STORNOPHONE 900

M9660

ADJUSTMENT PROCEDURE

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Service Coordination

81-03

ADJUSTMENT PROCEDURE
M9660

GENERAL

Test Setup, RX - TX
Measuring instruments
Tools
Cable connectors, misc.
Voltage reg. adjustment

1. Receiver adj. components

1.1 RC injection signal PLL, Crystal osc.?
1.2 Receiver frequency setting
1.3 RC front-end
1.4 Audio Level/power output
1.5 Receiver sensitivity
1.6 Squelch setting
1.7 RX current consumption

2. Transmitter adjustments

2.1 Exciter adjustments
2.2 TX frequency setting
2.3 TX power
2.4 Modulation, AF sensitivity
2.5 TX current consumption

ALIGNMENT PROCEDURE

This procedure covers a UHF radio (403-512 MHz) in the dual PLL simplex and duplex versions.

For testing the equipment it is necessary to use the correct control head and accessories. Which control head to be used in depending of the software package.

It is convenient to use a voltmeter Zi $\geq$ 20 Kohm/V which is connected to the central metering (CM) connectors for testing.

Measuring instruments

RF signal generator	10-512 MHz
Multimeter	R_i= 20 Kohm/V
AC Voltmeter	Z_i= >20 Kohm
Distortion meter	
DC Ampere meter	0-0.1/2/10 A
DC Power Supply	10-20 V/10 A
	Current limiter
	adj. 0.1-10A
AF signal generator	0-5 kHz
RF Power meter	0-40 W
Deviation meter	406-512 MHz
Frequency counter	10-512 MHz

Central Metering Test box
Control Head

Tools

Alignment tool	Code No. B800775
-	B800770
-	B800773

AF Dummy Load 8 ohm/5 W

CENTRAL METERING CONNECTORS (CM)

PA		Connect meter to -	+
1.	A-		
2.	A+	1	2
3.			
4.	FINAL CURRENT	4	2
5.	DRIVE CURRENT	5	2
6.			
7.			
8.	POWER CONTROL	1	8
9.	FORWARD POWER	1	9
10.	INPUT DRIVE	1	10

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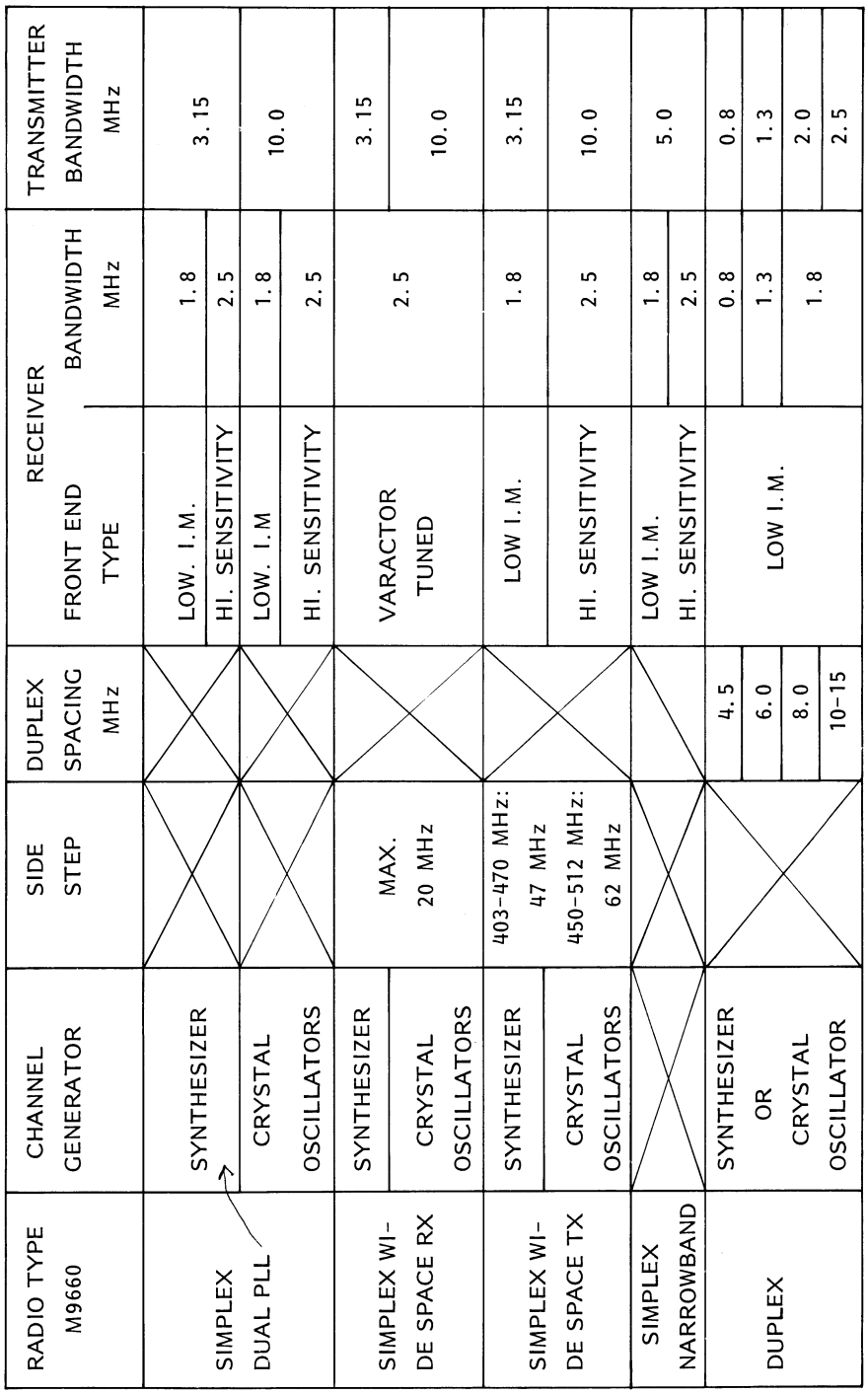

