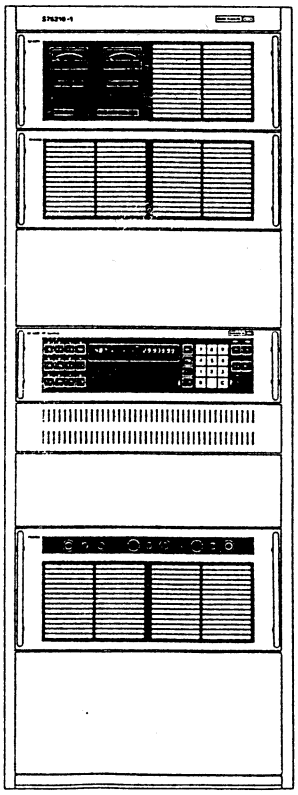
TECHNICAL TRAINING COURSE

FOR

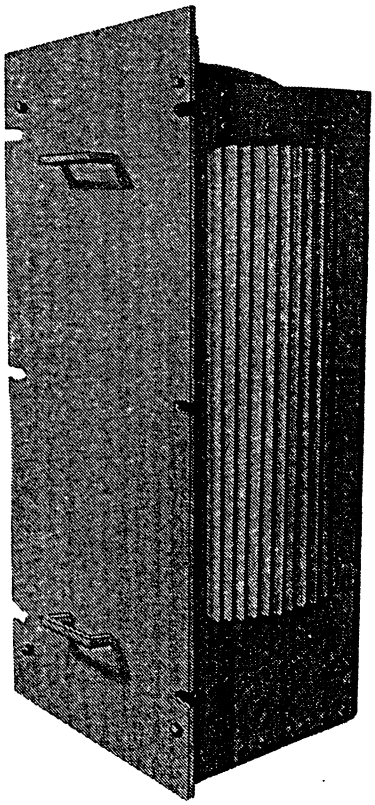
NORSKE TELEVERKET & LUFTFARTSVERKET

08 – 14 May 1992

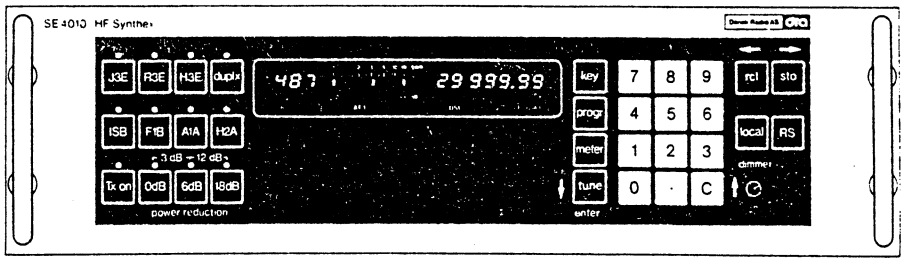
S76210-1
HF SSB/ISB Communications Transmitter



TU 4013
Antenna Tuner



SE 4010
HF Synthex



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SYSTEM DESCRIPTION

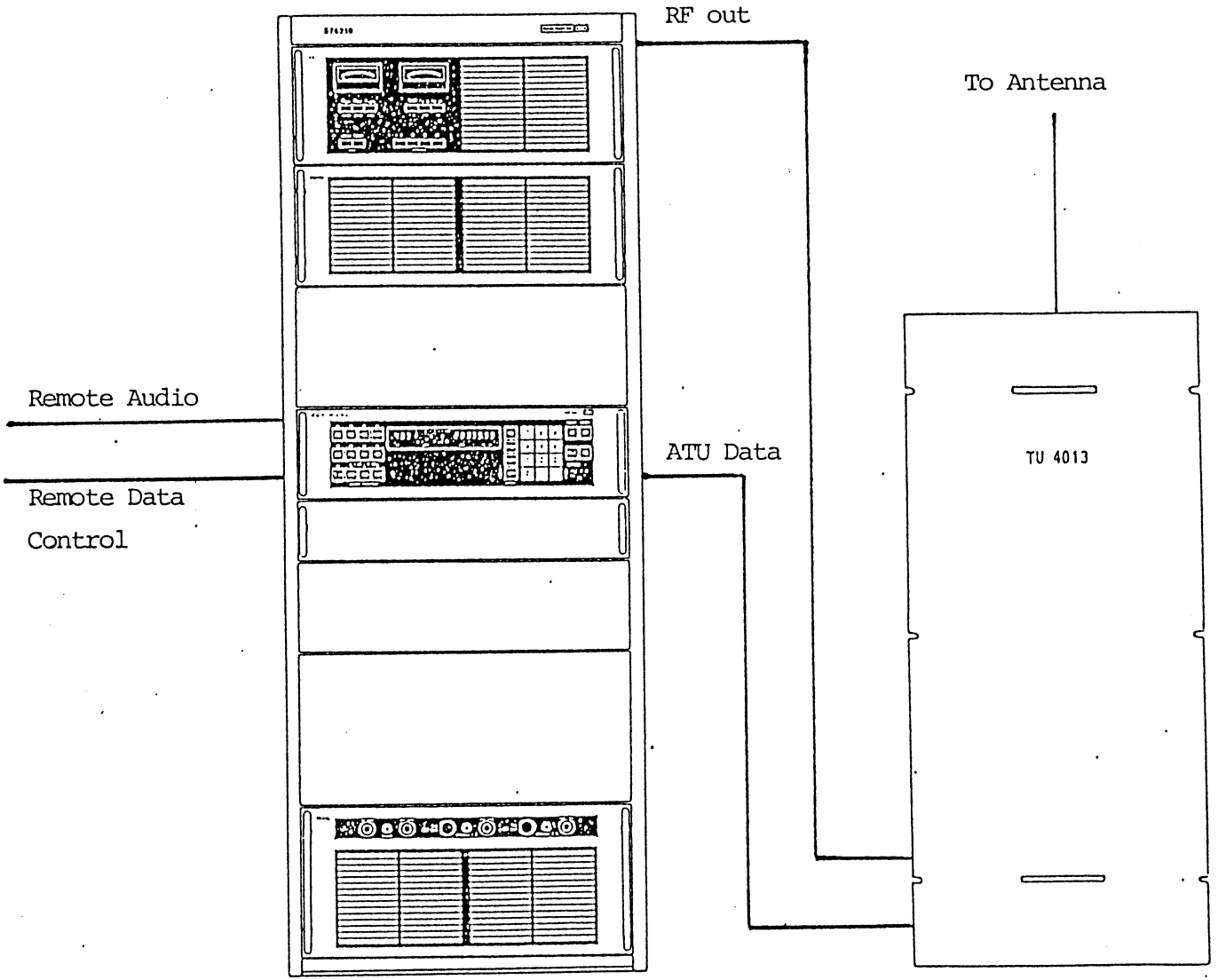
The system consists of two (three), see the figure, items:

- one 500 Watt transmitter
- one antenna tuner
- (one antenna)

The system interconnection is simple:

- Only two cables, one coax and one multi-cable, between the transmitter and the antenna tuner.
- Only two cables for the remote control.

All interconnections, except for the data lines for the antenna tuner, are terminated in easily installable connectors.



System Configuration

CONFIGURATION SE4010

The overall functional block diagram of the exciter is shown in the figure.

In the Modulator Assembly A7 the AF inputs are mixed with the first LO at 1.4 MHz. In this way the two sidebands are generated. Finally the two sidebands and the carrier are amplified, by controlled amplifiers, to the wanted amplitudes and then summed together.

On the IF Assembly A3, the 1.4 MHz signal from the Modulator Assembly is mixed with second LO signal at 73.6 MHz and the sum-frequency at 75.0 MHz is fed to a voltage controlled attenuator via a bandpass filter. This attenuator is, via the Interface Assembly A5 and the Microcomputer Assembly A8, controlled by the detected output power of the corresponding transmitter. In this way the output power is constantly held on the selected level. After the controlled attenuator, the 75.0 MHz signal is mixed to the output frequency with the third LO at 76.5 MHz to 105 MHz. Finally the signal is amplified up to 1 W in the WBA Assembly A4. The Standard Assembly A2 generates the first LO signal at 1.4 MHz, the second LO signal at 73.6 MHz and the Synthesizer Assembly reference signal.

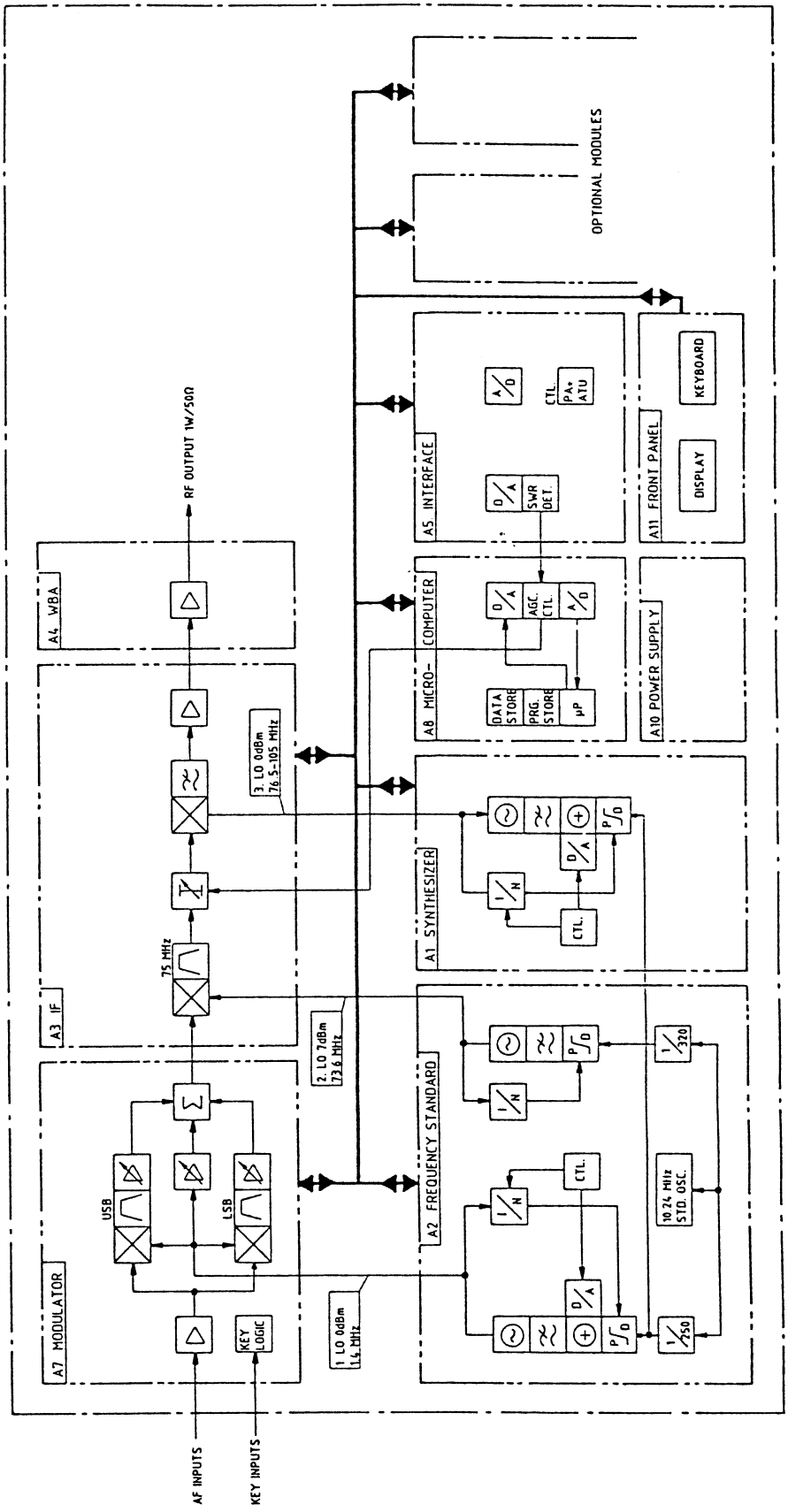
The Synthesizer Assembly A1, generates the third LO signal tunable from 76.5 MHz to 105 MHz in 10 Hz increments.

The Microcomputer Assembly A8 performs the overall control of the exciter.

Typical tasks handled by the assembly:

- Control of the individual assemblies
- Keyboard and step-tune reading
- Display refreshing
- ALC through multiplexed D/A-A/D conversion
- Power level set-up
- Programmable memory set-ups
- Remote control
- Diagnostic routines

Communication between the Microcomputer Assembly and the remaining assemblies is conducted over an internal bus running on the mother PC-board and the front panel ribbon cable.



Overall Functional Block Diagram.

FAST SYNTHESIZER MODULE A1/SE4010

The functional block diagram of the synthesizer is shown in the next figure.

The assembly generates the 75 to 105 MHz local Oscillator (LO) signal for Assembly A3. The synthesizer is based on the Direct Digital Synthesis (DDS) technique, enabling fast frequency shift. The DDS submodule A1A1 generates a 2.672 to 4.0 MHz reference signal for the main loop, variable in 10 Hz steps. A clock signal for the DDS comes from the Clock Loop. A dedicated block diagram of the DDS is shown in a separate figure.

In the Clock Loop a 20.97152 MHz VCXO is locked to the 40.96 kHz reference signal from the master reference oscillator on Standard Assembly A2.

The Clock Loop also delivers a clock signal to the Coarse Loop, where this is divided down to a 327.68 kHz reference signal. The N divider of the Coarse Loop combined with the 16(17) prescaler has a division ratio between 241 and 332, resulting in a Coarse Loop output frequency that is 2.672 to 4.0 MHz higher than the LO output from the Main Loop.

In the Main Loop the output of the main oscillator is mixed down with the Coarse Loop output. The resulting signal is routed to a phase detector where it is compared with the DDS output. The frequencies of these two signals are the same when the loop is locked, resulting in a 75 to 104.99999 MHz LO output with 10 Hz resolution.

A clamping circuit prevents the Main Loop from exceeding its locking range and the loop has a variable loop filter, controlled by a lock detector timing circuit, to assure high switching speed.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
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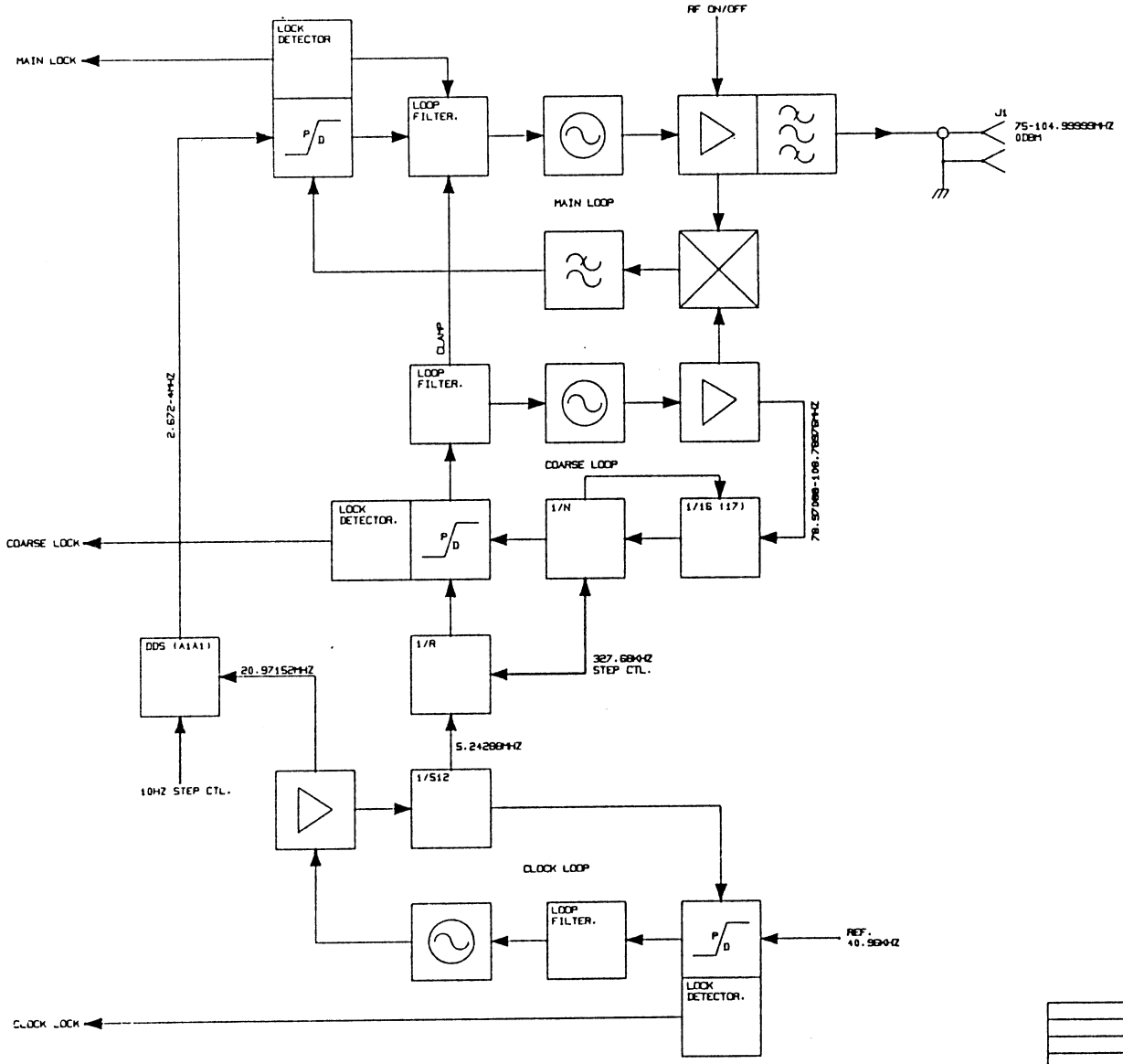

		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH BS 308	1	DANSK RADIO AS		A
			A			
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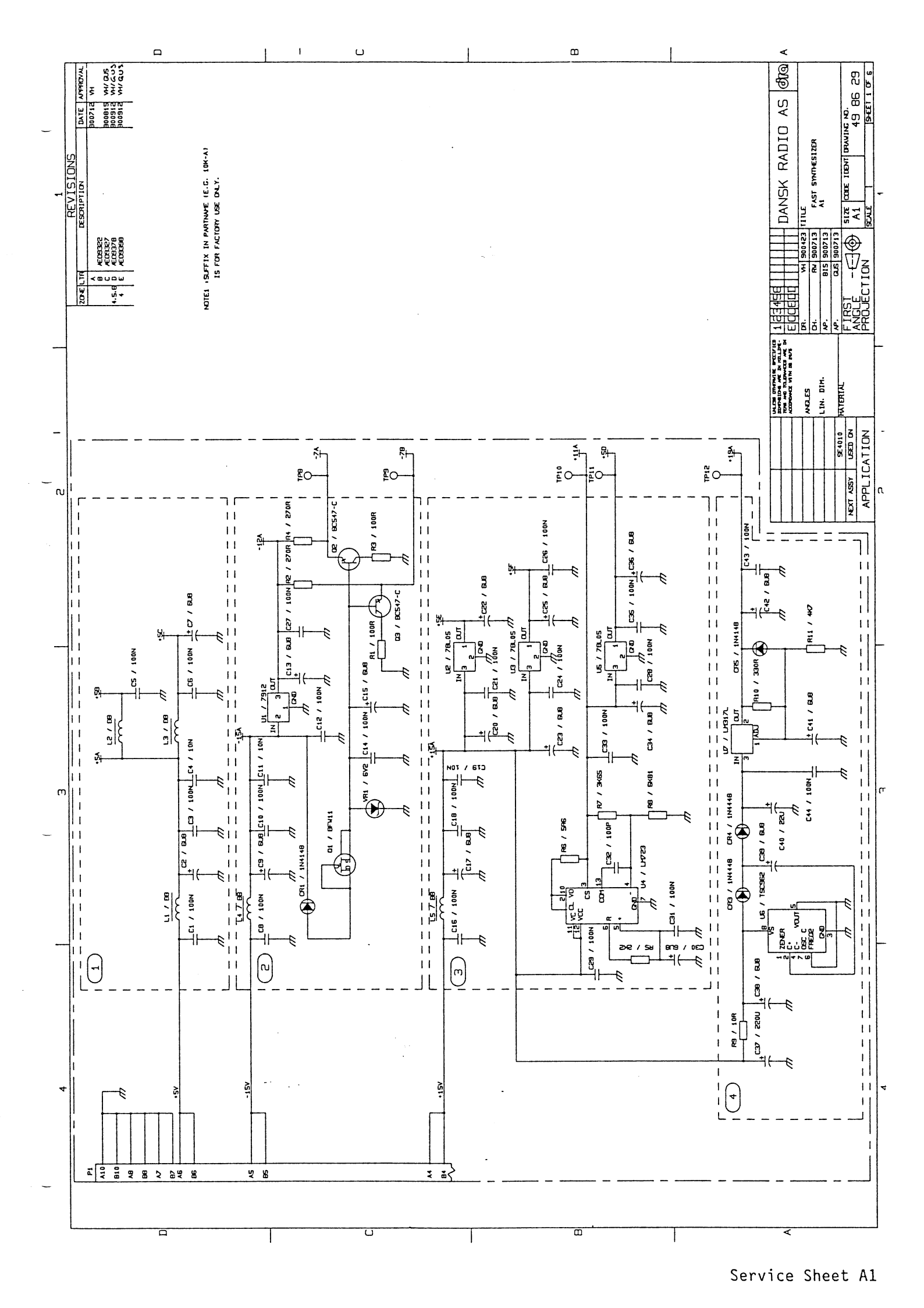
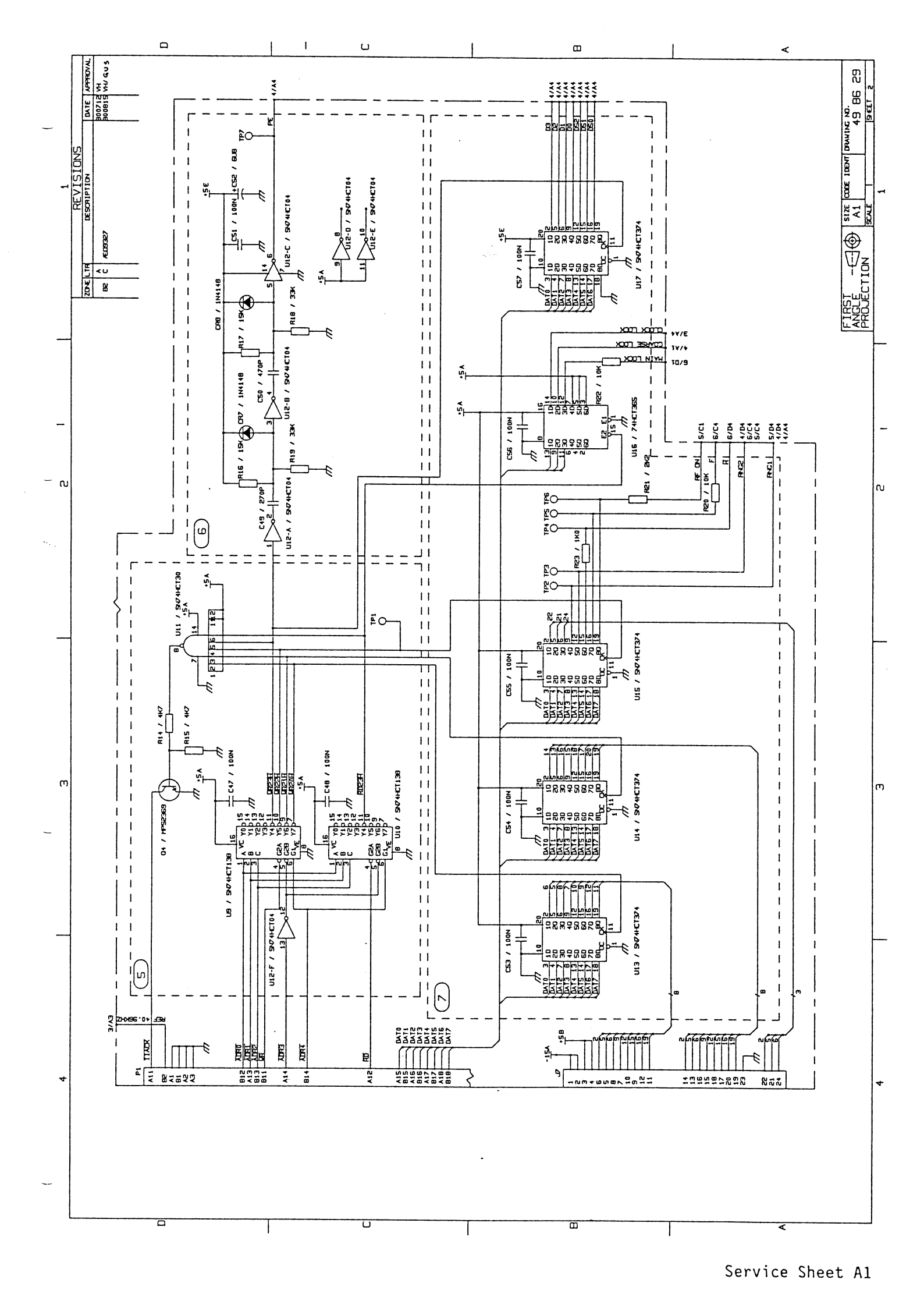
		LIN. DIM.	CH. AW 900828	CONFIGURATION FAST SYNTHESIZER A1		
			AP. 900828			
		MATERIAL	AP. GUS 900828			
NEXT ASSY	USED ON		FIRST ANGLE PROJECTION	SIZE A1	CODE IDENT	DRAWING NO. 49 86 29
APPLICATION				SCALE		SHEET 1 OF 1

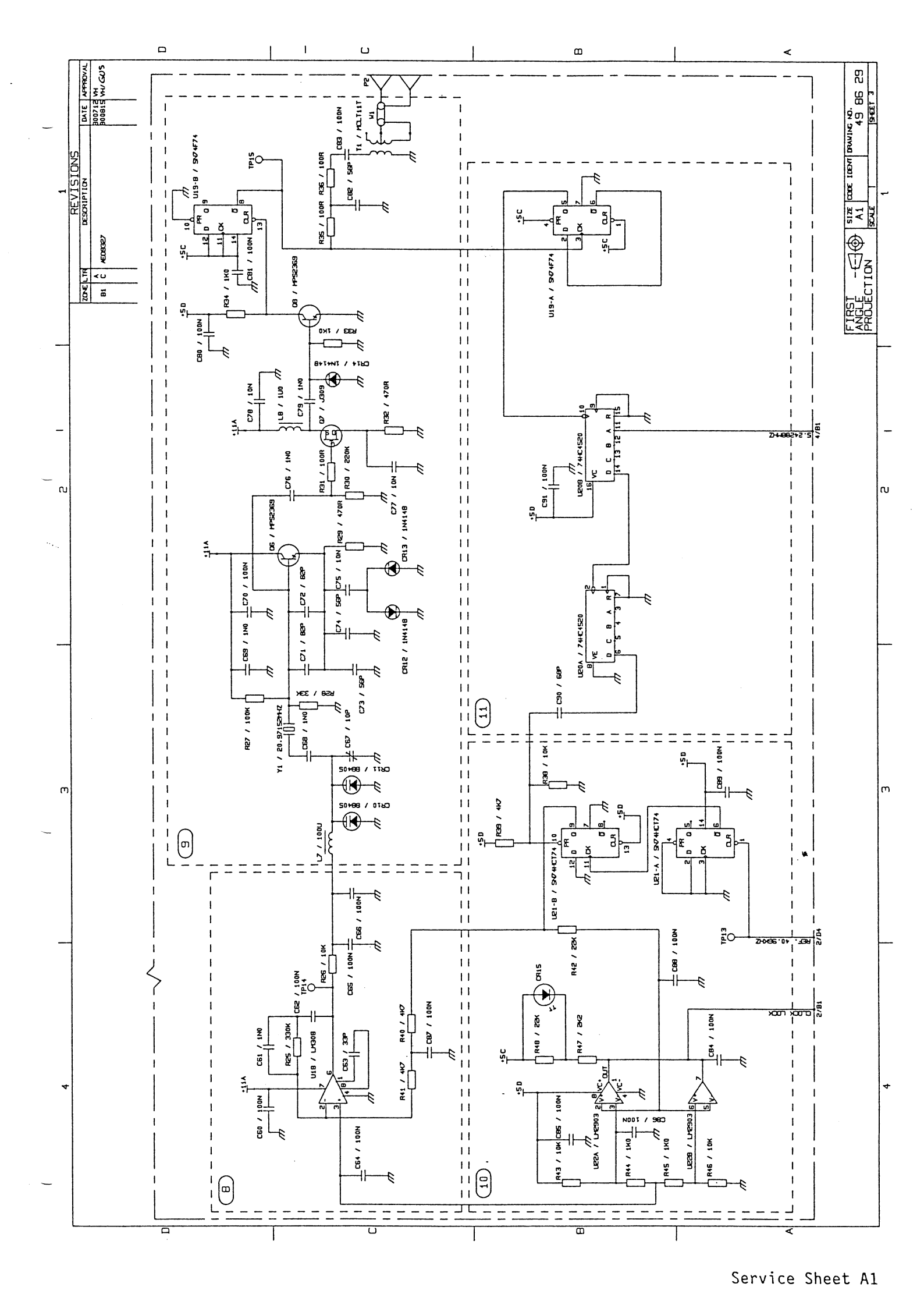
Service Sheet



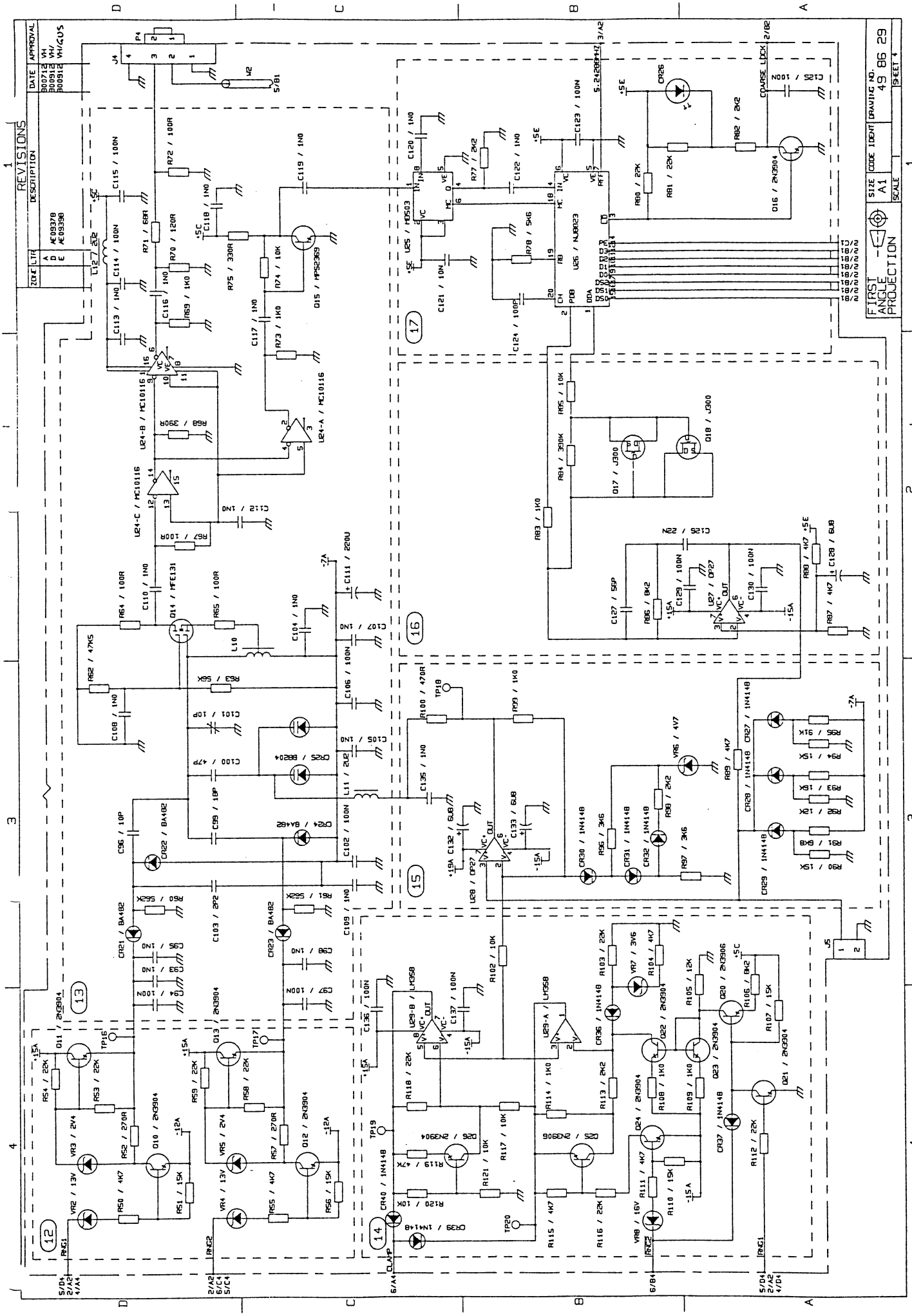
Service Sheet A1



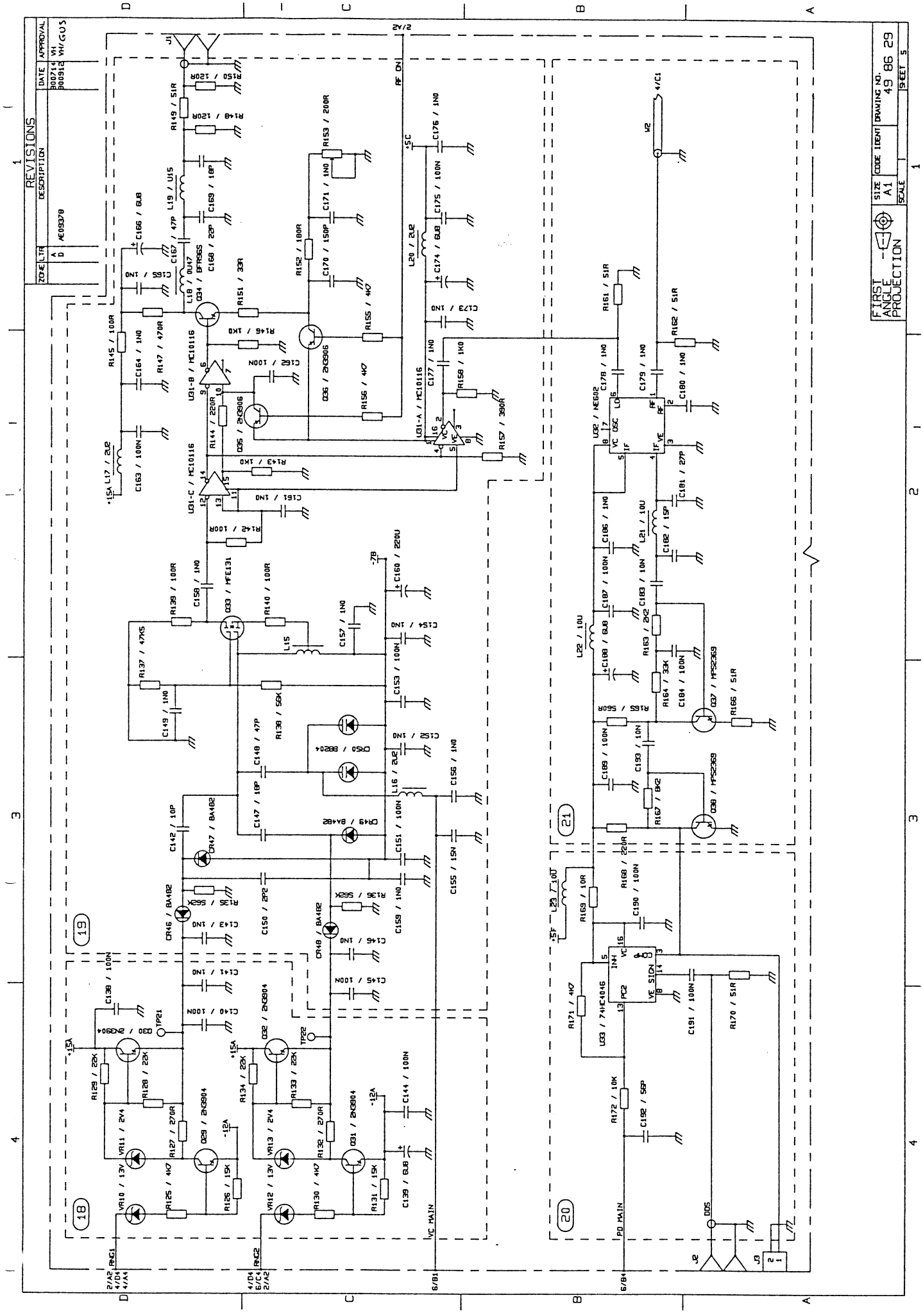
Service Sheet A1



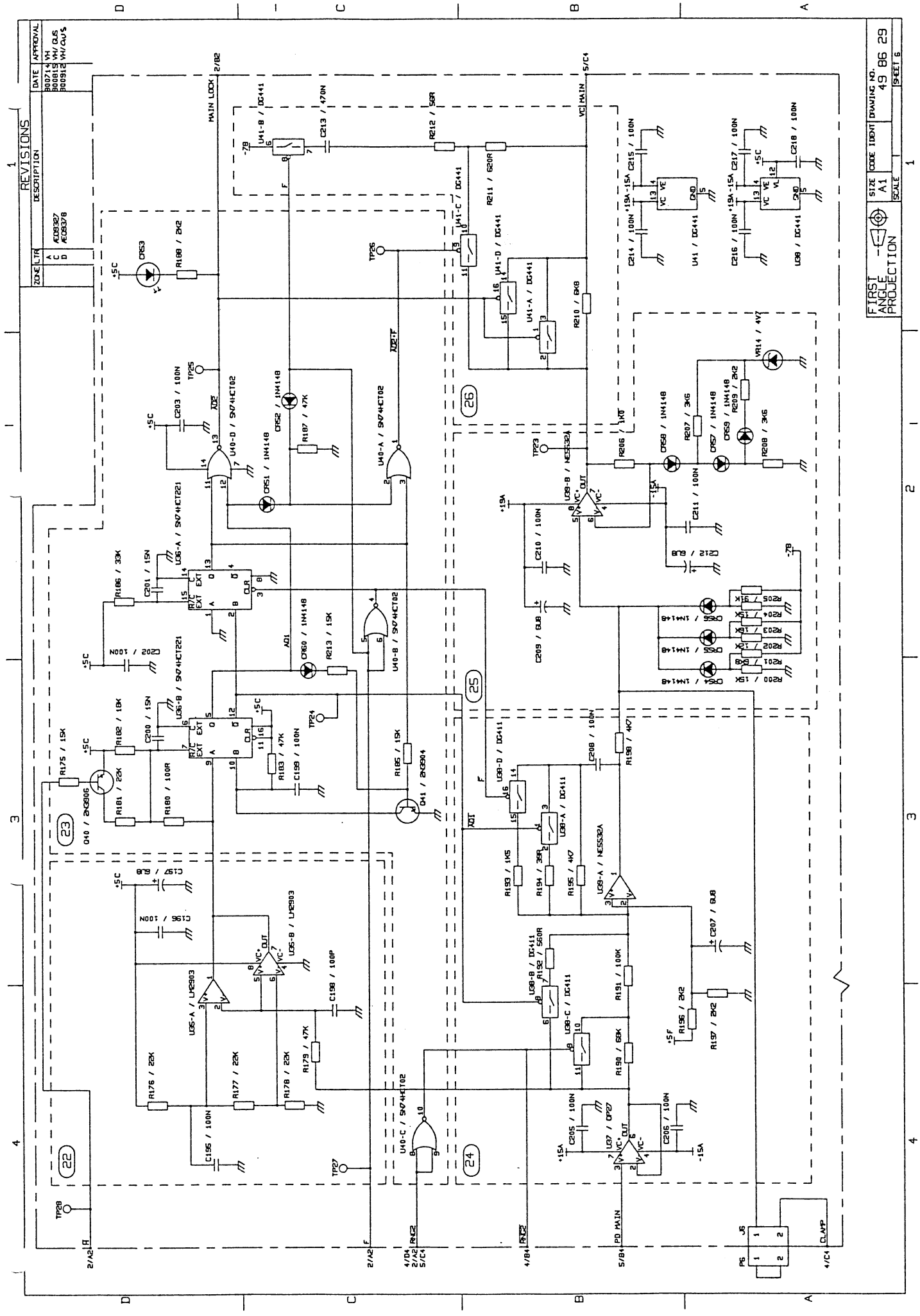
Service Sheet A1



Service Sheet A1



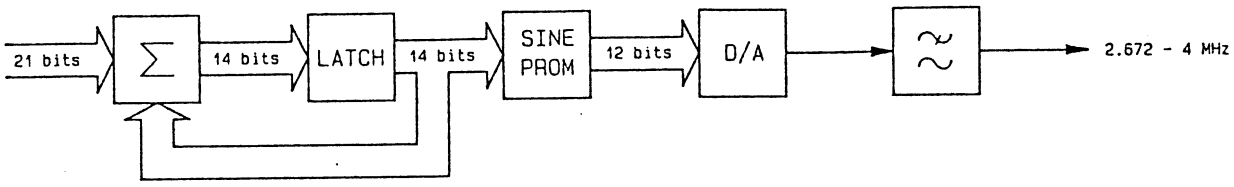
Service Sheet A1



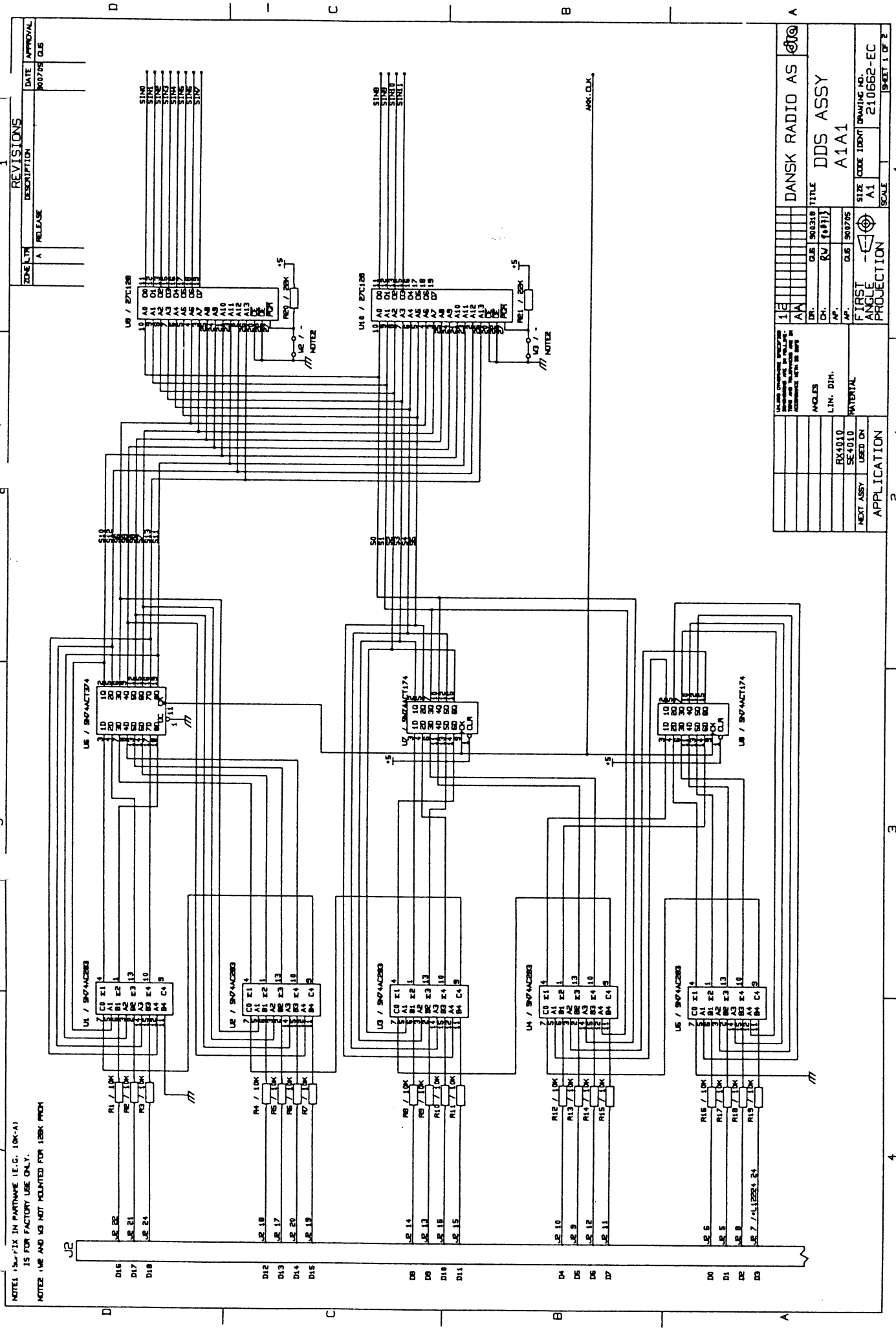
Service Sheet A1

Direct Digital Synthesizer A1A1/SE4010

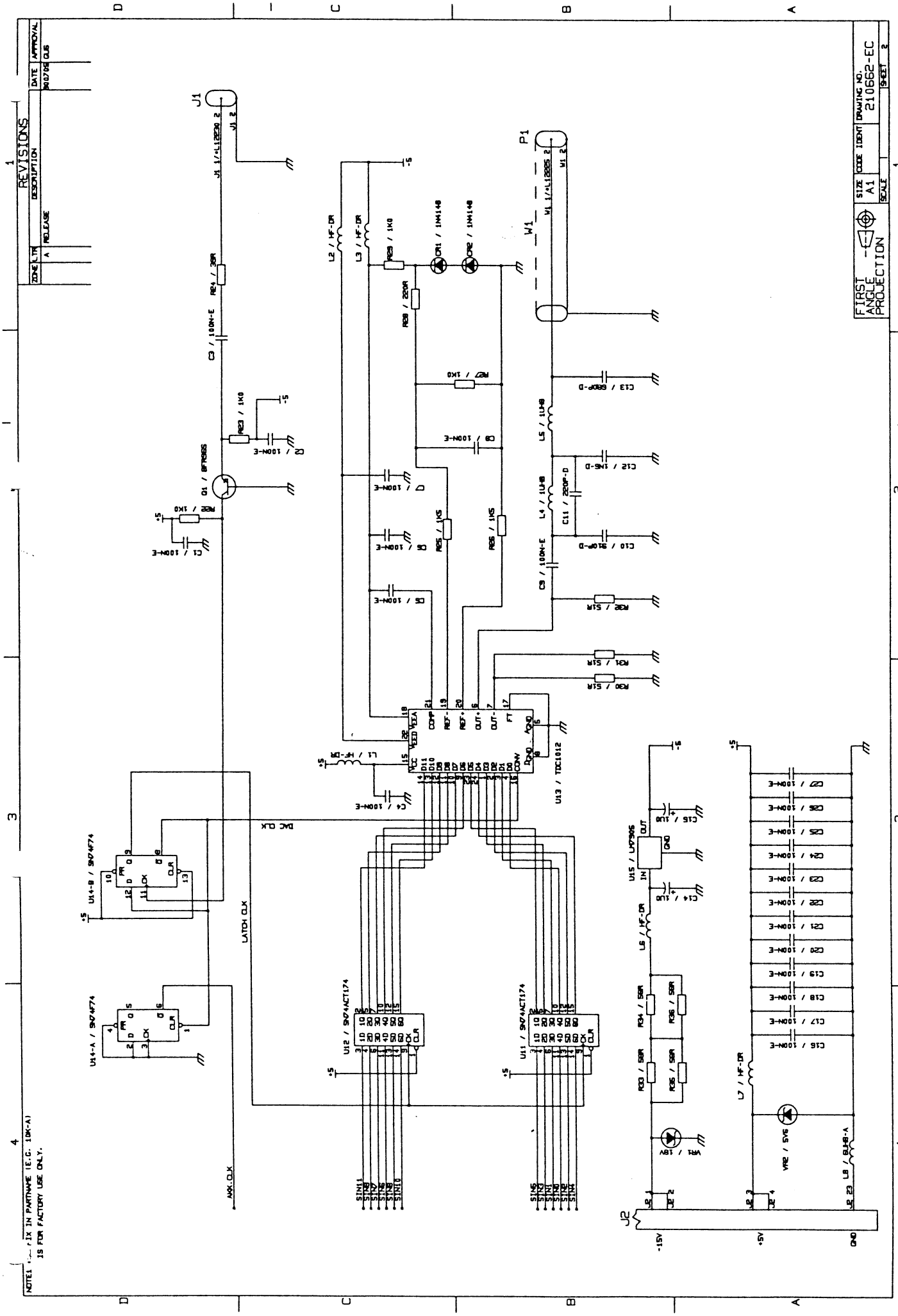
The functional block diagram of the DDS is shown in the figure below.



The adder and the following latch form a fast phase accumulator. The 21 bits input to the phase accumulator is truncated to 14 bits at the output and sent to the sine-PROM. These 14 bits represent the phase of a sinewave. The 12 bits output of the sine-PROM represents the corresponding magnitude of the sinewave. The 12 bits are clocked into a very linear D/A converter and the analog output of the converter is fed to a lowpass filter. The resulting output signal of the DDS is a signal with a fundamental frequency of 2,672-4MHz.



Service Sheet A1A1



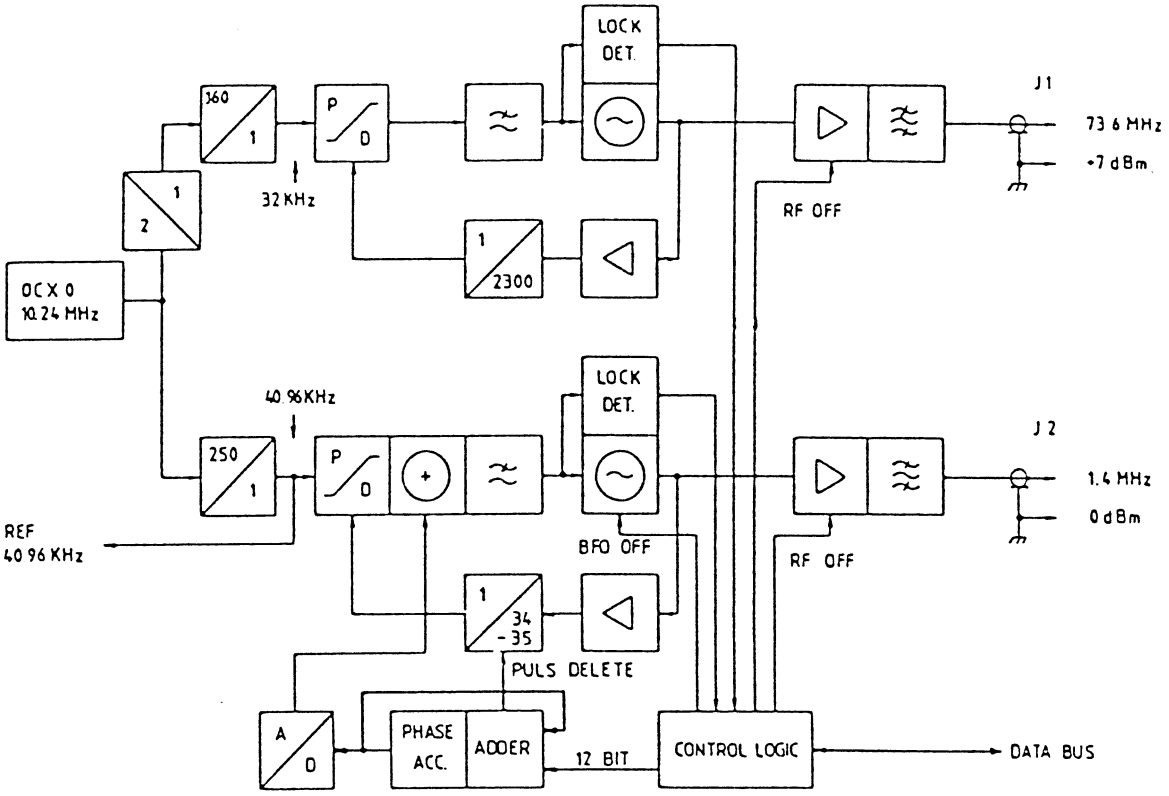
Service Sheet A1A1

FREQUENCY STANDARD MODULE A2/SE4010

The functional block diagram of the Standard Assembly is shown below.

The assembly holds three basic functions:

- 10.24 MHz stable master oscillator
- 73.6 MHz synthesized 2nd LO
- 1.4 MHz synthesized 1st LO



The output signal from the 10.24 MHz oven controlled crystal oscillator (OCXO) is applied to two divider chains. One generating 32 kHz reference clock for the 73.6 MHz loop, and one generating 40.96 kHz reference clock for the 1.4 MHz loop and the A Standard Assembly with temperature compensated crystal oscillator (TCXO) instead of OCXO is optionally available. Also standard assemblies with TCXO or OCXO with possibilities for synchronizing to external 1, 5 or 10 MHz reference signals are available. Another option is an assembly with OCXO and reference output of 5.12 MHz.

FREQUENCY STANDARD MODULE A2/SE4010

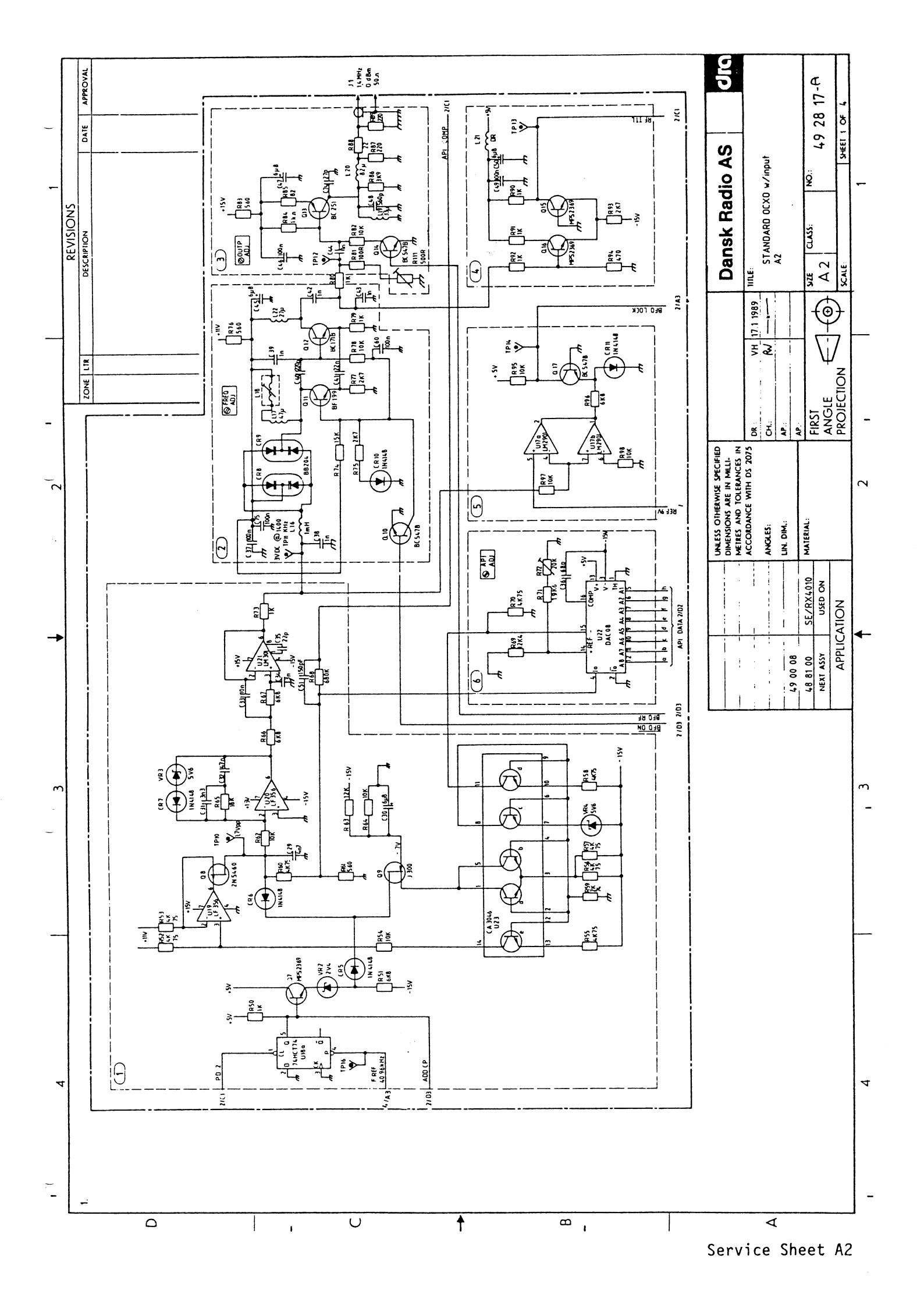
The 73.6 MHz oscillator is formed by a voltage controlled crystal oscillator ensuring low side-band noise. The loop has a 10 Hz bandwidth compensating for frequency drift.

The 1.4 MHz synthesizer is tunable in 10 Hz increments. The loop reference frequency is 40.96 kHz and the corresponding loop bandwidth approx. 800 Hz.

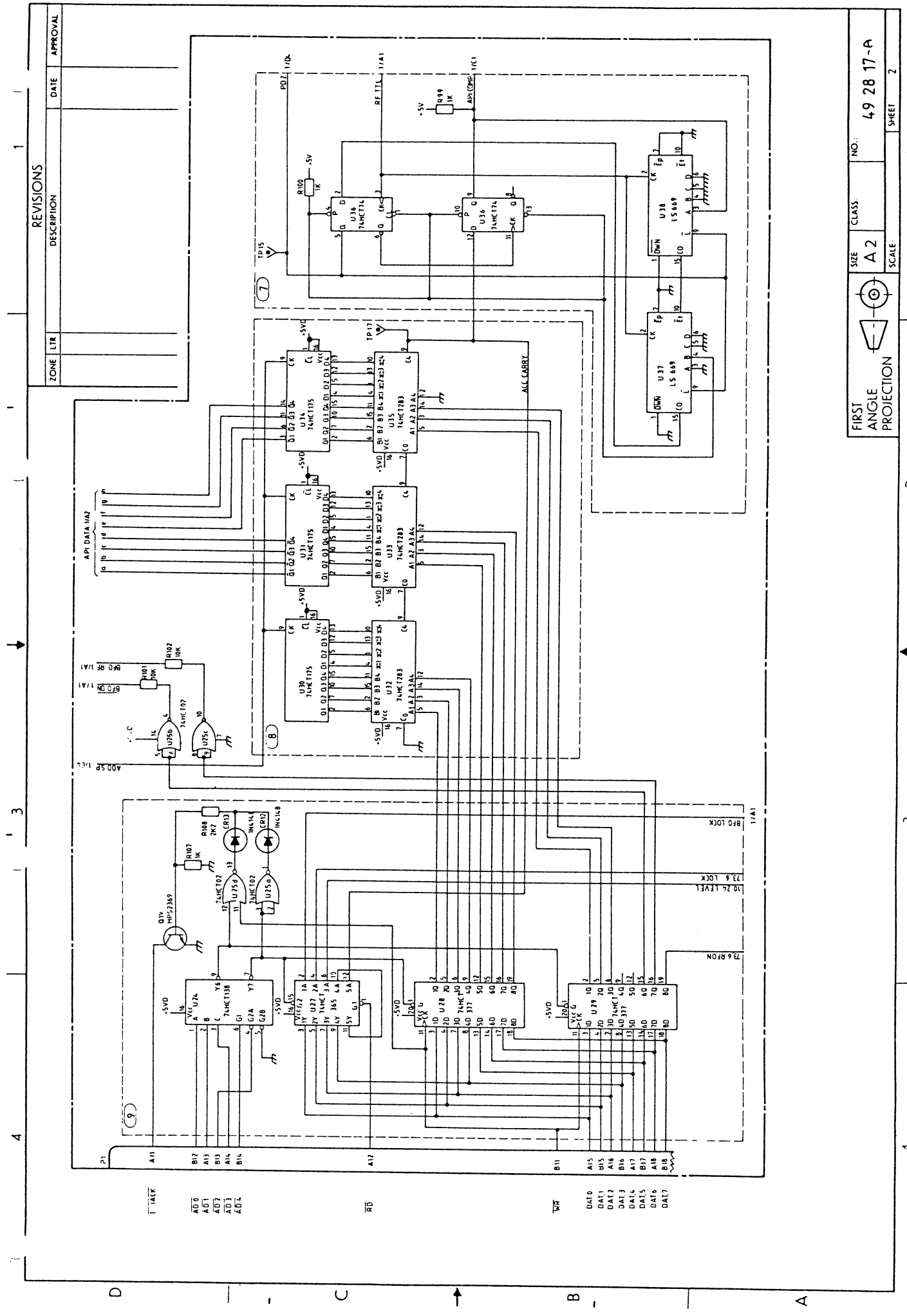
The loop uses a fractional N technique, where the loop output frequency is equal to the number of N.P. times the reference frequency, where N and P are positive integers. Due to the limited tuning requirements for the loop, the N number is fixed 34. The programmed number P is used as input to a digital loop adding the fractional ratio to an accumulated residual fraction.

Every time the accumulated residual fraction overflows, the N divider is commanded to divide by 35, deleting one vco clock pulse. The average vco frequency will be raised in this way with

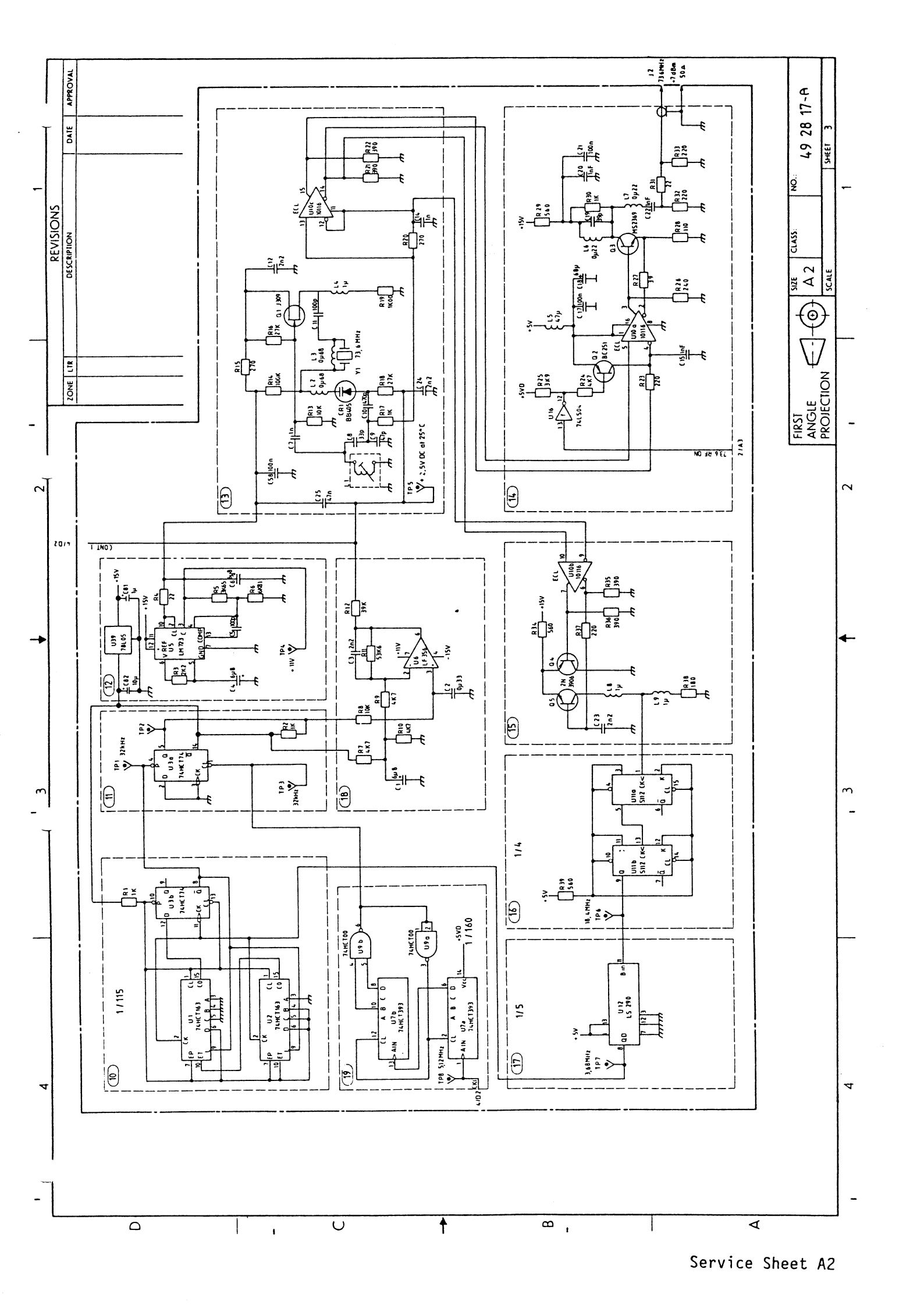
40.96 kHz divided by P. To compensate for pulse delete sidebands on the 1.4 MHz signal, the residual fraction is converted to an analogue signal and added to the error signal from the phase detector. The composed error signal is filtered before entering the control input of the voltage controlled oscillator.



