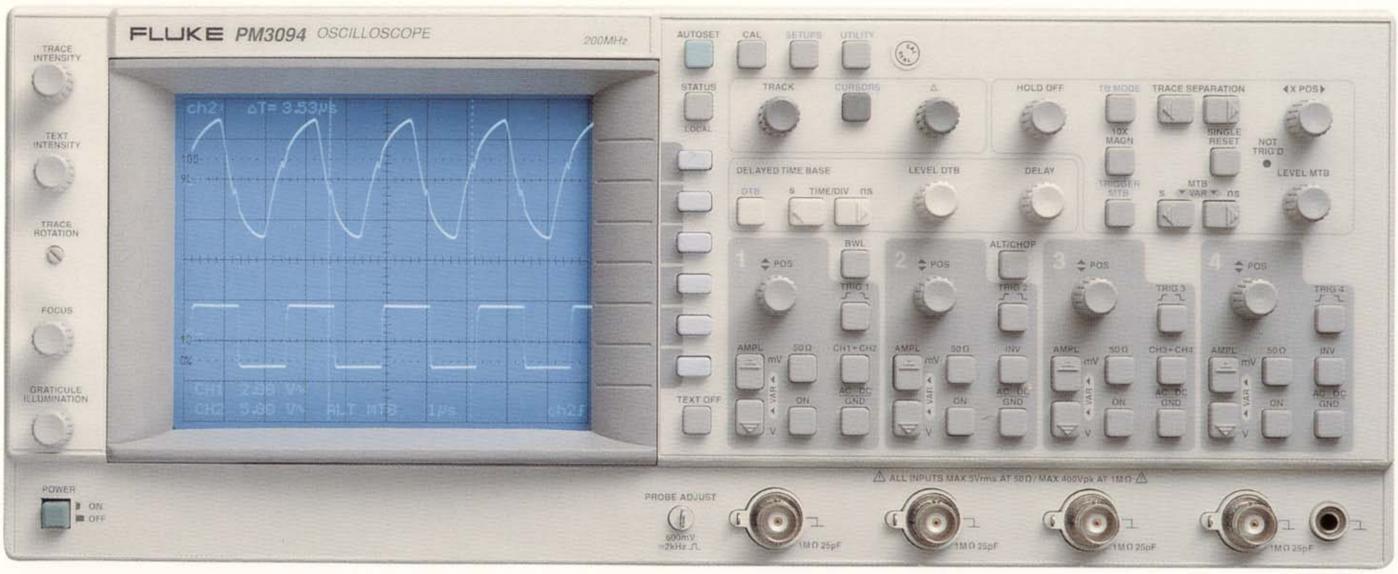
PM3082 - PM3084 100 MHz
PM3092 - PM3094 200 MHz
ANALOG OSCILLOSCOPES

Service Manual



FLUKE®

PM3082 - PM3084 100 MHz
PM3092 - PM3094 200 MHz
Analog Oscilloscopes

Service Manual

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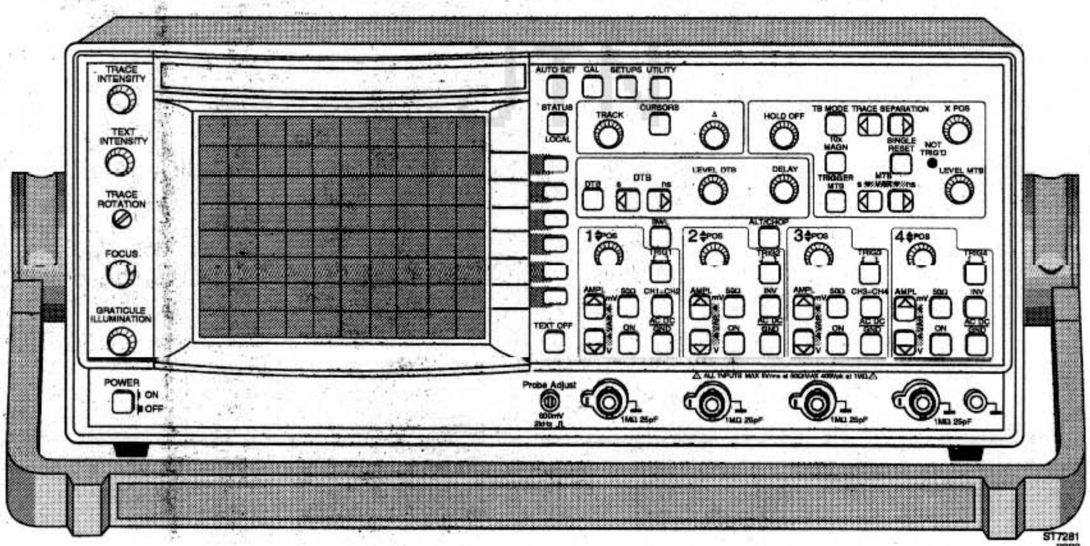
10 April '97



ST7281
9303

Warning: **These servicing instructions are for use by qualified personnel only. To reduce the risc of electric shock do not perform any servicing other than that contained in the operating instructions unless you are fully qualified to do so.**

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DECLARATION OF CONFORMITY
for

FLUKE
Analog Oscilloscopes
PM3082, PM3084, PM3092, PM3094

Manufacturer
Fluke Industrial B.V.
Lelyweg 1
7602 EA Almelo
The Netherlands

Statement of Conformity
Based on test results using appropriate standards, the product is in conformity with
Electromagnetic Compatibility Directive 89/336/EEC
Low Voltage Directive 73/23/EEC

Sample tests
Standards used:

IEC 348 (1978)
Safety Requirements for Electronic Measuring Apparatus

EN 50081-1 (1992)
Electromagnetic Compatibility. Generic Emission Standard:
EN55022 and EN60555-2

EN 50082-1 (1992)
Electromagnetic Compatibility. Generic Immunity Standard:
IEC801 -2, -3, -4, -5

The tests have been performed in a typical configuration.

This Conformity is indicated by the symbol CE, i.e. "Conformité européenne".

TABLE OF CONTENTS

1 SAFETY INSTRUCTIONS

Read these pages carefully before installation and use of the instrument.

1.1 INTRODUCTION

The following paragraphs contain information, cautions and warnings which must be followed to ensure safe operation and to keep the instrument in a safe condition.

WARNING: **Servicing described in this manual is to be done only by qualified service personnel. To avoid electric shock, do not service the instrument unless you are qualified to do so.**

1.2 SAFETY PRECAUTIONS

For the correct and safe use of this instrument it is essential that both operating and servicing personnel follow generally accepted safety procedures in addition to the safety precautions specified in this manual.
Specific warning and caution statements, where they apply, will be found throughout the manual.
Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

1.3 CAUTION AND WARNING STATEMENTS

CAUTION: **Is used to indicate correct operating or maintentance procedures in order to prevent damage to or destruction of the equipment or other property.**

WARNING: **Calls attention to a potential danger that requires correct procedures or practices in order to prevent personal injury.**

1.4 SYMBOLS


Live part (black/yellow)


High voltage terminal ≥ 1000 V (red)


Attention refer to the manual:
This symbol is to indicate that information about usage of a feature is contained in the manual.


Protective ground terminal (black)


Static sensitive components (black/yellow)

1.5 IMPAIRED SAFETY-PROTECTION

Whenever it is likely that safety has been impaired, the instrument must be turned off and disconnected from line power. The matter should then be referred to qualified technicians. Safety protection is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

1.6 GENERAL SATETY INFORMATION

WARNING: Removing the instrument cover or removing parts, except those to which access can be gained by hand, is likely to expose live parts and accessible terminals which can be dangerous to live.

The instrument shall be disconnected from all voltage sources before it is opened.

Capacitors inside the instrument can hold their charge even if the instrument has been separated from all voltage sources.

WARNING: Any interruption of the protective ground conductor inside or outside the instrument, or disconnection of the protective ground terminal, is likely to make the instrument dangerous. Intentional interruption is prohibited.

Components which are important for the safety of the instrument may only be replaced by components obtained through your local FLUKE organisation. (See also section 9).

After repair and maintenance in the primary circuit, safety inspection and tests, as mentioned in section 9 have to be performed.

2 CHARACTERISTICS

A. Performance Characteristics

- Properties expressed in numerical values with tolerances, ranges or limits stated, are guaranteed by the manufacturer.
- Properties expressed in numerical values without tolerances, ranges or limits stated, represent the characteristics of an average instrument.
- This specification is valid if the temperature has not changed more than + or -5 °C since the last AUTO CAL and the probe is of the same 10:1 model as delivered with the instrument.
- For definitions of terms, reference is made to IEC Publication 351-1, 359.

B. Safety Characteristics

This instrument has been designed and tested in accordance with IEC Publication 348, Safety requirements for Electronic Measuring Apparatus and has been supplied in a safe condition. This manual contains information and warnings which must be followed by the user to ensure safe operation and to keep the instrument in safe condition. The instrument has been designed for indoor use. It may occasionally be subjected to temperatures between + 5 °C and 10 °C without degradation of its safety.

C. Initial Characteristics

- Overall dimensions:
  - Height (without feet) : 139 mm 5.5"
  - Width (without handle) : 341 mm 13.5"
  - Length (without handle and front cover) : 481 mm 19"

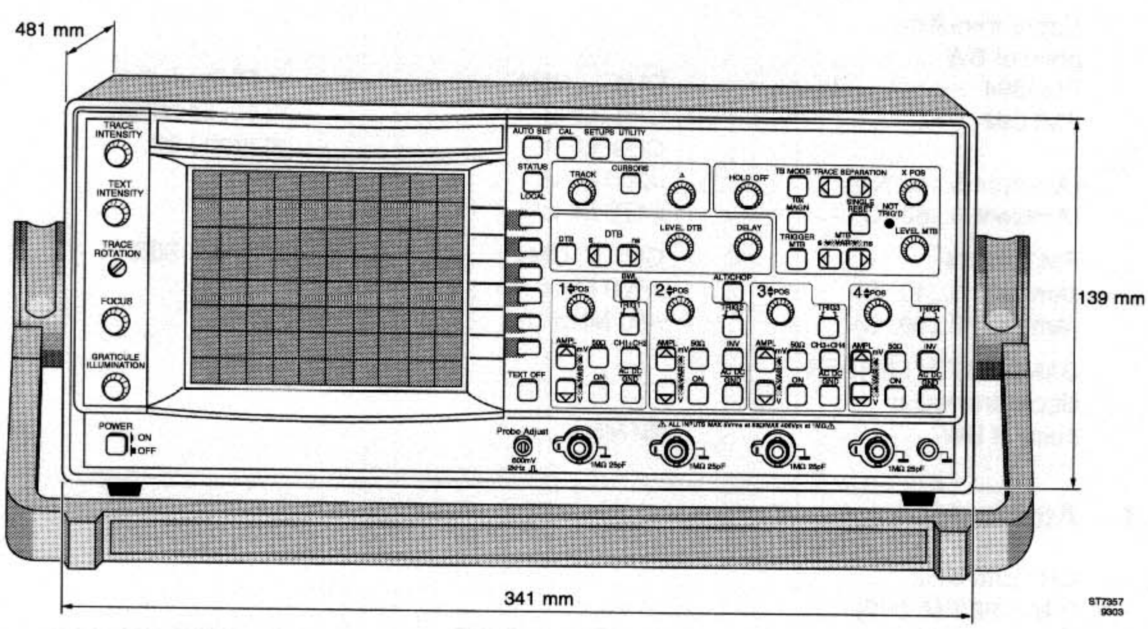


Figure 2.1 Dimensions

- Mass : 8.5 kg 17.6 lb.

- Operating positions:
  a) Horizontally on bottom feet
  b) Vertically on rear feet
  c) On the carrying handle in three sloping positions

2.1 VERTICAL

2.1.1 Channels

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
CHANNELS	CH1; CH2; CH3; CH4	Form a channelset Form a channelset

2.1.2 Deflection modes

MODES	CH1, CH2, CH3, CH4	CH2 and CH4 can be inverted to allow -CH2 or -CH4
	CH1 + CH2	CH2 can be inverted to allow CH1 - CH2
	CH3 + CH4	CH4 can be inverted to allow CH3 - CH4
	Alternate/Chopped	
Chopped mode: Chop. freq.	1 MHz	

2.1.3 Bandwidth

FREQUENCY RESPONSE		At BNC
Lower transition point of BW input coupling in AC pos.	<10 Hz	
Upper transition point of BW		
PM3094	CH1 ... CH4	in 50Ω position
PM3092	CH1, CH2	in 50Ω position
	CH3, CH4	at probe tip
(Ambient 5...40 °C)	>200 MHz	
(Ambient 0...50 °C)	>175 MHz	
PM3082/84	CH1 ... CH4	with ext. 50Ω
(Ambient 5...40 °C)	>100 MHz	
(Ambient 0...50 °C)	>90 MHz	
BANDWIDTH LIMITER Upper transition point of BW	20 MHz	

2.1.4 Attenuator

CH1 and CH2 (PM3092/PM3082) Steps	2 mV/div ... 5 V/div	In a 1-2-5 sequence
CH3 and CH4 (PM3092/PM3082) Steps	0.1V/div, 0.5V/div	
CH1 to CH4 (PM3094/PM3084) Steps	2mV/div...5V/div	in a 1-2-5- sequence
Variable gain mode	2mV/div...12.5V/div	Continuously variable

2.1.5 Input characteristics

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
INPUT CONNECTOR	BNC	See note 1
INPUT IMPEDANCE (in 1 MΩ pos.)		Measured at freq. <1MHz
R parallel:		
- value	1 MΩ	
- tolerance	±1 %	
C parallel:		
- value	25 pF	
- tolerance	±2 pF	
INPUT IMPEDANCE (in 50 Ω pos.)		PM3092 only CH1 and CH2. PM3094 all channels
R parallel:		
- value	50 Ω	
- tolerance	±1 %	
VSWR (typical)	1.5 : 1	See note 2

Note 1: *BNC with Probe Read Out Pin which causes the instrument to change V/div indication, input impedance and attenuator setting according to probe (when fitted with a probe indicator).*

Note 2: *Measured up to 200 MHz input frequency; in d.c. and a.c. coupling of input.*

2.1.6 Coupling

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
COUPLING	d.c.; a.c.; ground	See note 1

Note 1: *In GND position: channel disconnected from input, and connected to ground, BNC open (when not in 50 Ω position). The GND coupling is not available for CH3 and CH4 in PM3092 and PM3082.*

2.1.7 Dynamic range

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
DYNAMIC RANGE		
Up to 25 MHz (PM3082/84)	±12 div	Symmetrical
Up to 50 MHz (PM3092/94)	±12 div	Symmetrical
Up to 100 MHz (PM3082/84)	±4 div	Symmetrical
Up to 200 MHz (PM3092/94)	±4 div	Symmetrical

2.1.8 Position range

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
POSITION RANGE	±≥8 div	Symmetrical

2.1.9 Trace separation

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
TRACE SEPARATION		MTB and DTB
Min. range	>± 4 div	MTB fixed, DTB shifts

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.1.10 Input voltage limits

INPUT VOLTAGE LIMITS		See note 1
⚠ In high Z position (d.c. + a.c. peak)	±400 V	See note 2
In 50 Ω position		
d.c.	±5 V	
a.c. r.m.s.	5 V	See note 3
a.c. peak	±50 V	See note 3

Note 1: *Apparatus should be properly grounded through the protective ground conductor of the power cord.*

Note 2: *Up to 10 kHz; >10 kHz see figure 2.2*

Note 3: *Maximum of 50 mJ during any 100 ms interval.*

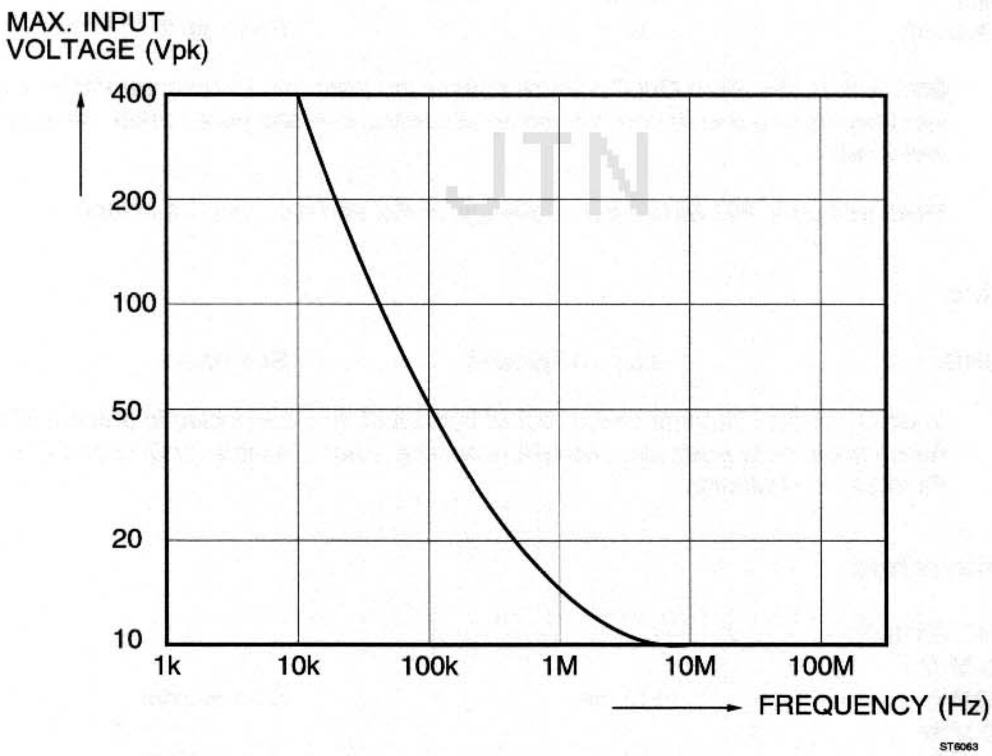


Figure 2.2 Max input voltage versus frequency

2.1.11 Step response

STEP RESPONSE	Is calculated from the formula: Risetime = 0.35 / Bandwidth and is measured over central 5 divisions (vertical)	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.1.12 Signal delay

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
VISUAL SIGNAL DELAY	≥15 ns	PM3092, PM3094
	≥13 ns	PM3082, PM3084
DELAY BETWEEN CHANNELS		
CH1 and CH2	<250 ps	
CH3 and CH4	<250 ps	
CH1...CH4	<250 ps	4 channel instruments
Any two channels	<500 ps	2+2 channel instruments

2.1.13 Vertical accuracies

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
ACCURACY deflection factor		
Gain error (d.c.)	±1.3 %	Over central 6 div. See note 1
Non linearity	≤2 %	See note 2
MAX. BASELINE INSTABILITY		
Jump (all between steps, VAR and N/I)	0.2 div or 1 mV	Whichever is greater (after autocal)
Drift	0.1 div/h	
Temperature coefficient	0.03div/K	
CHANNEL ISOLATION		
Of deselected channels at 10 MHz	100 : 1	See note 3
Of deselected channels at upper transition point	50 : 1	See note 4
Between selected channel	50 : 1	See note 5
CMRR		See note 6
at 1 MHz	100 : 1	
at 50 MHz	25 : 1	

Note 1: *add 1.5 % for variable gain mode*

Note 2: *2 div centerscreen signal with a frequency of 50 kHz, shifted within central 6 div.*

Note 3: *At 10 MHz; input to deselected channel equivalent to 8 div. or less.*

Note 4: *PM3092/3094 at 200 MHz; PM3082/3084 at 100 MHz; channels with equal V/div setting; input to deselected channels equivalent to 6 div.*

Note 5: *PM3092/3094 at 200 MHz; PM3082/3084 at 100 MHz; channels with equal V/div. settings; input to either channel 6 div. PM3092/94: max input amplitude 3 Vpp*

Note 6: *Between any two input channels at same attenuator setting; VAR of V/div setting adjusted for best CMRR; measured with max. 8 div input at each channel (center screen).*

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.2 TIMEBASE

2.2.1 Timebase modes

TIMEBASE MODES	MTB only MTB and DTB DTB only	MTB = Main Time Base alternating DTB = Delayed Time Base
MTB trigger modes	AUTO TRIGGERED SINGLE	free run after 100ms
DTB trigger modes	DTB starts DTB triggered	starts after adjusted DELAY time starts on first trigger after DELAY time

2.2.2 Timebase settings

MTB (PM3092/94)		
Settings	0.5 s/div ... 20 ns/div	Note 1
Variable Time/Div range	1.25 s/div ... 20 ns/div	MTB only; continuously variable
DTB (PM3092/94)		
Settings	0.5 ms/div ... 20 ns/div	Note 1 Note 3
MTB (PM3082/84)		
Settings	0.5 s/div ... 50 ns/div	Note 1
Variable Time/Div range	1.25 s/div ... 50 ns/div	MTB only; continuously variable
DTB (PM3082/84)		
Settings	0.5 ms/div ... 50 ns/div	Note 1 Note 3
TIMEBASE MAGNIFICATION	10x	Note 2

Note 1: *In a 1-2-5 sequence. By means of the timebase magnifier (x10) the range is extended to 2 ns/div (PM3092/94) or to 5 ns/div (PM3082/84).*

Note 2: *Expands the normal time/div. by 10 times (MTB and DTB)*

Note 3: *The DTB sweepspeed is higher or equal to MTB time/div. setting.*

2.2.3 DTB delay

DELAY TIME	2 ns ... 4.9 s	
Position range	0.1 ... 9.9 div	
Resolution	1 : 40000	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.2.4 Timebase accuracies, Delaytime accuracy, DTB jitter

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
TIMEBASE ACCURACY Unmagnified:	± (1.3% of reading + 0.5% of central 8 div)	Note 1
Magnified: up to 10 ns/div	± (1.3% of reading + 1.0% of central 8 div)	Note 2 Note 1
in 5ns/div and 2ns/div	± (1.8% of reading + 1.5% of central 8 div)	Note 1

Note 1: *add 1% of reading in variable mode*

Note 2: *valid over central unmagnified 8 div*

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
DELAYTIME ACCURACY	±(0.8% of reading + 0.3% of central 8 div + 4ns)	Note 1 PM3092, PM3094
	±(0.8% of reading + 0.3% of central 8 div + 5ns)	Note 1 PM3082, PM3084

Note 1: *add 1% of reading in variable mode.*

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
DTB jitter in starts	1 part of 25000	

2.2.5 External horizontal deflection

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
DEFLECTION SOURCES	Line and CH1...CH4	
LINE DEFLECTION Deflection amplitude	6 ±1.7 div	Between 49 and 61 Hz at 220 V
CHANNEL DEFLECTION Error limit Linearity error limit	 ±5% ±2%	Refer to VERTICAL Over central 6.div. Note 1
Dynamic range up to100kHz up to 2MHz	 20 div 10 div	
POSITION RANGE	±5 div	
FREQUENCY RESPONSE Upper transition point	 2 MHz	
MAX. PHASE DIFFERENCE Between horizontal and vertical	 3 °	 Up to 100 kHz

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.3 TRIGGERING

2.3.1 Source

SOURCE(S) MTB-triggering	CH1...CH4, Line; Composite	Note 1
SOURCE(S) DTB-triggering	CH1...CH4, TV-line	Note 2

Note 1: *Each displayed channel provides its own triggering. This feature is available in the alternated mode.*

Note 2: *Only available when MTB-mode is switched in TV*

2.3.2 Modes

MODES MTB-triggering	EDGE TV	
MODES DTB-triggering	EDGE	

2.3.3 TV systems

TV systems	TV HDTV	Note 1 Note 1

Note 1: *Field1, Field2 and TVline selection possible.*

2.3.4 Coupling

BANDWIDTH EDGE TRIGGER MTB		vertical coupling in DC
Lower transition point of BW		BW = Bandwidth
Trigger coupling:		
DC	d.c.	
AC	10 Hz	
LF-reject	30 kHz	
HF-reject	d.c.	
Upper transition point of BW		
Trigger coupling:		
DC	See sensitivity	
AC	See sensitivity	
LF-reject	See sensitivity	
HF-reject	30 kHz	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
BANDWIDTH EDGE TRIGGER DTB		vertical coupling in DC
Lower transition point of BW		BW = Bandwidth
Trigger coupling:		
DC	d.c.	
AC	10 Hz	
LF-reject	30 kHz	
HF-reject	d.c.	
Upper transition point of BW		
Trigger coupling:		
DC	See sensitivity	
AC	See sensitivity	
LF-reject	See sensitivity	
HF-reject	30 kHz	

2.3.5 Sensitivity

EDGE TRIGGER SENSITIVITY MTB/DTB (PM3092/94)		See note 1 & 3
d.c. to 100 MHz	0.5 div	
d.c. to 200 MHz	1.0 div	
d.c. to 300 MHz	2.0 div	See note 2
EDGE TRIGGER SENSITIVITY MTB/DTB (PM3082/84)		See note 1 & 3
d.c. to 50 MHz	0.5 div	
d.c. to 100 MHz	1.0 div	
d.c. to 200 MHz	2.0 div	See note 2
TV TRIGGER SENSITIVITY		See note 1
amplitude of sync pulse	0.7 div	

Note 1: *All figures are valid for an ambient temperature range of 5 ... 40 °C, add 20 % for ambient 0 ... 50 °C.*

Note 2: *Measured with a 2 div centerscreen signal.*

Note 3: *In noise trigger multiply stated value by 2.*

2.3.6 Slope

Slope selection edge	+ or -	MTB and DTB. See note1

Note 1: *In TV-triggering pos/neg video.*

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.3.7 Level

LEVEL CONTROL RANGE MTB EDGE Unless in Level-p(eak)p(eak) TV	 ± 8 div Note 1 Fixed	
LEVEL CONTROL RANGE DTB EDGE	 ± 8 div	
TRIGGERLEVEL Accuracy	 ≤0.2 div	 at 1 MHz input signal triggercoupling DC.
Triggergap	0.4 div	at 1 MHz input signal; in noise triggering multiply by 2.

Note 1: *The control range of the trigger level is related to the peak-peak value and duty cycle of the trigger signal.*

2.3.8 Hold Off

HOLDOFF SETTING Minimum	 2 us or 3 div. of MTB setting	 Whichever is greater
Maximum	2 s or 20 div. of MTB setting	Whichever is smaller

2.4 CURSORS

2.4.1 Cursor Control

NUMBER OF CURSORS	4	
CURSOR MODES		See note 1
Manual	Amplitude Time Both	ΔV, V1&V2 to GND,ratio ΔT, 1/ΔT, Ratio, Phase See note 2 and 3
Measure	Vpp	ΔVpp, Vp+&Vp- to GND Vdc to GND Risetime 10%-90% 20%-80% See note 4

Note 1: *In the "MTB + DTB" and "DTB" timebasemode, all waveform operations are performed on DTB traces.*

Note 2: *The ratio range is 0% ... 999% where 100% corresponds to the value in the cursor read out at the moment that the "ΔT=100%"- or "ΔV=100%"-button is pushed.*

Note 3: *The phase range is 0° ... 999° where 360° corresponds to the value in the cursor read out at the moment that the "ΔT=360°"-button is pushed.*

Note 4: *Amplitude cursors track the min. and max. value of the signal; not possible with DTB on.*

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.4.2 Cursor Accuracies

VOLTAGE MEASUREMENT		Note 1
Manual	±1% of FULL SCALE	
Vpp mode:	±3% of FULL SCALE + 800 µV	Note 2
TIME MEASUREMENTS		Note 3
Unmagnified time base	±1% of FULL SCALE	
Magnified time base up to 10ns/div:	±1.4% of FULL SCALE	
Magnified time base in 5ns/div. and 2ns/div	±2.2% of FULL SCALE	

Note 1: *Measured with 1kHz square wave within central 6 div.*

Note 2: *For signals >1 div.*
Vpp mode follows the trigger system frequency response curve.
1 kHz/120 mV sinewave over 6 div.: Readout 120 mV ±3.6 mV.

Note 3: *Within central 8 div.*

2.5 FRONT PANEL MEMORY

Memory size	10 fronts

2.6 BLANKING OR Z-AXIS

Input connector	BNC	
Input impedance	10 kΩ	
Input coupling	dc	
Max. input voltage	±10V	
Input voltage unblanked	0.5V or less	See note 1
Input voltage blanked	+ 2.4 V or more	See note 1
Response time	80ns	Risetime 2 ns

Note 1: *Half tones are possible at input voltages between +0.8V and +2.4V.*

2.7 DISPLAY

CRT		
Deflection	Electrostatic	Vector
Dimensions (h x v)	80 mm x 100 mm	8 x 10 divisions
Phosphor:		
Standard	Green GH (P31)	
GRATICULE	Fixed	
Y-AXIS ORTHOGONALITY	90° +/- 0.5°	
ACCELERATING VOLTAGE	16.5 kV	
Writing speed	>1.8 cm/ns	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
TRACE ROTATION		Screw driver adjustment
Min range	10°	External field <0.1 mT
Min overrange	2°	
TRACE DISTORTION		Deviation from straight line inside 6x8 div
At center of screen	<0.3 mm	
Else	<1.0 mm	

2.8 EXTERNAL INTERFACES

2.8.1 Calibrator

WAVEFORM		
Shape	square-wave	
INTERNAL IMPEDANCE		
Value	1200 Ω	
OUTPUT VOLTAGE		
Peak - peak value	600 mV	See note 1
Tolerance	1%	
OUTPUT CURRENT		
Peak - peak value	0.5 mA	See note 2
FREQUENCY		
Value	2 kHz	
Tolerance	±20 %	

Note 1: Positive going with respect to ground: open voltage (halves when terminated with 1200 Ω).

Note 2: When output short circuited (halves when terminated with 1200 Ω).

2.8.2 Standard external interfaces

TYPE OF INTERFACE — EIA-232-D (RS 232) — CPL (Compact Programming Language) See operating guide

PINNING PIN	I/O	NAME	
1	-	-	Not connected
2	I	RXD	Received data
3	O	TXD	Transmitted data
4	O	DTR	Data terminal ready
5	-	GND	Signal ground
6	I	DSR	Data set ready
7	O	RTS	Request to send
8	I	CTS	Clear to send
9	-	-	Not connected

TRANSMISSION MODES — Asynchronous, Full duplex

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
HANDSHAKE		
Hardware	RTS/CTS and DSR/ DTR	Default: not active Note 1
Software	XON/XOFF	Default: not active Note 1
BAUDRATE	75, 110, 150, 300, 600,1200, 2000, 2400, 4800, 9600, 19200, 38400	Receiving and transmitting Default: 1200 Note 1
NUMBER OF STOP BITS	1	
PARITY	odd, even or no	Default: no parity See note 1
CHARACTER LENGTH	7 or 8	Default: 8, See note 1
ERROR RESPONSE	See operating guide	
ELECTRICAL		
TXD and RXD		
Spacing "0"	≥+3V	
Marking "1"	≤-3V	
RTS, CTS, DSR and DTR		
ON	≥+3V	
OFF	≤-3V	
Current output	≤10mA	
Impedance Output	300Ω ± 10%	
Impedance Input	≥3kΩ ≤7kΩ	
Voltage Output	≥-12V ≤+12V	
Voltage Input	≥-25V ≤+25V	
Connector	Shielded	9 pole RAP male connector according MIL-C-24308

Note 1: *Selectable via UTILITY-menu and CPL.*
When battery installed, same as last power-off value.

2.8.3 Optional external interfaces

IEEE	ANSI/IEEE 488.2	SCPI, See 1.17

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.9 AUTOSET & CALIBRATION

2.9.1 AUTO SET

Vertical deflection,	2 ... 5 div	Note 1
Horizontal deflection	Max. 6 periods on CRT	Note 1
	At input signal 10 mV ... 25V 40 Hz ... 30 MHz	

Note 1: *AUTO SET selects the proper channel, sets vertical deflection, timebase speed, intensity and triggering for easy to read display of input signals or user programmable AUTO SET items.*

2.9.2 Calibration

CALIBRATION FACILITIES	Auto CAL	See note 1

Note 1: *Calibrates vertical offset and gain, horizontal offset, gain and sweeptime, trigger offset and gain.*

2.10 POWER SUPPLY & BATTERY BACKUP

2.10.1 Power supply

LINE VOLTAGE a.c. (r.m.s.) Operation Tolerance	 100 V ...240V ± 10%	
LINE FREQUENCY Nominal Limits of operation	 50 Hz...400 Hz 45 Hz...440 Hz	
LINE WAVEFORM CHARACTERISTICS Max. waveform deviation factor Crest factor	 10 % 1.27...1.56	At nominal source voltage
ALLOWABLE POWER INTERRUPTION	20 ms	See note 1
POWER CONSUMPTION Without options Max. power consumption	 60 W 80 W	
POWER CORD Length Power plug	 2.1 m (82.7") Nat. version	

Note 1: *At lowest allowable source voltage. After this time the oscilloscope data is saved before the instrument goes down and an automatic power-on sequence starts after restoration of the power source voltage.*

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.10.2 Battery backup

DATA & SETTINGS RETENTION	See note 1	
Retention time	2 years	
Batteries:		
Recommended type	LR 6	See note 2
Quantity	2	
Temperature range	0...+70 °C	See Note 3

Note 1: *When instrument is switched off or during mains failure.*

Note 2: *According to IEC 285 (= Alkaline Manganese Penlight Battery), e.g. LR6.*

Note 3: *At -40...0 °C settings retention is uncertain. It is advised to remove batteries from instrument when it is stored during longer periods (>24h) below -30 °C or above 60 °C. UNDER NO CIRCUMSTANCES BATTERIES SHOULD BE LEFT IN THE INSTRUMENT AT TEMPERATURES BEYOND THE RATED RANGE OF THE BATTERY SPECIFICATION.*

2.11 MECHANICS

PORTABLE VERSION		
Dimensions:		Handle excluded
Length	481 mm	Add 5 mm for cover and 65 mm for handle
Width	341 mm	Add 50 mm for handle
Height	139 mm	Add 8 mm for feet
Mass: Instrument	8.5 kg	
COOLING	Forced air, Regulated	No air filter

2.12 ENVIRONMETAL

2.12.1 General

The characteristics are valid only if instrument is checked in accordance with the official checking procedure. Warming-up and recovery time are in accordance with MIL-T-28800D par. 3.7.1.1. The instrument meets the environmental requirements of MIL-T-28800D Type III Class 3, Style D, Color R, unless specified otherwise.

2.12.2 Environmental

TEMPERATURE		See note 1
Operating:		
min. low temperature	0 °C	
max. high temperature	+ 50 °C	
Non operating (storage):		
min. low temperature	- 40 °C	
max. high temperature	+70 °C	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
MAX. HUMIDITY		See note 1
Operating and Non operating (storage)	95 %	Relative humidity non condensing

Note 1: In accordance with MIL-T-28800D par. 3.7.2.1.1. (FIGURE 2).

MAX. ALTITUDE		
Operating	4.6 km	See note 4
Non operating (storage)	12 km	See note 5
VIBRATION (OPERATING)		See note 6
Freq. ranges:		g level at max. freq.:
	5 Hz ... 15 Hz	0.7 at 15 Hz
	16 Hz ... 25 Hz	1.3 at 25 Hz
	26 Hz ... 55Hz	3 at 55 Hz
At each frequency range:		
Cycling time	15 min	
Resonance search	5 min	
Resonance dwell	10 min	See note 7

Note 4: In accordance with MIL-T-28800D par 3.7.3.
Note 5: Maximum operating temperature derated 3 °C for each km above sea level.
Note 6: In accordance with MIL-T-28800D par. 3.7.4.1.
Note 7: At each resonance frequency (or at 33 Hz if no resonance was found).

SHOCK (OPERATING)		See note 8
Amount of shocks		
total	18	
each axis	6	3 in each direction
Shock waveform	half sinewave	
Duration	6-9 ms	
Peak acceleration	400 m/s^2	
BENCH HANDLING		See note 9
Meets requirements of	MIL-ST-810, method 516 procedure V	
TRANSPORTATION	Drop height 0.76 m	See note 11
SALT ATMOSPHERE		
Structural parts	See note 10	

Note 8: In accordance with MIL-T-28800D par. 3.7.5.1.
Note 9: In accordance with MIL-T-28800D par. 3.7.5.3.
Note 10: In accordance with MIL-T-28800D par. 3.7.8.1.
Note 11: Drop in shipping container on 8 corners, 12 edges, 6 surfaces.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.13 EMI

2.13.1 General aspects and Susceptibility

2.13.1.1 General

Meets MIL-T-28800D, Type III, Class 3 (Navy requirement, unless specified otherwise).

Meets MIL-STD-461C as follows:

-	Conducted Emissions	Part 2	CE01 (Narrow band)
		Part 4	CE03
-	Conducted Susceptibility	Part 2	CS01
		Part 5	CS06 (Limited to 300V)
-	Radiated Emissions	Part 5 and 6	RE01
		Part 2	RE02 (1 GHz max)

2.13.1.2 Susceptibility

Meets harmonized product requirements of 89/336EEC, EN50081.1 and EN50082.1 with addition of the tables 1 to 8.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

The PM3082 and PM3084, including standard accessories, conform with the EEC Directive 89/336 for EMI immunity, as defined by IEC 801-3, with the addition of the following tables.

Table 1.

	Susceptibility: no visible disturbance		
Frequency range: 10 kHz .. 25 MHz	E = < 0.1V/m	E = 1 V/m	E = 3 V/m
Stand alone	2 mV/div ... 5 V/div	2 mV/div ... 5 V/div	2 mV/div ... 5 V/div
With PM9010/091	2 mV/div ... 5 V/div	10 mV/div ... 5 V/div	20 mV/div ... 5 V/div

Table 2.

	Susceptibility: no visible disturbance		
Frequency range: 25 MHz ... 1 GHz	E = < 0.1V/m	E = 1 V/m	E = 3 V/m
Stand alone	2 mV/div ... 5 V/div	5 mV/div ... 5 V/div	10 mV/div ... 5 V/div
With PM9010/091	2 mV/div ... 5 V/div	50 mV/div ... 5 V/div	200 mV/div ... 5 V/div

Table 3.

	Susceptibility: disturbance less than 10 % of full scale		
Frequency range: 10 kHz .. 25 MHz	E = < 0.1V/m	E = 1V/m	E = 3 V/m
Stand alone	N/A	N/A	N/A
With PM9010/091	N/A	2 mV/div ... 5 mV/div	5 mV/div ... 10 mV/div

Table 4.

	Susceptibility: disturbance less than 10 % of full scale		
Frequency range: 25 MHz ... 1 GHz	E = < 0.1V/m	E = 1V/m	E = 3 V/m
Stand alone	N/A	2 mV/div	2 mV/div ... 5 mV/div
With PM9010/091	N/A	10 mV/div ... 20 mV/div	50 mV/div .... 100 mV/div

For conditions not specified in tables 1 - 4, a susceptibility effect of more than 10 % is possible.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

The PM3094 and PM3092, including standard accessories, conform with the EEC Directive 89/336 for EMI immunity, as defined by IEC 801-3, with the addition of the following tables.

Table 5.

	Susceptibility: no visible disturbance		
Frequency range: 10 kHz .. 25 MHz	E = < 0.1V/m	E = 1 V/m	E = 3 V/m
Stand alone	2 mV/div ... 5 V/div	2 mV/div ... 5 V/div	2 mV/div ... 5 V/div
With PM9020/091	2 mV/div ... 5 V/div	10 mV/div ... 5 V/div	20 mV/div ... 5 V/div

Table 6.

	Susceptibility: no visible disturbance		
Frequency range: 25 MHz ... 1 GHz	E = < 0.1V/m	E = 1 V/m	E = 3 V/m
Stand alone	2 mV/div ... 5 V/div	2 mV/div ... 5 V/div	10 mV/div ... 5 V/div
With PM9020/091	2 mV/div ... 5 V/div	200 mV/div ... 5 V/div	500 mV/div ... 5 V/div

Table 7.

	Susceptibility: disturbance less than 10 % of full scale		
Frequency range: 10 kHz.. 25 MHz	E = < 0.1V/m	E = 1V/m	E = 3 V/m
Stand alone	N/A	N/A	N/A
With PM9020/091	N/A	2 mV/div ... 5 mV/div	5 mV/div ... 10 mV/div

Table 8.

	Susceptibility: disturbance less than 10 % of full scale		
Frequency range: 25 MHz ... 1 GHz	E = < 0.1V/m	E = 1V/m	E = 3 V/m
Stand alone	N/A	N/A	2 mV/div ... 5 mV/div
With PM9020/091	N/A	50 mV/div ... 100 mV/div	100 mV/div ... 200 mV/div

For conditions not specified in tables 5-8, a susceptibility effect of more than 10 % is possible.

2.13.2 VDE requirements

The instrument meets the requirements of VDE 0871, Grenzwertklasse B.

2.13.3 Additional EMI requirements

The instrument is tested in accordance with IEC 351-1 par 5.1.3.1. The maximum deflection factor is 7 mm/mT (0.7 mm/gauss). This value measured with the instrument in a homogeneous field (in any direction with respect to the instrument) with a flux intensity (peak to peak value) of 1.42 mT (14.2 gauss) and of symmetrical sine wave form with frequency of 45 Hz ... 66 Hz.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.14 SAFETY

MEETS REQUIREMENTS OF	IEC 348 Class I	See note 1
	UL 1244	See note 2
	CSA C22.2 No231	See note 2
	VDE 0411	See note 1
APPROVALS (applied for)	CSA C22.2 No231	
MAX. X-RADIATION	MIL-T-28800D par. 3.9.3.4.a	

Note 1: *Except for power cord, unless shipped with universal European power plug.*

Note 2: *Except for power cord, unless shipped with North American power plug.*

2.15 ACCESSORIES

PACKED WITH INSTRUMENT		
Signal input (passive)	2 x 10 MΩ, 10:1 probe with readout (1.5 m)	
Contrast filter	Blue	
Front cover	Can be locked on instrument	
Users Manual		
Reference Manual		

2.16 OPTIONS & OPTIONAL VERSIONS

2.16.1 Line Cord

LINE CORD	Universal European	in accordance with VDE
	North American	in accordance with CSA, UL
	United Kingdom	in accordance with BSI
	Australian	in accordance with SAA
	Swiss	in accordance with SAV

2.16.2 Options versions

EXTERNAL INTERFACES		
	Y-out, MTB-gate, DTB-gate, EXT triggering	Factory installed only
	IEEE	Factory installed only

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.16.3 Optional outputs

Y SIGNAL OUT	BNC	
Source	CH1	
Coupling	as CH1	
Voltage: into 1 MΩ	20 mV/div	
with a tolerance of	±10 %	
into 50 Ω	10 mV/div	
with a tolerance of	±10 %	
Freq. response (PM3092/94)	dc ... 200 MHz	Terminated with 50Ω
Freq. response (PM3082/84)	dc ... 100 MHz	Terminated with 50Ω
Dynamic range	±10div	At 50 MHz
MTB/DTB GATE OUT		
Connector	BNC	
Output impedance	1 kΩ	
Voltage:		
Timebase not running	0.2 ± 0.2 V	
Timebase running	3.7 ± 1.3 V	

2.16.4 Optional external MTB trigger input

SOURCE(S) MTB-triggering	CH1 ... CH4 External Composite	 No line triggering
INPUT CONNECTOR	BNC	At rear of instrument
INPUT IMPEDANCE		Measured at freq.<1MHz
R parallel - value	1 M Ω	
- tolerance	± 1 %	
C parallel - value	25 pF	
- tolerance	± 5 pF	
DYNAMIC RANGE		
Up to 10 MHz	± 2.5 V	Symmetrical
INPUT VOLTAGE LIMITS		See note 1
(d.c. + a.c. peak)	± 400 V	See note 2

Note 1: *Apparatus should be properly grounded through the protective ground conductor of the power cord.*

Note 2: *Up to 10 kHz; > 10kHz see figure 1.1.*

EDGE TRIGGER SENSITIVITY		See note 3
d.c. to 5 MHz	100 mV	
d.c. to 10 MHz	200 mV	

Note 3: *In noise-trigger multiply stated value by 2.*

TRIGGERLEVEL		
Range	± 1.45 V	See note 4
Accuracy	≤ 0.45 V	at 1 kHz inputsignal triggercoupling DC

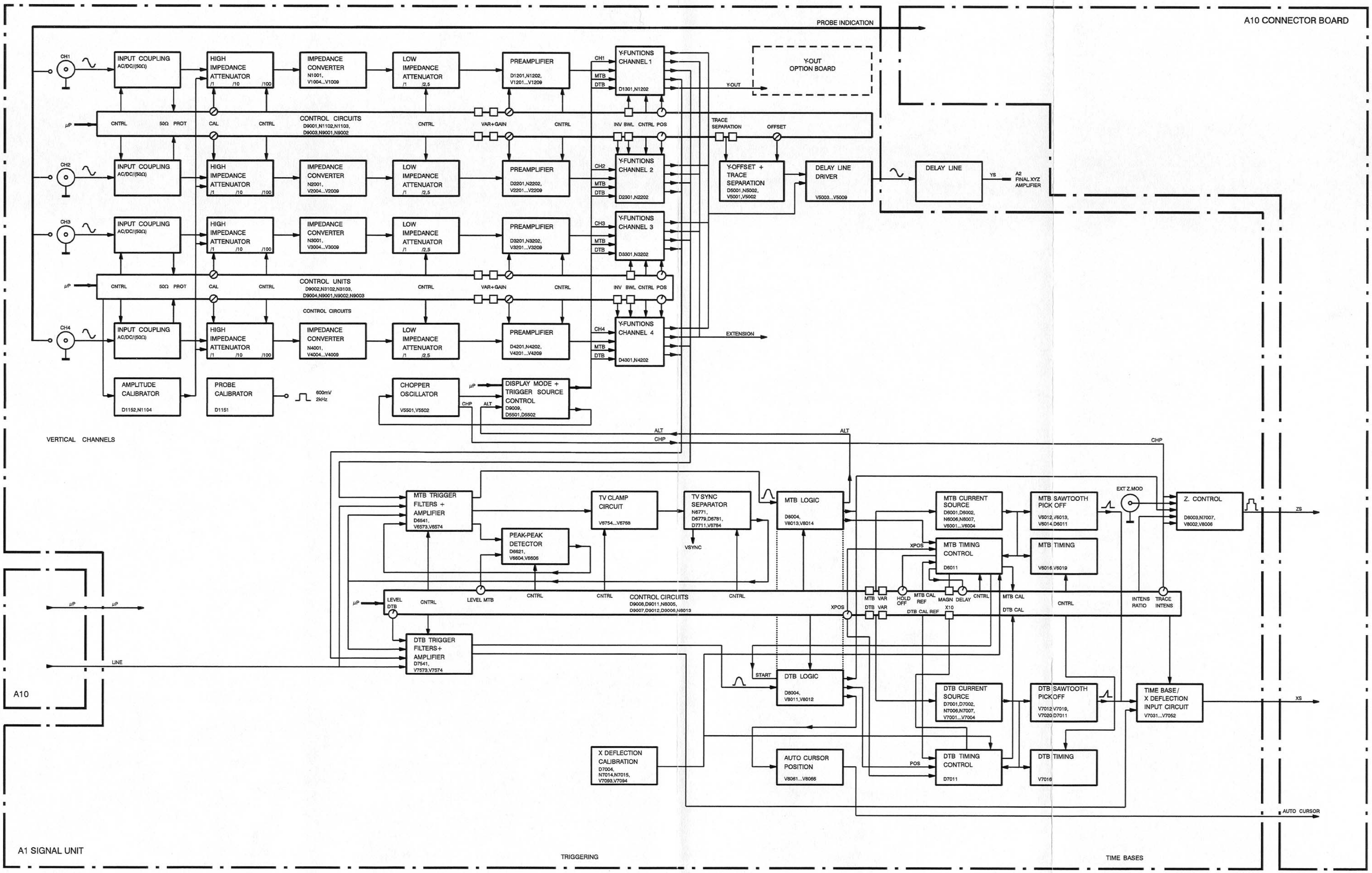
Note 4: *With Level-pp on the range is restricted to the peak-peak value of the trigger signal.*

2.17 SPECIFICATION OF IEEE-OPTION

TYPE OF INTERFACE	ANSI/IEEE 488.2	SCPI (see SCPI operating manual) Note 1
INTERFACE REPERTORY		
Source handshake	SH1	Complete capability
Acceptor handshake	AH1	Complete capability
Talker	T5	Basic talker: yes Serial poll: yes Talk only: yes Unaddress if MLA: yes
Listener	L3	Basic listener: yes Listener only: yes Unaddress if MTA: yes
Service request	SR1	Complete capability
Remote local	RL1	Complete capability
Parallel poll	PPO	No capability
Device clear	DC1	Complete capability
Device trigger	DT1	Complete capability
Controller	CO	No capability
ELECTRICAL INTERFACE		
Busdrivers	E2	Three state (true=0 … 0.8V; false=2 … 5V)
Connector	Shielded	Amphenol type 57FE-20240-20SD35
Pin 1 … 4	DIO1 … DIO4	
Pin 13 … 16	DIO5 … DIO8	
Pin 18 … 23	GND	
Pin 24	Logic GND	
Pin 5	EOI	
Pin 6	DAV	
Pin 7	NRFD	
Pin 8	NDAC	
Pin 9	IFC	
Pin 10	SRQ	
Pin 11	ATN	
Pin 12	Shield	
Pin 17	REN	
FUNCTION SELECTION	Via UTIL-MENU	Busaddress Default: 8 Note 2
INTERFACE STATUS INDICATOR	On screen	

Note 1: *Talker/listener.*

Note 2: *When battery installed, same as last power-off value.*



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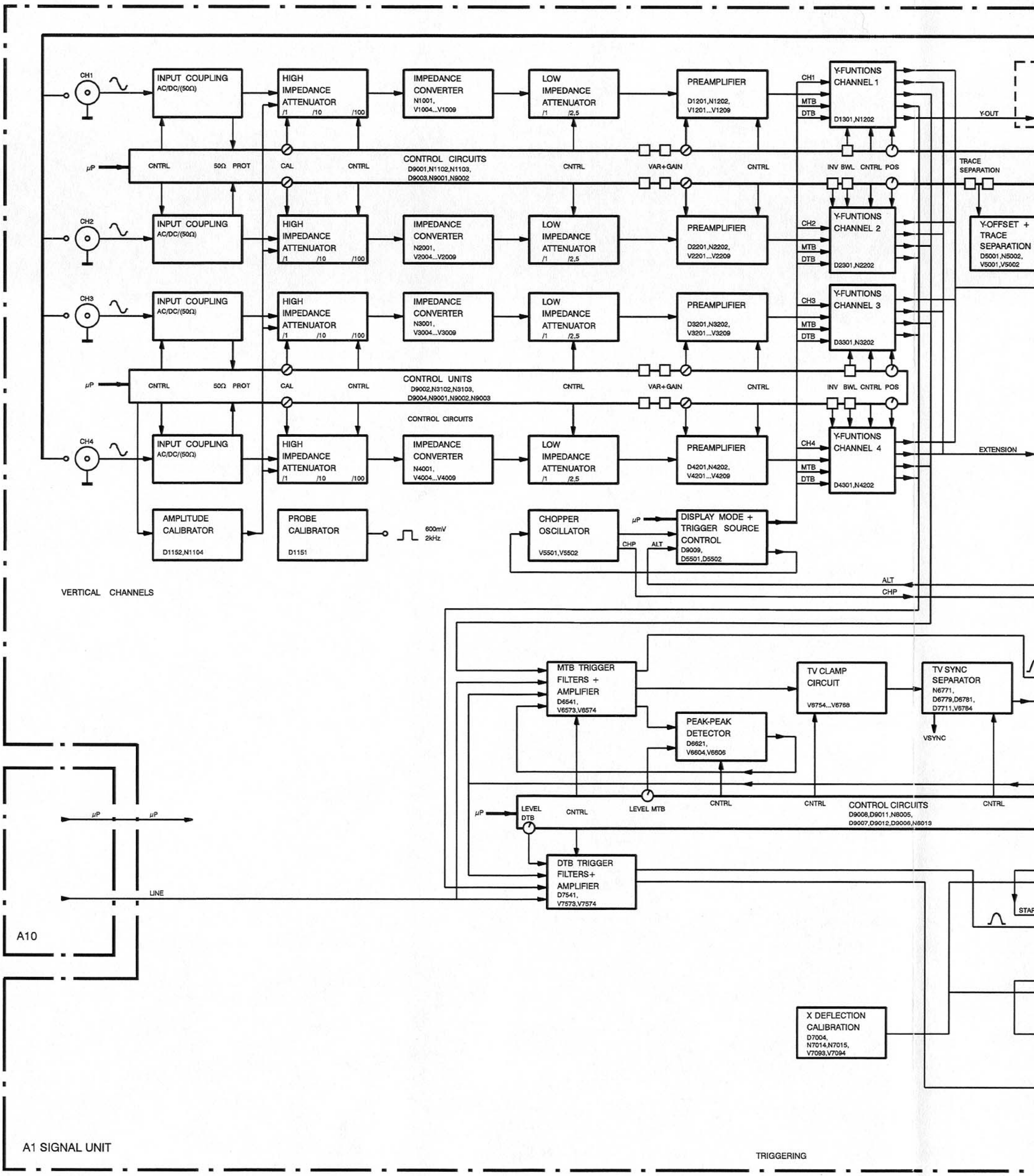
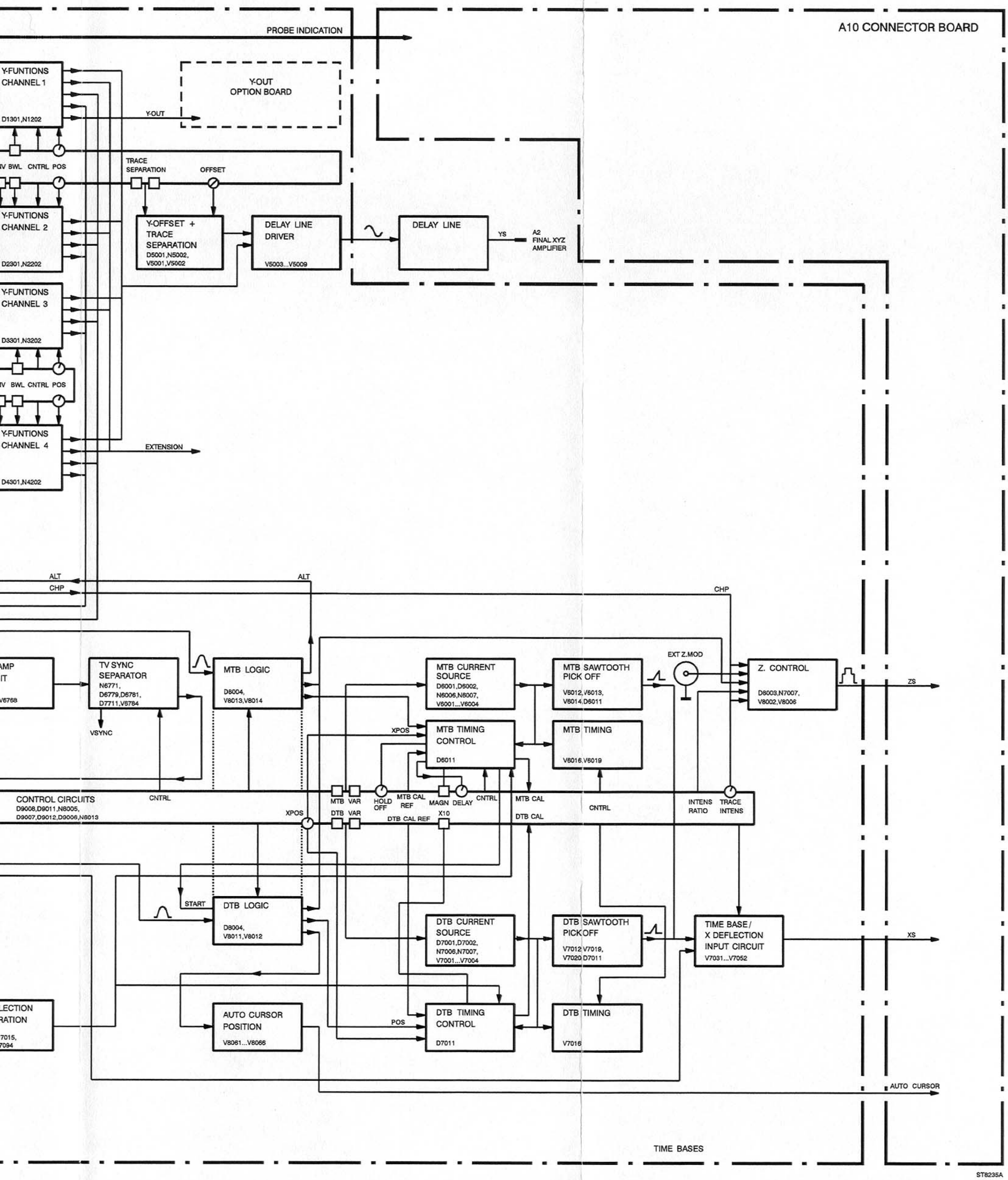


CH1
INPUT COUPLING AC/DC/(50Ω)
HIGH IMPEDANCE ATTENUATOR /1 /10 /100
IMPEDANCE CONVERTER N1001, V1004...V1009
LOW IMPEDANCE ATTENUATOR /1 /2,5
PREAMPLIFIER D1201,N1202, V1201...V1209
Y-FUNTIONS CHANNEL 1 D1301,N1202
CH1
MTB
DTB
Y-OUT
μP
CNTRL
50Ω PROT
CAL
CONTROL CIRCUITS D9001,N1102,N1103, D9003,N9001,N9002
VAR+GAIN
INV BWL CNTRL POS
TRACE SEPARATION
CH2
INPUT COUPLING AC/DC/(50Ω)
HIGH IMPEDANCE ATTENUATOR /1 /10 /100
IMPEDANCE CONVERTER N2001, V2004...V2009
LOW IMPEDANCE ATTENUATOR /1 /2,5
PREAMPLIFIER D2201,N2202, V2201...V2209
Y-FUNTIONS CHANNEL 2 D2301,N2202
Y-OFFSET + TRACE SEPARATION D5001,N5002, V5001,V5002
CH3
INPUT COUPLING AC/DC/(50Ω)
HIGH IMPEDANCE ATTENUATOR /1 /10 /100
IMPEDANCE CONVERTER N3001, V3004...V3009
LOW IMPEDANCE ATTENUATOR /1 /2,5
PREAMPLIFIER D3201,N3202, V3201...V3209
Y-FUNTIONS CHANNEL 3 D3301,N3202
CONTROL UNITS D9002,N3102,N3103, D9004,N9001,N9002,N9003
CONTROL CIRCUITS
CH4
INPUT COUPLING AC/DC/(50Ω)
HIGH IMPEDANCE ATTENUATOR /1 /10 /100
IMPEDANCE CONVERTER N4001, V4004...V4009
LOW IMPEDANCE ATTENUATOR /1 /2,5
PREAMPLIFIER D4201,N4202, V4201...V4209
Y-FUNTIONS CHANNEL 4 D4301,N4202
EXTENSION
AMPLITUDE CALIBRATOR D1152,N1104
PROBE CALIBRATOR D1151
600mV 2kHz
CHOPPER OSCILLATOR V5501,V5502
CHP
ALT
DISPLAY MODE + TRIGGER SOURCE CONTROL D9009, D5501,D5502
VERTICAL CHANNELS
MTB TRIGGER FILTERS + AMPLIFIER D6541, V6573,V6574
TV CLAMP CIRCUIT V6754...V6768
TV SYNC SEPARATOR N6771, D6779,D6781, D7711,V6784
VSYNC
PEAK-PEAK DETECTOR D6621, V6604,V6606
LEVEL DTB
LEVEL MTB
CONTROL CIRCUITS D9008,D9011,N8005, D9007,D9012,D9006,N8013
DTB TRIGGER FILTERS+ AMPLIFIER D7541, V7573,V7574
LINE
A10
X DEFLECTION CALIBRATION D7004, N7014,N7015, V7093,V7094
A1 SIGNAL UNIT
TRIGGERING


A10 CONNECTOR BOARD
PROBE INDICATION
Y-FUNTIONS CHANNEL 1
D1301,N1202
Y-OUT
Y-OUT OPTION BOARD
BWL CNTRL POS
TRACE SEPARATION
OFFSET
Y-FUNTIONS CHANNEL 2
D2301,N2202
Y-OFFSET + TRACE SEPARATION
D5001,N5002, V5001,V5002
DELAY LINE DRIVER
V5003...V5009
DELAY LINE
YS
A2 FINAL XYZ AMPLIFIER
Y-FUNTIONS CHANNEL 3
D3301,N3202
BWL CNTRL POS
Y-FUNTIONS CHANNEL 4
D4301,N4202
EXTENSION
ALT
CHP
ALT
CHP
TV SYNC SEPARATOR
N6771, D6779,D6781, D7711,V6784
VSYNC
MTB LOGIC
D8004, V8013,V8014
MTB CURRENT SOURCE
D6001,D6002, N6006,N6007, V6001...V6004
MTB SAWTOOTH PICK OFF
V6012,V6013, V6014,D6011
EXT Z.MOD
Z. CONTROL
D6003,N7007, V8002,V8006
ZS
XPOS
MTB TIMING CONTROL
D6011
MTB TIMING
V6016,V6019
CONTROL CIRCUITS
D9008,D9011,N8005, D9007,D9012,D9006,N6013
CNTRL
XPOS
MTB VAR
DTB VAR
HOLD OFF
MTB CAL REF
MAGN
DELAY
CNTRL
DTB CAL REF
X10
MTB CAL
DTB CAL
CNTRL
INTENS RATIO
TRACE INTENS
START
DTB LOGIC
D8004, V8011,V8012
DTB CURRENT SOURCE
D7001,D7002, N7006,N7007, V7001...V7004
DTB SAWTOOTH PICKOFF
V7012,V7019, V7020,D7011
TIME BASE / X DEFLECTION INPUT CIRCUIT
V7031...V7052
XS
AUTO CURSOR POSITION
V8061...V8066
POS
DTB TIMING CONTROL
D7011
DTB TIMING
V7016
AUTO CURSOR
TIME BASES
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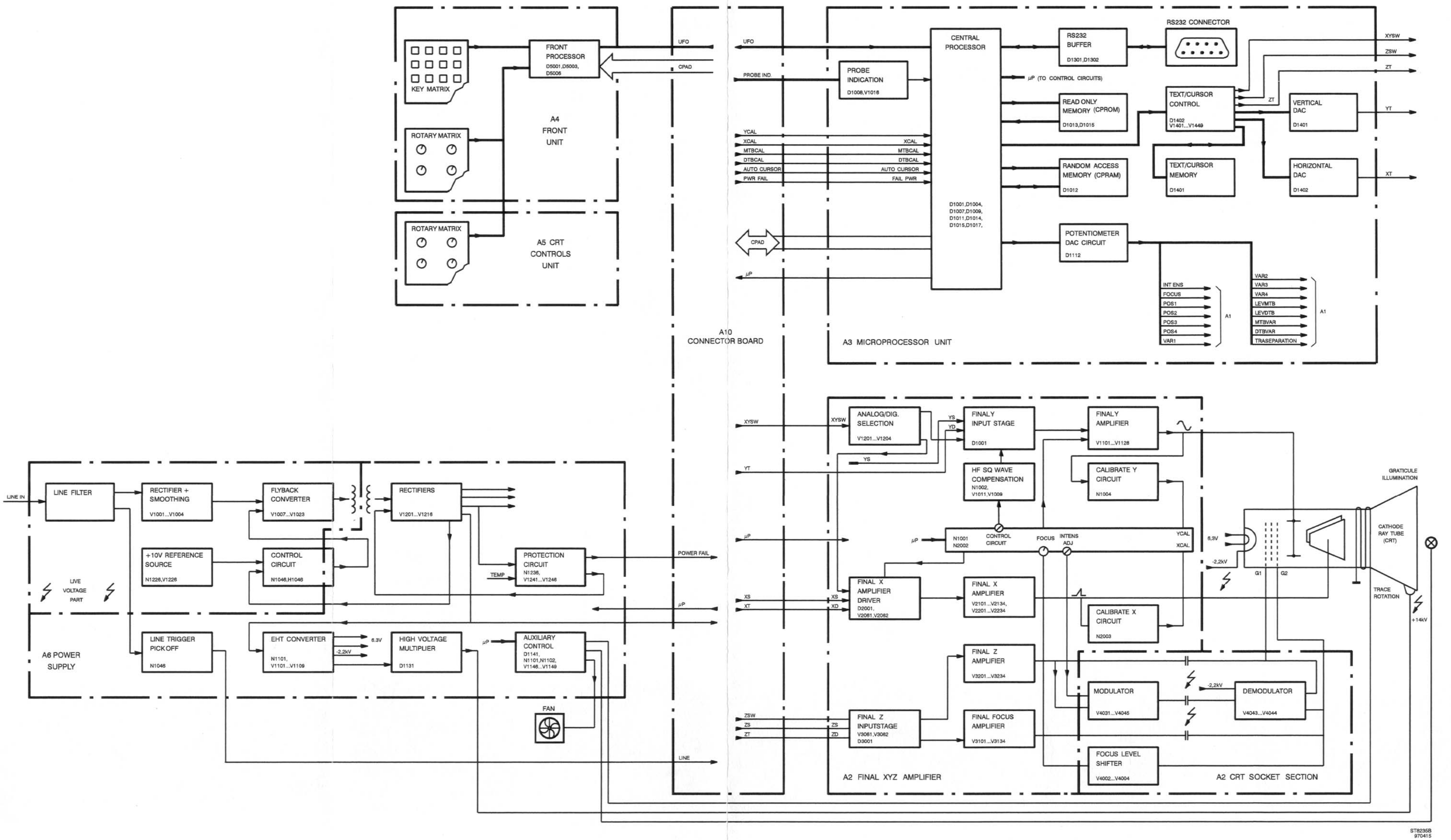

FRONT PROCESSOR
D5001,D5003, D5006
KEY MATRIX
ROTARY MATRIX
A4 FRONT UNIT
A5 CRT CONTROLS UNIT
A10 CONNECTOR BOARD
UFO
CPAD
PROBE IND.
YCAL
XCAL
MTBCAL
DTBCAL
AUTO CURSOR
PWR FAIL
PROBE INDICATION
D1008,V1016
CENTRAL PROCESSOR
D1001,D1004, D1007,D1009, D1011,D1014, D1015,D1017,
RS232 BUFFER
D1301,D1302
RS232 CONNECTOR
µP (TO CONTROL CIRCUITS)
READ ONLY MEMORY (CPROM)
D1013,D1015
RANDOM ACCESS MEMORY (CPRAM)
D1012
TEXT/CURSOR CONTROL
D1402 V1401...V1449
TEXT/CURSOR MEMORY
D1401
VERTICAL DAC
D1401
HORIZONTAL DAC
D1402
POTENTIOMETER DAC CIRCUIT
D1112
XYSW
ZSW
ZT
YT
XT
INT ENS
FOCUS
POS1
POS2
POS3
POS4
VAR1
VAR2
VAR3
VAR4
LEVMTB
LEVDTB
MTBVAR
DTBVAR
TRASEPARATION
A1
A3 MICROPROCESSOR UNIT
LINE IN
LINE FILTER
RECTIFIER + SMOOTHING
V1001...V1004
FLYBACK CONVERTER
V1007...V1023
RECTIFIERS
V1201...V1216
+10V REFERENCE SOURCE
N1226,V1226
CONTROL CIRCUIT
N1046,H1046
PROTECTION CIRCUIT
N1236, V1241...V1246
TEMP
LIVE VOLTAGE PART
LINE TRIGGER PICK OFF
N1046
EHT CONVERTER
N1101, V1101...V1109
6.3V
-2,2kV
HIGH VOLTAGE MULTIPLIER
D1131
AUXILIARY CONTROL
D1141, N1101,N1102, V1146...V1149
A6 POWER SUPPLY
FAN
POWER FAIL
µP
LINE
ANALOG/DIG. SELECTION
V1201...V1204
FINAL Y INPUT STAGE
D1001
FINAL Y AMPLIFIER
V1101...V1128
HF SQ WAVE COMPENSATION
N1002, V1011,V1009
CALIBRATE Y CIRCUIT
N1004
YS
YD
N1001 N2002
CONTROL CIRCUIT
FOCUS
INTENS ADJ
FINAL X AMPLIFIER DRIVER
D2001, V2061,V2062
FINAL X AMPLIFIER
V2101...V2134, V2201...V2234
CALIBRATE X CIRCUIT
N2003
XS
XD
FINAL Z AMPLIFIER
V3201...V3234
FINAL Z INPUTSTAGE
V3061,V3062 D3001
FINAL FOCUS AMPLIFIER
V3101...V3134
ZS
ZD
A2 FINAL XYZ AMPLIFIER
MODULATOR
V4031...V4045
DEMODULATOR
V4043...V4044
FOCUS LEVEL SHIFTER
V4002...V4004
A2 CRT SOCKET SECTION
GRATICULE ILLUMINATION
CATHODE RAY TUBE (CRT)
TRACE ROTATION
+14kV
G1
G2
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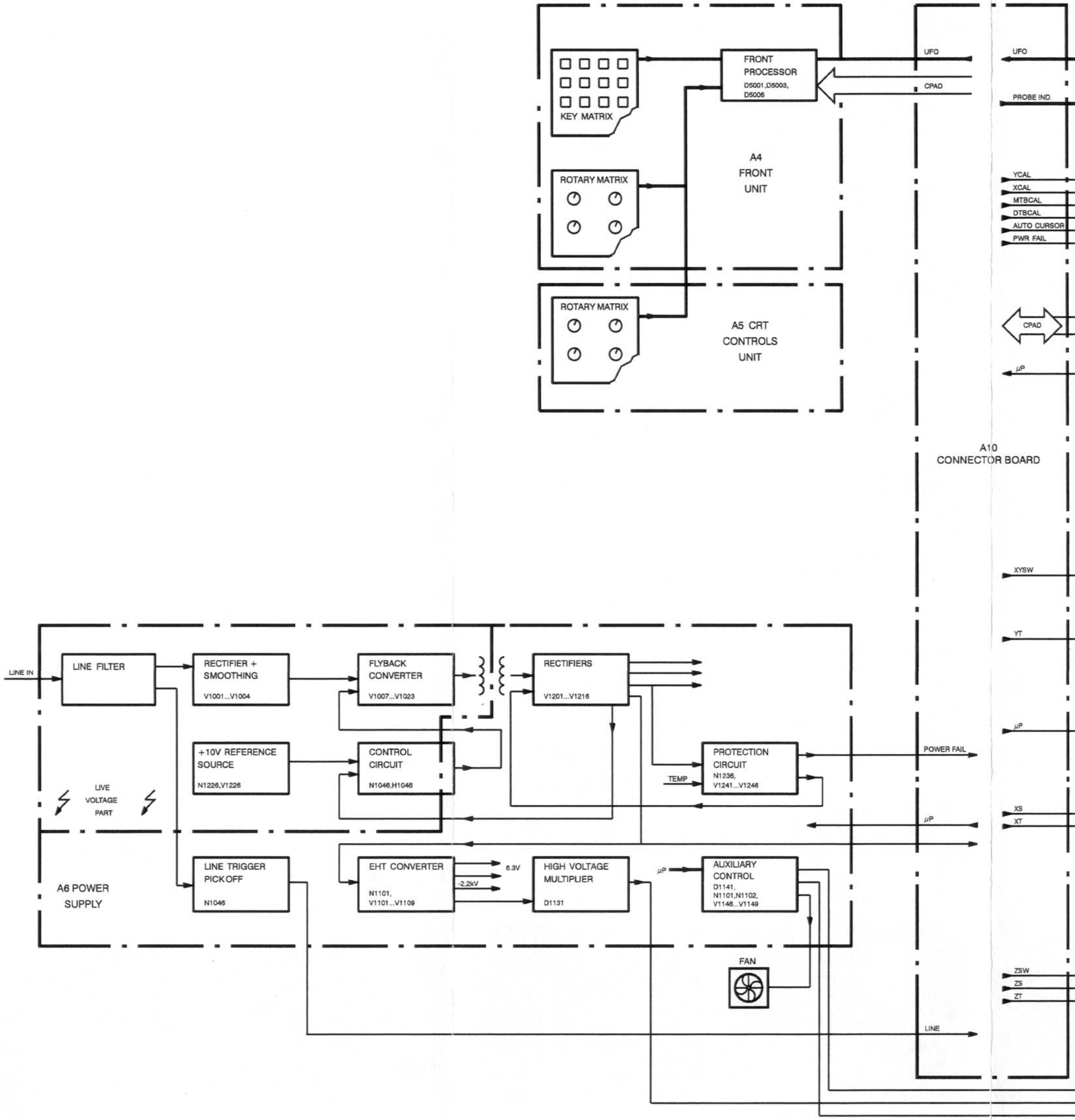
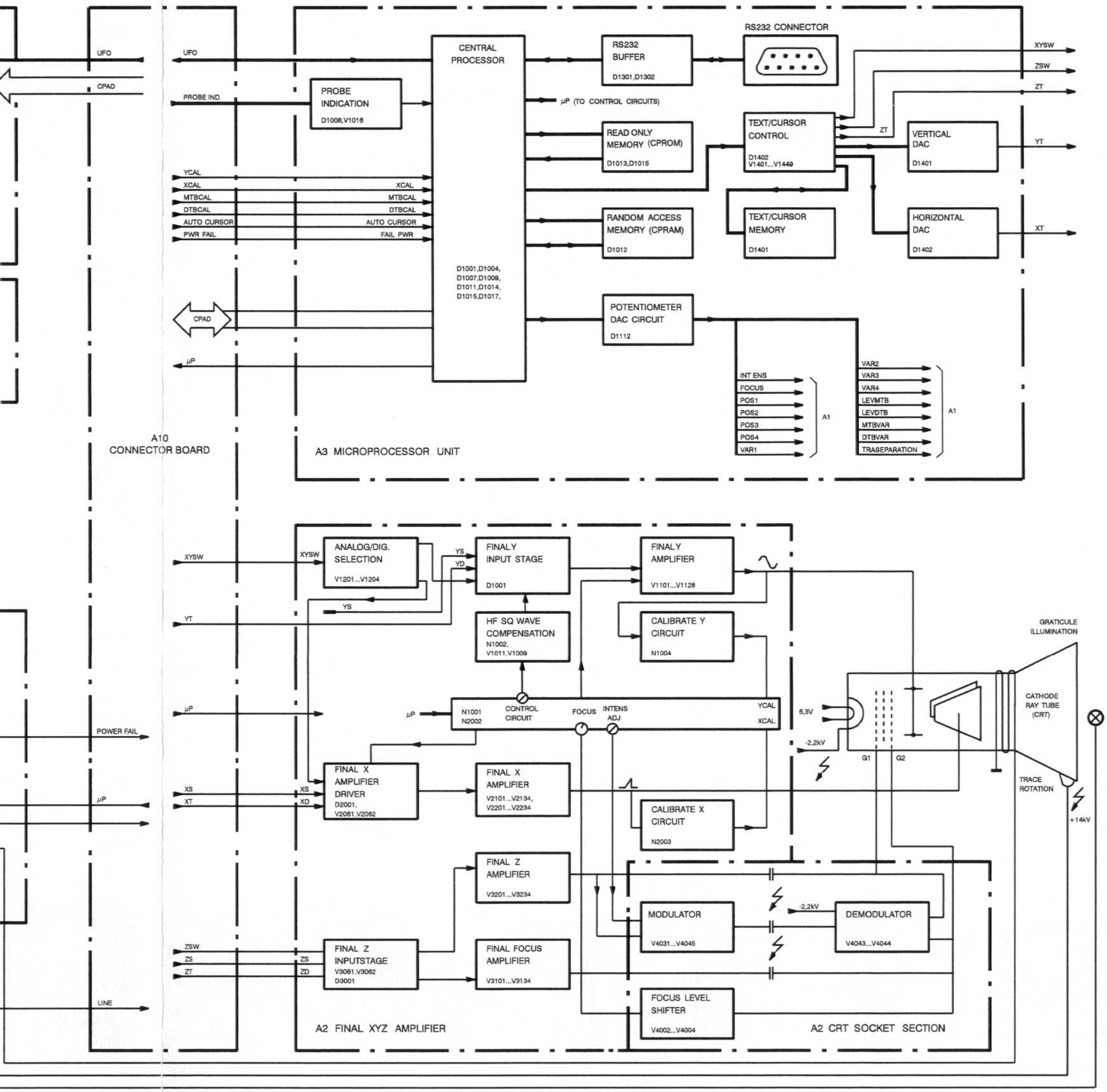

KEY MATRIX
FRONT
PROCESSOR
D5001,D5003,
D5006
ROTARY MATRIX
A4
FRONT
UNIT
ROTARY MATRIX
A5 CRT
CONTROLS
UNIT
UFO
CPAD
UFO
PROBE IND.
YCAL
XCAL
MTBCAL
DTBCAL
AUTO CURSOR
PWR FAIL
CPAD
μP
A10
CONNECTOR BOARD
XYSW
YT
μP
XS
XT
ZSW
ZS
ZT
LINE
LINE IN
LINE FILTER
RECTIFIER +
SMOOTHING
V1001...V1004
FLYBACK
CONVERTER
V1007...V1023
RECTIFIERS
V1201...V1216
+10V REFERENCE
SOURCE
N1226,V1226
CONTROL
CIRCUIT
N1046,H1046
PROTECTION
CIRCUIT
N1236,
V1241...V1246
TEMP
POWER FAIL
μP
LIVE
VOLTAGE
PART
A6 POWER
SUPPLY
LINE TRIGGER
PICK OFF
N1046
EHT CONVERTER
N1101,
V1101...V1109
6.3V
-2.2kV
HIGH VOLTAGE
MULTIPLIER
D1131
μP
AUXILIARY
CONTROL
D1141,
N1101,N1102,
V1146...V1149
FAN



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3 DESCRIPTIONS

3.1 General description

3.1.1 Introduction to oscilloscope family

The family consists of four analog general purpose oscilloscopes with model numbers PM3082, PM3084, PM3092 and PM3094. All instruments have four vertical channels. Differences between these models are the vertical bandwidth, the features of the vertical channels 3 and 4 and the presence of switcheable 50Ω input impedance.

Vertical bandwidth is 100 or 200 MHz. The 'true 4 channel' oscilloscopes have four channels with a wide range of input sensitivities. Channel 3 and 4 in the '4 channel' versions offer the most commonly used input sensitivities (0.1 and 0.5 V/div). The table below explains the differences.

Model number	4 chann	true 4 chann	100 MHz	200MHz	Input impedance
PM3082	*		*		1 MΩ
PM3084		*	*		1 MΩ
PM3092	*			*	1 MΩ/50 Ω (CH1,2) 1 MΩ (CH3,4)
PM3094		*		*	1 MΩ/50 Ω

The printed circuit boards (units) and mechanical parts in this family of oscilloscopes have a high degree of standardization. The ordering codes for these parts are listed in chapter 4 'Parts'. In this chapter differences between PM3082, PM3084, PM3092 and PM3094 are mentioned.

3.1.2 Introduction to descriptions

Section 3.2 contains the description of the block diagram. The information in this diagram is presented in such a way that the link with the circuit diagrams in chapter 5 'Unit descriptions' can be found easily.

In chapter 4 'Parts' all general parts are described. These are, for example, the printed circuit boards (units), cables and mechanical parts that are not fixed to a specific unit. Cables are clearly identified on an interconnection diagram.

In chapter 5 the units are described in sequence of their number (A1, A2, A3, ...). Per unit the following information is given:

- Description
- Signal name list
- Unit lay-out (and location raster for the large units)
- Circuit diagrams
- Parts lists

3.1.3 Explanation of signal names

Throughout the circuit diagrams signal names are used. These names make it easier to trace a signal going from one circuit diagram to another. In many cases the signal name and also the component to which a certain node is connected are given in the circuit diagrams.

For every printed circuit board a signal name list is shown in alphabetical order. It shows:
- The meaning/function of the signal.
- The signal source(s).
- The signal destination(s).

Signal names are chosen up in a logical way. Basically signal names (e.g. MTBPPLEV-HD) consist of two parts:
- A functional part with a maximum of 10 characters (e.g. MTBPPLEV). The part is arranged such that recognition is easy.
- An extension with a maximum of 2 characters (e.g. HD). The extension is not always used.

The first characters (e.g. MTB) in the **functional part** indicate the part of the oscilloscope. Examples are:
- AT1, AT2, AT3, AT4: the input attenuators of channel 1, 2, 3, 4.
- PA1, PA2, PA3, PA4: the preamplifiers of channel 1, 2, 3, 4.
- FNC1, FNC2, FNC3, FNC4: the function selection parts of channel 1, 2, 3, 4. MTR: main time base triggering.
- MTB: main time base.
- DTR: delayed time base triggering.
- DTB: delayed time base.

The last set of characters in the **functional part** (e.g. PPLEV) indicates the function: in this example Peak-Peak LEVel triggering is switched on/off.

The first character of the **extension** indicates if the signal is active when high (H), active when low (L) or that this is not fixed (X, for instance the output of a counter).

The second character of the **extension** indicates the kind of logic. Possible abbreviations are: T (TTL), E (ECL), A (analog signal), C (CMOS 12 ... 15V) and D (CMOS 5V).

3.1.4 Voltage values in the circuit diagrams.

Throughout the circuit diagrams voltage values are indicated. This facilitates fault finding in the vertical channels, triggering, time base and final amplifiers. Most of the voltages consist of an AC signal superimposed on a DC biasing voltage. Some of the AC voltages are small. They must be measured with an oscilloscope via a 1:1 probe and AC coupled input. The DC signal component is bigger and must be measured with the measuring oscilloscope with DC coupled input. The nodes where a signal can be measured are indicated with a dot on the p.c.b. lay-outs.

The oscilloscope under test must be prepared as follows:
- Connect the CAL voltage via a 10:1 probe with indication ring to the input of the suspected channel.
- Press the STATUS and TEXT OFF key simultaneously to get a defined starting position.
- Press the AUTOSET key.
- Put AMPL/VAR of the active channel to 0.1 V: this should give 6 vertical divisions of signal on the screen.

Some important notes:

- To measure some signals, it is necessary to unlock units. Refer to chapter 8.5 for details on how to proceed.
- The given AC and DC signals are average values: your oscilloscope under test may deviate from the values given in the circuit diagrams.
- Although the oscilloscope is in standard setting, it may be necessary to do manual selections for certain measurements. To measure e.g. the delayed time base and its triggering, it is necessary to activate DTB and to select a channel as DTB trigger source.
- When measuring in the final amplifiers, it advised to switch off all text. This gives 'cleaner' signals at the outputs. The text is written inbetween the signal at a random basis.
- Measuring the outputs of the final Y amplifier must be done with a 10 kΩ resistor between probe tip and signal. This avoids oscillations.

3.2 BLOCK DIAGRAM DESCRIPTION.

3.2.1 Introduction.

This block diagram and description are based upon the most complex version of this family of analog oscilloscopes. Therefore there may be minor differences between your oscilloscope and the block diagram and its description. Where differences may occur it is mentioned in the text.

The item numbers of active components are indicated each block of the diagram. This facilitates to make the link with the circuit diagrams.

The oscilloscope is controlled by a microprocessor that connects to many blocks. Therefore throughout this block diagram CONTROL CIRCUITS can be found that are controlled by the microprocessor. The output signals can be simple on/off signals e.g. to switch a certain vertical channel on and off. There are also adjustable dc voltages e.g. to determine the gain of a vertical channel. Blocks that are under control of the microprocessor have the input signal "uP". In the vertical, horizontal and time base sections, circuits are added for microcomputer controlled automatic calibration.

This description is divided according to the functional blocks that can be distinguished:

- Vertical channels: there are 4 vertical channels.
- Triggering and time bases: there are sections for main- and delayed time base.
- Final amplifiers: for vertical (Y) and horizontal (X) deflection, intensity (Z) and focusing control.
- Front unit and microprocessor unit.
- Power supply unit.

Also the printed circuit boards (units) are indicated in the blockdiagram. These units are:

- Signal unit A1: is the largest of all and incorporates 4 vertical channels and main- and delayed triggering and time base.
- Final XYZ amplifier A2: all final amplifiers are present here. A separate part is connected to the CRT socket.
- Microprocessor unit A3.
- Front unit A4: incorporates most of the rotary knobs and keys.
- CRT controls unit A5: incorporates the rotary knobs for the display functions.
- Power supply unit A6: supplies various voltages to the other circuit boards.
- Motherboard A10: many signals are routed via this unit.

3.2.2 Vertical channels.

There are 4 vertical channels that are mainly identical. A difference is that the 200 MHz oscilloscope versions have a switchable 50Ω input impedance while the 100 MHz types do not have this feature. Another difference is between the 4 channel and the 2 + 2 channel versions. The 4 channel scopes have 4 identical vertical channels (CH1, CH2, CH3 and CH4) with an extensive range of input sensitivities. The various input sensitivities are made by combinations of settings of HIGH IMPEDANCE ATTENUATOR, LOW IMPEDANCE ATTENUATOR and PREAMPLIFIER.
The 2 + 2 channel versions have 2 identical vertical channels (CH1 and CH2) with an extensive range of input sensitivities. The other 2 channels (CH3 and CH4) are identical and have 2 switchable input sensitivities. Channel 1 operation and the differences with channels 2, 3 and 4 are now explained.

The CH1 input signal is applied to the INPUT COUPLING block. Here selection between ac or dc coupled input is done. Moreover in the 200 MHz oscilloscopes selection between 50Ω and 1 MΩ input impedance is done here. A signal 50Ω PROTection signals via the CONTROL CIRCUITS to the microprocessor if the dissipation in the 50Ω termination resistor gets too high.

The block HIGH IMPEDANCE ATTENUATOR incorporates the attenuation coefficients /100, /10 and /1. This block has a fixed attenuation in channels with 2 input sensitivities such as present in the 2 + 2 channel oscilloscopes. The input signal originating from the AMPLITUDE CALIBRATOR is used to automatically calibrate the vertical channels. The AMPLITUDE CALIBRATOR is a generator that can deliver 8 different accurate voltages. The HIGH IMPEDANCE ATTENUATOR also comprises a high-frequency square-wave adjustment; this is done by adjustment of dc signal CAL.

The IMPEDANCE CONVERTER converts the input signal at high input impedance into an output signal at a low impedance. This block is followed by a LOW IMPEDANCE ATTENUATOR that makes the attenuation coefficients /2,5 and /1. This block has a fixed attenuation in channels with 2 input sensitivities such as present in the 2 + 2 channel oscilloscopes.

The PREAMPLIFIER incorporates gain/attenuation coefficients x1, x5, /2 and also continuous GAIN control via a microprocessor adjustable dc signal. The PREAMPLIFIER is followed by Y-FUNCTIONS CHANNEL 1. In this block the selection is achieved of vertical display via channel 1, Main Time Base (MTB) triggering via channel 1 and Delayed Time Base (DTB) triggering via channel 1. Also the filter for the Bandwidth Limiter (BWL), the vertical position control (POS) and an output for future extensions (EXT). From Y-FUNCTIONS CHANNEL 1 the signal for the Y- OUTput socket is derived. The Y-FUNCTIONS blocks of channel 2 and 4 have an INVert function for signal inversion.

The selection of the vertical channel, MTB and DTB trigger source is initiated by the block DISPLAY MODE + TRIGGER SOURCE CONTROL. The channels and trigger sources to be displayed are controlled by the microprocessor (uP). In ALTernate display mode the switching between channels/trigger sources occurs at the end of the MTB sweep. The signal ALT controls this. For the vertical display mode CHOPpped a 2MHz CHOPPER OSCILLATOR is present. Display blanking during switching from one channel to another is done via signal CHP.

The selected vertical channel(s) are applied to the DELAY LINE DRIVER. This block is an amplifier that has the correct output impedance to drive the DELAY LINE. The DELAY LINE itself consists of a coaxial cable giving sufficient signal delay so that propagation delay in the trigger circuits is compensated. Because of this leading edges of fast-rising pulses can be made visible. The Y-OFFSET + TRACE SEPARATION block can influence the offset of the signal applied to the DELAY LINE DRIVER. This is used as offset compensation and also for TRACE SEParation in ALTernate Time Base mode.

The PROBE CALIBRATOR is a generator delivering a 2kHz/600mV square- wave signal. This signal can be used to adjust the square-wave response of attenuator probes.

3.2.3 Triggering and time bases.

The sections for Main Time Base (MTB) and Delayed Time Base (DTB) are for the greater part identical. Therefore the MTB part is extensively described and then the DTB part briefly.

Main Time Base Description.
The possible trigger sources are applied to the block MTB TRIGGER FILTERS + AMPLIFIER. The selection for triggering on the vertical channels 1, 2, 3 or 4 is done in the Y-FUNCTIONS blocks in the vertical section. Triggering is also possible on the LINE trigger signal that is derived from the mains. The MTB TRIGGER FILTERS + AMPLIFIER incorporates filters for HF- reject, LF-reject and ac or dc signal coupling. The block also incorporates the +/- slope selection. The dc control signal LEVEL MTB originating from the CONTROL CIRCUITS is routed via the PEAK-PEAK DETECTOR. This block limits in peak-peak mode the LEVEL MTB range just within the peak-peak value of the signal. For this purpose the trigger signal is applied to an input of the detector. The LEVEL MTB control signal is not limited if the peak-peak mode is inactive.

For triggering on TV synchronization pulses the blocks TV CLAMP CIRCUIT and TV SYNC SEPARATOR are used. The CLAMP CIRCUIT separates the synchronization pulses from the composite video signal. The video information is not necessary for triggering. The TV SYNC SEPARATOR filters out line, frame and field pulses. This is done for various TV systems including HDTV.

The block MTB TRIGGER FILTERS + AMPLIFIER sends trigger pulses to the MTB LOGIC. This logic is combined with the DTB LOGIC. The three output signals are used to start MTB (applied to MTB TIMING CONTROL), to switch intensity on and off (applied to Z CONTROL) and for ALTernate display switching (applied to DISPLAY MODE + TRIGGER SOURCE CONTROL).

The MTB is based on the principle that selectable capacitors (inside block MTB TIMING) are charged with a selectable constant current (from MTB CURRENT SOURCE). This results in a sawtooth voltage across the capacitor(s) that rises linearly with the time. As a consequence a time-linear horizontal deflection is obtained. The sawtooth voltage is routed to the horizontal deflection part via the MTB SAWTOOTH PICK OFF. This block serves as a high to low impedance converter so that the load to the timing capacitor(s) is minimal. Various time base sweep speeds are obtained by selecting different combinations of current values and timing capacitors. The function MTB VARiable works via the MTB CURRENT SOURCE.

The MTB TIMING CONTROL discharges the capacitor(s) if the maximum level of the sawtooth is reached. The MTB TIMING CONTROL allows the charging process to start again if a trigger occurs. The functions X POSition, HOLD OFF and 10x MAGN are applied to and realized in the MTB TIMING CONTROL. HOLD OFF determines the time between discharge of the timing capacitors and the moment that a trigger pulse is allowed to start the MTB again.

The MTB TIMING CONTROL accomplishes the DELAY time function. The sawtooth voltage is compared with an adjustable dc voltage. The DTB is started where both voltages have the same level: this condition is signalled to the DTB LOGIC via signal START.

The MTB TIMING CONTROL also plays a role in the automatic MTB calibration. A reference voltage MTBCALREF is compared with the sawtooth voltage. The time necessary for the sawtooth to reach the MTBCALREF level is monitored by the microprocessor via signal MTBCAL. If necessary the MTB is readjusted. Automatic calibration of the X-path (including output circuit of MTB TIMING CONTROL) is done with accurate voltages from the block X DEFLECTION CALIBRATION.

Delayed Time Base Description.
The function of DTB TRIGGER FILTERS + AMPLIFIER is identical to the corresponding block in the MTB part. A "peak-peak detector" for LEVEL DTB is not present. The range of this control is always fixed and not related to the peak-peak level of the signal. Blocks for TV triggering are not present in the DTB section. TV triggering of the DTB occurs via output signals from the TV SYNC SEPARATOR in the MTB section.

An output signal from DTB TRIGGER FILTERS + AMPLIFIERS can be used for X DEFLection (MTB and DTB are off then) via the block TIME BASE / X DEFLECTION INPUT CIRCUIT.

The function of DTB CURRENT SOURCE, DTB TIMING and DTB SAWTOOTH PICK OFF is identical to the corresponding blocks in the MTB section. For the DTB LOGIC there is an extra input signal START to start the DTB directly after the adjusted delay time. The START signal originates from the MTB TIMING CONTROL.
The block AUTO CURSOR POSITION is used to position the voltage cursors automatically on the top and bottom level of the signal. The top and bottom levels are detected via the DTB triggering: the microprocessor scans the waveform by successively changing the DTB LEVEL and checking if triggers are still detected. Automatic calibration of the X-path (including output circuit of DTB TIMING CONTROL) is done with accurate voltages from the block X DEFLECTION CALIBRATION.

The DTB TIMING CONTROL is simpler than the corresponding block in the MTB. The functions DELAY and HOLD OFF are not present. DTB uses the MTB hold off time. This is due to the fact that the DTB can not run while the MTB does not.

X deflection selection and intensity control.
The block TIME BASE/X DEFLECTION INPUT CIRCUIT permits selection between horizontal deflection via MTB/DTB or via a signal selected via the DTB triggering (X DEFL mode).

The block Z-CONTROL controls the intensity of the signal on the screen. This also affects the focusing. Signal intensity and the intensity of text is determined in the final amplifier section.

The signal intensity is determined by the MTB LOGIC (light on/off) and DTB LOGIC (intensified part during run of DTB). The ratio between intensity of MTB and DTB is determined by control signal INTENS RATIO. Input signal CHP gives display blanking in vertical display mode chopped when switching from one channel to another. The control signal TRACE INTENSITY is influenced by the control with the same name. Intensity can also externally be controlled via input socket EXT Z MOD.

3.2.4 Final amplifiers

The final amplifier can be split up in parts for vertical (Y) and horizontal (X) deflection and parts for intensity (Z) and focusing control. Input signals originate from vertical (Y) channels and time bases (X and Z). The signals that determine X, Y and Z of the text originate from the text generator on the microprocessor unit. The signal that switches between text and trace (SW signal) display originates also from the text generator. The outputs of the final amplifiers drive the Cathode Ray Tube (CRT). The various sections are explained now in sequence.

Vertical deflection.
The FINAL Y INPUT STAGE receives input signal for signal display (YS) from the DELAY LINE. A second input signal (YT) determines the vertical component of the text information. The input signal that comes from TEXT/TRACE SELECTION controls switching between text and trace display. The HF SQ WAVE COMPENSATION is controlled by the microcomputer provides that signal distortion from the DELAY LINE is compensated in the FINAL Y INPUT STAGE. The FINAL Y AMPLIFIER drives the vertical deflection plates of the CRT. The voltage applied to these plates is measured by the block CALIBRATE Y CIRCUIT. Its output signal YCAL is applied to the microprocessor; this is part of the automatic vertical calibration facility.

Horizontal deflection.
The FINAL X AMPLIFIER DRIVER receives input signal for signal display (XS) from the Main and Delayed Time Base sections. A second input signal (XT) determines the horizontal (X) component of the text information. The input signal that comes from TEXT/TRACE SELECTION controls switching between text and trace display. The FINAL X AMPLIFIER drives the horizonal deflection plates of the CRT. The voltage applied to these plates is measured by the block CALIBRATE X CIRCUIT. Its output signal XCAL is applied to the microprocessor; this is part of the automatic horizontal calibration facility.

Intensity and focusing.

The FINAL Z INPUT STAGE receives input signal for trace intensity (ZS) from the Z CONTROL block in the time base section. A second input signal (ZT) determines the intensity (Z) component of the text information. An input signal SW that comes from the microprocessor allows switching between text and trace intensity. The FINAL Z AMPLIFIER drives the intensity control electrode G1 of the CRT. This electrode is at a very negative -2.2kV voltage level. It is for that reason that a high-voltage blocking capacitor is necessary between G1 and the output of the FINAL Z AMPLIFIER. However only the ac component in the signal can pass through the capacitor. The dc and lf components are applied to the MODULATOR and modulated on a high-frequency carrier. Now they can pass through a capacitor, are demodulated in the DEMODULATOR and then the dc, lf and hf components are recombined.

The FINAL Z INPUT STAGE drives, in parallel with the FINAL Z AMPLIFIER, the FINAL FOCUS AMPLIFIER. This has the result that a well-focused spot over a large intensity range is obtained. The FINAL FOCUS AMPLIFIER drives the intensity control electrode G3 of the CRT. This electrode is at a very negative -2.2kV voltage level. It is for that reason that a high-voltage blocking capacitor is necessary between G3 and the output of the FINAL FOCUS AMPLIFIER. The ac component in the focusing signal passes through a high-voltage capacitor. The lf and dc components are derived from the DEMODULATOR that is also used in the intensity part. Focus control is possible via the FOCUS LEVEL SHIFTER.

3.2.5 Front unit and microprocessor

The front unit and microprocessor are the sections where all oscilloscope functions are controlled. Also the generation of text and the automatic calibration is controlled by the microprocessor. The operations performed by the microprocessor are determined by the ROTARY MATRIX and KEY MATRIX. Also commands from an external computer connected to the RS232 connector have the same result.

The ROTARY MATRIX and keys in the KEY MATRIX present at front unit A4 are read by the FRONT PROCESSOR. Also the ROTARY MATRIX that is present on the CRT controls unit A5 is read by the FRONT PROCESSOR. The CENTRAL PROCESSOR on the MICROPROCESSOR UNIT A6 is informed by the FRONT PROCESSOR of the settings selected with the front panel controls. Incorporated in the CENTRAL PROCESSOR is a complete RS232 interface. Serial communication is possible via the RS232 BUFFER.

The CENTRAL PROCESSOR has many inputs and outputs and forms the heart of the oscilloscope's control section. First of all there are a READ ONLY MEMORY (CPROM) and a RANDOM ACCESS MEMORY (CPRAM). The POTENTIOMETER DAC CIRCUIT is able to produce 16 independently adjustable dc voltages. These voltages are used for continuous controllable functions such as POSition, FOCUS and VARiable.

The CENTRAL PROCESSOR also has a number of analog inputs that are internally converted into digital. These inputs are used for automatic calibration (YCAL, XCAL, MTBCAL and DTBCAL), AUTOCURsor position, power fail and probe indication (via PROBE DETECTION block). An important output is the "uP" output. It is via this output that the CONTROL CIRCUIT blocks found throughout the block diagram are controlled.

The CENTRAL PROCESSOR communicates to the TEXT/CURSOR CONTROL which text and cursors have to be displayed. This information is stored in the TEXT/CURSOR MEMORY. The TEXT/CURSOR CONTROL has one output that switches (SW) the vertical, horizontal and intensity/focusing sections between normal signal (trace) display and text display. This text display is done in between the signal display in such a sequence that "holes" in the signal are almost invisible. The YT output of the digital-to-analog converter VERTICAL DAC produces the analog signal that determines the vertical position during text display. The XT output of the HORIZONTAL DAC does the same for horizontal text display. The ZT output produces a signal that determines the intensity during text display.

3.2.6 Power supply

The power supply is a switched mode type and has high efficiency. It can function on a wide range of LINE input voltages. An important part of the power supply is directly connected to the mains. This part carries LIVE VOLTAGE and measurements and repairs must be carried out via a separation transformer by a qualified technician.

The LINE IN voltage is applied to the LINE FILTER. This block prevents line interference from entering the supply unit. Also interference generated by the power supply does not enter the mains. An output signal of the filter is applied to the LINE TRIGGER PICK OFF in order to facilitate line triggering of the time bases.

The other output signal is applied to RECTIFIER + SMOOTHING: the output of this block has a dc voltage of which the height depends on the applied line voltage. This dc voltage is applied to the FLYBACK CONVERTER. This block incorporates a high voltage switching element that converts the dc voltage into a high-frequency ac voltage. This ac voltage is applied to the primary winding of a transformer. The secondary winding has many taps with connected RECTIFIERS: this gives the required supply voltages for the oscilloscope. The +5V POSTREGULATOR gives additional stabilization of the +5V supply voltage.

Stabilization of the output voltages at different line voltages is achieved by varying the on/off ratio of the switching element in the FLYBACK CONVERTER. The on/off ratio is determined in the CONTROL CIRCUIT by comparing the accurate output voltage of the +10V REFERENCE SOURCE and an output voltage of the RECTIFIERS.

The EHT CONVERTER generates the 6.3V heater voltage and -2.2kV cathode voltage for the Cathode Ray Tube (CRT). The +14kV final accelerator voltage for the CRT is generated in the HIGH VOLTAGE MULTIPLIER.

The AUXILIARY CONTROL is controlled by the microprocessor (uP) and generates three dc voltages that are used for TRACE ROTATION adjustment, GRATICULE ILLUMINATION adjustment and speed control for the FAN.

The PROTECTION CIRCUIT switches the power supply off in case of over and under output voltage, too low line voltage and too high temperature.

4 PARTS

4.1 UNITS

Item	Figure	Ordering code	Description
63a	4.5	5322 214 90896	A1 Signal unit PM3082 (*)
63b	4.5	5322 214 90898	A1 Signal unit PM3084 (*)
63c	4.5	5322 214 91027	A1 Signal unit PM3092 (*)
63d	4.5	5322 214 90724	A1 Signal unit PM3094 (*)
59a	4.4	5322 216 04243	A2 XYZ amplifier unit 100 MHz ~~189990~~
59b	4.4	5322 216 04244	A2 XYZ amplifier unit 200 MHz 189990
43a	4.4	5322 214 90729 924618	A3 Microprocessor unit 924618
43b	4.4	5322 214 91309 156452	A3 Microprocessor unit with IEEE
74	4.6	5322 214 90726	A4 Front unit 924642
77	4.6	5322 214 90727	A5 CRT controls unit
42	4.4	5322 216 04245	A6 Power supply unit 189993/06/924654
71	4.6	5322 214 90742	A10 Connector board
--	--	5322 218 61479	Extension unit for A3 and A6

(*) See also section 5.1.6

4.2 INTERCONNECTION CABLES

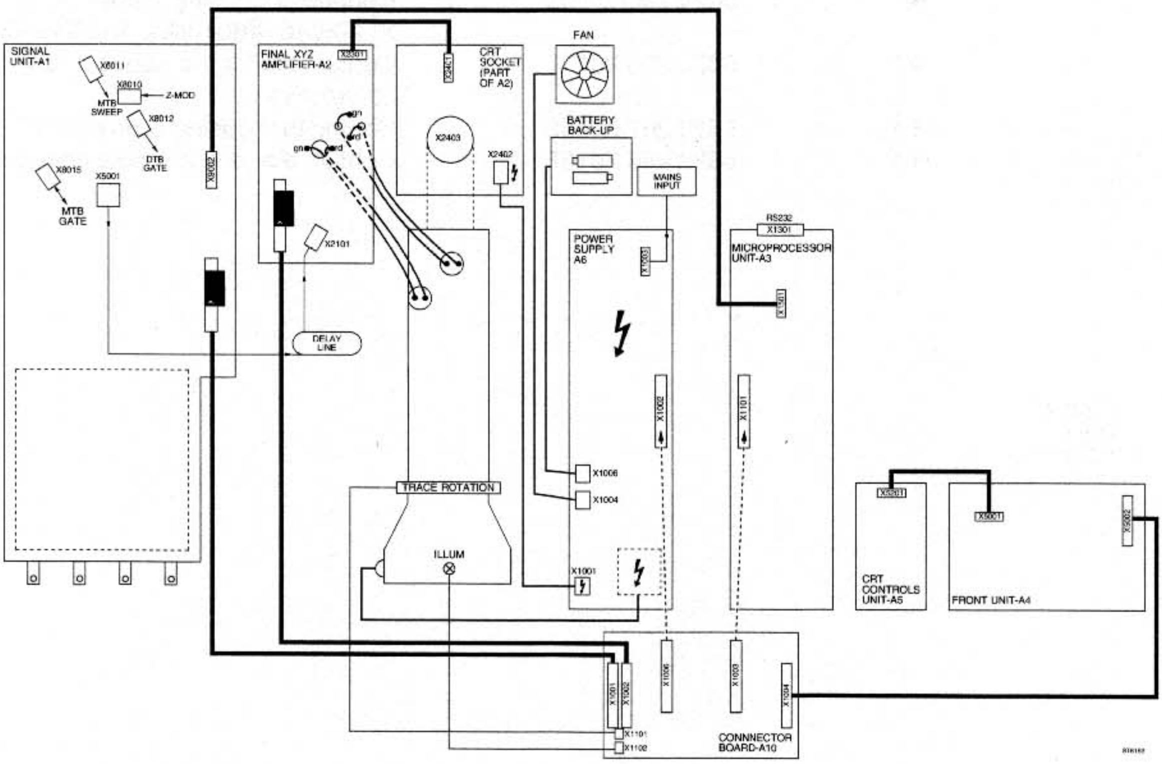


Figure 4.3 Units lay-out and Interconnections

Note: for location of these items in the oscilloscope refer to the figures.

Item	Figure	Ordering code	Description
23	4.3	5322 321 21616	Line cord European type
23	4.3	5322 321 10446	Line cord USA type
23	4.3	5322 321 21617	Line cord British type
23	4.3	5322 321 21618	Line cord Swiss type
23	4.3	5322 321 30387	Line cord Australian type
23	4.3	5322 321 30386	Line cord South Africa
41a	4.4	5322 320 40281	Delay line 100 MHz
41b	4.4	5322 214 90732	Delay line 200 MHz
53	4.4	5322 321 61284	Flat cable 50-pole 18 cm (connects X1002 / X2501)
55	4.4	5322 321 61291	Red wire to CRT, 105 mm (4/instr., can be adapted to otherlengths)
58	4.4	5322 321 61287	White flat cable 12-pole (connects X2301 / X2401)
64	4.5	5322 321 61286	White flat cable 16-pole (connects X1501 / X9002)
66	4.5	5322 321 61283	Flat cable 50-pole 10 cm (connects X1001 / X9001)
72	4.6	5322 321 61288	White flat cable 28-pole (connects X5002 / X1004)
76	4.6	5322 321 61289	White flat cable 12-pole (connects X5201 / X5001)
--	4.1	5322 268 40233	Connector housing 3-pole (X1001/A6, X2402/A2).
--	4.1	5322 268 40232	Connector housing 2-pole (X1004/A6, X1006/A6, X8010/A1, X1102/A10).
--	4.1	5322 268 20176	Contact pin for the above 2- and 3-pole connectors.
--	4.1	5322 267 50452	Connector housing 5-pole (X1003/A6).
--	4.1	5322 268 24128	Contact pin for the 5-pole connector.

4.3 MECHANICAL PARTS

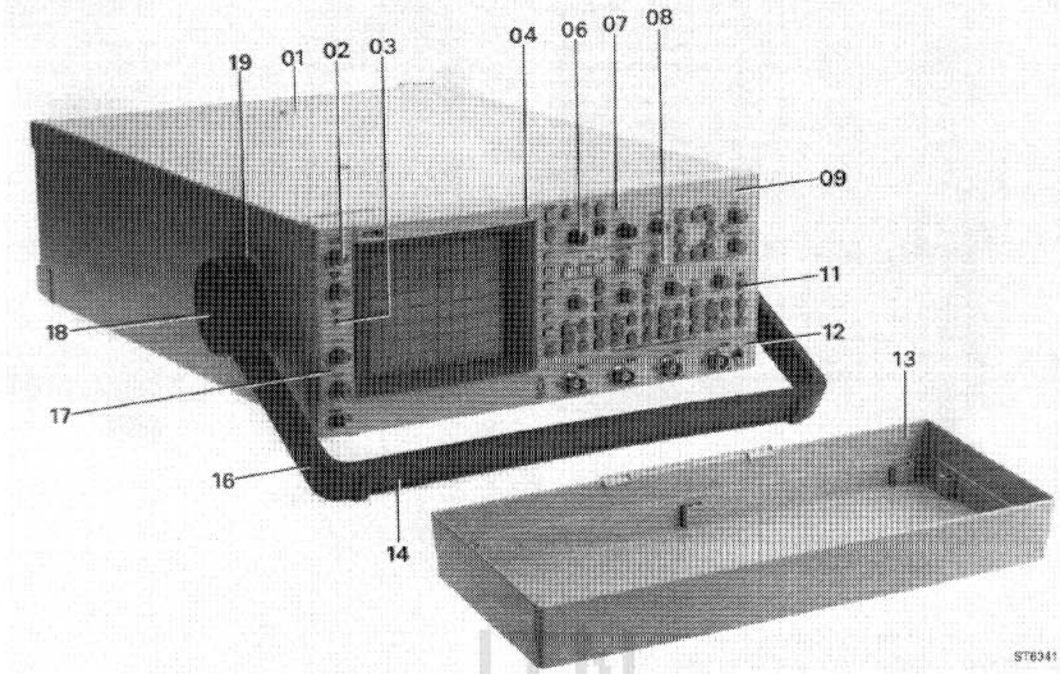


Figure 4.4 Mechanical parts, front and side panel

Item	Ordering code	Qty	Description
01	5322 447 91922	01	Cabinet
02	5322 414 20404	11	Light grey control knob
03	5322 535 93245	01	TRACE ROT shaft
04a	5322 455 81196	01	Textstrip bezel PM3094
04b	5322 455 81195	01	Textstrip bezel PM3092
04c	5322 455 81194	01	Textstrip bezel PM3084
04d	5322 455 81193	01	Textstrip bezel PM3082
06	5322 414 20406	02	Dark grey control knob
07	5322 455 81144	01	CAL-SEAL sticker
08	5322 414 20405	02	Dark mushroom control knob
09a	5322 455 81201	01	Textplate (adhesive) PM3094
09b	5322 455 81199	01	Textplate (adhesive) PM3092
09c	5322 455 81198	01	Textplate (adhesive) PM3084
09d	5322 455 81197	01	Textplate (adhesive) PM3082
11	5322 414 20407	01	Pushbutton mat (buttons not required must be cutoff with a sharp knife)
12a	5322 455 81178	01	Textstrip BNC's 100MHz
12b	5322 456 10025	01	Textstrip BNC's 200MHz
13	5322 447 70121	01	Front cover
14	5322 455 81104	01	Textstrip handle
16	5322 498 50326	01	Handle complete
17	5322 455 81141	01	Textstrip CRT controls
18	5322 462 41848	02	Handle cover
19	5322 498 50268	02	Locking clip

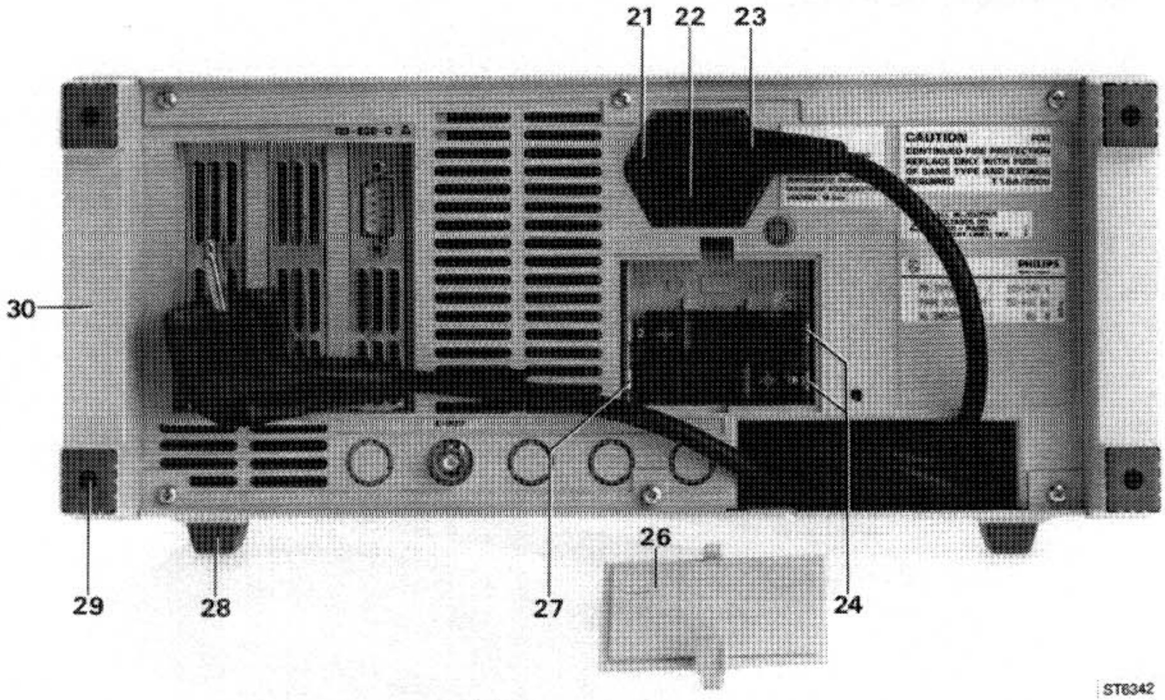


Figure 4.5 Mechanical parts, rear panel

Note: for items not listed refer to chapter 4.2.

Item	Ordering code	Qty	Description
21	5322 219 82813	01	Mains input connector
22	4822 070 31602	01	Fuse 5x20 1,6AT
24	5322 492 70941	02	Contact spring single
26	5322 456 90426	01	Battery compartment cover
27	5322 492 70975	01	Contact spring dual
28	5322 462 41697	04	Bottom foot
29	5322 462 41846	04	Rear foot
30	5322 256 91793	02	Rear socle

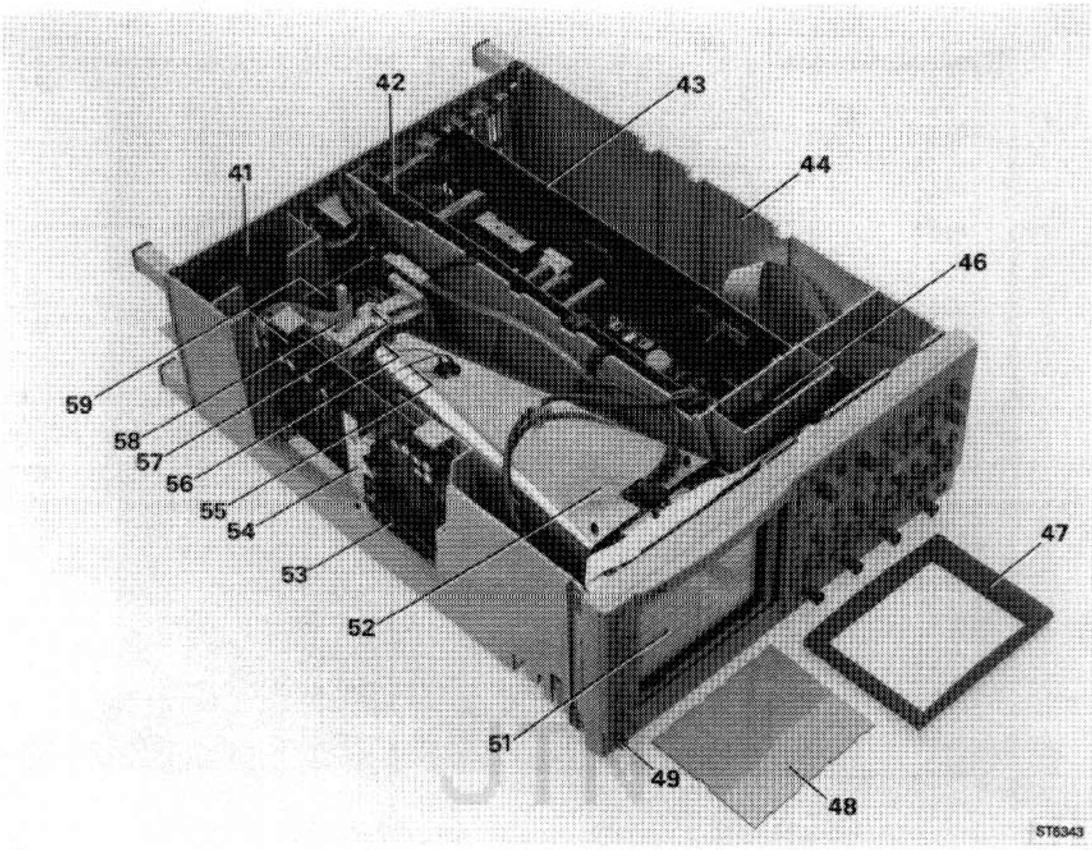


Figure 4.6 Mechanical parts inside instrument

Note: for items not listed refer to chapter 4.1.2 and 4.2.

Item	Ordering code	Qty	Description
44	5322 464 90708	01	Chassis complete
46	5322 361 10614	01	Fan
47	5322 381 11276	01	Bezel
48	5322 480 30181	01	Blue contrast filter
49	5322 414 20568	01	Power on/off knob
51a	5322 131 11065	01	CRT D14-373 GH/123 (V0001) - 100 MHz
51b	5322 131 11179	01	CRT D14-383 GH/123 (V 0001) - 200 MHz
52	5322 466 30493	01	CRT shielding
54	5322 255 41227	01	Heatsink
56	5322 466 30164	01	CRT manchet, rubber
57	5322 462 10263	01	CRT support, plastic

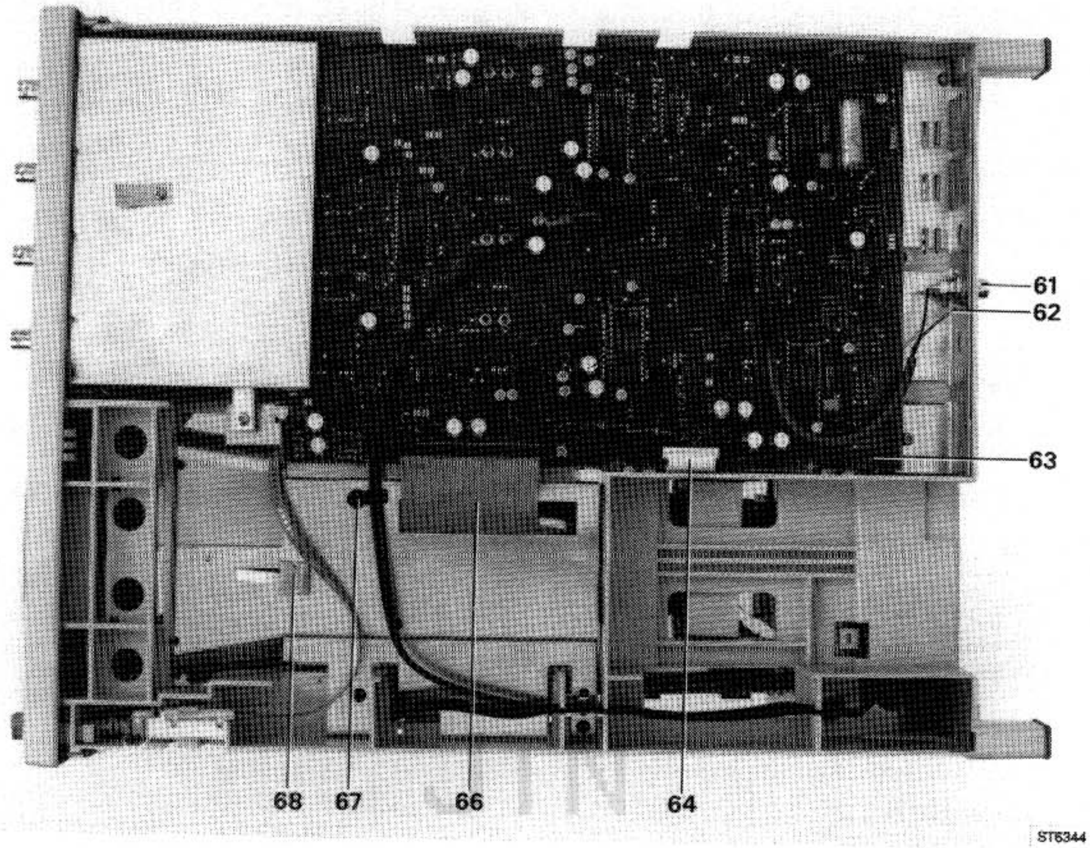


Figure 4.7 Mechanical parts, bottom view

Note: for items not listed refer to chapter 4.1.2 and 4.2.

Item	Ordering code	Qty	Description
61	5322 267 10004	01	BNC connector Z-mod
62	5322 290 34022	01	Solder tag for Z-mod
67	5322 401 10954	01	Clamp for delay line (plastic)
68	5322 290 61045	01	Earth contact CRT shielding

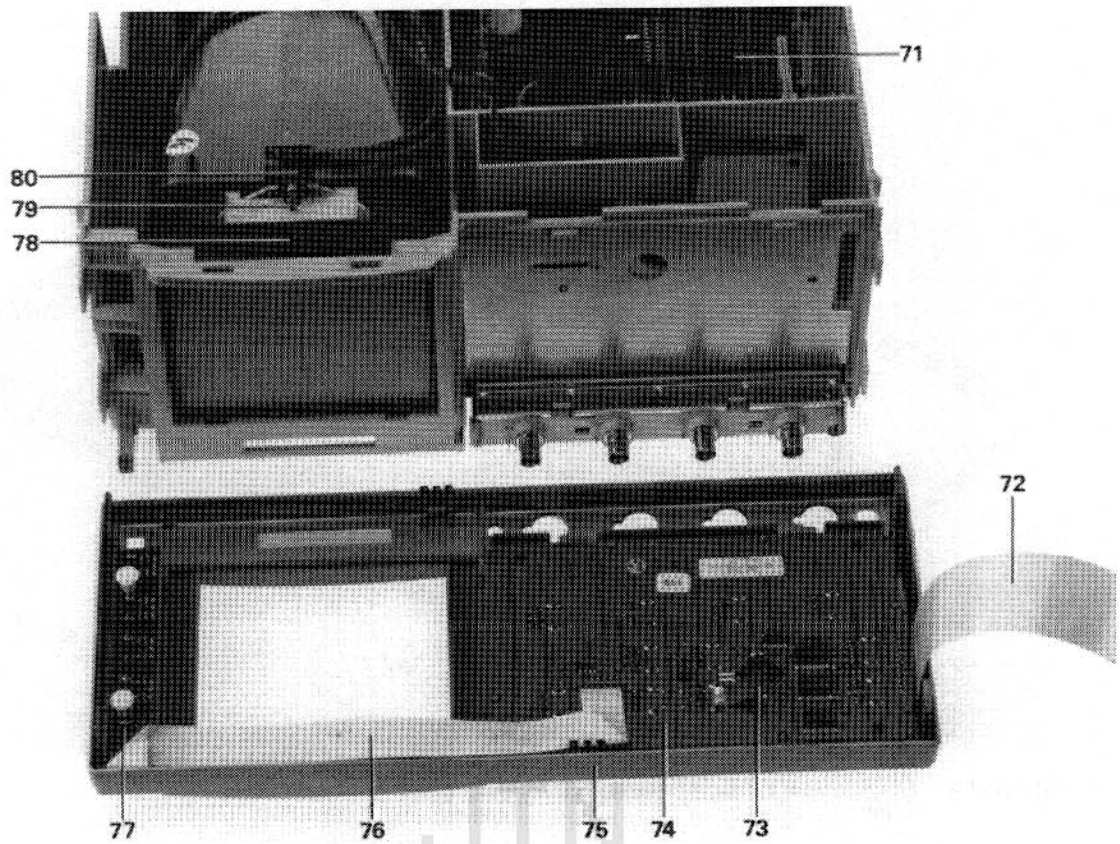


Figure 4.8 Mechanical parts behind front panel

Note: for items not listed refer to chapter 4.1.2 and 4.2.

Item	Ordering code	Qty	Description
73	5322 290 61044	01	Earth contact
75	5322 447 91923	01	Front frame
78	5322 460 60404	01	CRT frontrubber
79	5322 462 40957	01	Light conductor
80	5322 134 41076	01	Lamp 28V 80mA (E 1001)
--	5322 492 71668	01	Grouding clip, top side of front
--	5322 492 71669	01	Grounding clip, bottom side of front
76	5322 321 61289	930966	

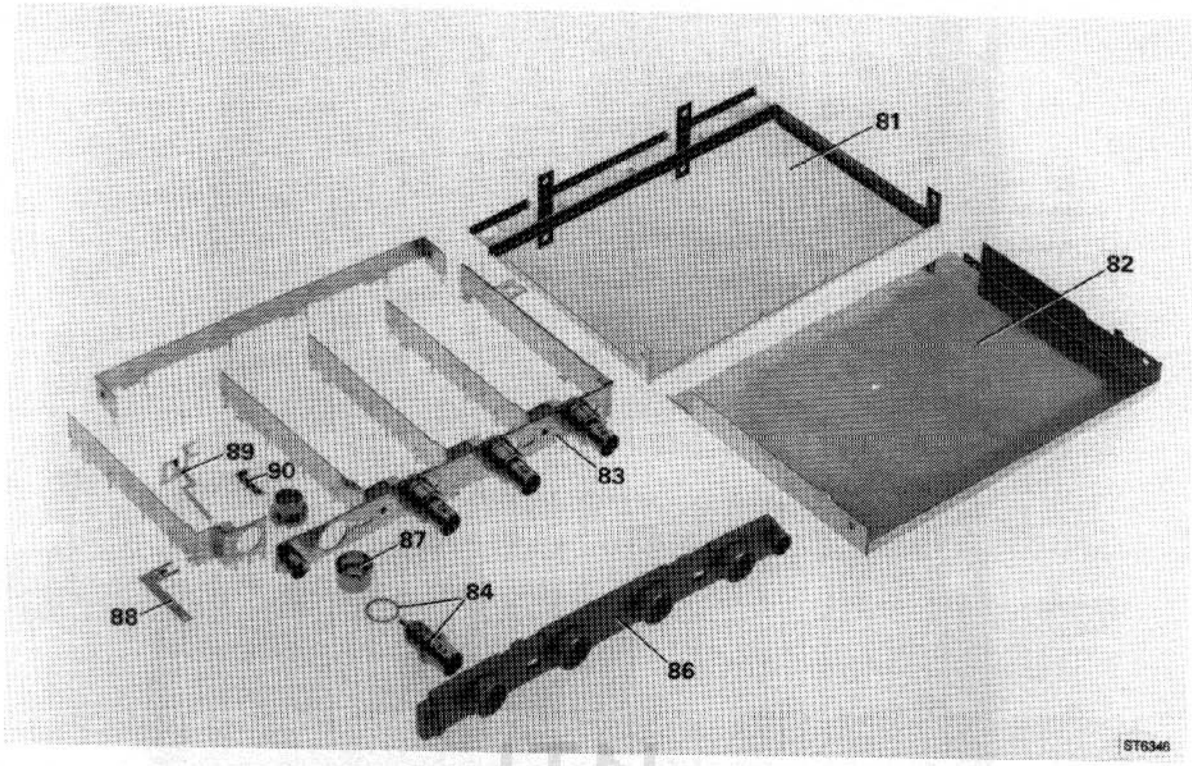


Figure 4.9 Mechanical parts, screening of input circuit

Item	Ordering code	Qty	Description
81	5322 466 30405	01	Top screening
82	5322 466 30404	01	Bottom screening
83	5322 256 91792	01	BNC holder
84	5322 267 10191	04	BNC coax connector
86	5322 462 41847	01	BNC insulator, plastic
87	5322 532 21188	04	BNC spacer
88	5322 535 93244	01	Probe calibration pin
89	5322 492 70939	04	Indication spring
90	5322 401 11419	04	Soldering bracket for BNC

5 UNIT DESCRIPTIONS

5.1 SIGNAL UNIT A1

5.1.1 Description A1

5.1.1.1 Introduction

With the exception of the final stages, unit A1 incorporates the vertical channels, the triggering, the time bases and the intensity (Z) control. The unit A1 description is split into the following chapters:
- Input attenuators and calibrator.
- Preamplifiers.
-
- Y-functions and delay line driver.
- Triggering.
- Main and delayed time base.

The complete signal unit is divided over 18 circuit diagrams. These diagrams and their main interconnections are listed in the table.
Diagram 11 includes the circuitry that controls the functions in the vertical channels.
Diagram 18 shows the connectors that make contact with other units in the oscilloscope via the connector board. These units are:
- The final amplifier unit A2: horizontal deflection signal and intensity control.
- The microprocessor unit A3: control signals and potentiometer functions.
- The power supply unit A6: supply voltages and line trigger signal.

Diagram	Description	Input signal coming from	Output signal going to	Control signal coming from
1,2,3,4	Attenuator ch.1,2,3,4	input 1,2,3,4	diagr.6,7	diagr.5,11
5	Attenuator control	diagr.1,2,3,4	diagr.1,2,3,4,18	diagr.11
6	Preamplifier ch.1,2	diagram 1,2	diagr.8	diagr.11,18
7	Preamplifier ch.3,4	diagram 3,4	diagr.8	diagr.11,18
8	Y-functions	diagram 6,7	diagr.9	diagr.10,11,18
9	Delay line driver	diagram 8	delay line	diagr.10,18
10	Display + trigg control	diagram 18	diagr.8,9	diagr.18
11	Control circuits	diagram 18	diagr. 1,2,3,4,5,6,7,8	diagr.18
12	MTB trigger	diagram 8	diagr.13,15	diagr.12,18
13	TV/line trigger	diagram 12,18	diagr.12,14	diagr.12,14
14	DTB trigger	diagram 8	diagr.15,17	diagr.14,18
15	Time base logic	diagram 12,14	diagr.16,17,18	diagr.15,18
16	Main time base	diagram 15	diagr.17	diagr.18
17	Delayed time base	diagram 15	diagr.18	diagr.18
18	Connectors	unit A6	unit A2,A3	unit A3

5.1.1.2 *Input attenuators and calibrator*

Diagram 1, 2, 3, 4

The attenuators of channels 1, 2, 3 and 4 are identical, therefore only channel 1 is explained. Every attenuator basically consists of four sections. These sections are:

- The input circuit with 50Ω termination resistor and AC/DC input coupling circuit.
- The high impedance attenuator with divide by 1, divide by 10 and divide by 100 sections.
- The impedance converter. This is the active stage.
- The low impedance attenuator that can give an additional divide by 2.5.

The attenuator sections are switched by voltage pulse operated relays. This reduces power dissipation. Every relay has two change-over contacts. After a pulse the contacts stay in the selected position. One side of each relay coil is connected to the common potential AT12REP; the other side to a voltage that differs per relay.
Setting a relay in the position as drawn in the diagram (rest position) is achieved by a positive 10 ms pulse on common line AT12REP while the other control line stays at 0 V level. The other side of the relay coils that must not switch are applied to the already mentioned 10 ms positive pulse. Switching a relay to the position opposite to the one in the diagram (activated position) is achieved by a 10 ms positive pulse at the other side of the relay while AT12REP is kept at 0 V. This principle is demonstrated in figure 5.1 where the /1 relay is switched to the rest position and the /10 relay is activated.

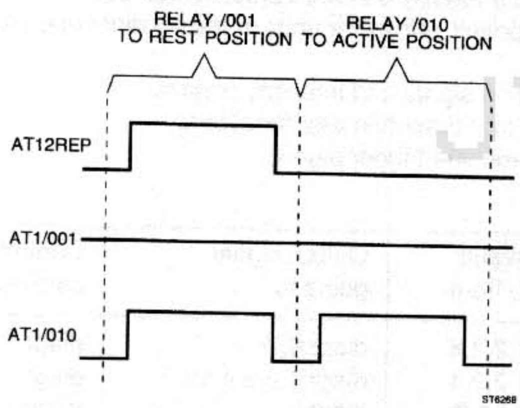


Figure 5.10 Switching pulses for relay

Input circuit
The 50Ω termination resistor is formed by the resistors R1006/R1007. It is switched by relay contact K1001. The NTC resistor R1011 is placed between R1006 and R1007 and measures the temperature of these resistors. This information is routed to the microprocessor on unit A3. If necessary the 50Ω position is switched off.
The DC blocking capacitor is C1001. In DC position the capacitor is not used and discharged via R1002. The signal path is via K1002.

High impedance attenuator
The divide by one section (/1) is switched via the relay contacts K1003. It switches the input signal through without further attenuation.
The divide by ten section (/10) is present between the relay contacts K1004. The /10 is accomplished by R1016, R1027, R1031 and R1032.
The divide by hundred section (/100) is present between the relay contacts K1006 and K1004/6,4. The /100 is accomplished by R1021 and R1023.
LF square wave calibration is achieved via the dual varicap diode V1002. Influence of the signal on the capacitance value is eliminated by two diodes with opposite polarization. The compensation factor and consequently the voltages AT1LFCOR1 and AT1LFCOR0 are depending on the selected attenuator position.

The signal ATCAL is applied to /33 attenuator R1008/R1009. ATCAL can supply several accurate voltages that are used for vertical calibrations.

Impedance converter

This active stage consists of three sections with different frequency ranges. The sections partly make use of the same components:

- The HF section for frequencies above 5 kHz. It is formed by C1021, FET V1006 and the two emitter followers V1008 and V1009. The FETs V1004 and V1005 are used for input protection. V1007 is a current source.
- The LF section for frequencies 30 Hz to 5 kHz. It is formed by operational amplifier N1001 (gain 2x) that receives the LF input signal via divide-by-two attenuator R1031/R1032. The capacitors C1023 and C1025 are frequency determining components in the N1001 feedback loop. The N1001 output signal is routed via R1034, V1006 and the emitter followers V1008 and V1009.
- The DC section for frequencies DC to 30 Hz. It is formed by operational amplifier N1001 (gain 2x) that receives the input signal via divide-by-two attenuator R1031/R1032. Via feedback resistor R1037 the voltage at the output of the impedance converter is compared with the input level via the + and inputs of N1001. This keeps the DC output value of the impedance converter exactly at the required value. This compensates for DC drift. Part of the feedback loop is V1001 that determines the low-frequency gain. The N1001 output signal is routed via R1034, V1006 and the emitter followers V1008 and V1009.

The low impedance attenuator is formed by R1072 and R1073. Switching is accomplished by V1012 and V1013. V1012 conducts in the /1 position and V1013 in the /2,5 position. The attenuator output signal is an unbalanced signal. The unbalanced output signal is applied to the succeeding stage via R1071 and via R1074.

Diagram 5

Probe indication circuit

There are four identical circuits of which the one for channel 1 is described. The resistor in the indication ring of the probe is present between X1002 and ground potential. The resistance value is measured by the microprocessor on unit A3.
The temperature of the 50Ω termination resistors on diagram 1 is measured by NTC resistor R1011. This resistor is placed in between the two termination resistors. If the temperature gets too high, the + input of N1101 becomes lower than the input. This makes output 13 of N1101 low and 0 volt is detected by the microprocessor via the probe indication line PROBE1. This is the sign for the microprocessor that the 50Ω resistor is too hot and it is switched off.

LF square wave calibration

This circuit produces the voltages for the varicap diodes V1002. The diodes require control voltages with opposite polarity. There are four identical circuits for the four vertical channels. The input signal AT1LFCAL is produced by a DAC and has the range 0 ... 10 volt. This is converted via the operational amplifiers N1102, N1103 into two signals that range from -5 ... -15 volt (AT1LFCOR0) and +5 ... +15 volt (AT1LFCOR1) respectively.

Amplitude Calibrator

This circuit consists of 8-position multiplexer D1152 and operational amplifier N1104. It can supply 8 accurate voltages of 10V, 5V, 2V, 1V, 500mV, 200mV and 0V. They are supplied to the vertical channels 1, 2, 3 and 4 for calibration voltages. The voltages are derived from a voltage divider with precision resistors R1192 through R1197. The divider is supplied with an accurate 10 V reference voltage. Under control of a three bit address ATCAL0 ... ATCAL2 one of the outputs of the voltage divider is selected via D1152. This signal is routed to the vertical channels via buffer N1104.

Loop gain calibration

The output voltage range of a digital-to-analog converter (DAC) is changed via resistor network R1112, R1113 and R1114. The output voltage is applied to V1001 that determines the low-frequency gain in the channel 1 attenuator.

Calibrator
This circuit is used for probe adjustment. It is built up around triple analog multiplexer D1151. The sections D1151/1,2,10,15 and D1151/3,4,5,9 form a 2 kHz oscillator. The third section D1151/11,12,13,14 switches in the 2 kHz rate of the oscillator. The oscillation principle is now explained with the simplified diagram in the figure.

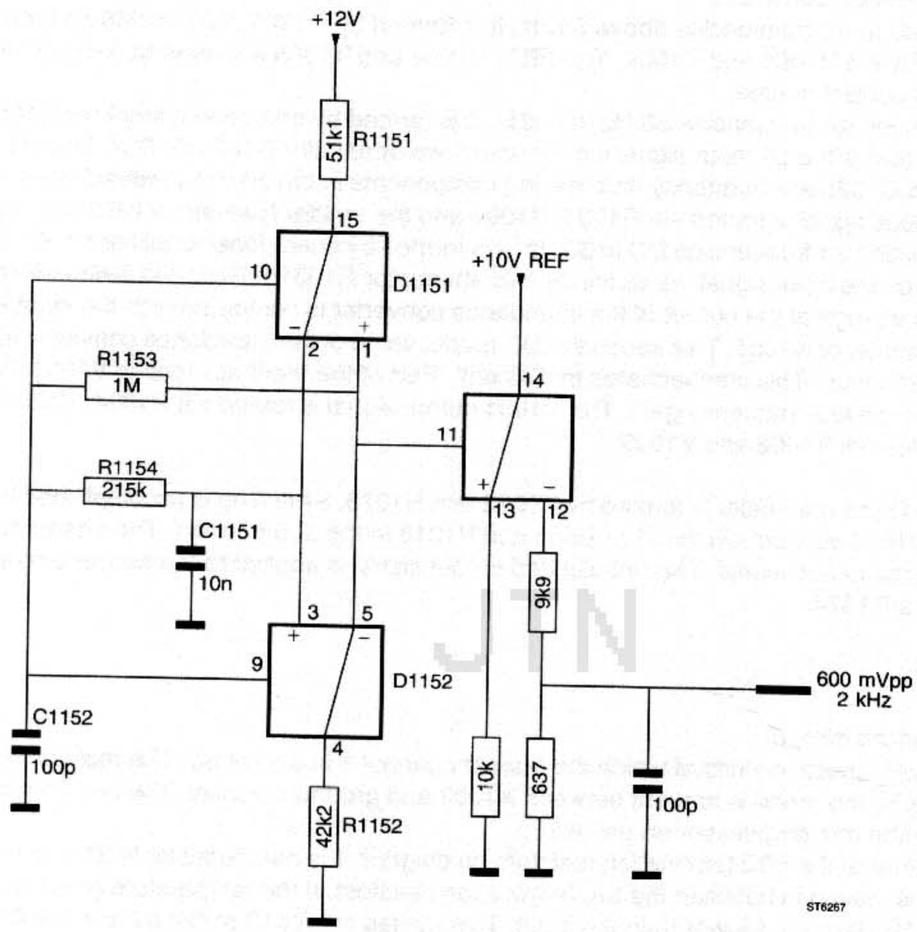


Figure 5.11 Simplified diagram of CAL generator

The start is in the situation as given in the figure. C1151 charges from +12V via R1151 and the switch contacts 15 and 2. After some time the voltage across C1151 reaches the digital "High" level and the switch contacts go to the opposite position. This causes C1151 to discharge to 0V via switch contacts 3 and 4 and R1152. Via switch contacts 15 and 1 and R1153 a gap is created between the switching moments. The charging/discharging process makes pin 11 high and low at a 2 kHz rate. This connects voltage divider R1156/R1157 and R1158, R1159 with + 10VREF or leaves it floating in the 2 kHz rate.

5.1.1.3 Preamplifiers

Diagram 6, 7

The preamplifiers for channel 1 and 2 and associated current sources are given in diagram 6. Diagram 7 gives this for channel 3 and 4. Channel 1, 2, 3 and 4 are identical, therefore only channel 1 is explained.

The output signals AT1OUT1 and AT1OUT0 from the channel 1 attenuator are applied to pin 3 and 5 of amplifier IC D1201. The balanced output signal of this IC is available at pin 18 and 19. This signal is routed to the Y-functions section via the level shifters V1201 and V1202.

The amplifier D1201 can be switched to a number of attenuation/gain positions that are dependent on the channel 1 AMPL position. The gain x1 position is determined by R1205/R1206/C1205 that are present across pin 6 and 7. The x1 is switched by control signal PA1X1.
The attenuation /2 is determined by R1207 and switched by PA1/2.
The gain x5 is determined by R1208/R1210/R1215/C1210 and switched by PA1X5. Continuous gain control is determined by DAC output signal VAR1 that is applied to pin 20. This signal comes from microprocessor unit A3. It is used for front panel gain control in fine steps and also for gain calibration.

The complete range of the channel 1 input sensitivities is controlled via front panel control AMPL. It is accomplished by the combination of input attenuator positions and the x1, /2, x5 and the VAR1 functions.

Offset control is achieved via the DAC output signal PA1OFFSET that is applied to the D1201 input pin 13. The DAC signal PA1OFFSTRG gives an offset signal in the current sources V1208 (PA1LSA) and V1209 (PA1LSB). PA1LSA and PA1LSB are applied to level shifters V1201/V1202. This is used to compensate for offset in the trigger path and also influences the offset in the vertical channel. This in turn is compensated via the POS1 signal in the Y-functions section.

The circuit in the bottom half of the diagram includes a number of current sources for the channel 1 and 2 preamplifiers. The reference for all these current sources is PAVREF that is present at N1251/pin 3. This is converted in a reference voltage at the collector of V1252 that is applied to the current sources. The currents for channel 1 are PA1ICL, PA1ISY, PA1LSA and PA1LSB. The currents for channel 2 are PA2ICL, PA2ISY, PA2LSA and PA2LSB. PA2LSA and PA2LSB are adjustable via DAC output signal PA2OFFSTRG.

5.1.1.4 Y functions and delay line driver

Diagram 8

This diagram shows the channel 1, 2, 3 and 4 function circuits D1301, D2301, D3301 and D4301. The balanced output signals of each cicuit are available at pin 7 and 8. They are all applied to the resistance network R1313 through R4314 that is shown on the next diagram. The output of this network feeds the delay line driver.

The four function circuits are almost identical. Compared with channel 1 and 3, channels 2 and 4 have additional invert functions. For this reason, only the channel 2 circuit is explained. Here the balanced input signal is applied to pin 25 and 26 of D2301. The balanced output signal at pin 7 and 8 is switched by control signal CNT2CH-HX. The balanced output signals FNC2MTR0 and FNC2MTR1 that are available at pin 13 and 14 are used for triggering the main time base. This is switched via control signal CNT2MT-HT. The balanced output signals FNC2DTR0 and FNC2DTR1 that are available at pin 1 and 2 are used for triggering the delayed time base. This is switched via control signal CNT2DT-HT.

Channel 2 position control is achieved via an adjustable analog DAC voltage POS2 from the microprocessor unit A3. This voltage is applied to input 9 of operational amplifier N2202. This IC converts the DAC voltage POS2 (1 ... 4 V) into a voltage between -8 and +8 V. This voltage is converted into a current via resistor R2311, because pin 12 of D2301 is a virtual ground.

The balanced output signals FNCYOP0 and FNCYOP1 at pin 5 and 6 of D2301 of the channel 1 can be used to provide signals for the Y-out option. The (optional) Y-out circuit (present in channel 1 only) is located on an additional unit that is connected via the connectors X1303 through X1310. This is switched via control signal YOP-HX at pin 4. If no option installed, the signal is switched off by a low level supplied via R1312. If the option is present the switching is achieved by a signal coming from the additional unit.

The balanced output signals FNC1DPO0 and FNC1DPO1 at pin 9 and 10 can be used to provide signals for future instrument extensions such as a digital signal storage. This is present on all 4 channels. Biasing current for these outputs is provided via V1302, V1313 and R1307. The capacitor C1301 determines the cut-off frequency if the bandwidth limiter is active. The limiter is switched via signal FNCBWL.

The following table summarizes the functions and related pin numbers of the IC's used in the circuit diagram:

Output (pin)	On/Off (pin)	Invert (pin)	Bandw. Lim. (pin)	Pos (pin)
MTB Trig (13,14)	20	19	--	--
DTB Trig (1,2)	24	23	--	--
Y-out (5,6)	4	3	28	--
Digital out (9,10)	--	3	28	12
Chann. out (7,8)	11	3	28	12

Diagram 9

This diagram shows the delay line driver and associated circuitry. The delay line driver itself consists of the balanced amplifier branches V5003/V5006/V5008 and V5004/V5007/V5009. These amplifiers serve as a 9x amplifier and level shifter. V5011/V5012/V5013/V5014 clamp the input signal in order to reduce the output voltage swing applied to the delay line. The balanced input current (100 uA/div) signals from channel 1, 2, 3 and 4 are FNC1OUT0/FNC2OUT0/FNC3OUT0/FNC4OUT0 and FNC1OUT1/FNC2OUT1/FNC3OUT1/FNC4OUT1. The output voltage (45 mV/div when connected to the delay line, 90 mV/div when open) signals DLDOUT0 and DLDOUT1 supply the delay line. The resistors R5051 and R5052 give correct 50Ω termination impedance.

The Y-offset control part is supplied with the DAC output signal DLDOFFSET (delay line driver offset) that is used for instrument calibration. The DAC output signal TRASEP gives trace separation between main and delayed time base display in alternate time base mode. TRASEP is passed through via analog switch D5001/6,8,9 if control signal TRASEP-HC is high.

Operational amplifier N5001/5,6,7 makes a stable +4 V reference voltage.
Operational amplifier N5001/2,3,1 keeps DLDDCLEVEL0 and DLDDCLEVEL1 at equal level by influencing the level at DLDDCCORR.

Diagram 10

This diagram comprises the circuitry that controls the vertical channels 1, 2, 3 and 4 and the main (MTR) and delayed (DTR) trigger sources. The heart is formed by IC D9009. The IC is loaded with information about the control functions that must be executed. This happens via the input lines SCL (Serial CLock) and SDA (Serial DAta) that come from the microprocessor unit A3. At turn-on D9009 gets a reset at pin 17. This occurs via V5506 which is controlled by output D9004/11 on the next diagram.

The channels 1, 2, 3 and 4 are switched via the output pins 2, 3, 4 and 5 of D9009. The main time base trigger (MTR) source of channel 1, 2, 3 and 4 is switched via the control signals that are available at pin 2, 12, 1 and 13 of multiplexer D5501. This multiplexer is supplied with 3 lines that come from pin 25, 26 and 27 of D9009. The signal CNT2MTI-HT that is present at pin 11 of AND gate

D5503 gives the necessary inversion of the main trigger path if channel 2 is in the inverted mode. The signal CNT4MTI-HT that is present at pin 4 of AND gate D5503 gives inversion of the main trigger path if channel 4 is in the inverted mode.

The delayed time base trigger (DTR) source of channel 1, 2, 3 and 4 is switched via the control signals that are available at pin 2, 12, 1 and 13 of multiplexer D5502. This multiplexer is supplied with 3 lines that come from pin 22, 23 and 24 of D9009. The signal CNT2DTI-HT that is present at pin 10 of AND gate D5503 gives the necessary inversion of the delayed trigger path if channel 2 is in the inverted mode. The signal CNT4DTI-HT that is present at pin 3 of and-gate D5503 gives inversion of the main trigger path if channel 4 is in the inverted mode.

The input pin 9 ALTCLN of D9009 gives channel/trigger source switching in the alternate display mode. The circuit with V5503 converts the current input signal ALTCLK (ALTernate CLock) from the time base logic into a voltage signal. The input pin 17 PUDML gives D9009 a preset when switching the oscilloscope on.

For the chopped display mode a chopper oscillator V5501/V5502 is present. It is switched on when control signal CHSW (CHopper SWitch) is high. The output signal of the oscillator is applied to pin 7 of D9009. The signal CHBLANK gives display blanking when switching between one channel to another.

The D9009 output signal TRASEP-HC activates the trace separation control in alternate time base mode. This signal is high if the delayed time base is active and low for the main time base. The output signal TBSEL controls the choice between main time base (high) and delayed time base (low) for horizontal deflection.

Diagram 11

This diagram includes the generation of control signals for the channel 1, 2, 3 and 4 attenuators, preamplifiers, Y-function and delay line driver circuits. The names of the control signals indicate exactly which circuit part is controlled:

- The signals starting with AT1, AT2, AT3 and AT4 control the ATtenuators of respectively channels 1, 2, 3 and 4. The attenuators and associated signal name lists are indicated in the description belonging to figures 1, 2, 3 and 4.
- The signals starting with PA1, PA2, PA3 and PA4 control the PreAmplifiers of respectively channels 1, 2, 3 and 4. The preamplifiers and associated signal name lists are indicated in the description belonging to figures 6 and 7.
- The signals starting with FNC1, FNC2, FNC3 and FNC4 control the Y- FuNCtion (channel and trigger source switching) of respectively channels 1, 2, 3 and 4. The Y-function blocks and associated signal name lists are indicated in the description for diagram 8.
- The signals starting with DLD control the Delay Line Driver. This circuit part and associated signal name list are indicated in the description for diagram 9.

A part of the control functions are simple on/off functions; e.g. the switching of a certain attenuator section. Other control functions consist of an adjustable DC voltage; e.g. the DC voltage that determines the gain of an amplifier section.

D9001 and D9002 have outputs that are able to drive the relays in the attenuator sections of channels 1, 2, 3 and 4. The IC's are controlled by the microprocessor on unit A3. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The enable signals

DLEN0-HT (Data Latch ENable) and DLEN1-HT determine if D9001 or D9002 reacts on the SDA/SCL signals. The figure below indicates the relation between SDA and SCL.

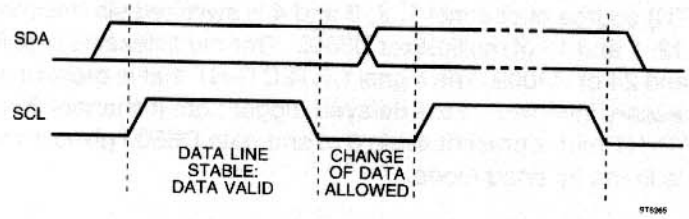


Figure 5.12 Relation of serial bus signals SDA and SCL

D9003 and D9004 have outputs that control a number of on/off functions in the preamplifier. The IC's are connected in cascade as a shift register. The IC's are controlled by the microprocessor on unit A3. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The enable signal STROBE0-HT in relation with SCL and SDA is indicated in the figure below. New data can be clocked into the shift register if STROBE0-HT is low. The new data becomes available at the outputs at the low-to-high transition of STROBE0-HT.

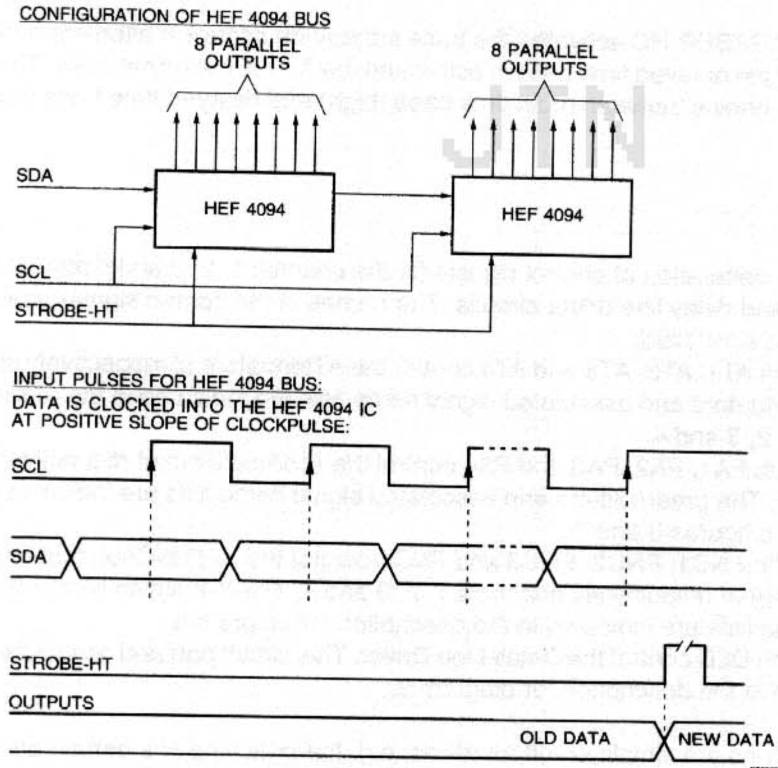


Figure 5.13 Configuration of serial control bus

N9001, N9002 and N9003 are octal digital-to-analog converters (DAC's). Each IC has 8 outputs capable of delivering a DC voltage that is adjustable between 0.5 and 9.5 V. This is controlled by the microprocessor on unit A3 via 6 bits of information that allow 64 adjustment steps. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The data bits are preceeded by address bits that are compared with the fixed address A0/A1/A2 applied to pin 7, 8 and 9. This determines if N9001, N9002 or N9003 reacts on the bitstream.

Note: *a solder pad is present in the SDA and SCL input lines of every IC. This gives the possibility to isolate a suspected IC from the other in case a fault is suspected.*

5.1.1.5 *Main and delayed time base triggering*

Diagram 12

The main time base triggering (MTR) is mainly formed by IC D6541. The other IC D6621 is the peak-peak detector for the trigger level. The balanced input signal for triggering on vertical channels 1, 2, 3 or 4 is applied to pin 7 and 8. This signal can originate from one of the 4 vertical preamplifier sections where the source selection is also done. The dc biasing currents come from the circuit with V6506, V6507 and V6532. This circuit is also supplied with the line trigger sinewave signal MTRLINE that comes from the power supply. This signal can be used for mains/line triggering and is selected on the next diagram.
The output signal of D6541 is available at pin 19 and 20. This signal is routed to the main time base (MTB) via the level shifters V6573 and V6574. The signal MTRVIDEO from output pin 2 of D6541 is routed to the TV trigger circuit.

The IC D6541 incorporates the filters for HF reject (external capacitor C6549), LF reject (external capacitor C6551) and AC (external capacitors C6559, C6561, C6562). These filter modes are switched with the control signals MTRLF-HD (pin 3) and MTRHF-HD (pin 14). Positive/negative slope and video are switched with the control signals MTRSLOPE (pin 21) and MTRTVSEL-HD (pin 4). The logic levels of these control signals are indicated in two tables on the diagram. The signal MTRSEN is a DAC output voltage that determines the gain of the trigger amplifier.

A balanced current signal leaves D6541 at pins 26 and 27. This signal is converted into a voltage signal via V6604 and V6606. The voltage signal is applied to pins 3 and 7 of the peak-peak detector D6621. This IC detects the positive and negative peak values of the trigger signal. It reduces in the peak-peak trigger mode (switched with MTRPPLEV-HD) the range of the level (LEVMTB) to just within the peak-peak signal value.

The output of the peak-peak detector is present at pin 14 and 15 and routed to level input pin 22 and 23 of D6541, via the level shifter with V6667, V6668, V6686 and V6687. At this point a level offset correction is also introduced via DAC signal MTRBAL. The level is fixed in TV trigger mode by giving signal LEVMTB a predefined fixed level. The output pulse MTRTVSYNC from the TV synchronization separator circuit (see next diagram) is applied to the base of V6687. This signal is interrupted if the TV trigger mode is off.

The series parallel converter D9011 has outputs that control a number of on/off functions in the MTB triggering. D9011 is controlled by the microprocessor on unit A3. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The enable signal is STROBE1-HT.

Diagram 13

This diagram shows the TV trigger circuit. The signal MTRVIDEO from pin 2 of MTR circuit D6541 is applied to the input of the TV CLAMP circuit V6754/V6757/V6759/V6763/V6768. The peak level of the synchronization pulses is detected via V6757 and C6758. The TV signal at the base of V6768 is kept at a constant level via V6759 and V6754. Diode V6761 cuts off the video information so that only synchronization pulses are applied to input pin 2 of N6771.

The TV synchronization separator N6771 is able to decode three different types of sync pulses. The analog control signal MTRTVMODE at pin 6 can have 3 different values that determine the TV standard in which the circuit will work. The standards and respective control voltages are indicated in a table.

N6771 separates the TV synchronization pulses. The following signals are available at its outputs:

- Pin 1 carries negative going line (MTRTVL) pulses. These pulses can be applied to the MTB trigger (MTR) section via multiplexer D6781. Via multiplexer D7711/3,4,5,9 they are applied to the delayed trigger (DTR) section.
- Pin 3 carries the negative going field pulses (MTRTVFR) that appear at the beginning of field 1 and field 2.

- Pin 7. The signal is high during field 1 and low during field 2. Field 1 and Field 2 together form one frame.

The set/reset flipflops D6779 make the field 1 (MTRTVFLD1) and field 2 (MTRTVFLD2) pulses. As input signals are used the output signals at pin 7 and 3 of N6771.

The multiplexers D6781 and D7771 select the TV and line trigger sources for MTR and DTR:
- The MTB TV trigger signal is MTRTVSYNC. It originates from D6781/14.
- The DTB TV trigger signal is DTRTVL. It originates from D7711/15.
- The signal VSYNC from D6781/4 is not used: it will be used for extensions such as digital signal storage.
- The MTB mains/line trigger signal is MTRLINE. It is switched via D5001/10,11,12.
- The DTB mains/line trigger signal is DTRLINE. It originates from D7711/13.

Diagram 14

This diagram shows the DTB trigger (DTR) circuits. This circuit is build up around D7541. It is a simplified replica of the main trigger circuit. This because of the fact that the DTR is not equipped with peak-peak trigger facility. The level signal LEVDTB is applied almost directly to pin 22 and 23 of D7541. The transistors V7686 and V7687 are used to convert an asymmetrical LEVDTB signal into a symmetrical signal. At this point the TV line synchronization pulses (DTRTVL) are applied to the delayed trigger section when required.

The XDEFL CIRCUIT is used for X-DEFLection via the balanced X deflection signals DTRXDEF1 and DTRXDEF0 (pin 15 and 16 of D7541). The outputs of the circuit are TBXOUT1/TBXOUT0 and are applied to the time base section. It is there where the selection is done between X- deflection signal, MTB sawtooth and DTB sawtooth. Position control is achieved by signal DTRXPOS which is derived from LEVDTB via switch D7711/4,9,3. This switch is indicated on the preceding circuit diagram.

D9013 is used to determine the modification state of the unit A1. This is important in connection with the microprocessor hardware. The 8 outputs of D9013 are made high one by one after the oscilloscope is turned on. Via output diodes V7801 ... V7808 the high level is passed through. Depending on the modification state of the unit, one or more diodes are inserted into the p.c.b.. This gives the possibility to program 256 different modification levels.

5.1.1.6 *Main and delayed time base and control logic*

Diagram 15

This diagram incorporates the control logic for the main and delayed time base. This logic consists mainly of IC D8004. Also the input signal for the final Z-amplifier is generated on this diagram and occurs in D8003.

The selected trigger signals for the main time base are MTRIG0/MTRIG1 and are applied to pin 7 and pin 6 of D8004. This results via output pin 24 and V8013/V8014 into signal MTBGATE that starts the main time base (MTB). Signal STRCALM-HT is used to start the MTB via V8003. This occurs during autocalibration of the MTB.

The signal ALTCLK is derived here via V8018. This signal is used for display switching in ALTernate display mode. This happens in D9009 in the section that controls the display and trigger sources.

The selected trigger signals for delayed time base (DTB) are DTRIG0/DTRIG1 and are applied to pin 9 and pin 8 of D8004. This results via output pin 18 and V8012/V8011 into signal DTBGATE that starts the DTB. Signal STRCALD-HT is used to start the DTB via V8007. This occurs during autocalibration of the DTB.

D8004 has inputs and outputs with the following functions:
- TBEOHO-LX goes low at the end of the hold-off period.
- TBAUTO-LD is low if auto free run mode is active.
- TBEOM-HX goes high at the end of the MTB sweep.
- TBSTD-LX goes low to start the DTB sweep.
- TBEOD-HX goes high at the end of the delayed sweep.
- TBNOTTR-HT goes high if the MTB is not triggered.
- TBSEL selects MTB if high and DTB if low.
- TBSSG-HT goes high at the end of a single sweep.
- DSOM (pin 2) goes high if a MTB trigger occurs. The connected circuit with V8023/V8024 is used for extensions such as digital signal storage.
- DSOD goes high if a DTB trigger occurs. The connected circuit with V8029/V8031 is used for extensions such as digital signal storage. DSOD is also input signal for the "V peak-peak circuit".
- TBCAUT is connected with timing network R8052/R8066/R8133/C8011/V8067/V8068. This network determines in auto free run mode the 100ms waiting time after which the MTB becomes free running.

V8061/V8062/V8063/V8066 form the "V peak-peak circuit". It plays a role as the automatic positioning of the cursors on the top and bottom of the signal (Vpp mode). This function works via the DTB trigger circuit and is mainly software based. V8062/V8063 form a set-reset flipflop with inputs with hysteresis. The flipflop is set with the DSOD pulse that goes high at the moment that a DTB trigger pulse is detected. This is signalled to the microprocessor via V8066 which makes the TTL signal VPPTEST-LD. The shape of the waveform is scanned by the microprocessor by monitoring the signal VPPTEST-LD at different DTB trigger LEVEL positions. The flipflop is reset by the microprocessor via signal STRCALD-HT.

The balanced output signals ZTRA0 and ZTRA1 from pin 10 and 11 of D8003 are applied to the final Z-amplifier in order to control the intensity on the CRT screen. An important input signal is TBZB from D8004/19. This signal is high if the MTB sweep is on and during this time the light on the CRT is on. The intensified part during the time that the DTB sweep is on is switched on if signal TBZA is high. TBZA originates from D8004/20.
The signal CHBL that is applied to D8003/15 is influenced from the chopper blanking signal CHBLANK-HX and from the external Z-MODulation signal. The DAC output signals TBINTRAT-XA (pin 3) and INTTRA respectively influence the intensity ratio between MTB and DTB display and the total intensity on the CRT.
The signal TBXDEFL-LD (pin 6) switches the light continuously on if it is low. This happens in the X-DEFLection mode.

The circuit with V8002/V8006 is used for Z-MODulation via the BNC socket at the rear of the oscilloscope. The output signal of the circuit is TBZEXT and it is applied to D8003/16.

D9008 has outputs that control a number of on/off functions. The IC's of this type are connected in cascade as a shift register. The IC's are controlled by the microprocessor on unit A3. This happens via the data signal TBD01 (from the preceding D9011); the synchronization signal TBSCL (Time Base Serial CLock). The enable signal is STROBE1-HT. New data can be clocked into the shift register if STROBE1-HT is low. The new data becomes available at the outputs at the low-to-high transition of STROBE1-HT.

N8005 is an octal digital-to-analog converter. The IC has 8 outputs that can deliver a DC voltage that is adjustable between 0.5 and 9.5 V. This is controlled by the microprocessor on unit A3 via 6 bits of information that allow 64 adjustment steps. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The data bits are preceeded by address bits that are compared with the fixed address A0/A1/A2 applied to pin 7, 8 and 9. This determines if N8005 or similar IC's in the instrument will react on the bitstream.

Note: *a solder pad is present in the SDA and SCL input lines of each IC. This gives the possibility to isolate one IC from the others in case a fault is suspected.*

Diagram 16

This diagram indicates the timing circuits for the MTB. The principle of the time base is that a capacitor is charged with a constant current. This gives a time-linear voltage across the capacitor; the so- called sawtooth or sweep signal. The timing capacitance consists of C6011 that is always in circuit and C6012, C6013 that are activated via the switching transistors V6016 and V6019. The MTB control is done in IC D6011.

The constant current is supplied via transistor V6003 and V6005. The current source consists of voltage divider R6002 through R6007 with precision resistors. The voltage across this divider can be influenced by DAC output voltage MTBVAR via N6007/5,6,7 and V6001. This is necessary for continuous time/div control (VAR) and calibration. The voltage on a tap of the voltage divider can be selected via multiplexer D6001. This voltage (MCSCONTROL) is applied to the base of V6003 and V6004. This occurs via operational amplifier N6006. Via multiplexer D6002 two different emitter resistance values can be selected for V6003 and another two for V6004. The resistance values differ by a factor of 10: the emitter resistance for V6003 is switchable between R6014 (time base magnifier x10) and R6013 (magnifier x1). The emitter resistance for V6004 is switchable between R6016 (time base magnifier x10) and R6015 (magnifier x1).

The current from V6004 is applied to pin 16 of D6011 and is used as a reference. The sawtooth that is generated across the timing capacitor(s) is applied to pin 18 of D6011. Inside this IC is the time base switching transistor. The start of the sawtooth is initiated by signal MTBGATE that is applied to pin 20 of D6011. The sawtooth is also applied to pin 17 and converted into a balanced output signal that is available pin 12 and 13. The MTB sweep pickoff circuit consists of Source follower V6013 (and matching V6014) and emitter follower V6012. Horizontal position control is achieved via DAC output signal TBXPOS at pin 14.

Input signal TBCALREF at D6011/28 and output signal MTBCALTST at D6011/24 provide autocalibration of the time base. The sweep is switched on via STRCALM-HT and MTBGATE and compared with reference voltage TBCALREF. Via switching of output signal MTBCALTST, the microprocessor knows if the current source delivers the correct current. In case of inaccuracies the microprocessor makes corrections.

The start of the DTB is initiated by a low level of signal TBSTD-LX at pin 1 of D6011. The signal is generated via comparison of the MTB sawtooth signal and the adjustable DC voltage DTBM (delay time multiplier). The DTBM signal is coming from DAC output N6014/6 via operational amplifier N6008/5,6,7.

The signal TBEOM-HX at pin 4 of D6011 becomes high at the end of the MTB sweep. The signal TBEOHO-LX at pin 5 of D6011 becomes low at the end of the hold off period. The length of the hold off period is determined by the DAC output voltage HOLDOFF that is applied to D6011/7.

The MTB is switched on by making MTBONOFF (D6011/11) high. This signal is derived from control signal TBSEL. TBSEL is high during X deflection by the MTB and low during DTB. The MTB is also off in external X- deflection mode.

V6006 is on during the fast time base positions. It activates a stabilizing circuit that is connected with D6011/21.

The circuit with V6042 and C6033 assures that the hold off time in the fastest time base positions will never become shorter than 3 us. The circuit with C6035, V6002, C6017, V6008 and C6415 is responsable for the hold off timing. C6035 is always in circuit and C6017 and C6415 are activated by switching transistors. The capacitors are charged in parallel with the MTB timing capacitors. During the hold-off time that follows they are discharged by a current source inside D6011. The hold- off time can be varied by varying the discharging current.

The table shows the active main time base sections as a function of time/div setting:

main time base									
Time	Current source				Charge	Timing caps		Hold off caps	
/div	MTBI2	.I1	.I0	.I10	Current V6005/c	C6012 MTBC2	C6013 MTBC3	C6415 HONAN	C6017 HOMU
0.5s	L	L	L	L	8uA	L	H	H	H
0.2s	L	L	H	L	18uA	L	H	H	H
0.1s	L	H	L	L	35uA	L	H	H	H
50ms	L	L	L	H	70uA	L	H	H	H
20ms	L	L	H	H	175uA	L	H	H	H
10ms	L	H	L	H	350uA	L	H	H	L
5ms	L	H	H	H	700uA	L	H	H	L
2ms	H	L	L	H	1.75mA	L	H	H	L
1ms	H	L	H	H	3.5mA	L	H	H	L
.5ms	L	L	L	L	8uA	H	L	H	L
.2ms	L	L	H	L	18uA	H	L	H	L
.1ms	L	H	L	L	35uA	H	L	L	L
50us	L	L	L	H	70uA	H	L	L	L
20us	L	L	H	H	175uA	H	L	L	L
10us	L	H	L	H	350uA	H	L	L	L
5us	L	H	H	H	700uA	H	L	L	L
2us	H	L	L	H	1.75mA	H	L	L	L
1us	H	L	H	H	3.5mA	H	L	L	L
.5us	L	L	L	H	70uA	L	L	L	L
.2us	L	L	H	H	175uA	L	L	L	L
.1us	L	H	L	H	350uA	L	L	L	L
50ns	L	H	H	H	700uA	L	L	L	L
20ns	H	L	L	H	1.75mA	L	L	L	L

Diagram 17

This diagram indicates the timing circuits for the DTB. It is basically identical to the diagram of the MTB. For a description refer to the explanation of the corresponding circuit parts in diagram 16. The additional parts in this diagram are explained below.

The point where the input signals for the final X amplifier are applied is present on this diagram. This point is formed by the emitters of V7031 and V7032. The balanced signals that are applied are the combined MTB and DTB outputs TBXOUT0/TBXOUT1 and the external X-DEFLection signals TBXOUT0-XA/TBXOUT1-XA.

The circuit with N7016 makes an accurate voltage +15TBREF for the MTB and DTB timing circuits. Also the TBCALREF voltage for time base calibration is made here. As a reference for this circuit the +10VREF is used.

The circuit with D7005 converts the 5 digital 0V/5V signals into one analog signal with 32 possible levels. This signal can be read by an analog input of the microprocessor.

The circuit with multiplexer D7004 selects accurate voltages that come from a divider network with precision resistors R7064 through R7067. Operational amplifier N7014/2,3,6 is supplied with these voltages in order to calibrate the X-path from the MTB.
Operational amplifier N7015/2,3,6 does the same for DTB. Voltage DSW (present at the DTB output) is made equal to the selected voltage from the voltage divider R7064 through R7067. This occurs via feedback signal DCLOOP. This gives a defined input voltage for the X-path (including the D7011

output stage). The output voltage XCAL at the horizontal deflection plates of the CRT is measured and horizontal calibrations are performed. During normal oscilloscope functioning the multiplexer connects pin 3 + 4 and pin 13 + 11. This switches V7093 and V7094 on and the feedback paths for MTB and DTB are interrupted.

The table shows the active delayed time base sections as a function of time/div setting:

delayed time base						
Time	Current source				Charge	Timing capacitor
/div	DTBI2	.I1	.I0	.I10	Current V7005/c	C7012 DTBC2
.5ms	L	L	L	L	8uA	H
.2ms	L	L	H	L	18uA	H
.1ms	L	H	L	L	35uA	H
50us	L	L	L	H	70uA	H
20us	L	L	H	H	175uA	H
10us	L	H	L	H	350uA	H
5us	L	H	H	H	700uA	H
2us	H	L	L	H	1.75mA	H
1us	H	L	H	H	3.5mA	H
.5us	L	L	L	H	70uA	L
.2us	L	L	H	H	175uA	L
.1us	L	H	L	H	350uA	L
50ns	L	H	H	H	700uA	L
20ns	H	L	L	H	1.75mA	L

5.1.2 Signal name list

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.

