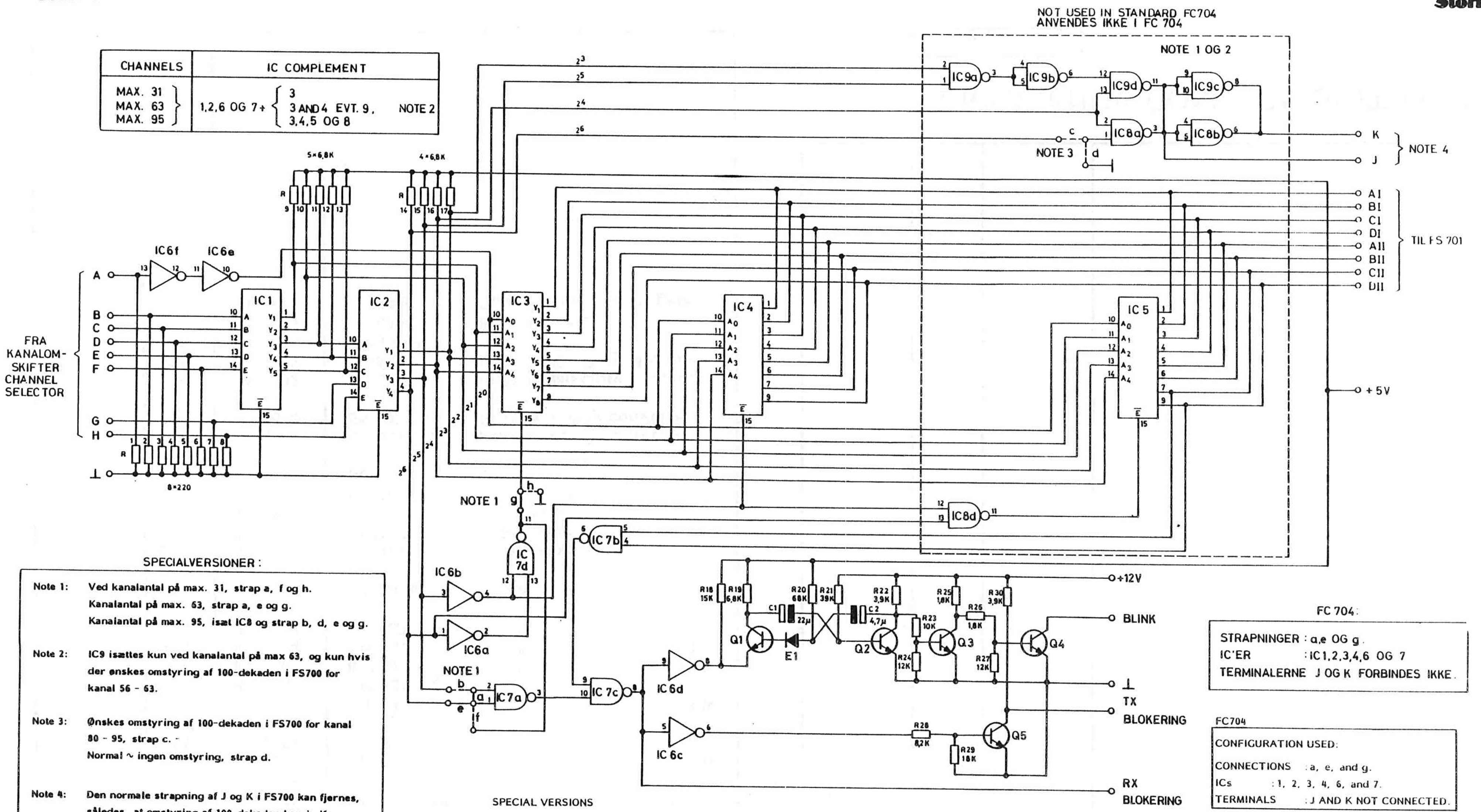
TYPE	NO.	CODE	DATA
			Kit for Increasing Channels
	IC1	14.5071	SN64145 BCD to decimal decoder
	IC2	14.5071	SN64145 BCD to decimal decoder
	IC10	14.5034	SN6404 Hex Inverter
	IC11	14.5024	SN6400 Quadr. 2-input NAND gate

FREQUENCY CONTROL UNIT
FREKVENSKONTROLENHED

FC703

X401.864

CHANNELS	IC COMPLEMENT	
MAX. 31	1,2,6 OG 7+	3
MAX. 63		3 AND 4 EVT. 9, NOTE 2
MAX. 95		3,4,5 OG 8



SPECIALVERSIONER:

Note 1: Ved kanalantal på max. 31, strap a, f og h.
Kanalantal på max. 63, strap a, e og g.
Kanalantal på max. 95, isæt IC8 og strap b, d, e og g.

Note 2: IC9 isættes kun ved kanalantal på max 63, og kun hvis der ønskes omstyring af 100-dekaden i FS700 for kanal 56 - 63.

Note 3: Ønskes omstyring af 100-dekaden i FS700 for kanal 80 - 95, strap c.
Normal ~ ingen omstyring, strap d.

Note 4: Den normale strapning af J og K i FS700 kan fjernes, således, at omstyring af 100-dekaden kan indføres som nævnt i note 2 og 3.
Deleforhold 6xx: J=1 og K=0 (NORMAL)
Deleforhold 5xx: J=0 og K=1

SPECIAL VERSIONS

NOTE 1: FOR MAXIMUM 31 CHANNELS, CONNECT a, f, and g.
FOR MAXIMUM 63 CHANNELS, CONNECT a, e, and g.
FOR MAXIMUM 95 CHANNELS, CONNECT b, d, e, and g AND INSERT IC8.

NOTE 2: IC9 IS ONLY INSERTED FOR A MAXIMUM OF 63 CHANNELS AND ONLY WHEN THE 100 DECADE CONTROL CODE IN FS701 IS TO BE REVERSED FOR CHANNEL 56 - 63.

NOTE 3: FOR REVERSING OF THE 100 DECADE CONTROL CODE FOR CHANNEL 80 - 95, CONNECT c. NORMAL CONDITION, i. e. NO REVERSING, CONNECT d.

NOTE 4: THE NORMAL CONNECTION OF J AND K IN FS701 CAN BE OMITTED IN ORDER TO REVERSE THE 100 DECADE AS STATED IN NOTE 2 AND 3.
DIVISOR 6xx: J=1 and K=0 (NORMAL)
DIVISOR 5xx: J=0 and K=1.

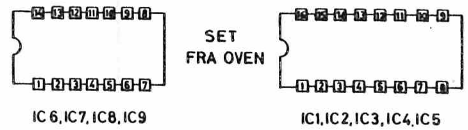
IC		Vcc PIN	GND PIN
1	SN 64184	16	8
2	SN 64184	16	8
3	PROM 5102	16	8
4	PROM 5103	16	8
5	PROM	16	8
6	SN 6404	14	7
7	SN 6400	14	7
8	SN 6400	14	7
9	SN 6400	14	7

FC 704:

STRAPNINGER : a,e OG g.
IC'ER : IC1,2,3,4,6 OG 7
TERMINALERNE J OG K FORBINDES IKKE.

FC704

CONFIGURATION USED:
CONNECTIONS : a, e, and g.
ICs : 1, 2, 3, 4, 6, and 7.
TERMINALS : J AND K NOT CONNECTED.



FREQUENCY CONTROL UNIT
FREKVENSKONTROLENHED
FC 704

D402.145

Storno

TYPE	Nº	CODE	DATA
FC704		10.3236	Frequency Control Unit (CQM713Dx63N)
	C1	73.5127	22 µF 20% tantal 16 V
	C2	73.5126	4.7 µF 20% tantal 16 V
	R1-R8	80.5241	220 Ω 5% carbon film 1/8 W
	R9-R19	80.5259	6.8 KΩ 5% " 1/8 W
	R20	80.5241	68 KΩ 5% " 1/8 W
	R21	80.5268	39 KΩ 5% " 1/8 W
	R22	80.5256	3.9 KΩ 5% " 1/8 W
	R23	80.5261	10 KΩ 5% " 1/8 W
	R24	80.5261	12 KΩ 5% " 1/8 W
	R25	80.5252	1.8 KΩ 5% " 1/8 W
	R26	80.5252	1.8 KΩ 5% " 1/8 W
	R27	80.5262	12 KΩ 5% " 1/8 W
	R28	80.5260	8.2 KΩ 5% " 1/8 W
	R29	80.5264	18 KΩ 5% " 1/8 W
	R30	80.5256	3.9 KΩ 5% " 1/8 W
	E1	99.5237	1 N 4148 Diode
	Q1	99.5117	BC 167 Transistor
	Q2	99.5117	BC 167 Transistor
	Q3	99.5117	BC 167 Transistor
	Q4	99.5117	BC 167 Transistor
	Q5	99.5117	BC 167 Transistor
	IC1	14.5063	SN 64184 N BCD to binary converter
	IC2	14.5063	SN 64184 N BCD to binary converter
	IC3	14.5102	5102 N ROM (Read Only Memory)
	IC4	14.5103	5103 N ROM (Read Only Memory)
	IC5		Not used
	IC6	14.5034	SN 6404 Hex. Inverter
	IC7	14.5024	SN 6400 Quad 2-input NAND gate.

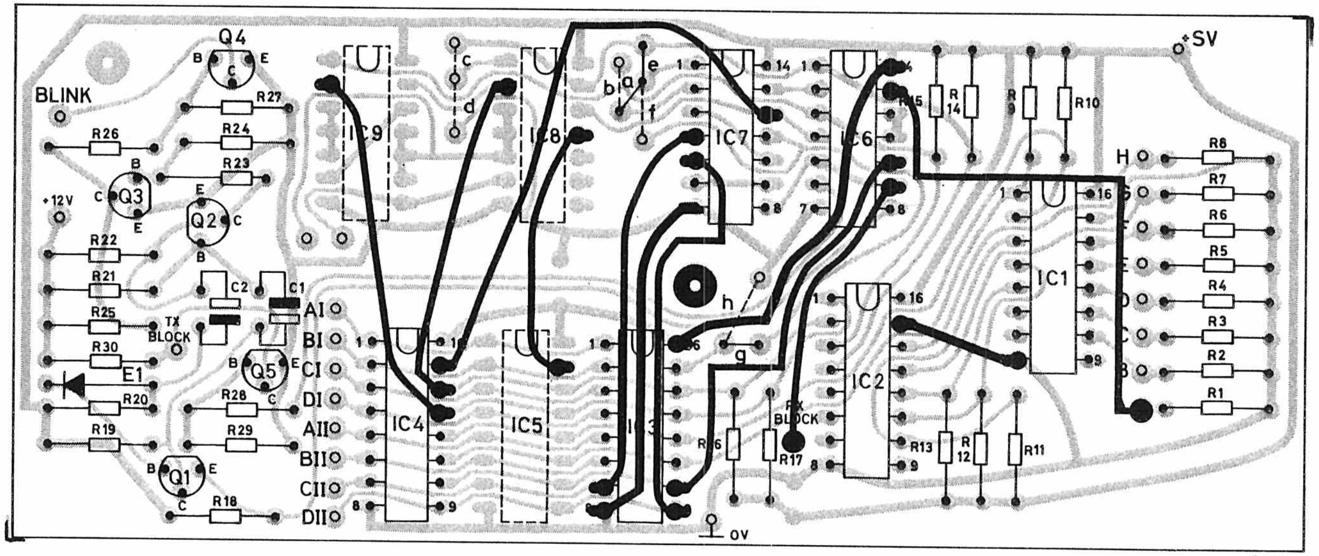
Storno

TYPE	Nº	CODE	DATA

FREQUENCY CONTROL UNIT FC704

X402.365

Storno

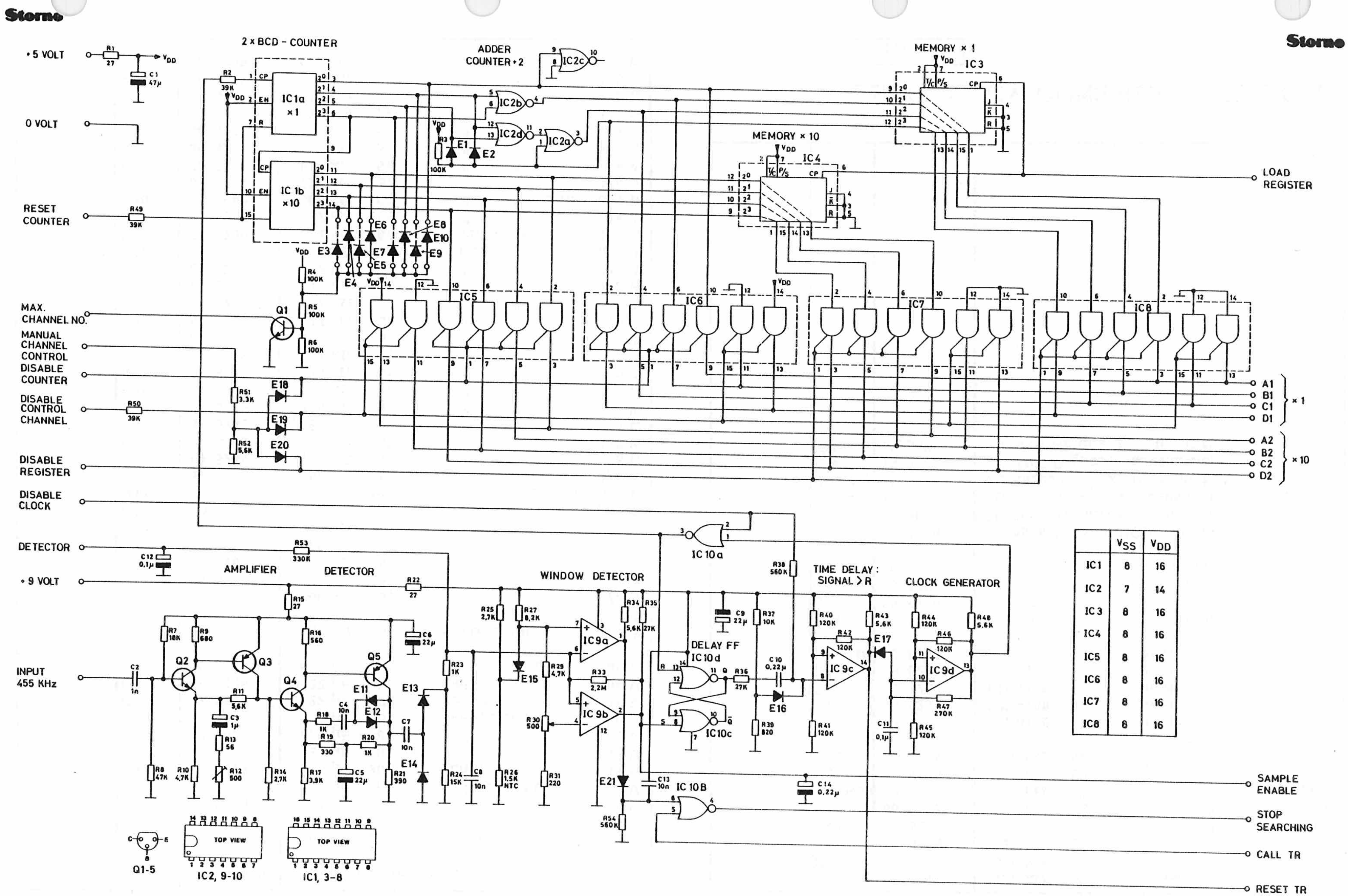


PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

FREQUENCY CONTROL UNIT
FREKVENSKONTROLENHED

FC 704

D 402.431



	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 402.383/2

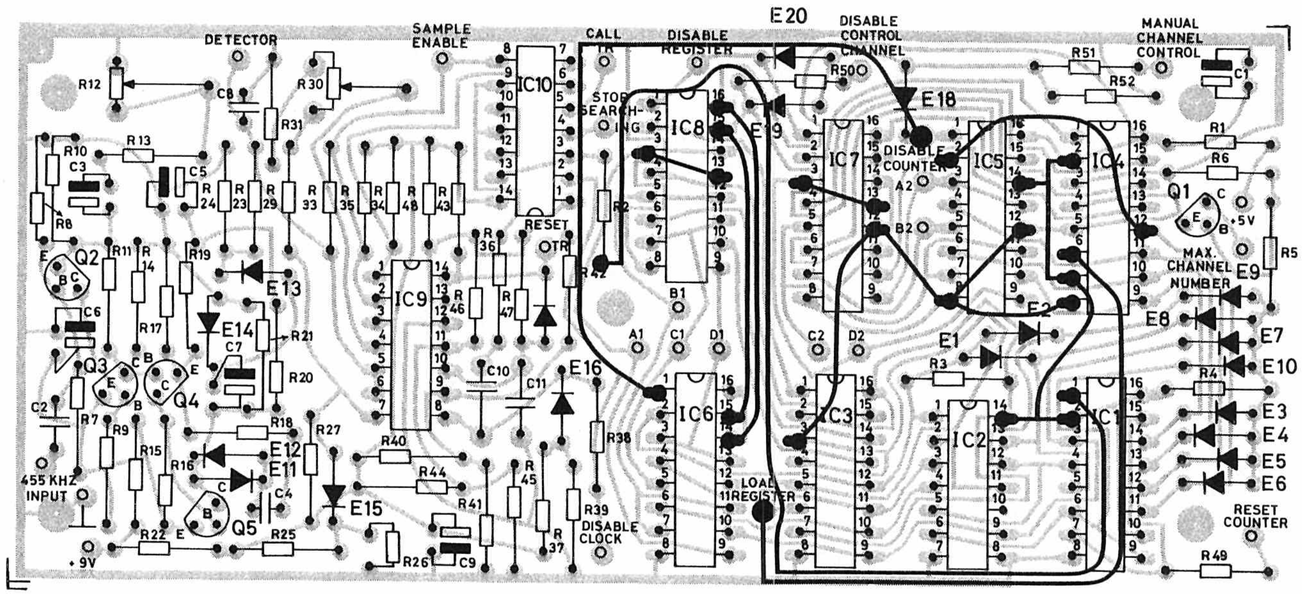
TYPE	Nº	CODE	DATA
FC705		10. 3374-00	Frequency Control Unit
	C1	73. 5124	47 µF 20% tantal 6. 3 V
	C2	74. 5155	1 nF -20/+80% ceram PL 63 V
	C3	73. 5114	1 µF 20% tantal 35 V
	C4	76. 5070	10 nF 10% polyester FL 50 V
	C5	73. 5127	22 µF 20% tantal 16 V
	C6	73. 5127	22 µF 20% " 16 V
	C7	73. 5089	0. 1 µF 20% " 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. 5258	5. 6kΩ 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. / 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. 463/2

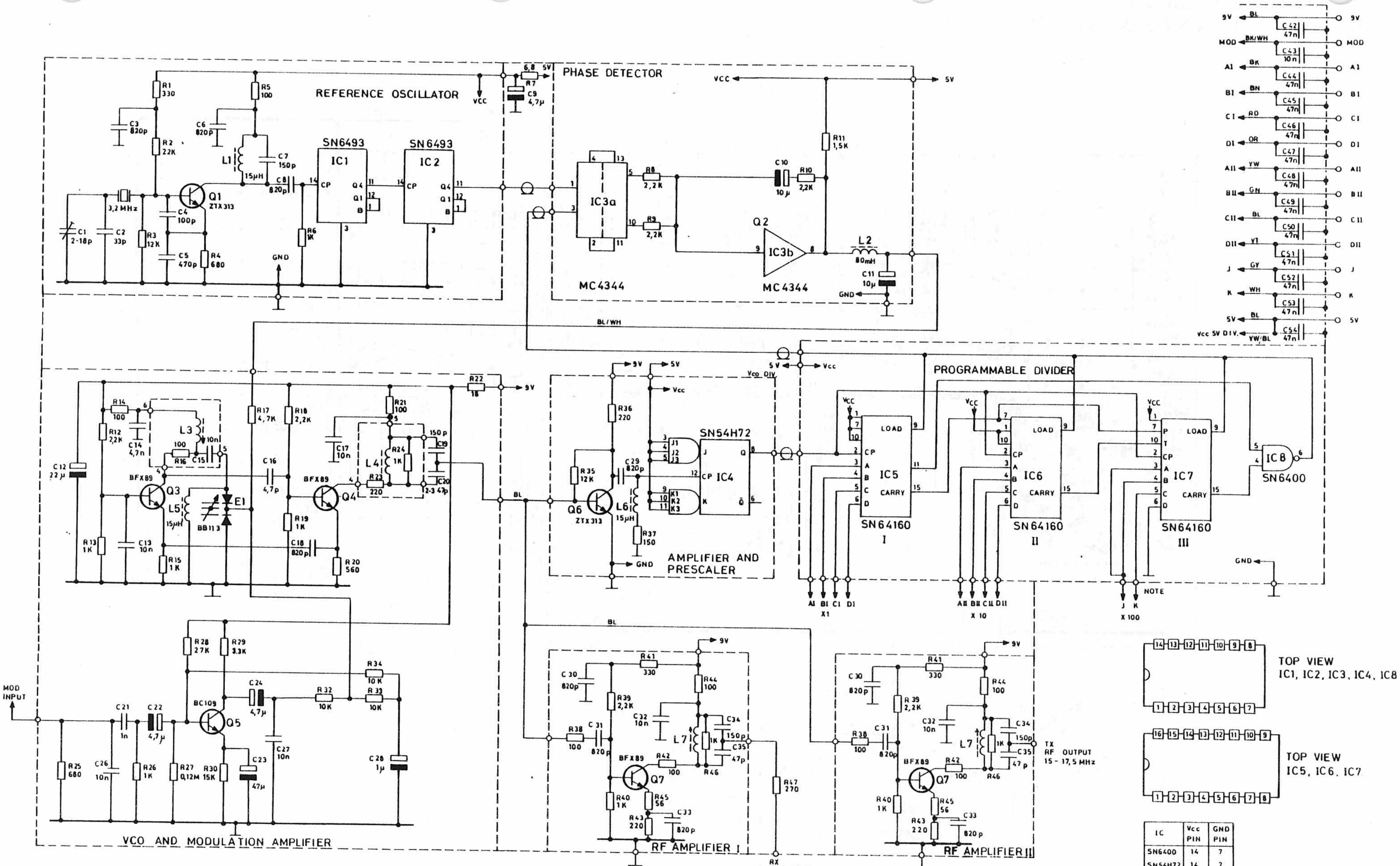
Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

FREQUENCY CONTROL UNIT FC705

D 402.508



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

NOTE: IN CQM713 (X49DK AND X46N) J AND K ARE CONNECTED INTERNALLY IN THE PROGRAMMABLE DIVIDER TO +5V AND CHASSIS RESPECTIVELY.
THESE CONNECTIONS ARE NOT MADE IN CQM763D.

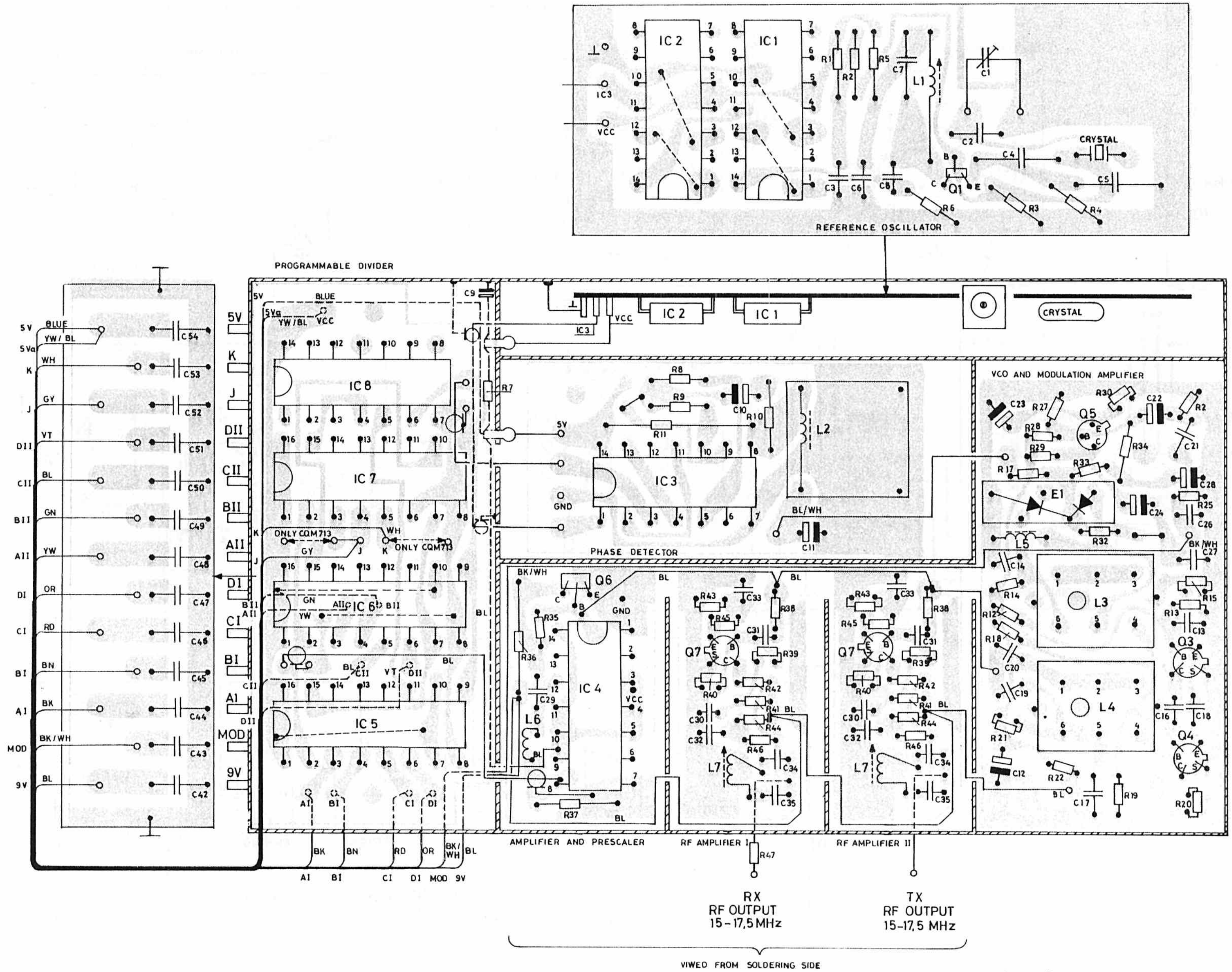
I CQM713D (X49DK OG X46N) ER J OG K STRAPPET TIL H.H.V. 5V OG STEL INTERNT I DEN PROGRAMMERBARE DELER.
I CQM763D ER OVENNÆVNTE STRAPNING IKKE INDFØRT.

FREQUENCY SYNTESIZER
FREKVENSSYNTESEENHED

FS701

D401.714/3

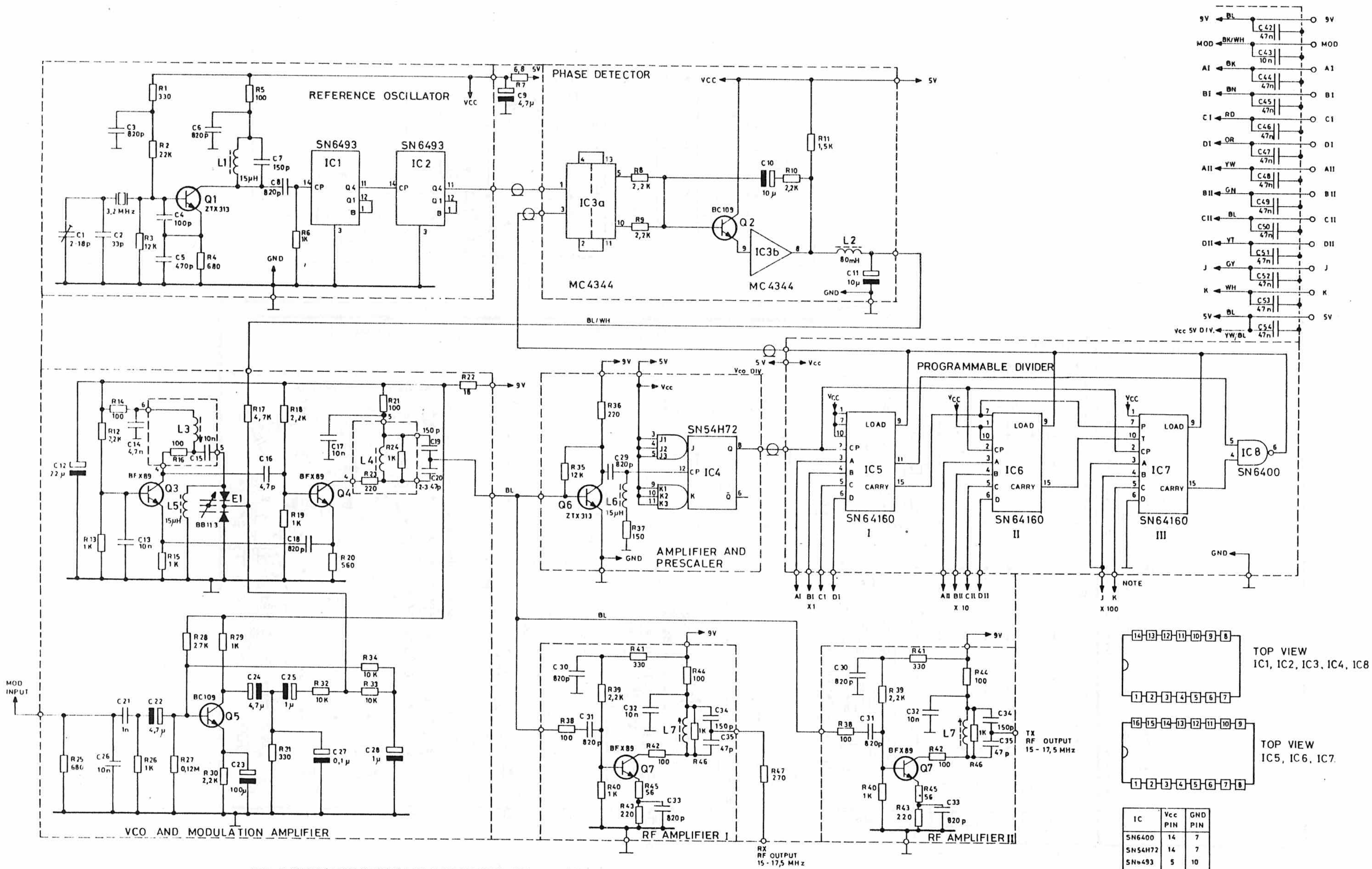
Storno



FREQUENCY SYNTESIZER
FREKVENSSYNTESEENHED

FS701

D401.891/3



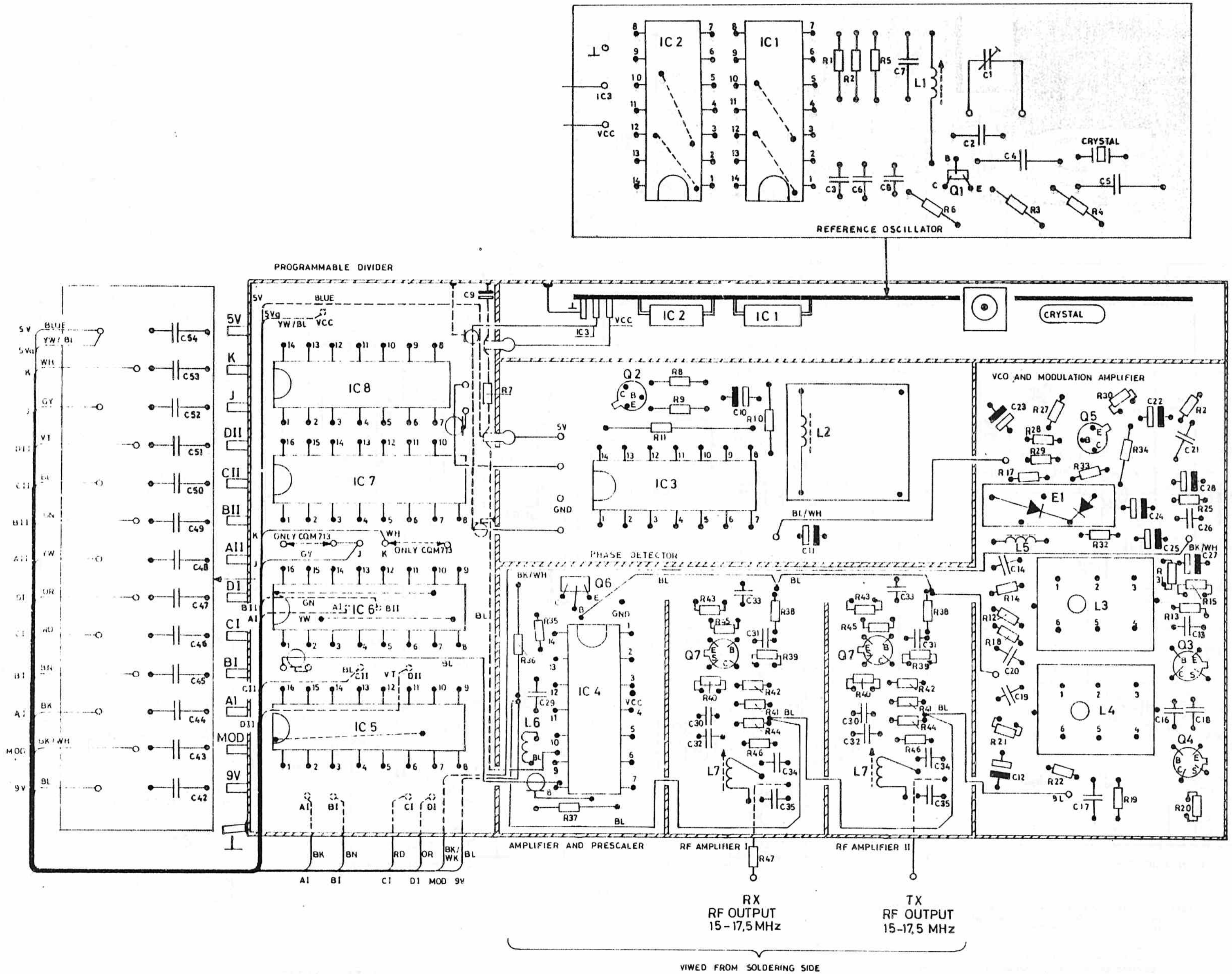
IC	Vcc PIN	GND PIN
SN6400	14	7
SN54H72	14	7
SN6493	5	10
SN64160	16	8
MC4344	14	7

NOTE IN CQM713 (X49DK AND X46N) J AND K ARE CONNECTED INTERNALLY IN THE PROGRAMMABLE DIVIDER TO +5V AND CHASSIS RESPECTIVELY. THESE CONNECTIONS ARE NOT MADE IN CQM763D.

I CQM713D (X49DK OG X46N) ER J OG K STRAPPET TIL H.H.V. 5V OG STEL INTERNT I DEN PROGRAMMERBARE DELER.
I CQM763D ER OVENNÆVNTE STRAPNING IKKE INDFØRT.

FREQUENCY SYNTESIZER
FREKVENSSYNTESEENHED FS701

D401



FREQUENCY SYNTESIZER
FREKVENSSYNTESEENHED

FS701

D

Storno

TYPE	NO.	CODE	DATA	
FS701		10.2923	Frequency Synthesizer	
			PC BOARD	
	C9	73.5126	4.7 μF 20% tantal	35 V
	R7	80.5223	6.8 Ω 5% carbon film	1/8W
	R47	80.5042	270Ω 5% -	1/10W
			CAPACITANCE BOARD	
	C42	74.5283	47 nF 20% ceram CP	50 V
	C43	74.5281	10 nF 20% ceram CP	50 V
	C44 - - C54	74.5283	47 nF 20% ceram CP	50 V
			REFERENCE OSCILLATOR	
	C1	78.5044	2-18 pF trimmer	
	C2	74.5116	33 pF 5% ceram TB	160 V
	C3	74.5314	820 pF -20+80% ceram PL	63 V
	C4	76.5102	100 pF 2.5 % polystyr TB	25 V
	C5	76.5065	470 pF 5% polystyr TB	160 V
	C6	74.5314	820 pF -20+80% ceram PL	63 V
	C7	76.5103	150 pF 2.5 % polystyr TB	25 V
	C8	74.5314	820 pF -20+80% ceram PL	63 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
	R6	80.5049	1 KΩ 5% -	1/10W
	L1	63.5007	15 μH 20% choke	200mA
	Q1	99.5293	Transistor ZTX313	
	IC1	14.5043	SN6493 4-bit binary counter	
	IC2	14.5043	SN6493 4-bit binary counter	
			PHASE DETECTOR	
	C10	73.5109	10 μF 20% tantal	16 V
	C11	73.5109	10 μF 20% tantal	16 V
	R8	80.5053	2.2 KΩ 5% carbon film	1/10W
	R9	80.5053	2.2 KΩ 5% -	1/10W
	R10	80.5053	2.2 KΩ 5% -	1/10W

Storno

TYPE	NO.	CODE	DATA	
	R11	80.5051	1.5 KΩ 5% carbon film	1/10W
	L2	61.1222	80 mH coil	
	Q2	99.5201	Transistor BC109	
	IC3	14.5060	MC4344 Phase/frequency detector	
			VCO AND MODULATION AMPLIFIER	
	C12	73.5127	22 μF 20% tantal	16 V
	C13	76.5070	10 nF 10% polyester FL	50 V
	C14	76.5061	4.7 nF 10% polyester FL	50 V
	C15	76.5070	10 nF 10% polyester FL	50 V
	C16	74.5318	4.7 pF ± 0.25 pF ceram PL	100 V
	C17	76.5070	10 nF 10% polyester FL	50 V
	C18	74.5314	820 pF -20+80% ceram PL	63 V
	C19	76.5103	150 pF 2.5 % polyester TB	25 V
	C20	74.5319	47 pF 2% ceram PL	100 V
	C21	76.5069	1 nF 10% polystyr FL	50 V
	C22	73.5126	4.7 μF 20% tantal	35 V
	C23	73.5128	100 μF 20% taltal	3 V
	C24	73.5126	4.7 μF 20% tantal	35 V
	C25	73.5135	1 μF -20+80% tantal	16 V
	C26	76.5070	10 nF 10% polyester FL	50 V
	C27	73.5089	0.1 μF 20% tantal	35 V
	C28	73.5135	1 μF -20+50% tantal	16 V
	R12	80.5053	2.2 KΩ 5% carbon film	1/10W
	R13	80.5049	1 KΩ 5% -	1/10W
	R14	80.5037	100Ω 5% -	1/10W
	R15	80.5049	1 KΩ 5% -	1/10W
	R16	80.5037	100Ω 5% -	1/10W
	R17	80.5057	4.7 KΩ 5% -	1/10W
	R18	80.5053	2.2 KΩ 5% -	1/10W
	R19	80.5049	1KΩ 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	220Ω 5% -	1/10W
	R24	80.5049	1 KΩ 5% -	1/10W
	R25	80.5047	120 KΩ 5% -	1/10W

FREQUENCY SYNTHESIZER FS701
FREKVENSSYNTESEENHED

X401.863

TYPE	NO.	CODE	DATA	
	R26	80.5049	1 KΩ 5% carbon film	1/10W
	R27	80.5074	120 KΩ 5% -	1/10W
	R28	80.5066	27 KΩ 5% -	1/10W
	R29	80.5049	1 KΩ 5% -	1/10W
	R30	80.5053	2.2. KΩ 5% -	1/10W
	R31	80.5043	330 Ω 5% -	1/10W
	R32	80.5061	10 KΩ 5% -	1/10W
	R33	80.5061	10 KΩ 5% -	1/10W
	R34	80.5061	10 KΩ 5% -	1/10W
	L3	61.1220	RF coil	
	L4	61.1221	RF coil	
	L5	63.5007	15 μH 20% choke	200 mA
	E1	99.5292	Triple cap. diode BB113	
	Q3	99.5240	Transistor BFX89	
	Q4	99.5240	Transistor BFX89	
	Q5	99.5201	Transistor BC109	
			AMPLIFIER AND PRESCALER	
	C29	74.5314	820 pF -20+80% ceram PL	63 V
	R35	80.5062	12 KΩ 5% carbon film	1/10W
	R36	80.5241	220Ω 5% -	1/8W
	R37	80.5039	150Ω 5% -	1/10W
	L6	63.5007	15 μH 20% choke	200mA
	Q6	99.5293	Transistor ZTX313	
	IC4	14.5062	SN54H72 Gated J-K flip-flop	
			PROGRAMMABLE DIVIDER	
	IC5	14.5061	SN64160 Synkronous decade counter	
	IC6	14.5061	SN64160 - - -	
	IC7	14.5061	SN64160 - - -	
	IC8	14.5024	SN6400 Quadr. 2-input NAND-gate	
			RF AMPLIFIERS (2 identical modules)	
	C30	74.5314	820 pF -20+80 % ceram PL	63 V
	C31	74.5314	820 pF -20+80% ceram PL	63 V
	C32	76.5070	10 nF 10% polyester FL	50 V

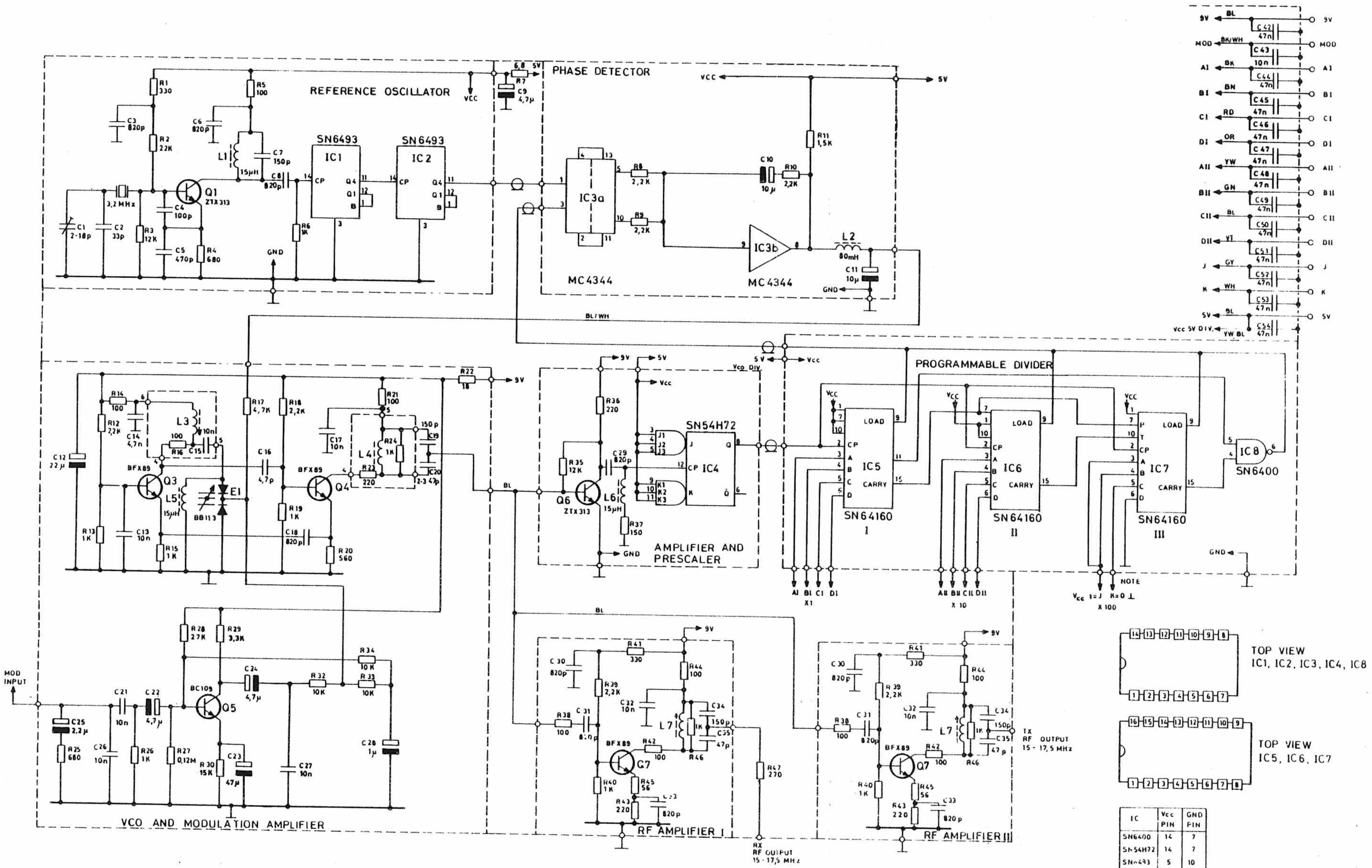
TYPE	NO.	CODE	DATA	
	C33	74.5314	820 pF -20+80% ceram PL	25 V
	C34	76.5103	150 pF 2.5 % polyestyren TB	100 V
	C35	74.5319	47 pF 2% ceram PL	100 V
	R38	80.5037	100Ω 5% carbon film	1/10W
	R39	80.5053	2.2 KΩ -	1/10W
	R40	80.5049	1 KΩ 5% -	1/10W
	R41	80.5043	330Ω 5% -	1/10W
	R42	80.5037	100 Ω 5% -	1/10W
	R43	80.5041	220Ω 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
	L7	61.1233	RF coil	
	Q7	99.5240	Transistor BFX89	

FREQUENCY SYNTHESIZER
FREKVENSSYNTESEENHED

FS701

X401.863

Storno



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

FREQUENCY SYNTESIZER
FREKVENSSYNTESEENHED

FS702

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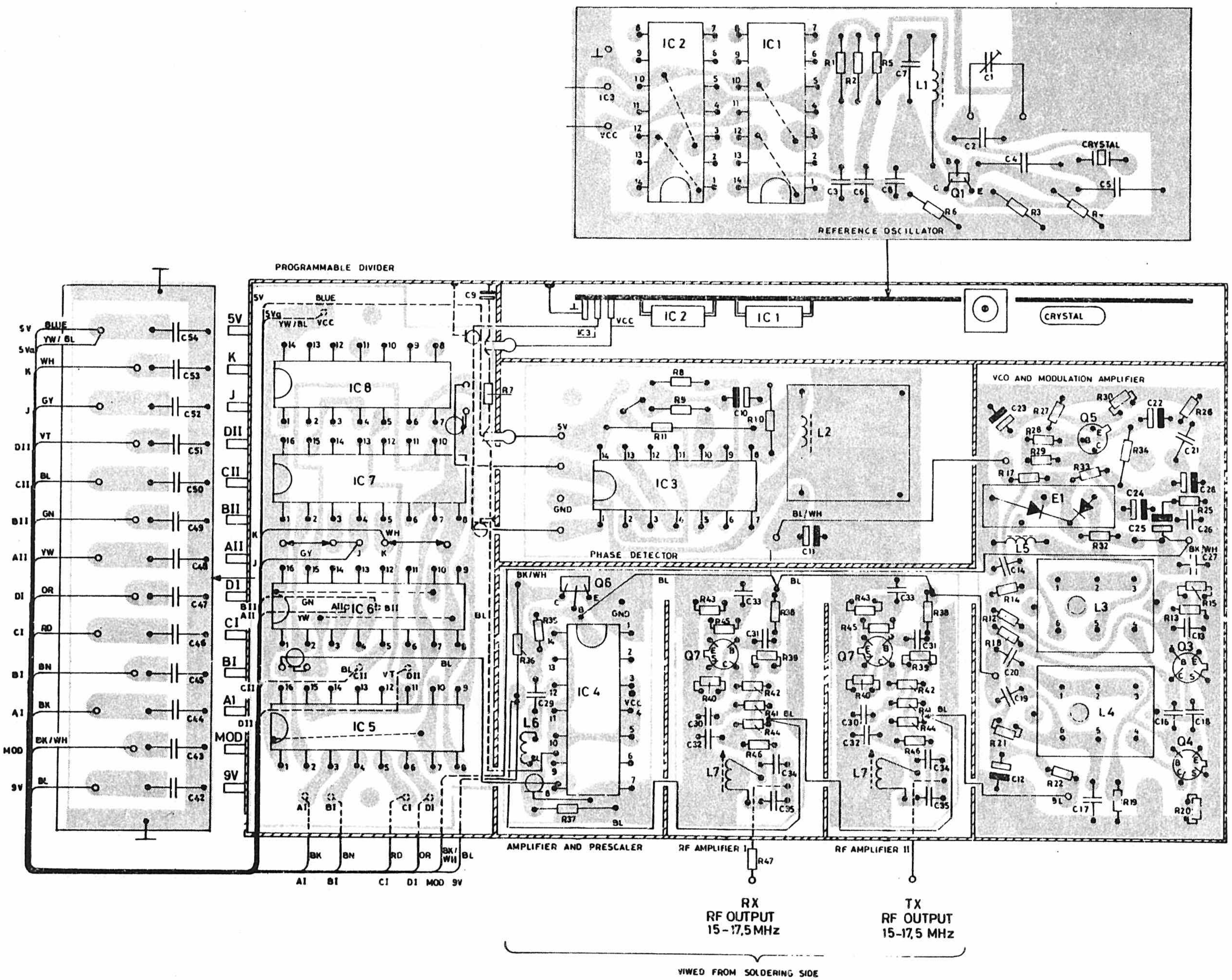


FREQUENCY SYNTESIZER
FREKVENSSYNTESEENHED

FS702

D402.550

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

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

STORNOPHONE 700

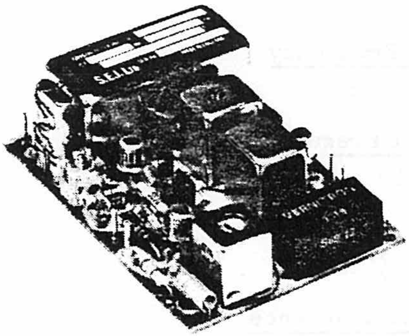
MAINTENANCE MANUAL

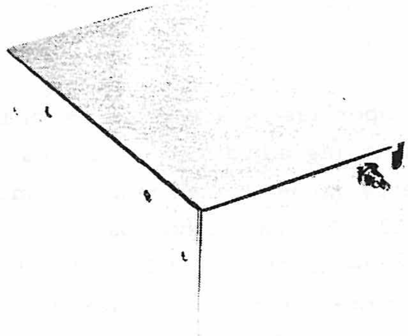
VOLUME II

Section 4

TITLE		Code
IC700	Description	60.185-E1
IC701	Schematic	D401.326/3
	Part List	X401.315/3
IC703	Schematic	D401.327/2
	Part List	X401.314/3
IC704	Schematic	D401.365/3
	Part List	X401.795/2
IC705	Schematic	D402.373
	Part List	X402.611
ID701	Schematic	D401.885/2
	Part List	X402.105
MT701	Schematic	D401.844
	Part List	X401.965
MT704	Installation	D402.507/2

IF CONVERTER IC701/IC703/IC704





Description

General

The IF converter converts the receiver section's 1st intermediate frequency of 10.7 MHz to 455 kHz which is the 2nd intermediate frequency

IC701 is employed in equipment for 50 kHz channel separation.
IC703 is employed in equipment for 25 kHz and for 20 kHz separation.
IC704 is employed in equipment for 12.5 kHz channel separation.

All IC700 units contain the following stages:
a 10.7 MHz crystal filter
a high intermediate frequency amplifier
a local oscillator
a mixer
a 455 kHz ceramic filter

Crystal Filters

The requirements for selectivity are partly met through use of the crystal filter and partly through the 455 kHz ceramic filter in the output of the unit.

There are 3 different crystal filters employed, according to channel separation. One is for IC701, one is for IC703 and the last is for IC704. In IC701 and IC703 there are 4 crystals in the filter and in IC704 there are 6. The matching impedances for all three types are identical.

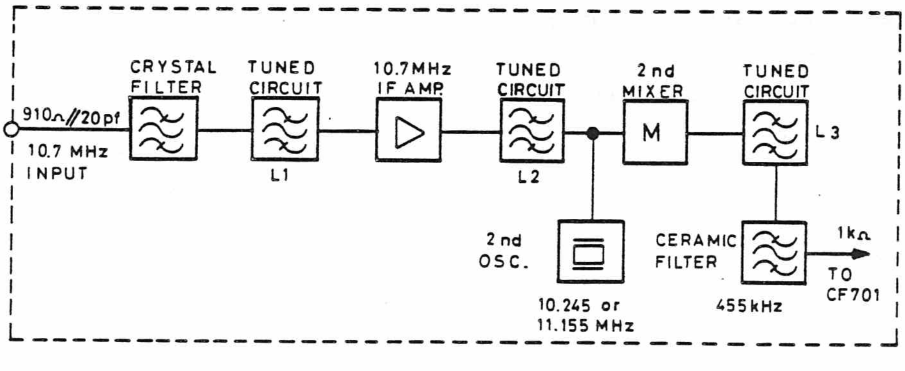
The crystal filter is coupled to the high intermediate frequency stage, Q1, through a parallel resonant circuit.

High IF Amplifier

A transistor having a low noise figure and minimum internal feedback is chosen for this circuit so that variations in the collector impedance will have negligible influence on the crystal matching impedance.

Oscillator

The oscillator is a crystal driven Colpitts oscillator in a grounded collector configuration. The crystal frequency is normally 10.245 MHz but in cases where



Storno

a harmonic of the local oscillator coincides with the receiver antenna frequency, interference can occur. Therefore, a crystal frequency of 11.155 MHz would be employed instead.

The crystal operates in a parallel resonant circuit; fine-tuning adjustment of the oscillator frequency is performed with trimmer capacitor C12. The capacitive load for the crystal is made up of C14, C15 and C16, which also forms the necessary feedback loop. Variations in the IF amplifier have negligible influence on the oscillator frequency.

Mixer

The local oscillator signal and the 10.7 MHz IF signal are applied to the base of Q2. To achieve greater amplification, a bipolar transistor is employed here. In order that the bipolar mixer, however, does not deteriorate the excellent blocking and intermodulation characteristics achieved with the FET mixer in the receiver converter module, the crystal filter has been inserted.

Ceramic Filter

From the collector of the 2nd mixer the signal is passed via matching network L3 to a ceramic 455 kHz filter.

There are 3 different types of ceramic filters, one for each IC700 unit.

Strong signals can alter the output impedance of the 2nd mixer as well as the input impedance in the CF701 unit. Attenuating resistors are therefore inserted before and after the ceramic filter in order to ensure the least possible variation in filter matching impedance.
From the output of the ceramic filter the 455 kHz IF signal is coupled to the IF circuitry in CF701.

Technical Specifications

Converter IC701

Input Frequency
10.7 MHz

Output Frequency
455 kHz

Input Impedance
910 Ω // 20 pF

Output Impedance
1 kΩ

Maximum Frequency Diviation
± 15 kHz

Bandwidth
At 3 dB attenuation relative to 10.7 MHz:
> ± 12 kHz
< ± 20 kHz
At 70 dB attenuation relative to 10.7 MHz:
< ± 35 kHz

Bandpass Ripple (typ. 1 dB)

gar. < 3 dB

Oscillator Frequency
Crystal spec. S-98-12 in temp. range
-25° to $+65^{\circ}$C: 10.245 MHz or 11.155 MHz

Oscillator Frequency adjustable by
$> \pm 30 \times 10^{-6}$

Voltage Gain (typ. 23 dB)
gar. > 20 dB

Current Consumption typ. 8 mA

Temperature Range
operating range: -25° to $+65^{\circ}$C
functioning range: -30° to $+75^{\circ}$C

Storno

Converter IC703

Input Frequency

10.7 MHz

Output Frequency

455 kHz

Input Impedance

910 Ω// 20 pF

Output Impedance

1 kΩ

Maximum Frequency Deviation

At 20 kHz bandwidth: ± 4 kHz

At 25 kHz bandwidth: ± 5 kHz

Bandwidth

At 3 dB attenuation relative to 10.7 MHz:

> ± 5 kHz

< ± 8.5 kHz

At 75 dB attenuation relative to 10.7 MHz:

± 17 kHz

Band-pass Ripple (typ. 1 dB)

gar. < 3 dB

Oscillator Frequency

Crystal specification S-98-12 in temp. range -25° to $+65^{\circ}$C: 10.245 MHz or 11.155 MHz

Oscillator Frequency Adjustable by

> ± 30 x 10^{-6}

Voltage Gain (typ. 26 dB)

gar. > 23 dB

Current Consumption typ. 8 mA

Temperature Range

operating range: –25 to $+65^{\circ}$C

functioning range: –30 to $+75^{\circ}$C

Converter IC704

Input Frequency

10.7 MHz

Output Frequency

455 kHz

Input Impedance

910 Ω//20 pF

Output Impedance

1 kΩ

Maximum Frequency Deviation

± 2.5 kHz

Bandwidth

at 3 dB attenuation relative to 10.7 MHz:

> ± 2.7 kHz

at 6 dB attenuation relative to 10.7 MHz:

< ± 3.8 kHz

at 80 dB attenuation relative to 10.7 MHz:

< ± 10 kHz

Band-Pass Ripple, typ. 1 dB: gar. < 3 dB

Oscillator Frequency

Crystal spec. S-98-12 in temperature range -25° to $+65^{\circ}$C: 10.245 or 11.155 MHz

Oscillator Frequency Adjustable by

> ± 30 x 10^{-6}

Voltage Gain (typ. 23 dB)

gar. > 20 dB

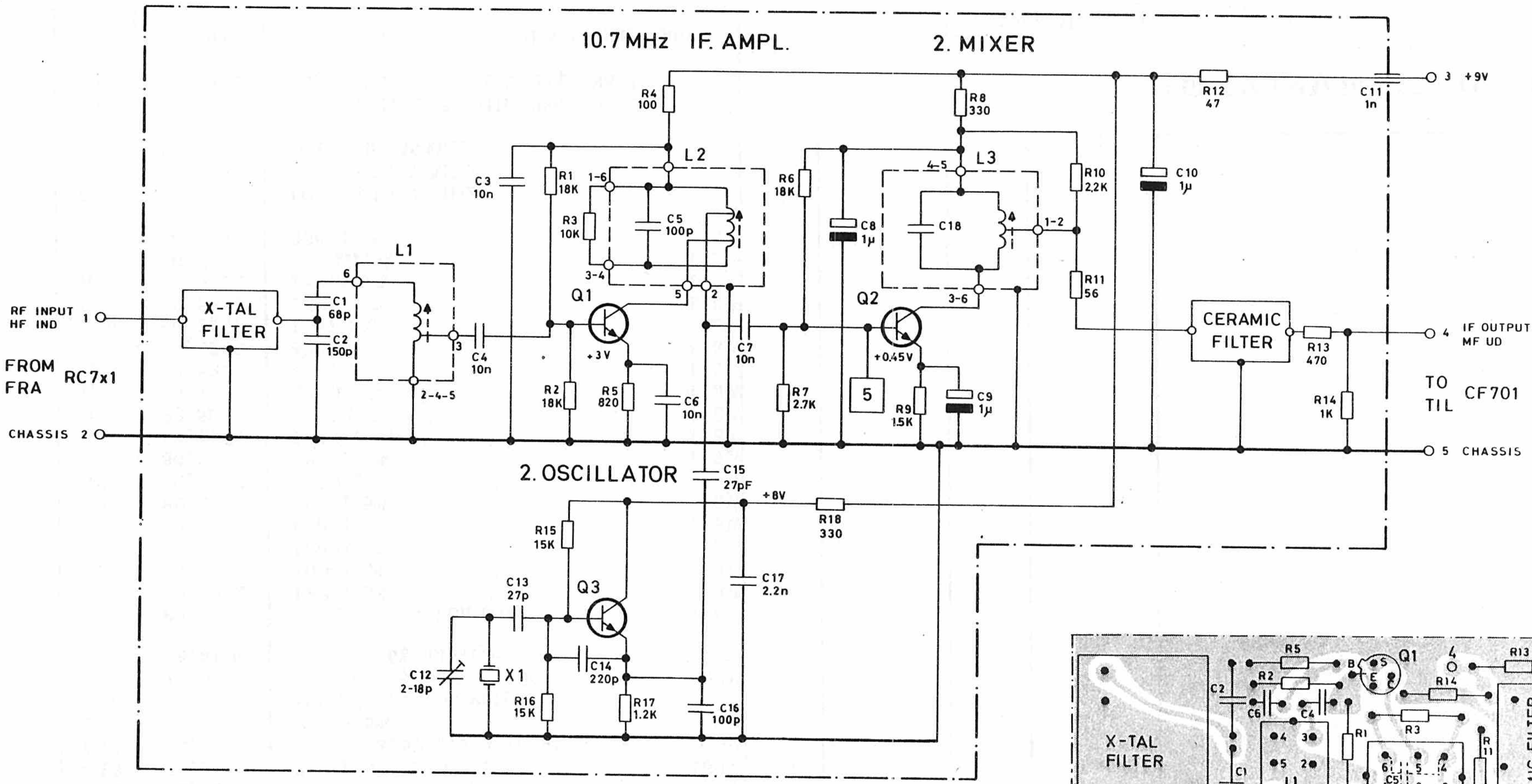
Current Consumption

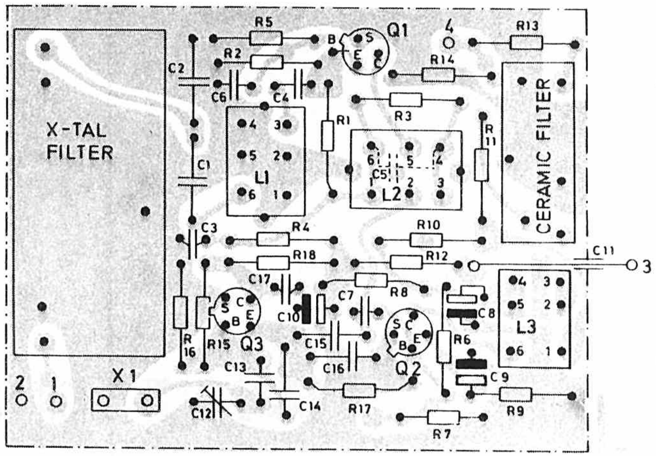
8 mA

Temperature Range

operating range: -25° to $+65^{\circ}$C

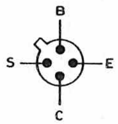
functioning range: -30° to $+75^{\circ}$C



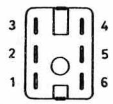


PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

Q1-Q3



L1-L2-L3



BOTTOM VIEW
SET FRA BUNDEN

IF CONVERTER IC701

D 401.326/3

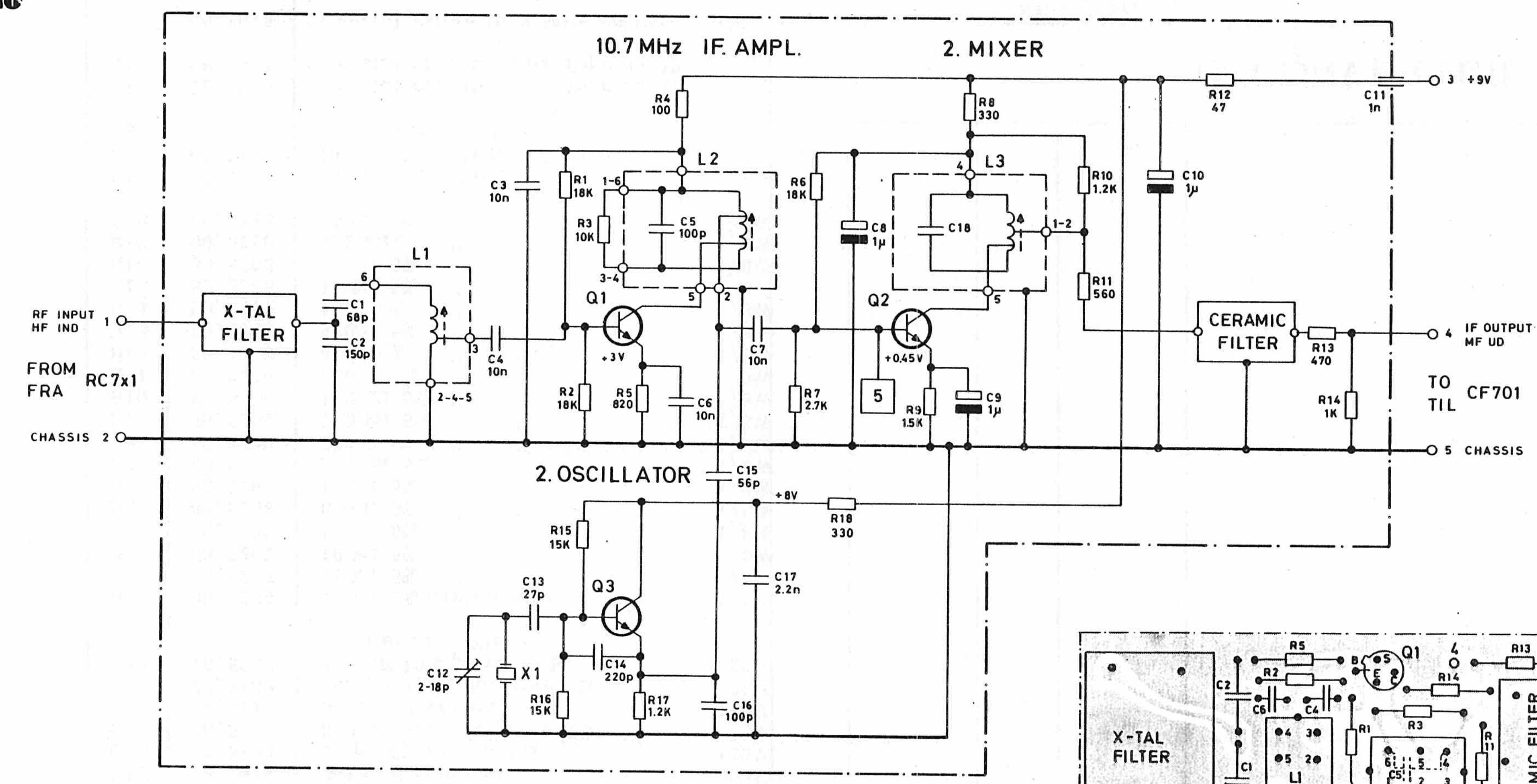
TYPE	NO.	CODE	DATA	
IC701		10.2435	IF Converter	
	C1	76.5101	68 pF 2.5% polystyr TB	25V
	C2	76.5103	150 pF 2.5% polystyr TB	25V
	C3	76.5070	10 nF 10% polyest. FL	50V
	C4	76.5070	10 nF 10% polyest. FL	50V
	C5	76.5102	100 pF 2.5% polystyr TB	25V
	C6	76.5070	10 nF 10% polyest. FL	50V
	C7	76.5070	10 nF 10% polyest. FL	50V
	C8	73.5114	1 µF 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	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	80.5251	1.5 kΩ 5% " "	1/8W
	R10	80.5253	2.2KΩ 5% " "	1/8W
	R11	80.5234	56 Ω 5% " "	1/8W
	R12	80.5233	47 Ω 5% " "	1/8W
	R13	80.5245	470 Ω 5% " "	1/8W
	R14	80.5249	1 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	
		69.5015	Crystal Filter 10.7 MHz 50 KHz 50dB	

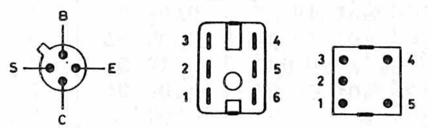
Storno

TYPE	NO.	CODE	DATA
		69.5013-00	Ceramic Filter 455 kHz
	Q1	99.5168	BF173 Transistor
	Q2	99.5166	BF167 Transistor
	Q3	99.5168	BF173 Transistor

IF CONVERTER IC701

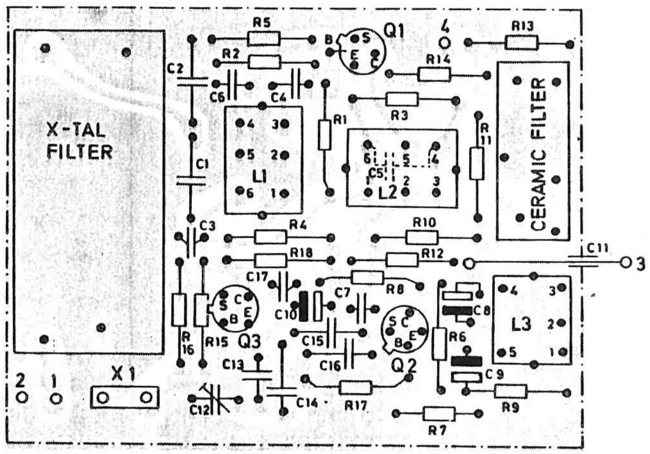
Storno





BOTTOM VIEW
SET FRA BUNDEN

PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



IF CONVERTER IC701

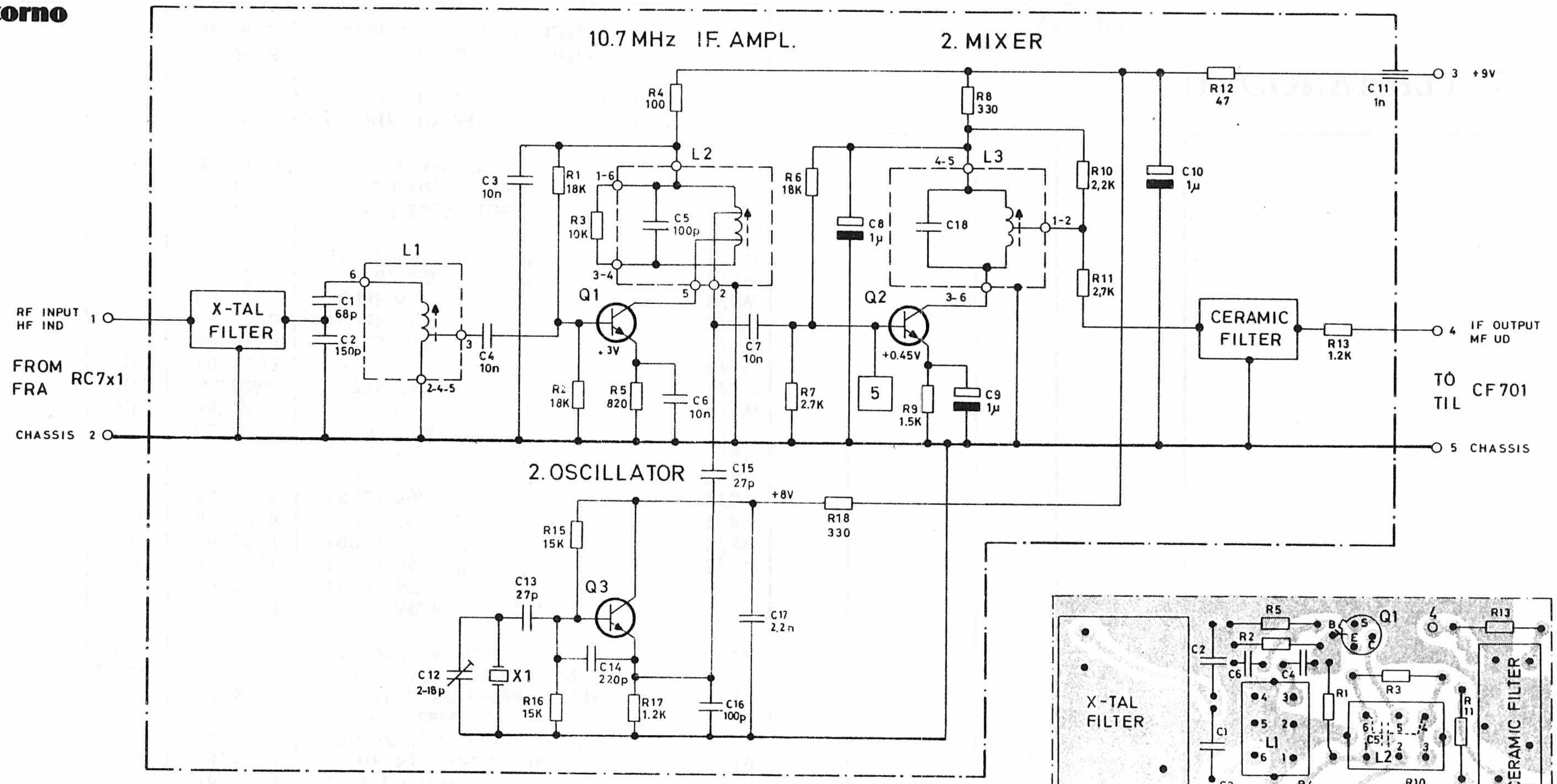
D 401.326/2

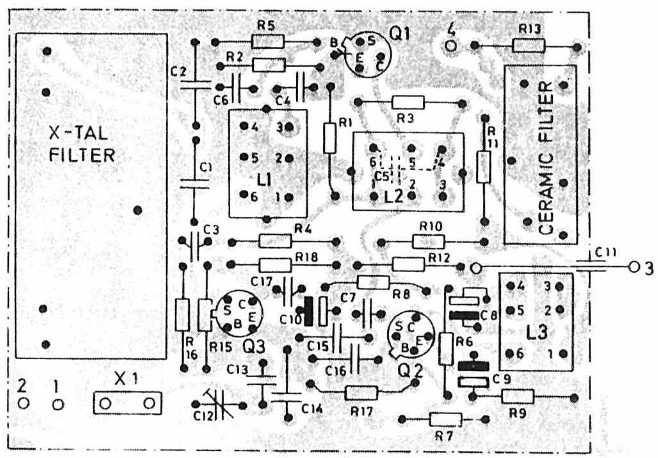
TYPE	NO.	CODE	DATA	
IC701		10.2435	IF Converter	
	C1	76.5101	68 pF 2.5% polystyr TB	25V
	C2	76.5103	150 pF 2.5% polystyr TB	25V
	C3	76.5070	10 nF 10% polyest. FL	50V
	C4	76.5070	10 nF 10% polyest. FL	50V
	C5	76.5102	100 pF 2.5% polystyr TB	25V
	C6	76.5070	10 nF 10% polyest. FL	50V
	C7	76.5070	10 nF 10% polyest. FL	50V
	C8	73.5114	1 μF 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	74.5111	56 pF 5% ceram	160V
	C16	76.5102	100 pF 2.5% polystyr TB	25V
	C17	76.5059	2.2 nF 10% polyest. FL	50V
	C18		See Ceramic Filter	
	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	80.5251	1.5 kΩ 5% " "	1/8W
	R10	80.5250	1.2 kΩ 5% " "	1/8W
	R11	80.5246	560 Ω 5% " "	1/8W
	R12	80.5233	47 Ω 5% " "	1/8W
	R13	80.5245	470 Ω 5% " "	1/8W
	R14	80.5249	1 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		See Ceramic Filter	
	X1	98.5010	Crystal 10.2450 MHz Type 98-12	
	X1	98.5011	Crystal 11.1550 MHz Type 98-12	
		69.5015	Crystal Filter 10.7 MHz 50 KHz 50dB	

TYPE	NO.	CODE	DATA
		69.5013-01	Ceramic Filter 455 kHz L3 and C18 included
	Q1	99.5168	BF173 Transistor
	Q2	99.5166	BF167 Transistor
	Q3	99.5168	BF173 Transistor

IF CONVERTER IC701

Storno

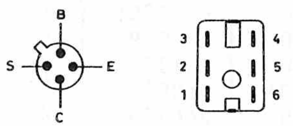




PRINTED CIRCUIT VIWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN.

Q1-Q3

L1-L2-L3



BOTTOM VIEW
SET FRA BUNDEN

Storno

IF CONVERTER
MF KONVERTER

IC703

D401.327/2

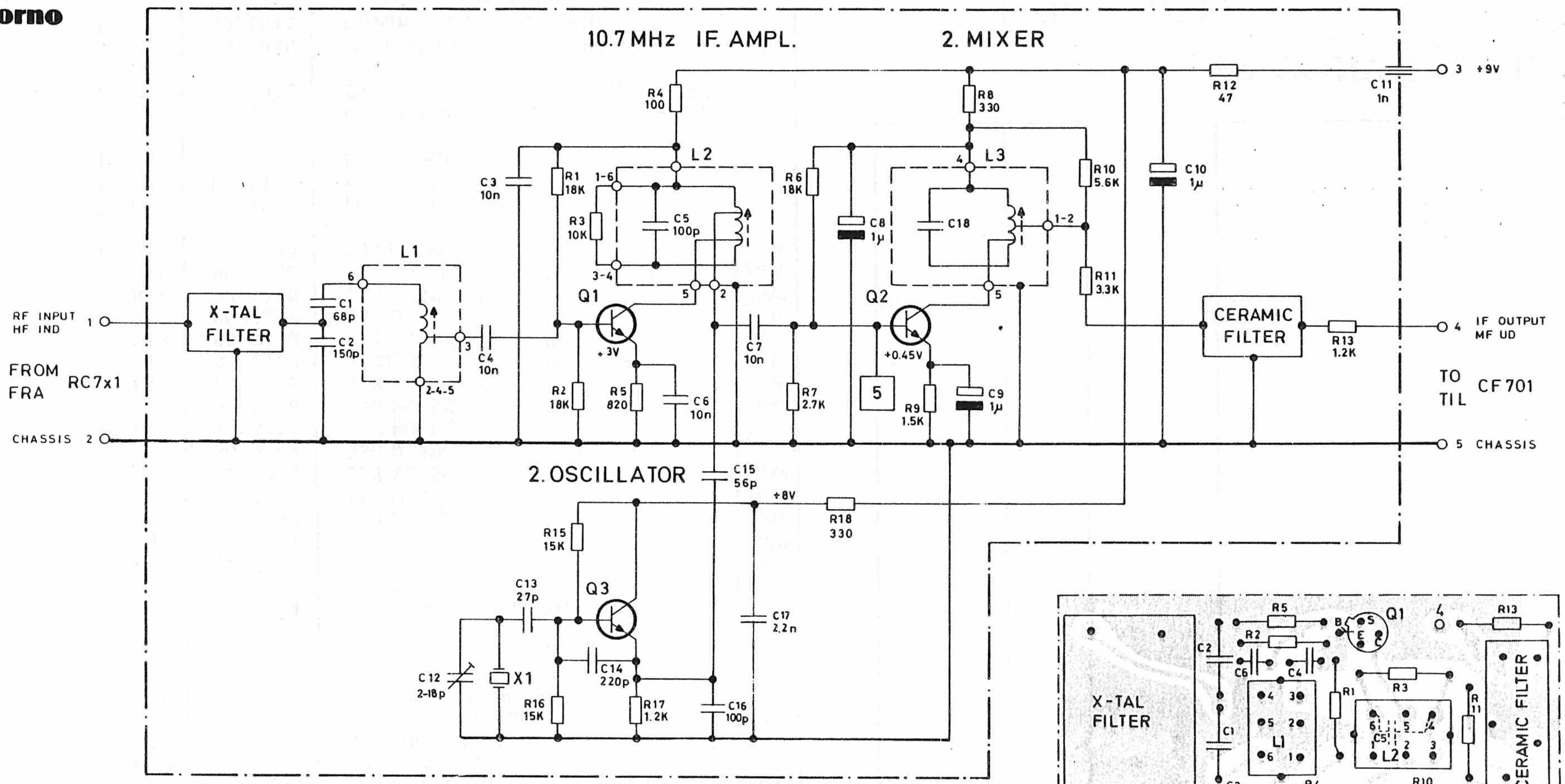
TYPE	NO.	CODE	DATA	
IC703		10.2432	IF Converter	
	C1	76.5101	68 pF 2.5% polystyr TB	25V
	C2	76.5103	150 pF 2.5% polystyr TB	25V
	C3	76.5070	10 nF 10% polyest. FL	50V
	C4	76.5070	10 nF 10% polyest. FL	50V
	C5	76.5102	100 pF 2.5% polystyr TB	25V
	C6	76.5070	10 nF 10% polyest. FL	50V
	C7	76.5070	10 nF 10% 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	

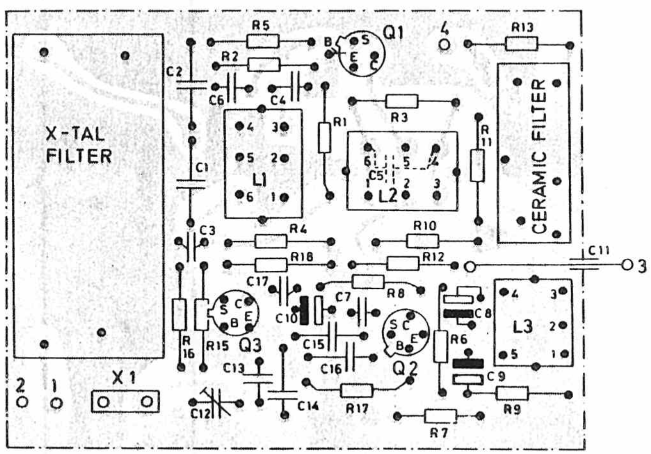
Storno

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

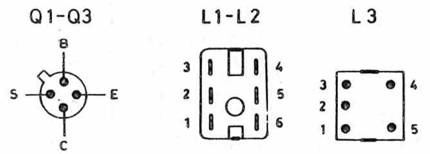
IF CONVERTER IC703

 Storno





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



BOTTOM VIEW
SET FRA BUNDEN

IF CONVERTER
MF KONVERTER

IC703

D401.327

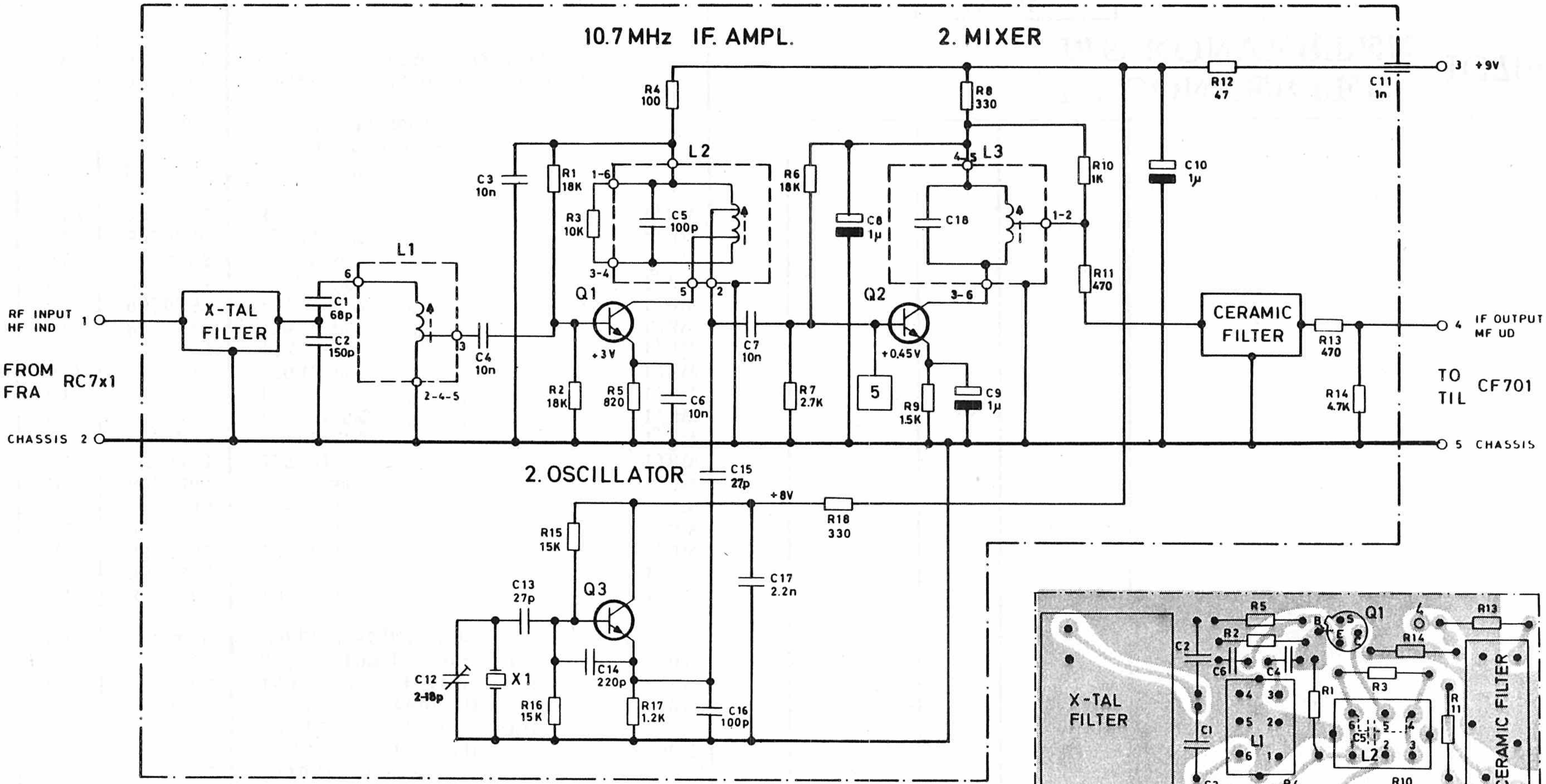
TYPE	NO.	CODE	DATA	
IC703		10.2432	IF Converter	
	C1	76.5101	68 pF 2.5% polystyr TB	25V
	C2	76.5103	150 pF 2.5% polystyr TB	25V
	C3	76.5070	10 nF 10% polyest. FL	50V
	C4	76.5070	10 nF 10% polyest. FL	50V
	C5	76.5102	100 pF 2.5% polystyr TB	25V
	C6	76.5070	10 nF 10% polyest. FL	50V
	C7	76.5070	10 nF 10% 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	74.5111	56 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		See Ceramic Filter	
	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	80.5258	5.6 kΩ 5% " "	1/8W
	R11	80.5255	3.3 kΩ 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		See Ceramic Filter	
	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	
		69.5014	Ceramic Filter 455 kHz L3 and C18 included	

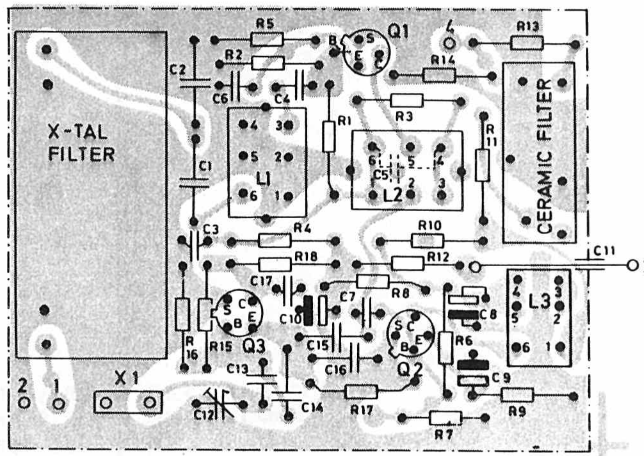
Storno

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

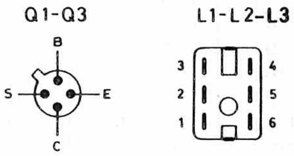
IF CONVERTER IC703

Storno





PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



BOTTOM VIEW
SET FRA BUNDEN

IF CONVERTER
MF KONVERTER

IC704

D401.365/3

Storno

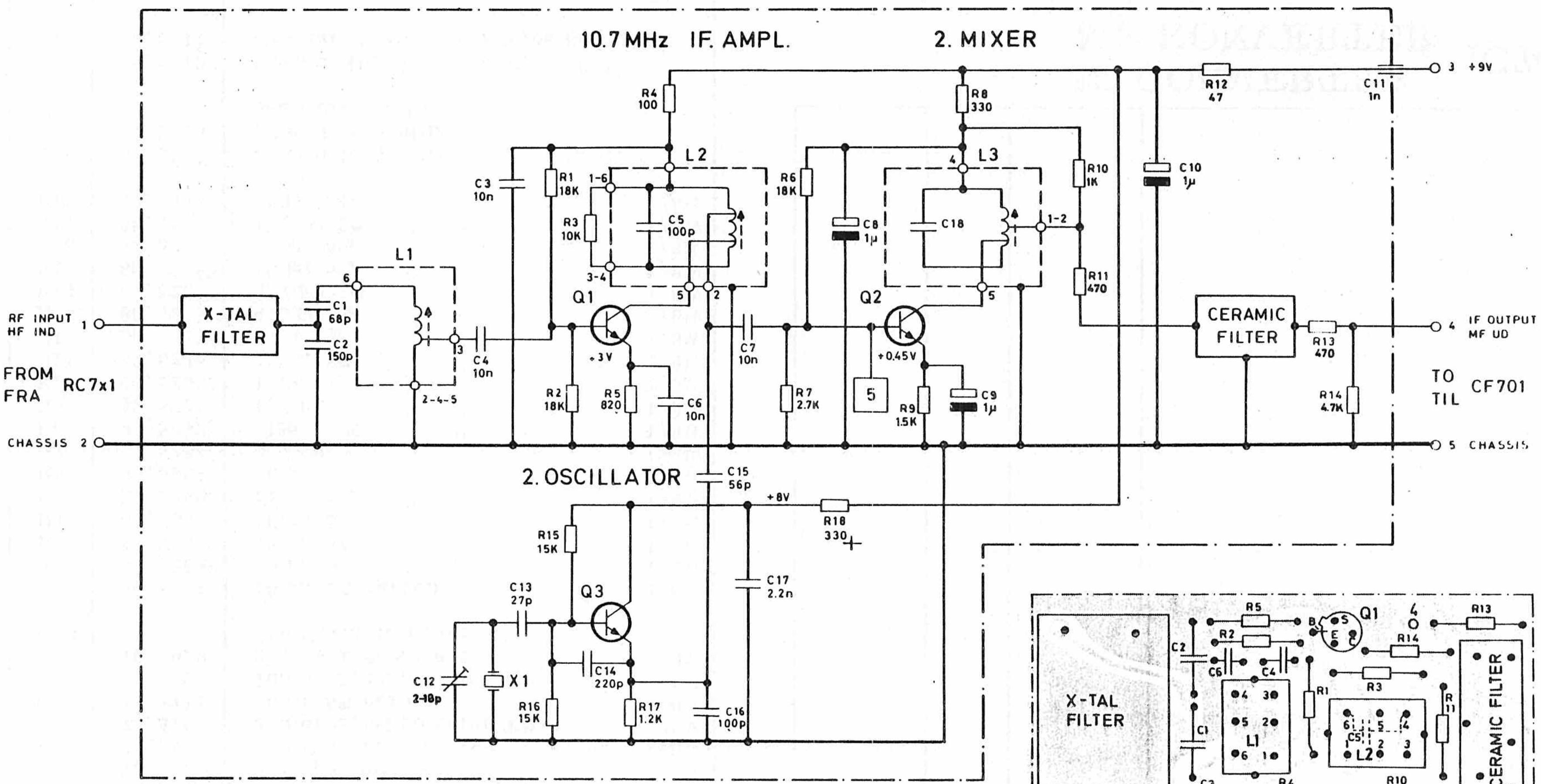
TYPE	NO.	CODE	DATA	
IC704		10.2517	IF Converter	
	C1	76.5101	68 pF 2.5% polystyr TB	25V
	C2	76.5103	150 pF 2.5% polystyr TB	25V
	C3	76.5070	10 nF 10% polyest. FL	50V
	C4	76.5070	10 nF 10% polyest. FL	50V
	C5	76.5102	100 pF 2.5% polystyr TB	25V
	C6	76.5070	10 nF 10% polyest. FL	50V
	C7	76.5070	10 nF 10% polyest. FL	50V
	C8	73.5114	1 µF 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	80.5251	1.5 kΩ 5% " "	1/8W
	R10	80.5249	1 kΩ 5% " "	1/8W
	R11	80.5245	470 Ω 5% " "	1/8W
	R12	80.5233	47 Ω 5% " "	1/8W
	R13	80.5245	470 Ω 5% " "	1/8W
	R14	80.5257	4.7 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	

Storno

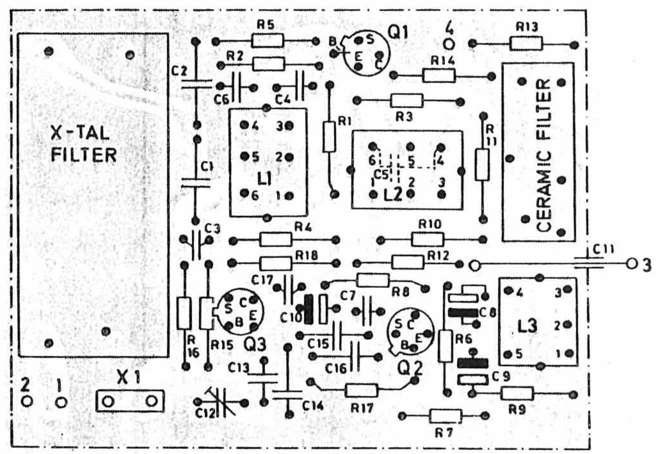
TYPE	NO.	CODE	DATA
		69.5018	Crystal Filter 10.7 MHz
		69.5014-00	Ceramic Filter 455 kHz
	Q1	99.5168	BF173 Transistor
	Q2	99.5166	BF167 Transistor
	Q3	99.5168	BF173 Transistor

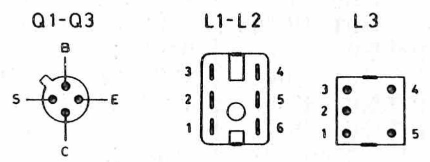
IF CONVERTER
MF KONVERTER
IC704

X401.795/2



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN





BOTTOM VIEW
SET FRA BUNDEN

IF CONVERTER
MF KONVERTER

IC704

D401.365/2

TYPE	NO.	CODE	DATA	
IC704		10.2517	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	1 μF 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	74.5111	56 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		See Ceramic Filter	
	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	80.5251	1.5 kΩ 5% " "	1/8W
	R10	80.5249	1 kΩ 5% " "	1/8W
	R11	80.5245	470 Ω 5% " "	1/8W
	R12	80.5233	47 Ω 5% " "	1/8W
	R13	80.5245	470 Ω 5% " "	1/8W
	R14	80.5257	4.7 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		See Ceramic Filter	
	X1	98.5010	Crystal 10.2450 MHz Type 98-12	
	X1	98.5011	Crystal 11.1550 MHz Type 98-12	

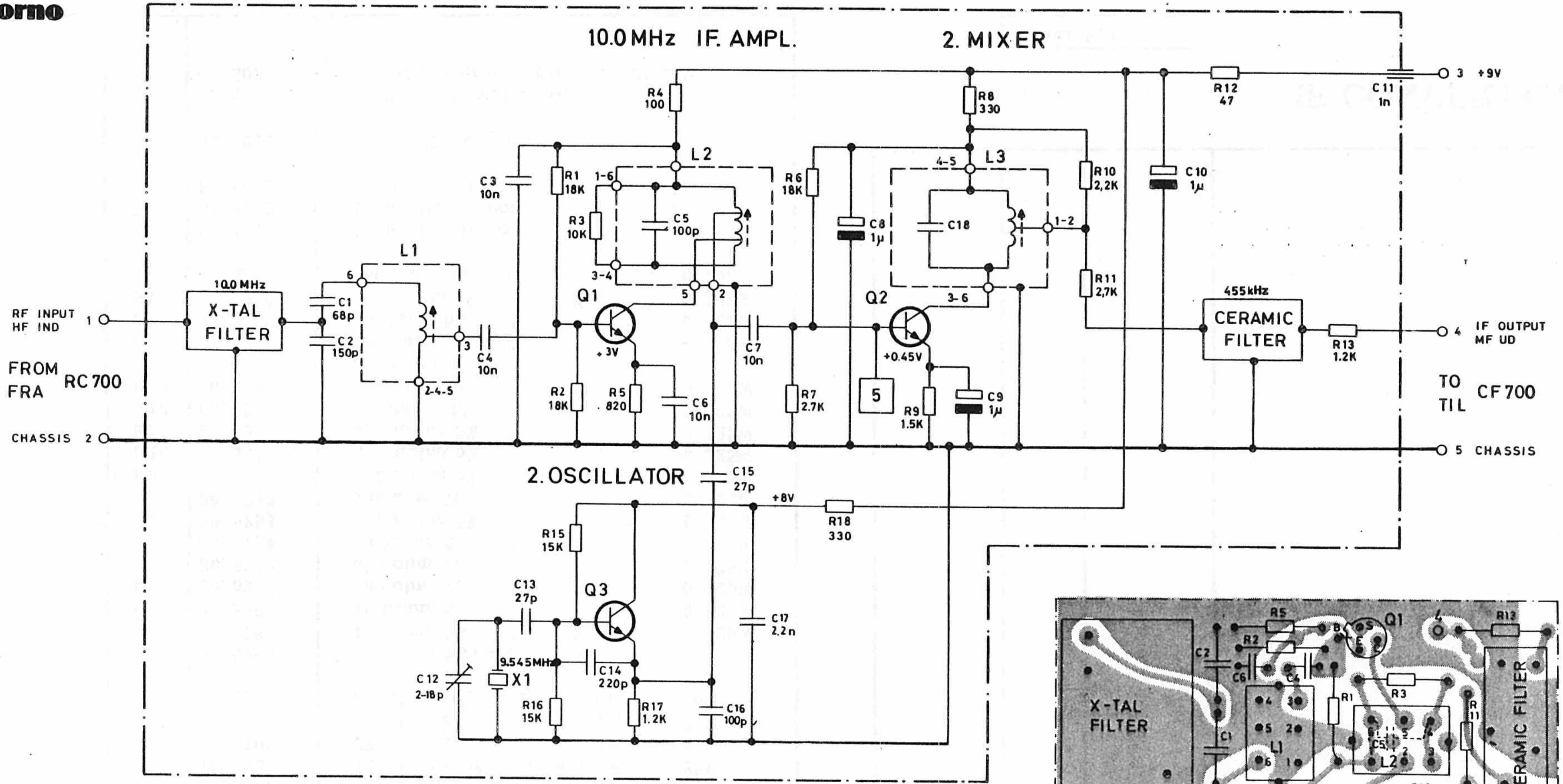
Storno

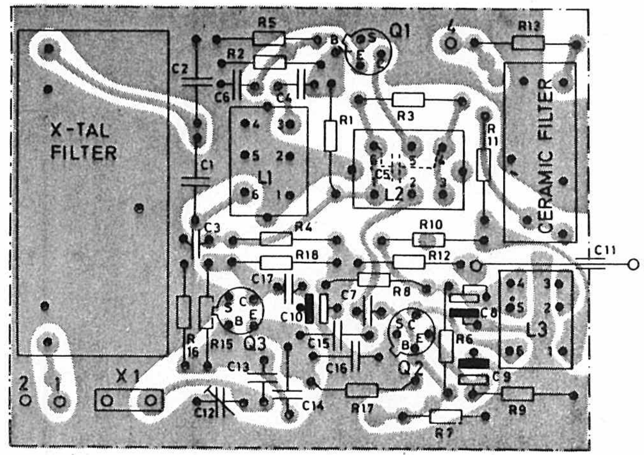
TYPE	NO.	CODE	DATA
		69.5018	Crystal Filter 10.7 MHz
		69.5019	Ceramic Filter 455 kHz
			L3 and C18 included
	Q1	99.5168	BF173 Transistor
	Q2	99.5166	BF167 Transistor
	Q3	99.5168	BF173 Transistor

IF CONVERTER
MF KONVERTER

IC704

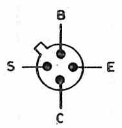
X401.795



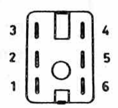


PRINTED CIRCUIT VIWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN.

Q1-Q3



L1-L2-L3



BOTTOM VIEW
SET FRA BUNDEN

IF CONVERTER
MF KONVERTER

IC705

D402.373

Storno

Storno

TYPE	Nº	CODE	DATA
		10.3498	IC 705 IF Converter
	C1	76.5101	68pF 2.5% polystyr. TB 25V
	C2	76.5103	150pF 2.5% polystyr. TB 25V
	C3	76.5070	10nF 10% polyest. FL 50V
	C4	76.5070	10nF 10% polyest. FL 50V
	C5	76.5102	100pF 2.5% polyest. FL 50V
	C6	76.5070	10nF 10% polyest. FL 50V
	C7	76.5070	10nF 10% polyest. FL 50V
	C8	73.5114	1uF 20% tantal. 35V
	C9	73.5114	1uF 20% tantal. 35V
	C10	73.5114	1uF 20% tantal. 35V
	C11	74.5167	1nF- 20/+80% ceram FT 300V
	C12	78.5044	2-18pF teflon 300V
	C13	74.5192	27pF 5% ceram TB 160V
	C14	76.5104	220pF 2.5% polystyr. TB 25V
	C15	74.5107	27pF 5% ceram. TB 160V
	C16	76.5102	100pF 2.5% polystyr. TB 25V
	C17	76.5059	2.2nF 10% polyest. FL 50V
	R1	80.5264	18 Kohm 5% carbon film 0.125W
	R2	80.5264	18 Kohm 5% " " 0.125W
	R3	80.5261	10 Kohm 5% " " 0.125W
	R4	80.5237	100 ohm 5% " " 0.125W
	R5	80.5248	820 ohm 5% " " 0.125W
	R6	80.5264	18 Kohm 5% " " 0.125W
	R7	80.5254	2.7 Kohm 5% " " 0.125W
	R8	80.5243	330 ohm 5% " " 0.125W
	R9	80.5251	1.5 Kohm 5% " " 0.125W
	R10	80.5253	2.2 Kohm 5% " " 0.125W
	R11	80.5254	2.7 Kohm 5% " " 0.125W
	R12	80.5233	47 ohm 5% " " 0.125W
	R13	80.5250	1.2 Kohm 5% " " 0.125W
	R14		Not used
	R15	80.5263	15 Kohm 5% " " 0.125W
	R16	80.5263	15 Kohm 5% " " 0.125W
	R17	80.5250	1.2 Kohm 5% " " 0.125W
	R18	80.5243	330 ohm 5% " " 0.125W
	L1	61.1122	10.0 MHz IF coil
	L2	61.5023	10.0 MHz IF coil
	L3	61.5021	455 kHz IF coil
	X1	98.5014	9.545 MHz Crystal
		69.5032	10.0 MHz Crystal Filter
		69.5031	455 kHz Ceramic Filter 20/25 kHz

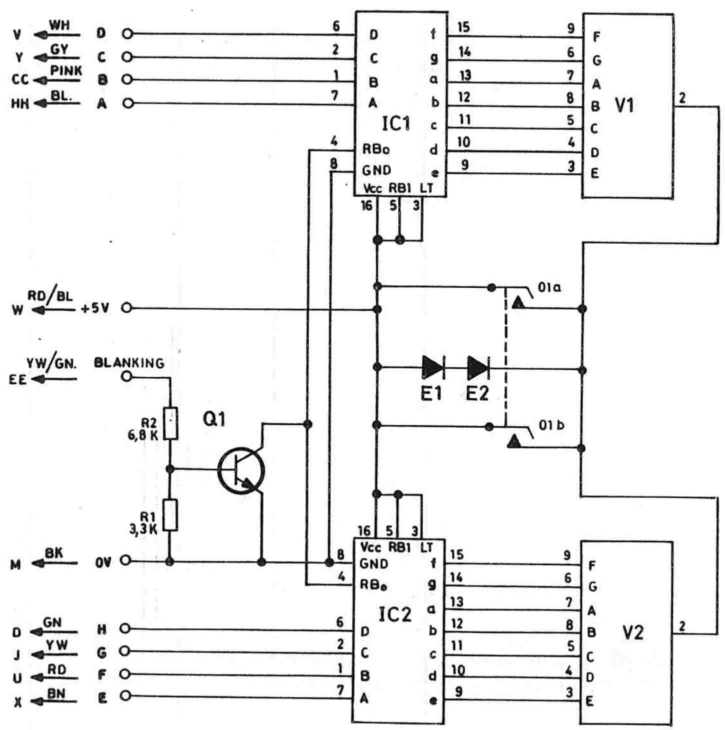
Storno

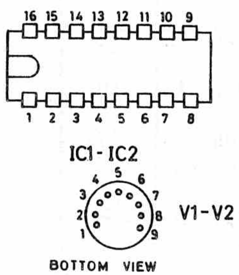
TYPE	Nº	CODE	DATA
	Q1	99.5168	BF 173 Transistor
	Q2	99.5166	BF 167 Transistor
	Q3	99.5168	BF 173 Transistor

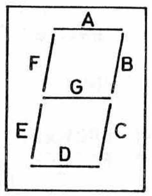
IF CONVERTER IC705

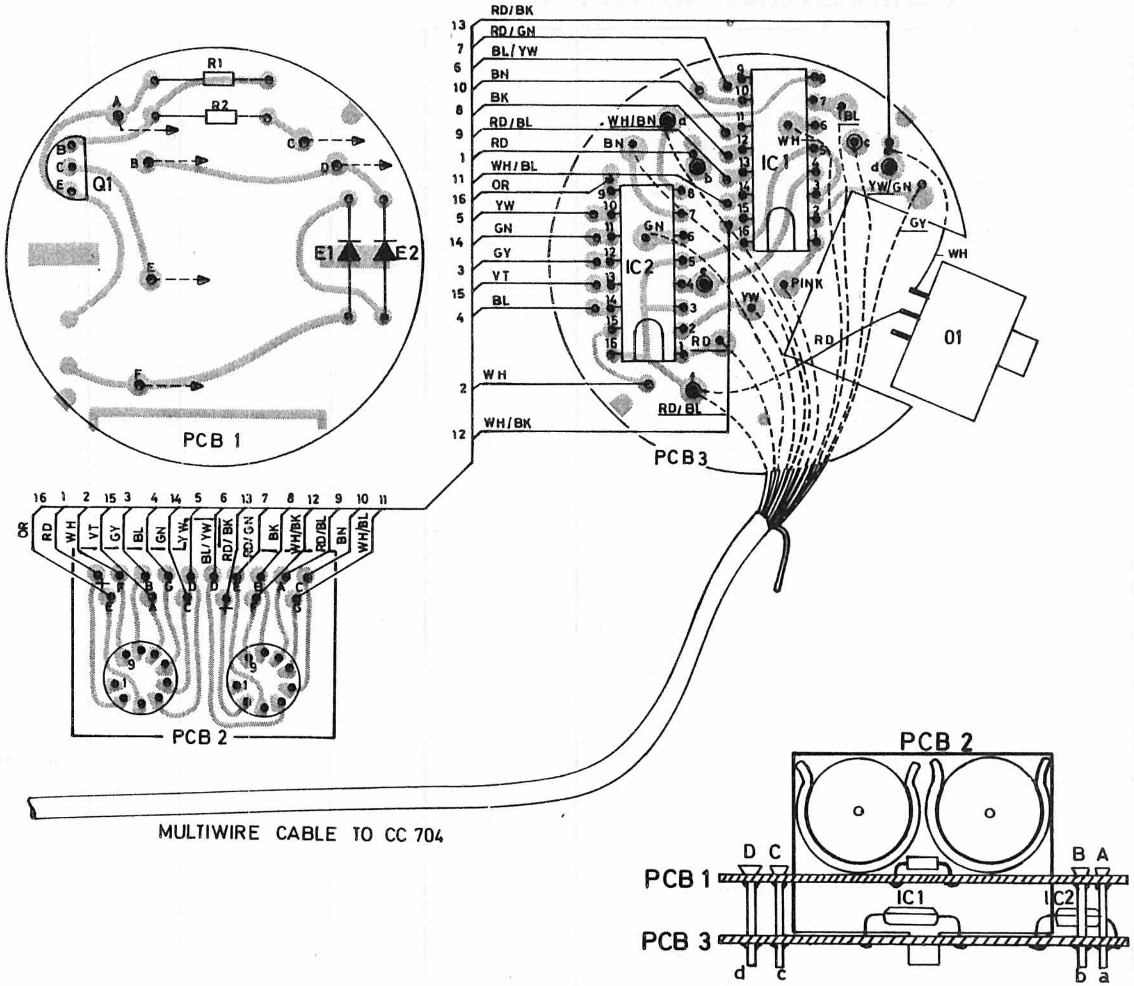
Storno

Storno






7 - SEGMENT INDICATOR



CHANNEL INDICATOR
KANALINDIKATOR

ID701

D401.885/2

TYPE	NO.	CODE	DATA
ID701		10.2930-00	Channel Indicator 00-99
	R1	80.5255	3.3KΩ 5% carbon film 1/8W
	R2	80.5259	6.8KΩ 5% " 1/8W
	E1	99.5020	1N4004 Diode
	E2	99.5020	1N4004 Diode
	01	47.5103	Switch
	Q1	99.5117	BC167 Transistor
	IC1	14.5058	SN6447A 7-segment decoder-driver
	IC2	14.5058	SN6447A 7-segment decoder-driver
	V1	92.5106	7-segment display
	V2	92.5106	7-segment display

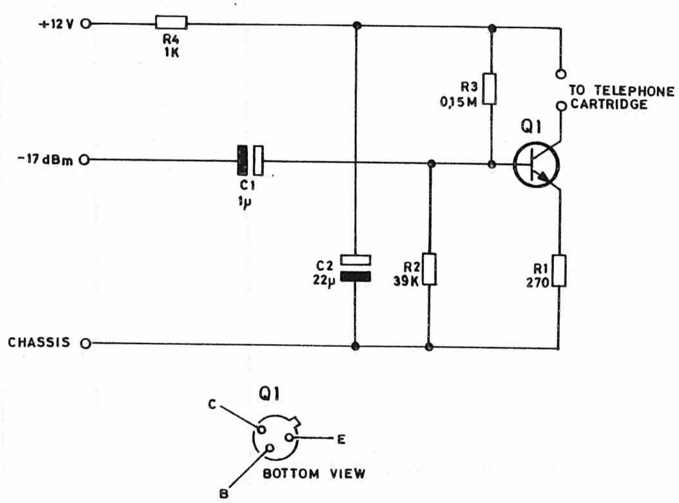
Storno

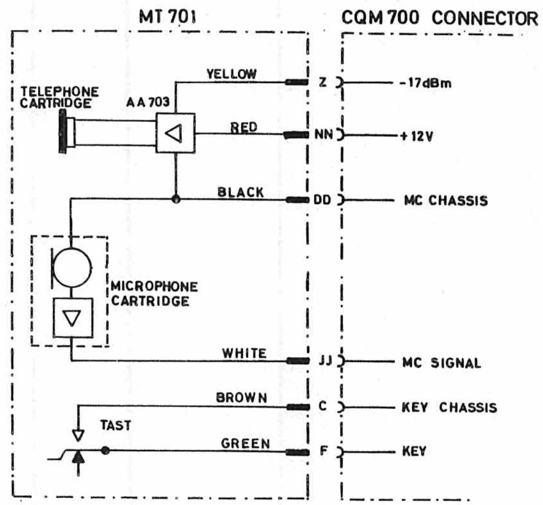
TYPE	NO.	CODE	DATA

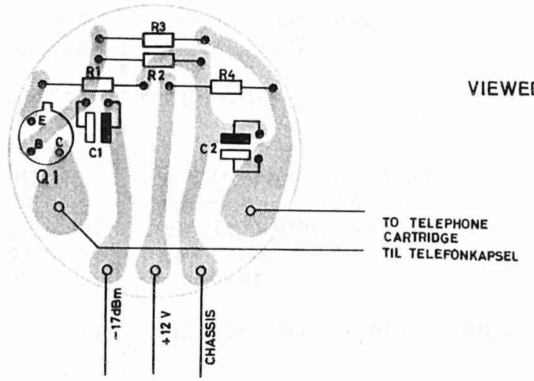
CHANNEL INDICATOR
KANALINDIKATOR

ID701

Storno







VIEWED FROM COMPONENT SIDE

HANDSET
MIKROTELEFON

MT701

D401.844

Storno

TYPE	NO.	CODE	DATA		
MT 701		96.0096	Handset and Retainer HS602a		
		96.0097	Handset		
		37.0110	Retainer		
		10.2809	AA703 Amplifier		
		96.5085	Telephone Cartridge		65Ω
		96.5074	Microphone, dynamic		1500Ω
AA 703		10.2809	Amplifier		
	C1	73.5114	1μF	20% tantal	35V
	C2	73.5127	22μF	20% tantal	16V
	R1	80.5242	270Ω	5% carbon film	1/8W
	R2	80.5268	39KΩ	5% "	1/8W
	R3	80.5275	150KΩ	5% "	1/8W
	R4	80.5249	1KΩ	5% "	1/8W
	Q1	99.5143	BC108 Transistor		

Storno

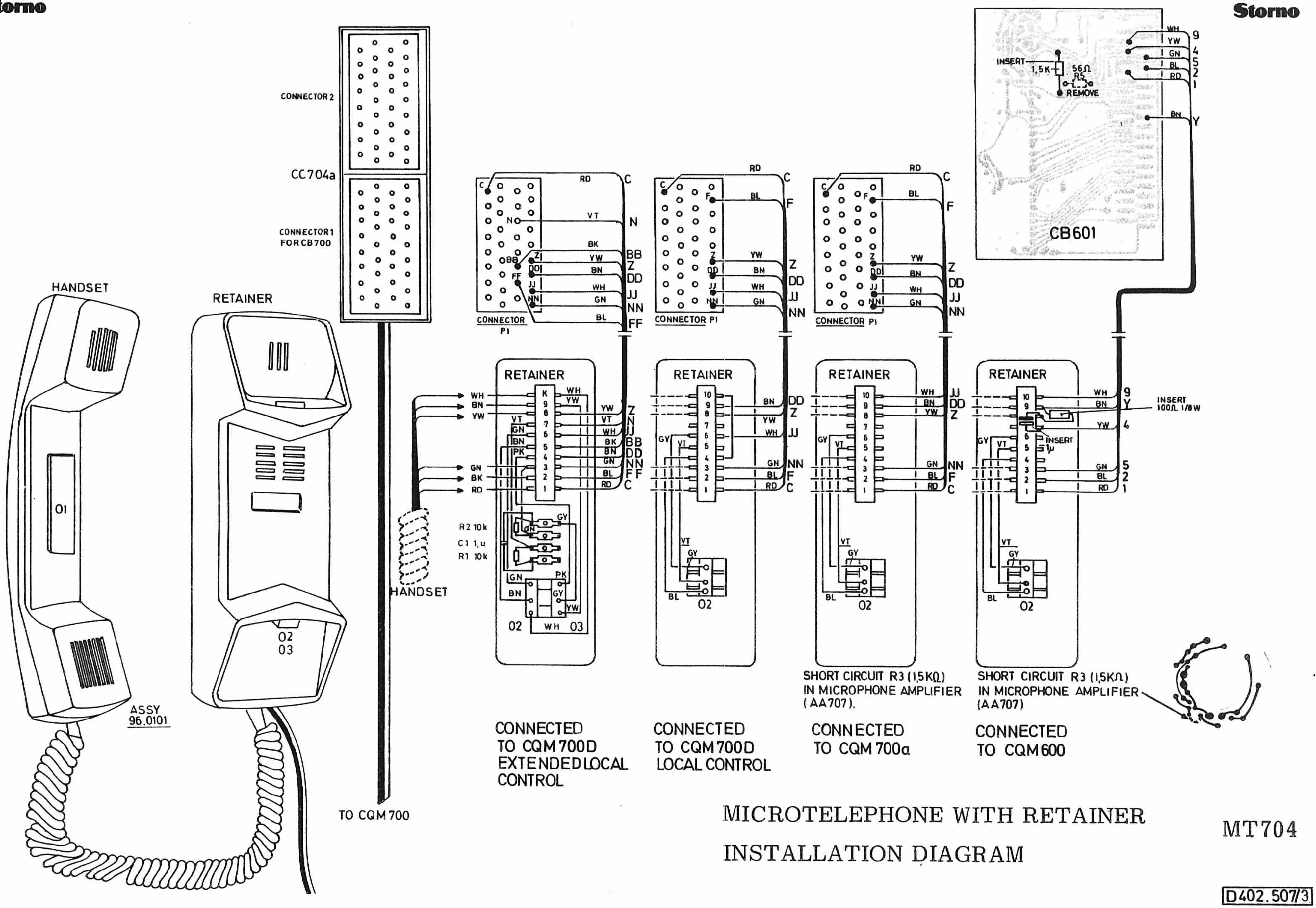
TYPE	NO.	CODE	DATA

HANDSET
MIKROTELEFON

MT701

X401.965

Storno



MICROTELEPHONE WITH RETAINER INSTALLATION DIAGRAM

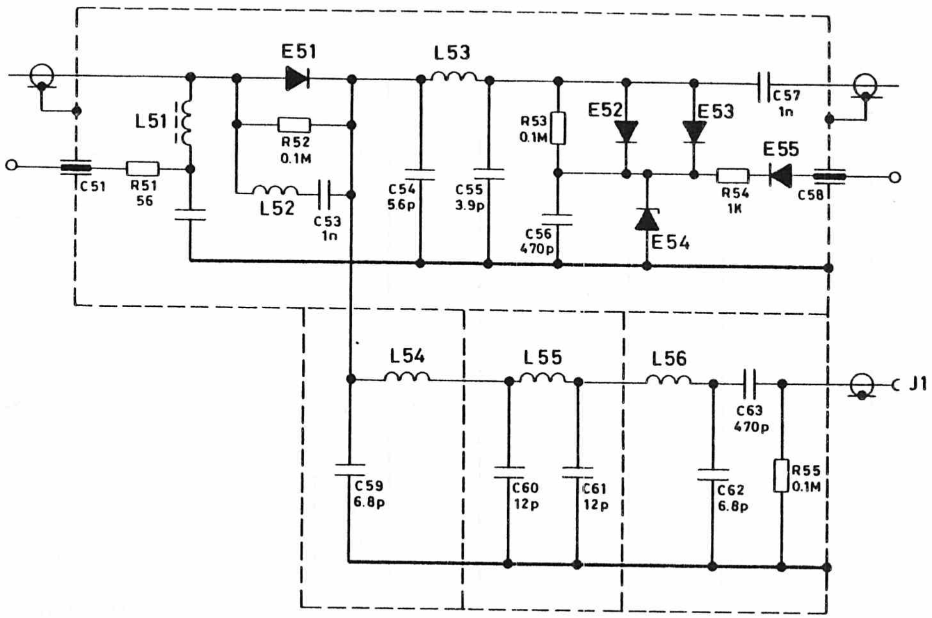
MT704

D402.507/3

TITLE		Code
PA711	Description 1 - 2	60.194-E1
AS711	Description	60.197-E1
PA711	Schematic	D401.710
	Part List 1 - 2	X401.782
PA712	Description 1 - 3	60.200-E1
AS712	Description	60.202-E1
	Schematic	D401.654/4
	Component Lay-out	D401.835
	Part List 1 - 2	X401.800
PA713	Schematic	D401.952
	Part List	X401.948
PA714	Schematic	D402.250
	Part List	X402.374/3
PA715	Schematic	D402.335
	Part List	X402.368
PA731	Description 1 - 2	60.195-E1
AS731	Description	60.198-E1
PA731	Schematic	D401.888
	Part List 1 - 2	X401.787
PA732	Description 1 - 3	60.231-E1
	Schematic	D401.956/2
	Component Lay-out	D402.395
	Part List 1 - 2	X401.957
PA761	Description 1 - 2	60.196-E1
AS761	Description 1 - 2	60.199-E1
PA761	Schematic	D401.324/4
	Part List 1 - 2	X401.619

STORNOPHONE 700
MAINTENANCE MANUAL
VOLUME II
Section 5

PA762	Description 1 - 3	60.201-E1
AS762	Description	60.203-E1
PA762	Schematic	D401.790
	Component Lay-out	D401.979
	Part List	X401.862
PA763	Schematic	D401.872
	Part List	X401.861
PA764	Schematic	D402.080
	Part List	X402.163
PA765	Scematic	D402.139/2
	Part List	X402.164



ANTENNA SWITCH AS761

D401.334

TYPE	NO.	CODE	DATA	
AS761		10.2427	Antenna Switching Unit	
	C51	69.5007	VHF Filter FT	
	C52	74.5155	1 nF -20 +80% ceram PL	63V
	C53	74.5155	1 nF -20 +80% ceram PL	63V
	C54	74.5004	5.6 pF ±0.25 pF ceram DI	400V
	C55	74.5130	3.9 pF ±0.25 pF ceram DI	250V
	C56	74.5162	470 pF -20 +50% ceram DI	400V
	C57	74.5155	1 nF -20 +80% ceram PL	63V
	C58	69.5007	VHF Filter FT	
	C59	74.5021	6.8 pF ±0.25 pF ceram DI	400V
	C60	74.5194	12 pF 5% ceram DI	400V
	C61	74.5194	12 pF 5% ceram DI	400V
	C62	74.5021	6.8 pF ±0.25 pF ceram DI	400V
	C63	74.5094	470 pF 20% ceram DI	400V
	R51	80.5234	56 Ω 5% carbon film	1/8W
	R52	80.5273	0.1 MΩ 5% " "	1/8W
	R53	80.5273	0.1 MΩ 5% " "	1/8W
	R54	80.5049	1 kΩ 5% " "	1/8W
	R55	80.5073	0.1 MΩ 5% " "	1/8W
	L51	63.5008	0.47 µH 20% RF choke	2.2A
	L52	62.0809	RF coil	
	L53	62.0810	RF coil	
	L54	62.0811	RF coil	
	L55	62.0811	RF coil	
	L56	62.0811	RF coil	
	E51	99.5244	BA182 Diode	
	E52	99.5244	BA182 Diode	
	E53	99.5244	BA182 Diode	
	E54	99.5224	Zenerdiode 4.7V 5%	0.25W
	E55	99.5237	1N4148 Diode	

Storno

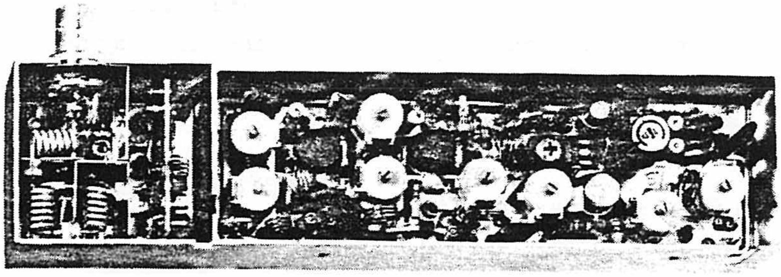
TYPE	NO.	CODE	DATA

ANTENNA SWITCH AS761

X401.317

Storno

RF POWER AMPLIFIER PA711

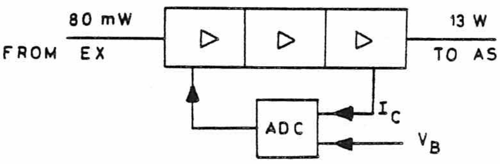


Description

General

PA711 contains 3 power amplifier stages and a current regulating circuit. The unit is completely shielded, being built into a combination heat sink and shield which also contains the antenna switching unit.

The current regulating circuit monitors both the supply voltage and the output transistor collector current, preventing overloading of the transistors due to either too high a voltage or too great a standing wave ratio in the output load. This circuit also allows the output power to be more independent of the power supply or of variations in power output from the exciter.



RF Power Amplifier

The first driver, Q3, gets its collector voltage via the ADC circuit regulating transistor, Q2. Increasing or decreasing the collector voltage to Q3 regulates the drive power applied to the following stages.

π-network C6, L2, C7 and C8 matches the exciter output impedance to the input impedance of Q3. Due to this impedance matching it is also possible to drive the PA stage from a 50Ω generator. Q3 amplifies the exciter signal of about 80 mW to approx. 400 mW, which is necessary to drive Q4 properly.

Transistor Q4 further amplifies the power to approx. 3 W in order to be able to drive the final power amplifier, Q5.

Output transistor Q5 amplifies the RF power signal to approximately 13 W and the following matching network of L12, C22, C23 and L13 suppresses harmonics of the fundamental VHF frequency while transforming the collector impedance of Q5 to the antenna impedance of 50 Ω. Resistor R13 in the output transistor collector path is the current monitoring resistor for the ADC circuit.

Current Regulating Circuit (ADC)

The purpose of the regulating circuit is to protect the transistors against overloads caused by too high a supply voltage and to limit current through the output transistor in case of mismatching. To accomplish this, the regulating circuit must monitor the supply voltage as well as the collector current through the transistor and from such results regulate the collector voltage to the first RF driver transistor, Q3, and thus the driver power to the following stages.

The circuit consists of two DC coupled transistor stages, Q1 and Q2. Base to Q1 is tied to a reference voltage that can be determined by setting the trimming potentiometer, R2. Reference voltage is developed across diodes E1 and E2, which are biased into forward conduction. This introduces a temperature dependency in the reference voltage that compensates for the temperature dependency in the reference voltage that compensates for the temperature characteristics of the transistors.

For easier understanding of the circuit principle, first ignore its voltage dependent features; therefore, imagine that resistor R5 is removed from the circuit.

The DC return path for the emitter of Q1 is through R13 to the positive voltage terminal. R13 carries the collector current from the output amplifier Q5. A rise in this collector current will mean an increase in the voltage drop across R13, causing the emitter of Q1 to become less positive and the collector voltage will likewise become less positive. This decreases bias to Q2, decreasing the current through this transistor. Since Q2 is in series with the DC collector path of Q3, the effect will be that of placing a larger resistor in series with the collector supply, thus reducing collector voltage to Q3. The RF drive to the output stage will fall, thereby counteracting the original increase in collector current.

If the supply voltage increases, the current through the output transistors will be kept constant as already explained, but the power dissipation in the transistor will increase along with the voltage. To counteract this effect, a voltage regulating loop is included.

Imagine R5 connected back into the circuit again so that a voltage divider consisting of R4 and R5 will develop a voltage across R4 in proportion to the supply voltage.

When the supply voltage increases so will the voltage drop across R4 and the base-emitter bias for Q1 will fall, again resulting in a reduction of collector voltage to Q3 and a reduction in the drive to the output stage.

The reduction of drive power decreases the current through Q5 and R13 just enough to counteract the original increase of voltage across R4. By selecting a suitable ratio between resistors R4, R5 and R13, the desired amount of regulation can be achieved.

The transmitter output power can be set to the desired level by means of potentiometer R2 in the ADC circuit.

Technical Specifications

Frequency Range

146 - 174 MHz

Supply Voltage

Nominal 13.6 V (12.5 V)

Operating range 10 - 16 V

Output Power at 13.6 V : 12 W

With output power set for 12 W at 13.6 V, as measured through AS711 :

Output power at 16 V	11 W
Output power at 12.5 V	11 W
Output power at 10 V	6 W

Current Consumption

at nominal voltage 13.6 V :	2.0 A
at 16 V :	1.8 A
at 10 V :	1.5 A

Input Power

80 mW

Input Impedance

50 Ω

Output Impedance

50 Ω

Gain

24 dB

Temperature Range

Operating range : -25° to $+70^{\circ}$ C

Functioning range : -30° to $+80^{\circ}$ C

Mechanical Dimensions

25 x 42 x 168 mm

(PC board : 35.6 x 119.4 mm)

ANTENNA SWITCH AS711

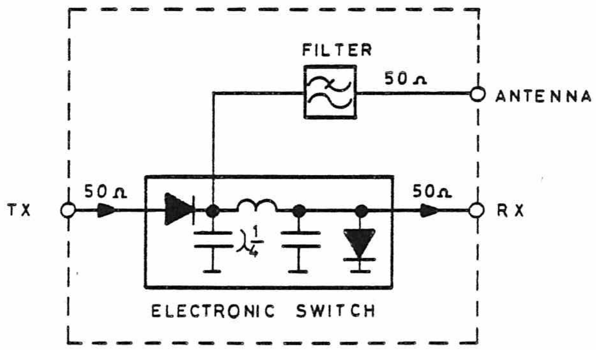
Description

General

The antenna switch AS711 contains a circuit for electronically switching the antenna between the transmitter and the receiver sections, and a low-pass filter that attenuates undesired frequencies, such as harmonics of the signal frequency, thus preventing their being radiated from the antenna.

AS711 mounts directly into the combination heat sink and shield for PA711.

The following simplified diagram shows the operating principle for the AS sub-unit.



The Electronic Switch

Refer to the complete schematic diagram D 401.710.

By switching a +9 V potential between terminals 1 and 2, the antenna is electronically switched between transmit and receive.

When transmitting, diodes E51 + E52 and E53 + E54 conduct. The receiver terminal will see a short circuit.

The 1/4 wave impedance circuit consisting of C54, L53 and C55 transforms the short to an open circuit at the antenna, thus the transmit signal reaches the antenna with minimum loss.

When receiving, the diodes are effectively blocked due to the bias across zener diode E55. Now the diodes only represent a small capacity that includes itself in the 1/4 wave impedance circuit, as far as the receiver terminal is concerned.

The transmitter terminal, however, looks into a parallel resonant circuit made up of L52 and the capacities of E51 and E52, and is thereby isolated from the antenna.

The received signal is now free to pass from the antenna to the receiver input with minimum loss.

The Low-pass Filter

The low-pass filter is a 7-pole Chebishev filter exhibiting negligible band-pass ripple and minimum insertion loss.

The filter is built on a metal plate chassis having three closed compartments. It requires no alignment.

Technical Specification

Frequency Range
146 - 174 MHz

Input and Output Impedance
50 Ω

Insertion Loss (transmitter to antenna)
0.4 dB

Insertion Loss (antenna to receiver)
0.6 dB

Separation between Transmitter and Receiver
28 dB

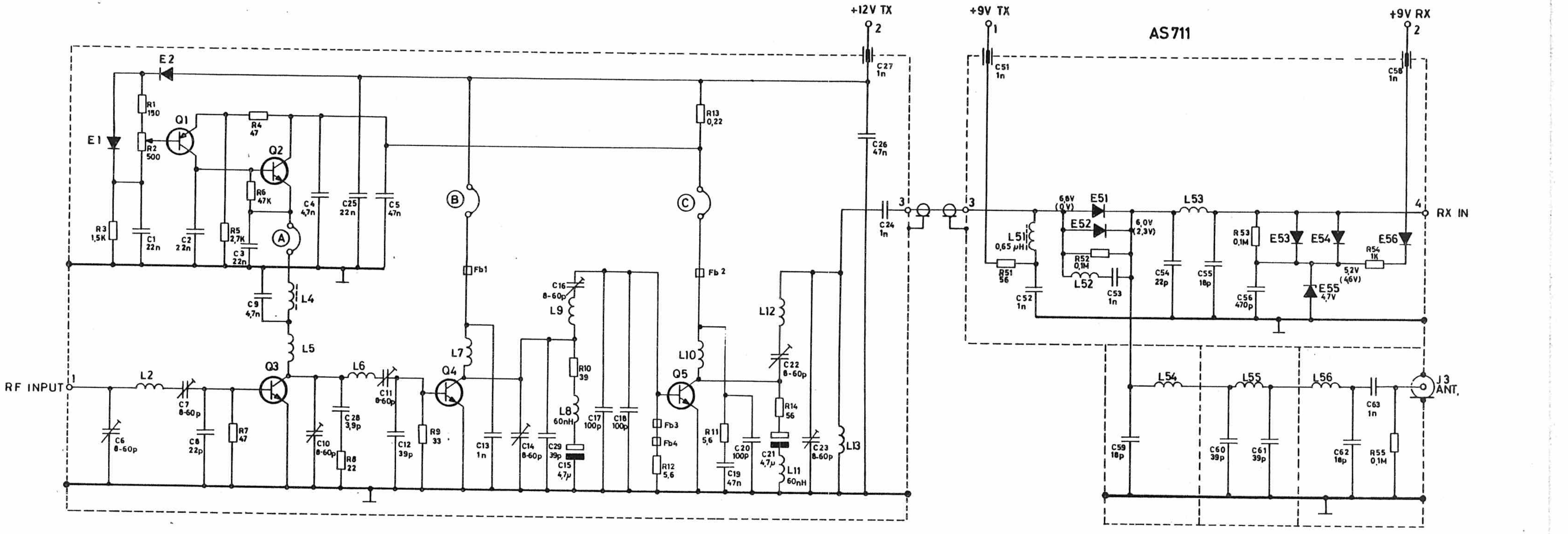
Second Harmonic (292 MHz) Attenuation
55 dB

Current Drain, transmit
38 mA

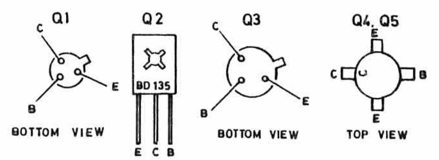
Current Drain, receive
4 mA

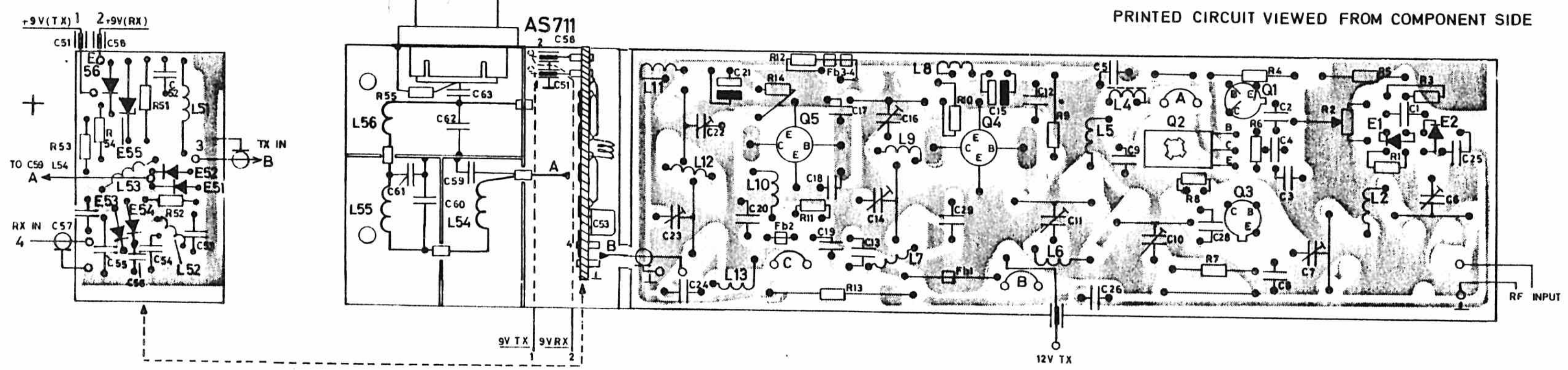
Temperature Range
operating range -25° to $+70^{\circ}C$
functioning range -30° to $+80^{\circ}C$

Dimensions
40 x 38 x 22



DC VOLTAGES WITH BRACKET ARE MEASURED IN TRANSMIT MODE.
DC VOLTAGES WITHOUT BRACKETS ARE MEASURED IN RECEIVE MODE.



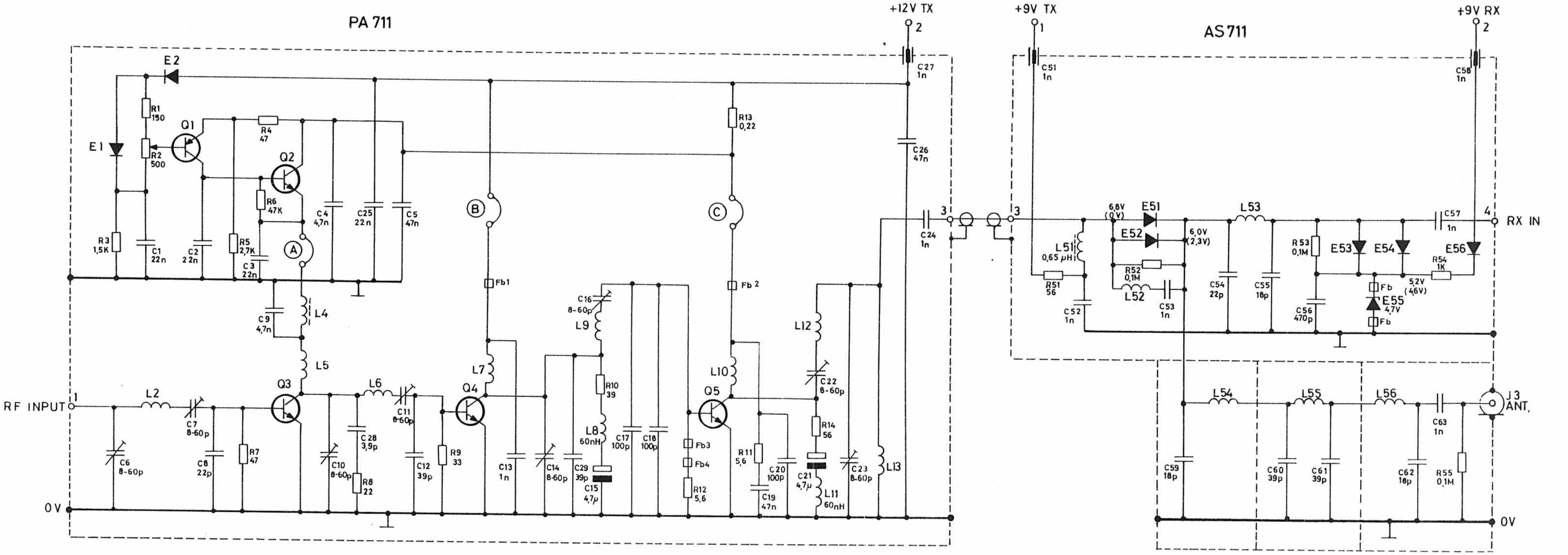


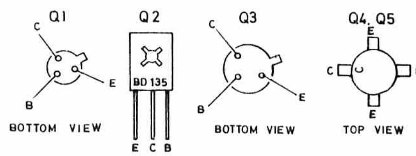
PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

RF POWER AMPLIFIER
HF EFFEKTFORSTÆRKER

PA711

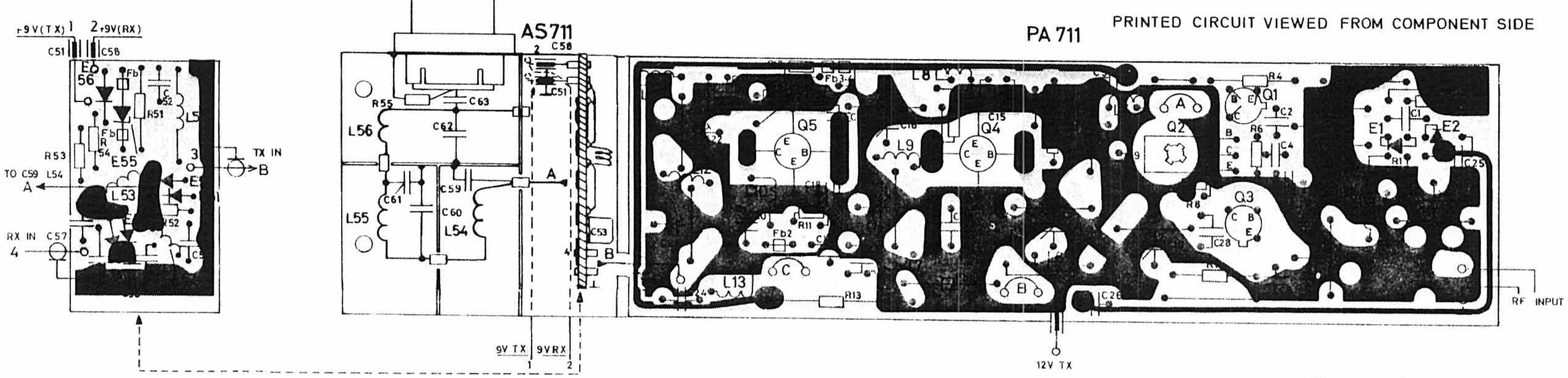
D401.710





DC VOLTAGES WITH BRACKET ARE MEASURED IN TRANSMIT MODE.
DC VOLTAGES WITHOUT BRACKETS ARE MEASURED IN RECEIVE MODE.

PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE



RF POWER AMPLIFIER
HF EFFEKTFORSTÆRKER

PA711

D401.710/2

TYPE	NO.	CODE	DATA	
PA711		10.2558	Power Amplifier (incl. AS711)	
AS711		10.2553	Antenna Switch	
	C1	76.5061	4.7 nF 10% polyest FL	50 V
	C2	76.5061	4.7 nF 10% polyest FL	50 V
	C3	76.5061	4.7 nF 10% polyest FL	50 V
	C4	76.5061	4.7 nF 10% polyest FL	50 V
	C5	76.5072	47 nF 10% polyest FL	50 V
	C6	78.5052	8-60 pF trimmer	100 V
	C7	78.5052	8-60 pF trimmer	100 V
	C8	74.5106	22 pF 5% ceram TB	160 V
	C9	76.5061	4.7 nF 10% polyest FL	50 V
	C10	78.5052	8-60 pF trimmer	100 V
	C11	78.5052	8-60 pF trimmer	100 V
	C12	74.5117	39 pF 5% ceram TB	160 V
	C13	74.5155	1 nF -20+50% ceram PL	63 V
	C14	78.5052	8-60 pF trimmer	100 V
	C15	73.5126	4.7 μF 20% tantal	35 V
	C16	78.5052	8-60 pF trimmer	100 V
	C17	74.5199	100 pF 20% ceram PL	25 V
	C18	74.5199	100 pF 20% ceram PL	25 V
	C19	76.5052	47 nF 10% polyest FL	50 V
	C20	74.5013	100 pF 20% ceram DI	400 V
	C21	73.5126	4.7 μF 20% tantal	35 V
	C22	78.5052	8-60 pF trimmer	100 V
	C23	78.5052	8-60 pF trimmer	400 V
	C24	74.5015	1 nF-20+50% ceram DI	400 V
	C25	76.5061	4.7 nF polyest FL	50 V
	C26	76.5072	47 nF 10% polyest FL	50 V
	C28	74.5130	3.9 pF ± 25 pF 5% ceram DI	250 V
	C29	74.5117	39 pF 5% ceram TB	160 V
	R1	80.5239	150 Ω 5% carbon film	1/8 W
	R2	86.5042	500 Ω 20% potentiometer	0.1 W
	R3	80.5251	1.5 KΩ 5% carbon film	1/8 W
	R4	80.5233	47 Ω 5% carbon film	1/8 W
	R5	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R6	80.5269	47 KΩ 5% carbon film	1/8 W
	R7	80.5233	47 Ω 5% carbon film	1/8 W
	R8	80.5229	22 Ω 5% carbon film	1/8 W
	R9	80.5231	33 Ω 5% carbon film	1/8 W
	R10	80.5432	39 Ω 5% carbon film	1/4 W
	R11	80.5222	5.6 Ω 5% carbon film	1/8 W
	R12	80.5222	5.6 Ω 5% carbon film	1/8 W
	R13	82.5205	0.22 Ω 10% wire wound	1 W
	R14	80.5434	56 Ω 5% carbon film	1/4 W
	L2	62.0822	RF coil 146-174 MHz	

Storno

TYPE	NO.	CODE	DATA	
	L4	63.5008	0.47 μH 20% RF choke	
	L5	62.0822	RF coil 146-174 MHz	
	L6	62.0823	RF coil 146-174 MHz	
	L7	62.0824	RF coil 146-174 MHz	
	L8	61.5011	0.06 μH 20% RF choke	
	L9	62.0825	RF-coil 146-174 MHz	
	L10	62.0824	RF coil 146-174 MHz	
	L11	61.5011	0.06 μH 20% RF choke	
	L12	62.0827	RF coil 146-174 MHz	
	L13	62.0826	RF coil 146-174 MHz	
	E1	99.5028	1N914 Diode	
	E2	99.5028	1N914 Diode	
	Q1	99.5230	BC178 Transistor	
	Q2	99.5235	BD135 Transistor	
	Q3	99.5229	2N4427 Transistor	
	Q4	99.5252	BLY87A Transistor	
	Q5	99.5253	BLY88A Transistor	
AS711		10.2553	Antenna Switch	
	C51	69.5007	VHF feed-through filter	
	C52	74.5155	1nF -20+80% ceram PL	63 V
	C53	74.5155	1 nF -20+80% ceram PL	63 V
	C54	74.5008	22 pF ± 5% ceram DI	400 V
	C55	74.5138	18 pF 5% ceram DI	125 V
	C56	74.5162	470 pF-20+50% ceram DI	400 V
	C57	74.5155	1 nF -20+80%ceram PL	63V
	C58	69.5007	VHF feed-through filter	
	C59	74.5796	18 pF 5% ceram DI	400 V
	C60	74.5197	39 pF 5% ceram DI	400 V
	C61	74.5197	39 pF 5% ceram DI	400 V
	C62	74.5196	10 pF 5% ceram DI	400 V
	C63	74.5015	1 nF 20% ceram DI	400 V
	R51	80.5234	56 Ω 5% carbon film	1/8 W
	R52	80.5073	0.1 MΩ 5% carbon film	0.1 W
	R53	80.5073	0.1 MΩ 5% carbon film	0.1 W
	R54	80.5049	1 KΩ 5% carbon film	0.1 W
	R55	80.5273	0.1 MΩ 5% carbon film	1/8 W
	L51	62.0662-01	0.65 μH RF choke	
	L52	62.0818	RF coil	

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA711

X401.782

TYPE	NO.	CODE	DATA
	L53	62.0817	RF coil
	L54		
	L55	62.0816	RF coil
	L56		
	E51	99.5244	BA182 Diode
	E52	99.5244	BA182 Diode
	E53	99.5244	BA182 Diode
	E54	99.5244	BA182 Diode
	E55	99.5224	4.7 V 5% zenerdiode 0.25W
	E56	99.5237	1N4148 Diode

Storno

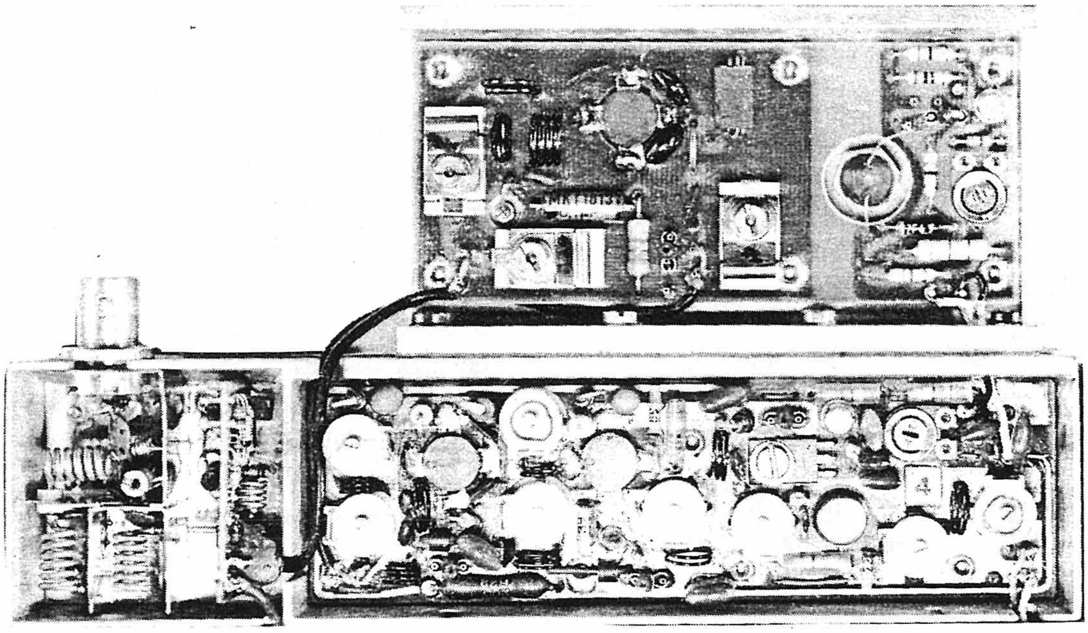
TYPE	NO.	CODE	DATA

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA711

X401.782

RF POWER AMPLIFIER PA712



Description

PA712 comprises 4 RF power amplifier stages, three in the driver and one in the booster as well as a regulating and temperature protection circuit and, finally, an electronic antenna switching unit with filter, AS712.

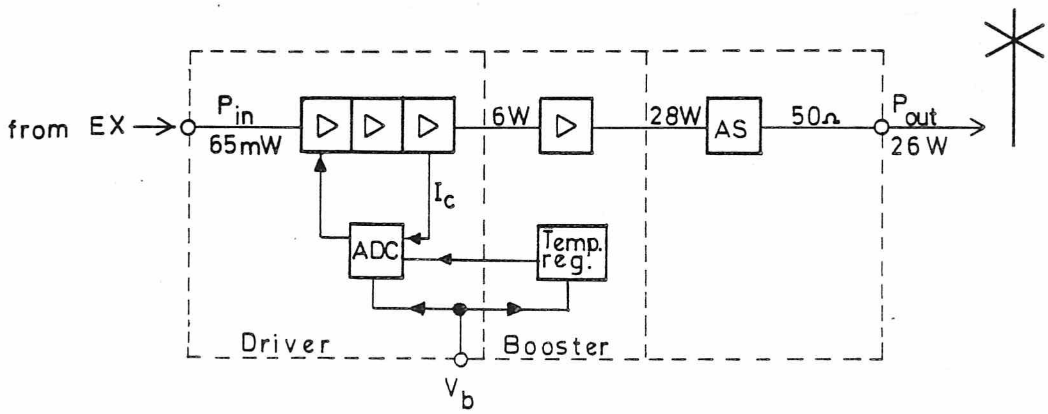
PA712 is completely shielded, as it is built into a combination heat sink and shield. However, heat dissipation will be insufficient without the external heat sink/cabinet CA703.

The regulating and temperature protection circuit protects the transistors and other components in the unit against incurring damages when operated within the permissible values of supply voltages and temperatures, or as a result of prolonged short circuits or too great a standing wave ratio in the output load.

RF Power Amplifier

The first driver, Q3, gets its collector voltage via the ADC circuit regulating transistor, Q2. Increasing or decreasing the collector voltage to Q3 regulates the drive power applied to the following stages.

π- network C6, L2, C7 and C8 matches the exciter output impedance to the input impedance of Q3. Due to this impedance matching it is also possible to drive the PA stage from a 50 Ω generator.



Q3, Q4 and Q5 amplify the exciter output signal of 80 mW to 6 W in order to drive the booster stage. Matching network L12, C22, C23 and L13 suppresses harmonics of the fundamental VHF frequency while transforming the collector impedance of Q5 to 50 Ω. Resistor R13 in the collector return of Q5 is the current monitoring resistor for the ADC circuit.

Booster Stage

Q101 amplifies the 6 W output power from the driver stage to 28 W and applies the signal to AS712. Due to the inherent losses in the AS unit the PA output power is then 26 W.

Current Regulating Circuit (ADC)

The purpose of the regulating circuit is to protect the transistors against overloads caused by excessive supply voltage and to limit current through the output transistor in case of mismatching. To accomplish this, the regulating circuit must monitor the supply voltage as well as the collector current through Q5 in the driver stage and from such results regulate the collector voltage to the first driver transistor Q3, and thus the drive power to the following stages.

The circuit consists of two DC coupled transistor stages, Q1 and Q2. Base to Q1 is tied to a reference voltage that can be determined by setting potentiometer R2. Reference voltage is developed across diodes E1 and E2, which are biased into forward conduction. This introduces a temperature dependency in the reference voltage that compensates for the temperature characteristics of the transistors.

For easier understanding of the circuit principle, first ignore its voltage dependent features; therefore, imagine that resistor R5 is removed from the circuit.

The DC return path for the emitter of Q1 is through R13 to the positive voltage terminal. R13 also carries the collector current from transistor Q5. A rise in this collector current will mean an increase in the voltage drop across R13, causing the emitter of Q1 to become less positive and the collector voltage will likewise become less positive. This decreases forward bias to Q2, decreasing the current through this transistor. Since Q2 is in series with the DC collector path of Q3, the effect will be that of placing a larger resistor in series with the collector supply, thus reducing collector voltage to Q3. The RF drive to the output stage will fall, thereby counteracting the original increase in collector current.

If the supply voltage increases, the current through Q5 will be kept constant as already explained, but the power dissipation in the transistor will increase along with the voltage. To counteract this effect, a voltage regulating loop is included.

Imagine R5 connected back into the circuit again so that a voltage divider consisting of R4 and R5 will develop a voltage across R4 in proportion to the supply voltage.

When the supply voltage increases so will the voltage drop across R4 and the base-emitter bias for Q1 will fall, again resulting in a reduction of collector voltage to Q3 and a reduction in the drive to the output stage.

The reduction of drive power decreases the current through Q5 and R13 just enough to counteract the original increase of voltage across R4. By selecting a suitable ratio between resistors R4, R5 and R13 the desired amount of regulation can be achieved.

The transmitter power can be set to the desired level by means of potentiometer R2 in the ADC circuit.

Temperature Protection Circuit

Since transistor Q101 in the booster stage is not directly included in the ADC loop, it requires extra thermal protection which is accomplished by means of a PTC resistor, R102, which is mounted close to Q101. When Q101, and R102 along with it, reach a certain temperature the increasing resistance of R102, which is also a part of the ADC loop of the driver stage, regulates (reduces) the drive to Q101.

Storno

Thus the output power of the PA unit is regulated to a preset level that ensures thermal protection of Q101 and other components.

The temperature protection circuit operates in the following manner: Under normal operating conditions (prior to regulation) Q102 is biased to cut-off by the voltage divider network of R104 and the PTC resistor (60 Ω) connected across zener diode E101 for a stable source. As the temperature in the PA stage rises the resistance of R102 increases and Q101 begins to pass current. When R102 reaches 1.2 kΩ Q102 will be completely open. When Q102 opens up, the circuit shunts diodes E1 and E2 and the voltage across these diodes falls, causing the base-emitter voltage for Q1 to fall, as well.

As a result, Q3's collector voltage falls, too, thereby also reducing the drive to the following stages.

The mount of regulation (reduction in output power) is preset by potentiometer R107. Q102's emitter resistor is included to flatten out the regulation characteristic. Diode E102 in the collector lead of Q102 ensures temperature compensation of the reference voltage at the base of Q1 even at maximum regulation.

Technical Specifications

Frequency Range
146 to 174 MHz

Nominal Supply Voltage
13 V

Output Power
With output power set for 26 W at 13 V

output power at 15.5 V	26 W
output power at 10 V	16 W

Current Consumption
At nominal 13 V: 4.3 A
at 15.5 V: 4 A
at 10 V: 3.5 A

Input Power
nominal 80 mW
minimum 65 mW

Input Impedance
50 Ω

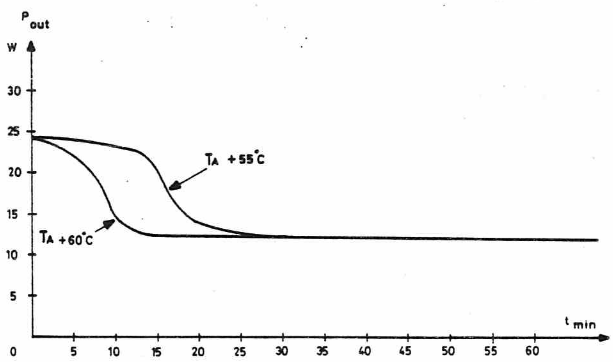
Output Impedance
50 Ω

Gain with P_{in} = 65 mW
26 dB

Reduction of Output Power vs. Ambient Temperature

Continuous, T_A -25° to $+25^{\circ}C$	0.8 dB
Intermittent, T_A -25° to $+55^{\circ}C$	0.8 dB
Continuous, T_A $+55^{\circ}$ C	3 dB

(refer to response curve below)



Typical output power regulating characteristic of PA712 with CA703 mounted. Plotted for ambient temperatures of $+55^{\circ}C$ and $+60^{\circ}C$, at nominal voltage, continous keying of transmitter.

Temperature Range
operating $-25^{\circ}C$ to $+55^{\circ}C$
functioning $-30^{\circ}C$ to $+60^{\circ}C$.

