9424 DIGITAL OSCILLOSCOPE

SERVICE MANUAL

Version 1.0

May 1993

TABLE OF CONTENTS

G E N E R A L   I N F O R M A T I O N

Initial Inspection

It is recommended that the shipment be thoroughly inspected immediately upon delivery to the purchaser. All material in the container should be checked against the enclosed Packing List. LeCroy cannot accept responsibility for shortages in comparison with the Packing List unless notified promptly. If the shipment is damaged in any way, please contact the Customer Service Department or local field office immediately.

Warranty

LeCroy warrants its oscilloscope products to operate within specifications under normal use for a period of two years from date of shipment. Spares, replacement parts and repairs are warranted for 90 days. The instrument's firmware is thoroughly tested and thought to be functional, but is supplied "as is" with no warranty of any kind covering detailed performance. Products not manufactured by LeCroy are covered solely by the warranty of the original equipment manufacturer.

In exercising this warranty, LeCroy will repair or, at its option, replace any product returned to the Customer Service Department or an authorized service facility within the warranty period, provided that the warrantor's examination discloses that the product is defective due to workmanship or materials and that the defect has not been caused by misuse, neglect, accident or abnormal conditions or operation.

LeCroy will return all in-warranty products with transportation prepaid.

This warranty is in lieu of all other warranties, expressed or implied, including but not limited to any implied warranty of merchantability, fitness, or adequacy for any particular purpose or use. LeCroy shall not be liable for any special, incidental, or consequential damages, whether in contract or otherwise.

Product Assistance

Answers to questions concerning installation, calibration, and use of LeCroy equipment are available from the Customer Service Department, 700 Chestnut Ridge road, Chestnut Ridge, New York 10977-6499, U.S.A., tel: (914) 578-6060, or 6061, and 2 rue du Pré-de-la-Fontaine, 1217 Meyrin 1, Geneva, Switzerland, tel: (41) 22 / 719.21.11, or your local field engineering office.

Maintenance Agreements

LeCroy offers a selection of customer support services. Maintenance agreements provide extended warranty and allow the customer to budget maintenance costs after the initial two year warranty has expired. Other services such as installation, training, enhancements and on-site repair are available through specific Supplemental Support Agreements.

Documentation Discrepancies

LeCroy is committed to providing state-of-the-art instrumentation and is continually refining and improving the performance of its products. While physical modifications can be implemented quite rapidly, the corrected documentation frequently requires more time to produce. Consequently, this manual may not agree in every detail with the accompanying product. There may be small discrepancies in the values of components for the purposes of pulse shape, timing, offset, etc., and, occasionally, minor logic changes, Where any such inconsistencies exist, please be assured that the unit is correct and incorporates the most up-to-date circuitry. In a similar way the firmware may undergo revision when the instrument is serviced. Should this be the case, manual updates will be made available as necessary.

Service Procedure

Products requiring maintenance should be returned to the Customer Service Department or authorized service facility. LeCroy will repair or replace any product under warranty at no charge. The purchaser is only responsible for one way transportation charges.

For all LeCroy products in need of repair after the warranty period, the customer must provide a Purchase Order Number before repairs can be initiated. The customer will be billed for parts and labor for the repair, as well as for shipping.

Return Procedure

To determine your nearest authorized service facility, contact the Customer Service Department or your field office. All products returned for repair should be identified by the model and serial numbers and include a description of the defect or failure, name and phone number of the user, and, in the case of products returned to the factory, a Return Authorization Number (RAN). The RAN may be obtained by contacting the customer service department in New York, tel: (914)578-6060, or 6061 ; in Geneva, tel: (41)22/719.21.11, or your nearest sales office.

Return shipment should be made prepaid. LeCroy will not accept C.O.D. or Collect Return Shipments. Air-freight is generally recommended. Wherever possible, the original shipping carton should be used. If a substitute carton is used, it should be rigid and be packed such that the product is surrounded with a minimum of four inches of excelsior or similar shock-absorbing material. In addressing the shipment, it is important that the Return Authorization Number be displayed on the outside of the container to ensure its prompt routing to the proper department within LeCroy.

Safety Precautions.

The following servicing instructions are for use by qualified personnel only. Do not perform any servicing other than contained in service instructions. Refer to procedures prior to performing any service.

Exercise extreme safety when testing high energy power circuits. Always turn the power OFF, disconnect the power cord, discharge the cathode ray tube and all capacitors before disassembling the instrument.

The **W A R N I N G** symbol used in this manual indicates dangers that could result in personal injury.

The **C A U T I O N** symbol used in this manual identify conditions or practices that could damage the instrument.

Antistatic Precautions

C A U T I O N

Any static charge that builds on your person or clothing may be sufficient to destroy CMOS components, integrated circuits.
In order to avoid possible damage, the usual precautions against static electricity are required.

- Handle the boards in antistatic boxes or containers with foam specially designed to prevent static build-up.
- Ground yourself with a suitable wrist strap.
- Disassembly the instrument at a properly grounded work station equipped with antistatic mat.
- When handling the boards, do not touch the pins.
- Stock the boards in antistatic bags.