RADIO TYPE M9660	CHANNEL GENERATOR	SIDE STEP	DUPLEX SPACING MHz	RECEIVER FRONT END TYPE	RECEIVER BANDWIDTH MHz	TRANSMITTER BANDWIDTH MHz
SIMPLEX DUAL PLL	SYNTHESIZER			LOW. I.M.	1.8	3.15
				HI. SENSITIVITY	2.5	
	CRYSTAL OSCILLATORS			LOW. I.M	1.8	10.0
				HI. SENSITIVITY	2.5	
SIMPLEX WIDE SPACE RX	SYNTHESIZER	MAX. 20 MHz		VARACTOR TUNED	2.5	3.15
	CRYSTAL OSCILLATORS					10.0
SIMPLEX WIDE SPACE TX	SYNTHESIZER	403-470 MHz: 47 MHz 450-512 MHz: 62 MHz		LOW I.M.	1.8	3.15
	CRYSTAL OSCILLATORS			HI. SENSITIVITY	2.5	10.0
SIMPLEX NARROWBAND				LOW I.M.	1.8	5.0
				HI. SENSITIVITY	2.5	
DUPLEX	SYNTHESIZER OR CRYSTAL OSCILLATOR		4.5	LOW I.M.	0.8	0.8
			6.0		1.3	1.3
			8.0		1.8	2.0
			10-15			2.5

FIG. 1. SYSTEM BANDWIDTH TABLE

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TX		Connect meter to
		- +
1.	A-	
2.	A-	
3.	FS VCO TUNE	1 - 3
4.	FS OSCILLATOR	1 - 4
5.	TX LEVEL	1 - 5
6.	TX PLL TUNE	1 - 6
7.	TX STATUS	1 - 7
8.	TX FILTER	1 - 8
9.	TX TRIPLER	1 - 9
10.	OSCILLATOR	1 - 10

RX		Connect meter to
		- +
1.	A-	
2.	A-	
3.	DISCR	1 - 3
4.	IF AMPL.	1 - 4
5.	RX MIXER	1 - 5
6.	RX PLL TUNE	1 - 6
7.	RX LOCK DETECT.	1 - 7
8.	RX FILTER	1 - 8
9.	RX TRIPLER	1 - 9
10.	OSCILLATOR	1 - 10

SYSTEM		Connect meter to
		- +
1.	A-	
2.	A+	1 - 2
3.	+9 V	1 - 3
4.	+5 V	1 - 4
5.	MIC. HI.	(1 - 5)$^{+}$
6.	LS HI.	6 - 7
7.	LS LO	
8.	TX KEY	(1 - 8)$^{+}$
9.	CG DISABLE	(1 - 9)$^{+}$
10.	HL41	

$^{+}$) Connections used

Multiconnector

1.	Spare 2 (H22)	21	Spare 8 (H53)
2.	Spare 3 (H23)	22	
3.	Spare 1 (H24)	23	
4.	Spare 5 (H26)	24	
5.	N.C.	25	
6.	LS High	26	
7.	Serial Data Up	27	
8.	Spare Audio	28	
9.	MC High	29	
10.	LS Low	30	
11.	Serial Data Down	31	
12.	CG DISABLE	32	
13.	MC Low	33	
14.	Logic GDN	34	
15.	A-	35	
16.	ON/OFF	36	
17.	A+	37	A+ (Battery)
18.	A-	38	A- (Battery)
19.	A+	39	A+ (Battery)
20.	Spare 7 (H27)	40	A- (Battery)

Check of the polarity- and overvoltage protection

Set the power supply to V_{Batt} = 13.6 V
Set the current limiter on the power supply to 0.1 A and connect the power supply with reverse polarity to the equipment. With a DVM across the power leads it should show <1.5 V. Then connect the power supply with the normal polarity and set the current limiter to 3 A.

Check of internal voltages

Put the test set system jack in the system plug. Connect the voltmeter to 1 and 4 where the +5 V is measured. The meter should show 5.0 V.
Connect the voltmeter to 1 and 3 where the +9 V is measured. The meter should show 9.0 V.
N.B. This measurement is not accurate enough for adjusting the voltages with in the 0.5% tolerance. To doing that, it is necessary to use a digital voltmeter.

1. Alignment and control of the receiver

1.1 Alignment of the receiver injection

Put the RX/TX jack in the RX plug and connect the voltmeter to 1 and 10.

a) Tune L_3 and L_{12} in the PL961/964 for maximum meter reading (1.5 V).

b) Connect the voltmeter to 1 and 9. Tune L_{13} and then L_{12} to maximum meter reading. Retune L_3, L_{12}, L_{13} for maximum. The voltage shall be approx. 0.9 V. (0,7 - 1V)

c) Connect the voltmeter to 1 and 8. Detune L_{14} and L_{15}. Now tune L_{14} for maximum meter reading, and after this, tune L_{15} to minimum (0.9 V).
Caution: The maximum and minimum shall be well defined and easy to find.
Do not retune L_{14}.

d) Connect the voltmeter to 1 and 7 and tune C1 slowly until the meter reading goes high (0.85 V).

e) Select a center channel on the control head. Connect the voltmeter to 1 and 6. Fine tune C1 for 0.6 V reading.

f) Connect the voltmeter to 1 and 5. Tune L2, L3 and C1 in RC96X for maximum reading, approx. 0.5 V.
The setting of C1 is critical and the adjustment is performed by turning C1 to maximum reading and then a little back.