Mechanical Dimensions
168 x 97 x 32 mm

ANTENNA SWITCH AS712

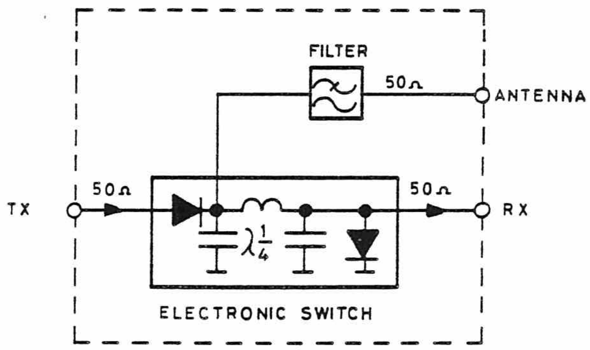
Description

General

The antenna switch AS712 contains a circuit for electronically switching the antenna between the transmitter and the receiver sections, and a low-pass filter that attenuates undesired frequencies, such as harmonics of the signal frequency, thus preventing their being radiated from the antenna.

AS712 mounts directly into the combination heat sink and shield for PA712 and is used in 2 metre simplex equipment for 25 W output power.

The following simplified diagram shows the operating principle for the AS sub-unit.



The Electronic Switch

Refer to the complete schematic diagram D401.654.

By switching a +9 V potential between terminals 1 and 2, the antenna is electronically switched between transmit and receive.

When transmitting, diodes E51, E52, E53 and E54, E55 and E56 conduct. The receiver terminal will see a short circuit.

The 1/4 wave impedance circuit consisting of C54, L53 and C55 transforms the short to an open circuit at the antenna, thus the transmit signal reaches the antenna with minimum loss.

When receiving, the diodes are effectively blocked due to the bias across zener diode E57. Now the diodes only represent a small capacity that includes itself in the 1/4 wave impedance circuit, as far as the receiver terminal is concerned.

The transmitter terminal, however, looks into a parallel resonant circuit made up of L52 and the capacities of E51, E52 and E53, and is thereby isolated from the antenna.

The received signal is now free to pass from the antenna to the receiver input with minimum loss.

The Low-pass Filter

The low-pass filter is a 7-pole Chebishev filter exhibiting negligible band-pass ripple and minimum insertion loss.

The filter is built on a metal plate chassis having three closed compartments. It requires no alignment.

Technical Specifications

Frequency Range

146 to 174 MHz

Input and output Impedance

50 Ω

Insertion Loss (transmitter to antenna)

0.4 dB

Insertion Loss (antenna to receiver)

0.6 dB

Separation between Transmitter and Receiver

28 dB

Second Harmonic (292 MHz) Attenuation

55 dB

Current Consumption, Transmit

46 mA

Current Consumption, Receive

8 mA

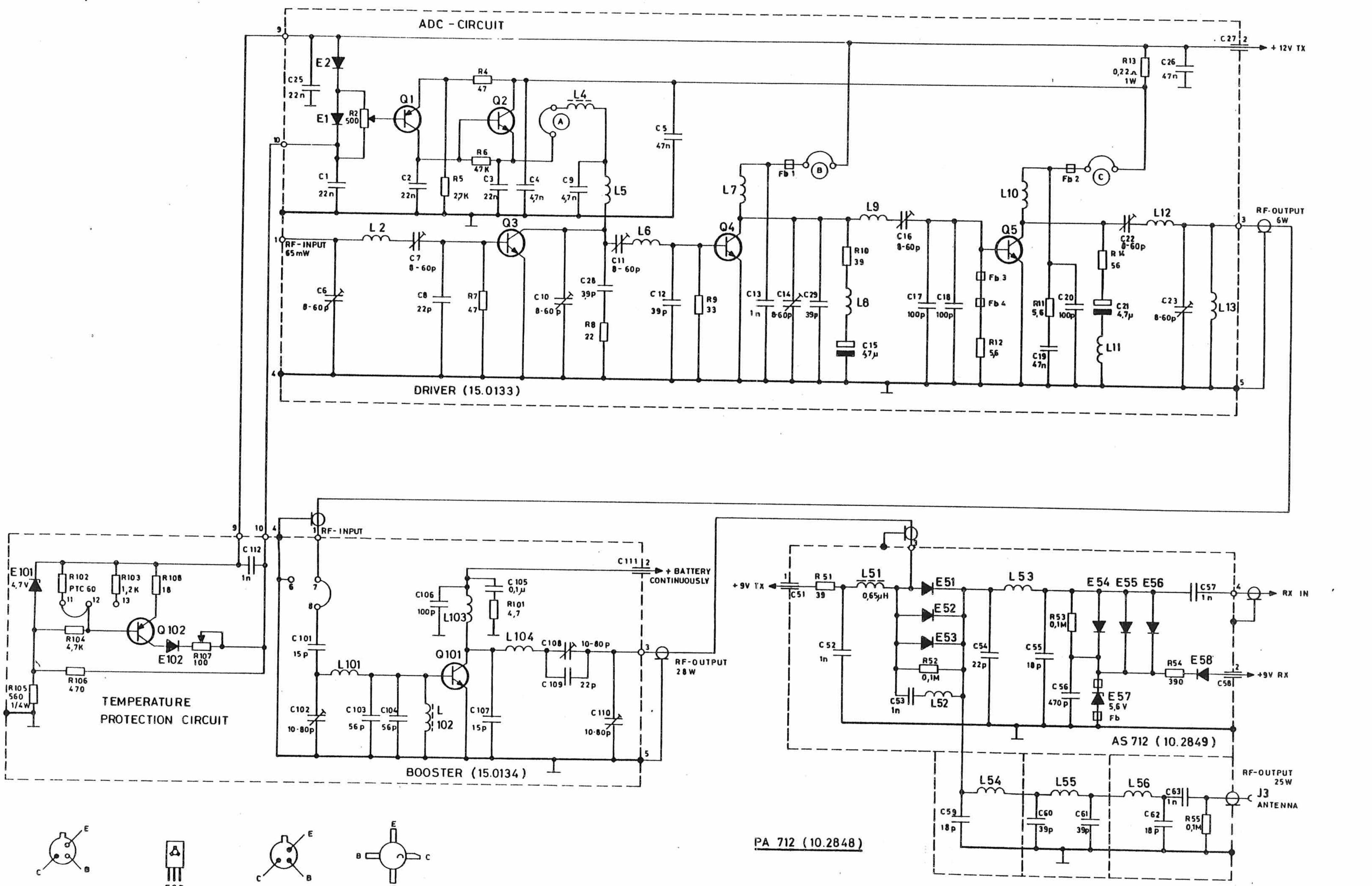
Temperature Range

working range: -25° to $+70^{\circ}C$

functioning range: -30° to $+80^{\circ}C$

Dimensions

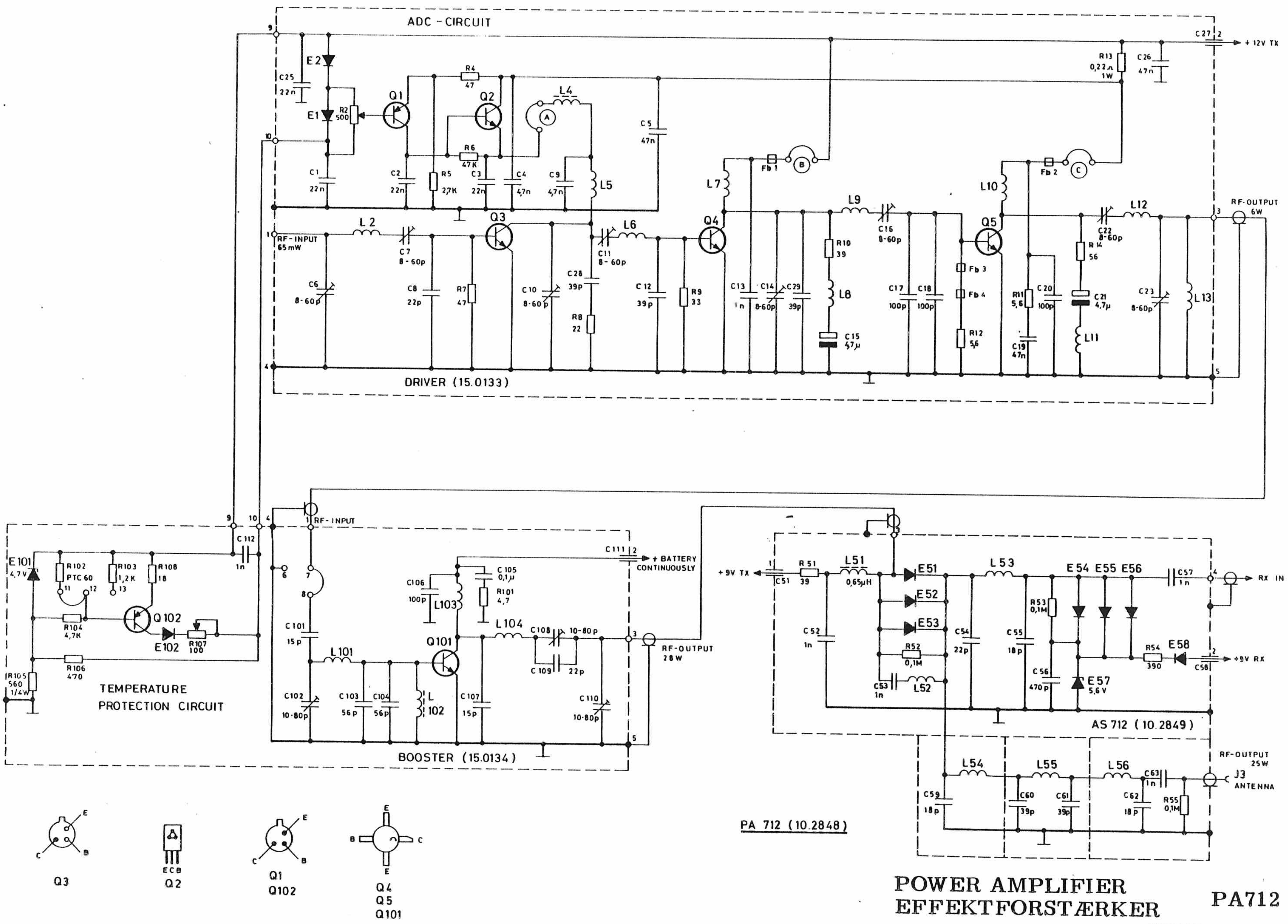
40 x 38 x 22 mm



POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA712

D 401.654/4

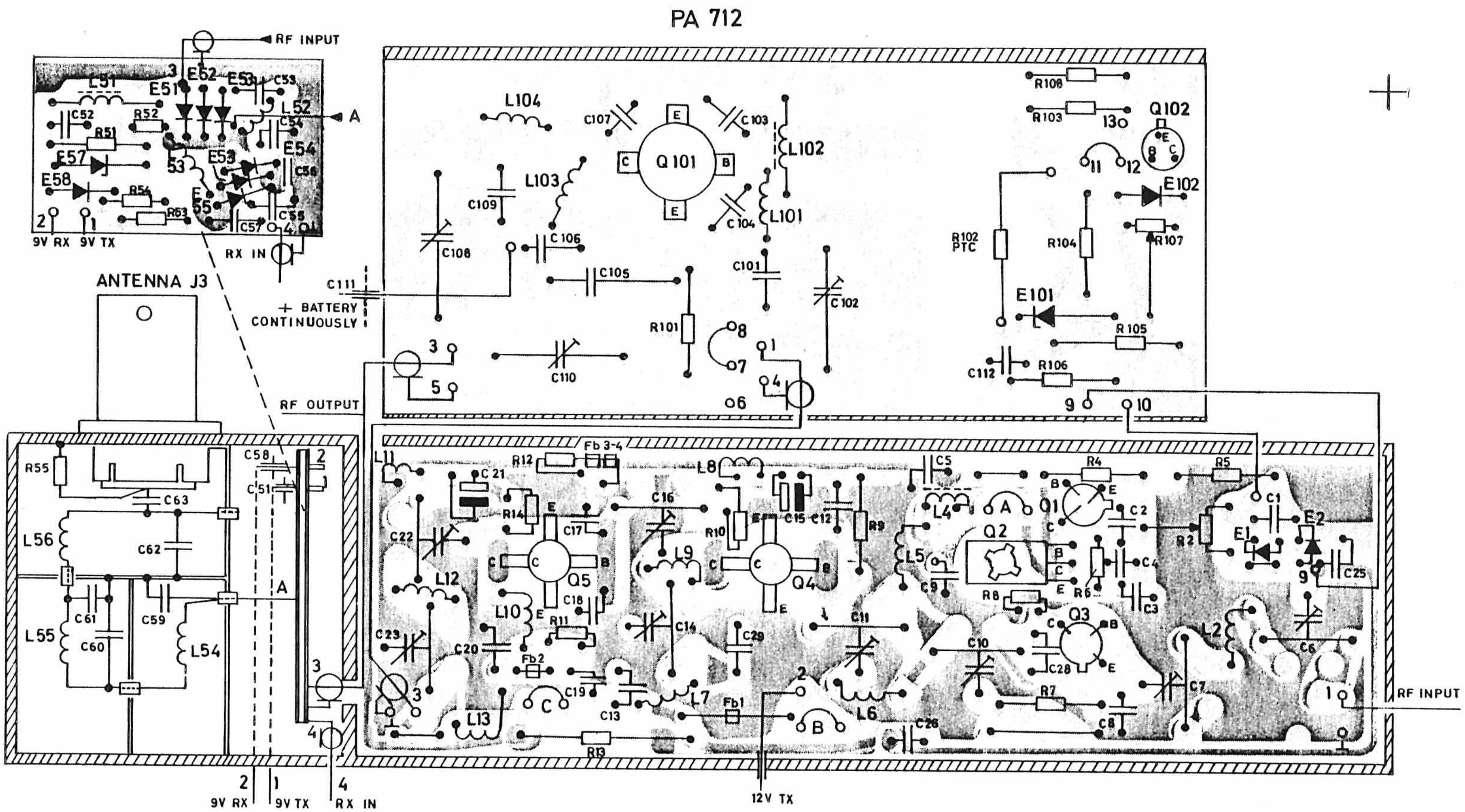


POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA712

D 401.654/2

Storno



POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA712

D 401.835

Storno

TYPE	NO.	CODE	DATA	
PA712		10.2848-00	Power Amplifier	
	C1	76.5071	22nF 10% polyest FL	50V
	C2	76.5071	22nF 10% polyest FL	50V
	C3	76.5071	22nF 10% polyest FL	50V
	C4	76.5061	4.7nF polyest FL	50V
	C5	76.5072	47nF 10% polyest FL	50V
	C6	76.5052	8-60pF Trimmer	100V
	C7	78.5052	8-60pF Trimmer	100V
	C8	74.5106	22pF 5% ceram TB	160V
	C9	76.5061	4,7nF 10% polyest FL	50V
	C10	78.5052	8-60pF Trimmer	100V
	C11	78.5052	8-60pF Trimmer	100V
	C12	74.5117	39pF 5% ceram TB	160V
	C13	74.5155	1nF-20+50% ceram PL	63V
	C14	78.5052	8-60pF Trimmer	100V
	C15	73.5126	4.7μF 20% tantal	35V
	C16	78.5052	8-60pF Trimmer	100V
	C17	74.5199	100pF 20% ceram	25V
	C18	74.5199	100pF 20% ceram	25V
	C19	76.5072	47nF 10% polyest FL	50V
	C20	74.5013	100pF 20% ceram DI	400V
	C21	73.5126	4.7nF 20% tantal	35V
	C22	78.5052	8-60pF Trimmer	100V
	C23	78.5052	8-60pF Trimmer	100V
	C25	76.5071	22nF 10% polyest FL	50V
	C26	76.5072	47nF 10% polyest FL	50V
	C27	69.5023	VHF feed-through filter	
	C28	74.5130	3.9pF ±0.25pF ceram DI	250V
	C29	74.5117	39pF 5% ceram TB	160V
	C51	69.5007	VHF Feed-through filter	
	C52	74.5155	1nF -20+80% ceram PL	63V
	C53	74.5155	1nF-20+80% ceram PL	63V
	C54	74.5008	22pF 5% ceram	400V
	C55	74.5196	18pF 5% ceram DI	400V
	C56	74.5162	470pF-20+50% DI	400V
	C57	74.5155	1nF-20+80% ceram PL	63V
	C58	69.5007	VHF Feed-through filter	
	C59	74.5196	18pF 5% ceram DI	400V
	C60	74.5197	39pF 5% ceram DI	400V
	C61	74.5197	39pF 5% ceram DI	400V
	C62	74.5196	18pF 5% ceram DI	400V
	C63	74.5015	1nF 20% ceram DI	400V
	C101	74.5046	15pF 5% ceram DI	400V
	C102	78.5053	10-80pF Trimmer, mica	500V

Storno

TYPE	NO.	CODE	DATA	
	C103	75.5015	56pF 5% mica	500V
	C104	75.5015	56pF 5% mica	500V
	C105	76.5073	0.1μF 10% polyester TB	100V
	C106	74.5013	100pF 20% ceram DI	500V
	C107	74.5046	15pF 5% ceram DI	400V
	C108	78.5053	10-80pF Trimmer, mica	500V
	C109	75.5017	22pF 5% mica	500V
	C110	78.5053	10-80pF Trimmer, mica	500V
	C111	69.5023	VHF Feed-through filter	
	C112	74.5155	1nF-20+80% ceram PL	63V
	R2	86.5042	500Ω 20% potentiometer	0.1W
	R4	80.5233	47Ω 5% carbon film	1/8W
	R5	80.5254	2.7kΩ 5% carbon film	1/8W
	R6	80.5269	47kΩ 5% carbon film	1/8W
	R7	80.5233	47Ω 5% carbon film	1/8W
	R8	80.5229	22Ω 5% carbon film	1/8W
	R9	80.5231	33Ω 5% carbon film	1/8W
	R10	80.5432	39Ω 5% carbon film	1/8W
	R11	80.5222	5.6Ω 5% carbon film	1/8W
	R12	80.5222	5.6Ω 5% carbon film	1/8W
	R13	82.5205	0.22 Ω 10% wiriwound	1 W
	R14	80.5434	56 Ω 5% carbon film	1/4 W
	R51	80.5232	39 Ω 5% carbon film	1/8 W
	R52	80.5073	0.1 MΩ 5% carbon film	1/10W
	R53	80.5073	0.1 MΩ 5% carbon film	1/10W
	R54	80.5044	390 Ω 5% carbon film	1/10W
	R55	80.5273	0.1 MΩ 5% carbon film	1/8 W
	R101	80.5421	4.7 Ω 5% carbon film	1/4 W
	R102	89.5066	60 Ω -50 +100% PTC Thermistor	
	R103	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R104	80.5257	4.7 KΩ 5% carbon film	1/8 W
	R105	80.5446	560 Ω 5% carbon film	1/4 W
	R106	80.5245	470 Ω 5% carbon film	1/8 W
	R107	86.5051	100 Ω 20% potentiometer	1/10W
	R108	80.5228	18 Ω carbon film	1/8 W
	L2	62.0822	RF coil 146-174 MHz	
	L4	63.5008	0.47 μH 20% RF choke	2.2 A

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA712

X 401.800

Storno

TYPE	NO.	CODE	DATA
	L5	62.0822	RF coil 146-174 MHz
	L6	62.0823	RF coil 146-174 MHz
	L7	62.0824	RF coil 146-174 MHz
	L8	61.5011	0.06 μH 20% RF choke
	L9	62.0825	RF coil 146-174 MHz
	L10	62.0824	RF coil 146-174 MHz
	L11	61.5011	0.06 μH 20% RF choke
	L12	62.0826	RF coil 146-174 MHz
	L13	62.0827	RF coil 146-174 MHz
	L51	62.0662	0.65 μH RF choke
	L52	62.0818	RF coil
	L53	62.0817	RF coil
	L54		
	L55	62.0816	RF coil
	L56		
	L101	62.0840	RF coil 146-174 MHz
	L102	61.5013	RF-choke
	L103	62.0841	RF coil 146-174 MHz
	L104	62.0842	RF coil 146-174 MHz
	E1	99.5028	1N914 Diode
	E2	99.5028	1N914 Diode
	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 5.6 V 5% 1 W
	E58	99.5237	1N4148 Diode
	E101	99.5224	Zenerdiode 4.7 V 5% 1/4 W
	E102	99.5237	1N4148 Diode
	Q1	99.5230	BC178 Transistor
	Q2	99.5235	BD135 Transistor
	Q3	99.5229	2N4427 Transistor
	Q4	99.5252	BLY87A Transistor
	Q5	99.5253	BLY88A Transistor
	Q101	99.5230	BC178 Transistor
	Q102	99.5280	BLY89A Transistor

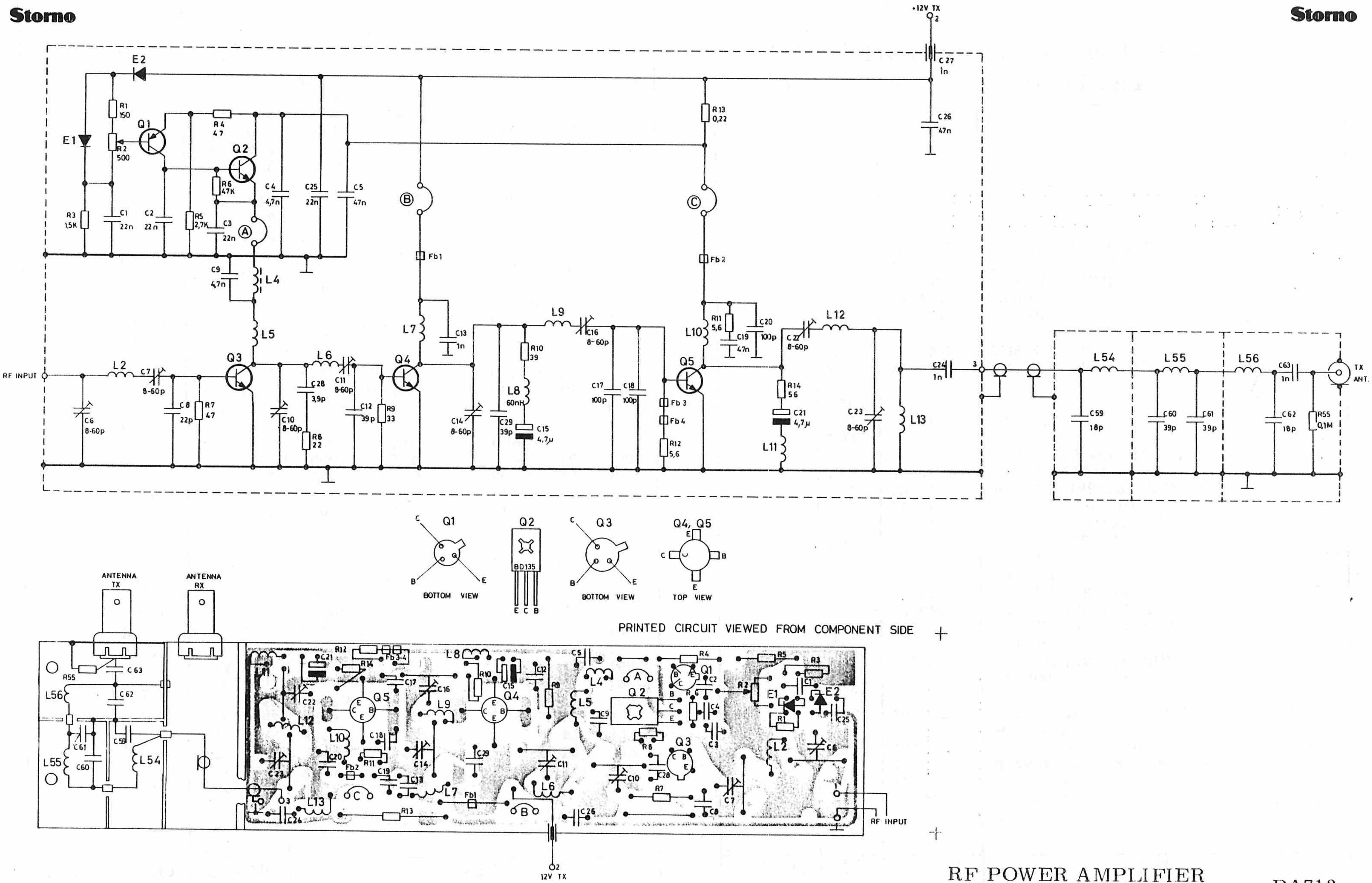
Storno

TYPE	NO.	CODE	DATA

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA712

X401.800
2 af 2



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

RF POWER AMPLIFIER
HF EFFEKTFORSTÆRKER

PA713

D401.952

Storno

TYPE	NO.	CODE	DATA
PA 713		10.2938	Power Amplifier
	C1	76.5061	4.7nF 10% polyest FL 50V
	C2	76.5061	4.7nF 10% polyest FL 50V
	C3	76.5061	4.7nF 10% polyest FL 50V
	C4	76.5061	4.7nF 10% polyest FL 50V
	C5	76.5062	47nF 10% polyest FL 50V
	C6	78.5052	8-60pF trimmer 100V
	C7	78.5052	8-60pF trimmer 100V
	C8	74.5106	22pF 5% ceram TB 160V
	C9	76.5061	4.7nF 10% polyest FL 5oV
	C10	78.5052	8-60pF trimmer 100V
	C11	78.5052	8-60pF trimmer 100V
	C12	74.5117	39pF 5% ceram TB 16oV
	C13	74.5155	1nF-2o/+50% ceram PL 63V
	C14	78.5062	8-60pF trimmer 100V
	C15	73.5126	4.7µF 20% tantal 35V
	C16	78.5062	8-60p trimmer 100V
	C17	74.5199	100pF 20% ceram PL 25V
	C18	74.5199	100pF 20% ceram PL 25V
	C19	76.5052	47nF 10% polyest FL 50V
	C20	74.5013	100pF 20% ceram DI 400V
	C21	73.5126	4.7µF 20% tantal 35V
	C22	78.5052	8-60pF trimmer 100V
	C23	78.5052	8-60pF trimmer 100V
	C24	74.5015	1nF -20/+50% ceram DI 400V
	C25	76.5061	4.7nF 10% polyest FL 50V
	C26	76.5072	47nF 10% polyest FL 50V
	C27		Not used
	C28	74.5130	3.9pF± 2.5pF ceram DI 250V
	C29	74.5117	39pF 5% ceram TB 160V
			C30 - C58 Not used
	C59	74.5196	18pF 5% ceram DI 400V
	C60	74.5197	39pF 5% ceram DI 400V
	C61	74.5197	39pF 5% ceram DI 400V
	C62	74.5196	18pF 5% ceram DI 400V
	C63	74.5015	1nF 20% ceram DI 400V
	R1	80.5239	150 Ω 5% carbon film 1/8W
	R2	86.5042	500 Ω 20% potentiometer 1/10W
	R3	80.5251	1.5 KΩ 5% carbon film 1/8W
	R4	80.5233	47 Ω 5% " 1/8W
	R5	80.5254	2.7 KΩ 5% " 1/8W
	R6	80.5269	47 KΩ 5% " 1/8W
	R7	80.5233	47 Ω 5% " 1/8W
	R8	80.5229	22 Ω 5% " 1/8W
	R9	80.5231	33 Ω 5% " 1/8W

Storno

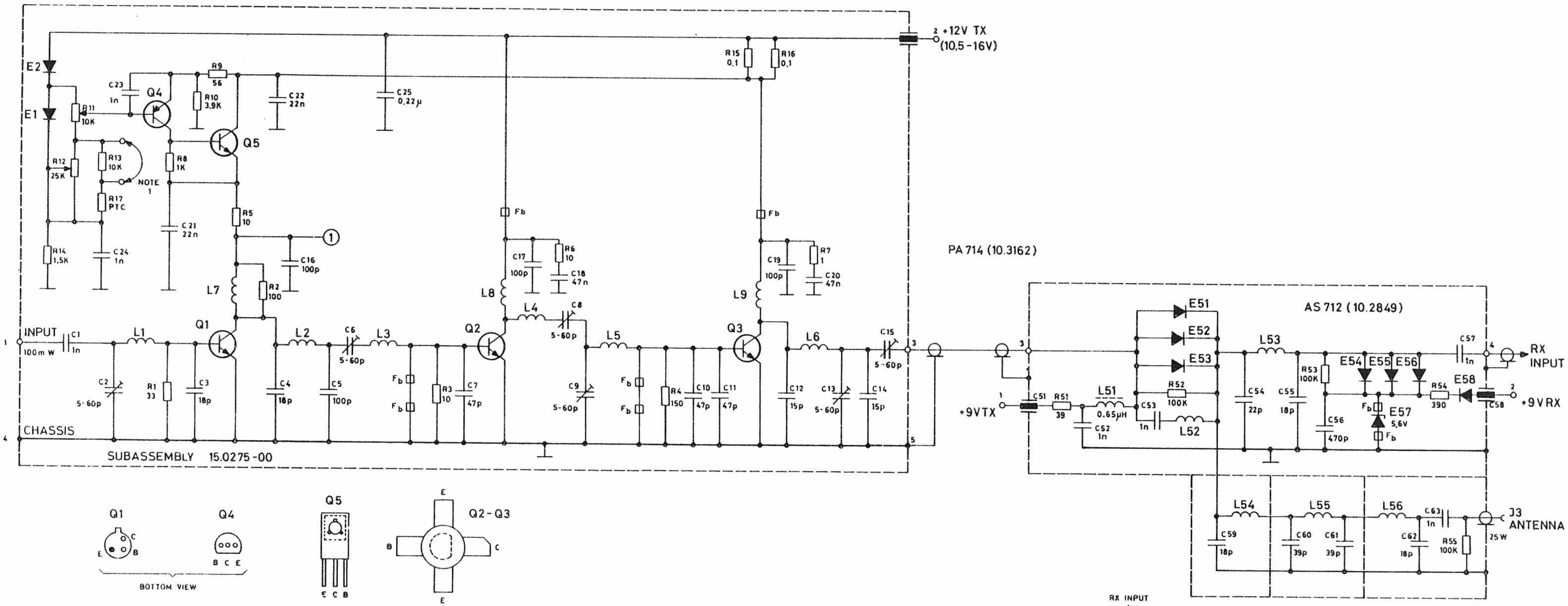
TYPE	NO.	CODE	DATA
	R10	80.5432	39 Ω 5% carbon film 1/4W
	R11	80.5222	5.6 Ω 5% " 1/8W
	R12	80.5222	5.6 Ω 5% " 1/8W
	R13	82.5205	0.22 Ω 10% wire wound 1W
	R14	80.5434	56 Ω 5% carbon film 1/8W
			R15-R54 Not used
	R55	80.5273	0.1 MΩ 5% carbon film 1/8W
	L1		Not used
	L2	62.0822	RF coil 146-174 MHz
	L3		Not used
	L4	63.5008	0.47 µH 20% RF choke
	L5	62.0822	RF coil 146-174 MHz
	L6	62.0823	RF coil 146-174 MHz
	L7	62.0824	RF coil 146-174 MHz
	L8	61.5011	0.06 µH 20% RF choke
	L9	62.0825	RF coil 146-174 MHz
	L10	62.0825	RF coil 146-174 MHz
	L11	61-5011	0.06 µH 20% RF choke
	L12	62.0827	RF coil 146-174 MHz
	L13	62.0826	RF coil 146-174 MHz
			L14 - L53 Not used
	L54		
	L55	62.0816	RF coil
	L56		
	E1	99.5028	1N914 Diode
	E2	99.5028	1N914 Diode
	Q1	99.5230	BC178 Transistor
	Q2	99.5235	BD135 Transistor
	Q3	99.5229	2N4427 Transistor
	Q4	99.5252	BLY87A Transistor
	Q5	99.5253	BLY88A Transistor

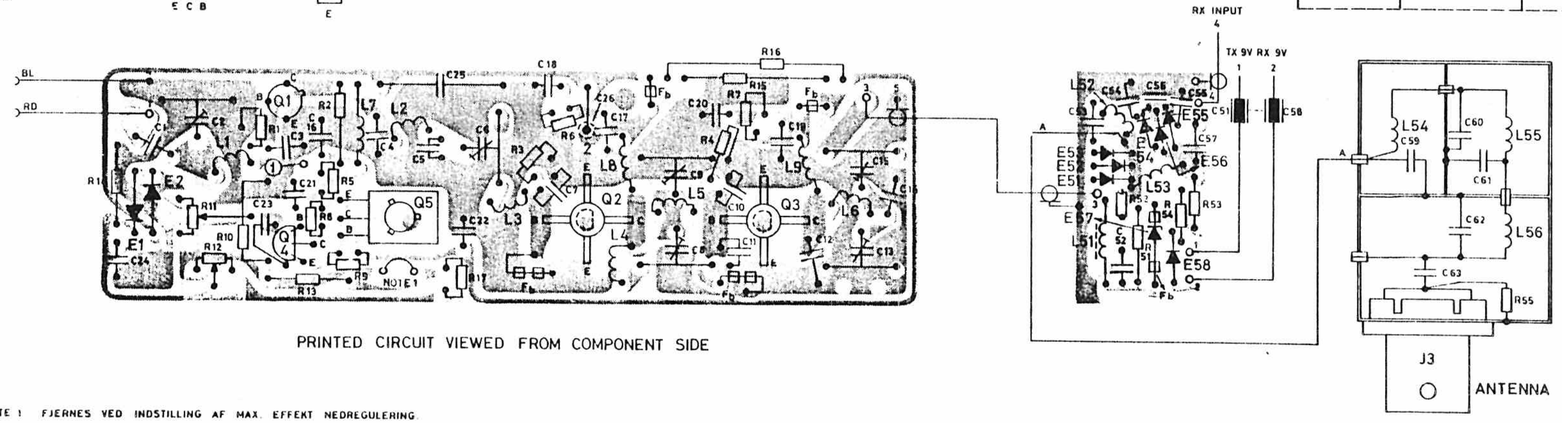
RF POWER AMPLIFIER
HF EFFEKTFORSTÆRKER

PA713

X401.948

Storno





PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

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

Storno

RF POWER AMPLIFIER PA714

D402.250

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 10º polyester 50 V
	C19	74.5155	1nF-20 + 80% ceram 63 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
	L10	63.5008	RF choke
	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

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

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	99.5323	Transistor		2 N 6082	
	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

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

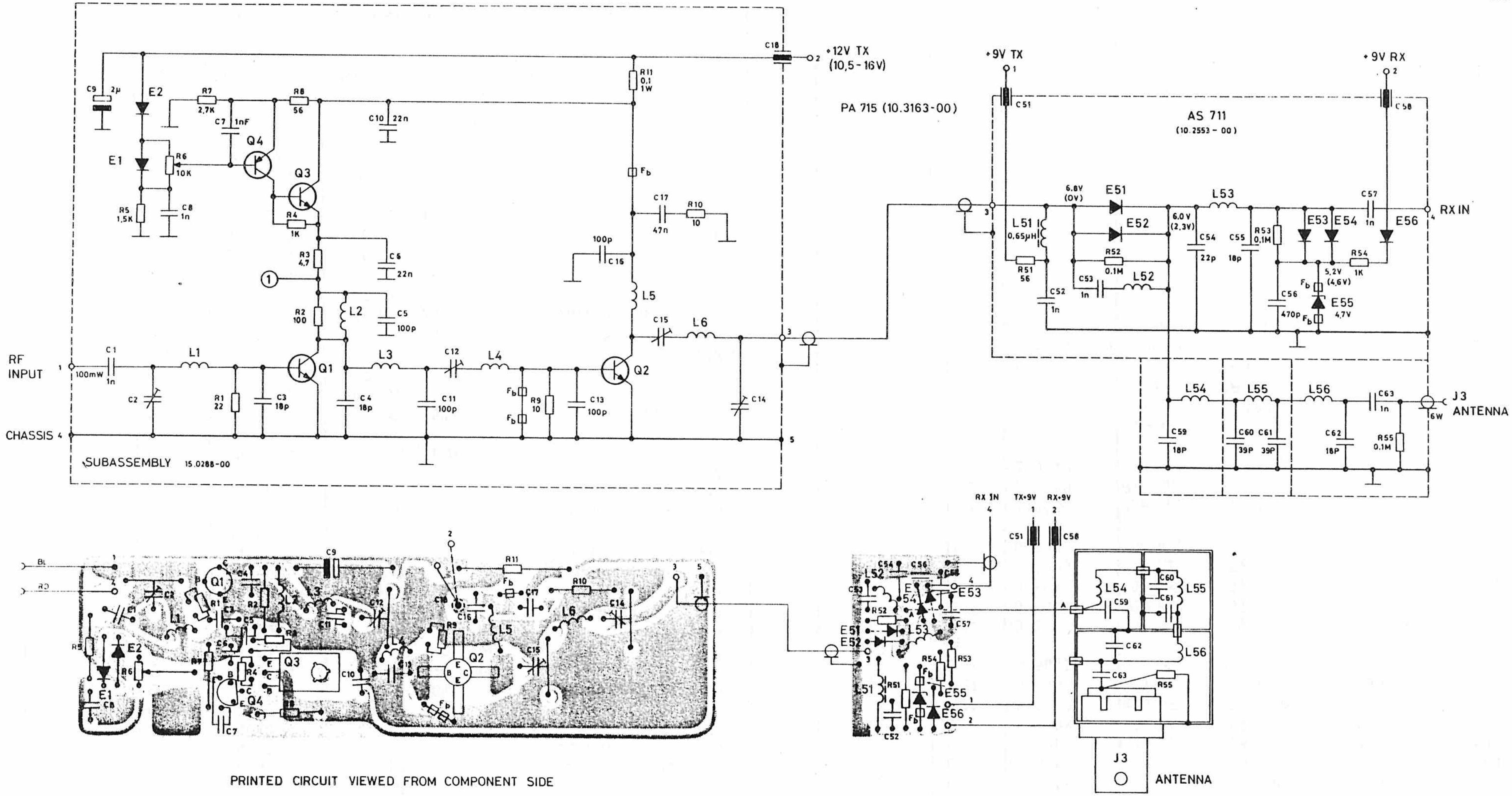
Storno

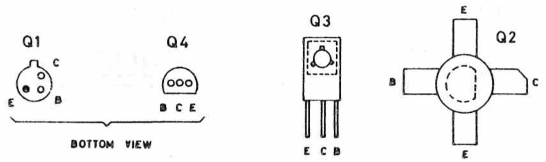
TYPE	Nº	CODE	DATA

POWER AMPLIFIER PA714

X402.374

Storno





RF POWER AMPLIFIER PA715

D 402.335

Storno

Storno

TYPE	Nº	CODE	DATA
PA715		10.3163-00	Power Amplifier (AS711 incl.)
	C1	74.5115	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	74.5013	100 pF 20% " 400 V
	C6	76.5071	22 nF 10% polyester 50 V
	C7	74.5155	1 nF -20 + 80% ceram 63 V
	C8	74.5155	1 nF -20 + 80% " 63 V
	C9	73.5064	2 µF -10 + 100% 70 V
	C10	76.5071	22 nF 10% polyester 50 V
	C11	74.5342	100 pF 2% ceram 63 V
	C12	78.5061	5/60 pF teflon trimmer 300 V
	C13	74.5013	100 pF 20% ceram 400 V
	C14	78.5061	5/60 pF teflon trimmer 300 V
	C15	78.5061	5/60 pF teflon trimmer 300 V
	C16	74.5013	100 pF 20% ceram 400 V
	C17	76.5072	47 nF 10 % polyester 50 V
	C18	69.5023	Filter feed-through
	R1	80.5229	22 Ω 5% carbon film 1/8 W
	R2	80.5237	100 Ω 5% " 1/8 W
	R3	80.5221	4.7 Ω 5% " 1/8 W
	R4	80.5249	1 KΩ 5% " 1/8 W
	R5	80.5251	1.5 KΩ 5% " 1/8 W
	R6	86.5039	10 KΩ 20 % trim carbon film 1/8 W
	R7	80.5254	2.7 KΩ 5% " 1/8 W
	R8	80.5234	56 Ω 5% " 1/8 W
	R9	80.5225	10 Ω 5% " 1/8 W
	R10	80.5225	10 Ω 5% " 1/8 W
	R11	82.5208	0.1 Ω 10% wire wound 1/8 W
	E1	99.5028	1 N 914 Diode
	E2	99.5028	1 N 914 Diode
	L1	62.0941	RF coil 146 - 174 MHz
	L2	62.0651	0.08 µH RF choke
	L3	62.0930	RF coil 146 - 174 MHz
	L4	62.0930	RF coil 146 - 174 MHz
	Q1	99.5321	Transistor MRF237
	Q2	99.5322	Transistor MRF212
	Q3	99.5235	Transistor BD135
	Q4	99.5144-01	Transistor BC214L
		15.0288	Subassembly

Storno

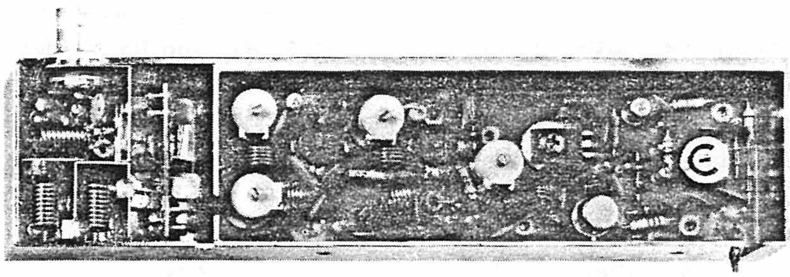
TYPE	Nº	CODE	DATA
AS711		10.2553-00	Antenna Switching Unit
	C52	74.5155	1 nF -20 + 80% ceram 63 V
	C53	74.5155	1 nF -20 + 80% " 63 V
	C54	74.5008	22 pF 5% " 400 V
	C55	74.5138	18 pF 5% " 125 V
	C56	74.5162	470 pF -20 + 50% 400 V
	C57	74.5155	1 nF -20 + 80% ceram 63 V
	C63	74.5015	1 nF 20% " 400 V
	R51	80.5234	56 Ω 5% carbon film 1/10 W
	R52	80.5073	100 KΩ 5% " 1/10 W
	R53	80.5073	100 KΩ 5% " 1/10 W
	R54	80.5049	1 KΩ 5% " 1/10 W
	R55	80.5273	100 KΩ 5% " 1/8 W
	L51	62.0662-01	0,65 µH RF choke
	L52	62.0818	RF coil
	L53	62.0817	RF coil
	E51	99.5244	Diode BA182
	E52	99.5244	Diode BA182
	E53	99.5244	Diode BA182
	E54	99.5244	Diode BA182
	E55	99.5224	Zenerdiode 4,7 V 5% 0.25 W
	E56	99.5237	Diode 1N4148

POWER AMPLIFIER PA715

X402.368

 Storno

RF POWER AMPLIFIER PA731



Description

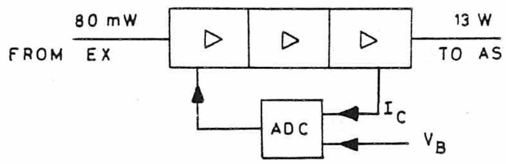
General

PA731 contains 3 power amplifier stages and a current regulating circuit.

The unit is completely shielded, being built into a combination heat sink and shield which also contains the antenna switching unit.

The current regulating circuit monitors both the supply voltage and the output transistor collector current, preventing overloading of the transistors due to either too high a voltage or too great a standing wave ratio in the output load. This circuit also allows the output power to be more independent of the power supply or of variations in power output from the exciter.

RF Power Amplifier



The first driver, Q1, gets its collector voltage via the ADC circuit regulating transistor, Q5. Increasing or decreasing the collector voltage to Q1 regulates the drive power applied to the following stages.

Q1 amplifies the exciter signal of about 80 mW to approx. 400 mW, which is necessary to drive Q2 properly.

Transistor Q2 further amplifies the power to approx. 3 W in order to be able to drive the final power amplifier, Q3.

Output transistor Q3 amplifies the RF power signal to approximately 14 W and the following matching network of L7, C18/C19 and C20/C21 suppresses harmonics of the fundamental VHF frequency while transforming the collector impedance of Q3 to the antenna impedance of 50 Ω. Resistor R8 in the output transistor collector path is the current monitoring resistor for the ADC circuit.

Current Regulating Circuit (ADC)

The purpose of the regulating circuit is to protect the transistors against overloads caused by too high a supply voltage and to limit current through the output transistor in case of mismatching. To accomplish this, the regulating circuit must monitor the supply voltage as well as the collector current through the transistor and from such results regulate the collector voltage to the first RF driver transistor, Q1, and thus the drive power to the following stages.

The circuit consists of two DC coupled transistor stages, Q4 and Q5. Base to Q4 is tied to a reference voltage that can be determined by setting the trimming potentiometer, R10. Reference voltage is developed across diodes E1 and E2, which are biased into forward conduction. This introduces a temperature dependency in the reference voltage that compensates for the temperature characteristics of the transistors.

For easier understanding of the circuit principle, first ignore its voltage dependent features; therefore, imagine that resistor R13 is removed from the circuit.

The DC return path for the emitter of Q4 is through R8 to the positive voltage terminal. R8 carries the collector current from the output amplifier Q3. A rise in this collector current will mean an increase in the voltage drop across R8, causing the emitter of Q4 to become less positive and the collector voltage will likewise become less positive. This decreases bias to Q5, decreasing the current through this transistor. Since Q5 is in series with the DC collector path of Q1, the effect will be that of placing a larger resistor in series with the collector supply, thus reducing collector voltage to Q1. The RF drive to the output stage will fall, thereby counteracting the original increase in collector current.

If the supply voltage increases, the current through the output transistors will be kept constant as already explained, but the power dissipation in the transistor will increase along with the voltage. To counteract this effect, a voltage regulating loop is included.

Imagine R13 connected back into the circuit again so that a voltage divider consisting of R15 and R13 will develop a voltage across R15 in proportion to the supply voltage.

When the supply voltage increases so will the voltage drop across R15 and the base-emitter bias for Q4 will fall, again resulting in a reduction of collector voltage to Q1 and a reduction in the drive to the output stage.

The reduction of drive power decreases the current through Q3 and R8 just enough to counteract the original increase of voltage across R15.

The transmitter output power can be set to the desired level by means of potentiometer R10 in the ADC circuit.

By selecting a suitable ratio between resistors R15, R13 and R8 the desired amount of regulation can be achieved.

Technical Specification

Frequency Range

68 - 88 MHz

Supply Voltage

Nominal	13.6 V (12.5 V)
Operating range	10 - 16 V

Output Power at 13.6 V : 13.5 W

With output power set for 12 W at 13.6 V, as measured through AS731 :

Output power at 16 V	13 W
Output power at 10 V	8 W

Current Consumption

at nominal voltage 13.6 V :	2.0 A
at 16 V :	1.85 A
at 10 V :	1.7 A

Input Power

(min. 50 mW, max. 150 mW) 80 mW

Input Impedance

50 Ω

Output Impedance

50 Ω

Gain at P_{in} = 50 mW

24 dB

Temperature Range

Operating range :	-25° to $+70^{\circ}$ C
Functioning range :	-30° to $+80^{\circ}$ C

Mechanical Dimensions

25 x 42 x 168 mm

(PC board : 35.6 x 119.4 mm)

Storno

ANTENNA SWITCH AS731

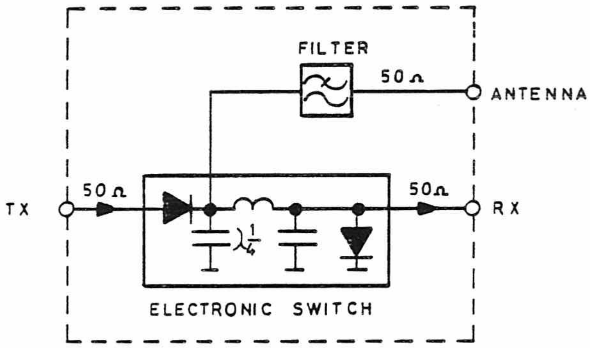
Description

General

The antenna switch AS731 contains a circuit for electronically switching the antenna between the transmitter and the receiver sections, and a low-pass filter that attenuates undesired frequencies, such as harmonics of the signal frequency, thus preventing their being radiated from the antenna.

AS731 mounts directly into the combination heat sink and shield for PA731.

The following simplified diagram shows the operating principle for the AS sub-unit.



The Electronic Switch

Refer to the complete schematic diagram D401.364.

By switching a +9 V potential between terminals 1 and 2, the antenna is electronically switched between transmit and receive.

When transmitting, diodes E51, E52, E53, and E54 conduct. The receiver terminal will see a short circuit.

The 1/4 wave impedance circuit consisting of C53, L52 and C54 transforms the short to an open circuit at the antenna, thus the transmit signal reaches the antenna with minimum loss.

When receiving, the diodes are effectively blocked due to the bias across zener diode E55. Now the diodes only represent a small capacity which, at the frequencies involved, has negligible influence upon the signal path from antenna to receiver.

The transmitter terminal, however, is isolated from the antenna.

The received signal is now free to pass from the antenna to the receiver input with minimum loss.

The Low-pass Filter

The low-pass filter is a 7-pole Chebishev filter exhibiting negligible band-pass ripple and minimum insertion loss.

The filter is built on a metal plate chassis having three closed compartments. It requires no alignment.

Technical Specification

Frequency Range
68 - 88 MHz

Input and Output Impedance
50 Ω

Insertion Loss (transmitter to antenna)
0.5 dB

Insertion Loss (antenna to receiver)
0.6 dB

Separation between Transmitter and Receiver
27 dB

Second Harmonic (136 MHz) Attenuation
46 dB

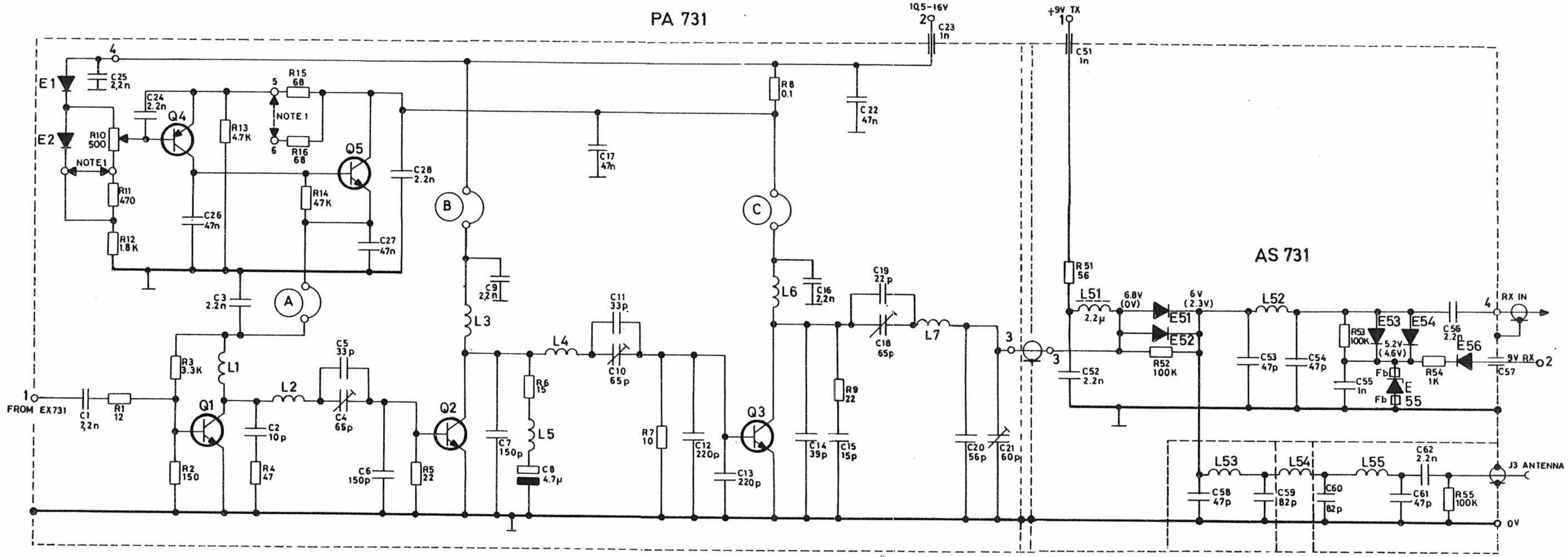
Current Drain, transmit
38 mA

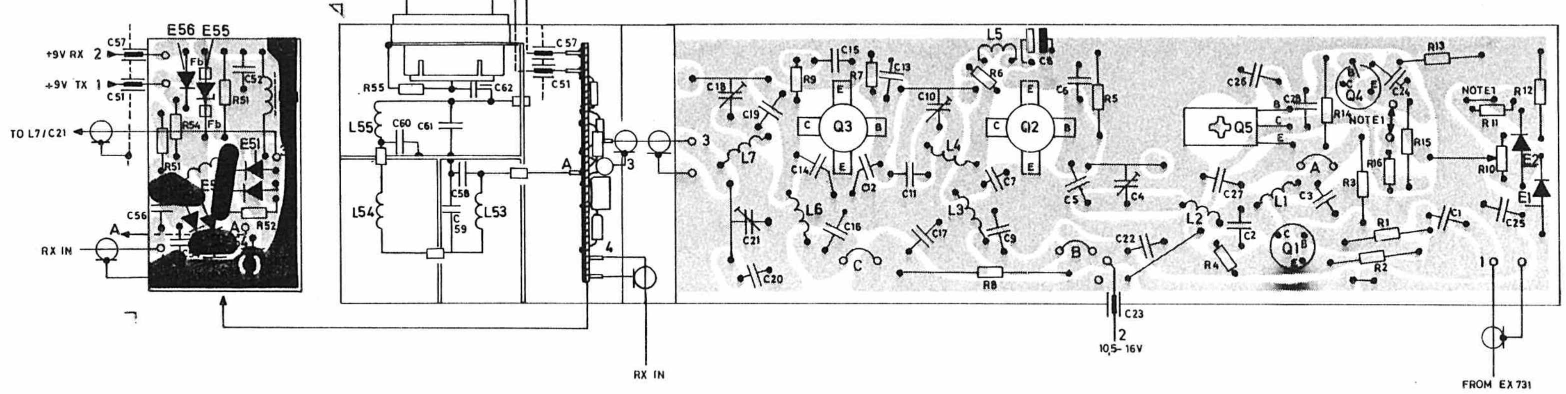
Current Drain, receive
4 mA

Temperature Range
operating range -25° to $+70^{\circ}$C
functioning range -30° to $+70^{\circ}$C

Dimensions
40 x 38 x 22 mm

Storno





Note 1: Connect term. 5 and 6 for 6W.
Remove strap for 6 W.
Forbind term. 5 og 6 ved 6 W.
Fjern strapning ved 6 W.

DC voltages without paranthesis measured in transmit mode

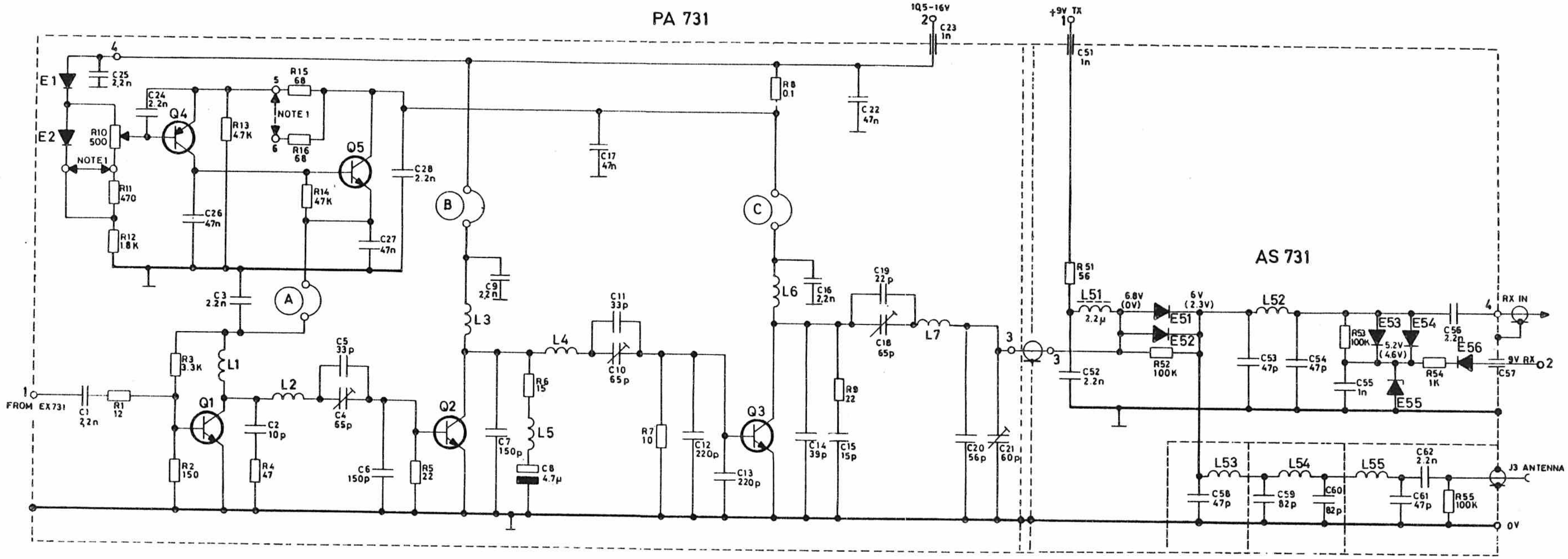
DC voltages with paranthesis measured in receive mode

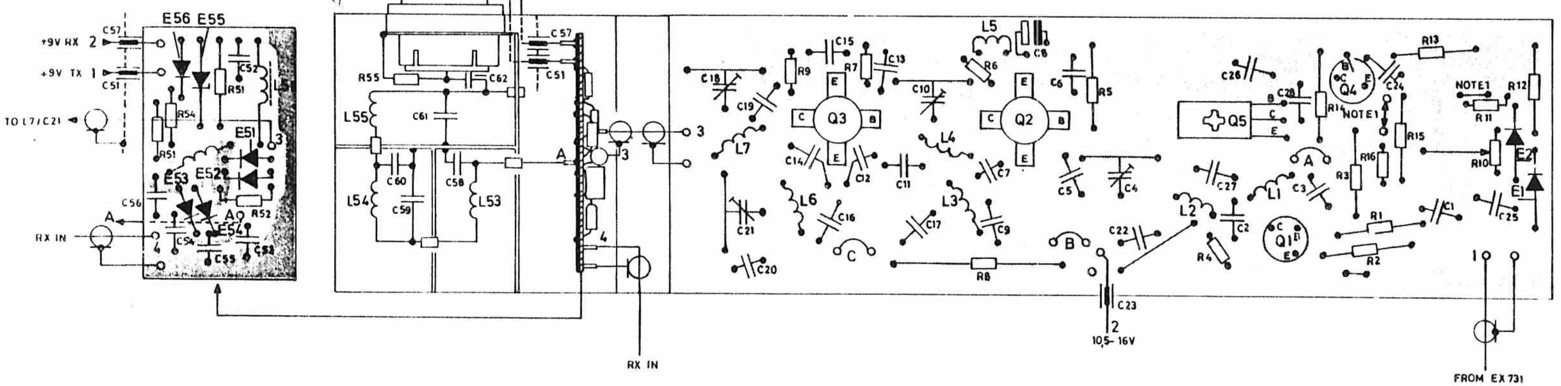
POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA731

D401.888/2

Storno





Note 1: Connect term. 5 and 6 for 6W.
Remove strap for 6 W.
Forbind term. 5 og 6 ved 6 W.
Fjern strapning ved 6 W.

DC voltages without paranthesis measured in transmit mode

DC voltages with paranthesis measured in receive mode

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA731

D401.888

Storno

TYPE	NO.	CODE	DATA	
PA 731		10.2629-00	Power amplifier (AS 731 incl.)	
	C1	74.5163	2.2nF - 20+80% ceram PL	63V
	C2	74.5135	10pF 5% ceram DI	125V
	C3	74.5163	22nF - 20+80% ceram PL	63V
	C4	78.5052	8 - 60pF trimmer	100V
	C5	74.5116	33pF 5% ceram TB	160V
	C6	74.5202	150pF 10% ceram PL	25V
	C7	74.5202	150pF 10% ceram PL	25V
	C8	73.5126	4.7μF 20% tantal	35V
	C9	74.5163	2.2nF - 20+80% ceram PL	63V
	C10	78.5052	8 - 60pF trimmer	100V
	C11	74.5116	33pF 5% ceram TB	160V
	C12	74.5203	220pF 10% ceram	25V
	C13	74.5203	220pF 10% ceram PL	25V
	C14	74.5197	39pF 5% ceram DI	400V
	C15	74.5137	15pF 5% ceram DI	125V
	C16	74,5163	2.2nF - 20+80% ceram PL	63V
	C17	76.5072	47nF 10% polyest FL	50V
	C18	78.5052	8 - 60pF trimmer	100V
	C19	74.5008	22pF 5% ceram DI	400V
	C20	75.5015	56pF 5% mica	500V
	C21	78.5052	8 -60pF trimmer	100V
	C22	76.5072	47nF 10% polyest. FL	50V
	C23	69.5023	VHF feed - through filter	
	C24	74.5163	2.2nF - 20+80% ceram PL	63V
	C25	74.5163	2.2nF - 20+80% ceram PL	63V
	C26	76.5072	47nF 10% polyest FL	50V
	C27	76.5072	47nF 10% polyest FL	50V

Storno

TYPE	NO.	CODE	DATA	
	C28	74.5163	2.2nF - 20x80% ceram PL	63V
	R1	80.5226	12Ω 5% carbonfilm	1/8W
	R2	80.5239	150Ω 5% carbon film	1/8W
	R3	80.5255	3.3kΩ 5% carbon film	1/8W
	R4	80.5233	47Ω 5% carbon film	1/8W
	R5	80.5229	22Ω 5% carbon film	1/8W
	R6	80.5427	15Ω 5% carbon film	1/4W
	R7	80.5225	10Ω 5% carbon film	1/8W
	R8	82.5208	0.1Ω 10% wire wound	1W
	R9	80.5429	22Ω 5% carbon film	1/4W
	R10	86.5042	500Ω 20% potentiometer	0.1W
	R11	80.5245	470Ω 5% carbon film	1/8W
	R12	80.5252	1.8kΩ 5% carbon film	1/8W
	R13	80.5257	4.7kΩ 5% carbon film	1/8W
	R14	80.5269	47kΩ 5% carbob film	1/8W
	R15	80.5235	68Ω 5% carbon film	1/8W
	R16	80.5235	68Ω 5% carbon film	1/8W
	L1	62.0828	RF coil 68 - 88 MHz	
	L2	62.0832	RF coil 68 - 88 MHz	
	L3	62.0829	RF coil 68 - 88 MHz	
	L4	62.0830	RF coil 68 - 88 MHz	
	L5	62.0651	0.08μH RF choke	
	L6	62.0831	RF coil 68 - 88 MHz	
	L7	62.0829	RF coil 68 - 88 MHz	

RF POWER AMPLIFIER
HF EFFEKTFORSTÆRKER

PA731

X 401.787

Storno

TYPE	NO.	CODE	DATA	
	E1	99.5028	1N 914 diode	
	E2	99.5028	1N 914 diode	
	Q1	99.5229	2 N 4427 transistor	
	Q2	99.5252	BLY 87 A transistor	
	Q3	99.5253	BLY 88 A transistor	
	Q4	99.5230	BC 178 transistor	
	Q5	99.5235	BD 135 transistor	
AS 731		10.2668-00	Antenna switch	
	C51	69.5007	VHF feed - through filter	
	C52	74.5163	2.2nF -20 +80% ceram PL	63V
	C53	74.5014	47pF 5% mica	500V
	C54	74.5118	47pF 5% ceram TB	160V
	C55	74.5204	1nF - 20+80% ceram DI	400V
	C56	74.5163	2.2nF -20+80% ceram PL	63V
	C57	69.5007	VHF feed - through filter	
	C58	75.5014	47pF 5% mica	500V
	C59	75.5016	82pF 5% mica	500V
	C60	75.5016	82pF 5% mica	500V
	C61	75.5014	47pF 5% mica	500V
	C62	74.5093	2.2nF - 20+80% ceram DI	400V
	R51	80.5234	56Ω 5% carbon film	1/8W
	R52	80.5073	0.1MΩ 5% carbon film	0.1W
	R53	80.5073	0.1MΩ 5% carbon film	0.W
	R54	80.5049	1kΩ 5% carbon film	0.1W
	R55	80.5273	0.1MΩ 5% carbon film	1/8W

Storno

TYPE	NO.	CODE	DATA	
	L51	63.5006	2.2μH 20% RF choke	0.6A
	L52	62.0836	RF coil 68 - 88 MHz	
	L53	62.0837	RF coil 68 - 88 MHz	
	L54	62.0837	RF coil 68 - 88 MHz	
	L55	62.0837	RF coil 68 - 88 MHz	
	E51	99.5214	BA 182 diode	
	E52	99.5214	BA 182 diode	
	E53	99.5214	BA 182 diode	
	E54	99.5214	BA 182 diode	
	E55	99.5224	4.7V 5% zenerdiode	0.25W
	E56	99.5237	1N 4148 diode	

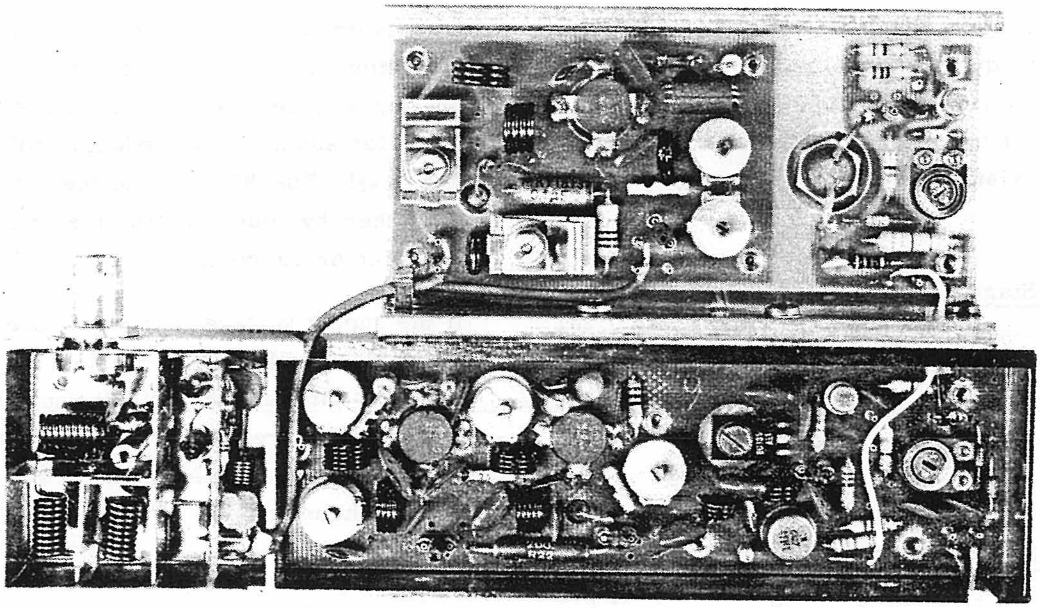
POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA731

X401.787

Storno

RF POWER AMPLIFIER PA732



Description

PA732 comprises 4 RF power amplifier stages, three in the driver and one in the booster as well as a regulating and temperature protection circuit and, finally, an electronic antenna switching unit with filter, AS732.

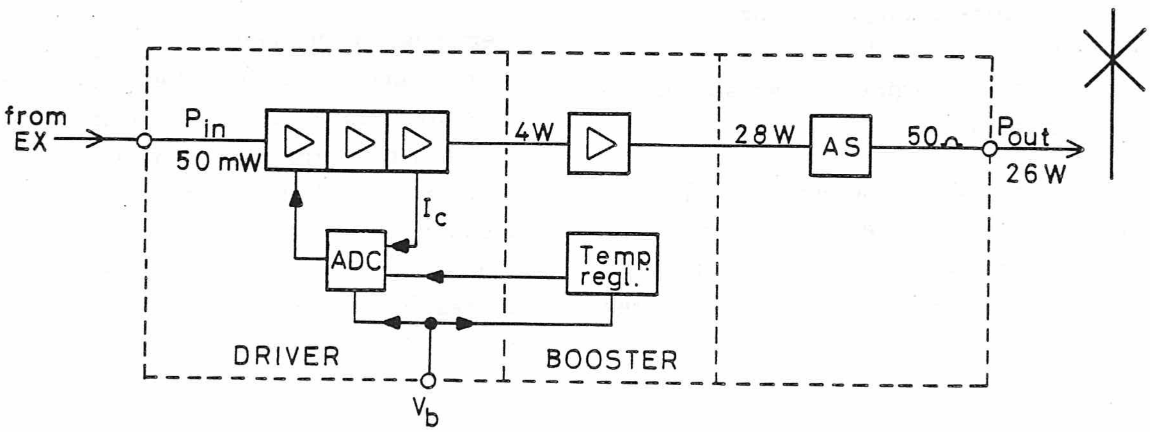
PA732 is completely shielded, as it is built into a combination heat sink and shield. However, heat dissipation will be insufficient without the external heat sink/cabinet CA703.

The regulating and temperature protection circuit protects the transistors and other components in the unit against incurring damages when operated within the permissible values of supply voltages and temperatures, or as a result of prolonged short circuits or too great a standing wave ratio in the output load.

RF Power Amplifier

The first driver, Q1, gets its collector voltage via the ADC circuit regulating transistor, Q5. Increasing or decreasing the collector voltage to Q1 regulates the drive power applied to the following stages.

RC-network C1, R1, R2 and R3 matches the exciter output impedance to the input impedance of Q1. Due to this impedance matching it is also possible to drive the PA stage from a 50 Ω generator.



Q1, Q2 and Q3 amplify the exciter output signal of 50 mW to 4 W in order to drive the booster stage. Matching network L7, C18, C19, C20 and C21 suppresses harmonics of the fundamental VHF frequency while transforming the collector impedance of Q3 to 50 Ω. Resistor R8 in the collector return of Q3 is the current monitoring resistor for the ADC circuit.

Booster Stage

Q101 amplifies the 4 W output power from the driver stage to 28 W and applies the signal to AS732. Due to the inherent losses in the AS unit the PA output power is then 26 W.

Current Regulating Circuit (ADC)

The purpose of the regulating circuit is to protect the transistors against overloads caused by excessive supply voltage and to limit current through the output transistor in case of mismatching. To accomplish this, the regulating circuit must monitor the supply voltage as well as the collector current through Q3 in the driver stage and from such results regulate the collector voltage to the first driver transistor Q1, and thus the drive power to the following stages.

The circuit consists of two DC coupled transistor stages, Q4 and Q5. Base to Q4 is tied to a reference voltage that can be determined by setting potentiometer R10. Reference voltage is developed across diodes E1 and E2, which are biased into forward conduction. This introduces a temperature dependency in the reference voltage that compensates for the temperature characteristics of the transistors.

For easier understanding of the circuit principle, first ignore its voltage dependent features; therefore, imagine that resistor R13 is removed from the circuit.

The DC return path for the emitter of Q4 is through R8 to the positive voltage terminal. R8 also carries the collector current from transistor Q3. A rise in this collector current will mean an increase in the voltage drop accros R8, causing the emitter of Q4 to become less positive and the collector voltage will likewise become less positive. This decreases forward bias to Q5, decreasing the current through this transistor. Since Q5 is in series with the DC collector path of Q1, the effect will be that of placing a larger resistor in series with the collector supply, thus reducing collector voltage to Q1. The RF drive to the output stage will fall, thereby counteracting the original increase in collector current.

If the supply voltage increases, the current through Q3 will be kept constant as already explained, but the power dissipation in the transistor will increase along with the voltage. To counteract this effect, a voltage regulating loop is included.

Imagine R13 connected back into the circuit again so that a voltage divider consisting of R15 and R13 will develop a voltage across R15 in proportion to the supply voltage.

When the supply voltage increases so will the voltage drop across R15 and the base-emitter bias for Q4 will fall, again resulting in a reduction of collector voltage to Q1 and a reduction in the drive to the output stage.

The reduction of drive power decreases the current through Q3 and R8 just enough to counteract the original increase of voltage across R15. By selecting a suitable ratio between resistors R15, R13 and R8 the desired amount of regulation can be achieved.

The transmitter power can be set to the desired level by means of potentiometer R10 in the ADC circuit.

Temperature Protection Circuit

Since transistor Q101 in the booster stage is not directly included in the ADC loop, it requires extra thermal protection which is accomplished by means of a PTC resistor, R109, which is mounted close to Q101. When Q101, and R109 along with it, reach a certain temperature the increasing resistance of R109, which is also a part of the ADC loop of the driver stage, regulates (reduces) the drive to Q101.

Storno

Thus the output power of the PA unit is regulated to a preset level that ensures thermal protection of Q101 and other components.

The temperature protection circuit operates in the following manner: Under normal operating conditions (prior to regulation) Q102 is biased to cut-off by the voltage divider network of R104 and the PTC resistor (60 Ω) connected across zener diode E101 for a stable source. As the temperature in the PA stage rises the resistance of R109 increases and Q102 begins to pass current. When R109 reaches 1.2 kΩ Q102 will be completely open. When Q102 opens up, the circuit shunts diodes E1 and E2 and the voltage across these diodes falls, causing the base-emitter voltage for Q4 to fall, as well.

As a result, Q1's collector voltage falls, too, thereby also reducing the drive to the following stages.

The amount of regulation (reduction in output power) is preset by potentiometer R107. Q102's emitter resistor is included to flatten out the regulation characteristic. Diode E102 in the collector lead of Q102 ensures temperature compensation of the reference voltage at the base of Q4 even at maximum regulation.

Technical Specifications

Frequency Range
68 to 88 MHz

Nominal Supply Voltage
13 V

Output Power
With output power set for 26 W at 13 V

output power at 15.5 V	26 W
output power at 10 V	16 W

Current Consumption
At nominal 13 V: 4.3 A
at 15.5 V: 4 A
at 10 V: 3.5 A

Input Power
nominal 80 mW
minimum 50 mW

Input Impedance
50 Ω

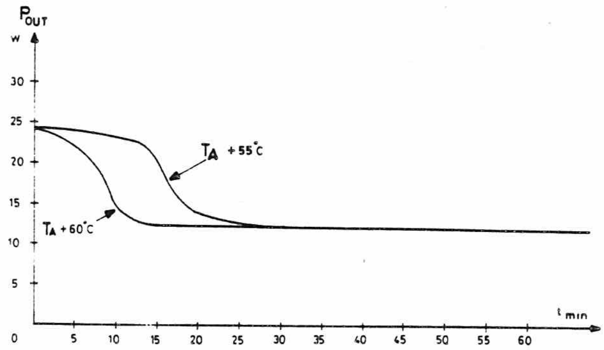
Output Impedance
50 Ω

Gain with P_{in} = 50 mW
27 dB

Reduction of Output Power
vs. Ambient Temperature

Continuous, T_A -25° to +25°C	0.6 dB
Intermittent, T_A -25° to +55°C	0.6 dB
Continuous, T_A +55°C	3 dB

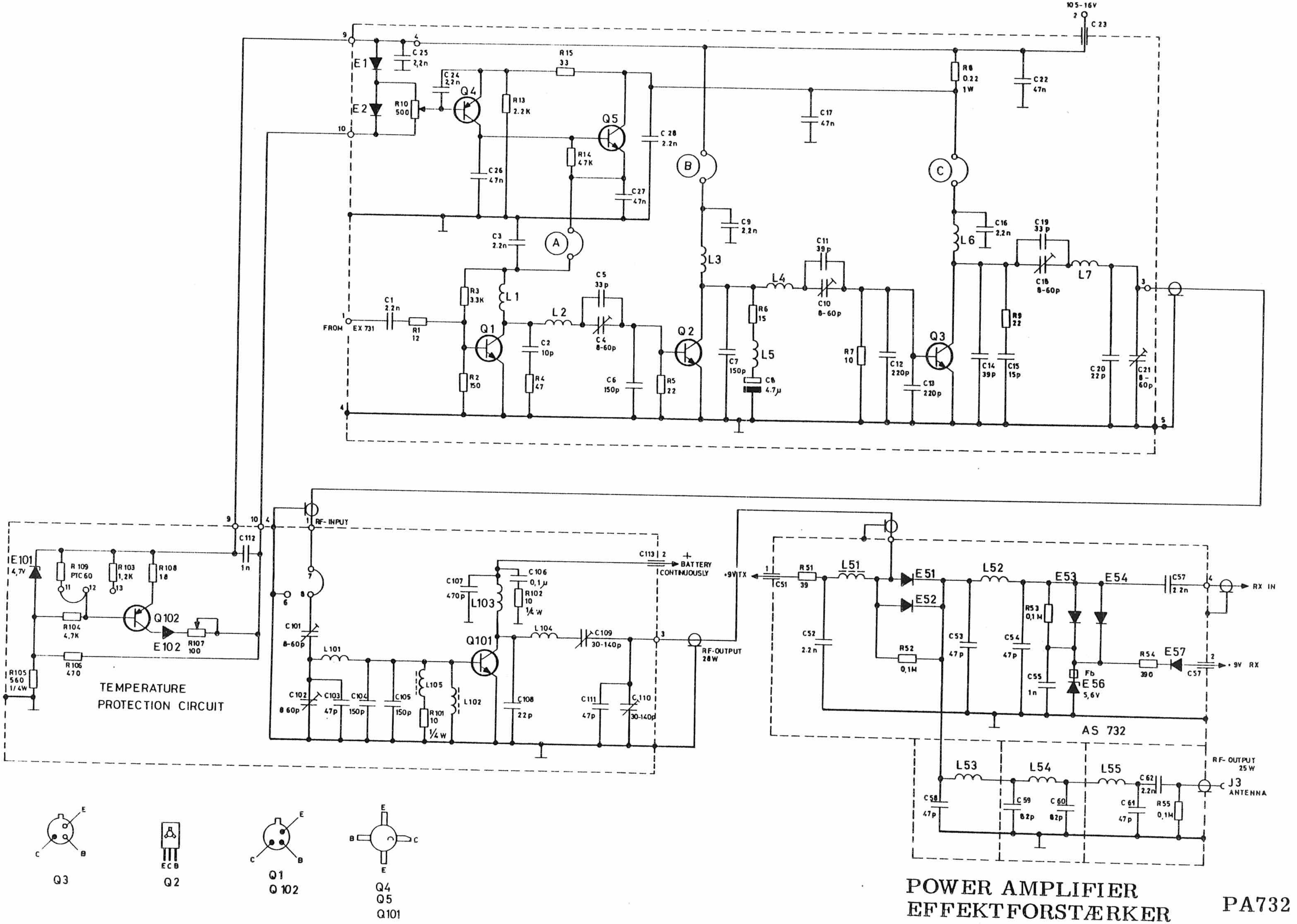
(refer to response curve below)



Typical output power regulating characteristic of PA732 with CA703 mounted. Plotted for ambient temperatures of +55°C and +60°C, at nominal voltage, continuous keying of transmitter.

Temperature Range
operating -25°C to +55°C
functioning -30°C to +60°C.

Mechanical Dimensions
168 x 97 x 32 mm

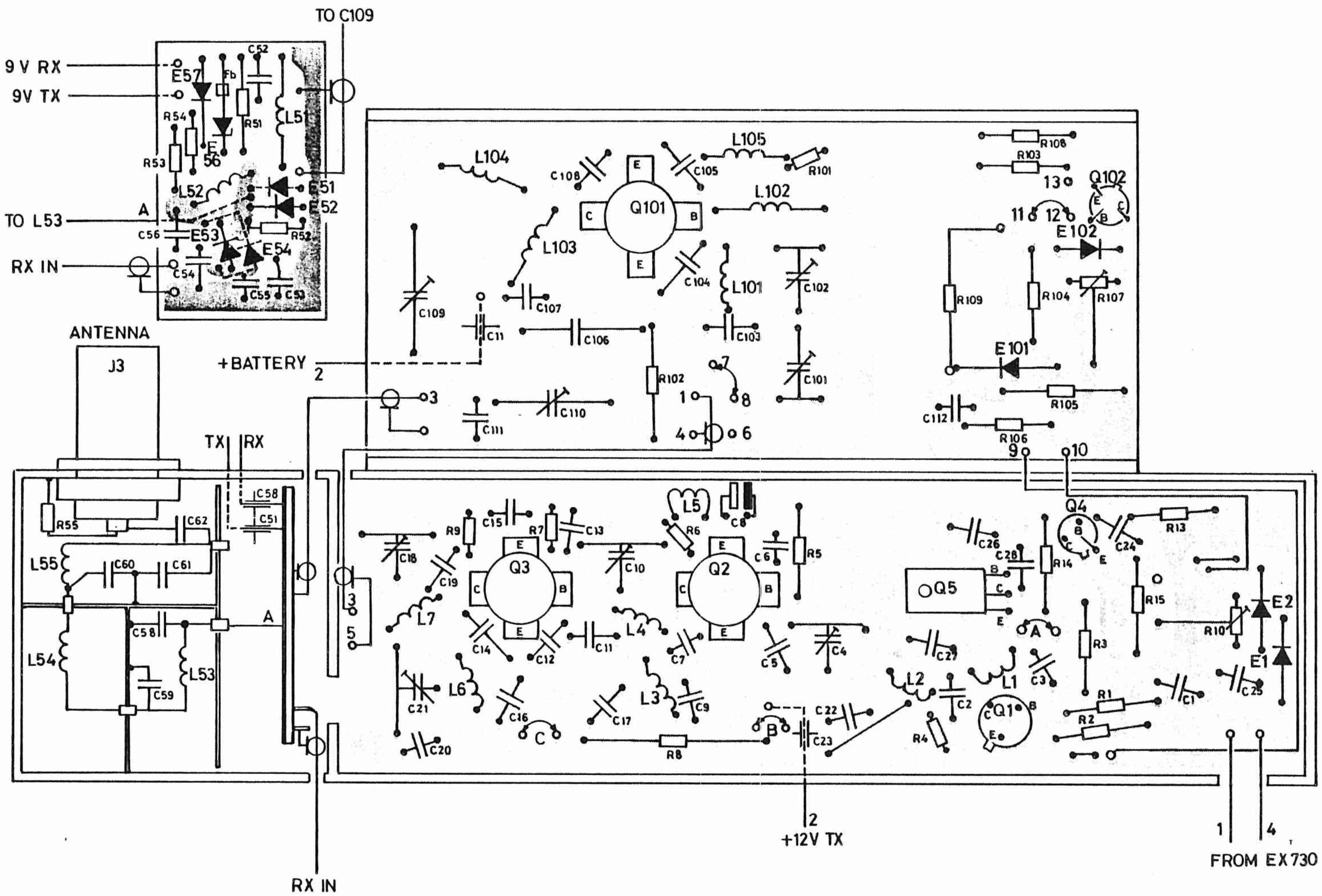


POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA732

D 401.956/2

Storno

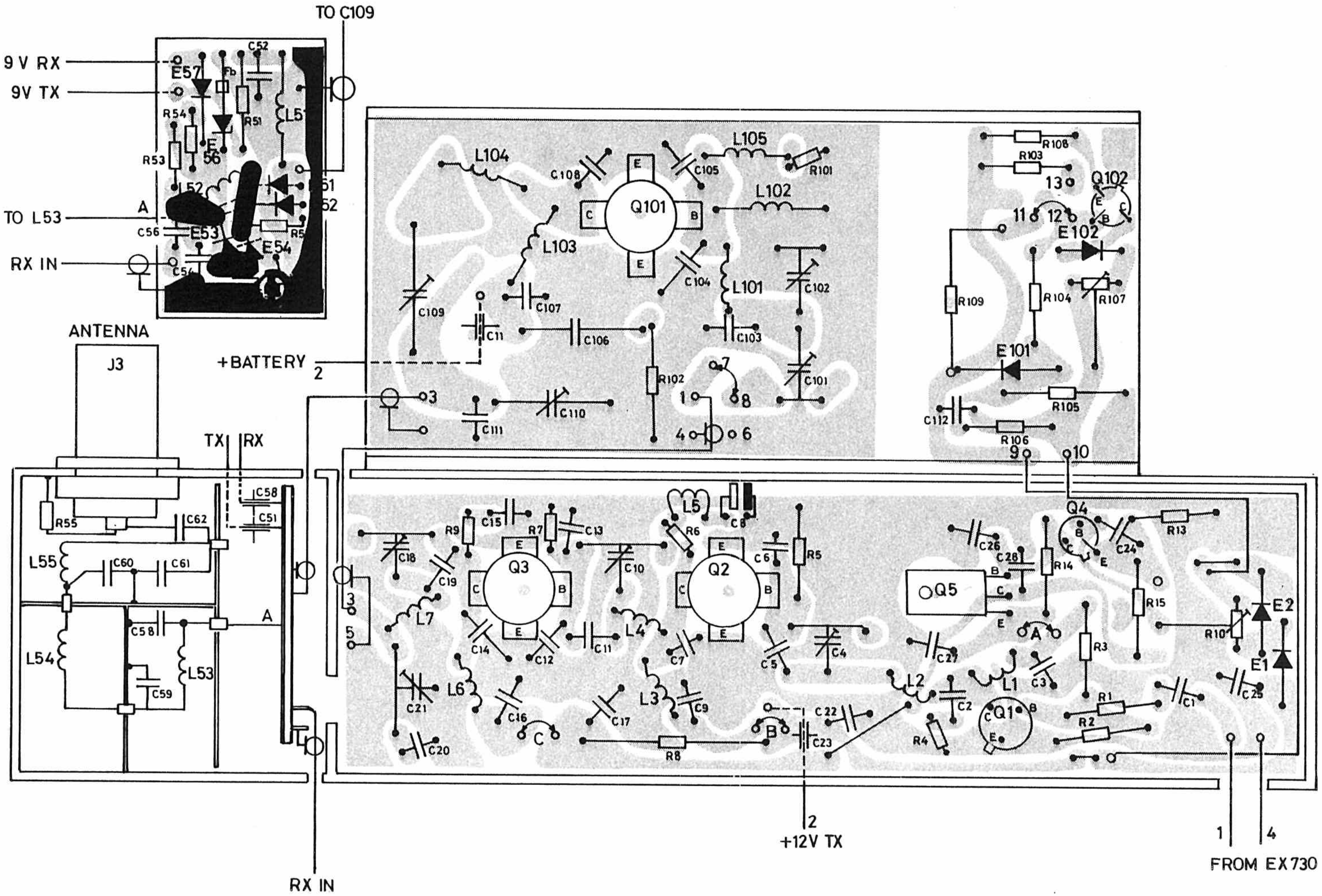


POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA732

D402.168

Storno



POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA732

D402.395

Storno

TYPE	NO.	CODE	DATA	
PA732		10.3044	POWER AMPLIFIER	
	C1	74.5163	2.2nF -20+80% ceram PL	63V
	C2	74.5135	10pF ± 5% N150 ceram DI	125V
	C3	74.5163	2.2nF -20+80% ceram PL	63V
	C4	78.5052	8-60pF Trimmer	100V
	C5	74.5116	33pF ± 5% N075 ceram TB	160V
	C6	74.5202	150pF ± 10% N750 ceram PL	25V
	C7	74.5202	150pF ± 10% N750 ceram PL	25V
	C8	73.5126	4.7μF 20% tantal	35V
	C9	74.5163	2.2nF -20+80% ceram PL	63V
	C10	78.5052	8-60pF Trimmer	100V
	C11	74.5117	39pF ± 5% N075 ceram TB	160V
	C12	74.5203	220pF ± 10% N750 ceram PL	25V
	C13	74.5203	220pF ± 10% N750 ceram PL	25V
	C14	74.5197	39pF ± 5% N150 DI	400V
	C15	74.5137	15pF ± 5% N150 ceram DI	125V
	C16	74.5163	2.2nF -20+80% ceram PL	63V
	C17	76.5072	47nF 10% polyest. FL	50V
	C18	78.5052	8-60pF Trimmer	100V
	C19	74.5116	33pF ± 5% N075 ceram TB	160V
	C20	74.5008	22pF ± 5% N150 ceram DI	400V
	C21	78.5052	8-60pF Trimmer	100V
	C22	76.5072	47nF 10% polyest. FL	50V
	C23	69.5023	VHF feed-through filter	
	C24	74.5163	2.2nF -20+80% ceram PL	63V
	C25	74.5163	2.2nF -20+80% ceram PL	63V
	C26	76.5072	47nF 10% polyest. FL	50V
	C27	76.5072	47nF 10% polyest. FL	50V
	C28	74.5163	2.2nF -20+80% ceram PL	63V
	C51	69.5007	VHF feed-through filter	
	C52	74.5163	2.2nF -20+80% ceram PL	63V
	C53	75.5014	47pF ± 5% mica	500V
	C54	74.5118	47pF 5% N075 TB	160V
	C55	74.5204	1nF -20+80% ceram DI	400V
	C56	74.5163	2.2nF -20+80% ceram PL	63V
	C57	69.5007	VHF feed-through filter	
	C58	75.5014	47pF 5% mica	500V
	C59	75.5016	82pF 5% mica	500V
	C60	75.5016	82pF 5% mica	500V
	C61	75.5014	47pF 5% mica	500V
	C62	74.5093	2.2nF -20+50% ceramic DI	400V
	C101	78.5052	8-60pF Trimmer	100V
	C102	78.5052	8-60pF Trimmer	100V
	C103	74.5118	47pF 5% N075 ceram TB	160V
	C104	74.5166	150pF ± 10% N750 ceram PL	63V
	C105	74.5166	150pF ± 10% N750 ceram PL	63V

Storno

TYPE	NO.	CODE	DATA	
	C106	76.5073	0.1μF ± 10% polyest. TB	100V
	C107	74.5094	470pF ± 20% K2000D	500V
	C108	74.5008	22pF ± 5% N150 ceram DI	400V
	C109	78.5057	30-140pF mica	500V
	C110	78.5057	30-140pF mica	500V
	C111	75.5014	47pF ± 5% mica	500V
	C112	74.5155	1nF -20+80% ceram PL	63V
	C113	69.5023	VHF feed-through filter	
	R1	80.5226	12Ω 5% carbon film	1/8W
	R2	80.5239	150Ω 5% carbon film	1/8W
	R3	80.5255	3.3k 5% carbon film	1/8W
	R4	80.5233	47Ω 5% carbon film	1/8W
	R5	80.5229	22Ω 5% carbon film	1/8W
	R6	80.5427	15Ω 5% carbon film	1/4W
	R7	80.5225	10Ω 5% carbon film	1/8W
	R8	82.5205	0.22Ω 10% Wire wound	1W
	R9	80.5429	22Ω 5% carbon film	1/4W
	R10	86.5042	500Ω 20% trim carbon	0.1W
	R13	80.5253	2.2kΩ 5% carbon film	1/8W
	R14	80.5269	47kΩ 5% carbon film	1/8W
	R15	80.5231	33Ω 5% carbon film	1/8W
	R51	80.5232	39Ω 5% carbon film	1/8W
	R52	80.5073	100kΩ 5% carbon film	1/10W
	R53	80.5073	100kΩ 5% carbon film	1/10W
	R54	80.5044	390Ω 5% carbon film	1/10W
	R55	80.5273	0.1 MΩ 5% carbon film	1/8W
	R101	80.5425	10Ω 5% carbon film	1/4W
	R102	80.5425	10Ω 5% carbon film	1/4W
	R103	80.5250	1.2kΩ 5% carbon film	1/8W
	R104	80.5257	4.7kΩ 5% carbon film	1/8W
	R105	80.5446	560Ω 5% carbon film	1/4W
	R106	80.5245	470Ω 5% carbon film	1/8W
	R107	86.5051	100Ω 20% potentiometer	1/10W
	R108	80.5228	18Ω 5% carbon film	1/8W
	R109	89.5066	60Ω -50+100% PTC thermistor	
	L1	62.0828	RF coil 68-88 MHz	
	L2	62.0832	RF coil 68-88 MHz	
	L3	62.0829	RF coil 68-88 MHz	
	L4	62.0830	RF coil 68-88 MHz	

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA732

X 401.957

Storno

TYPE	NO.	CODE	DATA
	L5	62.0651	0.08μH RF choke
	L6	62.0831	RF coil 68-88 MHz
	L7	62.0829	RF coil 68-88 MHz
	L51	63.5006	2.2μH +20% RF choke 0.6A
	L52	62.0836	RF coil
	L53	62.0837	RF coil
	L54	62.0837	RF coil
	L55	62.0837	RF coil
	L101	62.0893	RF coil 68-88 MHz
	L102	61.5016	Wide band RF choke
	L103	62.0841	RF coil 68-88 MHz
	L104	62.0894	RF coil 68-88 MHz
	L105	62.0651	0.08μH RF choke
	E1	99.5028	1N914 diode
	E2	99.5028	1N914 diode
	E51	99.5244	BA182 diode
	E52	99.5244	BA182 diode
	E53	99.5244	BA182 diode
	E54	99.5244	BA182 diode
	E56	99.5282	Zener diode 5.6V 5% 1W
	E57	99.5237	1N4148 diode
	E101	99.5224	Zener diode 4.7V 5% 1/4W
	E102	99.5237	1N4148 diode
	Q1	99.5229	2N4427 transistor
	Q2	99.5252	BLY87A transistor
	Q3	99.5253	BLY88A transistor
	Q4	99.5230	BC178 transistor
	Q5	99.5235	BD135 transistor
	Q101	99.5280	BLY89A transistor
	Q102	99.5230	BC178 transistor

Storno

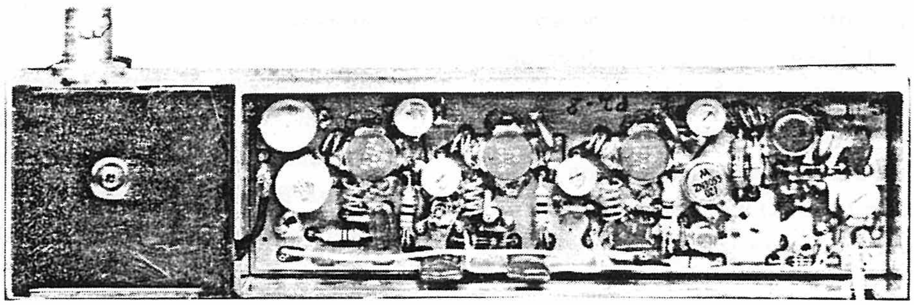
TYPE	NO.	CODE	DATA

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA732

X 401.957

RF POWER AMPLIFIER PA761

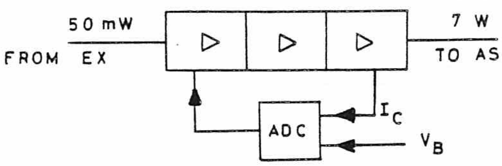


Description

General

PA761 contains 4 power amplifier stages and a current regulating circuit. It is built on a double-sided printed circuit board and includes transistors packaged in capstan-type housings. The unit is completely shielded, being built into a combination heat sink and shield which also contains the antenna switching unit.

The current regulating circuit monitors both the supply voltage and the output transistor collector current, preventing overloading of the transistors due to either too high a voltage or too great a standing wave ratio in the output load. This circuit also allows the output power to be more independent of the power supply or of variations in power output from the exciter.



RF Power Amplifier

The first driver, Q3, gets its collector voltage via the ADC circuit regulating transistor, Q2. Increasing or decreasing the collector voltage to Q3 regulates the drive power applied to the following stages.

π-network C3, L1 and C4 matches the exciter output impedance to the input impedance of Q3. Due to this impedance matching it is also possible to drive the PA stage from a 50 Ω generator. Q3 amplifies the exciter signal of about 50 mW to approx. 100 mW, which is necessary to drive Q4 properly.

Transistors Q4 and Q5 further amplify the power to approx. 2W in order to drive the final power amplifier, Q6.

Output transistor Q6 amplifies the RF power signal to approximately 7 W and the following matching network of L12, C21 and C22 suppresses harmonics of the fundamental VHF frequency while transforming the collector impedance of Q6 to the antenna impedance of 50 Ω. Resistor R12 in the output transistor collector path is the current monitoring resistor for the ADC circuit.

Current Regulating Circuit (ADC)

The purpose of the regulating circuit is to protect the transistors against overloads caused by too high a supply voltage and to limit current through the output transistor in case of mismatching. To accomplish this, the regulating circuit must monitor the supply voltage as well as the collector current through the transistor and from such results regulate the collector voltage to the first RF driver transistor, Q3, and thus the drive power to the following stages.

The circuit consists of two DC coupled transistor stages, Q1 and Q2. Base to Q1 is tied to a reference voltage that can be determined by setting the trimming potentiometer, R2. Reference voltage is developed across diodes E1 and E2, which are biased into forward conduction. This introduces a temperature dependency in the rererence voltage that compensates for the temperature characteristics of the transistors.

For easier understanding of the circuit principle, first ignore its voltage dependent features; therefore, imagine that resistor R4 is removed from the circuit.

The DC return path for the emitter of Q1 is through R12 to the positive voltage terminal. R12 carries the collector current from the output amplifier, Q6. A rise in this collector current will mean an increase in the voltage drop across R12, causing the emitter of Q1 to become less positive and the collector voltage will likewise become less positive. This decreases bias to Q2, decreasing the current through this transistor. Since Q2 is in series with the DC collector path of Q3, the effect will be that of placing a larger resistor in series with the collector supply, thus reducing collector voltage to Q3. The RF drive to the output stage will fall, thereby counteracting the original increase in collector current.

If the supply voltage increases, the current through the output transistors will be kept constant as already explained, but the power dissipation in the transistor will increase along with the voltage. To counteract this effect, a voltage regulating loop is included.

Imagine R4 connected back into the circuit again so that a voltage divider consisting of R3 and R4 will develop a voltage across R3 in proportion to the supply voltage.

When the supply voltage increases so will the voltage drop across R3 and the base-emitter bias for Q1 will fall, again resulting in a reduction of collector voltage to Q3 and a reduction in the drive to the output stage.

The reduction of drive power decreases the current through Q6 and R12 just enough to counteract the original increase of voltage across R3. By selecting a suitable ratio between resistors R3, R4 and R12 the desired amount of regulation can be achieved.

Technical Specification

Frequency Range

400 to 470 MHz

Supply Voltage

Nominal	13.6 V (12.5 V)
Operating range	10 - 16 V

Output Power at 13.6 V : 6.5 W

With output power set for
6 W at 16 V ,
as measured through AS761 :

Output power at 16 V	6 W
Output power at 12.5 V	6 W
Output power at 10 V	4 W

Current Consumption

at nominal voltage 13.6 V :	1.2 A
at 16 V :	1.0 A
at 10 V :	1.1 A

Input Power

50 mW

Input Impedance

50 Ω

Output Impedance

50 Ω

Gain

22 dB

Temperature Range

Operating range :	-25° to $+70^{\circ}$ C
Functioning range :	-30° to $+80^{\circ}$ C

Mechanical Dimensions

25 x 42 x 168 mm

(PC board : 35.6 x 119.4 mm)

ANTENNA SWITCH AS761

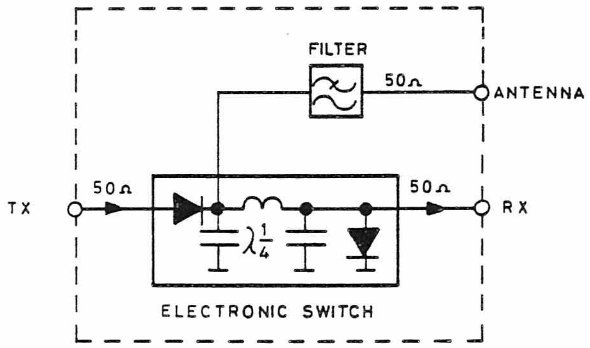
Description

General

The antenna switch AS761 contains a circuit for electronically switching the antenna between the transmitter and the receiver sections, and a low-pass filter that attenuates undesired frequencies, such as harmonics of the signal frequency, thus preventing their being radiated from the antenna.

AS761 mounts directly into the combination heat sink and shield for PA761.

The following simplified diagram shows the operating principle for the AS subunit.



The Electronic Switch

Refer to the complete schematic diagram.

By switching a +9 V potential between terminals 1 and 2, the antenna is electronically switched between transmit and receive.

When transmitting, diodes E51 and E52/E53 conduct and the receiver terminal will see a short circuit.

The 1/4 wave impedance circuit consisting of C54, L53 and C55 transforms the short to an open circuit at the antenna, thus the transmit signal reaches the antenna with minimum loss.

When receiving, the diodes are effectively blocked due to the bias across zener diode E54. Now the diodes only represent a small capacity that includes itself in the 1/4 wave impedance circuit, as far as the receiver terminal is concerned.

The transmitter terminal, however, looks into a parallel resonant circuit made up of L52 and the capacity of E51, and is thereby isolated from the antenna.

The received signal is now free to pass from the antenna to the receiver input with minimum loss.

The Low-pass Filter

The low-pass filter is a 7-pole Chebishev filter exhibiting neligible band-pass ripple and minimum insertion loss.

The filter is built on a metal plate chassis having three closed compartments. It requires no alignment.

Technical Specifications

Frequency Range
420 - 470 MHz

Input and Output Impedance
50 Ω

Insertion Loss (transmitter to antenna)
0.5 dB

Insertion Loss (antenna to receiver)
0.6 dB

Separation between Transmitter and Receiver
25 dB

Second Harmonic (840 MHz) Attenuation
70 dB

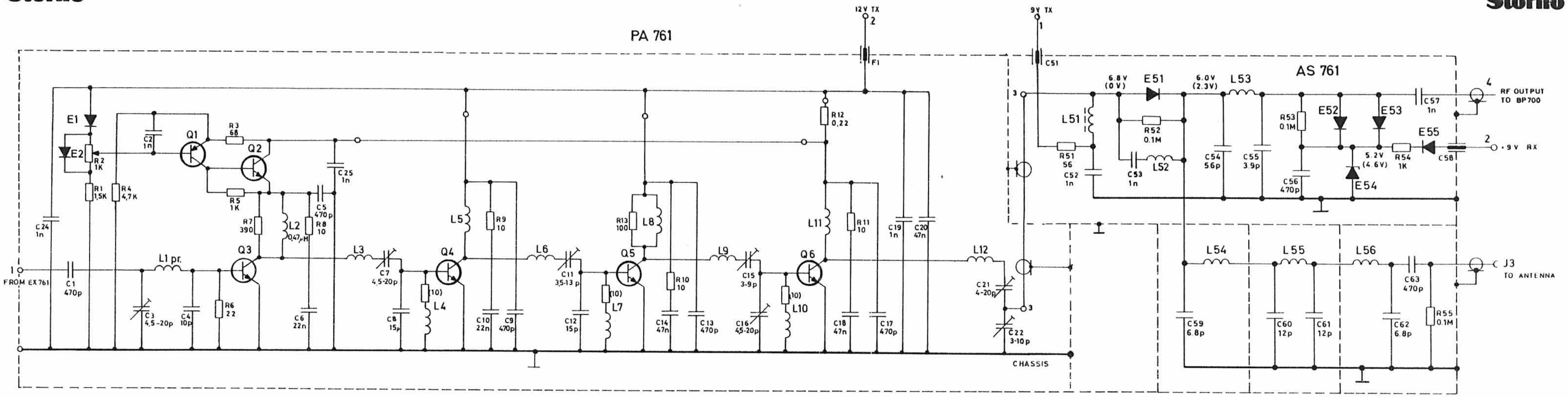
Current Drain, transmit
38 mA

Current Drain, receive
4 mA

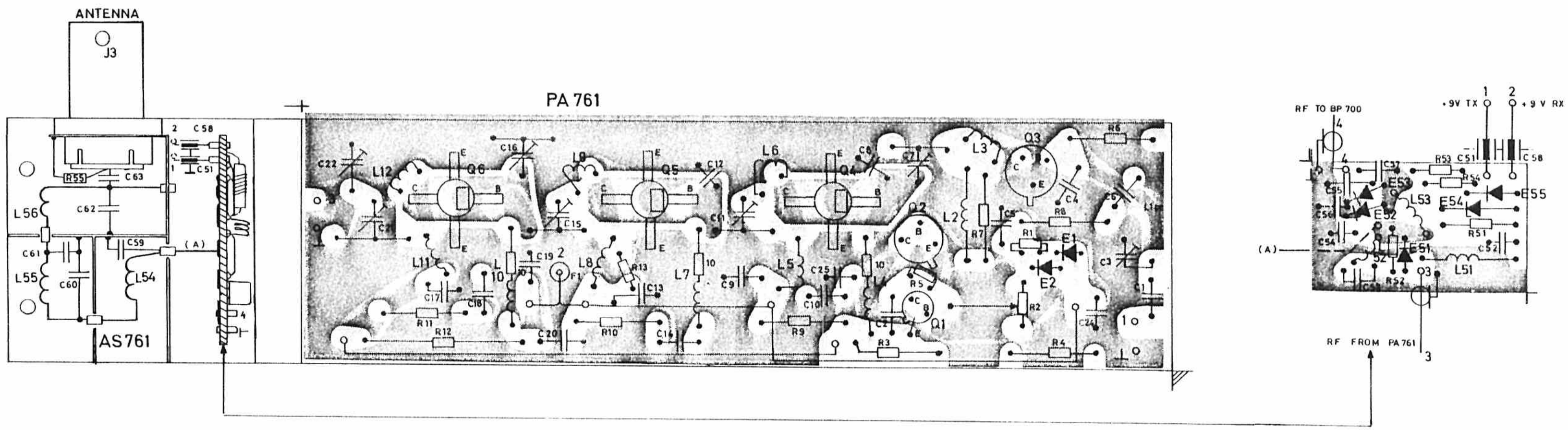
Temperature Range
operating range -25° to $+70^{\circ}$C
functioning range -30° to $+80^{\circ}$C

Dimensions
40 x 38 x 22 mm

 Storno



DC VOLTAGE WITHOUT ( ) DURING TRANSMITTING
DC VOLTAGE WITH ( ) DURING RECEIVING



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

POWER AMPLIFIER PA761

D401.324/5

Storno

TYPE	NO.	CODE	DATA	
PA761		10.2428	Power Amplifier (incl. AS761)	
	C1	74.5161	470pF-20/+80% ceram PL	63V
	C2	74.5155	1nF-20/+80% ceram PL	63V
	C3	78.5026	4,5-20pF trimmer	160V
	C4	74.5006	10pF 5% ceram DI	400V
	C5	74.5161	470pF-20-80% ceram PL	63V
	C6	76.5071	22nF 10% polyest. FL	50V
	C7	78.5026	4,5-20pF trimmer	160V
	C8	74.5046	15pF 5% ceram DI	400V
	C9	74.5161	470pF-20/+80% ceram PL	63V
	C10	76.5071	22nF 10% polyest. FL	50V
	C11	78.5025	3,5-13pF trimmer	160V
	C12	74.5046	15pF 5% ceram DI	400V
	C13	74.5161	470pF-20+80% ceram	63V
	C14	76.5072	47nF 10% polyest. FL	50V
	C15	78.5050	3-9pF trimmer	160V
	C16	78.5026	4,5-20pF trimmer	160V
	C17	74.5161	470pF-20/+80% ceram PL	63V
	C18	76.5072	47nF 10% polyest. FL	50V
	C19	74.5155	1nF-20/+80% ceram PL	63V
	C20	76.5072	47nF 10% polyest. FL	50V
	C21	78.5031	4-20pF trimmer	250V
	C22	78.5051	3-10pF trimmer	250V
	C23			
	C24	74.5155	1nF-20/+80% ceram PL	63V
	C25	74.5155	1nF-20/+80% ceram PL	63V
	R1	80.5251	1,5k Ω 5% carbon film	1/8W
	R2	86.5058	1 k Ω 20% trim. pot.	0.1W
	R3	80.5235	68 Ω 5% carbon film	1/8W
	R4	80.5257	4.7k Ω 5% carbon film	1/8W
	R5	80.5270	56k Ω 5% carbon film	1/8W
	R6	80.5229	22 Ω 5% carbon film	1/8W
	R7	80.5244	390 Ω 5% carbon film	1/8W
	R8	80.5225	10 Ω 5% carbon film	1/8W
	R9	80.5225	10 Ω 5% carbon film	1/8W
	R10	80.5225	10 Ω 5% carbon film	1/8W
	R11	80.5225	10 Ω 5% carbon film	1/8W
	R12	82.5205	0,22 Ω 10% wire wound	1W
	R13	80.5237	100 Ω 5% carbon film	1/8W
	L1		Printed coil	
	L2	63.5008	0.47μH 20% RF choke 2.2A	
	L3	62.0794	RF coil 420-470 MHz	
	L4	62.0795	RF coil 420-470MHz (10 Ω 1/8W)	
	L5	62.0796	RF coil 420-470MHz	
	L6	62.0797	RF coil 420-470MHz	

Storno

TYPE	NO.	CODE	DATA	
	L7	62.0795	RF coil 420-470MHz (10 Ω 1/8W)	
	L8	62.0798	RF coil 420-470MHz	
	L9	62.0797	RF coil 420-470MHz	
	L10	62.0795	RF coil 420-470MHz (10 Ω 1/8W)	
	L11	62.0799	RF coil 420-470MHz	
	L12	62.0797	RF coil 420-470 MHz	
	F1	69.5023	Feed-through filter	
	E1	99.5028	1N914 Diode	
	E2	99.5028	1N914 Diode	
	Q1	99.5230	BC178 Transistor	
	Q2	99.5128	2N3053 Transistor	
	Q3	99.5229	2N4427 Transistor	
	Q4	99.5242	BLX67 Transistor	
	Q5	99.5242	BLX67 Transistor	
	Q6	99.5243	BLX68 Transistor	
AS761		10.2427	Antenna Switching Unit	
	C51	69.5007	VHF Filter FT	
	C52	74.5155	1 nF -20 +80% ceram PL	63V
	C53	74.5155	1 nF -20 +80% ceram PL	63V
	C54	74.5004	5.6 pF ±0.25 pF ceram DI	400V
	C55	74.5130	3.9 pF ±0.25 pF ceram DI	250V
	C56	74.5162	470 pF -20 +50% ceram DI	400V
	C57	74.5155	1 nF -20 +80% ceram PL	63V
	C58	69.5007	VHF Filter FT	
	C59	74.5021	6.8 pF ±0.25 pF ceram DI	400V
	C60	74.5194	12 pF 5% ceram DI	400V
	C61	74.5194	12 pF 5% ceram DI	400V
	C62	74.5021	6.8 pF ±0.25 pF ceram DI	400V
	C63	74.5094	470 pF 20% ceram DI	400V
	R51	80.5234	56 Ω 5% carbon film	1/8W
	R52	80.5273	0.1 MΩ 5% " "	1/8W
	R53	80.5273	0.1 MΩ 5% " "	1/8W
	R54	80.5049	.1 kΩ 5% " "	1/8W
	R55	80.5073	0.1 MΩ 5% " "	1/8W

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA761

X401.619

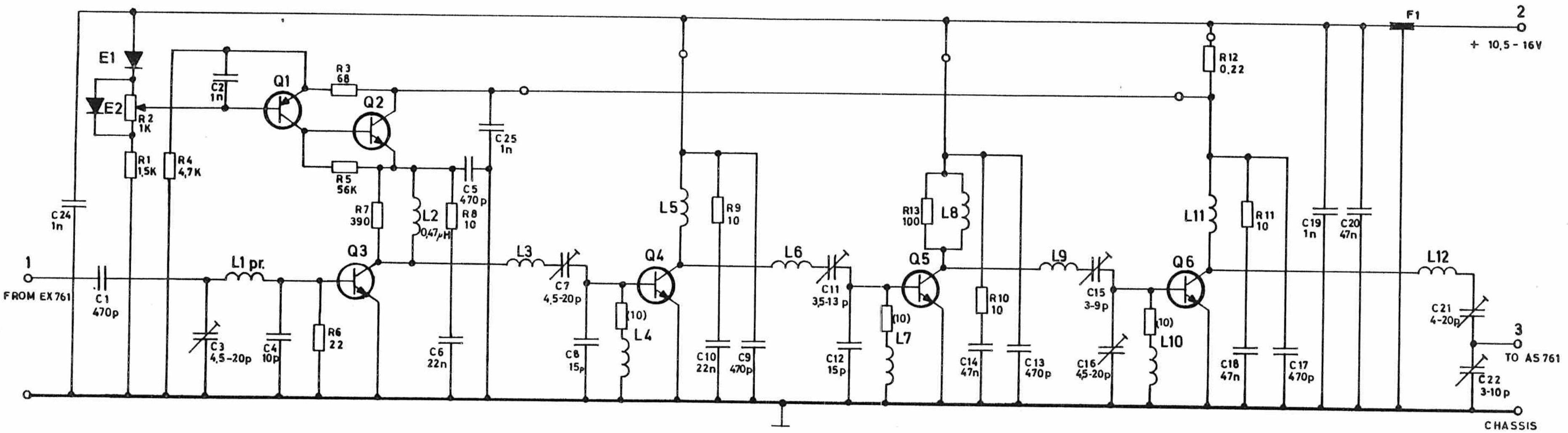
TYPE	NO.	CODE	DATA	
	L51	63.5008	0.47 μH 20% RF choke	2.2A
	L52	62.0809	RF coil	
	L53	62.0810	RF coil	
	L54	62.0811	RF coil	
	L55	62.0811	RF coil	
	L56	62.0811	RF coil	
	E51	99.5244	BA182 Diode	
	E52	99.5244	BA182 Diode	
	E53	99.5244	BA182 Diode	
	E54	99.5224	Zenerdiode 4.7V 5%	0.25W
	E55	99.5237	1N4148 Diode	

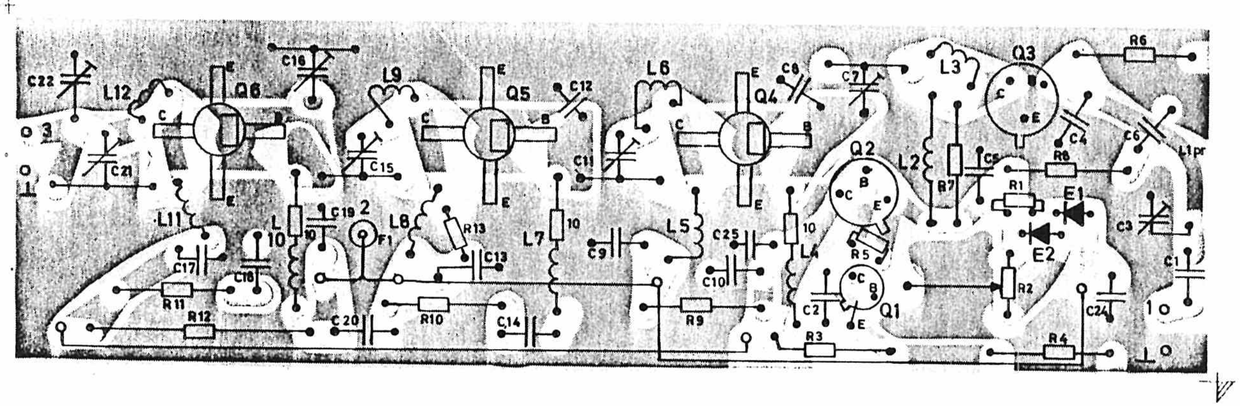
Storno

TYPE	NO.	CODE	DATA

POWER AMPLIFIER
EFFEKTFORSTÆRKER
PA761

X401.619



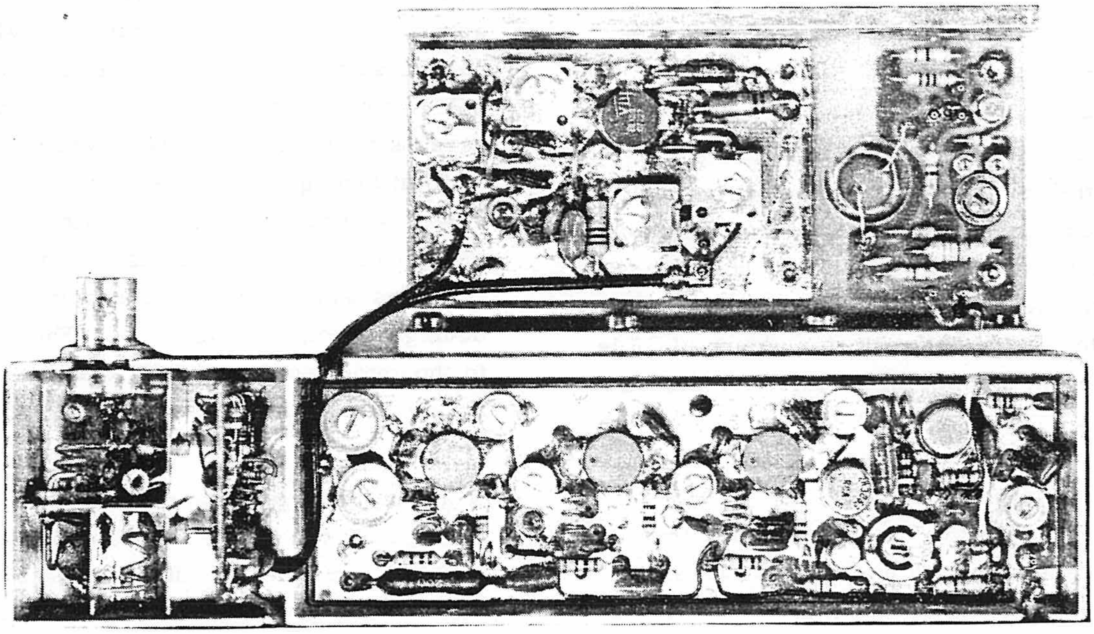


PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

POWER AMPLIFIER PA761

D401.324/3

RF POWER AMPLIFIER PA762



Description

The PA762 RF power amplifier is designed to operate with supply voltages between 10 and 16 volts. At nominal supply voltages it will amplify the driving power at its input (50 mW) to an output level of 15 W into the antenna load

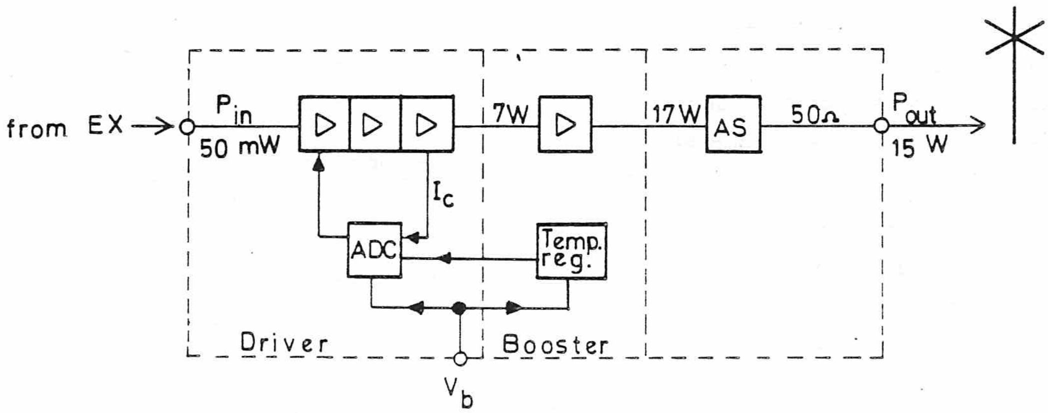
The unit comprises 5 RF power amplifier stages, four in the driver and one in the booster as well as a regulating and temperature protection circuit and, finally, an electronic antenna switching unit with filter, AS762.

PA762 is completely shielded, as it is built into a combination heat sink and shield. However, heat dissipation will be insufficient without the external heat sink / cabinet CA703.

The regulating and temperature protection circuit protects the transistors and other components in the unit against incurring damages when operated within the permissible values of supply voltages and temperatures, or as a result of prolonged short circuits or too great a standing wave ratio in the output load.

RF Power Amplifier

The first driver, Q3, gets its collector voltage via the ADC circuit regulating transistor, Q2. Increasing or decreasing the collector voltage to Q3 regulates in the drive power applied to the following stages.



π-network C3, L1, and C4 match the exciter output impedance to the input impedance of Q3. Due to this impedance matching it is also possible to drive the PA stage from a 50 Ω generator.

Q3, Q4, Q5 and and Q6 amplify the exciter output signal of 80 mW to 7 W in order to drive the booster stage. Matching network L12, C21 and C22 suppresses harmonics of the fundamental VHF frequency while transforming the collector impedance of Q6 to 50Ω. Resistor R12 in the collector return of Q6 is the current monitoring resistor for the ADC circuit.

Booster Stage

Q101 amplifies the 7 W output power from the driver stage to 17 W and applies the signal to AS762. Due to the inherent losses in the AS unit the PA output power is then 15 W.

Current Regulating Circuit (ADC)

The purpose of the regulating circuit is to protect the transistors against overloads caused by excessive supply voltage and to limit current through the output transistor in case of mismatching. To accomplish this, the regulating circuit must monitor the supply voltage as well as the collector current through Q6 in the driver stage, and from such results regulate the collector voltage to the first driver transistor, Q3, and thus the drive power to the following stages.

The circuit consists of two DC coupled transistor stages Q1 and Q2. Base to Q1 is tied to a reference voltage that can be determined by setting potentiometer R2. Reference voltage is developed across diodes E1 and E2, which are biased into forward conduction. This introduces a temperature dependency in the reference voltage that compensates for the temperature characteristics of the transistors.

For easier understanding of the circuit principle, first ignore its voltage dependent features; therefore, imagine that resistor R4 is removed from the circuit.

The DC return path for the emitter of Q1 is through R12 to the positive voltage terminal. R12 also carries the collector current from transistor Q6. A rise in this collector current will mean an increase in the voltage drop across R12, causing the emitter of Q1 to become less positive and the collector voltage will likewise become less positive. This decreases forward bias to Q2, decreasing the current through this transistor. Since Q2 is in series with the DC collector path of Q3, the effect will be that of placing a larger resistor in series with the collector supply, thus reducing collector voltage to Q3. The RF drive to the output stage will fall, thereby counteracting the original increase in collector current.

If the supply voltage increases, the current through Q6 will be kept constant as already explained, but the power dissipation in the transistor will increase along with the voltage. To counteract this effect, a voltage regulating loop is included.

Imagine R4 connected back into the circuit again so that a voltage divider consisting of R3 and R4 will develop a voltage across R3 in proportion to the supply voltage.

When the supply voltage increases so will the voltage drop across R3 and the base-emitter bias for Q1 will fall, again resulting in a reduction of collector voltage to Q3 and a reduction in the drive to the output stage.

The reduction of drive power decreases the current through Q6 and E12 just enough to counteract the original increase of voltage across R3. By selecting a suitable ratio between resistors R3, R4 and R12 the desired amount of regulation can be achieved.

The transmitter power can be set to the desired level by means of potentiometer R2 in the ADC circuit.

Temperature Protection Circuit

Since transistor Q101 in the booster stage is not directly included in the ADC loop, it requires extra thermal protection which is accomplished by means of a PTC resistor, R109, which is mounted close to Q101. When Q101, and R109 along with it, reach a certain temper-

Storno

ature the increasing resistance of R109, which is also a part of the ADC loop of the driver stage, regulates (reduces) the drive to Q101. Thus the output power of the PA unit is regulated to a preset level that ensures thermal protection of Q101 and other components.

The temperature protection circuit operates in the following manner: Under normal operating conditions (prior to regulation) Q102 is biased to cut-off by the voltage divider network of R104 and the PTC resistor (60 Ω) connected across zener diode E101 for a stable source. As the temperature in the PA stage rises the resistance of R109 increases and Q101 begins to pass current. When R109 reaches 1.2 kΩ, Q102 will be completely open. When Q102 opens up, the circuit shunts diodes E1 and E2 and the voltage across these diodes falls causing the base-emitter voltage for Q1 to fall, as well.

As a result, Q3's collector voltage falls, too, thereby also reducing the drive to the following stages.

The amount of regulation (reduction in output power) is preset by potentiometer R107. Q102's emitter resistor is included to flatten out the regulation characteristic. Diode E102 in the collector lead of Q102 ensures temperature compensation of the reference voltage at the base of Q1 even at maximum regulation.

Technical Specifications

Frequency Range
420 to 470 MHz

Nominal Supply Voltage
13 V

Output Power at 13 V
17 W

Output power as measured through AS762:
at 15.5 V: 18 W
at 10 V: 10 W

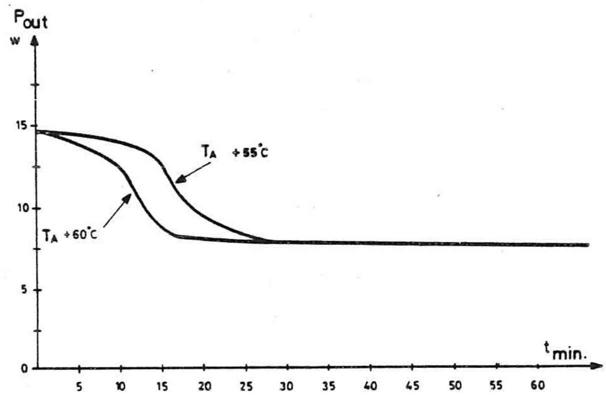
Current Drain
3.4 A

at 15.5 V: 3.2 A
at 10 V: 2.5 A

Input Power
80 mW
Minimum: 50 mW

Generator Impedance
50 Ω
Gain with P_{IN} = 50 mW: 25 dB

Reduction of Output Power vs. Ambient Temperature
Continuous, T_A –25° to +25°C: 0.8 dB
Intermittent, T_A –25° to +55°C: 0.8 dB
Continous, T_A +55°C: 3 dB
(refer to response curve below)



Typical output power regulating characteristics of PA762 with CA703 mounted. Plotted for ambient temperatures of +55°C and +60°C, at nominal voltage, continous keying of transmitter.

Temperature Range
operating range –25° to +55°C
functioning range –30° to +60°C

Mechanical Dimensions
168 x 97 x 32 mm

ANTENNA SWITCH AS762

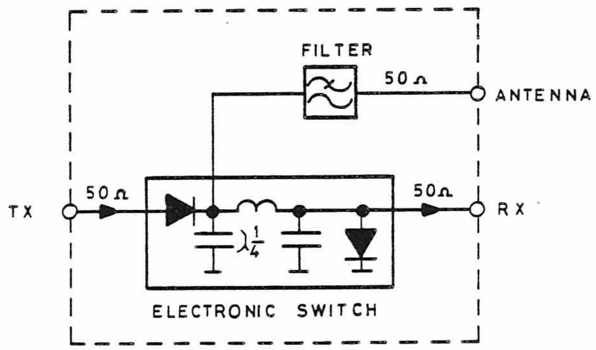
Description

General

The antenna switch AS762 contains a circuit for electronically switching the antenna between the transmitter and the receiver sections, and a low-pass filter that attenuates undesired frequencies, such as harmonics of the signal frequency thus preventing their being radiated from the antenna.

AS762 mounts directly into the combination heat sink and shield for PA761 for use in 450 MHz simplex equipment having 15 W output power.

The following simplified diagram shows the operating principle for the AS sub-unit.



The Electronic Switch

Refer to the complete schematic diagram.

By switching a +9 V potential between terminals 1 and 2, the antenna is electronially switched between transmit and receive.

When transmitting, diodes E51, E52 + E53 and E54, E55 and E56 conduct and the receiver terminal will see a short circuit.

The 1/4 wave impedance circuit consisting of C54, L53 and C55 transforms the short to an open circuit at the antenna, thus the transmit signal reaches the antenna with minimum loss.

When receiving, the diodes are effectively blocked due to the bias across zener diode E57. Now the diodes only represent a small capacity that includes itself in the 1/4 wave impedance circuit, as far as the receiver terminal is concerned.

The transmitter terminal, however, looks into a parallel resonant circuit made up of L52 and the capacities of E51, E52 and E53, and is thereby isolated from the antenna.

The received signal is now free to pass from the antenna to the receiver input with minimum loss.

The Low-pass Filter

The low-pass filter is a 7-pole Chebisev filter exhibiting negligible band-pass ripple and minimum insertion loss.

The filter is built on a metal plate chassis having three closed compartments. It requires no alignment.

Technical Specifications

Frequency Range
420 - 470 MHz

Input and Output Impedance
50 Ω

Insertion Loss (transmitter to antenna)
0.5 dB

Insertion Loss (antenna to receiver
0.6 dB

Separation between Transmitter and Receiver
25 dB

Second Harmonic (840 MHz) Attenuation
70 dB

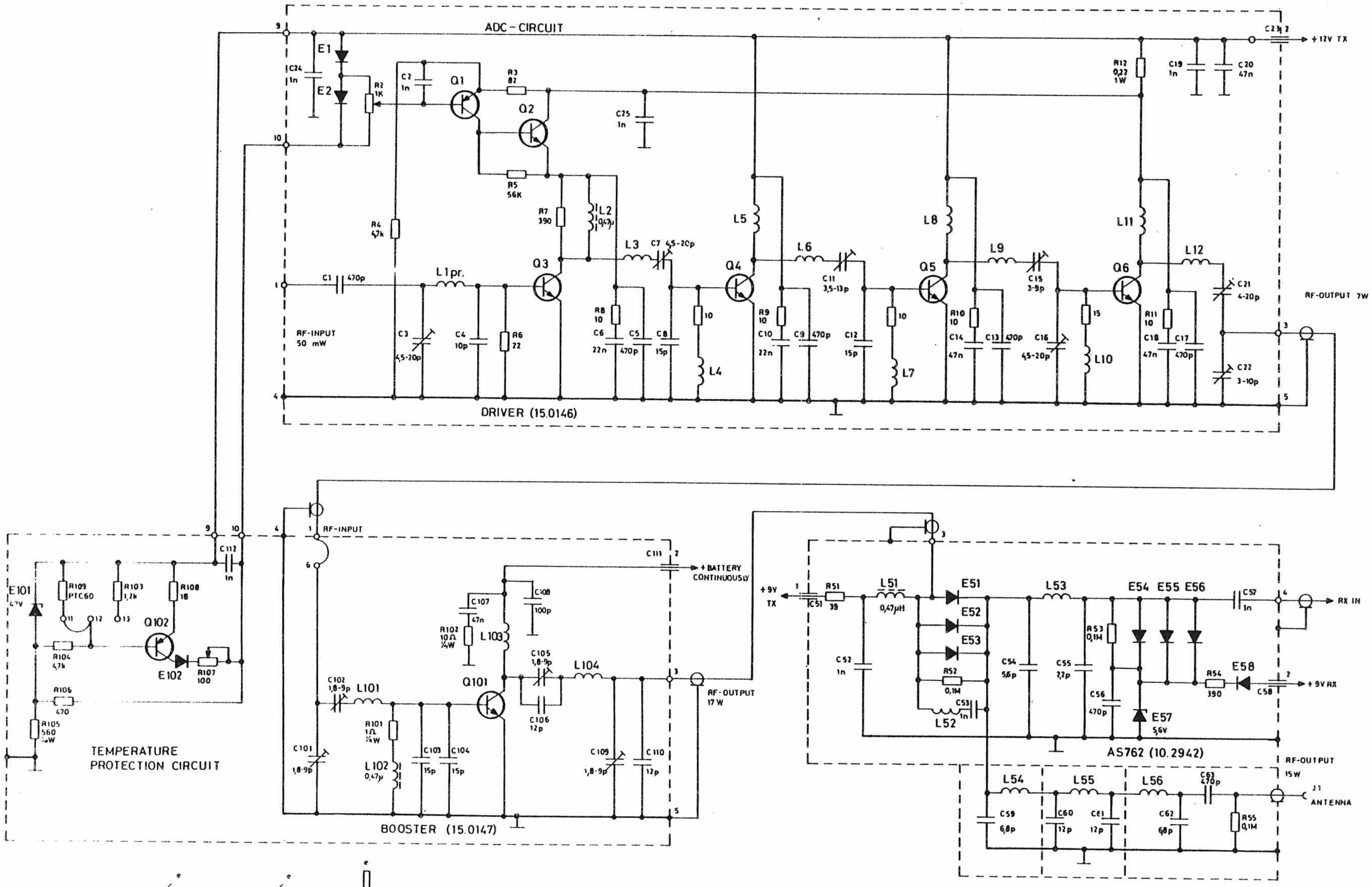
Current Drain, transmit
46 mA

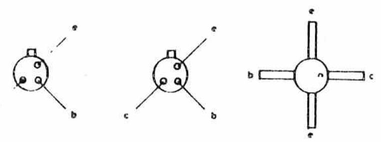
Current Drain, receive
8 mA

Temperature Range
operating range -25° to +70°C
functioning range -30° to +80°C

Dimensions
40 x 38 x 22 mm

Storno



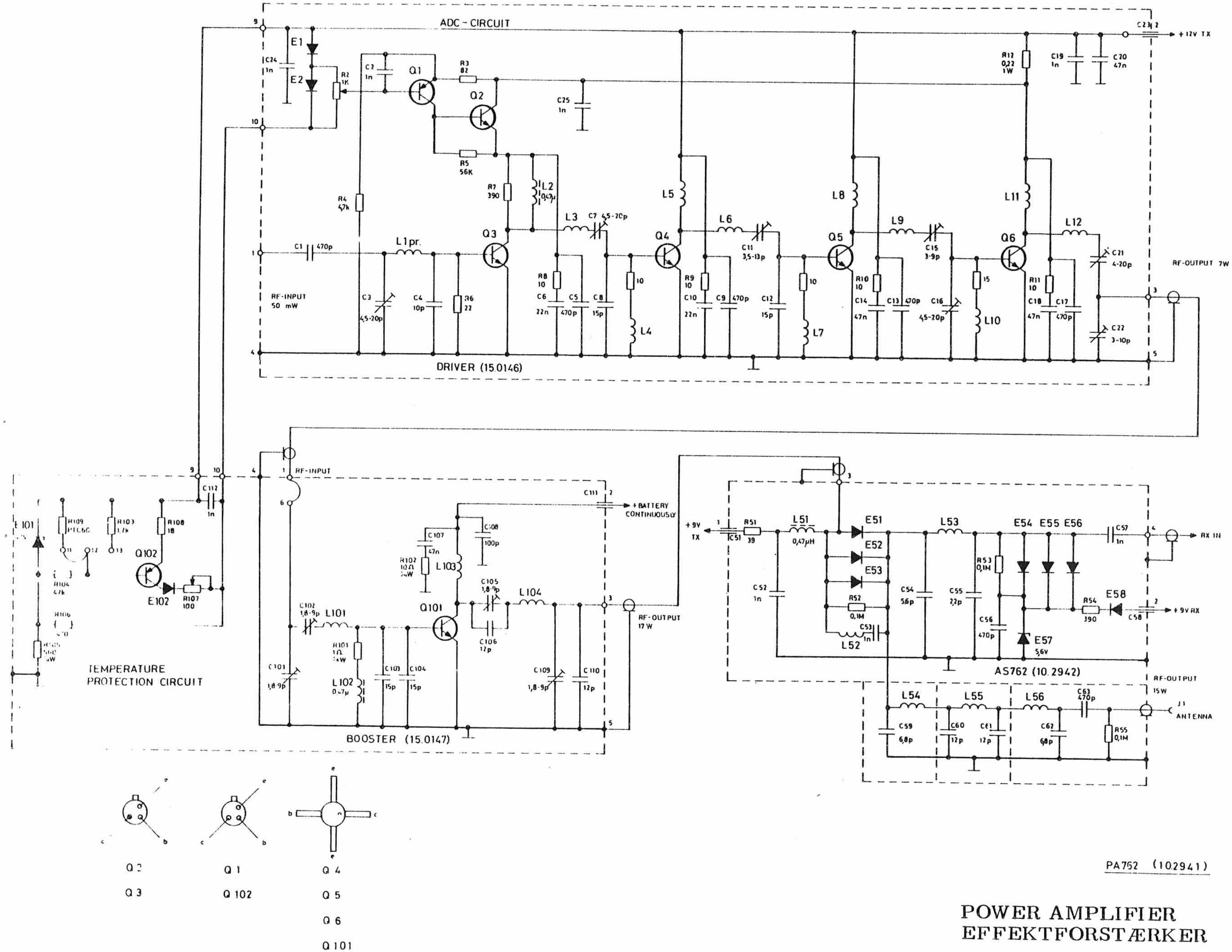


PA762 (102941)

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA762

D401.790

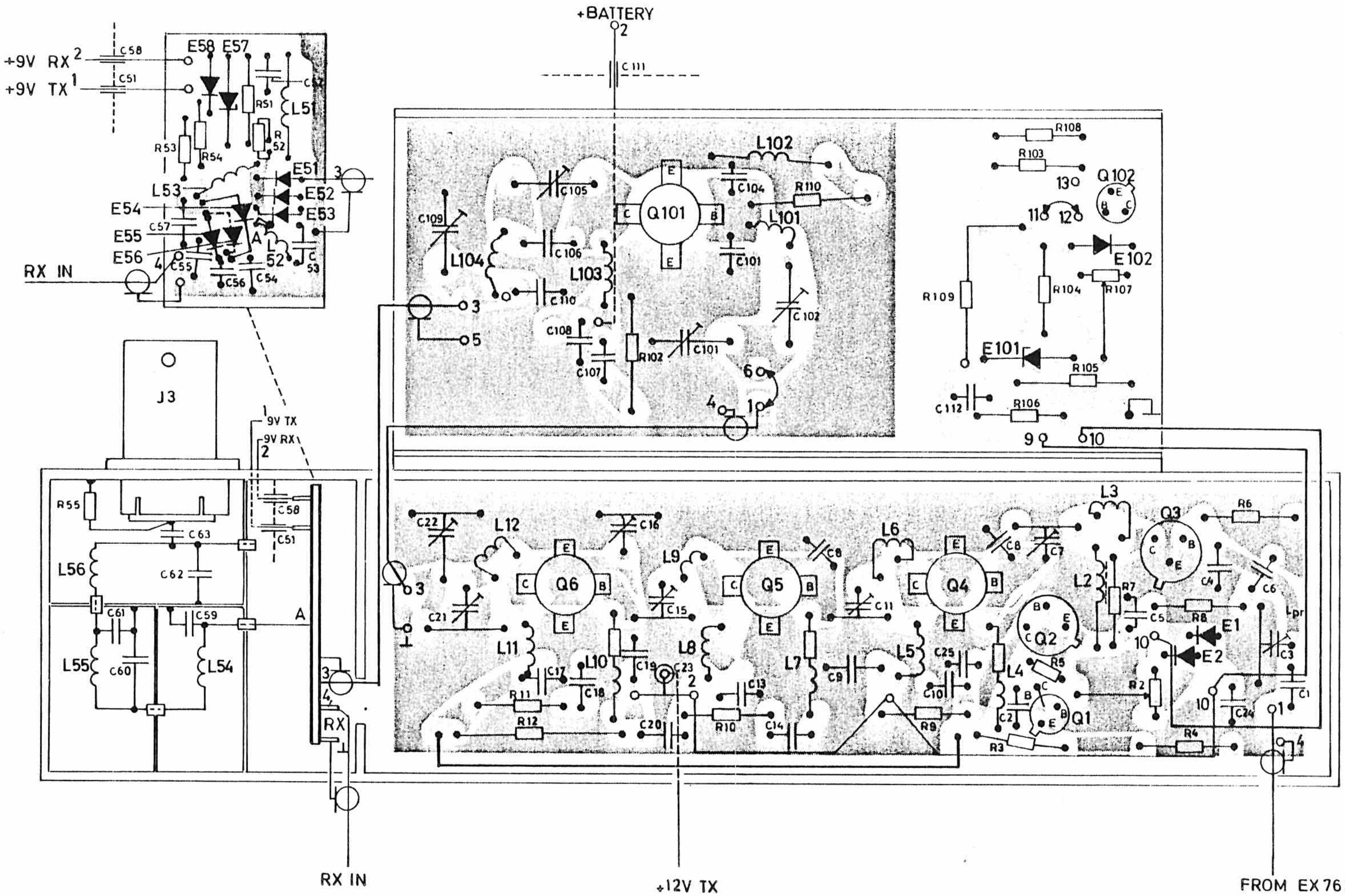


PA762 (102941)

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA762

D401.790



POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA762

D401.979

Storno

TYPE	NO.	CODE	DATA	
PA762		10.2941	Power Amplifier	
			DRIVER	
	C1	74.5161	470 pF -20+80% ceram PL	63 V
	C2	74.5155	1 nF -20+80% ceram PL	63 V
	C3	78.5026	4.5 - 20 pF trimmer	
	C4	74.5006	10 pF 5% ceram DI	400 V
	C5	74.5161	470 pF -20+80% ceram PL	63 V
	C6	76.5071	22 nF 10% polyest FL	50 V
	C7	78.5026	4.5 - 20 pF trimmer	
	C8	74.5046	15 pF 5% ceram DI	400 V
	C9	74.5161	470 pF -20+80% ceram PL	63 V
	C10	76 5071	22 nF 10% polyest. FL	50 V
	C11	78.5025	3.5-13 pF trimmer	160 V
	C12	74.5046	15 pF 5% ceram DI	400 V
	C13	74.5161	470 pF -20+80% ceram PL	63 V
	C14	76.5072	47 nF 10% polyest. FL	50 V
	C15	78.5050	3-9 pF trimmer	
	C16	78.5026	4.5-20 pF trimmer	
	C17	74.5161	470 pF -20+80 ceram PL	63 V
	C18	76.5072	47 nF 10% polyest. FL	50 V
	C19	74.5155	1 nF -20+80% ceram PL	63 V
	C20	76.5072	47 nF 10% polyest FL	50 V
	C21	78.5031	4-20 pF trimmerø	
	C22	78.5051	3-10 pF trimmer	
	C23	69.5023	Feed-trhough filter	
	C24	74.5155	1 nF -20+80% ceram PL	63 V
	C25	74.5155	1 nF -20+ 80% ceram PL	63 V
	R2	86.5058	1 KΩ 20% potentiometer	0.1W
	R3	80.5236	82 Ω 5% carbon filter	1/8W
	R4	80.5257	4.7 KΩ 5% -	1/8W
	R5	80.5270	56 KΩ 5% -	1/8W
	R6	80.5229	22 Ω 5% -	1/8W
	R7	80.5244	390Ω 5% -	1/8W
	R8	80.5225	10Ω 5% -	1/8W
	R9	80.5225	10Ω 5% -	1/8W
	R10	80.5225	10Ω 5% -	1/8W
	R11	80.5225	10Ω 5% -	1/8W
	R12	82.5205	0.22Ω 10% wire wound	1 W
	L2	63.5008	0.47 μH 20% RF choke	2.2A
	L3	62.0794	RF coil 420-470 MHz	
	L4	62.0795	RF coil 420-470 MHz	
			(made with 10Ω resistor 80.5225)	
	L5	62.0796	RF coil 420-470 MHz	
	L6	62.0797	RF coil 420-470 MHz	
	L7	62.0795	RF coil 420-470 MHz	
			(made with 10Ω resistor 80.5225)	

Storno

TYPE	NO.	CODE	DATA	
	L8	62.0798	RF coil 420-470 MHz	
	L9	62.0797	RF coil 420-470 MHz	
	L10	62.0880	RF coil 420-470 MHz	
			(made with 15Ω resistor 80.5227)	
	L11	62.0799	RF coil 420-470 MHz	
	L12	62.0797	RF coil 420-470 MHz	
	E1	99.5028	Diode 1N914	
	E2	99.5028	Diode 1 N914	
	Q1	99.5230	Transistor BC178	
	Q2	99.5128	Transistor 2N3053	
	Q3	99.5229	Transistor 2N4427	
	Q4	99.5242	Transistor BLX67	
	Q5	99,5242	Transistor BLX67	
	Q6	99.5243	Transistor BLX68	
			BOOSTER	
	C101	78.5056	1.8-9 pF trimmer	
	C102	78.5056	1.8-9 pF trimmer	
	C103	74.5317	15 pF 10 % ceram	400 V
	C104	74.5317	15 pF 10% ceram	400 V
	C105	78.5056	1.8-9 pF trimmer	
	C106	74.5194	12 pF 5% ceram DI	400 V
	C107	76.5072	47 nF 10% polyest. FL	50 V
	C108	74.5013	100 pF 20% ceram DI	500 V
	C109	78.5056	1.8-9 pF trimmer	
	C110	74.5194	12 pF 5% ceram DI	400 V
	C111	69.5023	Feed-through filter	
	C112	74.5155	1 nF -20+80% ceram PL	63 V
	R101	89.5031	1 Ω 10% oxide	1/2W
	R102	80.5425	10Ω 5% carbon film	1/4 W
	R103	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R104	80.5257	4.7 KΩ 5% carbon film	1/8 W
	R105	80.5446	560 Ω 5% -	1/4 W
	R106	80.5245	470 Ω 5% -	1/8 W
	R107	86.5051	100Ω 20% potentiometer	0.1 W
	R108	80.5228	18 Ω 5% carbon film	1/8 W
	R109	89.5066	Thermistor PTC, 60Ω -50+100%	
	L101	62.0879	RF coil 420-470 MHz	
	L102	63.5008	0.47 μH ± 20% RF choke	2.2 A

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA762

X401.862

TYPE	NO.	CODE	DATA	
	L103	62.0840	RF coil 420-470 MHz	
	L104	62.0840	RF coil 420-470 MHz	
	E101	99.5224	Zener Diode 4.7 V 5%	1/4W
	E102	99.5237	Diode 1N4148	
	Q101	99.5284	Transistor BLX69	
	Q102	99.5230	Transistor BC178	

TYPE	NO.	CODE	DATA	
AS762		10.2942	Antenna Switch	
	C51	69.5007	VHF feed-through filter	
	C52	74.5155	1nF -20/+80% ceram PL	63V
	C53	74.5155	1nF -20/+80% ceram PL	63V
	C54	74.5004	5.6pF ±0.25pF ceram DI	400V
	C55	74.5315	2.2pF ±0.25pF ceram DI	400V
	C56	74.5162	470pF -20/+50% ceram DI	400V
	C57	74.5155	1nF -20/+80% ceram PL	63V
	C58	69.5007	VHF feed-through filter	
	C59	74.5021	6.8pF ±0.25pF ceram DI	400V
	C60	74.5194	12pF 5% ceram DI	400V
	C61	74.5194	12pF 5% ceram DI	400V
	C62	74.5021	6.8pF ±0.25pF ceram DI	400V
	C63	74.5094	470pF 20% ceram DI	400V
	R51	80.5232	39 Ω 5% carbon film	1/8W
	R52	80.5073	100kΩ 5% carbon film	1/10W
	R53	80.5073	100kΩ 5% carbon film	1/10W
	R54	80.5044	390Ω 5% carbon film	1/10W
	R55	80.5273	100kΩ 5% carbon film	1/8W
	L51	63.5008	RF choke 0.47μH ±20% 2.2A	
	L52	62.0871	RF coil	
	L53	62.0810	RF coil	
	L54	62.0811	RF coil	
	L55	62.0811	RF coil	
	L56	62.0811	RF coil	
	E51	99.5187	Diode BA244	
	E52	99.5187	Diode BA244	
	E53	99.5187	Diode BA244	
	E54	99.5187	Diode BA244	
	E55	99.5187	Diode BA244	
	E56	99.5187	Diode BA244	
	E57	99.5282	Zener Diode 5.6V 5%	1W
	E58	99.5237	Diode 1N4148	

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA762

X401.862

Storno

TYPE	NO.	CODE	DATA	
PA762		10.2941	Power Amplifier	
			DRIVER	
	C1	74.5161	470 pF -20+80% ceram PL	63 V
	C2	74.5155	1 nF -20+80% ceram PL	63 V
	C3	78.5026	4.5 - 20 pF trimmer	
	C4	74.5006	10 pF 5% ceram DI	400 V
	C5	74.5161	470 pF -20+80% ceram PL	63 V
	C6	76.5071	22 nF 10% polyest FL	50 V
	C7	78.5026	4.5 - 20 pF trimmer	
	C8	74.5046	15 pF 5% ceram DI	400 V
	C9	74.5161	470 pF -20+80% ceram PL	63 V
	C10	76 5071	22 nF 10% polyest. FL	50 V
	C11	78.5025	3.5-13 pF trimmer	160 V
	C12	74.5046	15 pF 5% ceram DI	400 V
	C13	74.5161	470 pF -20+80% ceram PL	63 V
	C14	76.5072	47 nF 10% polyest. FL	50 V
	C15	78.5050	3-9 pF trimmer	
	C16	78.5026	4.5-20 pF trimmer	
	C17	74.5161	470 pF -20+80 ceram PL	63 V
	C18	76.5072	47 nF 10% polyest. FL	50 V
	C19	74.5155	1 nF -20+80% ceram PL	63 V
	C20	76.5072	47 nF 10% polyest FL	50 V
	C21	78.5031	4-20 pF trimmerø	
	C22	78.5051	3-10 pF trimmer	
	C23	69.5023	Feed-trhough filter	
	C24	74.5155	1 nF -20+80% ceram PL	63 V
	C25	74.5155	1 nF -20+ 80% ceram PL	63 V
	R2	86.5058	1 KΩ 20% potentiometer	0.1W
	R3	80.5236	82 Ω 5% carbon filter	1/8W
	R4	80.5257	4.7 KΩ 5% -	1/8W
	R5	80.5270	56 KΩ 5% -	1/8W
	R6	80.5229	22 Ω 5% -	1/8W
	R7	80.5244	390Ω 5% -	1/8W
	R8	80.5225	10Ω 5% -	1/8W
	R9	80.5225	10Ω 5% -	1/8W
	R10	80.5225	10Ω 5% -	1/8W
	R11	80.5225	10Ω 5% -	1/8W
	R12	82.5205	0.22Ω 10% wire wound	1 W
	L2	63.5008	0.47 μH 20% RF choke	2.2A
	L3	62.0794	RF coil 420-470 MHz	
	L4	62.0795	RF coil 420-470 MHz	
			(made with 10Ω resistor 80.5225)	
	L5	62.0796	RF coil 420-470 MHz	
	L6	62.0797	RF coil 420-470 MHz	
	L7	62.0795	RF coil 420-470 MHz	
			(made with 10Ω resistor 80.5225)	

Storno

TYPE	NO.	CODE	DATA	
	L8	62.0798	RF coil 420-470 MHz	
	L9	62.0797	RF coil 420-470 MHz	
	L10	62.0880	RF coil 420-470 MHz	
			(made with 15Ω resistor 80.5227)	
	L11	62.0799	RF coil 420-470 MHz	
	L12	62.0797	RF coil 420-470 MHz	
	E1	99.5028	Diode 1N914	
	E2	99.5028	Diode 1 N914	
	Q1	99.5230	Transistor BC178	
	Q2	99.5128	Transistor 2N3053	
	Q3	99.5229	Transistor 2N4427	
	Q4	99.5242	Transistor. BLX67	
	Q5	99,5242	Transistor BLX67	
	Q6	99.5243	Transistor BLX68	
			BOOSTER	
	C101	78.5056	1.8-9 pF trimmer	
	C102	78.5050	1.8-9 pF trimmer	
	C103	74.5317	15 pF 10 % ceram	400 V
	C104	74.5317	15 pF 10% ceram	400 V
	C105	78.5056	1.8-9 pF trimmer	
	C106	74.5194	12 pF 5% ceram DI	400 V
	C107	76.5072	47 nF 10% polyest. FL	50 V
	C108	74.5013	100 pF 20% ceram DI	500 V
	C109	78.5056	1.8-9 pF trimmer	
	C110	74.5194	12 pF 5% ceram DI	400 V
	C111	69.5023	Feed-through filter	
	C112	74.5155	1 nF -20+80% ceram PL	63 V
	R101	89.5031	1 Ω 10% oxide	1/2W
	R102	80.5425	10Ω 5% carbon film	1/4 W
	R103	80.5259	1.2 KΩ 5% carbon film	1/8 W
	R104	80.5257	4.7 KΩ 5% carbon film	1/8 W
	R105	80.5446	560 Ω 5% -	1/4 W
	R106	80.5245	470 Ω 5% -	1/8 W
	R107	86.5051	100Ω 20% potentiometer	0.1 W
	R108	80.5228	18 Ω 5% carbon film	1/8 W
	R109	89.5066	Thermistor PTC, 60Ω -50+100%	
	L101	62.0879	RF coil 420-470 MHz	
	L102	63.5008	0.47 μH ± 20% RF choke	2.2 A

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA762

X401.862

Storno

TYPE	NO.	CODE	DATA
	L103	62.0840	RF coil 420-470 MHz
	L104	62.0840	RF coil 420-470 MHz
	E101	99.5224	Zener Diode 4.7 V 5% 1/4W
	E102	99.5237	Diode 1N4148
	Q101	99.5284	Transistor BLX69
	Q102	99.5230	Transistor BC178

Storno

TYPE	NO.	CODE	DATA

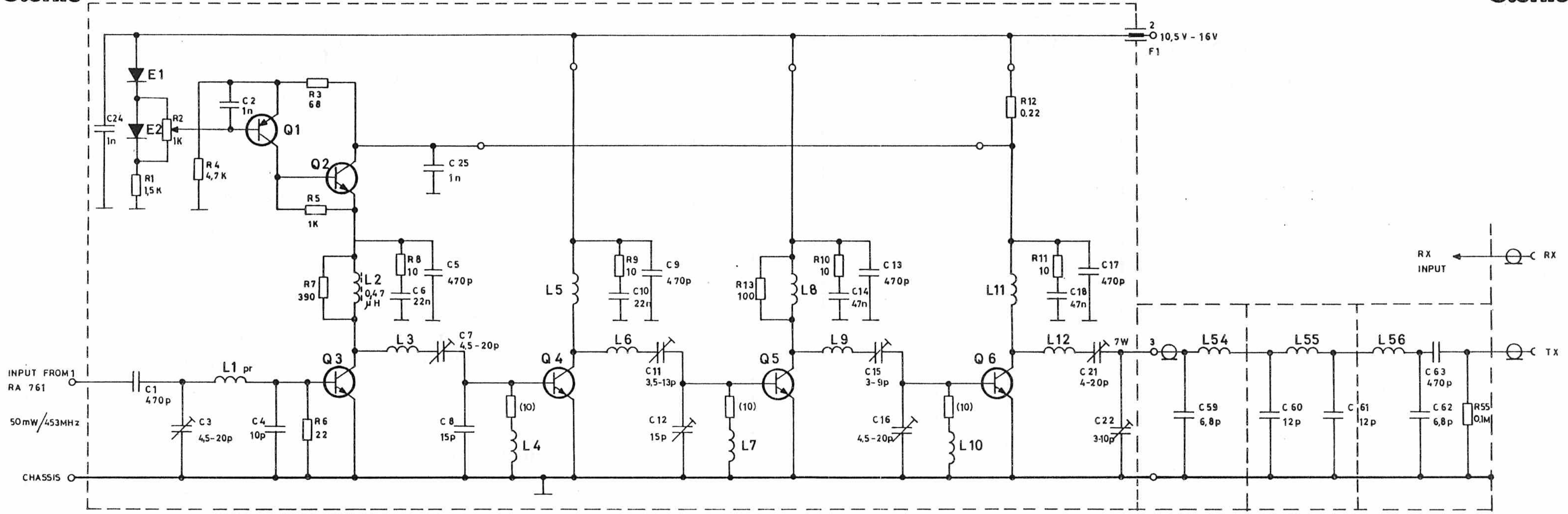
POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA762

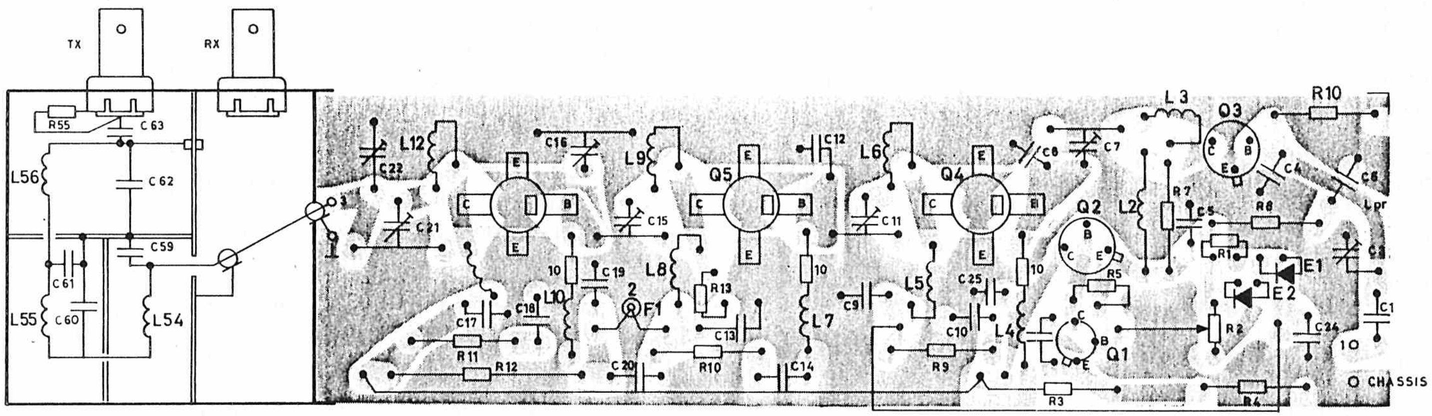
X401.862

Storno

Storno



COMPONENT SIDE VIEW
SET FRA KOMPONENTSIDE



POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA763

D401.872

TYPE	NO.	CODE	DATA	
PA763		10.2926	Power Amplifier	
	C1	74.5161	470 pF -20 +80% ceram PL	63 V
	C2	74.5155	1 nF -20+80% ceram PL	63 V
	C3	78.5026	4.5—20 pF trimmer	
	C4	74.5006	10 pF 5% ceram DI	400 V
	C5	74.5161	470 pF -20+80% ceram PL	63 V
	C6	76.5071	22 nF 10% polyest FL	50 V
	C7	78.5026	4.5—20 pF trimmer	
	C8	74.5046	15 pF 5% ceram DI	400 V
	C9	74.5161	470 pF -20+80% ceram PL	63 V
	C10	76.5071	22 nF 10% polyest FL	50 V
	C11	78.5025	3.5 —13 pF trimmer	
	C12	74.5046	15 pF 5% ceram DI	400 V
	C13	74.5161	470 pF -20+80% ceram PL	63 V
	C14	76.5072	47 nF 10% polyest FL	50 V
	C15	78.5050	3-9 pF trimmer	
	C16	78.5026	4.5—20 pF trimmer	
	C17	74.5161	470 pF -10+80% ceram PL	63 V
	C18	76.5072	47 nF 10% polyest FL	50 V
	C19	74.5155	1 nF -20+80% ceram PL	63 V
	C20	76.5072	47 nF 10% polyest FL	50 V
	C21	78.5031	4 —20pF trimmer	
	C22	78.5051	3 —10 pF trimmer	
	C24	74.5155	1 nF -20+80% ceram PL	63 V
	C25	74.5155	1 nF -20+80% ceram PL	63 V
	R1	80.5251	1.5 KΩ 5% carbon film	1/8 W
	R2	86.5058	1 KΩ 20% potentiometer	0.1 W
	R3	80.5235	68 Ω 5% carbon film	1/8 W
	R4	80.5257	4.7 KΩ 5% carbon film	1/8 W
	R5	80.5270	56 KΩ 5% -	1/8 W
	R6	80.5229	22 Ω 5% -	1/8 W
	R7	80.5244	390 Ω 5% -	1/8 W
	R8	80.5225	10 Ω 5% -	1/8 W
	R9	80.5225	10 Ω 5% -	1/8 W
	R10	80.5225	10 Ω 5% -	1/8 W
	R11	80.5225	10 Ω 5% -	1/8 W
	R12	82.5205	0.22 Ω 10% wire wound	1 W
	R13	80.5237	100 Ω 5% carbon film	1/8 W
	L2	63.5008	0.47 μH 20% RF choke	2.2 A
	L3	62.0794	RF Coil 420-470 MHz	
	L4	62.0795	RF Coil 420-470 MHz (made with 10 Ω resistor 80.5225)	
	L5	62.0796	RF Coil 420-470 MHz	
	L6	62.0797	RF Coil 420-470 MHz	

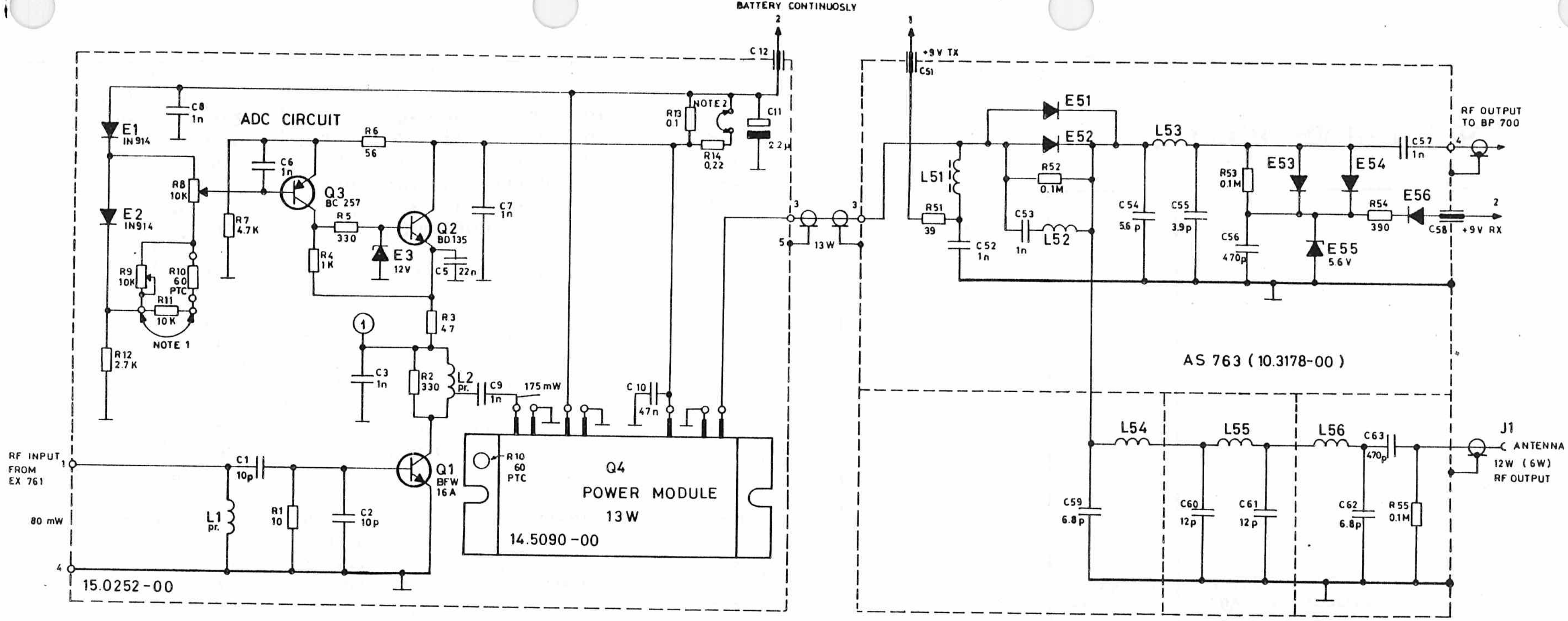
Storno

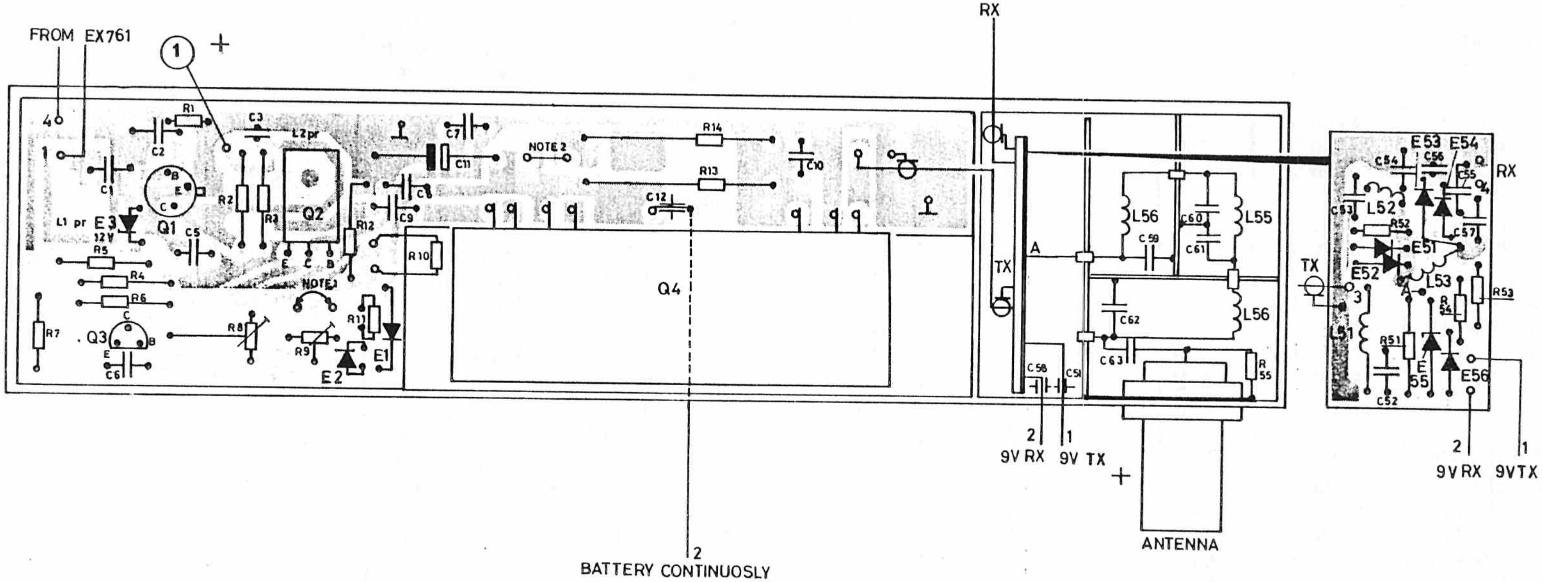
TYPE	NO.	CODE	DATA
	L7	62.0795	RF Coil 420-470 MHz (made with 10 Ω resistor 80.5225)
	L8	62.0798	RF Coil 420-470 MHz
	L9	62.0797	RF Coil 420-470 MHz
	L10	62.0795	RF Coil 420-470 MHz (made with 10 Ω resistor 80.5225)
	L11	62.0799	RF Coil 420-470 MHz
	L12	62.0797	RF Coil 420-470 MHz
	E1	99.5028	Diode 1N914
	E2	99.5028	Diode 1N914
	Q1	99.5230	Transistor BC178
	Q2	99.5128	Transistor 2N3053
	Q3	99.5229	Transistor 2N4427
	Q4	99.5242	Transistor BLX67
	Q5	99.5242	Transistor BLX67
	Q6	99.5243	Transistor BLX66

POWER AMPLIFIER
EFFEKTFORSTÆRKER

PA763

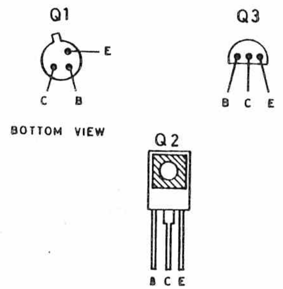
X 401.861





NOTE 1:
REMOVE SHORTING LINK WHEN ADJUSTING ADC RANGE

NOTE 2:
REMOVE STRAP FOR 6W RF OUTPUT



POWER AMPLIFIER
EFFEKTFORSTÆRKER . PA764

D 402.080

TYPE	NO.	CODE	DATA
PA764		10.3177-00	UHF Power Amplifier
	C1	74.5006	10 pF 5% ceram DI 400V
	C2	74.5006	10 pF 5% ceram DI 400V
	C3	74.5325	1 nF -20% + 80% ceram no lead 400V
	C4		not used
	C5	76.5071	22 nF 10% polyest FL 50V
	C6	74.5155	1 nF - 20% +80% ceram PL 63V
	C7	74.5155	1 nF - 20% +80% ceram PL 63V
	C8	74.5155	1 nF - 20% +80% ceram PL 63V
	C9	74.5155	1 nF - 20% +80% ceram PL 63V
	C10	76.5072	47 nF 10% polyest FL 50V
	C11	73.5064	2.2 µF - 10% +100% elco 63V
	C12	69.5023	VHF feed through filter
	R1	80.5225	10 Ω 5% carbon filter 1/8W
	R2	80.5243	330 Ω 5% " " 1/8W
	R3	80.5233	47 Ω 5% " " 1/8W
	R4	80.5249	1KΩ 5% " " 1/8W
	R5	80.5243	330 Ω 5% " " 1/8W
	R6	80.5234	56 Ω 5% " " 1/8W
	R7	80.5257	4.7KΩ 5% " " 1/8W
	R8	86.5039	10KΩ 20% potentiometer 0.1W
	R9	86.5037	10KΩ 20% " 0.05W
	R10	89.5071	60 Ω - 50KΩ PTC 30V
	R11	80.5261	10KΩ 5% carbon film 1/8W
	R12	80.5254	2.7KΩ 5% " " 1/8W
	R13	82.5208	0.1 Ω 10% wirewound 1W
	R14	82.5205	0.22 Ω 10% wirewound 1W
	E1	99.5028	IN914 Diode
	E2	99.5028	IN914 Diode
	E3	99.5223	12V 5% Zenerdiode 1/4W
	Q1	99.5298	BFW16A Transistor
	Q2	99.5235	BD135 Transistor
	Q3	99.5144	BC214L Transistor
	Q4	14.5090	UHF Power Module 13W
		10.3178	AS763 Antenna Switch
	C51	69.5007	VHF feed through filter
	C52	74.5155	1 nF - 20% +80% ceram PL 50V
	C53	74.5155	1 nF - 20% +80% ceram PL 50V
	C54	74.5004	5.6 pF ± 0.25 pF ceram DI 400V
	C55	74.5130	3.9 pF ± 0.25 pF ceram DI 250V
	C56	74.5162	470 pF - 20% +50% ceram DI 250V
	C57	74.5155	1 nF - 20% +80% ceram PL 50V

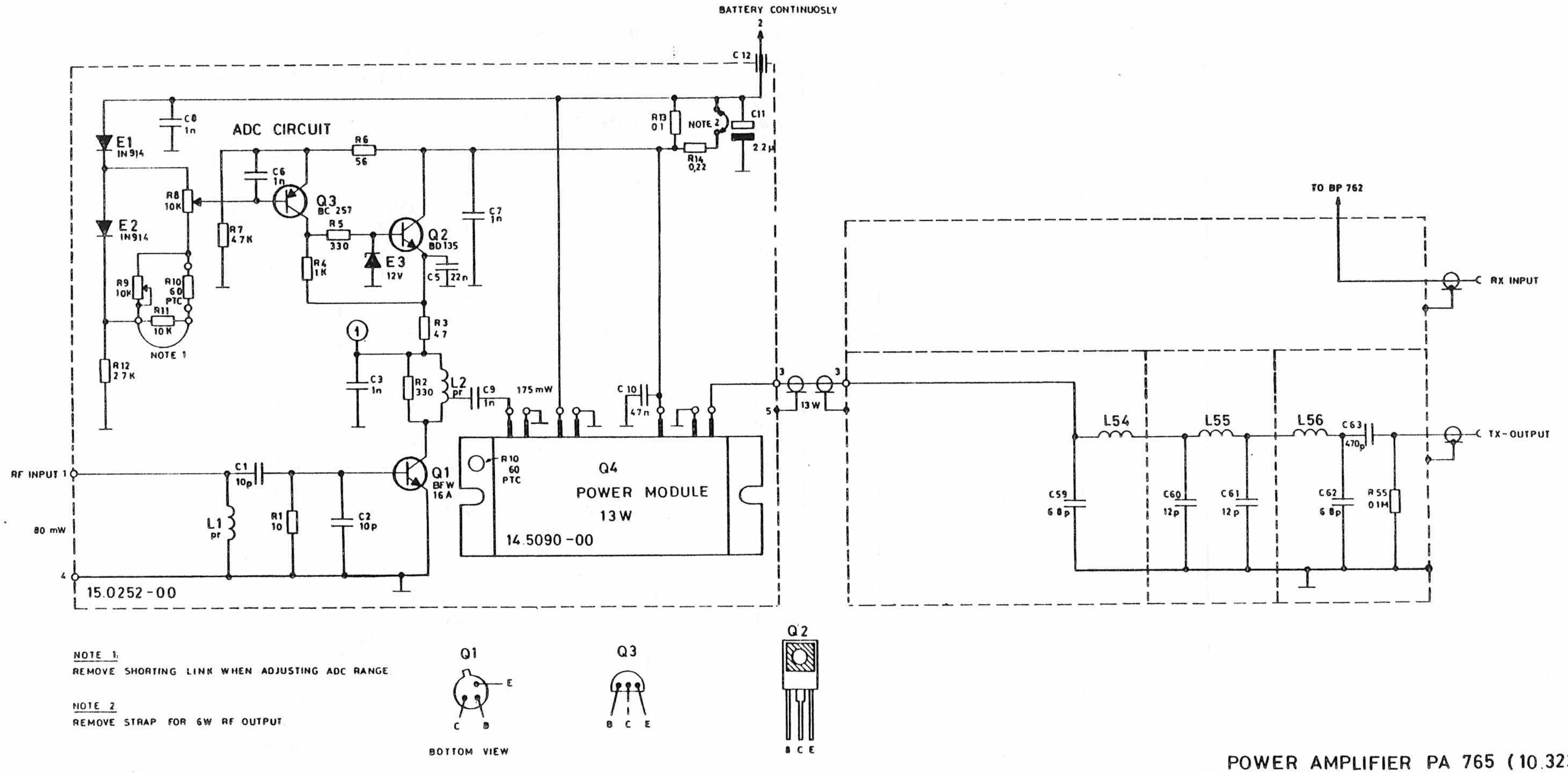
Storno

TYPE	NO.	CODE	DATA
	C58	69.5007	VHF feed through filter
	C59	74.5021	6.8 pF ± 0.25 ceram DI 400V
	C60	74.5194	12 pF 5% ceram DI 400V
	C61	74.5194	12 pF 5% ceram DI 400V
	C62	74.5021	6.8 pF ± 0.25 pF ceram DI 400V
	C63	74.5094	470 pF 20% ceram DI 400V
	R51	80.5232	39 Ω 5% carbon film 1/8W
	R52	80.5073	100KΩ 5% " " 1/8W
	R53	80.5073	100KΩ 5% " " 1/8W
	R54	80.5044	390KΩ 5% " " 1/8W
	R55	80.5273	100KΩ 5% " " 1/8W
	L51	63.5008	0.47 µH 20% RF choke 2.2A
	L52	62.0923	RF coil
	L53	62.0810	RF coil
	L54	62.0811	RF coil
	L55	62.0811	RF coil
	L56	62.0811	RF coil
	E51	99.5244	BA182 Diode
	E52	99.5244	BA182 Diode
	E53	99.5244	BA182 Diode
	E54	99.5244	BA182 Diode
	E55	99.5282	5.6V 5% Zenerdiode 1/8W
	E56	99.5237	IN4148 Diode

POWER AMPLIFIER PA764

X402.163

Storno



NOTE 1:
REMOVE SHORTING LINK WHEN ADJUSTING ADC RANGE

NOTE 2
REMOVE STRAP FOR 6W RF OUTPUT

POWER AMPLIFIER PA 765 (10.3238-00)

D 402.139/2

Storno

Storno

TYPE	NO.	CODE	DATA
PA765		10.3238-00	UHF Power Amplifier
	C1	74.5006	10 pF 5% ceram DI 400V
	C2	74.5006	10 pF 5% " DI 400V
	C3	74.5325	1 nF -20% +80% " no lead 400V
	C4		Not used
	C5	76.5071	22 nF 10% polyest FL 50V
	C6	74.5155	1 nF -20% +80% ceram PL 63V
	C7	74.5155	1 nF -20% +80% ceram PL 63V
	C8	74.5155	1 nF -20% +80% ceram PL 63V
	C9	74.5155	1 nF -20% +80% ceram PL 63V
	C10	76.5072	47 nF 10% polyest FL 50V
	C11	73.5064	2.2 µF -10 + 100% elco 63V
	C59	74.5021	6.8 pF ±0.25 pF ceram DI 400V
	C60	74.5194	12 pF 5% " DI 400V
	C61	74.5194	12 pF 5% " DI 400V
	C62	74.5021	6.8 pF ±0.25 pF " DI 400V
	C63	74.5094	470 nF 20% " DI 400V
	R1	80.5225	10 Ω 5% carbon film 1/8W
	R2	80.5243	330 Ω 5% " " 1/8W
	R3	80.5233	47 Ω 5% " " 1/8W
	R4	80.5249	1KΩ 5% " " 1/8W
	R5	80.5243	330 Ω 5% " " 1/8W
	R6	80.5234	56 Ω 5% " " 1/8W
	R7	80.5257	4.7KΩ 5% " " 1/8W
	R8	80.5039	10KΩ 20% potentiometer 0.1W
	R9	86.5037	10KΩ 20% " 0.1W
	R10	89.5071	60 Ω - 50 Ω PTC 30V
	R11	80.5261	10KΩ 5% carbon film 1/8W
	R12	80.5254	2.7KΩ 5% " " 1/8W
	R13	82.5208	0.1 Ω 10% wire wound 1W
	R14	82.5205	0.22Ω 10% " " 1W
	R55	80.5273	100KΩ 5% carbon film 1/8W
	L54	62.0811	RF coil
	L55	62.0811	RF coil
	L56	62.0811	RF coil
	E1	99.5028	IN914 Diode
	E2	99.5028	IN914 Diode
	E3	99.5223	12V 5% Zenerdiode 1/4W
	Q1	99.5298	BFW16A Transistor
	Q2	99.5235	BD135 Transistor
	Q3	99.5144	BC214L Transistor
	Q4	14.5090	UHF Power Module 13W

Storno

TYPE	NO.	CODE	DATA

POWER AMPLIFIER PA765

X402.164

STORNOPHONE 700
MAINTENANCE MANUAL
VOLUME II
Section 6

STORNOPHONE 700

MAINTENANCE MANUAL

VOLUME II

Section 6

POWER SUPPLY PS701

Description

General

This power supply is designed for mobile radio sets in the CQM700 series. The unit operates from a DC supply in the neighbourhood of 24 V, supplying a DC voltage in the proximity of 12 V from its output.