Corporate Headquarters

LECROY CORPORATION
700 CHESTNUT RIDGE ROAD
CHESTNUT RIDGE, NY 10977-6499

USA

TEL: (914) 425-2000
FAX: (914) 425-8967

European Headquarters

LECROY SA
2, CHEMIN PRE-DE-LA-FONTAINE
P.O. BOX 341
CH-1217 MEYRIN 1 GENEVA
SWITZERLAND

TEL: (22) 719-21-11
FAX: (22) 782-39-15

USA

LECROY CORPORATION
700 CHESTNUT RIDGE RD
CHESTNUT RIDGE NY 10977-6499

TEL: (914) 578-6060 or 6061
FAX: (914) 425-8967

LECROY CORPORATION
14800 CENTRAL AVE SE
ALBUQUERQUE NM 87123

TEL: (505) 293-8100
FAX: (505) 293-9617

LECROY CORPORATION
5912 STONERIDGE MALL RD STE 150
PLEASANTON CA 94588

TEL: (510) 463-2600
FAX: (510) 463-9179

Europe

LECROY GMBH
MANNHEIMERSTRASSE 177
POSTFACH 103767
D-6900 HEIDELBERG
WEST GERMANY

TEL: 49.6221.831001
FAX: 49.6221.834655

LECROY BV
WAALRESEWEG 17
NL-5554 HA VALKENSWAARD
THE NETHERLANDS

TEL: 31.4902.8.9285
FAX: 31.4902.42628

LECROY LTD
28 BLACKLANDS WAY
ABINGDON BUSINESS PARK
ABINGDON, OXON OX14 1DY
GREAT BRITAIN

TEL: 44.23.553.31.14
FAX: 44.23.552.87.96

LECROY SRL
VIA CONCESIO 325
I-00188 ROMA
ITALY

TEL: 39.6.300.97.00
FAX: 39.6.300.96.00

LECROY SRL
VIA PINTURICCHIO, 9
20133 MILANO
ITALY

TEL: 39.2.20.47.082
FAX: 39.2.20.47.026

ESSA
EQUIPOS Y SISTEMAS SA
APOLONIO MORALES 13-B
E-28036 MADRID

TEL: 34.1.359.0088
FAX: 34.1.359.0298

LECROY SARL
B.P. 214
AVENUE DU PARANA
F-91941 LES ULIS CEDEX
FRANCE

TEL: 33.1.69.18.83.20
FAX: 33.1.69.07.40.42

LECROY SA
BAHNOFSTRASSE 18
5600 LENZBURG
SWITZERLAND

TEL: 4164.519.181
FAX: 4164.519.192

DEWETRON ELEKTRONISCHE
MESSGERAETE Ges.M.B.H.
FOELLINGERSTRASSE 9E
8044 GRAZ
AUSTRIA

TEL: 43.316.391.804
FAX: 43.316.391.052

LUTRONIC
VIBEHOLMS ALLE 11-15
2600 GLOSTRUP
DENMARK

TEL: 45.4245.9764
FAX: 45.4363.0720

ORBIS OY
VANHA KAARELANTIE 9
01610 VANTAA
FINLAND

TEL: 358.0.566.4066
FAX: 358.0.531.604

HELLENIC SCIENTIFIC REP., LTD
11 VRASSIDA STREET
115 28 ATHENS
GREECE

TEL: 30.1.721.1140 or 721.3154
FAX: 30.1.724.1374

AVANTEC
TVETENVEIEN 6
0661 OSLO
NORWAY

TEL: 472.63.05.20
FAX: 472.65.84.14

ABB NERA A/S
P.O BOX 10
KOKSTADVEGEN 23
KOKSTAD
BERGEN, NORWAY

TEL: 351.2.815.680
FAX: 351.2.815.630

MEASUREMENT SYSTEMS
SCANDINAVIA AB
P.O. BOX 393
FORETAGSALLEN 12, HUS 5 BV
184 24 AKERSBERGA
SWEDEN

TEL: 46.8.540.68100
FAX: 46.8.540.66536

M.T. BRANDAO, LDA
RUA DO QUANZA, 150
4000 PORTO
PORTUGAL

TEL: 351.2.815.680
FAX: 351.2.815.630

Eastern Europe

ELSINCO GMBH
ROTENMUHLGASSE 11
1120 VIENNA
AUSTRIA

TEL: 43.222.812.1751
FAX: 43.222.812.2329

Mideast

AMMO
60 PINKAS STREET
P.O. BOX 21384
61213 TEL AVIV
ISRAEL

TEL: 972.3.453.157
FAX: 972.3.544.1468

Asia

LECROY JAPAN CORPORATION
ESAKA SANSHO BLDG - 3RD FLOOR
16-3, 3-CHOME
TARUMICHO, SUITA CITY
OSAKA 564 JAPAN

TEL: 816.330.0961
FAX: 816.330.8096

LECROY JAPAN CORPORATION
ZAIKEN BLDG 6TH FLOOR
19-3, 2-CHOME
SASAZUKA, SHIBUYA-KU
TOKYO 151 JAPAN

TEL: 813.3376-9400
FAX: 813.3376.9587

SCIENTIFIC DEVICES AUSTRALIA
2 JACKS ROAD
SOUTH OAKLEIGH, VICTORIA
AUSTRALIA

TEL: 61.3579.3622
FAX: 61.3579.0971

TATA-HONEYWELL
55-A/8 & 9 HADAPSPAR
INDUSTRIAL ESTATE
PUNE 411 013 INDIA

TEL: 91.212.670445
FAX: 91.212.672205

E.C. GOUGH, LTD
245 ST.ASAPH STREET
P.O. BOX 22073
CHRISTCHURCH
NEW ZEALAND

TEL: 64.3.3798.740
FAX: 64.3.3796.776

ELECTRO TECH CORPORATION
1ST FLOOR, 16 KAZI CHAMBERS
BAHADURSHAH ZAFAR ROAD
KARACHI-74800
PAKISTAN

TEL: 92.21.493-8087 (dial slowly)
TLX: 95.22.57.00

ABEX ENGINEERING PTE. LTD.
126 JOO SENG ROAD # 09-05
GOLD PINE INDUSTRIAL BLDG
SINGAPORE 1336

TEL: 65.283.6288
FAX: 65.283.6628

MEASURETRONIX
2102/31 RAMKAMHANG ROAD
BANGKOK 10240
THAILAND

TEL: 66.2.375.2733-4
FAX: 66.2.374.996

EURO TECH (FAR EAST), LTD.
18 F, GEE CHANG HONG CENTER
65 WONG CHUCK HAND RD
HONG KONG

TEL: 8.52.814.0311
FAX: 8.52.873.5974

LeColn Technology CO.,LTD.
12F, NO 216, SEC 1,
HO PING E ROAD
TAIPEI TAIWAN R.O.C

TEL: 886.2.365.0612
FAX: 886.2.367.1792

P.T. DWI TUNGGAL JAYA SAKTI
WISMA RAJAWALI, 14TH FLOOR
JL JENDRAL SUDIRMAN
34 JAKARTA 10220 INDONESIA

TEL: 62.21.570.4563
FAX: 62.21.583.218

WOOJOO HI-TECH CORP.
DONGHYUN BLDG.
102-4 MOONJUNG-DONG,
SONGPA-KU
SEOUL 138-200 KOREA

TEL: 82.2.449.5472
FAX: 82.2.449.5475

North America

LECROY CANADA, INC.
2751 JACQUES CARTIER EST STE 200
LONGUEUIL,PQ,J4N 1L7
CANADA

TEL: 514 928-4707
FAX: 514 928-0969

ROHDE & SCHWARZ CANADA INC.
555 MARCH ROAD
KANATA, ONTARIO K2K 2M5
CANADA

TEL: 613.592.8000
FAX: 613.592.8009

South America

SEARCH SA
VIAMONTE 1716 - PISO 7
1055 CAPITAL FEDERAL
ARGENTINA

TEL: 54.1.46.6156
FAX: 54.1.394.8374

ATP-HI-TEK
ALAMEDA AMAZONAS
422 ALPHAVILLE 06454
BARUEN, SP BRAZIL

TEL: 55.11.421.5477
FAX: 55.11.421.5032

Central America

NUCLEOELECTRONICA, SA
CALZ. LAS AGUILAS 101
DELEGATCION ALVARO OBREGON
01710 MEXICO, 20, d.f.
MEXICO

TEL: 52.5593.604
FAX: 52.5593.6021

South Africa

WESTPLEX TEST & MEASUREMENTS LTD
TUSCANY HOUSE
376 OAK AVENUE
RANDBURG 2194
REPUBLIC OF SOUTH AFRICA

TEL: 27.11.787.0473
FAX: 27.11.787.0237

Chapter 1

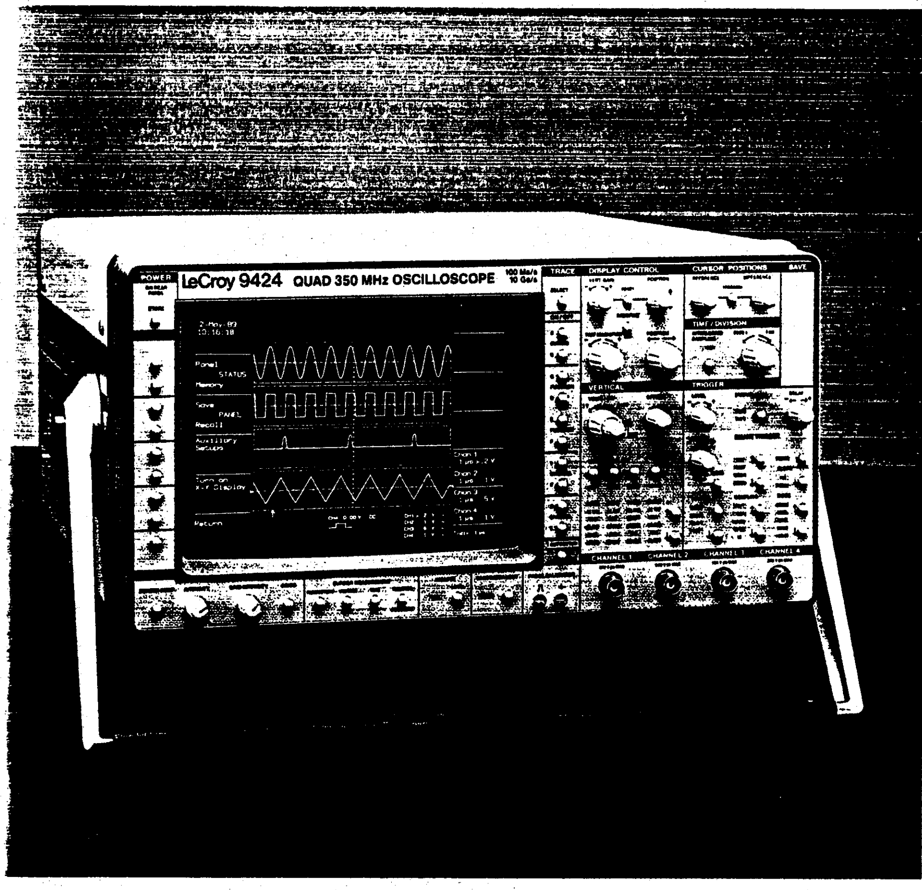
SPECIFICATIONS

DIGITAL OSCILLOSCOPE
350 MHz BANDWIDTH, 100 Ms/s, RIS 10 Gs/s

LeCroy

MODEL 9424 PORTABLE QUAD–CHANNEL OSCILLOSCOPE

9424



Above. the 9424 displays up to four traces simultaneously (in quad–grid mode) on its large high–resolution screen.