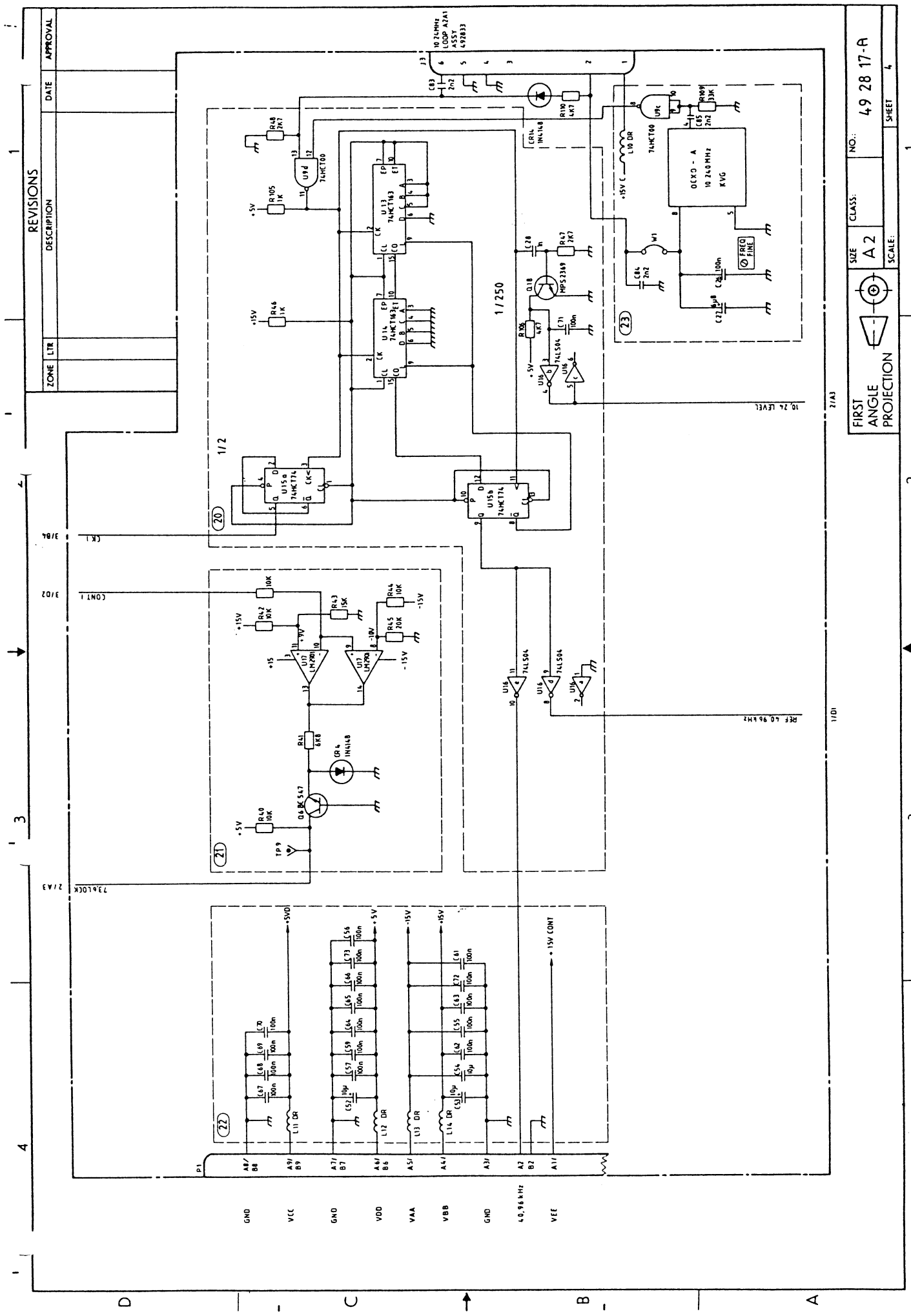
Service Sheet A2



Service Sheet A2



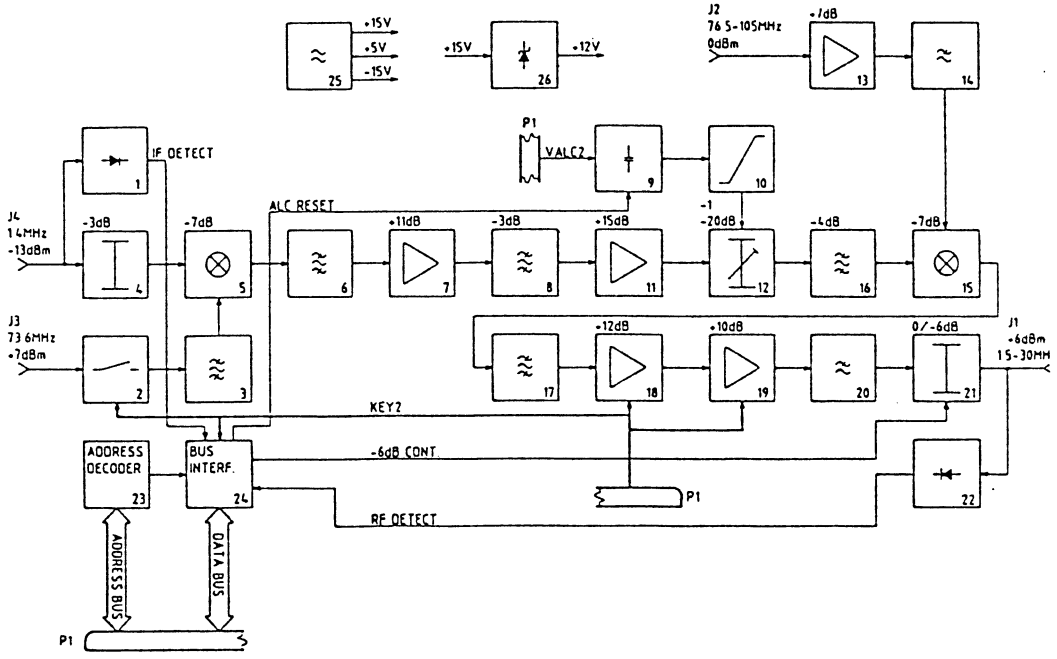
Service Sheet A2



Service Sheet A2

IF MODULE A3/SE4010

The functional block diagram of the IF Assembly is shown in the figure below:

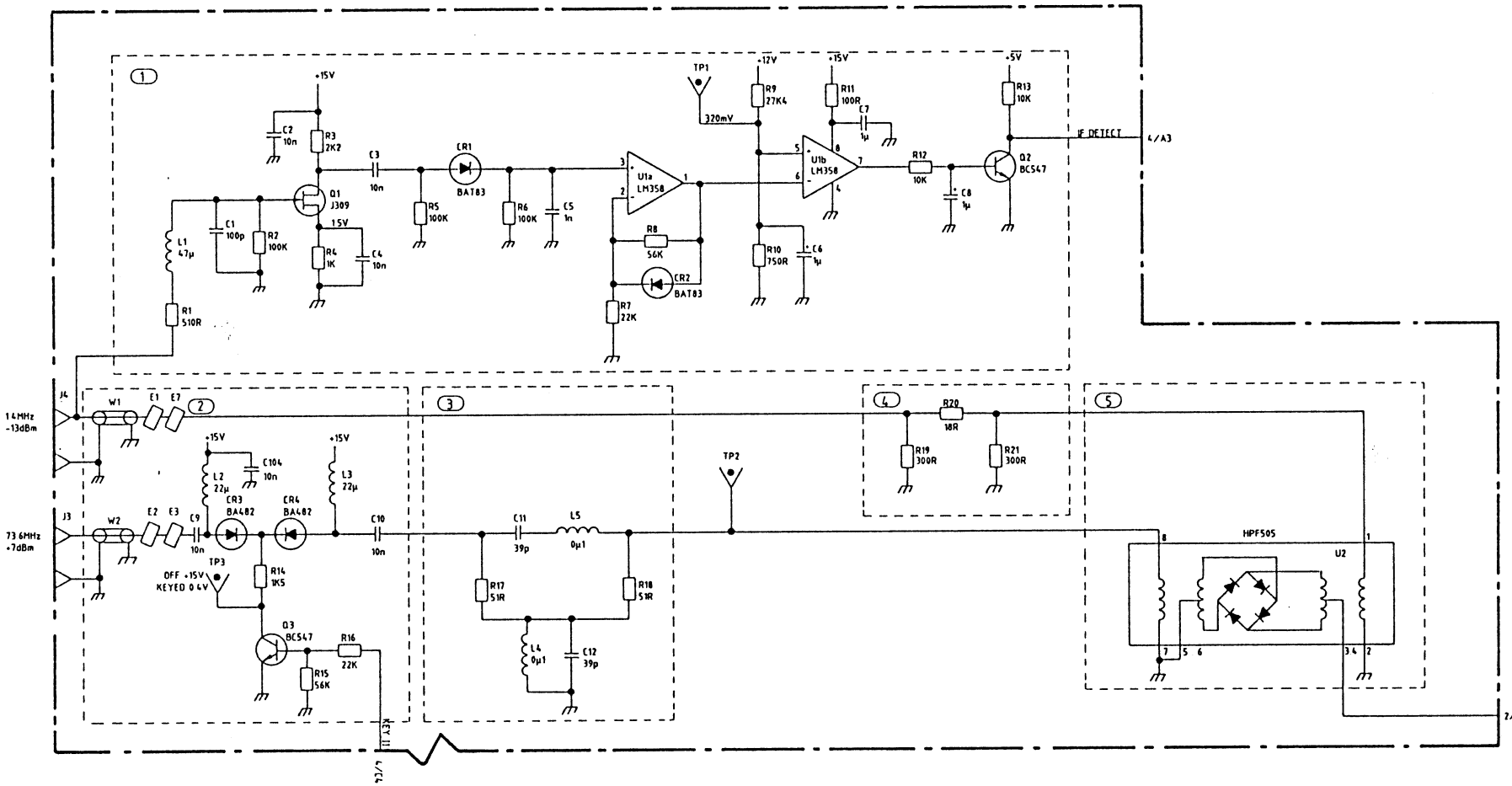


The IF is a double conversion circuit. It first converts the 1.4MHz signal to 75MHz and from 75MHz to a signal in the frequency range of 1.5MHz to 30MHz. The double conversion takes place to ease the suppression of the image signals.

The 1.4MHz signal is converted to a 75MHz signal in the second mixer 5 which is fed with a 73.6MHz signal controlled by KEY2. The 75MHz signal is amplified in 7 and 11, its level is controlled in 12 and the bandwidth in 16, a crystal filter. The third mixer is driven by a LO signal in the frequency range of 76.5-105MHz. The output from the third mixer is band-limited in 17, a diplexer, and amplified in 18 and 19, two amplifiers controlled by KEY2. The amplifiers are followed by a lowpass filter 20 and a controlled 6dB attenuator 21.

The interface part of the IF controls the 6dB attenuator and ALC reset function, while it at the same time allows the microprocessor to check the input and output levels in the circuit, through the detectors located at the input 1 and the output 22. Also the status of KEY2 is read on the IF assembly.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
S.3	C	ÆO9145	8.6.90	VH
		REVISED	22.4.88	VH
3/D4		ÆM88128	27.4.89	VH

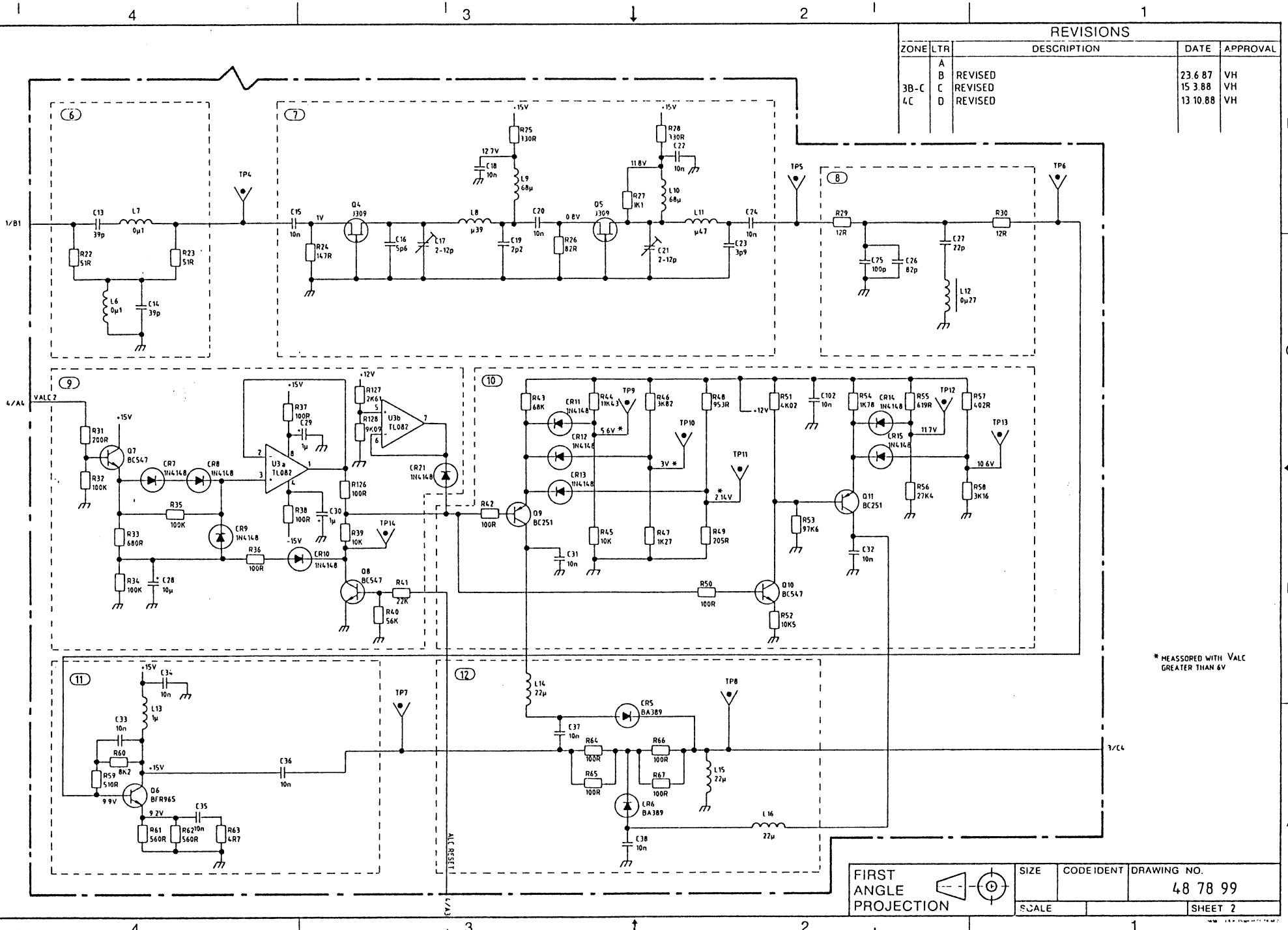


		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075	Dansk Radio AS
		ANGLES	DR. VH 24.3 1987
		LIN. DIM.	CH.
			AP.
	SE4010	MATERIAL	AP.
NEXT ASSY	USED ON		FIRST ANGLE PROJECTION
APPLICATION			

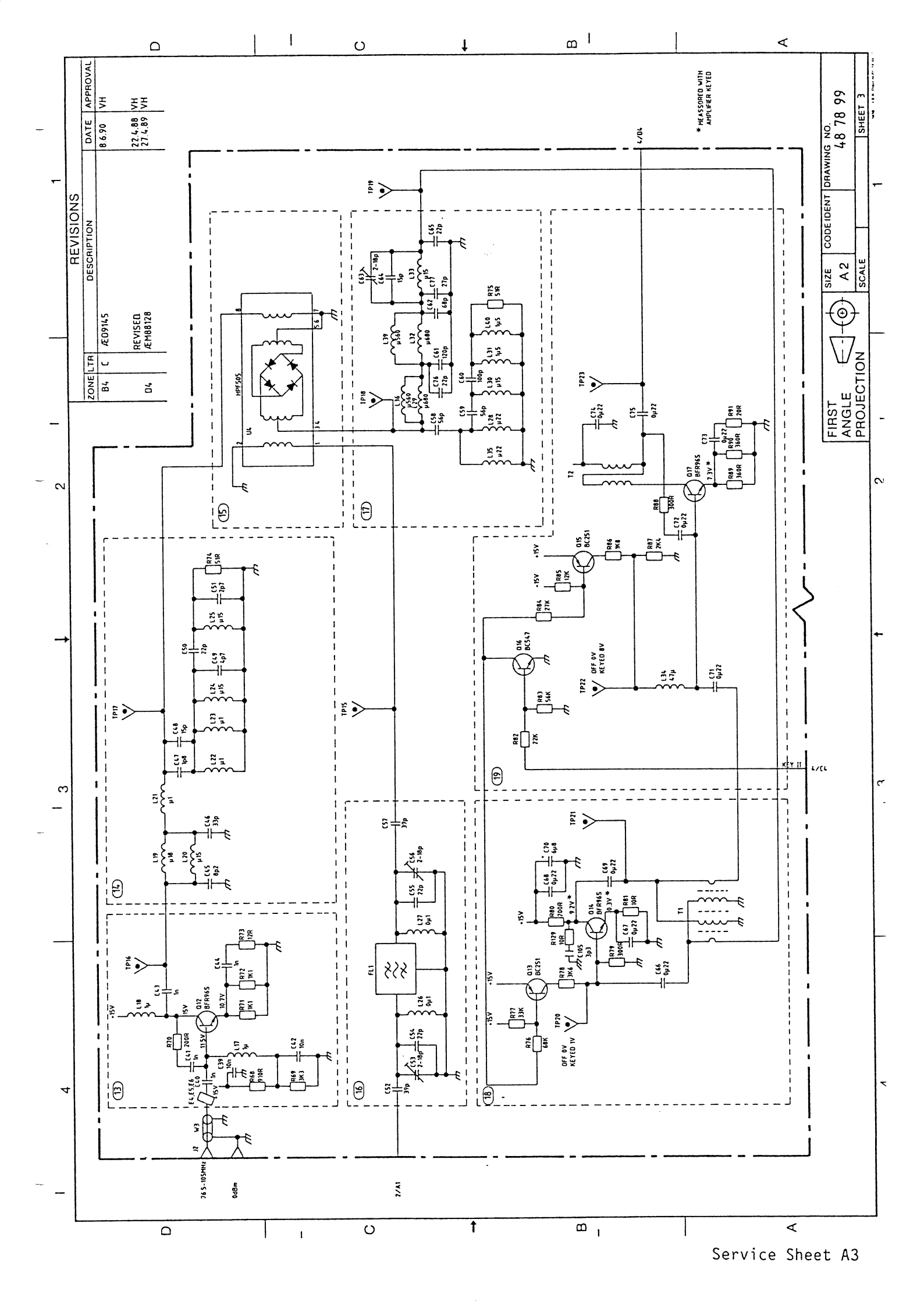
TITLE: IF MODULE A3 SE4010

SIZE: A2 | CODE IDENT | DRAWING NO. 48 78 99

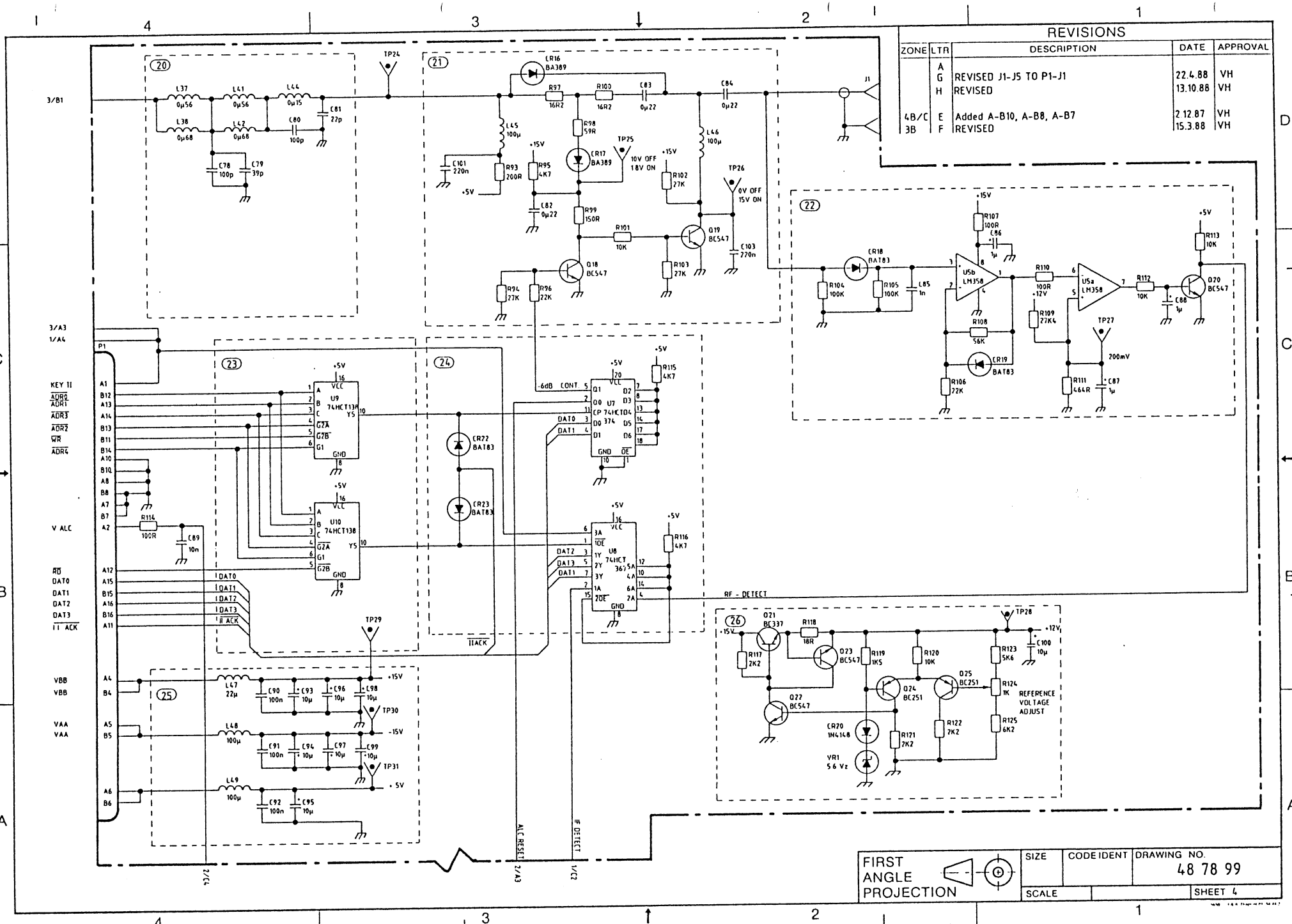
SCALE | SHEET 1 OF 4



Service Sheet A3



Service Sheet A3


REVISIONS
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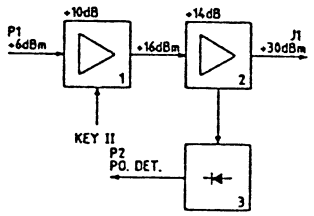
A | REVISED J1-J5 TO P1-J1 | 22.4.88 | VH
G | REVISED | 13.10.88 | VH
H | Added A-B10, A-B8, A-B7 | 2.12.87 | VH
4B/C | E | REVISED | 15.3.88 | VH
3B | F
FIRST ANGLE PROJECTION
SIZE
CODE IDENT
DRAWING NO. 48 78 99
SCALE
SHEET 4
Service Sheet A3

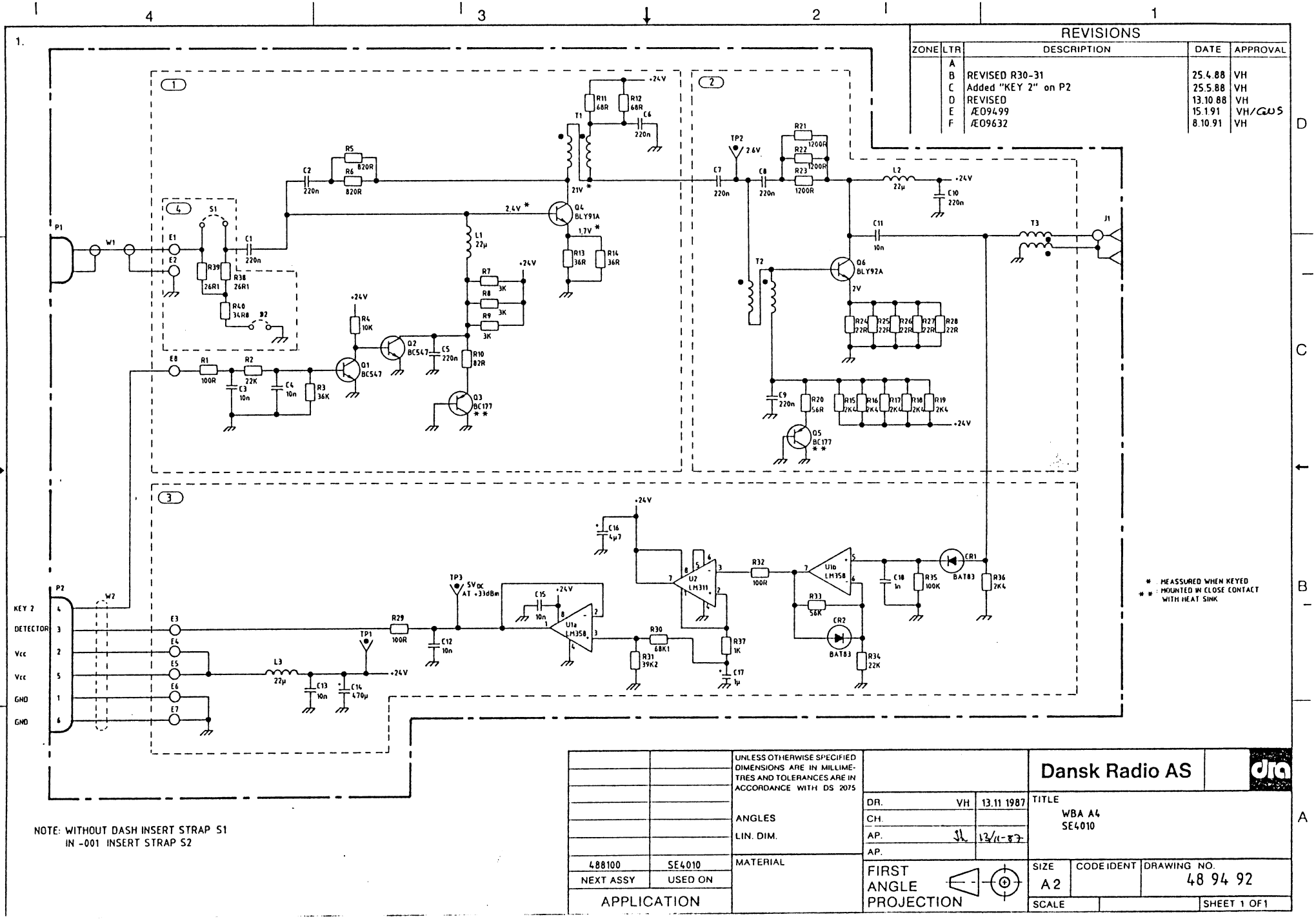
WIDEBAND AMPLIFIER A4/SE4010

The functional block diagram of the WBA Assembly is shown in the figure below:



The Wide Band Amplifier increases the RF output level of the IF Assembly from nominal +6dBm to the level required to drive the power amplifier of the Transmitter.

The WBA consists of two amplifiers, one with a gain of 10dB **1** and one with a gain of 14dB 2. The output level can be monitored on the front panel meter by means of the detector 3.



Service Sheet A4

INTERFACE MODULE A5/SE4010

The ADDRESS DECODING AND DATA IN/OUT BUFFERS circuit, decodes the addresses used by the module. The 8 bit external data bus is buffered by the in/out buffer circuit.

The REFERENCE VOLTAGE circuit consists of an 8 bits DAC controlled by the microprocessor. The reference voltage circuit gives a 10 volt reference voltage for the ALC circuit, too.

The INTERRUPT HANDLING CIRCUIT consists of 6 mutually independent D-flip flops. The interrupt status can be read by the microprocessor and the flip flops can be reset without affecting the interrupt status.

The SUPPLY VOLTAGE WATCH DOG circuit continuously measures the supply voltage. If the voltage drops below 4.7 volts the circuit interrupts the microprocessor and disables the output latches. The A/D CONVERTER CIRCUIT consists of a 4 channel ADC. The input circuits protect the ADC and convert the applied signals.

The 12 BITS OUTPUT CIRCUIT consists of 12 similar internal pull up to 5 volts active low open drain outputs.

The 8 BITS OUTPUT CIRCUIT consists of 8 output circuits designed to give the correct output voltage for the PA unit.

The 4 DIGITAL INPUT CIRCUIT consists of 4 similar input internal pull up to 5 volts.

The 2 DIGITAL INPUT circuit consists of two different input circuits. The input impedance of each input can be change depending on type of the PA unit the SE4010 has to control.

The BAUD RATE CLOCK CIRCUIT consists of a X-tal controlled clock generator for driving the seriel communication to the ATU.

The ATU IN/OUT PUT INTERFACE circuit consists of 2 digital inputs and 3 not pulled up active low open drain outputs.

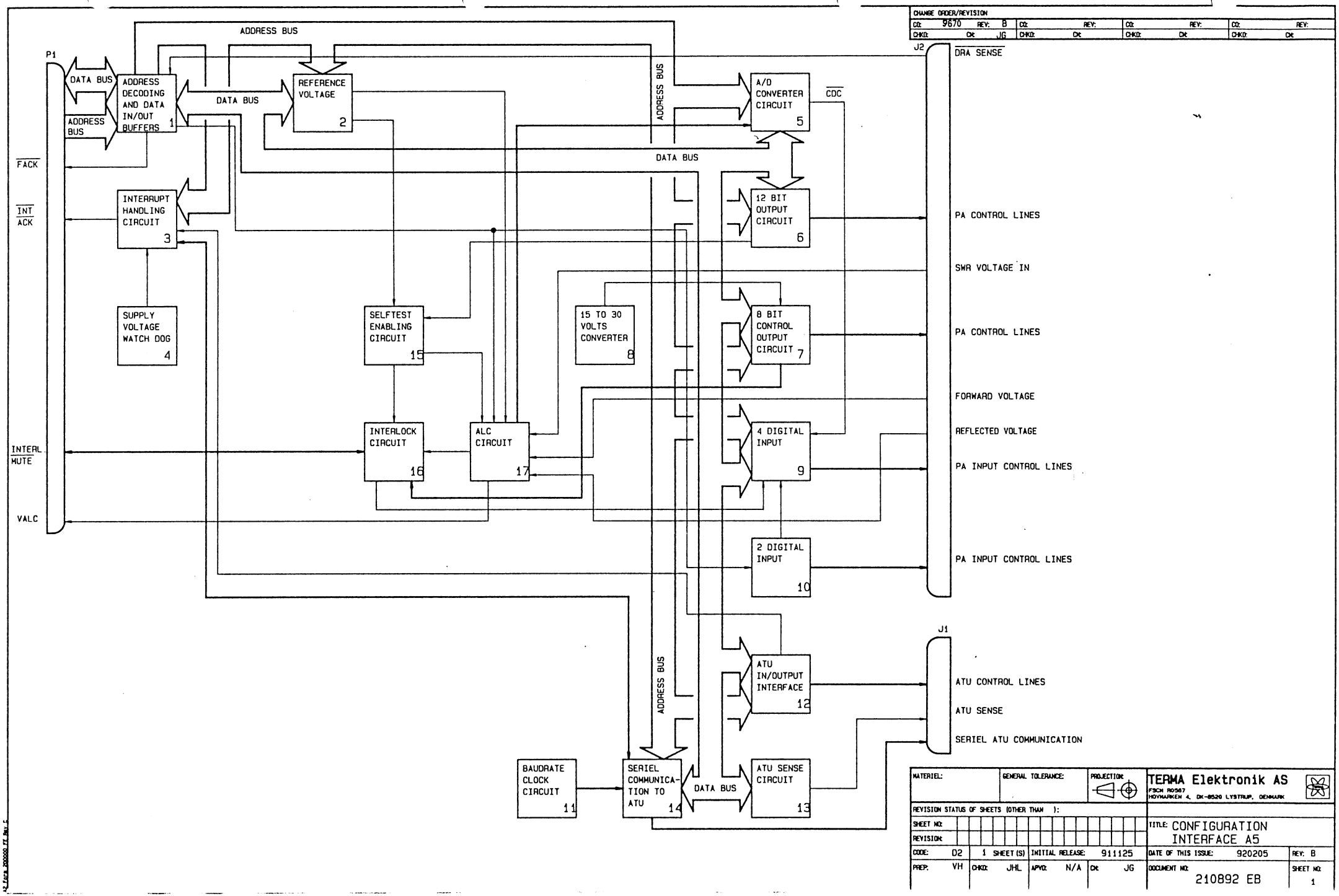
The ATU SENSE CIRCUIT detects if an ATU is connected.

The SERIAL COMMUNICATION TO ATU circuit consists of an USART which gives the proper communication to the ATU. The line driver gives the correct driver capability according to the RS485 standard.

The SELFTEST ENABLING CIRCUIT is active during selftest.

The INTERLOCK CIRCUIT is active when the SWR voltage is too high. The INTERLOCK CIRCUIT is controlled by the microprocessor.

The ALC CIRCUIT contains the necessary circuits for control of the output power level of the Power Amplifier. The circuit includes a power reduction circuit which reduces the output power in accordance with mismatch on the antenna output.



CHANGE ORDER/REVISION							
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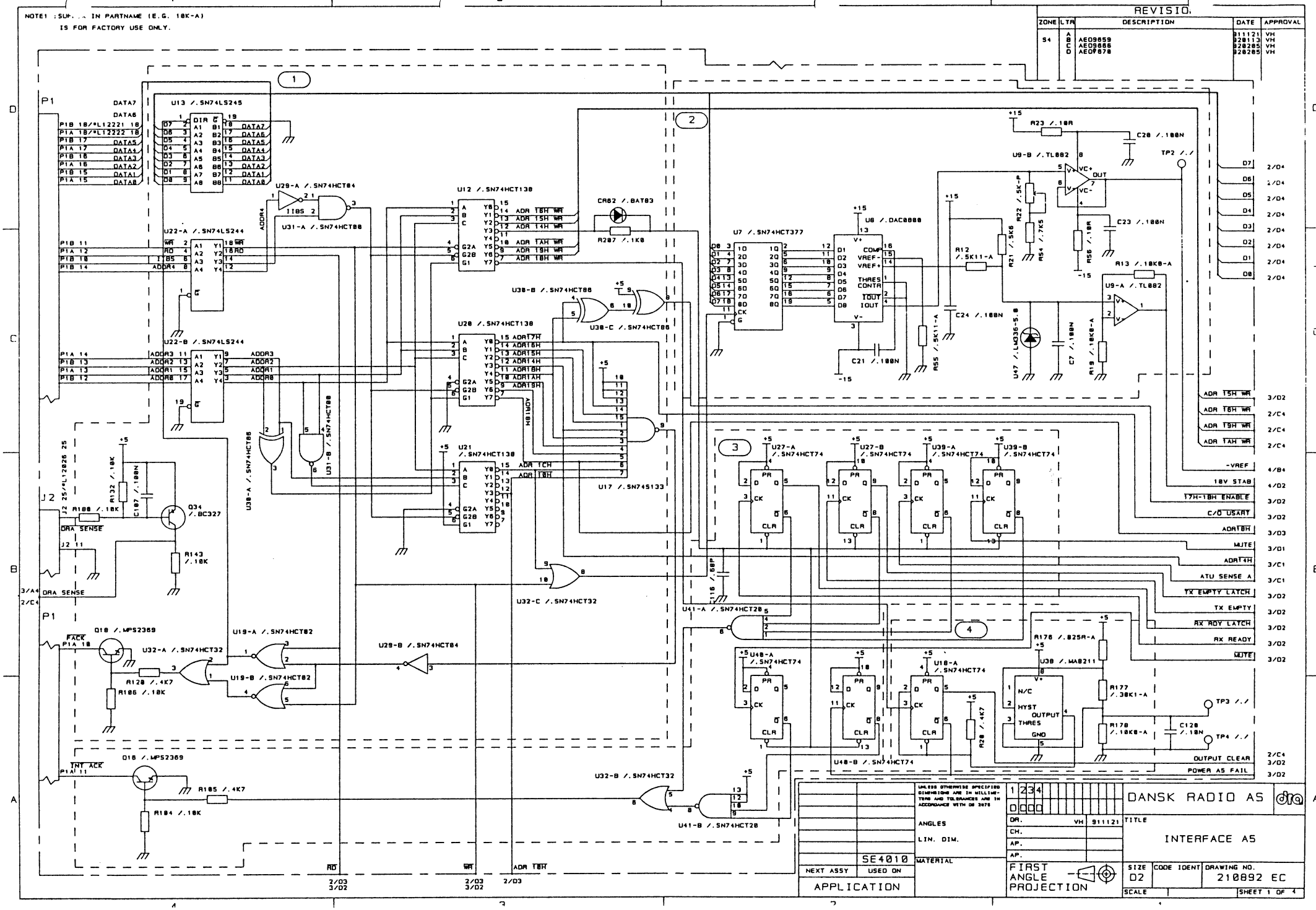
CHKD: Dt: JG	CHKD:	Dt:	CHKD:	Dt:	CHKD:	Dt:	

MATERIEL:	GENERAL TOLERANCE:	PROJECTION:	TERMA Elektronik AS FSCM 80567 HOVMARKEN 4, DK-8520 LYSTRUP, DENMARK
REVISION STATUS OF SHEETS (OTHER THAN):			
SHEET NO:			TITLE: CONFIGURATION INTERFACE A5
REVISION:			

CODE: 02	1 SHEET (S)	INITIAL RELEASE: 911125				DATE OF THIS ISSUE: 920205	REV: B
PREP: VH	CHKD: JHL	APVD: N/A	Dt: JG			DOCUMENT NO: 210892 EB	SHEET NO: 1


NOTE1 :SUF. .. IN PARTNAME (E.G. 18K-A)
IS FOR FACTORY USE ONLY.
REVISIO.
ZONE LTR DESCRIPTION DATE APPROVAL
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B AE09913 920113 VH
C AE09866 920205 VH
D AE09878 920205 VH
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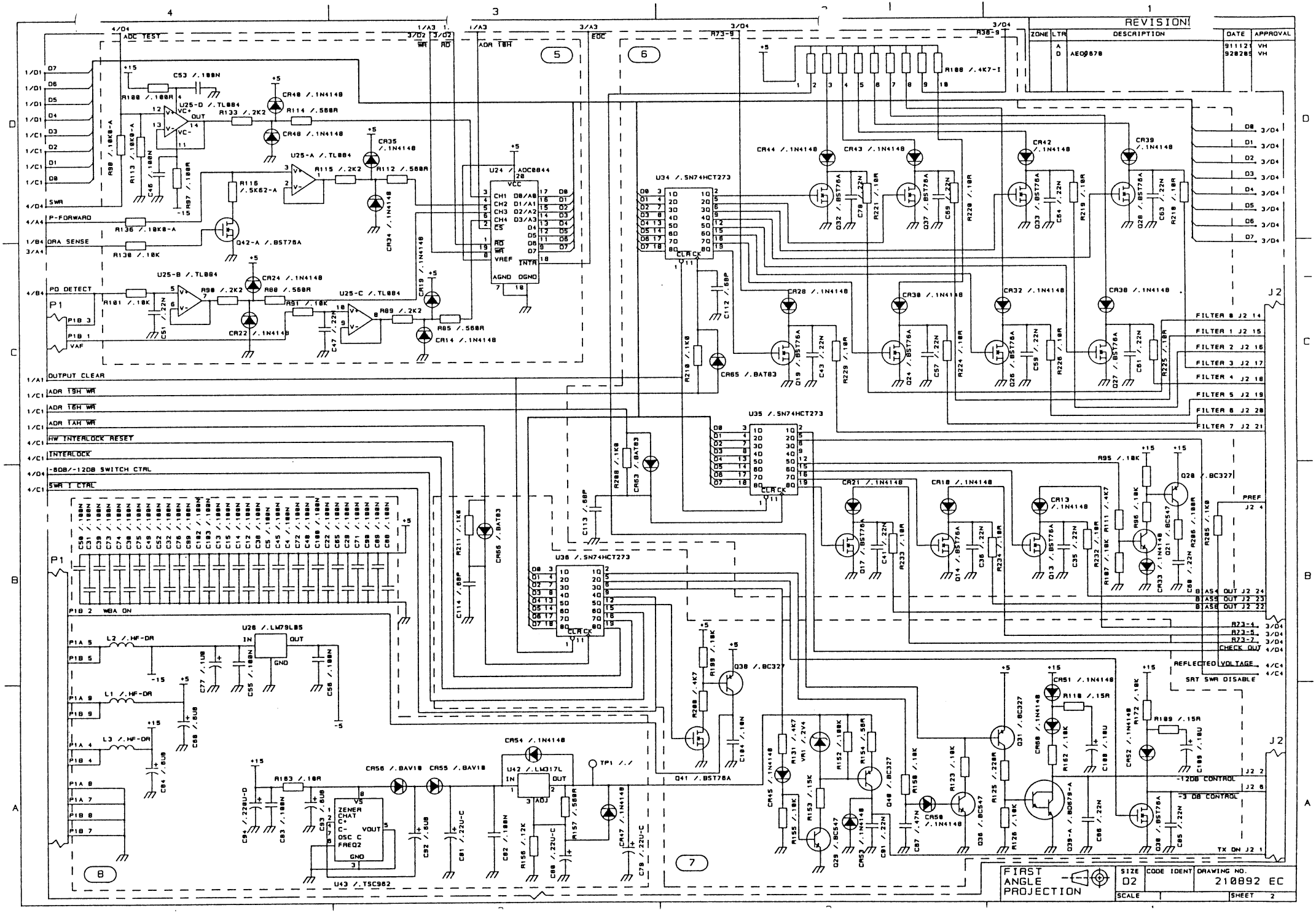
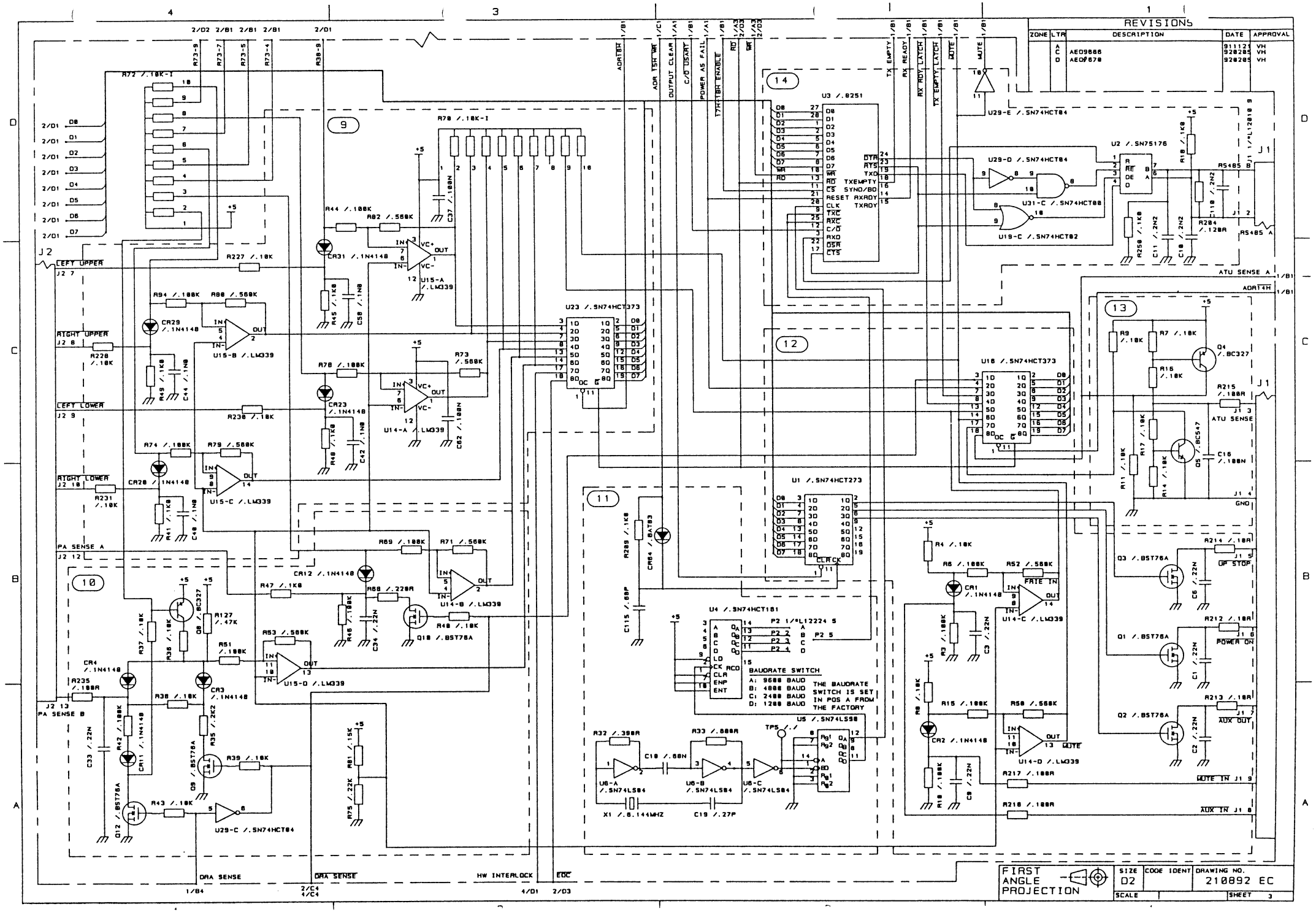
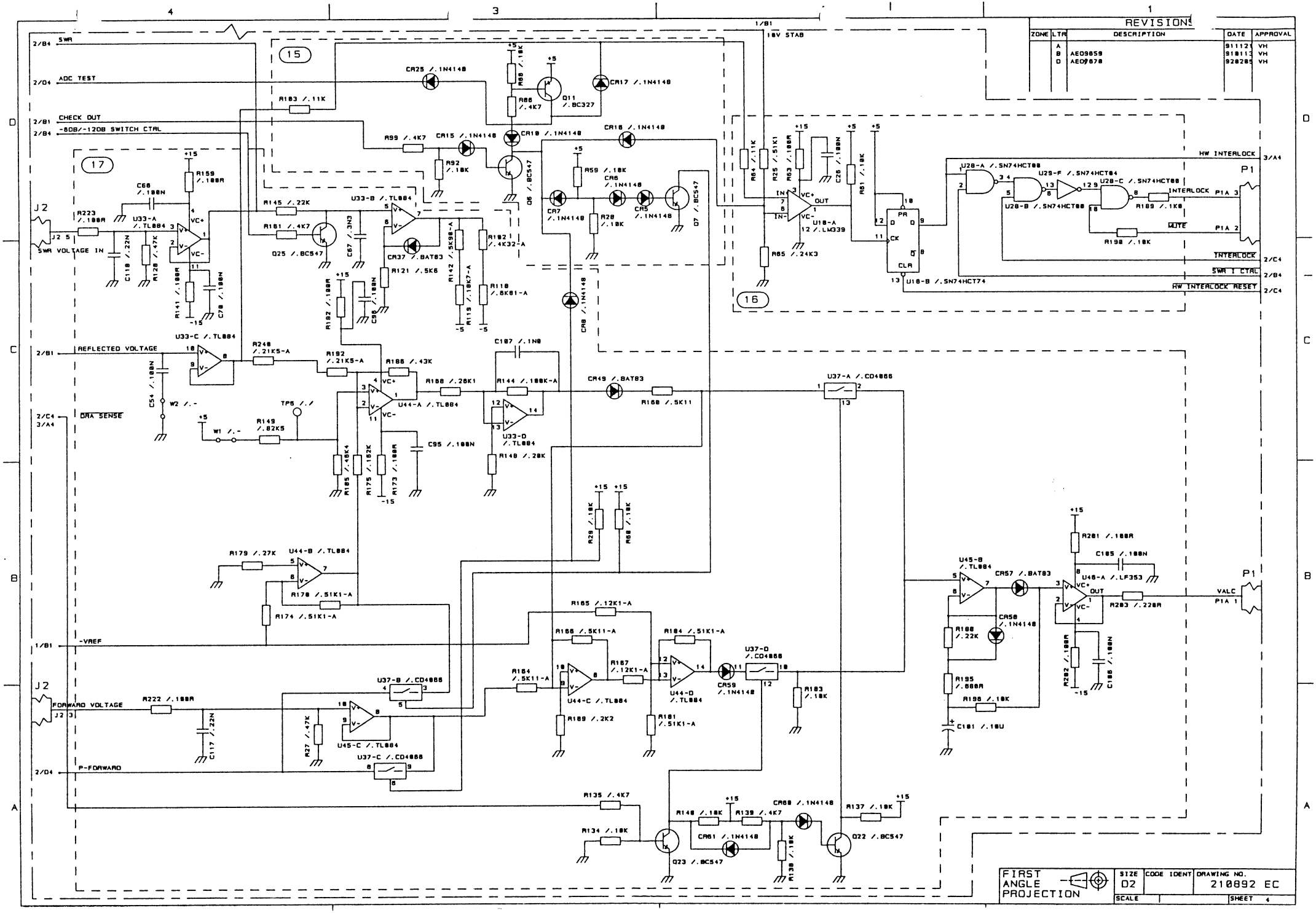
U48-A /.SN74HCT74
U48-B /.SN74HCT74
U18-A /.SN74HCT74
CR62 /.BAT83
R207 /.1K8
R23 /.18R
C20 /.100N
R22 /.5K-P
R21 /.5K6
R54 /.7K5
C23 /.100N
R55 /.18R
R12 /.5K11-A
C24 /.100N
C21 /.100N
R55 /.5K11-A
U47 /.LM336-5.0
C7 /.100N
R19 /.18K8-A
R13 /.18K8-A
R132 /.10K
C107 /.100N
R188 /.10K
Q34 /.BC327
R143 /.10K
D18 /.MPS2369
R128 /.4K7
R186 /.10K
R185 /.4K7
R184 /.10K
R176 /.825R-A
R177 /.36K1-A
R178 /.18K8-A
C128 /.18N
R28 /.4K7
C16 /.68P
TP2 /./
TP3 /./
TP4 /./
D7 2/D4
D6 2/D4
D5 2/D4
D4 2/D4
D3 2/D4
D2 2/D4
D1 2/D4
D0 2/D4
ADR T5H WR 3/D2
ADR T6H WR 2/C4
ADR T5H WR 2/C4
ADR TAH WR 2/C4
-VREF 4/B4
18V STAB 4/D2
17H-18H ENABLE 3/D2
C/D USART 3/D2
ADR18H 3/D3
MUTE 3/D1
ADR14H 3/C1
ATU SENSE A 3/C1
TX EMPTY LATCH 3/D2
TX EMPTY 3/D2
RX RDY LATCH 3/D2
RX READY 3/D2
MUTE 3/D2
OUTPUT CLEAR 2/C4 3/D2
POWER A5 FAIL 3/D2
DRA SENSE
INT ACK
FACK
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS AND TOLERANCES ARE IN ACCORDANCE WITH DS 3078
ANGLES
LIN. DIM.
MATERIAL
SE4010
NEXT ASSY
USED ON
APPLICATION
FIRST ANGLE PROJECTION
DANSK RADIO AS
DR. VH 911121
CH.
AP.
AP.
TITLE
INTERFACE A5
SIZE D2
CODE IDENT
DRAWING NO. 210892 EC
SCALE
SHEET 1 OF 4

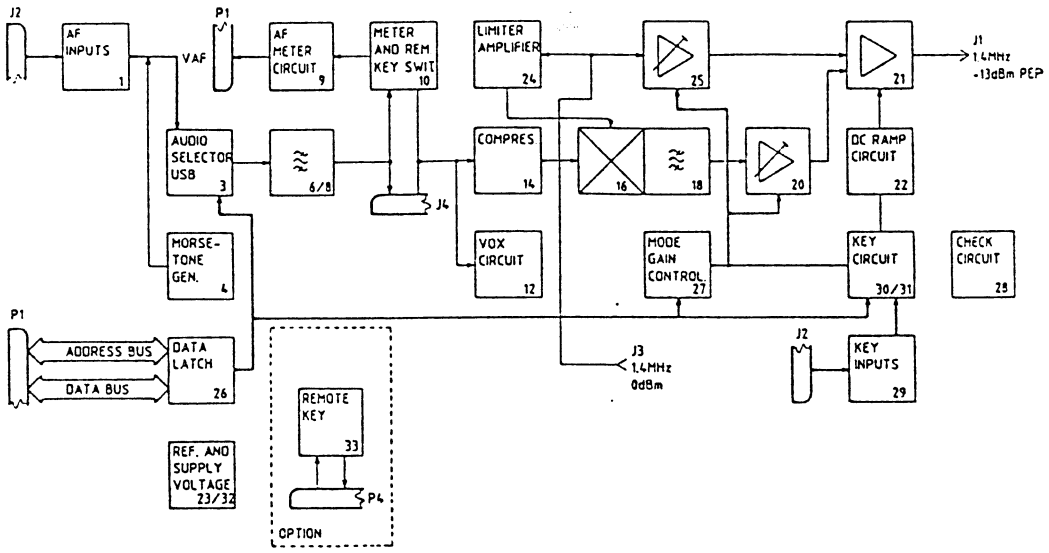

REVISION
ZONE LTR DESCRIPTION DATE APPROVAL
A AE0/0678 911121 VH
D 920285 VH
ADC TEST
ADR TSH
U24 /.ADC0844
U25-D /.TL084
U25-A /.TL084
U25-B /.TL084
U25-C /.TL084
U34 /.SN74HCT273
U35 /.SN74HCT273
U36 /.SN74HCT273
U26 /.LM79L05
U42 /.LM317L
U43 /.TSC962
Q42-A /.BST76A
Q41 /.BST76A
Q38 /.BC327
Q28 /.BC327
Q31 /.BC327
Q40 /.BC327
Q29 /.BC547
Q36 /.BC547
Q39-A /.BD679-A
P-FORWARD
REFLECTED VOLTAGE
SAT SWR DISABLE
-12DB CONTROL
-3 DB CONTROL
TX ON J2 1
CHECK OUT
PREF
OUTPUT CLEAR
INTERLOCK
HW INTERLOCK RESET
-808/-1208 SWITCH CTRL
SWR 1 CTRL
WBA ON
FILTER 0 J2 14
FILTER 1 J2 15
FILTER 2 J2 16
FILTER 3 J2 17
FILTER 4 J2 18
FILTER 5 J2 19
FILTER 6 J2 20
FILTER 7 J2 21
FIRST ANGLE PROJECTION
SIZE D2
CODE IDENT
DRAWING NO. 210892 EC
SCALE
SHEET 2


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
C | AE09666 | 911121 | VH
D | AE09670 | 920205 | VH
U3 /.8251
U1 /.SN74HCT273
U4 /.SN74HCT181
U5 /.SN74LS598
U23 /.SN74HCT373
U18 /.SN74HCT373
U2 /.SN75176
U15-A /.LM339
U15-B /.LM339
U15-C /.LM339
U15-D /.LM339
U14-A /.LM339
U14-B /.LM339
U14-C /.LM339
U14-D /.LM339
U29-C /.SN74HCT04
U29-D /.SN74HCT04
U29-E /.SN74HCT04
U31-C /.SN74HCT08
U19-C /.SN74HCT02
U6-A /.SN74LS04
U6-B /.SN74LS04
U6-C /.SN74LS04
BAUDRATE SWITCH
A: 9600 BAUD
B: 4800 BAUD
C: 2400 BAUD
D: 1200 BAUD
THE BAUDRATE SWITCH IS SET IN POS A FROM THE FACTORY
LEFT UPPER
RIGHT UPPER
LEFT LOWER
RIGHT LOWER
PA SENSE A
PA SENSE B
ATU SENSE A
ATU SENSE
GND
UP STOP
POWER ON
AUX OUT
MUTE
MUTE IN
AUX IN
FATE IN
ADR SENSE
HW INTERLOCK
EOC
FIRST ANGLE PROJECTION
SIZE D2
DRAWING NO. 210892 EC
SCALE
SHEET 3


REVISIONS
ZONE LTR DESCRIPTION DATE APPROVAL
A 911124 VH
B AE09859 911113 VH
D AE09878 920205 VH
SWR
ADC TEST
CHECK OUT
-80B/-120B SWITCH CTRL
SWR VOLTAGE IN
REFLECTED VOLTAGE
FORWARD VOLTAGE
P-FORWARD
-VREF
ORA SENSE
18V STAB
HW INTERLOCK
INTERLOCK
SWR 1 CTRL
HW INTERLOCK RESET
VOLTS
U33-A /.TL084
U33-B /.TL084
U33-C /.TL084
U33-D /.TL084
U44-A /.TL084
U44-B /.TL084
U44-C /.TL084
U44-D /.TL084
U45-B /.TL084
U45-C /.TL084
U37-A /.CD4066
U37-B /.CD4066
U37-C /.CD4066
U37-D /.CD4066
U46-A /.LF353
U18-A /.LM339
U18-B /.SN74HCT74
U28-A /.SN74HCT08
U28-B /.SN74HCT08
U28-C /.SN74HCT08
U29-F /.SN74HCT04
Q11 /.BC327
Q22 /.BC547
Q23 /.BC547
Q25 /.BC547
Q5 /.BC547
Q7 /.BC547
CR37 /.BAT83
CR49 /.BAT83
CR57 /.BAT83
CR25 /.1N4148
CR17 /.1N4148
CR18 /.1N4148
CR15 /.1N4148
CR16 /.1N4148
CR6 /.1N4148
CR7 /.1N4148
CR5 /.1N4148
CR8 /.1N4148
CR58 /.1N4148
CR59 /.1N4148
CR60 /.1N4148
CR61 /.1N4148
P1
VALC
P1A 1
P1A 2
P1A 3
FIRST ANGLE PROJECTION
SIZE D2
CODE IDENT
DRAWING NO. 210892 EC
SCALE
SHEET 4

MODULATOR MODULE A7/SE4010

The functional block diagram for the SSB version of the Modulator Assembly is shown in the figure below.



Modulator Assembly, SSB version

The AF-signals are fed to the Modulator Assembly via the balanced line transformers or the microphone amplifiers. The wanted AF-input is selected and fed to the compressor through a bandpass filter.

The meter and remote key switch switches the AF meter circuit between LSB and USB, and is also used when the Remote Key is supplied*.

The VOX is placed immediately before the compressor. With this circuit it is possible to key the exciter when the amplitude of the supplied AF-signal exceeds a certain level.

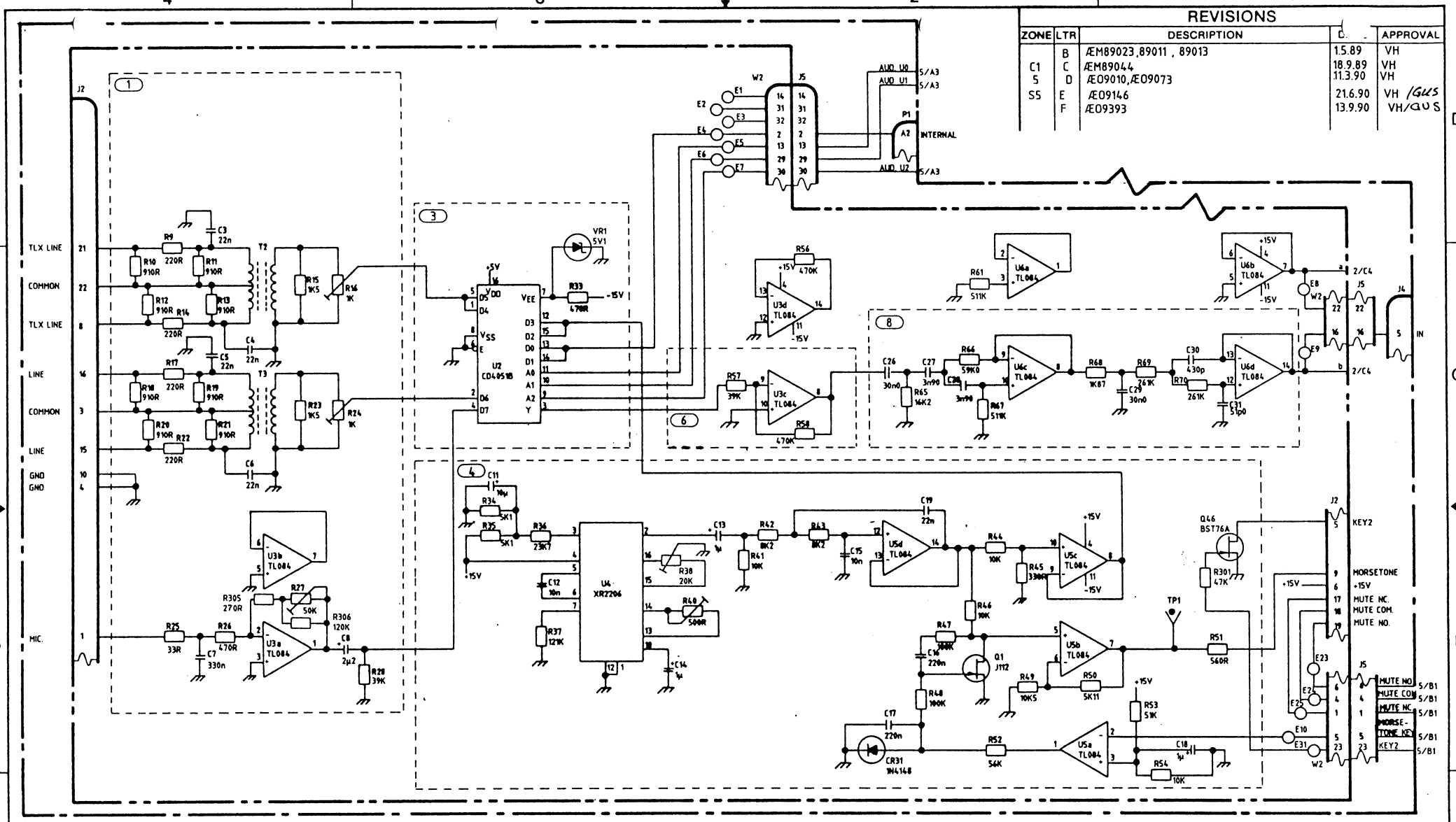
After the compressor, the compressed signal is mixed with the first LO signal at 1.4MHz in the mixer, and the respective sideband is selected by the following crystal filter. The wanted sideband (USB or LSB) is selected by offsetting the first LO signal of 1.4MHz.

The 1.4MHz signal is fed to the mixers through a limiter amplifier. The signal from the limiter amplifier is a square wave signal with an amplitude independent of temperature variations.

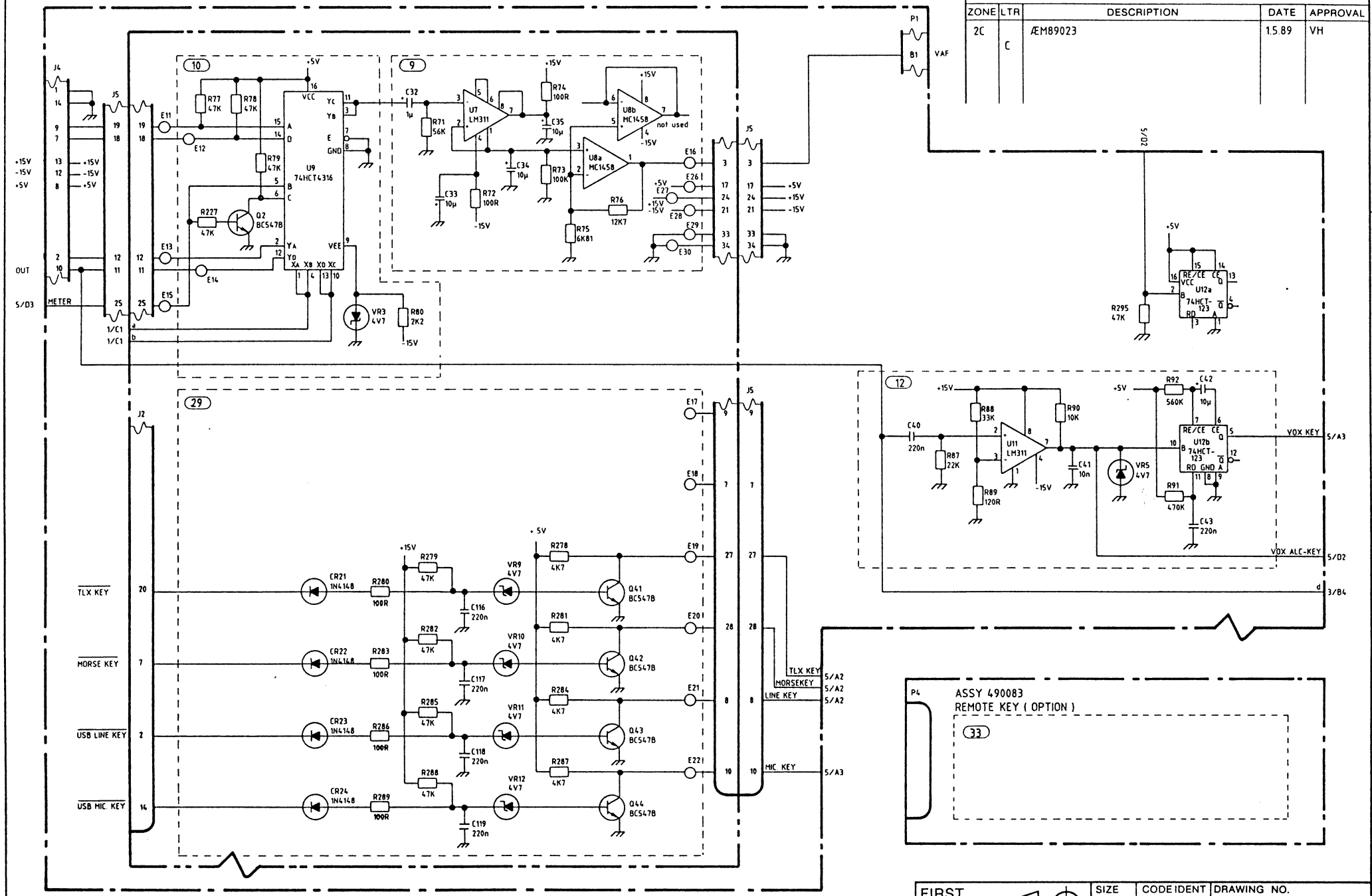
The sideband and a 1.4MHz carrier signal are fed into a gain controlled amplifier before the two signals are summed together. The gain of the amplifiers is dependent of the mode.

The shaper after the summing amplifier shapes the envelope of the output signal when the exciter is keyed. Finally the signal is amplified to -13dBm/50Ω.

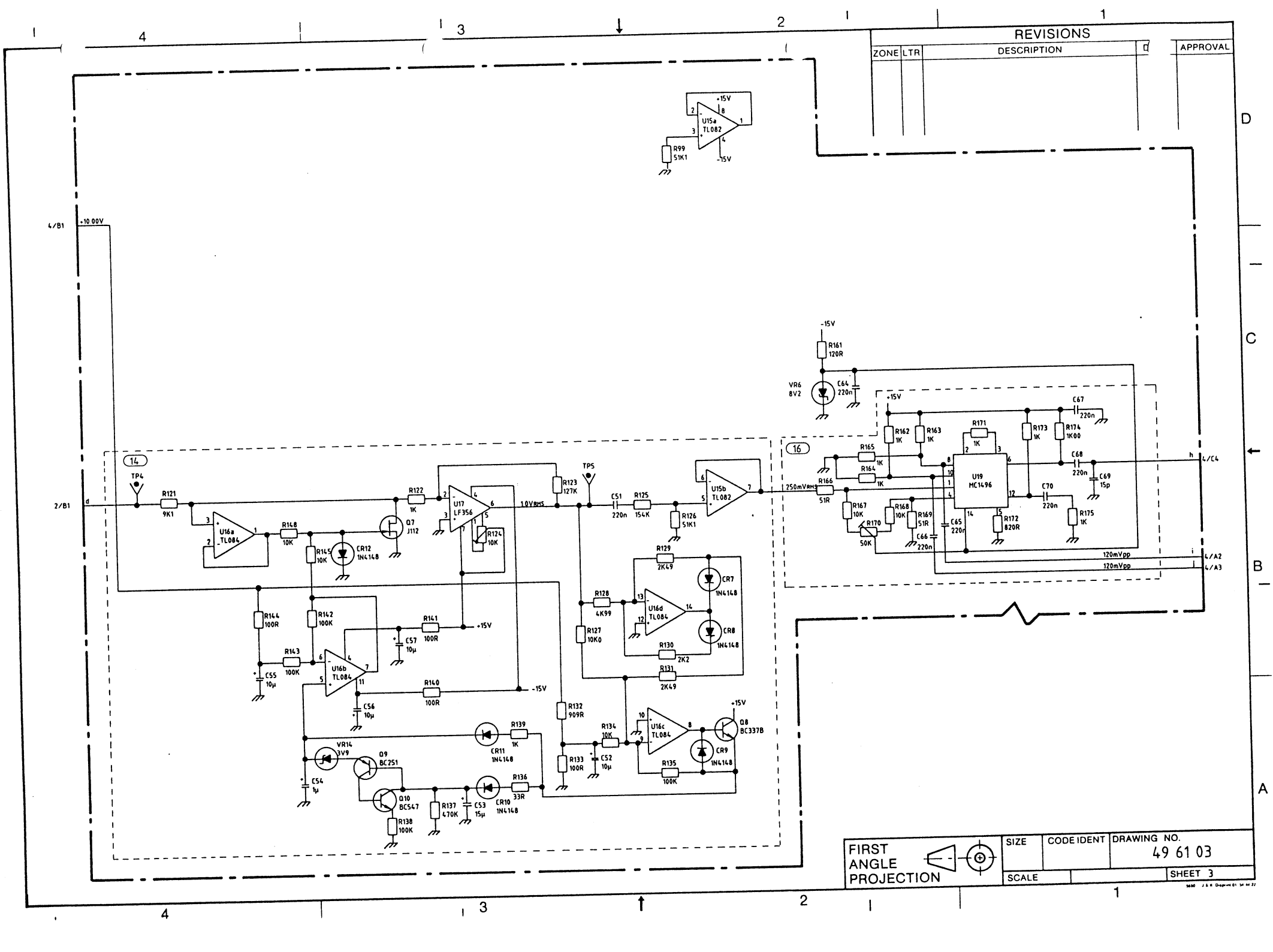
* The Remote Key is an option, which is used to key the exciter in connection with the Transmitter Remote Control TC4010.