The input to the power supply has no DC connection to chassis ground and thus is floating in reference to ground. The negative side of the output, however, is at chassis ground potential.

By means of taps on the secondary of the transformer T1 the output can be wired to accommodate a maximum current drain of either 4.0 A or 8.0 A.

The unit is housed in a cast metal cabinet and contains three stages; an input filter, a DC/DC converter, and a series voltage regulator circuit.

When installing the PS701 the positive output lead must be protected with either a 5.0 A fuse (for the 4.0 A version) or an 8.0 A fuse (for the 8.0 A version). In the input, in the battery lead that is NOT connected to the vehicle chassis, a 6.0 A fuse must be inserted. Moreover, an on/off switch needs also to be incorporated into the input lead since there is no start relay in the power supply.

The DC Converter

The DC/DC converter consists of the converter circuit and transformer T1. The converter tran transistors, Q1 and Q2, are coupled in a normal, common-emitter push-pull configuration.

The converter operating frequency is determined by the characteristics of T2 and the voltage across its primary winding and is approximately 12 to 15 kHz. T2, the saturation transformer, is dimensioned to saturate before T1 in order to prevent excessive peak currents through the transistors.

The primary winding of the saturation transformer, T2, and a series resistor, R6, are inserted between the collectors of Q1 and Q2. The secondary winding of T2, which is a bifilar winding, is placed between the bases of these same transistors.

When power is initially applied to the input there is 0 V across the series resistor and the primary of T2. Therefore, in order to start the switching action in the converter a starting circuit must be employed. This circuit consists of Q3 and Q4. Q3, a programmed unijunction transistor, is the starting element and Q4 acts as an amplifier for Q3, ensuring that the converter circuit will start even under full load conditions.

When power is applied to the input a current from the battery, through the primary winding of T1 and resistor R4, builds up a voltage across capacitor C6 until it reaches a level where it causes Q3 to open. C6 discharging through Q3 drives the base of Q4 in the forward direction, providing forward bias to Q2. Q2 begins to pass current, and now the converter action can begin.

The time constant of the starting circuit is so long in comparison to the converter frequency that the starter will remain passive during operation.

The primary of T1, which is connected between the two collectors (Q1 and Q2), is made up of two identical bifilar windings. The secondary consists of two identical main windings, a winding for generating an auxiliary voltage for the series regulator circuit (transformer terminals 7 and 8), and a special auxiliary winding (transformer terminals 5 and 6) that can supply approx. 5 V for certain types of special equipment.

The connections to the main secondary windings will depend upon the maximum output

Storno

load requirements. The converter comes wired as a 4.0 A version from the factory. To modify it to the 8.0 A version, the lead from transformer terminal 10 must be in interchanged with that from terminal 9, and the lead from terminal 13 must be interchanged with that from terminal 12. In addition, the fuse in the output lead must be replaced with an 8.0 A fuse.

The two main secondary windings are connected as a full-wave rectifier incorporating diodes E7 and E8.

The Series Regulator

The purpose of the series voltage regulator circuit is to maintain the output voltage at some preset value within the proximity of 12 V. For maximum efficiency the regulator circuit setting should be 16 V with unloaded output.

The regulator circuit contains 2 transistor stages; a series element and driver, and an amplifier with a reference zener diode. The series element, Q5, operates in the grounded collector (emitter-follower) mode. Q5 and Q6 are a Darlington coupled amplifier which is controlled by the reference amplifier, Q7, whose base monitors any variations in the output voltage and compares it with the constant zener reference voltage at its emitter.

The auxiliary half-wave rectifier circuit incorporating diode E9 ensures that Q5 can be driven into complete saturation. Otherwise, the minimal voltage drop across Q5 would be:

$$V_{BE}(Q5) + V_{CE}(Q6) .$$

Thanks to the auxiliary voltage, the least drop is now : $V_{CE}(Q5)$.

The Input Filter

The filter employed in the input leads ensures compliance to the noise/interference specifications set forth in the German norm VDE 0875. Coil L1, consisting of identical windings both wound on the same core, forms a low-pass filter in conjunction with C1 and C2.

Technical Specifications

Supply Voltage
minimum: 21.0 V
normal: 25.2 V
maximum: 32.0 V

Output Voltage
minimum: 10.5 V
maximum: 16.0 V

Output Load
4.0 A version: 4.0 A
8.0 A version: 8.0 A

Output Voltage Ripple
$<$60 mV p.p.

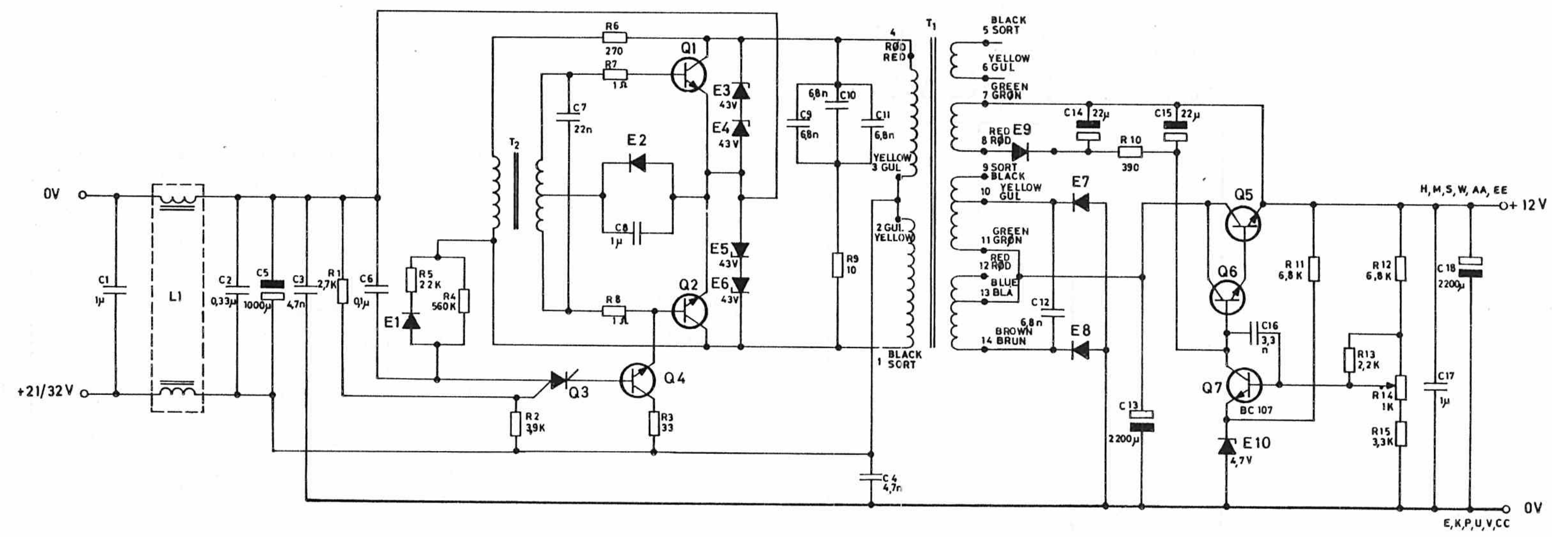
Current Consumption
25.2 V supply, unloaded output: 400 mA
25.2 V supply, 4.0 A output load: 3.0 A
25.2 V supply, 8.0 A output load: 6.1 A

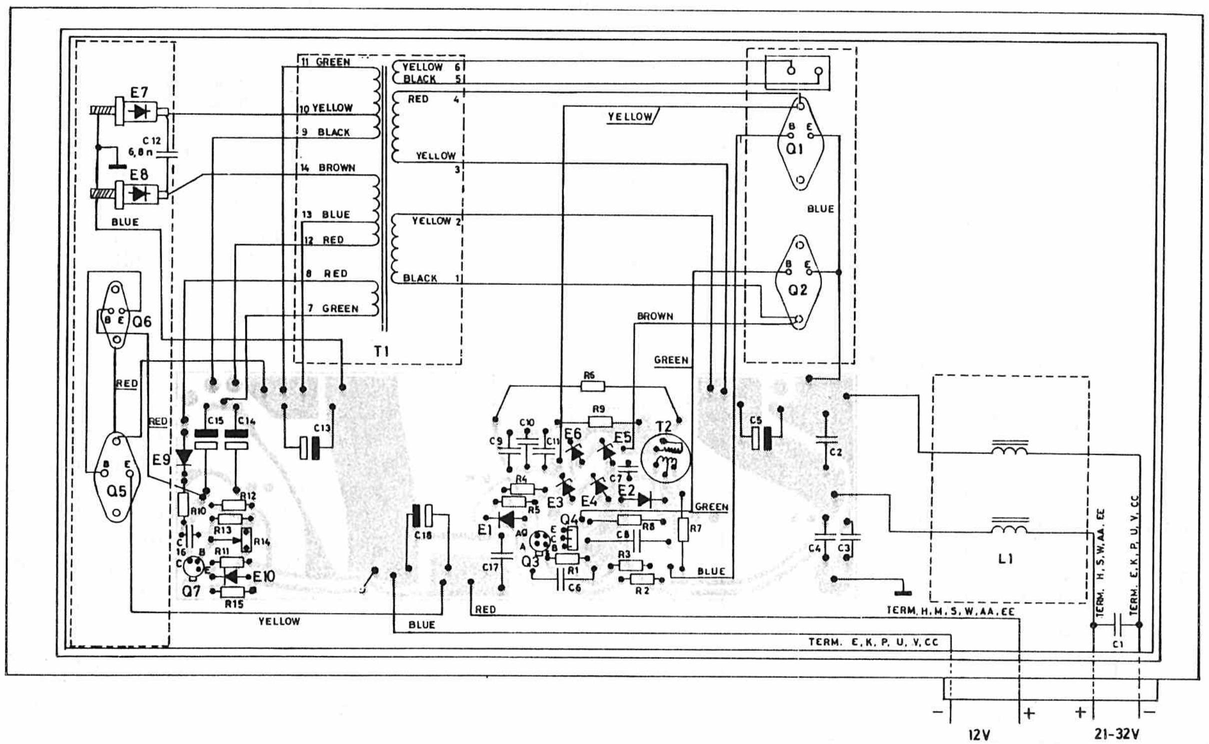
Converter Frequency
12 to 15 kHz

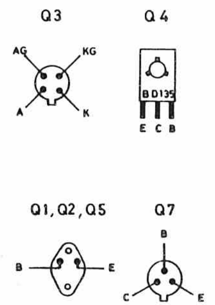
Ambient Temperature Range
4.0 A version
operating range: -25° to $+60^{\circ}$C
functioning range: -25° to $+80^{\circ}$C

8.0 A version, 30 minute duty period
operating range: -25° to $+60^{\circ}$C
functioning range: -25° to $+80^{\circ}$C

Storno







POWER SUPPLY UNIT
STRØMFORSYNING

PS701

D401.647/2

TYPE	NO.	CODE	DATA	
PS701		10.2448-00	Power supply unit	
	C1	76.5078	1μF 10% polyest TB	100V
	C2	76.5075	0.33μF10% polyest TB	100V
	C3	74.5285	4.7nF - 20+80% ceram DI	2000V
	C4	74.5285	4.7nF -20+80% ceram DI	2000V
	C5	73.5146	1000μF -10+100% elco	100V
	C6	76.5073	0.1μF 10% polyest TB	100V
	C7	76.5071	22nF 10% polyest FL	50V
	C8	76.5078	1μF 10% polyest TB	100V
	C9	74.5286	6.8nF 20% ceram DI	400V
	C10	74.5286	6.8nF 20% ceram DI	400V
	C11	74.5286	6.8nF 20% ceram DI	400V
	C12	74.5286	6.8nF 20% ceram DI	400V
	C13	73.5139	2200μF - 10+100% elco	40V
	C14	73.5145	22μF - 10+100% elco	40V
	C15	73.5145	22μF - 10+100 elco	40V
	C16	76.5060	3.3nF 10% polyest	50V
	C17	76.5096	1μF 20% polyest	100V
	C18	73.5139	2200μF - 10+100% elco	40V
	R1	80.5254	2,7kΩ 5% carbon film	1/8W
	R2	80.5256	3.9kΩ 5% carbon film	1/8W
	R3	80.5231	33Ω 5% carbon film	1/8W
	R4	80.5282	056MΩ 5% carbon film	1/8W
	R5	80.5253	2.2kΩ 5% carbon film	1/8W
	R6	84.5225	270Ω wire wound	9W
	R7	82.5201	1Ω 10% wire wound	1W
	R8	82.5201	1Ω 10% wire wound	1W
	R9	84.5019	10Ω 10% wire wound	5.5W
	R10	80.5244	390Ω 5% carbon film	1/8W
	R11	80.5259	6.8kΩ 5% carbon film	1/8W
	R12	80.5259	6.8kΩ 5% carbon film	1/8W
	R13	80.5253	2.2kΩ 5% carbon film	1/8W
	R14	86.5058	1KΩ 20% potentiometer	0.1W
	R15	80.5255	3.3kΩ 5% carbon film	1/8W
	L1	60.5161	Line filter	
	T1	60.5160	Converter transformer 24-12V 175W	
	T2	61.1118	Transformer, saturation	
	E1	99.5237	1N4148 diode	
	E2	99.5020	1N4004 diode	
	E3	99.5226	BZX70C43 zenerdiode	
	E4	99.5262	BZX70C43 zenerdiode	
	E5	99.5262	BZX70C43 zenerdiode	
	E6	99.5262	BZX70C43 zenerdiode	

TYPE	NO.	CODE	DATA
	E7	99.5260	BYX30-200R diode
	E8	99.5260	BY30-200R diode
	E9	99.5020	1N4004 diode
	E10	99.5224	4.7V 5% zenerdiode
	Q1	99.5261	BDY91 Transistor
	Q2	99.5261	BDY91 Transistor
	Q3	99.5238	BRY39 Transistor
	Q4	99.5235	BD135 Transistor
	Q5	99.5261	BDY91 Transistor
	Q6	99.5193	2N3054 Transistor
	Q7	99.5121	BC107 Transistor

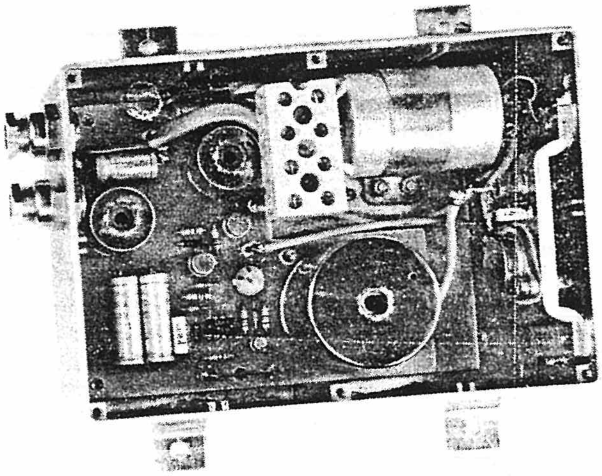
POWER SUPPLY UNIT
STRØMFORSYNING

PS701

X 401.789

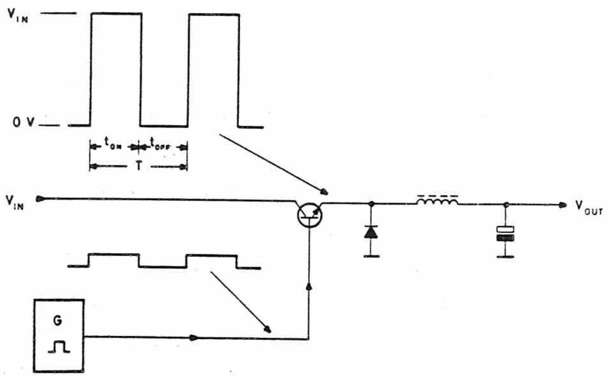
Storno

Power Supply Unit PS702



The PS702 power supply is a switching regulator for coverting a 24 V input voltage to 12 V output to supply a CQM700 radiotelephone.

The conversion from a high to a lower voltage is accomplished by alternately applying the input voltage (V_{IN}) and 0 volts (ground potential) to an LC lowpass filter, as shown below.



The output voltage will be the average value of the switched waveform. If the voltage drop across the transistor and diode is neglected, the output voltage will be:

$$V_{OUT} = V_{IN} X \frac{t_{ON}}{T}$$

which, in the case of a symmetric square wave and a 24 V input will be:

$$24 \text{ V} \times 1/2 = 12 \text{ V}$$

In addition, there will be a small amount of ripple voltage whose fundamental frequency is the switching frequency.

Notice that the output voltage, according to the formula, is independent of the load current.

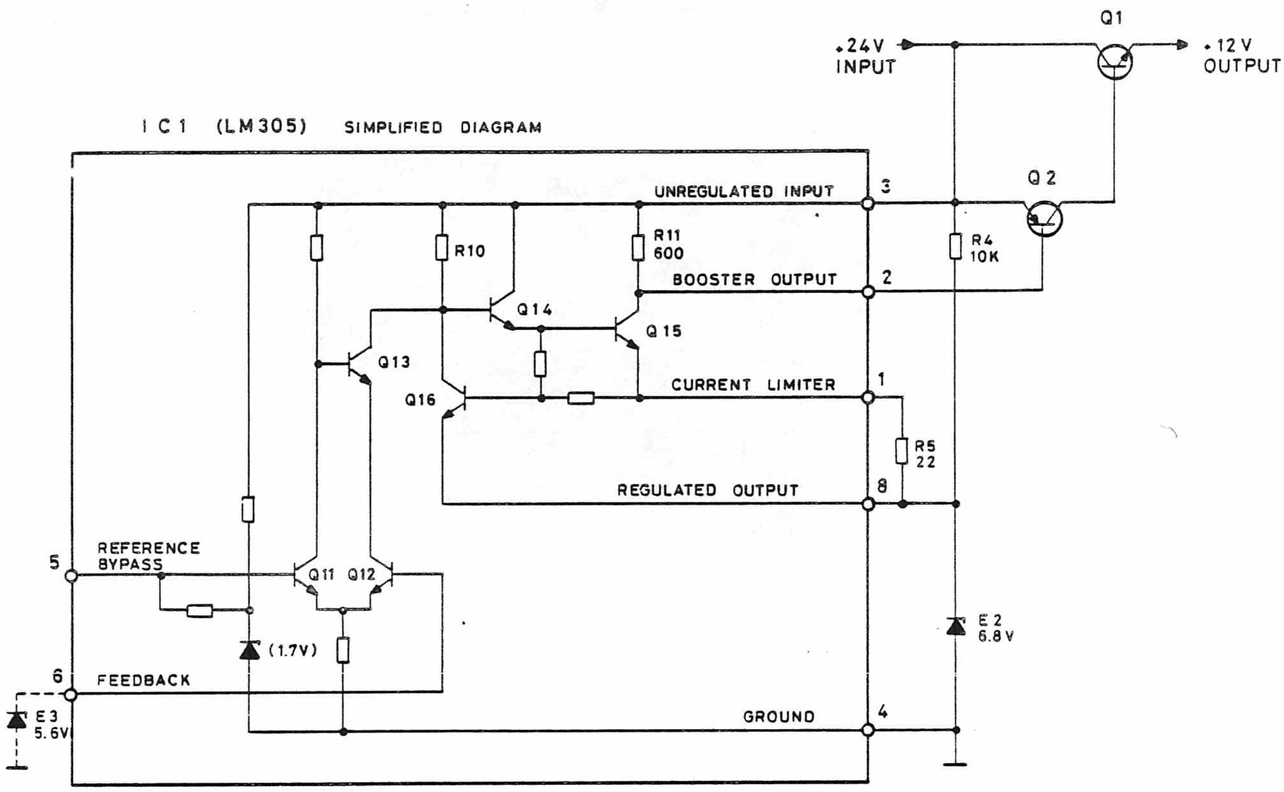
A regulating circuit monitors the output voltage and compares it to a reference voltage. The regulating circuit then accordingly regulates the ratio between ON and OFF time. Thus the output voltage is maintained at the proper level regardless of input voltage or load current.

A current regulating circuit protects the series switch transistors against being destroyed by overloads or short circuits at the power supply output.

LC filters in both the input and output circuits prevent excessive radiation of noise along the input and output leads.

Due to the switching principle the efficiency of this power supply is high, efficiency is on the order of 85%.

SWITCHING CIRCUIT



The LM305 integrated voltage regulator, IC1, drives the PNP switching transistor, Q2. An additional, NPN transistor, Q1, enables the circuit to handle the heavy currents required by the radiotelephone set (up to 8 amperes).

Q11 and Q12 make up a differential amplifier. The input from IC pin 6 is the inverting input, referred to as the feedback input. The non-inverting input, from IC pin 5, is called the reference bypass. This input is held at a potential of 1.7 V (typical value) by the internal IC circuitry. This potential is called the reference voltage.

If the voltage on input pin 6 is less positive than the reference voltage at the base of Q11, the differential amplifier turns Q13 OFF. This is how: Q11 conducts, pulling the base of Q13 LO while at the same time Q12 cuts off via emitter feedback, preventing any emitter current to flow through Q13. When Q13 goes OFF its collector is pulled up by R10, turning Q14 and Q15 ON. Notice that Q15's 600 ohm collector resistor, R11, is also the emitter-base biasing circuit for Q2, the switching transistor. Thus, when Q15 is driven ON, the collector current through R11 turns Q2 ON, as well. Q2 supplies drive to Q1, which also switches ON.

Now, if a voltage more positive than the internally generated reference voltage is applied to IC pin 6, Q12 will go ON, cutting Q11 OFF. The differential amplifier now forward biases Q13, which goes ON, turning Q14 and Q15 OFF. With no collector current through R11, Q2 loses its forward bias and switches OFF, also switching Q1 OFF.

In addition, there is a built-in current limiting feature in this circuit. Base current for Q2 flows via IC pin 2 (booster output), Q15, R5, and E2 to ground. The 22 ohm resistor R5 is called the current limiting resistor and is also the source of emitter-base bias for Q16. Whenever base current for Q2 tends to exceed the limit set by the value of R5, Q16 will begin to draw current through R10. This reduces the bias to Q14 and Q15, creating a state of equilibrium where the amount of base drive to Q2 is determined by the value of R5.

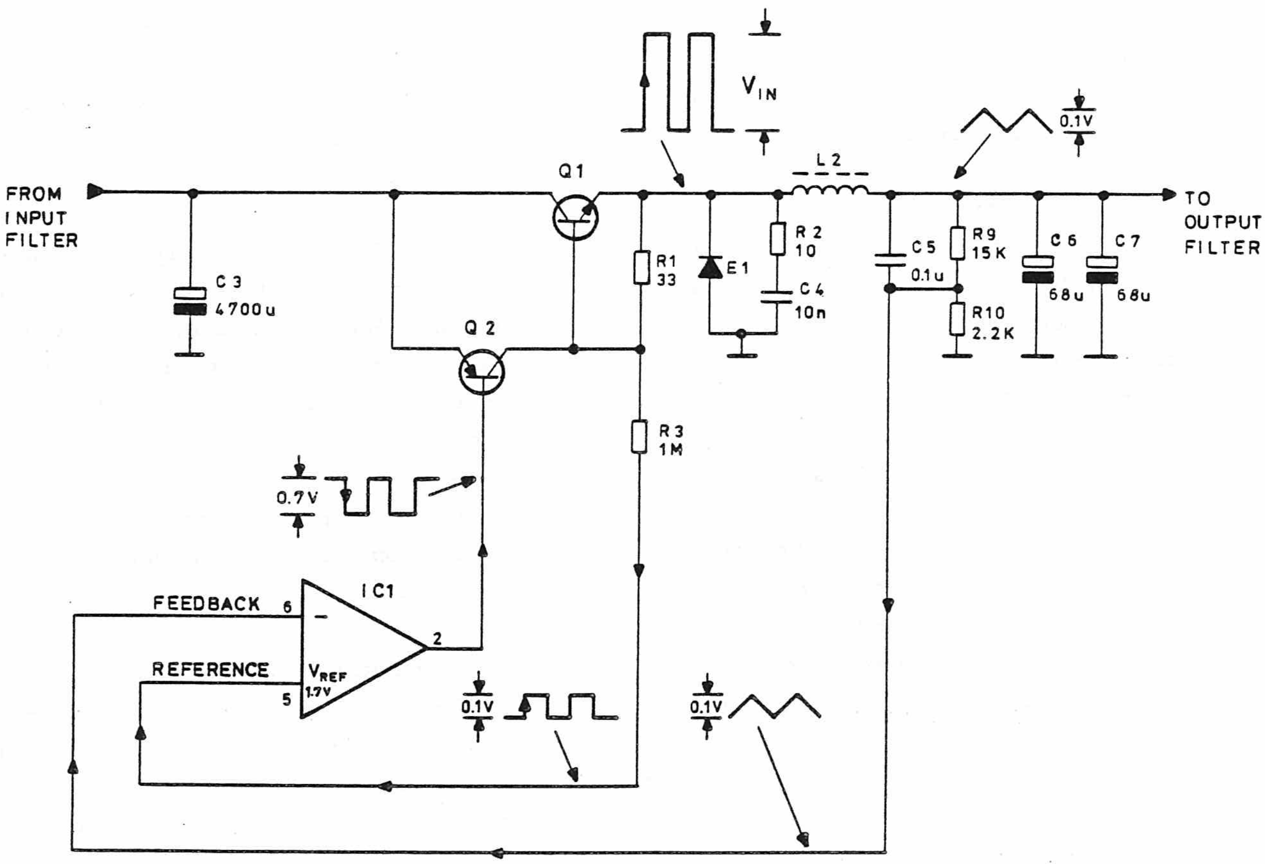
With a value of 22 ohms chosen for R5, the current will be limited to about 15 mA for temperatures within the nominal operating range.

Zener diode E2 keeps the regulated output voltage at IC pin 8 at approximately 6.8 V. E3, a 5.6 V Zener diode, is wired to IC pin 6. This ensures that the voltage to the feedback terminal cannot rise higher than the voltage at IC pin 1. Otherwise the circuit can latch up and burn out.

OSCILLATOR CIRCUIT

The integrated voltage regulator, IC1, monitors the output voltage by measuring the portion of the DC voltage that is dropped across R10. It also measures the full amplitude of the output ripple via bypass capacitor C5. Thus the instantaneous ripple amplitude adds with the sampled DC voltage at input terminal 1, pin 6 of IC1.

When power is initially to the PS702 there is no voltage at the output. Therefore there can be no bias available at pin 6 of IC1, and the internally generated reference voltage present at the noninverting input, pin 5, will then be able to drive the IC ON, which in turn drives Q2, then Q1, into conduction as well.



A positive voltage now begins building up on the collector of Q2 as well as on the emitter of Q1. A small portion of this rising voltage is fed back through resistor R3 to IC1 input terminal, pin 5. The amplitude of the feedback signal is determined by the ratio of R3 to the input impedance of the terminal. The polarity of the feedback signal is such that it causes the voltage at terminal 5 to become even more positive. This regenerative feedback therefore increases the gain of the amplifier, driving Q1 and Q2 even harder. (In fact, the amplitude of the feedback signal is sufficient to sustain oscillation in the circuit). Of course, this all happens very quickly, during the rise time of the square wave.

Meanwhile, filter capacitors C6 and C7 are charging up to the input voltage through L2 and Q1. The DC charge on these parallel capacitors is divided between R9 and R10. Remember, too, that C5 bypasses ripple voltages (including charging waveforms) around R9, directly to pin 6 of the regulator IC.

At some point the combined AC and DC voltages as seen at pin 6 of IC1 will become greater than the bias at pin 5, which bias is equal to the internal reference voltage plus the instantaneous value of the feedback signal. Now when the potential at terminal 6 has become more positive than that at terminal 5, the regulator switches state and cuts Q2 and Q1 OFF.

When this happens the magnetic field induced in coil L2 will attempt to maintain the current flow through the coil and in so doing biases catch diode E1 into forward conduction, in effect grounding the emitter of Q1. As seen at IC pin 5, the regenerative feedback via R3 is now a negative-going pulse. This, of course, is the correct polarity for driving the integrated amplifier and the switching transistors even further into cut-off.

The circuit remains cut off until C6 and C7 discharge enough so that the potential seen at pin 6 falls below that at pin 5 (the reference voltage minus the feedback - signal). At this point the IC switches state again and the circuit continues in this way to oscillate at a frequency determined by the reactance of L2, the capacitances of C6 and C7, and the amplitude of the feedback signal. Feedback resistor R3 is what determines the amplitude of the feedback signal.

(It is worth mentioning here that the output voltage does not reach its full 12 V potential immediately, but in several increments governed by the oscillator excursions and the frequency of oscillation. However, once the output voltage reaches its full value, it remains constant with only a slight ripple voltage).

The amplitude of the feedback signal, typically 100 mV, determines how great a voltage excursion the oscillator circuit must self-compensate for, the ripple superimposed on the filter capacitors C6 and C7 will have essentially the same amplitude as the feedback signal voltage. With L2, C6, and C7 as circuit constants, the rate of charging the filter capacitors is also constant. Thus, if the capacitors have to charge (or discharge) to a relatively greater voltage before the oscillator switches state, it will take a longer time to do so. On the other hand, if the feedback and ripple amplitudes are relatively less, the capacitors can reach the threshold levels in less time. This is what determines the frequency of oscillation.

The oscillator frequency is approximately 25 kHz. This frequency was chosen as a compromise between efficiency, which improves with lowering frequency, and the necessity of ensuring against radiating undesired signals that would fall within the audible range.

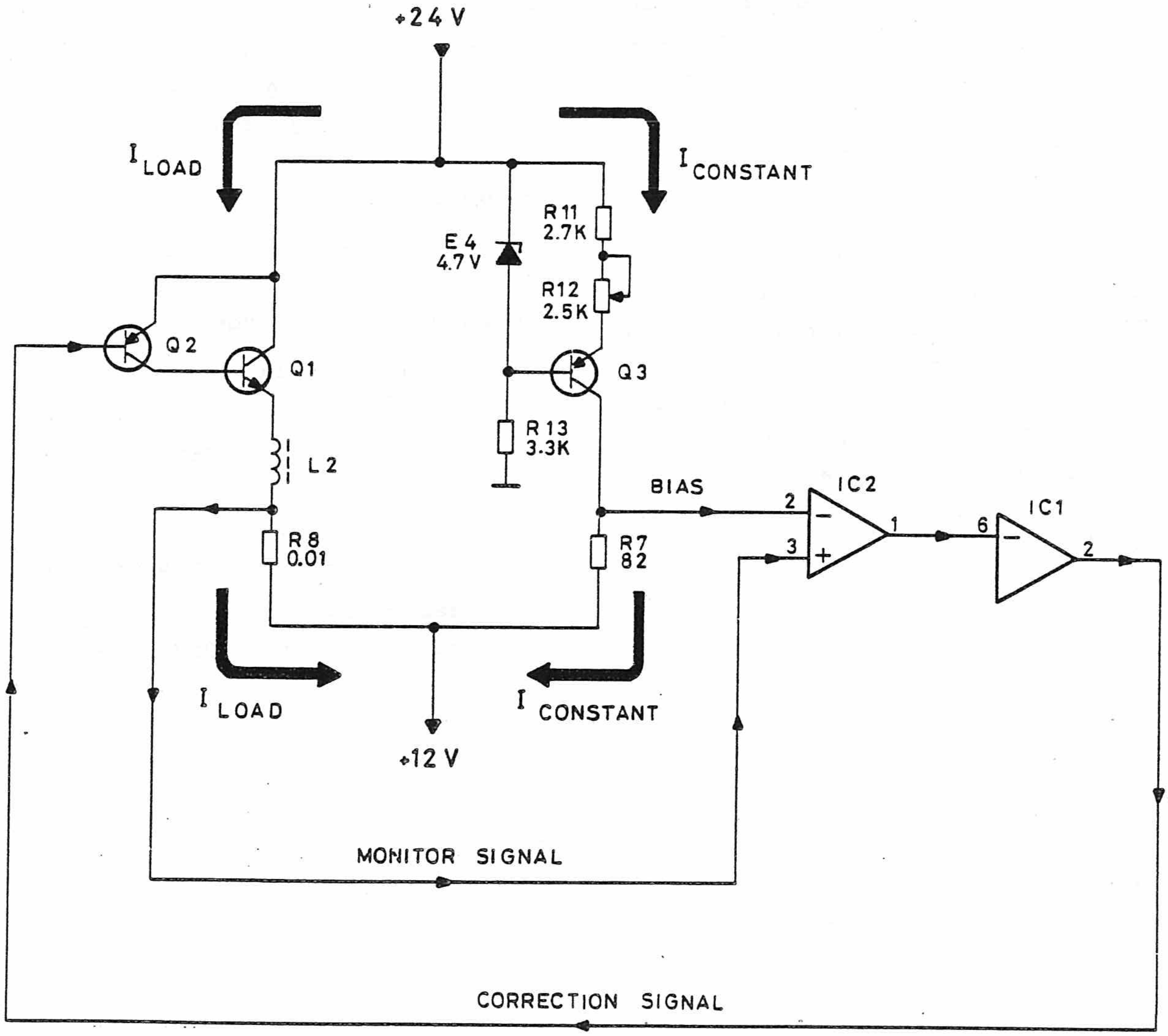
Storno

An RC network consisting of R2 and C10, accros catch diode E1, is a damping circuit used to attenuate switching transients that appear across E1. As explained earlier, E1 conducts heavily when Q1 is turned OFF. Right as Q1 goes ON again, E1 will still conduct because of its inherent reverse recovery time. The diode will thus act as a short circuit and a strong surge will pass from C3 through Q1 and E1. When all the charge stored in the catch diode is removed, the diode no longer conducts and pulse transients arise. At this point the damping circuit must handle the surge transients. This current surge, with its attendant transients, is the main cause of RF noise generated in the power supply.

OUTPUT CURRENT LIMITER CIRCUIT

Output current limiting is performed by comparator IC2. It compares the voltage drop across the 0,01 ohm resistor, R8, to the 82 ohm resistor, R7. Resistor R7 is in series with the constant current generator, Q3, and there will therefore be a uniform voltage drop across the resistor. On the other hand, resistor R8 is in series with the output load, so the voltage drop across R8 will depend upon the varying load conditions.

As long as the load current remains below a certain limit the voltage drop across R8 will be less than that across R7, and IC2 is held OFF.



Storno

When the load current increases, so does the voltage drop across R8, and if the current surpasses the set limit the voltage across R8 becomes greater than the voltage across R7. Now just the opposite condition exists: IC2 goes ON, driving IC1 OFF, which in turn switches Q2 and Q1 OFF, as well.

The maximum allowable load current before limiting will take place is set by adjusting potentiometer R12. Since R12 is in the emitter circuit of the constant current generator, Q3, its setting determines the voltage drop across R7.

Battery Protection

A double fuse box with two 5A fuses must be inserted in the leads from the battery and the vehicle chassis, one fuse in the battery lead and one in the chassis lead. It is not necessary to fuse the connections between power supply and CQM700 equipment.

SERVICING

A good practice to observe when servicing the PS702 is to load the output with a 50 ohm, 15W resistor or a suitable rheostat. Otherwise, if allowed to operate unloaded, the oscillator runs irregularly. This is a normal phenomenon and has no bad effect on the power supply, but it could be misleading when checking the performance of a unit.

Technical Specifications

Supply Voltage

minimum:	21.0 V
nominal:	27.2 V
maximum:	32.0 V

Output Voltage

minimum:	10.5 V
maximum:	16.0 V

Output Load

for output voltage > 10.5 V: 8 A min.

Output Ripple Voltage

$<$ 50 mV p.p.

Current Consumption

27.2 V supply, unloaded output:	10 mA
21.0 V supply, 8.0 A output load:	5.8 A
27.2 V supply, 8.0 A output load:	4.6 A

Efficiency

for $I_L > 0.5$ A: 87%

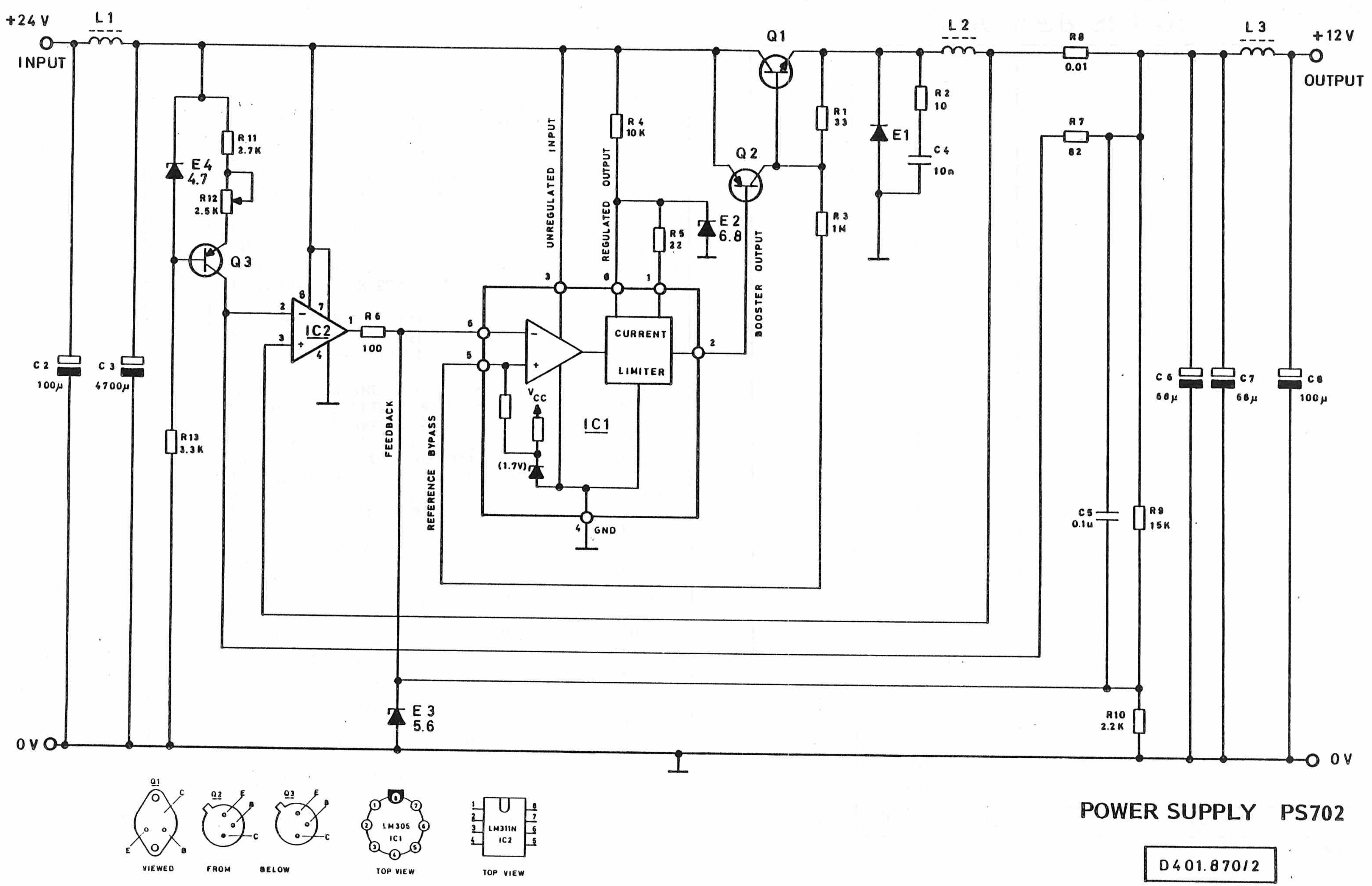
Ambient Temperature Range

(for continuous duty at 8 A)

operating range:	-25°C to +40°C
functioning range:	-25°C to +80°C

(for intermittent duty,
average load $\leq$ 4A and duty period $\leq$ 20 min.)

operating range:	-25°C to +60°C
functioning range:	-25°C to +80°C



POWER SUPPLY PS702

D401.870/2

Storno

TYPE	NO.	CODE	DATA	
PS702		10.2918	Power Supply	
	C2	73.5071	100µF - 10 + 50% elco	40V
	C3	73.5155	4700µF - 10 + 50% elco	40V
	C4	74.5109	10µF - 20 + 50% ceram FL	63V
	C5	76.5071	0.1µF 20% polyest. FL	50V
	C6	73.5154	68µF 20% elco	16V
	C7	73.5154	68µF 20% elco	16V
	C8	73.5071	100µF - 10 + 50% elco	40V
	R1	80.5231	33Ω 5% carbon film	1/8W
	R2	80.5225	10Ω 5% "	1/8W
	R3	80.5085	1MΩ 5% "	1/10W
	R4	80.5261	10KΩ 5% "	1/8W
	R5	80.5229	22Ω 5% "	1/8W
	R6	80.5237	100Ω 5% "	1/8W
	R7	80.5236	82Ω 5% "	1/8W
	R8	178.5005	0.01Ω constantan wire,	35mm
	R9	80.5263	15KΩ 5% carbon film	1/8W
	R10	80.5253	2.2KΩ 5% "	1/8W
	R11	80.5254	2.7KΩ 5% "	1/8W
	R12	86.5043	2.5KΩ potentiometer	1/10W
	R13	80.5255	3.3KΩ 5% carbon film	1/8W
	L1	61.1235	Filter coil	
	L2	61.1236	Filter coil	
	L3	61.1236	Filter coil	
	E1	99.5289	BYX 5o-200R diode	
	E2	99.5146	6.8V 5% Zener diode	1/4W
	E3	99.5114	5.6V 5% "	1/4W
	E4	99.5224	4.7V 5% "	1/4W
	Q1	99.5261	BDY91 Transistor	
	Q2	99.5215	2N2905A Transistor	
	Q3	99.5251	BC177 Transistor	
	IC1	14.5054	LM305 Voltage regulator	
	IC2	14.5070	LM311N Voltage comparator	

Storno

TYPE	NO.	CODE	DATA

POWER SUPPLY
STRØMFORSYNING

PS702

X401.937

Storno

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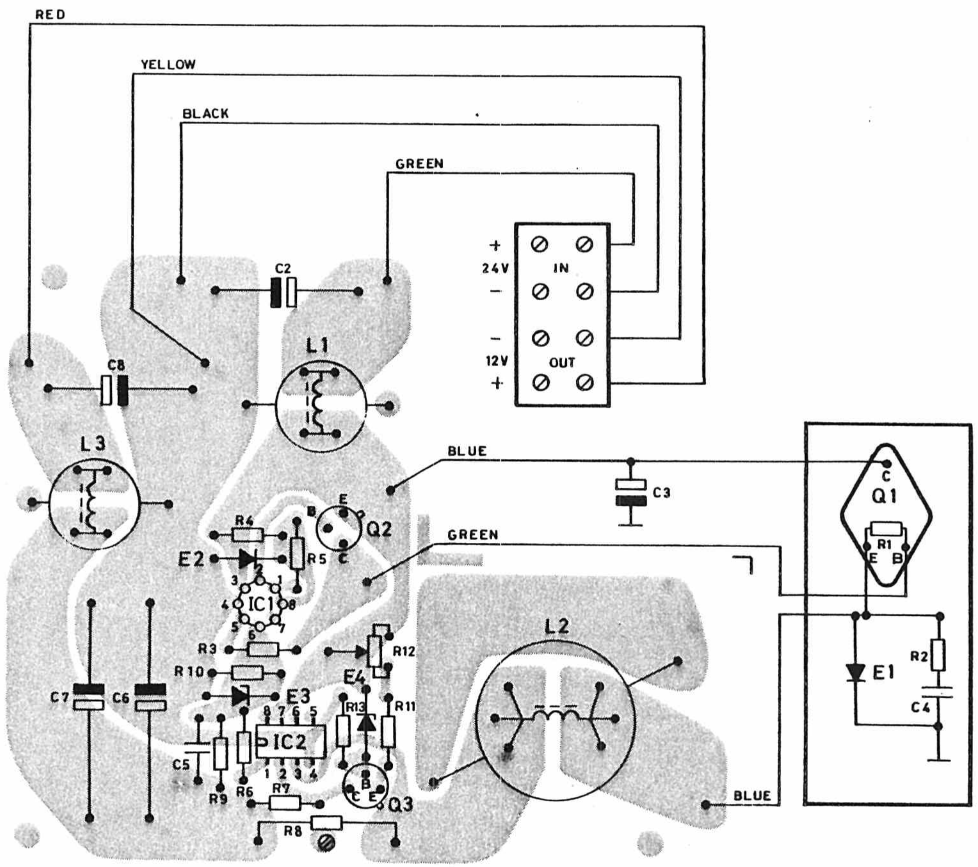


POWER SUPPLY
STRØMFORSYNING

PS702

D402.096

Storno

POWER SUPPLY UNIT PS703

Circuit Description

The power supply unit PS703 is operated from the mains. It converts 220 V AC to 13.5 V stabilized DC.

The PS703 consists of the following:

- Power transformer
- Rectifier
- Filter
- Series regulator
- Current Limiter

The power regulator is of the conventional series type with Q1 as the series pass element. Transistors Q2 and Q3 are driving Q1 in a three stage darlington configuration. The base voltage of Q3 is controlled by the error voltage amplifier Q5.

The reference voltage is provided by zener diode E6 and compared to the voltage derived from resistor chain R11, R12, and R13. The output voltage is adjusted by means of potentiometer R12. The circuit will oppose any change in the output voltage by regulating the voltage across the series transistor at a value that will keep the output voltage constant.

To reduce output ripple capacitor C5 provides AC feedback.

The current limiter is of the fold back type and consists of transistor Q4 and current sense resistor R7. Capacitors C3 and C4 introduce phase compensation to prevent instability.

Diode E3 protects the unit against reverse current due to incorrect connection and against transients from an inductive load.

Technical Specifications

Supply voltage

220 V AC ± 20%, 50 Hz.

Output Voltage

13.5 V DC.

Output current

max. 3.5 A.

Load regulation 0 - 3.5 A

< 200 mV (200 V AC).

< 1 V (175 V AC).

Line regulation

< 200 mV for 220 V ± 10%

< 1 V for 220 V ± 20%

Output voltage ripple

< 0,5 mV RMS at 3.5 A, 220 VAC ± 10%.

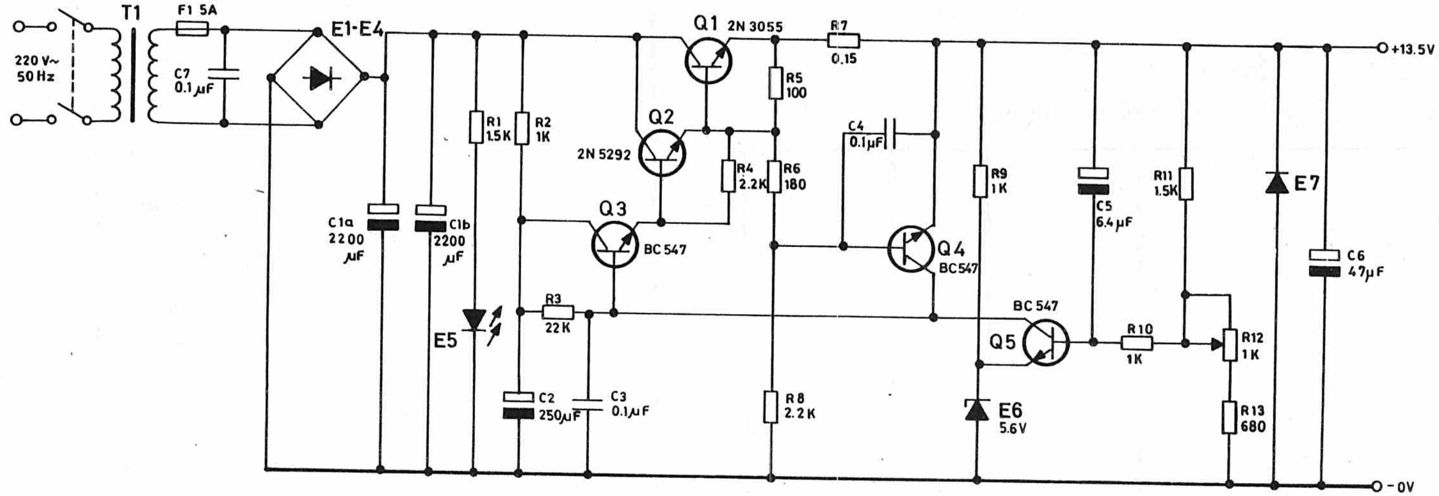
< 100 mV pp at 3.5 A, 175 VAC.

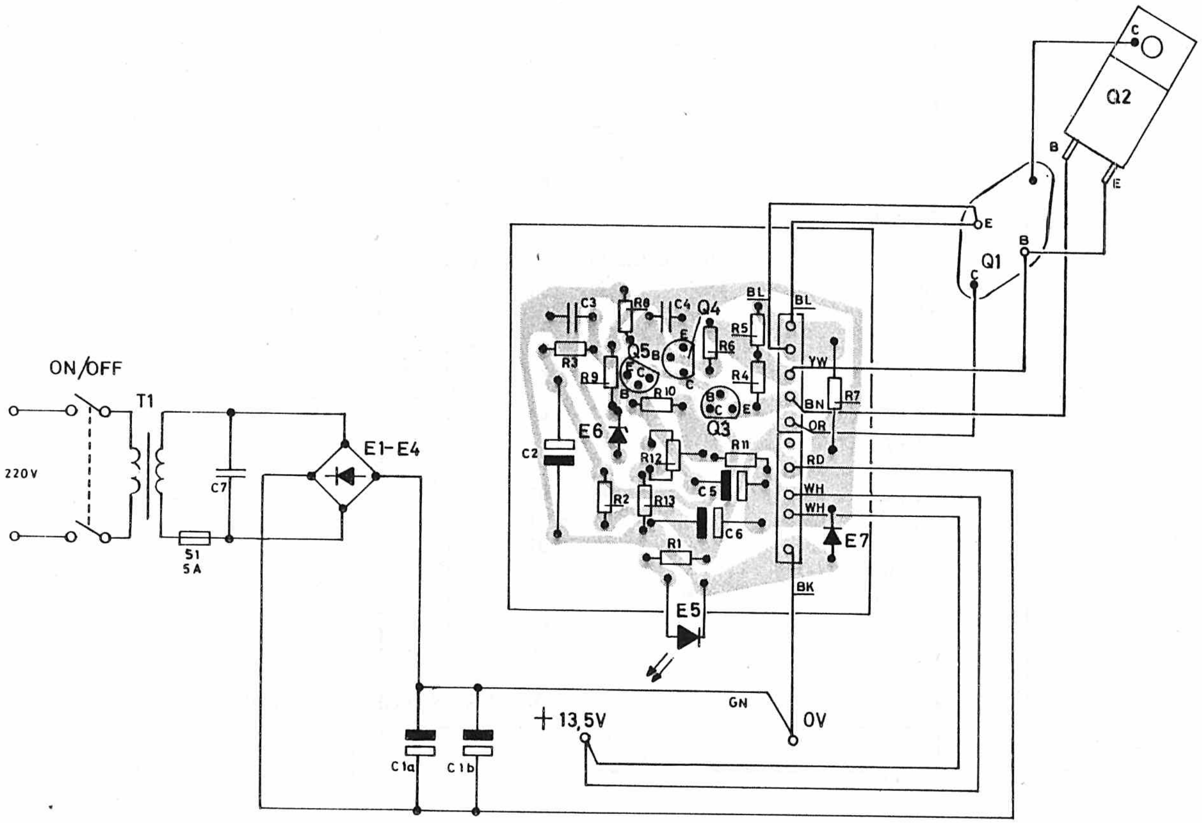
Short circuit current

< 1 A.

60.245-E1

Storno





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POWER SUPPLY
STRØMFORSYNING

PS703

D402.009

Storno

TYPE	Nº	CODE	DATA
PS703		10.3046	Power Supply Unit 220 V~/13.5 V DC
	C1		2 x 2200 µF or 4700 µF
	C2		220 µF -10 +50% 40 V
	C3		0.1 µF 10% polyester 100 V
	C4		0.1 µF 10% " 100 V
	C5		6.8 µF -10 +50% 40 V
	C6		47 µF -10 +50% 25 V
	C7		0.1 µF 10% polyester 100 V
	R1	81.5051	1.5 KΩ 5% carbon film 1/2 W
	R2	80.5449	1 KΩ 5% " " 1/4 W
	R3	80.5465	22 KΩ 5% " " 1/4 W
	R4	80.5453	2.2 KΩ 5% " " 1/4 W
	R5	80.5437	100 Ω 5% " " 1/4 W
	R6	80.5446	560 Ω 5% " " 1/4 W
	R7		0.15 Ω 10% wire wound 4 W
	R8	80.5453	2.2 KΩ 5% carbon film 1/4 W
	R9	80.5449	1 KΩ 5% " " 1/4 W
	R10	80.5449	1 KΩ 5% " " 1/4 W
	R11	80.5451	1.5 KΩ 5% " " 1/4 W
	R12		1 KΩ potentiometer
	R13	80.5447	680 Ω 5% carbon film 1/4 W
	E1, E2, E3, E4		6 SB 10 Rectifier bridge
	E5		LED red
	E6		5.6 V Zenerdiode 0.4 W
	E7		15 V " BZX 15 1 W
	Q1	99.5171	2 N 3055 Transistor
	Q2		2 N 5292 "
	Q3		BC 547 "
	Q4		BC 547 "
	Q5		BC 547 "
	T1		Mains transformer 220 V ~
	F1		Fuse 5 A
			ON/OFF Switch

Storno

TYPE	Nº	CODE	DATA

POWER SUPPLY UNIT
STRØMFORSYNING

PS703

X402.398

Storno

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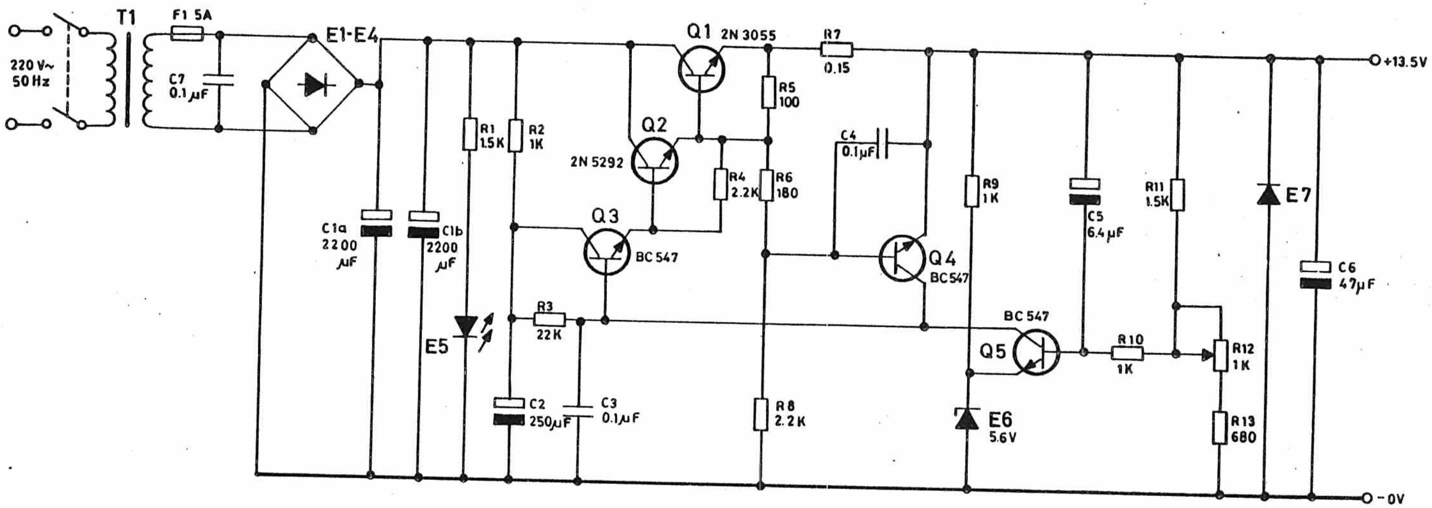

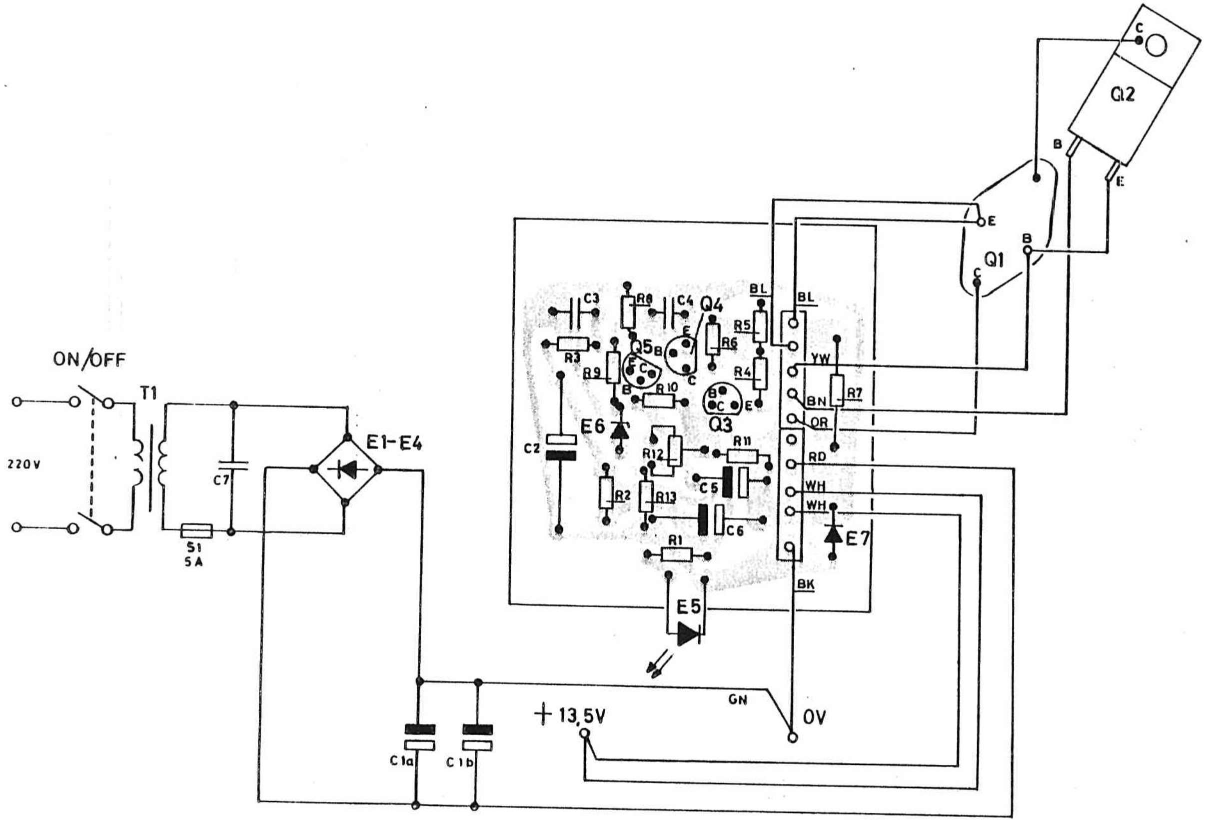

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POWER SUPPLY
STRØMFORSYNING

PS703

D402.009

Storno

POWER SUPPLY UNIT PS704

Circuit Description

The power supply unit PS704 is used in 24 Volt installations to reduce the battery voltage to 12 Volt for the radiotelephone.
The PS704 uses the series regulator principle with two transistors, Q1 and Q2, connected in parallel as the series element.
The transistors are driven by Q3 in a darlington configuration. Resistors R7 and R8 equalize the load current between Q1 and Q2.
The base voltage of driver transistor Q3 is controlled by the error amplifier Q4, the reference voltage of which is provided by zener diode E3.
Diode E5 protects the unit against reverse current due to incorrect connection and against transients from an inductive load.
In case of failure of the series transistors zener diode E4 will conduct and protect the load against excessive voltage.
Zener diode E1 protects the input against excessive voltage and against transients on the supply voltage.
In both cases fuse F1 will blow and must be replaced.

Technical Specifications

Input voltage

21 V - 32 V DC.

Polarity

Negative chassis.

Output Voltage

13.5 V

No load current

< 30 mA

Continnous load

1.5 A

Load duty cycle

5.5 A (1 min).
0.8 A (1 min).
0.4 A (3 min).

Output Overvoltage protection

Activated at voltages >16V.

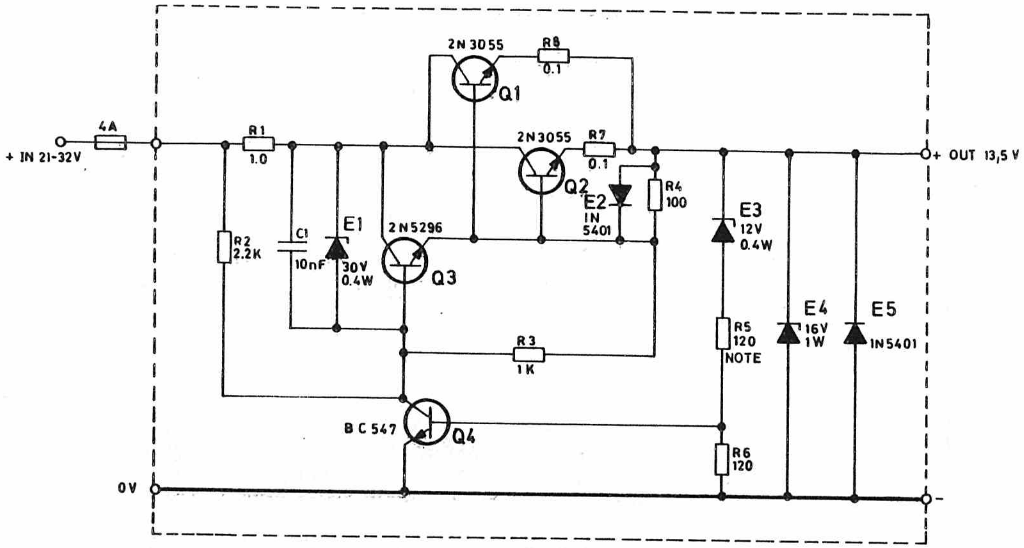
Temperature Range

-30°C - +55°C.

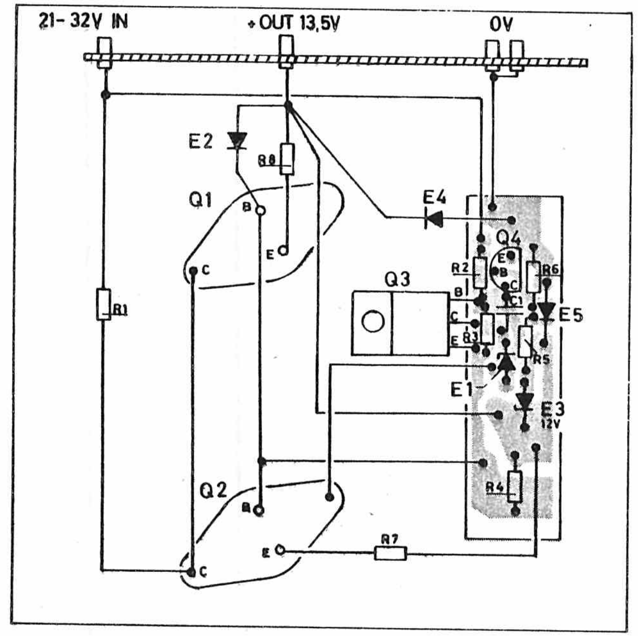
60.246-E1

Storno

Storno



NOTE: ADJUSTED TO 13.5V OUTPUT
JUSTERET FOR 13.5V UD
R_{min} = 120Ω
$R_{max.}$ = 330Ω



POWER SUPPLY
STRØMFORSYNING

PS704

D402.044

Storno

TYPE	Nº	CODE	DATA
PS704		10.3049	Voltageregulator 24 V DC/13.5 V DC
	C1		10 nF 10% polyest.
	R1		1 Ω Resistance wire
	R2	80.5453	2.2 KΩ 5% carbon film 1/4 W
	R3	80.5449	1 KΩ 5% " " 1/4 W
	R4	80.5437	100 Ω 5% " " 1/4 W
	R5	80.54XX	120-330 Ω 5% " " 1/4 W
	R6	80.5438	120 Ω 5% " " 1/4 W
	R7		0.1 Ω Resistance wire
	R8		0.1 Ω " "
	E1		30 V Zenerdiode 0.4 W
	E2	99.5220	1 N 5401 Diode
	E3		12 V Zenerdiode 0.4 W
	E4		16 V Zenerdiode 1 W
	E5	99.5220	1 N 5401 Diode
	Q1	99.5171	2 N 3055 Transistor
	Q2	99.5171	2 N 3055 "
	Q3		2 N 5296 "
	Q4		BC 547 "
			Fuse 4 A

Storno

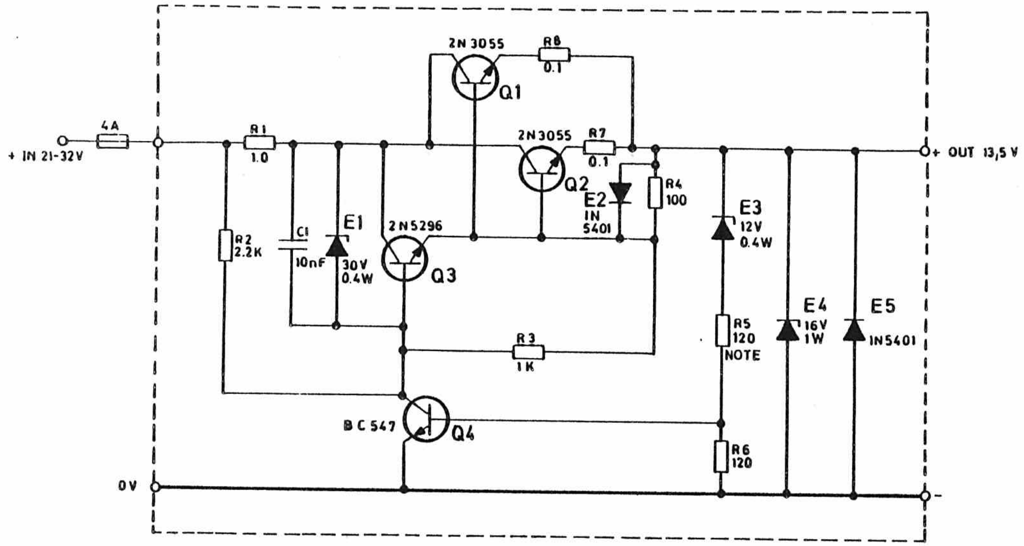
TYPE	Nº	CODE	DATA

POWER SUPPLY UNIT
STRØMFORSYNING

PS704

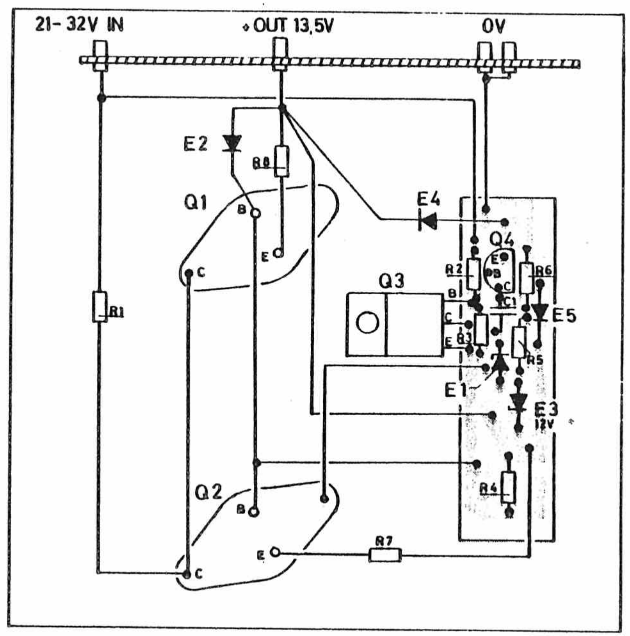
X402.397

Storno



NOTE: ADJUSTED TO 13.5V OUTPUT
JUSTERET FOR 13.5V UD
R_{min} = 120Ω
$R_{max.}$ = 330Ω

Storno

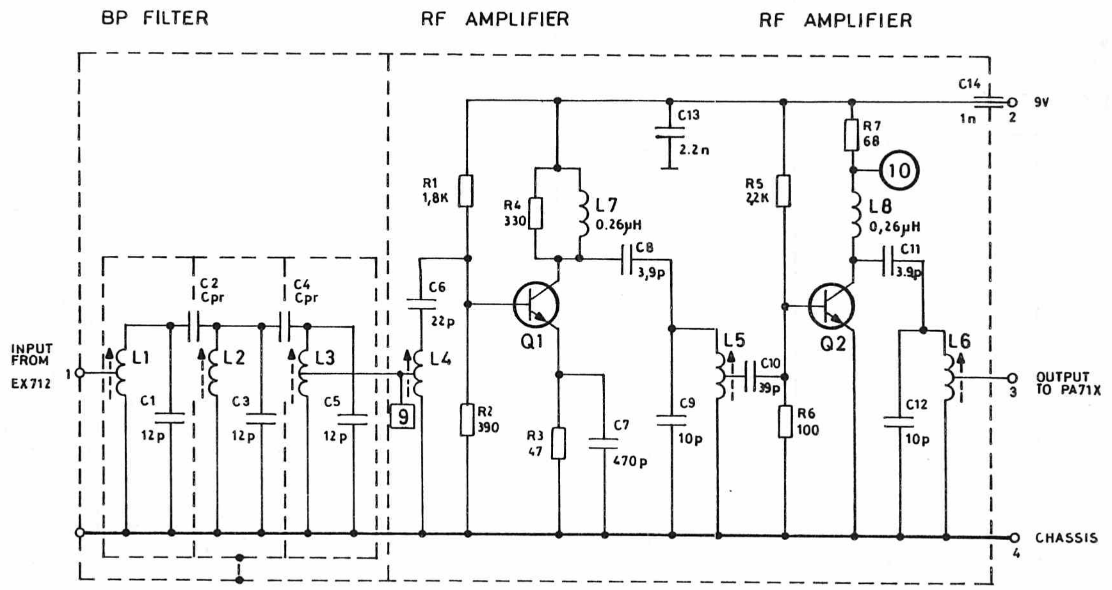


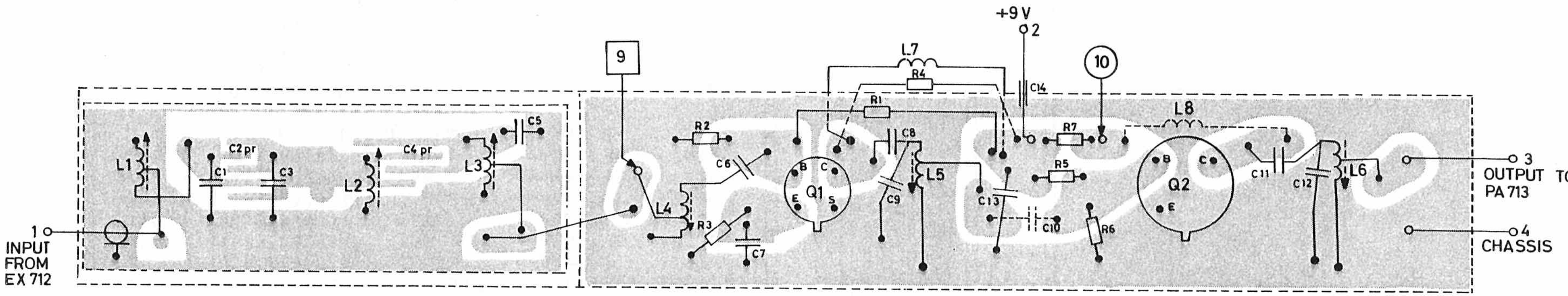
POWER SUPPLY
STRØMFORSYNING

PS704

D402.044

Storno





RF AMPLIFIER
HF FORSTÆRKER

RA711

D401.848/2

Storno

Storno

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

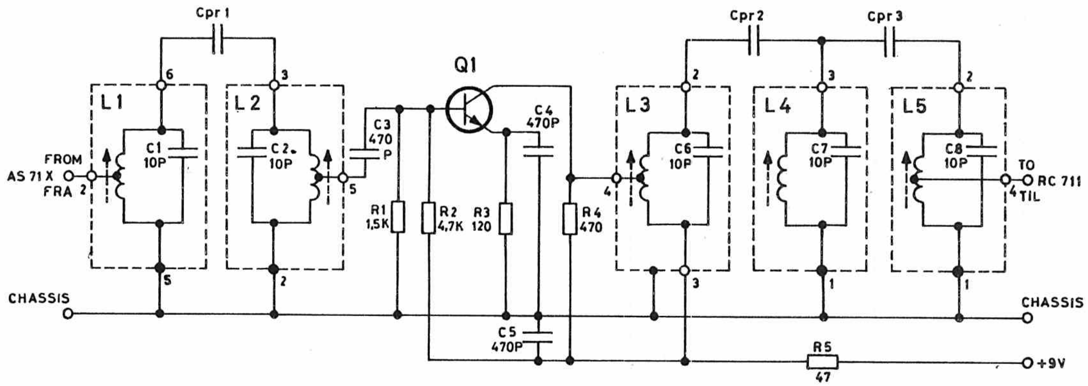
Storno

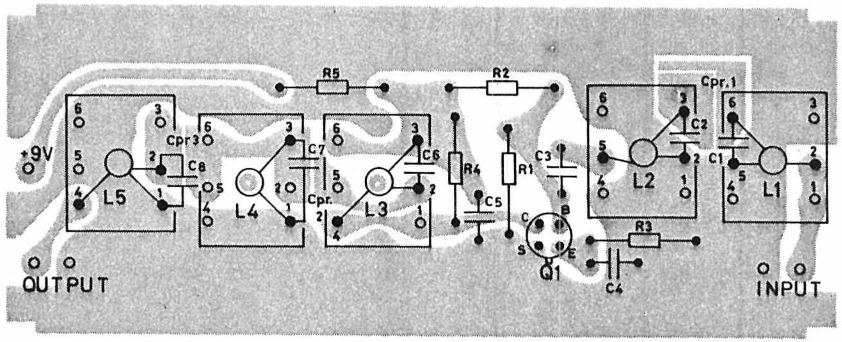
TYPE	NO.	CODE	DATA

RF AMPLIFIER
HF FORSTÆRKER

RA711

X401.941





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

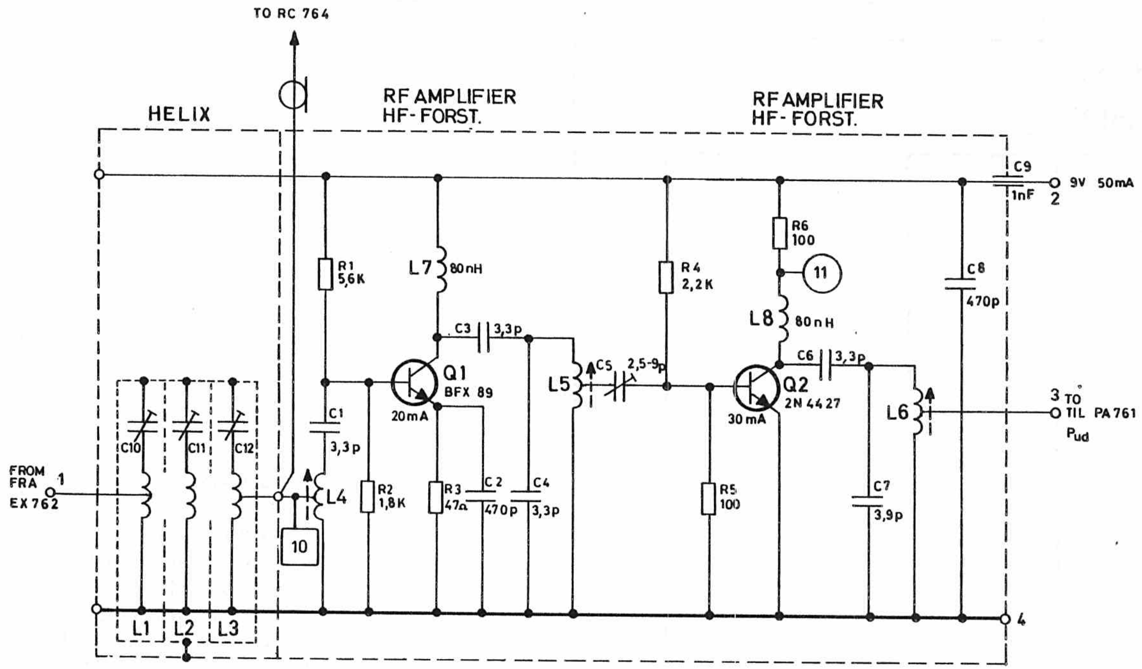
Storno

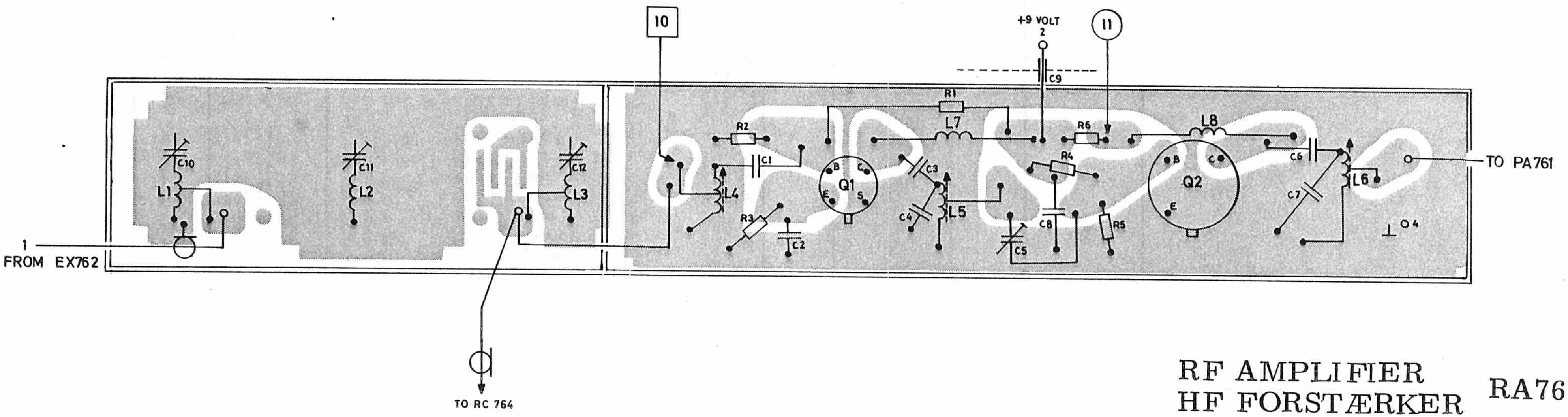
TYPE	Nº	CODE	DATA

RF-AMPLIFIER RA712

X402.367

Storno





RF AMPLIFIER
HF FORSTÆRKER

RA761

D 401.778/3

TYPE	NO.	CODE	DATA	
RA761		10.2925	RF Amplifier	
	C1	74.5129	3.3 pF ± 0.25 pF ceram DI	250 V
	C2	74.5162	470 pF-20+50% ceram DI	400 V
	C3	74.5129	3.3 pF ±0.25 pF ceram DI	250 V
	C4	74.5129	3.3 pF ± 0.25 pF ceram DI	250 V
	C5	78.5055	2.5 - 9 pF trimmer	100 V
	C6	74.5129	3.3 pF ± 0.25 pF ceram DI	250 V
	C7	74.5130	3.9 pF ±0.25 pF ceram DI	250 V
	C8	74.5161	470 pF-20 +80% ceram PL	63 V
	C9	74.5198	1 nF -20+50% ceram FT	30 V
	R1	80.5058	5.6 KΩ 5% carbon film	0.1 W
	R2	80.5052	1.8 KΩ 5% -	0.1 W
	R3	80.5033	47 Ω 5% -	0.1 W
	R4	80.5053	2.2 KΩ 5% -	0.1 W
	R5	80.5037	100Ω 5% -	0.1 W
	R6	80.5237	100 Ω 5% -	1/8 W
	L1	61.	Helix coil 420-470 MHz	
	L2	61.	Helix Coil 420-470 MHz	
	L3	61.	Helix Coil 420-470 MHz	
	L4	61.1223	RF-Coil 420-470 MHz	
	L5	61.1224	RF Coil 420-470 MHz	
	L6	61.1224	RF Coil 420-470 MHz	
	L7	62.0651	0.08 μH RF choke	
	L8	62.0651	0.08 μH RF choke	
	Q1	99.5240	BFX89 Transistor	
	Q2	99.5229	2N4427 Transistor	

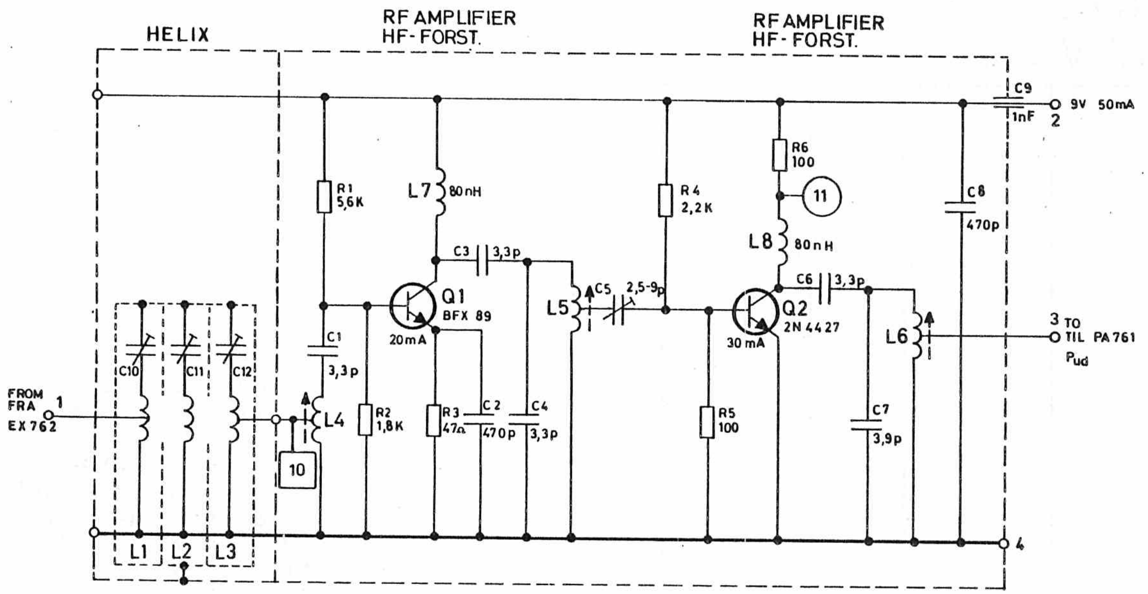
Storno

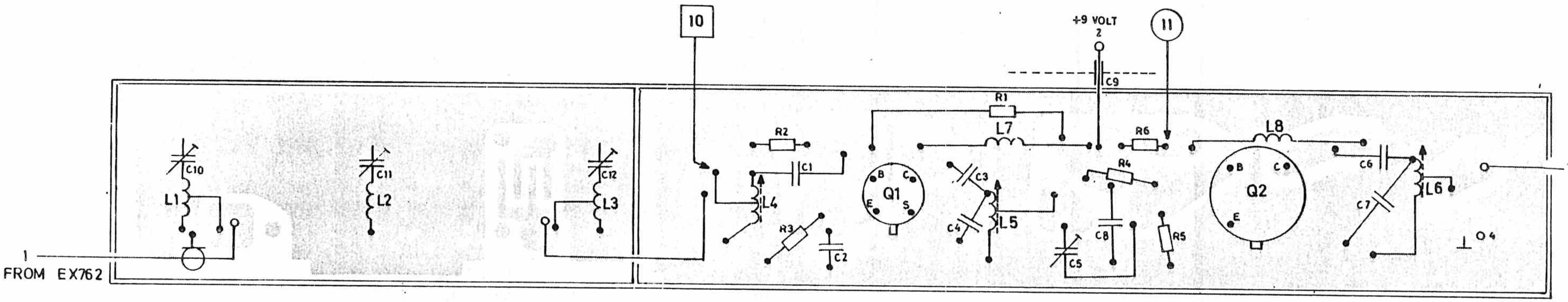
TYPE	NO.	CODE	DATA

RF AMPLIFIER
HF FORSTÆRKER

RA761

X 401.860





RF AMPLIFIER
HF FORSTÆRKER

RA761

D401.778/2

TYPE	NO.	CODE	DATA	
RA761		10.2925	RF Amplifier	
	C1	74.5129	3.3 pF ± 0.25 pF ceram DI	250 V
	C2	74.5162	470 pF-20+50% ceram DI	400 V
	C3	74.5129	3.3 pF ±0.25 pF ceram DI	250 V
	C4	74.5129	3.3 pF ± 0.25 pF ceram DI	250 V
	C5	78.5055	2.5 - 9 pF trimmer	100 V
	C6	74.5129	3.3 pF ± 0.25 pF ceram DI	250 V
	C7	74.5130	3.9 pF ±0.25 pF ceram DI	250 V
	C8	74.5161	470 pF-20 +80% ceram PL	63 V
	C9	74.5198	1 nF -20+50% ceram FT	30 V
	R1	80.5058	5.6 KΩ 5% carbon film	0.1 W
	R2	80.5052	1.8 KΩ 5% -	0.1 W
	R3	80.5033	47 Ω 5% -	0.1 W
	R4	80.5053	2.2 KΩ 5% -	0.1 W
	R5	80.5037	100Ω 5% -	0.1 W
	R6	80.5237	100 Ω 5% -	1/8 W
	L1	61.	Helix coil 420-470 MHz	
	L2	61.	Helix Coil 420-470 MHz	
	L3	61.	Helix Coil 420-470 MHz	
	L4	61.1223	RF-Coil 420-470 MHz	
	L5	61.1224	RF Coil 420-470 MHz	
	L6	61.1224	RF Coil 420-470 MHz	
	L7	62.0651	0.08 μH RF choke	
	L8	62.0651	0.08 μH RF choke	
	Q1	99.5240	BFX89 Transistor	
	Q2	99.5229	2N4427 Transistor	

Storno

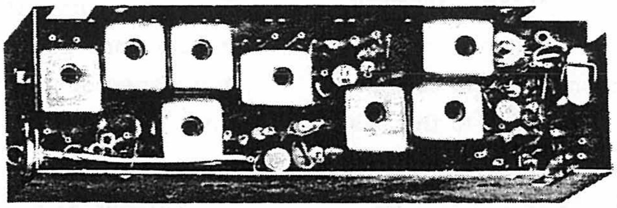
TYPE	NO.	CODE	DATA

RF AMPLIFIER
HF FORSTÆRKER

RA761

X 401.860

RECEIVER CONVERTER RC711



Description

General

The RC711 consists of an oscillator/tripler stage, two frequency doublers and a mixer; it receives the incoming antenna signal from the band-pass filter BP711, and its output works into the 10.7 MHz crystal filter found in the input of the IF converter, IC700.

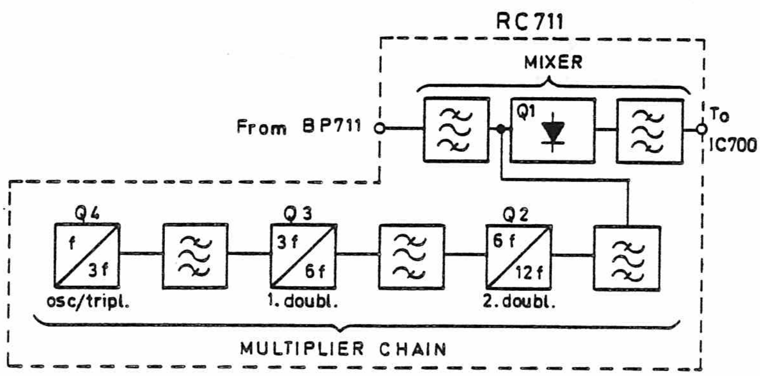
This unit is designed for use in equipment belonging to the CQM700 series and operating in the frequency range of 146 to 174 MHz. The receiver converter, as its name implies, converts the receiver VHF frequencies to 10.7 MHz, which is the first intermediate frequency. To suppress spurious radiation the unit is enclosed in a metal shielding.

The Oscillator and Frequency Multiplier Stages

The oscillator included in the RC stage is sufficient for single channel service, but multichannel operation requires a separate oscillator for each additional channel. These are to be found in the XS701 module. A function of the channel switch causes any oscillator signal selected from XS701 to fed directly to the collector circuit of Q4 via the p-c board terminal connection. Of course, when an oscillator in XS701 is operating, the oscillator in RC711 is made inoperative by disconnecting its emitter return through the channel switch. For single channel operation the emitter of Q4 will be tied to chassis ground as shown on the schematic diagram.

The LC circuit incorporating L7 in the collector of oscillator Q4 is tuned to the 3rd harmonic of the oscillator frequency(ies), as is the tuned circuit of L8 which forwards the signal to the base of Q3.

Two tuned circuits are required to suppress spurious frequencies since the composite product of the 14th harmonic of the oscillator frequency lies within the radiotelephone's VHF pass-band.



The signal is amplified in Q3 and here the LC circuit incorporating L6 in its collector is tuned to the 2nd harmonic of the signal at its base. This, then, is the first doubler. The resistor in series with the collector ensures circuit stability.

The signal is taken off from the joint of the capacitive divider network and fed to the base of Q2, the second frequency doubler. Again, the collector circuit is tuned to the 2nd harmonic of the signal at the base. The signal available to the mixer stage, Q1, is 12 times the frequency of the oscillator.

Three tuned circuits are employed between the collector of Q2 and the mixer gate; L5, L4, and L3. High selectivity is necessary here as spurious signals from the frequency multipliers can otherwise have an effect on the mixer sensitivity.

The transistor types employed were selected because of their high gain characteristics and, at the same time, minimum noise figure.

When checking the drive voltage to the transistors the collector current is used as an indication of drive signal level (an increase in drive signal results in an increase in collector current).

The Mixer

The antenna signal is applied to the gate of the J-FET transistor, Q1, through the matching network, L1, which is designed for negligible insertion loss and whereby the matching to the mixer is accomplished so as to achieve the best possible noise figure.

A field-effect transistor, having good intermodulation and blocking characteristics, is used as the mixer.

The capacitor inserted between Q1's drain and ground is to improve circuit gain and stability. The capacitor is intended to make up a series resonant trap at the antenna frequency.

The output circuit, L2, is tuned to 10.7 MHz and the inductance is tapped down to match the impedance of the crystal filter in the IC700 input.

Technical Specifications

Frequency Range

146 to 174 MHz

Bandwidth

Input circuit: 15 MHz
output circuit: 0.3 MHz
Multiplier (at the output frequency): 1.5 MHz

Impedances

Nominal input impedance at L1: 50 Ω
Output impedance at L2: 910 Ω 20 pF

Oscillator Frequency

$fx = \frac{fs - 10.7}{12}$: 11.3 to 13.6 MHz

Frequency Multiplication Factor

3 x 2 x 2 : 12 times

Supply Voltage

Nominal: + 9 V

Current Consumption

20 mA

Ambient Temperature Range

operating range: -25^{o} to $+65^{o}$C
functioning range: -30^{o} to $+75^{o}$C

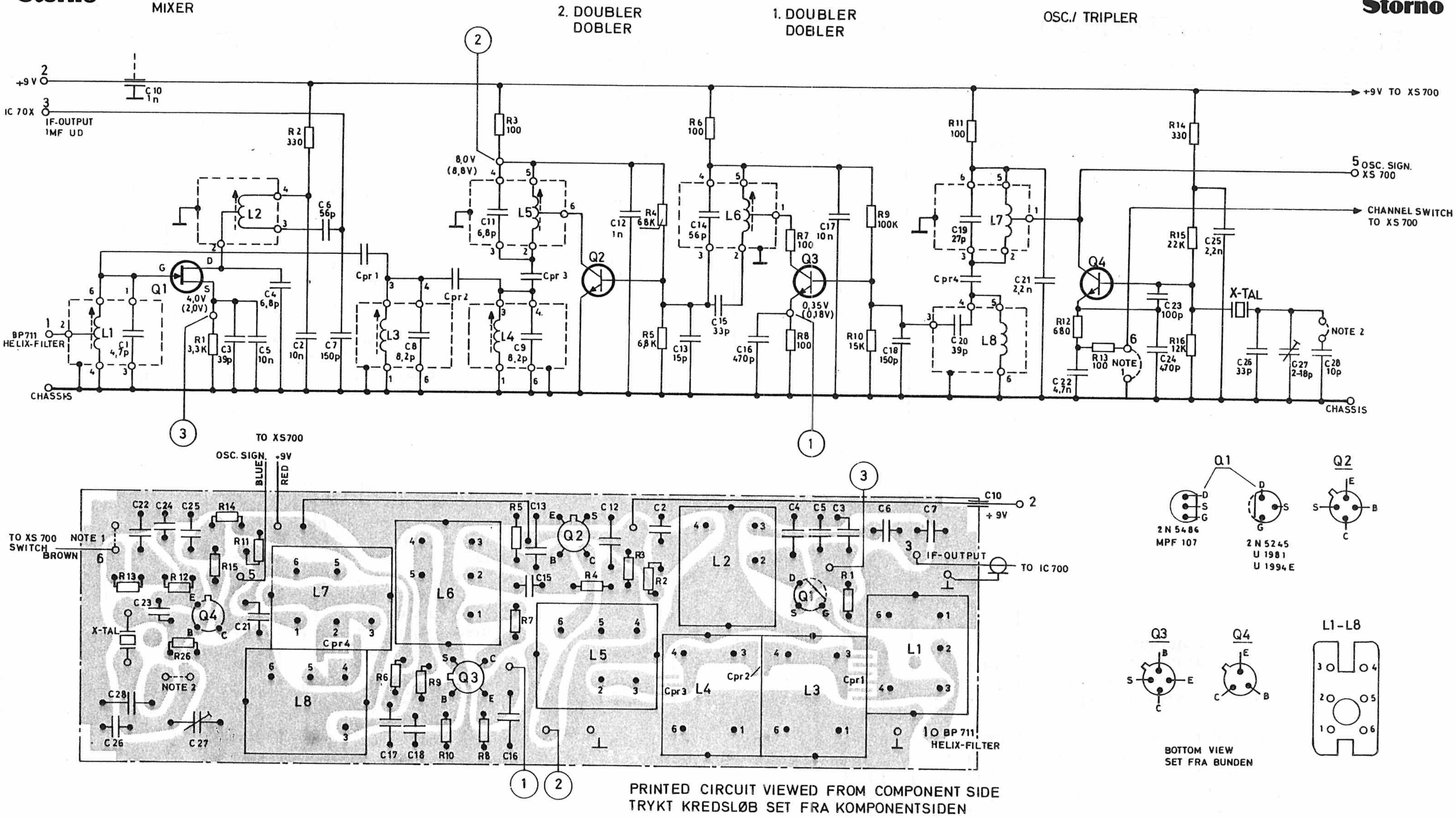
Mechanical Dimensions

Width = 28 mm, length = 92 mm, height = 24 mm

Weight

40 g

Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

Cpr 1 - Cpr 4 ARE PRINTED CAPACITORS.

DC VOLTAGE WITHOUT BRACKETS ARE MEASURED WITH SIGNAL.
DC VOLTAGE WITH BRACKETS ARE MEASURED WITHOUT SIGNAL.

NOTE 1. STRAP FOR 1 CHANNEL.
NOTE 2. TO EXTEND THE LOWER RANGE OF FREQUENCY PULLING INSERT STRAP.

Cpr 1-4 ER I PRINTPLADEN.

DC SPÆNDINGER UDEN PARANTES ER MÅLT MED SIGNAL.
DC SPÆNDINGER MED PARANTES ER MÅLT UDEN SIGNAL.

NOTE 1 STRAPPES VED 1 KANAL.
NOTE 2 STRAPPES FOR STØRRE-FREKVENSTRÆKNING NEDEFTER.

RECEIVER CONVERTER
MODTAGERKONVERTER

RC711

D401.342/2

Storno

TYPE	NO.	CODE	DATA	
RC711		10.2557	Receiver Converter	
	C1	74.5131	4.7 pF ±0.25 pF ceram DI	250V
	C2	74.5109	10 nF -20 +80% ceram PL	20V
	C3	74.5117	39 pF 5% ceram TB	160V
	C4	74.5133	6.8 pF ±0.25pF ceram DI	250V
	C5	74.5109	10 nF -20 +80% ceram PL	20V
	C6	74.5111	56 pF 5% ceram TB	160V
	C7	76.5103	150 pF 2.5% polystyr. TB	25V
	C8	74.5134	8.2 pF ±0.25 pF ceram DI	250V
	C9	74.5134	8.2 pF ±0.25 pF ceram DI	250V
	C10			
	C11	74.5133	6.8 pF ±0.25 pF ceram DI	250V
	C12	74.5155	1 nF -20 +80% ceram PL	63V
	C13	74.5137	15 pF 5% ceram DI	125V
	C14	74.5111	56 pF 5% ceram TB	160V
	C15	74.5116	33 pF 5% ceram TB	160V
	C16	74.5161	470 pF -20 +80% ceram PL	63V
	C17	74.5109	10 nF -20 +80% ceram PL	20V
	C18	76.5103	150 pF 2.5% polystyr TB	25V
	C19	74.5116	33 pF 5% ceram TB	160V
	C20	74.5116	33 pF 5% ceram TB	160V
	C21	76.5059	2.2 nF 10% polyest FL	50V
	C22	76.5061	4.7 nF 10% polyest FL	50V
	C23	76.5102	100 pF 2.5% polystyr TB	25V
	C24	76.5106	470 pF 2.5%	
	C25	76.5059	2.2 nF 10% polyest FL	50V
	C26	74.5191	33 pF 5% ceram TB	160V
	C27	78.5044	2-18 pF trimmer	300V
	C28	74.5135	10 pF 5% ceram DI	125V
	R1	80.5255	3.3 kΩ 5% carbon film	1/8W
	R2	80.5243	330 Ω 5% " "	1/8W
	R3	80.5237	100 Ω 5% " "	1/8W
	R4	80.5271	68 kΩ 5% " "	1/8W
	R5	80.5259	6.8 kΩ 5% " "	1/8W
	R6	80.5237	100 Ω 5% " "	1/8W
	R7	80.5237	100 Ω 5% " "	1/8W
	R8	80.5237	100 Ω 5% " "	1/8W
	R9	80.5273	0.1 MΩ 5% " "	1/8W
	R10	80.5263	15 kΩ 5% " "	1/8W
	R11	80.5237	100 Ω 5% " "	1/8W
	R12	80.5247	680 Ω 5% " "	1/8W
	R13	80.5237	100 Ω 5% " "	1/8W
	R14	80.5243	330 Ω 5% " "	1/8W
	R15	80.5265	22 kΩ 5% " "	1/8W
	R16	80.5262	12 kΩ 5% " "	1/8W

Storno

TYPE	NO.	CODE	DATA
	L1	61.1142	RF coil 146-174 MHz
	L2	61.1143	IF coil 10.7 MHz
	L3	61.1144	RF coil 135.3 - 163.3 MHz
	L4	61.1144	RF coil 135.3 - 163.3 MHz
	L5	61.1146	RF coil 135.3 - 163.3 MHz
	L6	61.1147	RF coil 67.65 - 81.65 MHz
	L7	61.1145	RF coil 33.8 - 40.8 MHz
	L8	61.1149	RF coil 33.8 - 40.8 MHz
	Q1	99.5245	2N5245 Transistor J-FET
	Q2	99.5217	2N918 Transistor
	Q3	99.5168	BF173 Transistor
	Q4	99.5139	BSX19 Transistor

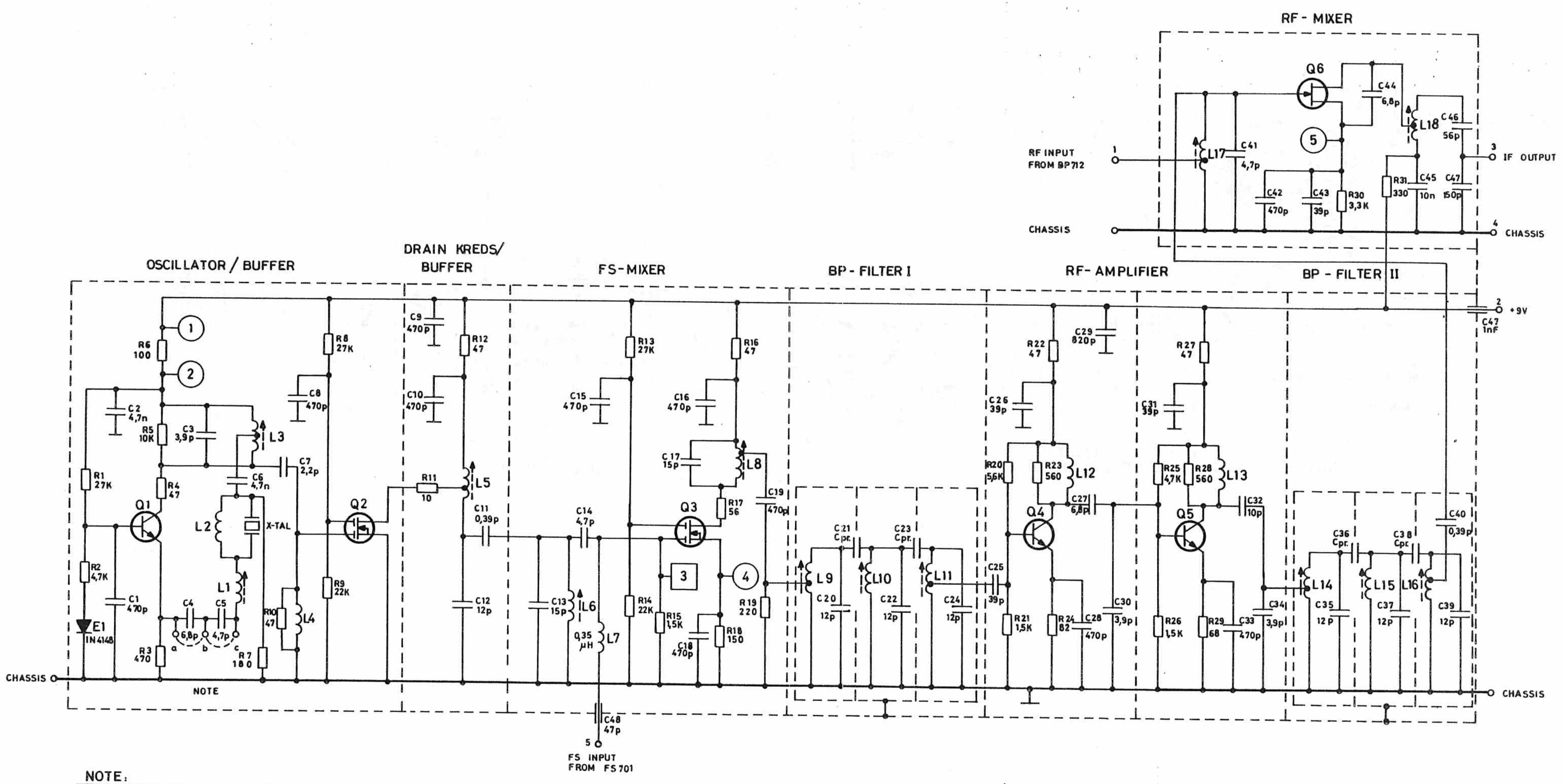
RECEIVER CONVERTER
MODTAGERKONVERTER

RC711

X401.382

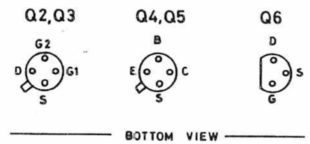
Storno

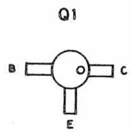
Storno



NOTE:

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



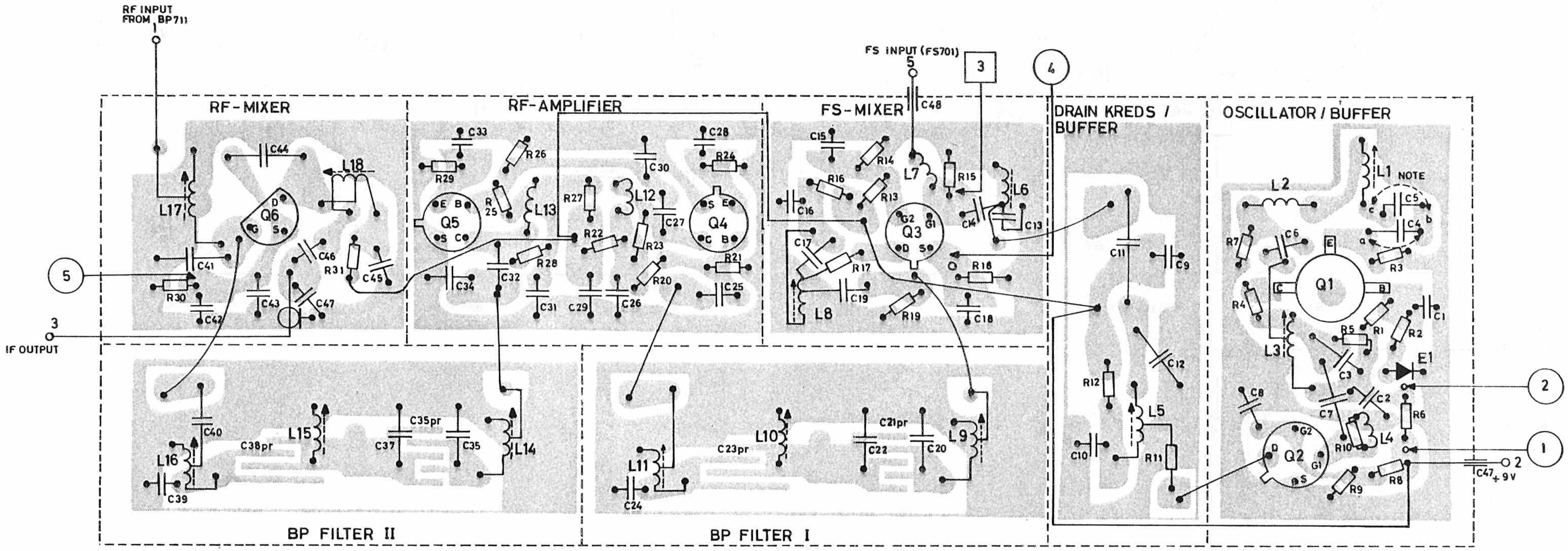


RECEIVER CONVERTER
MODTAGERKONVERTER

RC712

D401.846/2

Storno



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

RECEIVER CONVERTER
MODTAGERKONVERTER

RC712

X401.942/2

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	80.5040	180Ω 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

Storno

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

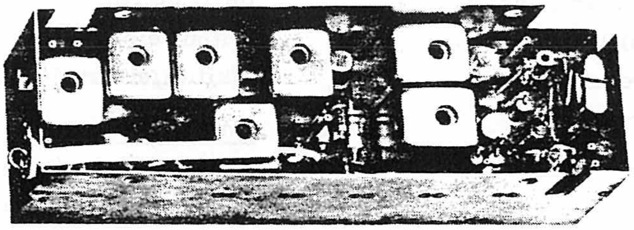
TYPE	NO.	CODE	DATA

RECEIVER CONVERTER
MODTAGERKONVERTER

RC712

X401.942

RECEIVER CONVERTER RC731



Description

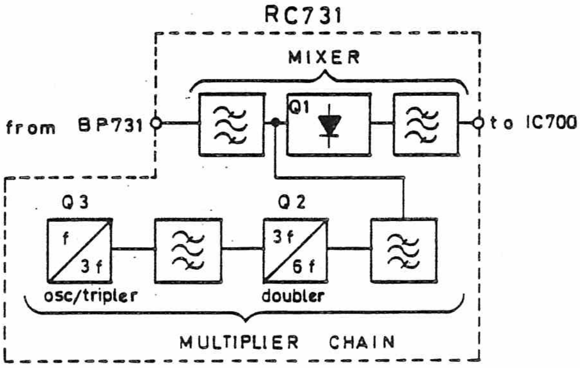
General

The RC731 consists of an oscillator/tripler stage, a frequency doubler and a mixer; it receives the incoming antenna signal from the band-pass filter BP731 and its output works into the 10.7 MHz crystal filter found in the input of the IF converter, IC700.

This unit is designed for use in equipment belonging to the CQM700 series and operating in the frequency range of 68 to 88 MHz. The receiver converter, as its name implies, converts the receiver VHF frequencies to 10.7 MHz, which is the first intermediate frequency. To suppress spurious radiation the unit is enclosed in a metal shielding.

<u>The Oscillator and Frequency Multiplier Stages</u>

The oscillator included in the RC stage is sufficient for single channel service, but multichannel operation requires a separate oscillator for each additional channel.



These are to be found in the XS701 module. A function of the channel switch causes any oscillator signal selected from XS701 to be fed directly to the collector circuit of Q3 via the p-c board terminal connection. Of course, when an oscillator in XS701 is operating, the oscillator in RC731 is made inoperative. This is done by disconnecting its emitter return through the channel switch. For single channel operation the emitter of Q3 will be tied to chassis ground as shown on the schematic diagram.

The LC circuit incorporating L6 in the collector of oscillator Q3 is tuned to the 3rd harmonic of the oscillator frequency(ies), as is the tuned circuit of L7 which forwards the signal to the base of Q2.

Two tuned circuits are required to suppress spurious frequencies since the composite product of the 8th harmonic of the oscillator frequency lies within the radiotelephone's VHF pass-band.

The signal is amplified in Q2 and here the LC circuit incorporating L5 in its collector is tuned to the 2nd harmonic of the signal at its base. This is the doubler. The signal available to the mixer, Q1, is 6 times the frequency of the oscillator.

Three tuned circuits are employed between the collector of Q2 and the mixer gate; L5, L4, and L3. High selectivity is necessary here as spurious signals from the frequency multipliers can otherwise have an effect on the mixer sensitivity.

The transistor types employed were selected because of their high gain characteristics and, at the same time, minimum noise figure.

When checking the drive voltage to the transistors the collector current is used as an indication of drive signal level (an increase in drive signal results in an increase in collector current).

The Mixer

The antenna signal is applied to the gate of the J-FET transistor, Q1, through the matching network, L1, which is designed for negligible insertion loss and whereby the matching to the mixer is accomplished so as to achieve the best possible noise figure.

A field-effect transistor, having good intermodulation and blocking characteristics, is used as the mixer.

The capacitor inserted between Q1's drain and source is to improve circuit gain and stability. The capacitor is intended to make up a series resonant trap at the antenna frequency.

The output circuit, L2, is tuned to 10.7 MHz and the inductance is tapped down to match the impedance of the crystal filter in the IC700 input.

Technical Specifications

Frequency Range
68 to 88 MHz

Bandwidth
Input circuit L1: 5 MHz
Output circuit L2: 0.3 MHz
Multiplier (at the output frequency: 1.2 MHz

Impedances
Nominal input impedance at L1: 50 Ω
Output impedance at L2: 910 Ω // 20 pF

Oscillator Frequency
$fx = \frac{fs - 10.7}{6}$: 9.55 to 12.9 MHz

Frequency Multiplication Factor
3 x 2 = 6 times

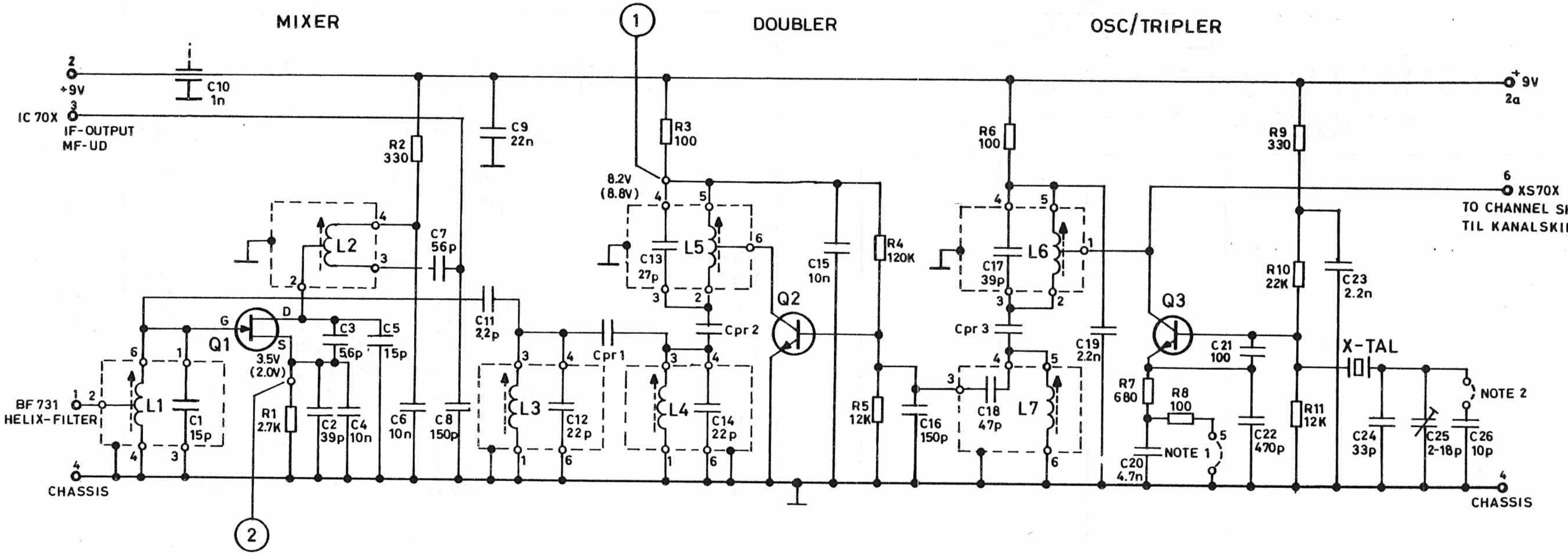
Supply Voltage
Nominal: + 9 V

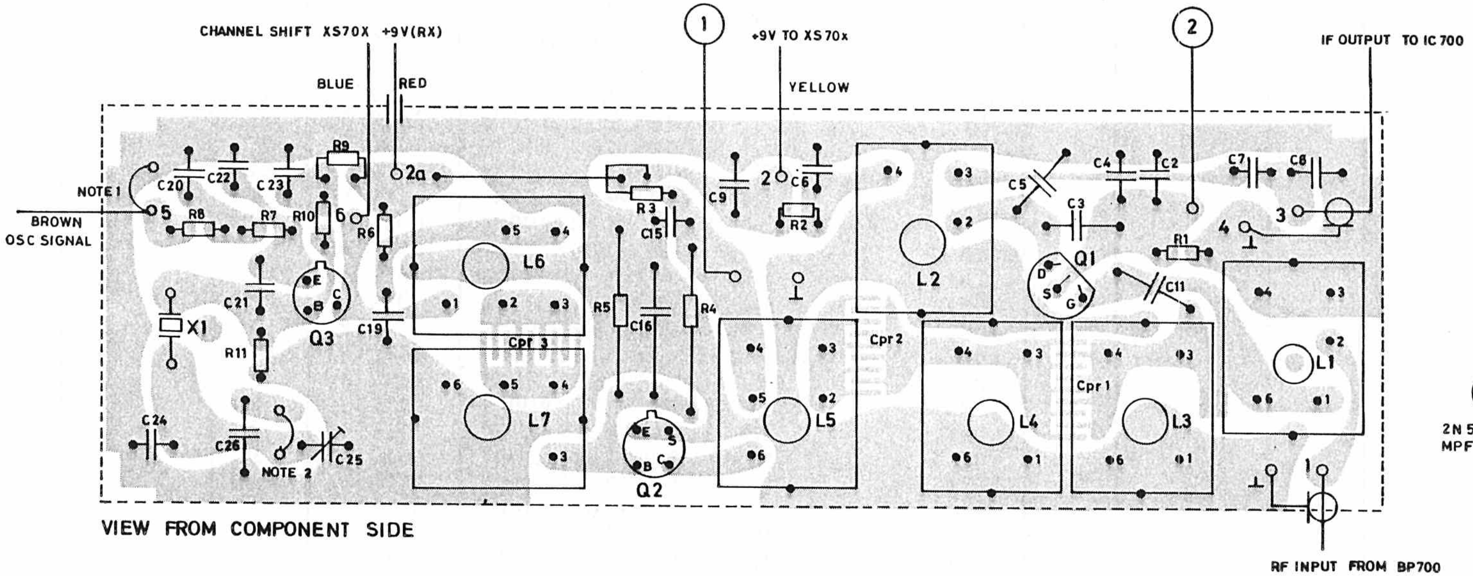
Current Consumption
15 mA

Ambient Temperature Range
Operating range: -25° to $+65^{\circ}$C
Functioning range: -30° to $+75^{\circ}$C

Mechanical Dimensions
width = 28 mm, length = 92 mm,
length = 24 mm

Weight
40 g





VIEW FROM COMPONENT SIDE

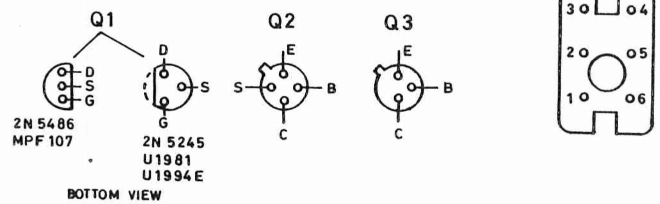
Cpr 1 - 3 printed capacitors

DC voltages without paranthesis measured with signal

DC voltages with paranthesis measured without signal

Note 1: Strap for 1 channel

Note 2: Insert strap to extend lower frequency pulling range



RECEIVER CONVERTER
MODTAGERKONVERTER

RC731

D401.341/3

Storno

TYPE	NO.	CODE	DATA	
RC731		10.2631-00	RECEIVER CONVERTER	
	C1	74.5105	15pF 5% ceram TB	160V
	C2	74.5117	39pF 5% ceram TB	160V
	C3	74.5132	5.6pF ±0.25pF ceram DI	250V
	C4	74.5109	10nF -20/+80% ceram PL	20V
	C5	74.5137	15pF 5% ceram TB	160V
	C6	74.5109	10nF -20/+80% ceram PL	20V
	C7	74.5111	56pF 5% ceram TB	160V
	C8	76.5103	150pF 2.5% polystyr TB	25V
	C9	76.5071	22nF 10% polystyr FL	50V
	C10	74.5198	1nF -20/+50% ceram FT	30V
	C11	74.5127	2.2pF ±0.25pF ceram DI	250V
	C12	74.5106	22pF 5% ceram TB	160V
	C14	74.5106	22pF 5% ceram TB	160V
	C15	74.5109	10nF -20/+80% PL	20V
	C16	76.5103	150pF 2.5% polystyr TB	25V
	C17	74.5117	39pF 5% ceram TB	160V
	C18	74.5118	47pF 5% ceram TB	160V
	C19	76.5059	2.2nF 10% polyest. FL	50V
	C20	76.5061	4.7nF 10% polyest. FL	50V
	C21	76.5102	100pF 2.5% polystyr TB	25V
	C22	76.5106	470pF 2.5% polystyr TB	25V
	C23	76.5059	2.2nF 10% polyest. FL	50V
	C24	74.5191	33pF 5% ceram TB	160V
	C25	78.5044	2-18pF trimmer	300V
	C26	74.5135	10pF 5% ceram DI	125V
	R1	80.5254	2.7kΩ 5% carbon film	1/8W
	R2	80.5243	330Ω 5% carbon film	1/8W
	R3	80.5237	100Ω 5% carbon film	1/8W
	R4	80.5274	0.12MΩ 5% carbon film	1/8W
	R5	80.5262	12kΩ 5% carbon film	1/8W
	R6	80.5237	100Ω 5% carbon film	1/8W
	R7	80.5247	680Ω 5% carbon film	1/8W
	R8	80.5237	100Ω 5% carbon film	1/8W
	R9	80.5243	330Ω 5% carbon film	1/8W
	R10	80.5265	22kΩ 5% carbon film	1/8W
	R11	80.5262	12kΩ 5% carbon film	1/8W
	L1	61.1159	RF coil 68-88 MHz	
	L2	61.1143	IF coil 10.7 MHz	
	L3	61.1161	RF coil 57.3-77.3 MHz	
	L4	61.1162	RF coil 57.3-77.3 MHz	
	L5	61.1163	RF coil 57.3-77.3 MHz	
	L6	61.1164	RF coil 28.65-38.65 MHz	
	L7	61.1165	RF coil 28.65-38.65 MHz	

Storno

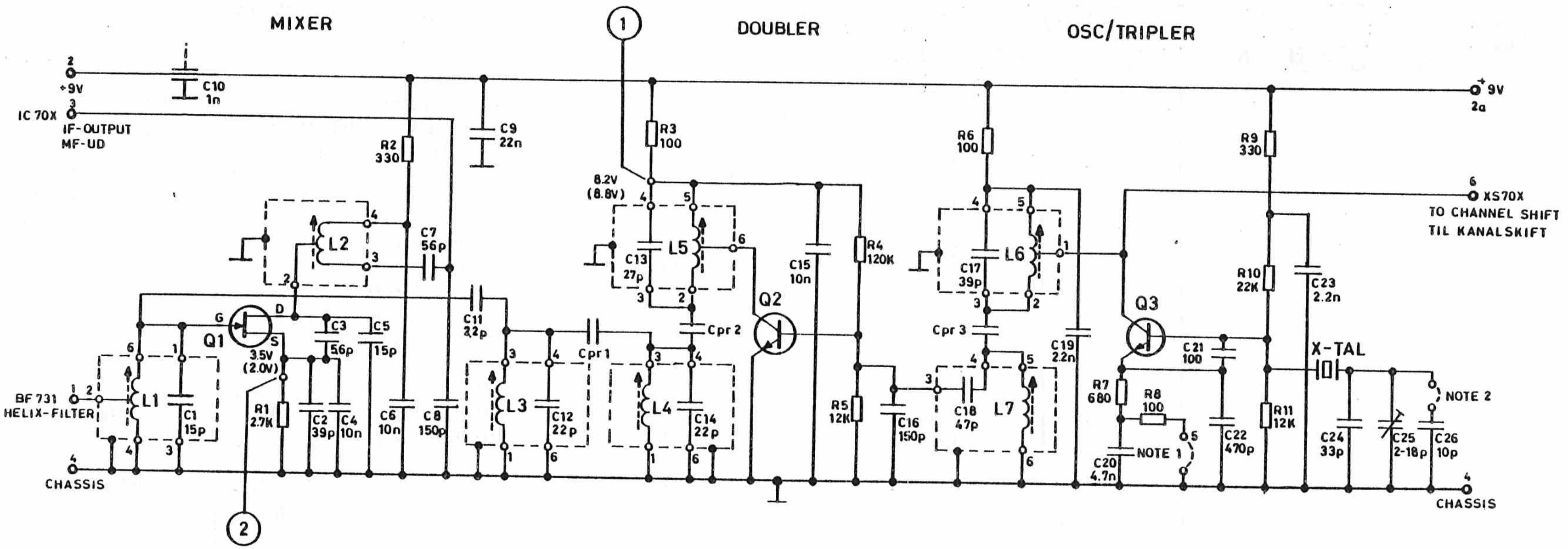
TYPE	NO.	CODE	DATA
	Q1	99.5245	Transistor 2N5245 FET
	Q2	99.5217	Transistor 2N918
	Q3	99.5139	Transistor BSX19

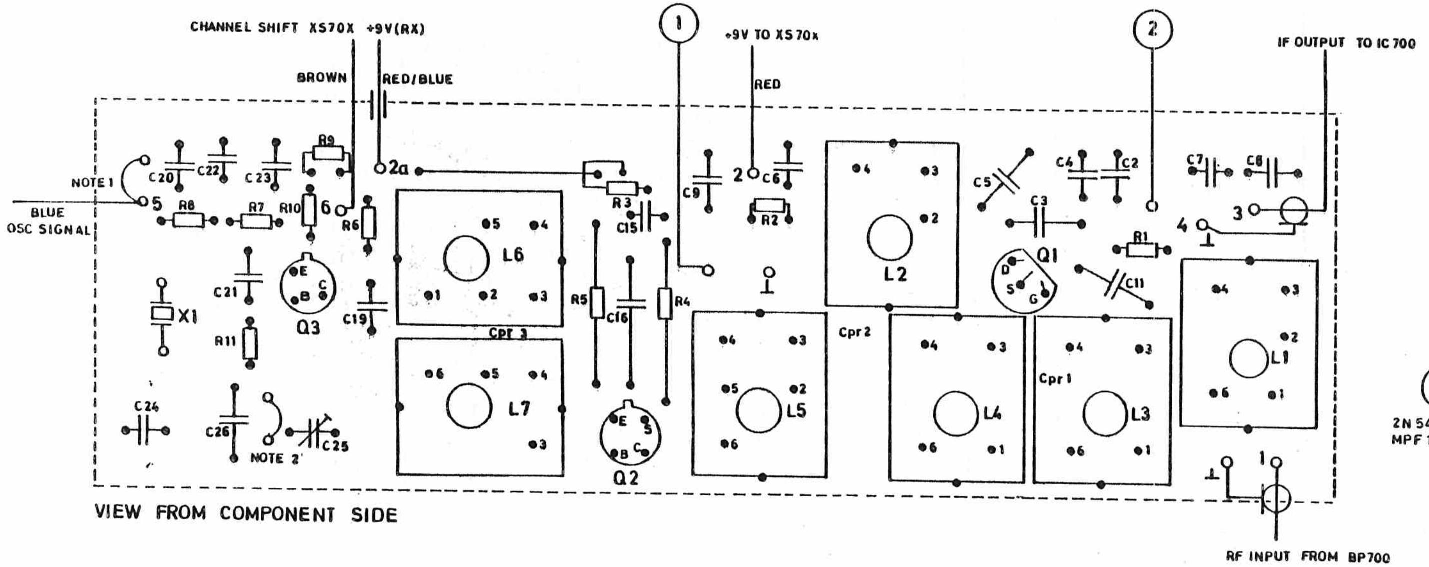
RECEIVER CONVERTER
MODTAGERKONVERTER

RC731

X401.537

Storno





VIEW FROM COMPONENT SIDE

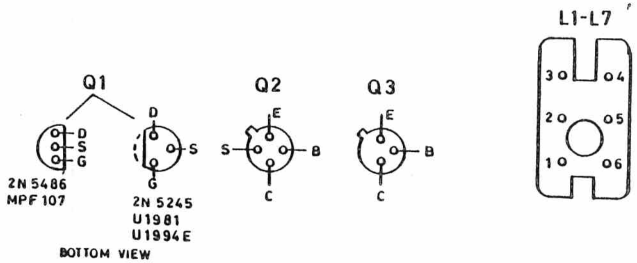
Cpr 1 - 3 printed capacitors

DC voltages without paranthesis measured with signal

DC voltages with paranthesis measured without signal

Note 1: Strap for 1 channel

Note 2: Insert strap to extend lower frequency pulling range



RECEIVER CONVERTER
MODTAGERKONVERTER

RC731

D401.341/2

Storno

TYPE	NO.	CODE	DATA	
RC731		10.2631-00	RECEIVER CONVERTER	
	C1	74.5105	15pF 5% ceram TB	160V
	C2	74.5117	39pF 5% ceram TB	160V
	C3	74.5132	5.6pF ±0.25pF ceram DI	250V
	C4	74.5109	10nF -20/+80% ceram PL	20V
	C5	74.5137	15pF 5% ceram TB	160V
	C6	74.5109	10nF -20/+80% ceram PL	20V
	C7	74.5111	56pF 5% ceram TB	160V
	C8	76.5103	150pF 2.5% polystyr TB	25V
	C9	76.5071	22nF 10% polystyr FL	50V
	C10	74.5198	1nF -20/+50% ceram FT	30V
	C11	74.5127	2.2pF ±0.25pF ceram DI	250V
	C12	74.5106	22pF 5% ceram TB	160V
	C14	74.5106	22pF 5% ceram TB	160V
	C15	74.5109	10nF -20/+80% PL	20V
	C16	76.5103	150pF 2.5% polystyr TB	25V
	C17	74.5117	39pF 5% ceram TB	160V
	C18	74.5118	47pF 5% ceram TB	160V
	C19	76.5059	2.2nF 10% polyest. FL	50V
	C20	76.5061	4.7nF 10% polyest. FL	50V
	C21	76.5102	100pF 2.5% polystyr TB	25V
	C22	76.5106	470pF 2.5% polystyr TB	25V
	C23	76.5059	2.2nF 10% polyest. FL	50V
	C24	74.5191	33pF 5% ceram TB	160V
	C25	78.5044	2-18pF trimmer	300V
	C26	74.5135	10pF 5% ceram DI	125V
	R1	80.5254	2.7kΩ 5% carbon film	1/8W
	R2	80.5243	330Ω 5% carbon film	1/8W
	R3	80.5237	100Ω 5% carbon film	1/8W
	R4	80.5274	0.12MΩ 5% carbon film	1/8W
	R5	80.5262	12kΩ 5% carbon film	1/8W
	R6	80.5237	100Ω 5% carbon film	1/8W
	R7	80.5247	680Ω 5% carbon film	1/8W
	R8	80.5237	100Ω 5% carbon film	1/8W
	R9	80.5243	330Ω 5% carbon film	1/8W
	R10	80.5265	22kΩ 5% carbon film	1/8W
	R11	80.5262	12kΩ 5% carbon film	1/8W
	L1	61.1159	RF coil 68-88 MHz	
	L2	61.1143	IF coil 10.7 MHz	
	L3	61.1161	RF coil 57.3-77.3 MHz	
	L4	61.1162	RF coil 57.3-77.3 MHz	
	L5	61.1163	RF coil 57.3-77.3 MHz	
	L6	61.1164	RF coil 28.65-38.65 MHz	
	L7	61.1165	RF coil 28.65-38.65 MHz	

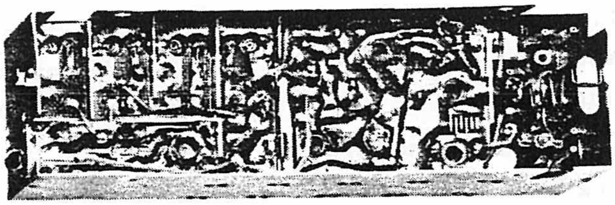
Storno

TYPE	NO.	CODE	DATA
	Q1	99.5245	Transistor 2N5245 FET
	Q2	99.5217	Transistor 2N918
	Q3	99.5139	Transistor BSX19

RECEIVER CONVERTER
MODTAGERKONVERTER RC731

X401.537

RECEIVER CONVERTER RC761



Description

General

The RC761 consists of an oscillator/tripler stage, another frequency tripler, two frequency doublers and a mixer; it receives the incoming antenna signal from the band-pass filter BP761 and its output works into the 10.7 MHz crystal filter found in the input of the IF converter, IC700.

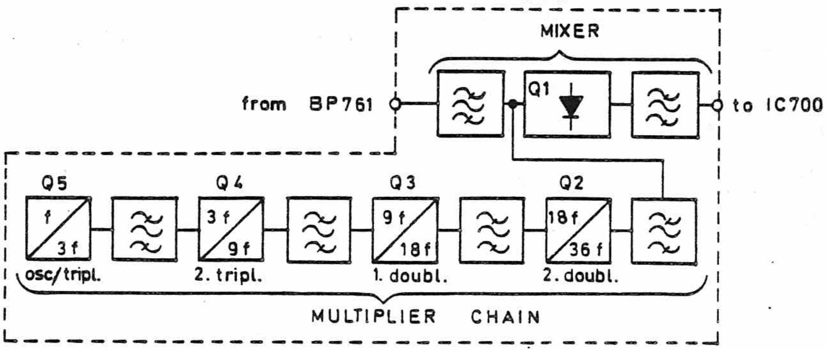
This unit is designed for use in equipment belonging to the CQM700 series and operating in the frequency range of 420 to 470 MHz. The receiver converter, as its name implies, converts the receiver UHF frequencies to 10.7 MHz, which is the first intermediate frequency. To suppress spurious radiation the unit is enclosed in a metal shielding.

The Oscillator and Frequency Multiplier Stages.

The oscillator included in the RC stage is sufficient for single channel service, but multichannel operation requires a separate oscillator for each additional channel. These are to be found in the XS701 module. A function of the channel switch causes any oscillator signal selected from XS701 to be fed directly to the collector circuit of Q5 via the p-c board terminal connection. Of course, when an oscillator in XS701 is operating, the oscillator in RC711 is made inoperative by disconnecting its emitter return through the channel switch. For single channel operation the emitter of Q5 will be tied to chassis ground as shown on the schematic diagram.

The LC circuit incorporating L8 in the collector of oscillator Q5 is tuned to be 3rd harmonic of the oscillator frequency(ies), as is the tuned circuit of L9 which forwards the signal to the base of Q4.

Two tuned circuits are required to suppress spurious frequencies since the composite product of 38th harmonic of the oscillator frequency lies within the radiotelephone's VHF pass-band.



The LC circuit of L7, C26 and C27 is tuned to the third harmonic of the signal applied to and amplified in Q4. The signal, now at 9 times the oscillator frequency, is fed to base of Q3. The signal take off point is at the junction of the capacitors. The resistor in series with the collector ensures circuit stability.

The signal is next amplified in Q3 and here the LC circuit incorporating L6 in its collector is tuned to the 2nd harmonic of the signal at its base. This, then, is the first doubler.

The signal is taken off from the joint of the capacitive divider network and fed to the base of Q2, the second frequency doubler. Again, the collector circuit is tuned to the 2nd harmonic of the signal at the base. The signal available to the mixer stage, Q1, is 36 times the frequency of the oscillator.