- **Four Channels with 350 MHz Bandwidth**
- **50K of Non–volatile Memory per Channel**
- **FASTGLITCH Trigger Mode**
- **Pulse Parameters and Auto–setup**
- **TV Trigger and XY Display Mode**
- **Signal Processing and FFT Analysis**

THE VERSATILE INSTRUMENT FOR MULTI–CHANNEL DESIGN AND TEST

The LeCroy 9424 Quad–channel Digital Oscilloscope is a portable instrument for high–frequency, multi–channel recording.

Combining 350 MHz bandwidth, 50K of non–volatile acquisition memory per channel, advanced triggering capabilities and digital design, the instrument offers many advantages over traditional multi–channel oscilloscopes. Independent 8–bit ADCs (for each channel) sample repetitive waveforms at up to 10 gigasamples/sec (single–shot phenomena at up to 100 megasamples/sec) to enable measurements with better timing resolution and precision. Extensive signal processing (including pulse parameters, averaging, mathematics and FFT analysis) performs complex measurements in a fraction of a second. Hard copies can be made directly over RS–232–C or GPIB onto a wide range of digital plotters and printers.

FEATURES

High bandwidth – The 9424 **portable digital oscilloscope** provides 350 MHz bandwidth on four channels. This high bandwidth, in combination with many other exceptional features, enables users to keep pace with current and future test and measurement requirements.

High fidelity ADCs – High–resolution 8–bit Flash ADCs deliver outstanding signal–to–noise ratios and wide dynamic range. Sampling rates up to 100 megasamples/sec for single–shot applications and 10 gigasamples/sec for repetitive waveforms are achieved simultaneously over four channels.

Long non–volatile memories – Four non–volatile 50K acquisition memories, one per channel, store signals. Long memories provide better timing resolution, and allow a wide range of time–base settings where maximum ADC sampling rate (and high single–shot bandwidth) is possible. Non–volatile waveform storage of 1 to 200 waveforms is possible by segmenting the four acquisition memories. An additional 200K of RAM is available for waveform processing, storage and display.

Comprehensive triggering – Capabilities include pre– and post–triggering, trigger hold–off by time or number of events, delay by time or number of events,TV trigger, logic trigger, state qualified trigger, time/events qualified trigger, and width–based triggers including FASTGLITCH and interval–width trigger.

FASTGLITCH triggering – LeCroy's innovative FASTGLITCH trigger enables the 9424 to trigger even on non–recurrent glitches less than 2.5 nsec wide, independently of the time–base speed.

Peak detection – Long memories and high sampling rates, together with min/max display routines, provide peak detection down to 0.002% of the record length (10 nsec minimum for single–shot measurements and 0.1 nsec minimum in RIS).

Signal processing – Built–in waveform processing includes mathematics (add, subtract and invert) and summation averaging (up to 1000 sweeps). Modular architecture allows easy installation of extended signal processing packages such as fast Fourier analysis.

Pulse parameters – Up to ten signal characteristics (risetime, falltime, RMS voltage, etc.) can be automatically calculated on displayed, stored, expanded and processed waveforms. The 9424's remarkable processing power means that these values are instantaneously updated when a new waveform is acquired.

Waveform expansion – Fine signal details are revealed using LeCroy's exclusive MULTI–ZOOM expansion which magnifies waveforms up to 1000 times. Expanded waveforms have improved timing resolution (up to ± 0.001% of full scale) and can be analyzed further using the 9424's signal processing and pulse parameter routines.

Ease of use, auto–setup – Extensive processing power and familiar analog controls make the 9424 exceptionally responsive and easy to use. Repetitive waveforms are acquired in approximately one second with the convenient auto–setup facility. Recurring front–panel setups can be stored and recalled via simple push–button controls.

FUNCTIONAL DESCRIPTION

The LeCroy 9424 offers a breakthrough in digital oscilloscope technology by combining high bandwidth (350 MHz), portability and four independent input channels. Designed for use in mainstream electronics, telecommunications, applied research and automated testing, the instrument delivers better overall precision and enables improved productivity for applications requiring multi–channel waveform recording.

ACCURACY AND PRECISION

Using the latest ideas in digital technology, the Model 9424 features the speed and precision that have become standard in all LeCroy oscilloscopes. Waveforms are digitized by independent 8–bit (12–bit with averaging) Flash ADCs that provide a high signal–to–noise ratio and superior dynamic resolution. Sampling rates of up to 10 gigasamples/sec are available for repetitive signals and up to 100 megasamples/sec for transient signals.

Each channel of the 9424 features a massive 50K of non–volatile acquisition memory for easy waveform capture, better horizontal resolution and fast sampling rates on **all** time–base settings.

ADVANCED TRIGGERING

The 9424 features the most advanced trigger system available in any four–channel oscilloscope. Each of the inputs (Channel 1, 2 and 4) has independent circuits to allow individual adjustment of the trigger level, slope and coupling. Simple push–button controls and rotary knobs let the user select and adjust all the appropriate trigger parameters, such as hold–off or pre– and post–trigger settings, with ease and precision. Unique trigger graphics summarize the trigger configuration at a glance.

Tracking rare glitches, spikes, missing bits and drop–outs is easy using the 9424's FASTGLITCH or INTERVAL trigger modes. Both modes can be used to provide stable triggering on even the most troublesome phenomena. For television or video development and test, the 9424 includes a TV trigger facility that is ideal for use on NTSC, PAL or SECAM systems. Triggering on lines and fields enables jitter–free viewing (and expansion) of any portion of a TV signal under investigation.

High–speed logic testing is effortless using the 9424's PATTERN trigger mode. Logic status on three inputs may be simultaneously examined, enabling the 9424 to trigger on entering or exiting any predefined pattern. Users can even specify the length of time for which a pattern must remain valid before allowing a trigger to occur.

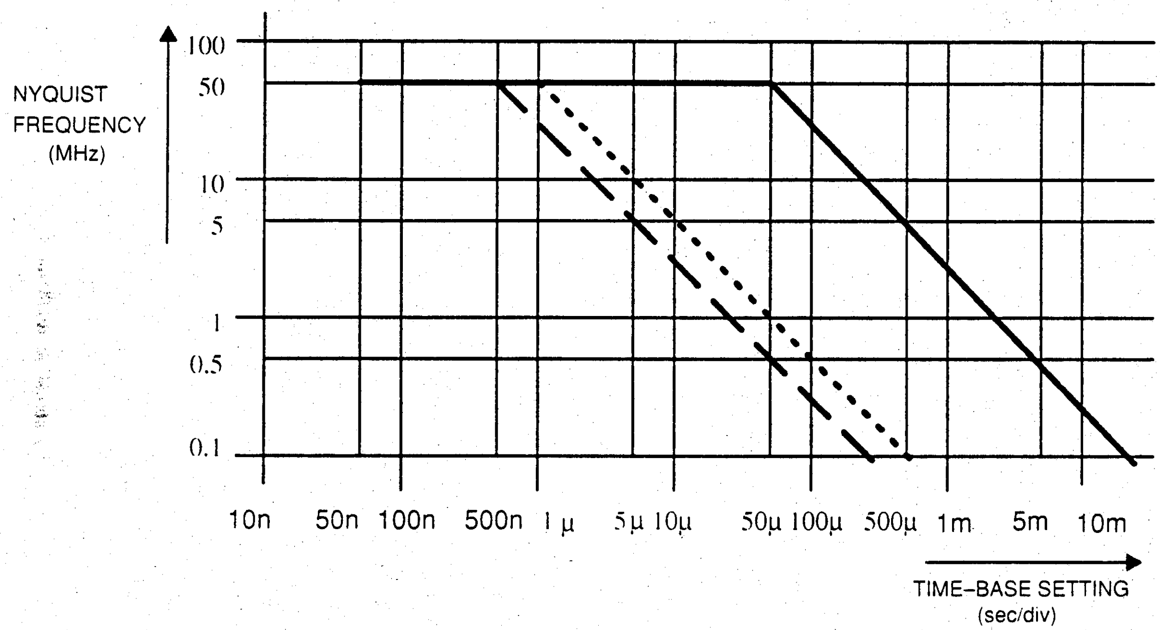
For conditional triggering applications the 9424 includes both STATE QUALIFIED and TIME/EVENT QUALIFIED modes of operation.

FOUR–CHANNEL PROCESSING

For situations that require noise reduction or improved dynamic range, the 9424 includes summation averaging (up to 1000 waveforms) simultaneously over four channels. Built–in arithmetic (add, subtract and invert) and pulse parameter measurements are also standard. Up to 10 parameters can be automatically calculated on live, stored or processed waveforms.