REVISIONS
ZONE | LTR | DESCRIPTION | D. . | APPROVAL
B | ÆM89023,89011 , 89013 | 1.5.89 | VH
C1 C | ÆM89044 | 18.9.89 | VH
5 D | ÆO9010,ÆO9073 | 11.3.90 | VH
S5 E | ÆO9146 | 21.6.90 | VH /GUS
F | ÆO9393 | 13.9.90 | VH/GUS
TLX LINE
COMMON
TLX LINE
LINE
COMMON
LINE
GND
GND
MIC.
U2 CD4051B
U3a TL084
U3b TL084
U3c TL084
U3d TL084
U4 XR2206
U5a TL084
U5b TL084
U5c TL084
U5d TL084
U6a TL084
U6b TL084
U6c TL084
U6d TL084
Q1 J112
Q46 BST76A
CR31 1N4148
VR1 5V1
AUD U0
AUD U1
AUD U2
INTERNAL
KEY2
MORSETONE
+15V
MUTE NC.
MUTE COM.
MUTE NO.
MUTE NO
MUTE COM
MUTE NC
MORSE-TONE KEY
KEY2
IN
TP1
Dansk Radio AS
TITLE
MODULATOR A7 , SSB
SE4010
DR. VH 4.11 1988
CH.
AP.
AP.
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075
ANGLES
LIN. DIM.
MATERIAL
FIRST ANGLE PROJECTION
SIZE A2
CODE IDENT
DRAWING NO. 49 61 03
SCALE
SHEET 1 OF 5
48 81 00 | SE4010
NEXT ASSY | USED ON
APPLICATION

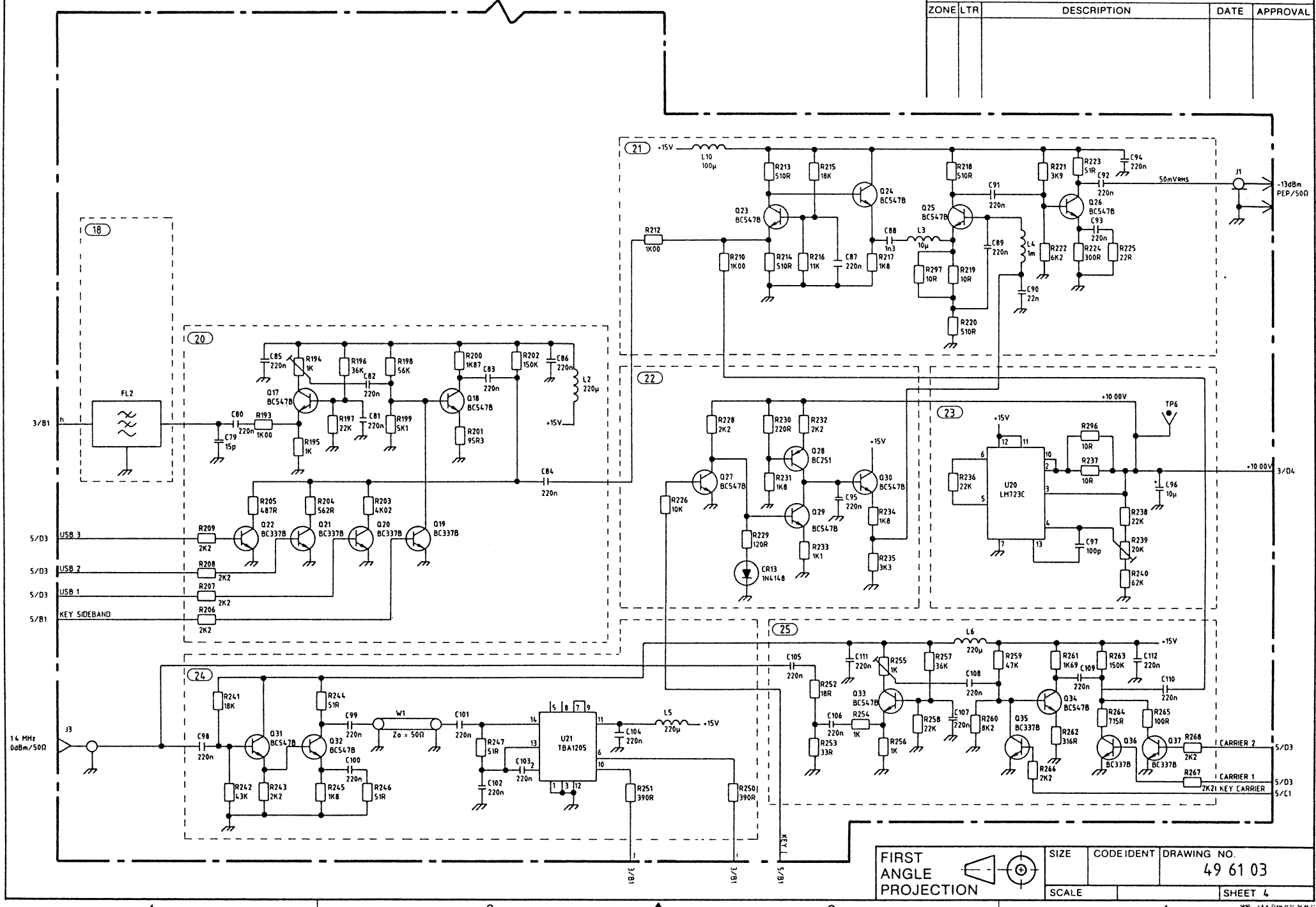
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
2C	C	ÆM89023	1.5.89	VH



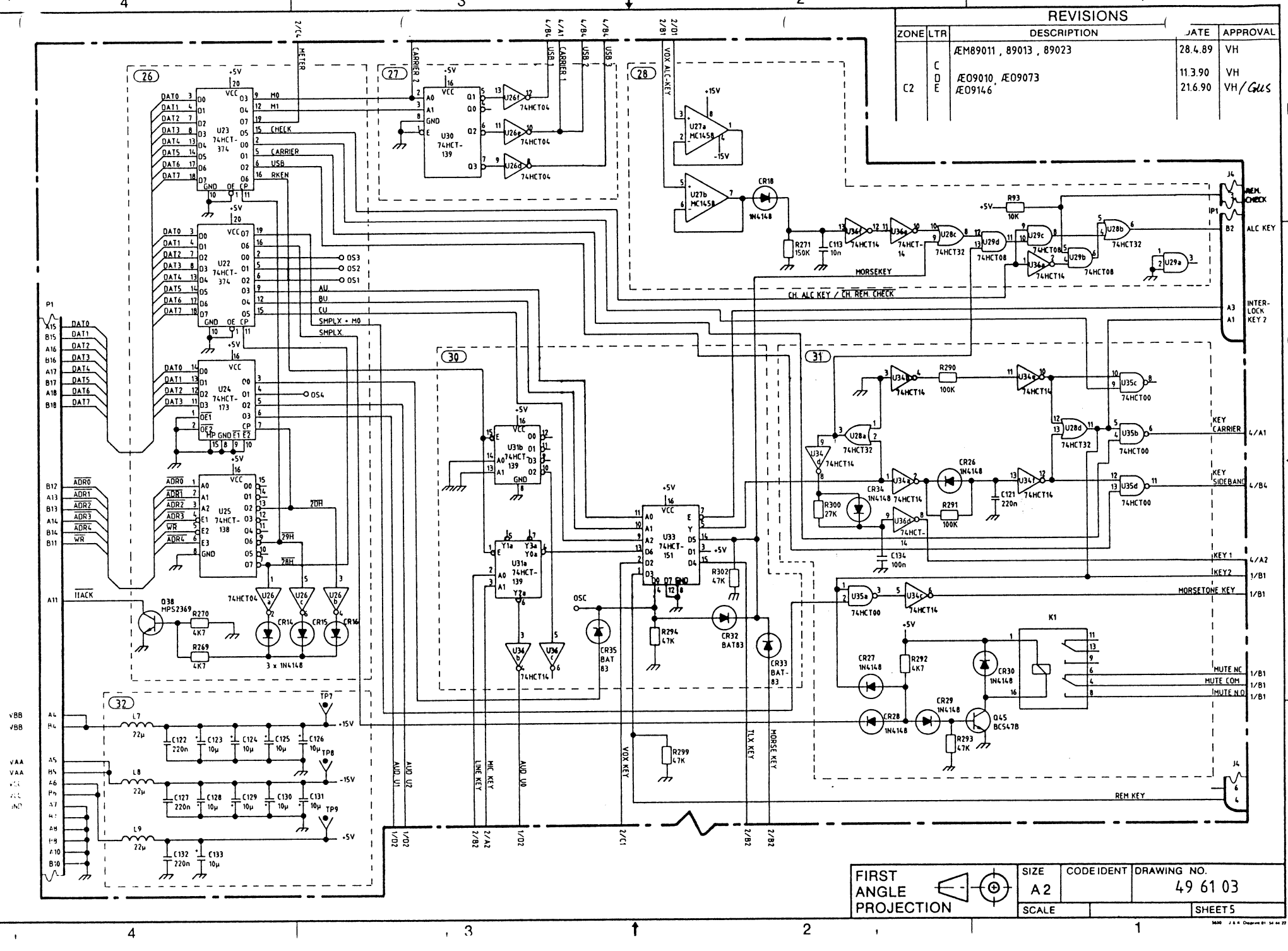
FIRST ANGLE PROJECTION	SIZE A2	CODE IDENT	DRAWING NO. 49 61 03
	SCALE		SHEET 2

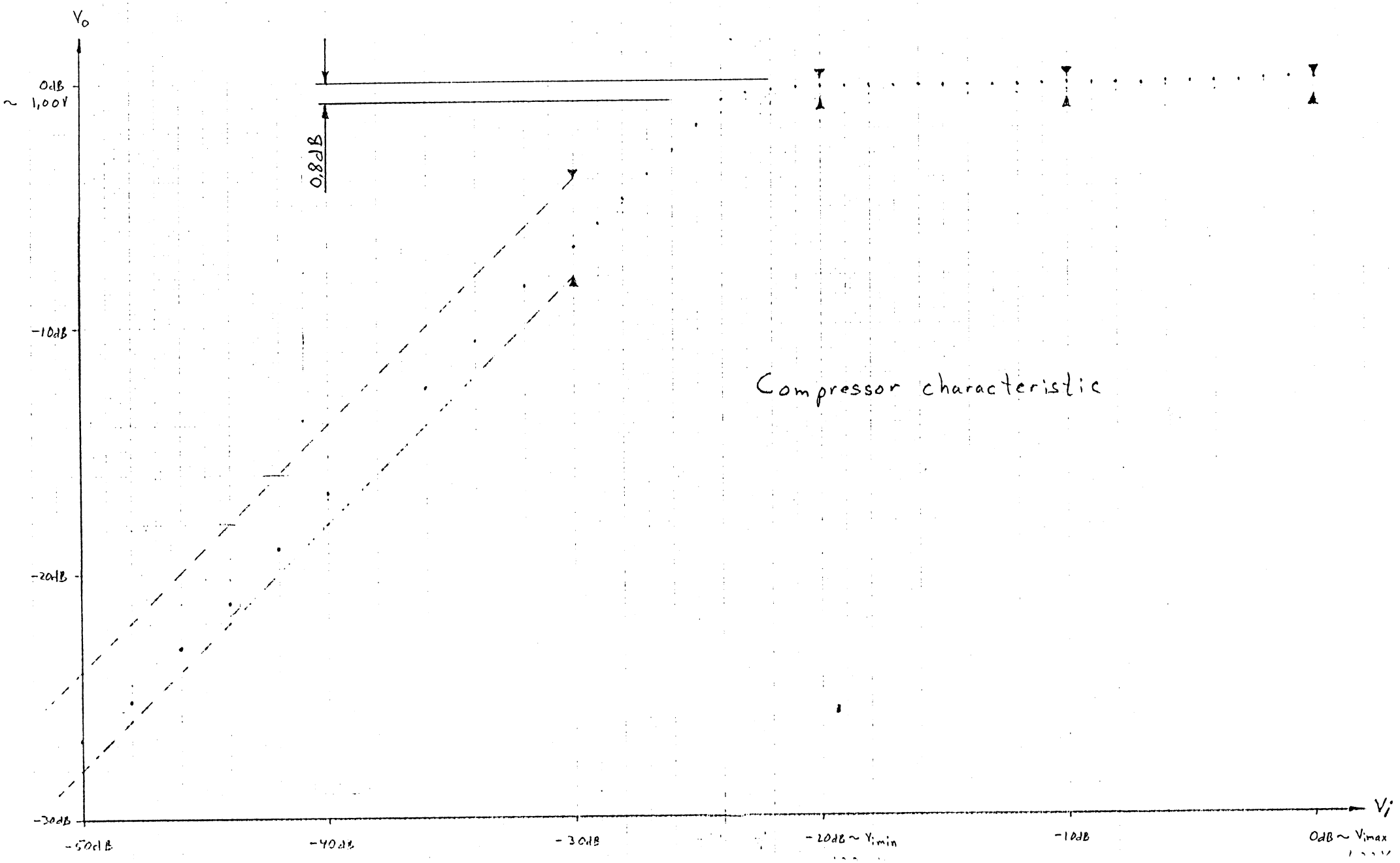

REVISIONS
ZONE
LTR
DESCRIPTION
APPROVAL
+15V
U15a TL082
R99 51K1
-15V
4/B1
+10 00V
2/B1
14
TP4
R121 9K1
U16a TL084
R148 10K
R145 10K
CR12 1N4148
Q7 J112
R122 1K
U17 LF356
R124 10K
1.0VRMS
R123 127K
TP5
C51 220n
R125 154K
R126 51K1
U15b TL082
R129 2K49
R128 4K99
R127 10K0
U16d TL084
CR7 1N4148
CR8 1N4148
R130 2K2
R131 2K49
R144 100R
R142 100K
R141 100R
C57 10µ
R143 100K
C55 10µ
U16b TL084
R140 100R
C56 10µ
R132 909R
R133 100R
C52 10µ
R134 10K
U16c TL084
Q8 BC337B
CR9 1N4148
R135 100K
R139 1K
CR11 1N4148
VR14 3V9
Q9 BC251
C54 1µ
Q10 BC547
R137 470K
C53 15µ
R136 33R
CR10 1N4148
R138 100K
16
-15V
R161 120R
VR6 8V2
C64 220n
+15V
R162 1K
R163 1K
R171 1K
R173 1K
R174 1K00
C67 220n
R165 1K
R164 1K
C68 220n
C69 15p
h
4/C4
250mVRMS
R166 51R
U19 MC1496
C70 220n
R167 10K
R168 10K
R169 51R
R170 50K
C65 220n
C66 220n
R172 820R
R175 1K
120mVpp
120mVpp
i
4/A2
4/A3
FIRST ANGLE PROJECTION
SIZE
CODE IDENT
DRAWING NO.
49 61 03
SCALE
SHEET 3

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL



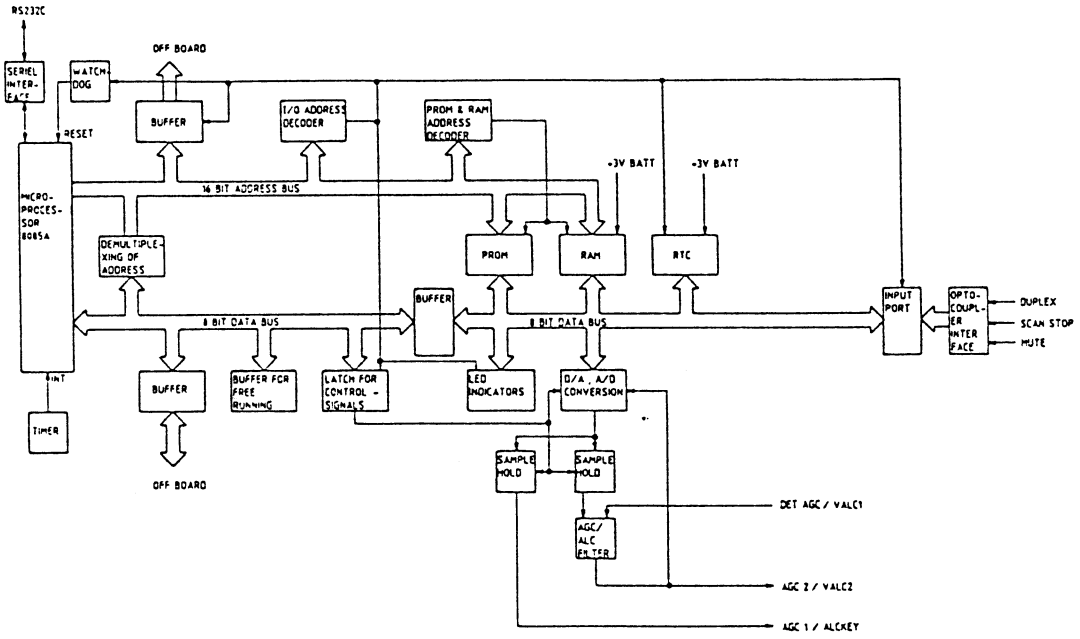
FIRST ANGLE PROJECTION	SIZE	CODE IDENT	DRAWING NO. 49 61 03
	SCALE		SHEET 4


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
C2 | C | ÆM89011 , 89013 , 89023 | 28.4.89 | VH
D | ÆO9010, ÆO9073 | 11.3.90 | VH
E | ÆO9146 | 21.6.90 | VH/GWS
FIRST ANGLE PROJECTION
SIZE A2
CODE IDENT
DRAWING NO. 49 61 03
SCALE
SHEET 5
26
27
28
30
31
32
U23 74HCT-374
U22 74HCT-374
U24 74HCT-173
U25 74HCT-138
U30 74HCT-139
U31a 74HCT-139
U31b 74HCT-139
U33 74HCT-151
U27a MC1458
U27b MC1458
U26a U26b U26c U26d 74HCT04
U34a U34b U34c U34d U34e U34f 74HCT14
U28a U28b U28c U28d 74HCT32
U29a U29b U29c U29d 74HCT08
U35a U35b U35c U35d 74HCT00
Q38 MPS2369
Q45 BC547B
CR14 CR15 CR16 3 x 1N4148
CR18 1N4148
CR26 1N4148
CR27 1N4148
CR28 1N4148
CR29 1N4148
CR30 1N4148
CR32 BAT83
CR33 BAT-83
CR34 1N4148
CR35 BAT 83
K1
R270 4K7
R269 4K7
R271 150K
R290 100K
R291 100K
R292 4K7
R293 47K
R294 47K
R299 47K
R300 27K
R302 47K
R93 10K
C113 10n
C121 220n
C122 220n
C123 10µ
C124 10µ
C125 10µ
C126 10µ
C127 220n
C128 10µ
C129 10µ
C130 10µ
C131 10µ
C132 220n
C133 10µ
C134 100n
L7 22µ
L8 22µ
L9 22µ
TP7 +15V
TP8 -15V
TP9 +5V
J4
IP1
REM. CHECK
ALC KEY
INTER-LOCK KEY 2
KEY CARRIER 4/A1
KEY SIDEBAND 4/B4
KEY 1 4/A2
KEY2 1/B1
MORSETONE KEY 1/B1
MUTE NC 1/B1
MUTE COM 1/B1
MUTE NO 1/B1
REM KEY
MORSEKEY
CH. ALC KEY / CH. REM. CHECK
METER
CARRIER 2
CARRIER 1
USB 1
USB 2
USB 3
VOX ALC-KEY
OS3
OS2
OS1
AU
BU
CU
SMPLX + MO
SMPLX
OS4
20H
29H
28H
IIACK
OSC
VOX KEY
TLX KEY
MORSE KEY
MIC KEY
LINE KEY
AUD U1
AUD U2
AUD U0
+5V
+15V
-15V
VBB
VAA
P1


V_o
0dB
1,00V
-10dB
-20dB
-30dB
0,8dB
Compressor characteristic
V_i
-50dB
-40dB
-30dB
-20dB ~ V_{imin}
-10dB
0dB ~ V_{imax}

MICROCOMPUTER ASSEMBLY A8/SE4010

The functional block diagram of the Microcomputer Assembly is shown below:



The assembly consists of a 8085 microprocessor large scale integrated circuit that controls all basic functions within the exciter.

The operating system software for the microcomputer is stored in three programmable read-only memories (PROM's). Each PROM is capable of storing 16K x 8-bit words.

A random access memory chip (RAM), capable of storing 8k x 8-bit words, is required for the temporary storage and manipulation of input and output data. During power failure and receiver standby, the RAM is powered from a 3V battery backup preventing interruptions from disturbing the stored data.

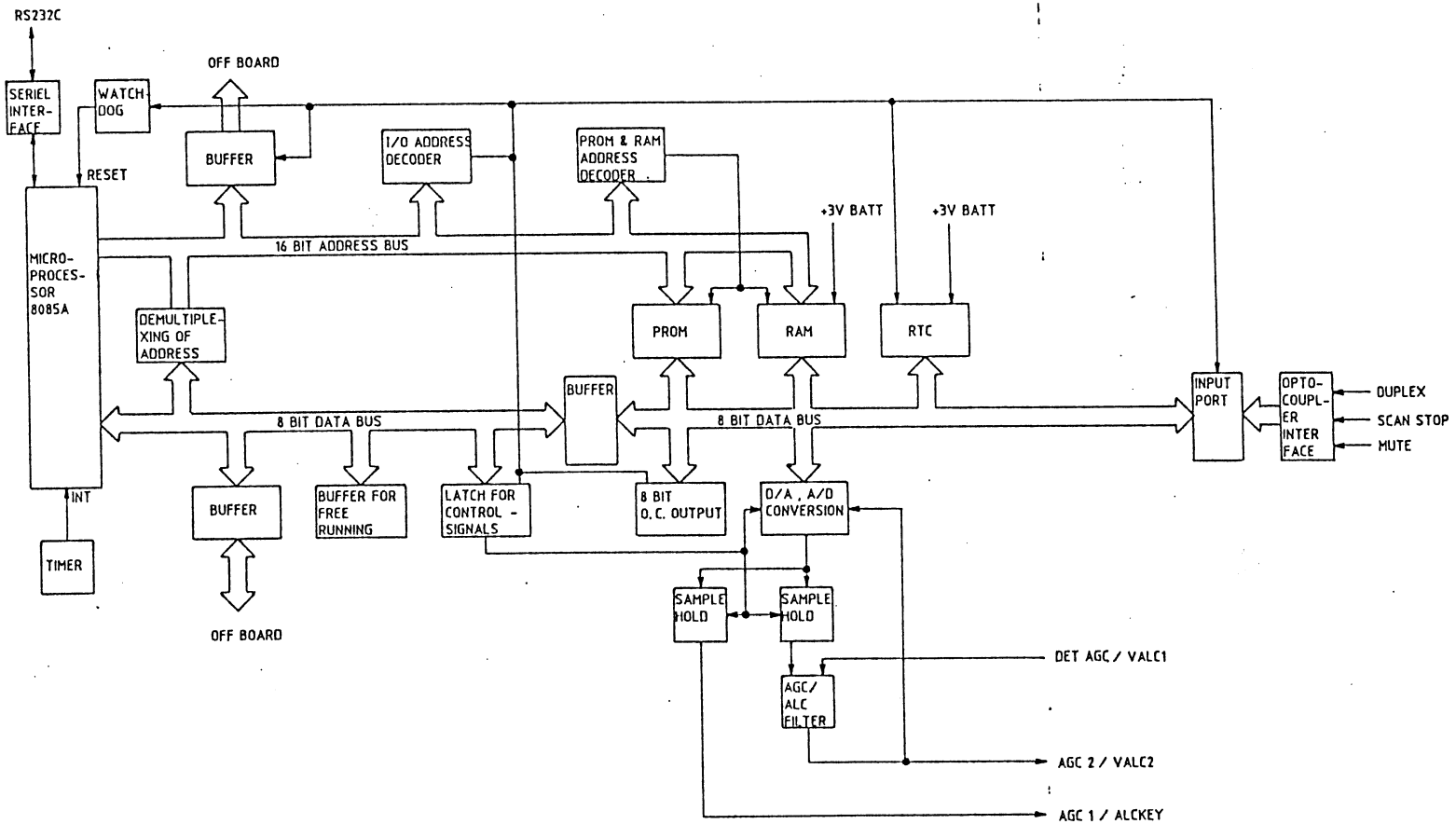
Various buffers and decoders assure proper drive levels and timing to and from various circuits and input/output ports.

A battery back-upped real time clock integrated circuit is mounted to ensure correct time keeping even during power failure or exciter standby.

Timing of the Assembly is via a 6.144MHz crystal oscillator contained in the CPU.

The Microprocessor Assembly performs the automatic level control ALC. Analogue loops provides fast attack ALC-levels for the IF assembly. The peak voltage of **VALC1** is held by a sample and hold circuit. As long as **ALCKEY** is a logical "1", the microcomputer will approach **VALC2** to **VALC1**.

REVISIONS				
ZONE	LTR	DESCRIPTION		APPROVAL
		ÆM88110 ÆM89032	18.11.88 9.5.89	VH VH



		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075
471909	RC4000	ANGLES
471712	RX4000	LIN. DIM.
488240	RX4009	
488100	SE4010	MATERIAL
NEXT ASSY	USED ON	

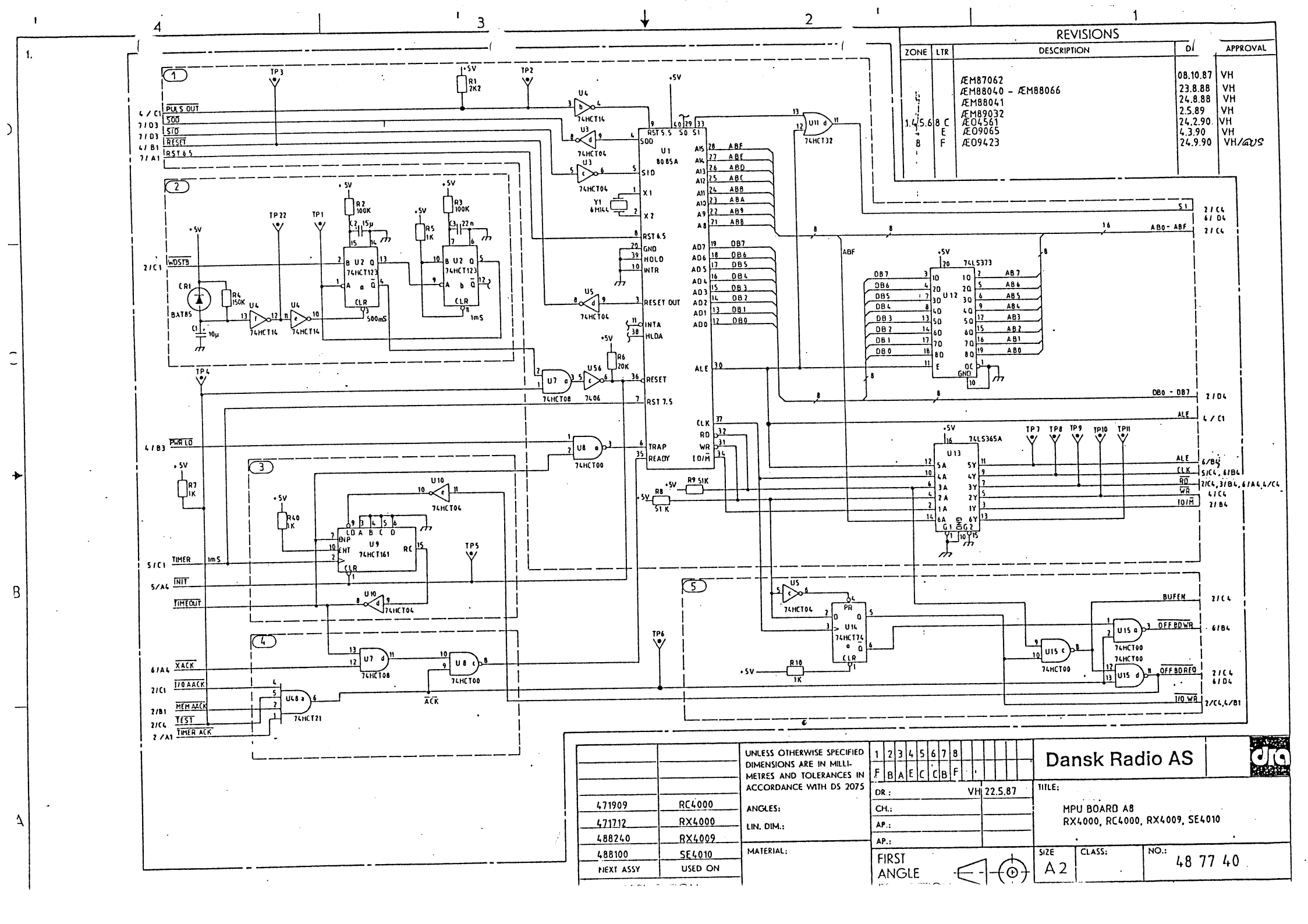
DR.	VH	22.5.87
CH.		
AP.	NIF	110587
AP.		

FIRST ANGLE

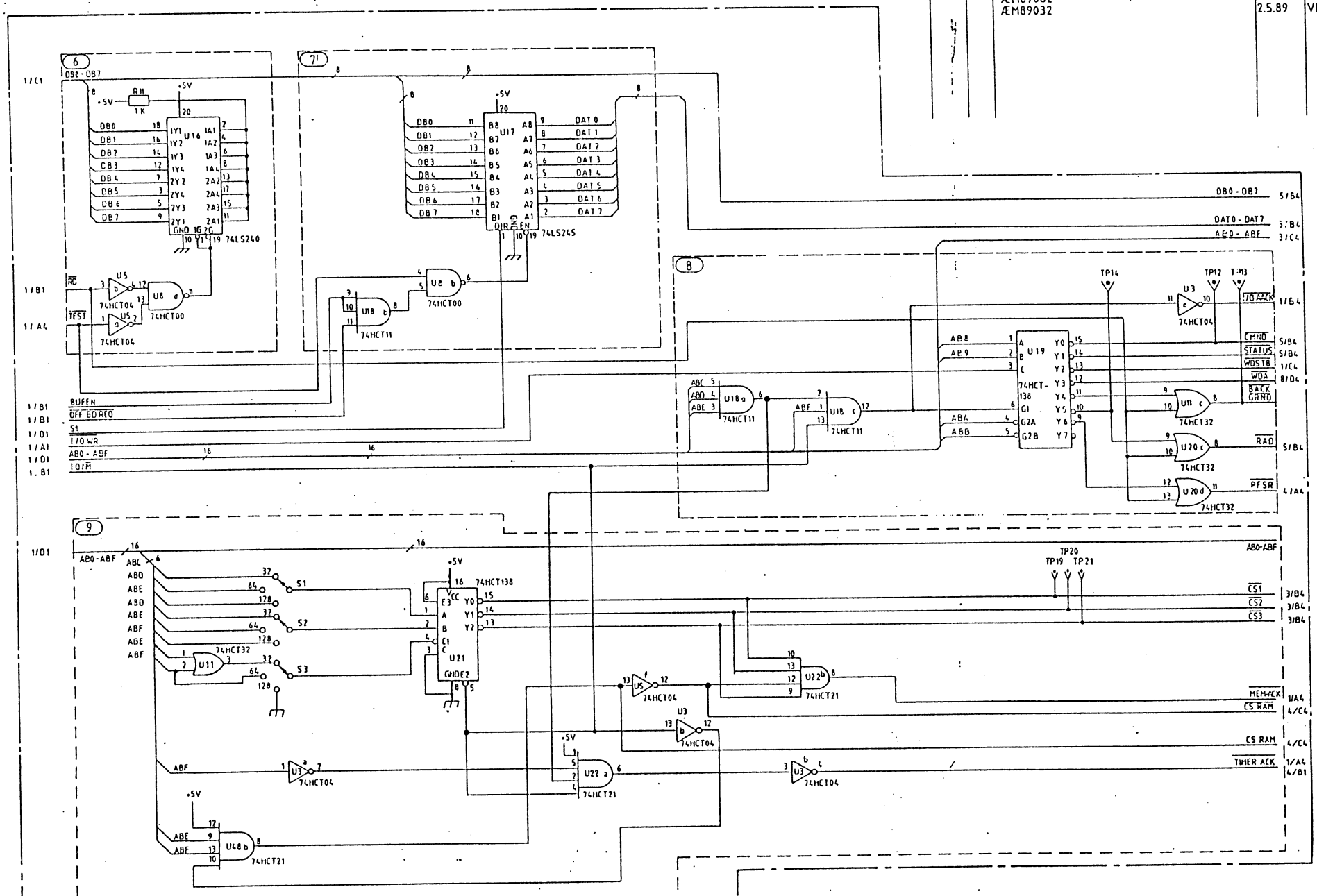
Dansk Radio AS

TITLE
CONFIGURATION
MPU BOARD
RC4000, RX4000, RX4009, SE4010

SIZE	CODE IDENT	DRAWING NO.
A2		48 77 40-B

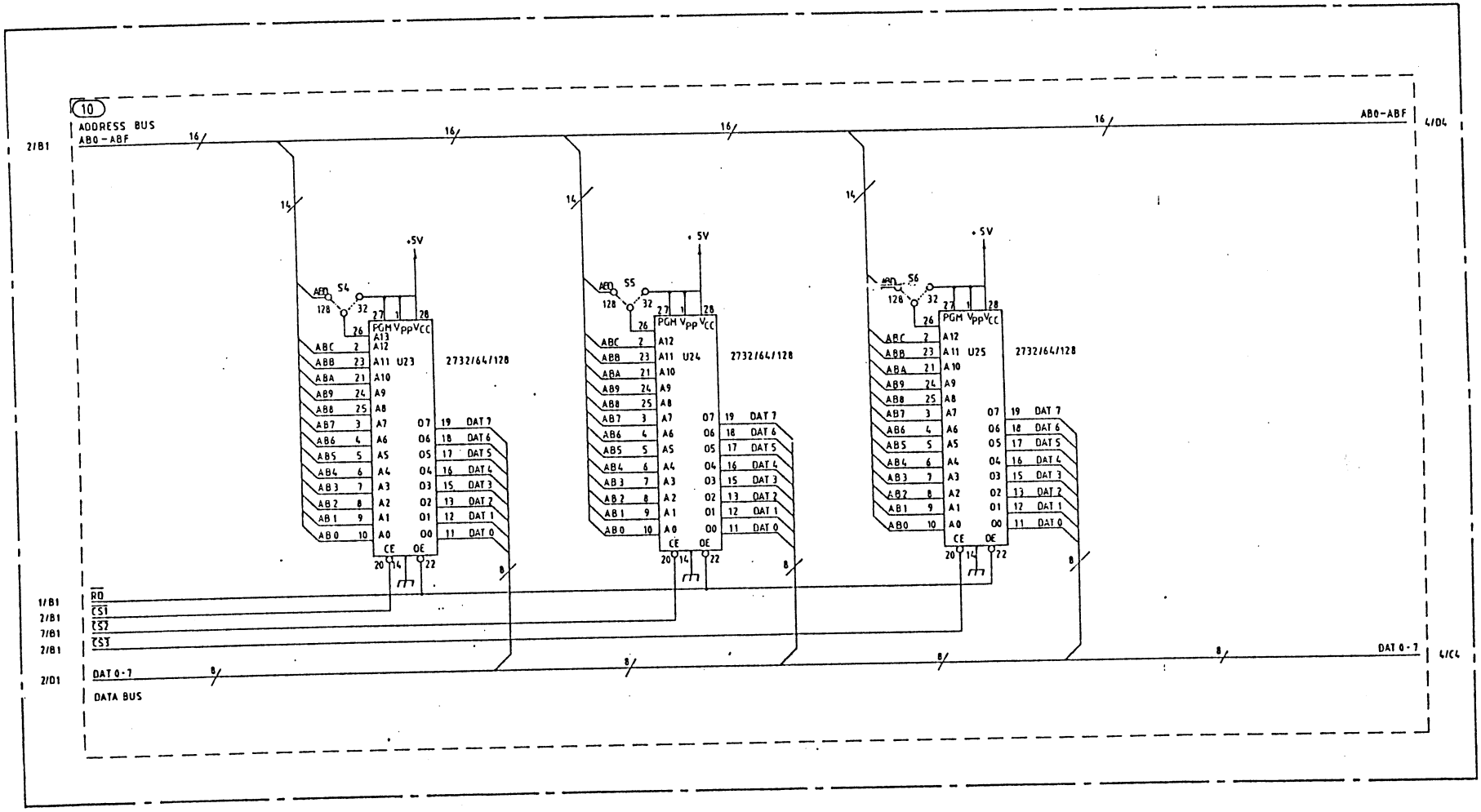

REVISIONS
ZONE | LTR | DESCRIPTION | DI | APPROVAL
ÆM87062 | 08.10.87 | VH
ÆM88040 - ÆM88066 | 23.8.88 | VH
ÆM88041 | 24.8.88 | VH
ÆM89032 | 2.5.89 | VH
1.4.5.6 | 8 | C | ÆO4561 | 24.2.90 | VH
E | ÆO9065 | 4.3.90 | VH
8 | F | ÆO9423 | 24.9.90 | VH/GUS
Dansk Radio AS
TITLE:
MPU BOARD A8
RX4000, RC4000, RX4009, SE4010
SIZE A2
CLASS:
NO.: 48 77 40
DR.: VH 22.5.87
CH.:
AP.:
AP.:
FIRST ANGLE
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES IN ACCORDANCE WITH DS 2075
ANGLES:
LIN. DIM.:
MATERIAL:
471909 RC4000
471712 RX4000
488240 RX4009
488100 SE4010
NEXT ASSY
USED ON
U1 8085A
U2 74HCT123
U3 74HCT04
U4 74HCT14
U5 74HCT04
U6 7406
U7 74HCT08
U8 74HCT00
U9 74HCT161
U10 74HCT04
U11 74HCT32
U12 74LS373
U13 74LS365A
U14 74HCT74
U15 74HCT00
U48 74HCT21
Y1 6MHz
R1 2K2
R2 100K
R3 100K
R4 150K
R5 1K
R6 20K
R7 1K
R8 51K
R9 51K
R10 1K
R40 1K
C1 10µ
C2 15µ
C3 22n
CR1 BAT85
TP1 TP2 TP3 TP4 TP5 TP6 TP7 TP8 TP9 TP10 TP11 TP22
PULS OUT
SOD
SID
RESET
RST 6.5
WDSTB
PWR LO
TIMER
INIT
TIMEOUT
XACK
I/O AACK
MEM AACK
TEST
TIMER ACK
ACK
BUFEN
OFF BDWR
OFF BDRQ
I/O WR
ALE
CLK
RD
WR
IO/M
AB0 - AB7
DB0 - DB7
500mS
1mS
1mS

REVISIONS				
ZONE	LTR	DESCRIPTION	DAT	APPROVAL
		ÆM87062	08.10.87	VH
		ÆM89032	2.5.89	VH



FIRST ANGLE PROJECTION	SIZE	CODE IDENT NO	DRAWING NO
	A2		48 77 40-B

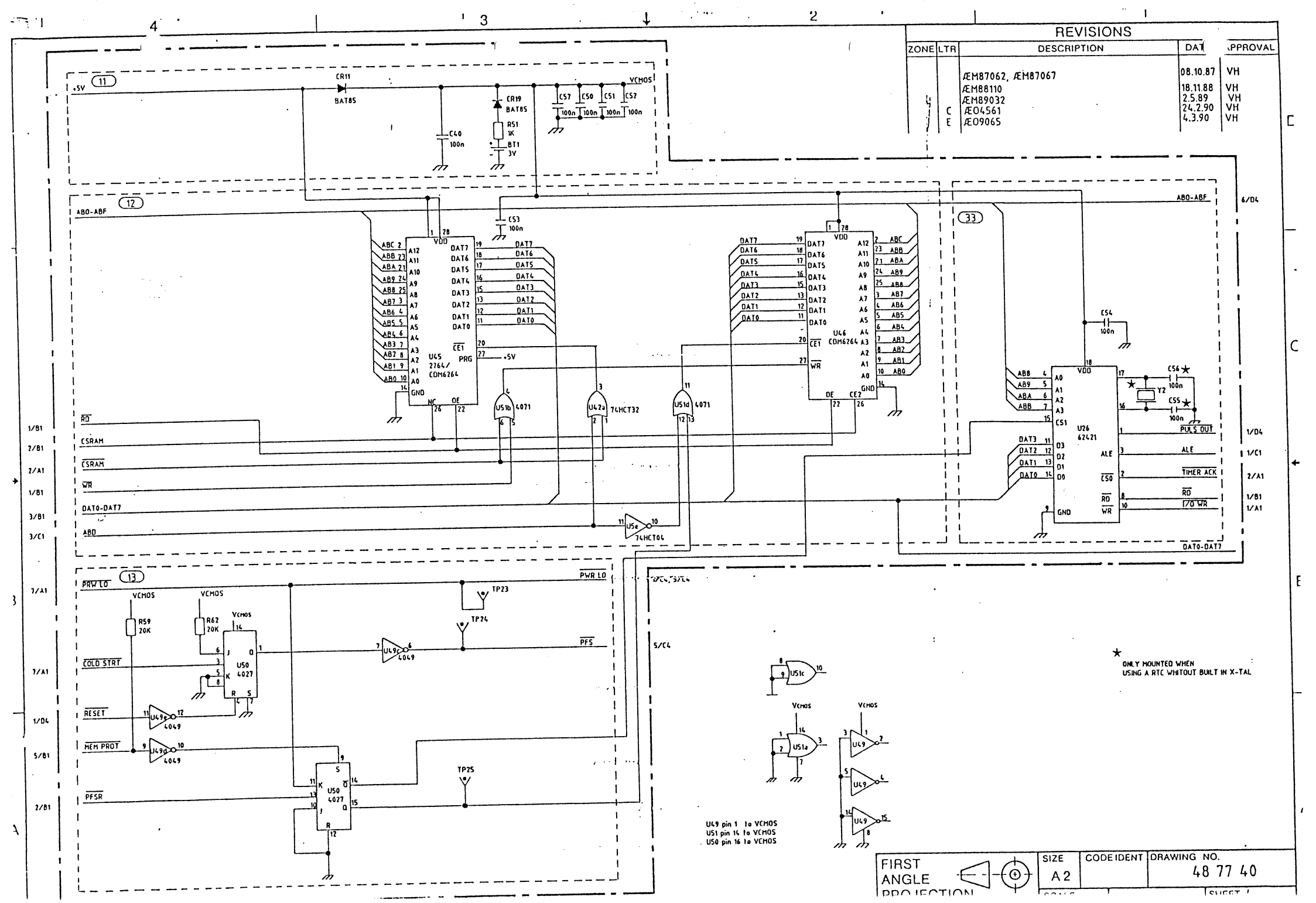
REVISIONS			
ZONE	LTR	DESCRIPTION	APPROVAL



FIRST ANGLE PROJECTION	SIZE	CODE IDENT	DRAWING NO.
	A2		48 77 40-A

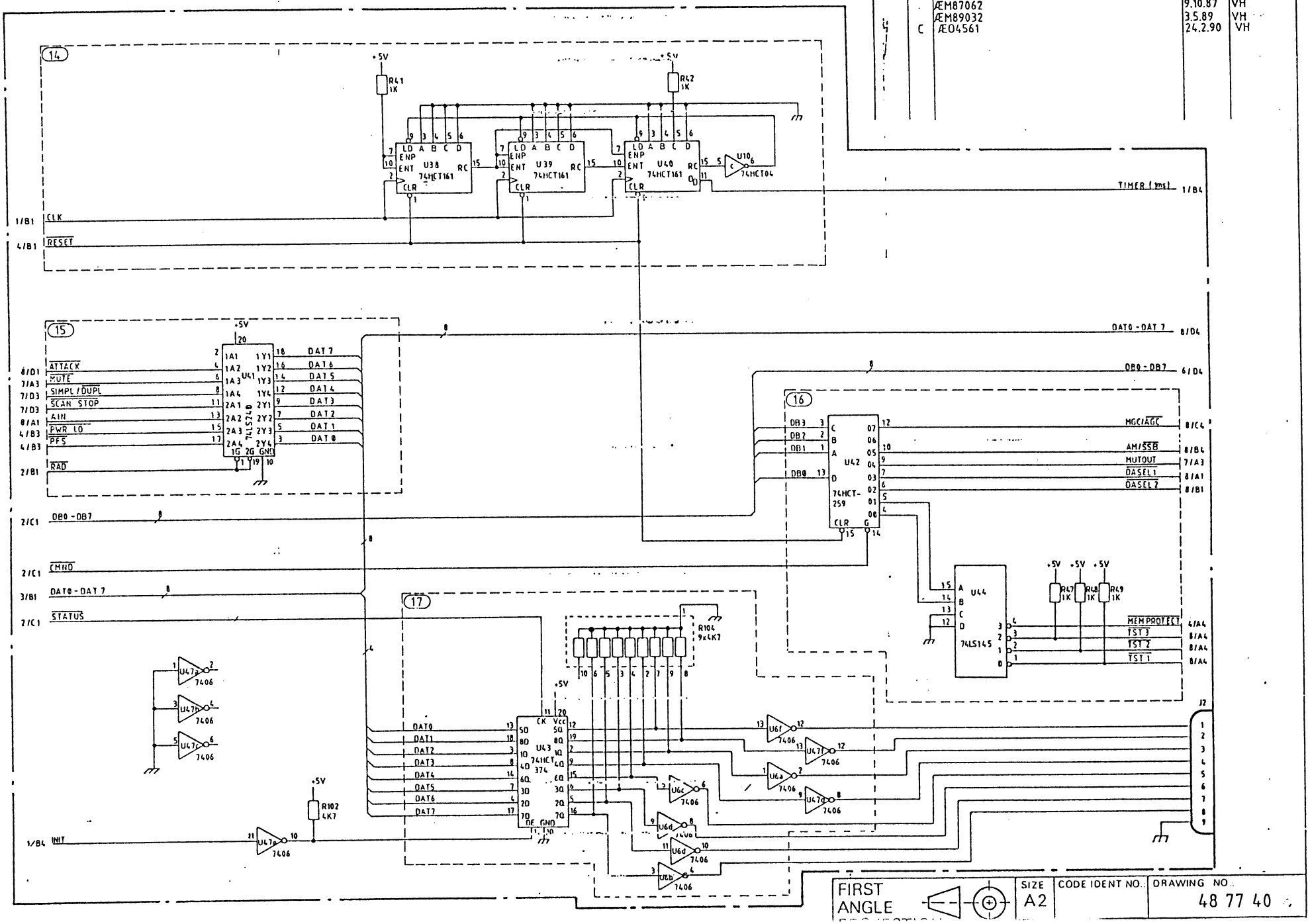
SHEET 3

REVISIONS				
ZONE	LTR	DESCRIPTION	DAT	APPROVAL
		ÆM87062, ÆM87067	08.10.87	VH
		ÆM88110	18.11.88	VH
		ÆM89032	2.5.89	VH
	C	ÆO4561	24.2.90	VH
	E	ÆO9065	4.3.90	VH

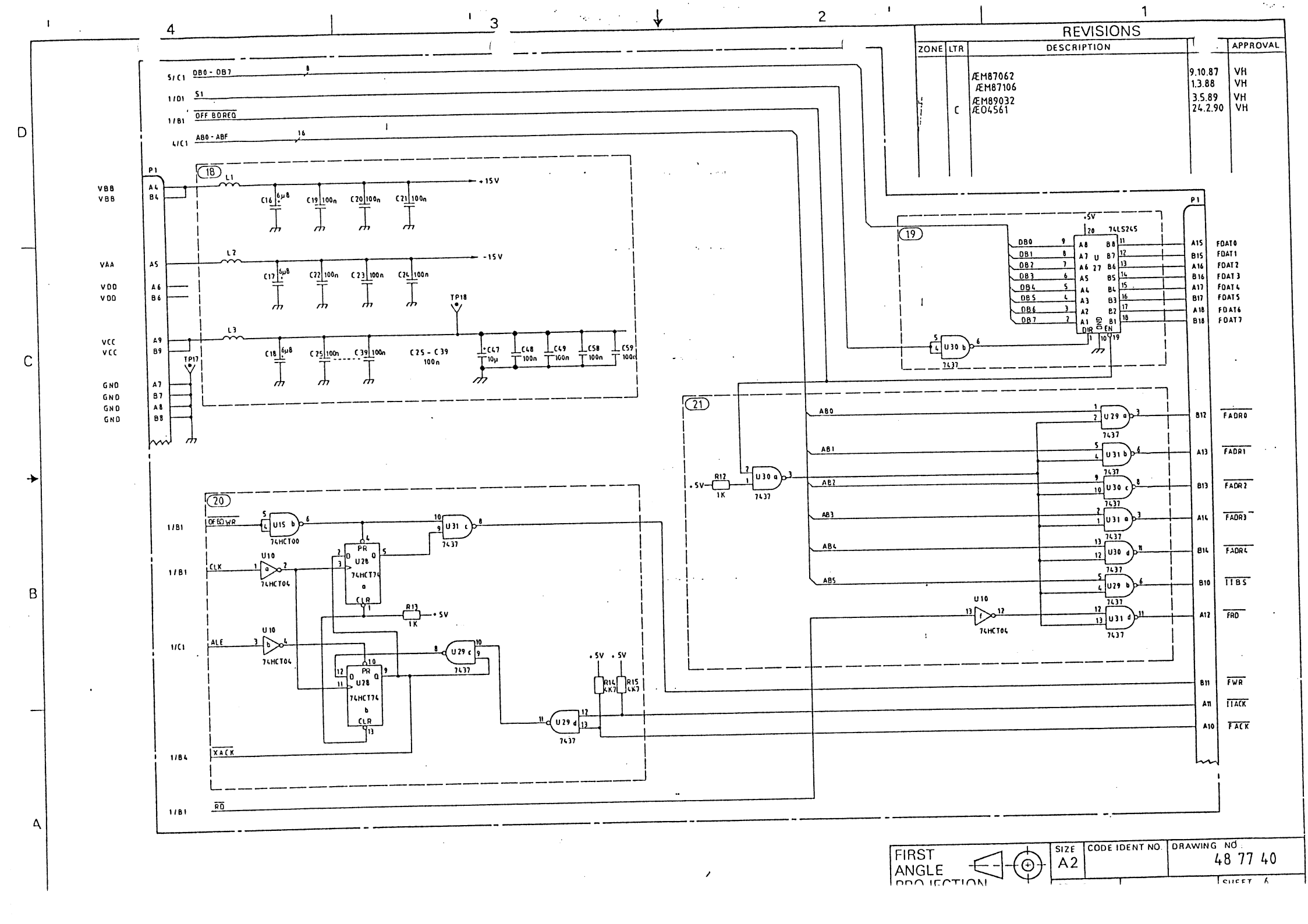


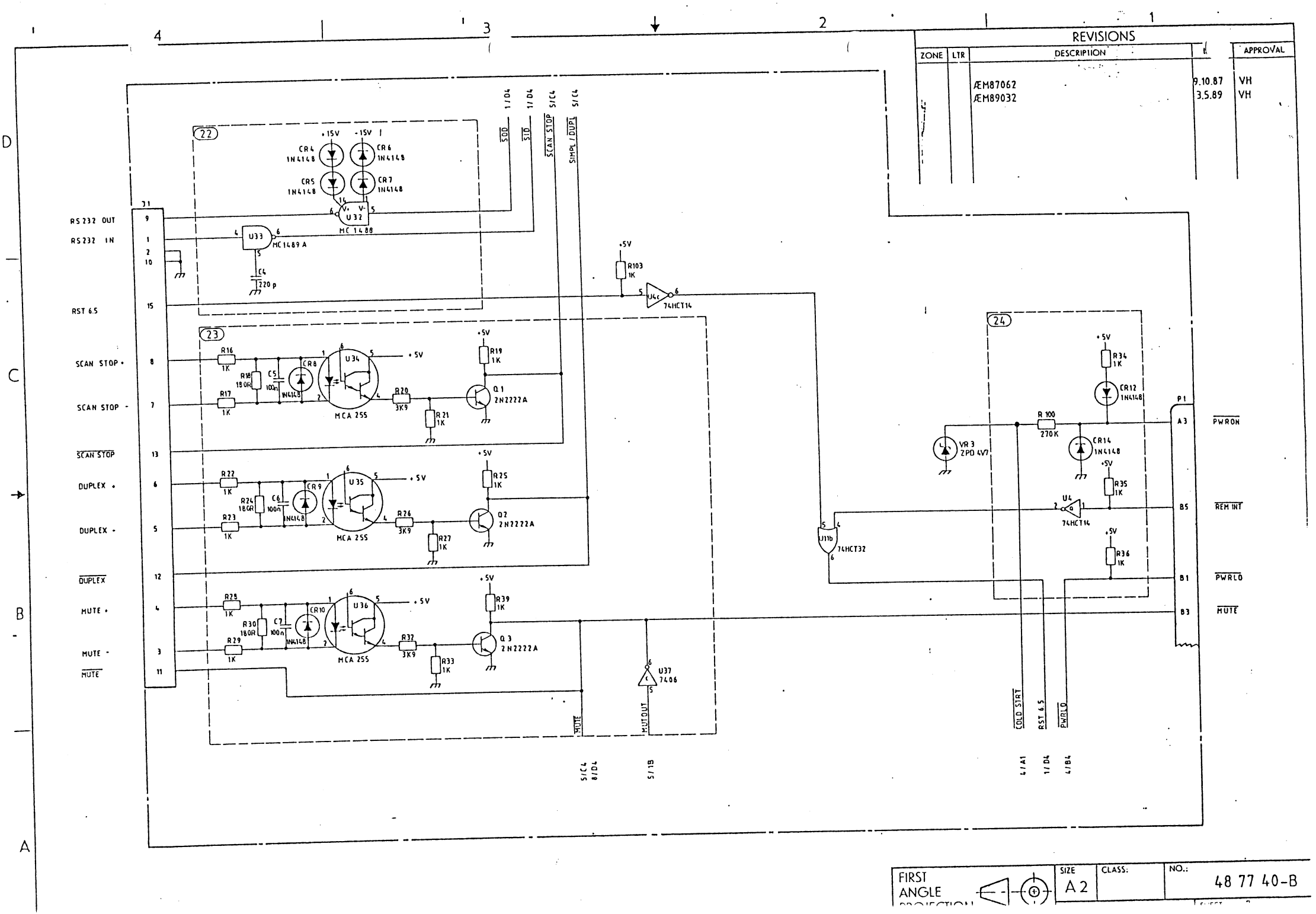
FIRST ANGLE PROJECTION	SIZE	CODE IDENT	DRAWING NO.
	A2		48 77 40

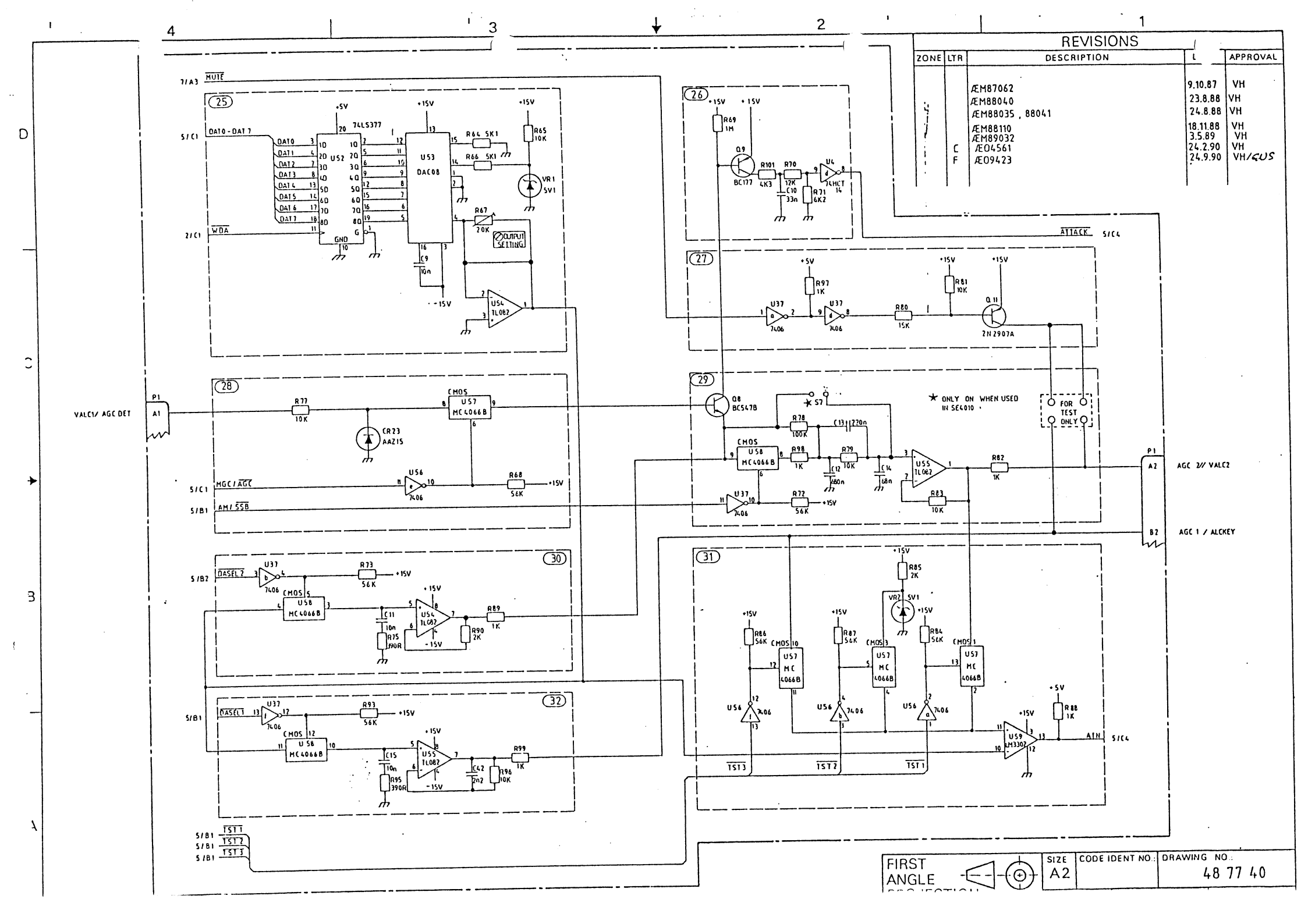
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
		ÆM87062	9.10.87	VH
		ÆM89032	3.5.89	VH
	C	ÆO4561	24.2.90	VH



FIRST ANGLE	SIZE	CODE IDENT NO.	DRAWING NO.
	A2		48 77 40

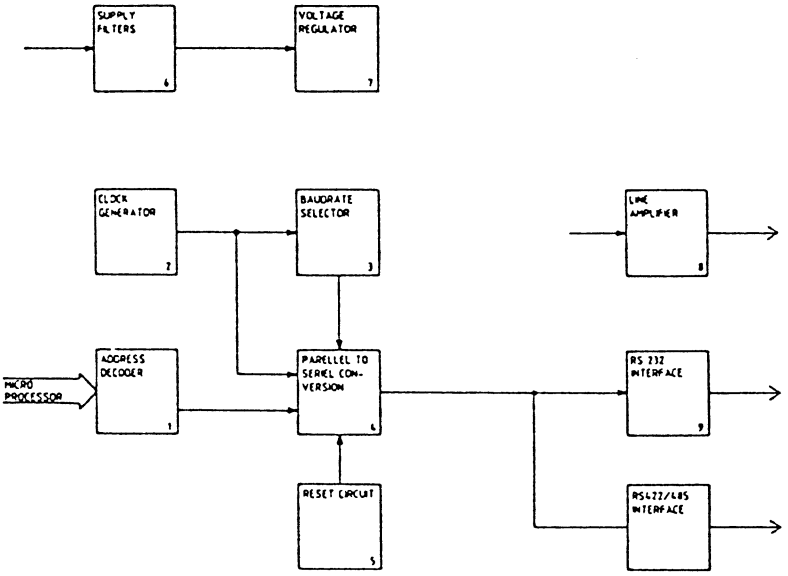

REVISIONS
ZONE LTR DESCRIPTION APPROVAL
ÆM87062 9.10.87 VH
ÆM87106 1.3.88 VH
C ÆM89032 3.5.89 VH
ÆO4561 24.2.90 VH
S/C1 DB0 - DB7
1/D1 S1
1/B1 OFF BOREQ
4/C1 AB0 - AB F
P1
VBB A4 B4
VAA A5
VDD A6 B6
VCC A9 B9
GND A7 B7 A8 B8
18
L1 +15V C16 6µ8 C19 100n C20 100n C21 100n
L2 -15V C17 6µ8 C22 100n C23 100n C24 100n
L3 C18 6µ8 C25 100n C39 100n C25 - C39 100n C47 10µ C48 100n C49 100n C58 100n C59 100n
TP17 TP18
19
+5V 74LS245
DB0 DB1 DB2 DB3 DB4 DB5 DB6 DB7
A8 A7 A6 A5 A4 A3 A2 A1 DIR GND EN
B8 B7 B6 B5 B4 B3 B2 B1
U30 b 7437
A15 FDAT0 B15 FDAT1 A16 FDAT2 B16 FDAT3 A17 FDAT4 B17 FDAT5 A18 FDAT6 B18 FDAT7
20
1/B1 OFBDWR U15 b 74HCT00
CLK U10 a 74HCT04
PR U28 74HCT74 a CLR
R13 1K +5V
ALE U10 b 74HCT04
U29 c 7437
PR U28 74HCT74 b CLR
U29 d 7437
R14 4K7 R15 4K7
XACK
RD
21
AB0 AB1 AB2 AB3 AB4 AB5
+5V R12 1K U30 a 7437
U29 a U31 b U30 c U31 a U30 d U29 b U31 d 7437
U10 f 74HCT04
B12 FADR0 A13 FADR1 B13 FADR2 A14 FADR3 B14 FADR4 B10 IIBS A12 FRD B11 FWR A11 IIACK A10 FACK
FIRST ANGLE PROJECTION
SIZE A2
CODE IDENT NO.
DRAWING NO. 48 77 40
SHEET 6


REVISIONS
ZONE | LTR | DESCRIPTION | APPROVAL
ÆM87062 9.10.87 VH
ÆM89032 3.5.89 VH
RS 232 OUT
RS 232 IN
RST 6.5
SCAN STOP +
SCAN STOP -
SCAN STOP
DUPLEX +
DUPLEX -
DUPLEX
MUTE +
MUTE -
MUTE
MC 1488
MC1489 A
MCA 255
74HCT14
74HCT32
7406
2N2222A
1N4148
+5V
-15V
PWRON
REM INT
PWRLO
COLD STRT
RST 6.5
SIMPL / DUPL
SCAN STOP
SIO
SOD
FIRST ANGLE PROJECTION
SIZE A2
CLASS:
NO.: 48 77 40-B

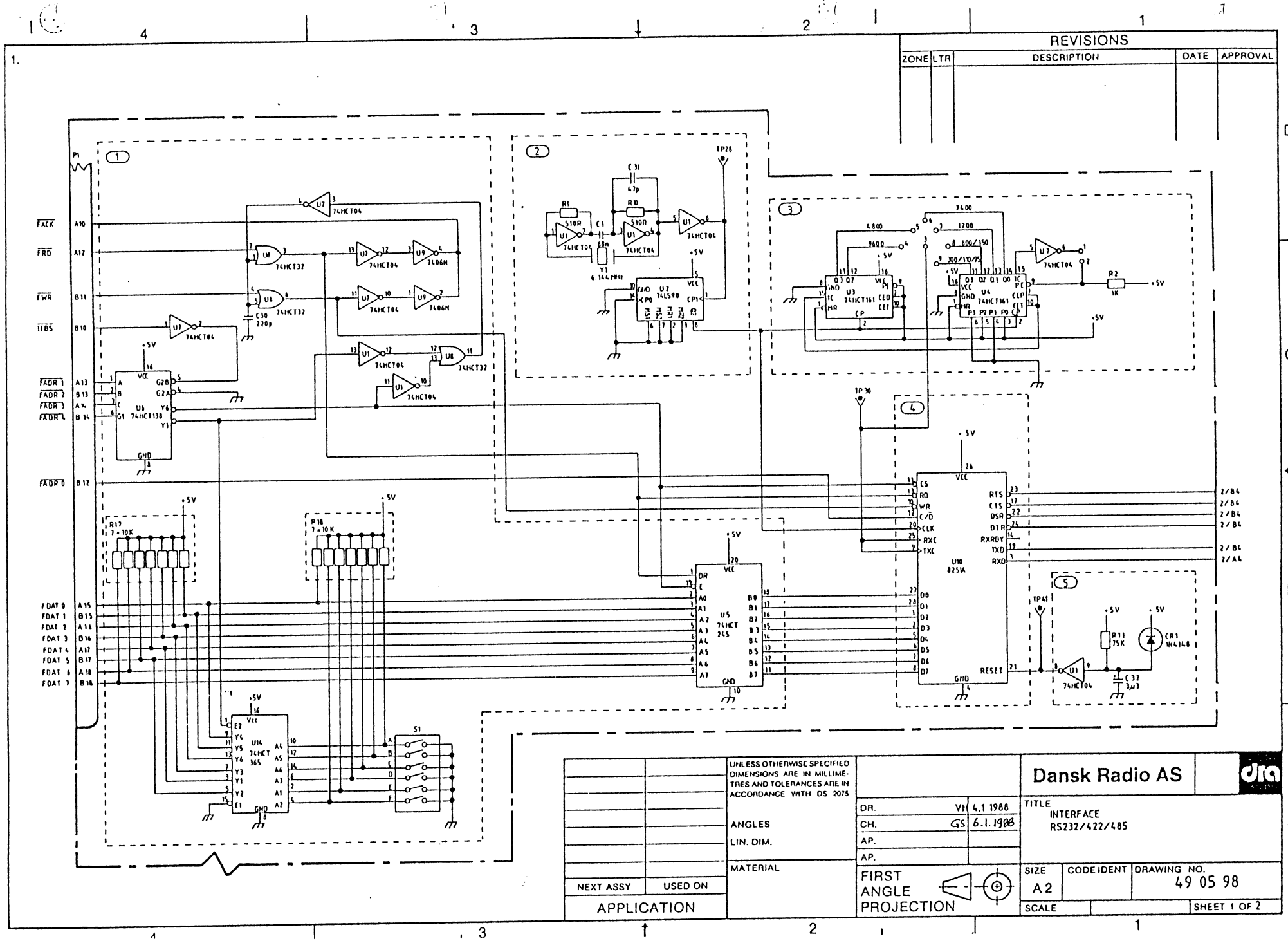

REVISIONS
ZONE LTR DESCRIPTION DATE APPROVAL
ÆM87062 9.10.87 VH
ÆM88040 23.8.88 VH
ÆM88035 , 88041 24.8.88 VH
ÆM88110 18.11.88 VH
ÆM89032 3.5.89 VH
C ÆO4561 24.2.90 VH
F ÆO9423 24.9.90 VH/GUS
MUTE
25
DAT0 - DAT 7
WDA
74LS377
U52
U53
DAC08
U54
TL082
R64 5K1
R66 5K1
R65 10K
R67 20K
OUTPUT SETTING
VR1 5V1
C9 10n
+5V
+15V
-15V
GND
26
R69 1M
Q9
BC177
R101 4K3
R70 12K
C10 33n
R71 6K2
U4
74HCT 14
ATTACK
27
R97 1K
U37
7406
R80 15K
R81 10K
Q11
2N2907A
28
P1
A1
VALC1/ AGC DET
R77 10K
CR23 AAZ15
CMOS
U57
MC4066B
U56
R68 56K
MGC / AGC
AM / SSB
29
Q8
BC547B
S7
★ ONLY ON WHEN USED IN SE4010
FOR TEST ONLY
R78 100K
C13 220n
U58
R98 1K
R79 10K
C12 680n
C14 68n
U55
TL082
R82 1K
R83 10K
R72 56K
P1
A2
AGC 2// VALC2
B2
AGC 1 / ALCKEY
30
OASEL2
R73 56K
C11 10n
R75 390R
R89 1K
R90 2K
31
R85 2K
VR2 5V1
R86 56K
R87 56K
R84 56K
R88 1K
U59
LM3302
AIN
TST3
TST2
TST1
32
OASEL1
R93 56K
C15 10n
R95 390R
C42 2n2
R96 10K
R99 1K
FIRST ANGLE
SIZE A2
CODE IDENT NO.:
DRAWING NO.: 48 77 40

REMOTE MODULE A9/SE4010

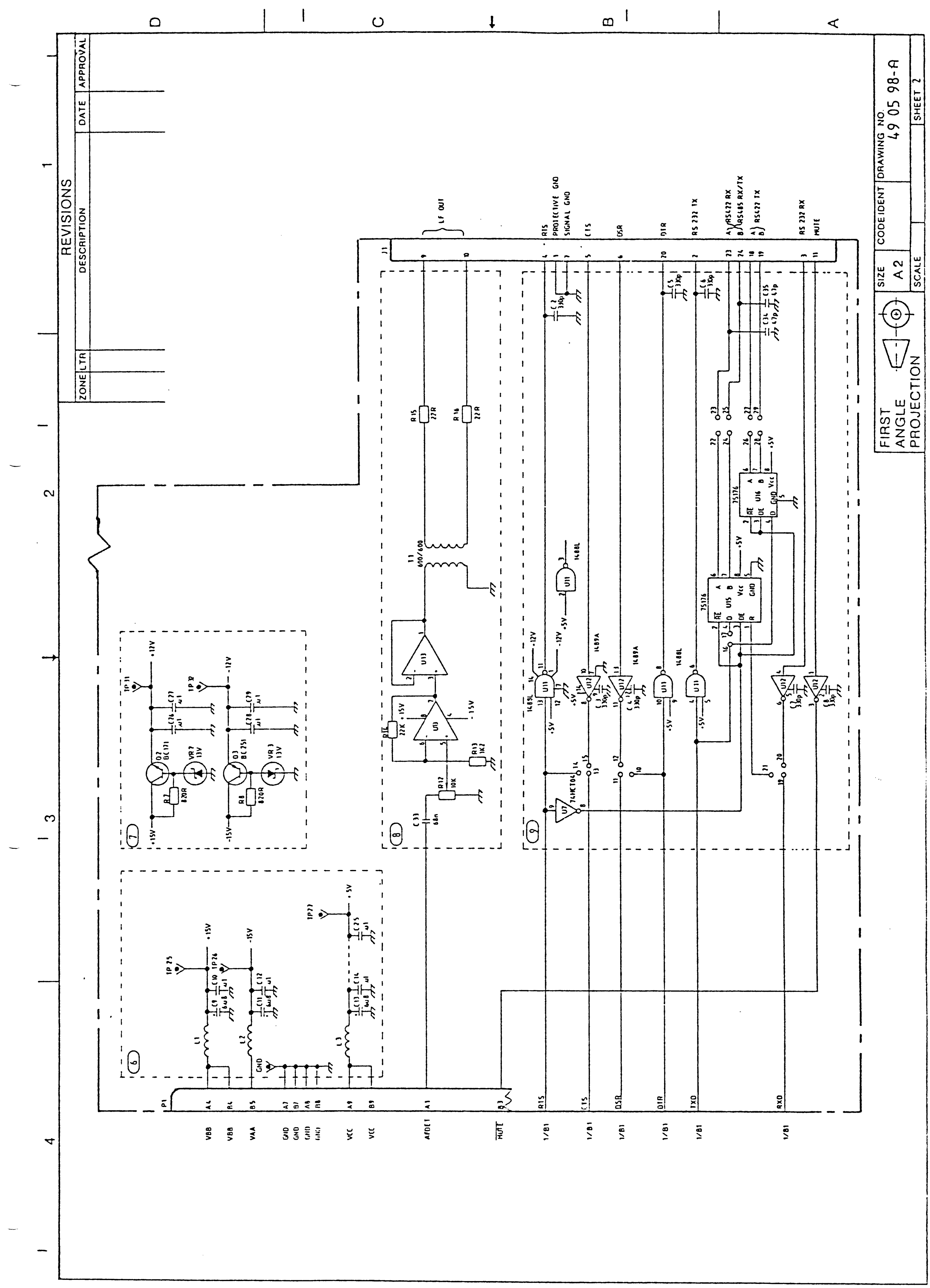
The functional block diagram of the Remote Interface Assembly is shown below:



The clock generator (2) running at 6.144 MHz delivers clock pulses to the parallel to serial conversion circuit (4) with a frequency of 1.2288 MHz. The baudrate generator (3) controls the baudrate of the remote communication. The parallel to serial conversion circuit (4) interfaces the serial databus to an 8-bit databus which is controlled by the microprocessor of the equipment via the address decoder (1). The serial databus is converted to RS232C, RS422 or RS485 levels in the interface circuits. A balanced line output (8) is available when the module is installed in an RX4010 receiver.