Three tuned circuits are employed between the collector of Q2 and the mixer gate; L5, L4, and L3. High selectivity is necessary here as spurious signals from the frequency multipliers can otherwise have an effect on the mixer sensitivity.

The transistor types employed were selected because of their high gain characteristics and, at the same time, minimum noise figure.

When checking the drive voltage to the transistors the collector current is used as an indication of drive signal level (an increase in drive signal results in an increase in collector current).

The mixer

The antenna signal is applied to the gate of the J-FET transistor, Q1, through the matching network, L1, which is designed for negligible insertion loss and whereby the matching to the mixer is accomplished so as to achieve the best possible noise figure.

A field-effect transistor, having good intermodulation and blocking characteristics, is used as the mixer.

Two parallel capacitors placed between drain and source of Q1 improve circuit gain and stability. They make up a series resonant trap at the antenna frequency.

The output circuit, L2, is tuned to 10.7 MHz and the inductance is tapped down to match the impedance of the crystal filter in the IC700 input.

Technical Specifications

Frequency Range
420 to 470 MHz

Bandwidth
Input Circuit: 20 MHz
Output circuit: 0.3 MHz
Multiplier: 4 MHz

Impedances
Nominal input impedance at L1: 50 Ω
Output impedance at L2: 910 Ω// 20 pF

Oscillator Frequency
$fx = \frac{fs - 10.7}{36} = 11.35$ to 12.75 MHz

Frequency Multiplication Factor
3 x 3 x 2 x 2 = 36 times

Supply Voltage
Nominal: +9 V

Current Concumption
30 mA

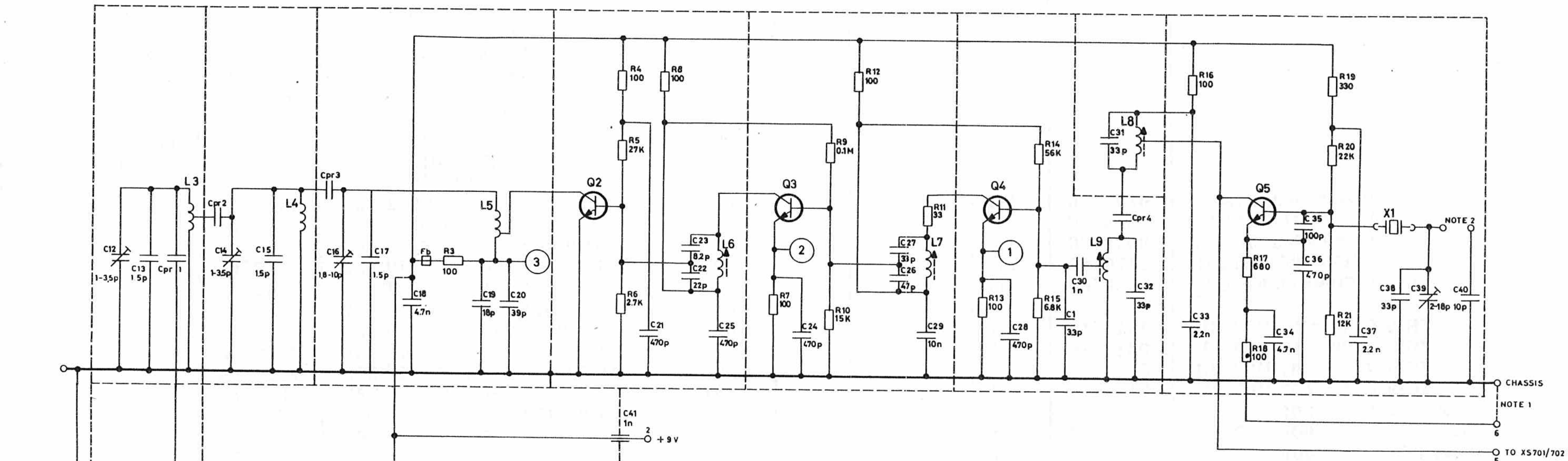
Ambient Temperature Range
Operating range: -25° to $+65^{\circ}$C
Functioning range: -30° to $+75^{\circ}$C

Mechanical Dimensions
Width = 29 mm, length = 92 mm, height = 23.5 mm

Weight
66 g

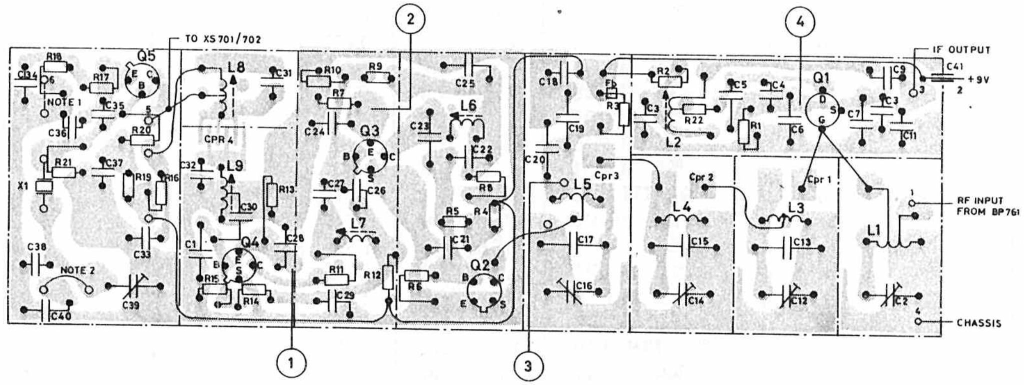
Storno

Storno



NOTE 1: STRAP WITH ONE CHANNEL ONLY
NOTE 2: TO EXTEND THE LOWER RANGE OF FREQUENCY PULLING INSERT STRAP.

PRINTED CIRCUIT VIEWED FROM SOLDERING SIDE

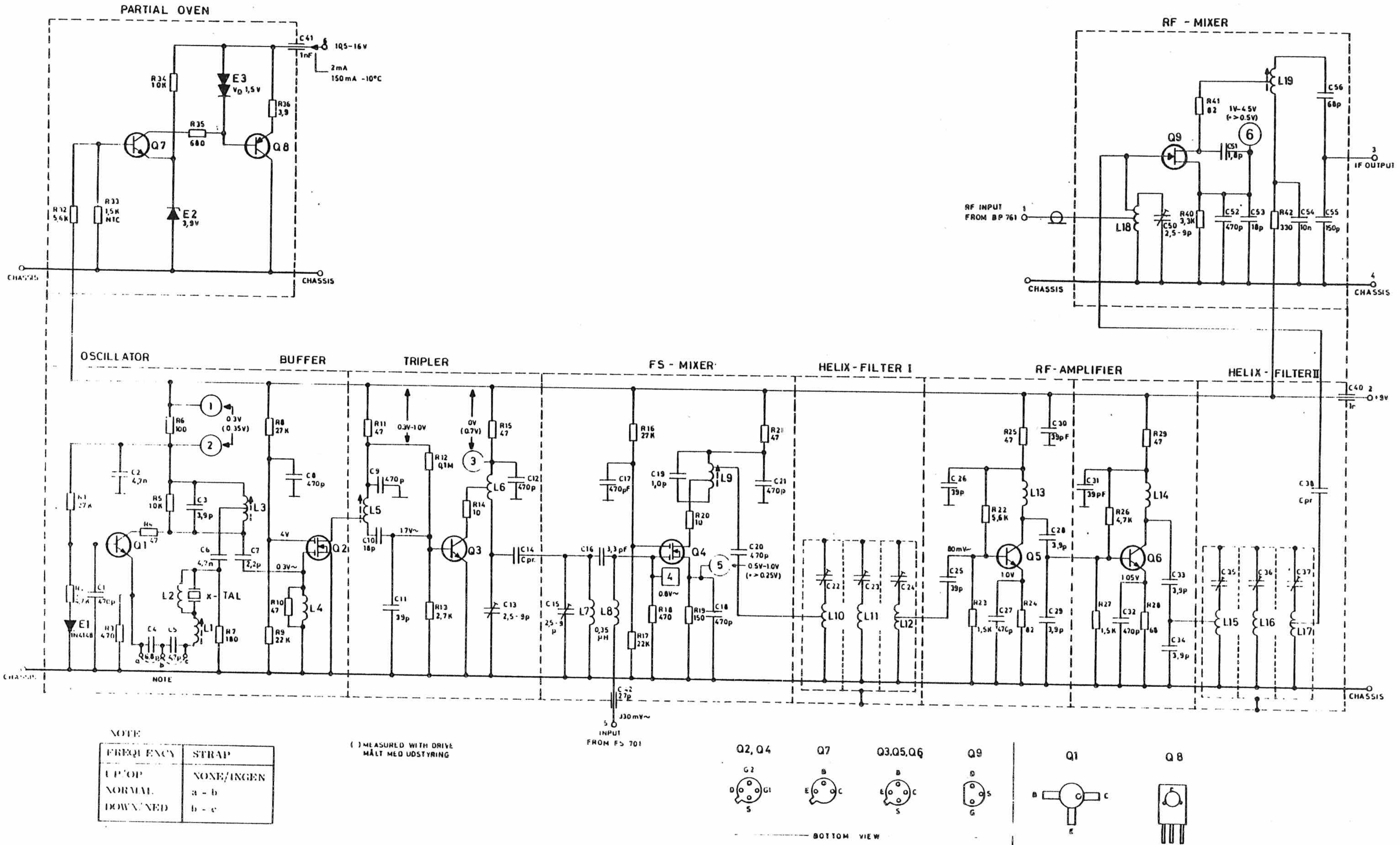


RECEIVER CONVERTER RC761

D 401.333/2

TYPE	NO.	CODE	DATA	
RC761		10.2430	Receiver Converter	
	C1	74.5129	3.3 pF ±0.25 pF ceram DI	250V
	C2	78.5048	1.8 - 10 pF trimmer	300V
	C3	74.5109	10 nF -20 +80% ceram PL	20V
	C4	74.5126	1.8 pF ±0.25 pF ceram BD	250V
	C5	74.5135	10 pF 5% ceram DI	125V
	C6	74.5138	18 pF 5% ceram DI	125V
	C7	74.5138	18 pF 5% ceram DI	125V
	C8	74.5109	10 nF -20 +80% ceram PL	20V
	C9	74.5195	39 pF 5% ceram TB	160V
	C11	76.5102	100 pF 2.5 pF polystyr TB	125V
	C12	78.5047	1-3.5 pF trimmer	300V
	C13	74.5189	1.5 pF ±0.25 pF ceram BD	250V
	C14	78.5047	1-3.5 pF trimmer	300V
	C15	74.5189	1.5 pF ±0.25 pF ceram BD	250V
	C16	78.5048	1.8-10 pF trimmer	300V
	C17	74.5189	1.5 pF ±0.25 pF ceram BD	250V
	C18	76.5061	4.7 nF 10% polyest. FL	50V
	C19	74.5138	18 pF 5% ceram DI	125V
	C20	74.5117	39 pF 5% ceram TB	160V
	C21	74.5161	470 pF -20 +80% ceram PL	63V
	C22	74.5106	22 pF 5% ceram TB	160V
	C23	74.5134	8.2 pF ±0.25 pF ceram DI	250V
	C24	74.5161	470 pF -20 +80% ceram PL	63V
	C25	74.5161	470 pF -20 +80% ceram PL	63V
	C26	74.5118	47 pF 5% ceram TB	160V
	C27	74.5116	33 pF 5% ceram TB	160V
	C28	74.5161	470 pF -20 +80% ceram PL	63V
	C29	74.5109	10 nF -20 +80% ceram PL	20V
	C30	74.5155	1 nF -20 +80% ceram PL	63V
	C31	74.5116	33 pF 5% ceram TB	160V
	C32	74.5116	33 pF 5% ceram TB	160V
	C33	76.5059	2.2 nF 10% polyest. FL	50V
	C34	76.5061	4.7 nF 10% polyest. FL	50V
	C35	76.5102	100 pF 2.5% polystyr TB	25V
	C36	76.5106	470 pF 2.5% polystyr TB	25V
	C37	76.5059	2.2 nF 10% polyest. FL	50V
	C38	74.5191	33 pF 5% ceram TB	160V
	C39	78.5044	2-18 pF trimmer	300V
	C40	74.5135	10 pF 5% ceram DI	125V
	C41	74.5198	1 nF -20 +50% ceram FT	30V
	R1	80.5255	3.3 kΩ 5% carbon film	1/8W
	R2	80.5243	330 Ω 5% " "	1/8W
	R3	80.5237	100 Ω 5% " "	1/8W
	R4	80.5237	100 Ω 5% " "	1/8W

TYPE	NO.	CODE	DATA	
	R5	80.5266	27 kΩ 5% carbon film	1/8W
	R6	80.5254	2.7 kΩ 5% " "	1/8W
	R7	80.5237	100 Ω 5% " "	1/8W
	R8	80.5237	100 Ω 5% " "	1/8W
	R9	80.5273	0.1 MΩ 5% " "	1/8W
	R10	80.5263	15 kΩ 5% " "	1/8W
	R11	80.5231	33 Ω 5% " "	1/8W
	R12	80.5237	100 Ω 5% " "	1/8W
	R13	80.5237	100 Ω 5% " "	1/8W
	R14	80.5270	56 kΩ 5% " "	1/8W
	R15	80.5259	6.8 kΩ 5% " "	1/8W
	R16	80.5237	100 Ω 5% " "	1/8W
	R17	80.5247	680 Ω 5% " "	1/8W
	R18	80.5237	100 Ω 5% " "	1/8W
	R19	80.5243	330 Ω 5% " "	1/8W
	R20	80.5265	22 kΩ 5% " "	1/8W
	R21	80.5262	12 kΩ 5% " "	1/8W
	R22	80.5036	82Ω 5% " "	1/10W
	L1	62.0814	RF coil 420 - 470 MHz	
	L2	61.1117	IF coil 10.7 MHz	
	L3	62.0812	RF coil 409.3 - 459.3 MHz	
	L4	62.0815	RF coil 409.3 - 459.3 MHz	
	L5	62.0813	RF coil 409.3 - 459.3 MHz	
	L6	61.1118	RF coil 204 - 230 MHz	
	L7	61.1119	RF coil 102 - 115 MHz	
	L8	61.1120	RF coil 34 - 38.5 MHz	
	L9	61.1121	RF coil 34 - 38.5 MHz	
	Q1	99.5245	2N5245 Transistor FET	
	Q2	99.5217	2N918 Transistor	
	Q3	99.5168	BF173 Transistor	
	Q4	99.5168	BF173 Transistor	
	Q5	99.5139	BSX19 Transistor	



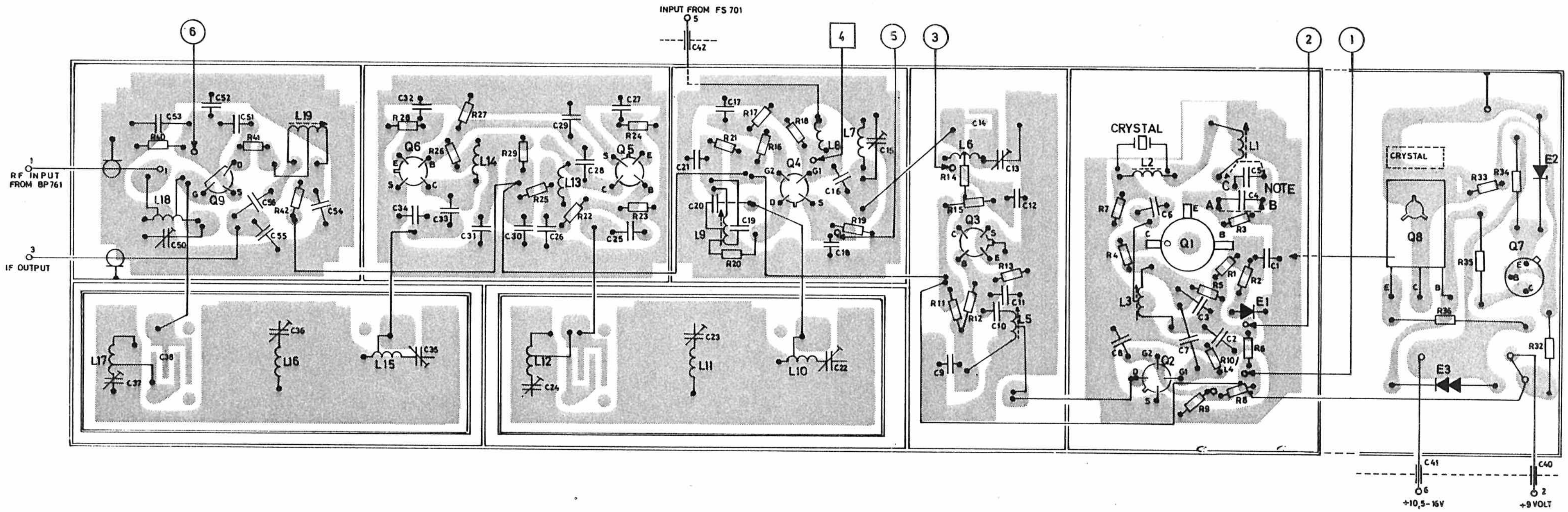
NOTE

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

RECEIVER CONVERTER
MODTAGERKONVERTER

RC762

D401.785



RECEIVER CONVERTER
MODTAGERKONVERTER

RC762

D401.896

Storno

TYPE	NO.	CODE	DATA	
RC762		10.2922	Receiver Converter	
	C1	74.5162	470 pF -20+50% ceram DI	400 V
	C2	74.5108	4.7 nF -20+80% ceram PL	20 V
	C3	74.5302	3.9 pF ± 0.25 pF ceram PL	63 V
	C4	74.5321	6.8 pF ± 0.25 pF ceram PL	100 V
	C5	74.5318	4.7 pF ± 0.25 pF ceram PL	100 V
	C6	74.5108	4.7 nF -20+80% ceram PL	20 V
	C7	74.5299	2.2 pF ±0.25 pF ceram PL	63 V
	C8	74.5161	470 pF -20+80% ceram PL	63 V
	C9	74.5162	470 pF -20 +50% ceram DI	400 V
	C10	74.5310	18 pF 5% ceram PL	63 V
	C11	74.5316	39 pF 5% ceram PL	63 V
	C12	74.5162	470 pF -20+50% ceram DI	400 V
	C13	78.5055	2.5 - 9 pF trimmer DI	100 V
	C14		Printed capacitor	
	C15		2.5 - 9 pF trimmer DI	100 V
	C16	74.5301	3.3 pF ± 0.25 pF ceram PL	63 V
	C17	74.5162	470 pF -20+50% ceram DI	400 V
	C18	74.5162	470 pF -20+50% ceram DI	400 V
	C19	74.5123	1.0 pF ± 0.25 pF ceram DI	250 V
	C20	74.5161	470 pF -20+80% ceram PL	63 V
	C21	74.5162	470 pF -20+50% ceram DI	400 V
	C22		Helix Coil Adjustor	
	C23		Helix Coil Adjustor	
	C24	Heli	Helic Coil Adjustor	
	C25	74.5316	39 pF 5% ceram PL	63 V
	C26	74.5316	39 pF 5% ceram PL	63 V
	C27	74.5162	470 pF -20+50% ceram DI	400 V
	C28	74.5302	30 pF ± 0.25 pF ceram PL	63 V
	C29	74.5302	3.9 pF ± 0.25 pF ceram PL	63 V
	C30	74.5316	39 pF 5% ceram PL	63 V
	C31	74.5316	39 pF 5% ceram PL	63 V
	C32	74.5162	470 pF -20+50% ceram DI	400 V
	C33	74.5302	3.9 pF ± 0.25 pF ceram PL	63 V
	C34	74.5302	3.9 pF ± 0.25 pF ceram PL	63 V
	C35		Helix Coil Adjustor	
	C36		Helix Coil Adjustor	
	C37		Helix Coil Adjustor	
	C38		Printed Capacitor	
	C40	74.5198	1nF -20+50% ceram FT	30 V
	C41	74.5198	1 nF -20+50% ceram FT	30 V
	C42	74.5322	27 pF 20% ceram FT	400 V
	C50	78.5055	2.5 - 9 pF trimmer DI	100 V
	C51	74.5126	1.8 pF ± 0.25 pF ceram BD	250 V
	C52	74.5162	470 pF -20+50% ceram DI	400 V
	C53	74.5138	18 pF 5% ceram DI	125 V
	C54	74.5109	10 nF -20+80% ceram PL	20 V

Storno

TYPE	NO.	CODE	DATA		
	C55	76.5103	150 pF 2.5 % polystyr. TB		25 V
	C56	76.5101	68 pF 2.5 % polystyr. TB		25 V
	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%	-	1/8 W
	R7	80.5040	180 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%	-	1/10W
	R11	80.5033	47 Ω 5%	-	1/10W
	R12	80.5073	100 KΩ 5%	-	1/10W
	R13	80.5054	2.7 KΩ 5%	-	1/10W
	R14	80.5025	10 Ω 5%	-	1/10W
	R15	80.5033	47 Ω 5%	-	1/10W
	R16	80.5066	27 KΩ 5%	-	1/10W
	R17	80.5065	22 KΩ 5%	-	1/10W
	R18	80.5045	470 Ω 5%	-	1/10W
	R19	80.5239	150Ω 5%	-	1/10W
	R20	80.5025	10 Ω 5%	-	1/10W
	R21	80.5033	47Ω 5%	-	1/10W
	R22	80.5058	5.8 KΩ 5%	-	1/10W
	R23	80.5051	1.5 KΩ 5%	-	1/10W
	R24	80.5036	82 Ω 5%	-	1/10W
	R25	80.5033	47 Ω 5%	-	1/10W
	R26	80.5057	4.7 KΩ 5%	-	1/10W
	R27	80.5051	1.5 KΩ 5%	-	1/10W
	R28	80.5035	68Ω 5%	-	1/10W
	R29	80.5033	47Ω 5%	-	1/10W
	R32	80.5058	5.6 KΩ 5%	-	1/10W
	R33	89.5060	1.5 KΩ 5% NTC		1/2 W
	R34	80.5061	10 KΩ 5% carbon film		1/10W
	R35	80.5047	680 Ω 5%	-	1/10W
	R40	80.5255	3.3 KΩ 5%	-	1/8 W
	R41	80.5036	82 Ω 5%	-	1/10W
	R42	80.5243	330 Ω 5%	-	1/8 W
	L1	61.1234	RF Coil		
	L2	61.1230	RF Coil		

RECEIVER CONVERTER
MODTAGERKONVERTER

RC762

X 401.865

Storno

TYPE	NO.	CODE	DATA
	L3	61.1229	RC Coil 119-159 MHz
	L4	61.1231	RF Choke, R10 incl.
	L5	61.1227	RF Coil
	L6	62.0876	RF Coil
	L7	62.0877	RF Coil
	L8	62.0659/01	RF Choke 0.35 μH
	L9	61.1228	RF Coil
	L10	61.	Helix Coil 409.3-459.3 MHz
	L11	61.	Helix Coil 409.3-459.3 MHz
	L12	61.	Helix Coil 409.3-459.3 MHz
	L13	62.0875	RF Coil
	L14	62.0875	RF Coil
	L15	61.	Helix Coil 409.3-459.3 MHz
	L16	61.	Helix Coil 409.3-459.3 MHz
	L17	61.	Helix Coil 409.3-459.3 MHz
	L18	61.1117	IF Coil 10.7 MHz
	E1	99.5237	1N4148 Diode
	E2	99.5225	3.9 V Zenerdiode
	E3	99.5209	1.5 V Stab. diode
	Q1	99.5290	BFR90 Transistor
	Q2	99.5291	3N205 Transistor FET
	Q3	99.5240	BFX89 Transistor
	Q4	99.5291	3N205 Transistor FET
	Q5	99.5240	BFX89 Transistor
	Q6	99.5240	BFX89 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5236	BD136 Transistor
	Q9	99.5245	2N5245 Transistor J-FET

Storno

TYPE	NO.	CODE	DATA

RECEIVER CONVERTER
MODTAGERKONVERTER

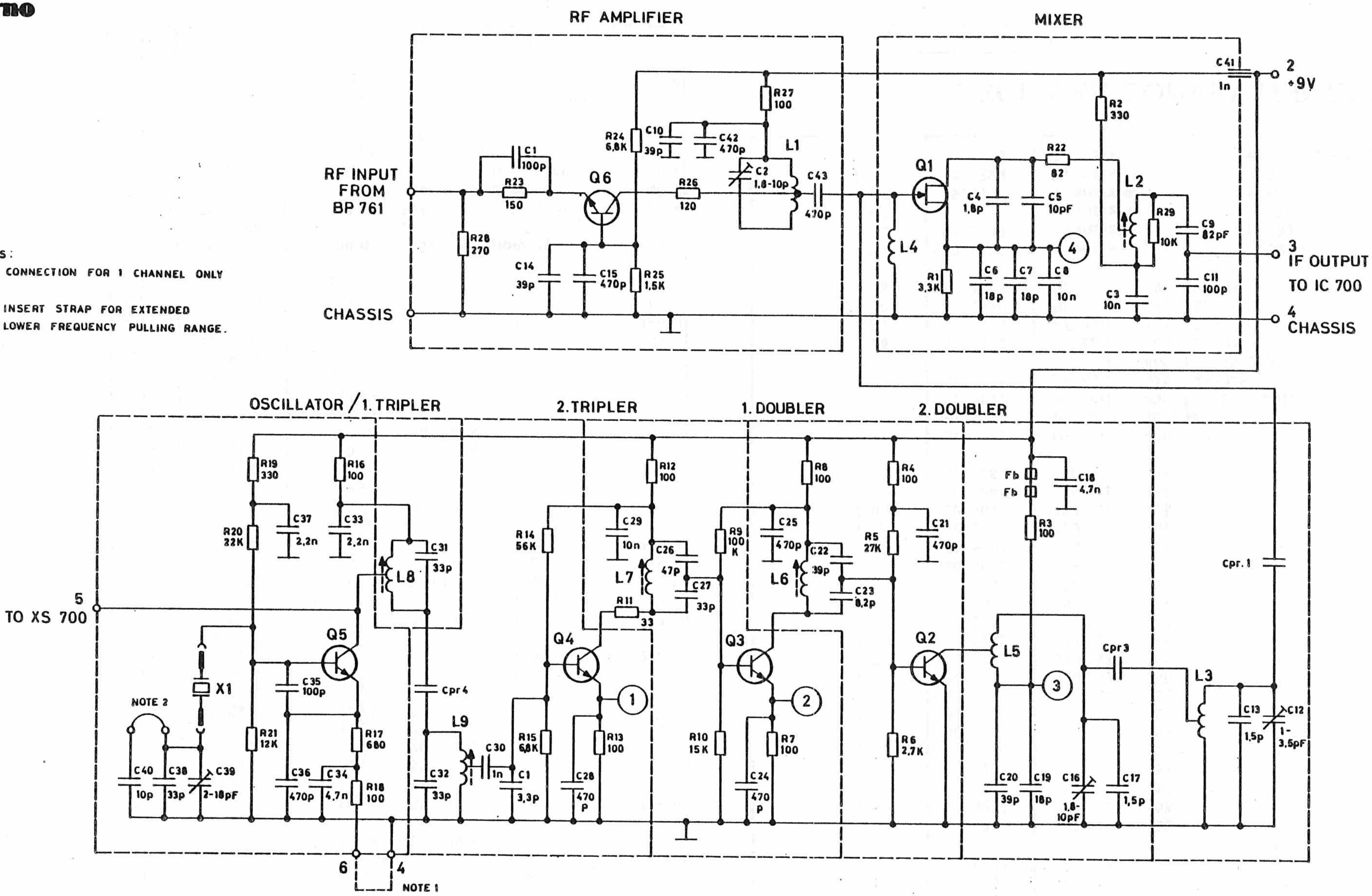
RC762

X401.865/2

NOTES:

1 : CONNECTION FOR 1 CHANNEL ONLY

2 : INSERT STRAP FOR EXTENDED LOWER FREQUENCY PULLING RANGE.



RECEIVER CONVERTER RC763

D 402.259

Storno

TYPE	Nº	CODE	DATA			
RC763		10. 3432-00	Receiver Converter			
	C1	74. 5338	100 pF	5%	ceram	63 V
	C2	78. 5048	1. 8/10 pF		teflon trimmer	300 V
	C3	74. 5109	10 nF	-20 + 80%	ceram	20 V
	C4	74. 5126	1. 8 pF	0. 25 pF	"	250 V
	C5	74. 5135	10 pF	5%	"	125 V
	C6	74. 5138	18 pF	5%	"	125 V
	C7	74. 5138	18 pF	5%	"	125 V
	C8	74. 5109	10 nF	-20 + 80%	"	20 V
	C9	74. 5348	82 pF	2%	"	63 V
	C10	74. 5338	39 pF	5%	"	63 V
	C11	74. 5349	100 pF	2%	"	63 V
	C12	78. 5047	1/3. 5 pF		teflon trimmer	300 V
	C13	74. 5189	1. 5 pF	0. 25 pF	ceram	250 V
	C14	74. 5338	39 pF	5%	"	63 V
	C15	74. 5312	470 pF	-20 + 80%	"	63 V
	C16	78. 5048	1. 8/10 pF		teflon trimmer	300 V
	C17	74. 5189	1. 5 pF	0. 25 pF	ceram	250 V
	C18	76. 5061	4. 7 nF	10%	polyester	50 V
	C19	74. 5138	18 pF	5%	ceram	125 V
	C20	74. 5117	39 pF	5%	"	160 V
	C21	74. 5161	470 pF	-20 + 80%	"	63 V
	C22	74. 5338	39 pF	5%	"	63 V
	C23	74. 5134	8. 2 pF	0. 25 pF	"	250 V
	C24	74. 5161	470 pF	-20 + 80%	"	63 V
	C25	74. 5161	470 pF	-20 + 80%	"	63 V
	C26	74. 5118	47 pF	5%	"	160 V
	C27	74. 5116	33 pF	5%	"	160 V
	C28	74. 5161	470 pF	-20 + 80%	"	63 V
	C29	74. 5109	10 nF	-20 + 80%	"	20 V
	C30	74. 5155	1 nF	-20 + 80%	"	63 V
	C31	74. 5116	33 pF	5%	"	160 V
	C32	74. 5116	33 pF	5%	"	160 V
	C33	76. 5059	2. 2 nF	10%	polyester	50 V
	C34	76. 5061	4. 7 nF	10%	"	50 V
	C35	76. 5102	100 pF	2. 5%	polystyr	25 V
	C36	76. 5106	470 pF	2. 5%	"	25 V
	C37	76. 5059	2. 2 nF	10%	polyester	50 V
	C38	74. 5191	33 pF	5%	ceram	160 V
	C39	76. 5044	2/18 pF		teflon trimmer	300 V
	C40	74. 5135	10 pF	5%	ceram	125 V
	C41	74. 5198	1 nF	-20 + 80%	"	30 V
	R1	80. 5255	3. 3 KΩ	5%	carbon film	1/8 W
	R2	80. 5243	330 Ω	5%	"	1/8 W
	R3	80. 5237	100 Ω	5%	"	1/8 W
	R4	80. 5237	100 Ω	5%	"	1/8 W

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TYPE	Nº	CODE	DATA			
	R5	80. 5266	27 KΩ	5%	carbon film	1/8 W
	R6	80. 5254	2. 7 KΩ	5%	"	1/8 W
	R7	80. 5237	100 Ω	5%	"	1/8 W
	R8	80. 5237	100 Ω	5%	"	1/8 W
	R9	80. 5273	100 KΩ	5%	"	1/8 W
	R10	80. 5263	15 KΩ	5%	"	1/8 W
	R11	80. 5231	33 Ω	5%	"	1/8 W
	R12	80. 5237	100 Ω	5%	"	1/8 W
	R13	80. 5237	100 Ω	5%	"	1/8 W
	R14	80. 5270	56 KΩ	5%	"	1/8 W
	R15	80. 5259	6. 8 KΩ	5%	"	1/8 W
	R16	80. 5237	100 Ω	5%	"	1/8 W
	R17	80. 5247	680 Ω	5%	"	1/8 W
	R18	80. 5237	100 Ω	5%	"	1/8 W
	R19	80. 5243	330 Ω	5%	"	1/8 W
	R20	80. 5265	22 KΩ	5%	"	1/8 W
	R21	80. 5262	12 KΩ	5%	"	1/8 W
	R22	80. 5036	82 Ω	5%	"	1/10 W
	R23	80. 5039	150 Ω	5%	"	1/10 W
	R24	80. 5059	6. 8 KΩ	5%	"	1/10 W
	R25	80. 5051	1. 5 KΩ	5%	"	1/10 W
	R26	80. 5038	120 Ω	5%	"	1/10 W
	R27	80. 5037	100 Ω	5%	"	1/10 W
	R28	80. 5042	270 Ω	5%	"	1/10 W
	R29	80. 5061	10 KΩ	5%	"	1/10 W
	L1	62. 0936	RF coil	420 - 470 MHz		
	L2	61. 1117	IF coil	10. 7 MHz		
	L3	62. 0812	RF coil	409. 3 - 459. 3 MHz		
	L4	62. 0935	RF coil	420 - 470 MHz		
	L5	62. 0813	RF coil	409. 3 - 459. 3 MHz		
	L6	61. 1118	RF coil	204 - 230 MHz		
	L7	61. 1119	RF coil	102 - 115 MHz		
	L8	61. 1120	RF coil	34 - 38. 5 MHz		
	L9	61. 1121	RF coil	34 - 28. 5 MHz		
	Q1	99. 5245	Transistor		2 N 5245	
	Q2	99. 5240	Transistor		BFX 89	
	Q3	99. 5168	Transistor		BF 173	
	Q4	99. 5168	Transistor		BF 173	
	Q5	99. 5294	Transistor		2 N 2369 A	
	Q6	99. 5320	Transistor		BFR 93 / BFR 35 A	

RECEIVER CONVERTER RC763

X402. 366

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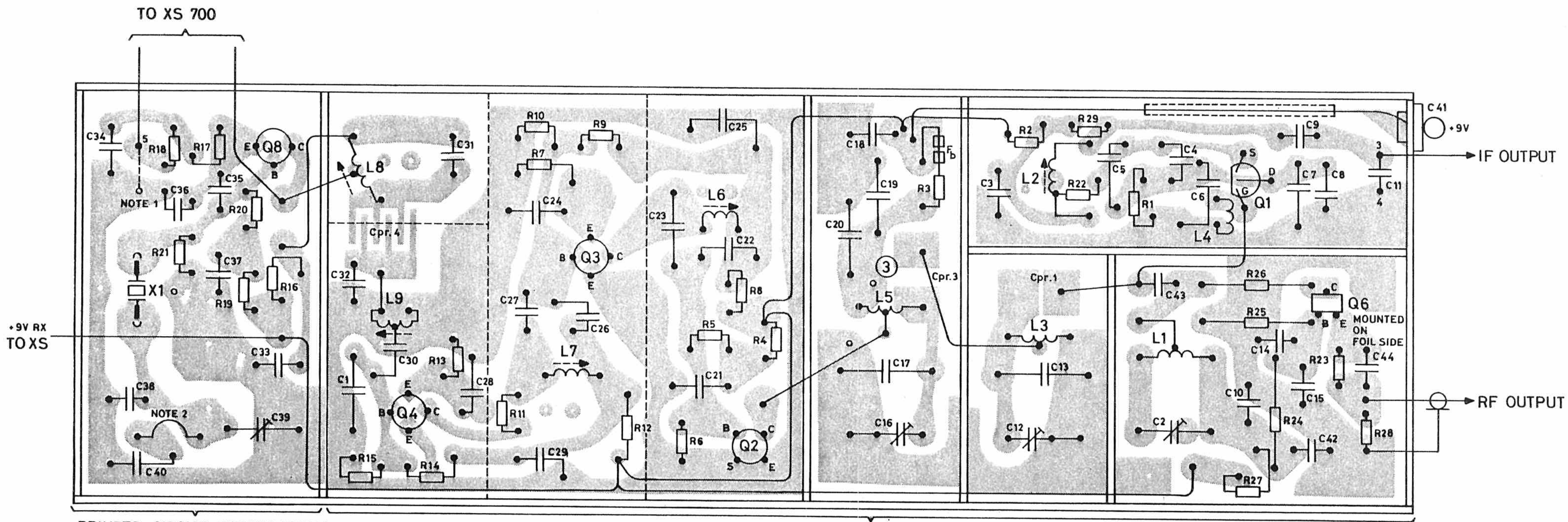


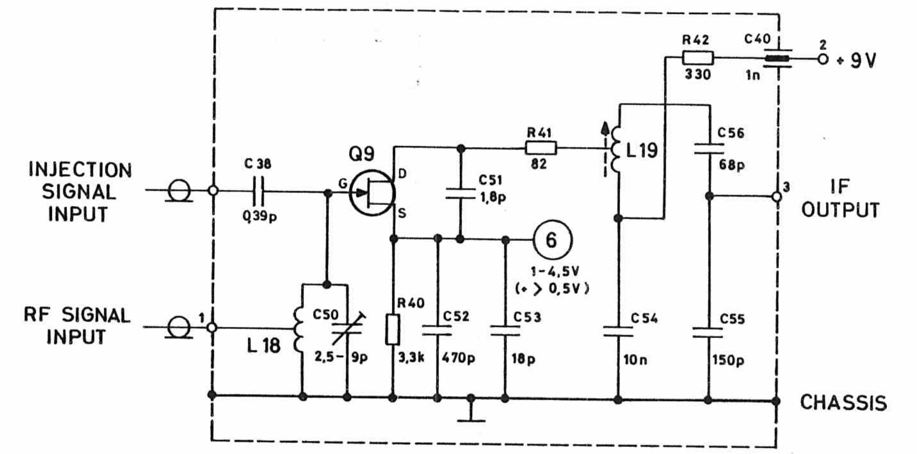
PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

PRINTED CIRCUITS VIEWED FROM SOLDERING SIDE

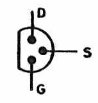
RECEIVER CONVERTER RC763

D402.422

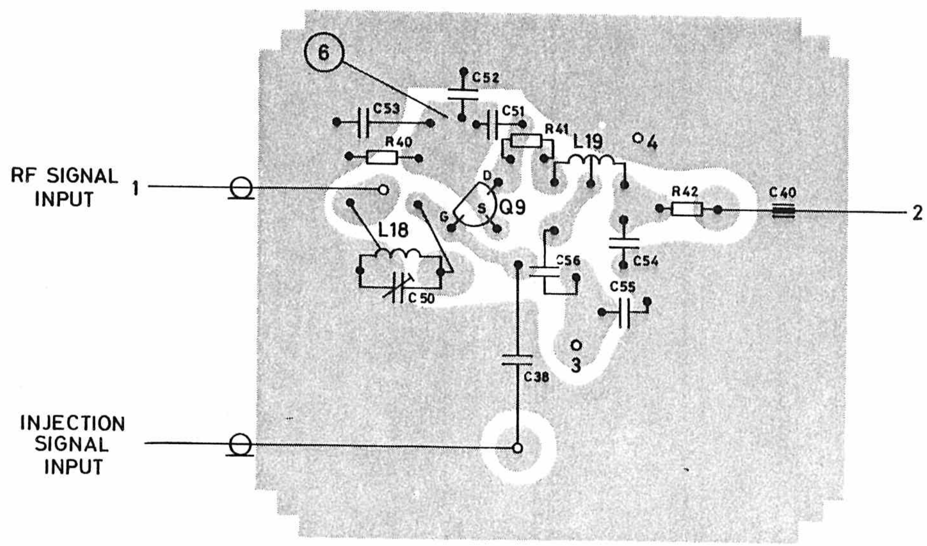
Storno



( ) VOLTAGE INCREASE MEASURED
WITH INJECTION SIGNAL APPLIED.



Q9
BOTTOM VIEW



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RECEIVER CONVERTER RC764

D 402.369/2

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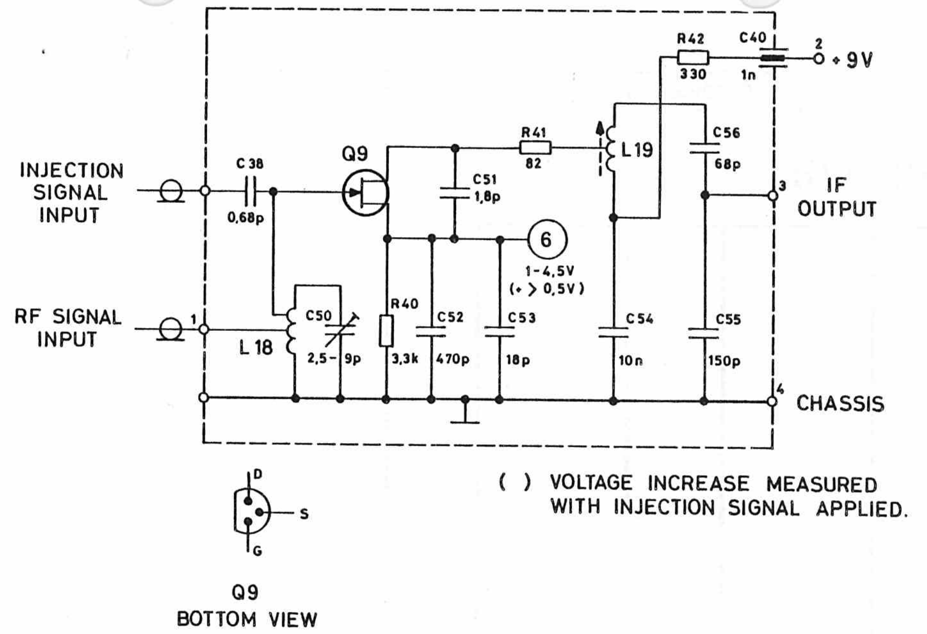
TYPE	Nº	CODE	DATA
RC764		10.3497-00	Receiver Converter
	C38	74.5121	0.68 pF ± 0.1 pF ceram BD 250 V
	C40	74.5198	1 nF -20/+50% " FT 30 V
	C50	78.5055	2.5 - 9 pF trimmer 100 V
	C51	74.5126	1.8 pF ± 0.25 pF ceram BD 250 V
	C52	74.5162	470 pF -20/+50% " DI 400 V
	C53	74.5138	18 pF 5% " DI 125 V
	C54	74.5109	10 nF -20/+80% " PL 20 V
	C55	76.5103	150 pF 2.5% polystyr TB 25 V
	C56	76.5101	68 pF 2.5% " TB 25 V
	R40	80.5255	3.3 kΩ 5% carbon film 1/8 W
	R41	80.5036	82 Ω 5% " " 1/10 W
	R42	80.5243	330 Ω 5% " " 1/8 W
	L18	62.0878	RF coil 420 - 470 MHz.
	L19	61.1117	IF coil 10.7 MHz.
	Q9	99.5245	2 N 5245 Transistor J-FET

Storno

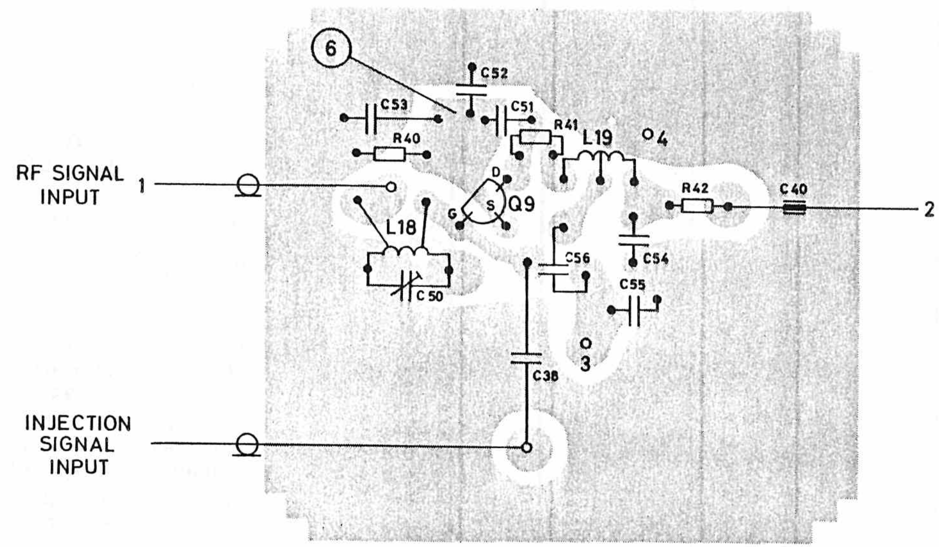
TYPE	Nº	CODE	DATA

RECEIVER CONVERTER RC764

X402.547



( ) VOLTAGE INCREASE MEASURED WITH INJECTION SIGNAL APPLIED.



RECEIVER CONVERTER RC764

D 402.369

Storno

TYPE	Nº	CODE	DATA
RC764		10.3497-00	Receiver Converter
	C38	74.5121	0.68 pF ± 0.1 pF ceram BD 250 V
	C40	74.5198	1 nF -20/+50% " FT 30 V
	C50	78.5055	2.5 - 9 pF trimmer 100 V
	C51	74.5126	1.8 pF ± 0.25 pF ceram BD 250 V
	C52	74.5162	470 pF -20/+50% " DI 400 V
	C53	74.5138	18 pF 5% " DI 125 V
	C54	74.5109	10 nF -20/+80% " PL 20 V
	C55	76.5103	150 pF 2.5% polystyr TB 25 V
	C56	76.5101	68 pF 2.5% " TB 25 V
	R40	80.5255	3.3 kΩ 5% carbon film 1/8 W
	R41	80.5036	82 Ω 5% " " 1/10 W
	R42	80.5243	330 Ω 5% " " 1/8 W
	L18	62.0878	RF coil 420 - 470 MHz.
	L19	61.1117	IF coil 10.7 MHz.
	Q9	99.5245	2 N 5245 Transistor J-FET

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TYPE	Nº	CODE	DATA

RECEIVER CONVERTER RC764

TITLE		Code
SR781	Description 1 - 7	60.253-E1
	Functional Diagram	D402.111
	Schematic	D401.825
	Component Lay-out	D402.353
	Part List	X401.962
SR783	Schematic	D402.372
	Component Lay-out	D402.511
	Part List	X402.453
SR785	Description 1 - 8	60.218-E1
	Schematic	D401.722
	Component Lay-out	D401.978
	Part List 1 - 2	X401.701
SR785a	Description 1 - 7	60.232-E1
	Functional Diagram	D401.977/2
	Schematic	D401.894
	Component Lay-out	D402.159
	Part List 1 - 2	X401.963
SR7841	Description 1 -11	60.219-E1
	Schematic	D401.706/2
	Component Lay-out	D401.711/2
	Part List 1 - 1	X401.695/2
SR7841a	Description	60.347-E1
	Schematic	D402.056
	Component Lay-out	D402.468
	Part List 1 - 3	X402.184
ST7845	Description 1 - 3	60.230-E1
	Functional Diagram	D401.966
	Schematic	D401.583/4
	Component Lay-out	D401.686
	Part List	X401.689/2
SU704	Installation	D402.371

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SEQUENTIAL TONE RECEIVER SR781

Description

SR781 is a sequential tone receiver for selective calling. It was developed for use in Stornophone 700 radiotelephone equipment. The frequencies employed are the standard CCIR series: 960 Hz to 2110 Hz.

SR781 is designed to operate on a 5-tone sequence, but can also be set to accommodate a 4-tone sequence.

GENERAL DESCRIPTION

Upon reception of a signal having the correct tones in the proper sequence the following events take place (in the receiver):

The call Lamp lights, the AF Muting is cancelled and the Key Lock function "unlocks". An audio alarm signal of about 1.5 seconds in duration can be sent out over the radiotelephone's loudspeaker, and when the vehicle's traffic horn is connected to the tone receiver via an auxilliary relay, the horn will also sound for the same length of time.

There is also a provision for automatically turning off the car's broadcast band receiver when a call arrives.

The audio circuit and the Key Lock are both turned on and off manually by means of the LS IN/OUT push button. Since the switch that "unlocks" the Key Lock also turns on the loudspeaker, the operator is forced to check for the presence of another signal on the channel before being able to key his transmitter.

In addition, the tone receiver is equipped with an Occupied Lamp controlled by the squelch circuit in the radiotelephone receiver. Thus, if an RF signal having that channel's frequency is present at the antenna input it will cause the Occupied Lamp to light as an indication that the channel is not free.

After reception of a correct call the speaker will remain open until the LS IN/OUT button is depressed.

Logic Terms

Positive logic is employed in SR781, logical references are:

1. low voltage level (~ OV) = logic state "O" (LO)

2. high voltage level (~ 5V) = logic state "1" (HI)

Tone Signalling

The first tone of a sequential signal, arriving from input terminal 35, passes through the Amplifier/Limiter, IC1, where it becomes suitable for applying to the tuned circuit of L1 and C8.

In stand by the resonant frequency of the tuned Circuit is set up by the first Tone Gate, Q4, for the first tone of its code. If the first tone received corresponds to the circuit resonant frequency, it becomes selected, is then amplified by IC2 and detected by E1.

The correct tone will thus fire the Schmitt Trigger, IC3a, whose output drives the Clock Delay (CP Delay) circuit, IC3b. This circuit produces a Clock Pulse whose leading (positive going) edge is delayed approximately 15 msec. from the Schmitt Trigger output signal.

The clock pulse is applied to the Counter circuit, IC6a, IC7a and IC6b. The counter is arranged as a Synchronous, divide-by-5 counter whose binary states are read out in BCD (binary coded decimal) mode in the Decoders, IC4a-d and IC5a-b.

The first five Decoders drive the Tone Gates, Q4-Q8. The output of the sixth Decoder, IC5b, is applied to the Readout circuit, IC7b.

The Readout flip-flop is also timed by the same clock pulses that toggle the Counter flip-flops.

At the end of a tone pulse, the Schmitt Trigger reverts to its quiescent state and the resultant trailing (negative going) pulse edge from the CP Delay output causes the Counter flip-flops to change state. (So far, with just the first pulse completed, only Counter IC6a is affected.)

The Decoders sense the new binary state and turn Tone Gate Q4 OFF and Tone Gate Q5 ON, thus setting the resonant circuit up for the second tone in the sequential code.

Suppose that the next tone received does not match the receiver's code. It will not be selected by the resonant circuit and no signal will be available to fire the Schmitt Trigger. When the Schmitt Trigger was fired the first time, it also turned Q1 ON and activated the Clear Delay circuit, IC3c. The output of IC3c then enabled the Counters by applying a HI logical state to their Clear inputs. The Clear Delay output remains HI for about 220 msec. after the Schmitt Trigger has returned to "0". If the second tone does not activate the Schmitt Trigger by then, Q1 goes OFF and the Clear Delay output goes LO, clearing the counter and setting the Decoders back to the stand by position, i.e. ready to receive the first tone again. This is what happens if the second, or any consequent tone fails (for instance, if the tone is not the correct one for the particular receiver under consideration).

The 2nd, 3rd, 4th and 5th tones of a sequence occur like the 1st, each time stepping the Decoder one position forward until the final tone has been received.

When all five tones have been received, at the end of the 5th tone, IC7b clears the Holding Circuit, IC8, and turns transistor Q2 ON.

Q2 drives the Alarm Delay circuit.

All the functions mentioned in the beginning of this description, i.e. Call Lamp, AF Mutting, Key Lock, Alarm Tone Generator, etc. occur at this time.

The Call Lamp and the speaker will remain ON until switched OFF manually with the LS IN/OUT push button (via terminal 32).

If the operator later wants to make a call he must first "unlock" the Key Lock function with the LS IN/OUT push button again, thus turning the loudspeaker ON. If there is any traffic on his channel, he will hear it and be warned before he can key his transmitter.

CIRCUIT DESCRIPTION

Input Stage (IC1)

Input terminal 35 can be wired in either of two positions (marked DK and SV on schematic diagram D401.825):

DK = input signal through C2 and R1, linear response

SV = input signal differentiated through C1 to match the modulation index used in Sweden and by Storno.

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The amplifier circuit incorporates amplitude limiting for signal levels above the minimum required to activate the Schmitt Trigger.

Resistor R6 sets the amplifier sensitivity.

Amplifier Stage (IC2)

The signal is inductively coupled to the Amplifier via the parallel resonant circuit, L1 and C8.

Five of the taps on tone coil L1 are wired to Tone Gates Q4 to Q8, respectively (with a 4-tone code, Q8 is not used). When a Tone Gate is ON, i.e. conducting, it completes a path from its coil tap to chassis ground and the parallel resonant circuit for that particular tone frequency is formed.

NTC resistor R13 compensates for variations in circuit Q caused by changes in ambient temperature.

The selected signal passes to operational amplifier IC2, which is bootstrapped so as not to load the resonant circuit. Amplifier gain is determined by the ratio of R17 to R19.

Detector and Schmitt Trigger (E1, E2, IC3a)

The amplified tone signal is then rectified by the forward-biased diode, E1, and filtered by C13. The resultant DC voltage is present at the invertering input of IC3a.

When the rectified voltage exceeds the threshold level set by R21, R22, R25, R26 and diode E2, the output of the Schmitt Trigger switches from LO (~ 0V) to HI (~ 5V) and remains in that state for the duration of the tone pulse.

Feedback to the non-inverting input via R27 produces a circuit hysteresis of circa 0.2 V.

When the tone ends the Schmitt Trigger switches back to its quiescent state, i.e.: output LO.

Feedback through C14 and R29 will hold the Schmitt Trigger output LO for approx. 10 msec.

Clock Delay (E4, IC3b)

In stand by the Schmitt Trigger output state is LO, C15 is discharged through E4, and the potential at the non-inverting input is also LO (IC3b output is also LO).

Notice that the voltage divider network of R41 and R42 determines the threshold voltage at the inverting inputs of all 3 "delay" circuits, IC3b, IC3c and IC3d.

Now, when the Schmitt Trigger output goes HI, it reverse-biases diode E4 and capacitor C15 begins to charge through resistors R31 and R32. The moment the charge on C15, as seen at the non-inverting input of the comparator, reaches the threshold level, the output switches to the HI state.

It takes C15 approx. 15 msec. to charge up to the threshold level of IC3b. This is what determines the Clock Delay time, removing the short circuit across R30 lengthens the delay time.

At the end of the tone the Schmitt Trigger output returns to its LO state and C15 can once again discharge through E4 and R32. The time constant of this circuit provides a delay at the negative going trailing edge of the pulse, too. These delays prevent random noise pulses from operating the circuit erratically.

Clear Delay (Q1, IC3c)

In stand by, Q1 is OFF and C16 has no charge on it. When the Schmitt Trigger output goes HI it drives Q1 ON, and C16

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builds up a charge via R37 and Q1, triggering comparator IC3c so its output goes HI. The clear Delay circuit operates similarly to the Clock Delay circuit.

As long as the Schmitt Trigger keeps operating at the normal tone intervals, Q1 can maintain the charge on C16. At the end of the 5th tone, the Schmitt Trigger reverts to its quiescent state (output LO) and turns Q1 OFF, as the emitter of Q1 will be biased by the charge on C16. The discharge path for C16 is through R36 and R37. In about 220 msec. the voltage at the non-inverting input of IC3c will fall back to the threshold level and the comparator output switches state. The LO potential at the Clear Delay output clears the Counter and the Readout circuits. Since the interval between tones is normally much less than 220 msec., the Clear Delay will remain OFF (output HI) throughout the entire tone sequence.

Counter (IC6a, IC7a, IC6b)

The Counter elements are J-K master-slave flip-flops arranged as a synchronous, divide-by-five counter that is clocked by the Clock Delay output and is cleared by the Clear Delay output. All of the normal (Q) and complement ($\overline{Q}$) Counter outputs are wired to appropriate Decoder inputs (IC4 and IC5).

The binary information present at each flip-flop input when a clock pulse arrives will be transferred to the output by the trailing edge of the clock pulse. A 5-tone code sequence correct for the receiver in question, produces 5 clock pulses, one for each tone pulse.

220 msec. after the 5th tone ends, the logical "0" (LO) state at the Clear Delay output clears the Counter flip-flops. However, the Counter will not be able to start counting again until the flip-flops are enabled by the Clear Delay output being switched to logical "1" again by the Schmitt Trigger action.

Decoder (IC4a-d, IC5a) and Tone Gates (Q4 - Q8)

The wiring between the Counter outputs and Decoder NOR gate inputs is arranged to drive the Tone Gates one at a time.

The output of a NOR gate is HI (logical state "1") only when all of its inputs are LO (logical state "0"). If either or both of its inputs are HI, the NOR gate output will be LO.

In stand by, both inputs to IC4a are LO and the output is therefore HI. The other 5 Decoder NOR gates have at least one of their inputs HI, so their outputs will all be LO. Tone Gate Q4 is thus held ON by IC4a, while Q5-Q8 are held OFF by IC4b - IC5a.

Transistor Q4, conducting hard, acts as a virtual short circuit from chassis ground to whichever tone coil tap is specified for the first tone of the code sequence. At the end of the first clock pulse, one of the inputs to IC4a goes HI, the NOR gate output goes LO, and Q4 cuts off. At the same time both inputs to IC4b are now LO, its output goes HI, and Q5 goes ON to tune the resonant circuit for the 2nd tone of the code sequence.

One special consideration here is that the actual maximum HI potential measurable at the NOR gate output is limited to approx. 0.7 V by the conducting Tone Gate transistor's emitter-base junction.
With each correct pulse the Counter steps the Decoder one position forward until the final tone has been received.

Readout Circuit (IC5b, IC7b)

At the end of the 4th tone of a 5-tone signal (or the 3rd tone of a 4-tone signal) both inputs to IC5b will be LO, and the NOR gate output will go HI, driving the J input of IC7b HI, as well.

Now, with its J input driven HI and its K input held as chassis ground potential, IC7b can switch output states when the trailing (negative going) edge of the 5th (or 4th) tone pulse arrives. The normal (Q) output activates the Alarm Delay circuit, and the complement ($\overline{Q}$) output clears the Holding Circuit, IC8.

220 msec. later the Clear Delay, IC3c, clears the Counter and Readout circuits, and the Tone Receiver is set up for the first tone again by the Decoder and Tone Gate circuits.

A strapping arrangement at the input of IC5b allows for either 4 or 5-tone codes.

Alarm Delay (IC3d, Q2, Q3)

Transistor Q2 is normally OFF and the output of IC3d is HI, Q3, a PNP transistor, is held OFF, and so is Q13.

When the Q output of IC7b in the Readout circuit goes HI at the end of the last tone pulse, it drives Q2 ON. Then capacitor C18 quickly charges through the conducting transistor Q2. When the charge reaches the threshold established by the resistive divider circuit of R41 and R42 the output of IC3d goes LO, turning Q3, then Q13 ON.
Q13 acts as a switch capable of carrying 100 mA of current between ground and terminal 37, the connection for an auxillary alarm relay.

As long as the Clear Delay, IC3c, output remains HI, Q2 is held ON by IC7b and maintains the charge across C18. 220 msec. after the last pulse from the Clock Delay, IC3b, ends, IC3c switches state and clears the Counter and Readout IC's. The Q output of IC7b returns to logical "0", turning Q2 OFF. C 18 now discharges slowly through R43 and R44.
The time constant of C18, R43 and R44 is calculated so that the Alarm Delay, IC3d, output switches back to logical "1" approx. 1.3 sec. after the end of the final clock pulse.

The Alarm Delay is a comparator circuit that operates in the same manner as the Clock Delay.

Holding Circuit (IC8, Q9, Q11)
Call Lamp + Key Lock Switches (Q10, Q11)

The Holding Circuit is an integrated flip-flop with its J and K inputs both tied to logical "1" through R64. With both the J and the K inputs HI, the flip-flop output will complement itself for each clock pulse arriving at the CP (toggle) input. Notice that the CP input is also tied to +Vcc, through R62. This simulates the flat top portion of a clock pulse.

Now, whenever the LS IN/OUT push button on the radiotelephone control panel is pressed, terminal 32 is grounded. C30 at the CP input discharges quickly through the 27Ω resistor, R63, and the flip-flop sees a negative going trailing edge of a "clock pulse" and switches state. When the push button is released again, C30 charges up to +Vcc through R62, forming the positive going leading edge of the next "clock pulse".

Only the normal (Q) output is used in this circuit, it switches Q11 ON and OFF.

As just seen, IC8 is designed so that it can only be toggled manually by means of the LS IN/OUT switch. However, the Clear input is operated electronically from the $\overline{Q}$ output of Readout flip-flop IC7b.

C32 provides a drive pulse to the base of Q9, saturating the transistor as soon as the radiotelephone is turned on. This pulls the collector of Q9 down to ground, presetting IC8. In the preset state, the Q output is HI and Q11 is held OFF, and Q10 and Q12 are likewise OFF.

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With the collector of Q9 LO, diode E3 keeps the Schmitt Trigger output at logical "0", as well, inhibiting both the Clock and the Clear Delay circuits.

As capacitor C32 accumulates a charge, the charging current decreases until it no longer can forward bias Q9. The transistor goes OFF, its collector voltage goes HI, and IC8 becomes enabled.

Diode E6 serves to discharge C32 when the equipment is turned off.

Each time the LS IN/OUT button is pressed, IC8 changes state, switching Q11 ON or OFF and, in turn, driving Q10 and Q12 into saturation or cut-off.
When Q10 conducts it provides a ground connection to light the Call Lamp and, when applicable to operate a relay for muting the car's broadcast band radio.

Q12, conducting simultaneously, turns the loudspeaker ON and also unlocks the Key Lock function.

At the end of the last tone pulse in a sequence, the complement output ($\bar{Q}$) of IC7b clears IC8, whose output goes LO and turns Q11 ON. Q10 and Q12 are then driven into saturation. 220 msec. after, the Clear Delay clears the Counter and Readout circuits and $\bar{Q}$ of IC7b goes HI again. IC8 can be manually toggled via terminal 32 any time afterwards.

Note that whenever the speaker is in operation, whether turned on manually or by an incoming call, the Call Lamp will light.

Occupied Lamp Switch (Q14)

Whenever the channel is occupied a DC voltage from the Squelch circuit, via terminal 41, turns Q14 ON and establishes a ground connection to the Occupied Lamp, so it can light.

Alarm Tone Generator (IC5c, IC5d)

Two NOR gates, coupled to operate as a free-running (astable) multivibrator, generate an audio signal that is available at terminal 20. The Generator can be strapped to the output of IC3d or to +Vcc through R61.

In stand by, IC3d has a HI output, which would inhibit NOR gate IC5d. When a selective call comes through, the Alarm Delay output goes LO for approx. 1.5 sec. During that interval the multivibrator can oscillate at a frequency determined by the time constants of R57 / C27 and R58 / C26. When Alarm Delay output goes HI again the oscillator stops.

Regardless of the state of IC8 a correct tone signal will clear the flip-flop and turn Q11, then Q10 and Q12 ON. Thus, a tone call has higher priority than the manual switch.

Clock Pulse	Clear Delay	IC6a				IC7a				IC6b				IC4a	IC4b	IC4c	IC4d	IC5a	IC5b	IC7b
		J	K	Q	$\bar{Q}$	J	K	Q	$\bar{Q}$	J	K	Q	$\bar{Q}$							$\bar{Q}$
0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1
1	1	1	0	1	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1
2	1	1	0	1	0	1	0	1	0	1	0	0	1	0	0	1	0	0	0	1
3	1	0	1	1	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0	1
4	1	0	1	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	1
5	1	0	1	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0
Δ	0	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1

NOTE: Δ = 220 msec. after the end of the 5th tone

Storno

Technical Specifications

Supply Power

Nominal	:	13.6 V
Minimum	:	10.5 V
Maximum	:	16.0 V

Current Drain

Stand by: 24 mA ± 4 mA

Regulated Voltage

Nominal 4.9 V

Temperature Range

Operating range: $-25^{o}C$ to $+60^{o}C$
Functioning range: $-30^{o}C$ to $+60^{o}C$

Maximum Load Currents

Terminal 37 ALARM	100 mA (for 1.5 sec.)
Terminal 47 CALL	100 mA
Terminal 45 OCCUPIED	100 mA
Terminal 51 and 43 KEY LOCK	10 mA
Terminal 34 AF MUTING I_{load}	min. 0.75 mA for V_{out} = 8 V

Input Impedance

≥ 6KΩ

Signal Input Level

Nominal at 1000 Hz: 110 mV

AF Muting

In conjunction with terminal 18 of CF701 or CF702:
≥ 60 dB.

Signalling Code

Sequence of 4 or 5 tone bursts of 100 ms ± 10 ms duration with maximum 10 ms interval between tone bursts.

Tone Signal Frequencies

Coil terminal	Tone frequency
1	960Hz
2	1022Hz
3	1124Hz
4	1197Hz
5	1275Hz
6	1358Hz
7	1446Hz
8	1540Hz
9	1640Hz
10	1747Hz
11	1860Hz
12	1981Hz
13	2110Hz

Frequency Accuracy

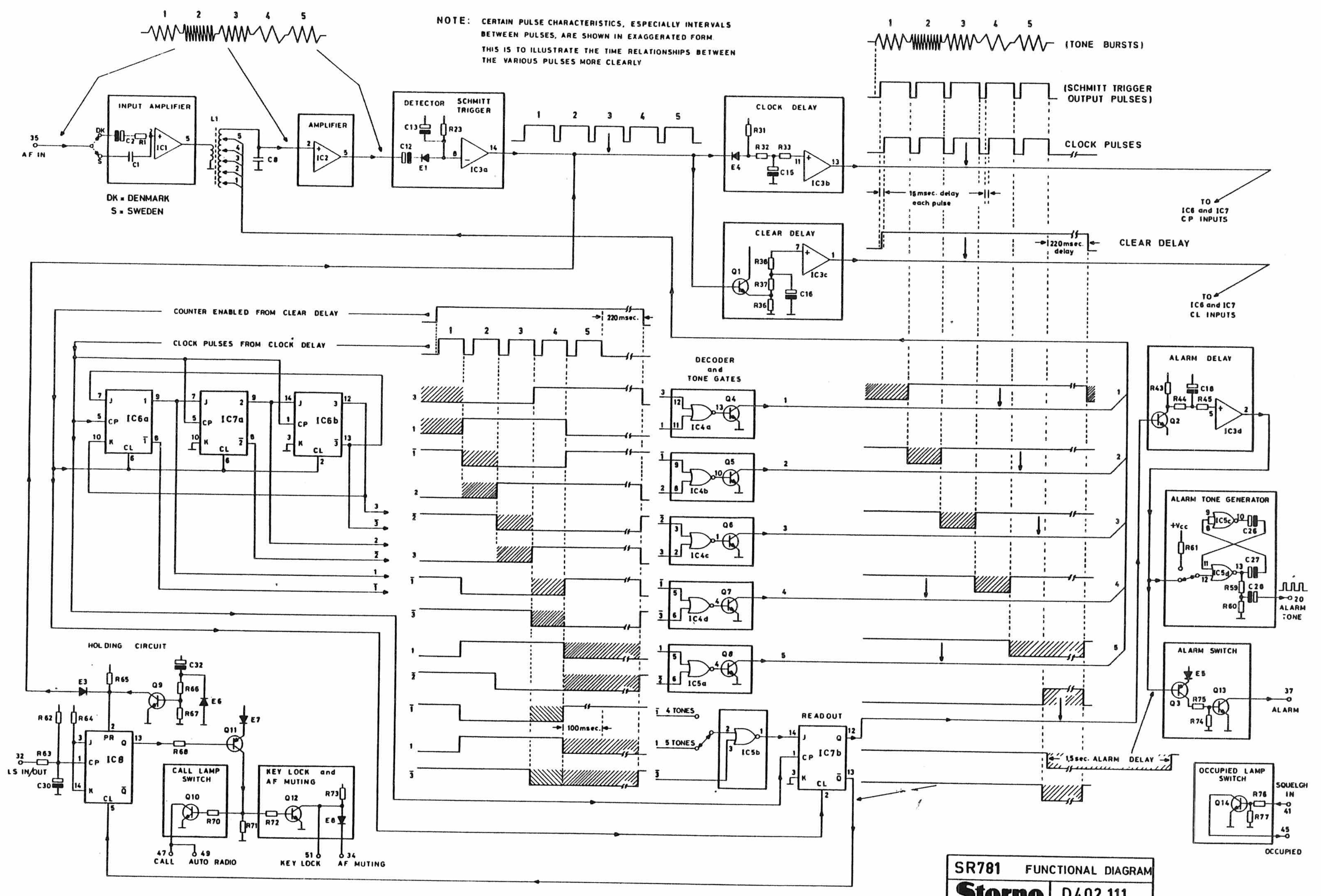
Coil tuned for 1022Hz: ≤ 0.3% for all tones

Frequency Stability

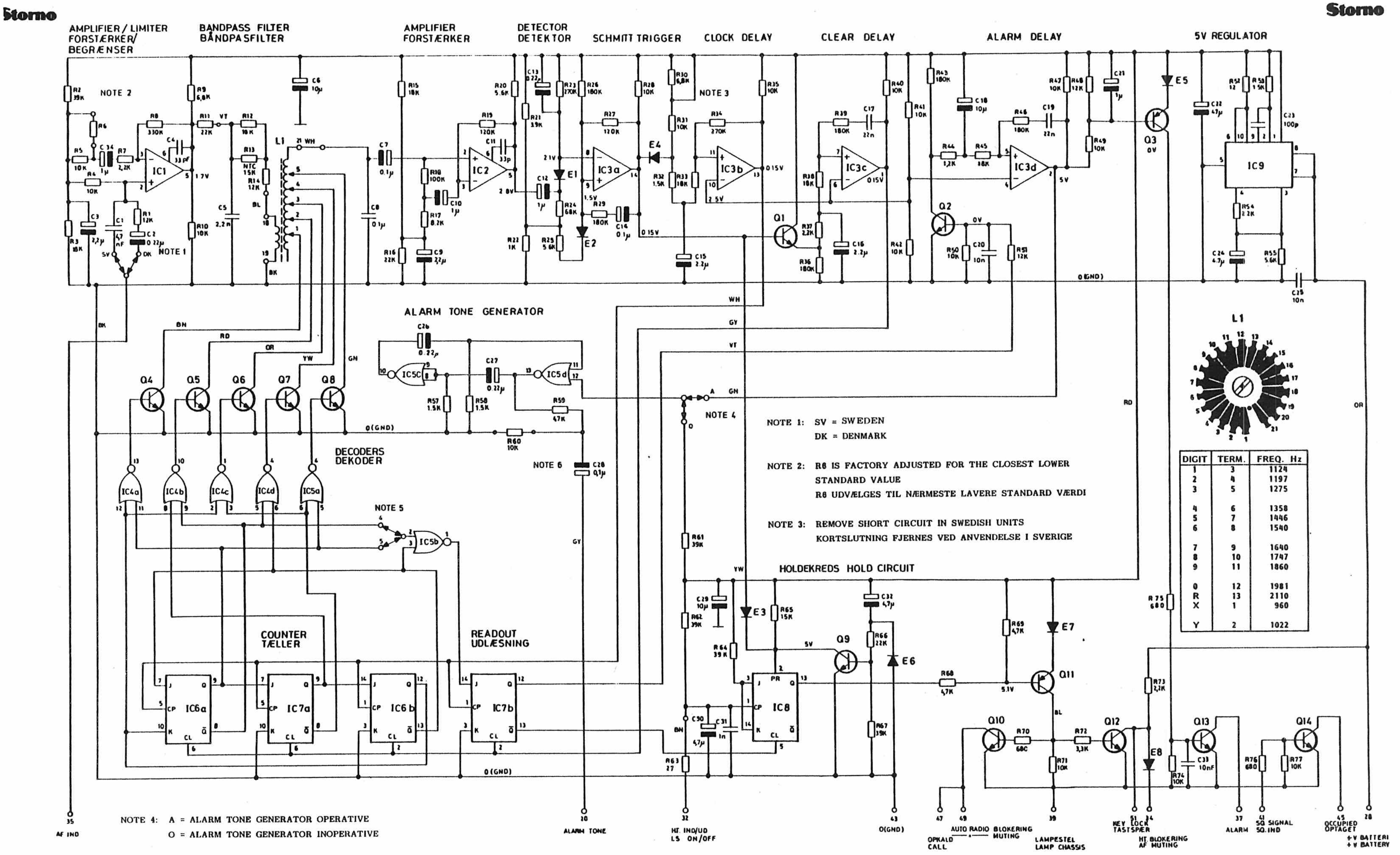
(typically ≤ 0.5%) ≤ 1.0%

Selectivity

Frequencies differing from f_o by 3% or more are unable to trigger the tone receiver.



SR781 FUNCTIONAL DIAGRAM
Storno D402.111



DIGIT	TERM.	FREQ. Hz
1	3	1124
2	4	1197
3	5	1275
4	6	1358
5	7	1446
6	8	1540
7	9	1640
8	10	1747
9	11	1860
0	12	1981
R	13	2110
X	1	960
Y	2	1022

NOTE 1: SV = SWEDEN
DK = DENMARK

NOTE 2: R6 IS FACTORY ADJUSTED FOR THE CLOSEST LOWER STANDARD VALUE
R6 UDVÆLGES TIL NÆRMESTE LAVERE STANDARD VÆRDI

NOTE 3: REMOVE SHORT CIRCUIT IN SWEDISH UNITS
KORTSLUTNING FJERNES VED ANVENDELSE I SVERIGE

NOTE 4: A = ALARM TONE GENERATOR OPERATIVE
O = ALARM TONE GENERATOR INOPERATIVE

NOTE 5: 4 = 4 DIGIT CALL
5 = 5 DIGIT CALL
4 = OPKALD MED 4 CIFRE
5 = OPKALD MED 5 CIFRE

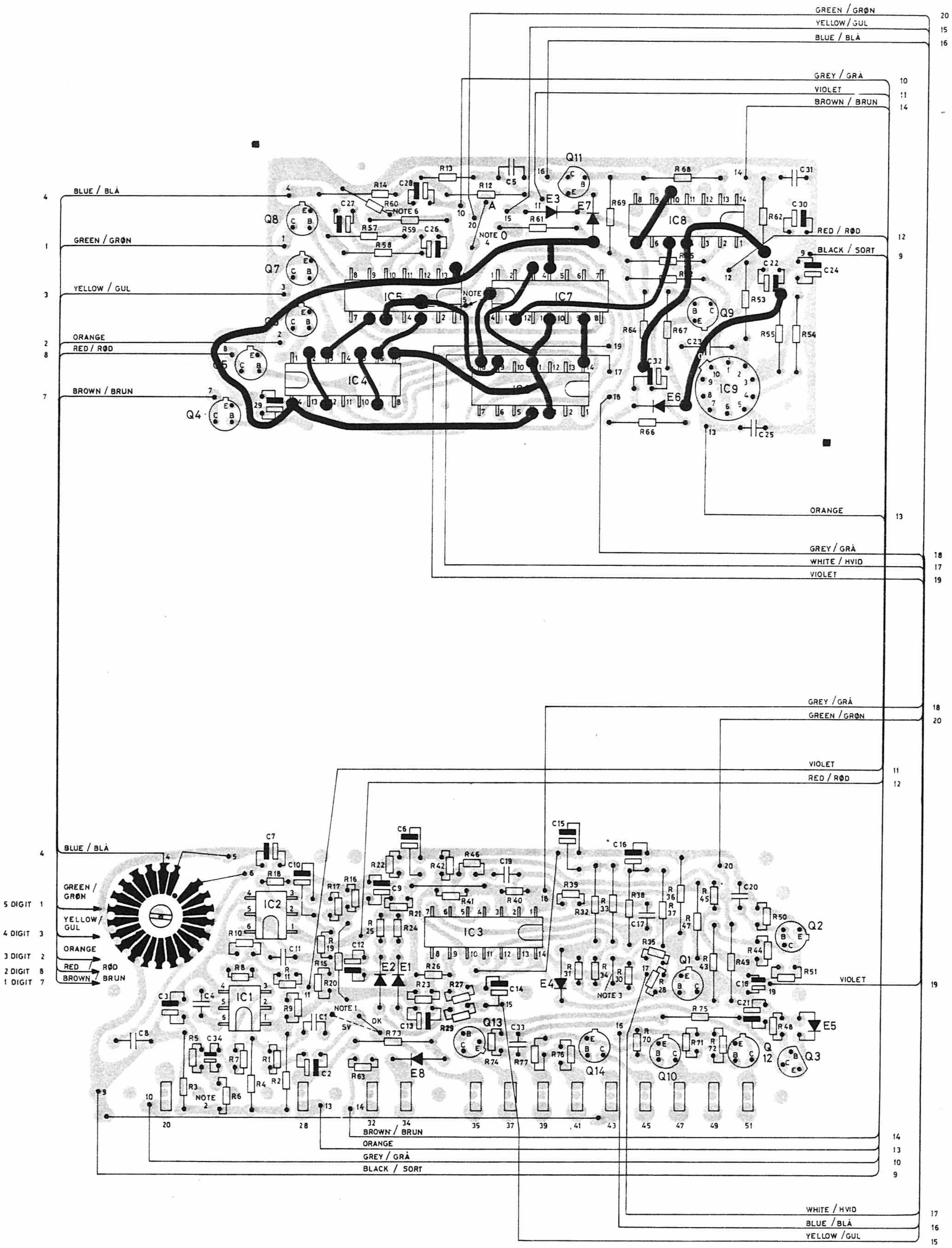
NOTE 6: R60 ADJUSTS THE ALARM TONE LEVEL
ALARMTONESTYRKEN INDSTILLES MED R60

SEQUENTIAL TONE RECEIVER SEKVENSTONEMODTAGER

SR781

D401.825

Storno



SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR781

D402.353

Storno

TYPE	NO.	CODE	DATA	
SR781		10.2965	Sequential Tone Receiver	
	C1	74.5061	4.7nF 10% polyest. FL	50V
	C2	73.5118	0.22µF 20% tantal	35V
	C3	73.5102	2.2µF 20% tantal	35V
	C4	74.5116	33pF 5% ceram TB	160V
	C5	76.5059	2.2nF 10% polyest. FL	50V
	C6	73.5109	10µF 20% tantal	16V
	C7	73.5089	0.1µF 20% tantal	35V
	C8	76.5068	0.1µF 1% polystyr TB	63V
	C9	73.5102	2.2µF 20% tantal	35V
	C10	73.5114	1µF 20% tantal	35V
	C11	74.5116	33pF 5% ceram TB	160V
	C12	73.5114	1µF 20% tantal	35V
	C13	73.5118	0.22µF 20% tantal	35V
	C14	73.5089	0.1µF 20% tantal	35V
	C15	73.5102	2.2µF 20% tantal	35V
	C16	73.5102	2.2µF 20% tantal	35%
	C17	76.5071	22nF 10% polyest. FL	50V
	C18	73.5109	10µF 20% tantal	16V
	C19	76.5071	22nF 10% polyest. FL	50V
	C20	76.5070	10nF 10% polyest. FL	50V
	C21	73.5114	1µF 20% tantal	35V
	C22	73.5124	47µF 20% tantal	6.3V
	C23	74.5165	100pF 10% ceram PL	63V
	C24	73.5126	4.7µF 20% tantal	35V
	C25	76.5070	10nF 10% polyest. FL	50V
	C26	73.5118	0.22µF 20% tantal	35V
	C27	73.5118	0.22µF 20% tantal	35V
	C28	73.5089	0.1µF 20% tantal	35V
	C29	73.5109	10µF 20% tantal	16V
	C30	73.5126	4.7µF 20% tantal	35V
	C31	74.5155	1nF -20+80% ceram PL	63V
	C32	73.5126	4.7µF 20% tantal	35V
	C33	76.5070	10nF 10% polyest. FL	50V
	C34	73.5114	1µF 20% tantal	35V
	R1	80.5262	12kΩ 5% carbon film	1/8W
	R2	80.5268	39kΩ 5% carbon film	1/8W
	R3	80.5264	18kΩ 5% carbon film	1/8W
	R4	80.5261	10kΩ 5% carbon film	1/8W
	R5	80.5261	10kΩ 5% carbon film	1/8W
	R6	80.52xx	Adjusted	1/8W
	R7	80.5253	2.2kΩ 5% carbon film	1/8W
	R8	80.5279	0.33 MΩ 5% carbon film	1/8W
	R9	80.5259	6.8kΩ 5% carbon film	1/8W
	R10	80.5261	10kΩ 5% carbon film	1/8W
	R11	80.5265	22kΩ 5% carbon film	1/8W

Storno

TYPE	NO.	CODE	DATA	
	R12	80.5264	18kΩ 5% carbon film	1/8W
	R13	89.5009	15kΩ 20% NTC	0.6W
	R14	80.5262	12kΩ 5% carbon film	1/8W
	R15	80.5264	18kΩ 5% carbon film	1/8W
	R16	80.5265	22kΩ 5% carbon film	1/8W
	R17	80.5260	8.2kΩ 5% carbon film	1/8W
	R18	80.5273	0.1 MΩ 5% carbon film	1/8W
	R19	80.5274	0.12 MΩ 5% carbon film	1/8W
	R20	80.5258	5.6kΩ 5% carbon film	1/8W
	R21	80.5256	3.9kΩ 5% carbon film	1/8W
	R22	80.5249	1kΩ 5% carbon film	1/8W
	R23	80.5278	0.27MΩ 5% carbon film	1/8W
	R24	80.5271	68kΩ 5% carbon film	1/8W
	R25	80.5258	5.6kΩ 5% carbon film	1/8W
	R26	80.5276	0.18 MΩ 5% carbon film	1/8W
	R27	80.5274	0.12 MΩ 5% carbon film	1/8W
	R28	80.5261	10kΩ 5% carbon film	1/8W
	R29	80.5276	0.18 MΩ 5% carbon film	1/8W
	R30	80.5259	6.8kΩ 5% carbon film	1/8W
	R31	80.5261	10kΩ 5% carbon film	1/8W
	R32	80.5251	1.5kΩ 5% carbon film	1/8W
	R33	80.5264	18kΩ 5% carbon film	1/8W
	R34	80.5278	0.27 MΩ 5% carbon film	1/8W
	R35	80.5261	10kΩ 5% carbon film	1/8W
	R36	80.5276	0.18 MΩ 5% carbon film	1/8W
	R37	80.5253	2.2kΩ 5% carbon film	1/8W
	R38	80.5264	18kΩ 5% carbon film	1/8W
	R39	80.5276	0.18 MΩ 5% carbon film	1/8W
	R40	80.5261	10kΩ 5% carbon film	1/8W
	R41	80.5261	10kΩ 5% carbon film	1/8W
	R42	80.5261	10kΩ 5% carbon film	1/8W
	R43	80.5276	0.18 MΩ 5% carbon film	1/8W
	R44	80.5250	1.2kΩ 5% carbon film	1/8W
	R45	80.5264	18kΩ 5% carbon film	1/8W
	R46	80.5276	0.18 MΩ 5% carbon film	1/8W
	R47	80.5261	10kΩ 5% carbon film	1/8W
	R48	80.5262	12kΩ 5% carbon film	1/8W
	R49	80.5261	10kΩ 5% carbon film	1/8W
	R50	80.5261	10kΩ 5% carbon film	1/8W
	R51	80.5262	12kΩ 5% carbon film	1/8W
	R52	80.5226	12Ω 5% carbon film	1/8W
	R53	80.5251	1.5kΩ 5% carbon film	1/8W

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR781

X401.962

Storno

TYPE	NO.	CODE	DATA
	R54	80.5253	2.2kΩ 5% carbon film 1/8W
	R55	80.5258	5.6kΩ 5% carbon film 1/8W
	R56		Not used
	R57	80.5251	1.5kΩ 5% carbon film 1/8W
	R58	80.5251	1.5kΩ 5% carbon film 1/8W
	R59	80.5269	47kΩ 5% carbon film 1/8W
	R60	80.5061	10kΩ 5% carbon film 1/10W
	R61	80.5268	39kΩ 5% carbon film 1/8W
	R62	80.5268	39kΩ 5% carbon film 1/8W
	R63	80.5230	27Ω 5% carbon film 1/8W
	R64	80.5268	39kΩ 5% carbon film 1/8W
	R65	80.5263	15kΩ 5% carbon film 1/8W
	R66	80.5265	22kΩ 5% carbon film 1/8W
	R67	80.5268	39kΩ 5% carbon film 1/8W
	R68	80.5257	4.7kΩ 5% carbon film 1/8W
	R69	80.5257	4.7kΩ 5% carbon film 1/8W
	R70	80.5246	680Ω 5% carbon film 1/8W
	R71	80.5261	10kΩ 5% carbon film 1/8W
	R72	80.5255	3.3kΩ 5% carbon film 1/8W
	R73	80.5253	2.2kΩ 5% carbon film 1/8W
	R74	80.5261	10kΩ 5% carbon film 1/8W
	R75	80.5246	680Ω 5% carbon film 1/8W
	R76	80.5246	680Ω 5% carbon film 1/8W
	R77	80.5261	10kΩ 5% carbon film 1/8W
	L1	61.1172	Tone coil
	E1	99.5237	1N4148 Diode
	E2	99.5237	1N4148 Diode
	E3	99.5237	1N4148 Diode
	E4	99.5237	1N4148 Diode
	E5	99.5237	1N4148 Diode
	E6	99.5237	1N4148 Diode
	E7	99.5237	1N4148 Diode
	E8	99.5237	1N4148 Diode
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5144	S5144 Transistor
	Q4	99.5201	BC109 Transistor
	Q5	99.5201	BC109 Transistor
	Q6	99.5201	BC109 Transistor
	Q7	99.5201	BC109 Transistor
	Q8	99.5201	BC109 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor
	Q11	99.5144	S5144 Transistor
	Q12	99.5143	BC108 Transistor

Storno

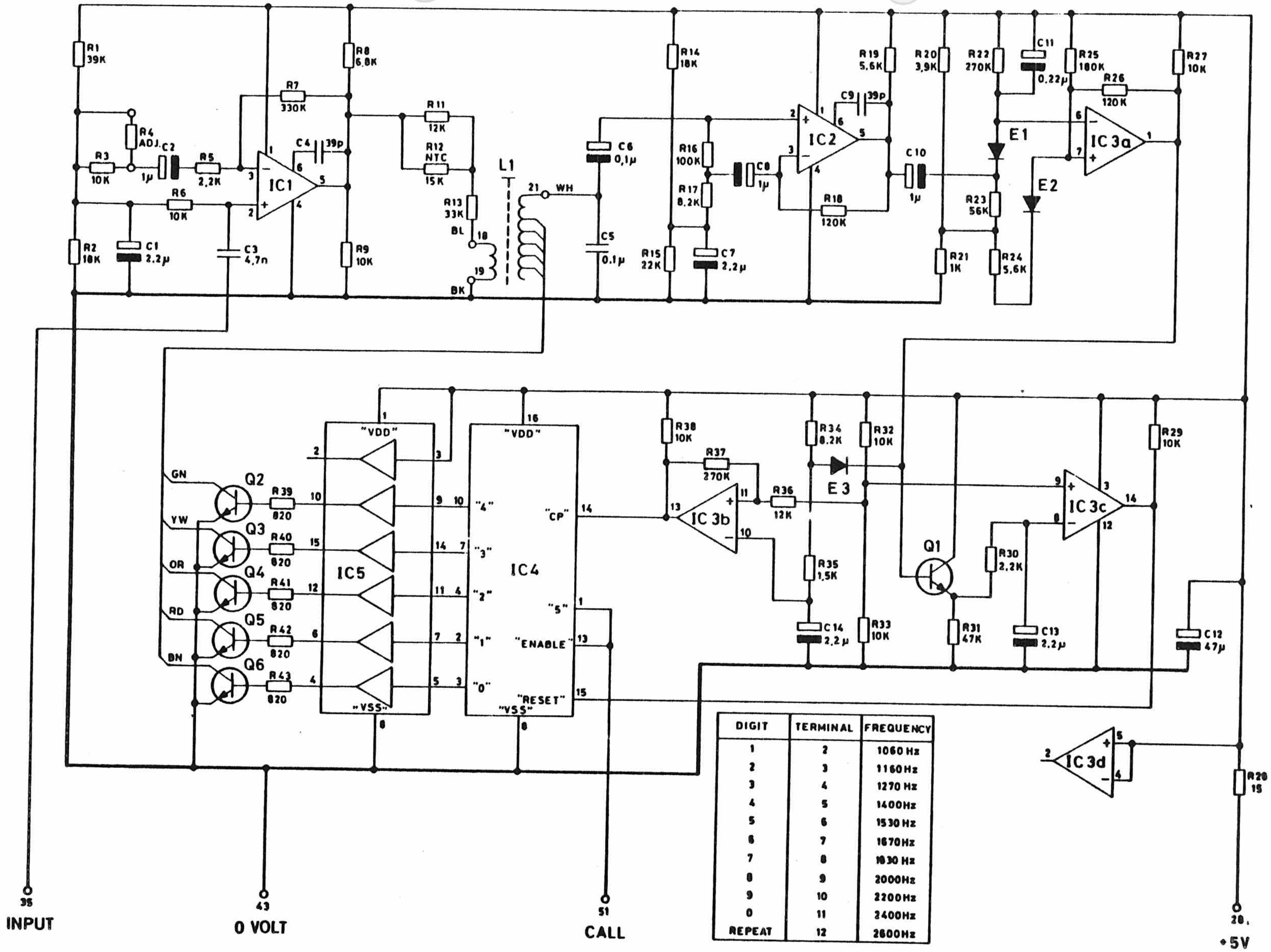
TYPE	NO.	CODE	DATA
	Q13	99.5143	BC108 Transistor
	Q14	99.5143	BC108 Transistor
	IC1	14.5017	Operational Amplifier
	IC2	14.5017	Operational Amplifier
	IC3	14.5019	Quadruple comparator
	IC4	14.5018	Quadruple 2-input pos. NOR Gate
	IC5	14.5018	Quadruple 2-input pos. NOR Gate
	IC6	14.5008	Dual J-K master-Slave Flip-Flop
	IC7	14.5008	Dual J-K master-Slave Flip-Flop
	IC8	14.5056	Dual J-K master-Slave Flip-Flop
	IC9	14.5055	Voltage regulator

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR781

X401.962

Storno



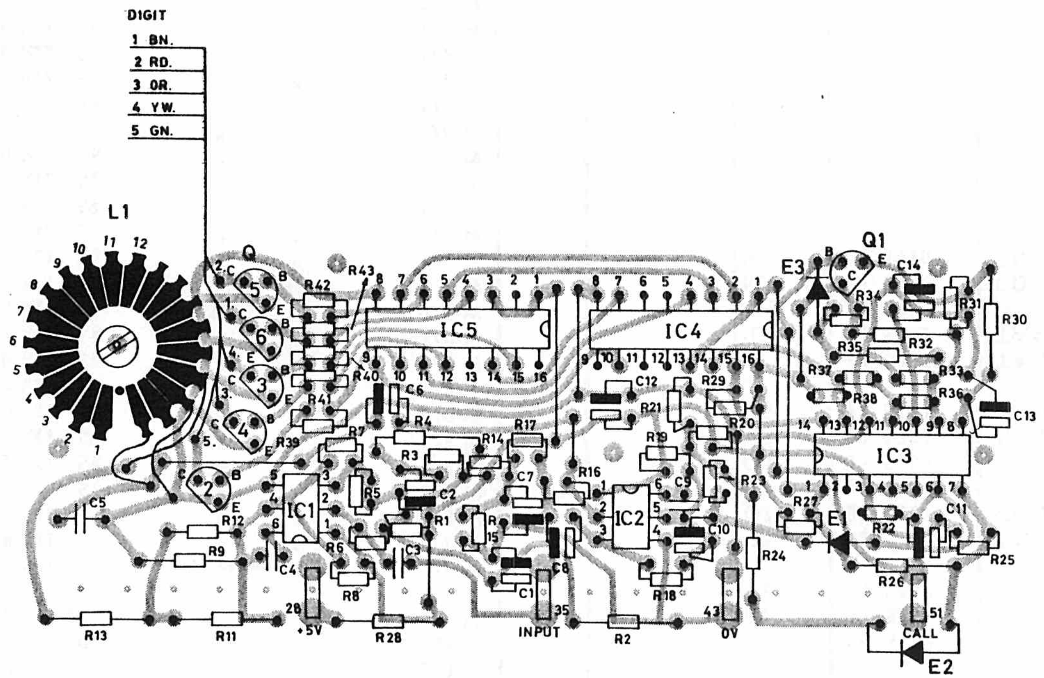
DIGIT	TERMINAL	FREQUENCY
1	2	1060 Hz
2	3	1160 Hz
3	4	1270 Hz
4	5	1400 Hz
5	6	1530 Hz
6	7	1670 Hz
7	8	1830 Hz
8	9	2000 Hz
9	10	2200 Hz
0	11	2400 Hz
REPEAT	12	2600 Hz

Storno

SEQUENTIAL TONE RECEIVER SR783

D402.372

Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

SEQUENTIAL TONE RECEIVER SR783

D402.511

Storno

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

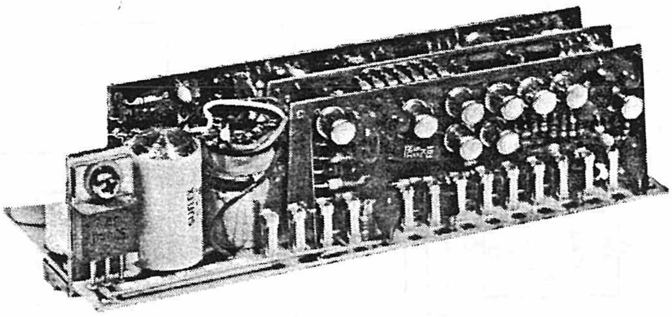
Storno

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

SEQUENTIAL TONE RECEIVER
SR785



Introduction

SR785 is a sequential tone receiver for selective calling. It was developed for use in Stornophone 700 radiotelephone equipment. The frequencies employed are the standard Storno series: 970 Hz to 2800 Hz.

SR785 is designed to operate on a 5-tone sequence, but can also be set to accommodate a 4-tone sequence.

General Description

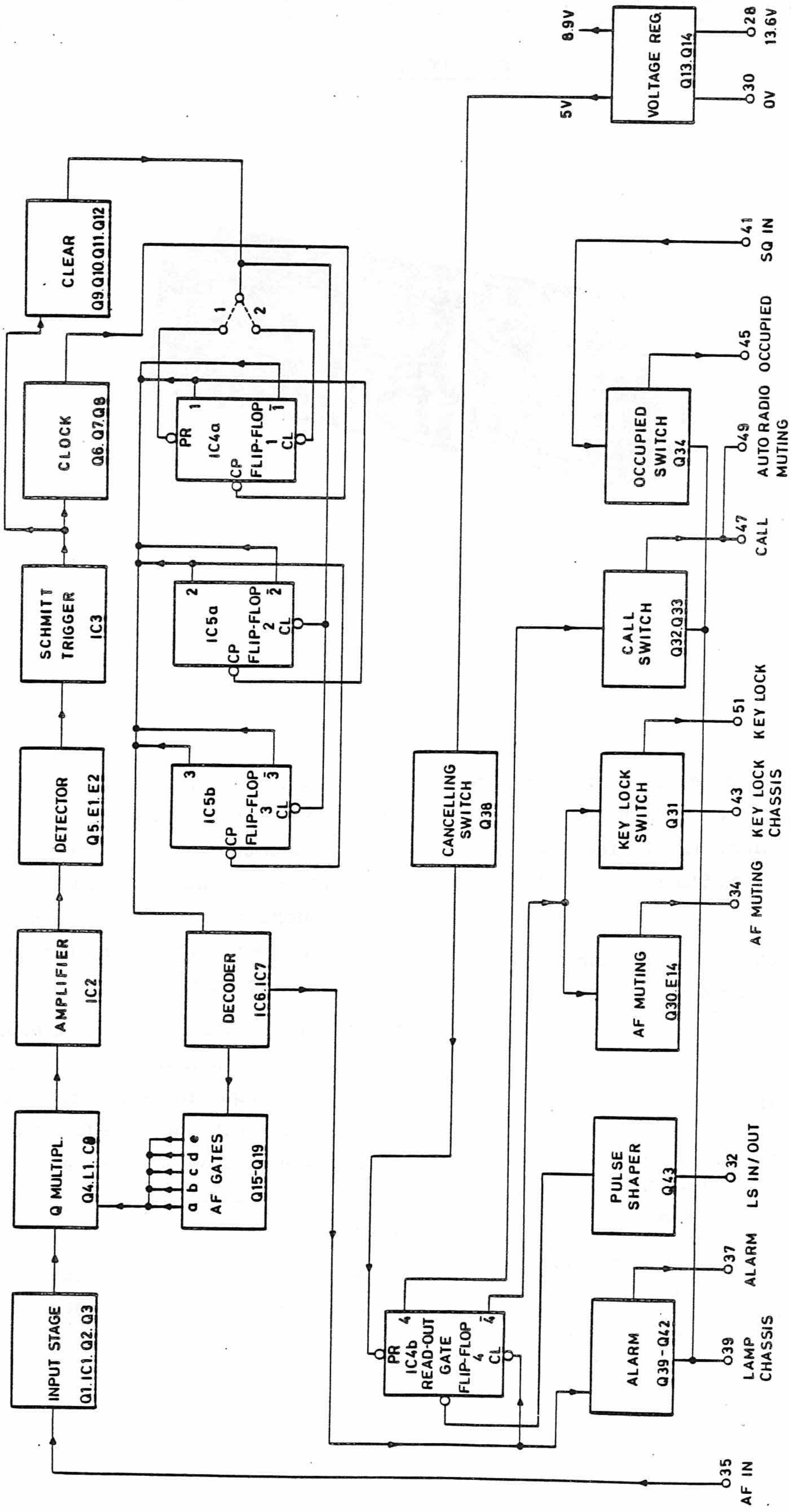
Upon reception of a signal having the correct tones in the proper sequence the following events take place (in the receiver):

The Call Lamp lights, the AF Muting is cancelled and the Key Lock function "unlocks". When the vehicle's traffic horn is connected to the tone receiver via an auxiliary relay, the horn will also sound for about one second.

The audio circuit and the Key Lock are both turned on and off manually by means of the LS IN/OUT push button. Since the switch that "unlocks" the Key Lock also turns on the loudspeaker, the operator is forced to check for the presence of another signal on the channel before being able to key his transmitter.

In addition, the tone receiver is equipped with an Occupied Lamp controlled by the squelch circuit in the radiotelephone receiver. Thus, if an RF signal having that channel's frequency is present at the antenna input it will cause the Occupied Lamp to light as an indication that the channel is not free.

After reception of a correct call the speaker will remain open until the LS IN/OUT button is depressed.



NOTE:
FOR 4-TONE CALLING: INSERT STRAP 1.
FOR 5-TONE CALLING: INSERT STRAP 2.

SR785

Logic Terms

Positive logic is employed in SR785; logical references are:

1. low voltage level (~0 V) = logic state "0" (LO)
2. high voltage level (~5 V) = logic state "1" (HI)

5-tone Signalling

The Input Stage includes Q1, IC1, Q2 and Q3. The first tone of a sequential tone signal, arriving from input terminal 35, passes through the input stage, where it becomes suitable for applying to the Q Multiplier.

In stand by the Q Multiplier is tuned, via AF Gate a, for the first tone of its code. If the first tone received corresponds to the circuit resonant frequency, it becomes selected, is then amplified in IC2 and rectified at the Detector, Q5, E1, and E2.

The rectified signal turns the Schmitt Trigger, IC3, ON. The output of IC3 becomes logic "1" and suspends the Clear function (Q9 - Q12). Binary Counters FF1 to FF3 are then ready to count.

A 25 ms delay is introduced between the time that the Schmitt Trigger output becomes logic "1" and the clock pulse from the Clock stage goes "1".

When the 1st tone ends, the Schmitt Trigger output goes "0" again, bringing the Clock output to logic "0". Counter FF1 then switches state, also causing the Decoder (IC6 and IC7) to step to the next AF gate, which is b.

The output of the Clear stage remains at logic "1" for about 40 ms after the Schmitt Trigger has returned to "0". The next (2nd) tone must be received within that time or the Clear function will reset the Counter and the Decoder will go back to stand by, i.e. ready to receive the 1st tone again.

The 2nd, 3rd, 4th, and 5th tones of a sequence occur like the 1st, each time stepping the Decoder one position forward until the final tone is received. At the end of the 5th tone the $IC7_c$ output goes "0" which causes the Alarm circuit to ground terminal 37. A relay connected here will sound the traffic horn for approximately 1 second.

$IC7_c$ also clears the Read-out Gate, FF4. This lights the Call Lamp via FF4 output 4 and terminal 47 while turning the speaker ON via output $\bar{4}$ and terminal 34.

The Call Lamp and the speaker will remain ON until switched OFF manually with the LS IN/OUT push button (via terminal 32).

When the channel is occupied (a carrier wave being received) the receiver squelch circuit feeds a voltage to terminal 41 (SQUELCH IN). The Occupied Lamp lights via terminal 45.

The Key Lock disables the transmitter via terminal 51. The voltage regulator will only supply power to the transmitter section when terminal 51 (KEY LOCK) from SR785 is at chassis ground potential.

Conditions for transmitting are:

AF Muting cancelled (term. 34 LO)
Call Lamp ON (term. 47 to ground)
Key Lock cancelled (term. 51 to ground)

Approximately 40 ms after the last tone in the sequence, the Clear output goes "0", clearing Counter FF1 - FF3. AF Gate a is then set to wait for the 1st tone of a new call.

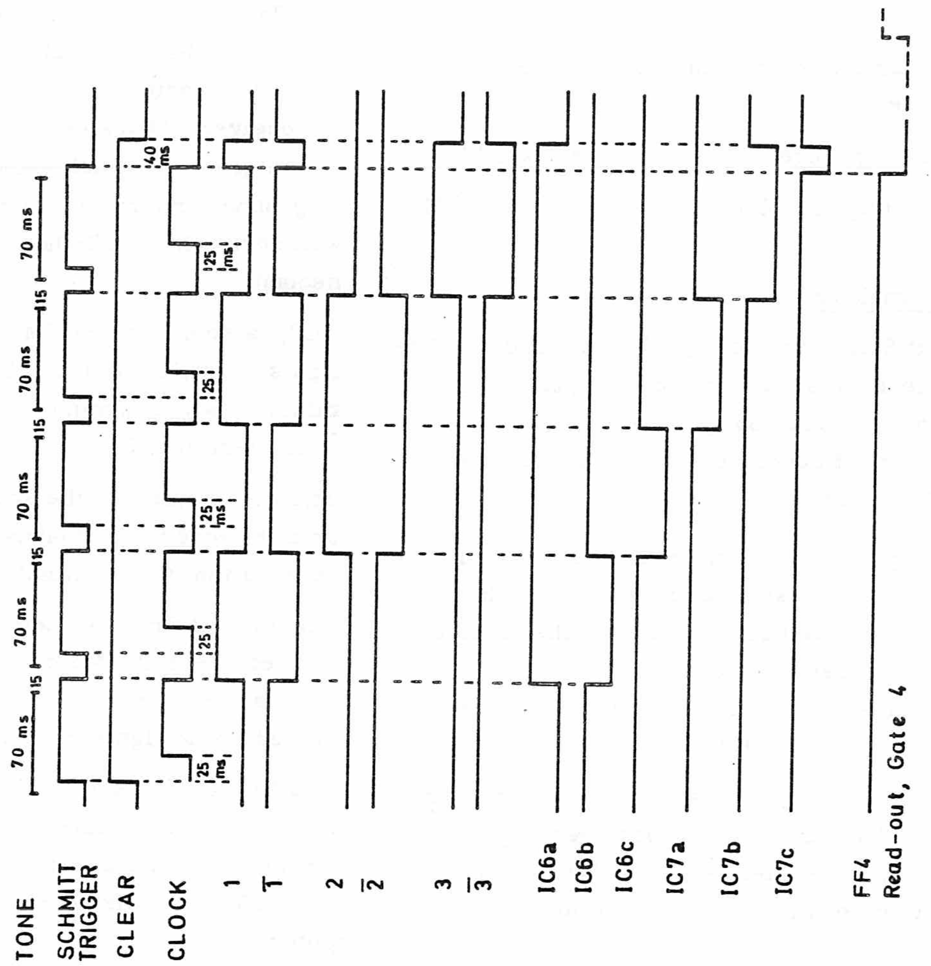
4-tone Signals

SR785 can also be strapped for 4-tone code signalling. The Clear output will then preset FF1 to switch in AF Gate b when in stand by, thus by-passing Gate a.

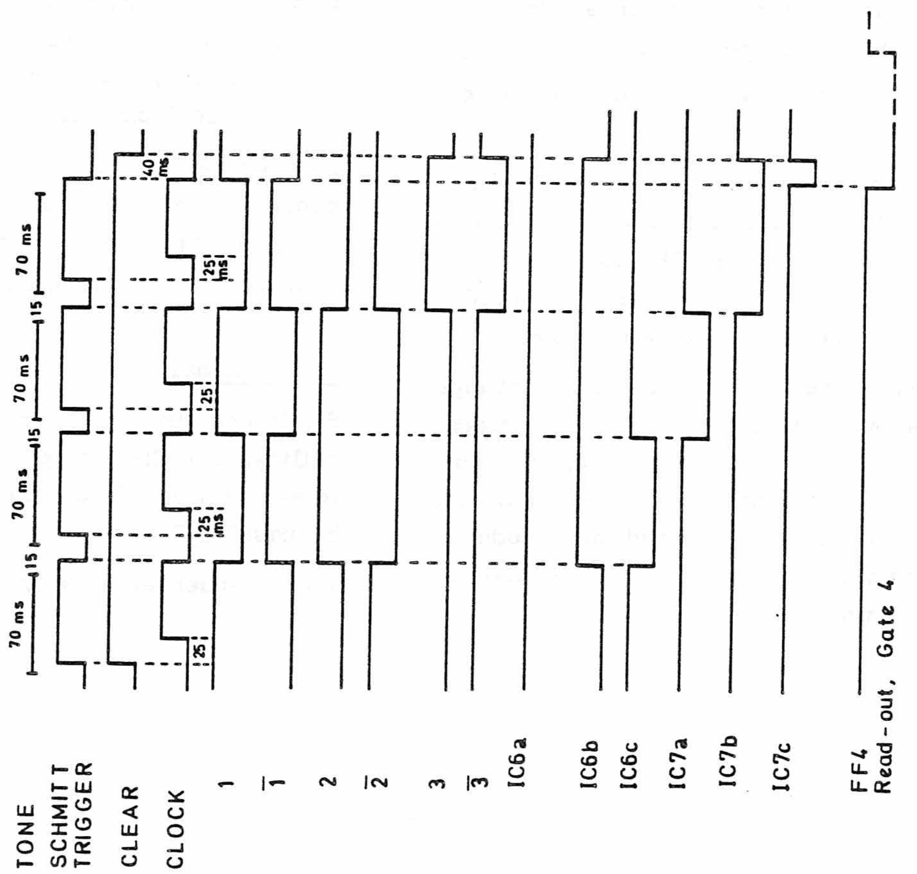
Pulse sequences for 4 and 5-tone signals follow:

Storno

5-TONE PULSE SEQUENCE



4-TONE PULSE SEQUENCE



Input Stage (Q1, IC 1, Q2, Q3)

The pre-emphasis network includes Q1, R4 and C4.

IC 1 is a linear amplifier. Signal clipping begins when the signal amplitude approaches the supply voltage level (5V). Full amplitude limiting occurs when the input signal is 6 dB above the nominal 110 mV value.

R5 and R8 determine the amplifier gain. Voltage divider R6 and R7 sets the DC output level.

The limiting action and the narrow pass-band of the subsequent Q Multiplier ensure selectivity. Tones differing by at least 4.5 % from the resonant frequency will not be able to trigger the tone receiver.

Transistors Q2 and Q3 are arranged so that they present an extremely low output impedance (on the order of 1Ω) which is suitable as a common return connection for the resonant circuit in the following stage.

Q Multiplier (Q4)

The Q Multiplier involves a parallel resonant circuit, L1 and C8. This is very loosely coupled to the transistor, Q4, in order to maintain a constant Q over the entire tone range. C8 in the resonant circuit is grounded through the output impedances of the driver transistors while the relevant terminals of coil L1 are alternately grounded through the AF Gates, a - e (Q15 - Q19).

A portion of the tone signal is reapplied to L1 in phase by means of a feedback winding in the collector circuit of Q4, approximately doubling the Q of L1.

To offset the effect of temperature upon the Q of L1 an NTC resistor, R19, is inserted in the emitter circuit of Q4. R19, aided by R17 and R18, maintains a nearly flat temperature response from -30° C to +80° C.

Amplifier (IC2)

The signal from the Q Multiplier is DC coupled to the non-inverting input of IC2. Amplifier gain, and thus trigger level for the Schmitt Trigger, is adjustable by changing the value of R20.

Detector (Q5, E1, E2)

Emitter follower Q5 drives the voltage doubling rectifier circuit.

Schmitt Trigger (IC3)

The Schmitt Trigger is an operational amplifier working as a threshold detector to control the Clock and the Clear settings. The threshold voltage is set by network R29, E3, and R30.

In stand by the state of the non-inverting input is logic "0", thus the trigger output is also "0". When the rectified DC voltage from the Detector surpasses the threshold the Schmitt Trigger switches state and the output goes "1".

Clock (Q6, Q7, Q8)

The Clock toggles Counter FF1 after first introducing a 25 ms delay in order to prevent erratic operation. The Clock output pulse is delayed until the Schmitt Trigger has displayed a logic "1" output state for approx. 25 ms. Delay time is adjustable by means of R35.

In stand by the output state of IC3 is "0", holding Q6, Q7, and Q8 ON. Clock output is also "0". When IC3 triggers, its output goes logic "1". This cuts off Q6, and C16 begins charging through R34 in parallel with R35. After the set delay time, Q7 becomes reverse biased and cuts off, turning Q8 OFF. Clock output at the collector of Q8 goes "1".

When the tone ends, the Schmitt Trigger returns to its quiescent state and Q6 goes ON an C16 discharges rapidly through Q6 and R36, turning Q7, then Q8 ON. Clock output switches to logic state "0", and FF1 toggles.

Clear Circuit (Q9 - Q12, E5, E6)

The Clear circuit sets the Counter to stand by approx. 40 ms after the last correct tone arrives. Where the tone code is correct for the receiver setting the last tone will, of course, be the 5 th tone (4 th tone with 4-tone signalling). In the event of an incorrect tone code, the tone receiver will respond normally until one of the tones in the false sequence fails to match the resonant frequency set up by the AF Gates. Since each tone lasts for about 70 ms, the Clear circuit will have reset the Counter to stand by before the incorrect tone expires and prior to the arrival of the next tone.

Emitter follower Q9 is driven by the Schmitt Trigger output through diode E5. In stand by, E5 cannot conduct, and Q9 is OFF. Q10, Q11, and Q12 are all ON, and output is at logic "0".

When the Schmitt Trigger output goes "1", E5 conducts, turning Q9 ON. C18 discharges through Q9, whereby Q10, Q11, and Q12 go OFF (output state "1"). The Counter is now able to start counting.

At the end of a tone E5 stops conducting (trigger output at "0" again) and C18 charges through R42 and R43. The charge building up on C18 eventually overcomes the emitter bias and turns Q10 ON. Emitter voltage for Q10, and thus the time elapsing before the Clear circuit returns to its quiescent state, is determined by voltage divider R45 and R46. When Q10 conducts, it turns Q11 and Q12 ON, as well, resetting the Counter to stand by.

The 40 ms delay is measured as the time elapsed between the Schmitt Trigger output "0" and when the Clear output goes "0".

Tones in a sequence arrive with maximum 15 ms interval between them, which is fast enough to keep the Clear output at "1".

When battery voltage is initially applied to the circuit a positive pulse is fed through E6 to the base of Q11, driving Q12 into saturation and ensuring that the Counter is cleared and ready to accommodate an incoming call.

Counter FF1 - FF3 ($IC4_a$, $IC5_a$, $IC5_b$)

The Counter is composed of three J-K master-slave flip-flops with their J-K inputs all tied to logic state "1" through resistor R87. Each FF will thus toggle whenever it receives a clock pulse at the same time that its Clear input is held at "1". The Clock stage toggles FF1, FF1 toggles FF2, and FF2 toggles FF3.

FF1 has a Preset as well as a Clear function, allowing the tone receiver to be strapped to either 4-tone or 5-tone sequencies.

Truth tables for these two modes follow:

Truth Table for the Counter

5-tone

	1	$\overline{1}$	2	$\overline{2}$	3	$\overline{3}$
Cleared (pending call)	0	1	0	1	0	1
After the first tone	1	0	0	1	0	1
After the second tone	0	1	1	0	0	1
After the third tone	1	0	1	0	0	1
After the fourth tone	0	1	0	1	1	0
After the fifth tone	1	0	0	1	1	0
40 ms after the last tone (cleared pending call)	0	1	0	1	0	1

4-tone

	1	$\overline{1}$	2	$\overline{2}$	3	$\overline{3}$
Preset (pending call)	1	0	0	1	0	1
After the first tone	0	1	1	0	0	1
After the second tone	1	0	1	0	0	1
After the third tone	0	1	0	1	1	0
After the fourth tone	1	0	0	1	1	0
40 ms after the last tone (cleared pending call)	1	0	0	1	0	1

Decoder (IC6, IC7)

Each Decoder IC contains 3 separate, 3-input TTL NAND gates.

The output of a NAND gate is LO (logic "0") only when all of its inputs are HI (logic "1").

In stand by, 5-tone mode, the output of $IC6_a$ is always "0". In the 4-tone mode, the output of $IC6_b$ will be "0", instead.

At the end of a correct tone call $IC7_c$ presents a logic "0" to the Read-out Gate and to the Alarm circuit. The Alarm output, terminal 37, goes "0" through Q42.

AF Gates a, b, c, d, e (Q15 - Q19)

The AF Gates are controlled from the Decoder NAND gates, $IC6_a$ - $IC7_b$. When a transistor

Storno

base is driven L0 (logic "0") by a NAND gate, that transistor will conduct and ground the coil terminal connected to its collector.

Alarm Circuit (Q39 - Q42, E18)

In stand by, Q39 is ON and E18 cannot conduct. Q40 and Q41 are both ON, and Q42 is OFF.

A correct call turns Q39 OFF and C46 charges through E18, causing Q40 and Q41 to turn OFF, driving Q42 ON, and connecting terminal 37 (ALARM) to chassis ground.

After approximately 40 ms (the clear delay) $IC7_c$ goes "1" and turns Q39 ON again. E18 can no longer conduct and C46 discharges through R114. After the delay caused by the time constant of C46 - R114, Q40 and Q41 turn ON and disconnect the Alarm circuit common return through Q42. The Alarm stays ON for approximately 1 second.

AF Muting and Key Lock Switch (Q30, Q31, E14)

The AF Muting and the Key Lock are controlled by the output of Read-out Gate $IC4_b$ (output $\overline{4}$).

In stand by the outputs of Q30 and Q31 are HI (∿ +10V), E14 conducts and the loudspeaker is muted through terminal 34.

As long as the potential at terminal 51 is HI, the transmitter keying function is also disabled.

When the Read-out Gate is activated, output $\overline{4}$ goes "1", and Q30 and Q31 conduct, suspending the AF Muting and Key Lock functions.

Call and Occupied Lamp Switches (Q32, Q33, Q34)

The Call Lamp Switch, Q33, lights the Call Lamp by grounding it through terminal 47.

Terminal 49, in parallel with terminal 47, is provided for automatic muting of the vehicle's broadcast band radio, and requires an auxiliary relay.

At the end of a tone sequence, output 4 of FF4 goes "0", cutting Q32 OFF and turning Q33 ON, to complete the common return path for terminals 47 and 49.

Whenever the channel is occupied a DC voltage from the Squelch circuit, via terminal 41, turns Q34 ON, grounding the Occupied Lamp through terminal 45.

Cancelling Switch (Q38)

When the radiotelephone is turned ON the output functions must not be activated. To ensure this, Q38 feeds a negative pulse ("0") to the Preset of the Read-out Gate. When the battery voltage is switched ON, C41 discharges through Q38 which goes ON briefly, presetting the Read-out Gate.

Technical Specifications

Supply Power

Nominal:	13.6 V
Minimum:	10.5 V
Maximum:	16.0 V

Current Drain

Stand by: 100 mA ± 15 mA

Regulated Voltages

Nominal: 8.9 V and 4.9 V

Temperature Range

Operating range: -25°C to $+60^{\circ}$C
Functioning range: -30°C to $+80^{\circ}$C

Input Impedance

≥ 6 KΩ

Signal Input Level

Nominal at 1000 Hz: 110 mV

Equalization

Preemphasis (by RC function) f_c = 1000 Hz

Signalling Code

Sequence of 4 or 5 tone bursts of 70 ms ± 15 ms duration with maximum 15 ms interval between tone bursts.

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Tone Signal Frequencies

Coil terminal	Tone frequency
1	970 Hz
2	1060 Hz
3	1160 Hz
4	1270 Hz
5	1400 Hz
6	1530 Hz
7	1670 Hz
8	1830 Hz
9	2000 Hz
10	2200 Hz
11	2400 Hz
12	2600 Hz
13	2800 Hz

Frequency Accuracy

Coil tuned for 1060 Hz: $\leq$ 0.4% for all tones

Frequency Stability

(typically $\leq$0.5%): $\leq$ 1.0%

Selectivity

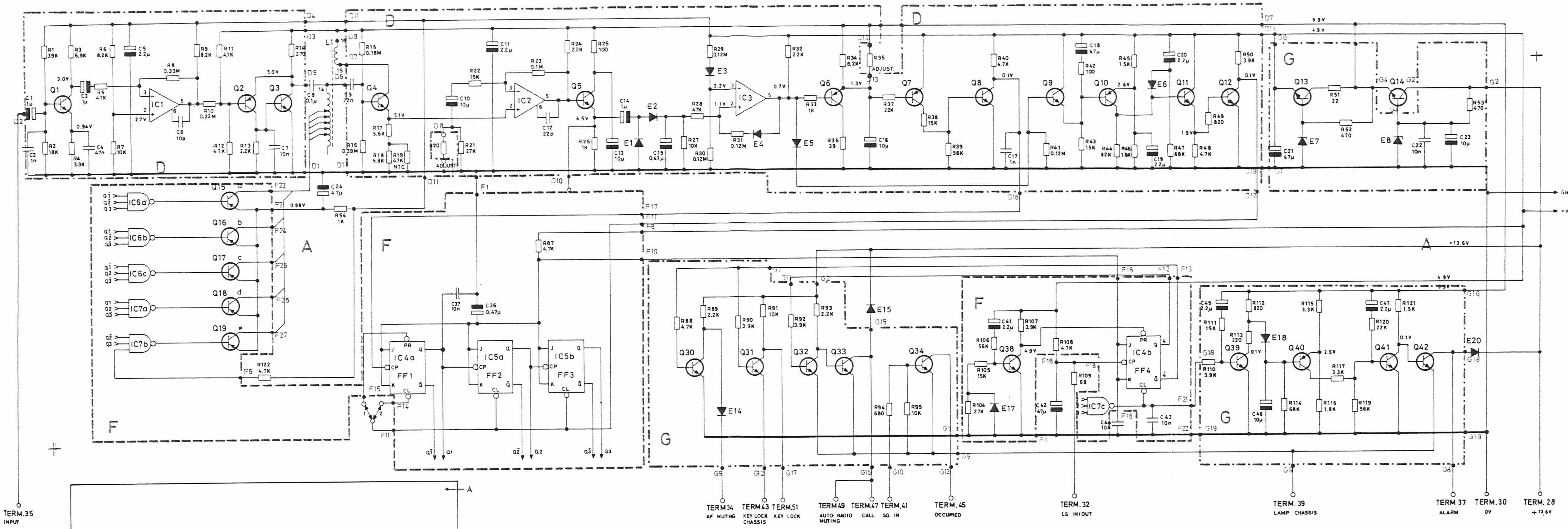
Frequencies differing from f_o by 4.5% or more are unable to trigger the tone receiver.

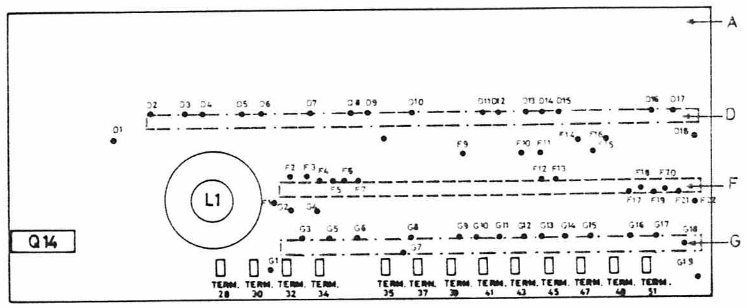
Maximum Load Currents

Terminal 37	ALARM	100 mA (for 1.2 sec)
Terminal 47	CALL	100 mA
Terminal 45	OCCUPIED	100 mA
Terminal 51 and 43	KEY LOCK	10 mA
Terminal 34	AF MUTING	I_{load} min. 0.75 mA for V_{out} = 8 V

AF Muting

In conjunction with terminal 18 of CF701: $\geq$ 60 dB.



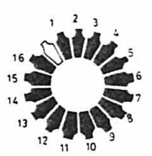


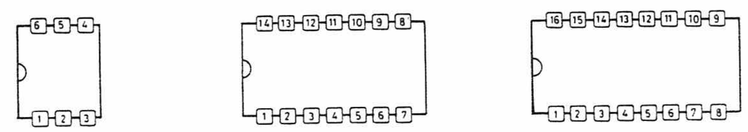
4-TONE SEQUENTIAL RECEIVER: INSERT STRAP 1

5-TONE SEQUENTIAL RECEIVER: INSERT STRAP 2

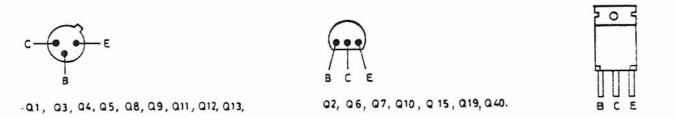
TERM.	DIGIT	FREQ.
1	X	970 Hz
2	1	1060 -
3	2	1160 -
4	3	1270 -
5	4	1400 -
6	5	1530 -
7	6	1670 -
8	7	1830 -
9	8	2000 -
10	9	2200 -
11	0	2400 -
12	REPEAT	2600 -
13	ALARM	2800 -

	Vcc PIN	GND PIN
IC1	2	6
IC2	2	6
IC3	2	6
IC4	5	13
IC5	4	11
IC6	14	7
IC7	14	7


L1


IC1, IC2, IC3.   IC5, IC6, IC7.   IC4

TOP VIEW


Q1, Q3, Q4, Q5, Q8, Q9, Q11, Q12, Q13, Q30, Q34, Q38, Q39, Q41, Q42.

Q2, Q6, Q7, Q10, Q15, Q19, Q40.

BOTTOM VIEW

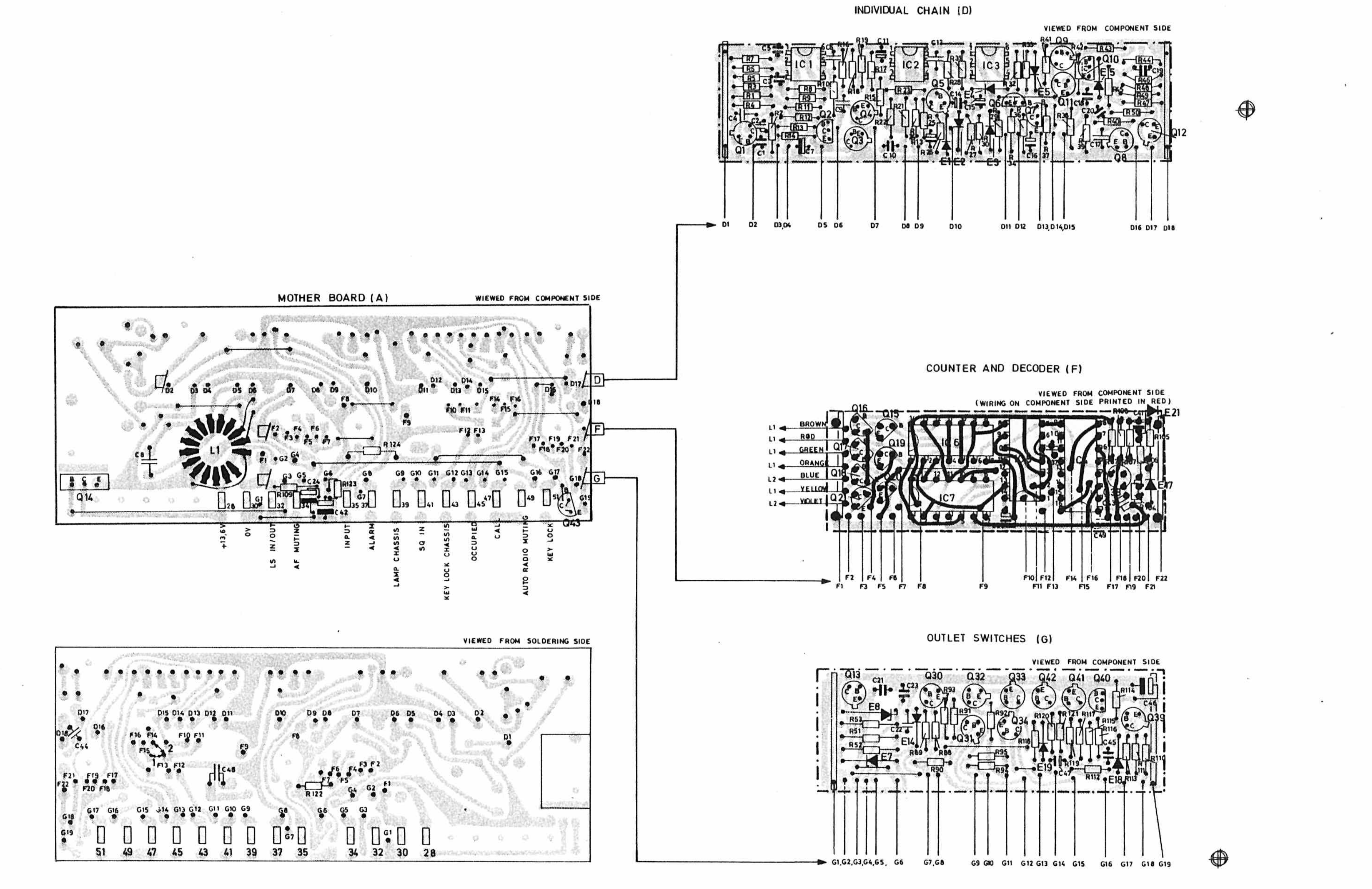
Q14

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR785

D401.722

Storno



SEQUENTIAL TONE RECEIVER SR785
SEKVENSTONEMODTAGER

D401.978

Storno

TYPE	NO.	CODE	DATA	
SR785		10.2541	Sequential Tone Receiver	
	C1	73.5135	1μF -20 + 50% tantal	16V
	C2	76.5069	1nF 10% polyest. FL	50V
	C3	73.5135	1μF -20 + 50% tantal	16V
	C4	76.5072	47nF 10% polyest. FL	50V
	C5	73.5129	2.2μF -20 + 50% tantal	10V
	C6	74.5135	10pF 5% ceram	125V
	C7	76.5070	10nF 10% polyest. FL	50V
	C8	76.5068	0.1μF 1% polystyr TB	63V
	C9	76.5071	22nF 10% polyest. FL	50V
	C10	73.5109	10μF 20% tantal	16V
	C11	73.5129	2.2μF -20 + 50% tantal	10V
	C12	74.5106	22pF ± 0.5pF ceram	160V
	C13	73.5109	10μF 20% tantal	16V
	C14	73.5114	1μF 20% tantal	35V
	C15	73.5125	0.47μF 20% tantal	35V
	C16	73.5109	10μF 20% tantal	16V
	C17	76.5069	1nF 10% polyest. FL	50V
	C18	73.5126	4.7μF 20% tantal	35V
	C19	73.5129	2.2μF -20 + 50% tantal	10V
	C20	73.5129	2.2μF -20 + 50% tantal	10V
	C21	73.5124	47μF 20% tantal	6.3V
	C22	76.5070	10nF 10% polyest. FL	50V
	C23	73.2109	10μF 20% tantal	16V
	C24	73.5124	47μF 20% tantal	6.3V
	C36	73.5134	0.47μF -20 + 50% tantal	16V
	C37	74.5109	10nF -20 + 80% ceram PL	20V
	C41	73.5129	2.2μF -20 + 50% tantal	10V
	C42	73.5124	47μF 20% tantal	6.3V
	C43	74.5109	10nF -20 + 80% ceram PL	20V
	C44	74.5109	10nF -20 + 80% ceram PL	20V
	C45	73.5129	2.2μF -20 + 50% tantal	10V
	C46	73.5109	10μF 20% tantal	16V
	C47	73.5129	2.2μF -20 + 50% tantal	10V
	R1	80.5068	39kΩ 5% carbon film	0.1W
	R2	80.5064	18kΩ 5% carbon film	0.1W
	R3	80.5059	6.8kΩ 5% carbon film	0.1W
	R4	80.5055	3.3kΩ 5% carbon film	0.1W
	R5	80.5069	47kΩ 5% carbon film	0.1W
	R6	80.5060	8.2kΩ 5% carbon film	0.1W
	R7	80.5061	10kΩ 5% carbon film	0.1W
	R8	80.5079	0.39MΩ 5% carbon film	0.1W
	R9	80.5060	8.2kΩ 5% carbon film	0.1W
	R10	80.5077	0.22MΩ 5% carbon film	0.1W
	R11	80.5057	4.7kΩ 5% carbon film	0.1W

Storno

TYPE	NO.	CODE	DATA	
	R12	80.5057	4.7kΩ 5% carbon film	0.1W
	R13	80.5053	2.2kΩ 5% carbon film	0.1W
	R14	80.5042	270Ω 5% carbon film	0.1W
	R15	80.5076	0.18MΩ 5% carbon film	0.1W
	R16	80.5080	0.39MΩ 5% carbon film	0.1W
	R17	80.5058	5.6kΩ 5% carbon film	0.1W
	R18	80.5059	6.8kΩ 5% carbon film	0.1W
	R19	89.5009	4.7kΩ 20% NTC	0.6W
	R20	80.50xx	Adjusted 5% carbon film	0.1W
	R21	80.5066	27kΩ 5% carbon film	0.1W
	R22	80.5063	15kΩ 5% carbon film	0.1W
	R23	80.5073	0.1MΩ 5% carbon film	0.1W
	R24	80.5053	2.2kΩ 5% carbon film	0.1W
	R25	80.5037	100Ω 5% carbon film	0.1W
	R26	80.5049	1kΩ 5% carbon film	0.1W
	R27	80.5061	10kΩ 5% carbon film	0.1W
	R28	80.5069	47kΩ 5% carbon film	0.1W
	R29	80.5074	0.12MΩ 5% carbon film	0.1W
	R30	80.5074	0.12MΩ 5% carbon film	0.1W
	R31	80.5074	0.12MΩ 5% carbon film	0.1W
	R32	80.5053	2.2kΩ 5% carbon film	0.1W
	R33	80.5049	1kΩ 5% carbon film	0.1W
	R34	80.5060	8.2kΩ 5% carbon film	0.1W
	R35	80.50xx	Adjusted 5% carbon film	0.1W
	R36	80.5032	39Ω 5% carbon film	0.1W
	R37	80.5065	22kΩ 5% carbon film	0.1W
	R38	80.5063	15kΩ 5% carbon film	0.1W
	R39	80.5070	56kΩ 5% carbon film	0.1W
	R40	80.5057	4.7kΩ 5% carbon film	0.1W
	R41	80.5074	0.12MΩ 5% carbon film	0.1W
	R42	80.5037	100Ω 5% carbon film	0.1W
	R43	80.5063	15kΩ 5% carbon film	0.1W
	R44	80.5072	82kΩ 5% carbon film	0.1W
	R45	80.5051	1.5kΩ 5% carbon film	0.1W
	R46	80.5052	1.8kΩ 5% carbon film	0.1W
	R47	80.5071	68kΩ 5% carbon film	0.1W
	R48	80.5057	4.7kΩ 5% carbon film	0.1W
	R49	80.5048	820Ω 5% carbon film	0.1W
	R50	80.5056	3.9kΩ 5% carbon film	0.1W
	R51	80.5229	22Ω 5% carbon film	1/8W
	R52	80.5245	470Ω 5% carbon film	1/8W
	R53	80.5245	470Ω 5% carbon film	1/8W

SEQUENTIAL TONE RECEIVER SR785
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X401.701

TYPE	NO.	CODE	DATA	
	R54	80.5049	1kΩ 5% carbon film	0.1W
	R87	80.5057	4.7kΩ 5% carbon film	0.1W
	R88	80.5057	4.7kΩ 5% carbon film	0.1W
	R89	80.5053	2.2kΩ 5% carbon film	0.1W
	R90	80.5056	3.9kΩ 5% carbon film	0.1W
	R91	80.5061	10kΩ 5% carbon film	0.1W
	R92	80.5056	3.9kΩ 5% carbon film	0.1W
	R93	80.5053	2.2kΩ 5% carbon film	0.1W
	R94	80.5047	680Ω 5% carbon film	0.1W
	R95	80.5061	10kΩ 5% carbon film	0.1W
	R104	80.5066	27kΩ 5% carbon film	0.1W
	R105	80.5063	15kΩ 5% carbon film	0.1W
	R106	80.5070	56kΩ 5% carbon film	0.1W
	R107	80.5056	3.9kΩ 5% carbon film	0.1W
	R108	80.5057	4.7kΩ 5% carbon film	0.1W
	R109	80.5035	68Ω 5% carbon film	0.1W
	R110	80.5056	3.9kΩ 5% carbon film	0.1W
	R111	80.5063	15kΩ 5% carbon film	0.1W
	R112	80.5048	820Ω 5% carbon film	0.1W
	R113	80.5041	220Ω 5% carbon film	0.1W
	R114	80.5071	68kΩ 5% carbon film	0.1W
	R115	80.5055	3.3kΩ 5% carbon film	0.1W
	R116	80.5052	1.8kΩ 5% carbon film	0.1W
	R117	80.5055	3.3kΩ 5% carbon film	0.1W
	R119	80.5070	56kΩ 5% carbon film	0.1W
	R120	80.5065	22kΩ 5% carbon film	0.1W
	R121	80.5051	1.5kΩ 5% carbon film	0.1W
	R122	80.5057	4.7kΩ 5% carbon film	0.1W
	L1	61.1148	Tone coil	
	E1	99.5237	1N4148 Diode	
	E2	99.5237	1N4148 Diode	
	E3	99.5237	1N4148 Diode	
	E4	99.5237	1N4148 Diode	
	E5	99.5237	1N4148 Diode	
	E6	99.5237	1N4148 Diode	
	E7	99.5114	5.6V 5% Zenerdiode	0.25W
	E8	99.5042	9.1V 5% Zenerdiode	0.25W
	E14	99.5237	1N4148 Diode	
	E15	99.5020	1N4004 Diode	
	E17	99.5237	1N4148 Diode	
	E18	99.5237	1N4148 Diode	
	E20	99.5020	1N4004 Diode	
	Q1	99.5143	BC108 Transistor	
	Q2	99.5144	BC214L Transistor	

TYPE	NO.	CODE	DATA
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5144	BC214L Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5144	BC214L Transistor
	Q11	99.5143	BC108 Transistor
	Q12	99.5143	BC108 Transistor
	Q13	99.5143	BC108 Transistor
	Q14	99.5246	TIP31 Transistor
	Q15	99.5144	BC214L Transistor
	Q16	99.5144	BC214L Transistor
	Q17	99.5144	BC214L Transistor
	Q18	99.5144	BC214L Transistor
	Q19	99.5144	BC214L Transistor
	Q30	99.5143	BC108 Transistor
	Q31	99.5143	BC108 Transistor
	Q32	99.5143	BC108 Transistor
	Q33	99.5143	BC108 Transistor
	Q34	99.5143	BC108 Transistor
	Q38	99.5143	BC108 Transistor
	Q39	99.5143	BC108 Transistor
	Q40	99.5143	BC108 Transistor
	Q41	99.5143	BC108 Transistor
	Q42	99.5143	BC108 Transistor
	IC1	14.5017	TAA861 Operational Amplifier
	IC2	14.5017	TAA861 Operational Amplifier
	IC3	14.5017	TAA861 Operational Amplifier
	IC4	14.5009	Dual J-K Master-slave F.F. Clear/pres.
	IC5	14.5008	Dual J-K Master-slave F.F. Clear
	IC6	14.5007	Triple 3-input NAND Gate
	IC7	14.5007	Triple 3-input NAND Gate

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR785

X401.701

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TYPE	NO.	CODE	DATA	
SR785		10.2541	Sequential Tone Receiver	
	C1	73.5135	1μF -20 + 50% tantal	16V
	C2	76.5069	1nF 10% polyest. FL	50V
	C3	73.5135	1μF -20 + 50% tantal	16V
	C4	76.5072	47nF 10% polyest. FL	50V
	C5	73.5129	2.2μF -20 + 50% tantal	10V
	C6	74.5135	10pF 5% ceram	125V
	C7	76.5070	10nF 10% polyest. FL	50V
	C8	76.5068	0.1μF 1% polystyr TB	63V
	C9	76.5071	22nF 10% polyest. FL	50V
	C10	73.5109	10μF 20% tantal	16V
	C11	73.5129	2.2μF -20 + 50% tantal	10V
	C12	74.5106	22pF ±0.5pF ceram	160V
	C13	73.5109	10μF 20% tantal	16V
	C14	73.5114	1μF 20% tantal	35V
	C15	73.5125	0.47μF 20% tantal	35V
	C16	73.5109	10μF 20% tantal	16V
	C17	76.5069	1nF 10% polyest. FL	50V
	C18	73.5126	4.7μF 20% tantal	35V
	C19	73.5129	2.2μF -20 + 50% tantal	10V
	C20	73.5129	2.2μF -20 + 50% tantal	10V
	C21	73.5124	47μF 20% tantal	6.3V
	C22	76.5070	10nF 10% polyest. FL	50V
	C23	73.2109	10μF 20% tantal	16V
	C24	73.5124	47μF 20% tantal	6.3V
	C36	74.5134	0.47μF -20+50% tantal	16V
	C37	74.5109	10 nF -20+80% ceram PL	20V
	C41	73.5129	2.2μF -20+50% tantal	10V
	C42	73.5129	2.2μF -20+50% tantal	10V
	C43	74.5109	10nF -20+80% ceram PL	20V
	C44	74.5109	10nF -20+80% ceram PL	20V
	C45	73.5129	2.2μF -20+50% tantal	10V
	C46	73.5109	10μF 20% tantal	16V
	C47	73.5129	2.2μF -20+50% tantal	10V
	C48	76.5070	10 nF 10% polyest. FL	50V
	C49	74.5155	1 nF -20+80% ceram PL	63V
	R1	80.5068	39 kΩ 5% carbon film	0.1W
	R2	80.5064	18 kΩ 5% carbon film	0.1W
	R3	80.5059	6.8kΩ 5% carbon film	0.1W
	R4	80.5055	3.3kΩ 5% carbon film	0.1W
	R5	80.5069	47kΩ 5% carbon film	0.1W
	R6	80.5060	8,2kΩ 5% carbon film	0.1W
	R7	80.5061	10kΩ 5% carbon film	0.1W
	R8	80.5079	0.39 MΩ 5% carbon film	0.1W
	R9	80.5060	8.2kΩ 5% carbon film	0.1W
	R10	80.5077	0.22 MΩ 5% carbon film	0.1W
	R11	80.5057	4.7kΩ 5% carbon film	0.1W

Storno

TYPE	NO.	CODE	DATA	
	R12	80.5057	4.7kΩ 5% carbon film	0.1W
	R13	80.5053	2.2kΩ 5% carbon film	0.1W
	R14	80.5042	270Ω 5% carbon film	0.1W
	R15	80.5076	0.18MΩ 5% carbon film	0.1W
	R16	80.5080	0.39MΩ 5% carbon film	0.1W
	R17	80.5058	5.6kΩ 5% carbon film	0.1W
	R18	80.5059	6.8kΩ 5% carbon film	0.1W
	R19	89.5009	4.7kΩ 20% NTC	0.6W
	R20	80.50xx	Adjusted 5% carbon film	0.1W
	R21	80.5066	27kΩ 5% carbon film	0.1W
	R22	80.5063	15kΩ 5% carbon film	0.1W
	R23	80.5073	0.1MΩ 5% carbon film	0.1W
	R24	80.5053	2.2kΩ 5% carbon film	0.1W
	R25	80.5037	100Ω 5% carbon film	0.1W
	R26	80.5049	1kΩ 5% carbon film	0.1W
	R27	80.5061	10kΩ 5% carbon film	0.1W
	R28	80.5069	47kΩ 5% carbon film	0.1W
	R29	80.5074	0.12MΩ 5% carbon film	0.1W
	R30	80.5074	0.12MΩ 5% carbon film	0.1W
	R31	80.5074	0.12MΩ 5% carbon film	0.1W
	R32	80.5053	2.2kΩ 5% carbon film	0.1W
	R33	80.5049	1kΩ 5% carbon film	0.1W
	R34	80.5060	8.2kΩ 5% carbon film	0.1W
	R35	80.50xx	Adjusted 5% carbon film	0.1W
	R36	80.5032	39Ω 5% carbon film	0.1W
	R37	80.5065	22kΩ 5% carbon film	0.1W
	R38	80.5063	15kΩ 5% carbon film	0.1W
	R39	80.5070	56kΩ 5% carbon film	0.1W
	R40	80.5057	4.7kΩ 5% carbon film	0.1W
	R41	80.5074	0.12MΩ 5% carbon film	0.1W
	R42	80.5037	100Ω 5% carbon film	0.1W
	R43	80.5063	15kΩ 5% carbon film	0.1W
	R44	80.5072	82kΩ 5% carbon film	0.1W
	R45	80.5051	1.5kΩ 5% carbon film	0.1W
	R46	80.5052	1.8kΩ 5% carbon film	0.1W
	R47	80.5071	68kΩ 5% carbon film	0.1W
	R48	80.5057	4.7kΩ 5% carbon film	0.1W
	R49	80.5048	820Ω 5% carbon film	0.1W
	R50	80.5056	3.9kΩ 5% carbon film	0.1W
	R51	80.5229	22Ω 5% carbon film	1/8W
	R52	80.5245	470Ω 5% carbon film	1/8W
	R53	80.5245	470Ω 5% carbon film	1/8W

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR785

X401.701/2

TYPE	NO.	CODE	DATA
	R54	80.5049	1kΩ 5% carbon film 0.1W
	R87	80.5057	4.7kΩ 5% carbon film 0.1W
	R88	80.5057	4.7kΩ 5% carbon film 0.1W
	R89	80.5053	2.2kΩ 5% carbon film 0.1W
	R90	80.5056	3.9kΩ 5% carbon film 0.1W
	R91	80.5061	10kΩ 5% carbon film 0.1W
	R92	80.5056	3.9kΩ 5% carbon film 0.1W
	R93	80.5053	2.2kΩ 5% carbon film 0.1W
	R94	80.5047	680Ω 5% carbon film 0.1W
	R95	80.5061	10kΩ 5% carbon film 0.1W
	R104	80.5066	27kΩ 5% carbon film 0.1W
	R105	80.5063	15kΩ 5% carbon film 0.1W
	R106	80.5070	56kΩ 5% carbon film 0.1W
	R107	80.5056	3.9kΩ 5% carbon film 0.1W
	R108	80.5057	4.7kΩ 5% carbon film 0.1W
	R109	80.5027	15Ω 5% carbon film 0.1W
	R110	80.5056	3.9kΩ 5% carbon film 0.1W
	R111	80.5063	15kΩ 5% carbon film 0.1W
	R112	80.5048	820Ω 5% carbon film 0.1W
	R113	80.5041	220Ω 5% carbon film 0.1W
	R114	80.5071	68kΩ 5% carbon film 0.1W
	R115	80.5055	3.3kΩ 5% carbon film 0.1W
	R116	80.5052	1.8kΩ 5% carbon film 0.1W
	R117	80.5055	3.3kΩ 5% carbon film 0.1W
	R119	80.5070	56kΩ 5% carbon film 0.1W
	R120	80.5065	22kΩ 5% carbon film 0.1W
	R121	80.5051	1.5kΩ 5% carbon film 0.1W
	R122	80.5057	4.7kΩ 5% carbon film 0.1W
	R123	80.5072	82 KΩ 5% carbon film 0.1W
	R124	80.5064	18 KΩ 5% carbon film 0.1W
	L1	61.1148	Tone coil
	E1	99.5237	1N4148 Diode
	E2	99.5237	1N4148 Diode
	E3	99.5237	1N4148 Diode
	E4	99.5237	1N4148 Diode
	E5	99.5237	1N4148 Diode
	E6	99.5237	1N4148 Diode
	E7	99.5114	5.6V 5% Zenerdiode 0.25W
	E8	99.5042	9.1V 5% Zenerdiode 0.25W
	E14	99.5237	1N4148 Diode
	E17	99.5237	1N4148 Diode
	E18	99.5237	1N4148 Diode
	Q1	99.5143	BC108 Transistor
	Q2	99.5144	BC214L Transistor

Storno

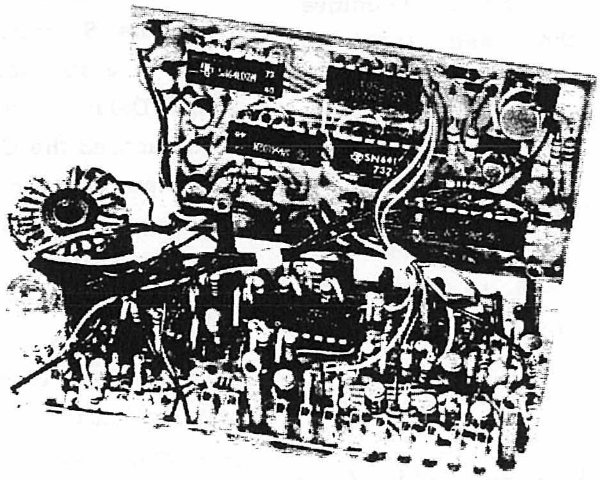
TYPE	NO.	CODE	DATA
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5144	BC214L Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5144	BC214L Transistor
	Q11	99.5143	BC108 Transistor
	Q12	99.5143	BC108 Transistor
	Q13	99.5143	BC108 Transistor
	Q14	99.5246	TIP31 Transistor
	Q15	99.5144	BC214L Transistor
	Q16	99.5144	BC214L Transistor
	Q17	99.5144	BC214L Transistor
	Q18	99.5144	BC214L Transistor
	Q19	99.5144	BC214L Transistor
	Q30	99.5143	BC108 Transistor
	Q31	99.5143	BC108 Transistor
	Q32	99.5143	BC108 Transistor
	Q33	99.5143	BC108 Transistor
	Q34	99.5143	BC108 Transistor
	Q38	99.5143	BC108 Transistor
	Q39	99.5143	BC108 Transistor
	Q40	99.5143	BC108 Transistor
	Q41	99.5143	BC108 Transistor
	Q42	99.5143	BC108 Transistor
	Q43	99.5117	BC167 Transistor
	IC1	14.5017	TAA861 Operational Amplifier
	IC2	14.5017	TAA861 Operational Amplifier
	IC3	14.5017	TAA861 Operational Amplifier
	IC4	14.5009	Dual J-K Master-slave F.F. Clear/pres.
	IC5	14.5008	Dual J-K Master-slave F.F. Clear
	IC6	14.5007	Triple 3-input NAND Gate
	IC7	14.5007	Triple 3-input NAND Gate

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR785

X401.701/2

SEQUENTIAL TONE RECEIVER SR785a



Description

SR785a is a sequential tone receiver for selective calling. It was developed for use in Stornophone 700 radiotelephone equipment. The frequencies employed are the standard Storno series: 970 Hz to 2800 Hz.

SR785a is designed to operate on a 5-tone sequence, but can also be set to accommodate a 4-tone sequence.

GENERAL DESCRIPTION

Upon reception of a signal having the correct tones in the proper sequence the following events take place (in the receiver):

The Call Lamp lights, the AF Muting is cancelled and the Key Lock function "unlocks". An audio alarm signal of about 1.3 seconds in duration can be sent out over the radiotelephone's loudspeaker, and when the vehicle's traffic horn is connected to the tone receiver via an auxiliary relay, the horn will also sound for the same length of time.

There is also a provision for automatically turning off the car's broadcast band receiver when a call arrives.

The audio circuit and the Key Lock are both turned on and off manually by means of the LS IN/OUT push button. Since the switch that "unlocks" the Key Lock also turns on the loudspeaker, the operator is forced to check for the presence of another signal on the channel before being able to key his transmitter.

In addition, the tone receiver is equipped with an Occupied Lamp controlled by the squelch circuit in the radiotelephone receiver. Thus, if an RF signal having that channel's frequency is present at the antenna input it will cause the Occupied Lamp to light as an indication that the channel is not free.

After reception of a correct call the speaker will remain open until the LS IN/OUT button is depressed.

Logic Terms

Positive logic is employed in SR785a; logical references are:

1. low voltage level (~ 0V) = logic state "0" (LO)
2. high voltage level (~ 5V) = logic state "1" (HI)

Storno

Tone Signalling

The first tone of a sequential signal, arriving from input terminal 35, passes through the Amplifier/Limiter, IC1, where it becomes suitable for applying to the tuned circuit of L1 and C8.

In stand by the resonant frequency of the tuned Circuit is set up by the first Tone Gate, Q4, for the first tone of its code. If the first tone received corresponds to the circuit resonant frequency, it becomes selected, is then amplified by IC2 and detected by E1.

The correct tone will thus fire the Schmitt Trigger, IC3a, whose output drives the Clock Delay (CP Delay) circuit, IC3b. This circuit produces a Clock Pulse whose leading (positive going) edge is delayed approximately 15 msec. from the Schmitt Trigger output signal.

The clock pulse is applied to the Counter circuit, IC6a, IC7a and IC6b. The Counter is arranged as a synchronous, divide-by-5 counter whose binary states are read out in BCD (binary coded decimal) mode in the Decoders, IC4a-d and IC5a-b.

The first five Decoders drive the Tone Gates, Q4-Q8. The output of the sixth Decoder, IC5b, is applied to the Readout circuit, IC7b.

The Readout flip-flop is also timed by the same clock pulses that toggle the Counter flip-flops.

At the end of a tone pulse, the Schmitt Trigger reverts to its quiescent state and the resultant trailing (negative going) pulse edge from the CP Delay output causes the Counter flip-flops to change state. (So far, with just the first pulse completed, only Counter IC6a is affected.)

The Decoders sense the new binary state and turn Tone Gate Q4 OFF and Tone Gate Q5 ON, thus setting the resonant circuit up for the second tone in the sequential code.

Suppose that the next tone received does not match the receiver's code. It will not be selected by the resonant circuit and no signal will be available to fire the Schmitt Trigger. When the Schmitt Trigger was fired the first time, it also turned Q1 ON and activated the Clear Delay circuit, IC3c. The output of IC3c then enabled the Counters by applying a HI logical state to their Clear inputs. The Clear Delay output remains HI for about 70 msec. after the Schmitt Trigger has returned to "0". If the second tone does not activate the Schmitt Trigger by then, Q1 goes OFF and the Clear Delay output goes LO, clearing the counter and setting the Decoders back to the stand by position, i.e. ready to receive the first tone again. This is what happens if the second, or any consequent tone fails (for instance, if the tone is not the correct one for the particular receiver under consideration).

The 2nd, 3rd, 4th and 5th tones of a sequence occur like the 1st, each time stepping the Decoder one position forward until the final tone has been received.

When all five tones have been received, at the end of the 5th tone, IC7b clears the Holding Circuit, IC8, and turns transistor Q2 ON.

Q2 drives the Alarm Delay circuit.

All the functions mentioned in the beginning of this description, i.e. Call Lamp, AF Muting, Key Lock, Alarm Tone Generator, etc. occur at this time.

The Call Lamp and the speaker will remain ON until switched OFF manually with the LS IN/OUT push button (via terminal 32).

If the operator later wants to make a call, he must first "unlock" the Key Lock function with the LS IN/OUT push button again, thus turning the loudspeaker ON. If there is any traffic on his channel, he will hear it and be warned before he can key his transmitter.

Storno

CIRCUIT DESCRIPTION

Input Stage (IC1)

Input terminal 35 can be wired in either of two positions (marked DK and SV on schematic diagram D401.894):

DK = input signal through C2 and R1, linear response
SV = input signal differentiated through C1 to match the modulation index used in Sweden and by Storno.

The amplifier circuit incorporates amplitude limiting for signal levels above the minimum required to activate the Schmitt Trigger.

Resistor R6 sets the amplifier sensitivity.

Amplifier Stage (IC2)

The signal is inductively coupled to the Amplifier via the parallel resonant circuit, L1 and C8.

Five of the taps on tone coil L1 are wired to Tone Gates Q4 to Q8, respectively (with a 4-tone code, Q8 is not used). When a Tone Gate is ON, i.e. conducting, it completes a path from its coil tap to chassis ground and the parallel resonant circuit for that particular tone frequency is formed.

NTC resistor R13 compensates for variations in circuit Q caused by changes in ambient temperature.
The selected signal passes to operational amplifier IC2, which is bootstrapped so as not to load the resonant circuit. Amplifier gain is determined by the ratio of R17 to R19.

Detector and Schmitt Trigger (E1, E2, IC3a)

The amplified tone signal is then rectified by the forward-biased diode, E1, and filtered by C13. The resultant DC voltage is present at the invertering input of IC3a.

When the rectified voltage exceeds the threshold level set by R21, R22, R25, R26 and diode E2, the output of the Schmitt Trigger switches from LO (~ 0V) to HI (~ 5V) and remains in that state for the duration of the tone pulse.

Feedback to the non-inverting input via R27 produces a circuit hysteresis of circa 0.2 V.

When the tone ends the Schmitt Trigger switches back to its quiescent state, i.e.: output LO.

Clock Delay (E4, IC3b)

In stand by the Schmitt Trigger output state is LO, C15 is discharged through E4, and the potential at the non-inverting input is also LO (IC3b output is also LO).

Notice that the voltage divider network of R41 and R42 determines the threshold voltage at the inverting inputs of all 3 "delay" circuits, IC3b, IC3c and IC3d.

Now, when the Schmitt Trigger output goes HI, it reverse-biases diode E4 and capacitor C15 begins to charge through resistors R31 and R32. The moment the charge on C15, as seen at the non-inverting input of the comparator, reaches the threshold level, the output switches to the HI state.

It takes C15 approx. 15 msec. to charge up to the threshold level of IC3b. This is what determines the Clock Delay time; removing the short circuit across R30 lengthens the delay time.

At the end of the tone the Schmitt Trigger output returns to its LO state and C15 can once again discharge through E4 and R32. The time constant of this circuit provides a delay at the negative going trailing edge of the pulse, too. These delays prevent random noise pulses from operating the circuit erratically.

Clear Delay (Q1, IC3c)

In stand by, Q1 is OFF and C16 has no charge on it. When the Schmitt Trigger output goes HI it drives Q1 ON, and C16 builds up a charge via R37 and Q1, triggering comparator IC3c so its output goes HI. The Clear Delay circuit operates similarly to the Clock Delay circuit.

As long as the Schmitt Trigger keeps operating at the normal tone intervals, Q1 can maintain the charge on C16. At the end of the 5th tone, the Schmitt Trigger reverts to its quiescent state (output LO) and turns Q1 OFF, as the emitter of Q1 will be biased by the charge on C16. The discharge path for C16 is through R36 and R37. In about 70 msec. the voltage at the non-inverting input of IC3c will fall back to the threshold level and the comparator output switches state. The LO potential at the Clear Delay output clears the Counter and the Readout circuits. Since the interval between tones is normally much less than 70 msec., the Clear Delay will remain OFF (output HI) throughout the entire tone sequence.