Computations are made using high–speed processing so that values appear instantly on the screen. Additional processing power can be added by installing LeCroy's waveform processing options. WP02 performs spectral analysis and WP01 provides waveform characterization and extended mathematical analysis (integration, differentiation, etc.) as well as averaging.

SINGLE–SHOT BANDWIDTH (NYQUIST FREQUENCY) Vs. TIME–BASE SETTING



Single–shot bandwidth is a function of sampling rate. Long memories enable higher sampling rates at equal time–base settings. Above. the 9424 (solid line) is compared to oscilloscopes with 1K (dotted line) and 512 points (dashed line) of memory. At slower time–base settings, the single–shot bandwidth of the 9424, expressed as Nyquist frequency, is typically 50 times higher than in oscilloscopes with 1K memory and 100 times higher than in those with only 512 points.

SPECIFICATIONS

VERTICAL ANALOG SECTION

Bandwidth (– 3 dB):
@ **50 Ω:** DC to 350 MHz.
@ **1 MΩ AC:** < 10 Hz to 250 MHz typical at the probe tip.
@ **1 MΩ DC:** DC to 250 MHz typical at the probe tip.

Input impedance: 1 MΩ // 30 pF and 50 Ω ± 1%.

Channels: Four independent channels; standard BNC connector inputs.

Sensitivity range: 5 mV/div to 2.5 V/div; continuously variable from 1 to 2.5 times the fixed setting. Fixed settings range from 5 mV/div to 1 V/div (in a 1, 2, 5 sequence). Sensitivity can be extended to 25 V/div using a D9010 High Impedance divider connected to the input BNLs.

Vertical expansion: up to 5 times (with averaging, up to 10 times or 500 µV/div sensitivity).

Scale factors: Probe attenuation factors of ×1, ×10, ×100, ×1000 or ×10000 may be selected and are remotely programmable.

Offset: ± 12 times the fixed sensitivity setting in 0.02 division increments up to ± 10 V max; ± 24 div @ 10 mV/div; ± 48 div @ 5mV/div.

DC accuracy: ≤ ± 2%.

Bandwidth limiter: 80 MHz (– 3 dB) typical.

Max. input voltage: 250 V (DC + peak AC) at 1 MΩ, ± 5 V DC (500 mW) or 5 V RMS at 50 Ω.

VERTICAL DIGITAL SECTION

ADCs: One per channel, 8–bit Flash.

Conversion rate: Up to 100 megasamples/sec for transients, up to 10 gigasamples/sec for repetitive signals, simultaneously on all channels.

Aperture uncertainty: ± 10 psec.

Acquisition memories, Channels 1, 2, 3 and 4: Non–volatile memories (battery–backed for a minimum of 2 years) of 50 kilowords per channel can be segmented into 2, 5, 10, 20, 50, 100 or 200 blocks.

Reference memories C and D: 50K, 16–bit word memories, each storing one acquired or processed waveform, or up to 200 segmented waveforms.

Function memories E and F: Two 50K, 16–bit word memories for waveform processing.

Peak and Glitch Detection

Minimum and maximum peaks as fast as 0.002% of the record length (minimum 10 nsec) are captured and displayed with 100% probability.

Using LeCroy's new FASTGLITCH trigger technique (see the trigger section below), glitches faster than 2.5 nsec can be detected on all time–base settings.

HORIZONTAL SECTION

Time Base

Range: 1 nsec/div to 5000 sec/div.
Clock accuracy: ≤ ± 0.01%.
Interpolator resolution: 5 psec.
Sampling clock output: BNC connector on rear panel.
External clock input: BNC connector on rear panel.

Acquisition Modes

Random Interleaved Sampling (RIS) for repetitive signals from 1 nsec/div to 20 µsec/div.

Single shot for transient signals and repetitive signals from 50 nsec/div to 200 msec/div.

Roll for slowly–changing signals from 500 msec/div to 5000 sec/div.

Sequence mode divides the acquisition memory into 2, 5, 10, 20, 50, 100, or 200 segments.

Horizontal expansion: MULTI ZOOM mode allows different signals or different sections of the same signal to be expanded up to 1000 times.

Trigger

Pre–trigger recording: Adjustable in 0.2% increments to 100% of full scale (grid width).

Post–trigger delay: Adjustable in 0.02 division increments up to 10,000 divisions.

Rate: Up to 500 MHz using HF trigger coupling.

Timing: Trigger timing (date and time) is listed in the memory status menu. The timing of subsequent triggers in sequence mode is measured with 0.1 sec absolute resolution, or nanosecond resolution relative to the time of the first trigger.

Trigger output: BNC connector on rear panel.

Trigger veto: BNC connector on rear panel.

Standard Trigger

Sources: CHAN1, CHAN2, CHAN4, LINE. CHAN1, CHAN2 and CHAN4 have independent trigger circuits allowing slope, coupling and level to be set individually for each source. (CHAN3 is used for TV trigger).
Slope: Positive, negative.
Coupling: HF, AC, LF REJ, HF REJ, DC.

Modes:

Auto: Automatically re–arms after each sweep. If no trigger occurs, one is generated at an appropriate rate.

Normal: Re–arms after each sweep. If no trigger occurs after a reasonable length of time, the message "No or Slow Trigger" is displayed.

Single (hold): Holds display after a trigger occurs. Re–arms only when the "single" button is pressed again.

Sequence: Stores multiple events in segmented acquisition memories.

SMART Trigger

Single–source trigger operational modes:
Hold–off by time: 25 nsec to 20 sec.
Hold–off by events: 0 to 10^9 events.

Width–based trigger modes:

Pulse width < (FASTGLITCH): Triggers on opposite slopes of pulses narrower than a value in the range 2.5 nsec to 20 sec.
Pulse width >: Triggers on opposite slopes of pulses wider than a value in the range 2.5 nsec to 20 sec.
Interval width <: Triggers on similar slopes of signals narrower than a value in the range 10 nsec to 20 sec.
Interval width >: Triggers on similar slopes of signals wider than a value in the range 25 nsec to 20 sec.

Multi–source trigger operational modes:

Pattern: Triggers on the logical AND of CHAN1, CHAN2 and CHAN4, where each source can be defined as high (H), low (L) or don't care (X). The trigger can be selected at the beginning (entered) or at the end (exited) of the specified pattern.

Bi–level: This is a special condition of Pattern trigger which allows the 9424 to trigger on any signal that exceeds a certain pre–set high or low trigger level. The signal must be connected simultaneously to two channels. The third trigger channel must be set to don't care (X).

State qualified: Allows the 9424 to trigger on any source (CHAN1, CHAN2 or CHAN4), while requiring that a certain pattern of the other two channels is present or absent. In addition, a delay by time or by number of events can be selected from the moment the pattern is valid.

Time/Event qualified: Allows the 9424 to trigger on any source (CHAN1, CHAN2 or CHAN4), as soon as a certain pattern of the three channels is entered or exited. From the moment of validity. a delay can be defined in terms of time or number of events.

TV: Allows stable triggering on TV signals that comply with PAL, SECAM or NTSC standards. Selection of both line and field number is possible. Active on CHAN3 only.

DISPLAY

CRT: 12.5 × 17.5 cm (5 × 7 inches); magnetic deflection; vector type.

Resolution: 4096 × 4096 points.

Real–time clock: Date, hours, minutes, seconds.

Grid: Internally generated; separate intensity control for grid and waveforms. Single, dual, quad and pulse parameter measurement grid mode.

XY mode: Plots any two sources (CHAN 1, CHAN2, CHAN3, CHAN4, MEMORY C or D, FUNCTION E or F and EXPAND A and B) against one another. Operates on live waveforms with cursor readout.

Hard copy: Single or multi–pen digital plotters as well as IBM, HP QuietJet, HP ThinkJet, HP LaserJet and EPSON printers can be used to make hard copies of the display. Screen dumps are activated by a front–panel button or via remote control. Plotters supported are: the HP 7400 and 7500 series, Philips PM 8151, Graphtek FP 5301, and compatible models. Plotting is done in parallel with normal 9424 operation.

Graphics: All waveforms and display information are presented using vector (linear) graphics. Expanded waveforms use LeCroy's DOT–LINEAR graphics that highlight actual data points and interpolate linearly between them.

Menus: Waveform storage; acquisition parameters; memory status; save/recall front–panel configurations; SMART trigger; waveform parameters, RS–232–C configuration; hardcopy setup and real–time clock setup, averaging, and arithmetic.

Cursors

Relative time: Two cursors provide time measurements with a resolution of ± 0.2% of full scale for unexpanded traces; up to 10% of the sampling interval for expanded traces. The corresponding frequency information is also provided.