1.2 Adjusting the injection frequency

For adjusting the injection frequency to the correct frequency the first point is to check the synthesizer frequency. Connect a counter to the output of the FS (J_1/P_2) (See fig. 2), output level 0 dBm. The output frequency should be from 13 - 15 MHz as follows:

1) at 12.5 kHz or 25 kHz channel spacing: a multiple of 12.5 kHz i.e. xx.xxx000 MHz or xx.xxx500 MHz.
2) at 20 kHz channel spacing: a multiple of 20 kHz.
3) at 30 kHz channel spacing: a multiple of 30 kHz.

If the frequency is not correct adjust the coil (FREQ. L1 in XO9012) in the FS reference oscillator.

Then connect the counter to the output of PL961/964 (J_2/P_1) and connect the FS to the PL. The correct frequency of the PL is: F_{ant} -21.4 MHz. The frequency is adjustable with L_2 (FREQ.) in PL961/964, see fig. 2. Select a channel frequency which corresponds to the specified antenna frequency.

1.3 Alignment of the receiver front end

This adjustment is only necessary if the helix filter is out of adjustment or needs readjustment.
Connect the voltmeter to 1 and 4. (limiter in IF amplifier).

Set the signal generator to f_{ant} and a level of 100 dB/1 uV, or 100 mV on signal frequency.
For easier adjustment it will be useful to preadjust TS1-TS5 (refer to fig. 3)

To avoid limiting in the IF amplifier decrease the level from the signal generator to level below the limiting point as the sensitivity increases and before finetuning.

a) Front end RC 961/965

1) Adjust the tuning slugs TS1-4, C_1 and L_4 to maximumvoltmeter reading (IF amplifier). Adjust TS 5 to the same height as the other TS.
2) Detune TS2 and TS4 about 4 turns (~3 mm).
3) Adjust TS1-3-5 and C_1 for maxi-

mum voltmeter reading (IF amplifier).

4) Adjust TS2-4 for maximum voltmeter reading.
5) Repeat pt. 4.
6) Fine adjust TS1-2-3-4-5, C_1 and L_4 for maximum voltmeter reading.
7) CHECK the voltmeter reading for giving approximately 0.65 V with an input voltage of 10 uV (EMF).

b) Front end RC962/966

1) Adjust TS1 - 5, C_1 and L_4 for maximum voltmeter reading.
2) CHECK the voltmeter reading for giving 0.65 V with an input voltage of approx. 3 uV (EMF).

1.4 Duplex

1.5 Alignment of the audio signal

Connect an 8-ohm/5 W load between LS HI - LS LO (1 - 6).
Connect an AF voltmeter across the load.
Set the RF level from the signal generator to 1 mV EMF on the signal frequency.
The squelch control on the control head shall be unactivated and a possible subadiosignal shall be unmuted. Activate the LS function.

The signal from the signal generator shall be modulated with 1 kHz and the deviation is set to:

3.0 kHz for 25 kHz channel spacing
1.5 kHz for 12.5 kHz channel spacing
2.5 kHz for 20 kHz channel spacing

On the controlbox the volume is set to level 7. With the potmeter R_{vol} (see fig. 1) the output level is adjusted to 5 W in a load of 8 ohm (6.3 V RMS).

1.6 Checking the receiver sensitivity

The audio level is set to level 6:
Secure descriminator "0"=
value with signal ~o.5 V (pin 1 - 3)

Possible sinad test. AF ~80 mV

a) On center channel:

With RC961/965:
CEPT SPECIFICATION
20 dB psoph. sinad
for V_{input}= 0.70 uV EMF

EIA SPECIFICATION
12 dB sinad
for V_{input}= 0.35 uV 1/2 EMF

With RC961/965 +duplexer:
CEPT SPECIFICATION
20 dB psoph. sinad
for V_{input}= 0.90 uV EMF

EIA SPECIFICATION
12 dB sinad
for V_{input}= 0.45 uV 1/2 EMF

With RC962/966:
CEPT SPECIFICATION
20 dB psoph. sinad
for V_{input}= 0.40 uV EMF

EIA SPECIFICATION
12 dB sinad
for V_{input}= 0.20 uV 1/2 EMF

With RC962/966 the sensitivity can be optimised by finetuning TS2 for maximum sinad.

b) On lowest and highest channel:
Compared with the measurement on center channel the degradation shall be below 1 dB.

1.6 Adjustment of the squelch

a) Equipment with fix squelch.
The squelch control on the control head shall be activated. (See fig. 1). With R_{sq} the squelch shall be adjusted to open for the RF signal which gives a SINAD ratio between 8 - 12 dB (EIA) at the audio output.
When the RF signal is removed, the squelch shall be closed i.e. no AF output.

1.7 Check of the current consumption for the receiver

V_{volt} = 13.6 V

Condition: off:	<75 mA
stand by:	<1 A
audio 5 W output:	<2.4 A

2. Alignment and check of the transmitter

Select a center channel.
Set the power supply to W_{Batt} = 13.6 V.
Set the current limiter of the power supply to 10 A. Connect the powermeter and a dummy load to the coax-connector on the front of the equipment. Key the transmitter.

2.1 Alignment of the exciter

Put the RX/TX jack in the TX central metering.

a) Connect the voltmeter to 1 and 10. Tune L_3 and L_{16} in PL962 for maximum meter reading (0.85 V). (See fig. 2)

b) Connect the voltmeter to 1 and 9. Tune L_3, L15 and L16 for maximum meter reading 0.7-1.0 V.

c) Connect the voltmeter to 1 and 8. Detune L11 and L12. Then tune L12 to max. and after this, tune L11 to minimum (2.8 V).
Caution: The maximum and minimum shall be well-defined and easy to find.
Do not retune L12.

d) Connect the voltmeter to 1 and 7. Tune C2 slowly until the CM output goes high, approx. 0.7 V.

e) Connect the voltmeter to 1 and 6. Fine tune C2 to 0.8 V on the voltmeter. The setting of C2 is critical and the adjustment is performed by turning C2 to maximum reading and then a little back. (flat part of curve).
Check the output level from the TX PLL. The voltage should be approx. 0.4 V.