Counter (IC6a, IC7a, IC6b)

The Counter elements are J-K master-slave flip-flops arranged as a synchronous, divide-by-five counter that is clocked by the Clock Delay output and is cleared by the Clear Delay output. All of the normal (Q) and complement ($\overline{Q}$) Counter outputs are wired to appropriate Decoder inputs (IC4 and IC5).

The binary information present at each flip-flop input when a clock pulse arrives will be transferred to the output by the trailing edge of the clock pulse. A 5-tone code sequence, correct for the receiver in question, produces 5 clock pulses, one for each tone pulse.

70 msec. after the 5th tone ends, the logical "0" (LO) state at the Clear Delay output clears the Counter flip-flops. However, the Counter will not be able to start counting again until the flip-flops are enabled by the Clear Delay output being switched to logical "1" again by the Schmitt Trigger action.

Decoder (IC4a-d, IC5a)

and Tone Gates (Q4-Q8)

The wiring between the Counter outputs and the Decoder NOR gate inputs is arranged to drive the Tone Gates one at a time.

The output of a NOR gate is HI (logical state "1") only when all of its inputs are LO (logical state "0"). If either or both of its inputs are HI, the NOR gate output will be LO.

In stand by, both inputs to IC4a are LO and the output is therefore HI. The other 5 Decoder NOR gates have at least one of their inputs HI, so their outputs will all be LO. Tone Gate Q4 is thus held ON by IC4a, while Q5-Q8 are held OFF by IC4b - IC5a.

Transistor Q4, conducting hard, acts as a virtual short circuit from chassis ground to whichever tone coil tap is specified for the first tone of the code sequence. At the end of the first clock pulse, one of the inputs to IC4a goes HI, the NOR gate output goes LO, and Q4 cuts off. At the same time both inputs to IC4b are now LO, its output goes HI, and Q5 goes ON to tune the resonant circuit for the 2nd tone of the code sequence.

One special consideration here is that the actual maximum HI potential measurable at the NOR gate output is limited to approx. 0.7 V by the conducting Tone Gate transistor's emitter-base junction.
With each correct pulse the Counter steps the Decoder one position forward until the final tone has been received.

Readout Circuit (IC5b, IC7b)

At the end of the 4th tone of a 5-tone signal (or the 3rd tone of a 4-tone signal) both inputs to IC5b will be LO, and the NOR gate output will go HI, driving the J input of IC7b HI, as well.

Now, with its J input driven HI and its K input held at chassis ground potential, IC7b can switch output states when the trailing (negative going) edge of the 5th (or 4th) tone pulse arrives. The normal (Q) output activates the Alarm Delay circuit, and the complement ($\overline{Q}$) output clears the Holding Circuit, IC8.

70 msec. later the Clear Delay, IC3c, clears the Counter and Readout circuits, and the Tone

Receiver is set up for the first tone again by the Decoder and Tone Gate circuits.

A strapping arrangement at the input of IC5b allows for either 4 or 5-tone codes.

Alarm Delay (IC3d, Q2, Q3)

Transistor Q2 is normally OFF and the output of IC3d is HI; Q3, a PNP transistor, is held OFF, and so is Q13.

When the Q output of IC7b in the Readout circuit goes HI at the end of the last tone pulse, it drives Q2 ON. Then capacitor C18 quickly charges through the conducting transistor Q2. When the charge reaches the threshold established by the resistive divider circuit of R41 and R42 the output of IC3d goes LO, turning Q3, then Q13 ON.

Q13 acts as a switch capable of carrying 100 mA of current between ground and terminal 37, the connection for an auxiliary alarm relay.

As long as the Clear Delay, IC3c, output remains HI, Q2 is held ON by IC7b and maintains the charge across C18. 70 msec. after the last pulse from the Clock Delay, IC3b, ends, IC3c switches state and clears the Counter and Readout IC's. The Q output of IC7b returns to logical "0", turning Q2 OFF. C18 now discharges slowly through R43 and R44.

The time constant of C18, R43 and R44 is calculated so that the Alarm Delay, IC3d, output switches back to logical "1" approx. 1,3 sec. after the end of the final clock pulse.

The Alarm Delay is a comparator circuit that operates in the same manner as the Clock Delay.

Holding Circuit (IC8, Q9, Q11)

Call Lamp + Key Lock Switches (Q10, Q11)

The Holding Circuit is an integrated flip-flop with its J and K inputs both tied to logical "1" through R64. With both the J and the K inputs HI, the flip-flop output will complement itself for each clock pulse arriving at the CP (toggle) input. Notice that the CP input is also tied to +Vcc, through R62. This simulates the flat top portion of a clock pulse. Now whenever the LS IN/OUT push button on the radiotelephone control panel is pressed, terminal 32 is grounded. C30 at the CP input discharges quickly through the 27Ω resistor, R63, and the flip-flop sees a negative going trailing edge of a "clock pulse" and switches state. When the push button is released again, C30 charges up to +Vcc through R62, forming the positive going leading edge of the next "clock pulse".

Only the normal (Q) output is used in this circuit; it switches Q11 ON and OFF.

As just seen, IC8 is designed so that it can only be toggled manually by means of the LS IN/OUT switch. However, the Clear input is operated electronically from the $\overline{Q}$ output of Readout flip-flop IC7b.

C32 provides a drive pulse to the base of Q9, saturating the transistor as soon as the radiotelephone is turned on. This pulls the collector of Q9 down to ground, presetting IC8. In the preset state, the Q output is HI and Q11 is held OFF, and Q10 and Q12 are likewise OFF.

With the collector of Q9 LO, diode E3 keeps the Schmitt Trigger output at logical "0", as well, inhibiting both the Clock and the Clear Delay circuits.

As capacitor C32 accumulates a charge, the charging current decreases until it no longer can forward bias Q9. The transistor goes OFF, its collector voltage goes HI, and IC8 becomes enabled.

Diode E6 serves to discharge C32 when the equipment is turned off.

Each time the LS IN/OUT button is pressed, IC8 changes state, switching Q11 ON or OFF and, in turn, driving Q10 and Q12 into saturation or cut-off.

When Q10 conducts it provides a ground connection to light the Call Lamp and, when ap-

Storno

plicable, to operate a relay for muting the car's broadcast band radio.

Q12, conducting simultaneously, turns the loudspeaker ON and also unlocks the Key Lock function.

At the end of the last tone pulse in a sequence, the complement output ($\overline{Q}$) of IC7b clears IC8, whose output goes LO and turns Q11 ON. Q10 and Q12 are then driven into saturation. 70 msec. after, the Clear Delay clears the Counter and Readout circuits and $\overline{Q}$ of IC7b goes HI again. IC8 can be manually toggled via terminal 32 any time afterwards.

Note that whenever the speaker is in operation, whether turned on manually or by an incoming call, the Call Lamp will light.

Occupied Lamp Switch (Q14)

Whenever the channel is occupied a DC voltage from the Squelch circuit, via terminal 41, turns Q14 ON and establishes a ground connection to the Occupied Lamp, so it can light.

Alarm Tone Generator (IC5c, IC5d)

Two NOR gates, coupled to operate as a free-running (astable) multivibrator, generate an audio signal that is available at terminal 20. The Generator can be strapped to the output of IC3d or to +Vcc through R61.

In stand by, IC3d has a HI output, which would inhibit NOR gate IC5d. When a selective call comes through, the Alarm Delay output goes LO for approx. 1.3 sec. During that interval the multivibrator can oscillate at a frequency determined by the time constants of R57 / C27 and R58 / C26. When the Alarm Delay output goes HI again the oscillator stops.

On the other hand, if its input is tied to +Vcc, IC5d would be permanently inhibited and no audio signal could be generated, at all.

Output signal level can be regulated by resistor R60.

Regardless of the state of IC8 a correct tone signal will clear the flip-flop and turn Q11, then Q10 and Q12 ON. Thus, a tone call has higher priority than the manual switch.

T R U T H   T A B L E

for Counter, Readout, and Decoder Circuits

Clock Pulse	Clear Delay	IC6a J	K	Q	$\overline{Q}$	IC7a J	K	Q	$\overline{Q}$	IC6b J	K	Q	$\overline{Q}$	IC4a	IC4b	IC4c	IC4d	IC5a	IC5b	IC7b $\overline{Q}$
0	0	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1
1	1	1	0	1	0	1	0	0	1	0	0	0	1	0	1	0	0	0	0	1
2	1	1	0	1	0	1	0	1	0	1	0	0	1	0	0	1	0	0	0	1
3	1	0	1	1	0	1	0	1	0	1	0	1	0	0	0	0	1	0	0	1
4	1	0	1	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	1
5	1	0	1	0	1	0	0	1	0	1	0	1	0	0	0	0	0	1	1	0
△	0	1	0	0	1	0	0	0	1	0	0	0	1	1	0	0	0	0	0	1

NOTE: △ = 70 msec. after the end of the 5th tone

SEQUENTIAL TONE RECEIVER

SR785a

Technical Specification

Supply Power

Nominal: 13.6 V
Minimum: 10.5 V
Maximum: 16.0 V

Current Drain

Stand by: 24 mA ± 4 mA

Regulated Voltage

Nominal 4.9 V

Temperature Range

Operating range: -25°C to +60°C
Functioning range: -30°C to +80°C

Maximum Load Currents

Terminal 37	ALARM	100 mA (for 1.3 sec.)
Terminal 47	Call	100 mA
Terminal 45	OCCUPIED	100 mA
Terminal 51 and 43	KEY LOCK	10 mA
Terminal 34	AF MUTING	I_{load} min. 0.75 mA for V_{out} = 8 V

Input Impedance

≥ 6 KΩ

Signal Input Level

Nominal at 1000 Hz: 110 mV

AF Muting

In conjunction with terminal 18 of CF701 or CF702:
≥ 60 dB.

Signalling Code

Sequence of 4 or 5 tone bursts of 70 ms ± 15 ms duration with maximum 15 ms interval between tone bursts.

Tone Signal Frequencies

Coil terminal	Tone frequency
1	970 Hz
2	1060 Hz
3	1160 Hz
4	1270 Hz
5	1400 Hz
6	1530 Hz
7	1670 Hz
8	1830 Hz
9	2000 Hz
10	2200 Hz
11	2400 Hz
12	2600 Hz
13	2800 Hz

Frequency Accuracy

Coil tuned for 1060 Hz: ≤ 0.3% for all tones

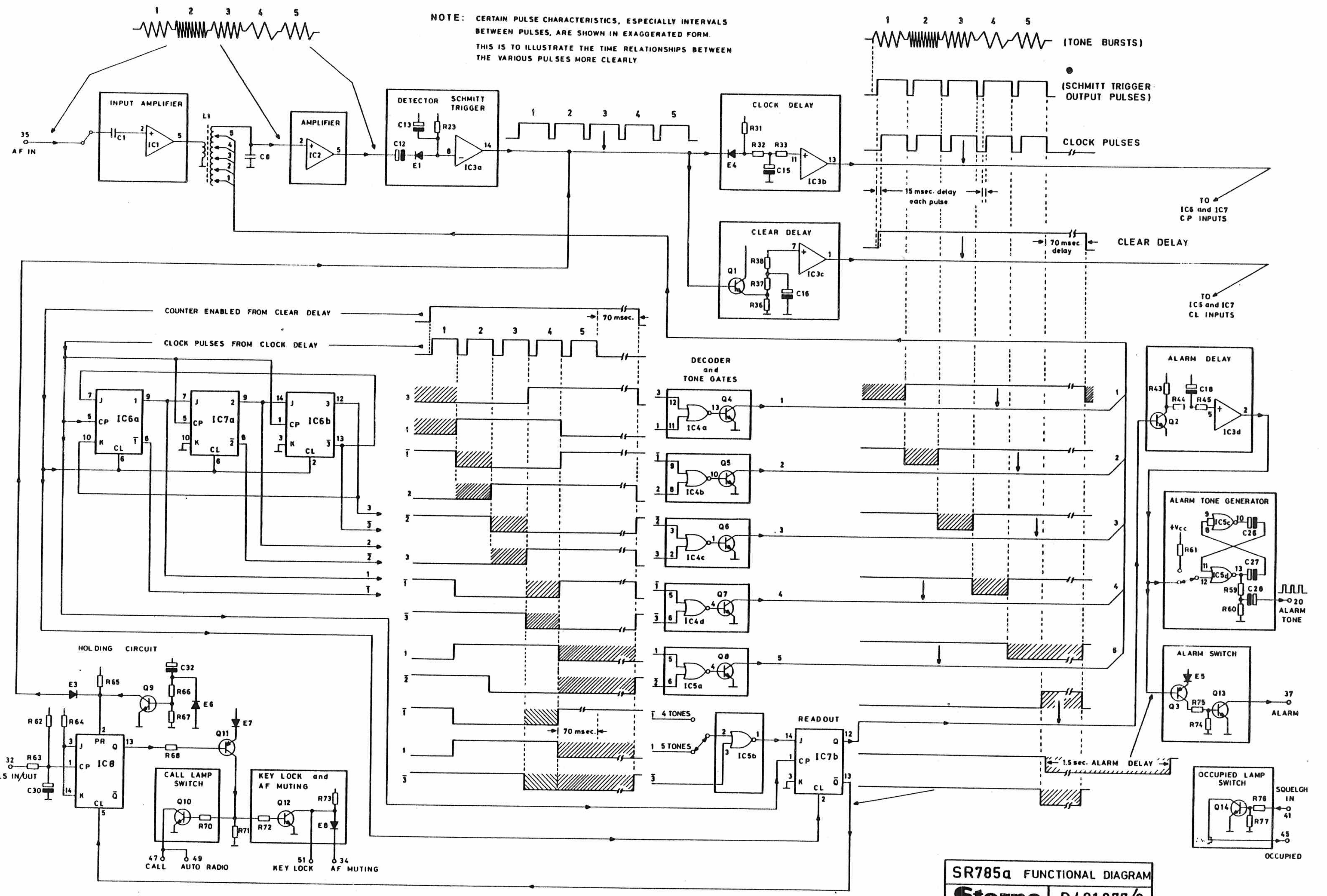
Frequency Stability

(typically ≤ 0.5%) ≤ 1.0%

Selectivity

Frequencies differing from f_o by 4% or more are unable to trigger the tone receiver.

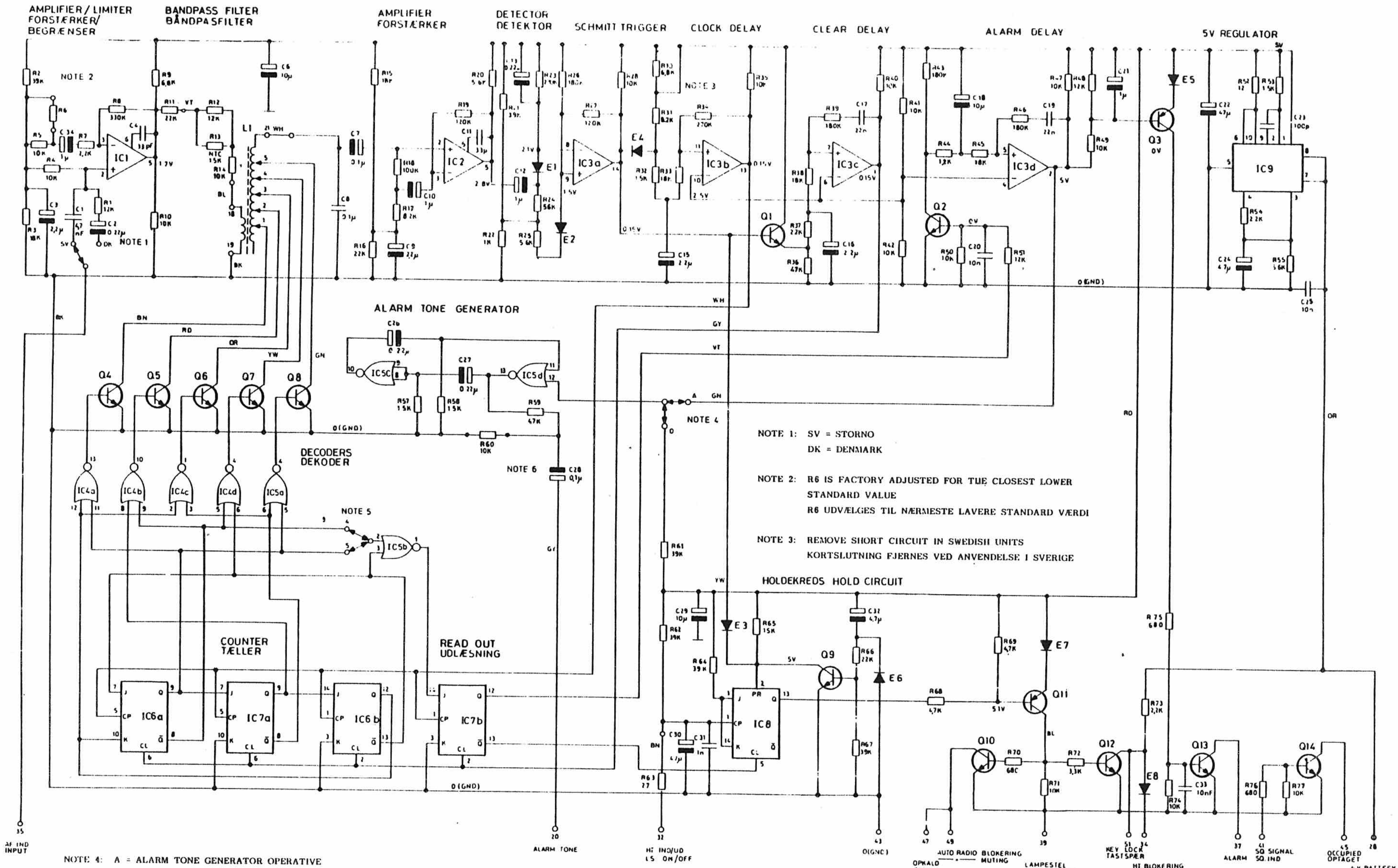
NOTE: CERTAIN PULSE CHARACTERISTICS, ESPECIALLY INTERVALS BETWEEN PULSES, ARE SHOWN IN EXAGGERATED FORM. THIS IS TO ILLUSTRATE THE TIME RELATIONSHIPS BETWEEN THE VARIOUS PULSES MORE CLEARLY



SR785a FUNCTIONAL DIAGRAM

Storno D401.977/2

Storno



NOTE 1: SV = STORNO
DK = DENMARK

NOTE 2: R6 IS FACTORY ADJUSTED FOR THE CLOSEST LOWER STANDARD VALUE
R6 UDVÆLGES TIL NÆRMESTE LAVERE STANDARD VÆRDI

NOTE 3: REMOVE SHORT CIRCUIT IN SWEDISH UNITS
KORTSLUTNING FJERNES VED ANVENDELSE I SVERIGE

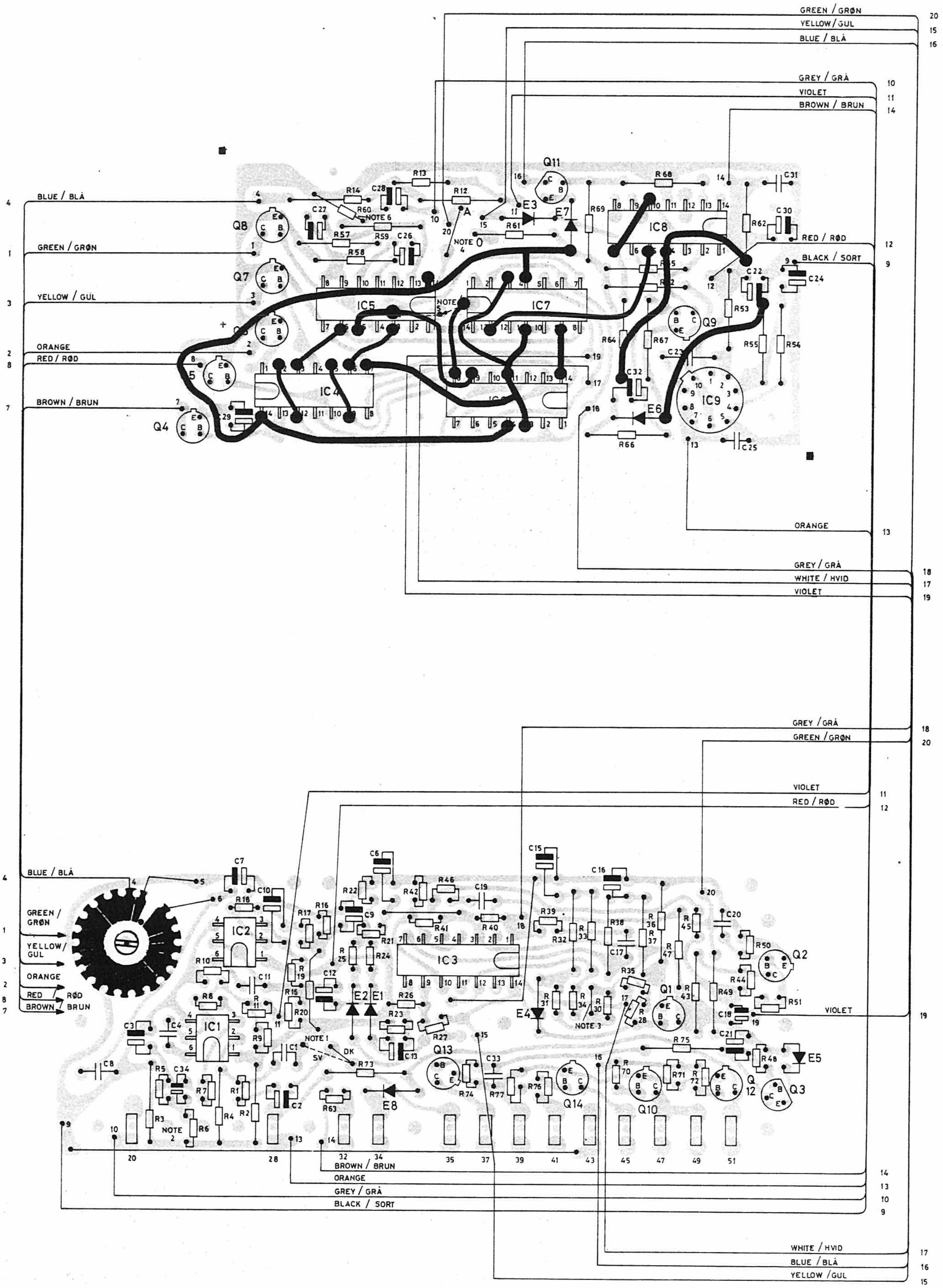
NOTE 4: A = ALARM TONE GENERATOR OPERATIVE
O = ALARM TONE GENERATOR INOPERATIVE

NOTE 5: 4 = 4 DIGIT CALL
5 = 5 DIGIT CALL
4 = OPKALD MED 4 CIFRE
5 = OPKALD MED 5 CIFRE

NOTE 6: R60 ADJUSTS THE ALARM TONE LEVEL
ALARMTONESTYRKEN INDSTILLES MED R60

SEQUENTIAL TONE RECEIVER SR785a
SEKVENSTONEMODTAGER

D401.894



SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR785a

D402.159

Storno

TYPE	NO.	CODE	DATA	
SR785a		10.2541-01	Sequential Tone Receiver	
	C1	74.5061	4.7nF 10% polyest. FL	50V
	C2	73.5118	0.22µF 20% tantal	35V
	C3	73.5102	2.2µF 20% tantal	35V
	C4	74.5116	33pF 5% ceram TB	160V
	C5		not used	
	C6	73.5109	10µF 20% tantal	16V
	C7	73.5089	0.1µF 20% tantal	35V
	C8	76.5068	0.1µF 1% polystyr TB	63V
	C9	73.5102	2.2µF 20% tantal	35V
	C10	73.5114	1µF 20% tantal	35V
	C11	74.5116	33pF 5% ceram TB	160V
	C12	73.5114	1µF 20% tantal	35V
	C13	73.5118	0.22µF 20% tantal	35V
	C14		not used	
	C15	73.5102	2.2µF 20% tantal	35V
	C16	73.5102	2.2µF 20% tantal	35V
	C17	76.5071	22nF 10% polyest. FL	50V
	C18	73.5109	10µF 20% tantal	16V
	C19	76.5071	22nF 10% polyest. FL	50V
	C20	76.5070	10NF 10% polyest. FL	50V
	C21	73.5114	1µF 20% tantal	35V
	C22	73.5124	47nF 20% tantal	6.3V
	C23	74.5165	100pF 10% ceram	63V
	C24	73.5126	4.7µF 20% tantal	35V
	C25	76.5070	10nF 10% polyest. FL	50V
	C26	73.5118	0.22µF 20% tantal	35V
	C27	73.5118	0.22µF 20% tantal	35V
	C28	73.5089	0.1µF 20% tantal	35V
	C29	73.5109	10µF 20% tantal	16V
	C30	73.5126	4.7µF 20% tantal	35V
	C31	74.5155	1nF -20+80% ceram PL	63V
	C32	73.5126	4.7µF 20% tantal	35V
	C33	76.5070	10nF 10% polyest. FL	50V
	C34	73.5114	1µF 20% tantal	35V
	R1	80.5262	12kΩ 5% carbon film	1/8W
	R2	80.5268	39kΩ 5% carbon film	1/8W
	R3	80.5264	18kΩ 5% carbon film	1/8W
	R4	80.5261	10kΩ 5% carbon film	1/8W
	R5	80.5261	10kΩ 5% carbon film	1/8W
	R6	80.52xx	Adjusted	1/8W
	R7	80.5253	2.2kΩ 5% carbon film	1/8W
	R8	80.5279	0.33 MΩ 5% carbon film	1/8W
	R9	80.5259	6.8kΩ 5% carbon film	1/8W
	R10	80.5261	10kΩ 5% carbon film	1/8W
	R11	80.5265	22kΩ 5% carbon film	1/8W

Storno

TYPE	NO.	CODE	DATA	
	R12	80.5262	12kΩ 5% carbon film	1/8W
	R13	89.5009	15kΩ 20% NTC	0.6W
	R14	80.5261	10kΩ 5% carbon film	1/8W
	R15	80.5264	18kΩ 5% carbon film	1/8W
	R16	80.5265	22kΩ 5% carbon film	1/8W
	R17	80.5260	8.2kΩ 5% carbon film	1/8W
	R18	80.5273	0.1 MΩ 5% carbon film	1/8W
	R19	80.5273	0.12 MΩ 5% carbon film	1/8W
	R20	80.5258	5.6kΩ 5% carbon film	1/8W
	R21	80.5256	3.9kΩ 5% carbon film	1/8W
	R22	80.5249	1kΩ 5% carbon film	1/8W
	R23	80.5278	0.2 MΩ 5% carbon film	1/8W
	R24	80.5270	56kΩ 5% carbon film	1/8W
	R25	80.5258	5.6kΩ 5% carbon film	1/8W
	R26	80.5276	0.18 MΩ 5% carbon film	1/8W
	R27	80.5274	0.12 MΩ 5% carbon film	1/8W
	R28	80.5261	10kΩ 5% carbon film	1/8W
	R29		Not used	
	R30	80.5259	6.8kΩ 5% carbon film	1/8W
	R31	80.5260	8.2kΩ 5% carbon film	1/8W
	R32	80.5251	1.5kΩ 5% carbon film	1/8W
	R33	80.5264	18kΩ 5% carbon film	1/8W
	R34	80.5278	0.27 MΩ 5% carbon film	1/8W
	R35	80.5261	10kΩ 5% carbon film	1/8W
	R36	80.5269	47kΩ 5% carbon film	1/8W
	R37	80.5253	2.2kΩ 5% carbon film	1/8W
	R38	80.5264	18kΩ 5% carbon film	1/8W
	R39	80.5276	0.18 MΩ 5% carbon film	1/8W
	R40	80.5261	10kΩ 5% carbon film	1/8W
	R41	80.5261	10kΩ 5% carbon film	1/8W
	R42	80.5261	10kΩ 5% carbon film	1/8W
	R43	80.5276	0.18 MΩ 5% carbon film	1/8W
	R44	80.5250	1.2kΩ 5% carbon film	1/8W
	R45	80.5264	18kΩ 5% carbon film	1/8W
	R46	80.5276	0.18 MΩ 5% carbon film	1/8W
	R47	80.5261	10kΩ 5% carbon film	1/8W
	R48	80.5262	12kΩ 5% carbon film	1/8W
	R49	80.5261	10kΩ 5% carbon film	1/8W
	R50	80.5261	10kΩ 5% carbon film	1/8W
	R51	80.5262	12kΩ 5% carbon film	1/8W
	R52	80.5226	12Ω 5% carbon film	1/8W
	R53	80.5251	1.5Ω 5% carbon film	1/8W

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR785a

X401.963

TYPE	NO.	CODE	DATA
	R54	80.5253	2.2kΩ 5% carbon film 1/8W
	R55	80.5258	5.6kΩ 5% carbon film 1/8W
	R56		Not used
	R57	80.5251	1.5kΩ 5% carbon film 1/8W
	R58	80.5251	1.5kΩ 5% carbon film 1/8W
	R59	80.5269	47kΩ 5% carbon film 1/8W
	R60	80.5061	10kΩ 5% carbon film 1/10W
	R61	80.5268	39kΩ 5% carbon film 1/8W
	R62	80.5268	39kΩ 5% carbon film 1/8W
	R63	27Ω 5% carbon film	1/8W
	R64	80.5268	39kΩ 5% carbon film 1/8W
	R65	80.5263	15kΩ 5% carbon film 1/8W
	R66	80.5265	22kΩ 5% carbon film 1/8W
	R67	80.5268	39kΩ 5% carbon film 1/8W
	R68	80.5257	4.7kΩ 5% carbon film 1/8W
	R69	80.5257	4.7kΩ 5% carbon film 1/8W
	R70	80.5246	680Ω 5% carbon film 1/8W
	R71	80.5261	10kΩ 5% carbon film 1/8W
	R72	80.5255	3.3kΩ 5% carbon film 1/8W
	R73	80.5253	2.2kΩ 5% carbon film 1/8W
	R74	80.5261	10kΩ 5% carbon film 1/8W
	R75	80.5246	680Ω 5% carbon film 1/8W
	R76	80.5246	680Ω 5% carbon film 1/8W
	R77	80.5261	10kΩ 5% carbon film 1/8W
	L1	61.1259	Tone coil
	E1	99.5237	1N4148 Diode
	E2	99.5237	1N4148 Diode
	E3	99.5237	1N4148 Diode
	E4	99.5237	1N4148 Diode
	E5	99.5237	1N4148 Diode
	E6	99.5237	1N4148 Diode
	E7	99.5237	1N4148 Diode
	E8	99.5237	1N4148 Diode
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5144	S5144 Transistor
	Q4	99.5201	BC109 Transistor
	Q5	99.5201	BC109 Transistor
	Q6	99.5201	BC109 Transistor
	Q7	99.5201	BC109 Transistor
	Q8	99.5201	BC109 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor
	Q11	99.5144	S5144 Transistor
	Q12	99.5143	BC108 Transistor

Storno

TYPE	NO.	CODE	DATA
	Q13	99.5143	BC108 Transistor
	Q14	99.5143	BC108 Transistor
	IC1	14.5017	Operational Amplifier
	IC2	14.5017	Operational Amplifier
	IC3	14.5019	Quadruple comparator
	IC4	14.5018	Quadruple 2-input pos. NOR Gate
	IC5	14.5018	Quadruple 2-input pos. NOR Gate
	IC6	14.5008	Dual J-K master-slave Flip-Flop
	IC7	14.5008	Dual J-K master-slave Flip-Flop
	IC8	14.5056	Dual J-K master-slave Flip-Flop
	IC9	14.5055	Voltage regulator

SEQUENTIAL TONE RECEIVER
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SR785a

X401.963

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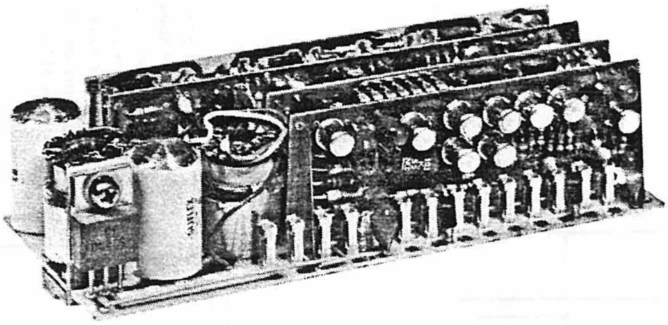
SEQUENTIAL TONE RECEIVER
SR7841



Introduction

SR7841 is a sequential tone receiver for selective calling. It was developed for use in Stornophone 700 radiotelephone equipment. The frequencies employed are the standard Storno series: 970 Hz to 2800 Hz.

The SR7841 tone receiver can be coded for any of the following operating modes:

- 4 or 5 tones, individual call, only
- 4 or 5 tones, including one group call digit
- 4 or 5 tones, including two group call digits

General Description

Individual Call

Upon reception of a signal having the correct tones in the proper sequence the following events take place (in the receiver):

The Call Lamp lights, the AF Muting is cancelled and the Key Lock function "unlocks". When the vehicle's traffic horn is connected to the tone receiver via an auxiliary relay, the horn will also sound for about one second.

The audio circuit and the Key Lock are both turned on and off manually by means of the LS IN / OUT push button. Since the switch that "unlocks" the Key Lock also turns on the loudspeaker, the operator is forced to check for the presence of another signal on the channel before being able to key his transmitter.

In addition, the tone receiver is equipped with an Occupied Lamp controlled by the squelch circuit in the radiotelephone receiver. Thus, if an RF signal having that channel's frequency is present at the antenna input it will cause the Occupied Lamp to light as an indication that the channel is not free.

At the end of a call the Call Lamp, governed by the receiver Squelch, goes out when the carrier disappears.

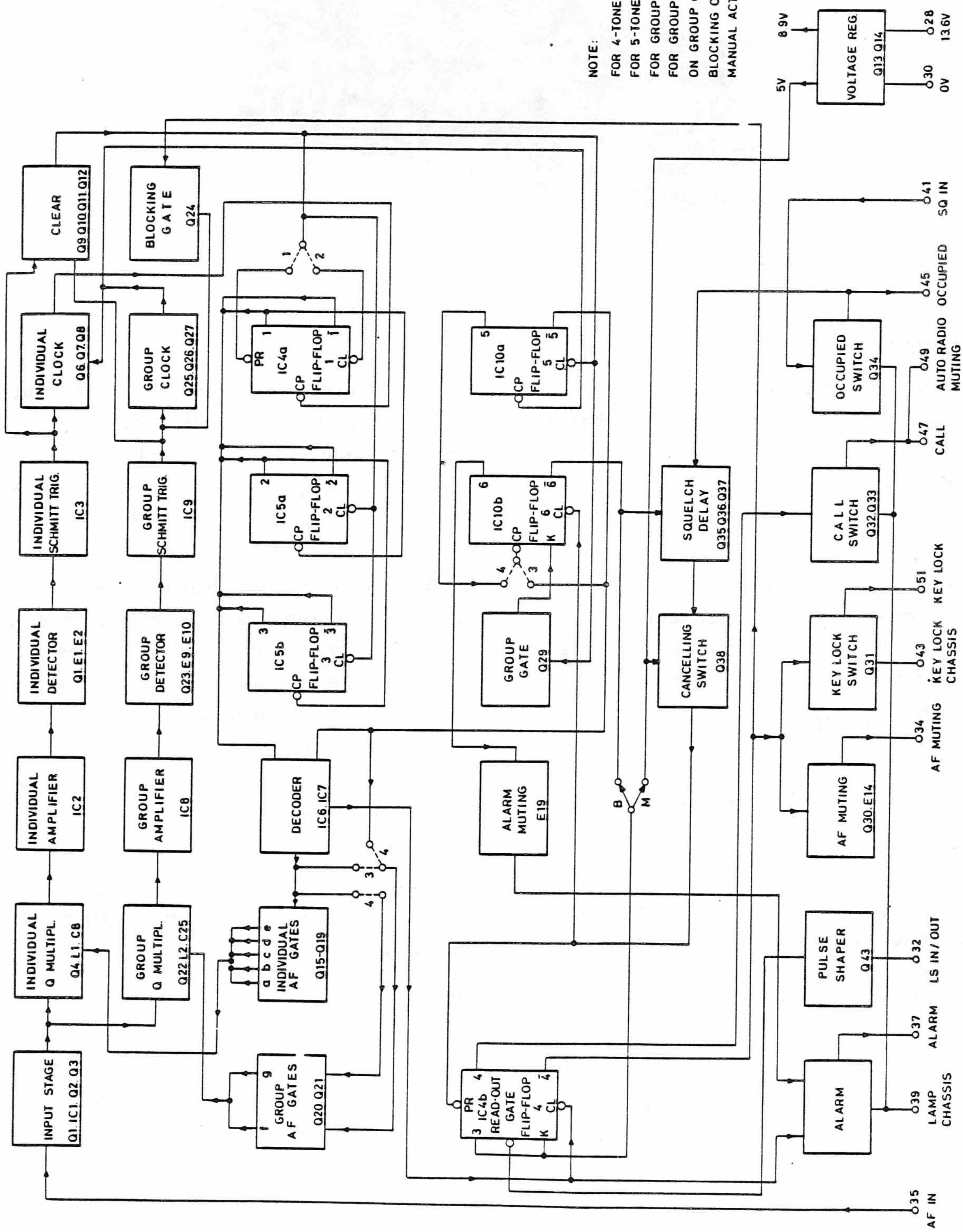
After reception of a correct call the speaker will remain open until the LS IN / OUT button is depressed.

Group Call

Group calls do not activate the Alarm circuit. Also, the loudspeaker becomes automatically muted again at the end of a group call.

NOTE:
FOR 4-TONE SIGNALLING: INSERT STRAP 1.
FOR 5-TONE SIGNALLING: INSERT STRAP 2.
FOR GROUP CALL WITH 1 FIGURE: INSERT STRAP 3.
FOR GROUP CALL WITH 2 FIGURE: INSERT STRAP 4.
ON GROUP CALL:
BLOCKING OF READ-OUT GATE: INSERT STRAP B.
MANUAL ACTIVATING OF READ-OUT GATE: INSERT STRAP M.

SR7841



Storno

Logic Terms

Positive logic is employed in SR7841; logical references are:

1. low voltage level (~0V) = logic state "0" (LO)
2. high voltage level (~5V) = logic state "1" (HI)

Mode of Operation

5-tone Individual Signalling

The Input Stage includes Q1, IC1, Q2 and Q3. The first tone of a sequential tone signal, arriving from input terminal 35, passes through the input stage, where it becomes suitable for applying to the Q Multiplier.

In stand by the Q Multiplier is tuned, via Individual AF Gate a, for the first tone of its code. If the first tone received corresponds to the circuit resonant frequency, it becomes selected, is then amplified in IC2 and rectified at the Detector, Q5, E1, and E2.

The rectified signal turns the Individual Schmitt Trigger, IC3, ON. The output of IC3 becomes logic "1" and suspends the Clear function (Q9 - Q12). Individual Counters FF1 to FF3 and Group Counter FF5 are then ready to count.

A 25 ms delay is introduced between the time that the Schmitt Trigger output becomes logic "1" and the clock pulse from the Clock stage goes "1". When the 1st tone ends, the Schmitt Trigger output goes "0" again, bringing the Clock output to logic "0". Counter FF1 then switches state, also causing the Decoder (IC6 and IC7) to step to the next AF Gate, which is b.

The output of the Clear stage remains at logic "1" for about 40 ms after the Schmitt Trigger has returned to "0". The next (2nd) tone must be received within that time or the Clear function will reset the Counter and the Decoder will go back to stand by, i.e. ready to receive the 1st tone again.

The 2nd, 3rd, 4th, and 5th tones of a sequence occur like the 1st, each time stepping the Decoder one position forward until the final tone is received. At the end of the 5th tone the $IC7_c$ output goes "0" which causes the Alarm circuit to ground terminal 37. A relay connected here will sound the traffic horn for approximately 1 second.

$IC7_c$ also clears the Read-out Gate, FF4. This lights the Call Lamp via FF4 output 4 and terminal 47 while turning the speaker ON via output $\bar{4}$ and terminal 34.

The Call Lamp and the speaker will remain ON until switched OFF manually with the LS IN/OUT push button (via terminal 32).

When the channel is occupied (a carrier wave being received) the receiver squelch circuit feeds a DC voltage to terminal 41 (SQUELCH IN). The Occupied Lamp lights via terminal 45.

The Key Lock disables the transmitter via terminal 51. The voltage regulator will only supply power to the transmitter section when terminal 51 (KEY LOCK) from SR7841 is at chassis ground potential.

Conditions for transmitting are:

AF Muting cancelled (term. 34 LO)
Call Lamp ON (term. 47 to ground)
Key Lock cancelled (term. 51 to ground)

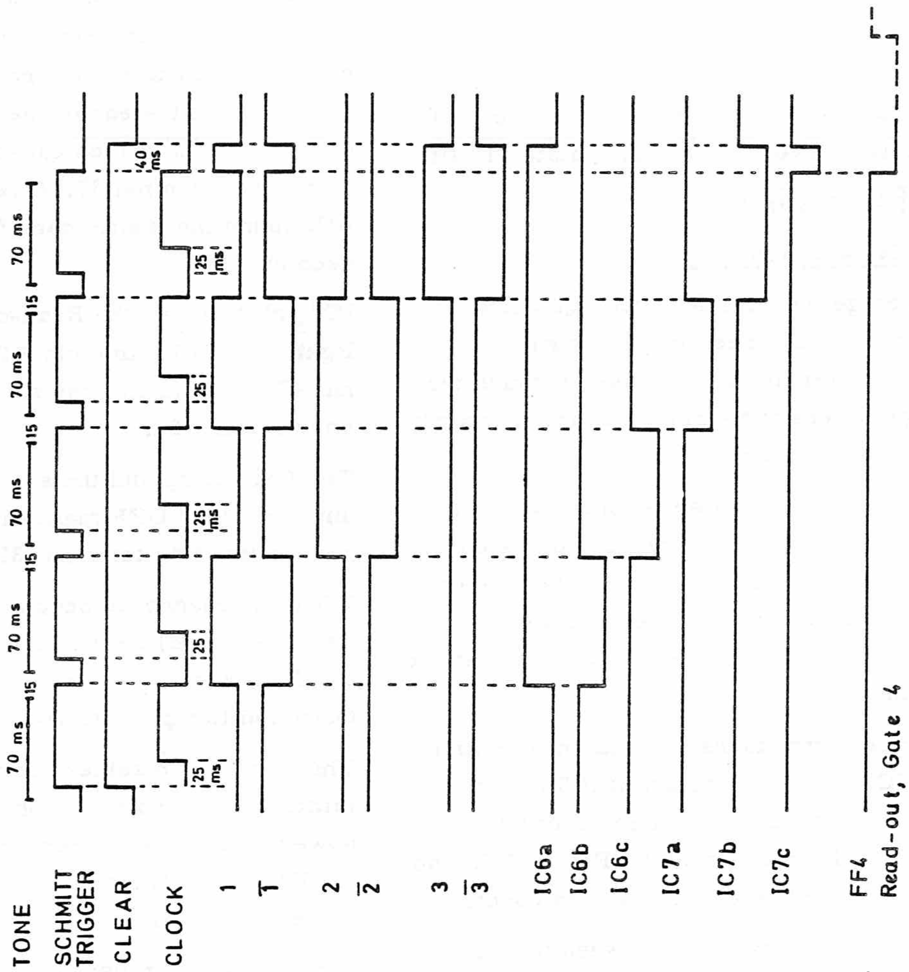
Approximately 40 ms after the last tone in the sequence, the Clear output goes "0", clearing Counter FF1 - FF3. AF Gate a is then set to wait for the 1st tone of a new call.

4-tone Signals

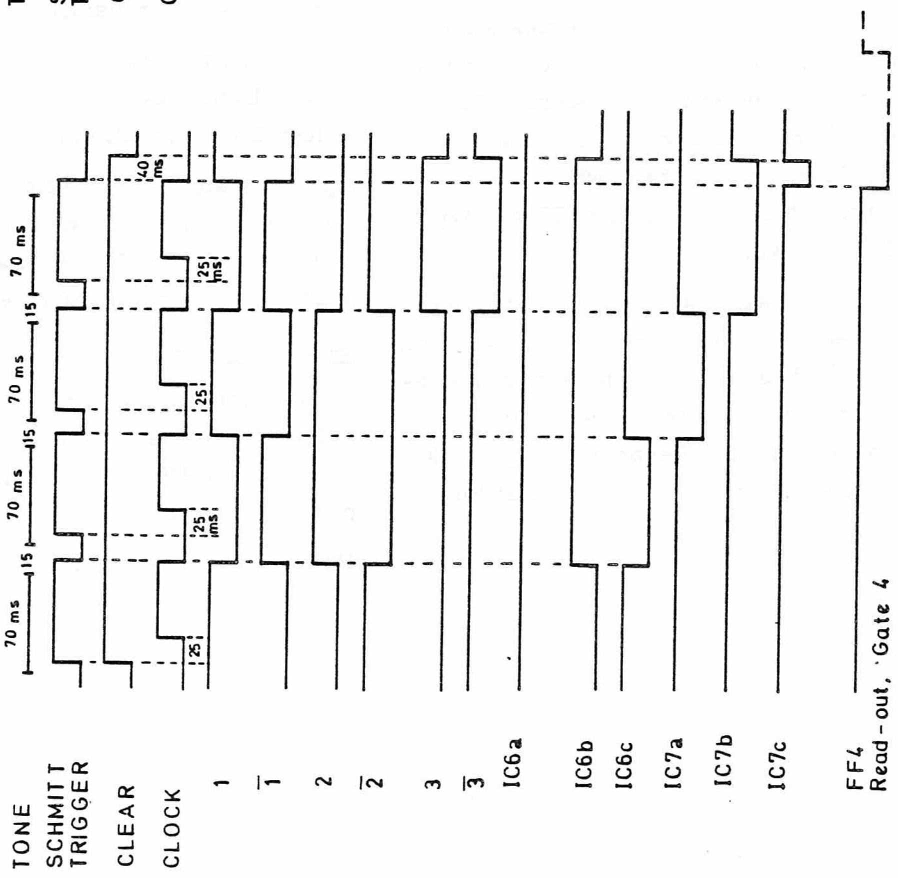
SR7841 can also be strapped for 4-tone code signalling. The Clear output will then preset FF1 to switch in AF Gate b when in stand by, thus bypassing Gate a.

Pulse sequences for 4 and 5-tone signals follow:

5-TONE PULSE SEQUENCE



4-TONE PULSE SEQUENCE



Storno

Group Calls, One Group Digit

The first 4 tones of a 5-tone signal take place just as described for individual calling. Now the receiver is ready for the final tone (digit).

Preparing for the final digit, AF Gate e sets coil L1 for the frequency that would normally be the 5th tone of the sequence. At the same time, AF Gate g sets coil L2 for the group tone. The two Q Multiplier inputs are parallel connected.

If the incoming tone has the frequency for an individual call the Individual Q Multiplier will respond, resulting in a normal individual call. However, if the 5th tone matches the group digit frequency the Group Q Multiplier will respond.

The chain of circuits consisting of the Group Q Multiplier, Group Amplifier, Group Detector, Group Schmitt Trigger, and Group Clock are identical with the Individual chain.

The signal proceeds through the Group chain to the output of the Group Schmitt Trigger. The trigger output goes "1", so the Clear circuit function will still be suspended and Individual Counters FF1 - FF3 as well as Group Counter FF5 can count.

After the 25 ms delay the Group Clock output goes "1". The Group Clock drives the Individual Clock via transistor Q28, forcing the Individual Clock output to follow the Group Clock Output; i.e. when the Group Clock output goes logic "1", so does the Individual Clock output.

When the 5th tone ends, the output of the Group Schmitt Trigger goes "0". The Group Counter toggles and reads:

output $\bar{5}$ = "0"
output 6 = "1"
output $\bar{6}$ = "0"

The k input of FF6 receives its signal from the Group Gate, Q29. Since Q29's base is driven by the Clear output, FF6 input k is held at logic level "0" as long as the Clear output is at logic "1". The j input is tied to logic "1" through R86.

The FF6 outputs do not change state when the group call ends, but remain at:

6 = "1"
$\bar{6}$ = "0"

until the carrier falls away and a cancelling pulse clears FF6.

Decoder $IC7_c$ goes "0" at the end of the last tone, clearing Read-out Gate FF4: 4 = "0"
$\bar{4}$ = "1"

Approx. 40 ms later, the Clear output returns to "0".

The Call Lamp lights and the AF Muting is cancelled (terminals 34 and 47 grounded). The Alarm, however, does not go ON for a group call as the logic "1" at FF6 output 6 keeps Q41 ON (and Q42 OFF).

Individual Counter FF1 - FF3 and Group Counter FF5 clear.

AF Gate a is set for a new call.

When an RF carrier is occupying the channel, Q34 holds terminal 45 (OCCUPIED) at chassis ground potential and Q36 is held OFF through E16. In the case of a group call, FF6 output $\bar{6}$ goes "0" after the last digit is received and the L0 signal holds Q35 OFF. Collector of Q35 tends to go H1, but Q34 and E16 prevent this.

When the RF carrier disappears terminal 45 goes HI, reverse biasing E16; with Q35 OFF, Q36 and Q37 can go ON, sending a positive pulse to Q38 whose collector then goes L0, presetting FF4.

output 4 goes "1"
output $\bar{4}$ goes "0"

The Call Lamp turns OFF and the AF Muting ON.

The negative pulse from Q38 also clears FF6.

output 6 goes "0"
output $\bar{6}$ goes "1"

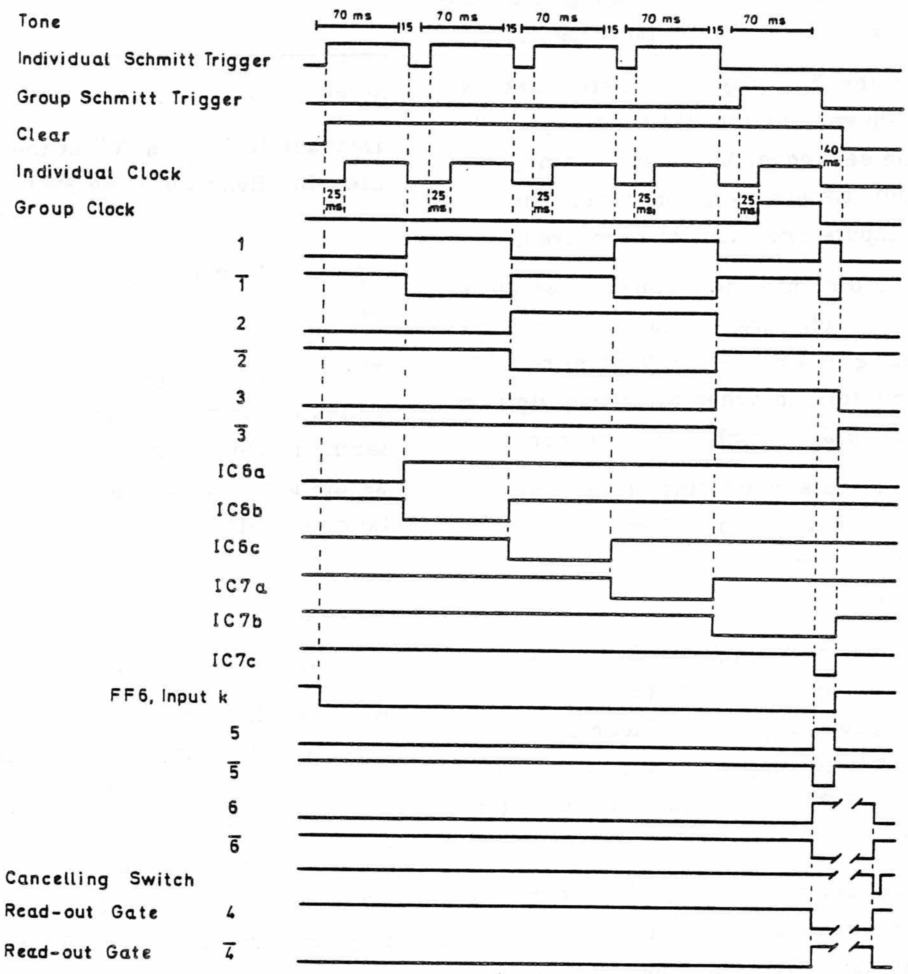
A delay of about 300 ms is introduced in order to avoid possible problems due to fading.

The tone receiver is now ready for a new call.

Pulse sequences for 5-tone signals with one group digit are as follows:

SR7841

PULSE SEQUENCE, 5 Tones with 1 Group Digit



Group Call, Two Group Digits

The first 3 tones of a 5-tone signal take place just as described for individual calling. Now the receiver is ready for the fourth tone (digit). Notice the change between strapping lugs 3 and 4.

AF Gate d sets coil L1 for the frequency that would normally be the 4th tone of the sequence. At the same time, AF gate f sets coil L2 for the first group tone.

If the last two tones have the same frequencies as the 4th and 5th tone of the individual code, the result will be a normal individual call. However, if they have the group digit frequencies, the Group Q Multiplier will respond to them.

The Group circuits take over from the Individual circuits; the Group Schmitt Trigger drives the Clear circuit and the Group Clock. The Individual Clock follows the Group Clock, as just described in the preceding section.

When the 4th tone ends, $IC7_a$ goes "1", inhibiting AF Gates d and f. FF5 output $\bar{5}$ will be at logic state "0", inhibiting Decoder $IC7_b$ and thereby also AF Gate e (which only functions for individual calls).

The logic "0" from output $\bar{5}$ is also present at the base of Q21, so AF Gate g is open for the 2nd group digit (5th tone of the sequence).

When the final tone ceases FF6 outputs go:

output 6 = "1"
output $\bar{6}$ = "0"

Clearing circuit action, Alarm suspension as well as clearing and resetting of the Counters, Read-out Gate, AF Gates, etc. all occur as previously described in the section on group calling with only one group digit.

Pulse sequences for 5-tone signals with two group digits are as follows:

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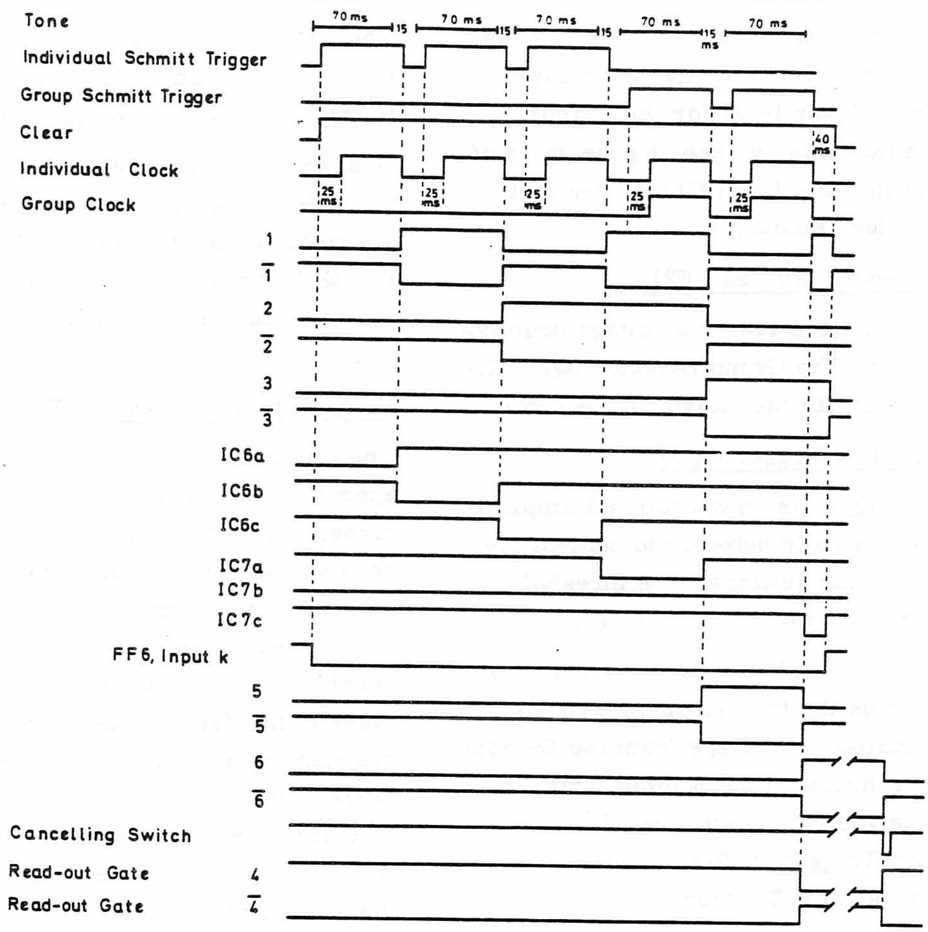
SR7841

PULSE SEQUENCE, 5 Tones with 2 Group Digits



Circuit Description

Input Stage (Q1, IC1, Q2, Q3)

The pre-emphasis network includes Q1, R4, and C4.

IC1 is a linear amplifier. Signal clipping begins when the signal amplitude approaches the supply voltage level (5 V). Full amplitude limiting occurs when the input signal is 6 dB above the nominal 110 mV value.

R5 and R8 determine the amplifier gain. Voltage divider R6 and R7 sets the DC output level.

The limiting action and the narrow pass-band of the subsequent Q Multiplier ensure selectivity. Tones differing by at least 4.5% from the resonant frequency will not be able to trigger the tone receiver.

Transistors Q2 and Q3 are arranged so that they present an extremely low output impedance (on the order of 1 Ω) which is suitable as a common return connection for the resonant circuit in the following stage.

Individual Q Multiplier (Q4)

The Q Multiplier involves a parallel resonant circuit, L1 and C8. This is very loosely coupled to the transistor, Q4, in order to maintain a constant Q over the entire tone range. C8 in the resonant circuit is grounded through the output impedances of the driver transistors while the relevant terminals of coil L1 are alternately grounded through the AF Gates, a - e (Q15 - Q19)

A portion of the tone signal is reapplied to L1 in phase by means of a feedback winding in the collector circuit of Q4, approximately doubling the Q of L1.

To offset the effect of temperature upon the Q of L1 an NTC resistor, R19, is inserted in the emitter circuit of Q4. R19, aided by R17 and R18, maintains a nearly flat temperature response from $-30^{\circ}C$ to $+80^{\circ}C$. The Group Q Multiplier (Q22) is identical with the Individual Q Multiplier.

Storno

Individual Amplifier (IC2)

The signal from the Q Multiplier is DC coupled to the non-inverting input of IC2. Amplifier gain, and thus trigger level for the Schmitt Trigger, is adjustable by changing the value of R20. The Group Amplifier (IC8) is identical with the Individual Amplifier.

Individual Detector (Q5, E1, E2)

Emitter follower Q5 drives the voltage doubling rectifier circuit. The Group Detector (Q23, E9, E10) is identical with the Individual Detector.

Individual Schmitt Trigger (IC3)

The Schmitt Trigger is an operational amplifier working as a threshold detector to control the Clock and the Clear settings. The threshold voltage is set by network R29, E3, and R30.

In stand by the state of the non-inverting input is logic "0", thus the trigger output is also "0". When the rectified DC voltage from the Detector surpasses the threshold the Schmitt Trigger switches state and the output goes "1". The Group Schmitt Trigger (IC9) is identical with the Individual Schmitt Trigger.

Individual Clock (Q6, Q7, Q8)

The Individual Clock toggles Counter FF1 after first introducing a 25 ms delay in order to prevent erratic operation. The Clock output pulse is delayed until the Schmitt Trigger has displayed a logic "1" output state for approx. 25 ms. Delay time is adjustable by means of R35.

In stand by the output state of IC3 is "0", holding Q6, Q7, and Q8 ON. Clock output is also "0". When IC3 triggers, its output goes logic "1". This cuts off Q6, and C16 begins charging through R34 in parallel with R35. After the set delay time, Q7 becomes reverse biased and cuts off, turning Q8 OFF. Clock output at the collector of Q8 goes "1".

When the tone ends, the Schmitt Trigger returns to its quiescent state and Q6 goes ON and C16 discharges rapidly through Q6 and R36, turning Q7, then Q8 ON. Clock output switches to logic state "0" and FF1 toggles.

Group Clock (Q25 - Q27)

The Group Clock toggles Group Counter FF5. Circuit operation, including the 25 ms delay, is the same as for the Individual Clock.

Q28 drives the Individual Clock so that its output follows the output of the Group Clock. When the collector of Q27 (Group Clock output) goes HI, Q28 conducts, grounding the base of Q8 whose collector (Individual Clock output) goes HI.

Clear Circuit (Q9 - Q12, E5, E6, E13)

The Clear circuit sets the Counter to stand by approx. 40 ms after the last correct tone arrives. Where the tone code is correct for the receiver setting the last tone will, of course, be the 5th tone (4th tone with 4-tone signalling). In the event of an incorrect tone code, the tone receiver will respond normally until one of the tones in the false sequence fails to match the resonant frequency set up by the AF Gates. Since each tone lasts for about 70 ms, the Clear circuit will have reset the Counter to stand by before the incorrect tone expires and prior to the arrival of the next tone.

Emitter follower Q9 is driven by the Schmitt Trigger outputs through diode E5 or through E13. In stand by, E5 (E13) cannot conduct, and Q9 is OFF. Q10, Q11, and Q12 are all ON, and output is at logic "0".

When one of the Schmitt Trigger outputs goes "1", E5 or E13 conducts, turning Q9 ON. C18 discharges through Q9, whereby Q10, Q11, and Q12 go OFF (output state "1"). The Counter is now able to start counting.

At the end of a tone E5 (E13) stops conducting (trigger output at "0" again) and C18 charges through R42 and R43. The charge building up on C18 eventually overcomes the emitter bias and turns Q10 ON. Emitter voltage for Q10, and thus the time elapsing before the Clear circuit returns to its quiescent state, is determined by voltage divider R45 and R46. When Q10 conducts, it turns Q11 and Q12 ON, as well, resetting the counter to stand by.

The 40 ms delay is measured as the time elapsed between the Schmitt Trigger output "0" and when the Clear output goes "1".

Tones in a sequence arrive with maximum 15 ms interval between them, which is fast enough to keep the Clear output at "1".

When battery voltage is initially applied to the circuit a positive pulse is fed through E6 to the base of Q11, driving Q12 into saturation and ensuring that the Counter is cleared and ready to accomodate an incoming call.

Individual Counter FF1 - FF3 ($IC4_a$, $IC5_a$, $IC5_b$)

The Individual Counter is composed of three J-K master-slave flip-flops with their J-K inputs all tied to logic state "1" through resistor R87. Each FF will thus toggle whenever it receives a clock pulse at the same time that its Clear input is held at "1". The Clock stage toggles FF1, FF1 toggles FF2, and FF2 toggles FF3.

FF1 has a Preset as well as a Clear function, allowing the tone receiver to be strapped to either 4-tone or 5-tone sequencies.

Truth tables for these two models follow:

Truth Table for the Individual Counter

5-tone

	1	$\bar{1}$	2	$\bar{2}$	3	$\bar{3}$
Cleared (pending call)	0	1	0	1	0	1
After first tone	1	0	0	1	0	1
After second tone	0	1	1	0	0	1
After third tone	1	0	1	0	0	1
After fourth tone	0	1	0	1	1	0
After fifth tone	1	0	0	1	1	0
40 mS after last tone (cleared, pending call)	0	1	0	1	0	1

4-tone

	1	$\bar{1}$	2	$\bar{2}$	3	$\bar{3}$
Preset (pending call)	1	0	0	1	0	1
After first tone	0	1	1	0	0	1
After second tone	1	0	1	0	0	1
After third tone	0	1	0	1	1	0
After fourth tone	1	0	0	1	1	0
40 mS after last tone (cleared, pending call)	1	0	0	1	0	1

The truth table for group calls will be similar.

Group Counter FF5 - FF6 ($IC10_a$, $IC10_b$)

The Group Counter comprises two J-K master-slave flip-flops which are coupled quite similarly to FF1 - FF3 in the Individual Counter except that the K input of FF6 is controlled by Group Gate Q29.

Group Gate (Q29) and Blocking Gate (Q24)

These two gates prevent inadvertent cancelling of the group call set-up when or if the group call tone sequence is retransmitted.

During the tone signalling sequence, inverter Q29 holds the FF6 K input at logic state "0" to inhibit the Counter from switching output states and thus cancelling the call set-up.

After the group call is set up, Q24 will be held ON by FF4 output $\bar{4}$. The logic "1" level at this output turns Q24 ON, placing a short circuit across the Group Schmitt Trigger output so that no new group signal can reach the clock circuits.

The Blocking Gate has another function; when the loudspeaker is turned ON, an incoming group call must not be able to interrupt the connection. Since FF4 output $\bar{4}$ is at logic state "1" whenever the speaker is ON (as when a call comes through or when set up by the LS IN / OUT push button via terminal 32), Q24 short circuits the Group Schmitt Trigger as just explained.

Truth Tables for Group Counter

One Group Digit	5	$\bar{5}$	6	$\bar{6}$
Cleared (pending call)	0	1	0	1
After first tone	1	0	1	0
40 ms later (Clear circuit output returns to "0"	0	1	1	0
300 ms after carrier disappears (Squelch Delay triggers Cancelling Switch)	0	1	0	1

Two Group Digits	5	$\bar{5}$	6	$\bar{6}$
Cleared (pending call)	0	1	0	1
After first tone	1	0	0	1
After second tone	0	1	1	0
40 ms later (Clear circuit output returns to "0")	0	1	1	0
300 ms after carrier disappears (Squelch Delay triggers Cancelling Switch)	0	1	0	1

Decoder (IC6, IC7)

Each Decoder IC contains 3 separate, 3-input TTL NAND gates.

The output of a NAND gate is LO (logic "0") only when all of its inputs are HI (logic "1").

In stand by, 5-tone mode, the output of $IC6_a$ is always "0". In the 4-tone mode, the output of $IC6_b$ will be "0", instead.

At the end of a correct tone call $IC7_c$ presents a logic "0" to the Read-out Gate and to the Alarm circuit. The Alarm output, terminal 37, goes "0" through Q42, but only for individual calls. Group calls do not activate the Alarm circuit.

Individual AF Gates a, b, c, d, e (Q15 - Q19)

The AF Gates are controlled from the Decoder NAND gates, $IC6_a$ - $IC7_b$. When a transistor base is driven LO (logic "0") by a NAND gate, that transistor will conduct and ground the coil terminal connected to its collector.

Group AF Gates f and g (Q20, Q21)

For tone signals with only one group digit, Q21 is controlled from $IC7_b$. Q20 is not connected.

For signals having two group digits, the first Group AF Gate, Q20, is connected in parallel with the fourth Individual AF Gate, Q18. Both gates are driven by $IC7_a$. The second (last) Group AF Gate, Q21, is driven directly by FF5 output $\bar{5}$.

Alarm Circuit (Q39 - Q42, E18)

In stand by, Q39 is ON and E18 cannot conduct. Q40 and Q41 are both ON, and Q42 is OFF.

A correct call turns Q39 OFF and C46 charges through E18, causing Q40 and Q41 to turn OFF, driving Q42 ON, and connecting terminal 37 (ALARM) to chassis ground.

After approximately 40 ms (the clear delay) $IC7_c$ goes "1" and turns Q39 ON again. E18 can no longer conduct and C46 discharges through R114. After the delay caused by the time constant of C46 - R114, Q40 and Q41 turn ON and disconnect the Alarm circuit common return through Q42. The Alarm stays ON for approximately 1 second.

Group calls, however, do not activate the Alarm circuit. After receipt of the last group tone, FF6 output 6 goes "1". E19 then conducts, holding Q41 ON, thus Q42 stays cut off.

AF Muting and Key Lock Switch (Q30, Q31, E14)

The AF Muting and the Key Lock are controlled by the output of Read-out Gate $IC4_b$ (output $\bar{4}$).

In stand by the outputs of Q30 and Q31 are HI ($\sim$+10 V), E14 conducts and the loudspeaker is muted through terminal 34.

As long as the potential at terminal 51 is HI, the transmitter keying function is also disabled.

When the Read-out Gate is activated, output $\bar{4}$ goes "1", and Q30 and Q31 conduct, suspending the AF Muting and Key Lock functions.

Call and Occupied Lamp Switches (Q32, Q33, Q34)

The Call Lamp Switch, Q33, lights the Call Lamp by grounding it through terminal 47.

Terminal 49, in parallel with terminal 47, is provided for automatic muting of the vehicle's broadcast band radio, and requires an auxiliary relay.

At the end of a tone sequence, output 4 of FF4 goes "0", cutting Q32 OFF and turning Q33 ON, to complete the common return path for terminals 47 and 49.

Whenever the channel is occupied a DC voltage from the Squelch circuit, via terminal 41, turns Q34 ON, grounding the Occupied Lamp through terminal 45.

Cancelling Switch (Q38)

When the radiotelephone is turned ON the output functions must not be activated. To ensure this, Q38 feeds a negative pulse ("0") to the Preset of the Read-out Gate. When the battery voltage is switched ON, C41 discharges through Q38 which goes ON briefly, presetting the Read-out Gate.

The Cancelling Switch also serves to cancel out the call set-up when a group call expires. Receiving a pulse from the Delay circuit, Q38 then forwards a logic "0" to the preset input of FF4, the Read-out Gate.

Squelch Delay (Q35 - Q37)

Fading can be a problem when receiving a group call. To ensure uninterrupted reception, a time delay of approx. 300 ms is introduced before allowing the Cancelling Switch to clear down the connection. The delay is measured from the time that terminal 45 goes HI to when Q38 Collector goes LO.

After a group call is set up, FF6 output $\bar{6}$ goes "0" and Q35 goes OFF. As long as the RF carrier is present, Q34 is still ON and E16 conducts, keeping Q36 OFF. When the carrier disappears, Q34 goes OFF, E16 can no longer conduct, and C39 begins to charge through R98. Approx. 300 ms later, Q36 goes ON, turning Q37 ON. Q37 feeds a positive pulse to Q38, which in turn applies a negative pulse ("0") to the Read-out Gate preset, cancelling the group call.

This same pulse from Q38 also clears FF6, and the tone receiver is ready for a new call.

Technical Specifications

Supply Power

Nominal: 13.6 V
Minimum: 10.5 V
Maximum: 16.0 V

Current Drain

Stand by: 115 mA ± 15 mA

Regulated Voltages

Nominal 8.9 V and 4.9 V

Temperature Range

Operating range: –25°C to +60°C
Functioning range: –30°C to +80°C

Input Impedance

≥ 6 KΩ

Equalization

Preemphasis (by RC function) f_c=1000Hz

Signal Input Level

Nominal at 1000 Hz: 110 mV

Signalling Code

Sequence of 4 or 5 tone bursts of 70 ms ± 15 ms duration with maximum 15 ms interval between tone bursts.

Tone Signal Frequencies

Coil terminal	Tone frequency
1	970 Hz
2	1060 Hz
3	1160 Hz
4	1270 Hz
5	1400 Hz
6	1530 Hz
7	1670 Hz
8	1830 Hz
9	2000 Hz
10	2200 Hz
11	2400 Hz
12	2600 Hz
13	2800 Hz

Frequency Accuracy

Coil tuned for 1060 Hz: ≤ 0.4% for all tones

Frequency Stability

(typically ≤ 0.5%) ≤ 1.0%

Selectivity

Frequencies differing from f_o by 4.5% or more are unable to trigger the tone receiver.

Maximum Load Currents

Terminal 37	ALARM	100 mA (for 1.2 sec)
Terminal 47	CALL	100 mA
Terminal 45	OCCUPIED	100 mA
Terminal 51 and 43	KEY LOCK	10 mA
Terminal 34	AF MUTING	I_{load} min. 0.75 mA for V_{out} = 8 V

AF Muting

In conjunction with terminal 18 of CF701: ≥ 60 dB

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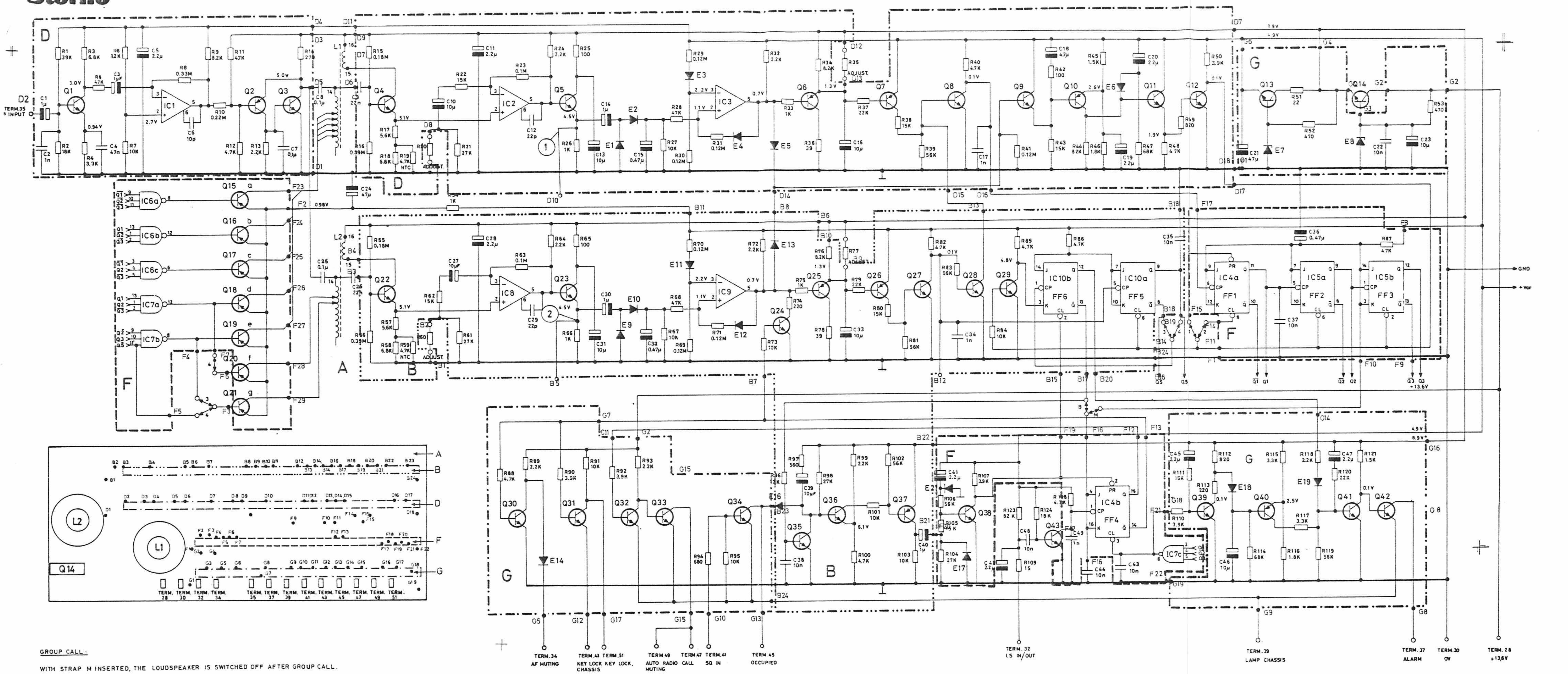


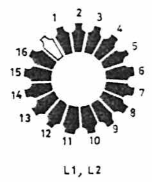
GROUP CALL:

WITH STRAP M INSERTED, THE LOUDSPEAKER IS SWITCHED OFF AFTER GROUP CALL.

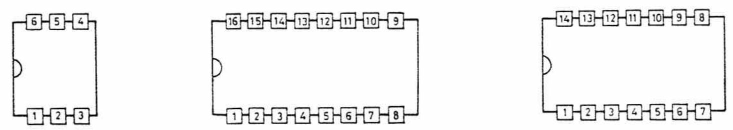
WITH STRAP B INSERTED, THE LOUDSPEAKER REMAINS ON AFTER THE GROUP CALL.

TERM.	DIGIT	FREQ.
1	X	970 Hz
2	1	1060 -
3	2	1160 -
4	3	1270 -
5	4	1400 -
6	5	1530 -
7	6	1670 -
8	7	1830 -
9	8	2000 -
10	9	2200 -
11	0	2400 -
12	REPEAT	2600 -
13	ALARM	2800 -

	Vcc PIN	GND PIN
IC1	2	6
IC2	2	6
IC3	2	6
IC4	5	13
IC5	4	11
IC6	14	7
IC7	14	7
IC8	2	6
IC9	2	6
IC10	4	11



L1, L2



IC1. IC2. IC3.
IC8. IC9

IC4

IC5. IC6. IC7. IC10

TOP VIEW

4-TONE SEQUENTIAL RECEIVER: INSERT STRAP 1

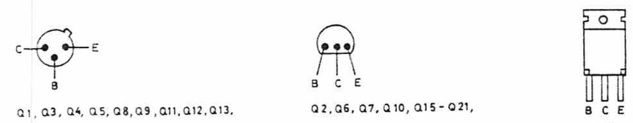
5-TONE SEQUENTIAL RECEIVER: INSERT STRAP 2

4-TONE SEQUENTIAL RECEIVER WITH 1-TONE GROUP CALL: INSERT STRAPS 1 AND 3

4-TONE SEQUENTIAL RECEIVER WITH 2-TONE GROUP CALL: INSERT STRAPS 1 AND 4

5-TONE SEQUENTIAL RECEIVER WITH 1-TONE GROUP CALL: INSERT STRAPS 2 AND 3

5-TONE SEQUENTIAL RECEIVER WITH 2-TONE GROUP CALL: INSERT STRAPS 2 AND 4



Q1, Q3, Q4, Q5, Q8, Q9, Q11, Q12, Q13, Q22, Q23, Q24, Q27 - Q39, Q41, Q42.

Q2, Q6, Q7, Q10, Q15 - Q21, Q25, Q26, Q35, Q37, Q40.

Q14

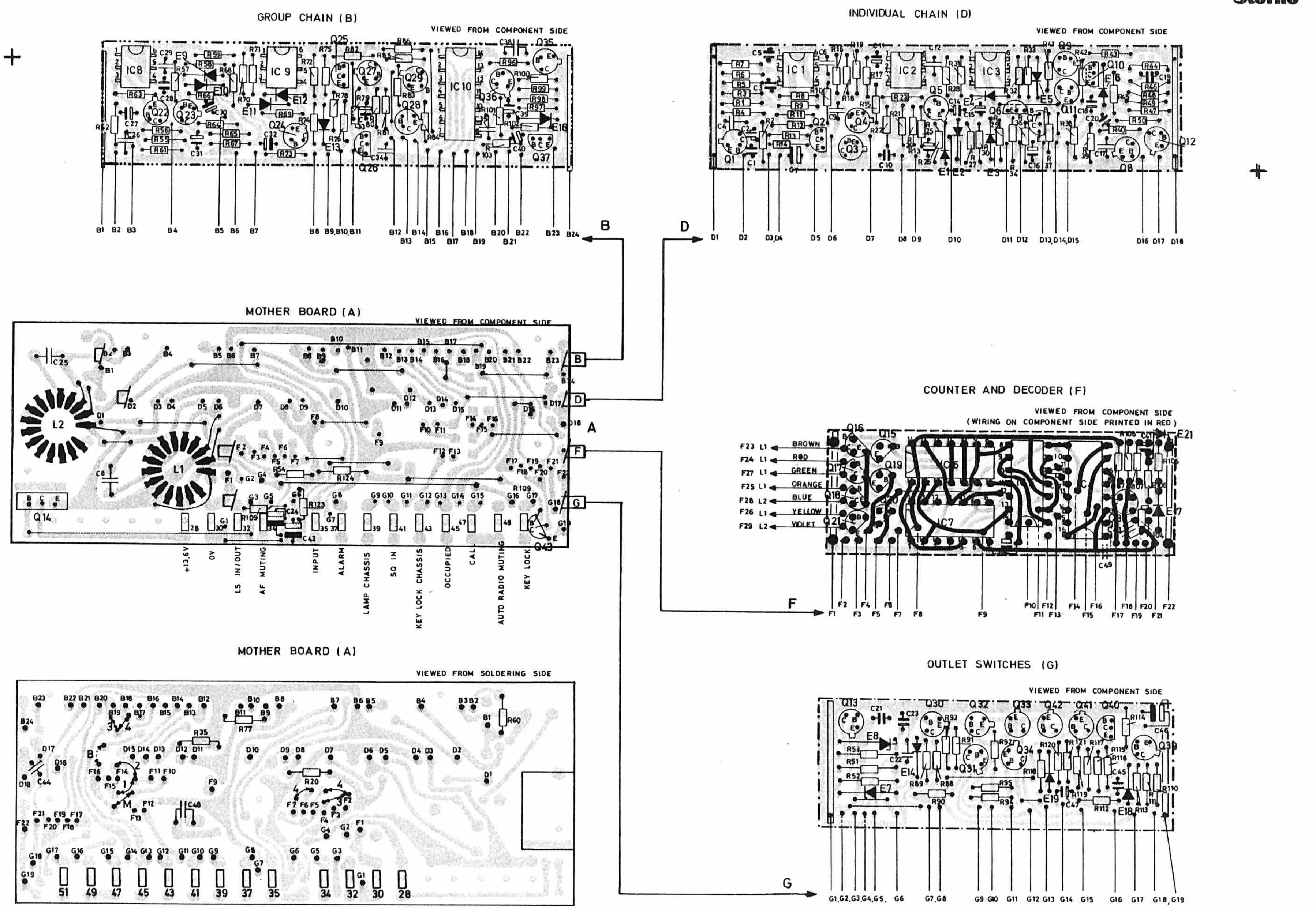
BOTTOM VIEW

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR7841

D401.706/2

Storno



SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR7841

D401.711/2

Storno

TYPE	NO.	CODE	DATA	
SR7841		10.2456	Sequential Tone Receiver	
	C1	73.5135	1μF -20+50% tantal	16V
	C2	76.5069	1nF 10% polyest. FL	50V
	C3	73.5135	1μF -20+50% tantal	16V
	C4	76.5072	47nF 10% polyest. FL	50V
	C5	73.5129	2.2μF -20+50% tantal	10V
	C6	74.5135	10pF 5% ceram	125V
	C7	76.5070	10nF 10% polyest. FL	50V
	C8	76.5068	0.1μF 1% polystyren TB	63V
	C9	76.5071	22nF 10% polyest. FL	50V
	C10	73.5109	10μF 20% tantal	16V
	C11	73.5129	2.2μF -20+50% tantal	10V
	C12	74.5106	22pF ± 0.5pF ceram	160V
	C13	73.5109	10μF 20% tantal	16V
	C14	73.5114	1μF 20% tantal	35V
	C15	73.5125	0.47μF 20% tantal	35V
	C16	73.5109	10μF 20% tantal	16V
	C17	76.5069	1nF 10% polyest. FL	50V
	C18	73.5126	4.7μF 20% tantal	35V
	C19	73.5129	2.2μF -20+50% tantal	10V
	C20	73.5129	2.2μF -20+50% tantal	10V
	C21	73.5124	47μF 20% tantal	6.3V
	C22	76.5070	10nF 10% polyest. FL	50V
	C23	73.5109	10μF 20% tantal	16V
	C24	73.5124	47μF 20% tantal	6.3V
	C25	76.5068	0.1μF 1% polystyr TB	63V
	C26	76.5071	22nF 10% polyest. FL	50V
	C27	73.5109	10μF 20% tantal	16V
	C28	73.5129	2.2μF -20/+50% tantal	10V
	C29	74.5106	22pF ± 0.5pF ceram	160V
	C30	73.5114	1μF 20% tantal	35V
	C31	73.5109	10μF 20% tantal	16V
	C32	73.5125	0.47μF 20% tantal	35V
	C33	73.5109	10μF 20% tantal	16V
	C34	76.5069	1nF 10% polyest. FL	50V
	C35	74.5109	10nF -20/+80% ceram PL	20V
	C36	73.5134	0.47μF -20+50% tantal	16V
	C37	74.5109	10nF -20/+80% ceram PL	20V
	C38	74.5109	10nF -20/+80% ceram PL	20V
	C39	73.5109	10μF 20% tantal	16V
	C40	73.5135	1μF -20/+50% tantal	16V
	C41	73.5129	2.2μF -20+50% tantal	10V
	C42	73.5129	2.2μF -20+50% tantal	10V
	C43	74.5109	10nF -20+80% ceram PL	20V
	C44	74.5109	10nF -20+80% ceram PL	20V
	C45	73.5129	2.2μF -20+50% tantal	10V
	C46	73.5109	10μF 20% tantal	16V

Storno

TYPE	NO.	CODE	DATA	
	C47	73.5129	2.2μF -20+50% tantal	10V
	R1	80.5068	39kΩ 5% carbon film	0.1W
	R2	80.5064	18kΩ 5% carbon film	0.1W
	R3	80.5059	6.8kΩ 5% carbon film	0.1W
	R4	80.5055	3.3kΩ 5% carbon film	0.1W
	R5	80.5069	47kΩ 5% carbon film	0.1W
	R6	80.5060	8.2kΩ 5% carbon film	0.1W
	R7	80.5061	10kΩ 5% carbon film	0.1W
	R8	80.5079	0.33MΩ 5% carbon film	0.1W
	R9	80.5060	8.2kΩ 5% carbon film	0.1W
	R10	80.5077	0.22MΩ 5% carbon film	0.1W
	R11	80.5057	4.7kΩ 5% carbon film	0.1W
	R12	80.5057	4.7kΩ 5% carbon film	0.1W
	R13	80.5053	2.2kΩ 5% carbon film	0.1W
	R14	80.5042	270Ω 5% carbon film	0.1W
	R15	80.5076	0.18MΩ 5% carbon film	0.1W
	R16	80.5080	0.39MΩ 5% carbon film	0.1W
	R17	80.5058	5.6kΩ 5% carbon film	0.1W
	R18	80.5059	6.8kΩ 5% carbon film	0.1W
	R19	89.5009	4.7kΩ 20% NTC	0.6W
	R20	80.50xx	Adjusted 5% carbon film	0.1W
	R21	80.5066	27kΩ 5% carbon film	0.1W
	R22	80.5063	15kΩ 5% carbon film	0.1W
	R23	80.5073	0.1MΩ 5% carbon film	0.1W
	R24	80.5053	2.2kΩ 5% carbon film	0.1W
	R25	80.5037	100Ω 5% carbon film	0.1W
	R26	80.5049	1kΩ 5% carbon film	0.1W
	R27	80.5061	10kΩ 5% carbon film	0.1W
	R28	80.5069	47kΩ 5% carbon film	0.1W
	R29	80.5074	0.12MΩ 5% carbon film	0.1W
	R30	80.5074	0.12MΩ 5% carbon film	0.1W
	R31	80.5074	0.12mΩ 5% carbon film	0.1W
	R32	80.5053	2.2kΩ 5% carbon film	0.1W
	R33	80.5049	1kΩ 5% carbon film	0.1W
	R34	80.5060	8.2kΩ 5% carbon film	0.1W
	R35	80.50xx	Adjusted 5% carbon film	0.1W
	R36	80.5032	39Ω 5% carbon film	0,1W
	R37	80.5065	22kΩ 5% carbon film	0.1W
	R38	80.5063	15kΩ 5% carbon film	0.1W
	R39	80.5070	56kΩ 5% carbon film	0.1W
	R40	80.5057	4.7kΩ 5% carbon film	0.1W

SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR7841

X401.695/2

TYPE	NO.	CODE	DATA	
	R41	80.5074	0.12MΩ 5% carbon film	0.1W
	R42	80.5037	100Ω 5% carbon film	0.1W
	R43	80.5063	15kΩ 5% carbon film	0.1W
	R44	80.5072	82kΩ 5% carbon film	0.1W
	R45	80.5051	1.5kΩ 5% carbon film	0.1W
	R46	80.5052	1.8kΩ 5% carbon film	0.1W
	R47	80.5071	68kΩ 5% carbon film	0.1W
	R48	80.5057	4.7kΩ 5% carbon film	0.1W
	R49	80.5048	820Ω 5% carbon film	0.1W
	R50	80.5056	3.9kΩ 5% carbon film	0.1W
	R51	80.5229	22Ω 5% carbon film	1/8W
	R52	80.5245	470Ω 5% carbon film	1/8W
	R53	80.5245	470Ω 5% carbon film	1/8W
	R54	80.5049	1kΩ 5% carbon film	0.1W
	R55	80.5076	0.18MΩ 5% carbon film	0.1W
	R56	80.5080	0.39MΩ 5% carbon film	0.1W
	R57	80.5058	5.6kΩ 5% carbon film	0.1W
	R58	80.5059	6.8kΩ 5% carbon film	0.1W
	R59	89.5009	4.7kΩ NTC 20%	0.6W
	R60	80.50xx	Adjusted 5% carbon film	0.1W
	R61	80.5066	27kΩ 5% carbon film	0.1W
	R62	80.5063	15kΩ 5% carbon film	0.1W
	R63	80.5073	0.1MΩ 5% carbon film	0.1W
	R64	80.5053	2.2kΩ 5% carbon film	0.1W
	R65	80.5037	100Ω 5% carbon film	0.1W
	R66	80.5049	1kΩ 5% carbon film	0.1W
	R67	80.5061	10kΩ 5% carbon film	0.1W
	R68	80.5069	47kΩ 5% carbon film	0.1W
	R69	80.5074	0.12MΩ 5% carbon film	0.1W
	R70	80.5074	0.12MΩ 5% carbon film	0.1W
	R71	80.5074	0.12MΩ 5% carbon film	0.1W
	R72	80.5053	2.2kΩ 5% carbon film	0.1W
	R73	80.5061	10kΩ 5% carbon film	0.1W
	R74	80.5041	220Ω 5% carbon film	0.1W
	R75	80.5049	1kΩ 5% carbon film	0.1W
	R76	80.5060	8.2kΩ 5% carbon film	0.1W
	R77	80.50xx	Adjusted 5% carbon film	0.1W
	R78	80.5032	39Ω 5% carbon film	0.1W
	R79	80.5065	22kΩ 5% carbon film	0.1W
	R80	80.5063	15kΩ 5% carbon film	0.1W
	R81	80.5070	56kΩ 5% carbon film	0.1W
	R82	80.5057	4.7kΩ 5% carbon film	0.1W
	R83	80.5070	56kΩ 5% carbon film	0.1W
	R84	80.5061	10kΩ 5% carbon film	0.1W
	R85	80.5057	4.7kΩ 5% carbon film	0.1W
	R86	80.5057	4.7kΩ 5% carbon film	0.1W
	R87	80.5057	4.7kΩ 5% carbon film	0.1W
	R88	80.5057	4.7kΩ 5% carbon film	0.1W

Storno

TYPE	NO.	CODE	DATA	
	R89	80.5053	2.2kΩ 5% carbon film	0.1W
	R90	80.5056	3.9kΩ 5% carbon film	0.1W
	R91	80.5061	10kΩ 5% carbon film	0.1W
	R92	80.5056	3.9kΩ 5% carbon film	0.1W
	R93	80.5053	2.2kΩ 5% carbon film	0.1W
	R94	80.5047	680Ω 5% carbon film	0.1W
	R95	80.5061	10kΩ 5% carbon film	0.1W
	R96	80.5062	12kΩ 5% carbon film	0.1W
	R97	80.5046	560Ω 5% carbon film	0.1W
	R98	80.5066	27kΩ 5% carbon film	0.1W
	R99	80.5053	2.2kΩ 5% carbon film	0.1W
	R100	80.5057	4.7kΩ 5% carbon film	0.1W
	R101	80.5061	10kΩ 5% carbon film	0.1W
	R102	80.5070	56kΩ 5% carbon film	0.1W
	R103	80.5061	10kΩ 5% carbon film	0.1W
	R104	80.5066	27kΩ 5% carbon film	0.1W
	R105	80.5063	15kΩ 5% carbon film	0.1W
	R106	80.5070	56kΩ 5% carbon film	0.1W
	R107	80.5056	3.9kΩ 5% carbon film	0.1W
	R108	80.5057	4.7kΩ 5% carbon film	0.1W
	R109	80.5027	15Ω 5% carbon film	0.1W
	R110	80.5056	3.9kΩ 5% carbon film	0.1W
	R111	80.5063	15kΩ 5% carbon film	0.1W
	R112	80.5048	820Ω 5% carbon film	0.1W
	R113	80.5041	220Ω 5% carbon film	0.1W
	R114	80.5071	68 Ω 5% carbon film	0.1W
	R115	80.5055	3.3kΩ 5% carbon film	0.1W
	R116	80.5052	1.8kΩ 5% carbon film	0.1W
	R117	80.5055	3.3kΩ 5% carbon film	0.1W
	R118	80.5053	2.2kΩ 5% carbon film	0.1W
	R119	80.5070	56kΩ 5% carbon film	0.1W
	R120	80.5065	22kΩ 5% carbon film	0.1W
	R121	80.5051	1.5kΩ 5% carbon film	0.1W
	R123	80.5072	82 KΩ 5% carbon film	0.1W
	R124	80.5064	18 KΩ 5% carbon film	0.1W
	L1	61.1148	Tone coil	
	L2	61.1148	Tone coil	
	E1	99.5237	1N4148 Diode	
	E2	99.5237	1N4148 Diode	
	E3	99.5237	1N4148 Diode	
	E4	99.5237	1N4148 Diode	
	E5	99.5237	1N4148 Diode	

SEQUENTIAL TONE RECEIVER SR7841
SEKVENSTONEMODTAGER

TYPE	NO.	CODE	DATA
	E6	99.5237	1N4148 Diode
	E7	99.5114	5.6V 5% Zenerdiode 0.25W
	E8	99.5042	9.1V 5% Zenerdiode 0.25W
	E9	99.5237	1N4148 Diode
	E10	99.5237	1N4148 Diode
	E11	99.5237	1N4148 Diode
	E12	99.5237	1N4148 Diode
	E13	99.5237	1N4148 Diode
	E14	99.5237	1N4148 Diode
	E16	99.5237	1N4148 Diode
	E17	99.5237	1N4148 Diode
	E18	99.5237	1N4148 Diode
	E19	99.5237	1N4148 Diode
	Q1	99.5143	BC108 Transistor
	Q2	99.5144	BC214L Transistor
	Q3	99.5743	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5144	BC214L Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5144	BC214L Transistor
	Q11	99.5143	BC108 Transistor
	Q12	99.5143	BC108 Transistor
	Q13	99.5143	BC108 Transistor
	Q14	99.5246	TIP31 Transistor
	Q15	99.5144	BC214L Transistor
	Q16	99.5144	BC214L Transistor
	Q17	99.5144	BC214L Transistor
	Q18	99.5144	BC214L Transistor
	Q19	99.5144	BC214L Transistor
	Q20	99.5144	BC214L Transistor
	Q21	99.5144	BC214L Transistor
	Q22	99.5143	BC108 Transistor
	Q23	99.5143	BC108 Transistor
	Q24	99.5143	BC108 Transistor
	Q25	99.5144	BC214L Transistor
	Q26	99.5144	BC214L Transistor
	Q27	99.5143	BC108 Transistor
	Q28	99.5143	BC108 Transistor
	Q29	99.5143	BC108 Transistor
	Q30	99.5143	BC108 Transistor
	Q31	99.5143	BC108 Transistor
	Q32	99.5143	BC108 Transistor

TYPE	NO.	CODE	DATA
	Q33	99.5143	BC108 Transistor
	Q34	99.5143	BC108 Transistor
	Q35	99.5143	BC108 Transistor
	Q36	99.5143	BC108 Transistor
	Q37	99.5144	BC214L Transistor
	Q38	99.5143	BC108 Transistor
	Q39	99.5143	BC108 Transistor
	Q40	99.5144	BC214L Transistor
	Q41	99.5143	BC108 Transistor
	Q42	99.5143	BC108 Transistor
	Q43	99.5117	BC167 Transistor
	IC1	14.5017	TAA861 Operational Amplifier
	IC2	14.5017	TAA861 Operational Amplifier
	IC3	14.5017	TAA861 Operational Amplifier
	IC4	14.5009	Dual J-K, master slave FF/clear-preset
	IC5	14.5008	Dual J-K, master slave FF/clear
	IC6	14.5007	Triple 3-input NAND-gate
	IC7	14.5007	Triple 3-input NAND-gate
	IC8	14.5017	TAA861 Operational Amplifier
	IC9	14.5017	TAA861 Operational Amplifier
	IC10	14.5008	Dual J-K, master slave FF/clear

SEQUENTIAL TONE RECEIVER SR7841
SEKVENSTONEMODTAGER

X401.695/2

Storno

TYPE	NO.	CODE	DATA	
SR7841		10.2456	Sequential Tone Receiver	
	C1	73.5135	1µF -20+50% tantal	16V
	C2	76.5069	1nF 10% polyest. FL	50V
	C3	73.5135	1µF -20+50% tantal	16V
	C4	76.5072	47nF 10% polyest. FL	50V
	C5	73.5129	2.2µF -20+50% tantal	10V
	C6	74.5135	10pF 5% ceram	125V
	C7	76.5070	10nF 10% polyest. FL	50V
	C8	76.5068	0.1µF 1% polystyren TB	63V
	C9	76.5071	22nF 10% polyest. FL	50V
	C10	73.5109	10µF 20% tantal	16V
	C11	73.5129	2.2µF -20+50% tantal	10V
	C12	74.5106	22pF ± 0.5pF ceram	160V
	C13	73.5109	10µF 20% tantal	16V
	C14	73.5114	1µF 20% tantal	35V
	C15	73.5125	0.47µF 20% tantal	35V
	C16	73.5109	10µF 20% tantal	16V
	C17	76.5069	1nF 10% polyest. FL	50V
	C18	73.5126	4.7µF 20% tantal	35V
	C19	73.5129	2.2µF -20+50% tantal	10V
	C20	73.5129	2.2µF -20+50% tantal	10V
	C21	73.5124	47µF 20% tantal	6.3V
	C22	76.5070	10nF 10% polyest. FL	50V
	C23	73.5109	10µF 20% tantal	16V
	C24	73.5124	47µF 20% tantal	6.3V
	C25	76.5068	0.1µF 1% polystyr TB	63V
	C26	76.5071	22nF 10% polyest. FL	50V
	C27	73.5109	10µF 20% tantal	16V
	C28	73.5129	2.2µF -20/+50% tantal	10V
	C29	74.5106	22pF ± 0.5pF ceram	160V
	C30	73.5114	1µF 20% tantal	35V
	C31	73.5109	10µF 20% tantal	16V
	C32	73.5125	0.47µF 20% tantal	35V
	C33	73.5109	10µF 20% tantal	16V
	C34	76.5069	1nF 10% polyest. FL	50V
	C35	74.5109	10nF -20/+80% ceram PL	20V
	C36	73.5134	0.47µF -20+50% tantal	16V
	C37	74.5109	10nF -20/+80% ceram PL	20V
	C38	74.5109	10nF -20/+80% ceram PL	20V
	C39	73.5109	10µF 20% tantal	16V
	C40	73.5135	1µF -20/+50% tantal	16V
	C41	73.5129	2.2µF -20+50% tantal	10V
	C42	73.5124	47µF 20% tantal	6.3V
	C43	74.5109	10nF -20+80% ceram PL	20V
	C44	74.5109	10nF -20+80% ceram PL	20V
	C45	73.5129	2.2µF -20+50% tantal	10V
	C46	73.5109	10µF 20% tantal	16V

Storno

TYPE	NO.	CODE	DATA	
	C47	73.5129	2.2µF -20+50% tantal	10V
	R1	80.5068	39kΩ 5% carbon film	0.1W
	R2	80.5064	18kΩ 5% carbon film	0.1W
	R3	80.5059	6.8kΩ 5% carbon film	0.1W
	R4	80.5055	3.3kΩ 5% carbon film	0.1W
	R5	80.5069	47kΩ 5% carbon film	0.1W
	R6	80.5060	8.2kΩ 5% carbon film	0.1W
	R7	80.5061	10kΩ 5% carbon film	0.1W
	R8	80.5079	0.33MΩ 5% carbon film	0.1W
	R9	80.5060	8.2kΩ 5% carbon film	0.1W
	R10	80.5077	0.22MΩ 5% carbon film	0.1W
	R11	80.5057	4.7kΩ 5% carbon film	0.1W
	R12	80.5057	4.7kΩ 5% carbon film	0.1W
	R13	80.5053	2.2kΩ 5% carbon film	0.1W
	R14	80.5042	270Ω 5% carbon film	0.1W
	R15	80.5076	0.18MΩ 5% carbon film	0.1W
	R16	80.5080	0.39MΩ 5% carbon film	0.1W
	R17	80.5058	5.6kΩ 5% carbon film	0.1W
	R18	80.5059	6.8kΩ 5% carbon film	0.1W
	R19	89.5009	4.7kΩ 20% NTC	0.6W
	R20	80.50xx	Adjusted 5% carbon film	0.1W
	R21	80.5066	27kΩ 5% carbon film	0.1W
	R22	80.5063	15kΩ 5% carbon film	0.1W
	R23	80.5073	0.1MΩ 5% carbon film	0.1W
	R24	80.5053	2.2kΩ 5% carbon film	0.1W
	R25	80.5037	100Ω 5% carbon film	0.1W
	R26	80.5049	1kΩ 5% carbon film	0.1W
	R27	80.5061	10kΩ 5% carbon film	0.1W
	R28	80.5069	47kΩ 5% carbon film	0.1W
	R29	80.5074	0.12MΩ 5% carbon film	0.1W
	R30	80.5074	0.12MΩ 5% carbon film	0.1W
	R31	80.5074	0.12mΩ 5% carbon film	0.1W
	R32	80.5053	2.2kΩ 5% carbon film	0.1W
	R33	80.5049	1kΩ 5% carbon film	0.1W
	R34	80.5060	8.2kΩ 5% carbon film	0.1W
	R35	80.50xx	Adjusted 5% carbon film	0.1W
	R36	80.5032	39Ω 5% carbon film	0.1W
	R37	80.5065	22kΩ 5% carbon film	0.1W
	R38	80.5063	15kΩ 5% carbon film	0.1W
	R39	80.5070	56kΩ 5% carbon film	0.1W
	R40	80.5057	4.7kΩ 5% carbon film	0.1W

SEQUENTIAL TONE RECEIVER SEKVENSTONEMODTAGER SR7841

X401,695

TYPE	NO.	CODE	DATA		
	R41	80.5074	0.12MΩ 5%	carbon film	0.1W
	R42	80.5037	100Ω 5%	carbon film	0.1W
	R43	80.5063	15kΩ 5%	carbon film	0.1W
	R44	80.5072	82kΩ 5%	carbon film	0.1W
	R45	80.5051	1.5kΩ 5%	carbon film	0.1W
	R46	80.5052	1.8kΩ 5%	carbon film	0.1W
	R47	80.5071	68kΩ 5%	carbon film	0.1W
	R48	80.5057	4.7kΩ 5%	carbon film	0.1W
	R49	80.5048	820Ω 5%	carbon film	0.1W
	R50	80.5056	3.9kΩ 5%	carbon film	0.1W
	R51	80.5229	22Ω 5%	carbon film	1/8W
	R52	80.5245	470Ω 5%	carbon film	1/8W
	R53	80.5245	470Ω 5%	carbon film	1/8W
	R54	80.5049	1kΩ 5%	carbon film	0.1W
	R55	80.5076	0.18MΩ 5%	carbon film	0.1W
	R56	80.5080	0.39MΩ 5%	carbon film	0.1W
	R57	80.5058	5.6kΩ 5%	carbon film	0.1W
	R58	80.5059	6.8kΩ 5%	carbon film	0.1W
	R59	89.5009	4.7kΩ NTC 20%		0.6W
	R60	80.50xx	Adjusted 5%	carbon film	0.1W
	R61	80.5066	27kΩ 5%	carbon film	0.1W
	R62	80.5063	15kΩ 5%	carbon film	0.1W
	R63	80.5073	0.1MΩ 5%	carbon film	0.1W
	R64	80.5053	2.2kΩ 5%	carbon film	0.1W
	R65	80.5037	100Ω 5%	carbon film	0.1W
	R66	80.5049	1kΩ 5%	carbon film	0.1W
	R67	80.5061	10kΩ 5%	carbon film	0.1W
	R68	80.5069	47kΩ 5%	carbon film	0.1W
	R69	80.5074	0.12MΩ 5%	carbon film	0.1W
	R70	80.5074	0.12MΩ 5%	carbon film	0.1W
	R71	80.5074	0.12MΩ 5%	carbon film	0.1W
	R72	80.5053	2.2kΩ 5%	carbon film	0.1W
	R73	80.5061	10kΩ 5%	carbon film	0.1W
	R74	80.5041	220Ω 5%	carbon film	0.1W
	R75	80.5049	1kΩ 5%	carbon film	0.1W
	R76	80.5060	8.2kΩ 5%	carbon film	0.1W
	R77	80.50xx	Adjusted 5%	carbon film	0.1W
	R78	80.5032	39Ω 5%	carbon film	0.1W
	R79	80.5065	22kΩ 5%	carbon film	0.1W
	R80	80.5063	15kΩ 5%	carbon film	0.1W
	R81	80.5070	56kΩ 5%	carbon film	0.1W
	R82	80.5057	4.7kΩ 5%	carbon film	0.1W
	R83	80.5070	56kΩ 5%	carbon film	0.1W
	R84	80.5061	10kΩ 5%	carbon film	0.1W
	R85	80.5057	4.7kΩ 5%	carbon film	0.1W
	R86	80.5057	4.7kΩ 5%	carbon film	0.1W
	R87	80.5057	4.7kΩ 5%	carbon film	0.1W
	R88	80.5057	4.7kΩ 5%	carbon film	0.1W

TYPE	NO.	CODE	DATA		
	R89	80.5053	2.2kΩ 5%	carbon film	0.1W
	R90	80.5056	3.9kΩ 5%	carbon film	0.1W
	R91	80.5061	10kΩ 5%	carbon film	0.1W
	R92	80.5056	3.9kΩ 5%	carbon film	0.1W
	R93	80.5053	2.2kΩ 5%	carbon film	0.1W
	R94	80.5047	680Ω 5%	carbon film	0.1W
	R95	80.5061	10kΩ 5%	carbon film	0.1W
	R96	80.5062	12kΩ 5%	carbon film	0.1W
	R97	80.5046	560Ω 5%	carbon film	0.1W
	R98	80.5066	27kΩ 5%	carbon film	0.1W
	R99	80.5053	2.2kΩ 5%	carbon film	0.1W
	R100	80.5057	4.7kΩ 5%	carbon film	0.1W
	R101	80.5061	10kΩ 5%	carbon film	0.1W
	R102	80.5070	56kΩ 5%	carbon film	0.1W
	R103	80.5061	10kΩ 5%	carbon film	0.1W
	R104	80.5066	27kΩ 5%	carbon film	0.1W
	R105	80.5063	15kΩ 5%	carbon film	0.1W
	R106	80.5070	56kΩ 5%	carbon film	0.1W
	R107	80.5056	3.9kΩ 5%	carbon film	0.1W
	R108	80.5057	4.7kΩ 5%	carbon film	0.1W
	R109	80.5035	68Ω 5%	carbon film	0.1W
	R110	80.5056	3.9kΩ 5%	carbon film	0.1W
	R111	80.5063	15kΩ 5%	carbon film	0.1W
	R112	80.5048	820Ω 5%	carbon film	0.1W
	R113	80.5041	220Ω 5%	carbon film	0.1W
	R114	80.5071	68kΩ 5%	carbon film	0.1W
	R115	80.5055	3.3kΩ 5%	carbon film	0.1W
	R116	80.5052	1.8kΩ 5%	carbon film	0.1W
	R117	80.5055	3.3kΩ 5%	carbon film	0.1W
	R118	80.5053	2.2kΩ 5%	carbon film	0.1W
	R119	80.5070	56kΩ 5%	carbon film	0.1W
	R120	80.5065	22kΩ 5%	carbon film	0.1W
	R121	80.5051	1.5kΩ 5%	carbon film	0.1W
	L1	61.1148	Tone coil		
	L2	61.1148	Tone coil		
	E1	99.5237	1N4148 Diode		
	E2	99.5237	1N4148 Diode		
	E3	99.5237	1N4148 Diode		
	E4	99.5237	1N4148 Diode		
	E5	99.5237	1N4148 Diode		

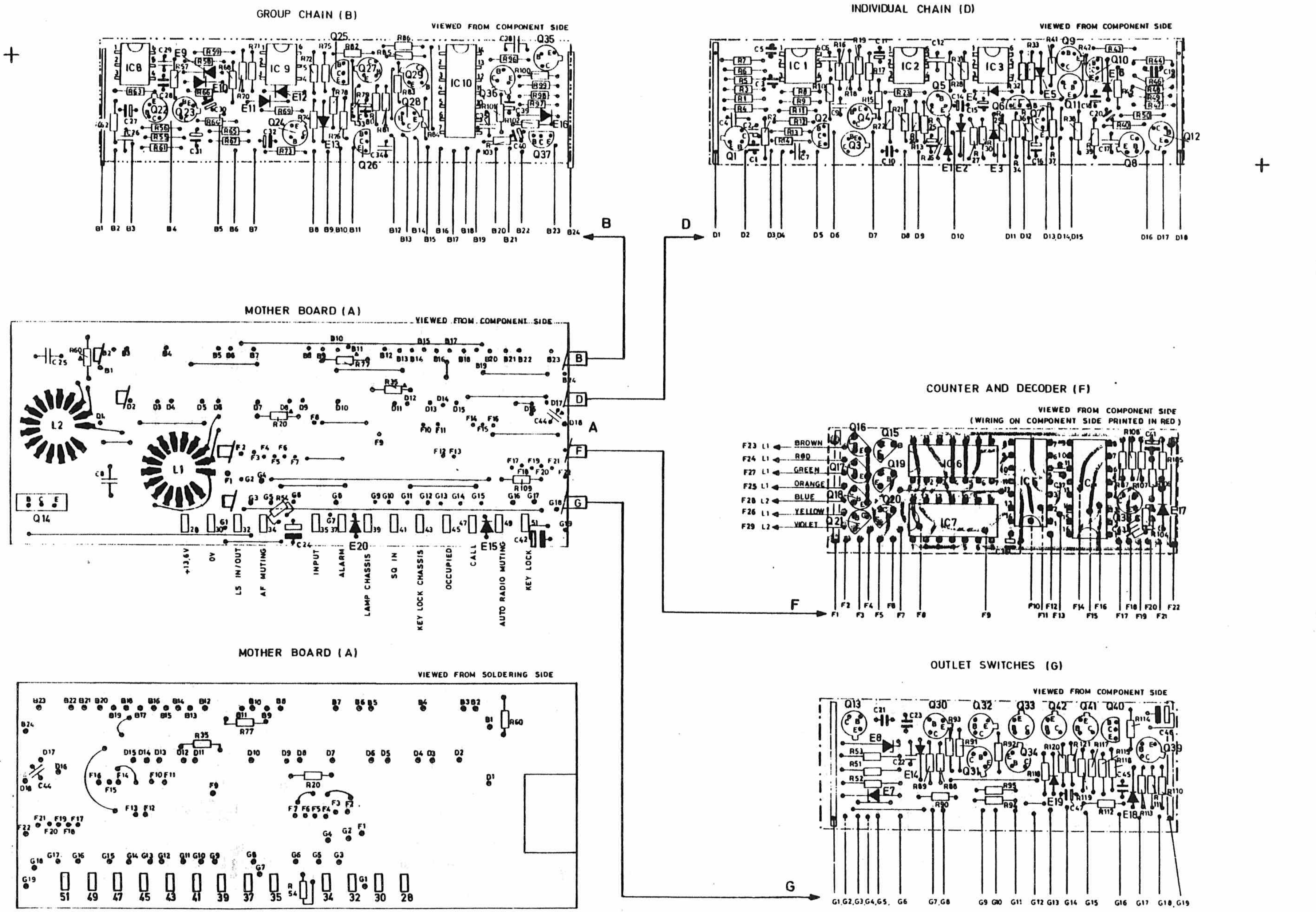
SEQUENTIAL TONE RECEIVER SR7841
SEKVENSTONEMODTAGER

TYPE	NO.	CODE	DATA
	E6	99.5237	1N4148 Diode
	E7	99.5114	5.6V 5% Zenerdiode 0.25W
	E8	99.5042	9.1V 5% Zenerdiode 0.25W
	E9	99.5237	1N4148 Diode
	E10	99.5237	1N4148 Diode
	E11	99.5237	1N4148 Diode
	E12	99.5237	1N4148 Diode
	E13	99.5237	1N4148 Diode
	E14	99.5237	1N4148 Diode
	E15	99.5020	1N4004 Diode
	E16	99.5237	1N4148 Diode
	E17	99.5237	1N4148 Diode
	E18	99.5237	1N4148 Diode
	E19	99.5237	1N4148 Diode
	E20	99.5020	1N4004 Diode
	Q1	99.5143	BC108 Transistor
	Q2	99.5144	BC214L Transistor
	Q3	99.5743	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5144	BC214L Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5144	BC214L Transistor
	Q11	99.5143	BC108 Transistor
	Q12	99.5143	BC108 Transistor
	Q13	99.5143	BC108 Transistor
	Q14	99.5246	TIP31 Transistor
	Q15	99.5144	BC214L Transistor
	Q16	99.5144	BC214L Transistor
	Q17	99.5144	BC214L Transistor
	Q18	99.5144	BC214L Transistor
	Q19	99.5144	BC214L Transistor
	Q20	99.5144	BC214L Transistor
	Q21	99.5144	BC214L Transistor
	Q22	99.5143	BC108 Transistor
	Q23	99.5143	BC108 Transistor
	Q24	99.5143	BC108 Transistor
	Q25	99.5144	BC214L Transistor
	Q26	99.5144	BC214L Transistor
	Q27	99.5143	BC108 Transistor
	Q28	99.5143	BC108 Transistor
	Q29	99.5143	BC108 Transistor
	Q30	99.5143	BC108 Transistor
	Q31	99.5143	BC108 Transistor
	Q32	99.5143	BC108 Transistor

TYPE	NO.	CODE	DATA
	Q33	99.5143	BC108 Transistor
	Q34	99.5143	BC108 Transistor
	Q35	99.5143	BC108 Transistor
	Q36	99.5143	BC108 Transistor
	Q37	99.5144	BC214L Transistor
	Q38	99.5143	BC108 Transistor
	Q39	99.5143	BC108 Transistor
	Q40	99.5144	BC214L Transistor
	Q41	99.5143	BC108 Transistor
	Q42	99.5143	BC108 Transistor
	IC1	14.5017	TAA861 Operational Amplifier
	IC2	14.5017	TAA861 Operational Amplifier
	IC3	14.5017	TAA861 Operational Amplifier
	IC4	14.5009	Dual J-K, master slave FF/clear-preset
	IC5	14.5008	Dual J-K, master slave FF/clear
	IC6	14.5007	Triple 3-input NAND-gate
	IC7	14.5007	Triple 3-input NAND-gate
	IC8	14.5017	TAA861 Operational Amplifier
	IC9	14.5017	TAA861 Operational Amplifier
	IC10	14.5008	Dual J-K, master slave FF/clear

SEQUENTIAL TONE RECEIVER SR7841
SEKVENSTONEMODTAGER

X401.695



SEQUENTIAL TONE RECEIVER
SEKVENSTONEMODTAGER

SR7841

D401.711

SEQUENTIAL TONE RECEIVER

SR7841a

Introduction

SR7841a is a sequential tone receiver for selective calling in Stornophone 700 radiotelephone equipment. The frequencies employed are the standard Storno series: 970 Hz to 2800 Hz.

The SR7841a tone receiver can be coded for any of the following operating modes:

- 4 or 5 tones, individual call, only
- 4 or 5 tones, including one group call digit
- 4 or 5 tones, including two group call digits.

General Description

Individual Call

Upon reception of a signal having the correct tones in the proper sequence the following events take place (in the receiver):

The Call Lamp lights, the AF Muting is cancelled and the Key Lock function "unlocks". When the vehicle's traffic horn is connected to the tone receiver via an auxiliary relay, the horn will also sound for about one second.

The audio circuit and the Key Lock are both turned on and off manually by means of the LS IN/OUT push button. Since the switch that "unlocks" the Key Lock also turns on the loudspeaker, the operator is forced to check for the presence of another signal on the channel before being able to key his transmitter.

In addition, the tone receiver is equipped with an Occupied Lamp controlled by the squelch circuit of the radiotelephone receiver. Thus, if an RF signal on the channel frequency is present at the antenna input it will cause the Occupied Lamp to light as an indication that the channel is not free.

At the end of a call the Call Lamp, governed by the receiver Squelch, goes out when the carrier disappears.

After reception of a correct call the speaker will remain open until the LS IN/OUT button is depressed.

Group Call

Group calls do not activate the Alarm circuit and the transmitter lock does not "unlock". The Call Lamp and the loudspeaker are both turned on. During the call the Occupied Lamp is on and 300 ms after it goes off the loudspeaker is turned off as it is controlled by the squelch circuit. If, what will not be normal procedures, the call is to be answered the Loudspeaker and the key lock must be released manually.

Mode of Operation

Logic Terms

Low voltage (~ 0 V) = logic state '0'.
High voltage ($\sim > 7$ V) = logic state '1'.

(refer to block diagram).

5-tone Individual Call Signalling

The first tone of a sequential tone signal passes through the input stage and limiter, which provide the frequency response, level, and impedance transformation, and becomes suitable for applying to the resonant circuit and Q-multiplier.

In stand by the Q-multiplier is tuned, via gate "a" to the first of its code. If the first tone corresponds to the circuit resonant frequency, it becomes selected and rectified by the Individual Call Detector.

The detector output is, in stand by, approx. 9 V, i. e. logic '1'. A received tone causes the detector output to become 0 V, i. e. logic '0'.

The clock delay circuit is activated via the OR-gate and after the elapse of 20 ms the voltage on the counter's clock input goes logic '0'. Simultaneous the clear delay circuit is activated.

In stand by the counter's clear input is logic '1', and the counter is inhibited.

Activating the clear circuit causes the voltage to go logic '0', delay approx. 7 ms, and the counter inhibit disappears. This condition remains unchanged as long as the detector receives a signal. When the 1st tone ends, the detector output voltage goes logic '1'. Also the counter input (delay approx. 3 ms) changes and the counter steps one position forward and, via an inverter and gate b, tunes the circuit to the second tone.

The 2nd, 3rd, 4th, and 5th tones of a sequence occur like the 1st, each time stepping the counter one position forward until the final tone disappears.

At the end of the 5th tone the counter steps to position 6 and an output signal is applied to both inputs on the Read Out circuit (AA and BB) via the logic part of the circuit. This releases the individual call functions.

The clear input of the counter remains logic '0', but 150 ms after the last tone of the sequence the clear delay output goes logic '1' and the counter is reset to stand by position, i. e. ready to receive the 1st tone again. If one tone of the sequence is lacking, or the frequency does not correspond to the code to which the tone receiver is set, the clear input likewise goes to logic '1', and 150 ms after the last of the correctly received tones the receiver is set to receive the first tone of a new call.

Group Call

A group call takes place just as described for individual calling, as the resonant circuit, Q-multiplier, and detector circuits are identical. When the counter is in position 4 (in the case of a 5 digit call with 2 group digits) and gate d sets the individual tone coil via gate f. Likewise, the 5th tone and the 2nd group tone is selected by gates e and g, respectively. The two output circuits are joined in the OR-gate.

The call will proceed through, regardless of the tones being the frequencies of an individual call or group call. The logic circuits alone deside the type of call and apply the output of the counter to the Read Out circuit.

Signals on both inputs, AA and BB, give the functions of an individual call, and signal on BB alone gives a group call.

Logic Circuit

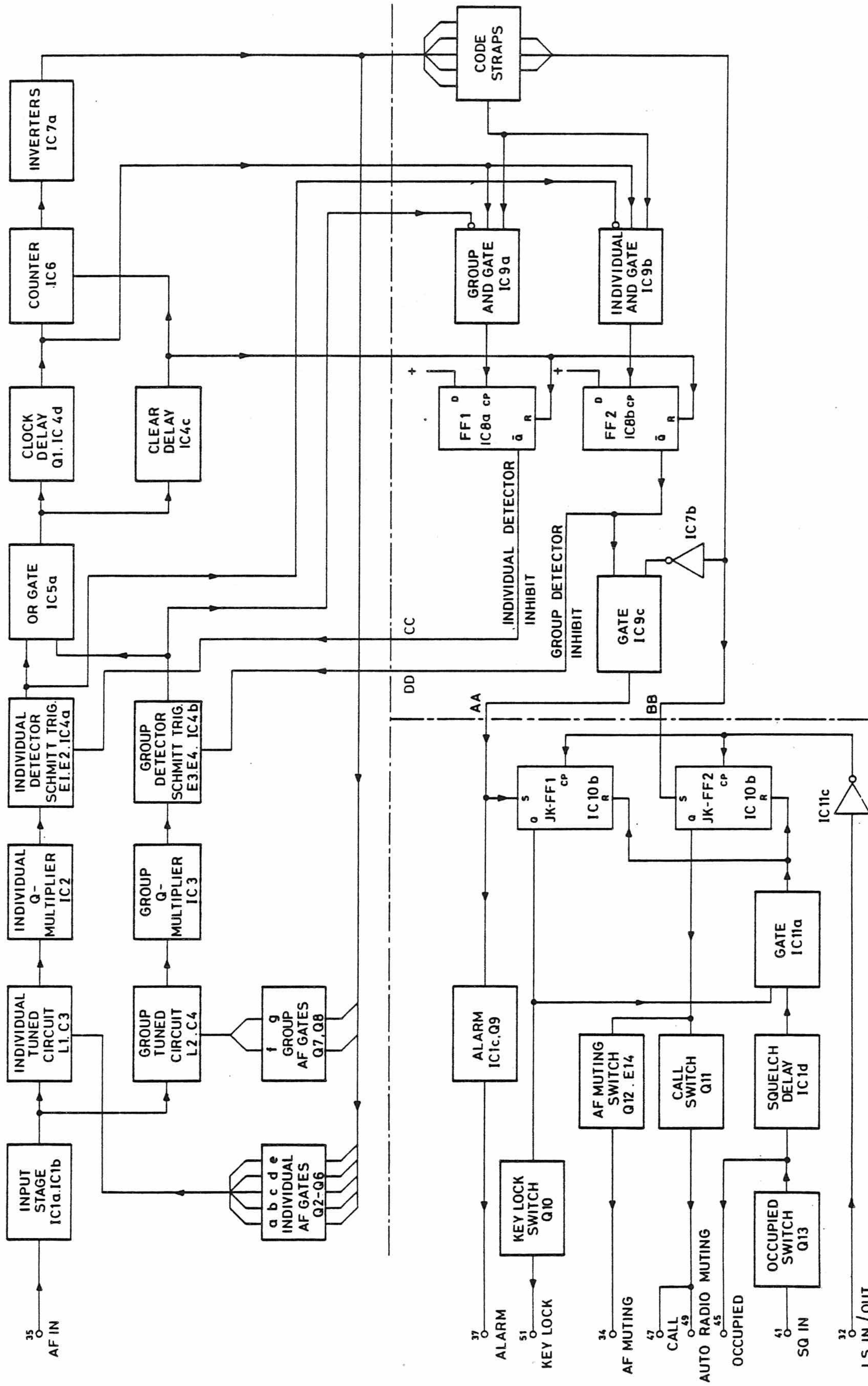
The logic circuit has two functions. It controls the signals as they proceed through the two signal channels, the individual call channel and the group call channel, and it controls the output pulse from the counter to the Read Out Circuit in order to release the proper functions.

The individual call detector and the group call detector may be inhibited by the logic circuit.

The first 3 tones of a 5-tone signal take place just as described. Now the tone receiver is ready for the 4th tone of the individual call and the 1st tone of the group tones.

If the last two tones have the same frequencies as the 4th and 5th tone of the individual code, the result will be a normal individual call, and the group tone detector is inhibited as soon as the 4th tone is accepted (after 20 ms). However, if they have the group call frequencies, the individual tone detector is inhibited when the tone is accepted.

When the 5th tone appears, only one circuit is functioning and hence a group call is recognized only if the 4th tone is a group call. The call will not be transfered to the output circuit before also the 5th tone is accepted and the counter has stepped to its 6th position.


INPUT STAGE IC1a.IC1b
INDIVIDUAL TUNED CIRCUIT L1.C3
INDIVIDUAL Q-MULTIPLIER IC2
INDIVIDUAL DETECTOR SCHMITT TRIG. E1.E2. IC4a
OR GATE IC5a
CLOCK DELAY Q1. IC 4d
COUNTER IC6
INVERTERS IC7a
GROUP TUNED CIRCUIT L2. C4
GROUP Q-MULTIPLIER IC3
GROUP DETECTOR SCHMITT TRIG. E3.E4. IC4b
CLEAR DELAY IC4c
a b c d e INDIVIDUAL AF GATES Q2-Q6
f g GROUP AF GATES Q7.Q8
CODE STRAPS
GROUP AND GATE IC9a
INDIVIDUAL AND GATE IC9b
FF1 IC8a
FF2 IC8b
INDIVIDUAL DETECTOR INHIBIT
GROUP DETECTOR INHIBIT
IC7b
GATE IC9c
CC
DD
AA
BB
JK-FF1 IC10b
JK-FF2 IC10b
IC11c
GATE IC11a
ALARM IC1c.Q9
KEY LOCK SWITCH Q10
AF MUTING SWITCH Q12. E14
CALL SWITCH Q11
SQUELCH DELAY IC1d
OCCUPIED SWITCH Q13
35 AF IN
37 ALARM
51 KEY LOCK
34 AF MUTING
47 CALL
49 AUTO RADIO MUTING
45 OCCUPIED
41 SQ IN
32 LS IN/OUT

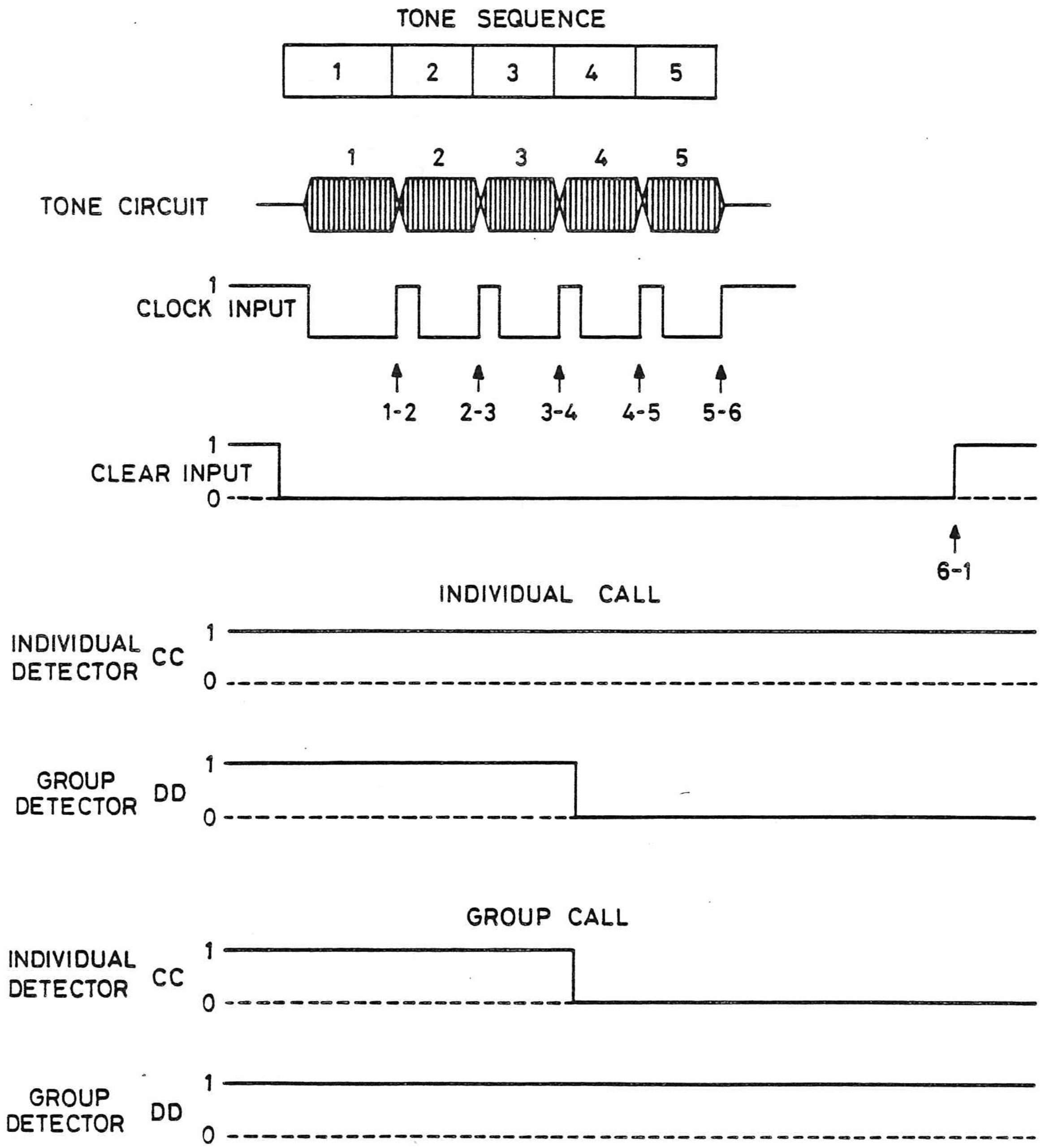
SR 7841a

Controlling the Counter Output

When all 5 tones are correctly received the counter produces an output (output 6 is logic '1'). This condition occurs regardless of the call being individual or group.

If the 4th tone is received by the group circuit it toggles D flip-flop DFF 1; if it is an individual tone D flip-flop 2 is toggled. The output pulse from the counter is applied directly to BB, but to AA it passes through gate 9a which is controlled by the $\bar{Q}$ output of D flip-flop DFF2. For an individual call the $\bar{Q}$ is logic '0' and the gate is open applying the signal to both the AA and BB outputs.

For a group call $\bar{Q}$ is logic '1' which inhibits the gate and the signal is applied to BB only.



TIMING DIAGRAM SR 7841a

The amplifier output is applied to the detector and a portion of the signal is reapplied in phase to the feed-back winding via compensating networks, R11 - R12 - R13 (R15 - R16 - R17), thereby increasing the circuit Q. This configuration enables a relatively small coil form to be used without loss of temperature stability and detoriation of circuit Q.

To offset the effect of temperature upon the signal level an NTC resistor is inserted in the compensation network.

Detectors

The detector includes the rectifiers E1 - E2 (E3 - E4) and the Schmitt trigger IC4a (IC4b). The trigger level is set by the bias difference between the inverting and non-inverting inputs of IC4a (IC4b) and the hysteresis by resistor R32 (R37).

The trigger level is adjusted to be approx. 6 dB below the point of full limiting by selection of R7 (R8), and thus differences in trigger levels and amplification can be equalized. This adjustment does not influence on the sensitivity which is not adjustable, as minor variations are not important.

NOR Circuit

Joining the detector output signals for individual call and group call is by means of a NOR gate, IC5a. A tone signal produces a positive voltage (logic '1') at the detector output. An output signal from one detector only, applied to the NOR gate, causes the output to be logic '0'. The detector output signals are applied to the logic circuit, too.

Clock Delay

The Clock Delay Circuit includes Q1 and IC4d. When the IC5a NOR output goes logic '0' transistor Q1 cuts off and C14, which in stand by has charged to 9 V, begins discharging through R46-R47, the time constant being 29.7 ms.

IC4d is controlled by the voltage of C14 and the output goes logic '0' after approx. 22 ms. When the signal disappears and the NOR gate goes logic '1', Q1 goes ON and C14 charges via R47 with a time constant of 3.3 ms. IC4d changes state to logic '1' and the counter is toggled at the positive edge. If the signal disappears before the elapse of the 22 ms, IC4d has not changed to logic '0', and hence the counter is not toggled. This prevents the counter from being toggled by noise pulses.

Clear Delay

The Clear Delay circuit includes E5, IC4c, and their associated components.

In stand by diode E5 is reverse biased and C13 charged to 9 V. The IC4c output is logic '1' and the counter reset to position 1 and cannot be toggled.

When the NOR gate, IC5a, goes logic '0' diode E5 conducts and C13 discharge via R42. The time constant is 7 ms which is less than the clock delay (22 ms). IC4c changes state, logic '1' to logic '0', and the counter is now ready to count.

When the signal disappears the NOR gate, IC5a, reverts to logic '1', diode E5 is reverse biased, and C13 charges to 9 V via R41-R42 the time constant being 190 ms. When the charge building up eventually overcomes the reference voltage, 4.5 V, IC4c goes logic '1' (approx. 150 ms) whereby the counter is reset to position 1 (stand by). Since the intervals between tones are only few milliseconds, the resetting to stand by first takes place when all tones contained in the signal have passed or if one of the tones fails to match the code.

Counter

The counter, IC6, is a 8 bit Johnson Counter toggled at the positive edge of the clock pulse and reset by applying a logic '1' to the reset input. Both the clock input and the reset input may be isolated by removing straps on the printed wiring board in order to control the counter manually during service and fault tracing.

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4-tone Signals, or One Group Digit

If the signal code contains 4 tones the counter is strapped to produce the output signal in the 5th position. If two group digits are used, the 3rd tone becomes the first group tone, and the logic control circuit is strapped to enable the counter's 3rd position to control gates 9 a and 9 b.

Using 5 tones and 1 group digit the gates are controlled by the 5th position of the counter.

Using 4 tones and 1 group digit the gates are controlled by the 4th position of the counter.

(refer to the diagram for strapping combinations.)

Read Out Functions

The Read Out functions are controlled by two J - K flip-flops, FF1 and FF2, of which the FF1 controls the Key Lock function and the FF2 the Call Lamp and the AF Muting.

The FF1 is preset via the AA input, the FF2 via the BB input. The LS IN/OUT terminal toggles both flip-flops via the clock input, and the FF1 J - K inputs are controlled by FF2 in order to be complementary when toggled via the clock input (refer to truth table).

The AA input also controls the Alarm Delay Circuit, which produces an alarm signal for approx. 1 sec. after the AA input changes from logic '0' to logic '1'.

The Squelch In voltage (terminal 41) controls, partly the Occupied Lamp via a transistor, partly a delay circuit which resets FF1 and FF2 approx. 300 ms after the Occupied Lamp turns off. This resetting of FF1 and FF2 takes place via a gate, IC11a, which is controlled by FF1. The reset will only be effective when the FF1 is off (Q = 1), i.e. after a group call.

When turning the equipment on it must be ensured that the alarm function is not activated and that the flip-flops remain in the reset position. A transistor, Q14, short circuits the alarm and reset circuits when the supply voltage is applied. After charging of a capacitor the transistor turns off.

Circuit Description

The input circuit includes an RC-circuit (R2-C1) to offset the de-emphasis of the sequential tone generator, a preamplifier, IC1a, and a limiter stage, IC1b.

The nominal input level is -17 dBm, but the desired sensitivity is -27 dBm. The preamplifier is necessary in order to achieve this, but strong feed-back is introduced to avoid overload at levels lower than specified.

A series resistor, R4, between the preamplifier and the limiter determines the sensitivity.

The output is applied to the selective circuits via series resistors.

Resonant Circuits and Q-multipliers

The selective circuits involve coils and capacitors, 47 nF, to which the signals and the feed-back are applied by means of separate windings.

The top of the L - C circuit is coupled to the amplifier, IC2 (IC3), via an RC circuit, R14-C5 (R18 - C6).

Clock	$Q2_m$	$Q2_{m+1}$	J_1	K_1	$Q1_m$	$Q1_{m+1}$
↑	0	1	1	0	0	1
↑	1	0	0	1	0	0
↑	0	1	1	0	1	1
↑	1	0	0	1	1	0

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Inverters and AF Gate Transistors

The AF gates connect to the counter, IC6, via inverters. When a transistor base is driven logic '0' by an inverter, that transistor will conduct and ground the coil terminal. The PNP transistors have their collectors connected to the tone coil terminals and their emitters to a +1.5 V d.c. voltage, which is a.c. bypassed to chassis ground.

As the counter produces a positive voltage (logic '1'), and the transistors turn on for logic '0', inverters are inserted. They also function as buffer circuits in order to provide adequate drive for the transistor.

Resistor R78 prevents high voltage transients across L2 when the first group tone is selected.

Logic Circuit

The Logic Circuit includes two D flip-flops, IC8a and IC8b, two NOR gates, IC9a and IC9b, and three inverters, IC5a, IC5b, and IC7b.

The D flip-flop IC8a is toggled by the IC9a output which is logic '1' when the group detector output is logic '1', the clock pulse output is logic '0', and the counter output 4 is logic '1'.

As the D input of IC8a connects to $+V_B$ the Q output stays logic '1' after the flip-flop has been toggled. Likewise, D flip-flop IC8b is toggled by the individual detector, the clock pulse output, and the counter's 4th output.

Whenever the IC8a flip-flop is toggled the individual detector is inhibited as the voltage at the Schmitt trigger's non-inverting (+) input goes logic '0'.

If IC8b is toggled the Q output goes logic '0', and NOR gate IC9c will apply logic '1' to the AA when the BB goes logic '1'; the BB signal is applied to the IC9a NOR gate via an inverter.

Alarm Circuit

The Alarm Circuit includes IC1c, Q9, and their associated components.

The output voltage of the logic circuit (AA = logic '1') charges C17 in 150 ms. This causes the output of IC1c to go logic '1' and this positive voltage is applied to the input via R55. When the voltage charging C17 disappears, the capacitor begins discharging through R58; the time constant is 846 ms. When the capacitor voltage has decreased to below trigger level the circuit reverts to stand by. Logic '1' at the IC1c output drives Q9 ON and grounds terminal 37.

Squelch Delay

Whenever the RF channel is occupied the receiver squelch feeds a positive voltage to terminal 41. This voltage turns Q13 ON, grounding the Occupied Lamp through terminal 45. Q13 also causes E11 to conduct and C18 to discharge through E11 -Q13, and thus the Schmitt trigger output, IC1d, goes logic '0'.

When the RF carrier disappears Q13 turns off, and E11 is no longer conducting. Now C18 is allowed to charge through 180 kΩ; time constant 390 ms. At the Schmitt trigger threshold the output voltage goes logic '1', and a positive pulse is fed, via C20, gate IC11a and inverter IC11b to the flip-flop reset inputs.

Flip-flop Trigger Circuit

As IC10a and IC11b trigger on a positive edge IC11c is inserted to invert the LS IN/OUT function. The IC11c input connect to $+V_B$ through R72 causing the clock inputs on IC10a and IC11b to be logic '0' in stand by. Grounding the LS IN/OUT, terminal 32, via R73 and bypass capacitor C19, triggers the flip-flops. C19 protects the input against transients and prevents malfunction due to contact bouncing. The R-C values, 100 Ω - 0.1 μF, are optimum with respect to the pulse rise time.

Start Circuit

When battery voltage is initially applied C21 charges and transistor Q14 opens momentarily. Via diodes

Storno

E13 and E14 the Alarm Delay is inhibited, and the flip-flops, IC10a - IC10b, are reset via inverter IC11b. As the charging of C21 proceeds (time constant approx. 1 sec.) the voltage at Q14's base decreases and eventually Q14 turns off. When turning the equipment off, C21 discharges via diode E12 giving a very short delay time. This makes the circuit passive for repeated operations of the on/off switch.

Read Out Circuits

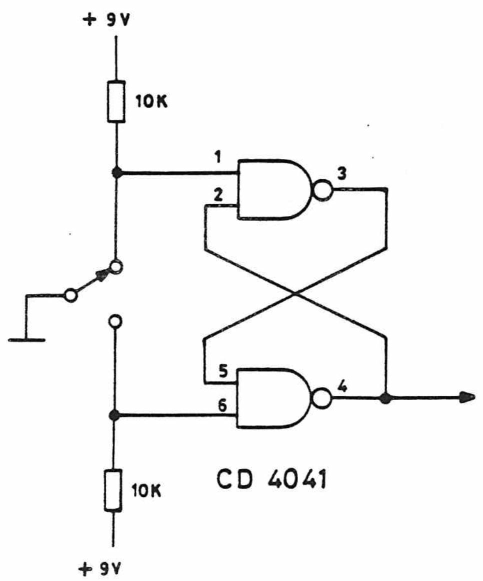
The Key Lock function is controlled by the output of IC10a and Q10, the Call Lamp by the output of IC10b and Q11, and the AF Muting by Q12. Terminal 49 is provided for automatic muting of the vehicle's broadcast band radio, and requires an auxiliary relay.

Voltage Regulator

The digital Cosmos circuits requires an internal supply voltage which is 9 V. The low current drain, 30 mA maximum, enables a simple voltage regulation circuit to be used (Q15 - E15).

Fault Tracing

To ease fault tracing the counter's clock and clear inputs, pin 14 and 15, may be isolated from the detectors when removing two straps on the printed circuit board. The counter may now be controlled by two auxiliary switches



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with antibounce circuits, see diagram, enabling proper switching of tones, test of the selective circuits, and the detector functions to be checked. Likewise, the inhibiting voltages to the detector circuits may be removed from IC8, pin 2 and pin 12, and connected to $+V_B$ (= logic '1'). Disabling the detector inhibit circuit will ease checking of the circuits in case of faults in the logic system.

Before initiating a systematic fault finding procedure the tone receiver is inspected for correct tone frequencies and setting of the code.

If the fault is not obviously located to one part of the circuit, most of the circuits on the lower printed board can be tested by applying pulses to AA and BB using a switch circuit as shown in the diagram.

The detector circuits and the logic circuits are tested by applying an input and tracing the signal through the channels to BB. If a static receiver test applying one tone at the time shows no fault, and the signal levels are correct, but the receiver refuses to accept a call, the Clock Delay circuit and the Clear Delay circuit must be investigated.

A tone signalling generator, Storno type TS-G13 and a storage oscilloscope will facilitate tests and fault tracing.

SPECIFICATIONS

Supply Voltage

Nominal:	13.6 V
Minimum:	10.5 V
Maximum:	16.0 V

Current Drain

Stand by: 25 mA ± 5 mA

Temperature Range

Operating range	: -25°C to +60°C
Functioning range	: -30°C to +80°C

Input Impedance

> 6 kΩ asymmetrical

Signal Input Level

Nominal at 1000 Hz : 110 mV r.m.s. ($\sim$ -17 dBm).

Equalization

Deemphasis (by RC function) f_c = 1000 Hz.

Signalling Code

Sequence of 4 or 5 tone bursts of 70 ms ± 15 ms duration with maximum 15 ms interval between tone bursts.

Frequency Accuracy

Coil tuned to 1060 Hz: $\leq$ 0.4%

Frequency Stability

(typically $\leq$ 0.5%) $\leq$ 1%

Selectivity

Frequencies differing from f_o by 4.5% or more are unable to trigger the tone receiver.

Tone Signal Frequencies

Coil terminal	Tone frequency
1	(885) do not comply with specifications
2	970
3	1060
4	1160
5	1270
6	1400
7	1530
8	1670
9	1830
10	2000
11	2200
12	2400
13	2600
14	2800
15	(2900) do not comply with specifications

Maximum Load Currents

Terminal 37	ALARM	100 mA (for 1 sec.)
Terminal 47	CALL	100 mA
Terminal 45	OCCUPIED	100 mA
Terminal 51 and 43	KEY LOCK	10 mA
Terminal 34	AF MUTING	I_{load} min. 0.75 mA for V_{OUT} = 8 V.

AF Muting

In conjunction with terminal 18 of CF701: $\geq$ 60 dB

Maximum Sensitivity

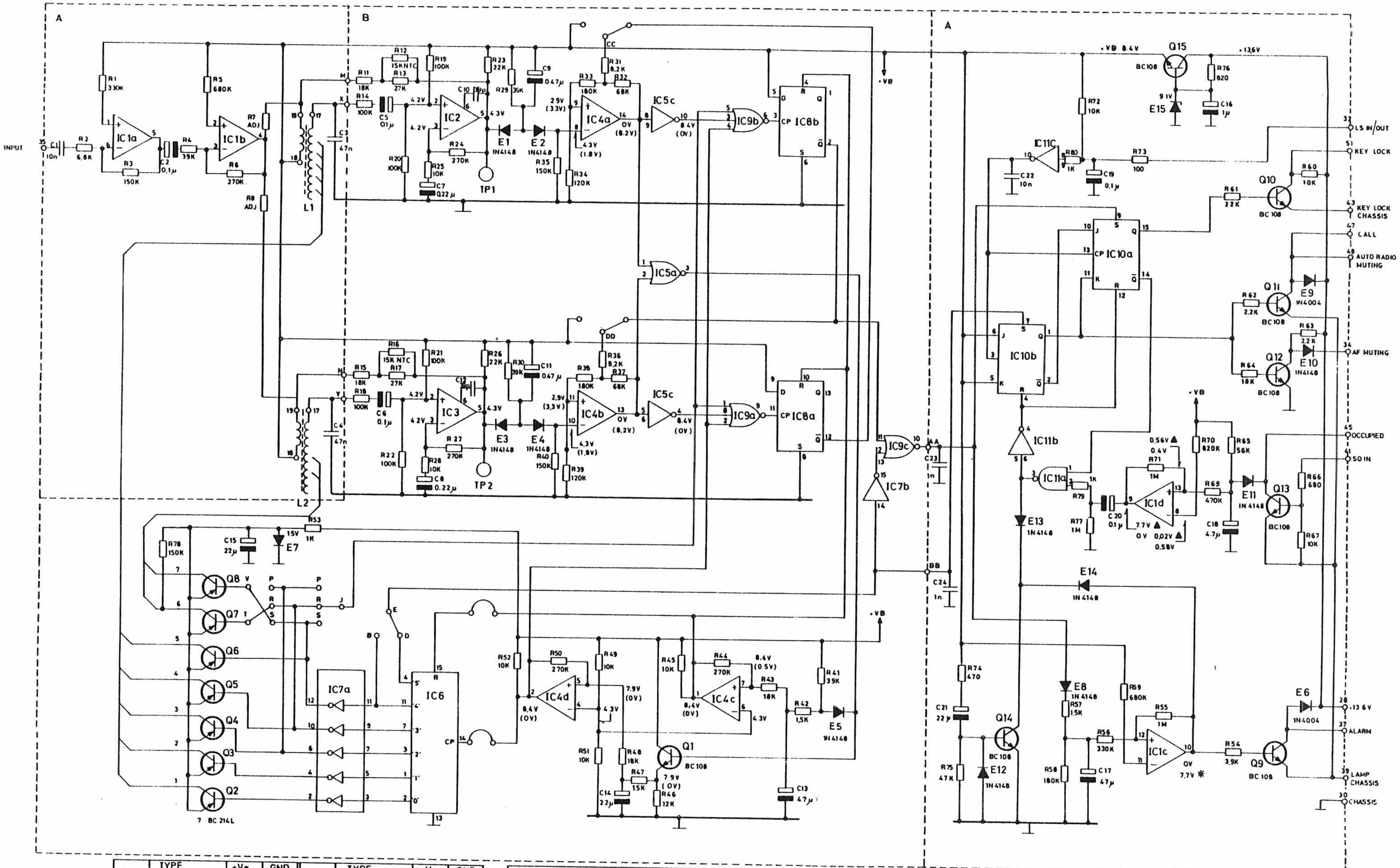
-27 dBm

Clear Down Delay (after group call)

approx. 300 ms.

Failure Rate for 3 dB SINAD

$< 10^{-3}$



	TYPE	+VB	GND		TYPE	+VB	GND
IC1	LM 2900	14	7	IC7	CD 4049	1	8
IC2	TAA 865A	1	4	IC8	CD 4013	14	7
IC3	TAA 865A	1	4	IC9	CD 4025	14	7
IC4	MC 3302	3	12	IC10	CD 4027	16	8
IC5	CD 4001	14	7	IC11	CD 4011	14	7
IC6	CD4022	16	8				

TONE COMBINATIONS				CONNECTIONS			
5 INDIVIDUAL		2 GROUP					
5	-	1	-	E-D	J-R	R-T	S-V
5	-	1	-	E-D	J-S		S-V
4	-	2	-	E-B	J-P	P-T	R-V
4	-	1	-	E-B	J-R		R-V

VOLTAGE WITHIN ( ) MEASURED WITH SIGNAL APPLIED.

VOLTAGE MARKED * MEASURED WITH ALARM SIGNAL.

VOLTAGE MARKED ▲ MEASURED WITH THE RECEIVER SQUELCHED.

SEQUENTIAL TONE RECEIVER SR 7841a

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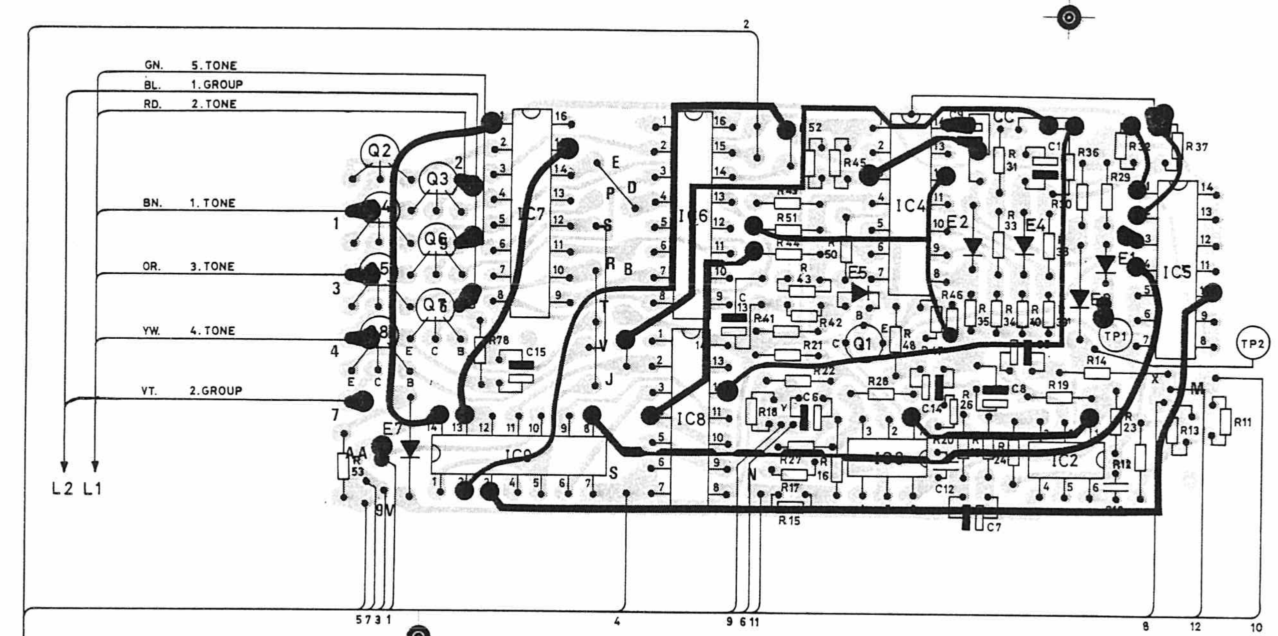
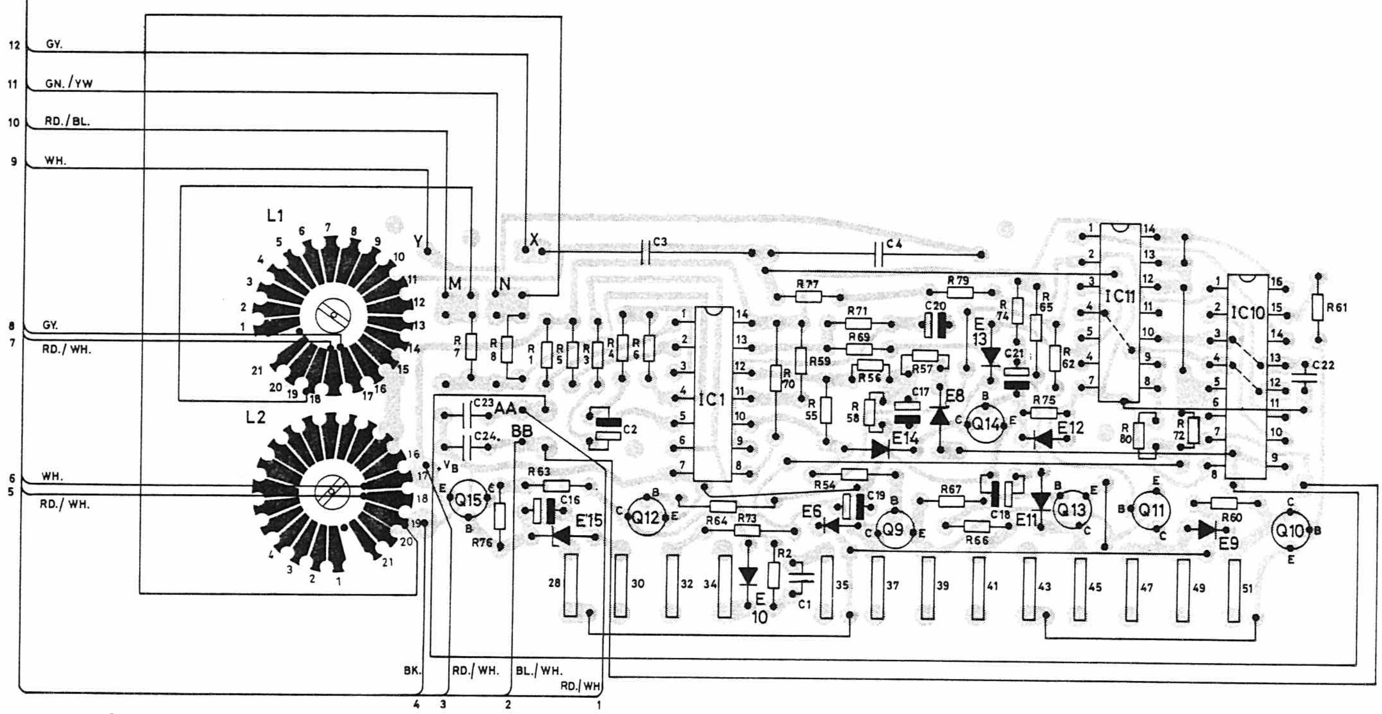


PRINTED CIRCUITS VIEWED FROM COMPONENT SIDE.