Relative voltage: Two horizontal bars measure voltage differences to ± 0.2% of full scale.

Absolute time: A cross–hair marker measures absolute voltage versus signal ground, as well as the time relative to the trigger.

Absolute voltage: A reference bar measures absolute voltage with respect to ground.

Pulse parameters: Two cross–hair cursors are used to define a region of interest for which pulse parameters will be calculated automatically.

AUTO–SETUP

Pressing the auto–setup button automatically scales the time base, trigger and sensitivity settings to display a wide range of repetitive input signals.

Type of signals detected: Repetitive signals with amplitudes between 2 mV and 8 V, frequency above 50 Hz and a duty cycle greater than 0.1%.

Auto–setup time: Approximately 2 sec.

WAVEFORM PROCESSING

Waveform processing routines are called and set up via menus. These include arithmetic functions (add, subtract and invert), and summation averaging (up to 1000 signals).

Pulse parameters: Based on ANSI/IEEE Std 181–1977 "Standard on Pulse Measurement and Analysis by Objective Techniques". The terminology is derived from IEEE Std 194–1977 "Standard Pulse Terms and Definitions".

Automatic measurements determine:

Maximum	Period
Minimum	Pulse width
Mean	Risetime
Standard deviation	Falltime
RMS	Delay

Sources: CHAN1, CHAN2, CHAN3, CHAN4, MEMORY C or D, FUNCTION E or F, EXPAND A or B. Cursors define the measurement zone. When more than one pulse is present in the measurement zone, averaged results for period, width, risetime and falltime are given.

REMOTE CONTROL

Front–panel controls, including variable gain, offset, position controls and cursors, as well as all internal functions are programmable.

RS–232–C port: For computer/terminal control or plotter connection. Asynchronous up to 19200 baud.

GPIB port: (IEEE–488). Configured as talker/listener for computer control and fast data transfer. Address switches on rear panel.

Local/remote: Remote control can be interrupted for local (manual) control at any time (except when in remote control with the lock–out state selected) by pushing a button on the front panel.

PROBES

Model: Four P9020 (×10, 10 MΩ //16 pF) probes supplied.

Probe calibration: 1 kHz square wave, 1 V p–p.

Probe power: Two rear–panel power outlets for use with active probes provide ± 15 V, + 5 V DC.

SELF TESTS

Auto–calibration ensures accuracy of:

DC accuracy: ± 2% full scale > 5 mV/div
± 3% full scale at 5 mV/div

Time: 20 psec RMS.

GENERAL

Temperature: 5 to 40° C (41 to 104° F) rated; 0 to 50° C (32 to 122° F) operating.

Humidity: < 80%.

Power required: 110 or 220 V AC, 45 to 440 Hz, 275 W.

Battery backup: Lithium batteries maintain front–panel settings and waveform data for 2 years.

Dimensions: (HWD) 19.2 × 37.0 × 49.5 cm, (7 1/2 × 14 1/2 × 19 1/2 inches).

Weight: 15 kg (33 lbs) net, 20 kg (44 lb) shipping.

Warranty: 2 years

ORDERING INFORMATION

Oscilloscope and Options

Code	Description
9424	Digital Oscilloscope
9424WP01	Waveform Processing Option
9424WP02	Fast Fourier Processing Option

Oscilloscope Accessories

OM9424	Operator's Manual
9424–FC	Front Cover
9424–MC01	Card Reader plus 512K Memory Card
9424–MC02	128K Memory Card
9424–MC04	512K Memory Card
CA9001	Camera (using Polaroid film) and Hood.

Oscilloscope Accessories (cont'd)

CA9002	Camera Adapter (35 mm) with Hood
D9010	10:1 High Impedance Divider
DC/GPIB–2	2–meter GPIB Cable
DP9001	Digital Plotter, 8–pen A4 size
DP9003	Epson Printer
OC9001	Oscilloscope Cart
P9010	10:1 Oscilloscope Probe
P9010/2	10:1 Oscilloscope Probe with 2 m cable
P9011	10:1/1:1 Oscilloscope Probe
P9020	10:1 Oscilloscope Probe (300 MHz)
P9100	100:1 Oscilloscope Probe
RM9400	Rackmount
SG9001	High Voltage Protector
TC9001	Transit Case
TC9002	Carrying Bag

U.S. SALES OFFICES

1–800–5–LeCroy (1–800–553–2769):

automatically connects you to your local sales office.

WORLDWIDE

Argentina: Search SA, (01) 394–5882
Australia: Scient. Devices Pty, Ltd, (03) 579–3622
Austria: Dewetron Elekr. GmbH, (0316) 391804
Benelux: LeCroy B.V. *31–4902–89285
Brazil: A. Santos, (021) 233 5590
Canada: Rayonics, W. Ontario, (416) 736–1600
Denmark: Lutronic, (42) 459764
Finland: Labtronic OY, (90) 847144
France: LeCroy Sarl (1) 69073897
Germany: LeCroy GmbH, (06221) 81001
(North) (0405) 42713
Greece: Hellenic S/R Ltd., (01) 721 1140
India: Electronic Ent., (022) 4137096
Israel: Ammo, (03) 453157
Italy: LeCroy S.r.l., Roma (06) 327.02.02 or 331.31.46
Milano (02) 2940–5634
Japan: Toyo Corp., (03) 279 0771
Korea: Samduk Science & Ind., Ltd., (02) 468 0491
Mexico: Nucleoelectronica SA, (905) 593 6043
New Zealand: E.C. Gough Ltd., (03) 798–740
Norway: Avantec AS, (02)630520
Pakistan: Electronuclear Corp., (021) 418087
Portugal: M.T. Brandao, Lta., (02) 691116
Singapore: Sing. Electr. and Eng. Ltd (65) 481–8888
Spain: Anadig Ingenieros SA, (01) 433 2412
Switzerland: LeCroy S.A. (022) 719 21 11
Sweden: MSS AB, (0764) 68100
Taiwan: Topward El.Inst., Ltd., (02) 601 8801
Thailand: Measuretronix Ltd., (02) 374 2516
United Kingdom: LeCroy Ltd., (0235) 33 114

LeCroy

Innovators in Instrumentation

LeCROY CORPORATE HEADQUARTERS
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977–6499
Telephone: (914) 425–2000
TWX:(710) 577–2832
Fax: (914) 425–8967

LeCROY EUROPEAN HEADQUARTERS
2, rue Pré–de–la–Fontaine
P.O. Box 341
1217 Meyrin 1–Geneva, Switzerland
Telephone: (022) 710 21 11 Telex: 41 90 58
Fax: (022) 782 39 15

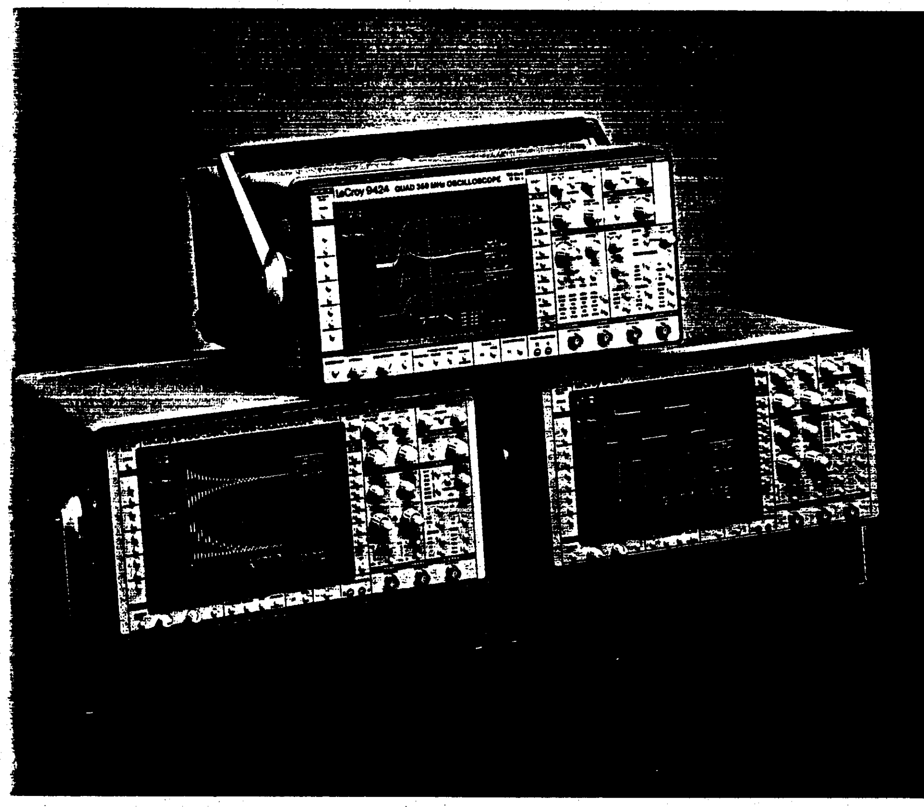
TDS 040/004

WAVEFORM PROCESSING PACKAGE
AVERAGING, MATHEMATICS, HIGH RESOLUTION

LeCroy

WP01 WAVEFORM PROCESSING FIRMWARE FOR MODELS 9420/24/50 DIGITAL OSCILLOSCOPES

9420/24/50 WP01



Added as a factory option or retrofitted in the field, the WP01 Waveform Processing Package adds high–speed averaging, filtering and mathematical capabilities to the Models 9420, 9424 or 9450 digital oscilloscopes.