NAME	MEANING	SOURCE	DESTINATION
ALTCLK	ALTERNATE DISPLAY MODE CLOCK	V8018:15	V5503:10
ATCAL	SIGNAL FOR GAIN CALIBRATION	N1104:05	R1008:01
			R2008:02
			R3008:03
			R4008:04
AT1AC/DC	AC/DC INPUT COUPLING SELECTION CH1	D9001:11	K1002:01
AT1LFCAL	LF CORRECTION CONTROL SIGNAL CH1	N9001:11	R1102:05
AT1LFCOR0	LF CORRECTION 0 CH1	N1102:05	R1029:01
AT1LFCOR1	LF CORRECTION 1 CH1	N1103:05	R1028:01
AT1LOOPCAL	LF GAIN CONTROL CH1	N9001:11	R1113:05
AT1LOOPCOR	LF GAIN CONTROL IN FEEDBACK LOOP CH1	R1113:05	V1001:01
AT1OFFSET	OFFSET CONTROL SIGNAL CH1	N9001:11	R1039:01
AT1OUT0	ATTENUATOR 1 OUTPUT 0 CH1	R1074:01	D1201:06
AT1OUT1	ATTENUATOR 1 OUTPUT 1 CH1	V1013:01	D1201:06
AT1PROBE	PROBE DETECTION SIGNAL CH1	X1002:01	R1096:05
AT1PROT	50Ω PROTECTION CH1	R1011:01	N1101:05

AT1.50E	50Ω INPUT IMPEDANCE SELECTION CH1	D9001:11	K1001:01
AT1/001	/1 ATTENUATOR SELECTION CH1	D9001:11	K1003:01
AT1/010	/10 ATTENUATOR SELECTION CH1	D9001:11	K1004:01
AT1/100	/100 ATTENUATOR SELECTION CH1	D9001:11	K1006:01
AT1/2.5	/2.5 ATTENUATOR SELECTION CH1	D9001:11	V1017:01
AT12REP	COMMON FOR ALL RELAIS CH 1, 2	D9001:11	K1001...
			K1006:01
			K2001...
			K2006:02
AT2AC/DC	AC/DC INPUT COUPLING SELECTION CH2	D9001:11	K2002:02
AT2LFCAL	LF CORRECTION CONTROL SIGNAL CH2	N9001:11	R2102:05
AT2LFCOR0	LF CORRECTION 0 CH2	N1102:05	R2029:02
AT2LFCOR1	LF CORRECTION 1 CH2	N1103:05	R2028:02
AT2LOOPCAL	LF GAIN CONTROL CH2	N9001:11	R2113:05
AT2LOOPCOR	LF GAIN CONTROL IN FEEDBACK LOOP CH2	R2113:05	V2001:02
AT2OFFSET	OFFSET CONTROL SIGNAL CH2	N9002:11	R2039:02
AT2OUT0	ATTENUATOR 2 OUTPUT 0 CH2	R2074:02	D2201:06
AT2OUT1	ATTENUATOR 2 OUTPUT 1 CH2	V2113:02	D2201:06
AT2PROBE	PROBE DETECTION SIGNAL CH2	X2002:02	R2096:05
AT2PROT	50Ω PROTECTION CH2	R2011:02	N1101:05
AT2.50E	50Ω INPUT IMPEDANCE SELECTION CH2	D9001:11	K2001:02
AT2/001	/1 ATTENUATOR SELECTION CH2	D9001:11	K2003:02
AT2/010	/10 ATTENUATOR SELECTION CH2	D9001:11	K2004:02
AT2/100	/100 ATTENUATOR SELECTION CH2	D9001:11	K2006:02
AT2/2.5	/2.5 ATTENUATOR SELECTION CH2	D9001:11	V2017:02
AT3AC/DC	AC/DC INPUT COUPLING SELECTION CH3	D9002:11	K3002:03
AT3LFCAL	LF CORRECTION CONTROL SIGNAL CH3	N9003:11	R3102:05
AT3LFCOR0	LF CORRECTION 0 CH3	N3102:05	R3029:03
AT3LFCOR1	LF CORRECTION 1 CH3	N3103:05	R3028:03
AT3LOOPCAL	LF GAIN CONTROL CH3	N9003:11	R3113:05
AT3LOOPCOR	LF GAIN CONTROL IN FEEDBACK LOOP CH3	R3113:05	V3001:03
AT3OFFSET	OFFSET CONTROL SIGNAL CH3	N9002:11	R3039:03
AT3OUT0	ATTENUATOR 3 OUTPUT 0 CH3	R3074:03	D3201:07
AT3OUT1	ATTENUATOR 3 OUTPUT 1 CH3	V3013:03	D3201:07
AT3PROBE	PROBE DETECTION SIGNAL CH3	X3002:03	R3096:05
AT3PROT	50Ω PROTECTION CH3	R3011:03	N1101:05
AT3.50E	50Ω INPUT IMPEDANCE SELECTION CH3	D9002:11	K3001:03
AT3/001	/1 ATTENUATOR SELECTION CH3	D9002:11	K3003:03
AT3/010	/10 ATTENUATOR SELECTION CH3	D9002:11	K3004:03
AT3/100	/100 ATTENUATOR SELECTION CH3	D9002:11	K3006:03
AT3/2.5	/2.5 ATTENUATOR SELECTION CH3	D9002:11	V3016:03
AT34REP	COMMON FOR ALL RELAIS CH 3, 4	D9002:11	K3001...
			K3006:03
			K4001...
			K4006:04
AT4AC/DC	AC/DC INPUT COUPLING SELECTION CH4	D9002:11	K4002:04
AT4LFCAL	LF CORRECTION CONTROL SIGNAL CH4	N9003:11	R4102:05
AT4LFCOR0	LF CORRECTION 0 CH4	N3102:05	R4029:04
AT4LFCOR1	LF CORRECTION 1 CH4	N3103:05	R4028:04
AT4LOOPCAL	LF GAIN CONTROL CH4	N9003:11	R4113:05
AT4LOOPCOR	LF GAIN CONTROL IN FEEDBACK LOOP CH4	R4113:05	V4001:04
AT4OFFSET	OFFSET CONTROL SIGNAL CH4	N9003:11	R4039:04
AT4OUT0	ATTENUATOR 4 OUTPUT 0 CH4	R4074:04	D4201:07

AT4OUT1	ATTENUATOR 4 OUTPUT 1 CH4	R4013:04	D4201:07
AT4PROBE	PROBE DETECTION SIGNAL CH4	X4002:04	R4096:05
AT4PROT	50Ω PROTECTION CH4	R4011:04	N1101:05
AT4.50E	50Ω INPUT IMPEDANCE SELECTION CH4	D9002:11	K4001:04
AT4/001	/1 ATTENUATOR SELECTION CH4	D9002:11	K4003:04
AT4/010	/10 ATTENUATOR SELECTION CH4	D9002:11	K4004:04
AT4/100	/100 ATTENUATOR SELECTION CH4	D9002:11	K4006:04
AT4/2.5	/2.5 ATTENUATOR SELECTION CH4	D9002:11	V4017:04
CNT1CH-HX	CHANNEL 1 ON/OFF SIGNAL	R5559:10	D1301:08
CNT1DT-HT	DTB TRIGGER ON CH1 ON/OFF	D5502:10	D1301:08
CNT1MT-HT	MTB TRIGGER ON CH1 ON/OFF	D5501:10	D1301:08
CNT2CH-HX	CHANNEL 2 ON/OFF SIGNAL	R5558:10	D2301:08
CNT2DT-HT	DTB TRIGGER ON CH2 ON/OFF	D5502:10	D2301:08
CNT2MT-HT	MTB TRIGGER ON CH2 ON/OFF	D5501:10	D2301:08
CNT3CH-HX	CHANNEL 3 ON/OFF SIGNAL	R5557:10	D3301:08
CNT3DT-HT	DTB TRIGGER ON CH3 ON/OFF	D5502:10	D3301:08
CNT3MT-HT	MTB TRIGGER ON CH3 ON/OFF	D5501:10	D3301:08
CNT4CH-HX	CHANNEL 4 ON/OFF SIGNAL	R5556:10	D4301:08
CNT4DT-HT	DTB TRIGGER ON CH4 ON/OFF	D5502:10	D4301:08
CNT4MT-HT	MTB TRIGGER ON CH4 ON/OFF	D5501:10	D4301:08
CPBLANK-HX	CHOPPER BLANKING SIGNAL	R5517:10	C8002:15
DLDOFFSET	DELAY LINE DRIVER OFFSET	N9003:11	R5018:09
DLDOUT0	DELAY LINE DRIVER OUTPUT 0	R5063:09	DELAY LINE
DLDOUT1	DELAY LINE DRIVER OUTPUT 1	R5062:09	DELAY LINE
DLEN0-HT	DATA LATCH ENABLE 0	X9001:18	D9001:11
DLEN1-HT	DATA LATCH ENABLE 1	X9001:18	D9002:11
DLEN2-HT	DATA LATCH ENABLE 2	X9001:18	D9006:16
DSOD	SET OF FLIPFLOP AUTOPOS Y-CURSOR	D8004:15	R8057:15
DTBCALTST	DTB CAL TEST SIGNAL	D7011:17	D7005:17
DTBVAR	DTB VARIABLE CONTROL SIGNAL	N8005:15	R7009:17
DTBGATE	DTB GATE SIGNAL	V8011:15	D7011:17
DTRHF-HD	DELAYED TRIGGER HF FILTER SWITCH	D9012:14	R7544:14
DTRIG0	DELAYED TRIGGER OUTPUT SIGNAL 0	V7574:14	D8004:15
DTRIG1	DELAYED TRIGGER OUTPUT SIGNAL 1	V7573:14	D8004:15
DTRLF-HD	DELAYED TRIGGER LF FILTER SWITCH	D9007:17	R7542:14
DTRLINE	X-DEFLECTION VIA LINE SIGNAL	D7711:13	V7506:14
DTRLINESW-HD	X-DEFLECTION VIA LINE SWITCHING	D9012:14	D7711:13
DTRSEN	DELAYED TRIGGER SENSITIVITY CONTROL	N8005:15	R7554:14
DTRSLOPE	DELAYED TRIGGER SLOPE CONTROL	D9007:17	R7547:14
DTRTVL	DELAYED TRIGGER TV LINE TRIG SIGNAL	D7711:13	R7696:14
DTRTVSEL-HD	DELAYED TV TRIGGER SELECTION	R7543:14	D7711:13
DTRXDEF0	DELAYED TRIGGER X DEFLECTION SIGNAL 0	D7541:14	R7754:14
DTRXDEF1	DELAYED TRIGGER X DEFLECTION SIGNAL 1	D7541:14	R7753:14
DTRXDSEL-HD	DELAYED TRIGGER X DEFLECTION SELECTION	D9012:14	R7546:14
FNCBWL	BANDWIDTH LIMITER ON/OFF	D9003:11	D1301:08
			D2301:08
			D3301:08
			D4301:08
FNC1DTR0	DTB TRIGGER ON CH1 OUTPUT SIGNAL 0	D1301:08	R7522:14
FNC1DTR1	DTB TRIGGER ON CH1 OUTPUT SIGNAL 1	D1301:08	R7521:14
FNC1MTR0	MTB TRIGGER ON CH1 OUTPUT SIGNAL 0	D1301:08	R6522:12
FNC1MTR1	MTR TRIGGER ON CH1 OUTPUT SIGNAL 1	D1301:08	R6521:12

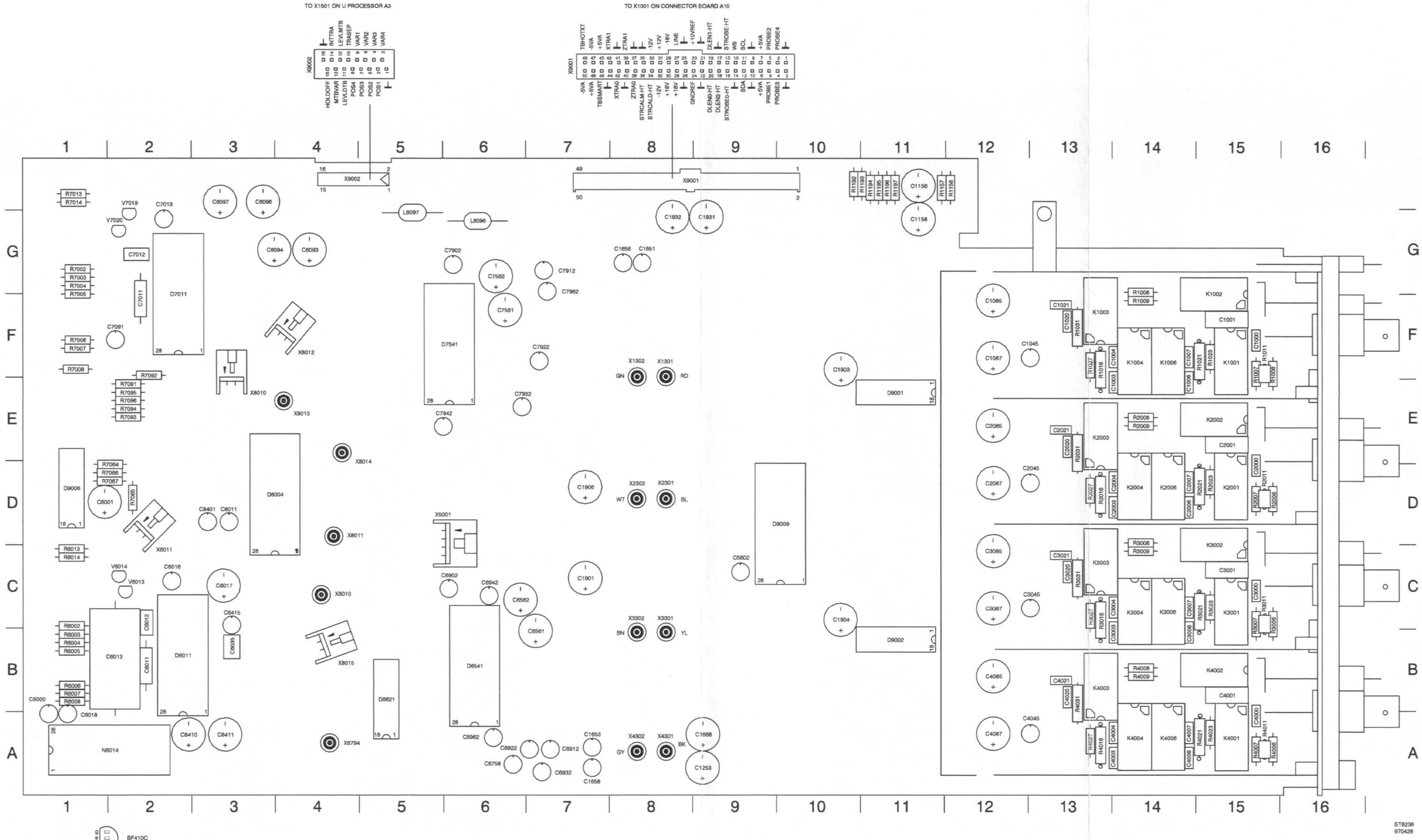
FNC1OUT0	CHANNEL 1 OUTPUT SIGNAL 0	D1301:08	R1313:09
FNC1OUT1	CHANNEL 1 OUTPUT SIGNAL 1	D1301:08	R1314:09
FNCYOP0	Y-OUT OPTION SIGNAL 0	D1301:08	Y-option
FNCYOP1	Y-OUT OPTION SIGNAL 1	D1301:08	Y-option
FNC2DTR0	DTB TRIGGER ON CH2 OUTPUT SIGNAL 0	D2301:08	R7524:14
FNC2DTR1	DTB TRIGGER ON CH2 OUTPUT SIGNAL 1	D2301:08	R7523:14
FNC2MTR0	MTB TRIGGER ON CH2 OUTPUT SIGNAL 0	D2301:08	R6524:12
FNC2MTR1	MTR TRIGGER ON CH2 OUTPUT SIGNAL 1	D2301:08	R6523:12
FNC2OUT0	CHANNEL 2 OUTPUT SIGNAL 0	D2301:08	R2313:09
FNC2OUT1	CHANNEL 2 OUTPUT SIGNAL 1	D2301:08	R2314:09
FNC3DTR0	DTB TRIGGER ON CH3 OUTPUT SIGNAL 0	D3301:08	R7527:14
FNC3DTR1	DTB TRIGGER ON CH3 OUTPUT SIGNAL 1	D3301:08	R7526:14
FNC3MTR0	MTB TRIGGER ON CH3 OUTPUT SIGNAL 0	D3301:08	R6527:12
FNC3MTR1	MTR TRIGGER ON CH3 OUTPUT SIGNAL 1	D3301:08	R6526:12
FNC3OUT0	CHANNEL 3 OUTPUT SIGNAL 0	D3301:08	R3313:09
FNC3OUT1	CHANNEL 3 OUTPUT SIGNAL 1	D3301:08	R3314:09
FNC4DTR0	DTB TRIGGER ON CH4 OUTPUT SIGNAL 0	D4301:08	R7529:14
FNC4DTR1	DTB TRIGGER ON CH4 OUTPUT SIGNAL 1	D4301:08	R7528:14
FNC4MTR0	MTB TRIGGER ON CH4 OUTPUT SIGNAL 0	D4301:08	R6529:12
FNC4MTR1	MTR TRIGGER ON CH4 OUTPUT SIGNAL 1	D4301:08	R6528:12
FNC4OUT0	CHANNEL 4 OUTPUT SIGNAL 0	D4301:08	R4313:09
FNC4OUT1	CHANNEL 4 OUTPUT SIGNAL 1	D4301:08	R4314:09
HOLDOFF	HOLD OFF CONTROL SIGNAL	X9002:18	R6032:16
INTTRA	TRACE INTENSITY CONTROL	X9002:18	R8049:15
LEVDTB	DELAYED TRIGGER LEVEL CONTROL	X9002:18	R7681:14
LEVMTB	MAIN TRIGGER LEVEL CONTROL	X9002:18	R6622:12
LINE	LINE TRIGGER SIGNAL	X9001:18	R7711:13
MTBCALTST	MTB CAL TEST SIGNAL	D6011:16	D7005:17
MTBGATE	MTB GATE SIGNAL	V8014:15	D6011:16
MTBVAR	MTB VARIABLE CONTROL SIGNAL	X9002:18	R6009:16
MTRBAL	MAIN TRIGGER BALANCE	N8005:15	R6709:12
MTRHF-HD	MAIN TRIGGER HF FILTER SWITCH	D9008:15	R6544:12
MTRIG0	MAIN TRIGGER OUTPUT SIGNAL 0	V6574:12	D8004:15
MTRIG1	MAIN TRIGGER OUTPUT SIGNAL 1	V6573:12	D8004:15
MTRLF-HD	MAIN TRIGGER LF FILTER SWITCH	D9011:12	R6542:12
MTRLINE	MAIN TRIGGER LINE TRIGGER SIGNAL	D5001:13	V6506:12
MTRPPLEV-HD	MAIN TRIGGERING AUTO PP OFF	D9011:12	V6628:12
MTRSEN	MAIN TRIGGER SENSITIVITY CONTROL	N8005:15	R6554:12
MTRSLOPE	MAIN TRIGGER SLOPE CONTROL	D9011:12	R6547:12
MTRTVMODE	MAIN TRIGGER TV SYSTEM SELECTION	N8005:15	R6772:13
MTRTVSEL-HD	MAIN TV TRIGGER SELECTION	D9011:12	V6757:13
MTRVIDEO	MAIN TV TRIGGER INPUT SIGNAL	D6541:12	V6754:13
PA1/2	ATTENUATION /2	CONTROL CH1	
D9003:11	D1201:06		
PA1ICL	CLAMP LEVEL CURRENT CH1	V1206:06	D1201:06
PA1ISY	SUPPLY CURRENT CH1	V1207:06	D1201:06
PA1LSA	LEVEL SHIFT A CH1	V1208:06	R1216:06
PA1LSB	LEVEL SHIFT B CH1	V1209:06	R1217:06

PA1OFFSET	OFFSET INPUT CIRCUIT CH1	N9001:11	R1203:06
PA1OFFSTRG	OFFSET LEVEL SHIFTER CH1	N9001:11	R1229:06
PA1OUT0	OUTPUT SIGNAL 0 CH1	V1202:06	R1301:08
PA1OUT1	OUTPUT SIGNAL 1 CH1	V1201:06	R1302:08
PA1X1	GAIN X1 CONTROL CH1	D9003:11	D1201:06
PA1X5	GAIN X5 CONTROL CH1	D9003:11	D1201:06
PAVREF	PREAMPL REFERENCE VOLTAGE	N1251:06	R1200:06
			R2200:06
			R3200:07
			R4200:07
PA2/2	ATTENUATION /2 CONTROL CH2	D9003:11	D2201:06
PA2ICL	CLAMP LEVEL CURRENT CH2	V2206:06	D2201:06
PA2ISY	SUPPLY CURRENT CH2	V2207:06	D2201:06
PA2LSA	LEVEL SHIFT A CH2	V2208:06	R2216:06
PA2LSB	LEVEL SHIFT B CH2	V2209:06	R2217:06
PA2OFFSET	OFFSET INPUT CIRCUIT CH2	N9002:11	R2203:06
PA2OFFSTRG	OFFSET LEVEL SHIFTER CH2	N9002:11	R2229:06
PA2OUT0	OUTPUT SIGNAL 0 CH2	V2202:06	R2301:08
PA2OUT1	OUTPUT SIGNAL 1 CH2	V2201:06	R2302:08
PA2X1	GAIN X1 CONTROL CH2	D9003:11	D2201:06
PA2X5	GAIN X5 CONTROL CH2	D9003:11	D2201:06
PA3/2	ATTENUATION /2 CONTROL CH3	D9004:11	D3201:07
PA3ICL	CLAMP LEVEL CURRENT CH3	V3206:07	D3201:07
PA3ISY	SUPPLY CURRENT CH3	V3207:07	D3201:07
PA3LSA	LEVEL SHIFT A CH3	V3208:07	R3216:07
PA3LSB	LEVEL SHIFT B CH3	V3209:07	R3217:07
PA3OFFSET	OFFSET INPUT CIRCUIT CH3	N9003:11	R3203:07
PA3OFFSTRG	OFFSET LEVEL SHIFTER CH3	N9003:11	R3229:07
PA3OUT0	OUTPUT SIGNAL 0 CH3	V3202:07	R3301:08
PA3OUT1	OUTPUT SIGNAL 1 CH3	V3201:07	R3302:08
PA3X1	GAIN X1 CONTROL CH3	D9004:11	D3201:07
PA3X5	GAIN X5 CONTROL CH3	D9004:11	D3201:07
PA4/2	ATTENUATION /2 CONTROL CH4	D9004:11	D4201:07
PA4ICL	CLAMP LEVEL CURRENT CH4	V4206:07	D4201:07
PA4ISY	SUPPLY CURRENT CH4	V4207:07	D4201:07
PA4LSA	LEVEL SHIFT A CH4	V4208:07	R4216:07
PA4LSB	LEVEL SHIFT B CH4	V4209:07	R4217:07
PA4OFFSET	OFFSET INPUT CIRCUIT CH4	N9003:11	R4203:07
PA4OFFSTRG	OFFSET LEVEL SHIFTER CH4	N9003:11	R4229:07
PA4OUT0	OUTPUT SIGNAL 0 CH4	V4202:07	R4301:08
PA4OUT1	OUTPUT SIGNAL 1 CH4	V4201:07	R4302:08
PA4X1	GAIN X1 CONTROL CH4	D9004:11	D4201:07
PA4X5	GAIN X5 CONTROL CH4	D9004:11	D4201:07
POS1	POSITION CONTROL CH1	X9002:18	R1308:08
POS2	POSITION CONTROL CH2	X9002:18	R2308:08
POS3	POSITION CONTROL CH3	X9002:18	R3308:08
POS4	POSITION CONTROL CH4	X9002:18	R4308:08
PROBE1	PROBE DETECTION/50Ω PROTECTION CH1	R1093:05	X9001:18
PROBE2	PROBE DETECTION/50Ω PROTECTION CH2	R2093:05	X9001:18
PROBE3	PROBE DETECTION/50Ω PROTECTION CH3	R3093:05	X9001:18
PROBE4	PROBE DETECTION/50Ω PROTECTION CH4	R4093:05	X9001:18

SCL	SERIAL CLOCK	X9001:18	D9009:10
			D9001:11
			D9002:11
			D9003:11
			D9004:11
			D9006:16
			D9007:17
			D9008:15
			D9011:12
			D9012:14
			N8005:15
			N9001:11
			N9002:11
			N9003:11
			R8403:16
SDA	SERIAL DATA	X9001:18	D9009:10
			D9001:11
			D9002:11
			D9003:11
			D9004:11
			D9006:16
			D9011:12
			N8005:15
			N9001:11
			N9002:11
			N9003:11
			R8404:16
STRCALD-HT	RESET FLIPFLOP AUTOPOS Y-CURSOR	X9001:18	V8065:15
			V8007:15
STROBE0-HT	STROBE/ENABLE SIGNAL 0	X9001:18	D9003:11
			D9004:11
STROBE1-HT	STROBE/ENABLE SIGNAL 1	X9001:18	D9007:17
			D9008:15
			D9011:12
			D9012:14
TBAUTO-LD	TIME BASE AUTO FREE RUN CONTROL	D9007:17	D8004:15
TBCALREF	TIME BASE CALIBRATION REFERENCE	V7011:17	D6011:16
			D7011:17
TBD01	TIME BASE SERIAL DATA 01	D9011:12	D9008:15
TBD02	TIME BASE SERIAL DATA 02	D9008:15	D9007:17
TBD03	TIME BASE SERIAL DATA 03	D9007:17	D9012:14
TBEOM-HX	TIME BASE END OF MAIN SWEEP	D6011:16	D8004:15
TBEOD-HX	TIME BASE END OF DELAYED SWEEP	D7011:17	D8004:15
TBEOHO-LX	TIME BASE END OF HOLD OFF	D6011:16	D8004:15
TBHOTXT	TIME BASE HOLD OFF FOR TEXT DISPLAY	R8026:15	X9001:18
TBINTRAT-XA	INTENS RATIO CONTROL SIGNAL	N8005:15	R8007:15
TBNOTTR-HT	TIME BASE NOT TRIGGERED SIGNAL	D8004:15	D7005:17
TDADA	TIME BASE SERIAL DATA	R8404:16	N6014:16
TDACL	TIME BASE SERIAL CLOCK	R8403:16	D9006:16
			D9007:17
			D9008:15
			D9011:12
			D9012:14
			N6013:16
			N8005:15

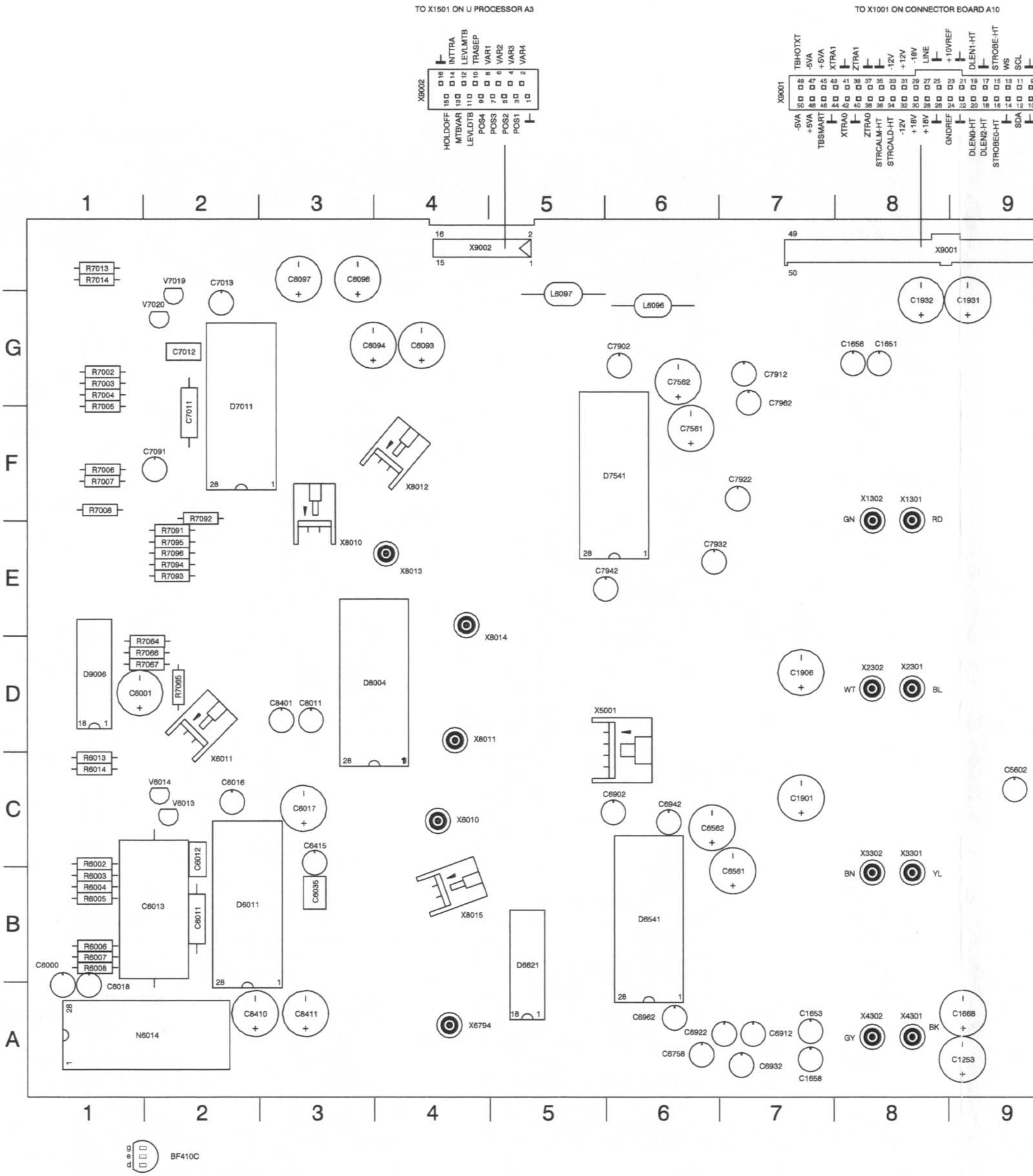
TBSEL	TIME BASE MTB/DTB SELECTION	R5501:10	R6018:16 R7028:17 R8072:15
TBSTD-LX	TIME BASE START OF DTB	D6011:16	D8004:15
TBSSG-HT	TIME BASE END OF SINGLE SWEEP	D8004:15	D7005:17
TBSMART	TIME BASE TEST SIGNALS	C7054:17	X9001:18
TBXDEFL-LD	X DEFLECTION CONTROL SIGNAL	D9012:14	V8015:15 R7772:
TBXOUT0	TIME BASE OUTPUT 0	D6011:16 D7011:17	R7077:17
TBXOUT0-XA	X DEFLECTION OUTPUT 0	R7754:14	V7031:17
TBXOUT1	TIME BASE OUTPUT 1	D6011:16 D7011:17	R7078:17
TBXOUT1-XA	X DEFLECTION OUTPUT 1	R7753:14	V7032:17
TBXPOS	TIME X POSITION	R8411:16	R6017:16 R7099:17
TRASEP	ANALOG TRACE SEPARATION SIGNAL	X9002:18	R5021:09
TRASEP-HC	DIGITAL TRACE SEPARATION CONTROL	R5524:10	D5001:09
VAR1	VARIABLE GAIN CONTROL CH1	X9002:18	R1211:06
VAR2	VARIABLE GAIN CONTROL CH2	X9002:18	R2211:06
VAR3	VARIABLE GAIN CONTROL CH3	X9002:18	R3211:07
VAR4	VARIABLE GAIN CONTROL CH4	X9002:18	R4211:07
VPPTEST-LD	VOLT PP TEST AUTOPOS Y-CURSOR	V8066:15	D7005:17
XTRA0	X DEFLECTION OUTPUT SIGNAL 0	V7150:17	X9001:18
XTRA1	X DEFLECTION OUTPUT SIGNAL 1	V7151:17	X9001:18
ZTRA0	INTENSITY OUTPUT SIGNAL 0	D8003:15	X9001:18
ZTRA1	INTENSITY OUTPUT SIGNAL 1	D8003:15	X9001:18

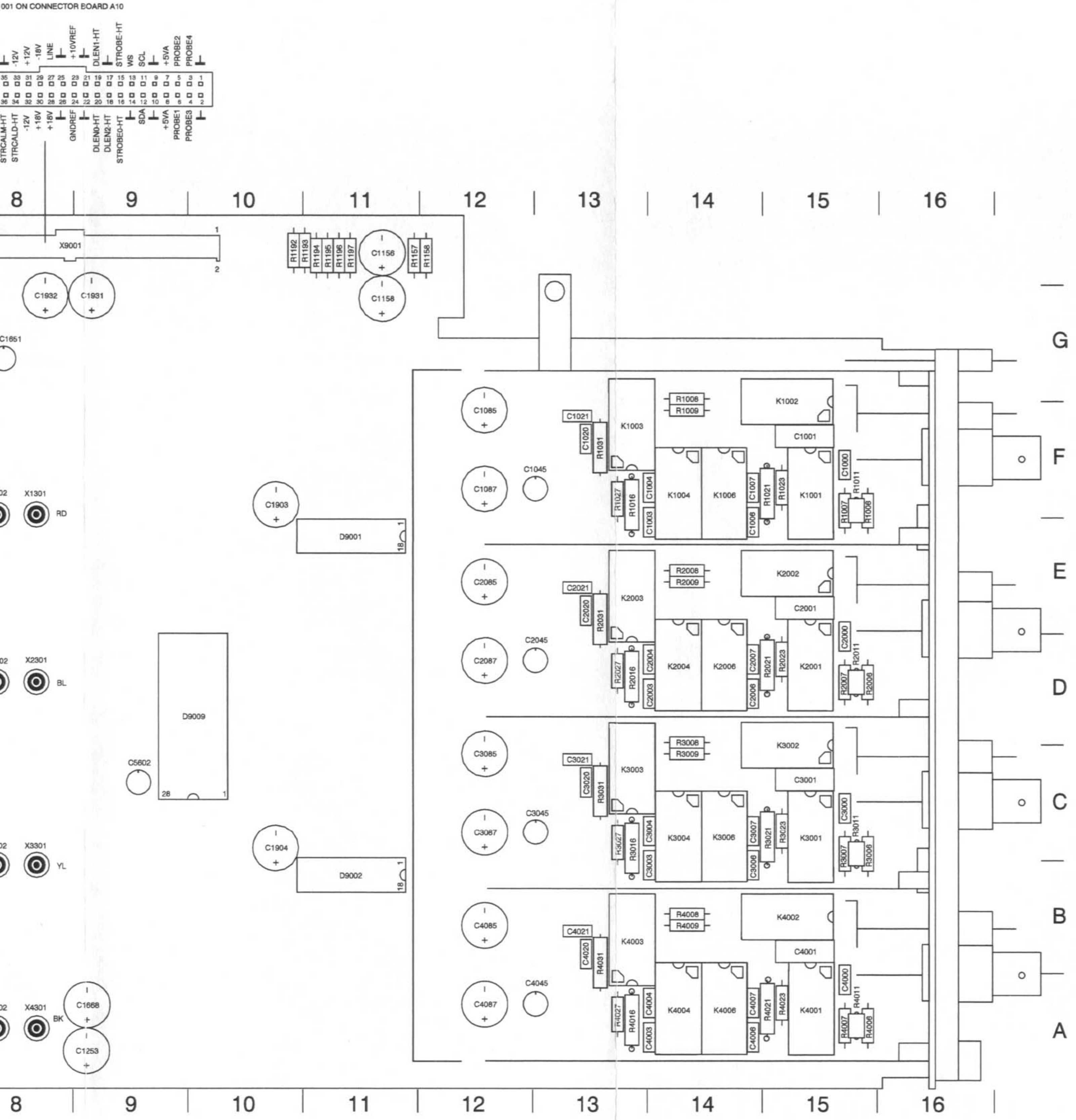
5.1.3 Unit lay-outs



Lay-out 1 - Large component side of signal unit A1

5.1.3 Unit lay-outs





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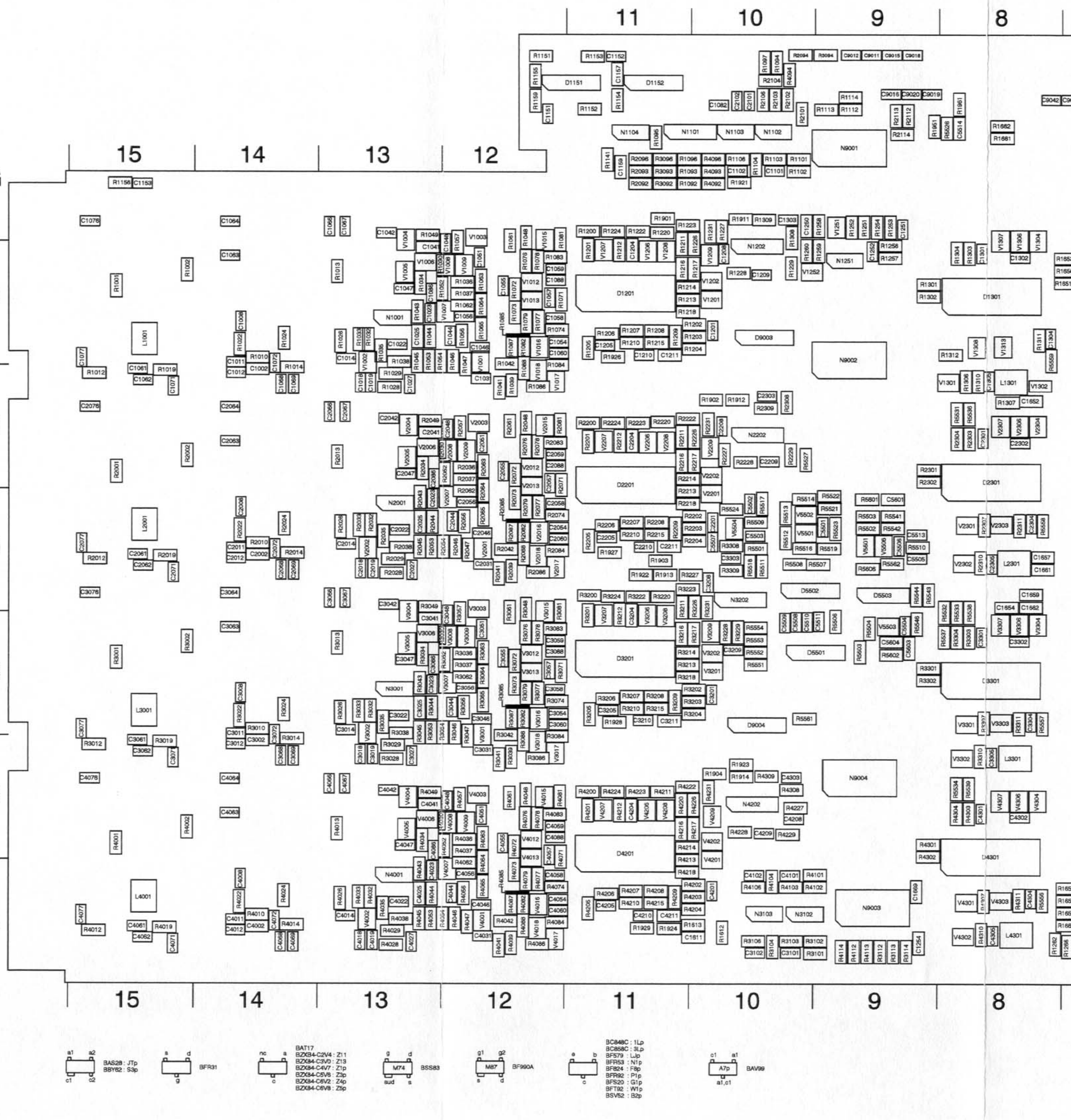
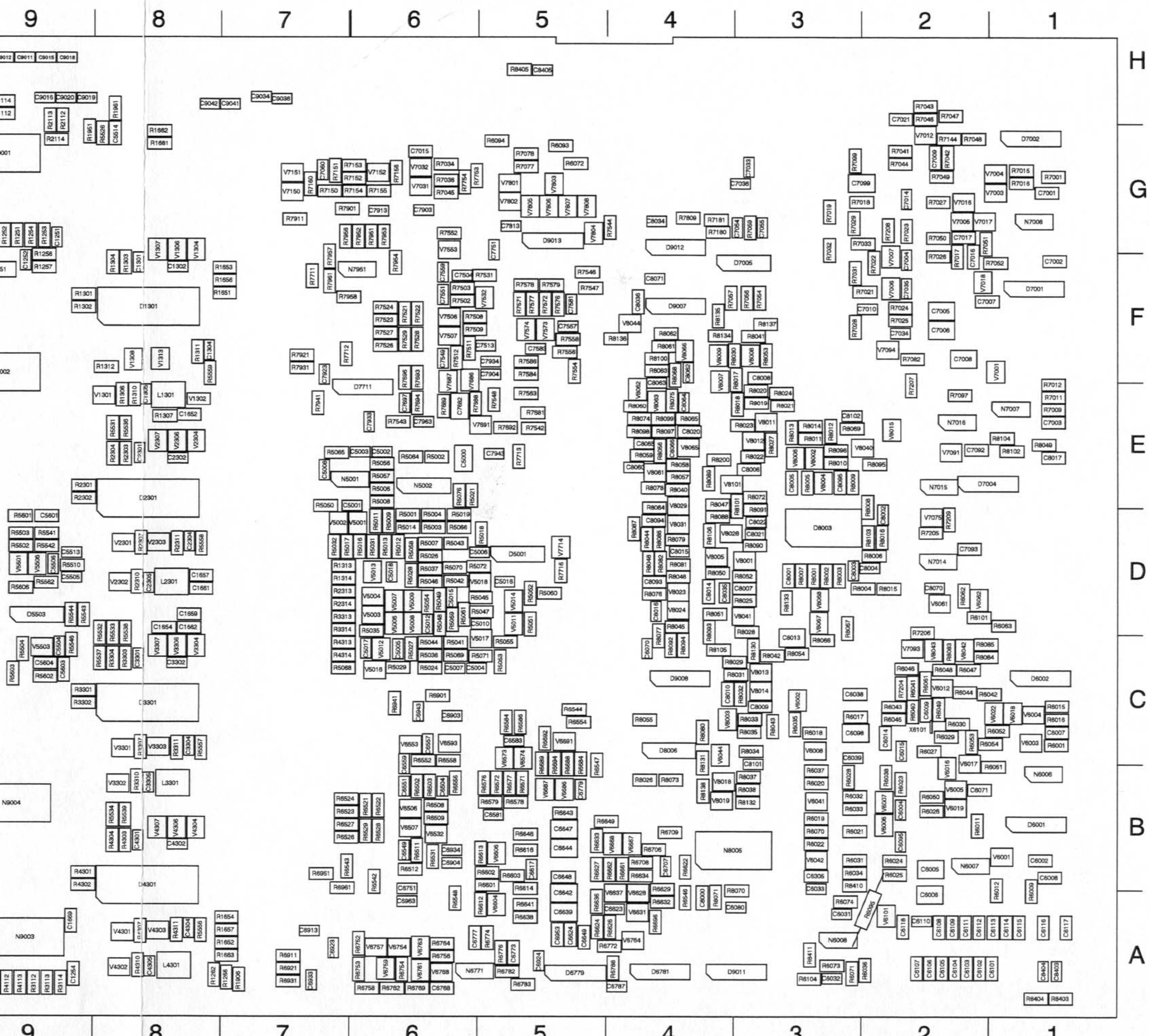
Lay-out 1 - Large component side of signal unit A1

Lay-out 2 - Small component side of signal unit A1


15
14
13
12
11
10
9
8
G
F
E
D
C
B
A
BAS28 : JTp
BBY62 : S3p
BFR31
BAT17
BZX84-C2V4 : Z11
BZX84-C3V0 : Z13
BZX84-C4V7 : Z1p
BZX84-C5V6 : Z3p
BZX84-C6V2 : Z4p
BZX84-C6V8 : Z5p
M74
BSS83
M87
BF990A
BC848C : 1Lp
BC858C : 3Lp
BF579 : LJp
BFR53 : N1p
BF824 : F8p
BFR92 : P1p
BFS20 : G1p
BFT92 : W1p
BSV52 : B2p
A7p
BAV99



Lay-out 2 - Small component side of signal unit A1

5.1.4 Location list Signal Unit A1

'-L' means that the component is located on the side with the large components. Otherwise the component is located on the side with small components (SMD's: surface mounted devices)

C1001 F15-L
C1002 F14
C1003 F14-L
C1004 F14-L
C1005 F15
C1006 F14-L
C1007 F14-L
C1008 F14
C1011 F14
C1012 F14
C1014 F13
C1018 E13
C1019 E13
C1021 F13-L
C1022 F13
C1023 F13
C1025 F13
C1027 E13
C1041 G13
C1042 G13
C1044 F12
C1045 F13-L
C1046 F12
C1047 F13
C1048 G12
C1049 G13
C1051 F12
C1054 F12
C1055 F12
C1056 F12
C1057 F12
C1058 F12
C1059 F12
C1060 F12
C1061 F15
C1062 E15
C1063 F14
C1064 G14
C1066 G13
C1067 G13
C1068 E14
C1069 E14
C1071 E15
C1076 G15
C1077 F15
C1082 H10
C1085 G12-L
C1086 F13
C1087 F12-L
C1088 F12
C1101 G10
C1102 G10
C1151 H12
C1152 H11
C1153 G15
C1156 H11-L
C1157 H11
C1158 H11-L
C1159 G11
C1201 F10
C1204 G11
C1205 F11
C1208 F10
C1209 F10
C1210 F11
C1211 F11
C1250 G10
C1251 G9
C1252 G9
C1254 A9
C1301 F8
C1302 F8
C1303 G10
C1304 F8
C1305 F8
C1651 G8-L
C1653 A7-L
C1654 D8
C1656 G8-L
C1657 D8
C1658 A7-L
C1659 D8
C1661 D8
C1662 D8
C1669 A9
C1901 C7-L
C1903 F10-L
C1904 C10-L
C1906 D7-L
C1931 H8-L
C1932 H8-L
C2001 E15-L
C2002 D14
C2003 D14-L
C2004 D14-L
C2005 D15
C2006 D14-L
C2007 D14-L
C2008 D14
C2011 D14
C2012 D14
C2014 D13
C2018 D13
C2019 D13
C2021 E13-L
C2022 D13
C2023 D13
C2025 D13
C2027 D13
C2031 D12
C2041 E13
C2042 E13
C2044 D12
C2045 D13-L
C2046 D12
C2047 E13
C2048 E12
C2051 E12
C2054 D12
C2055 E12
C2056 D12
C2057 E12
C2058 D12
C2059 E12
C2060 D12
C2061 D15
C2062 D15
C2063 E14
C2064 E14
C2066 E13
C2067 E13
C2068 D14
C2069 D14
C2071 D15
C2072 D14
C2076 E15
C2077 D15
C2085 E12-L
C2086 E13
C2087 D12-L
C2088 E12
C2101 H10
C2102 H10
C2201 D10
C2204 E11
C2205 D11
C2208 E10
C2209 E10
C2210 D11
C2211 D11
C2301 E8
C2302 E8
C2303 E10
C2304 D8
C2305 D8
C3001 C15-L
C3002 B14
C3003 B14-L
C3004 C14-L
C3005 C15
C3006 D14-L
C3007 C14-L
C3008 C14
C3011 C14
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C3014 C13
C3018 B13
C3019 B13
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C3023 C13
C3025 C13
C3027 B13
C3031 B12
C3041 D13
C3042 D13
C3044 C12
C3045 C13-L
C3046 C12
C3047 C13
C3048 D12
C3051 C12
C3054 C12
C3055 C12
C3056 C12
C3057 C12
C3058 C12
C3059 C12
C3060 C12
C3061 C15
C3062 B15
C3063 C14
C3064 D14
C3066 D13
C3067 D13
C3068 B14
C3069 B14
C3071 B15
C3072 C14
C3076 D15
C3077 C15
C3085 C12-L
C3086 C13
C3087 C12-L

C3088 C12
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C3102 A10
C3201 C10
C3204 D11
C3205 C11
C3208 D10
C3209 C10
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C3302 C8
C3303 D10
C3304 C8
C3305 C8
C4001 B15-L
C4002 A14
C4003 A14-L
C4004 A14-L
C4005 A15
C4006 A14-L
C4007 A14-L
C4008 A14
C4011 A14
C4012 A14
C4014 A13
C4018 A13
C4019 A13
C4021 B13-L
C4022 A13
C4023 A13
C4025 A13
C4027 A13
C4031 A12
C4041 B13
C4042 B13
C4044 A12
C4045 A13-L
C4046 A12
C4047 B13
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C4209 B10
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C8071 F4
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C8094 D4
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C8405 H5
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C9012 H9
C9015 H9
C9016 H9
C9018 H9
C9019 H9
C9020 H9
C9034 H7
C9036 H7
C9041 H8
C9042 H8
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D1152 H11
D1201 F11
D1301 F8
D2201 E11
D2301 E8
D3201 C11
D3301 C8
D4201 B11
D4301 B8
D5001 D5
D5501 C10
D5502 D10
D5503 D9
D6001 B1
D6002 C1
D6011 B2-L
D6541 B6-L
D6621 B5-L
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D6781 A4
D7001 F1
D7002 G1

D7004 E2
D7005 F3
D7541 F6-L
D8003 D3
D8006 C4
D9001 E11-L
D9002 B11-L
D9003 F10
D9004 C10
D9006 D1-L
D9007 F4
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D9009 D10-L
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D9013 G5
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K1004 F14-L
K1006 F14-L
K2001 D15-L
K2002 D15-L
K2003 E13-L
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K2006 D14-L
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L6097 H5-L
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N1101 H11
N1102 G10
N1103 G10
N1104 G11
N1202 G10
N1251 F9
N2001 D13
N2202 E10
N3001 C13
N3102 A10
N3103 A10
N3202 D10
N4001 A13

N4204 B10
N5001 E7
N5002 E6
N6006 B1
N6007 B2
N6008 A3
N6014 A2-L
N6771 A6
N7006 G1
N7007 E1
N7014 D2
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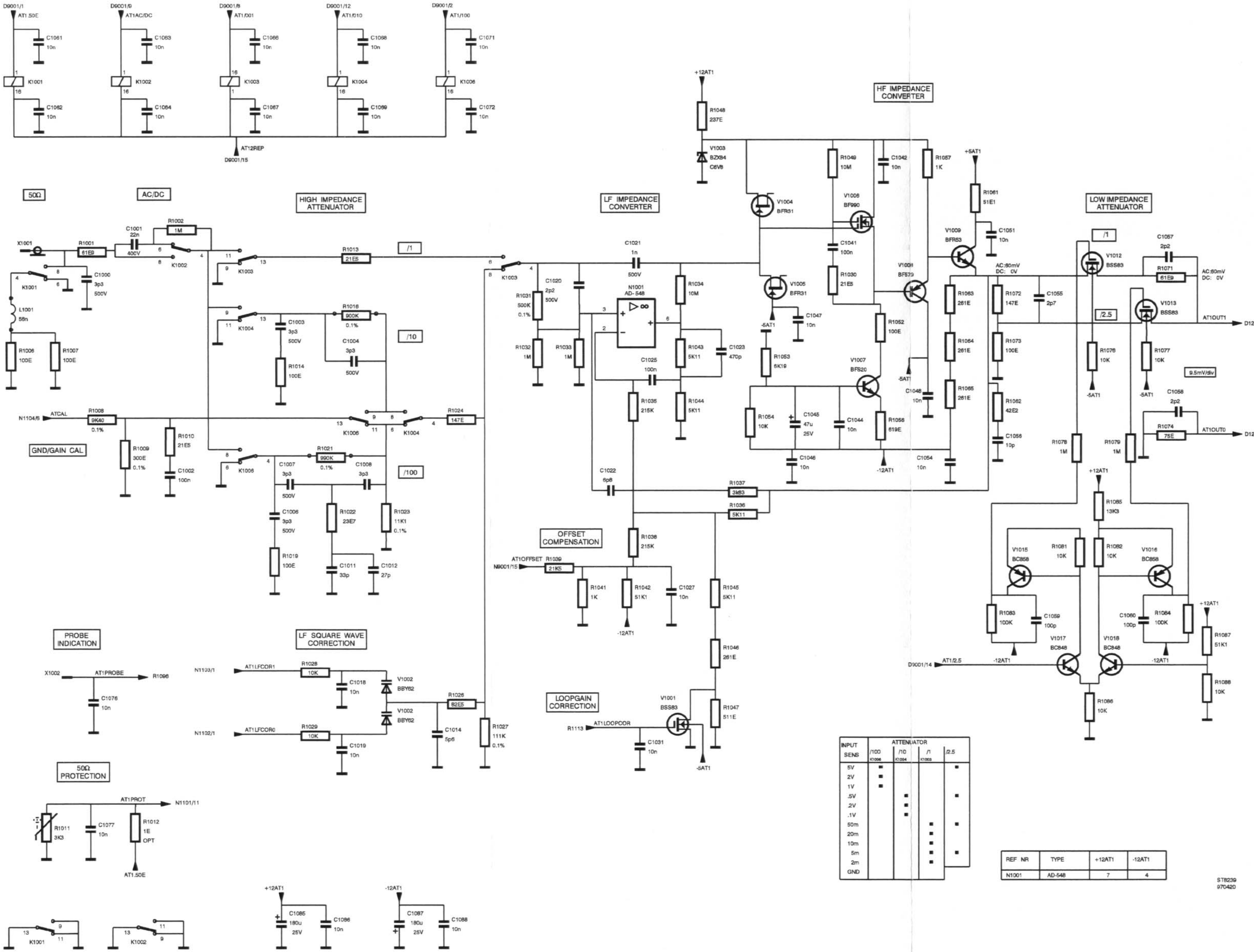
V6004 C1
V6005 B2
V6006 B2
V6007 B2
V6008 C3
V6012 C2
V6013 C2-L
V6014 C2-L
V6016 B2
V6017 B2
V6018 C1

V6019 B2
V6022 C2
V6041 B3
V6042 B3
V6044 C4
V6062 D2
V6101 A2
V6506 B6
V6507 B6
V6532 B6
V6553 C6
V6573 C5
V6574 C5
V6593 C6
V6604 A5
V6606 B5
V6628 A4
V6631 A4
V6637 A4
V6667 B4
V6668 B5
V6686 B5
V6687 B5
V6691 C5
V6754 A6
V6757 A6
V6759 A6
V6761 A6
V6763 A6
V6764 A4
V6768 A6
V6784 A5
V7001 F2
V7003 G2
V7004 G2
V7005 G2
V7006 F2
V7007 F2
V7012 G2
V7016 G2
V7017 G2
V7018 F2
V7019 H2-L
V7020 G2-L
V7031 G6
V7032 G6
V7075 D2
V7091 E2
V7093 C2
V7094 F2
V7150 G7
V7151 G7
V7152 G6
V7506 F6
V7507 F6
V7532 F6
V7553 G6
V7573 F5
V7574 F5
V7686 F6
V7687 F6
V7691 E6
V7714 D5
V7801 G5
V7802 G5
V7803 G5
V7804 G5
V7805 G5
V7806 G5
V7807 G5
V7808 G5
V8002 E3
V8003 C4
V8004 E3
V8006 E3
V8007 F4
V8008 F3
V8009 F4
V8011 E3
V8012 E3
V8013 C3
V8014 C3
V8015 E2
V8018 B4
V8019 B4
V8023 D4
V8024 D4
V8028 D4
V8029 E4
V8031 D4
V8040 E3
V8041 D4
V8042 C2
V8043 C2
V8044 F4
V8061 E4
V8062 E4
V8063 E4
V8065 E4
V8066 F4
V8067 D3
V8068 D3
V8101 E4
X5001 D6-L
X9001 H8-L
X9002 H4-L

5.1.5 Circuit diagrams

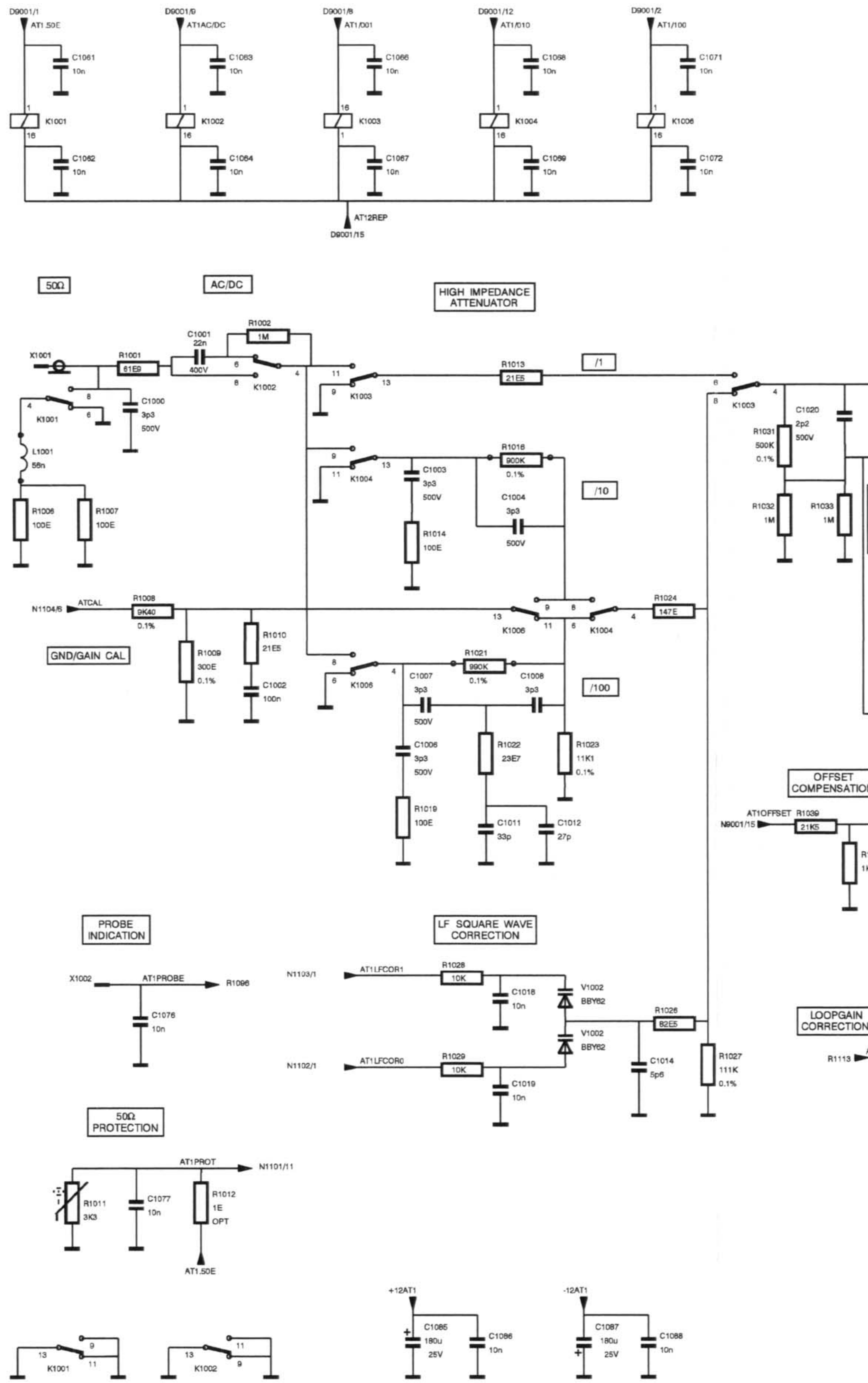


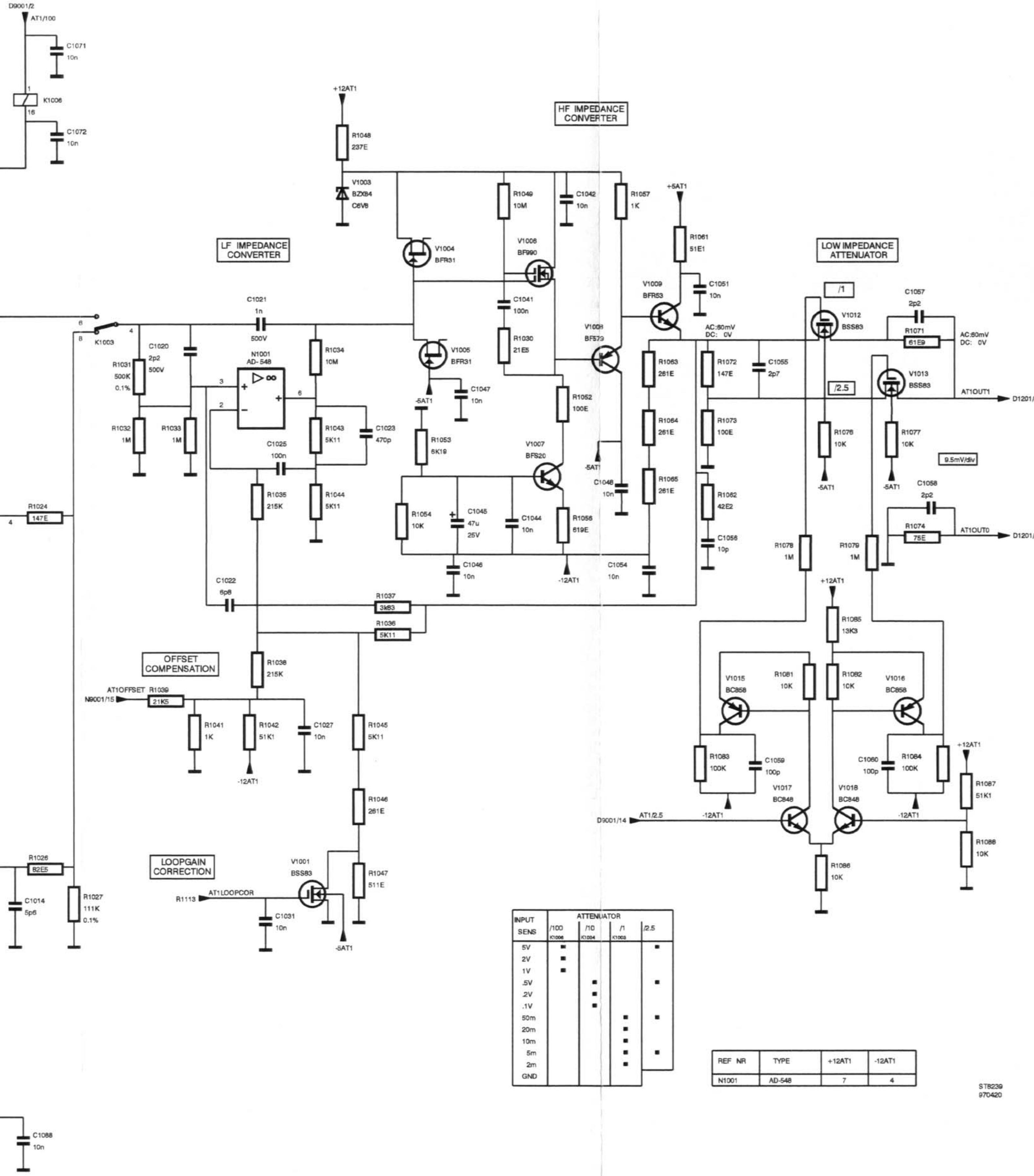
INPUT SENS	ATTENUATOR /100 K1006	/10 K1004	/1 K1003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT1	-12AT1
N1001	AD-548	7	4

A1; Diagram 1 - Attenuator CH 1 (PM3094/PM3092)

5.1.5 Circuit diagrams

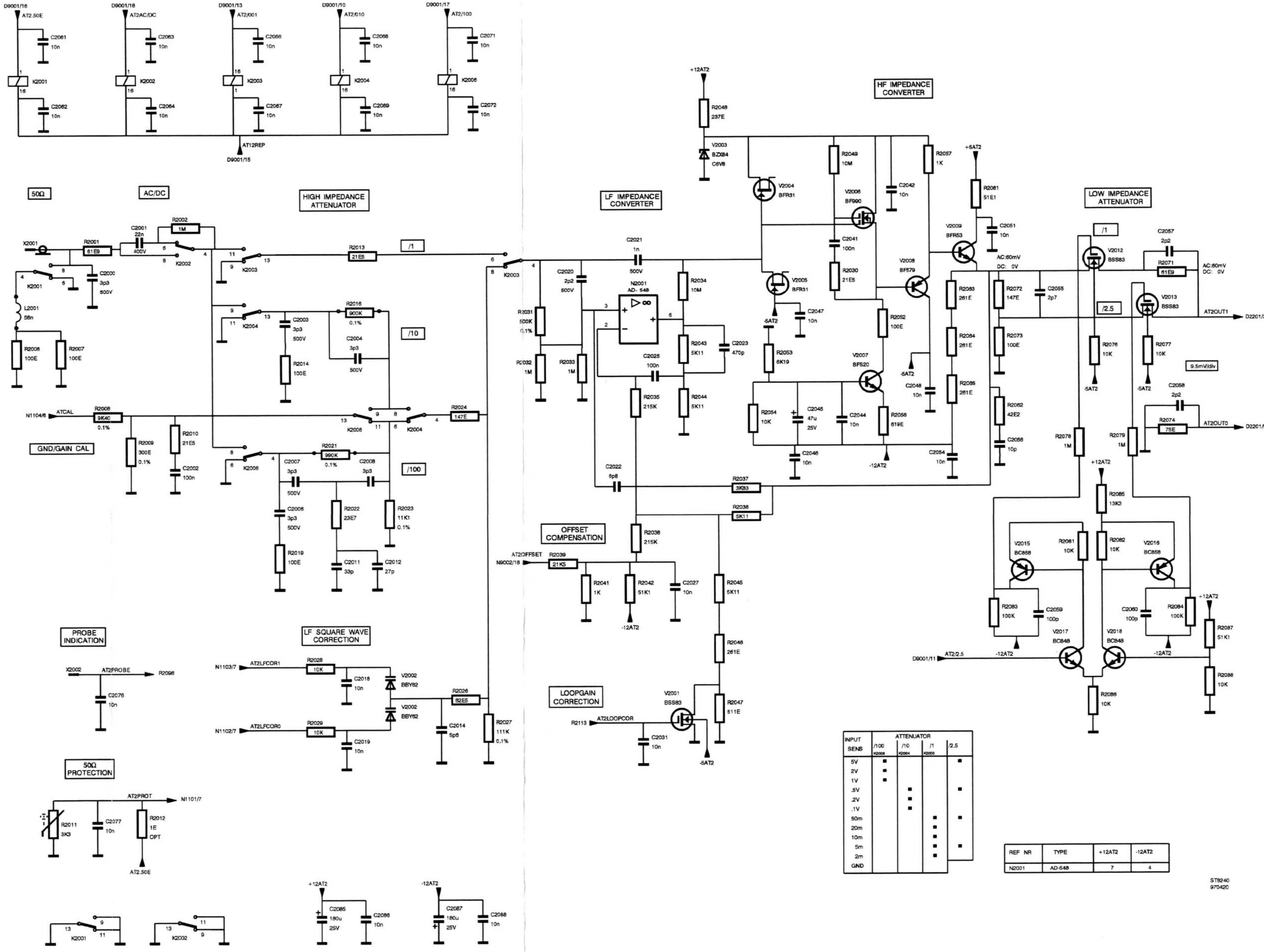




INPUT SENS	ATTENUATOR /100 K1006	/10 K1004	/1 K1003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT1	-12AT1
N1001	AD-548	7	4

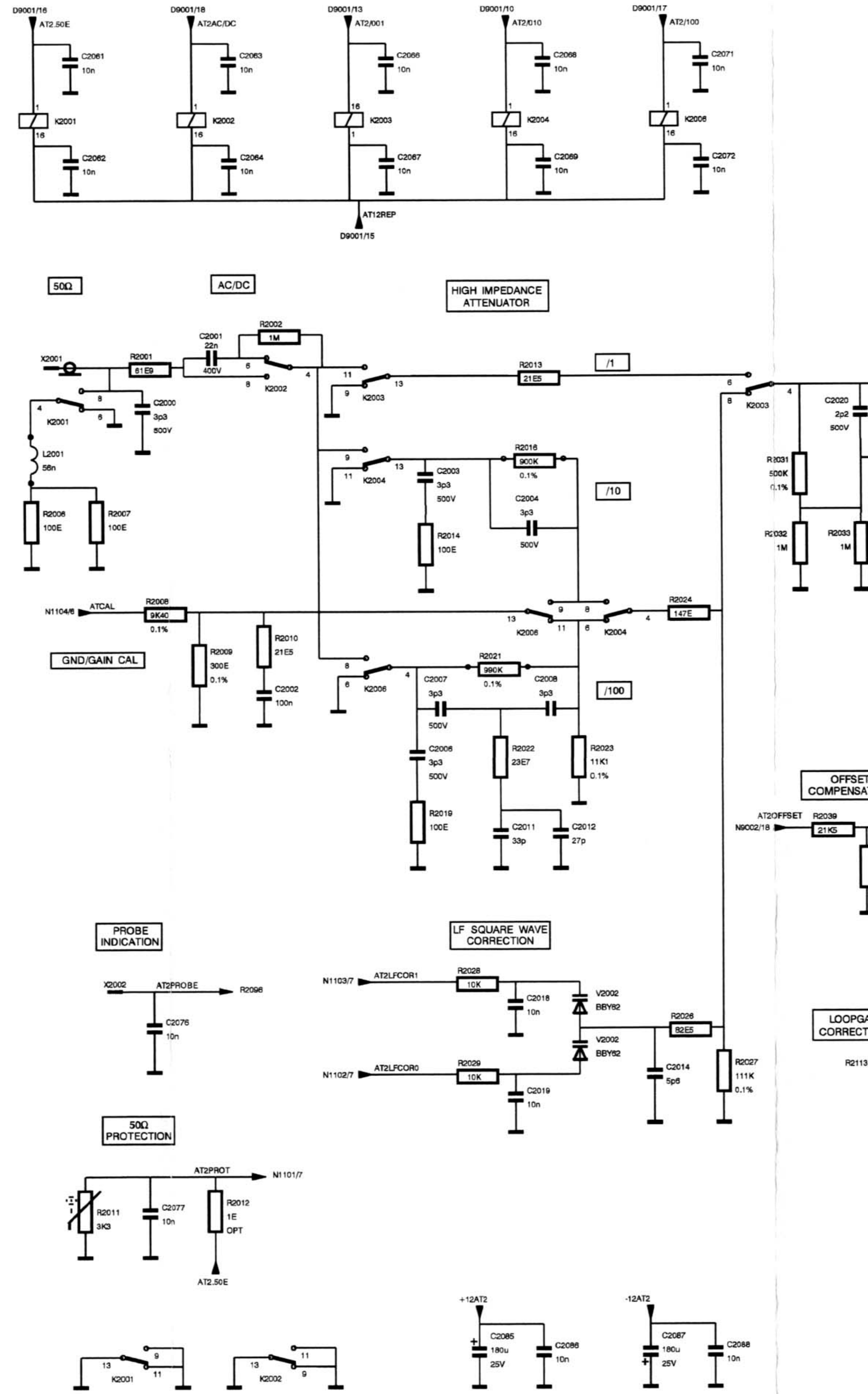
A1; Diagram 1 - Attenuator CH 1 (PM3094/PM3092)



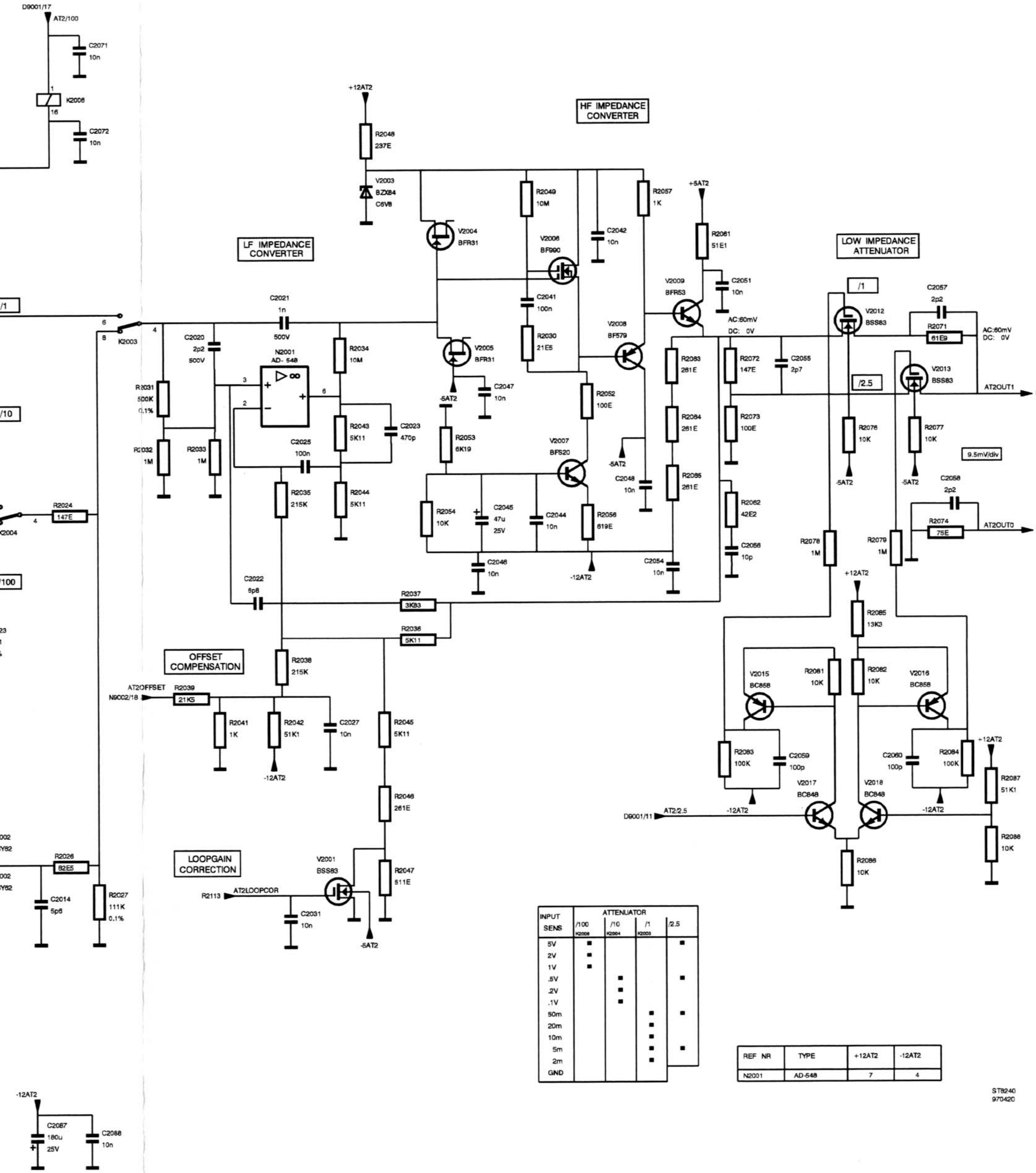
INPUT SENS	ATTENUATOR /100 K2006	/10 K2004	/1 K2003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT2	-12AT2
N2001	AD-548	7	4

A1; Diagram 2 - Attenuator CH 2 (PM3094/PM3092)



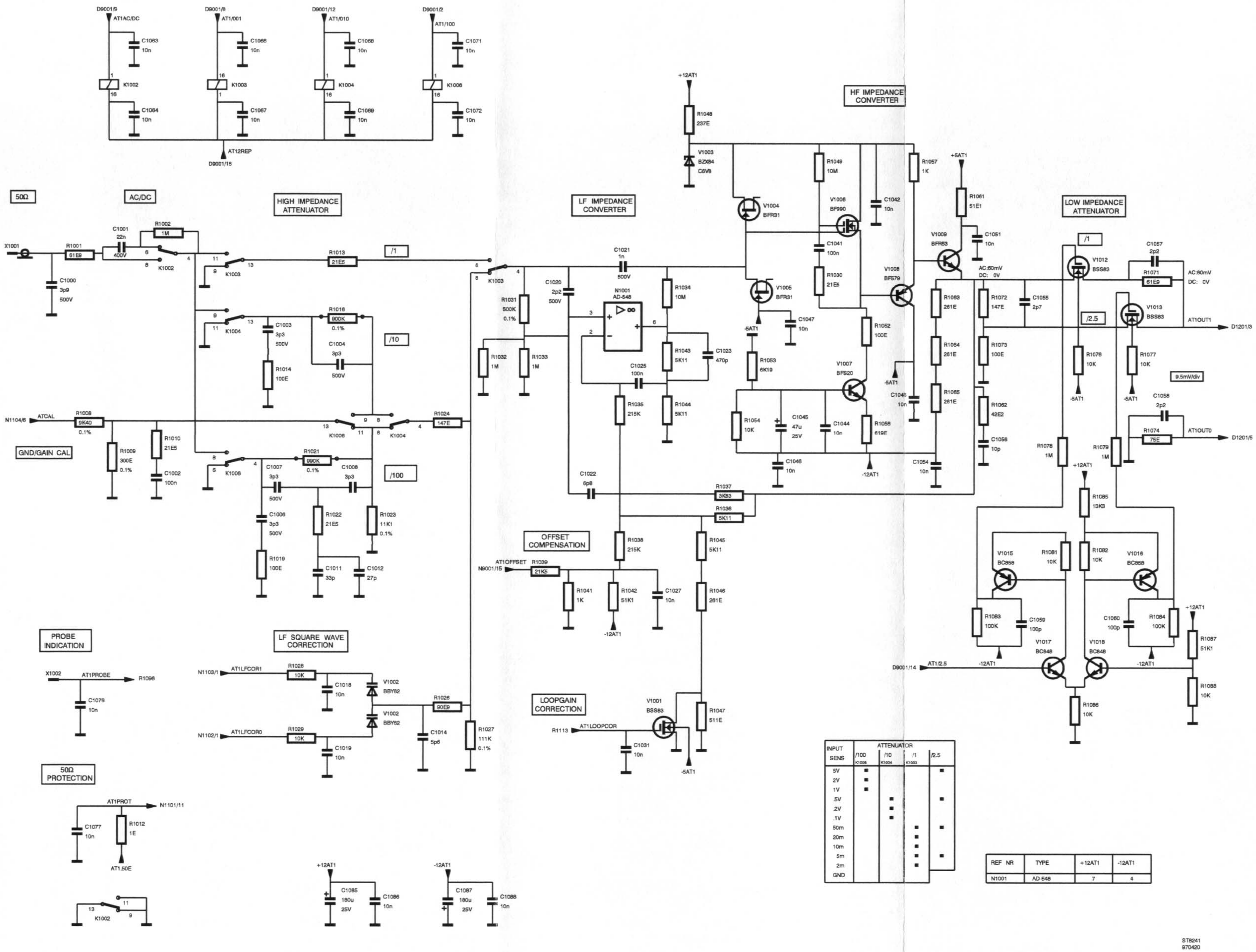
D9001/16
AT2.50E
C2061
10n
K2001
C2062
10n
D9001/18
AT2AC/DC
C2063
10n
K2002
C2064
10n
D9001/13
AT2/001
C2066
10n
K2003
C2067
10n
D9001/10
AT2/010
C2068
10n
K2004
C2069
10n
D9001/17
AT2/100
C2071
10n
K2006
C2072
10n
AT12REP
D9001/15
50Ω
AC/DC
HIGH IMPEDANCE ATTENUATOR
X2001
R2001
61E9
C2001
22n
400V
R2002
1M
C2000
3p3
500V
L2001
56n
R2006
100E
R2007
100E
R2013
21E5
/1
C2020
2p2
500V
R2031
500K
0.1%
R2032
1M
R2033
1M
R2016
900K
0.1%
C2003
3p3
500V
C2004
3p3
500V
R2014
100E
/10
N1104/6
ATCAL
R2008
9K40
0.1%
R2009
300E
0.1%
R2010
21E5
C2002
100n
GND/GAIN CAL
R2024
147E
R2021
990K
0.1%
C2007
3p3
500V
C2008
3p3
/100
C2006
3p3
500V
R2022
23E7
R2023
11K1
0.1%
R2019
100E
C2011
33p
C2012
27p
OFFSET COMPENSAT
AT2OFFSET
N9002/18
R2039
21K5
PROBE INDICATION
X2002
AT2PROBE
R2096
C2076
10n
LF SQUARE WAVE CORRECTION
N1103/7
AT2LFCOR1
R2028
10K
C2018
10n
V2002
BBY62
R2026
82E5
N1102/7
AT2LFCOR0
R2029
10K
C2019
10n
C2014
5p6
R2027
111K
0.1%
LOOPGA CORRECT
R2113
50Ω PROTECTION
AT2PROT
N1101/7
R2011
3K3
C2077
10n
R2012
1E
OPT
AT2.50E
+12AT2
C2085
180u
25V
C2086
10n
-12AT2
C2087
180u
25V
C2088
10n
K2001
K2002



INPUT SENS	/100 K2006	/10 K2004	/1 K2003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT2	-12AT2
N2001	AD-548	7	4

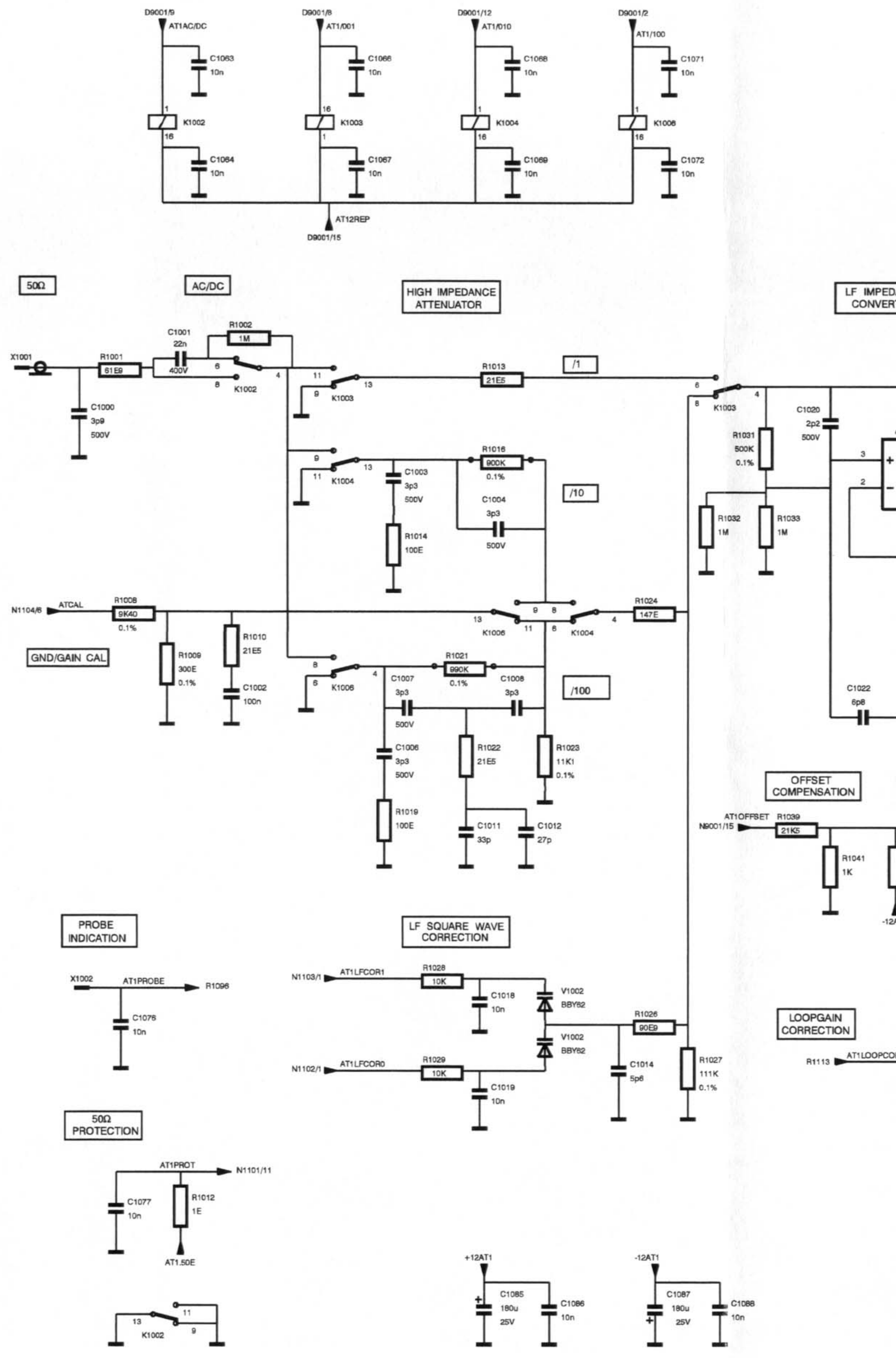
A1; Diagram 2 - Attenuator CH 2 (PM3094/PM3092)

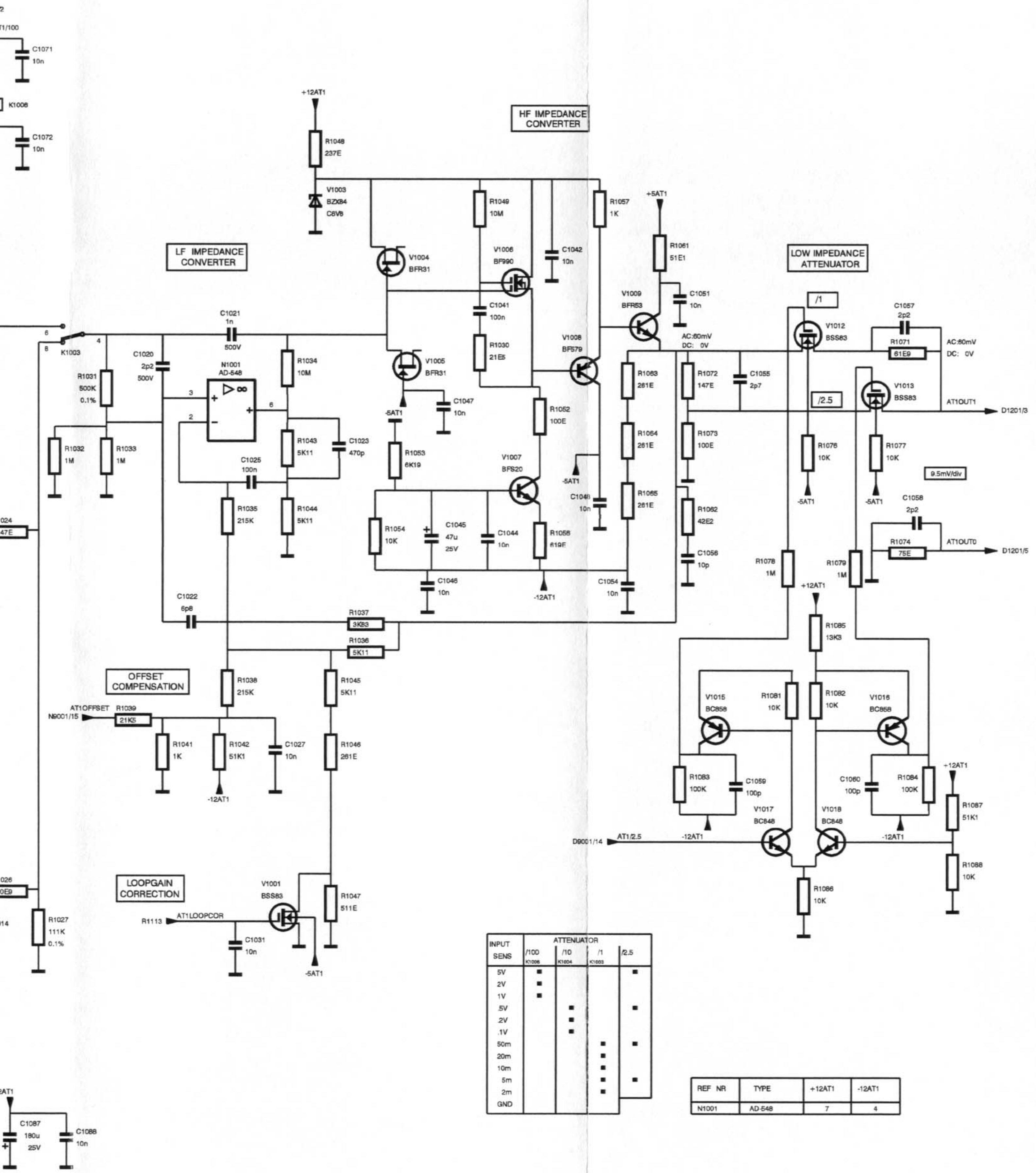


INPUT SENS	ATTENUATOR /100 K1006	/10 K1004	/1 K1003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT1	-12AT1
N1001	AD-548	7	4

A1; Diagram 2a - Attenuator CH 1 (PM3094/PM3092)


50Ω
AC/DC
HIGH IMPEDANCE ATTENUATOR
LF IMPEDA CONVERT
/1
/10
/100
GND/GAIN CAL
OFFSET COMPENSATION
PROBE INDICATION
LF SQUARE WAVE CORRECTION
LOOPGAIN CORRECTION
50Ω PROTECTION

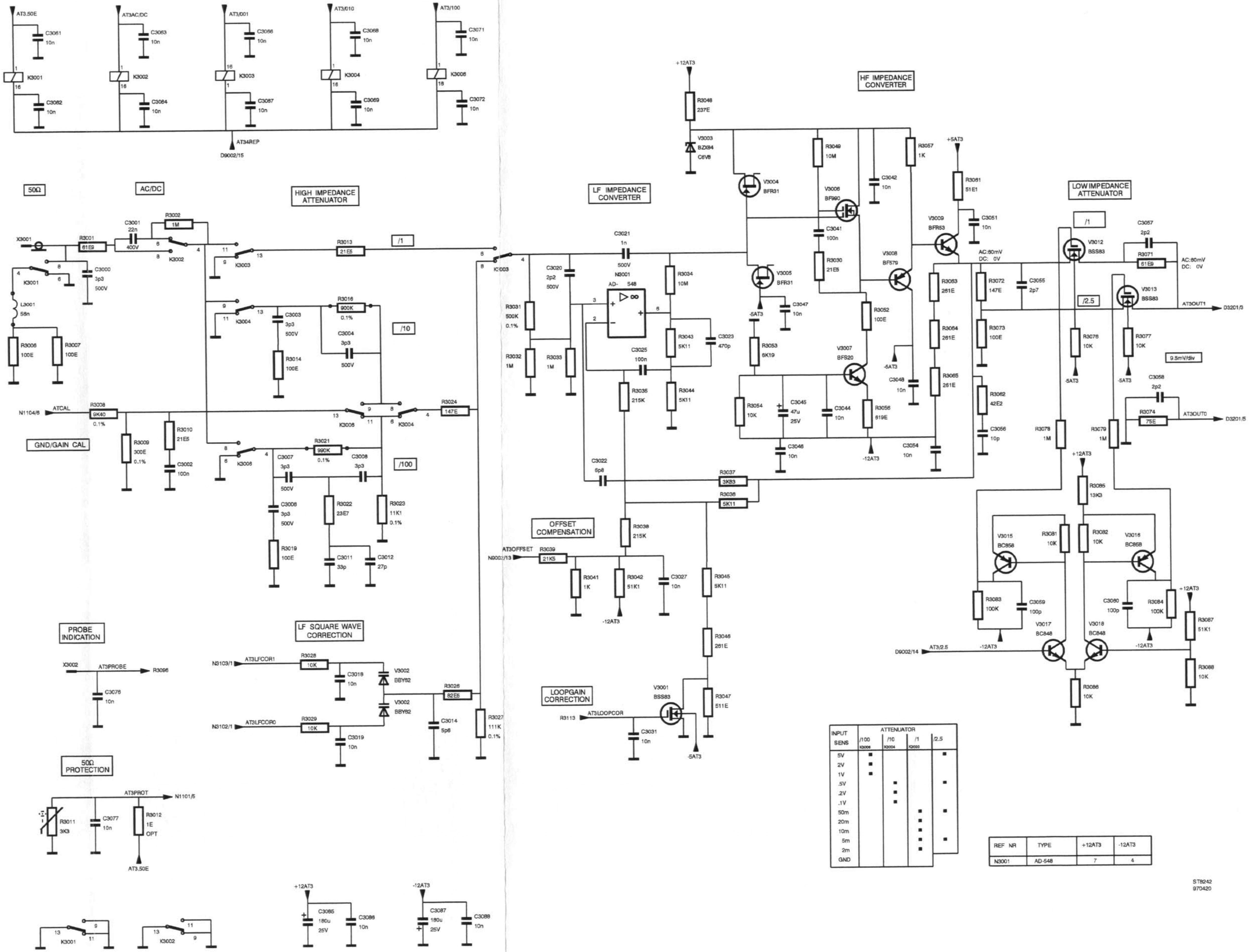


INPUT SENS	ATTENUATOR /100 K1006	/10 K1004	/1 K1003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT1	-12AT1
N1001	AD-548	7	4

ST8241
970420

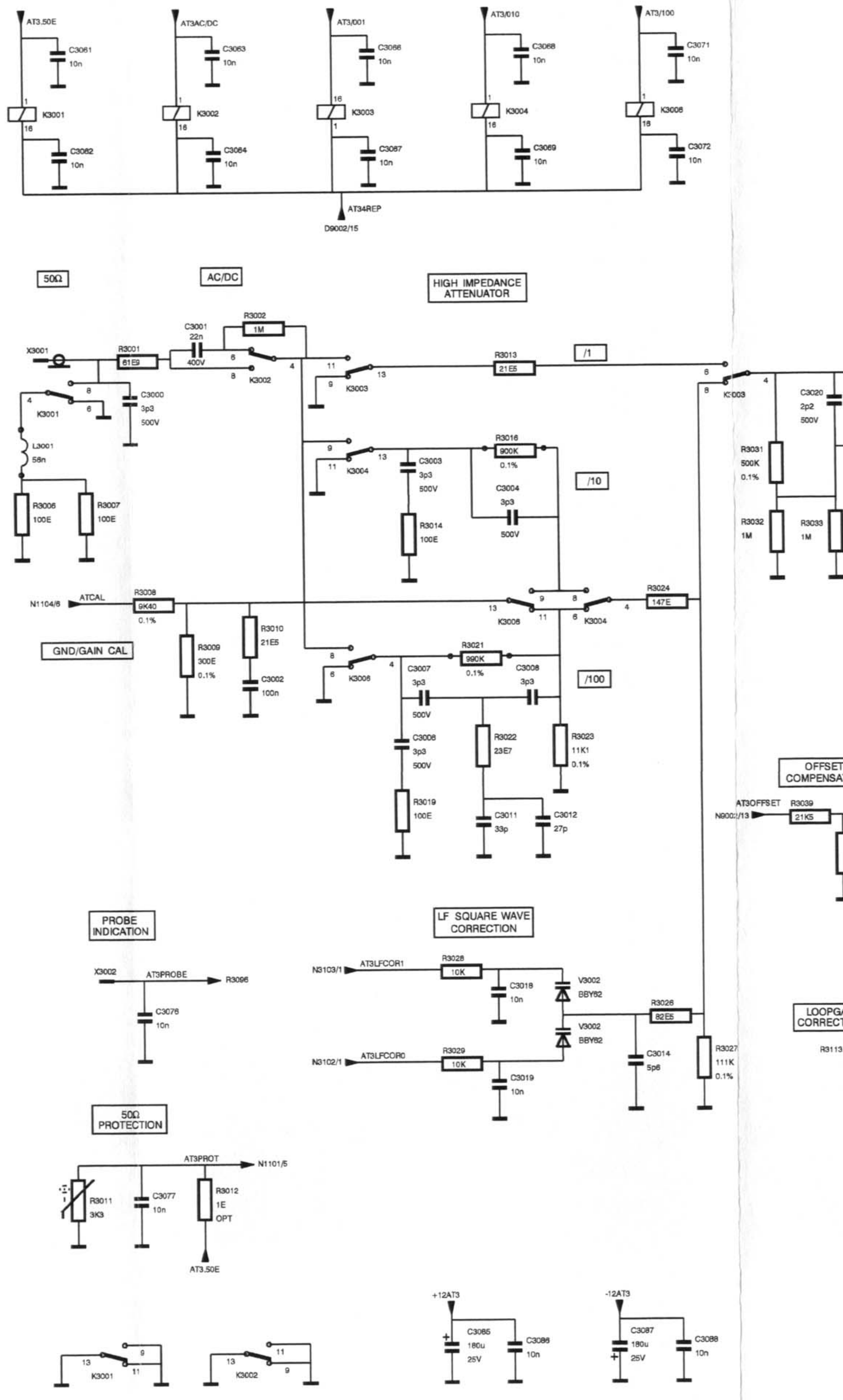
A1; Diagram 2a - Attenuator CH 1 (PM3094/PM3092)

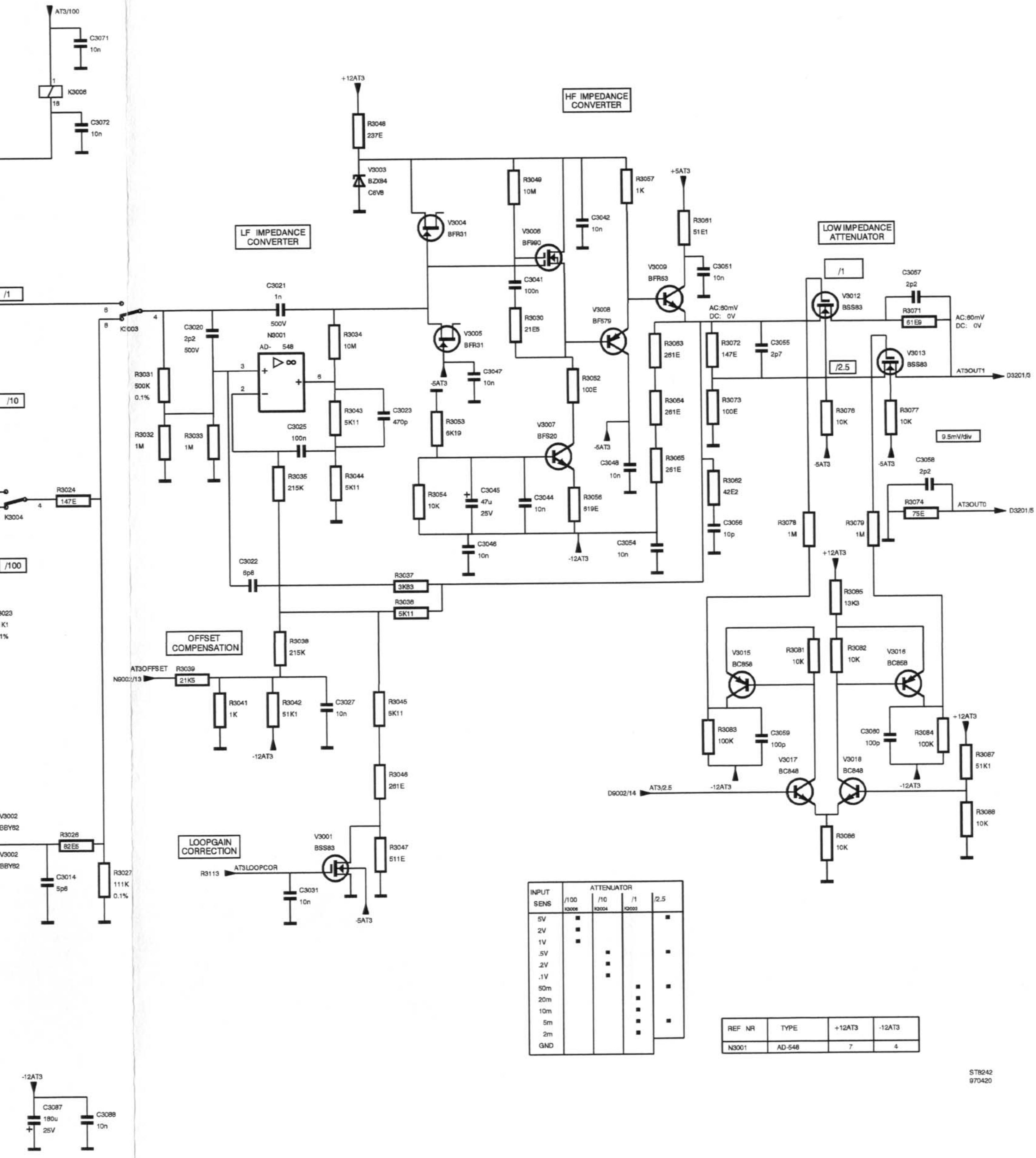


INPUT SENS	ATTENUATOR /100 K3006	/10 K3004	/1 K3003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT3	-12AT3
N3001	AD-548	7	4

Diagram 3 - Attenuator CH 3 (PM3094)

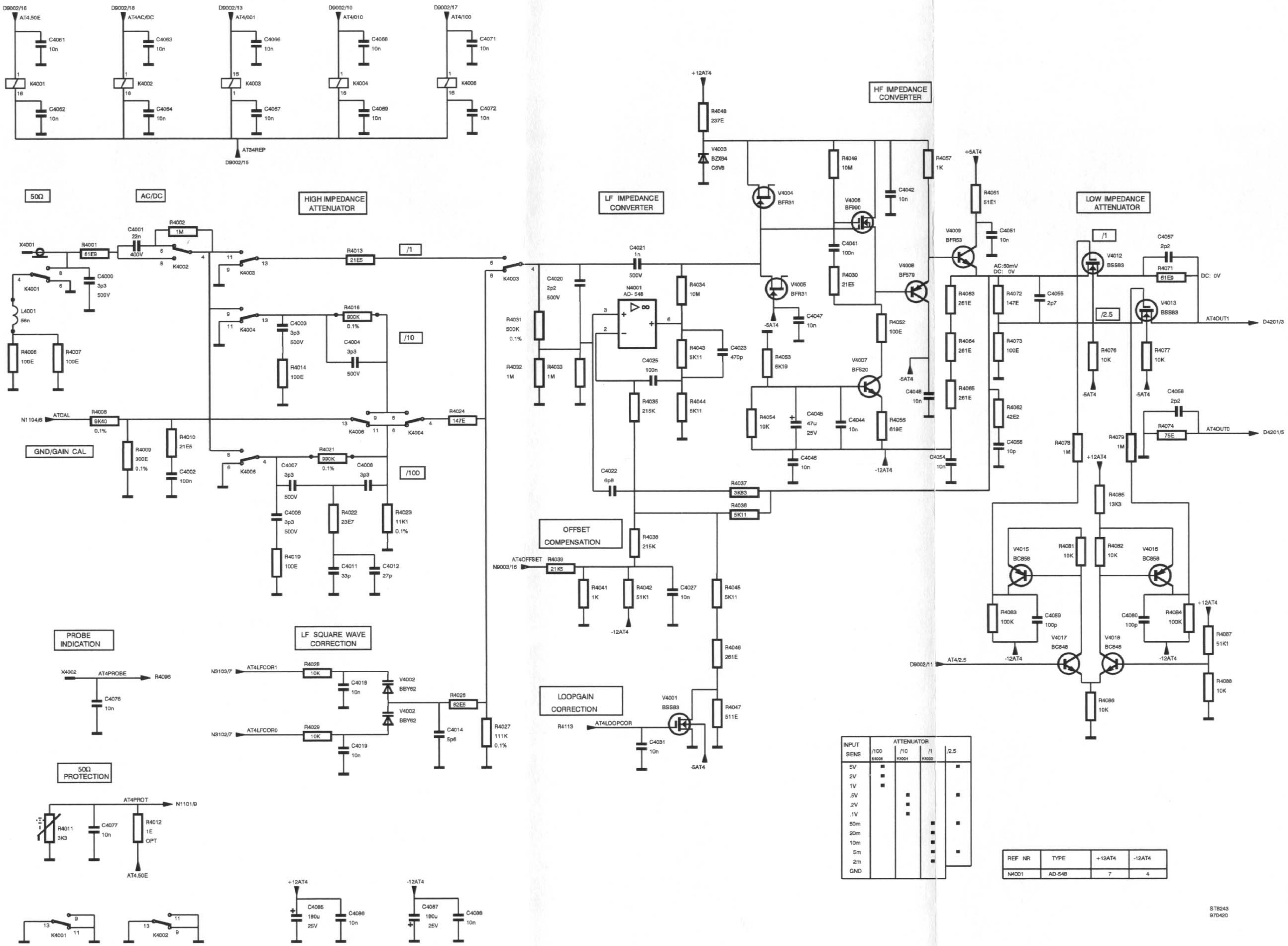

AT3.50E
C3061
10n
K3001
C3062
10n
AT3AC/DC
C3063
10n
K3002
C3064
10n
AT3/001
C3066
10n
K3003
C3067
10n
AT3/010
C3068
10n
K3004
C3069
10n
AT3/100
C3071
10n
K3006
C3072
10n
AT34REP
D9002/15
50Ω
AC/DC
HIGH IMPEDANCE
ATTENUATOR
X3001
R3001
61E9
C3001
22n
400V
R3002
1M
C3000
3p3
500V
L3001
56n
R3006
100E
R3007
100E
R3013
21E5
/1
R3016
900K
0.1%
C3003
3p3
500V
C3004
3p3
500V
R3014
100E
/10
C3020
2p2
500V
R3031
500K
0.1%
R3032
1M
R3033
1M
N1104/6
ATCAL
R3008
9K40
0.1%
R3009
300E
0.1%
R3010
21E5
C3002
100n
GND/GAIN CAL
R3024
147E
R3021
990K
0.1%
C3007
3p3
500V
C3008
3p3
/100
C3006
3p3
500V
R3022
23E7
R3023
11K1
0.1%
R3019
100E
C3011
33p
C3012
27p
OFFSET
COMPENSA
AT3OFFSET
N9002/13
R3039
21K5
PROBE
INDICATION
X3002
AT3PROBE
R3096
C3076
10n
LF SQUARE WAVE
CORRECTION
N3103/1
AT3LFCOR1
R3028
10K
C3018
10n
V3002
BBY62
R3026
82E5
N3102/1
AT3LFCOR0
R3029
10K
C3019
10n
C3014
5p6
R3027
111K
0.1%
LOOPGA
CORRECT
R3113
50Ω
PROTECTION
AT3PROT
N1101/5
R3011
3K3
C3077
10n
R3012
1E
OPT
AT3.50E
+12AT3
C3085
180u
25V
C3086
10n
-12AT3
C3087
180u
25V
C3088
10n



INPUT SENS	ATTENUATOR /100 K3006	/10 K3004	/1 K3003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT3	-12AT3
N3001	AD-548	7	4

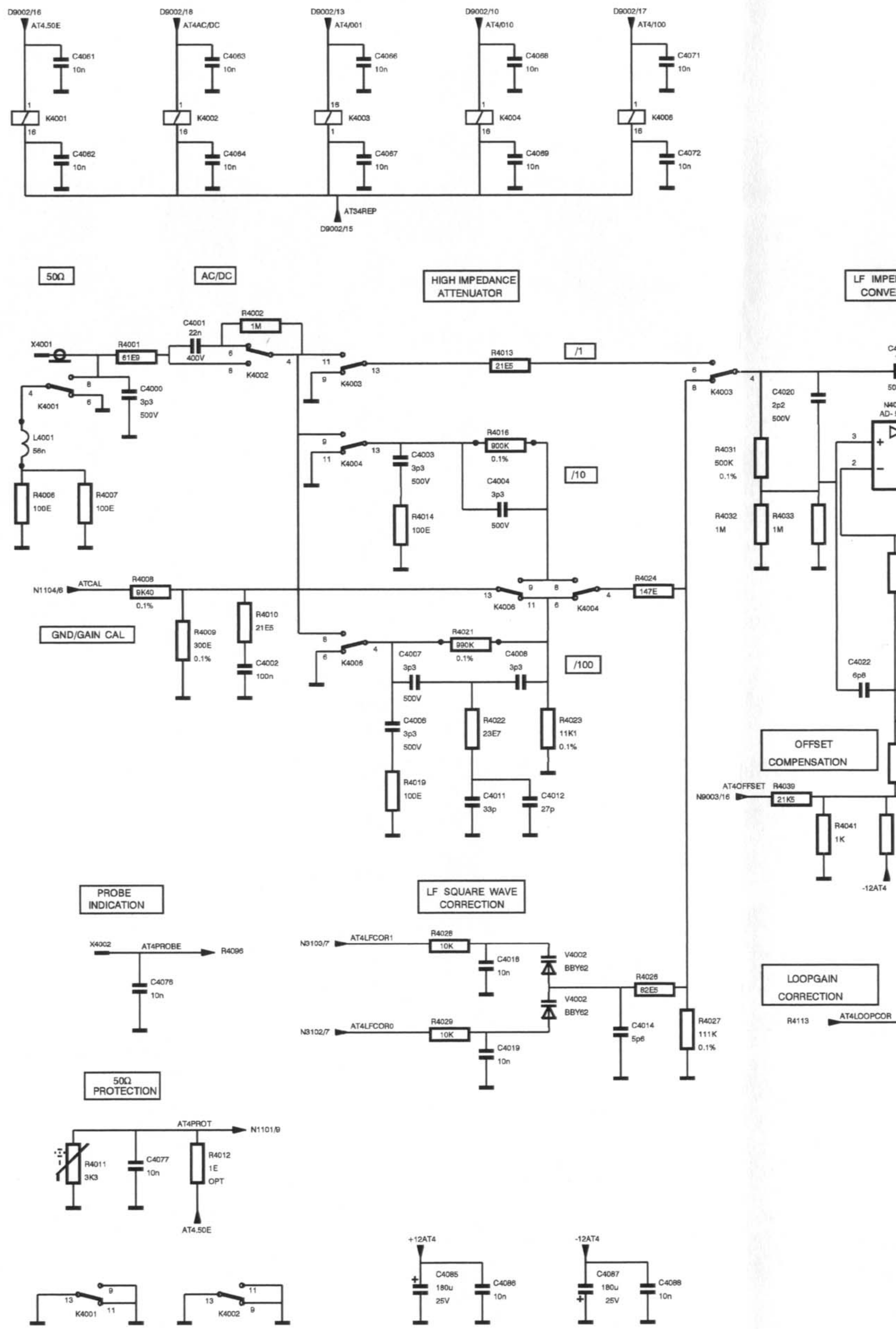
Diagram 3 - Attenuator CH 3 (PM3094)

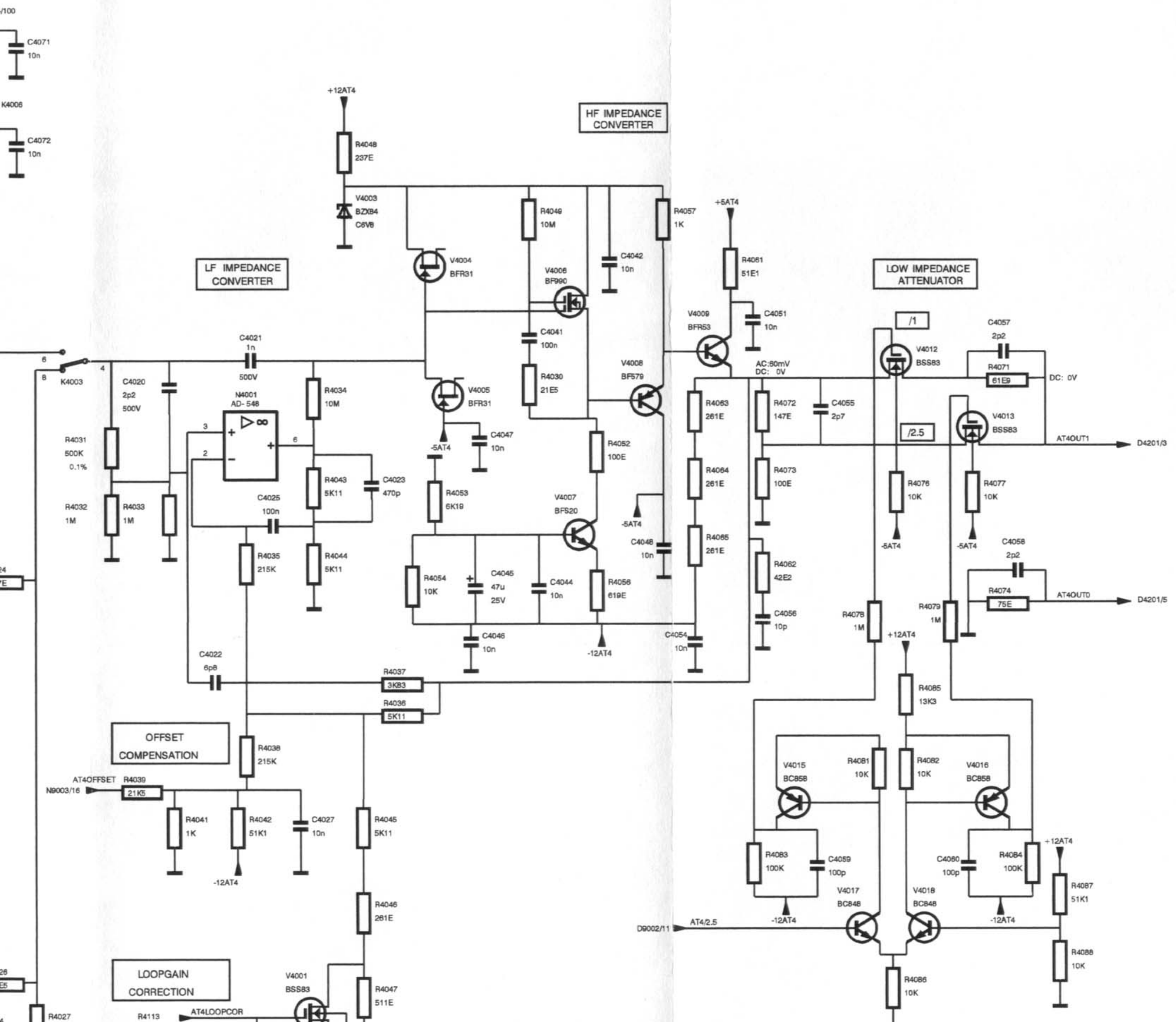


INPUT SENS	/100 K4006	/10 K4004	/1 K4003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT4	-12AT4
N4001	AD-548	7	4

Diagram 4 - Attenuator CH 4 (PM3094)


50Ω
AC/DC
HIGH IMPEDANCE ATTENUATOR
LF IMPE
CONVE
/1
/10
/100
GND/GAIN CAL
OFFSET COMPENSATION
PROBE INDICATION
LF SQUARE WAVE CORRECTION
LOOPGAIN CORRECTION
50Ω PROTECTION

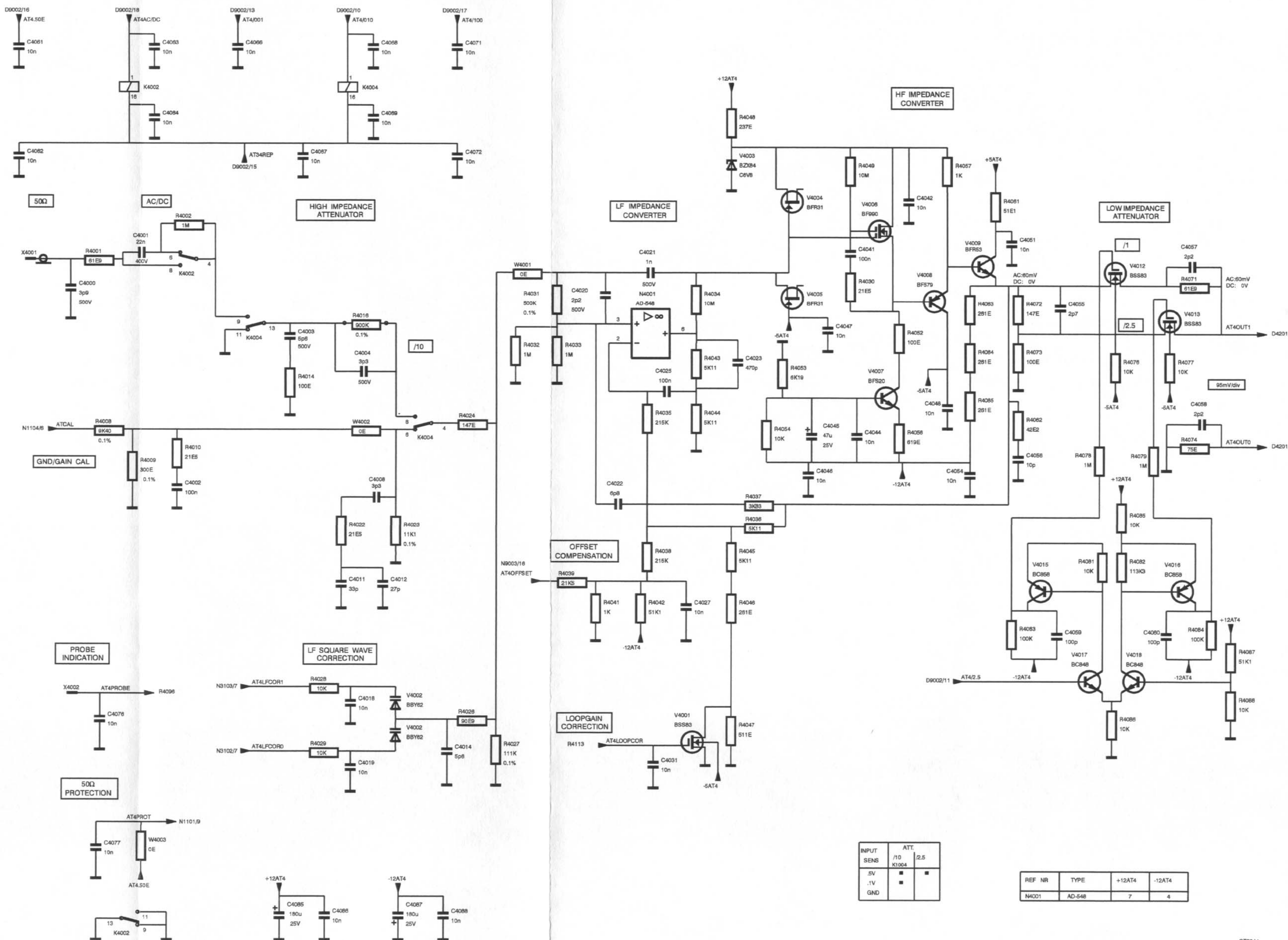


INPUT SENS	ATTENUATOR /100 K4006	/10 K4004	/1 K4003	/2.5
5V	■			■
2V	■			
1V	■			
.5V		■		■
.2V		■		
.1V		■		
50m			■	■
20m			■	
10m			■	
5m			■	■
2m			■	
GND				

REF NR	TYPE	+12AT4	-12AT4
N4001	AD-548	7	4

ST8243
970420

Diagram 4 - Attenuator CH 4 (PM3094)

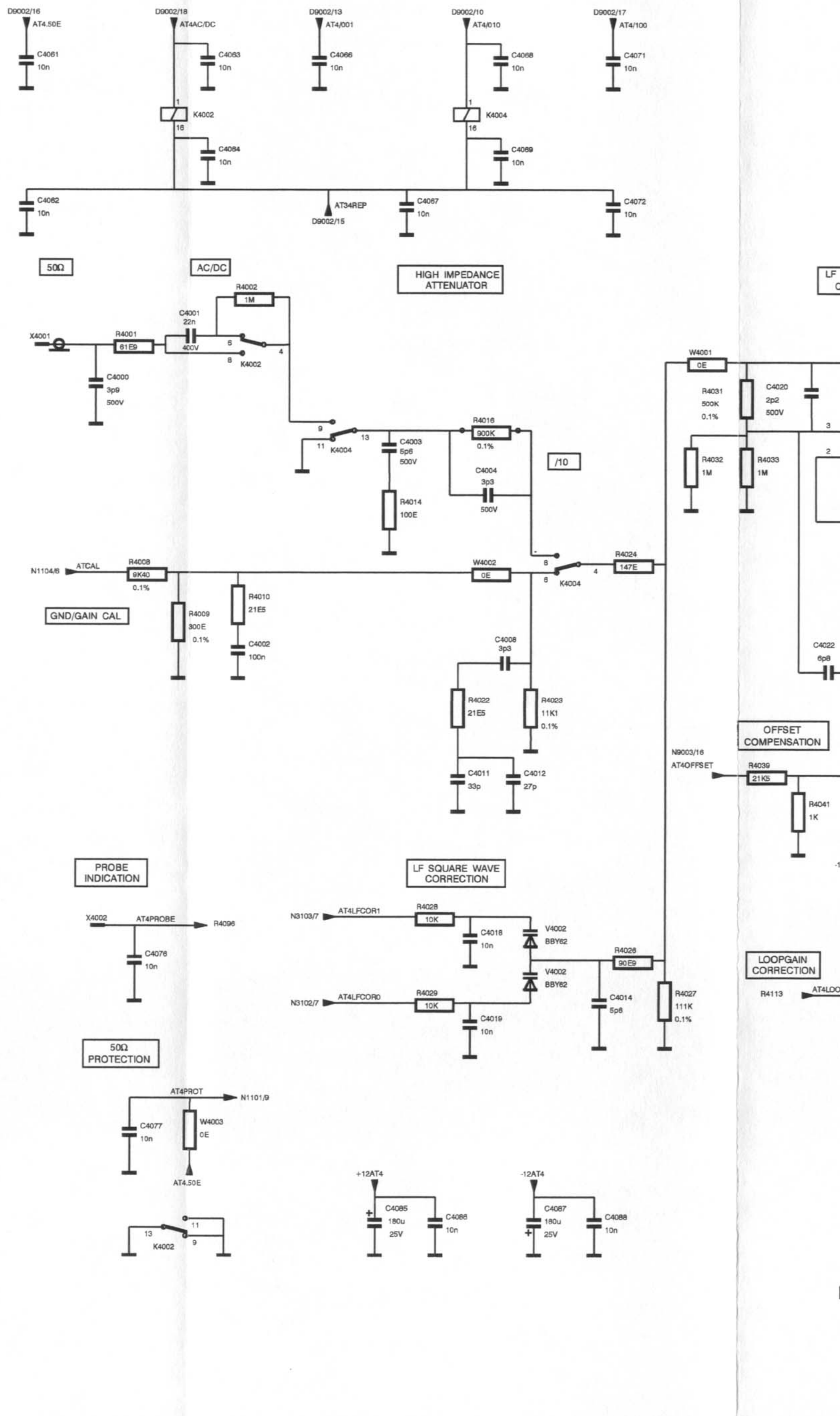


INPUT SENS	ATT. /10 K1004	/2.5
.5V	■	■
.1V	■	
GND		

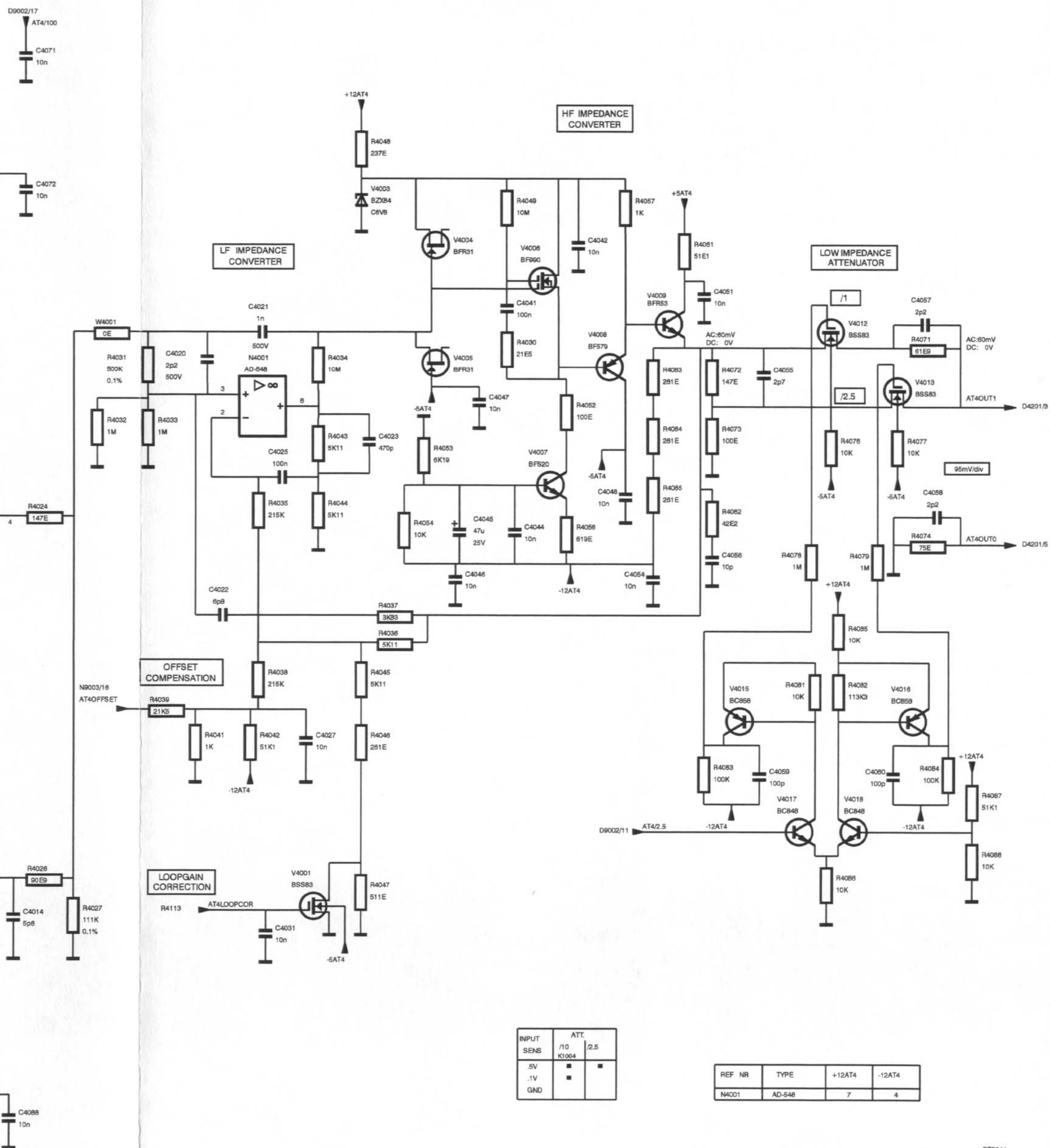
REF NR	TYPE	+12AT4	-12AT4
N4001	AD-548	7	4

ST8244
970420

Diagram 4a - Attenuator CH 3 (PM3092/PM3082)



50Ω
AC/DC
HIGH IMPEDANCE ATTENUATOR
/10
GND/GAIN CAL
OFFSET COMPENSATION
PROBE INDICATION
LF SQUARE WAVE CORRECTION
LOOPGAIN CORRECTION
50Ω PROTECTION
D9002/16 AT4.50E C4061 10n
D9002/18 AT4AC/DC C4063 10n K4002 C4064 10n
D9002/13 AT4/001 C4066 10n
D9002/10 AT4/010 C4068 10n K4004 C4069 10n
D9002/17 AT4/100 C4071 10n
C4062 10n
AT34REP D9002/15
C4067 10n
C4072 10n
X4001 R4001 61E9 C4001 22n 400V R4002 1M K4002
C4000 3p9 500V
K4004 C4003 5p6 500V R4014 100E
R4016 900K 0.1%
C4004 3p3 500V
N1104/6 ATCAL R4008 9K40 0.1%
R4009 300E 0.1%
R4010 21E5 C4002 100n
W4002 0E
R4024 147E
C4008 3p3
R4022 21E5
R4023 11K1 0.1%
C4011 33p
C4012 27p
W4001 0E
R4031 500K 0.1%
C4020 2p2 500V
R4032 1M
R4033 1M
C4022 6p8
N9003/16 AT4OFFSET R4039 21K5
R4041 1K
X4002 AT4PROBE R4096
C4076 10n
N3103/7 AT4LFCOR1 R4028 10K C4018 10n
V4002 BBY62
N3102/7 AT4LFCOR0 R4029 10K C4019 10n
R4026 90E9
C4014 5p6
R4027 111K 0.1%
R4113 AT4LOO
AT4PROT N1101/9
C4077 10n
W4003 0E
AT4.50E
K4002
+12AT4 C4085 180u 25V C4086 10n
-12AT4 C4087 180u 25V C4088 10n

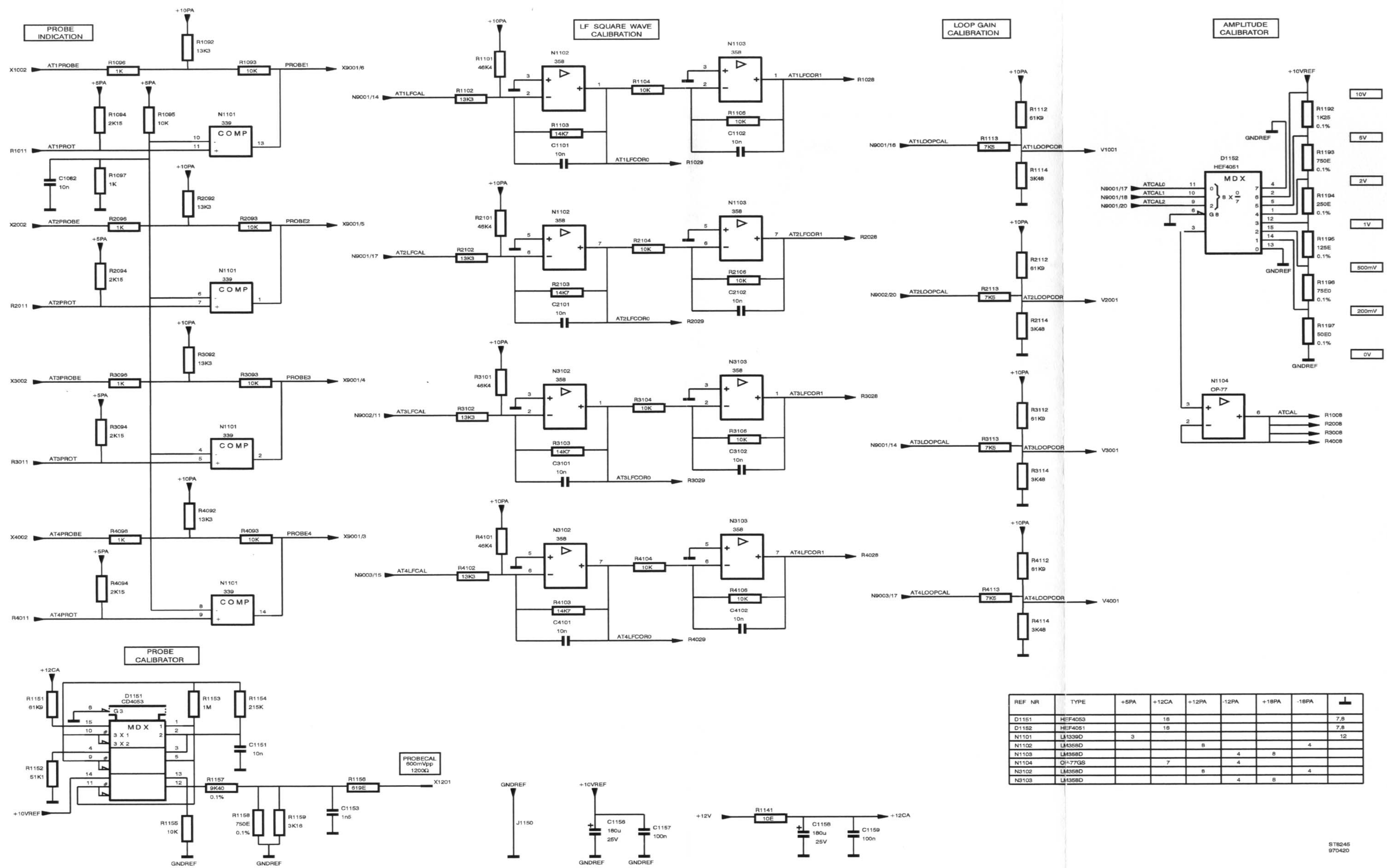


INPUT SENS	ATT. /10 K1004	/2.5
.5V	■	■
.1V	■	
GND		

REF NR	TYPE	+12AT4	-12AT4
N4001	AD-548	7	4

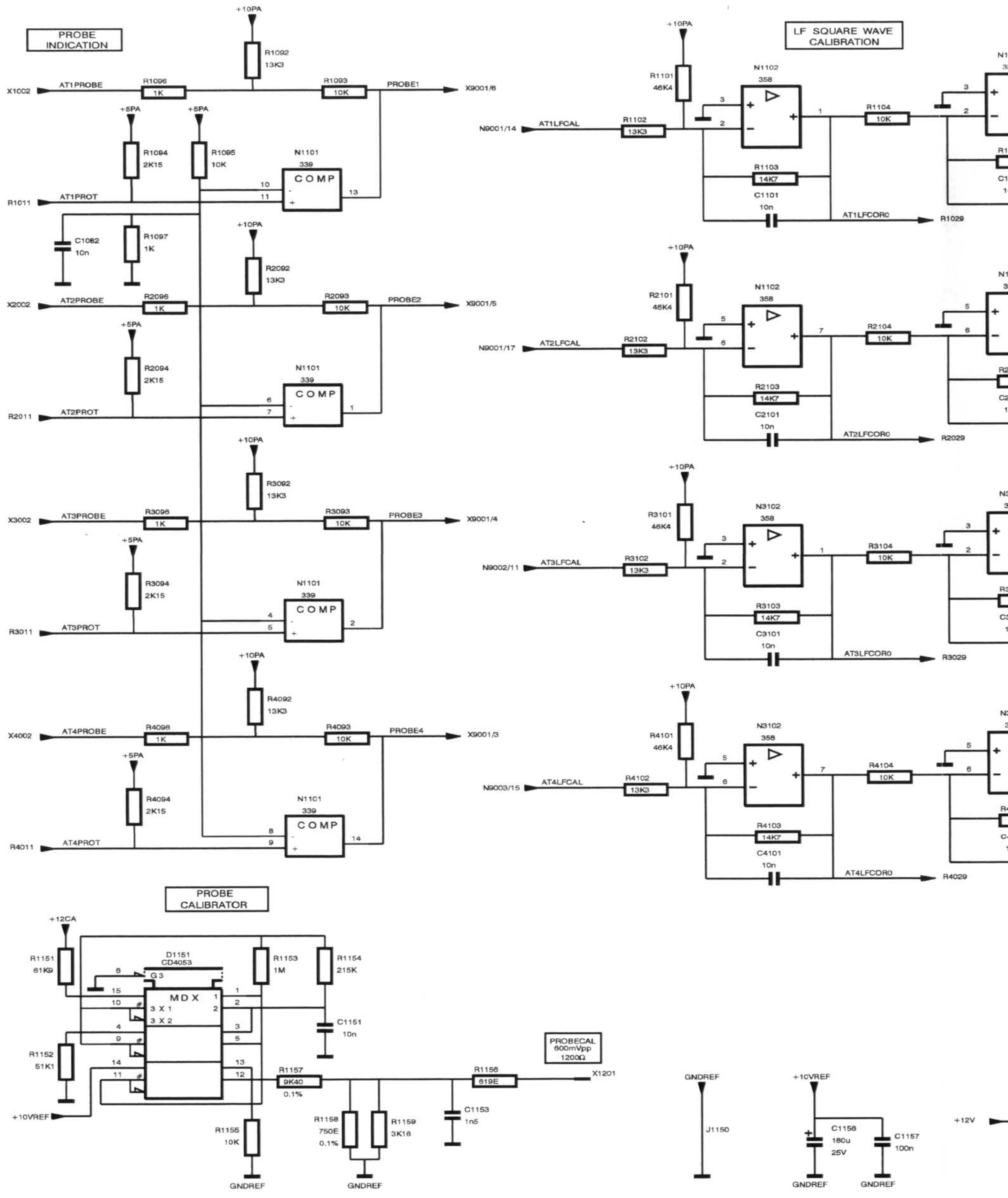
ST8244
970420

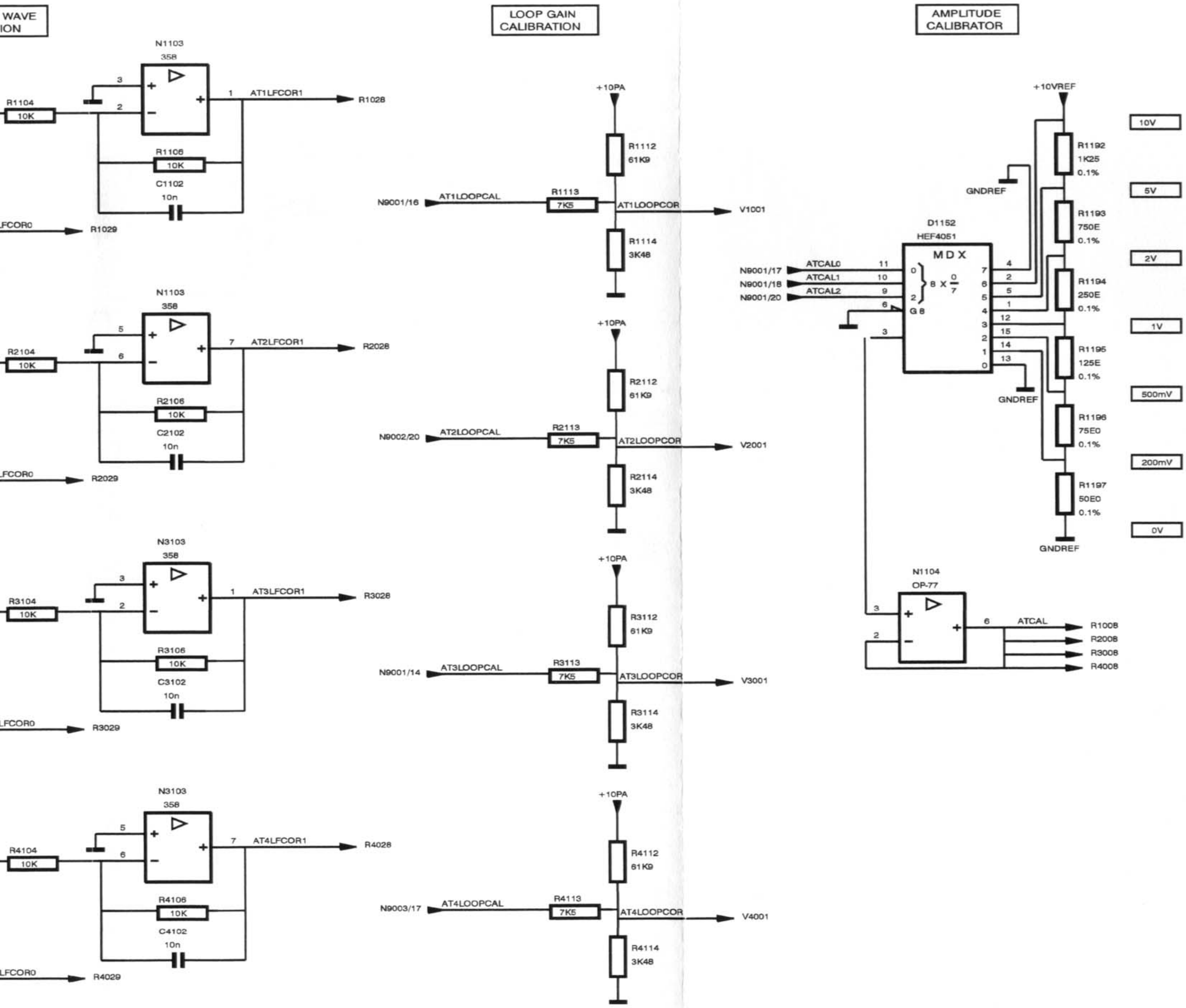
Diagram 4a - Attenuator CH 3 (PM3092/PM3082)



REF NR	TYPE	+5PA	+12CA	+12PA	-12PA	+18PA	-18PA	$\perp$
D1151	HEF4053		16					7,8
D1152	HEF4051		16					7,8
N1101	LM339D	3						12
N1102	LM358D			8			4	
N1103	LM358D				4	8		
N1104	OP-77GS		7		4			
N3102	LM358D			8			4	
N3103	LM358D				4	8		

Diagram 5 - Attenuator control + CAL generator


PROBE INDICATION
LF SQUARE WAVE CALIBRATION
PROBE CALIBRATOR
PROBECAL 600mVpp 1200Ω
AT1PROBE
AT2PROBE
AT3PROBE
AT4PROBE
AT1PROT
AT2PROT
AT3PROT
AT4PROT
PROBE1
PROBE2
PROBE3
PROBE4
AT1LFCAL
AT2LFCAL
AT3LFCAL
AT4LFCAL
AT1LFCOR0
AT2LFCOR0
AT3LFCOR0
AT4LFCOR0
N1101 339 COMP
N1102 358
N3102 358
D1151 CD4053
GNDREF
J1150
+10VREF
C1156 180u 25V
C1157 100n
+12V



REF NR	TYPE	+5PA	+12CA	+12PA	-12PA	+18PA	-18PA	⊥
D1151	HEF4053		16					7,8
D1152	HEF4051		16					7,8
N1101	LM339D	3						12
N1102	LM358D			8			4	
N1103	LM358D				4	8		
N1104	OP-77GS		7		4			
N3102	LM358D			8			4	
N3103	LM358D				4	8		

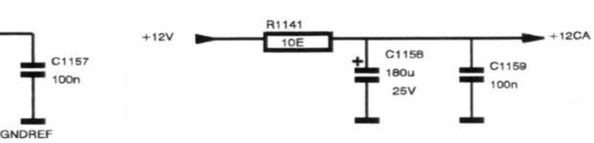


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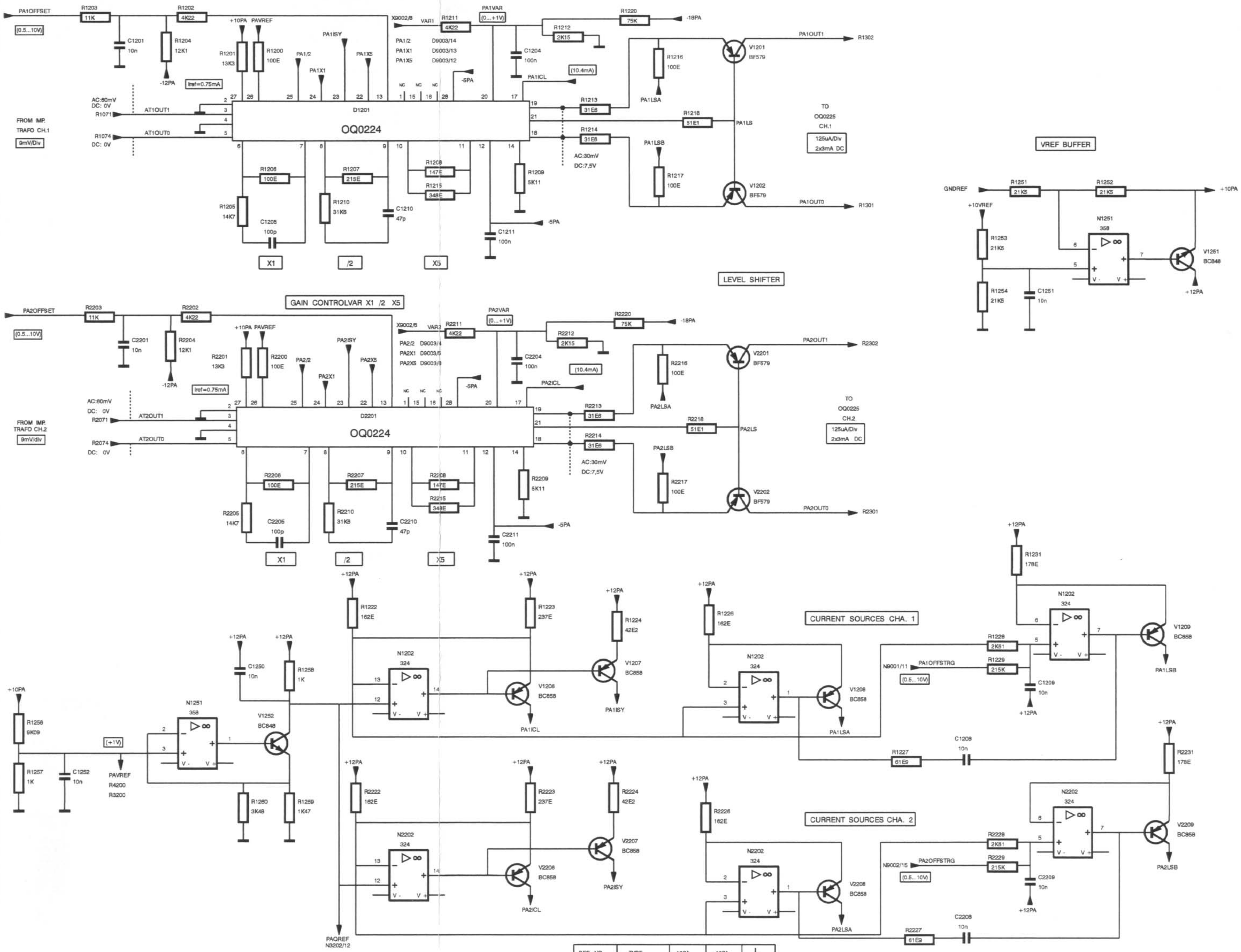
Diagram 5 - Attenuator control + CAL generator



REF NR	TYPE	-12PA	+18PA	⊥
D1201	OQ0224			
D2201	OQ0224			
N1202	LM324	11	4	
N1251	LM358		8	4
N2202	LM324	11	4	

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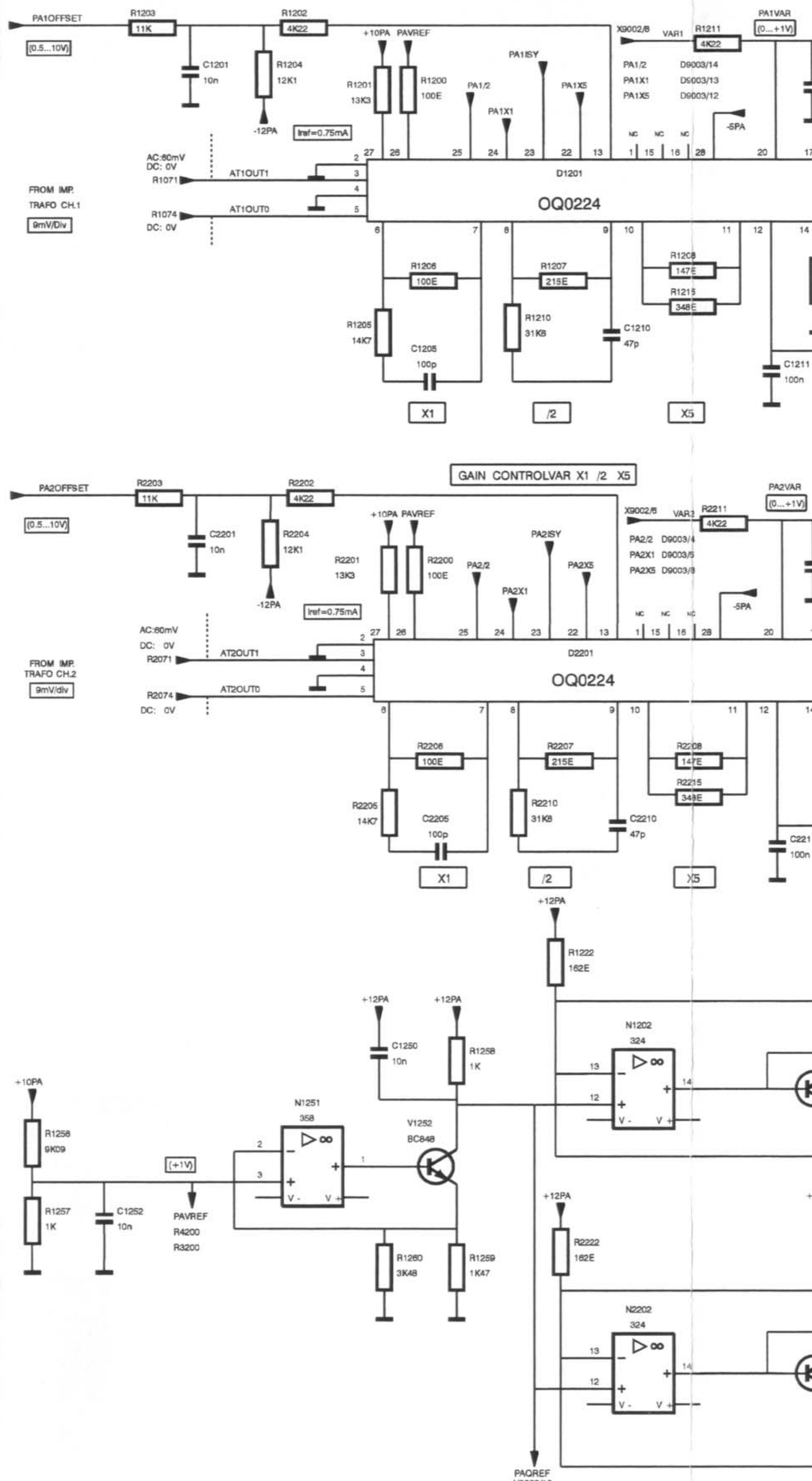
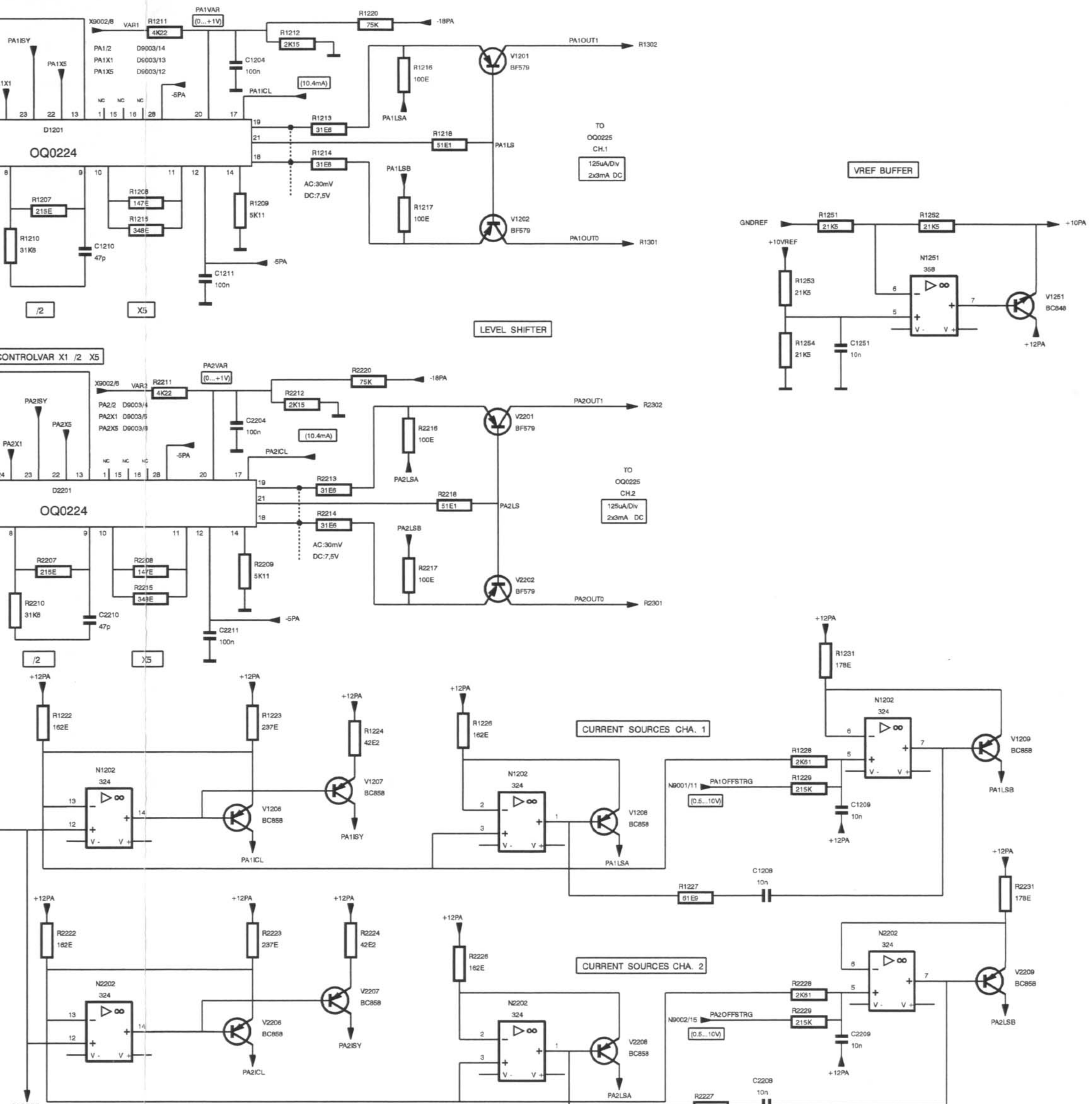
Diagram 6 - Preamplifier CH 1 and CH 2



PA1OFFSET
[0.5...10V]
R1203 11K
R1202 4K22
C1201 10n
R1204 12K1
-12PA
+10PA PAVREF
R1201 13K3
R1200 100E
Iref=0.75mA
PA1/2
PA1X1
PA1ISY
PA1X5
X9002/8 VAR1 R1211 4K22
PA1VAR [0...+1V]
PA1/2 D9003/14
PA1X1 D9003/13
PA1X5 D9003/12
-5PA
AC:60mV DC: 0V
R1071
AT1OUT1
FROM IMP. TRAFO CH.1
9mV/Div
R1074 DC: 0V
AT1OUT0
D1201
OQ0224
R1206 100E
R1207 215E
R1208 147E
R1215 348E
R1205 14K7
C1206 100p
R1210 31K6
C1210 47p
C1211 100n
X1
/2
X5
GAIN CONTROLVAR X1 /2 X5
PA2OFFSET
[0.5...10V]
R2203 11K
R2202 4K22
C2201 10n
R2204 12K1
-12PA
+10PA PAVREF
R2201 13K3
R2200 100E
Iref=0.75mA
PA2/2
PA2X1
PA2ISY
PA2X5
X9002/6 VAR2 R2211 4K22
PA2VAR [0...+1V]
PA2/2 D9003/4
PA2X1 D9003/5
PA2X5 D9003/6
-5PA
AC:60mV DC: 0V
R2071
AT2OUT1
FROM IMP. TRAFO CH.2
9mV/div
R2074 DC: 0V
AT2OUT0
D2201
OQ0224
R2206 100E
R2207 215E
R2208 147E
R2215 348E
R2205 14K7
C2205 100p
R2210 31K6
C2210 47p
C221 100n
X1
/2
X5
+12PA
R1222 162E
+12PA
C1250 10n
+12PA
R1258 1K
N1202 324
+10PA
R1256 9K09
N1251 358
V1252 BC848
[+1V]
PAVREF R4200 R3200
R1257 1K
C1252 10n
R1260 3K48
R1259 1K47
+12PA
R2222 162E
N2202 324
PAQREF N3202/12



REF NR	TYPE	-12PA	+18PA	⊥
D1201	OQ0224			
D2201	OQ0224			
N1202	LM324	11	4	
N1251	LM358		8	4
N2202	LM324	11	4	

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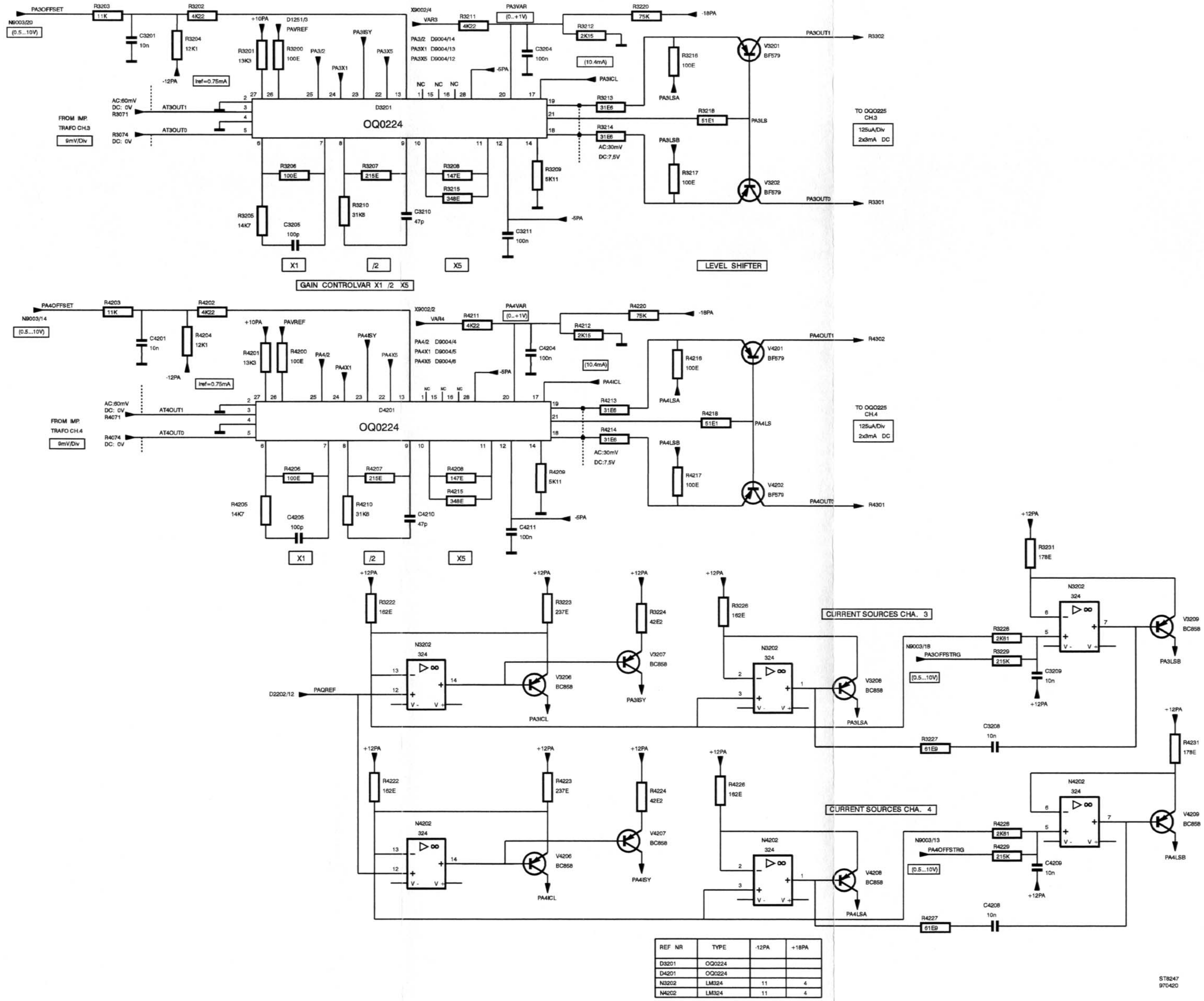
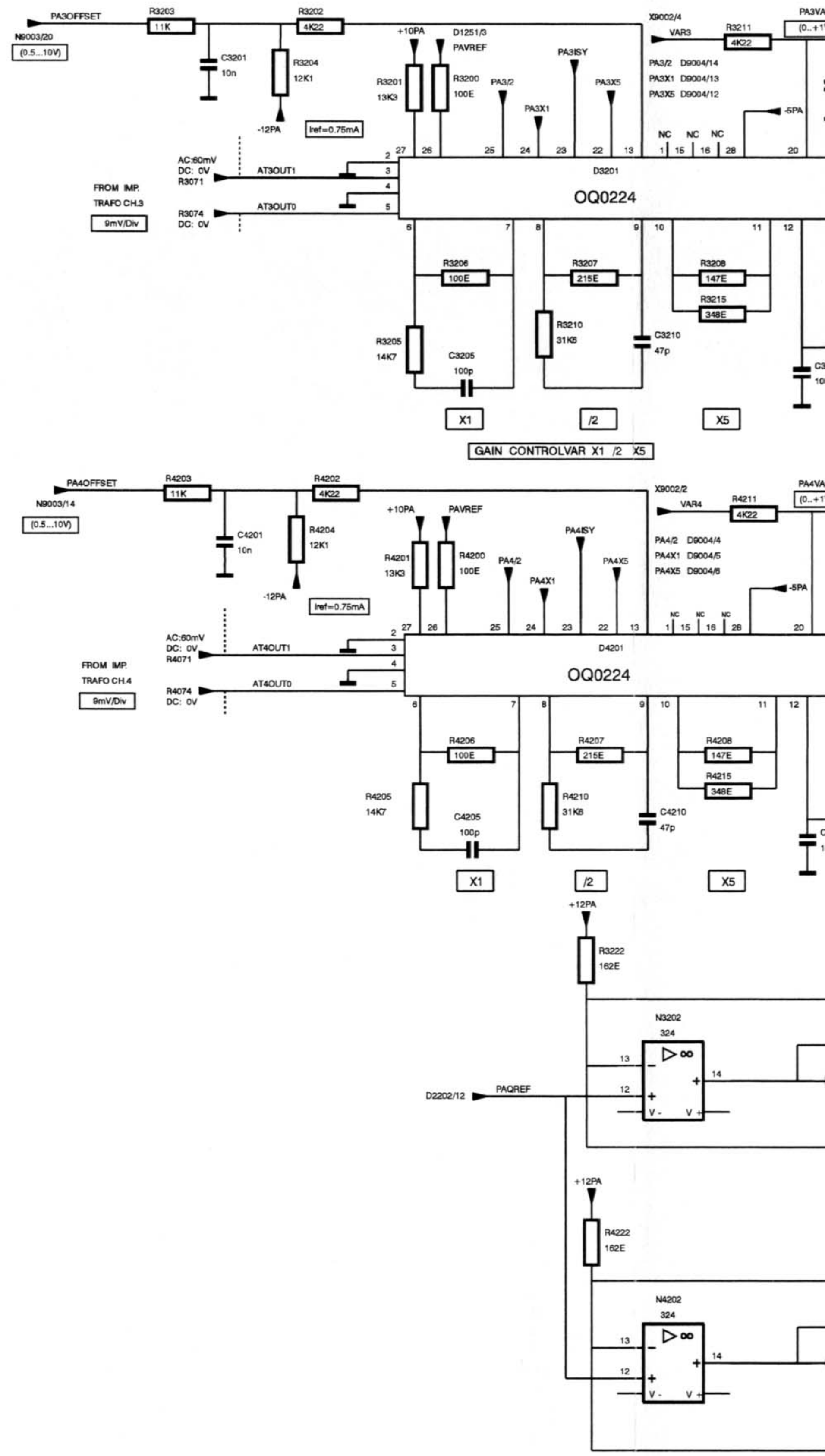
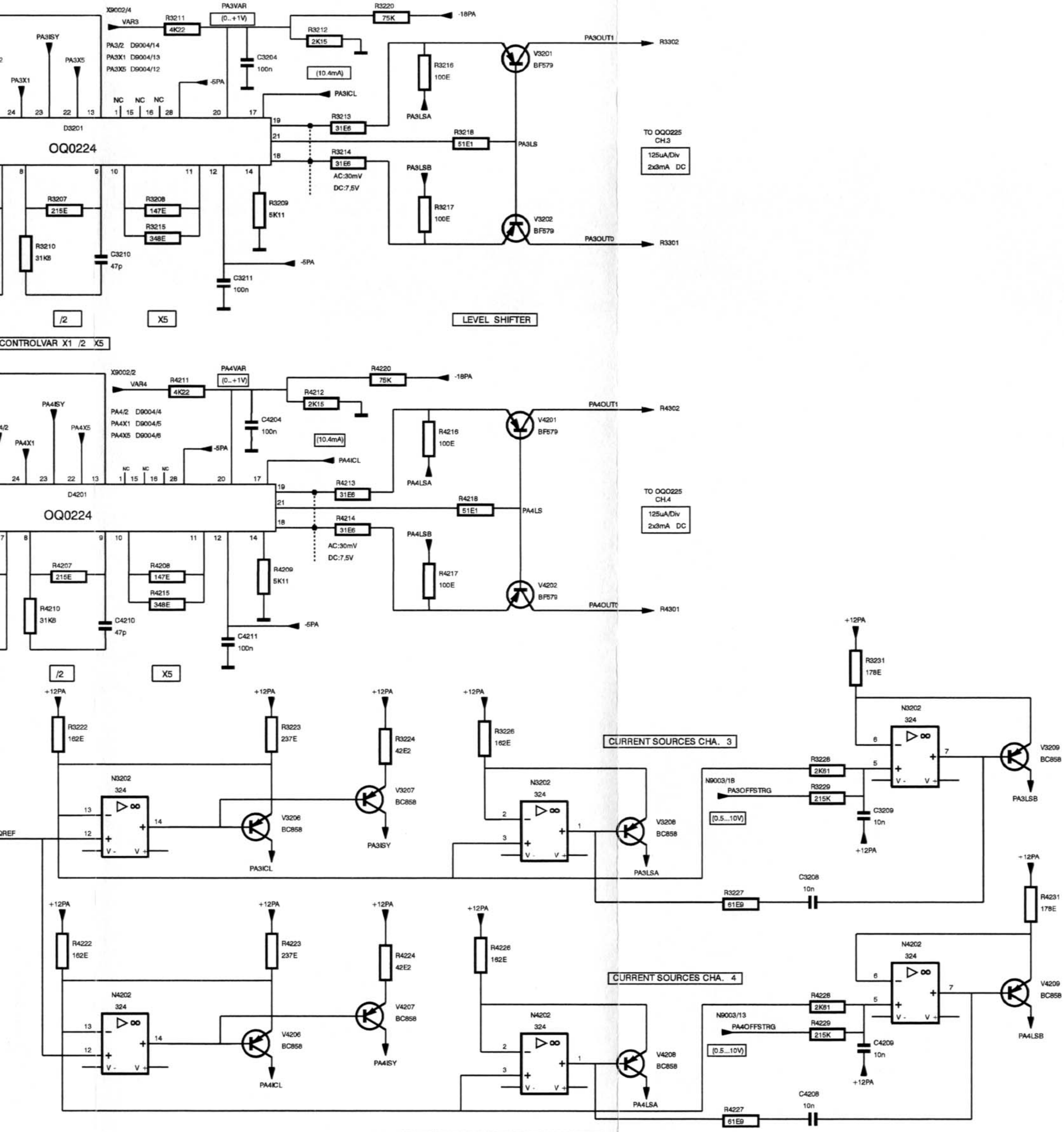
Diagram 6 - Preamplifier CH 1 and CH 2



REF NR	TYPE	-12PA	+18PA
D3201	OQ0224		
D4201	OQ0224		
N3202	LM324	11	4
N4202	LM324	11	4

Diagram 7 - Preamplifier CH 3 and CH 4


PA3OFFSET
N9003/20
(0.5...10V)
R3203 11K
C3201 10n
R3202 4K22
R3204 12K1
-12PA
Iref=0.75mA
+10PA
D1251/3 PAVREF
R3201 13K3
R3200 100E
PA3/2
PA3X1
PA3ISY
PA3X5
X9002/4
VAR3
R3211 4K22
PA3/2 D9004/14
PA3X1 D9004/13
PA3X5 D9004/12
-5PA
D3201
OQ0224
AC:60mV
DC: 0V
R3071
AT3OUT1
FROM IMP.
TRAFO CH.3
R3074
DC: 0V
AT3OUT0
9mV/Div
R3206 100E
R3207 215E
R3208 147E
R3215 348E
R3205 14K7
C3205 100p
R3210 31K6
C3210 47p
X1
/2
X5
GAIN CONTROLVAR X1 /2 X5
PA4OFFSET
N9003/14
(0.5...10V)
R4203 11K
C4201 10n
R4202 4K22
R4204 12K1
-12PA
Iref=0.75mA
+10PA
PAVREF
R4201 13K3
R4200 100E
PA4/2
PA4X1
PA4ISY
PA4X5
X9002/2
VAR4
R4211 4K22
PA4/2 D9004/4
PA4X1 D9004/5
PA4X5 D9004/6
-5PA
D4201
OQ0224
AC:60mV
DC: 0V
R4071
AT4OUT1
FROM IMP.
TRAFO CH.4
R4074
DC: 0V
AT4OUT0
9mV/Div
R4206 100E
R4207 215E
R4208 147E
R4215 348E
R4205 14K7
C4205 100p
R4210 31K6
C4210 47p
X1
/2
X5
+12PA
R3222 162E
N3202 324
D2202/12
PAQREF
+12PA
R4222 162E
N4202 324



REF NR	TYPE	-12PA	+18PA
D3201	OQ0224		
D4201	OQ0224		
N3202	LM324	11	4
N4202	LM324	11	4

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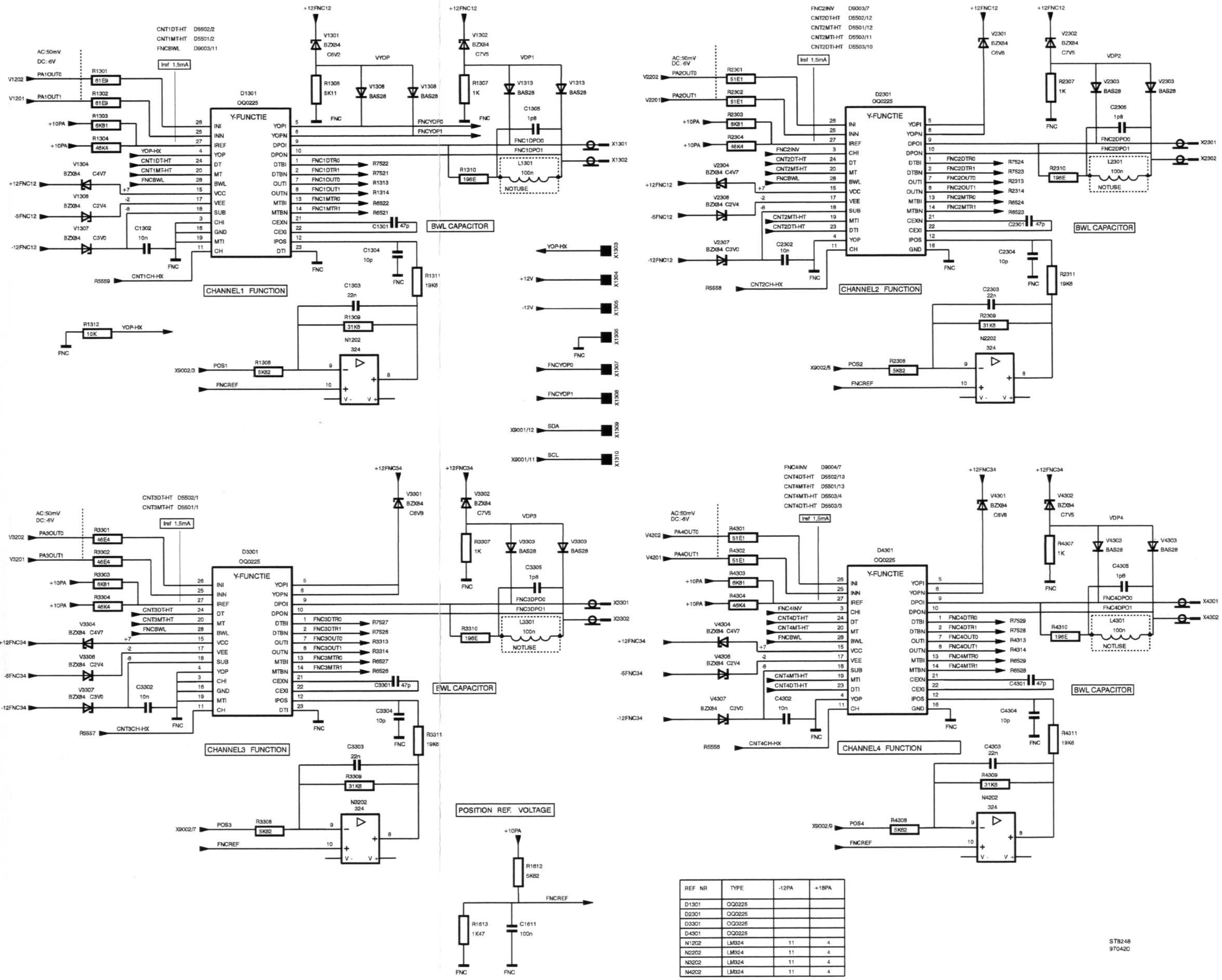
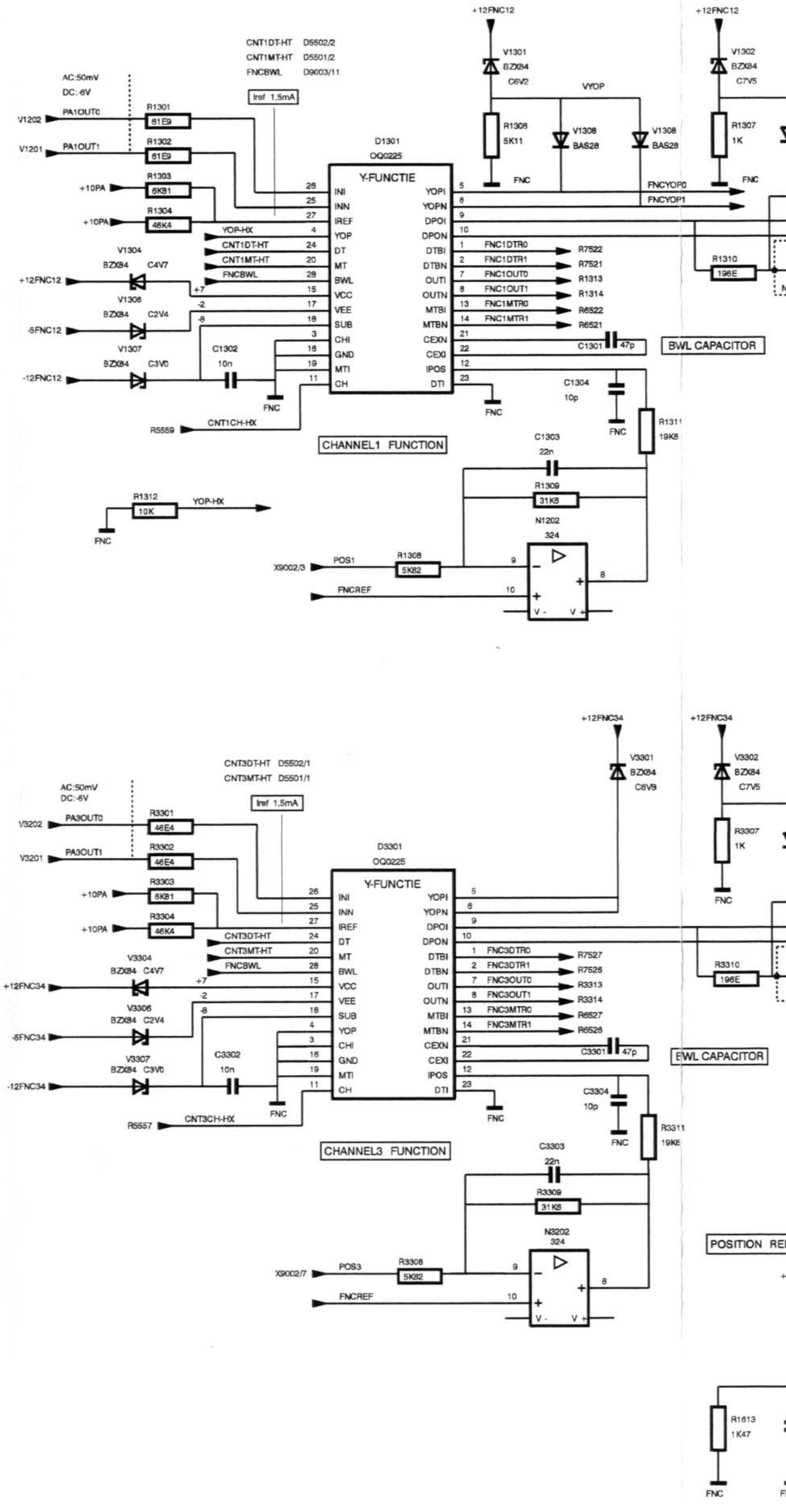
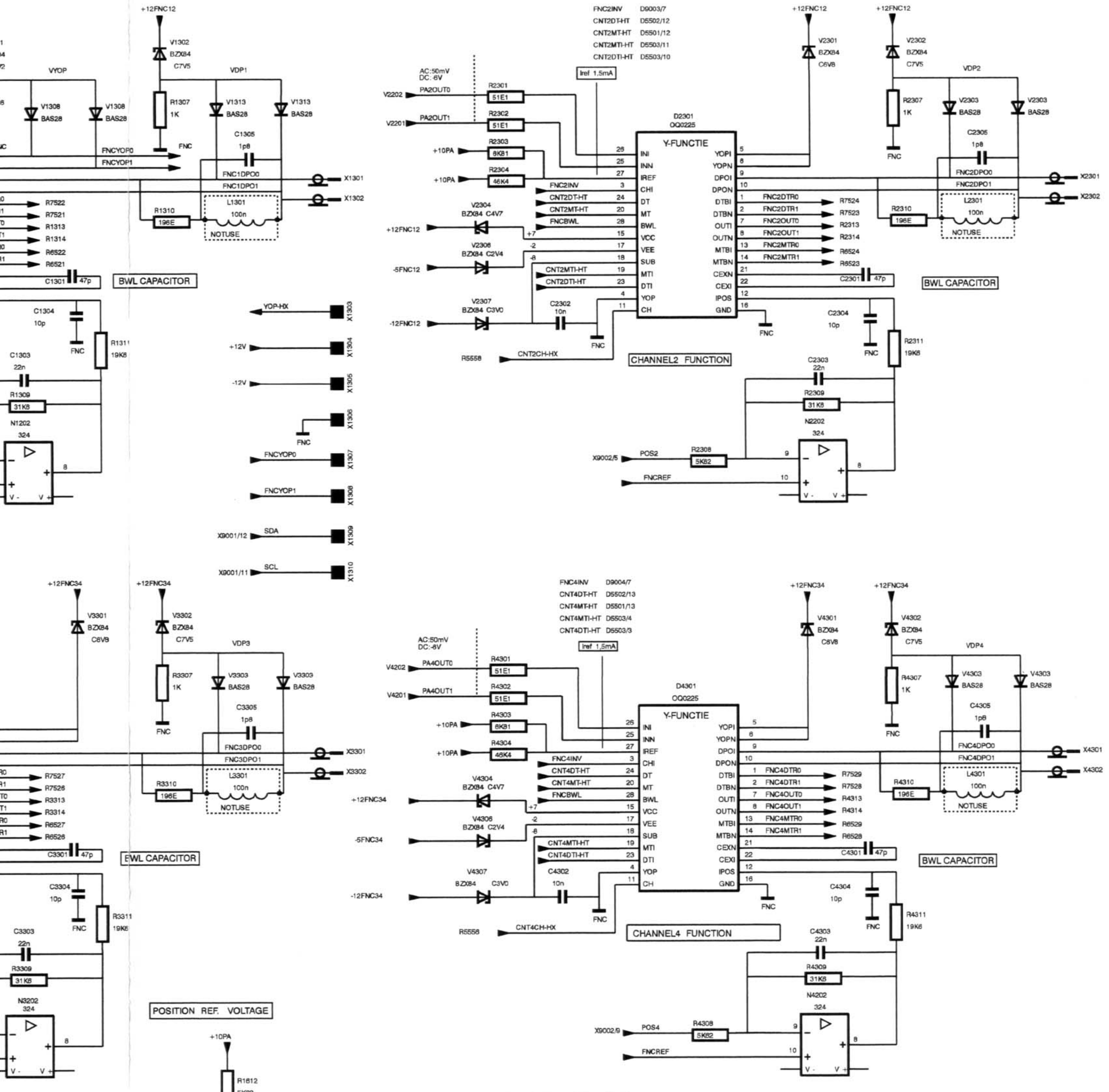
Diagram 7 - Preamplifier CH 3 and CH 4