2.2 Adjusting the transmitter frequency

For synthesizer adjustment refer to 1.2.
Connect the frequency counter through an attenuator to the output of PL962 (J_1/P_1) (output level 0.5 W).
The frequency is adjustable with L_2 in PL962 see fig. 2. The transmitter signal shall be unmodulated.

2.3 Adjusting of the transmitter output

With R_{PA} in the stage (see fig. 2) the power level is adjusted to the specified level.

2.4 Adjusting the transmitter modulation

Connect the deviation-meter through the attenuator to the ant. connector on the front of the equipment, and the AF signal generator to the modulation input 1 - 5 (MIC. HI.).

a) Adjusting Δf max.
Set the level from the AF signal generator to 1.0 V. Measure the deviation on the deviation meter. The AF frequency is changed between 300 and 3000 Hz to find the frequency where the deviation reaches the highest value. At this

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frequency the deviation is adjusted with R_2 in PL962/965 (see fig. 2) to the specified level.

Channel spacing 25 kHz	f_{max} ±4.5 kHz
Channel spacing 20 kHz	f_{max} ±3.6 kHz
Channel spacing 12.5 kHz	f_{max} ±2.3 kHz

b) Checking the audio sensitivity
The AF frequency is set to 1000 Hz and the level from the AF generator is changed to the level where the deviation is:

Channel spacing 25 kHz	Δf_{max} = 3.0 kHz
Channel spacing 20 kHz	Δf_{max} = 2.4 kHz
Channel spacing 12.5 kHz	Δf_{max} = 1.5 kHz

The level from the AF generator should be 100 mV ±3 dB.

2.5 Checking of the current consumption for the transmitter

RF output	10 W (simplex)	:<4.5 A
RF output	25 W (simplex)	:<7.5 A
RF output	25 W (simplex)	:<11.5 A