SEQUENTIAL TONE RECEIVER SR7841a

D402.468

Storno

TYPE	NO.	CODE	DATA				
SR7841a		19.2456-01	Sequential Tone Receiver				
	C1	76.5070	10 nF	10%	polyest	FL	50V
	C2	73.5089	0.1 µF	20%	tantal		35V
	C3	76.5123	47 nF	2.5%	polystyr		63V
	C4	76.5123	47 nF	2.5%	polystyr		63V
	C5	73.5089	0.1 µF	20%	tantal		35V
	C6	73.5089	0.1 µF	20%	tantal		35V
	C7	73.5118	0.22µF	20%	tantal		35V
	C8	73.5118	0.22µF	20%	tantal		35V
	C9	73.5125	0.47µF	20%	tantal		35V
	C10	74.5316	39 pF	5%	ceram	PL	63V
	C11	73.5125	0.47µF	20%	tantal		35V
	C12	74.5316	39 pF	5%	ceram	PL	63V
	C13	73.5126	4.7 µF	20%	tantal		35V
	C14	73.5102	2.2 µF	20%	tantal		35V
	C15	73.5127	22 µF	20%	tantal		16V
	C16	73.5114	1 µF	20%	tantal		35V
	C17	73.5126	4.7 µF	20%	tantal		35V
	C18	73.5126	4.7 µF	20%	tantal		35V
	C19	73.5089	0.1 µF	20%	tantal		35V
	C20	73.5089	0.1 µF	20%	tantal		35V
	C21	73.5127	22 µF	20%	tantal		16V
	C22	76.5070	10 nF	10%	polyest	FL	50V
	C23	74.5155	1 nF	- 20% +80%	ceram	PL	63V
	C24	74.5155	1 nF	- 20% +80%	ceram	PL	63V
	R1	80.5079	330KΩ	5%	carbon film		0.1W
	R2	80.5079	6.8KΩ	5%	" "		0.1W
	R3	80.5075	150KΩ	5%	" "		0.1W
	R4	80.5068	39KΩ	5%	" "		0.1W
	R5	80.5083	680KΩ	5%	" "		0.1W
	R6	80.5078	270KΩ	5%	" "		0.1W
	R7	80.50xx	Adjusted 33KΩ - 68KΩ				0.1W
	R8	80.50xx	Adjusted 33KΩ - 68KΩ				0.1W
	R9		Not used				
	R10		Not used				
	R11	80.5064	18KΩ	5%	carbon film		0.1W
	R12	89.5010	15KΩ	20%	NTC		0.6W
	R13	80.5066	27KΩ	5%	carbon film		0.1W
	R14	80.5073	100KΩ	5%	" "		0.1W
	R15	80.5064	18KΩ	5%	" "		0.1W
	R16	89.5010	15KΩ	20%	NTC		0.6W
	R17	80.5066	27KΩ	5%	carbon film		0.1W
	R18	80.5073	100KΩ	5%	" "		0.1W
	R19	80.5073	100KΩ	5%	" "		0.1W
	R20	80.5073	100KΩ	5%	" "		0.1W
	R21	80.5073	100KΩ	5%	" "		0.1W
	R22	80.5073	100KΩ	5%	" "		0.1W

Storno

TYPE	NO.	CODE	DATA			
	R23	80.5065	22KΩ	5%	carbon film	0.1W
	R24	80.5078	270KΩ	5%	" "	0.1W
	R25	80.5061	10KΩ	5%	" "	0.1W
	R26	80.5065	22KΩ	5%	" "	0.1W
	R27	80.5078	270KΩ	5%	" "	0.1W
	R28	80.5061	10KΩ	5%	" "	0.1W
	R29	80.5068	39KΩ	5%	" "	0.1W
	R30	80.5068	39KΩ	5%	" "	0.1W
	R31	80.5060	8.2KΩ	5%	" "	0.1W
	R32	80.5071	68KΩ	5%	" "	0.1W
	R33	80.5076	180KΩ	5%	" "	0.1W
	R34	80.5074	120KΩ	5%	" "	0.1W
	R35	80.5075	150KΩ	5%	" "	0.1W
	R36	80.5060	8.2KΩ	5%	" "	0.1W
	R37	80.5071	68KΩ	5%	" "	0.1W
	R38	80.5076	180KΩ	5%	" "	0.1W
	R39	80.5074	120KΩ	5%	" "	0.1W
	R40	80.5075	150KΩ	5%	" "	0.1W
	R41	80.5068	39KΩ	5%	" "	0.1W
	R42	80.5051	1.5KΩ	5%	" "	0.1W
	R43	80.5064	18KΩ	5%	" "	0.1W
	R44	80.5078	270KΩ	5%	" "	0.1W
	R45	80.5061	10KΩ	5%	" "	0.1W
	R46	80.5062	12KΩ	5%	" "	0.1W
	R47	80.5051	1.5KΩ	5%	" "	0.1W
	R48	80.5064	18KΩ	5%	" "	0.1W
	R49	80.5061	10KΩ	5%	" "	0.1W
	R50	80.5078	270KΩ	5%	" "	0.1W
	R51	80.5061	10KΩ	5%	" "	0.1W
	R52	80.5061	10KΩ	5%	" "	0.1W
	R53	80.5049	1KΩ	5%	" "	0.1W
	R54	80.5056	3.9KΩ	5%	" "	0.1W
	R55	80.5085	1MΩ	5%	" "	0.1W
	R56	80.5079	330KΩ	5%	" "	0.1W
	R57	80.5051	1.5KΩ	5%	" "	0.1W
	R58	80.5076	180KΩ	5%	" "	0.1W
	R59	80.5083	680KΩ	5%	" "	0.1W
	R60	80.5061	10KΩ	5%	" "	0.1W
	R61	80.5053	2.2KΩ	5%	" "	0.1W
	R62	80.5053	2.2KΩ	5%	" "	0.1W
	R63	80.5053	2.2KΩ	5%	" "	0.1W
	R64	80.5064	18KΩ	5%	" "	0.1W

SEQUENTIAL TONE RECEIVER SR7841a

X402.184

Storno

TYPE	NO.	CODE	DATA
	R65	80.5069	56KΩ 5% carbon film 0.1W
	R66	80.5047	680KΩ 5% " " 0.1W
	R67	80.5061	10KΩ 5% " " 0.1W
	R68		Not used
	R69	80.5081	470KΩ 5% carbon film 0.1W
	R70	80.5084	820KΩ 5% " " 0.1W
	R71	80.5085	1MΩ 5% " " 0.1W
	R72	80.5061	10KΩ 5% " " 0.1W
	R73	80.5037	100 Ω 5% " " 0.1W
	R74	80.5045	470 Ω 5% " " 0.1W
	R75	80.5068	47KΩ 5% " " 0.1W
	R76	80.5048	820KΩ 5% " " 0.1W
	R77	80.5085	1MΩ 5% " " 0.1W
	R78	80.5075	150KΩ 5% " " 0.1W
	R79	80.5049	1KΩ 5% " " 0.1W
	R80	80.5049	1KΩ 5% " " 0.1W
	L1	61.1292	Tone Coil
	L2	61.1292	Tone Coil

Storno

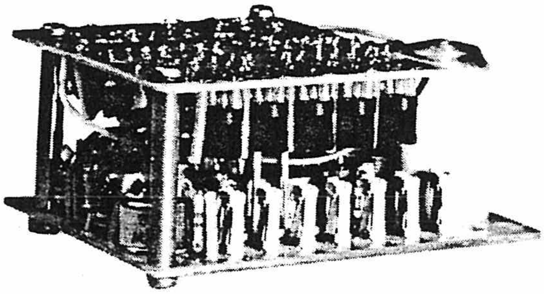
TYPE	NO.	CODE	DATA

SEQUENTIAL TONE RECEIVER SR7841a

X402.184

Storno

SEQUENTIAL TONE TRANSMITTER
ST7845

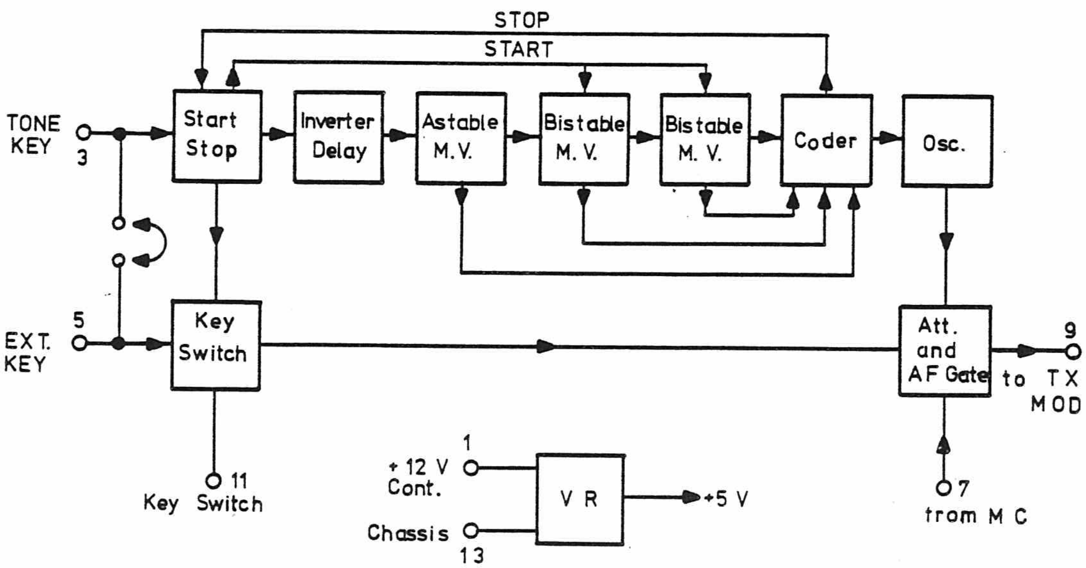


Description

General

ST7845 is a sequential tone transmitter developed for the Stornophone 700 series radiotelephones. ST7845 generates a five (or four) tone sequence code. When the Tone Key button is depressed ST7845 generates seven consecutive pulses, each of 70 msec. duration. The first two (or three) pulses are unmodulated and the last five (or four) pulses are modulated by the tone oscillator.

An AF Gate blocks the voice modulation during the tone sequence and the transmitter is keyed through the Key Switch. After generating all seven pulses of the sequence, approximately 490 msec., the transmission stops, even if the tone key button remains depressed. This is because the start signal is a short-duration, capacitively coupled pulse that is relatively independent of how long the tone key button is held down, and gives only one start pulse for each time the tone key is activated.



Storno

Start - Stop Circuit (Q1, Q2) and Key Switch (Q18)

The Start - Stop Circuit is an RS flip-flop consisting of Q1 and Q2. In stand by Q1 is ON and Q2 is OFF. Operating the Tone Key grounds terminal 3, causing a negative pulse through E1, C1, and E2 to turn Q1 OFF. The RS flip-flop then switches state.

Several things now happen. First, when the collector of Q1 goes HI, the positive potential (logic state 1') enables the two flip-flops, IC1a and IC1b.

The HI potential also turns Q17 and Q18 ON. Q18, the Key Switch, establishes a connection between terminals 5 and 11, causing the RX - TX Switch in the CQM700 to switch to the TX, or transmit condition.
Q17 drives the AF Gate, Q16. When Q17 is turned ON the HI potential through R39, which forward biases Q16, disappears through E9 and Q17 so Q16 becomes cut off. Thus, during the transmission of the tone sequence, no signal from the microphone amplifier can reach the modulator to interfere.

At the end of a tone sequence, $\overline{2}$, $\overline{3}$, and $\overline{4}$ all go logical 1' and the output of $IC2_b$ will go 0'. The negative going pulse, applied to the base of Q2 via C6 and E3, turns the transistor OFF. The Start - Stop flip-flop then returns to its stand by position until another start pulse arrives from terminal 3.

Inverter (Delay) Circuit (Q3)

In stand by Q3 is held ON by the HI potential at the collector of Q2, via R9 and E4. The standard version of ST7845 does not incorporate a delay here, but upon request C2 can be added. C2 and R10 can be arranged to introduce a time delay of from 0.1 sec. to 1.5 sec. before the first tone is transmitted.

In this case, R10 must not be less than 10 kΩ nor C2 greater than 47μF.

Astable Multivibrator (Q4, Q5)

This Multivibrator generates square wave pulses having a repetition rate of approximately 140 msec. to produce the 70 msec. output pulses mentioned in the General section at the beginning of this description.

In standby the LO potential at the collector of Q3 holds Q4 OFF, via E5. Q5 will be ON.

When the tone sequence starts, Q3 switches OFF and E5 becomes reverse biased. C5 then begins to charge toward $+V_{cc}$, switching Q4 ON. C4 discharges through Q4, driving Q5 OFF. Cutoff time for Q5 is determined by the time constant of R13 // R14 and C4. Likewise, cutoff time for Q4 is determined by R15 // R16 and C5. The regenerative action of the multivibrator generates square wave pulses which are taken off from the collector of Q5 and applied to the first bistable multivibrator, $IC1_a$.

The resistances of R13 and R16 are chosen to adjust the two pulse lengths to 70 msec. each. Resistor values can be from 33kΩ to 100kΩ.

Bistable Multivibrators ($IC1_a$, $IC1_b$)

These two Multivibrators are identical, J-K master-slave flip-flops packaged in the same DIP. With the J-K inputs tied to logical 1' via R18, their outputs will switch state for every clock pulse.

The square wave output from the collector of Q5 toggles the first flip-flop, $IC1_a$, and the normal (Q) output of $IC1_a$ toggles $IC1_b$. The square wave repetition rate (frequency) is divided by two in each flip-flop stage.

Coder (Q6 - Q10 and IC2, IC3)

IC2 and IC3 are two DIP's, each containing three triple-input NAND gates. Five of these NAND gates drive the 5 transistor gates, Q6 to Q10. When all three inputs of a NAND gate are HI, the output goes LO, driving its associated transistor ON, enabling the tone oscillator to operate.

60.230-E1

Storno

The transistor gates switch in the selected oscillator coil taps in the following sequence :

tone A	tone B	tone C	tone D	tone E
Q9 ON	Q6 ON	Q10 ON	Q7 ON	Q8 ON

For 4-tone signalling, the green lead from the collector of Q8 to the tone coil will not be soldered to the coil terminal at all.

If any one of the inputs to a NAND gate is LO, the output will be HI and its transistor gate will be held at cutoff.

Oscillator (Q11, Q12)

Q11 and Q12 operate as a differential amplifier in a Hartley oscillator configuration. Using a differential amplifier ensures ample feedback at all frequencies.

Attenuator (Q13, Q14)

Q13 adjusts (attenuates) the oscillator signal to the required level, while emitter follower Q14 matches the low input impedance of the modulator circuit in the CQM700.

R36 and C9 in the collector of Q13 provide the desired frequency response (6 dB de-emphasis pr. octave, f_c = 1000 Hz). R34 in the emitter adjusts the output level.

AF Gate (Q16, Q17)

In stand by Q16 is forward biased by the HI potential through R39, and the microphone amplifier from terminal 7 is thus connected through to the modulator at terminal 9.

When the start pulse drives Q1 OFF, the HI potential from Q1's collector drives Q17 ON and the HI potential through R39 disappears through E9 and Q17 to ground. This switches Q16 OFF and any microphone signal will be isolated from the modulator as long as the tone code is being transmitted.

The tone sequence is applied to the modulator circuit via terminal 9.

Voltage Regulator (E7, Q15)

The Voltage Regulator is designed to keep the V_{cc} at +5 V ±5% for all battery voltages from + 10.5 V to +16 V.

Storno

SEQUENTIAL TONE TRANSMITTER ST7845

Technical Specification

Tone Frequencies

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

Pulse Sequences

4-tone sequence	3 pulses (unmodulated), 70 m sec. ±15 m sec. each. 4 pulses (modulated), 70 m sec. ±15 m sec.
5-tone sequence	2 pulses (unmodulated), 70 m sec. ±15 m sec. each. 5 pulses (modulated), 70 m sec. ±15 m sec.

Frequency Stability

≤ 1%

Frequency Accuracy

≤ 0.5%

Frequency Response

6 dB pr. octave de-emphasis
f_c = 1000 Hz

Output Impedance

600 Ω ±20%

Output Level (at 1000 Hz)

-17 dBm +1/-0 dB

Distortion (tone modulation)

≤ 3%

AF Gate Attenuation

≥ 50 dB

Distortion (voice modulation)

≤ 5%

Power Supply

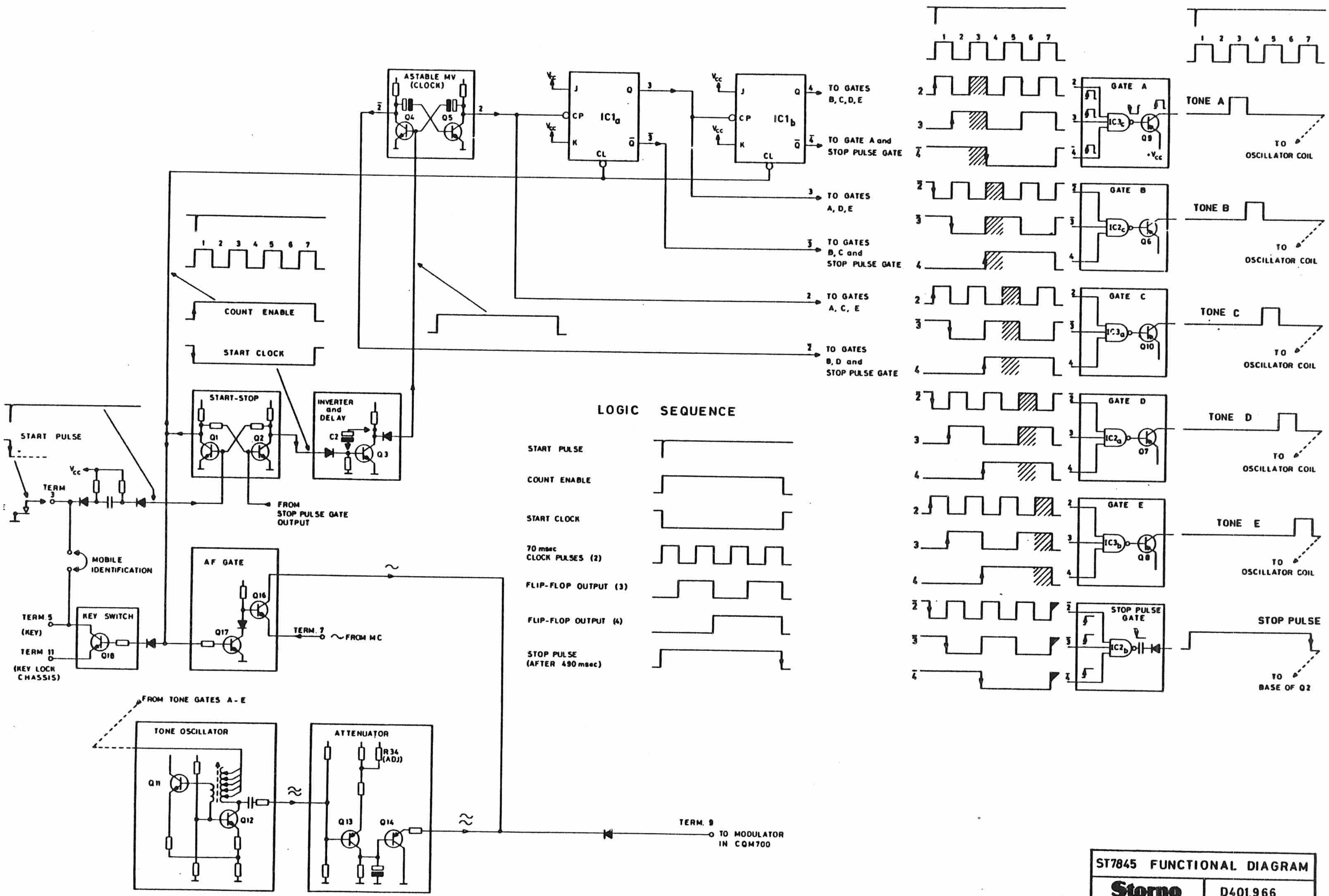
minimum:	10.5 V
maximum:	16 V
nominal:	13.6 V

Current Consumption

Stand by:	32 - 44 mA
Activated:	42 - 54 mA

Temperature Range

Operating range: -25° - +60°C
Functioning range: -30° - +80°C



ST7845 FUNCTIONAL DIAGRAM

Storno

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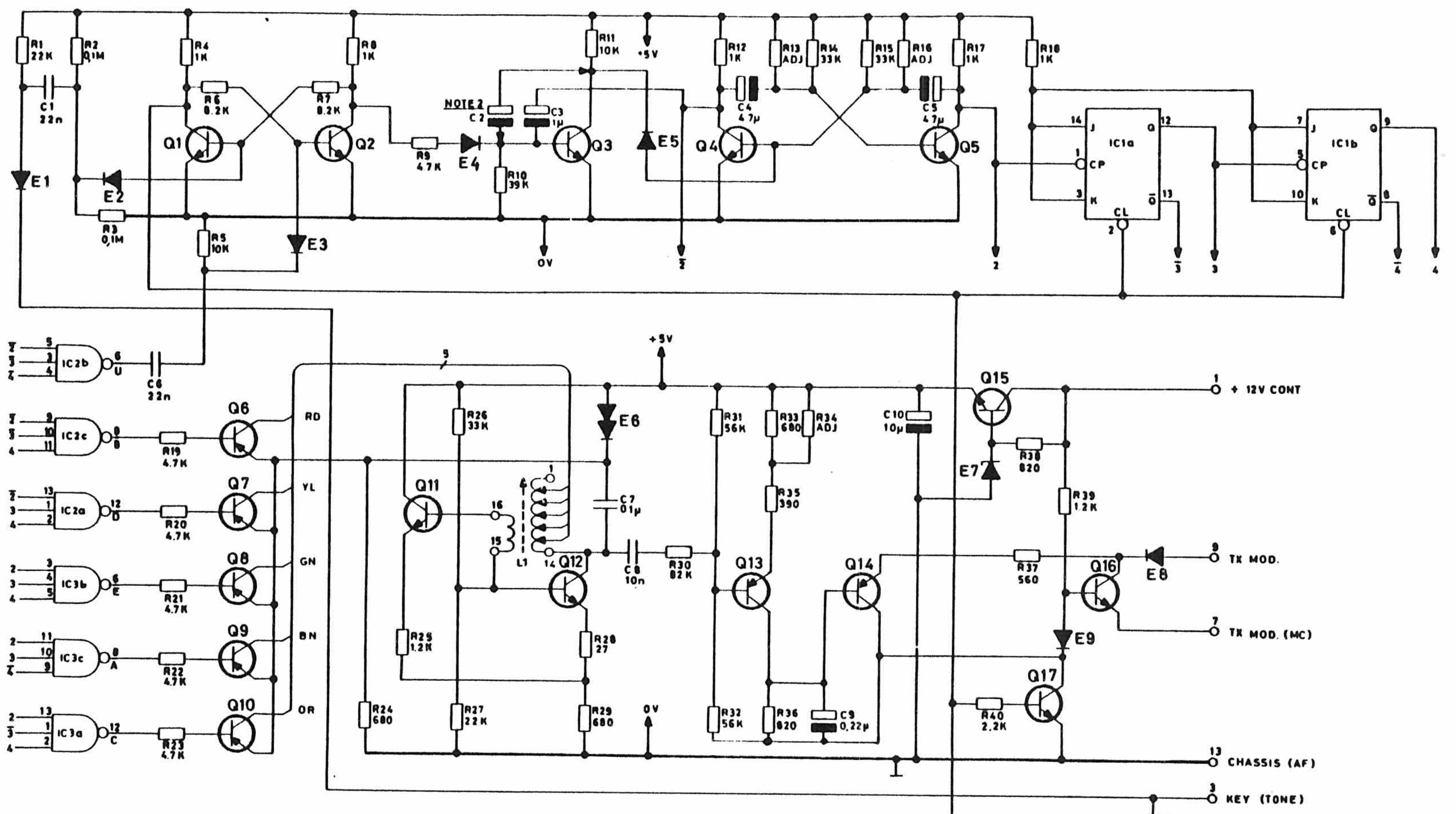
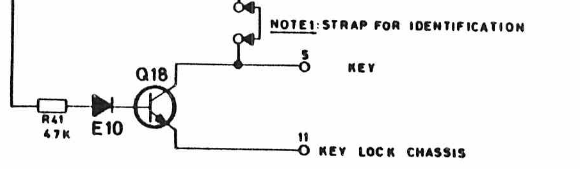
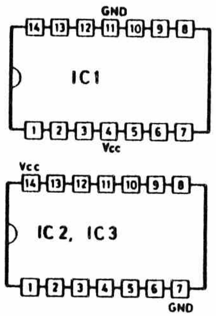
Storno

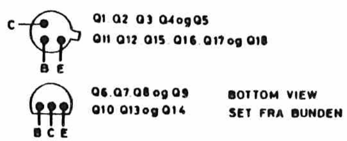


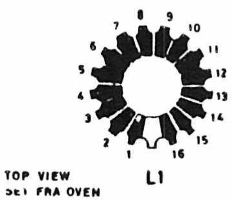


TERM.	FREQ	DIGIT
1	970 Hz	
2	1060 –	1
3	1160 –	2
4	1270 –	3
5	1400 –	4
6	1530 –	5
7	1670 –	6
8	1830 –	7
9	2000 –	8
10	2200 –	9
11	2400 –	0
12	2600 –	REPEAT
13	2800 –	ALARM
14		
15		
16		

NOTE 2: INSERT C2 FOR DELAY
R 10 MIN. 10K.
C2 MAX 47u
DELAY TIME 0,1 - 1,5 SEC.







SEQUENTIAL TONE TRANSMITTER
SEKVENSTONESENDER

ST7845

D401. 583/4

Storno

TYPE	NO.	CODE	DATA		
ST7845		10.2455-01	Tone Sequence Transmitter		
	C1	76.5071	22nF 10%	polyest FL	50V
	C2				
	C3	73.5114	1μF 20%	tantal	35V
	C4	73.5126	4.7μF 20%	tantal	35V
	C5	73.5126	4.7μF 20%	tantal	35V
	C6	76.5071	22nF 10%	polyest. FL	50V
	C7	76.5068	0.1μF 1%	polystyr TB	63V
	C8	76.5070	10nF 10%	polyest. FL	50V
	C9	73.5118	0.22μF 20%	tantal	35V
	C10	73.5109	10μF 20%	tantal	16V
	R1	80.5253	2.2KΩ 5%	carbon film	1/8W
	R2	80.5273	0.1MΩ 5%	carbon film	1/8W
	R3	80.5273	0.1MΩ 5%	carbon film	1/8W
	R4	80.5249	1KΩ 5%	carbon film	1/8W
	R5	80.5261	10KΩ 5%	carbon film	1/8W
	R6	80.5260	8.2KΩ 5%	carbon film	1/8W
	R7	80.5260	8.2KΩ 5%	carbon film	1/8W
	R8	80.5249	1KΩ 5%	carbon film	1/8W
	R9	80.5257	4.7KΩ 5%	carbon film	1/8W
	R10	80.5268	39KΩ 5%	carbon film	1/8W
	R11	80.5261	10KΩ 5%	carbon film	1/8W
	R12	80.5249	1KΩ 5%	carbon film	1/8W
	R13	80.52XX	Adjusted		
	R14	80.5267	33KΩ 5%	carbon film	1/8W
	R15	80.5267	33KΩ 5%	carbon film	1/8W
	R16	80.52XX	Adjusted		
	R17	80.5249	1KΩ 5%	carbon film	1/8W
	R18	80.5249	1KΩ 5%	carbon film	1/8W
	R19	80.5257	4.7KΩ 5%	carbon film	1/8W
	R20	80.5257	4.7KΩ 5%	carbon film	1/8W
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W
	R22	80.5257	4.7KΩ 5%	carbon film	1/8W
	R23	80.5257	4.7KΩ 5%	carbon film	1/8W
	R24	80.5247	680Ω 5%	carbon film	1/8W
	R25	80.5250	1.2KΩ 5%	carbon film	1/8W
	R26	80.5267	33KΩ 5%	carbon film	1/8W
	R27	80.5265	22KΩ 5%	carbon film	1/8W
	R28	80.5230	27Ω 5%	carbon film	1/8W
	R29	80.5247	680Ω 5%	carbon film	1/8W
	R30	80.5272	82KΩ 5%	carbon film	1/8W
	R31	80.5270	56KΩ 5%	carbon film	1/8W
	R32	80.5270	56KΩ 5%	carbon film	1/8W
	R33	80.5247	680Ω 5%	carbon film	1/8W
	R34	80.52XX	Adjusted		
	R35	80.5244	390Ω 5%	carbon film	1/8W

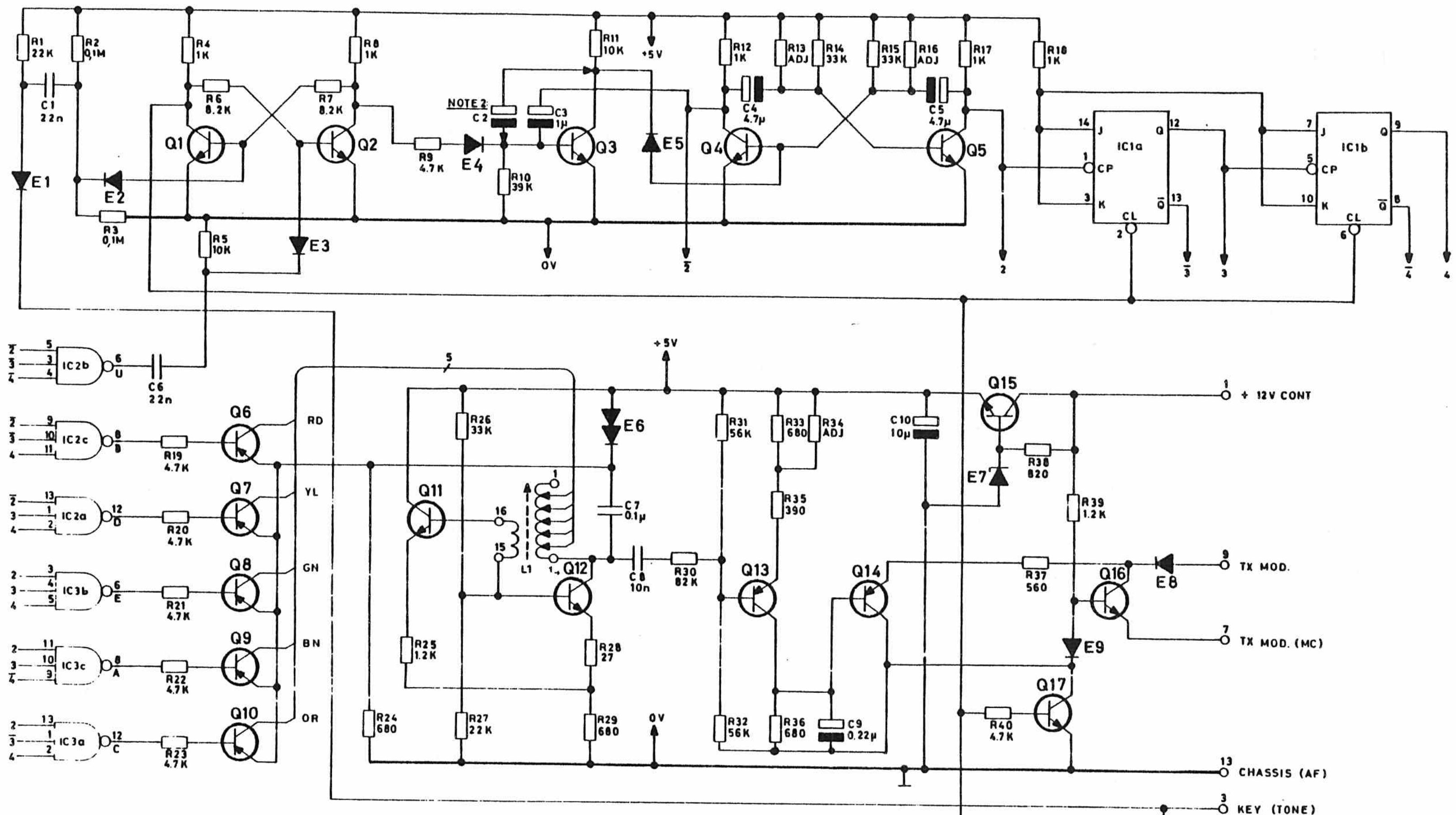
Storno

TYPE	NO.	CODE	DATA		
	R36	80.5248	820Ω 5%	carbon film	1/8W
	R37	80.5246	560Ω 5%	carbon film	1/8W
	R38	80.5248	820Ω 5%	carbon film	1/8W
	R39	80.5250	1.2KΩ 5%	carbon film	1/8W
	R40	80.5253	2.2KΩ 5%	carbon film	1/8W
	R41	80.5257	4.7KΩ 5%	carbon film	1/8W
	L1	61.1140	Tone coil		
	E1	99.5028	1N914 Diode		
	E2	99.5028	1N914 Diode		
	E3	99.5028	1N914 Diode		
	E4	99.5028	1N914 Diode		
	E5	99.5219	AAZ15		
	E6	99.5209	Stab. diode ZE 1.5		
	E7	99.5114	Zenerdiode 5.6V 5%		1/4W
	E8	99.5219	AAZ15		
	E9	99.5219	AAZ15		
	E10	99.5028	1N914 Diode		
	Q1	99.5143	BC108	Transistor	
	Q2	99.5143	BC108	Transistor	
	Q3	99.5121	BC107	Transistor	
	Q4	99.5121	BC107	Transistor	
	Q5	99.5121	BC107	Transistor	
	Q6	99.5144	BC214L	Transistor	
	Q7	99.5144	BC214L	Transistor	
	Q8	99.5144	BC214L	Transistor	
	Q9	99.5144	BC214L	Transistor	
	Q10	99.5144	BC214L	Transistor	
	Q11	99.5143	BC108	Transistor	
	Q12	99.5143	BC108	Transistor	
	Q13	99.5144	BC214L	Transistor	
	Q14	99.5144	BC214L	Transistor	
	Q15	99.5128	2N3053	Transistor	
	Q16	99.5143	BC108	Transistor	
	Q17	99.5143	BC108	Transistor	
	Q18	99.5143	BC108	Transistor	
	IC1	14.5008	Dual J-K Master-Slave Flip-Flop		
	IC2	14.5007	Triple 3-input NAND Gate		
	IC3	14.5007	Triple 3-input NAND Gate		

SEQUENTIAL TONE TRANSMITTER ST7845
SEKVENSTONESENDER

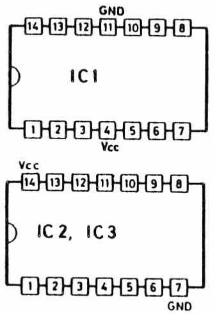
X401.689/2

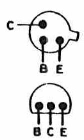
Storno



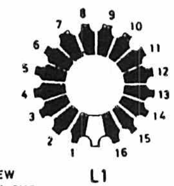
TERM	FREQ	DIGIT
1	970 Hz	
2	1060 –	1
3	1160 –	2
4	1270 –	3
5	1400 –	4
6	1530 –	5
7	1670 –	6
8	1830 –	7
9	2000 –	8
10	2200 –	9
11	2400 –	0
12	2600 –	REPEAT
13	2800 –	ALARM
14		
15		
16		

NOTE 2: INSERT C2 FOR DELAY
R 10 MIN. 10K.
C 2 MAX. 47u
DELAY TIME: 0,1 – 1,5 SEC.





BOTTOM VIEW
SET FRA BUNDEN



TOP VIEW
SET FRA OVEN

SEQUENTIAL TONE TRANSMITTER
SEKVENSTONESENDER

ST7845

D401. 583/3

Storno

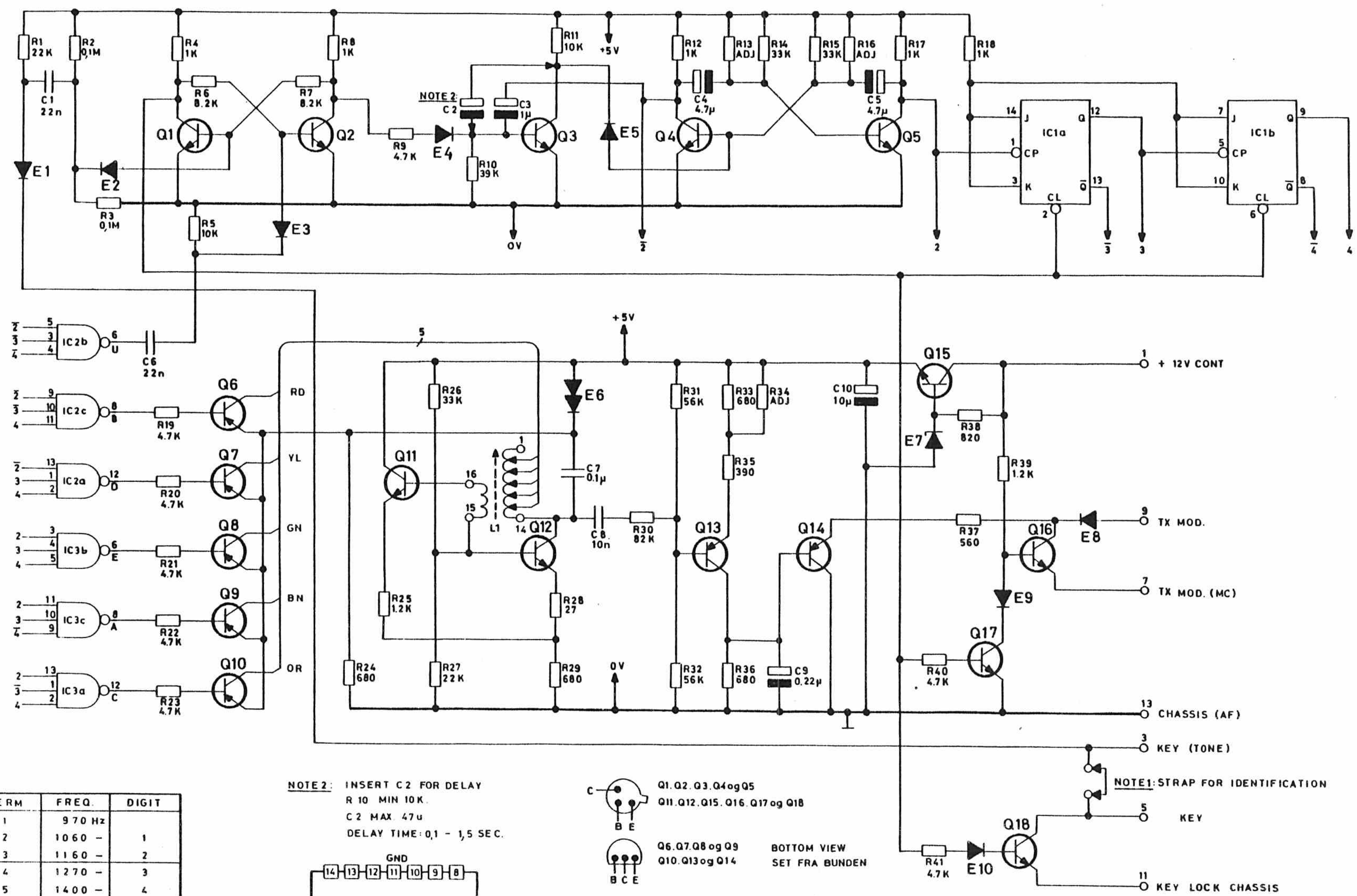
TYPE	NO.	CODE	DATA		
ST7845		10.2455-01	Tone Sequence Transmitter		
	C1	76.5071	22nF 10%	polyest FL	50V
	C2				
	C3	73.5114	1μF 20%	tantal	35V
	C4	73.5126	4.7μF 20%	tantal	35V
	C5	73.5126	4.7μF 20%	tantal	35V
	C6	76.5071	22nF 10%	polyest. FL	50V
	C7	76.5068	0.1μF 1%	polystyr TB	63V
	C8	76.5070	10nF 10%	polyest. FL	50V
	C9	73.5118	0.22μF 20%	tantal	35V
	C10	73.5109	10μF 20%	tantal	16V
	R1	80.5253	2.2KΩ 5%	carbon film	1/8W
	R2	80.5273	0.1MΩ 5%	carbon film	1/8W
	R3	80.5273	0.1MΩ 5%	carbon film	1/8W
	R4	80.5249	1KΩ 5%	carbon film	1/8W
	R5	80.5261	10KΩ 5%	carbon film	1/8W
	R6	80.5260	8.2KΩ 5%	carbon film	1/8W
	R7	80.5260	8.2KΩ 5%	carbon film	1/8W
	R8	80.5249	1KΩ 5%	carbon film	1/8W
	R9	80.5257	4.7KΩ 5%	carbon film	1/8W
	R10	80.5268	39KΩ 5%	carbon film	1/8W
	R11	80.5261	10KΩ 5%	carbon film	1/8W
	R12	80.5249	1KΩ 5%	carbon film	1/8W
	R13	80.52XX	Adjusted		
	R14	80.5267	33KΩ 5%	carbon film	1/8W
	R15	80.5267	33KΩ 5%	carbon film	1/8W
	R16	80.52XX	Adjusted		
	R17	80.5249	1KΩ 5%	carbon film	1/8W
	R18	80.5249	1KΩ 5%	carbon film	1/8W
	R19	80.5257	4.7KΩ 5%	carbon film	1/8W
	R20	80.5257	4.7KΩ 5%	carbon film	1/8W
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W
	R22	80.5257	4.7KΩ 5%	carbon film	1/8W
	R23	80.5257	4.7KΩ 5%	carbon film	1/8W
	R24	80.5247	680Ω 5%	carbon film	1/8W
	R25	80.5250	1.2KΩ 5%	carbon film	1/8W
	R26	80.5267	33KΩ 5%	carbon film	1/8W
	R27	80.5265	22KΩ 5%	carbon film	1/8W
	R28	80.5230	27Ω 5%	carbon film	1/8W
	R29	80.5247	680Ω 5%	carbon film	1/8W
	R30	80.5272	82KΩ 5%	carbon film	1/8W
	R31	80.5270	56KΩ 5%	carbon film	1/8W
	R32	80.5270	56KΩ 5%	carbon film	1/8W
	R33	80.5247	680Ω 5%	carbon film	1/8W
	R34	80.52XX	Adjusted		
	R35	80.5244	390Ω 5%	carbon film	1/8W

Storno

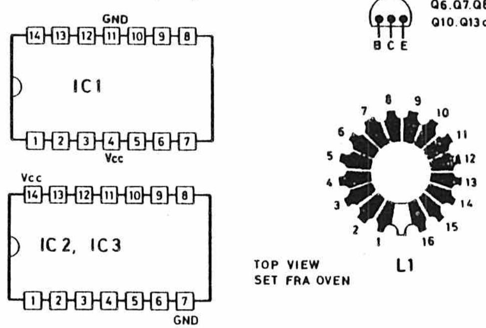
TYPE	NO.	CODE	DATA		
	R36	80.5248	820Ω 5%	carbon film	1/8W
	R37	80.5246	560Ω 5%	carbon film	1/8W
	R38	80.5248	820Ω 5%	carbon film	1/8W
	R39	80.5250	1.2KΩ 5%	carbon film	1/8W
	R40	80.5253	2.2KΩ 5%	carbon film	1/8W
	R41	80.5257	4.7KΩ 5%	carbon film	1/8W
	L1	61.1140	Tone coil		
	E1	99.5028	1N914 Diode		
	E2	99.5028	1N914 Diode		
	E3	99.5028	1N914 Diode		
	E4	99.5028	1N914 Diode		
	E5	99.5219	AAZ15		
	E6	99.5209	Stab. diode ZE 1.5		
	E7	99.5114	Zenerdiode 5.6V 5%		1/4W
	E8	99.5219	AAZ15		
	E9	99.5219	AAZ15		
	E10	99.5028	1N914 Diode		
	Q1	99.5143	BC108	Transistor	
	Q2	99.5143	BC108	Transistor	
	Q3	99.5121	BC107	Transistor	
	Q4	99.5121	BC107	Transistor	
	Q5	99.5121	BC107	Transistor	
	Q6	99.5144	BC214L	Transistor	
	Q7	99.5144	BC214L	Transistor	
	Q8	99.5144	BC214L	Transistor	
	Q9	99.5144	BC214L	Transistor	
	Q10	99.5144	BC214L	Transistor	
	Q11	99.5143	BC108	Transistor	
	Q12	99.5143	BC108	Transistor	
	Q13	99.5144	BC214L	Transistor	
	Q14	99.5144	BC214L	Transistor	
	Q15	99.5128	2N3053	Transistor	
	Q16	99.5143	BC108	Transistor	
	Q17	99.5143	BC108	Transistor	
	Q18	99.5143	BC108	Transistor	
	IC1	14.5008	Dual J-K Master-Slave Flip-Flop		
	IC2	14.5007	Triple 3-input NAND Gate		
	IC3	14.5007	Triple 3-input NAND Gate		

SEQUENTIAL TONE TRANSMITTER ST7845
SEKVENSTONESENDER

X401.689/2



NOTE 2: INSERT C2 FOR DELAY
R 10 MIN 10K.
C 2 MAX 47u
DELAY TIME: 0,1 - 1,5 SEC.



TERM	FREQ.	DIGIT
1	970 Hz	
2	1060 –	1
3	1160 –	2
4	1270 –	3
5	1400 –	4
6	1530 –	5
7	1670 –	6
8	1830 –	7
9	2000 –	8
10	2200 –	9
11	2400 –	0
12	2600 –	REPEAT
13	2800 –	ALARM
14		
15		
16		

SEQUENTIAL TONE TRANSMITTER, ST7845
SEKVENSTONESENDER

D401. 583/2

TYPE	NO.	CODE	DATA		
ST7845		10.2455	Tone Sequence Transmitter		
	C1	76.5071	22nF 10%	polyest FL	50V
	C2				
	C3	73.5114	1μF 20%	tantal	35V
	C4	73.5126	4.7μF 20%	tantal	35V
	C5	73.5126	4.7μF 20%	tantal	35V
	C6	76.5071	22nF 10%	polyest. FL	50V
	C7	76.5068	0.1μF 1%	polystyr TB	63V
	C8	76.5070	10nF 10%	polyest. FL	50V
	C9	73.5118	0.22μF 20%	tantal	35V
	C10	73.5109	10μF 20%	tantal	16V
	R1	80.5253	2.2KΩ 5%	carbon film	1/8W
	R2	80.5273	0.1MΩ 5%	carbon film	1/8W
	R3	80.5273	0.1MΩ 5%	carbon film	1/8W
	R4	80.5249	1KΩ 5%	carbon film	1/8W
	R5	80.5261	10KΩ 5%	carbon film	1/8W
	R6	80.5260	8.2KΩ 5%	carbon film	1/8W
	R7	80.5260	8.2KΩ 5%	carbon film	1/8W
	R8	80.5249	1KΩ 5%	carbon film	1/8W
	R9	80.5257	4.7KΩ 5%	carbon film	1/8W
	R10	80.5268	39KΩ 5%	carbon film	1/8W
	R11	80.5261	10KΩ 5%	carbon film	1/8W
	R12	80.5249	1KΩ 5%	carbon film	1/8W
	R13	80.52XX	Adjusted		
	R14	80.5267	33KΩ 5%	carbon film	1/8W
	R15	80.5267	33KΩ 5%	carbon film	1/8W
	R16	80.52XX	Adjusted		
	R17	80.5249	1KΩ 5%	carbon film	1/8W
	R18	80.5249	1KΩ 5%	carbon film	1/8W
	R19	80.5257	4.7KΩ 5%	carbon film	1/8W
	R20	80.5257	4.7KΩ 5%	carbon film	1/8W
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W
	R22	80.5257	4.7KΩ 5%	carbon film	1/8W
	R23	80.5257	4.7KΩ 5%	carbon film	1/8W
	R24	80.5247	680Ω 5%	carbon film	1/8W
	R25	80.5250	1.2KΩ 5%	carbon film	1/8W
	R26	80.5267	33KΩ 5%	carbon film	1/8W
	R27	80.5265	22KΩ 5%	carbon film	1/8W
	R28	80.5230	27Ω 5%	carbon film	1/8W
	R29	80.5247	680Ω 5%	carbon film	1/8W
	R30	80.5272	82KΩ 5%	carbon film	1/8W
	R31	80.5270	56KΩ 5%	carbon film	1/8W
	R32	80.5270	56KΩ 5%	carbon film	1/8W
	R33	80.5247	680Ω 5%	carbon film	1/8W
	R34	80.52XX	Adjusted		
	R35	80.5244	390Ω 5%	carbon film	1/8W

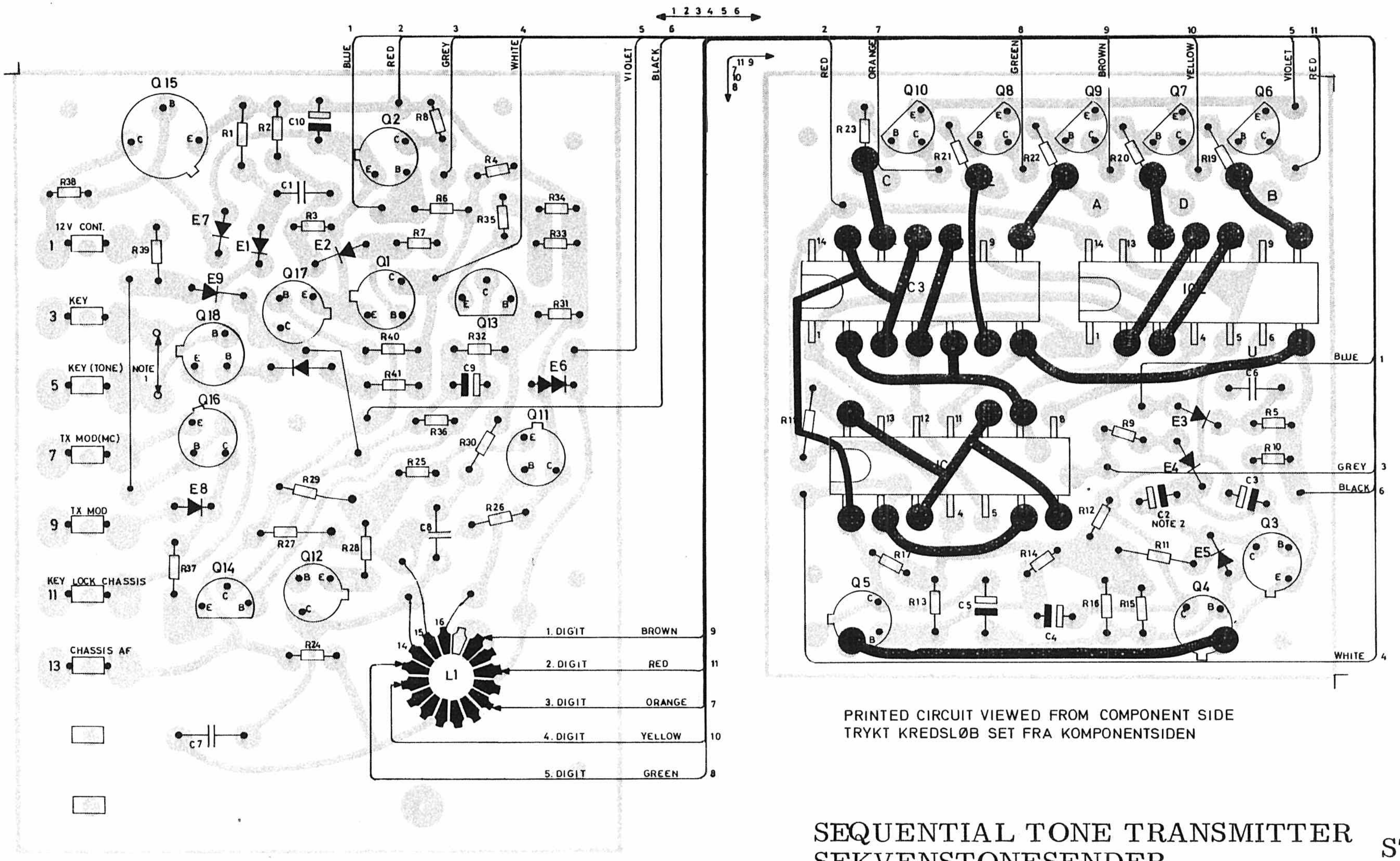
Storno

TYPE	NO.	CODE	DATA		
	R36	80.5247	680Ω 5%	carbon film	1/8W
	R37	80.5246	560Ω 5%	carbon film	1/8W
	R38	80.5248	820Ω 5%	carbon film	1/8W
	R39	80.5250	1.2KΩ 5%	carbon film	1/8W
	R40	80.5257	4.7KΩ 5%	carbon film	1/8W
	R41	80.5257	4.7KΩ 5%	carbon film	1/8W
	L1	61.1140	Tone coil		
	E1	99.5028	1N914 Diode		
	E2	99.5028	1N914 Diode		
	E3	99.5028	1N914 Diode		
	E4	99.5028	1N914 Diode		
	E5	99.5219	AAZ15		
	E6	99.5209	Stab. diode ZE 1.5		
	E7	99.5114	Zenerdiode 5.6V 5%		1/4W
	E8	99.5219	AAZ15		
	E9	99.5219	AAZ15		
	E10	99.5028	1N914 Diode		
	Q1	99.5143	BC108	Transistor	
	Q2	99.5143	BC108	Transistor	
	Q3	99.5121	BC107	Transistor	
	Q4	99.5121	BC107	Transistor	
	Q5	99.5121	BC107	Transistor	
	Q6	99.5144	BC214L	Transistor	
	Q7	99.5144	BC214L	Transistor	
	Q8	99.5144	BC214L	Transistor	
	Q9	99.5144	BC214L	Transistor	
	Q10	99.5144	BC214L	Transistor	
	Q11	99.5143	BC108	Transistor	
	Q12	99.5143	BC108	Transistor	
	Q13	99.5144	BC214L	Transistor	
	Q14	99.5144	BC214L	Transistor	
	Q15	99.5128	2N3053	Transistor	
	Q16	99.5143	BC108	Transistor	
	Q17	99.5143	BC108	Transistor	
	Q18	99.5143	BC108	Transistor	
	IC1	14.5008	Dual J-K Master-Slave Flip-Flop		
	IC2	14.5007	Triple 3-input NAND Gate		
	IC3	14.5007	Triple 3-input NAND Gate		

SEQUENTIAL TONE TRANSMITTER ST7845
SEKVENSTONESENDER

X401.689

Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

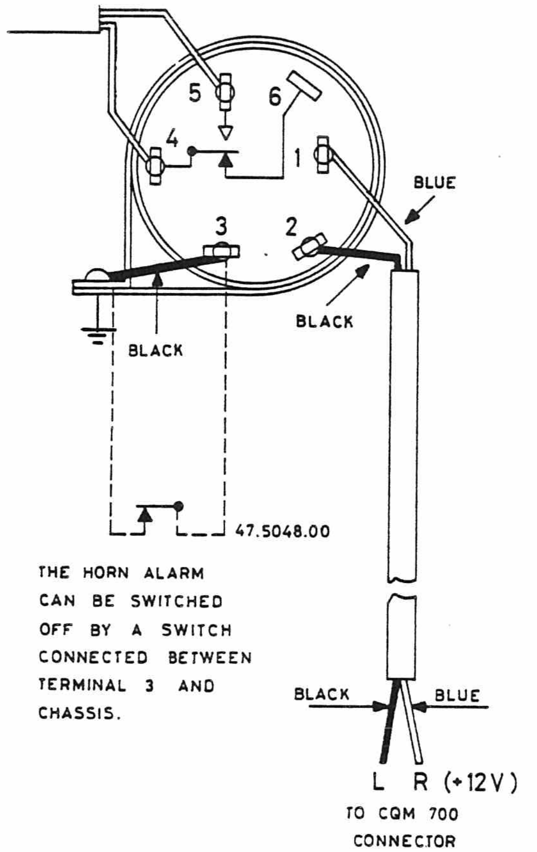
SEQUENTIAL TONE TRANSMITTER
SEKVENSTONESENDER

ST7845

D401.686

 Storno

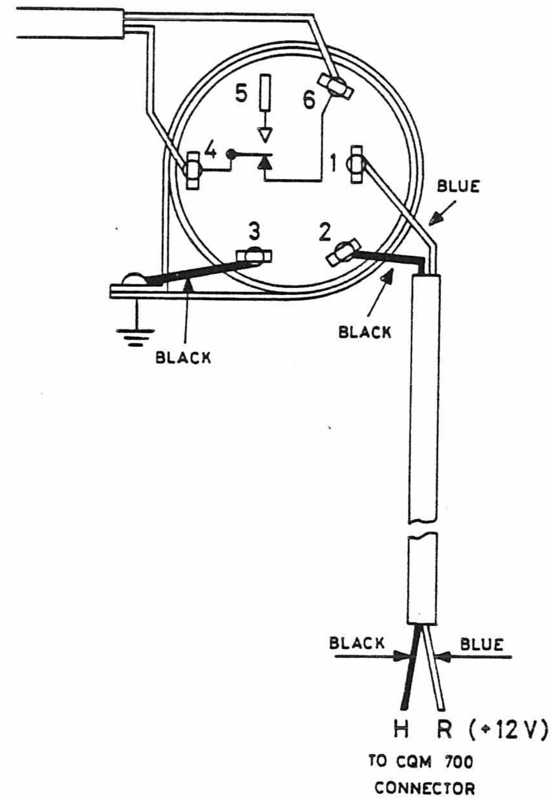
TO HORN OR BELL



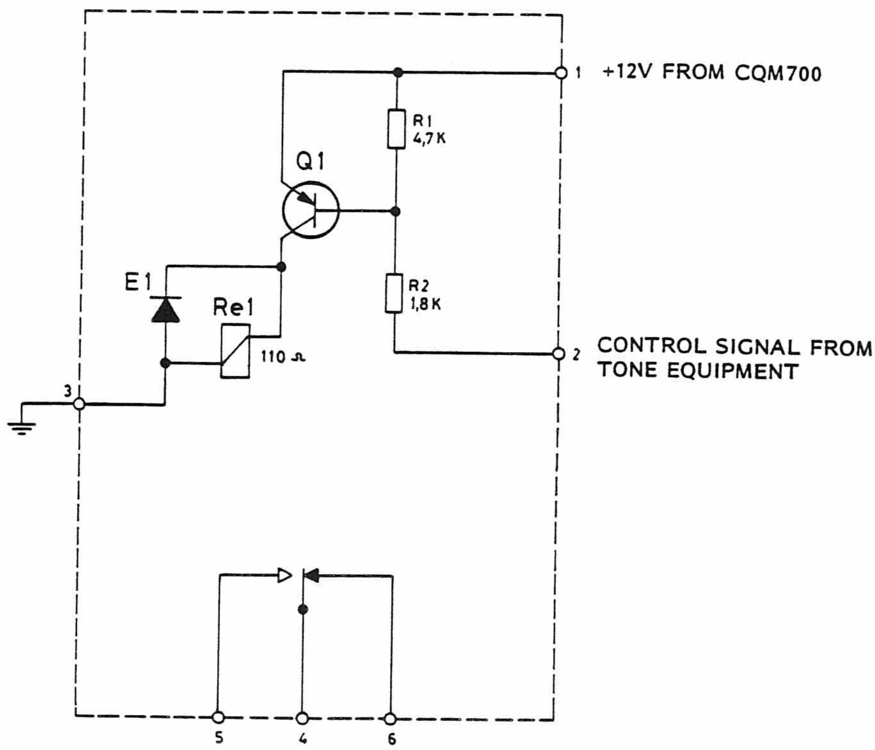
THE HORN ALARM CAN BE SWITCHED OFF BY A SWITCH CONNECTED BETWEEN TERMINAL 3 AND CHASSIS.

ALARM

DISCONNECTING AUTO RADIO



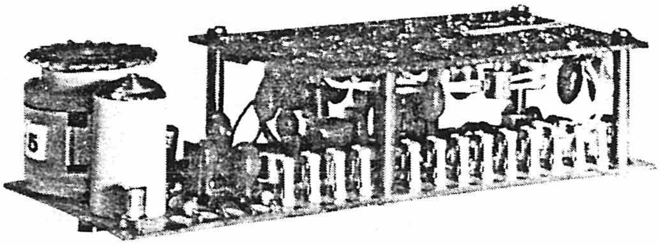
AUTO RADIO MUTING



INSTALLATION OF SWITCHING UNIT SU704

Storno

TONE RECEIVER
TR782 TR783 TR785



Introduction

TR782, TR783, and TR785 are selective tone receivers developed for use with Stornophone 700 radiotelephones. They are designed as double tone receivers but can also be employed in single tone mode. With the exception of a few frequency determining components, TR782, TR783, and TR785 are identical, and as far as this description is concerned, will be treated as though they were the same unit.

Tone frequencies for each unit are:
(frequencies in Hz)

TR782	TR783	TR785
615	825	370
675	1010	450
735	1240	550
805	1435	675
885	1520	825
970	1750	1040
1060	1860	1240
1160	1980	1520
1270	2000	1860
1400	2135	2280
1530	2280	
1670	2450	
1830		
2000		
2200		
2400		
2600		
2900		

General Description

Upon receipt of the appropriate tone signal with a duration of $>$700 ms the Call Lamp will light, the AF muting will be cancelled and the Key Locking function will "unlock".

The vehicle's traffic horn can be connected to the tone receiver via an auxiliary relay. Then, after the initial 700 ms required to establish a path through the tone receiver, the horn will sound for long as the tone signal continues to be received.

The audio circuit and the Key Lock are both turned on and off manually by means of the LS IN/OUT push button.

Since the Key Lock is "unlocked" with the same switch that turns on the loudspeaker, the operator is forced to check for the presence of another signal on the channel before being able to key his transmitter.

In addition, the tone receiver is equipped with an Occupied Lamp controlled by the squelch circuit in the radiotelephone. Thus, if an RF signal having that channel's frequency is present at the antenna input it will cause the Occupied Lamp to light as an indication that the channel is not free.

Circuit Description

Pre-emphasis Stage

The pre-emphasis network includes transistor Q1 and follows an RC characteristic, 6 dB/octave, with cut-off frequency at 1000 Hz.

Storno

Amplifier and Amplitude Limiter

Transistor Q2 amplifies the incoming signal linearly until diodes E1 and E2 begin conducting.

When the incoming double tone signal reaches a level of approx. 8 dB above minimum triggering level (approx. 3 dB when connected as a single tone receiver) full amplitude limiting of the signal occurs:

Trigger level, V_{IN} = –29 dBm (–23 dBm) at 1000 Hz.

Due to this limiting action along with the narrow pass band of the subsequent Q multiplier, adjacent tones having frequencies that differ from the resonant frequency by at least 4.5 % will be unable to trigger the tone receiver.

Driver

Transistors Q3 and Q4 are arranged so that they present an extremely low output impedance (on the order of 1Ω) which is suitable as a ground return for the resonant circuit in the following stage.

Q Multiplier

The Q multiplier stage involves a parallel resonant circuit; this is coupled very loosely to the transistor, Q5, in order to maintain a constant Q over the entire tone range. C8 in the resonant circuit is grounded through the output impedance of the driver transistors while the relevant terminal(s) of coil L1 are alternately grounded through the AF gates, Q19 and Q20. This will be explained in the next section.

Part of the tone signal is reapplied to L1 in phase by means of a feedback winding in the collector circuit of Q5, approximately doubling the Q of L1.

To offset the effect of temperature upon the Q of L1 an NTC resistor, R20, is inserted in the emitter circuit of Q5. R20, aided by R19 and R21, maintains a nearly flat temperature response from –30°C to +80°C.

Astable Multivibrator and AF Gates

Transistors Q21 and Q22 form an astable multivibrator, driving the two AF gates, Q19 and Q20. When Q21 (Q22) conducts it drives Q20 (Q19) ON. The ground connection, which also determines the resonant frequency of the tuned circuit, is through Q20 (Q19) and capacitor C19.

The multivibrator action turns the two AF gates alternately ON and OFF, switching tone frequencies at the pulse repetition rate of approx. 500 ms.

Amplifier, Emitter, Follower, and Detector

Q6 amplifies the signal from the Q multiplier; its input resistance is bootstrapped to a value that will not load the Q multiplier.

The signal proceeds from Q6 to emitter follower Q7, then to the detector circuit, a conventional voltage doubler where R25 insures linearity for stronger signals.

The time constant of R25, C13, and R26/27 is long enough to form a low-pass filter for the tone signal components while short enough to react to the 250 ms half-periods of the multivibrator. For instance, should one of the tones of a double tone signal fail (tone does not match the receiver), the rectified DC voltage will drop to nearly 0 before the next tone arrives.

R27 sets the DC output level.

Schmitt Trigger, Delay Circuit, and Inverter

Q8 and Q9 make up the Schmitt trigger. When a correct tone is received, the rectified DC voltage at the trigger input, base of Q8, turns the circuit ON and the high potential at the collector of Q9 cuts E5 OFF. A charge begins to build up on C14 through R34; when the charge reaches approx. 0.6 V above the emitter voltage of Q10, that transistor will go ON. This last circuit introduces a 700 ms delay between input and output. Refer to the General Description.

With no signal at the trigger input, the circuit is OFF and E5 conducts. C14 discharges through E5 and Q9, turning Q10 OFF.

Build-up time between gate shifts in the Q multifier is approx. 20 to 30 ms, which is considerable compared with the detector time constant and the fast action of the Schmitt trigger.

A resistor, R32 is inserted in the discharge path of C14 to introduce a time lag of approx. 40 ms in order to compensate for the Q multiplier build-up time, ensuring that Q10 does not turn off intermittently between tones.

When Q10 turns ON, it turns the inverter, Q11 ON as well.

Switch and Alarm Gate

When Q11 goes ON, it turns Q12 ON. Q12 switches the external alarm circuit ON by pulling the Alarm terminal, 37, virtually down to chassis potential. Q12, and therefore the alarm device, remains ON as long as the correct tone combination continues to be received.

Bistable Multivibrator and Outlet Switches

The bistable multivibrator comprises Q13 and Q14. There are two possibilities for triggering the multivibrator:

(1) automatically, by reception of a correct tone call
(2) manually, by pushbutton

Consider the manual mode first: pressing a pushbutton on the control panel grounds terminal 32, causing a trigger pulse via C15 and C16 to change the state of the bistable circuit.

Regardless of the state of the bistable multivibrator a correct tone signal will, as previously mentioned, turn Q12 ON whereby the base of Q13 becomes grounded via E6 and Q12. If Q13 happens to be ON at the time, it will be switched OFF; if it is already OFF, it will be held there. Thus, a tone call has higher priority than the manual switch.

Whenever Q13 is OFF the following occurs:

(1) Q18 goes ON, connecting terminal 34 (AF Muting) to chassis through diode E12 and allowing the loudspeaker amplifier to operate.

(2) Q17 goes ON, lighting the Call Lamp via terminal 47.

(3) Q15 goes ON, releasing the Key Lock via terminal 51. It is then possible to operate the transmitter.

When the tone signal disappears the operator can change the state of the bistable circuit manually, as explained earlier.

Squelch Gate

When another call is in progress on the channel the RF signal will be detected in the radiotelephone receiver. The receiver squelch system will then feed a DC voltage (approx. +5 V emf / R_G = 1 kΩ) to terminal 41. Q16 will be driven ON and will light the Occupied Lamp through terminal 45.

Audio Radio Muting

If the vehicle also has a broadcast radio installed, an auxiliary relay connected to terminal 49 may be used to silence the radio during the time that the Key Lock is released.

Technical Specifications

Tone Receiver TR782

Power Supply
Operating range: 10.5 V - 16.0 V
Nominal: 13.6 V

Current Consumption
Stand by: nom. 45 mA

Temperature Range
Operating range: -25° - $+60^{\circ}$C
Functioning range: -30° - $+80^{\circ}$C

Input Impedance
$>$ 6 kΩ

Signal Input Level
Nominal at 1000 Hz: -23 dBm

Equalization
Preemphasis (by RC function) f_c = 1 kHz

Signal Code
2 preset tone frequencies, received simultaneously for min. 700 mS

Signal Frequencies

615, 675, 735, 805, 885, 970, 1060, 1160, 1270, 1400, 1530, 1670, 1830, 2000, 2200, 2400, 2600, 2900 Hz

Frequency Accuracy

With coil adjusted for 1060 Hz: ≤ 0.3 %

Frequency Stability

(Typically ≤0.5 %): ≤1.0%

Selectivity

Frequencies differing from f_o by 4.5 % or more are unable to trigger the tone receiver.

Maximum Load Currents

Terminal 37, "ALARM"	100 mA
Terminal 47 + 49, "CALL"	100 mA
Terminal 45, "OCCUPIED"	60 mA
Terminal 51, "KEY LOCK"	60 mA
Terminal 34, "AF MUTING"	5 mA

AF Muting

In conjunction with AA7xx : ≥ 60 dB

Tone Receiver TR783

Power Supply

Operating range: 10.5 V - 16.0 V
Nominal: 13.6 V

Current Consumption

Stand by: nom. 45 mA

Temperature Range

Operating range: $-25^{o}C$ - $+60^{o}C$
Functioning range: $-30^{o}C$ - $+80^{o}C$

Input Impedance

>6 kΩ

Signal Input Level

Nominal at 1000 Hz: –23 dBm

Equalization

Preemphasis (by RC function) f_c = 1 kHz

Signal Code

2 preset tone frequencies, received simultaneously for min. 700 mS

Storno

Signal Frequencies

825, 1010, 1240, 1435, 1520, 1750, 1860, 1980, 2000 2135, 2280, 2450.

Frequency Accuracy

With coil adjusted for 1010 Hz = ≤ 0.3 %

Frequency Stability

(Typically ≤ 0.5 %): ≤1.0 %

Selectivity

Frequencies differing from f_o by 4.5 % or more are unable to trigger the tone receiver.

Maximum Load Currents

Terminal 37, "ALARM"	100 mA
Terminal 47 + 49, "CALL"	100 mA
Terminal 45, "OCCUPIED"	60 mA
Terminal 51, "KEY LOCK"	60 mA
Terminal 34, "AF MUTING"	5 mA

AF Muting

In conjunction with AA7xx: ≥ 60 dB

Tone Receiver TR785

Power Supply

Operating range: 10.5 V - 16.0 V
Nominal: 13.6 V

Current Consumption

Stand by: nom. 45 mA

Temperature Range

Operating range: $-25^{o}C$ - $+60^{o}C$
Functioning range: $-30^{o}C$ - $+80^{o}C$

Input Impedance

>6 kΩ

Signal Input Level

Nominal at 1000 Hz : –23 dBm

Equalization

Preemphasis (by RC function) f_c = 1 kHz

Signal Code

2 preset tone frequencies, received simultaneously for min. 700 mS.

Storno

Signal Frequencies

370, 450, 550, 675, 825, 1010, 1240, 1520, 1860, 2280

Frequency Accuracy

With coil adjusted for 1010 Hz: $\leq$ 0.3 %

Frequency Stability

(Typically $\leq$ 0.5 %): $\leq$ 1.0 %

Selectivity

Frequencies differing from f_o by 4.5 % or more are unable to trigger the tone receiver.

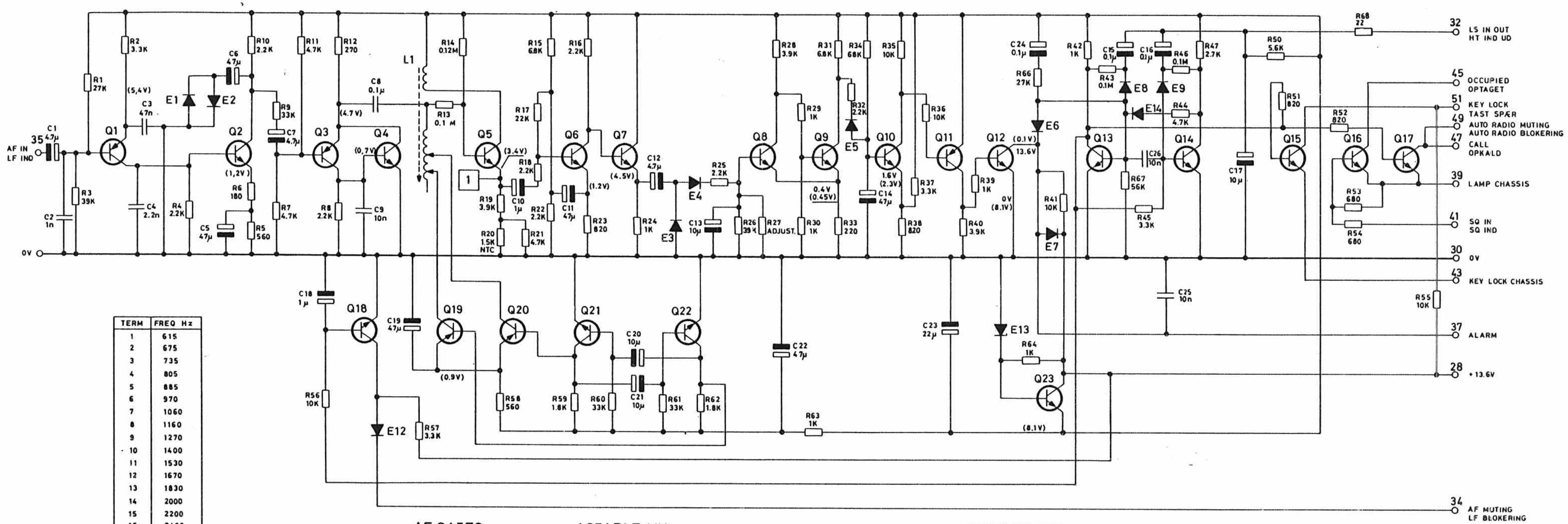
Maximum Load Currents

Terminal 37, "ALARM"	100 mA
Terminal 47 +49, "CALL"	100 mA
Terminal 45, "OCCUPIED"	60 mA
Terminal 51, "KEY LOCK"	60 mA
Terminal 34, "AF MUTING"	5 mA

AF Muting

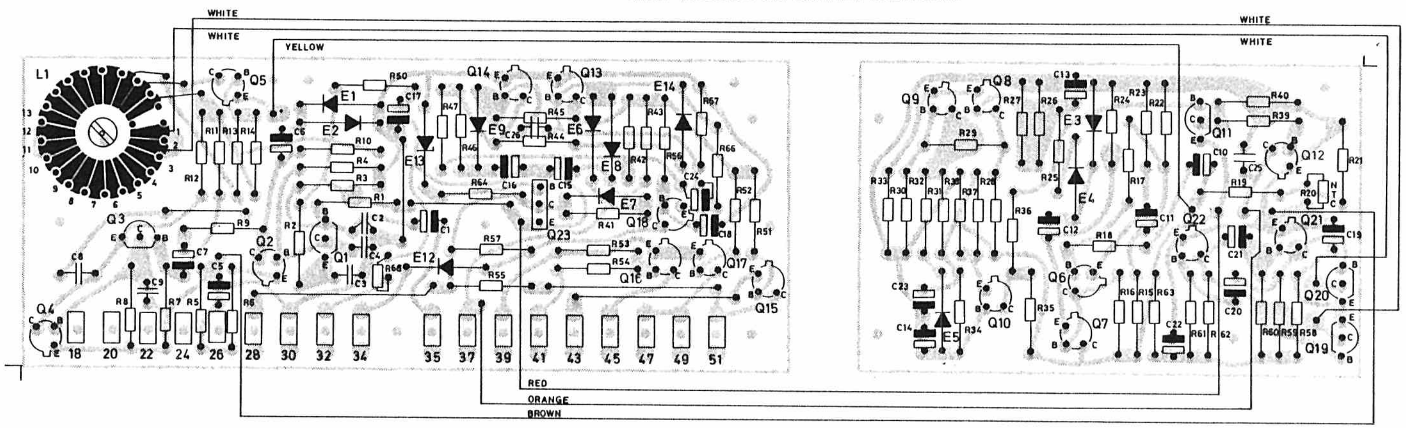
In conjunction with AA7xx: 60 dB.

Storno

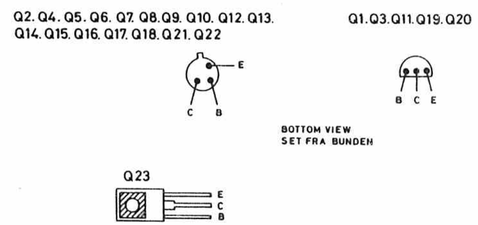


TERM	FREQ Hz
1	615
2	675
3	735
4	805
5	885
6	970
7	1060
8	1160
9	1270
10	1400
11	1530
12	1670
13	1830
14	2000
15	2200
16	2400
17	2600
18	2900

PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



VOLTAGES WITH ( ) V_{in} 1060Hz = 55mV
VOLTAGES WITHOUT ( ) V_{in} 0V



TONE RECEIVER TR782
TONEMODTAGER

D401.161/6

Storno

TYPE	NO.	CODE	DATA		
TR782		10.2449	Tone Receiver		
	C1	73.5126	4.7μF 20%	tantal	35V
	C2	76.5069	1nF 10%	polyest. FL	50V
	C3	76.5072	47nF 10%	polyest. FL	50V
	C4	76.5059	2.2nF 10%	polyest. FL	50V
	C5	73.5124	47μF 20%	tantal	6.3V
	C6	73.5124	47μF 20%	tantal	6.3V
	C7	73.5126	4.7μF 20%	tantal	35V
	C8	76.5068	0.1μF 1%	polystyr TB	63V
	C9	76.5070	10nF 10%	polyest. FL	50V
	C10	73.5114	1μF 20%	tantal	35V
	C11	73.5124	47μF 20%	tantal	6.3V
	C12	73.5126	4.7μF 20%	tantal	35V
	C13	73.5109	10μF 20%	tantal	16V
	C14	73.5124	47μF 20%	tantal	6.3V
	C15	73.5089	0.1μF 20%	tantal	35V
	C16	73.5089	0.1μF 20%	tantal	35V
	C17	73.5109	10μF 20%	tantal	16V
	C18	73.5114	1μF 20%	tantal	35V
	C19	73.5124	47μF 20%	tantal	6.3V
	C20	73.5109	10μF 20%	tantal	16V
	C21	73.5109	10μF 20%	tantal	16V
	C22	73.5124	47μF 20%	tantal	6.3V
	C23	73.5127	22μF 20%	tantal	16V
	C24	73.5089	0.1μF 20%	tantal	35V
	C25	76.5070	10nF 10%	polyest. FL	50V
	C26	76.5070	10nF 10%	polyest. FL	50V
	R1	80.5266	27KΩ 5%	carbon film	1/8W
	R2	80.5255	3.3KΩ 5%	carbon film	1/8W
	R3	80.5268	39KΩ 5%	carbon film	1/8W
	R4	80.5253	2.2KΩ 5%	carbon film	1/8W
	R5	80.5246	560Ω 5%	carbon film	1/8W
	R6	80.5240	180Ω 5%	carbon film	1/8W
	R7	80.5257	4.7KΩ 5%	carbon film	1/8W
	R8	80.5253	2.2KΩ 5%	carbon film	1/8W
	R9	80.5267	33KΩ 5%	carbon film	1/8W
	R10	80.5253	2.2KΩ 5%	carbon film	1/8W
	R11	80.5257	4.7KΩ 5%	carbon film	1/8W
	R12	80.5242	270Ω 5%	carbon film	1/8W
	R13	80.5273	0.1 MΩ 5%	carbon film	1/8W
	R14	80.5274	0.12 MΩ 5%	carbon film	1/8W
	R15	80.5259	6.8KΩ 5%	carbon film	1/8W
	R16	80.5253	2.2KΩ 5%	carbon film	1/8W
	R17	80.5265	22KΩ 5%	carbon film	1/8W
	R18	80.5253	2.2KΩ 5%	carbon film	1/8W
	R19	80.5256	3.9KΩ 5%	carbon film	1/8W
	R20	89.5008	1.5KΩ 20%	NTC	1/2W

Storno

TYPE	NO.	CODE	DATA		
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W
	R22	80.5253	2.2KΩ 5%	carbon film	1/8W
	R23	80.5248	820Ω 5%	carbon film	1/8W
	R24	80.5249	1 KΩ 5%	carbon film	1/8W
	R25	80.5253	2.2KΩ 5%	carbon film	1/8W
	R26	80.5268	39KΩ 5%	carbon film	1/8W
	R27	80.52XX	Adjusted		1/8W
	R28	80.5256	3.9KΩ 5%	carbon film	1/8W
	R29	80.5249	1 KΩ 5%	carbon film	1/8W
	R30	80.5249	1 KΩ 5%	carbon film	1/8W
	R31	80.5259	6.8KΩ 5%	carbon film	1/8W
	R32	80.5253	2.2KΩ 5%	carbon film	1/8W
	R33	80.5241	220Ω 5%	carbon film	1/8W
	R34	80.5271	68KΩ 5%	carbon film	1/8W
	R35	80.5261	10KΩ 5%	carbon film	1/8W
	R36	80.5261	10KΩ 5%	carbon film	1/8W
	R37	80.5255	3.3KΩ 5%	carbon film	1/8W
	R38	80.5247	680Ω 5%	carbon film	1/8W
	R39	80.5249	1 KΩ 5%	carbon film	1/8W
	R40	80.5256	3.9KΩ 5%	carbon film	1/8W
	R41	80.5261	10KΩ 5%	carbon film	1/8W
	R42	80.5249	1 KΩ 5%	carbon film	1/8W
	R43	80.5273	0.1 MΩ 5%	carbon film	1/8W
	R44	80.5257	4.7KΩ 5%	carbon film	1/8W
	R45	80.5255	3.3KΩ 5%	carbon film	1/8W
	R46	80.5273	0.1 MΩ 5%	carbon film	1/8W
	R47	80.5254	2.7KΩ 5%	carbon film	1/8W
	R48				
	R49				
	R50	80.5258	5.6KΩ 5%	carbon film	1/8W
	R51	80.5248	820Ω 5%	carbon film	1/8W
	R52	80.5248	820Ω 5%	carbon film	1/8W
	R53	80.5247	680Ω 5%	carbon film	1/8W
	R54	80.5247	680Ω 5%	carbon film	1/8W
	R55	80.5261	10KΩ 5%	carbon film	1/8W
	R56	80.5261	10KΩ 5%	carbon film	1/8W
	R57	80.5255	3.3KΩ 5%	carbon film	1/8W
	R58	80.5246	560Ω 5%	carbon film	1/8W
	R59	80.5252	1.8KΩ 5%	carbon film	1/8W
	R60	80.5267	33KΩ 5%	carbon film	1/8W
	R61	80.5267	33KΩ 5%	carbon film	1/8W
	R62	80.5252	1.8KΩ 5%	carbon film	1/8W
	R63	80.5249	1 KΩ 5%	carbon film	1/8W

TONE RECEIVER TR782
TONEMODTAGER

X401.650/2

Storno

TYPE	NO.	CODE	DATA
	R64	80.5249	1 KΩ 5% carbon film 1/8W
	R65		
	R66	80.5266	27KΩ 5% carbon film 1/8W
	R67	80.5270	56KΩ 5% carbon film 1/8W
	R68	80.5229	22Ω 5% carbon film 1/8W
	L1	61.1133	Tone coil
	E1	99.5211	Stab. diode 0.8V 5% 1/4W
	E2	99.5211	Stab. diode 0.8V 5% 1/4W
	E3	99.5219	AAZ15 Diode
	E4	99.5219	AAZ15 Diode
	E5	99.5219	AAZ15 Diode
	E6	99.5219	AAZ15 Diode
	E7	99.5020	1N4004 Diode
	E8	99.5028	1N914 Diode
	E9	99.5028	1N914 Diode
	E10		
	E11		
	E12	99.5219	AAZ15 Diode
	E13	99.5042	Zenerdiode 9.1 V 5% 1/4W
	E14	99.5219	AAZ15 Diode
	Q1	99.5144	BC214L Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5144	BC214L Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5143	BC108 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor
	Q11	99.5144	BC214L Transistor
	Q12	99.5143	BC108 Transistor
	Q13	99.5143	BC108 Transistor
	Q14	99.5143	BC108 Transistor
	Q15	99.5143	BC108 Transistor
	Q16	99.5143	BC108 Transistor
	Q17	99.5143	BC108 Transistor
	Q18	99.5143	BC108 Transistor
	Q19	99.5144	BC214L Transistor
	Q20	99.5144	BC214L Transistor
	Q21	99.5143	BC108 Transistor
	Q22	99.5143	BC108 Transistor
	Q23	99.5235	BD135 Transistor

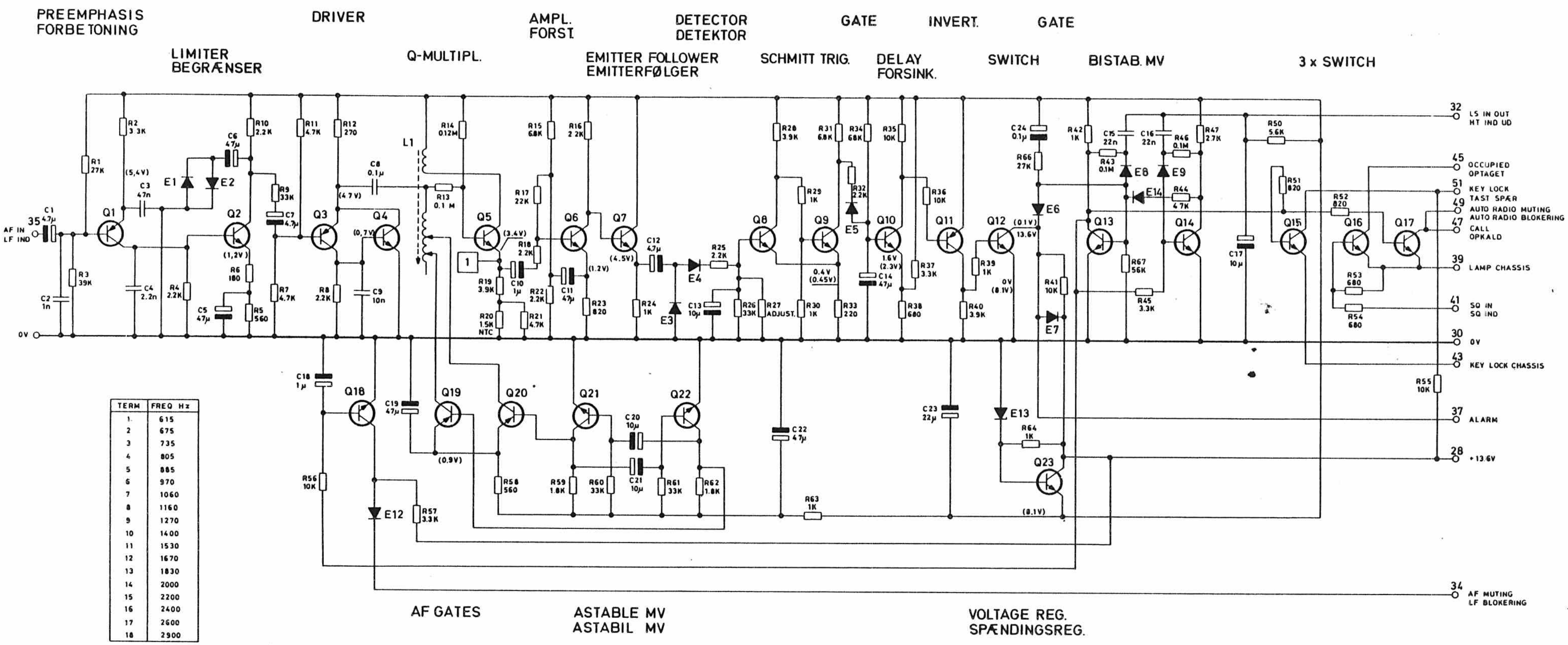
Storno

TYPE	NO.	CODE	DATA

TONE RECEIVER
TONEMODTAGER TR782

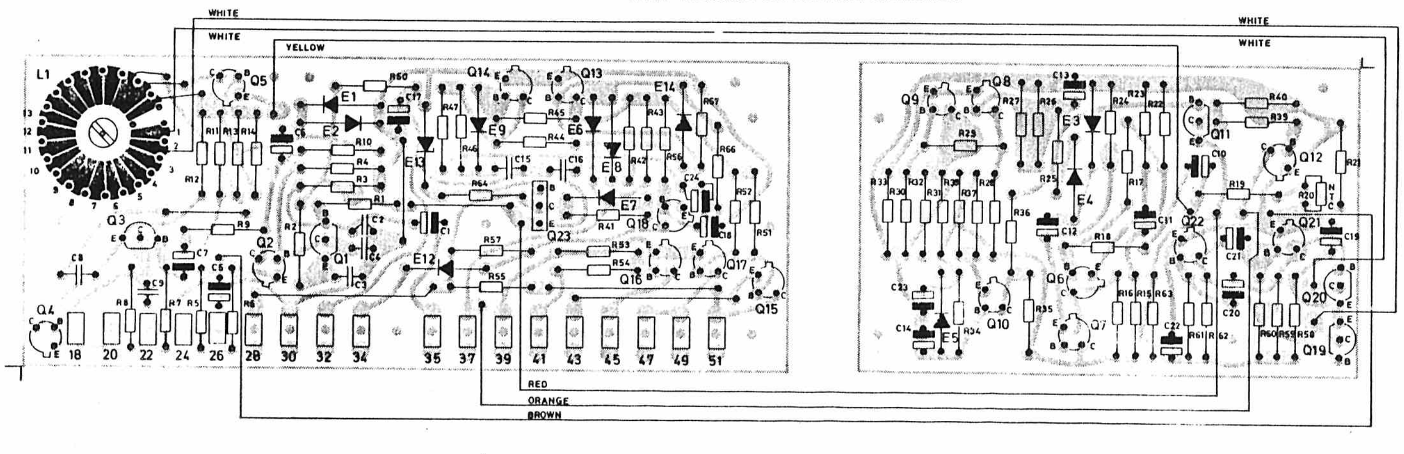
X401.650/2

Storno

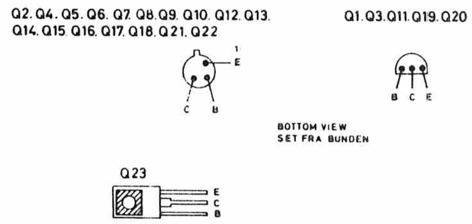


TERM	FREQ Hz
1	615
2	675
3	735
4	805
5	885
6	970
7	1060
8	1160
9	1270
10	1400
11	1530
12	1670
13	1830
14	2000
15	2200
16	2400
17	2600
18	2900

PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



VOLTAGES WITH ( ) V_{in} 1060Hz = 55mV
VOLTAGES WITHOUT ( ) V_{in} 0V



TONE RECEIVER TR782
TONEMODTAGER

D401.161/5

Storno

TYPE	NO.	CODE	DATA		
TR782		10.2449	Tone Receiver		
	C1	73.5126	4.7μF 20%	tantal	35V
	C2	76.5069	1nF 10%	polyest. FL	50V
	C3	76.5072	47nF 10%	polyest. FL	50V
	C4	76.5059	2.2nF 10%	polyest. FL	50V
	C5	73.5124	47μF 20%	tantal	6.3V
	C6	73.5124	47μF 20%	tantal	6.3V
	C7	73.5126	4.7μF 20%	tantal	35V
	C8	76.5068	0.1μF 1%	polystyr TB	63V
	C9	76.5070	10nF 10%	polyest. FL	50V
	C10	73.5114	1μF 20%	tantal	35V
	C11	73.5124	47μF 20%	tantal	6.3V
	C12	73.5126	4.7μF 20%	tantal	35V
	C13	73.5109	10μF 20%	tantal	16V
	C14	73.5124	47μF 20%	tantal	6.3V
	C15	76.5071	22nF 10%	polyest. FL	50V
	C16	76.5071	22nF 10%	polyest. FL	50V
	C17	73.5109	10μF 20%	tantal	16V
	C18	73.5114	1μF 20%	tantal	35V
	C19	73.5124	47μF 20%	tantal	6.3V
	C20	73.5109	10μF 20%	tantal	16V
	C21	73.5109	10μF 20%	tantal	16V
	C22	73.5124	47μF 20%	tantal	6.3V
	C23	73.5127	22μF 20%	tantal	16V
	C24	73.5089	0.1μF 20%	tantal	35V
	R1	80.5266	27KΩ 5%	carbon film	1/8W
	R2	80.5255	3.3KΩ 5%	carbon film	1/8W
	R3	80.5268	39KΩ 5%	carbon film	1/8W
	R4	80.5253	2.2KΩ 5%	carbon film	1/8W
	R5	80.5246	560Ω 5%	carbon film	1/8W
	R6	80.5240	180Ω 5%	carbon film	1/8W
	R7	80.5257	4.7KΩ 5%	carbon film	1/8W
	R8	80.5253	2.2KΩ 5%	carbon film	1/8W
	R9	80.5267	33KΩ 5%	carbon film	1/8W
	R10	80.5253	2.2KΩ 5%	carbon film	1/8W
	R11	80.5257	4.7KΩ 5%	carbon film	1/8W
	R12	80.5242	270Ω 5%	carbon film	1/8W
	R13	80.5273	0.1MΩ 5%	carbon film	1/8W
	R14	80.5274	0.12MΩ 5%	carbon film	1/8W
	R15	80.5259	6.8KΩ 5%	carbon film	1/8W
	R16	80.5253	2.2KΩ 5%	carbon film	1/8W
	R17	80.5265	22KΩ 5%	carbon film	1/8W
	R18	80.5253	2.2KΩ 5%	carbon film	1/8W
	R19	80.5256	3.9KΩ 5%	carbon film	1/8W
	R20	89.5008	1.5KΩ 20%	NTC	1/2W
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W

Storno

TYPE	NO.	CODE	DATA		
	R22	80.5253	2.2KΩ 5%	carbon film	1/8W
	R23	80.5248	820Ω 5%	carbon film	1/8W
	R24	80.5249	1KΩ 5%	carbon film	1/8W
	R25	80.5253	2.2KΩ 5%	carbon film	1/8W
	R26	80.5267	33KΩ 5%	carbon film	1/8W
	R27	80.52XX	Adjusted		1/8W
	R28	80.5256	3.9KΩ 5%	carbon film	1/8W
	R29	80.5249	1KΩ 5%	carbon film	1/8W
	R30	80.5249	1KΩ 5%	carbon film	1/8W
	R31	80.5259	6.8KΩ 5%	carbon film	1/8W
	R32	80.5253	2.2KΩ 5%	carbon film	1/8W
	R33	80.5241	220Ω 5%	carbon film	1/8W
	R34	80.5271	68KΩ 5%	carbon film	1/8W
	R35	80.5261	10KΩ 5%	carbon film	1/8W
	R36	80.5261	10KΩ 5%	carbon film	1/8W
	R37	80.5255	3.3KΩ 5%	carbon film	1/8W
	R38	80.5247	680Ω 5%	carbon film	1/8W
	R39	80.5249	1KΩ 5%	carbon film	1/8W
	R40	80.5256	3.9KΩ 5%	carbon film	1/8W
	R41	80.5261	10KΩ 5%	carbon film	1/8W
	R42	80.5249	1KΩ 5%	carbon film	1/8W
	R43	80.5273	0.1MΩ 5%	carbon film	1/8W
	R44	80.5257	4.7KΩ 5%	carbon film	1/8W
	R45	80.5255	3.3KΩ 5%	carbon film	1/8W
	R46	80.5273	0.1MΩ 5%	carbon film	1/8W
	R47	80.5254	2.7KΩ 5%	carbon film	1/8W
	R48				
	R49				
	R50	80.5258	5.6KΩ 5%	carbon film	1/8W
	R51	80.5248	820Ω 5%	carbon film	1/8W
	R52	80.5248	820Ω 5%	carbon film	1/8W
	R53	80.5247	680Ω 5%	carbon film	1/8W
	R54	80.5247	680Ω 5%	carbon film	1/8W
	R55	80.5261	10KΩ 5%	carbon film	1/8W
	R56	80.5261	10KΩ 5%	carbon film	1/8W
	R57	80.5255	3.3KΩ 5%	carbon film	1/8W
	R58	80.5246	560Ω 5%	carbon film	1/8W
	R59	80.5252	1.8KΩ 5%	carbon film	1/8W
	R60	80.5267	33KΩ 5%	carbon film	1/8W
	R61	80.5267	33KΩ 5%	carbon film	1/8W
	R62	80.5252	1.8KΩ 5%	carbon film	1/8W
	R63	80.5249	1KΩ 5%	carbon film	1/8W

TONE RECEIVER
TONEMODTAGER
TR782

Storno

TYPE	NO.	CODE	DATA	
	R64	80.5249	1KΩ 5% carbon film	1/8W
	R65			
	R66	80.5266	27KΩ 5% carbon film	1/8W
	L1	61.1133	Tone coil	
	E1	99.5211	Stab. diode 0.8V 5%	1/4W
	E2	99.5211	Stab. diode 0.8V 5%	1/4W
	E3	99.5219	AAZ15 Diode	
	E4	99.5219	AAZ15 Diode	
	E5	99.5219	AAZ15 Diode	
	E6	99.5219	AAZ15 Diode	
	E7	99.5020	1N4004 Diode	
	E8	99.5028	1N914 Diode	
	E9	99.5028	1N914 Diode	
	E10			
	E11			
	E12	99.5219	AAZ15 Diode	
	E13	99.5042	Zenerdiode 9.1V 5%	1/4W
	E14	99.5219	AAZ15 Diode	
	Q1	99.5144	BC214L Transistor	
	Q2	99.5143	BC108 Transistor	
	Q3	99.5144	BC214L Transistor	
	Q4	99.5143	BC108 Transistor	
	Q5	99.5143	BC108 Transistor	
	Q6	99.5143	BC108 Transistor	
	Q7	99.5143	BC108 Transistor	
	Q8	99.5143	BC108 Transistor	
	Q9	99.5143	BC108 Transistor	
	Q10	99.5143	BC108 Transistor	
	Q11	99.5144	BC214L Transistor	
	Q12	99.5143	BC108 Transistor	
	Q13	99.5143	BC108 Transistor	
	Q14	99.5143	BC108 Transistor	
	Q15	99.5143	BC108 Transistor	
	Q16	99.5143	BC108 Transistor	
	Q17	99.5143	BC108 Transistor	
	Q18	99.5143	BC108 Transistor	
	Q19	99.5144	BC214L Transistor	
	Q20	99.5144	BC214L Transistor	
	Q21	99.5143	BC108 Transistor	
	Q22	99.5143	BC108 Transistor	
	Q23	99.5235	BD135 Transistor	

Storno

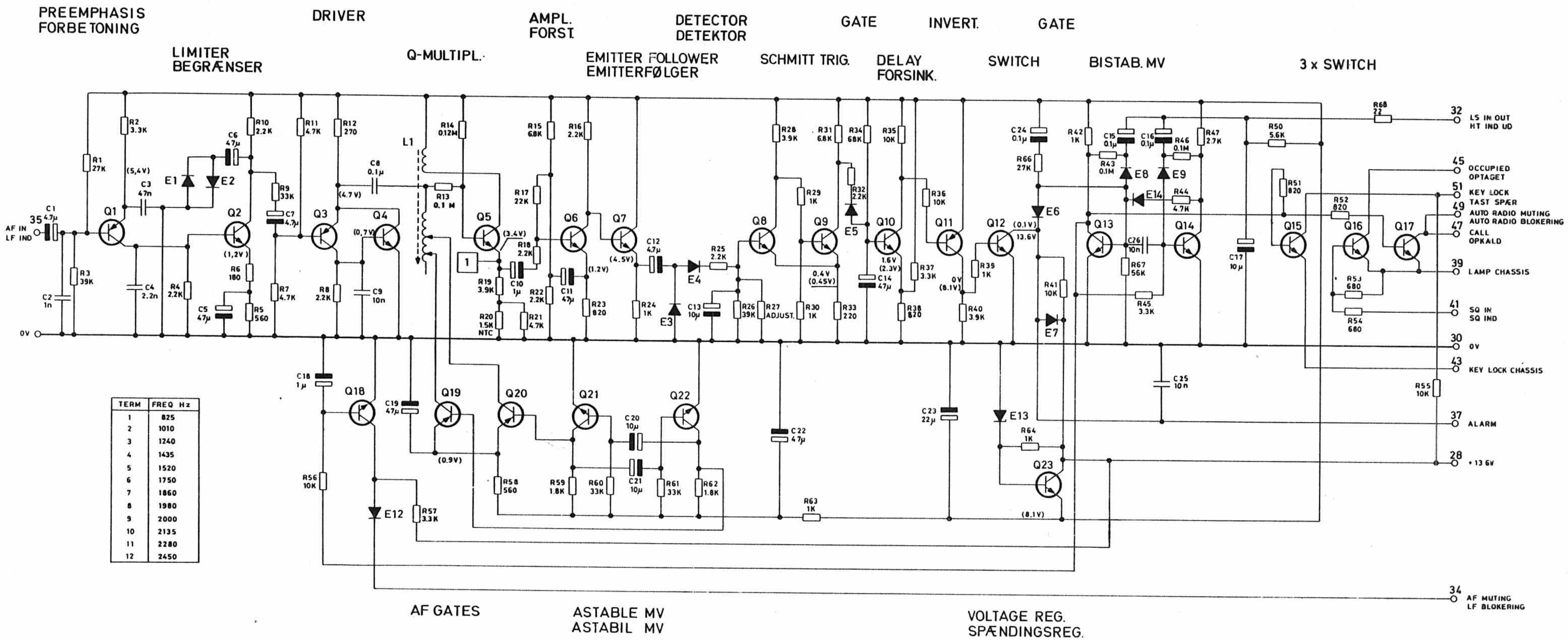
TYPE	NO.	CODE	DATA

TONE RECEIVER
TONEMODTAGER

TR782

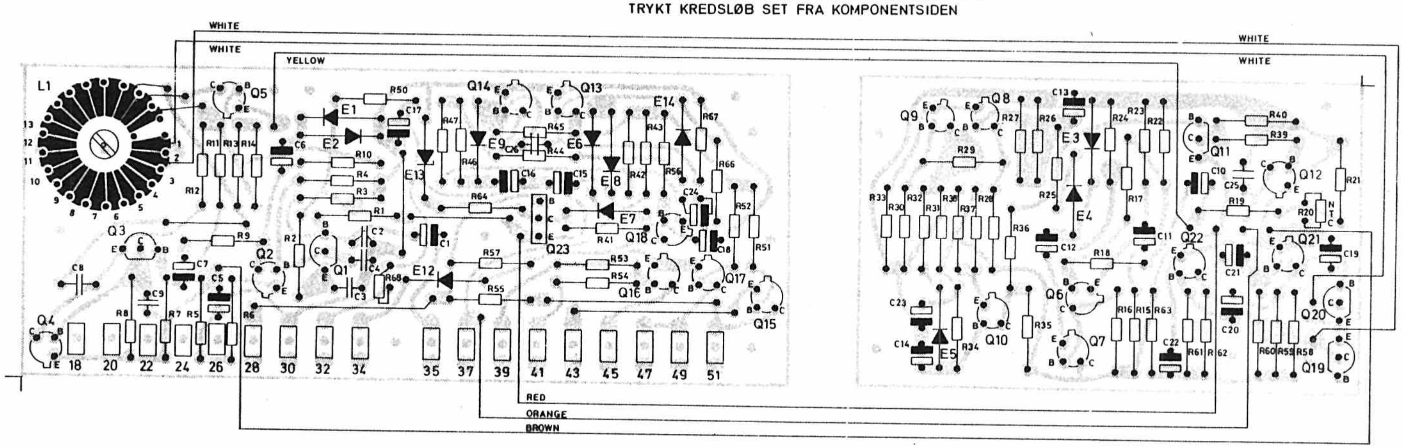
X401.650

Storno



TERM	FREQ Hz
1	825
2	1010
3	1240
4	1435
5	1520
6	1750
7	1860
8	1980
9	2000
10	2135
11	2280
12	2450

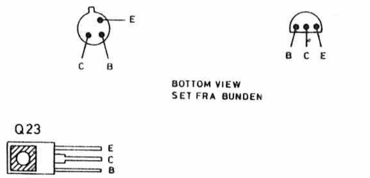
PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



VOLTAGES WITH ( ) V_{in} 1060Hz = 55mV
VOLTAGES WITHOUT ( ) V_{in} 0V

Q2. Q4. Q5. Q6. Q7. Q8. Q9. Q10. Q12. Q13. Q14. Q15. Q16. Q17. Q18. Q21. Q22

Q1. Q3. Q11. Q19. Q20



BOTTOM VIEW
SET FRA BUNDEN

TONE RECEIVER TR783
TONEMODTAGER

D401.231/3

Storno

TYPE	NO.	CODE	DATA		
TR783		10.2452	Tone Receiver		
	C1	73.5126	4.7μF 20%	tantal	35V
	C2	76.5069	1nF 10%	polyest. FL	50V
	C3	76.5072	47nF 10%	polyest. FL	50V
	C4	76.5059	2.2nF 10%	polyest FL	50V
	C5	73.5124	47μF 20%	tantal	6.3V
	C6	73.5124	47μF 20%	tantal	6.3V
	C7	73.5126	4.7μF 20%	tantal	35V
	C8	76.5068	0.1μF 1%	polystyr TB	63V
	C9	76.5070	10nF 10%	polyest. FL	50V
	C10	73.5114	1μF 20%	tantal	35V
	C11	73.5124	47μF 20%	tantal	6.3V
	C12	73.5126	4.7μF 20%	tantal	35V
	C13	73.5109	10μF 20%	tantal	16V
	C14	73.5124	47μF 20%	tantal	6.3V
	C15	73.5089	0.1μF 20%	tantal	35V
	C16	73.5089	0.1μF 20%	tantal	35V
	C17	73.5109	10μF 20%	tantal	16V
	C18	73.5114	1μF 20%	tantal	35V
	C19	73.5124	47μF 20%	tantal	6.3V
	C20	73.5109	10μF 20%	tantal	16V
	C21	73.5109	10μF 20%	tantal	16V
	C22	73.5124	47μF 20%	tantal	6.3V
	C23	73.5127	22μF 20%	tantal	16V
	C24	73.5089	0.1μF 20%	tantal	35V
	C25	76.5070	10nF 10%	polyest. FL	50V
	C26	76.5070	10nF 10%	polyest. FL	50V
	R1	80.5266	27KΩ 5%	carbon film	1/8W
	R2	80.5255	3.3KΩ 5%	carbon film	1/8W
	R3	80.5268	39KΩ 5%	carbon film	1/8W
	R4	80.5253	2.2KΩ 5%	carbon film	1/8W
	R5	80.5246	560Ω 5%	carbon film	1/8W
	R6	80.5240	180Ω 5%	carbon film	1/8W
	R7	80.5257	4.7KΩ 5%	carbon film	1/8W
	R8	80.5253	2.2KΩ 5%	carbon film	1/8W
	R9	80.5267	33KΩ 5%	carbon film	1/8W
	R10	80.5253	2.2KΩ 5%	carbon film	1/8W
	R11	80.5257	4.7KΩ 5%	carbon film	1/8W
	R12	80.5242	270Ω 5%	carbon film	1/8W
	R13	80.5273	0.1MΩ 5%	carbon film	1/8W
	R14	80.5274	0.12MΩ 5%	carbon film	1/8W
	R15	80.5259	6.8KΩ 5%	carbon film	1/8W
	R16	80.5253	2.2KΩ 5%	carbon film	1/8W
	R17	80.5265	22KΩ 5%	carbon film	1/8W
	R18	80.5253	2.2KΩ 5%	carbon film	1/8W
	R19	80.5256	3.9KΩ 5%	carbon film	1/8W
	R20	89.5008	1.5KΩ 20%	NTC	1/2W

Storno

TYPE	NO.	CODE	DATA		
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W
	R22	80.5253	2.2KΩ 5%	carbon film	1/8W
	R23	80.5248	820Ω 5%	carbon film	1/8W
	R24	80.5249	1 KΩ 5%	carbon film	1/8W
	R25	80.5253	2.2KΩ 5%	carbon film	1/8W
	R26	80.5268	39KΩ 5%	carbon film	1/8W
	R27	80.52XX	Adjusted		1/8W
	R28	80.5256	3.9KΩ 5%	carbon film	1/8W
	R29	80.5249	1 KΩ 5%	carbon film	1/8W
	R30	80.5249	1 KΩ 5%	carbon film	1/8W
	R31	80.5259	6.8KΩ 5%	carbon film	1/8W
	R32	80.5253	2.2KΩ 5%	carbon film	1/8W
	R33	80.5241	220Ω 5%	carbon film	1/8W
	R34	80.5271	68KΩ 5%	carbon film	1/8W
	R35	80.5261	10KΩ 5%	carbon film	1/8W
	R36	80.5261	10KΩ 5%	carbon film	1/8W
	R37	80.5255	3.3KΩ 5%	carbon film	1/8W
	R38	80.5247	680Ω 5%	carbon film	1/8W
	R39	80.5249	1 KΩ 5%	carbon film	1/8W
	R40	80.5256	3.9KΩ 5%	carbon film	1/8W
	R41	80.5261	10KΩ 5%	carbon film	1/8W
	R42	80.5249	1 KΩ 5%	carbon film	1/8W
	R43	80.5273	0.1 MΩ 5%	carbon film	1/8W
	R44	80.5257	4.7KΩ 5%	carbon film	1/8W
	R45	80.5255	3.3KΩ 5%	carbon film	1/8W
	R46	80.5273	0.1 MΩ 5%	carbon film	1/8W
	R47	80.5254	2.7KΩ 5%	carbon film	1/8W
	R48				
	R49				
	R50	80.5258	5.6KΩ 5%	carbon film	1/8W
	R51	80.5248	820Ω 5%	carbon film	1/8W
	R52	80.5248	820Ω 5%	carbon film	1/8W
	R53	80.5247	680Ω 5%	carbon film	1/8W
	R54	80.5247	680Ω 5%	carbon film	1/8W
	R55	80.5261	10KΩ 5%	carbon film	1/8W
	R56	80.5261	10KΩ 5%	carbon film	1/8W
	R57	80.5255	3.3KΩ 5%	carbon film	1/8W
	R58	80.5246	560Ω 5%	carbon film	1/8W
	R59	80.5252	1.8KΩ 5%	carbon film	1/8W
	R60	80.5267	33KΩ 5%	carbon film	1/8W
	R61	80.5267	33KΩ 5%	carbon film	1/8W
	R62	80.5252	1.8KΩ 5%	carbon film	1/8W
	R63	80.5249	1 KΩ 5%	carbon film	1/8W

TONE RECEIVER
TONEMODTAGER TR783

Storno

TYPE	NO.	CODE	DATA		
	R64	80.5249	1 KΩ 5%	carbon film	1/8W
	R65				
	R66	80.5266	27KΩ 5%	carbon film	1/8W
	R67	80.5270	56KΩ 5%	carbon film	1/8W
	R68	80.5229	22Ω 5%	carbon film	1/8W
	L1	61.1135	Tone coil		
	E1	99.5211	Stab. diode 0.8 V 5%		1/4W
	E2	99.5211	Stab. diode 0.8 V 5%		1/4W
	E3	99.5219	AAZ15 Diode		
	E4	99.5219	AAZ15 Diode		
	E5	99.5219	AAZ15 Diode		
	E6	99.5219	AAZ15 Diode		
	E7	99.5020	1N4004 Diode		
	E8	99.5028	1N914 Diode		
	E9	99.5028	1N914 Diode		
	E10				
	E11				
	E12	99.5219	AAZ15 Diode		
	E13	99.5042	Zenerdiode 9.1 V 5%		1/4W
	E14	99.5219	AAZ15 Diode		
	Q1	99.5144	BC214L	Transistor	
	Q2	99.5143	BC108	Transistor	
	Q3	99.5144	BC214L	Transistor	
	Q4	99.5143	BC108	Transistor	
	Q5	99.5143	BC108	Transistor	
	Q6	99.5143	BC108	Transistor	
	Q7	99.5143	BC108	Transistor	
	Q8	99.5143	BC108	Transistor	
	Q9	99.5143	BC108	Transistor	
	Q10	99.5143	BC108	Transistor	
	Q11	99.5144	BC214L	Transistor	
	Q12	99.5143	BC108	Transistor	
	Q13	99.5143	BC108	Transistor	
	Q14	99.5143	BC108	Transistor	
	Q15	99.5143	BC108	Transistor	
	Q16	99.5143	BC108	Transistor	
	Q17	99.5143	BC108	Transistor	
	Q18	99.5143	BC108	Transistor	
	Q19	99.5144	BC214L	Transistor	
	Q20	99.5144	BC214L	Transistor	
	Q21	99.5143	BC108	Transistor	
	Q22	99.5143	BC108	Transistor	
	Q23	99.5235	BD135	Transistor	

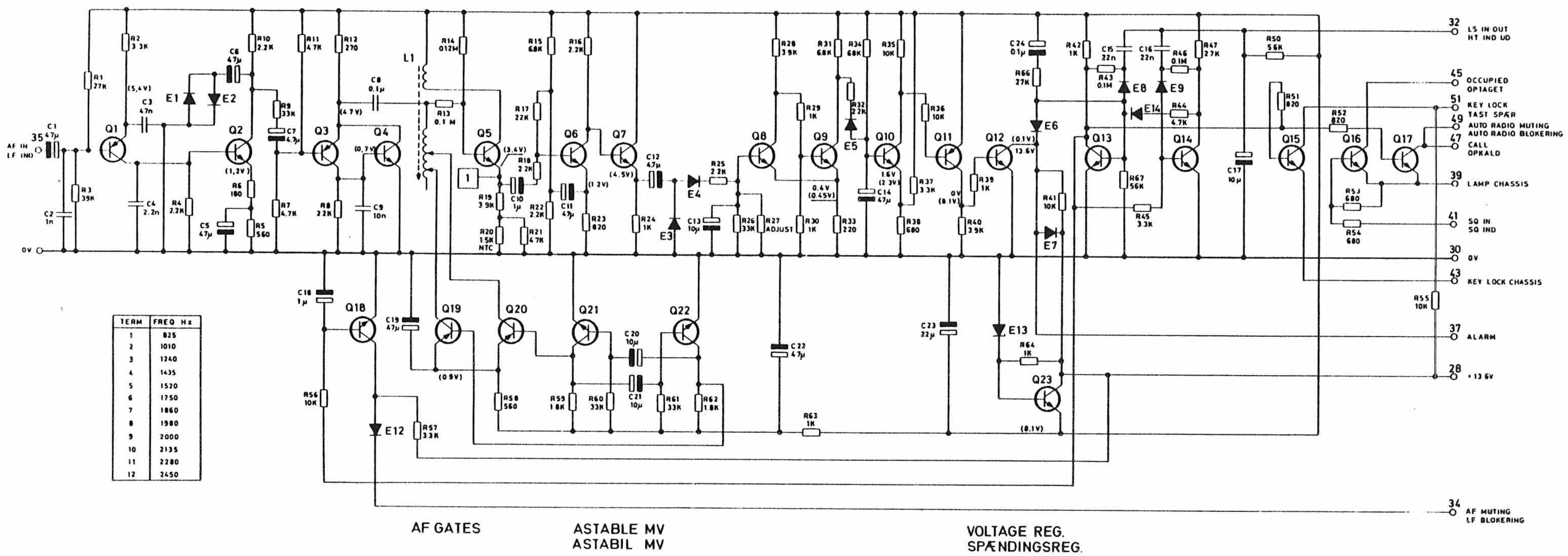
Storno

TYPE	NO.	CODE	DATA

TONE RECEIVER
TONEMODTAGER TR783

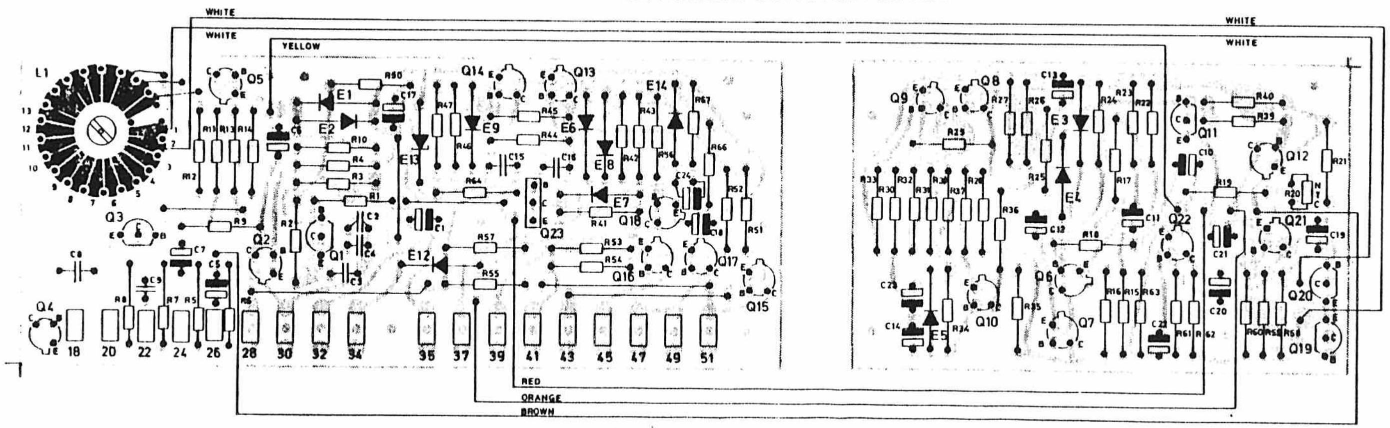
X401.699/2

Storno

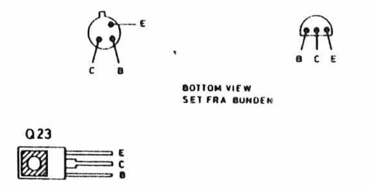


TERM	FREQ Hz
1	825
2	1010
3	1240
4	1435
5	1520
6	1750
7	1860
8	1980
9	2000
10	2135
11	2280
12	2450

PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



VOLTAGES WITH ( ) V_{in} 1060Hz = 55mV
VOLTAGES WITHOUT ( ) V_{in} 0V



TONE RECEIVER TR783
TONEMODTAGER

D401.231/2

TYPE	NO.	CODE	DATA		
TR783		10.2452	Tone Receiver		
	C1	73.5126	4.7μF 20%	tantal	35V
	C2	76.5069	1nF 10%	polyest. FL	50V
	C3	76.5072	47nF 10%	polyest. FL	50V
	C4	76.5059	2.2nF 10%	polyest. FL	50V
	C5	73.5124	47μF 20%	tantal	6.3V
	C6	73.5124	47μF 20%	tantal	6.3V
	C7	73.5126	4.7μF 20%	tantal	35V
	C8	76.5068	0.1μF 1%	polystyr TB	63V
	C9	76.5070	10nF 10%	polyest. FL	50V
	C10	73.5114	1μF 20%	tantal	35V
	C11	73.5124	47μF 20%	tantal	6.3V
	C12	73.5126	4.7μF 20%	tantal	35V
	C13	73.5109	10μF 20%	tantal	16V
	C14	73.5124	47μF 20%	tantal	6.3V
	C15	76.5071	22nF 10%	polyest. FL	50V
	C16	76.5071	22nF 10%	polyest. FL	50V
	C17	73.5109	10μF 20%	tantal	16V
	C18	73.5114	1μF 20%	tantal	35V
	C19	73.5124	47μF 20%	tantal	6.3V
	C20	73.5109	10μF 20%	tantal	16V
	C21	73.5109	10μF 20%	tantal	16V
	C22	73.5124	47μF 20%	tantal	6.3V
	C23	73.5127	22μF 20%	tantal	16V
	C24	73.5089	0.1μF 20%	tantal	35V
	R1	80.5266	27KΩ 5%	carbon film	1/8W
	R2	80.5255	3.3KΩ 5%	carbon film	1/8W
	R3	80.5268	39KΩ 5%	carbon film	1/8W
	R4	80.5253	2.2KΩ 5%	carbon film	1/8W
	R5	80.5246	560Ω 5%	carbon film	1/8W
	R6	80.5240	180Ω 5%	carbon film	1/8W
	R7	80.5257	4.7KΩ 5%	carbon film	1/8W
	R8	80.5253	2.2KΩ 5%	carbon film	1/8W
	R9	80.5267	33KΩ 5%	carbon film	1/8W
	R10	80.5253	2.2KΩ 5%	carbon film	1/8W
	R11	80.5257	4.7KΩ 5%	carbon film	1/8W
	R12	80.5242	270Ω 5%	carbon film	1/8W
	R13	80.5273	0.1MΩ 5%	carbon film	1/8W
	R14	80.5274	0.12MΩ 5%	carbon film	1/8W
	R15	80.5259	6.8KΩ 5%	carbon film	1/8W
	R16	80.5253	2.2KΩ 5%	carbon film	1/8W
	R17	80.5265	22KΩ 5%	carbon film	1/8W
	R18	80.5253	2.2KΩ 5%	carbon film	1/8W
	R19	80.5256	3.9KΩ 5%	carbon film	1/8W
	R20	89.5008	1.5KΩ 20%	NTC	1/2W
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W

Storno

TYPE	NO.	CODE	DATA		
	R22	80.5253	2.2KΩ 5%	carbon film	1/8W
	R23	80.5248	820Ω 5%	carbon film	1/8W
	R24	80.5249	1KΩ 5%	carbon film	1/8W
	R25	80.5253	2.2KΩ 5%	carbon film	1/8W
	R26	80.5267	33KΩ 5%	carbon film	1/8W
	R27	80.52XX	Adjusted		1/8W
	R28	80.5256	3.9KΩ 5%	carbon film	1/8W
	R29	80.5249	1KΩ 5%	carbon film	1/8W
	R30	80.5249	1KΩ 5%	carbon film	1/8W
	R31	80.5259	6.8KΩ 5%	carbon film	1/8W
	R32	80.5253	2.2KΩ 5%	carbon film	1/8W
	R33	80.5241	220Ω 5%	carbon film	1/8W
	R34	80.5271	68KΩ 5%	carbon film	1/8W
	R35	80.5261	10KΩ 5%	carbon film	1/8W
	R36	80.5261	10KΩ 5%	carbon film	1/8W
	R37	80.5255	3.3KΩ 5%	carbon film	1/8W
	R38	80.5247	680Ω 5%	carbon film	1/8W
	R39	80.5249	1KΩ 5%	carbon film	1/8W
	R40	80.5256	3.9KΩ 5%	carbon film	1/8W
	R41	80.5261	10KΩ 5%	carbon film	1/8W
	R42	80.5249	1KΩ 5%	carbon film	1/8W
	R43	80.5273	0.1MΩ 5%	carbon film	1/8W
	R44	80.5257	4.7KΩ 5%	carbon film	1/8W
	R45	80.5255	3.3KΩ 5%	carbon film	1/8W
	R46	80.5273	0.1MΩ 5%	carbon film	1/8W
	R47	80.5254	2.7KΩ 5%	carbon film	1/8W
	R48				
	R49				
	R50	80.5258	5.6KΩ 5%	carbon film	1/8W
	R51	80.5248	820Ω 5%	carbon film	1/8W
	R52	80.5248	820Ω 5%	carbon film	1/8W
	R53	80.5247	680Ω 5%	carbon film	1/8W
	R54	80.5247	680Ω 5%	carbon film	1/8W
	R55	80.5261	10KΩ 5%	carbon film	1/8W
	R56	80.5261	10KΩ 5%	carbon film	1/8W
	R57	80.5255	3.3KΩ 5%	carbon film	1/8W
	R58	80.5246	560Ω 5%	carbon film	1/8W
	R59	80.5252	1.8KΩ 5%	carbon film	1/8W
	R60	80.5267	33KΩ 5%	carbon film	1/8W
	R61	80.5267	33KΩ 5%	carbon film	1/8W
	R62	80.5252	1.8KΩ 5%	carbon film	1/8W
	R63	80.5249	1KΩ 5%	carbon film	1/8W

TONE RECEIVER TR783
TONEMODTAGER

TYPE	NO.	CODE	DATA	
	R64	80.5249	1KΩ 5% carbon film	1/8W
	R65			
	R66	80.5266	27KΩ 5% carbon film	1/8W
	L1	61.1135	Tone coil	
	E1	99.5211	Stab. diode 0.8V 5%	1/4W
	E2	99.5211	Stab. diode 0.8V 5%	1/4W
	E3	99.5219	AAZ15 Diode	
	E4	99.5219	AAZ15 Diode	
	E5	99.5219	AAZ15 Diode	
	E6	99.5219	AAZ15 Diode	
	E7	99.5020	1N4004 Diode	
	E8	99.5028	1N914 Diode	
	E9	99.5028	1N914 Diode	
	E10			
	E11			
	E12	99.5219	AAZ15 Diode	
	E13	99.5042	Zenerdiode 9.1V 5%	1/4W
	E14	99.5219	AAZ15 Diode	
	Q1	99.5144	BC214L Transistor	
	Q2	99.5143	BC108 Transistor	
	Q3	99.5144	BC214L Transistor	
	Q4	99.5143	BC108 Transistor	
	Q5	99.5143	BC108 Transistor	
	Q6	99.5143	BC108 Transistor	
	Q7	99.5143	BC108 Transistor	
	Q8	99.5143	BC108 Transistor	
	Q9	99.5143	BC108 Transistor	
	Q10	99.5143	BC108 Transistor	
	Q11	99.5144	BC214L Transistor	
	Q12	99.5143	BC108 Transistor	
	Q13	99.5143	BC108 Transistor	
	Q14	99.5143	BC108 Transistor	
	Q15	99.5143	BC108 Transistor	
	Q16	99.5143	BC108 Transistor	
	Q17	99.5143	BC108 Transistor	
	Q18	99.5143	BC108 Transistor	
	Q19	99.5144	BC214L Transistor	
	Q20	99.5144	BC214L Transistor	
	Q21	99.5143	BC108 Transistor	
	Q22	99.5143	BC108 Transistor	
	Q23	99.5235	BD135 Transistor	

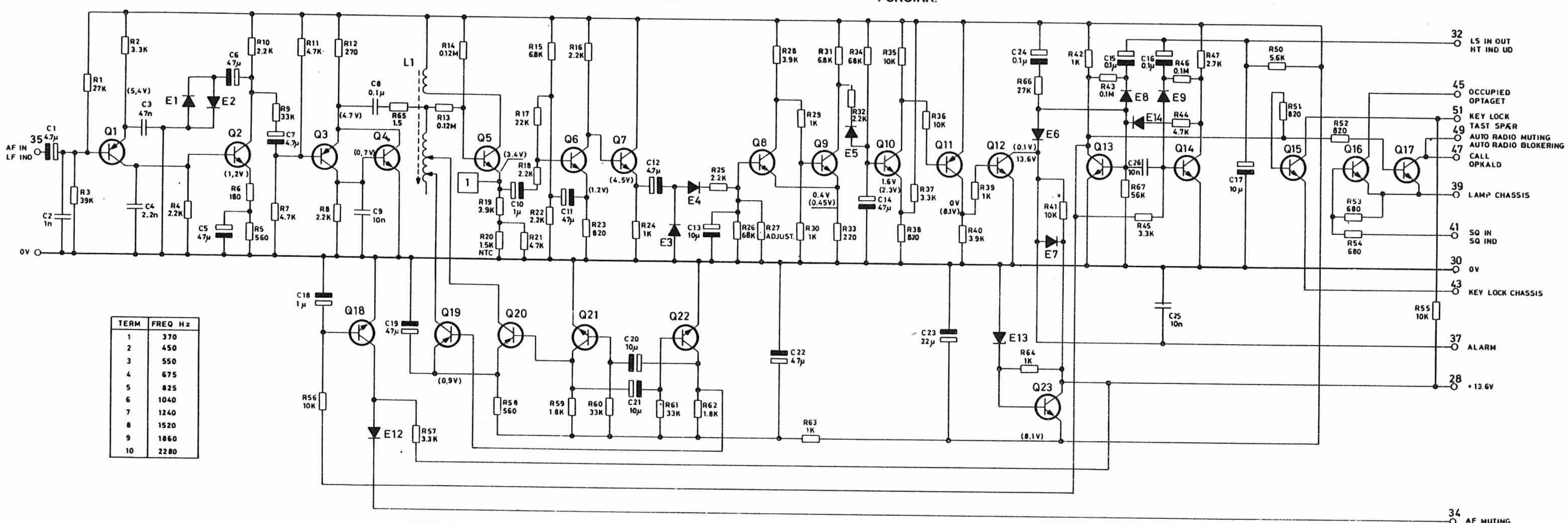
TYPE	NO.	CODE	DATA

TONE RECEIVER
TONEMODTAGER

TR783

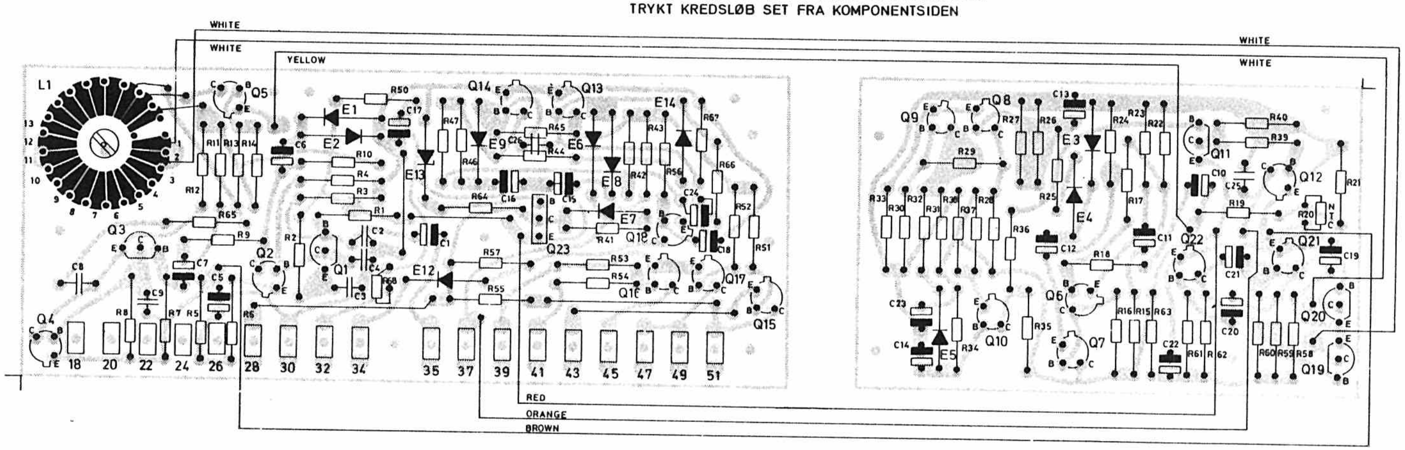
X401.699

Storno



TERM	FREQ Hz
1	370
2	450
3	550
4	675
5	825
6	1040
7	1240
8	1520
9	1860
10	2280

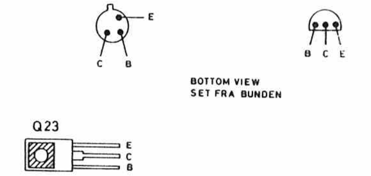
PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



VOLTAGES WITH ( ) V_{in} 1060Hz = 55mV
VOLTAGES WITHOUT ( ) V_{in} 0V

Q2. Q4. Q5. Q6. Q7. Q8. Q9. Q10. Q12. Q13. Q14. Q15. Q16. Q17. Q18. Q21. Q22

Q1. Q3. Q11. Q19. Q20



BOTTOM VIEW
SET FRA BUNDEN

TONE RECEIVER
TONEMODTAGER
TR785

D401.230/3

Storno

Storno

TYPE	NO.	CODE	DATA		
TR785		10.2451	Tone Receiver		
	C1	73.5126	4.7μF 20%	tantal	35V
	C2	76.5069	1nF 10%	polyest. FL	50V
	C3	76.5072	47nF 10%	polyest. FL	50V
	C4	76.5059	2.2nF 10%	polyest. FL	50V
	C5	73.5124	47μF 20%	tantal	6.3V
	C6	73.5124	47μF 20%	tantal	6.3V
	C7	73.5126	4.7μF 20%	tantal	35V
	C8	76.5068	0.1μF 1%	polystyr TB	63V
	C9	76.5070	10nF 10%	polyest. FL	50V
	C10	73.5114	1μF 20%	tantal	35V
	C11	73.5124	47μF 20%	tantal	6.3V
	C12	73.5126	4.7μF 20%	tantal	35V
	C13	73.5109	10μF 20%	tantal	16V
	C14	73.5124	47μF 20%	tantal	6.3V
	C15	73.5089	0.1μF 20%	tantal	35V
	C16	73.5089	0.1μF 20%	tantal	35V
	C17	73.5109	10μF 20%	tantal	16V
	C18	73.5114	1μF 20%	tantal	35V
	C19	73.5124	47μF 20%	tantal	6.3V
	C20	73.5109	10μF 20%	tantal	16V
	C21	73.5109	10μF 20%	tantal	16V
	C22	73.5124	47μF 20%	tantal	6.3V
	C23	73.5127	22μF 20%	tantal	16V
	C24	73.5089	0.1 μF 20%	tantal	35V
	C25	76.5070	10nF 10%	polyest. FL	50V
	C26	76.5070	10nF 10%	polyest. FL	50V
	R1	80.5266	27KΩ 5%	carbon film	1/8W
	R2	80.5255	3.3KΩ 5%	carbon film	1/8W
	R3	80.5268	39KΩ 5%	carbon film	1/8W
	R4	80.5253	2.2KΩ 5%	carbon film	1/8W
	R5	80.5246	560Ω 5%	carbon film	1/8W
	R6	80.5240	180Ω 5%	carbon film	1/8W
	R7	80.5257	4.7KΩ 5%	carbon film	1/8W
	R8	80.5253	2.2KΩ 5%	carbon film	1/8W
	R9	80.5267	33KΩ 5%	carbon film	1/8W
	R10	80.5253	2.2KΩ 5%	carbon film	1/8W
	R11	80.5257	4.7KΩ 5%	carbon film	1/8W
	R12	80.5242	270Ω 5%	carbon film	1/8W
	R13	80.5274	0.12 MΩ 5%	carbon film	1/8W
	R14	80.5274	0.12 MΩ 5%	carbon film	1/8W
	R15	80.5259	6.8KΩ 5%	carbon film	1/8W
	R16	80.5253	2.2KΩ 5%	carbon film	1/8W
	R17	80.5265	22KΩ 5%	carbon film	1/8W
	R18	80.5253	2.2KΩ 5%	carbon film	1/8W
	R19	80.5256	3.9KΩ 5%	carbon film	1/8W
	R20	89.5008	1.5KΩ 20%	NTC	1/2W
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W

Storno

TYPE	NO.	CODE	DATA		
	R22	80.5253	2.2KΩ 5%	carbon film	1/8W
	R23	80.5248	820Ω 5%	carbon film	1/8W
	R24	80.5249	1 KΩ 5%	carbon film	1/8W
	R25	80.5253	2.2KΩ 5%	carbon film	1/8W
	R26	80.5268	39KΩ 5%	carbon film	1/8W
	R27	80.52XX	Adjusted		1/8W
	R28	80.5256	3.9KΩ 5%	carbon film	1/8W
	R29	80.5249	1 KΩ 5%	carbon film	1/8W
	R30	80.5249	1 KΩ 5%	carbon film	1/8W
	R31	80.5259	6.8KΩ 5%	carbon film	1/8W
	R32	80.5253	2.2KΩ 5%	carbon film	1/8W
	R33	80.5241	220Ω 5%	carbon film	1/8W
	R34	80.5271	68KΩ 5%	carbon film	1/8W
	R35	80.5261	10KΩ 5%	carbon film	1/8W
	R36	80.5261	10KΩ 5%	carbon film	1/8W
	R37	80.5255	3.3KΩ 5%	carbon film	1/8W
	R38	80.5247	680Ω 5%	carbon film	1/8W
	R39	80.5249	1 KΩ 5%	carbon film	1/8W
	R40	80.5256	3.9KΩ 5%	carbon film	1/8W
	R41	80.5261	10KΩ 5%	carbon film	1/8W
	R42	80.5249	1 KΩ 5%	carbon film	1/8W
	R43	80.5273	0.1 MΩ 5%	carbon film	1/8W
	R44	80.5257	4.7KΩ 5%	carbon film	1/8W
	R45	80.5255	3.3KΩ 5%	carbon film	1/8W
	R46	80.5273	0.1 MΩ 5%	carbon film	1/8W
	R47	80.5254	2.7KΩ 5%	carbon film	1/8W
	R48				
	R49				
	R50	80.5258	5.6KΩ 5%	carbon film	1/8W
	R51	80.5248	820Ω 5%	carbon film	1/8W
	R52	80.5248	820Ω 5%	carbon film	1/8W
	R53	80.5247	680Ω 5%	carbon film	1/8W
	R54	80.5247	680Ω 5%	carbon film	1/8W
	R55	80.5261	10KΩ 5%	carbon film	1/8W
	R56	80.5261	10KΩ 5%	carbon film	1/8W
	R57	80.5255	3.3KΩ 5%	carbon film	1/8W
	R58	80.5246	560Ω 5%	carbon film	1/8W
	R59	80.5252	1.8KΩ 5%	carbon film	1/8W
	R60	80.5267	33KΩ 5%	carbon film	1/8W
	R61	80.5267	33KΩ 5%	carbon film	1/8W
	R62	80.5252	1.8KΩ 5%	carbon film	1/8W
	R63	80.5249	1 KΩ 5%	carbon film	1/8W

TONE RECEIVER
TONEMODTAGER TR785

X401.700/2

Storno

TYPE	NO.	CODE	DATA
	R64	80.5249	1 KΩ 5% carbon film 1/8W
	R65	80.5215	1.5Ω 5% carbon film 1/8W
	R66	80.5266	27KΩ 5% carbon film 1/8W
	R67	80.5270	56KΩ 5% carbon film 1/8W
	R68	80.5229	22Ω 5% carbon film 1/8W
	L1	61.1134	Tone coil
	E1	99.5211	Stab. diode 0.8 V 5% 1/4W
	E2	99.5211	Stab. diode 0.8 V 5% 1/4W
	E3	99.5219	AAZ15 Diode
	E4	99.5219	AAZ15 Diode
	E5	99.5219	AAZ15 Diode
	E6	99.5219	AAZ15 Diode
	E7	99.5020	1N4004 Diode
	E8	99.5028	1N914 Diode
	E9	99.5028	1N914 Diode
	E10		
	E11		
	E12	99.5219	AAZ15 Diode
	E13	99.5042	Zenerdiode 9.1 V 5% 1/4W
	E14	99.5219	AAZ15 Diode
	Q1	99.5144	BC214L Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5144	BC214L Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5143	BC108 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor
	Q11	99.5144	BC214L Transistor
	Q12	99.5143	BC108 Transistor
	Q13	99.5143	BC108 Transistor
	Q14	99.5143	BC108 Transistor
	Q15	99.5143	BC108 Transistor
	Q16	99.5143	BC108 Transistor
	Q17	99.5143	BC108 Transistor
	Q18	99.5143	BC108 Transistor
	Q19	99.5144	BC214L Transistor
	Q20	99.5144	BC214L Transistor
	Q21	99.5143	BC108 Transistor
	Q22	99.5143	BC108 Transistor
	Q23	99.5235	BD135 Transistor

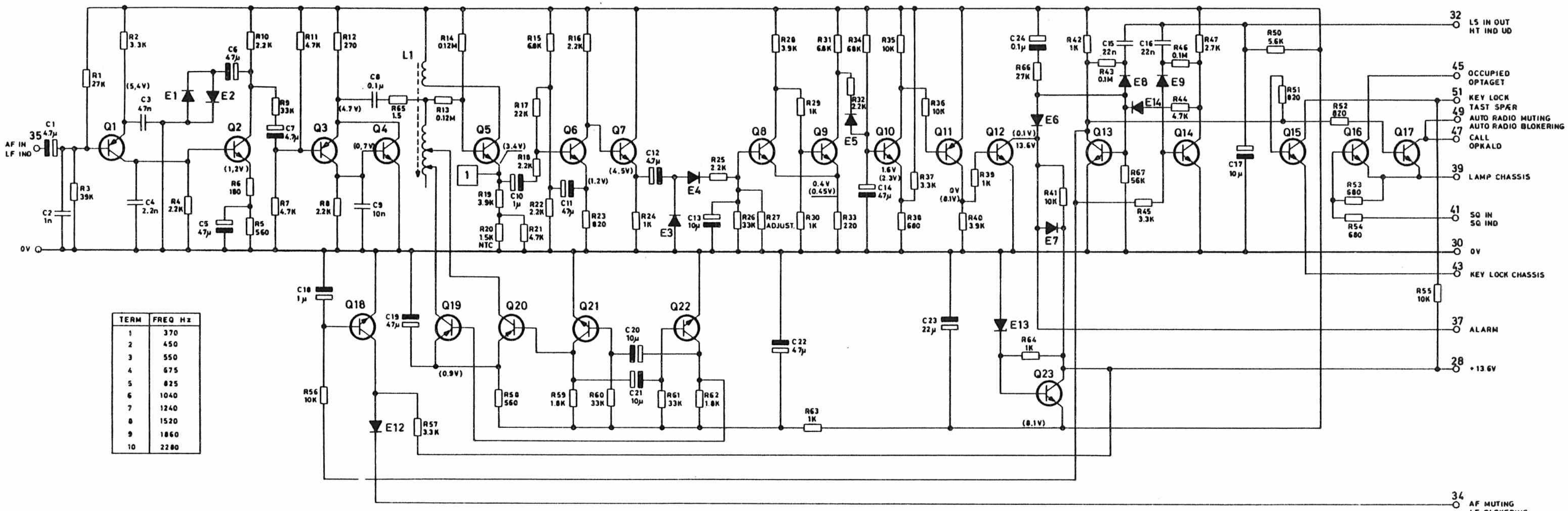
Storno

TYPE	NO.	CODE	DATA

TONE RECEIVER TR785
TONEMODTAGER

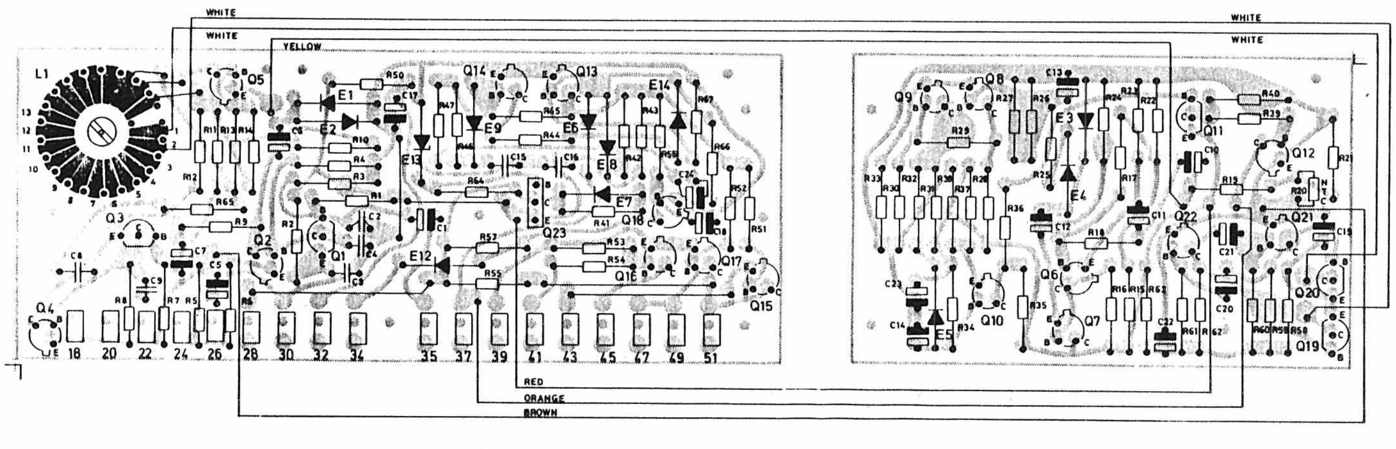
X401.700/2

Storno

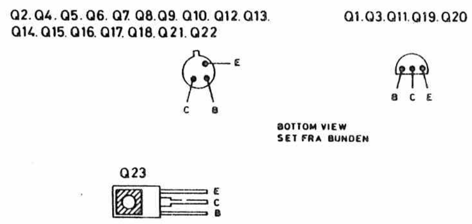


TERM	FREQ Hz
1	370
2	450
3	550
4	675
5	825
6	1040
7	1240
8	1520
9	1860
10	2280

PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



VOLTAGES WITH ( ) V_{in} 1060Hz = 55mV
VOLTAGES WITHOUT ( ) V_{in} 0V



TONE RECEIVER TR785
TONEMODTAGER

D401.230/2

Storno

TYPE	NO.	CODE	DATA		
TR785		10.2451	Tone Receiver		
	C1	73.5126	4.7µF 20%	tantal	35V
	C2	76.5069	1nF 10%	polyest. FL	50V
	C3	76.5072	47nF 10%	polyest. FL	50V
	C4	76.5059	2.2nF 10%	polyest. FL	50V
	C5	73.5124	47µF 20%	tantal	6.3V
	C6	73.5124	47µF 20%	tantal	6.3V
	C7	73.5126	4.7µF 20%	tantal	35V
	C8	76.5068	0.1µF 1%	polystyr TB	63V
	C9	76.5070	10nF 10%	polyest. FL	50V
	C10	73.5114	1µF 20%	tantal	35V
	C11	73.5124	47µF 20%	tantal	6.3V
	C12	73.5126	4.7µF 20%	tantal	35V
	C13	73.5109	10µF 20%	tantal	16V
	C14	73.5124	47µF 20%	tantal	6.3V
	C15	76.5071	22nF 10%	polyest. FL	50V
	C16	76.5071	22nF 10%	polyest. FL	50V
	C17	73.5109	10µF 20%	tantal	16V
	C18	73.5114	1µF 20%	tantal	35V
	C19	73.5124	47µF 20%	tantal	6.3V
	C20	73.5109	10µF 20%	tantal	16V
	C21	73.5109	10µF 20%	tantal	16V
	C22	73.5124	47µF 20%	tantal	6.3V
	C23	73.5127	22µF 20%	tantal	16V
	C24	73.5089	0.1µF 20%	tantal	35V
	R1	80.5266	27KΩ 5%	carbon film	1/8W
	R2	80.5255	3.3KΩ 5%	carbon film	1/8W
	R3	80.5268	39KΩ 5%	carbon film	1/8W
	R4	80.5253	2.2KΩ 5%	carbon film	1/8W
	R5	80.5246	560Ω 5%	carbon film	1/8W
	R6	80.5240	180Ω 5%	carbon film	1/8W
	R7	80.5257	4.7KΩ 5%	carbon film	1/8W
	R8	80.5253	2.2KΩ 5%	carbon film	1/8W
	R9	80.5267	33KΩ 5%	carbon film	1/8W
	R10	80.5253	2.2KΩ 5%	carbon film	1/8W
	R11	80.5257	4.7KΩ 5%	carbon film	1/8W
	R12	80.5242	270Ω 5%	carbon film	1/8W
	R13	80.5274	0.12MΩ 5%	carbon film	1/8W
	R14	80.5274	0.12MΩ 5%	carbon film	1/8W
	R15	80.5259	6.8KΩ 5%	carbon film	1/8W
	R16	80.5253	2.2KΩ 5%	carbon film	1/8W
	R17	80.5265	22KΩ 5%	carbon film	1/8W
	R18	80.5253	2.2KΩ 5%	carbon film	1/8W
	R19	80.5256	3.9KΩ 5%	carbon film	1/8W
	R20	89.5008	1.5KΩ 20%	NTC	1/2W
	R21	80.5257	4.7KΩ 5%	carbon film	1/8W

Storno

TYPE	NO.	CODE	DATA		
	R22	80.5253	2.2KΩ 5%	carbon film	1/8W
	R23	80.5248	820Ω 5%	carbon film	1/8W
	R24	80.5249	1KΩ 5%	carbon film	1/8W
	R25	80.5253	2.2KΩ 5%	carbon film	1/8W
	R26	80.5267	33KΩ 5%	carbon film	1/8W
	R27	80.52XX	Adjusted		1/8W
	R28	80.5256	3.9KΩ 5%	carbon film	1/8W
	R29	80.5249	1KΩ 5%	carbon film	1/8W
	R30	80.5249	1KΩ 5%	carbon film	1/8W
	R31	80.5259	6.8KΩ 5%	carbon film	1/8W
	R32	80.5253	2.2KΩ 5%	carbon film	1/8W
	R33	80.5241	220Ω 5%	carbon film	1/8W
	R34	80.5271	68KΩ 5%	carbon film	1/8W
	R35	80.5261	10KΩ 5%	carbon film	1/8W
	R36	80.5261	10KΩ 5%	carbon film	1/8W
	R37	80.5255	3.3KΩ 5%	carbon film	1/8W
	R38	80.5247	680Ω 5%	carbon film	1/8W
	R39	80.5249	1KΩ 5%	carbon film	1/8W
	R40	80.5256	3.9KΩ 5%	carbon film	1/8W
	R41	80.5261	10KΩ 5%	carbon film	1/8W
	R42	80.5249	1KΩ 5%	carbon film	1/8W
	R43	80.5273	0.1MΩ 5%	carbon film	1/8W
	R44	80.5257	4.7KΩ 5%	carbon film	1/8W
	R45	80.5255	3.3KΩ 5%	carbon film	1/8W
	R46	80.5273	0.1MΩ 5%	carbon film	1/8W
	R47	80.5254	2.7KΩ 5%	carbon film	1/8W
	R48				
	R49				
	R50	80.5258	5.6KΩ 5%	carbon film	1/8W
	R51	80.5248	820Ω 5%	carbon film	1/8W
	R52	80.5248	820Ω 5%	carbon film	1/8W
	R53	80.5247	680Ω 5%	carbon film	1/8W
	R54	80.5247	680Ω 5%	carbon film	1/8W
	R55	80.5261	10KΩ 5%	carbon film	1/8W
	R56	80.5261	10KΩ 5%	carbon film	1/8W
	R57	80.5255	3.3KΩ 5%	carbon film	1/8W
	R58	80.5246	560Ω 5%	carbon film	1/8W
	R59	80.5252	1.8KΩ 5%	carbon film	1/8W
	R60	80.5267	33KΩ 5%	carbon film	1/8W
	R61	80.5267	33KΩ 5%	carbon film	1/8W
	R62	80.5252	1.8KΩ 5%	carbon film	1/8W
	R63	80.5249	1KΩ 5%	carbon film	1/8W

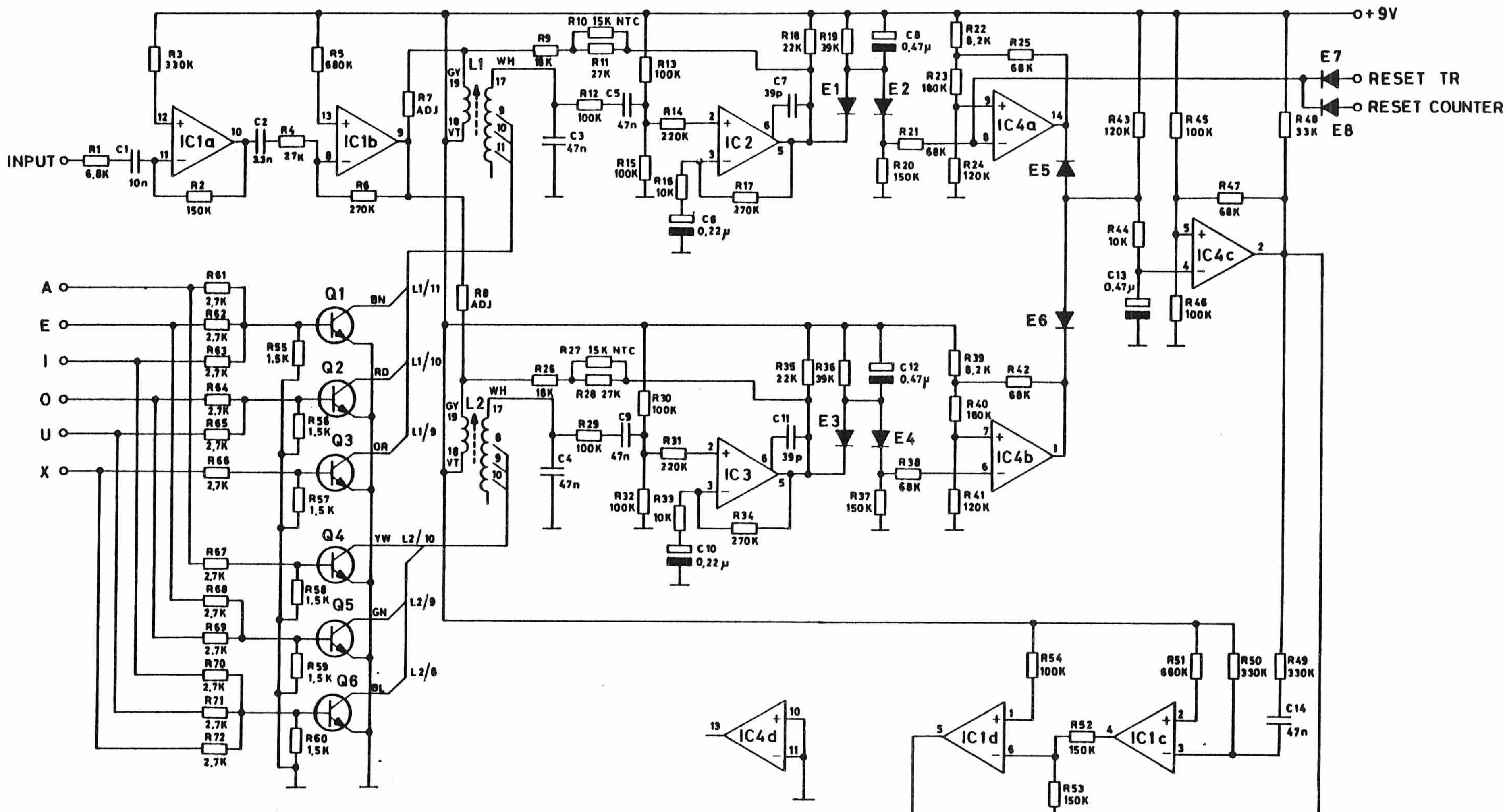
TYPE	NO.	CODE	DATA	
	R64	80.5249	1KΩ 5% carbon film	1/8W
	R65	80.5215	1.5Ω 5% carbon film	1/8W
	R66	80.5266	27KΩ 5% carbon film	1/8W
	L1	61.1134	Tone coil	
	E1	99.5211	Stab. diode 0.8V 5%	1/4W
	E2	99.5211	Stab. diode 0.8V 5%	1/4W
	E3	99.5219	AAZ15 Diode	
	E4	99.5219	AAZ15 Diode	
	E5	99.5219	AAZ15 Diode	
	E6	99.5219	AAZ15 Diode	
	E7	99.5020	1N4004 Diode	
	E8	99.5028	1N914 Diode	
	E9	99.5028	1N914 Diode	
	E10			
	E11			
	E12	99.5219	AAZ15 Diode	
	E13	99.5042	Zenerdiode 9.1V 5%	1/4W
	E14	99.5219	AAZ15 Diode	
	Q1	99.5144	BC214L Transistor	
	Q2	99.5143	BC108 Transistor	
	Q3	99.5144	BC214L Transistor	
	Q4	99.5143	BC108 Transistor	
	Q5	99.5143	BC108 Transistor	
	Q6	99.5143	BC108 Transistor	
	Q7	99.5143	BC108 Transistor	
	Q8	99.5143	BC108 Transistor	
	Q9	99.5143	BC108 Transistor	
	Q10	99.5143	BC108 Transistor	
	Q11	99.5144	BC214L Transistor	
	Q12	99.5143	BC108 Transistor	
	Q13	99.5143	BC108 Transistor	
	Q14	99.5143	BC108 Transistor	
	Q15	99.5143	BC108 Transistor	
	Q16	99.5143	BC108 Transistor	
	Q17	99.5143	BC108 Transistor	
	Q18	99.5143	BC108 Transistor	
	Q19	99.5144	BC214L Transistor	
	Q20	99.5144	BC214L Transistor	
	Q21	99.5143	BC108 Transistor	
	Q22	99.5143	BC108 Transistor	
	Q23	99.5235	BD135 Transistor	

Storno

TYPE	NO.	CODE	DATA

TONE RECEIVER
TONEMODTAGER TR785

Storno



	0V	+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

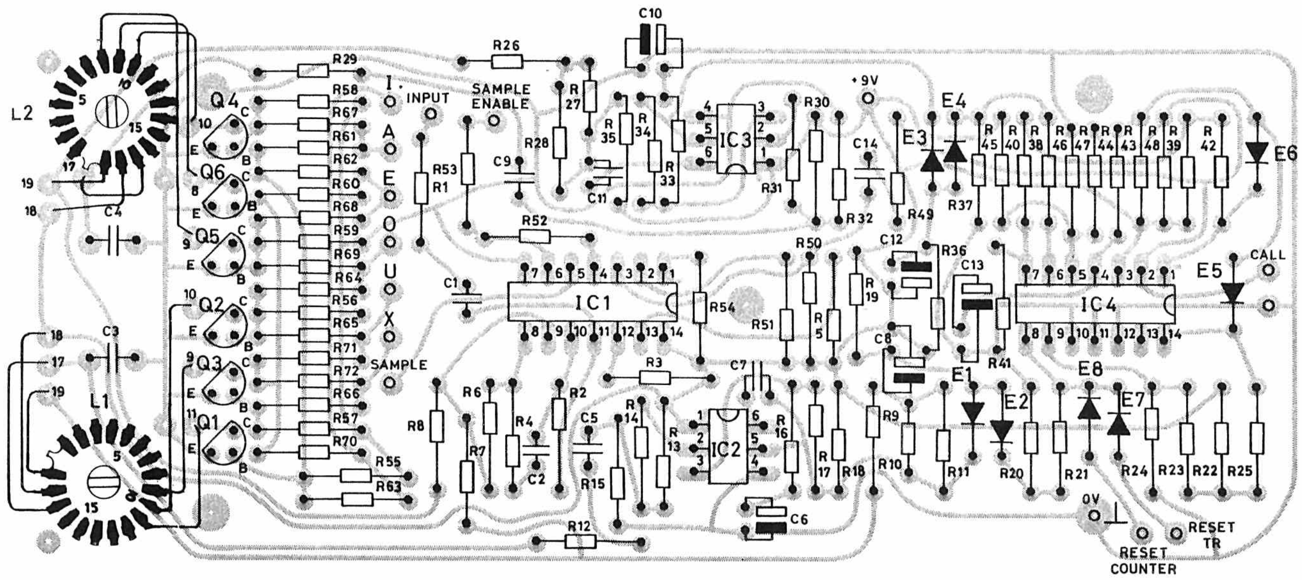
TYPE	Nº	CODE	DATA			
	R32	80. 5273	100 kΩ	5%	carbon film	1/8 W
	R33	80. 5261	10 kΩ	5%	" "	1/8 W
	R34	80. 5278	270 kΩ	5%	" "	1/8 W
	R35	80. 5265	22 kΩ	5%	" "	1/8 W
	R36	80. 5268	39 kΩ	5%	" "	1/8 W
	R37	80. 5275	150 kΩ	5%	" "	1/8 W
	R38	80. 5271	68 kΩ	5%	" "	1/8 W
	R39	80. 5260	8. 2 kΩ	5%	" "	1/8 W
	R40	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			

X402. 466

TONE RECEIVER TR786

Storno

Storno



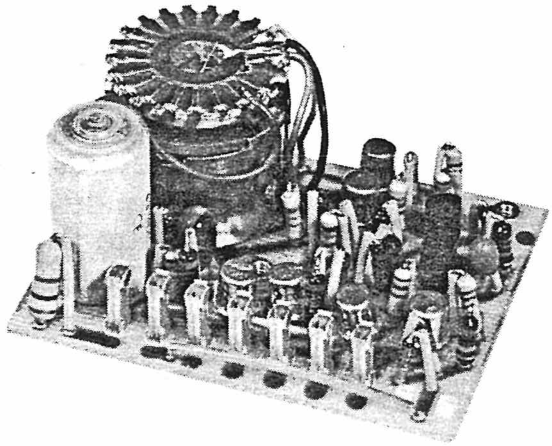
PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE.