REF NR	TYPE	-12PA	+18PA
D1301	OQ0225		
D2301	OQ0225		
D3301	OQ0225		
D4301	OQ0225		
N1202	LM324	11	4
N2202	LM324	11	4
N3202	LM324	11	4
N4202	LM324	11	4

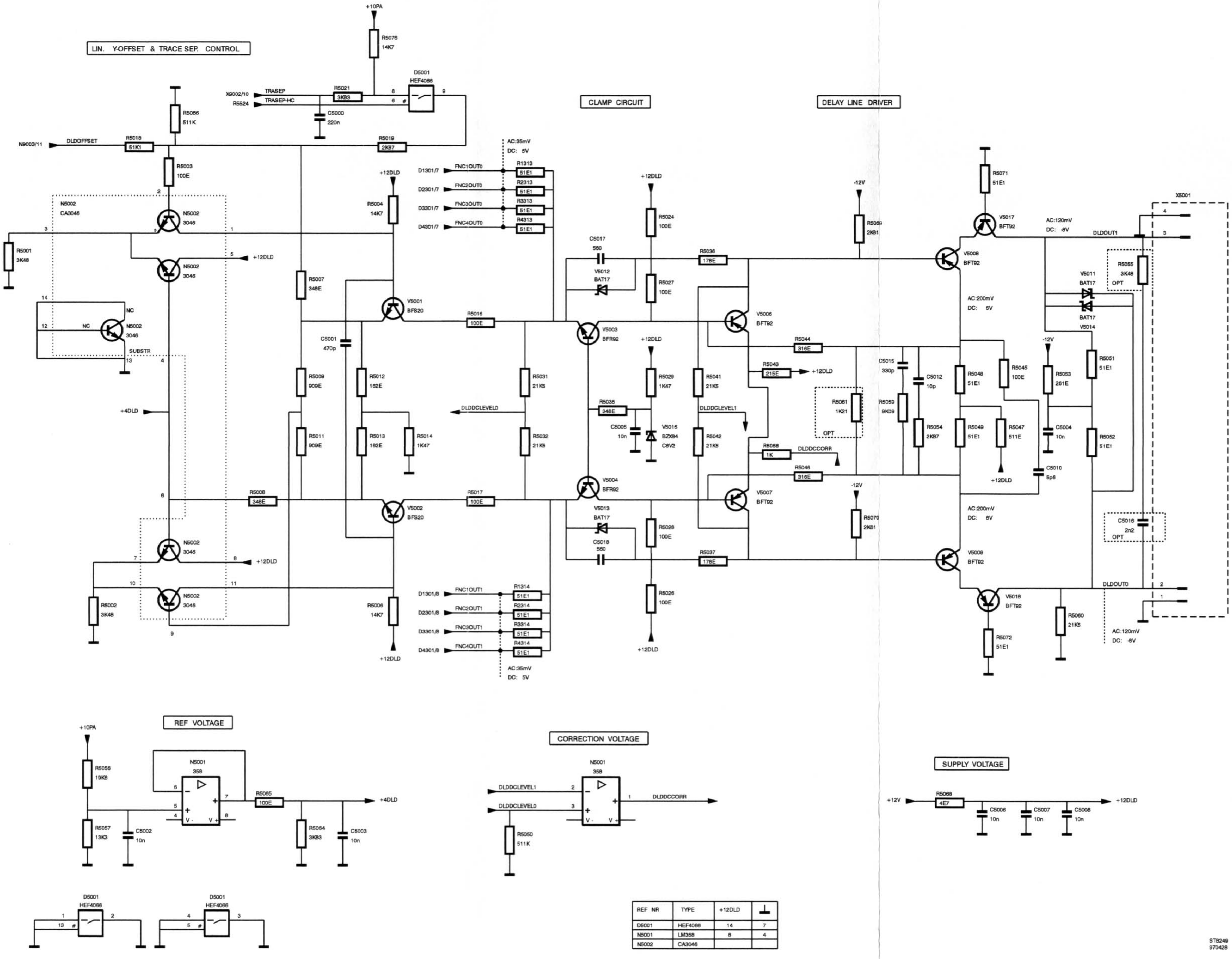
Diagram 8 - Y-functions


CNT1DT-HT D5502/2
CNT1MT-HT D5501/2
FNCBWL D9003/11
Iref 1,5mA
AC:50mV
DC:-6V
V1202 PA1OUT0 R1301 61E9
V1201 PA1OUT1 R1302 61E9
+10PA R1303 6K81
+10PA R1304 46K4
D1301
OQ0225
Y-FUNCTIE
INI INN IREF YOP DT MT BWL VCC VEE SUB CHI GND MTI CH
YOPI YOPN DPOI DPON DTBI DTBN OUTI OUTN MTBI MTBN CEXN CEXI IPOS DTI
YOP-HX
CNT1DT-HT
CNT1MT-HT
FNCBWL
V1304 BZX84 C4V7
+12FNC12
V1306 BZX84 C2V4
-5FNC12
V1307 BZX84 C3V0
-12FNC12
C1302 10n
FNC
R5559 CNT1CH-HX
CHANNEL1 FUNCTION
+12FNC12
V1301 BZX84 C6V2
R1305 5K11
VYOP
V1308 BAS28
V1309 BAS28
FNCYOP0
FNCYOP1
FNC1DTR0 R7522
FNC1DTR1 R7521
FNC1OUT0 R1313
FNC1OUT1 R1314
FNC1MTR0 R6522
FNC1MTR1 R6521
C1301 47p
BWL CAPACITOR
C1304 10p
R1311 19K6
C1303 22n
R1309 31K6
N1202 324
X9002/3 POS1 R1308 5K62
FNCREF
R1312 10K YOP-HX
+12FNC12
V1302 BZX84 C7V5
R1307 1K
R1310 196E
CNT3DT-HT D5502/1
CNT3MT-HT D5501/1
Iref 1,5mA
AC:50mV
DC:-6V
V3202 PA3OUT0 R3301 46E4
V3201 PA3OUT1 R3302 46E4
+10PA R3303 6K81
+10PA R3304 46K4
D3301
OQ0225
Y-FUNCTIE
CNT3DT-HT
CNT3MT-HT
FNCBWL
V3304 BZX84 C4V7
+12FNC34
V3306 BZX84 C2V4
-5FNC34
V3307 BZX84 C3V0
-12FNC34
C3302 10n
R5557 CNT3CH-HX
CHANNEL3 FUNCTION
+12FNC34
V3301 BZX84 C6V8
FNC3DTR0 R7527
FNC3DTR1 R7526
FNC3OUT0 R3313
FNC3OUT1 R3314
FNC3MTR0 R6527
FNC3MTR1 R6526
C3301 47p
BWL CAPACITOR
C3304 10p
R3311 19K6
C3303 22n
R3309 31K6
N3202 324
X9002/7 POS3 R3308 5K62
FNCREF
+12FNC34
V3302 BZX84 C7V5
R3307 1K
R3310 196E
POSITION RE
R1613 1K47



REF NR	TYPE	-12PA	+18PA
D1301	OQ0225		
D2301	OQ0225		
D3301	OQ0225		
D4301	OQ0225		
N1202	LM324	11	4
N2202	LM324	11	4
N3202	LM324	11	4
N4202	LM324	11	4

Diagram 8 - Y-functions



REF NR	TYPE	+12DLD	⊥
D5001	HEF4066	14	7
N5001	LM358	8	4
N5002	CA3046		

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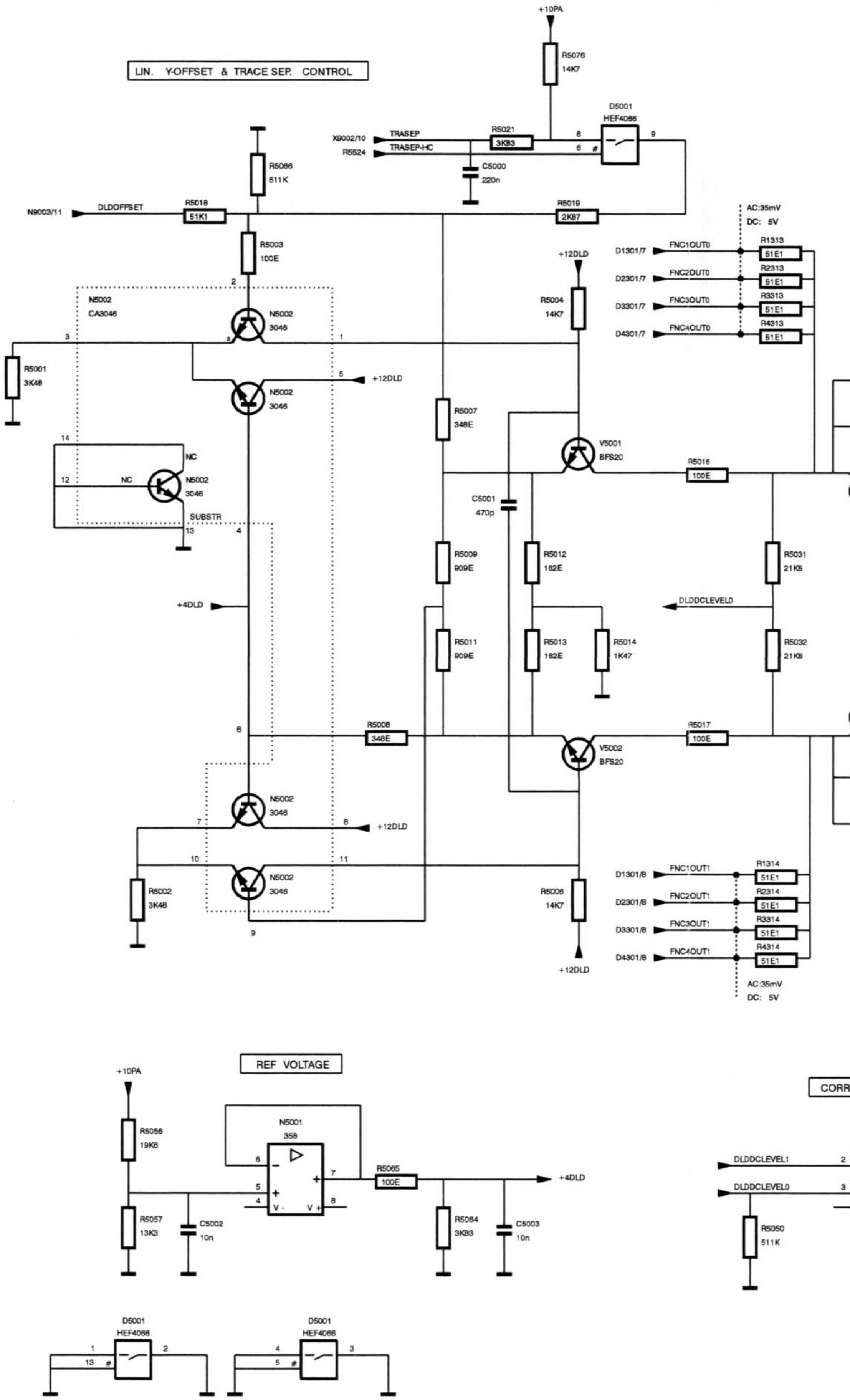
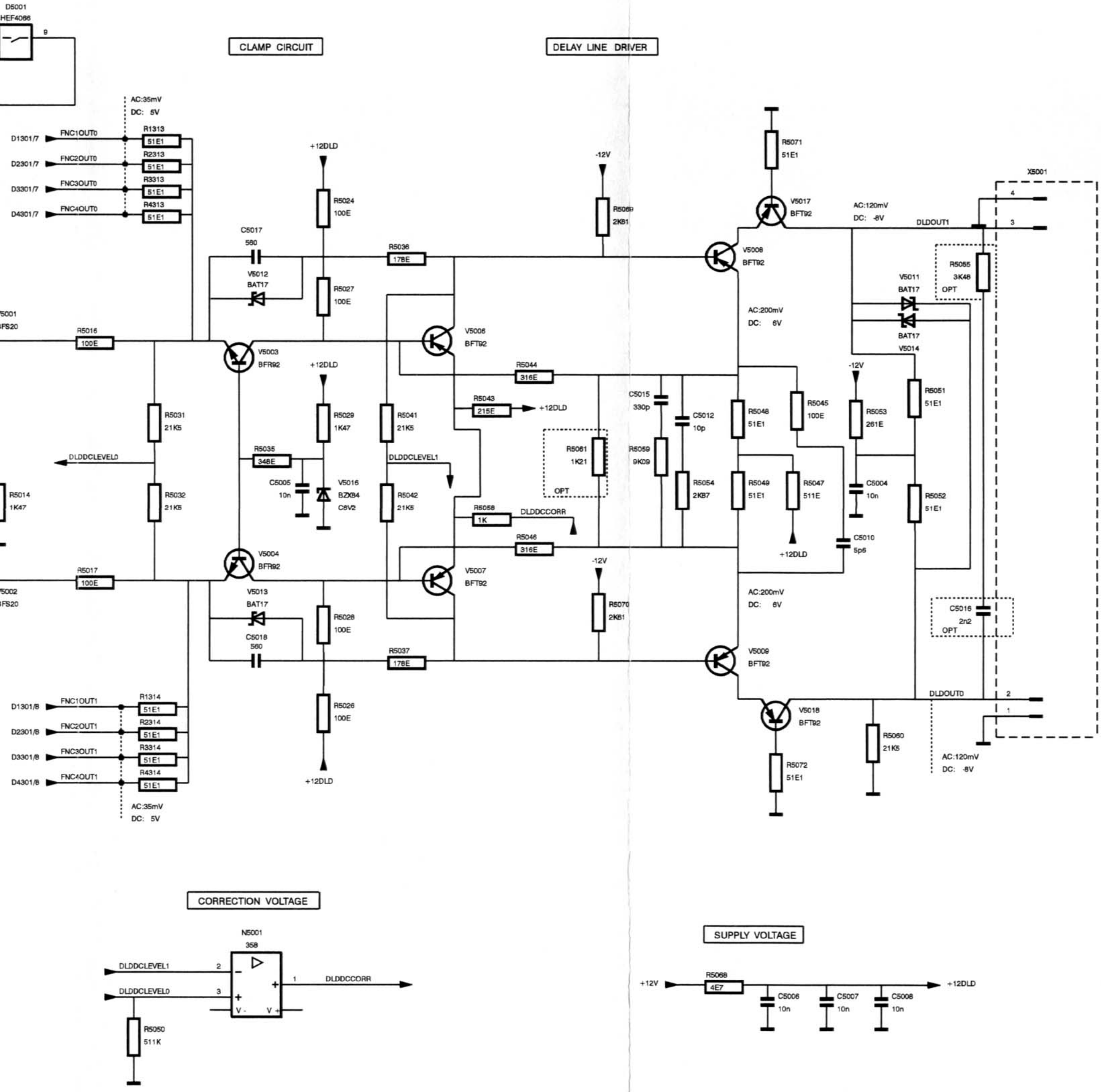
Diagram 9 - Delay line driver (PM3094/PM3092)



LIN. Y-OFFSET & TRACE SEP. CONTROL
+10PA
R5076
14K7
D5001
HEF4066
X9002/10
R5524
TRASEP
TRASEP-HC
R5021
3K83
C5000
220n
R5066
511K
N9003/11
DLDOFFSET
R5018
51K1
R5019
2K87
R5003
100E
N5002
CA3046
3046
R5001
3K48
+12DLD
R5004
14K7
R5007
348E
V5001
BFS20
R5016
100E
NC
SUBSTR
C5001
470p
R5009
909E
R5012
162E
R5031
21K5
+4DLD
DLDDCLEVEL0
R5011
909E
R5013
162E
R5014
1K47
R5032
21K5
R5008
348E
V5002
BFS20
R5017
100E
R5002
3K48
R5006
14K7
AC:35mV
DC: 5V
D1301/7
FNC1OUT0
R1313
51E1
D2301/7
FNC2OUT0
R2313
D3301/7
FNC3OUT0
R3313
D4301/7
FNC4OUT0
R4313
D1301/8
FNC1OUT1
R1314
D2301/8
FNC2OUT1
R2314
D3301/8
FNC3OUT1
R3314
D4301/8
FNC4OUT1
R4314
REF VOLTAGE
N5001
358
R5056
19K6
R5057
13K3
C5002
10n
R5065
100E
R5064
3K83
C5003
10n
CORR
DLDDCLEVEL1
DLDDCLEVEL0
R5050
511K



REF NR	TYPE	+12DLD	⊥
D5001	HEF4066	14	7
N5001	LM358	8	4
N5002	CA3046		

ST8249
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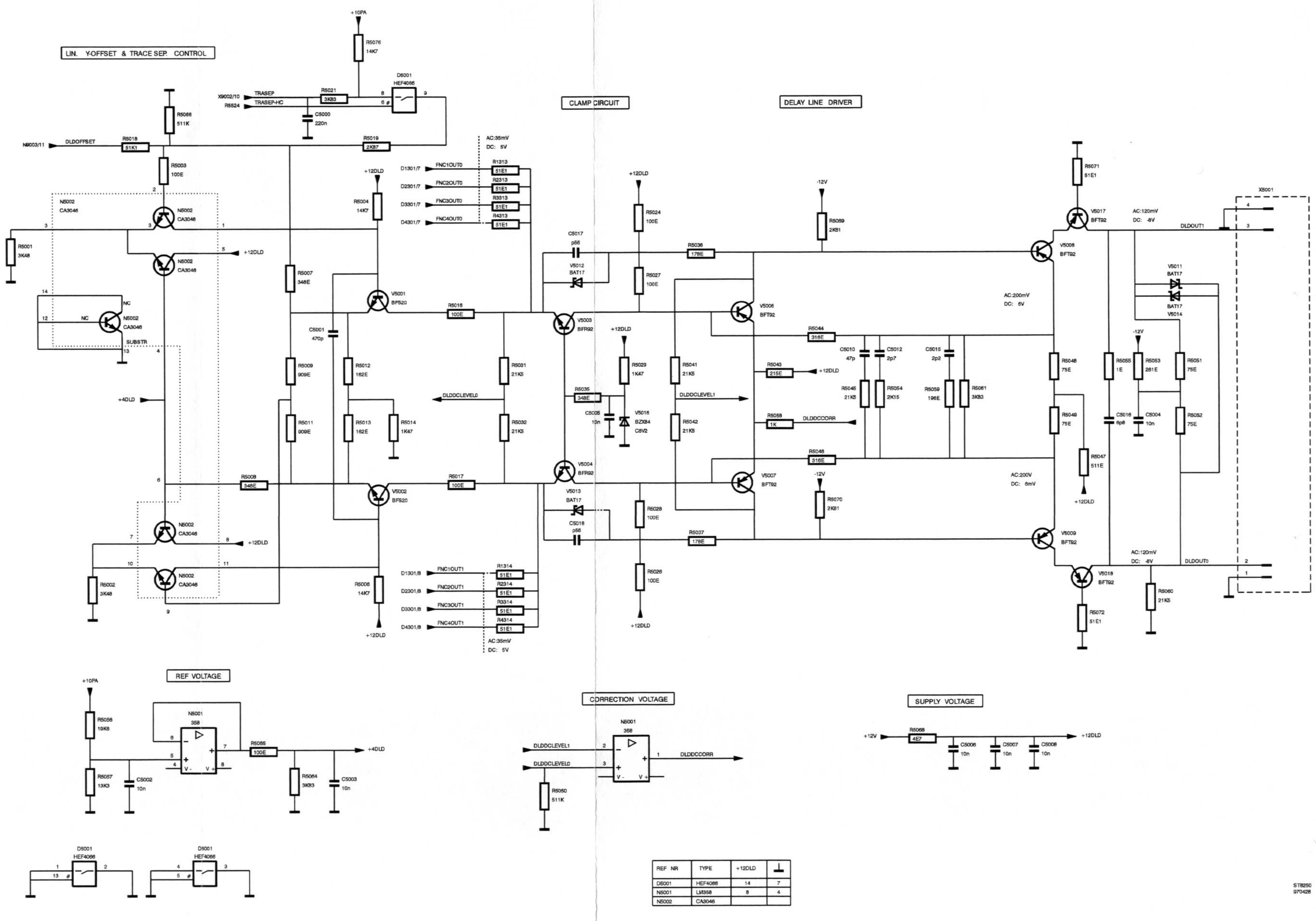
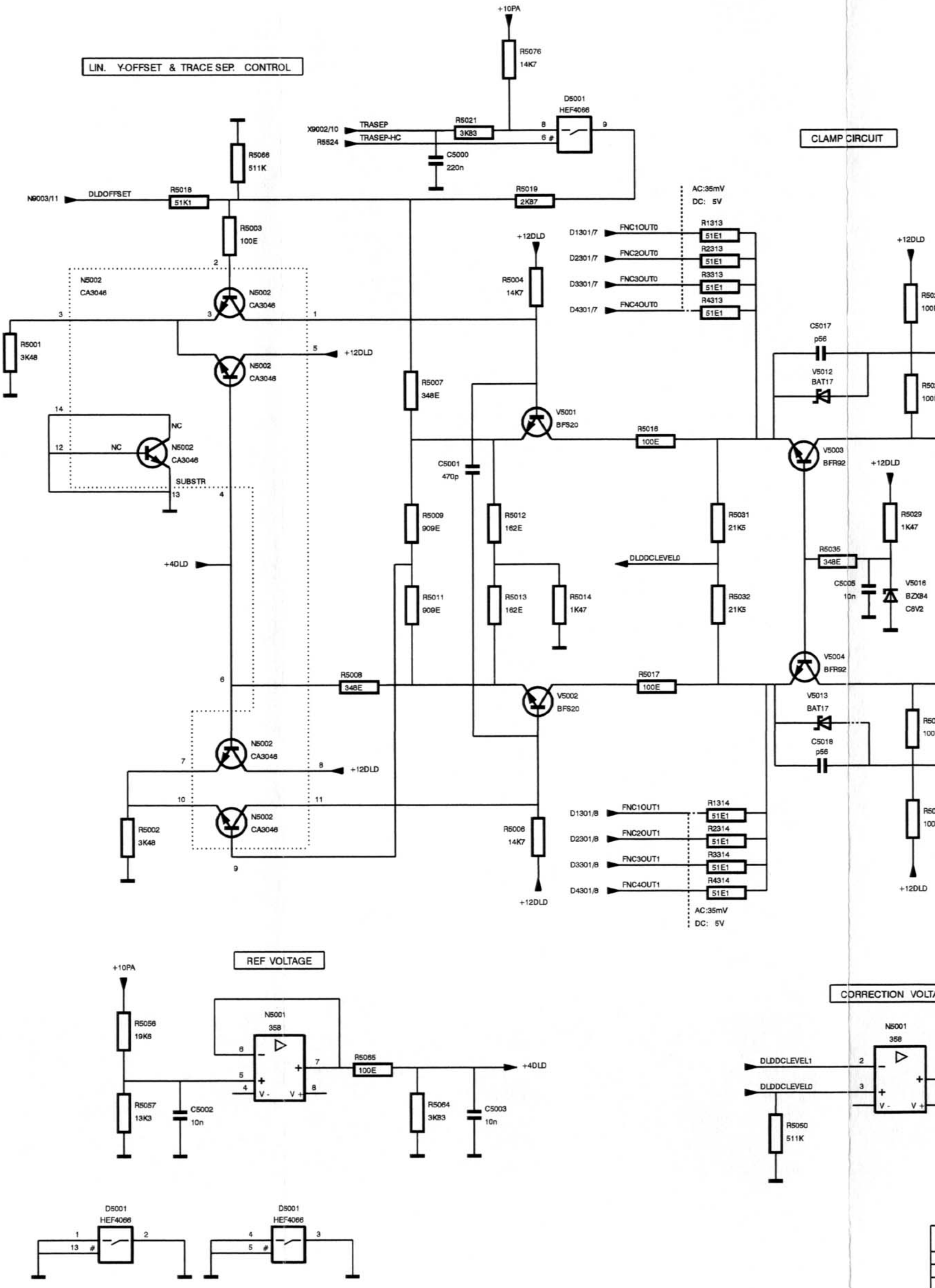
Diagram 9 - Delay line driver (PM3094/PM3092)

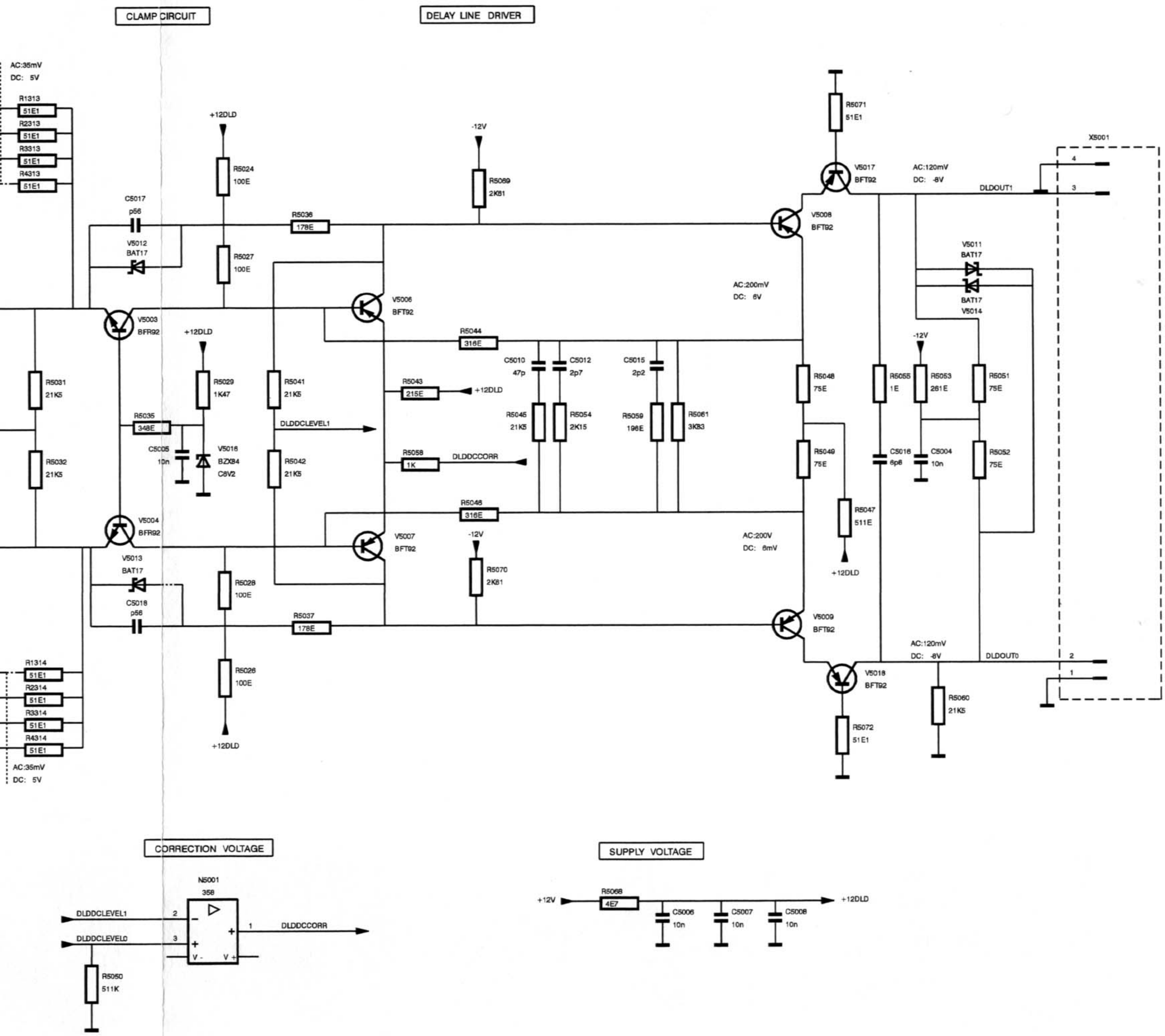


REF NR	TYPE	+12DLD	⊥
D5001	HEF4066	14	7
N5001	LM358	8	4
N5002	CA3046		

Diagram 9a - Delay line driver (PM3084/PM3082)



LIN. Y-OFFSET & TRACE SEP. CONTROL
CLAMP CIRCUIT
REF VOLTAGE
CORRECTION VOLTA
+10PA
R5076
14K7
D5001
HEF4066
X9002/10
TRASEP
R5524
TRASEP-HC
R5021
3K83
C5000
220n
R5066
511K
N9003/11
DLDOFFSET
R5018
51K1
R5019
2K87
R5003
100E
N5002
CA3046
R5001
3K48
SUBSTR
+4DLD
R5007
348E
V5001
BFS20
+12DLD
R5004
14K7
C5001
470p
R5009
909E
R5011
909E
R5012
162E
R5013
162E
R5014
1K47
R5016
100E
R5017
100E
R5008
348E
V5002
BFS20
R5006
14K7
R5002
3K48
AC:35mV
DC: 5V
D1301/7
FNC1OUT0
R1313
51E1
D2301/7
FNC2OUT0
R2313
D3301/7
FNC3OUT0
R3313
D4301/7
FNC4OUT0
R4313
DLDDCLEVEL0
R5031
21K5
R5032
21K5
V5003
BFR92
V5004
BFR92
C5017
p56
V5012
BAT17
V5013
BAT17
C5018
p56
R5029
1K47
R5035
348E
C5005
10n
V5016
BZX84
C6V2
D1301/8
FNC1OUT1
R1314
D2301/8
FNC2OUT1
R2314
D3301/8
FNC3OUT1
R3314
D4301/8
FNC4OUT1
R4314
N5001
358
R5056
19K6
R5057
13K3
C5002
10n
R5065
100E
R5064
3K83
C5003
10n
DLDDCLEVEL1
R5050
511K



REF NR	TYPE	+12DLD	⊥
D5001	HEF4066	14	7
N5001	LM358	8	4
N5002	CA3046		

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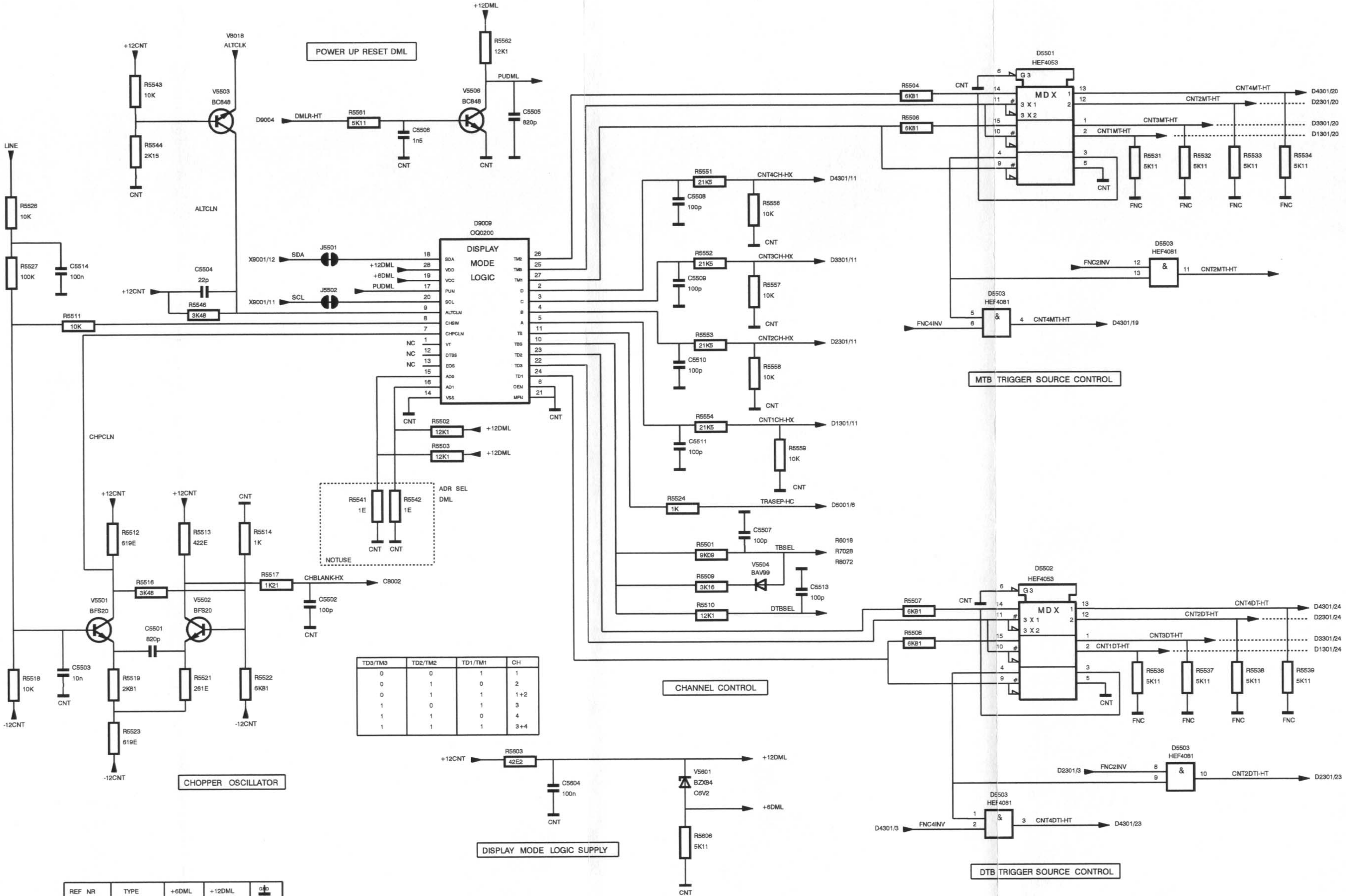
Diagram 9a - Delay line driver (PM3084/PM3082)



TD3/TM3	TD2/TM2	TD1/TM1	CH
0	0	1	1
0	1	0	2
0	1	1	1+2
1	0	1	3
1	1	0	4
1	1	1	3+4

REF NR	TYPE	+6DML	+12DML	GND
D5501	HEF4053		16	7,8
D5502	HEF4053		16	7,8
D5503	HEF4081	14		7
D9009	OQ0200			

ST8251
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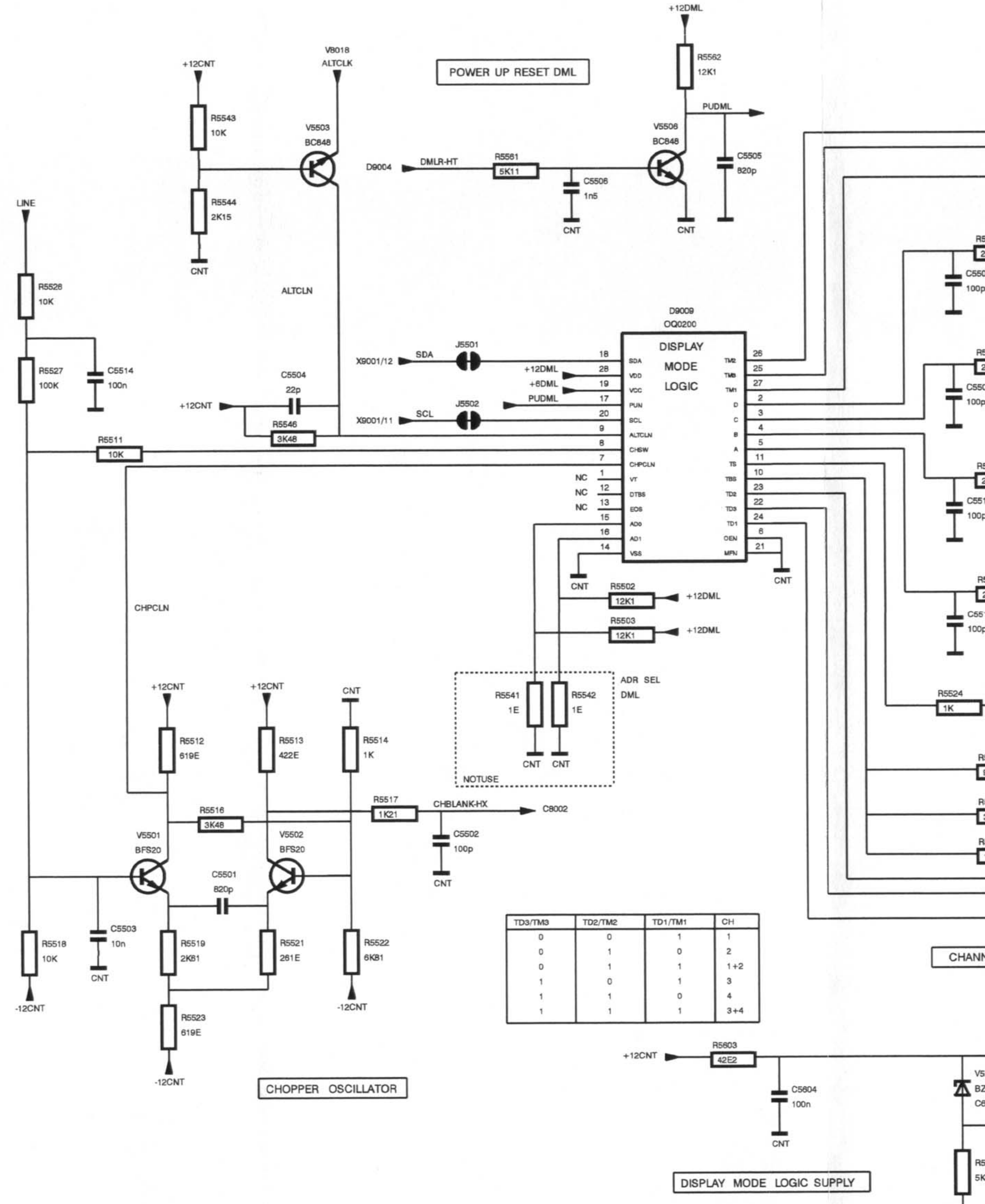
Diagram 10 - Display and trigger control



TD3/TM3	TD2/TM2	TD1/TM1	CH
0	0	1	1
0	1	0	2
0	1	1	1+2
1	0	1	3
1	1	0	4
1	1	1	3+4

REF NR	TYPE	+6DML	+12DML	GND
D5501	HEF4053		16	7,8
D5502	HEF4053		16	7,8
D5503	HEF4081	14		7
D9009	OQ0200			

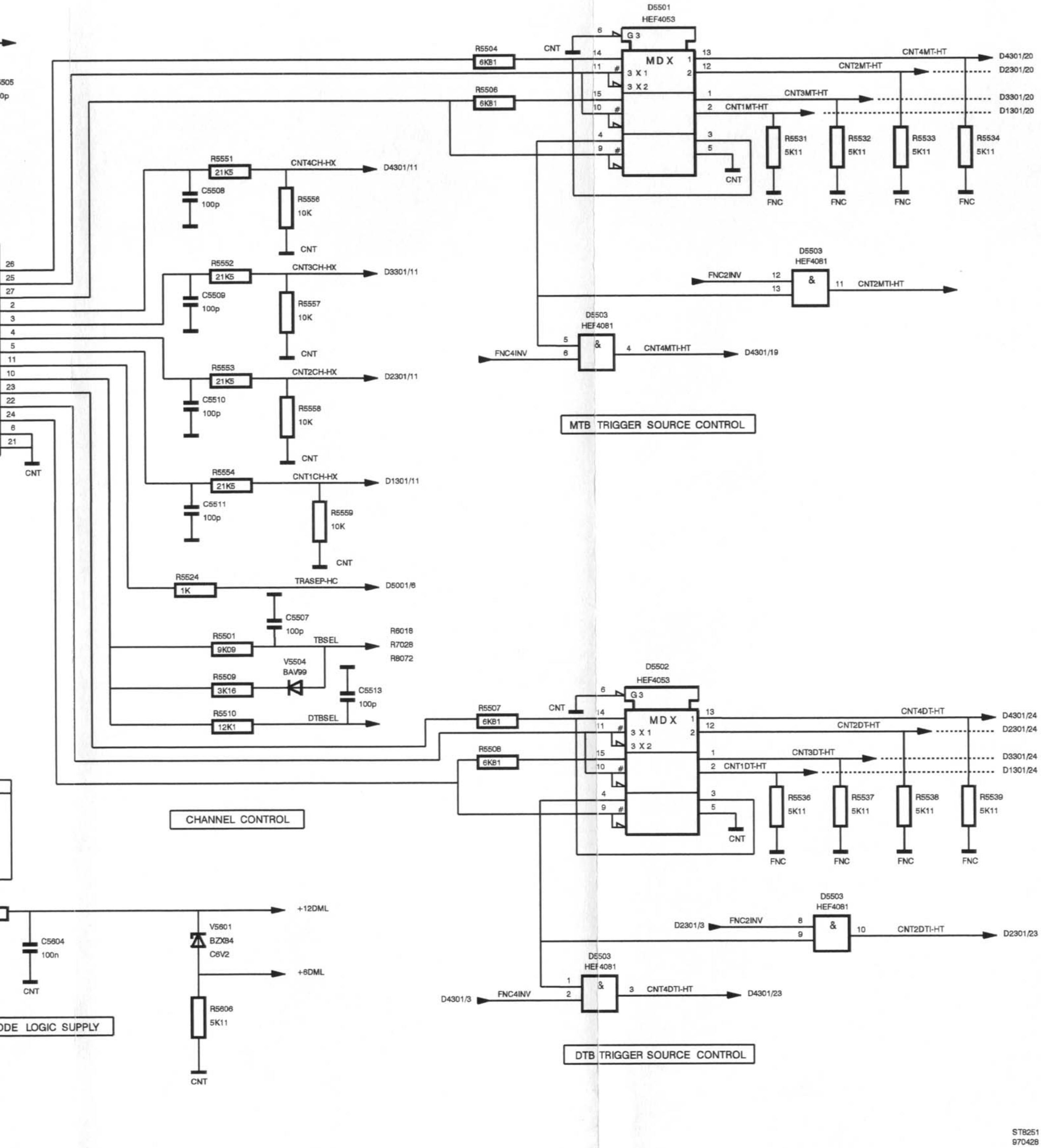
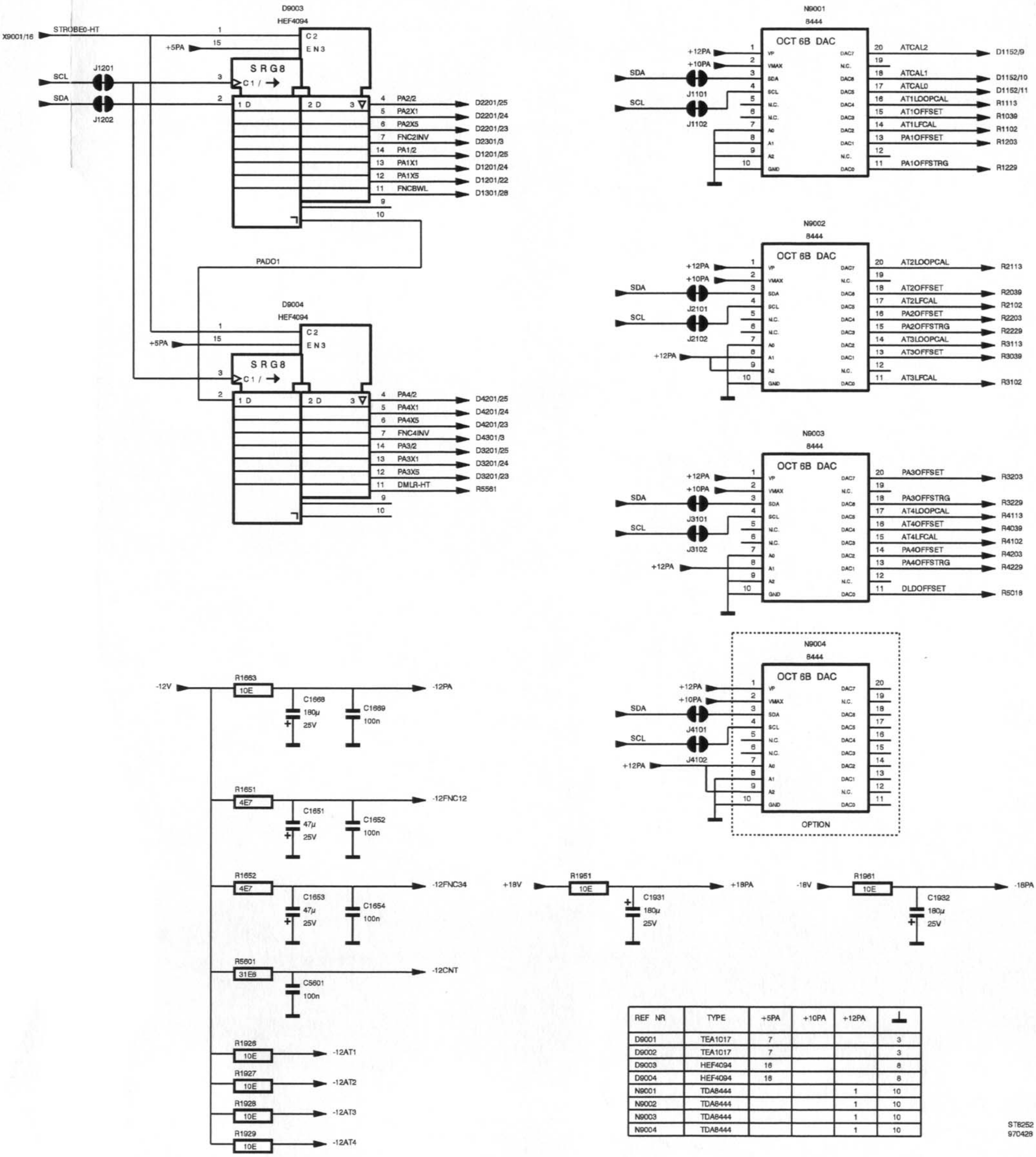


Diagram 10 - Display and trigger control



REF NR	TYPE	+5PA	+10PA	+12PA	⊥
D9001	TEA1017	7			3
D9002	TEA1017	7			3
D9003	HEF4094	16			8
D9004	HEF4094	16			8
N9001	TDA8444			1	10
N9002	TDA8444			1	10
N9003	TDA8444			1	10
N9004	TDA8444			1	10

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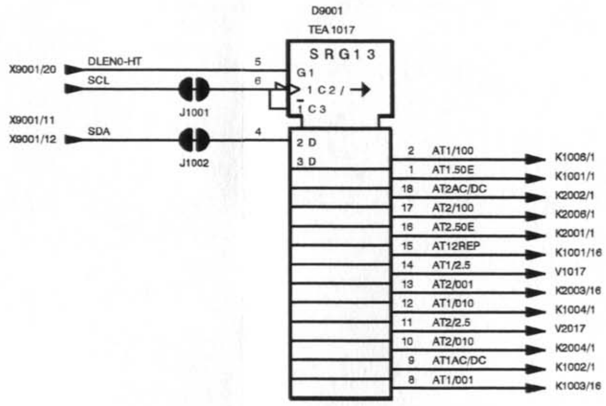
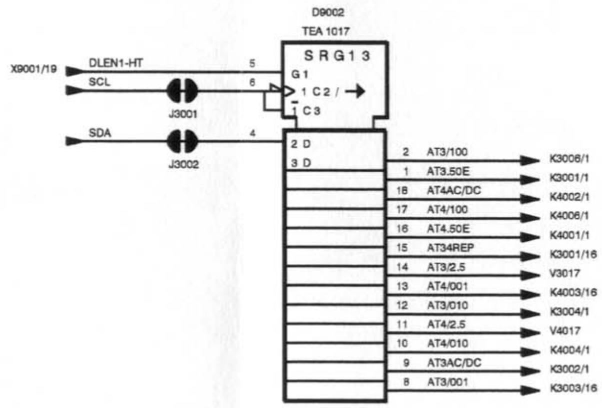
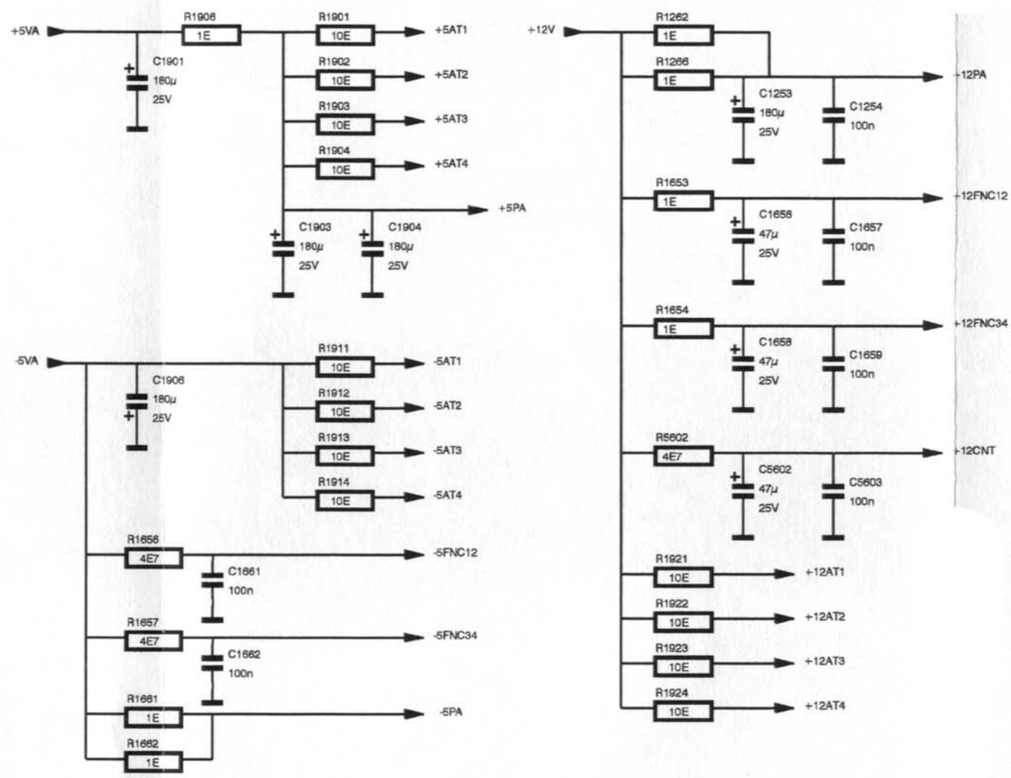
Diagram 11 - Control circuits


D9001
TEA 1017
SRG13
X9001/20
DLEN0-HT
SCL
J1001
X9001/11
X9001/12
SDA
J1002
AT1/100 K1006/1
AT1.50E K1001/1
AT2AC/DC K2002/1
AT2/100 K2006/1
AT2.50E K2001/1
AT12REP K1001/16
AT1/2.5 V1017
AT2/001 K2003/16
AT1/010 K1004/1
AT2/2.5 V2017
AT2/010 K2004/1
AT1AC/DC K1002/1
AT1/001 K1003/16


D9002
TEA 1017
SRG13
X9001/19
DLEN1-HT
SCL
J3001
SDA
J3002
AT3/100 K3006/1
AT3.50E K3001/1
AT4AC/DC K4002/1
AT4/100 K4006/1
AT4.50E K4001/1
AT34REP K3001/16
AT3/2.5 V3017
AT4/001 K4003/16
AT3/010 K3004/1
AT4/2.5 V4017
AT4/010 K4004/1
AT3AC/DC K3002/1
AT3/001 K3003/16


+5VA
R1906 1E
C1901 180µ 25V
R1901 10E +5AT1
R1902 10E +5AT2
R1903 10E +5AT3
R1904 10E +5AT4
+5PA
C1903 180µ 25V
C1904 180µ 25V
-5VA
C1906 180µ 25V
R1911 10E -5AT1
R1912 10E -5AT2
R1913 10E -5AT3
R1914 10E -5AT4
R1656 4E7 -5FNC12
C1661 100n
R1657 4E7 -5FNC34
C1662 100n
R1661 1E -5PA
R1662 1E
+12V
R1262 1E
R1266 1E
+12PA
C1253 180µ 25V
C1254 100n
R1653 1E +12FNC12
C1656 47µ 25V
C1657 100n
R1654 1E +12FNC34
C1658 47µ 25V
C1659 100n
R5602 4E7 +12CNT
C5602 47µ 25V
C5603 100n
R1921 10E +12AT1
R1922 10E +12AT2
R1923 10E +12AT3
R1924 10E +12AT4

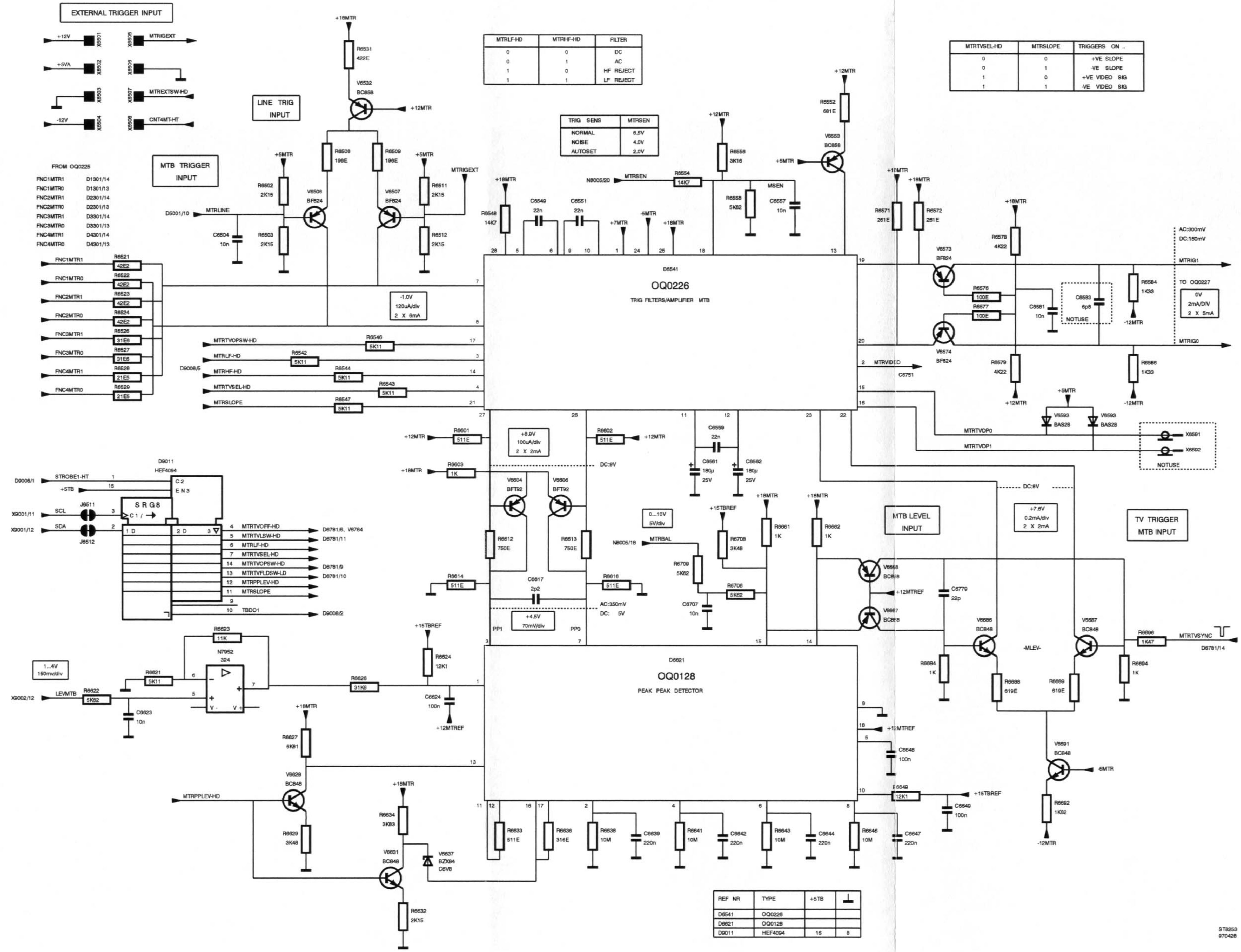
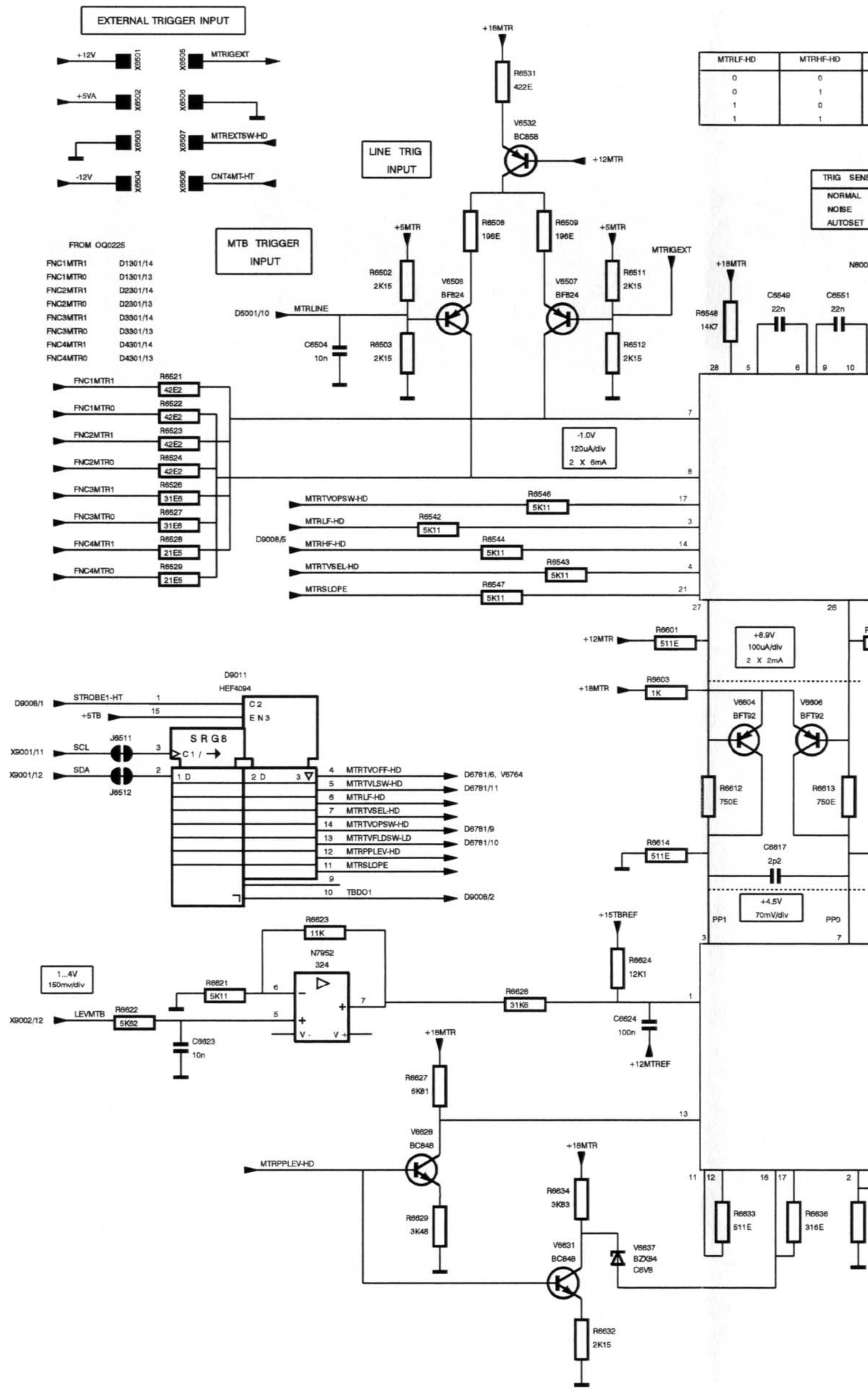
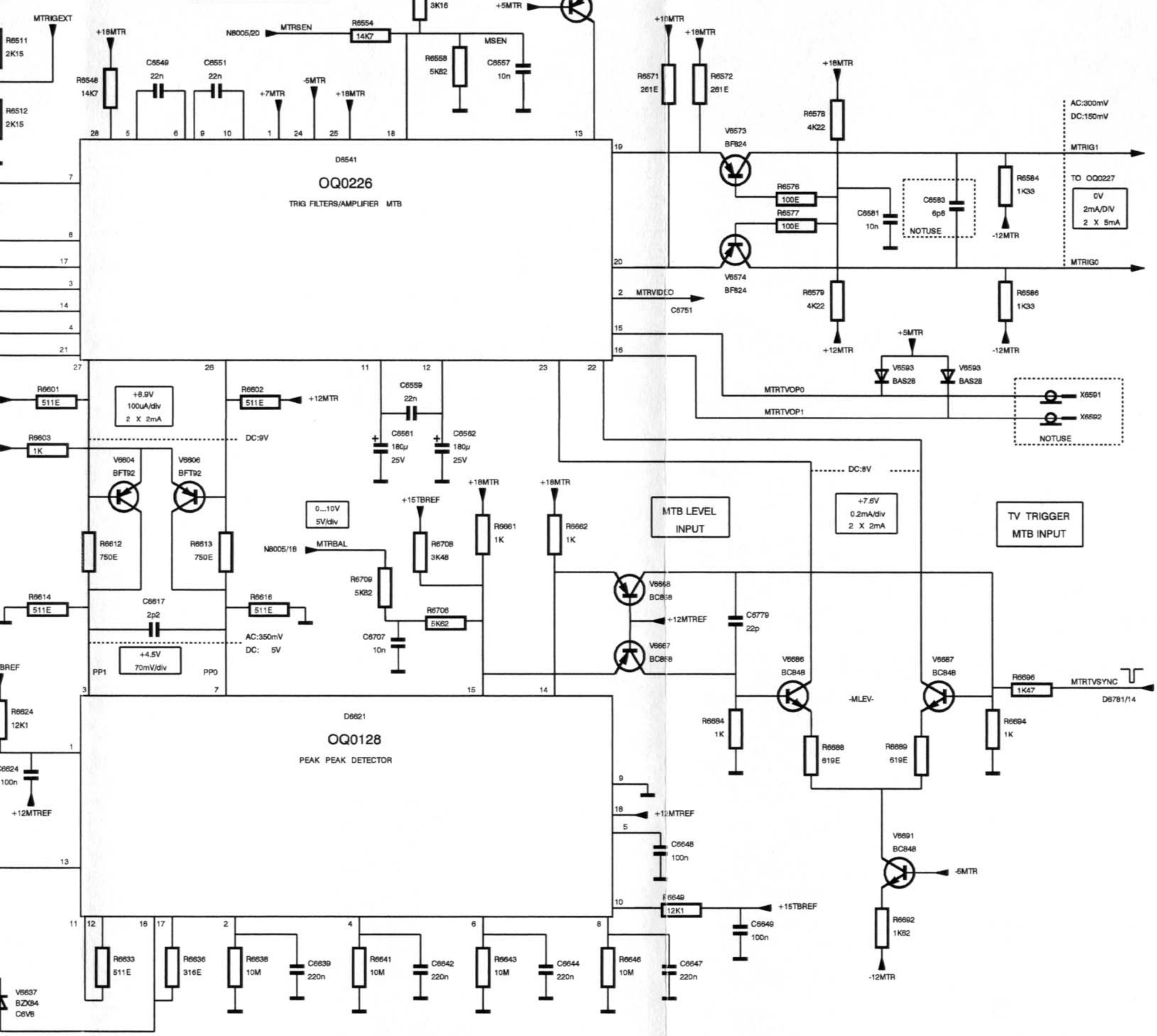


Diagram 12 - MTB trigger



MTRLF-HD	MTRHF-HD
0	0
0	1
1	0
1	1



MTRLF-HD	MTRHF-HD	FILTER
0	0	DC
0	1	AC
1	0	HF REJECT
1	1	LF REJECT

TRIG SENS	MTRSEN
NORMAL	6.5V
NOISE	4.0V
AUTOSET	2.0V

MTRTVSEL-HD	MTRSLOPE	TRIGGERS ON ..
0	0	+VE SLOPE
0	1	-VE SLOPE
1	0	+VE VIDEO SIG
1	1	-VE VIDEO SIG

REF NR	TYPE	+5TB	⊥
D6541	OQ0226		
D6621	OQ0128		
D9011	HEF4094	16	8

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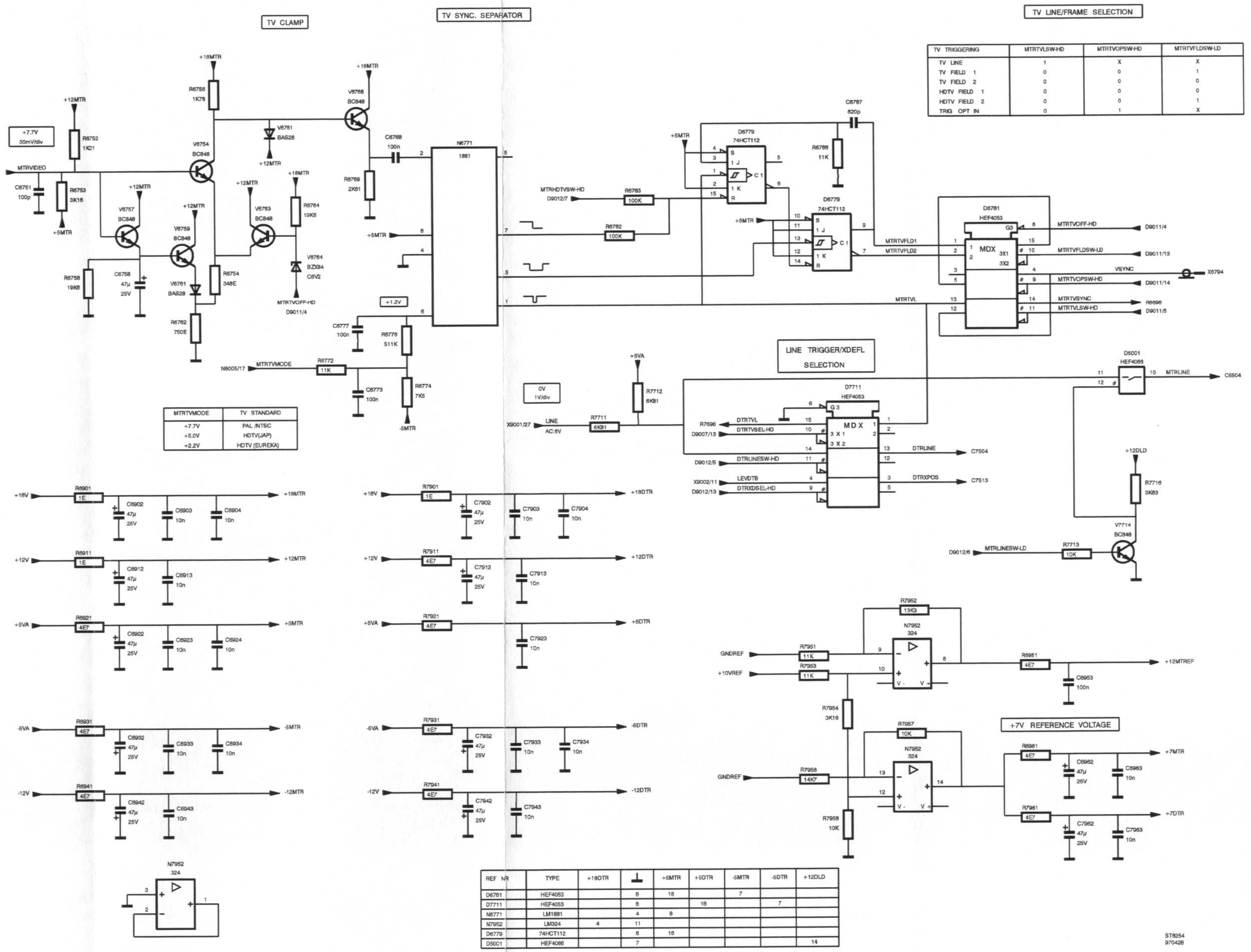
Diagram 12 - MTB trigger

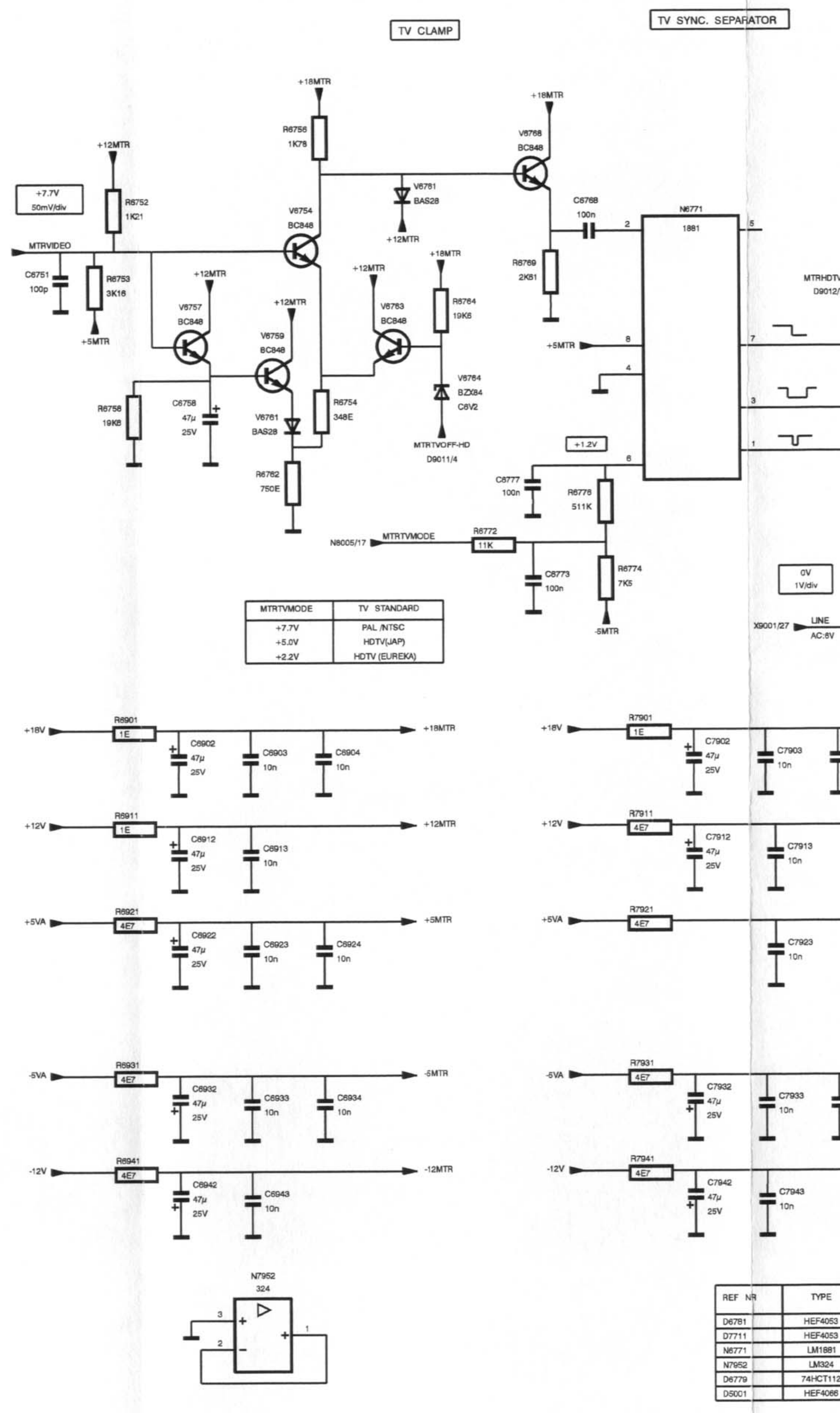


TV TRIGGERING	MTRTVLSW-HD	MTRTVOPSW-HD	MTRTVFLDSW-LD
TV LINE	1	X	X
TV FIELD 1	0	0	1
TV FIELD 2	0	0	0
HDTV FIELD 1	0	0	0
HDTV FIELD 2	0	0	1
TRIG OPT IN	0	1	X

MTRTVMODE	TV STANDARD
+7.7V	PAL /NTSC
+5.0V	HDTV(JAP)
+2.2V	HDTV (EUREKA)

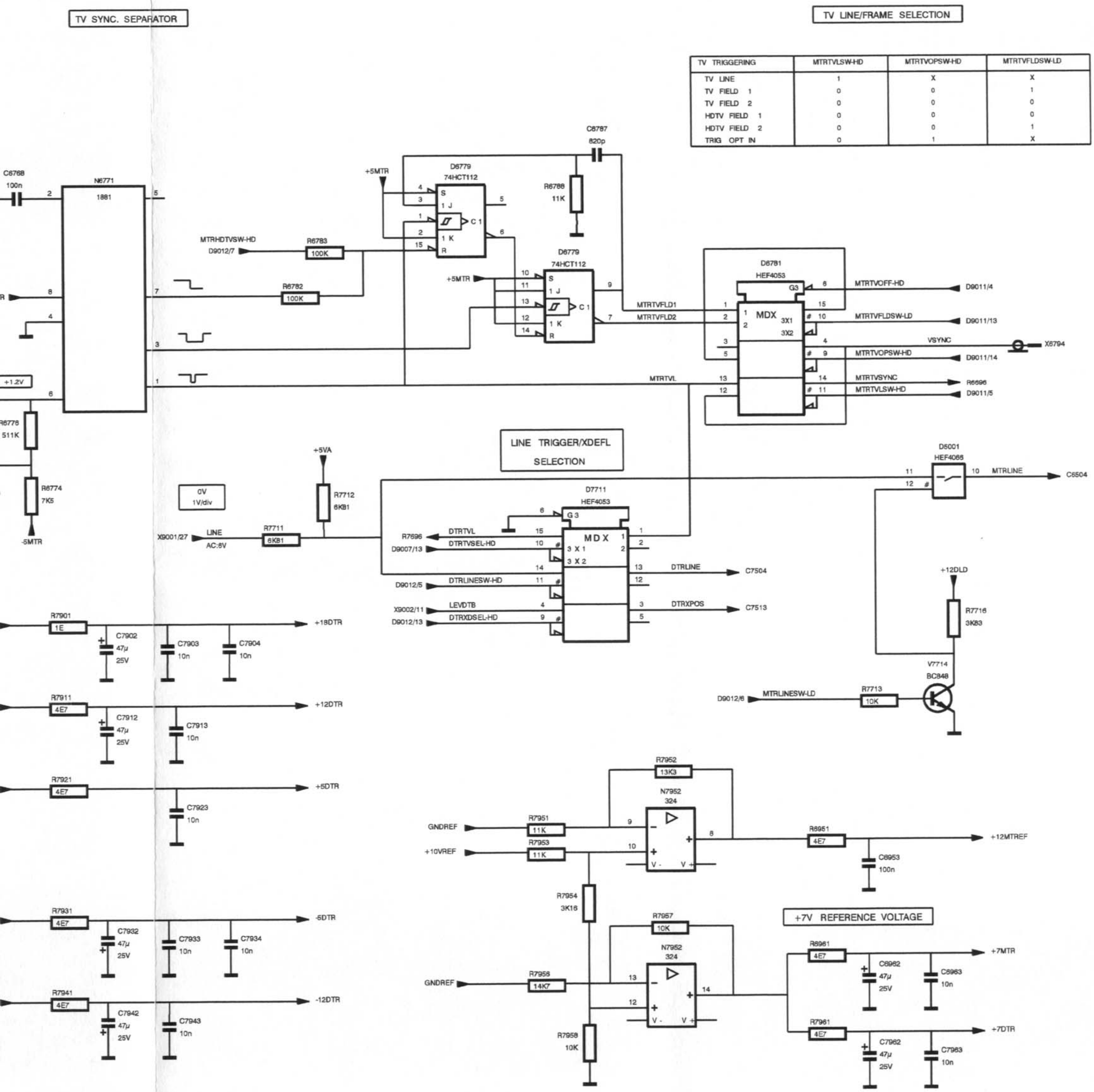
REF NR	TYPE	+18DTR	⊥	+5MTR	+5DTR	-5MTR	-5DTR	+12DLD
D6781	HEF4053		8	16		7		
D7711	HEF4053		8		16		7	
N6771	LM1881		4	8				
N7952	LM324	4	11					
D6779	74HCT112		8	16				
D5001	HEF4066		7					14

Diagram 13 - TV/line trigger



MTRTVMODE	TV STANDARD
+7.7V	PAL /NTSC
+5.0V	HDTV(JAP)
+2.2V	HDTV (EUREKA)

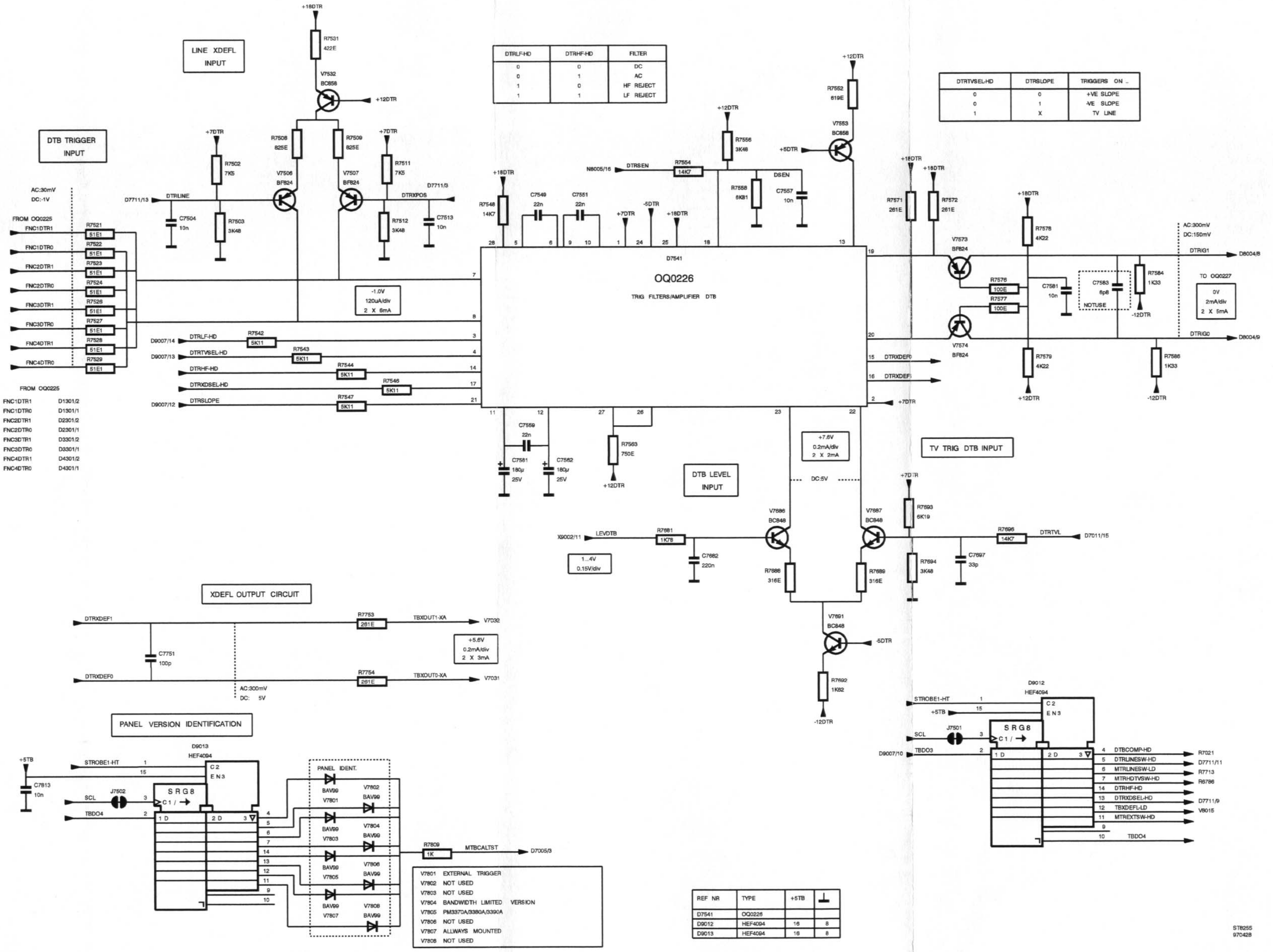
REF NR	TYPE
D6781	HEF4053
D7711	HEF4053
N6771	LM1881
N7952	LM324
D6779	74HCT112
D5001	HEF4066



TV TRIGGERING	MTRTVLSW-HD	MTRTVOPSW-HD	MTRTVFLDSW-LD
TV LINE	1	X	X
TV FIELD 1	0	0	1
TV FIELD 2	0	0	0
HDTV FIELD 1	0	0	0
HDTV FIELD 2	0	0	1
TRIG OPT IN	0	1	X

REF NR	TYPE	+18DTR	⊥	+5MTR	+5DTR	-5MTR	-5DTR	+12DLD
D6781	HEF4053		8	16		7		
D7711	HEF4053		8		16		7	
N6771	LM1881		4	8				
N7952	LM324	4	11					
D6779	74HCT112		8	16				
D5001	HEF4066		7					14

Diagram 13 - TV/line trigger



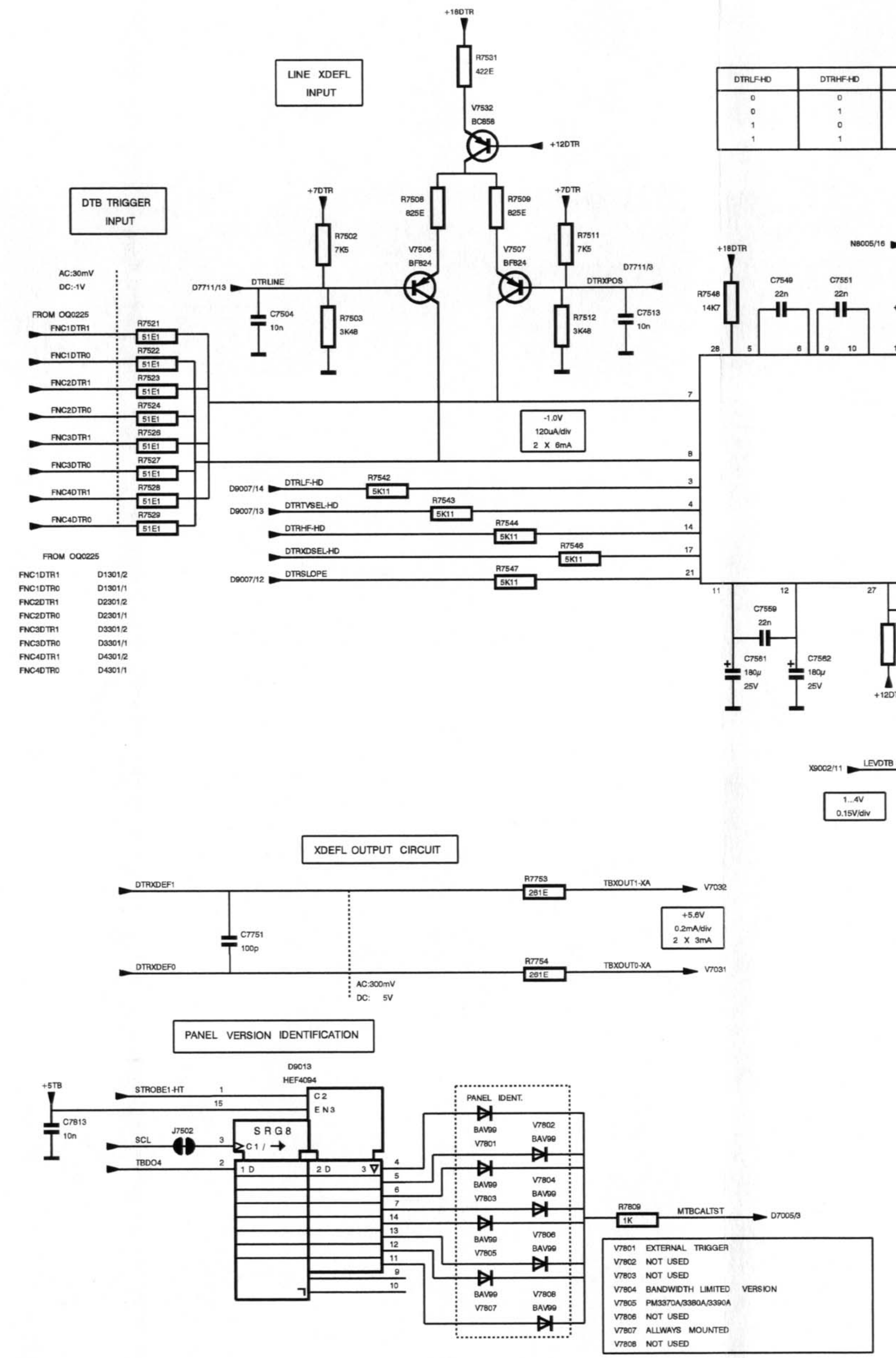
DTRLF-HD	DTRHF-HD	FILTER
0	0	DC
0	1	AC
1	0	HF REJECT
1	1	LF REJECT

DTRTVSEL-HD	DTRSLOPE	TRIGGERS ON ..
0	0	+VE SLOPE
0	1	-VE SLOPE
1	X	TV LINE

REF NR	TYPE	+5TB	⊥
D7541	OQ0226		
D9012	HEF4094	16	8
D9013	HEF4094	16	8

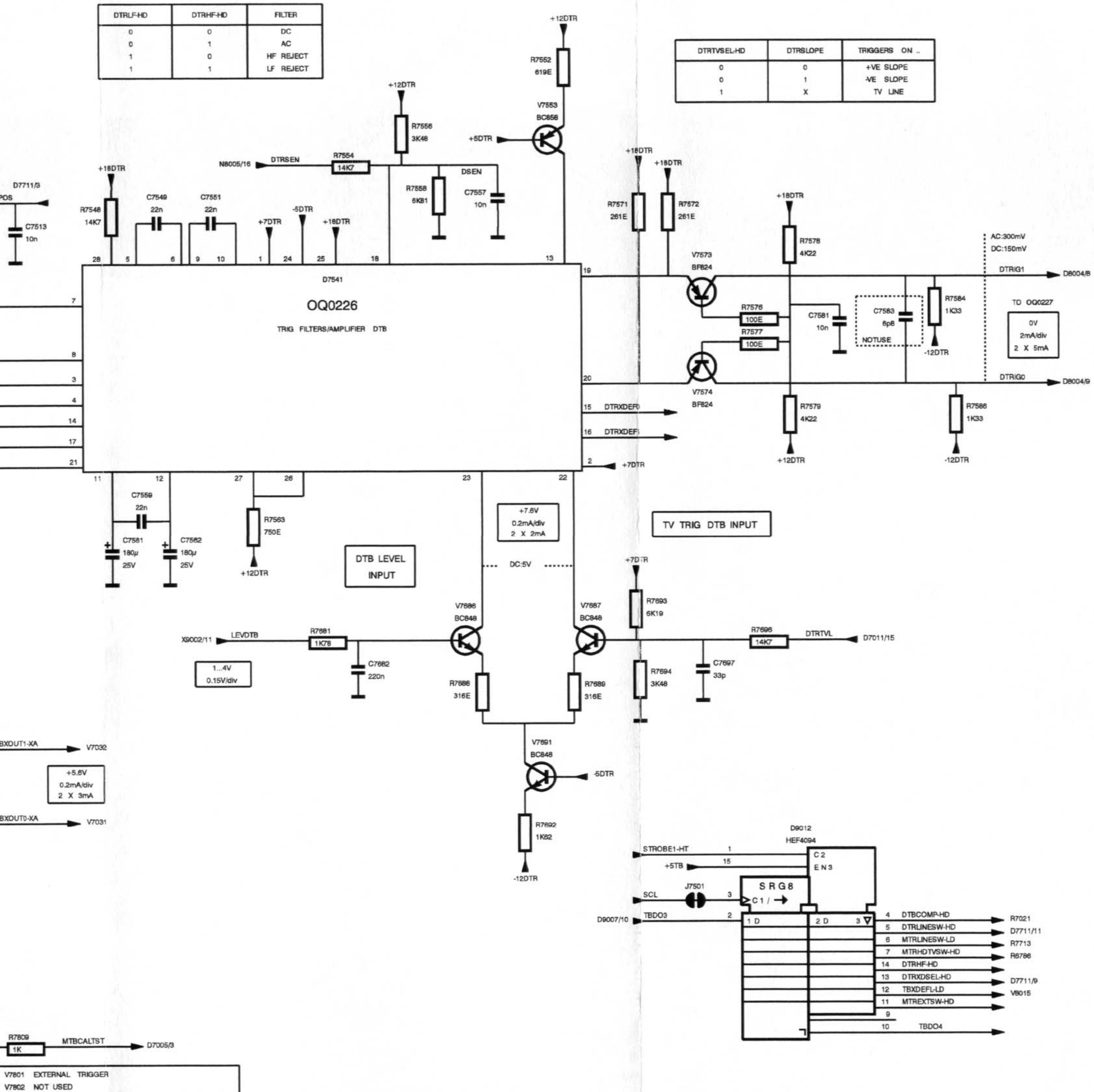
Diagram 14 - DTB trigger

DTRLF-HD	DTRHF-HD
0	0
0	1
1	0
1	1



DTRLF-HD	DTRHF-HD	FILTER
0	0	DC
0	1	AC
1	0	HF REJECT
1	1	LF REJECT

DTRTVSEL-HD	DTRSLOPE	TRIGGERS ON ..
0	0	+VE SLOPE
0	1	-VE SLOPE
1	X	TV LINE



V7801	EXTERNAL TRIGGER
V7802	NOT USED
V7803	NOT USED
V7804	BANDWIDTH LIMITED VERSION
V7805	PM3370A/3380A/3390A
V7806	NOT USED
V7807	ALLWAYS MOUNTED
V7808	NOT USED

REF NR	TYPE	+5TB	⊥
D7541	OQ0226		
D9012	HEF4094	16	8
D9013	HEF4094	16	8

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Diagram 14 - DTB trigger

REF NO	TYPE	+5TB	+12TB	⊥
D8003	OQ0235	20		1
D8004	OQ0227	28	4	
D8006	HEF40106	14		7
D9008	HEF4094	14		7
N8005	TDA8444		1	10

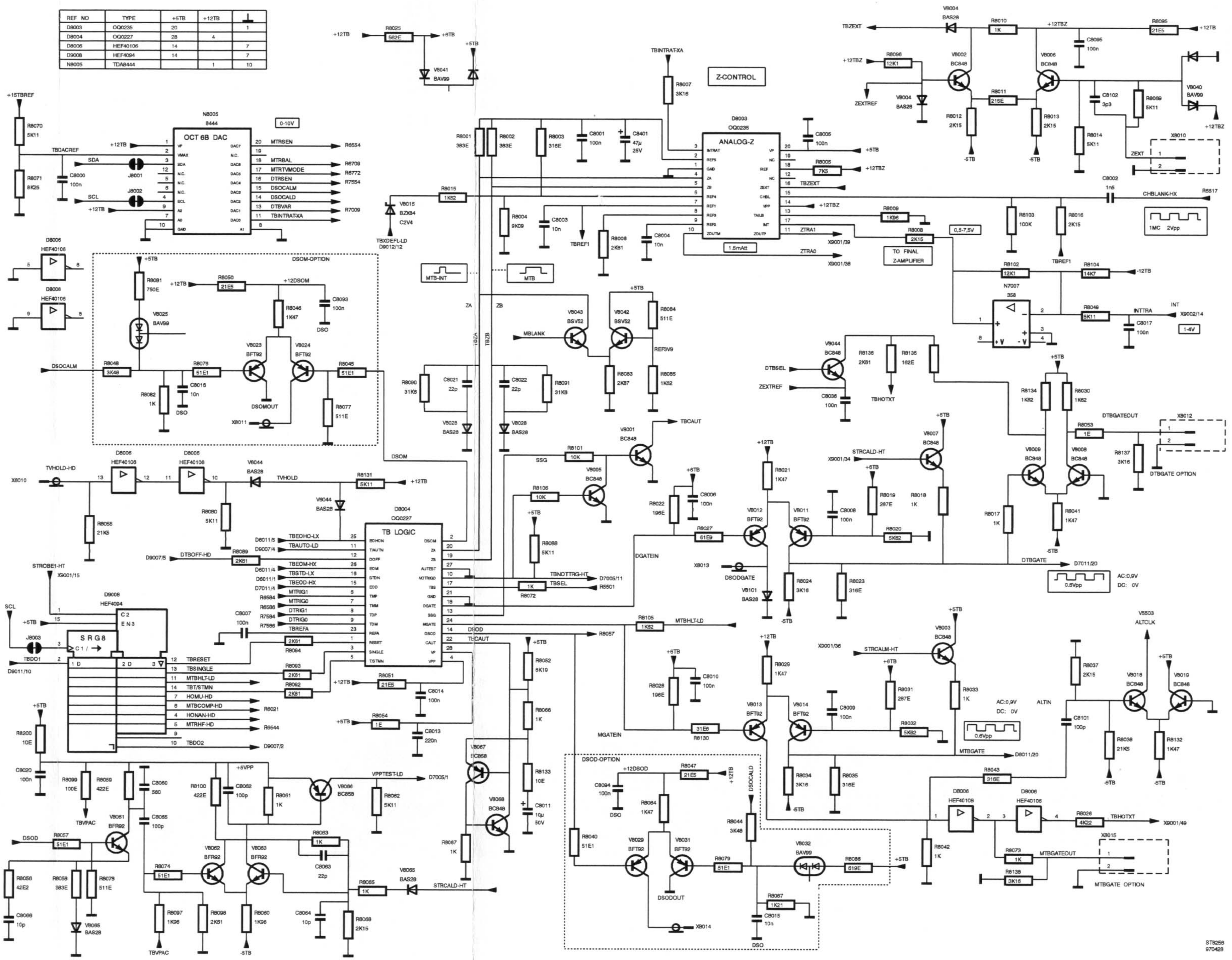
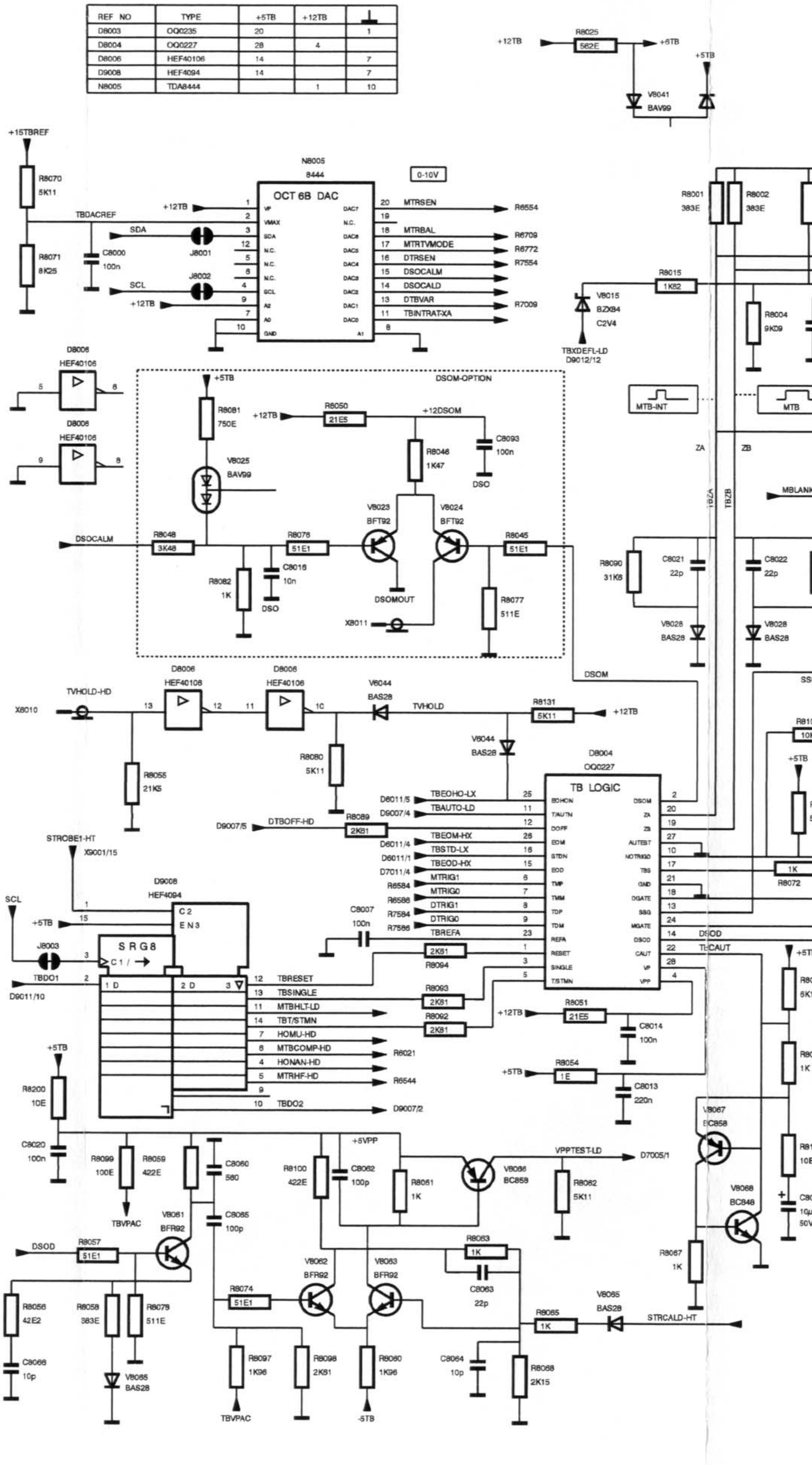


Diagram 15 - Time base logic

REF NO	TYPE	+5TB	+12TB	⊥
D8003	OQ0235	20		1
D8004	OQ0227	28	4	
D8006	HEF40106	14		7
D9008	HEF4094	14		7
N8005	TDA8444		1	10



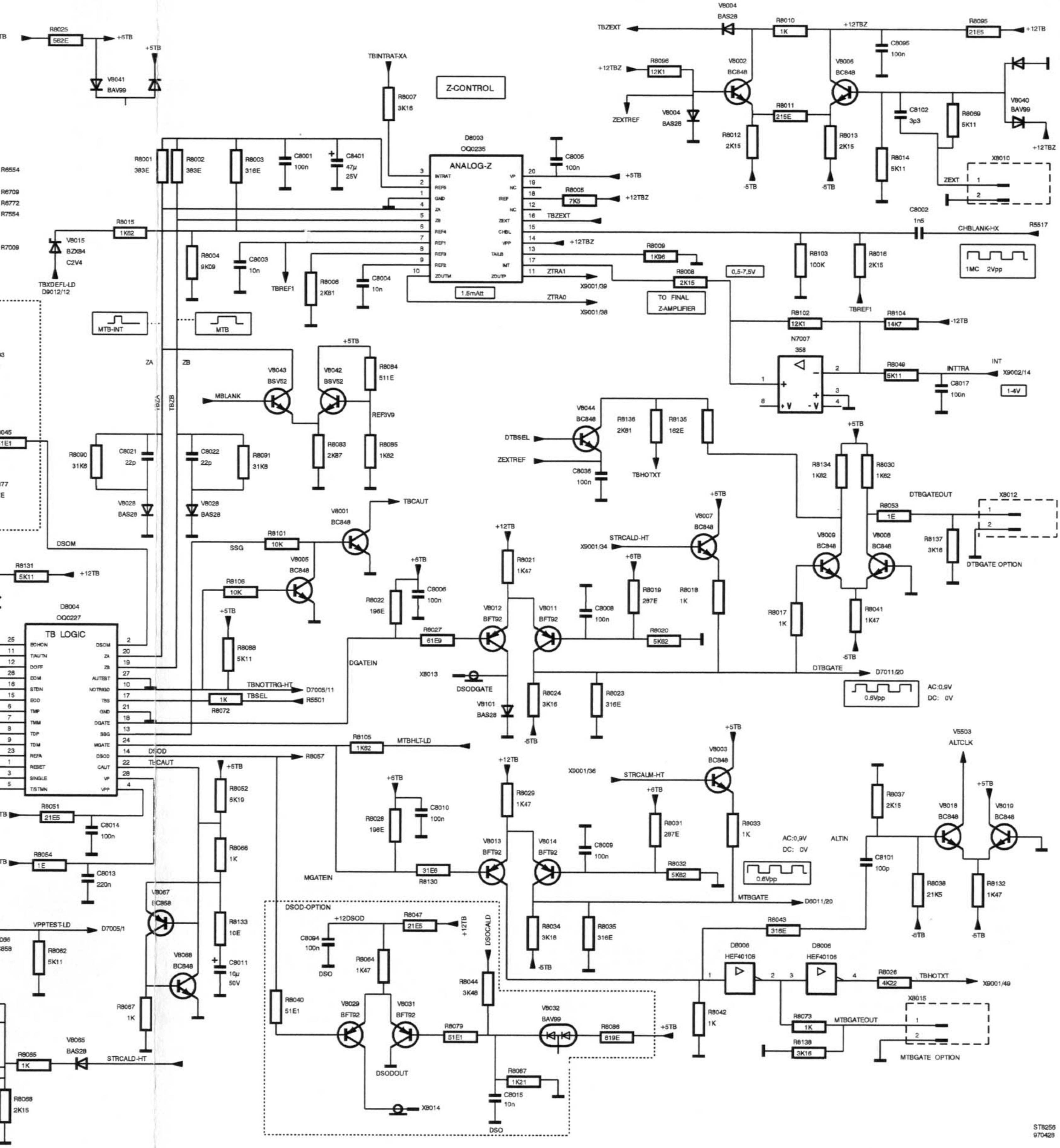
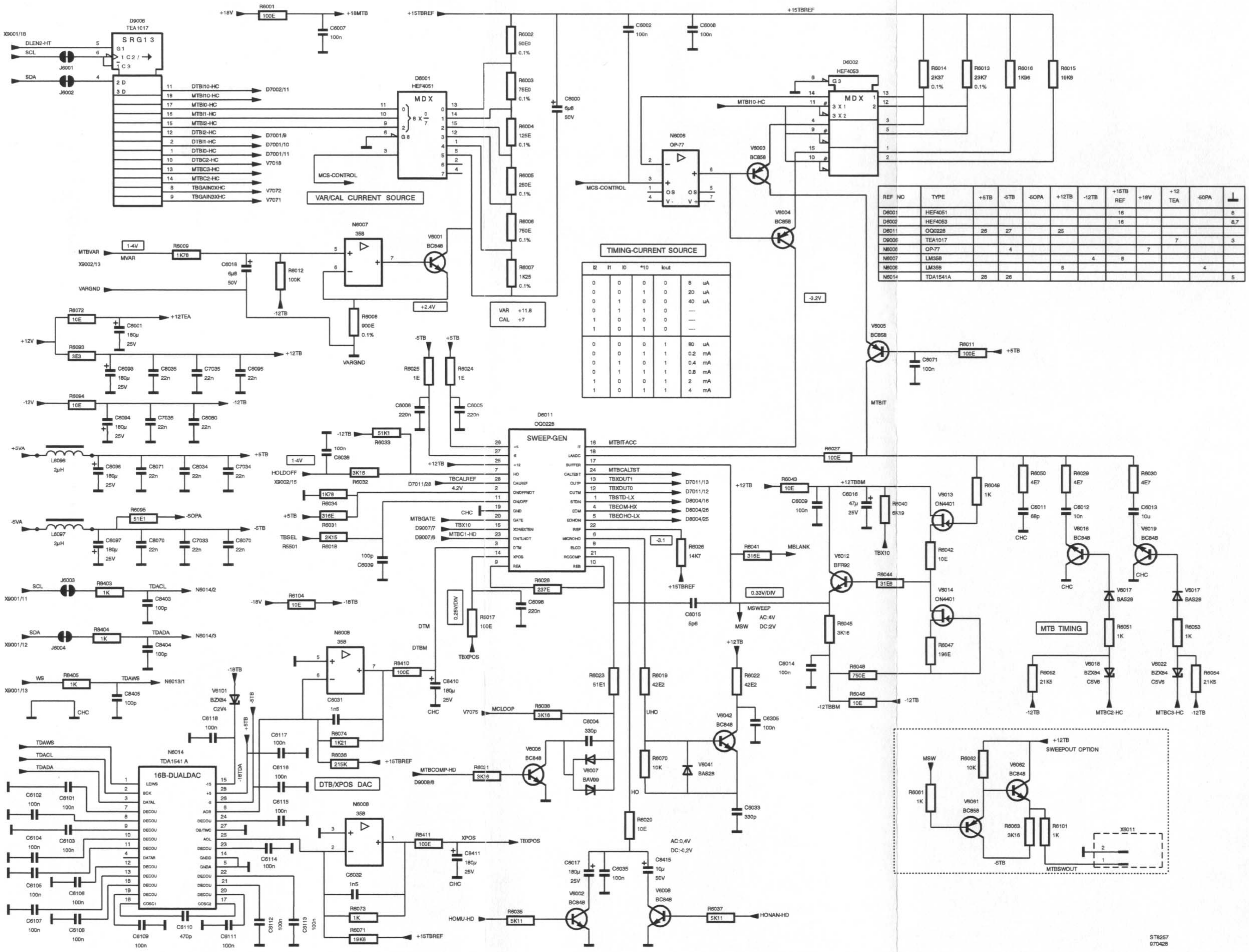


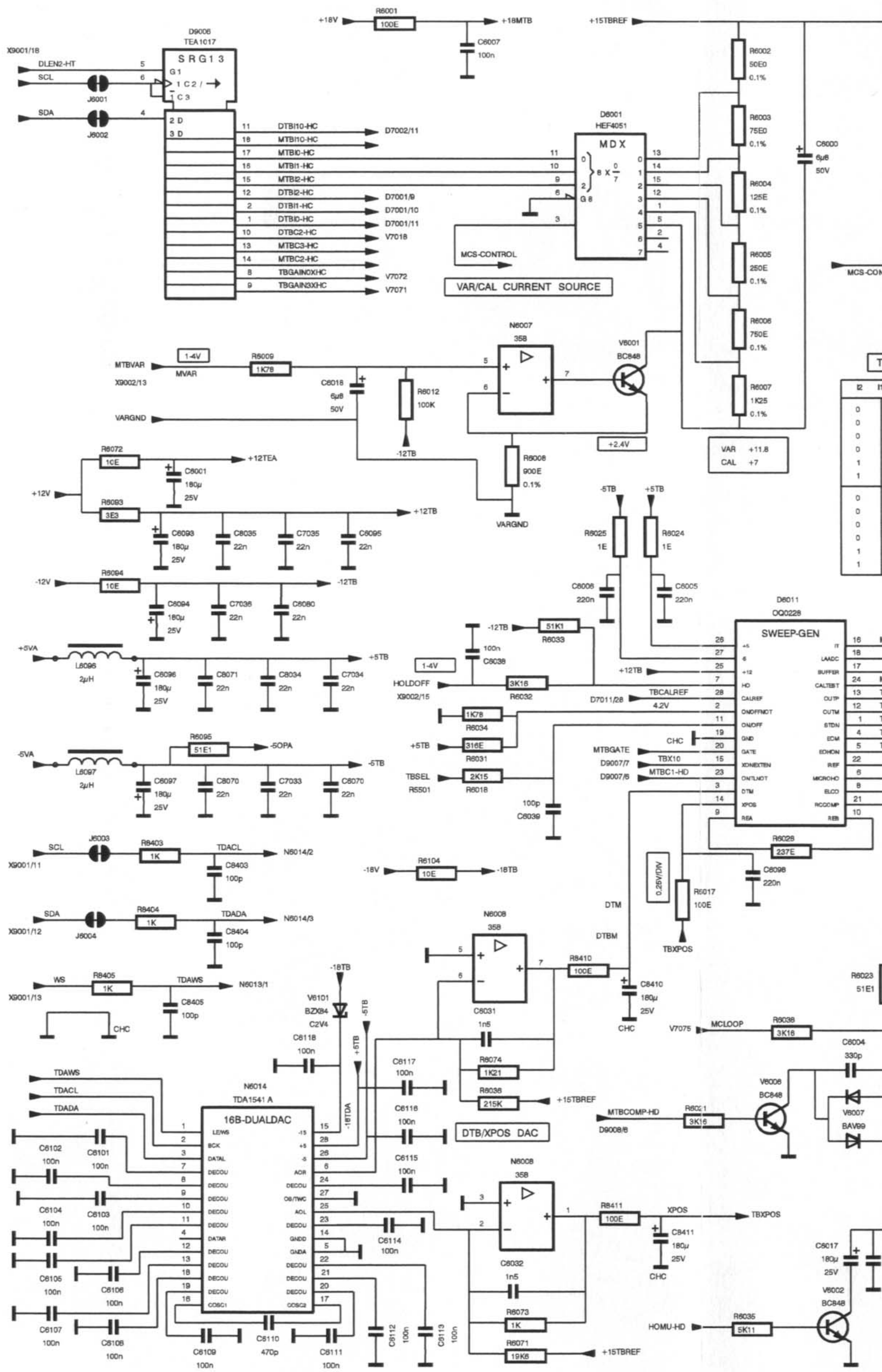
Diagram 15 - Time base logic

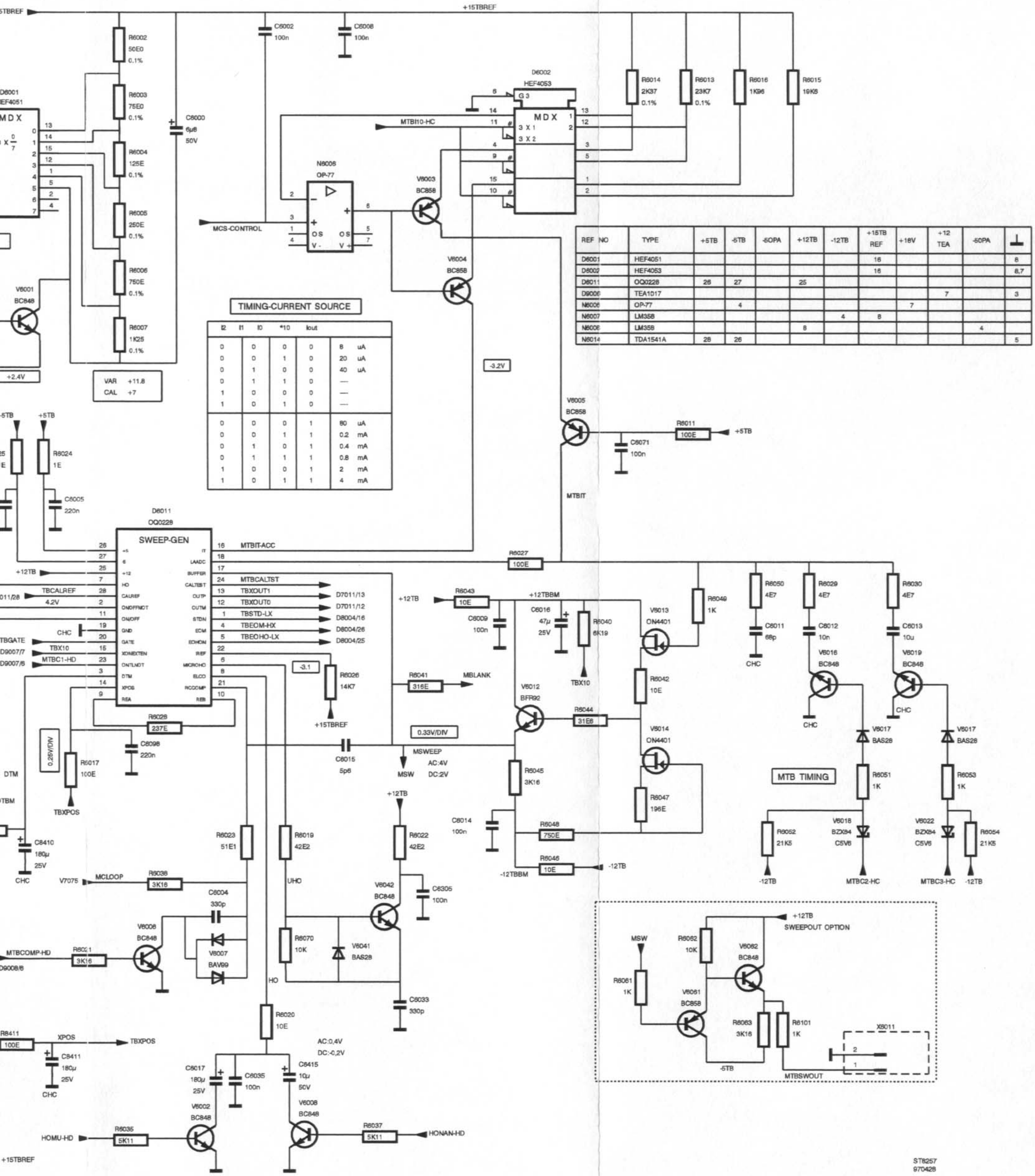


I2	I1	I0	*10	Iout
0	0	0	0	8 uA
0	0	1	0	20 uA
0	1	0	0	40 uA
0	1	1	0	—
1	0	0	0	—
1	0	1	0	—
0	0	0	1	80 uA
0	0	1	1	0.2 mA
0	1	0	1	0.4 mA
0	1	1	1	0.8 mA
1	0	0	1	2 mA
1	0	1	1	4 mA

REF NO	TYPE	+5TB	-5TB	-5OPA	+12TB	-12TB	+15TB REF	+18V	+12 TEA	-50PA	⊥
D6001	HEF4051						16				8
D6002	HEF4053						16				8,7
D6011	OQ0228	26	27		25						
D9006	TEA1017								7		3
N6006	OP-77		4					7			
N6007	LM358					4	8				
N6008	LM358				8					4	
N6014	TDA1541A	28	26								5

Diagram 16 - Main time base


D9006
TEA1017
SRG13
D6001
HEF4051
MDX
MCS-CONTROL
VAR/CAL CURRENT SOURCE
VAR +11.8
CAL +7
N6007
358
V6001
BC848
MTBVAR
MVAR
VARGND
HOLDOFF
TBCALREF
TBSEL
D6011
OQ0228
SWEEP-GEN
N6008
358
N6014
TDA1541 A
16B-DUALDAC
DTB/XPOS DAC
V6101
BZX84
C2V4
TDAWS
TDACL
TDADA
MTBGATE
MTBCOMP-HD
HOMU-HD
MCLOOP
XPOS
TBXPOS
V6006
BC848
V6007
BAV99
V6002
BC848

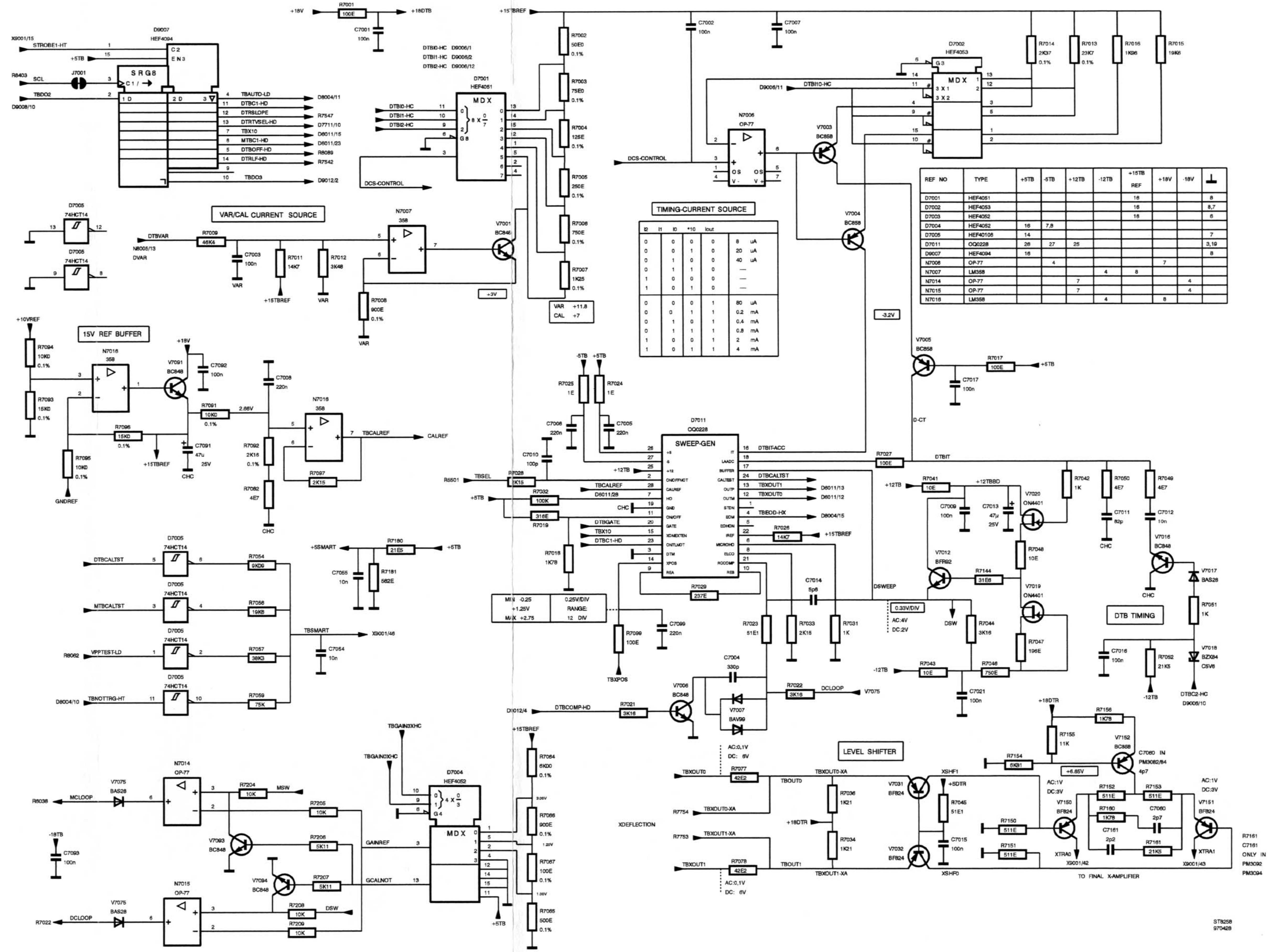


TIMING-CURRENT SOURCE

I2	I1	I0	*10	Iout	
0	0	0	0	8	uA
0	0	1	0	20	uA
0	1	0	0	40	uA
0	1	1	0	—	
1	0	0	0	—	
1	0	1	0	—	
0	0	0	1	80	uA
0	0	1	1	0.2	mA
0	1	0	1	0.4	mA
0	1	1	1	0.8	mA
1	0	0	1	2	mA
1	0	1	1	4	mA

REF NO	TYPE	+5TB	-5TB	-5OPA	+12TB	-12TB	+15TB REF	+18V	+12 TEA	-50PA	⊥
D6001	HEF4051						16				8
D6002	HEF4053						16				8,7
D6011	OQ0228	26	27		25						
D9006	TEA1017								7		3
N6006	OP-77		4					7			
N6007	LM358					4	8				
N6008	LM358				8					4	
N6014	TDA1541A	28	26								5

Diagram 16 - Main time base

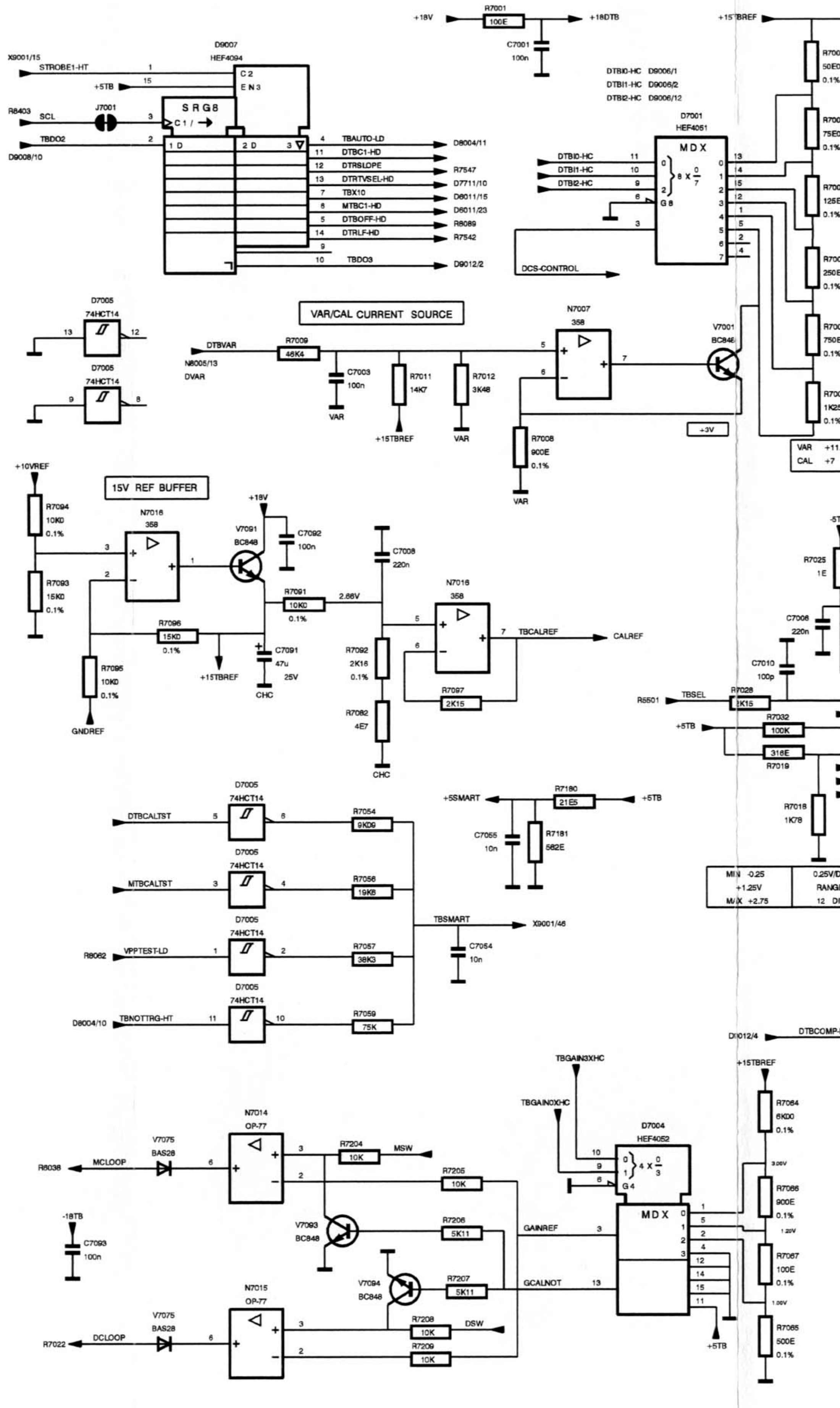


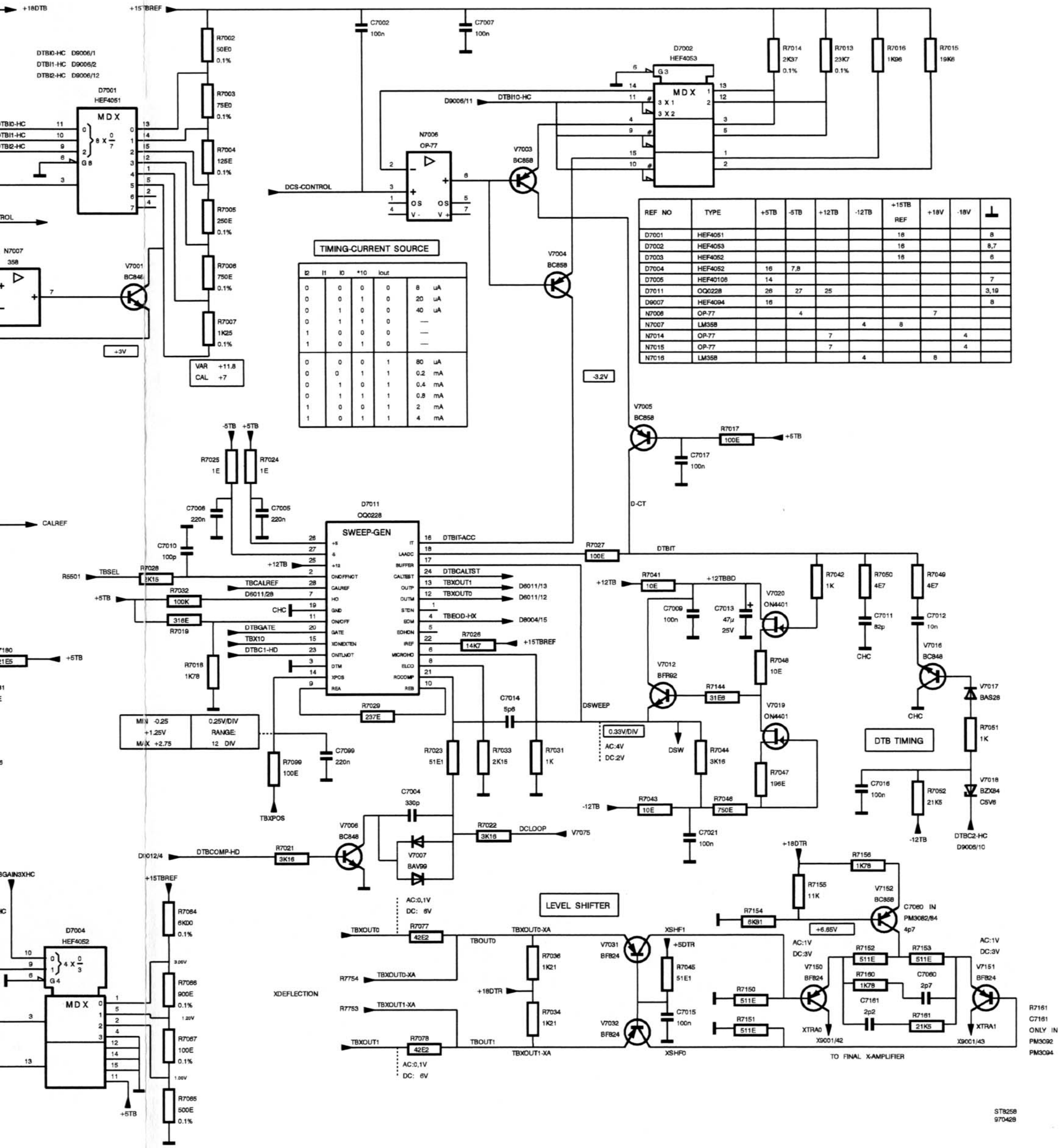
REF NO	TYPE	+5TB	-5TB	+12TB	-12TB	+15TB REF	+18V	-18V	⊥
D7001	HEF4051					16			8
D7002	HEF4053					16			8,7
D7003	HEF4052					16			6
D7004	HEF4052	16	7,8						
D7005	HEF40106	14							7
D7011	OQ0228	26	27	25					3,19
D9007	HEF4094	16							8
N7006	OP-77		4				7		
N7007	LM358				4	8			
N7014	OP-77			7				4	
N7015	OP-77			7				4	
N7016	LM358				4		8		

TIMING-CURRENT SOURCE

I2	I1	I0	*10	Iout
0	0	0	0	8 uA
0	0	1	0	20 uA
0	1	0	0	40 uA
0	1	1	0	—
1	0	0	0	—
1	0	1	0	—
0	0	0	1	80 uA
0	0	1	1	0.2 mA
0	1	0	1	0.4 mA
0	1	1	1	0.8 mA
1	0	0	1	2 mA
1	0	1	1	4 mA

Diagram 17 - Delayed time base


VAR/CAL CURRENT SOURCE
15V REF BUFFER
D9007
HEF4094
SRG8
D7001
HEF4051
MDX
N7007
358
V7001
BC848
D7005
74HCT14
N7016
358
V7091
BC848
N7018
358
TBCALREF
CALREF
DTBVAR
N8005/13
DVAR
STROBE1-HT
X9001/15
SCL
R8403
TBDO2
D9008/10
TBAUTO-LD
DTBC1-HD
DTRSLOPE
DTRTVSEL-HD
TBX10
MTBC1-HD
DTBOFF-HD
DTRLF-HD
TBDO3
DCS-CONTROL
TBSMART
X9001/46
DTBCALTST
MTBCALTST
VPPTEST-LD
TBNOTTRG-HT
+5SMART
N7014
OP-77
N7015
OP-77
MCLOOP
DCLOOP
MSW
DSW
GAINREF
GCALNOT
D7004
HEF4052
TBGAIN3XHC
TBGAIN0XHC
DTBCOMP
+15TBREF
+10VREF
GNDREF
+18V
+18DTB
+5TB
-18TB



TIMING-CURRENT SOURCE

I2	I1	I0	*10	Iout
0	0	0	0	8 uA
0	0	1	0	20 uA
0	1	0	0	40 uA
0	1	1	0	—
1	0	0	0	—
1	0	1	0	—
0	0	0	1	80 uA
0	0	1	1	0.2 mA
0	1	0	1	0.4 mA
0	1	1	1	0.8 mA
1	0	0	1	2 mA
1	0	1	1	4 mA

REF NO	TYPE	+5TB	-5TB	+12TB	-12TB	+15TB REF	+18V	-18V	⊥
D7001	HEF4051					16			8
D7002	HEF4053					16			8,7
D7003	HEF4052					16			6
D7004	HEF4052	16	7,8						
D7005	HEF40106	14							7
D7011	OQ0228	26	27	25					3,19
D9007	HEF4094	16							8
N7006	OP-77		4				7		
N7007	LM358				4	8			
N7014	OP-77			7				4	
N7015	OP-77			7				4	
N7016	LM358				4		8		

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Diagram 17 - Delayed time base

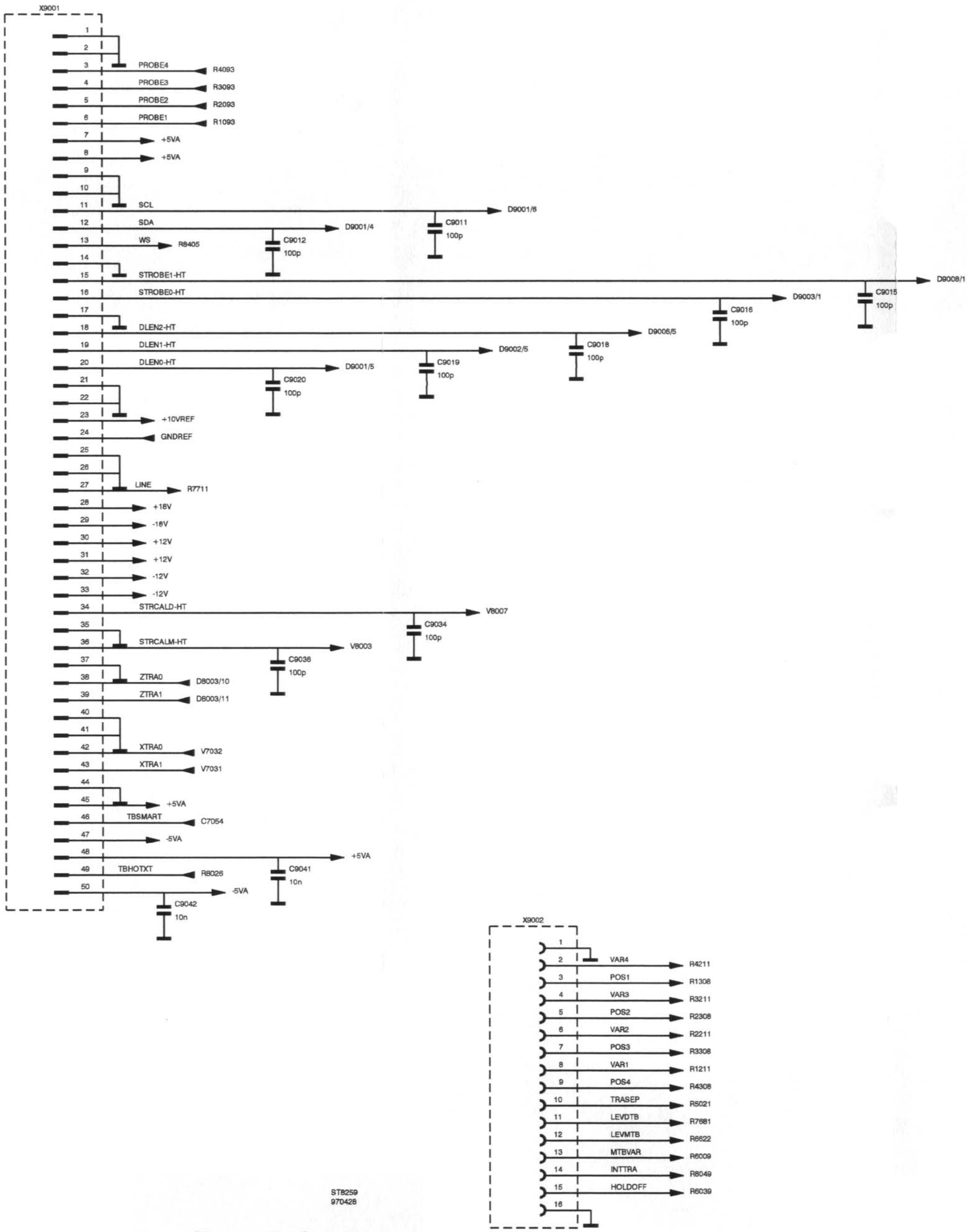


Diagram 18 - Connectors

5.1.6 Parts list

MECHANICAL

Item	Description		Ordering code
A1	BOARD,PRINTED	SIGNAL UNIT 94	5322 214 90724
A1	BOARD,PRINTED	SIGNAL UNIT 92	5322 214 91027
A1	BOARD,PRINTED	SIGNAL UNIT 82	5322 214 90896
A1	BOARD,PRINTED	SIGNAL UNIT 84	5322 214 90898
0002	SPECIAL NVT	FOR BNC	5322 506 41006
0003	RING	BNC SPACER	5322 532 21188
0004	HOLDER	BNC HOLDER	5322 256 91792
0005	PLATE	SCREENING PARTITION	5322 466 83049
0006	PIN	CALIBRATION PIN	5322 535 93244
0007	BRACKET	SOLDERING BRACKET	5322 401 11419
0008	SPRING	INDICATION SPRING	5322 492 70939
0010	SHIELD	SCREENING CAP 2	5322 466 30404
0011	SHIELD	SCREENING CAP 1	5322 466 30405
0012	SCREENING	SCREENING PLATE	5322 466 83051
0014	CAP	BNC ISOLATOR	5322 462 41847
0017	CAP,PROTECT.	SCREENING CAP C	5322 447 70131

CAPACITORS

Item	Description		Ordering code
C1000	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C1001	CAP.FOIL	AP 400V 10% 22NF	5322 121 70399
C1002	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1003	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C1004	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C1006	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C1007	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C1008	CAP.CHIP	AP 63V 0.25PF 3.3PF	5322 122 32286
C1011	CAP.CHIP	AP 63V 5% 33PF	5322 122 32659
C1012	CAP.CHIP	AP 63V 5% 27PF	5322 122 31946
C1014	CAP.CHIP	AP 63V 0.5PF 5.6PF	5322 122 32967
C1018	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1019	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1020	CAP.CERAMIC	500V 0.25PF 2.2PF	5322 122 32774
C1021	CAP.CERAMIC	500V 10% 1NF	4822 122 31175
C1022	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269
C1023	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C1025	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1027	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1031	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1041	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1042	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1044	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1045	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C1046	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1047	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1048	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098

Item	Description		Ordering code
C1051	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1054	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1055	CAP.CHIP	AP 63V 0.25PF 2P7	5322 122 31873
C1056	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C1057	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C1058	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C1059	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C1060	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C1061	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1062	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1063	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1064	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1066	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1067	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1068	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1069	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1071	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1072	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1076	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1077	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1082	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1085	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1086	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1087	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1088	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1101	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1102	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1151	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1153	CAP.CHIP	AP 63V 10% 1.5NF	5322 122 31865
C1156	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1157	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1158	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1159	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1201	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1204	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1205	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C1208	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1209	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1210	CAP.CERAMIC	AP 63V 5% 47PF	5322 122 32452
C1211	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1250	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1251	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1252	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1253	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1254	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1301	CAP.CERAMIC	AP 63V 5% 47PF	5322 122 32452
C1302	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1303	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C1304	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C1305	CAP.CERAMIC	AP 63V 0.25PF 1.8PF	5322 126 10343

Item	Description		Ordering code
C1611	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1651	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C1652	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1653	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C1654	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1656	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C1657	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1658	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C1659	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1661	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1662	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1668	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1669	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1901	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1903	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1904	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1906	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1931	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C1932	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C2000	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C2001	CAP.FOIL	400V 10% 22NF	5322 121 70399
C2002	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2003	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C2004	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C2006	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C2007	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C2008	CAP.CHIP	AP 63V 0.25PF 3.3PF	5322 122 32286
C2011	CAP.CHIP	AP 63V 5% 33PF	5322 122 32659
C2012	CAP.CHIP	AP 63V 5% 27PF	5322 122 31946
C2014	CAP.CHIP	AP 63V 0.5PF 5.6PF	5322 122 32967
C2018	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2019	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2020	CAP.CERAMIC	500V 0.25PF 2.2PF	5322 122 32774
C2021	CAP.CERAMIC	500V 10% 1NF	4822 122 31175
C2022	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269
C2023	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C2025	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2027	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2031	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2041	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2042	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2044	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2045	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C2046	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2047	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2048	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2051	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2054	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2055	CAP.CHIP	AP 63V 0.25PF 2P7	5322 122 31873
C2056	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448

Item	Description		Ordering code
C2057	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C2058	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C2059	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C2060	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C2061	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2062	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2063	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2064	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2066	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2067	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2068	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2069	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2071	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2072	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2076	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2077	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2085	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C2086	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2087	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C2088	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2101	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2102	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2201	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2204	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2205	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C2208	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2209	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2210	CAP.CERAMIC	AP 63V 5% 47PF	5322 122 32452
C2211	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2301	CAP.CERAMIC	AP 63V 5% 47PF	5322 122 32452
C2302	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2303	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C2304	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C2305	CAP.CERAMIC	AP 63V 0.25PF 1.8PF	5322 126 10343
C3000	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C3001	CAP.FOIL	400V 10% 22NF	5322 121 70399
C3002	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3003	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C3004	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C3006	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C3007	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C3008	CAP.CHIP	AP 63V 0.25PF 3.3PF	5322 122 32286
C3011	CAP.CHIP	AP 63V 5% 33PF	5322 122 32659
C3012	CAP.CHIP	AP 63V 5% 27PF	5322 122 31946
C3014	CAP.CHIP	AP 63V 0.5PF 5.6PF	5322 122 32967
C3018	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3019	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3020	CAP.CERAMIC	500V 0.25PF 2.2PF	5322 122 32774
C3021	CAP.CERAMIC	500V 10% 1NF	4822 122 31175
C3022	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269

Item	Description		Ordering code
C3023	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C3025	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3027	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3031	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3041	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3042	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3044	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3045	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C3046	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3047	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3048	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3051	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3054	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3055	CAP.CHIP	AP 63V 0.25PF 2P7	5322 122 31873
C3056	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C3057	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C3058	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C3059	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C3060	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C3061	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3062	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3063	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3064	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3066	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3067	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3068	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3069	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3071	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3072	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3076	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3077	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3085	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C3086	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3087	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C3088	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3101	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3102	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3201	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3204	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3205	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C3208	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3209	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3210	CAP.CERAMIC	AP 63V 5% 47PF	5322 122 32452
C3211	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3301	CAP.CERAMIC	AP 63V 5% 47PF	5322 122 32452
C3302	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3303	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C3304	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C3305	CAP.CERAMIC	AP 63V 0.25PF 1.8PF	5322 126 10343
C4000	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188

Item	Description		Ordering code
C4001	CAP.FOIL	400V 10% 22NF	5322 121 70399
C4002	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C4003	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C4004	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C4006	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C4007	CAP.CERAMIC	500V 0.25PF 3.3PF	4822 122 31188
C4008	CAP.CHIP	AP 63V 0.25PF 3.3PF	5322 122 32286
C4011	CAP.CHIP	AP 63V 5% 33PF	5322 122 32659
C4012	CAP.CHIP	AP 63V 5% 27PF	5322 122 31946
C4014	CAP.CHIP	AP 63V 0.5PF 5.6PF	5322 122 32967
C4018	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4019	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4020	CAP.CERAMIC	500V 0.25PF 2.2PF	5322 122 32774
C4021	CAP.CERAMIC	500V 10% 1NF	4822 122 31175
C4022	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269
C4023	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C4025	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C4027	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4031	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4041	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C4042	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4044	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4045	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C4046	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4047	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4048	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4051	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4054	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4055	CAP.CHIP	AP 63V 0.25PF 2P7	5322 122 31873
C4056	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C4057	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C4058	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C4059	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C4060	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C4061	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4062	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4063	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4064	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4066	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4067	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4068	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4069	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4071	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4072	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4076	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4077	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4085	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C4086	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4087	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C4088	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098

Item	Description		Ordering code
C4101	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4102	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4201	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4204	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C4205	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C4208	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4209	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4210	CAP.CERAMIC	AP 63V 5% 47PF	5322 122 32452
C4211	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C4301	CAP.CERAMIC	AP 63V 5% 47PF	5322 122 32452
C4302	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4303	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C4304	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C4305	CAP.CERAMIC	AP 63V 0.25PF 1.8PF	5322 126 10343
C5000	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C5001	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C5002	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5003	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5004	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5005	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5006	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5007	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5008	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5010	CAP.CERAMIC	AP 63V 0.5PF 5.6PF	5322 122 32967
C5012	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C5015	CAP.CHIP	AP 63V 5% 330PF	5322 122 31863
C5016	CAP.CHIP (100 MHz)	AP 63V 10% 6.8PF	5322 122 32269
C5016	CAP.CHIP (200 MHz)	AP 63V 10% 2.2NF	4822 122 33127
C5017	CAP.CERAMIC	AP 63V 0.25PF 0.56PF	5322 122 33083
C5018	CAP.CERAMIC	AP 63V 0.25PF 0.56PF	5322 122 33083
C5501	CAP.CHIP	AP 63V 5% 820PF	5322 126 10184
C5502	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C5503	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5504	CAP.CHIP	AP 63V 5% 22PF	5322 122 32658
C5505	CAP.CHIP	AP 63V 5% 820PF	5322 126 10184
C5506	CAP.CHIP	AP 63V 10% 1.5NF	5322 122 31865
C5507	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C5508	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C5509	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C5510	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C5511	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C5513	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C5514	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C5601	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C5602	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C5603	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C5604	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6000	CAP.FOIL	50V 20% 6.8UF	5322 124 42389
C6001	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C6002	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496

Item	Description		Ordering code
C6004	CAP.CHIP	AP 63V 5% 330PF	5322 122 31863
C6005	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C6006	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C6007	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6008	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6009	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6011	CAP.FOIL	630V 1% 68PF	5322 121 70127
C6012	CAP.FOIL	63V 5% 10NF	5322 121 70116
C6013	CAP.ELECTROLYT.	100V 10% 10UF	5322 124 20164
C6014	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6015	CAP.CERAMIC	AP 63V 0.5PF 5.6PF	5322 122 32967
C6016	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C6017	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C6018	CAP.FOIL	50V 20% 6.8UF	5322 124 42389
C6031	CAP.CHIP	AP 63V 10% 1.5NF	5322 122 31865
C6032	CAP.CHIP	AP 63V 10% 1.5NF	5322 122 31865
C6033	CAP.CHIP	AP 63V 5% 330PF	5322 122 31863
C6035	CAP.FOIL	63V 10% 100NF	5322 121 42386
C6038	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6039	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C6070	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C6071	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6080	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C6093	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C6094	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C6095	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C6096	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C6097	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C6098	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C6101	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6102	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6103	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6104	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6105	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6106	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6107	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6108	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6109	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6110	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C6111	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6112	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6113	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6114	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6115	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6116	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6117	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6118	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6305	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6415	CAP.ELECTROLYT.	50V 20% 10UF	5322 124 21731
C6504	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098

Item	Description		Ordering code
C6549	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C6551	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C6557	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6559	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C6561	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C6562	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C6581	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6583	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269
C6617	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C6623	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6624	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6639	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C6642	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C6644	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C6647	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C6648	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6649	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6707	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6751	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C6758	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C6768	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6773	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6777	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6779	CAP.CHIP	AP 63V 5% 22PF	5322 122 32658
C6787	CAP.CHIP	AP 63V 5% 820PF	5322 126 10184
C6902	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C6903	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6904	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6912	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C6913	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6922	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C6923	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6924	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6932	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C6933	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6934	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6942	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C6943	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C6953	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C6962	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C6963	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7001	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7002	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7003	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7004	CAP.CHIP	AP 63V 5% 330PF	5322 122 31863
C7005	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C7006	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C7007	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7008	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C7009	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496

Item	Description		Ordering code
C7010	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C7011	CAP.FOIL	630V 1% 82PF	5322 121 70498
C7012	CAP.FOIL	63V 5% 10NF	5322 121 70116
C7013	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C7014	CAP.CERAMIC	AP 63V 0.5PF 5.6PF	5322 122 32967
C7015	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7016	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7017	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7021	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7033	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C7034	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C7035	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C7036	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C7054	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7055	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7060	CAP.CERAMIC	AP 63V 0.25PF 2.7PF	5322 122 31873
C7091	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C7092	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7093	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C7099	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C7161	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C7504	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7513	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7549	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C7551	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C7557	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7559	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C7561	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C7562	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C7581	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7583	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269
C7682	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C7697	CAP.CHIP	AP 63V 5% 33PF	5322 122 32659
C7751	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C7813	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7902	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C7903	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7904	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7912	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C7913	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7923	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7932	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C7933	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7934	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7942	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C7943	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C7962	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C7963	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C8000	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8001	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496

Item	Description		Ordering code
C8002	CAP.CHIP	AP 63V 10% 1.5NF	5322 122 31865
C8003	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C8004	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C8005	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8006	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8007	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8008	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8009	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8010	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8011	CAP.ELECTROLYT.	50V 20% 10UF	5322 124 21731
C8013	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C8014	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8015	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C8016	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C8017	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8020	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8021	CAP.CHIP	AP 63V 5% 22PF	5322 122 32658
C8022	CAP.CHIP	AP 63V 5% 22PF	5322 122 32658
C8034	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C8035	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C8036	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8060	CAP.CERAMIC	AP 63V 0.25PF 0.56PF	5322 122 33083
C8062	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C8063	CAP.CHIP	AP 63V 5% 22PF	5322 122 32658
C8064	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C8065	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C8066	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C8070	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C8071	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C8093	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8094	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8095	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C8101	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C8102	CAP.CHIP	AP 63V 0.25PF 3.3PF	5322 122 32286
C8401	CAP.ELECTROLYT.	25V 20% 47UF	5322 121 10472
C8403	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C8404	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C8405	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C8410	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C8411	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C9011	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9012	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9015	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9016	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9018	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9019	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9020	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9034	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9036	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C9041	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C9042	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098

Item	Description		Ordering code

DIGITAL INTEGRATED CIRCUITS

D1151	INTEGR.CIRCUIT	CD4053BCM NSC	5322 209 33502
D1152	INTEGR.CIRCUIT	HEF4051BT PEL	5322 209 11446
D1201	INTEGR.CIRCUIT	OQ0224 INPUT CIRCUIT	5322 209 12457
D1301	INTEGR.CIRCUIT	OQ0225 OUTPUT CIRC.	5322 209 12458
D2201	INTEGR.CIRCUIT	OQ0224 INPUT CIRCUIT	5322 209 12457
D2301	INTEGR.CIRCUIT	OQ0225 OUTPUT CIRC.	5322 209 12458
D3201	INTEGR.CIRCUIT	OQ0224 INPUT CIRCUIT	5322 209 12457
D3301	INTEGR.CIRCUIT	OQ0225 OUTPUT CIRC.	5322 209 12458
D4201	INTEGR.CIRCUIT	OQ0224 INPUT CIRCUIT	5322 209 12457
D4301	INTEGR.CIRCUIT	OQ0225 OUTPUT CIRC.	5322 209 12458
D5001	INTEGR.CIRCUIT	HEF4066BT PEL	5322 209 14542
D5501	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D5502	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D5503	INTEGR.CIRCUIT	HEF4081BT PEL	5322 209 14483
D6001	INTEGR.CIRCUIT	HEF4051BT PEL	5322 209 11446
D6002	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D6011	INTEGR.CIRCUIT	OQ0228 SAWCHIP	5322 209 12466
D6541	INTEGR.CIRCUIT	OQ0226 TRIGGER AMPL.	5322 209 12464
D6621	INTEGR.CIRCUIT	OQ0128 SSP	5322 209 82925
D6779	INTEGR.CIRCUIT	PC74HCT112T PEL	5322 209 11825
D6781	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D7001	INTEGR.CIRCUIT	HEF4051BT PEL	5322 209 11446
D7002	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D7004	INTEGR.CIRCUIT	HEF4052BT PEL	5322 209 11102
D7005	INTEGR.CIRCUIT	PC74HCT14T PEL	5322 209 71568
D7011	INTEGR.CIRCUIT	OQ0228 SAWCHIP	5322 209 12466
D7541	INTEGR.CIRCUIT	OQ0226 TRIGGER AMPL.	5322 209 12464
D7711	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D8003	INTEGR.CIRCUIT	OQ0235 Z-LOGIC	5322 209 12461
D8004	INTEGR.CIRCUIT	OQ0227 TIMEBASE LOG.	5322 209 12465
D8006	INTEGR.CIRCUIT	HEF40106BT PEL	5322 209 14486
D9001	INTEGR.CIRCUIT	TEA1017/N9 PEL	5322 209 60191
D9002	INTEGR.CIRCUIT	TEA1017/N9 PEL	5322 209 60191
D9003	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D9004	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D9006	INTEGR.CIRCUIT	TEA1017/N9 PEL	5322 209 60191
D9007	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D9008	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D9009	INTEGR.CIRCUIT	OQ0200 DISPL.MODE LO	5322 209 82924
D9011	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D9012	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D9013	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306

Item	Description		Ordering code
RELAIS			
K1001	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K1002	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K1003	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K1004	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K1006	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K2001	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K2002	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K2003	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K2004	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K2006	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K3001	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K3002	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K3003	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K3004	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K3006	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K4001	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K4002	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K4003	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K4004	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
K4006	RELAY	DPDT RELAIS RAL3W-K	5322 280 80745
COILS			
L1001	COIL	0.056UH 5% TDK	5322 157 63381
L1301	COIL	0.1UH 5% TDK	5322 157 63647
L2001	COIL	0.056UH 5% TDK	5322 157 63381
L2301	COIL	0.1UH 5% TDK	5322 157 63647
L3001	COIL	0.056UH 5% TDK	5322 157 63381
L3301	COIL	0.1UH 5% TDK	5322 157 63647
L4001	COIL	0.056UH 5% TDK	5322 157 63381
L4301	COIL	0.1UH 5% TDK	5322 157 63647
L6096	COIL	2.0UH TDK	4822 157 51757
L6097	COIL	2.0UH TDK	4822 157 51757
ANALOG INTEGRATED CIRCUITS			
N1001	INTEGR.CIRCUIT	AD548JR AND	5322 209 31298
N1101	INTEGR.CIRCUIT	LM339D SIG	5322 209 70684
N1102	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N1103	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N1104	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N1202	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N1251	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N2001	INTEGR.CIRCUIT	AD548JR AND	5322 209 31298
N2202	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N3001	INTEGR.CIRCUIT	AD548JR AND	5322 209 31298
N3102	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N3103	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N3202	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N4001	INTEGR.CIRCUIT	AD548JR AND	5322 209 31298
N4202	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473

Item	Description		Ordering code
N5001	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N5002	INTEGR.CIRCUIT	LM3046M NSC	5322 209 30229
N6006	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N6007	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N6008	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N6014	INTEGR.CIRCUIT	TDA1541A/N2 PEL	4822 209 72544
N6771	INTEGR.CIRCUIT	LM1881M NSC	4822 209 60767
N7006	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N7007	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N7014	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N7015	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N7016	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N7952	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N8005	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N9001	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N9002	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N9003	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N9004	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233

RESISTORS

R1001	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R1002	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R1006	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R1007	RES.METAL FILM	ST MRS25 1% 100E	4822 050 21001
R1008	RES.METAL FILM	PR24 1/4W 0.1% 9K4	5322 116 83712
R1009	RES.METAL FILM	PR24 1/4W 0.1% 300E	5322 116 51814
R1010	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R1011	RES.N.T.C.	NTC 640 2% 3K3	5322 116 30421
R1012	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1013	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R1014	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1016	RES.METAL FILM	PR34 0.4W 0.1% 900K	5322 116 51832
R1019	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1021	RES.METAL FILM	PR34 0.4W 0.1% 990K	5322 116 83104
R1022	RES.CHIP	RMC1/8 1% 23E7	5322 117 10591
R1023	RES.METAL FILM	PR24 1/4W 0.1% 11K1	5322 116 83101
R1024	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R1026	RES.CHIP	RMC1/8 1% 82E5	5322 111 92017
R1027	RES.METAL FILM	PR24 1/4W 0.1% 111K	5322 116 83099
R1028	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1029	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1030	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R1031	RES.METAL FILM	PR34 0.4W 0.1% 500K	5322 116 83103
R1032	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R1033	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R1034	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R1035	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1036	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1037	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R1038	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543

Item	Description		Ordering code
R1039	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R1041	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R1042	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R1043	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1044	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1045	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1046	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R1047	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R1048	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R1049	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R1052	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1053	RES.METAL FILM	HIP RC-02H 1% 6K19	5322 117 10577
R1054	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1056	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R1057	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R1061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R1062	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R1063	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R1064	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R1065	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R1071	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R1072	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R1073	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1074	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R1076	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1077	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1078	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R1079	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R1081	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1082	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1083	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1084	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1085	RES.CHIP	HIP RC-02H 1% 13K3	4822 051 51333
R1086	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1087	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R1088	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1092	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R1093	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1094	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R1095	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1096	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R1097	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R1101	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R1102	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R1103	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R1104	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1106	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1112	RES.METAL FILM	HIP RC-02H 1% 61K9	5322 117 10578
R1113	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R1114	RES.CHIP	HIP RC-02H 1% 3K48	5322 117 10557

Item	Description		Ordering code
R1141	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1151	RES.METAL FILM	HIP RC-02H 1% 61K9	5322 117 10578
R1152	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R1153	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R1154	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1155	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1156	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R1157	RES.METAL FILM	PR24 1/4W 0.1% 9K4	5322 116 83712
R1158	RES.METAL FILM	PR24 1/4W 0.1% 750E	5322 116 53173
R1159	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R1192	RES.METAL FILM	PR24 1/4W 0.1% 1K25	5322 116 53177
R1193	RES.METAL FILM	PR24 1/4W 0.1% 750E	5322 116 53173
R1194	RES.METAL FILM	PR24 1/4W 0.1% 250E	5322 116 53166
R1195	RES.METAL FILM	PR24 1/4W 0.1% 125E	5322 116 53176
R1196	RES.METAL FILM	PR24 1/4W 0.1% 75E	5322 116 53168
R1197	RES.METAL FILM	PR24 1/4W 0.1% 50E	5322 116 53165
R1200	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1201	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R1202	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R1203	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R1204	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R1205	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R1206	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1207	RES.CHIP	HIP RC-02H 1% 215E	5322 117 10484
R1208	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R1209	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1210	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R1211	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R1212	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R1213	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R1214	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R1215	RES.METAL FILM	HIP RC-02H 1% 348E	5322 117 10556
R1216	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1217	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1218	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R1220	RES.METAL FILM	HIP RC-02H 1% 75K	5322 117 10584
R1222	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R1223	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R1224	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R1226	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R1227	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R1228	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R1229	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1231	RES.METAL FILM	HIP RC-02H 1% 178E	5322 117 10534
R1251	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R1252	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R1253	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R1254	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R1256	RES.METAL FILM	HIP RC-02H 1% 9K09	5322 117 10589
R1257	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102

Item	Description		Ordering code
R1258	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R1259	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R1260	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R1262	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1266	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1301	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R1302	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R1303	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R1304	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R1306	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1307	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R1308	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R1309	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R1310	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R1311	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R1312	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1313	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R1314	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R1612	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R1613	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R1651	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R1652	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R1653	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1654	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1656	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R1657	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R1661	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1662	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1663	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1901	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1902	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1903	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1904	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1906	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1911	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1912	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1913	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1914	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1921	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1922	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1923	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1924	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1926	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1927	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1928	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1929	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1951	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1961	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2001	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R2002	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105

Item	Description		Ordering code
R2006	RES.METAL FILM	ST MRS25 1% 100E	4822 050 21001
R2007	RES.METAL FILM	ST MRS25 1% 100E	4822 050 21001
R2008	RES.METAL FILM	PR24 1/4W 0.1% 9K4	5322 116 83712
R2009	RES.METAL FILM	PR24 1/4W 0.1% 300E	5322 116 51814
R2010	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2011	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R2012	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R2013	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2014	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2016	RES.METAL FILM	PR34 0.4W 0.1% 900K	5322 116 51832
R2019	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2021	RES.METAL FILM	PR34 0.4W 0.1% 990K	5322 116 83104
R2022	RES.CHIP	RMC1/8 1% 23E7	5322 117 10591
R2023	RES.METAL FILM	PR24 1/4W 0.1% 11K1	5322 116 83101
R2024	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R2026	RES.CHIP	RMC1/8 1% 82E5	5322 111 92017
R2027	RES.METAL FILM	PR24 1/4W 0.1% 111K	5322 116 83099
R2028	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2029	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2030	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2031	RES.METAL FILM	PR34 0.4W 0.1% 500K	5322 116 83103
R2032	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R2033	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R2034	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R2035	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2036	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R2037	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R2038	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2039	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R2041	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R2042	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R2043	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R2044	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R2045	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R2046	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R2047	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R2048	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R2049	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R2052	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2053	RES.METAL FILM	HIP RC-02H 1% 6K19	5322 117 10577
R2054	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2056	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R2057	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R2061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2062	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R2063	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R2064	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R2065	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R2071	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R2072	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526

Item	Description		Ordering code
R2073	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2074	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R2076	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2077	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2078	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R2079	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R2081	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2082	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2083	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R2084	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R2085	RES.CHIP	HIP RC-02H 1% 13K3	4822 051 51333
R2086	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2087	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R2088	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2092	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R2093	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2094	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R2096	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R2101	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R2102	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R2103	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R2104	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2106	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2112	RES.METAL FILM	HIP RC-02H 1% 61K9	5322 117 10578
R2113	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R2114	RES.CHIP	HIP RC-02H 1% 3K48	5322 117 10557
R2200	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2201	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R2202	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R2203	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R2204	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R2205	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R2206	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2207	RES.CHIP	HIP RC-02H 1% 215E	5322 117 10484
R2208	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R2209	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R2210	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R2211	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R2212	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R2213	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R2214	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R2215	RES.METAL FILM	HIP RC-02H 1% 348E	5322 117 10556
R2216	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2217	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2218	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2220	RES.METAL FILM	HIP RC-02H 1% 75K	5322 117 10584
R2222	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R2223	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R2224	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R2226	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529

Item	Description		Ordering code
R2227	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R2228	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R2229	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2231	RES.METAL FILM	HIP RC-02H 1% 178E	5322 117 10534
R2301	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2302	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2303	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R2304	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R2307	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R2308	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R2309	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R2310	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R2311	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R2313	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2314	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R3001	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R3002	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R3006	RES.METAL FILM	ST MRS25 1% 100E	4822 050 21001
R3007	RES.METAL FILM	ST MRS25 1% 100E	4822 050 21001
R3008	RES.METAL FILM	PR24 1/4W 0.1% 9K4	5322 116 83712
R3009	RES.METAL FILM	PR24 1/4W 0.1% 300E	5322 116 51814
R3010	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3011	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R3012	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R3013	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3014	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3016	RES.METAL FILM	PR34 0.4W 0.1% 900K	5322 116 51832
R3019	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3021	RES.METAL FILM	PR34 0.4W 0.1% 990K	5322 116 83104
R3022	RES.CHIP	RMC1/8 1% 23E7	5322 117 10591
R3023	RES.METAL FILM	PR24 1/4W 0.1% 11K1	5322 116 83101
R3024	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R3026	RES.CHIP	RMC1/8 1% 82E5	5322 111 92017
R3027	RES.METAL FILM	PR24 1/4W 0.1% 111K	5322 116 83099
R3028	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3029	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3030	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3031	RES.METAL FILM	PR34 0.4W 0.1% 500K	5322 116 83103
R3032	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R3033	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R3034	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R3035	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R3036	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3037	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R3038	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R3039	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R3041	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R3042	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R3043	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3044	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487

Item	Description		Ordering code
R3045	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3046	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R3047	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R3048	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R3049	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R3052	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3053	RES.METAL FILM	HIP RC-02H 1% 6K19	5322 117 10577
R3054	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3056	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R3057	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R3061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R3062	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R3063	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R3064	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R3065	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R3071	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R3072	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R3073	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3074	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R3076	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3077	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3078	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R3079	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R3081	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3082	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3083	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R3084	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R3085	RES.CHIP	HIP RC-02H 1% 13K3	4822 051 51333
R3086	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3087	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R3088	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3092	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R3093	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3094	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R3096	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R3101	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R3102	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R3103	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R3104	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3106	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3112	RES.METAL FILM	HIP RC-02H 1% 61K9	5322 117 10578
R3113	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R3114	RES.CHIP	HIP RC-02H 1% 3K48	5322 117 10557
R3200	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3201	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R3202	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R3203	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R3204	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R3205	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R3206	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101

Item	Description		Ordering code
R3207	RES.CHIP	HIP RC-02H 1% 215E	5322 117 10484
R3208	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R3209	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3210	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R3211	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R3212	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R3213	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R3214	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R3215	RES.METAL FILM	HIP RC-02H 1% 348E	5322 117 10556
R3216	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3217	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3218	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R3220	RES.METAL FILM	HIP RC-02H 1% 75K	5322 117 10584
R3222	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R3223	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R3224	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R3226	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R3227	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R3228	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R3229	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R3231	RES.METAL FILM	HIP RC-02H 1% 178E	5322 117 10534
R3301	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R3302	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R3303	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R3304	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R3307	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R3308	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R3309	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R3310	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R3311	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R3313	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R3314	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R4001	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R4002	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R4006	RES.METAL FILM	ST MRS25 1% 100E	4822 050 21001
R4007	RES.METAL FILM	ST MRS25 1% 100E	4822 050 21001
R4008	RES.METAL FILM	PR24 1/4W 0.1% 9K4	5322 116 83712
R4009	RES.METAL FILM	PR24 1/4W 0.1% 300E	5322 116 51814
R4010	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R4011	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R4012	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R4013	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R4014	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R4016	RES.METAL FILM	PR34 0.4W 0.1% 900K	5322 116 51832
R4019	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R4021	RES.METAL FILM	PR34 0.4W 0.1% 990K	5322 116 83104
R4022	RES.CHIP	RMC1/8 1% 23E7	5322 117 10591
R4023	RES.METAL FILM	PR24 1/4W 0.1% 11K1	5322 116 83101
R4024	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R4026	RES.CHIP	RMC1/8 1% 82E5	5322 111 92017

Item	Description		Ordering code
R4027	RES.METAL FILM	PR24 1/4W 0.1% 111K	5322 116 83099
R4028	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4029	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4030	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R4031	RES.METAL FILM	PR34 0.4W 0.1% 500K	5322 116 83103
R4032	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R4033	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R4034	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R4035	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R4036	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R4037	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R4038	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R4039	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R4041	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R4042	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R4043	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R4044	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R4045	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R4046	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R4047	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R4048	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R4049	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R4052	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R4053	RES.METAL FILM	HIP RC-02H 1% 6K19	5322 117 10577
R4054	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4056	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R4057	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R4061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R4062	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R4063	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R4064	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R4065	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R4071	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R4072	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R4073	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R4074	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R4076	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4077	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4078	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R4079	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R4081	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4082	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4083	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R4084	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R4086	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4087	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R4088	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4092	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R4093	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4094	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485

Item	Description		Ordering code
R4096	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R4101	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R4102	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R4103	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R4104	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4106	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R4112	RES.METAL FILM	HIP RC-02H 1% 61K9	5322 117 10578
R4113	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R4114	RES.CHIP	HIP RC-02H 1% 3K48	5322 117 10557
R4200	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R4201	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R4202	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R4203	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R4204	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R4205	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R4206	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R4207	RES.CHIP	HIP RC-02H 1% 215E	5322 117 10484
R4208	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R4209	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R4210	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R4211	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R4212	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R4213	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R4214	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R4215	RES.METAL FILM	HIP RC-02H 1% 348E	5322 117 10556
R4216	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R4217	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R4218	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R4220	RES.METAL FILM	HIP RC-02H 1% 75K	5322 117 10584
R4222	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R4223	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R4224	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R4226	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R4227	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R4228	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R4229	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R4231	RES.METAL FILM	HIP RC-02H 1% 178E	5322 117 10534
R4301	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R4302	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R4303	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R4304	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R4307	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R4308	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R4309	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R4310	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R4311	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R4313	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R4314	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R5001	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R5002	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557

Item	Description		Ordering code
R5003	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R5004	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R5006	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R5007	RES.METAL FILM	HIP RC-02H 1% 348E	5322 117 10556
R5008	RES.METAL FILM	HIP RC-02H 1% 348E	5322 117 10556
R5009	RES.METAL FILM	HIP RC-02H 1% 909E	5322 117 10588
R5011	RES.METAL FILM	HIP RC-02H 1% 909E	5322 117 10588
R5012	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R5013	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R5014	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R5016	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R5017	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R5018	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R5019	RES.METAL FILM	HIP RC-02H 1% 2K87	5322 117 10549
R5021	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R5024	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R5026	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R5027	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R5028	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R5029	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R5031	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5032	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5035	RES.METAL FILM	HIP RC-02H 1% 348E	5322 117 10556
R5036	RES.METAL FILM	HIP RC-02H 1% 178E	5322 117 10534
R5037	RES.METAL FILM	HIP RC-02H 1% 178E	5322 117 10534
R5041	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5042	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5043	RES.CHIP	HIP RC-02H 1% 215E	5322 117 10484
R5044	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R5045	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R5046	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R5047	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R5048	RES.MET.GLAZED	RMC1/8 1% 51E1	5322 117 11737
R5049	RES.MET.GLAZED	RMC1/8 1% 51E1	5322 117 11737
R5050	RES.METAL FILM	HIP RC-02H 1% 511K	5322 117 10571
R5051	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R5052	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R5053	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R5054	RES.METAL FILM	HIP RC-02H 1% 2K87	5322 117 10549
R5055	RES.CHIP (100MHz)	HIP RC-02H 1% 1E	4822 051 10108
R5055	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R5056	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R5057	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R5058	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R5059	RES.METAL FILM	HIP RC-02H 1% 9K09	5322 117 10589
R5060	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5061	RES.CHIP (100 MHz)	HIP RC-02H 1% 3K83	5322 117 10561
R5061	RES.CHIP (200 MHz)	HIP RC-02H 1% 1K21	4822 051 51212
R5064	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R5065	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101

Item	Description		Ordering code
R5066	RES.METAL FILM	HIP RC-02H 1% 511K	5322 117 10571
R5068	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R5069	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R5070	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R5071	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R5072	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R5076	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R5501	RES.METAL FILM	HIP RC-02H 1% 9K09	5322 117 10589
R5502	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R5503	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R5504	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R5506	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R5507	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R5508	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R5509	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R5510	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R5511	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5512	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R5513	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564
R5514	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R5516	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R5517	RES.METAL FILM	HIP RC-02H 1% 1K21	5322 117 10521
R5518	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5519	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R5521	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R5522	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R5523	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R5524	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R5526	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5527	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R5531	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5532	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5533	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5534	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5536	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5537	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5538	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5539	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5541	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5542	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5543	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5544	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R5546	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R5551	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5552	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5553	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5554	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R5556	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5557	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5558	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103

Item	Description		Ordering code
R5559	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5561	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R5562	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R5601	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R5602	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R5603	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R5606	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6001	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R6002	RES.METAL FILM	PR24 1/4W 0.1% 50E	5322 116 53165
R6003	RES.METAL FILM	PR24 1/4W 0.1% 75E	5322 116 53168
R6004	RES.METAL FILM	PR24 1/4W 0.1% 125E	5322 116 53176
R6005	RES.METAL FILM	PR24 1/4W 0.1% 250E	5322 116 53166
R6006	RES.METAL FILM	PR24 1/4W 0.1% 750E	5322 116 53173
R6007	RES.METAL FILM	PR24 1/4W 0.1% 1K25	5322 116 53177
R6008	RES.METAL FILM	PR24 1/4W 0.1% 900E	5322 116 83098
R6009	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R6011	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R6012	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R6013	RES.METAL FILM	PR24 1/4W 0.1% 23K7	5322 116 53169
R6014	RES.METAL FILM	PR24 1/4W 0.1% 2K37	5322 116 53171
R6015	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R6016	RES.METAL FILM	HIP RC-02H 1% 1K96	5322 117 10539
R6017	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R6018	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R6019	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R6020	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R6021	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R6022	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R6023	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R6024	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R6025	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R6026	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R6027	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R6028	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R6029	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R6030	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R6031	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R6032	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R6033	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R6034	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R6035	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6036	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R6037	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6038	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R6040	RES.METAL FILM	HIP RC-02H 1% 6K19	5322 117 10577
R6041	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R6042	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R6043	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R6044	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R6045	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553

Item	Description		Ordering code
R6046	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R6047	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R6048	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R6049	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6050	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R6051	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6052	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R6053	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6054	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R6061	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6062	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R6063	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R6070	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R6071	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R6072	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R6073	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6074	RES.METAL FILM	HIP RC-02H 1% 1K21	5322 117 10521
R6093	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R6094	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R6095	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R6101	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6104	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R6502	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R6503	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R6508	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R6509	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R6511	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R6512	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R6521	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R6522	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R6523	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R6524	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R6526	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R6527	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R6528	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R6529	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R6531	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564
R6542	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6543	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6544	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6546	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6547	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6548	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R6552	RES.METAL FILM	HIP RC-02H 1% 681E	5322 117 10579
R6554	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R6556	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R6558	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R6571	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R6572	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R6576	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101

Item	Description		Ordering code
R6577	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R6578	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R6579	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R6584	RES.METAL FILM	HIP RC-02H 1% 1K33	5322 117 10524
R6586	RES.METAL FILM	HIP RC-02H 1% 1K33	5322 117 10524
R6601	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R6602	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R6603	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6612	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R6613	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R6614	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R6616	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R6621	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R6622	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R6623	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R6624	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R6626	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R6627	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R6629	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R6632	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R6633	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R6634	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R6636	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R6638	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R6641	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R6643	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R6646	RES.CHIP	HIP RC-01 5% 10M	4822 051 10106
R6649	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R6661	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6662	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6684	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6688	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R6689	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R6692	RES.METAL FILM	HIP RC-02H 1% 1K62	5322 117 10531
R6694	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R6696	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R6706	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R6708	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R6709	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R6752	RES.METAL FILM	HIP RC-02H 1% 1K21	5322 117 10521
R6753	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R6754	RES.METAL FILM	HIP RC-02H 1% 348E	5322 117 10556
R6756	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R6758	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R6762	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R6764	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R6769	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R6772	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R6774	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R6776	RES.METAL FILM	HIP RC-02H 1% 511K	5322 117 10571

Item	Description		Ordering code
R6782	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R6783	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R6788	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R6901	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R6911	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R6921	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R6931	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R6941	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R6951	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R6961	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R7001	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R7002	RES.METAL FILM	PR24 1/4W 0.1% 50E	5322 116 53165
R7003	RES.METAL FILM	PR24 1/4W 0.1% 75E	5322 116 53168
R7004	RES.METAL FILM	PR24 1/4W 0.1% 125E	5322 116 53176
R7005	RES.METAL FILM	PR24 1/4W 0.1% 250E	5322 116 53166
R7006	RES.METAL FILM	PR24 1/4W 0.1% 750E	5322 116 53173
R7007	RES.METAL FILM	PR24 1/4W 0.1% 1K25	5322 116 53177
R7008	RES.METAL FILM	PR24 1/4W 0.1% 900E	5322 116 83098
R7009	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R7011	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R7012	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R7013	RES.METAL FILM	PR24 1/4W 0.1% 23K7	5322 116 53169
R7014	RES.METAL FILM	PR24 1/4W 0.1% 2K37	5322 116 53171
R7015	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R7016	RES.METAL FILM	HIP RC-02H 1% 1K96	5322 117 10539
R7017	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R7018	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R7019	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R7021	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R7022	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R7023	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7024	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R7025	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R7026	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R7027	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R7028	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R7029	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R7031	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R7032	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R7033	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R7034	RES.METAL FILM	HIP RC-02H 1% 1K21	5322 117 10521
R7036	RES.METAL FILM	HIP RC-02H 1% 1K21	5322 117 10521
R7041	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R7042	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R7043	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R7044	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R7045	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7046	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R7047	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R7048	RES.CHIP	RMC1/8 1% 10E	4822 111 91885

Item	Description		Ordering code
R7049	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R7050	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R7051	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R7052	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R7054	RES.METAL FILM	HIP RC-02H 1% 9K09	5322 117 10589
R7056	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R7057	RES.METAL FILM	HIP RC-02H 1% 38K3	5322 117 10562
R7059	RES.METAL FILM	HIP RC-02H 1% 75K	5322 117 10584
R7064	RES.METAL FILM	PR24 1/4W 0.1% 6K	5322 116 83102
R7065	RES.METAL FILM	PR24 1/4W 0.1% 500E	5322 116 83097
R7066	RES.METAL FILM	PR24 1/4W 0.1% 900E	5322 116 83098
R7067	RES.METAL FILM	PR24 1/4W 0.1% 100E	5322 116 51701
R7077	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R7078	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R7082	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R7091	RES.METAL FILM	PR24 1/4W 0.1% 10K	5322 116 82868
R7092	RES.METAL FILM	PR24 1/4W 0.1% 2K16	5322 116 83126
R7093	RES.METAL FILM	PR24 1/4W 0.1% 15K	5322 117 10592
R7094	RES.METAL FILM	PR24 1/4W 0.1% 10K	5322 116 82868
R7095	RES.METAL FILM	PR24 1/4W 0.1% 10K	5322 116 82868
R7096	RES.METAL FILM	PR24 1/4W 0.1% 15K	5322 117 10592
R7097	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R7099	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R7144	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R7150	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R7151	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R7152	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R7153	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R7154	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R7155	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R7156	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R7160	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R7161	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R7180	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R7181	RES.METAL FILM	HIP RC-02H 1% 562E	5322 117 10572
R7204	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R7205	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R7206	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R7207	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R7208	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R7209	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R7502	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R7503	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R7508	RES.METAL FILM	HIP RC-02H 1% 825E	5322 117 10585
R7509	RES.METAL FILM	HIP RC-02H 1% 825E	5322 117 10585
R7511	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R7512	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R7521	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7522	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7523	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893

Item	Description		Ordering code
R7524	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7526	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7527	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7528	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7529	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R7531	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564
R7542	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R7543	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R7544	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R7546	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R7547	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R7548	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R7552	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R7554	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R7556	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R7558	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R7563	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R7571	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R7572	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R7576	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R7577	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R7578	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R7579	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R7584	RES.METAL FILM	HIP RC-02H 1% 1K33	5322 117 10524
R7586	RES.METAL FILM	HIP RC-02H 1% 1K33	5322 117 10524
R7681	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R7688	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R7689	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R7692	RES.METAL FILM	HIP RC-02H 1% 1K62	5322 117 10531
R7693	RES.METAL FILM	HIP RC-02H 1% 6K19	5322 117 10577
R7694	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R7696	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R7711	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R7712	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R7713	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R7716	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R7753	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R7754	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R7809	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R7901	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R7911	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R7921	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R7931	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R7941	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R7951	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R7952	RES.METAL FILM	HIP RC-02H 1% 13K3	5322 117 10525
R7953	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R7954	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R7956	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R7957	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103

Item	Description		Ordering code
R7958	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R7961	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R8001	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559
R8002	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559
R8003	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R8004	RES.METAL FILM	HIP RC-02H 1% 9K09	5322 117 10589
R8005	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R8006	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R8007	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R8008	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R8009	RES.METAL FILM	HIP RC-02H 1% 1K96	5322 117 10539
R8010	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8011	RES.CHIP	HIP RC-02H 1% 215E	5322 117 10484
R8012	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R8013	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R8014	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R8015	RES.METAL FILM	HIP RC-02H 1% 1K62	5322 117 10531
R8016	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R8017	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8018	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8019	RES.CHIP	HIP RC-02H 1% 287E	4822 051 52871
R8020	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R8021	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R8022	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R8023	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R8024	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R8025	RES.METAL FILM	HIP RC-02H 1% 562E	5322 117 10572
R8026	RES.METAL FILM	HIP RC-02H 1% 4K22	5322 117 10565
R8027	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R8028	RES.METAL FILM	HIP RC-02H 1% 196E	5322 117 10538
R8029	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R8030	RES.METAL FILM	HIP RC-02H 1% 1K62	5322 117 10531
R8031	RES.CHIP	HIP RC-02H 1% 287E	4822 051 52871
R8032	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R8033	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8034	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R8035	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R8037	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R8038	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R8040	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R8041	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R8042	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8043	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R8044	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R8045	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R8046	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R8047	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R8048	RES.METAL FILM	HIP RC-02H 1% 3K48	5322 117 10557
R8049	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R8050	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014

Item	Description		Ordering code
R8051	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R8052	RES.METAL FILM	HIP RC-02H 1% 6K19	5322 117 10577
R8053	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R8054	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R8055	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R8056	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R8057	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R8058	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559
R8059	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564
R8060	RES.METAL FILM	HIP RC-02H 1% 1K96	5322 117 10539
R8061	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8062	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R8063	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8064	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R8065	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8066	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8067	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8068	RES.CHIP	HIP RC-02H 1% 2K15	5322 117 10485
R8069	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R8070	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R8071	RES.CHIP	HIP RC-02H 1% 8K25	5322 117 10586
R8072	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8073	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8074	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R8075	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R8076	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R8077	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R8078	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R8079	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R8080	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R8081	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R8082	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8083	RES.METAL FILM	HIP RC-02H 1% 2K87	5322 117 10549
R8084	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R8085	RES.METAL FILM	HIP RC-02H 1% 1K62	5322 117 10531
R8086	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R8087	RES.METAL FILM	HIP RC-02H 1% 1K21	5322 117 10521
R8088	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R8089	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R8090	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R8091	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R8092	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R8093	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R8094	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R8095	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R8096	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R8097	RES.METAL FILM	HIP RC-02H 1% 1K96	5322 117 10539
R8098	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R8099	RES.CHIP	RMC1/8 1% 100E	4822 051 10101
R8100	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564

Item	Description		Ordering code
R8101	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R8102	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R8103	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R8104	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R8105	RES.METAL FILM	HIP RC-02H 1% 1K62	5322 117 10531
R8106	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R8130	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R8131	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R8132	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R8133	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R8134	RES.METAL FILM	HIP RC-02H 1% 1K62	5322 117 10531
R8135	RES.METAL FILM	HIP RC-02H 1% 162E	5322 117 10529
R8136	RES.METAL FILM	HIP RC-02H 1% 2K61	5322 117 10547
R8137	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R8138	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R8200	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R8403	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8404	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8405	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R8410	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R8411	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101

SEMICONDUCTORS

V1001	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V1002	DIODE	BBY62 PEL	5322 130 82685
V1003	DIODE,REFERENCE	BZX84-C6V8 PEL	5322 130 80406
V1004	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V1005	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V1006	TRANSISTOR,CHIP	BF990A PEL	4822 130 62657
V1007	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V1008	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V1009	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V1012	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V1013	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V1015	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1017	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V1018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V1201	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V1202	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V1206	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1207	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1208	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1209	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1251	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V1252	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V1301	DIODE,REFERENCE	BZX84-C6V2 PEL	5322 130 33671
V1302	DIODE,REFERENCE	BZX84-C7V5 PEL	5322 130 33763
V1304	DIODE,REFERENCE	BZX84-C4V7 PEL	5322 130 31937
V1306	DIODE,REFERENCE	BZX84-C2V4 PEL	4822 130 33703

Item	Description		Ordering code
V1307	DIODE,REFERENCE	BZX84-C3V0 PEL	5322 130 32739
V1308	DIODE,CHIP	BAS28 PEL	5322 130 80214
V1313	DIODE,CHIP	BAS28 PEL	5322 130 80214
V2001	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V2002	DIODE	BBY62 PEL	5322 130 82685
V2003	DIODE,REFERENCE	BZX84-C6V8 PEL	5322 130 80406
V2004	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V2005	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V2006	TRANSISTOR,CHIP	BF990A PEL	4822 130 62657
V2007	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V2008	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V2009	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V2012	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V2013	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V2015	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2017	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V2018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V2201	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V2202	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V2206	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2207	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2208	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2209	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2301	DIODE,REFERENCE	BZX84-C6V8 PEL	5322 130 80406
V2302	DIODE,REFERENCE	BZX84-C7V5 PEL	5322 130 33763
V2303	DIODE,CHIP	BAS28 PEL	5322 130 80214
V2304	DIODE,REFERENCE	BZX84-C4V7 PEL	5322 130 31937
V2306	DIODE,REFERENCE	BZX84-C2V4 PEL	4822 130 33703
V2307	DIODE,REFERENCE	BZX84-C3V0 PEL	5322 130 32739
V3001	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V3002	DIODE	BBY62 PEL	5322 130 82685
V3003	DIODE,REFERENCE	BZX84-C6V8 PEL	5322 130 80406
V3004	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V3005	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V3006	TRANSISTOR,CHIP	BF990A PEL	4822 130 62657
V3007	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V3008	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V3009	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V3012	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V3013	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V3015	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3017	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V3018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V3201	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V3202	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V3206	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3207	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3208	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513

Item	Description		Ordering code
V3209	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3301	DIODE,REFERENCE	BZX84-C6V8 PEL	5322 130 80406
V3302	DIODE,REFERENCE	BZX84-C7V5 PEL	5322 130 33763
V3303	DIODE,CHIP	BAS28 PEL	5322 130 80214
V3304	DIODE,REFERENCE	BZX84-C4V7 PEL	5322 130 31937
V3306	DIODE,REFERENCE	BZX84-C2V4 PEL	4822 130 33703
V3307	DIODE,REFERENCE	BZX84-C3V0 PEL	5322 130 32739
V4001	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V4002	DIODE	BBY62 PEL	5322 130 82685
V4003	DIODE,REFERENCE	BZX84-C6V8 PEL	5322 130 80406
V4004	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V4005	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V4006	TRANSISTOR,CHIP	BF990A PEL	4822 130 62657
V4007	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V4008	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V4009	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V4012	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V4013	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V4015	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V4016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V4017	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V4018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V4201	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V4202	TRANSISTOR,CHIP	BF579 TEL	5322 130 63453
V4206	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V4207	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V4208	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V4209	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V4301	DIODE,REFERENCE	BZX84-C6V8 PEL	5322 130 80406
V4302	DIODE,REFERENCE	BZX84-C7V5 PEL	5322 130 33763
V4303	DIODE,CHIP	BAS28 PEL	5322 130 80214
V4304	DIODE,REFERENCE	BZX84-C4V7 PEL	5322 130 31937
V4306	DIODE,REFERENCE	BZX84-C2V4 PEL	4822 130 33703
V4307	DIODE,REFERENCE	BZX84-C3V0 PEL	5322 130 32739
V5001	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V5002	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V5003	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V5004	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V5006	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V5007	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V5008	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V5009	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V5011	DIODE,CHIP	BAT17 PEL	5322 130 31544
V5012	DIODE,CHIP	BAT17 PEL	5322 130 31544
V5013	DIODE,CHIP	BAT17 PEL	5322 130 31544
V5014	DIODE,CHIP	BAT17 PEL	5322 130 31544
V5016	DIODE,REFERENCE	BZX84-C6V2 PEL	5322 130 33671
V5017	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V5018	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V5501	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718

Item	Description		Ordering code
V5502	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V5503	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V5504	DIODE,CHIP	BAV99 PEL	5322 130 34337
V5506	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V5601	DIODE,REFERENCE	BZX84-C6V2 PEL	5322 130 33671
V6001	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6002	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6003	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V6004	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V6005	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V6006	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6007	DIODE,CHIP	BAV99 PEL	5322 130 34337
V6008	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6012	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V6013	TRANSISTOR	FET ON4401 PEL	5322 130 61498
V6014	TRANSISTOR	FET ON4401 PEL	5322 130 61498
V6016	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6017	DIODE,CHIP	BAS28 PEL	5322 130 80214
V6018	DIODE,REFERENCE	BZX84-C5V6 PEL	4822 130 80125
V6019	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6022	DIODE,REFERENCE	BZX84-C5V6 PEL	4822 130 80125
V6041	DIODE,CHIP	BAS28 PEL	5322 130 80214
V6042	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6044	DIODE,CHIP	BAS28 PEL	5322 130 80214
V6061	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V6062	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6101	DIODE,REFERENCE	BZX84-C2V4 PEL	4822 130 33703
V6506	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V6507	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V6532	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V6553	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V6573	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V6574	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V6593	DIODE,CHIP	BAS28 PEL	5322 130 80214
V6604	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V6606	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V6628	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6631	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6637	DIODE,REFERENCE	BZX84-C6V8 PEL	5322 130 80406
V6667	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V6668	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V6686	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6687	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6691	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6754	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6757	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6759	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6761	DIODE,CHIP	BAS28 PEL	5322 130 80214
V6763	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V6764	DIODE,REFERENCE	BZX84-C6V2 PEL	5322 130 33671

Item	Description		Ordering code
V6768	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7001	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7003	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V7004	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V7005	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V7006	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7007	DIODE,CHIP	BAV99 PEL	5322 130 34337
V7012	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V7016	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7017	DIODE,CHIP	BAS28 PEL	5322 130 80214
V7018	DIODE,REFERENCE	BZX84-C5V6 PEL	4822 130 80125
V7019	TRANSISTOR	FET ON4401 PEL	5322 130 61498
V7020	TRANSISTOR	FET ON4401 PEL	5322 130 61498
V7031	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V7032	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V7075	DIODE,CHIP	BAS28 PEL	5322 130 80214
V7091	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7093	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7094	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7150	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V7151	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V7152	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V7506	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V7507	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V7532	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V7553	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V7573	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V7574	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V7686	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7687	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7691	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7714	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V7801	DIODE,CHIP	BAV99 PEL	5322 130 34337
V7802	DIODE,CHIP	BAV99 PEL	5322 130 34337
V7803	DIODE,CHIP	BAV99 PEL	5322 130 34337
V7804	DIODE,CHIP	BAV99 PEL	5322 130 34337
V7805	DIODE,CHIP	BAV99 PEL	5322 130 34337
V7806	DIODE,CHIP	BAV99 PEL	5322 130 34337
V7807	DIODE,CHIP	BAV99 PEL	5322 130 34337
V7808	DIODE,CHIP	BAV99 PEL	5322 130 34337
V8001	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8002	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8003	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8004	DIODE,CHIP	BAS28 PEL	5322 130 80214
V8005	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8006	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8007	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8008	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8009	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8011	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711

Item	Description		Ordering code
V8012	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V8013	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V8014	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V8015	DIODE,REFERENCE	BZX84-C2V4 PEL	4822 130 33703
V8018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8019	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8023	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V8024	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V8025	DIODE,CHIP	BAV99 PEL	5322 130 34337
V8028	DIODE,CHIP	BAS28 PEL	5322 130 80214
V8029	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V8031	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V8032	DIODE,CHIP	BAV99 PEL	5322 130 34337
V8040	DIODE,CHIP	BAV99 PEL	5322 130 34337
V8041	DIODE,CHIP	BAV99 PEL	5322 130 34337
V8042	TRANSISTOR,CHIP	BSV52 PEL	5322 130 44336
V8043	TRANSISTOR,CHIP	BSV52 PEL	5322 130 44336
V8044	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8061	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V8062	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V8063	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V8065	DIODE,CHIP	BAS28 PEL	5322 130 80214
V8066	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V8067	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V8068	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V8101	DIODE,CHIP	BAS28 PEL	5322 130 80214

CONNECTORS

Item	Description		Ordering code
X1301	SOCKET,MALE	50 OHM BUS	5322 265 10266
X1301	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X1302	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X1302	SOCKET,MALE	50 OHM BUS	5322 265 10266
X2301	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X2301	SOCKET,MALE	50 OHM BUS	5322 265 10266
X2302	SOCKET,MALE	50 OHM BUS	5322 265 10266
X2302	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X3301	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X3301	SOCKET,MALE	50 OHM BUS	5322 265 10266
X3302	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X3302	SOCKET,MALE	50 OHM BUS	5322 265 10266
X4108	SOCKET,MALE	50 OHM BUS	5322 265 10266
X4108	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X4301	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X4301	SOCKET,MALE	50 OHM BUS	5322 265 10266
X4302	SOCKET,MALE	50 OHM BUS	5322 265 10266
X4302	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X5001	CONNECTOR	DIPS 4-P HAAKS OMSL	5322 265 30907
X6010	SOCKET,MALE	50 OHM BUS	5322 265 10266
X6010	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141

Item	Description		Ordering code
X6591	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X6591	SOCKET,MALE	50 OHM BUS	5322 265 10266
X6592	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X6592	SOCKET,MALE	50 OHM BUS	5322 265 10266
X6794	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X6794	SOCKET,MALE	50 OHM BUS	5322 265 10266
X8011	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X8011	SOCKET,MALE	50 OHM BUS	5322 265 10266
X8013	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X8013	SOCKET,MALE	50 OHM BUS	5322 265 10266
X8014	HOLD,OBJECTIVE	CONTACTPIN	5322 268 14141
X8014	SOCKET,MALE	50 OHM BUS	5322 265 10266
X9001	CONNECTOR	50-P DBL STRGHT	5322 265 61242
X9002	CONNECTOR	16-P 1.25MM STR	5322 267 51107

Coloured indication rings for mini coax sockets on printed circuit boards:

black:	5322 325 50231	brown:	5322 325 50232	red:	5322 325 50233
orange:	5322 325 50234	yellow:	5322 325 50235	green:	5322 325 50236
blue:	5322 325 50237	violet:	5322 325 50238	grey:	5322 325 50239
white:	5322 325 50241				

5.2 FINAL XYZ AMPLIFIER A2

5.2.1 Description A2-200 MHz version

5.2.1.1 Final Y amplifier

Diagram 1

The output signal from the delay line is applied to the input pins 6 and 9 of amplifier IC D1001. This IC and surrounding components comprise the MF and HF square wave compensations. Also the vertical CRT text signal is applied to D1001 (pin 15 and 16). The switching between text/cursors and signal is done via control signals that are applied to pin 17 and 18 of D1001. Text is written if the voltage at pin 18 is higher than at pin 17. This switching signal is derived from the collector of the transistors V1201 and V1202. The control signals XYSW1 and XYSW0 come from the text/cursor generator IC on microprocessor unit A3. Via the transistors V1203 and V1204 similar switching signals XSW1 and XSW0 are routed to the X-deflection section for switching between text and signal.