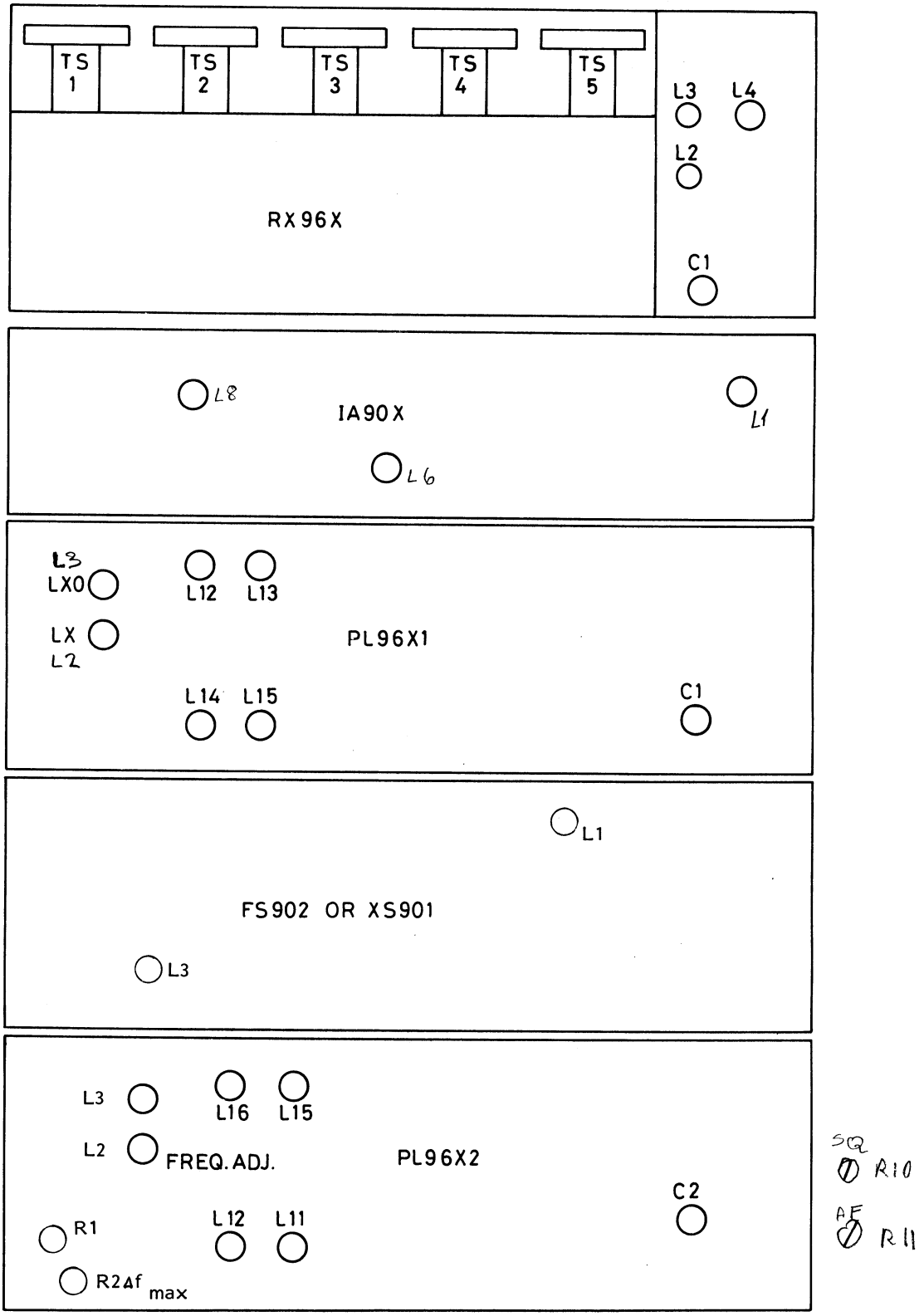

FIG. 2. ADJUSTABLE COMPONENTS

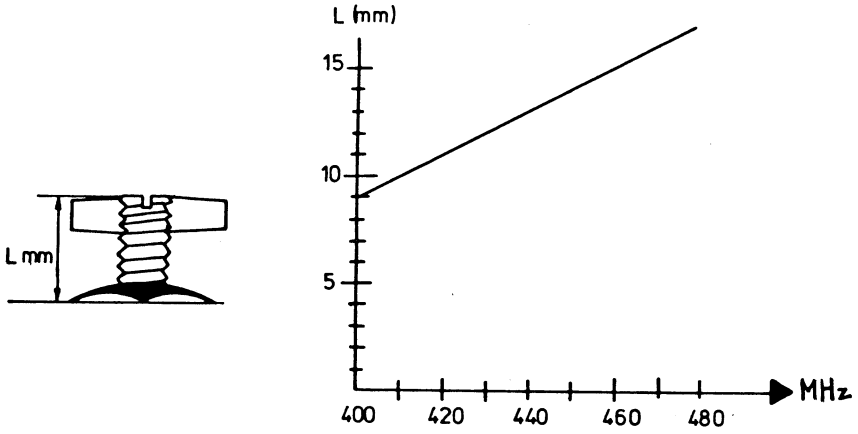

FIG. 3. PRESETTING OF HELIX FILTER

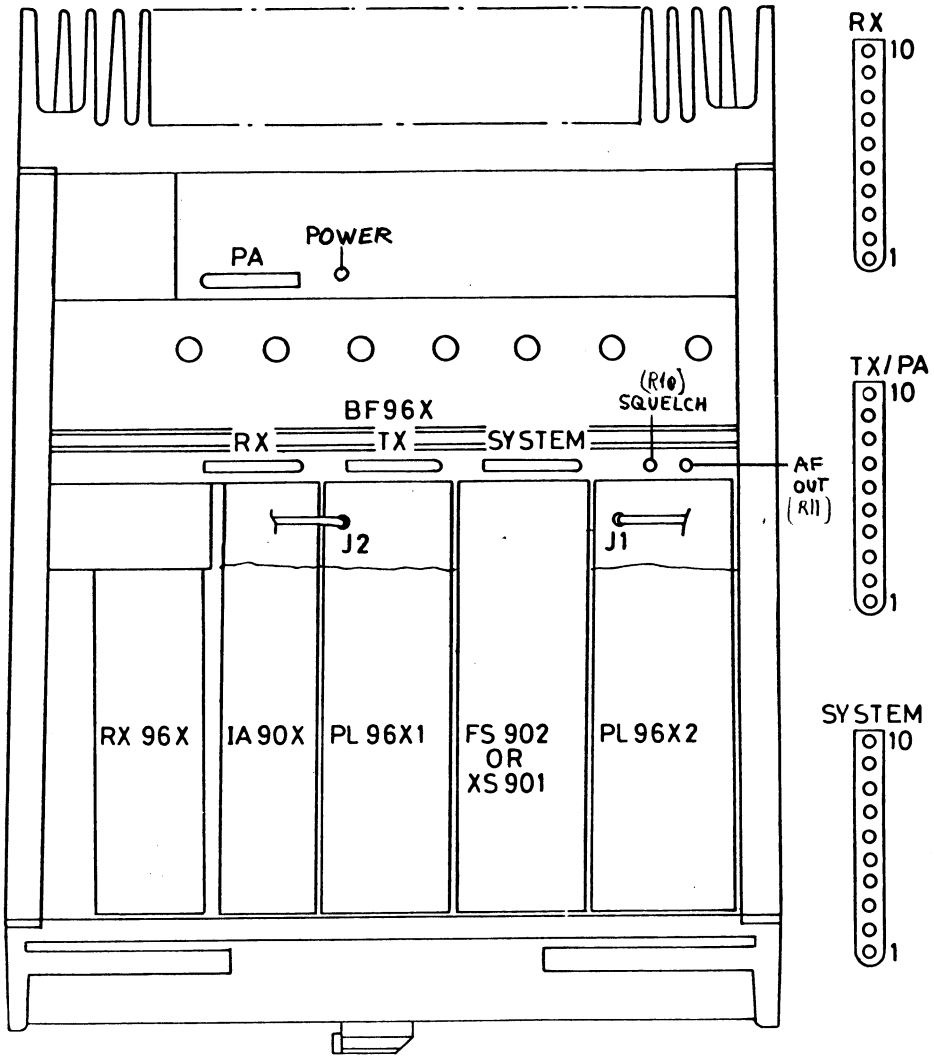