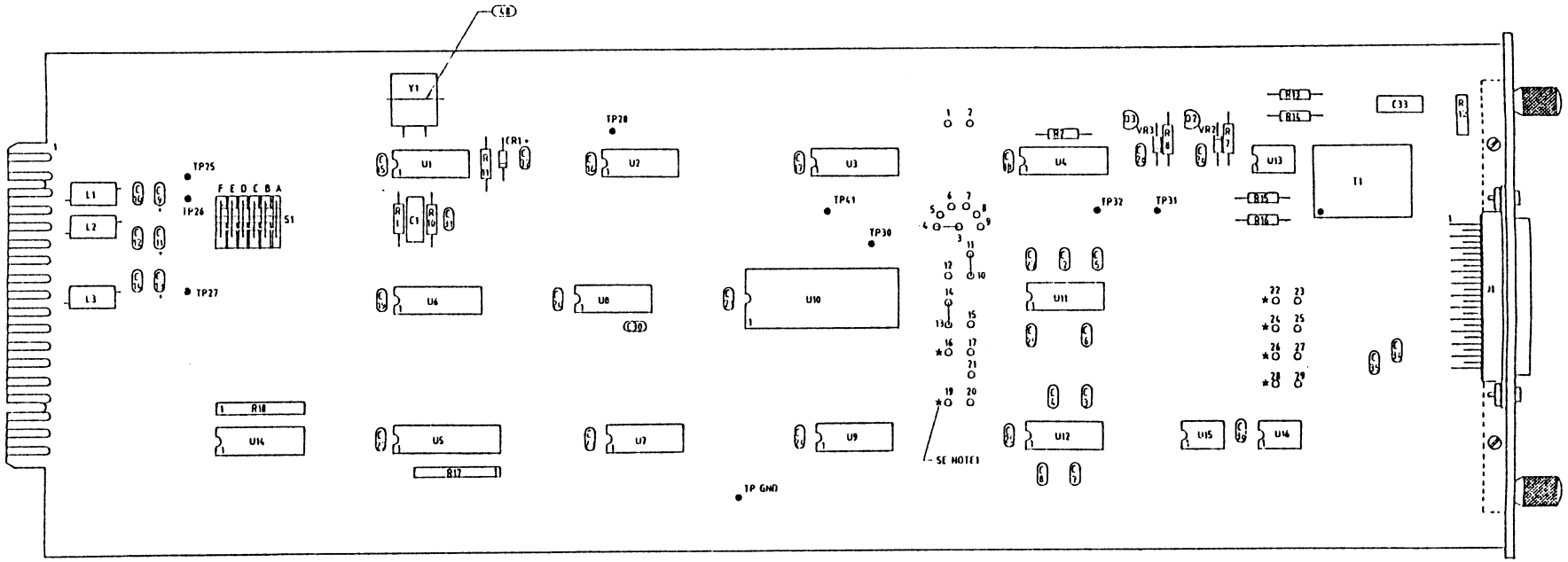


Service Sheet A9


REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPROVAL
FIRST ANGLE PROJECTION
SIZE
A2
SCALE
CODE IDENT
DRAWING NO
49 05 98-A
SHEET 2
LF OUT
RTS
PROTECTIVE GND
SIGNAL GND
CTS
DSR
DTR
RS 232 TX
RS422 RX
RS485 RX/TX
RS422 TX
RS 232 RX
MUTE
75176
600/600
VBB
VAA
GND
VCC
AFDET
MUTE
1/B1

1. STRAPS MONTERES KUN I DEN ENE SIDE

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
	A			
	B	409059	4 1990	VH
	C	409561	1991	VH
	D	408838	3 91	VH



NEXT ASSY	USED ON	APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 3175

ANGLES
LIN DIM
MATERIAL

FIRST ANGLE PROJECTION

DR	VH	5 1 1988
CH	GS	6 1 1988
AP		
AP		

Dansk Radio AS

TITLE
COMPONENT LOCATION
INTERFACE
RS232/422/485

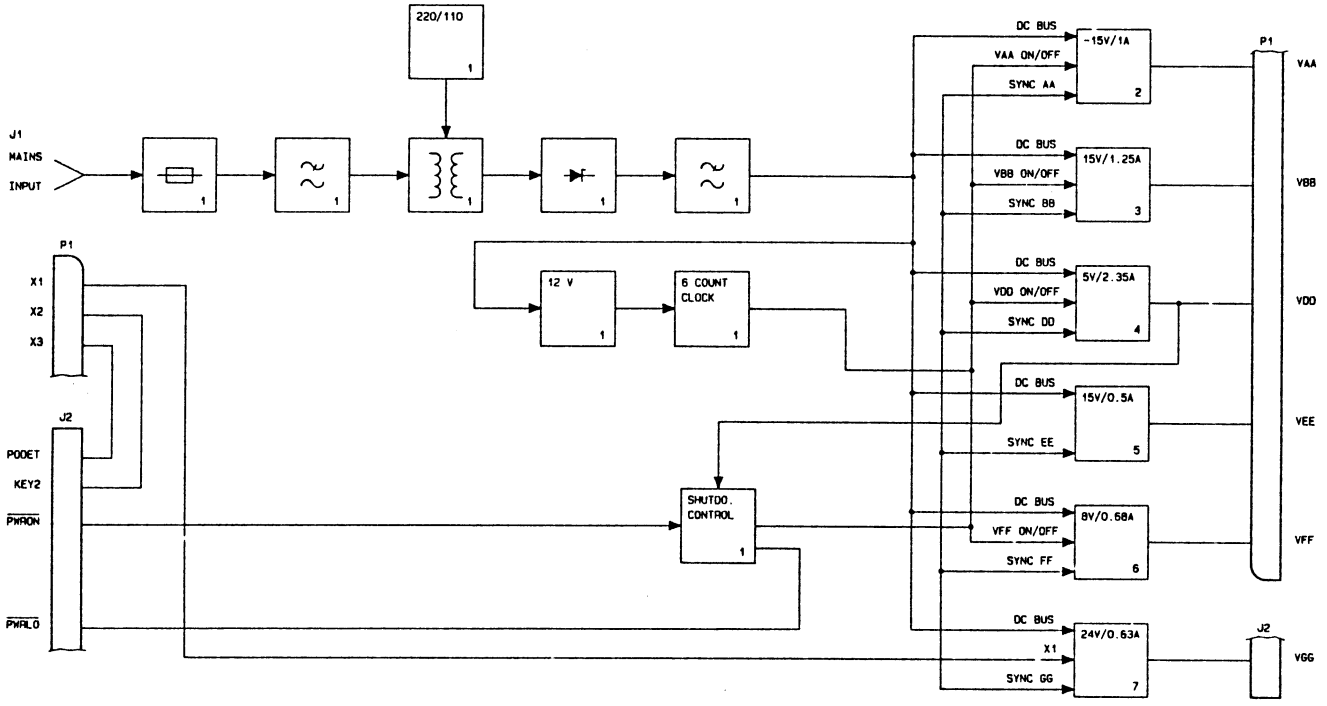
SIZE	CODE IDENT	DRAWING NO
A1		49 05 98

SCALE 2:1 SHEET 1 OF 1

Service Sheet A9

POWER SUPPLY A10/SE4010

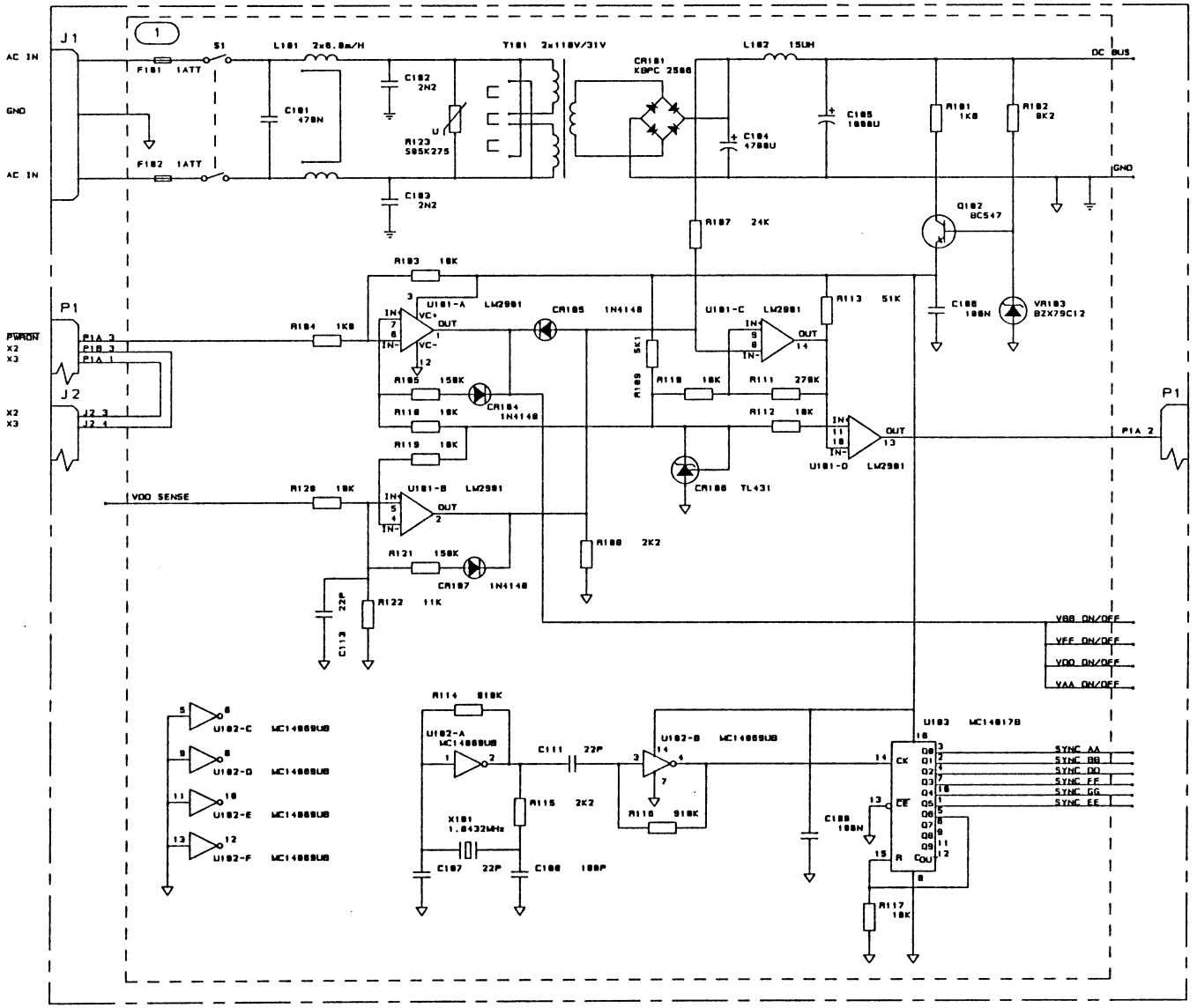
The functional block diagram of the Power Supply Assembly is shown in the figure below.



The Power Supply Assembly is a secondary switch mode power supply with 6 output voltages and a total of 70W output power. A secondary switch mode power supply is a power supply where the mains is connected through a transformer, giving the galvanic insulation between input and output.

Block 1 contains the transformer, rectifier and filter and a 6-phase clock used for the 6 regulators. Blocks 2 to 7 contain the regulators for the 6 different output voltages. Further block 1 contains the Shutdown control, which controls the 5 regulators. The 6th regulator, 5 giving VEE can only be shut down by switching off the mains. The signal **PWRON** energize the regulators giving VAA, VBB, VDD and VFF, while the regulator giving VGG is controlled by the signal **X1**.

All the regulators are overvoltage protected, as well as current limited.



REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
	A		928317	VH
	B	ÆD 9713	928429	GuS

488188	SE4818
NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2370

ANGLES

LIN. DIM.

MATERIAL

DANSK RADIO AS

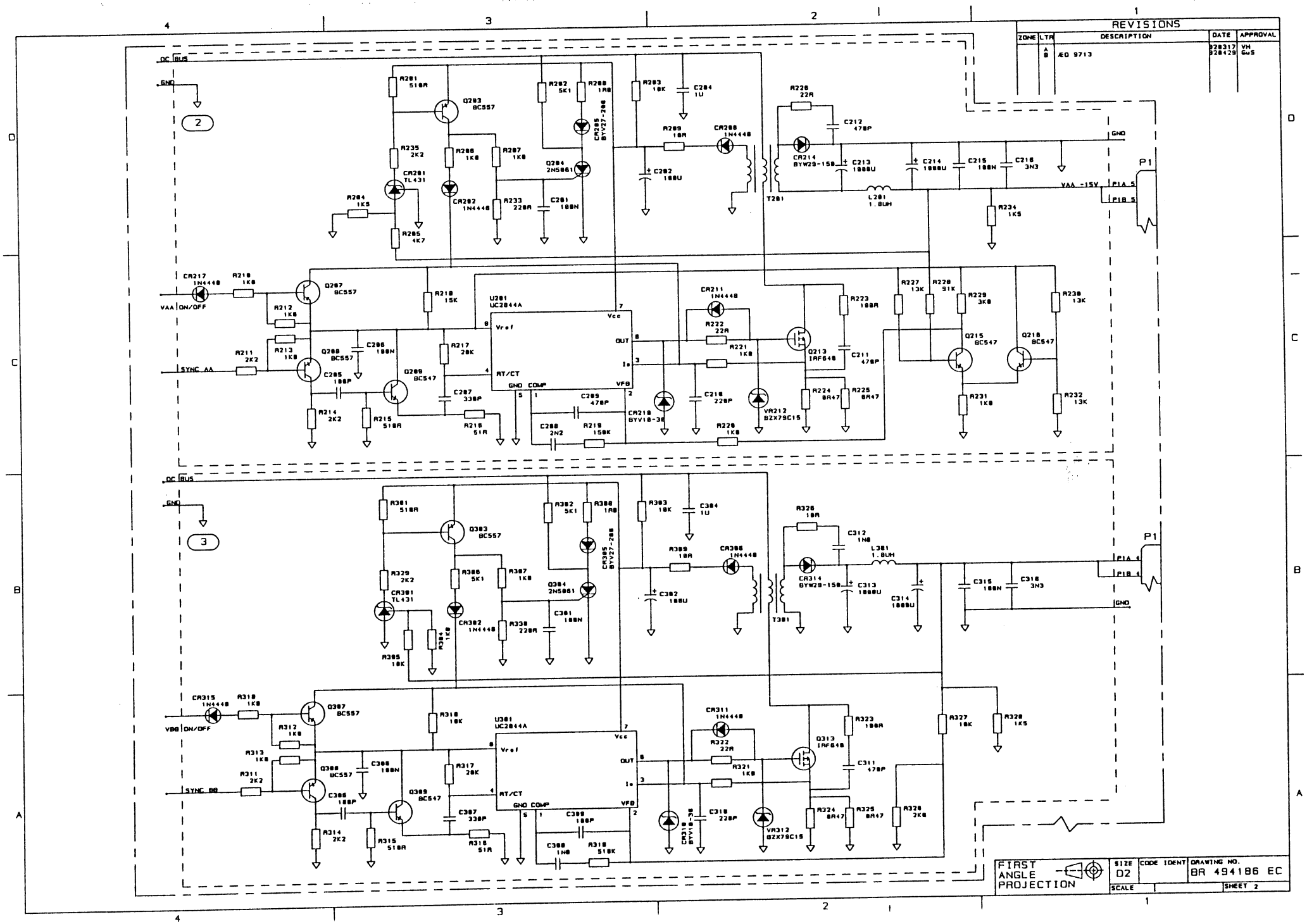
DR.	VH	961205
CH.	GuS	928318
AP.	CA	928328
AP.		

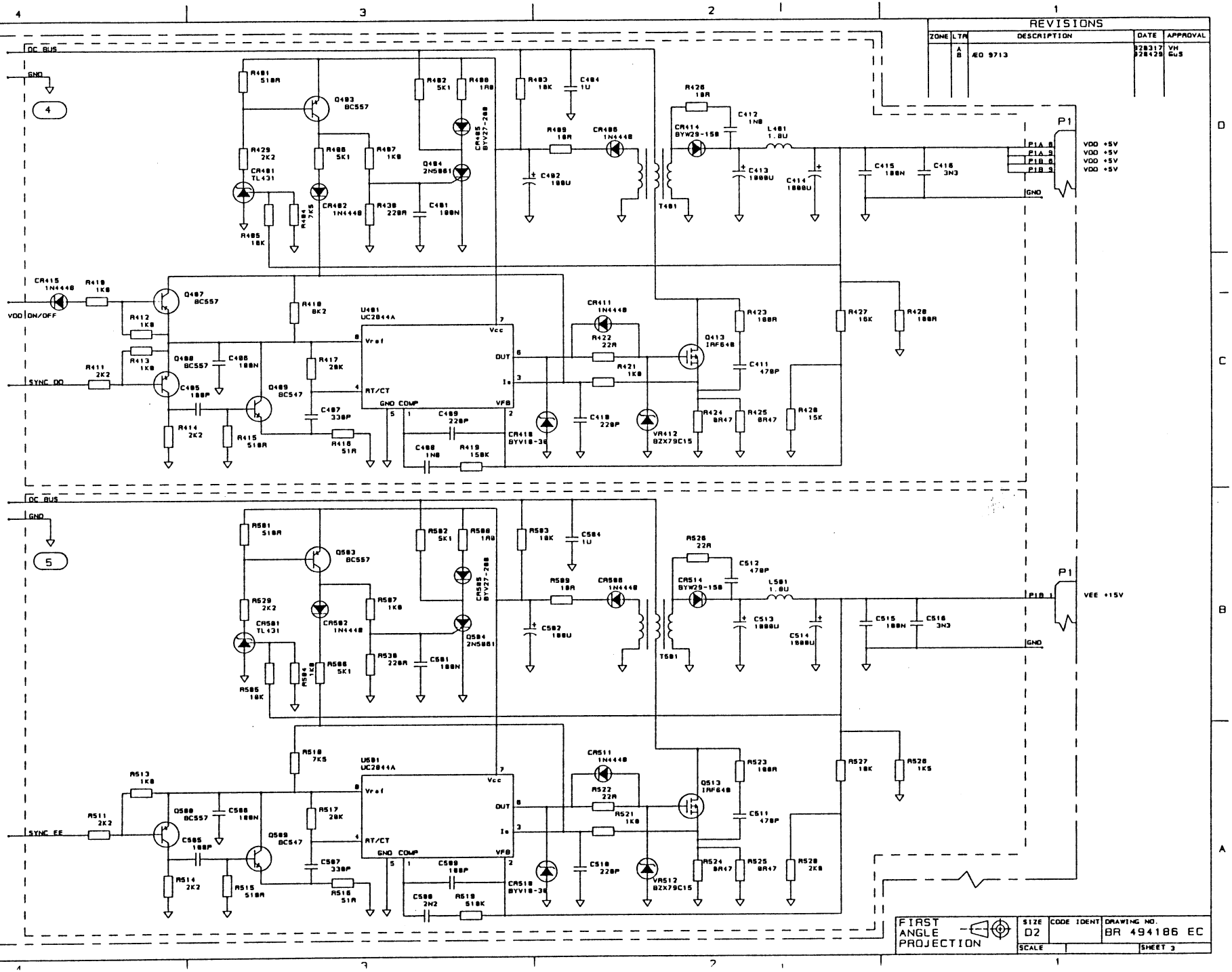
TITLE: POWER SUPPLY A10

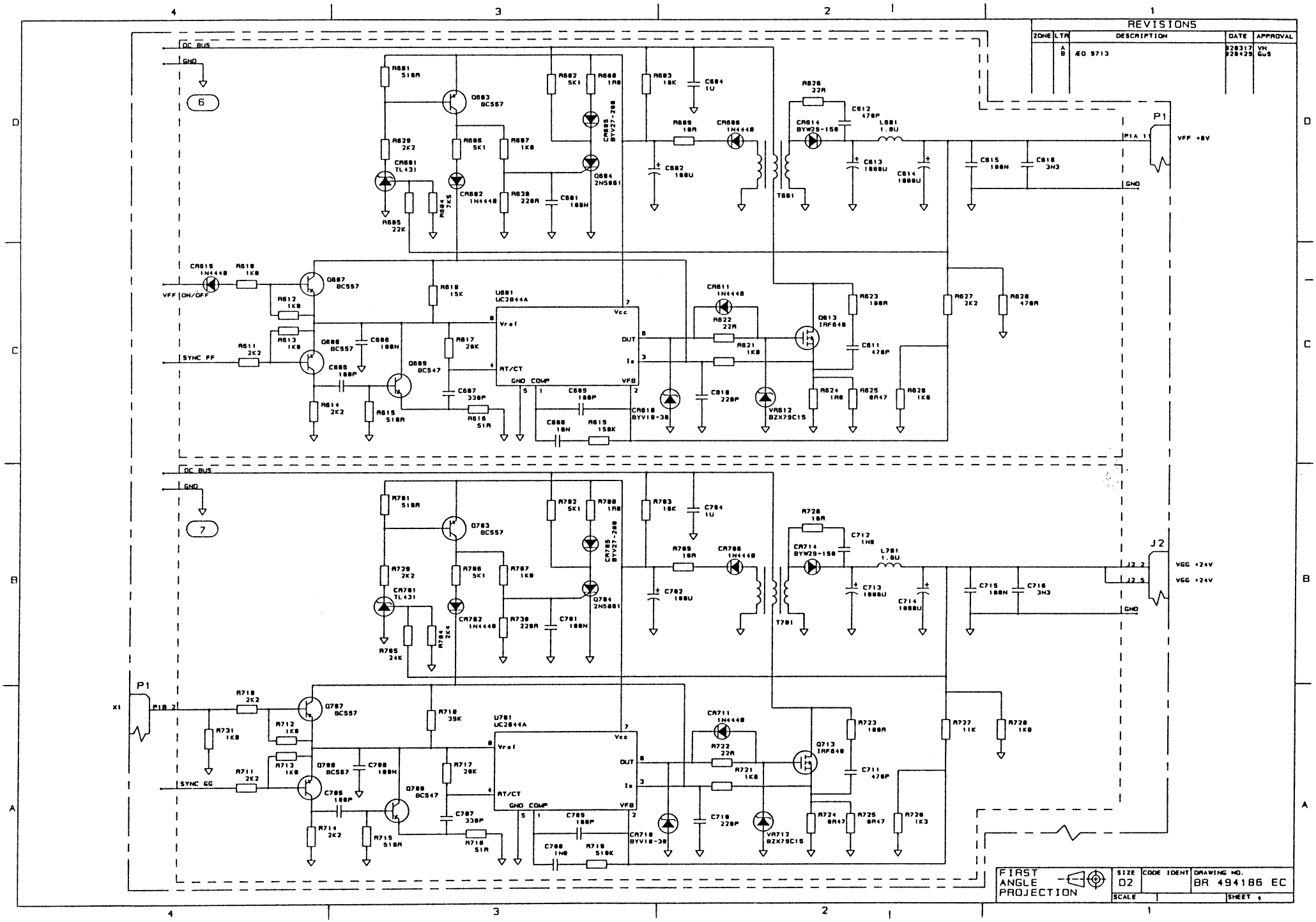
FIRST ANGLE PROJECTION

SIZE	CODE IDENT	DRAWING NO.
D2		BR494186 EC

SCALE | SHEET 1 OF 4

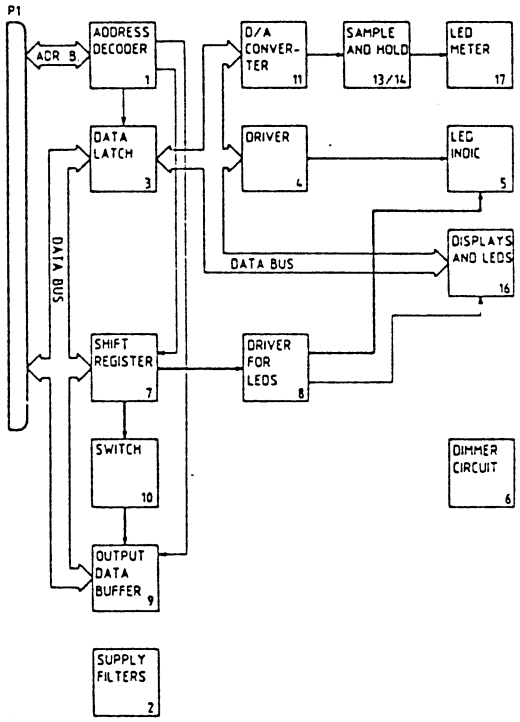

REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
A | ÆD 9713 | 928317 | VH
B | | 928429 | GwS
DC BUS
GND
2
3
VAA ON/OFF
SYNC AA
VBB ON/OFF
SYNC BB
U201 UC2844A
U301 UC2844A
Vref
Vcc
OUT
Io
RT/CT
GND COMP
VFB
T201
T301
L201 1.8UH
L301 1.8UH
P1
P1A 5
P1B 5
P1A 4
P1B 4
VAA -15V
CR214 BYW29-150
CR314 BYW29-150
VR212 BZX79C15
VR312 BZX79C15
Q213 IRF640
Q313 IRF640
Q215 BC547
Q216 BC547
Q289 BC547
Q389 BC547
FIRST ANGLE PROJECTION
SIZE A2
CODE IDENT
DRAWING NO. BR 494186 EC
SCALE
SHEET 2


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
A | ÆO 9713 | 928317 | VH
B | | 928429 | GwS
DC BUS
GND
VDD ON/OFF
SYNC DD
U401 UC2844A
Vref
Vcc
OUT
Io
AT/CT
GND COMP
VFB
T401
P1
VDD +5V
VDD +5V
VDD +5V
VDD +5V
GND
DC BUS
GND
SYNC EE
U501 UC2844A
T501
P1
VEE +15V
GND
FIRST ANGLE PROJECTION
SIZE D2
CODE IDENT
DRAWING NO. BR 494186 EC
SCALE
SHEET 3


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
A | ÆO 9713 | 928317 | VH
B | | 928429 | GUS
DC BUS
GND
6
R681 510R
Q683 BC557
R682 5K1
R688 1K8
CR685 BYV27-200
R683 10K
C684 1U
R826 22R
C612 470P
P1
R689 10R
CR686 1N4448
CR614 BYW29-150
L681 1.8U
P1A 1
VFF +8V
R829 2K2
R686 5K1
R687 1KB
C613 1000U
C614 1000U
C615 100N
C616 3N3
CR681 TL431
CR682 1N4448
R838 220R
C681 100N
Q684 2N5681
R685 22K
R684 7K5
T681
GND
CR615 1N4448
R619 1KB
Q687 BC557
VFF
ON/OFF
R618 15K
U681 UC2844A
CR611 1N4448
R623 100R
R627 2K2
R628 470R
R612 1KB
Vcc
Vref
R822 22R
Q613 IRF840
R613 1KB
OUT
R821 1KB
C611 470P
SYNC FF
R611 2K2
Q688 BC557
C686 100N
R617 26K
Io
RT/CT
Q689 BC547
C685 100P
GND COMP
VFB
C687 330P
C689 100P
R624 1R8
R625 0R47
R626 1KB
R614 2K2
R615 510R
R616 51R
CR618 BYV10-30
C688 10N
R619 150K
C618 220P
VR612 BZX79C15
DC BUS
GND
7
R781 510R
Q783 BC557
R782 5K1
R788 1KB
CR785 BYV27-200
R783 10K
C784 1U
R728 10R
C712 1N8
J2
R789 10R
CR786 1N4448
CR714 BYW29-150
L781 1.8U
J2 2
VGG +24V
R729 2K2
R786 5K1
R787 1KB
C713 1000U
C714 1000U
C715 100N
C716 3N3
J2 5
VGG +24V
CR781 TL431
CR782 1N4448
R738 220R
C781 100N
Q784 2N5681
R784 2K4
R785 24K
T781
GND
P1
X1
P1B 2
R718 2K2
Q787 BC557
R717 39K
U781 UC2844A
CR711 1N4448
R723 100R
R727 11K
R728 1KB
R731 1KB
R712 1KB
Vcc
Vref
R722 22R
Q713 IRF840
R713 1KB
OUT
R721 1KB
C711 470P
SYNC GG
R711 2K2
Q788 BC557
C788 100N
R717 26K
Io
RT/CT
Q789 BC547
C785 100P
GND COMP
VFB
C787 330P
C789 100P
R724 0R47
R725 0R47
R726 1K3
R714 2K2
R715 510R
R716 51R
CR718 BYV10-30
C788 1N8
R719 510K
C718 220P
VR712 BZX79C15
FIRST ANGLE PROJECTION
SIZE D2
CODE IDENT
DRAWING NO. BR 494186 EC
SCALE
SHEET 4

FRONT PANEL A11/SE4010

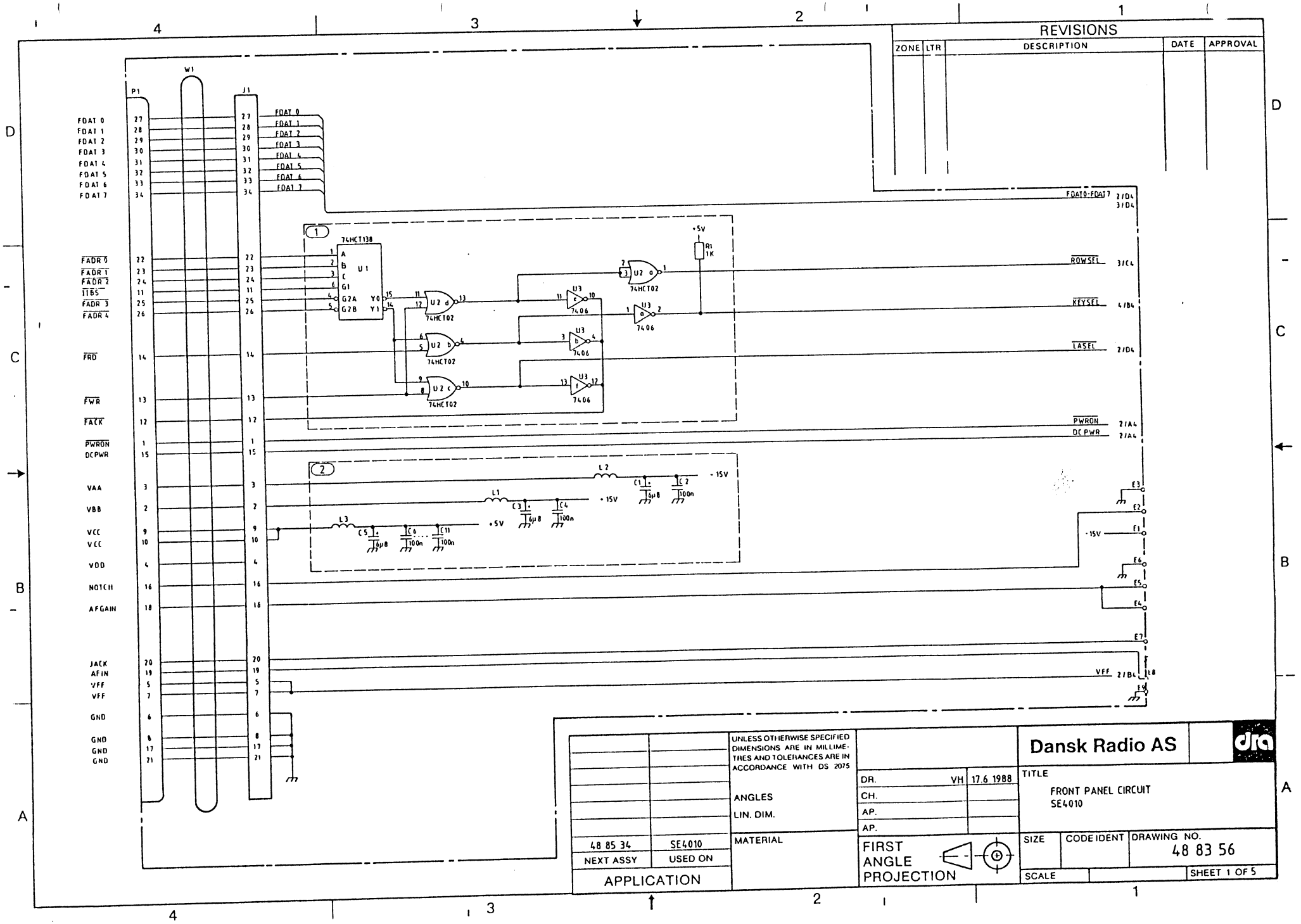
The functional block diagram of the front panel assembly is shown in the figure below:



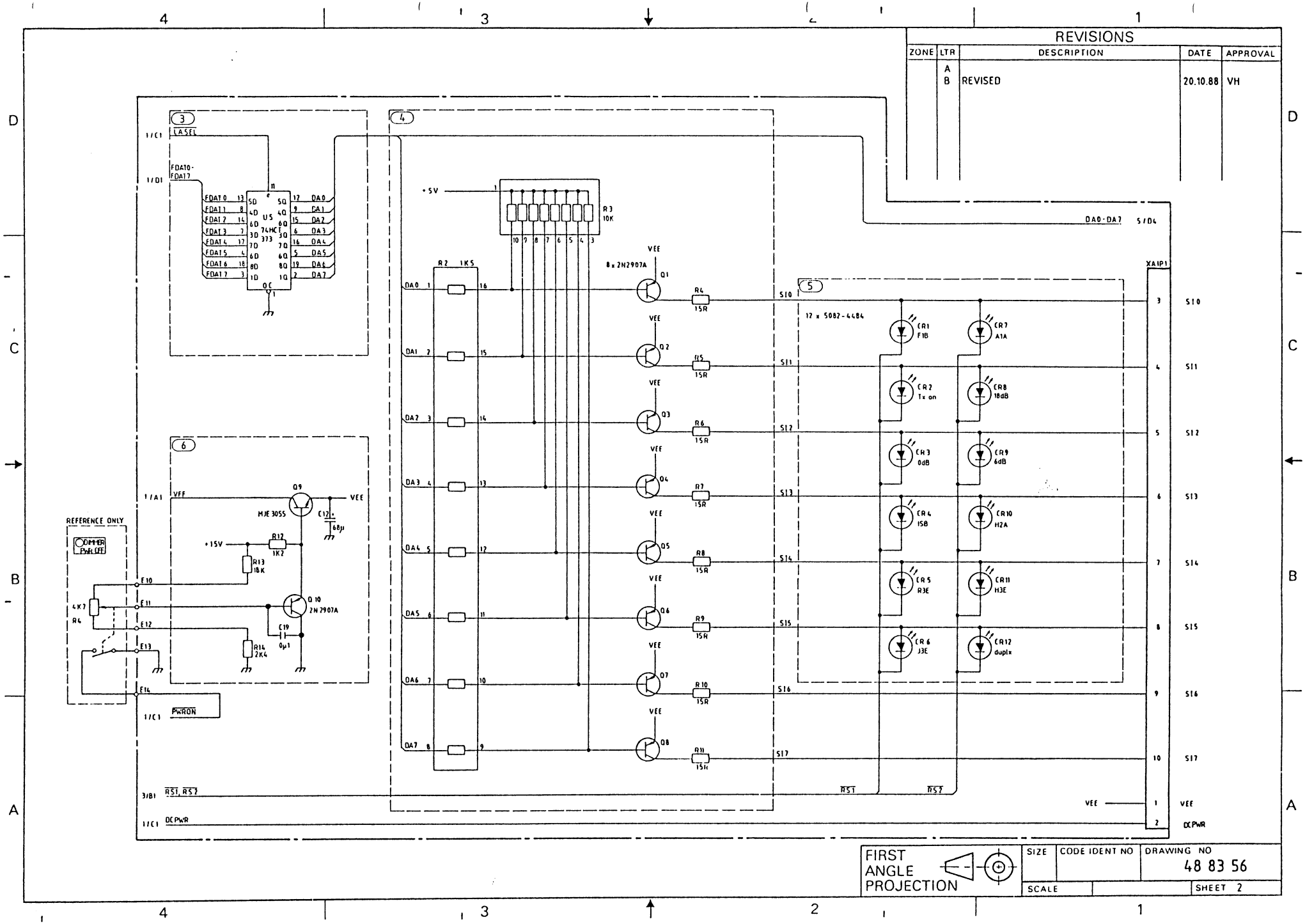
The front panel assembly mounts and interconnects most of the front panel controls, including power ON/OFF dimmer, mode-, key-, meter- and power select. The LEDs and meter read-outs are also mounted on this assembly.

All digital controlled push buttons are scanned by the Microcomputer Assembly. The LED read-outs and the front panel meter are synchronously updated.

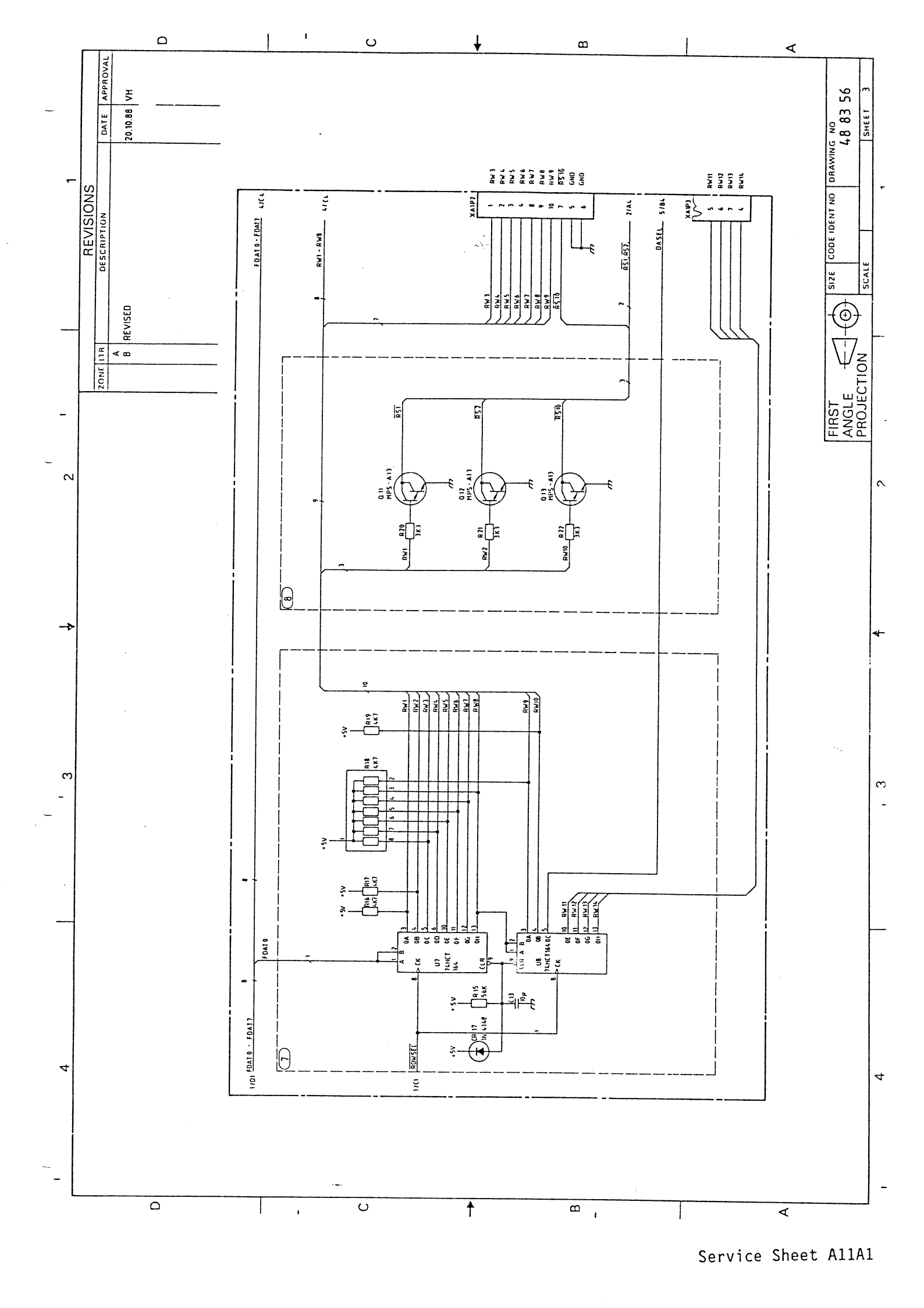
A single ribbon cable interconnects the assembly to the exciter mother board.



Service Sheet A11A1

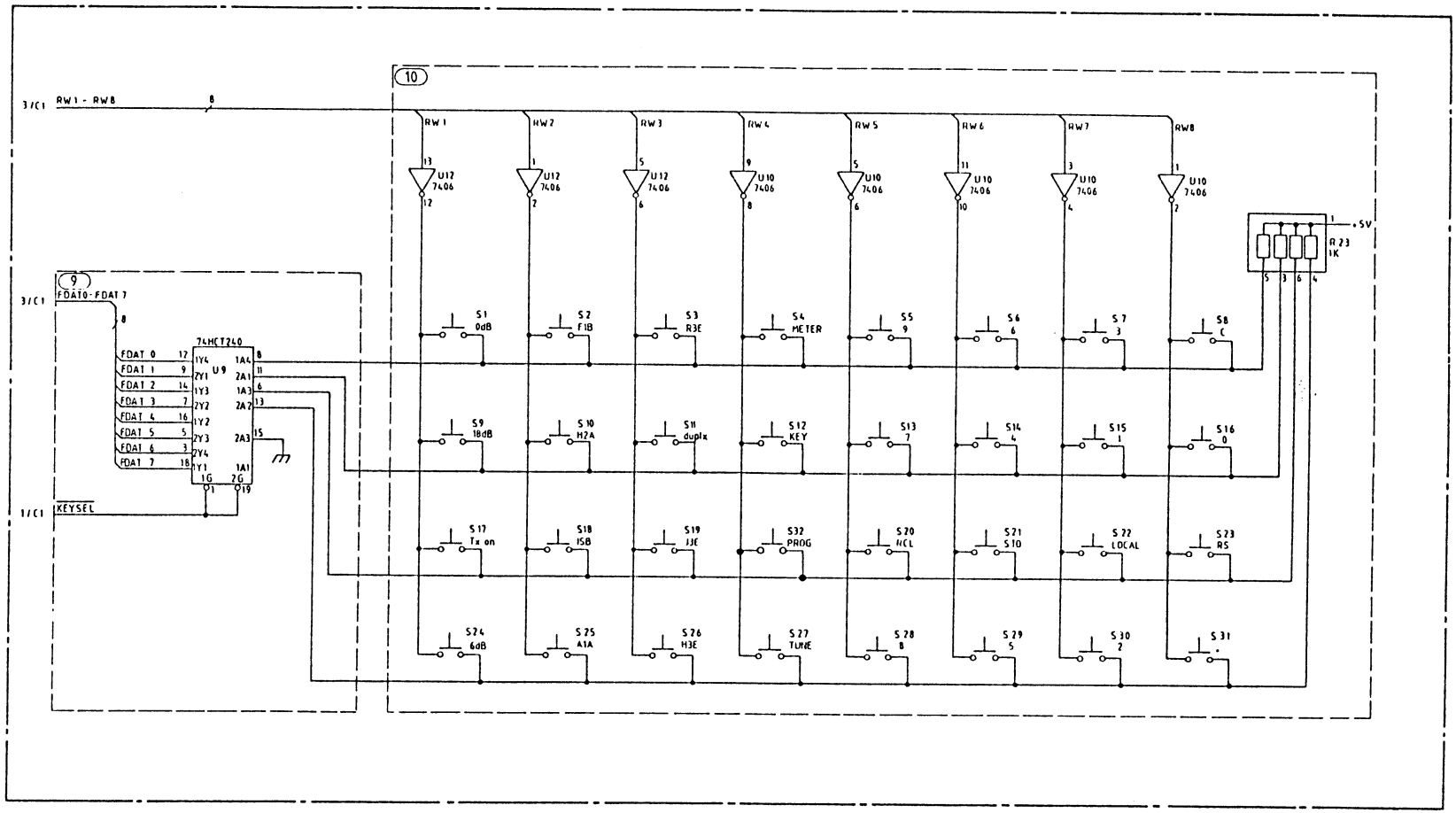


Service Sheet A11A1



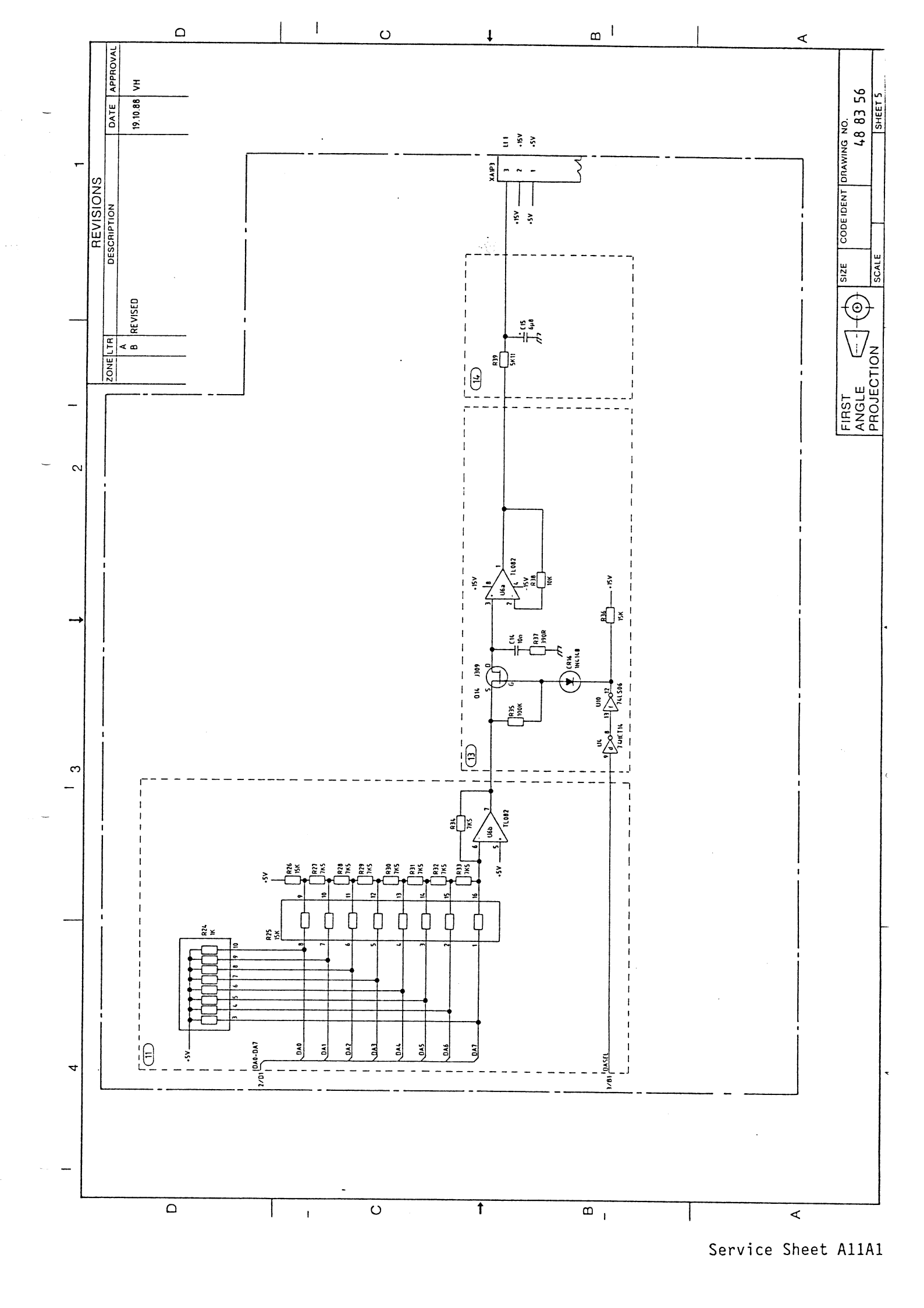
Service Sheet A11A1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
	A			
B4	B	REVISED	13.9.88	VH
	C	REVISED	20.10.88	VH



FIRST ANGLE PROJECTION	SIZE	CODE IDENT NO	DRAWING NO 48 83 56
	SCALE		SHEET 4

Service Sheet A11A1



Service Sheet A11A1

SELF TEST AND PROGRAM FACILITIES SE4010

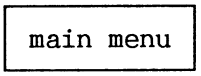
The Program Function

The program function is selected by pressing the **[PROGR]** key followed by the program number. The program number is accepted by pressing the **[enter]** key.

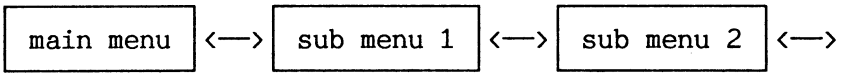
The operation of the programs can be illustrated in this way:

1) Select the program.

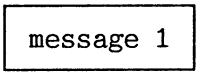
2) The main menu will be displayed.



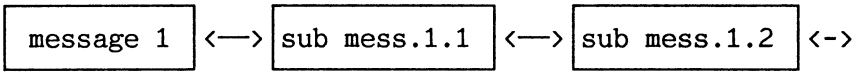
3) The menus are scrolled by **[←]** and **[→]** keys.



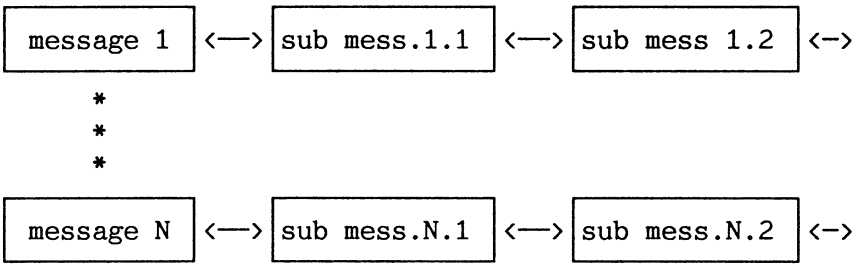
4) The first message is displayed when a menu is selected by pressing **[enter]** while the menu is shown.



5 Sub messages may be scrolled by using **[←]** and **[→]** keys.



6) Messages are scrolled by using the down arrow and the up arrow keys.



7) Pressing the down arrow keys after the last message returns the SE4010 to the former setting.

SELF TEST AND PROGRAM FACILITIES SE4010

SE4010 Programs

Program 1: 24 hours clock.

Program 30: F1B audio frequency offset.

Program 31: Selection of data side band in B9W mode, not applicable.

Program 34: FSK Modulator (A6) frequency selection, not applicable.

Program 35: FSK Modulator (A6) on/off, not applicable.

Program 40: AEL Automatic Error Log.

Program 41: ARTEL Automatic Remote Transmission Error Log.

Program 42: Accumulated On-time.

Clock Viewing and Setting
Program 1

Display and setting of clock used for alarm functions.

F1B Audio Frequency Offset
Program 30

In a F1B transmission the center frequency of the two tones is normally transmitted as the displayed frequency. Program 30 allow programming of audio center frequencies in steps of 10 Hz.

Selection of data side band in B9W mode
Program 31

Not applicable using SSB version of SE4010.

FSK Modulator (A6) frequency selection
Program 34

Not applicable.

FSK Modulator (A6) on/off
Program 35

Not applicable.

SELF TEST AND PROGRAM FACILITIES SE4010

AEL Automatic Error Log
Program 40

Used to display faults in the synthex and the connected transmitter. The status are continuously monitored by the microprocessor in the synthex.

ARTEL Automatic Remote Transmission Error Log
Program 41

By installations where the equipment is remote-controlled, the quality of the remote transmission is continuously registered.

Accumulated On-time
Program 42

An internal counter in the synthex counts the number of hours the synthex has been switched on. Another counter counts the number of hours the transmitter has been switched on.

Self Test Program, manual
Program 49

Manual test of the exciter functionability.

Self Test Program, automatic
Program 49

Automatic test of the exciter functionability.

Clear All

Clears all user programmable channels and programs.

SELF TEST AND PROGRAM FACILITIES SE4010

Test Sequences of the Self Test

a) If the remote module (A9) is present (option), the remote address of the SE4010 is displayed.

b) Software version.

c) Software options.
0000000 means no options.

d) Key board test.

e) LED and display test.

f) (A8 module) Real Time Clock, DAC and SH circuit test.

g) (A2 module) Standard Oscillator test.

h) (A1 module) Synthesizer test.

i) (A7A2 module) Remote Key test. (option)

j) (A5 module) Interface module test.

k) (ATU) Antenna Tuner test. (option)

l) (A3 module) IF module test.

m) (A7 module) Modulator module test.

n) (A4 module) Wide Band Amplifier test.

o) Assembly status.

p) Test end. Return to setting displayed in the displays when entering the self test program.

Key Values During Self-Test

KEY DEPRESSED	VALUE DISPLAYED
J3E	11
R3E	10
H3E	12
duplx	13
ISB	18
F1B	19
A1A	1A
H2A	1B
0dB	21
6dB	22
18dB	24
key	36
progr	38
meter	35
C	37
.	8A
0	80
1	81
2	82
3	83
4	84
5	85
6	86
7	87
8	88
9	89
rcl	31
sto	30

SELF TEST AND PROGRAM FACILITIES SE4010

Self-Test Fault Analysis Table

Error code			Fault Description
no	A1		A1 is not mounted.
Err	A1	1	A1 has not locked on 29999.99kHz: A1 or A2 defect.
Err	A1	2	A1 has not locked on 25000.00kHz: A1 or A2 defect.
Err	A1	3	A1 has not locked on 20000.01kHz: A1 or A2 defect.
Err	A1	4	A1 has not locked on 19999.99kHz: A1 or A2 defect.
Err	A1	5	A1 has not locked on 16000.00kHz: A1 or A2 defect.
Err	A1	6	A1 has not locked on 12000.01kHz: A1 or A2 defect.
Err	A1	7	A1 has not locked on 11999.99kHz: A1 or A2 defect.
Err	A1	8	A1 has not locked on 9000.00kHz: A1 or A2 defect.
Err	A1	9	A1 has not locked on 6000.01kHz: A1 or A2 defect.
Err	A1	10	A1 has not locked on 5999.99kHz: A1 or A2 defect.
Err	A1	11	A1 has not locked on 3000.00kHz: A1 or A2 defect.
Err	A1	12	A1 has not locked on 1500.00kHz: A1 or A2 defect.
Err	A1	13	A2 is not mounted.
no	A2		A2 is not mounted.
Err	A2	1	10.24MHz oscillator not oscillating: A2 defect.
Err	A2	2	73.6MHz loop has not locked: A2 defect.
Err	A2	3	1.4MHz loop has not locked: A2 defect.
no	A3		A3 is not mounted.
Err	A3	1	Test of A3 is not possible because A1 is missing.
Err	A3	2	Test of A3 is not possible because A1 has failed during test.
Err	A3	3	Test of A3 is not possible because A2 is missing.
Err	A3	4	Test of A3 is not possible because A2 has failed during test.
Err	A3	5	Test of A3 is not possible because A7 is missing.
Err	A3	6	Test of A3 is not possible because A5 is missing.
Err	A3	8	A1 has not locked: A1 is defect.
Err	A3	9	No input signal to A3: Cable between A7J1 and A3J4 defect or missing. A7 defect.

Self-Test Fault Analysis Table, continued

Err	A3	10	No output signal from A3: Missing oscillator signals, defect cables or A3 defect.
Err	A3	11	Input signal to A3 when exciter is interlocked: A5 or A7 defect.
Err	A3	12	Output signal from A3 when exciter is interlocked: A5 or A7 defect.
Err	A3	13	No input signal to A3 after interlock reset: A3, A5 or A7 defect.
Err	A3	14	No output signal from A3 after interlock reset: A3 defect.
Err	A3	15	The Voltage Controlled Attenuator is defect: A3 defect.
Err	A3	16	The Voltage Controlled Attenuator has too much attenuation: A3 defect.
Err	A3	17	The Voltage Controlled Attenuator has too little attenuation: A3 defect.
Err	A3	18	Same as "Err A3 9".
Err	A3	19	ALC Reset defect: A3 defect.
Err	A4	1	Test of A4 is not possible because A1 is missing.
Err	A4	2	Test of A4 is not possible because A1 has failed during test.
Err	A4	3	Test of A4 is not possible because A2 is missing.
Err	A4	4	Test of A4 is not possible because A2 has failed during test.
Err	A4	5	Test of A4 is not possible because A3 is missing.
Err	A4	6	Test of A4 is not possible because A3 has failed during test.
Err	A4	7	Test of A4 is not possible because A5 is missing.
Err	A4	8	Test of A4 is not possible because A7 is missing.
Err	A4	9	Test of A4 is not possible because A7 has failed during test.
Err	A4	13	A1 has not locked: A1 defect.
Err	A4	14	A4 defect or missing.
Err	A4	15	The gain of A4 is too small: A4 defect.
Err	A4	16	A4 defect or missing.
no	A5		A5 is not mounted.
no	A7		A7 is not mounted.
no	A7A2		The Remote Key (option) is not mounted.
Err	A7A2		Conflicting data read: A7J4 bad. A7 or A7A2 defect.
Err	A7	2	Signal from Morsetone Generator through USB not detected: A5 or A7 defect.
Err	A7	3	Signal from Check Circuit through USB not received by A8: A7 defect.

Self-Test Fault Analysis Table, continued

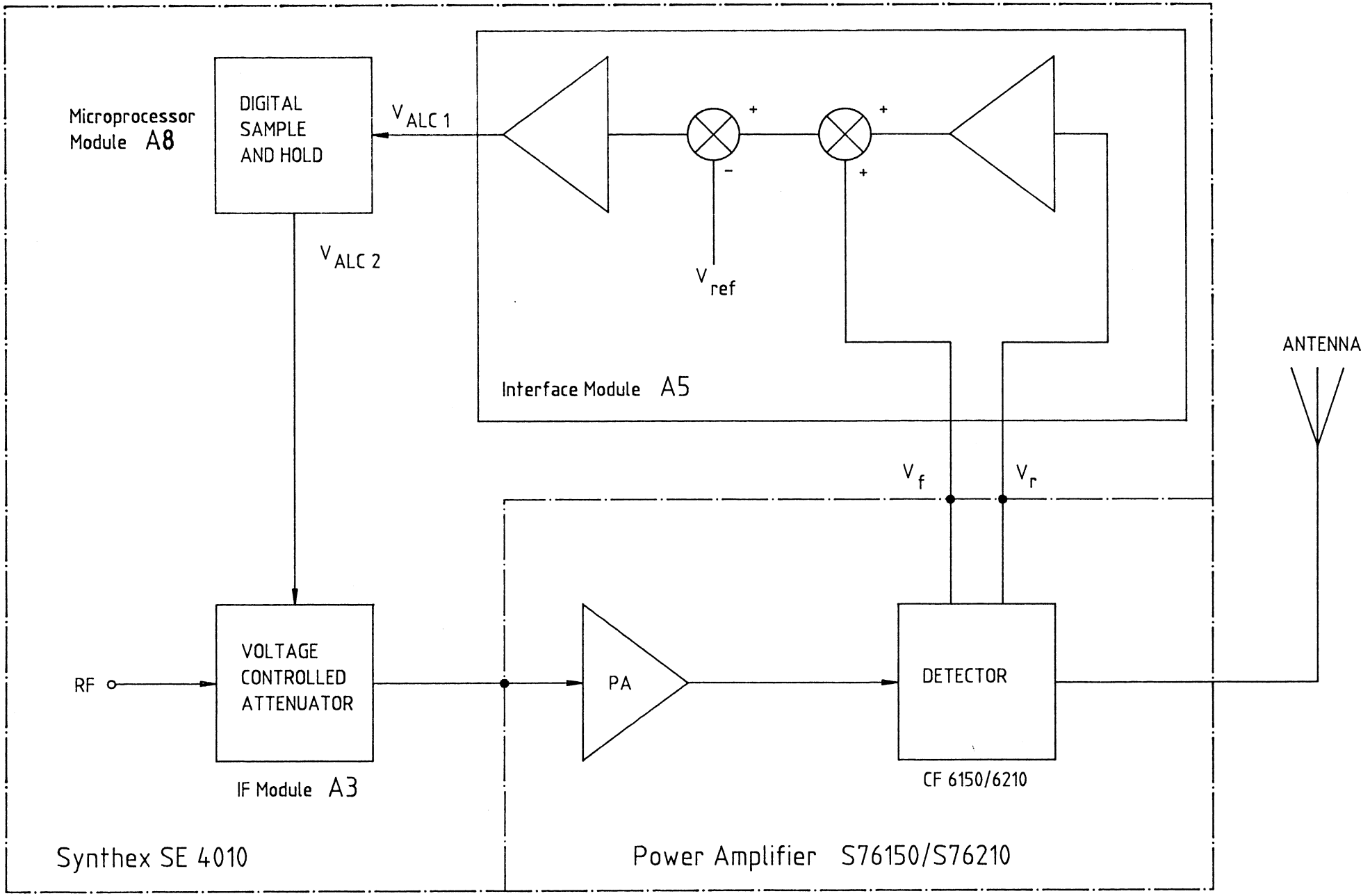
Err	A7	4	Signal from Morsetone Generator through LSB not detected: A5 or A7 defect.
Err	A7	5	Signal from Check Circuit through LSB not received by A8: A7 defect.
Err	A7	6	No USB output from A7: A7 defect. Cable between A7J1 and A3J4 defect or missing.
Err	A7	7	No LSB signal from A7: A7 defect. Cable between A7J1 and A3J4 defect or missing.
Err	A7	8	Test of A7 is not possible because A1 is missing.
Err	A7	9	Test of A7 is not possible because A1 has failed during test.
Err	A7	10	Test of A7 is not possible because A2 is missing.
Err	A7	11	Test of A7 is not possible because A2 has failed during test.
Err	A7	12	Test of A7 is not possible because A5 is missing.
Err	A8 clock		The Real Time Clock is defect: A8 defect.
Err	A8 dAC		D/A Converter defect: A8 defect.
Err	A8 StrP		A8 is not correct strapped.
no	ATU		The Antenna Tuner Controller (option) is not mounted in the Power Amplifier rack or the cables W102, W123 or W124 is bad or missing.
Err	ATU	1	The Antenna Tuner Controller is mounted. Conflicting status read: Antenna Tuner Controller or A5 defect.