TONE RECEIVER TR786

D402.510

Storno

TONE TRANSMITTER
TT781 TT783



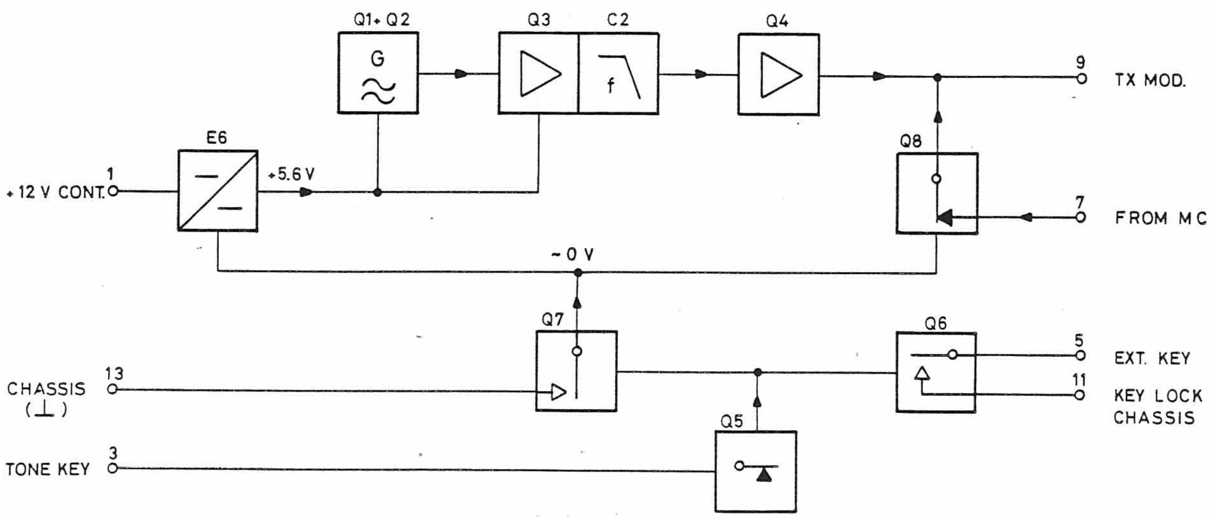
Description

TT781 and TT783 are single tone transmitters for CQM700 series radiotelephones. They are identical except for their tone coils.

The TT781 is for use in CQM700 equipment operating on the public telephone service. It generates a tone to seize, and upon termination of the call, to release the telephone circuit. Only the 2400 Hz and the 2900 Hz tones are used.

The TT783 can generate any of the 12 tones in the 825 to 2450 Hz series.

BLACK DIAGRAM of TT781 / TT783 :
(refer to the schematic diagram,
D401.577, for TT783)



TT783 (SHOWN IN STAND BY)

60.228-E1

Storno

In principle, Q1 and Q2 operate as a differential amplifier in a Hartley type oscillator configuration.
The supply voltage is stabilized with zener diode E6 to keep the oscillator output level constant.

Q3 serves to adjust (attenuate) the signal level and, with C2, to introduce de-emphasis before applying the signal to the output stage, Q4.

Emitter follower Q4 provides a low output impedance to match the input impedance of the modulator.

In stand by, R14 and E2 hold Q5 ON. Q5 holds Q6 and Q7 OFF. With Q7 OFF, there is no ground connection to Q1, Q2, Q3, and Q4.
Q8 is forward biased by the high positive potential through R17, thus allowing the microphone signal to pass between terminals 7 and 9.

Depressing the tone key grounds terminal 3 and the positive potential through R14 disappears through E1. Without forward bias, Q5 cuts off and the collector voltage rises, driving Q6 and Q7 ON.

When Q6 goes ON, it establishes a ground path from terminal 11 to terminal 5. This switches the regulator voltage from RX to TX, keying the transmitter.

When Q7 conducts, it completes the ground connection to the tone generator circuits, and the tone signal is applied to the modulator via terminal 9. Q7 also cuts off Q8, preventing any microphone signal from interfering with the tone signal.

When the tone key is released the circuit returns to stand by.

Technical Specification

Power Supply
10.5 V - 16 V

Current Consumption
Stand by: 6 - 10 mA
Activated: 16 - 33 mA

Temperature Range
Operating range: -25°C - +60°C
Functioning range: -30°C - +80°C

Output Impedance
600 Ω ± 20%

Frequency Response
6 dB pr. octave de-emphasis
f_c = 1000 Hz

Distortion (voice modulation)
$\leq$ 5%

AF Gate Attenuation
$\geq$ 50 dB

Distortion (tone modulation)
$\leq$ 3%

TONE TRANSMITTER TT781

Tone Frequencies
2400, 2900 Hz

Frequency Accuracy
$\leq$ 0.3%

Frequency Stability
$\leq$ 0.6%

Output Level
- 21 dBm +1/-0dB (69 mV) at 2400 Hz

TONE TRANSMITTER TT783

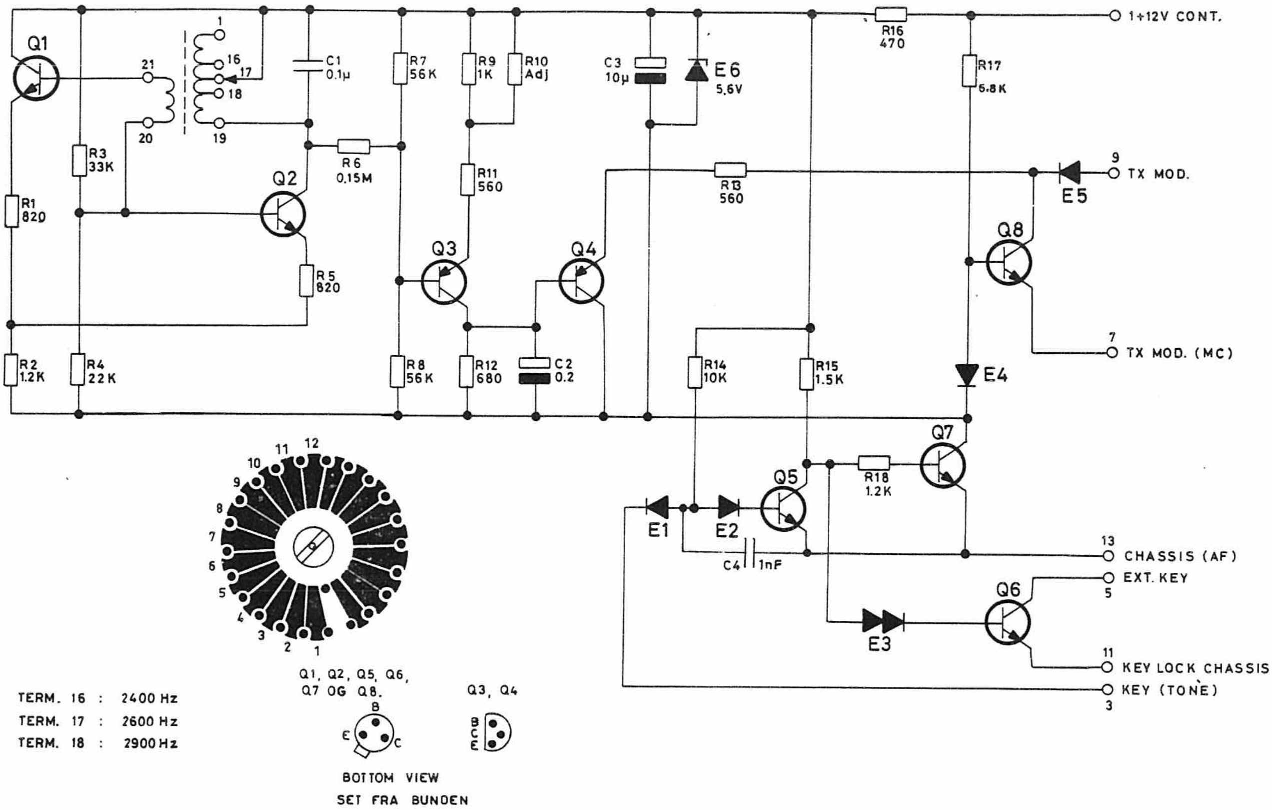
Tone Frequencies
825, 1010, 1240, 1435, 1520, 1750, 1860, 1980, 2000, 2135, 2280, 2450 Hz.

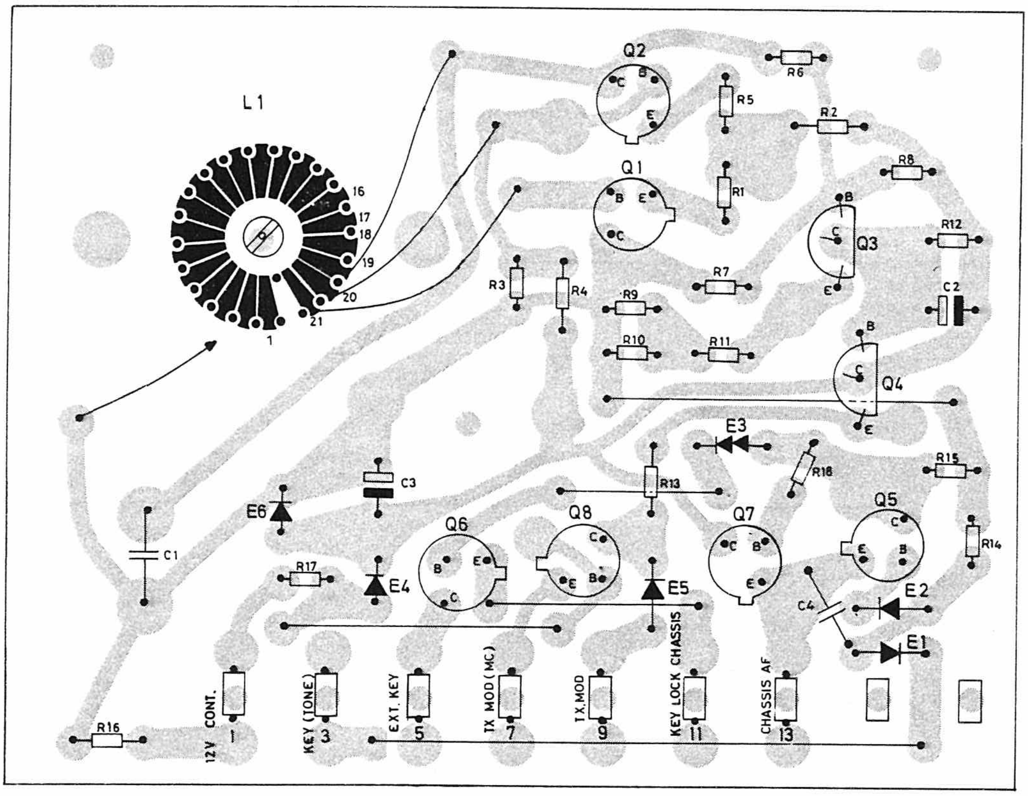
Frequency Accuracy
$\leq$ 0.5%

Frequency Stability
$\leq$ 1%

Output Level
-17 dBm +1/0dB (110mV) at 1000 Hz

Storno





TONE TRANSMITTER
TONESENDER

TT781

D 402.161

Storno

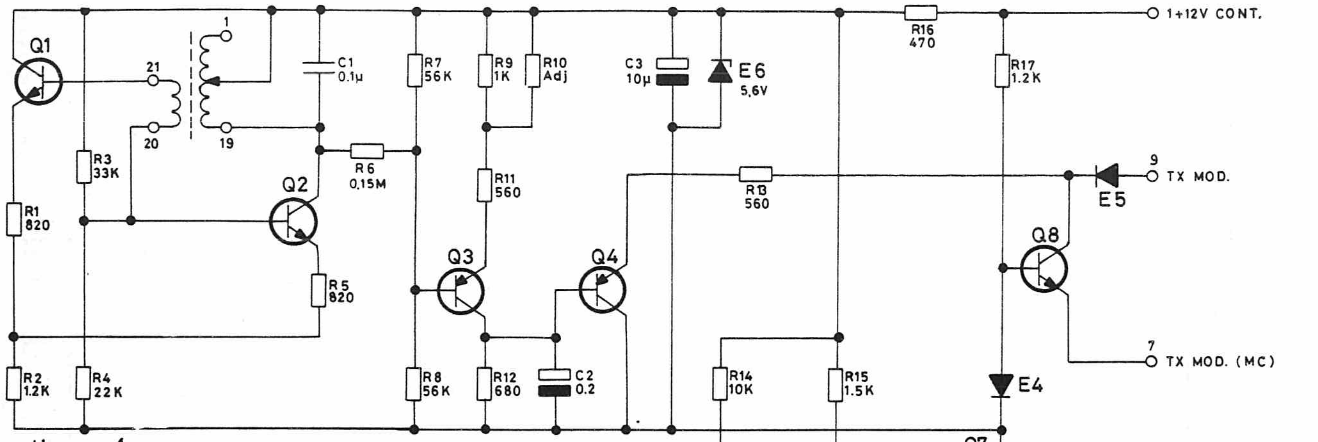
TYPE	NO.	CODE	DATA
TT781		10.3042-00	Tone Transmitter
	C1	76.5068	0.1 µF 1% polystyr TB 63V
	C2	73.5118	0.22µF 20% tantal 35V
	C3	73.5109	10 µF 20% tantal 16V
	C4	74.5155	1 nF -20% +80% ceram PL 63V
	R1	80.5248	820 Ω 5% carbon film 1/8W
	R2	80.5250	1.2KΩ 5% " " 1/8W
	R3	80.5267	33KΩ 5% " " 1/8W
	R4	80.5265	22KΩ 5% " " 1/8W
	R5	80.5248	820 Ω 5% " " 1/8W
	R6	80.5275	0.15MΩ 5% " " 1/8W
	R7	80.5270	56KΩ 5% " " 1/8W
	R8	80.5270	56KΩ 5% " " 1/8W
	R9	80.5249	1KΩ 5% " " 1/8W
	R10	80.52xx	Adjusted 5% " " 1/8W
	R11	80.5246	560 Ω 5% " " 1/8W
	R12	80.5247	680 Ω 5% " " 1/8W
	R13	80.5246	560 Ω 5% " " 1/8W
	R14	80.5261	10KΩ 5% " " 1/8W
	R15	80.5251	1.5KΩ 5% " " 1/8W
	R16	80.5445	470 Ω 5% " " 1/8W
	R17	80.5250	1.2KΩ 5% " " 1/8W
	R18	80.5250	1.2KΩ 5% " " 1/8W
	L1	61.1133	Tone coil
	E1	99.5028	1N914 Diode
	E2	99.5028	1N914 Diode
	E3	99.5209	1.5V Stab. Diode
	E4	99.5219	AAZ15 Diode
	E5	99.5219	AAZ15 Diode
	E6	99.5114	5.6V Zenerdiode 5% 1/4W
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5144	BC214L Transistor
	Q4	99.5144	BC214L Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5143	BC108 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor

Storno

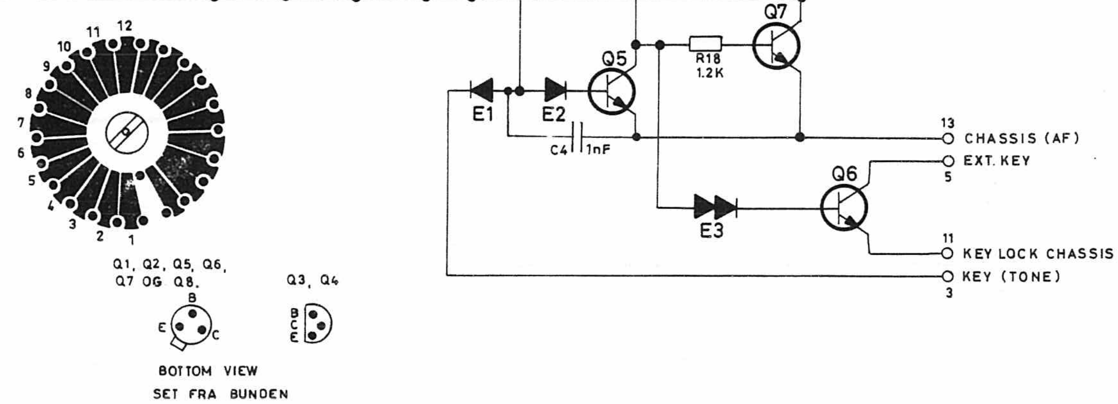
TYPE	NO.	CODE	DATA

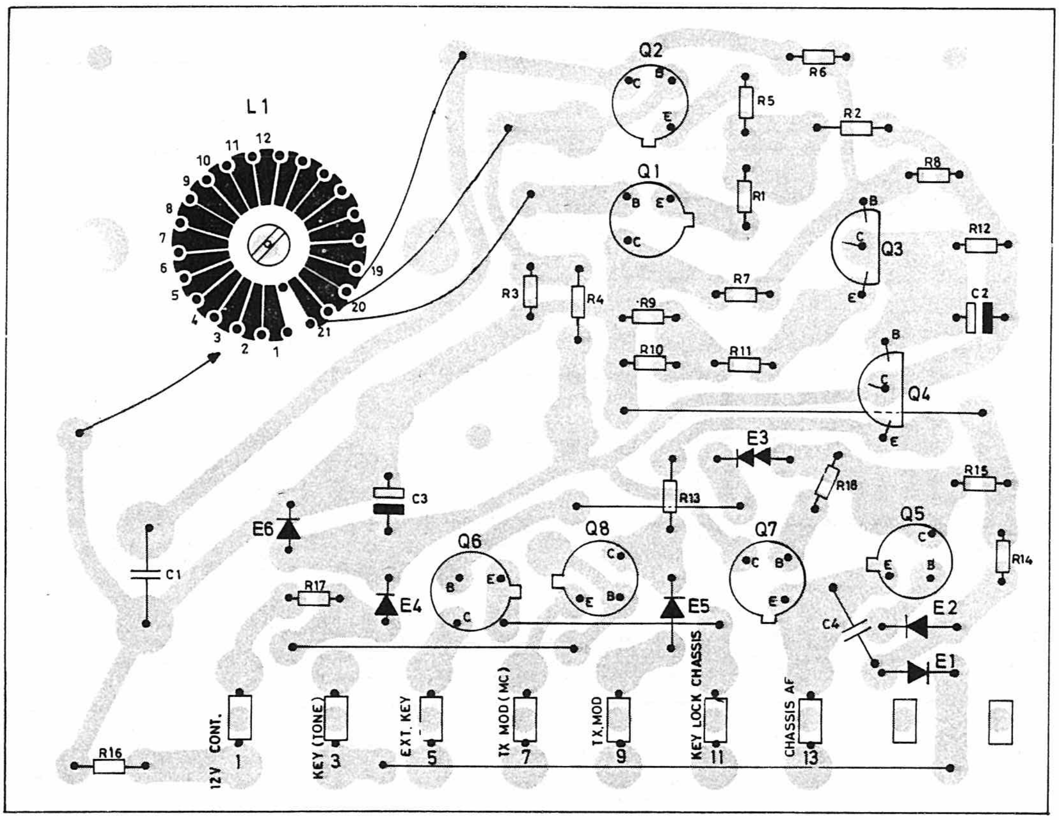
TONE TRANSMITTER TT781

Storno



L1	f
TERM. 1	825 Hz
TERM. 2	1010 Hz
TERM. 3	1240 Hz
TERM. 4	1435 Hz
TERM. 5	1520 Hz
TERM. 6	1750 Hz
TERM. 7	1860 Hz
TERM. 8	1980 Hz
TERM. 9	2000 Hz
TERM. 10	2135 Hz
TERM. 11	2280 Hz
TERM 12	2450 Hz





TONE TRANSMITTER
TONESENDER

TT783

D401.557/3

Storno

TYPE	NO.	CODE	DATA
TT783		10.2454	Tone Transmitter
	C1	76.5068	0,1μF 1% polystyr. TB 63V
	C2	73.5118	0,22μF 20% tantal 35V
	C3	73.5109	10μF 20% tantal 16V
	C4	74.5155	1 nF -20 +80% ceram PL 63V
	R1	80.5248	820Ω 5% carbonfilm 1/8W
	R2	80.5250	1,2KΩ 5% carbonfilm 1/8W
	R3	80.5267	33KΩ 5% carbonfilm 1/8W
	R4	80.5265	22KΩ 5% carbonfilm 1/8W
	R5	80.5248	820Ω 5% carbonfilm 1/8W
	R6	80.5275	0,15MΩ 5% carbonfilm 1/8W
	R7	80.5270	56KΩ 5% carbonfilm 1/8W
	R8	80.5270	56KΩ 5% carbonfilm 1/8W
	R9	80.5249	1KΩ 5% carbonfilm 1/8W
	R10	80.52XX	Adj. 5% carbonfilm 1/8W
	R11	80.5246	560Ω 5% carbonfilm 1/8W
	R12	80.5247	680Ω 5% carbonfilm 1/8W
	R13	80.5246	560Ω 5% carbonfilm 1/8W
	R14	80.5261	10KΩ 5% carbonfilm 1/8W
	R15	80.5251	1,5KΩ 5% carbonfilm 1/8W
	R16	80.5445	470Ω 5% carbonfilm 1/4W
	R17	80.5259	6.8KΩ 5% carbonfilm 1/8W
	R18	80.5250	1,2KΩ 5% carbonfilm 1/8W
	L1	61.1158	Tone coil
	E1	99.5028	1N914 Diode
	E2	99.5028	1N914 Diode
	E3	99.5209	1,5V Stab. Diode
	E4	99.5219	AAZ15 Diode
	E5	99.5219	AAZ15 Diode
	E6	99.5114	5,6V Zenerdiode 5% 1/4W
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5144	BC214L Transistor
	Q4	99.5144	BC214L Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5143	BC108 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor

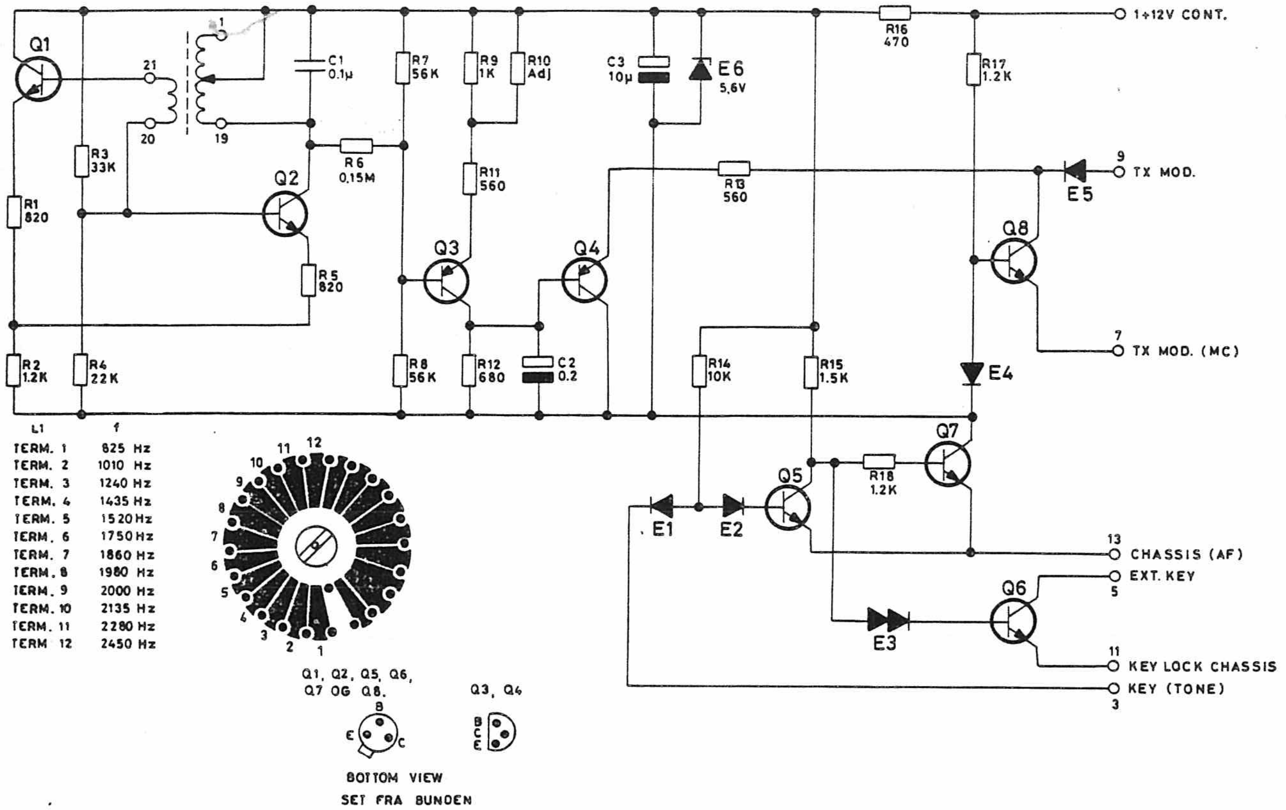
Storno

TYPE	NO.	CODE	DATA

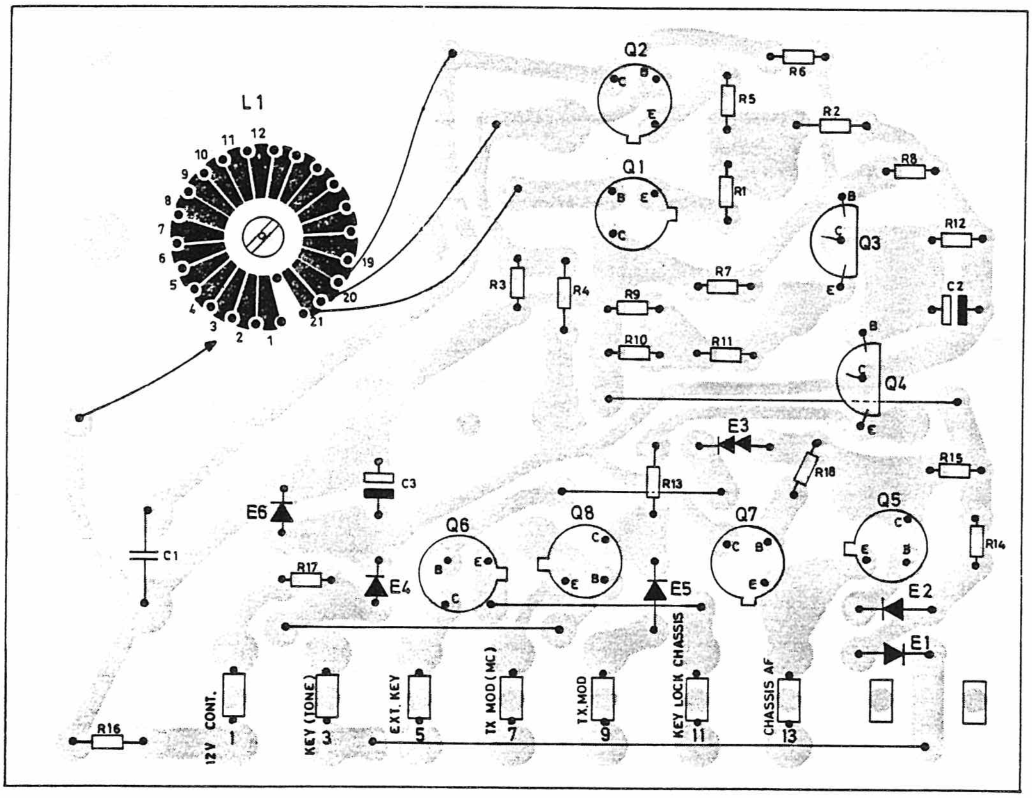
TONE TRANSMITTER TT783
TONESENDER

X401.687/2

Storno



L1	f
TERM. 1	825 Hz
TERM. 2	1010 Hz
TERM. 3	1240 Hz
TERM. 4	1435 Hz
TERM. 5	1520 Hz
TERM. 6	1750 Hz
TERM. 7	1860 Hz
TERM. 8	1980 Hz
TERM. 9	2000 Hz
TERM. 10	2135 Hz
TERM. 11	2280 Hz
TERM. 12	2450 Hz



TONE TRANSMITTER
TONESENDER

TT783

D401.557/2

Storno

TYPE	NO.	CODE	DATA
TT783		10.2454	Tone Transmitter
	C1	76.5068	0,1μF 1% polystyr. TB 63V
	C2	73.5118	0,22μF 20% tantal 35V
	C3	73.5109	10μF 20% tantal 16V
	R1	80.5248	820Ω 5% carbonfilm 1/8W
	R2	80.5250	1,2KΩ 5% carbonfilm 1/8W
	R3	80.5267	33KΩ 5% carbonfilm 1/8W
	R4	80.5265	22KΩ 5% carbonfilm 1/8W
	R5	80.5248	820Ω 5% carbonfilm 1/8W
	R6	80.5275	0,15MΩ 5% carbonfilm 1/8W
	R7	80.5270	56KΩ 5% carbonfilm 1/8W
	R8	80.5270	56KΩ 5% carbonfilm 1/8W
	R9	80.5249	1KΩ 5% carbonfilm 1/8W
	R10	80.52XX	Adj. 5% carbonfilm 1/8W
	R11	80.5246	560Ω 5% carbonfilm 1/8W
	R12	80.5247	680Ω 5% carbonfilm 1/8W
	R13	80.5246	560Ω 5% carbonfilm 1/8W
	R14	80.5261	10KΩ 5% carbonfilm 1/8W
	R15	80.5251	1,5KΩ 5% carbonfilm 1/8W
	R16	80.5445	470Ω 5% carbonfilm 1/4W
	R17	80.5250	1,2KΩ 5% carbonfilm 1/8W
	R18	80.5250	1,2KΩ 5% carbonfilm 1/8W
	L1	61.1158	Tone coil
	E1	99.5028	1N914 Diode
	E2	99.5028	1N914 Diode
	E3	99.5209	1,5V Stab. Diode
	E4	99.5219	AAZ15 Diode
	E5	99.5219	AAZ15 Diode
	E6	99.5114	5,6V Zenerdiode 5% 1/4W
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5144	BC214L Transistor
	Q4	99.5144	BC214L Transistor
	Q5	99.5143	BC108 Transistor
	Q6	99.5143	BC108 Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor

Storno

TYPE	NO.	CODE	DATA

TONE TRANSMITTER TONESENDER

TT783

X401.687

Storno

TONE TRANSMITTER
TT784

TT784 is a tone transmitter for the CQM713 P3 radiotelephone.

It can be used for single and double tone operation.

In principle, Q1 and Q2 operate as a differential amplifier in a Hartley type oscillator configuration.

Q3 and Q4 make up an identical oscillator.

The supply voltage is stabilized with zener diode E1 to keep the oscillator output constant.

The oscillators can be set to generate one of the following signals:

a: 2400 Hz single tone
b: 2600 Hz single tone
c: 2400 Hz and 2600 Hz double tone

When one of the oscillators is not to be energised it is inhibited by applying +7.5 V to its inhibit terminal.

Q5 serves to adjust (attenuate) the signal level and, with C3, to introduce de-emphasis before applying the signal to the output stage, Q6.

Emitter follower Q6 provides low impedance to match the input impedance of the modulator.

In stand by, R21 and E5 hold Q7 ON. Q7 holds Q8 and Q9 OFF. With Q8 OFF, there is no ground connection to Q1, Q2, Q3, Q4, Q5, and Q6. Q10 is forward biased by the high positive potential through R23, thus allowing the microphone signal to pass between terminals 7 and 9.

Depressing the tone key grounds terminal 3 and the positive potential through R21 disappears through E6. Without forward bias, Q7 cuts off and the collector voltage rises, driving Q8 and Q9 ON.

When Q9 goes ON, it establishes a ground path from terminal 11 to terminal 5. This switches the regulator voltage from RX to TX, keying the transmitter.

When Q8 conducts, it completes the ground connection to the tone generator circuits, and the tone signal is applied to the modulator via terminal 9. Q8 also cuts off Q10; preventing any microphone signal from interfering with the tone signal.

When the tone key is released the circuit returns to stand by.

Technical Specifications

Power Supply

10.5 - 16 V

Current Consumption

Stand by: 5 - 10 mA
Activated: 10 - 25 mA

Temperature Range

-10°C - +50°C

Tone Combinations

a: 2400 Hz
b: 2600 Hz
c: 2400 Hz + 2600 Hz

Frequency Accuracy

$\leq \pm 0.1\%$

Frequency Stability

$\leq \pm 0.5\%$

Frequency Response

6 dB/octave de-emphasis
f_c = 1000 Hz

Output Impedance

600 Ω ± 20%

60.349-E1

Storno

Output Level

Adjustable

Nominal: 2400 Hz - 39.5 mV

2600 Hz - 36.5 mV

Distortion (tone modulation)

$\leq$ 3%

Distortion (voice modulation)

$\leq$ 5%

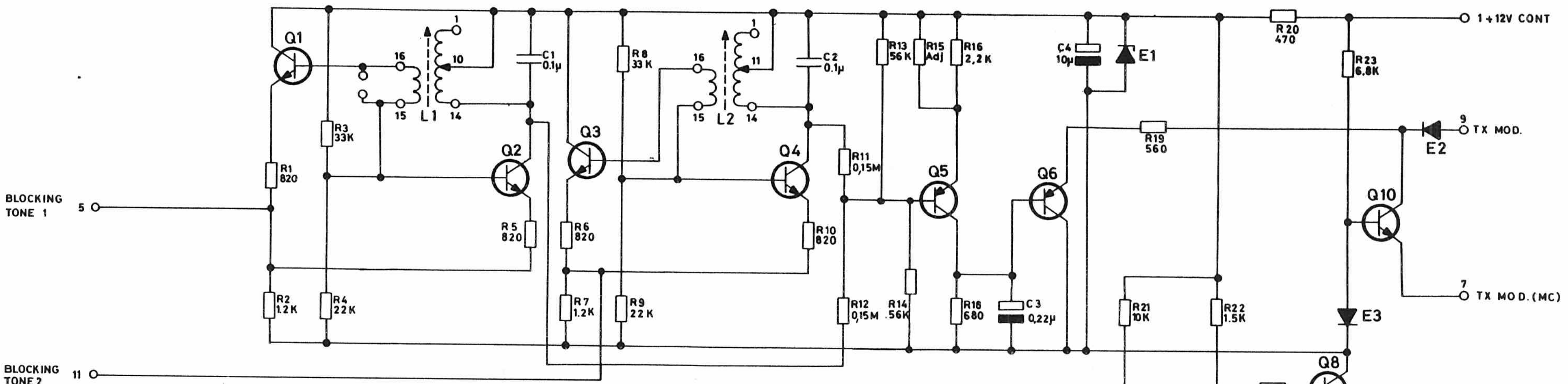
AF Gate Attenuation

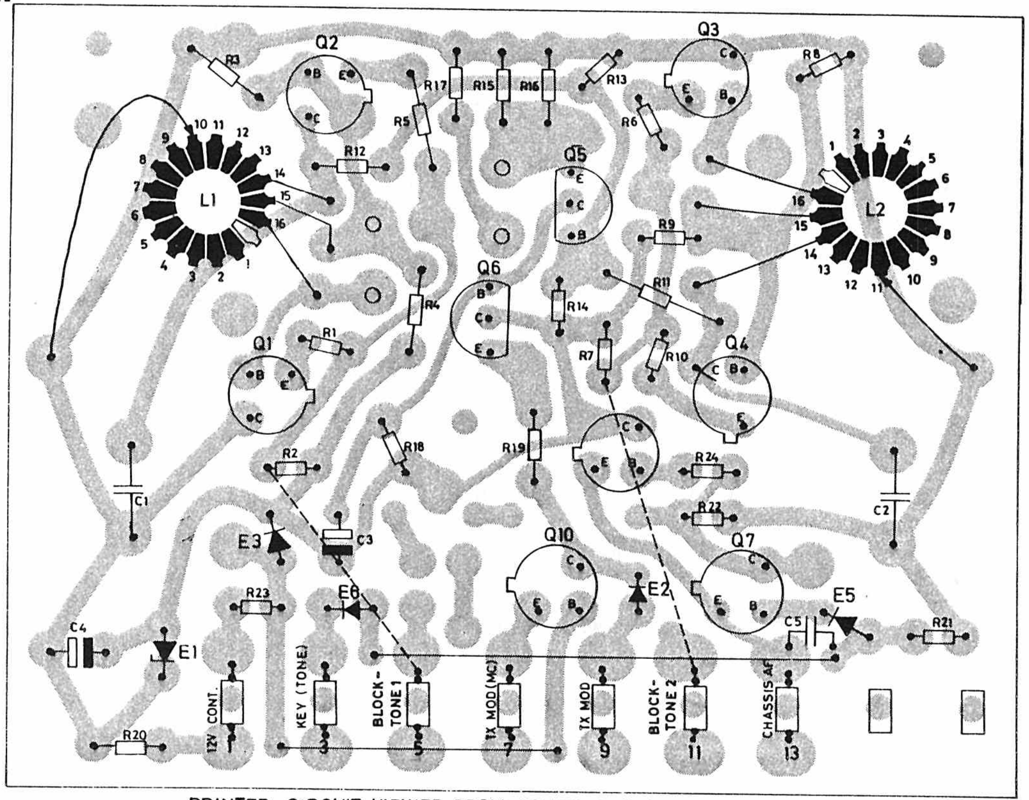
$\geq$ 50 dB

Dimensions

43.2 x 56 x 28 mm

Storno

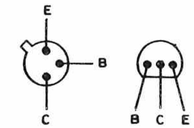




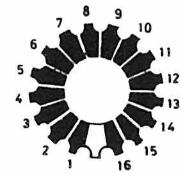
PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

Q1, Q2, Q3, Q4,
Q7, Q8, , Q10.

Q5 - Q6



BOTTOM VIEW
SET FRA BUNDEN



L1 - L2

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

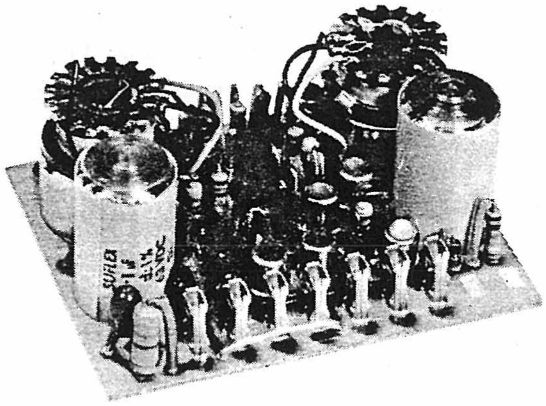
TONE TRANSMITTER TT784

X402.543

Storno

TONE TRANSMITTER

TT7812 TT7813 TT7814



Description

TT7812 is a tone transmitter for CQM700 series radiotelephones. It can be used for single or double tone operation.

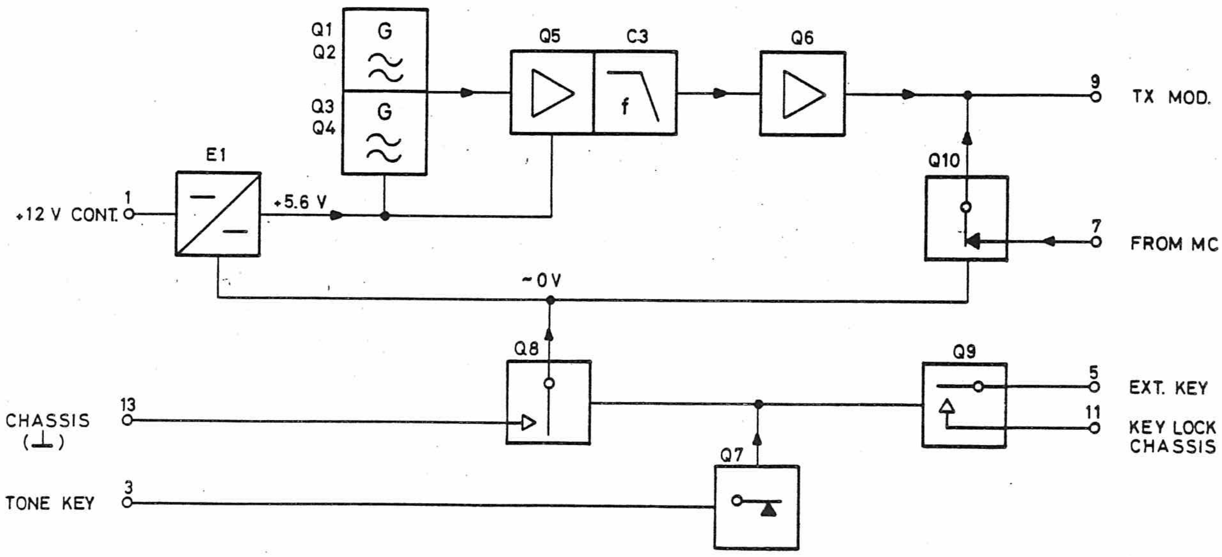
In principle, Q1 and Q2 operate as a differential amplifier in a Hartley type oscillator configuration. Q3 and Q4 make up an identical oscillator. The supply voltage is stabilized with zener diode E1 to keep the oscillator output level constant.

Each oscillator can be set to generate any one of the 12 tones in the standard Storno tone series of 1060 Hz to 2900 Hz. For single tone transmission the feedback winding of one of the oscillator coils must be shorted out (refer to diagram D401.556).

Except for tone coil L2, TT7812, TT7813, and TT7814 are identical.

TT7813 : (refer to diagram D401.774) Coil L2 accommodates the tone series of 570 Hz to 1530 Hz.

TT7814 : (refer to diagram D401.775) Coil L2 accommodates the tone series of 615 Hz to 970 Hz.



TT7812, TT7813, TT7814 (IN STAND BY)

Storno

The remainder of this description applies to all three tone transmitters alike.

Q5 serves to adjust (attenuate) the signal level and, with C3, to introduce de-emphasis before applying the signal to the output stage, Q6.

Emitter follower Q6 provides a low output impedance to match the input impedance of the modulator.

In stand by, R21 and E5 hold Q7 ON. Q7 holds Q8 and Q9 OFF. With Q8 OFF, there is no ground connection to Q1, Q2, Q3, Q4, Q5, and Q6. Q10 is forward biased by the high positive potential through R23, Thus allowing the microphone signal to pass between terminals 7 and 9.

Depressing the tone key grounds terminal 3 and the positive potential through R21 disappears through E6. Without forward bias, Q7 cuts off and the collector voltage rises, driving Q8 and Q9 ON.

When Q9 goes ON, it establishes a ground path from terminal 11 to terminal 5. This switches the regulator voltage from RX to TX, keying the transmitter.

When Q8 conducts, it completes the ground connection to the tone generator circuits, and the tone signal is applied to the modulator via terminal 9. Q8 also cuts off Q10, preventing any microphone signal from interfering with the tone signal.

When the tone key is released the circuit returns to stand by.

Technical Specification

Power Supply

10.5 - 16 V

Current Consumption

Stand by: 6 - 10 mA

Activated: 16 - 33 mA

Ambient Temperature

Operating range: -25°C - +60°C

Functioning range: -30°C - +80°C

Frequency Accuracy

$\leq$ 0.5%

Frequency Stability

$\leq$ 1%

Frequency Response

6 dB pr. octave de-emphasis

f_c = 1000 Hz.

Output Impedance

600 Ω ± 20%

Output Level

Single tone: -17 dBm +1/-0 dB (110mV) at 1000 Hz.

Double tone: -17 dBm +1/-0 dB (110mV) at 1000 Hz.

(each tone 55 mV)

Distortion (tone modulation)

$\leq$ 5%

Distortion (voice modulation)

$\leq$ 5%

AF Gate Attenuation

$\geq$ 50 dB

TONE TRANSMITTER TT7812

Tone Frequencies

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

TONE TRANSMITTER TT7813

Tone Frequencies

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

b. 570, 650, 740, 850, 1060, 1160, 1270, 1400, 1530 Hz.

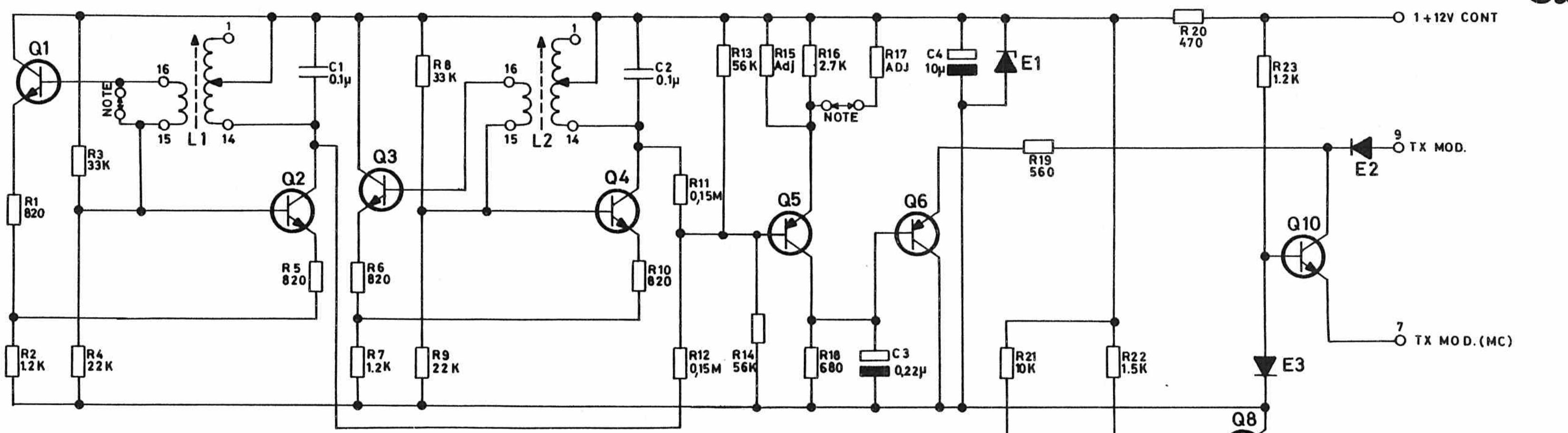
TONE TRANSMITTER TT7814

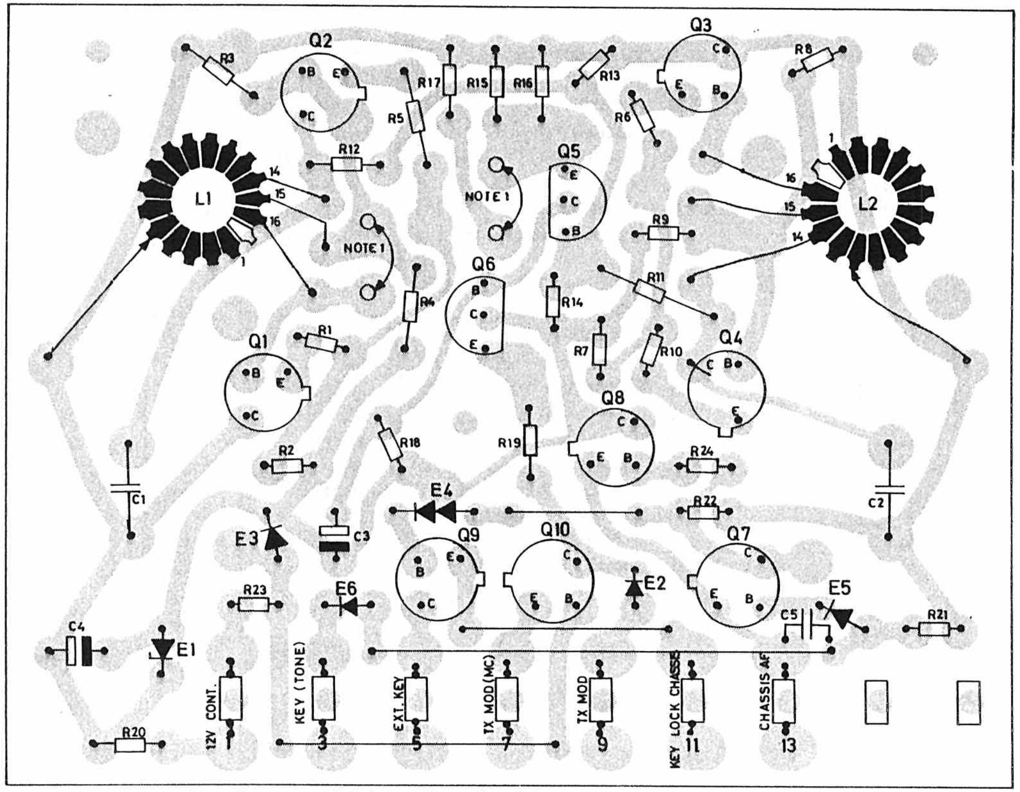
Tone Frequencies

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

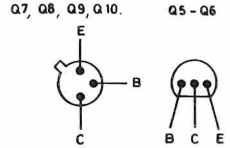
b. 615, 675, 735, 805, 885, 970 Hz.

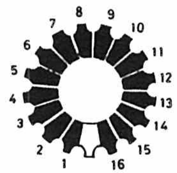
Storno





PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN





L1-L2

NOTE: INSERT SHORTING LINKS AND ADJUST R17 FOR SINGLE TONE MODULATION.
STRAPPEBØJLER ISÆTTES OG R17 JUSTERES VED ENKELTTONEMODULATION.

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 TT7812
TONESENDER

D 401. 556/3

Storno

TYPE	NO.	CODE	DATA	
TT7812		10.2453	Tone Transmitter	
TT7813		10.2896	Tone Transmitter	
TT7814		10.2907	Tone Transmitter	
	C1	76.5068	0.1 μF 1% polystyr TB	63 V
	C2	76.5068	0.1 μF 1% polystyr TB	63 V
	C3	73.5118	0.22 μF 20% tantal	35 V
	C4	73.5109	10 μF 20% tantal	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% carbon film	1/8 W
	R3	80.5267	33 KΩ 5% carbon film	1/8 W
	R4	80.5265	22 KΩ 5% carbon film	1/8 W
	R5	80.5248	820 Ω 5% carbon film	1/8 W
	R6	80.5248	820 Ω 5% carbon film	1/8 W
	R7	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R8	80.5267	33 KΩ 5% carbon film	1/8 W
	R9	80.5265	22 KΩ 5% carbon film	1/8 W
	R10	80.5248	820 Ω 5% carbon film	1/8 W
	R11	80.5275	0.15 MΩ 5% carbon film	1/8 W
	R12	80.5275	0.15 MΩ 5% carbon film	1/8 W
	R13	80.5270	56 KΩ 5% carbon film	1/8 W
	R14	80.5270	56 KΩ 5% carbon film	1/8 W
	R15	80.52XX	Adjusted carbon film	
	R16	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R17	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R18	80.5247	680 Ω 5% carbon film	1/8 W
	R19	80.5246	560 Ω 5% carbon film	1/8 W
	R20	80.5445	470 Ω 5% carbon film	1/4 W
	R21	80.5261	10 KΩ 5% carbon film	1/8 W
	R22	80.5251	1.5 KΩ 5% carbon film	1/8 W
	R23	80.5259	6.8 KΩ 5% carbon film	1/8 W
	R24	80.5250	1.2 KΩ 5% carbon film	1/8 W
	L1	61.1157	Tone Coil	
TT7812	L2	61.1157	Tone Coil	
TT7813	L2	61.1196	Tone Coil	
TT7814	L2	61.1189	Tone Coil	
	E1	99.5114	Zenerdiode 5.6 V 5%	1/4 W
	E2	99.5219	AAZ15 Diode	
	E3	99.5219	AAZ15 Diode	
	E4	99.5209	Stab. diode ZE1.5	
	E5	99.5028	1N914 Diode	
	E6	99.5028	1N914 Diode	

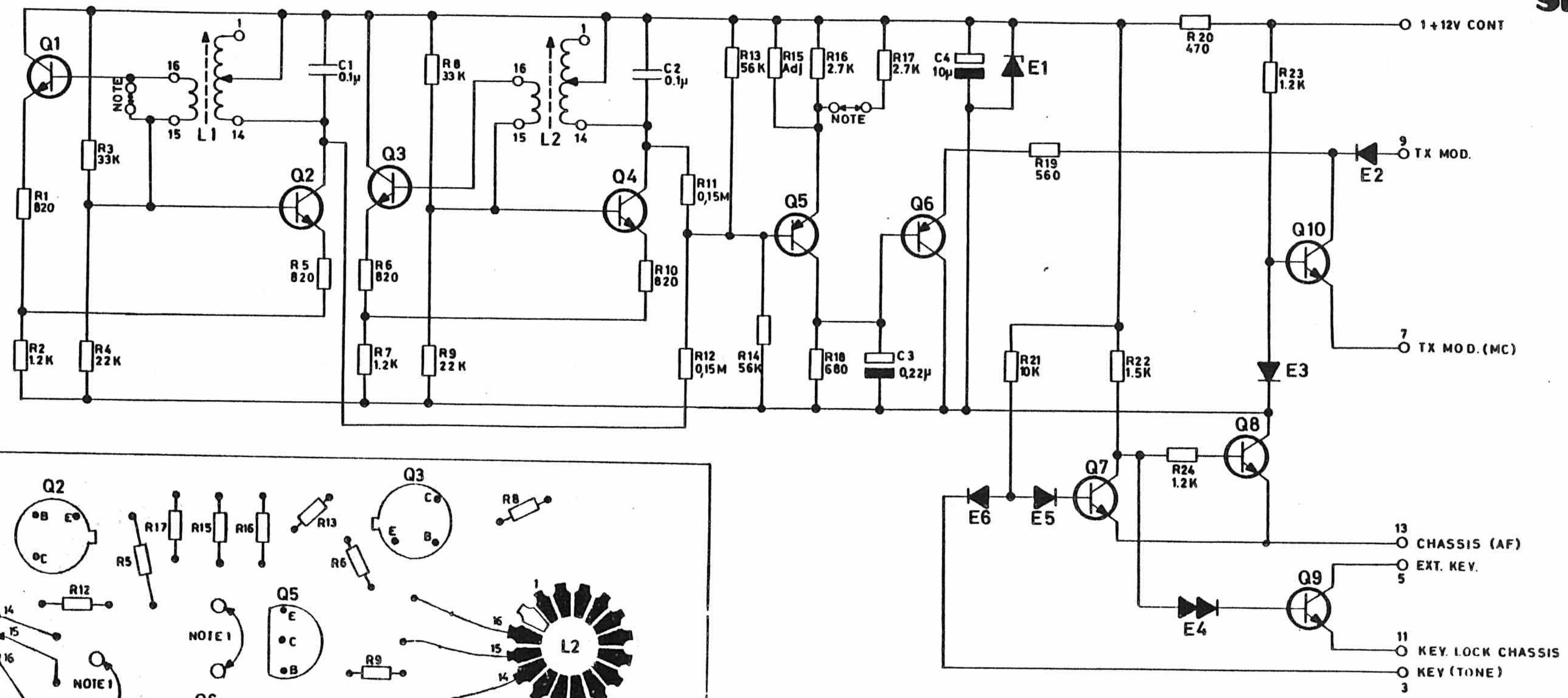
Storno

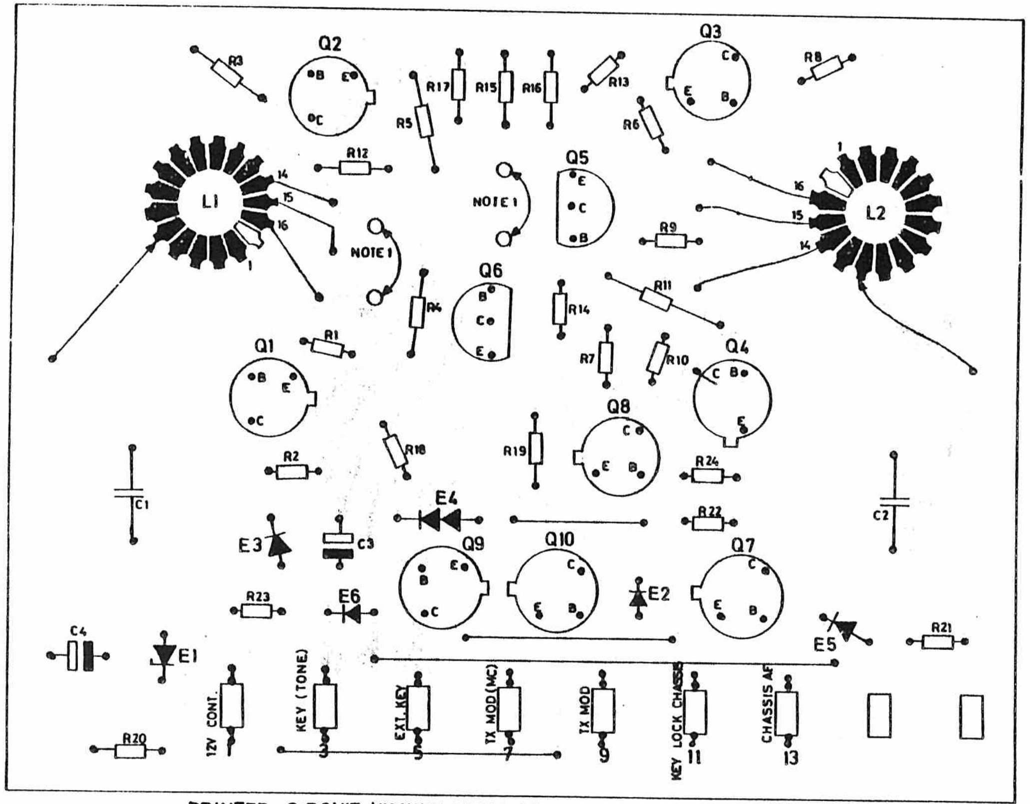
TYPE	NO.	CODE	DATA
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5144	BC214L Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor

TONE TRANSMITTER TT7812, TT7813, TT7814
TONESENDER

X401.688/3

Storno

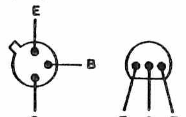




PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

Q1, Q2, Q3, Q4,
Q7, Q8, Q9, Q10.

Q5 - Q6



BOTTOM VIEW
SET FRA BUNDEN.

L1 - L2

NOTE: INSERT SHORTING LINKS FOR SINGLE TONE MODULATION.
STRAPPEBØJLER ISÆTTES VED ENKELT-TONEMODULATION.

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

TT7812

D401. 556/2

Storno

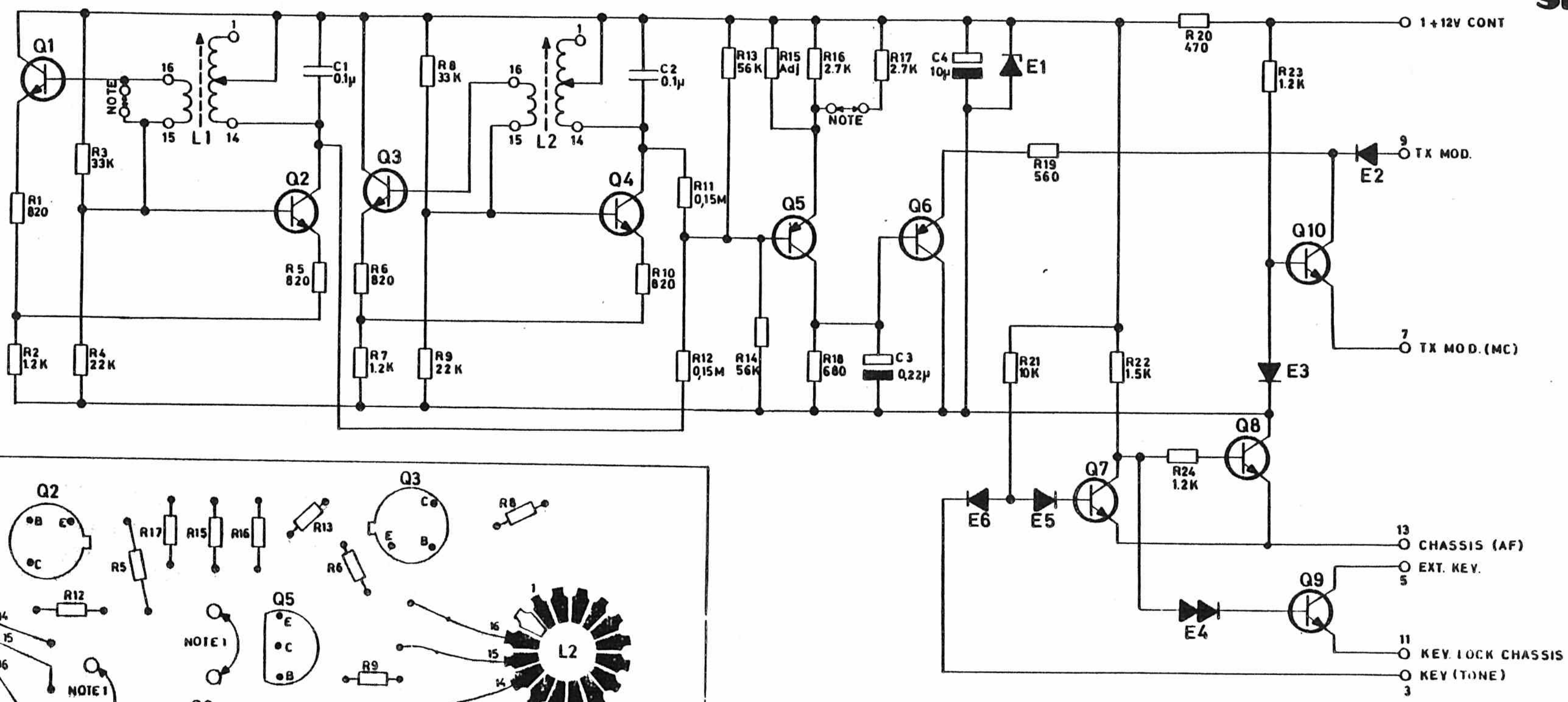
TYPE	NO.	CODE	DATA
TT7812		10.2453	Tone Transmitter
TT7813		10.2896	Tone Transmitter
TT7814		10.2907	Tone Transmitter
	C1	76.5068	0.1 µF 1% polystyr TB 63 V
	C2	76.5068	0.1 µF 1% polystyr TB 63 V
	C3	73.5118	0.22 µF 20% tantal 35 V
	C4	73.5109	10 µF 20% tantal 16 V
	R1	80.5248	820 Ω 5% carbon Film 1/8 W
	R2	80.5250	1.2 KΩ 5% carbon film 1/8 W
	R3	80.5267	33 KΩ 5% carbon film 1/8 W
	R4	80.5265	22 KΩ 5% carbon film 1/8 W
	R5	80.5248	820 Ω 5% carbon film 1/8 W
	R6	80.5248	820 Ω 5% carbon film 1/8 W
	R7	80.5250	1.2 KΩ 5% carbon film 1/8 W
	R8	80.5267	33 KΩ 5% carbon film 1/8 W
	R9	80.5265	22 KΩ 5% carbon film 1/8 W
	R10	80.5248	820 Ω 5% carbon film 1/8 W
	R11	80.5275	0.15 MΩ 5% carbon film 1/8 W
	R12	80.5275	0.15 MΩ 5% carbon film 1/8 W
	R13	80.5270	56 KΩ 5% carbon film 1/8 W
	R14	80.5270	56 KΩ 5% carbon film 1/8 W
	R15	80.52XX	Adjusted carbon film
	R16	80.5254	2.7 KΩ 5% carbon film 1/8 W
	R17	80.5254	2.7 KΩ 5% carbon film 1/8 W
	R18	80.5247	680 Ω 5% carbon film 1/8 W
	R19	80.5246	560 Ω 5% carbon film 1/8 W
	R20	80.5445	470 Ω 5% carbon film 1/4 W
	R21	80.5261	10 KΩ 5% carbon film 1/8 W
	R22	80.5251	1.5 KΩ 5% carbon film 1/8 W
	R23	80.5250	1.2 KΩ 5% carbon film 1/8 W
	R24	80.5250	1.2 KΩ 5% carbon film 1/8 W
	L1	61.1157	Tone Coil
TT7812	L2	61.1157	Tone Coil
TT7813	L2	61.1196	Tone Coil
TT7814	L2	61.1189	Tone Coil
	E1	99.5114	Zenerdiode 5.6 V 5% 1/4 W
	E2	99.5219	AAZ15 Diode
	E3	99.5219	AAZ15 Diode
	E4	99.5209	Stab. diode ZE1.5
	E5	99.5028	1N914 Diode
	E6	99.5028	1N914 Diode

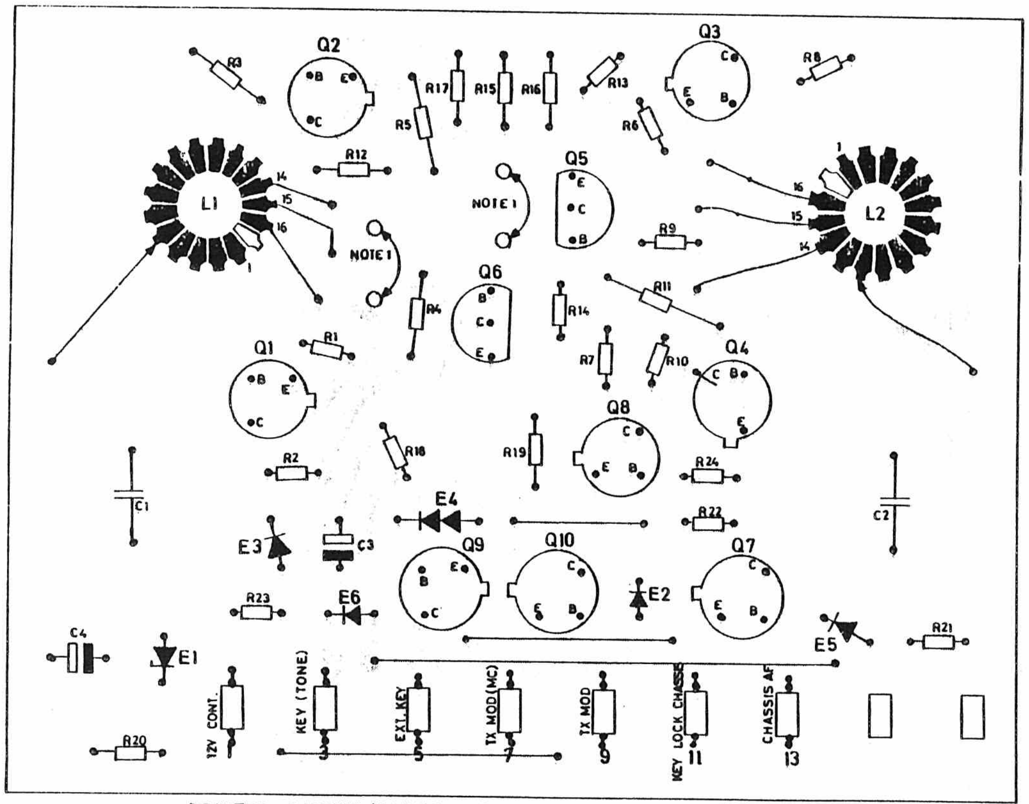
TYPE	NO.	CODE	DATA
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5144	BC214L Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor

TONE TRANSMITTER TT7812, TT7813, TT7814
TONESENDER

X401.688/2

Storno

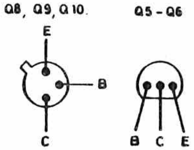




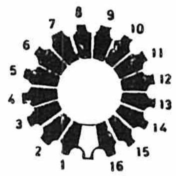
PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

Q1, Q2, Q3, Q4,
Q7, Q8, Q9, Q10.

Q5 - Q6



BOTTOM VIEW
SET FRA BUNDEN.



L1 - L2

NOTE: INSERT SHORTING LINKS FOR SINGLE TONE MODULATION.
STRAPPEBØJLER ISÆTTES VED ENKELT-TONEMODULATION.

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

TT7812

D401.556/2

Storno

TYPE	NO.	CODE	DATA	
TT7812		10.2453	Tone Transmitter	
	C1	76.5068	0.1μF 1% polystyr TB	63V
	C2	76.5068	0.1μF 1% polystyr TB	63V
	C3	73.5118	0.22μF 20% tantal	35V
	C4	73.5109	10μF 20% tantal	16V
	R1	80.5248	820Ω 5% carbon film	1/8W
	R2	80.5250	1.2KΩ 5% carbon film	1/8W
	R3	80.5267	33KΩ 5% carbon film	1/8W
	R4	80.5265	22KΩ 5% carbon film	1/8W
	R5	80.5248	820Ω 5% carbon film	1/8W
	R6	80.5248	820Ω 5% carbon film	1/8W
	R7	80.5250	1.2KΩ 5% carbon film	1/8W
	R8	80.5267	33KΩ 5% carbon film	1/8W
	R9	80.5265	22KΩ 5% carbon film	1/8W
	R10	80.5248	820Ω 5% carbon film	1/8W
	R11	80.5275	0.15MΩ 5% carbon film	1/8W
	R12	80.5275	0.15MΩ 5% carbon film	1/8W
	R13	80.5270	56KΩ 5% carbon film	1/8W
	R14	80.5270	56KΩ 5% carbon film	1/8W
	R15	80.52XX	Adjusted carbon film	
	R16	80.5254	2.7KΩ 5% carbon film	1/8W
	R17	80.5254	2.7KΩ 5% carbon film	1/8W
	R18	80.5247	680Ω 5% carbon film	1/8W
	R19	80.5246	560Ω 5% carbon film	1/8W
	R20	80.5445	470Ω 5% carbon film	1/4W
	R21	80.5261	10KΩ 5% carbon film	1/8W
	R22	80.5251	1.5KΩ 5% carbon film	1/8W
	R23	80.5250	1.2KΩ 5% carbon film	1/8W
	R24	80.5250	1.2KΩ 5% carbon film	1/8W
	L1	61.1157	Tone Coil	
	L2	61.1157	Tone Coil	
	E1	99.5114	Zenerdiode 5.6V 5%	1/4W
	E2	99.5219	AAZ15 Diode	
	E3	99.5219	AAZ15 Diode	
	E4	99.5209	Stab. diode ZE1.5	
	E5	99.5028	1N914 Diode	
	E6	99.5028	1N914 Diode	
	Q1	99.5143	BC108 Transistor	
	Q2	99.5143	BC108 Transistor	
	Q3	99.5143	BC108 Transistor	
	Q4	99.5143	BC108 Transistor	
	Q5	99.5144	BC214L Transistor	
	Q6	99.5144	BC214L Transistor	

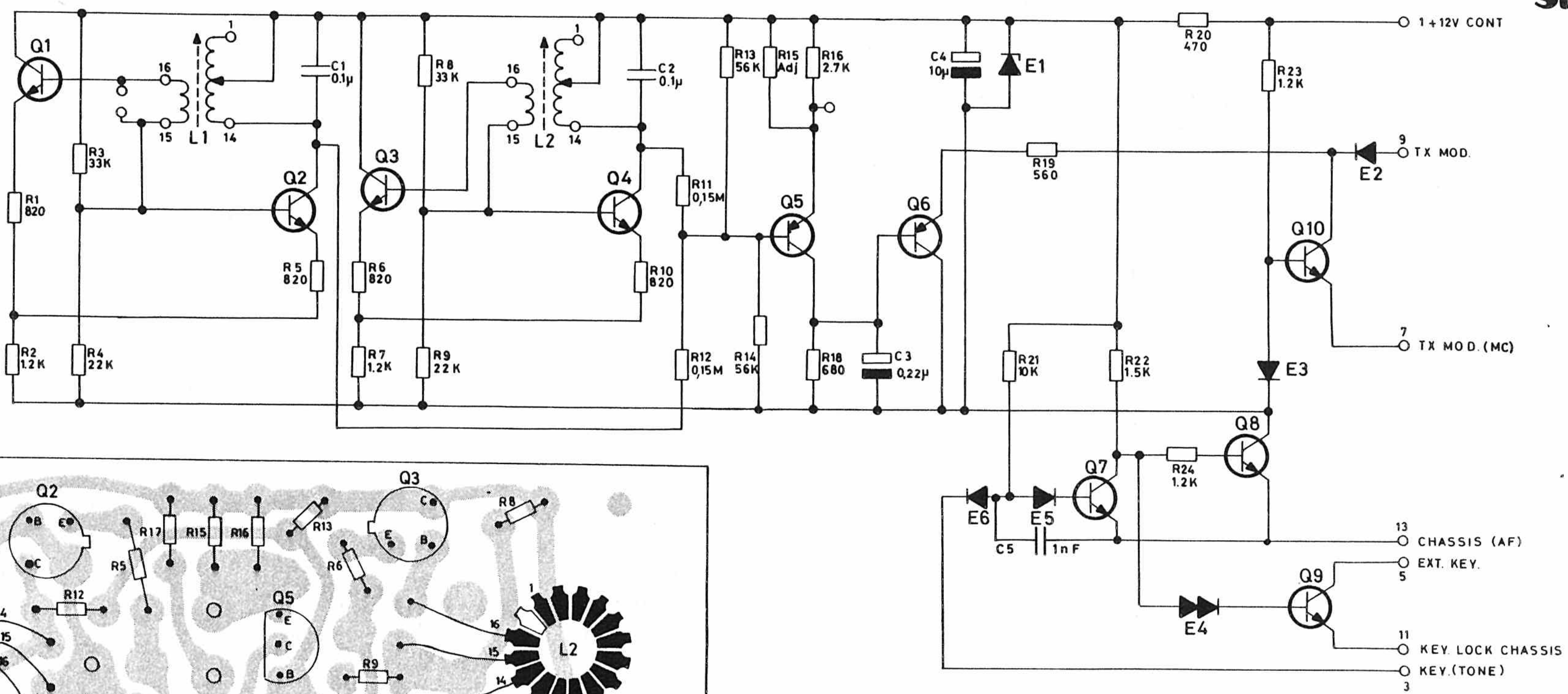
Storno

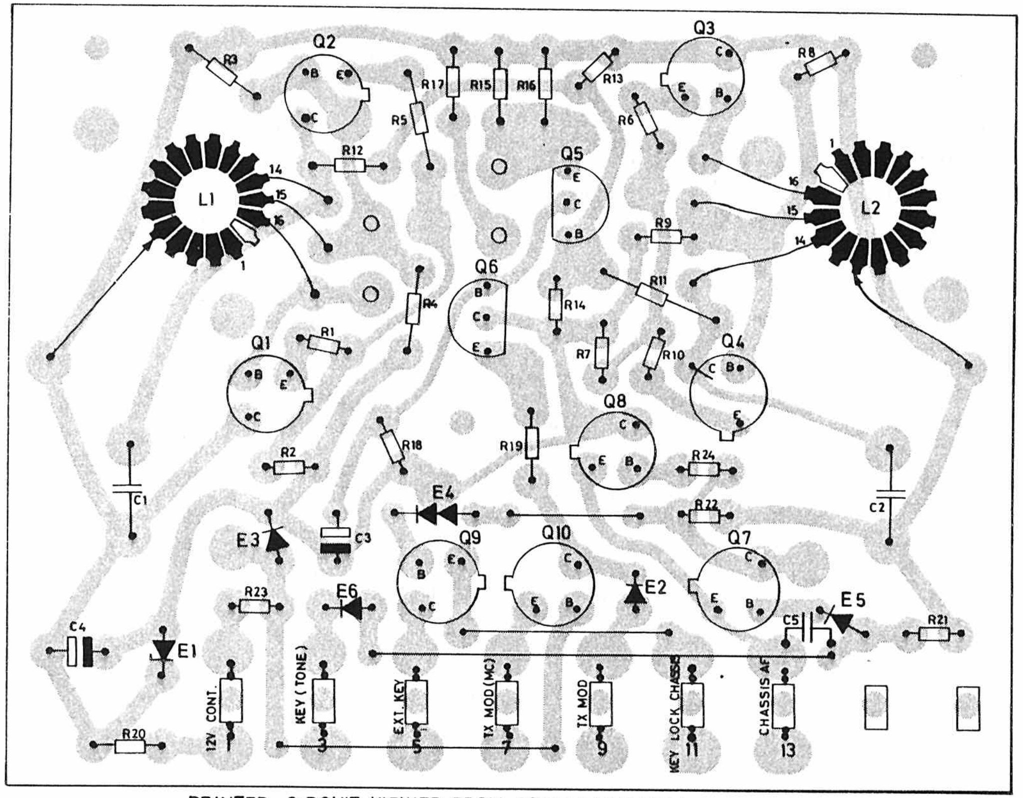
TYPE	NO.	CODE	DATA
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor

TONE TRANSMITTER TONESENDER TT7812

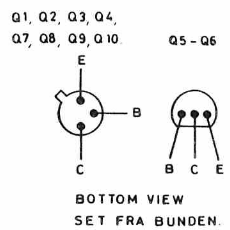
X401.688

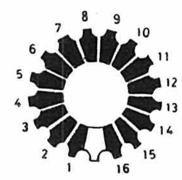
Storno





PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN





L1- L2

TERM.	L1 FREQ.	L2 FREQ.
1	1060 Hz	570 Hz
2	1160 –	650
3	1270 –	740
4	1400 –	850
5	1530 –	1060
6	1670 –	1160
7	1830 –	1270
8	2000 –	1400
9	2200 –	1530
10	2400 –	
11	2600 –	
12	2900 –	

TONE TRANSMITTER TONESENDER TT7813

D 401.774/2

Storno

TYPE	NO.	CODE	DATA
TT7812		10.2453	Tone Transmitter
TT7813		10.2896	Tone Transmitter
TT7814		10.2907	Tone Transmitter
	C1	76.5068	0.1 μF 1% polystyr TB 63 V
	C2	76.5068	0.1 μF 1% polystyr TB 63 V
	C3	73.5118	0.22 μF 20% tantal 35 V
	C4	73.5109	10 μF 20% tantal 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% carbon film 1/8 W
	R3	80.5267	33 KΩ 5% carbon film 1/8 W
	R4	80.5265	22 KΩ 5% carbon film 1/8 W
	R5	80.5248	820 Ω 5% carbon film 1/8 W
	R6	80.5248	820 Ω 5% carbon film 1/8 W
	R7	80.5250	1.2 KΩ 5% carbon film 1/8 W
	R8	80.5267	33 KΩ 5% carbon film 1/8 W
	R9	80.5265	22 KΩ 5% carbon film 1/8 W
	R10	80.5248	820 Ω 5% carbon film 1/8 W
	R11	80.5275	0.15 MΩ 5% carbon film 1/8 W
	R12	80.5275	0.15 MΩ 5% carbon film 1/8 W
	R13	80.5270	56 KΩ 5% carbon film 1/8 W
	R14	80.5270	56 KΩ 5% carbon film 1/8 W
	R15	80.52XX	Adjusted carbon film
	R16	80.5254	2.7 KΩ 5% carbon film 1/8 W
	R17	80.5254	2.7 KΩ 5% carbon film 1/8 W
	R18	80.5247	680 Ω 5% carbon film 1/8 W
	R19	80.5246	560 Ω 5% carbon film 1/8 W
	R20	80.5445	470 Ω 5% carbon film 1/4 W
	R21	80.5261	10 KΩ 5% carbon film 1/8 W
	R22	80.5251	1.5 KΩ 5% carbon film 1/8 W
	R23	80.5259	6.8 KΩ 5% carbon film 1/8 W
	R24	80.5250	1.2 KΩ 5% carbon film 1/8 W
	L1	61.1157	Tone Coil
TT7812	L2	61.1157	Tone Coil
TT7813	L2	61.1196	Tone Coil
TT7814	L2	61.1189	Tone Coil
	E1	99.5114	Zenerdiode 5.6 V 5% 1/4 W
	E2	99.5219	AAZ15 Diode
	E3	99.5219	AAZ15 Diode
	E4	99.5209	Stab. diode ZE1.5
	E5	99.5028	1N914 Diode
	E6	99.5028	1N914 Diode

Storno

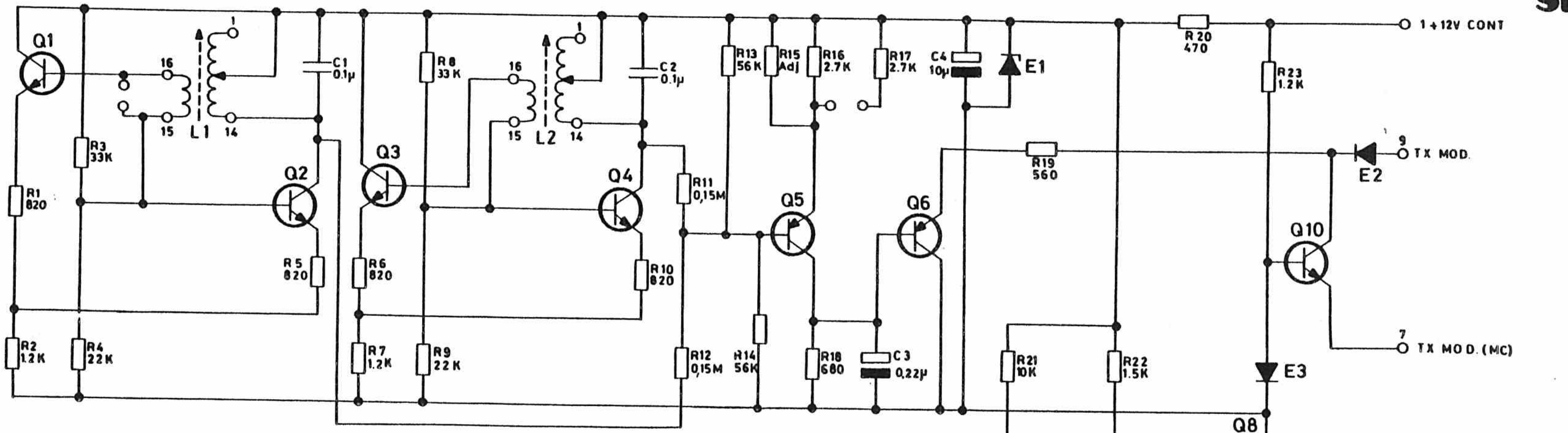
TYPE	NO.	CODE	DATA
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5144	BC214L Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor

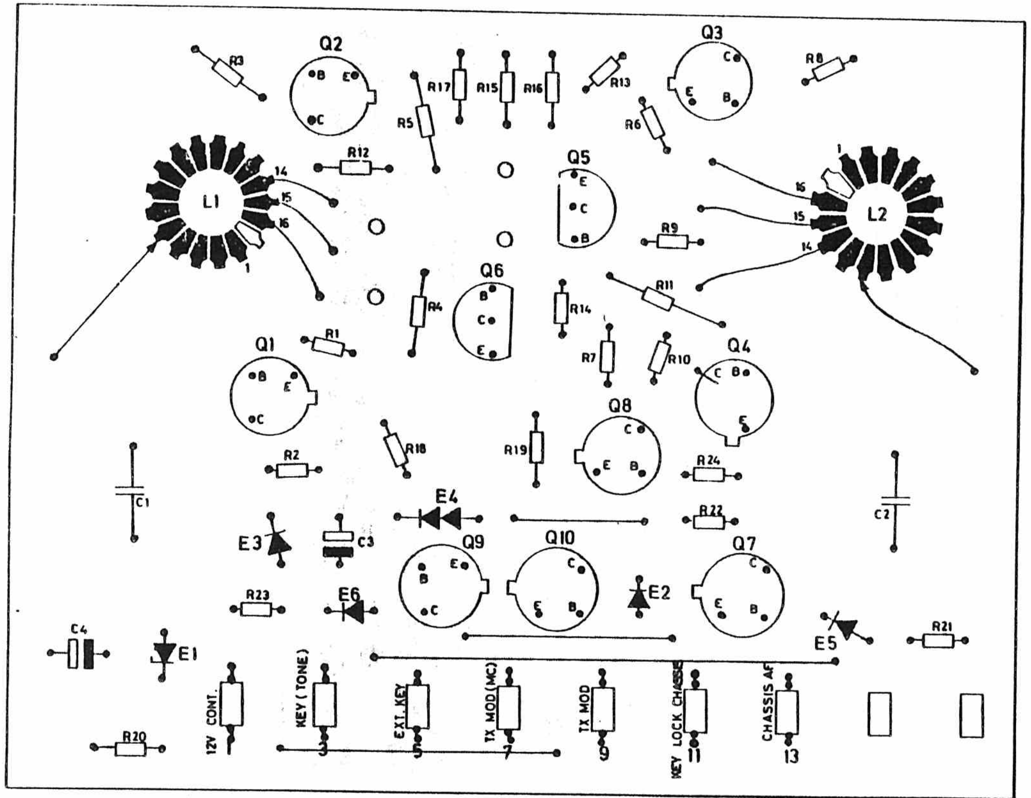
TONE TRANSMITTER TT7812, TT7813, TT7814
TONESENDER

X401.688/3

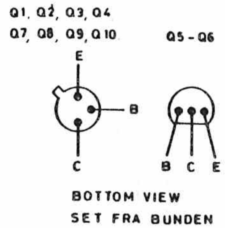
Storno

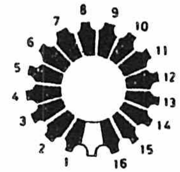
Storno





PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN





L1 - L2

TERM.	L1 FREQ.	L2 FREQ.
1	1060 Hz	570 Hz
2	1160 –	650
3	1270 –	740
4	1400 –	850
5	1530 –	1060
6	1670 –	1160
7	1830 –	1270
8	2000 –	1400
9	2200 –	1530
10	2400 –	
11	2600 –	
12	2900 –	

TONE TRANSMITTER TT7813
TONESENDER

D 401.774

Storno

TYPE	NO.	CODE	DATA	
TT7812		10.2453	Tone Transmitter	
TT7813		10.2896	Tone Transmitter	
TT7814		10.2907	Tone Transmitter	
	C1	76.5068	0.1 μF 1% polystyr TB	63 V
	C2	76.5068	0.1 μF 1% polystyr TB	63 V
	C3	73.5118	0.22 μF 20% tantal	35 V
	C4	73.5109	10 μF 20% tantal	16 V
	R1	80.5248	820 Ω 5% carbon Film	1/8 W
	R2	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R3	80.5267	33 KΩ 5% carbon film	1/8 W
	R4	80.5265	22 KΩ 5% carbon film	1/8 W
	R5	80.5248	820 Ω 5% carbon film	1/8 W
	R6	80.5248	820 Ω 5% carbon film	1/8 W
	R7	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R8	80.5267	33 KΩ 5% carbon film	1/8 W
	R9	80.5265	22 KΩ 5% carbon film	1/8 W
	R10	80.5248	820 Ω 5% carbon film	1/8 W
	R11	80.5275	0.15 MΩ 5% carbon film	1/8 W
	R12	80.5275	0.15 MΩ 5% carbon film	1/8 W
	R13	80.5270	56 KΩ 5% carbon film	1/8 W
	R14	80.5270	56 KΩ 5% carbon film	1/8 W
	R15	80.52XX	Adjusted carbon film	
	R16	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R17	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R18	80.5247	680 Ω 5% carbon film	1/8 W
	R19	80.5246	560 Ω 5% carbon film	1/8 W
	R20	80.5445	470 Ω 5% carbon film	1/4 W
	R21	80.5261	10 KΩ 5% carbon film	1/8 W
	R22	80.5251	1.5 KΩ 5% carbon film	1/8 W
	R23	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R24	80.5250	1.2 KΩ 5% carbon film	1/8 W
	L1	61.1157	Tone Coil	
TT7812	L2	61.1157	Tone Coil	
TT7813	L2	61.1196	Tone Coil	
TT7814	L2	61.1189	Tone Coil	
	E1	99.5114	Zenerdiode 5.6 V 5%	1/4 W
	E2	99.5219	AAZ15 Diode	
	E3	99.5219	AAZ15 Diode	
	E4	99.5209	Stab. diode ZE1.5	
	E5	99.5028	1N914 Diode	
	E6	99.5028	1N914 Diode	

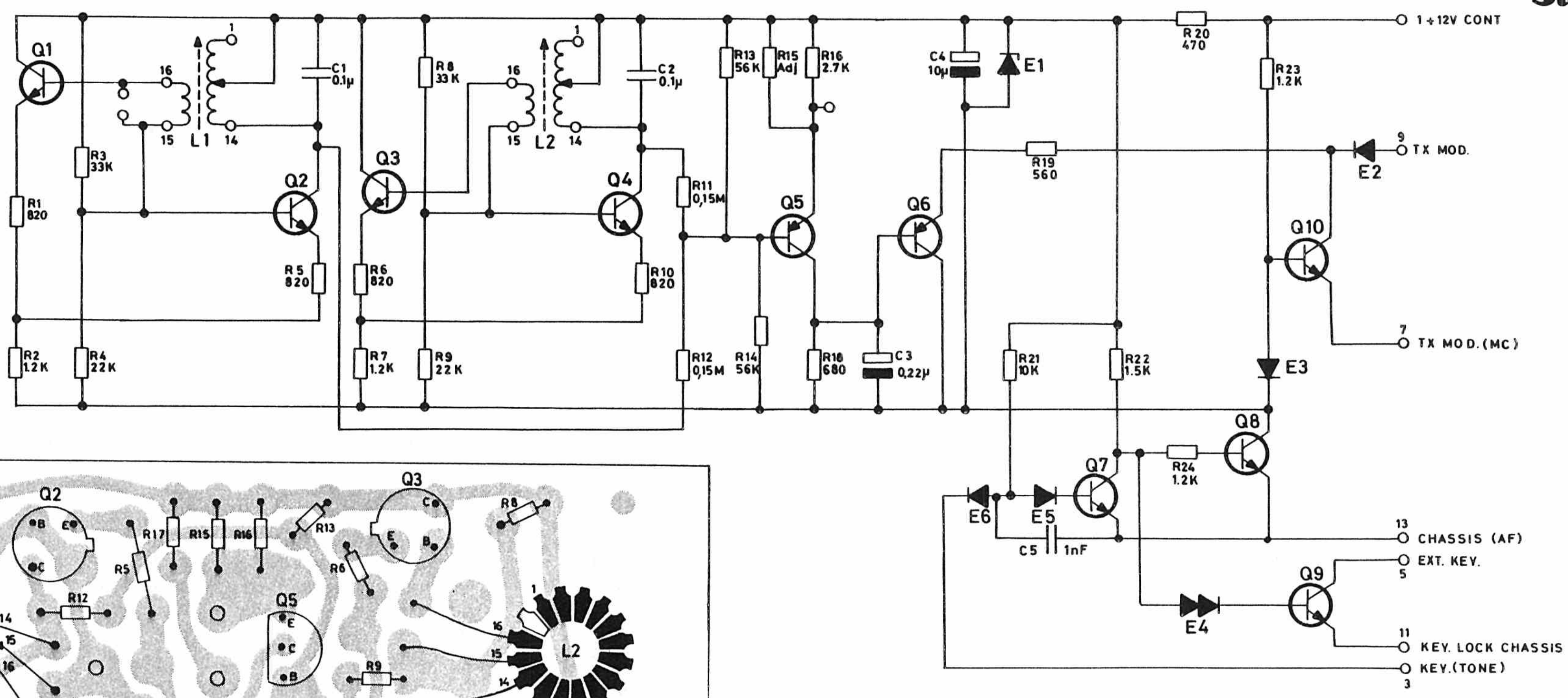
Storno

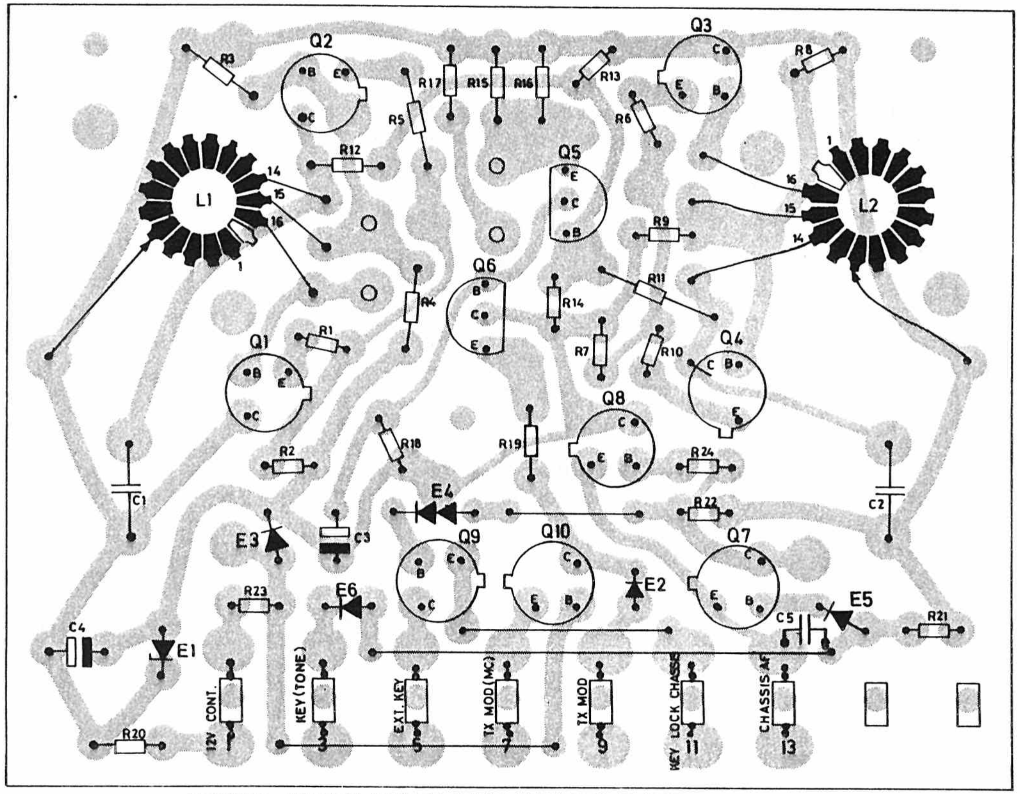
TYPE	NO.	CODE	DATA
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5144	BC214L Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor

TONE TRANSMITTER TT7812, TT7813, TT7814
TONESENDER

X401.688/2

Storno

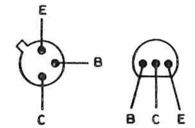




PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN

Q1, Q2, Q3, Q4,
Q7, Q8, Q9, Q10.

Q5 - Q6



BOTTOM VIEW
SET FRA BUNDEN.

L1 - L2

TERM.	L1 FREQ.	L2 FREQ.
1	1060 Hz	615 Hz
2	1160 –	675 –
3	1270 –	735 –
4	1400 –	805 –
5	1530 –	885 –
6	1670 –	970 –
7	1830 –	
8	2000 –	
9	2200 –	
10	2400 –	
11	2600 –	
12	2900 –	

TONE TRANSMITTER
TONESENDER

TT7814

D 401. 775/2

Storno

TYPE	NO.	CODE	DATA	
TT7812		10.2453	Tone Transmitter	
TT7813		10.2896	Tone Transmitter	
TT7814		10.2907	Tone Transmitter	
	C1	76.5068	0.1 μF 1% polystyr TB	63 V
	C2	76.5068	0.1 μF 1% polystyr TB	63 V
	C3	73.5118	0.22 μF 20% tantal	35 V
	C4	73.5109	10 μF 20% tantal	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% carbon film	1/8 W
	R3	80.5267	33 KΩ 5% carbon film	1/8 W
	R4	80.5265	22 KΩ 5% carbon film	1/8 W
	R5	80.5248	820 Ω 5% carbon film	1/8 W
	R6	80.5248	820 Ω 5% carbon film	1/8 W
	R7	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R8	80.5267	33 KΩ 5% carbon film	1/8 W
	R9	80.5265	22 KΩ 5% carbon film	1/8 W
	R10	80.5248	820 Ω 5% carbon film	1/8 W
	R11	80.5275	0.15 MΩ 5% carbon film	1/8 W
	R12	80.5275	0.15 MΩ 5% carbon film	1/8 W
	R13	80.5270	56 KΩ 5% carbon film	1/8 W
	R14	80.5270	56 KΩ 5% carbon film	1/8 W
	R15	80.52XX	Adjusted carbon film	
	R16	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R17	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R18	80.5247	680 Ω 5% carbon film	1/8 W
	R19	80.5246	560 Ω 5% carbon film	1/8 W
	R20	80.5445	470 Ω 5% carbon film	1/4 W
	R21	80.5261	10 KΩ 5% carbon film	1/8 W
	R22	80.5251	1.5 KΩ 5% carbon film	1/8 W
	R23	80.5259	6.8 KΩ 5% carbon film	1/8 W
	R24	80.5250	1.2 KΩ 5% carbon film	1/8 W
	L1	61.1157	Tone Coil	
TT7812	L2	61.1157	Tone Coil	
TT7813	L2	61.1196	Tone Coil	
TT7814	L2	61.1189	Tone Coil	
	E1	99.5114	Zenerdiode 5.6 V 5%	1/4 W
	E2	99.5219	AAZ15 Diode	
	E3	99.5219	AAZ15 Diode	
	E4	99.5209	Stab. diode ZE1.5	
	E5	99.5028	1N914 Diode	
	E6	99.5028	1N914 Diode	

Storno

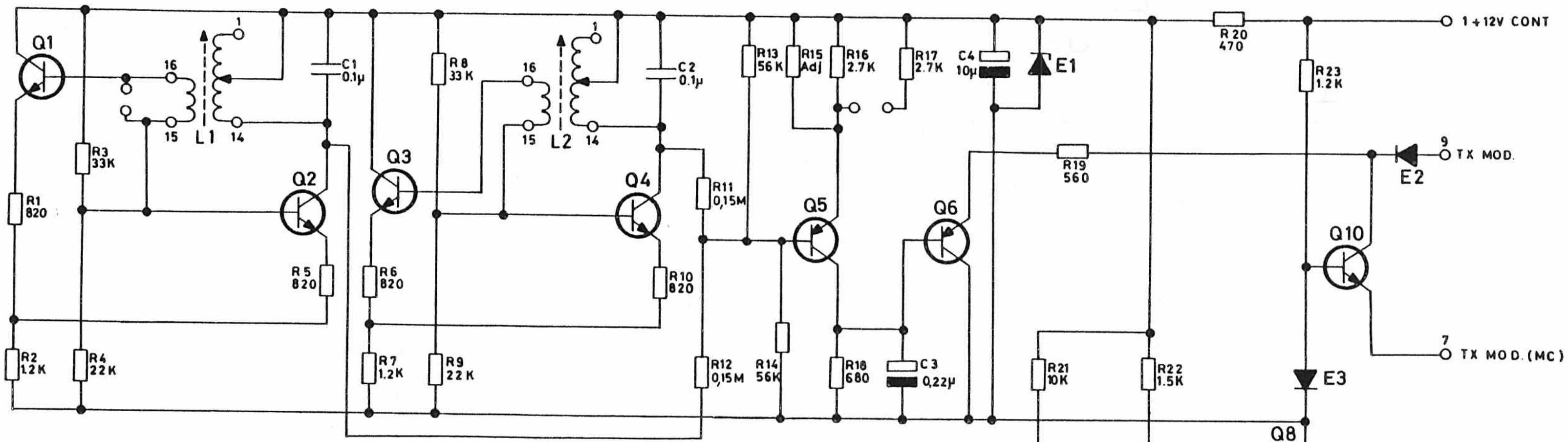
TYPE	NO.	CODE	DATA
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5144	BC214L Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor

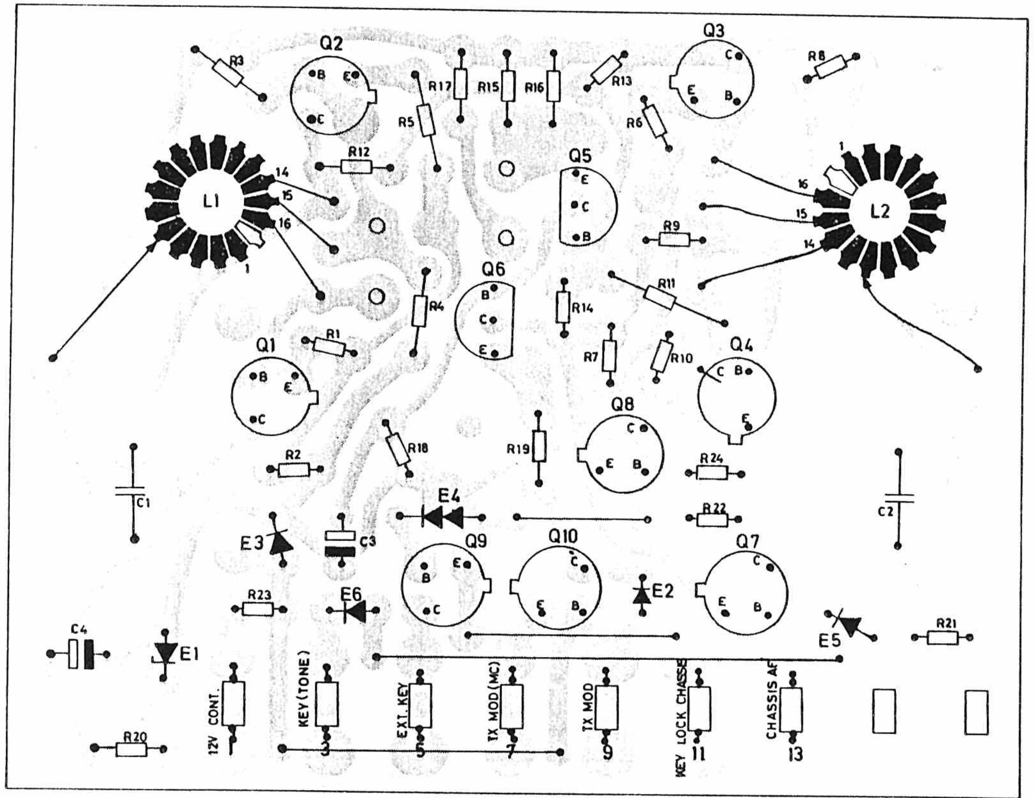
TONE TRANSMITTER TT7812, TT7813, TT7814
TONESENDER

X401.688/3

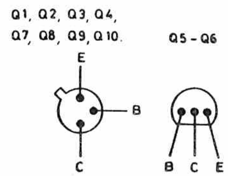
Storno

Storno

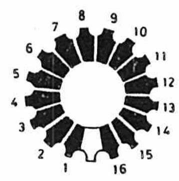




PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE
TRYKT KREDSLØB SET FRA KOMPONENTSIDEN



BOTTOM VIEW
SET FRA BUNDEN.



L1 - L2

TERM.	L1 FREQ.	L2 FREQ.
1	1060 Hz	615 Hz
2	1160 –	675 –
3	1270 –	735 –
4	1400 –	805 –
5	1530 –	885 –
6	1670 –	970 –
7	1830 –	
8	2000 –	
9	2200 –	
10	2400 –	
11	2600 –	
12	2900 –	

TONE TRANSMITTER
TONESENDER

TT7814

D 401.775

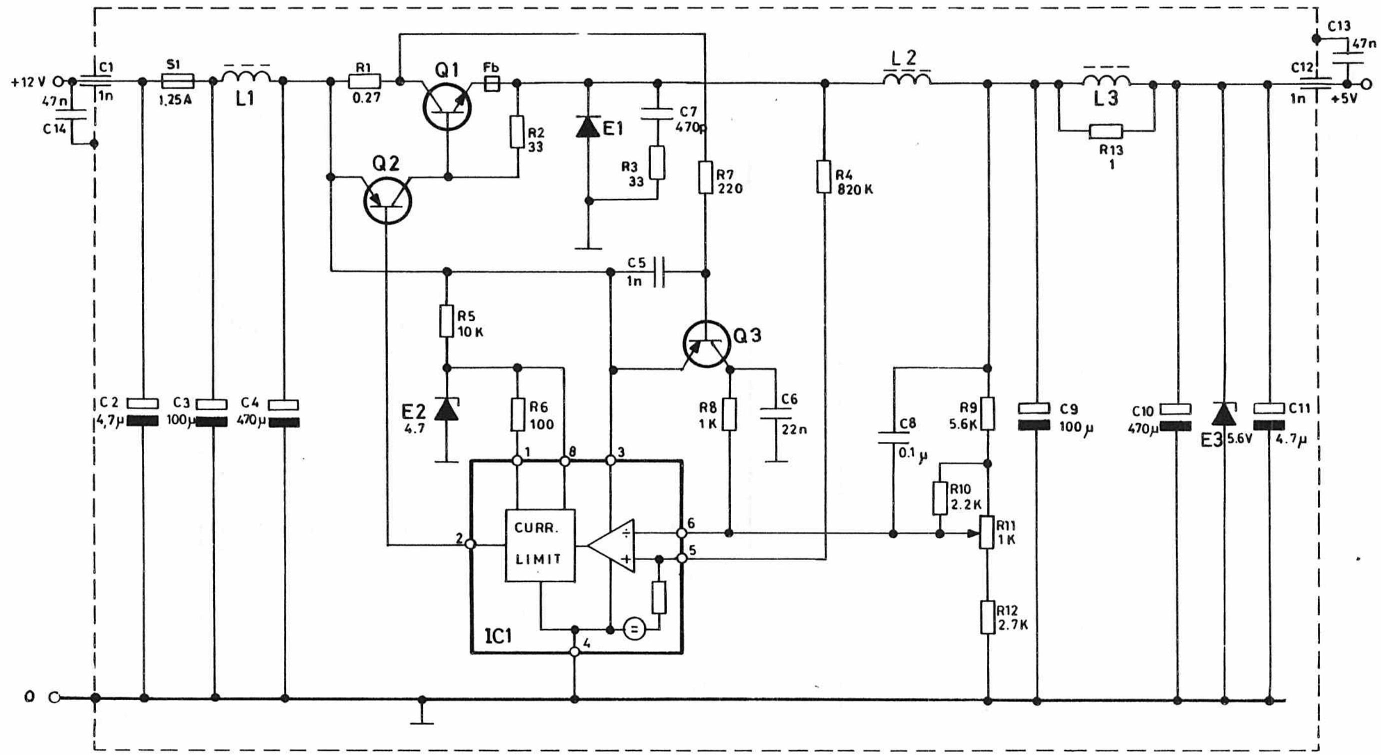
TYPE	NO.	CODE	DATA	
TT7812		10.2453	Tone Transmitter	
TT7813		10.2896	Tone Transmitter	
TT7814		10.2907	Tone Transmitter	
	C1	76.5068	0.1 µF 1% polystyr TB	63 V
	C2	76.5068	0.1 µF 1% polystyr TB	63 V
	C3	73.5118	0.22 µF 20% tantal	35 V
	C4	73.5109	10 µF 20% tantal	16 V
	R1	80.5248	820 Ω 5% carbon Film	1/8 W
	R2	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R3	80.5267	33 KΩ 5% carbon film	1/8 W
	R4	80.5265	22 KΩ 5% carbon film	1/8 W
	R5	80.5248	820 Ω 5% carbon film	1/8 W
	R6	80.5248	820 Ω 5% carbon film	1/8 W
	R7	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R8	80.5267	33 KΩ 5% carbon film	1/8 W
	R9	80.5265	22 KΩ 5% carbon film	1/8 W
	R10	80.5248	820 Ω 5% carbon film	1/8 W
	R11	80.5275	0.15 MΩ 5% carbon film	1/8 W
	R12	80.5275	0.15 MΩ 5% carbon film	1/8 W
	R13	80.5270	56 KΩ 5% carbon film	1/8 W
	R14	80.5270	56 KΩ 5% carbon film	1/8 W
	R15	80.52XX	Adjusted carbon film	
	R16	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R17	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R18	80.5247	680 Ω 5% carbon film	1/8 W
	R19	80.5246	560 Ω 5% carbon film	1/8 W
	R20	80.5445	470 Ω 5% carbon film	1/4 W
	R21	80.5261	10 KΩ 5% carbon film	1/8 W
	R22	80.5251	1.5 KΩ 5% carbon film	1/8 W
	R23	80.5250	1.2 KΩ 5% carbon film	1/8 W
	R24	80.5250	1.2 KΩ 5% carbon film	1/8 W
	L1	61.1157	Tone Coil	
TT7812	L2	61.1157	Tone Coil	
TT7813	L2	61.1196	Tone Coil	
TT7814	L2	61.1189	Tone Coil	
	E1	99.5114	Zenerdiode 5.6 V 5%	1/4 W
	E2	99.5219	AAZ15 Diode	
	E3	99.5219	AAZ15 Diode	
	E4	99.5209	Stab. diode ZE1.5	
	E5	99.5028	1N914 Diode	
	E6	99.5028	1N914 Diode	

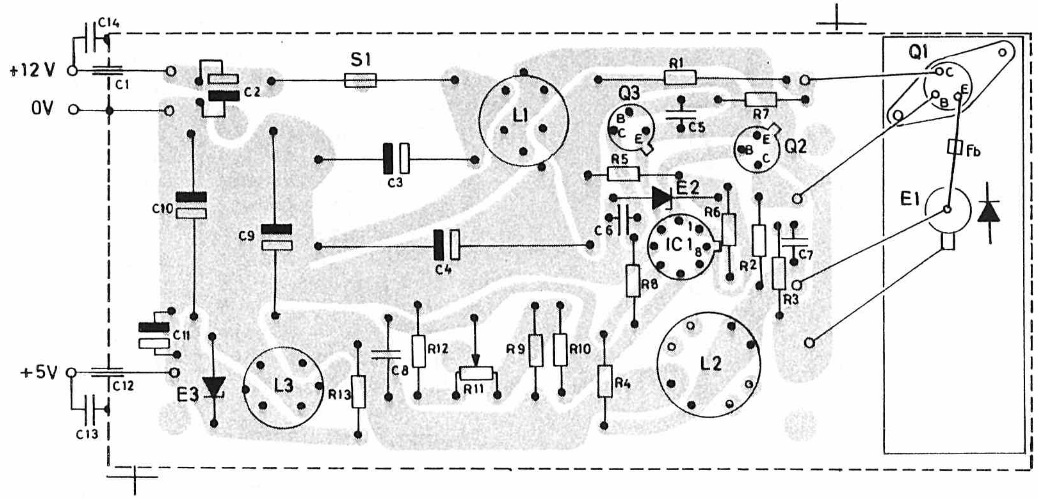
TYPE	NO.	CODE	DATA
	Q1	99.5143	BC108 Transistor
	Q2	99.5143	BC108 Transistor
	Q3	99.5143	BC108 Transistor
	Q4	99.5143	BC108 Transistor
	Q5	99.5144	BC214L Transistor
	Q6	99.5144	BC214L Transistor
	Q7	99.5143	BC108 Transistor
	Q8	99.5143	BC108 Transistor
	Q9	99.5143	BC108 Transistor
	Q10	99.5143	BC108 Transistor

TONE TRANSMITTER TT7812, TT7813, TT7814
TONESENDER

X401.688/2

STORNOPHONE 700
MAINTENANCE MANUAL
MANUAL II
Section 8





VOLTAGE REGULATOR
SPÆNDINGSREGULATOR

VR701

D401.780

Storno

TYPE	NO.	CODE	DATA	
VR701		10.2928	Voltage Regulator	
	C1	74.5167	1 nF -20+80% ceram FT	300 V
	C2	73.5126	4.7 μF 20% tantal	35 V
	C3	73.5151	100 μF -10+50% elco	16 V
	C4	73.5137	470 μF -10+50% elco	16 V
	C5	74.5155	1 nF -20+50% ceram PL	63 V
	C6	76.5071	22 nF 10% polyester FL	50 V
	C7	74.5161	470 pF -20+50%	63 V
	C8	76.5091	0.1 μF 20% polyester FL	100 V
	C9	73.5071	100 μF -10+50% elco	40 V
	C10	73.5150	470 μF -10+50% elco	6 V
	C11	73.5126	4.7 μF 20% tantal	35 V
	C12	74.5167	1 nF -20+80% ceram FT	300 V
	C13	76.5072	47 nF 10% polyest FL	50 V
	C14	76.5072	47 nF 10% polyest FL	50 V
	R1	82.5209	0.27 Ω 10% wire wound	1 W
	R2	80.5231	33 Ω 5% carbon film	1/8 W
	R3	80.5231	33 Ω 5% -	1/8 W
	R4	80.5284	820 KΩ 5% -	1/8 W
	R5	80.5261	10 KΩ 5% -	1/8 W
	R6	80.5237	100 Ω 5% -	1/8 W
	R7	80.5241	220 Ω 5% -	1/8 W
	R8	80.5249	1 KΩ 5% -	1/8 W
	R9	80.5258	5.6 KΩ 5% -	1/8 W
	R10	80.5253	2.2 KΩ 5% -	1/8 W
	R11	86.5058	1 KΩ potentiometer	0.1 W
	R12	80.5254	2.7 KΩ 5% carbon film	1/8 W
	R13	80.5213	1 Ω 5% -	1/8 W
	L1	61.1199	Filter coil 160 μH	
	L2	61.1200	Filter coil 200 μH	
	L3	61.1201	Filter coil 65 μH	
	E1	99.5289	BYX50-200R Diode	
	E2	99.5224	4.7 V 5% Zenerdiode	
	E3	99.5282	5.6 V 5% Zenerdiode	
	Q1	99.5288	BSV64 Transistor	
	Q2	99.5215	2N2905 Transistor	
	Q3	99.5215	2N2905 Transistor	
	IC1	14.5054	LM305 Voltage regulator	

Storno

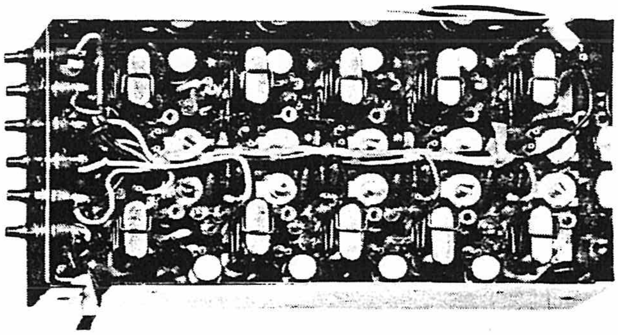
TYPE	NO.	CODE	DATA

VOLTAGE REGULATOR
SPÆNDINGSREGULATOR

VR701

X 401.858

Channel Switching Unit XS701



Description

The oscillator switching unit consists of 5 receiver and 5 transmitter oscillators. For each channel the receiver and transmitter oscillators share a common terminal connection to the channel selector switching arrangement.

The collector resistor for the transmitter oscillator for channel 1, located in the exciter module (EX700), is also common to all of the other transmitter oscillators, channel 2-6, located in the XS701 crystal switching unit.

Similarly, all the receiver oscillators have their collectors working into one common resonant circuit tuned to the 3rd harmonic of the crystal frequency, and located in the 1st local oscillator collector load in the RC700 receiver converter module.

Switching between oscillators is accomplished by returning the oscillator emitter to chassis ground through the switching terminal for the selected channel which, as previously mentioned, is common to both oscillators belonging to that particular channel. The switching terminals for all the oscillators not in use are disconnected, or open.

Technical Specifications

Supply Voltage

9 V

Frequency Range

Receiver:

crystal frequency: 11.2 - 14.7833 MHz

output frequency: 33.6 - 44.35 MHz

Transmitter:

crystal and output frequency: 11.33-14.67 MHz

Temperature Range

-30° to $+80^\circ$C

Oscillator Frequency adjustable by:

$\frac{\Delta f}{f} \geqslant \pm\ 30 \times 10^{-6}$

Frequency Stability

For voltage variations of ±2.5 % at 9 V:

$\frac{\Delta f}{f} \leqslant \pm\ 0.1 \times 10^{-6}$

For temperatures between

-25°C and $+75^\circ$C: $\frac{\Delta f}{f} \leq 2 \times 10^{-6}$

Load Impedances

Receiver loading circuit's input impedance: 1 KΩ // 4.7 pF

Transmitter loading circuit's input impedance: 470Ω // 22 pF

Output Voltage

Receiver: (dependent upon crystal activity) 700 mV

Transmitter: (dependent upon crystal activity) 170 mV

Power Consumption

Transmitter: 4.6 mA

Receiver: 4.3 mA

Crystal Types

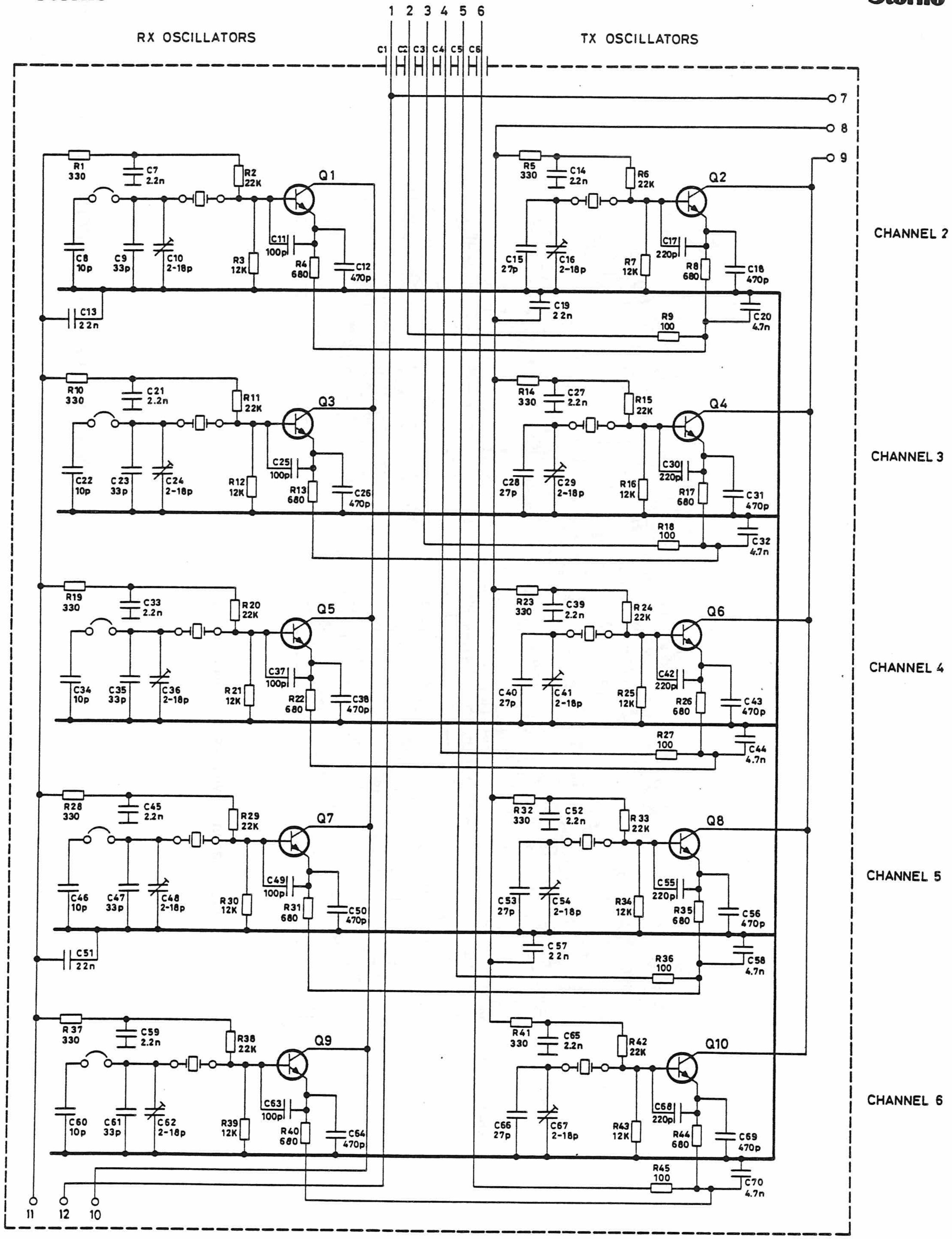
98-12, 98-20 or 98-26

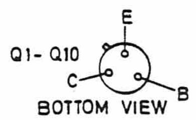
Dimensions

92 x 46 x 25 mm

Storno

Storno

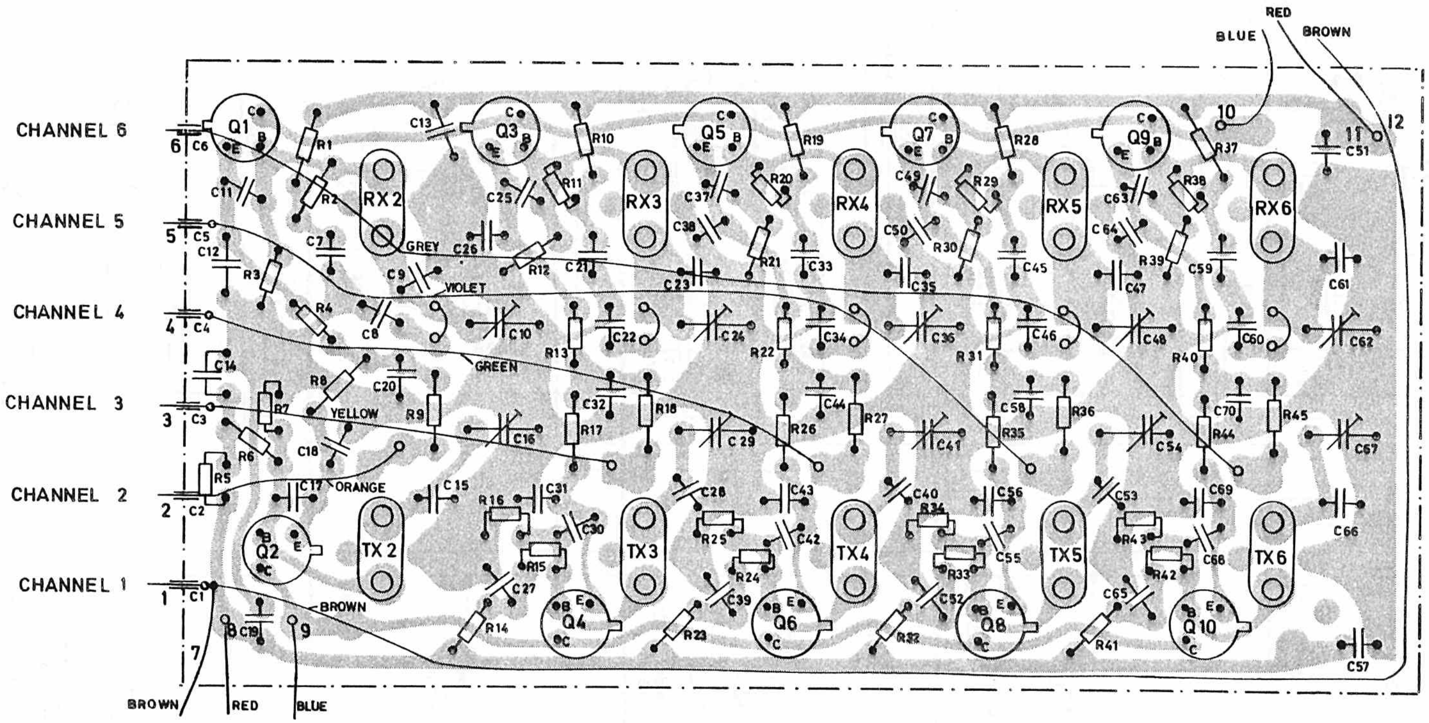




CRYSTAL SWITCH UNIT XS701

D401.328/3

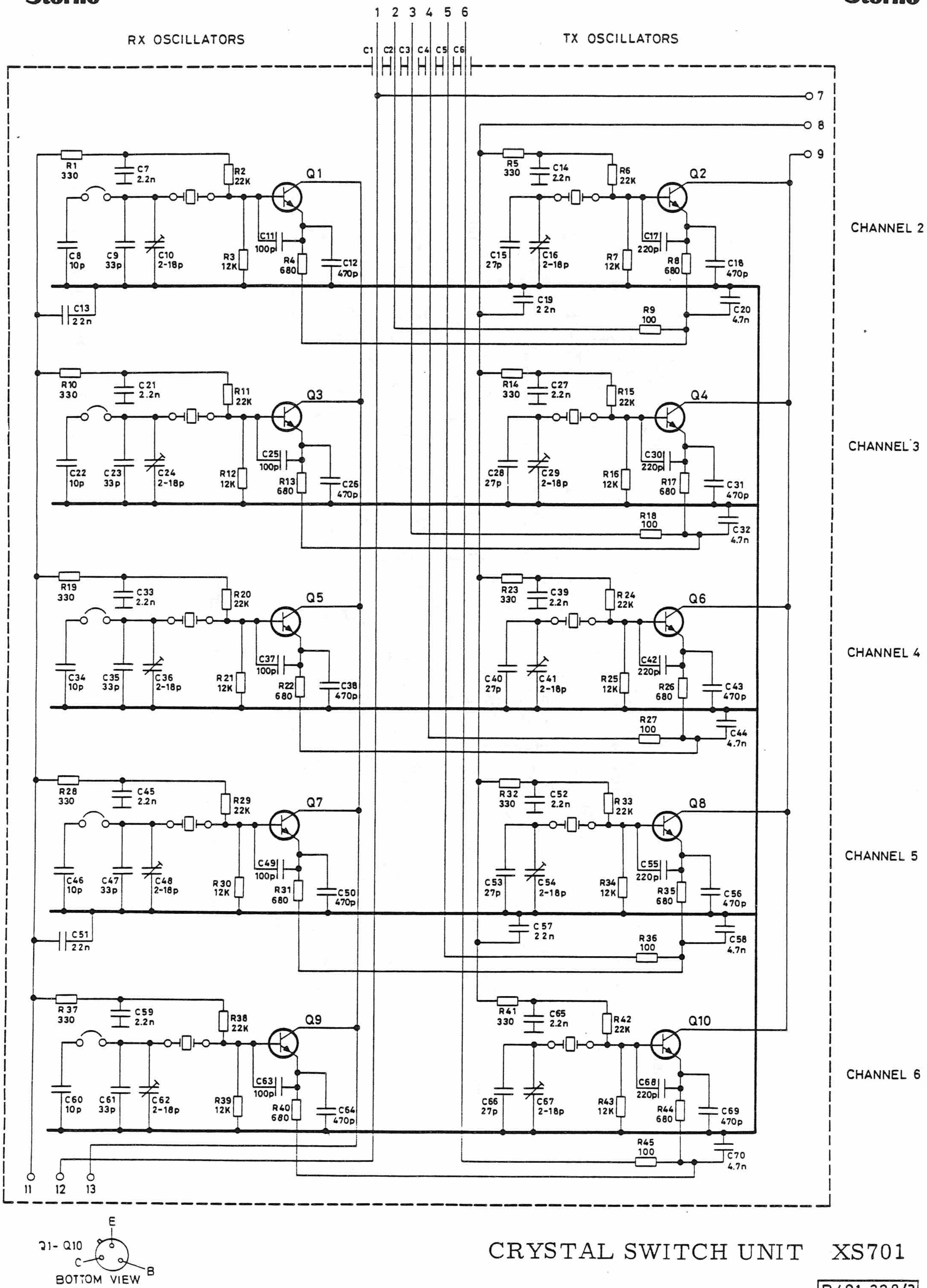
Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

CRYSTAL OSCILLATOR PANEL XS701

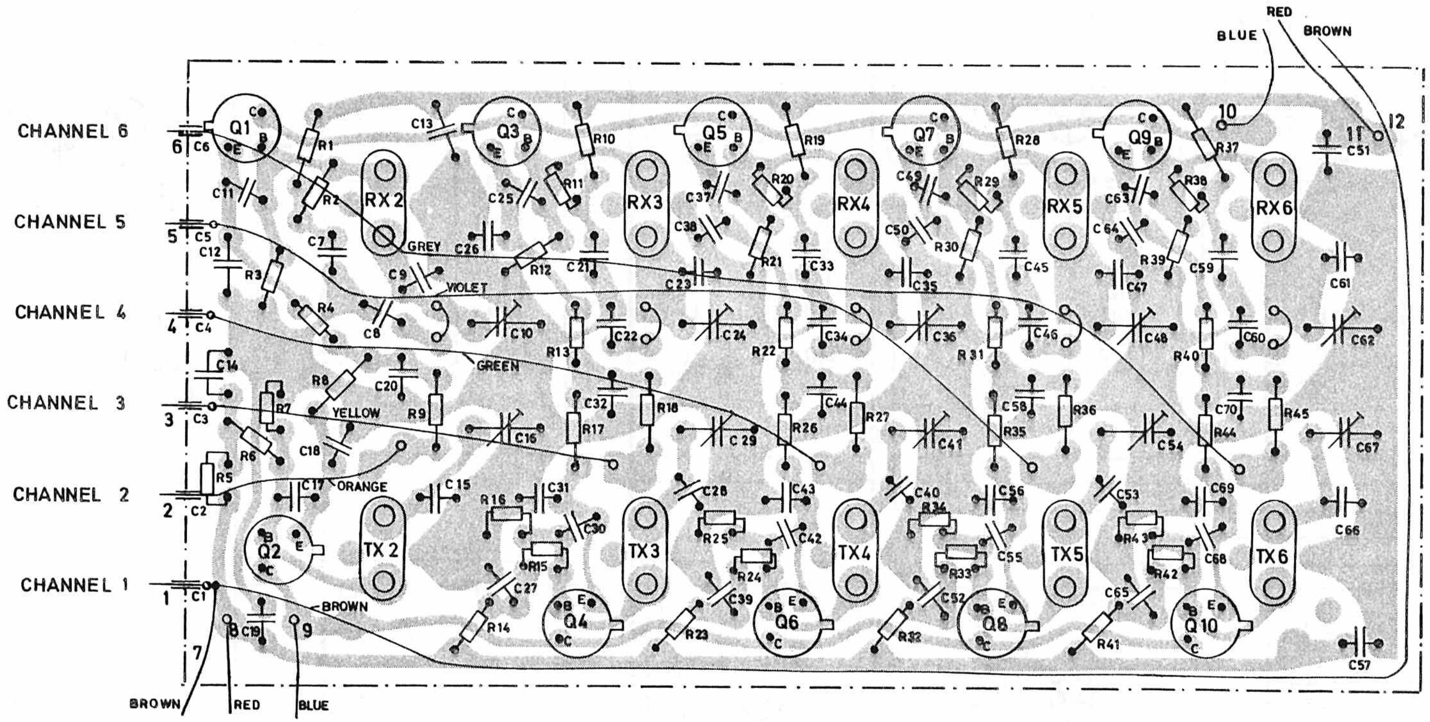
D401.518



CRYSTAL SWITCH UNIT XS701

D401.328/2

Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

CRYSTAL OSCILLATOR PANEL XS701

D401.518

Storno

TYPE	NO.	CODE	DATA	
XS701		10.2436	Crystal Switching Unit	
	C1	74.5167	1 nF -20 +80% ceram FT	300V
	C2	74.5167	1 nF -20 +80% ceram FT	300V
	C3	74.5167	1 nF -20 +80% ceram FT	300V
	C4	74.5167	1 nF -20 +80% ceram FT	300V
	C5	74.5167	1 nF -20 +80% ceram FT	300V
	C6	74.5167	1 nF -20 +80% ceram FT	300V
	C7	76.5059	2.2 nF 10% polyest. FL	50V
	C8	74.5135	10 pF 5% ceram DI	125V
	C9	74.5191	33 pF 5% ceram TB	160V
	C10	78.5044	2-18 pF trimmer	300V
	C11	76.5102	100 pF 2.5% polystyr TB	25V
	C12	76.5106	470 pF 2.5% polystyr TB	25V
	C13	76.5071	22 nF 10% polyest. FL	50V
	C14	76.5059	2.2 nF 10% polyest. FL	50V
	C15	74.5192	27 pF 5% ceram TB	160V
	C16	78.5044	2-18 pF trimmer	300V
	C17	76.5104	220 pF 2.5% polystyr TB	25V
	C18	76.5106	470 pF 2.5% polystyr TB	25V
	C19	76.5071	22 nF 10% polyest. FL	50V
	C20	76.5061	4.7 nF 10% polyest. FL	50V
	C21	76.5059	2.2 nF 10% polyest. FL	50V
	C22	74.5135	10 pF 5% ceram DI	125V
	C23	74.5191	33 pF 5% ceram TB	160V
	C24	78.5044	2-18 pF trimmer	300V
	C25	76.5102	100 pF 2.5% polystyr TB	25V
	C26	76.5106	470 pF 2.5% polystyr TB	25V
	C27	76.5059	2.2 nF 10% polyest. FL	50V
	C28	74.5192	27 pF 5% ceram TB	160V
	C29	78.5044	2-18 pF trimmer	300V
	C30	76.5104	220 pF 2.5% polystyr TB	25V
	C31	76.5106	470 pF 2.5% polystyr TB	25V
	C32	76.5061	4.7 nF 10% polyest. FL	50V
	C33	76.5059	2.2 nF 10% polyest. FL	50V
	C34	74.5135	10 pF 5% ceram DI	125V
	C35	74.5191	33 pF 5% ceram TB	160V
	C36	78.5044	2-18 pF trimmer	300V
	C37	76.5102	100 pF 2.5% polystyr TB	25V
	C38	76.5106	470 pF 2.5% polystyr TB	25V
	C39	76.5059	2.2 nF 10% polyest. FL	50V
	C40	74.5192	27 pF 5% ceram TB	160V
	C41	78.5044	2-18 pF trimmer	300V
	C42	76.5104	220 pF 2.5% polystyr TB	25V
	C43	76.5106	470 pF 2.5% polystyr TB	25V
	C44	76.5061	4.7 nF 10% polyest. FL	50V
	C45	76.5059	2.2 nF 10% polyest. FL	50V
	C46	74.5135	10 pF 10% ceram DI	125V

Storno

TYPE	NO.	CODE	DATA	
	C47	74.5191	33 pF 5% ceram TB	160V
	C48	78.5044	2-18 pF trimmer	300V
	C49	76.5102	100 pF 2.5% polystyr TB	25V
	C50	76.5106	470 pF 2.5% polystyr TB	25V
	C51	76.5071	22 nF 10% polyest. FL	50V
	C52	76.5059	2.2 nF 10% polyest. FL	50V
	C53	74.5192	27 pF 5% ceram TB	160V
	C54	78.5044	2-18 pF trimmer	300V
	C55	76.5104	220 pF 2.5% polystyr TB	25V
	C56	76.5106	470 pF 2.5% polystyr TB	25V
	C57	76.5071	22 nF 10% polyest. FL	50V
	C58	76.5061	4.7 nF 10% polyest. FL	50V
	C59	76.5059	2.2 nF 10% polyest. FL	50V
	C60	74.5135	10 pF 5% ceram DI	125V
	C61	74.5191	33 pF 5% ceram TB	160V
	C62	78.5044	2-18 pF trimmer	300V
	C63	76.5102	100 pF 2.5% polystyr TB	25V
	C64	76.5106	470 pF 2.5% polystyr TB	25V
	C65	76.5059	2.2 nF 10% polyest. FL	50V
	C66	74.5192	27 pF 5% ceram TB	160V
	C67	78.5044	2-18 pF trimmer	300V
	C68	76.5104	220 pF 2.5% polystyr TB	25V
	C69	76.5106	470 pF 2.5% polystyr TB	25V
	C70	76.5061	4.7 nF 10% polyest. FL	50V
	R1	80.5243	330 Ω 5% carbon film	1/8W
	R2	80.5265	22 kΩ 5% " "	1/8W
	R3	80.5262	12 kΩ 5% " "	1/8W
	R4	80.5247	680 Ω 5% " "	1/8W
	R5	80.5243	330 Ω 5% " "	1/8W
	R6	80.5265	22 kΩ 5% " "	1/8W
	R7	80.5262	12 kΩ 5% " "	1/8W
	R8	80.5247	680 Ω 5% " "	1/8W
	R9	80.5237	100 Ω 5% " "	1/8W
	R10	80.5243	330 Ω 5% " "	1/8W
	R11	80.5265	22 kΩ 5% " "	1/8W
	R12	80.5262	12 kΩ 5% " "	1/8W
	R13	80.5247	680 Ω 5% " "	1/8W
	R14	80.5243	330 Ω 5% " "	1/8W
	R15	80.5265	22 kΩ 5% " "	1/8W
	R16	80.5262	12 kΩ 5% " "	1/8W
	R17	80.5247	680 Ω 5% " "	1/8W

CRYSTAL SWITCH UNIT XS701

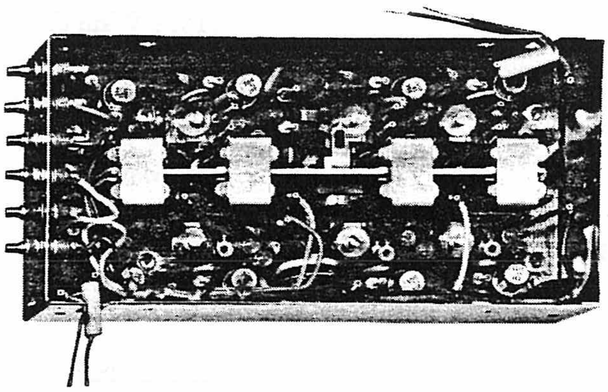
TYPE	NO.	CODE	DATA
	R18	80.5237	100 Ω 5% carbon film 1/8W
	R19	80.5243	330 Ω 5% " " 1/8W
	R20	80.5265	22 kΩ 5% " " 1/8W
	R21	80.5262	12 kΩ 5% " " 1/8W
	R22	80.5247	680 Ω 5% " " 1/8W
	R23	80.5243	330 Ω 5% " " 1/8W
	R24	80.5265	22 kΩ 5% " " 1/8W
	R25	80.5262	12 kΩ 5% " " 1/8W
	R26	80.5247	680 Ω 5% " " 1/8W
	R27	80.5237	100 Ω 5% " " 1/8W
	R28	80.5243	330 Ω 5% " " 1/8W
	R29	80.5265	22 kΩ 5% " " 1/8W
	R30	80.5262	12 kΩ 5% " " 1/8W
	R31	80.5247	680 Ω 5% " " 1/8W
	R32	80.5243	330 Ω 5% " " 1/8W
	R33	80.5265	22 kΩ 5% " " 1/8W
	R34	80.5262	12 kΩ 5% " " 1/8W
	R35	80.5247	680 Ω 5% " " 1/8W
	R36	80.5237	100 Ω 5% " " 1/8W
	R37	80.5243	330 Ω 5% " " 1/8W
	R38	80.5265	22 kΩ 5% " " 1/8W
	R39	80.5262	12 kΩ 5% " " 1/8W
	R40	80.5247	680 Ω 5% " " 1/8W
	R41	80.5243	330 Ω 5% " " 1/8W
	R42	80.5265	22 kΩ 5% " " 1/8W
	R43	80.5262	12 kΩ 5% " " 1/8W
	R44	80.5247	680 Ω 5% " " 1/8W
	R45	80.5237	100 Ω 5% " " 1/8W
	Q1	99.5139	BSX19 Transistor
	Q2	99.5139	BSX19 "
	Q3	99.5139	BSX19 "
	Q4	99.5139	BSX19 "
	Q5	99.5139	BSX19 "
	Q6	99.5139	BSX19 "
	Q7	99.5139	BSX19 "
	Q8	99.5139	BSX19 "
	Q9	99.5139	BSX19 "
	Q10	99.5139	BSX19 "

Storno

TYPE	NO.	CODE	DATA

CRYSTAL SWITCH UNIT XS701

Channel Switching Unit XS702



Description

The oscillator switching unit consists of 4 receiver and 4 transmitter oscillators. For each channel the receiver and transmitter oscillators are physically placed right across from each other on the circuit board, and both oscillators share a common terminal connection to the channel selector switching arrangement.

To compensate for crystal frequency drift at low temperatures, the circuit is arranged so that a transistor-driven common heating element is in thermal contact with all eight crystals.

Regulating Circuit

The regulating circuit is controlled by an NTC resistor which has thermal contact with the heating element. When the resistance of the NTC resistor reaches a value of approx. 6 KΩ, transistor Q9 will conduct. Q9 then drives Q10 into conduction. The current through Q10 heats the metal rail heating element. Heating the rail causes the resistance of the NTC resistor to decrease. In this manner the temperature of the heating rail is regulated to approx. -5°C when the ambient temperature drops below that figure. The maximum current through Q10 can be preset by means of R39.

The Oscillators

A collector resistor in the EX700 exciter module is common to all four transmitter oscillator collectors. Similarly, all four receiver oscillators have their collectors working into one common resonant circuit tuned to the 3rd harmonic of the crystal frequency, and located in the RC700 receiver converter module.

Switching between oscillators is accomplished by returning the oscillator emitter to chassis ground through the switching terminal for the selected channel which, as previously mentioned, is common to both oscillators belonging to that particular channel. The switching terminals for all the oscillators not in use are disconnected , or open.

During transmit, the transmitter oscillators not in use can pass no spurious currents and thus will not oscillate. With their emitter returns open, the idle transmitter oscillators are effectively held at cut-off by the emitter-base diodes of their related receiver oscillators.

Likewise, during receive, the transmitter oscillators will cut off the idle receiver local oscillators.

Technical Specifications

Supply Voltage

Oscillators +9 V

Regulating Circuit +9V and +13.6 V

Frequency Range

Receiver

crystal frequency 11.2-14.78333 MHz

output frequency 33.6-44.35 MHz

Transmitter

crystal and output frequency 11.33-14.67 MHz

Storno

Temperature Range

-30°C to +80°C

Oscillator Frequency adjustable by

$\frac{\Delta f}{f}$ ± 30 x 10^{-6}

Frequency Stability

For voltage variations of ± 2.5% at 9 V

$\frac{\Delta f}{f}$ ± 0.1 x 10^{-6}

For temperatures between -30°C to +70°C with crystal types 98-20 or 98-26:

$\frac{\Delta f}{f}$ 5 x 10^{-6}

Load Impedances

Receiver: loading circuit's input impedance: 1 KΩ// 4.7 pF

Transmitter: loading circuit's input impedance: 470Ω// 220 pF

Output Voltage

Receiver: (dependent upon crystal acticity) 700 mV

Transmitter: (dependent upon crystal acticity) 170 mV

Power Consumption

+9 V supply

Transmitter: 5.3 mA

Receiver: 5.6 mA

+13.6 V supply

For temperatures > ca. -5°C: 1 mA

For temperatures from ca. -5°C to -30°C the current rises practically linearly as ambient temperatures falls.