The output signals from pin 21 and 22 of D1001 are routed to the final Y-amplifier that drives the vertical deflection plates of the CRT. This final stage is indicated on the next diagram.

The delay line leads are terminated into 50Ω. The impedance is composed by 300Ω inside D1001 parallelled by external impedances of 60Ω formed by the external resistors R1024/R1026 and R1027/R1028. All termination resistors are applied to a voltage controlled by D1001/pin 13. Pin 13 determines the common mode voltage level of the D1001 inputs. The HF square wave compensation is achieved by the two dual varicap diodes V1009 and V1011 together with associated resistors. A fixed mid- frequency compensation network is formed by C1006 and associated resistors.
Varicap V1009 is controlled by the output signal at pin 20 of octal DAC N1001. This output voltage can be in the range 0 to 10 V and controls varicap V1009 via operational amplifier N1002/1,2,3. This operational amplifier converts the N1001 output voltage (that is related to 0 V) into a voltage related to the voltage at D1001/pin 13.
Varicap V1011 is controlled by the output signal at pin 18 of octal DAC N1001. This output voltage can be in the range 0 to 10 V and controls varicap V1011 via operational amplifier N1002/5,6,7. This operational amplifier converts the N1001 output voltage (that is related to 0 V) into a voltage related to the voltage at D1001/pin 13.

LF square wave compensation is also done inside D1001. This is controlled via currents applied to pin 27 and 28. These currents are derived from the N1001 DAC voltage outputs 13 and 11 via the transistors V1014 and V1016. The actual compensating components are situated outside D1001 and are R1037/C1011/R1038 and R1029/C1009/R1031. V1023 and V1024 form a 20 mA current source to supply the bias current for the final stage inside D1001. V1024 is switched as a diode and gives temperature compensation.

Offset is adjusted via the currents from the collectors of V1021 and V1022. These currents are controlled by the DAC output pins 17 (Most Significant DAC) and 16 (Least Significant DAC). Two parallel DAC outputs are used to obtain sufficient resolution. V1018 is a current source and V1019 is for temperature compensation. Gain control occurs via an adjustable current applied to D1001/pin 26. This is done via N1001/pin 14 and R1051

DAC output N1001/15 applies via operational amplifier N1003/1,2,3 the signal YFSHF to the final stage on the next diagram. YFSHF is an adjustable dc voltage that is applied to varicap diodes that control the HF square wave response.

Diagram 2

This diagram shows the push-pull output amplifier. The input signal is a current and the output signal is a voltage. The output signal is applied to the vertical upper and lower plates of the CRT. The total sensitivity at the plates is 4V/div. One plate is driven by push-pull stage V1106/V1111. The driver transistors are V1102 and V1103. The input signal is YPREOUT1.

The other plate is driven by push-pull stage V1107/V1112. The driver transistors are V1101 and V1104. The input signal is YPREOUT0. The output voltage applied to the CRT deflection plates is controlled by the feedback networks R1101/R1141/R1143/C1101/V1113/R1140/C1121 and R1102/R1142/R1144/C1102/V1113/R1145/C1122.

The push-pull amplifier stages are connected between +18 V and -18V supply voltages via current sources. One of these is V1122 with temperature compensation via V1121. The other is V1123 and is adjusted via operational amplifier N1003/5,6,7. This assures that the common mode voltage at the plates of the CRT is 0 V.
The resistance network between L1101 and L1102 avoids extreme differences in power dissipation in the output transistors when a dc voltage difference exists between the CRT deflection plates.

The input of the final stage is at a common mode level of 9V dc because of the output level from D1001. This voltage is made by the dc current sources V1021 and V1022. The current from these sources is partly used by the D1001 output stage (pin 21 and 22). The remaining currents give a 9 V dc across the feedback resistors R1101/R1141 and R1102/1142. Because the output lines to the CRT plates are at 0V common mode level, the inputs are at 9V common mode level. The current in the feedback resistors runs via L1101, L1102 and V1126 to the -18V supply.

The bias current for the driver stage V1101/V1102/V1103/V1104 is controlled by V1127 and V1128 via R1167 and R1168. V1127 converts voltage into current. This current is compared with current from source V1128/R1166. In case of a difference between these currents, the resulting current feeds the base of V1103 and V1104.

The circuit with operational amplifier N1004/2,3,6 is used for automatic calibration of the vertical deflection. It measures the voltage at the vertical deflection plates of the CRT. This value is applied as signal YCAL to the microprocessor on unit A3.

5.2.1.2 *Final X and Z amplifiers*

Diagram 3

This diagram shows the final X amplifier. It drives the horizontal plates of the CRT. The plate sensitivity equals 8.5 V/div. The input circuit is formed by IC D2001. The octal DAC N2002 supplies the analog control signals that are used throughout the circuit.

Input pin 5 and 6 of D2001 receive the time base sawtooth or the X- deflection signal signal. Input pin 9 and 10 receive the text/cursor X- deflection signal. The selection between text/cursors and sawtooth/X- deflection signal is done via the signals XSW0 and XSW1 that are applied to pin 7 and 8 of D2001. These signals are derived from XYSW0 and XYSW1 that come from the text generator IC on microprocessor unit A3. Text is displayed with XSW0 at 0 mA and XSW1 at 1 mA. Trace is displayed with XSW0 at 1 mA and XSW1 at 0 mA.

Gain control is possible via pin 1 of D2001. This is used for trace gain control via signal XTRAGC. Gain control to compensate for CRT tolerances is achieved via pin 14 of D2001. This is controlled via the DAC output signals XCRTGCL and XCRTGCH. Offset control to compensate for CRT tolerances is achieved via pin 15 of D2001. This is controlled via the DAC output signals XCRTOFH and XCRTOFL. Adjustment of the HF response (and linearity) is achieved via signal XHFADJ via pin 17 and 26 of D2001.

The final X-amplifier consists of two identical halves that receive input signals that are in opposite phase. These signals originate from the D2001 outputs pin 24/25 (XDRIL0/XDRIL1) and pin 18/19 (XDRIR0/XDRIR1). The two X-amplifier sections drive respectively the left and right deflection plate of the CRT.

The final X amplifier half that drives the left deflection plate is explained now. Its function is identical to that of the other amplifier half. The balanced input signals XDRIL1 and XDRIL0 are applied to input stage V2101. V2104 is a current source. XDRIL0 is not used and connected to +5 V. In the collector circuit of V2101 are the zener diodes V2102/V2103 that function as level shifters. The emitter followers V2132 and V2111 supply the output stage V2134/V2113 with signal. V2113 functions as an amplifier stage and V2134 mainly as a current source. V2134 receives signal via C2131 and mainly functions as amplifier stage in the fastest sweep speeds. Via R2133/R2134 however some dc drive is also applied to V2134.

The circuit with operational amplifier N2003 is used to measure the output voltage that is applied to the X-deflection plates of the CRT. This measurement is done via high-ohmic resistors R2301 and R2302. The analog output voltage XCAL of N2003 is applied to an ADC incorporated in the microprocessor on unit A3. This enables the microprocessor to exactly measure the horizontal output voltage. This is used for automatic calibration of the horizontal deflection.

Diagram 4

This diagram shows the final intensity (Z) and focusing amplifiers. These amplifiers drive the intensity electrode G1 and the focusing electrode G3 of the CRT. The input circuit is formed by IC D3001.

Input pin 5 and 6 of D3001 receive the Z-pulses ZLTRA0 and ZLTRA1 that determine the intensity during signal display. Input pin 9 and 10 receive the Z-pulse ZTXT0 and ZTXT1 that determine the intensity during text display. The selection between signal intensity and text intensity is done via the signals ZSW0 and ZSW1 that are applied to pin 7 and 8 of D3001. These signals originate from the text generator IC on microprocessor unit A3. Text is displayed with ZSW0 at 0 mA and ZSW1 at 1 mA. Trace is displayed with ZSW0 at 1 mA and ZSW1 at 0 mA.

The final Z-amplifier and the focusing amplifier are identical halves that receive input signals that are in opposite phase. These signals originate from the D3001 outputs pin 24/25 (ZDRIF1/ZDRIF0) and pin 18/19 (ZDRII0/ZDRII1).

Via V3002 part of the ripple on the negative CRT cathode voltage (ZRIPPLE) is applied to pin 15 of D3001. This compensates for unwanted intensity modulation due to this ripple.
The diodes V3236, V3136, V3237 and V3137 protect D3001 against possible high voltage surges.

V3301 supplies the intensity determining signal INTEN-DA. This signal adjusts the "dark level" of the CRT. V3301 is controlled by DAC N2002 output signal DARK. V3311 supplies signal ASTIG that determines the astigmatism of the CRT. V3311 is controlled by DAC N2002 output signal ASTDR.

The upper amplifier half that is used for the dynamic focus control is explained now. Its function is identical to that of the lower amplifier half that is used for intensity (Z) control. The balanced input signals ZDRIF1 and ZDRIF0 are applied to input stage V3101. V3104 is a current source. ZDRIF0 is not used and connects to +5 V. In the collector circuit of V3101 are the zener diodes V3102/V3103 that function as level shifters. The emitter followers V3132 and V3111 supply the output stage V3134/V3113 with signal. V3113 functions as an amplifier stage and V3134 mainly as a current source. V3134 receives signal via C3131 and mainly functions as amplifier stage for fast input signals. Via R3133/R3134 however some dc drive is also applied to V3134.

The circuit with V3282/V3212 suppresses the light on the screen at power down. V3282 becomes conductive via the fast falling +12 V and the slowly falling charge in C3281.

Diagram 5

In this diagram the circuit is shown that forms an interface between the signals that determine the intensity/focusing and the CRT electrodes G1/G3 that control intensity/focusing. These electrodes, the cathode and filament (heater) of the CRT are at a high negative voltage. This voltage is separated from the other oscilloscope circuits via the 3kV capacitors C4004, C4061, C4036 and C4037.

The intensity is influenced by the output signal INTEN-AA of the Z- amplifier and the signal INTEN-DA. INTEN-AA is determined via the front-panel TRACE INTENSITY, TEXT INTENSITY, MTBI and chopper blanking control signals. The HF component in the INTEN-AA signal is applied to G1 of the CRT via C4037. The DC and LF components are applied to the base of V4034. The INTEN-DA signal is applied to the base of V4032 and forms the clamplevel (dark level) of the DC and LF part of INTEN-AA derived from V4034. These two transistors form the inputs of a 150kHz modulator that basically consists of V4031 and V4033. The LF and DC components that are modulated on the 150 kHz carrier signal can pass via buffer stage V4038/V4039 and then via high voltage blocking capacitor C4036. Behind capacitor C4036 demodulation takes place via the diodes V4043 and V4044. This results in the original INTEN-AA signal that is superpositioned on the INTEN-DA voltage that corrects the cut-off voltage of the CRT applied to G1 and via R4051 also to G3. Across R4044 a small negative voltage (compared with the cathode) is developed for G1. This voltage is not big enough to make the CRT screen dark. This means that the signals to darken the screen and to control intensity are applied via C4036 and C4037.

The HF component from the focusing amplifier output signal FOCUS-AA is applied to G3 via C4004 and voltage divider R4008/R4009/C4002/C4003. This assures optimal tracking between focus and intensity. The signal FOCUS-DA is determined via the FOCUS control at the instruments front panel. The signal FOCUS-DA is then mixed with the LF component of FOCUS-AA before its level is adapted to the nominal G3 voltage via transistors V4002/V4003/V4004.

Diagram 6

This diagram shows the RC-branches and regulators N5131 that give the supply voltages for the various circuits. Also the connectors X2501 and X2301 are indicated here. X2301 is the connector where the flat cable leaves for the small unit that incorporates the CRT-socket X2403. The flat cable arrives at the small CRT-socket unit at X2401.

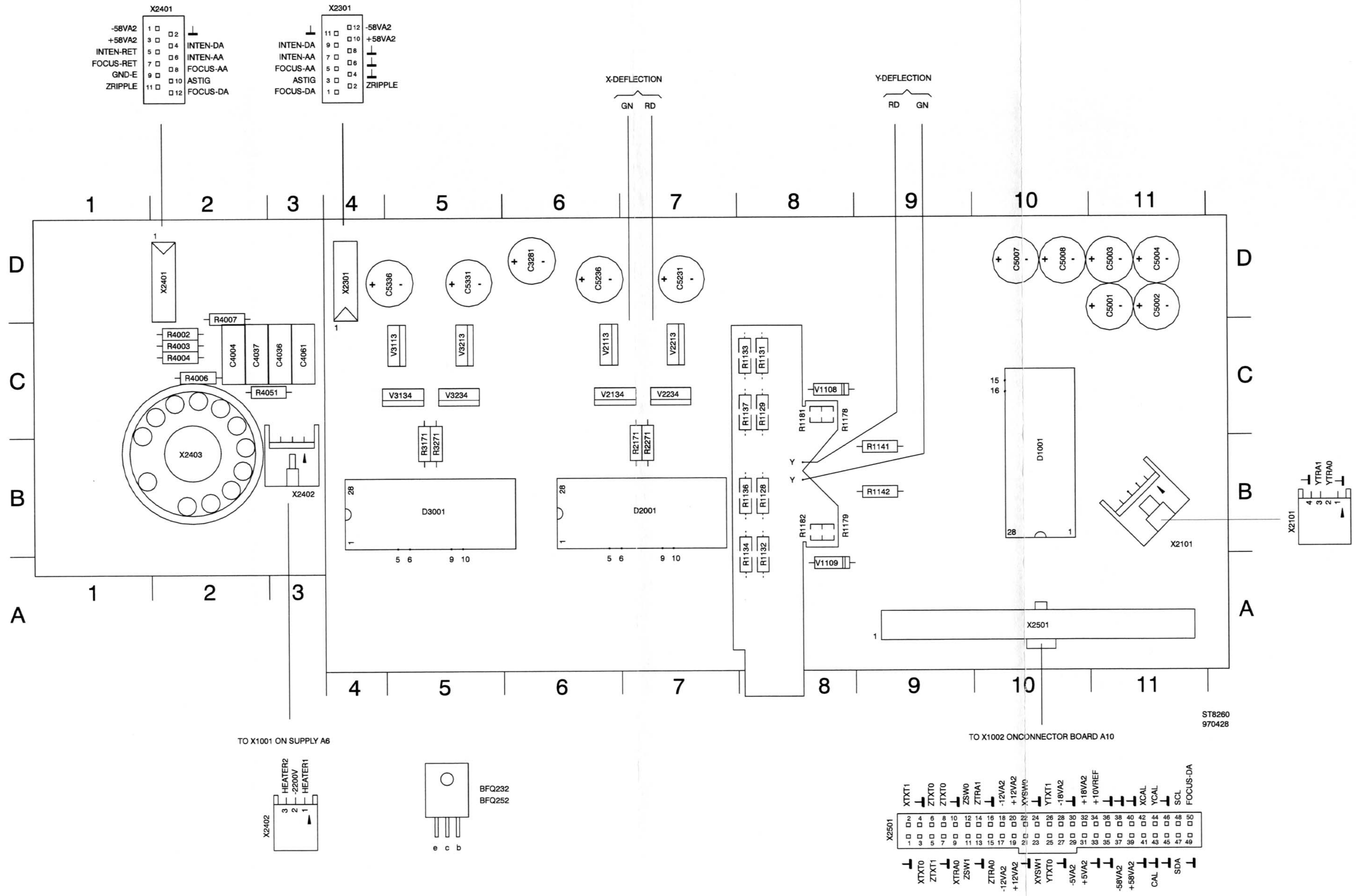
5.2.2 Signal name list A2-200 MHz version

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.

NAME	MEANING	SOURCE	DESTINATION
ASTDR	DRIVER SIGNAL FOR ASTIGMATISM	N2002:03	R3313:04
ASTIG	ASTIGMATISM CONTROL	V3311:04	X2301:06 X2401:05 X2403:05
DARK	DRIVER SIGNAL FOR DC PART INTENS	N2002:03	V3301:04
FOCUS-AA	AC PART FOCUSING SIGNAL	R3161:04	X2301:06 X2401:05 R4008:05
FOCUS-DA	DC PART FOCUSING SIGNAL	X2501:06	X2301:06 X2401:05 C4001:05 R4001:05
G1	INTENSITY GRID 1 OF CRT	C4037:05 R4044:05	X2403:05
G3	FOCUSING GRID 3 OF CRT	C4004:05 R4051:05	X2403:05
HEATER1	FILAMENT SUPPLY F1 OF CRT	X2402:05	X2403:05
HEATER2	FILAMENT SUPPLY F2 OF CRT	X2402:05	X2403:05
INTEN-AA	AC PART OF INTENSITY SIGNAL	R3261:04	X2401:05 C4037:05
INTEN-DA	DC PART OF INTENSITY SIGNAL	V3301:04	X2301:06 X2401:05 V4032:05
SCL	SERIAL CLOCK	X2501:06	J1002:06 J2002:06
SDA	SERIAL DATA	X2501:06	J1001:06 J2001:06
XCAL	AUTOCAL SIGNAL X DEFLECTION	R2313:03	X2501:06
XDRIL0	DRIVE SIGNAL 0 LEFT X AMPLIFIER	D2001:03	R2101:03
XDRIL1	DRIVE SIGNAL 1 LEFT X AMPLIFIER	D2001:03	R2103:03
XDRIR0	DRIVE SIGNAL 0 RIGHT X AMPLIFIER	D2001:03	R2203:03
XDRIR1	DRIVE SIGNAL 1 RIGHT X AMPLIFIER	D2001:03	R2201:03
XHFADJ	HF ADJUSTMENT X AMPLIFIER	N2002:03	R2018:03
XLTXT0	X SHIFT TEXT 0	V2062:03	D2001:03
XLTXT1	X SHIFT TEXT 1	V2061:03	D2001:03
XOUT0	X OUTPUT 0	V2134:03 V2113:03	R2171:03
XOUT1	X OUTPUT 1	V2234:03 V2213:03	R2271:03
XPLATE0	X OUTPUT 0 TO CRT	R2161:03	CRT LEFT PLATE
XPLATE1	X OUTPUT 1 TO CRT	R2261:03	CRT RGHT PLATE

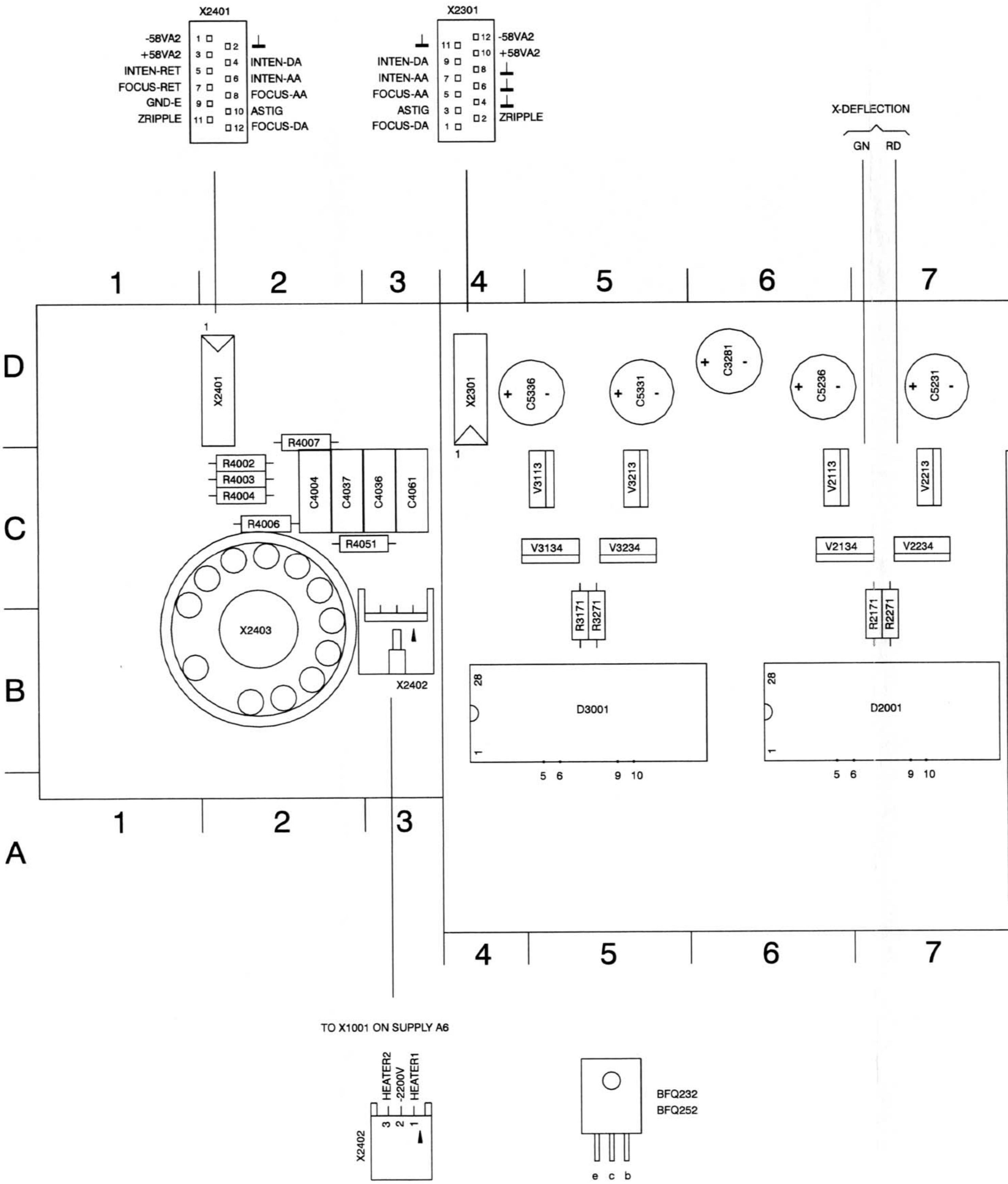
XSCL	SERIAL CLOCK X SECTION	J2002:06	N2002:03
XSDA	SERIAL DATA X SECTION	J2001:06	N2002:03
XSW0	X SWITCH SIGNAL 0 TRACE/TEXT	V1204:01	D2001:03
XSW1	X SWITCH SIGNAL 1 TRACE/TEXT	V1203:01	D2001:03
XYSW0	X/Y SWITCH SIGNAL 0 TRACE/TEXT	X2501:06	R1204:01
XYSW1	X/Y SWITCH SIGNAL 1 TRACE/TEXT	X2501:06	R1201:01
XTRA0	X TRACE 0 SIGNAL	X2501:06	R2004:03
XTRA1	X TRACE 1 SIGNAL	X2501:06	R2006:03
XTXT0	X TEXT 0 SIGNAL	X2501:06	R2063:03
XTXT1	X TEXT 1 SIGNAL	X2501:06	R2064:03
YCAL	AUTOCAL SIGNAL Y DEFLECTION	R1309:02	X2501:06
YFSH	HF SQ WAVE RESPONSE FINAL Y	N1003:01	R1146:02 R1147:02
YPREOUT0	Y PREAMPLIFIER OUT 0	R1061:01	V1101:01
YPREOUT1	Y PREAMPLIFIER OUT 1	R1059:01	V1102:01
YSCL	SERIAL CLOCK Y SECTION	J1002:06	N1001:01
YSDA	SERIAL DATA Y SECTION	J1001:06	N1001:01
YSW0	Y SWITCH SIGNAL 0 TRACE/TEXT	V1202:01	D1001:01
YSW1	Y SWITCH SIGNAL 1 TRACE/TEXT	V1201:01	D1001:01
YTRA0	Y TRACE 0 OUT FROM DELAY LINE	X2101:01	D1001:01
YTRA1	Y TRACE 1 OUT FROM DELAY LINE	X2102:01	D1001:01
YTXT0	Y TEXT 0 SIGNAL	X2501:01	D1001:01
YTXT1	Y TEXT 1 SIGNAL	X2501:01	D1001:01
ZDRIF0	DRIVER SIGNAL 0 FOCUS AMPLIFIER	D3001:04	R3101:04
ZDRIF1	DRIVER SIGNAL 1 FOCUS AMPLIFIER	D3001:04	R3103:04
ZDRII0	DRIVER SIGNAL 0 INTENS AMPLIFIER	D3001:04	R3203:04
ZDRII1	DRIVER SIGNAL 1 INTENS AMPLIFIER	D3001:04	R3201:04
ZLTRA0	Z LEVEL TRACE INTENSITY 0	V3062:04	R3004:04
ZLTRA1	Z LEVEL TRACE INTENSITY 1	V3061:04	R3006:04
ZOUTF	FEEDBACK SIGNAL FOCUS AMPLIFIER	V3113:04	R3171:04
ZOUTI	FEEDBACK SIGNAL INTENSITY AMPL.	V3213:04	R3271:04
ZRIPPLE	RIPPLE ON NEGATIVE HIGH VOLTAGE	C4061:05	V3001:04
ZSW0	Z SWITCH SIGNAL 0 TEXT/TRACE	X2501:06	D3001:04
ZSW1	Z SWITCH SIGNAL 1 TEXT/TRACE	X2501:06	D3001:04
ZTRA0	Z TRACE INTENSITY 0	X2501:06	R3063:04
ZTRA1	Z TRACE INTENSITY 1	X2501:06	R3064:04
ZTXT0	Z TEXT 0 SIGNAL	X2501:06	R3007:04
ZTXT1	Z TEXT 1 SIGNAL	X2501:06	R3008:04

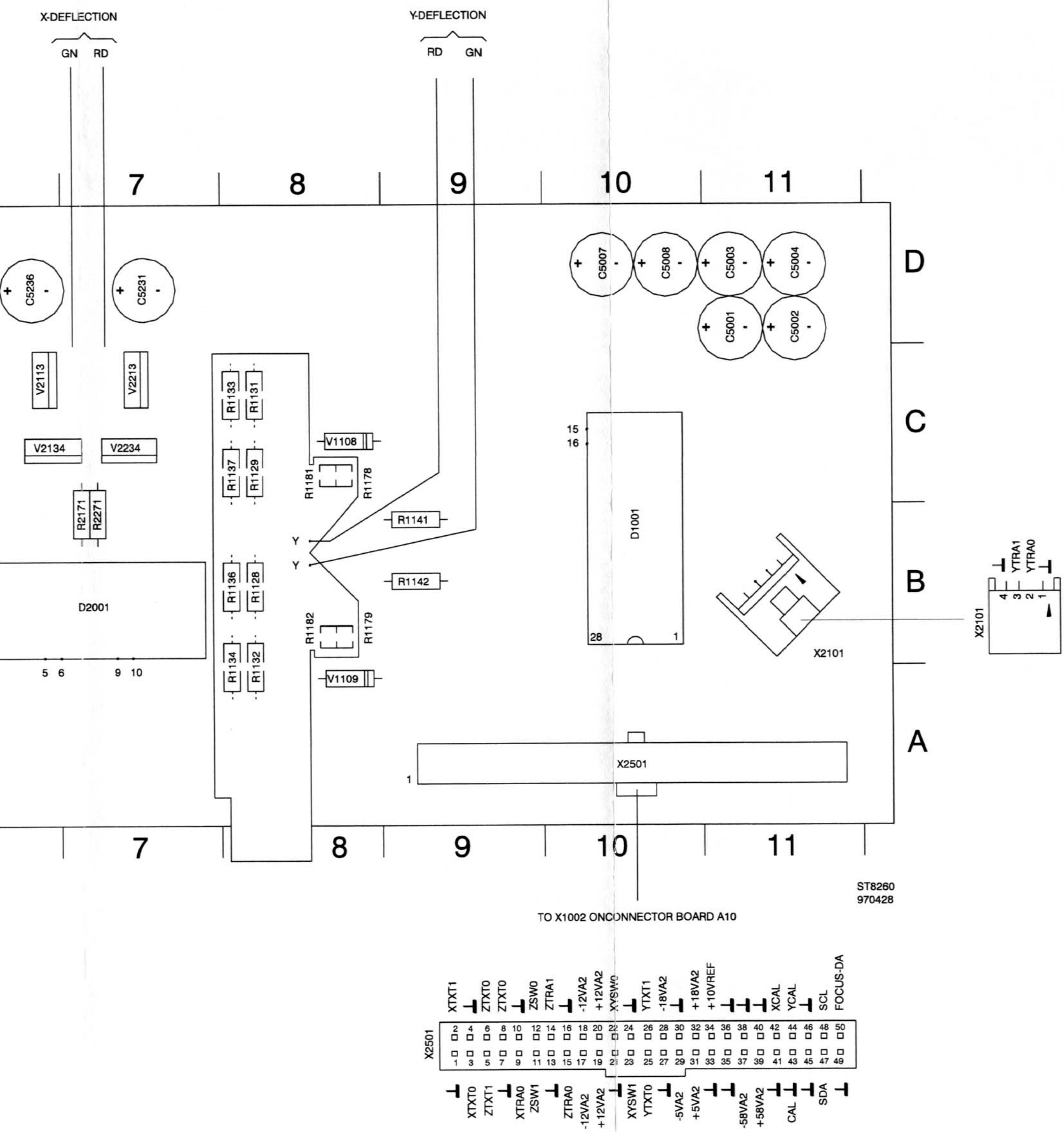
5.2.3 Unit lay-outs A2-200 MHz version



Lay-out 1 - Large component side of XYZ amplifier unit A2-200 MHz

5.2.3 Unit lay-outs A2-200 MHz version





Lay-out 1 - Large component side of XYZ amplifier unit A2-200 MHz

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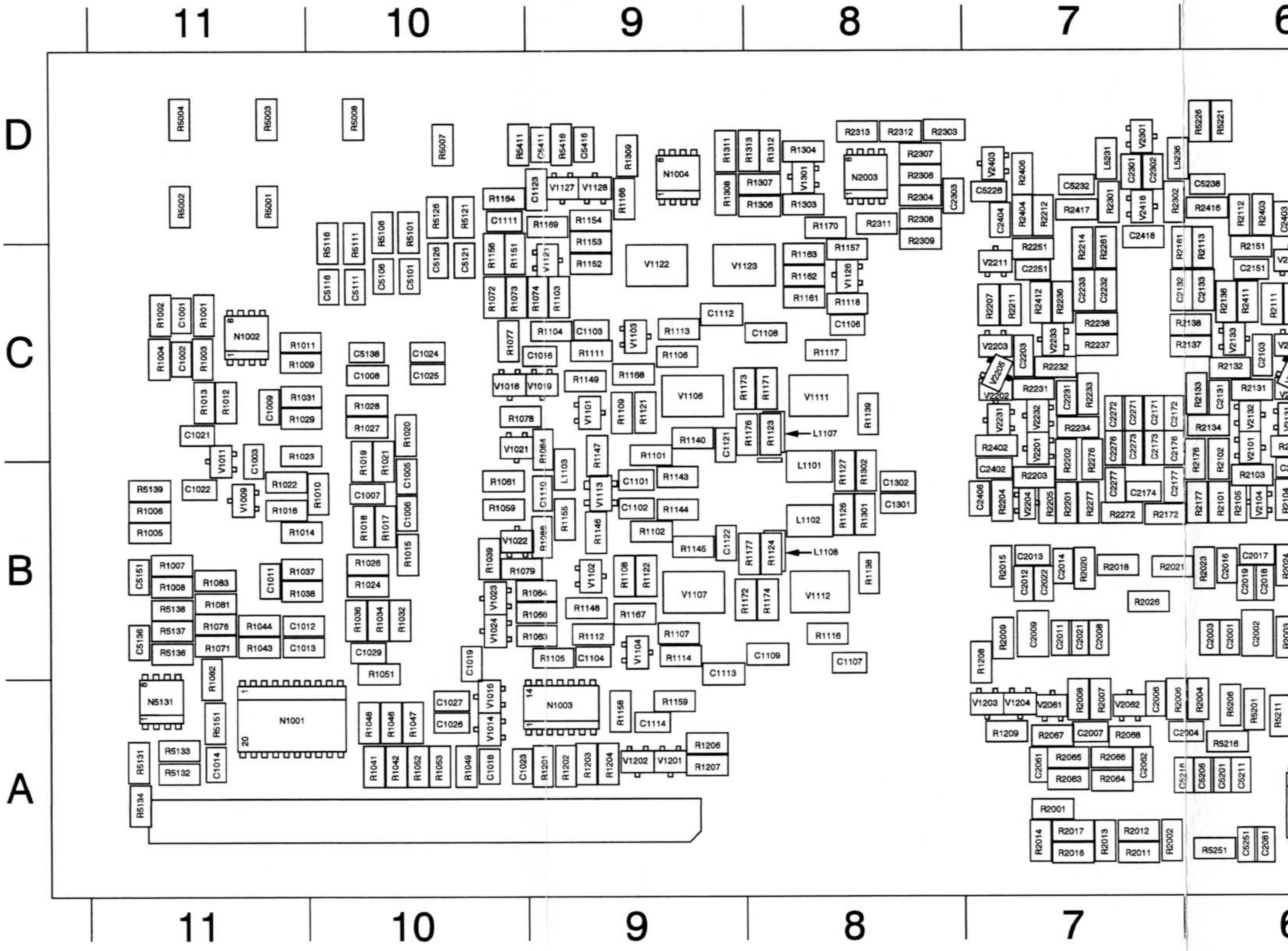
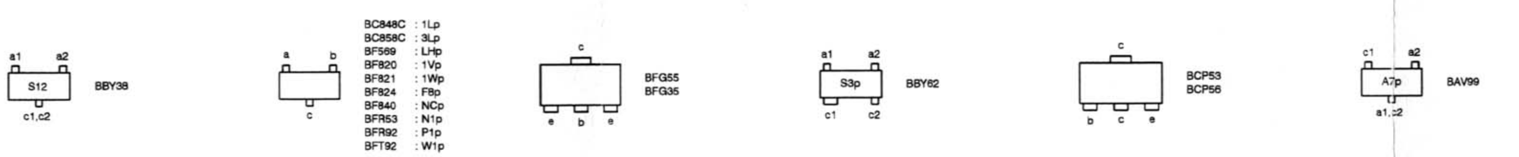
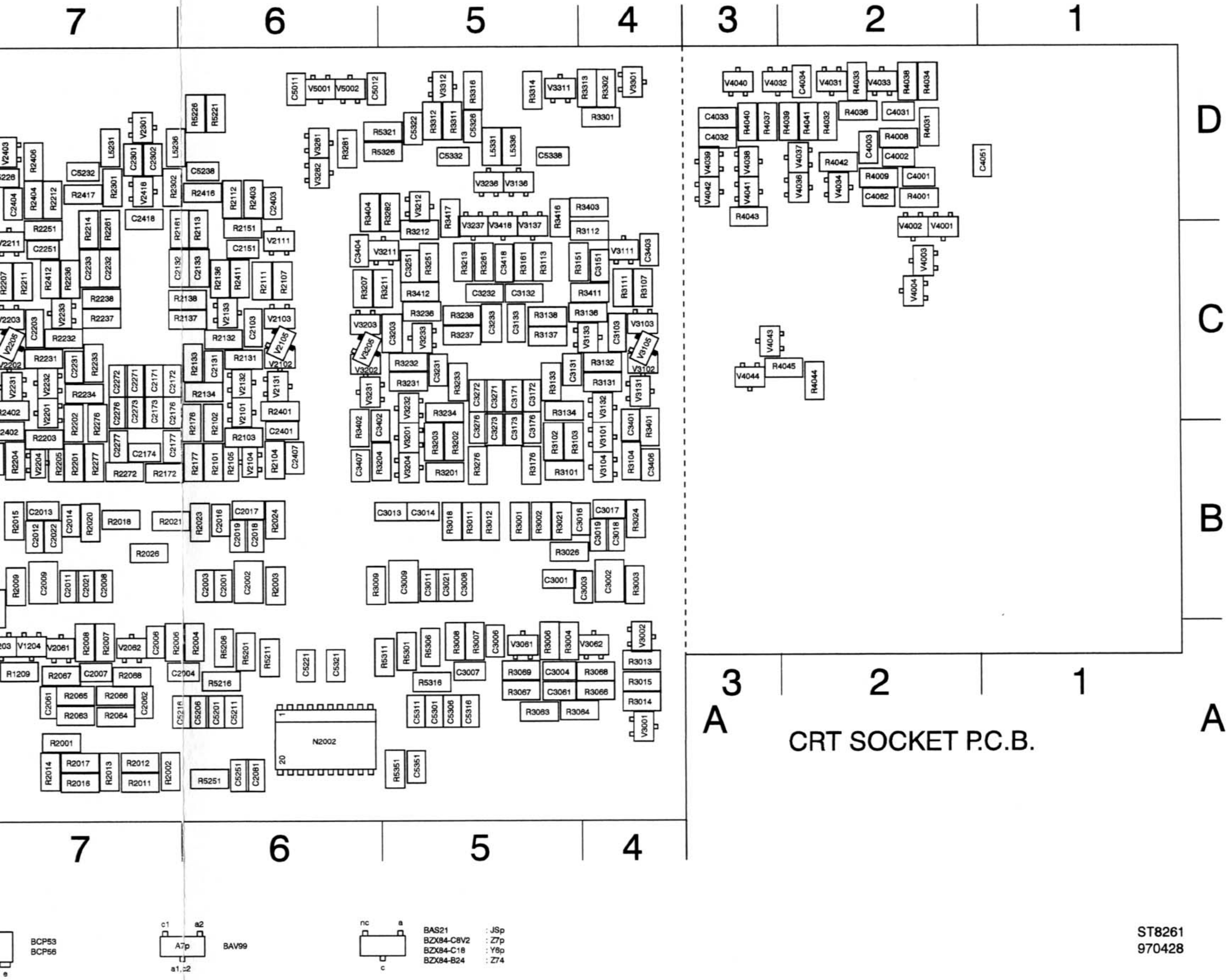
Lay-out 2 - Small component side of XYZ amplifier unit A2-200 MHz


11 10 9 8 7 6
D
C
B
A
11 10 9 8 7 6


a1 a2
S12
c1,c2
BBY38
a b
c
BC848C : 1Lp
BC858C : 3Lp
BF569 : LHp
BF820 : 1Vp
BF821 : 1Wp
BF824 : F8p
BF840 : NCp
BFR53 : N1p
BFR92 : P1p
BFT92 : W1p
c
e b e
BFG55
BFG35
a1 a2
S3p
c1 c2
BBY62
c
b c e
BCP53
BCP56
c1 a2
A7p
a1,c2
BAV99



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Lay-out 2 - Small component side of XYZ amplifier unit A2-200 MHz

5.2.4 Location list A2-200 MHz version

'-L' means that the component is located on the side with the large components. Otherwise the component is located on the side with small components.

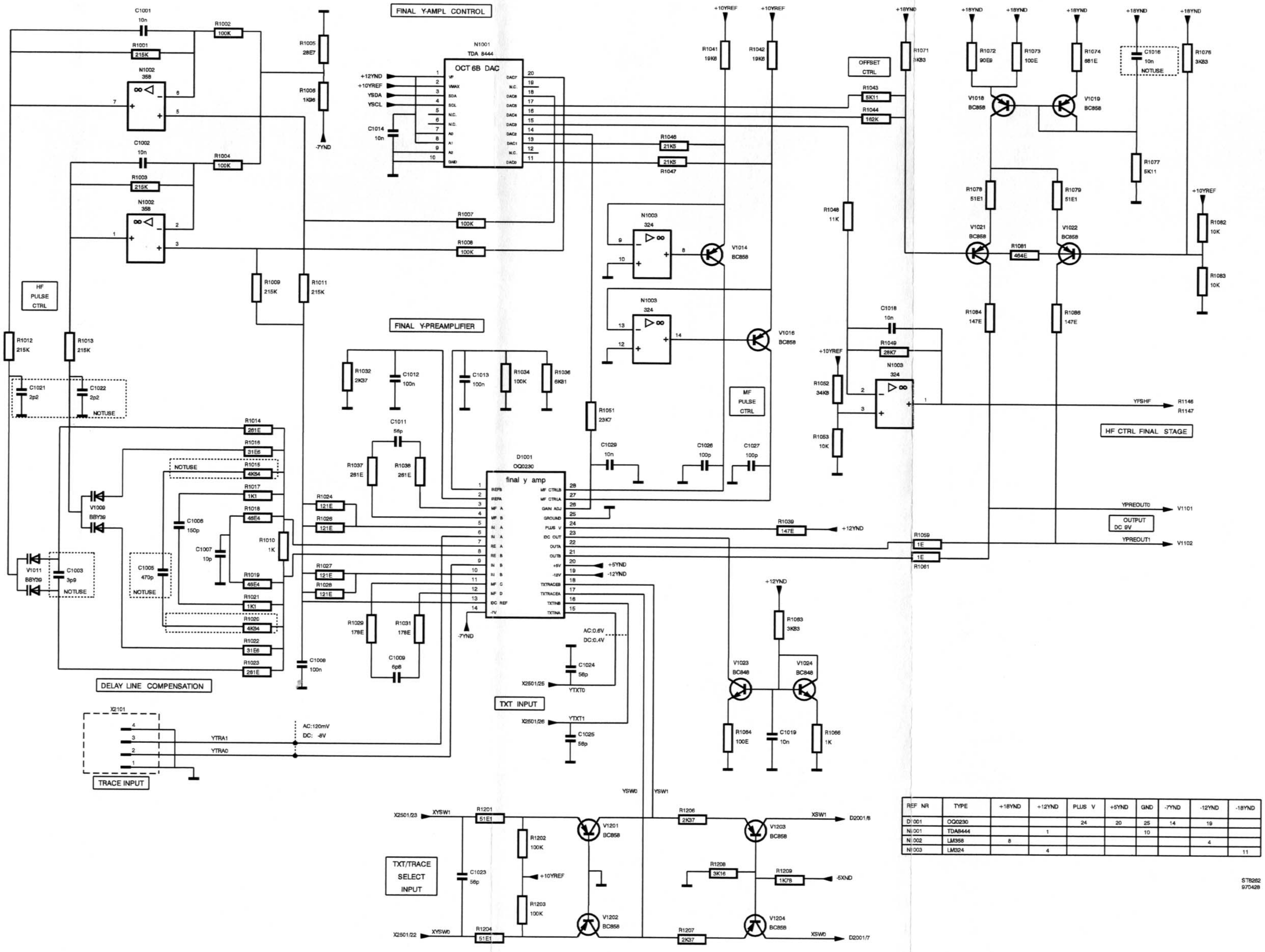
C1001 C11
C1002 C11
C1003 B11
C1005 B10
C1006 B10
C1007 B10
C1008 C10
C1009 C11
C1011 B11
C1012 B11
C1013 B11
C1014 A11
C1016 C10
C1018 A10
C1019 B10
C1021 C11
C1022 B11
C1023 A10
C1024 C10
C1025 C10
C1026 A10
C1027 A10
C1029 B10
C1101 B9
C1102 B9
C1103 C9
C1104 B9
C1106 C8
C1107 B8
C1108 C9
C1109 B9
C1110 B9
C1111 D10
C1112 C9
C1113 B9
C1114 A9
C1121 C9
C1122 B9
C1123 D9
C1301 B8
C1302 B8
C2001 B6
C2002 B6
C2003 B6
C2004 A7
C2006 A7
C2007 A7
C2008 B7
C2009 B7
C2011 B7
C2012 B7
C2013 B7
C2014 B7
C2016 B6
C2017 B6
C2018 B6
C2019 B6
C2021 B7
C2022 B7
C2061 A7
C2062 A7
C2081 A6
C2103 C6
C2131 C6
C2132 C7
C2133 C6
C2151 C6
C2171 C7
C2172 C7
C2173 C7
C2174 B7
C2176 C7
C2177 B7
C2203 C7
C2231 C7
C2232 C7
C2233 C7
C2251 C7
C2271 C7
C2272 C7
C2273 C7
C2276 C7
C2277 B7
C2301 D7
C2302 D7
C2303 D7
C2401 B6
C2402 B7
C2403 D6
C2404 D7
C2406 B7
C2407 B6
C2418 D7
C3001 B5
C3002 B4
C3003 B5
C3004 A5
C3006 A5
C3007 A5
C3008 B5
C3009 B5
C3011 B5
C3013 B6
C3014 B5
C3016 B5
C3017 B4
C3018 B4
C3019 B4
C3021 B5
C3061 A5
C3103 C4
C3131 C5
C3132 C5
C3133 C5
C3151 C4
C3171 C5
C3172 C5
C3173 B5
C3176 B5
C3203 C5
C3231 C5
C3232 C5
C3233 C5
C3251 C5
C3271 C5
C3272 C5
C3273 B5
C3276 B5
C3281 D6-L
C3401 B4
C3402 B6
C3403 C4
C3404 C6
C3406 B4
C3407 B6
C3418 C5
C4001 D2
C4002 D2
C4003 D2
C4004 C2-L
C4031 D2
C4032 D3
C4033 D3
C4034 D2
C4036 C3-L
C4037 C2-L
C4051 D2
C4061 C3-L
C4062 D2
C5001 D11-L
C5002 D11-L
C5003 D11-L
C5004 D11-L
C5007 D10-L
C5008 D10-L
C5011 D6
C5012 D6
C5101 C10
C5106 C10
C5111 C10
C5116 C10
C5121 C10
C5126 C10
C5136 B11
C5138 C10
C5151 B11
C5201 A6
C5206 A6
C5211 A6
C5216 A7
C5221 A6
C5226 D7
C5231 D7-L
C5232 D7
C5236 D6-L
C5238 D6
C5251 A6
C5301 A5
C5306 A5
C5311 A5
C5316 A5
C5321 A6
C5322 D5
C5326 D5
C5331 D5-L
C5332 D5
C5336 D5-L
C5338 D5
C5351 A5
C5411 D9
C5416 D9
D1001 B10-L
D2001 B7-L
D3001 B5-L
L1101 B8
L1102 B8
N1001 A11
N1002 C11
N1003 A9
N1004 D9

N2002 A6
N2003 D8
N5131 A11
R1001 C11
R1002 C11
R1003 C11
R1004 C11
R1005 B11
R1006 B11
R1007 B11
R1008 B11
R1009 C11
R1010 B11
R1011 C11
R1012 C11
R1013 C11
R1014 B11
R1015 B10
R1016 B11
R1017 B10
R1018 B10
R1019 B10
R1020 C10
R1021 B10
R1022 B11
R1023 C11
R1024 B10
R1026 B10
R1027 C10
R1028 C10
R1029 C11
R1031 C11
R1032 B10
R1034 B10
R1036 B10
R1037 B11
R1038 B11
R1039 B10
R1041 A10
R1042 A10
R1043 B11
R1044 B11
R1046 A10
R1047 A10
R1048 A10
R1049 A10
R1051 B10
R1052 A10
R1053 A10
R1059 B10
R1061 B10
R1063 B10
R1064 B10
R1066 B10
R1071 B11
R1072 C10
R1073 C10
R1074 C10
R1076 B11
R1077 C10
R1078 C10
R1079 B10
R1081 B11
R1082 A11
R1083 B11
R1084 C9
R1086 B9
R1101 C9
R1102 B9
R1103 C9
R1104 C9
R1105 B9
R1106 C9
R1107 B9
R1108 B9
R1109 C9
R1111 C9
R1112 B9
R1113 C9
R1114 B9
R1116 B9
R1117 C9
R1118 C8
R1121 C8
R1122 B8
R1123 C8
R1124 B8
R1126 B8
R1127 B8
R1128 B8-L
R1129 C8-L
R1131 C8-L
R1132 A8-L
R1133 C8-L
R1134 A8-L
R1136 B8-L
R1137 C8-L
R1138 B8
R1139 C8
R1140 C9
R1141 C9-L
R1142 B9-L
R1143 B9
R1144 B9
R1145 B9
R1146 B9
R1147 B9
R1148 B9
R1149 C9
R1150 B9
R1151 C10
R1152 C9
R1153 D9
R1154 D9
R1155 B9
R1156 C10
R1157 D8
R1158 A9
R1159 A9
R1161 C8
R1162 C8
R1163 C8
R1164 D10
R1166 D9
R1167 B9
R1168 C9
R1169 D10
R1170 D8
R1171 C8
R1172 B9
R1173 C9
R1174 B8
R1176 C9
R1177 B9
R1178 C8-L
R1179 B8-L
R1181 C8-L
R1182 B8-L
R1201 A9
R1202 A9
R1203 A9
R1204 A9
R1206 A9
R1207 A9
R1208 B7
R1209 A7
R1301 B8
R1302 B8
R1303 D8
R1304 D8
R1306 D9
R1307 D9
R1308 D9
R1309 D9
R1311 D9
R1312 D8
R1313 D9
R2001 A7
R2002 A7
R2003 B6
R2004 A6
R2006 A7
R2007 A7
R2008 A7
R2009 B7
R2011 A7
R2012 A7
R2013 A7
R2014 A7
R2015 B7
R2016 A7
R2017 A7
R2018 B7
R2020 B7
R2021 B7
R2023 B6
R2024 B6
R2026 B7
R2063 A7
R2064 A7
R2065 A7
R2066 A7
R2067 A7
R2068 A7
R2101 B6
R2102 B6
R2103 B6
R2104 B6
R2107 C6
R2111 C6
R2112 D6
R2113 C6
R2131 C6
R2132 C6
R2133 C6
R2134 C6
R2136 C6
R2137 C7
R2138 C7
R2151 D6
R2161 C7
R2171 B7-L
R2172 B7
R2176 B6
R2177 B6
R2201 B7
R2202 B7
R2203 B7
R2204 B7
R2207 C7
R2211 C7
R2212 D7
R2214 C7
R2231 C7
R2232 C7
R2233 C7
R2234 C7
R2236 C7
R2237 C7
R2238 C7
R2251 D7
R2261 C7
R2271 B7-L
R2272 B7

R2276 B7
R2277 B7
R2301 D7
R2302 D7
R2303 D8
R2304 D8
R2306 D8
R2307 D8
R2308 D8
R2309 D8
R2311 D8
R2312 D8
R2313 D8
R2401 C6
R2402 C7
R2403 D6
R2404 D7
R2406 D7
R2411 C6
R2412 C7
R2416 D6
R2417 D7
R3001 B5
R3002 B5
R3003 B4
R3004 A5
R3006 A5
R3007 A5
R3008 A5
R3009 B6
R3011 B5
R3012 B5
R3013 A4
R3014 A4
R3015 A4
R3018 B5
R3021 B5
R3024 B4
R3026 B5
R3063 A5
R3064 A5
R3066 A5
R3067 A5
R3068 A5
R3069 A5
R3101 B5
R3102 B5
R3103 B5
R3104 B4
R3107 C4
R3111 C4
R3112 C5
R3113 C5
R3131 C4
R3132 C4
R3133 C5
R3134 C5
R3136 C5
R3137 C5
R3138 C5
R3151 C5
R3161 C5
R3171 B5-L
R3176 B5
R3201 B5
R3202 B5
R3203 B5
R3204 B6
R3207 C6
R3211 C6
R3212 C5
R3213 C5
R3231 C5
R3232 C5
R3233 C5
R3234 C5
R3236 C5
R3237 C5
R3238 C5
R3251 C5
R3261 C5
R3271 B5-L
R3276 B5
R3281 D6
R3282 D5
R3301 D4
R3302 D4
R3311 D5
R3312 D5
R3313 D4
R3314 D5
R3316 D5
R3401 B4
R3402 B6
R3403 D5
R3404 D6
R3411 C5
R3412 C5
R3416 D5
R3417 D5
R4001 D2
R4002 C2-L
R4003 C2-L
R4004 C2-L
R4006 C2-L
R4007 D2-L
R4008 D2
R4009 D2
R4031 D2
R4032 D2
R4033 D2
R4034 D2
R4036 D2
R4037 D3
R4038 D2
R4039 D2
R4040 D3
R4041 D2
R4042 D2
R4043 D3
R4044 C2
R4045 C3
R4051 C2-L
R5001 D11
R5002 D11
R5003 D11
R5004 D11
R5007 D10
R5008 D10
R5101 D10
R5106 D10
R5111 C10
R5116 C10
R5121 D10
R5126 D10
R5131 A11
R5132 A11
R5133 A11
R5134 A11
R5136 B11
R5137 B11
R5138 B11
R5139 B11
R5151 A11
R5201 A6
R5206 A6
R5211 A6
R5216 A6
R5221 D6
R5226 D6
R5231 D7
R5236 D7
R5251 A6
R5301 A5
R5306 A5
R5311 A6
R5316 A5
R5321 D6
R5326 D6
R5331 D5
R5336 D5
R5351 A5
R5411 D10
R5416 D9
V1009 B11
V1011 B11
V1014 A10
V1016 A10
V1018 C10
V1019 C10
V1021 C10
V1022 B10
V1023 B10
V1024 B10
V1101 C9
V1102 B9
V1103 C9
V1104 B9
V1106 C9
V1107 B9
V1108 C8-L
V1109 B8-L
V1111 C8
V1112 B8
V1113 B9
V1121 C9
V1122 C9
V1123 C9
V1126 C8
V1127 D9
V1128 D9
V1201 A9
V1202 A9
V1203 A7
V1204 A7
V1301 D8
V2019 B6
V2061 A7
V2062 A7
V2101 C6
V2102 C6
V2103 C6
V2104 B6
V2111 C6
V2113 C6-L
V2131 C6
V2132 C6
V2133 C6
V2134 C7-L
V2201 C7
V2202 C7
V2203 C7
V2204 B7
V2211 C7
V2213 C7-L
V2231 C7
V2232 C7
V2233 C7
V2234 C7-L
V2301 D7
V2403 D7
V2418 D7
V3001 A4
V3002 A4

V3061 A5
V3062 A5
V3101 B4
V3102 C4
V3103 C4
V3104 B4
V3111 C4
V3113 C5-L
V3131 C4
V3132 C4
V3133 C4
V3134 C5-L
V3136 D5
V3137 D5
V3201 B5
V3202 C6
V3203 C6
V3204 B5
V3211 C6
V3212 D5
V3213 C5-L
V3231 C6
V3232 C5
V3233 C5
V3234 C5-L
V3236 D5
V3237 D5
V3281 D6
V3282 D6
V3301 D4
V3311 D5
V3312 D5
V3418 D5
V4001 D2
V4002 D2
V4003 C2
V4004 C2
V4031 D2
V4032 D3
V4033 D2
V4034 D2
V4036 D2
V4037 D2
V4038 D3
V4039 D3
V4040 D3
V4041 D3
V4042 D3
V4043 C3
V4044 C3
V5001 D6
V5002 D6
X2101 A11-L
X2301 D4-L
X2401 D2-L
X2402 B3-L
X2403 B3-L
X2501 A10-L

5.2.5 Circuit diagrams A2-200 MHz version



REF NR	TYPE	+18YND	+12YND	PLUS V	+5YND	GND	-7YND	-12YND	-18YND
D1001	OQ0230			24	20	25	14	19	
N1001	TDA8444		1			10			
N1002	LM358	8						4	
N1003	LM324		4						11

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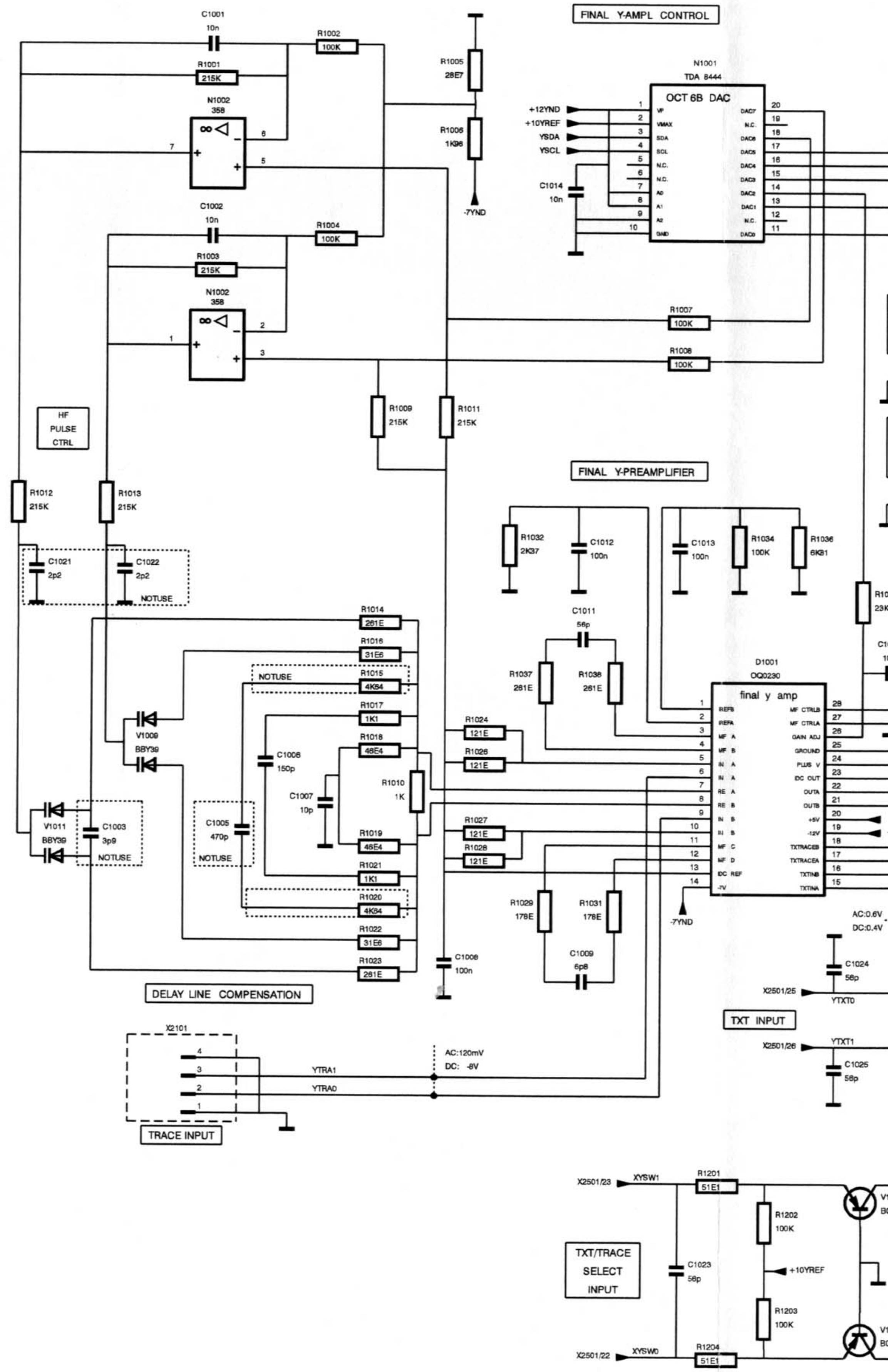
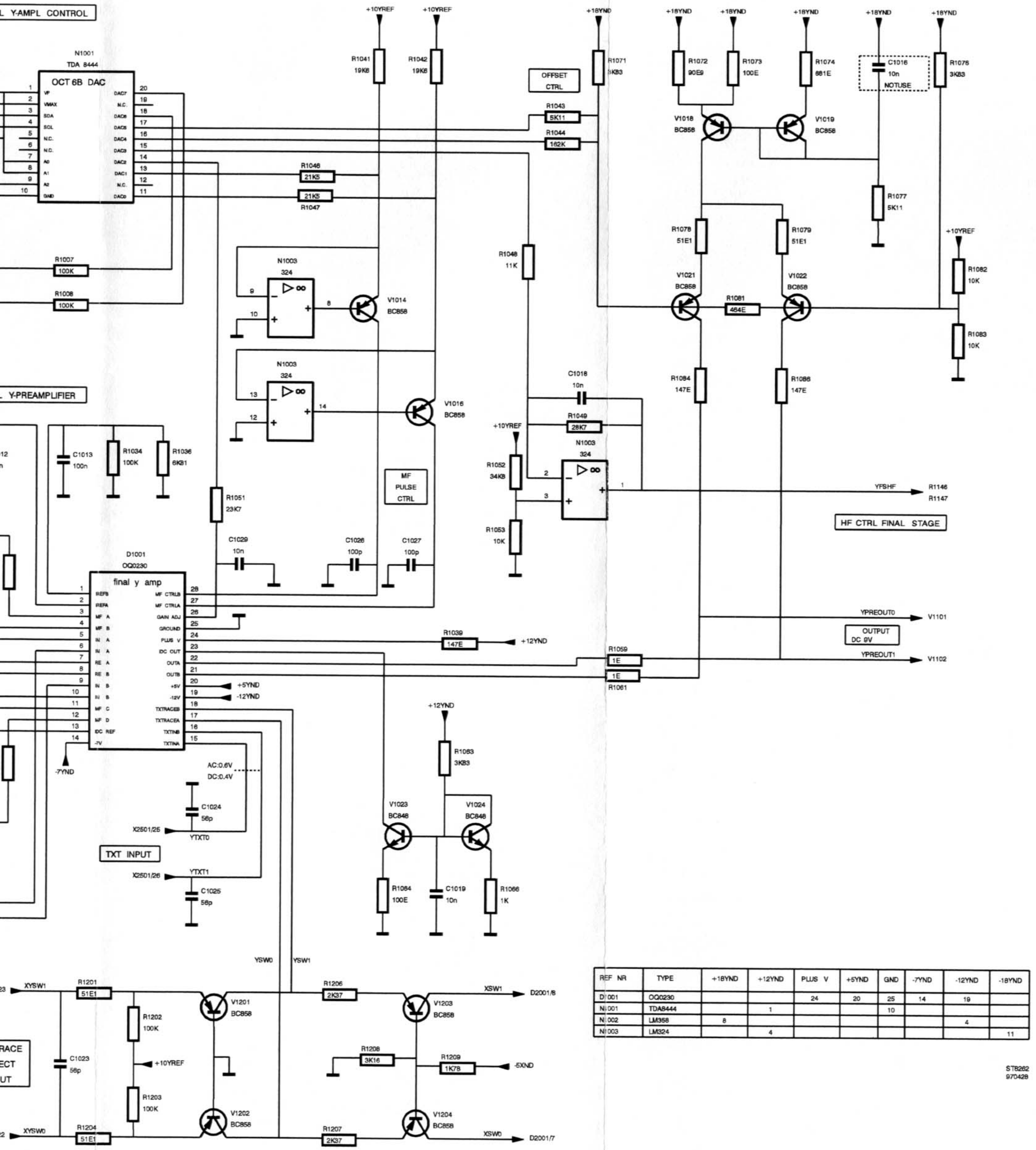
A2 (200 MHz) - Diagram 1 ; Final Y preamplifier and control

5.2.5 Circuit diagrams A2-200 MHz version





REF NR	TYPE	+18YND	+12YND	PLUS V	+5YND	GND	-7YND	-12YND	-18YND
D1001	OQ0230			24	20	25	14	19	
N1001	TDA8444		1			10			
N1002	LM358	8						4	
N1003	LM324		4						11

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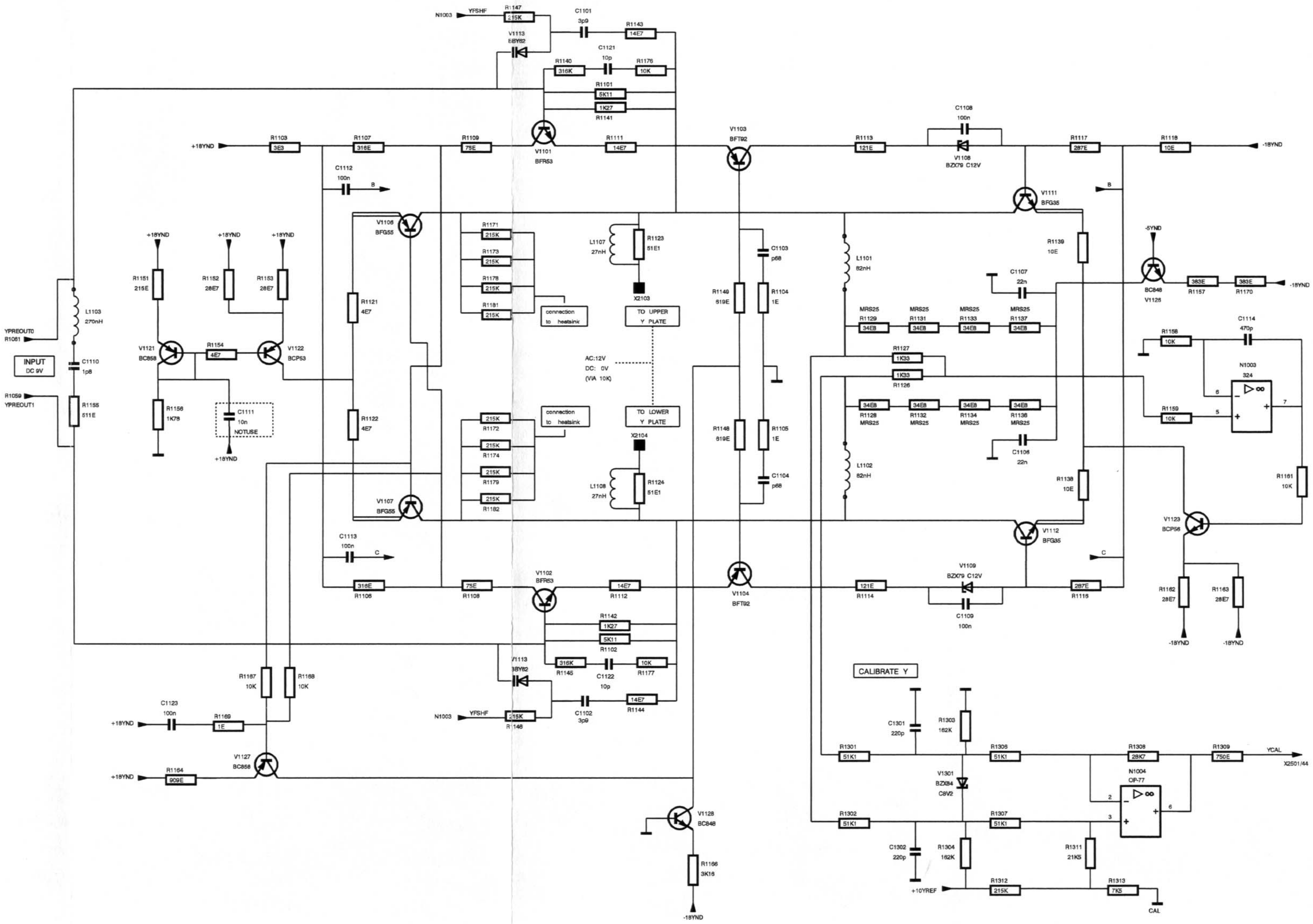
A2 (200 MHz) - Diagram 1 ; Final Y preamplifier and control



REF NR	TYPE	+12YND	+12CND	GND	-12CND	-18YND
N1003	LM324	4				11
N1004	OP-77		7		4	

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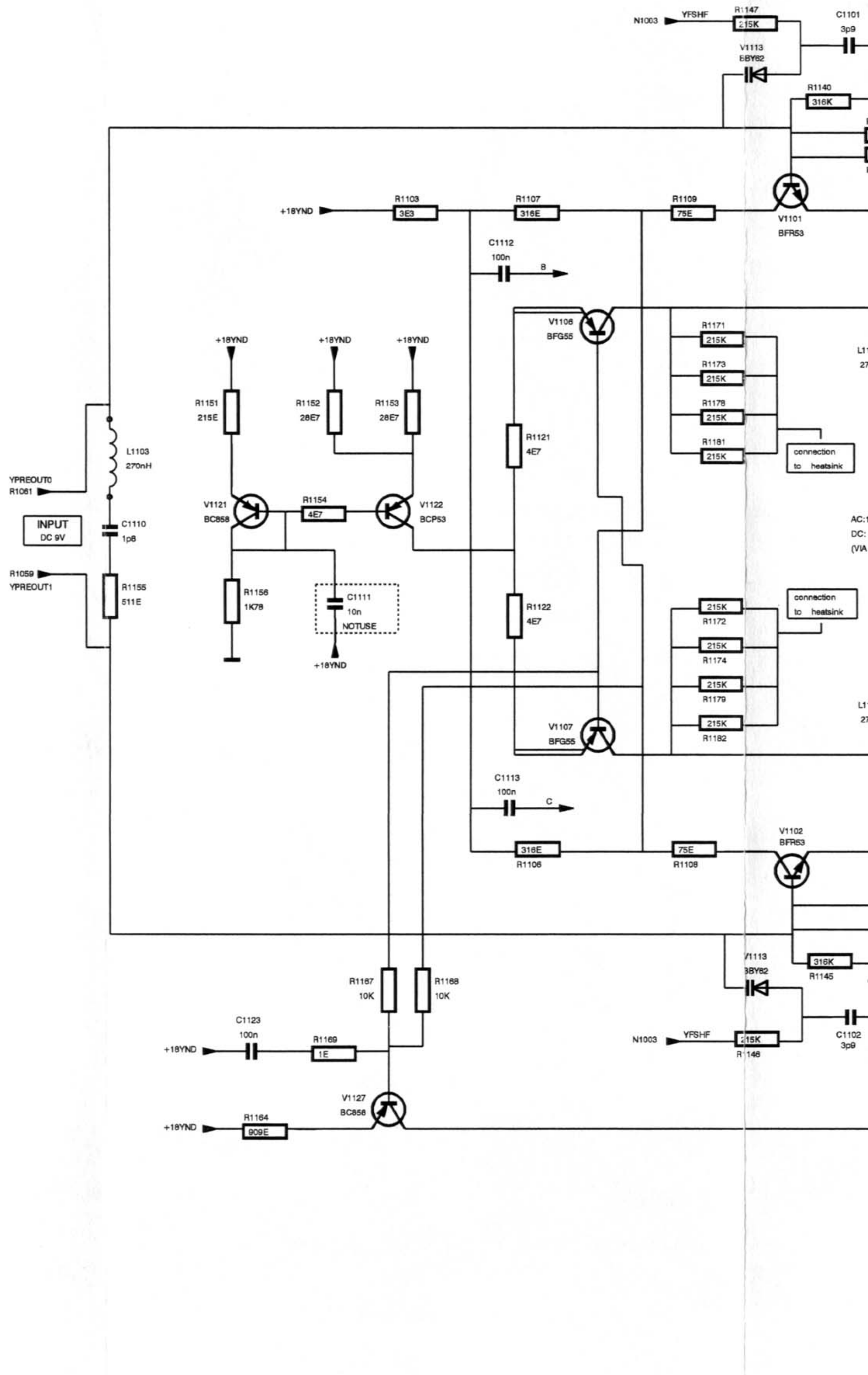
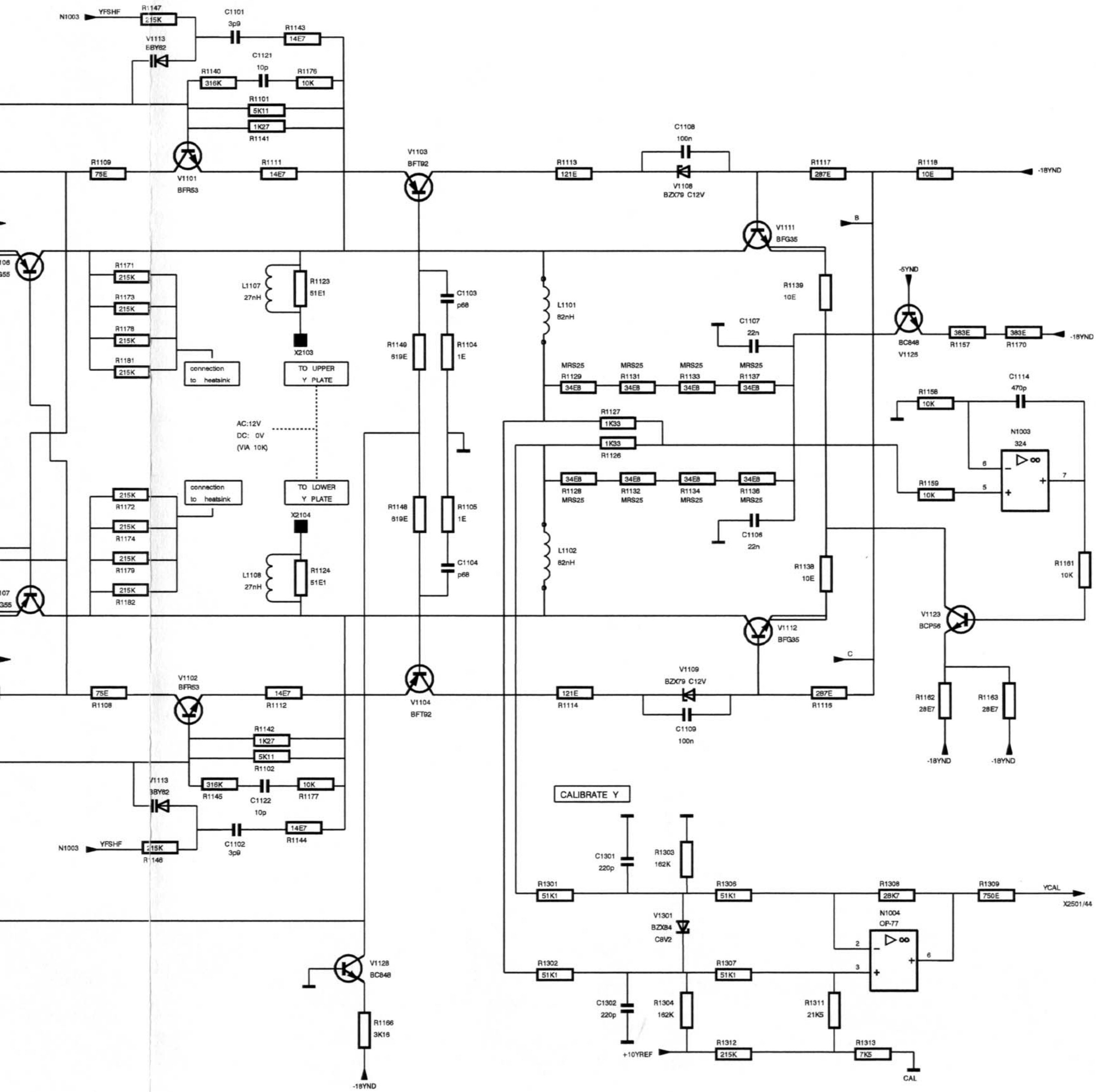
A2 (200 MHz) - Diagram 2 ; Final Y output stage



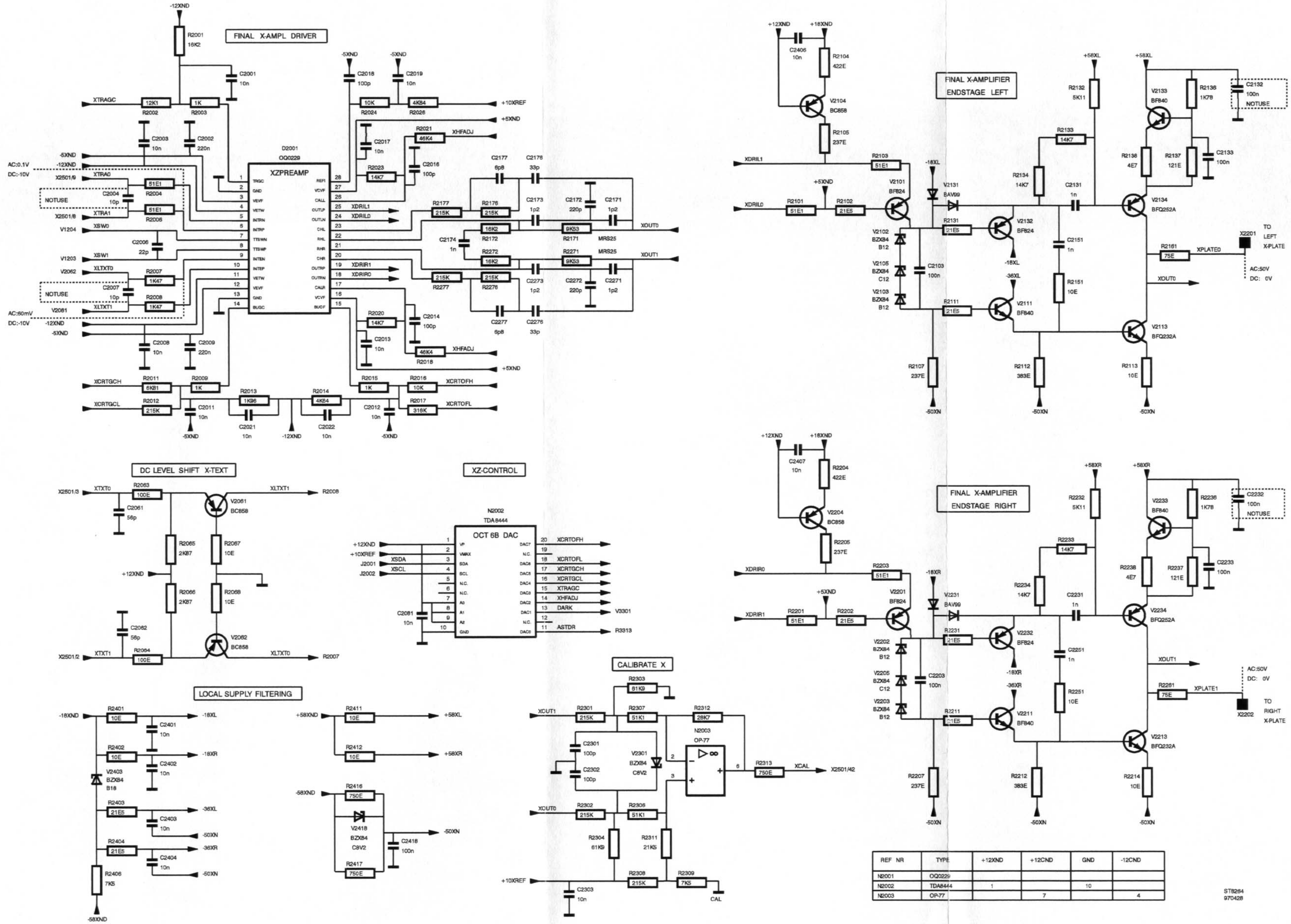
N1003
YFSHF
R1147
215K
C1101
3p9
V1113
BBY62
R1140
316K
+18YND
R1103
3E3
R1107
316E
R1109
75E
V1101
BFR53
C1112
100n
B
V1106
BFG55
R1171
215K
R1173
215K
R1178
215K
R1181
215K
connection
to heatsink
R1151
215E
R1152
28E7
R1153
28E7
R1121
4E7
L1103
270nH
YPREOUT0
R1061
V1121
BC858
R1154
4E7
V1122
BCP53
INPUT
DC 9V
C1110
1p8
R1059
YPREOUT1
R1155
511E
R1156
1K78
C1111
10n
NOTUSE
R1122
4E7
R1172
R1174
R1179
R1182
V1107
BFG55
C1113
100n
C
R1106
R1108
V1102
BFR53
R1145
R1167
10K
R1168
10K
C1123
R1169
1E
C1102
R1146
V1127
BC858
R1164
909E



REF NR	TYPE	+12YND	+12CND	GND	-12CND	-18YND
N1003	LM324	4				11
N1004	OP-77		7		4	

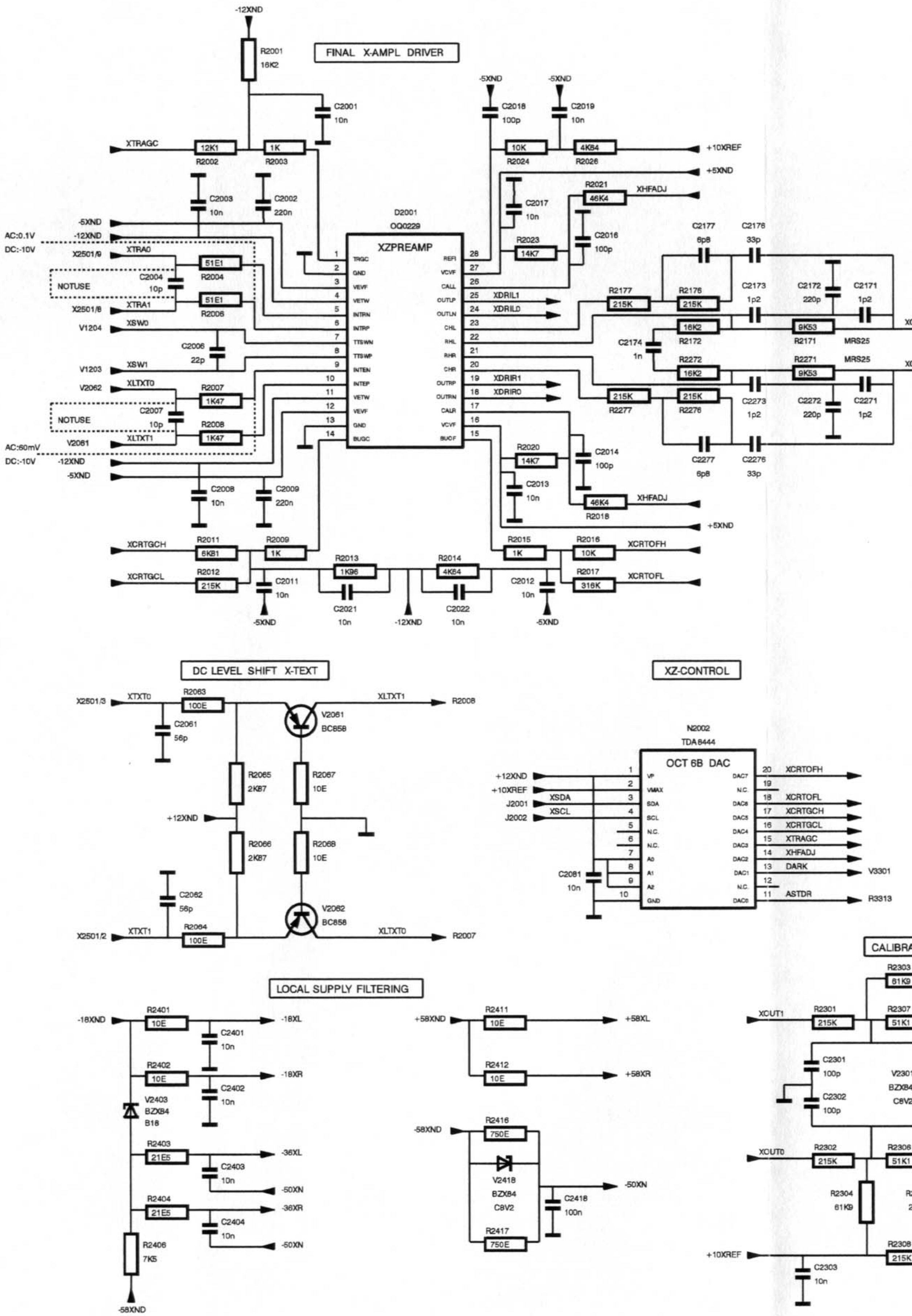
ST8263
970428

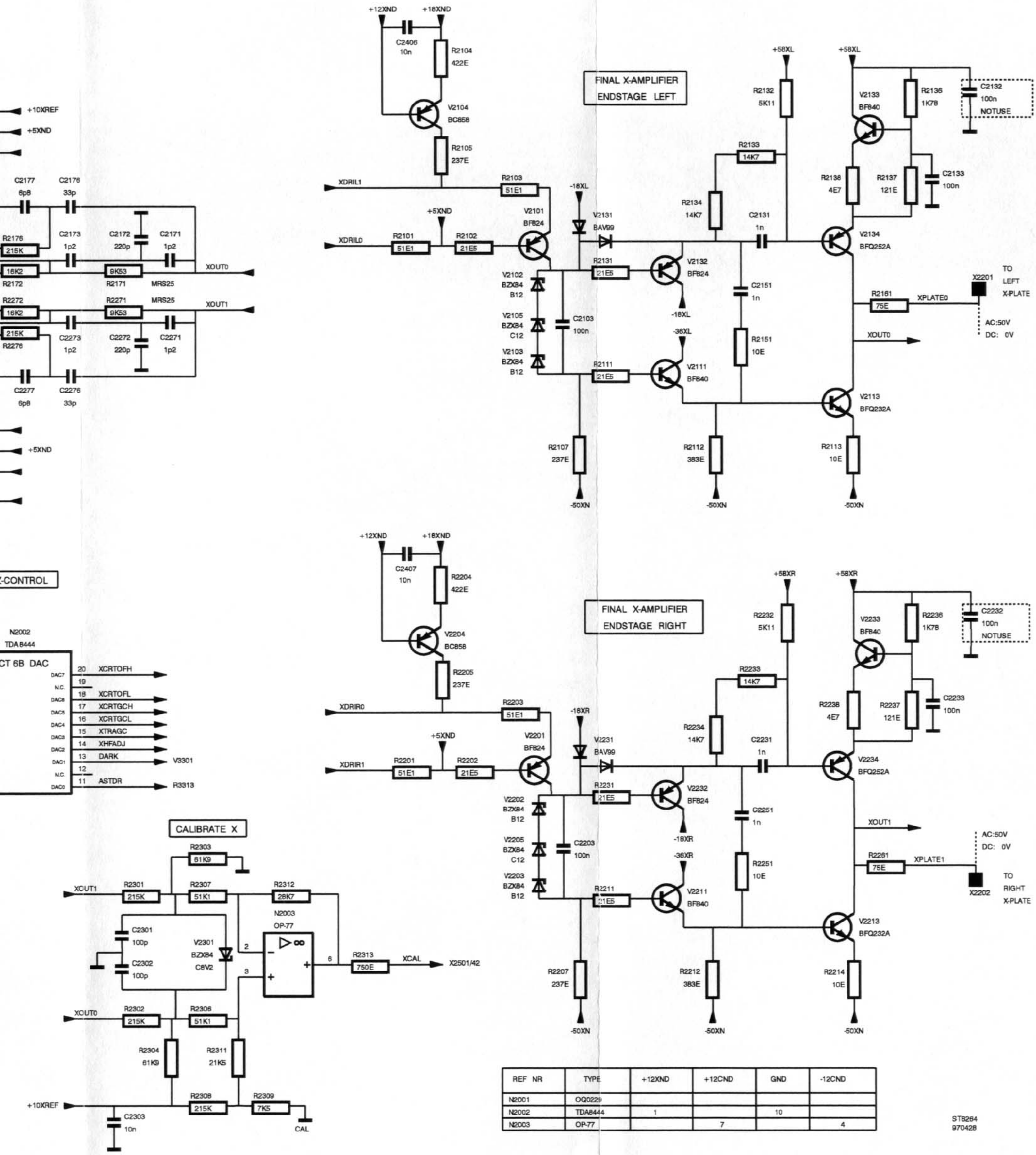
A2 (200 MHz) - Diagram 2 ; Final Y output stage



REF NR	TYPE	+12XND	+12CND	GND	-12CND
N2001	OQ0229				
N2002	TDA8444	1		10	
N2003	OP-77		7		4

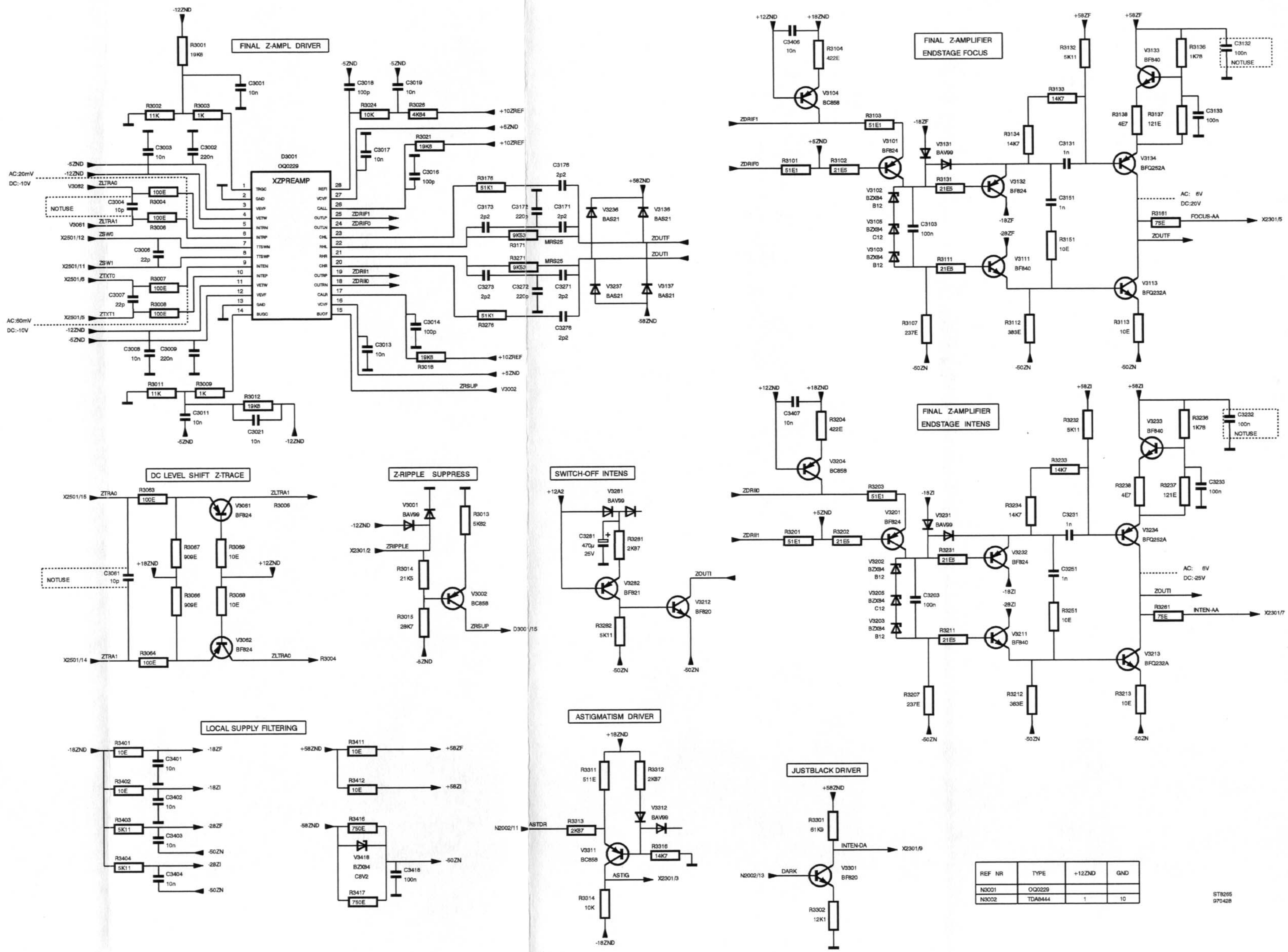
A2 (200 MHz) - Diagram 3 ; Final X preamplifier and control


FINAL X-AMPL DRIVER
-12XND
R2001
16K2
C2001
10n
XTRAGC
12K1
R2002
1K
R2003
C2003
10n
C2002
220n
D2001
OQ0229
XZPREAMP
AC:0.1V
DC:-10V
NOTUSE
C2004
10p
51E1
R2004
51E1
R2006
C2006
22p
1K47
R2007
C2007
10p
1K47
R2008
AC:60mV
DC:-10V
C2008
10n
C2009
220n
XCRTGCH
6K81
R2011
1K
R2009
XCRTGCL
215K
R2012
C2011
10n
1K96
R2013
C2021
10n
4K64
R2014
C2022
10n
C2012
10n
-5XND
C2018
100p
C2019
10n
10K
R2024
4K64
R2026
+10XREF
+5XND
46K4
R2021
XHFADJ
C2017
10n
14K7
R2023
C2016
100p
XDRIL1
XDRIL0
XDRIR1
XDRIR0
R2177
215K
R2176
215K
C2177
6p8
C2176
33p
C2173
1p2
C2172
220p
C2171
1p2
16K2
R2172
9K53
R2171
MRS25
C2174
1n
R2272
16K2
R2271
9K53
215K
R2277
215K
R2276
C2273
1p2
C2272
220p
C2271
1p2
C2277
6p8
C2276
33p
R2020
14K7
C2013
10n
C2014
100p
46K4
R2018
1K
R2015
10K
R2016
XCRTOFH
316K
R2017
XCRTOFL
DC LEVEL SHIFT X-TEXT
X2501/3
XTXT0
R2063
100E
C2061
56p
XLTXT1
R2008
V2061
BC858
R2065
2K87
R2067
10E
+12XND
R2066
2K87
R2068
10E
C2062
56p
V2062
BC858
X2501/2
XTXT1
R2064
100E
XLTXT0
R2007
XZ-CONTROL
N2002
TDA8444
OCT 6B DAC
+12XND
+10XREF
J2001
XSDA
J2002
XSCL
C2081
10n
XCRTOFH
XCRTOFL
XCRTGCH
XCRTGCL
XTRAGC
XHFADJ
DARK
V3301
ASTDR
R3313
LOCAL SUPPLY FILTERING
-18XND
R2401
10E
-18XL
C2401
10n
R2402
10E
-18XR
C2402
10n
V2403
BZX84
B18
R2403
21E5
-36XL
C2403
10n
-50XN
R2404
21E5
-36XR
C2404
10n
-50XN
R2406
7K5
-58XND
+58XND
R2411
10E
+58XL
R2412
10E
+58XR
-58XND
R2416
750E
V2418
BZX84
C8V2
C2418
100n
-50XN
R2417
750E
CALIBRA
R2303
61K9
XOUT1
R2301
215K
R2307
51K1
C2301
100p
C2302
100p
V2301
BZX84
C8V2
XOUT0
R2302
215K
R2306
51K1
R2304
61K9
+10XREF
R2308
215K
C2303
10n



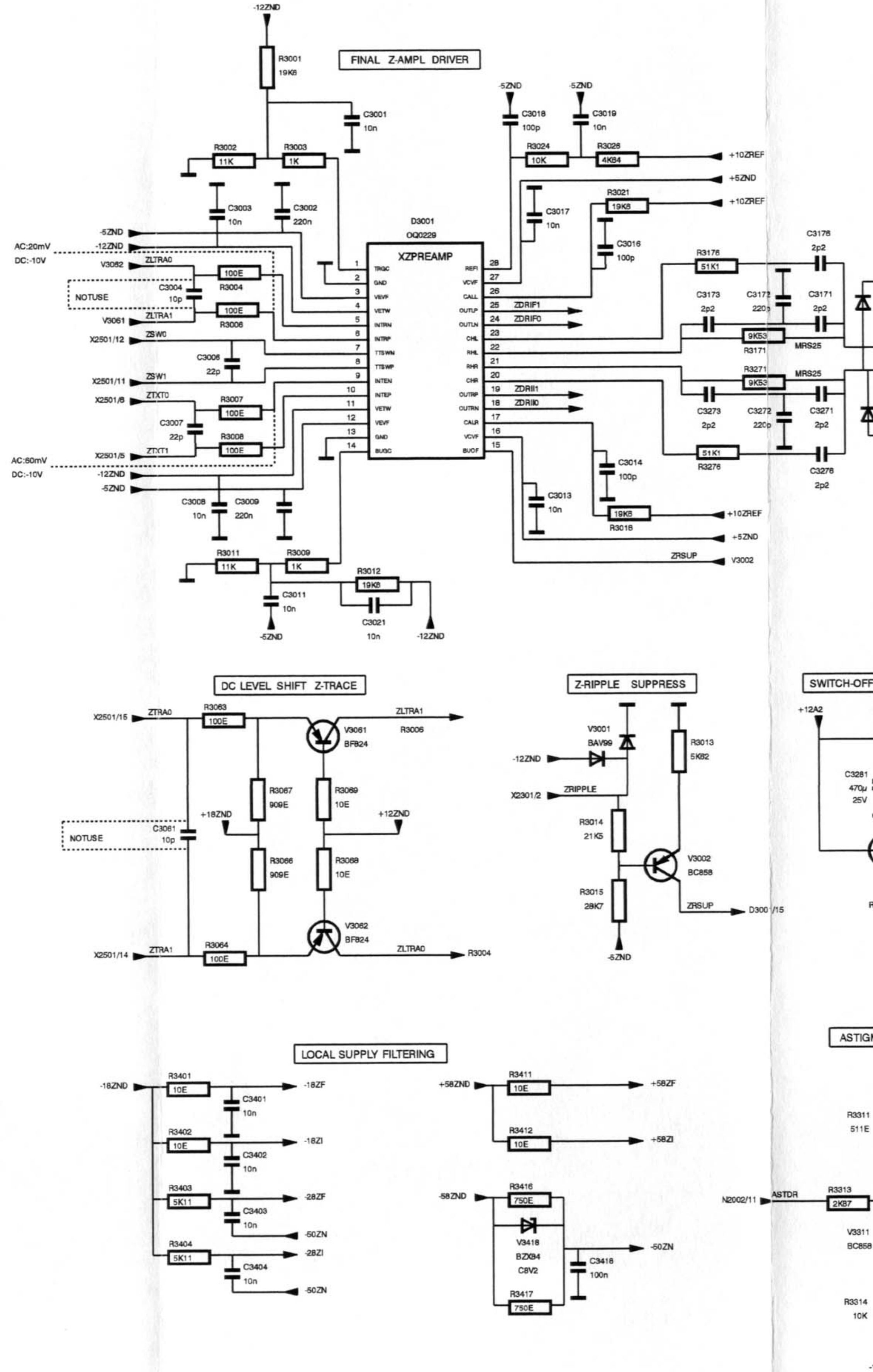
REF NR	TYPE	+12XND	+12CND	GND	-12CND
N2001	OQ0229				
N2002	TDA8444	1		10	
N2003	OP-77		7		4

A2 (200 MHz) - Diagram 3 ; Final X preamplifier and control

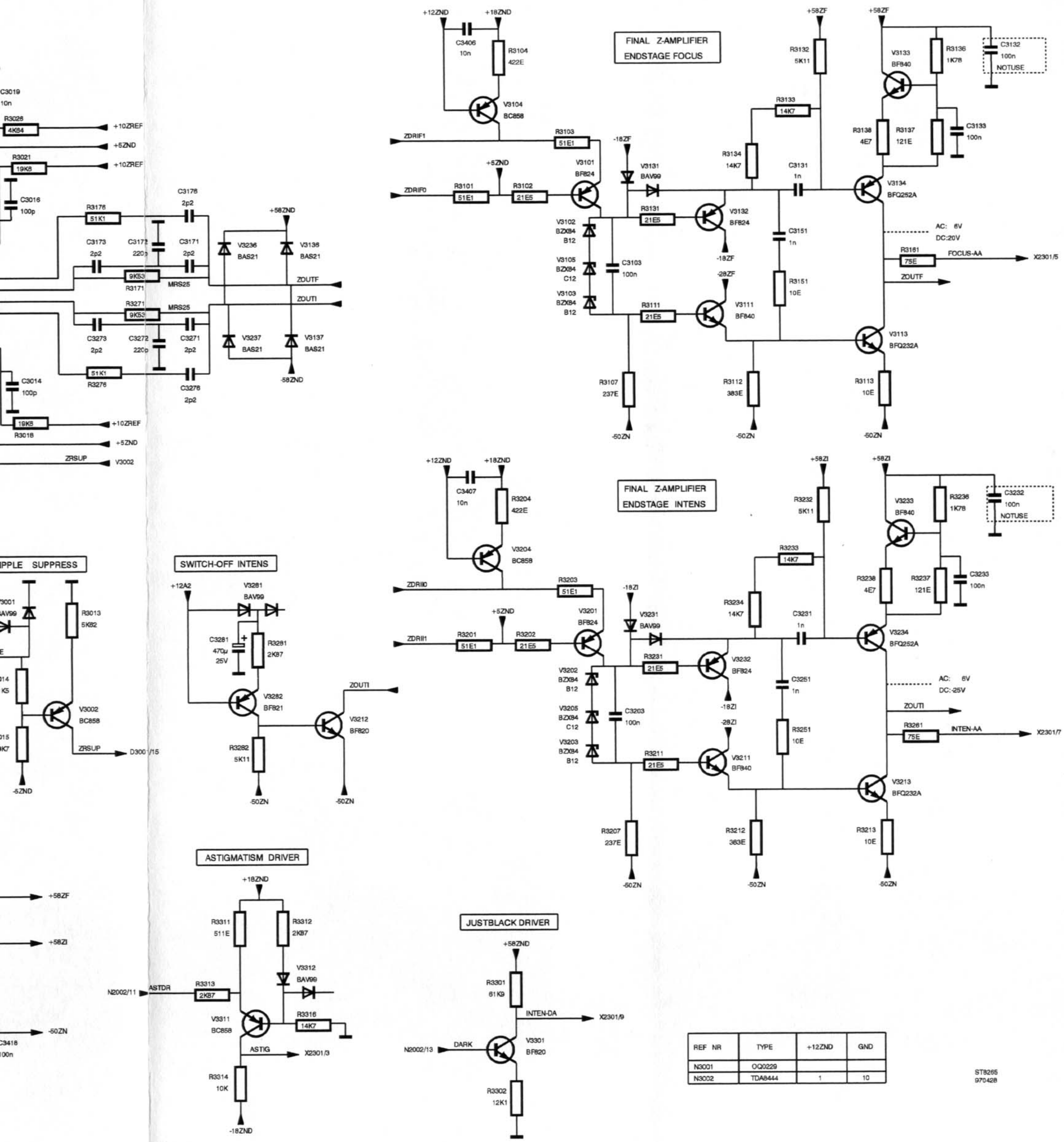


REF NR	TYPE	+12ZND	GND
N3001	OQ0229		
N3002	TDA8444	1	10

A2 (200 MHz) - Diagram 4 ; Final Z amplifier

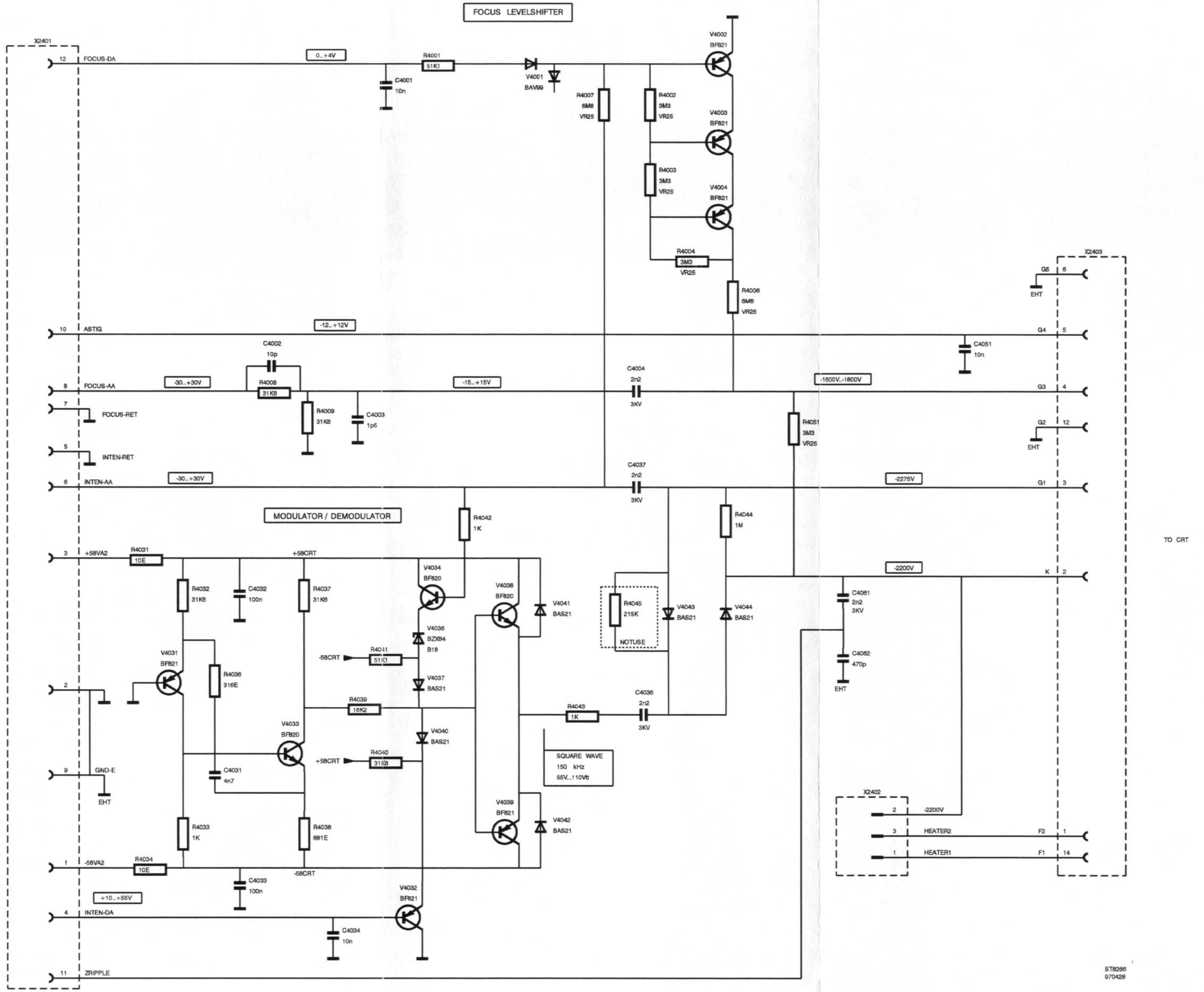


FINAL Z-AMPL DRIVER
D3001
OQ0229
XZPREAMP
R3001 19K6
C3001 10n
R3002 11K
R3003 1K
C3003 10n
C3002 220n
C3018 100p
C3019 10n
R3024 10K
R3026 4K64
+10ZREF
+5ZND
R3021 19K6
C3017 10n
C3016 100p
R3004 100E
R3006 100E
C3004 10p
NOTUSE
C3006 22p
R3007 100E
R3008 100E
C3007 22p
AC:20mV
DC:-10V
AC:60mV
DC:-10V
ZDRIF1
ZDRIF0
ZDRII1
ZDRII0
R3176 51K1
C3176 2p2
C3173 2p2
C3172 220p
C3171 2p2
R3171 9K53
MRS25
R3271 9K53
C3273 2p2
C3272 220p
C3271 2p2
R3276 51K1
C3276 2p2
C3014 100p
C3013 10n
R3018 19K6
ZRSUP
V3002
C3008 10n
C3009 220n
R3011 11K
R3009 1K
R3012 19K6
C3011 10n
C3021 10n
-12ZND
-5ZND
DC LEVEL SHIFT Z-TRACE
X2501/15
ZTRA0
R3063 100E
V3061 BF824
ZTLRA1
R3067 909E
R3066 909E
R3069 10E
R3068 10E
+18ZND
+12ZND
C3061 10p
NOTUSE
V3062 BF824
X2501/14
ZTRA1
R3064 100E
ZTLRA0
R3004
Z-RIPPLE SUPPRESS
V3001 BAV99
R3013 5K62
X2301/2
ZRIPPLE
R3014 21K5
R3015 28K7
V3002 BC858
ZRSUP
D3001/15
SWITCH-OFF
+12A2
C3281 470μ 25V
LOCAL SUPPLY FILTERING
-18ZND
R3401 10E
C3401 10n
-18ZF
R3402 10E
C3402 10n
-18ZI
R3403 5K11
C3403 10n
-28ZF
-50ZN
R3404 5K11
C3404 10n
-28ZI
-50ZN
+58ZND
R3411 10E
+58ZF
R3412 10E
+58ZI
-58ZND
R3416 750E
V3418 BZX84 C8V2
C3418 100n
-50ZN
R3417 750E
ASTIGM
R3311 511E
N2002/11
ASTDR
R3313 2K87
V3311 BC858
R3314 10K

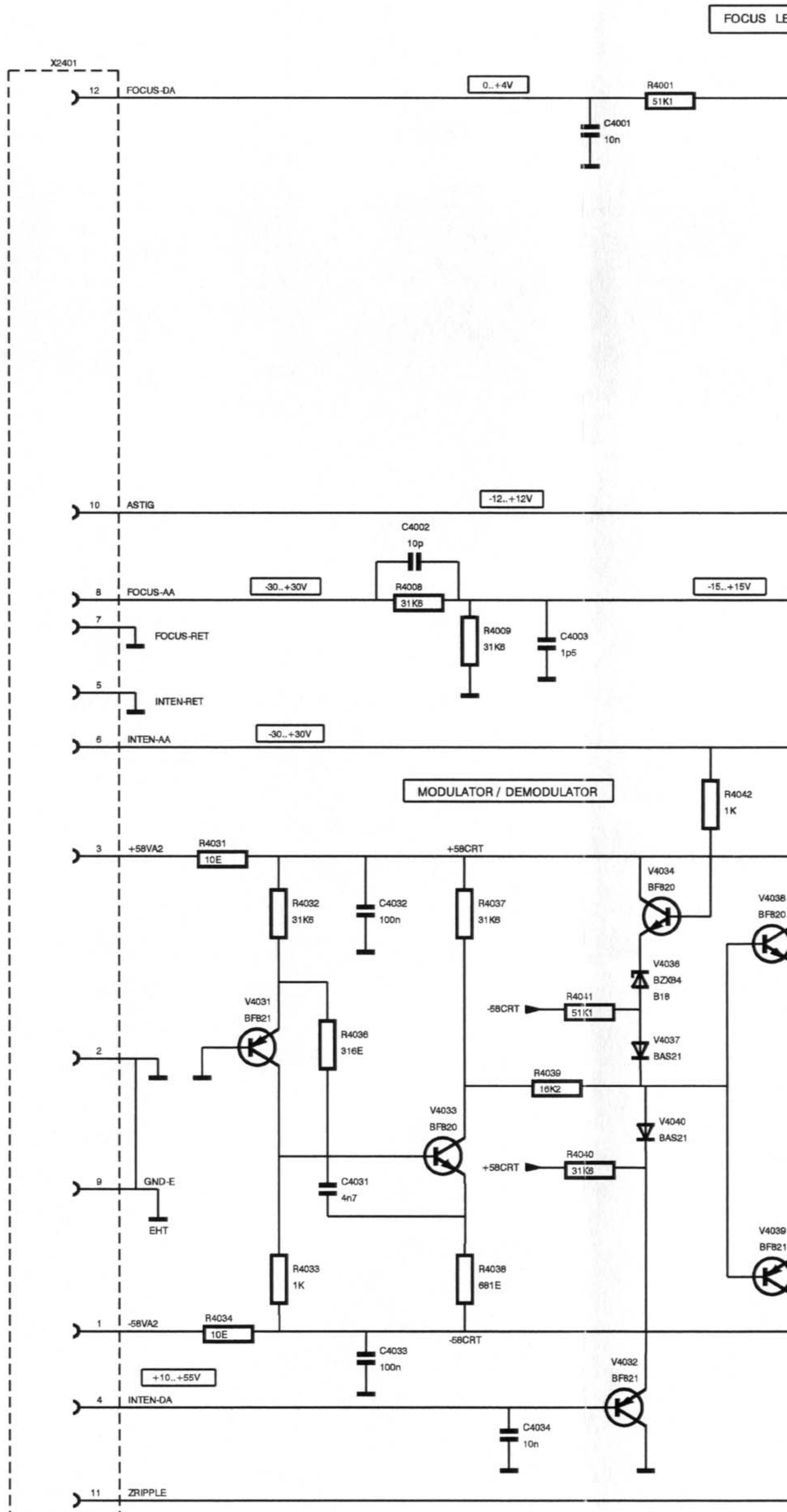


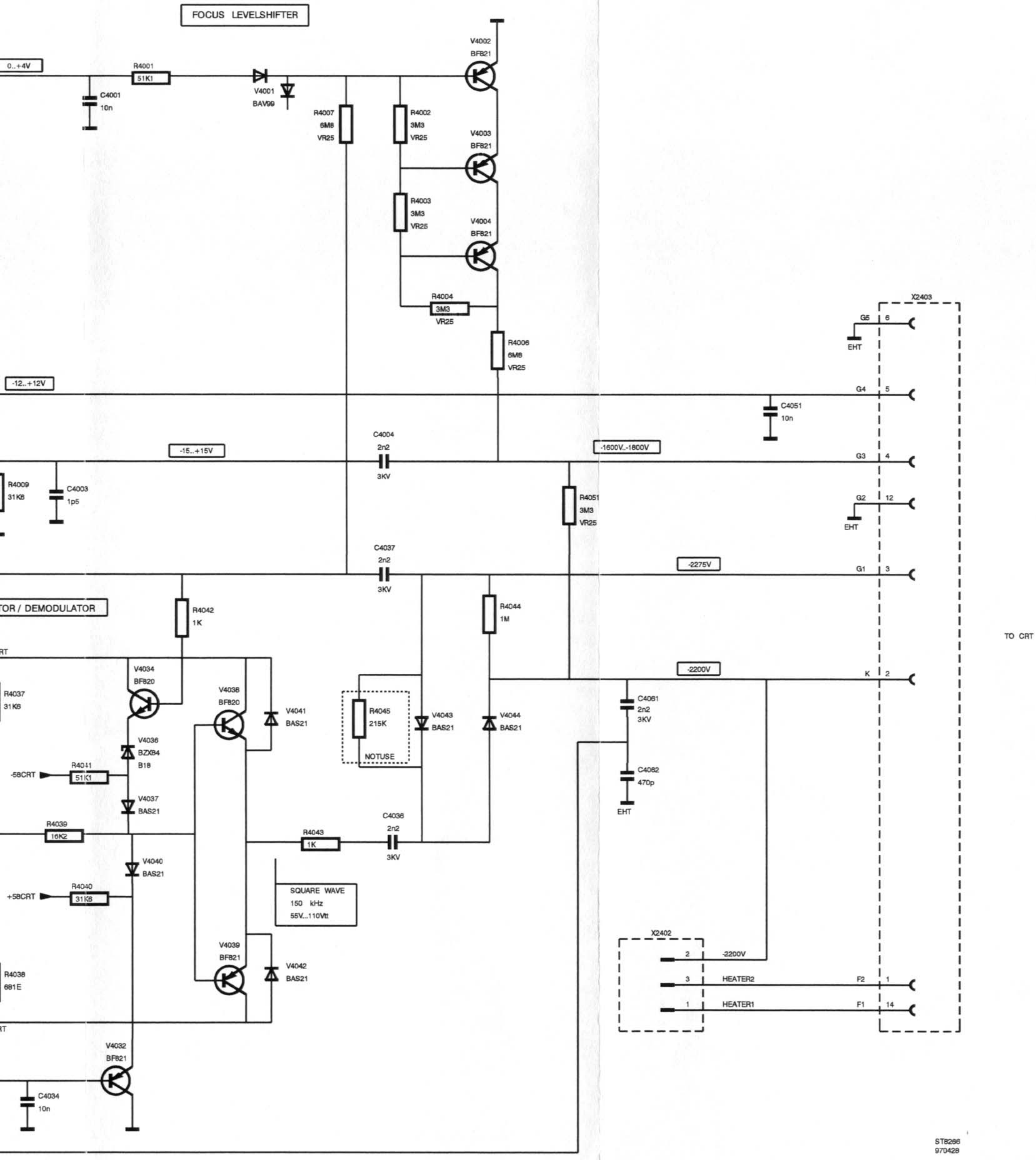
REF NR	TYPE	+12ZND	GND
N3001	OQ0229		
N3002	TDA8444	1	10

A2 (200 MHz) - Diagram 4 ; Final Z amplifier

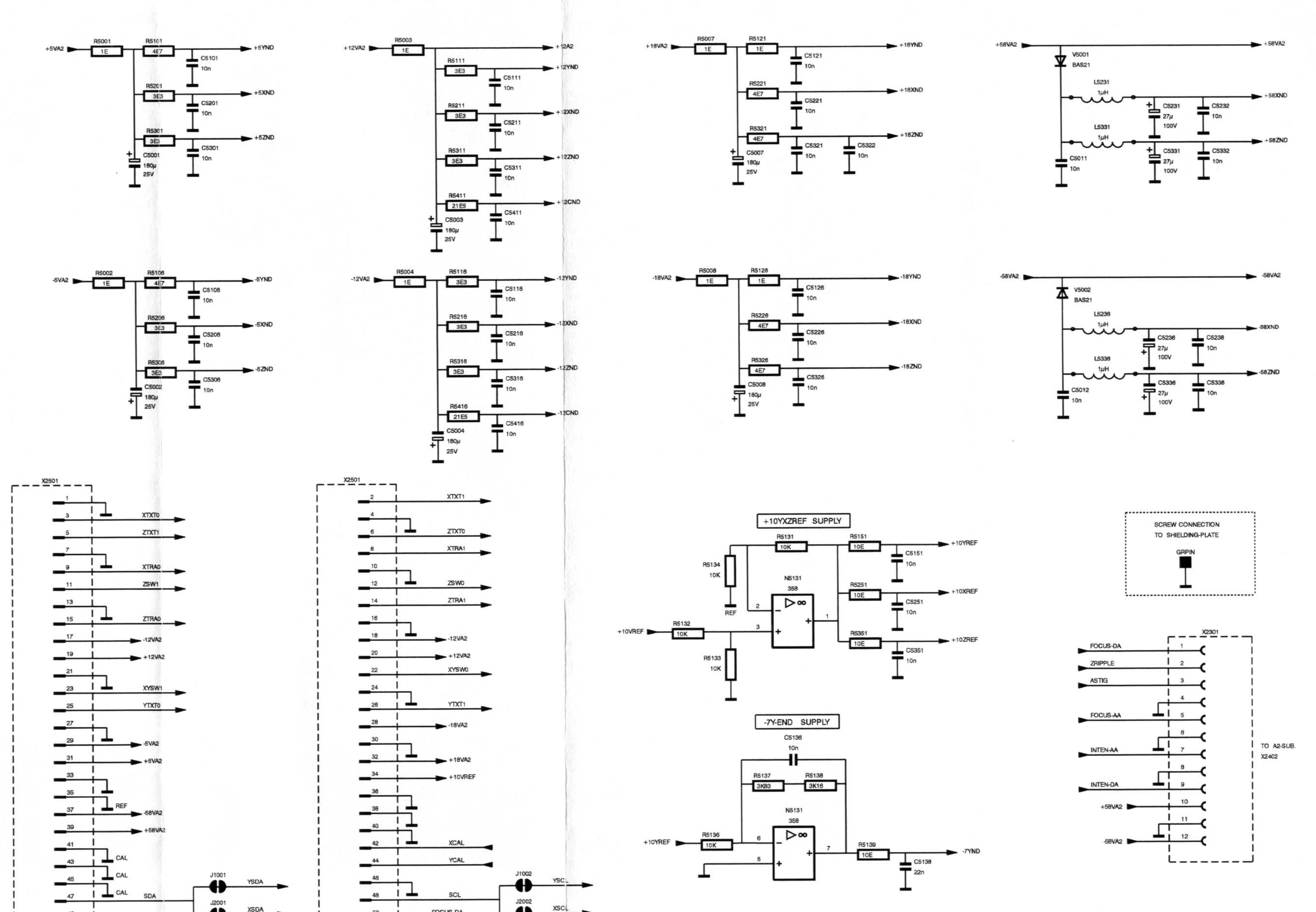


A2 (200 MHz) - Diagram 5 ; Modulator/demodulator and focus control


FOCUS LE
X2401
12 FOCUS-DA
0..+4V
C4001
10n
R4001
51K1
10 ASTIG
-12..+12V
C4002
10p
8 FOCUS-AA
-30..+30V
R4008
31K6
-15..+15V
R4009
31K6
C4003
1p5
7 FOCUS-RET
5 INTEN-RET
6 INTEN-AA
-30..+30V
MODULATOR / DEMODULATOR
R4042
1K
3 +58VA2
R4031
10E
+58CRT
R4032
31K6
C4032
100n
R4037
31K6
V4034
BF820
V4038
BF820
V4036
BZX84
B18
V4031
BF821
R4036
316E
-58CRT
R4041
51K1
V4037
BAS21
2
R4039
16K2
V4033
BF820
V4040
BAS21
+58CRT
R4040
31K6
9 GND-E
C4031
4n7
EHT
V4039
BF821
R4033
1K
R4038
681E
1 -58VA2
R4034
10E
C4033
100n
-58CRT
V4032
BF821
+10..+55V
4 INTEN-DA
C4034
10n
11 ZRIPPLE

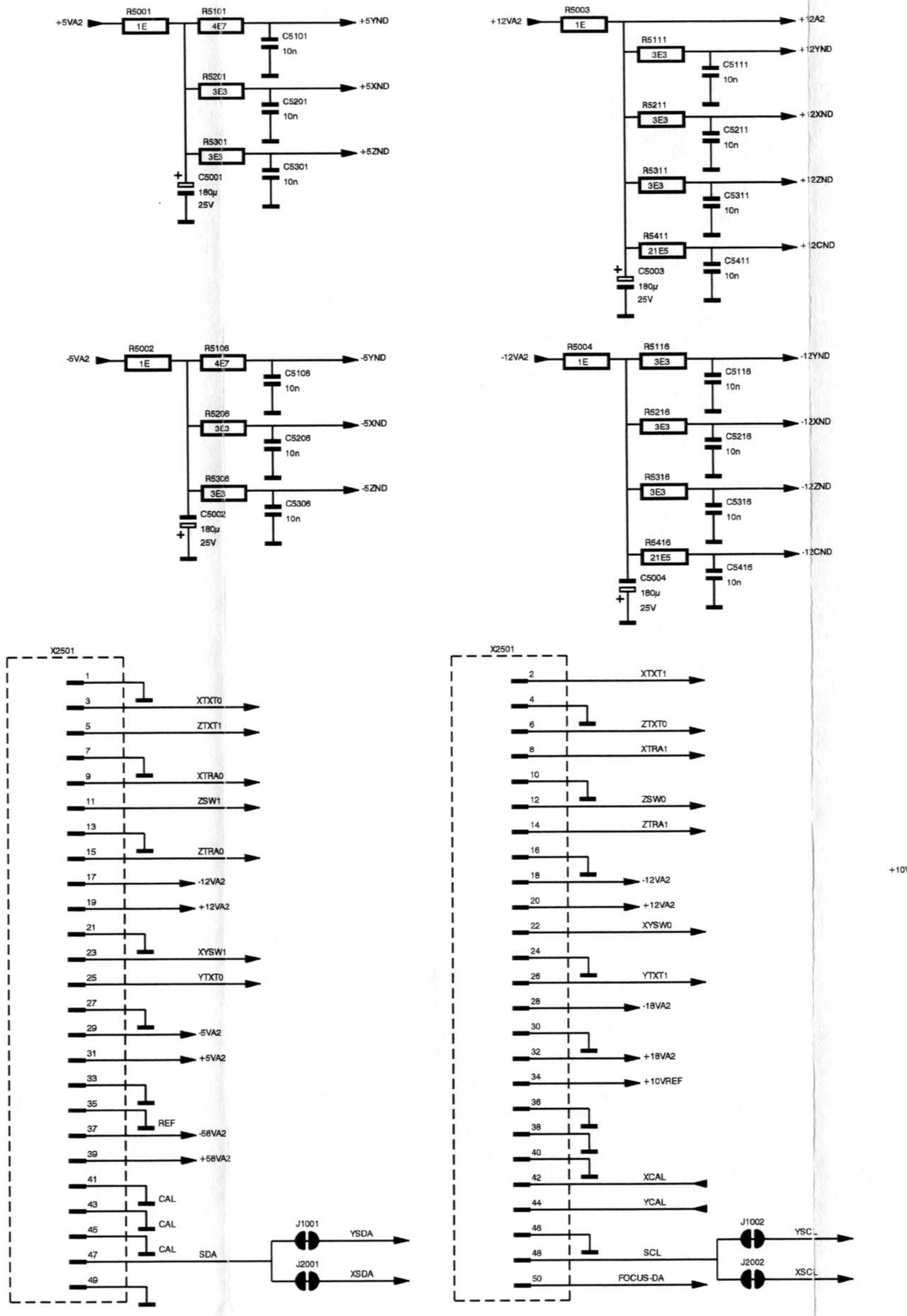


A2 (200 MHz) - Diagram 5 ; Modulator/demodulator and focus control

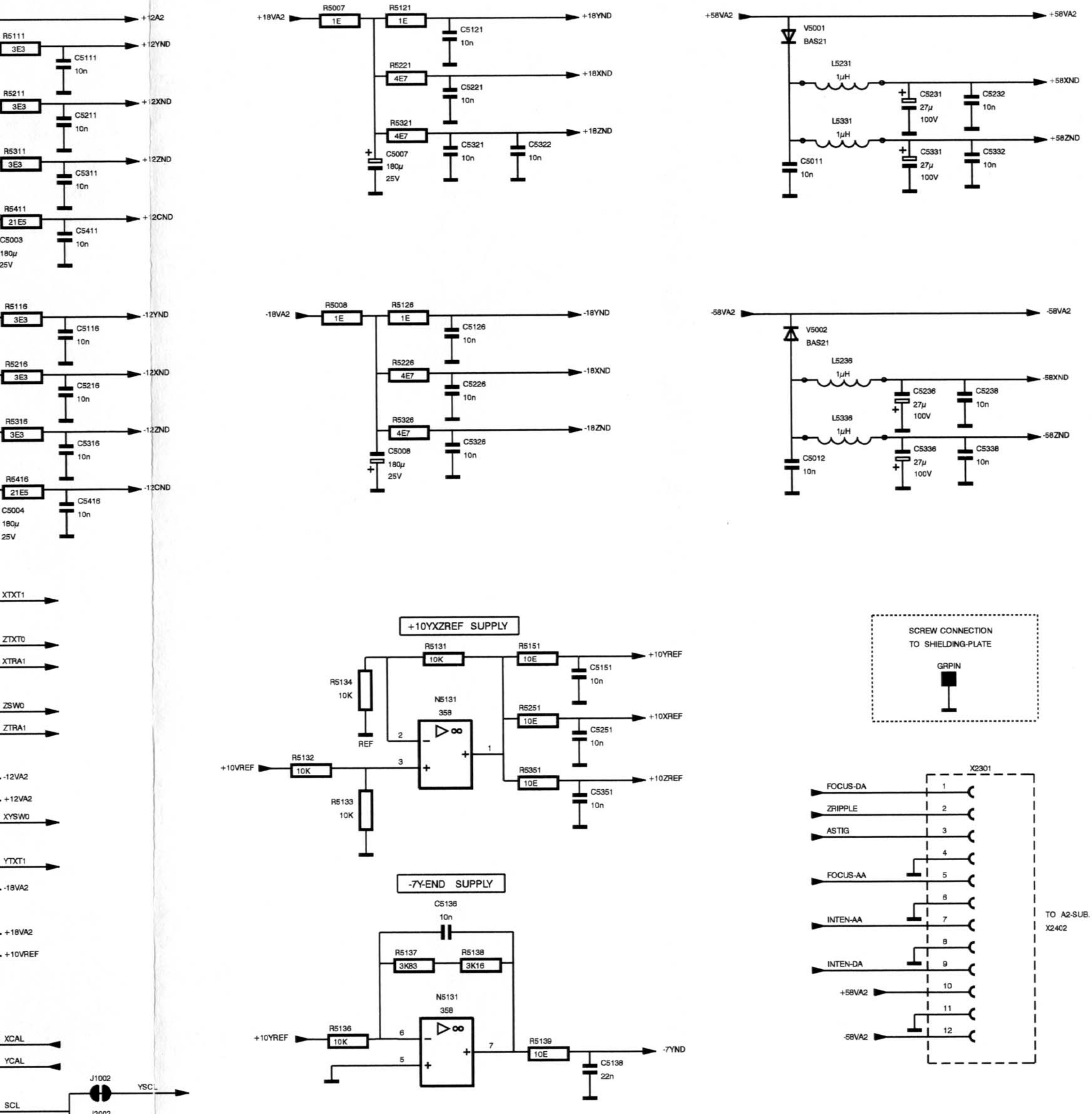


REF NR	TYPE	-12YND	+18YND
N5131	LM358	4	8

A2 (200 MHz) - Diagram 6 ; Supply circuits



+5VA2
R5001
1E
R5101
4E7
C5101
10n
+5YND
R5201
3E3
C5201
10n
+5XND
R5301
3E3
C5301
10n
+5ZND
C5001
180μ
25V
+12VA2
R5003
1E
+12A2
R5111
3E3
C5111
10n
+12YND
R5211
3E3
C5211
10n
+12XND
R5311
3E3
C5311
10n
+12ZND
R5411
21E5
C5411
10n
+12CND
C5003
180μ
25V
-5VA2
R5002
1E
R5106
4E7
C5106
10n
-5YND
R5206
3E3
C5206
10n
-5XND
R5306
3E3
C5306
10n
-5ZND
C5002
180μ
25V
-12VA2
R5004
1E
R5116
3E3
C5116
10n
-12YND
R5216
3E3
C5216
10n
-12XND
R5316
3E3
C5316
10n
-12ZND
R5416
21E5
C5416
10n
-12CND
C5004
180μ
25V
X2501
XTXT0
ZTXT1
XTRA0
ZSW1
ZTRA0
-12VA2
+12VA2
XYSW1
YTXT0
-5VA2
+5VA2
REF
-58VA2
+58VA2
CAL
CAL
CAL
SDA
J1001
YSDA
J2001
XSDA
X2501
XTXT1
ZTXT0
XTRA1
ZSW0
ZTRA1
-12VA2
+12VA2
XYSW0
YTXT1
-18VA2
+18VA2
+10VREF
XCAL
YCAL
SCL
FOCUS-DA
J1002
YSCL
J2002
XSCL



REF NR	TYPE	-12YND	+18YND
N5131	LM358	4	8

ST8267
970428

A2 (200 MHz) - Diagram 6 ; Supply circuits

Item	Description		Ordering code

5.2.6 Parts list A2-200 MHz version

MECHANICAL

Item	Description		Ordering code
0001	CABLE,CONNECT.	ASSY CABLE CRT	5322 321 62202
0003	CABLE,CONNECT.	ASSY CABLE CRT	5322 321 62198
0004	CABLE,CONNECT.	ASSY CABLE CRT	5322 321 62199
A202	BOARD,PRINTED	FINAL X-Y-Z UNIT A2	5322 216 04244

CAPACITORS

Item	Description		Ordering code
C1001	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1002	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1003	CAP.CERAMIC	AP 63V 0.25PF 3.9PF	5322 122 31944
C1005	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C1006	CAP.CHIP	AP 63V 5% 150PF	5322 122 33538
C1007	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C1008	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1009	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269
C1011	CAP.CHIP	AP 63V 5% 56PF	5322 122 32661
C1012	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1013	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1014	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1016	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1018	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1019	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1021	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C1022	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C1023	CAP.CHIP	AP 63V 5% 56PF	5322 122 32661
C1024	CAP.CHIP	AP 63V 5% 56PF	5322 122 32661
C1025	CAP.CHIP	AP 63V 5% 56PF	5322 122 32661
C1026	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C1027	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C1029	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1101	CAP.CERAMIC	AP 63V 0.25PF 3.9PF	5322 122 31944
C1102	CAP.CERAMIC	AP 63V 0.25PF 3.9PF	5322 122 31944
C1103	CAP.CHIP	AP 63V 0.25PF 0.68PF	4822 126 12342
C1104	CAP.CHIP	AP 63V 0.25PF 0.68PF	4822 126 12342
C1106	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C1107	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C1108	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1109	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1110	CAP.CHIP	AP 63V 0.25PF 1.8PF	5322 126 10343
C1111	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C1112	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1113	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1114	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C1121	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C1122	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C1123	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C1301	CAP.CHIP	AP 63V 5% 220PF	4822 122 33575

Item	Description		Ordering code
C1302	CAP.CHIP	AP 63V 5% 220PF	4822 122 33575
C2001	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2002	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C2003	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2004	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C2006	CAP.CHIP	AP 63V 5% 22PF	5322 122 32658
C2007	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C2008	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2009	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C2011	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2012	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2013	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2014	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C2016	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C2017	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2018	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C2019	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2021	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2022	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2061	CAP.CHIP	AP 63V 5% 56PF	5322 122 32661
C2062	CAP.CHIP	AP 63V 5% 56PF	5322 122 32661
C2081	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2103	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2131	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C2132	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2133	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2151	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C2171	CAP.CHIP	AP 63V 0.25PF 1.2PF	5322 122 33537
C2172	CAP.CHIP	AP 63V 5% 220PF	4822 122 33575
C2173	CAP.CHIP	AP 63V 0.25PF 1.2PF	5322 122 33537
C2174	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C2176	CAP.CHIP	AP 63V 5% 33PF	5322 122 32659
C2177	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269
C2203	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2231	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C2232	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2233	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C2251	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C2271	CAP.CHIP	AP 63V 0.25PF 1.2PF	5322 122 33537
C2272	CAP.CHIP	AP 63V 5% 220PF	4822 122 33537
C2273	CAP.CHIP	AP 63V 0.25PF 1.2PF	5322 122 33537
C2276	CAP.CHIP	AP 63V 5% 33PF	5322 122 32659
C2277	CAP.CHIP	AP 63V 0.5PF 6.8PF	5322 122 32269
C2301	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C2302	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C2303	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2401	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2402	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2403	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2404	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098

Item	Description		Ordering code
C2406	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2407	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C2418	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3001	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3002	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C3003	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3004	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C3006	CAP.CHIP	AP 63V 5% 22PF	5322 122 32658
C3007	CAP.CHIP	AP 63V 5% 22PF	5322 122 32658
C3008	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3009	CAP.CHIP	AP 63V 10% 220NF	4822 122 32916
C3011	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3013	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3014	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C3016	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C3017	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3018	CAP.CHIP	AP 63V 5% 100PF	5322 122 32531
C3019	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3021	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3061	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C3103	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3131	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C3132	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3133	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3151	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C3171	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C3172	CAP.CHIP	AP 63V 5% 220PF	4822 122 33575
C3173	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C3176	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C3203	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3231	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C3232	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3233	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C3251	CAP.CHIP	AP 63V 5% 1NF	5322 126 10511
C3271	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C3272	CAP.CHIP	AP 63V 5% 220PF	4822 122 33575
C3273	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C3276	CAP.CHIP	AP 63V 0.25PF 2.2PF	5322 122 33063
C3281	CAP.FOIL	25V 20% 470UF	5322 121 43885
C3401	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3402	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3403	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3404	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3406	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3407	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C3418	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C4001	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4002	CAP.CERAMIC	AP 63V 5% 10PF	5322 122 32448
C4003	CAP.CHIP	AP 63V 0.25PF 1.5PF	5322 126 10225
C4004	CAP.	-10+10% 2.2NF	5322 122 33851

Item	Description		Ordering code
C4031	CAP.CHIP	AP 63V 10% 4.7NF	5322 126 10223
C4032	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C4033	CAP.CHIP	AP 63V 10% 100NF	4822 122 33496
C4034	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4036	CAP.	-10+10% 2.2NF	5322 122 33851
C4037	CAP.	-10+10% 2.2NF	5322 122 33851
C4051	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C4061	CAP.	-10+10% 2.2NF	5322 122 33851
C4062	CAP.CHIP	AP 63V 5% 470PF	5322 122 32268
C5001	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C5002	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C5003	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C5004	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C5007	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C5008	CAP.ELECTROLYT.	25V 20% 180UF	5322 124 42228
C5011	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5012	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5101	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5106	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5111	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5116	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5121	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5126	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5136	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5138	CAP.CHIP	AP 63V 10% 22NF	5322 122 32654
C5151	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5201	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5206	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5211	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5216	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5221	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5226	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5231	CAP.ELECTROLYT.	100V 20% 27UF	5322 124 42193
C5232	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5236	CAP.ELECTROLYT.	100V 20% 27UF	5322 124 42193
C5238	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5251	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5301	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5306	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5311	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5316	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5321	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5322	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5326	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5331	CAP.ELECTROLYT.	100V 20% 27UF	5322 124 42193
C5332	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5336	CAP.ELECTROLYT.	100V 20% 27UF	5322 124 42193
C5338	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5351	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5411	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098
C5416	CAP.CHIP	AP 63V 10% 10NF	5322 122 34098

Item	Description		Ordering code
INTEGRATED CIRCUITS			
D1001	INTEGR.CIRCUIT	OQ0230 FINAL Y AMPL	5322 209 12467
D2001	INTEGR.CIRCUIT	OQ0229 FINAL X-Z AMP	5322 209 12459
D3001	INTEGR.CIRCUIT	OQ0229 FINAL X-Z AMP	5322 209 12459
N1001	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N1002	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N1003	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N1004	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N2002	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N2003	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N5131	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
COILS			
L1101	COIL	0.082UH 5% TDK	5322 157 63382
L1102	COIL	0.082UH 5% TDK	5322 157 63382
L1103	COIL	0.27UH 5% TDK	5322 157 70204
L1107	COIL	0.027UH 5% TDK	5322 157 70857
L1108	COIL	0.027UH 5% TDK	5322 157 70857
L5231	COIL	1UH 5% TDK	5322 157 63648
L5236	COIL	1UH 5% TDK	5322 157 63648
L5331	COIL	1UH 5% TDK	5322 157 63648
L5336	COIL	1UH 5% TDK	5322 157 63648
RESISTORS			
R1001	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1002	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1003	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1004	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1005	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R1006	RES.METAL FILM	HIP RC-02H 1% 1K96	5322 117 10539
R1007	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1008	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1009	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1010	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R1011	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1012	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1013	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1014	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R1015	RES.CHIP	HIP RC-02H 1% 4K64	4822 051 54642
R1016	RES.CHIP	RMC1/8 1% 31E6	5322 117 11732
R1017	RES.CHIP	HIP RC-02H 1% 1K1	4822 051 51102
R1018	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R1019	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R1020	RES.CHIP	HIP RC-02H 1% 4K64	4822 051 54642
R1021	RES.CHIP	HIP RC-02H 1% 1K1	4822 051 51102
R1022	RES.CHIP	RMC1/8 1% 31E6	5322 117 11732
R1023	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R1024	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R1026	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519

Item	Description		Ordering code
R1027	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R1028	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R1029	RES.METAL FILM	HIP RC-02H 1% 178E	5322 117 10534
R1031	RES.METAL FILM	HIP RC-02H 1% 178E	5322 117 10534
R1032	RES.METAL FILM	HIP RC-02H 1% 2K37	5322 117 10545
R1034	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1036	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R1037	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R1038	RES.CHIP	HIP RC-02H 1% 261E	4822 051 52611
R1039	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R1041	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R1042	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R1043	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1044	RES.METAL FILM	HIP RC-02H 1% 162K	5322 117 10533
R1046	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R1047	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R1048	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R1049	RES.METAL FILM	HIP RC-02H 1% 28K7	5322 117 10551
R1051	RES.METAL FILM	HIP RC-02H 1% 23K7	5322 117 10546
R1052	RES.METAL FILM	HIP RC-02H 1% 34K8	5322 117 10558
R1053	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1059	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1061	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1063	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R1064	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1066	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R1071	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R1072	RES.CHIP	HIP RC-02H 1% 90E9	5322 117 12557
R1073	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R1074	RES.METAL FILM	HIP RC-02H 1% 681E	5322 117 10579
R1076	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R1077	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1078	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R1079	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R1081	RES.METAL FILM	HIP RC-02H 1% 464E	5322 117 10567
R1082	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1083	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1084	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R1086	RES.METAL FILM	HIP RC-02H 1% 147E	5322 117 10526
R1101	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1102	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R1103	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R1104	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1105	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1106	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R1107	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R1108	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R1109	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R1111	RES.CHIP	HIP RC-01 5% 14E7	5322 117 12555

Item	Description		Ordering code
R1112	RES.CHIP	HIP RC-01 5% 14E7	5322 117 12555
R1113	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R1114	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R1116	RES.CHIP	HIP RC-02H 1% 287E	4822 051 52871
R1117	RES.CHIP	HIP RC-02H 1% 287E	4822 051 52871
R1118	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1121	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R1122	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R1123	RES.CHIP	HIP RC-01 5% 51E1	5322 117 11737
R1124	RES.CHIP	HIP RC-01 5% 51E1	5322 117 11737
R1126	RES.METAL FILM	HIP RC-02H 1% 1K33	5322 117 10524
R1127	RES.METAL FILM	HIP RC-02H 1% 1K33	5322 117 10524
R1128	RES.METAL FILM	ST MRS25 1% 34E8	4822 050 23489
R1129	RES.METAL FILM	ST MRS25 1% 34E8	4822 050 23489
R1131	RES.METAL FILM	ST MRS25 1% 34E8	4822 050 23489
R1132	RES.METAL FILM	ST MRS25 1% 34E8	4822 050 23489
R1133	RES.METAL FILM	ST MRS25 1% 34E8	4822 050 23489
R1134	RES.METAL FILM	ST MRS25 1% 34E8	4822 050 23489
R1136	RES.METAL FILM	ST MRS25 1% 34E8	4822 050 23489
R1137	RES.METAL FILM	ST MRS25 1% 34E8	4822 050 23489
R1138	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1139	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R1140	RES.METAL FILM	HIP RC-02H 1% 316K	5322 117 10555
R1141	RES.METAL FILM	ST MRS25 1% 1K27	4822 050 21272
R1142	RES.METAL FILM	ST MRS25 1% 1K27	4822 050 21272
R1143	RES.CHIP	HIP RC-01 5% 14E7	5322 117 12555
R1144	RES.CHIP	HIP RC-01 5% 14E7	5322 117 12555
R1145	RES.METAL FILM	HIP RC-02H 1% 316K	5322 117 10555
R1146	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1147	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1148	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R1149	RES.METAL FILM	HIP RC-02H 1% 619E	5322 117 10576
R1151	RES.CHIP	HIP RC-02H 1% 215E	5322 117 10484
R1152	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R1153	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R1154	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R1155	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R1156	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R1157	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559
R1158	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1159	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1161	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1162	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R1163	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R1164	RES.METAL FILM	HIP RC-02H 1% 909E	5322 117 10588
R1166	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R1167	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1168	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1169	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R1170	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559

Item	Description		Ordering code
R1171	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1172	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1173	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1174	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1176	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1177	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R1178	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1179	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1181	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1182	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R1202	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1203	RES.CHIP	HIP RC-02H 1% 100K	4822 051 10104
R1204	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R1206	RES.METAL FILM	HIP RC-02H 1% 2K37	5322 117 10545
R1207	RES.METAL FILM	HIP RC-02H 1% 2K37	5322 117 10545
R1208	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R1209	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R1301	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R1302	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R1303	RES.METAL FILM	HIP RC-02H 1% 162K	5322 117 10533
R1304	RES.METAL FILM	HIP RC-02H 1% 162K	5322 117 10533
R1306	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R1307	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R1308	RES.METAL FILM	HIP RC-02H 1% 28K7	5322 117 10551
R1309	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R1311	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R1312	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R1313	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R2001	RES.METAL FILM	HIP RC-02H 1% 16K2	5322 117 10532
R2002	RES.METAL FILM	HIP RC-02H 1% 12K1	5322 117 10522
R2003	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R2004	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2006	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2007	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R2008	RES.METAL FILM	HIP RC-02H 1% 1K47	5322 117 10527
R2009	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R2011	RES.METAL FILM	HIP RC-02H 1% 6K81	5322 117 10581
R2012	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2013	RES.METAL FILM	HIP RC-02H 1% 1K96	5322 117 10539
R2014	RES.CHIP	HIP RC-02H 1% 4K64	4822 051 54642
R2015	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R2016	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2017	RES.METAL FILM	HIP RC-02H 1% 316K	5322 117 10555
R2018	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R2020	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R2021	RES.CHIP	HIP RC-02H 1% 46K4	5322 117 10486
R2023	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R2024	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R2026	RES.CHIP	HIP RC-02H 1% 4K64	4822 051 54642

Item	Description		Ordering code
R2063	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2064	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R2065	RES.METAL FILM	HIP RC-02H 1% 2K87	5322 117 10549
R2066	RES.METAL FILM	HIP RC-02H 1% 2K87	5322 117 10549
R2067	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2068	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2101	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2102	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2103	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2104	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564
R2105	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R2107	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R2111	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2112	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559
R2113	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2131	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2132	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R2133	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R2134	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R2136	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R2137	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R2138	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R2151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2161	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R2171	RES.METAL FILM	ST MRS25 1% 9K53	4822 050 29532
R2172	RES.METAL FILM	HIP RC-02H 1% 16K2	5322 117 10532
R2176	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2177	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2202	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2203	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R2205	RES.CHIP	RMC1/8 1% 237E	5322 117 10544
R2204	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564
R2207	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R2211	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2212	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559
R2214	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2231	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2232	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R2233	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R2234	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R2236	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R2237	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R2238	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R2251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2261	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R2271	RES.METAL FILM	ST MRS25 1% 9K53	4822 050 29532
R2272	RES.METAL FILM	HIP RC-02H 1% 16K2	5322 117 10532
R2276	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2277	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543

Item	Description		Ordering code
R2301	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2302	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2303	RES.METAL FILM	HIP RC-02H 1% 61K9	5322 117 10578
R2304	RES.METAL FILM	HIP RC-02H 1% 61K9	5322 117 10578
R2306	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R2307	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R2308	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R2309	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R2311	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R2312	RES.METAL FILM	HIP RC-02H 1% 28K7	5322 117 10551
R2313	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R2401	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2402	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2403	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2404	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R2406	RES.METAL FILM	HIP RC-02H 1% 7K5	5322 117 10583
R2411	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2412	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R2416	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R2417	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R3001	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R3002	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R3003	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R3004	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3006	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3007	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3008	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3009	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R3011	RES.CHIP	HIP RC-02H 1% 11K	4822 051 10113
R3012	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R3013	RES.METAL FILM	HIP RC-02H 1% 5K62	5322 117 10573
R3014	RES.METAL FILM	HIP RC-02H 1% 21K5	5322 117 10542
R3015	RES.METAL FILM	HIP RC-02H 1% 28K7	5322 117 10551
R3018	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R3021	RES.METAL FILM	HIP RC-02H 1% 19K6	5322 117 10541
R3024	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3026	RES.CHIP	HIP RC-02H 1% 4K64	4822 051 54642
R3063	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3064	RES.CHIP	HIP RC-02H 1% 100E	4822 051 10101
R3066	RES.METAL FILM	HIP RC-02H 1% 909E	5322 117 10588
R3067	RES.METAL FILM	HIP RC-02H 1% 909E	5322 117 10588
R3068	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3069	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3101	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R3102	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3103	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R3104	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564
R3107	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R3111	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3112	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559

Item	Description		Ordering code
R3113	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3131	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3132	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3133	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R3134	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R3136	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R3137	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R3138	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R3151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3161	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R3171	RES.METAL FILM	ST MRS25 1% 9K53	4822 050 29532
R3176	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R3201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R3202	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3203	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R3204	RES.METAL FILM	HIP RC-02H 1% 422E	5322 117 10564
R3207	RES.METAL FILM	HIP RC-02H 1% 237E	5322 117 10544
R3211	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3212	RES.METAL FILM	HIP RC-02H 1% 383E	5322 117 10559
R3213	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3231	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R3232	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3233	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R3234	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R3236	RES.METAL FILM	HIP RC-02H 1% 1K78	5322 117 10535
R3237	RES.METAL FILM	HIP RC-02H 1% 121E	5322 117 10519
R3238	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R3251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3261	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R3271	RES.METAL FILM	ST MRS25 1% 9K53	4822 050 29532
R3276	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R3281	RES.METAL FILM	HIP RC-02H 1% 2K87	5322 117 10549
R3282	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3301	RES.METAL FILM	HIP RC-02H 1% 61K9	5322 117 10578
R3302	RES.CHIP	HIP RC-02H 1% 12K1	4822 051 51213
R3311	RES.METAL FILM	HIP RC-02H 1% 511E	5322 117 10569
R3312	RES.METAL FILM	HIP RC-02H 1% 2K87	5322 117 10549
R3313	RES.METAL FILM	HIP RC-02H 1% 2K87	5322 117 10549
R3314	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R3316	RES.METAL FILM	HIP RC-02H 1% 14K7	5322 117 10528
R3401	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3402	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3403	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3404	RES.CHIP	HIP RC-02H 1% 5K11	5322 117 10487
R3411	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3412	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R3416	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R3417	RES.METAL FILM	HIP RC-02H 1% 750E	5322 117 10582
R4001	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R4002	RES.HI-TENSION	RST VR25 5% 3M3	4822 053 20335

Item	Description		Ordering code
R4003	RES.HI-TENSION	RST VR25 5% 3M3	4822 053 20335
R4004	RES.HI-TENSION	RST VR25 5% 3M3	4822 053 20335
R4006	RES.HI-TENSION	RST VR25 5% 6M8	4822 053 20685
R4007	RES.HI-TENSION	RST VR25 5% 6M8	4822 053 20685
R4008	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R4009	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R4031	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R4032	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R4033	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R4034	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R4036	RES.METAL FILM	HIP RC-02H 1% 316E	5322 117 10552
R4037	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R4038	RES.METAL FILM	HIP RC-02H 1% 681E	5322 117 10579
R4039	RES.METAL FILM	HIP RC-02H 1% 16K2	5322 117 10532
R4040	RES.METAL FILM	HIP RC-02H 1% 31K6	5322 117 10554
R4041	RES.CHIP	HIP RC-02H 1% 51K1	4822 051 55113
R4042	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R4043	RES.CHIP	HIP RC-02H 1% 1K	4822 051 10102
R4044	RES.CHIP	HIP RC-02H 1% 1M	4822 051 10105
R4045	RES.METAL FILM	HIP RC-02H 1% 215K	5322 117 10543
R4051	RES.HI-TENSION	RST VR25 5% 3M3	4822 053 20335
R5001	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5002	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5003	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5004	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5007	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5008	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5101	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R5106	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R5111	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5116	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5121	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5126	RES.CHIP	HIP RC-01 5% 1E	4822 051 10108
R5131	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5132	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5133	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5134	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5136	RES.CHIP	HIP RC-02H 1% 10K	4822 051 10103
R5137	RES.METAL FILM	HIP RC-02H 1% 3K83	5322 117 10561
R5138	RES.METAL FILM	HIP RC-02H 1% 3K16	5322 117 10553
R5139	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R5151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R5201	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5206	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5211	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5216	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5221	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R5226	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R5251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R5301	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338

Item	Description		Ordering code
R5306	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5311	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5316	RES.CHIP	HIP RC-01 5% 3E3	4822 051 10338
R5321	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R5326	RES.CHIP	HIP RC-01 5% 4E7	4822 051 10478
R5351	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R5411	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R5416	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014

SEMICONDUCTORS

V1009	DIODE,CHIP	BBY39 PEL	5322 130 82199
V1011	DIODE,CHIP	BBY39 PEL	5322 130 82199
V1014	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1018	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1019	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1021	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1022	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1023	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V1024	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V1101	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V1102	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V1103	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V1104	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V1106	TRANSISTOR	BFG55 PEL	5322 130 62806
V1107	TRANSISTOR	BFG55 PEL	5322 130 62806
V1108	DIODE,REFERENCE	BZX79-C12 PEL	4822 130 34197
V1109	DIODE,REFERENCE	BZX79-C12 PEL	4822 130 34197
V1111	TRANSISTOR,CHIP	BFG35 PEL	5322 130 62805
V1112	TRANSISTOR,CHIP	BFG35 PEL	5322 130 62805
V1113	DIODE	BBY62 PEL	5322 130 82685
V1121	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1122	TRANSISTOR,CHIP	BCP53 PEL	5322 130 62804
V1123	TRANSISTOR,CHIP	BCP56 PEL	5322 130 63033
V1126	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V1127	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1128	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V1201	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1202	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1203	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1204	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V1301	DIODE,REFERENCE	BZX84-C8V2 PEL	5322 130 80255
V2061	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2062	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2101	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V2102	DIODE	BZX84-B12 PEL	4822 130 83566
V2103	DIODE	BZX84-B12 PEL	4822 130 83566
V2104	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2105	DIODE	BZX84-B12 PEL	4822 130 83566

Item	Description		Ordering code
V2111	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V2113	TRANSISTOR	BFQ232A PEL	4822 130 62751
V2131	DIODE,CHIP	BAV99 PEL	5322 130 34337
V2132	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V2133	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V2134	TRANSISTOR	BFQ252A PEL	4822 130 62932
V2201	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V2202	DIODE	BZX84-B12 PEL	4822 130 83566
V2203	DIODE	BZX84-B12 PEL	4822 130 83566
V2204	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V2205	DIODE	BZX84-B12 PEL	4822 130 83566
V2211	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V2213	TRANSISTOR	BFQ232A PEL	4822 130 62751
V2231	DIODE,CHIP	BAV99 PEL	5322 130 34337
V2232	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V2233	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V2234	TRANSISTOR	BFQ252A PEL	4822 130 62932
V2301	DIODE,REFERENCE	BZX84-C8V2 PEL	5322 130 80255
V2403	DIODE	BZX84-B18 PEL	5322 130 83709
V2418	DIODE,REFERENCE	BZX84-C8V2 PEL	5322 130 80255
V3001	DIODE,CHIP	BAV99 PEL	5322 130 34337
V3002	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3061	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V3062	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V3101	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V3102	DIODE	BZX84-B12 PEL	4822 130 83566
V3103	DIODE	BZX84-B12 PEL	4822 130 83566
V3104	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3105	DIODE	BZX84-B12 PEL	4822 130 83566
V3111	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V3113	TRANSISTOR	BFQ232A PEL	4822 130 62751
V3131	DIODE,CHIP	BAV99 PEL	5322 130 34337
V3132	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V3133	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V3134	TRANSISTOR	BFQ252A PEL	4822 130 62932
V3136	DIODE,CHIP	BAS21 PEL	4822 130 33702
V3137	DIODE,CHIP	BAS21 PEL	4822 130 33702
V3201	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V3202	DIODE	BZX84-B12 PEL	4822 130 83566
V3203	DIODE	BZX84-B12 PEL	4822 130 83566
V3204	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3205	DIODE	BZX84-B12 PEL	4822 130 83566
V3211	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V3212	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V3213	TRANSISTOR	BFQ232A PEL	4822 130 62751
V3231	DIODE,CHIP	BAV99 PEL	5322 130 34337
V3232	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V3233	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V3234	TRANSISTOR	BFQ252A PEL	4822 130 62932
V3236	DIODE,CHIP	BAS21 PEL	4822 130 33702

Item	Description		Ordering code
V3237	DIODE,CHIP	BAS21 PEL	4822 130 33702
V3281	DIODE,CHIP	BAV99 PEL	5322 130 34337
V3282	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V3301	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V3311	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V3312	DIODE,CHIP	BAV99 PEL	5322 130 34337
V3418	DIODE,REFERENCE	BZX84-C8V2 PEL	5322 130 80255
V4001	DIODE,CHIP	BAV99 PEL	5322 130 34337
V4002	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V4003	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V4004	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V4031	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V4032	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V4033	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V4034	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V4036	DIODE,REFERENCE	BZX84-B18 PEL	5322 130 83709
V4037	DIODE,CHIP	BAS21 PEL	4822 130 33702
V4038	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V4039	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V4040	DIODE,CHIP	BAS21 PEL	4822 130 33702
V4041	DIODE,CHIP	BAS21 PEL	4822 130 33702
V4042	DIODE,CHIP	BAS21 PEL	4822 130 33702
V4043	DIODE,CHIP	BAS21 PEL	4822 130 33702
V4044	DIODE,CHIP	BAS21 PEL	4822 130 33702
V5001	DIODE,CHIP	BAS21 PEL	4822 130 33702
V5002	DIODE,CHIP	BAS21 PEL	4822 130 33702

CONNECTORS

X2101	CONNECTOR	4-P HAAKS OMSL	5322 265 30907
X2301	CONNECTOR	12-P 1.25MM STR	4822 267 50668
X2401	CONNECTOR	12-P 1.25MM STR	4822 267 50668
X2402	CONNECTOR	3-P SNG RT.ANG	5322 265 30433
X2403	SOCKET	55595 CRT SOCKET	5322 255 40502
X2501	CONNECTOR	50-P DBL STRGHT	5322 265 61242

5.2.7 Description of A2-100 MHz version.

5.2.7.1 Final Y amplifier.

Diagram 1.