- **Averaging – Summation and Continuous**
- **Arithmetic – incl. Addition, Subtraction, Ratio and Multiplication**
- **Functions – including Integration, Differentiation, Log, Exp, ABS and Square Root**
- **Extrema Mode – Storage of Extreme Positive and Negative Values**
- **High–Resolution Mode for 11–bit Performance**

FOR SIGNAL CHARACTERIZATION AND ANALYSIS

The LeCroy WP01 Waveform Processing package offers powerful routines that extend the processing capabilities of the Models 9420, 9424 and 9450 Digital Oscilloscopes. All processing is built in to eliminate the need for external computers and controllers. High–speed microprocessors are used to ensure that computed waveforms are displayed instantly on the screen. The package is fully programmable over the GPIB or RS–232–C interface and hard copies can be directly made on a wide range of digital plotters or printers.

FEATURES

Extensive Signal Averaging – Two operation modes:

- Summation averaging up to 1,000,000 waveforms.
- Continuous averaging with weighting factors up to 128.

Average speed up to 300,000 points/sec in summation averaging mode.

Offset Dithering – Improves the vertical resolution for low–noise measurements by several bits in summation averaging mode. Reduces the effect of ADC differential non–linearities.

Artifact Rejection – Rejects waveforms that exceed the dynamic range of the ADC to ensure statistical validity of summed average results.

Extrema Mode – Keeps track of time and amplitude drift by storing extreme positive and negative values, such as glitches, over a programmable number of sweeps.

Powerful Arithmetic – Processes identity, negation and reciprocal on single waveforms as well as addition, subtraction, multiplication or division on pairs of waveforms stored in the 9420/24/50's memory locations CH1, CH2 (CH3 and CH4 in the 9424), A, B, C, D, E and F. Waveform data can be normalized by additive or multiplicative constants.

Mathematical Functions – Computes integration, differentiation, square, square root, absolute value, exponential and log on single waveforms stored in the 9420/24/50 memory locations CH1, CH2 (CH3, CH4 in the 9424) A, B, C, D, E and F. Waveform data can be normalized by additive or multiplicative constants.

High Resolution – Allows filtering of the digitized signals, whether they are single–shot or repetitive, in order to increase the resolution of the displayed trace from 8 bits to 11 bits in steps of 0.5 bits.

Vertical Expansion – Provides vertical scale expansion by a factor of up to 10.

Chaining of Operations – Automatically chains two operations (four in the 9424):
Example: F(E) = Average (CH1–CH2).

An indefinite number of operations can be performed sequentially, either manually or via remote control.

Remote Control – Controls remotely all front–panel settings, as well as all waveform processing options via either GPIB or RS–232–C interfaces.

Color Archiving – Copies screen in color using a wide range of digital plotters or printers.

FUNCTIONAL DESCRIPTION

The WP01 waveform processing package for the Models 9420, 9424 and 9450 Digital Oscilloscopes is optimized for processing signals in real time. Powerful 68020 microprocessors and 68881 co–processors enable very rapid representation of results such as averages, integrations, exponentials and multiplications.

Waveform operations can be performed on live, stored, processed or expanded waveforms. They are selected through simple menus that allow functions to be chained together allowing more complex computations. For example, it is possible to perform the integration of an averaged waveform or the multiplication of a differentiated waveform.

All processing occurs in function memories E and F (C, D, E and F for the Model 9424) which may be displayed on the screen by simply pressing the appropriate function button. Processing is fully automatic and is simultaneous whenever more than one function has been selected.

SIGNAL AVERAGING

WP01 offers two powerful, high–speed averaging modes that can be used to reduce noise and improve the signal–to–noise ratio. Vertical resolution can be extended by several bits to improve dynamic range and increase the overall input sensitivity to as much as 500 µV/division.

Summed Averaging consists of the repeated addition (with equal weight) of recurrences of the selected source waveform. The number of acquisitions averaged can be selected between 2 and 1,000,000 sweeps with the accumulation automatically stopping when the number is reached. Signals exceeding the range of the oscilloscope's ADC can be automatically rejected to ensure valid summed averaging results.

The user may choose to "dither" the programmable offset of the input amplifier after each acquisition. Dithering uses slightly different portions of the ADC for successive waveforms so that the differential non–linearities are also averaged. As a result, in low–noise applications, the measurement precision and dynamic range are improved.

Continuous Averaging, sometimes called exponential averaging, is the repeated weighted average of the source waveform with the previous average. Averaging goes on indefinitely with each new acquisition and the effect of previous waveforms gradually tends to zero. Relative weighting factors can be chosen from 1:1 to 1:127. The method is particularly useful for monitoring noisy signals which may change slowly over a period of time.

HIGH RESOLUTION

The WP01 package provides a selective filtering technique that improves vertical resolution for reduced bandwidth applications. By effectively removing high–frequency noise, with digital smoothing functions, waveforms can be analyzed with resolution from 8 to 11 bits. The technique can be used with both single–shot and repetitive signals and provides an ideal method for smoothing transient phenomena.

EXTREMA MODE

Tracking rare glitches or monitoring signals drifting in time and amplitude is made easy with EXTREMA mode. EXTREMA waveforms are produced by repeatedly comparing acquisitions of a source waveform with a stored waveform that contains previous maximum and/or minimum excursions. Whenever a given data point of a new acquisition exceeds the existing data point of the stored waveform, the old data point is replaced by the new. In this way the envelope of all waveforms is accumulated for up to a maximum of 1,000,000 sweeps.

ARITHMETIC

WP01 offers basic arithmetic operations such as addition, subtraction, division and multiplication. These arithmetic functions can be performed on any source waveform on a point by point basis. Different vertical gains and offsets of the source waveforms are automatically taken into account in the computed result.

MATHEMATICAL FUNCTIONS

Functions including differentiation, integration, square, square root, logarithm (base 10 and e), exponential and absolute value may be performed on any source waveform. The waveforms may be multiplied by a constant factor or offset by a constant. Arithmetical and mathematical functions can also be chained together to construct more complex processing routines.

SPECIFICATIONS

SUMMATION AVERAGING

Number of sweeps: 1 to 1,000,000.
Number of input points: 50 to 50,000.
Offset dithering: only on acquisition channels; ON /OFF.
Artifact rejection: ON/OFF.
Vertical expansion: 10 × maximum.
Maximum sensitivity: 500 µV/div after vertical expansion.
Speed: up to 300,000 words/sec.

CONTINUOUS AVERAGING

Possible weighting factors: 1:1, 1:3, 1:7, 1:15, 1:31 and 1:127.
Number of input points: 50 to 50,000.
Vertical expansion: 10 × maximum.
Maximum sensitivity: 500 µV/div after vertical expansion.

ARITHMETIC

Identity, negation and reciprocal of any waveform. Addition, subtraction, multiplication, and ratio on any two waveforms.
Number of input points: 50 to 50,000.
Multiplicative constant on first input: from 0.001×10^{-33} to 999.999×10^{33}.
Additive constant on first input: from -999.999×10^{33} to 999.999×10^{33}.
Vertical expansion: 5 × maximum.

FUNCTIONS

Integration, differentiation, square, square root, logarithm and exponential (base e and 10).

Number of input points: 50 to 50,000.
Multiplicative constant on input: from 0.001×10^{-33} to 999.999×10^{33}.
Additive constant on input: from -999.999×10^{33} to 999.999×10^{33}.
Vertical expansion: 5 × maximum.

HIGH RESOLUTION

Choice of four low–pass filters for vertical resolution improvement from 8 to 11 bits at reduced bandwidth.