FIG. 4. MODULE LAYOUT AND CENTRAL METERING
POWER AND SQELCH ADJUSTMENT

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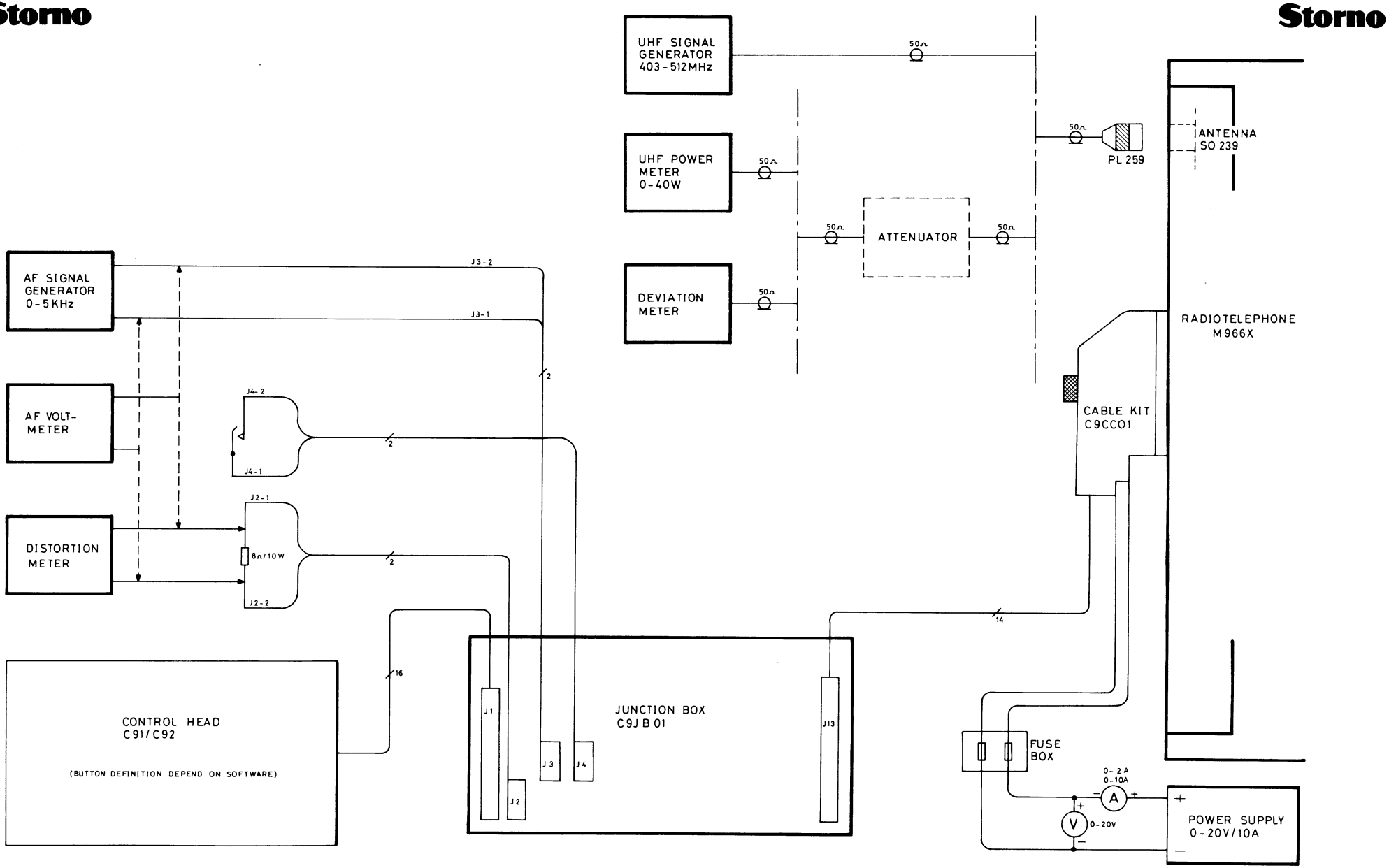