The output signal from the delay line is applied to the input pins 6 and 9 of amplifier IC D1001. This IC and surrounding components comprise the MF and HF square wave compensations. Also the vertical CRT text signal is applied to D1001 (pin 15 and 16). The switching between text/cursors and signal is done via control signals that are applied to pin 17 and 18 of D1001. Text is written if the voltage at pin 18 is higher than at pin 17. This switching signal is derived from the collector of the transistors V1201 and V1202. The control signals XYSW1 and XYSW0 come from the text/cursor generator IC on microprocessor unit A3. Via the transistors V1203 and V1204 similar switching signals XSW1 and XSW0 are routed to the X-deflection section for switching between text and signal.

The output signals from pin 21 and 22 of D1001 are routed via the common base circuits V1026 / V1027 to the final Y-amplifier. The final amplifier is located on the small printed circuit board at the CRT socket. It drives the vertical deflection plates of the CRT. This final stage is indicated on diagram 2.

The delay line leads are terminated into 75Ω. The impedance is composed by 300Ω inside D1001 parallelled by external impedances of 60Ω formed by the external resistors R1024/R1026 and R1027/R1028. All termination resistors are applied to a voltage controlled by D1001/pin 13. Pin 13 determines the common mode voltage level of the D1001 inputs. The HF square wave compensation is achieved by the two dual varicap diodes V1009 and V1011 together with associated resistors. Varicap V1009 is controlled by the output signal at pin 20 of octal DAC N1001. This output voltage can be in the range 0 to 10 V and controls varicap V1009 via operational amplifier N1002/1,2,3. This operational amplifier converts the N1001 output voltage (that is related to 0 V) into a voltage related to the voltage at D1001/pin 13.
Varicap V1011 is controlled by the output signal at pin 18 of octal DAC N1001. This output voltage can be in the range 0 to 10 V and controls varicap V1011 via operational amplifier N1002/5,6,7. This operational amplifier converts the N1001 output voltage (that is related to 0 V) into a voltage related to the voltage at D1001/pin 13.

LF square wave compensation is also done inside D1001. This is controlled via currents applied to pin 27 and 28. These currents are derived from the N1001 DAC voltage outputs 13 and 11 via the transistors V1014 and V1016. The actual compensating components are situated outside D1001 and are R1037/C1011/R1038 and R1029/C1009/R1031. V1023 and V1024 form a 20 mA current source to supply the bias current for the final stage inside D1001. V1024 is switched as a diode and gives temperature compensation.

Offset is adjusted via the currents from the collectors of V1021 and V1022. These currents are controlled by the DAC output pins 17 (coarse) and 16 (fine). Two parallel DAC outputs are used to obtain sufficient resolution. V1018 is a current source and V1019 is for temperature compensation. Gain control occurs via an adjustable current applied to D1001/pin 26. This is done via N1001/pin 14 and R1051

DAC output N1001/15 applies via operational amplifier N1003/1,2,3 the signal YFSHF to the final stage on diagram 2. YFSHF is an adjustable dc voltage that is applied to varicap diodes V4113 that control the HF square wave response of the output stage.

The circuit with operational amplifier N1004/2,3,6 is used for automatic calibration of the vertical deflection. It measures the voltage at the vertical deflection plates of the CRT. This value is applied as signal YCAL to the microprocessor on unit A3.

Diagram 2.

This diagram shows the Y-output amplifier. The amplifier is located at the small printed circuit board at the CRT socket. The input signal is a current and is applied to V4101 and V4102. The output signal is voltage and is applied to the vertical deflection plates of the CRT. Total sensitivity at the plates is 4V/div. One plate is driven by output stage V4111/V4108. V4111 and V4114 form a current source. The current source is an amplifier for higher frequencies because of coupling capacitor C4118. The driver transistors are V4103 and V4106. The input signal is YPREOUT1.

The other plate is driven by output stage V4109/V4112. V4112 is a current source. The current source is an amplifier for higher frequencies because of coupling capacitor C4119. The driver transistors are V4104 and V4107. The input signal is YPREOUT0.

The output signals ACALFB0 and ACALFB1 are routed to a circuit for automatic calibration of the vertical amplifiers. This circuit is present on the larger part of unit A2 and indicated on diagram 1.

5.2.7.2 *Final X and Z amplifiers.*

Diagram 3.

This diagram shows the final X amplifier. It drives the horizontal plates of the CRT. Total plate sensitivity equals 8.5 V/div. The input circuit is formed by IC D2001. The octal DAC N2002 supplies the analog control signals that are used throughout the circuit.

Input pin 5 and 6 of D2001 receive the time base sawtooth or the X- deflection signal signal. Input pin 9 and 10 receive the horizontal text/cursor signal. The selection between text/cursors and sawtooth/X- deflection signal is done via the signals XSW0 and XSW1 that are applied to pin 7 and 8 of D2001. These signals are derived from XYSW0 and XYSW1 that come from the text generator IC on microprocessor unit A3. Text is displayed with XSW0 at 0 mA and XSW1 at 1 mA. Trace is displayed with XSW0 at 1 mA and XSW1 at 0 mA.

Gain control is possible via pin 1 of D2001. This is used for trace gain control via signal XTRAGC. Gain control to compensate for CRT tolerances is achieved via pin 14 of D2001. This is controlled via the DAC output signals XCRTGCL (fine) and XCRTGCH (coarse). Offset control to compensate for CRT tolerances is achieved via pin 15 of D2001. This is controlled via the DAC output signals XCRTOFH (coarse) and XCRTOFL (fine). Adjustment of the HF response (and linearity) is achieved via signal XHFADJ via pin 17 and 26 of D2001.

The final X-amplifier consists of two identical halves that receive input signals that are in opposite phase. These signals originate from the D2001 outputs pin 24/25 (XDRIL0/XDRIL1) and pin 18/19 (XDRIR0/XDRIR1). The two X-amplifier sections drive respectively the left and right deflection plate of the CRT.

The final X amplifier half that drives the left deflection plate is explained now. Its function is identical to that of the other amplifier half. The balanced input signals XDRIL1 and XDRIL0 are applied to input stage V2101. V2134 is a current source. XDRIL0 is not used and connected to +6.8 V. In the collector circuit of V2101 are the zener diodes V2102/V2103 that function as level shifters. The emitter followers V2132 and V2111 supply the output stage V2134/V2113 with signal. V2113 functions as an amplifier stage and V2134 mainly as a current source. V2134 receives signal via C2131 and C2134 and functions as amplifier stage in the fastest sweep speeds. Via R2133/R2134 however some dc drive is also applied to V2134.

The circuit with operational amplifier N2003 is used to measure the output voltage that is applied to the X-deflection plates of the CRT. This measurement is done via high-ohmic resistors R2301 and R2302. The analog output voltage XCAL of N2003 is applied to an ADC incorporated in the microprocessor on unit A3. This enables the microprocessor to exactly measure the horizontal output voltage. This is used for automatic calibration of the horizontal deflection.

Diagram 4.

This diagram shows the final intensity (Z) and focusing amplifiers. These amplifiers drive the intensity electrode G1 and the focusing electrode G3 of the CRT. The input circuit is formed by IC D3001.

Input pin 5 and 6 of D3001 receive the Z-pulses ZLTRA0 and ZLTRA1 that determine the intensity during signal display. Input pin 9 and 10 receive the Z-pulse ZTXT0 and ZTXT1 that determine the intensity during text/cursor display. The selection between signal intensity and text intensity is done via the signals ZSW0 and ZSW1 that are applied to pin 7 and 8 of D3001. These signals originate from the text generator IC on microprocessor unit A3. Text is displayed with ZSW0 at 0 mA and ZSW1 at 1 mA. Trace is displayed with ZSW0 at 1 mA and ZSW1 at 0 mA.

The final Z-amplifier and the focusing amplifier are identical halves that receive input signals that are in opposite phase. These signals originate from the D3001 outputs pin 24/25 (ZDRIF1/ZDRIF0) and pin 18/19 (ZDRII0/ZDRII1).

Via V3002 part of the ripple on the negative CRT cathode voltage (ZRIPPLE) is applied to pin 15 of D3001. This compensates for unwanted intensity modulation due to this ripple.
The diodes V3236, V3136, V3237 and V3137 protect D3001 against possible high voltage surges.

V3301 supplies the intensity determining signal INTEN-DA. This signal adjusts the "dark level" of the CRT. V3301 is controlled by DAC N2002 output signal DARK. V3311 supplies signal ASTIG that determines the astigmatism of the CRT. V3311 is controlled by DAC N2002 output signal ASTDR.

The upper amplifier half that is used for the dynamic focus control is explained now. Its function is identical to that of the lower amplifier half that is used for intensity (Z) control. The balanced input signals ZDRIF1 and ZDRIF0 are applied to input stage V3101. ZDRIF0 is not used and connected to +6.8 V. In the collector circuit of V3101 are the zener diodes V3102/V3103 that function as level shifters. The emitter followers V3132 and V3111 supply the output stage V3134/V3113 with signal. V3113 functions as an amplifier stage and V3134 mainly as a current source. V3134 receives signal via C3131 and C3134. It mainly functions as amplifier stage for fast input signals. Via R3133/R3134 however some dc drive is also applied to V3134.

Diagram 5.

In this diagram the circuit is shown that forms an interface between the signals that determine the intensity/focusing and the CRT electrodes G1/G3 that control intensity/focusing. These electrodes, the cathode and filament (heater) of the CRT are at a high negative voltage. This voltage is separated from the other oscilloscope circuits via the 3kV capacitors C4004, C4061, C4036 and C4037.

The intensity is influenced by the output signal INTEN-AA of the Z- amplifier and the signal INTEN-DA. INTEN-AA is determined via the front-panel TRACE INTENSITY, TEXT INTENSITY, MTB on, DTB on and chopper blanking control signals. The HF component in the INTEN-AA signal is applied to G1 of the CRT via C4037. The DC and LF components are applied to the base of V4034. The INTEN-DA signal is applied to the base of V4032 and forms the clamplevel (dark level) of the DC and LF part of INTEN-AA derived from V4034. These two transistors form the inputs of a 150kHz modulator that basically consists of V4031 and V4033. The LF and DC components that are modulated on the 150 kHz carrier signal can pass via buffer stage V4038/V4039 and then via high voltage blocking capacitor C4036.
Behind capacitor C4036 demodulation takes place via the diodes V4043 and V4044. This results in the original INTEN-AA signal that is superpositioned on the INTEN-DA voltage that corrects the cut-off voltage of the CRT applied to G1 and via R4051 also to G3. Across R4044 a small negative voltage (compared with the cathode) is developed for G1. This voltage is not big enough to make the CRT screen dark. This means that the signals to darken the screen and to control intensity are applied via C4036 and C4037.

The HF component from the focusing amplifier output signal FOCUS-AA is applied to G3 via C4004 and voltage divider R4008/R4009/C4002/C4003. This assures optimal tracking between focus and intensity. The signal FOCUS-DA is determined via the FOCUS control at the instruments front panel.

The signal FOCUS-DA is then mixed with the LF component of FOCUS-AA before its level is adapted to the nominal G3 voltage via transistors V4002/V4003/V4004.

Diagram 6.

This diagram shows the RC-branches and regulators N5131 that give the supply voltages for the various circuits. Also the connectors X2501 and X2301 are indicated here. X2301 is the connector where the flat cable leaves for the small unit that incorporates the CRT-socket X2403. The flat cable arrives at the small CRT-socket unit at X2411.

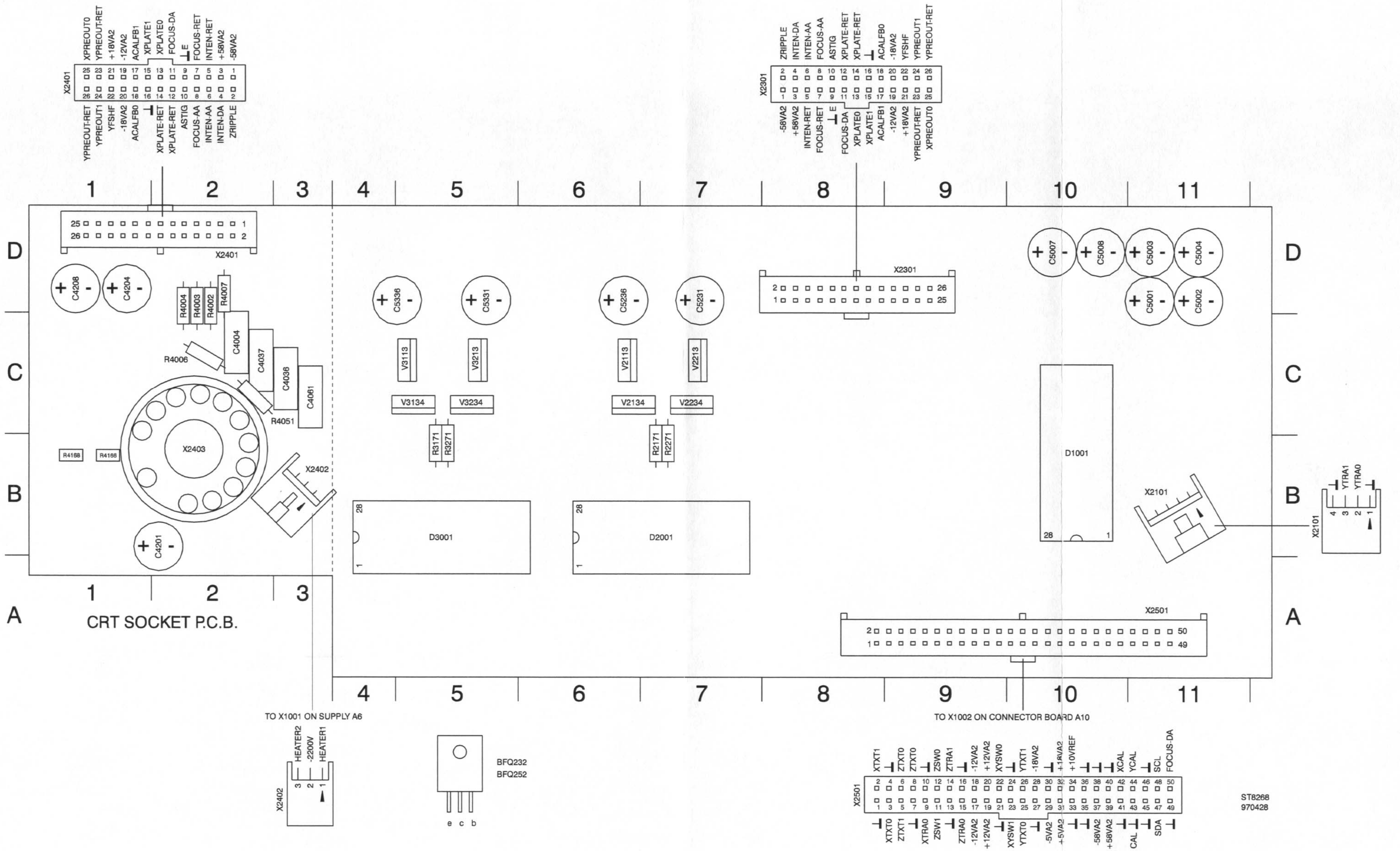
5.2.8 Signal name list A2-100 MHz version

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found

NAME	MEANING	SOURCE	DESTINATION
ACALF B0	AUTOCALL FUNCTION SIGNAL	R4164:02	X2411:02
		X2301:01	R1307:01
ACALF B1	AUTOCALL FUNCTION SIGNAL	R4163:02	X2411:02
		X2301:01	R1306:01
ASTDR	DRIVER SIGNAL FOR ASTIGMATISM	N2002:03	R3313:04
ASTIG	ASTIGMATISM CONTROL	V3311:04	X2301:06
		X2411:06	X2403:05
DARK	DRIVER SIGNAL FOR DC PART INTENS	N2002:03	V3301:04
FOCUS-AA	AC PART FOCUSING SIGNAL	R3161:04	X2301:06
		X2411:05	R4008:05
FOCUS-DA	DC PSRT FOCUSING SIGNAL	X2501:06	X2301:06
		X2411:05	R4001:05
G1	INTENSITY GRID 1 OF CRT	C4037:05	X2403:05
			R4044:05
G3	FOCUSING GRID 3 OF CRT	C4004:05	X2403:05
			R4051:05
HEATER1	FILAMENT SUPPLY F1 OF CRT	X2402:05	X2403:05
HEATER2	FILAMENT SUPPLY F2 OF CRT	X2402:05	X2403:05
INTEN-AA	AC PART OF INTENSITY SIGNAL	R3261:04	X2301:06
		X2411:05	C4037:05
INTEN-DA	DC PART OF INTENSITY SIGNAL	V3301:04	X2301:06
		X2411:05	V4032:05
SCL	SERIAL CLOCK	X2501:06	J1002:06
			J2002:06
SDA	SERIAL DATA	X2501:06	J1002:06
			J2001:06
XCAL	AUTOCAL SIGNAL X DEFLECTION	R2313:03	X2501:06
XCRTGCH	CRT X-GAIN CONTROL HIGH	N2002:03	R2011:03
XCRTGCL	CRT X-GAIN CONTROL LOW	N2002:03	R2012:03
XCRTOFH	CRT OFFSET CONTROL HIGH	N2002:03	R2016:03
XCRTOFL	CRT OFFSET CONTROL LOW	N2002:03	R2017:03
XDRIL0	DRIVE SIGNAL 0 LEFT X AMPLIFIER	D2001:03	R2101:03
XDRIL1	DRIVE SIGNAL 1 LEFT X AMPLIFIER	D2001:03	R2103:03
XDRIR0	DRIVE SIGNAL 0 RIGHT X AMPLIFIER	D2001:03	R2203:03
XDRIR1	DRIVE SIGNAL 1 RIGHT X AMPLIFIER	D2001:03	R2201:03
XHFADJ	HF ADJUSTMENT X AMPLIFIER	N2002:03	R2021:03
XLTXT0	X SHIFT TEXT 0	V2062:03	R2007:03
XLTXT1	X SHIFT TEST 1	V2062:03	R2008:03
XOUTO	X OUTPUT 0	V2134:03	R2171:03
		V2113:03	R2302:03

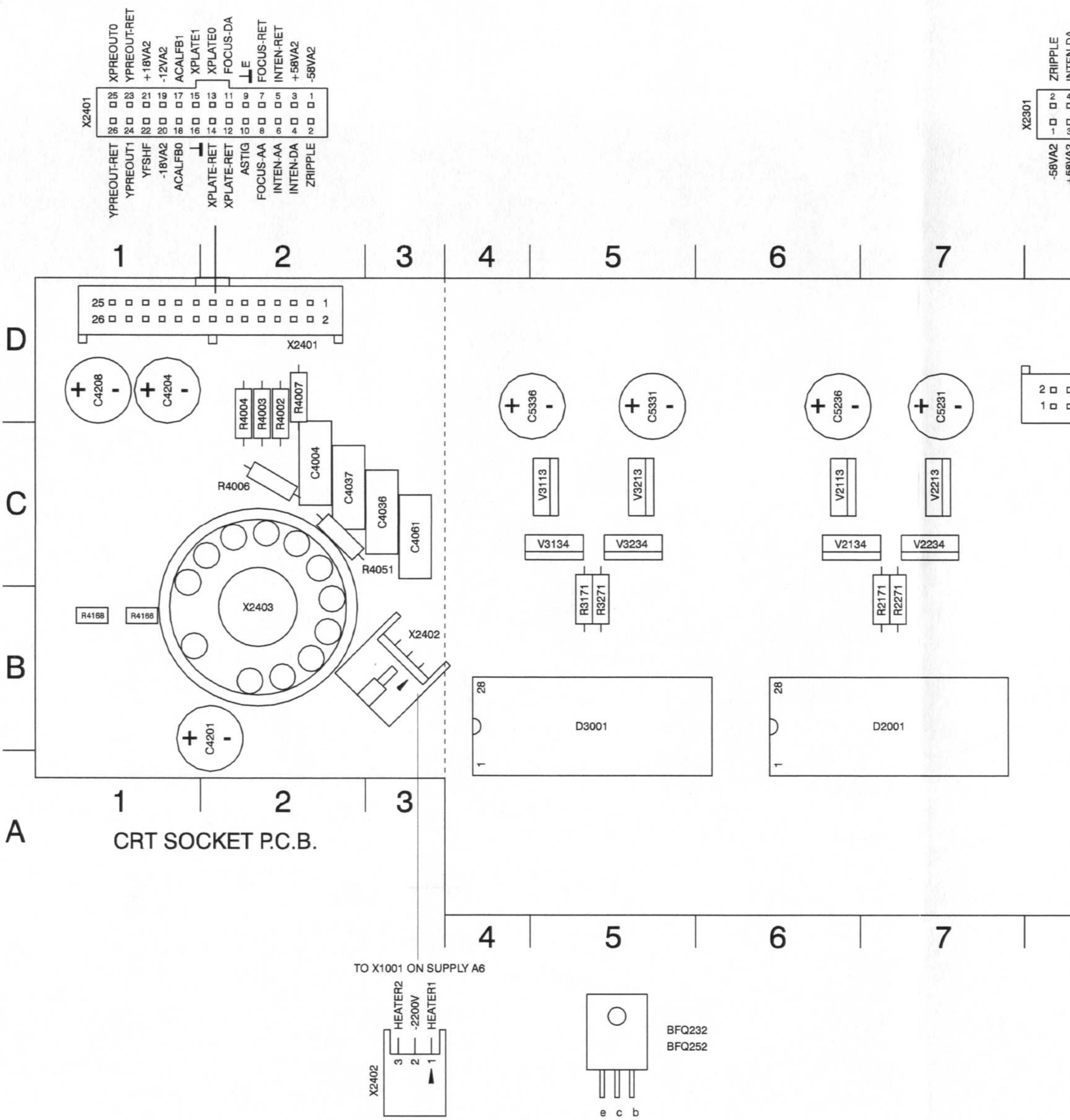
NAME	MEANING	SOURCE	DESTINATION
XOUT1	X OUTPUT 1	V2234:03	R2271:03
		V2213:03	R2301:03
XPLATE0	X OUTPUT 0 TO CRT LEFT PLATE	R2161:03	X2411:02
XPLATE1	X OUTPUT 1 TO CRT RIGHT PLATE	R2261:03	X2411:02
XPLATEC0	X OUTPUT 0 TO CRT LEFT PLATE	R4261:02	X2403:02
XPLATEC1	X OUTPUT 1 TO CRT RIGHT PLATE	R4262:02	X2403:02
XSCL	SERIAL CLOCK X SECTION	J2002:06	N2002:03
XSDA	SERIAL DATA X SECTION	J2001:06	N2002:03
XSWO	X SWITCH SIGNAL 0 TRACE/TEXT	V1204:01	D2001:03
XSW1	X SWITCH SIGNAL 1 TRACE/TEXT	V1203:01	D2001:03
XTRA0	X TRACE 0 SIGNAL	X2501:06	R2006:03
XTRA1	X TRACE 1 SIGNAL	X2501:06	R2006:03
XTRAGC	X TRACE SIGNAL GAIN CONTROL	N2002:03	R2002:03
XTXT0	X TEXT 0 SIGNAL	X2501:06	R2063:03
XTXT1	X TEXT 1 SIGNAL	X2501:06	R2064:03
XYSWO	X/Y SWITCH SIGNAL 0 TRACE/TEXT	X2501:06	R1204:01
XYSW1	X/Y SWITCH SIGNAL 1 TRACE/TEXT	X2501:06	R1201:01
YCAL	AUTOCAL SIGNAL Y DEFLECTION	R1309:01	X2501:06
YFSHF	HF SQ WAVE RESPONSE FINAL Y	R1091:01	X2301:06
		X2411:02	R4181:02
			R4182:02
YFSHF1	HF SQ WAVE RESPONSE FINAL Y 1	R4181:02	V4113:02
YFSHF2	HF SQ WAVE RESPONSE FINAL Y 2	R4182:02	V4114:02
YPREOUT0	Y PREAMPLIFIER OUT 0	V1027:01	X2301:06
		X2411:02	R4112:02
YPREOUT1	Y PREAMPLIFIER OUT 1	V1026:01	X2301:06
		X2411:02	R4111:02
YSCL	SERIAL CLOCK Y SECTION	J1002:06	N1001:01
YSDA	SERIAL DATA Y SECTION	J1001:06	N1001:01
YSW0	Y SWITCH SIGNAL 0 TRACE/TEXT	V1202:01	D1001:01
YSW1	Y SWITCH SIGNAL 1 TRACE/TEXT	V1201:01	D1001:01
YTRA0	Y TRACE 0 OUT FROM DELAY LINE	X2101:01	D1001:01
YTRA1	Y TRACE 1 OUT FROM DELAY LINE	X2101:01	D1001:01
YTXT0	Y TEXT 0 SIGNAL	X2501:06	D1001:01
YTXT1	Y TEXT 1 SIGNAL	X2501:06	D1001:01
ZDRIF0	DRIVER SIGNAL 0 FOCUS AMPLIFIER	D3001:04	R3101:04
ZDRIF1	DRIVER SIGNAL 1 FOCUS AMPLIFIER	D3001:04	R3103:04
ZDRII0	DRIVER SIGNAL 0 INTENS AMPLIFIER	D3001:04	R3203:04
ZDRII1	DRIVER SIGNAL 1 INTENS AMPLIFIER	D3001:04	R3201:04
ZLTRA0	Z LEVEL TRACE INTENSITY 0	V3062:04	R3004:04
ZLTRA1	Z LEVEL TRACE INTENSITY 1	V3061:04	R3006:04
ZOUTF	FEEDBACK SIGNAL FOCUS AMPLIFIER	V3113:04	R3171:04
ZOUTI	FEEDBACK SIGNAL INTENSITY AMPLIFIER	V3213:04	R3271:04
ZRIPPLE	RIPPLE ON NEGATIVE HIGH VOLTAGE	C4061:05	X2411:05
		X2301:06	R3014:04
ZRSUP	Z RIPPLE SUPPRESS	V3002:04	D3001:04
ZSW0	Z SWITCH SIGNAL O TEXT/TRACE	X2501:06	D3001:04
ZSW1	Z SWITCH SIGNAL 1 TEXT/TRACE	X2501:06	D3001:04
ZTRA0	Z TRACE INTENSITY 0	X2501:06	R3063:04
ZTRA1	Z TRACE INTENSITY 1	X2501:06	R3064:04
ZTXT0	Z TEXT 0 SIGNAL	X2501:06	R3007:04
ZTXT1	Z TEXT 1 SIGNAL	X2501:06	R3008:04

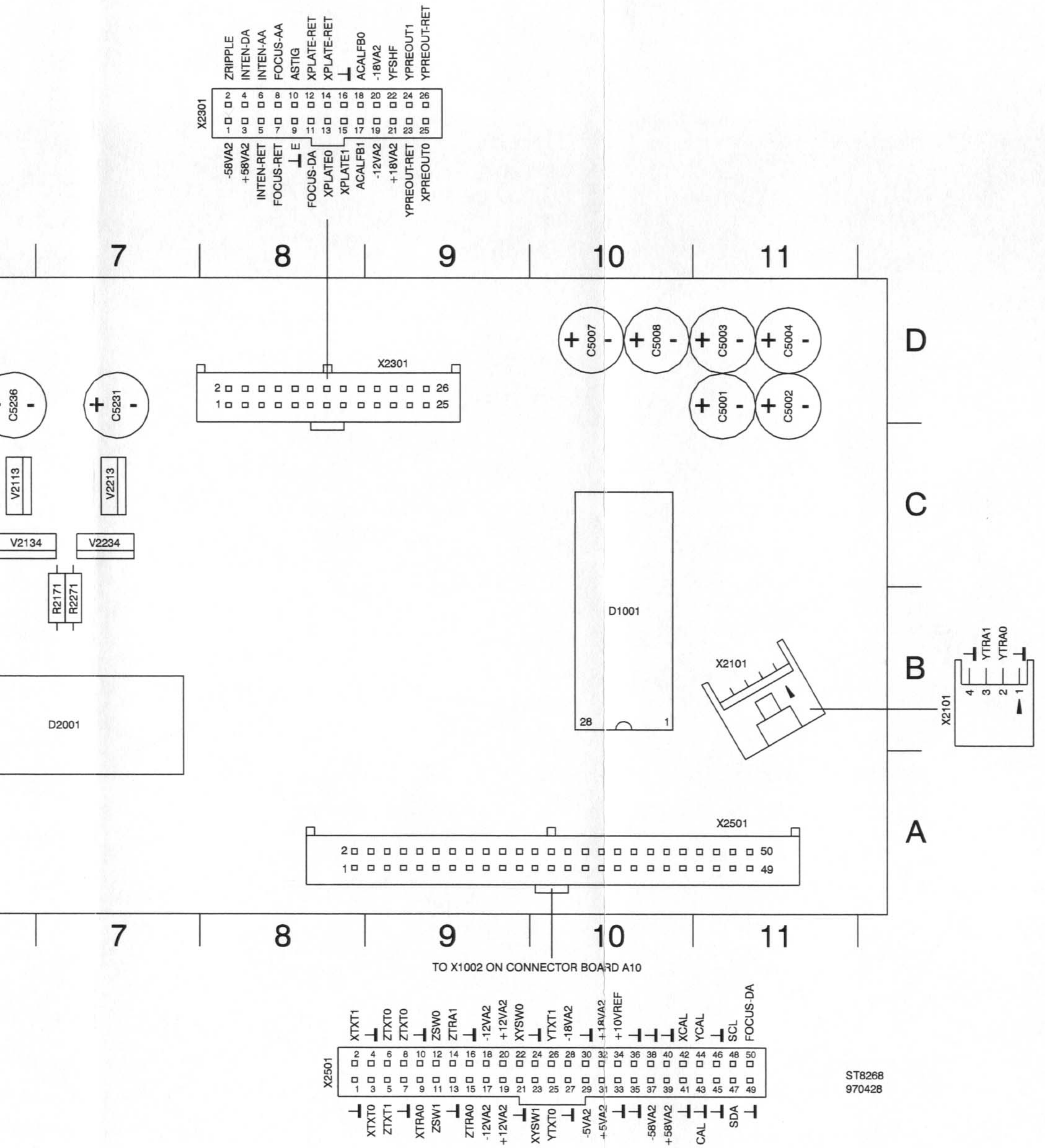
5.2.9 Unit lay-outs A2-100 MHz version



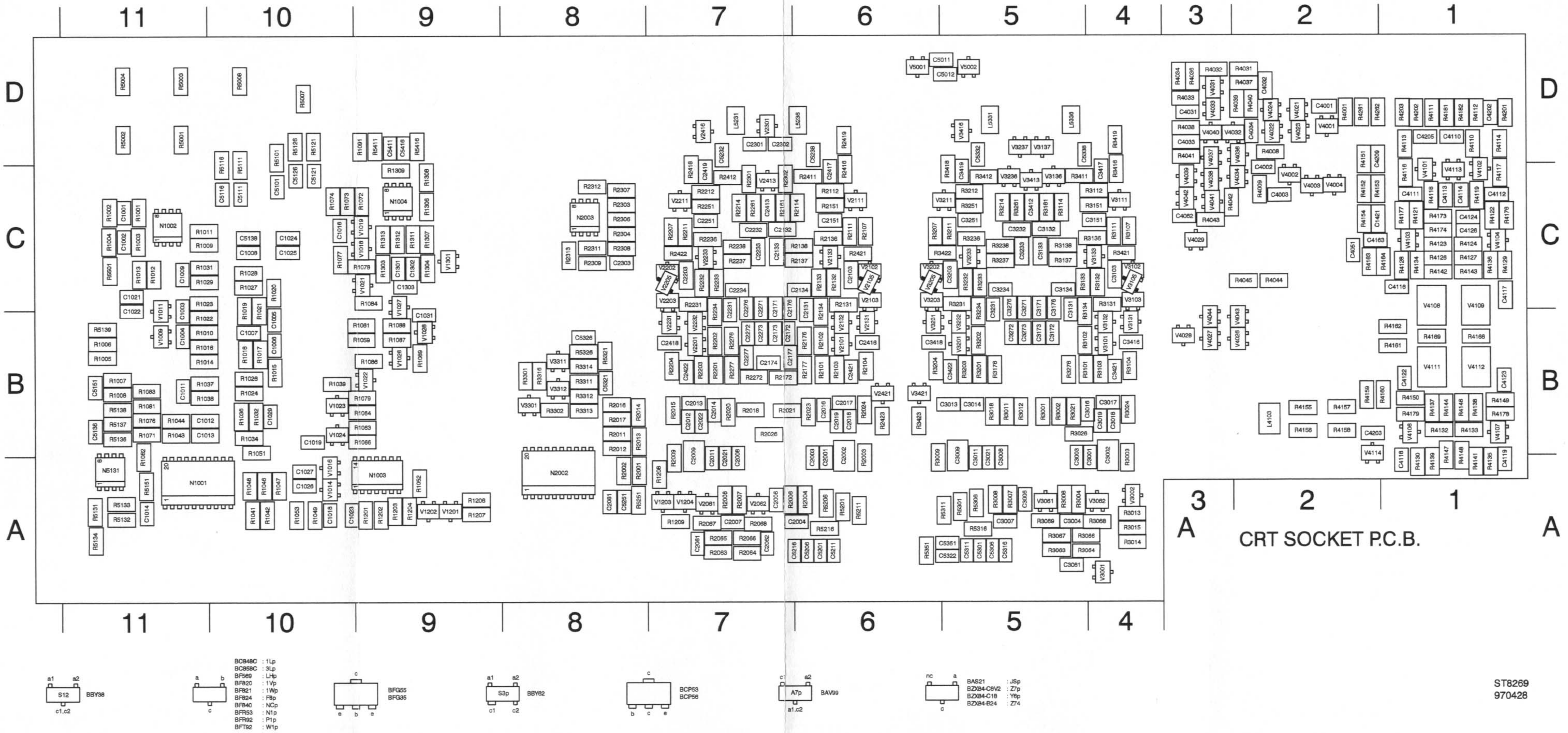
Lay-out 1 - Large component side of XYA amplifier unit A2-100MHz

5.2.9 Unit lay-outs A2-100 MHz version

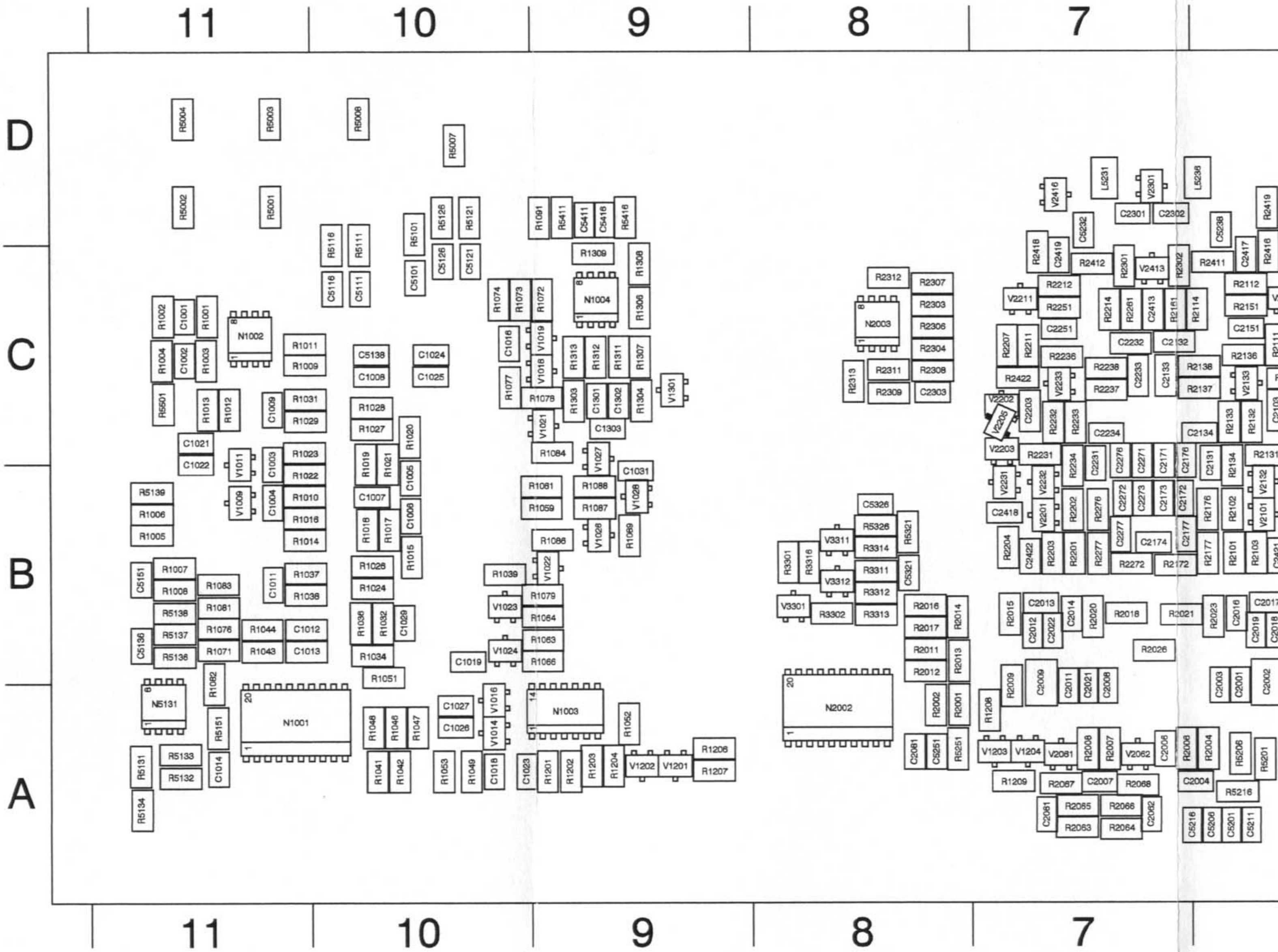




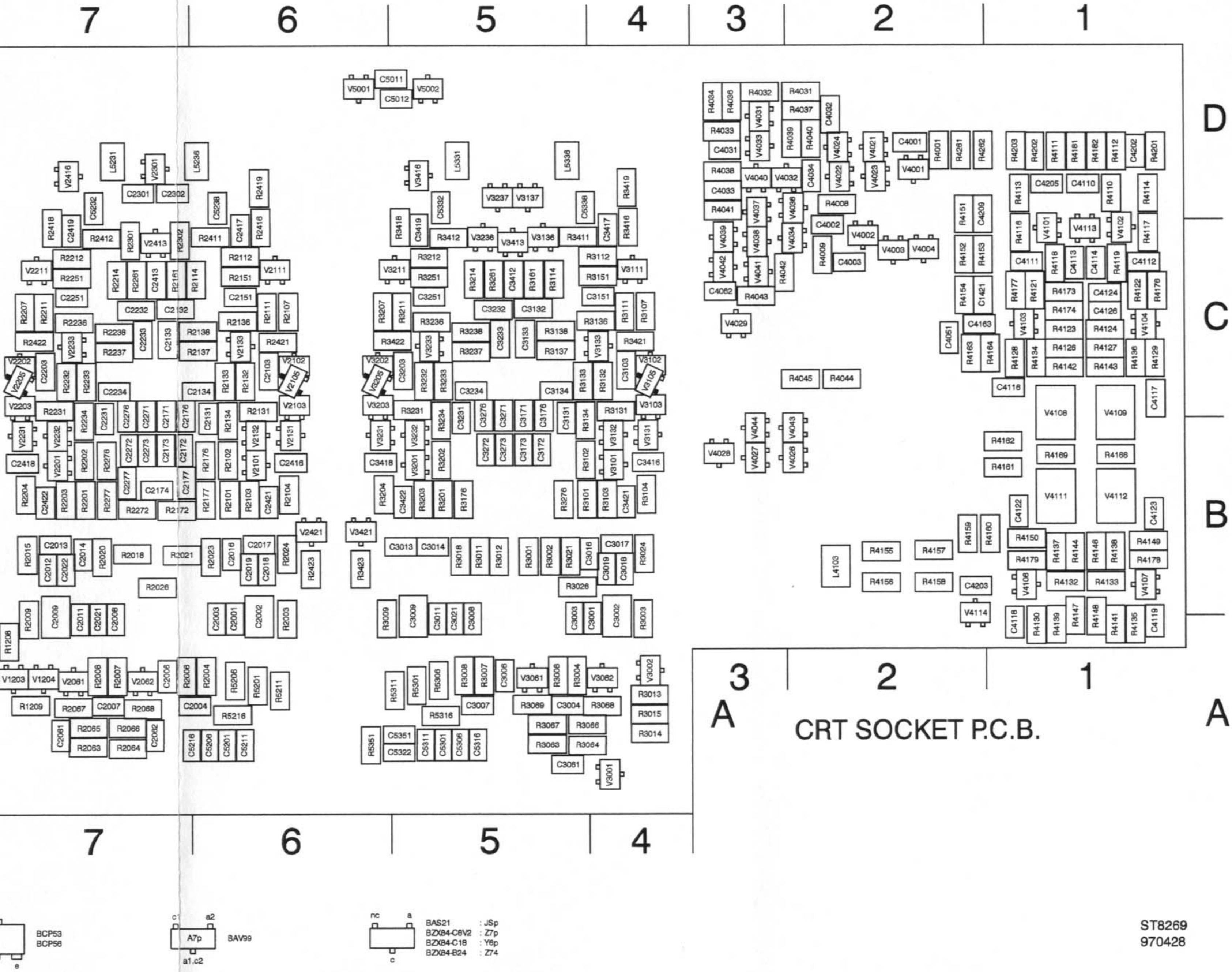
Lay-out 1 - Large component side of XYA amplifier unit A2-100MHz



Lay-out 2 - Small component side of XYZ amplifier unit A2-100MHz


11
10
9
8
7
D
C
B
A
N1001
N1002
N1003
N1004
N2002
N2003
N5131


a1 a2
S12
c1,c2
BBY38
a b
c
BC848C : 1Lp
BC858C : 3Lp
BF569 : LHp
BF820 : 1Vp
BF821 : 1Wp
BF824 : FBp
BF840 : NCp
BFR53 : N1p
BFR92 : P1p
BFT92 : W1p
c
e b e
BFG55
BFG35
a1 a2
S3p
c1 c2
BBY62
c
b c e
BCP53
BCP56
c1 a2
A7p
a1,c2
BAV99



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Lay-out 2 - Small component side of XYZ amplifier unit A2-100MHz

5.2.10 Location List A2-100 MHz version

'-L' means that the component is located on the side with the large components. Otherwise the component is located on the side with small components.

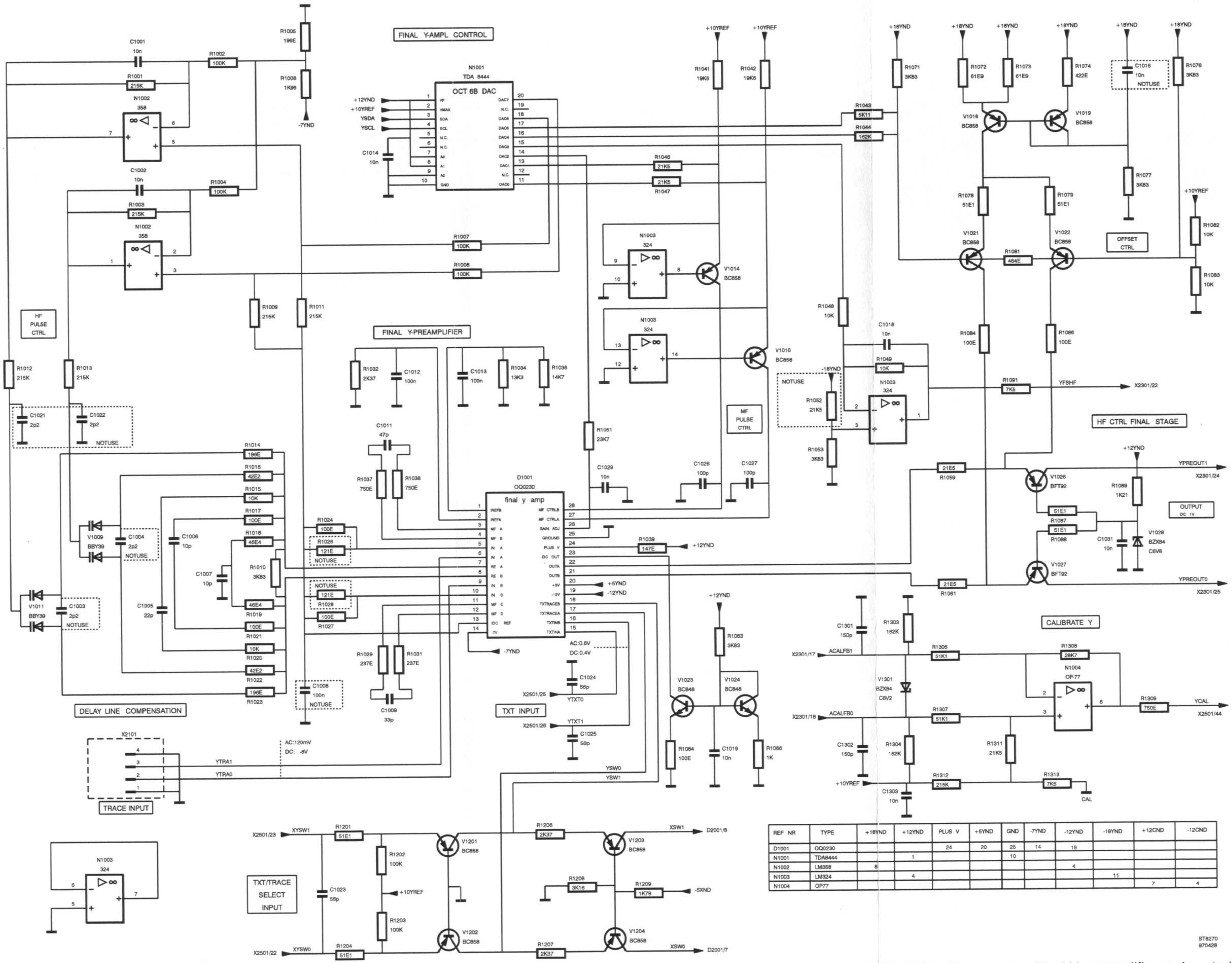
C1001 C11
C1002 C11
C1003 C11
C1004 B11
C1005 B10
C1006 B10
C1007 B10
C1008 C10
C1009 C11
C1011 B11
C1012 B11
C1013 B11
C1014 A11
C1016 C10
C1018 A10
C1019 B10
C1021 C11
C1022 C11
C1023 A10
C1024 C10
C1025 C10
C1026 A10
C1027 A10
C1029 B10
C1031 C9
C1301 C9
C1302 C9
C1303 C9
C2001 A6
C2002 A6
C2003 A6
C2004 A7
C2006 A7
C2007 A7
C2008 A7
C2009 A7
C2011 A7
C2012 B7
C2013 B7
C2014 B7
C2016 B6
C2017 B6
C2018 B6
C2019 B6
C2021 A7
C2022 B7
C2061 A7
C2062 A7
C2081 A8
C2103 C6
C2131 B6
C2132 C7
C2133 C7
C2134 C7
C2151 C6
C2171 C7
C2172 B7
C2173 B7
C2174 B7
C2176 C7
C2177 B7
C2203 C7
C2231 B7
C2232 C7
C2233 C7
C2234 C7
C2251 C7
C2271 C7
C2272 B7
C2273 B7
C2276 C7
C2277 B7
C2301 D7
C2302 D7
C2303 C8
C2413 C7
C2416 B6
C2417 C6
C2418 B7
C2419 C7
C2421 B6
C2422 B7
C3001 A5
C3002 A4
C3003 A5
C3004 A5
C3006 A5
C3007 A5
C3008 A5
C3009 A5
C3011 A5
C3013 B6
C3014 B5
C3016 B5
C3017 B4
C3018 B4
C3019 B4
C3021 A5
C3061 A5
C3103 C4
C3131 C5
C3132 C5
C3133 C5
C3134 C5
C3151 C5
C3171 C5
C3172 B5
C3173 B5
C3176 C5
C3203 C6
C3231 B5
C3232 C5
C3233 C5
C3234 C5
C3251 C5
C3271 C5
C3272 B5
C3273 B5
C3276 C5
C3412 C5
C3416 B4
C3417 C4
C3418 B6
C3419 C5
C3421 B4
C3422 B6
C4001 D2
C4002 D2
C4003 D2
C4004 C2-L
C4031 D3
C4032 C3
C4033 D3
C4034 D2
C4036 C3-L
C4037 C2-L
C4051 C2
C4061 C3-L
C4062 D2
C4111 C1
C4112 C1
C4113 C1
C4114 C1
C4116 C1
C4117 C1
C4118 B1
C4119 B1
C4121 C1
C4122 B1
C4123 B1
C4124 C1
C4163 D1
C4201 B1-L
C4202 B1
C4203 B1
C4204 D1-L
C4206 C1
C4207 C1
C4208 D1-L
C4209 C1
C5001 D11-L
C5002 D11-L
C5003 D11-L
C5004 D11-L
C5007 D10-L
C5008 D10-L
C5011 D6
C5012 D6
C5101 C10
C5111 C10
C5116 C10
C5121 C10
C5126 C10
C5136 B11
C5138 C10
C5151 B11
C5201 A6
C5206 A6
C5211 A6
C5216 A7
C5231 D7-L
C5232 D7
C5236 D6-L
C5238 D6
C5251 A8
C5301 A5
C5306 A5
C5311 A5
C5316 A5
C5321 B8
C5322 A6
C5326 B8
C5331 C5-L
C5332 D5
C5336 C5-L
C5338 D5
C5351 A6
C5411 D9
C5416 D9
D1001 B10-L

D2001 B7-L
D3001 B5-L
L4101 B2
L4102 B2
L4103 B2
N1001 A11
N1002 C11
N1003 A9
N1004 C9
N2002 A8
N2003 C8
N5131 A11
R1001 C11
R1002 C11
R1003 C11
R1004 C11
R1005 B11
R1006 B11
R1007 B11
R1008 B11
R1009 C11
R1010 B11
R1011 C11
R1012 C11
R1013 C11
R1014 B11
R1015 B10
R1016 B11
R1017 B10
R1018 B10
R1019 C10
R1020 C10
R1021 C10
R1022 C11
R1023 C11
R1024 B10
R1026 B10
R1027 C10
R1028 C10
R1029 C11
R1031 C11
R1032 B10
R1034 B10
R1036 B10
R1037 B11
R1038 B11
R1039 B10
R1041 A10
R1042 A10
R1043 B11
R1044 B11
R1046 A10
R1047 A10
R1048 A10
R1049 A10
R1051 B10
R1052 A9
R1053 A10
R1059 B10
R1061 B10
R1063 B10
R1064 B10
R1066 B10
R1071 B11
R1072 C10
R1073 C10
R1074 C10
R1076 B11
R1077 C10
R1078 C10
R1079 B10
R1081 B11
R1082 A11
R1083 B11
R1084 C10
R1086 B10
R1087 B9
R1088 B9
R1089 B9
R1091 D10
R1201 A10
R1202 A9
R1203 A9
R1204 A9
R1206 A9
R1207 A9
R1208 A7
R1209 A7
R1303 C9
R1304 C9
R1306 C9
R1307 C9
R1308 C9
R1309 D9
R1311 C9
R1312 C9
R1313 C9
R2001 A8
R2002 A8
R2003 A6
R2004 A6
R2006 A7
R2007 A7
R2008 A7
R2009 A7
R2011 B8
R2012 B8
R2013 B8
R2014 B8
R2015 B7
R2016 B8
R2017 B8
R2018 B7
R2020 B7
R2021 B7
R2023 B6
R2024 B6
R2026 B7
R2063 A7
R2064 A7
R2065 A7
R2066 A7
R2067 A7
R2068 A7
R2101 B6
R2102 B6
R2103 B6
R2104 B6
R2107 C6
R2111 C6
R2112 C6
R2114 C7
R2131 C6
R2132 C6
R2133 C6
R2134 B6
R2136 C6
R2137 C7
R2138 C7
R2151 C6
R2161 C7
R2171 B7-L
R2172 B7
R2176 B6
R2177 B6
R2201 B7
R2202 B7
R2203 B7
R2204 B7
R2207 C7
R2211 C7
R2212 C7
R2214 C7
R2231 C7
R2232 C7
R2233 C7
R2234 B7
R2236 C7
R2237 C7
R2238 C7
R2251 C7
R2261 C7
R2271 B7-L
R2272 B7
R2276 B7
R2277 B7
R2301 C7
R2302 C7
R2303 C8
R2304 C8
R2306 C8
R2307 C8
R2308 C8
R2309 C8
R2311 C8
R2312 C8
R2313 C8
R2411 C7
R2412 C7
R2416 C6
R2418 C7
R2419 D6
R2421 C6
R2422 C7
R2423 B6
R3001 B5
R3002 B5
R3003 A4
R3004 A5
R3006 A5
R3007 A5
R3008 A5
R3009 A6
R3011 B5
R3012 B5
R3013 A4
R3014 A4
R3015 A4
R3018 B5
R3021 B5
R3024 B4
R3026 B5
R3063 A5
R3064 A5
R3066 A5
R3067 A5
R3068 A5
R3069 A5
R3101 B5
R3102 B5
R3103 B4
R3104 B4
R3107 C4
R3111 C4
R3112 C5
R3114 C5
R3131 C4
R3132 C4
R3133 C5
R3134 B5
R3136 C5
R3137 C5
R3138 C5
R3151 C5

R3161 C5
R3171 B5-L
R3176 B5
R3201 B5
R3202 B5
R3203 B5
R3204 B6
R3207 C6
R3211 C6
R3212 C5
R3214 C5
R3231 C6
R3232 C5
R3233 C5
R3234 B5
R3236 C5
R3237 C5
R3238 C5
R3251 C5
R3261 C5
R3271 B5-L
R3276 B5
R3301 B8
R3302 B8
R3311 B8
R3312 B8
R3313 B8
R3314 B8
R3316 B8
R3411 C5
R3412 C5
R3416 C4
R3418 C6
R3419 D4
R3421 C4
R3422 C6
R3423 B6
R4001 D2
R4002 D2-L
R4003 D2-L
R4004 D2-L
R4006 C2-L
R4007 D2-L
R4008 D2
R4009 D2
R4031 D3
R4032 D3
R4033 D3
R4034 D3
R4036 D3
R4037 D3
R4038 D3
R4039 D3
R4040 D2
R4041 D3
R4042 C2
R4043 C3
R4044 C2
R4045 B3
R4051 C3-L
R4104 C2
R4111 D1
R4112 D1
R4113 D1
R4114 D1
R4116 D1
R4117 D1
R4118 C1
R4119 C1
R4121 C1
R4122 C1
R4123 C1
R4124 C1
R4126 C1
R4127 C1
R4128 C1
R4129 C1
R4131 B1
R4132 B1
R4133 B1
R4134 C1
R4136 C1
R4137 B1
R4138 B1
R4139 B1
R4141 B1
R4142 C1
R4143 C1
R4144 B1
R4146 B1
R4147 B1
R4148 B1
R4149 B1
R4151 B1
R4152 C2
R4153 C2
R4154 C1
R4155 B2
R4156 B2
R4157 B2
R4158 B2
R4159 B2
R4160 B2
R4161 B1
R4162 C1
R4163 C2
R4164 C2
R4166 B1-L
R4167 B1
R4168 B1-L
R4169 B1
R4181 D1
R4182 D1
R4201 D1
R4202 D2
R4203 D1
R4261 D2
R4262 D2
R5001 D11
R5002 D11
R5003 D11
R5004 D11
R5007 D10
R5008 D10
R5101 D10
R5111 D10
R5116 D10
R5121 D10
R5126 D10
R5131 A11
R5132 A11
R5133 A11
R5134 A11
R5136 B11
R5137 B11
R5138 B11
R5139 B11
R5151 A11
R5201 A6
R5202 A6
R5206 A6
R5211 A6
R5216 A6
R5231 D7
R5236 D7
R5251 A8
R5301 A5
R5306 A5
R5311 A6
R5316 A5
R5321 B8
R5326 B8
R5331 D5
R5336 D5
R5351 A6
R5411 D9
R5416 D9
R5501 C11
V1009 B11
V1011 C11
V1014 A10
V1016 A10
V1018 C10
V1019 C10
V1021 C10
V1022 B10
V1023 B10
V1024 B10
V1026 B9
V1027 C9
V1028 A9
V1201 B9
V1202 A9
V1203 A7
V1204 A7
V1301 C9
V2061 A7
V2062 A7
V2101 B6
V2102 C6
V2103 C6
V2111 C6
V2113 C7-L
V2131 B6
V2132 B6
V2133 C6
V2134 C7-L
V2201 B7
V2202 C7
V2203 C7
V2211 C7
V2213 C7-L
V2231 B7
V2232 B7
V2233 C7
V2234 C7-L
V2301 D7
V2413 C7
V2416 D7
V2421 B6
V3001 A4
V3002 A4
V3061 A5
V3062 A5
V3101 B4
V3102 C4
V3103 C4
V3111 C4
V3113 C5-L
V3131 C4
V3132 B4
V3133 C4
V3134 C5-L
V3136 C5
V3137 D5
V3201 B5
V3202 C6
V3203 C6
V3211 C6
V3213 C5-L
V3231 B6
V3232 B5
V3233 C5
V3234 C5-L

V3236 C5	V4031 D3	V4044 B3	V4113 D1
V3237 D5	V4032 D2	V4084 C3	V4114 B2
V3301 B8	V4033 D3	V4101 D1	V5001 D6
V3311 B8	V4034 C3	V4102 D1	V5002 D5
V3312 B8	V4036 D3	V4103 C1	X2101 B11-L
V3413 C5	V4037 D3	V4104 C1	X2301 D9-L
V3416 D5	V4038 C3	V4106 C1	X2401 D2-L
V3421 B6	V4039 C3	V4107 C1	X2402 B3-L
V4001 D2	V4040 D3	V4108 C1	X2403 B2-L
V4002 D2	V4041 C3	V4109 C1	X2501 A8-L
V4003 D2	V4042 C3	V4111 B1	
V4004 D2	V4043 C3	V4112 B1	

5.2.11 Circuit diagrams A2-100 MHz version



REF NR	TYPE	+18YND	+12YND	PLUS V	+5YND	GND	-7YND	-12YND	-18YND	+12CND	-12CND
D1001	OQ0230			24	20	25	14	19			
N1001	TDA8444		1			10					
N1002	LM358	8						4			
N1003	LM324		4						11		
N1004	OP77									7	4

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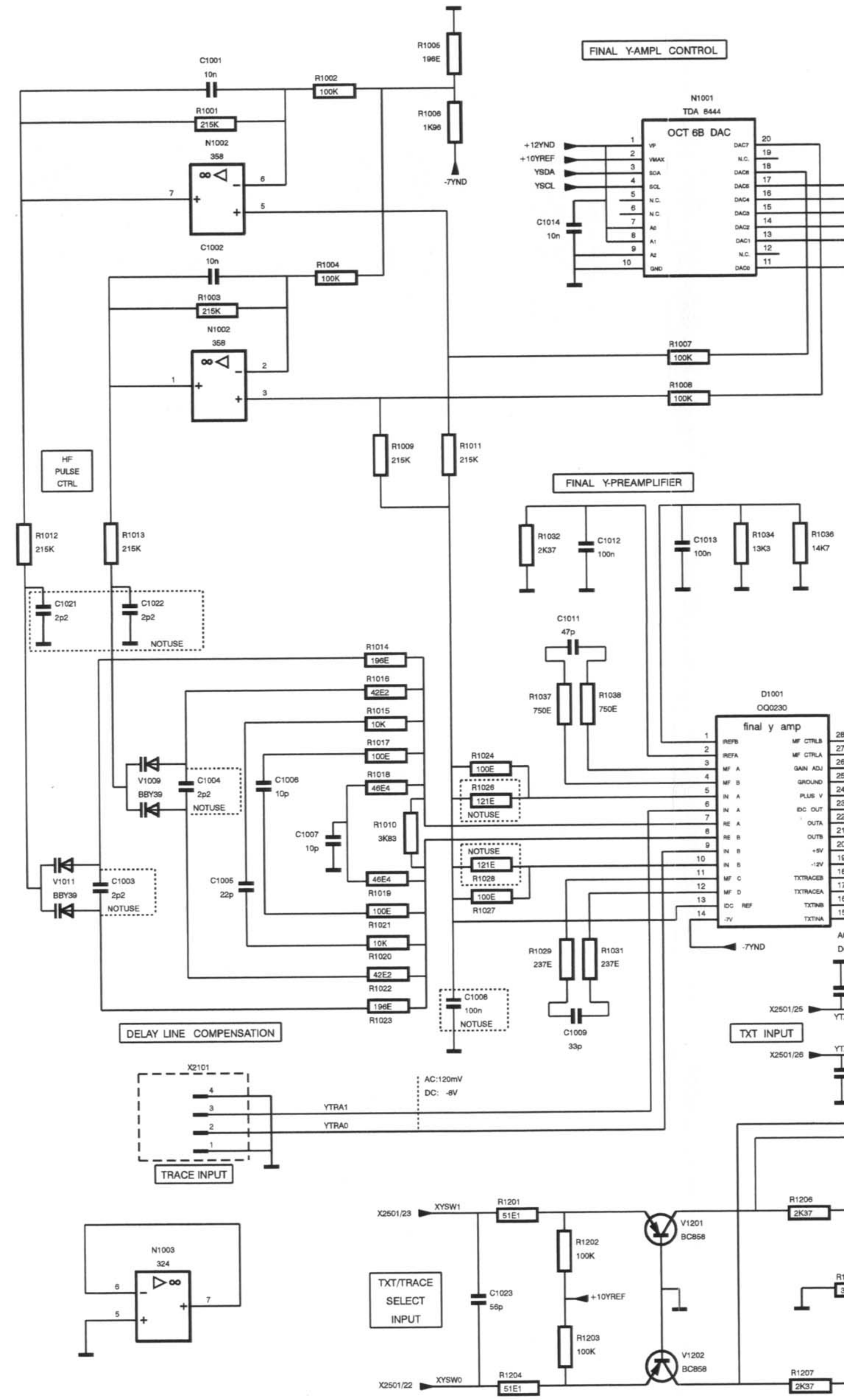
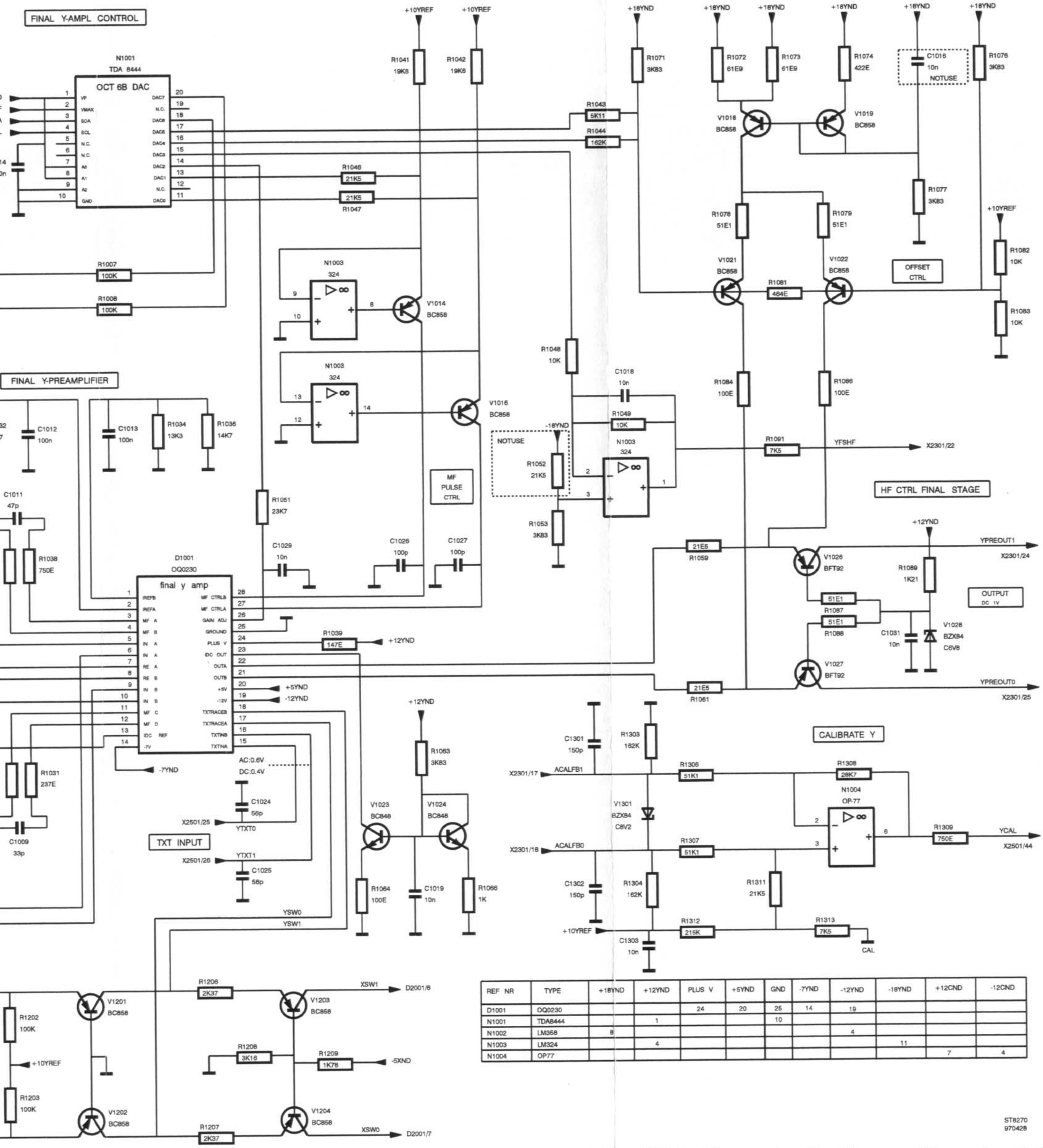
A2 (100 MHz) - Diagram 1a ; Final Y preamplifier and control

5.2.11 Circuit diagrams A2-100 MHz version





REF NR	TYPE	+18YND	+12YND	PLUS V	+5YND	GND	-7YND	-12YND	-18YND	+12CND	-12CND
D1001	OQ0230			24	20	25	14	19			
N1001	TDA8444		1			10					
N1002	LM358	8						4			
N1003	LM324		4						11		
N1004	OP77									7	4

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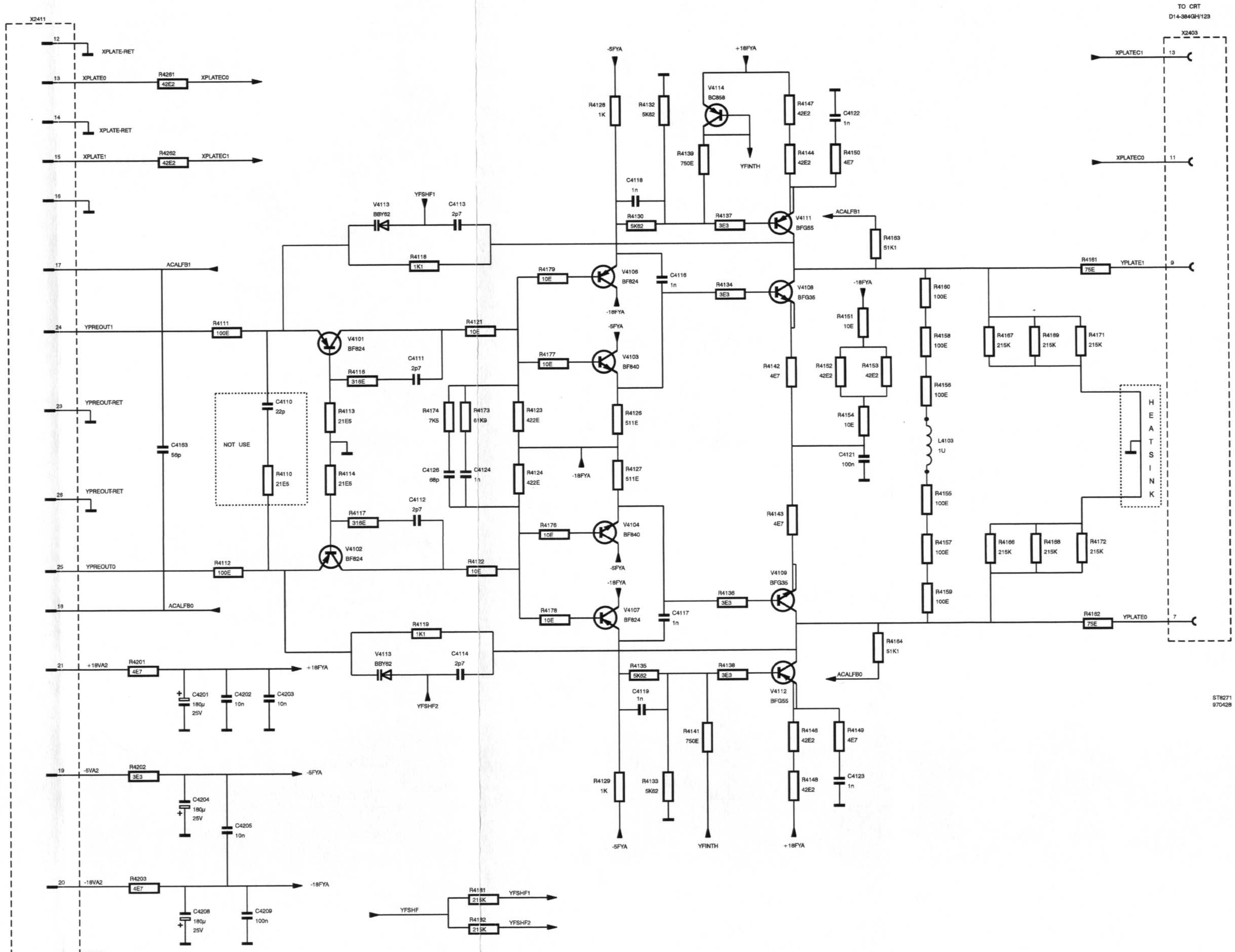
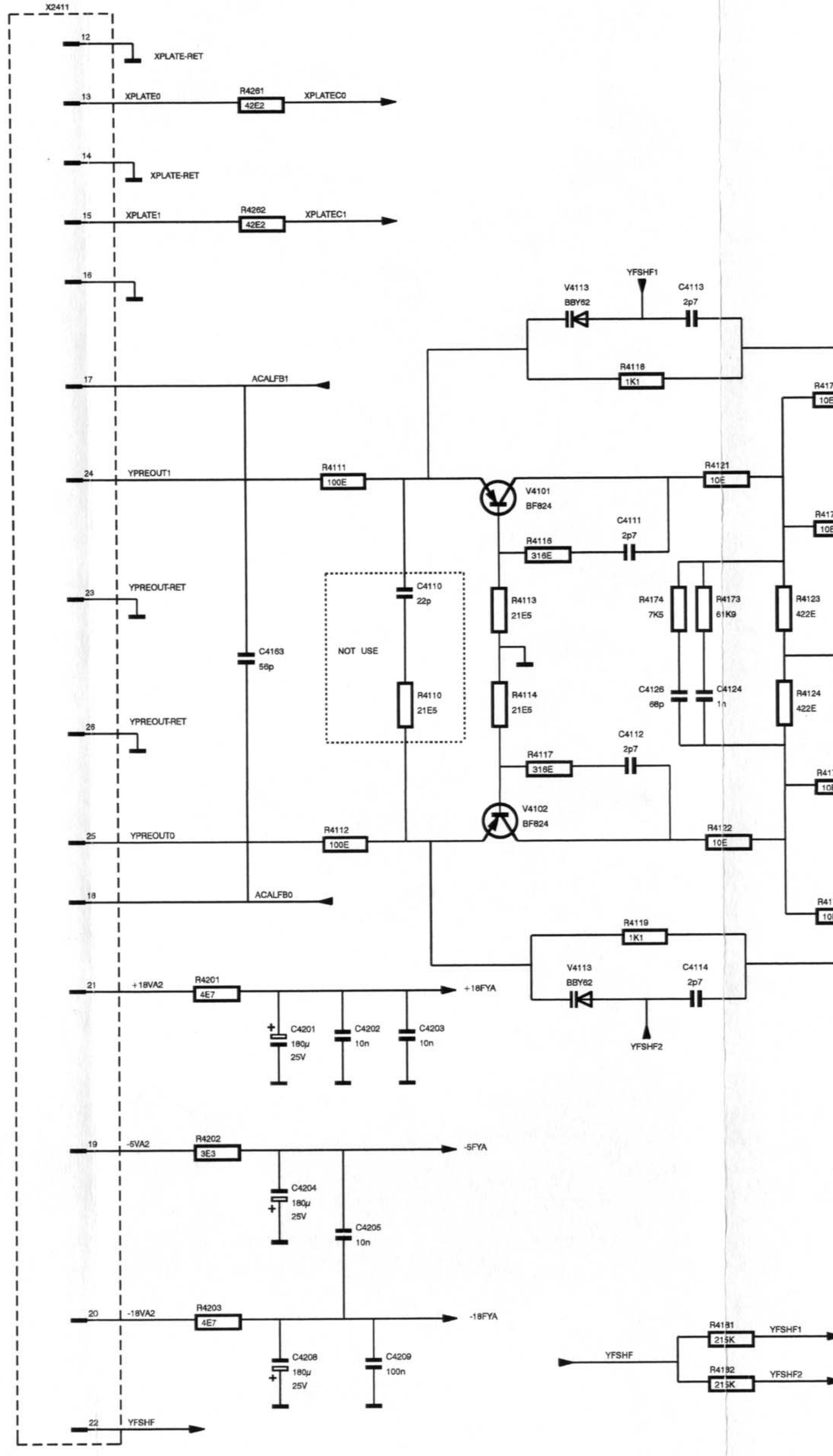
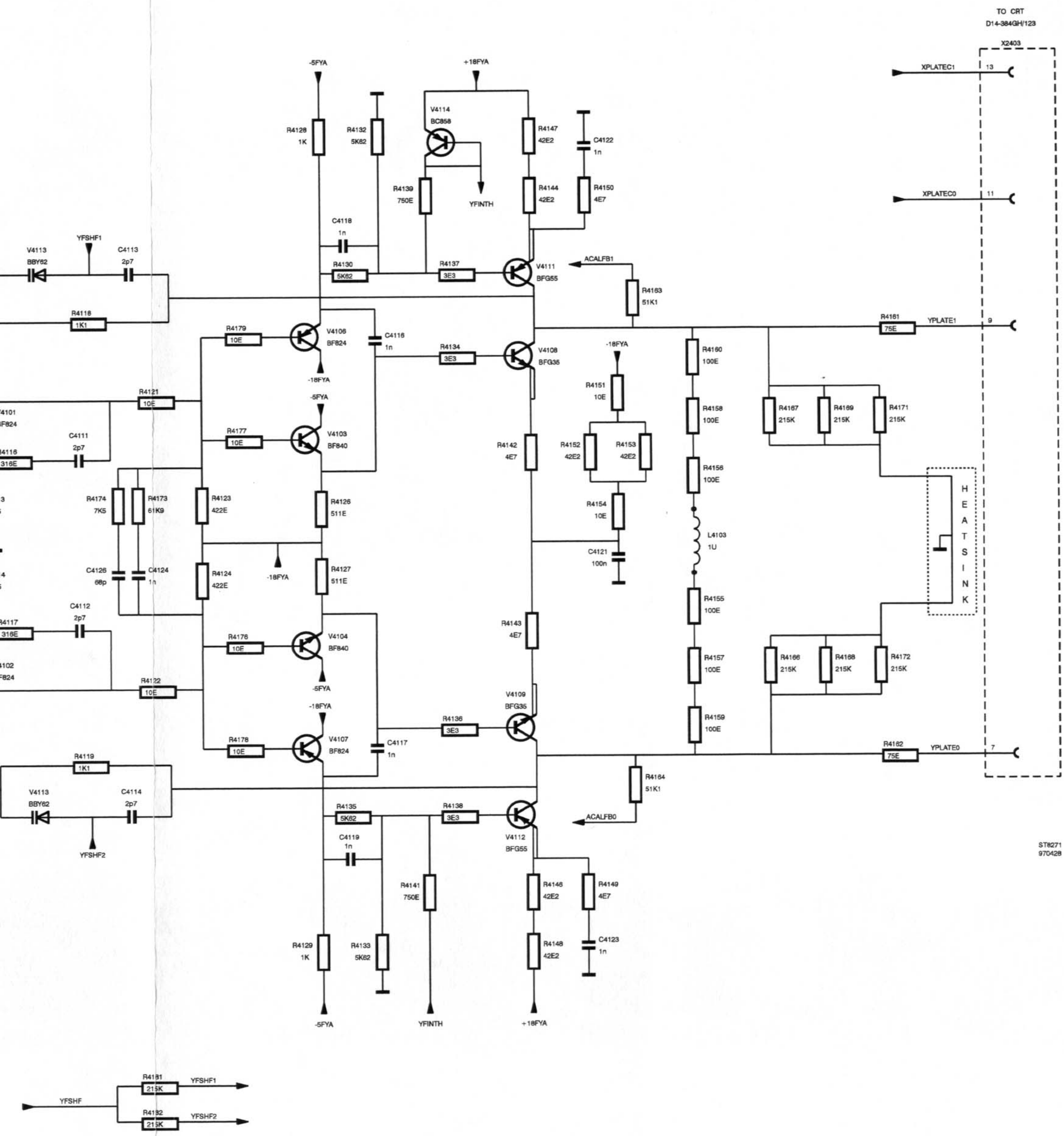
A2 (100 MHz) - Diagram 1a ; Final Y preamplifier and control



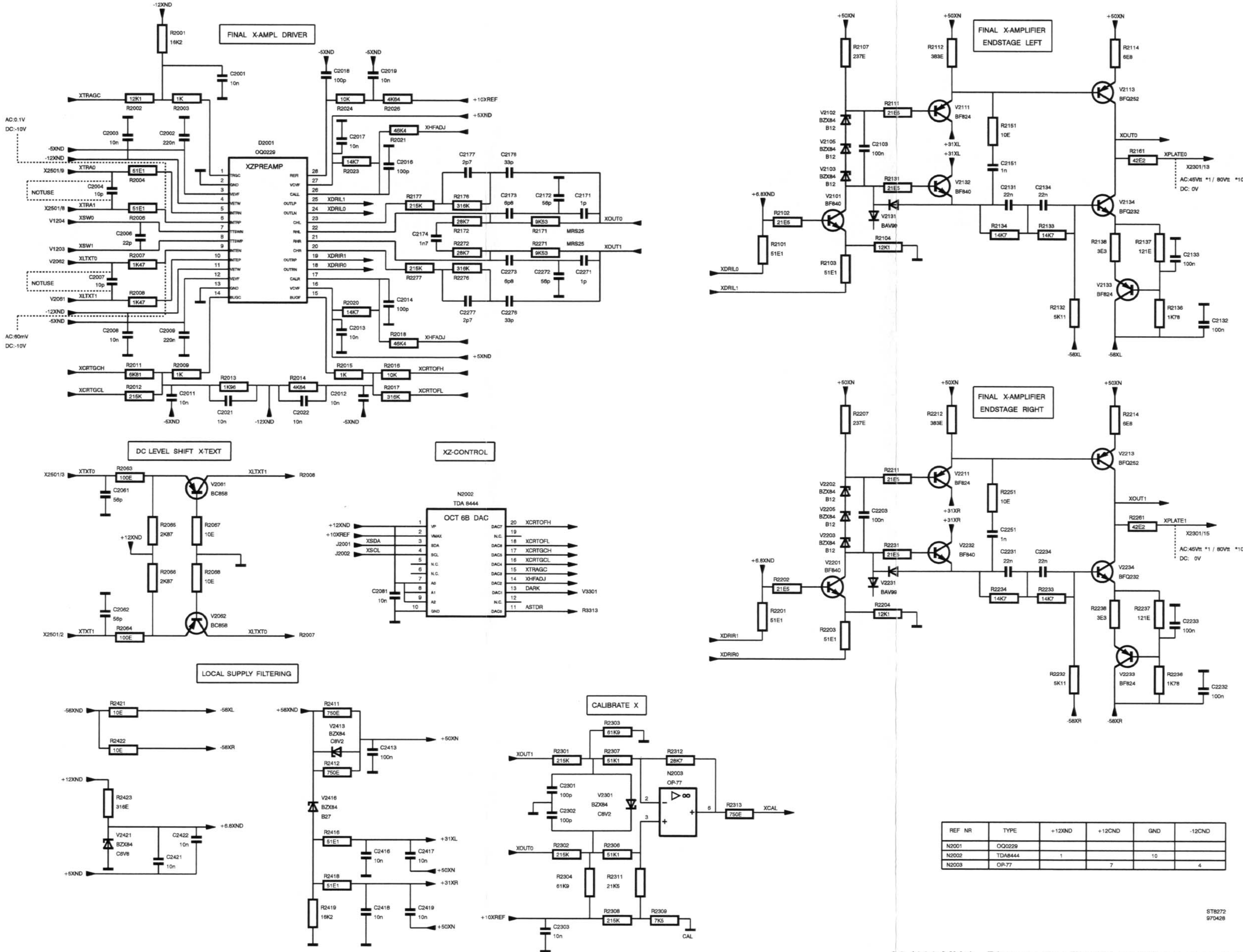
A2 (100 MHz) - Diagram 2a ; Final Y output stage



X2411
XPLATE-RET
XPLATE0
R4261
42E2
XPLATEC0
XPLATE-RET
XPLATE1
R4262
42E2
XPLATEC1
YFSHF1
V4113
BBY62
C4113
2p7
R4118
1K1
ACALFB1
YPREOUT1
R4111
100E
V4101
BF824
R4121
10E
C4111
2p7
R4116
316E
YPREOUT-RET
C4110
22p
R4113
21E5
R4174
7K5
R4173
61K9
R4123
422E
C4163
56p
NOT USE
R4110
21E5
R4114
21E5
C4126
68p
C4124
1n
R4124
422E
YPREOUT-RET
C4112
2p7
R4117
316E
V4102
BF824
YPREOUT0
R4112
100E
R4122
10E
ACALFB0
R4119
1K1
+18VA2
R4201
4E7
+18FYA
V4113
BBY62
C4114
2p7
C4201
180µ
25V
C4202
10n
C4203
10n
YFSHF2
-5VA2
R4202
3E3
-5FYA
C4204
180µ
25V
C4205
10n
-18VA2
R4203
4E7
-18FYA
C4208
180µ
25V
C4209
100n
R4181
215K
YFSHF1
YFSHF
R4182
215K
YFSHF2
YFSHF



A2 (100 MHz) - Diagram 2a ; Final Y output stage



REF NR	TYPE	+12XND	+12CND	GND	-12CND
N2001	OQ0229				
N2002	TDA8444	1		10	
N2003	OP-77		7		4

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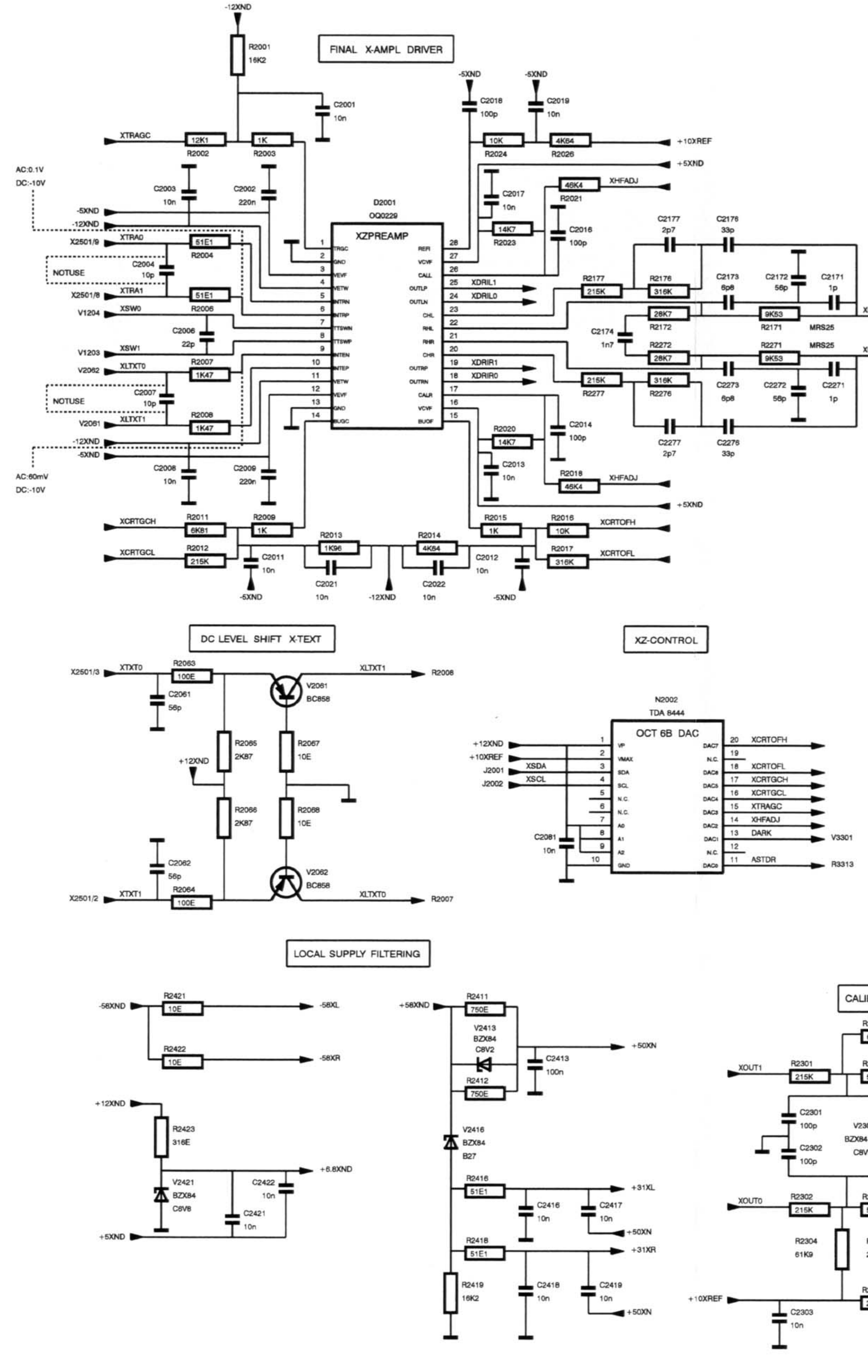
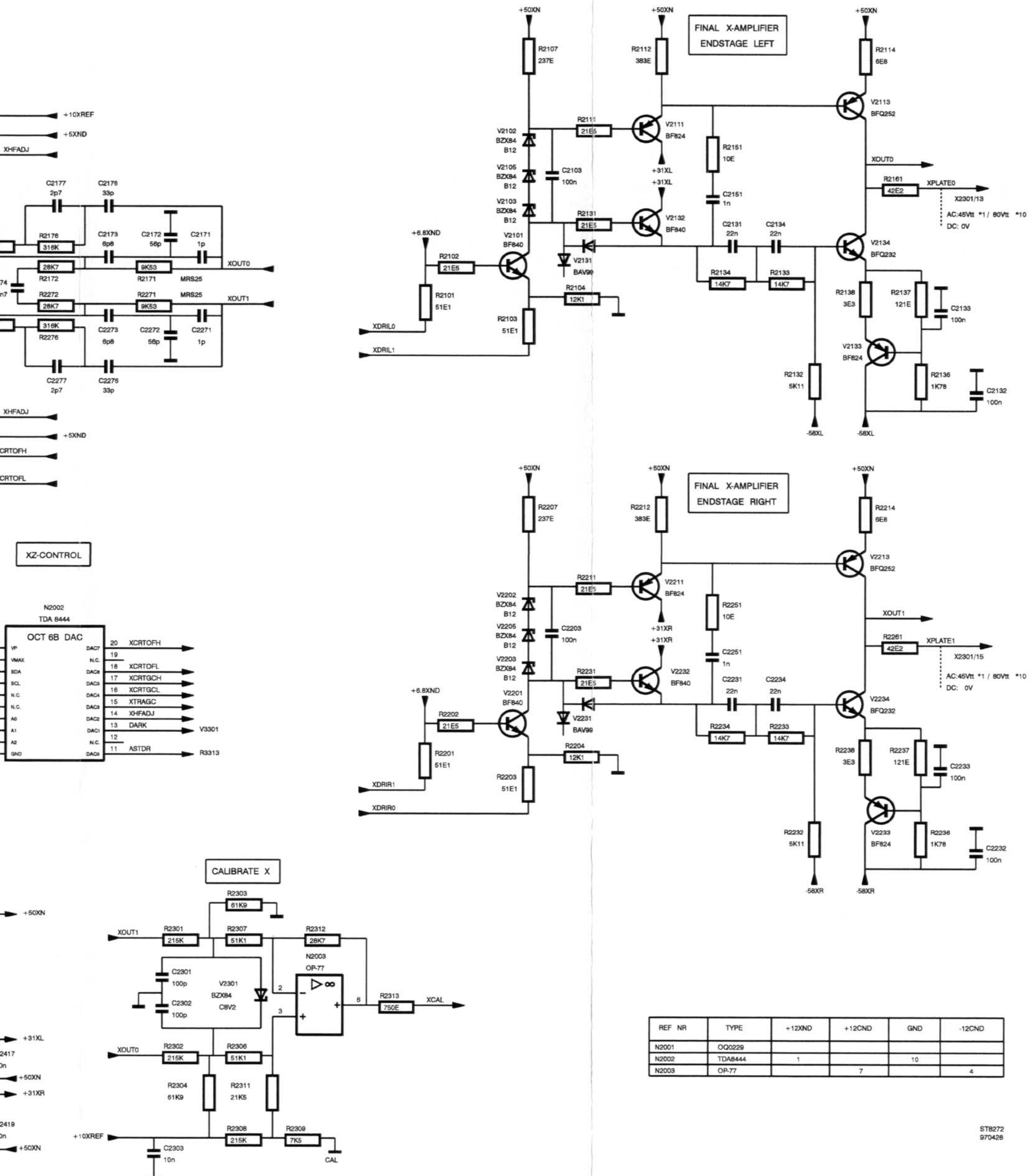
A2 (100 MHz) - Diagram 3a ; Final X amplifier and control


FINAL X-AMPL DRIVER
D2001
OQ0229
XZPREAMP
DC LEVEL SHIFT X-TEXT
XZ-CONTROL
N2002
TDA 8444
OCT 6B DAC
LOCAL SUPPLY FILTERING
XTRAGC
XCRTGCH
XCRTGCL
XCRTOFH
XCRTOFL
XHFADJ
+10XREF
+5XND
-5XND
-12XND
NOTUSE
AC:0.1V
DC:-10V
AC:60mV
DC:-10V
XDRIL1
XDRIL0
XDRIR1
XDRIR0
V2061
BC858
V2062
BC858
XLTXT1
XLTXT0
+12XND
XSDA
XSCL
DARK
ASTDR
-58XND
-58XL
-58XR
+58XND
+50XN
+31XL
+31XR
+6.8XND
XOUT1
XOUT0



REF NR	TYPE	+12XND	+12CND	GND	-12CND
N2001	OQ0229				
N2002	TDA8444	1		10	
N2003	OP-77		7		4

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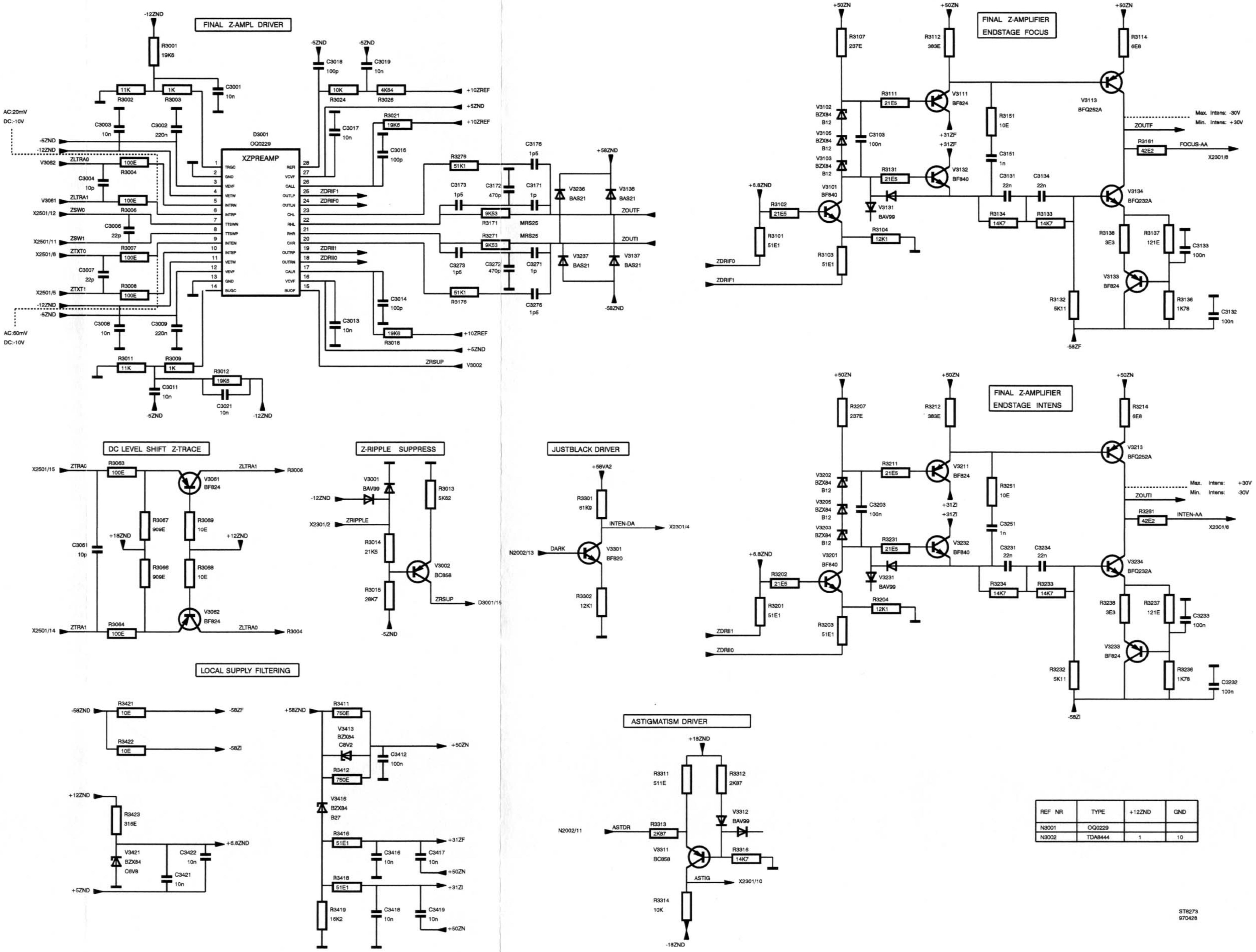
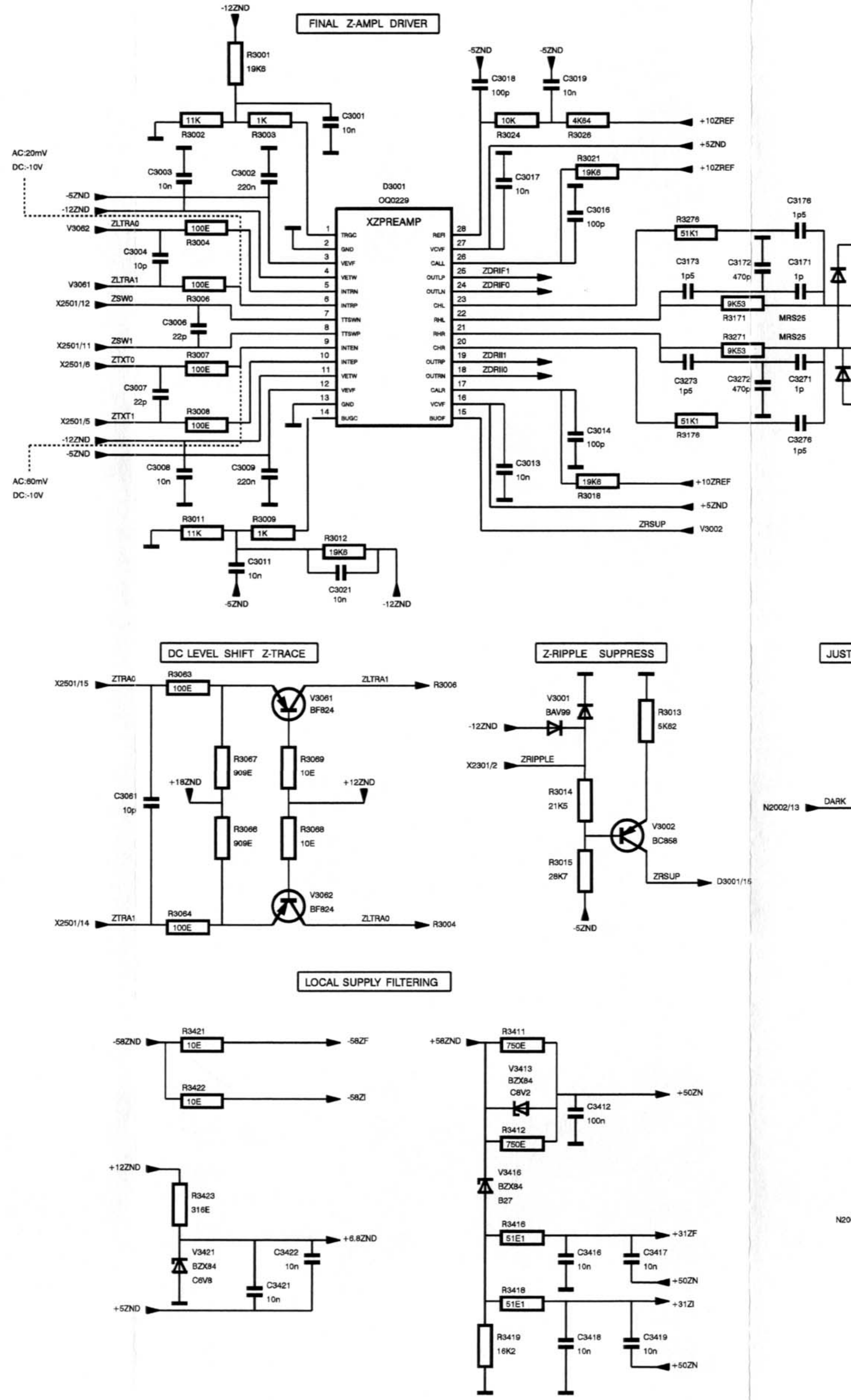
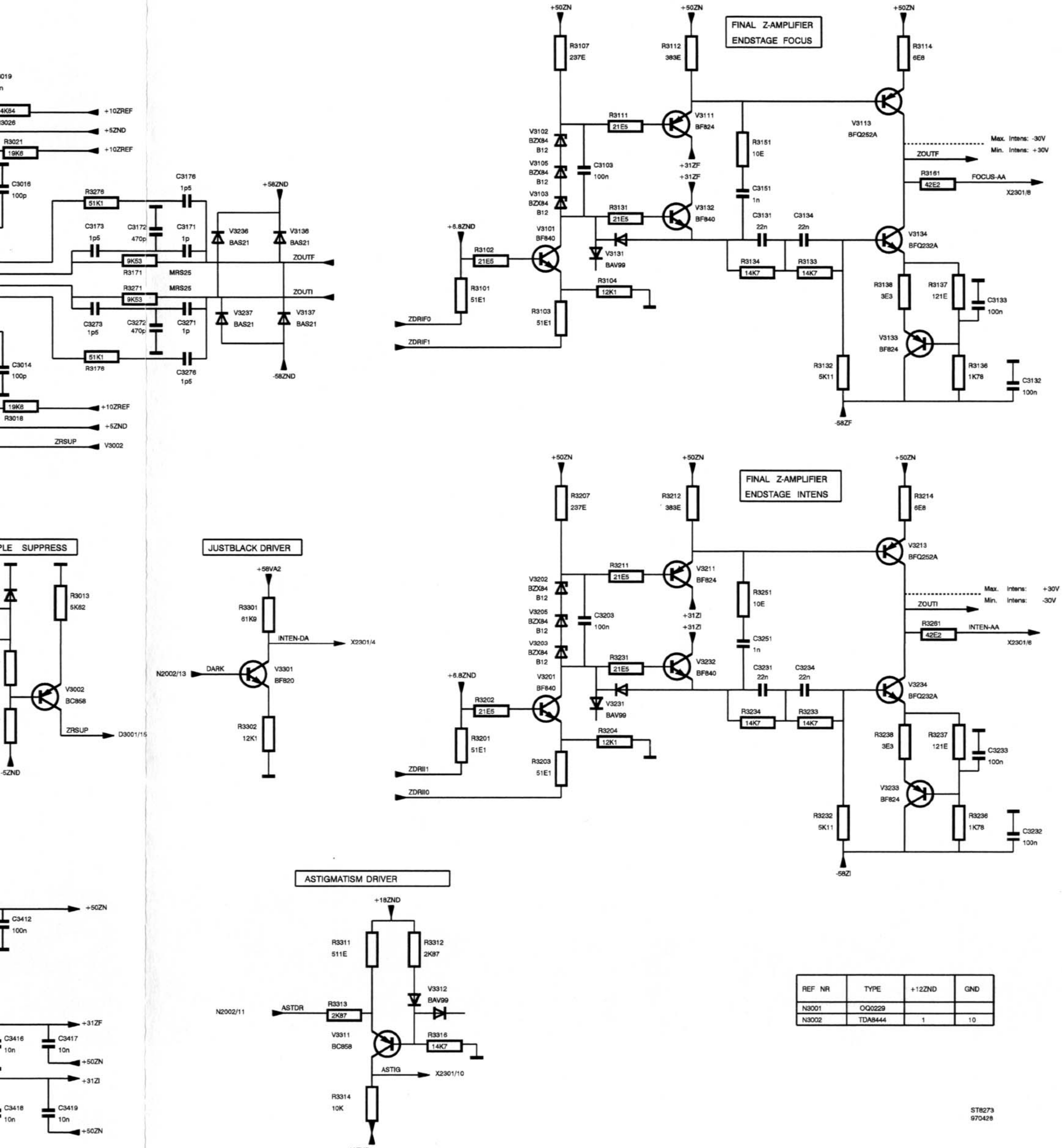
A2 (100 MHz) - Diagram 3a ; Final X amplifier and control



REF NR	TYPE	+12ZND	GND
N3001	OQ0229		
N3002	TDA8444	1	10

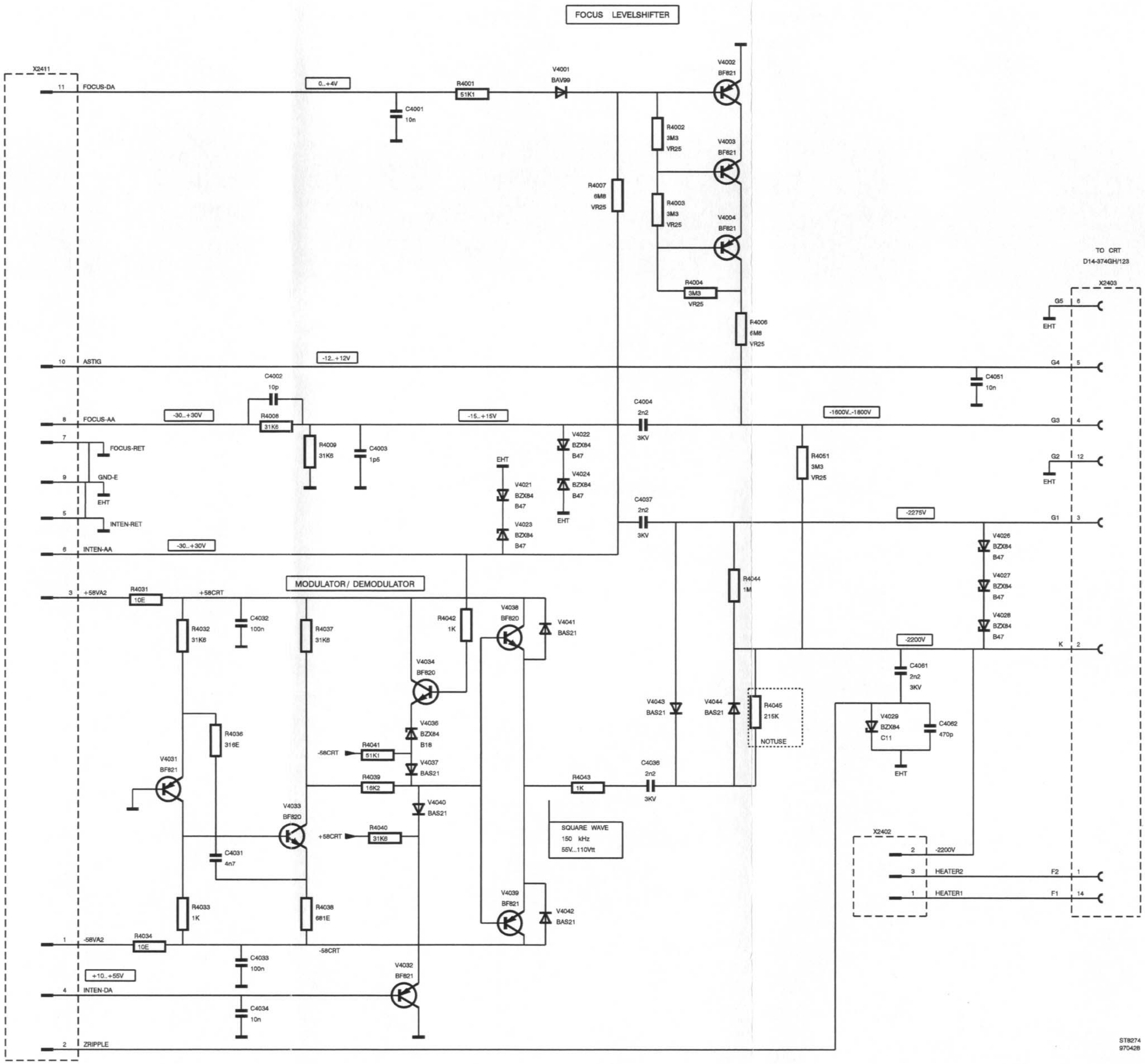
A2 (100 MHz) - Diagram 4a ; Final Z amplifier


FINAL Z-AMPL DRIVER
XZPREAMP
D3001
OQ0229
DC LEVEL SHIFT Z-TRACE
Z-RIPPLE SUPPRESS
LOCAL SUPPLY FILTERING
AC:20mV
DC:-10V
AC:60mV
DC:-10V
-12ZND
-5ZND
+10ZREF
+5ZND
ZDRIF1
ZDRIF0
ZDRII1
ZDRII0
ZRSUP
V3002
ZLTRA0
ZLTRA1
ZSW0
ZSW1
ZTXT0
ZTXT1
X2501/12
X2501/11
X2501/6
X2501/5
X2501/15
X2501/14
V3061
BF824
V3062
BF824
+18ZND
+12ZND
V3001
BAV99
X2301/2
ZRIPPLE
BC858
D3001/15
-58ZND
-58ZF
-58ZI
+58ZND
+50ZN
+31ZF
+31ZI
+6.8ZND
MRS25
N2002/13
DARK
JUST

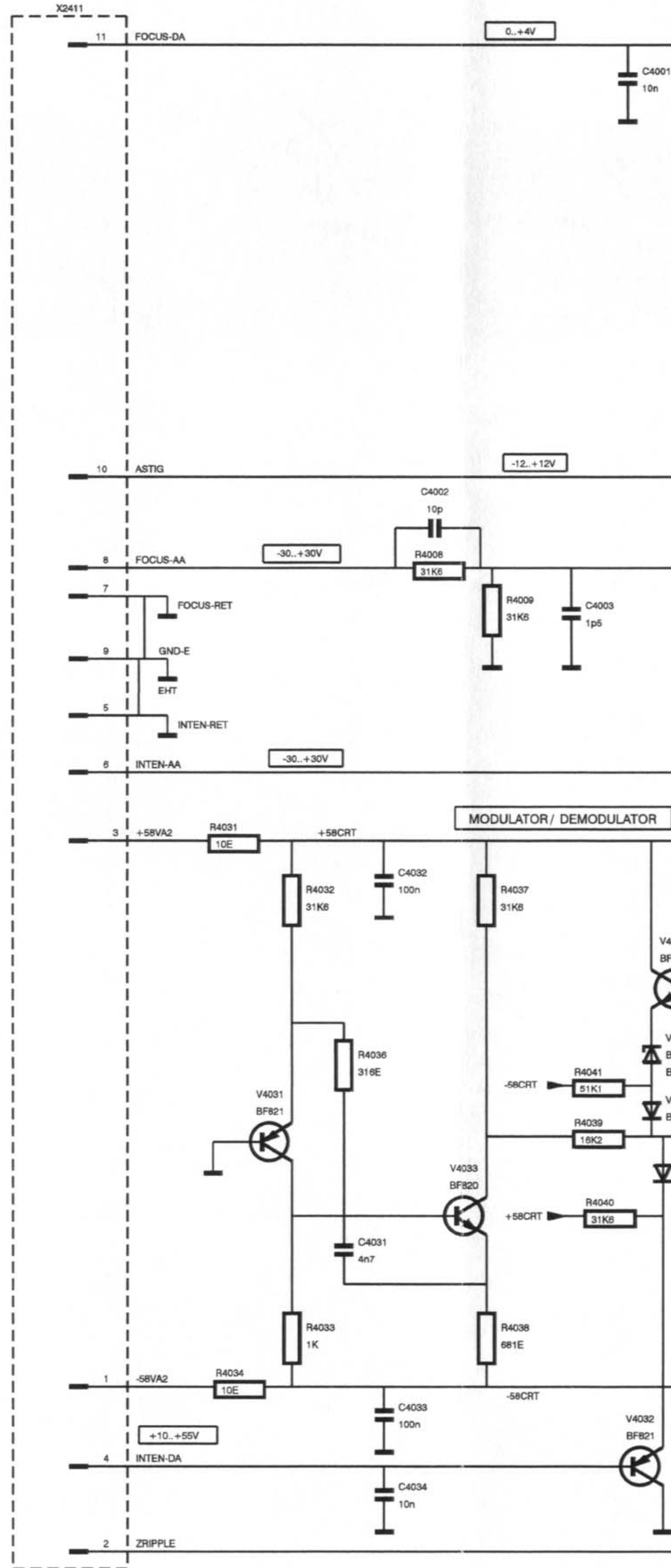


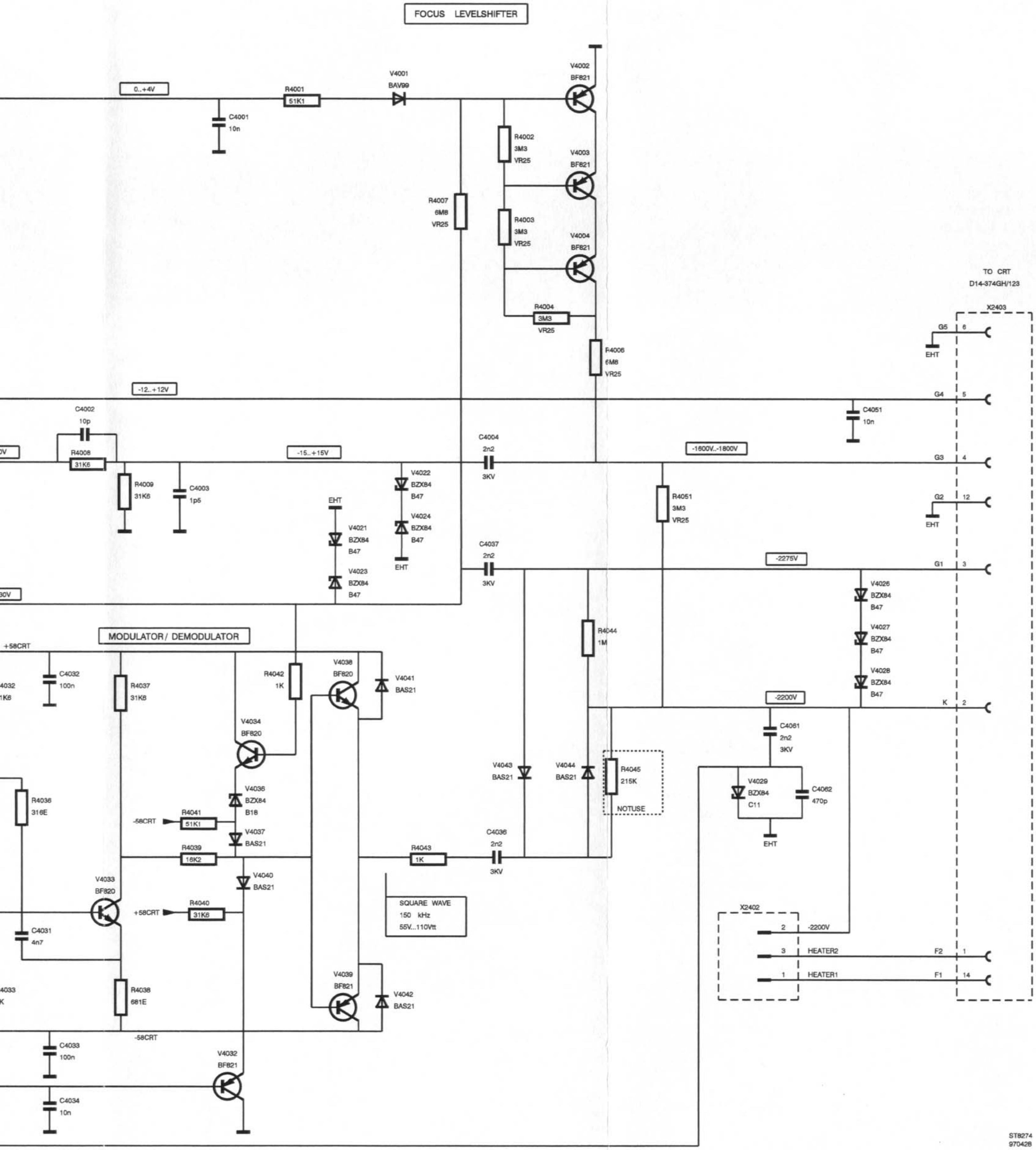
REF NR	TYPE	+12ZND	GND
N3001	OQ0229		
N3002	TDA8444	1	10

A2 (100 MHz) - Diagram 4a ; Final Z amplifier

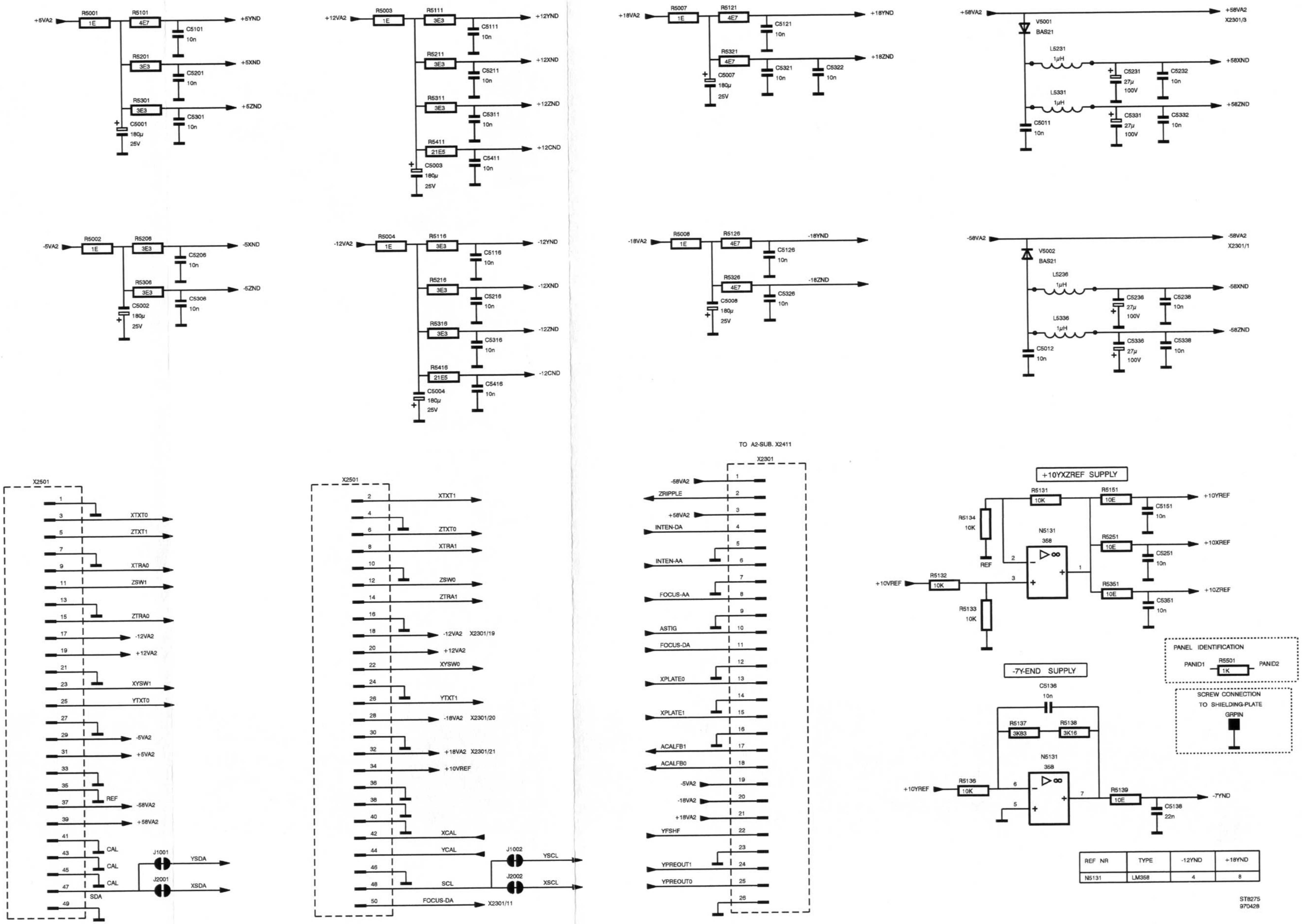


A2 (100 MHz) - Diagram 5a ; Modulator/demodulator and focus control


X2411
11 FOCUS-DA
0..+4V
C4001 10n
10 ASTIG
-12..+12V
C4002 10p
8 FOCUS-AA
-30..+30V
R4008 31K6
R4009 31K6
C4003 1p5
7
FOCUS-RET
9 GND-E
EHT
5
INTEN-RET
6 INTEN-AA
-30..+30V
MODULATOR / DEMODULATOR
3 +58VA2
R4031 10E
+58CRT
C4032 100n
R4032 31K6
R4037 31K6
R4036 316E
V4031 BF821
-58CRT
R4041 51K1
R4039 16K2
V4033 BF820
+58CRT
R4040 31K6
C4031 4n7
R4033 1K
R4038 681E
1 -58VA2
R4034 10E
-58CRT
C4033 100n
+10..+55V
V4032 BF821
4 INTEN-DA
C4034 10n
2 ZRIPPLE



A2 (100 MHz) - Diagram 5a ; Modulator/demodulator and focus control



REF NR	TYPE	-12YND	+18YND
N5131	LM358	4	8

ST8275
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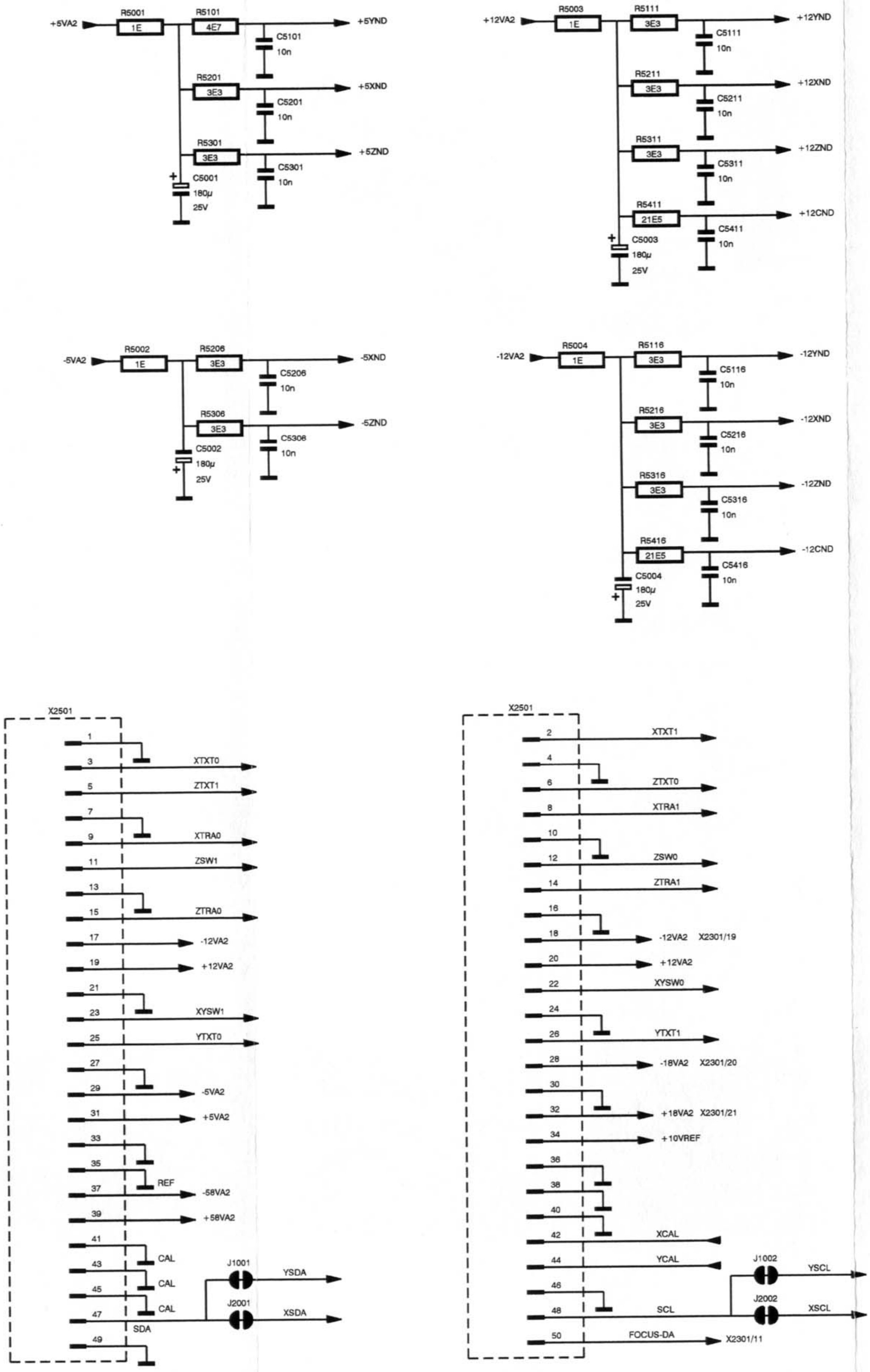
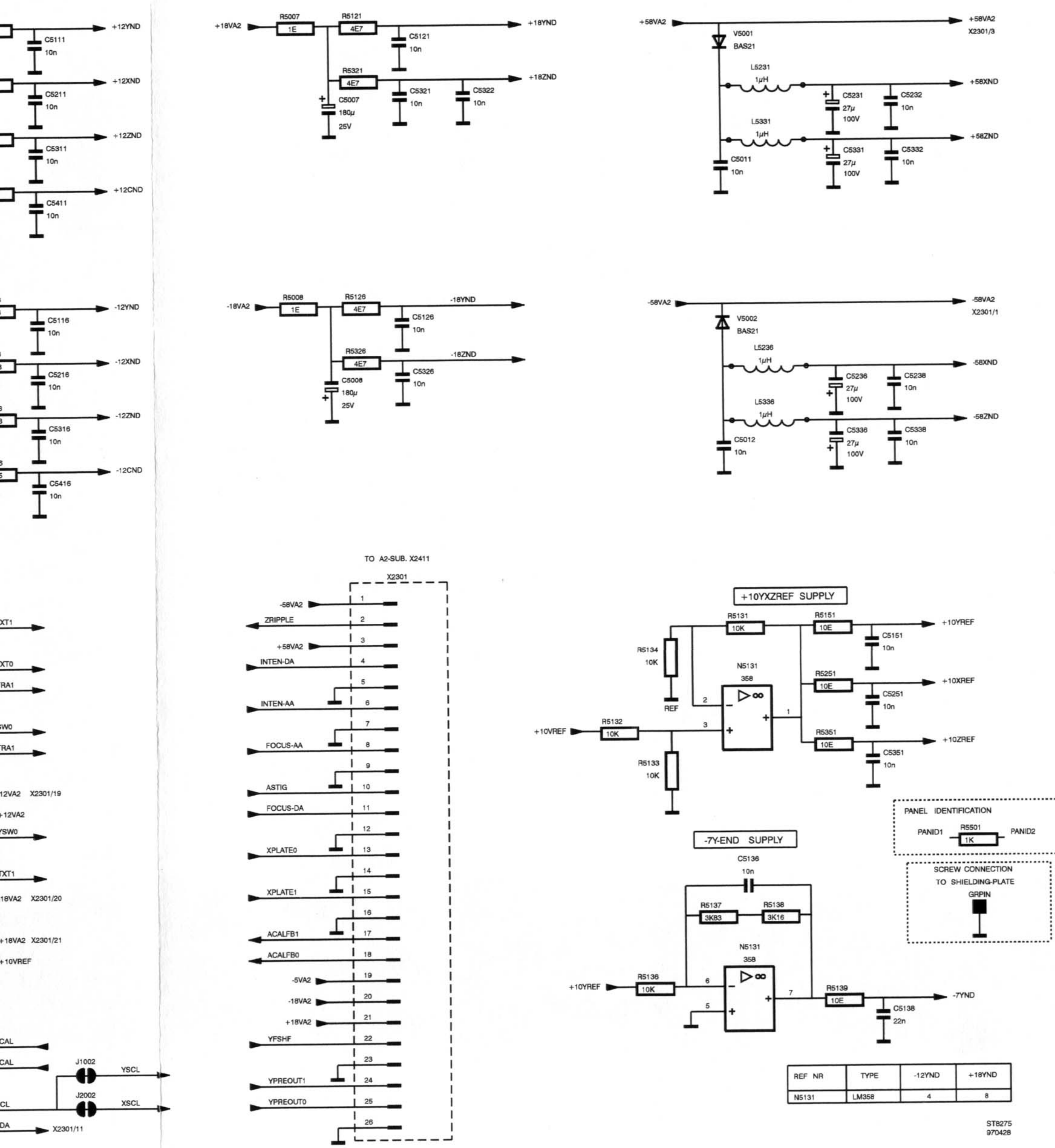
A2 (100 MHz) - Diagram 6a ; Supply circuits



+5VA2
R5001 1E
R5101 4E7
+5YND
C5101 10n
R5201 3E3
+5XND
C5201 10n
R5301 3E3
+5ZND
C5301 10n
C5001 180µ 25V
+12VA2
R5003 1E
R5111 3E3
+12YND
C5111 10n
R5211 3E3
+12XND
C5211 10n
R5311 3E3
+12ZND
C5311 10n
R5411 21E5
+12CND
C5411 10n
C5003 180µ 25V
-5VA2
R5002 1E
R5206 3E3
-5XND
C5206 10n
R5306 3E3
-5ZND
C5306 10n
C5002 180µ 25V
-12VA2
R5004 1E
R5116 3E3
-12YND
C5116 10n
R5216 3E3
-12XND
C5216 10n
R5316 3E3
-12ZND
C5316 10n
R5416 21E5
-12CND
C5416 10n
C5004 180µ 25V
X2501
1
3 XTXT0
5 ZTXT1
7
9 XTRA0
11 ZSW1
13
15 ZTRA0
17 -12VA2
19 +12VA2
21
23 XYSW1
25 YTXT0
27
29 -5VA2
31 +5VA2
33
35 REF
37 -58VA2
39 +58VA2
41 CAL
43 CAL
45 CAL
47 SDA
49
J1001 YSDA
J2001 XSDA
X2501
2 XTXT1
4
6 ZTXT0
8 XTRA1
10
12 ZSW0
14 ZTRA1
16
18 -12VA2 X2301/19
20 +12VA2
22 XYSW0
24
26 YTXT1
28 -18VA2 X2301/20
30
32 +18VA2 X2301/21
34 +10VREF
36
38
40
42 XCAL
44 YCAL
46
48 SCL
50 FOCUS-DA X2301/11
J1002 YSCL
J2002 XSCL



REF NR	TYPE	-12YND	+18YND
N5131	LM358	4	8

A2 (100 MHz) - Diagram 6a ; Supply circuits

5.2.12 Parts list A2-100 MHz version

CAPACITORS

Item	Description				Ordering code
C 1001	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 1002	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 1003	CAP.CHIP	63V	0.25PF	2.2PF	5322 122 33063
C 1005	CAP.CHIP	63V	5%	22PF	5322 122 32658
C 1006	CAP.CHIP	63V	5%	10PF	5322 122 32448
C 1007	CAP.CERAMIC	63V	5%	10PF	5322 122 32448
C 1009	CAP.CERAMIC	63V	5%	33PF	5322 122 32659
C 1011	CAP.CHIP	63V	5%	47PF	5322 122 32452
C 1012	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 1013	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 1014	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 1018	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 1019	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 1023	CAP.CHIP	63V	5%	56PF	5322 122 32661
C 1024	CAP.CHIP	63V	5%	56PF	5322 122 32661
C 1025	CAP.CHIP	63V	5%	56PF	5322 122 32661
C 1026	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 1027	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 1029	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 1031	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 1301	CAP.CHIP	63V	5%	150PF	5322 122 33538
C 1302	CAP.CHIP	63V	5%	150PF	5322 122 33538
C 1303	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2001	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2002	CAP.CHIP	63V	10%	220NF	4822 122 32916
C 2003	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2006	CAP.CHIP	63V	5%	22PF	5322 122 32658
C 2008	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2009	CAP.CHIP	63V	10%	220NF	4822 122 32916
C 2011	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2012	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2013	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2014	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 2016	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 2017	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2018	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 2019	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2021	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2022	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2061	CAP.CHIP	63V	5%	56PF	5322 122 32661
C 2062	CAP.CHIP	63V	5%	56PF	5322 122 32661
C 2081	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2103	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 2131	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 2132	CAP.CHIP	63V	10%	100NF	4822 122 33496

Item	Description				Ordering code
C 2133	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 2134	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 2151	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 2171	CAP.CHIP	63V	0.25PF	1PF	5322 122 32447
C 2172	CAP.CHIP	63V	5%	56PF	5322 122 32661
C 2173	CAP.CHIP	63V	0.25PF	6.8PF	5322 122 32269
C 2174	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 2176	CAP.CHIP	63V	5%	33PF	5322 122 32659
C 2177	CAP.CHIP	63V	0.5PF	2.7PF	5322 122 31873
C 2203	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 2231	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 2232	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 2233	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 2231	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 2251	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 2271	CAP.CHIP	63V	0.25PF	1PF	5322 122 32447
C 2272	CAP.CHIP	63V	5%	56PF	5322 122 32661
C 2273	CAP.CHIP	63V	0.25PF	6.8PF	5322 122 32269
C 2276	CAP.CHIP	63V	5%	33PF	5322 122 32659
C 2277	CAP.CHIP	63V	0.5PF	2.7PF	5322 122 31873
C 2301	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 2302	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 2303	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2413	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 2416	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2417	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2418	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2419	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2421	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 2422	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3001	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3002	CAP.CHIP	63V	10%	220NF	4822 122 32916
C 3003	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3004	CAP.CHIP	63V	5%	10PF	5322 122 32448
C 3006	CAP.CHIP	63V	5%	22PF	5322 122 32658
C 3007	CAP.CHIP	63V	5%	22PF	5322 122 32658
C 3008	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3009	CAP.CHIP	63V	10%	220NF	4822 122 32916
C 3011	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3013	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3014	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 3016	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 3017	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3018	CAP.CHIP	63V	5%	100PF	5322 122 32531
C 3019	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3021	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3061	CAP.CHIP	63V	5%	10PF	5322 122 32448
C 3103	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 3131	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 3132	CAP.CHIP	63V	10%	100NF	4822 122 33496

Item	Description				Ordering code
C 3133	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 3134	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 3151	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 3171	CAP.CHIP	63V	0.25PF	1PF	5322 122 32447
C 3172	CAP.CHIP	63V	5%	470PF	5322 122 32268
C 3173	CAP.CHIP	63V	0.25PF	1.5PF	5322 126 10225
C 3176	CAP.CHIP	63V	0.25PF	1.5PF	5322 126 10225
C 3203	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 3231	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 3232	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 3233	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 3234	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 3251	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 3271	CAP.CHIP	63V	0.25PF	1PF	5322 122 32447
C 3272	CAP.CHIP	63V	5%	470PF	5322 122 32268
C 3273	CAP.CHIP	63V	0.25PF	1.5PF	5322 126 10225
C 3276	CAP.CHIP	63V	0.25PF	1.5PF	5322 126 10225
C 3412	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 3416	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3417	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3418	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3419	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3421	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 3422	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4001	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4002	CAP.CHIP	63V	5%	150PF	5322 122 33538
C 4003	CAP.CHIP	63V	0.25PF	1.5PF	5322 126 10225
C 4004	CAP.		-10+10%	2.2NF	5322 122 33851
C 4031	CAP.CHIP	63V	10%	4.7NF	5322 126 10223
C 4032	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 4033	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 4034	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4036	CAP.		-10+10%	2.2NF	5322 122 33851
C 4037	CAP.		-10+10%	2.2NF	5322 122 33851
C 4051	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4061	CAP.		-10+10%	2.2NF	5322 122 33851
C 4062	CAP.CHIP	63V	5%	470PF	5322 122 32268
C 4110	CAP.CHIP	63V	5%	22PF	5322 122 32658
C 4111	CAP.CHIP	63V	0.25PF	2.7PF	5322 122 31873
C 4112	CAP.CHIP	63V	0.25PF	2.7PF	5322 122 31873
C 4113	CAP.CHIP	63V	0.25PF	2.7PF	5322 122 31873
C 4114	CAP.CHIP	63V	0.25PF	2.7PF	5322 122 31873
C 4116	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 4117	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 4118	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 4119	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 4121	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 4122	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 4123	CAP.CHIP	63V	5%	1NF	5322 126 10511
C 4124	CAP.CHIP	63V	5%	1NF	5322 126 10511

Item	Description				Ordering code
C 4126	CAP.CHIP	63V	5%	68PF	4822 122 33514
C 4163	CAP.CHIP	63V	5%	56PF	5322 122 32661
C 4201	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 4202	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4203	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4204	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 4205	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4206	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4207	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 4208	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 4209	CAP.CHIP	63V	10%	100NF	4822 122 33496
C 5001	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 5002	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 5003	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 5004	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 5007	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 5008	CAP.ELECTROLYT.	25V	20%	180UF	5322 124 42228
C 5011	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5012	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5101	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5111	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5116	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5121	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5126	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5136	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5138	CAP.CHIP	63V	10%	22NF	5322 122 32654
C 5151	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5201	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5206	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5211	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5216	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5231	CAP.ELECTROLYT.	100V	20%	27UF	5322 124 42193
C 5232	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5236	CAP.ELECTROLYT.	100V	20%	27UF	5322 124 42193
C 5238	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5251	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5301	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5306	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5311	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5316	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5321	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5322	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5326	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5331	CAP.ELECTROLYT.	100V	20%	27UF	5322 124 42193
C 5332	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5336	CAP.ELECTROLYT.	100V	20%	27UF	5322 124 42193
C 5338	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5351	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5411	CAP.CHIP	63V	10%	10NF	5322 122 34098
C 5416	CAP.CHIP	63V	10%	10NF	5322 122 34098

Item	Description		Ordering code
COILS			
L 4101	COIL	0.082UH 5% TDK	5322 157 63382
L 4102	COIL	0.082UH 5% TDK	5322 157 63382
L 41032	COIL	1UH 5% TDK	5322 157 63648
INTEGRATED CIRCUITS			
D 1001	INTEGR.CIRCUIT	OQ0230 FINAL Y	5322 209 12467
D 2001	INTEGR.CIRCUIT	OQ0229 FINAL X-Z	5322 209 12459
D 3001	INTEGR.CIRCUIT	OQ0229 FINAL X-Z	5322 209 12459
N 1001	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N 1002	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1003	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N 1004	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 2002	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N 2003	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 5131	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
RESISTORS			
R 1001	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1002	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1003	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1004	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1005	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 1006	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 1007	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1008	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1009	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1010	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1011	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1012	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1013	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1014	RES.CHIP	RC-02H 1% 196E	5322 117 10538
R 1015	RES.CHIP	RC-02H 1% 10K	4822 051 10103
R 1016	RES.CHIP	RMC1/8 1% 42E2	5322 117 11753
R 1017	RES.CHIP	RC-02H 1% 100E	4822 051 10101
R 1018	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 1019	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 1020	RES.CHIP	RC-02H 1% 10K	4822 051 10103
R 1021	RES.CHIP	RC-02H 1% 100E	4822 051 10101
R 1022	RES.CHIP	RMC1/8 1% 42E2	5322 117 117 53
R 1023	RES.CHIP	RC-02H 1% 196E	5322 117 10538
R 1024	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1027	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1029	RES.CHIP	RC-02H 1% 237E	5322 117 10544
R 1031	RES.CHIP	RC-02H 1% 237E	5322 117 10544
R 1032	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1034	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 1036	RES.CHIP	RC-02H 1% 14K7	5322 117 10528

Item	Description		Ordering code
R 1037	RES.CHIP	RC-02H 1% 750E	5322 117 10582
R 1038	RES.CHIP	RC-02H 1% 750E	5322 117 10582
R 1039	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 1041	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1042	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1043	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1044	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1046	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1047	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1048	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1049	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1051	RES.CHIP	RC-02H 1% 23K7	4822 051 52373
R 1053	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1059	RES.CHIP	RMC1/8 1% 21E5	5322 117 11734
R 1061	RES.CHIP	RMC1/8 1% 21E5	5322 117 11734
R 1063	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1066	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1071	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1072	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1073	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1074	RES.CHIP	RC-02H 1% 422E	5322 117 10564
R 1076	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1077	RES.CHIP	RC-02H 1% 3K83	5322 117 10561
R 1078	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1079	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1081	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1082	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1083	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1084	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1086	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1087	RES.CHIP	RC-02H 1% 51E1	5322 117 11731
R 1088	RES.CHIP	RC-02H 1% 51E1	5322 117 11731
R 1089	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 1091	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1202	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1203	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1204	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1206	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1207	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1208	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 1209	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 1303	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1304	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1306	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1307	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1308	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 1309	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 1311	RES.CHIP	RC-02H 1% 21K5	4822 051 52153

Item	Description		Ordering code
R 1312	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1313	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 2001	RES.CHIP	RC-02H 1% 16K5	5322 117 10532
R 2002	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 2003	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2004	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2006	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2007	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 2008	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 2009	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2011	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 2012	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2013	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 2014	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 2015	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2016	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2017	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 2018	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2020	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2021	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2023	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2024	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2026	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2063	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2065	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 2066	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 2067	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2068	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2101	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2102	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2103	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2104	RES.CHIP	RC-02H 1% 12K1	5322 117 10522
R 2107	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 2111	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2112	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 2114	RES.CHIP	RC-01 1% 6E8	4822 051 10688
R 2131	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2132	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2133	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2134	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2136	RES.CHIP	RC-02H 1% 1K78	5322 117 10535
R 2137	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 2138	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 2151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2161	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2171	RES.METAL FILM	MRS25 1% 9K53	4822 050 29532
R 2172	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 2176	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 2177	RES.CHIP	RC-02H 1% 261K	4822 051 52614

Item	Description		Ordering code
R 2201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2202	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2203	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2204	RES.CHIP	RC-02H 1% 12K1	5322 117 10522
R 2207	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 2211	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2212	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 2214	RES.CHIP	RMC1/8 1% 6E8	4822 051 10688
R 2231	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2232	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2233	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2234	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2236	RES.CHIP	RC-02H 1% 1K78	5322 117 10535
R 2237	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 2238	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 2251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2261	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2271	RES.METAL FILM	MRS25 1% 9K53	4822 050 29532
R 2272	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 2276	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 2277	RES.CHIP	RC-02H 1% 261K	4822 051 52614
R 2301	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2302	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2303	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 2304	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 2306	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 2307	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 2308	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2309	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 2311	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 2312	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 2313	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 2411	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 2412	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 2416	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2418	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2419	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2421	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2422	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2423	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 3001	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3002	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 3003	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3004	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3006	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3007	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3008	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3009	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3011	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 3012	RES.CHIP	RC-02H 1% 19K6	4822 051 51963

Item	Description		Ordering code
R 3013	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 3014	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 3015	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 3018	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3021	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3024	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3026	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3063	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3066	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 3067	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 3068	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3069	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3101	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3102	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3103	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3104	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 3107	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 3111	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3112	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 3114	RES.CHIP	RC-01 5% 6E8	4822 051 10688
R 3131	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3132	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3133	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3134	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3136	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 3137	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 3138	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 3151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3161	RES.CHIP	RMC1/8 1% 42K2	4822 111 91887
R 3171	RES.METAL FILM	MRS25 1% 9K53	4822 050 29532
R 3176	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 3201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3202	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3203	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3204	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 3207	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 3211	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3212	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 3214	RES.CHIP	RC-01 5% 6E8	4822 051 10688
R 3231	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3232	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3233	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3234	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3236	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 3237	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 3238	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 3251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3261	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 3271	RES.METAL FILM	MRS25 1% 9K53	4822 050 29532

Item	Description				Ordering code
R 3276	RES.CHIP	RC-02H	1%	51K1	4822 051 55113
R 3301	RES.CHIP	RC-02H	1%	61K9	4822 051 56193
R 3302	RES.CHIP	RC-02H	1%	12K1	4822 051 51213
R 3311	RES.CHIP	RC-02H	1%	511E	4822 051 55111
R 3312	RES.CHIP	RC-02H	1%	2K87	4822 051 52872
R 3313	RES.CHIP	RC-02H	1%	2K87	4822 051 52872
R 3314	RES.CHIP	RC-02H	1%	10K	4822 051 51003
R 3316	RES.CHIP	RC-02H	1%	14K7	4822 051 51473
R 3411	RES.CHIP	RC-02H	1%	750E	4822 051 57501
R 3412	RES.CHIP	RC-02H	1%	750E	4822 051 57501
R 3416	RES.CHIP	RMC1/8	1%	51E1	5322 111 91893
R 3418	RES.CHIP	RMC1/8	1%	51E1	5322 111 91893
R 3419	RES.CHIP	RC-02H	1%	16K2	4822 051 51623
R 3421	RES.CHIP	RMC1/8	1%	10E	4822 111 91885
R 3422	RES.CHIP	RMC1/8	1%	10E	4822 111 91885
R 3423	RES.CHIP	RC-02H	1%	316E	4822 051 53161
R 4001	RES.CHIP	RC-02H	1%	51K1	4822 051 55113
R 4002	RES.HI-TENSION	VR25	5%	3M3	4822 053 20335
R 4003	RES.HI-TENSION	VR25	5%	3M3	4822 053 20335
R 4004	RES.HI-TENSION	VR25	5%	3M3	4822 053 20335
R 4006	RES.HI-TENSION	VR25	5%	6M8	4822 053 20685
R 4007	RES.HI-TENSION	VR25	5%	6M8	4822 053 20685
R 4008	RES.CHIP	RC-02H	1%	31K6	4822 051 53163
R 4009	RES.CHIP	RC-02H	1%	31K6	4822 051 53163
R 4031	RES.CHIP	RMC1/8	1%	10E	4822 111 91885
R 4032	RES.CHIP	RC-02H	1%	31K6	4822 051 53163
R 4033	RES.CHIP	RC-02H	1%	1K	4822 051 51002
R 4034	RES.CHIP	RMC1/8	1%	10E	4822 111 91885
R 4036	RES.CHIP	RC-02H	1%	316E	4822 051 53161
R 4037	RES.CHIP	RC-02H	1%	31K6	4822 051 53163
R 4038	RES.CHIP	RC-02H	1%	681E	4822 051 56811
R 4039	RES.CHIP	RC-02H	1%	16K2	4822 051 51623
R 4040	RES.CHIP	RC-02H	1%	31K6	4822 051 53163
R 4041	RES.CHIP	RC-02H	1%	51K1	4822 051 55113
R 4042	RES.CHIP	RC-02H	1%	1K	4822 051 51002
R 4043	RES.CHIP	RC-02H	1%	1K	4822 051 51002
R 4044	RES.CHIP	RC-02H	1%	1M	4822 051 51005
R 4051	RES.HI-TENSION	VR25	5%	3M3	4822 053 20335
R 4110	RES.CHIP	RC-02H	1%	21E5	5322 111 92014
R 4111	RES.CHIP	RMC1/8	1%	100E	4822 051 10101
R 4112	RES.CHIP	RMC1/8	1%	100E	4822 051 10101
R 4113	RES.CHIP	RMC1/8	1%	21E5	5322 117 11734
R 4114	RES.CHIP	RMC1/8	1%	21E5	5322 117 11734
R 4116	RES.CHIP	RC-02H	1%	316E	5322 117 10552
R 4117	RES.CHIP	RC-02H	1%	316E	5322 117 10552
R 4118	RES.CHIP	RC-02H	1%	1K1	4822 051 51102
R 4119	RES.CHIP	RC-02H	1%	1K1	4822 051 51102
R 4121	RES.CHIP	RMC1/8	1%	10E	4822 111 91885
R 4122	RES.CHIP	RMC1/8	1%	10E	4822 111 91885
R 4123	RES.CHIP	RC-02H	1%	422E	4822 051 54221

Item	Description		Ordering code
R 4124	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 4126	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 4127	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 4128	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4129	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4130	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 4132	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 4133	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 4134	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4135	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 4136	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4137	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4138	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4139	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 4141	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 4142	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 4143	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 4144	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4146	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4147	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4148	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4149	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 4150	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 4151	RES.CHIP	RC-01 5% 10E	4822 111 91885
R 4152	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4153	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4154	RES.CHIP	RC-02H 1% 10E	4822 111 91885
R 4155	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4156	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4157	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4158	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4159	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4160	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4161	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 4162	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 4163	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4164	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4166	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4167	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4168	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4169	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4171	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4172	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4173	RES.CHIP	RC-02G 1% 61K9	4822 051 56193
R 4174	RES.CHIP	RC-02G 1% 7K50	4822 051 57502
R 4176	RES.CHIP	RC-02H 1% 10E	4822 111 91885
R 4177	RES.CHIP	RC-02H 1% 10K	4822 111 91885
R 4178	RES.CHIP	RC-02H 1% 10E	4822 111 91885
R 4179	RES.CHIP	RC-02H 1% 10E	4822 111 91885
R 4181	RES.CHIP	RC-02H 1% 215K	4822 051 52154

Item	Description		Ordering code
R 4182	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4201	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 4202	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4203	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 4261	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4262	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 5001	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5002	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5003	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5004	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5007	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5008	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5101	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5111	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5116	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5121	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5126	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5131	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5132	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5133	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5134	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5136	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5137	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 5138	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 5139	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5201	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5206	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5211	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5216	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5231	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5236	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5301	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5306	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5311	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5316	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5321	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5326	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5331	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5336	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5351	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5411	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 5416	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 5501	RES.CHIP	RC-02H 1% 1K	4822 051 51002

Item	Description			Ordering code
SEMI CONDUCTORS				
V 1009	DIODE,CHIP	BBY39	PEL	5322 130 82199
V 1011	DIODE,CHIP	BBY39	PEL	5322 130 82199
V 1014	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1016	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1018	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1019	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1021	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1022	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1023	TRANSISTOR,CHIP	BC848C	PEL	5322 130 42136
V 1024	TRANSISTOR,CHIP	BC848C	PEL	5322 130 42136
V 1026	TRANSISTOR,CHIP	BFT92	PEL	5322 130 44711
V 1027	TRANSISTOR,CHIP	BFT92	PEL	5322 130 44711
V 1028	DIODE,CHIP	BZX84-C6V8	PEL	5322 130 80406
V 1201	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1202	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1203	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1204	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 1301	DIODE,CHIP	BZX84-C8V2	PEL	5322 130 80255
V 2061	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 2062	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 2101	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 2102	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 2103	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 2105	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 2111	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 2113	TRANSISTOR	BFQ252A		4822 130 62932
V 2131	DIODE,CHIP	BAV99	PEL	5322 130 34337
V 2133	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 2132	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 2134	TRANSISTOR	BFQ232A		4822 130 62751
V 2201	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 2202	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 2203	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 2205	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 2211	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 2213	TRANSISTOR	BFQ252A		4822 130 62932
V 2231	DIODE,CHIP	BAV99	PEL	5322 130 34337
V 2232	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 2233	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 2234	TRANSISTOR	BFQ232A		4822 130 62751
V 2301	DIODE,CHIP	BZX84-C8V2	PEL	5322 130 80255
V 2413	DIODE,CHIP	BZX84-C8V2	PEL	5322 130 80255
V 2416	DIODE,CHIP	BZX84-B27	PEL	5322 130 82039
V 2421	DIODE,CHIP	BZX84-C6V8	PEL	5322 130 80406
V 3001	DIODE,CHIP	BAV99	PEL	5322 130 34337

Item	Description			Ordering code
V 3002	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 3061	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 3062	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 3101	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 3102	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 3103	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 3105	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 3111	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 3113	TRANSISTOR	BFQ252A		4822 130 62932
V 3131	DIODE,CHIP	BAV99	PEL	5322 130 34337
V 3132	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 3133	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 3134	TRANSISTOR	BFQ232A		4822 130 62751
V 3136	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 3137	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 3201	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 3202	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 3203	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 3205	DIODE,CHIP	BZX84-B12	PEL	4822 130 83566
V 3211	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 3213	TRANSISTOR	BFQ252A		4822 130 62932
V 3231	DIODE,CHIP	BAV99	PEL	5322 130 34337
V 3232	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 3233	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 3234	TRANSISTOR	BFQ232A		4822 130 62751
V 3236	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 3237	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 3301	TRANSISTOR,CHIP	BF820	PEL	5322 130 62802
V 3311	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 3312	DIODE,CHIP	BAV99	PEL	5322 130 34337
V 3413	DIODE,CHIP	BZX84-C8V2	PEL	5322 130 80255
V 3416	DIODE,CHIP	BZX84-B27	PEL	5322 130 82039
V 3421	DIODE,CHIP	BZX84-C6V8	PEL	5322 130 80406
V 4001	DIODE,CHIP	BAV99	PEL	5322 130 34337
V 4002	TRANSISTOR,CHIP	BF821	PEL	4822 130 61923
V 4003	TRANSISTOR,CHIP	BF821	PEL	4822 130 61923
V 4004	TRANSISTOR,CHIP	BF821	PEL	4822 130 61923
V 4031	TRANSISTOR,CHIP	BF821	PEL	4822 130 61923
V 4032	TRANSISTOR,CHIP	BF821	PEL	4822 130 61923
V 4033	TRANSISTOR,CHIP	BF820	PEL	5322 130 62802
V 4034	TRANSISTOR,CHIP	BF820	PEL	5322 130 62802
V 4036	DIODE,CHIP	BZX84-B18	PEL	5322 130 83709
V 4037	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 4038	TRANSISTOR,CHIP	BF820	PEL	5322 130 62802
V 4039	TRANSISTOR,CHIP	BF821	PEL	4822 130 61923
V 4040	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 4041	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 4042	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 4043	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 4044	DIODE,CHIP	BAS21	PEL	4822 130 33702

Item	Description			Ordering code
V 4101	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 4102	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 4103	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 4104	TRANSISTOR,CHIP	BF840	PEL	4822 130 60887
V 4106	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 4107	TRANSISTOR,CHIP	BF824	PEL	4822 130 60383
V 4108	TRANSISTOR,CHIP	BFG35	PEL	5322 130 62805
V 4109	TRANSISTOR,CHIP	BFG35	PEL	5322 130 62805
V 4111	TRANSISTOR,CHIP	BFG55	PEL	5322 130 62806
V 4112	TRANSISTOR,CHIP	BFG55	PEL	5322 130 62806
V 4113	DIODE,CHIP	BBY62	PEL	5322 130 82685
V 4114	TRANSISTOR,CHIP	BC858C	PEL	4822 130 42513
V 5001	DIODE,CHIP	BAS21	PEL	4822 130 33702
V 5002	DIODE,CHIP	BAS21	PEL	4822 130 33702

CONNECTORS AND SOCKETS

X 2101	CONNECTOR	4-P SNG	RT.ANG	5322 265 30907
X 2301	CONNECTOR	26-P DBL	STRGHT	4822 267 50668
X 2402	CONNECTOR	3-P SNG	RT.ANG	5322 265 30433
X 2403	SOCKET	55595	PEL	5322 255 40502
X 2411	CONNECTOR	26-P DBL	STRGHT	4822 267 50558
X 2501	CONNECTOR	50-P DBL	STRGHT	5322 265 61242

5.3 MICROPROCESSOR A3

5.3.1 Description A3

Introduction

The unit can be seen as the heart of the oscilloscope. It controls all oscilloscope functions and receives input signals from the following sources:

- the rotary and push button knobs present at front unit A4 and CRT controls unit A5.
- commands from an external computer that are applied to the RS232 interface that is part of microprocessor D1001.
- circuits throughout the oscilloscope indicating the state of the circuitry.
- commands from an external computer that are applied via the optional IEEE-488 interface. This interface is also located on unit A3.

Control signals coming from the microprocessor unit can be split up as follows:

- serial data that is applied to numerous digital-to-analog converters that control the continuous oscilloscope functions.
- serial data that is applied to latches that control "on/off" oscilloscope functions.
- 16 analog output voltages that control continuously variable "potentiometer" functions in the oscilloscope.

Diagram 1

The microprocessor system is formed by microprocessor D1001, FlashROM D1013 and RAM D1012. FlashROM D1015 is used for instrument extensions such as digital signal storage and processing. Amongst other features the processor incorporates 8 analog "ADC" inputs (ACH0 ... ACH7), a RS232 interface (CPTXD, CPRXD, CPDTR, CPRTS, CPCTS, CPDSR) and a I2C bus (SDAUP/SDA, SCLUP/SCL). Via the I2C bus structure many control buffers and digital-to-analog converters are loaded with data. D1001 has a 12 MHz clock with crystal G1001 that is connected between pin 8 and 9. Half the clock frequency is available as CPCLOCK at output pin 7. The 8 analog ADC inputs ACH0 ... ACH7 are used for the autocal function (YCAL and XCAL) and probe identification (PTEST-XA). These inputs are also used for temperature measurement (R1009) and time base status indication (signal TBSMART). The outputs PRMUX0 through PRMUX2 are used for the probe detection circuit on the next diagram.

D1011 demultiplexes the combined address and databits CPAD00 through CPAD07. The output consists of address-information only. Address information is present on the address/data bus if input ALE-HT is high.

The output latch D1017 creates the enable signals for the I2C bus latches and digital-to-analog converters that control the circuits throughout the oscilloscope.

Signal POWER-HT is low the first 250 ms after switching-on. This results via the gates D1007 in a low signal CPRESET-LT that initializes the microprocessor D1001. RESET-LT resets a number of chips at the unit A3 and also front unit A4. Signal EA is made high; this has the result that the microprocessor can only reach its internal ROM. This ROM incorporates the start-up routine. The routine ends by applying signal CPRSTCSLT to pin 11 of flipflop D1014. This makes signal EA low and the microprocessor can reach the FLASHROM D1013.

D1009 is a PAL that makes the selection for various chips on the unit. Examples are D1012 RAM selection via RAMCS-LT (pin 19) that results in RCS-LT via gate D1018. D1018 also generates the write pulse WRROM-LT for D1013. D1013 EPROM selection occurs via D1009 output signal ROM0CSLT. D1015 EPROM selection occurs via D1009 output signal ROM1CSLT.

D1016 is a 3 to 8 decoder that controls circuits on unit A3. Depending on the state of the 3 inputs CPA04 through CPA06, one of the 8 outputs is low at a time.

Diagram 2

The resistance value of the indication ring in the probe at channels 1, 2, 3 and 4 is present between ground and pin 13, 14, 15 and 12 of multiplexer D1008 respectively. The analog probe resistance value results in a certain DC voltage that is switched to ADC input PTEST-XA of the processor D1001.

The circuit part indicated with 'RS232-C INTERFACE' consists of a buffer D1302 that converts the microprocessor's TTL signals (0 and 5 volt) into -12 and +12 volt RS232 output levels. The buffer D1301 does the same in the opposite direction.

The buzzer circuit incorporates an oscillator built around the buffer D1301 and amplifier D1302. D1302 is enabled by flipflop D1102. The buzzer H1001 is a piezo ceramic transducer.

The +5 V reference voltage for the A.D.C.'s inside D1001 is derived from the instrument's +10 V reference voltage via operational amplifier N1801.

Diagram 3

This diagram shows the "DAC-POT" IC D1112 that converts the digital data from the microprocessor into 16 analog voltages. Each of these voltages is independently adjustable between 1 V and 4 V. The reference voltage for this D/A converter comes from N1101.

This diagram also shows the IEEE interface that is a factory-installed option. The heart of the interface is IEEE-controller D1104. The registers inside D1104 can be controlled by microprocessor D1001 via the buffer D1103. The clock for D1104 is generated by crystal oscillator G1111, D1101 and divider stage D1102. The bidirectional buffers D1107, D1108, D1109, D1111 form an interface between D1004 and the IEEE bus devices outside the oscilloscope. D1106 controls the bidirectional buffers.

Diagram 4

This diagram comprises the generation of CRT text and cursors. The heart of the system is formed by the text generator IC D1402. This device is controlled by the microprocessor via the 8 data bus lines CPA00 through CPA07. The text that has to be displayed is stored in RAM D1401. Every 19 ms the input TXTCS-LT at pin 35 of D1402 becomes active and the actual text information is written into the text generator.

The vertical component of the text display is represented by the 10 bits code Y0 through Y9. This is converted into analog via DAC N1401. The balanced current output signals are YTXT0 and YTXT1. These signals are in opposite phase.

The horizontal component of the text display is represented by the 10 bits code X0 through X9. Conversion into analog occurs via DAC N1402. The balanced current output signals are XTXT0 and XTXT1. These signals are in opposite phase.

The switching of the X and Y deflection between text and normal signal is controlled by the current signals XYSW0 and XYSW1 that are derived from pin 64 and 65 of D1402 and are in opposite phase. Text is displayed if XYSW1 is at 1mA and XYSW0 is at 0mA. Text display is on during the autocal procedure if TXTOPT-HT is high.

The current signals ZSW0 and ZSW1 switch the Z amplifier between signal display and text display and are derived from pin 80 and 1 of D1401. At time base sweep speeds of 0.1 ms/div and faster, parts of the text are displayed during the time base hold-off period. The presence of the hold off period is indicated to D1402 via V1401 by signal TBHOTXT. At sweep speeds of 0.2 ms/div and slower, the text is displayed at a random basis during the normal signal display that is interrupted for a while. This is done so that it is invisible to the user.

The signal ZINFO-LT that comes from pin 80 of D1401 determines the intensity of the text and cursors. This happens via the output current signals ZTXT0 and ZTXT1 that are in opposite phase. They originate from the circuit with V1448, V1449, V1443, V1444 and V1446. Intensity is also controlled by the front panel INTENS TEXT rotary that influences the DAC output signal INTRD0.

Diagram 5

Diagram 5 shows the pinning of the two connectors on microprocessor unit A3. Connector X1101 makes contact with the motherboard. Connector X1501 makes contact with the signal unit A1 via a flat cable. D1931 is a real-time clock that may be present as a factory-installed option.

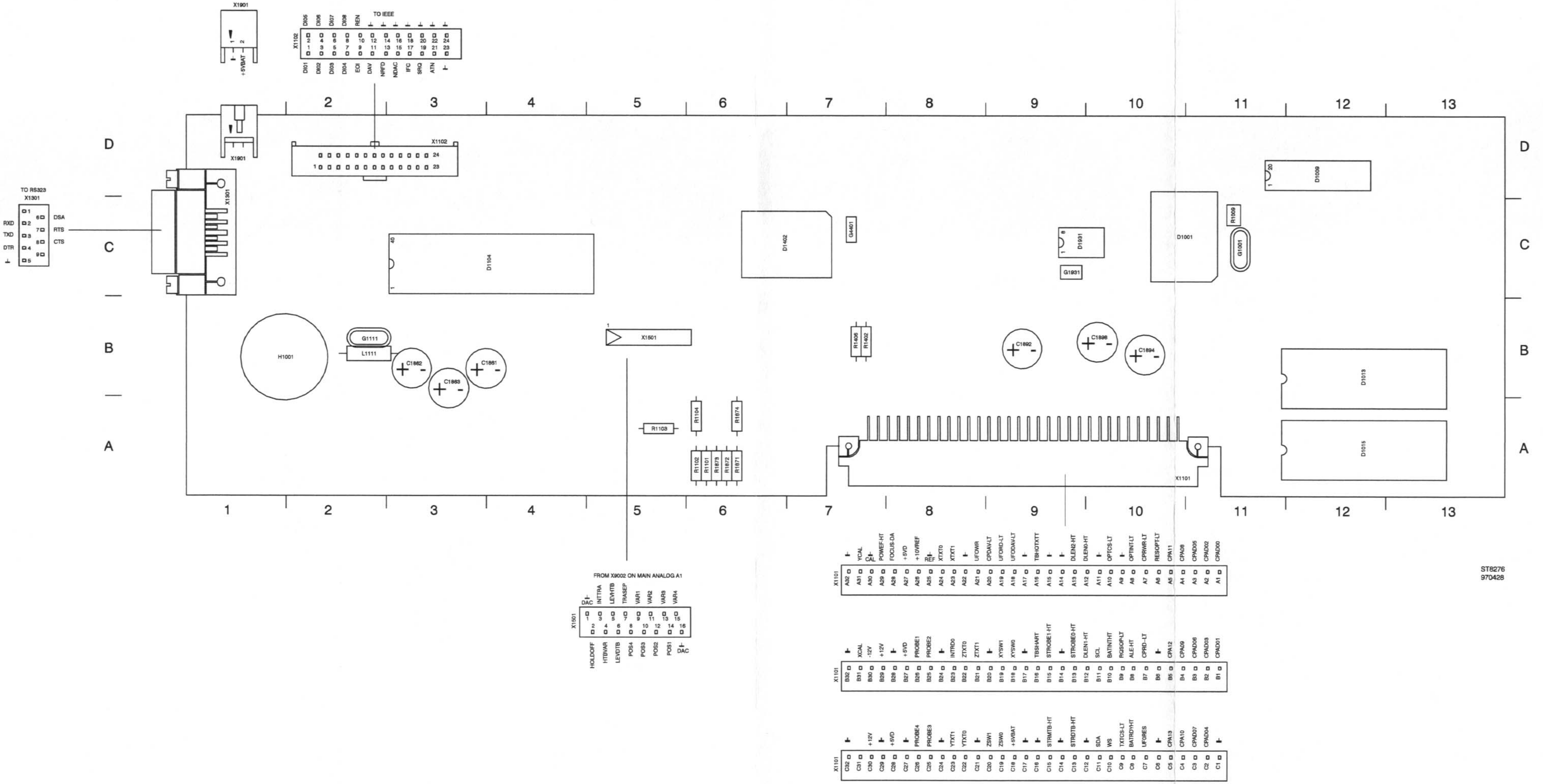
5.3.2 Signal name list A3

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.