Vertical expansion: 10 × maximum.
Maximum sensitivity: 500 µV/div after vertical expansion.
Maximum bandwidth (for 11 bit resolution):
- **RIS mode:** 80 MHz.
- **Single–shot mode:** 3.2 MHz (9450), 800 kHz (9420 and 9424).

Speed: from 50 kilowords/sec up to 300 kilowords/sec.

EXTREMA

Logs all extreme values of a waveform over a programmable number of sweeps. Maxima and minima can be displayed together, or separately by choosing ROOF or FLOOR traces.
Number of sweeps: 1 to 1,000,000.
Number of input points: 50 to 50,000.
Glitches as short as 0.002% of the time base (down to 2.5 nsec for the 9450, 10 nsec for the 9420 and 9424) are displayed.
Vertical expansion: 5 × maximum.

CHAINING OF OPERATIONS

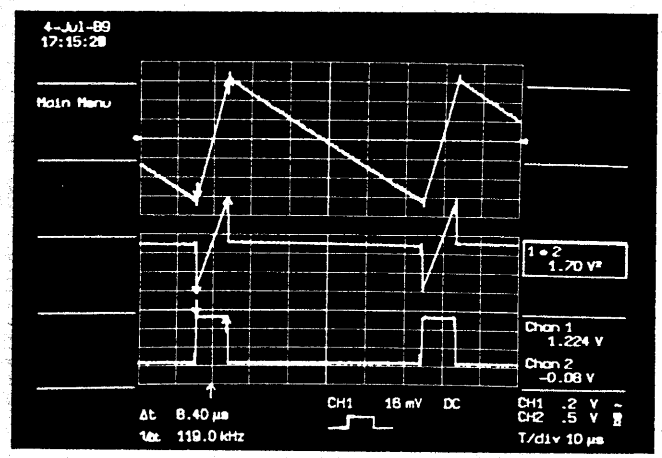
Two functions can be automatically chained using Functions E and F (four functions in the 9424). Using memory C and D for intermediate results, any number of operations can be chained manually or via remote control.

REMOTE CONTROL

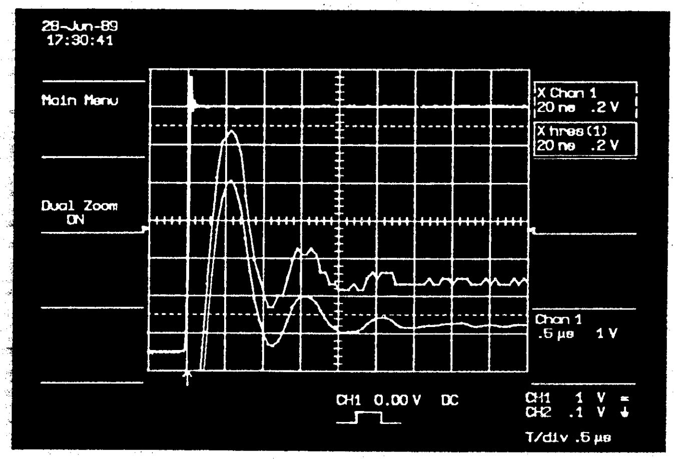
All controls and waveform processing functions are fully programmable using the oscilloscope's GPIB or RS–232–C interfaces. Simple English–like commands are used.

STORED FRONT PANELS

Up to 7 front–panel setups, including WP01 settings, can be stored in non–volatile memory and recalled using the menu buttons at the left side of the screen or via remote control.



Whether it's sophisticated functions (like integration, differentiation or logarithm) or simple mathematics (like addition, subtaction and multiplication), the WP01 package can calculate the results with just a touch of a button. Above, a ramp (top trace) and a square wave (lower trace) are multiplied together. The result is shown in the middle trace complete with cursor readout.



The WP01 package performs digital filtering techniques that allow improved vertical resolution and sensitivity. The above example shows the ringing on a step response (top trace) expanded 5 times vertically and 25 times horizontally (middle trace). The lower trace shows the same expansion but with 9–bit resolution. The second and third oscillations are now clearly visible.

LeCroy

Innovators in Instrumentation

LeCROY CORPORATE HEADQUARTERS
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977–6499
Telephone: (914) 578 6097
TWX:(710) 577–2832
Fax: (914) 425–8967

LeCROY EUROPEAN HEADQUARTERS
Route du Nant–d'Avril 101
P.O. Box 341
1217 Meyrin 1–Geneva, Switzerland
Telephone: (022) 782 33 55 Telex: 41 90 58
Fax: (022) 782 39 15

Other sales and service representatives throughout the world.

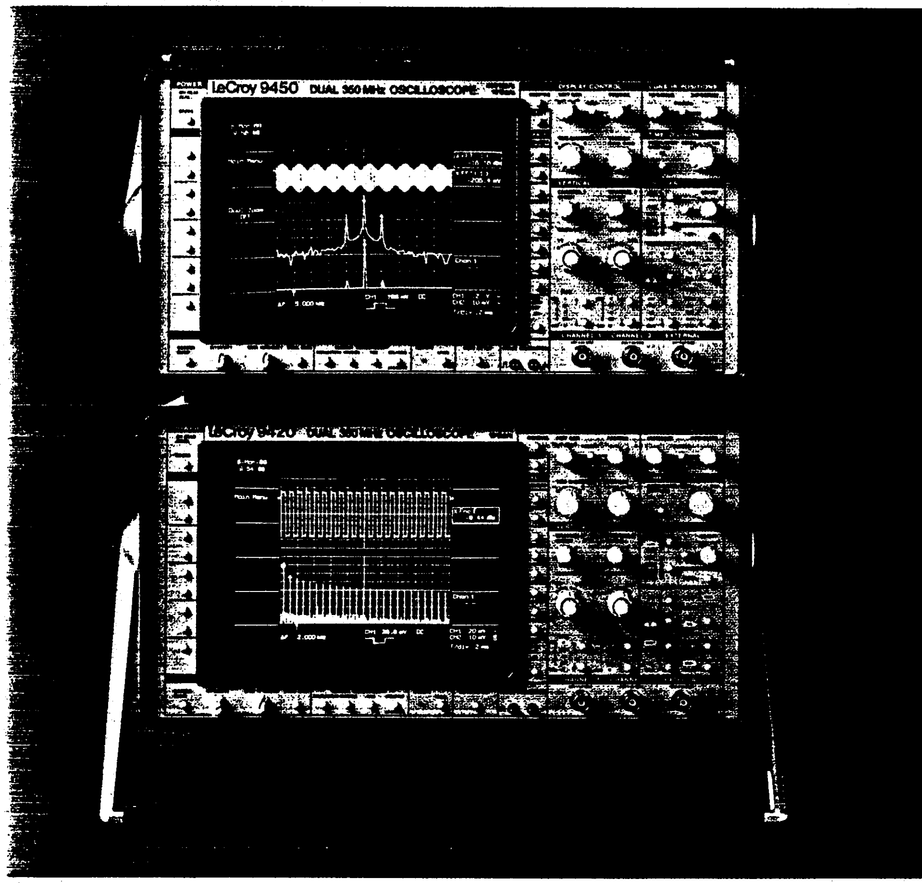
TDS 045/002

FAST FOURIER PROCESSING PACKAGE
50,000 POINT TRANSFORMS, SPECTRAL AVERAGING

LeCroy

WP02 SPECTRUM ANALYSIS FIRMWARE FOR MODELS 9420/24/50 DIGITAL OSCILLOSCOPES

9420/24/50 WP02



The instrument at the top (Model 9450) shows a modulated signal (top trace) analyzed in the frequency domain. Both power spectrum (middle trace) and magnitude (lower trace) are displayed. Side lobes 5 kHz from the fundamental frequency are clearly visible. The instrument at the bottom (Model 9420) shows a square wave (top trace) and its power spectrum (bottom trace).

- **50,000 point FFTs over Two (or Four) Channels Simultaneously**
- **Frequency Range from DC to > 350 MHz**
- **Frequency Resolution from 20 µHz to 100 MHz**
- **Up to 10 Gs/sec Sampling Rates**
- **Time and Frequency Domain Averaging**
- **Wide Selection of Display Formats and Window Functions**
- **1,000–point FFTs ten times a second!**

FREQUENCY DOMAIN MEASUREMENTS AND ANALYSIS

The WP02 Spectrum Analysis Package extends the range of measurement capabilities of the Models 9420 and 9450, two–channel Digital Oscilloscopes, and the Model 9424, four–channel Digital Oscilloscope. Fast Fourier Transforms (FFTs) rapidly convert time domain waveforms into frequency domain records to reveal valuable spectral information such as phase, magnitude and power. The package is fully programmable over GPIB and RS–232–C interfaces. Hard copies can be directly made on a wide range of plotters and printers. As the package is a firmware option which is installed inside the oscilloscope, it eliminates the need for any external controller and is easy to retrofit.