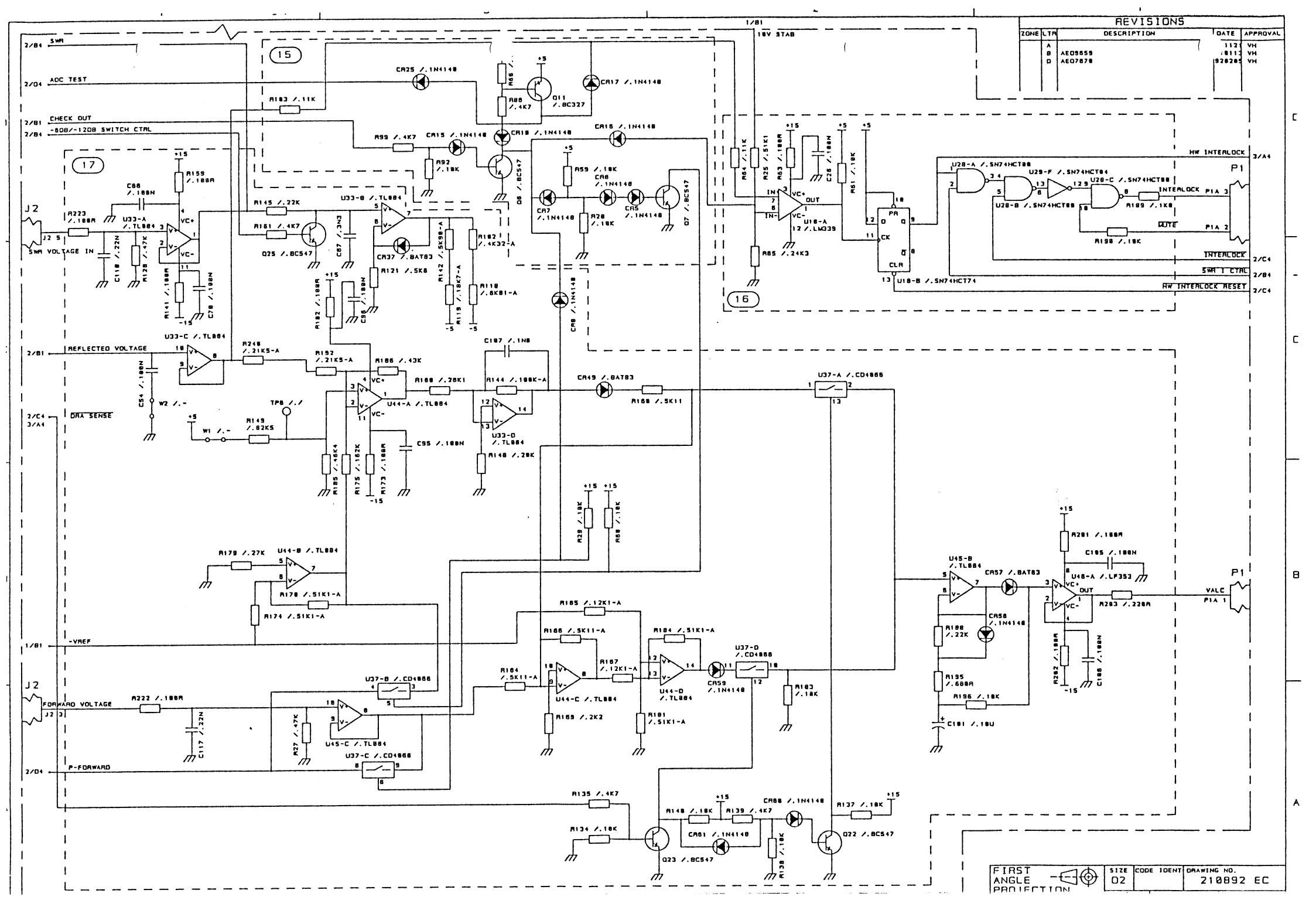
SELF TEST AND PROGRAM FACILITIES SE4010

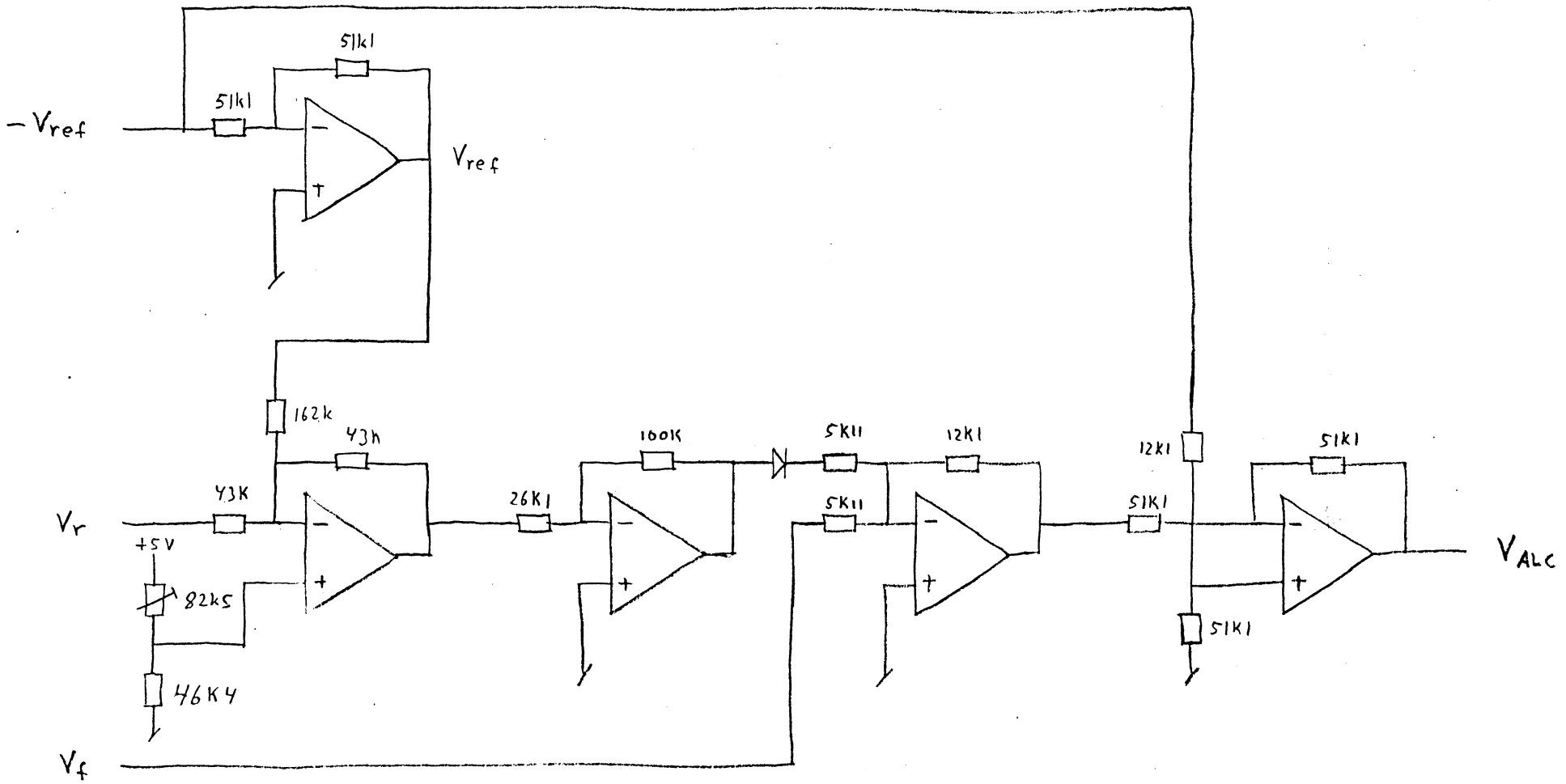
Error Codes

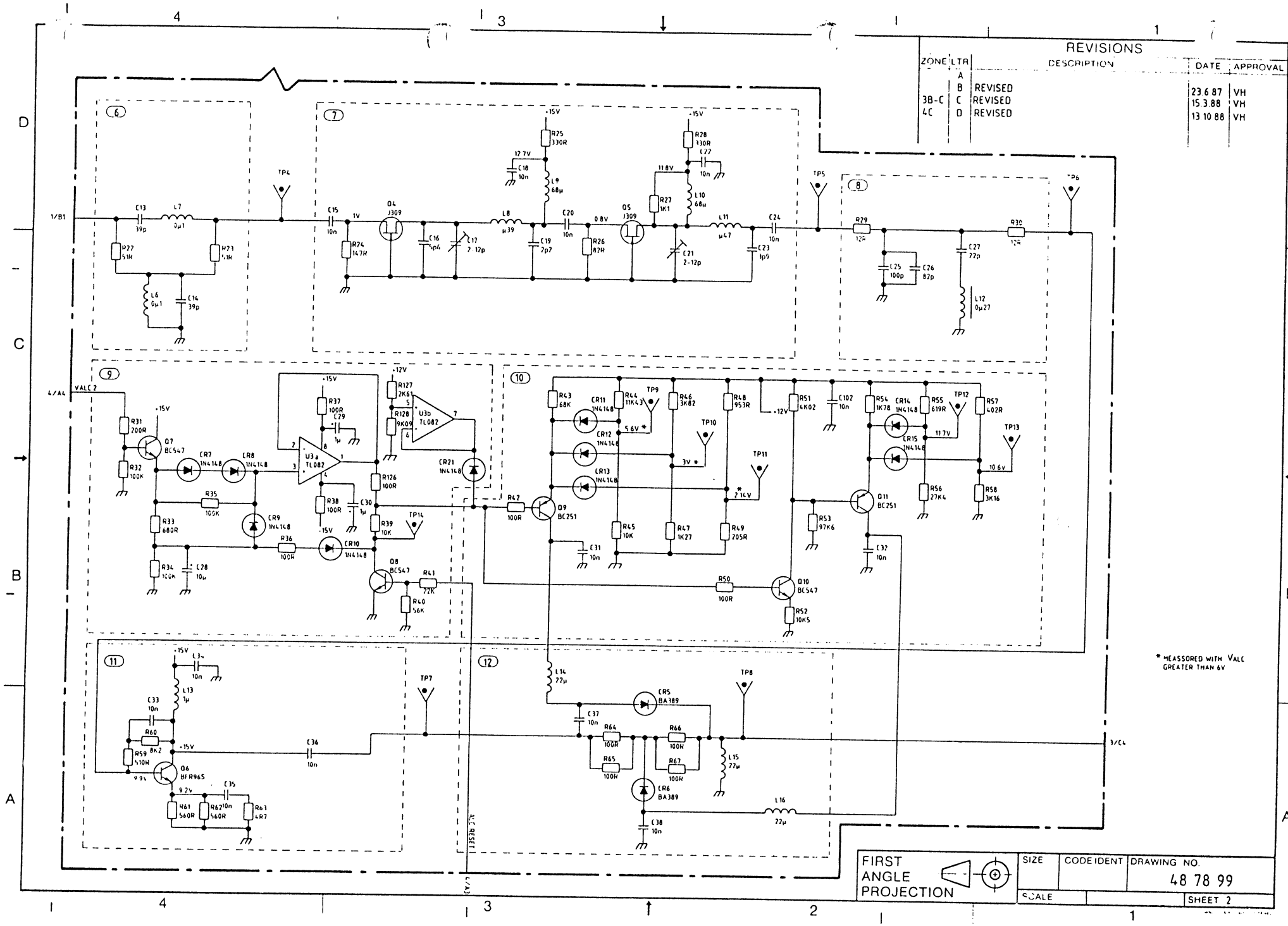
Error Codes	Remarks
Err. 1.4 LOC.	1.4 MHz loop on A2 out of lock
Err. 73.6 LOC.	73.6 MHz loop on A2 out of lock
Err. SYn. LOC.	76.5 - 105 MHz loop on A1 out of lock
Err. rEF. OSC.	Level from reference oscillator on A2 too low.
Err. PA. L.-1	Power Amplifier of upper PA drawer to the left switched off.
Err. PA. r.-1	Power Amplifier of upper PA drawer to the right switched off.
Err. PA. L.-2	Power Amplifier of lower PA drawer to the left switched off. (1 kW transmitter only).
Err. PA. r.-2	Power Amplifier of lower PA drawer to the right switched off. (1 kW transmitter only).
Err. PA. ALL	All Power Amplifiers switched off.
Err. Ant.rEF.	SWR greater than 5.
Err. A8 StrP	A8 strapped incorrectly.
Err. Atu.FAIL	Connected Antenna Tuner can not terminate tuning. Error message received from connected Antenna Tuner.
Err. Atu.dIS.	Antenna Tuner disconnected while mains is on.

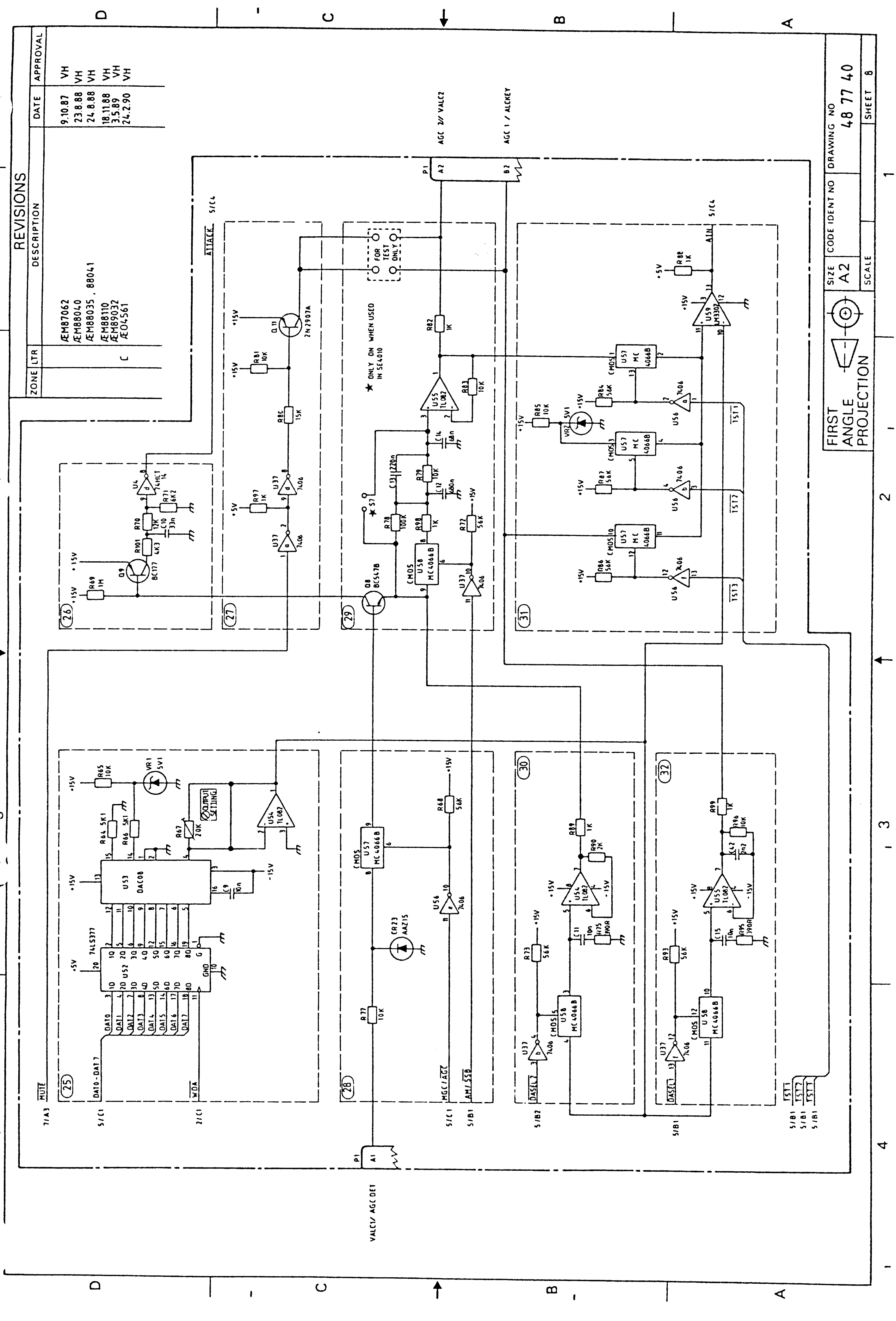
ALC LOOP

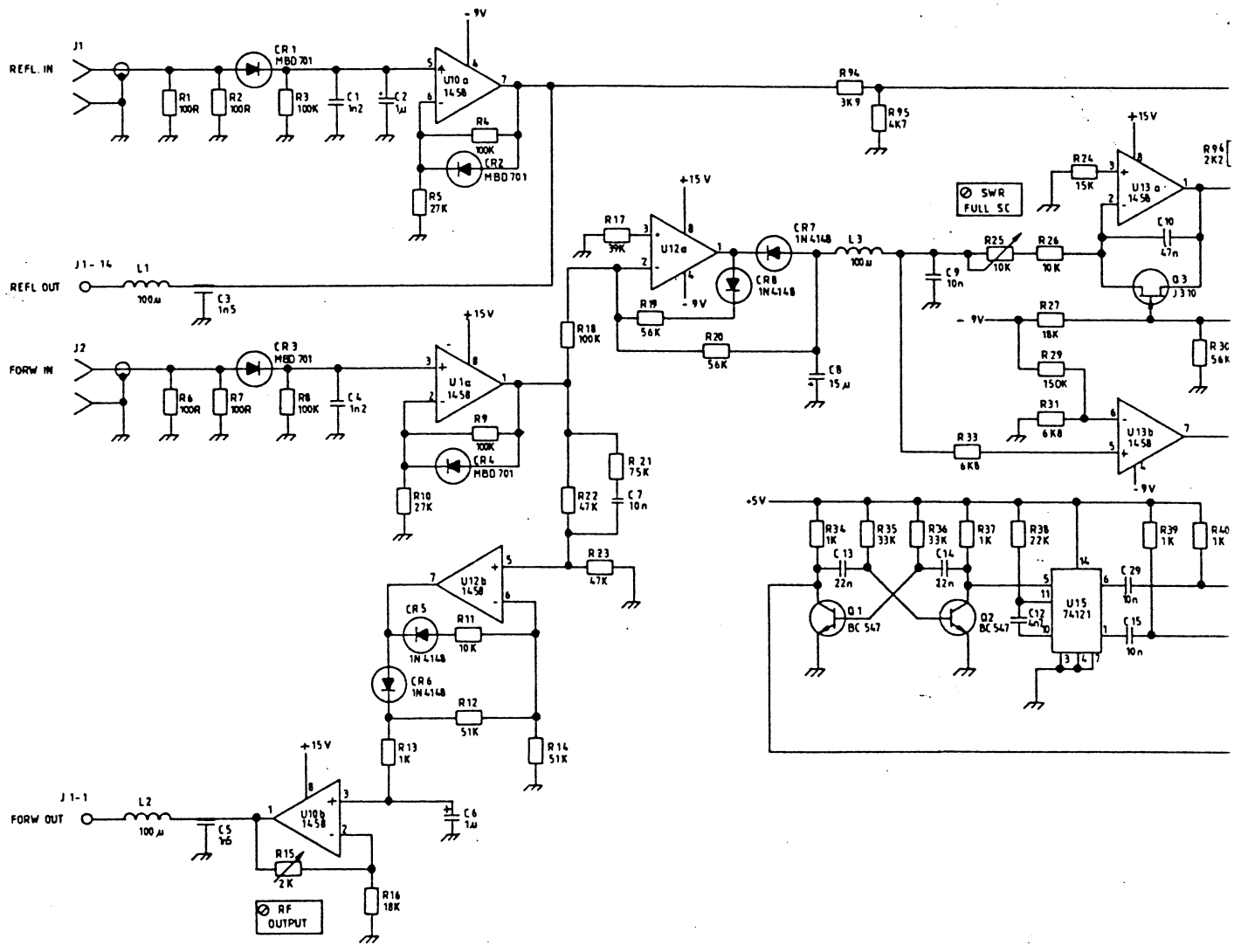

Microprocessor Module A8
DIGITAL SAMPLE AND HOLD
V ALC 1
V ALC 2
V ref
+
+
−
+
Interface Module A5
ANTENNA
V f
V r
RF
VOLTAGE CONTROLLED ATTENUATOR
IF Module A3
PA
DETECTOR
CF 6150/6210
Synthex SE 4010
Power Amplifier S76150/S76210


REVISIONS
ZONE LTR DESCRIPTION DATE APPROVAL
A 1121 VH
B AE09859 :8113 VH
D AE07878 920205 VH
SWR
ADC TEST
CHECK OUT
-808/-1208 SWITCH CTRL
SWR VOLTAGE IN
REFLECTED VOLTAGE
FORWARD VOLTAGE
P-FORWARD
-VREF
DRA SENSE
18V STAB
HW INTERLOCK
INTERLOCK
SWR 1 CTRL
HW INTERLOCK RESET
VALC
U33-A /.TL084
U33-B /.TL084
U33-C /.TL084
U33-D /.TL084
U44-A /.TL084
U44-B /.TL084
U44-C /.TL084
U44-D /.TL084
U45-B /.TL084
U45-C /.TL084
U37-A /.CD4066
U37-B /.CD4066
U37-C /.CD4066
U37-D /.CD4066
U18-A /.LM339
U18-B /.SN74HCT74
U28-A /.SN74HCT08
U28-B /.SN74HCT08
U28-C /.SN74HCT08
U29-F /.SN74HCT04
U46-A /.LF353
Q11 /.BC327
Q25 /.BC547
Q8 /.BC547
Q7 /.BC547
Q23 /.BC547
Q22 /.BC547
CR37 /.BAT83
CR49 /.BAT83
CR57 /.BAT83
FIRST ANGLE PROJECTION
SIZE 02
CODE IDENT
DRAWING NO. 210892 EC

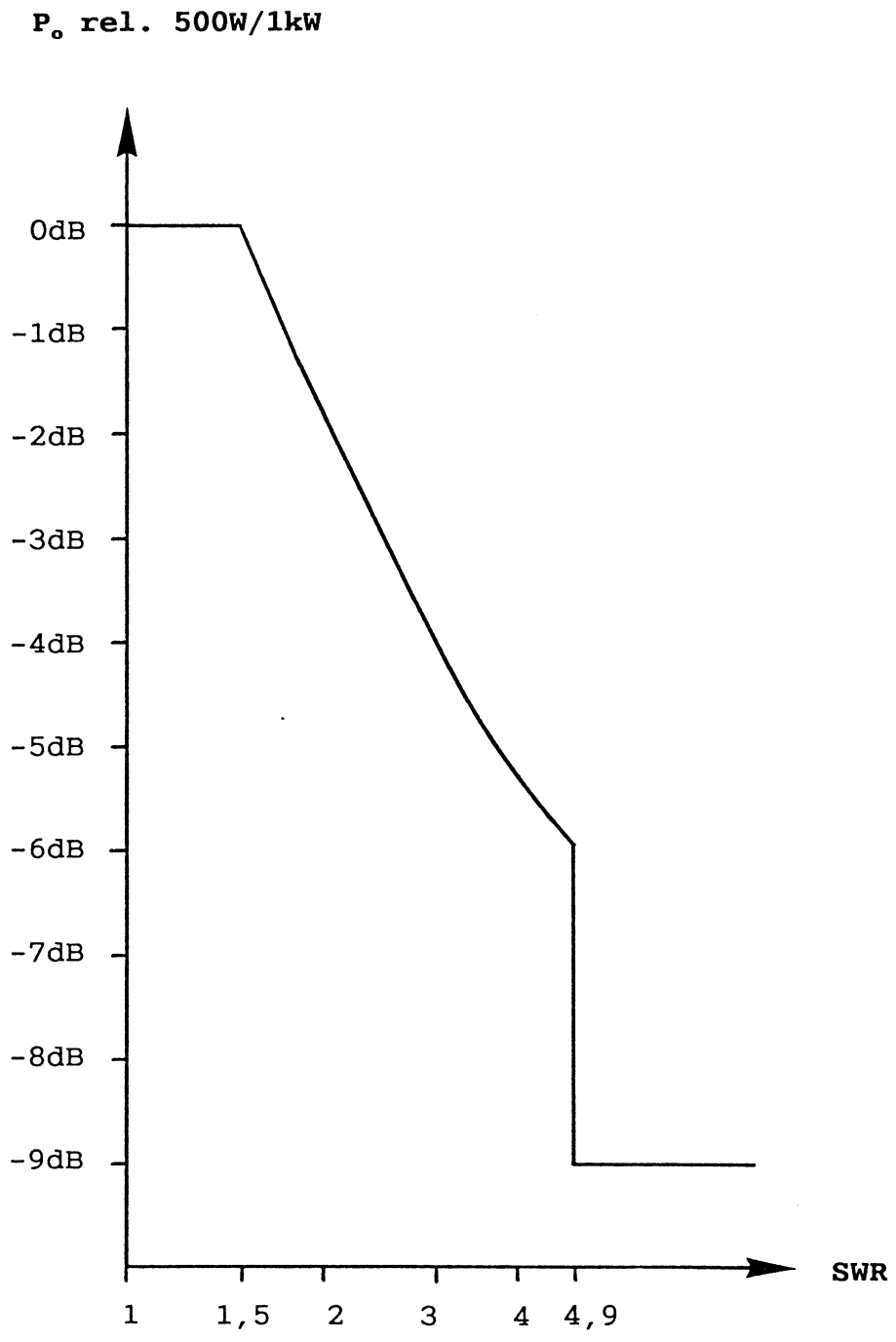

51k1
51k1
-Vref
Vref
162k
43h
43K
Vr
+5V
82k5
46K4
Vf
26K1
100K
5K11
5K11
12K1
12K1
51K1
51K1
51K1
VALC


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
A
B REVISED 23.6.87 VH
3B-C C REVISED 15.3.88 VH
4C D REVISED 13.10.88 VH
6
7
8
9
10
11
12
TP4
TP5
TP6
TP7
TP8
TP9
TP10
TP11
TP12
TP13
TP14
+15V
-15V
+12V
C13 39p
L7 0µ1
R27 51K
R23 51K
L6 0µ1
C14 39p
C15 10n
R74 147K
Q4 J309
C16 5p6
C17 2-12p
L8 µ39
C18 10n
R75 330R
L9 68µ
C19 2p7
C20 10n
R26 82K
Q5 J309
C21 2-12p
R28 330R
L22 10n
R27 1K1
L10 68µ
L11 µ47
C24 10n
C23 1p9
R29 12R
R30 12R
C25 100p
C26 82p
C27 22p
L12 0µ27
R31 200R
Q7 BC547
R32 100K
CR7 1N4148
CR8 1N4148
R35 100K
R33 680R
R34 100K
C28 10µ
CR9 1N4148
R36 100R
CR10 1N4148
U3a TL082
R37 100R
C29 1µ
R38 100R
C30 1µ
R39 10K
R126 100R
R127 2K61
R128 9K09
U3b TL082
CR21 1N4148
R42 100R
Q8 BC547
R41 22K
R40 56K
R43 68K
CR11 1N4148
CR12 1N4148
CR13 1N4148
R44 11K43
R45 10K
R46 3K82
R47 1K27
R48 953R
R49 205R
R51 4K02
C102 10n
R53 97K6
Q9 BC251
C31 10n
R50 100R
Q10 BC547
R52 10K5
Q11 BC251
C32 10n
R54 1K78
CR14 1N4148
CR15 1N4148
R55 619R
R56 27K4
R57 402R
R58 3K16
5.6V *
3V *
* 2.14V
11.7V
10.6V
L13 1µ
C33 10n
R60
R59 4K10
Q6 BFR96S
C35
R61 560R
R62 560R
R63 4R7
C36 10n
L14 22µ
CR5 BA389
C37 10n
R64 100R
R65 100R
R66 100R
R67 100R
L15 22µ
CR6 BA389
C38 10n
L16 22µ
* MEASSURED WITH VALC GREATER THAN 6V
FIRST ANGLE PROJECTION
SIZE
CODE IDENT
DRAWING NO. 48 78 99
SCALE
SHEET 2
Service Sheet A3


REVISIONS
ZONE
LTR
DESCRIPTION
DATE
APPROVAL
ÆM87062
ÆM88040
ÆM88035, 88041
ÆM88110
ÆM89032
ÆO4561
9.10.87
23.8.88
24.8.88
18.11.88
3.5.89
24.2.90
VH
FIRST ANGLE PROJECTION
SIZE A2
CODE IDENT NO
DRAWING NO
48 77 40
SCALE
SHEET 8
AGC 2// VALC2
AGC 1 / ALCKEY
VALC1/ AGC DET
ATTACK
MUTE
DAT0-DAT7
WDA
MGC / AGC
AM/ SSB
DASEL 2
DASEL 1
TST1
TST2
TST3
AIN
FOR TEST ONLY
ONLY ON WHEN USED IN SE4010

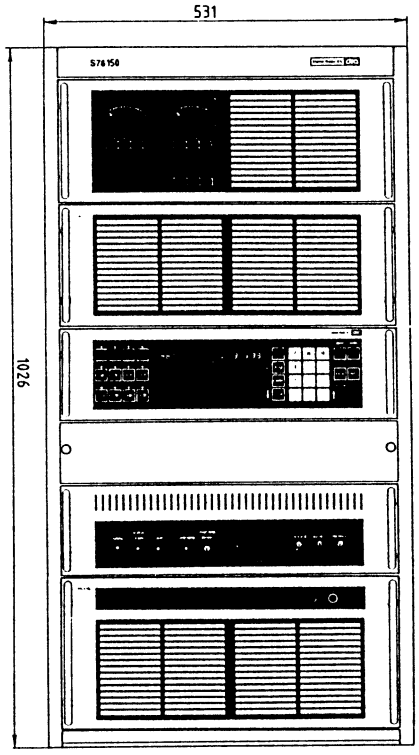

REFL. IN
J1
CR1 MBD 701
U10a 1458
-9V
R1 100R
R2 100R
R3 100K
C1 1n2
C2 1µ
R4 100K
CR2 MBD 701
R5 27K
R94 3K9
R95 4K7
+15V
R24 15K
U13a 1458
R96 2K2
C10 47n
Q3 J310
SWR FULL SC
J1-14
L1 100µ
REFL OUT
C3 1n5
R17 39K
U12a
CR7 1N4148
L3 100µ
CR8 1N4148
R25 10K
R26 10K
C9 10n
R19 56K
R20 56K
R27 18K
R29 150K
R31 6K8
R33 6K8
U13b 1458
R30 56K
J2
FORW IN
CR3 MBD 701
U1a 1458
R6 100R
R7 100R
R8 100K
C4 1n2
R9 100K
CR4 MBD 701
R10 27K
R18 100K
C8 15µ
R21 75K
R22 47K
C7 10n
R23 47K
+5V
R34 1K
R35 33K
R36 33K
R37 1K
R38 22K
R39 1K
R40 1K
C13 22n
C14 22n
Q1 BC 547
Q2 BC 547
U15 74121
C12 4n7
C29 10n
C15 10n
U12b 1458
CR5 1N4148
R11 10K
CR6 1N4148
R12 51K
R13 1K
R14 51K
J1-1
L2 100µ
FORW OUT
C5 1n5
U10b 1458
C6 1µ
R15 2K
R16 18K
RF OUTPUT

Power Reduction vs. SWR

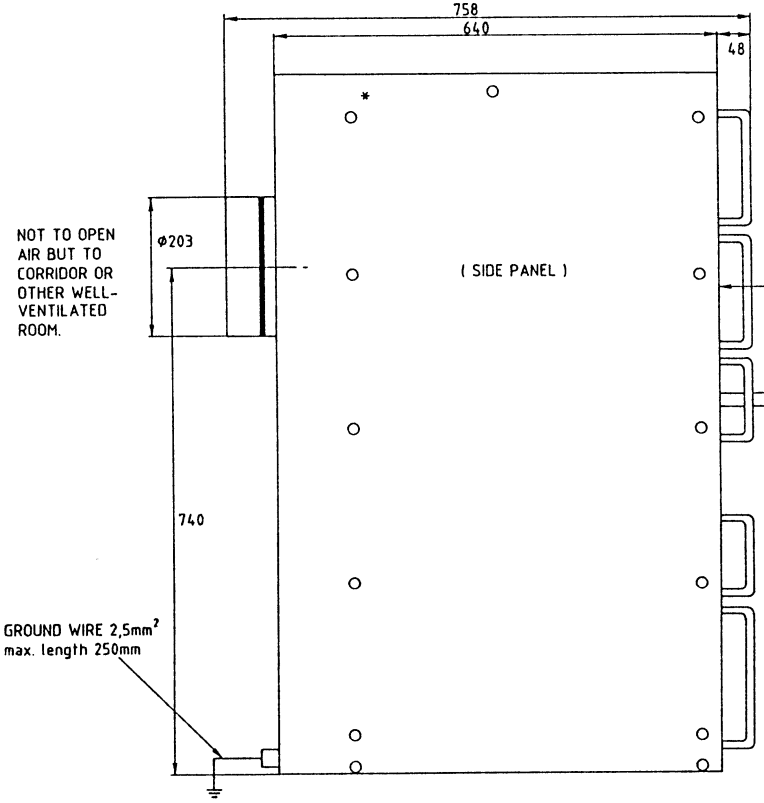


The curve is valid for transmitters with an output power of exactly 500W/1kW at SWR < 1:1,5.

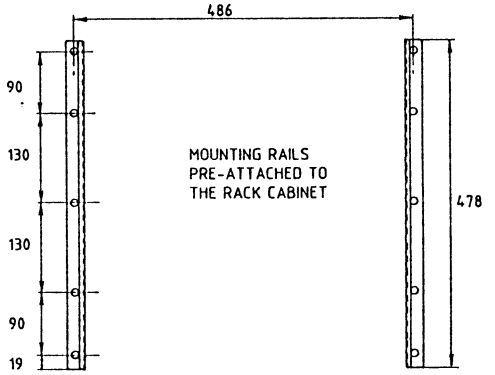
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL



FRONT VEIW



SIDE VIEW



* ACCESS TO MOUNTING RAILS IS OBTAINED BY REMOVING ALL MOUNTING SCREWS AT EACH SIDE-PANEL.

NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075

ANGLES

LIN. DIM.

MATERIAL

DR.	VH	13.3 1989
CH.		
AP.		
AP.		

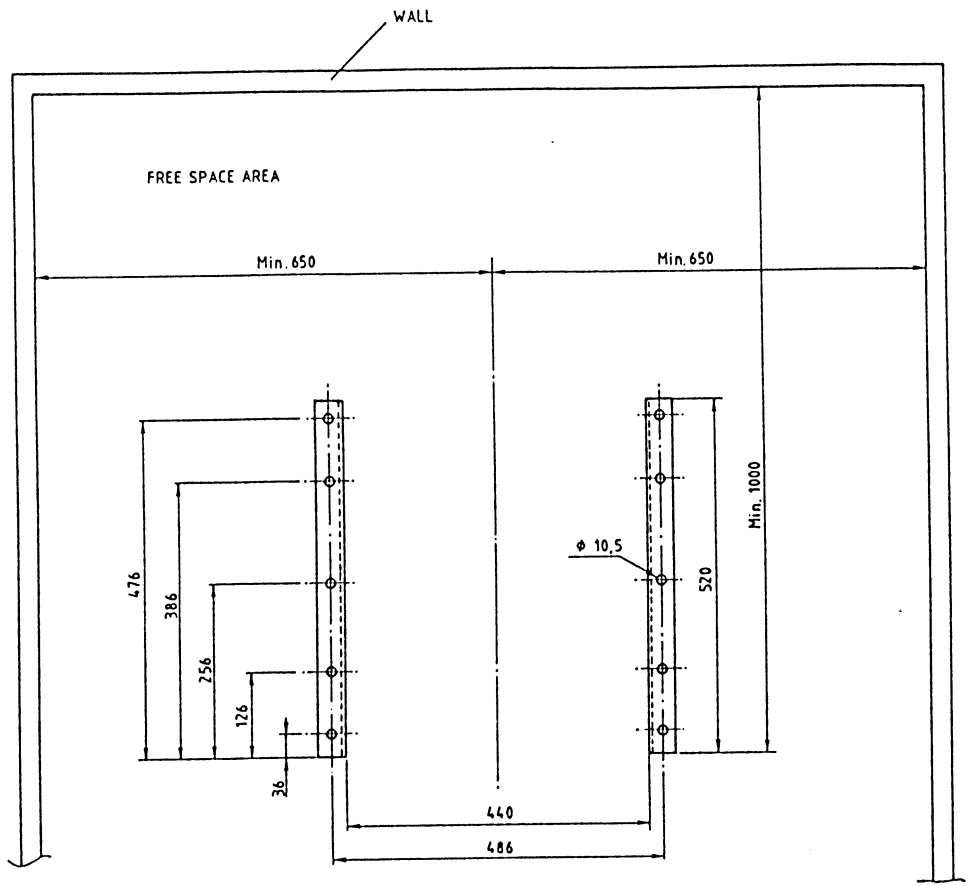
FIRST ANGLE PROJECTION

Dansk Radio AS

TITLE
INSTALLATION DIAGRAM
S76150-1
500W TRANSMITTER RACK

SIZE	CODE IDENT	DRAWING NO.
A2		49 66 50-A
SCALE		SHEET 1 OF 1

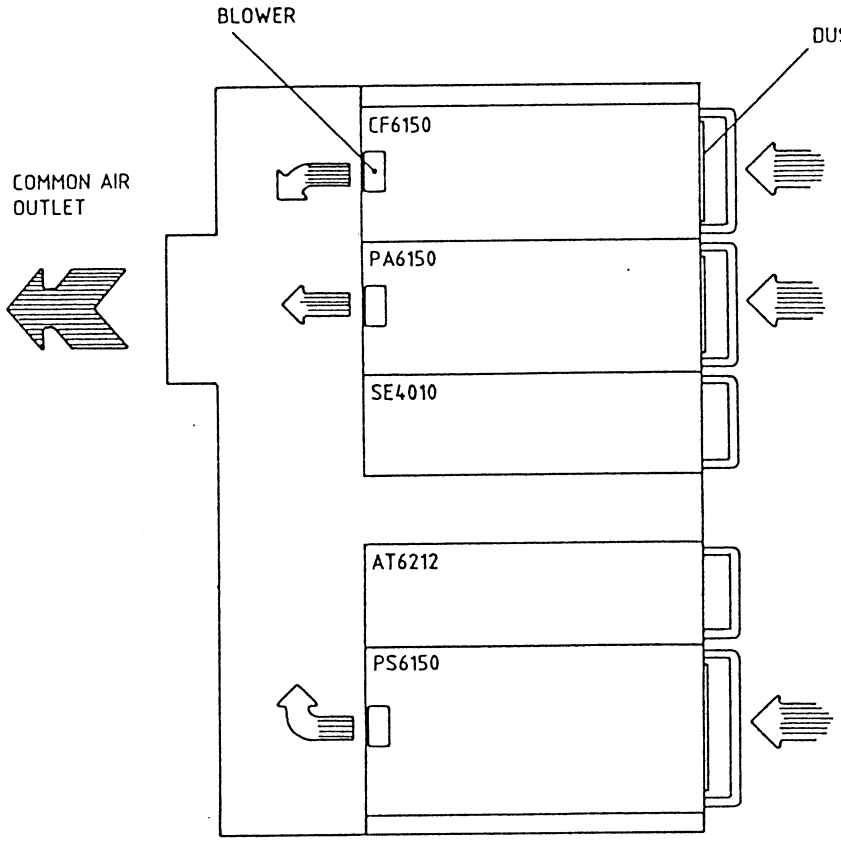
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
	A B	REVISED	7.12.88	VH



All demensions are in mm

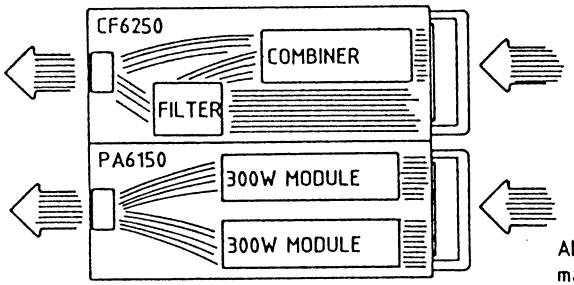
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075			Dansk Radio AS
		ANGLES	DR. F.S.P.	14-10-83	TITLE Mounting dimensions S76xxx
		LIN. DIM.	CH.		
			AP.		
NEXT ASSY	USED ON	MATERIAL	AP.		SIZE A2 / CODE IDENT / DRAWING NO PB-1767-2
APPLICATION			FIRST ANGLE PROJECTION		SCALE 1:5 / SHEET 1 OF 1

REVISIONS			
LTR	DESCRIPTION	DATE	APPROVAL



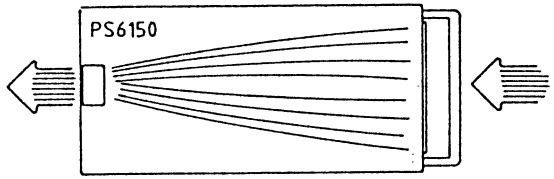
TOTAL AIRCOMSUMP-
TION APPROX 800m^{3}h

FLOW SPEED 7m/sec.



AIRFLOW 165m^{3}h
max. INPUT TEMP. = 55°C

TEMPERATURE RAISE AT OUTPUT
+20°C = max. OUTPUT TEMP. = 75°C



NEXT ASSY	USED ON		
APPLICATION			

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 405

ANGLES

LIN DIM

MATERIAL

DR	VH	10.3.89
CH		
AP		
AP		

FIRST ANGLE PROJECTION

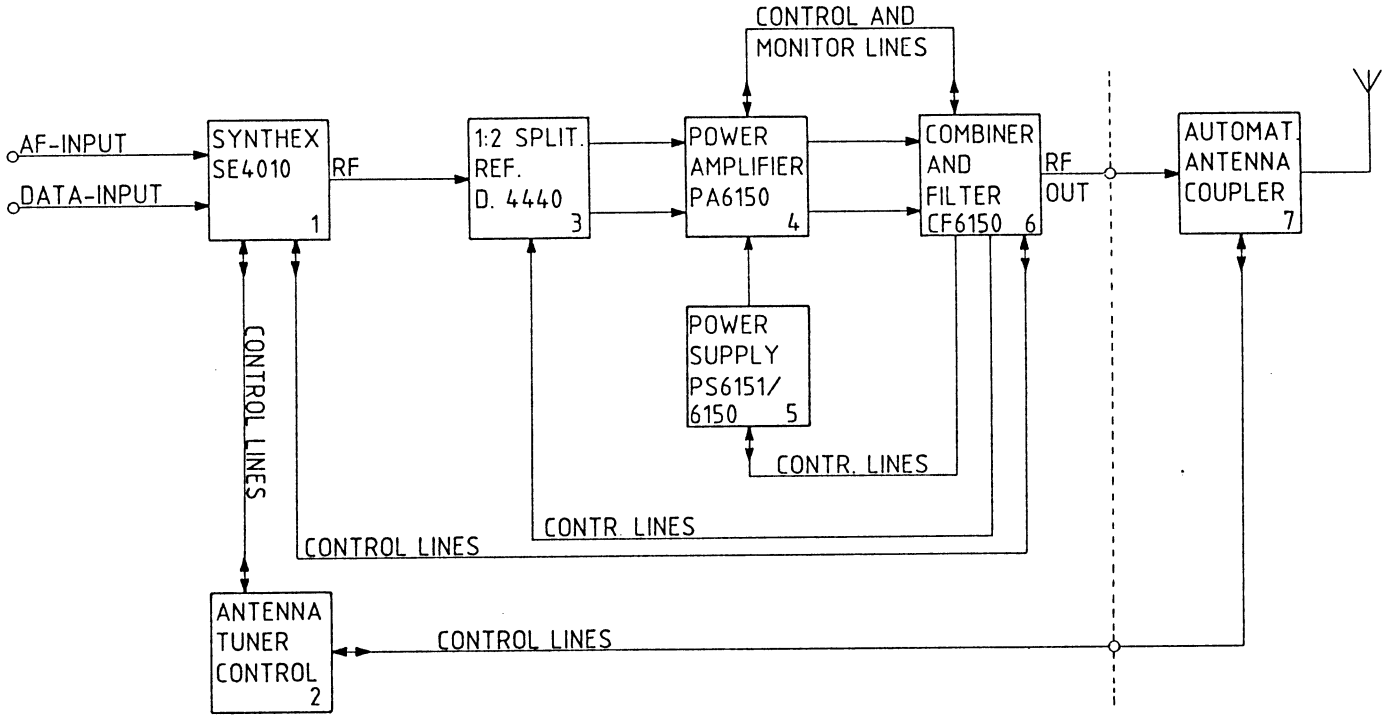
Dansk Radio AS

TITLE
VENTILATION OUTLINE
TRANSMITTER S76150-1

SIZE	CODE IDENT NO	DRAWING NO
A 3		49 66 69-A

SCALE | SHEET 1 OF 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL

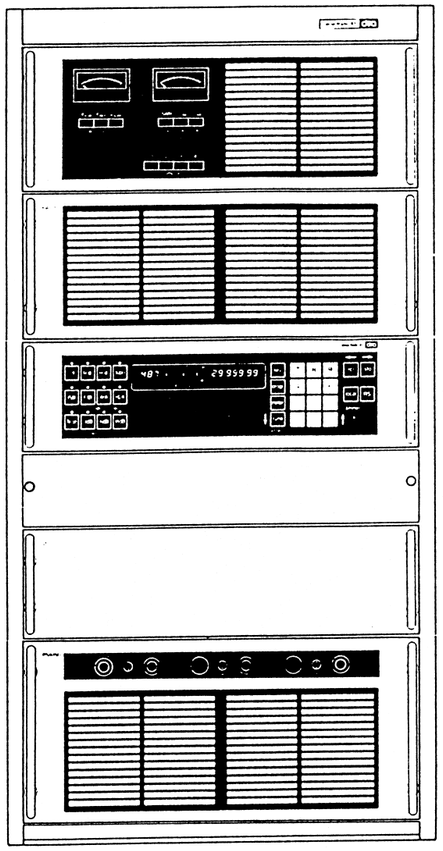


		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075		Dansk Radio AS	dra
		ANGLES	DR. VH 10.3 1989	TITLE CONFIGURATION TRANSMITTER S76150-1	
		LIN. DIM.	CH.		
		MATERIAL	AP.		
NEXT ASSY	USED ON		AP.		
APPLICATION			FIRST ANGLE PROJECTION	SIZE A2 / CODE IDENT / DRAWING NO. 49 66 77-A	
				SCALE / SHEET 1 OF 1	

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
	A			

1.

NORMAL FRONT VIEW



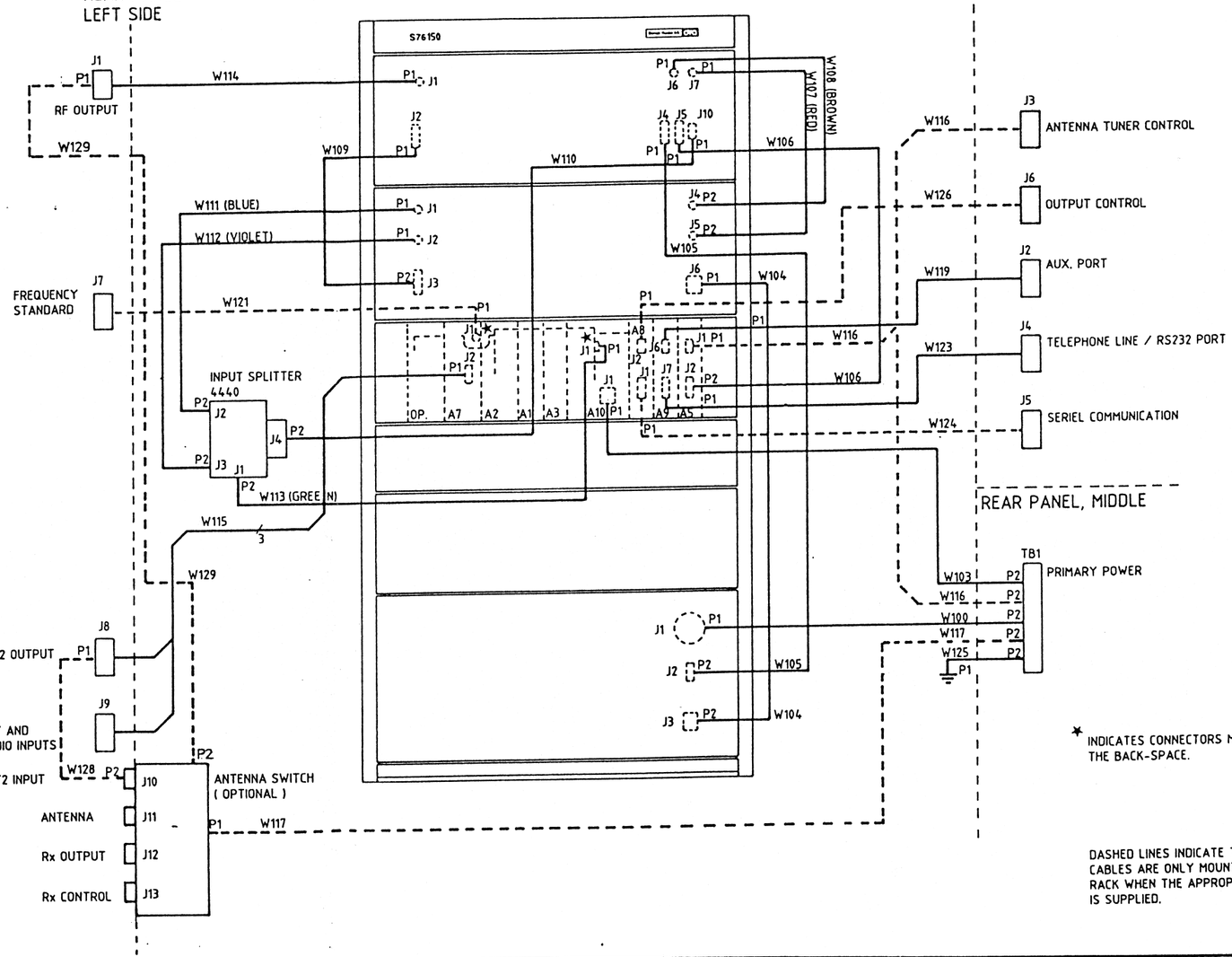
CF6150

PA6150

SE4010

PS6150

FRONT VIEW WITH INVISIBLE FRONT PANELS.



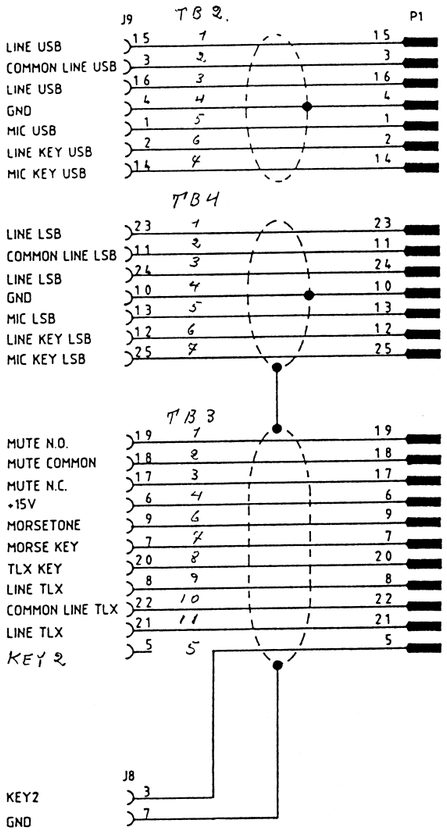
✱ INDICATES CONNECTORS MOUNTED ON THE BACK-SPACE.

DASHED LINES INDICATE THAT THE CABLES ARE ONLY MOUNTED IN THE RACK WHEN THE APPROPRIATE OPTION IS SUPPLIED.

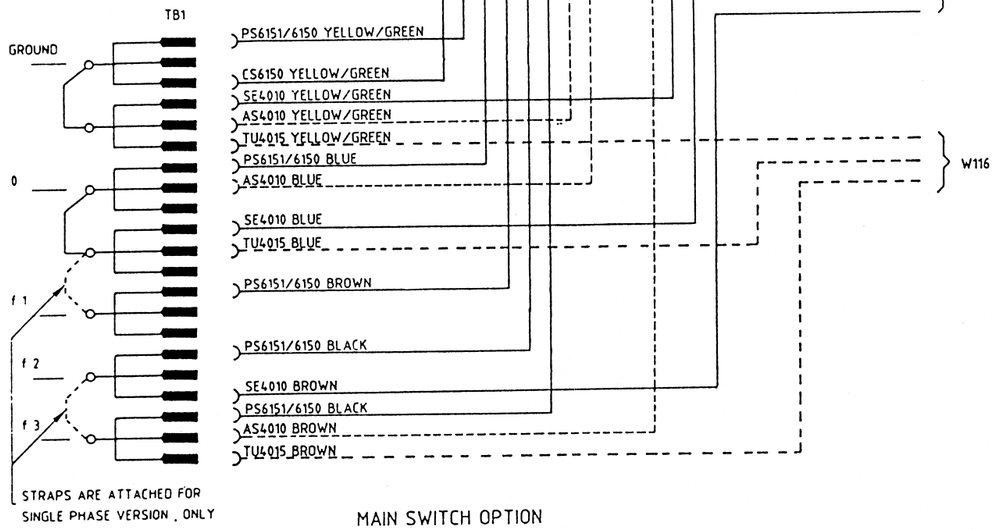
		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075	Dansk Radio AS
		ANGLES	DR. VH 24.10 1989
		LIN. DIM.	CH. CA 15.11.89
			AP.
		MATERIAL	AP.
	S76150		TITLE: INTERCONNECTION DIAGRAM FOR CABINET RACK AND PANEL CHASSIS ASSEMBLIES
NEXT ASSY	USED ON		FIRST ANGLE PROJECTION
APPLICATION			SIZE A2 · CODE IDENT · DRAWING NO. 210503-PD
			SCALE 1:5 · SHEET 1 OF 2

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
	A			

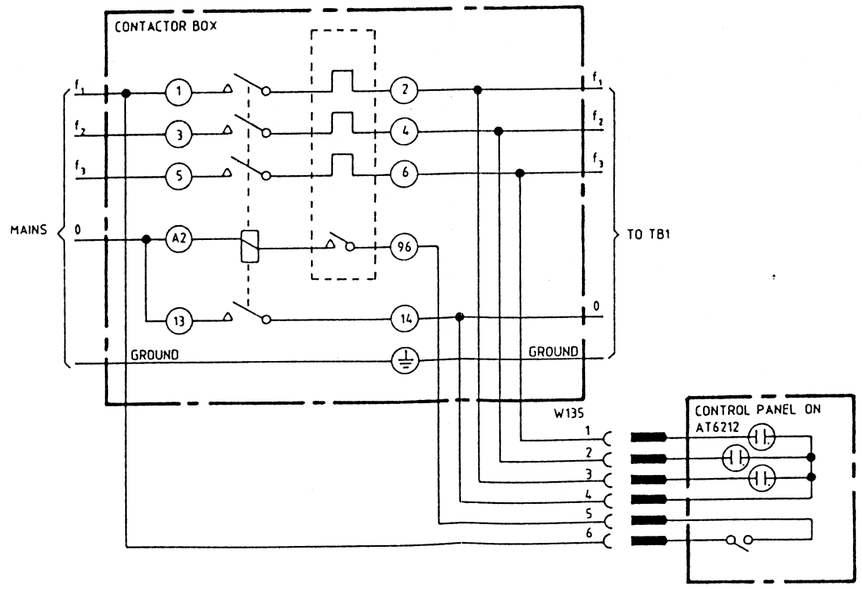
AUDIO AND KEY INPUTS



PRIMARY POWER



MAIN SWITCH OPTION

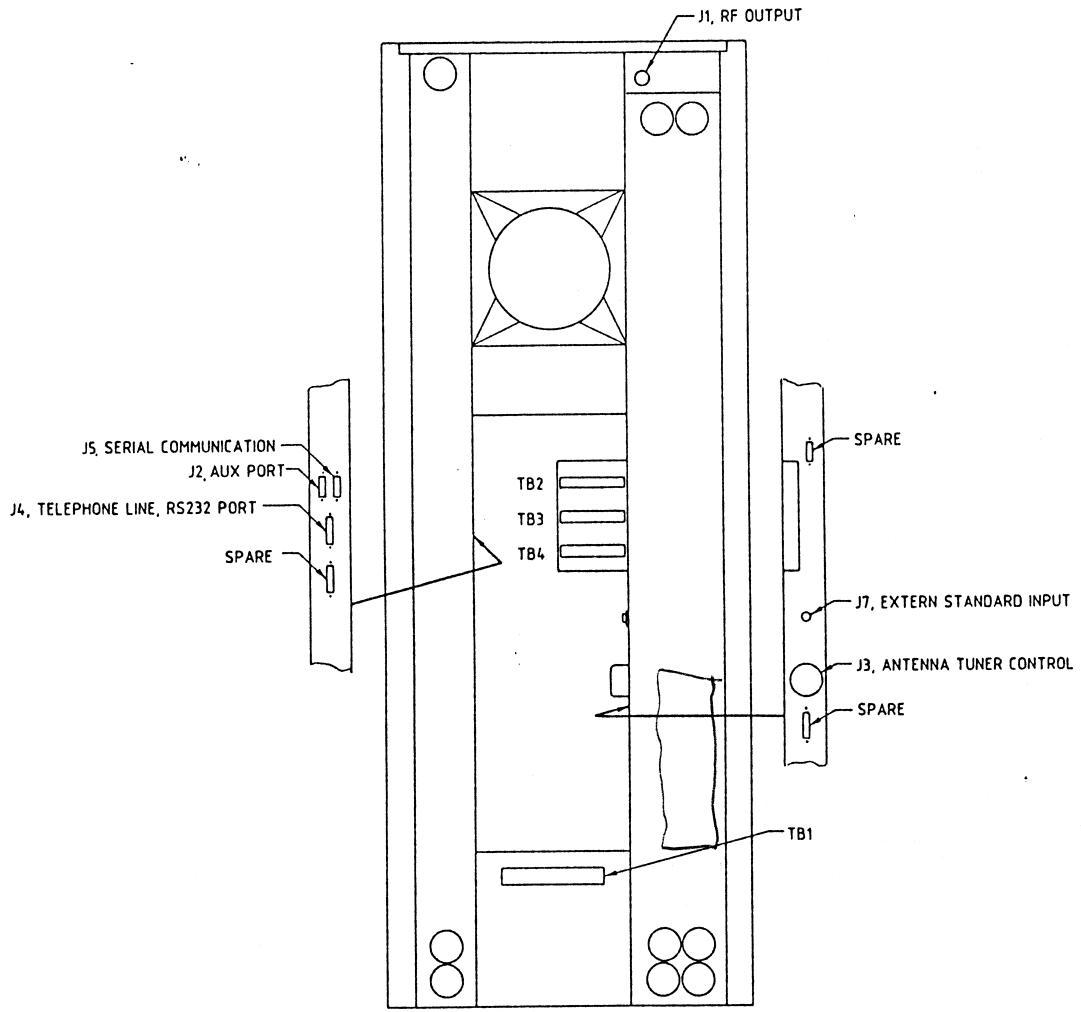


IN ALL OTHER INTERCONNECTION CABLES, FOR WHICH SPECIAL CONNECTION DIAGRAMS ARE NOT SHOWN, THE CONTACTS AT THE ONE END ARE CONNECTED TO THE CONTACT WITH THE SAME CONTACT NUMBER AT THE OTHER END.

DASHED LINES INDICATE THAT THE CABLES ARE ONLY MOUNTED IN THE RACK WHEN THE APPROPRIATE OPTION IS SUPPLIED.

FIRST ANGLE PROJECTION	SIZE A2	CODE IDENT	DRAWING NO. 210503-PD
	SCALE		SHEET 2

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL



NEXT ASSY	USED ON
APPLICATION	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075

ANGLES

LIN. DIM.

MATERIAL

FIRST ANGLE PROJECTION

DR.	VH	9.12 1988
CH.		
AP.		
AP.		

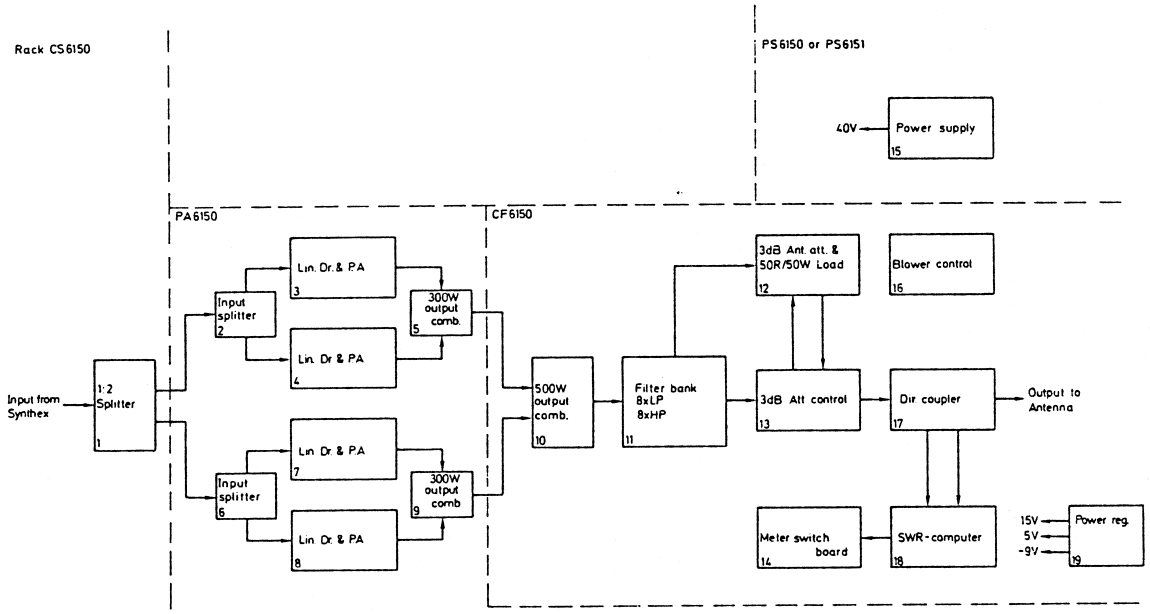
Dansk Radio AS

TITLE
REAR PANEL CONNECTIONS FOR
S76210-1 (S76150-1)
TRANSMITTER RACK

SIZE	CODE IDENT	DRAWING NO.
A2		49 65 96

SCALE

SHEET 1 OF 1



Block Diagram
Power Amplifier part

Ref. Designation 4471

S76150 DIAG No. 4471

Note 1:

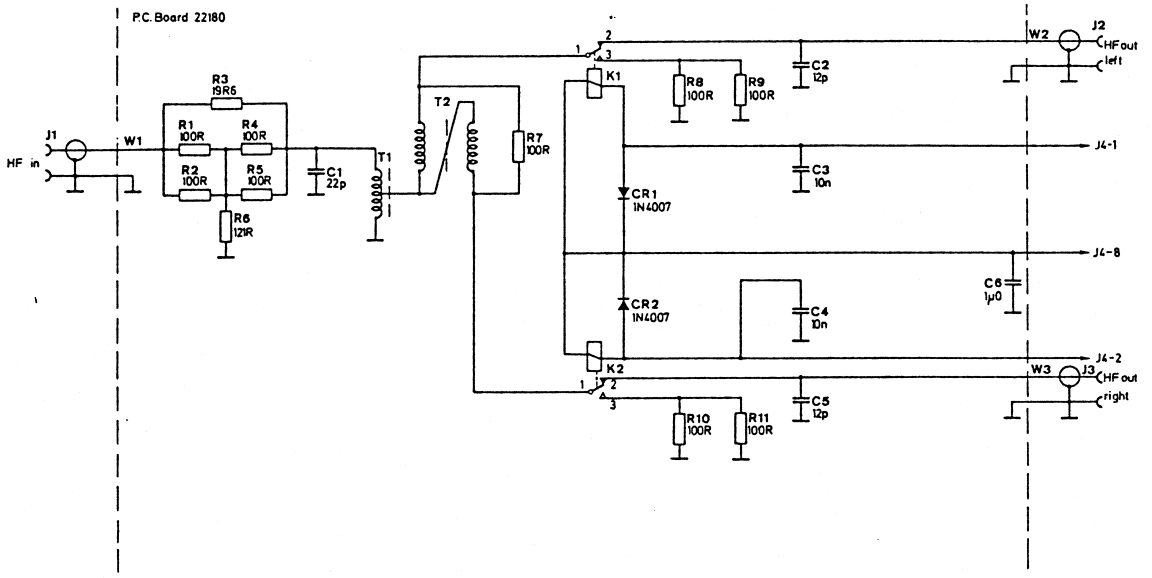
Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

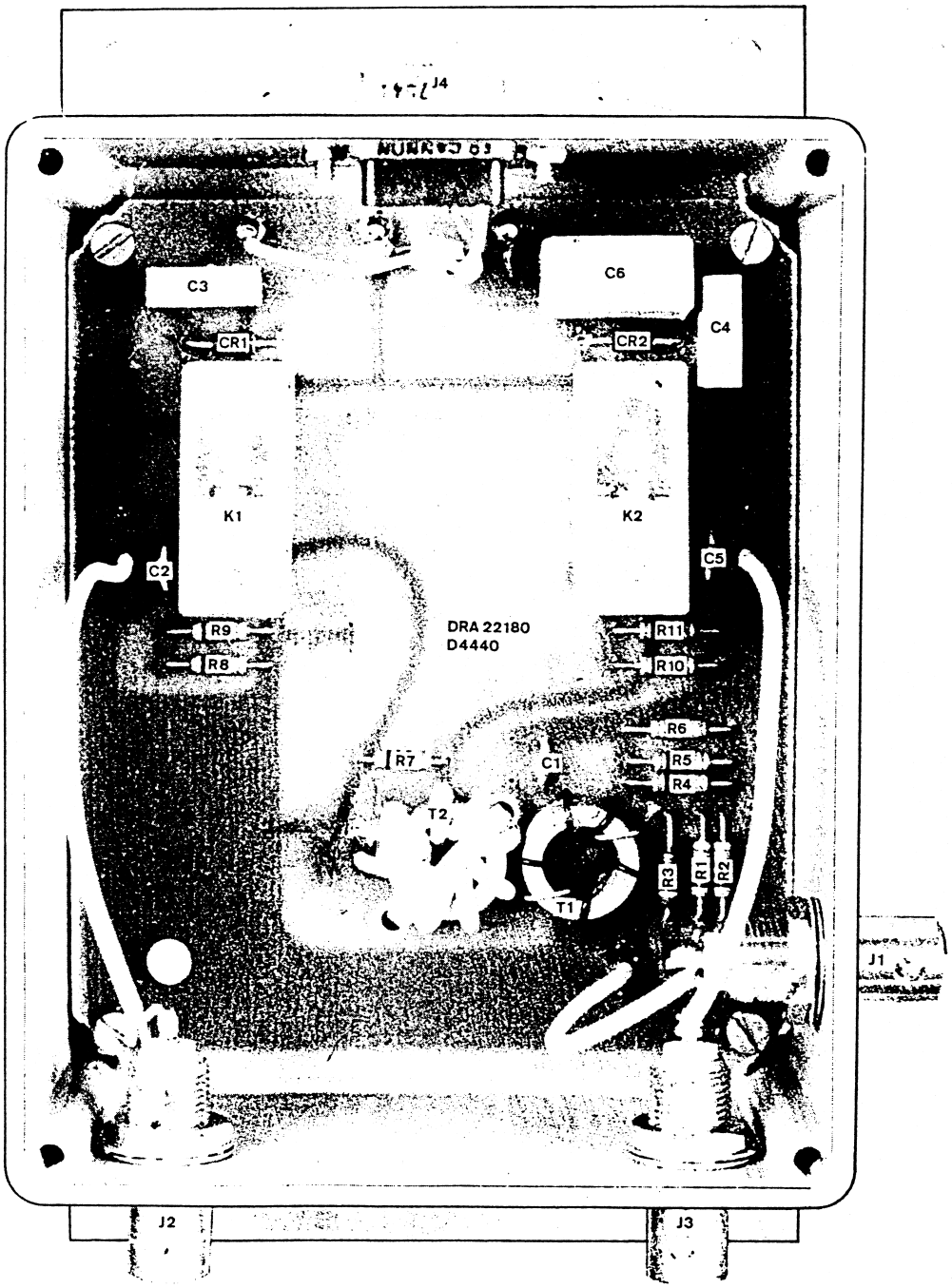
The capacitance units are indicated by means of the international prefixes p, n, and µ, (pF, nF, and µF).

The inductance units are indicated by means of the international prefixes µ, and m, (µH, and mH).