NAME	MEANING	SOURCE	DESTINATION
CPCTS	RS232 CLEAR TO SEND (TTL)	D1301:02	D1001:01
CPDSR	RS232 DATA SET READY (TTL)	D1301:02	D1001:01
CPDTR	RS232 DATA TERMINAL READY (TTL)	D1001:01	D1302:02
CPRTS	RS232 REQUEST TO SEND (TTL)	D1001:01	D1302:02
CPRXD	RS232 RECEIVE DATA (TTL)	D1301:02	D1001:01
CPTXD	RS232 TRANSMIT DATA (TTL)	D1001:01	D1302:02
DACPEN-LT	ENABLE SIGNAL FOR DACPOT CIRCUIT	D1016:01	D1112:03
DACPWR-LT	WRITE SIGNAL FOR DACPOT CIRCUIT	D1016:01	D1112:03
DLEN0-HT	DATA LATCH ENABLE 0	R1063:01	X1101:05
DLEN1-HT	DATA LATCH ENABLE 1	R1064:01	X1101:05
DLEN2-HT	DATA LATCH ENABLE 2	R1066:01	X1101:05
FOCUS-DA	DC PART FOCUSING SIGNAL	R1136:03	X1101:05
HOLDOFF	HOLD OFF CONTROL SIGNAL	R1122:03	X1501:05
INTTRA	TRACE INTENSITY CONTROL SIGNAL	R1123:03	X1501:05
MTBVAR	MAIN TB VAR CONTROL SIGNAL	R1124:03	X1501:05
LEVDTB	DELAYED TB LEVEL CONTROL SIGNAL	R1126:03	X1501:05
LEVMTB	MAIN TB LEVEL CONTROL SIGNAL	R1125:03	X1501:05
POS1	CH1 POSITION CONTROL SIGNAL	R1129:03	X1501:05
POS2	CH2 POSITION CONTROL SIGNAL	R1132:03	X1501:05
POS3	CH3 POSITION CONTROL SIGNAL	R1134:03	X1501:05
POS4	CH4 POSITION CONTROL SIGNAL	R1128:03	X1501:05
POWER-HT	POWER UP INDICATION SIGNAL	X1101:05	D1007:01
PRMUX0	PROBE READ-OUT MPX CONTROL 0	D1001:01	D1008:02
PRMUX1	PROBE READ-OUT MPX CONTROL 1	D1001:01	D1008:02
PRMUX2	PROBE READ-OUT MPX CONTROL 2	D1001:01	D1008:02
PROBE1	PROBE DETECTION/50Ω PROTECT CH1	X1101:05	V1014:02
PROBE2	PROBE DETECTION/50Ω PROTECT CH2	X1101:05	V1013:02
PROBE3	PROBE DETECTION/50Ω PROTECT CH3	X1101:05	V1012:02
PROBE4	PROBE DETECTION/50Ω PROTECT CH4	X1101:05	V1011:02
PTEST-XA	PROBE TEST SIGNAL	D1008:02	D1001:01
SCL	SERIAL CLOCK	R1054:01	X1101:05
SCLUP	SERIAL CLOCK AT MICROPROCESSOR	D1001:01	R1053:01
SDA	SERIAL DATA	R1052:01	X1101:05
SDAUP	SERIAL DATA AT MICROPROCESSOR	D1001:01	R1051:01
STROBE0-HT	STROBE/ENABLE SIGNAL 0	R1067:01	X1101:05
STROBE1-HT	STROBE/ENABLE SIGNAL 1	R1068:01	X1101:05

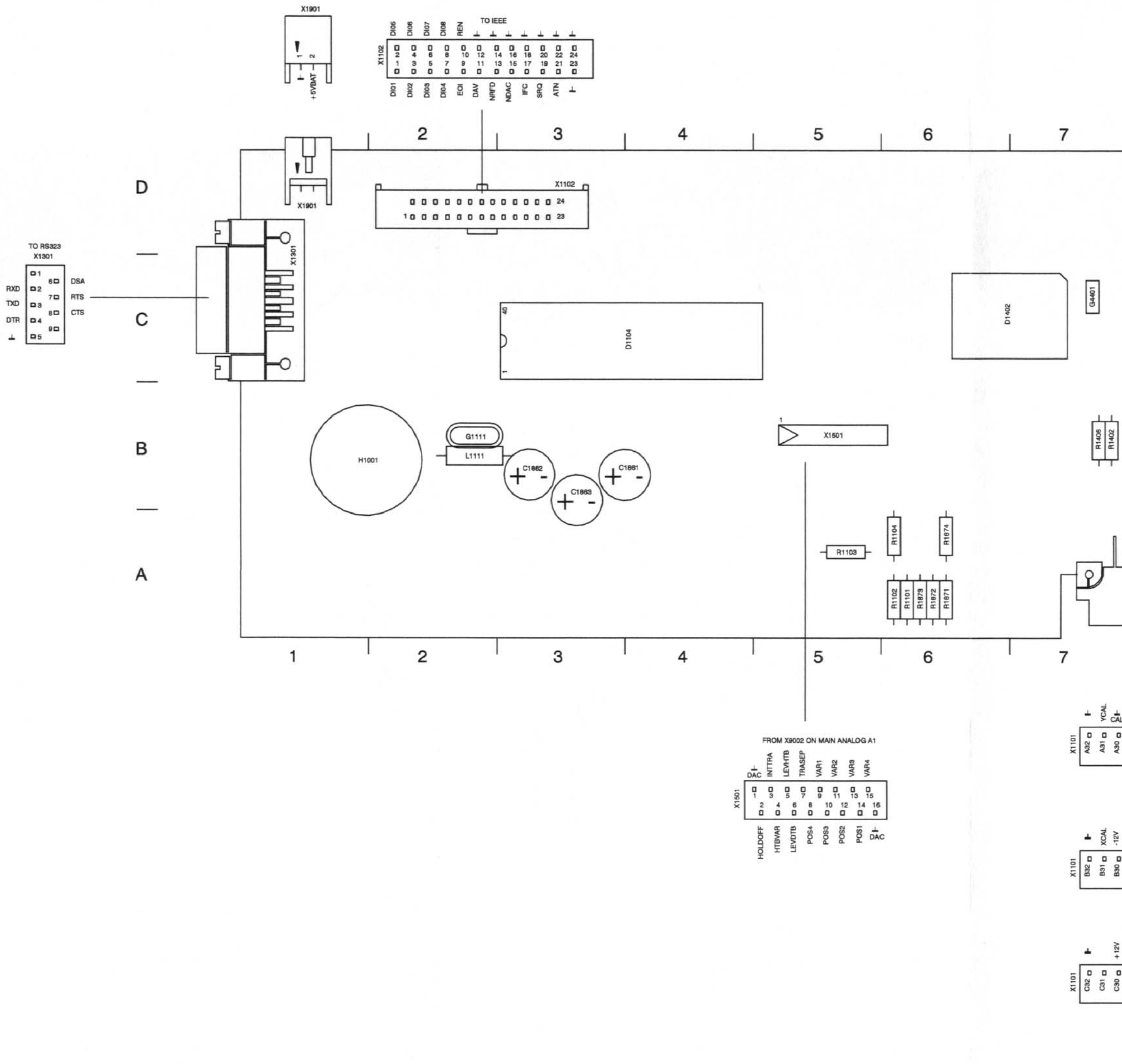
TBHOTXT	HOLD OFF INDICATION FOR TEXT IC	X1101:05	R1411:04
TRASEP	TRACE SEPARATION CONTROL SIGNAL	R1127:03	X1501:05
UFODAVLT	FRONT WRITES TO MICROPROCESSOR	X1101:05	D1001:01
UFOWR-LT	MICROPROCESSOR WRITES TO FRONT	D1016:01	X1101:05
VAR1	CH1 VARIABLE GAIN CONTROL SIGNAL	R1135:03	X1501:05
VAR2	CH2 VARIABLE GAIN CONTROL SIGNAL	R1133:03	X1501:05
VAR3	CH3 VARIABLE GAIN CONTROL SIGNAL	R1131:03	X1501:05
VAR4	CH4 VARIABLE GAIN CONTROL SIGNAL	R1130:03	X1501:05
XCAL	SIGNAL FOR X CALIBRATION	X1101:05	D1001:01
XTXT0	HORIZONTAL TEXT SIGNAL 0	R1451:04	X1101:05
XTXT1	HORIZONTAL TEXT SIGNAL 1	R1451:04	X1101:05
XYSW0	X AND Y SWITCHING TEXT/SIGNAL 0	V1431:04	X1101:05
XYSW1	X AND Y SWITCHING TEXT/SIGNAL 1	V1434:04	X1101:05
YCAL	SIGNAL FOR Y CALIBRATION	X1101:05	D1001:01
YTXT0	VERTICAL TEXT SIGNAL 0	R1453:04	X1501:05
YTXT1	VERTICAL TEXT SIGNAL 1	R1454:04	X1501:05
ZSW0	Z SWITCHING TEXT/SIGNAL 0	V1436:04	X1101:05
ZSW1	Z SWITCHING TEXT/SIGNAL 1	V1442:04	X1101:05
ZTXT0	TEXT INTENSITY 0	V1446:04	X1101:05
ZTXT1	TEXT INTENSITY 1	V1444:04	X1101:05

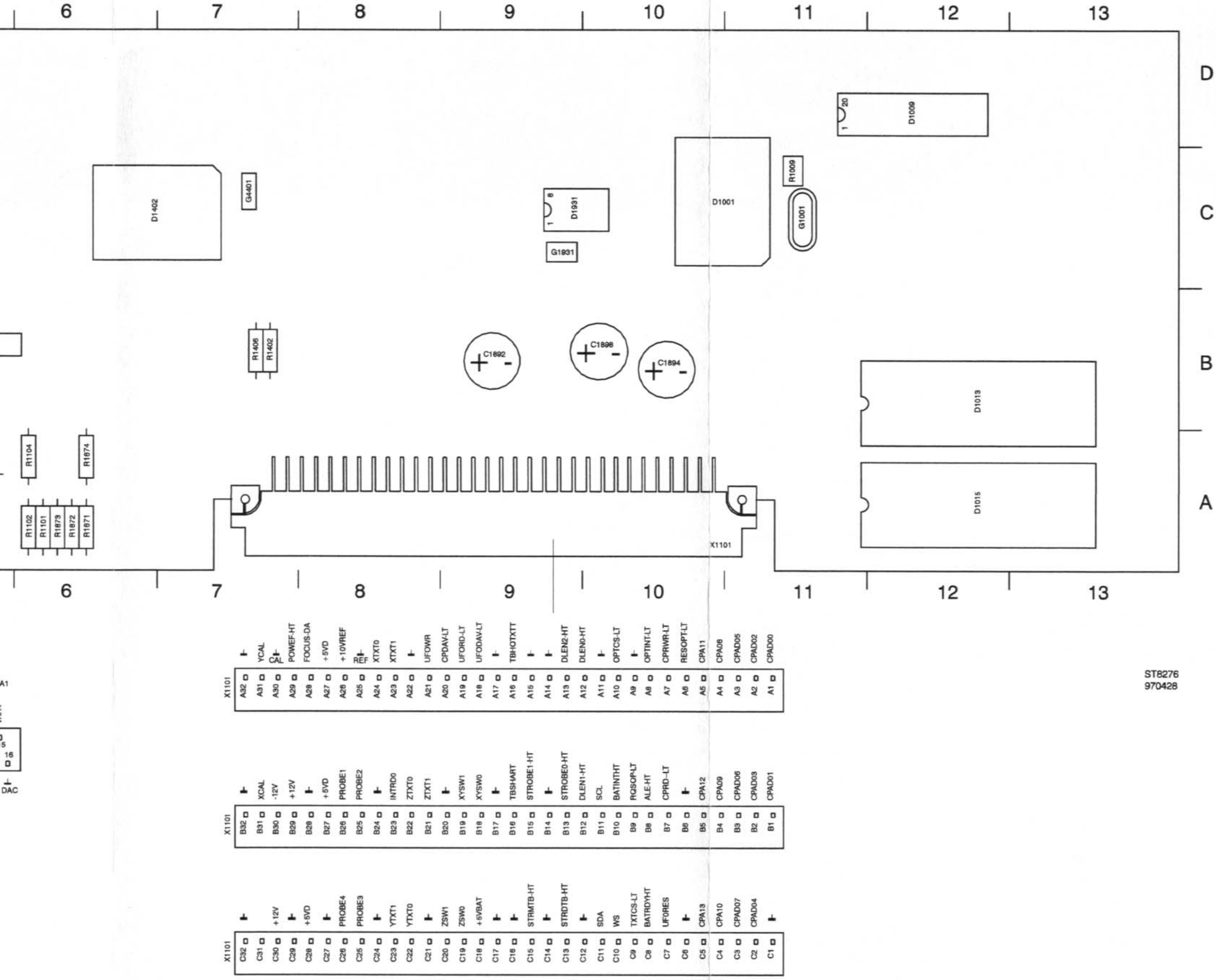
5.3.3 Unit lay-outs



Lay-out 14 - Wire component side

5.3.3 Unit lay-outs





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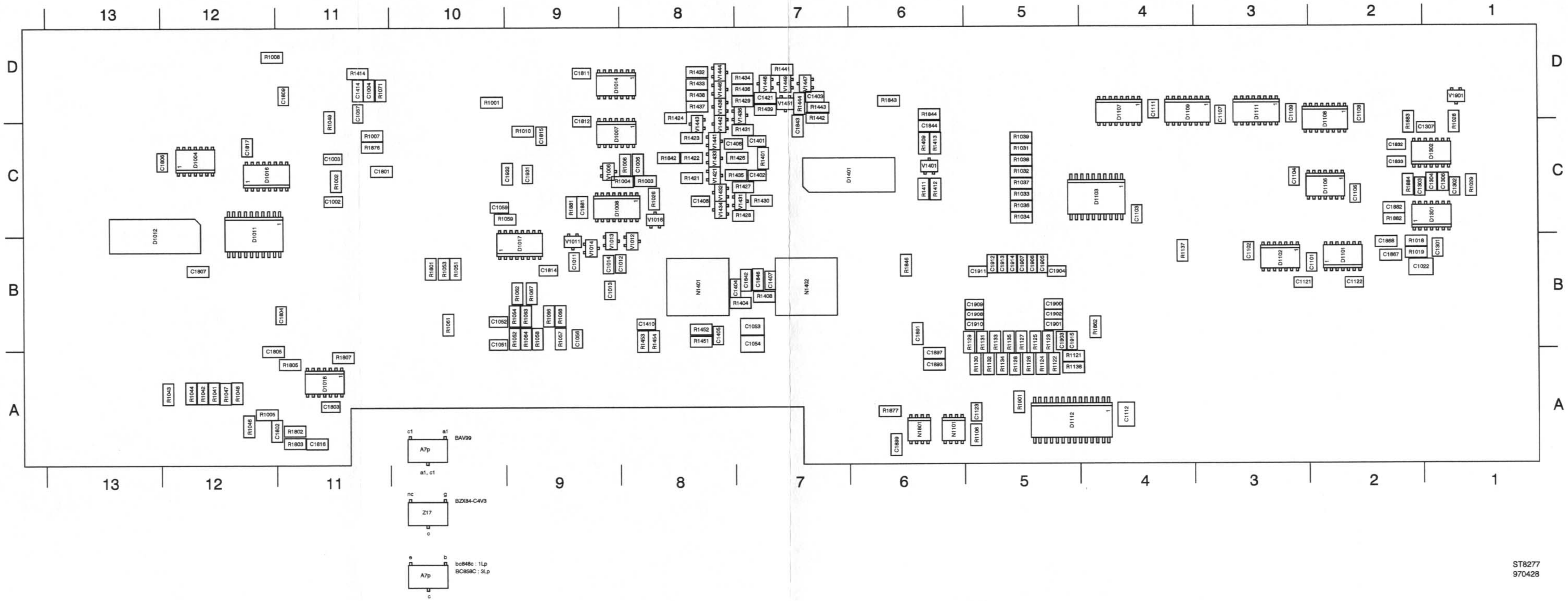
Lay-out 14 - Wire component side



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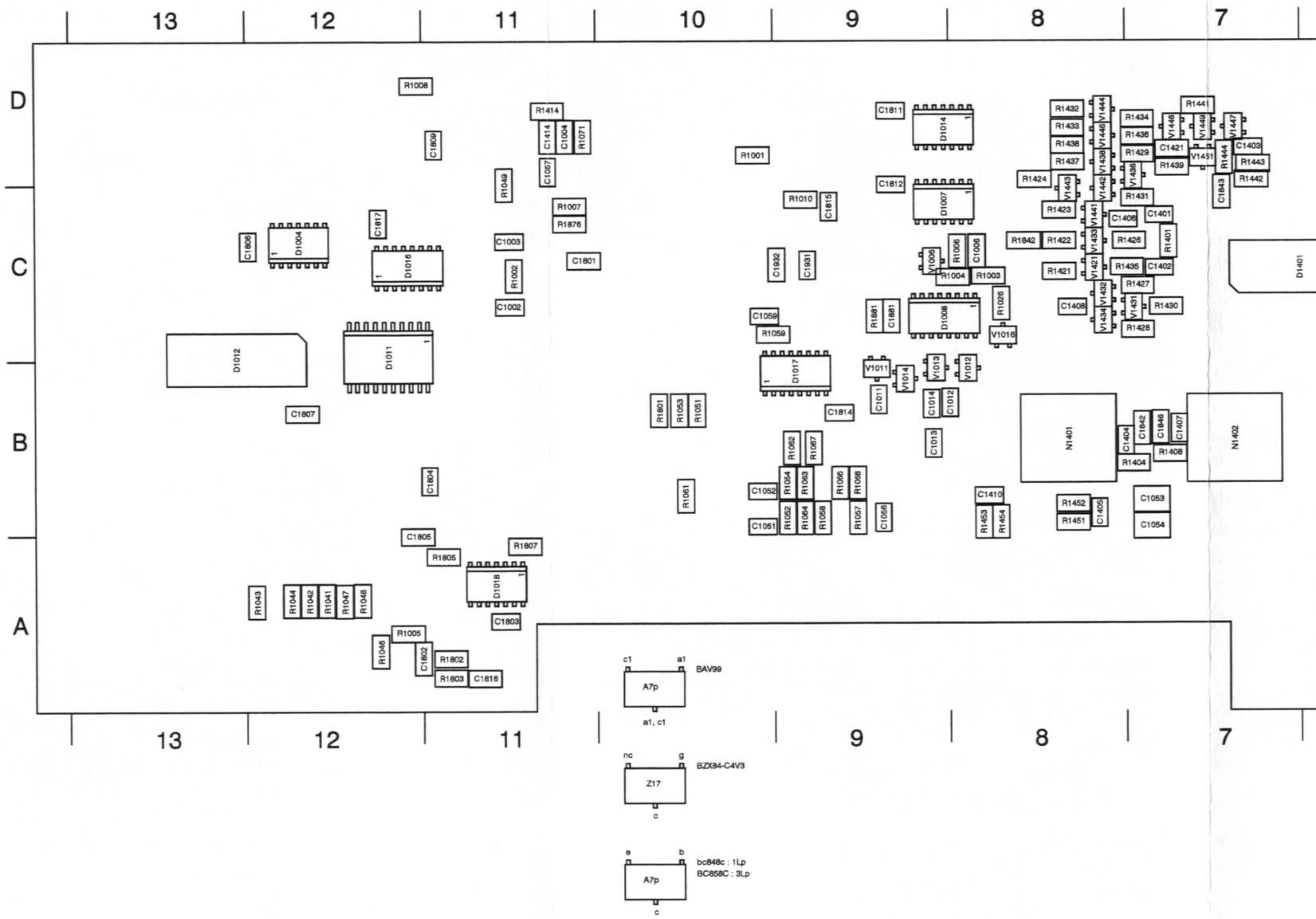
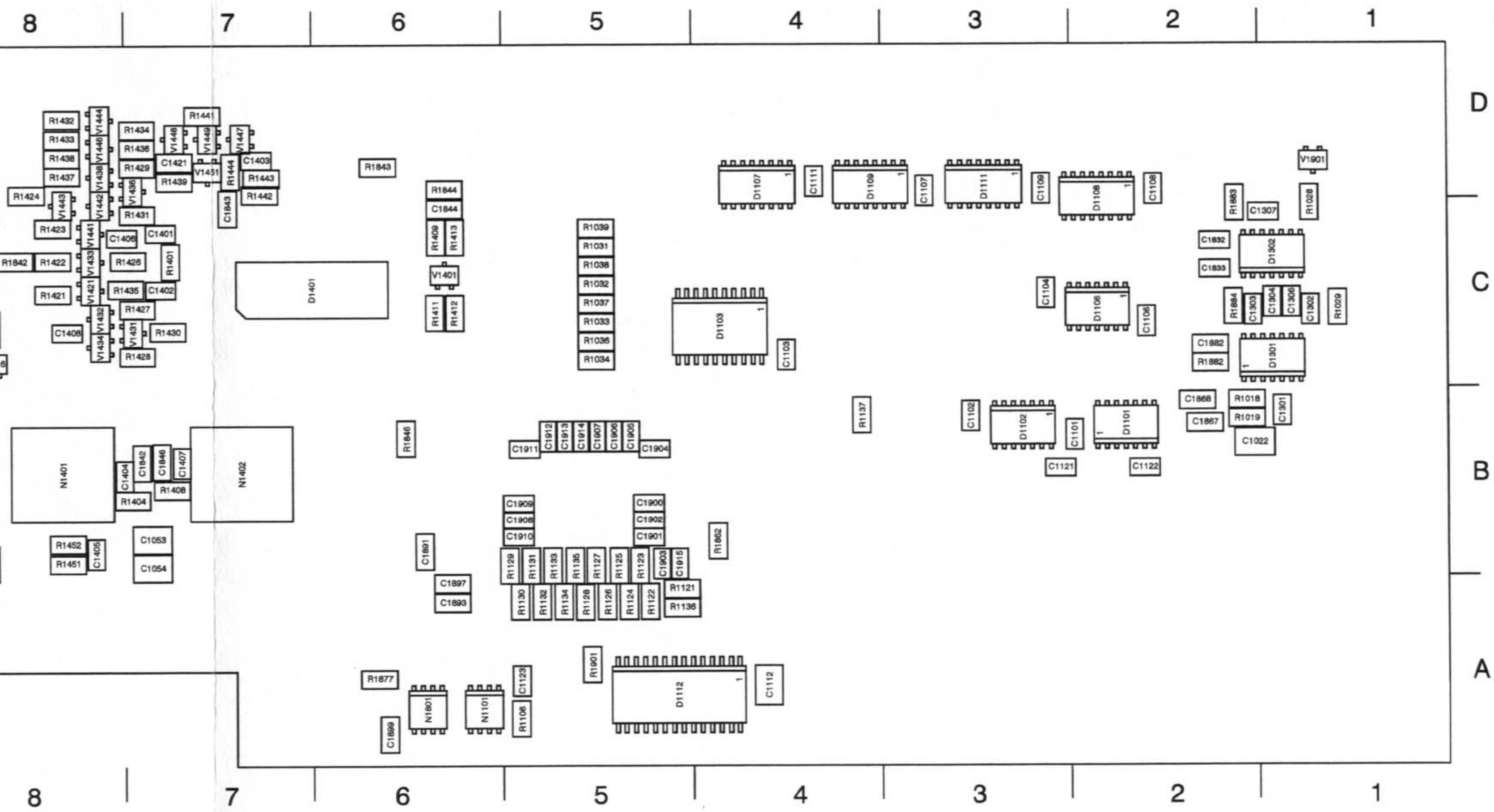
Lay-out 15 - Micro-miniature component side of microprocessor unit A3


13
12
11
10
9
8
7
D
C
B
A
BAV99
A7p
BZX84-C4V3
Z17
bc848c : 1Lp
BC858C : 3Lp
A7p



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Lay-out 15 - Micro-miniature component side of microprocessor unit A3

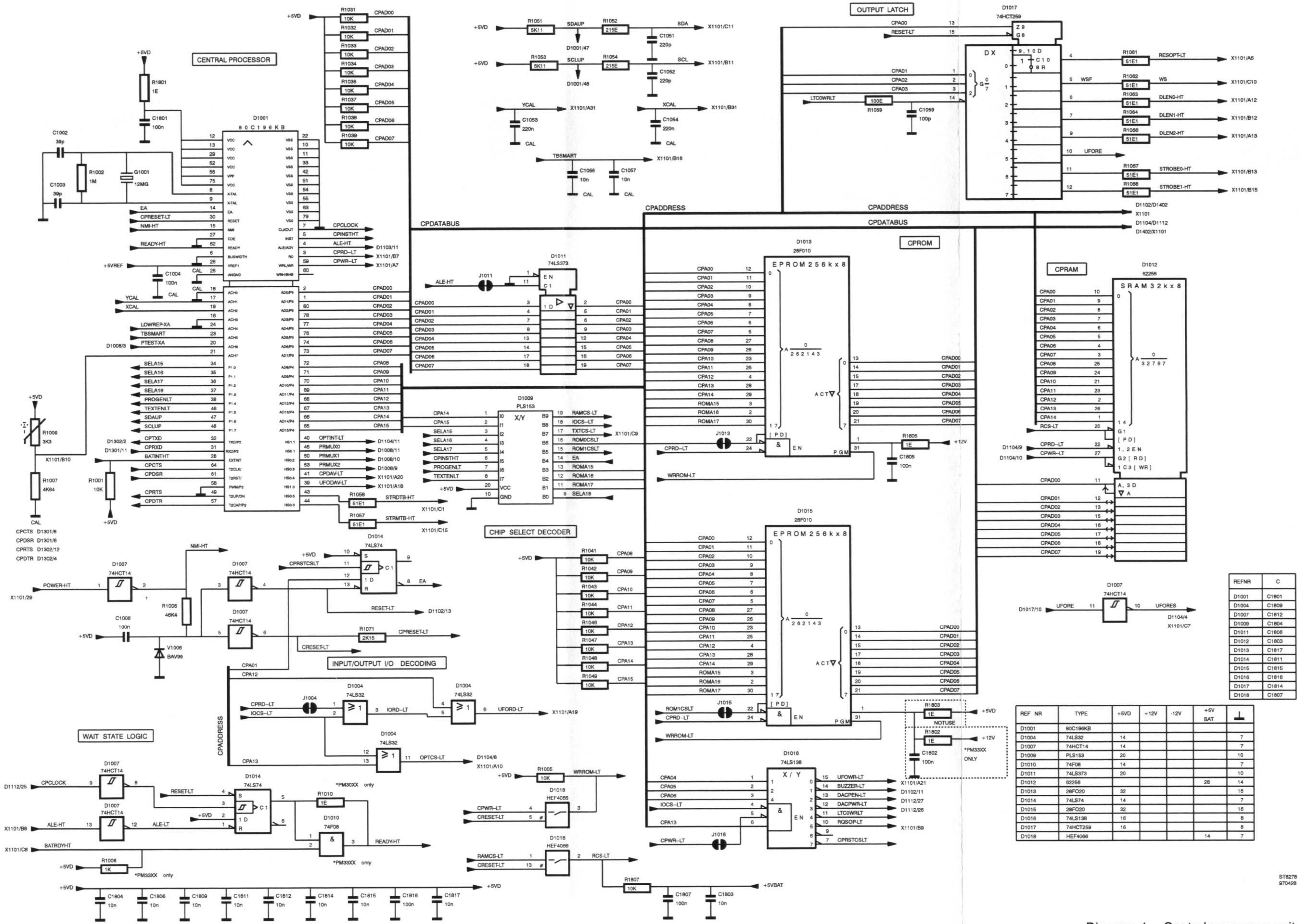
5.3.4 Location list Microprocessor unit A3

'-L' means that the component is located on the printed circuit board side with the large components. Otherwise the component is located on the side with small components (SMD's: surface mounted devices).

C1002 C11
C1003 C11
C1004 D11
C1011 B9
C1012 B8
C1013 B9
C1014 B9
C1022 B2
C1051 B10
C1052 B10
C1053 B7
C1054 B7
C1056 B9
C1101 B2
C1102 B3
C1103 C4
C1104 C3
C1106 C2
C1107 D3
C1108 D2
C1109 D3
C1111 D4
C1112 A4
C1121 B3
C1122 B2
C1123 A5
C1301 B1
C1302 C1
C1303 C2
C1304 C1
C1306 C1
C1307 C1
C1401 C7
C1402 C7
C1403 D7
C1404 B7
C1405 B8
C1406 C7
C1407 B7
C1408 C8
C1409 D7
C1410 B8
C1421 D7
C1801 C11
C1802 A11
C1803 A11
C1804 B11
C1805 B12
C1806 C12
C1807 B12
C1809 D11
C1811 D9
C1812 D9
C1814 C10
C1815 C9
C1816 A11
C1817 C12
C1832 C2
C1833 C2
C1842 B7
C1843 C7
C1844 C6
C1846 B7
C1861 B3-L
C1862 B3-L
C1863 B3-L
C1867 B2
C1868 B2
C1881 C9
C1882 C2
C1891 B6
C1892 B9-L
C1893 A6
C1894 B10-L
C1897 A6
C1898 B9-L
C1899 A6
D1001 C10-L
D1004 C12
D1007 C9
D1008 C9
D1009 D12-L
D1011 C12
D1012 C13
D1013 B12-L
D1014 D9
D1015 A12-L
D1016 C12
D1017 B9
D1018 A11
D1101 B2
D1102 B3
D1103 C4
D1104 C4-L
D1106 C2
D1107 D4
D1108 D2
D1109 D4
D1111 D3
D1112 A5
D1301 C1
D1302 C1
D1401 C7
D1402 C6-L
D1931 C9-L
G1001 C11-L
G1111 B2-L
G1931 C9-L
G4401 C7-L
H1001 D1-L
L1111 B2-L
N1101 A6
N1401 B8
N1402 B7
N1801 A6
R1001 D10
R1002 C11
R1003 D11
R1004 C11
R1005 A12
R1007 C11
R1008 D12
R1009 C11-L
R1010 C9
R1018 B2
R1019 B2
R1028 C1
R1029 C1
R1031 C5
R1032 C5
R1033 C5
R1034 C5
R1036 C5
R1037 C5
R1038 C5
R1039 C5
R1041 A12
R1042 A12
R1043 A12
R1044 A12
R1046 A12
R1047 A12
R1048 A12
R1049 D11
R1051 B10
R1052 B9
R1053 B10
R1054 B9
R1057 B9
R1058 B9
R1061 B10
R1062 B9
R1063 B9
R1064 B9
R1066 B9
R1067 B9
R1068 B9
R1071 D11
R1101 A6-L
R1102 A6-L
R1103 A5-L
R1104 A6-L
R1106 A5
R1121 A5
R1122 A5
R1123 B5
R1124 A5
R1125 B5
R1126 A5
R1127 B5
R1128 A5
R1129 B5
R1130 A5
R1131 B5
R1132 A5
R1133 B5
R1134 A5
R1135 B5
R1136 A5
R1137 B4
R1401 C7
R1402 B7-L
R1404 B7
R1406 B7-L
R1408 B7
R1409 C6
R1411 C6
R1412 C6
R1413 C6
R1421 C8
R1422 C8
R1423 C8
R1424 D8
R1426 C7
R1427 C7
R1428 C7
R1429 D7
R1430 C7
R1431 C7
R1432 D8

R1433 D8
R1434 D7
R1435 C7
R1436 D7
R1437 D8
R1438 D8
R1439 D7
R1441 D7
R1442 D7
R1443 D7
R1444 D7
R1451 B8
R1452 B8
R1453 B8
R1454 B8
R1801 B10
R1802 A11
R1803 A11
R1805 A11
R1807 A11
R1842 C8
R1843 D6
R1844 D6
R1846 B6
R1862 B4
R1871 A6-L
R1872 A6-L
R1873 A6-L
R1874 A6-L
R1876 D11
R1877 A6
R1881 C9
R1882 C2
R1883 C2
R1884 C2
R1901 A5
V1006 C9
V1011 B9
V1012 B8
V1013 B9
V1014 B9
V1401 C6
V1421 C8
V1431 C7
V1432 C8
V1433 C8
V1434 C8
V1436 D7
V1438 D8
V1441 C8
V1442 D8
V1443 D8
V1444 D8
V1446 D8
V1447 D7
V1448 D7
V1449 D7
V1451 D7
X1101 9A-L
X1102 D4-L
X1301 C1-L
X1501 B5-L

5.3.5 Circuit diagrams

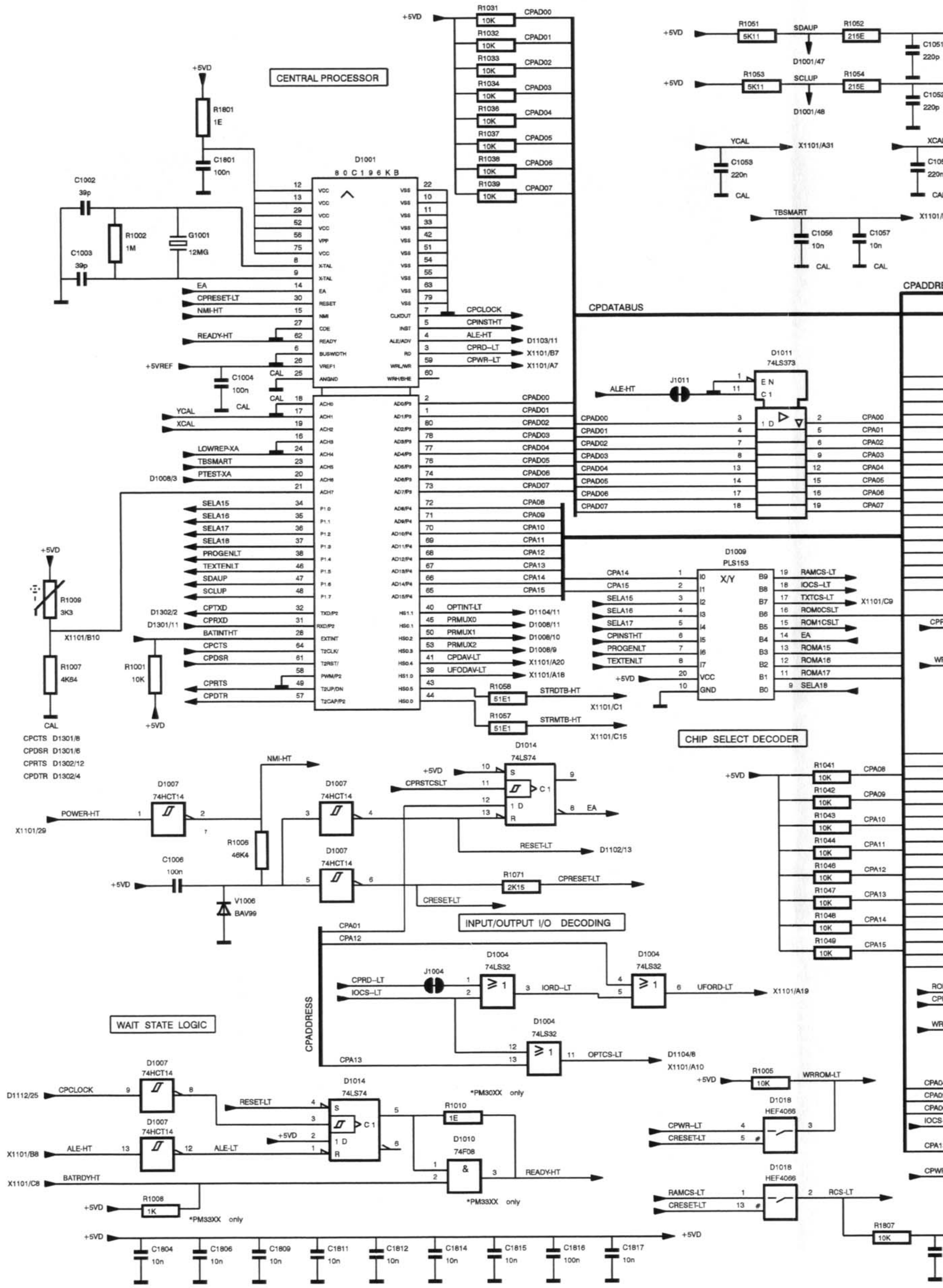


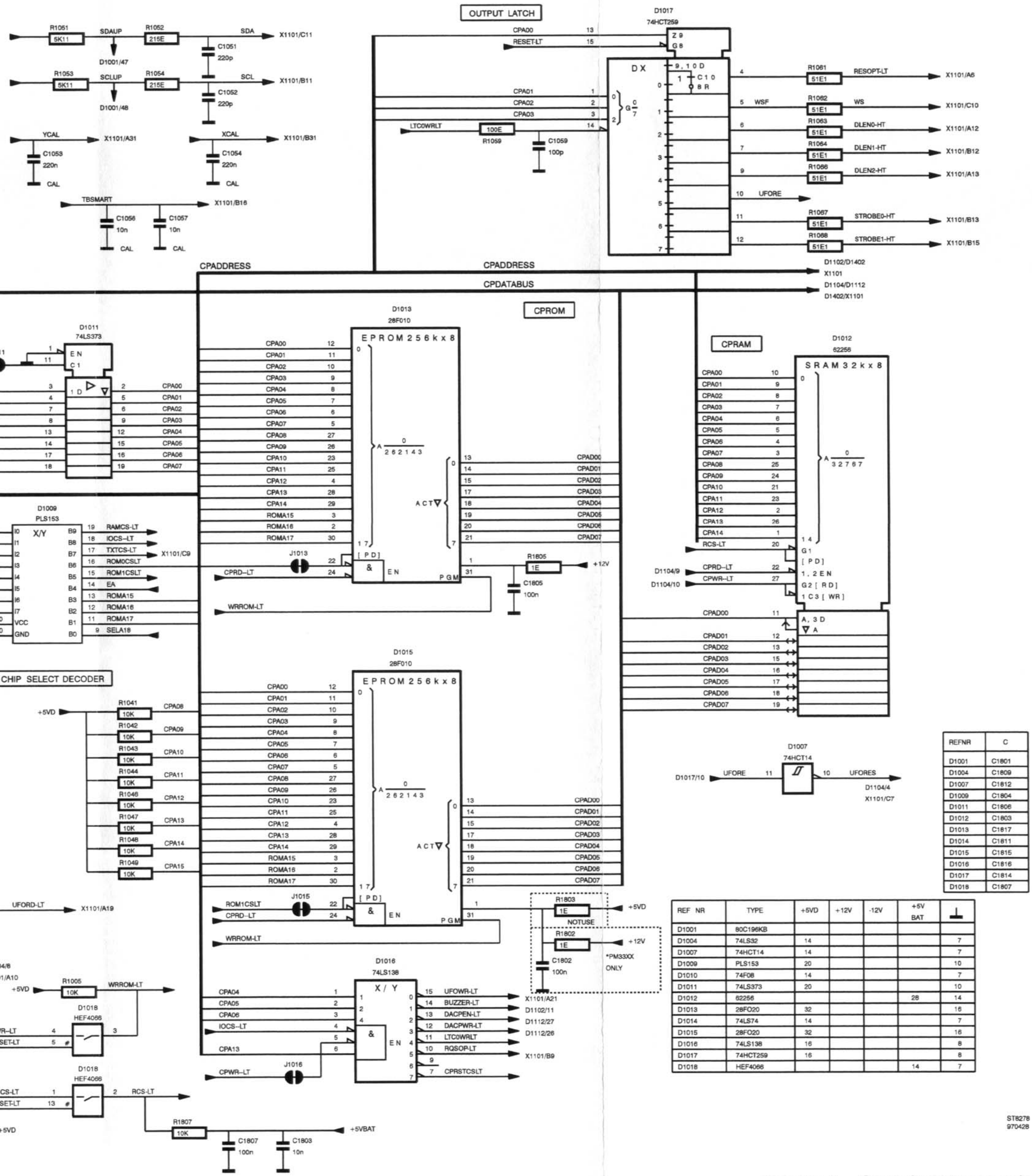
REF NR	TYPE	+5VD	+12V	-12V	+5V BAT	⊥
D1001	80C196KB					
D1004	74LS32	14				7
D1007	74HCT14	14				7
D1009	PLS153	20				10
D1010	74F08	14				7
D1011	74LS373	20				10
D1012	62256				28	14
D1013	28FO20	32				16
D1014	74LS74	14				7
D1015	28FO20	32				16
D1016	74LS138	16				8
D1017	74HCT259	16				8
D1018	HEF4066				14	7

REFNR	C
D1001	C1801
D1004	C1809
D1007	C1812
D1009	C1804
D1011	C1806
D1012	C1803
D1013	C1817
D1014	C1811
D1015	C1815
D1016	C1816
D1017	C1814
D1018	C1807

Diagram 1 - Central processor unit

5.3.5 Circuit diagrams

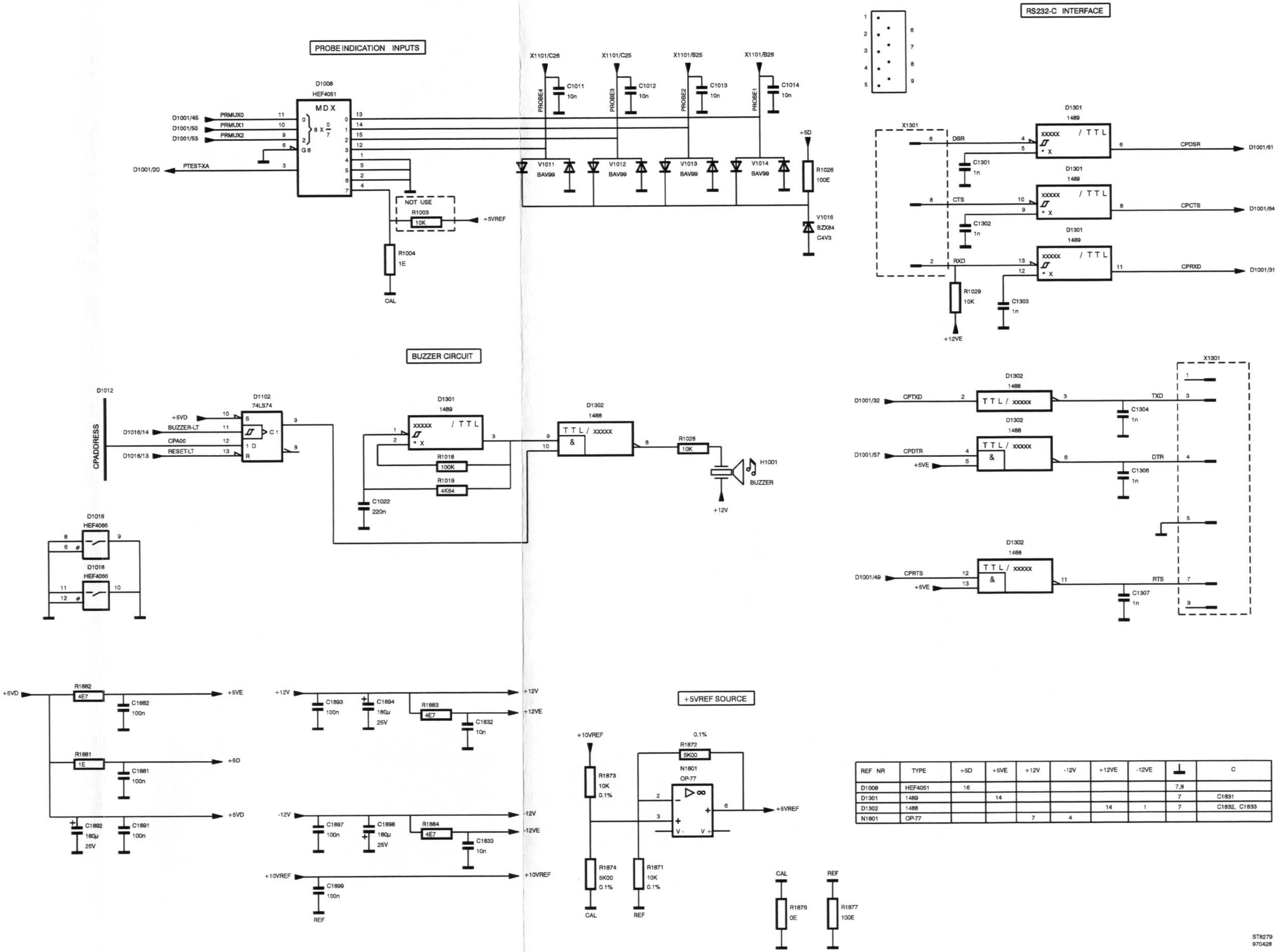




REFNR	C
D1001	C1801
D1004	C1809
D1007	C1812
D1009	C1804
D1011	C1806
D1012	C1803
D1013	C1817
D1014	C1811
D1015	C1815
D1016	C1816
D1017	C1814
D1018	C1807

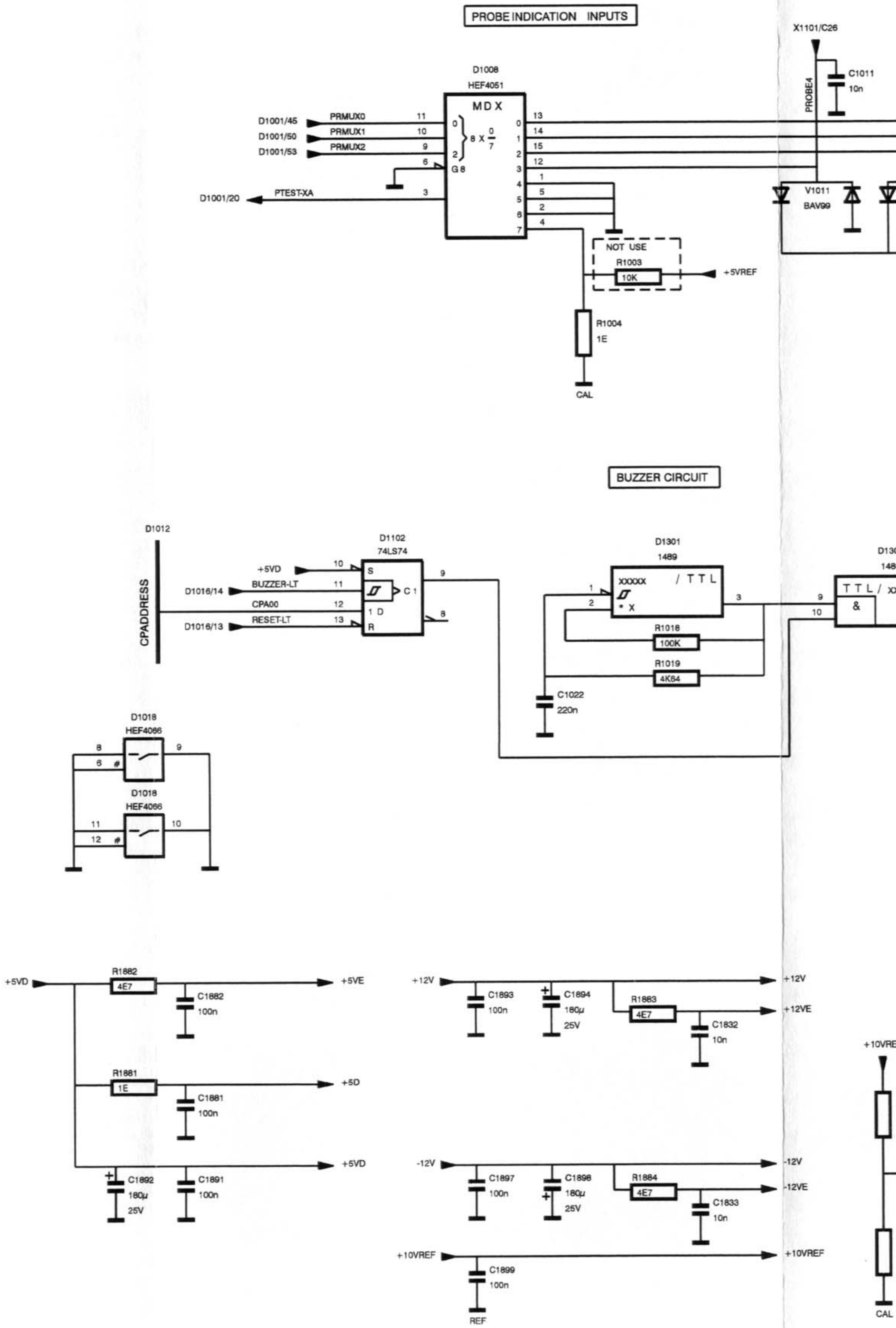
REF NR	TYPE	+5VD	+12V	-12V	+5V BAT	⊥
D1001	80C196KB					
D1004	74LS32	14				7
D1007	74HCT14	14				7
D1009	PLS153	20				10
D1010	74F08	14				7
D1011	74LS373	20				10
D1012	62256				28	14
D1013	28FO20	32				16
D1014	74LS74	14				7
D1015	28FO20	32				16
D1016	74LS138	16				8
D1017	74HCT259	16				8
D1018	HEF4066				14	7

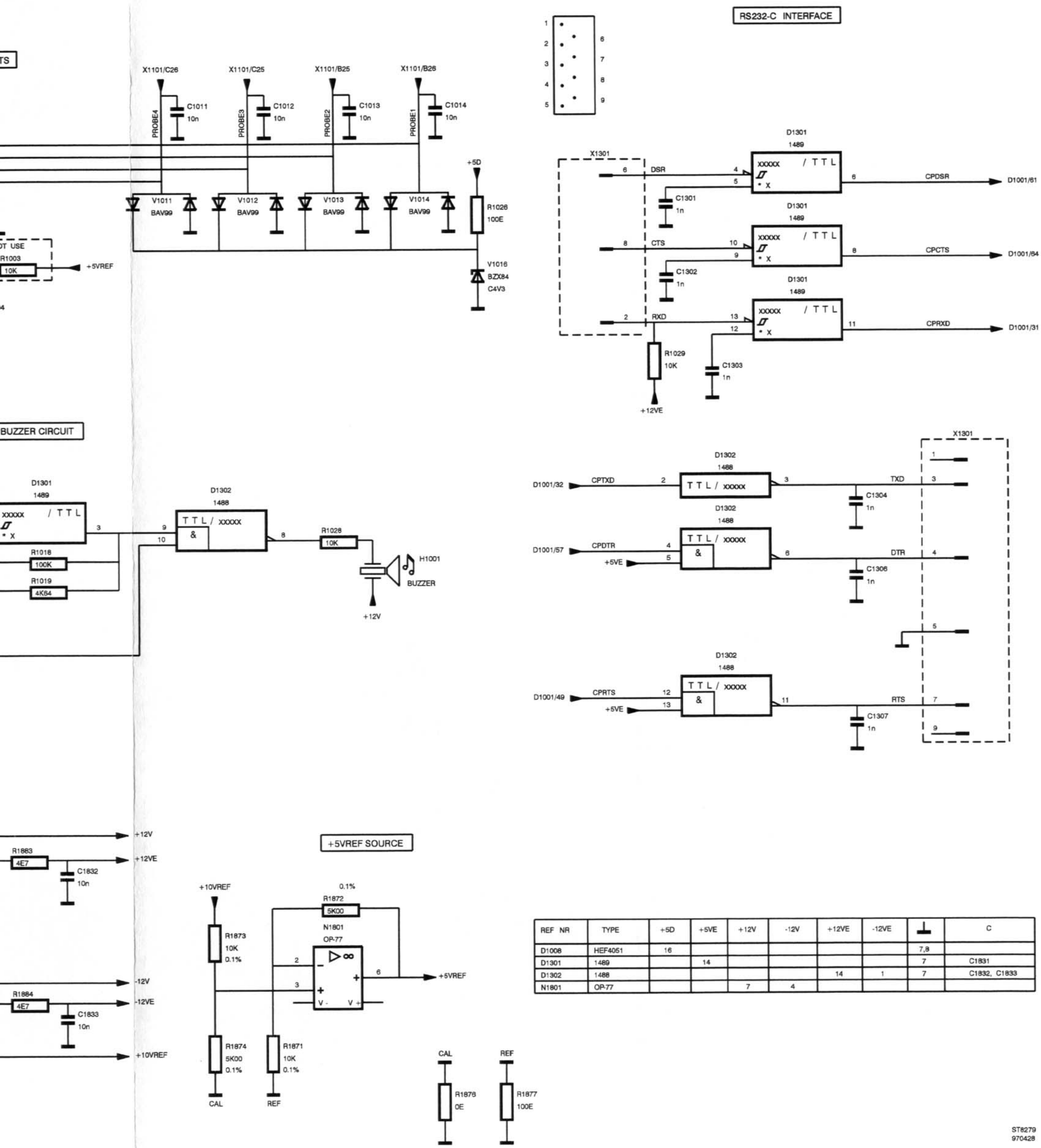
Diagram 1 - Central processor unit



REF NR	TYPE	+5D	+5VE	+12V	-12V	+12VE	-12VE	⊥	C
D1008	HEF4051	16						7,8	
D1301	1489		14					7	C1831
D1302	1488					14	1	7	C1832, C1833
N1801	OP-77			7	4				

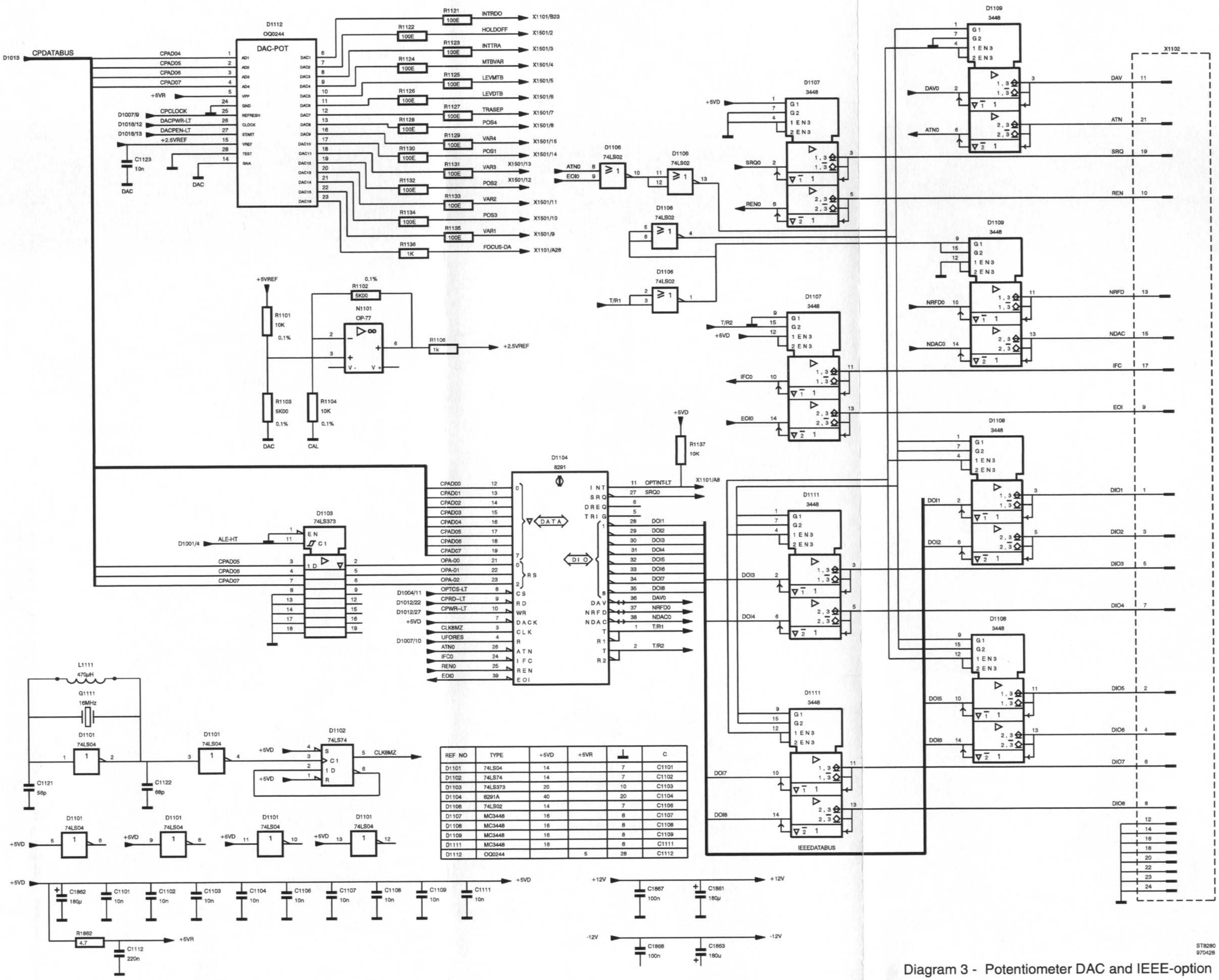
Diagram 2 - Auxiliary circuits


PROBE INDICATION INPUTS
D1008
HEF4051
MDX
D1001/45
D1001/50
D1001/53
PRMUX0
PRMUX1
PRMUX2
PTEST-XA
D1001/20
X1101/C26
PROBE4
C1011
10n
V1011
BAV99
NOT USE
R1003
10K
+5VREF
R1004
1E
CAL
BUZZER CIRCUIT
D1012
CPADDRESS
D1102
74LS74
+5VD
BUZZER-LT
CPA00
RESET-LT
D1016/14
D1016/13
D1301
1489
XXXXX
/ TTL
R1018
100K
R1019
4K64
C1022
220n
D1018
HEF4066
R1882
4E7
C1882
100n
+5VE
R1881
1E
C1881
100n
+5D
C1892
180µ
25V
C1891
100n
+12V
C1893
100n
C1894
180µ
25V
R1883
4E7
C1832
10n
+12VE
-12V
C1897
100n
C1898
180µ
25V
R1884
4E7
C1833
10n
-12VE
+10VREF
C1899
100n
REF



REF NR	TYPE	+5D	+5VE	+12V	-12V	+12VE	-12VE	⊥	C
D1008	HEF4051	16						7,8	
D1301	1489		14					7	C1831
D1302	1488					14	1	7	C1832, C1833
N1801	OP-77			7	4				

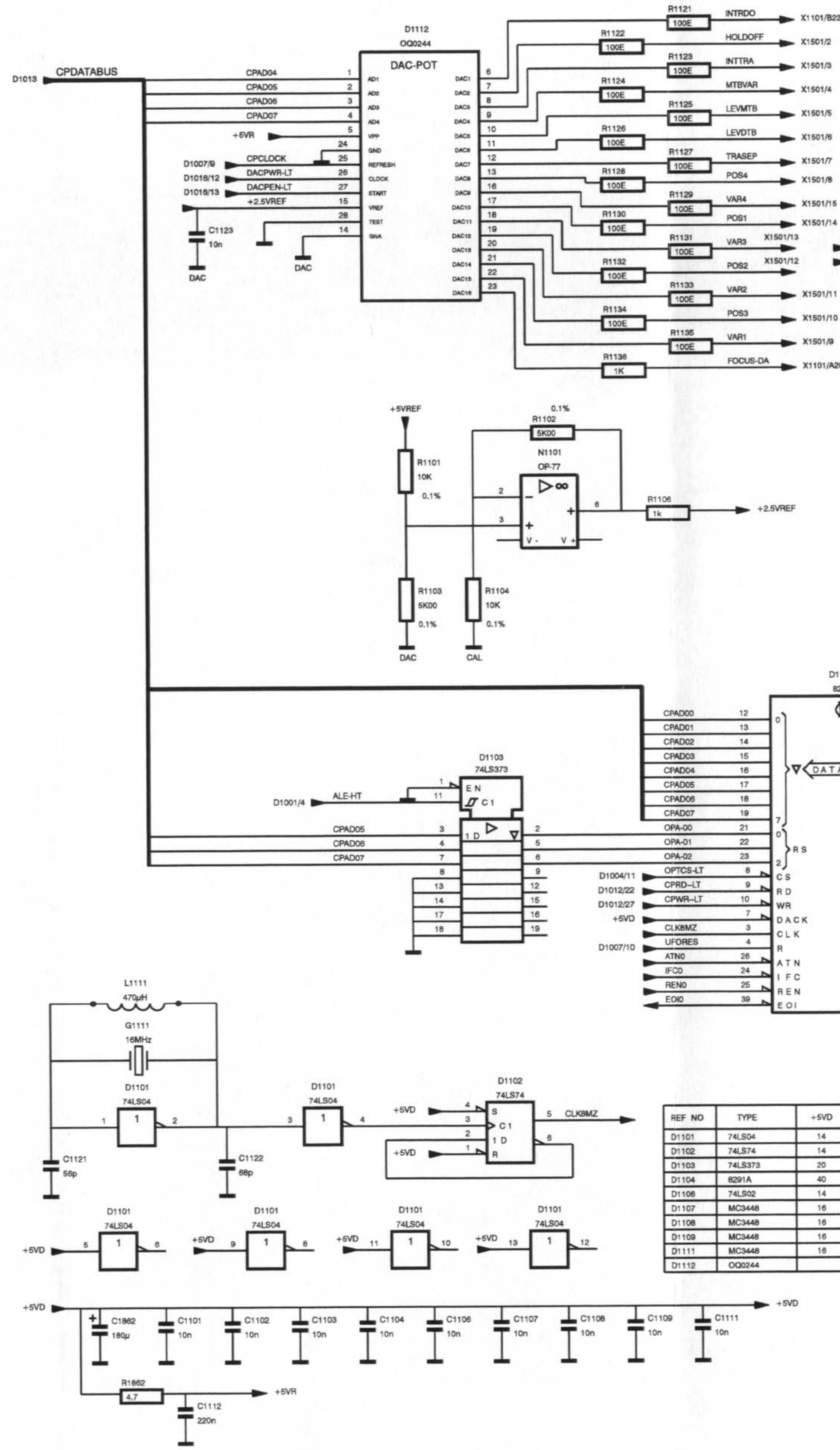
Diagram 2 - Auxiliary circuits



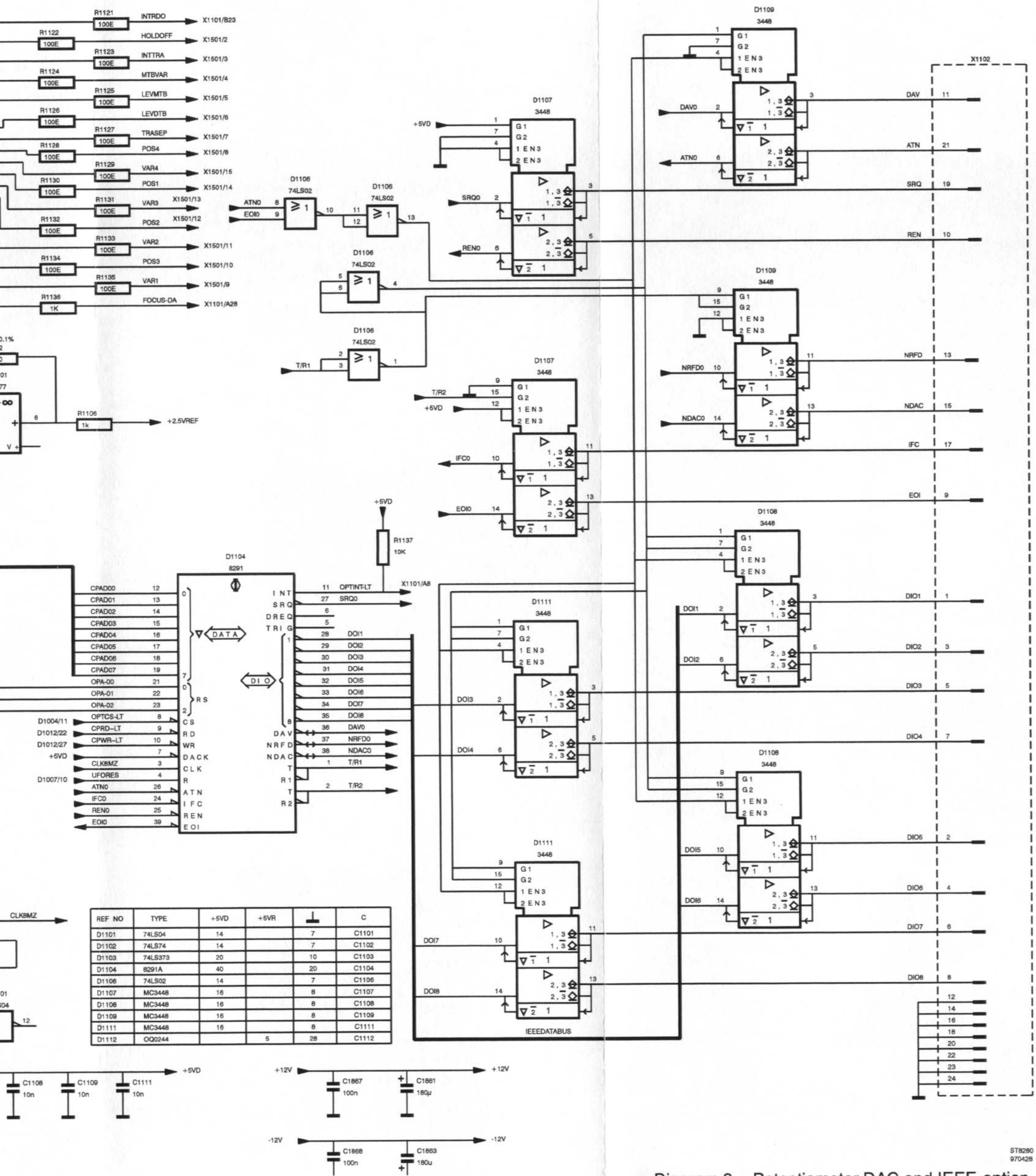
REF NO	TYPE	+5VD	+5VR	⊥	C
D1101	74LS04	14		7	C1101
D1102	74LS74	14		7	C1102
D1103	74LS373	20		10	C1103
D1104	8291A	40		20	C1104
D1106	74LS02	14		7	C1106
D1107	MC3448	16		8	C1107
D1108	MC3448	16		8	C1108
D1109	MC3448	16		8	C1109
D1111	MC3448	16		8	C1111
D1112	OQ0244		5	28	C1112

ST8280
970428

Diagram 3 - Potentiometer DAC and IEEE-option

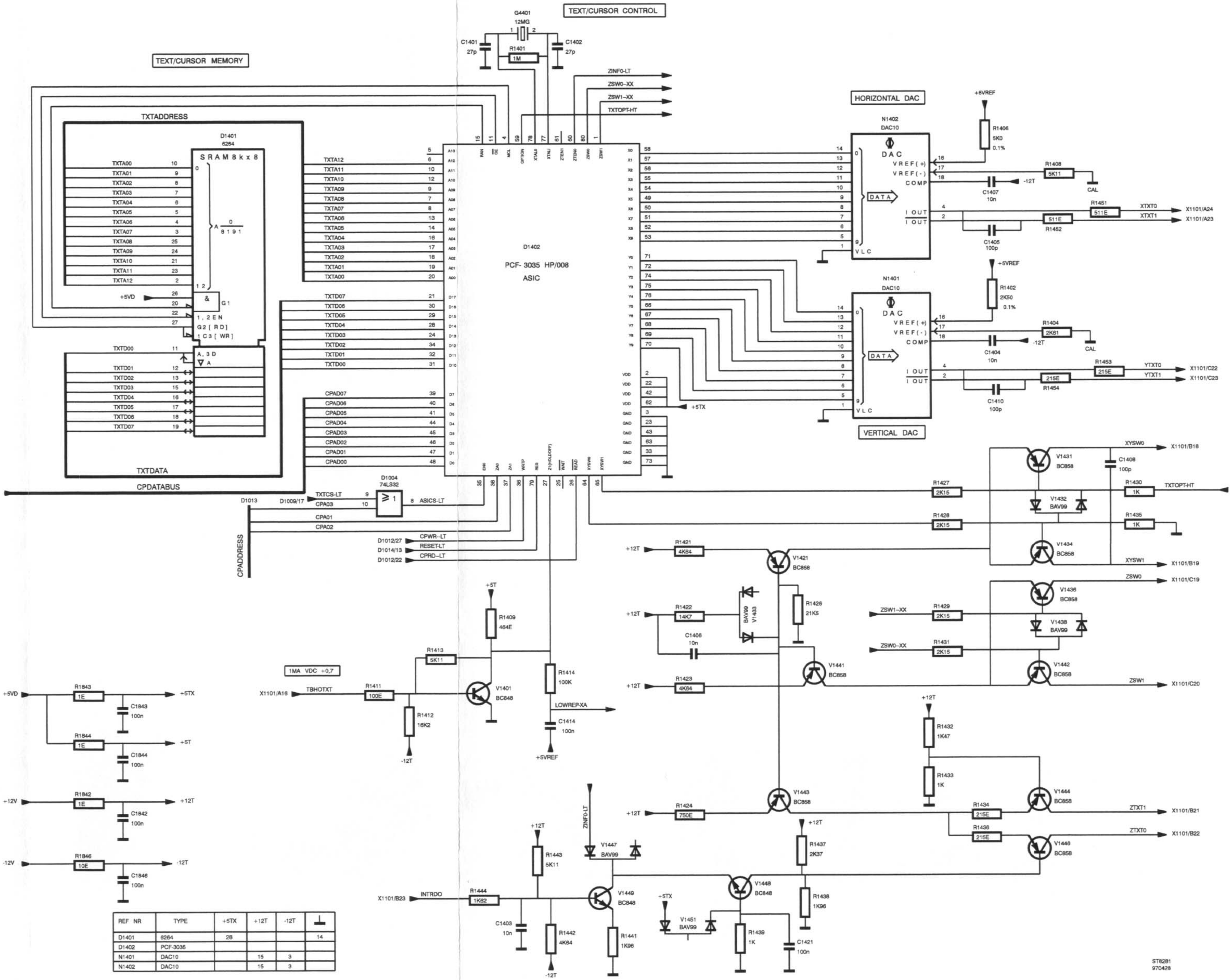


REF NO	TYPE	+5VD
D1101	74LS04	14
D1102	74LS74	14
D1103	74LS373	20
D1104	8291A	40
D1106	74LS02	14
D1107	MC3448	16
D1108	MC3448	16
D1109	MC3448	16
D1111	MC3448	16
D1112	OQ0244	



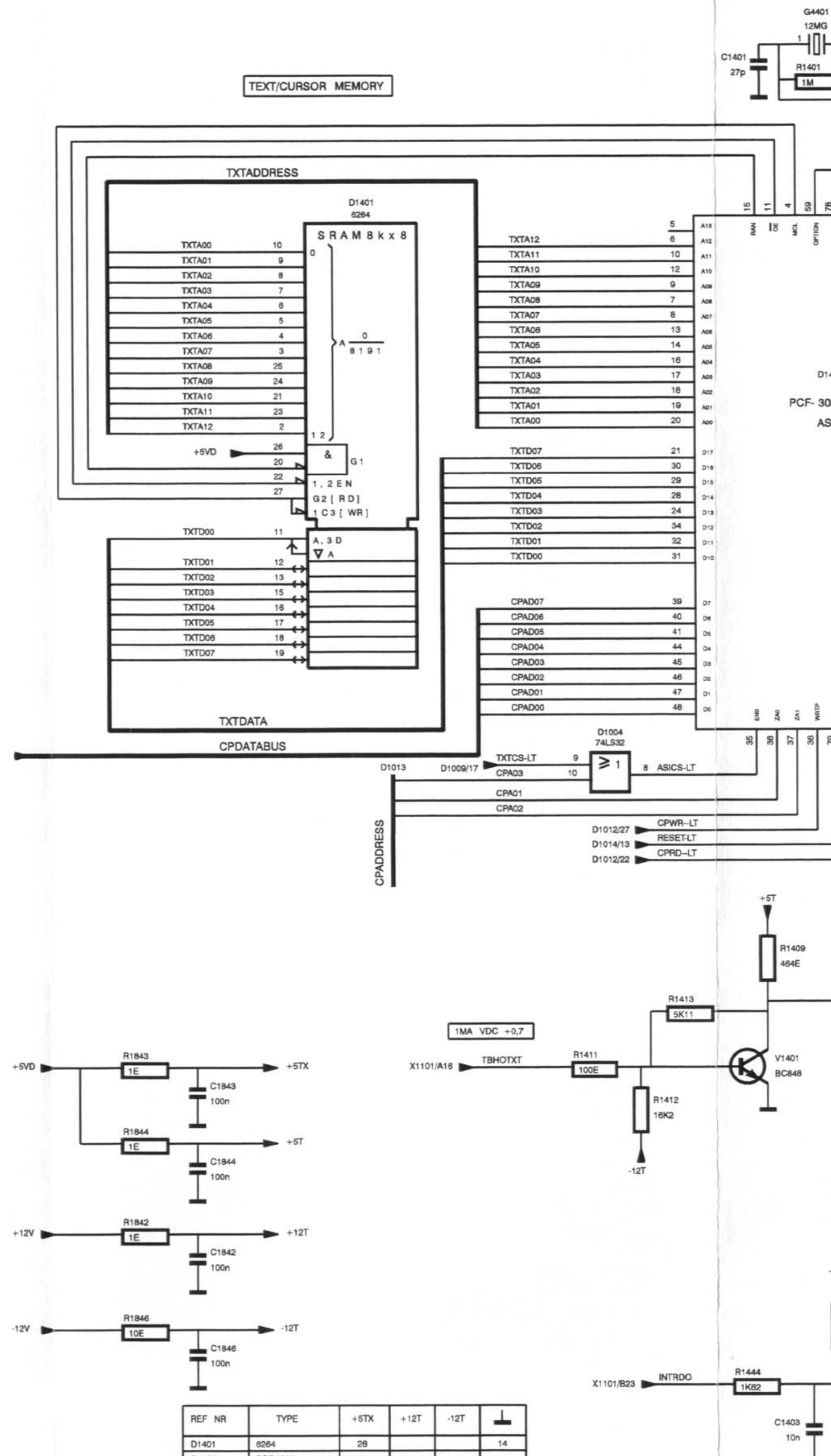
REF NO	TYPE	+5VD	+5VR	⊥	C
D1101	74LS04	14		7	C1101
D1102	74LS74	14		7	C1102
D1103	74LS373	20		10	C1103
D1104	8291A	40		20	C1104
D1106	74LS02	14		7	C1106
D1107	MC3448	16		8	C1107
D1108	MC3448	16		8	C1108
D1109	MC3448	16		8	C1109
D1111	MC3448	16		8	C1111
D1112	OQ0244		5	28	C1112

Diagram 3 - Potentiometer DAC and IEEE-option



REF NR	TYPE	+5TX	+12T	-12T	⊥
D1401	6264	28			14
D1402	PCF-3035				
N1401	DAC10		15	3	
N1402	DAC10		15	3	

Diagram 4 - Text and cursor circuit



REF NR	TYPE	+5TX	+12T	-12T	⊥
D1401	6264	28			14
D1402	PCF-3035				
N1401	DAC10		15	3	
N1402	DAC10		15	3	

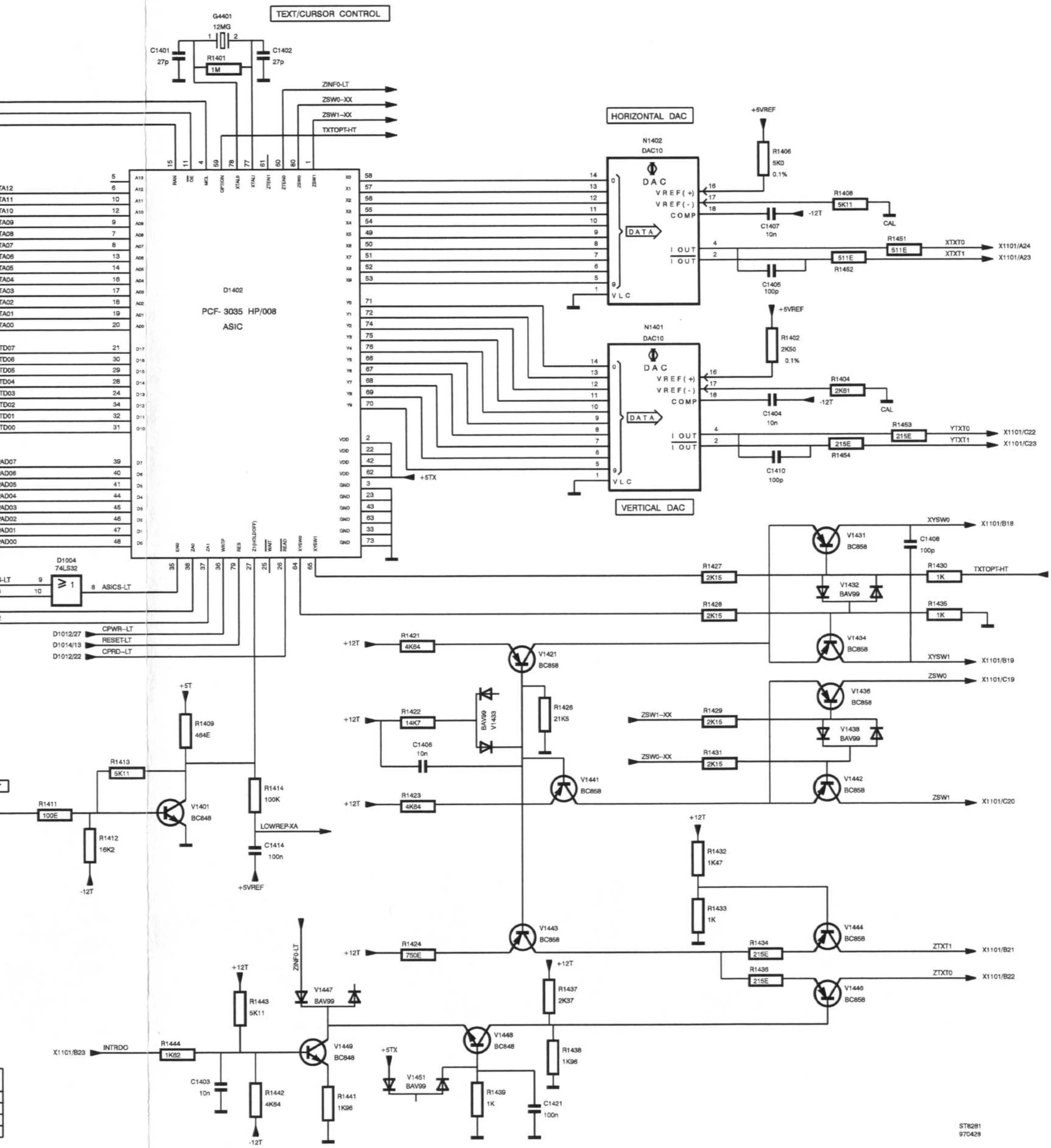


Diagram 4 - Text and cursor circuit

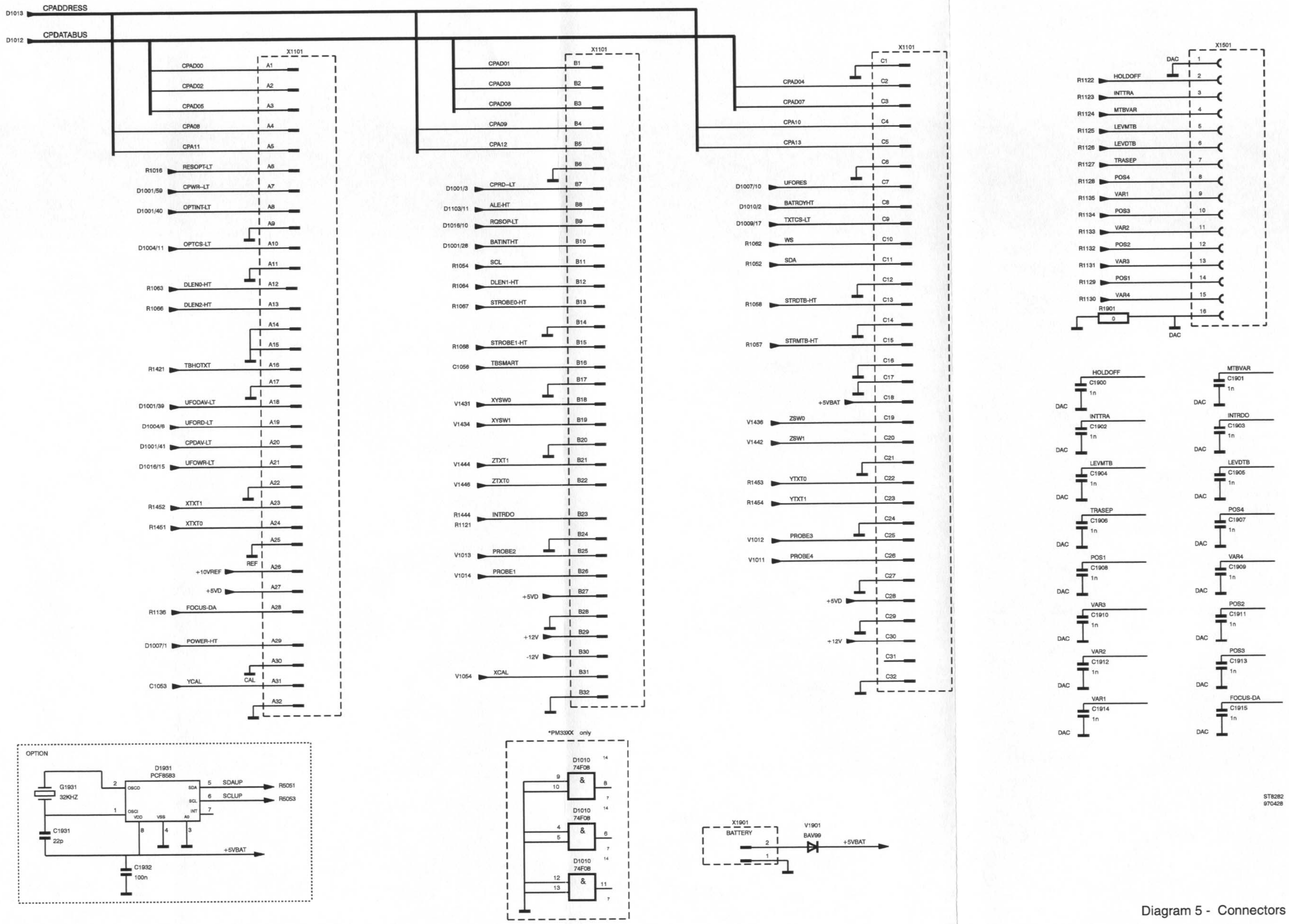
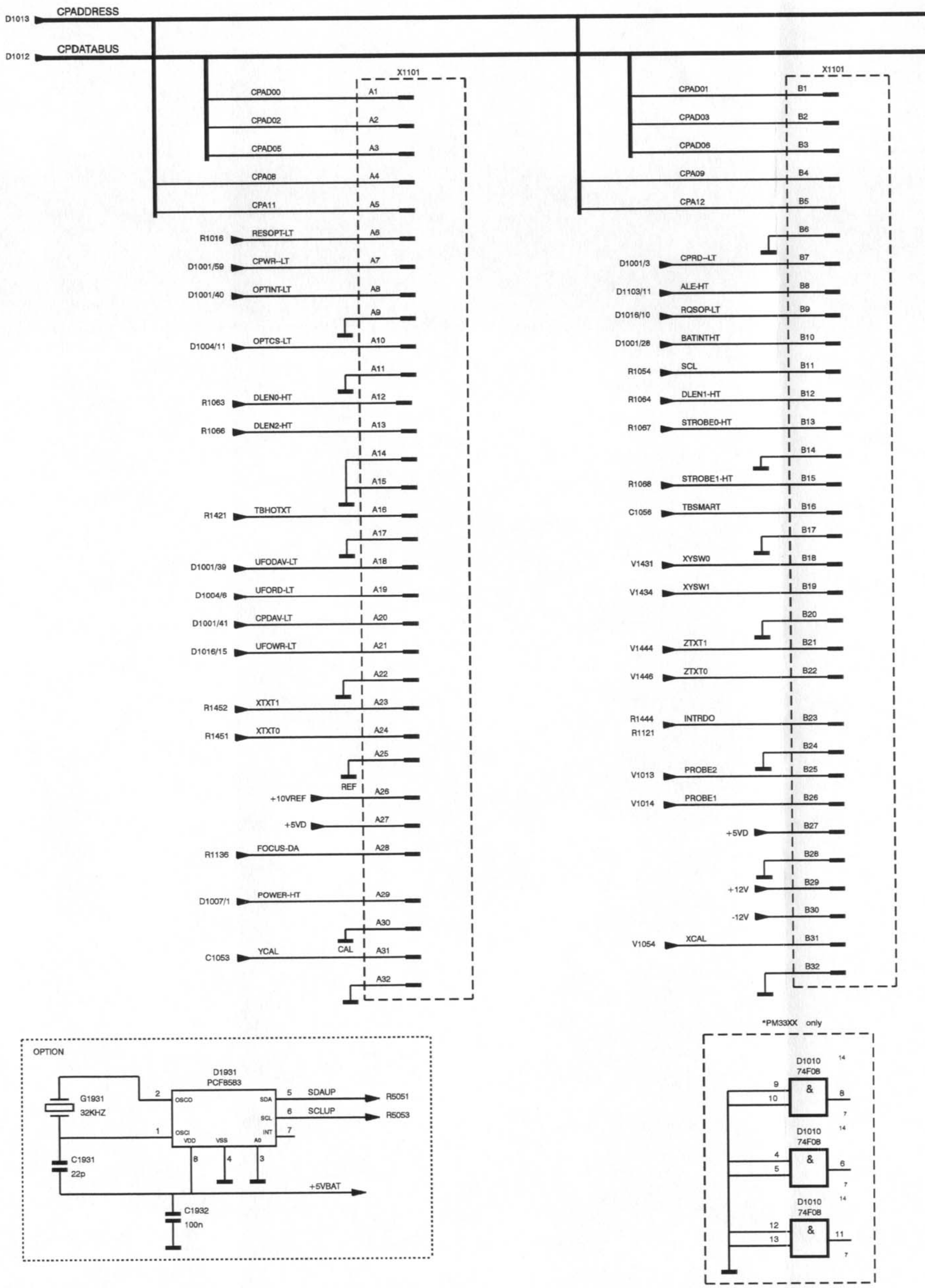


Diagram 5 - Connectors


D1013
CPADDRESS
D1012
CPDATABUS
X1101
CPAD00
A1
CPAD02
A2
CPAD05
A3
CPA08
A4
CPA11
A5
R1016
RESOPT-LT
A6
D1001/59
CPWR--LT
A7
D1001/40
OPTINT-LT
A8
A9
D1004/11
OPTCS-LT
A10
A11
R1063
DLEN0-HT
A12
R1066
DLEN2-HT
A13
A14
A15
R1421
TBHOTXT
A16
A17
D1001/39
UFODAV-LT
A18
D1004/6
UFORD-LT
A19
D1001/41
CPDAV-LT
A20
D1016/15
UFOWR-LT
A21
A22
R1452
XTXT1
A23
R1451
XTXT0
A24
A25
REF
+10VREF
A26
+5VD
A27
R1136
FOCUS-DA
A28
D1007/1
POWER-HT
A29
A30
C1053
YCAL
CAL
A31
A32
X1101
CPAD01
B1
CPAD03
B2
CPAD06
B3
CPA09
B4
CPA12
B5
B6
D1001/3
CPRD--LT
B7
D1103/11
ALE-HT
B8
D1016/10
RQSOP-LT
B9
D1001/28
BATINTHT
B10
R1054
SCL
B11
R1064
DLEN1-HT
B12
R1067
STROBE0-HT
B13
B14
R1068
STROBE1-HT
B15
C1056
TBSMART
B16
B17
V1431
XYSW0
B18
V1434
XYSW1
B19
B20
V1444
ZTXT1
B21
V1446
ZTXT0
B22
R1444
R1121
INTRDO
B23
B24
V1013
PROBE2
B25
V1014
PROBE1
B26
+5VD
B27
B28
+12V
B29
-12V
B30
V1054
XCAL
B31
B32
OPTION
G1931
32KHZ
D1931
PCF8583
OSCO
OSCI
VDD
VSS
A0
SDA
SCL
INT
SDAUP
SCLUP
R5051
R5053
C1931
22p
C1932
100n
+5VBAT
*PM33XX only
D1010
74F08
&
D1010
74F08
&
D1010
74F08
&

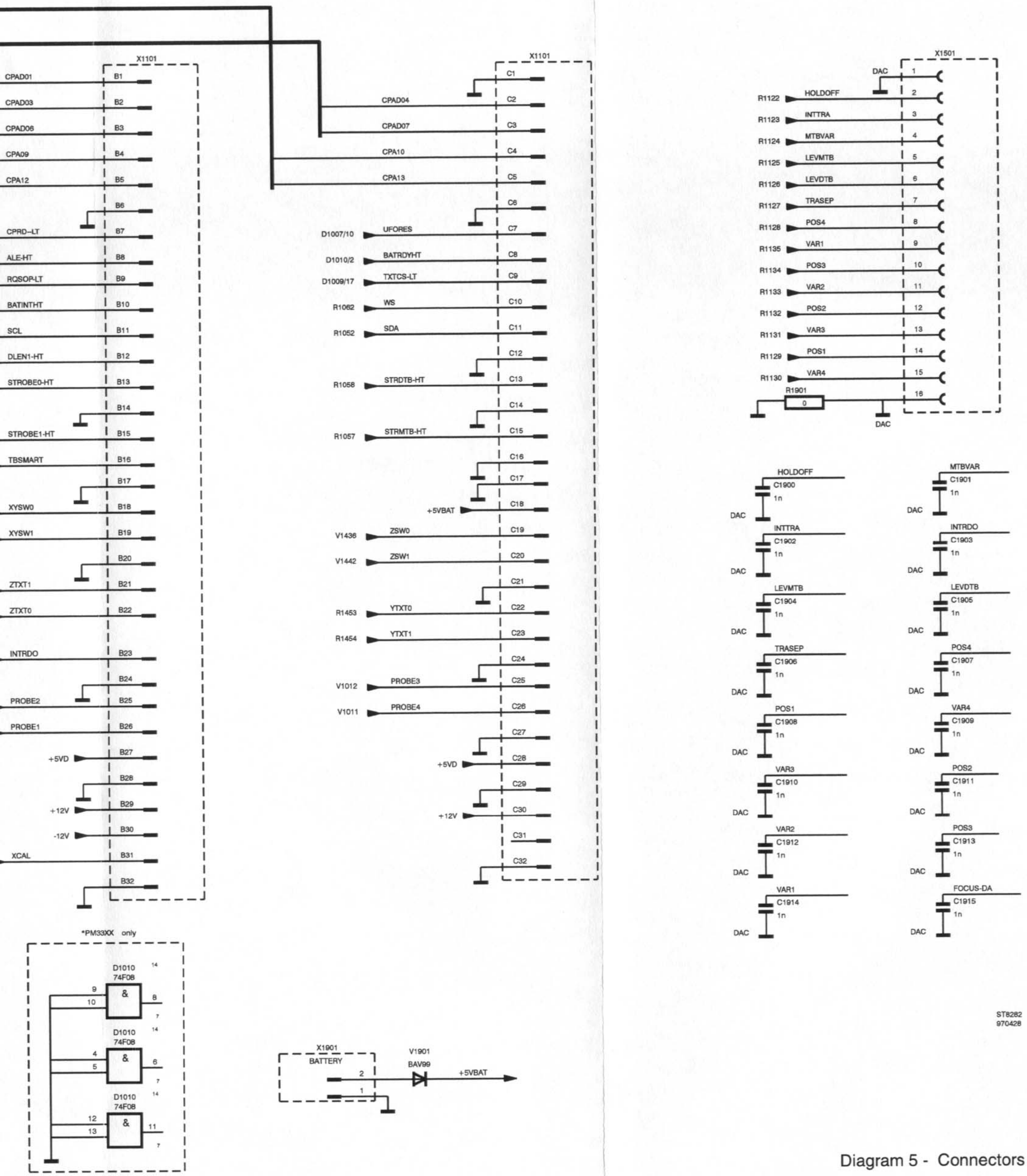


Diagram 5 - Connectors

5.3.6 Parts list

CAPACITORS

Item	Description		Ordering code
C 1002	CAP.CERAMIC	63V 5% 39pF	5322 122 32966
C 1003	CAP.CERAMIC	63V 5% 39pF	5322 122 32966
C 1004	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1006	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1012	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1013	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1014	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1021	CAP.CHIP	63V 10% 2.2nF	4822 121 41339
C 1022	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1051	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 1052	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 1053	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1054	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1056	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1057	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1059	CAP.CHIP	63V 10% 100pF	5322 122 32531
C 1102	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1112	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1123	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1301	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1302	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1303	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1304	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1306	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1307	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1401	CAP.CHIP	63V 5% 27pF	5322 122 31946
C 1402	CAP.CHIP	63V 5% 27pF	5322 122 31946
C 1403	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1404	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1405	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1406	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1407	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1408	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1410	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1414	CAP.CHIP	63V 5% 100nF	4822 122 33496
C 1421	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1801	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1802	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1803	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1804	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1805	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1806	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1807	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1809	CAP.CHIP	63V 10% 10nF	5322 122 34098

Item	Description		Ordering code
C 1811	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1812	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1814	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1815	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1816	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1817	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1832	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1833	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1842	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1843	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1844	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1846	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1861	CAP.CHIP	25V 20% 180µF	5322 124 42228
C 1862	CAP.CHIP	25V 20% 180µF	5322 124 42228
C 1863	CAP.CHIP	25V 20% 180µF	5322 124 42228
C 1867	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1868	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1881	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1882	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1889	CAP.CHIP	50V 10% 10nF	5322 124 21731
C 1891	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1892	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1893	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1894	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1897	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1898	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1899	CAP.CHIP	63V 10% 100nF	4822 122 33496

INTEGRATED CIRCUITS

D 1001	MICROPROC.		5322 209 52205
D 1004	INTEGR.CIRCUIT	N74LS32D PEL	5322 209 73968
D 1007	INTEGR.CIRCUIT	PC74HCT14T PEL	5322 209 71568
D 1008	INTEGR.CIRCUIT	HEF4051BT PEL	5322 209 11446
D 1009	I.C. ROM	PLS153AN-PROG	5322 209 52095
D 1009	INTEGR.CIRCUIT	PLS153AN PEL	5322 209 60478
D 1010	INTEGR.CIRCUIT	N74F08D PEL	5322 209 61002
D 1011	INTEGR.CIRCUIT	N74LS373D PEL	5322 209 60178
D 1012	INTEGR.CIRCUIT	56LFP-10TZU HIT	5322 209 30228
D 1013, D 1015	INTEGR.CIRCUIT	P28F010-150 (*!) and/or	5322 209 30267
	INTEGR.CIRCUIT	P28F020-150 (*!)	5322 209 52348

(*!): This <u>FLASH-ROM is EMPTY</u> and must be loaded with operating and calibration software. Refer to chapter 8.9.2 for further information. FLASH-ROM capacity depends on instrument configuration (e.g. IEEE option)

D 1014	INTEGR.CIRCUIT	N74LS74AD PEL	5322 209 60993
D 1015	FOR IEEE	P28F010-150 (*!)	5322 209 30267
D 1016	INTEGR.CIRCUIT	N74LS138D PEL	5322 209 61478
D 1017	INTEGR.CIRCUIT	PC74HCT259T PEL	4822 209 30086
D 1018	INTEGR.CIRCUIT	HEF4066BT PEL	5322 209 14542

Item	Description		Ordering code
D 1102	INTEGR.CIRCUIT	N74LS74AD PEL	5322 209 60993
D 1104	GPIB	P8291A	5322 209 81264
D 1112	INTEGR.CIRCUIT	OQ0244	5322 209 12468
D 1301	INTEGR.CIRCUIT	MC1489ADR2	5322 209 30232
D 1302	INTEGR.CIRCUIT	MC1488D MOT	5322 209 30269
N 1101	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
D 1401		264ALFP-12T	5322 209 30265
D 1402		PCF3035HP/008 TEXT ASIC	5322 209 30217
N 1101		OP-77GSR	5322 130 62791
N 1401		DAC10GS	5322 209 12469
N 1402		DAC10GS	5322 209 12469
N 1801	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791

RESISTORS

R 1001	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1002	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1003	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1004	RES.CHIP	RC-02H 1% 1E	4822 051 10108
R 1005	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1006	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 1007	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 1008	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1009	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R 1010	RES.CHIP	RC-02H 1% 1E	4822 051 10108
R 1018	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1019	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 1026	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1028	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1029	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1031	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1032	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1033	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1034	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1036	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1037	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1038	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1039	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1041	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1042	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1043	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1044	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1046	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1047	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1048	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1049	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1051	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1052	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1053	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1054	RES.CHIP	RC-02H 1% 215E	4822 051 52151

Item	Description		Ordering code
R 1057	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1058	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1059	RES.CHIP	RMC1/8 1% 100E	4822 051 51001
R 1061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1062	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1063	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1064	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1066	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1067	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1068	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1071	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 1101	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 1102	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 1103	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 1104	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 1106	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1121	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1122	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1123	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1124	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1125	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1126	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1127	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1128	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1129	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1130	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1131	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1132	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1133	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1134	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1135	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1136	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1137	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1401		RC-02H 1% 1M	4822 116 81165
R 1402		1/4W 0.1% 2k5	5322 116 80365
R 1404		RC-02H 1% 2k61	4822 111 91821
R 1406		1/4W 0.1% 5k	5322 116 80369
R 1408		RC-02H 1% 5k11	5322 116 81228
R 1409		RMHz 1/8 1% 464Ω	5322 116 82898
R 1411		RC-02H 1% 100Ω	5322 116 80426
R 1412		RC-02H 1% 16k2	5322 111 92025
R 1413		RC-02H 1% 5k11	5322 116 81228
R 1414	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1421		RC-02H 1% 4k64	5322 111 91903
R 1422		RC-02H 1% 14k7	4822 111 91816
R 1423		RC-02H 1% 1k47	5322 111 91902
R 1424		RC-02H 1% 750Ω	4822 116 82384
R 1426		RC-02H 1% 21k5	4822 111 91818
R 1427		RC-02H 1% 2k15	5322 116 81794
R 1428		RC-02H 1% 2k15	5322 116 81794

Item	Description		Ordering code
R 1429		RC-02H 1% 2k15	5322 116 81794
R 1430		RC-02H 1% 1k	5322 116 80427
R 1431		RC-02H 1% 2k15	5322 116 81794
R 1432		RC-02H 1% 1k47	5322 111 91902
R 1433		RC-02H 1% 1k	5322 116 80427
R 1434		RC-02H 1% 215Ω	5322 116 81226
R 1435		RC-02H 1% 1k	5322 116 80427
R 1436		RC-02H 1% 215Ω	5322 116 81226
R 1437		RC-02H 1% 2k37	4822 111 91819
R 1438		RC-02H 1% 1k96	5322 111 92027
R 1439		RC-02H 1% 1k	5322 116 80427
R 1441		RC-02H 1% 1k96	5322 111 92027
R 1442		RC-02H 1% 4k64	5322 111 91903
R 1443		RC-02H 1% 5k11	5322 116 81228
R 1444		RC-02H 1% 1k62	4822 116 82485
R 1451		RC-02H 1% 511Ω	4822 111 91826
R 1452		RC-02H 1% 511Ω	4822 111 91826
R 1453		RC-02H 1% 215Ω	5322 116 81226
R 1454		RC-02H 1% 215Ω	5322 116 81226
R 1801	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1802	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1805	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1807	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1842	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1843	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1844	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1846	RES.CHIP	RC-01 5% 10E	4822 111 91885
R 1862	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1871	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 1872	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 1873	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 1874	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 1876	RES.CHIP	RC-01 0E	4822 051 10008
R 1877	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1881	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1882	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1883	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1884	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1901	RES.CHIP	RC-01 0E	4822 051 10008

SEMICONDUCTORS

V 1006	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1011	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1012	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1013	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1014	DIODE,CHIP	BAV99 PEL	5322 130 34337

Item	Description		Ordering code
V 1016	DIODE,CHIP	BZX84-C4V3 PEL	5322 130 80256
V 1401		BC848C	5322 130 42136
V 1421		BC858C	4822 130 42513
V 1431		BC858C	4822 130 42513
V 1432		BAV99	5322 130 34337
V 1433		BAV99	5322 130 34337
V 1434		BC858C	4822 130 42513
V 1436		BC858C	4822 130 42513
V 1438		BAV99	5322 130 34337
V 1441		BC858C	4822 130 42513
V 1442		BC858C	4822 130 42513
V 1443		BC858C	4822 130 42513
V 1444		BC858C	4822 130 42513
V 1446		BC858C	4822 130 42513
V 1447		BAV99	5322 130 34337
V 1448		BC848C	5322 130 42136
V 1449		BC848C	5322 130 42136
V 1451		BAV99	5322 130 34337
V 1901		BAV99	5322 130 34337

CONNECTORS

X 1101	CONNECTOR	96-P PIN 2.54	5322 265 61238
X 1301	CONNECTOR	9-P PIN DIPS	5322 265 41143
X 1501	CONNECTOR	P 1.25MM STR	5322 267 51107
X1901	CONNECTOR		5322 265 20525

MISCELLANEOUS

G 1001	CRYSTAL	CRYSTAL 12MHz	5322 242 71444
G 1111	CRYSTAL	CRYSTAL 16MHz	5322 242 72193
H 1001	BUZZER	7EPP-4001 MUR	5322 280 10249

5.4 FRONT UNIT A4

5.4.1 Description

Diagram 1

The front unit incorporates several keys and a number of rotary knobs that are read by a microcomputer D5001. This microcomputer can communicate with the instrument's main microprocessor on unit A3 via connector X5002. The communication from front unit A4 to unit A3 occurs via buffer D5003. The communication in the opposite direction happens via buffer D5006. The flipflops D5004 are used to facilitate this communication.

If unit A3 wants to write information to front unit A4 the following occurs:
D5006 is loaded with 8 bits of information via write pulse UFOWR-LT. This pulse is also applied to flipflop D5004/11 and this makes CPDAV-LT low. This causes an interrupt for the front processor D5001. D5001 reads D5006 via the signal CPURD-LT.

If the front A4 wants to send information to A3 the following occurs:
D5003 is loaded with 8 bits of information via write pulse CPUWR-LT. This pulse is also applied to flipflop D5004/3 and this makes UFODAVLT low. This is recognized by the main microprocessor on unit A3. This device reads the contents of D5003 via signal UFORD-LT.

The rotaries and the keys are read via the 4 bit ROT-BUS and the 8 bit SW-BUS respectively. One bit in these busses is made low at a time and via the 8 bit UFOAD-BUS an 8 bit pattern is sent back to processor D5001. This bit pattern incorporates information concerning the keys/rotaries that are activated.

Diagram 2

The keys and rotaries are both grouped in a matrix. The key position is read out by making one of the SW lines low at a time. If a key is pressed, a low level is switched through to one of the 8 input lines of key latch D5002. The other lines stay at a high level via the pull-up resistors R5121 through R5129.

Each rotary can occupy 4 different states. A rotary incorporates a rotor contact that can make contact with one of the two stator contacts. It is also possible that the rotor makes no contact. The last possibility is that the rotor makes contact with both stator contacts. Most of the rotaries are present on front unit A4. Via connector X5001 the rotaries on the CRT controls unit A5 are read out. The rotaries are read out via the ROT-BUS lines RA, RB, RC and RD that are made low one at a time. This results in a certain bit pattern at the input of key latch D5002. This bit pattern is read by the microprocessor via enable signal PSEN--LT.

Diodes are used throughout the key and rotary matrix to guarantee that false information is not read by the microprocessor in case more than one control is operated at a time.

5.4.2 Signal name list A4.

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.

NAME	MEANING	SOURCE	DESTINATION
PSEN-LT	READ SIGNAL FOR KNOBS AND KEYS	D5001:01	D5002:02
UFODAVLT	FRONT WRITES TO MICROPROCESSOR	D5004:01	X5002:01
UFOWR-LT	MICROPROCESSOR WRITES TO FRONT	X5002:01	D5006:01
			D5004:01

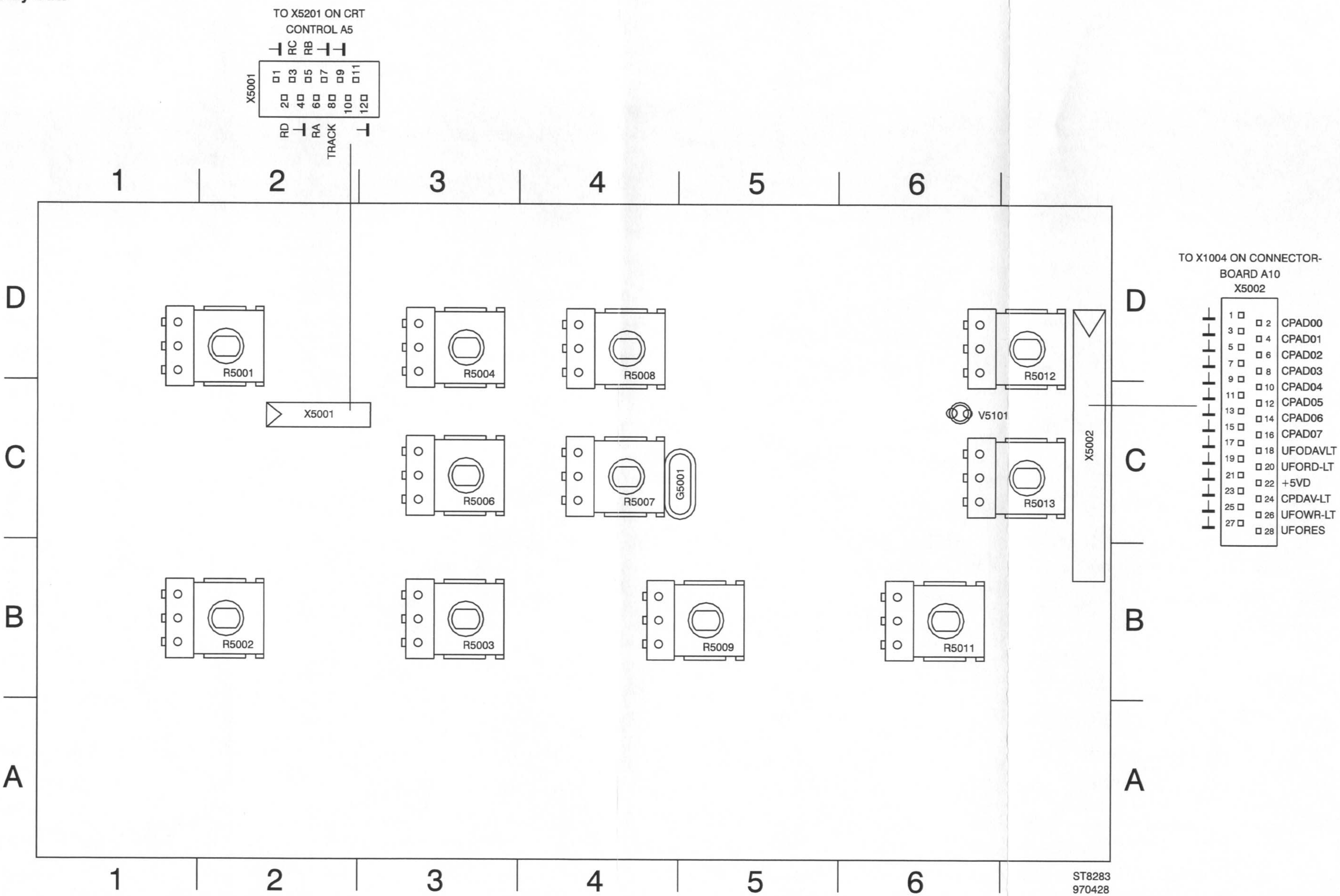
5.4.3 Key switches

Digital oscilloscopes: PM3394A, PM3392A, PM3384A , PM3382A and PM3380A
Analog oscilloscopes: PM3094, PM3092, PM3084 and PM3082
Test code is obtained via the UTIL MAINTENANCE menu. Refer to section 8.11.4.2 for detailed information.

SWITCH	DIGITAL OSC.	ANALOG OSC.	TEST CODE
S5001	DISPLAY		70
S5002	MATH		60
S5003	MEASURE		50
S5004	RECALL		40
S5006	SAVE		30
S5007	DSO		20
S5008	UTILITY	UTILITY	10
S5009	CAL	CAL	00
S5011	PLOT		71
S5012	MAGNIFY-R	TRACE SEPARATION-R	61
S5013	MAGNIFY-L	TRACE SEPARATION-L	51
S5014	TRIGGER	TB MODE	41
S5016	ACQUIRE		31
S5017	pin hole	pin hole	(21)
S5018	SETUPS	SETUPS	11
S5019	AUTO SET	AUTO SET	(01)
S5021	SINGLE	SINGLE/RESET	72
S5022	STOP		62
S5023	RUN	10x MAGN	52
S5024	CURSORS	CURSORS	42
S5026	DTB s	DTB s	32
S5027	SOFTKEY 2	SOFTKEY 2	22
S5028	SOFTKEY 1	SOFTKEY 1	12
S5029	STATUS/LOCAL	STATUS/LOCAL	02
S5031	TIME/DIV ns	MTB ns	73
S5032	TIME/DIV s	MTB s	63
S5033	TB MODE	TRIGGER MTB	53
S5034	DTB ns	DTB ns	43
S5036	MODE	DTB	33
S5037	SOFTKEY 3	SOFTKEY 3	23
S5038	SOFTKEY 4	SOFTKEY 4	13
S5039	SOFTKEY 5	SOFTKEY 5	03
S5041	AC/DC CH4	AC/DC CH4	74
S5042	INV CH4	INV CH4	64
S5043	TRIG CH4	TRIG CH4	54
S5044	AVERAGE	ALT CHOP	44
S5046		BWL	34
S5047	50Ω CH1	50Ω CH1	24
S5048	AMPL mV CH1	AMPL mV CH1	14
S5049	SOFTKEY 6	SOFTKEY 6	04

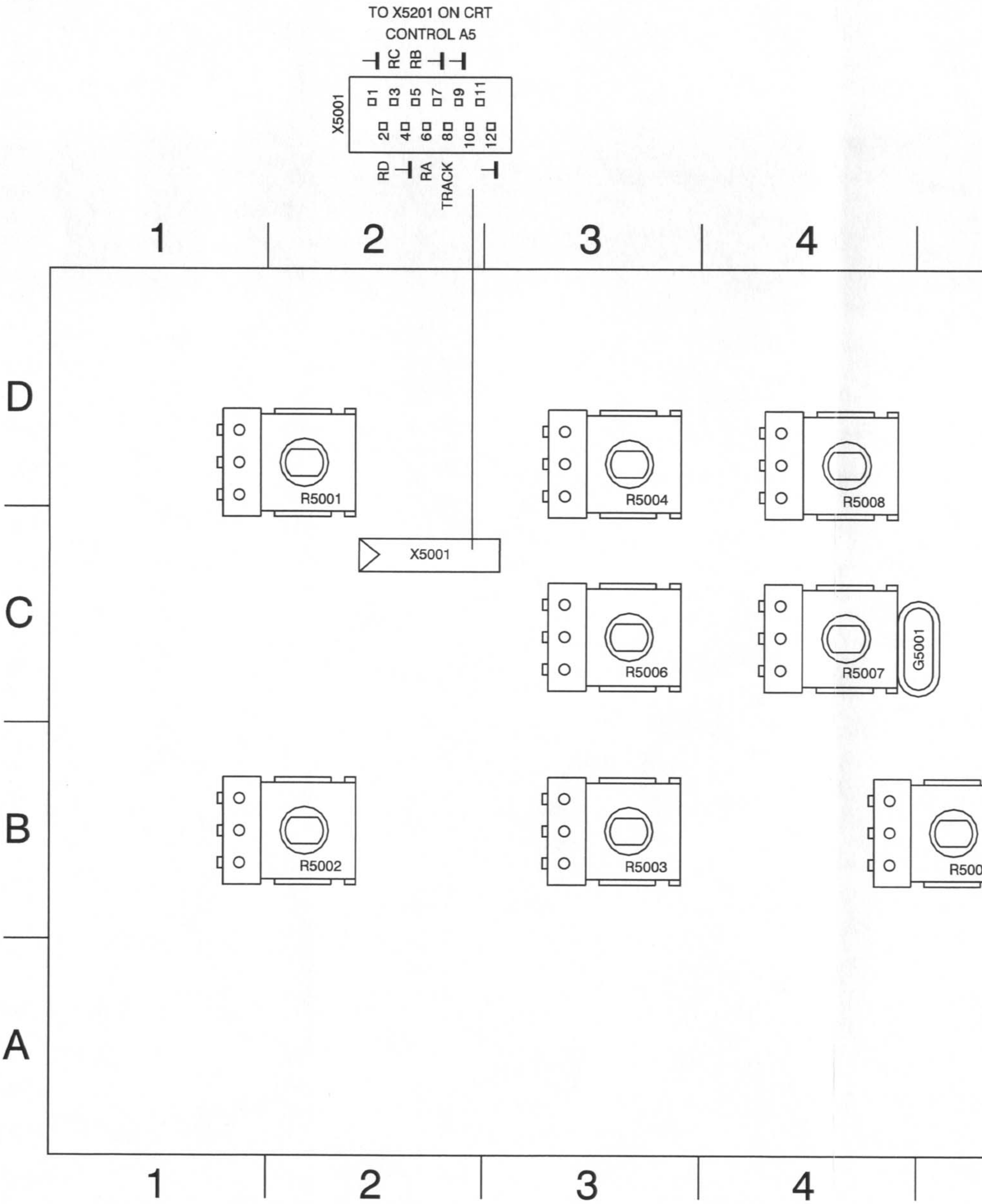
S5051	ON CH4	ON CH4	75
S5052	50Ω CH4	50Ω CH4	65
S5053	TRIG CH3	TRIG CH3	55
S5054	TRIG CH2	TRIG CH2	45
S5056	TRIG CH1	TRIG CH1	35
S5057	ON CH1	ON CH1	25
S5058	AMPL V CH1	AMPL V CH1	15
S5059	TEXT OFF	TEXT OFF	05
S5061	AMPL mV CH4	AMPL mV CH4	76
S5062	CH3+CH4	CH3+CH4	66
S5063	50Ω CH3	50Ω CH3	56
S5064	AMPL mV CH3	AMPL mV CH3	46
S5066	INV CH2	INV CH2	36
S5067	50Ω CH2	50Ω CH2	26
S5068	AMPL mV CH2	AMPL mV CH2	16
S5069	CH1+CH2	CH1+CH2	06
S5071	AMPL V CH4	AMPL V CH4	77
S5072	AC/DC CH3	AC/DC CH3	67
S5073	ON CH3	ON CH3	57
S5074	AMPL V CH3	AMPL V CH3	47
S5076	AC/DC CH2	AC/DC CH2	37
S5077	ON CH2	ON CH2	27
S5078	AMPL V CH2	AMPL V CH2	17
S5079	AC/DC CH1	AC/DC CH1	07
R5001	TRACK	TRACK	.A
R5002	POS 1	POS 1	.B
R5003	POS 2	POS 2	.3
R5004	DELTA	DELTA	.C
R5006	DELAY	LEVEL DTB	.4
R5007	TRIGGER POSITION	DELAY	.D
R5008	HOLD OFF	HOLD OFF	.5
R5009	POS 3	POS 3	.E
R5011	POS 4	POS 4	.6
R5012	X-POS	X-POS	.F
R5013	TRIGGER LEVEL	LEVEL MTB	.7

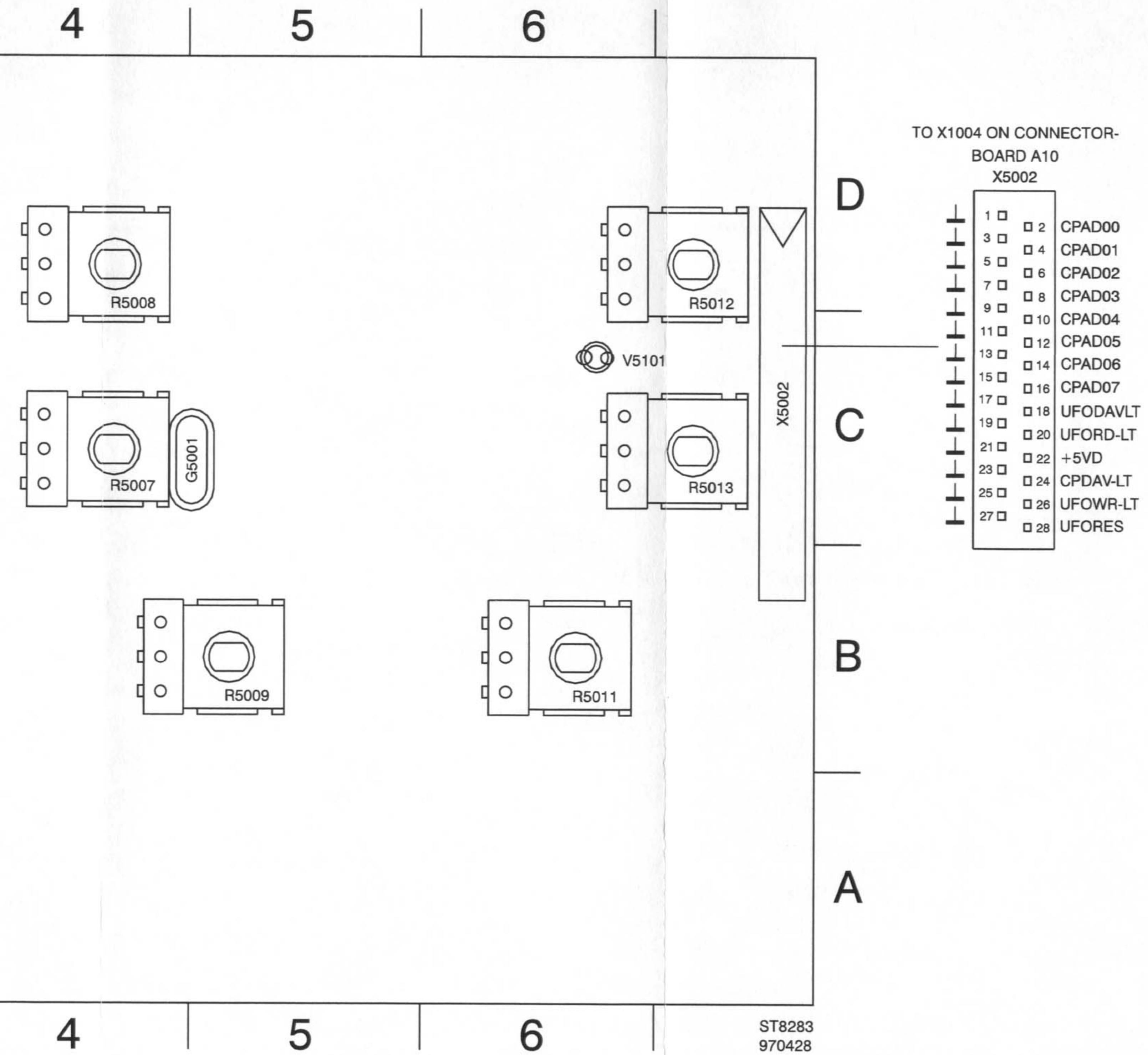
5.4.4 Unit lay-outs



Lay-out 14 - Large component side of front unit A4

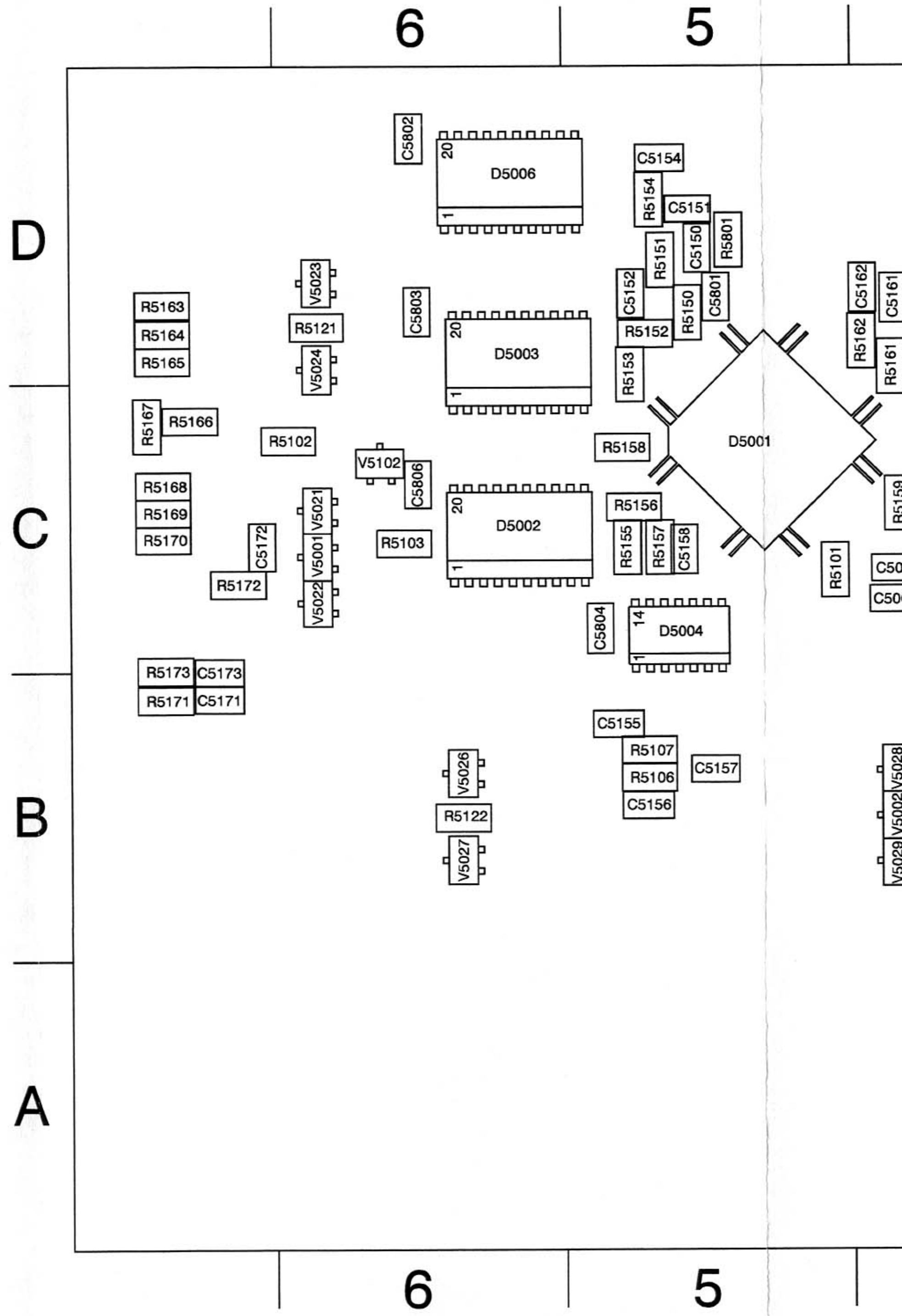
5.4.4 Unit lay-outs

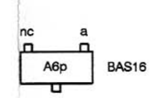


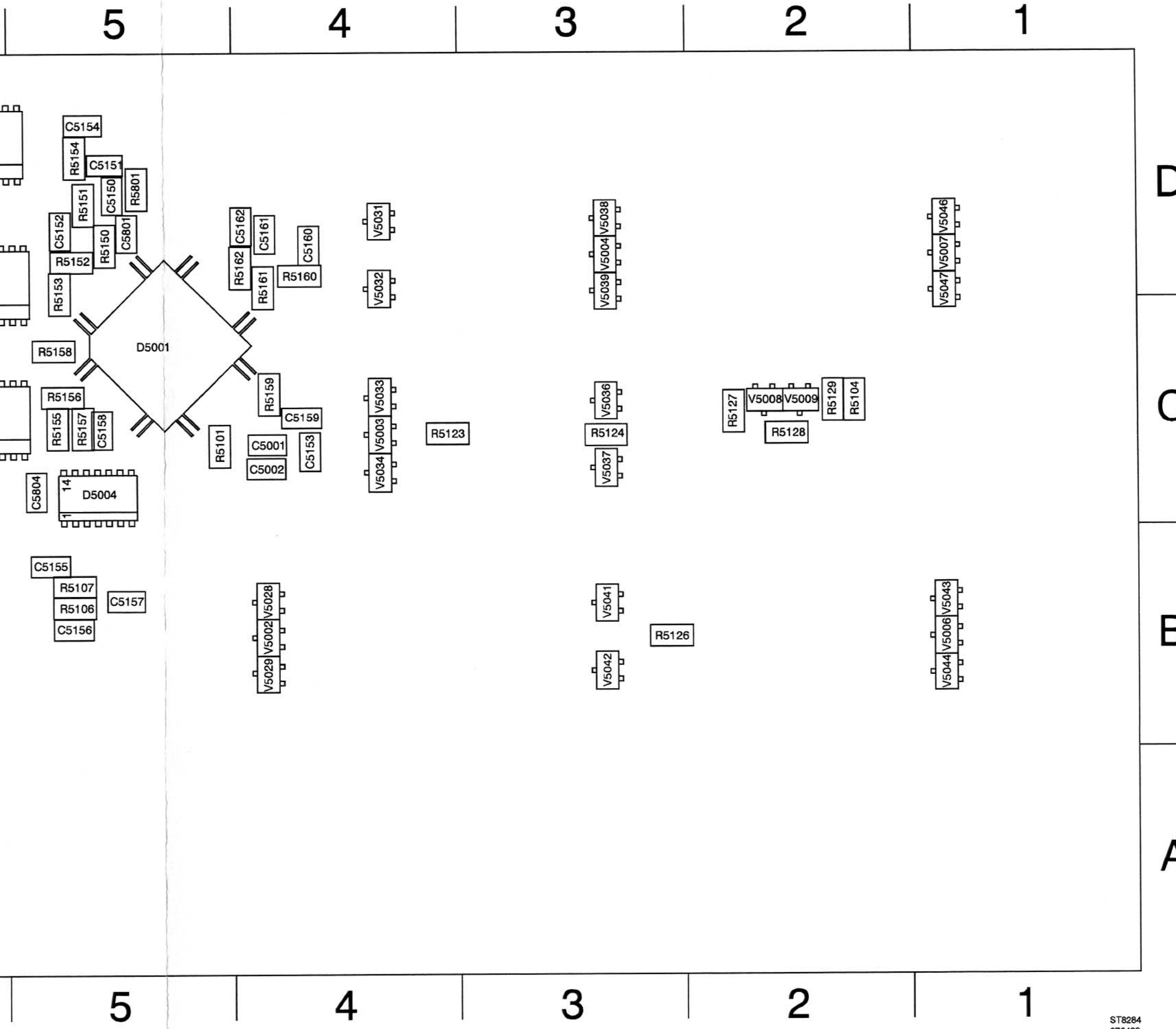


Lay-out 14 - Large component side of front unit A4

Lay-out 15 - Small component side of front unit A4

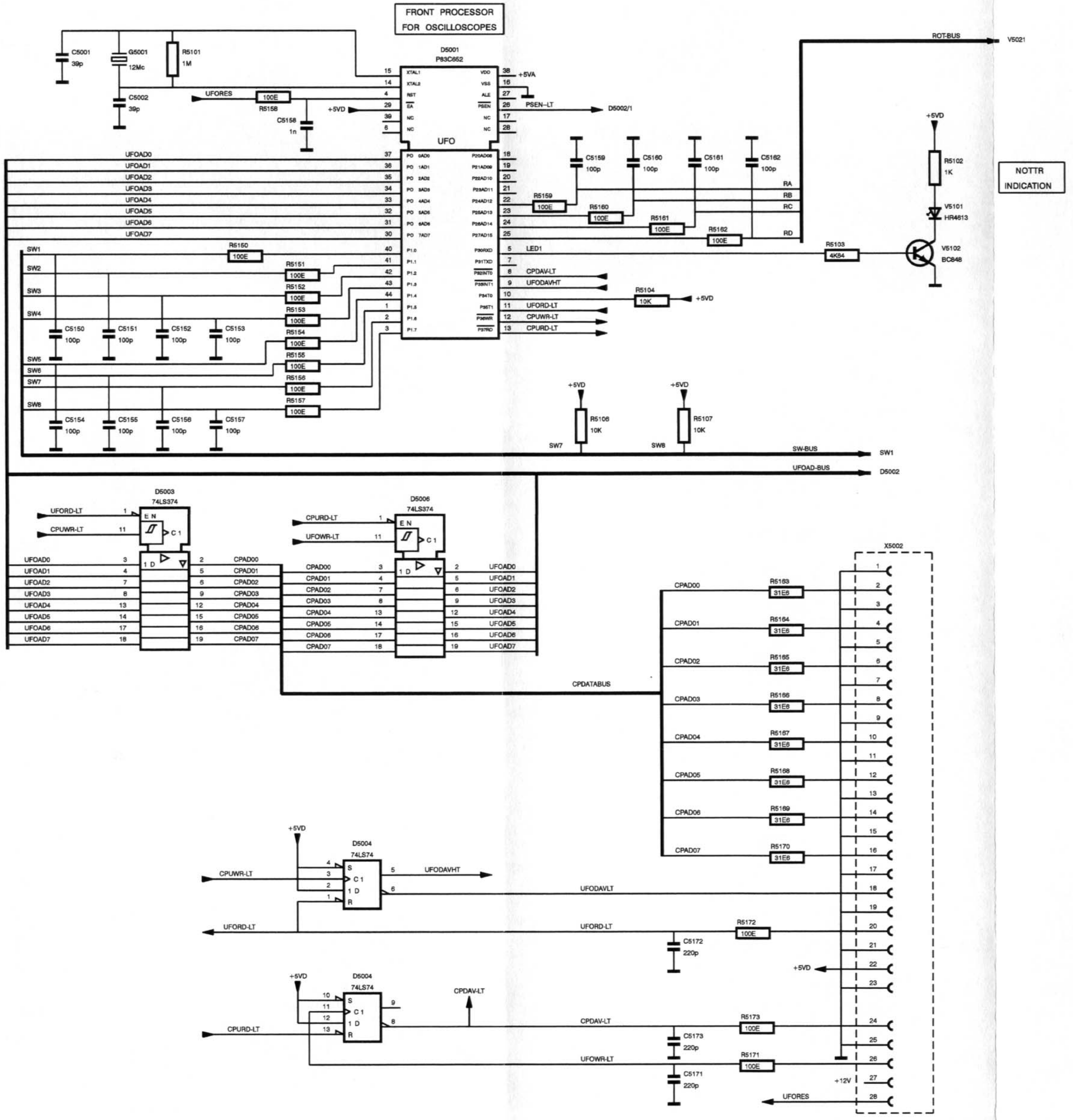

6
5
D
C
B
A
D5006
D5003
D5002
D5001
D5004
C5802
C5803
C5804
C5806
C5154
R5154
C5151
C5150
R5801
R5151
C5152
R5150
C5801
R5152
R5153
R5158
R5156
R5155
R5157
C5158
R5101
C5162
C5161
R5162
R5161
R5163
R5164
R5165
R5167
R5166
R5102
R5121
V5023
V5024
V5102
V5021
V5001
V5022
R5103
R5168
R5169
R5170
C5172
R5172
R5173
C5173
R5171
C5171
C5155
R5107
R5106
C5156
C5157
V5026
R5122
V5027
V5028
V5029

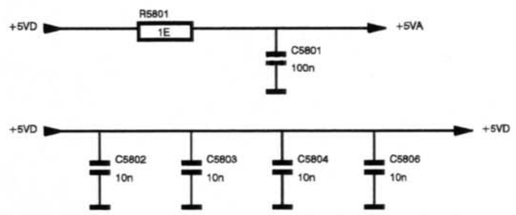

nc
a
A6p
c
BAS16



Lay-out 15 - Small component side of front unit A4

5.4.5 Circuit diagrams



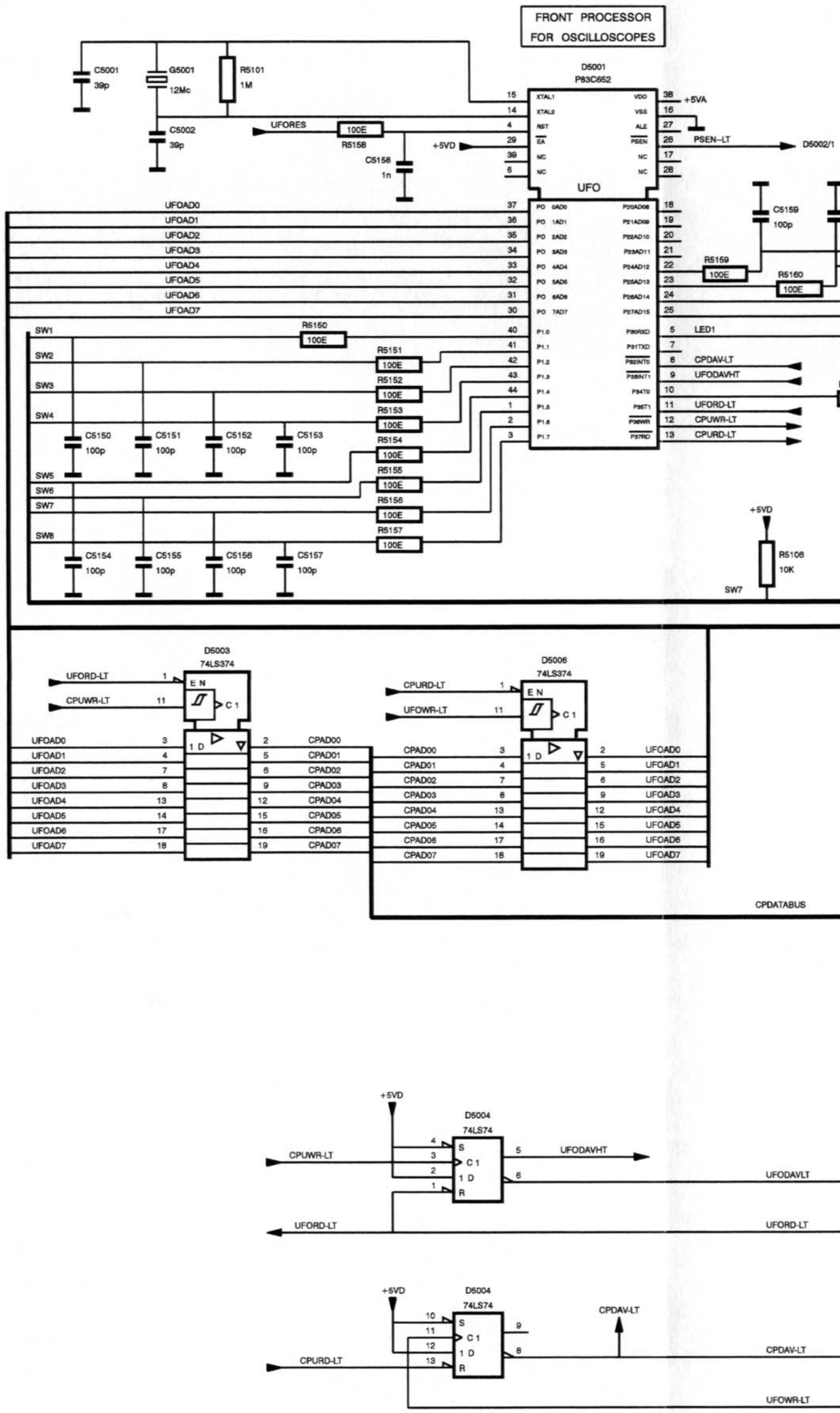


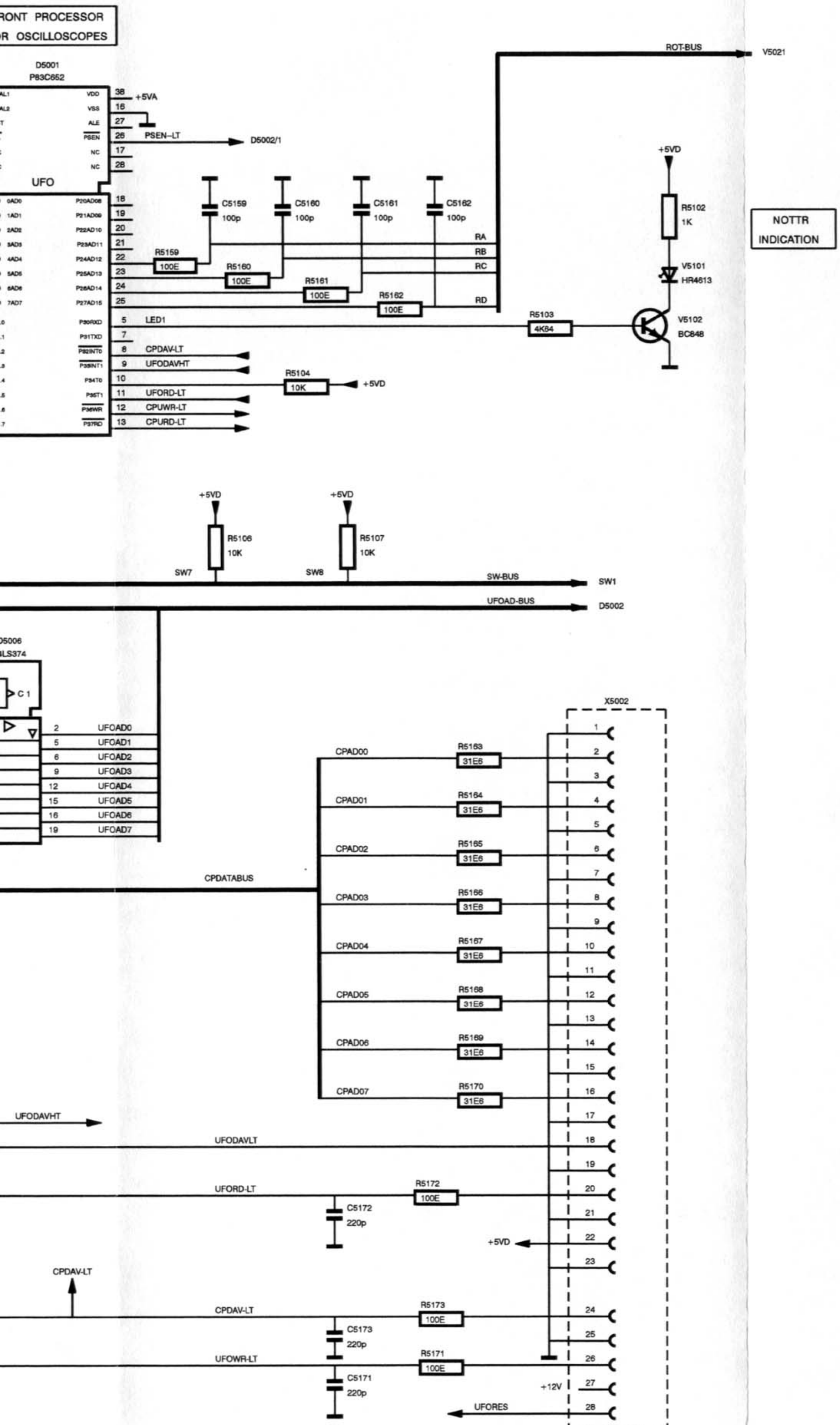
REF NR.	TYPE	+5VD	+5VA	⊥	C
D5001	PCB83C652		38	16	C5801
D5003	74LS374	20		10	C5803
D5004	74LS74	14		7	C5804
D5006	74LS374	20		10	C5806

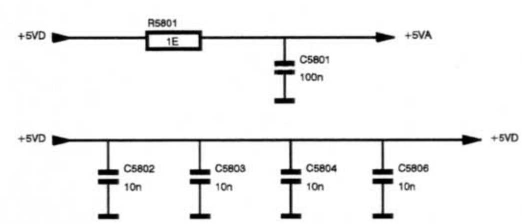
ST6285
970428

A4 - Diagram 1 ; Front processor

5.4.5 Circuit diagrams



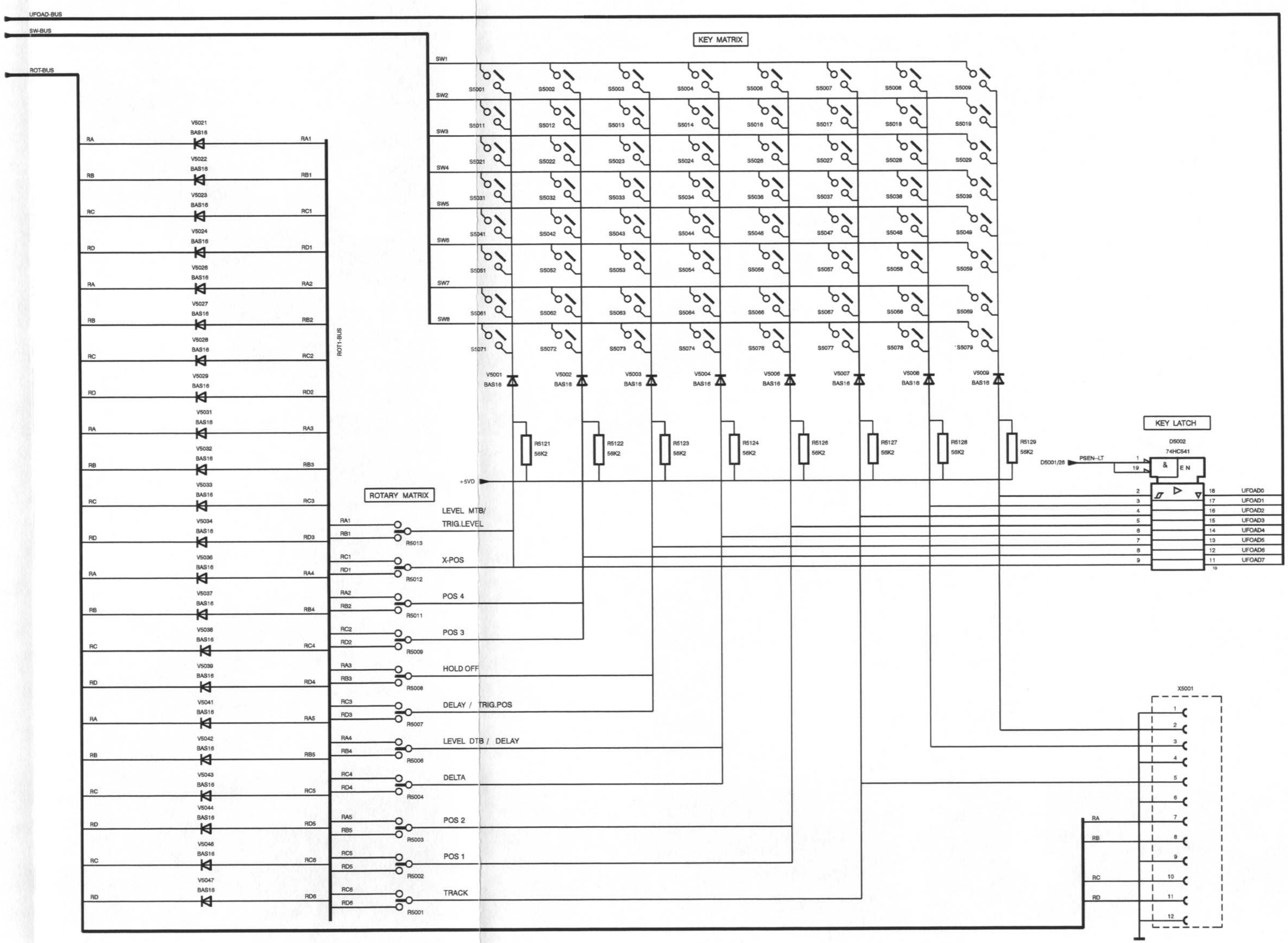




REF NR.	TYPE	+5VD	+5VA	⊥	C
D5001	PCB83C652		38	16	C5801
D5003	74LS374	20		10	C5803
D5004	74LS74	14		7	C5804
D5006	74LS374	20		10	C5806

ST8285
970428

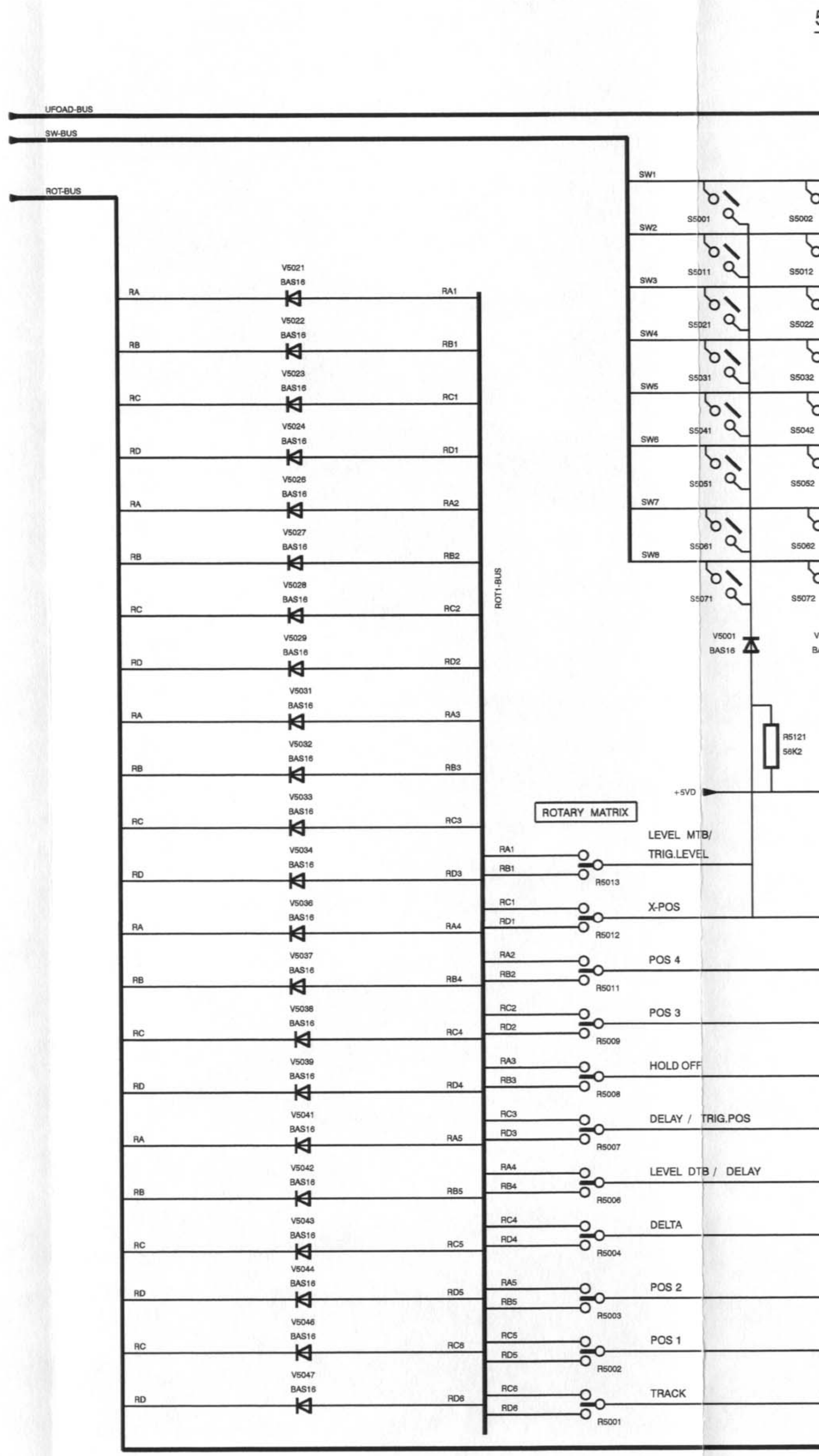
A4 - Diagram 1 ; Front processor

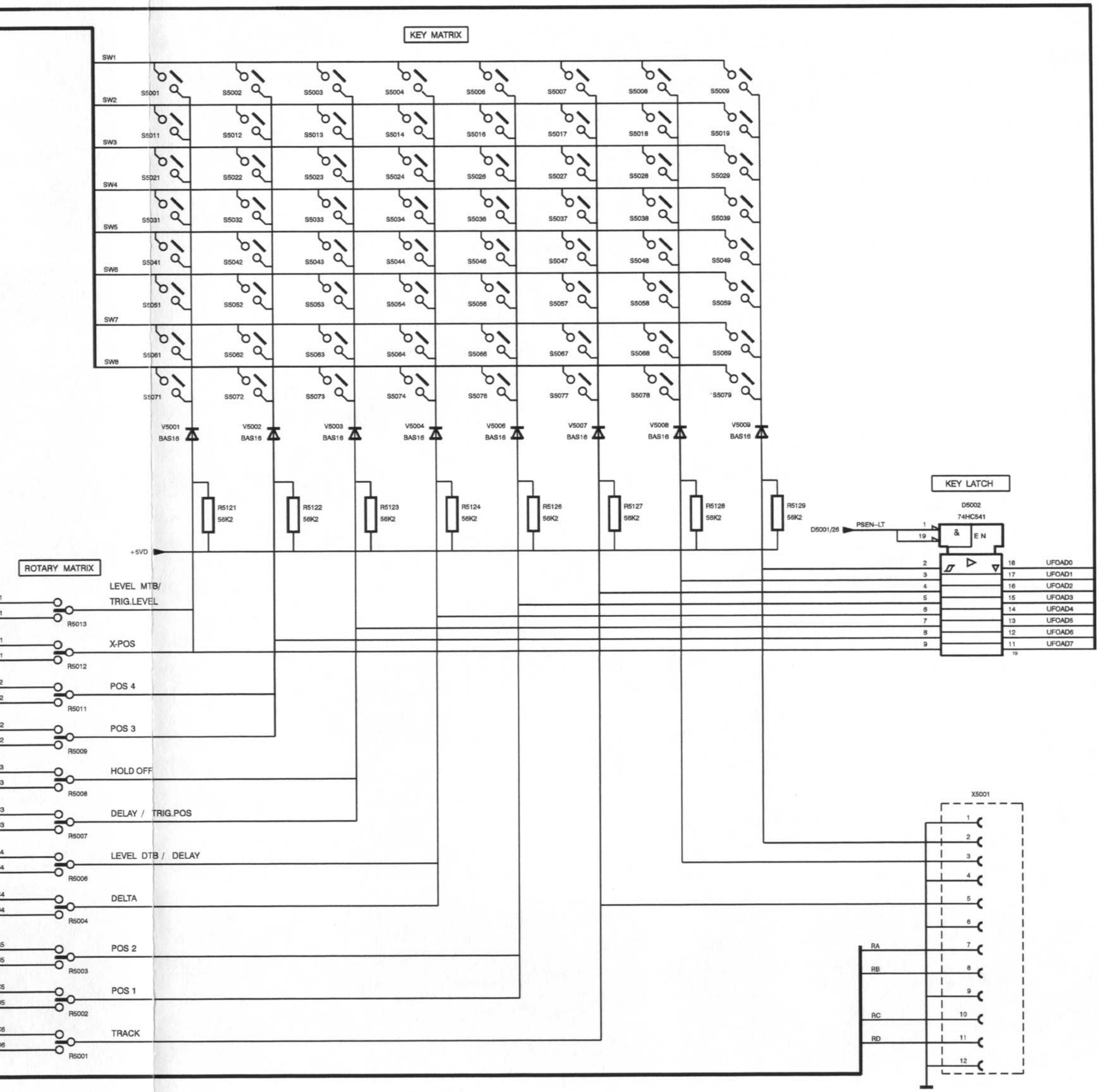


REF NR.	TYPE	+5VD	$\perp$	C
D5002	74HC541	20	10	C5802

ST8286
970428

A4 - Diagram 2 ; Key matrix


UFOAD-BUS
SW-BUS
ROT-BUS
SW1
SW2
SW3
SW4
SW5
SW6
SW7
SW8
S5001
S5002
S5011
S5012
S5021
S5022
S5031
S5032
S5041
S5042
S5051
S5052
S5061
S5062
S5071
S5072
V5001
BAS16
R5121
56K2
+5VD
ROT1-BUS
ROTARY MATRIX
V5021
V5022
V5023
V5024
V5026
V5027
V5028
V5029
V5031
V5032
V5033
V5034
V5036
V5037
V5038
V5039
V5041
V5042
V5043
V5044
V5046
V5047
RA
RB
RC
RD
RA1
RB1
RC1
RD1
RA2
RB2
RC2
RD2
RA3
RB3
RC3
RD3
RA4
RB4
RC4
RD4
RA5
RB5
RC5
RD5
RC6
RD6
LEVEL MTB/
TRIG.LEVEL
R5013
X-POS
R5012
POS 4
R5011
POS 3
R5009
HOLD OFF
R5008
DELAY / TRIG.POS
R5007
LEVEL DTB / DELAY
R5006
DELTA
R5004
POS 2
R5003
POS 1
R5002
TRACK
R5001



REF NR.	TYPE	+5VD	⊥	C
D5002	74HC541	20	10	C5802

A4 - Diagram 2 ; Key matrix

5.4.6 Parts list

Item	Description		Ordering code
CAPACITORS			
C 5001	CAP.CERAMIC	63V 5% 39pF	5322 122 32966
C 5002	CAP.CERAMIC	63V 5% 39pF	5322 122 32966
C 5150	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5151	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5152	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5153	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5154	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5155	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5156	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5157	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5158	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 5159	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5160	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5161	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5162	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5171	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 5172	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 5173	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 5801	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 5802	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5803	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5804	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5806	CAP.CHIP	63V 10% 10nF	5322 122 34098
INTEGRATED CIRCUITS			
D 5001	INTEGR.CIRCUIT	P83C652 EBB/077	5322 209 90095
D 5002	I.C. INTERFACE	PC74HC541T PEL	4822 209 63763
D 5003	INTEGR.CIRCUIT	N74LS374D PEL	5322 209 60995
D 5004	INTEGR.CIRCUIT	N74LS74AD PEL	5322 209 60993
D 5006	INTEGR.CIRCUIT	N74LS374D PEL	5322 209 60995
MISCELLANEOUS			
G 5004	CERAM FILTER	12MHZ KYO	5322 242 71444
H 5101	LED	TLHR4613 AEG	5322 130 81522
ROTARY SWITCHES			
R 5001	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5002	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5003	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5004	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5006	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036

Item	Description		Ordering code
R 5007	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5008	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5009	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5011	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5012	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5013	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
RESISTORS			
R 5101	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 5102	RES.CHIP	RC-02H 1% 1K	4822 051 10102
R 5103	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 5104	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5106	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5107	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5121	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5122	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5123	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5124	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5126	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5127	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5128	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5129	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5150	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5151	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5152	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5153	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5154	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5155	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5156	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5157	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5158	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5159	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5160	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5161	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5162	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5163	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5164	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5165	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5166	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5167	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5168	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5169	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5170	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5171	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5172	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5173	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5801	RES.CHIP	RC-01 5% 1E	4822 051 10108

Item	Description		Ordering code
SEMICONDUCTORS			
V 5001	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5002	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5003	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5004	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5006	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5007	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5008	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5009	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5021	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5022	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5023	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5024	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5026	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5027	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5028	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5029	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5031	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5032	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5033	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5034	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5036	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5037	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5038	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5039	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5041	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5042	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5043	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5044	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5046	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5047	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5102	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
CONNECTORS			
X 5001	CONNECTOR	P 1.25MM STR	4822 267 50668
X 5002	CONNECTOR	P 1.25MM STR	5322 267 60311

5.5 CRT CONTROLS UNIT A5

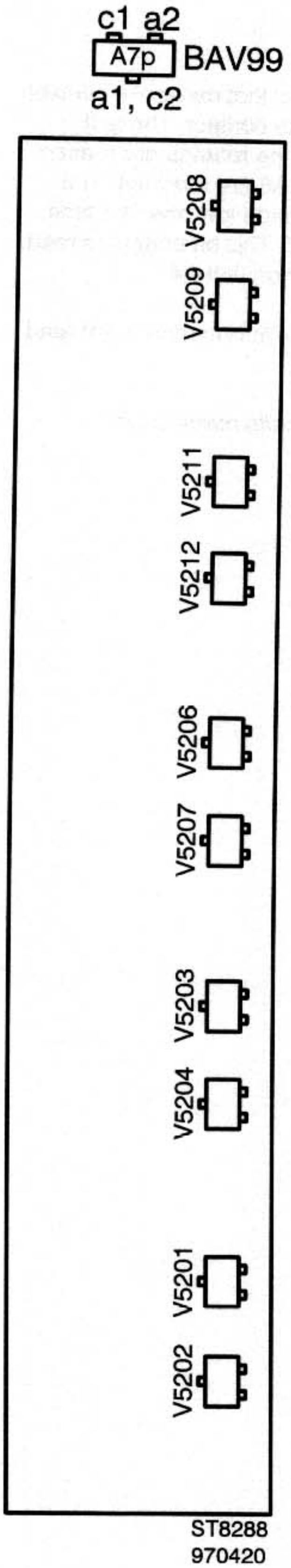
5.5.1 Description

Each rotary can occupy 4 different states. A rotary incorporates a rotor contact that can make contact with one of the two stator contacts. It is also possible that the rotor makes no contact. The last possibility is that the rotor makes contact with both stator contacts. Most of the rotaries are present on front unit A4. Via connector X5201 the rotaries on the CRT controls unit A5 are read out. The rotaries are read out via the ROT-BUS lines RA, RB, RC and RD that are made low one at a time. This results in a certain bit pattern at the input of key latch D5002 on unit A4. This bit pattern is read by the microprocessor via enable signal PSEN--LT from the front processor on unit A4.

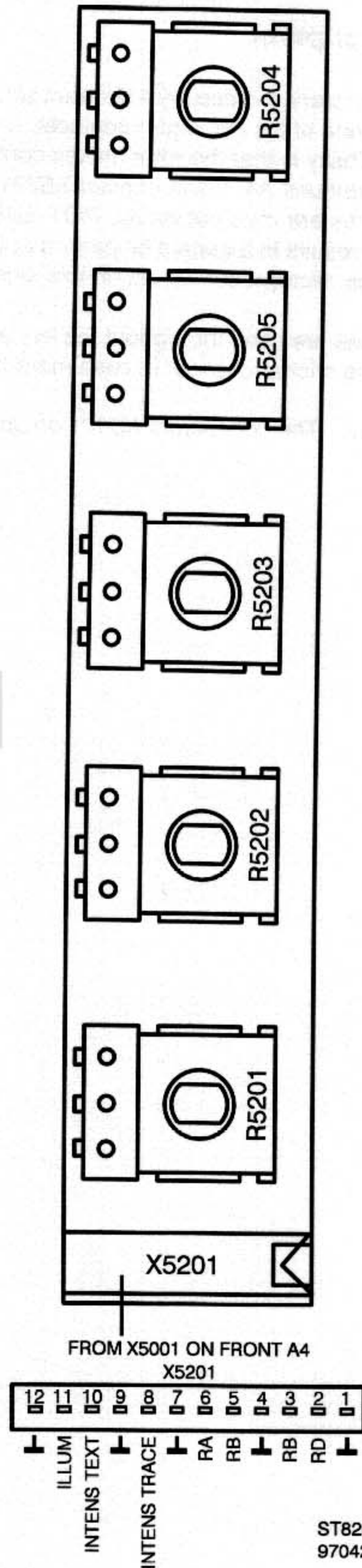
Diodes are used throughout the key and rotary matrix to guarantee that false information is not read by the microprocessor in case more than one control is operated at a time.

Note: The connectors X5001 on unit A4 and X5201 on unit A5 have opposite numeration.

5.5.2 Unit Lay-outs

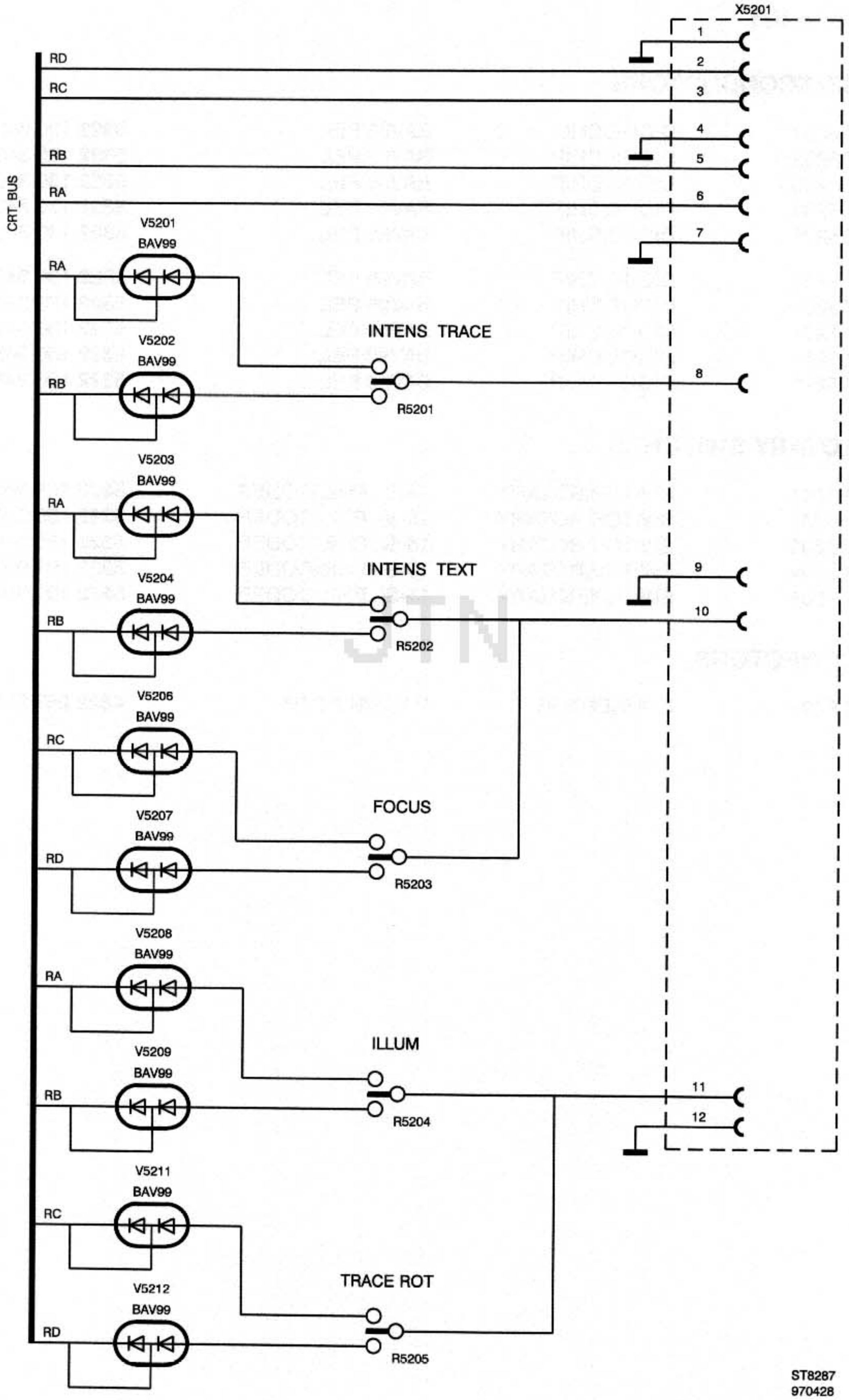


Lay-out 1; Smal component side of CRT controls unit A5



Lay-out 2; Large component side of CRT controls unit A5

5.5.3 Circiuit diagram



A5 - Diagram1; CRT controls unit

Item	Description		Ordering code

5.5.4 Parts list

SEMICONDUCTORS

V 5201	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5202	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5203	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5204	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5206	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5207	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5208	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5209	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5211	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5212	DIODE,CHIP	BAV99 PEL	5322 130 34337

ROTARY SWITCHES

R 5201	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5202	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5203	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5204	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5205	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036

CONECTORS

X 5201	CONNECTOR	P 1.25MM STR	4822 267 50668

5.6 POWER SUPPLY A6

5.6.1 Description A6

Diagram 1

Diagram 1 comprises the following circuit parts:
- input circuit
- converter circuit
- line trigger circuit

Input circuit

Input to the circuit is the mains voltage. The following voltages are allowed:
- AC voltage between 90 and 250 V
- Theoretically a DC voltage between 100 and 380 V can be applied.

The mains input is primarily protected by a slow acting 1.6 A fuse (1.6 AT), which is located on the rear of the instrument.
Inrush current limiting is provided by NTC resistor R1001.
By means of the capacitors C1002, C1003, C1004 and C1006, an input signal for the line trigger generator is made. The capacitors form a voltage divider. This functions only if the mains voltage is AC.

C1001, 1002, 1006, 1007 and L1001 are for interference suppression.
The mains voltage is rectified by V1001 through 1004 and smoothed by C1008 and C1009.
The output voltage from the rectifier at C1009 can between 100 and 380 V.

WARNING: For measurements in the primary circuit, the use of an isolating transformer is strongly recommended. If no isolating transformer is used, all measurements in the primary circuit must be carried out with floating measuring instruments.

Converter circuit

The power supply is a multiple output flyback converter of the SOPS (Self Oscillating Power Supply) principle. Basically, the converter consists of a switch with control circuitry (transistor V1019) and a transformer (T1001).
The first switching-on of V1019 is initiated by a small current via R1007/R1008. When V1019 is ON, the control voltage of T1001 pin 18 to C1011 is positive and this keeps V1016 and V1019 ON. During the ON or FORWARD cycle, the current through the primary winding of T1001 increases linearly, and energy (0.5 LI^2) is stored into this transformer. At about 2.5 A, this value is determined by the control circuit, thyristor V1014 is switched ON and due to this, V1019 is switched OFF. This is the beginning of the OFF or FLYBACK cycle. Now, the transformer voltages are reversed and the stored energy is transformed to the secondary windings. As long as the transformer is not fully demagnetized, the voltage from pin 18 to C1011 is negative and this will keep V1007, V1016 and V1019 switched OFF. As soon as the transformer demagnetizing has ended, this voltage becomes zero and so, a positive going voltage appears at C1011. Due to this, V1007, V1016 and V1019 are switched ON and the FORWARD cycle starts again.

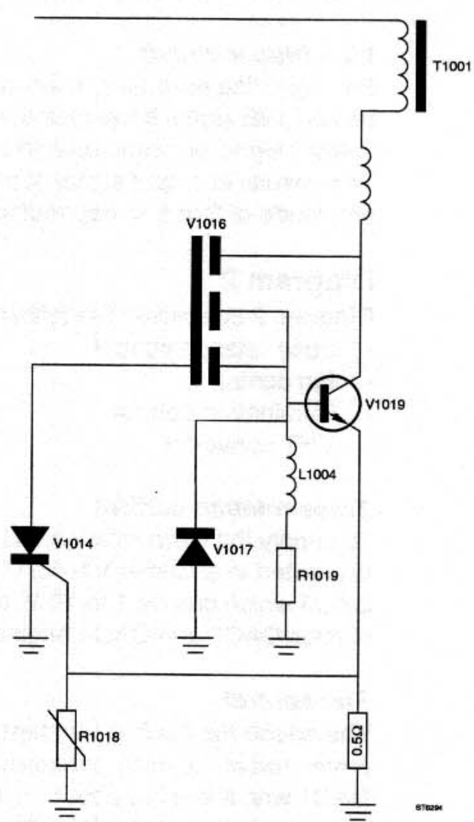


Figure 5.5 Converter circuit

To reduce the switching losses in V1019, a dV/dt limiter, often called "snubber", is used. C1021 decreases the dV/dt of the collector voltage of V1019 during switching off, as the current to the transistor can pass during a certain time through C1021. This slowing down of the collector voltage will reduce the switching losses during switching off. During the ON cycle, the energy in C1021 is transferred to L1006 and the capacitor is discharged. During the OFF cycle, the energy in L1006 is transferred to C1018 and during the next ON cycle, the energy in C1018 is delivered to the transformer. In that way, no energy is wasted. As a consequence of this system, the voltage at the transformer is slightly increased during the first part of the ON cycle, but this has no disadvantages.

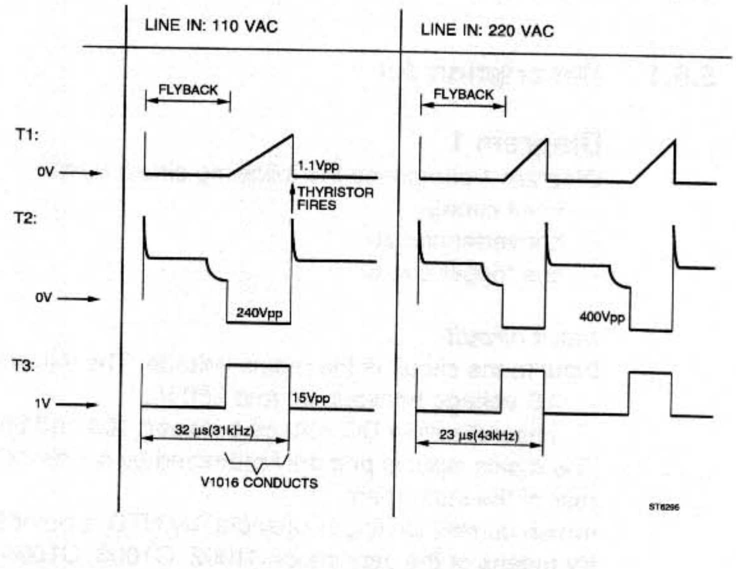


Figure 5.6 *Timing diagram converter circuit*

Voltage regulation takes place by varying the control voltage from R1046 to the gate of V1014. A more positive voltage will cause a smaller peak current through the transformer and this results in smaller output voltages. The converter frequency can be 20 to 50 kHz. This depends on the mains voltage and the load of the power supply. The lower the mains voltage, the lower the frequency. A lower load means a higher frequency. R1018 compensates for gate-cathode voltage variations of V1014 due to the temperature.

Line trigger circuit

For triggering purposes, a sinusoidal signal at the mains frequency is available. Of course there will be no LINE signal if the mains voltage is DC.
A small signal is picked up with capacitors C1002, C1003, C1004 and C1006 and amplified in N1046. This results in output signal at pin 1. This circuit provides a sine-wave with low distortion and with an amplitude of 3 to 8 V, depending on the mains voltage.

Diagram 2

Diagram 2 comprises the following circuit parts:

- trace rotation control
- fan control
- illumination control
- EHT converter

Trace rotation control

To supply the trace rotation coil, of which the resistance is about 200 Ω, a voltage of -10 V to +10 V is created in amplifier V1146-1147. Control takes place via a part of N1101 by means of the signal DAC3 which can be 1 to 10 V, together with the signal DAC0 with a level between 1 and 3V. The signals DAC3 and DAC0 originate from the microprocessor unit A3.

Fan control

The speed the cooling fan depends on the temperature in the oscilloscope. This temperature is measured at the microprocessor unit A3 by a NTC resistor. The microprocessor generates the signal DAC1 with a level of about 1.7 to 4 V. The fan is supplied by amplifier V1148 which is controlled by this signal. The output from the amplifier is a DC voltage of -10 to +10 V.

Illumination control
The illumination of the graticule must be variable. For this reason the illumination voltage can be varied between about 2 and 28 V. Control of the illumination amplifier V1148 takes place by means of the signal DAC2, level about 1.7 to 4 V. The output voltage from the amplifier is -16 to +10 V.

EHT converter
The EHT converter supplies three voltages.
- An AC voltage of 6,3 V (F1, F2), to supply the filament of the CRT.
- The cathode voltage to the CRT, a DC voltage of -2200 V.
- The post acceleration voltage to the CRT, a DC voltage of +14 kV.

These voltages are made in a separate converter, equipped with a separate transformer. The EHT converter is a resonant flyback converter, the output voltages of the transformer are sinusoidal.

Basically, the converter consists of a resonant LC circuit formed by the transformer with its parasitic capacitances. This resonance circuit defines the converter frequency which is about 80 kHz. Energy is supplied to this LC circuit by injecting current to it from the supply voltage, the +58 V, by switching ON V1109. Most of the time, V1109 is OFF. The primary peak to peak amplitude is about 200 V, the negative peak about -40 V. During the positive half of the sine-wave, capacitor C1111 is discharged very little via R1114.

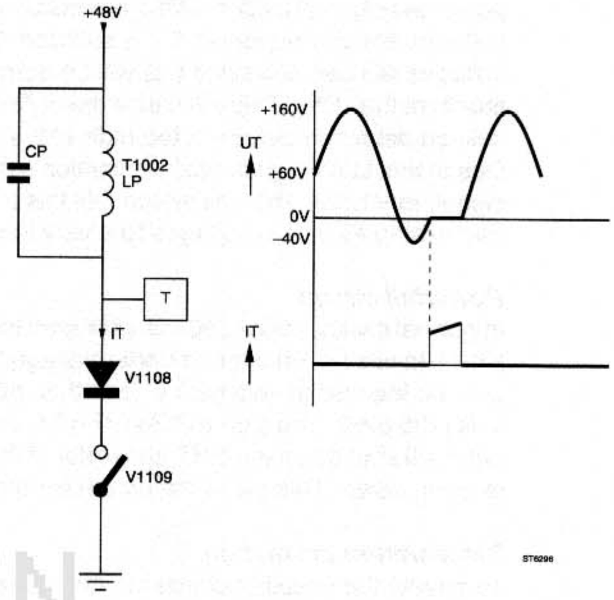


Figure 5.7 *High tension generator*

When the sine-wave reaches its most negative value, a small current will pass through C1111 and V1106 and this acts as base current for V1102. Due to this, the thyristor configuration V1102-1109 will be switched ON and energy is supplied to the resonant circuit. The ON time of V1109 can be controlled by the operational amplifier N1101 pin 7.

To protect against too high voltages, e.g. caused by a defective N1101, the circuit is provided with an over-voltage protection. This circuit consists of V1103 and V1104. The maximum output voltage is defined by this circuit as it will overrule the control circuit at too high voltage.

The AC voltage at T1002 pins 4 and 5 is used to supply the CRT filament voltage of 6.3 V. The voltage at pins 11 and 3 is rectified and this -2200 V is used as CRT cathode voltage. The voltage at pins 11 and 2 is rectified and multiplied in a cascade circuit. The output, +14 kV, is used as post acceleration voltage to the CRT.

Diagram 3
Diagram 3 comprises the following circuit parts:
- secondary output circuitry
- over- and under-voltage protection
- power fail circuit
- temperature protection
- 10 V reference circuit

Secondary output circuitry

The secondary output circuits consist of rectifier diodes and buffer capacitors, followed by chokes and capacitors for ripple suppression. The output circuits are protected against overload by the under voltage protection.

Over and under-voltage protection

To protect the oscilloscope circuitry against over-voltage and the supply circuits against overload, the power supply is provided with a protection circuit. As, due to the multiple output principle, the output voltages are interdependent, it is sufficient to check only one voltage. In case of overload, the output voltages will decrease and this will be detected by the under-voltage detection, V1241, which monitors the -12 V. This will cause the collector of V1241 to be LOW. In case of over-voltage, the over-voltage detection detects a too high +12 V or +5 V and this will cause pin 13 of N1236 to be LOW. Due to this LOW signal, the intervention circuit V1241-1242-1243 will cause a current, the TPDOWN signal, to V1213. This will switch ON this thyristor and this causes switching off the converter by decreasing all output voltages to a very low, safe value.

Powerfail circuit

In normal cases, about 250 ms after switching on, the signal POWER HT will become HIGH and stay HIGH. In case of an over- or under-voltage failure, the signal will become LOW due to V1242. In case of a too low mains voltage, i.e. less than 80 V (AC) or 100 V (DC), the signal will become LOW due to N1236 pin 2. The signal POWER HT is a logic signal, it will not switch off the main convertor circuit, but it will shut down the EHT-convertor. POWER HT signals to the microprocessor unit A3 that power is going down. This gives the processor the opportunity to save important data.