At +13.6 V and -10°C: 130 mA

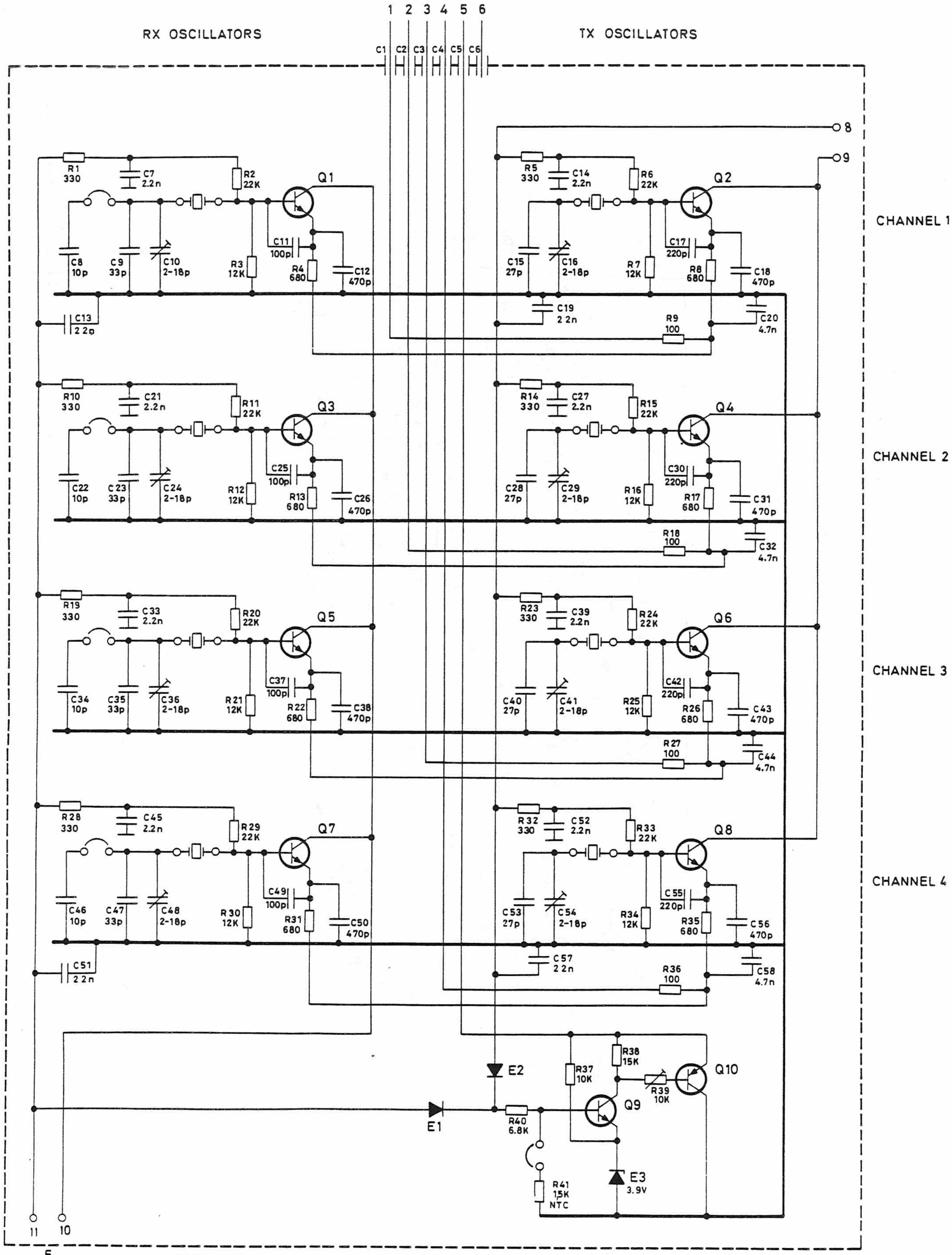
Crystal Types

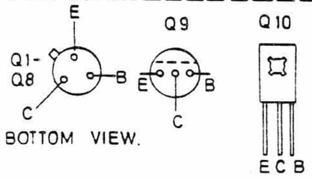
98-20 or 98-26

Dimensions

92 x 46 x 25 mm

Storno

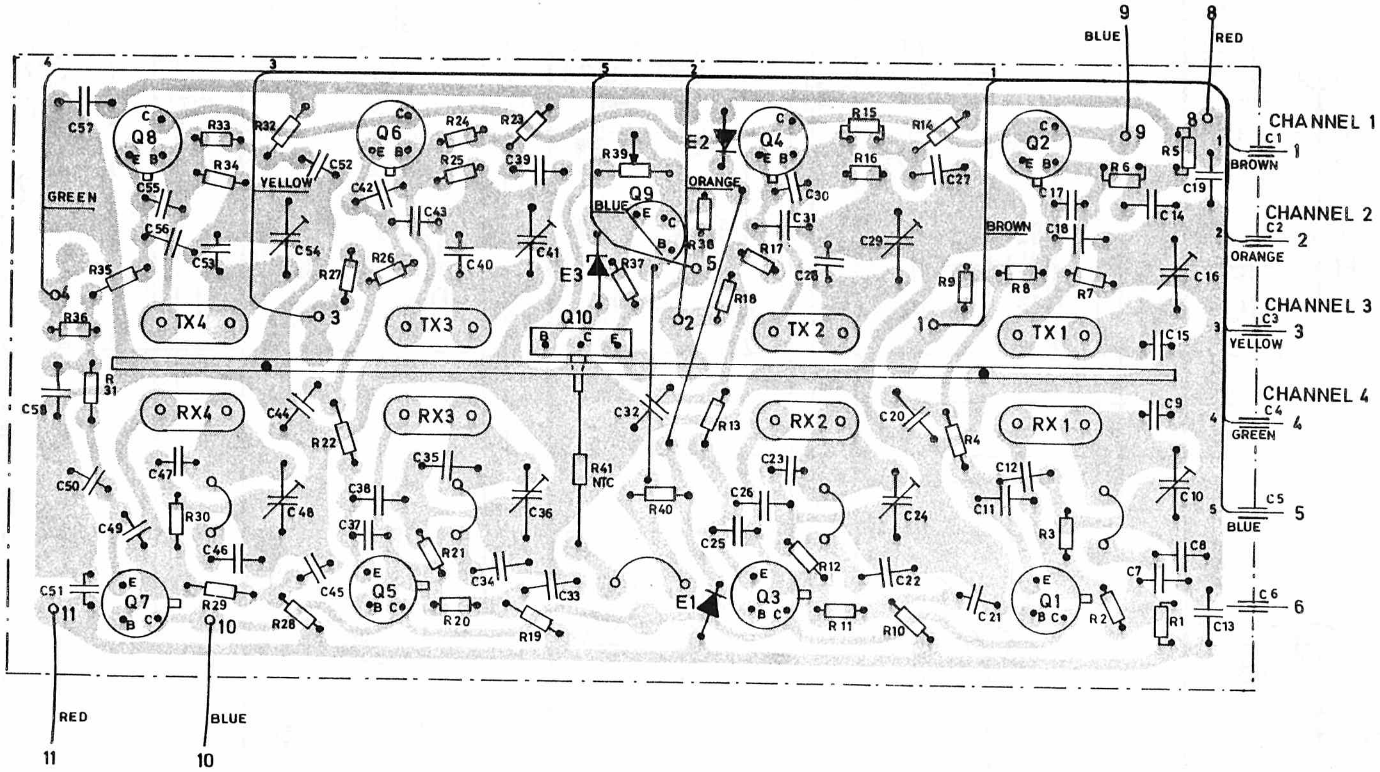




CRYSTAL SWITCH UNIT XS702

D 401.329/2

Storno



PRINTED CIRCUIT VIEWED FROM COMPONENT SIDE

CRYSTAL OSCILLATOR PANEL XS702

D401.517

Storno

TYPE	NO.	CODE	DATA	
XS702		10.2437	Crystal Switch Unit	
	C1	74.5167	1 nF -20 +80% ceram FT	300V
	C2	74.5167	1 nF -20 +80% ceram FT	300V
	C3	74.5167	1 nF -20 +80% ceram FT	300V
	C4	74.5167	1 nF -20 +80% ceram FT	300V
	C5	74.5167	1 nF -20 +80% ceram FT	300V
	C6	74.5167	1 nF -20 +80% ceram FT	300V
	C7	76.5059	2.2 nF 10% polyest. FL	50V
	C8	74.5135	10 pF 5% ceram DI	125V
	C9	74.5191	33 pF 5% ceram TB	160V
	C10	78.5044	2-18 pF trimmer	300V
	C11	76.5102	100 pF 2.5% polystyr TB	25V
	C12	76.5106	470 pF 2.5% polystyr TB	25V
	C13	76.5071	22 nF 10% polyest. FL	50V
	C14	76.5059	2.2 nF 10% polyest. FL	50V
	C15	74.5192	27 pF 5% ceram TB	160V
	C16	78.5044	2-18 pF trimmer	300V
	C17	76.5104	220 pF 2.5% polystyr TB	25V
	C18	76.5106	470 pF 2.5% polystyr TB	25V
	C19	76.5071	22 nF 10% polyest. FL	50V
	C20	76.5061	4.7 nF 10% polyest. FL	50V
	C21	76.5059	2.2 nF 10% polyest. FL	50V
	C22	74.5135	10 pF 5% ceram DI	125V
	C23	74.5191	33 pF 5% ceram TB	160V
	C24	78.5044	2-18 pF trimmer	300V
	C25	76.5102	100 pF 2.5% polystyr TB	25V
	C26	76.5106	470 pF 2.5% polystyr TB	25V
	C27	76.5059	2.2 nF 10% polyest. FL	50V
	C28	74.5192	27 pF 5% ceram TB	160V
	C29	78.5044	2-18 pF trimmer	300V
	C30	76.5104	220 pF 2.5% polystyr TB	25V
	C31	76.5106	470 pF 2.5% polystyr TB	2.5%
	C32	76.5061	4.7 nF 10% polyest. FL	50V
	C33	76.5059	2.2 nF 10% polyest. FL	50V
	C34	74.5135	10 pF 5% ceram DI	125V
	C35	74.5191	33 pF 5% ceram TB	160V
	C36	78.5044	2-18 pF trimmer	300V
	C37	76.5102	100 pF 2.5% polystyr TB	25V
	C38	76.5106	470 pF 2.5% polystyr TB	25V
	C39	76.5059	2.2 nF 10% polyest. FL	50V
	C40	74.5192	27 pF 5% ceram TB	160V
	C41	78.5044	2-18 pF trimmer	300V
	C42	76.5104	220 pF 2.5% polystyr TB	25V
	C43	76.5106	470 pF 2.5% polystyr TB	25V
	C44	76.5061	4.7 nF 10% polyest. FL	50V
	C45	76.5059	2.2 nF 10% polyest. FL	50V
	C46	74.5135	10 pF 5% ceram DI	125V

Storno

TYPE	NO.	CODE	DATA	
	C47	74.5191	33 pF 5% ceram TB	160V
	C48	78.5044	2-18 pF trimmer	300V
	C49	76.5102	100 pF 2.5% polystyr TB	25V
	C50	76.5106	470 pF 2.5% polystyr TB	25V
	C51	76.5071	22 nF 10% polyest. FL	50V
	C52	76.5059	2.2 nF 10% polyest. FL	50V
	C53	74.5192	27 pF 5% ceram TB	160V
	C54	78.5044	2-18 pF trimmer	300V
	C55	76.5104	220 pF 2.5% polystyr TB	25V
	C56	76.5106	470 pF 2.5% polystyr TB	25V
	C57	76.5071	22 nF 10% polyest. FL	50V
	C58	76.5061	4.7 nF 10% polyest. FL	50V
	R1	80.5243	330 Ω 5% carbon film	1/8W
	R2	80.5265	22 kΩ 5% " "	1/8W
	R3	80.5262	12 kΩ 5% " "	1/8W
	R4	80.5247	680 Ω 5% " "	1/8W
	R5	80.5243	330 Ω 5% " "	1/8W
	R6	80.5265	22 kΩ 5% " "	1/8W
	R7	80.5262	12 kΩ 5% " "	1/8W
	R8	80.5247	680 Ω 5% " "	1/8W
	R9	80.5237	100 Ω 5% " "	1/8W
	R10	80.5243	330 Ω 5% " "	1/8W
	R11	80.5265	22 kΩ 5% " "	1/8W
	R12	80.5262	12 kΩ 5% " "	1/8W
	R13	80.5247	680 Ω 5% " "	1/8W
	R14	80.5243	330 Ω 5% " "	1/8W
	R15	80.5265	22 kΩ 5% " "	1/8W
	R16	80.5262	12 kΩ 5% " "	1/8W
	R17	80.5247	680 Ω 5% " "	1/8W
	R18	80.5237	100 Ω 5% " "	1/8W
	R19	80.5243	330 Ω 5% " "	1/8W
	R20	80.5265	22 kΩ 5% " "	1/8W
	R21	80.5262	12 kΩ 5% " "	1/8W
	R22	80.5247	680 Ω 5% " "	1/8W
	R23	80.5243	330 Ω 5% " "	1/8W
	R24	80.5265	22 kΩ 5% " "	1/8W
	R25	80.5262	12 kΩ 5% " "	1/8W
	R26	80.5247	680 Ω 5% " "	1/8W
	R27	80.5237	100 Ω 5% " "	1/8W
	R28	80.5243	330 Ω 5% " "	1/8W
	R29	80.5265	22 kΩ 5% " "	1/8W

CRYSTAL SWITCH UNIT XS702

TYPE	NO.	CODE	DATA	
	R30	80.5262	12 kΩ 5% carbon film	1/8W
	R31	80.5247	680 Ω 5% " "	1/8W
	R32	80.5243	330 Ω 5% " "	1/8W
	R33	80.5265	22 kΩ 5% " "	1/8W
	R34	80.5264	12 kΩ 5% " "	1/8W
	R35	80.5247	680 Ω 5% " "	1/8W
	R36	80.5237	100 Ω 5% " "	1/8W
	R37	80.5261	10 kΩ 5% " "	1/8W
	R38	80.5263	15 kΩ 5% " "	1/8W
	R39	86.5068	10 kΩ 20% potentiometer	0.5W
	R40	80.5259	6.8 kΩ 5% carbon film	1/8W
	R41	89.5060	1.5 kΩ 5% NTC	0.5W
	E1	99.5028	1N914 Diode	
	E2	99.5028	1N914 Diode	
	E3	99.5225	Zenerdiode 3.9V 5%	1/4W
	Q1	99.5139	BSX19 Transistor	
	Q2	99.5139	BSX19 Transistor	
	Q3	99.5139	BSX19 Transistor	
	Q4	99.5139	BSX19 Transistor	
	Q5	99.5139	BSX19 Transistor	
	Q6	99.5139	BSX19 Transistor	
	Q7	99.5139	BSX19 Transistor	
	Q8	99.5139	BSX19 Transistor	
	Q9	99.5117	2N2924 Transistor	
	Q10	99.5236	BD136 Transistor	

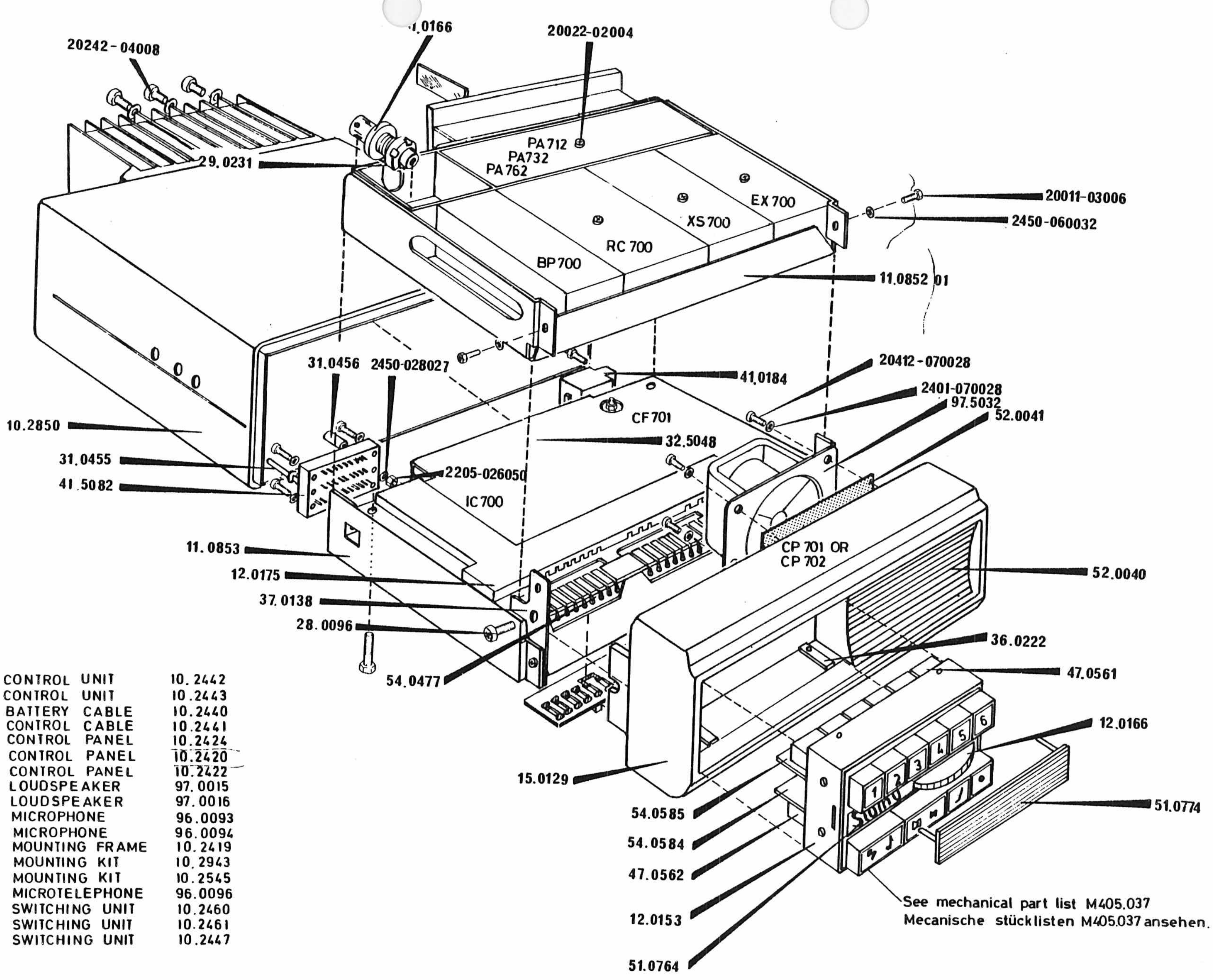
Storno

TYPE	NO.	CODE	DATA

CRYSTAL SWITCH UNIT XS702

TITLE		Code
CQM700-25/15	Mech. picture	M405.049
CQM700D	Mech. picture	M405.048/4
CQM713P3	Mech. picture	M405.080
CA701	Mech. picture	M405.030
	Part List	M405.030-2/2
	Part List	M405.030-3
CB700, CP700	Mech. picture	M405.037/2
	Part List	M405.037-2/2
	Part List	M405.037-3/2
CB704	Mech. picture	M405.047/3
CB705	Mech. picture	M405.078
CB2706	Lay-out	M405.055
CB706	Mech. Lay-out	M405-087
CC703	Mech. picture	M405.040/2
CC704	Mech. picture	M405.046/3
MC701-MK704	Mech. picture	M405.035/2
MC702-JB701	Mech. picture	M405.034/2
MC703	Mech. picture	M405.082
MC704	Mech. picture	M405.089
LS701	Mech. picture	M405.039/2
MK701	Mech. picture	M405.032/3
MN701	Mech. picture	M405.033/3
MT701-HS602a	Mech. picture	M405.041/2
MT703	Mech. picture	M405.081
MT704	Mech. picture	M405.085
PS701	Mech. picture	M405.045
	Part List	M405.045/2
PS701 connector	Mech. picture	M405.043/2
	Part List	M405.043/2
SU703	Mech. picture	M405.042/2

Storno

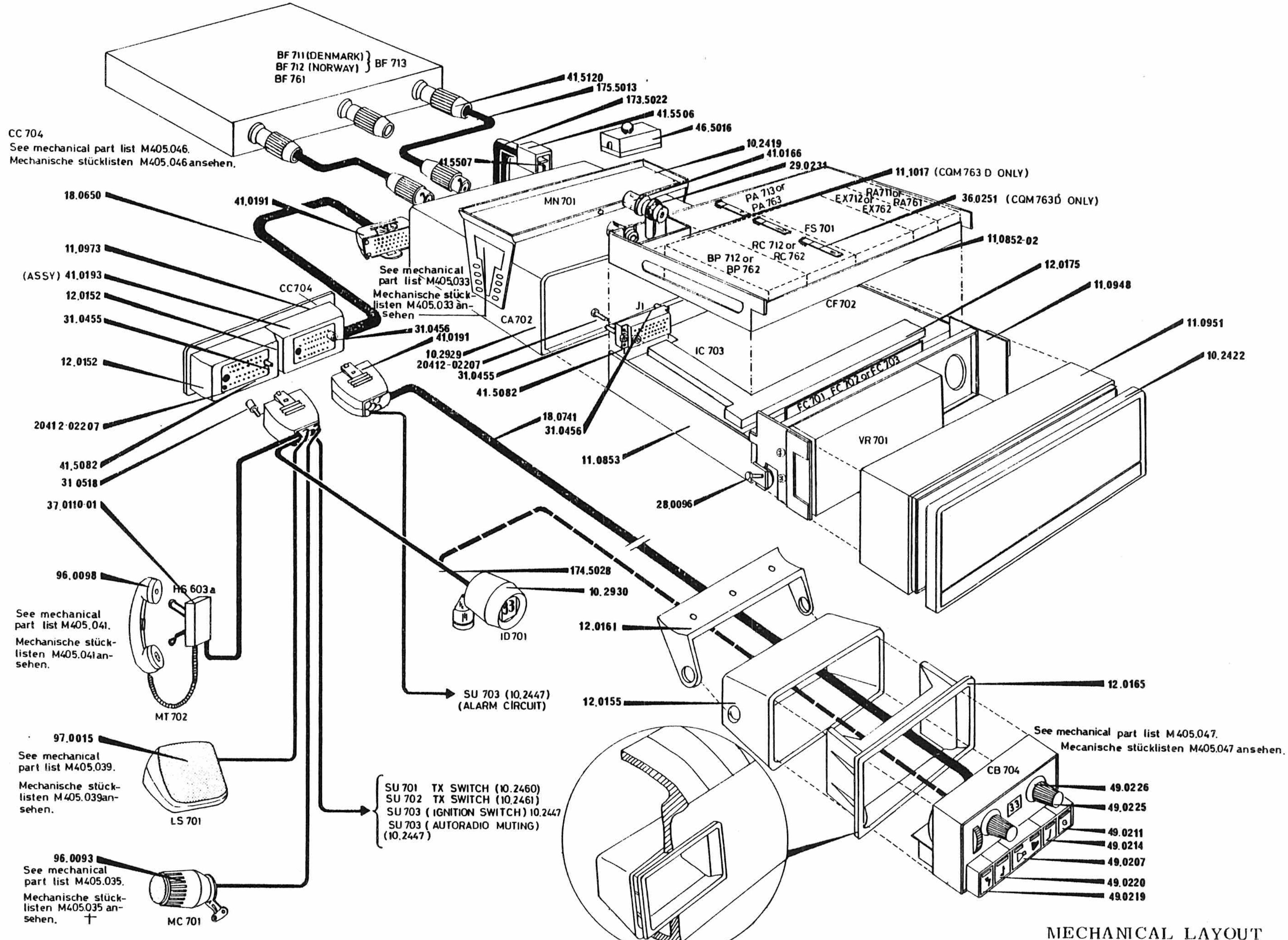


CB 701	CONTROL UNIT	10.2442
CB 702	CONTROL UNIT	10.2443
CC 701	BATTERY CABLE	10.2440
CC 703	CONTROL CABLE	10.2441
CP 701	CONTROL PANEL	10.2424
CP 702	CONTROL PANEL	10.2420
CP 703	CONTROL PANEL	10.2422
LS 701	LOUDSPEAKER	97.0015
LS 702	LOUDSPEAKER	97.0016
MC 701	MICROPHONE	96.0093
MC 702	MICROPHONE	96.0094
MN 701	MOUNTING FRAME	10.2419
MK 702	MOUNTING KIT	10.2943
MK 704	MOUNTING KIT	10.2545
MT 701	MICROTELEPHONE	96.0096
SU 701	SWITCHING UNIT	10.2460
SU 702	SWITCHING UNIT	10.2461
SU 703	SWITCHING UNIT	10.2447

MECHANICAL PART LIST
MECANISCHE STÜCKLISTEN

CQM700-25/15 W

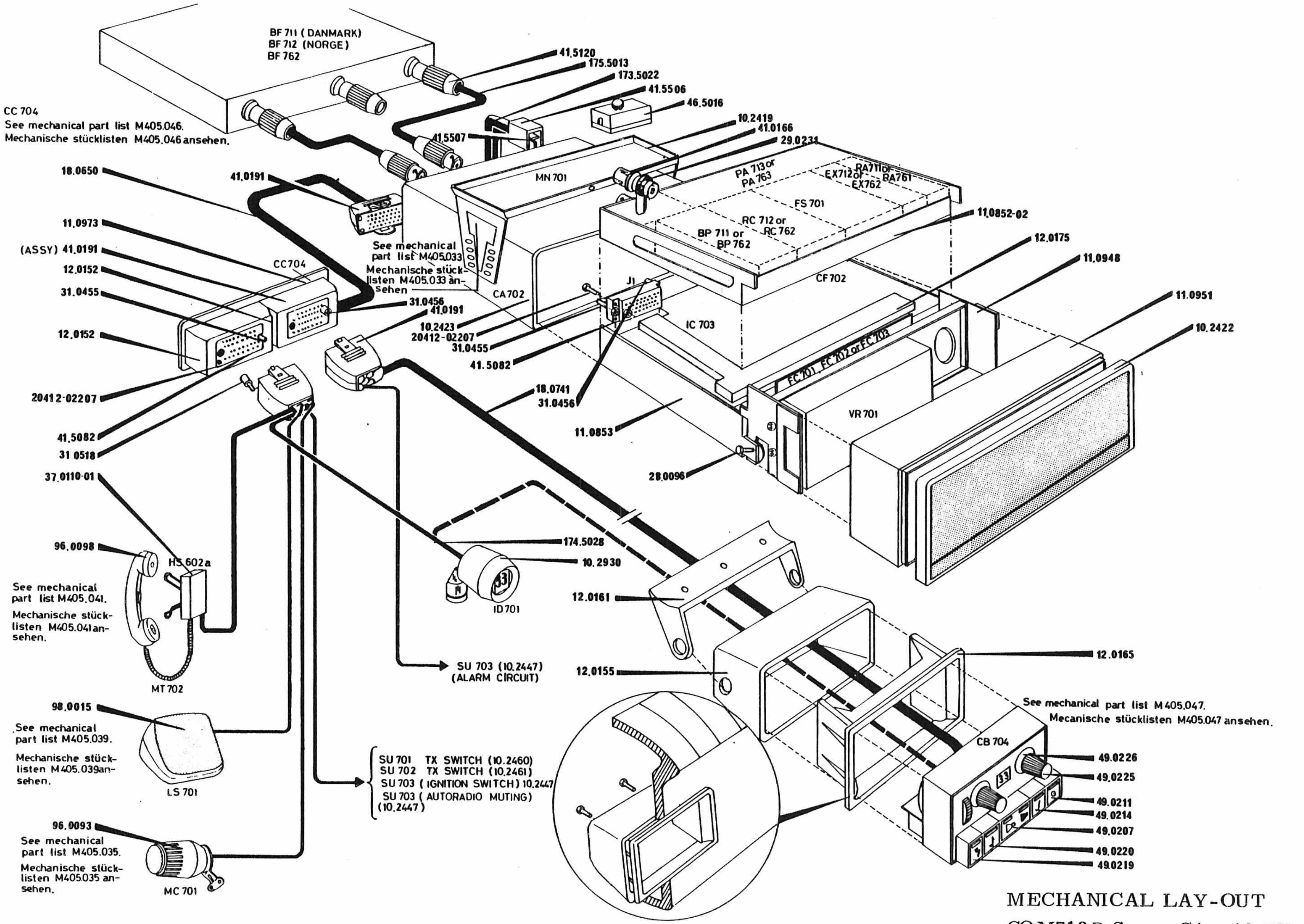
M405.049



MECHANICAL LAYOUT

CQM713 D Spec. C4 x 49 DK
CQM713 D Spec. C4 x 46 N
CQM763 D Spec. C4 x 80 S
CQM763 D Spec. C4 x 80 DK

M405.048/4

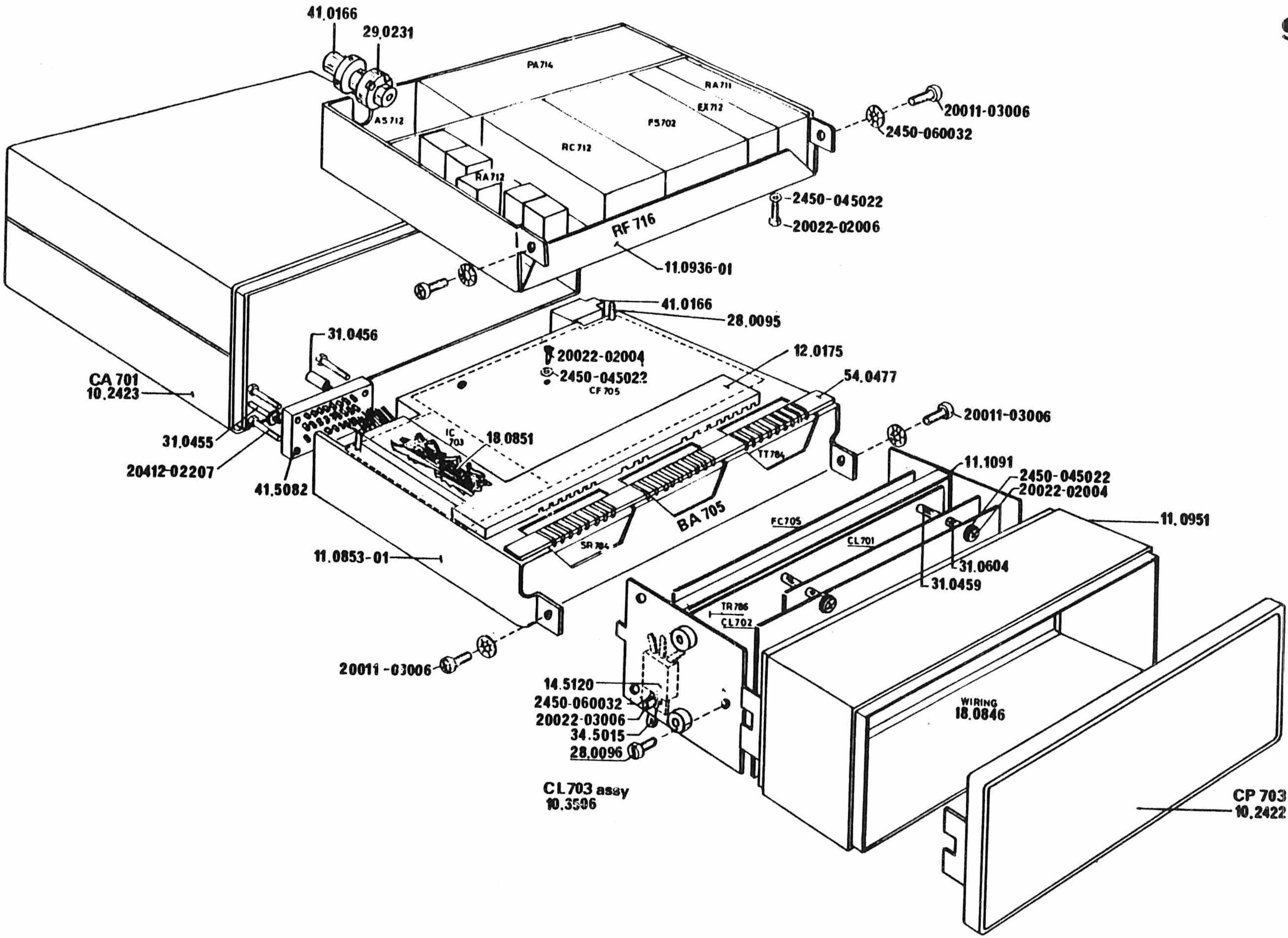


MECHANICAL LAY-OUT

CQM713D Spec. C4 x 49 DK
CQM713D Spec. C4 x 32 N
CQM763D Spec. C4 x 80 S

M405.048

Storno



Storno

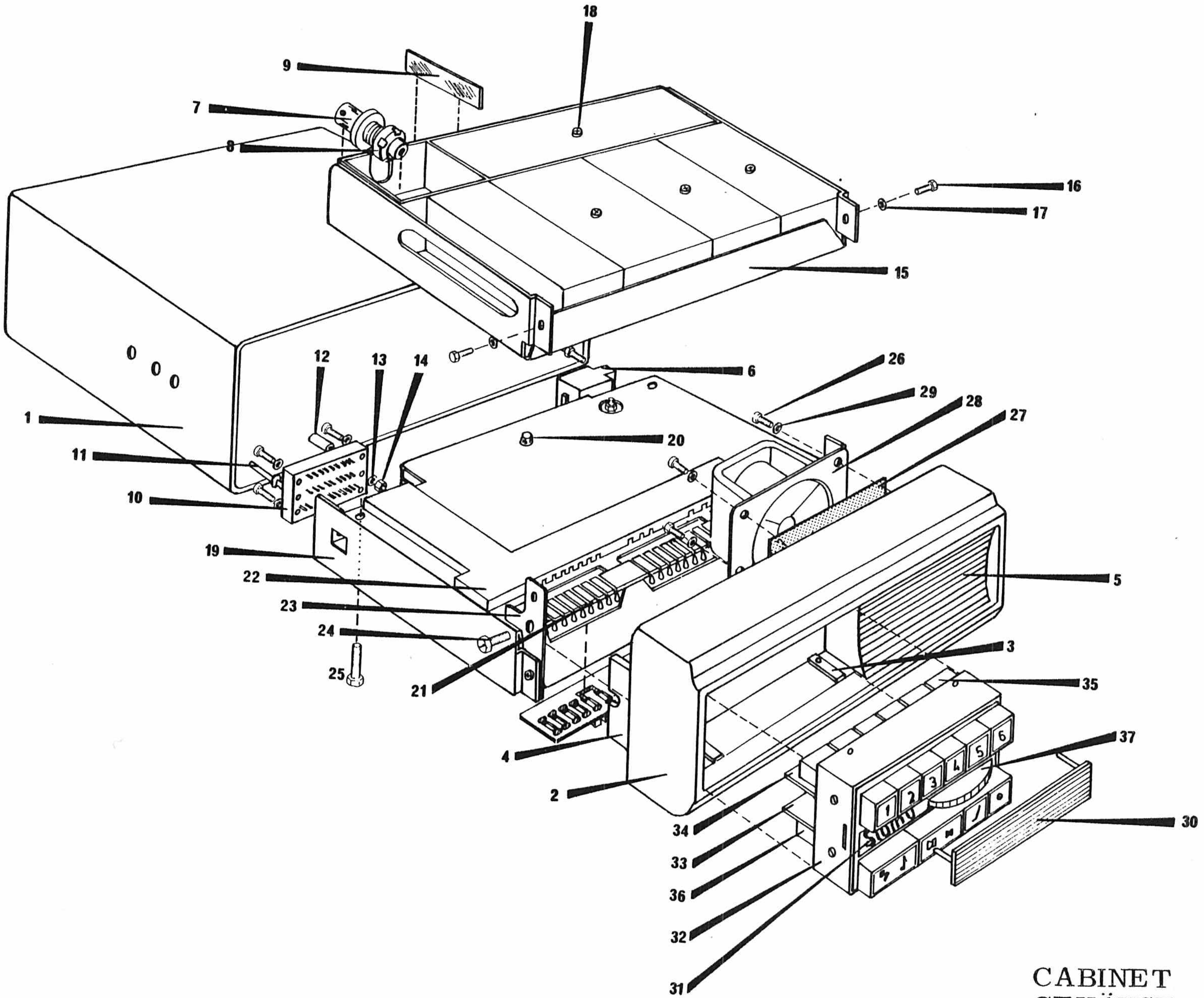
RADIOTELEPHONE

MECHANICAL LAY OUT

CQM713 P3

M405080

Storno



CABINET
GEHÄUSE

CA701

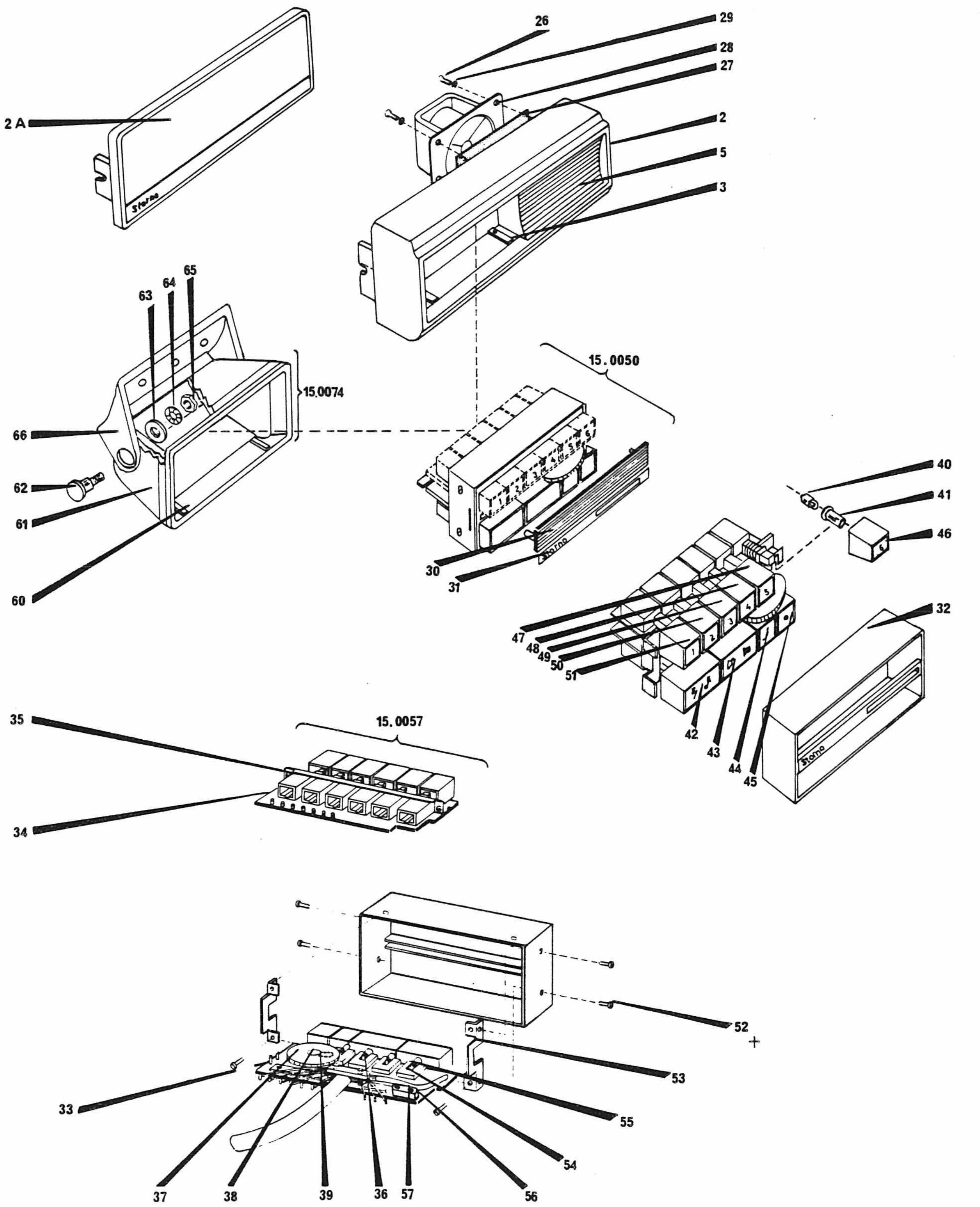
M405.030

ITEM	CODE	DESCRIPTION
1.	10.2423	CA701 Cabinet with item 9 CA701 Kabinet med Pos 9
2.	15.0129	Frame: Front (rivetted to Pos. 4) Forramme monteret med pos. 4
3.	36.0222	Retaining spring: Push button Ass. Fjeder for CP701/CP702
4.	33.0370	Bracket: Front Panel Plade for sammenspænding
5.	52.0040	Grill: Loudspeaker Pynteplade for højtaler
6.	41.0184	Connector: 12V Konnektor for 12V
7.	41.0166	Connector: Antenna Konnektor for antenne
8.	29.0231	Nut.: Position 7 Møtrik for Pos. 7
9.	12.0164	Shield: Plexiglas Dækplade for type nr.
10.	41.5082	Connector: 34 PIN Konnektor: 34 pol
11.	31.0455	PIN: Guide Styretap for pos. 10
12.	31.0456	Bush: Guide Styrebøsning for 10
13.	2450-048027	Spring washer Fjederskive
14.	2205-026050	Nut Møtrik
15.	11.0852-01	Chassis Chassis for RF700
16.	20011-03006	Retaining screw Skrue for pos. 15
17.	2450-060032	Lock washer Spændskive
18.	20022-02004	Retaining screw Skrue
19.	11.0853	Chassis Chassis for BA700
20.	32.5048	Bumper: Black Rubber Afstandsstykke gummi
21.	54.0477	Terminal Board Tilslutningsliste
22.	12.0175	Guide: Cable Asembly (Grey plastic) Kablingsholder (grå plastik)
23.	37.0138	Hinge: Chassis Sammenspændingsbøjle

CABINET
KABINET CA701

ITEM	CODE	DESCRIPTION
24.	28.0096	Retaining screw: Hinge Skrue
25.	28.0095	Retaining screw: BA Skrue for BA-bund
26.	20.412-02207	Retaining screw: Loudspeaker Skrue for højttaler
27.	52.0041	Dust cover Beskyttelsesnet
28.	97.5032	Loudspeaker 5Ω 2 Watt Højttaler 5Ω 2 Watt
29.	2401-070028	Washer Skive
30.	51.0774	Front plate: Blank (only CP701) Pynteplade (kun i CP701)
31.	51.0764	Label "STORNO" Skilt "STORNO"
32.	12.0153	Frame: Push button Ramme for betjeningspanel
33.	54.0585	Terminal Board: Push Button Ass. Lederplade for tast/tone
34.	54.0584	Terminal Board: Channel switch Lederplade for kanalomskifter
35.	47.0562	Switch ass.: Push button (Channel switch) Omskifterenhed: Kanalomskifter
36.	47.0561	Switch ass.: Push button (Tone-on/off) Omskifterenhed: Tast/tone
37.	12.0166	Knob: Volume Control Knap: Volumenkontrol
	10.2560	TB701 Terminal Board: Shorting Strap long Kortslutningsprint, lang (See note 1)
	10.2561	TB702 Terminal Board: Shorting Strap short Kortslutningspring, kort (See note 2)
		Note 1 If the radio equipment is not provided with tone/transmitter, a terminal board shorting strap TB701 should be mounted on the terminal board 54.0477.
		Note 2 If the radio equipment is not provided with tone/receiver, a terminal board shorting strap TB702 should be mounted on the terminal board 54.0477.

CABINET
KABINET CA701

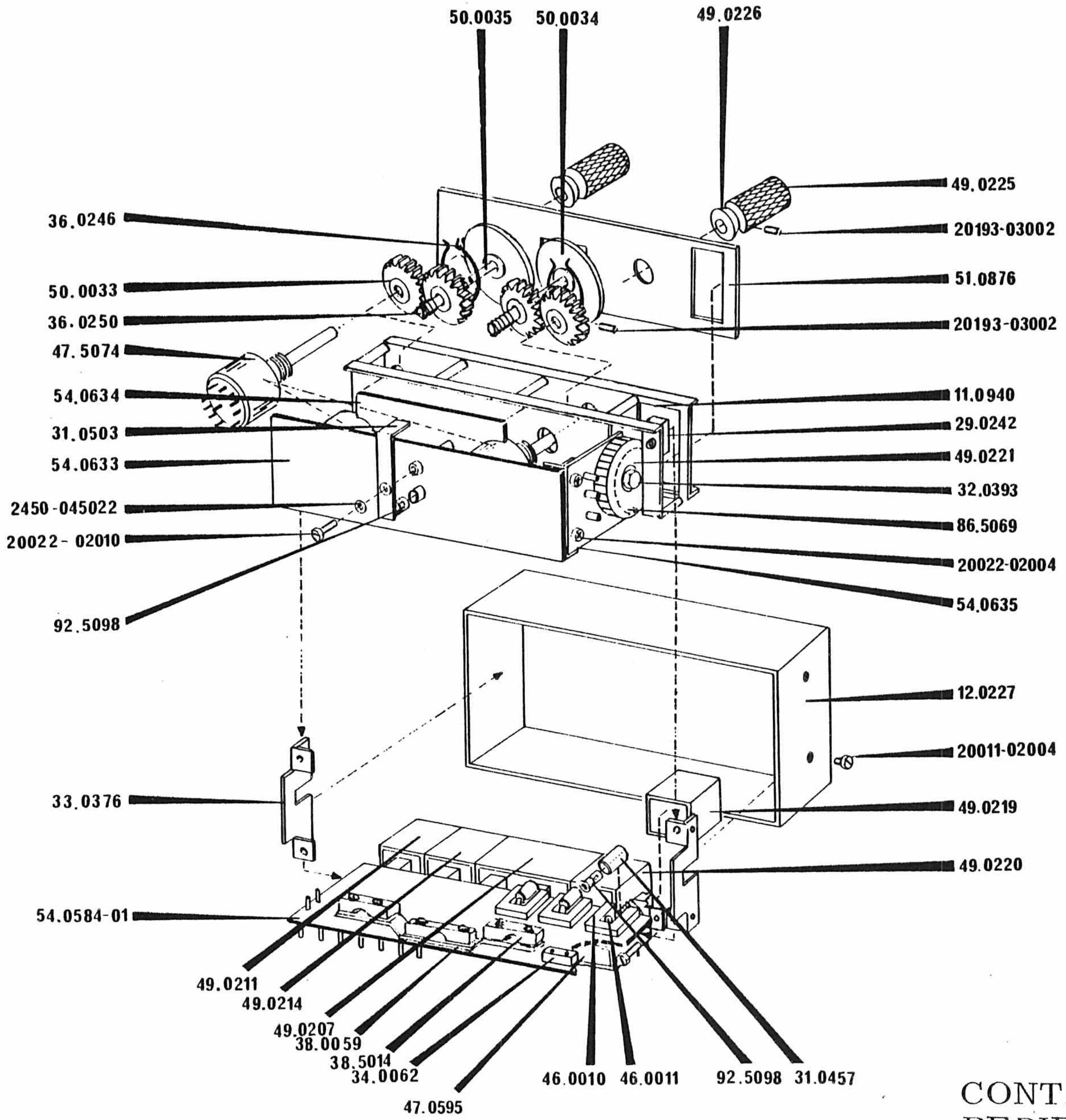


CONTROL UNITS CQM700
BEDIENGERÄTE (CB700, CP700)

ITEM	CODE	DESCRIPTION
	15.0050	Control Panel Complete (1 Channel) Betjeningspanel komplet (1 kanal)
	15.0057	Switch Unit Omskifter enhed
2.	15.0129	Frame: Front Forramme
2A	10.2422	Front Plate CP703 Forplade CP703
3.	36.0222	Retaining spring: Push button Ass. Fjeder for CP701/CP702
5.	52.0040	Grill: Loudspeaker Pynteplade for højttaler
26.	20.412-02207	Retaining screw: Loudspeaker Skrue for højttaler
27.	52.0041	Dust cover Beskyttelsesnet
28.	97.5032	Loudspeaker 5Ω 2 Watt Højttaler 5Ω 2 Watt
29.	2401-070028	Washer Skive
30.	51.0774	Front plate (only CP701) Pynteplade (kun i CP701)
31.	51.0764	Label "STORNO" Skilt "STORNO"
32.	12.0153	Frame: Push Button Ramme for betjeningspanel
33.	54.0584	Wiring Board: Push Button Ass. Lederplade for tast/tone
34.	54.0585	Wiring Board: Channel Switch Lederplade for kanalomskifter
35.	47.0562	Switch Ass: Push Button Ass. Channel Switch Omskifterenhed: Kanalomskifter
36.	47.0561	Switch Ass: Push Button (Tone On/Off) Omskifterenhed for tast/tone
37.	12.0166	Knob: Volume Control Knap for volumenkontrol
38.	86.5069	Potentiometer 5K Log. Potentiometer 5K Log.
39.	32.0393	Spring: Contact (Pos. 38) Fjeder for pos. 38
40.	92.5098	Incandescent Lamp 12V 0.06A Lampe 12V 0.06A
41.	31.0457	Bush (Pos. 40) Bøsning for pos. 40
42.	49.0208	Knob: Tone Knap: Tast/tone
43.	49.0207	Knob: Loudspeaker Knap: Højttaler
44.	49.0214	Knob: Squelch Knap: Squelch
45.	49.0211	Knob: On/Off Knap: Afbryder
46.	49.0216	Knob: Channel 6 Knap: Kanal 6
47.	49.0213	Knob: Channel 5 Knap: Kanal 5

ITEM	CODE	DESCRIPTION
48.	49.0210	Knob: Channel 4 Knap: Kanal 4
49.	49.0215	Knob: Channel 3 Knap: Kanal 3
50.	49.0212	Knob: Channel 2 Knap: Kanal 2
51.	49.0209	Knob: Channel 1 Knap: Kanel 1
52.	20011-02004	Screw Skrue
53.	33.0376	Bracket Bøjle for sammenspænding
54.	46.0010	Lamp Socket Lampeholder
55.	46.0011	Lamp Contact Lampe Kontakt
56.	39.0019	Connector 2 Pin Kontaktholder
57.	34.0062	Connector Pin Konnektor bøsning
60.	12.0165	Chassis ass. Chassis kompl.
61.	12.0155	Cabinet Kabinet
62.	28.0098	Screw Skrue
63.	2451-180062	Spring washer 18 x 6.2 x 0.6 Skive
64.	2442-090051	Washer Skive
65.	2207-050080	Nut Møtrik
66.	12.0161	Mounting frame Ophæng for CB700
60- 66	15.0074	Housing Svøb

Storno

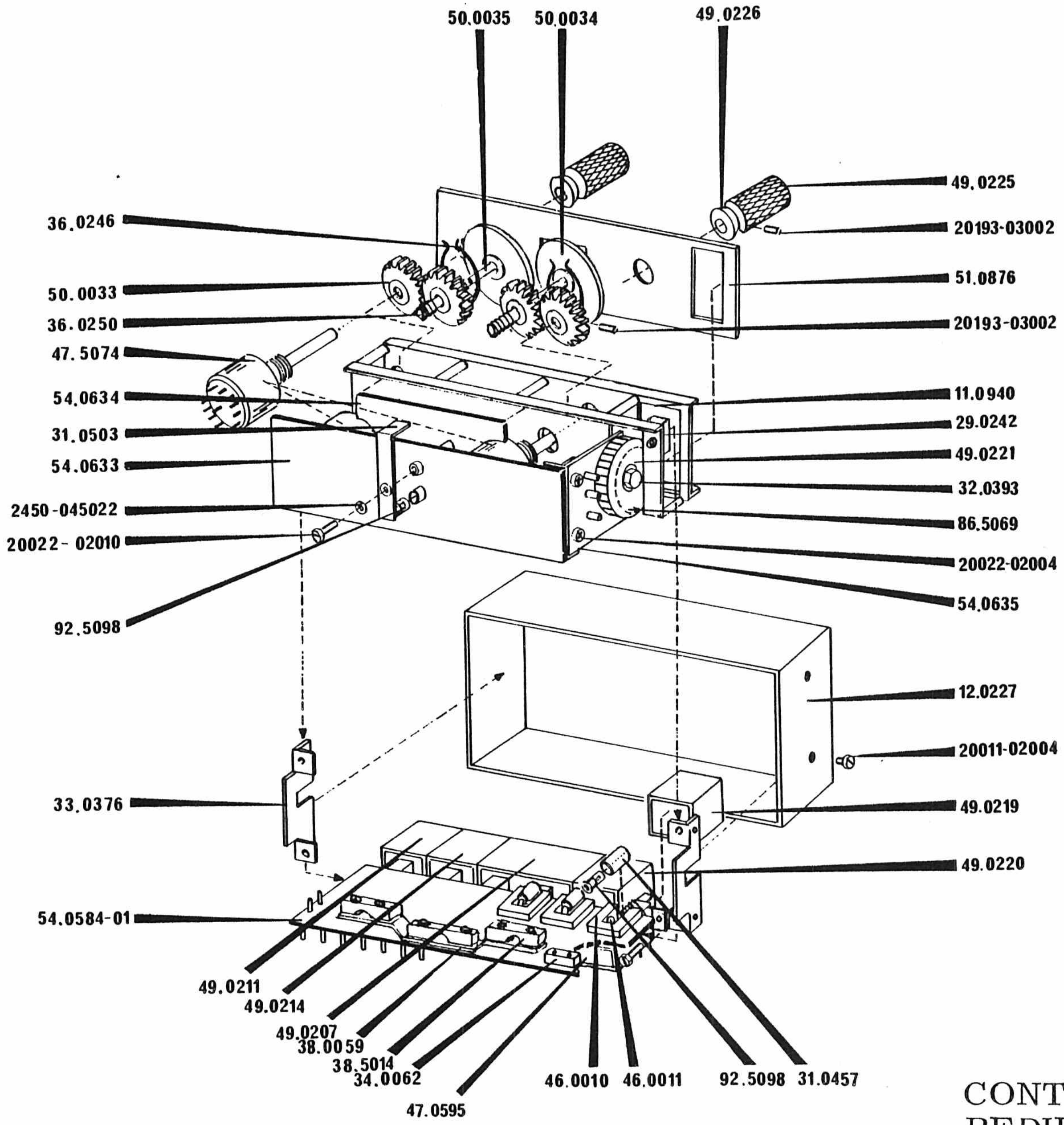


CONTROL UNIT
BEDIENGERÄTE

CB704

M405.047

Storno

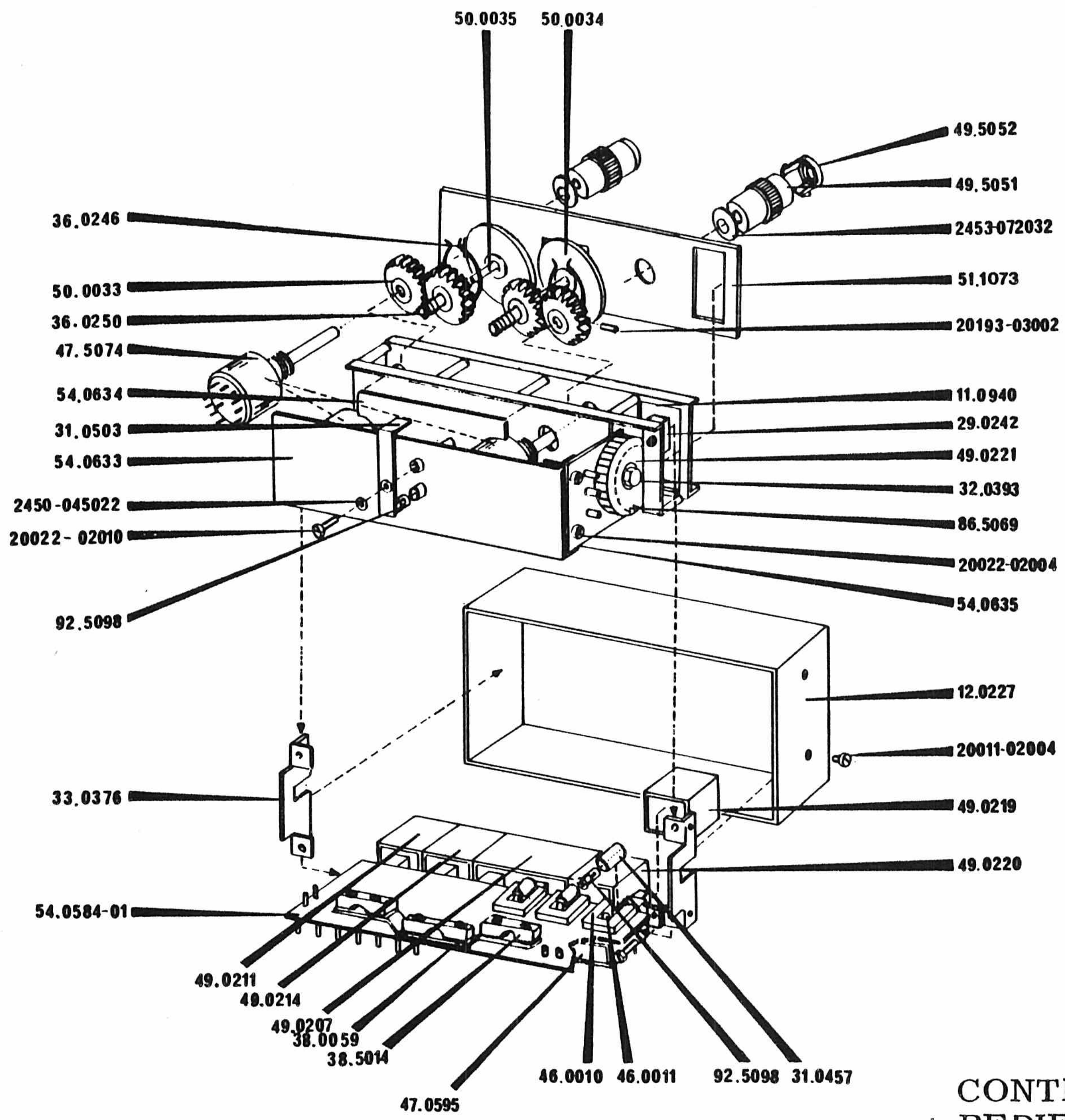


CONTROL UNIT
BEDIENGERÄTE

CB704

M405.047

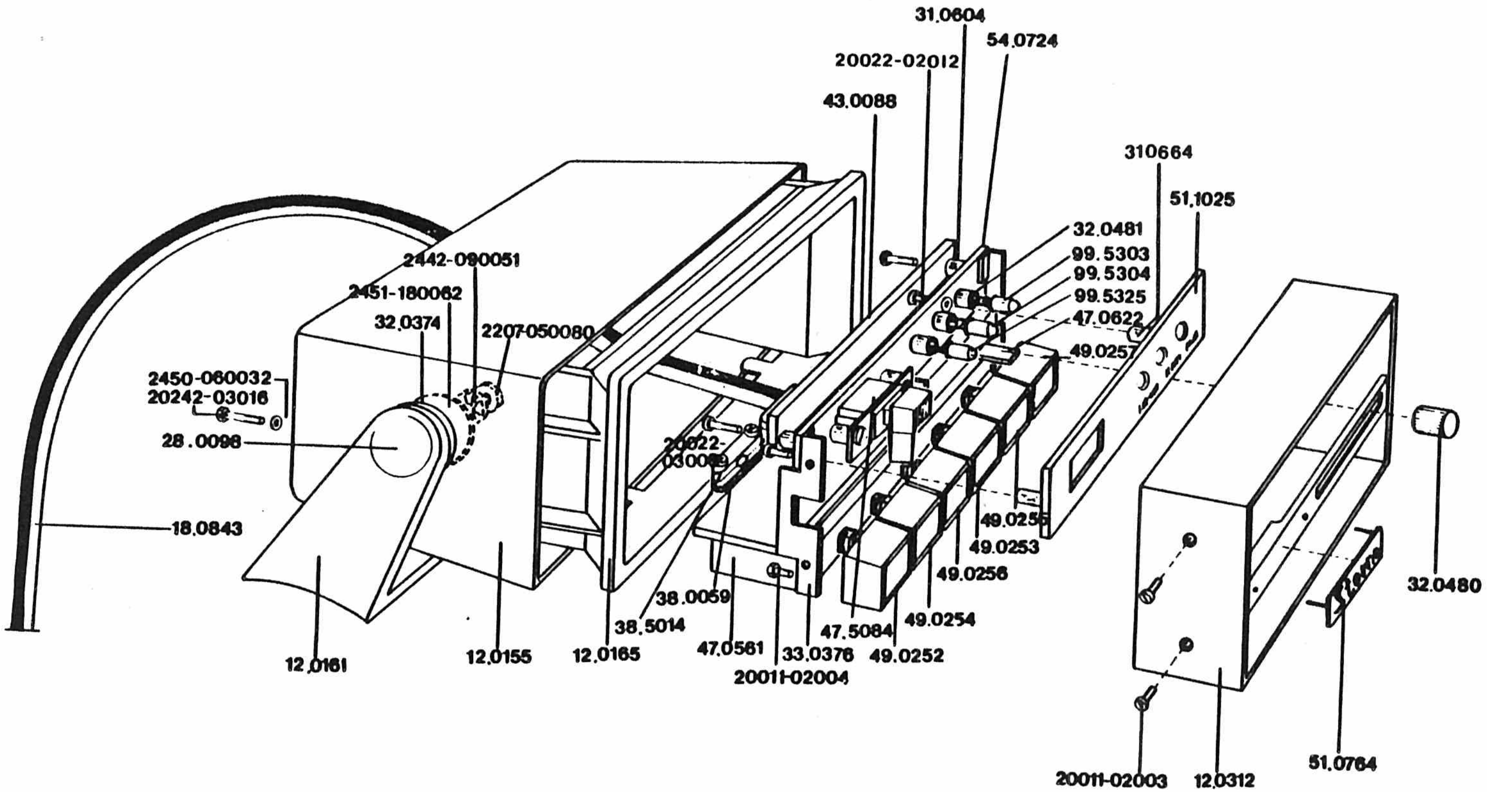
Storno



CONTROL UNIT
BEDIENGERÄTE

CB704

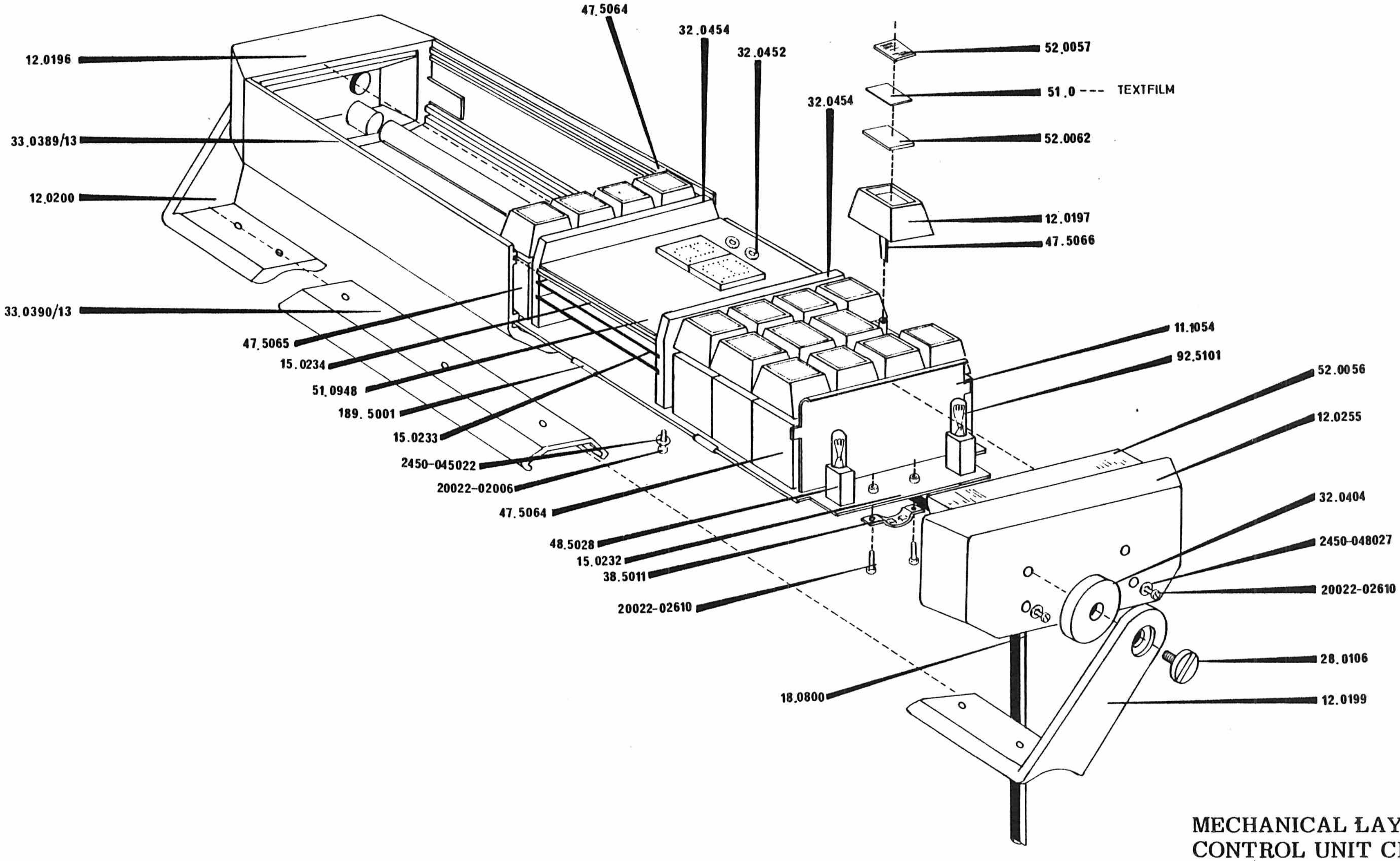
M405.047/3



CONTROL UNIT CB705

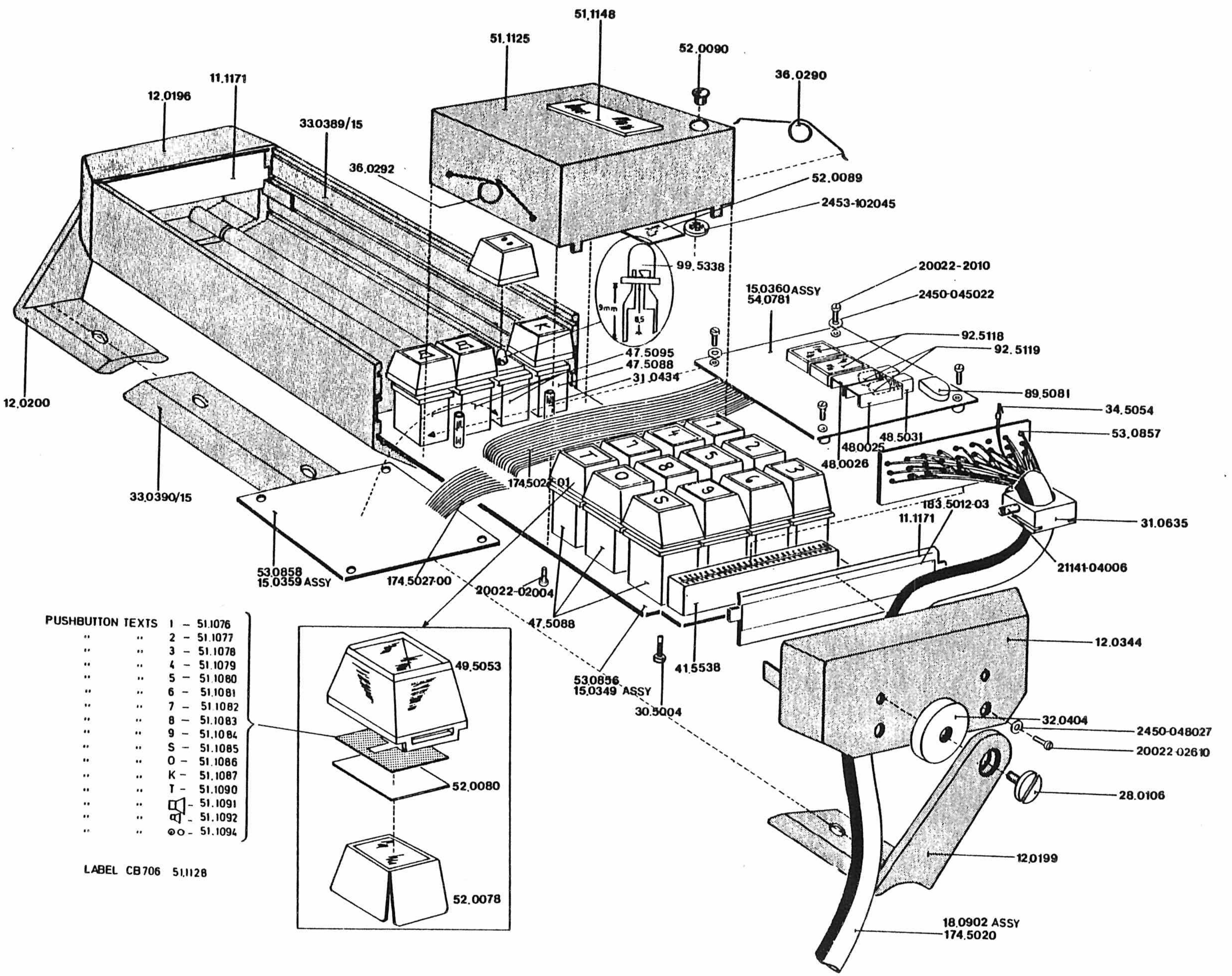
M405.078/2

Storno



MECHANICAL LAYOUT
CONTROL UNIT CB 2706

M405.055



PUSHBUTTON TEXTS 1 – 51.1076
" " 2 – 51.1077
" " 3 – 51.1078
" " 4 – 51.1079
" " 5 – 51.1080
" " 6 – 51.1081
" " 7 – 51.1082
" " 8 – 51.1083
" " 9 – 51.1084
" " S – 51.1085
" " O – 51.1086
" " K – 51.1087
" " T – 51.1090
" " – 51.1091
" " – 51.1092
" " ⊙○ – 51.1094

LABEL CB706 51.1128

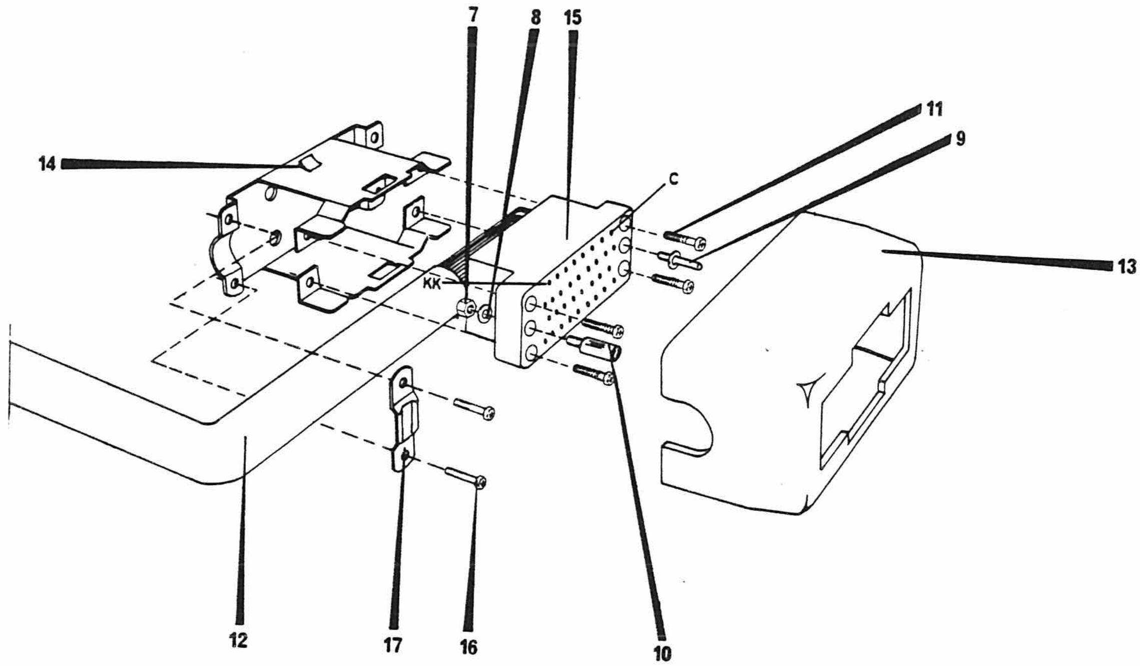
CONTROL UNIT
MECHANICAL LAYOUT

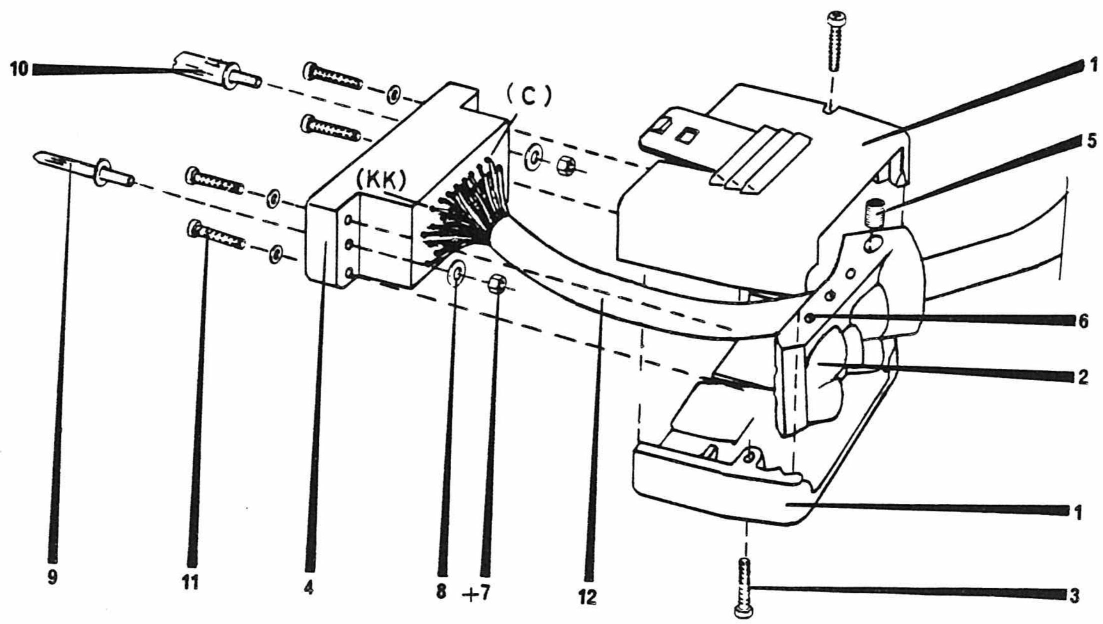
CB706

M405087

Storno

Storno





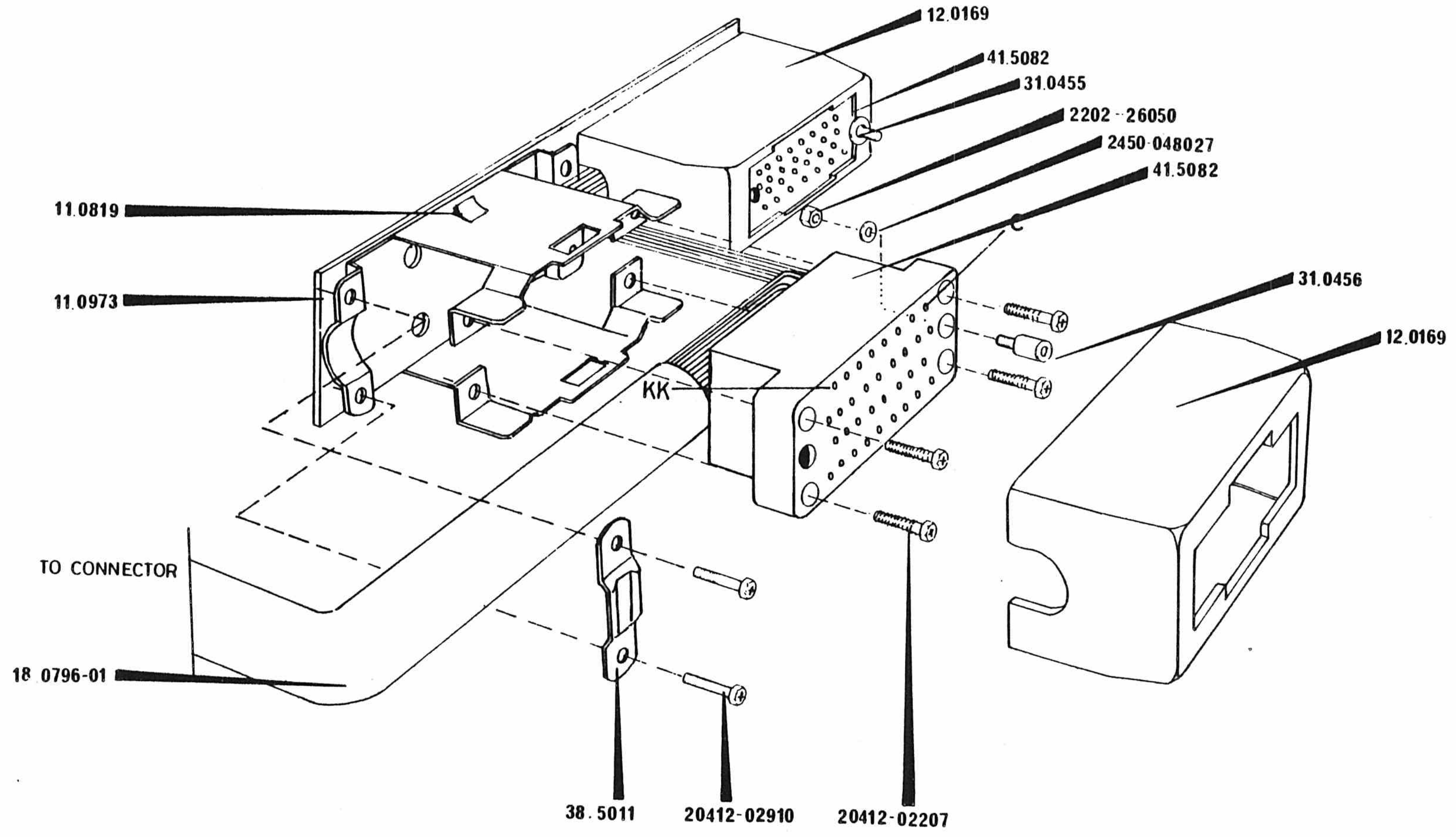
CONNECTOR AND EXTENSION CABLE
KONNEKTOR UND VERLÄNGERUNGS KABEL

CC703

M405.040

ITEM	CODE	DESCRIPTION
	41.0191	Connector Assy item (1-11) Konnektor komplet (Pos 1-11)
	41.0193	Connector assy (item 7-18) without item 12 Konnektor komplet (pos 7-18) uden Pos 12
1	12.0152	Housing Konnektor hus
2	12.0151	Cable hanger Kabelaflastning
3	20412-02207	Screw 2,2 x 7 Skrue 2,2 x 7
4	41.5523	Connector Housing 34 - poled Konnektor hus
5	21141-06006	Screw Polyamid M 6 x 6 Skrue poluamid M 6 x 6
6	21141-04006	Screw polyamid M 4 x 6 Skrue polyamid m 4 x 6
7	2201-026050	Nut 4 D - 2,6 x 5 Møtrik 4 D - 2,6 x 5
8	2450-048027	Washer 4,8 x 2,7 Skive
9	31.0455	Guide pin Styre tap
10	31.0456	Guide bush Styre bøsning
11	20412-02207	Screw 2,2 x 7 Skrue 2,2 x 7
12	18.0650	Wiring with pin contacts Kabel med kontaktben
13	12.0169	Housing Hus for konnektor
14	11.0819	Chassis Chassis
15	41.5524	Connector housing 34-poled Konnektor hus 34 pol
16	20412-02910	Screw Skrue
17	38.5011	Cable Clamp Aflastningsbøjle

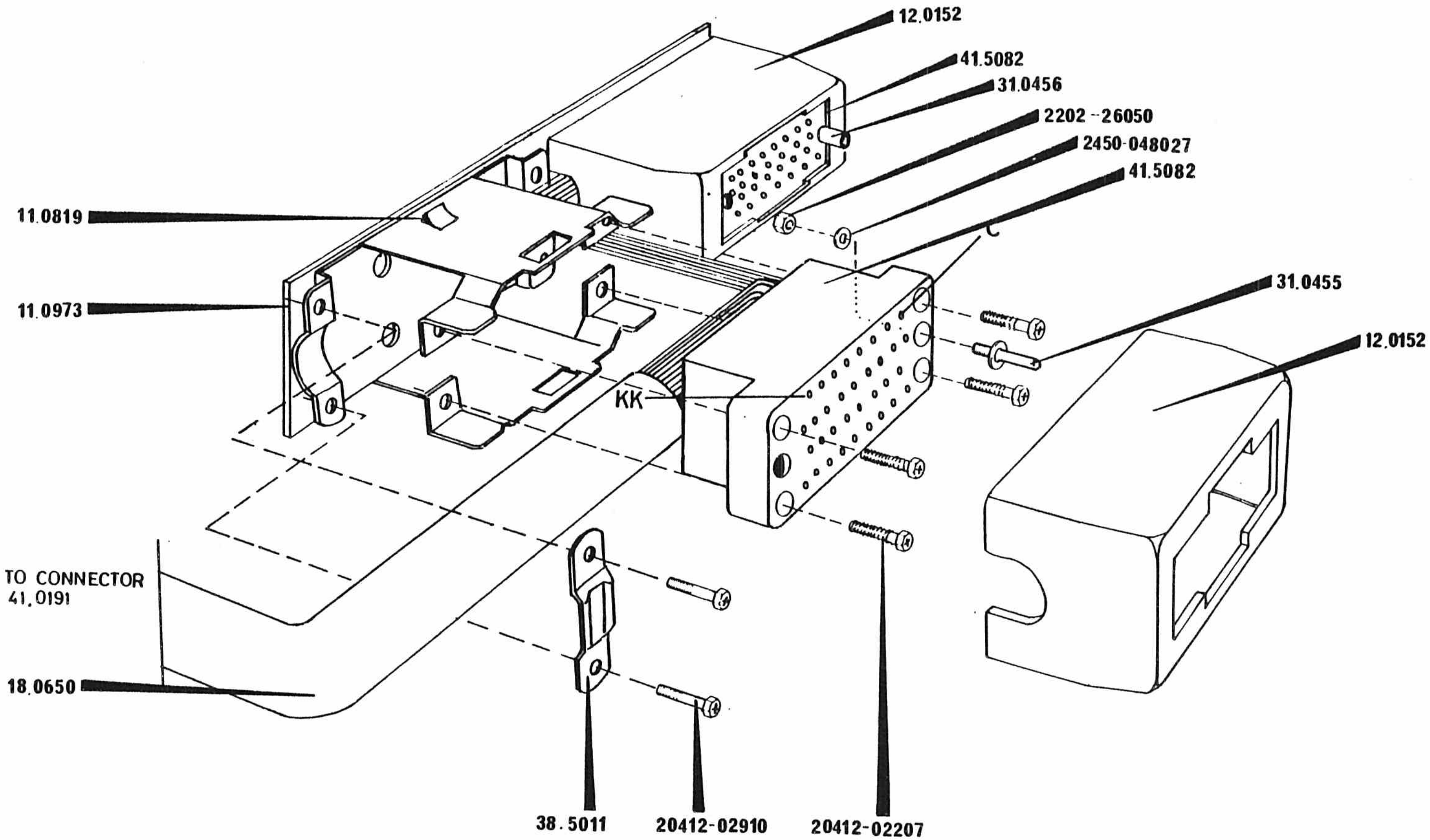
CONNECTOR AND EXTENSION CABLE CC703



MULTICONNECTOR
VIELFACHSTECKER

CC704

M405.046/3

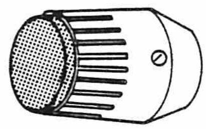


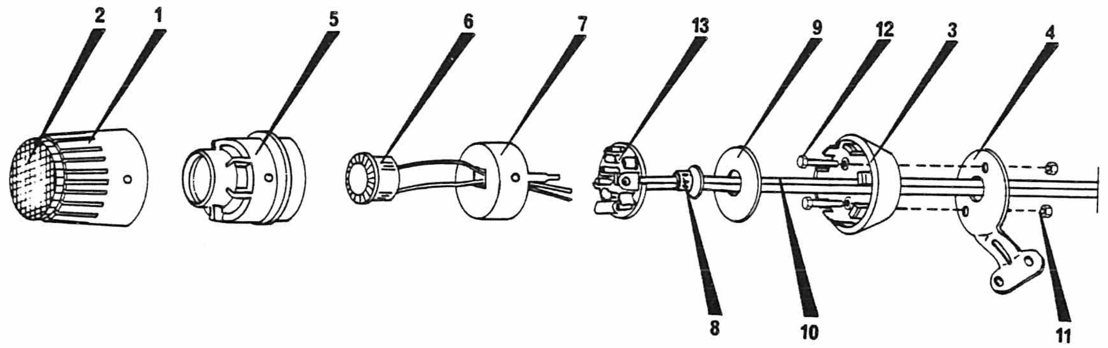
MULTICONNECTOR
VIELFACHSTECKER

CC704

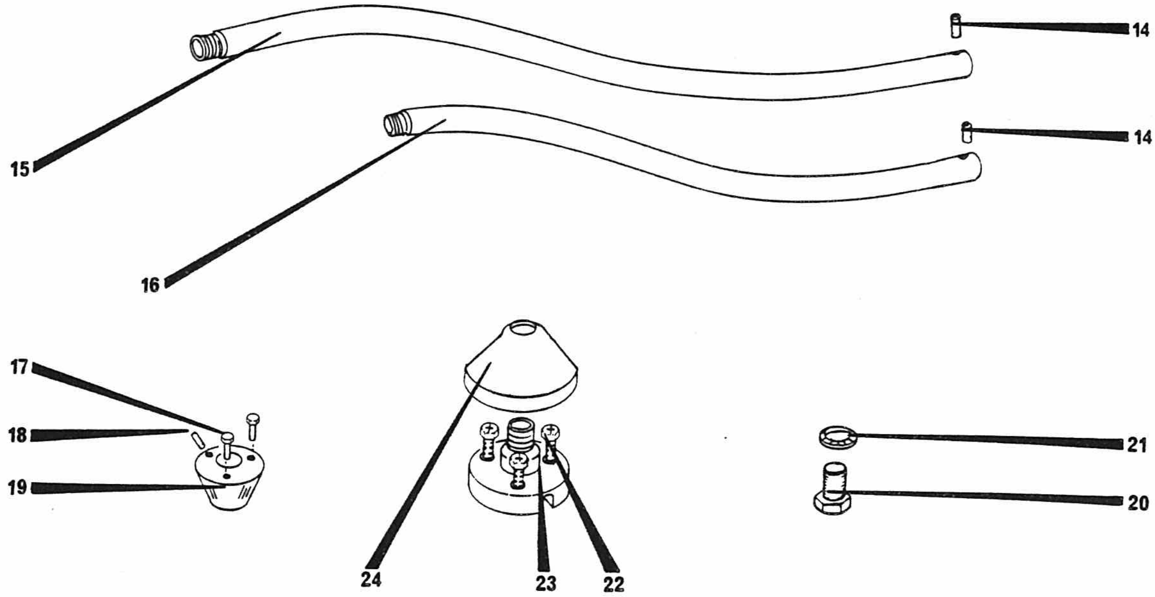
Storno

MICROPHONE MC701





MOUNTING KIT MK704



FIXED MICROPHONE MC701, MOUNTING KIT MK704
FEST MIKROFON MC702, EINBAU SATZ MK704

ITEM	CODE	DESCRIPTION
	96.0093	Microphone MC701 assembly Mikrofon MC701 komplet
1	15.0062	Microphone housing with dust cover Mikrofon hus med beskyttelsesnet
2	52.0038	Dust cover Beskyttelsesnet
3	12.0148	Microphone housing, rear Mikrofonhus, bagstykke
4	11.0816	Plate Plade
5	12.0147	Rubber suspension Gummiholder
6	96.5079	Microphone cartridge Mikrofon kapsel
7	68.0103	Can Skærmdåse
8	30.5023	Rivet 4.8 x 0.4 x 4.6 Nitte 4,8 x 0,4 x 4,6
9	53.0532	Washer Skive for bund
10	18.0627	2.5 m wiring with pin contact 2,5 m ledning med contaktben
11	2202-030055	Nut M3 x 5.5 Møtrik
12	20242-03006	Screw M3 x 6 Skrue M3 x 6
13	10.2488	AA701 amplifier AA701 forstærker

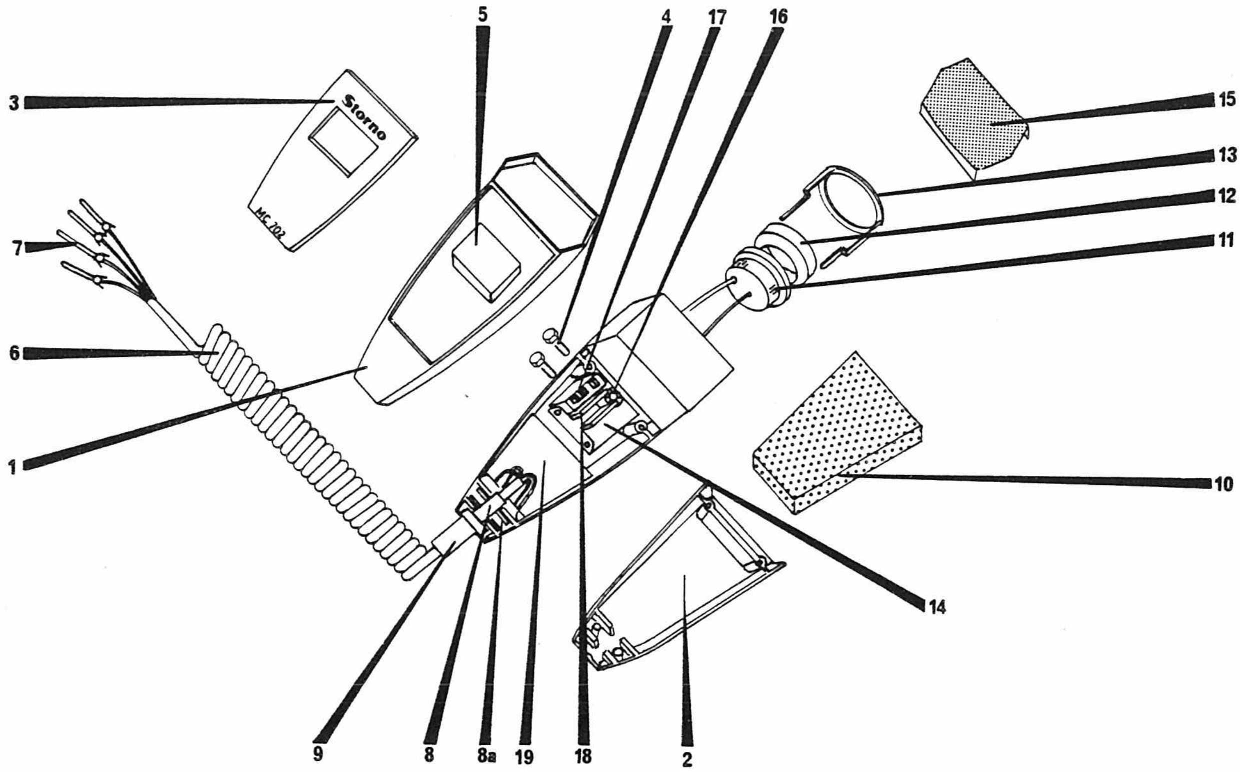
FIXED MICROPHONE ASS.
FAST MIKROFON KOMPL.

MC701

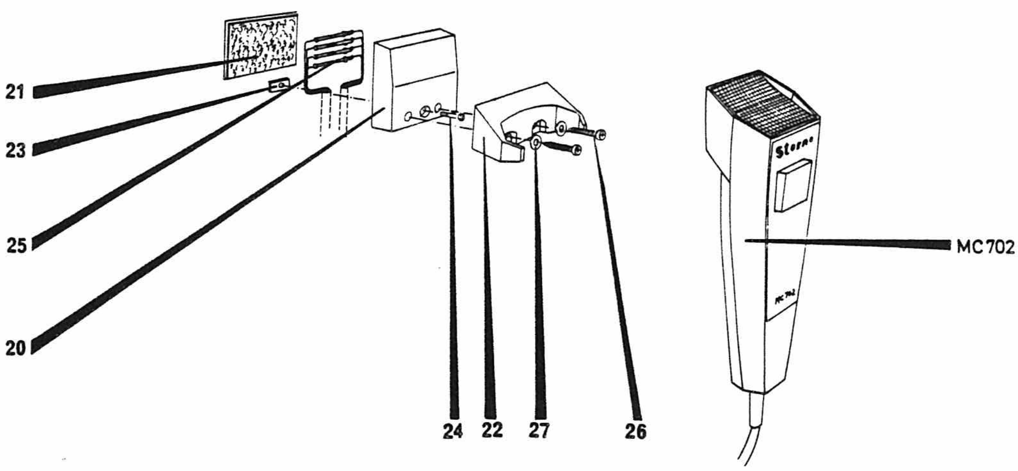
ITEM	CODE	DESCRIPTION
	10.2545	MK704 mounting kit / montage sæt
14	20193-03002	Scre Skrue
15	37.0140	Gooseneck 20 cm Svanehals 20 cm
16	37.0141	Gooseneck 35 cm Svanehals 35 cm
17	20242-03006	Screw Skrue
18	20063-03006	Screw Skrue
19	28.0099	Nipple for item 15 and 16 Nippel for pos 15 og 16
20	28.0065	Nipple for item 15 and 16 Nippel for pos 15 og 16
21	2441-180105	Washer Skive
22	20412-03913	Screw Skrue
23	28.0100	Nipple Nippel
24	32.0381	Cover Hætte

Storno

MICROPHONE MC 702



JUNCTION BOX JB 701 AND MC 702



FIST MICROPHONE MC702, JUNCTION BOX JB701
HANDMIKROFON MC702, ANSLUSSKASTEN JB701

ITEM	CODE	DESCRIPTION
	96.0094	MC702 Microphone ass. MC702 Mikrofon kompl.
1	12.0174	Microphone housing Mikrofon hus
2	12.0172	Cover plate Bagstykke
3	51.0780	Front plate Forplade
4	20011-02010	Screw 2 x 10 Skrue
5	12.0171	Button Knap
6	18.0652	Spiral core Spiral snøre
7	41.5519	Pin contact 0,12 x 0,22 Kontakt ben
8	31.0307-10	Shrink tube Krympe rør
8a	33.0361	Angle Vinkel
9	32.0383	Sleeve Gummitylle
10	32.0191	Foam packing Skumindlæg
11	96.5069	Microphone cartridge Mikrofon kapsel
12	32.0186-01	Rubberring Gummiring
13	37.0076	Spring for microphone unit Fjeder for mikrofon enhed
14	36.0202	Spring glip assembly Fjeder komplet
15	52.0043	Dust cover assembly Net for mikrofon komplet
16	2447-080030	Speed nuts 8 x 3 Låsering
17	47.5040	Microswitch Mikroswitch
18	33.0331-01	Bracket for item 14 Bøjle for pos 14
19	10.2548	AA702 Amplifier ass. AA702 Forstærker kompl.

FIST MICROPHONE
HÅNDMIKROFON

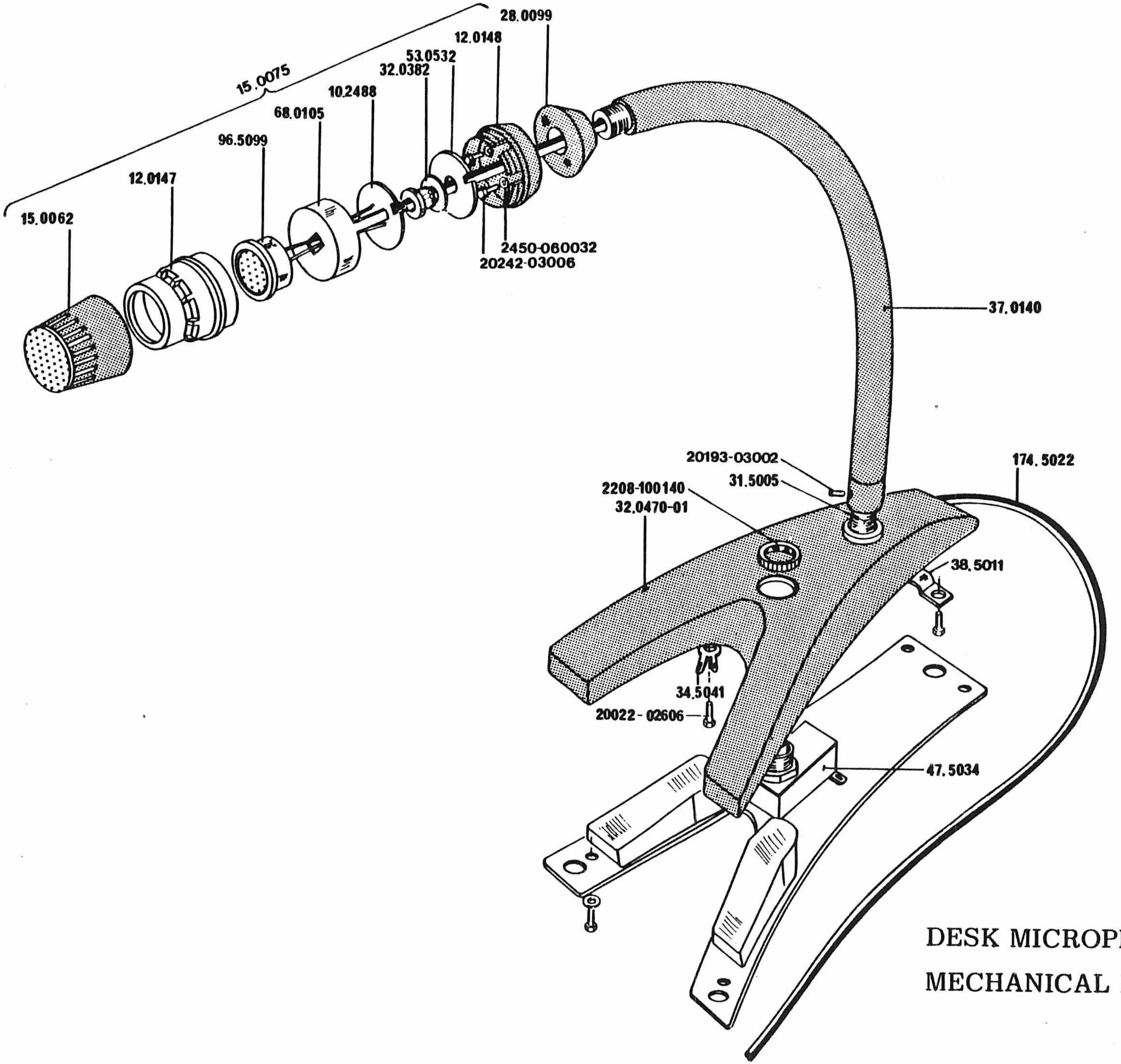
MC702

ITEM	CODE	DESCRIPTION
	10.2543	Junction box JB701 ass. Samleboks JB701 kompl.
20	12.0170	Housing black Hus sort
21	32.0377	Retaining plate: foam Skumplade
22	12.0173	Microphone retainer Mikrofon holder
23	38.0058	Cable clamp Kabelbøjle
24	20022-03008	Screw M 3 x 8 Skrue M 3 x 8
25	18.0646	Cable 2,50 m with pin and socket contact Kabel 2,50 m med stik monteret
26	20412-04225	Screw 4,2 x 25 Skrue 4,2 x 25
27	2450-080043	Washer Skiver

JUNCTION BOX ASS.
SAMLEBOKS KOMPL.

JB701

Storno

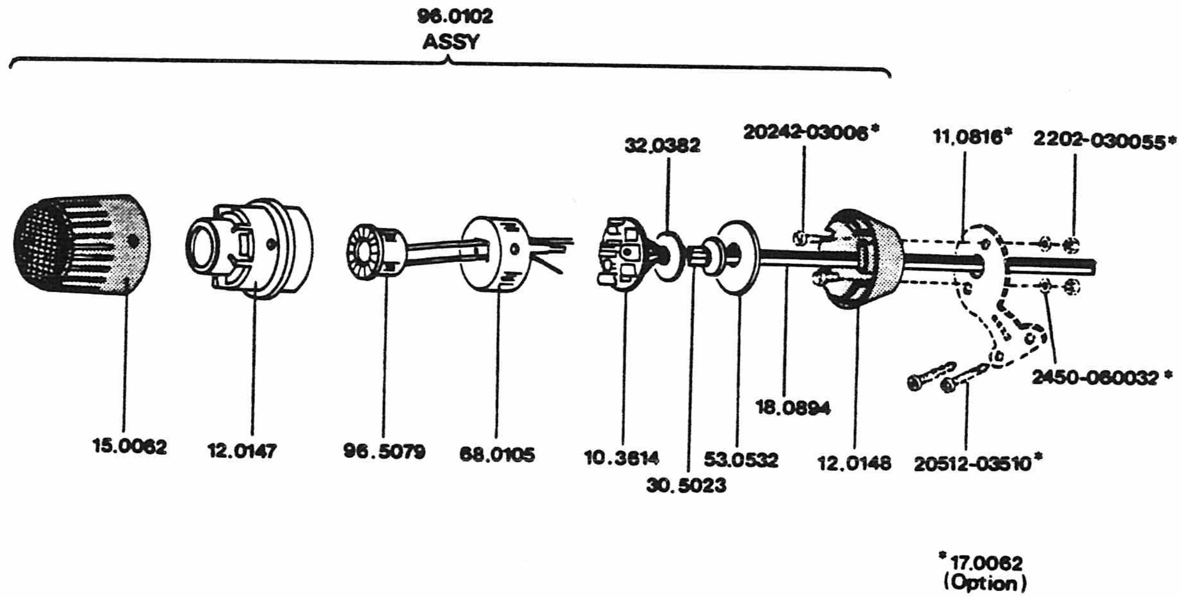


DESK MICROPHONE
MECHANICAL LAY OUT

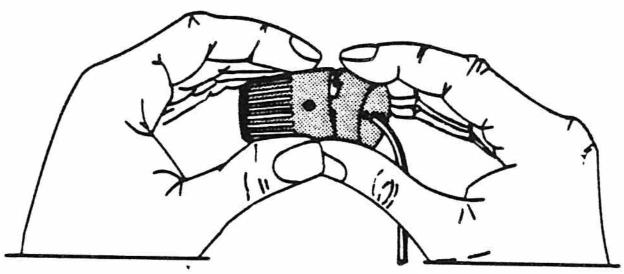
MC703

M405.082

Storno



DISMANTLING

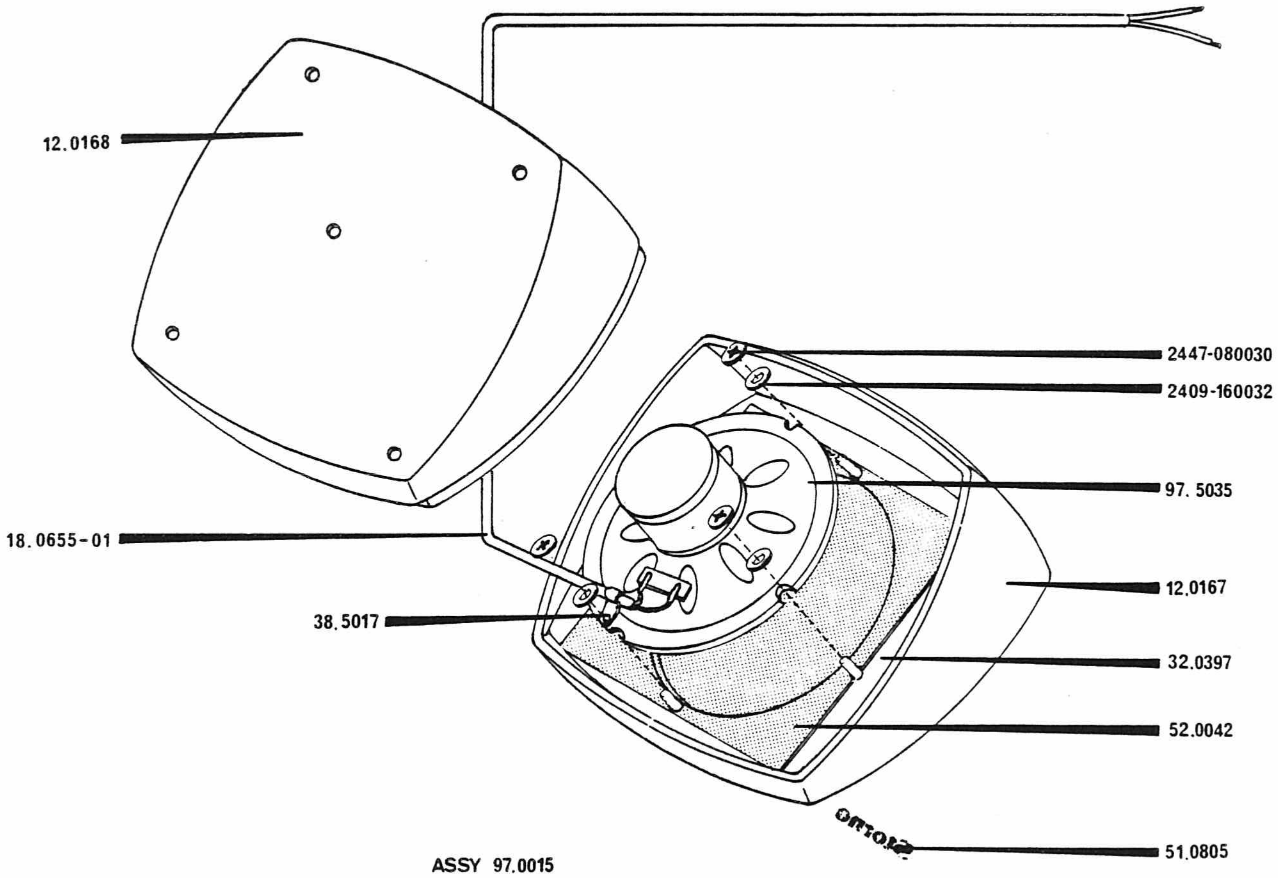


MICROPHONE

MECHANICAL LAY OUT

MC704

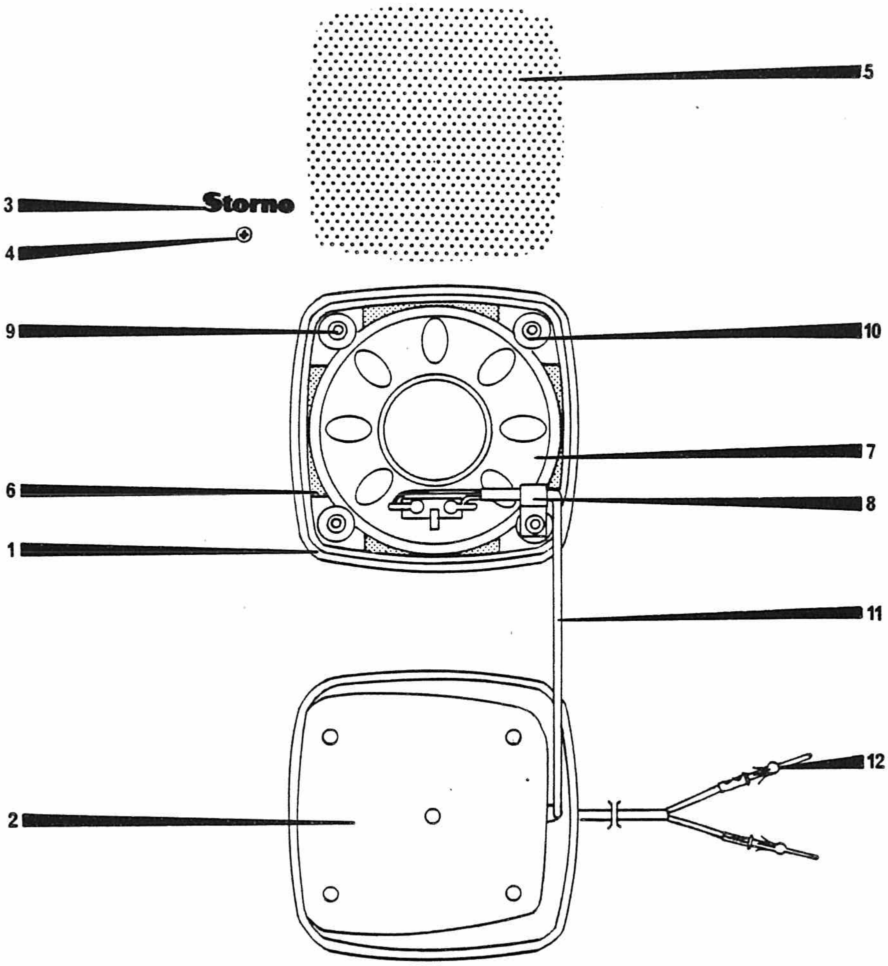
M405.089



LOUDSPEAKER LS701

Storno

Storno



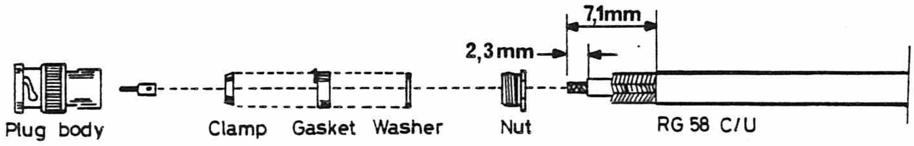
LOUDSPEAKER
LAUTSPRECHER

LS701

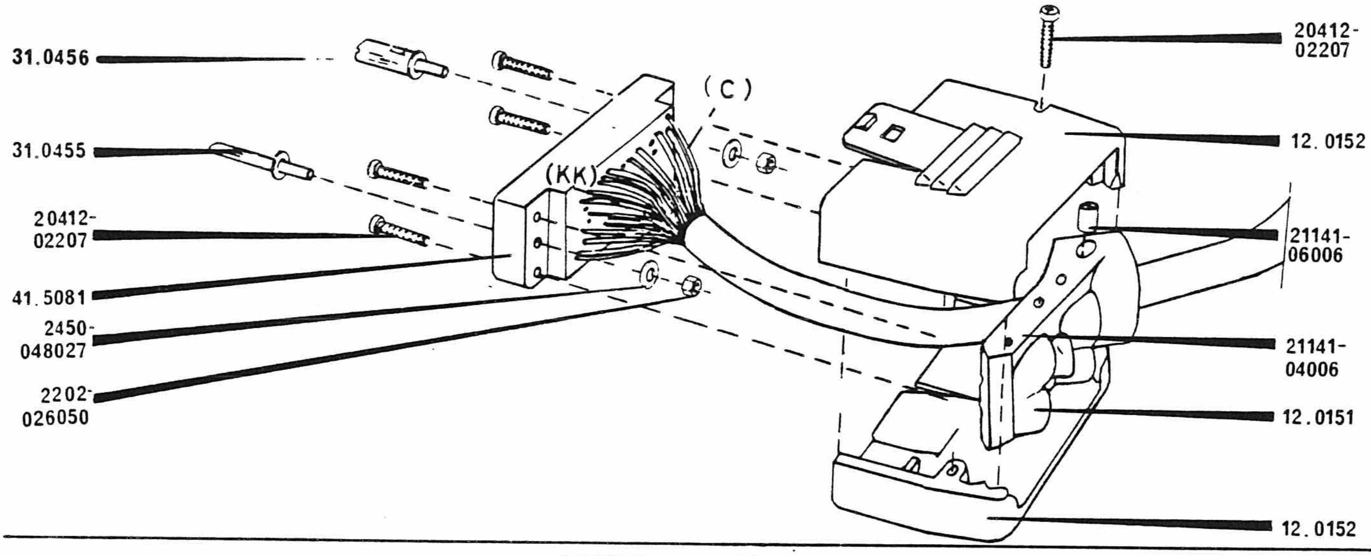
M405.039

ITEM	CODE	DESCRIPTION
	98.0015	Loud speaker assy. Højttaler komplet
1	12.0167	Cabinet front part Kabinet forside
2	12.0168	Cabinet rear part Kabinet bagside
3	51.0805	Motif Firmaskilt
4	2447-080030	Speed nut for item 3 Låseskive for pos. 3
5	52.0042	Grille Højttalernet
6	32.0397	Dust filter Støv filter
7	97.5035	Loud speaker Højttaler
8	38.5017	Cabel clamp Aflastningsbøjle
9	20412-02910	Screw 2,9 x 10 Skrue 2,9 x 10
10	2409-160032	Washer 16 x 3,2 x 1 Skive
11	18,0655	Wiring assy. with item 12 Ledning kompl. med pos. 12
12	41.5520	Pin Kontaktben

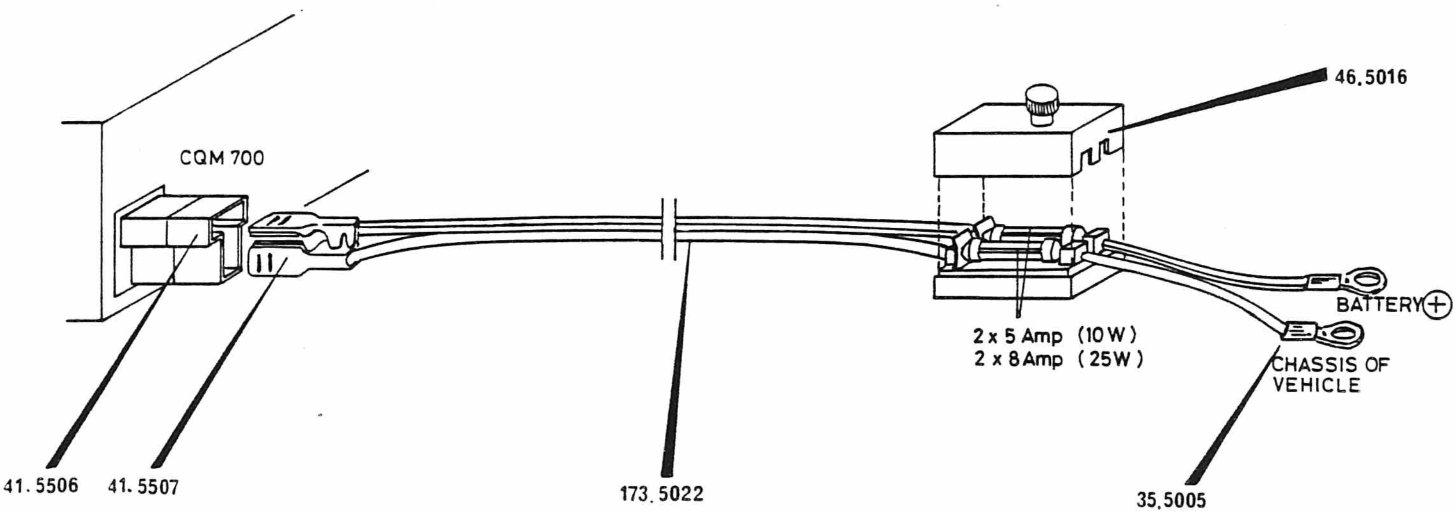
ANTENNA CONNECTOR (41.5120)



CONNECTOR ASSEMBLY (41.0191-01)



BATTERY CONNECTION

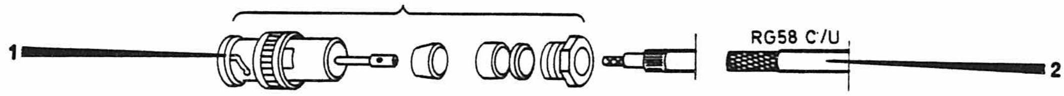


MOUNTING KIT
EINBAU SATZ

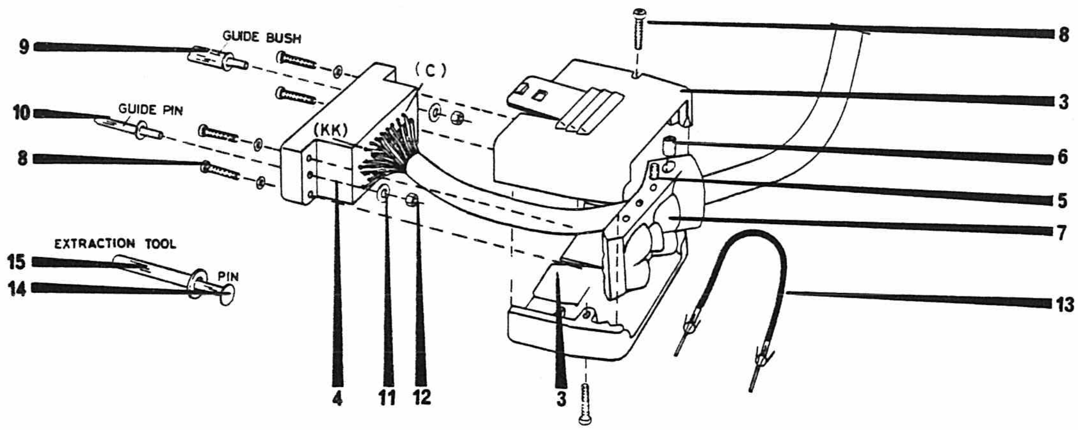
MK701

Storno

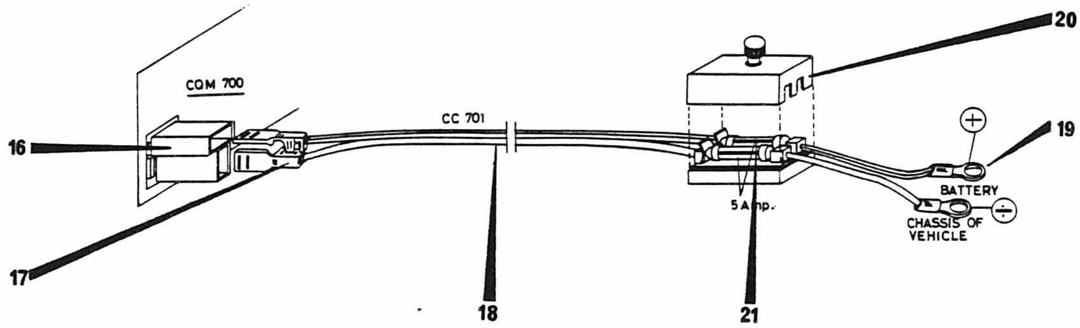
ANTENNA CONNECTOR 41.5120



CONNECTOR ASSEMBLY 41.0191



BATTERI CONNECTION



MOUNTING KIT
EINBAU SATZ

MK701

ITEM	CODE	DESCRIPTION
1	41.5120	Antenna connector Antenne konnektor
2	175.5013	Coax cable Coaxkabel
	41.0191	Connector assembly Konnektor komplet
3	12.0152	Housing Hushalvdel
4	41.5523	Connector 34 pole Konnektor 34 pol
5	21141-04006	Nylon screw M 4 x 6 Nylon skrue M 4 x 6
6	21141-06006	Nylon screw M 6 x 6 Nylon skrue M 6 x 6
7	12.0151	Cablehanger Aflastning for kabel
8	20.412-02207	Screw 2,2 x 7 Skrue
9	31.0456	Guide bush Styrebøsning
10	31.0455	Guide pin Styretap
11	2450-048027	Washer 4,8 x 2,7 Skive 4,8 x 2,7
12	2202-026050	Nut 6 kt 2,6 x 5 Møtrik 2,6 x 5
13	18.0668	Shorting strap Kortslutningsledning
14	31.0470	Pin for extraction tool Tap for udtrækkerværktøj
15	30.0033	Extraction tool Udtrækkerværktøj
	32.0394	Rubber plug for item 7 Gummiprop for pos 7
		Battery connection Batteri tilslutning
16	41.5506	Housing for item 17 Holder for pos 17
17	41.5507	Socket contact Kontakt
18	173.5022	Battry cable Batteri kabel
19	35.5005	Cable eye Kabelsko

MOUNTING KIT
MONTAGESÆT

MK701

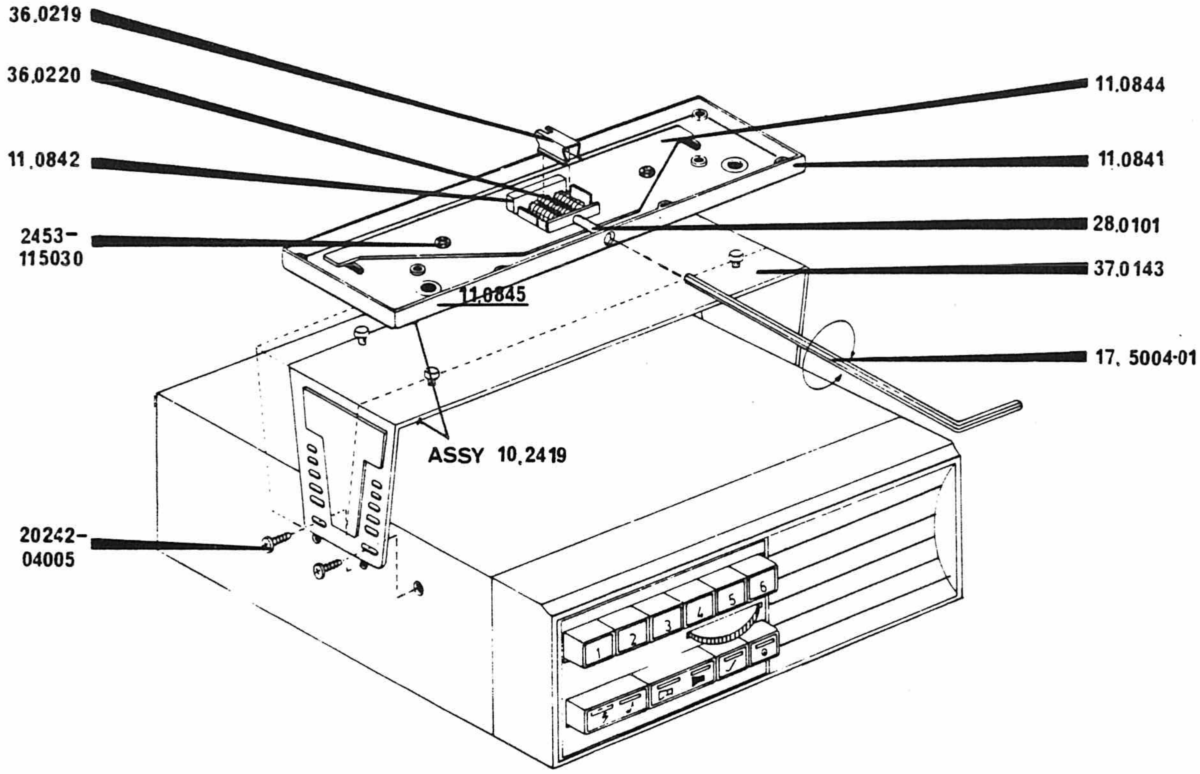
Storno

ITEM	CODE	DESCRIPTION
20	46.5016	Fusebox Sikringsboks
21	92.5100	Fuse 5 amp. Sikring 5 amp.

MOUNTING KIT
MONTAGESÆT

MK701

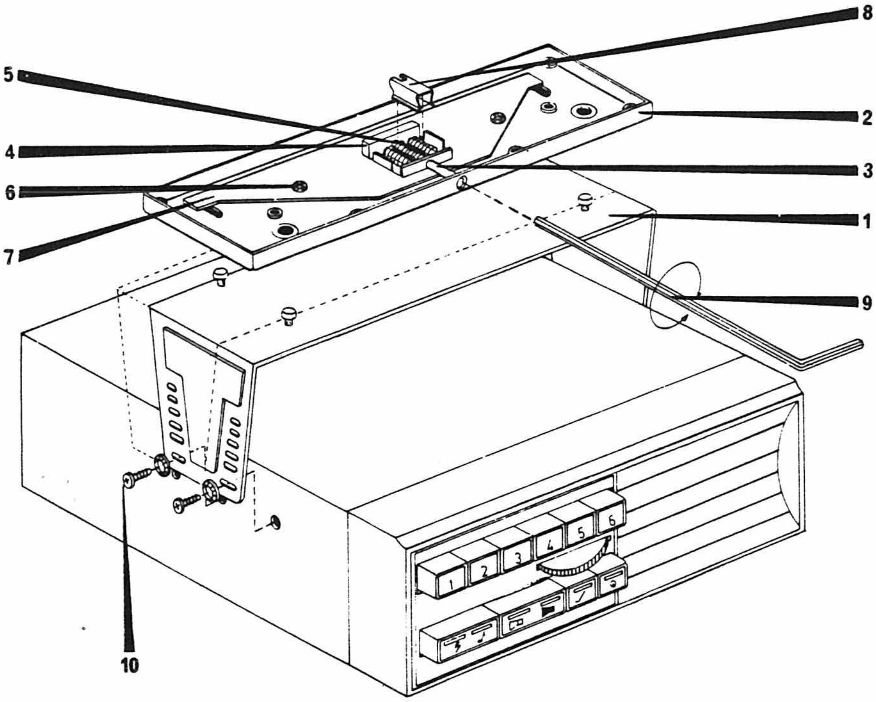
Storno



MOUNTING FRAME
OPSPÆNDINGSBESLAG

MN701

Storno



MOUNTING FRAME
OPSPÆNDINGSBESLAG

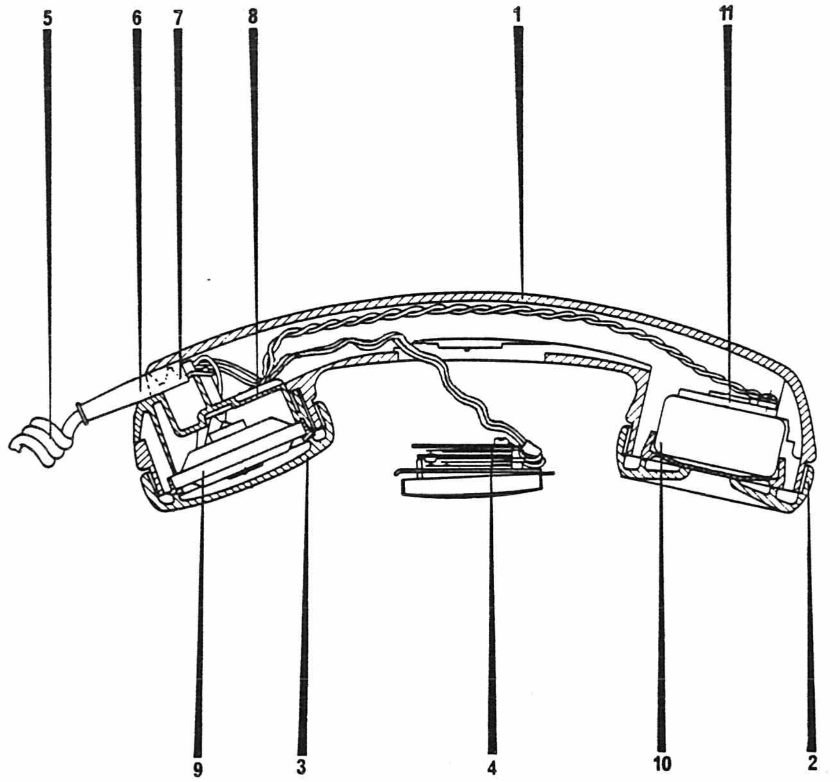
MN701

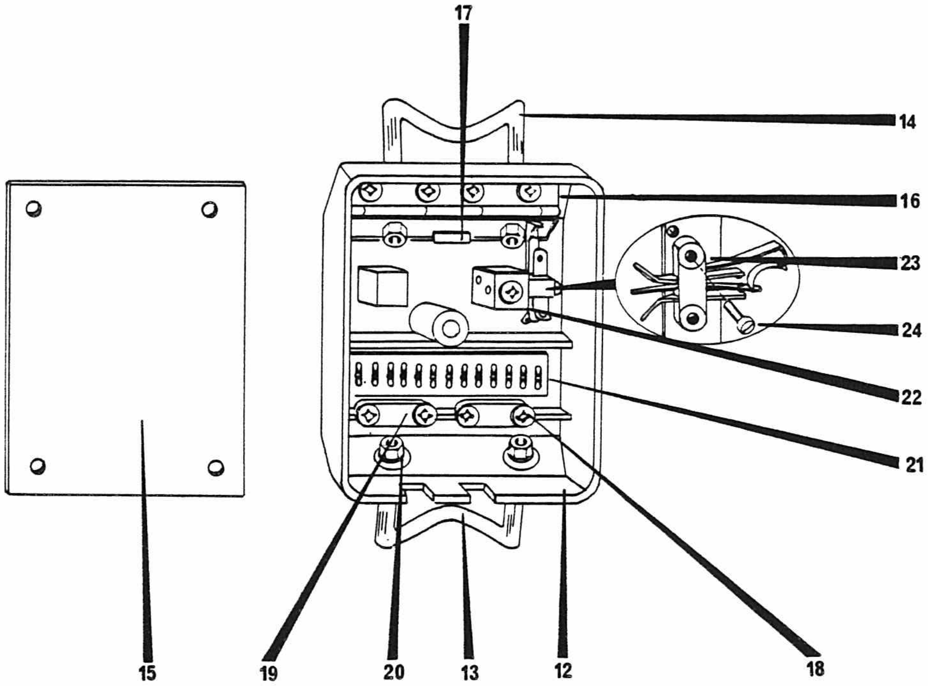
ITEM	CODE	DESCRIPTION
	10.2419	MN701. Mounting frame assembly Montagesæt komplet
1	37.0143	Mounting bracket Fastspændingsbeslag
2	11.0846	Mounting stand Montagebeslag
3	28.0101	Screw 5,5 cm Skrue 5,5 cm
4	11.0842	Guidepin: spring Holder for fjeder
5	36.0220	Spring for item 4 Fjeder for pos 4
6	2453-115030	Speed nut Låsering
7	11.0844	Lock plate: sheet metal Glideplade
8	36.0219	Retaining bar: spring Låsebøjle
9	17.5004-01	Unbrako tool Unbraconøgle
10	20242-04005	Screw 4 x 5 Skrue 4 x 5

MOUNTING FRAME ASS. CQM700
OPHÆNG KOMPLET CQM700

MN701

Storno





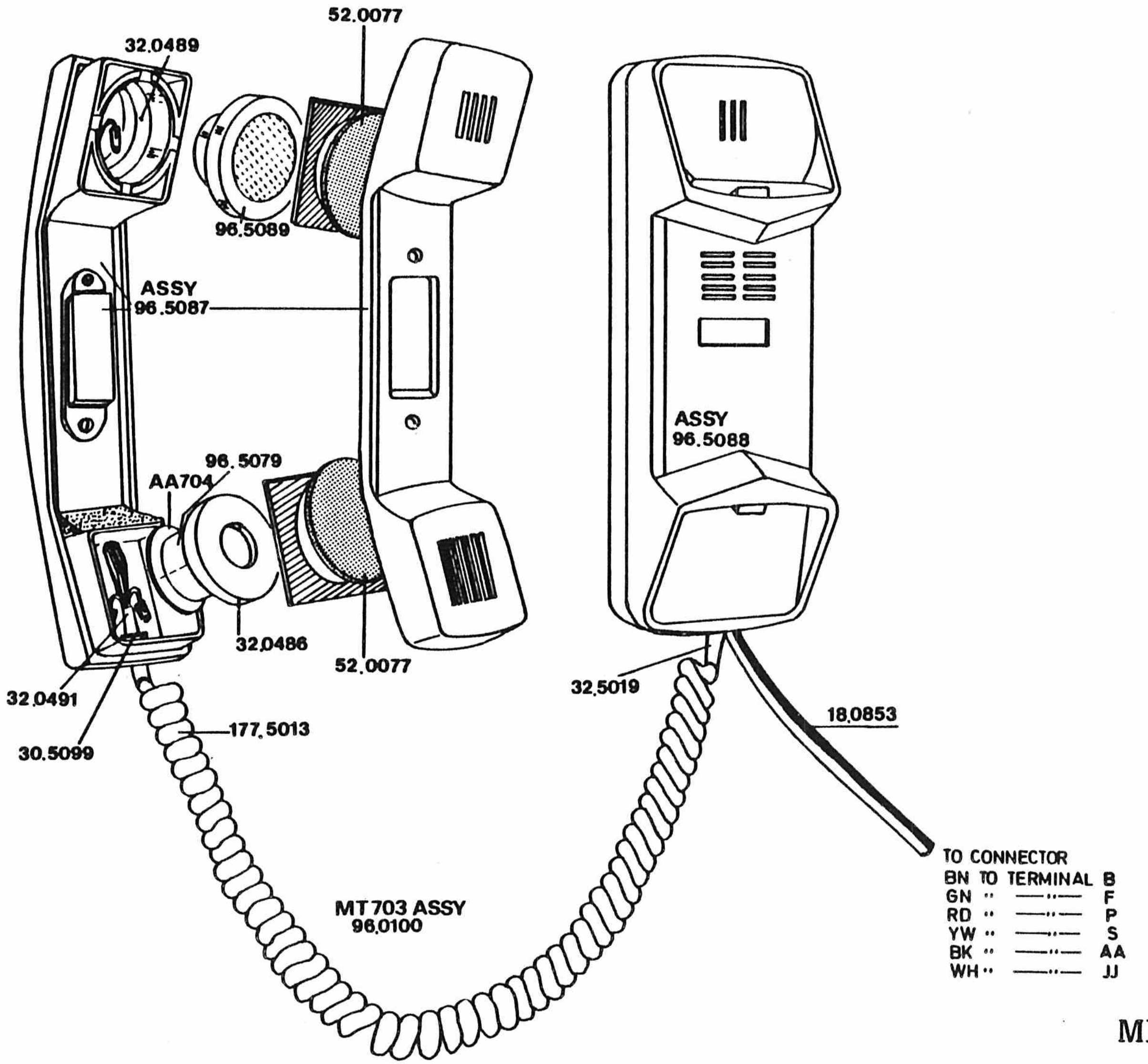
MICROTELEPHONE HANDSET
HANDAPPARAT

MT701/HS602a

ITEM	CODE	DESCRIPTION
	96.0097	Micro-telephone Handset Assy Mikrotelefon komplet
1	96.5080	Housing Mikrotelefon hus
2	96.5082	Telephone cover Dæksel for telefon
3	96.5083	Microphone cover Dæksel for mikrofon
4	96.5084	Push button Trykomskifter
5	18.0725	Coiled lead 6 core with item 6-7 Spiralsnøre 6 leder med pos. 6 og 7
6	32.5051	Rubber sleeve Gummi tylle
7	38.5037	Clamp strip Aflastningsbøjle
8	96.5081	Microphone insert Holder for mikrofon
9	96.5074	Microphone cartridge 1500 Ω Mikrofonkapsel 1500 Ω
10	96.5085	Telephone cartridge 65 Ω Telefon kapsel 65 Ω
11	10.2809	AA703 Amplifier assy AA703 Forstærker komplet
	37.0110-01	HS 602a Retainer assy Ophæng komplet
12	12.0137	Housing (Plastic) Hus (Plastik)
13	44.0085	Retaining arm fixed bøjle fast
14	44.0084-01	Retaining arm sprung Bøjle
15	11.0769-01	Bottom plate Bundplade
16	37.0139	Hinge Hængsel
17	36.0212	Spring Fjeder
18	20412-02910	Screw Skrue
19	38.5014	Clamp Aflastningsbøjle
20	2202-040079	Nut møtrik

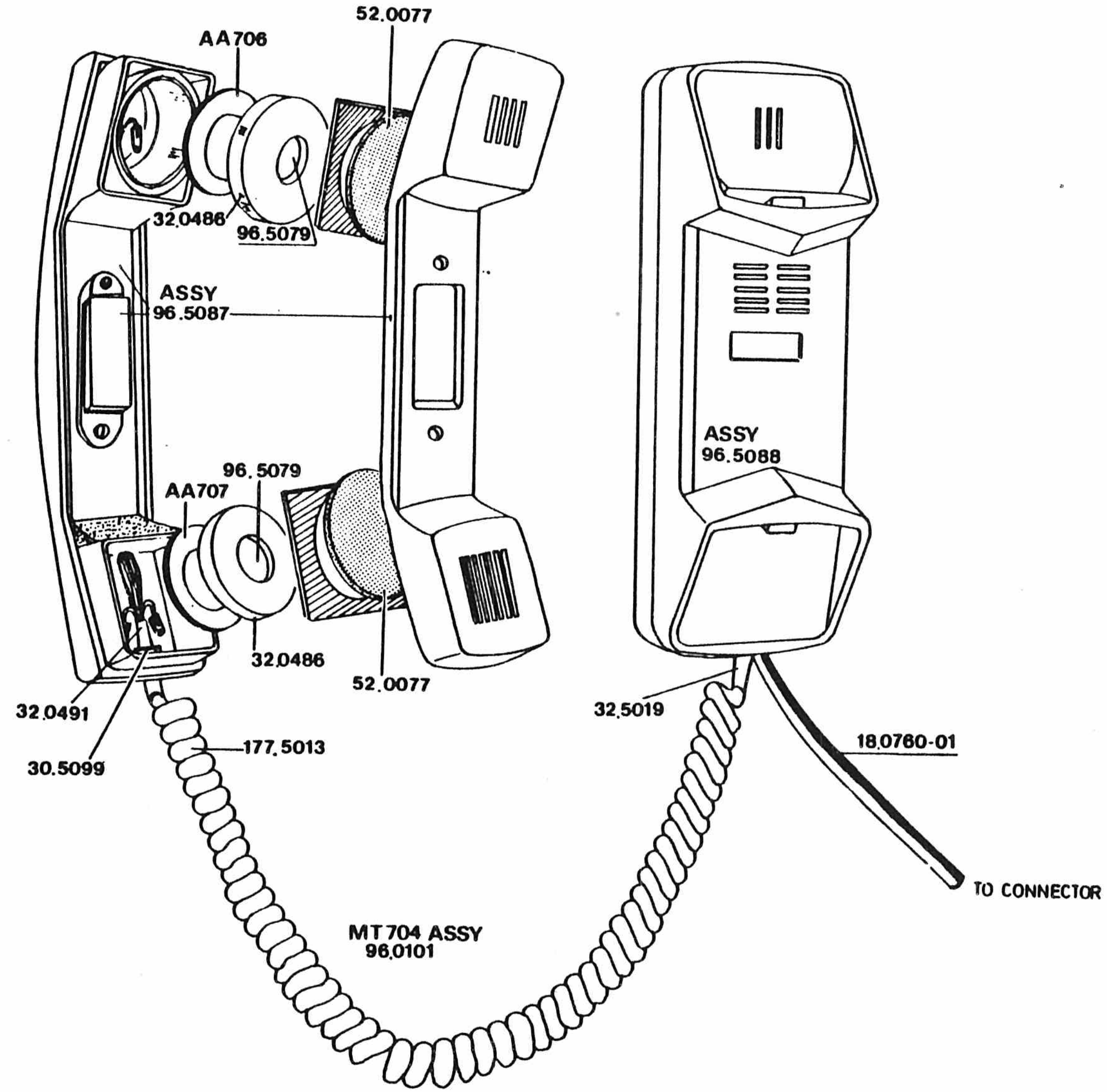
MICROTELEPHONE HANDSET MT701/HS602a

ITEM	CODE	DESCRIPTION
21	43.0083	Terminal board terminal brædt
22	33.0367	Bracket vinkel
23	47.5033	Microswitch mikroswitch
24	20011-02008	Screw Skrue



MICROTELEPHONE MT703

M405.081



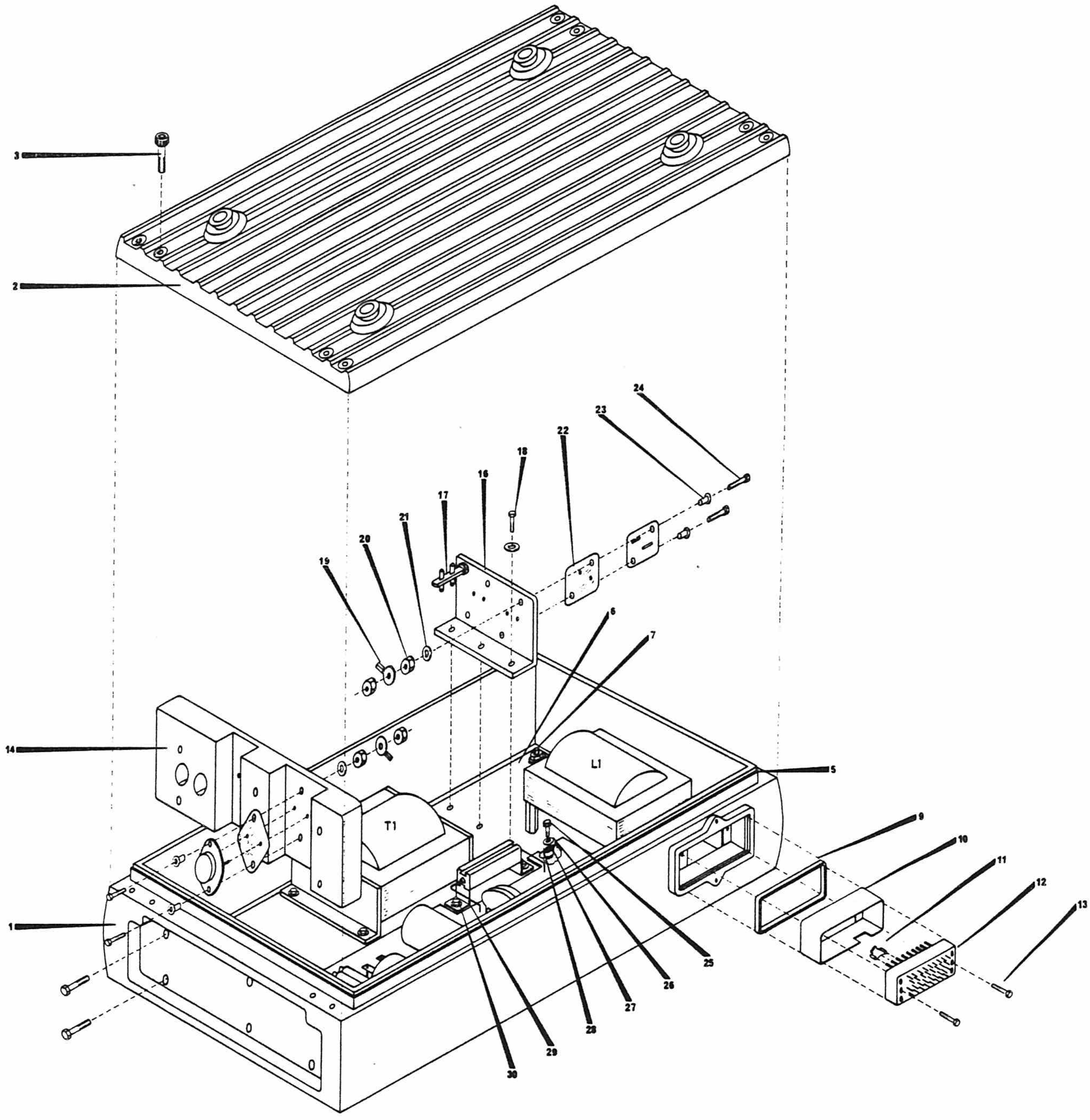
MICROTELEPHONE

MECHANICAL LAY OUT

MT704

M405.085

Storno

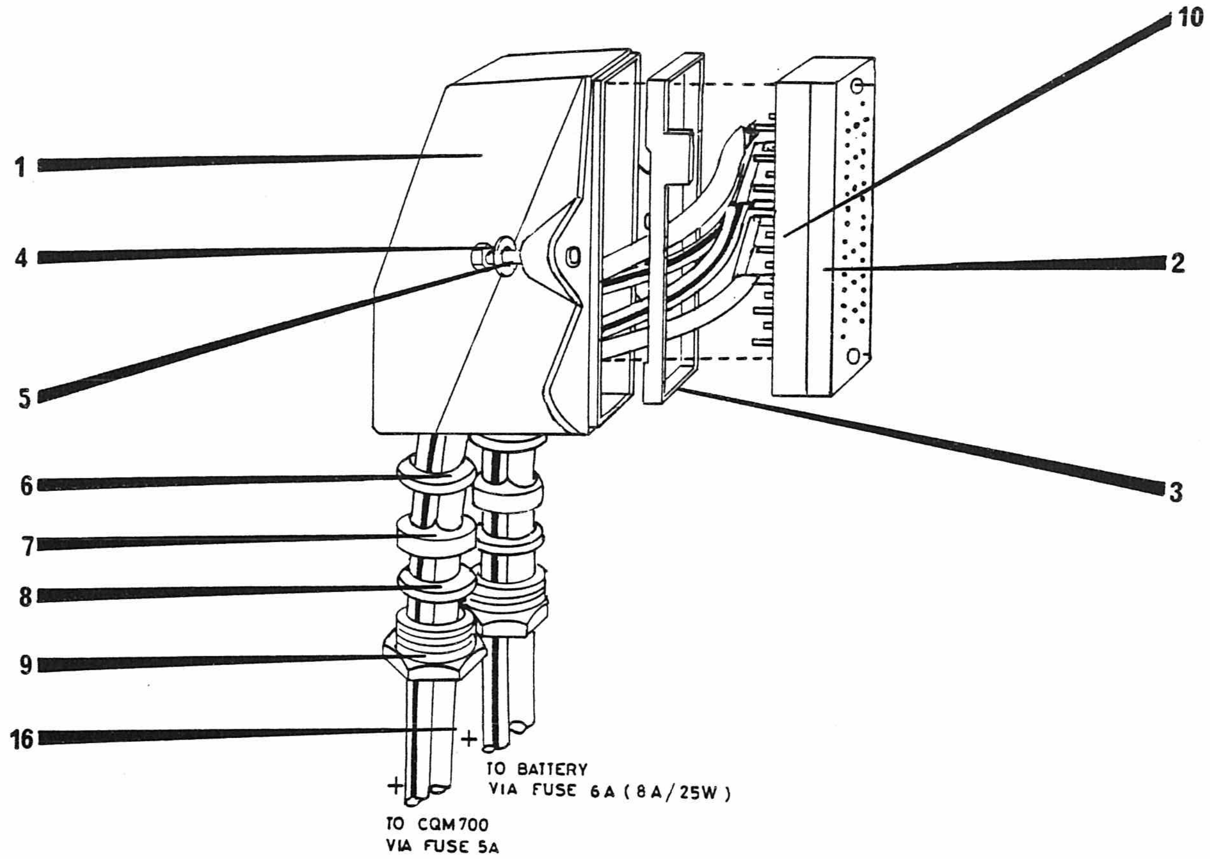


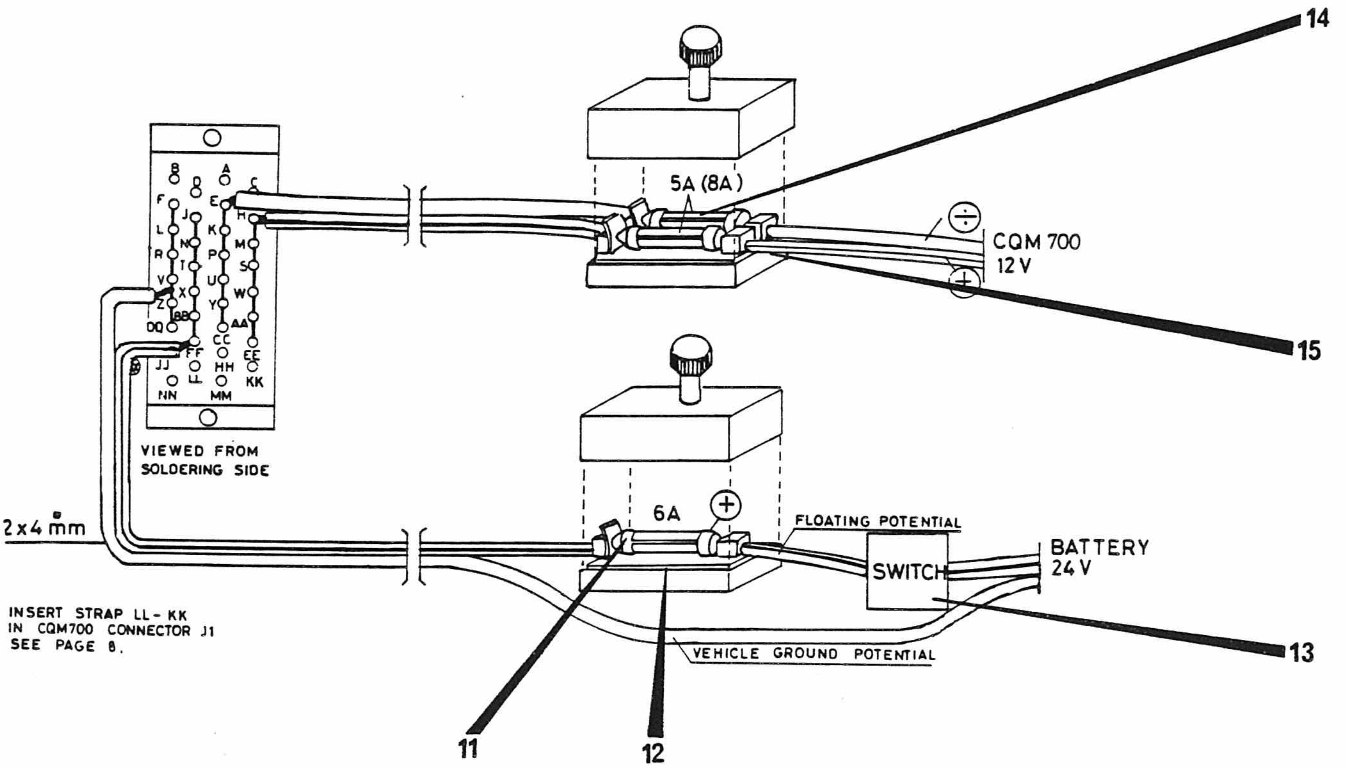
POWER SUPPLY UNIT
STROMVERSORGUNGSBAUGRUPPE PS701

M405.045

ITEM	CODE	DESCRIPTION
1	12.0201	PS 701 Cabinet PS 701 Kabinet
2	12.0119	Bottom Bund
3	20033-04016	Screw Skrue
5	32.0150	Packing Pakning
6	11.0881	Chassis plate Chassisplade
7	20052-04015	Screw Skrue
9	32.0160	Packing Pakning
10	13.0032	Codescreen Kodeskærm
11	34.0027	Shorting link Kortslutningsbøjle
12	41.5081	Connector Konnektor
13	20022-02608	Screw Skrue
14	59.0039	Heat sink Køleplade
16	59.0038	Heat sink Køleplade
17	43.5006	Stand-off Støttebuk
18	20022-04008	Screw Skrue
19	35.5008	Cable eye Kabeløje
20	2202-040070	Nut Møtrik
21	2450-080043	Washer Skive
22	99.5018	Mica Washer Glimmerskive
23	59.5007	Bush Isoleringsbøsning
24	20022-04015	Screw Skrue
25	20022-02610	Screw Skrue
26	2450-048027	Washer Skive
27	31.0269	Brass spacer Mess. stag
28	32.0406	Isolating plate Isolationsplade
29	38.5036	Mounting bracket for resistor Holder for modstand
30	20022-03004	Screw Skrue

Storno





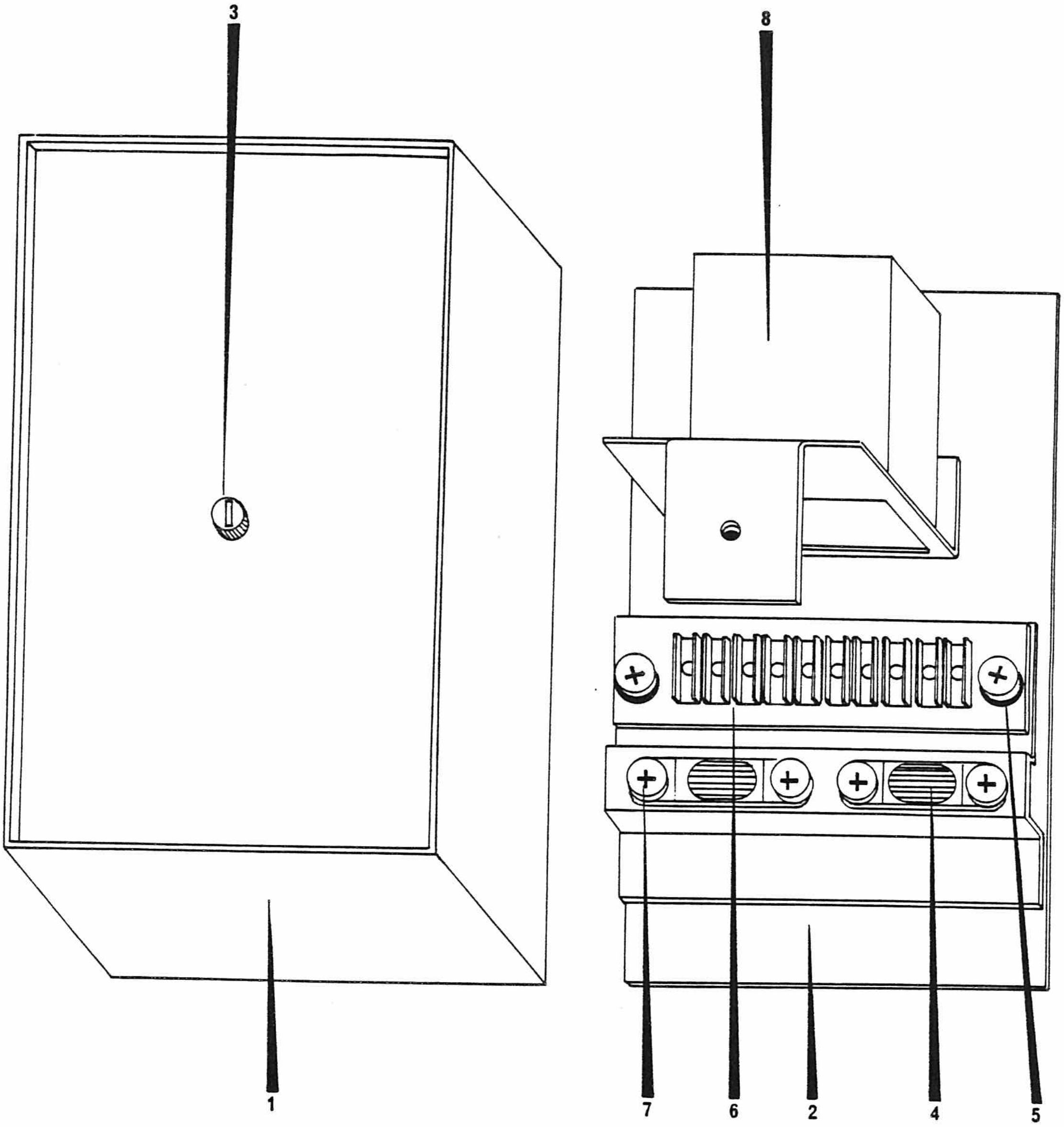
NOTE INSERT STRAP LL-KK IN CQM700 CONNECTOR J1 SEE PAGE 8.

CONNECTOR FOR PS 701

ITEM	CODE	DESCRIPTION
	17.0069	Installation Kit Assy. Item 1-14
	41.0195	Connector Assy. (Item 1-9)
1	12.0053	Connector Housing Konnektor hus
2	41.5082	34 Way Connector Female 34 pol multikonnektor hun
3	13.0026	Code Screen Kodeskærm
4	20.0033-040.18	Allen Screw M4 x 18 Skrue M4 x 18
5	36.0124	Washer Skive
6	29.0174	Washer Skive
7	32.0158	Sealing Ring Gummiskive
8	29.0174	Washer Skive
9	28.0066	Threaded Nipple Gevindstykke
10	34.0027	Shorting Link Kortslutningsbøjle
11	92.5066	Fuse 6 A Sikring 6 A
12	46.5010	Fuse Holder Sikringsholder
13	47.5075	Switch Afbryder
14	92.5100	Fuse 5 A Sikring 5 A
14a	92.5097	Fuse 8 A - 15/25 W only Sikring 8 A - 15/25 W only
15	46.5010	Fuse Box Sikringsbox
16	173.5022	Battery Cable 2 x 4 m^2 Batteri kabel.

INSTALLATION KIT FOR PS701

Storno



SWITCHING UNIT
UMSCHALTEINHEIT

SU703

M405.042

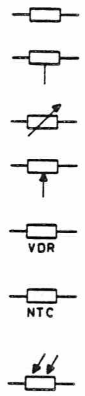
ITEM	CODE	DESCRIPTION
	10.2447	SU703 Switching unit assy SU703 Omskifterenhed komplet
1	12.5009	Housing (Plastic) Hus (Plastik)
2	11.0867	Groundplate assy bundplade komplet
3	20022-05008	Screw 5 x 8 Skrue 5 x 8
4	38.5011	Cablehanger Aflastningsbøjle
5	2450-060032	Washer Skive
6	43.0086	Terminal board assy Loddeliste komplet
7	20022-030040	Screw 3 x 4 Skrue 3 x 4
8	58.5023	Relay 12V/530 Ω Relæ 12V/530 Ω

STORNOPHONE700
MAINTENANCE MANUAL
VOLUME II
Section 10

TITLE	Code
Graphical symbols 1-3	60.085-E1

GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

Resistors (R)

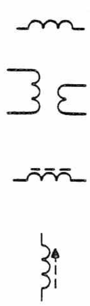


- Resistor
- Resistor with fixed tap
- Variable resistor
- Resistor with movable tap
- Varistor (voltage-dependent resistor)
- Temperature-dependent resistor with negative temperature coefficient
- Light-sensitive resistor (Photosensitive resistor)

Capacitors (C)

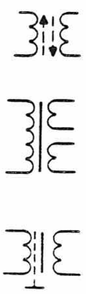
- Capacitor
- Variable capacitor
- Trimmer capacitor
- Feedthrough capacitor
- Electrolytic capacitor

Coils (L)



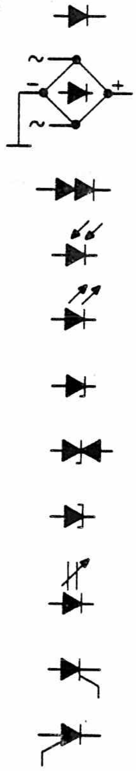
- RF coil, air core
- Coupled RF coils, air core
- RF coil with core
- RF coil with adjustable core
- AF choke

Transformers (T)



- Transformer with adjustable RF cores
- Transformer with iron core
- Transformer with screen connected to chassis

Diodes (E)

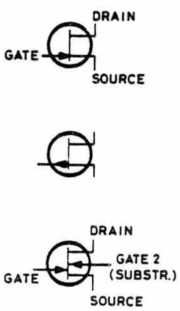


- Diode
- Bridge rectifier
- Series-connected stabilizer diodes within one case
- Light-sensitive diode (Photosensitive diode)
- Light-emitting diode
- Zener diode (unidirectional)
- Zener diode (bidirectional)
- Tunnel diode
- Varactor diode (capacitance diode)
- Controlled rectifier, PNPN (N-thyristor)
- Controlled rectifier, NPNP (P-thyristor)

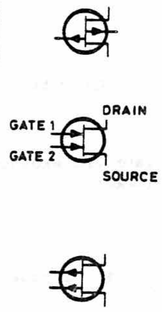
Transistors (Q)

- Transistor, PNP
- Transistor, NPN
- Light-sensitive transistor
- Unipolar transistor with N-type base
- Unipolar transistor with P-type base

Junction Field Effect Transistors (JFET)

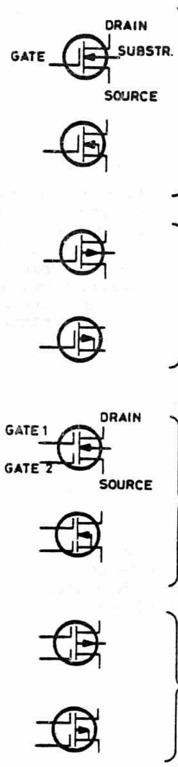


- N-channel JFET
- P-channel JFET
- N-channel dual gate JFET



- P-channel dual gate JFET
- N-channel JFET tetrode
- P-channel JFET tetrode

Insulated Gate Field Effect Transistors (IGFET or MOS)

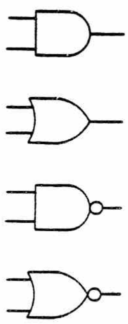


- N-channel IGFET (MOS)
- P-channel IGFET (MOS)
- N-channel dual gate IGFET (MOS)
- P-channel dual gate IGFET (MOS)

Integrated Circuits (IC)

Several integrated circuits contained within one case are designated by one common number followed by an identifying letter (a, b, c etc.). Thus, circuits IC1a, IC1b and IC1c are contained within one case.

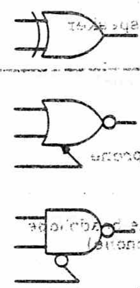
Gates



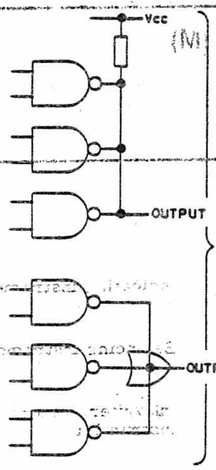
- AND gate
- OR gate
- NAND gate
- NOR gate

GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

Gates, continued



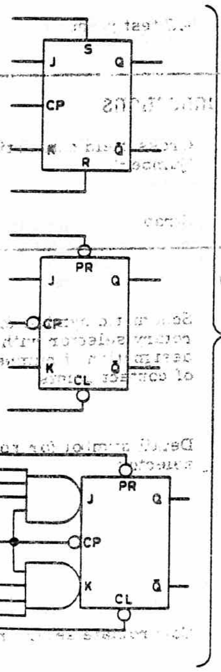
- Exclusive OR gate
- NOR gate with expander input (high)
- NAND gate with expander input (low)



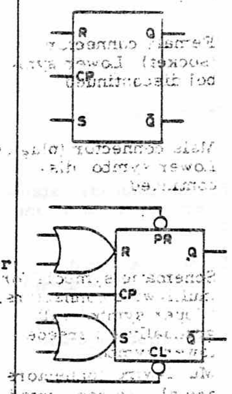
Wired OR (combined OR outputs) (presentation at top is used in detailed diagrams; presentation below is used in functional diagrams)

Flip-flops

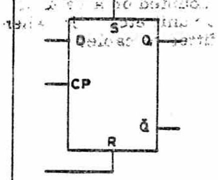
Abbreviations used:
S = Set
R = Reset
CP = Clock Pulse
PR = Preset
CL = Clear



J-K Flip-flops

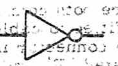


R-S Flip-flops



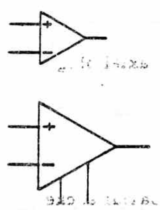
D Flip-flop

Inverters



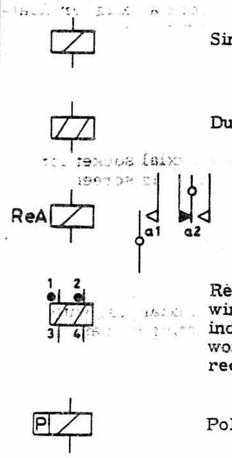
Inverter

Operational Amplifiers

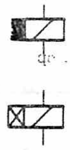


Operational amplifiers

Relays (RE)



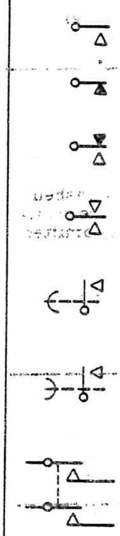
- Single-coil relay
- Dual-coil relay
- Relay with make contacts and change-over contacts
- Relay with direction of winding indicated. Dot indicates two coils wound in the same direction
- Polarized relay



- Coil for slow-release relay
- Coil for slow-acting relay

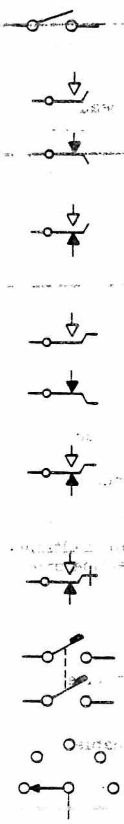
Contacts

Contacts are always shown in their non-operated positions unless otherwise specified



- Make contacts
- Break contacts
- Change-over contacts
- Change-over contacts, centre off
- Make contacts, delayed operation
- Make contacts, delayed release
- Mechanically coupled make contacts

Switches and Keys (O)



- On/off switch
- Locking keys or switches; push on, push off
- Non-locking self-releasing keys or switches
- Locking mutually releasing keys or switches (in row of push-buttons etc.)
- Self-releasing switch (overcurrent switch etc.)
- Rotary switch

GRAPHICAL SYMBOLS USED IN STORNO CIRCUIT DIAGRAMS

Lamps (V)

Indicator lamp

Neon lamp

Fuses and Cut-outs (S)

Fuse

Circuit-breaker

Tag Strips (KL)

Tag strip - dashed frame may be wholly or partly omitted

Batteries (BT)

Battery

Feedthrough Filters (F)

Feedthrough filter

Ferrite Beads (FB)

Ferrite bead

Crystals (X)

Crystal

Cables and Wires (W)

Usual conductor

Three conductors

Eight conductors

Shift from multiple-line to single-line presentation

Screened wire

Coaxial cable

Connectors (J and P)

Female connector (socket). Lower symbol discontinued

Male connector (plug). Lower symbol discontinued

Schematic symbols for multi-wire connectors. (Upper symbol will gradually supersede lower symbol)

Multi-wire connectors are always designated "J" when permanently mounted on a cabinet or unit etc., "P" when fitted to cables

Detail symbols for multi-wire connectors. (Upper symbol will gradually supersede lower symbol)

Where both connectors are fitted to cables, male connector is designated "P" and female connector "J"

Coaxial plug

Coaxial socket

Coaxial plug for floating screen

Coaxial socket for floating screen

Coaxial plug with mating socket

Loudspeakers (LS)

Loudspeaker

Telephones (TEL)

Telephone

Single headphone (earphone)

Double headphone (headset)

Microphones (M)

Meters etc.

Indicating instrument

Balancing instrument

Inkwriter, recording instrument

Test Points

DC test point

AC test point

Replaceable Connections

Cross-field connection (jumper)

Strap

Selectors (VG)

Schematic symbol for rotary selector with designation of number of contact points

Detail symbol for rotary selector

Co-ordinate selector