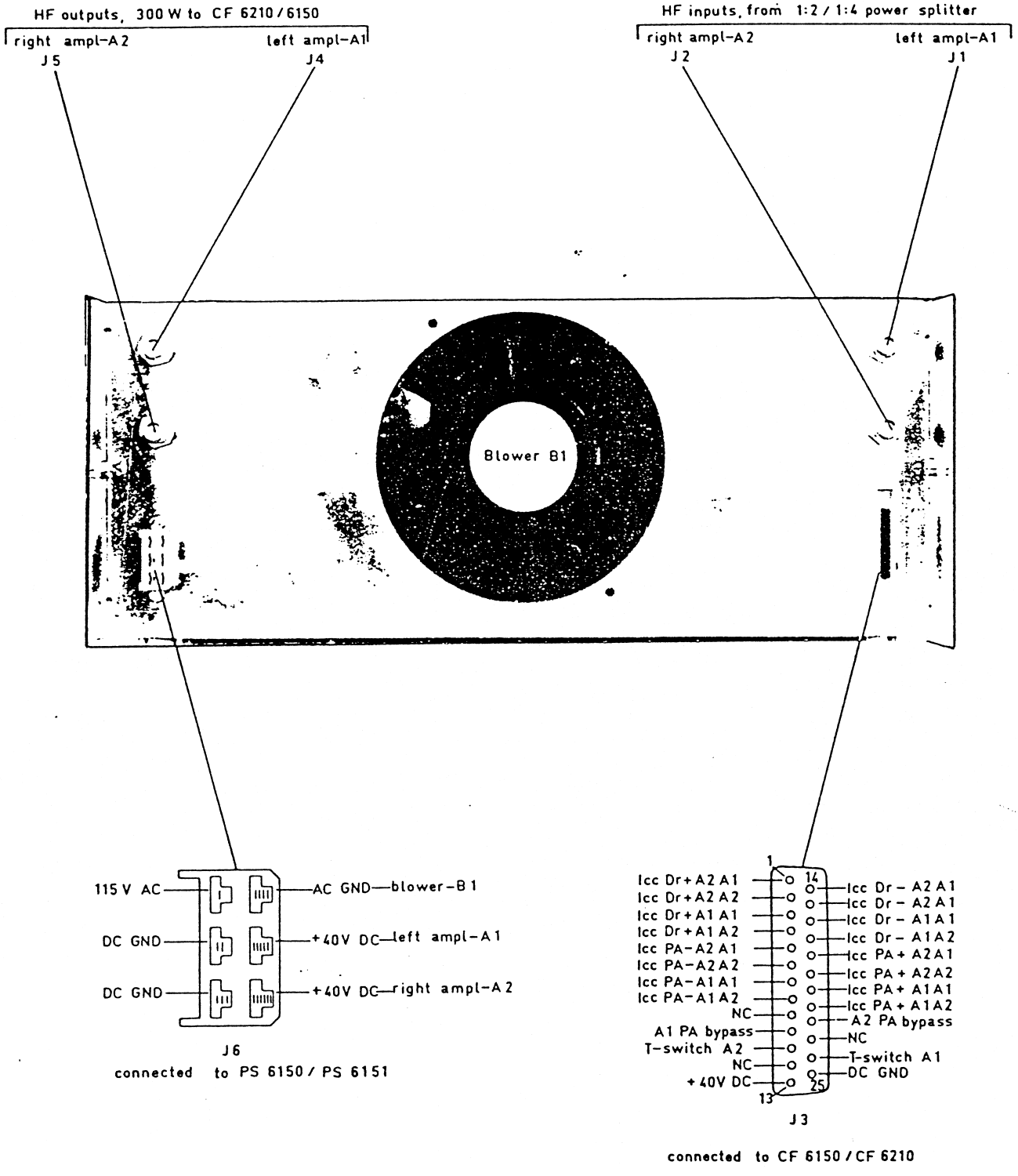


CS 6150 DIAG No. 4440

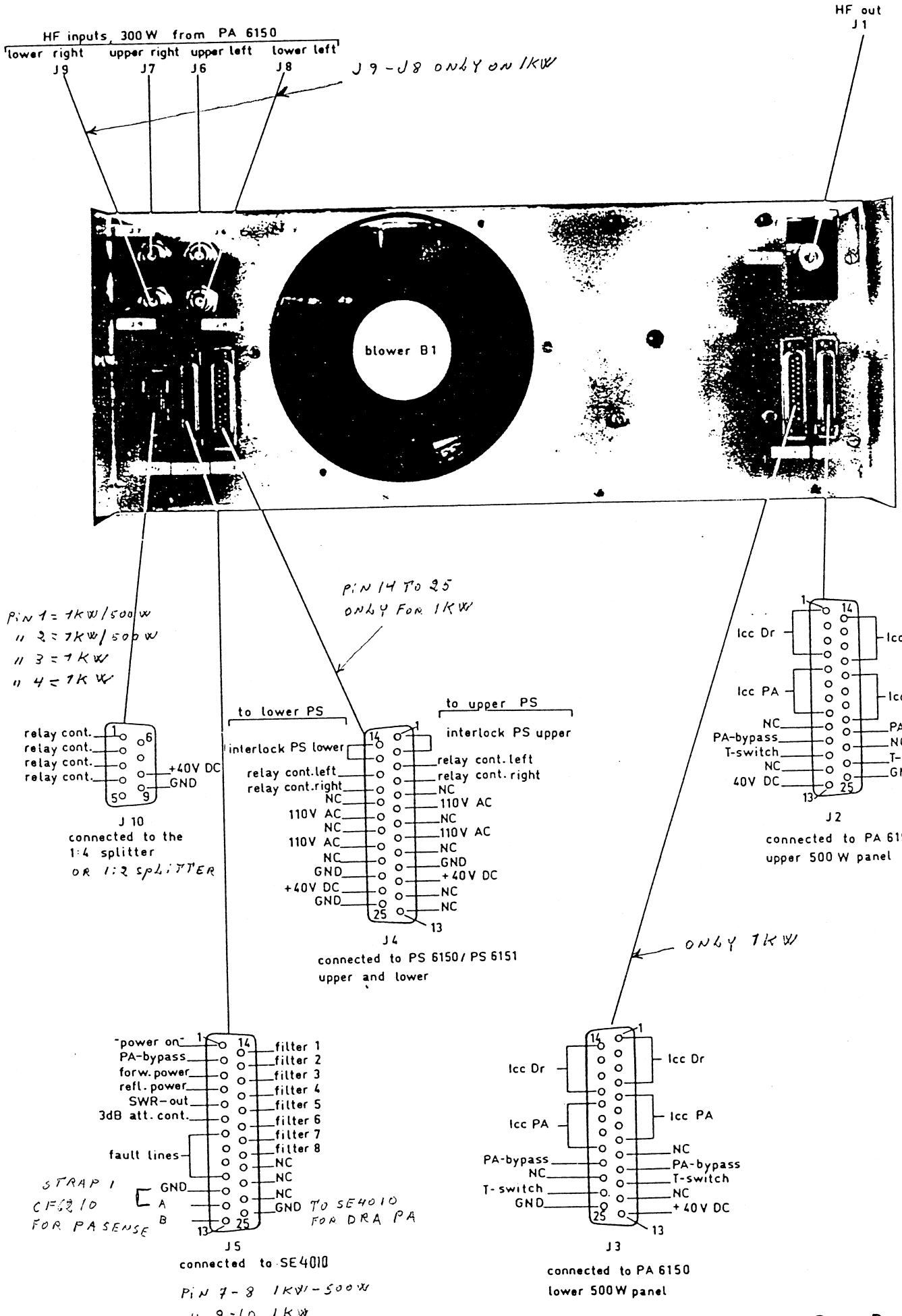
1:2 Splitter
Ref. Designation 4440



1:2 Splitter
Ref. Desig. 4440
Component Location

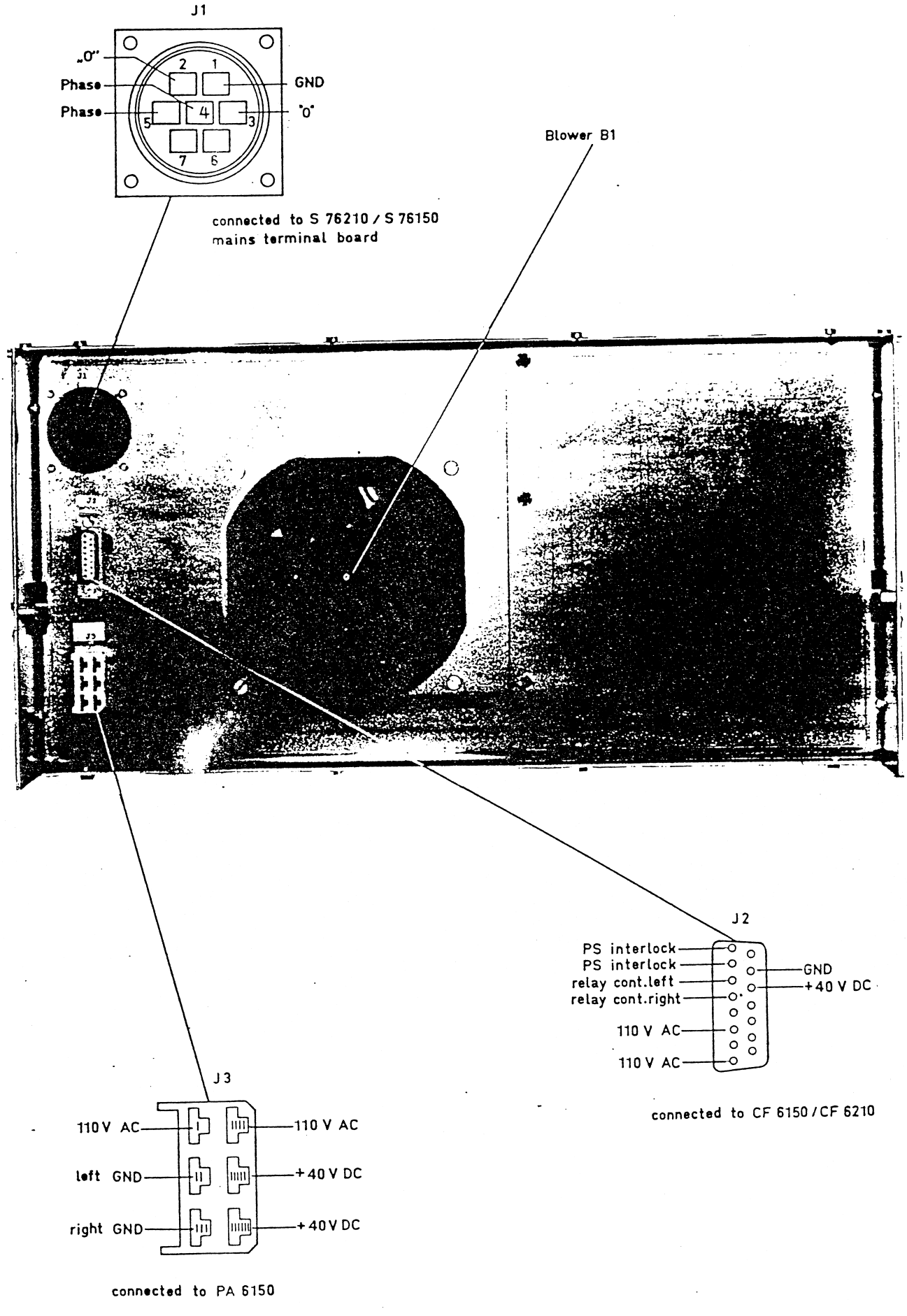


Rear view, 500-W PA Panel
Ref. Designation 4416



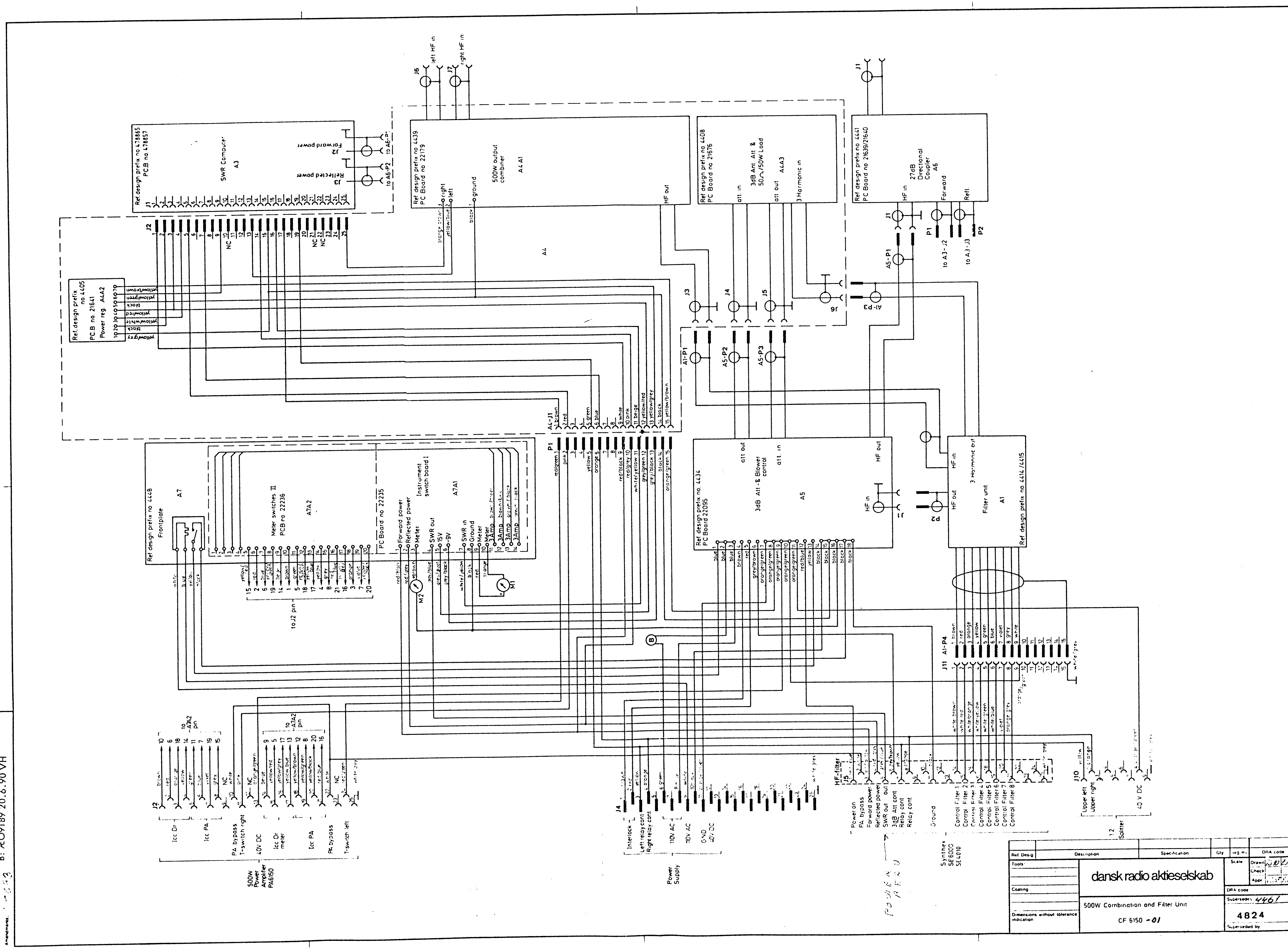
Rear Panel
Ref. Desig. 4418

3.2

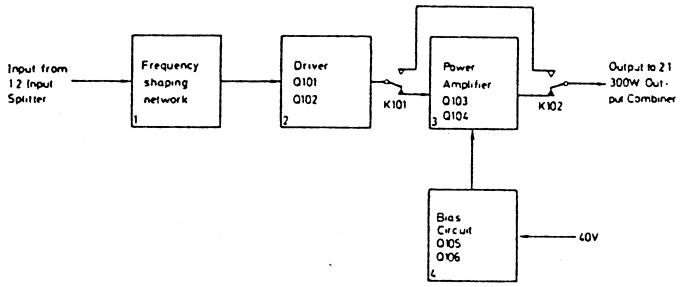


Rear Panel
Ref. Desig. 4481

3.2



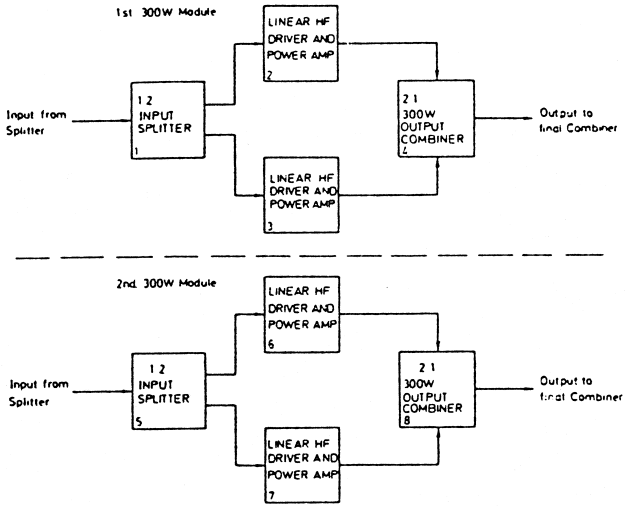
dansk radio aktieselskab
500W Combination and Filter Unit
CF 6150 -01
4824
Supersedes 4461
Dimensions without tolerance indication
B: ÆO9189 20.6.90 VH



Block Diagram 150-W Power Amplifier

PA 6150 DIAG No. 4444

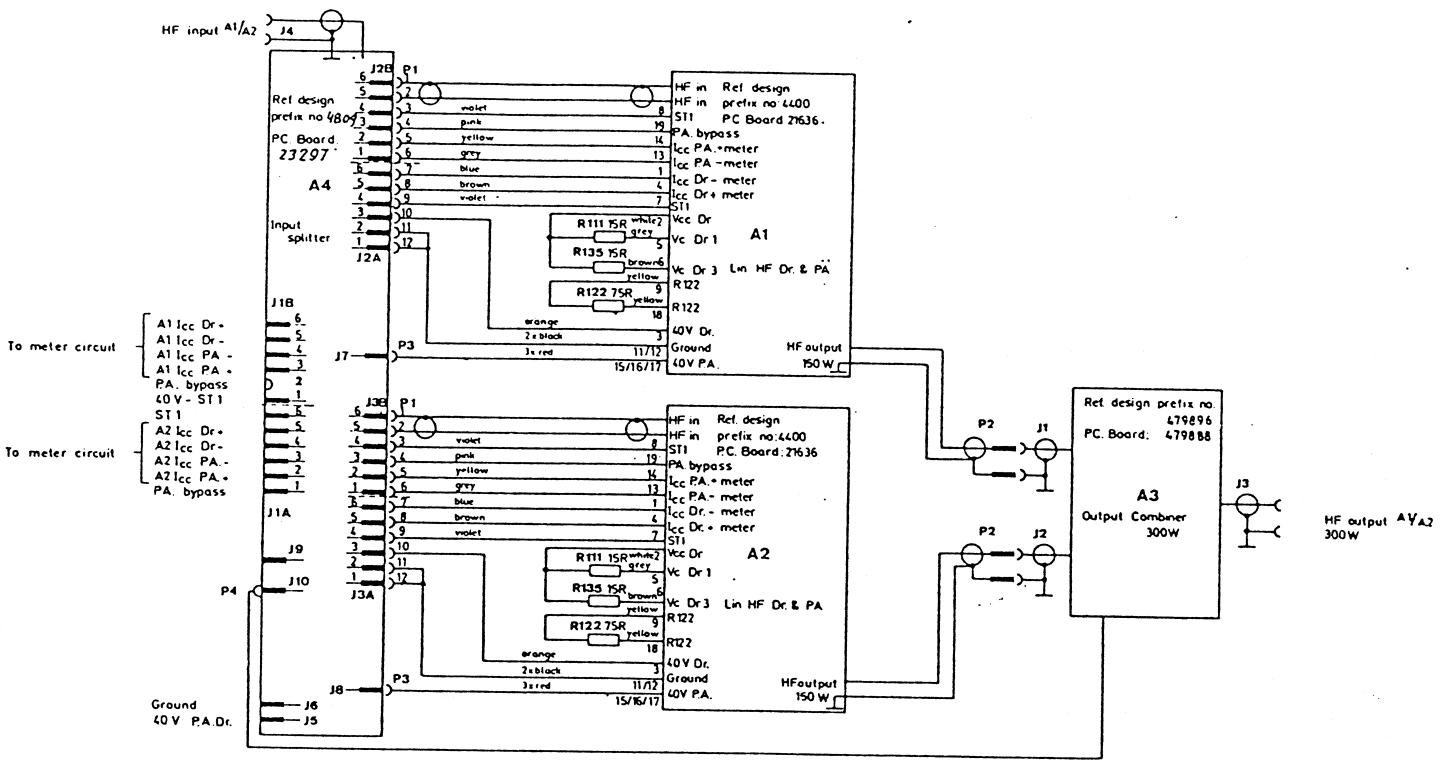
Ref. Designation 4444



Block Diagram 500-W PA Panel

PA 6150 DIAG No. 4445

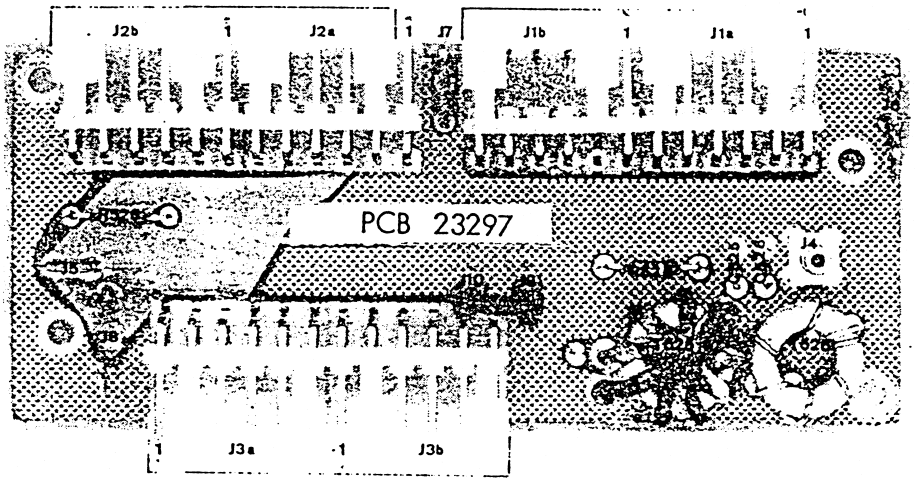
Ref. Designation 4445



PA 6150 DIAG No. 4478 / 1985-11

300-W Amplifier Unit

Ref. Designation 4478



Input Splitter

Ref. Desig. 4809

Component Location

Note 1:

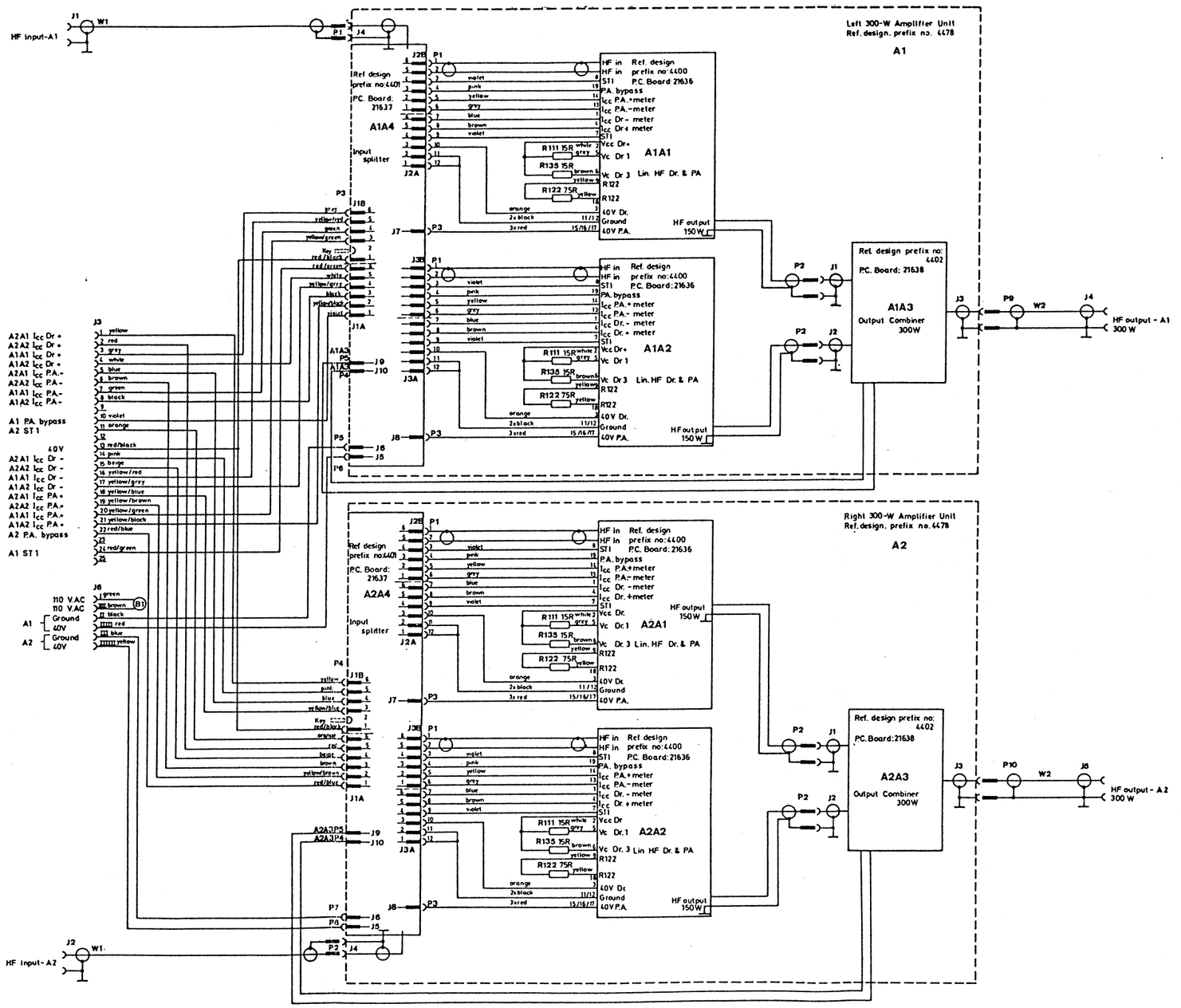
Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

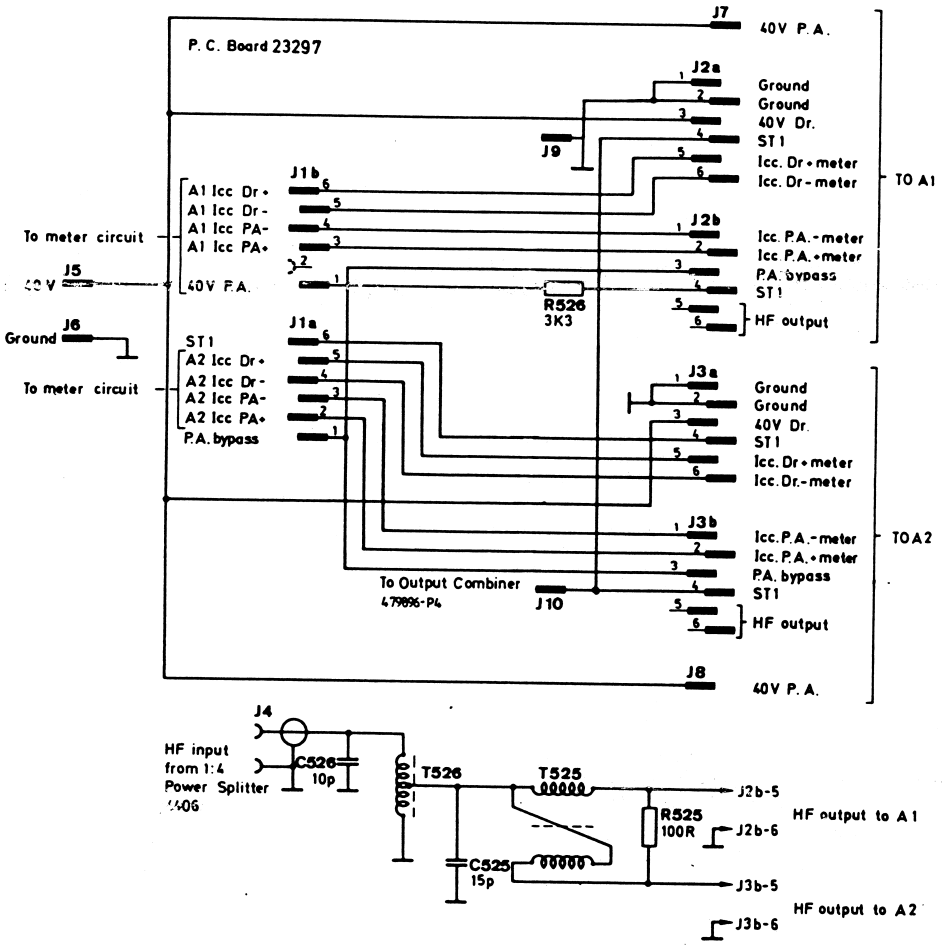
Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

The capacitance units are indicated by means of the international prefixes p, n, and µ, (pF, nF, and µF).

The inductance units are indicated by means of the international prefixes µ, and m, (µH, and mH).



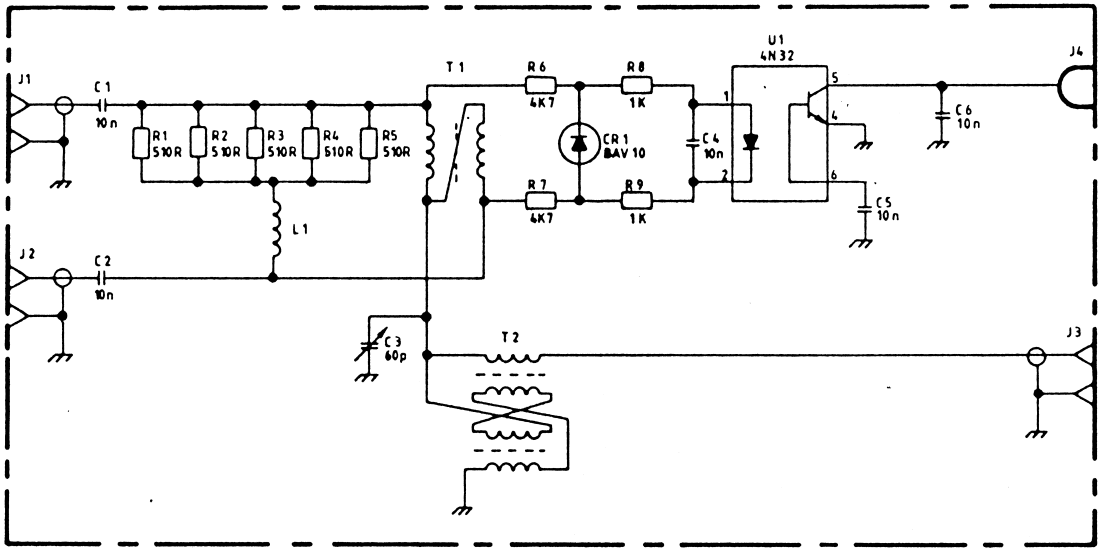


INPUT SPLITTER

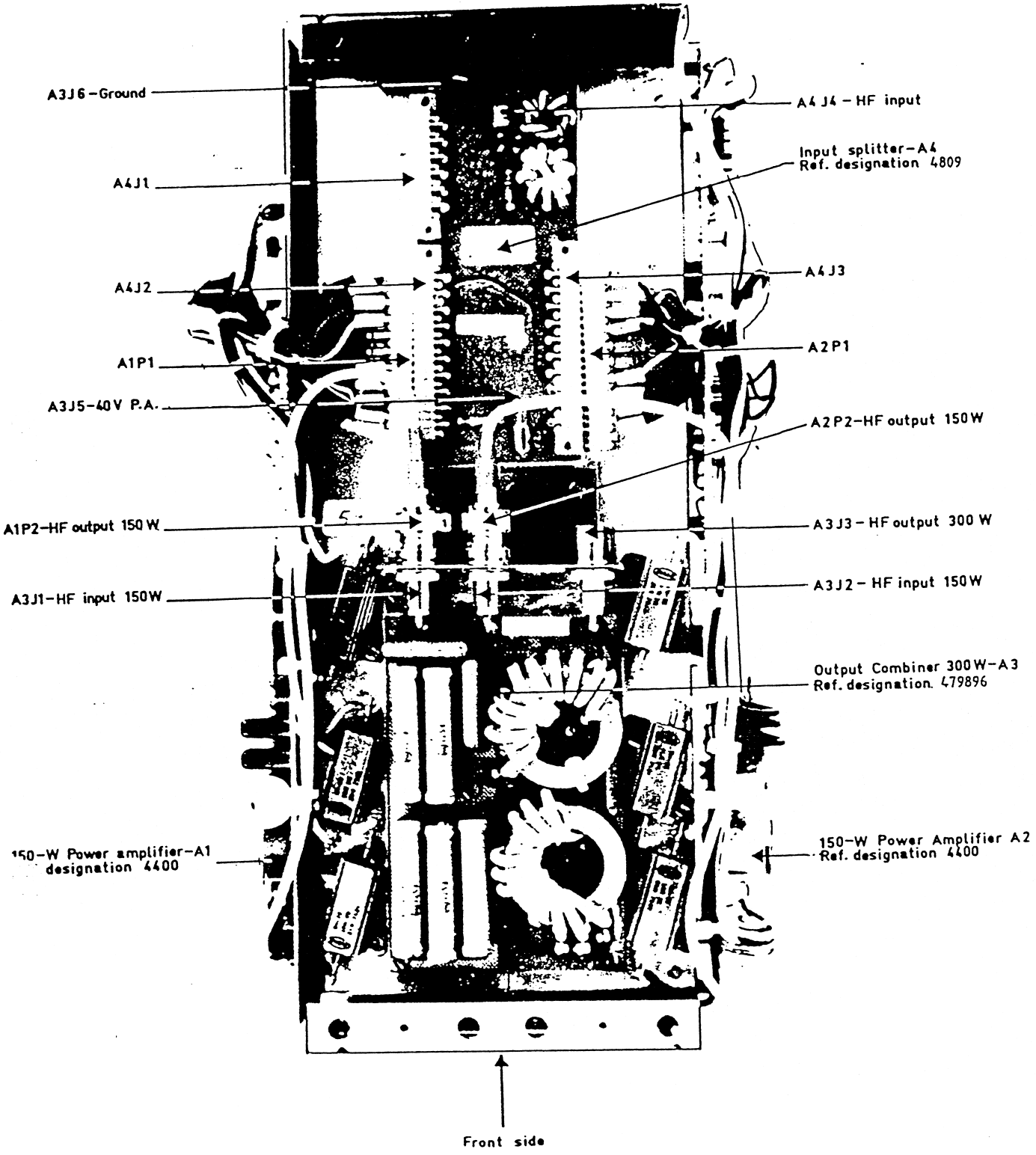
PA 6150 DIAG. No. 4809/ 1985-11

(Ref. Desig. 4809)

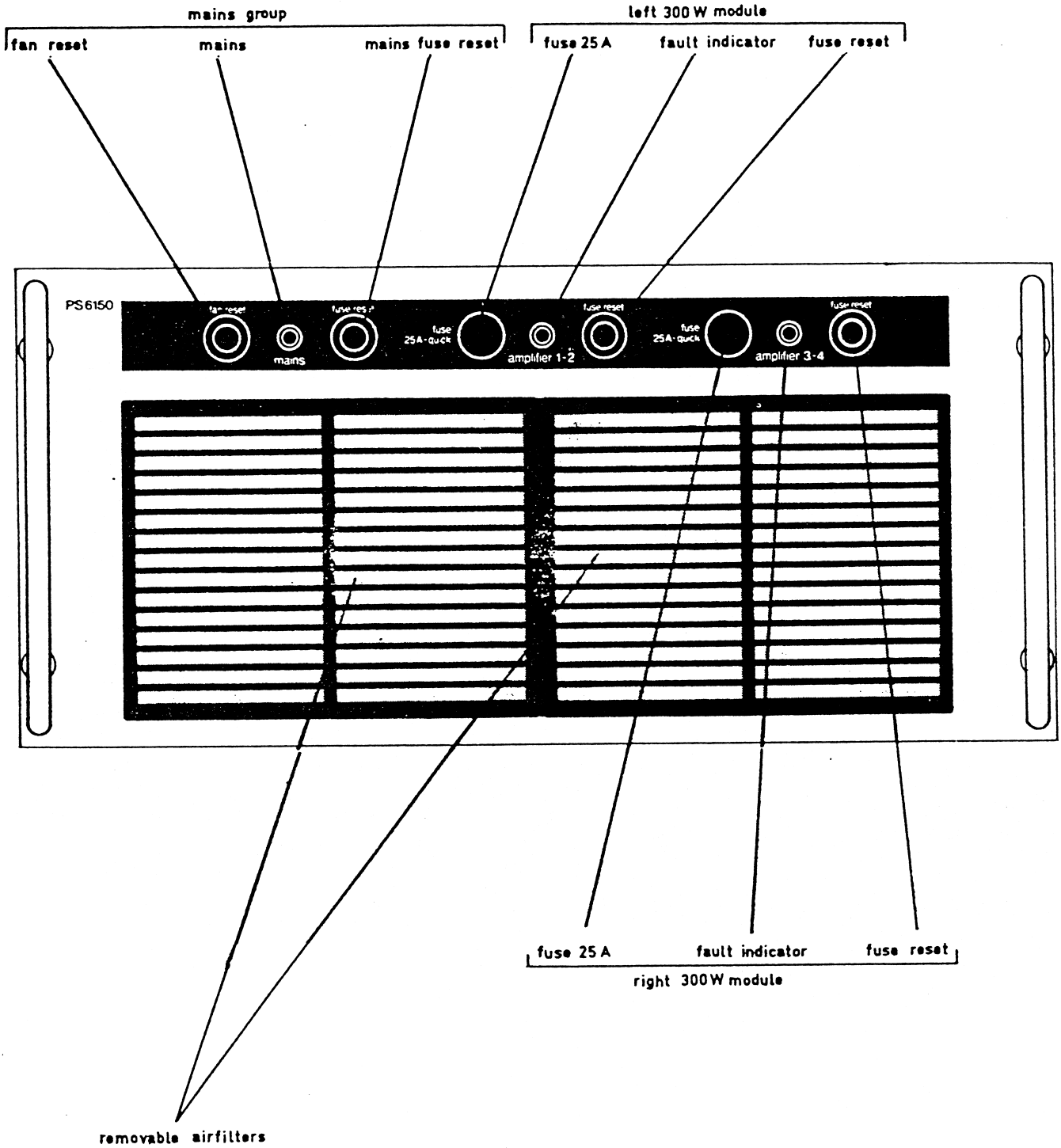
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL



		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETRES AND TOLERANCES ARE IN ACCORDANCE WITH DS 2075		**Dansk Radio AS**
			DR. V.H. 10.4 1985	TITLE: 300W POWER COMBINER
		ANGLES	CH. RW 850410	
		LIN. DIM.	AP.	
			AP.	
44 40 65	PA 6150	MATERIAL	FIRST ANGLE PROJECTION	SIZE A2 / CODE IDENT / DRAWING NO. 47 98 96
NEXT ASSY	USED ON			SCALE / SHEET 1 OF 1
APPLICATION				



Top View, 300-W Amplifier Unit
Ref. Designation 4478



Front Panel
Ref. Desig. 4481

Note 1:

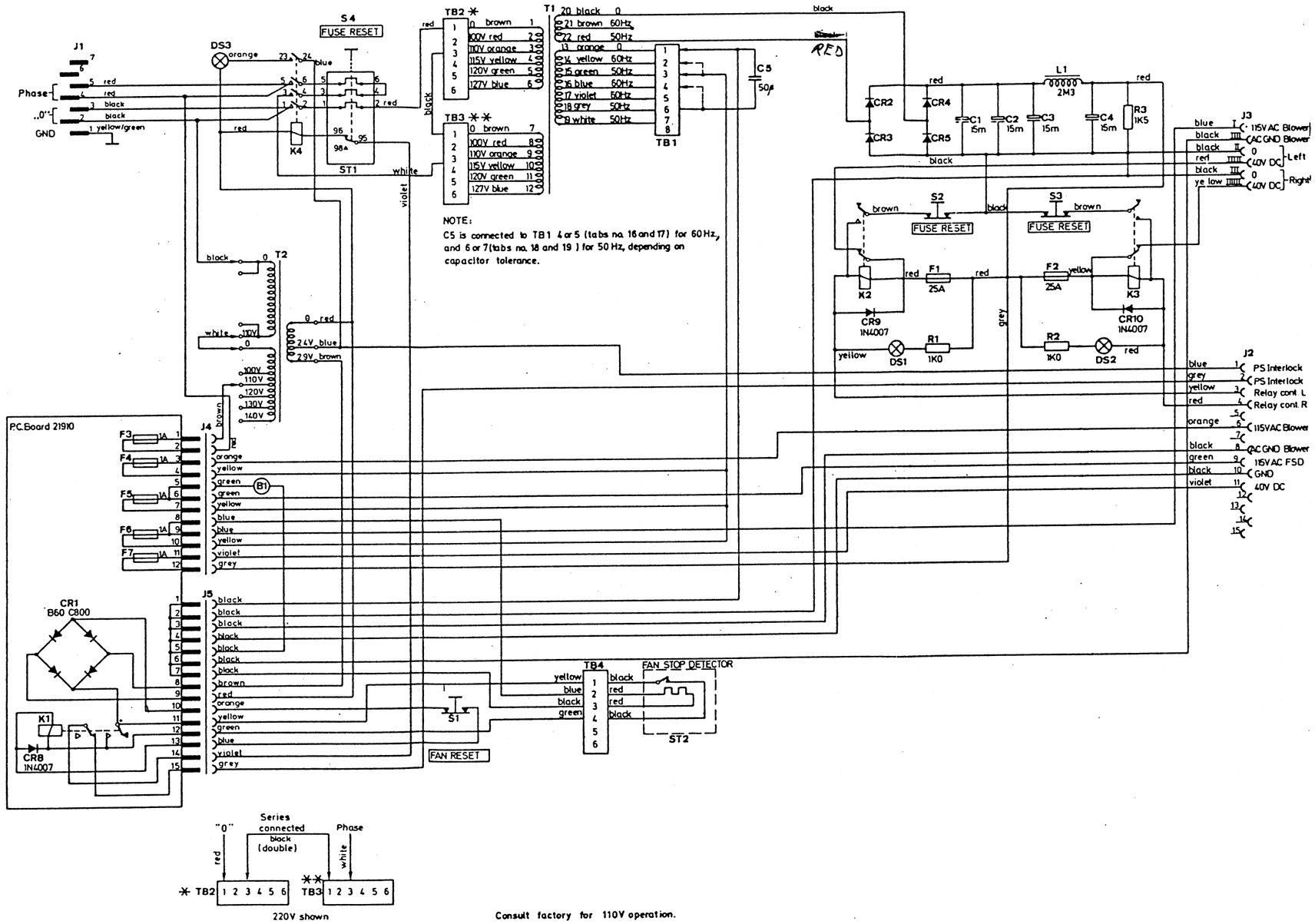
Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

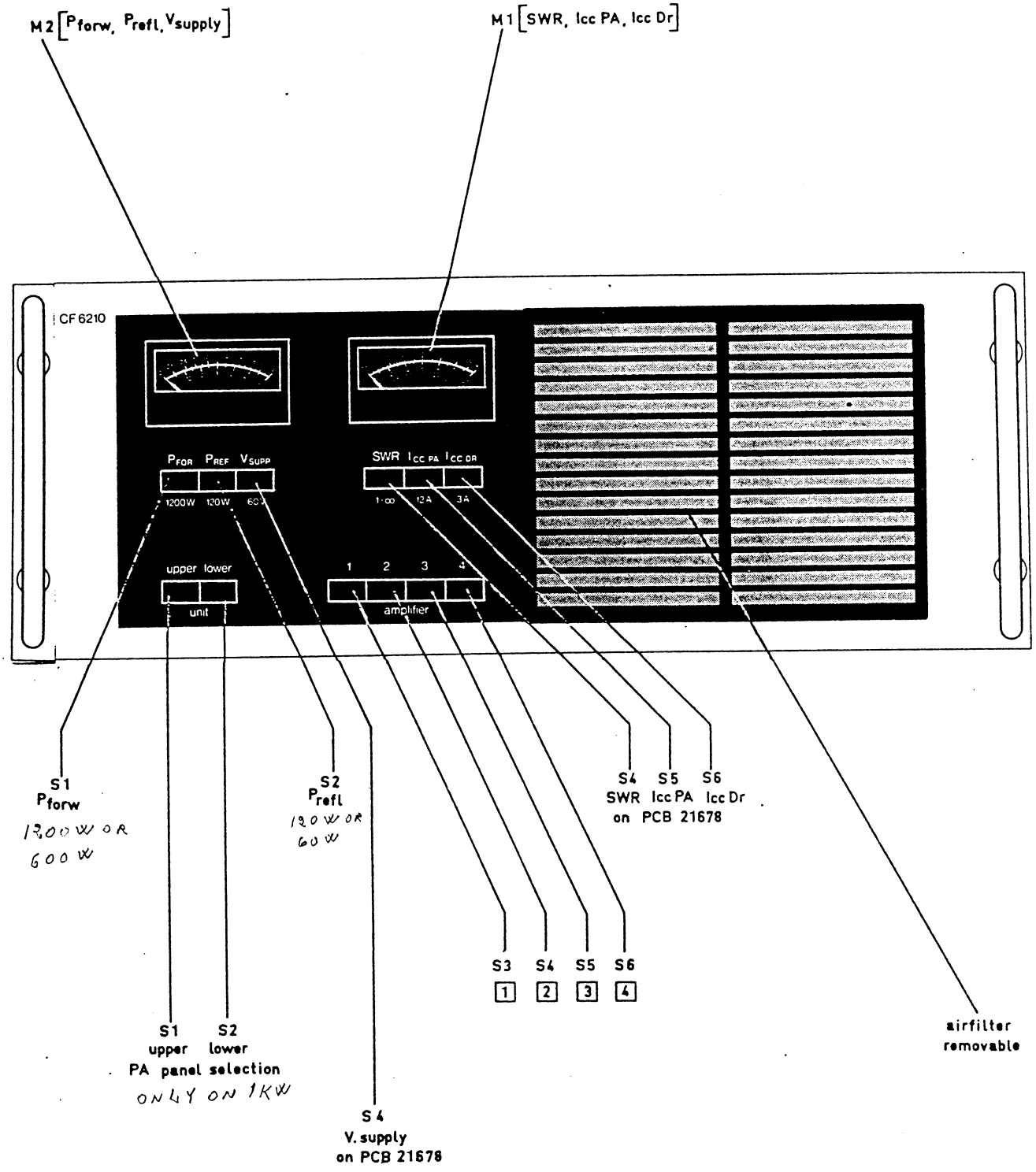
The capacitance units are indicated by means of the international prefixes p, n, and µ, (pF, nF, and µF).

The inductance units are indicated by means of the international prefixes µ, and m, (µH, and mH).

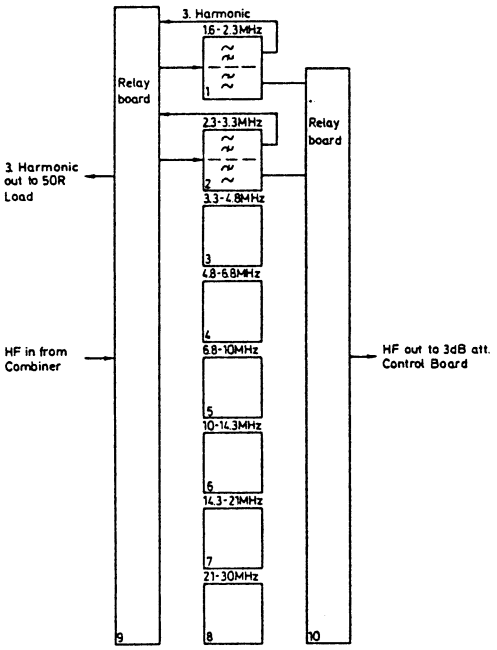


PS 6150 DIAG No. 4481 / 1979-12

1-Phase Power Supply
Ref. Designation 4481

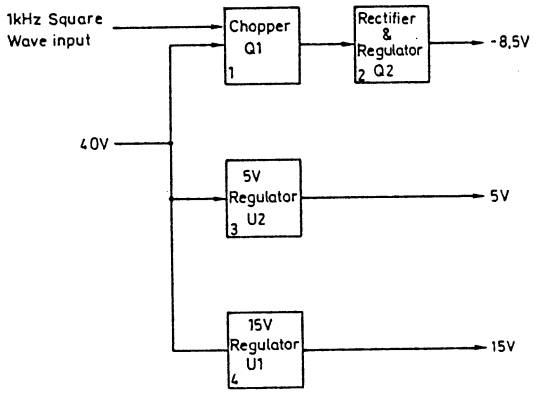


Front Panel
Ref. Desig. 4410



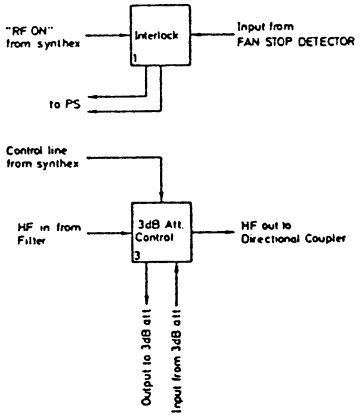
Block Diagram Filter Bank

Ref. Designation 4452



Block Diagram Power Regulator

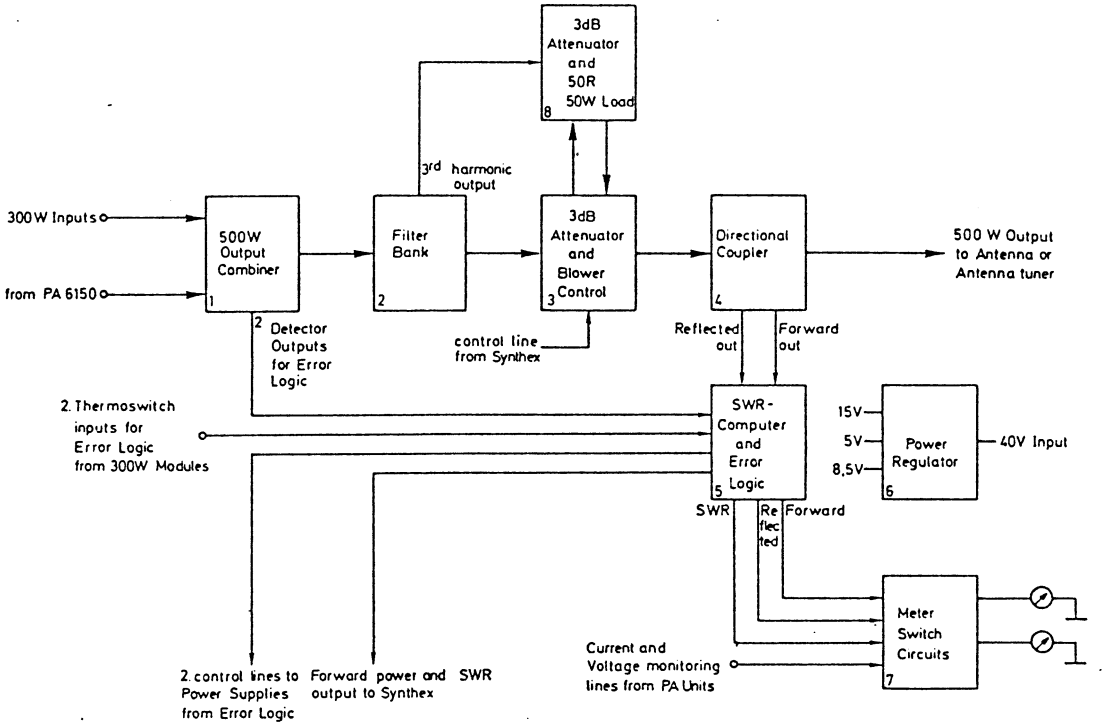
Ref. Designation 4453



Block Diagram 3-dB Attenuator and Blower Control

CF 6150 DIAG No. 4468

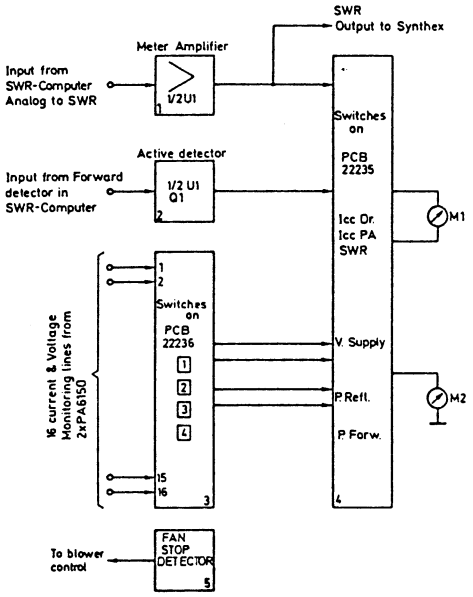
Ref. Designation 4468



Block Diagram Combination and Filter Panel

CF 6150 DIAG No. 4469

Ref. Designation 4469



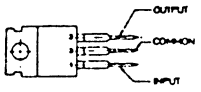
Block Diagram Front Panel

CF 6150 DIAG No. 4470

Ref. Designation 4470

μA 7815 UC

TO-220 PACKAGE (TOP VIEW)

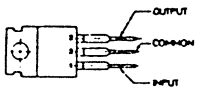


OUTPUT VOLTAGE	PART NO
5V	μA7805UC
15V	μA7815UC

U 1

μA 7805 UC

TO-220 PACKAGE (TOP VIEW)



OUTPUT VOLTAGE	PART NO
5V	μA7805UC
15V	μA7815UC

U 2

Note 1:

Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

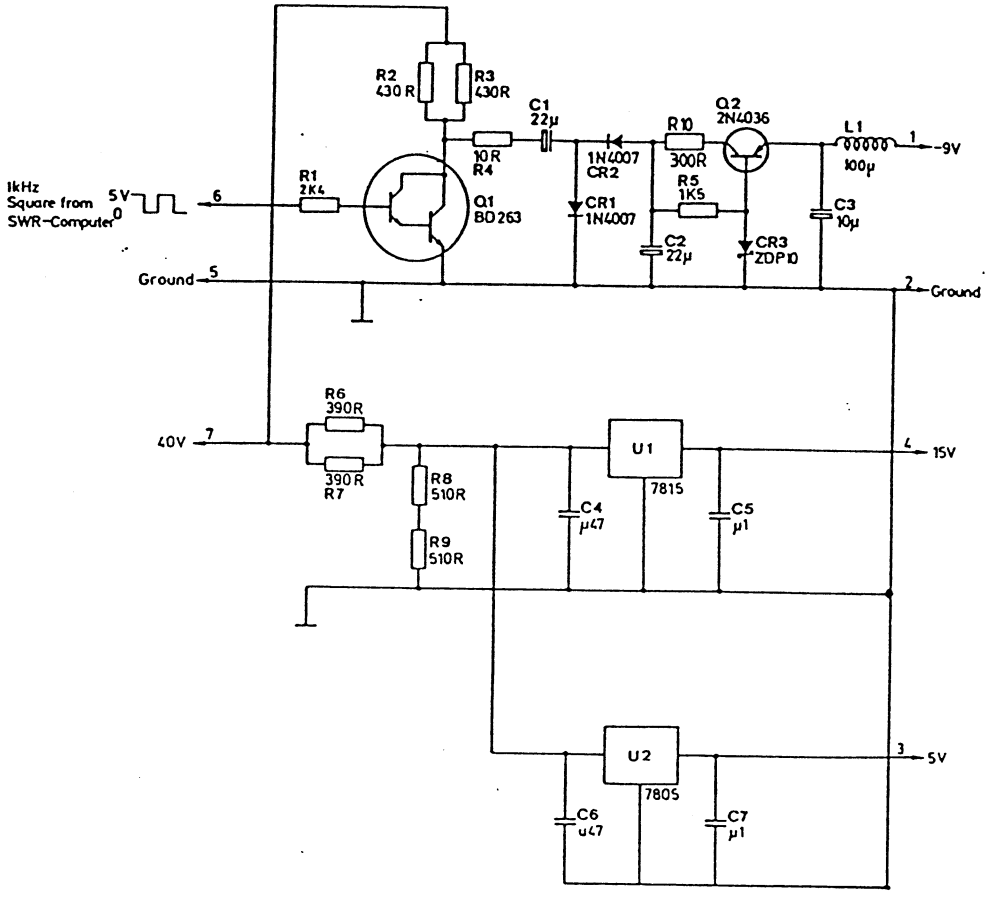
Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

The capacitance units are indicated by means of the international prefixes p, n, and μ, (pF, nF, and μF).

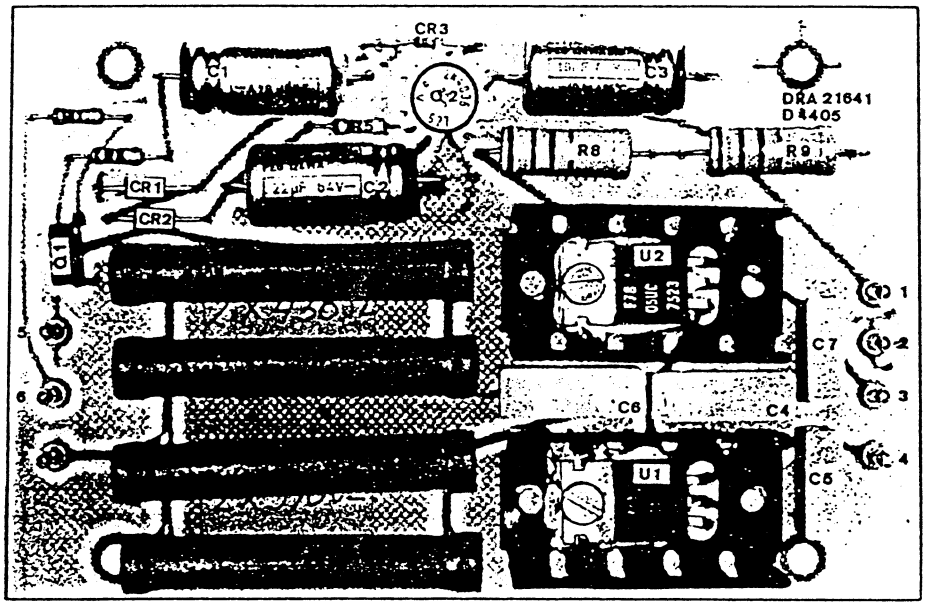
The inductance units are indicated by means of the international prefixes μ, and m, (μH, and mH).

P. C. Board 21641



Power Regulator

Ref. Designation 4405



Power Regulator
Ref. Desig. 4405
Component Location

Note 1:

Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

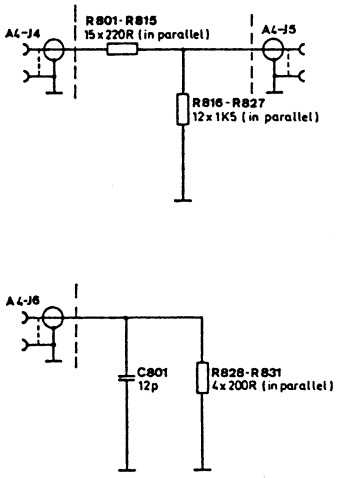
Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

The capacitance units are indicated by means of the international prefixes p, n, and µ, (pF, nF, and µF).

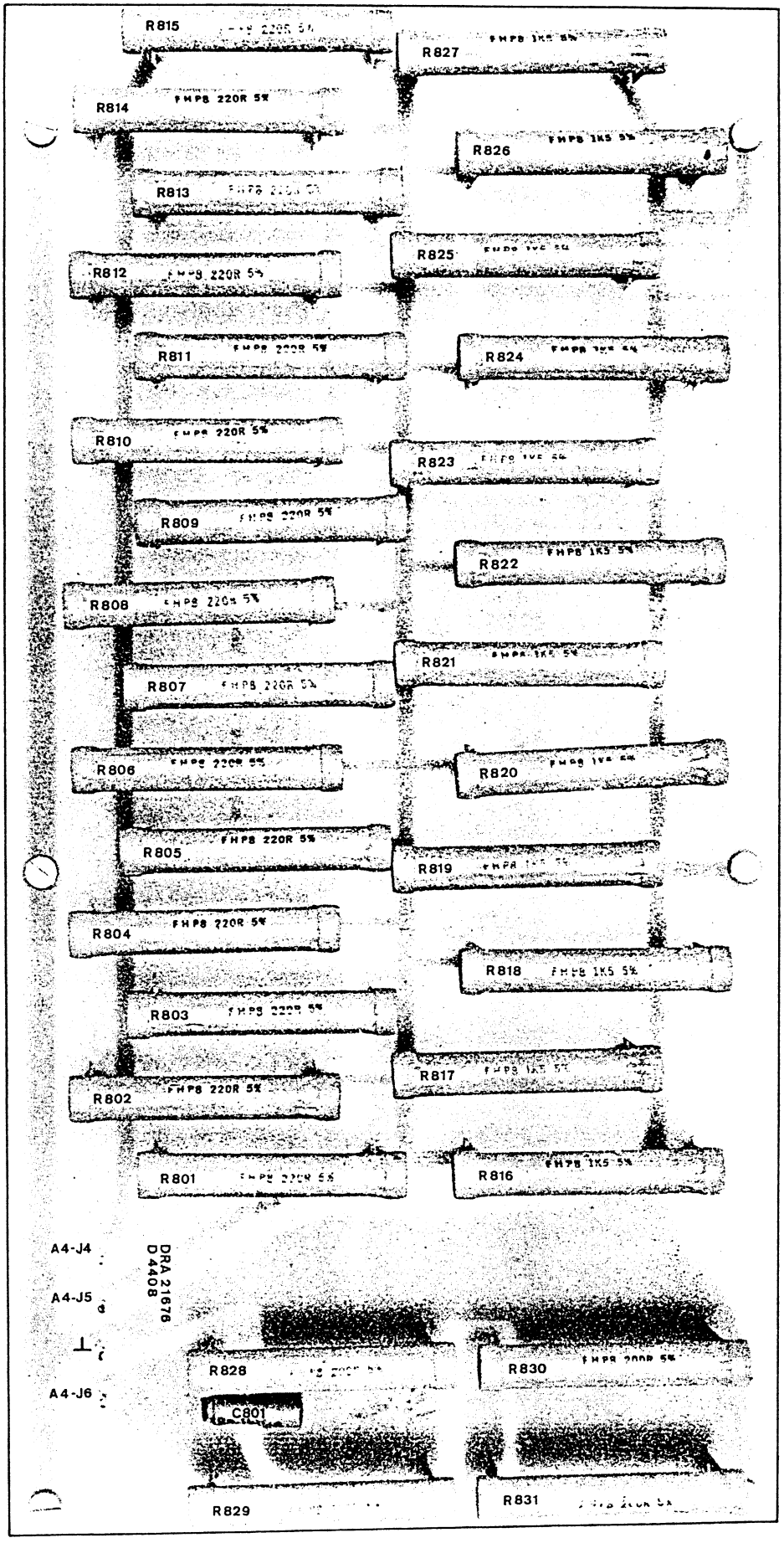
The inductance units are indicated by means of the international prefixes µ, and m, (µH, and mH).

P. C. Board 21676



3-dB Attenuator and 50 ohm/ 50-W Load

Ref. Designation 4408



dB Attenuator and 50-Ω/50-W Load.

Ref. Desig. 4408.

Component Location.

Note 1:

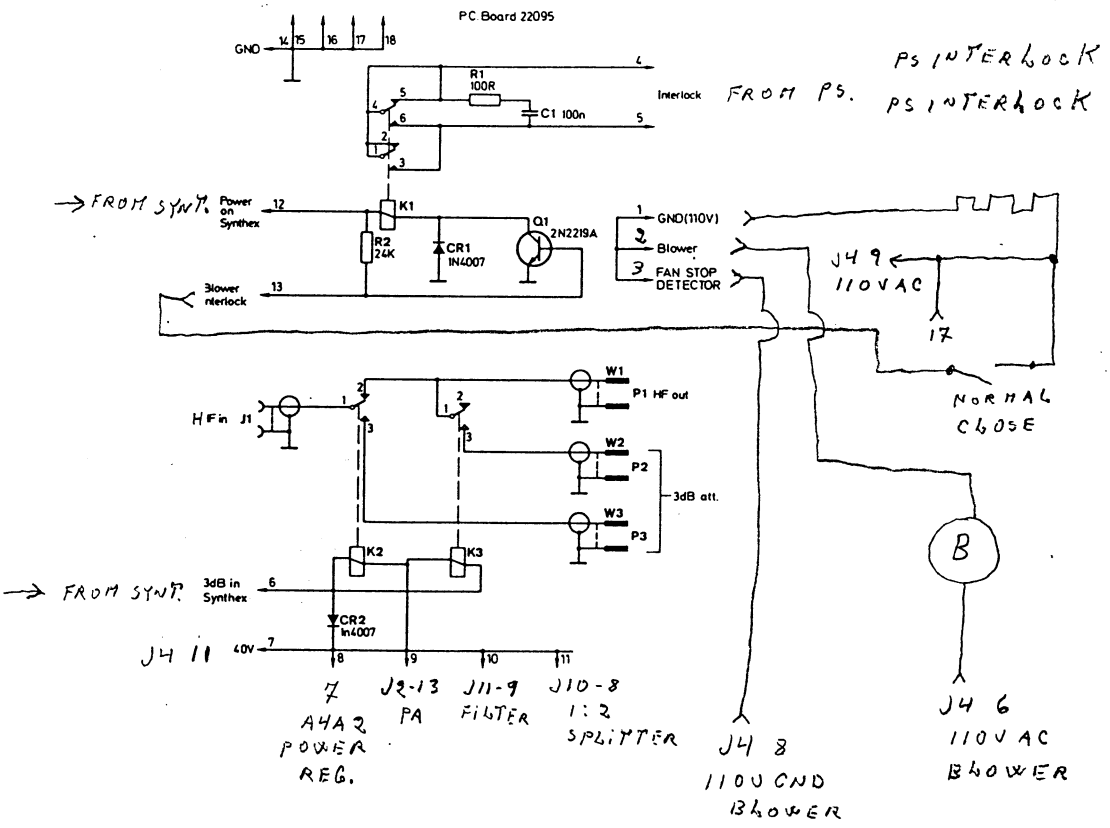
Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

The capacitance units are indicated by means of the international prefixes p, n, and µ, (pF, nF, and µF).

The inductance units are indicated by means of the international prefixes µ, and m, (µH, and mH).



3-dB Attenuator and Blower Control

CF6150 DIAG No. 4434

Ref. Designation 4434

Note 1:

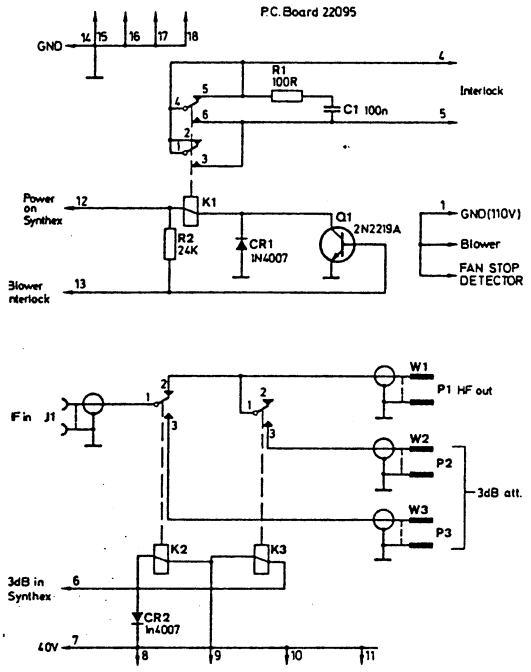
Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

The capacitance units are indicated by means of the international prefixes p, n, and µ, (pF, nF, and µF).

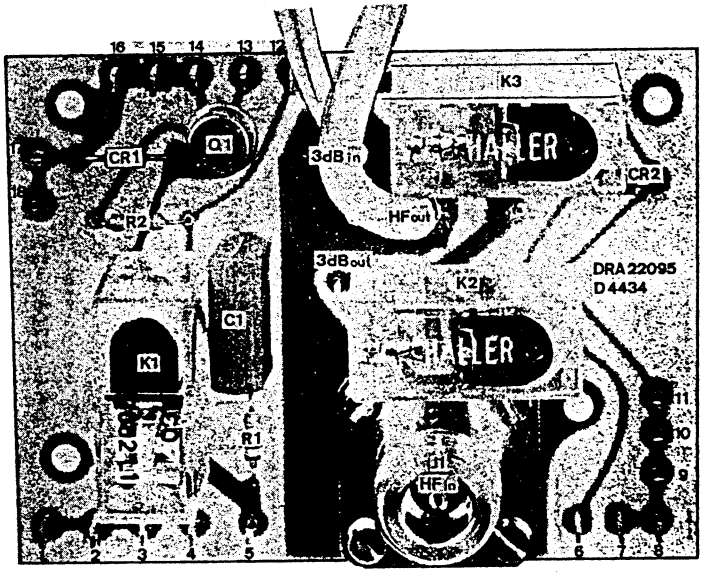
The inductance units are indicated by means of the international prefixes µ, and m, (µH, and mH).



3-dB Attenuator and Blower Control

CF6150 DIAG No. 4434

Ref. Designation 4434



3-dB Attenuator
and Blower Control
Ref. Desig. 4434
Component Location

Note 1:

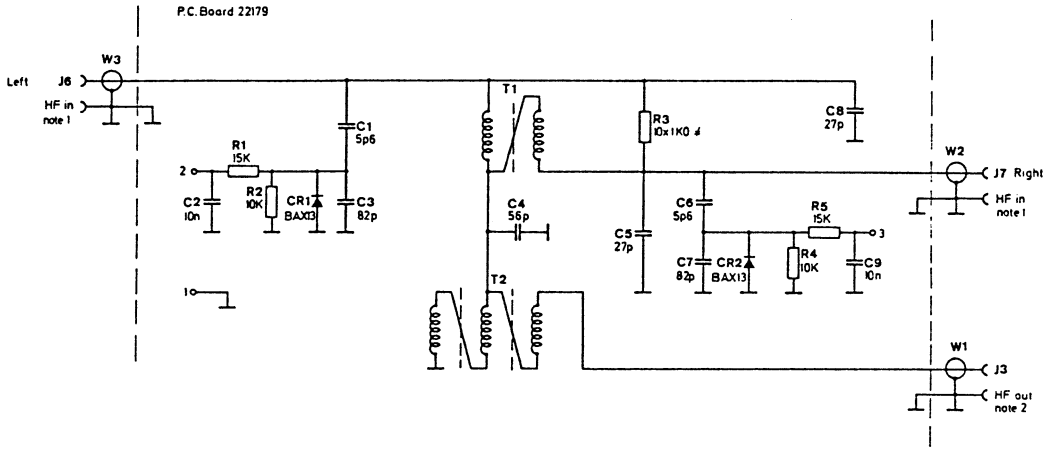
Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

The capacitance units are indicated by means of the international prefixes p, n, and µ, (pF, nF, and µF).

The inductance units are indicated by means of the international prefixes µ, and m, (µH, and mH).