Temperature protection.

To protect the circuits against too high temperatures, the oscilloscope is provided with an overheat shutdown circuit. The temperature of the power supply printed circuit board is monitored by NTC resistor R1231, which is located on the PCB. At temperatures higher than about +80 °C, pin 8 of N1236 will become HIGH and this will cause pin 14 to be LOW. Due to this, the TPDOWN signal becomes active and the converter is switched off by triggering V1213. This temperature protection is only meant for the power supply.

+10 V reference circuit

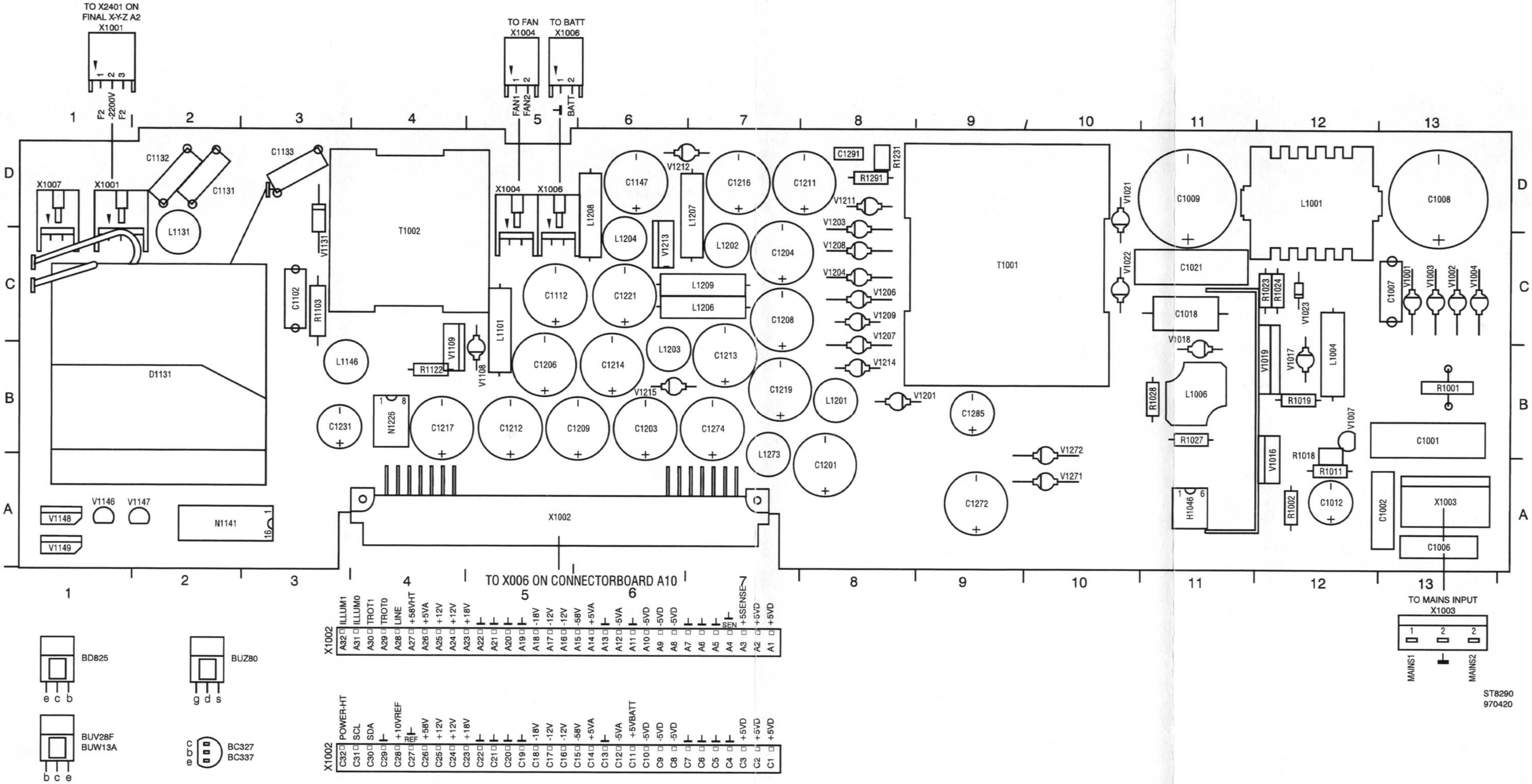
For application in the power supply and at other places in the oscilloscope, a stable +10 V reference voltage is needed. This voltage is made by N1226/V1226 in the power supply. The voltage is not adjustable. The accuracy is ±5 mV. Temperature coefficient is ±0,001°K. The load of the +10 V is about 10 mA.

5.6.2 Signal name list A6

Note: *In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.*

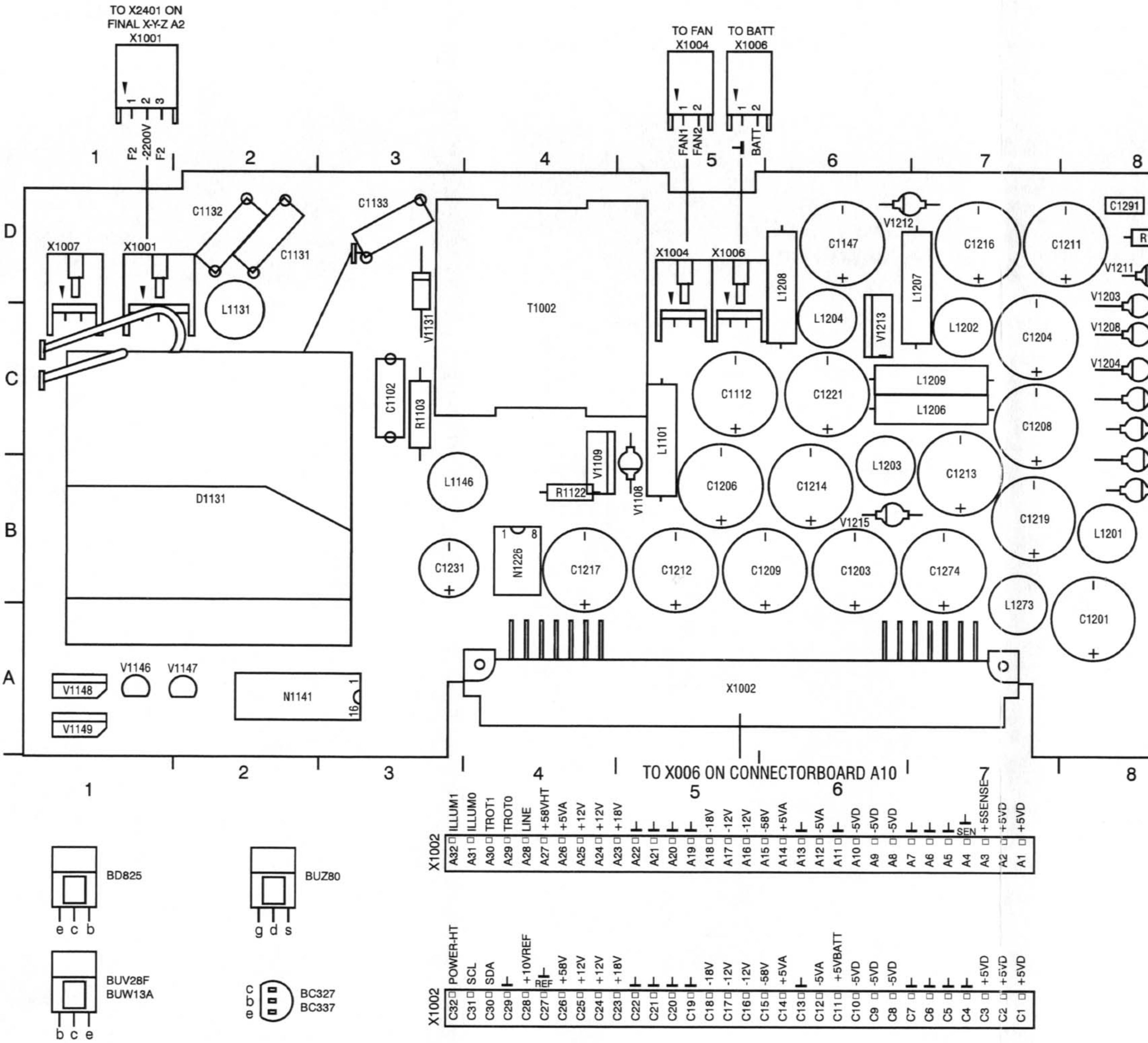
NAME	MEANING	SOURCE	DESTINATION
FAN0	FAN SUPPLY 0	S-12V:02	X1004:02
FAN1	FAN SUPPLY 1	L1146:02	X1004:02
ILLUM0	GRATICULE ILLUMINATION 0	S-18V:02	X1002:02
ILLUM1	GRATICULE ILLUMINATION 1	V1149:02	X1002:02
LINE	LINE/MAINS TRIGGER SIGNAL	N1046:01	X1002:01
POWER-HT	POWER UP INDICATION SIGNAL	N1236:03	X1002:03
			V1111:02
SCL	SERIAL CLOCK	X1002:02	N1141:02
SDA	SERIAL DATA	X1002:02	N1141:02
TROT0	TRACE ROTATION 0	EARTH:02	X1002:02
TROT1	TRACE ROTATION 1	V1146:02	X1002:02

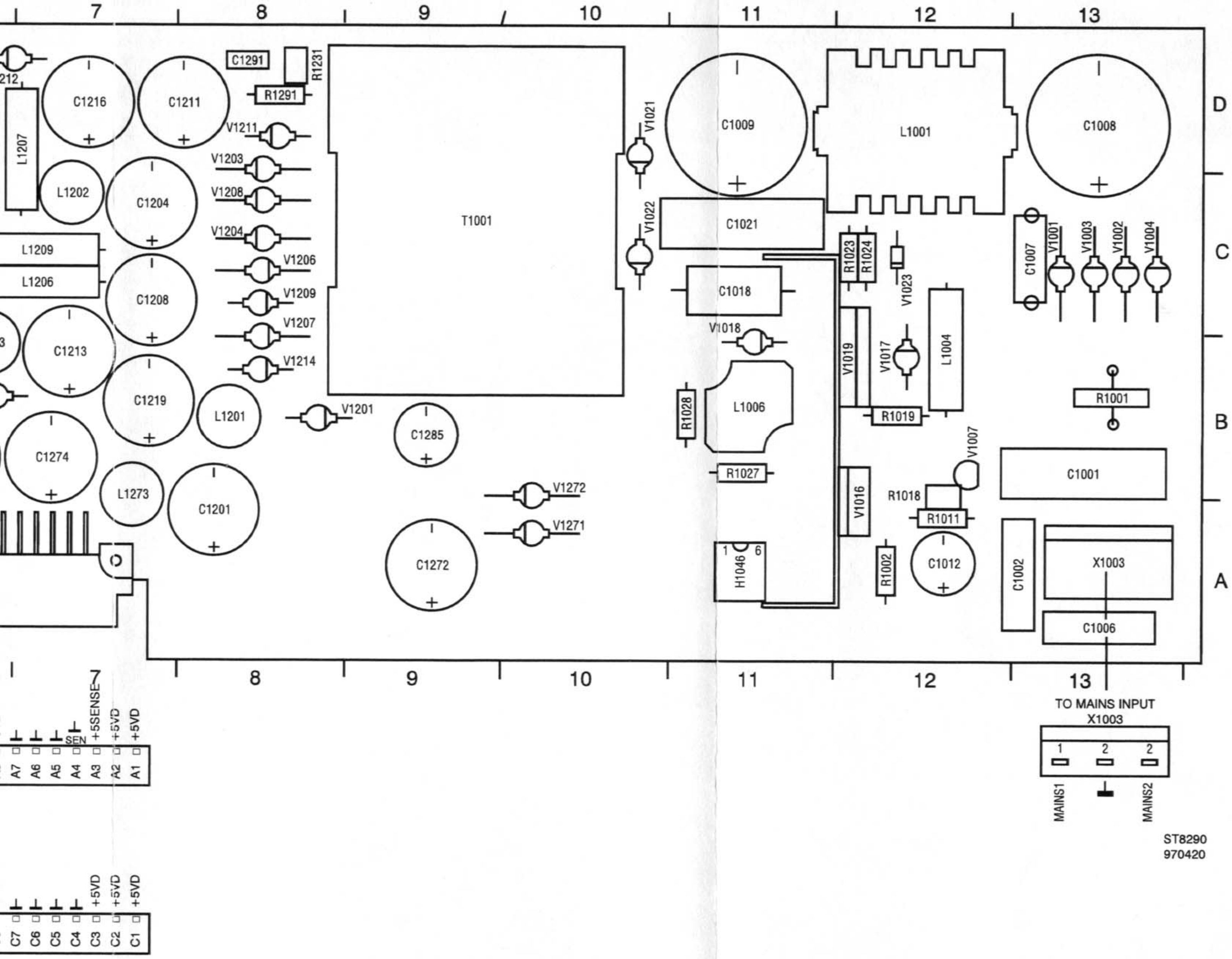
5.6.3 Unit lay-outs



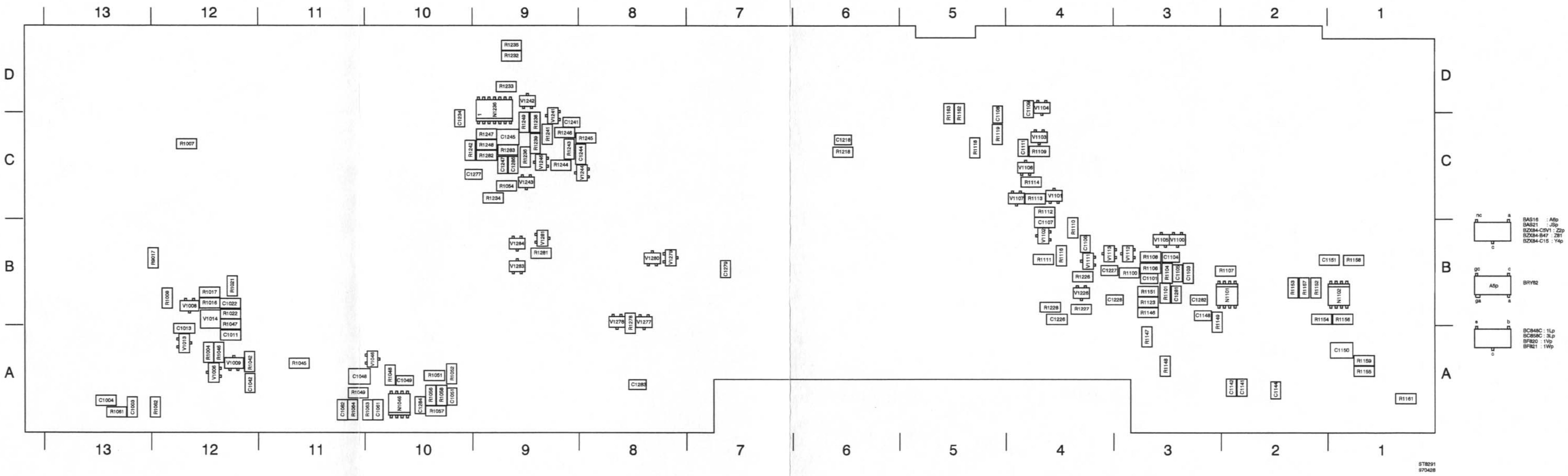
Lay-out 8 - Wire component side of power supply unit A6

5.6.3 Unit lay-outs

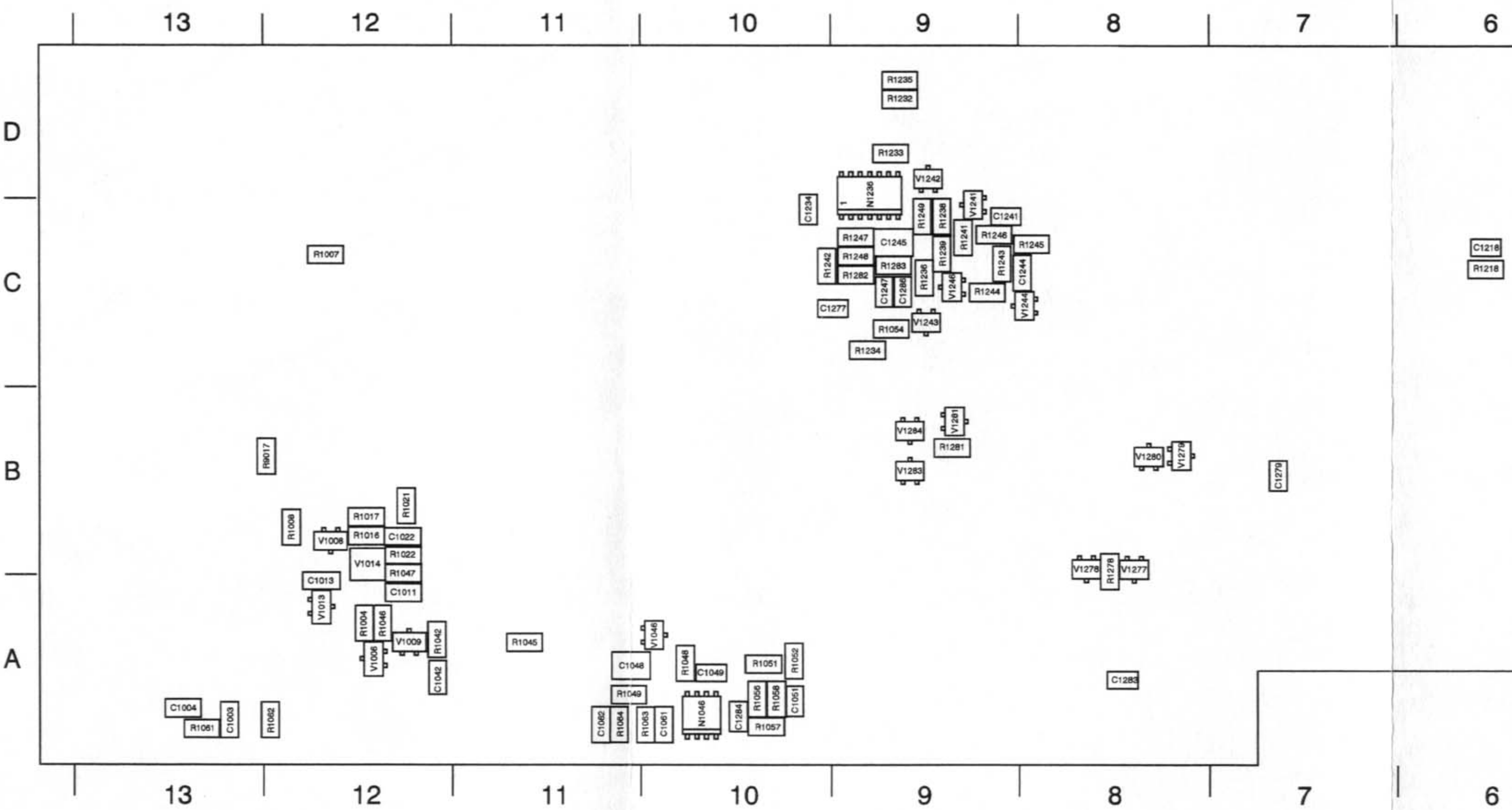




Lay-out 8 - Wire component side of power supply unit A6



Lay-out 9 - Micro miniature component side of power supply unit A6


13
12
11
10
9
8
7
6
D
C
B
A
R1235
R1232
R1233
V1242
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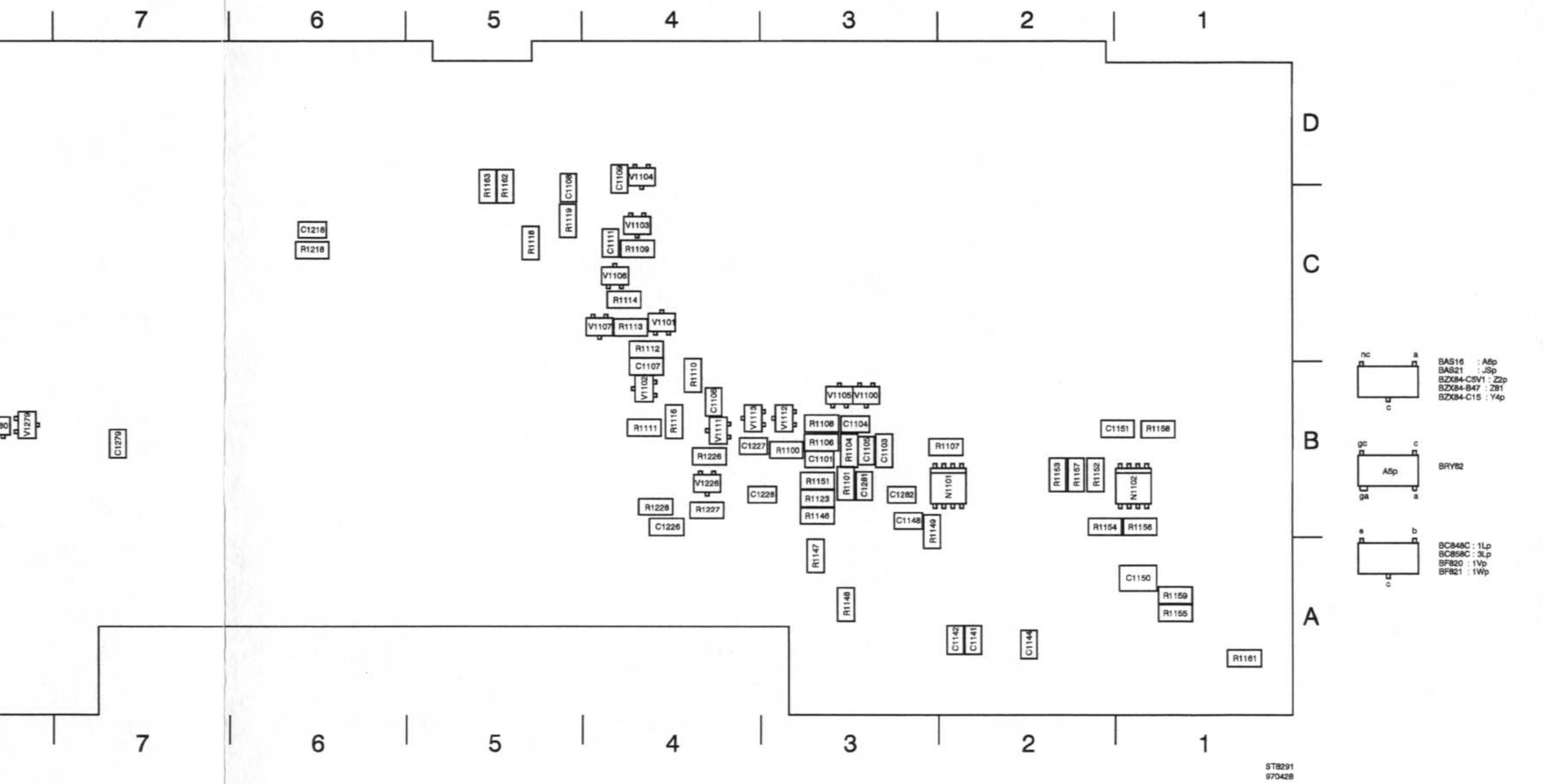
C1234
R1249
R1238
V1241
C1241
R1247
C1245
R1239
R1241
R1246
R1245
R1242
R1248
R1283
R1236
R1243
C1244
R1282
C1247
C1286
V1246
R1244
C1277
V1244
R1054
V1243
R1234
C1218
R1218
R1007
R9017
V1284
V1281
R1281
V1283
V1280
V1279
C1279
R1008
R1017
R1021
V1008
R1016
C1022
V1014
R1022
R1047
C1013
C1011
V1013
R1004
R1046
V1009
R1042
R1045
V1048
C1048
R1048
C1049
R1051
R1052
C1042
V1006
V1278
R1278
V1277
C1283
C1004
C1003
R1061
R1062
R1049
N1046
C1284
R1056
R1058
C1051
R1057
C1060
R1064
R1063
C1061



Lay-out 9 - Micro miniature component side of power supply unit A6

5.6.4 Location list Power Supply unit A3

'-L' means that the component is located on the printed circuit board side with the large components. Otherwise the component is located on the side with small components (SMD's: surface mounted devices).

C1001 B13-L
C1002 A13-L
C1003 A13
C1004 A13
C1006 A13-L
C1007 C13-L
C1008 D13-L
C1009 D11-L
C1011 A12
C1012 A12-L
C1013 A12
C1018 C11-L
C1021 C11-L
C1022 B12
C1042 A12
C1048 A11
C1049 A10
C1051 A10
C1061 A10
C1062 A11
C1101 B3
C1102 C3-L
C1103 B3
C1104 B3
C1106 B4
C1107 B4
C1108 C5
C1109 C4
C1111 C4
C1112 C5-L
C1131 D2-L
C1132 D2-L
C1133 D3-L
C1141 A2
C1142 A2
C1144 A2
C1147 D6-L
C1148 B3
C1150 B1
C1201 A8-L
C1203 B6-L
C1204 C7-L
C1206 B5-L
C1208 C7-L
C1209 B6-L
C1211 D8-L
C1212 B5-L
C1213 B7-L
C1214 B6-L
C1216 D7-L
C1217 B4-L
C1218 C6
C1219 B7-L
C1221 C6-L
C1226 B4
C1228 B4
C1231 B3-L
C1234 C10
C1241 C9
C1244 C8
C1245 C9
C1247 C9
C1272 A9-L
C1274 B7-L
C1277 C9
C1281 B3
C1282 B3
C1283 A8
C1284 A10
C1285 B9-L
C1286 C9
C1291 D8-L
D1131 B2-L
H1046 A11-L
L1001 D12-L
L1004 B12-L
L1006 B11-L
L1101 C5-L
L1131 C2-L
L1146 B3-L
L1201 B8-L
L1202 C7-L
L1203 B6-L
L1204 C6-L
L1206 C7-L
L1207 D7-L
L1208 D6-L
L1209 C7-L
L1273 B7-L
N1046 A10
N1101 B2
N1102 B1
N1141 A2-L
N1226 B4-L
N1236 D9
R1001 B13-L
R1002 A12-L
R1004 A12
R1007 C12
R1008 B12
R1011 A12-L
R1016 B12
R1017 B12
R1018 B12-L
R1019 B12-L
R1021 B12
R1022 B12
R1023 C12-L
R1024 C12-L
R1027 B11-L
R1028 B11-L
R1042 A12
R1046 A12
R1047 B12
R1048 A10
R1049 A11
R1051 A10
R1052 A10
R1054 C9
R1056 A10
R1057 A10
R1058 A10
R1061 A13
R1063 A11
R1064 A11
R1101 B3
R1103 C3-L
R1104 B3
R1106 B3
R1107 B2
R1108 B4
R1109 C4
R1111 B4
R1112 C4
R1113 B4
R1114 C4
R1116 B4
R1118 C5
R1119 C5
R1122 B4-L
R1123 B3
R1146 B3
R1147 A3
R1148 A3
R1149 B3
R1151 B3
R1152 B2
R1153 B2
R1154 B2
R1156 B1
R1157 B2
R1158 B1
R1218 C6
R1226 B4
R1227 B4
R1228 B4
R1231 D8-L
R1232 D9
R1233 D9
R1234 C9
R1235 D9
R1236 C9
R1238 C9
R1239 C9
R1241 C9
R1242 C10
R1243 C9
R1244 C9
R1245 C8
R1246 C9
R1247 C9
R1248 C9
R1249 C9
R1278 B8
R1281 B9
R1282 C9
R1283 C9
R1291 D8-L
T1001 C9-L
T1002 C4-L
V1001 C13-L
V1002 C13-L
V1003 C13-L
V1004 C13-L
V1006 A12
V1007 B12-L
V1008 B12
V1009 A12
V1013 A12
V1014 B12
V1016 A12-L
V1017 B12-L
V1018 C11-L
V1019 B12-L
V1021 D10-L
V1022 C10-L
V1023 C12-L
V1046 A10
V1101 C4
V1102 B4

V1103 C4
V1104 D4
V1106 C4
V1107 C4
V1108 B5-L
V1109 B4-L
V1111 B4
V1131 D3-L
V1146 A1-L
V1147 A2-L
V1148 A1-L
V1149 A1-L
V1201 B8-L
V1203 D8-L
V1204 C8-L
V1206 C8-L
V1207 C8-L
V1208 C8-L
V1209 C8-L
V1211 D8-L
V1212 D6-L
V1213 C6-L
V1214 B8-L
V1216 B6-L
V1226 B4
V1241 C9
V1242 D9
V1244 C8
V1246 C9
V1271 A10-L
V1272 B10-L
V1277 B8
V1278 B8
V1279 B8
V1280 B8
V1281 B9
V1283 B9
V1284 B9
X1001 D1-L
X1002 A5-L
X1003 A13-L
X1004 D5-L
X1006 D5-L
X1007 D1-L

5.6.5 Circuit diagrams

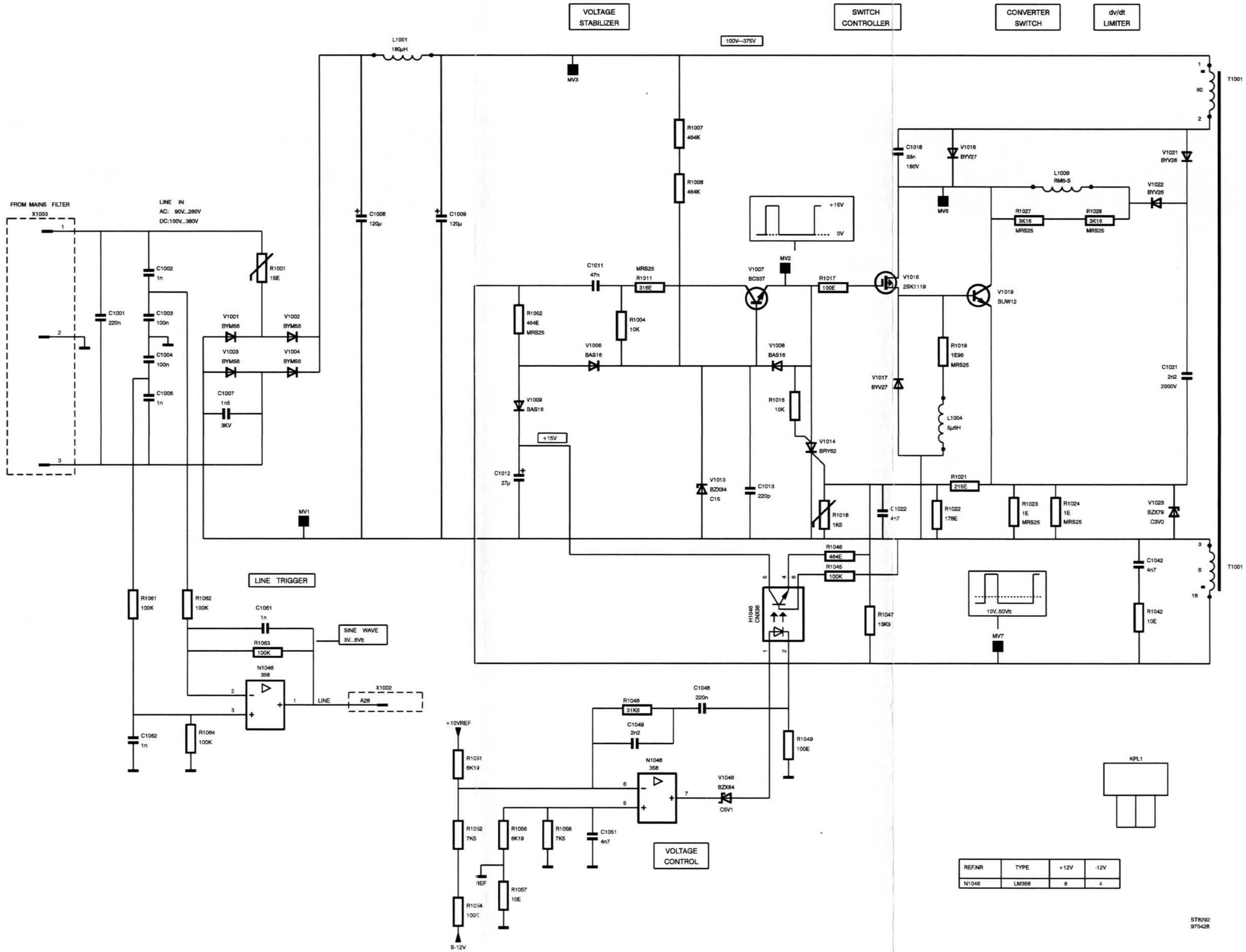
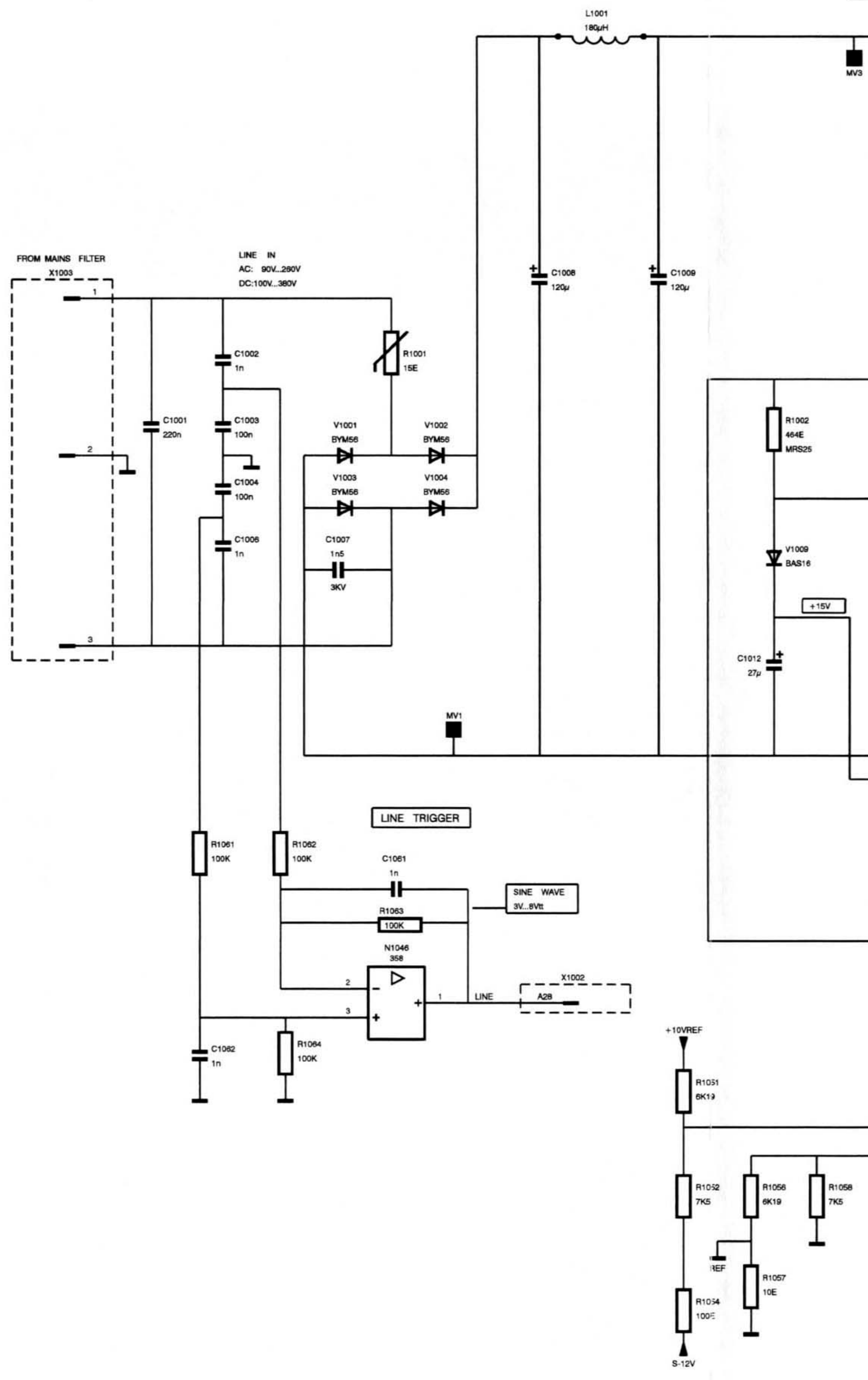
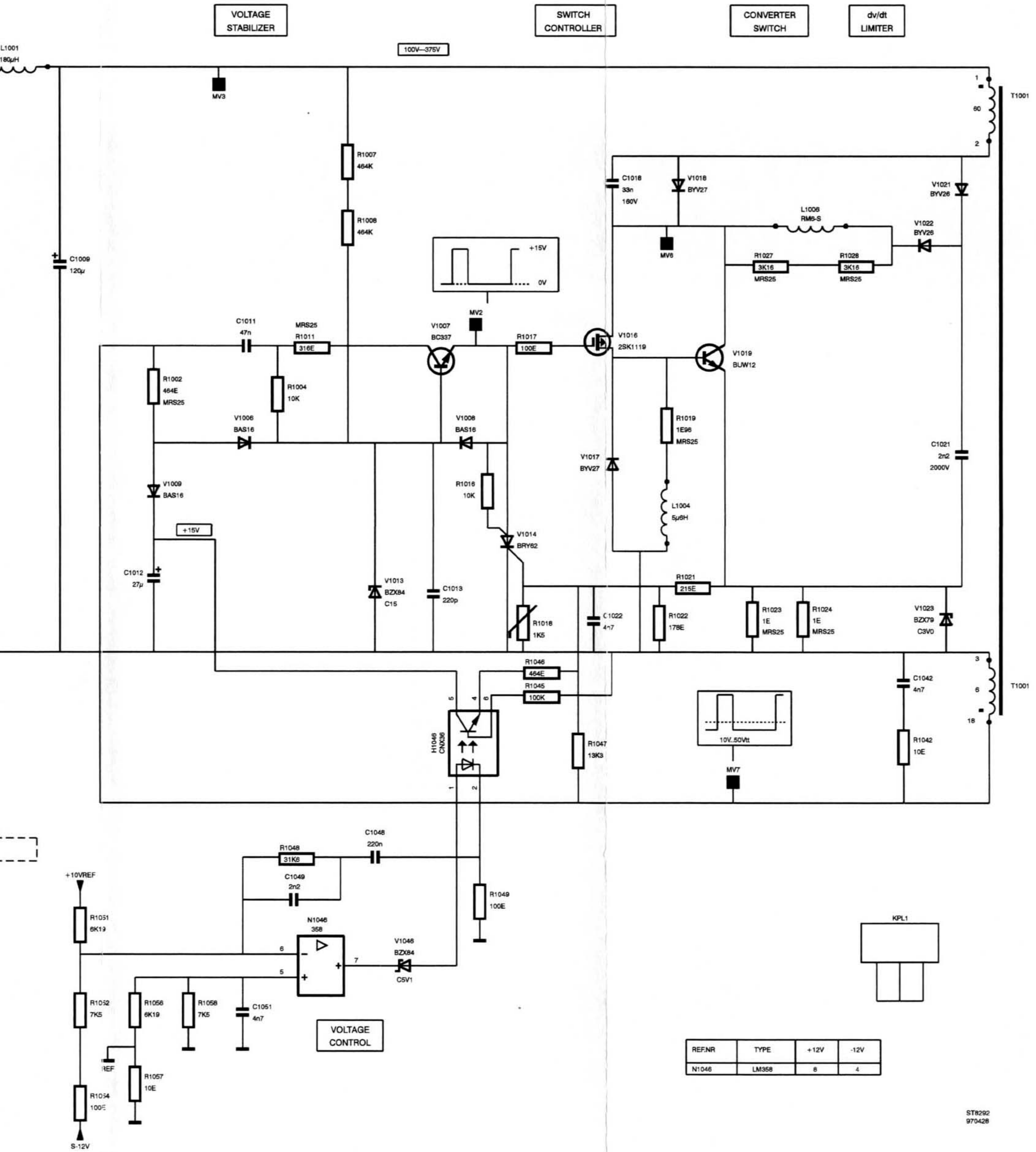


Diagram 1 - Converter circuit

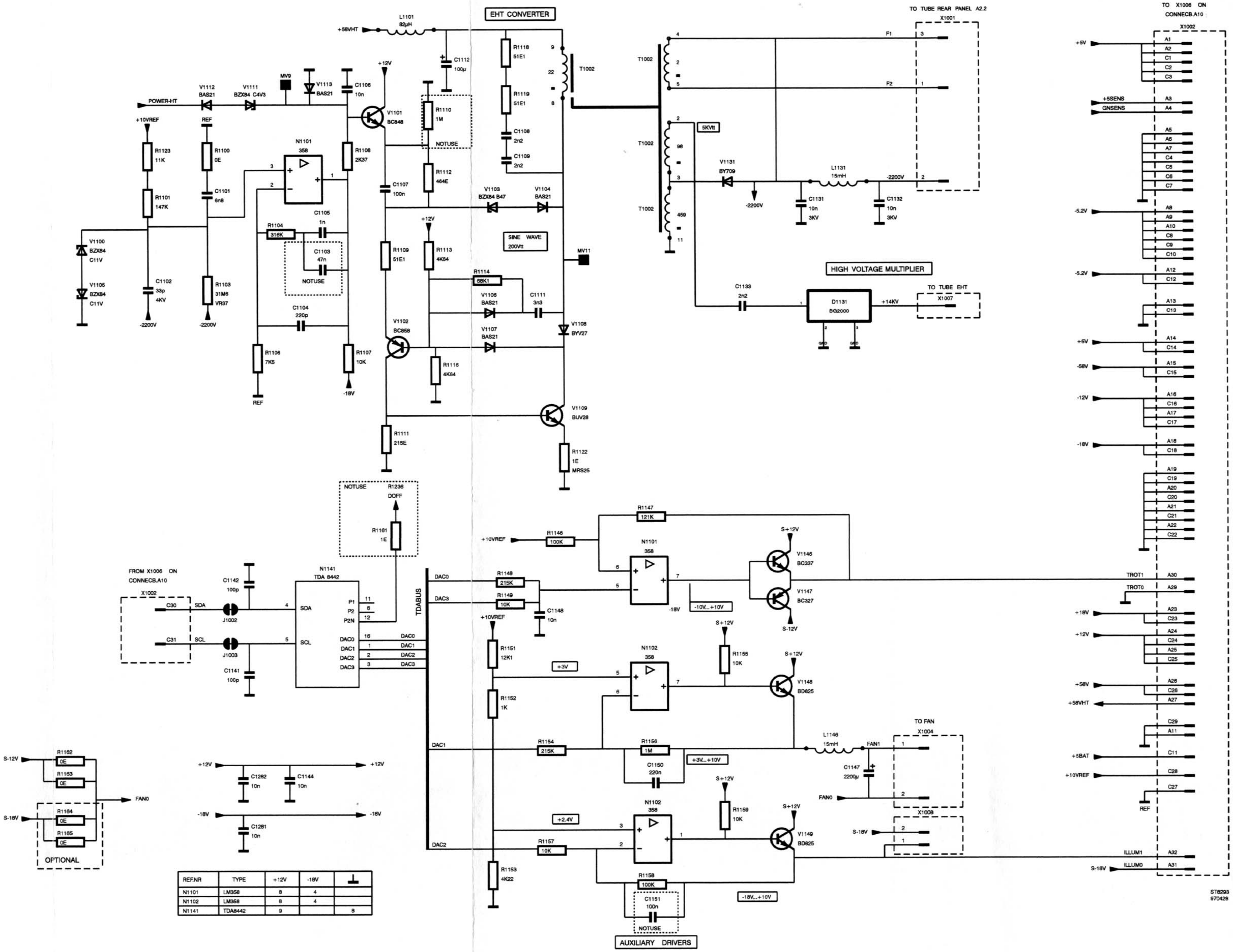
5.6.5 Circuit diagrams





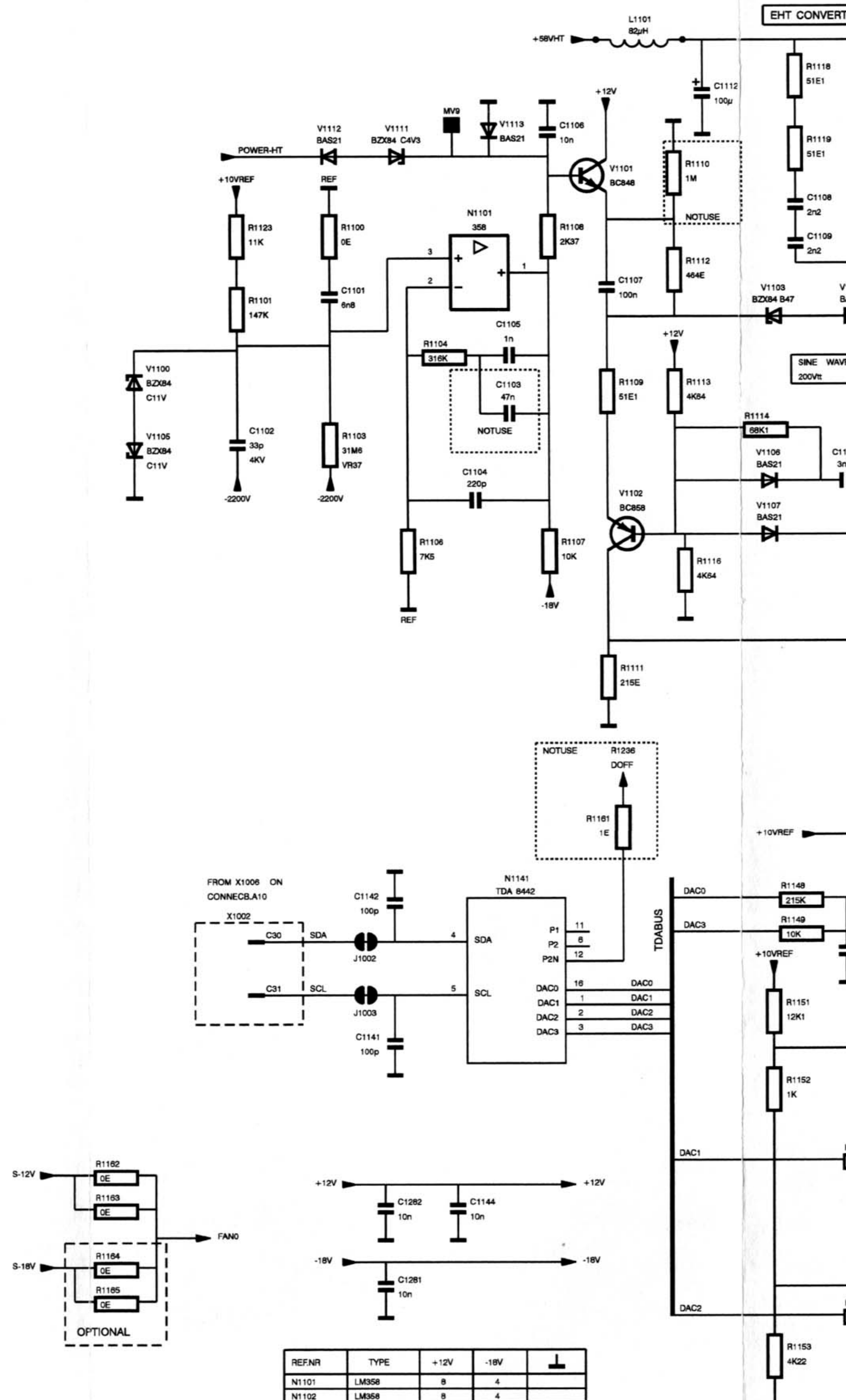
REF.NR	TYPE	+12V	-12V
N1046	LM358	8	4

Diagram 1 - Converter circuit



REF.NR	TYPE	+12V	-18V	⊥
N1101	LM358	8	4	
N1102	LM358	8	4	
N1141	TDA8442	9		8

Diagram 2 - EHT converter and auxiliary circuits



REF.NR	TYPE	+12V	-18V	⊥
N1101	LM358	8	4	
N1102	LM358	8	4	
N1141	TDA8442	9		8

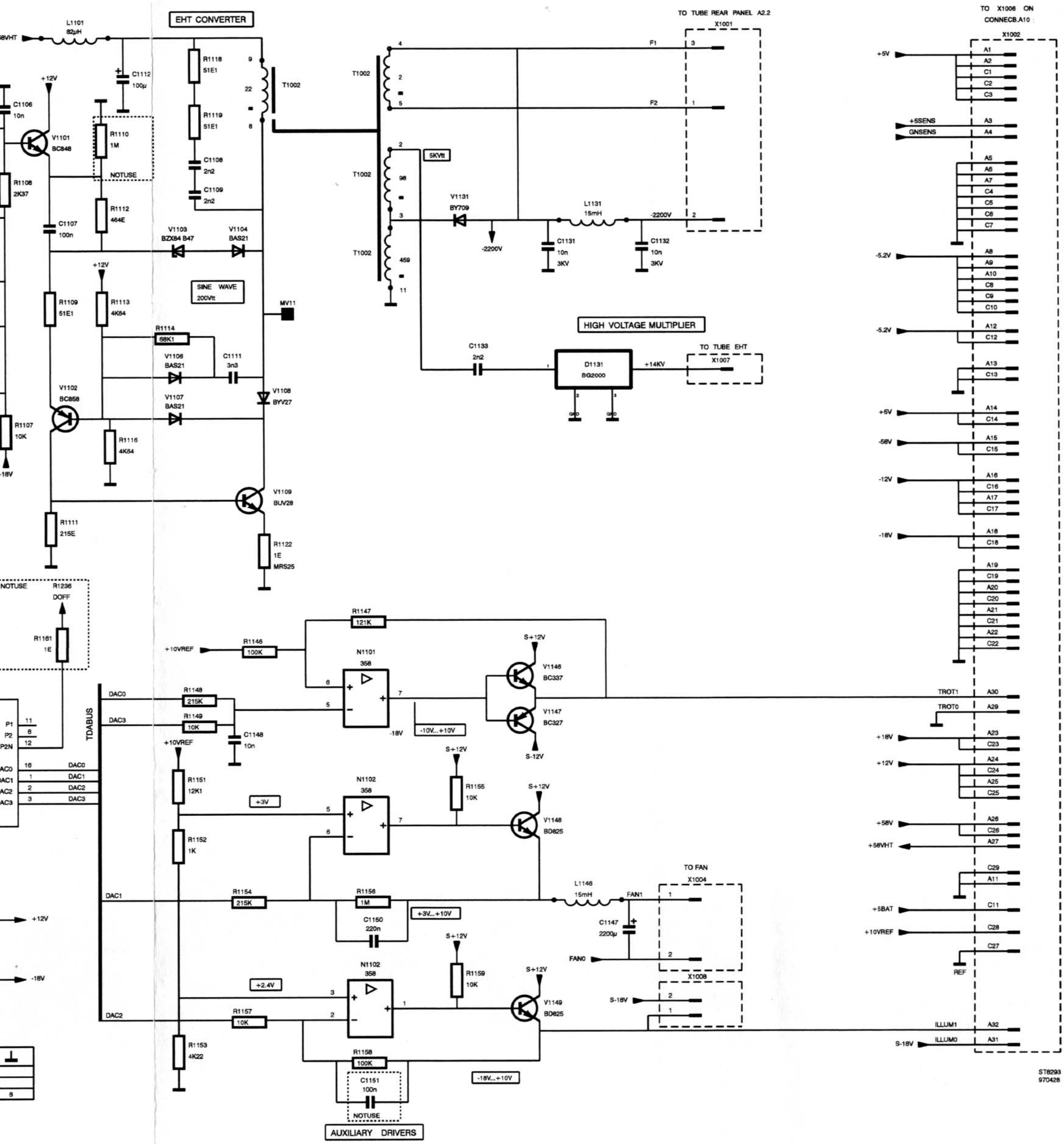
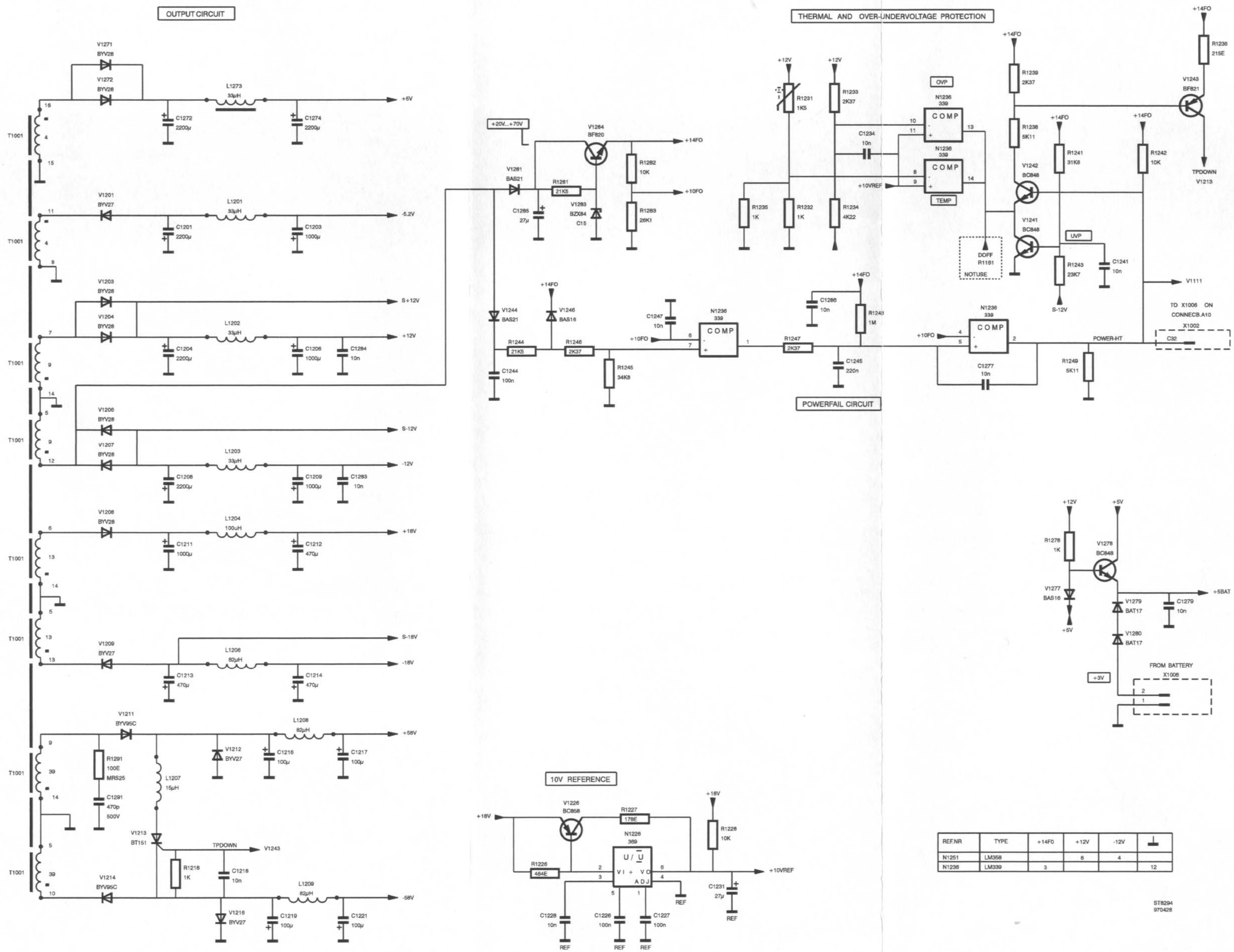


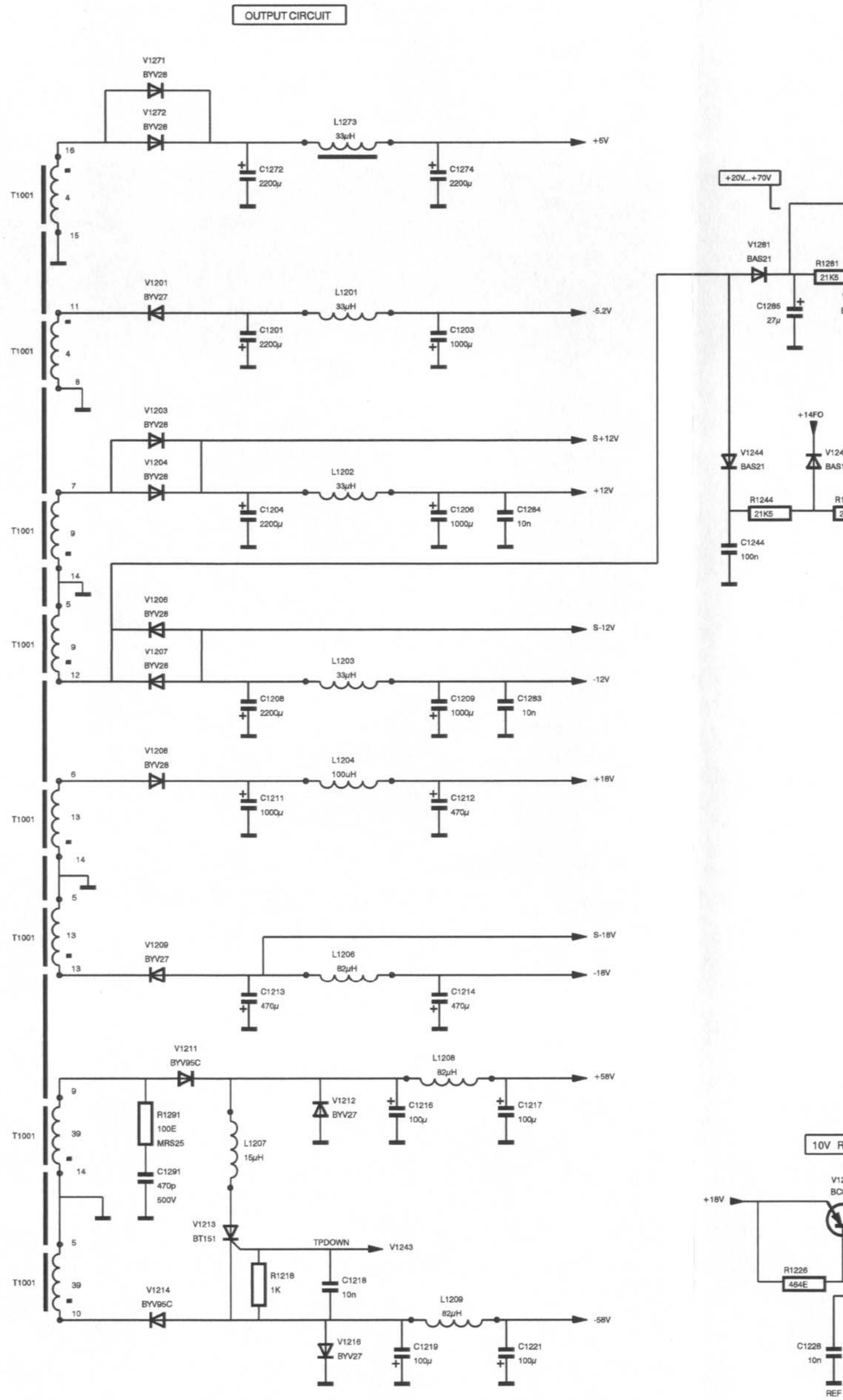
Diagram 2 - EHT converter and auxiliary circuits

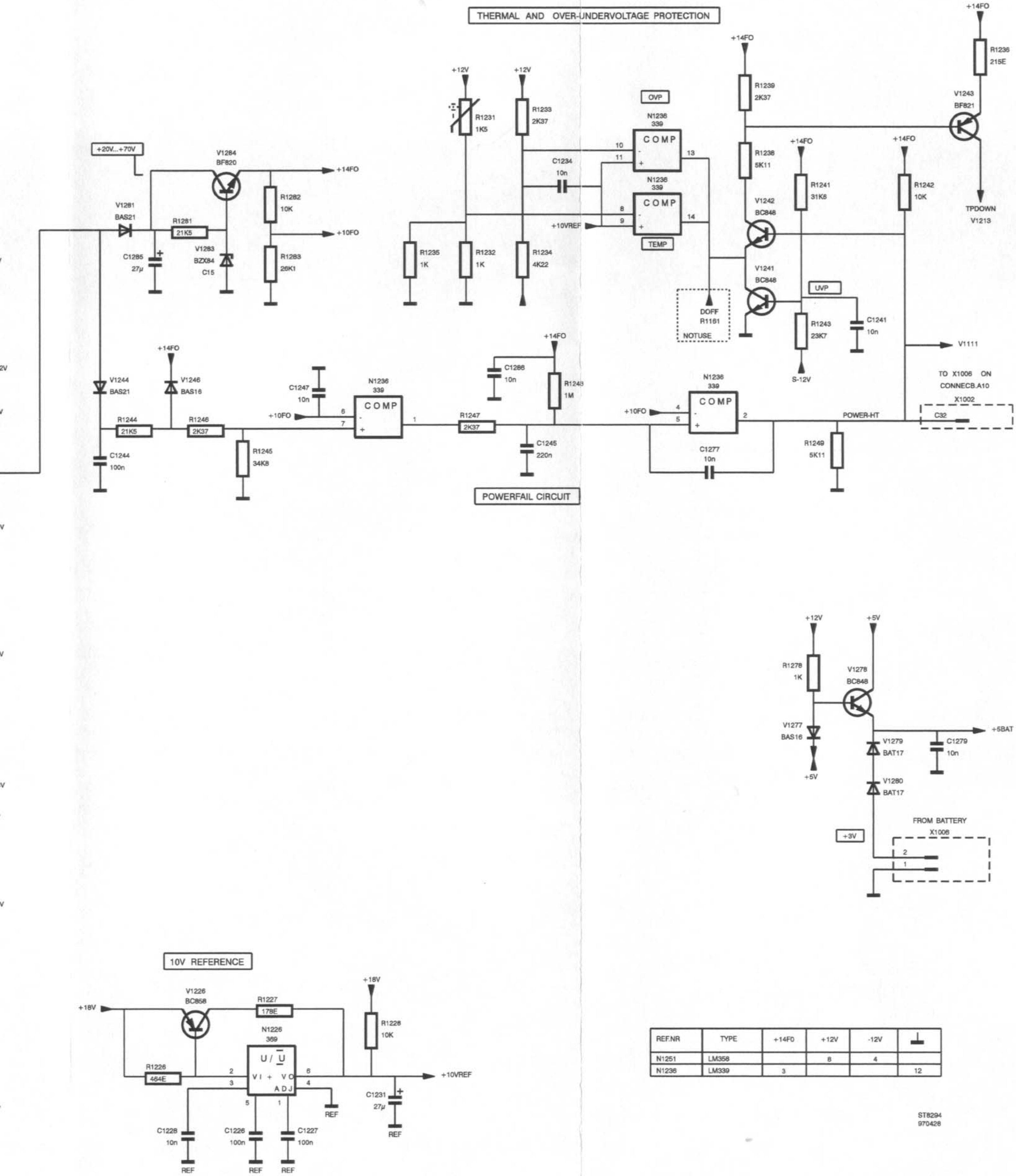


REF.NR	TYPE	+14F0	+12V	-12V	⊥
N1251	LM358		8	4	
N1236	LM339	3			12

ST8294
970428

Diagram 3 - Output circuit and protection circuits


OUTPUT CIRCUIT
V1271
BYV28
V1272
BYV28
L1273
33µH
+5V
C1272
2200µ
C1274
2200µ
T1001
V1201
BYV27
L1201
33µH
-5.2V
C1201
2200µ
C1203
1000µ
V1203
BYV28
S+12V
V1204
BYV28
L1202
33µH
+12V
C1204
2200µ
C1206
1000µ
C1284
10n
V1206
BYV28
S-12V
V1207
BYV28
L1203
33µH
-12V
C1208
2200µ
C1209
1000µ
C1283
10n
V1208
BYV28
L1204
100uH
+18V
C1211
1000µ
C1212
470µ
S-18V
V1209
BYV27
L1206
82µH
-18V
C1213
470µ
C1214
470µ
V1211
BYV95C
L1208
82µH
+58V
R1291
100E
MRS25
V1212
BYV27
C1216
100µ
C1217
100µ
L1207
15µH
C1291
470p
500V
V1213
BT151
TPDOWN
V1243
R1218
1K
C1218
10n
V1214
BYV95C
L1209
82µH
-58V
V1216
BYV27
C1219
100µ
C1221
100µ
+20V...+70V
V1281
BAS21
R1281
21K5
C1285
27µ
+14FO
V1244
BAS21
R1244
21K5
C1244
100n
10V
+18V
R1226
464E
C1228
10n
REF



REF.NR	TYPE	+14F0	+12V	-12V	⊥
N1251	LM358		8	4	
N1236	LM339	3			12

ST8294
970426

Diagram 3 - Output circuit and protection circuits

5.6.6 Parts list

CAPACITORS

Item	Description		Ordering code
C 1001	CAP.FOIL	250V 20% 220nF	5322 121 44372
C 1002	CAP.FOIL	-20+20% 1nF	5322 121 43656
C 1003	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1004	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1006	CAP.FOIL	-20+20% 1nF	5322 121 43656
C 1007	CAP.CERAMIC	3KV -20+50% 1.5nF	5322 122 50092
C 1008	CAP.ELECTROLYT.	400V 20% 120µF	5322 124 42231
C 1009	CAP.ELECTROLYT.	400V 20% 120µF	5322 124 42231
C 1011	CAP.CHIP	63V 10% 47nF	4822 122 32542
C 1012	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 1013	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 1018	CAP.FOIL	160V 1% 33nF	5322 121 50997
C 1021	CAP.FOIL	2KV 5% 3.3nF	5322 121 70117
C 1022	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 1042	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 1048	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1049	CAP.CHIP	63V 10% 2.2nF	4822 122 33127
C 1051	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 1061	CAP.CHIP	63V 10% 1nF	4822 122 31746
C 1062	CAP.CHIP	63V 10% 1nF	4822 122 31746
C 1101	CAP.CHIP	63V 10% 6.8nF	5322 122 31866
C 1102	CAP.CERAMIC	4KV -10+10% 33pF	5322 122 33081
C 1103	CAP.CHIP	63V 10% 47nF	4822 122 32542
C 1104	CAP.CERAMIC	63V 5% 220pF	4822 122 33575
C 1105	CAP.CHIP	63V 10% 1µF	5322 126 10511
C 1106	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1107	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1108	CAP.CHIP	63V 10% 2.2nF	4822 122 33127
C 1109	CAP.CHIP	63V 10% 2.2nF	4822 122 33127
C 1111	CAP.CHIP	63V 10% 3.3nF	4822 122 33891
C 1112	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1114	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1131	CAP.CERAMIC	3KV -20+50% 10nF	5322 126 12921
C 1132	CAP.CERAMIC	3KV -20+50% 10nF	5322 126 12921
C 1133	CAP.	-10+10% 2.2nF	5322 122 33851
C 1141	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1142	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1144	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1147	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1148	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1150	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1201	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1203	CAP.	25V -20+20% 1000µF	5322 124 23276
C 1204	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1206	CAP.	25V -20+20% 1000µF	5322 124 23276

Item	Description		Ordering code
C 1208	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1209	CAP.	25V -20+20% 1000µF	5322 124 23276
C 1211	CAP.	25V -20+20% 1000µF	5322 124 23276
C 1212	CAP.FOIL	25V 20% 470µF	5322 121 43885
C 1213	CAP.FOIL	25V 20% 470µF	5322 121 43885
C 1214	CAP.FOIL	25V 20% 470µF	5322 121 43885
C 1216	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1217	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1218	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1219	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1221	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1226	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1227	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1228	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1231	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 1234	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1241	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1244	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1245	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1247	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1251	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1252	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 1270	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1271	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1272	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1274	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1277	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1279	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1281	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1282	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1283	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1284	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1285	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 1286	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1291	CAP.CERAMIC	500V 10% 470pF	4822 122 31177

MISCELLANEOUS

H 1046	TRANSIST,PHOTO	CNX36U PEL	5322 130 91112
T 1001	TRANSFORMER	MAIN TRAFO	5322 148 60254
T 1002	TRANSFORMER	EHT TRAFO	5322 140 10587

Item	Description		Ordering code
COILS			
L 1001	COIL	ECH30 180UH TDK	5322 157 63378
L 1004	COIL	5.6UH	4822 157 52259
L 1006	COIL	RM6-S	5322 157 70858
L 1101	COIL	82UH	4822 158 10563
L 1131	COIL	0.015H TDK	5322 157 63383
L 1146	COIL	0.015H TDK	5322 157 63383
L 1201	COIL	33UH TDK	4822 157 62886
L 1202	COIL	33UH TDK	4822 157 62886
L 1203	COIL	33UH TDK	4822 157 62886
L 1204	COIL	100UH TDK	5322 157 52363
L 1206	COIL	82UH	4822 158 10563
L 1207	COIL	15UH	5322 157 52539
L 1208	COIL	82UH	4822 158 10563
L 1209	COIL	82UH	4822 158 10563
L 1273	COIL	3.3UH TDK	5322 157 53017
INTEGRATED CIRCUITS			
D 1131	EHT-MULTIPLIER	BG2000-641-515	5322 130 10177
N 1046	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1101	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1102	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1141	INTEGR.CIRCUIT	TDA8442/N3 PEL	4822 209 71703
N 1226	INTEGR.CIRCUIT	LM369DN NSC	5322 209 30266
N 1236	INTEGR.CIRCUIT	LM339D SIG	5322 209 70684
N 1251	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
RESISTORS			
R 1001	RES.N.T.C.	2.2A 15E	5322 116 34035
R 1002	RES.METAL FILM	MRS25 1% 464E	4822 050 24641
R 1004	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1007	RES.CHIP	RC-02H 1% 464K	4822 051 54644
R 1008	RES.CHIP	RC-02H 1% 464K	4822 051 54644
R 1011	RES.METAL FILM	MRS25 1% 316E	4822 050 23161
R 1016	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1018	RES.N.T.C.	0.5W 10% 1K5	4822 116 30248
R 1019	RES.METAL FILM	MRS25 1% 1E96	4822 050 21968
R 1021	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1022	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 1023	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 1024	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 1027	RES.METAL FILM	MRS25 1% 3K16	4822 050 23162
R 1028	RES.METAL FILM	MRS25 1% 3K16	4822 050 23162
R 1042	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1045	RES.CHIP	RC-02H 1% 100K	4822 051 21004
R 1046	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1047	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 1048	RES.CHIP	RC-02H 1% 31K6	4822 051 53163

Item	Description		Ordering code
R 1049	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1051	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 1052	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1054	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1056	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 1057	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1058	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1061	RES.CHIP	RC-02H 1% 100K	4822 051 10104
R 1062	RES.CHIP	RC-02H 1% 100K	4822 051 10104
R 1063	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1064	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1100	RES.CHIP	RC-02H 1% 0E	4822 051 10008
R 1101	RES.CHIP	RC-02H 1% 147K	4822 051 51474
R 1103	RES.HI-TENSION	VR37 1% 31M6	5322 116 64103
R 1104	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 1106	RES.CHIP	RC-02H 1% 7K5	5322 117 10583
R 1107	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1108	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1109	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1111	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1112	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1113	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 1114	RES.CHIP	RC-02H 1% 68K1	4822 051 56813
R 1116	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 1118	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1119	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1122	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 1123	RES.CHIP	RC-02H 1% 19K6	4822 051 10113
R 1146	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1147	RES.CHIP	RC-02H 1% 121K	4822 051 51214
R 1148	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1149	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1151	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 1152	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1153	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 1154	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1155	RES.CHIP	RC-02H 1% 10K	4822 051 10103
R 1156	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1157	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1158	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1159	RES.CHIP	RC-02H 1% 10K	4822 051 10103
R 1162	RES.CHIP	RC-02H 1% 0E	4822 051 10008
R 1163	RES.CHIP	RC-02H 1% 0E	4822 051 10008
R 1218	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1226	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1227	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 1228	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1231	RES.N.T.C.	0.5W 10% 1K5	4822 116 30248
R 1232	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 1233	RES.CHIP	RC-02H 1% 2K37	4822 051 52372

Item	Description		Ordering code
R 1234	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 1235	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1236	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1238	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1239	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1241	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 1242	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1243	RES.CHIP	RC-02H 1% 23K7	4822 051 52373
R 1244	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1245	RES.CHIP	RC-02H 1% 26K1	4822 051 52613
R 1246	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1247	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1248	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1249	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1251	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1253	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1254	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1256	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1257	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1258	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1260	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1261	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1262	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1263	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1264	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1278	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1281	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1282	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1283	RES.CHIP	RC-02H 1% 26K1	4822 051 52613
R 1291	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 9017	RES.CHIP	RC-02H 1% 100E	4822 051 51001

SEMICONDUCTORS

V 1001	DIODE	BYM56E PEL	4822 130 80254
V 1002	DIODE	BYM56E PEL	4822 130 80254
V 1003	DIODE	BYM56E PEL	4822 130 80254
V 1004	DIODE	BYM56E PEL	4822 130 80254
V 1006	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1007	TRANSISTOR	BC337 PEL	4822 130 40855
V 1008	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1009	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1013	DIODE,CHIP	BZX84-C15 PEL	5322 130 33662
V 1014	TRANSISTOR,CHIP	BRY62 PEL	5322 130 62661
V 1016	MOSFET	2SK1119	5322 130 63358
V 1017	DIODE	BYV27-150 PEL	4822 130 31628
V 1018	DIODE	BYV28-150 PEL	5322 130 32043
V 1019	DIODE	BUW12A PEL	5322 130 42114
V 1021	DIODE	BYV26C PEL	4822 130 32343
V 1022	DIODE	BYV26C PEL	4822 130 32343
V 1023	DIODE,REFERENCE	BZX79-C3V0 PEL	4822 130 31881

Item	Description		Ordering code
V 1046	DIODE,CHIP	BZX84-C5V1 PEL	5322 130 32835
V 1100	DIODE	BZX84-C11	4822 130 81338
V 1105	DIODE	BZX84-C11	4822 130 81338
V 1101	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1102	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1103	DIODE,CHIP	BZX84-B47 PEL	4822 130 82521
V 1104	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1106	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1107	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1108	DIODE	BYV27-150 PEL	4822 130 31628
V 1109	TRANSISTOR	BUL147	5322 130 63515
V 1111	DIODE,CHIP	BZX84-C4V3 PEL	5322 130 80256
V 1112	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1113	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1131	DIODE	BY8412 PEL	5322 130 82711
V 1146	TRANSISTOR	BC337 PEL	4822 130 40855
V 1147	TRANSISTOR	BC327 PEL	4822 130 40854
V 1148	TRANSISTOR	BD825 PEL	4822 130 41746
V 1149	TRANSISTOR	BD825 PEL	4822 130 41746
V 1201	DIODE	BYV28-150 PEL	5322 130 32043
V 1203	DIODE	BYV28-150 PEL	5322 130 32043
V 1204	DIODE	BYV28-150 PEL	5322 130 32043
V 1206	DIODE	BYV28-150 PEL	5322 130 32043
V 1207	DIODE	BYV28-150 PEL	5322 130 32043
V 1208	DIODE	BYV28-150 PEL	5322 130 32043
V 1209	DIODE	BYV27-150 PEL	4822 130 31628
V 1211	DIODE	BYV95C PEL	4822 130 41487
V 1212	DIODE	BYV27-150 PEL	4822 130 31628
V 1213	TRANSISTOR	BT151 PEL	5322 130 24081
V 1214	DIODE	BYV95C PEL	4822 130 41487
V 1216	DIODE	BYV27-150 PEL	4822 130 31628
V 1226	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1241	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1242	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1243	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 1244	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1246	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1251	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1252	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1253	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1271	DIODE	BYV28	5322 130 32043
V 1272	DIODE	BYV28	5322 130 32043
V 1277	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1278	TRANSISTOR,CHIP	BSVS2 PEL	5322 130 44336
V 1279	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 1280	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 1281	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1283	DIODE,CHIP	BZX84-C15 PEL	5322 130 33662
V 1284	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802

Item	Description		Ordering code
CONNECTORS			
X 1001	CONNECTOR	3-P SNG RT.ANG	5322 265 30433
X 1002	CONNECTOR	64-P PIN 2.54MM	5322 290 61087
X 1003	CONNECTOR	5-P SNG STRGHT	5322 265 30436
X 1004	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
X 1006	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
X 1008	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
MECHANICAL PARTS			
Fixing clip for	V 1019		5322 492 63721
Insulator for	V 1019		5322 466 62628
Fixing clip for	V 1016		4822 492 63051
Insulator for	V 1016		5322 255 41133
Fixing spring for	EHT multiplier D1131		5322 401 11111

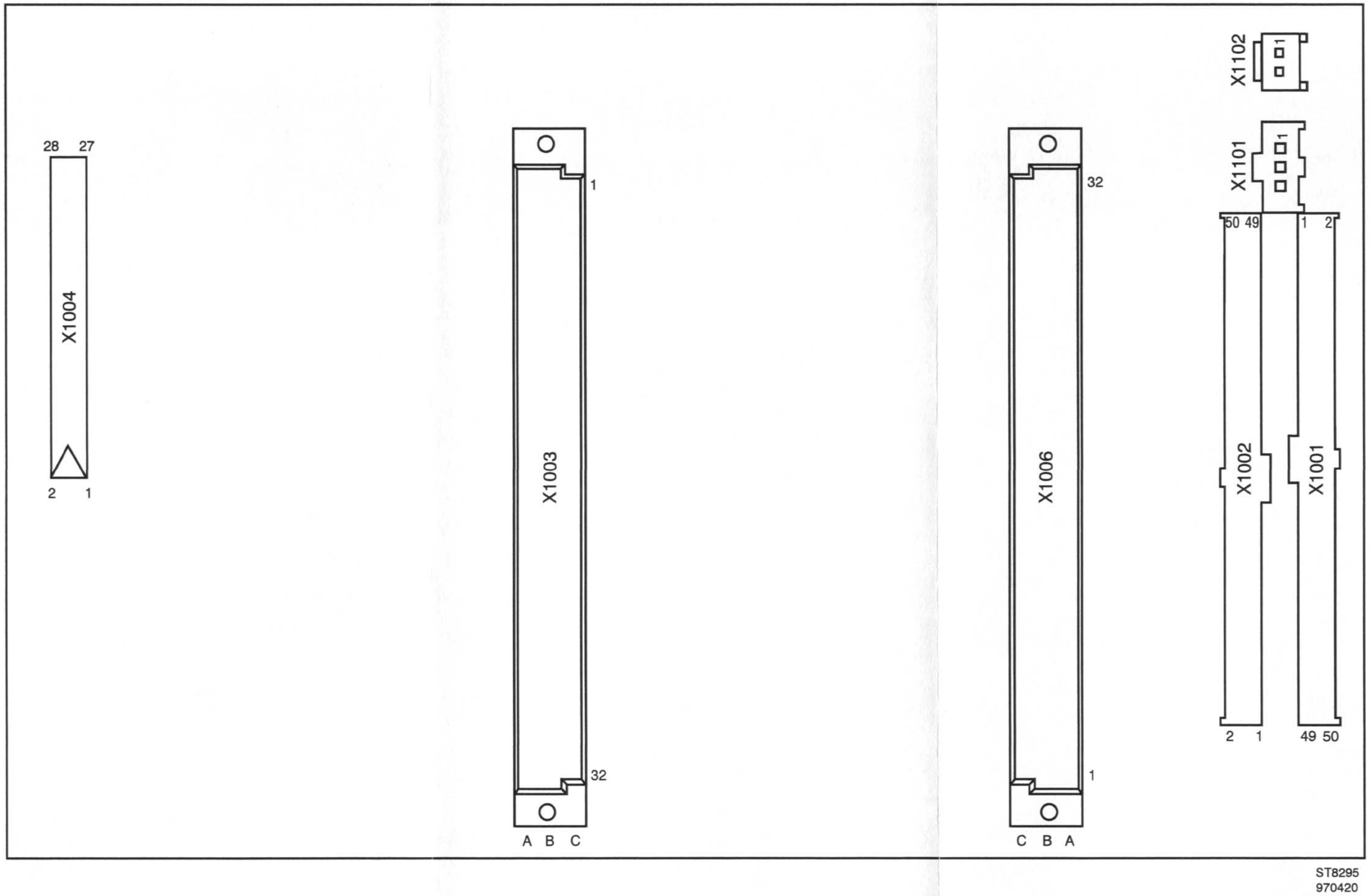
5.7 RESERVED FOR FUTURE EXTENSIONS

5.8 RESERVED FOR FUTURE EXTENSIONS

5.9 RESERVED FOR FUTURE EXTENSIONS

5.10 CONNECTOR BOARD A10

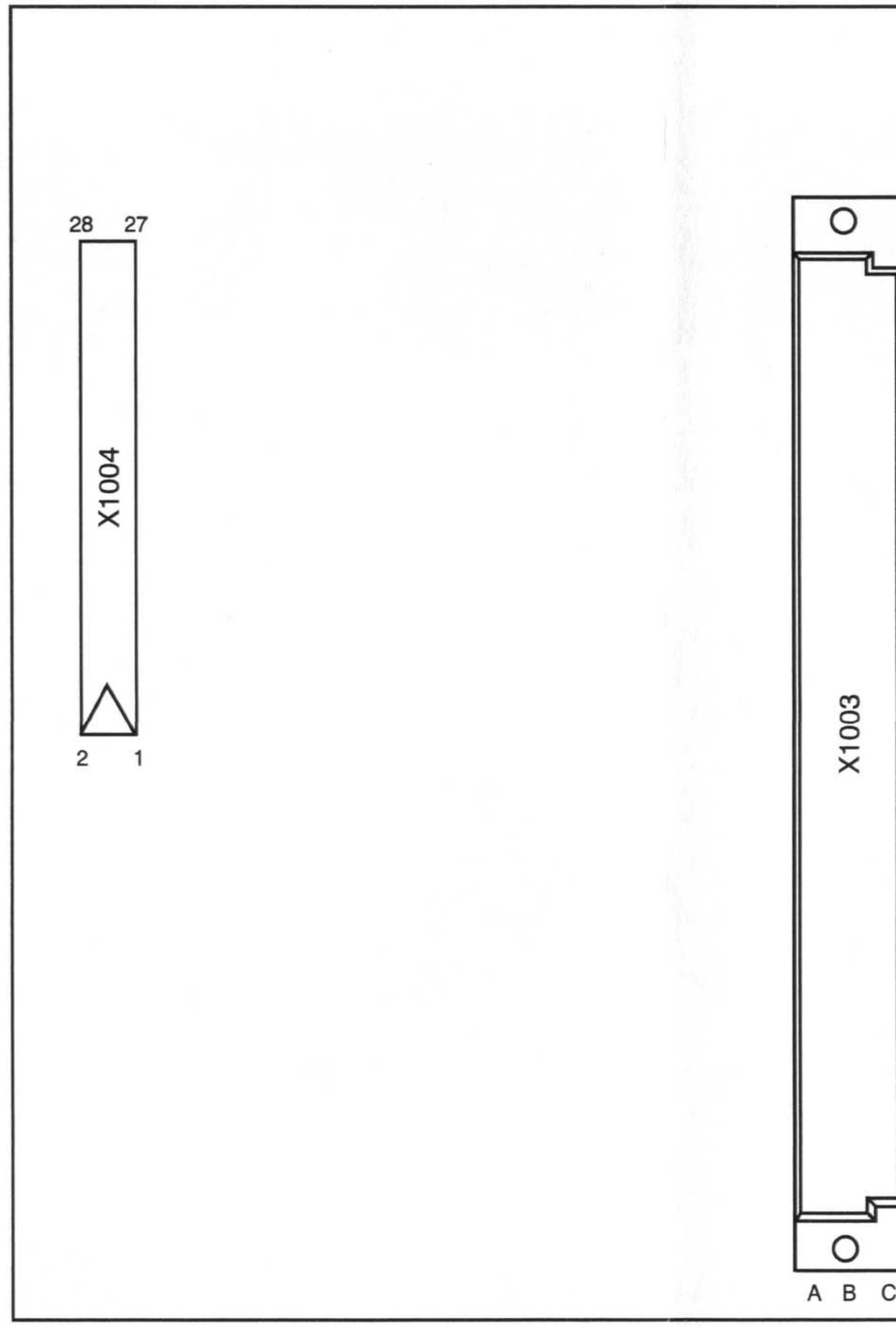
5.10.1 Unit lay-out

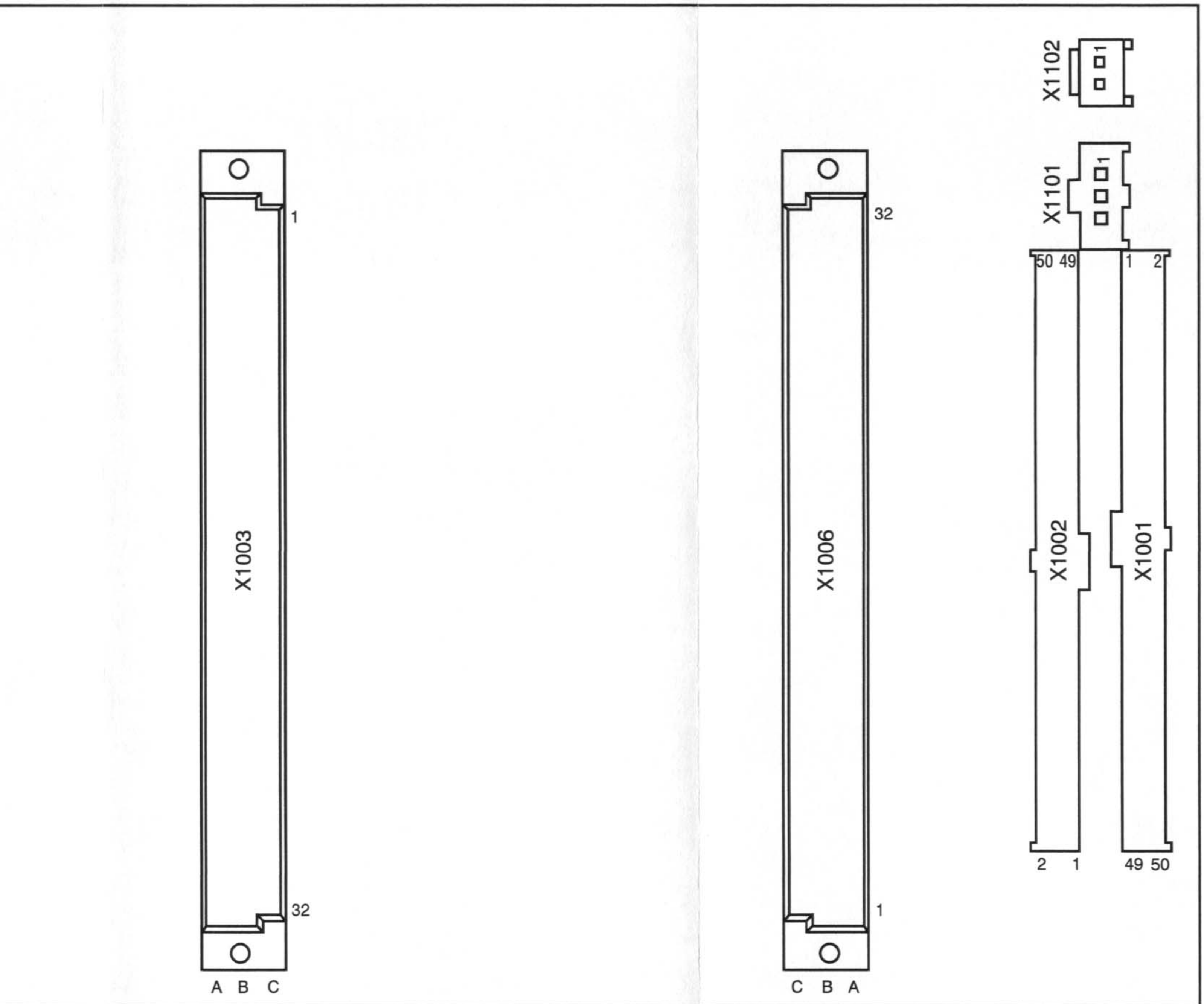


Lay-out 8 - lay-out of connector board A10

5.10 CONNECTOR BOARD A10

5.10.1 Unit lay-out





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Lay-out 8 - lay-out of connector board A10

5.10.2 Circuit Diagrams

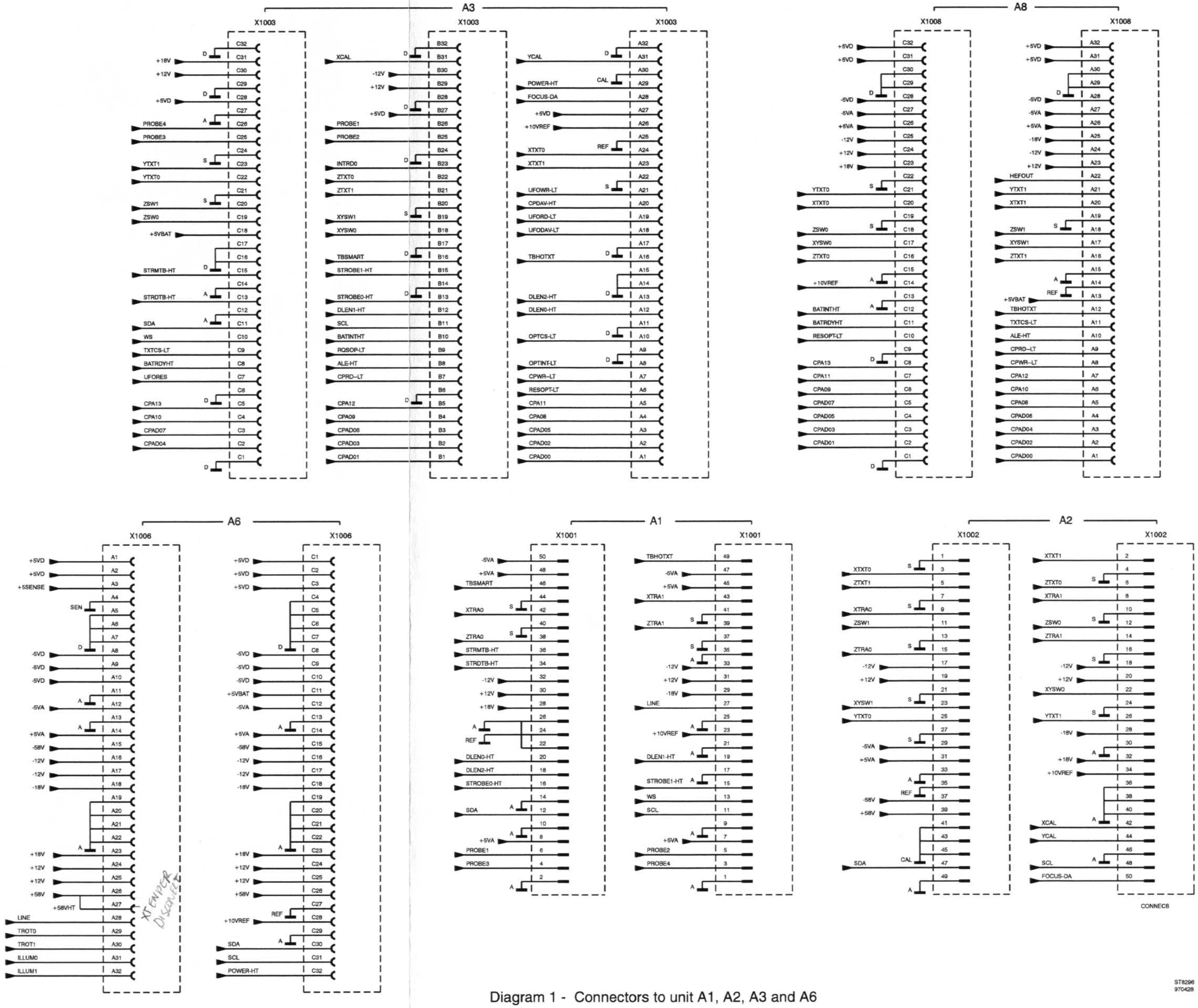
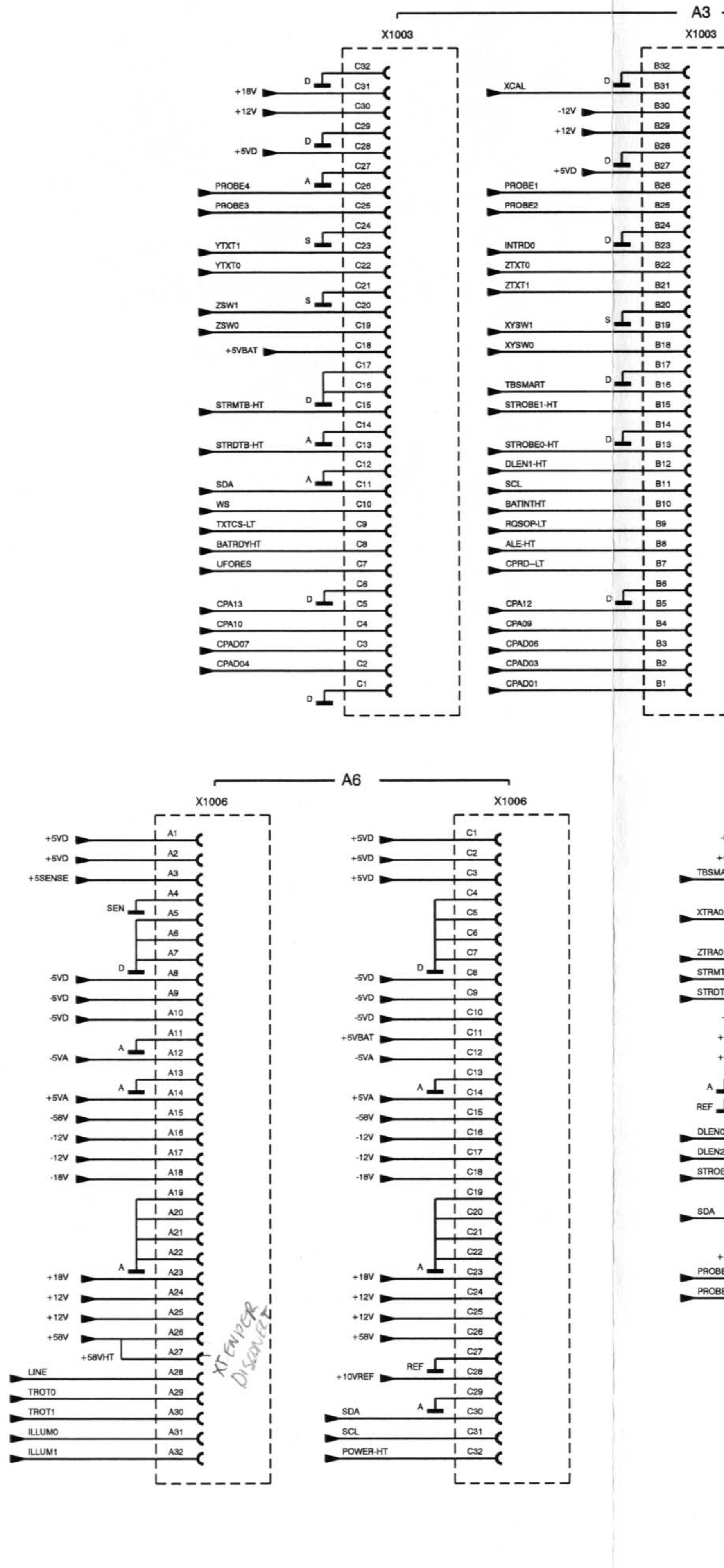


Diagram 1 - Connectors to unit A1, A2, A3 and A6

5.10.2 Circuit Diagrams



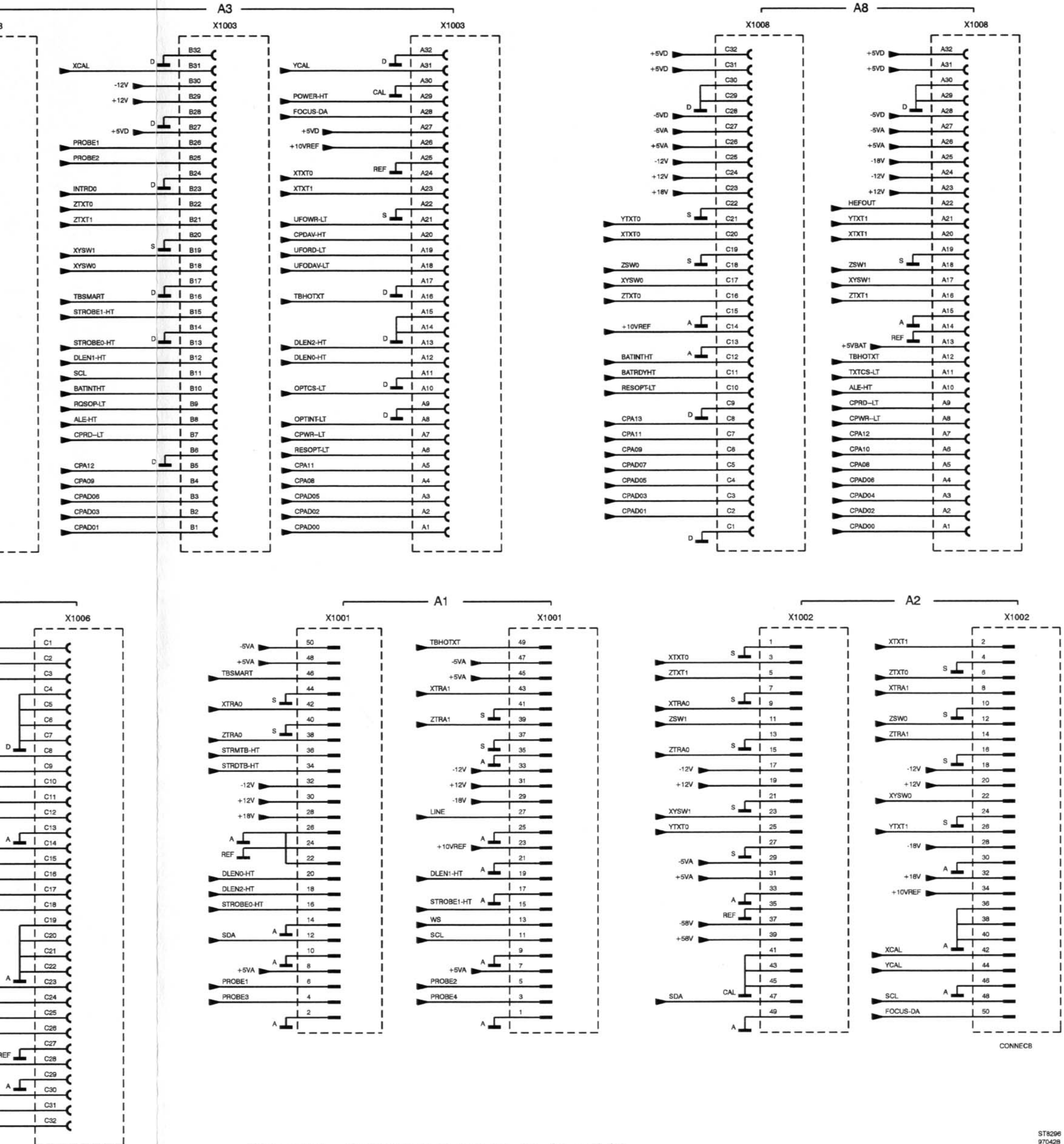


Diagram 1 - Connectors to unit A1, A2, A3 and A6

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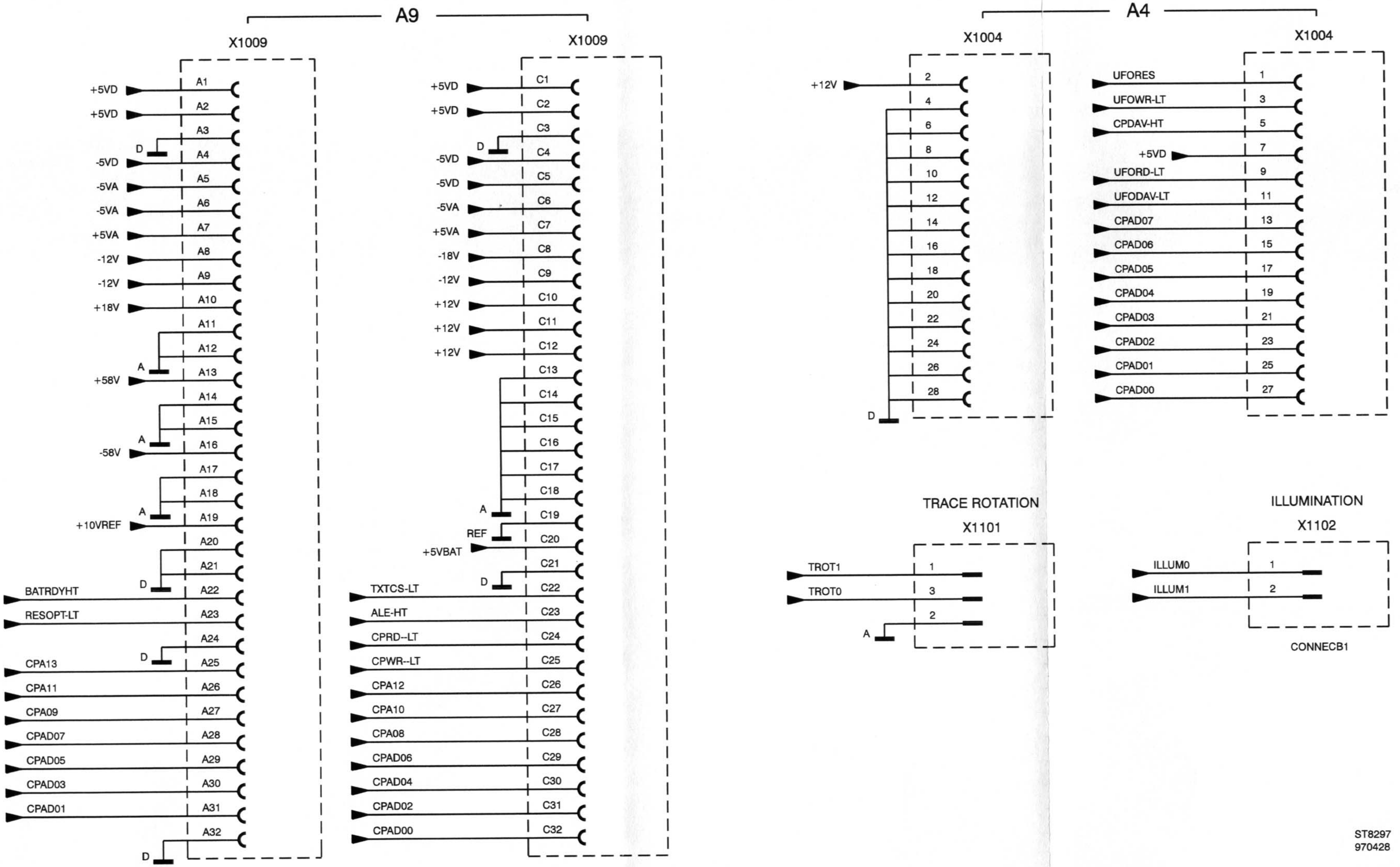
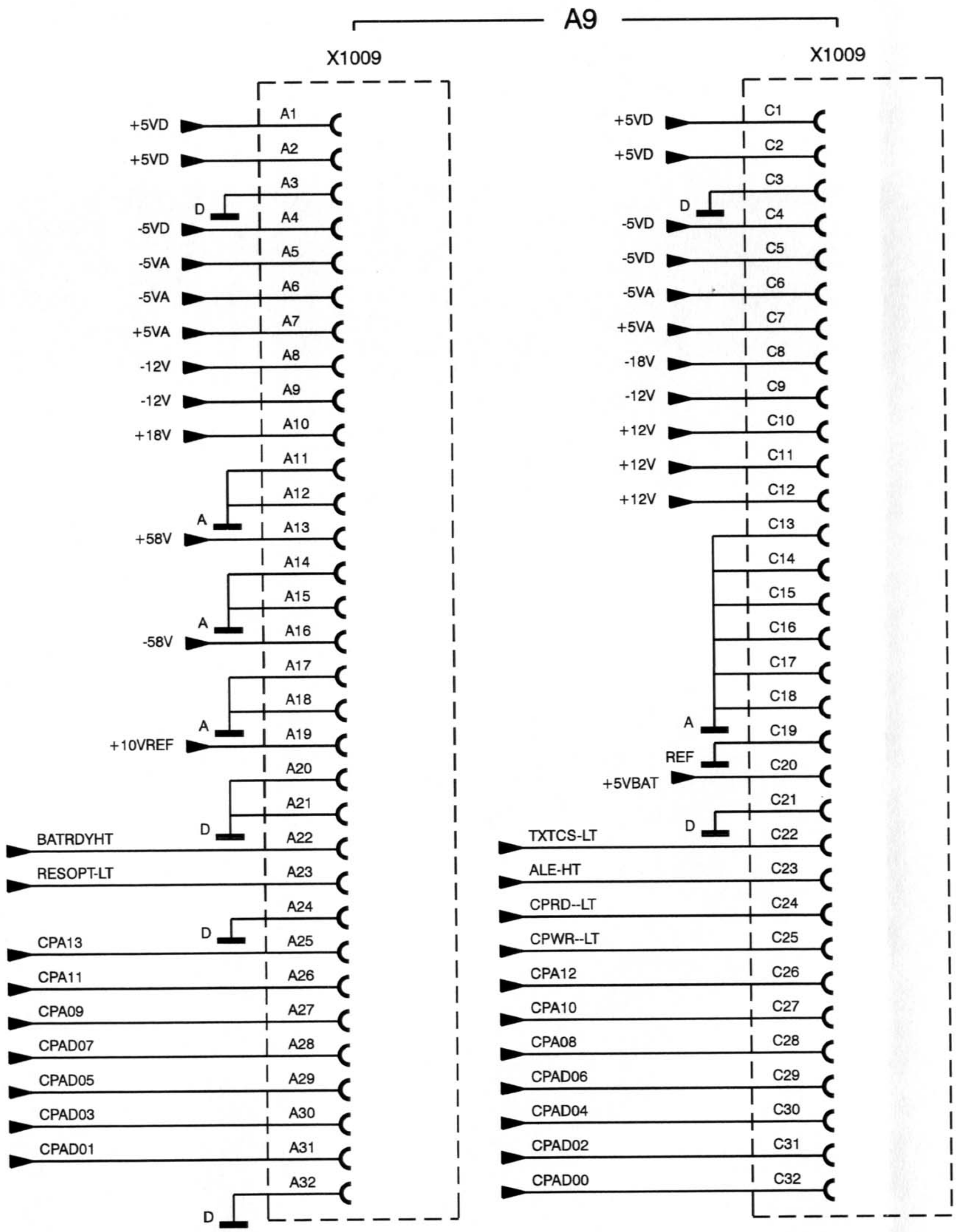
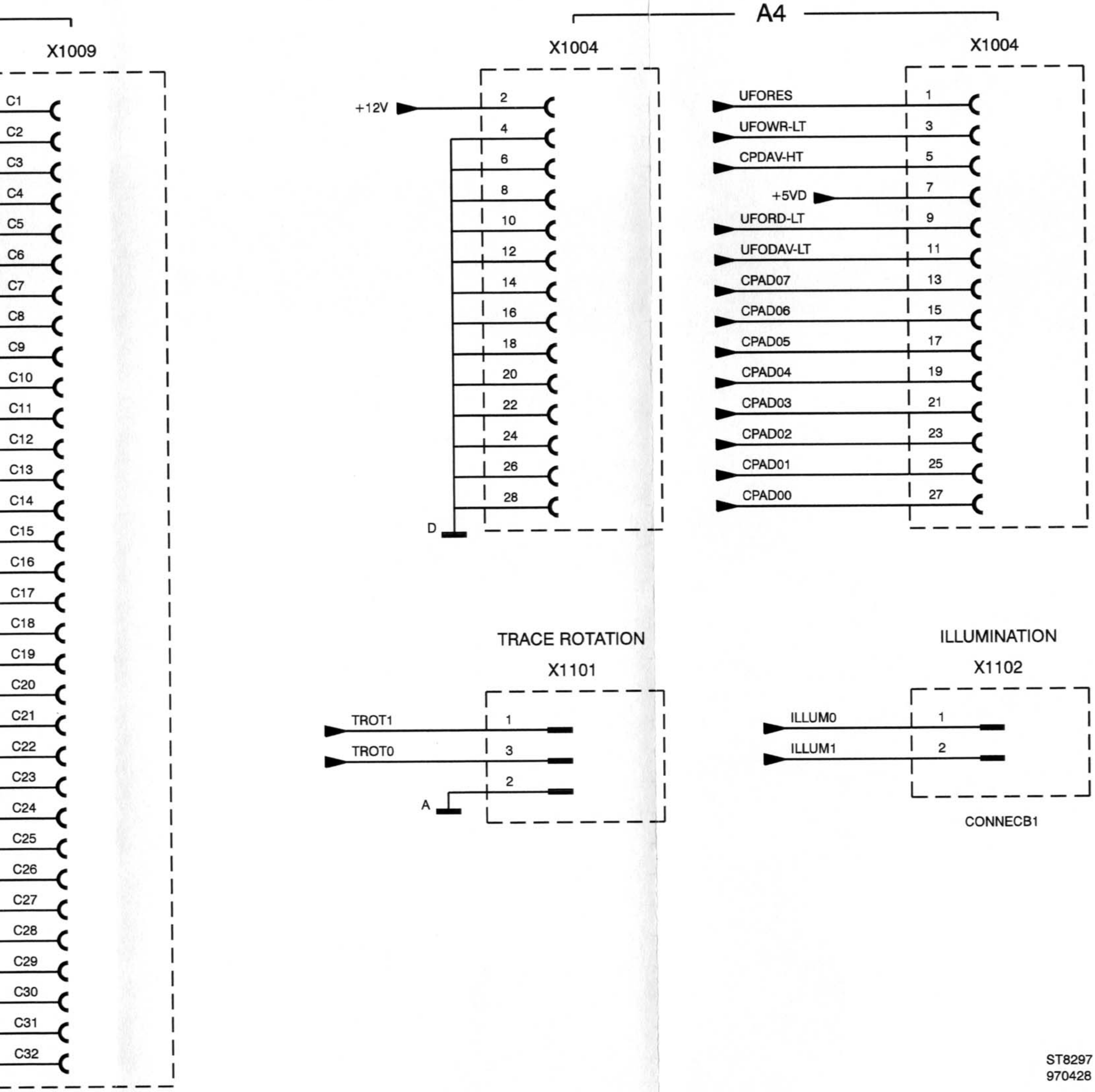


A10 - Diagram 2 ; Connectors to unit A4, A9, trace rotation and illumination


A9
X1009
X1009
+5VD A1
+5VD A2
A3
D A4
-5VD
-5VA A5
-5VA A6
+5VA A7
-12V A8
-12V A9
+18V A10
A11
A12
A A13
+58V
A14
A15
A A16
-58V
A17
A18
A A19
+10VREF
A20
A21
D A22
BATRDYHT
RESOPT-LT A23
A24
D A25
CPA13
CPA11 A26
CPA09 A27
CPAD07 A28
CPAD05 A29
CPAD03 A30
CPAD01 A31
A32
D
+5VD C1
+5VD C2
C3
D C4
-5VD
-5VD C5
-5VA C6
+5VA C7
-18V C8
-12V C9
+12V C10
+12V C11
+12V C12
C13
C14
C15
C16
C17
C18
A C19
REF C20
+5VBAT
C21
D C22
TXTCS-LT
ALE-HT C23
CPRD--LT C24
CPWR--LT C25
CPA12 C26
CPA10 C27
CPA08 C28
CPAD06 C29
CPAD04 C30
CPAD02 C31
CPAD00 C32



A10 - Diagram 2 ; Connectors to unit A4, A9, trace rotation and illumination

Item	Description		Ordering code

5.10.3 Parts list

CONNECTORS

X 1001	50-P DBL STRGHT	5322 265 61242
X 1002	50-P DBL STRGHT	5322 265 61242
X 1003	96-P 2.54MM	5322 267 51108
X 1004	P 1.25MM STR	5322 267 60311
X 1006	64-P 2.54MM	5322 267 70308
X 1011	3-P SNG STRGHT	5322 265 30434
X 1012	2-P SNG STRGHT	5322 265 20275

5.11 FACTORY INSTALLED OPTIONS

5.11.1 IEEE-OPTION

This option enables the oscilloscope to be controlled by an IEEE-system using the SCPI protocol (SCPI = Standard Commands for Programmable Instruments). The IEEE connector is located at the rear panel of the oscilloscope. The version number of this factory-installable option is /40. The interface circuitry is located at the microprocessor unit A3. The specification of the interface is given in chapter 2.17. Programming data is given in a separate 'SCPI Programming Manual'.

The description is a part of the explanation of the complete unit A3 and is given in chapter 5.3. The IEEE-option requires additional software and thus requires an additional flash-ROM D1015. The IEEE-components in an oscilloscope without IEEE- option are not inserted.

5.11.2 AUXILIARY OUTPUTS AND EXTERNAL TRIGGER OPTION

Introduction to auxiliary outputs option

This option comprises 4 rear panel BNC outputs that provide Y- out, MTB-gate-out, DTB-gate-out and External trigger input signals. The characteristics of the output signals are listed in chapter 2.16.3 'Optional outputs' in this manual. Characteristics of the external trigger input are listed in this chapter.

General description

MTB-gate-out and DTB-gate-out are realized by adding rear panel BNC sockets and coaxial interconnection cables. The coaxial cables lead to the already existing 2-pole connectors on signal unit A1. The necessary circuitry is already present on unit A1. Refer for this to figure 1. The Y- out requires a small printed circuit board, a rear panel BNC socket and a coaxial interconnection cable. The small printed circuit board is equipped with soldering pins that fit directly into unit A1. The lay-out of this unit is given in figure 2; the belonging circuit diagram in figure 3.

Circuit description

The balanced input signals for the Y-out unit are FNCYOP0 and FNCYOP1. The signals originate from pin 5 and 6 of D1301 in the Y-functions section of signal unit A1.
The input current signal is applied to common base circuit V1001/V1002. Then it is applied as current signal to pin 9 and 8 of N1001. The output current signals are routed from pin 11 and 6 to pin 13 and 16. The voltage signal at output pins 12 is used as feedback via C1002/R1009. The voltage signal at output pin 1 is used as output signal via the emitterfollowers N1001/2,3,4 and V1006. Feedback is achieved via R1024/C1011.

Parts list

Item number	Description	Service ord code
C 1001	10nF/63V	5322 122 34098
C 1002	3.3pF/63V	5322 122 32286
C 1006	1pF/63V	5322 122 32447
C 1009	10pF/63V	5322 122 32448
C 1011	2.7pF/63V	5322 122 31873
C 1012	10nF/63V	5322 122 34098
C 1013	10nF/63V	5322 122 34098
C 1014	5.6pF/63V	5322 122 32967
C 1017	22nF/63V	5322 122 32654
C 1018	100nF/63V	4822 122 33496
C 1019	100nF/63V	4822 122 33496
C 1021	100nF/63V	4822 122 33496

Item	Description	Service ord code
R 1001	12k1/1%	4822 051 51213
R 1002	1k1/1%	4822 051 51102
R 1003	1k/1%	4822 051 51002
R 1004	51E1/1%	5322 111 91893
R 1006	5k11/1%	4822 051 55112
R 1007	825E/1%	4822 051 58251
R 1008	825E/1%	4822 051 58251
R 1009	21E5/1%	5322 111 92014
R 1011	4E7/5%	4822 051 10478
R 1012	4E7/5%	4822 051 10478
R 1013	100E/1%	4822 051 51001
R 1014	100E/1%	4822 051 51001
R 1015	5k11/1%	4822 051 55112
R 1016	5k11/1%	4822 051 55112
R 1017	1k33/1%	4822 051 51332
R 1018	147E/1%	4822 051 51471
R 1019	348E/1%	4822 051 53481
R 1021	1k/1%	4822 051 51002
R 1022	1k/1%	4822 051 51002
R 1023	147E/1%	4822 051 51471
R 1024	51E1/1%	5322 111 91893
R 1026	100E/1%	4822 051 51001
R 1027	100E/1%	4822 051 51001
R 1028	750E/1%	4822 051 57501
R 1029	1k33/1%	4822 051 51332
R 1031	51E1/1%	5322 111 91893
R 1032	5k11/1%	4822 051 55112
R 1033	511E/1%	4822 051 55111
R 1034	147E/1%	4822 051 51471
R 1036	1k/1%	4822 051 51002
R 1037	51E1/1%	5322 111 91893
R 1038	511E/1%	4822 051 55111
R 1039	511E/1%	4822 051 55111
R 1041	4E7/5%	4822 051 10478
R 1042	4E7/5%	4822 051 10478
R 6101	1k/1%	4822 051 51002
R 8053	1E/5%	4822 051 10108
R 8073	1k/1%	4822 051 51002
R 8137	3k16/1%	4822 724 53162
R 8138	3k16/1%	4822 724 53162
V 1001	BF579	5322 130 61819
V 1002	BF579	5322 130 61819
X 1011	Male Header	5322 265 20525

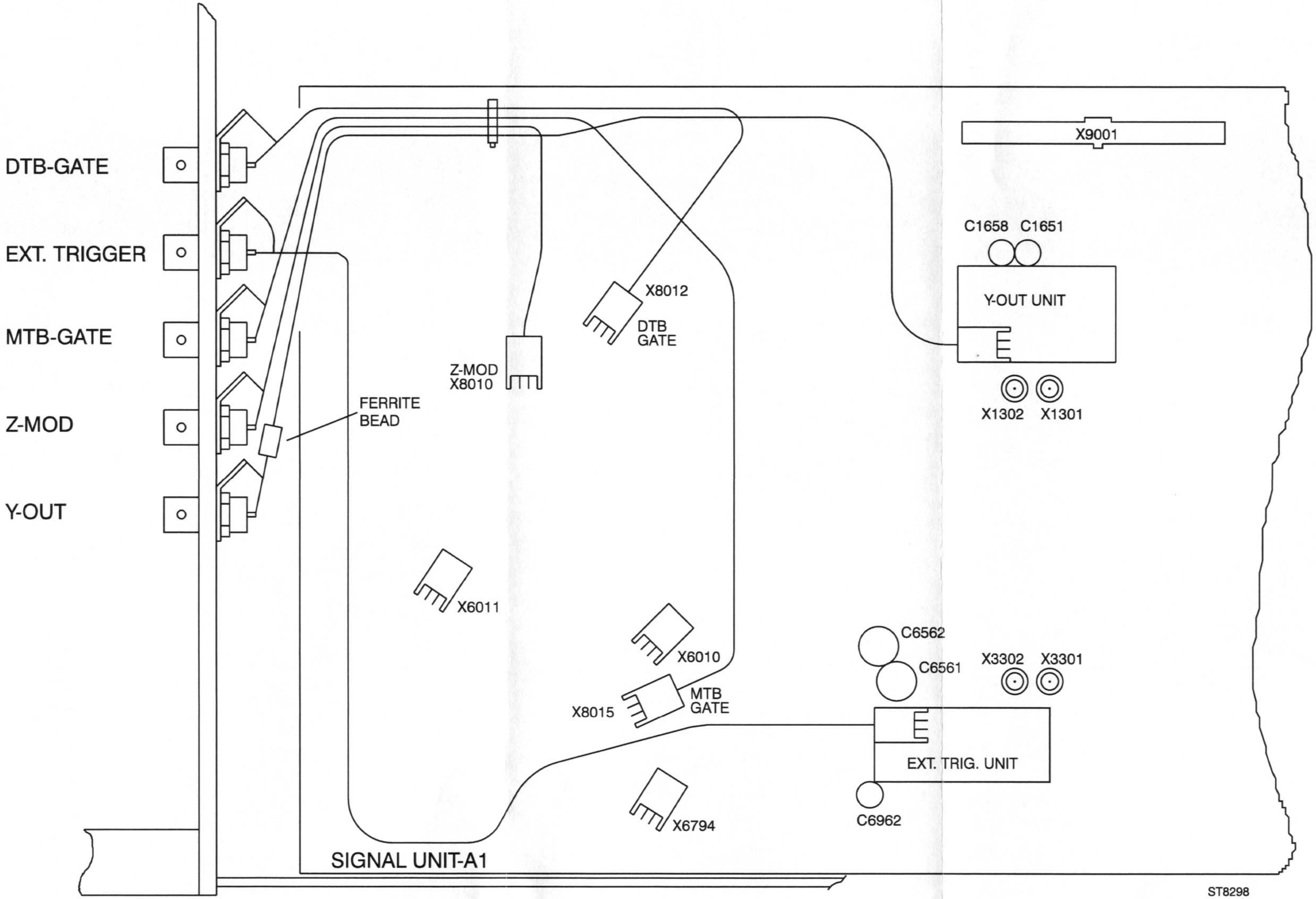


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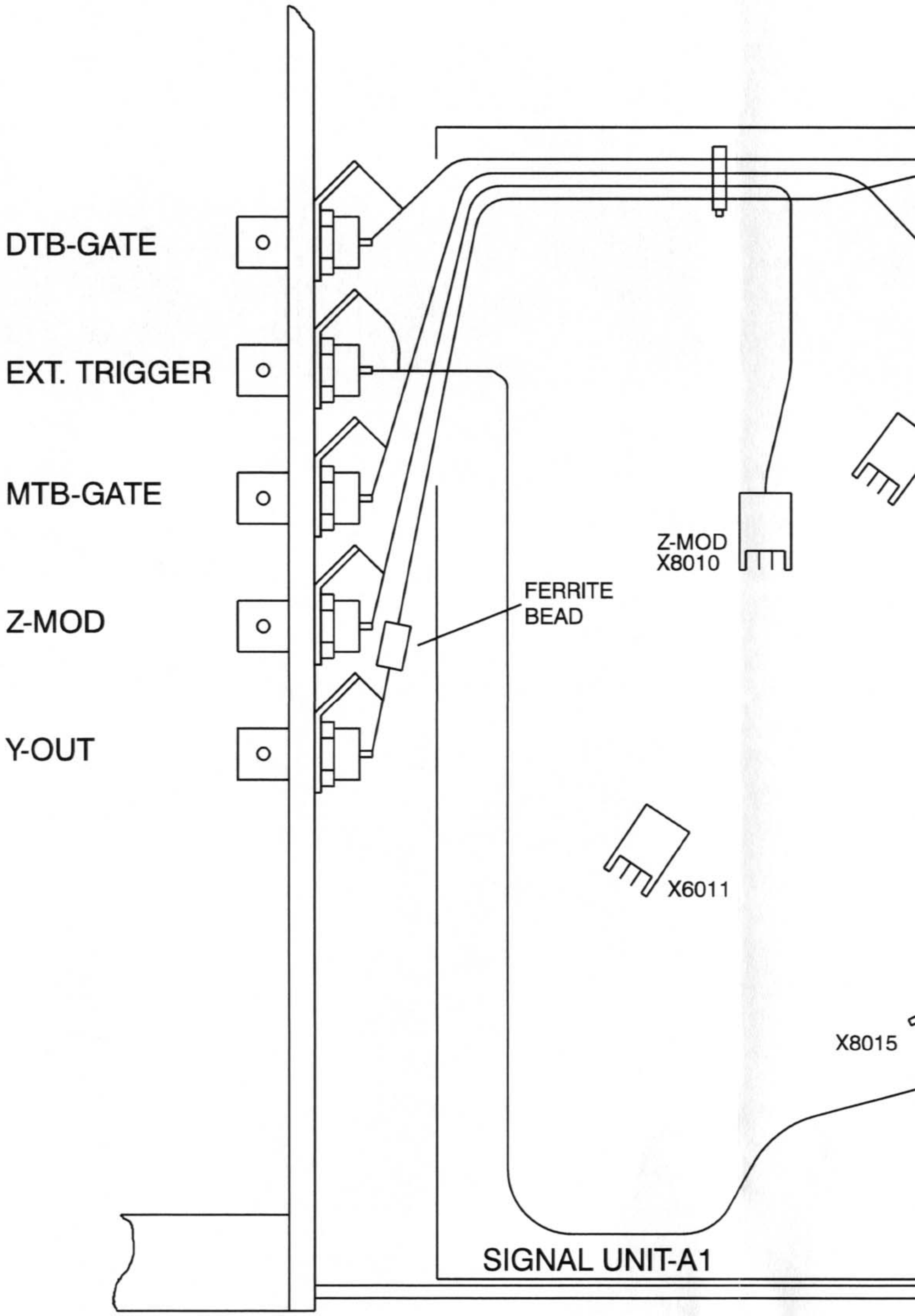
Fig. 1. Location of options Y-out and external trigger


DTB-GATE
EXT. TRIGGER
MTB-GATE
Z-MOD
Y-OUT
FERRITE
BEAD
Z-MOD
X8010
X6011
X8015
SIGNAL UNIT-A1

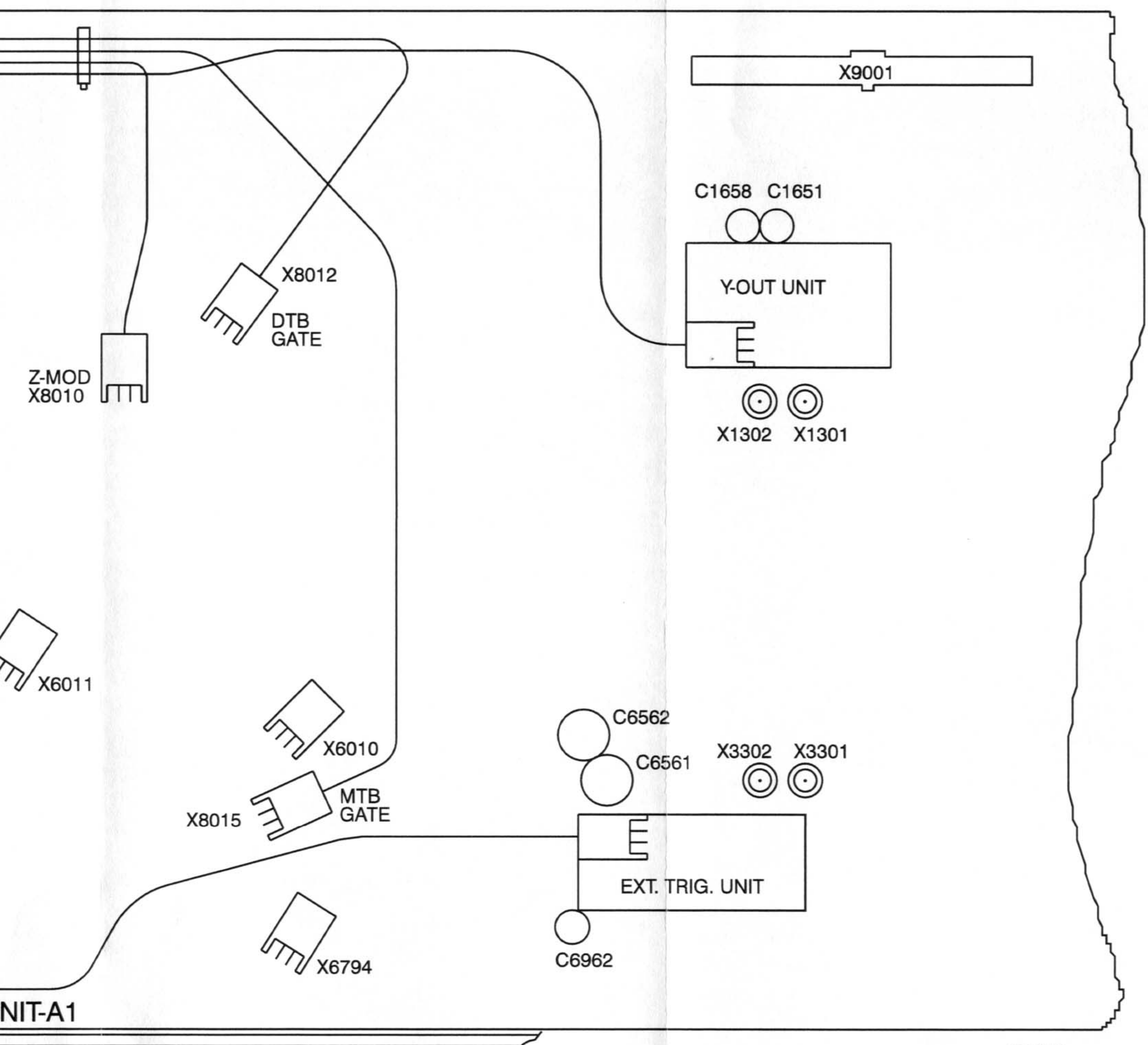


Fig. 1. Location of options Y-out and external trigger

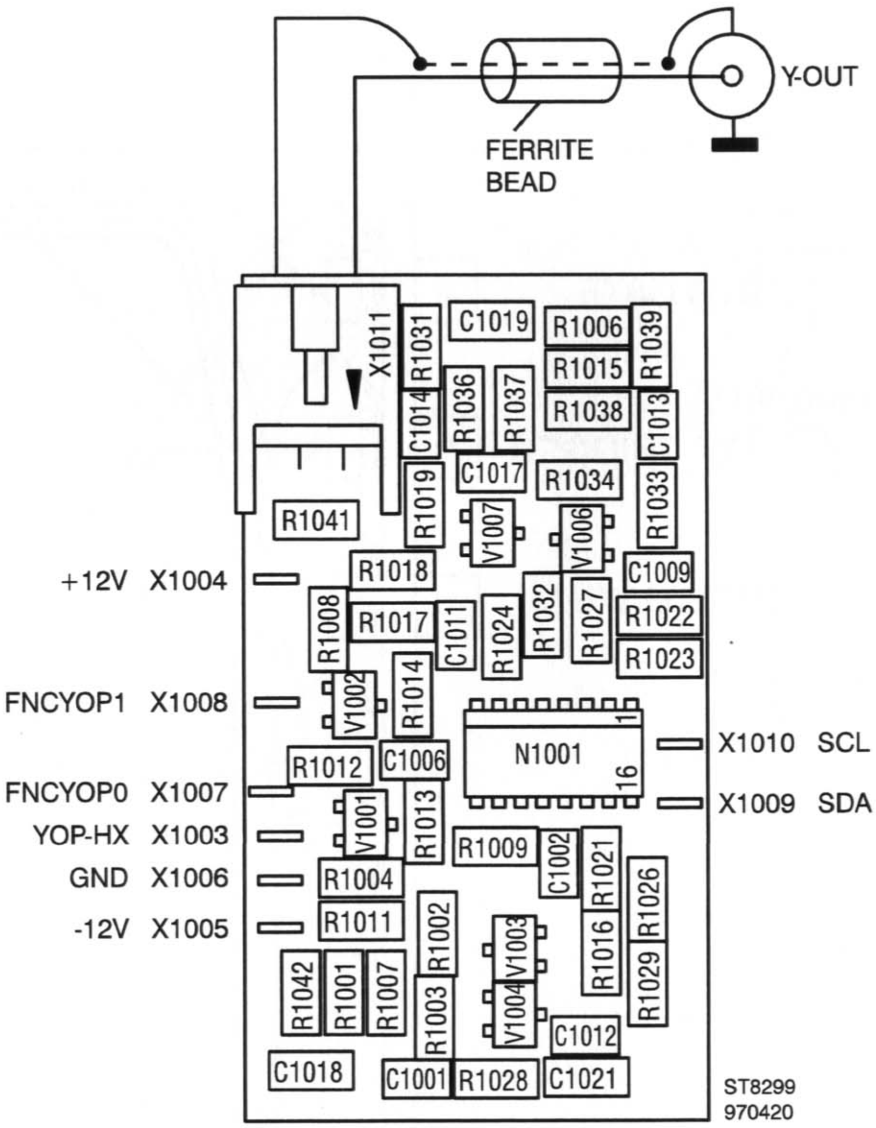


Fig. 2. Printed circuit board lay-out of Y-out unit

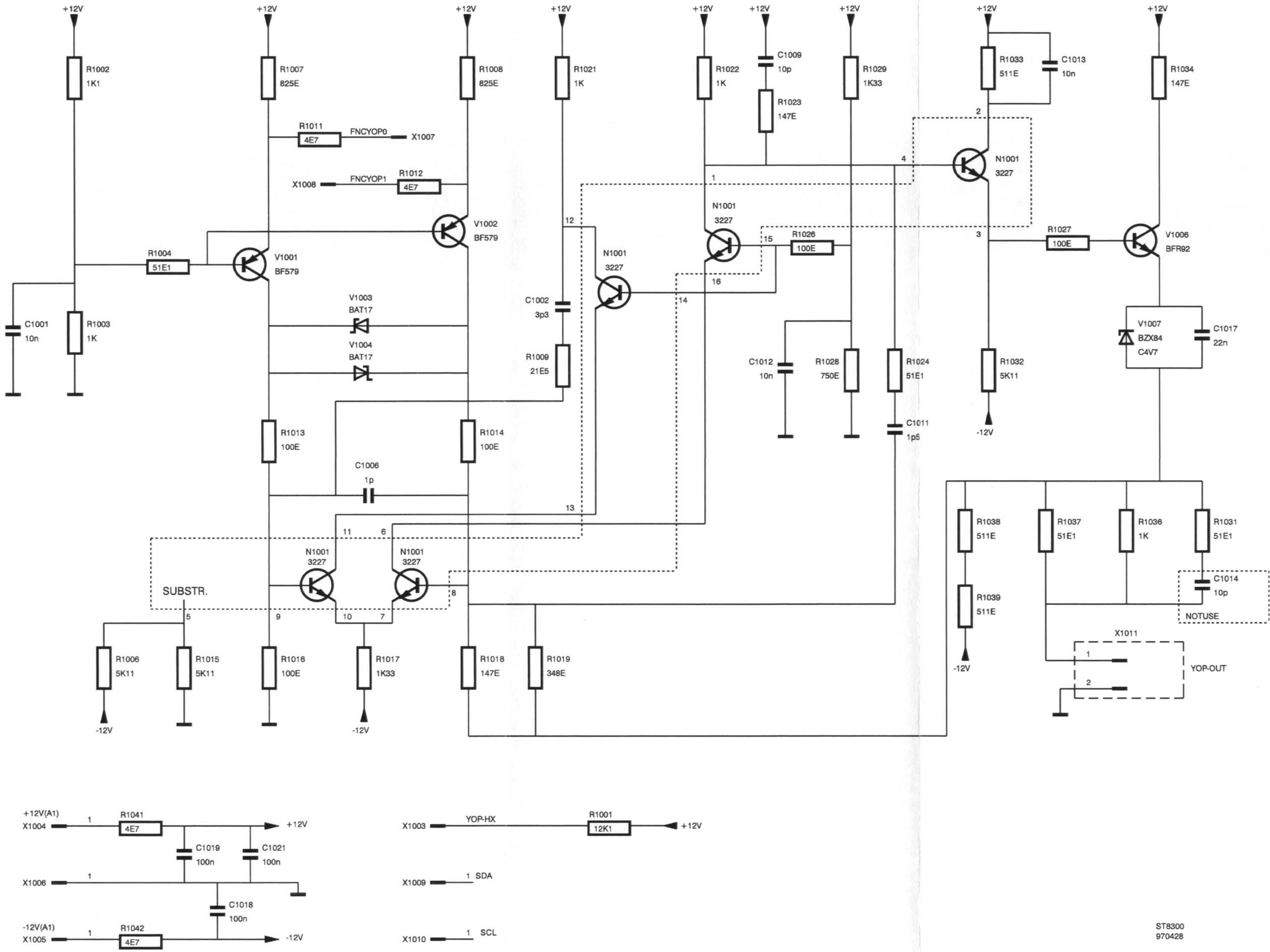
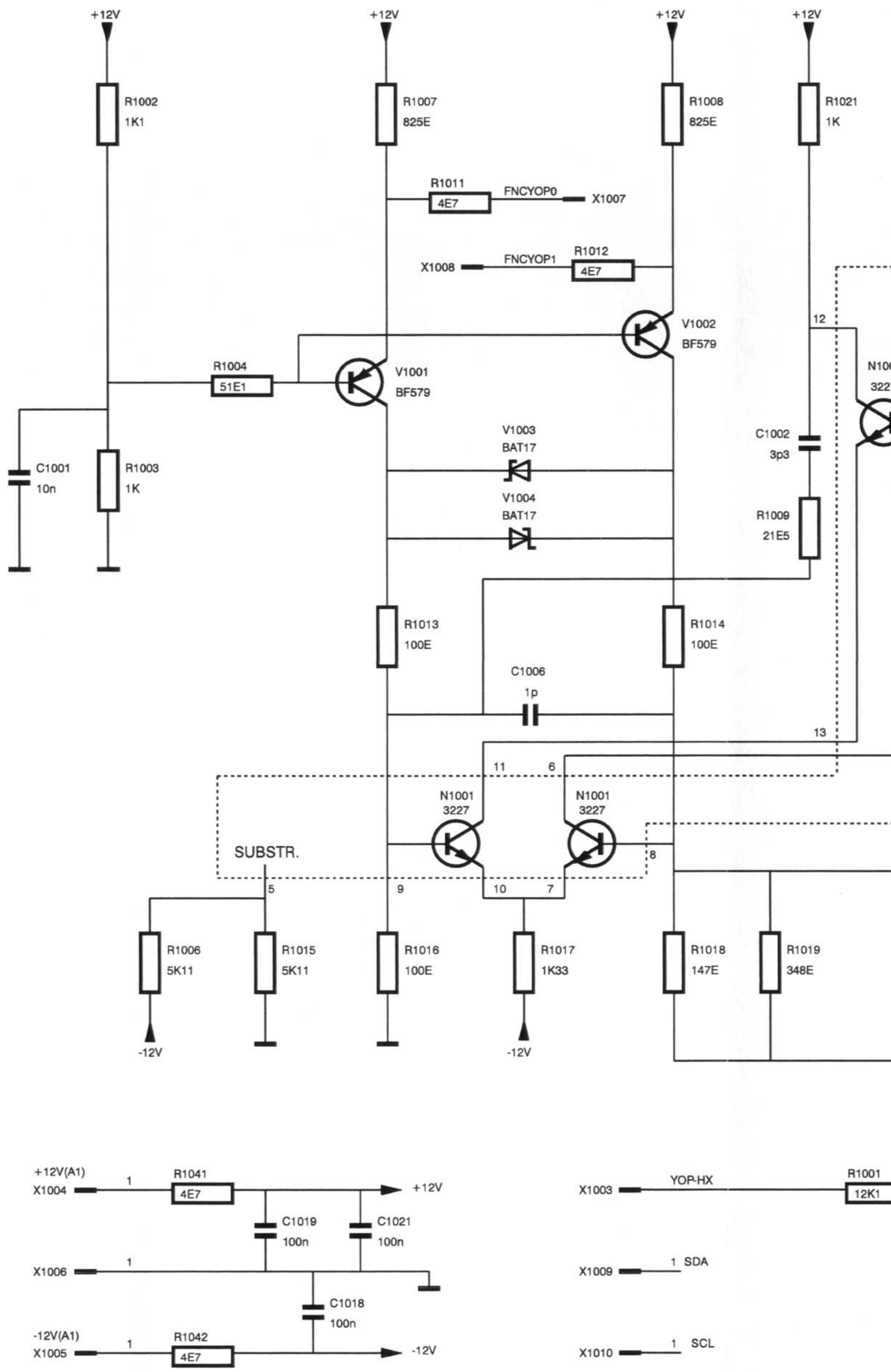


Fig. 3. Circuit diagram of Y-out unit


+12V
R1002
1K1
R1007
825E
R1008
825E
R1021
1K
R1011
4E7
FNCYOP0
X1007
X1008
FNCYOP1
R1012
4E7
V1002
BF579
R1004
51E1
V1001
BF579
C1001
10n
R1003
1K
V1003
BAT17
V1004
BAT17
C1002
3p3
R1009
21E5
R1013
100E
R1014
100E
C1006
1p
N1001
3227
SUBSTR.
R1006
5K11
R1015
5K11
R1016
100E
R1017
1K33
R1018
147E
R1019
348E
-12V
+12V(A1)
X1004
R1041
4E7
C1019
100n
C1021
100n
X1006
C1018
100n
-12V(A1)
X1005
R1042
4E7
X1003
YOP-HX
R1001
12K1
X1009
SDA
X1010
SCL

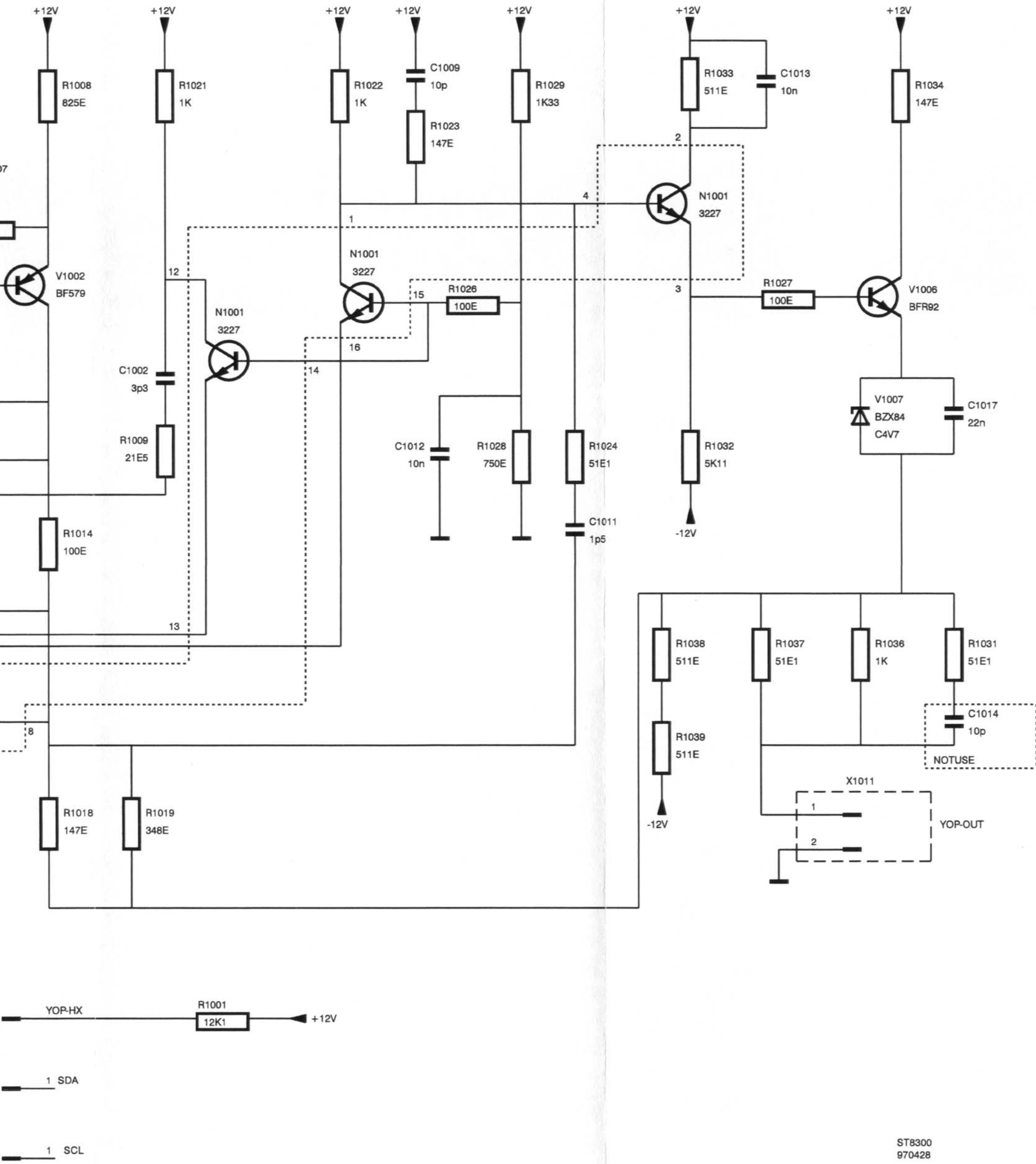


Fig. 3. Circuit diagram of Y-out unit

Introduction toexternal trigger option

The External Trigger Input option provides an extra input at the rear of the oscilloscope. This input can be used as the trigger source for the Main Time Base (MTB). The option is factory-installable only. The external trigger requires a small printed circuit board, a rear panel BNC socket and a coaxial interconnection cable.

The small printed circuit board is equipped with soldering pins that fit directly into unit A1. Refer to figure 1 for the exact location. The lay-out of this unit is given in figure 4; the belonging circuit diagram in figure 5.

The EXT TRIG input is suitable for use with the supplied 10:1 probe. The input characteristics are similar to those of CH1...CH4.
If External is chosen as trigger source, then the following trigger functions remain available:

- trigger filters ac, dc, lf_rej and hf_rej
- level-pp function
- +/- slope selection
- noise on/off

If External trigger is chosen as trigger source, then TV trigger mode is not available.
Line (50/60 Hz mains) as trigger source is not available.
If the External trigger option is present together with 'Y- out' option, then the DTB gate output of the Y-out is not available.

A diode V7801 (BAV99, 5322 130 34337) is added on signal unit A1. This diode is connected to the 'panel version identification' circuit D9013. By means of this, the internal software knows that the external trigger option is present. Diode V7801 is located on unit A1 between V7802 and R7077.

Characteristics

The following has to added to chapter 2.3.1 of 'characteristics'.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
Source		
SOURCE(S)	CH1 ... CH4	
MTB- triggering	External	No line triggering
	Composite	
Input characteristics		
INPUT CONNECTOR	BNC	At rear of instrument
INPUT IMPEDANCE		Measured at freq.<1MHz
R paralle		
- value	1 MΩ	
- tolerance	±1 %	
C parallel		
- value	25 pF	
- tolerance	±5 pF	
DYNAMIC RANGE		
Up to 10 MHz	±2.5 V	Symmetrical

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
INPUT VOLTAGE LIMITS		See note 1
(d.c. + a.c. peak)	±400 V	See note 2

Note 1: *Apparatus should be properly grounded through the protective ground conductor of the power cord.*

Note 2: *Up to 10 kHz; > 10kHz see figure 1.1.*

Sensitivity

EDGE TRIGGER SENSITIVITY		See note 3
d.c. to 5 MHz	100 mV	
d.c. to 10 MHz	200 mV	

Note 3: *In noise-trigger multiply stated value by 2.*

Trigger level

Range	±1.5 V	
Accuracy	≤0.4 V	See note 4 at 1 kHz inputsignal triggercoupling DC

Note 4: *With Level-pp on the range is restricted to the peak- peak value of the trigger signal.*

Circuit description

Refer to figure 5 for the circuit diagram. The input signal is routed via RC circuit R1001/C1002 and a coaxial cable to the small printed circuit board. Via protection diodes V2002 the signal is applied to the operational amplifier N2021. This device functions as amplifier and level shifter. The analog multiplexer D2031 the output signal MTRIGEXT. This signal is applied to the base of transistor V6507 in the MTB trigger section on unit A1 (diagram 12). Multiplexer D2031 applies -9 V (-9EXT) to the diodes V2012 if the external trigger signal is not needed. This suppresses the signal directly at the input.

Parts list

Item number	Description	Service ord code
C 1001	33pF/500V	4822 122 31202
C 2082	47uF/25V	4822 124 20699
C 2091	47uF/25V	4822 124 20699
C 2001	56pF/63V	5322 122 32661
C 2003	100nF/63V	4822 122 33496
C 2004	100nF/63V	4822 122 33496
C 2011	10nF/63V	5322 122 34098
C 2016	100nF/63V	4822 122 33496
C 2021	100pF/63V	5322 122 32531
C 2023	33pF/63V	5322 122 32659
C 2032	100nF/63V	4822 122 33496
C 2082	100nF/63V	4822 122 33496
C 2086	100nF/63V	4822 122 33496
C 2092	100nF/63V	4822 122 33496
C 2094	100nF/63V	4822 122 33496

Item	Description	Service ord code
D 2031	HEF4053BT	5322 209 14481
R 1001	750k/0.25%	5322 116 53588
R 2001	511k/1%	4822 051 55114
R 2002	511k/1%	4822 051 55114
R 2013	10M/5%	4822 051 10106
R 2014	10M/5%	4822 051 10106
R 2021	261E/1%	4822 051 52611
R 2022	14k7/1%	4822 051 51473
R 2023	1k47/1%	4822 051 51472
R 2024	3k16/1%	4822 051 53162
R 2033	1k47/1%	4822 051 51472
R 2051	14k7/1%	4822 051 51473
R 2052	2k15/1%	4822 051 52152
R 2054	5k11/1%	4822 051 55112
R 2061	2k15/1%	4822 051 51252
R 2062	14k7/1%	4822 051 51473
R 2063	5k11/1%	4822 051 55112
R 2081	4E7/5%	4822 051 10478
R 2086	4E7/5%	4822 051 10478
R 2091	4E7/5%	4822 051 10478
R 2094	5k11/5%	4822 051 55112
V 2002	BAS28	5322 130 80214
V 2012	BAS28	5322 130 80214
V 2053	BC848C	5322 130 42136
V 2064	BC858C	4822 130 42513
V 2093	BZX84-C3V0	5322 130 32739
X 2001	Male Header	5322 265 20525

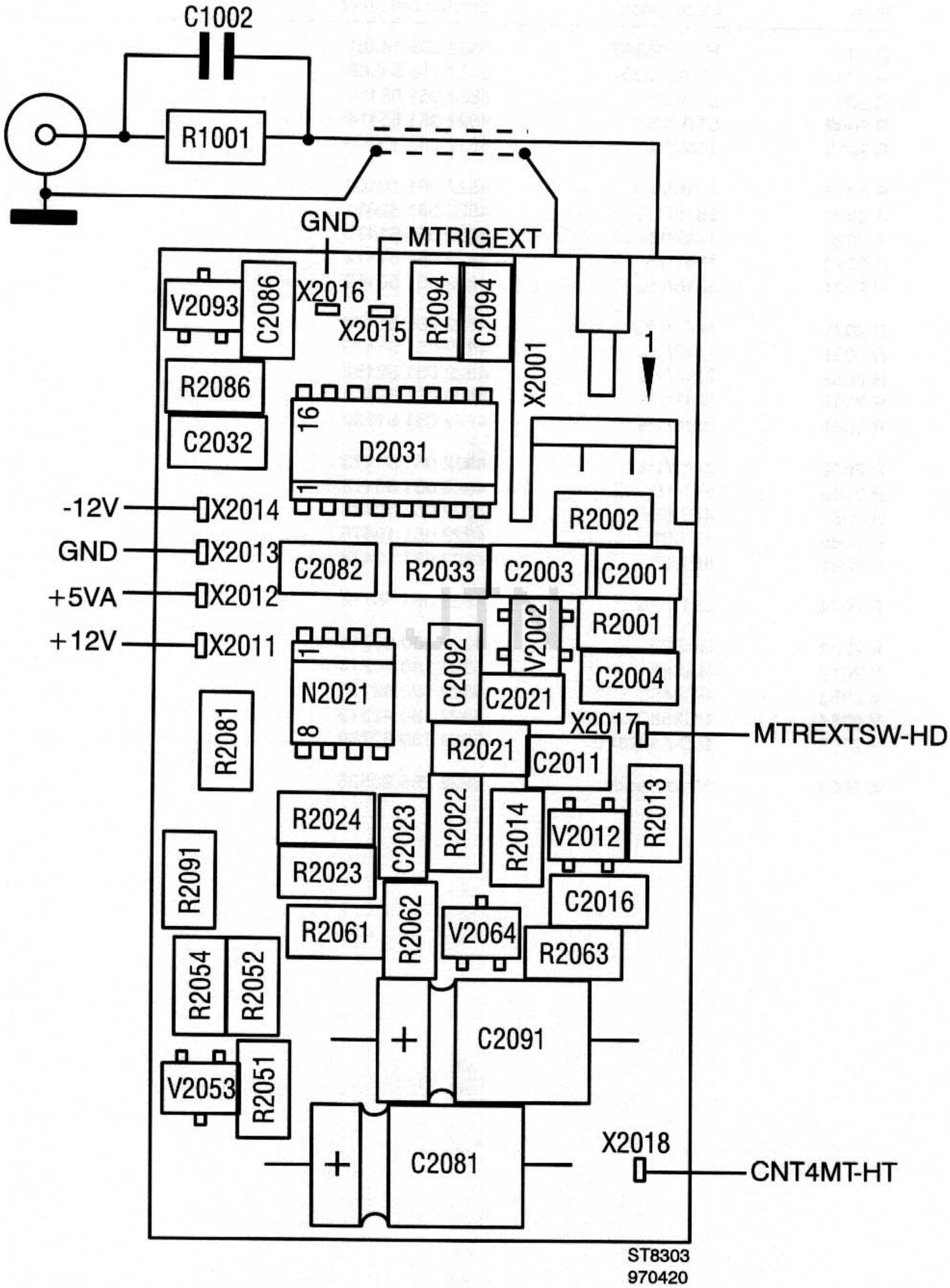
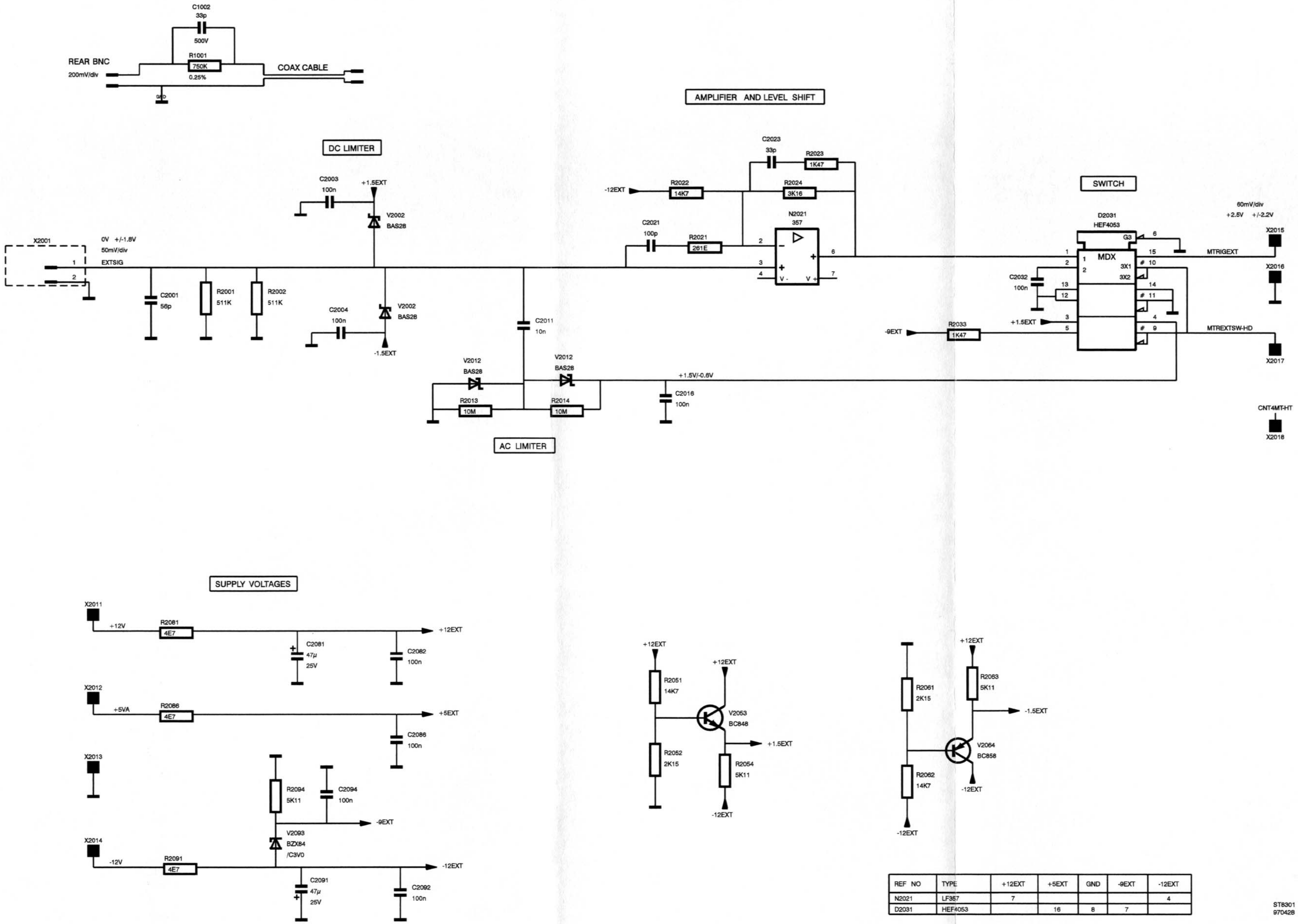


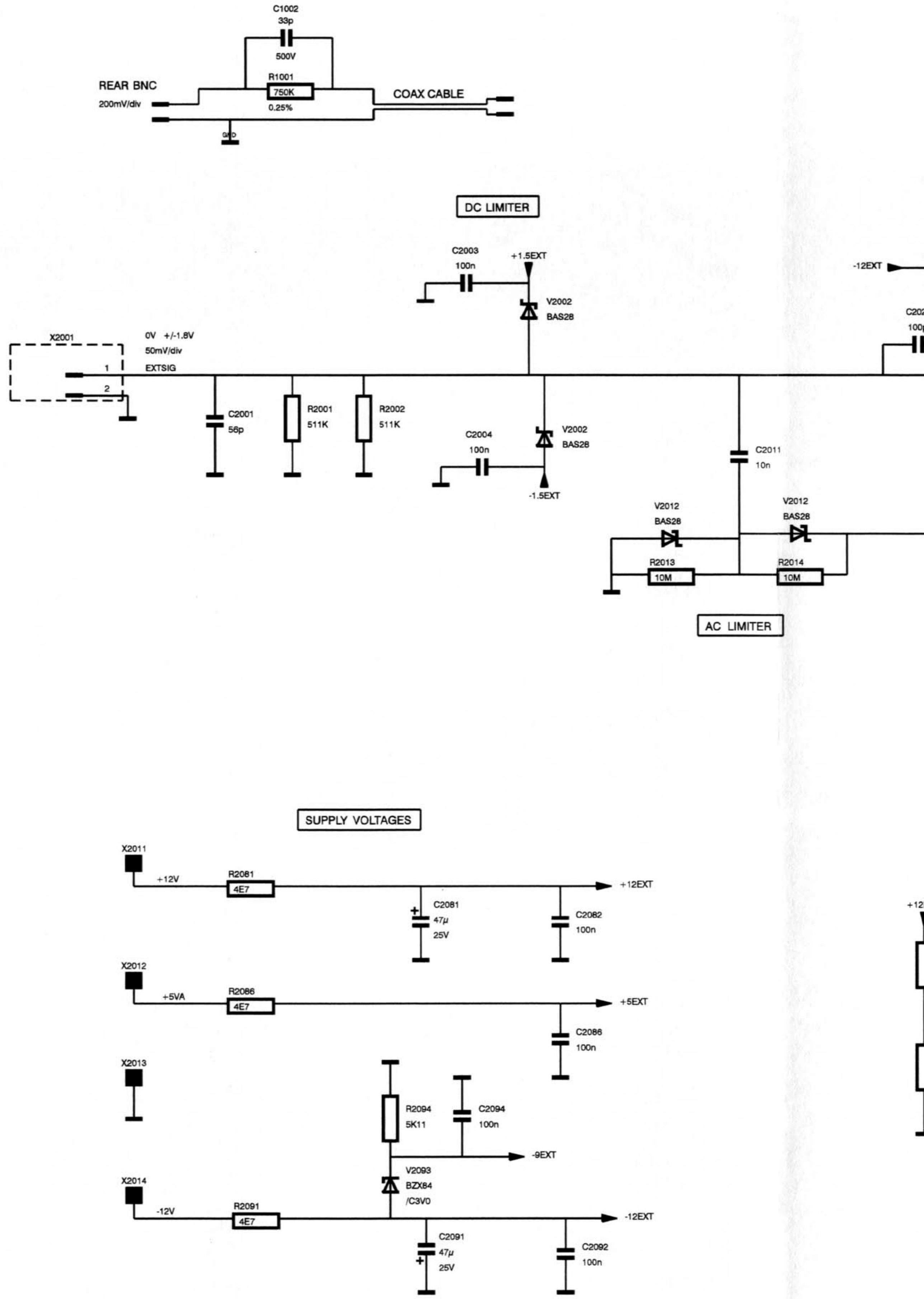
Fig. 4. Printed circuit board lay-out of external trigger unit

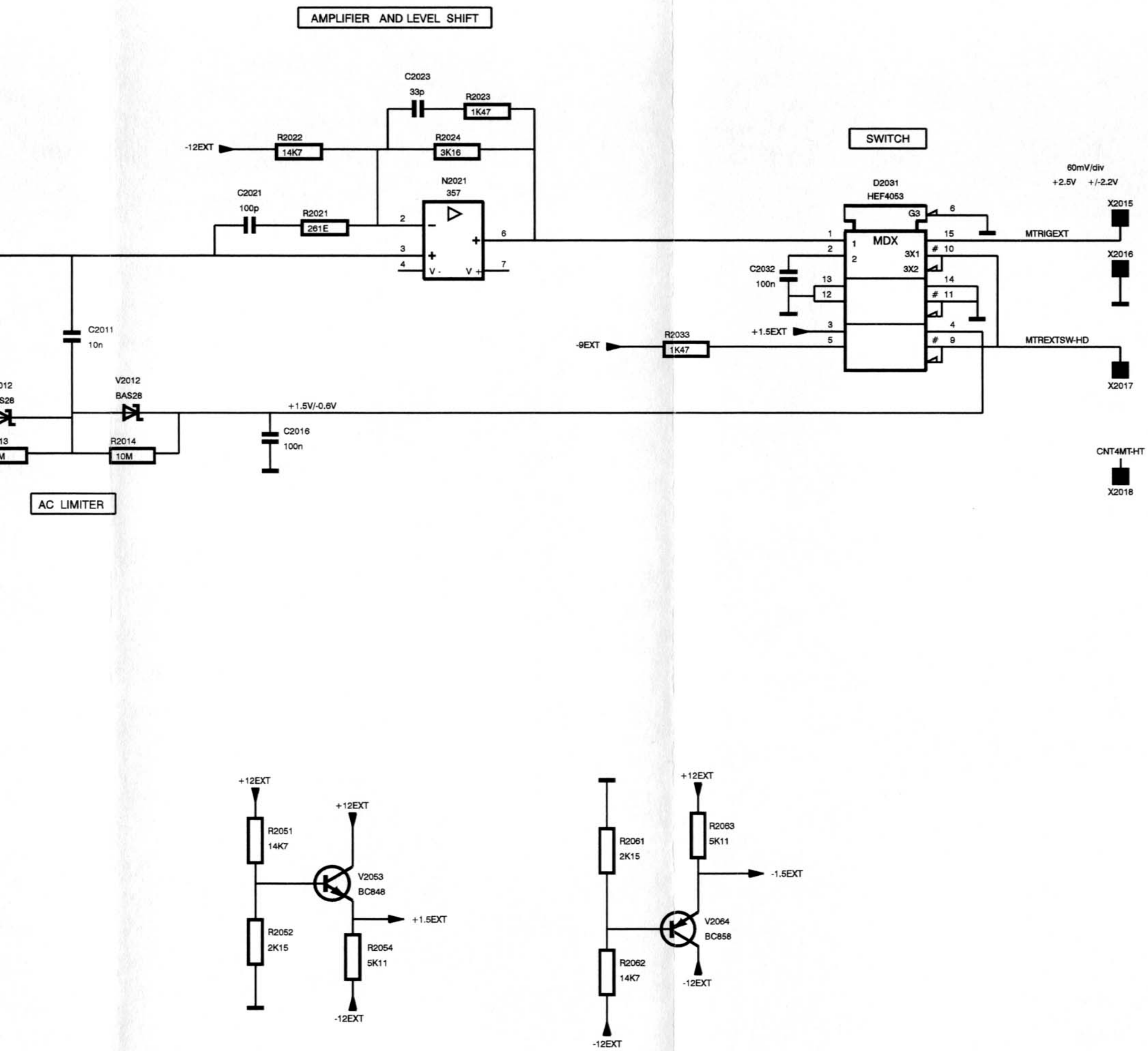


REF NO	TYPE	+12EXT	+5EXT	GND	-9EXT	-12EXT
N2021	LF357	7				4
D2031	HEF4053		16	8	7	

ST8301
970428

Fig. 5. Circuit diagram of external trigger unit


C1002
33p
500V
R1001
750K
0.25%
REAR BNC
200mV/div
COAX CABLE
GND
DC LIMITER
C2003
100n
+1.5EXT
V2002
BAS28
-12EXT
X2001
0V +/-1.8V
50mV/div
EXTSIG
1
2
C2001
56p
R2001
511K
R2002
511K
C2004
100n
V2002
BAS28
-1.5EXT
C2011
10n
V2012
BAS28
V2012
BAS28
R2013
10M
R2014
10M
AC LIMITER
SUPPLY VOLTAGES
X2011
+12V
R2081
4E7
+12EXT
C2081
47µ
25V
C2082
100n
X2012
+5VA
R2086
4E7
+5EXT
C2086
100n
X2013
R2094
5K11
C2094
100n
-9EXT
V2093
BZX84
/C3V0
X2014
-12V
R2091
4E7
-12EXT
C2091
47µ
25V
C2092
100n



REF NO	TYPE	+12EXT	+5EXT	GND	-9EXT	-12EXT
N2021	LF357	7				4
D2031	HEF4053		16	8	7	

ST8301
970428

Fig. 5. Circuit diagram of external trigger unit

6 PERFORMANCE TEST

6.1 GENERAL INFORMATION

WARNING: Before turning on the instrument, ensure that it has been installed in accordance with the Installation Instructions, outlined in Section 2 of the Operation Guide.

This procedure is intended to:

- Check the instrument's specification.
  Be used for incoming inspection to determine the acceptability of newly purchased instruments and/or recently recalibrated instruments.
  Check the necessity of recalibration after the specified recalibration intervals.

NOTE: The procedure does not check every facet of the instrument's calibration; rather, it is concerned primarily with those parts of the instrument which are essential to measurement accuracy and correct operation. Removing the instrument covers is not necessary to perform this procedure. All tests are made from the outside of the instrument.

If the test is started shortly after turning on the instrument, steps may be out of specification, due to insufficient warm up time. Be sure to allow the full warm up time of 30 minutes (under average conditions).

The tests are made with a stable, well-focused, low-intensity display. Unless otherwise noted, adjust the intensity, position, and trigger level controls as needed.

IMPORTANT NOTES

- The input voltage must be supplied to the CH1 input, unless otherwise stated. Set the MTB/VAR key pair to a suitable position, unless otherwise stated.
- Tolerances given are for the instrument under test and do not include test equipment error. Bear in mind that the test equipment and connecting cables are properly terminated.
  In case of high-frequency signals, this termination must be 50Ω. This is achieved with a 50Ω termination at the end of the cable. Such termination is not necessary for the PM3094 (all channels), or CH1, CH2 of the PM3092; these oscilloscopes feature switchable internal 50Ω input impedance.
- In some tests vertical channels CH2, CH3, CH4 appear in parentheses after CH1, e.g., CH1 (CH2, CH3, CH4). This indicates that the CH1 test should be performed first, followed by the tests for CH2, CH3 and CH4.
- Some of the tests are not necessary for all four oscilloscope types. This is indicated as necessary. The test step may then be skipped.
- Test steps where the use of a 10:1 probe is required, must be done with the probe type such as supplied with the oscilloscope.

6.2 RECOMMENDED TEST EQUIPMENT

Note: *The digital multimeter and oscilloscope are not required for this test.*

Note: *The FLUKE 5500A Multiproduct Calibrator is always used in SCOPE mode. The output signal must be taken from the BNC output 'Scope'.*

Type of instrument	Required specification	Example of recommended instrument
Function generator	Freq: 10 Hz...100kHz Sine wave/square-wave Ampl: 0...20 V(pp) Rise time ≤30 ns Duty cycle 50%	Fluke 5500A mode: wavegen
Constant amplitude sine wave generator	Freq: 50 kHz...300 MHz. Constant pp. amplitude of 10 mV to 5.5V.	Fluke 5500A mode: levsine
Square-wave calibration generator	For ampl. calibration: Freq: 1 kHz Ampl: 10 mV...50 V	Fluke 5500A mode: volt
	For rise time measurements: Freq: 10 kHz...1 MHz Ampl: 10...900 mV Rise time: ≤1 ns	Fluke 5500A mode: edge
Time marker generator	Repetition rate: 0.5s...2 ns	Fluke 5500A mode: marker
Digital multimeter	Wide voltage and current ranges.	Fluke 29/79 with AC, DC and resistance ranges. High voltage probe. Required: 1% accuracy, model 80K-40
Variable voltage transformer (VARIAC)	Well insulated output voltage 90...264V (ac)	
TV pattern generator with video output		Fluke PM5418
Oscilloscope	The bandwidth must be the same or higher than the bandwidth of the instrument under test.	Fluke PM3094
BNC/Probe tip adapter	For bandwidth check in PM3092	ord.nr. 5322 263 50022
50Ω cables, 75Ω cable, 50Ω terminations, 75Ω termination, 10:1 attenuator, T-piece, power splitter 2:1 attenuator	Fluke or e.g. Tektronix BNC types for fast risetime square-wave and high-frequency sinewave applications.	Fluke PM9074 Fluke PM9075 Fluke PM9581 TEK 011-0055-01 TEK 011-0059-02 Fluke PM9067 Fluke PM9584/02 TEK 011-0069-02

6.3 TEST PROCEDURE

6.3.1 Preliminary settings

Test equipment:

None

Settings/procedure and requirements:

1 - If not present install 2 penlight (LR6) back up batteries in the holder at the rear panel of the oscilloscope.
2 - Turn on the oscilloscope under test.
3 - Press the STATUS and TEXT OFF keys simultaneously. This assures that the oscilloscope follows the default reaction when the green AUTOSET key is pressed. The now following steps are applicable for PM3092 and PM3094.
4 - Press the UTILITY menu key to display the UTILITY menu.
5 - Press softkey AUTOSET to display the UTILITY AUTOSET menu.
6 - Press the relevant softkey to put the oscilloscope in the 'AUTOSET userprog' mode; the text 'userprog' must be intensified.
7 - Press softkey VERT.
8 - Select with softkey '1MΩ / 50Ω / unaffect' the 'unaffect' position.
9 - Check for the instrument settings in the lower part of the viewing area: when not available press TEXT OFF until the maximum amount of information is displayed.

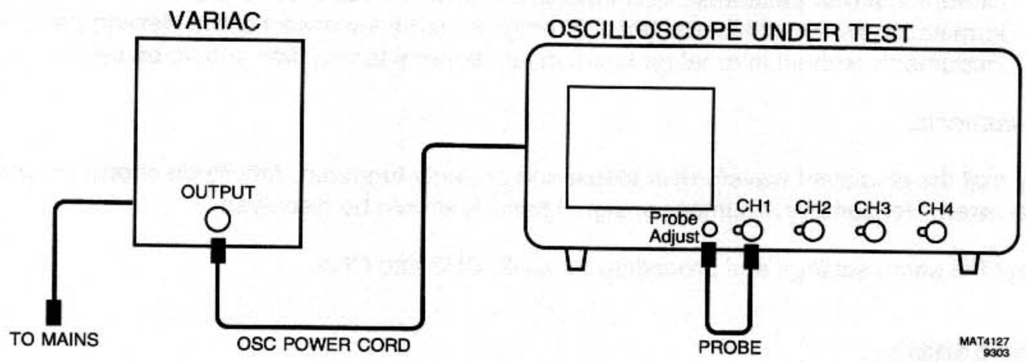
6.3.2 Power supply

This test checks the proper operation of the power supply at all possible line voltages.

Test equipment:

Variable voltage transformer (VARIAC)

Test set-up:



Settings/procedure:

1 - Adjust the input line voltage to the oscilloscope (output from VARIAC) to a desired value between 100 and 240V (rms), frequency 50...400 Hz.
2 - Press POWER ON on the oscilloscope.
3 - Apply the Probe Adjust signal from the front panel of the oscilloscope to input CH1 , e.g., by means of a 10:1 probe.
4 - Press the green AUTOSET key.

Requirements:

1 - Verify that the oscilloscope starts at any input voltage between 100 and 240V; in particular the line voltages 100, 120, 220 and 240V must be checked.
2 - Verify that the instrument's performance does not change over the indicated voltage range; and that the displayed Probe Adjust signal is distortion-free and has equal intensity.