TEST SETUP M9660

D402.901

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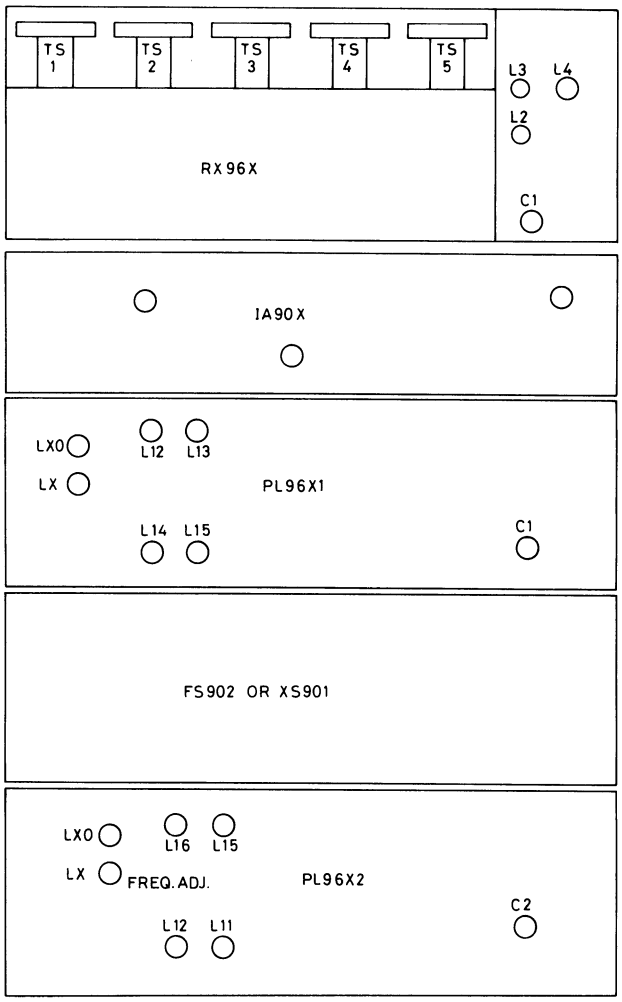
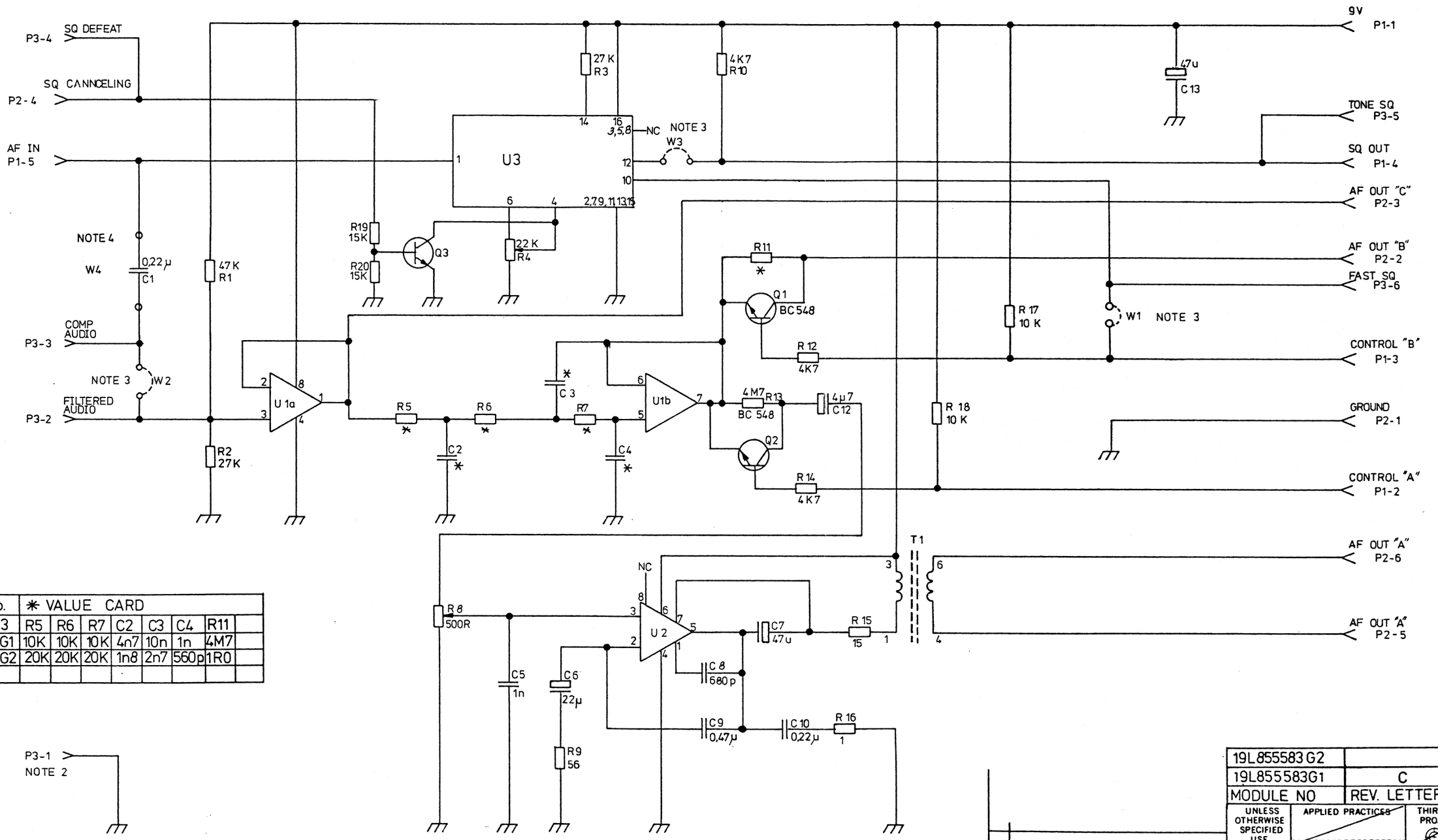


ADJUSTABLE COMPONENTS M9660

D402.902



CODE No.		* VALUE CARD						
19L855583		R5	R6	R7	C2	C3	C4	R11
AA 9018	G1	10K	10K	10K	4n7	10n	1n	4M7
AA 9022	G2	20K	20K	20K	1n8	2n7	560p	1R0

Notes:

1 All resistors are 1/4 watt unless otherwise specified
Resistor values in Ω unless followed by multiplier k or M.
Capacitor values in F unless followed by multiplier µ,n or p.
Inductance values in H unless followed by multiplier m or µ.

2 P3 IS USED TO INTERFACE CHANNEL GUARD EQUIPMENT.

3 W1 IS MOUNTED,WHEN GATING OF NON-DE-EMPHASIZED ("AF OUT-B") IS TO BE CONTROLLED BY THE "FAST SQ" SIGNAL. W2 AND W3 ARE TO BE USED TOGETHER WITH CG9010 (CHANNEL GUARD MODULE).