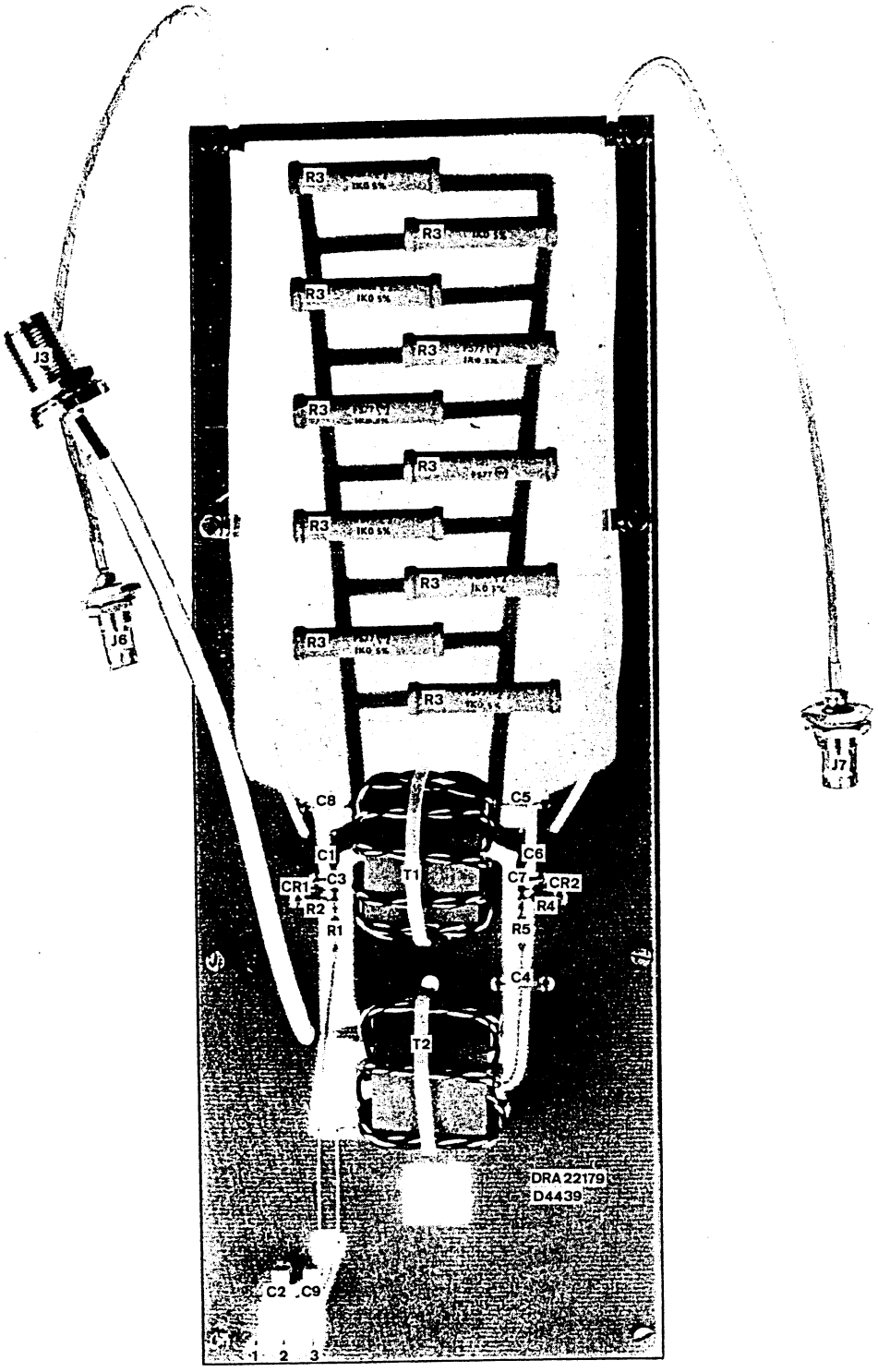


note 1 : J6, J7 are mounted on the rear of CF 6150
note 2 : J3 is mounted on the Combiner Channel

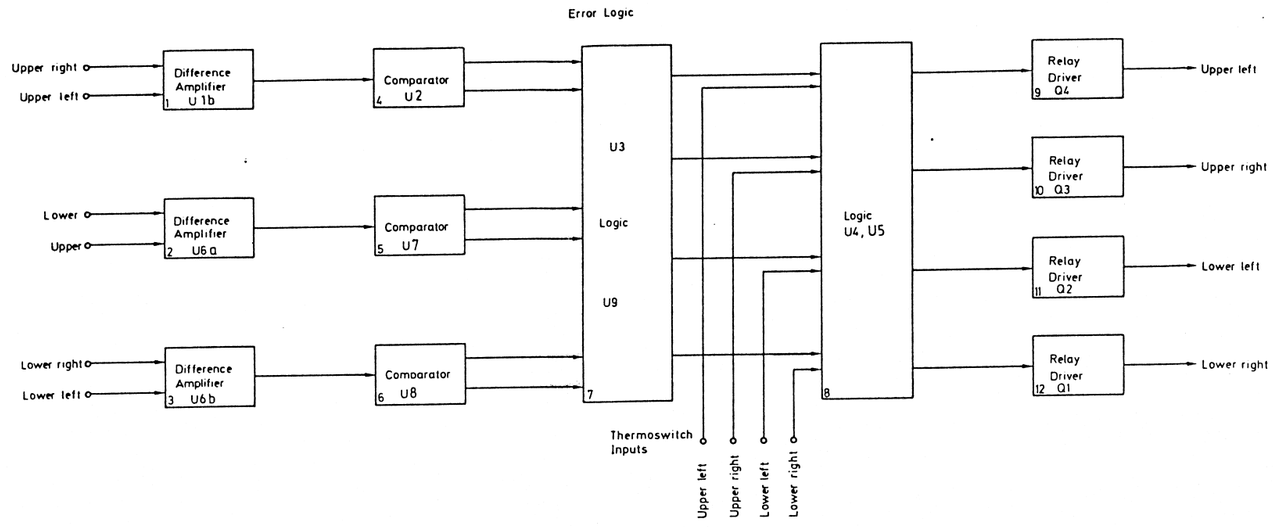
500-W Output Combiner

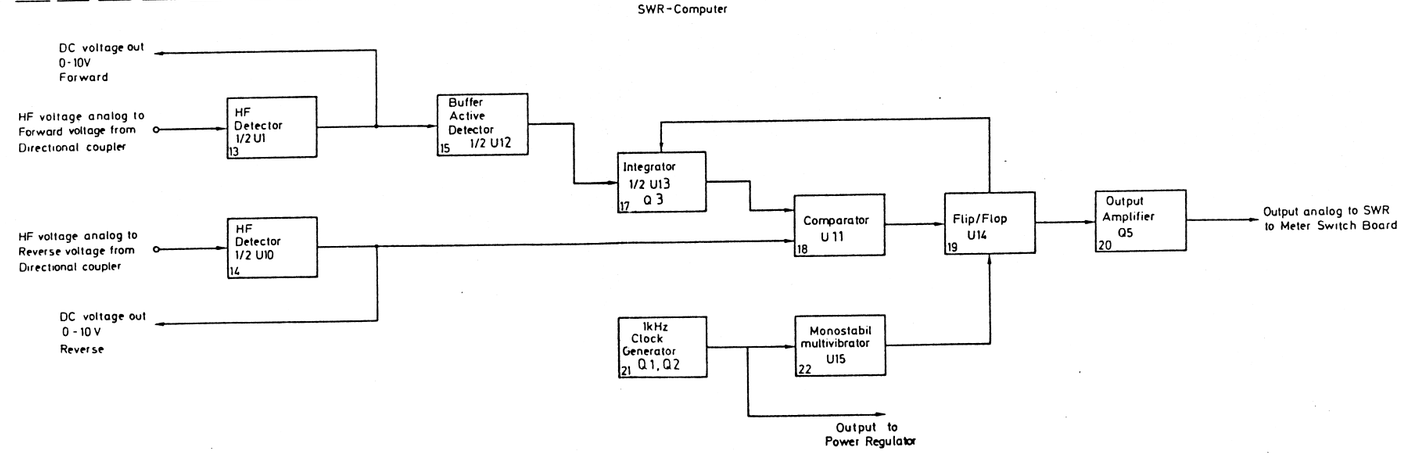
Ref. Designation 4439

CF 6150 DIAG No. 4439



500-W Output Combiner
Ref. Desig. 4439
Component Location

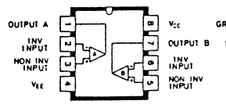




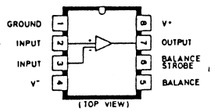
CF 6150 / CF 6210 DIAG. No. 4446A / 1985-02

BLOCK DIAGRAM SWR-COMPUTER

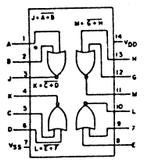
(Ref. Desig. 4446A)



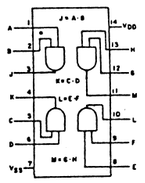
MC 1458



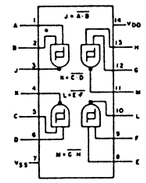
LM 311



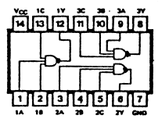
CD 4001



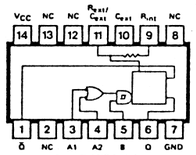
CD 4081



CD 4093



SN 7410 N



SN 74121 N

Note 1:

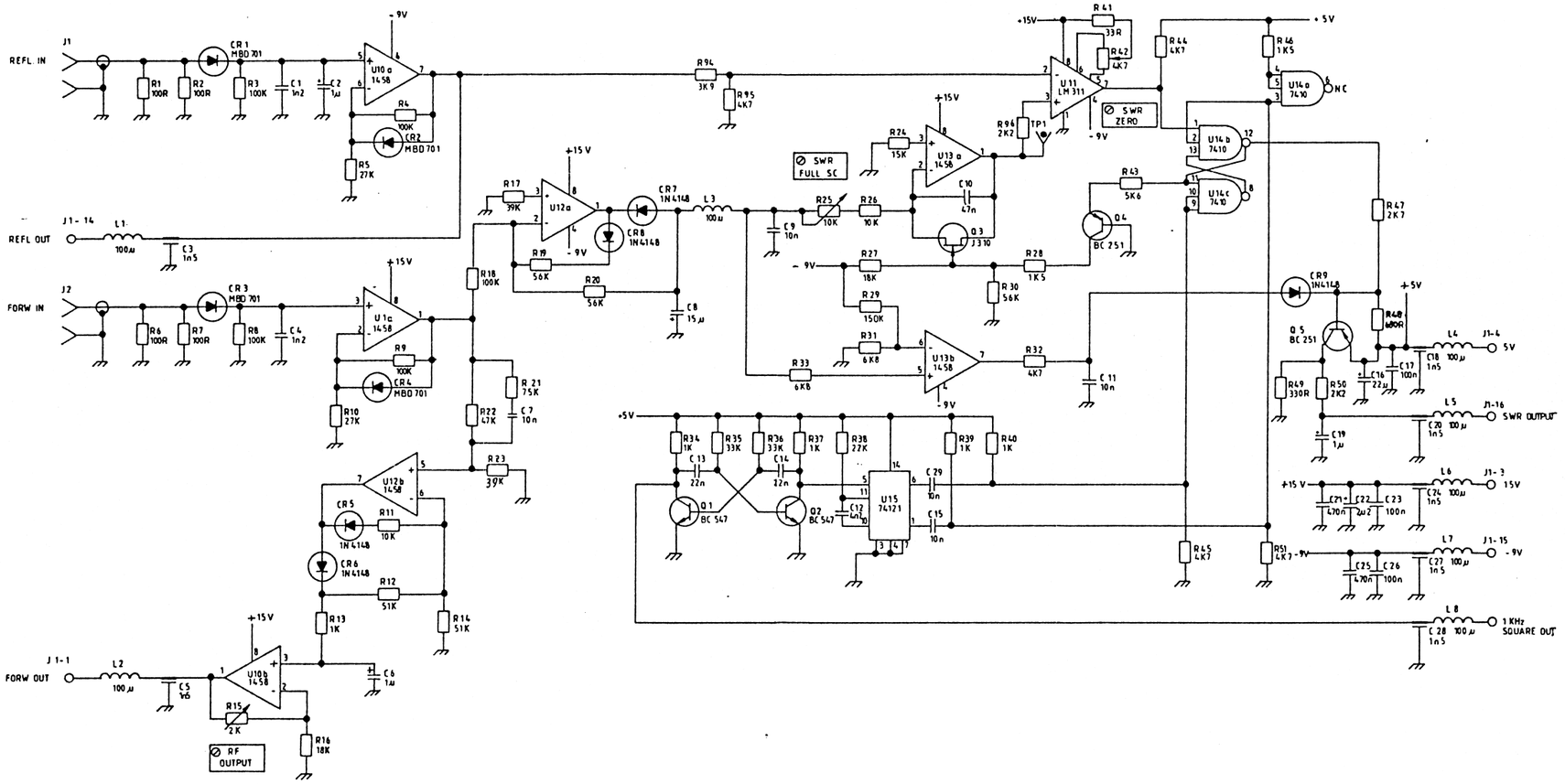
Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

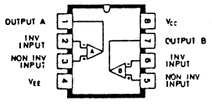
The capacitance units are indicated by means of the international prefixes p, n, and μ, (pF, nF, and μF).

The inductance units are indicated by means of the international prefixes μ, and m, (μH, and mH).

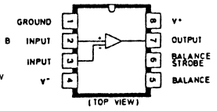


SWR COMPUTER AND ERROR LOGIC

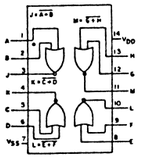
(Ref. Desig. 478865) Page 1 of 2



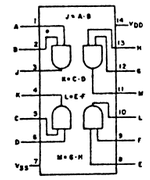
MC 1458



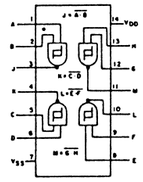
LM 311



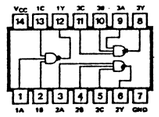
CD 4001



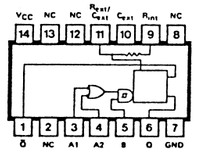
CD 4081



CD 4093



SN 7410 N



SN 74121 N

Note 1:

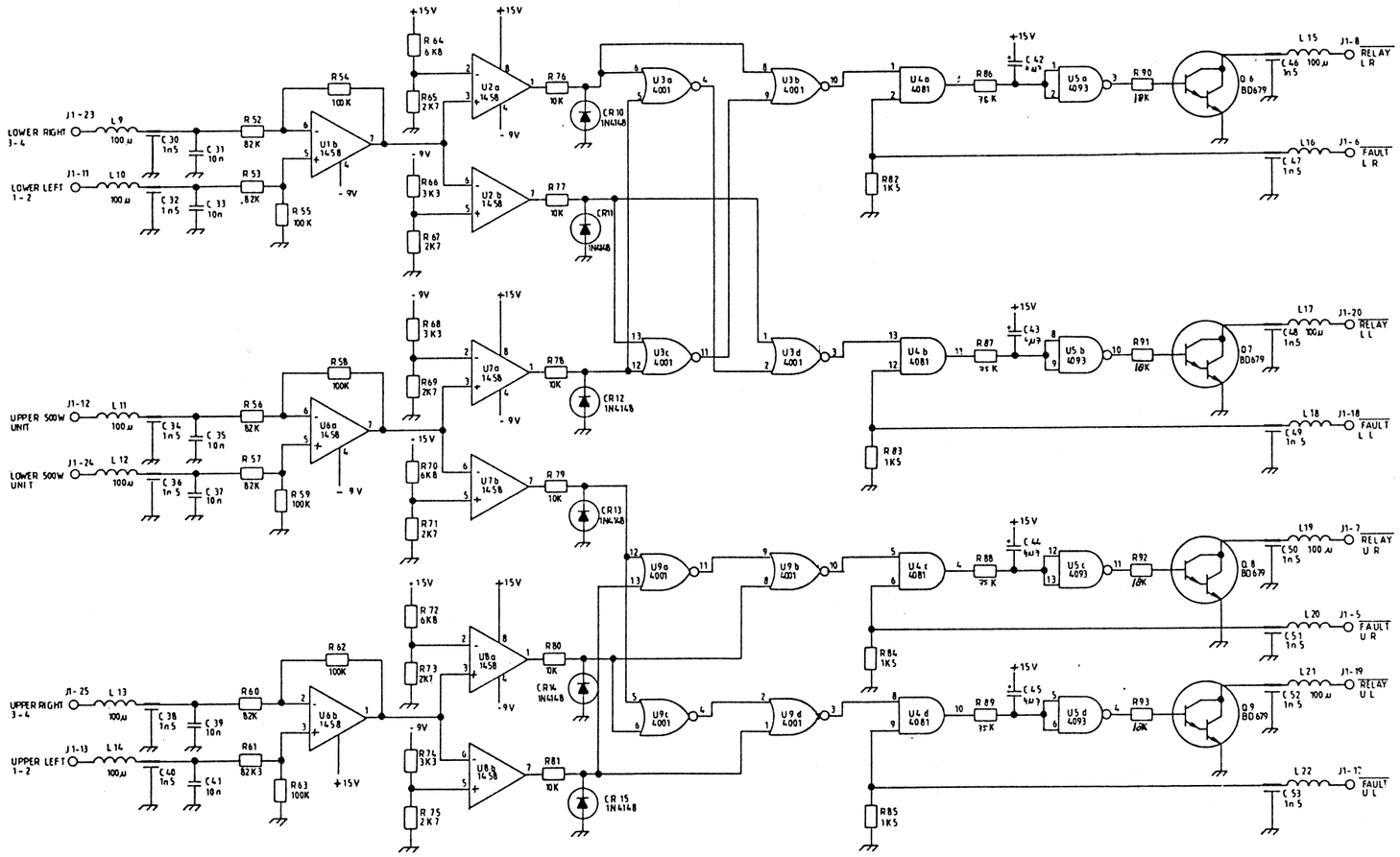
Partial Reference Designations are shown. For complete Designation prefix with Assembly and Subassembly Reference Designations (Circuit Diagram Nos.)

Note 2:

The code system used for indicating resistance values corresponds to that specified in IEC 62, with the exception that decimal fractions are used for values below 1Ω, e.g. 0,47 = 0,47Ω, but 4R7 = 4,7Ω.

The capacitance units are indicated by means of the international prefixes p, n, and µ, (pF, nF, and µF).

The inductance units are indicated by means of the international prefixes µ, and m, (µH, and mH).



SWR COMPUTER AND ERROR LOGIC

CONFIGURATION TU4013

The signal from the transmitter is used by the Detector Assembly A9 to measure the forward power, the reverse power, and the phase and modulus of the antenna impedance. This information is used, together with frequency information, by the Controller Assembly A8 to decide which tuning procedure and preset values to use.

The tuning elements are configured as an L-led with a lowpass characteristic.

The assemblies A1, A3, A4 and A5 form a narrowband tuner with two possible configurations, one being the capacitive element (A5) located at the transmitter input, the other being the capacitive element located at the antenna output.

The Dummy Load Assembly A2 serves as a test load during transmission and ATU selftest.

Assembly A6 and A7 are the broad band tuning elements used for compensation.

The Controller Assembly A8 performs the overall control of the antenna tuner and the data transmission between TU4013 and SE4010.

Typical tasks handled by the assembly:

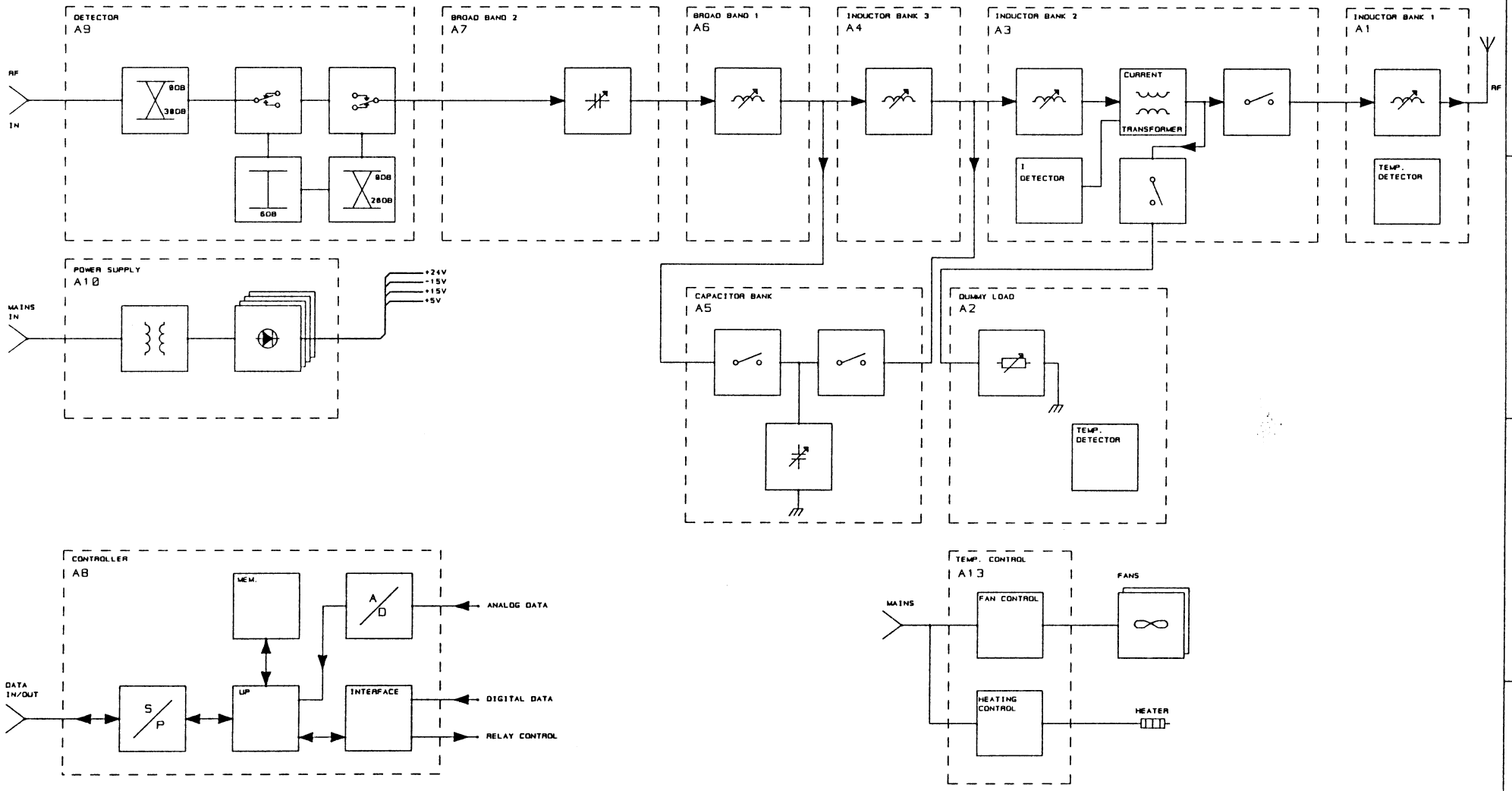
- Control of the individual assemblies.
- Calculations.
- Programmable memory set-ups.
- Data communication.
- Diagnostic routines.
- Adaptive tuning control.

Communication between the Controller Assembly and the remaining assemblies is conducted over two ribbon cabels. One cable contains the relay control lines, supervisory lines and supply for all assemblies except the Detector Assembly A9.
The other cable contains supply for the Controller Assembly and the Detector Assembly A9, as well as control and data lines between the the Controller and the Detector Assembly.

The Power Supply Assembly A10 supply the four voltages used by the assemblies in the tuner. The power supply can operate both on 115 and 220 Vac, single phase. Because of noise consideration the power supply is a linear type.

The Temperature Control Assembly A13 controls the blowers used for forced air circulation, activated at approximately 35^{o}C, and the heating elements, activated at approximately +10^{o}C, used under low temperature conditions.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
	A		928429	GuS



		UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN MILLIMETERS AND TOLERANCED ARE IN ACCORDANCE WITH DS 2870	1	DANSK RADIO AS	dra
			A		
		ANGLES	DR. GuS 928429	TITLE	
		LIN. DIM.	CH.	CONFIGURATION	
			AP.	ANTENNA TUNER	
		MATERIAL	AP.		
	TU4813		FIRST ANGLE PROJECTION	SIZE D2	CODE IDENT
NEXT ASSY	USED ON			SCALE	DRAWING NO. 210981-EB
APPLICATION					SHEET 1 OF 1

DUMMY LOAD A2/TU4013

Assy 210453-001
The Dummy Load consists of three resistors in series with a combined value of 49 ohms.

When the control lines **7R, 14R** and **28R** are high the relay K5 is automatically energized and the series combination of the three resistors is grounded forming a dummy load with a value of 49ohms.

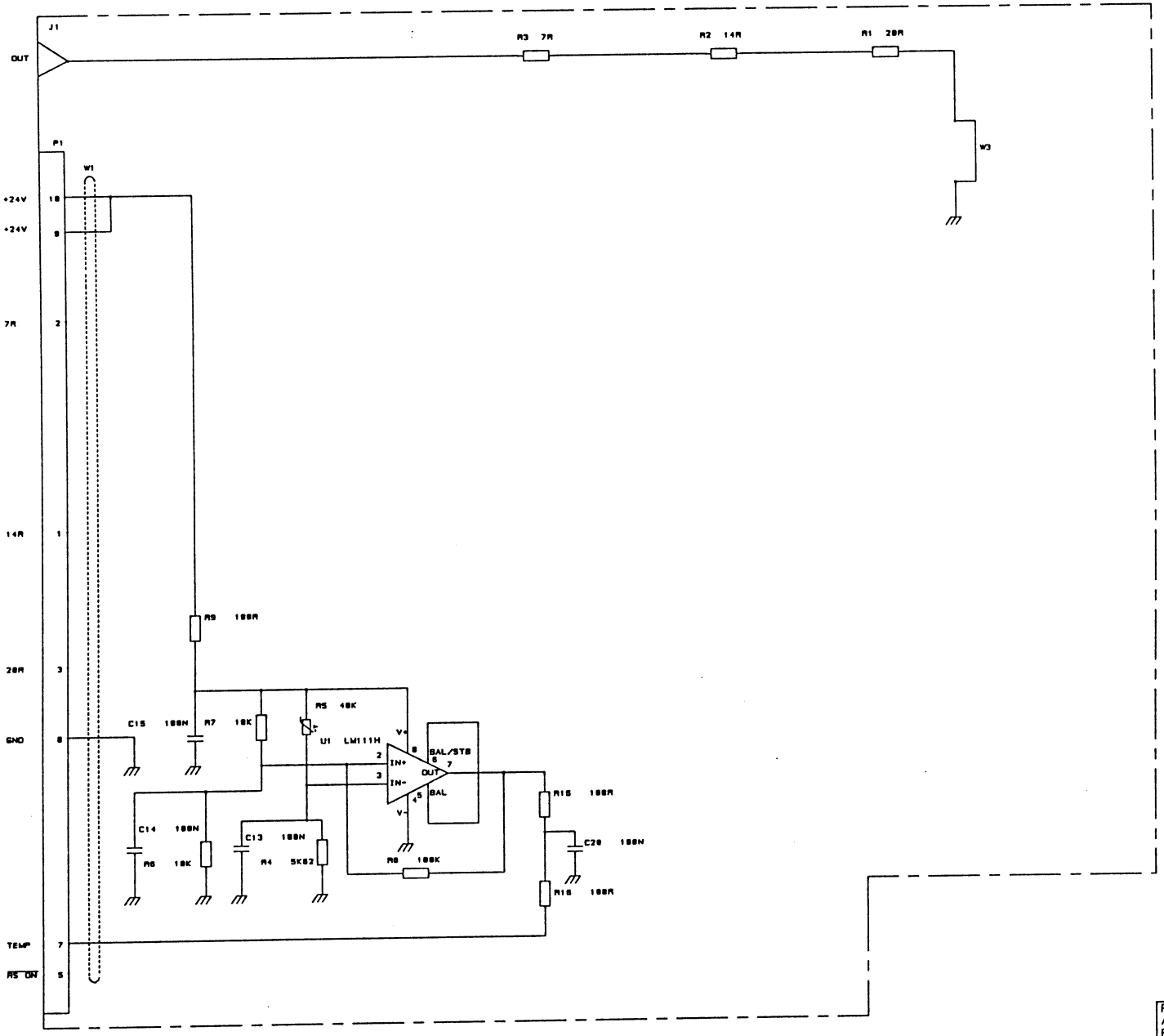
When the control line **RS ON** is activated, thereby energizing K4, the resistors are used to lower the Q of the antenna during broad band operation, by inserting the resistors in series with the tuning elements. During the broad band tuning a maximum of two resistors are available to avoid energizing the relay K5.

The Dummy Load is temperature-protected by a temperature measuring device R5. The circuit around U1 forms a comparator supervised by the Controller. The attack level of the protection is a temperature of 100°C and a decay temperature of approximately 80°C.

Assy 210453-002
The Dummy Load consists of three resistors in series with a combined value of 49 ohms grounded by the jumper W3.

The Dummy Load is temperature-protected by a temperature measuring device R5. The circuit around U1 forms a comparator supervised by the Controller. The attack level of the protection is a temperature of 100°C and a decay temperature of approximately 80°C.

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVAL
	E		928581	GuS



-881	SHEET 1
-882	SHEET 2

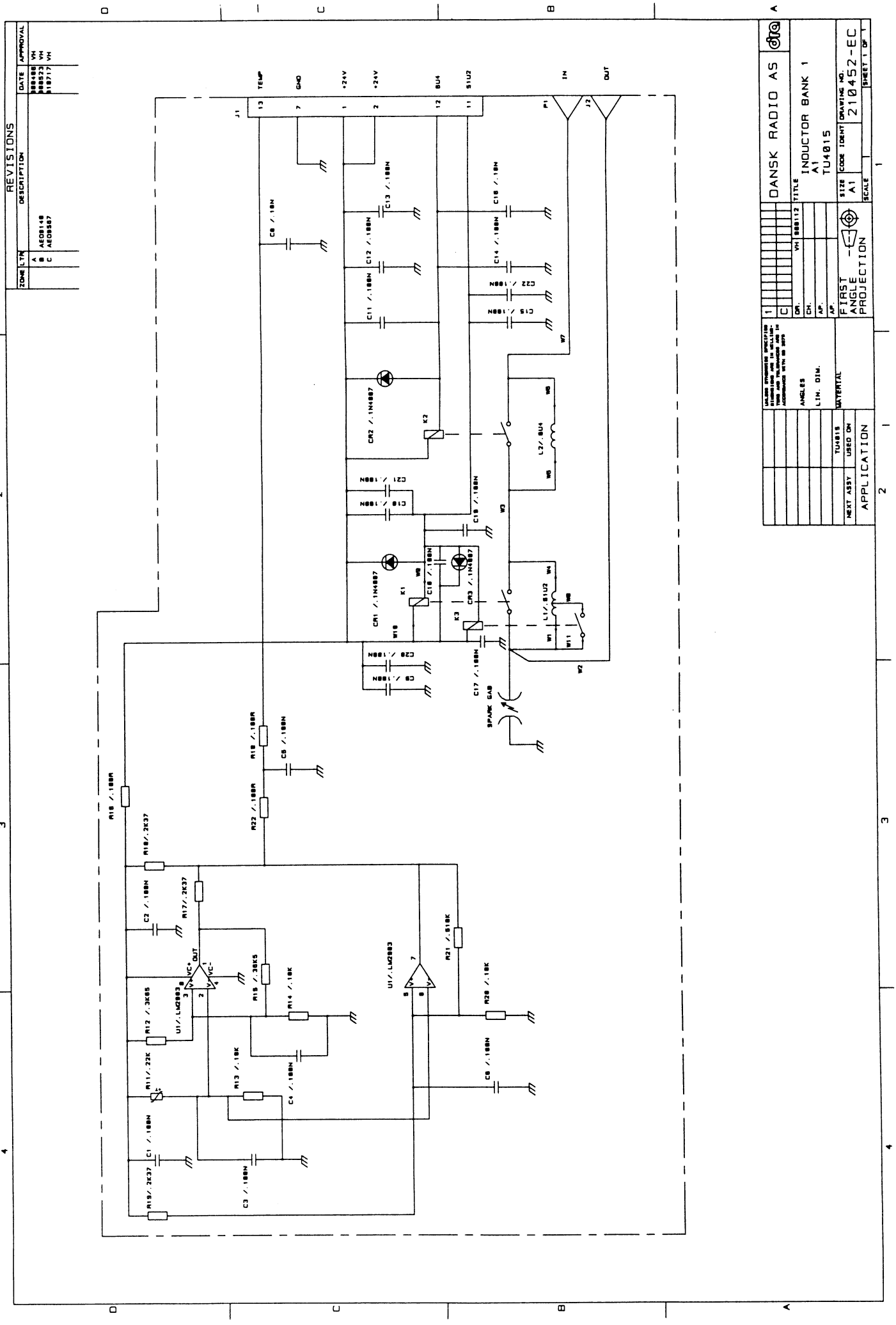
FIRST ANGLE PROJECTION	SIZE D2	CODE IDENT	DRAWING NO. 210453-EC
	SCALE		SHEET 2

INDUCTOR BANK 1 A1/TU4013

The two inductors in Inductor Bank 1 are activated by a high level on the control input on J1.

To protect the tuner from high voltages a spark gab is located close to the antenna outlet.

A dual temperature measuring circuit, supervised by the controller, is located on the Inductor Bank 1. Both measuring devices are formed as comparators. One of the temperature measuring circuits, U1a, has an attack temperature of 70°C and hysteresis of 10°C. The output is tied together with the output from the second temperature measuring device, U1b, through a resistor R17. The second temperature measuring device has an attack level of 80°C.


REVISIONS
ZONE LTR DESCRIPTION DATE APPROVAL
A AE08148 880408 VH
B AE08587 880523 VH
C 910717 VH
DANSK RADIO AS
TITLE INDUCTOR BANK 1
A1
TU4015
SIZE A1 CODE IDENT DRAWING NO. 210452-EC
SCALE SHEET 1 OF 1
FIRST ANGLE PROJECTION
APPLICATION
NEXT ASSY TU4015 USED ON
MATERIAL
ANGLES
LIN. DIM.
TEMP GND +24V +24V BU4 S1U2
J1
P1 IN
J2 OUT
SPARK GAB
U1/.LM2903
U1/.LM2903

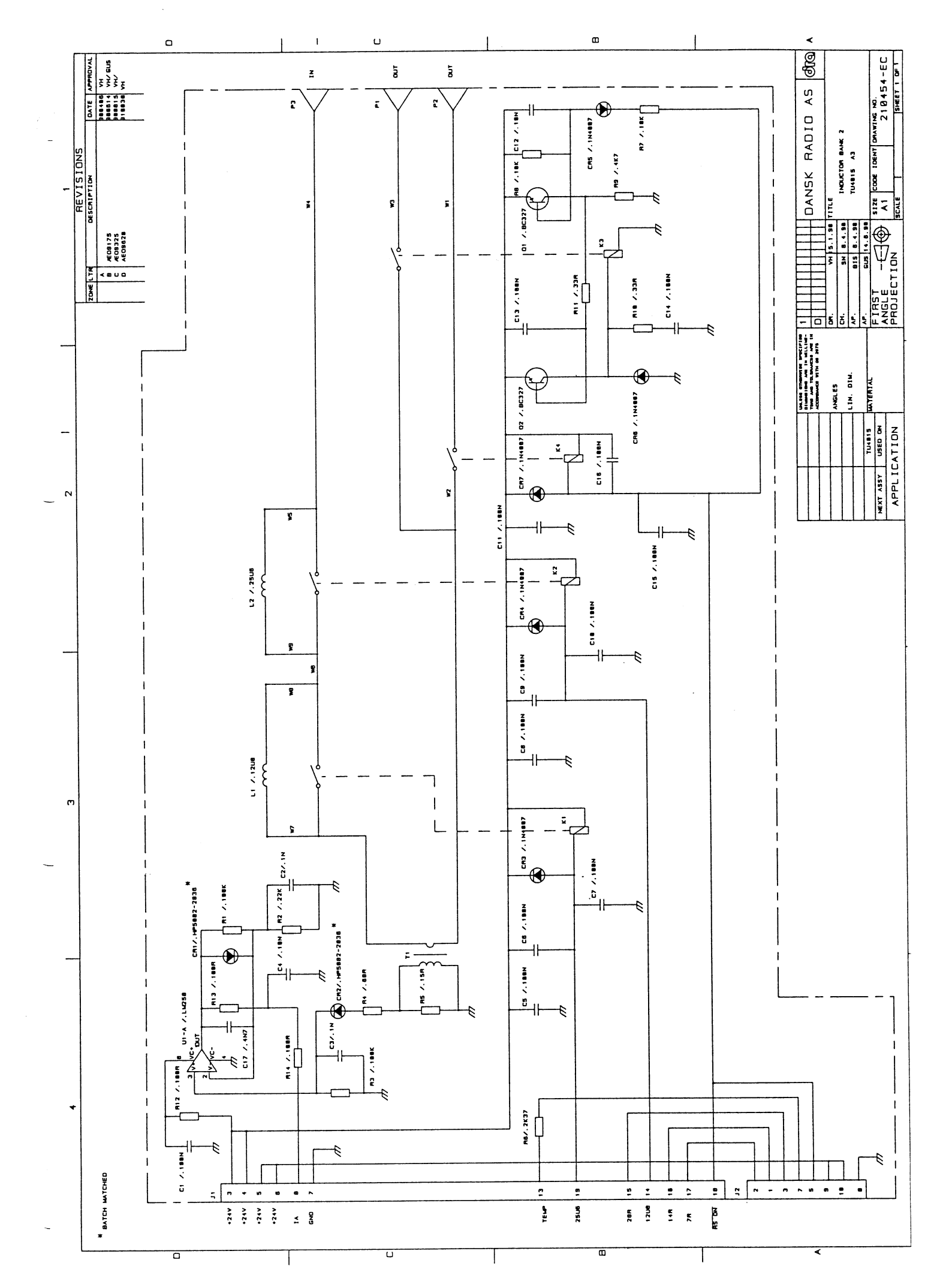
INDUCTOR BANK 2 A3/TU4013

The Inductor Bank 2 consists of two inductors and a current transformer. The inductors are controlled by K1 and K2, the inductors being active when a high level is present at the control input on J1.

The current transformer, T1, is used to measure the current in the inductors and thereby the antenna current. The current in the transformer is converted to a voltage by R5 and the rectified (by CR2) voltage is buffered by U1 giving an output voltage of +10 Vdc with a RF-current of 14 Arms.

The Inductor Bank has two outputs, one for interconnection to Inductor Bank 1 (through K3) and one for interconnection to the Dummy Load (through K4). The energizing of K3 is done with a high level on the control terminal **RS ON**. A low level on the control terminal energizes K4 and turns on Q1, thereby turning Q2 off, de-energizing K3.

The control signals for the Dummy Load A2 are routed through the Inductor Bank 2.



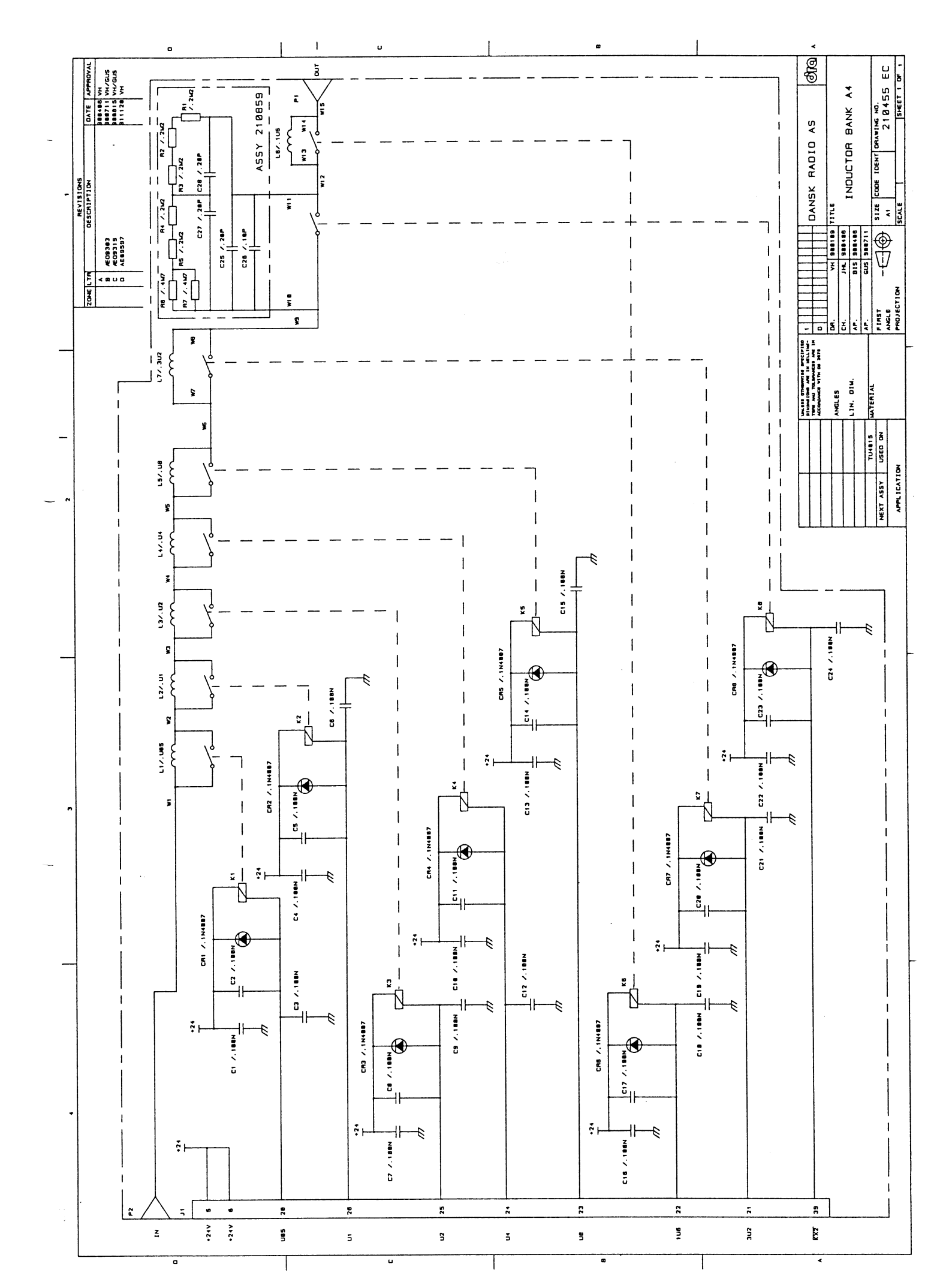
Service Sheet A3

INDUCTOR BANK 3 A4/TU4013

The Inductor Bank 3 consists of seven inductors and one capacitor (formed by 3 capacitors in parallel, namely C25-26-27). The inductors are controlled by the relays K1 through K7, while the capacitor (used for compensation of residual induction) is controlled by K8.

Both the inductors and the capacitor are active when a high level is present on the control pins on J1.

Parallel with the capacitors, C25-C26-C27, two resistors are located. These resistors are used as DC-pass for the static discharge of the tuner.

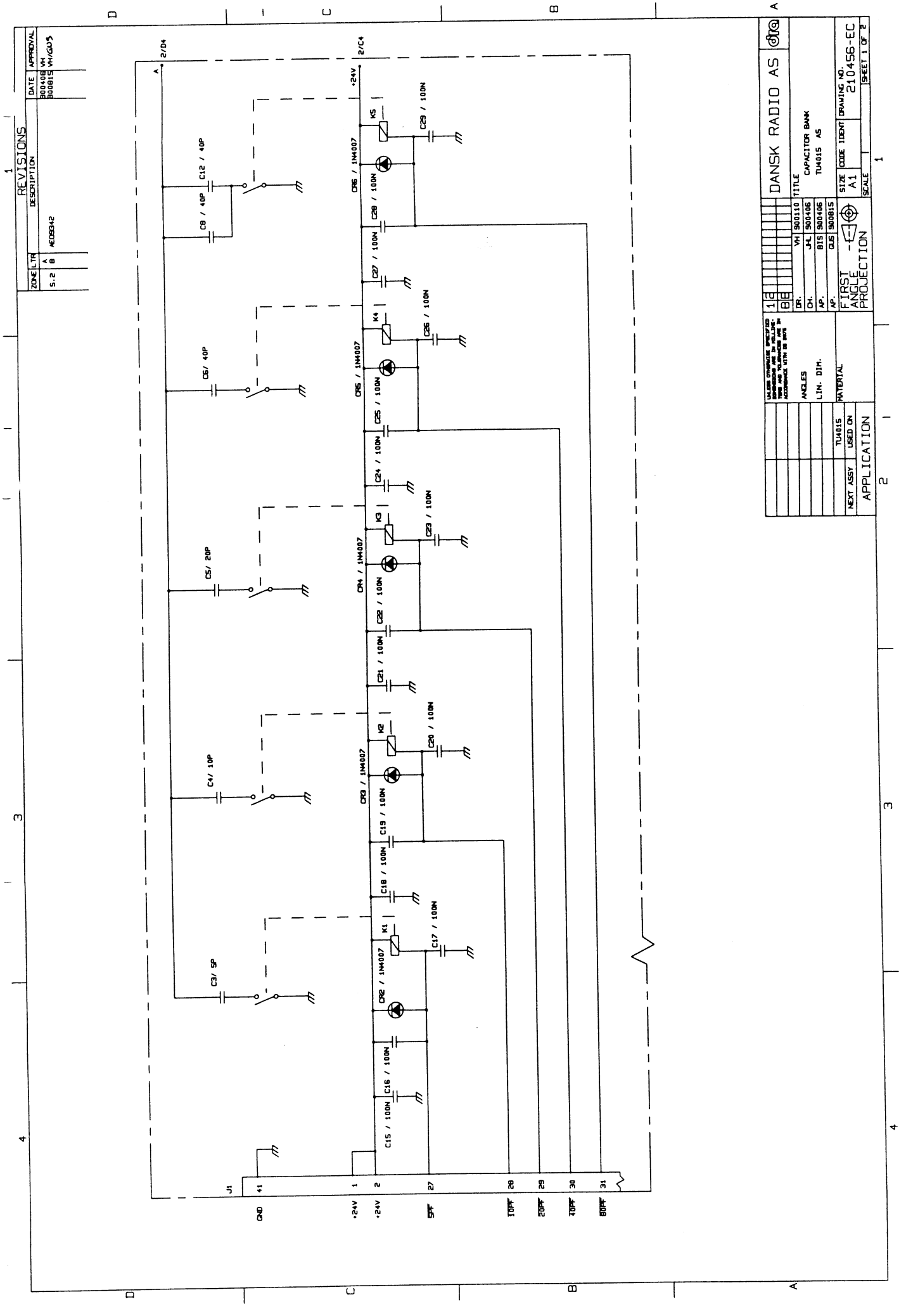


Service sheet A4

CAPACITOR BANK (1) A5/TU4013

The Capacitor Bank consists of 22 high power capacitors forming binary weighted sequence of 11 bits (the highest value consists of two capacitors, C13-C14, in parallel) with a minimum resolution of 5 pF.

The capacitors are controlled through the relays K1 through K12, each relay is energized by a low level on the control pin on J1.



Service Sheet A5

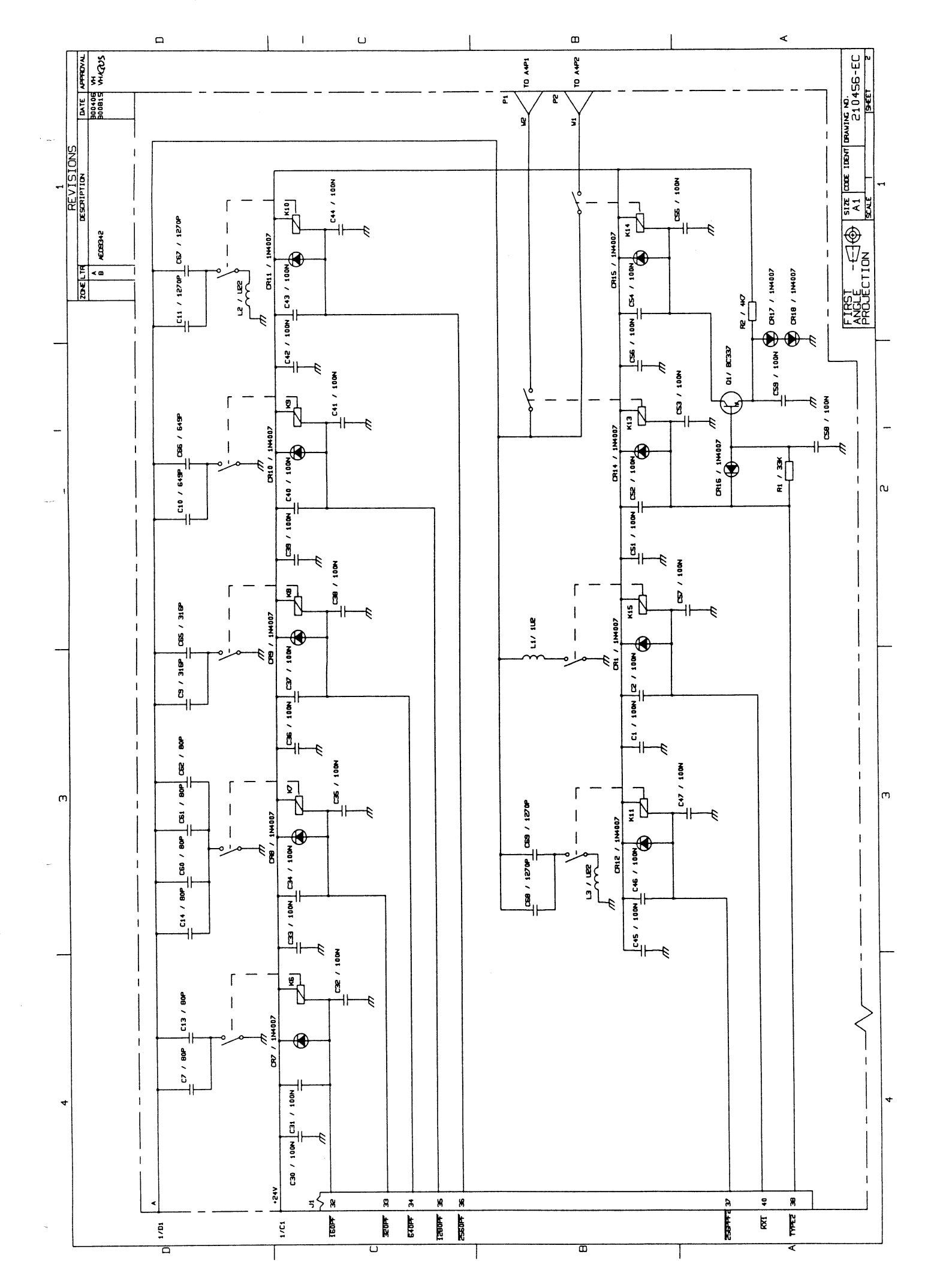
CAPACITOR BANK (2) A5/TU4013

The inductor, L1, is used to compensate for the stray capacitance in the circuit.

The Capacitor Bank has two outputs, each output defining the configuration of the tuner.

When the tuner is in the Type 1 mode the output from the capacitor is P2 through K14.

When the tuner is in the Type 2 mode Q1 is cut off, thereby de-energizing K14 while the output is P1 through K13.



Service Sheet A5

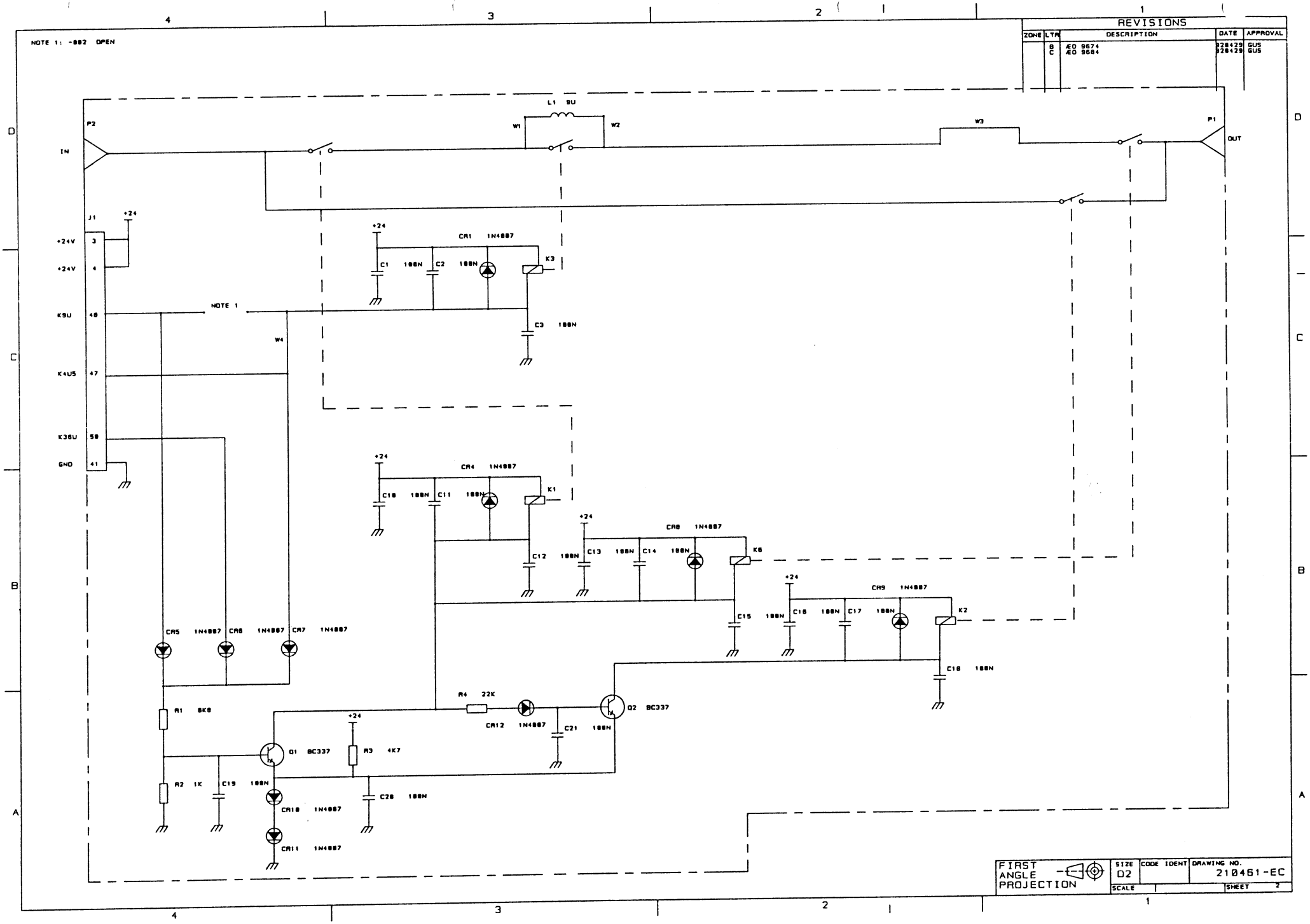
BROADBAND 1 A6/TU4013

Assy 210461-001
The three inductors (L1-L2-L3) are controlled through the relays K3-K4-K5. The inductors are active when a high level is present at one of the control inputs on J1.

To ensure a low residual inductance when none of the inductors are active three more relays are used, one for bypassing and two for disconnection. When no inductors are active relay K2 is active through Q2, thereby bypassing the inductors. If one or more of the inductors are activated the collector of Q1 goes low, thereby energizing K1 and K6 and turning off Q2, thereby de-energizing K2.

Assy 210461-002
The inductor, L2, is controlled through the relay K3. The inductor is active when a high level is present at the control input on J1.

To ensure a low residual inductance when none of the inductors are active three more relays are used, one for bypassing and two for disconnection. When the inductors are non-active, relay K2 is active through Q2, thereby bypassing the inductors. If the inductors are activated the collector of Q1 goes low, thereby energizing K1 and K6 and turning off Q2 and thereby de-energizing K2.


NOTE 1: -882 OPEN
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVAL
B ÆO 9674 926429 GUS
C ÆO 9684 926429 GUS
L1 9U
W1
W2
W3
W4
P1
P2
IN
OUT
J1
+24V 3
+24V 4
K9U 48
K4U5 47
K36U 58
GND 41
NOTE 1
+24
CR1 1N4887
C1 100N
C2 100N
K3
C3 100N
CR4 1N4887
C10 100N
C11 100N
K1
C12 100N
CR8 1N4887
C13 100N
C14 100N
K6
C15 100N
CR9 1N4887
C16 100N
C17 100N
K2
C18 100N
CR5 1N4887
CR6 1N4887
CR7 1N4887
R1 8K8
R2 1K
C19 100N
Q1 BC337
R3 4K7
CR10 1N4887
CR11 1N4887
C20 100N
R4 22K
CR12 1N4887
C21 100N
Q2 BC337
FIRST ANGLE PROJECTION
SIZE D2
CODE IDENT
DRAWING NO. 210461-EC
SCALE
SHEET 2

BROADBAND 2 A7/TU4013

Assy 210462-001
The inductor (L1) and the capacitors (C22 through C27) are controlled by the relays K1 through K6.

K7 is used to bypass the capacitors.

The inductor is active when a high level is present at the control pin while the rest of the functions are active when a low level is present.

All capacitors with a value of 10 nF are used to decouple the control lines before entering the Controller.

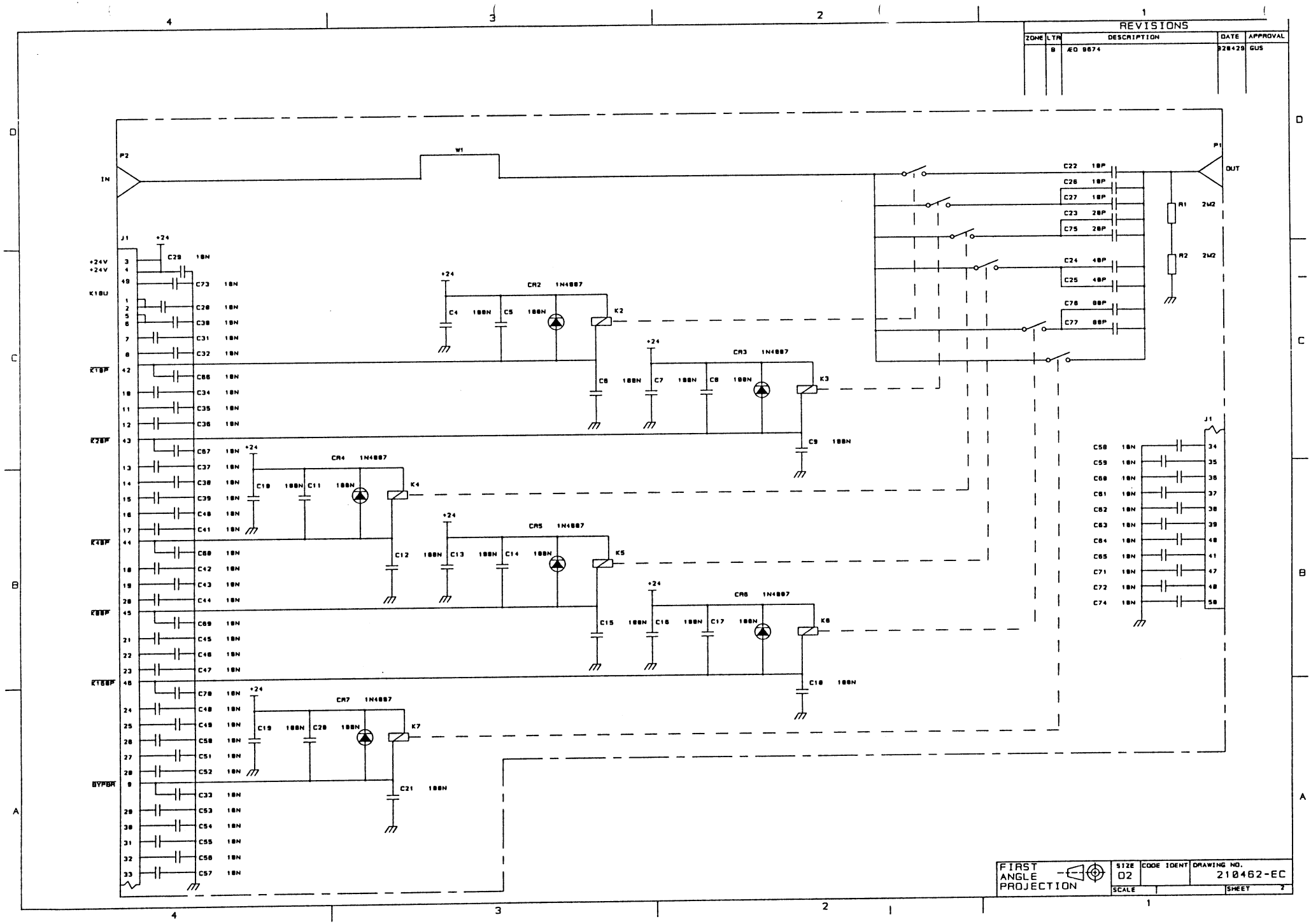
The two resistors, R1-R2, function as static discharge for the tuner.

Assy 210462-002
The capacitors (C22 through C27) are controlled by the relays K2 through K6.

K7 is used to bypass the capacitors.

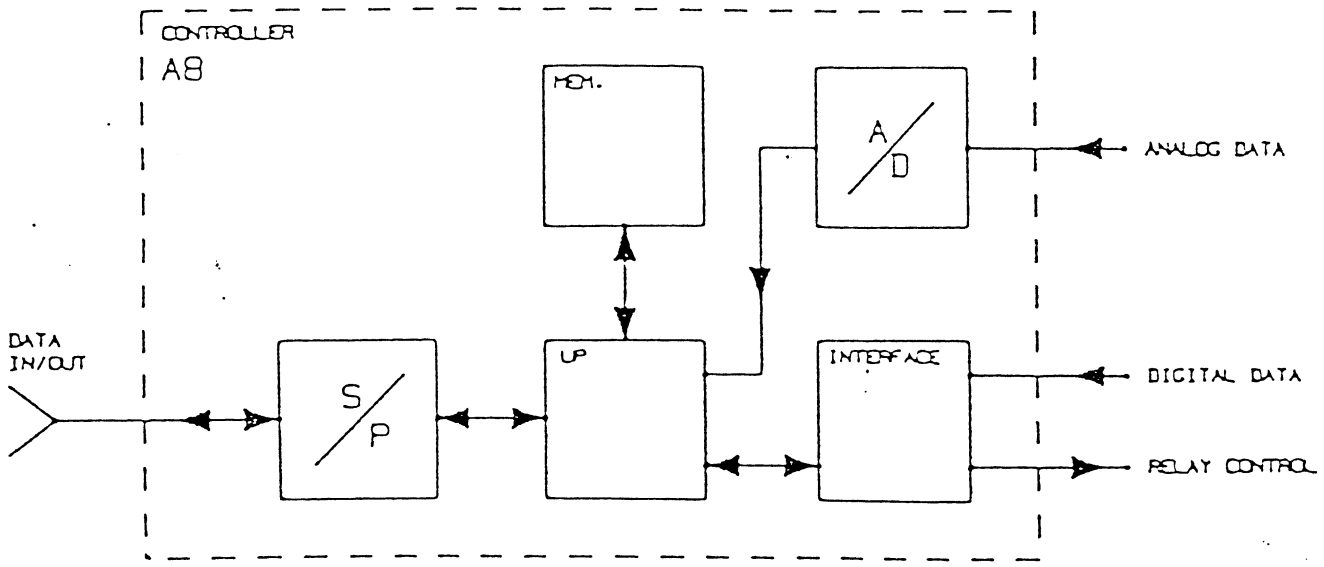
All capacitors with a value of 10 nF are used to decouple the control lines before entering the Controller.

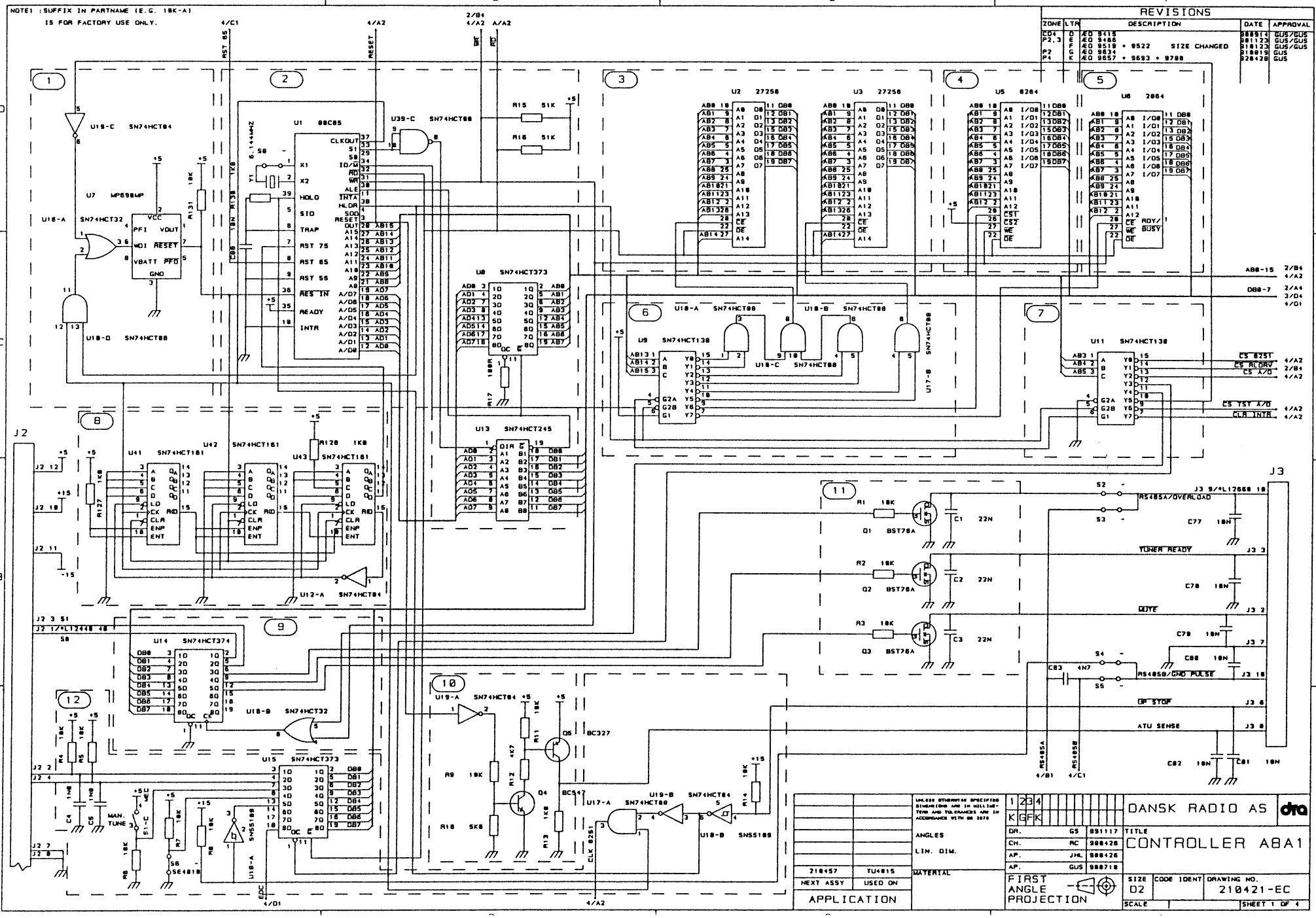
The two resistors, R1-R2, function as static discharge for the tuner.