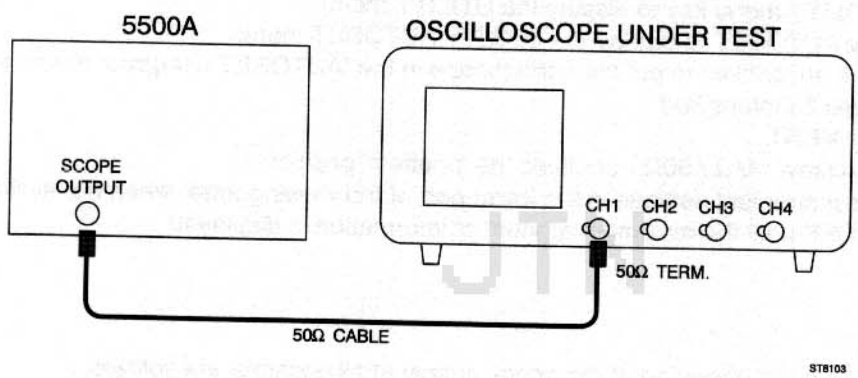
6.3.3 Auto set

This test checks the correct working of the AUTOSET function.

Test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generator SG 503)

Test set-up:



Settings/procedure:

1 - Apply a 10 MHz sine wave signal of 600 mV (pp into 50Ω) to input CH1;.
2 - Press the green AUTOSET key. Use a 50Ω termination at the end of the coax cable. For instruments with switchable 50Ω input impedance it is recommended to use the internal termination (when active, the text 'LZ' appears in the lower part of the viewing area). For instruments without internal termination, an external termination should be used.

Requirements:

Verify that the displayed waveform is stable and properly triggered. Amplitude should be within the screen area. Horizontally a number of signal periods should be displayed.

Repeat the same settings and procedure for CH2, CH3 and CH4.

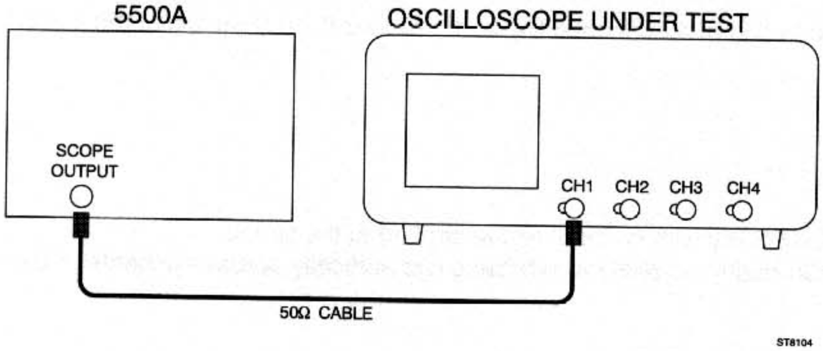
6.3.4 Orthogonality

This test checks the angle between the horizontal and vertical deflection plates (orthogonality).

Test equipment:

Fluke 5500A mode: wavegen, wave sine (Alternative: function generator PM5136)

Test set up:



Settings/procedure:

1 - Press the CAL key for a few seconds to start the autocal procedure. This takes approximately one minute. When ready, the oscilloscope is fine tuned to optimal accuracy.
2 - Apply a 50 Hz sine wave signal of 8 V(pp) to input CH1;
3 - Press the AUTOSET key and adjust the input signal to a trace- height of 8 div.
4 - Activate the GND function and verify that the straight line is exactly parallel to the horizontal graticule lines. If not, readjust the TRACE ROTATION.
5 - Switch the GND function off and verify that a signal of 8 divisions is displayed.
6 - Press the TB MODE menu key to display the TB MODE menu.
7 - Select X-DEFL 'on' in this menu; the text 'on' must be intensified. The name of the displayed menu now changes into : TB MODE X-DEFL.
8 - Select 'ch2' in the TB MODE X-DEFL menu.
9 - Use the X POS control to shift the vertical line to the center of the screen.

Requirements:

1 - Verify that the vertical line is parallel to the vertical graticule line in the center of the screen.
2 - Verify that the angle with respect to the horizontal graticule lines is 90° ± 0.5°x as indicated in the figure.

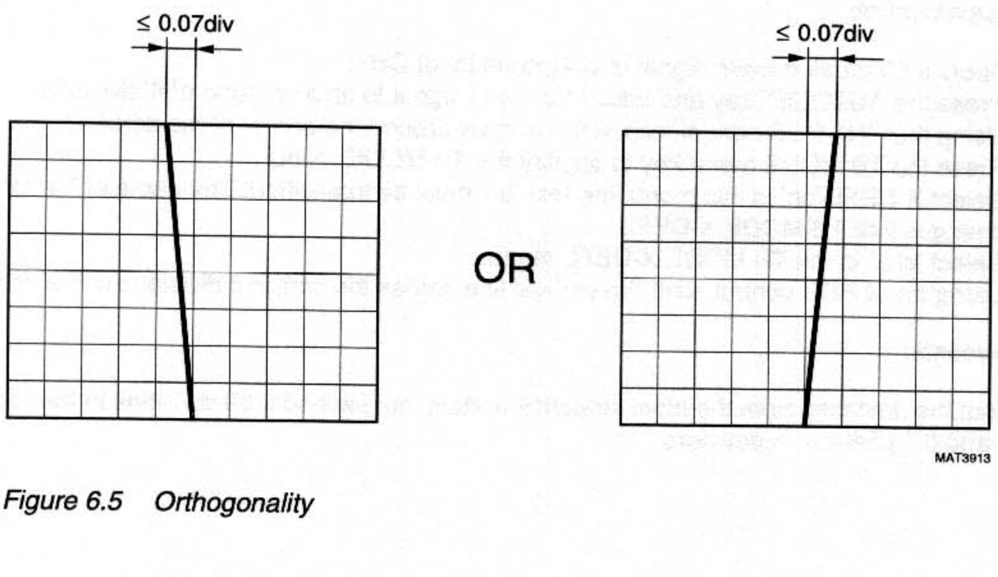


Figure 6.5 Orthogonality

6.3.5 Trace distortion

This test checks the distortion of a horizontal line in the central 6 x 8 divisions of the screen.

Test equipment:

None

Settings/procedure:

1 - Press the AUTOSET key with no input signal applied to the scope.
2 - Use the CH1 POS control to shift the timebase line vertically across the center 6 divisions of the screen.

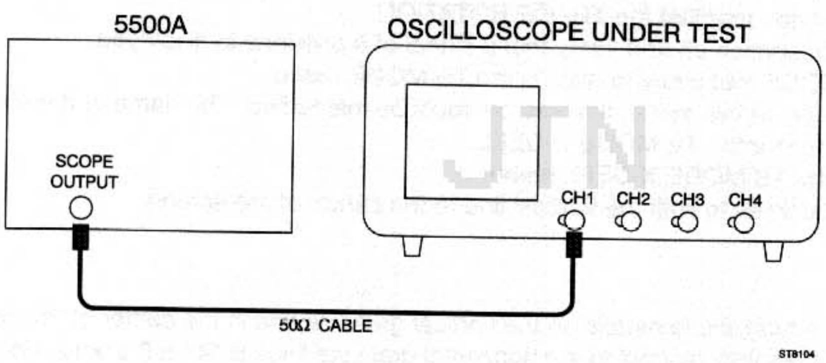
Requirements:

Verify that the deviation from the ideal straight line does not exceed 0.03 divisions in the center of screen and 0.1 divisions elsewhere.

Test equipment:

Fluke 5500A mode: wavegen, wave sine (Alternative: function generator PM5136)

Test set-up:



Settings/procedure:

1 - Apply a 50 Hz sine wave signal of 8 V(pp) to input CH1;
2 - Press the AUTOSET key and adjust the input signal to an amplitude of 8 divisions.
3 - Using the CH1 POS control, adjust the display around the center of the screen.
4 - Press the TB MODE menu key to display the TB MODE menu.
5 - Select X-DEFL 'on' in this menu; the text 'on' must be intensified. The name of the menu now changes into TB MODE X-DEFL.
6 - Select 'ch2' in the TB MODE X-DEFL menu.
7 - Using the X POS control, shift the vertical line across the center 8 divisions of the screen.

Requirements:

Verify that the deviation from the ideal straight line does not exceed 0.03 divisions in the center of screen and 0.1 divisions elsewhere.

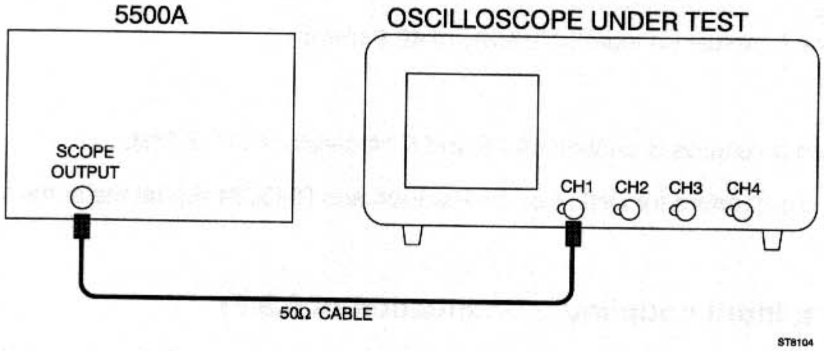
6.3.6 Vertical deflection; deflection coefficients

The vertical deflection coefficients of channels CH1, CH2, CH3, and CH4 are checked by means of a calibrated signal.

Test equipment:

Fluke 5500A mode: volt (Alternative: square-wave calibration generator PG 506)

Test set up:



Settings/procedure:

1 - Apply a 1 kHz square-wave signal of 20 mV to input CH1. Set the generator in volt mode. The generator must not be terminated with 50Ω (the text 'LZ' must not be visible in the lower part of the viewing area).
2 - Press the green AUTOSET key.
3 - Set CH1 to 5 mV/div and to DC input coupling. The waveform must be in the vertical middle of the screen.
4 - Press the BWL key to activate the bandwidth limiter.
5 - Press menukey TRIGGER MTB and activate softkey 'noise on' and 'hf-rej'.
6 - Change the input voltage and the setting of CH1 according to table I and verify that the amplitude of the signal agrees with this table. The signal should remain positioned in vertical center of the screen.

Note: Only the input sensitivities are checked that are essential for instrument accuracy.

Requirements:

table I.

Input voltage (pp)	Setting	Requirements
20 mV	5 mV	3.94...4.06 div (+/- 1.3%)
50 mV	10 mV	4.93...5.07 div (+/- 1.3%)
1V	0.2V	4.93...5.07 div (+/- 1.3%)
5V	1V	4.93...5.07 div (+/- 1.3%)

Repeat the settings/procedure in table I for CH2, CH3 and CH4. Use table II for CH3 and CH4 in PM3092 and PM3082.

table II.

Input voltage (pp)	Setting	Requirements
0.5V	0.1V	4.93...5.07 div (+/- 1.3%)
2V	0.5V	3.94...4.06 div (+/- 1.3%)

6.3.7 Vertical deflection; variable gain control range (continuation of 6.3.6)

This test checks the vertical VARiable gain control.

Settings/procedure:

1 - Apply a square-wave signal of 0.2V to input CH1 and press AUTOSET.
2 - Set CH1 to 50 mV/div and input coupling to DC. Using the CH1 POS control, center the waveform in the screen.
3 - Select the VARiable mode by simultaneously pressing both AMPL keys. The readout changes into 50.0 mV/div.
4 - Press the mV key to adjust an input sensitivity of 40.0 mV/div.

Requirements:

Verify that the displayed amplitude is between 4.86 and 5.14 divisions (+/- 2.8%).

Repeat the settings and procedure for CH2. For the PM3094 and PM3084 repeat the same steps for CH3 and CH4.

6.3.8 Vertical deflection; input coupling (continuation of 6.3.7)

This test verifies the operation of the AC input coupling. Also, the operation of the ground (GND) function is checked.

Settings/procedure:

1 - Switch the CH1 VARiable mode off by simultaneously pressing both AMPL/VAR keys. The readout changes to 50 mV.
2 - CH1 sensitivity is 50 mV/div; the vertical deflection is now 4 divisions.

Requirements:

1 - Activate the CH1 GND function and verify that a horizontal line is displayed.
2 - Select the AC input coupling and verify that a 4 divisions square-wave signal is displayed. Center this signal in the middle of the screen.
3 - Select the DC input coupling and verify that the 4 divisions square-wave signal moves up. This shift is caused by the signal's positive dc component: this component is not blocked in DC coupled mode.

Repeat the settings and procedure for CH2, CH3, and CH4. In the PM3092 and PM3082, the test of the GND function is skipped for CH3 and CH4.

6.3.9 Vertical cursor accuracy (continuation of 6.3.8.)

This test verifies the accuracy of the voltage cursors

Settings/procedure:

1 - Change the generator output voltage to 0.1V.
2 - Apply this voltage to CH1.
3 - Switch CH1 to ON and the other channels off.
4 - Select DC coupled input and 20 mV/div for CH1.
5 - Select CH1 as trigger source (TRIG 1).
6 - Center the 5 div square-wave (on the dotted horizontal lines of the graticule) with the POS rotary.
7 - Press the CURSORS menukey.
8 - Select 'on' and volt cursors (=) in the CURSORS menu.
9 - Select Δ V in the READOUT menu.

Requirements:

Position the cursor lines exactly on top and bottom of the signal using the TRACK and Δ controls. Check for a cursor readout between 98.4 and 101.6 mV.

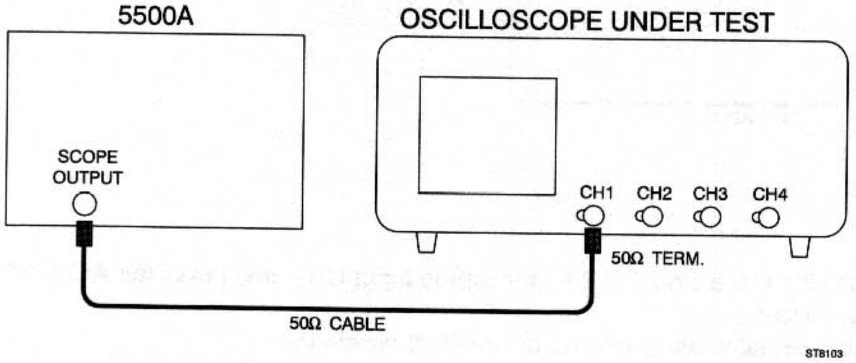
6.3.10 Vertical deflection, high-frequency response

This test verifies the upper transition point of the vertical bandwidth.

Test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generator SG 503)

Test set-up:



Settings/procedure:

1 - Apply a 50 kHz sine wave signal of 600 mV (pp into 50Ω) to input CH1, and press the AUTOSET key.
2 - Use an external 50Ω termination. Use the internal termination of the oscilloscope, when available (if active, the text 'LZ' is visible in the lower part of the viewing area).
3 - Set CH1 to 0.1 V/div.
4 - Adjust the input signal to an amplitude of exactly 6 divisions.
5 - Slowly increase the frequency to 200 MHz (PM3092, PM3094) or 100 MHz (PM3082, PM3084) and verify that the displayed amplitude does not drop below 4.2 divisions.
6 - Switch the frequency of the sine wave signal to 50 kHz.
7 - Use the BWL key to activate the vertical bandwidth limiter. The text BWL appears in the display area.
8 - Slowly increase the frequency to 20 MHz and verify that the vertical deflection has decreased to 4.2 div approximately at 20 MHz.
9 - Switch the bandwidth limiter (BWL) off.

Requirements:

The vertical deflection must be 4.2 divisions or more. For the bandwidth limiter the requirement is 4.2 div approximately at 20 MHz.

Repeat the above settings and procedure for CH2, CH3 and CH4. The procedure for CH3 and CH4 in PM3092 must be done via the 10:1 probe instead of the 50Ω cable. Oscilloscope in 1V/div and generator voltage 5 Vpp into 50Ω. Termination resistor directly at generator output. Use the BNC to probe tip adapter between termination resistor and probe tip. Adjust the amplitude at 50 kHz to 5 divisions, Check that the amplitude at higher frequencies does not drop below 3.5 div.

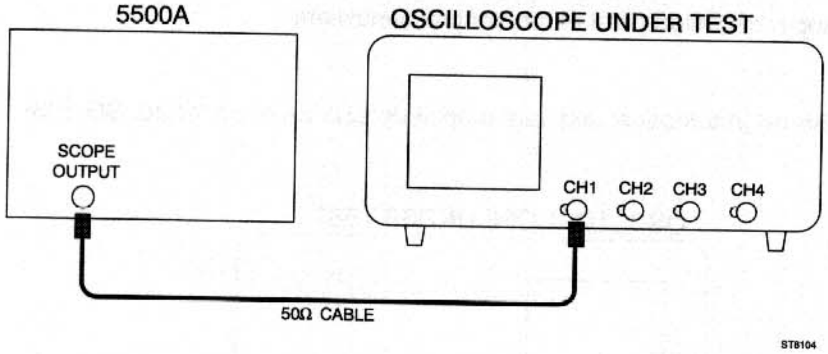
6.3.11 Vertical deflection, low-frequency response

This test verifies the lower transition point of the vertical bandwidth.

Test equipment:

Fluke 5500A mode: wavegen, wave sine (Alternative: function generator PM5136)

Test set up:



Settings/procedure:

1 - Apply a 5 kHz sine wave signal of 600 mV (pp) to input CH1, and press the AUTOSET key.
2 - Set CH1 to 0.1 V/div.
3 - Adjust the input signal to an amplitude of exactly 6 divisions.
4 - Lower the frequency to 10 Hz and verify that the displayed amplitude does not drop below 4.2 divisions.

Requirements:

The vertical deflection must be 4.2 divisions or more.

Repeat the above settings and procedure for CH2, CH3, and CH4.

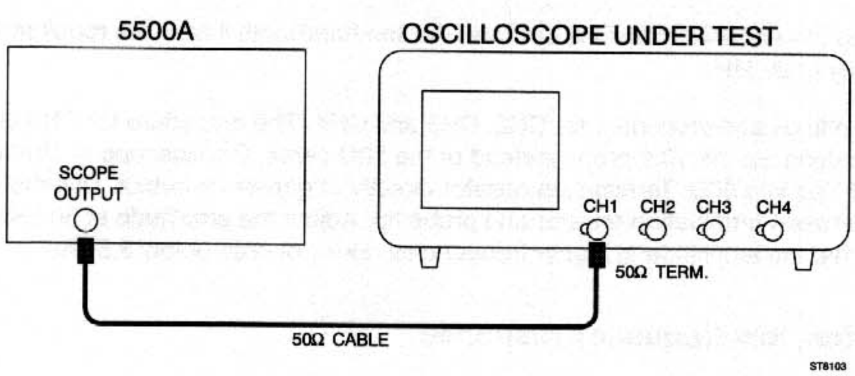
6.3.12 Vertical deflection; dynamic range at 25/50 MHz

The oscilloscope must be capable of displaying signal amplitudes that are larger than the screen. In practice, a low frequency signal with an amplitude equivalent to 24 divisions must be displayed with no distortion.

Test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generator SG 503)

Test set up:



Settings/procedure:

1 - Apply a 50 MHz (PM3092/94) or 25 MHz (PM3082/84) sine wave signal of 2.4 V(pp into 50Ω) to input CH1 and press the AUTOSET key.
2 - Use a 50Ω termination. Use the internal termination when avaialble.
3 - Set CH1 to 0.1 V/div.
4 - Using the CH1 POS control, shift the sine wave vertically over the screen.

Requirements:

Verify that top and bottom of the sine-wave signal of 24 divisions in amplitude can be displayed with no distortion.

Repeat the above settings and procedure for CH2, CH3, and CH4.

6.3.13 Vertical deflection; dynamic range at 100/200 MHz (continuation of 6.3.12)

In this test, the dynamic range of the amplifier is checked at a high frequency.

Settings/procedure:

1 - Apply a 200 MHz (PM3092, PM3094) or 100 MHz (PM3082, PM3084) sine-wave signal of 0.8V (pp into 50Ω) to input CH1.
2 - Press the AUTOSET key, and set CH1 to 0.1 V/div.
3 - Use a 50Ω termination. Use the internal termination when available.
4 - Set the amplitude to exactly 8 divisions.

Requirements:

Verify that the sine wave of 8 divisions in amplitude is displayed with no distortion.

Repeat the above settings and procedure for CH2, CH3, and CH4.

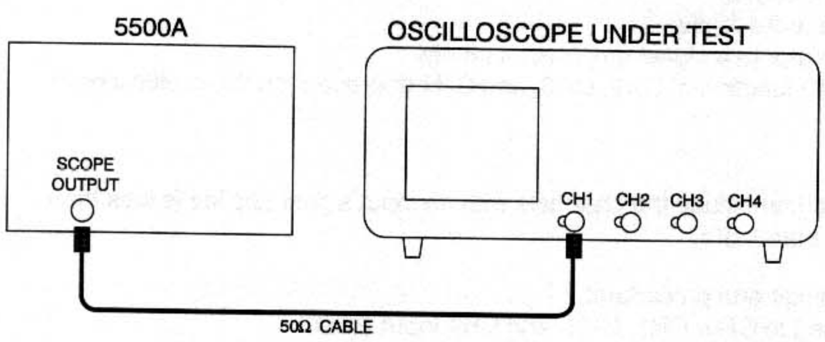
6.3.14 Vertical deflection; position range

The range of the vertical shift is checked with a sine-wave signal of 8 divisions in amplitude.

Test equipment

Fluke 5500A mode: wavegen, wave sine (Alternative: function generator PM5136)

Test set up:



Settings/procedure:

1 - Apply a 1 kHz sine wave signal with an amplitude of 0.8 V(pp) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.1 V/div.

Requirements

Turn the CH1 POS control fully clockwise and counterclockwise and verify that top and bottom of the 8 divisions signal can be positioned outside the graticule.

Repeat the above settings and procedure for CH2, CH3, and CH4.

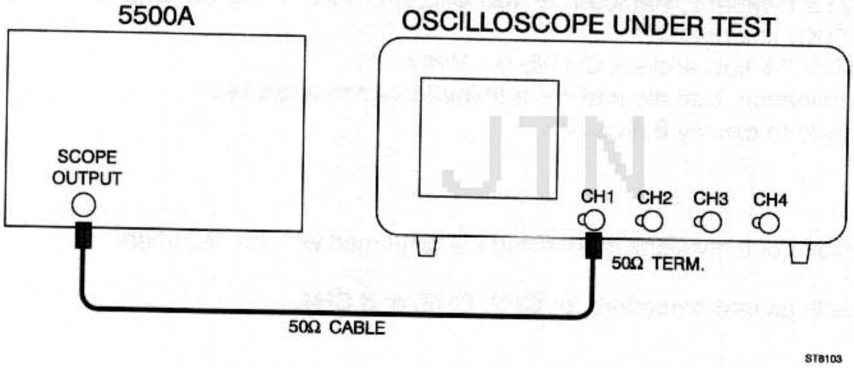
6.3.15 Vertical deflection; crosstalk between channels at 100/200 MHz

At higher frequencies there exists some crosstalk between any two channels. In the following test, crosstalk is verified at a high frequency.

Test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generator SG 503)

Test set up:



Settings/procedure:

1 - Apply a 200 MHz (PM3092, PM3094) or 100 MHz (PM3082, PM3084) sine-wave signal of 0.8V (pp into 50Ω) to input CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. Use the internal termination when available.
4 - Switch all channels ON.
5 - Set all channels to 0.1 V/div.
6 - Adjust the generator to a signal amplitude of 8 div.
7 - Activate the GND function of CH2, CH3, and CH4 (if present on the oscilloscope).

Requirements:

Verify that the displayed amplitude the channels with no input signal applied is less than 0.16 divisions, (better than 1:50).

Repeat the above settings and procedure:
- Input signal applied to CH2. CH1, CH3, and CH4 input GND.
- Input signal applied to CH3. CH1, CH2, and CH4 input GND.
- Input signal applied to CH4. CH1, CH2, and CH3 input GND.

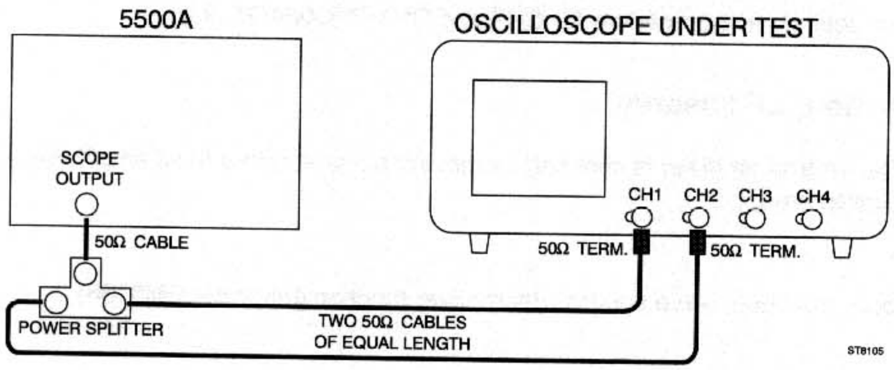
6.3.16 Vertical deflection; common mode rejection ratio at 1 MHz

The common mode rejection ratio (CMRR) is a measure of susceptibility to common mode signals. This susceptibility is verified in this test.

Test equipment:

- Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generator SG 503)
- Power splitter

Test set up:



Settings/procedure:

1 - Use a power splitter and two cables of equal length to CH1 and CH2. Apply a 1 MHz sine-wave signal of 1.6 V(pp into 50Ω) to inputs CH1 and CH2.
2 - Press the AUTOSET key.
3 - Use 50Ω terminations. Use the internal terminations when available.
4 - Set CH1 and CH2 to 0.1 V/div and adjust the generator voltage for a deflection of 8 divisions.
5 - Set CH1 and CH2 to DC input coupling.
6 - Press the CH1+CH2 key to activate the 'added' mode.
7 - Press the INV key of CH2; the result is the display of CH1-CH2.
8 - Press the ON keys of CH1 and CH2; this switches CH1 and CH2 off and only the differential signal (CH1 CH2) is now visible.
9 - Readjust the VAR function of CH1 or CH2 for minimum amplitude.

Requirements

Verify that the trace-height of the CH1-CH2 differential signal is less than 0.08 divisions.

Repeat the above settings and procedure for CH3 and CH4 (PM3084/94 only).

6.3.17 Vertical deflection; common mode rejection ratio at 50 MHz (continuation of 6.3.16)

The common mode rejection ratio (CMRR) indicates the susceptibility to common mode signals at higher frequencies. The susceptibility is verified in this test.

Settings/procedure:

1 - Use a power splitter and two cables of equal length to CH1 and CH2. Apply a sine-wave signal of 50 MHz with an amplitude of 0.8 V(pp into 50Ω) to inputs CH1 and CH2.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. Use the internal termination when available.
4 - Set CH1 and CH2 to 0.1 V/div and adjust the generator voltage for a deflection of 8 divisions.

5 - Set CH1 and CH2 to DC input coupling.
6 - Press the CH1+CH2 key; to activate the added mode.
7 - Press the INV key of CH2; the result is the display of the differential signal of CH1-CH2.
8 - Press the ON keys of CH1 and CH2; this switches CH1 and CH2 off and only the differential signal of CH1 CH2 display is now visible.
9 - Readjust the VAR function of CH1 or CH2 for minimum amplitude.

Requirements:

Verify that the amplitude of the CH1-CH2 differential signal is less than 0.32 divisions.

Repeat the above settings and procedure for CH3 and CH4(PM3084/94 only).

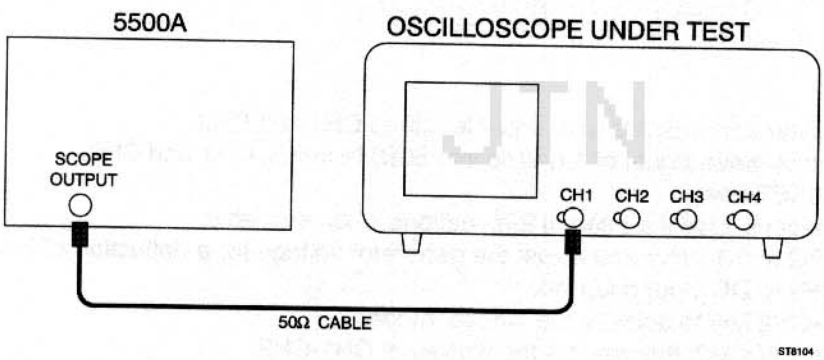
6.3.18 Vertical deflection; LF linearity

The linearity of the vertical amplifier is checked by moving a signal with a fixed amplitude vertically over the entire screen area.

Test equipment

Fluke 5500A mode: wavegen, wave square (Alternative: function generator PM5136)

Test set up:



Settings/procedure

1 - Apply a 50 kHz square-wave signal of 200 mV (pp) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.1 V/div.
3 - Move the square-wave signal to the vertical center of the screen.
4 - Adjust the generator output so that the displayed amplitude is exactly 2 divisions.
5 - Use the CH1 POS control to shift the signal across the central 6 divisions of the screen.

Requirements

Verify that the amplitude in the two upper and lower divisions is between 1.96 ...2.04 divisions (+/-2%).

Repeat the above settings and procedure for CH2, CH3 and CH4.

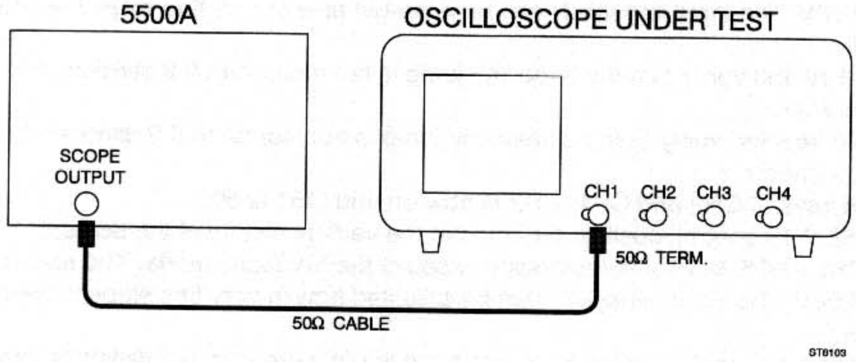
6.3.19 Vertical deflection; visual signal delay

Many applications require that the leading edge of a fast pulse triggering the oscilloscope be made visible. A fixed amount of signal delay is introduced in the vertical channels of this instrument to allow the timebase to start before the triggering leading edge causes vertical deflection to occur.
This delay is verified in the following test.

Test equipment

Fluke 5500A mode: edge (Alternative: square-wave calibration generator PG 506)

Test set-up:



Settings/procedure:

1 - Apply a signal with a fast rise time of less than 1 ns and an amplitude of 0.5 V (into 50Ω), and a frequency of 1 MHz, to input CH1. Set the generator in the 'edge' mode.
2 - Press the AUTOSET button and set CH1 to 0.1 V/div.
3 - Use a 50Ω termination. Use the internal termination when provided.
4 - Set the MTB to 50 ns/div.
5 - Press x10 MAGN and turn the X POS control to display the leading edge.
6 - Turn the TRACE INTENSITY control clockwise for maximum intensity.
7 - Press the TRIGGER MAIN TB menu key to access the TRIGGER MTB menu.
8 - Select level-pp 'off' mode in this menu.
9 - Select 'dc' trigger coupling in the menu.
10 - Adjust LEVEL MTB for a triggered display and maximum visible signal delay.

Requirements

Verify that the visible signal delay is at least 15 ns (3 divisions) for PM3092/PM3094.

For PM3082/PM3084, the visible signal delay should be at least 13 ns (2.6 divisions).

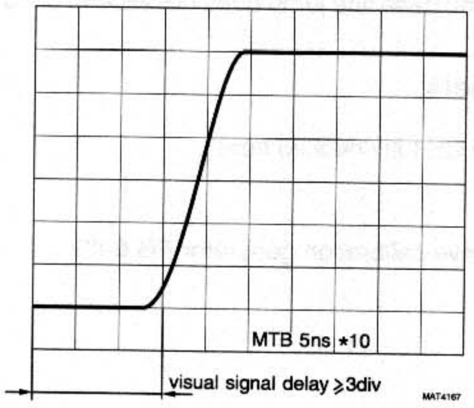


Figure 6.6 Visual signal delay

6.3.20 Vertical deflection; base line instability

In the following test, several adjustments of balance, offset and jump, are checked.

Test equipment

None

Settings/procedure and requirements:

1 - Press the AUTOSET key (no input signal) and set CH1 to 5 V/div.
2 - Use the CH1 POS control to position the trace in the vertical middle of the screen.
3 - Press both CH1 AMPL keys simultaneously to select the VARiable mode. The readout changes to 5.00V. The input sensitivity can be adjusted now in very fine steps between 2 mV and 12.5 V/div.
4 - Press the 'V' key and verify that the base line jump is not more than 0.2 divisions between 5.00V to 12.5 V/div.
5 - Press the 'mV' key and verify that the base line jump is not morethan 0.2 divisions between 12.5 V/div to 5 mV/div.
6 - Press the ON keys of CH2 and CH1; CH2 is now on and CH1 is off.
7 - Using the CH2 POS control, position the trace in the vertical middle of the screen.
8 - Press both CH2 AMPL keys simultaneously to select the VARiable mode. The readout changes to 5.00V. The input sensitivity can be adjusted now in very fine steps between 2 mV and 12.5 V/div.
9 - Press the 'V' key and verify that the base line jump is not more than 0.2 divisions between 5.00V to 12.5 V/div.
10 - Press the 'mV' key and verify that the base line jump does not 0.2 divisions between 12.5 V/div to 5 mV/div.
11 - Press the INV key repeatedly and verify that the base line jump is not more than 0.2 divisions.

For the PM3094 and PM3084 repeat the above procedure for CH3 and CH4. The CH3 settings are equal to those of CH1; the CH4 settings are equal to CH2.

For the PM3092 and PM3082 the following steps are required to check CH3 and CH4:

1 - Press the ON keys of CH3 and CH2; CH3 is now on and CH2 is off.
2 - Use the CH3 POS control to position the trace in the vertical center of the screen.
3 - Press the CH3 AMPL key repeatedly and verify that the base line jump does not exceed 0.2 divisions.
4 - Press the ON keys of CH4 and CH3; CH4 is now on and CH3 is off.
5 - Using the CH4 POS control, position the trace in the vertical center of the screen.
6 - Press the CH4 AMPL key repeatedly and verify that the base line jump does not exceed 0.2 divisions.
7 - Press the INV key repeatedly and verify that the base line jump does not exceed 0.2 divisions.

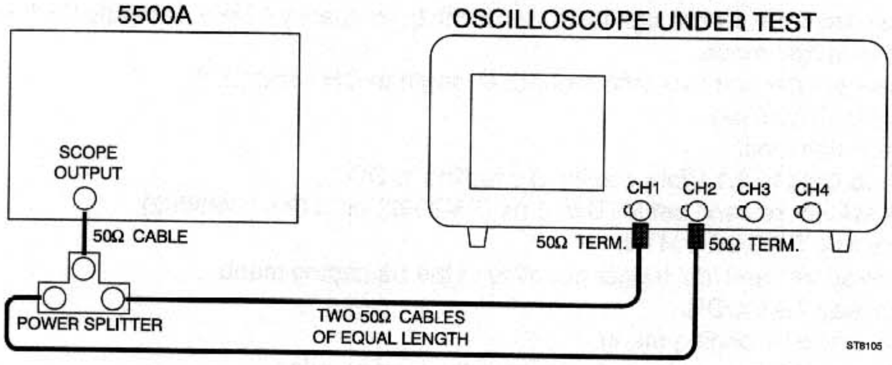
6.3.21 Delay difference between vertical channels

The delay difference between CH1, CH2, CH3, and CH4 is checked here.

Test equipment:

- Fluke 5500A mode: edge (Alternative: square wave calibration generator PG 506)
- Power splitter PM9584

Test set up:



Settings/procedure PM3092, PM3094, PM3082, PM3084:

1 - Apply a square-wave signal with a fast rise time of less than 1 ns, and an amplitude of 1V (into 50Ω), with a frequency of 1 MHz, to inputs CH1 and CH2. The generator must be set in the 'edge' mode.
Use a power splitter and two cables of equal length to CH1 and CH2.
2 - Press the AUTOSET key.
3 - Use 50Ω terminations. Use the internal terminations when available.
4 - Set CH1 and CH2 to 0.1 V/div and input coupling to DC.
5 - Press the 10x MAGN key and set the MTB to 2 ns/div (PM3092, PM3094) or to 5ns /div (PM3082, PM3084).
6 - Press menukey TRIGGER MTB.
7 - Select level-pp 'off' and 'dc' trigger coupling in the belonging menu.
8 - Press menukey TB MODE.
9 - Select 'trig' in the belonging menu.
10 - Adjust LEVEL MTB for a triggered display of the leading edge.
11 - Using the X POS and LEVEL MTB control, position the leading edges of the signals in the horizontal center of the screen.
12 - Using both CH1 and CH2 POS controls, adjust the vertical position of each trace between the dotted 0% and 100% lines. The signals appear to be superimposed.

Requirements

Verify that the delay difference between the two displayed signals is less than 0.25 ns.

This equals 0.13 divisions in PM3092 and PM3094 or 0.05 divisions in PM3082 and PM3084.

Repeat the above settings and procedure for CH3 and CH4.

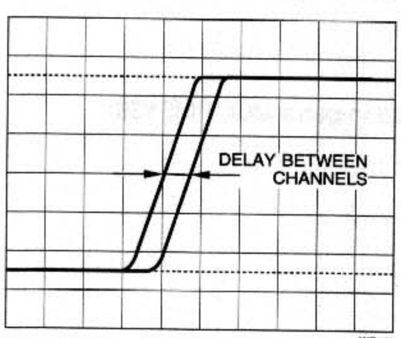


Figure 6.7 Delay difference ≤ 0.13 div in PM3092/94 or ≤ 0.05 div in PM3082/84.

settings/procedure PM3092 and PM3082:

1 - Apply a fast rise time (≤ 1 ns) signal of 1V (into 50Ω), frequency 1 MHz, to inputs CH1 and CH3. Generator in 'edge' mode.
Use a power splitter and two cables of equal length to CH1 and CH3.
2 - Press the AUTOSET key.
3 - Use 50Ω terminations.
4 - Set CH1 and CH3 to 0.1 V/div and input coupling to DC.
5 - Press 10x MAGN key and set MTB to 2 ns (PM3092) or to 5ns (PM3082).
6 - Press menukey TRIGGER MTB.
7 - Select level-pp 'off' and 'dc' trigger coupling in the belonging menu.
8 - Press menukey TB MODE.
9 - Select 'trig' in the belonging menu.
10 - Adjust LEVEL MTB for a triggered display of the leading edge.
11 - Position the rising edges of the signals in the horizontal center of the screen, by means of the X POS and LEVEL MTB control.
12 - Adjust the two traces between the dotted lines 0% and 100% by means of the CH1 and CH3 POS controls so that both signals cover each other.

requirements:

Verify that the delay difference between the two displayed signals is less than 0.5 ns: this equals 0.25 divisions in PM3092 or 0.1 divisions in PM3082.

Repeat settings/procedure for CH1 and CH4.

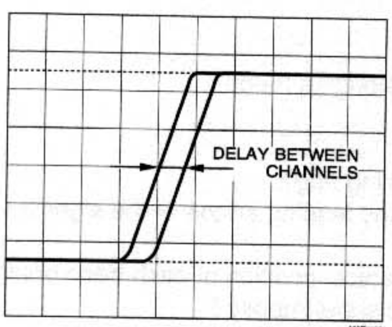


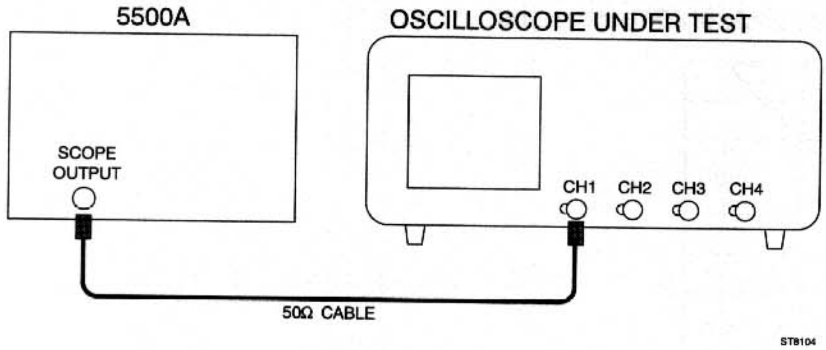
Figure 6.8 *Delay difference ≤ 0.25 div in PM3092 or ≤ 0.1 div in PM3082.*

6.3.22 Horizontal deflection; display modes and trace separation

The correct working of main timebase (MTB), delayed timebase (DTB) and the TRACE SEPARATION is checked.

test equipment:

Fluke 5500A mode: wavegen, wave sine (Alternative: function generator, PM5136) *test set-up*:



settings/procedure and requirements:

1 - Apply a 2 kHz sine-wave signal of 400 mV (pp) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.1 V/div.
3 - Adjust the generator signal to a trace height of 4 divisions.
4 - Set MTB to 0.5 ms.
5 - Press menukey DTB.
6 - Set DEL'D TB to 'on' in the DELAYED TIMEBASE menu.
7 - Set MAIN TB to 'on' in the DELAYED TIMEBASE menu.
8 - Set the DELAYED TIME BASE to 50 µs.
9 - Operate the DELAY control and verify that the intensified part can be shifted horizontally along the MAIN TB display.
10 - Operate the TRACE SEPARATION keys (or the TRACK control) and check that the DELAY TB and MAIN TB display can be shifted so that they do not cover each other.

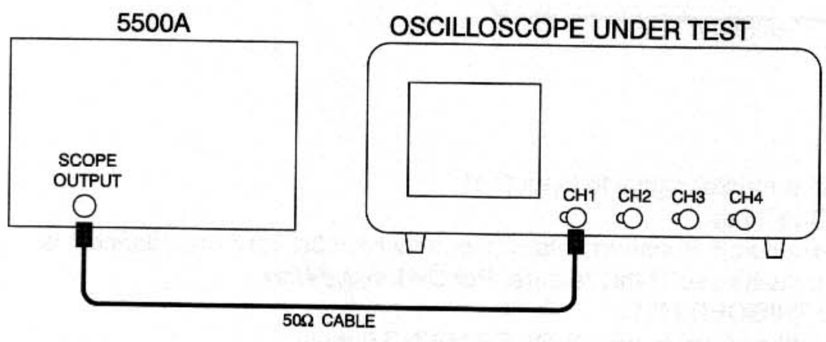
6.3.23 Horizontal deflection; X deflection

The correct working of the X Y mode (X-DEFL 'on') is tested.

test equipment:

Fluke 5500A mode: wavegen, wave sine (Alternative: function generator, PM5136)

test set-up:



settings/procedure:

1 - Apply a 2 kHz sine-wave signal of 800 mV (pp) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.1 V/div.
3 - Adjust the generator signal to a trace height of 8 divisions.
4 - Select X DEFL 'on' in the TB MODE menu (present under the TB MODE menu key).
5 - Select 'ch1' as X-deflection source in the TB MODE X-DEFL menu.
6 - Use the CH1 POS and X POS controls to obtain the display in the figure below.

requirements:

Verify that a line with an angle of 45° is displayed.

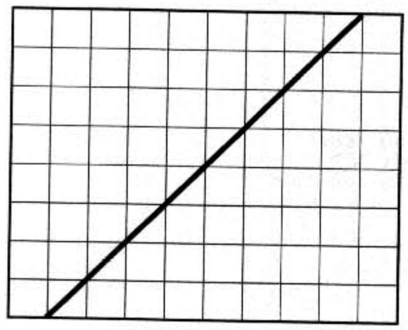


Figure 6.9 X deflection

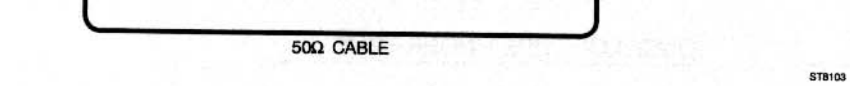
6.3.24 Horizontal deflection; main time-base deflection coefficients

The deflection coefficients of the main timebase generator (MTB) are verified by means of a calibration signal.

test equipment:

Fluke 5500A mode: marker (Alternative: time marker generator TG 501)

test set-up:



settings/procedure:

1 - Apply a 50 ns time marker signal to input CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature. Put CH1 in 0.2V/div.
4 - Press menukey TRIGGER MTB.
5 - Select level-pp 'off' and 'dc' in the TRIGGER MAIN TB menu.
6 - Press menukey TB MODE.
7 - Select 'trig' in the TB MODE menu.
8 - Adjust the LEVEL MTB rotary for a correctly triggered display.
9 - Verify the deflection coefficients of MTB with 10x MAGN off and 10x MAGN on (MGN in display) according to the requirements in the tables. Make use of the deflection error readout of the time marker generator.

Note: - *Error limits must be measured between the 2nd and the 10th graticule line (there are 11 graticule lines). These are the central 8 divisions.*
- *With 10x MAGN on (MGN), the central 10 divisions of the expanded 100 divisions of MTB are measured.*
- *Only the time base positions are checked that are essential for instrument accuracy.*

Requirements analog mode 10x MAGN off:

MTB setting	Marker pulse	Max. error
20 ns	20 ns	1.8% (PM3092/94)
0.1 µs	0.1 µs	1.8%
0.5 µs	0.5 µs	1.8%
1 µs	1 µs	1.8%
5 µs	5 µs	1.8%
20 µs	20 µs	1.8%
0.5 ms	0.5 ms	1.8%
1 ms	1 ms	1.8%
10 ms	10 ms	1.8%

Requirements analog mode 10x MAGN on (MGN):

MTB setting	Marker pulse	Max. error
2 ns	2 ns	3.3% (PM3092/94)
5 ns	5 ns	3.3%
10 ns	10 ns	2.3%
0.1 µs	0.1 µs	2.3%

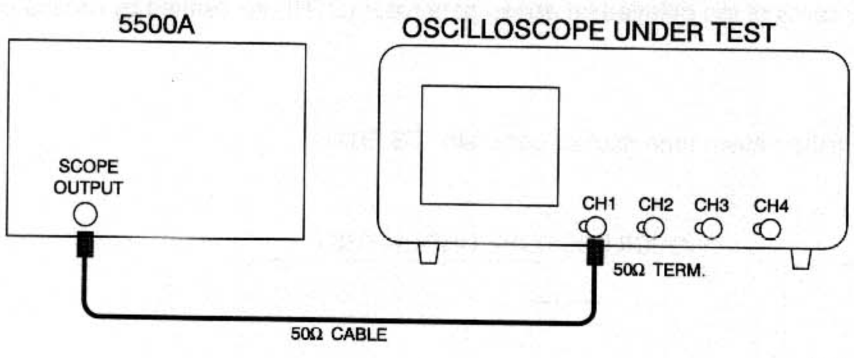
6.3.25 Horizontal deflection; VARiable mode accuracy MTB.

The horizontal MTB deflection coefficients can be varied in steps such as done in 6.3.24. A range of much finer steps can also be selected. Here, the accuracy of this range is checked.

test equipment:

Fluke 5500A mode: marker (Alternative: time marker generator TG 501)

test set-up:



Settings/procedure:

1 - Apply a 5 us time marker signal to input CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.

4 - Select in the TRIGGER MTB menu level-pp 'off' and 'dc' trigger coupling.
5 - Adjust LEVEL MTB for a correctly triggered display.
6 - Set the MTB to 5 us.
7 - Select the MTB VARiable mode by pressing both MTB keys at a time: the readout changes into 5.00 us.
8 - Press the 'ns' key and adjust the readout to 2.50 μs.

Requirements:

Verify that the horizontal distance between the time markers equals 2 divisions. Use the X POS control to align the marker pulses with the graticule. Now check (across the central 8 divisions) if the timebase accuracy is ± 2.8%: make use of the deflection error readout of the time marker generator to check this.

6.3.26 Time cursor accuracy (continuation of 6.3.25)

This test verifies the accuracy of the time cursors.

Settings/procedure:

1 - Switch the MTB VARiable mode off by pressing both MTB TIME/DIV keys at a time: the readout changes to 2 μs.
2 - Select 5 μs/div for the MTB.
3 - Switch the deflection error facility of the time marker generator to off.
4 - Press the CURSORS menukey.
5 - Select 'on' and time cursors (//) in the CURSORS menu.
6 - Select Δ T in the READOUT menu.

Requirements:

- Position one cursor line exactly on the 2nd time marker on the screen and the other cursor on the 10th time marker. The distance between both cursors is 8 time marker intervals then. Check for a cursor readout between 39.5 and 40.5 μs.

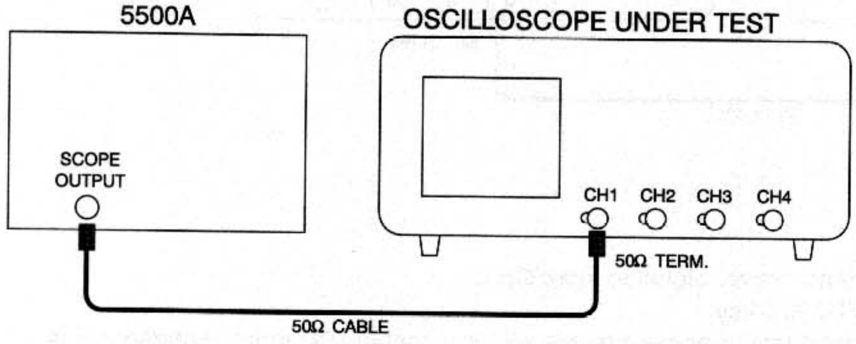
6.3.27 Horizontal deflection; delayed time-base deflection coefficients

The deflection coefficients of the delayed timebase generator (DTB) are verified by means of a calibration signal.

test equipment:

Fluke 5500A mode: (Alternative: time marker generator TG 501)

test set-up:



settings/procedure:

1 - Apply a 0.5 ms time marker signal to input CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature. Put CH1 in 0.2V/div.
4 - Select in the TRIGGER MTB menu level-pp 'off' and 'dc' trigger coupling.
5 - Press the TB MODE menu key: select in the belonging menu 'trig' mode.
6 - Adjust LEVEL MTB for a correctly triggered display.
7 - Set the trace height to about 4 divisions.
8 - Press menukey DTB and select in the belonging menu DEL'D TB 'on' and MAIN TB 'on'.
9 - Set MTB to 1 ms and DTB to 0.5 ms.
10 - Set the delay time to about 0 sec. using the DELAY control.
11 - Adjust the vertical position of the MTB display with the CH1 POS control in the top half of the viewing area.
12 - Adjust the vertical position of the DTB display with the TRACE SEPARATION keys (or the TRACK control).
13 - Verify the DTB deflection coefficients with 10x MAGN off and 10x MAGN on (MGN in display) according to the requirements in the tables. Make use of the deflection error readout of the time marker generator.

Note:
- *Error limits must be measured between the 2nd and the 10th graticule line (there are 11 graticule lines). These are the central 8 divisions.*
- *With 10x MAGN on (MGN), the central 10 divisions of the expanded 100 divisions of DTB are measured.*
- *Only the time base positions are checked that are essential for instrument accuracy.*
- *DTB TIME/DIV is electrically coupled with MTB TIME/DIV; to check the settings in the table only the key pair MTB TIME/DIV VAR must be pressed.*

Requirements analog mode 10x MAGN off:

DTB setting	MTB setting	Marker pulse	Max. error
0.5 ms	0.5 ms	0.5 ms	1.8%
20 μs	20 μs	20 μs	1.8%
5 μs	5 μs	5 μs	1.8%
1 μs	1 μs	1 μs	1.8%
0.5 μs	0.5 μs	0.5 μs	1.8%
0.1 μs	0.1 μs	0.1 μs	1.8%
50 ns	50 ns	50 ns	1.8%
20 ns	20 ns	20 ns	1.8% (PM3092/94)

Requirements analog mode 10x MAGN on (MGN):

DTB setting	MTB setting	Marker pulse	Max. error
0.1 μs	0.1 μs	0.1 μs	2.3%
10 ns	10 ns	10 ns	2.3%
5 ns	5 ns	5 ns	3.3%
2 ns	2 ns	2 ns	3.3% (PM3092/94)

6.3.28 Horizontal deflection; delay time multiplier

In this test the minimum and maximum delay time is checked.

test equipment:

None

settings/procedure and requirements:

1 - Press the AUTOSET key.
2 - Press the DTB menu key: select in the belonging menu DEL'D TB 'on' and MAIN TB 'on'.
3 - Set MTB to 0.5 μs.
4 - Set DTB to 50 ns.
5 - Adjust the vertical position of the MTB display with the CH1 POS control in the top half of the viewing area.
6 - Adjust the vertical position of the DTB display with the TRACE SEPARATION keys (or the TRACK control).
7 - Adjust the delay time to 500.0 ns by means of the DELAY control.
8 - Adjust the start of the MTB display exactly on the first graticule line by means of X POS.
9 - Verify that the difference between start of MTB and start of intensified part is between 0.9 ... 1.1 divisions.
10 - Adjust the delay time to 5.000 μs with the DELAY control.
11 - Verify that the difference between start of MTB and start of the intensified part is between 9.9 to 10.1 divisions.

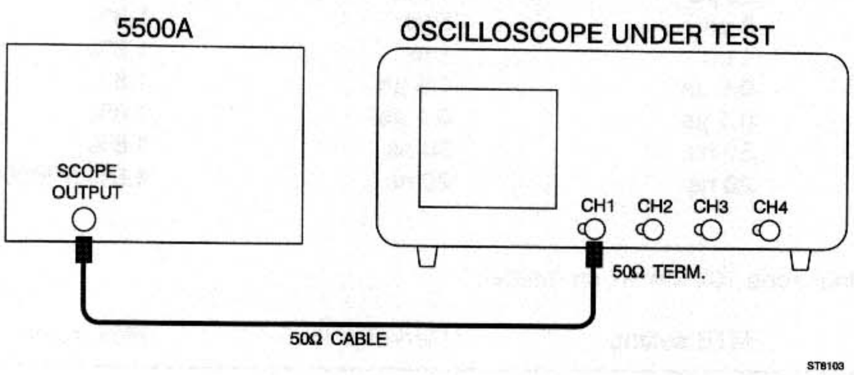
6.3.29 Horizontal deflection; delayed timebase jitter

There is a certain instability in the starting point, the so called jitter, of the DTB. The maximum allowed jitter is checked in this test.

test equipment:

Fluke 5500A mode: levsine (Alternative: function generator PM5136)

test set-up:



settings/procedure:

1 - Apply a 1 MHz sine-wave signal of 120 mV (pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set for a trace-height of 6 divisions.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Press menukey DTB and select in the belonging menu DEL'D TB 'on' and MAIN TB 'on'.
5 - Set MTB to 0.5 ms.
6 - Set DTB to 0.5 μs.
7 - Adjust the delay time to 0 s by means of the DELAY control.

8 - Switch the MAIN TB display to 'off' in the DELAYED TIME BASE menu: only the DELAY TB is displayed now.

requirements:

Verify that the jitter of the DTB is not more than 0.4 divisions. (1 part per 25000)

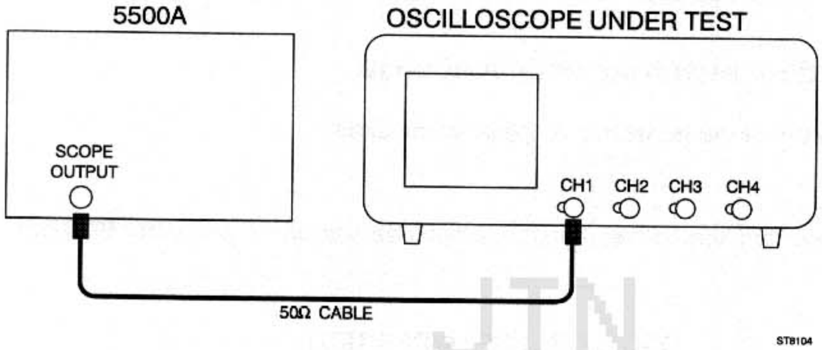
6.3.30 Horizontal deflection; X deflection coefficient via CH1

The amplification of the horizontal amplifier via the vertical input amplifier is checked.

test equipment:

Fluke 5500A mode: volt (Alternative: square-wave calibration generator PG 506)

test set-up:



settings/procedure:

1 - Apply a 1 kHz square-wave signal of 0.1V to input CH1. Generator in 'mode volt' mode and output not terminated into 50Ω ('LZ' must not appear in lower part of viewing area).
2 - Press the AUTOSET key.
3 - Set CH1 to 20 mV and DC coupled input.
4 - Select X-DEFL 'on' and 'ch1' in the menu under the TB MODE menukey.
5 - Press the CH2 ON key and then the CH1 ON key; the result is that CH2 is on and CH1 off.

requirements:

Verify that two dots with a horizontal distance of 4.7 ... 5.3 divisions are displayed.

6.3.31 Horizontal deflection; X deflection coefficient via 'line'

The amplification of the horizontal amplifier via the line trigger signal is checked. Do this test only when 220V line voltage is available.

test equipment:

None

settings/procedure:

1 - Press the AUTOSET key.
2 - Select X-DEFL 'on' in the menu under the TB MODE menukey.
3 - Select 'line' in the menu.

requirements:

Verify that a horizontal line of 4.3 to 7.7 divisions is displayed when the line voltage is 220 V (rms).

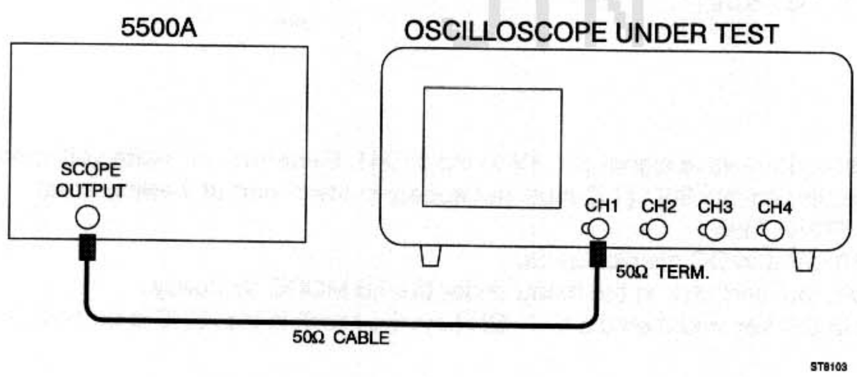
6.3.32 Horizontal deflection; high frequency response

In this test, the bandwidth of the horizontal amplifier is checked.

test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generator SG 503).

test set-up:



settings/procedure:

1 - Apply a 50 kHz sine-wave signal of 30 mV (pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set CH1 to 5 mV.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature ('LZ' must be visible in lower part of viewing area).
4 - Select X-DEFL 'on' in the menu under the TB MODE menukey.
5 - Select 'ch1' in the menu.
6 - Press the CH2 ON key and then the CH1 ON key: the result is that CH2 is on and CH1 off.
7 - Adjust the input voltage for exactly 6 divisions horizontal deflection.
8 - Increase the input frequency up to 2 MHz.

requirements:

Verify that the trace width is at least 4.2 divisions over the complete bandwidth range.

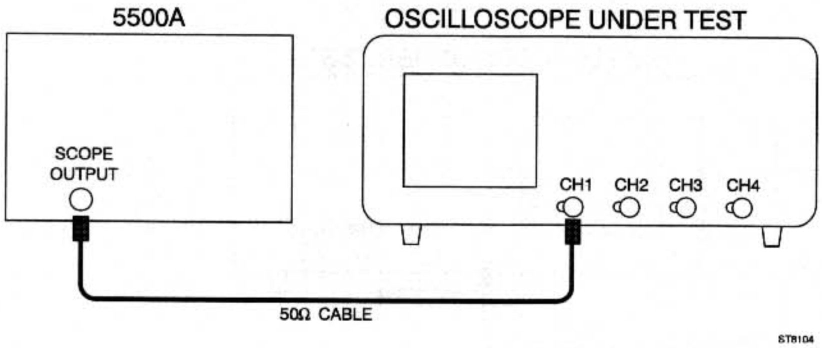
6.3.33 Maximum phase shift between horizontal and vertical deflection

There will be a certain phase shift between the horizontal and vertical amplifier. The value of this shift is measured here.

test equipment:

Fluke 5500A mode: wavegen, wave sine (Alternative: function generator, PM5136)

test set-up:



settings/procedure:

1 - Apply a 2 kHz sine-wave signal of 1.2 V (pp) to CH1.
2 - Press the AUTOSET key.
3 - Adjust the generator to a trace height of exactly 6 divisions.
4 - Select X-DEFL 'on' in the menu under the TB MODE menukey.
5 - Select 'ch1' in the menu.
6 - Increase the input frequency to 100 kHz.

requirements:

Verify that the phase shift is less than 3°, ≤0.32 div,see figure).

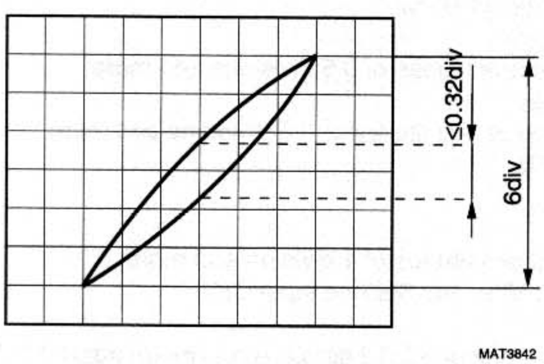


Figure 6.10 Phase shift between horizontal and vertical channel

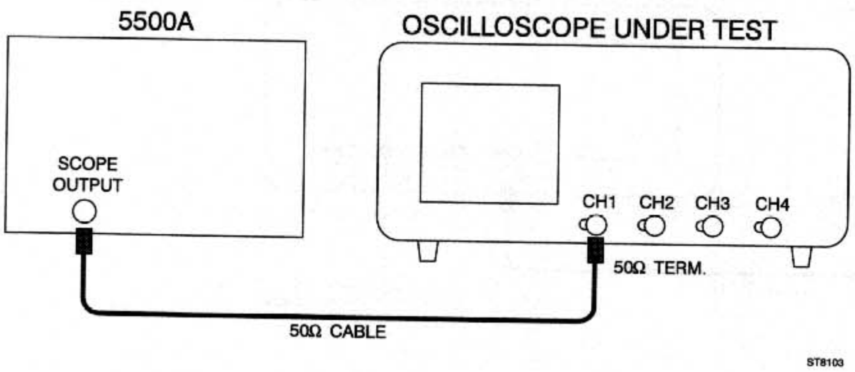
6.3.34 MTB triggering PM3092/3094; trigger sensitivity via CH1, CH2, CH3 and CH4

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the main timebase trigger sensitivity via the CH1, CH2, CH3 and CH4 inputs is checked.

test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generators (SG 503 + SG 504)

test set-up:



settings/procedure and requirements:

1 - Apply a 100 MHz sine-wave signal of 1 V(pp into 50Ω) from the calibrator to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.5 V/div.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Set the input coupling of CH1 to DC and POSition the signal in the vertical center of screen.
5 - Select 'trig' in the TB MODE menu.
6 - Press the TRIGGER MTB menu key and select level-pp 'off' and 'dc' trigger coupling in the belonging menu.
7 - Turn LEVEL MTB control for a well-triggered signal.
8 - Decrease the amplitude of the input signal.
9 - Verify that the signal is well-triggered at amplitudes of 0.5 divisions and more.
10 - Decrease the input frequency to 50 kHz.
11 - Verify that the signal stays well-triggered at amplitudes of 0.5 divisions and more.
12 - Increase the input frequency to 200 MHz.
13 - Increase the input voltage to 1 division.
14 - Turn LEVEL MTB.
15 - Verify that the signal is well-triggered at amplitudes of 1 division and more.
16 - Apply a 300 MHz sine-wave signal of 2 V(pp into 50Ω) to input CH1.
17 - Adjust the input voltage to 2 divisions.
18 - Verify that the signal is well-triggered at amplitudes of 2 divisions and more; adjust LEVEL MTB when necessary.

Repeat the procedure for CH2, CH3 and CH4 for the frequencies 50 kHz (0.5 div input signal) and 300 MHz (2 div input signal)

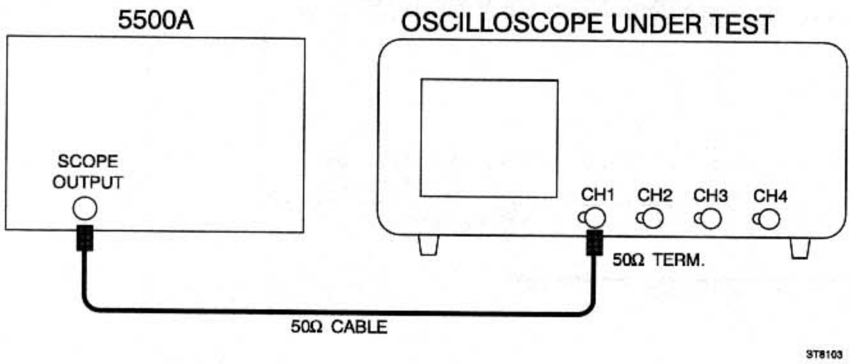
6.3.35 MTB triggering PM3082/3084; trigger sensitivity via CH1, CH2, CH3 and CH4

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the main timebase trigger sensitivity via the CH1, CH2, CH3 and CH4 inputs is checked.

test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generator SG 503)

test set-up:



settings/procedure and requirements:

1 - Apply a 50 MHz sine-wave signal of 1 V (pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.5 V/div.
3 - Use a 50Ω termination.
4 - Set the input coupling of CH1 to DC and POSition the signal in the vertical center of screen.
5 - Select 'trig' in the TB MODE menu.
6 - Press the TRIGGER MTB menu key and select level-pp 'off' and 'dc' trigger coupling in the belonging menu.
7 - Turn LEVEL MTB control for a well-triggered signal.
8 - Decrease the amplitude of the input signal.
9 - Verify that the signal is well-triggered at amplitudes of 0.5 divisions and more.
10 - Decrease the input frequency to 50 kHz.
11 - Verify that the signal stays well-triggered at amplitudes of 0.5 divisions and more.
12 - Increase the input frequency to 100 MHz.
13 - Increase the input voltage to 1 division.
14 - Turn LEVEL MTB.
15 - Verify that the signal is well-triggered at amplitudes of 1 division and more.
16 - Increase the input frequency to 200 MHz.
17 - Adjust the input voltage to 2 divisions.
18 - Verify that the signal is well-triggered at amplitudes of 2 divisions and more; adjust LEVEL MTB when necessary.

Repeat the procedure for CH2, CH3 and CH4 for the frequencies 50 kHz (0.5 div input signal) and 200 MHz (2 div input signal)

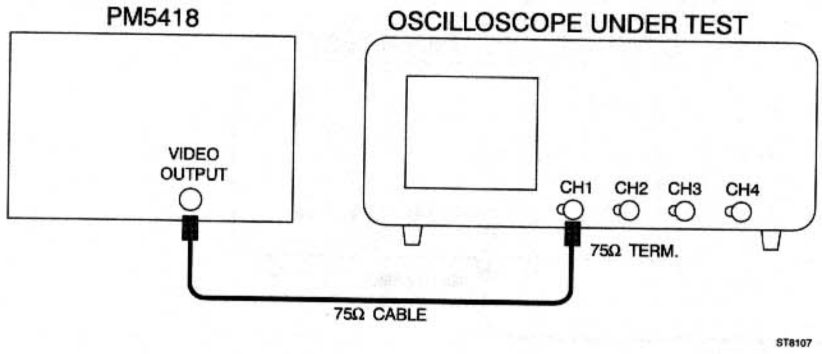
6.3.36 MTB/DTB triggering; trigger sensitivity TVL-TVF

This test checks the trigger sensitivity for television line- and field synchronization pulses.

test equipment:

TV pattern generator with video output (PM5418)

test set-up:



settings/procedure:

1 - Apply a video signal to input CH1 with an amplitude of about 1V synchronization pulse amplitude; use a 75Ω termination.
2 - Press the AUTOSET key.
3 - Select 'tv' twice in the menu under the TRIGGER MTB menukey.
4 - Select 'pos' or 'neg' (depends on employed generator) in the TRIGGER MAIN TB menu. The generator must be in 'pal' system mode.
5 - Select in the TRIGGER MAIN TB menu 'field 1', 'field 2' or 'lines'.

requirements:

Decrease the amplitude of the input signal and verify that the signal is well-triggered on the narrow TV line and the wide TV field pulse, at sync pulse amplitudes of 0.7 divisions and more.

Repeat settings/procedure with the generator in 'ntsc' mode.

settings/procedure:

6 - Select 'field 1', 'field 2' in the TRIGGER MAIN TB menu. The generator must be in 'pal' system mode.
7 - Press menu key DTB and select in the belonging menu DEL'D TB 'on', MAIN TB 'on' and 'tvline'.
8 - Adjust the vertical position of the MTB display with the CH1 POS control in the top half of the viewing area.
9 - Adjust the vertical position of the DTB display with the TRACE SEPARATION keys (or the TRACK control).

requirements:

Decrease the amplitude of the input signal and verify that the signal is well-triggered on the narrow TV line pulse, at sync pulse amplitudes of 0.7 divisions and more.

Repeat settings/procedure with the generator in 'ntsc' mode.

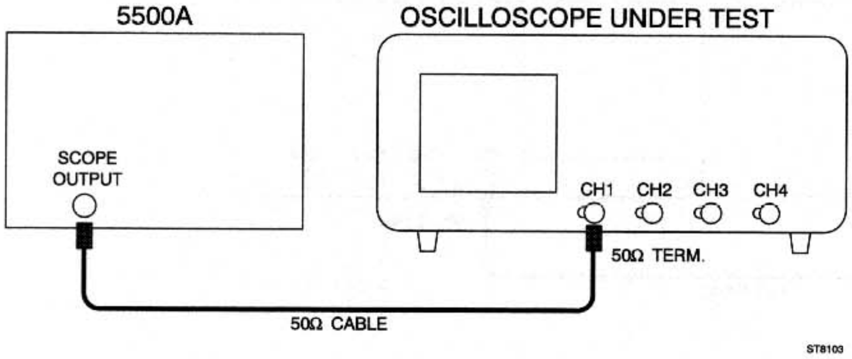
6.3.37 DTB triggering PM3092/3094; trigger sensitivity via CH1, CH2, CH3 and CH4

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the main timebase trigger sensitivity via the CH1, CH2, CH3 and CH4 inputs is checked.

test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generators (SG 503 + SG 504)

test set-up:



settings/procedure and requirements:

1 - Apply a 100 MHz sine-wave signal of 1 V(pp into 50Ω) from the calibrator to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.5 V/div.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Set the input coupling of CH1 to DC and POSition the signal in the vertical center of screen.
5 - Select 'trig' in the menu under menukey TB MODE.
6 - Press menukey TRIGGER MTB and select in the TRIGGER MAIN TB menu level-pp 'off' and 'dc' trigger coupling.
7 - Adjust LEVEL MTB for a correctly triggered display.
8 - Press menukey DTB and select DEL'D TB 'on' and MAIN TB 'on' in the belonging menu.
9 - Set MTB to 0.2 us/div and DTB to 20 ns/div.
10 - Adjust the DELAY control to a delay time of 1.000 μs.
11 - Select 'trig'd' and 'dc' coupling in the DELAYED TIME BASE menu and press the front panel key TRIG1. Or TRIG2 (CH2 on), TRIG3 (CH3 on), TRIG4 (CH4 on).
12 - Adjust the LEVEL DTB control for a well-triggered signal (intensified part must be visible).
13 - Operate the TRACE SEPARATION keys (or TRACK control) to separate MTB and DTB for well visible displays.
14 - Decrease the amplitude of the input signal.
15 - Verify that the DTB is well triggered at signal amplitudes of 0.5 divisions and more.
16 - Decrease the input frequency to 50 kHz. Set MTB to 50 μs/div and DTB to 20 μs/div.
17 - Verify that the DTB stays well triggered at signal amplitudes of 0.5 divisions and more.
18 - Increase the input frequency to 200 MHz.
19 - Increase the input voltage to 1 division.
20 - Operate the LEVEL DTB control.
21 - Verify that the DTB is well triggered at all amplitudes of 1 division or more.
22 - Apply a 300 MHz sine-wave signal of 2 V(pp into 50 ohm) from the calibrator to input CH1.
23 - Adjust the input voltage to 2 divisions.
24 - Verify that the DTB is well-triggered at signal amplitudes of 2 divisions and more: adjust the LEVEL DTB control if necessary.

Repeat the procedure for CH2, CH3 and CH4 for the frequencies 50 kHz (0.5 div input signal) and 300 MHz (2 div input signal)

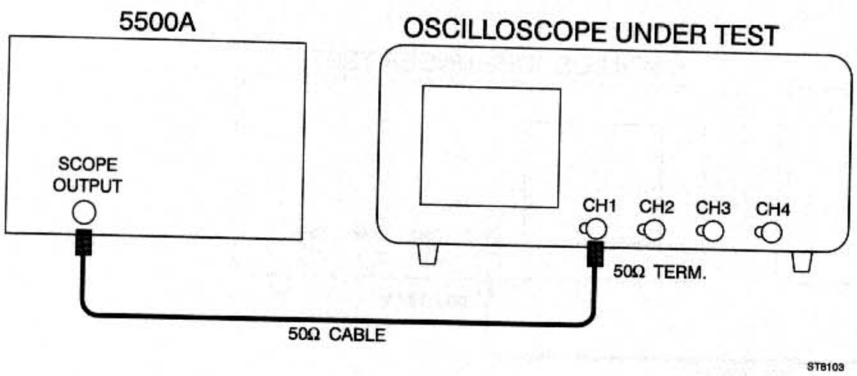
6.3.38 DTB triggering PM3082/3084; trigger sensitivity via CH1, CH2, CH3 and CH4

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the main timebase trigger sensitivity via the CH1, CH2, CH3 and CH4 inputs is checked.

test equipment:

Fluke 5500A mode: levsine (Alternative: constant amplitude sine wave generator SG 503)

test set-up:



settings/procedure and requirements:

1 - Apply a 50 MHz sine-wave signal of 1 V(pp into 50Ω) from the calibrator to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.5 V/div.
3 - Use a 50Ω termination.
4 - Set the input coupling of CH1 to DC and POSition the signal in the vertical center of screen.
5 - Select 'trig' in the menu under menukey TB MODE.
6 - Press menukey TRIGGER MTB and select in the TRIGGER MAIN TB menu level-pp 'off' and 'dc' trigger coupling.
7 - Adjust LEVEL MTB for a correctly triggered display.
8 - Press menukey DTB and select DEL'D TB 'on' and MAIN TB 'on' in the belonging menu.
9 - Set MTB to 0.2 μs/div and DTB to 20 ns/div.
10 - Adjust the DELAY control to a delay time of 1.000 μs.
11 - Select 'trig'd' and 'dc' coupling in the DELAYED TIME BASE menu and press the front panel key TRIG1. Or TRIG2 (CH2 on), TRIG3 (CH3 on), TRIG4 (CH4 on).
12 - Adjust the LEVEL DTB control for a well-triggered signal (intensified part must be visible).
13 - Operate the TRACE SEPARATION keys (or TRACK control) to separate MTB and DTB for well visible displays.
14 - Decrease the amplitude of the input signal.
15 - Verify that the DTB is well triggered at signal amplitudes of 0.5 divisions and more.
16 - Decrease the input frequency to 50 kHz. Set MTB to 50 μs/div and DTB to 20μs/div.
17 - Verify that the DTB stays well triggered at signal amplitudes of 0.5 divisions and more.
18 - Increase the input frequency to 100 MHz.
19 - Increase the input voltage to 1 division.
20 - Operate the LEVEL DTB control.
21 - Verify that the DTB is well triggered at all amplitudes of 1 division or more.
22 - Increase the input frequency to 200 MHz.
23 - Adjust the input voltage to 2 divisions.
24 - Verify that the DTB is well-triggered at signal amplitudes of 2 divisions and more: adjust the LEVEL DTB control if necessary.

Repeat the procedure for CH2, CH3 and CH4 for the frequencies 50 kHz (0.5 div input signal) and 200 MHz (2 div input signal)

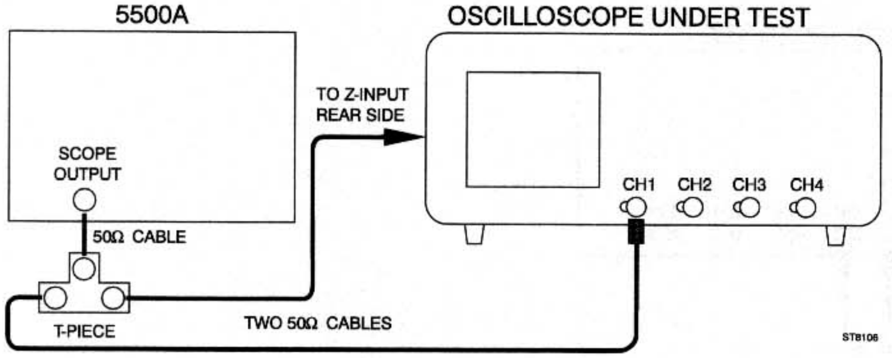
6.3.39 Z-MOD sensitivity

This test checks the sensitivity of the Z modulation facility.

test equipment:

- Fluke 5500A mode: wavegen, wave square (Alternative: function generator PM5136)
- T-piece

test set-up:



settings/procedure and requirements:

1 - Apply a 1 kHz square-wave signal, duty cycle 50%, amplitude between 0 to +2.5V, to input CH1. Adjust the generator to a signal of 2.5 Vpp with an offset of 1.25V.
2 - Press the AUTOSET key.
3 - Set MTB to 0.5 ms/div.
4 - Set the trace of CH1 in mid position with the CH1 POS control.
5 - Apply the same signal by means of the T-piece to the Z input (rear side).
6 - Adjust TRACE INTENSITY so that only the bottom half of the square-wave is displayed; the top half must be just invisible (0.5 ms light on; 0.5 ms light off).
7 - Decrease the input signal to 0.5 Vpp with an offset of 0.25V.
8 - Set CH1 to 0.5 V/div.
9 - Verify that the complete square-wave is visible.

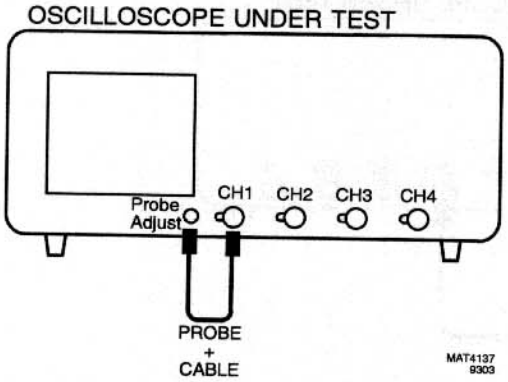
6.3.40 Probe Adjust signal; frequency and output voltage

The Probe Adjust (CAL) signal is a calibration signal with fixed frequency and voltage. In this test, the values of frequency and voltage are checked.

test equipment:

None

test set-up:



settings/procedure:

1 - Connect the Probe Adjust signal to input CH1 and press the AUTOSET key.
2 - Select GND of CH1.
3 - Set the trace in the center of the screen.
4 - Switches GND of CH1 off.
5 - Select DC input coupling for CH1.

requirements:

1 - Verify that a positive going square-wave signal of 0.6 V(pp) is displayed, i.e. 3 divisions vertical at 0.2V.
2 - Verify that the frequency of the displayed signal is about 2 kHz, i.e. a period time between 4.0 ... 6.0 divisions horizontal at MTB 0.1 ms.

7 CALIBRATION ADJUSTMENT PROCEDURE

7.1 INTRODUCTION

The calibration adjustment procedure can be split up in two:
- Manual adjustment
- Automatic calibration (AUTOCAL).

All calibration is done with the oscilloscope's cabinet closed. This eliminates calibration inaccuracies due to temperature changes.

Manual calibration data are protected by a keyword and a seal and must be changed by qualified personnel only. Some of the adjustments require external calibration equipment. A list of necessary equipment is given in chapter 6 (performance test). Manual calibration should be done after 2000 service hours or once a year.

Operation of the front panel CAL key activates the automatic calibration. AUTOCAL can only function usefully if the manual adjustments (especially the 'screen calibrations') are correct. The AUTOCAL function should in general be activated once a week. AUTOCAL should be used always after warming-up if the oscilloscope is used in extreme environmental conditions such as very high or low temperatures while maximum accuracy is needed. AUTOCAL requires no external calibration equipment.

The calibration adjustment should be started after a warming-up time of 30 minutes.

The most accurate adjustments are done with a well-focused low intensity display.

The calibration parameters are saved after power-down if the memory back-up batteries are installed. Additionally these parameters can be saved into the instrument's non-volatile memory. This is done by pressing softkey 'save calibr data' and then activation of the pin hole key. The number of times that this save action can be done is limited. The memory is full after a number (10x)of actions and needs to be cleared. Refer to chapter 8 (corrective maintenance) for how to proceed then.

7.2 DARK LEVEL OF CRT

- Press the STATUS and TEXT OFF keys simultaneously: this gives a defined position of the instrument settings.
- Adjust MTB/VAR to 1 ms/div.
- Select the key sequence 'UTILITY > MAINTENANCE > ENTER KEYWORD'.
- Enter the five digit keyword '3 2 4 1 5'. If correct, an automatic return to the UTIL MAINTENANCE menu is done.
- Press softkey MANUAL CALIBR.
- Select 'dark' with the TRACK rotary.
- Put the TEXT INTENSITY and TRACE INTENSITY rotaries in minimal intensity position.
- Adjust the Δ rotary so that the dot at the beginning of the CH1 trace is just invisible.
- Put TEXT INTENSITY and TRACE INTENSITY in normal intensity position again.
- Press softkey RETURN to go to the UTIL MAINTENANCE MENU.

7.3 TRACE ROTATION

- Adjust the INTENSITY TRACE rotary for a well-visible horizontal on the screen.
- Align the CH1 trace exactly in parallel with the horizontal graticule lines using screw-driver operated TRACE ROTATION rotary.

7.4 HORIZONTAL (X) GAIN AND OFFSET

- Press softkey SCREEN CALIBR.
- Select 'x-gain' with the softkeys.
- Adjust the TRACK (gain) and Δ (offset) rotary so that the two vertical lines coincide exactly with the 3rd and 9th graticule line.

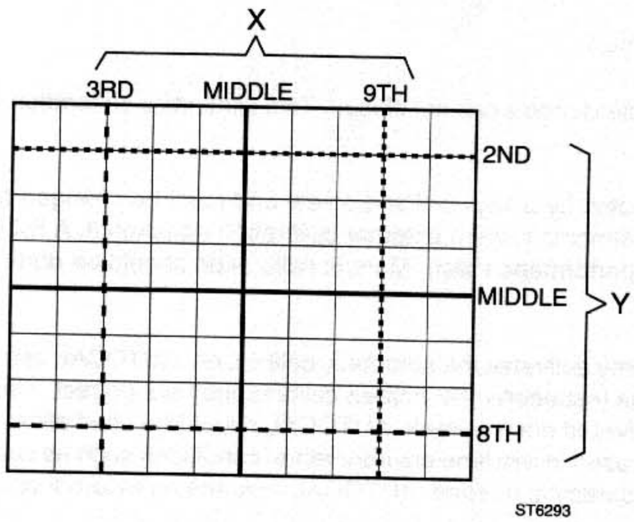


Figure 7.11 Position of lines for horizontal (X) and vertical (Y) gain and offset calibration

7.5 TEXT STABILITY AND X-OFFSET

- Select 'x-text' with the softkeys.
- Adjust the TRACK rotary to maximal stability of the text
- Adjust the Δ rotary so that the vertical line is exactly in the middle of the graticule.

7.6 VERTICAL (Y) GAIN AND OFFSET

- Select 'y-gain' with the softkeys.
- Adjust the TRACK (gain) and Δ (offset) rotary so that the two horizontal lines coincide exactly with the 2nd and 8th graticule line.
- Select 'y-offs' with the softkeys.
- Adjust the TRACK rotary so that the horizontal line is exactly in the middle of the graticule.
- Press softkey 'accept' if the screen calibrations are correct.
- Press softkey RETURN to go to the UTIL MAINTENANCE MENU.

7.7 ASTIGMATISM

- Press softkey MANUAL CALIBR.
- Select 'astig' with the TRACK rotary.
- Position the CH1 trace in the centre of the graticule.
- Adjust the Δ rotary for the best possible sharpness of text across the screen: the small dots from which the text is composed must be well visible. Adjustment of the FOCUS rotary is necessary during the adjustment.

7.8 AUTOCAL PROCEDURE

- Press the CAL key during 2 seconds.
- Within 2 minutes the instrument automatically does its main calibrations.
- Watch the CRT and check that no errors are reported. If errors are mentioned, the oscilloscope will need corrective maintenance. The error number indicates in what part of the oscilloscope the fault may be expected. Refer to chapter 8.13 for more information.

7.9 LF SQUARE-WAVE RESPONSE CH1

- Press menukey TB MODE.
- Switch X-DEFL to 'off' with the softkey.
- Switch CH1 to ON.
- Press the TRIG 1 key.
- Press menukey UTILITY.
- Press softkey MAINTENANCE.
- Press softkey MANUAL CALIBR.
- Select 'lf ch1' with the TRACK rotary.
- Select 'lfx100' with the softkeys.
- Put CH1 in 1 V/div with DC coupled input.
- Apply a square-wave signal of 100 kHz and 2.75 V(pp into 50Ω) from a calibrator (mode 'edge') to CH1. As an alternative you may use a 100 kHz/5 Vpp square-wave from a function generator.
- Use a 50Ω termination resistor between cable and oscilloscope input.
- Adjust MTB/VAR to 2 us/div.
- Adjust the Δ rotary for a flat pulse top (the initial overshoot should not be adjusted).
- Select 'lfx10' with the softkeys.
- Put CH1 in 0,1 V/div.
- Change the square-wave signal into 10 kHz/500 mV peak-peak.
- Adjust MTB/VAR to 20 us/div.
- Adjust the Δ rotary for a flat pulse top (the initial overshoot should not be adjusted).
- Remove the input signal.

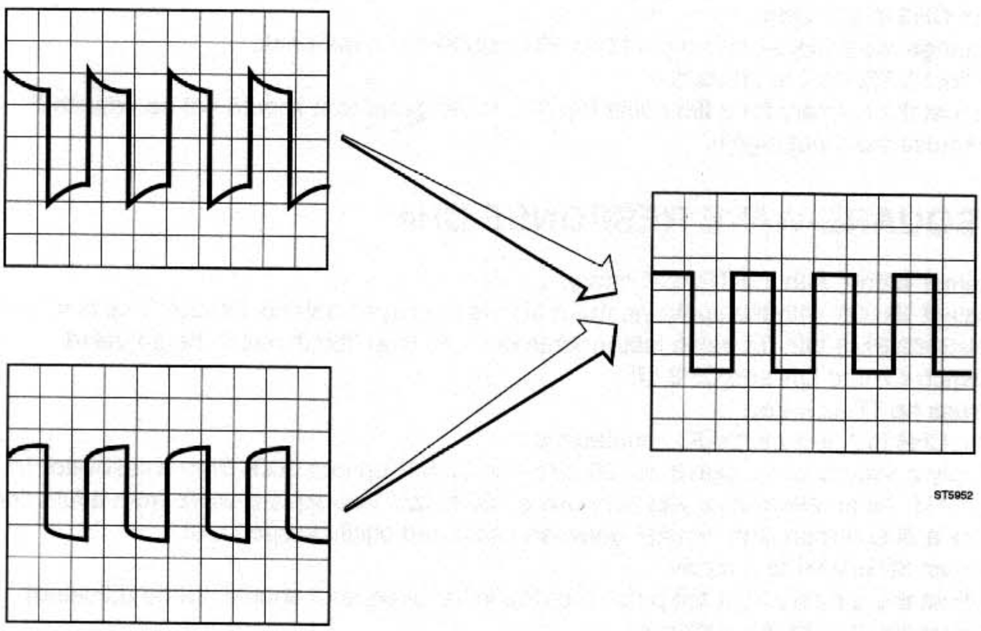


Figure 7.12 Adjustment of LF square wave response CH1, CH2, CH3 and CH4

7.10 LF SQUARE-WAVE RESPONSE CH2

- Select 'lf ch2' with the TRACK rotary.
- Select 'lfx100' with the softkeys.
- Switch CH2 to ON and CH1 off.
- Press the TRIG 2 key.
- Put CH2 in 1 V/div with DC coupled input.
- Apply a square-wave signal of 100 kHz and 2.75 V(pp into 50Ω) from a calibrator (mode 'edge') to CH2. As an alternative you may use a 100 kHz/5 Vpp square-wave from a function generator.
- Use a 50Ω termination resistor between cable and oscilloscope input.
- Adjust MTB/VAR to 2 us/div.
- Adjust the Δ rotary for a flat pulse top (the initial overshoot should not be adjusted).
- Select 'lfx10' with the softkeys.
- Put CH2 in 0,1 V/div.
- Change the square-wave signal into 10 kHz/500 mV peak-peak.
- Adjust MTB/VAR to 20 us/div.
- Adjust the Δ rotary for a flat pulse top (the initial overshoot should not be adjusted).
- Remove the input signal.

7.11 LF SQUARE-WAVE RESPONSE CH3

- Select 'lf ch3' with the TRACK rotary.
- Select 'lfx100' with the softkeys: the Δ sign is displayed behind 'lfx100'. This is not necessary in PM3082/PM3092: for these instruments only the step 'lfx10' has to be adjusted.
- Switch CH3 to ON and CH2 off.
- Press the TRIG 3 key.
- Put CH3 in 1 V/div with DC coupled input.
- Apply a square-wave signal of 100 kHz and 2.75 V(pp into 50Ω) from a calibrator (mode 'edge') to CH3. As an alternative you may use a 100 kHz/5 Vpp square-wave from a function generator.
- Use a 50Ω termination resistor between cable and oscilloscope input.
- Adjust MTB/VAR to 2 us/div.
- Adjust the Δ rotary for a flat pulse top (the initial overshoot should not be adjusted).
- Select 'lfx10' with the softkeys.
- Put CH3 in 0,1 V/div.
- Change the square-wave signal into 10kHz/500 mV peak-peak.
- Adjust MTB/VAR to 20 us/div.
- Adjust the Δ rotary for a flat pulse top (the initial overshoot should not be adjusted).
- Remove the input signal.

7.12 LF SQUARE-WAVE RESPONSE CH4

- Select 'lf ch4' with the TRACK rotary.
- Select 'lfx100' with the softkeys: the Δ sign is displayed behind 'lfx100'. This is not necessary in PM3082/PM3092: for these instruments only the step 'lfx10' has to be adjusted.
- Switch CH4 to ON and CH3 off.
- Press he TRIG 4 key.
- Put CH4 in 1 V/div with DC coupled input.
- Apply a square-wave signal of 100 kHz and 2.75 V(pp into 50Ω) from a calibrator (mode 'edge') to CH4. As an alternative you may use a 100 kHz/5 Vpp square-wave from a function generator.
- Use a 50Ω termination resistor between cable and oscilloscope input.
- Adjust MTB/VAR to 2 us/div.
- Adjust the Δ rotary for a flat pulse top (the initial overshoot should not be adjusted).
- Select 'lfx10' with the softkeys.
- Put CH4 in 0,1 V/div.
- Change the square-wave signal into 10 kHz/500 mV peak-peak.
- Adjust MTB/VAR to 20 us/div.
- Adjust the Δ rotary for a flat pulse top (the initial overshoot should not be adjusted).
- Remove the input signal.

7.13 HF SQUARE-WAVE RESPONSE FINAL Y AMPLIFIER

- Select 'hf y' with the TRACK rotary.
- Apply a 1V/1 MHz square-wave signal with a rise-time faster than 1 nsec to CH1. This signal is delivered in the 'edge' mode of the calibrator. As alternative you may use the fast-rise output of the square-wave calibration generator. Use a 10x (20 dB) attenuator at the end of the cable from the generator. For reduced channels (0.1 and 0.5 V/div): use a 2:1 (6dB) attenuator.
- Press AUTOSET.
- Select the key sequence 'UTILITY > MAINTENANCE > MANUAL CALIBR'.
- Put CH1 in 20 mV/div with DC coupled input. Reduced channels must be put in 0.1 V/div.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor directly at the oscilloscope input.
- Adjust MTB/VAR to its fastest position (20 or 50 ns/div). Small adjustments of MTB/VAR may be necessary to have a good view of signal details of interest.
- Select in succession 'pulse t4', 'pulse t3', 'pulse t2', 'pulse t1' and 'pulse t0' with the softkeys. Adjust the pulse top to maximum flatness and the risetime to the required value with the Δ rotary. The adjustments are a compromise between fast risetime and minimal pulse distortion (aberrations). The influence of these adjustments ranges between mid-frequency (pulse t4) and high-frequency (pulse t0). The requirement is a rise-time of ≤ 3,6 ns for 100 MHz instruments and ≤ 2 ns for 200 MHz. This value includes the generator rise-time. The pulse aberrations must not exceed + and – 6% (excl. aberrations of test generator). The adjustment of t1 and t0 should be done in such a way that aberrations of the pulse top are symmetrical at + and - 0.4 div (see fig. 7.3). This must be achieved in such a way that the number in the adjustment menu for t0 is low (e.g. 10 .. 15) and that for t1 is in the higher ranges (e.g. 55 .. 60).

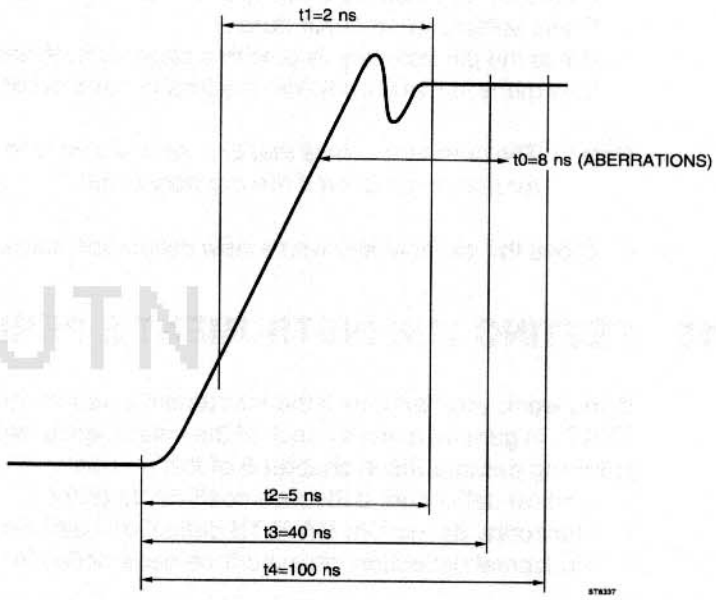


Figure 7.13 Influence of t4, t3, t2, t1 and t0 on HF square wave response

- Remove the input signal.
- Check if the pulse response (rise-time and aberrations) of CH2, CH3 or CH4 in 20 mV/div is within specification.
- Remove the input signal.
- Pulse response and bandwidth are interdependent: the higher the pulse aberrations, the higher the bandwidth and vice versa. To check the bandwidth apply a 120 mV/50 kHz sinewave from a constant amplitude sinewave generator (5500A calibrator in scope mode 'levsine') to CH1. For reduced channels apply 600 mV/50 kHz
- Press AUTOSET.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor directly at the oscilloscope input.
- Adjust the amplitude of the sine-wave to 6 div exactly.

- Increase the frequency of the sinewave up to 100 MHz (for 100 MHz instruments) or 200 MHz (for 200 MHz instruments) and check that the amplitude on the screen does not become smaller then 4,2 div.
- Remove the input signal.
- Repeat the bandwidth check for CH2, CH3 and CH4 (the bandwidth check for CH3 and CH4 of PM3092 must be checked via the 10:1 probe that is delivered with the oscilloscope).
- Remove the input signal.

7.14 SAVING THE CALIBRATION DATA

If you are sure that the instrument is well calibrated, the calibration data must be saved. For this proceed as follows:
- Turn the TRACK rotary until softkey text 'RETURN' is visible.
- Press softkey RETURN.
- If present, remove the calibration sticker from the pin hole.
- Press softkey 'save calibr data'.
- Press the pin hole key (e.g. with a paperclip). When doing this, it is indicated in the viewing area how many 'calibration fields' are free to save calibration data.

Note: The number of times that this 'save' action can be done is limited to 10. Refer to chapter 8.9.2 for how to proceed if the memory is full.

- Close the pin hole key with a new calibration sticker, part number 5322 455 81144.

7.15 TESTING THE INSTRUMENT'S PERFORMANCE

If you want, you can check the instrument's performance by means of chapter 6 'PERFORMANCE TEST'. In general a quick check of the instrument's main characteristics is sufficient. For this, use the following paragraphs in chapter 6 of this manual:
- Vertical deflection; deflection coefficients (6.3.6).
- Horizontal deflection; MAIN TB deflection coefficients (6.3.24).
- Horizontal deflection; delayed time-base deflection coefficients (6.3.27).

8 CORRECTIVE MAINTENANCE PROCEDURES

8.1 DISMANTLING THE INSTRUMENT

8.1.1 General information

This section contains the dismantling procedures required for the removal and testing of components during repair.
All circuit boards removed from the instrument must be adequately protected against damage, and all normal precautions regarding the use of tools must be observed.
During the dismantling a careful note must be made of all disconnected leads so that they can be reconnected to their correct terminals during assembly.

CAUTION: **Damage may result if:**
- **The instrument is switched-on when a circuit board has been removed.**
- **A circuit board is removed within one minute after switching-off the instrument.**

8.1.2 Removing the cabinet and carrying handle

Note: The cabinet does not need to be removed to do the calibration adjustment procedure.

To remove the cabinet proceed as follows:
- Fit the front cover on to the instrument.
- Hinge the carrying handle clear of the front cover.
- Place the instrument with the front cover on a flat surface.
- Pull off both plastic parts that are around the instrument's rear feet.
- Remove the screws (6) that secure the cabinet to the instrument's rear panel.
- Gently slide the cabinet (and carrying handle) off the instrument.

ATTENTION:
- *When installing the cabinet again, special care must be taken that cables are not damaged between the cabinet and the chassis. This is especially important for the flat cable above the Cathode Ray Tube (CRT) that connects Front unit A4 and CRT controls unit A5.*
- *Also take care that the cabinet fits well into the plastic front frame and that grounding fingers are not damaged during installation.*

The rotation points of the carrying handle are secured by means of metal 'omega' clips. After removal of these clips the handle can be removed by pulling both handle ends outwards away from the instrument.

8.2 REPLACEMENTS

WARNING: **The Extremely High Tension (EHT) cable is directly connected to the EHT-multiplier unit. When the EHT cable to the post-acceleration anode is disconnected, the cable must be discharged by shorting the terminal to the instrument's earth.**

8.2.1 Standard parts

Electrical and mechanical replacement parts can be obtained through your local FLUKE organization or representative. However, many of the standard electronic components can be obtained from other local suppliers. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating and description.

NOTE: Physical size and shape of a componenent may affect the instrument's performance, particularly at high frequencies. Always use direct-replacement components, unless it is known that a substitute will not degrade the instrument's performance.

8.2.2 Special parts

In addition to the standard electronic components, some special components are used:

- Components, manufactured or selected by Fluke to meet specific performance requirements.
- Components which are important for the safety of the instrument.

ATTENTION: Both type of components may only be replaced by components obtained through your local FLUKE organization of representative.

8.2.3 Transistors and Integrated Circuits

- Return transistors and IC's to their original positions, if removed during routine maintenance.
- Do not replace or switch semi-conductor devices unnecessarily, as it may affect the calibration of the instrument.
- Any replacement component should be of the original type or a direct replacement. Bend the leads to fit the socket or p.c.b. holes and cut the leads to the same length as on the component being replaced. See also the Performance Test in this manual.
- When a device has been replaced, check the operation of the part of the instrument that may be affected.

8.3 STATIC SENSITIVE COMPONENTS

In the oscilloscope the black/yellow 'static sensitive components' symbol is present (see also figure 8.1). This means that this instrument contains electrical components that can be damaged by electrostatical discharge.
Although all MOS integrated circuits incorporate protection against electrostatic discharge, they nevertheless can be damaged by accidental over-voltages.

Figure 8.14 Static sensitive symbol (black/yellow)

It is also possible that a delayed failure or 'wounding' effect may occur. When this happens the component will fail anywhere between two hours to six months later.

In storing and handling static sensitive components, the normal precautions for these devices are recommended. Handling and servicing static sensitive assemblies and components should be performed only at a static free workstation by qualified personnel.

CAUTION: Testing, handling and mounting call for special attention. Personnel, handling static sensitive devices, should normally be connected to ground via a high-ohmic resistor.

Extensive information on how to deal with static sensitive components is contained in Support Bulletin OSC296 (ordering number 4822 872 08407).

8.4 SOLDERING TECHNIQUES

8.4.1 General soldering techniques

Working method:

- Carefully unsolder the soldering tags of a semi-conductor one after the other.
- Remove all superfluous soldering material. Use desolder braided wire; ordering code: 4822 321 40042.
- Check that the leads of the replacement part are clean and pre-tinned on the soldering places.
- Place the replacement semiconductor exactly in the same position, and solder each lead to the relevant printed conductor on the printed circuit board.

NOTE: The maximum permissible soldering time is 10 seconds during which the temperature of the leads must not exceed 250 °C. The use of solder with a low melting point is recommended. Take care not to damage the plastic encapsulation of the semiconductor (softening point of the plastic is 150 °C).

ATTENTION: When you are soldering inside the instrument it is essential to use a low voltage soldering iron, the tip of which must be grounded to the chassis of the oscilloscope.

A suitable soldering iron is:
Mini soldering iron station, WECP-COD3 (regulated transformer) and Weller LR-20 (soldering iron).

Ordinary 60/40 solder with core and 35 ... 40 W pencil-type soldering iron can be used to do the majority of the soldering. If a higher wattage-rating soldering iron is used on the printed circuit board, excessive heat can cause the circuit wiring to separate from the base material.

8.4.2 Soldering micro-miniature semi-conductors

Because of the small dimensions of these SOT semi-conductors and the lack of space between the components on the printed circuit board, it is necessary to use a miniature soldering iron with a pin-point tip (max. diameter 1mm) to solder a SOT on to a printed circuit board.

Suitable soldering tools are:
- Mini soldering iron station, WECP-COD3 (regulated transformer) and Weller MLR-20 (mini soldering iron).
- A hot-air solder tool: Leister Hot-Jet.

Next, the following materials are recommended:
- Soldering tin, diameter 0.8 mm, SnPb 60/40 with a Resin Mildly Activated (RMA) flux. Ordering code: 4822 390 80133.
- Desolder braided wire; ordering code 4822 321 40042.
- Solder paste 26.
- Non-corrosive and Resin Mildly Activated (RMA) flux-Colophony. Ordering code: 4822 390 50025.

Refer to the Support Bulletin OSC296 (ordering code 4822 872 08407) for a complete discussion of the soldering techniques for SMD's.

8.5 REMOVING THE UNITS, MECHANICAL PARTS AND CRT

NOTE: For installation, reverse the sequence.

8.5.1 Removing the rotary knobs

Rotary knobs can be removed by simply pulling them off. The knobs have an integrated shaft and fixing device. Most of the knobs (11) have a light grey colour. The knobs for cursor positioning are dark grey. The knobs DELAY and LEVEL DTB are almost white ('dark mushroom').

For installation push the rotary into its hole, rotate it gently until it clicks into place.

8.5.2 Detachment of ribbon cables

The white ribbon cables are used together white connectors with integrated locking device. Proceed as follows to take the cable out of the connector:

- Lift the outside part of the connector: this unlocks the cable.
- Pull the ribbon cable out of the connector.

Proceed as follows to connect the the ribbon cable again:

- Push the ribbon cable fully into the connector. The blue line on the cable must be on the connector side where the contacts are visible (in unlocked position). Figure 8.2 explains this.
- Push down the outside part of the connector in order to lock the cable.

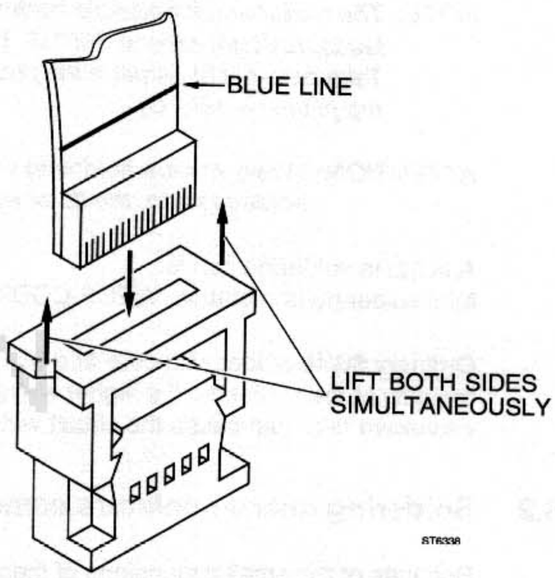


Figure 8.15 Mounting position of white ribbon cables in connector

8.5.3 Removal of the units in the front frame

The plastic front frame incorporates the Front unit A4 and the CRT controls unit A5. The frame can be removed from the chassis by bending out four clamping lips. Before doing so unlock the ribbon cable at the connector board.

Removal of Front unit A4:

- Pull the self-locking white plastic clamps.
- Remove the rotary knobs.
- Bend out the four clamping lips that secure unit A4 to the front frame and take the unit out.
- If required separate the rubber key mat from the printed circuit board.

NOTE:
- *Do not allow dirt to reach the contact areas of the printed circuit board and the key mat. If dirty, contact areas may be cleaned with cleansing alcohol.*
- *Small studs on the key mat position it on the printed circuit board. During installation the studs must be pressed gently into the matching holes of the circuit board. This can be done by using a small screwdriver.*
- *The key mat as delivered as a spare part is universal. It may be that the number of keys are too much for your instrument. If so, the unnessary keys must be cut off with a sharp knife.*

Removal of CRT controls unit A5:
- Remove the rotary knobs.
- Pull the two self-locking white plastic clamps.
- Take the unit out of the front frame.

8.5.4 Removal of the Power supply unit A6

WARNING: On the power supply unit there are many parts that carry dangerous high voltages. Some of these voltages remain some time after disconnecting the instrument from the mains. Therefore it is recommended to wait at least five minutes after having disconnected the instrument from the mains, before removing the printed circuit board. If working on the power supply under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved.

- Disconnect the oscilloscope from the mains.
- Remove the screw that secures the unit to the chassis.
- Unplug the cables from the -2.2 kV cathode/filament (3 wires), the fan (2 wires) and the back-up voltage (2 wires).

WARNING: The E.H.T. cable is directly connected to the E.H.T. multiplier that is present on the power supply. When the E.H.T. cable is disconnected from the CRT, the cable must be discharged by shorting it to the instrument's ground (e.g. the CRT shielding).

- Unplug the +14.3 kV connector from the CRT.
- Unlock the plastic clamps (are part of the chassis) that secure the lower edges of the unit.
- Slide the unit upwards out of the instrument and unplug the mains input connector (3 thick wires).

NOTE: The power supply unit can be measured under working conditions, by using the extension board with ordering code 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT- converter. For safety reasons it is strongly recommended to use this feature. Refer to chapter 8.8 for more faultfinding hints.

8.5.5 Removal of microprocessor unit A3

- Remove the screw that secures the unit to the rear panel.
- Remove the screw that secures (and grounds) the unit to the bottom chassis plate.
- Unplug the ribbon cable that leads to signal unit A1.
- If the IEEE option is installed, unplug the ribbon cable that leads to the IEEE-connector.
- Slide the unit upwards out of the instrument.

NOTE: The microprocessor unit can be measured under working conditions, by using the extension board with ordering code 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT- converter. This feature is not used when testing the microprocessor.

8.5.6 Removal of Final XYZ amplifier unit A2

ATTENTION: On the XYZ unit there are parts that carry high voltages. If working on the unit under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved.

- Remove the screw that secures (and grounds) the unit to the bottom chassis plate.
- Disconnect the 4 wires that lead to the CRT (The X- and Y-deflection plates): this action must be done carefully to avoid damage to the side connections of the CRT. For correct reinstallation refer to the wiring diagram in chapter 4.2.
- Bend out the two clamping lips that secure the unit at the top side. The unit is loosened now.

NOTE: The unit can be put now in an inclined position as shown in figure 8.3. Measuring on the SMD-component side in working condition is possible then. Measuring the output wires that lead to the X- and Y-deflection plates is possible with a 10 kΩ damping resistor between measuring point and probe tip. This avoids oscillations.

- Unplug two ribbon cables and take the unit out of the chassis.
- Unplug the delayline connector.

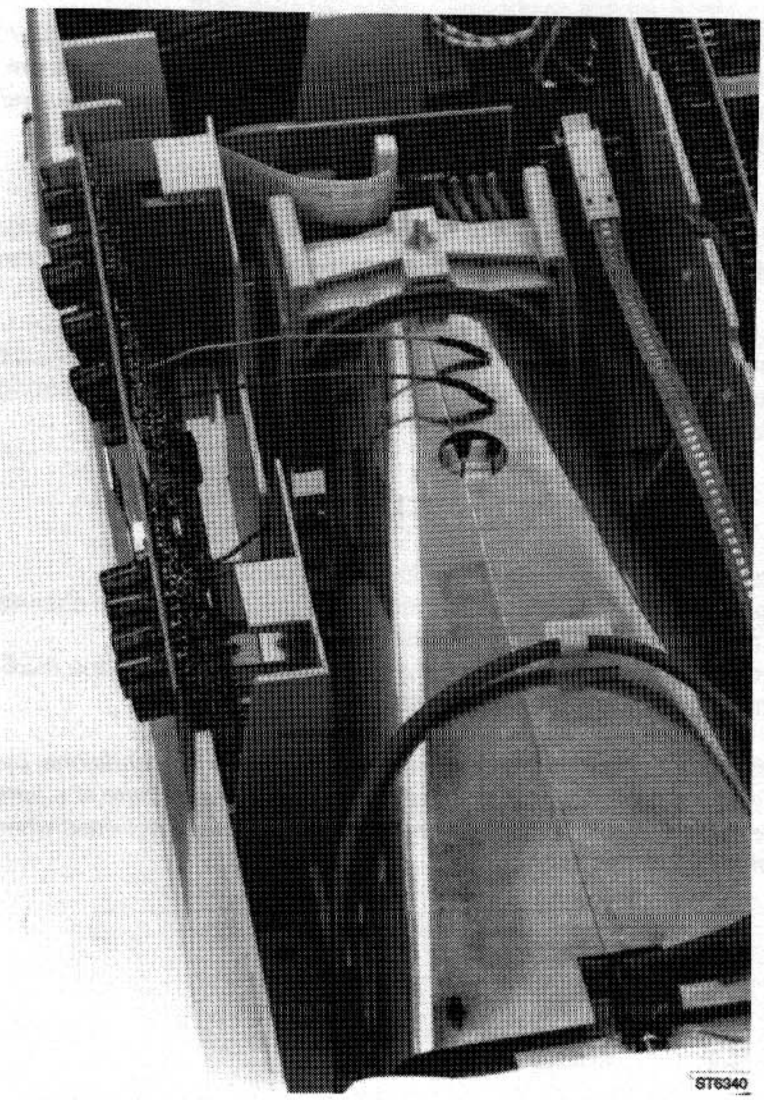


Figure 8.16 Final XYZ amplifier in inclined position

8.5.7 Removal of unit at socket of CRT

WARNING: On this unit there are parts that carry dangerous high voltages (-2.2 kV). Some of these voltages remain some time after disconnecting the instrument from the mains. Therefore it is recommended to wait at least five minutes after having disconnected the instrument from the mains, before removing the printed circuit board. If working on the unit under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved.

Now proceed as follows:
- Unplug the ribbon cable at the Final XYZ amplifier or at the CRT socket unit.
- Pull the unit gently off the CRT socket.
- Unplug the -2.2 kV cathode/filament (3 wires).

8.5.8 Removal of signal unit A1

- Remove 3 screws with washers that fix the printed circuit board to the chassis plate.
- Remove 1 long screw that fixes (and grounds) the screen of the input attenuators to the chassis plate.
- Unplug the blue ribbon cable.
- Lift the rear side of the unit over the plastic stud and slide the unit backwards: the unit becomes loose from the chassis now.

NOTE: The unit can be toppled over. The SMD component side is accessible now and can be measured in working condition after reinstallation of the blue ribbon cable. Figure 8.4 shows this.

- Unplug the white ribbon cable and the coaxial delayline connector.
- Unplug the connectors for the output options (MTB gate, DTB gate, Y-out and Ext trigger) if they are present in the instrument.
- Remove the unit from the instrument.

For removal of the screen of the attenuators proceed as follows:

Pull off the plactic bracket between the BNC inputs.
Remove the two screws between the BNC's.
Remove the two screws in the sides of the screening plate.

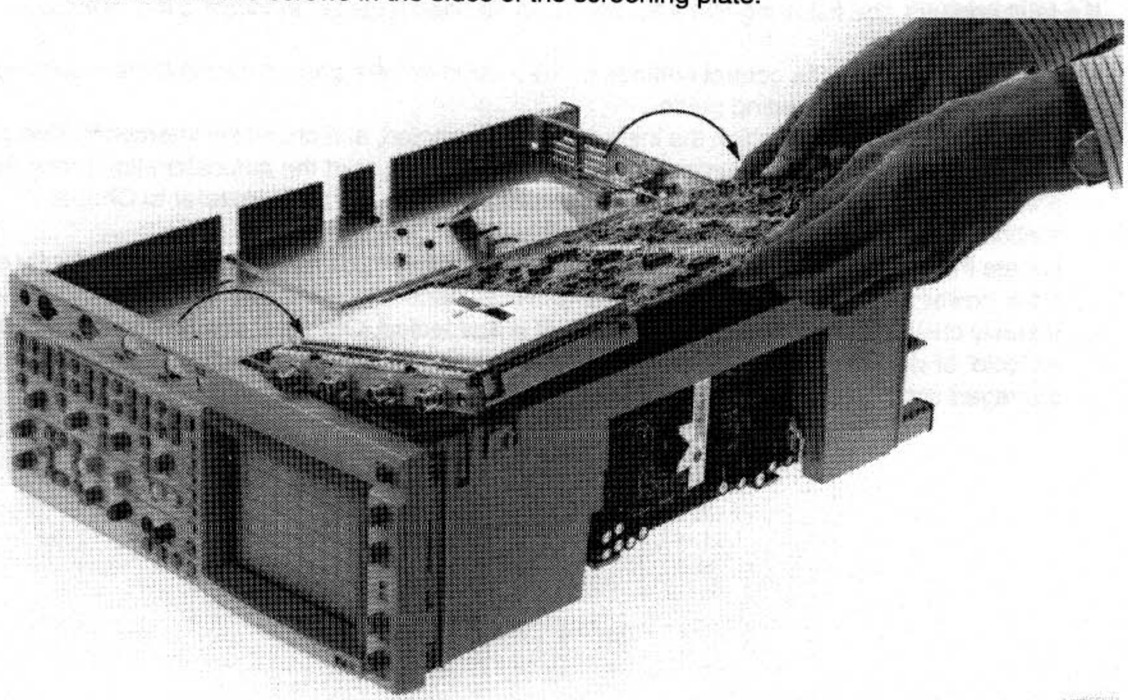


Figure 8.17 Signal unit in position to measure SMD component side

8.5.9 Removal of Cathode Ray Tube (CRT)

IMPORTANT:
- *Handle the CRT and its side connections carefully. Rough handling or scratching can cause the CRT to implode.*
- *When installing the CRT, first remove its protective cover. Then take care that its screen is pressed tight to the front side of the chassis.*

- Remove the unit from the socket of the CRT (refer to 8.5.7).
- Disconnect the 4 wires that lead to the CRT (The X- and Y-deflection plates): this action must be done carefully to avoid damage to the side connections of the CRT. For correct reinstallation refer to the wiring diagram in chapter 4.2.
- Pull the graticule lamp holder out of the front rubber.
- Remove the bezel and contrast filter.
- Unplug the trace rotation cable (3 wires) at the connector board.

WARNING: The E.H.T. cable is directly connected to the E.H.T. multiplier that is present on the power supply. When the E.H.T. cable is disconnected from the CRT, the cable must be discharged by shorting it to the instrument's ground (e.g. the CRT screen).

- Unlock the EHT cable and discharge it to ground potential.
- Push the two plastic clamping lips that secure the CRT support to the chassis and gently lift the CRT including its shield out of the oscilloscope.

8.6 INSTRUMENT REPACKING

If the instrument is to be shipped to a Service Centre for service or repair, attach a tag showing the full address and the name of the individual at the users firm that can be contacted. The Service Centre needs the complete instrument, its serial number and a fault description. If the original packing is not available, repack the instrument in such a way that no damage occurs during transport.

8.7 TROUBLESHOOTING TECHNIQUES

If a fault appears, the following test sequence can be used to assist in locating the defective component:
- Check to verify that the control settings of the instrument are correct. Consult the operating instructions in the Operating guide.
- Check the equipment to which the instrument is connected, and check the interconnection cables.
- Verify that the instrument is properly calibrated. If it is not, start the autocalibration procedure by pressing the CAL key for 2 seconds. If this does not solve the problem refer to Chapter 7 'Calibration Adjustment Procedure'.
- Locate the circuit(s) in which the fault is suspected: the symptom often indicates the faulty circuit. If the power supply is defective, the symptom may appear in several circuits.
- Visually check the circuit(s) in which the fault is suspected. Often it is possible to find faults such as 'cold' or defective solder joints, intermittent or open interconnection plugs and wires or damaged components.

8.8 TROUBLESHOOTING THE POWER SUPPLY

WARNING: On the power supply there are many parts that carry dangerous high voltages. Some of these voltages remain some time after disconnecting the unit from the mains. Therefore, it is recommended to wait at least five minutes after having disconnected the unit from the mains, before removing the unit. If working on the power supply unit under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved. The use of an mains isolation transformer is strongly recommended.

The table below indicates the output voltages, currents and power figures delivered by the power supply. To determine whether a certain fault condition is initiated by the power supply itself or by the connected oscilloscope circuits, a dummy load is listed in the table. The table gives also an example of the resistor types that can be used to compose the dummy load. The resistors and connector (ordering number 5322 267 70308) that fits on connector X1002 can be ordered.

Supply voltage	Current drain	Substitution resistance	Dissipated power	Dummy load resistors
+5 V	1735 mA	2.9Ω	5.4W	3x 10Ω/4W (4822 112 21054) in parellel
-5.2V	550 mA	9.1Ω	2.8W	10Ω/4W (4822 112 21054)
+12 V	1160 mA	10.3Ω	13.9W	22Ω/7W (4822 112 41063) and 27Ω/7W (4822 112 41065) in parallel
-12 V	850 mA	14.2Ω	10.1W	27Ω/7W (4822 112 41065) and 33Ω/7W (4822 112 41067) in parellel
+18 V	350 mA	51.4Ω	6.3W	2x 27Ω/4W (4822 112 21065) in series
-18 V	195 mA	92.5Ω	3.5W	2x 47Ω/4W (4822 112 21072) in series
+58 V	60 mA	966 Ω	12.1W	2x 470Ω/7W (4822 112 41098) in series
-58 V	80 mA	725 Ω	4.7W	330Ω/4W (4822 112 21094) and 390Ω/4W (4822 112 21096) in series
+10 Vref	9 mA	1100 Ω	0.1W	--
6.3Vac	240 mA	26.3Ω	1.5W	--
-2.2kV	700 uA	3.1MΩ	1.55W	--
+14.5kV	50 uA	290 MΩ	0.7W	--

Another way of fault location is the use of the extension board with ordering code 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT-converter. For safety reasons it is strongly recommended to use this feature.

The current drawn from a certain supply voltage can be measured after having removed the series choke and connecting a current meter instead of it. The chokes are L1273 (+5 V), L1201 (-5.2 V), L1202 (+12 V), L1203 (-12 V), L1204 (+18 V), L1206 (-18 V), L1208 (+58 V) and L1209 (- 58 V).

8.9 SPECIAL TOOLS

8.9.1 Extension board

For test and repair purposes the units A3 and A6 can be plugged in their connectors via an extension board. This board is available under ordering number 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT-converter. For safety reasons it is strongly recommended to use this feature.

8.9.2 Flash-ROM loader program

After calibration of the oscilloscope, the softkey 'save calibr data' must be pressed. This saves the calibration data in the oscilloscope's internal Flash-ROM. When the oscilloscope is turned off now, calibration data does not disappear with no back-up batteries installed. The save action can be done 10 times.

The Flash-ROM contains blocks of calibration data (of which the most recent block is valid) and the operating software. After operation of softkey 'save calibr data', the text 'XX CALIBRATION FIELDS FREE' is displayed. XX can be a figure between 10 ... 1 or 'NO'. In case of 'NO', the Flash ROM must be emptied and redundant blocks of calibration data must be removed. To have this done, send your oscilloscope to the nearest Service Center.

The data exchange takes place via the oscilloscope's RS232 interface. It occurs via a program running on a Personal Computer with RS232 interface.

The Flash-ROM D1013 as listed in the parts lists is empty. After exchange it must be filled with operating software and calibration data. Also for this the oscilloscope must be sent to the nearest Fluke Service Center.

8.10 RECALIBRATION AFTER REPAIR

After any electrical component has been renewed the calibration of its associated circuit should be checked, as well as the calibration of other closely-related circuits.
Since the power supply affects all circuits, calibration of the entire instrument should be checked it work has been done in the power supply or if the transformer has been renewed.

8.11 TROUBLE SHOOTING TOOLS

This family of analog oscilloscopes offers a number of possibilities to trace a fault. The tests 1 ... 4 can be done quickly and easily; however they require that parts of the oscilloscope function correctly. The display part and power supply must be OK. Also the keys must be read by the microprocessor. If the scope is 'dead,' you have to start with test 5.

The following tests can be selected:

1 Power-up tests that are done automatically each time that the oscilloscope is switched on. A fault is indicated by a screen message. For information refer to chapter 8.12.1 'Power-up test'.
2 Menu-operated tests that can be done without opening the instrument. Parts of the digital circuitry can be tested. Refer to chapter 8.12.3 'Selftest'.
3 Menu-operated tests that put circuitry in defined state. In most cases the oscilloscope must be opened to measure the result. For this an additional measuring oscilloscope must be used. Parts of the digital circuitry can be tested in an easy way. Refer to chapter 8.12.4 'Repair tools'.
4 The autoCalibration function is intended to automatically calibrate most of the oscilloscope's circuitry. In case of a defective circuit part, this calibration cannot be completed for the full 100%. The procedure is terminated then with an error number. Via a table this number indicates the circuit part where a fault may be expected. Refer to chapter 8.13 'The autocal procedure' for more information.
5 The tests 1 ... 4 can point in a quick and easy way to the approximate fault location. To find the defective component, you have to measure in the instrument. For this purpose the circuit diagrams in this manual are provided with DC and AC voltages that can be measured with and additional measuring oscilloscope. For details refer to chapter 3.1.4. 'Voltage values in the circuit diagrams'. Where no values are mentioned, it is often possible to measure by means of comparison between identical circuit parts. This can e.g. be used for the vertical channels, MTB/DTB trigger and MTB/DTB sweep circuits. Of course for comparison these circuit parts must have the same input signal and must be put in the same settings. Also supply voltages can be measured. When measuring the power supply, you have to take care of dangerous life voltages that are present.

8.12 TESTS BUILT INTO THE INSTRUMENT

8.12.1 Power-up test

After turning the oscilloscope on, power-up tests start automatically. The tests take less than a second. A message appears on the screen when errors are found. With no message displayed, the oscilloscope is ready for use. The tests that are sequentially done and the associated error messages are:

- The oscilloscope's internal control bus is checked. This is done by addressing N9001, N9002, N9003, N8005, N6014, D9009 (unit A1), N1001, N2002 (unit A2) and N1141 (unit A6).
  Message: 'NO ACKNOWLEDGE ON I2C BUS'.
- The oscilloscope's hardware configuration is tested on the units A1 and A3. On unit A1 is tested for 100 or 200 MHz and 4 or 2+2 channels. On A3 the presence of an IEEE interface and the amount of memories. Also is tested if the the software version corresponds with the hardware modification level.
  Messages: 'WRONG A1 HARDWARE VERSION' or 'WRONG A3 HARDWARE VERSION'.
- The communication between the front unit A4 (named 'ufo') and microprocessor A3 is checked.
  Message: 'CANNOT COMMUNICATE WITH UFO'.
- The contents of the settings memory is checked if back-up batteries are installed.
  Message: 'NO BATTERY BACKUP'.

8.12.2 Introduction to diagnostic tests

The tests are accessible via the softkey menu's. A good knowledge of the circuitry of the oscilloscope is necessary to take advantage of these tests. Refer to chapter 5 'Unit descriptions' for additional information and circuit diagrams.

Tests can be performed on:
- The microprocessor system.
- The inputs for the microprocessor (rotaries and keys via the processor in the front unit).
- The outputs from the microprocessor (digital to analog converters and output buffers).

The configuration of the microprocessor control part is given in the figure. The lines SDA (Serial DAta) and SCL (Serial CLock) are fed to the many circuits, where the serial information is converted into the different control signals.

NOTE: For servicing, solder joints are added in the p.c.b. tracks. These can be used to localize a fault in the bus by means of isolating a suspected IC from SCL or SDA lines.

Proceed as follows to reach the tests:
- Press menukey 'UTILITY'.
- Press softkey 'MAINTENANCE'.
- Now softkey selection is possible between 'SELFTEST' and 'REPAIR TOOLS'.

8.12.3 Selftest

Under the softkey 'SELFTEST' it is possible to run tests for the microprocessor memories. This comprises a checksum test for the ROM and a (non destructive) pattern write/read test for the RAM. With a toggle softkey, selection is possible between 'test-all' and 'specific'.

A test is started with softkey 'start'. A test that is being executed can be interrupted with softkey 'abort'. A test completed succesfully gives the screen message 'TEST PASSED'.
The selection 'test all' tests all memories. If a fault is found, 'specific' must be selected: this gives the possibility to determine what memory is defective. By means of the 'TRACK' rotary one of the memory devices can be selected. The selection (e.g. ram 0, ram 1, rom 0, rom 1) depends on the instrument's configuration.

Note: softkey 'RETURN' is used to move upwards in the menu structure.

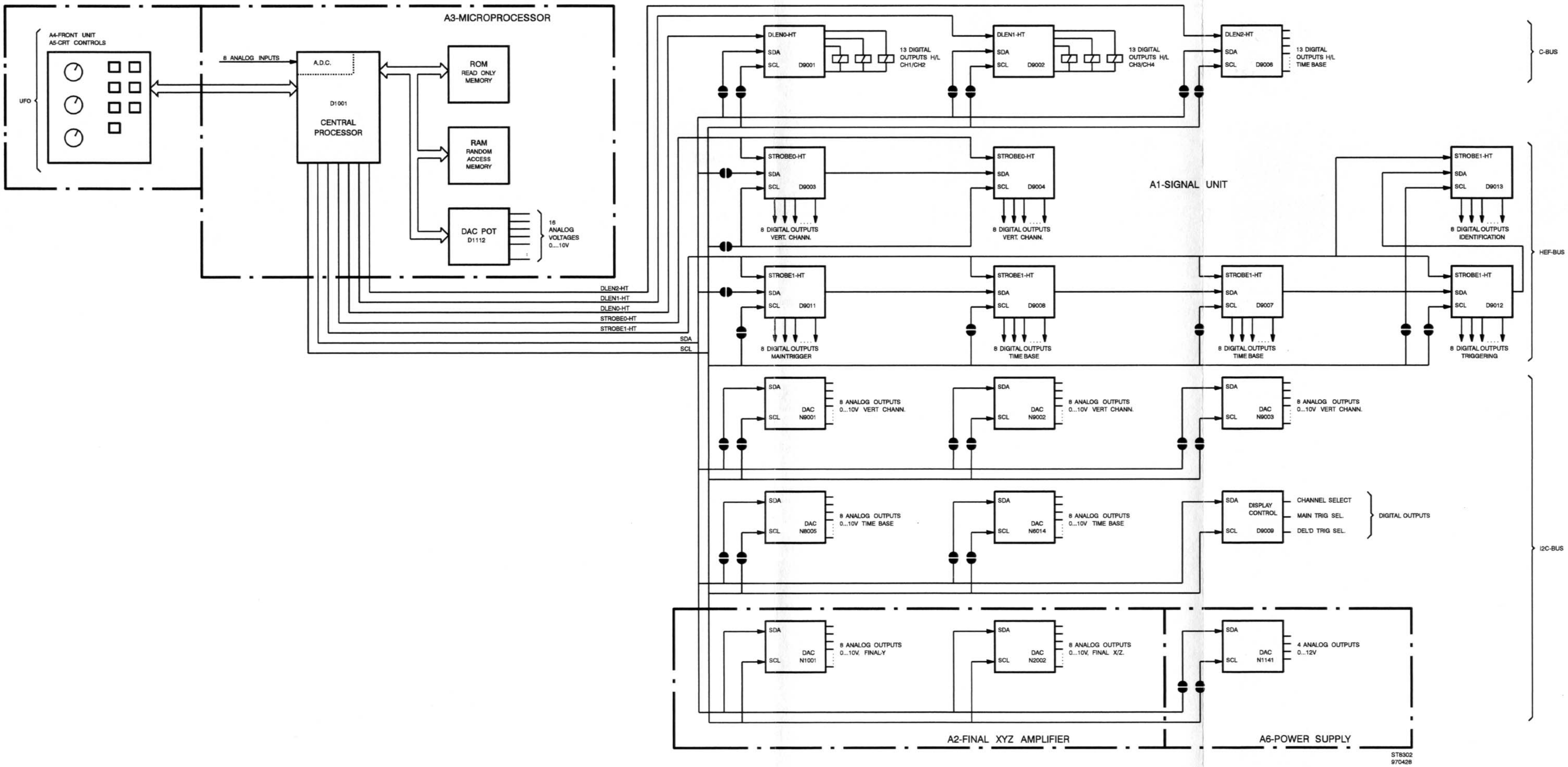
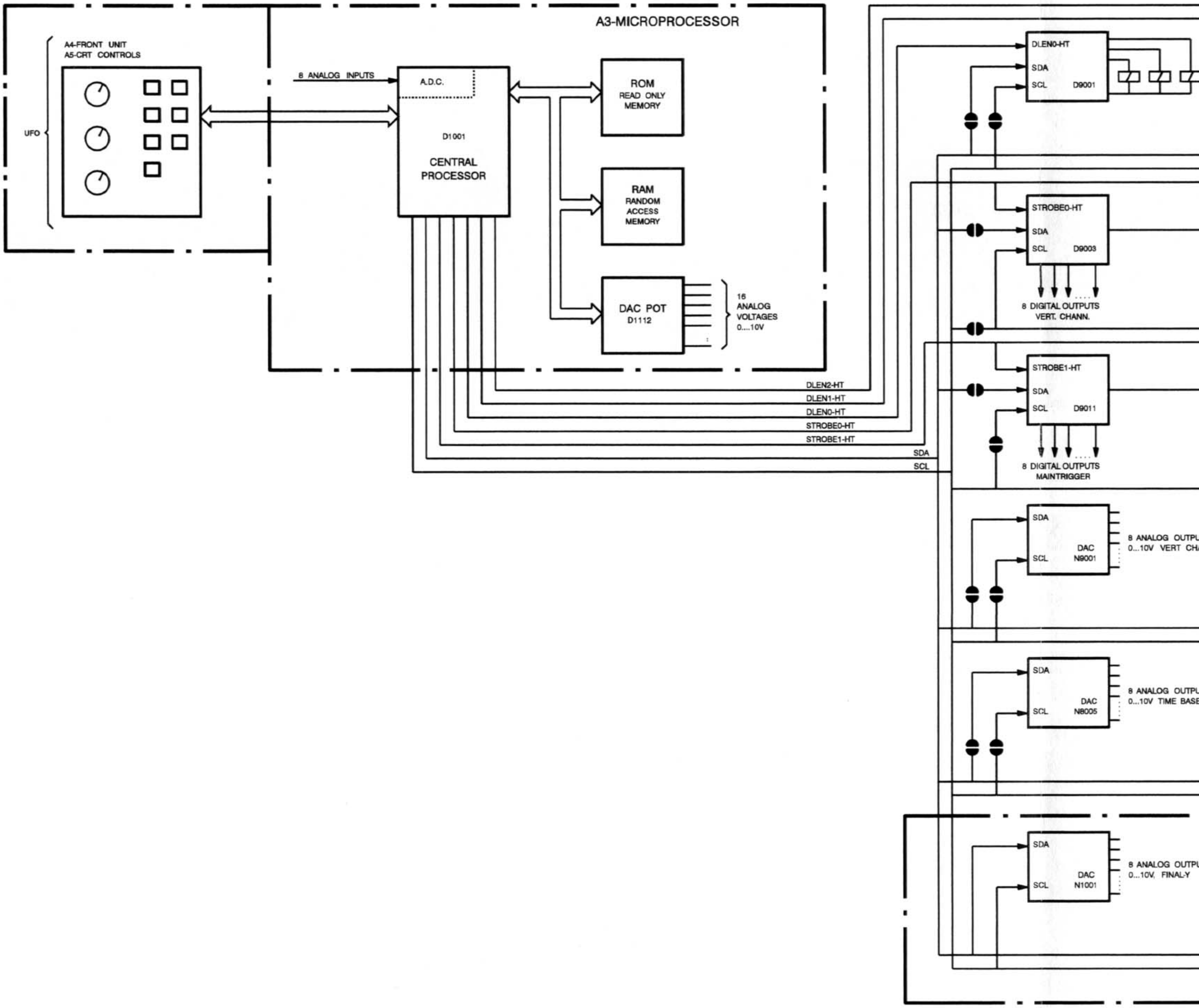


Figure 8.5. Configuration of mmicroprocessor control part


A3-MICROPROCESSOR
A4-FRONT UNIT
A5-CRT CONTROLS
UFO
8 ANALOG INPUTS
A.D.C.
D1001
CENTRAL PROCESSOR
ROM
READ ONLY MEMORY
RAM
RANDOM ACCESS MEMORY
DAC POT
D1112
16 ANALOG VOLTAGES 0....10V
DLEN2-HT
DLEN1-HT
DLEN0-HT
STROBE0-HT
STROBE1-HT
SDA
SCL
DLEN0-HT
SDA
SCL
D9001
STROBE0-HT
SDA
SCL
D9003
8 DIGITAL OUTPUTS
VERT. CHANN.
STROBE1-HT
SDA
SCL
D9011
8 DIGITAL OUTPUTS
MAINTRIGGER
SDA
SCL
DAC
N9001
8 ANALOG OUTPU
0...10V VERT CH
SDA
SCL
DAC
N8005
8 ANALOG OUTPU
0...10V TIME BASE
SDA
SCL
DAC
N1001
8 ANALOG OUTPU
0...10V, FINAL-Y

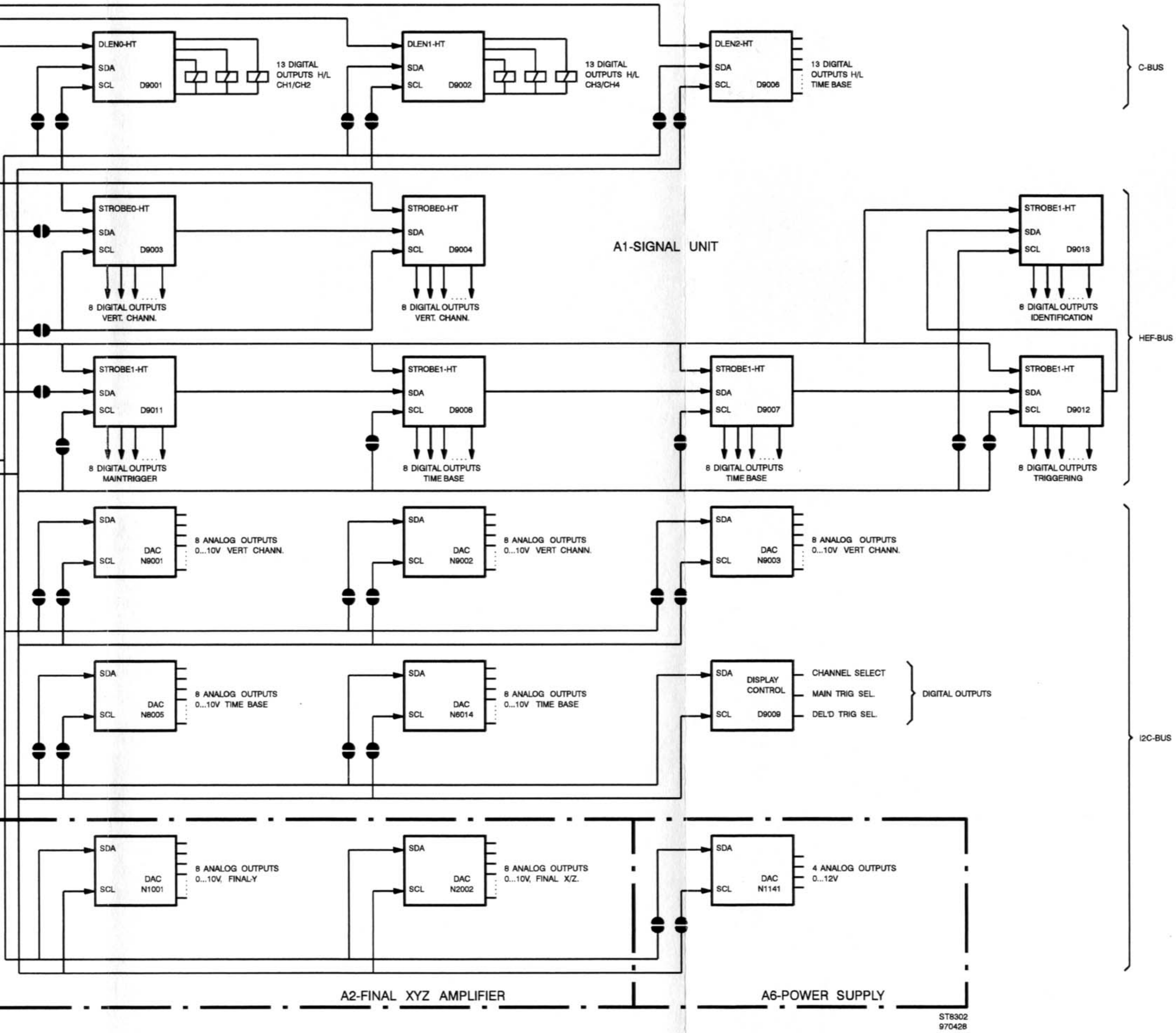


Figure 8.5. Configuration of mmicroprocessor control part

8.12.4 Repair tools

8.12.4.1 General

Under the softkey 'REPAIR TOOLS', tests can be selected concerning the exchange of information in the area around the microprocessor:

- Data exchange between keys/rotaries and microprocessor.
- Data exchange between microprocessor and the devices that control the oscilloscope circuits.

Tests can be selected with a softkey pair. A test can be activated with toggle softkey 'on off'. Data in connection with the tests is displayed in the viewing area as two lines of information. The last setting is present in the utmost right position of the lowest of the two lines.

8.12.4.2 Repair tools / ufo

With this test the proper functioning of the keys and rotaries at the front panel (ufo) can be tested. Each control has its own number. There is also information given concerning the position occupied by the controls. The tables below indicate the information from controls towards microprocessor. This is separately listed for rotaries and keys.

Rotaries (L is rotation left to right, R is rotation right to left, X indicates the rotation speed):

ILLUM	L/R0X	TEXT INTENSITY	L/R1X	TRACE INTENSITY	L/R2X
POS CH2	L/R3X	LEVEL DTB	L/R4X	HOLD OFF	L/R5X
POS CH4	L/R6X	LEVEL MTB	L/R7X	FOCUS	L/R8X
FOCUS	L/R8X	TRACE ROT	L/R9X	TRACK	L/RAX
POS CH1	L/RBX	'delta'	L/RCX	DELAY	L/RDX
POS CH3	L/REX	X POS	L/RFX		

Keys (A = autorepeat, M = more than 1 key pressed, X=P is function off, X=U is function on):

CAL	X00	AUTOSET	X01	STATUS LOCAL	X02
STATUS	X02	Softkey 5	X03	Softkey 6	X04
TEXT OFF	X05	CH1 + CH2	X06	AC DC GND CH1	X07
UTILITY	X10	SETUPS	X11	Softkey 1	X12
Softkey 4	X13	AMPL mV CH1	X14	AMPL V CH1	X15
AMPL mV CH2	X16	AMPL V CH2	X17	pin hole	X21
Softkey 2	X22	Softkey 3	X23	50 ohm CH1	X24
ON CH1	X25	50 ohm CH2	X26	ON CH2	X27
DTB s	X32	DTB trig	X33	BWL	X34
TRIG1	X35	INV CH2	X36	AC DC GND CH2	X37
TB MODE	X41	CURSORS	X42	DTB ns	X43
ALT CHOP	X44	TRIG2	X45	AMPL mV CH3	X46
AMPL V CH3	X47	TRACE SEP down	X51	MAGN	X52
TRIGGER MTB	X53	TRIG4	X54	TRIG3	X55
50 ohm CH3	X56	ON CH3	X57	TRACE SEP up	X61
MTB s	X63	INV CH4	X64	50 ohm CH4	X65
CH3 + CH4	X66	AC DC GND CH3	X67	RESET	X72
MTB ns	X73	AC DC GND CH4	X74	ON CH4	X75
AMPL mV CH4	X76	AMPL V CH4	X77		

Note: the table with keys is based upon PM3094. In other oscilloscope versions (PM3082, PM3084, PM3092) some of the keys are not present or have a different function.

8.12.4.3 *Repair tools / i2cbus*

This test displays the data (SDA) that is send by the microprocessor to a number of addressable devices. Synchronization is achieved via SCL. Each data block sent by the microprocessor is preceeded by an address on which the device can respond. The characters 'A, B, C, D, E and F' represent one hexadecimal character. The devices are the ADC's mentioned under 'REPAIR TOOLS / DAC ' and DAC N1141 on power supply unit A1.

Device	Unit	Name of circuit diagram	Address	Data format
D9009	A1	Display and trigger control	36	AB CD EF
N9001	A1	Control circuits	40	AB CD
N9002	A1	Control circuits	4C	AB CD
N9003	A1	Control circuits	44	AB CD
N8005	A1	Time base logic	48	AB CD
N1001	A2	Final Y preampl. + control	46	AB CD
N2002	A2	Final X amplifier + control	4E	AB CD
N1141	A6	EHT converter + auxiliary	88	AB CD

8.12.4.4 *Repair tools / adc*

This test displays the decimal representation of the input voltage applied to the analog inputs ACH0 ... ACH7 of the microprocessor D1001. The readout consists of two lines of information.

The first line displays in sequence the analog inputs:
- ACH7: the NTC-resistor R1009 (on unit A3) that measures the temperature inside the oscilloscope is connected to this input.
- ACH6 (PTEST-XA): the voltage value that represents the type of the probes applied to CH1 ... CH4 is applied to this input.
- ACH5 (TBSMART): the voltage value representing the state of a number of time base circuits is applied here. TBSMART originates from unit A1 and is applied to unit A3.
- ACH4: the applied voltage is used as a reference and derived from reference voltage +5VREF via voltage divider R1003/R1004 (unit A3).

The second line displays in sequence:
- ACH3: the applied voltage is 0 volt (CAL ground). Decimal value approx. 0.
- ACH2 (XCAL): the applied voltage originates from the measuring circuit of the horizontal output on unit A2. This is used for automatic calibration of he horizontal section.
- ACH1 (YCAL): the applied voltage originates from the measuring circuit of the vertical output on unit A2. This is used for automatic calibration of he vertical section.
- ACH0: the applied voltage is 0 volt (CAL ground). Decimal value approx. 0.

8.12.4.5 *Repair tools / hef*

To control simple on/off functions there are 7 buffers (of the type HEF4094) on unit A1: this structure is called the 'HEF-bus'. Each buffer has 8 outputs as shown in the figure. The buffers are divided into 2 groups: group 0 consists of 2 buffers and group 1 consists of 5 buffers. A group can be regarded as a shift register of 16 or 40 bits. Each group of buffers has its common enable signal: STROBE0-HT or STROBE1-HT.

The test makes the data (SDA) visible that is shifted by the microprocessor into the shift register. Data is displayed in the viewing area as two lines of information. The last data block is present in the utmost right position of the lowest of the two lines. Synchronization is achieved via SCL.

The configuration of group 0 and 1 is shown in the table:

Group	Enable signal	Buffers	Name of circuit diagram
0	STROBE0-HT	D9003	Control circuits
		D9004	Control circuits
1	STROBE1-HT	D9011	MTB trigger
		D9008	Time base logic
		D9007	Delayed time base
		D9012	DTB trigger
		D9013	DTB trigger

The data representation for group 0 is '0:ABCD'. Each character represents the hexadecimal (16 possible states) information for 4 outputs (total 16 outputs):
- Character 'A' represents the information for D9004 outputs 14, 13, 12, 11.
- Character 'B' represents the information for D9004 outputs 4, 5, 6, 7.
- Character 'C' represents the information for D9003 outputs 14, 13, 12, 11.
- Character 'D' represents the information for D9003 outputs 4, 5, 6, 7.

The data representation for group 1 is '1:ABCD 1:EFGH'. Each character represents the hexadecimal (16 possible states) information for 4 outputs (total 32 outputs):
- Character 'A' represents the information for D9012 outputs 14, 13, 12, 11.
- Character 'B' represents the information for D9012 outputs 4, 5, 6, 7.
- Character 'C' represents the information for D9007 outputs 14, 13, 12, 11.
- Character 'D' represents the information for D9007 outputs 4, 5, 6, 7.
- Character 'E' represents the information for D9008 outputs 14, 13, 12, 11.
- Character 'F' represents the information for D9008 outputs 4, 5, 6, 7.
- Character 'G' represents the information for D9011 outputs 14, 13, 12, 11.
- Character 'H' represents the information for D9011 outputs 4, 5, 6, 7.

Note: the data for D9013 is not displayed. This buffer is only used when turning-on the oscilloscope: it tests if hardware and software belong to each other.

8.12.4.6 Repair tools / cbus

To control on/off functions in the CH1 ... CH4 attenuators and in the main and delayed time base, there are 3 buffers on unit A1 of the instrument. This configuration is called the 'c-bus'. Each buffer has 13 outputs and can be regarded as a shift register of 13 bits. Each buffer has its own enable signal. The test makes the data (SDA) visible that is shifted by the microprocessor into the buffer. Synchronization is achieved via SCL.
The configuration is shown in the table:

Enable signal	Buffer	Name of circuit diagram
DLEN0-HT	D9001	Control circuits
DLEN1-HT	D9002	Control circuits
DLEN2-HT	D9006	Main time base

The data representation for D9006 is '0:ABCD'. Each character represents the hexadecimal (16 possible states) information for 4 outputs. The data representation for D9001 and D9002 is more complex: these buffers drive the pulse relays in the CH1 ... CH4 attenuators. Changing an attenuator setting can cause the generation of several '0:ABCD' blocks of data. Refer to chapter 5.1.1 for information on how the pulse relays are controlled. D9001 controls CH1 and CH2: data blocks have the configuration '0:ABCD'. D9002 controls CH3 and CH4: data blocks have the configuration '1:ABCD'.

8.12.4.7 Repair tools / DAC

Thoughout the oscilloscope there are several digital-to-analog converters (DAC's) that are controlled by the microprocessor. The 'REPAIR TOOLS' menu enables to select a certain DAC output (via TRACK) and to determine the output voltage (via Δ) at this output. After having opened the instrument, the voltage can be measured with a voltmeter or oscilloscope. The DAC output voltage range is between 0 ... 10V (1 ... 4V for D1112). This test is not influenced by softkey 'on off'. A DAC VALUE once changed returns to the old value if the menu is left.
The selections with the TRACK rotary have the configuration X.Y. The character X points to a certain DAC IC. The table shows the relation:

X-value	IC reference number	Unit number	Name of circuit diagram
0.Y	N9001	A1	Control circuits
2.Y	N9003	A1	Control circuits
3.Y	N1001	A2	Final Y preampl. + control
4.Y	N8005	A1	Time base logic
6.Y	N9002	A1	Control circuits
7.Y	N2002	A2	Final X amplifier + control
8.Y	D1112	A3	Potentiometer DAC + IEEE

The character Y points to a certain output within the selected DAC IC. The table shows this for N9001, N9002, N9003 and N8005 on unit A1:

Y-value	Pin	Name of generated signal:			
	number	N9001	N9002	N9003	N8005
X.0	11	PA1OFFSTRG	AT3LFCAL	DLDOFFSET	TBINTTRAT-XA
X.1	13	PA1OFFSET	AT3OFFSET	PA4OFFSTRG	DTBVAR
X.2	14	AT1LFCAL	AT3LOOPCAL	PA4OFFSET	DSOCALD
X.3	15	AT1OFFSET	PA2OFFSTRG	AT4LFCAL	DSOCALM
X.4	16	AT1LOOPCAL	PA2OFFSET	AT4OFFSET	DTRSEN
X.5	17	ATCAL0	AT2LFCAL	AT4LOOPCAL	MTRTVMODE
X.6	18	ATCAL1	AT2OFFSET	PA3OFFSTRG	MTRBAL
X.7	20	ATCAL2	AT2LOOPCAL	PA3OFFSET	MTRSEN

Note: for explanation of signal names, refer to chapter 5.1.2

For N1001 and N2002 (unit A2) refer to the table below:

Y-valuePinName/function of generated signal:

Y-value	Pin	Name/function of generated signal:	
	number	N1001	N2002
X.0	11	LF sq. wave	ASTDR
X.1	13	LF sq. wave	DARK
X.2	14	Gain	XHFADJ
X.3	15	HF sq. wave	XTRAGC
X.4	16	Offset	XCRTGCL
X.5	17	Offset	XCRTGCH
X.6	18	MF sq. wave	XCRTOFL
X.7	20	MF sq. wave	XCRTOFH

Note: for explanation of signal names, refer to chapter 5.2.2

For D1112 (unit A3) refer to the table below:

Y-value	Pin number	Pin name
X.6	16	POS CH1
X.4	19	POS CH2
X.2	21	POS CH3
X.8	13	POS CH4
X.1	22	VAR CH1
X.3	20	VAR CH2
X.5	18	VAR CH3
X.7	17	VAR CH4
X.12	9	VAR MTB
X.11	10	LEVEL MTB
X.10	11	LEVEL DTB
X.15	6	INTENS TEXT
X.9	12	TRACE SEP
X.0	23	FOCUS-DA
X.14	7	HOLD OFF
X.13	8	INTENS TRACE

IMPORTANT: After having completed these tests, it is recommended to reset the oscilloscope. Therefore press the keys 'STATUS' and 'TEXT OFF' simultaneously.

8.13 THE AUTOCAL PROCEDURE

8.13.1 Introduction

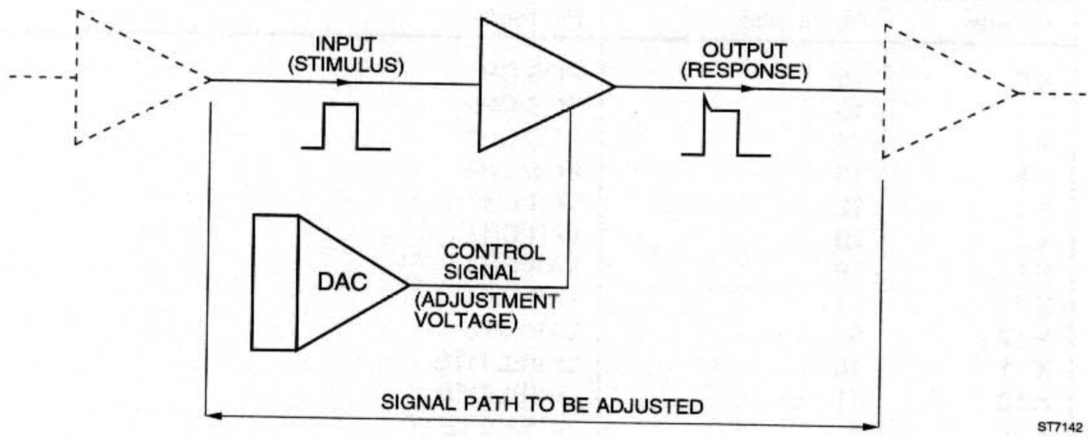
The oscilloscopes PM3094/92/84/82 have an **autocal** function. After pushing the CAL key for more than 2 seconds, a big number of adjustments are performed automatically. The advantages are:

- high measuring accuracy
- considerable gain of time. The manual calibration adjustment is limited to a job of half an hour.

The autocal procedure consists of a number of adjustment steps that are performed in sequence. Each step comprises a series of attempts - via 'successive approximation' - to obtain the ideal adjustment. The procedure is controlled by the instrument's microprocessor. The internal references are a very accurate 10 volt source and a quartz crystal.

During a calibration step, a defined **stimulus** is applied at a certain point in the circuit (the **input**). The **response** is measured at a later point in the circuit (the **output**). Somewhere inbetween, a digital-to-analog-converter (DAC) influences the performance of the circuitry. The DAC output is varied such that the output response has the desired value.

The figure shows this.



If a calibration step is not completed succesfully, this is indicated at the end of the autocal procedure. This is displayed on the CRT with a message:

'ERROR DURING AUTOCALIBRATION' Via key sequence UTILITY> MAINTENANCE, you can reach a screen where an error code YXX is displayed in the bottom text line.

YXX is a hexadecimal number indicating the first adjustment step that could not be adjusted to an optimal position.

8.13.2 FAULT LOCATION VIA ERROR CODES

The reason that an error code is displayed after an unsuccesful autocal can be:
1 - the manual calibration adjustment is not OK.
2 - a deviation of supply voltage(s) that affects all circuitry.
3 - a defective circuit part.

If calibration adjustment and power supply are OK, it may be that a defective circuit part is causing the error code. The error code gives information in what circuit part the fault may be found. **This circuit part lies of course between input (stimulus) and output (response).** This publication gives a survey to indicate for each error code the circuit part to be involved.

8.13.3 HOW TO USE THE ERROR CODE LISTS

The error codes are listed in sequence of error number: 001, 002, etc. They are grouped per function: time-base, final amplifiers, etc.

For each error code is given:
- error code: this is a hexadecimal figure.
- calibration step: a short description of the adjustment that could not be completed.
- input: signal name and circuit diagram number of the stimulus.
- control signal: signal name and circuit diagram number of the DAC output to be adjusted.
- output: signal name and circuit diagram number of the response.

The circuit diagram number (e.g. A2/1/D1001) gives information about the printed circuit board (A1, A2, etc.), the number of the diagram itself (1, 2, etc.) and the component to which the signal is applied (e.g. D1001). A node number (e.g. N1001/17) is given if a signal has no name.

The number of the circuit diagram is given for the 200 MHz version. For the 100 MHz version the corresponding circuit diagram should be used.

IMPORTANT:
The error code lists are a usefull help in faultfinding; in many cases a displayed error code will point to the defective circuit part. However bear in mind that there is is always a possibility that the fault will be found somewhere else.

8.13.4 ERROR CODE LISTS

Time base autocalibration

MTB (DTB) is put in defined time/div settings to adjust for the tolerance of each timing capacitor. Also VAR is adjusted. The sweep is switched on during a certain time. This happens via control signal STRCALM-HT (STRCALD-HT) that makes MTBGATE (DTBGATE) high. The sweep is compared inside sweep generator D6011 (D7011) with +2,7 V reference TBCALREF.

A deviation of the sawtooth makes MTBCALTST (DTBCALTST) low or high. The ideal time base adjustment is obtained after a number of steps.

Error code	Calibration step	Input(s)	Control signal	Output
001 003 004 006 007 008	MTB, 0.5us/div, C6011 MTB, 1us/div, VAR MTB, 20us/div, C6012 MTB, 40us/div, VAR MTB, 5ms/div, C6013 MTB, 10ms/div, VAR	STRCALM (A1/15/V8003) TBCALREF (A1/16/D6011)	MTBVAR (A1/16/R6009)	MTBCALTST (A1/16/D6011)
002 005	DTB, 0.5us/div, C7011 DTB, 20us/div, C7012	STRCALD (A1/15/V8007) TBCALREF (A1/17/D7011)	DTBVAR (A1/17/R7009)	DTBCALTST (A1/17/D7011)

Final amplifier autocalibration

Signals generated by the text generator - D1402 on microprocessor unit A3 in the analog versions; D8047 on digitizer unit A8 in the digital versions - are used as inputs. The output signals are measured on unit A2 on the Y- and X-deflection plates of the CRT. This results in the signals YCAL (vertical plates) and XCAL (horizontal plates).

Error code	Calibration step	Input(s) signal	Control	Output
00A	Y-offset, MSB	YTXT0/YTXT1 (A2/1/D1001)	N1001/17 (A2/1)	YCAL (A2/2/R1309)
00B	Y-offset, LSB	YTXT0/YTXT1	N1001/16 (A2/1)	YCAL
00C	Y-gain	YTXT0/YTXT1	N1001/14 (A2/1)	YCAL
00D 00F	X-offset, MSB	XTXT0/XTXT1 (A2/3/R2007)	XCRTOFH (A2/3/N2002)	XCAL (A2/3/R2313)
00E	X-gain, MSB	XTXT0/XTXT1	XCRTGCH (A2/3/N2002)	XCAL
010	X-offset, LSB	XTXT0/XTXT1	XCRTOFL (A2/3/N2002)	XCAL
011	X-gain, LSB	XTXT0/XTXT1	XCRTGCL (A2/3/N2002)	XCAL

Autocalibration of horizontal gain and offset

As input signals are used signals generated by generator circuit (D7004, N7014, N7015) on the DTB circuit diagram (unit A1). The accurate output signals are MCLOOP (MTB) and DCLOOP (DTB). The output signals are measured on the X-deflection plates of the CRT. This results in the signal XCAL (horizontal plates).

Error code	Calibration step	Input	Control signal	Output
013 015 01B 01C	X-pos, MTB x10 X-pos, MTB x1 X-pos 0 div, timebase X-pos -3 div, timebase	MCLOOP (A1/17/V7075)	TBXPOS (A1/17/R7099)	XCAL (A2/3/R2313)
014 016	X-gain, MTB x10 X-gain, MTB x1	MCLOOP	XTRAGC (A2/3/N2002)	XCAL
017 019	X-pos, DTB x1 X-pos, DTB x1	DCLOOP (A1/17/V7075)	TBXPOS	XCAL
018 01A	X-gain, DTB x10 X-gain, DTB x1	DCLOOP	XTRAGC	XCAL
01D 01E	X-pos 0 div, X-defl X-pos -3 div, X-defl	LEVDTB (A1/14/R7681)	TBXPOS	XCAL

Autocalibration of offset delay line driver and channels 4, 3, 2 and 1

As input is used the accurate signal ATCAL generated by circuit with D1152, N1104 on the circuit diagram of the input attenuators (unit A1).
The output signals are measured on the Y-deflection plates of the CRT (YCAL).

Delay line driver offset

The delay line driver input signals FNC..OUT0 and FNC..OUT1 are differentially 0 V. D.A.C. output DLDOFFSET is adjusted such that YCAL detects the mid screen position.

Error code	Calibration step	Input(s)	Control signal	Output
02C	Delay line driver offset	FNC..OUT0 FNC..OUT1 (A1/9/R1313,R1314)	DLDOFFSET (A1/9/R5018)	YCAL (A2/2/R1309)
02E 02F	Offset trace separation 0 div idem, 3 div	ATCAL (A1/1/R1008)	TRASEP (A1/9/R5021)	YCAL

Position midscreen

ATCAL is set such that a positive trace shift is obtained. The microprocessor controls the trace back to just above midscreen via POS4 in the Y-functions section.

DC loopgain

ATCAL generates a 13 Hz sq-wave. The microprocessor monitors the top of the sq-wave (via YCAL) at successive moments in time. In successive steps AT4LFCAL is adjusted for a correct sq-wave response.

VAR gain jump

ATCAL applies 0 V to the attenuator. VAR4 is varied between min and max in various sensitivity positions. The microprocessor adjusts PA4OFFSET to minimal trace jump (YCAL).

Error code	Calibration step	Input	Control signal	Output
Channel 4:				
021 023 025 027 029	POS midscreen CH4 10mV/div idem, 5mV/div idem, 5mV/div idem, 10mV/div idem, 20mV/div	ATCAL (A1/4/R4008)	POS4 (A1/8/R4308)	YCAL (A2/2/R1309)
022	DC loopgain CH4 LF square-wave	ATCAL	AT4LOOPCOR (A1/4/V4001)	YCAL
024	Attenuator offset 2<->5mV/div	Attenuator :1<->:2.5	AT4OFFSET (A1/4/R4039)	YCAL
026 028 02A	Preampl offset CH4 5mV/div idem, 10mV/div idem, 20mV/div	VAR4 (A1/7/R4211)	PA4OFFSET (A1/7/R4203)	YCAL
Channel 3:				
031 033 035 037 039	POS midscreen CH3 10mV/div idem, 5mV/div idem, 5mV/div idem, 10mV/div idem, 20mV/div	ATCAL (A1/3/R3008)	POS3 (A1/8/R3308)	YCAL (A2/2/R1309)
032	DC loopgain CH3 LF square-wave	ATCAL	AT3LOOPCOR (A1/3/V3001)	YCAL
034	Attenuator offset 2<->5mV/div	Attenuator :1<->:2.5	AT3OFFSET (A1/3/R3039)	YCAL
036 038 03A	Preampl offset CH3 5mV/div idem, 10mV/div idem, 20mV/div	VAR3 (A1/7/R3211)	PA3OFFSET (A1/7/R3203)	YCAL

Error code	Calibration step	Input	Control signal	Output
Channel 2:				
041	POS midscreen CH2 10mV/div	ATCAL (A1/2/R2008)	POS2 (A1/8/R2308)	YCAL (A2/2/R1309)
043	idem, 5mV/div			
045	idem, 5mV/div			
047	idem, 10mV/div			
049	idem, 20mV/div			
042	DC loopgain CH2 LF square-wave	ATCAL	AT2LOOPCOR (A1/2/V2001)	YCAL
044	Attenuator offset 2<->5mV/div	Attenuator :1<->:2.5	AT2OFFSET (A1/2/R2039)	YCAL
046	Preampl offset CH2 5mV/div	VAR2 (A1/6/R2211)	PA2OFFSET (A1/6/R2203)	YCAL
048	idem, 10mV/div			
04A	idem, 20mV/div			
Channel 1:				
051	POS midscreen CH1 10mV/div	ATCAL (A1/1/R1008)	POS1 (A1/8/R1308)	YCAL (A2/2/R1309)
053	idem, 5mV/div			
055	idem, 5mV/div			
057	idem, 10mV/div			
059	idem, 20mV/div			
052	DC loopgain CH1 LF square-wave	ATCAL	AT1LOOPCOR (A1/1/V1001)	YCAL
054	Attenuator offset 2<->5mV/div	Attenuator :1<->:2.5	AT1OFFSET (A1/1/R1039)	YCAL
056	Preampl offset CH1 5mV/div	VAR1 (A1/6/R1211)	PA1OFFSET (A1/6/R1203)	YCAL
058	idem, 10mV/div			
05A	idem, 20mV/div			

Autocalibration of trigger offset

The correctness of these adjustments is checked for MTB (DTB) via signal MTBCALTST (DTBCALTST).

Trigger offset MTB

Adjustment of the signal path between D6541 (final stage), D8004, V8013, V8014, D6011 is done here. LEVMTB is in mid position. For level-pp 'on' is MTRBAL varied such that triggering passes the trigger gap.

Trigger offset via vertical channels

Adjustment of the signal path between grounded input (ATCAL = GND) CH4, D4204, D4301, D6541 (dc coupled), D8004, V8013, V8014, D6011 is done here.

Trigger offset DTB

Adjustment of the signal path between D7541 (final stage), D8004, V8012, V8011, D7011 is done here. LEVDTB varied such that triggering passes the trigger gap.

Error code	Calibration step	Input	Control signal	Output
0A1	Trigger offset mtb pk-pk, + slope	LEVMTB (A1/12/R6622)	MTRBAL (A1/12/R6709)	MTBCALTST (A1/16/D6011)
0A2	idem, - slope			
0A3	idem, ac + slope			
0A4	idem, ac - slope			
0A5	Trigg. offs. mtb CH4, + slope	ATCAL (A1/4/R4008)	PA4OFFSTRG (A1/7/R4229)	MTBCALTST
0A6	idem, - slope			
0A7	Trigg. offs. mtb CH3, + slope	ATCAL (A1/3/R3008)	PA3OFFSTRG (A1/7/R3229)	MTBCALTST
0A8	idem, - slope			
0A9	Trigg. offs. mtb CH2, + slope	ATCAL (A1/2/R2008)	PA2OFFSTRG (A1/6/R2229)	MTBCALTST
0AA	idem, - slope			
0AB	Trigg. offs. mtb CH1, + slope	ATCAL (A1/1/R1008)	PA1OFFSTRG (A1/6/R1229)	MTBCALTST
0AC	idem, - slope			
0AD	Trigg. offs. dtb ac, + slope	ATCAL	LEVDTB (A1/14/R7681)	DTBCALTST (A1/17/D7011)
0AE	idem, - slope			
0AF	Trigg. offs. dtb CH4, + slope	ATCAL	LEVDTB	DTBCALTST
0B0	idem, CH4 - slope			
0B1	idem, CH3 + slope			
0B2	idem, CH3 - slope			
0B3	idem, CH2 + slope			
0B4	idem, CH2 - slope			
0B5	idem, CH1 + slope			
0B6	idem, CH1 - slope			

Autocal of normal/invert position and gain adjustment

Normal invert position

ATCAL applies 0 V (GND) to the CH4 attenuator. YCAL is adjusted to mid screen via POS4 in normal and in inverted mode. Then CH3 (normal mode only), CH2 and CH1 (normal mode only) are adjusted.

Gain adjustment

Gain is adjusted in various attenuator positions. ATCAL generates the required calibrated signals.

Error code	Calibration step	Input	Control signal	Output
Channel 4:				
061 062 063	Offset normal Offset invert Gain position	ATCAL (A1/4/R4008)	POS4 (A1/8/R4308)	YCAL (A2/2/R1309)
064 065 066 067 068 069 06A 06B 06C 06D	Gain x1, 2mV/div Gain /2.5, 2mV/div Gain x1, 5mV/div Gain /2, 5mV/div Gain x1, 10mV/div Gain /2, 10mV/div Gain x1, 20 mV/div Gain /2.5, 20mV/div Gain x1, 50mV/div Gain /2, 50mV/div	ATCAL	VAR4 (A1/7/R4211)	YCAL
Channel 3:				
071 073	Offset normal Gain position	ATCAL (A1/3/R3008)	POS3 (A1/8/R3308)	YCAL (A2/2/R1309)
074 075 076 077 078 079 07A 07B 07C 07D	Gain x1, 2mV/div Gain /2.5, 2mV/div Gain x1, 5mV/div Gain /2, 5mV/div Gain x1, 10mV/div Gain /2,10mV/div Gain x1, 20 mV/div Gain /2.5, 20mV/div Gain x1, 50mV/div Gain /2, 50mV/div	ATCAL	VAR3 (A1/7/R3211)	YCAL

Error code	Calibration step	Input	Control signal	Output
Channel 2				
081	Offset normal	ATCAL (A1/2/R2008)	POS2 (A1/8/R2308)	YCAL (A2/2/R1309)
082	Offset invert			
083	Gain position			
084	Gain x1, 2mV/div	ATCAL	VAR2 (A1/6/R2211)	YCAL
085	Gain /2.5, 2mV/div			
086	Gain x1, 5mV/div			
087	Gain /2, 5mV/div			
088	Gain x1, 10mV/div			
089	Gain /2, 10mV/div			
08A	Gain x1, 20 mV/div			
08B	Gain /2.5, 20mV/div			
08C	Gain x1, 50mV/div			
08D	Gain /2, 50mV/div			
Channel 1				
091	Offset normal	ATCAL (A1/1/R1008	POS1 (A1/8/R1308)	YCAL (A2/2/R1309)
093	Gain position			
094	Gain x1, 2mV/div	ATCAL	VAR1 (A1/6/R1211)	YCAL
095	Gain /2.5, 2mV/div			
096	Gain x1, 5mV/div			
097	Gain /2, 5mV/div			
098	Gain x1, 10mV/div			
099	Gain /2, 10mV/div			
09A	Gain x1, 20 mV/div			
09B	Gain /2.5, 20mV/div			
09C	Gain x1, 50mV/div			
09D	Gain /2, 50mV/div			

Autocal of trigger gain MTB/DTB

Via ATCAL a signal giving vertical deflection is applied. Coupling is dc and LEVMTB is varied such that the upper and lower level of the trigger gap are passed.
The gain is adjusted via MTRSEN. Next the same procedure is followed for DTB. Gain is adjusted with DTRSEN.

Errorcode	Calibration step	Input	Control signal	Output
0C1	Trigg. gain MTB dc, + slope	ATCAL (A1/1/R1008)	LEVMTB (A1/12/R6622)	MTBCALTST (A1/16/D6011)
0C2	idem, - slope			
0C3	Trigg. gain DTB dc, + slope	ATCAL	LEVDTB (A1/14/R7681)	DTBCALTST (A1/17/D7011)
0C4	idem, - slope			
0C5	Trigg. gap MTB upper, normal	LEVMTB (A1/12/R6622)	MTRSEN (A1/12/R6554)	MTBCALTST
0C6	idem, lower, normal			
0C7	idem, upper, noise			
0C8	idem, lower, noise			
0C9	idem, upper, autoset			
0CA	idem, lower, autoset			
0CB	Trigg. gap DTB upper, normal	LEVDTB (A1/14/R7681)	DTRSEN (A1/14/R7554)	DTBCALTST
0CC	idem, lower, normal			
0CD	idem, upper, noise			
0CE	idem, lower, noise			
0CF	idem, upper, autoset			
0D0	idem, lower, autoset			
0D1	Trigg. offs. MTB CH1, upper	ATCAL	LEVMTB	MTBCALTST
0D2	idem, CH1, lower			
0D5	idem, CH2, upper			
0D6	idem, CH2, lower			
0D9	idem, CH3, upper			
0DA	idem, CH3, lower			
0DD	idem, CH4, upper			
0DE	idem, CH4, lower			
0D3	Trigg. offs. DTB CH1, upper	ATCAL	LEVDTB	DTBCALTST
0D4	idem, CH1, lower			
0D7	idem, CH2, upper			
0D8	idem, CH2, lower			
0DB	idem, CH3, upper			
0DC	idem, CH3, lower			
0DF	idem, CH4, upper			
0E0	idem, CH4, lower			

9 SAFETY INSPECTION AND TESTS AFTER REPAIR AND MAINTENANCE IN THE PRIMARY CIRCUIT

9.1 GENERAL DIRECTIONS

- Take care that the creepage distances and clearances have not been reduced.
- Before soldering, bend the wires through the holes of the solder leads, or wrap the wires around the leads in the form of an open U, or, maintain wiring ridigity by cable clamps or cable lacing.
- Replace all insulating guards and plates after performing all repairs.

9.2 SAFETY COMPONENTS

For safety reasons, components in the primary circuit may only be replaced by components indicated in the replaceable parts list.

9.3 CHECKING PROTECTIVE GROUND

The correct connection and condition is checked by visual control and by measuring the resistance between the protective ground connection at the plug and the cabinet/frame. The resistance shall not be more than 0.5 Ω, test current 25A. During measurement the line cable should be removed from line power. Resistance variations indicate a defect.

9.4 CHECKING INSULATION RESISTANCE

Measure the insulation resistance at U = 500 V dc between the line connections and the protective ground connections. For this purpose, set the mains switch to ON. The insulation resistance shall not be less than 2 MΩ.

NOTE: The insulation resistance of 2 MΩ is a minimum requirement at 40 °C and 95% relative humidity. Under normal conditions the insulation resistance should be much higher (10 ... 20 MΩ).

9.5 CHECKING LEAKAGE CURRENT

The leakage current shall be measured between each pole of the line power supply in turn, and all accessible conductive parts connected together (including the measuring ground terminal).
The leakage current is not excessive if the measured currents from the mentioned parts is ≤ 0.5 mA rms (without filter capacitor) or ≤ 3.5 mA rms (with filter capacitor).

9.6 VOLTAGE TEST

The instrument shall withstand, without electrical breakdown, the application of a test voltage between the supply circuit and accessible conductive parts that are likely to become energized. The test potential shall be 1500 V rms or dc equivalent at supply-circuit frequency, applied for one second. The test shall be conducted when the instrument is fully assembled, and with the primary switch in the ON position.
During the test, both sides of the primary circuit of the instrument are connected together and to one terminal of the voltage test equipment; the other voltage test equipment terminal is connected to the accessible conductive parts.