4 IN 19L855583 G2 THE COMPONENTS C1, Q1, R12, R17 AND W1 ARE OMITTED AND C1 IS REPLACED BY W4.

19L855583 G2	
19L855583G1	C
MODULE NO	REV. LETTER

UNLESS OTHERWISE SPECIFIED USE — APPLIED PRACTICES — THIRD ANGLE PROJECTION

TOLERANCES — DECIMALS + — ANGLES + — SURFACES — SI-METRIC — FIRST ANGLE PROJECTION — 9L 38 — PRINTS TO

MATERIAL — FINISH

	Added G2	PBN 89 MAY 10
4	AN 4034	HuH 88 NOV 17
3	AN 2906	HuH 87 AUG 24
2	AN 2447	RTP 86 MAR 05
1	AN 2332	CE 85 MAY 10

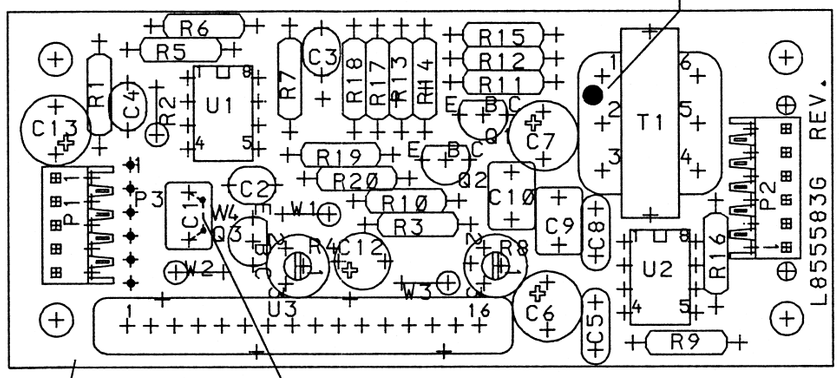
REVISIONS

FIRST MADE FOR AA 9018 — F.C.F.O. 19L855583

APPV — DATE 22-2-89 — TITLE DIAGRAM — PARTS LIST NO

MADE BY PBN/MSØ 83. NOV. 29 — ISSUED 10 AUG 1 — Storno — 19 L 855590 CONT ON SHEET F SH NO 1

RED DOT INDICATES TERM.1



ITEM 2

MARK APPLICABLE GROUP
NUMBER AND REVISION LETTER
COLOR BLACK
PER 19A700154P1
FOR LATEST REVISION LETTER
SEE 19K805267

(1) (2) NOTES:
1. SOLDER ALL ELECTRICAL CONNECTIONS.
2. COMPONENT LEADS TO PROTRUDE 1.5 MAX. BELOW SOLDER SIDE OF BOARD.

3. IN 19L855583G2 THE COMPONENTS C1,Q1,R12,R17 AND W1 ARE OMITTED AND C1 IS REPLACED BY W4.

UNLESS OTHERWISE SPECIFIED USE	APPLIED PRACTICES 19A701294	THIRD ANGLE PROJECTION	
TOLERANCES DECIMALS ± ANGLES ±	SURFACES √ SI-METRIC	FIRST ANGLE PROJECTION	9L27 PRINTSTO

Added G2 PBN 89 MAY 10 AA9022	MATERIAL	FINISH	
REC HuH 87 Nov 11			
1 AN2906 HuH 10-JUN-87			
REVISIONS			
FIRST MADE FOR AA9018	F.C.F.O. INDEX 19J708844		
APPV PBN	DATE 7-9-84	TITLE COMPONENT BD., P.W.	PARTSLIST ISSUED
		MADE BY PBN/JS	Storno
		ISSUED 17-AUG-84	19L855583 CONT ON SHEET F SH NO 1

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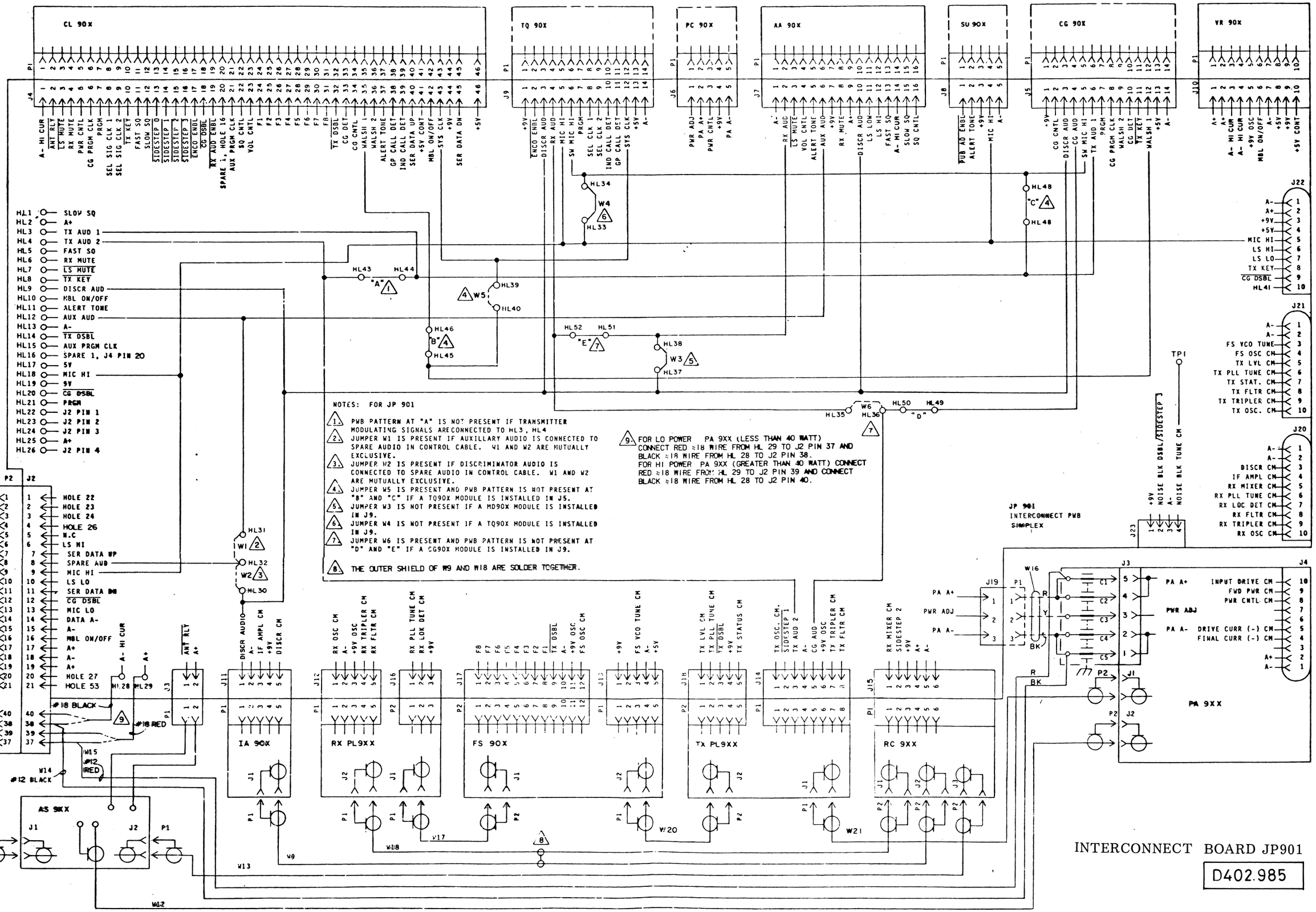

INTERCONNECT BOARD JP901

D402.985