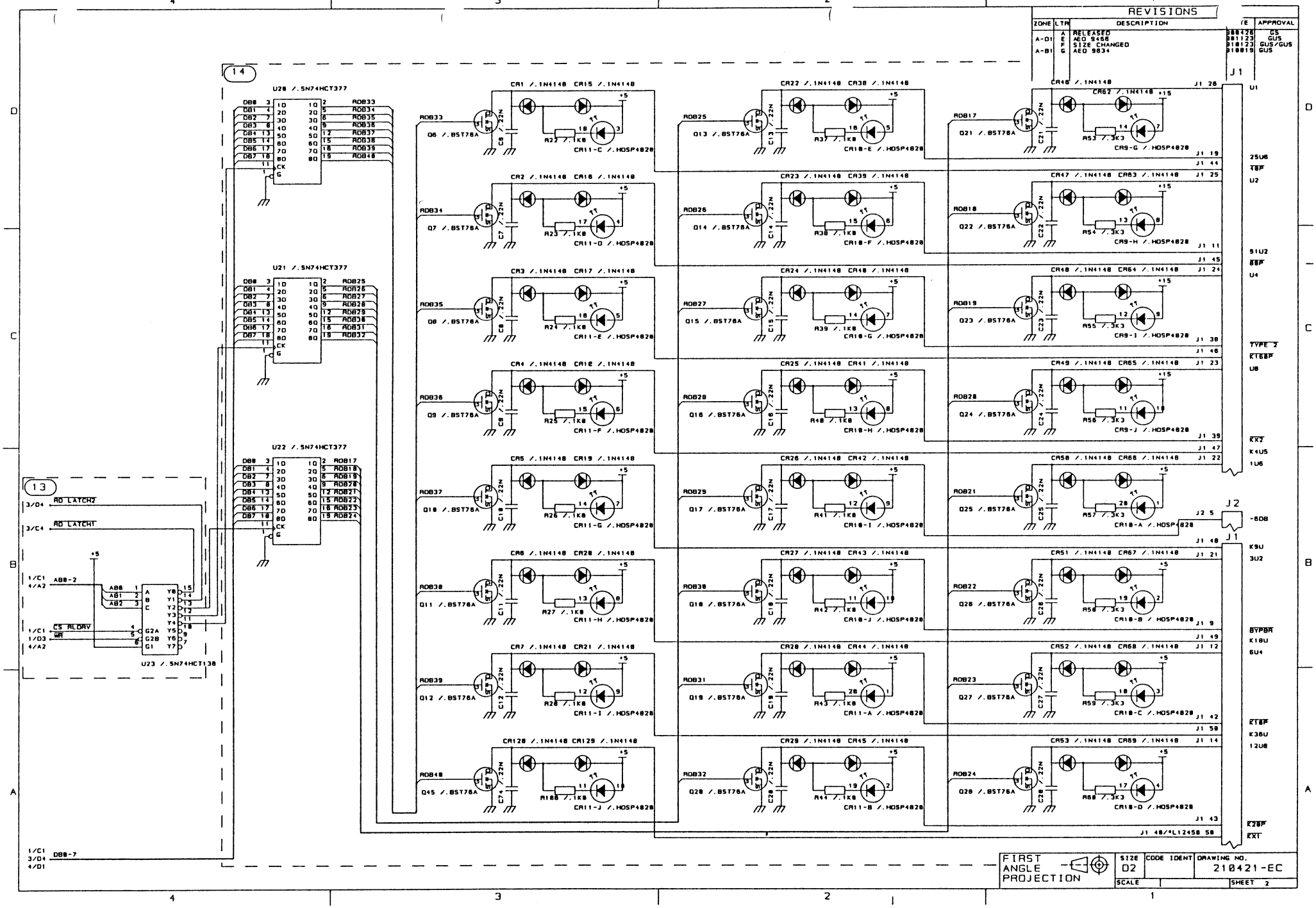

REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
B | ÆO 9674 | 328429 | GUS
P2
IN
W1
P1
OUT
J1
+24
+24V
+24V
K1BU
K1BF
K2BF
K4BF
K8BF
K16BF
BYPBR
C29 18N
C73 18N
C26 18N
C30 18N
C31 18N
C32 18N
C66 18N
C34 18N
C35 18N
C36 18N
C67 18N
C37 18N
C38 18N
C39 18N
C40 18N
C41 18N
C68 18N
C42 18N
C43 18N
C44 18N
C69 18N
C45 18N
C46 18N
C47 18N
C70 18N
C48 18N
C49 18N
C50 18N
C51 18N
C52 18N
C33 18N
C53 18N
C54 18N
C55 18N
C56 18N
C57 18N
CR2 1N4007
CR3 1N4007
CR4 1N4007
CR5 1N4007
CR6 1N4007
CR7 1N4007
K2
K3
K4
K5
K6
K7
C4 18N
C5 18N
C6 18N
C7 18N
C8 18N
C9 18N
C10 18N
C11 18N
C12 18N
C13 18N
C14 18N
C15 18N
C16 18N
C17 18N
C18 18N
C19 18N
C20 18N
C21 18N
C22 18P
C26 18P
C27 18P
C23 28P
C75 28P
C24 48P
C25 48P
C76 88P
C77 88P
R1 2M2
R2 2M2
C58 18N
C59 18N
C60 18N
C61 18N
C62 18N
C63 18N
C64 18N
C65 18N
C71 18N
C72 18N
C74 18N
FIRST ANGLE PROJECTION
SIZE 02
CODE IDENT
DRAWING NO. 210462-EC
SCALE 1
SHEET 2

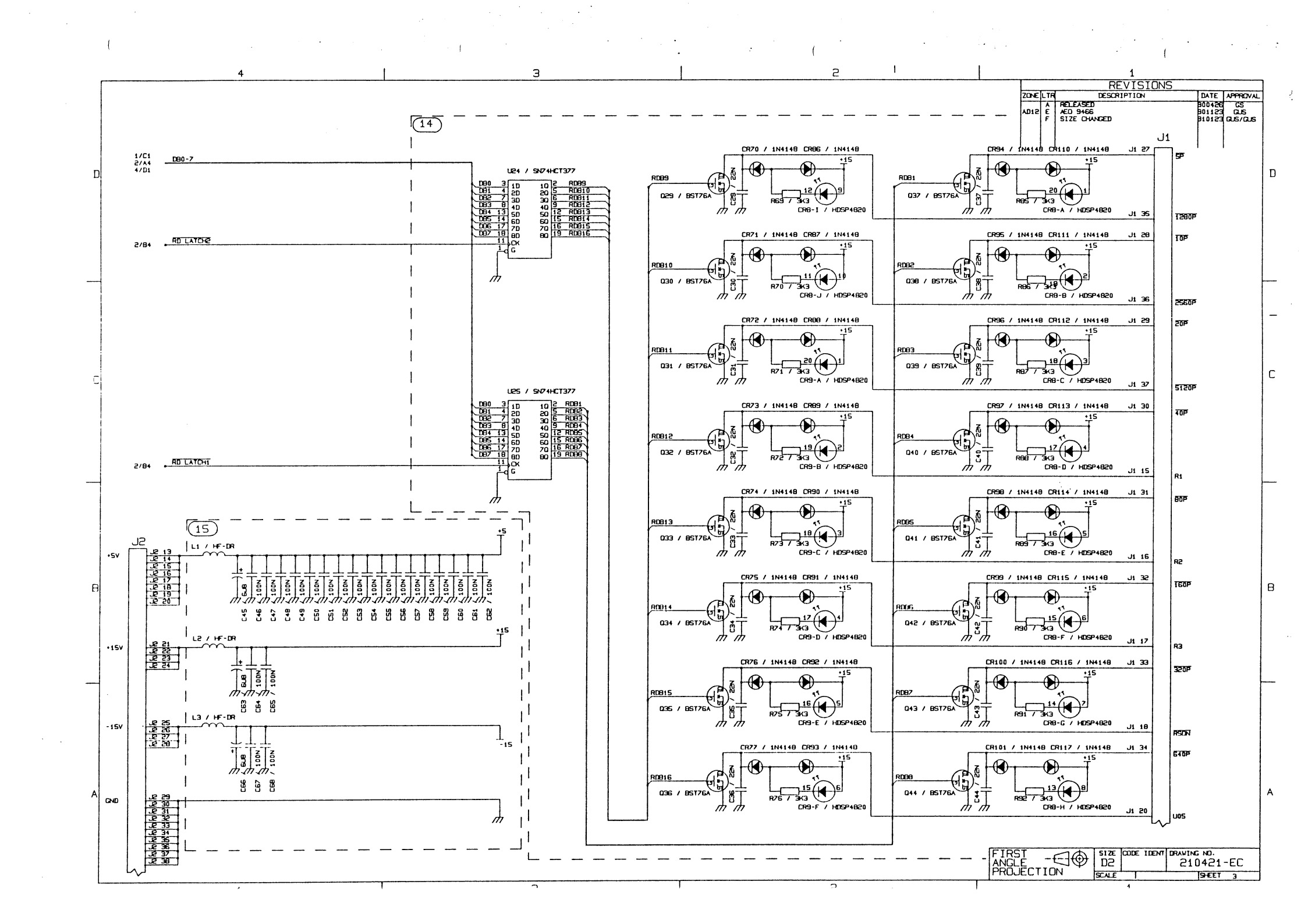
MICROPROCESSOR MODULE A8/TU4013

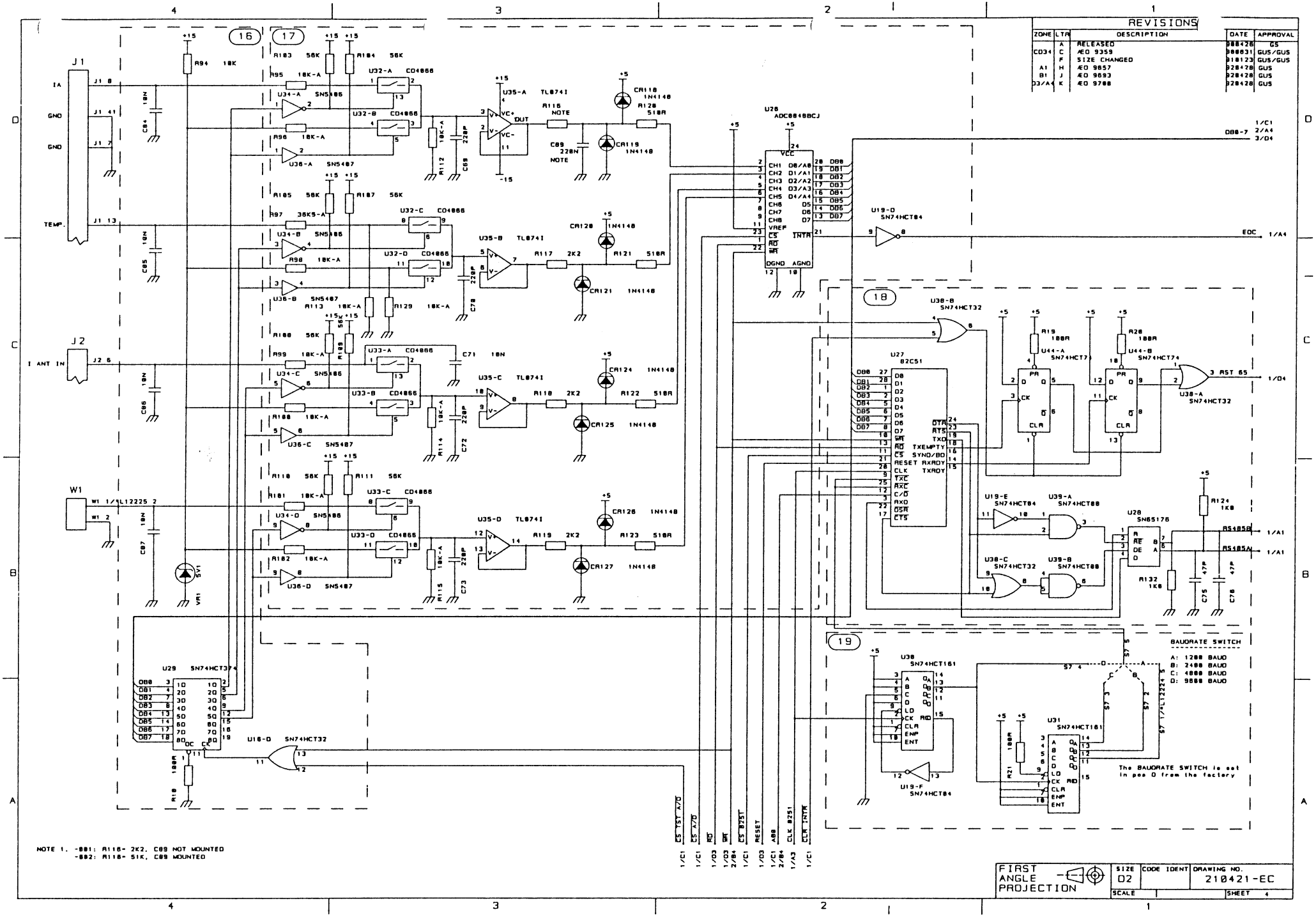
The functional block diagram is shown below:



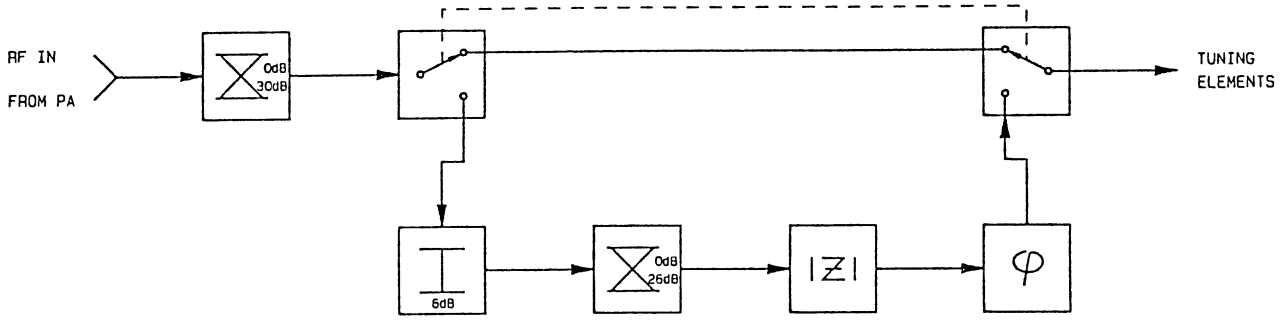

NOTE1 :SUFFIX IN PARTNAME (E.G. 18K-A1)
IS FOR FACTORY USE ONLY.
REVISIONS
ZONE LTR DESCRIPTION DATE APPROVAL
CD4 D Æ0 9418 880914 GUS/GUS
P2,3 E Æ0 9466 881123 GUS/GUS
Æ0 9519 + 9522 SIZE CHANGED 910123 GUS/GUS
P2 G Æ0 9634 910819 GUS
P4 K Æ0 9657 + 9693 + 9788 920428 GUS
U1 80C85
U2 27256
U3 27256
U5 8284
U6 2864
U7 MP698MP
U8 SN74HCT373
U9 SN74HCT138
U11 SN74HCT138
U12-A SN74HCT04
U13 SN74HCT245
U14 SN74HCT374
U15 SN74HCT373
U17-A SN74HCT08
U17-B SN74HCT08
U18-A SN74HCT32
U18-B SN74HCT32
U18-C SN74HCT08
U18-D SN74HCT08
U19-A SN74HCT04
U19-C SN74HCT04
U39-C SN74HCT08
U41 SN74HCT161
U42 SN74HCT161
U43 SN74HCT181
Q1 BST76A
Q2 BST76A
Q3 BST76A
Q4 BC547
Q5 BC327
J2
J3
TUNER READY
MUTE
OP STOP
ATU SENSE
RS485A/OVERLOAD
RS485B/GND PULSE
MAN. TUNE
APPLICATION
DANSK RADIO AS
CONTROLLER A8A1
DR. GS 891117
CH. RC 900428
AP. JHL 900426
AP. GUS 900718
FIRST ANGLE PROJECTION
SIZE D2
CODE IDENT
DRAWING NO. 210421-EC
SCALE
SHEET 1 OF 4


REVISIONS
ZONE LTR DESCRIPTION DATE APPROVAL
A RELEASED 880428 GS
E AEO 9466 881123 GUS
F SIZE CHANGED 910123 GUS/GUS
G AEO 9834 910819 GUS
U28 /.SN74HCT377
U21 /.SN74HCT377
U22 /.SN74HCT377
U23 /.SN74HCT138
RD LATCH2
RD LATCH1
CS RLDRV
DB8-7
J1
J2
FIRST ANGLE PROJECTION
SIZE D2
CODE IDENT
DRAWING NO. 210421-EC
SCALE
SHEET 2

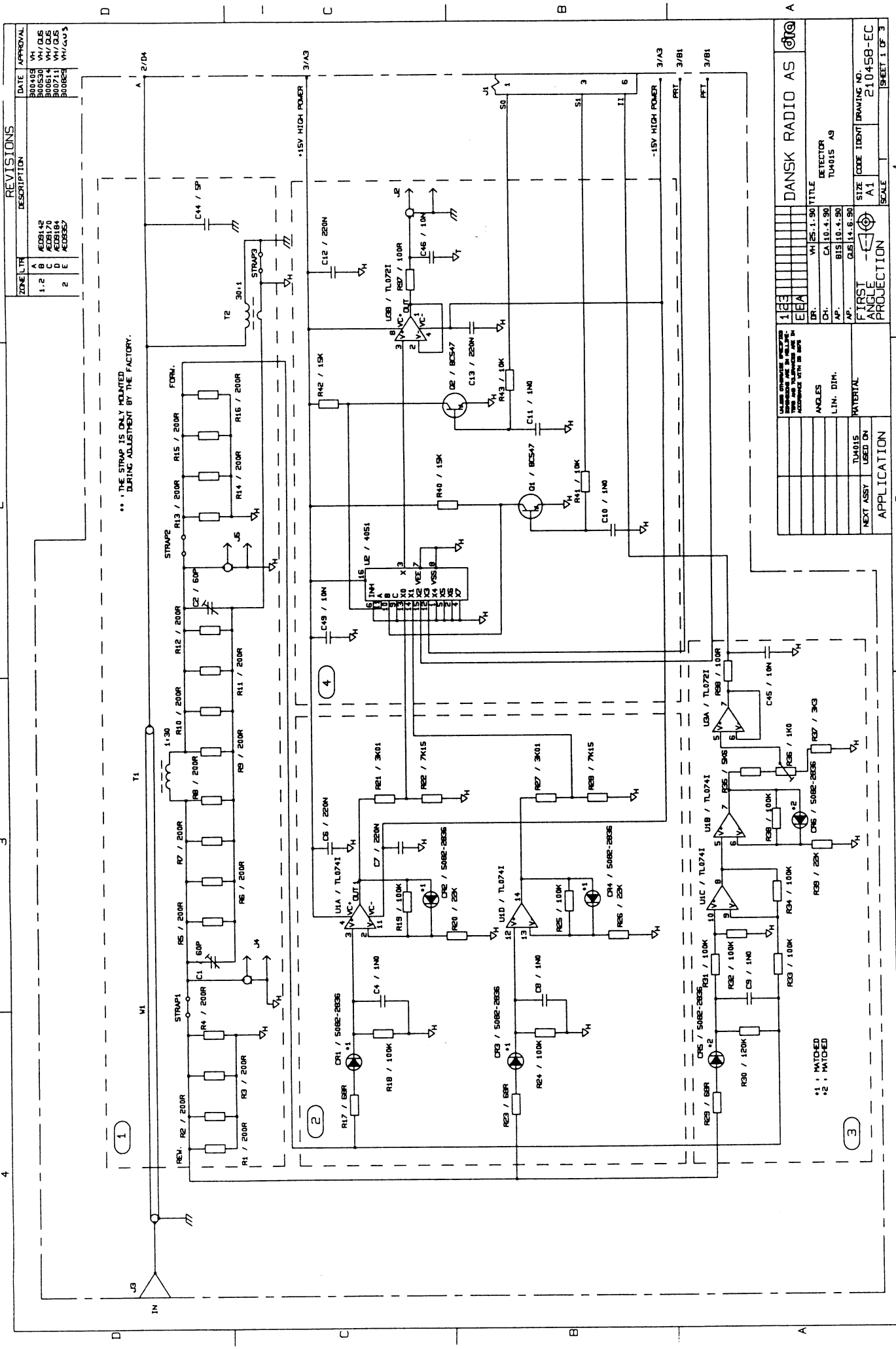

REVISIONS
ZONE LTR DESCRIPTION DATE APPROVAL
AD12 A RELEASED 900426 GS
E AEO 9466 901123 GUS
F SIZE CHANGED 910123 GUS/GUS
14
15
1/C1
2/A4
4/D1
DB0-7
2/B4
RD LATCH2
2/B4
RD LATCH1
U24 / SN74HCT377
U25 / SN74HCT377
J2
L1 / HF-DR
L2 / HF-DR
L3 / HF-DR
+5V
+15V
-15V
GND
J1
CR70 / 1N4148 CR86 / 1N4148
CR71 / 1N4148 CR87 / 1N4148
CR72 / 1N4148 CR88 / 1N4148
CR73 / 1N4148 CR89 / 1N4148
CR74 / 1N4148 CR90 / 1N4148
CR75 / 1N4148 CR91 / 1N4148
CR76 / 1N4148 CR92 / 1N4148
CR77 / 1N4148 CR93 / 1N4148
CR94 / 1N4148 CR110 / 1N4148
CR95 / 1N4148 CR111 / 1N4148
CR96 / 1N4148 CR112 / 1N4148
CR97 / 1N4148 CR113 / 1N4148
CR98 / 1N4148 CR114 / 1N4148
CR99 / 1N4148 CR115 / 1N4148
CR100 / 1N4148 CR116 / 1N4148
CR101 / 1N4148 CR117 / 1N4148
FIRST ANGLE PROJECTION
SIZE D2
CODE IDENT
DRAWING NO. 210421-EC
SCALE
SHEET 3


REVISIONS
ZONE | LTR | DESCRIPTION | DATE | APPROVAL
A | RELEASED | 880428 | GS
C034 | C | ÆO 9359 | 880831 | GUS/GUS
F | SIZE CHANGED | 910123 | GUS/GUS
A1 | H | ÆO 9657 | 920428 | GUS
B1 | J | ÆO 9693 | 920428 | GUS
D3/A4 | K | ÆO 9708 | 920428 | GUS
J1
J2
W1
U26 ADC0848BCJ
U27 82C51
U28 SN65176
U29 SN74HCT374
U30 SN74HCT161
U31 SN74HCT161
U32-A CD4066
U32-B CD4066
U32-C CD4066
U32-D CD4066
U33-A CD4066
U33-B CD4066
U33-C CD4066
U33-D CD4066
U34-A SN5486
U34-B SN5486
U34-C SN5486
U34-D SN5486
U35-A TL8741
U35-B TL8741
U35-C TL8741
U35-D TL8741
U36-A SN5407
U36-B SN5407
U36-C SN5407
U36-D SN5407
U38-A SN74HCT32
U38-B SN74HCT32
U38-C SN74HCT32
U38-D SN74HCT32
U39-A SN74HCT08
U39-B SN74HCT08
U44-A SN74HCT74
U44-B SN74HCT74
U19-D SN74HCT04
U19-E SN74HCT04
U19-F SN74HCT04
BAUDRATE SWITCH
A: 1200 BAUD
B: 2400 BAUD
C: 4800 BAUD
D: 9600 BAUD
The BAUDRATE SWITCH is set in pos D from the factory
NOTE 1. -001: R116- 2K2, C69 NOT MOUNTED
-002: R116- 51K, C69 MOUNTED
FIRST ANGLE PROJECTION
SIZE 02
CODE IDENT
DRAWING NO. 210421-EC
SCALE
SHEET 4

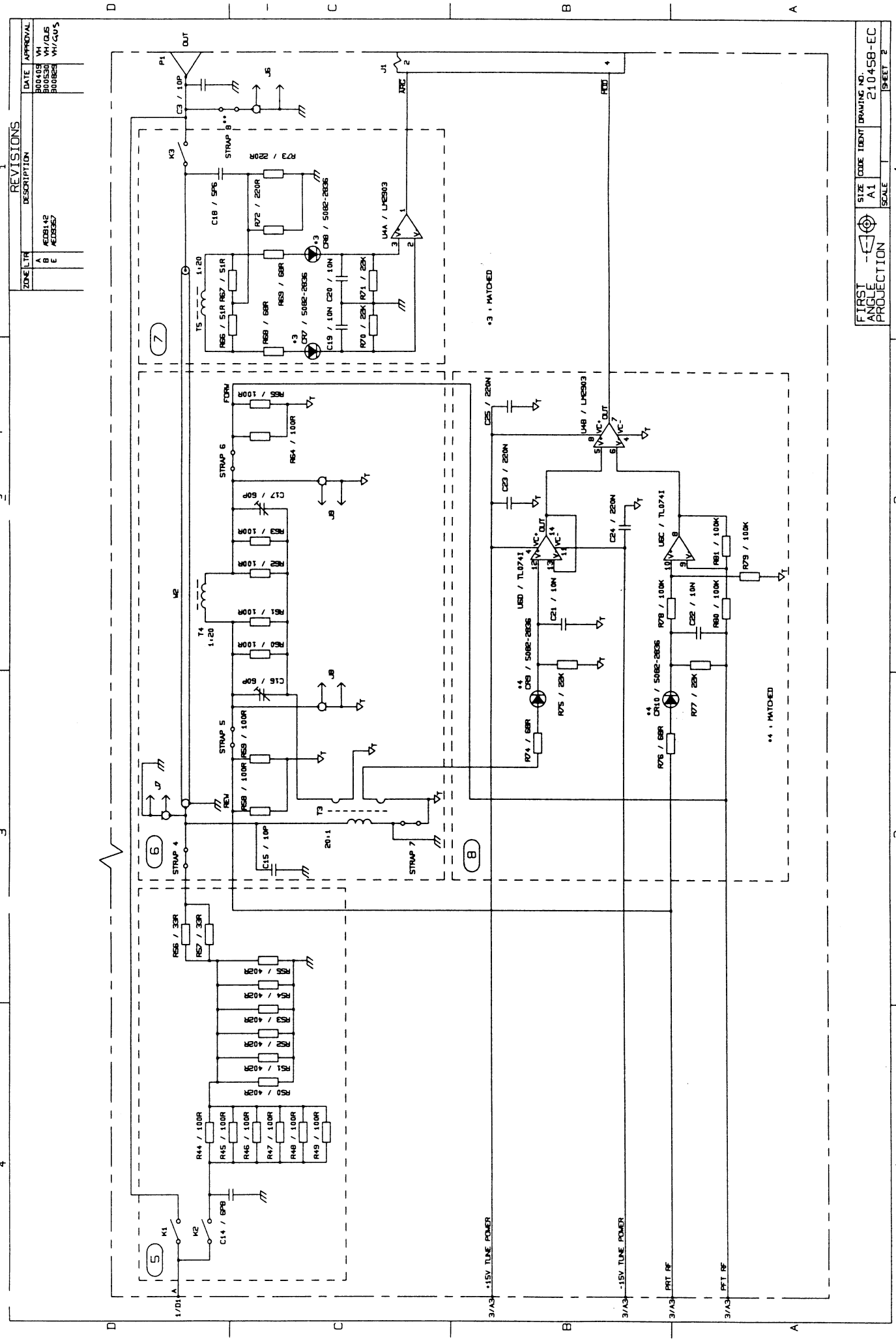
DETECTOR MODULE A9/TU4013



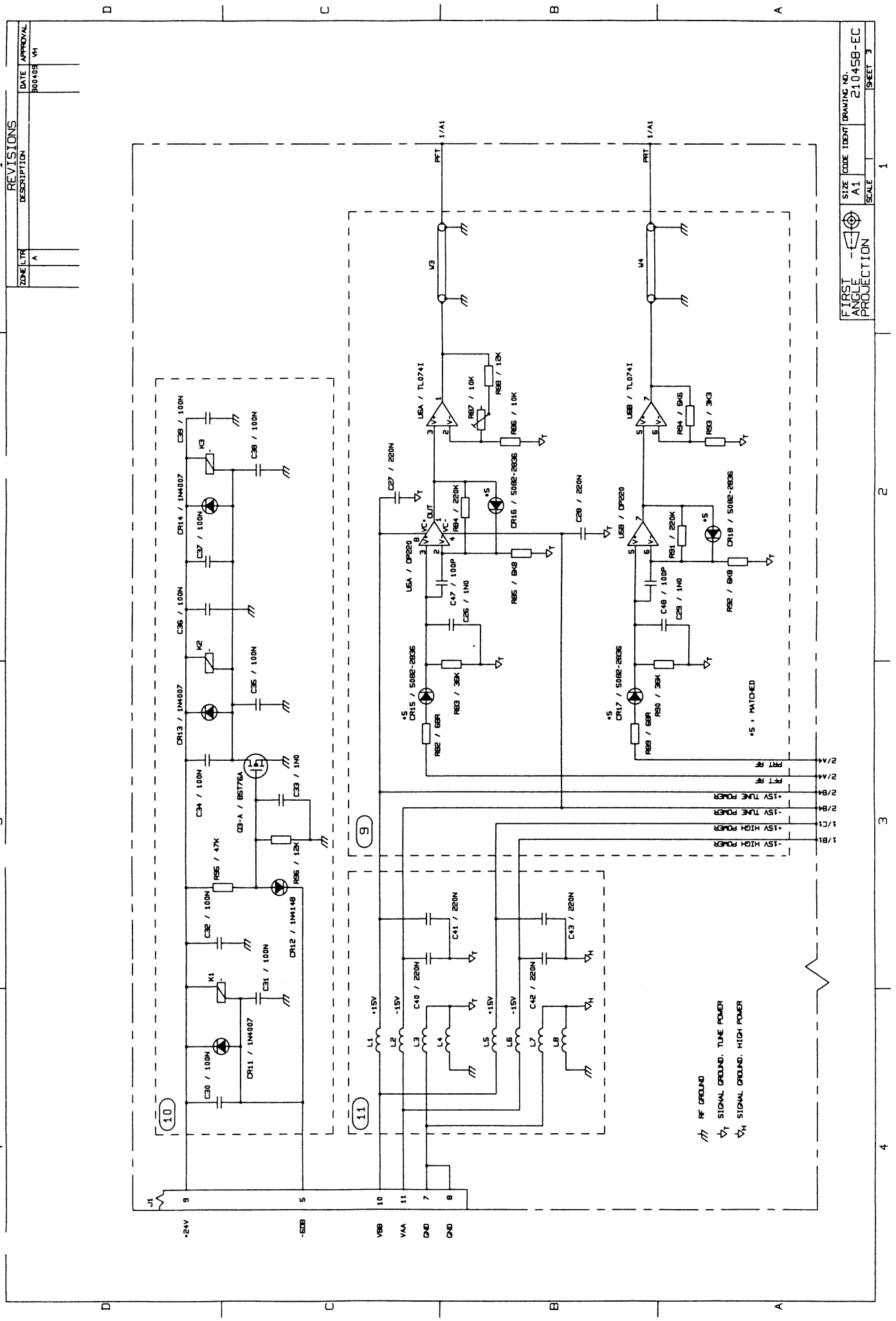
The signal from the transmitter is used by the Detector Assembly A9 to measure the forward power, the reverse power, and the phase and modulus of the antenna impedance. This information is used, together with frequency information, by the Controller Assembly A8 to decide which tuning procedure and preset values to use.



Service Sheet A9



Service Sheet A9



Service Sheet A9

POWER SUPPLY A10/TU4013

1 +5 V, 600 mA Regulator

U3 is a common used +5 V regulator, 7805, with extended temperature range. Thyristor Q8 is normally on. If CR15 is pulled to GND, through Q11, the basis current is removed from Q7 and thereby the gate current for Q8, turning the +5 V supply off.

2 +15 V, 160 mA Regulator

The circuit functions in the same manner as 1, except that U2 pin3 is lifted to +10 V with Q6, R7-8 to give an output voltage of +15 V.

3 -15 V, 130 mA Regulator

The circuit functions in the same manner as 1, except that U1 pin3 is lifted to +10 V with Q3, R3-4 to give an output voltage of +15 V.

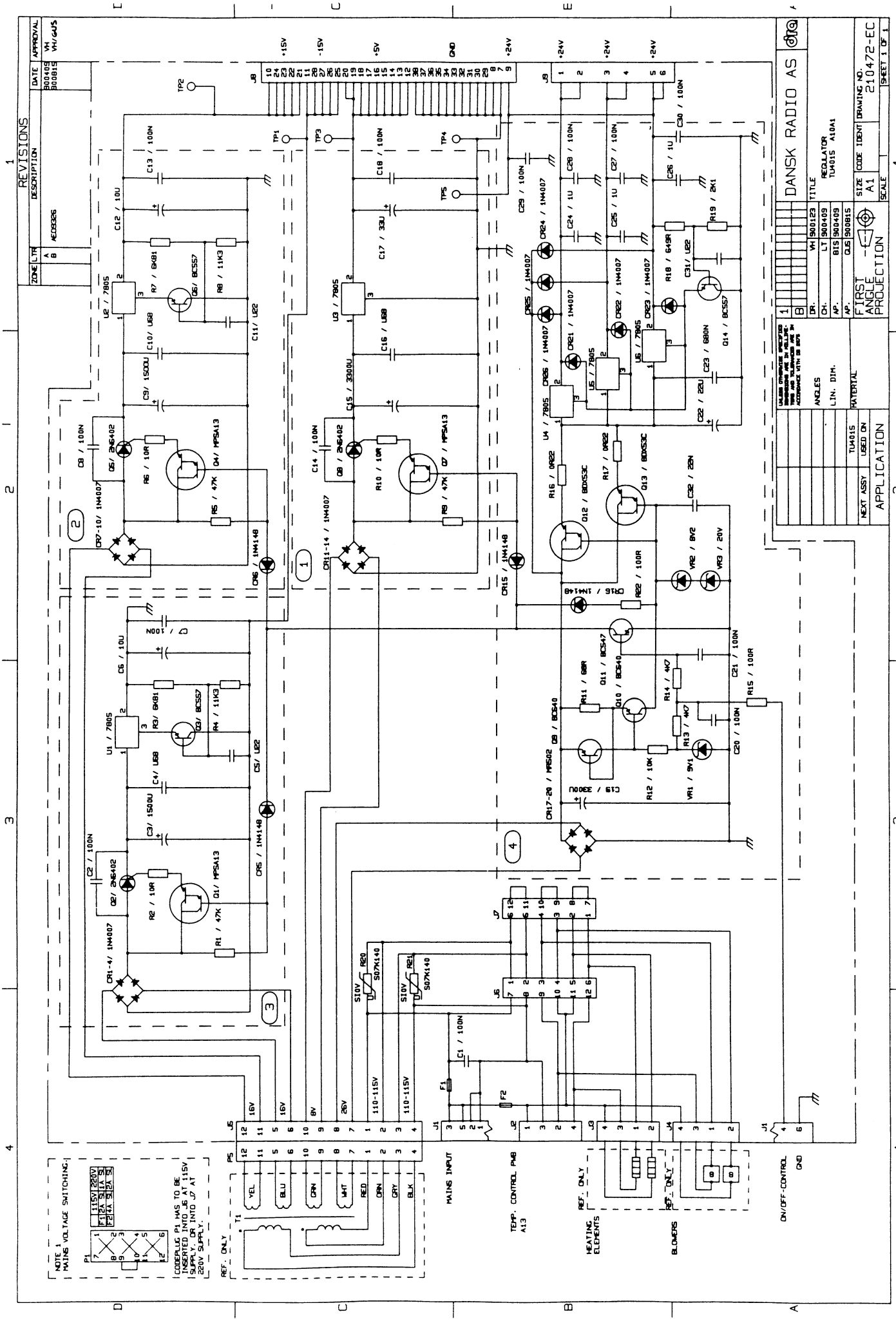
The output from the regulator is grounded and the output is taken from the negative input, thereby giving an output of -15 V.

4 +24 V, 3*600 mA Regulator

U4-5-6 are lifted to +19 V with Q14, R18-19 to give an output voltage of +15 V.

Q12-13 act as pre-regulators, with Q9-10 used as current regulators for VR2-3 to give a constant input voltage of +27 V to U4-5-6. CR16 cuts off the +24 V supply through Q11.

A logical 0 at J1 pin4 forces Q11 to go off, thereby turning the four supply voltages on.



Service Sheet A10A1

PRINCIPLES OF TUNING TU4013

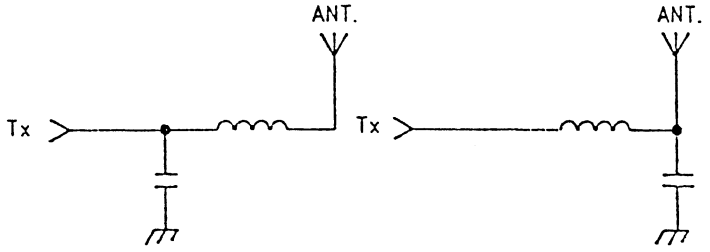
Introduction to Tuning

The TU4013 can be tuned by different procedures. The procedures are accessible on two levels.

> The first level is the automatic narrow band tune procedure which is initiated every time the **[tune]** key is pressed.
>
> The second level is only accessible through the program mode where manual tuning and manual/ silent tuning is performed.

The Tuning Strategy

The TU4013 is configured as an L-matching circuit with a lowpass characteristic. The capacitor in the circuit can be located at two places as shown in figure 1.



(a) (b)

Figure 1

Figure 1a is identified as Type 1 and 1b as Type 2. The choice of type to use during tuning is made automatically by the program in automatic tuning and by the operator in manual tuning.

PRINCIPLES OF TUNING TU4013

The tuning strategy operates in a Polar Impedance chart, shown in figure 2.

The Polar Impedance chart is divided into four quadrants, numbered 1 through 4. This information allows the operator to detect in which quadrant the antenna impedance is located.

With the aid of the quadrant and SWR information the operator can manually set the elements of the tuner to obtain a low SWR.

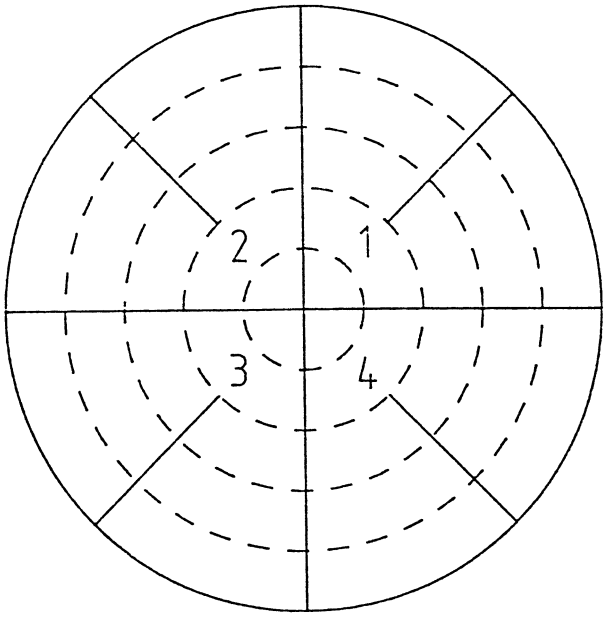


Figure 2

PRINCIPLES OF TUNING TU4013

Elements Available

The elements in the tuner are configured in a binary sequence.

The inductor elements are presented to the operator as numbers between 0 and 2047.

> The numbers for the inductors correspond to a factor of 0.05 uH/bit.

When operating with a Type 1 configuration the greatest number for the inductors available is 2047, while in a Type 2 configuration the greatest number available is 255.

The capacitor elements are presented to the operator as a number between 0 and 1535 in the frequency range 1.5-26.112 MHz and as a number between 0 and 511 in the frequency range 26.112-29.999 MHz.

> The numbers for the capacitors correspond to a factor of 5pF/bit.

PRINCIPLES OF TUNING TU4013

Example of Manual Tuning with a Type 1 Configuration
Figure 3 shows a Polar Impedance chart with a typical impedance point for a 12 meter whip antenna at a low frequency.

Tuning is carried out by increasing the value of the inductor, whereby the impedance of the antenna is shifted around the Polar impedance chart along the line marked L in figure 3, until a shift from quadrant 2 to 1 is obtained.

The next step is to increase the value of the capacitors, whereby a shift from quadrant 1 to 4 is obtained. The value of the capacitor is decreased so a shift from quadrant 4 to 1 is obtained.Next the value of L is decreased until quadrant 2 is obtained. The value of the inductor is then increased so a shift from quadrant 2 to 1 is obtained.

Next the value of C is increased until quadrant 1 is obtained and so on.

Through these shifts between quadrant 1, 2 and 4 with the L and C elements the SWR of the tuner will decrease, as indicated on the bargraph meter, to an acceptable level.

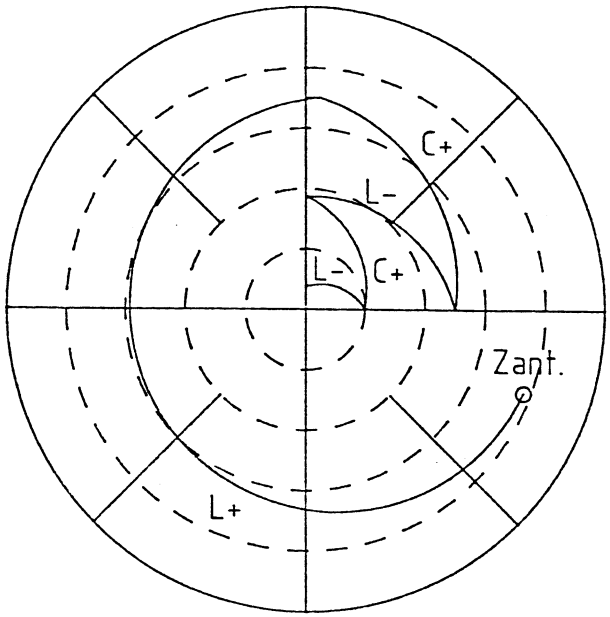


Figure 3

PRINCIPLES OF TUNING TU4013

Example of Manual Tuning with a Type 2 Configuration
Figure 4 shows a Polar Impedance chart with a typical impedance point for a 12 meter whip antenna at a high frequency.

Tuning is carried out by increasing the value of the capacitor, whereby the impedance of the antenna is shifted around the Polar impedance chart along the line marked C in figure 4, until a shift from quadrant 3 to 2 is obtained.

The operator may experience that a shift from quadrant 3 to 2 is not possible. In this case increase the value of L to obtain the shift.

The next step is to increase the value of the inductors, whereby a shift from quadrant 2 to 1 is obtained. The value of the inductor is then decreased so a shift from quadrant 1 to 2 is obtained.

Next the value of C is decreased until quadrant 3 is obtained. The value of the capacitor is then increased so a shift from quadrant 3 to 2 is obtained.

Through these shifts between quadrant 1, 2 and 3 with the L and C elements the SWR of the tuner will decrease, as indicated on the bargraph meter, to an acceptable level.

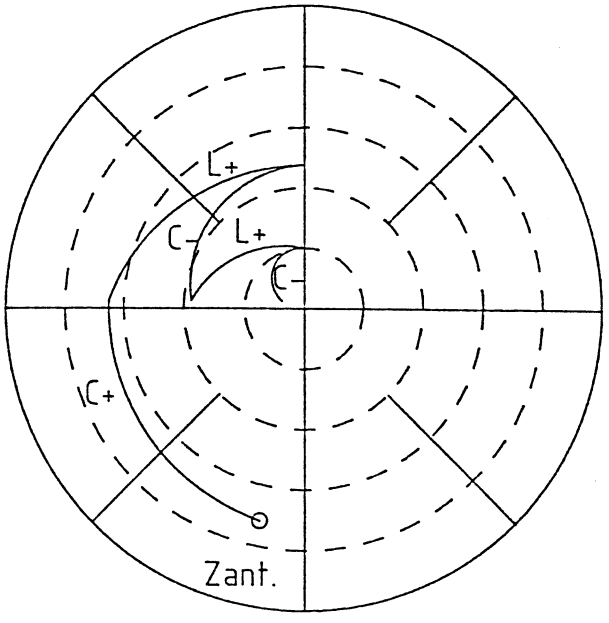


Figure 4

SELF TEST AND PROGRAM FACILITIES TU4013

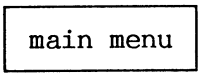
The Program Function

The program function is selected by pressing the **[PROGR]** key followed by the program number. The program number is accepted by pressing the **[enter]** key.

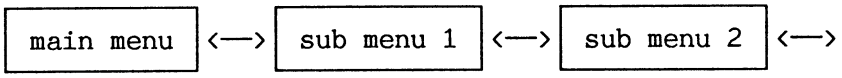
The operation of the programs can be illustrated in this way:

1) Select the program.

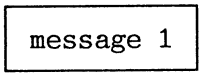
2) The main menu will be displayed.



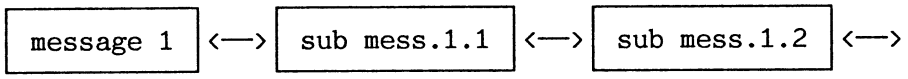
3) The menus are scrolled by [←] and [→] keys.



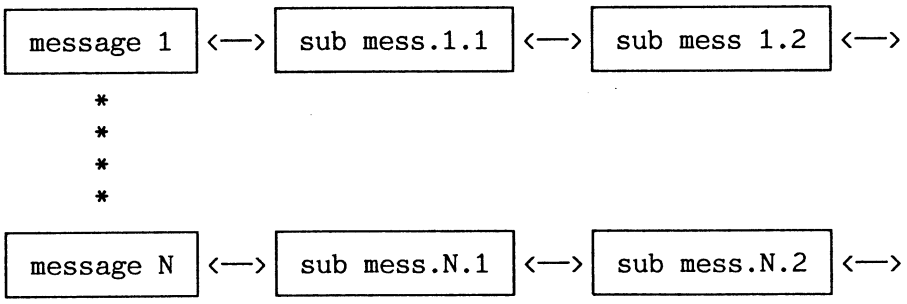
4) The first message is displayed when a menu is selected by pressing **[enter]** while the menu is shown.



5 Sub messages may be scrolled by using [←] and [→] keys.



6) Messages are scrolled by using the down arrow and the up arrow keys.



7) Pressing the down arrow keys after the last message returns the SE4010 to the former setting.

SELF TEST AND PROGRAM FACILITIES TU4013

TU4013 Programs

Program 50: Self Test

Program 51: Antenna tuner memory programming

Program 52: Antenna tuner memory clearing

Program 54: Dummy load ON/OFF

Program 55: Supervision of tuner power condition

Program 56: Battle ON/OFF

Program 57: Manual tuning

Program 58: Manual, Silent Tuning

Self Test
Program 50

The Self Test program is used to test the function of the tuner.

Antenna Tuner Memory Programming
Program 51

The programmable channels 1 through 99 are synchronized with the memory channels of the exciter, SE4010.

Antenna Tuner Memory Clearing
Program 52

After installation or service inspection of the antenna tuner or the antenna, the stored indication of tuner setting in the synthex memory must be cleared using program 52.

Dummy Load ON/OFF
Program 54

For transmitter testing a 500 W dummy load is available in the tuner.

Supervision of Tuner Power Condition
Program 55

When the tuner is operating it is possible to display the reflection coefficient (r.), the forward power (P.f.), the reflected power (P.r.) and the antenna current (i.A.) in the tuner.

SELF TEST AND PROGRAM FACILITIES TU4013

Battle ON/OFF
Program 56

The program function Battle ON/OFF allows the operator to bypass all the protection systems in the tuner.

Manual Tuning
Program 57

In manual tuning it is possible to tune the transmitter to a low VSWR operating the inductors and capacitors in the tuner.

Manual, Silent Tuning
Program 58

Program 58 has two menus, the main menu is displaying of tuner settings and the sub-menu manual setting of the tuner elements.

SELF TEST AND PROGRAM FACILITIES TU4013

Operational Status Information

During operation the following messages may occur:

AtuoFF.LinE

AtuFAIL

err.Cur. o.L.

err.Atu. tPr.

SELF TEST AND PROGRAM FACILITIES TU4013

Fatal Self Test Error Messages

Error code	Module	Possible faulty component(s)
Err Ad.con.	A8	The A/D converter failed
Err SYSt.1		The transmitter muting is not functioning. If not see paragraph for the A9 module.
	A9	The High power Detector.
Err PF.L1		The tune power is too low. If not see the paragraph for the A9 module.
	A9	K1, K2, K3, R44 through R57, or low power detector.
Err Pr.L1		The tune power is too low. If not see the paragraph for the A9 module.
	A9	K1, K2, K3, R44 through R57, or low power detector.
Err r.L	A9	Low power detector.
Err PF.L2		The Tx muting is not functioning, else see the paragraph for the A9 module
	A9	Low power detector.
Err Pr.L2		The Tx muting is not functioning, else see the paragraph for the A9 module.
	A9	Low power detector.
Err SYSt.3		The Tx muting is too slow.

SELF TEST AND PROGRAM FACILITIES TU4013

Self Test Error Messages

Error code	Module	Possible faulty component(s)
Err PF.H		The tune power is low.
Err Pr.H		The input SWR for the Tx is too high or the tune power too high
	A9	K1, K2, K3, R44 through R57
Err r.H		The input SWR for the Tx is too high
	A9	K1, K2, K3, R44 through R57
Err PF.H2		The Tx muting is low
Err Pr.H2		The Tx muting is low
Err SYSt.2		The SWR for the internal dummy load is too high.
	A2	R1, R2, R3,
	A3	K1, K2, K3, K4
	A4	L3, K3, C25, C26, C27, C28, R1, R2, K8
	A5	C3, C4, C5, C68, C69, C11, C67, L2, L3, K10, K11, K1, K2, K3, K13, K14
	A6	K1, K2, K6
	A7	K7, C22, C26, C27, K2, K3
Err L 1	A4	L1, K1
Err L 2	A4	L2, K2
Err L 3	A4	L3, K3
Err L 4	A4	L4, K4
Err L 5	A4	L5, K5
Err L 6	A4	L6, K6
Err L 7	A4	L7, K7

Self Test Error Messages, continued

Error code	Module	Possible faulty component(s)
Err L 9	A3	L2, K2
Err L 10	A3	L1, K1
Err C 2	A5	C4, K2
Err C 3	A5	C5, K3
Err C 4	A5	C6, K4
Err C 5	A5	C8, C12, K5
Err C 6	A5	C7, C13, K6
Err C 7	A5	C14,C60,C61,C62,K7
Err C 8	A5	C9, C65, K8
Err C 9	A5	C10, C66, K9
Err C 10	A5	C11, C67, K10
Err C 11	A5	C68, C69, K11
Err Lb 2	A6	L2, K1, K2, K3, K6
Err Cb 1	A7	C22, K2
Err Cb 2	A7	C26, C27, K3
Err Cb 3	A7	C23, C75, K4
Err Cb 4	A7	C24, C25, K5
Err Cb 5	A7	C76, C77, K6
Err BB	A7	K7
Err cP 1	A5	L1, K15
Err cP 2	A4	C25, C26, C27, C28, R1, R2, K8
Err tP	A5	K13, K14, Q1

REMOTE OPERATION

1. PROTOCOL IN GENERAL

Transmission of data is done by a Intel 8251 programmable communication interface.

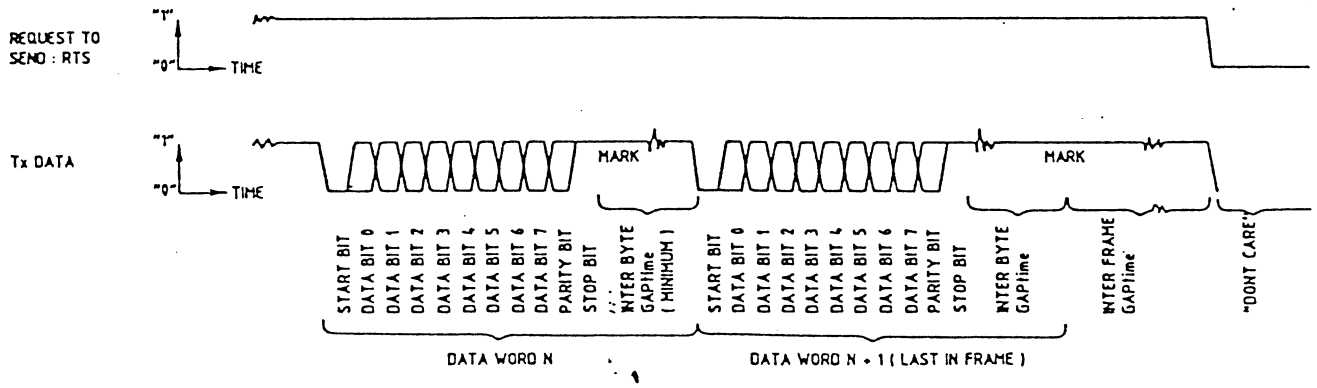
The transmission is: Asynchronous
1 start bit
8 data bits (a data byte)
1 odd parity bit
1 stop bit
INTER BYTE GAPtime (Only 9600 Baud).

After each 11 bit transmitted (start,data,parity,stop:bits) there must be a INTER BYTE GAPtime delay before the next 11 bits are transmitted (9600 Baud). This delay is necessary because the receiving software fetch received data only once per msec.

The hardware strapping on the A9 module of the unit must match the decided baudrate. The decided baudrate must also be stored in the memory of the line MASTER or MASTER CONTROLLER units, using program No. 20 on the units.

The transmission of a data package consists of transmission of a number of 8 bit data word. The total transmission of such a number of data will be referred to as a "data frame" or simply a "frame". A frame has a variable length.

INTER FRAME GAPtime / INTER BYTE GAPtime

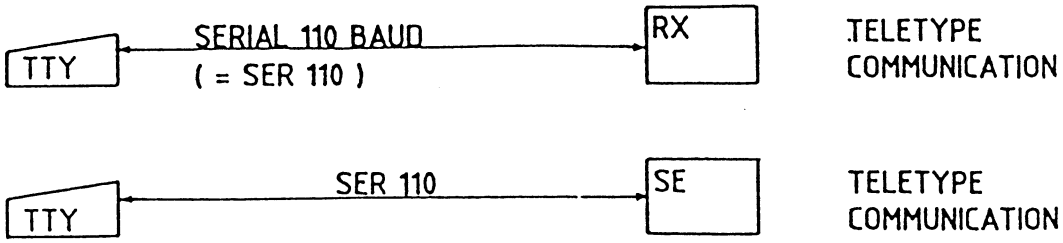


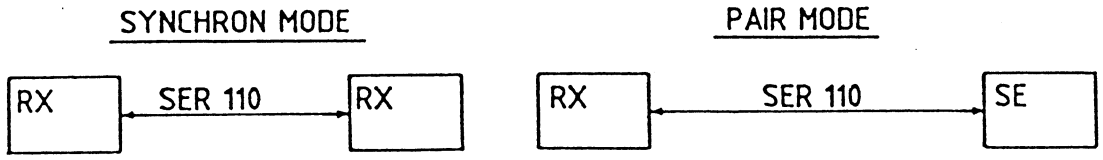
USING THE 1200 BAUD A9 MODULE RTS "LOW" WITHIN THE INTER FRAME GAPtime TELLS THE RECEIVING UNIT THAT THE TOTAL FRAME IS FINISHED. IF RTS DON'T BECOMES LOW THE TOTAL FRAME IS ACCEPTED AFTER THE INTER FRAME GAPtime.

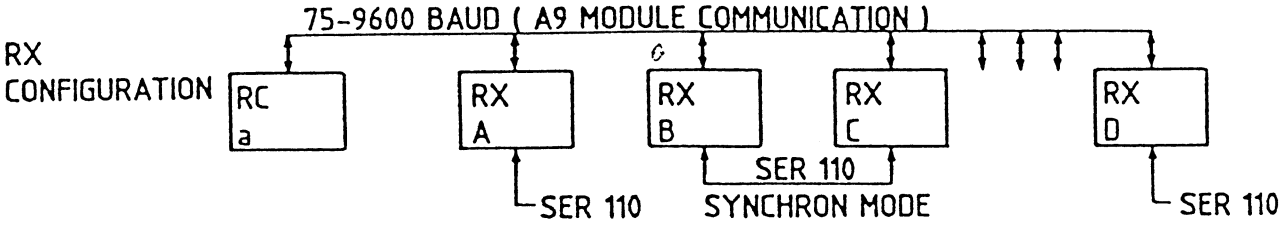
USING THE 9600 BAUD A9 MODULE RTS MUST BE "HIGH" WITHIN THE INTER FRAME GAPtime.

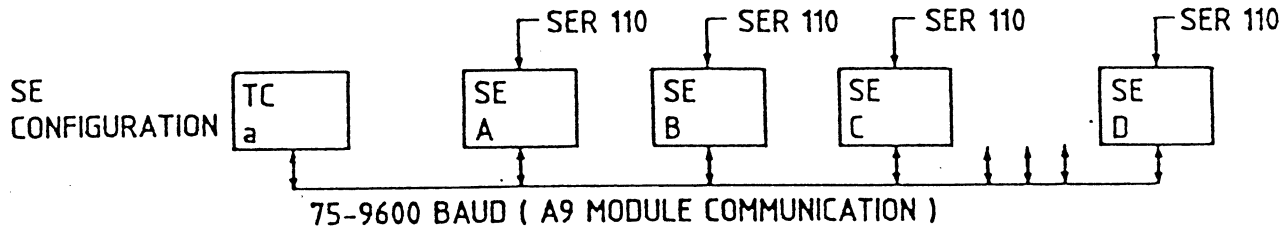
BAUD RATE	INTER FRAME GAPtime	INTER BYTE GAPtime
75	255 msec	0.0 msec
150	147 msec	0.0 msec
300	74 msec	0.0 msec
600	37 msec	0.0 msec
1200	19 msec	0.0 msec
2400	9 msec	0.0 msec
4800	6 msec	0.0 msec
9600	6 msec	0.9 msec

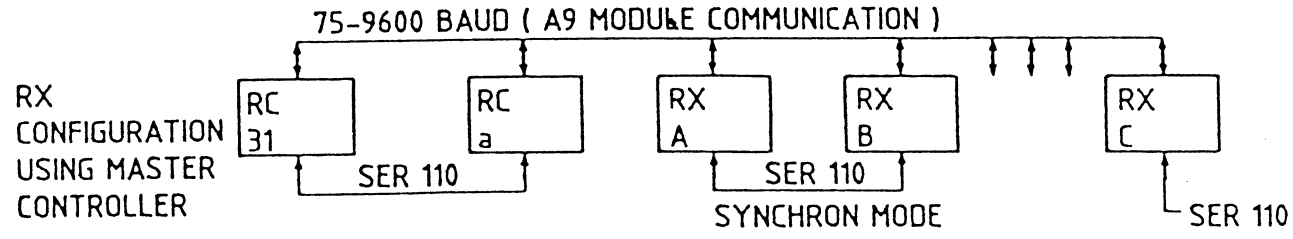
CONNECTION EXAMPLES

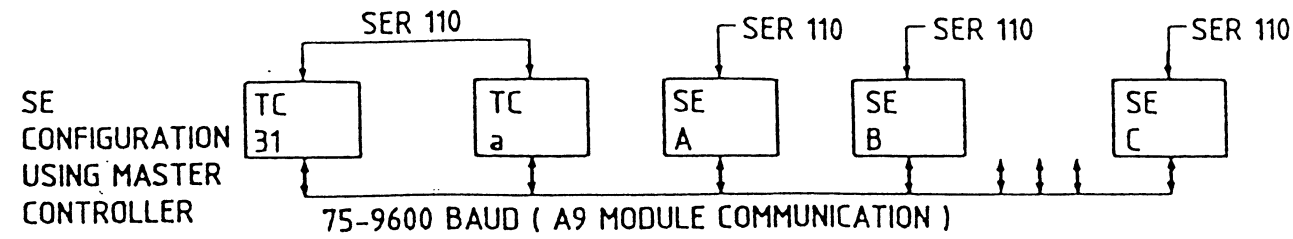








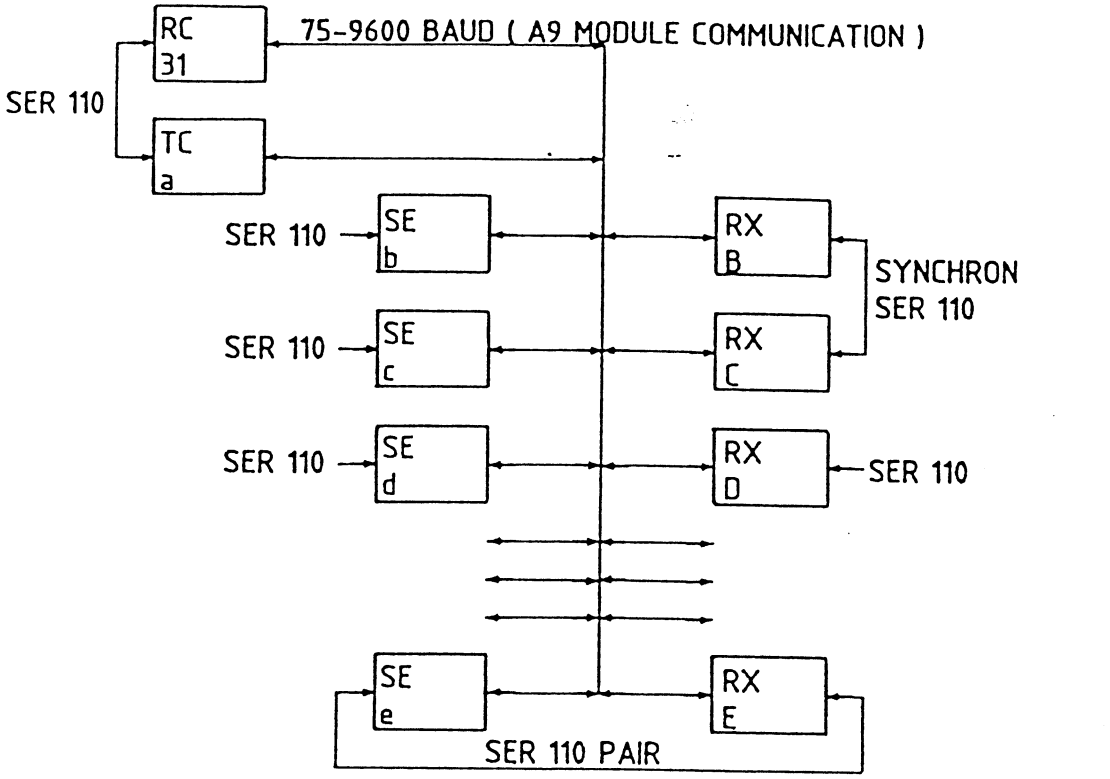




CONNECTION EXAMPLES continued

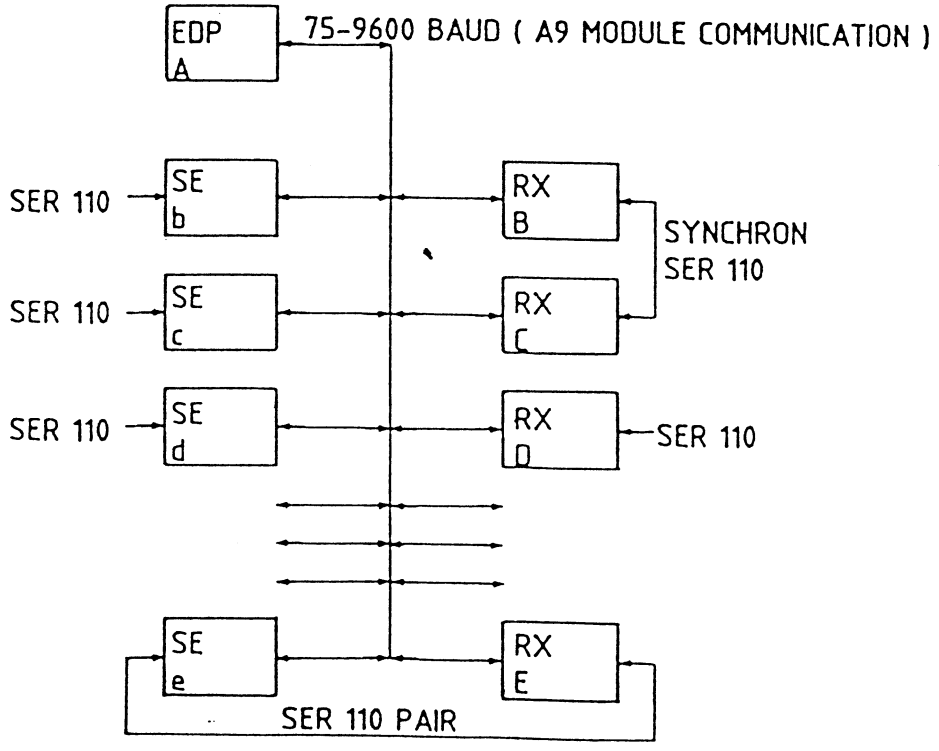
RX - SE CONFIGURATION

USING RC MASTER CONTROLLER



RX - SE CONFIGURATION

USING EDP CONTROLLER



1.1 COMMUNICATION TOOLS

Errors in network are often very difficult to locate.
To simplify the work of investigating causes of errors, there are built-in communication counters in the TC,RC,SE and RX software.

Both the normal communication via the A9 module, and the special communication via the serial 110 bps line are examined during communication.

The number of received frames and bytes are counted, as well as all errors recognized during receiving frames.

All information about the communication is stored in the AUTOMATIC REMOTE TRANSMISSION ERROR LOG (ARTEL)

1.2 ARTEL: AUTOMATIC REMOTE TRANSMISSION ERROR LOG

The counters in the ARTEL are all set to 0 when mains are switched on. Counters are incremented to a max. limit of 65535. When a counter reaches this limit, it starts counting from 0 again.

The counters for: received frames and bytes are only incremented when 256 frames (and bytes) are received.
The counter "to.S" is dedicated to the serial 110 bps communication. All the other counters are dedicated to the normal network communication.

To investigate the actual status of the counters, use program No. 41 on the TC,RC,SE and RX units.

EXPLANATION TO COUNTERS IN PROGRAM No. 41:

"r.Fr" :Number of received frames (MOD 256)

"r.bt" :Number of received bytes (MOD 256)

"Syn" :Number of synchronizing retransmissions.
Incremented every time a retransmission takes place.
REASON FOR RETRANSMISSION FROM A MASTER:
The master (TC or RC) does not receive an answering frame from a slave, within 1 sec.
REASON FOR RETRANSMISSION - ALL UNITS:
- The unit receives a wrong ACK (acknowledge)
- The unit receives a NACK (not acknowledge)

"Hd.E" :Number of header errors.
Incremented when.:
- A frame with more than 32 bytes has been received.
- The number of data in a frame does not fit together with the frame type.
- The received frame type does not exist.

"to.E" :Number of timeout errors.
Incremented when the unit has been waiting for an answering frame for more than 1 sec.

"Fr.E" :Number of framing errors.
Incremented when no stopbit has been detected after a data byte has been received. (*1)

"or.E" :Number of overrun errors.
Incremented when a new byte has arrived before the last has been read. (*1)

"Pt.E" :Number of parity errors.
Incremented when a parity error has occured. (*1)

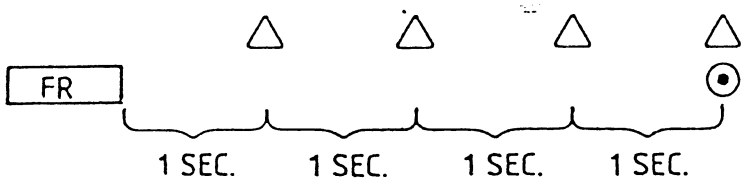
"to.S" :Number of timeouts/errors on the serial 110 bps line.
Incremented on wrong echo,retransmit command and if the echo has not been received within 1 sec.

(*1) :Acording to Intel 8251 specifications.

TIMEOUT ACTIONS ON UNITS

SLAVES:
If a slave reaches a timeout state. it remains listening up to 4 sec.. After the 4th sec. the slave displays "Err. OFFLINE" and must be addressed to be selected again.

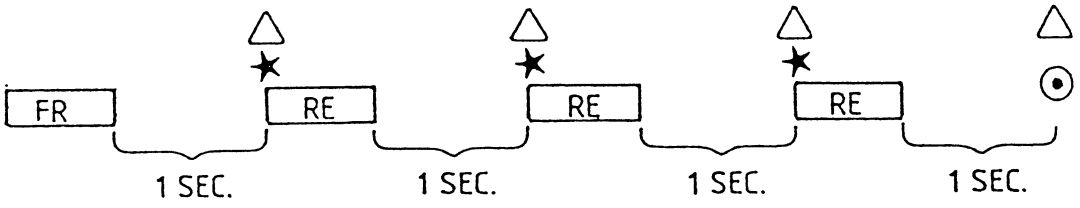
SCHEMATIC DRAWING



FR = LAST TRANSMITTED FRAME
△ = TIME OUT ERROR COUNTER INCREMENTED ("to.E ")
⊙ = UNIT NOT SELECTED. DISPLAYS " Err. OFFLINE "

MASTER AND MASTER CONTROLLERS:
If a master reaches a timeout state, it retransmits the last frame every 1 sec. (maximum 3 retransmissions). If there is no answer within 1 sec. after the last retransmission, the display shows "Err. OFFLINE" and automatic addressing of the last addressed unit starts.

SCHEMATIC DRAWING



FR = LAST TRANSMITTED FRAME
RE = RETRANSMISSION OF FRAME
△ = TIME OUT COUNTER INCREMENTED ("to.E")
★ = RETRANSMISSION COUNTER INCREMENTED ("syn")
⊙ = UNIT DISPLAYS " Err. OFFLINE " AND STARTS AUTOMATIC ADDRESSING

5.1 LOGIC STATE DIAGRAM OF SE AND RX UNITS.