FEATURES

Long record transforms – Extremely long record FFTs (up to 50,000 points) provide significant signal-to-noise ratio improvement.

Wide-band frequency analysis – DC to 350 MHz bandwidth with high resolution.

High sampling rates – Up to 10 gigasamples/sec effectively eliminates aliasing errors.

Broad spectrum coverage – Up to 25,000 spectral components.

Multi-channel analysis – All input channels can be analyzed simultaneously to allow comparison of independent signals for common frequency-domain characteristics.

Versatile display formats – Frequency-domain data may be presented as magnitude, phase, real, imaginary, complex, log-power and log-PSD (Power Spectral Density). These display formats can all be selected via menu options .

Standard window functions – Rectangular for transient signals; von Hann (Hanning) and Hamming for continuous waveform data; Flattop for accurate amplitude measurements; Blackman-Harris for maximum frequency resolution.

Calibrated vertical scaling – Flattop truncation window provides precisely calibrated vertical scaling for all spectral components.

Frequency domain averaging – Up to 50,000 FFT results may be averaged to reduce base-line noise and enable analysis of phase-incoherent signals or signals which cannot be triggered on.

Time-domain averaging – Averaging real-time signals prior to FFT execution can increase the dynamic range up to 70 dB.

Frequency cursors – Cursors give up to 0.004% frequency resolution and measure power or voltage differences to 0.2% of full scale.

Automatic DC suppression – DC signal components may be suppressed automatically prior to FFT execution (menu selected).

Full documentation – The oscilloscope's status in the frequency domain is fully documented on one comprehensive display page which specifies parameters such as Nyquist frequency, number of points, vertical scaling and window function.

Chaining of operations – Two operations (four in the 9424) can be automatically chained, e.g., Function F = FFT of (CH1 × CH2). Any number of operations can be performed sequentially, either manually or via remote control.

Full remote control – All front-panel settings and waveform processing functions are programmable via GPIB or RS-232-C interfaces. Acquired and processed waveforms can be down-loaded to a computer and can later be retrieved and displayed on the oscilloscope.

Color archiving – Provides color hard copies of the screen using a wide range of digital plotters.

Processing of expansions – Up to two regions (three in the 9424) of the same waveform, or of different waveforms, can be expanded and processed simultaneously.

FFT on segmented waveforms – Individual waveform segments can be expanded and then analyzed using FFT. Time and date information is automatically recorded for each segment.

FUNCTIONAL DESCRIPTION

FOURIER PROCESSING

Fourier processing is a mathematical technique which enables a time-domain waveform to be described in terms of frequency-domain magnitude and phase, or real and imaginary spectra. It is used, for example, in spectral analysis where a waveform is sampled and digitized, then transformed by a Discrete Fourier Transform (DFT). Fast Fourier Transforms (FFTs) are a set of algorithms used to reduce the computation time (by better than a factor of 100 for a 1000 point FFT) needed to evaluate a DFT. The principal advantage of FFT is the speed with which it can analyze large quantities of waveform samples. Using standard measurement techniques, FFT converts a time-domain measurement instrument into a digital spectrum analyzer.

The Spectrum Analysis package enhances the outstanding features of the LeCroy Models 9420, 9424 and 9450 . It provides high resolution and wide-band spectrum analysis together with sophisticated window functions and fast processing.

FFT AND LeCROY OSCILLOSCOPES

In FFT mode, LeCroy oscilloscopes provide measurement capabilities superior to those of common swept spectrum analyzers. It is now possible to perform spectral analysis on repetitive and single events at an attractive price. Users can obtain time and frequency values simultaneously and compare phases of the various frequency components with each other.

Rather than the commonly used "power of two" record lengths, the routines used in the WP02 package feature decimal record lengths which can be selected in a 1, 2, 5 sequence. Resulting spectra are also calibrated in convenient decimal Hertz values.

The WP02 package is supported by the exceptional acquisition characteristics which are the hallmark of LeCroy oscilloscopes (± 2% DC accuracy, high effective bits, improved resolution through averaging). Computations are made using 16–bit processing that allows high accuracy, stability and repeatability.

With LeCroy oscilloscopes, signals may be acquired and processed simultaneously using Channels 1 and 2 (1 to 4 in the 9424). This is particularly useful for network characterization or when looking for common frequency–domain characteristics on multiple signals.

IMPROVED RESOLUTION

The Fast Fourier Transform calculates equally–spaced frequency components from DC to the full instrument bandwidth. By lowering the sampling rate, it is possible to make measurements with 20 µHz resolution up to 0.5 Hz (Nyquist). By increasing the sampling rate to 10 gigasamples/sec (100 psec/point) in random interleaved sampling mode, the widest resolution becomes 100 MHz and the Nyquist frequency 5.0 GHz, comfortably above the highest frequency components recordable by the oscilloscope, thus virtually eliminating aliasing effects.

VERSATILE WINDOW FUNCTIONS

The WP02 FFT software provides a selection of window functions designed to minimize leakage and to maximize spectral resolution of single and non–cyclic events. These include the rectangular or unmodified window typically used for transient events, the von Hann (Hanning) and Hamming windows for continuous signals, and also the Flattop and Blackman–Harris windows for more precise amplitude (power) measurements or strong suppression of side lobes respectively.

SPECIFICATIONS

MEMORIES

Acquisition memory: 50K, 8–bit word memories per channel.
Reference and function memories: for the 9420/50 – 2 x 50K,16–bit word reference memories which can each store one acquired or processed waveform (or up to 200 segmented waveforms) and 2 x 50K, 16–bit word function memories for waveform processing. The 9424 has 4 x 50K, 16–bit word memories which can be used both as reference or as function memories.

FREQUENCY

Frequency range: DC to > 350 MHz.
Frequency resolution: 20 µHz to 100 MHz.
Nyquist frequency range: 0.5 Hz to 5 GHz.
Frequency scale factors: 0.05 Hz/div to 0.5 GHz/div in a 1–2–5 sequence.
Frequency accuracy: 0.01%
Horizontal expansion: up to 1000 times.
Selection of the transform size: 50 to 50,000 data points in 10 steps in a 1–2–5 sequence. The transform size defines the decimation applied to the signal after the acquisition.
The Nyquist frequency can be adjusted and optimized after signal acquisition and prior to FFT execution.

AMPLITUDE AND PHASE

Amplitude accuracy: better than 2%. Amplitude accuracy may be modified by the window function (see the window functions table below).
Signal overflow: a warning is provided at the top of the display when the input signal exceeds the ADC range.
DC suppression: selected via the menu (ON/OFF). It removes the DC component prior to FFT execution.
Number of traces: Time domain and frequency domain data can be displayed simultaneously (up to 4 waveforms).
Phase range: – 180° to + 180°.
Phase accuracy: ± 5° (for amplitude > 1.4 div).
Phase scale factor: 50° /division.
Zero base line: 0 div (center of screen).

Spectrum Display Formats and Scaling

Frequency scale: linear, real, imaginary or complex spectrum, in V/div, zero base line at 0 div (center of screen).
Power spectrum in dBm (1 mW into 50 Ω).
Power spectral density (PSD) in dBm.
Phase display: linear.
Magnitude display: linear.
Power and PSD spectra displays have 80 dB range (10 dB/div), expandable to 5, 2 or 1 dB/div.

Frequency Domain Power Averaging

Up to 50,000 spectra for power, PSD or magnitude.

Vertical Expansion

All spectral formats, up to 10 times, in a 1–2–5 sequence.

Window Functions

Rectangular, von Hann (Hanning), Hamming, Flattop and Blackman–Harris. The table below indicates the filter pass–band shape and the resolution:

FILTER PASS BAND AND RESOLUTION

Window type	Filter bandwidth at –6 dB [freq. bins]	Highest side lobe [dB]	Scallop loss [dB]	Noise band–width [freq.bins]
Rect–angular	1.21	–13	3.92	1.0
von Hann	2.00	–32	1.42	1.5
Hamming	1.81	–43	1.78	1.36
Flattop	1.78	–44	0.01	2.96
Blackman–Harris	1.81	–67	1.13	1.71

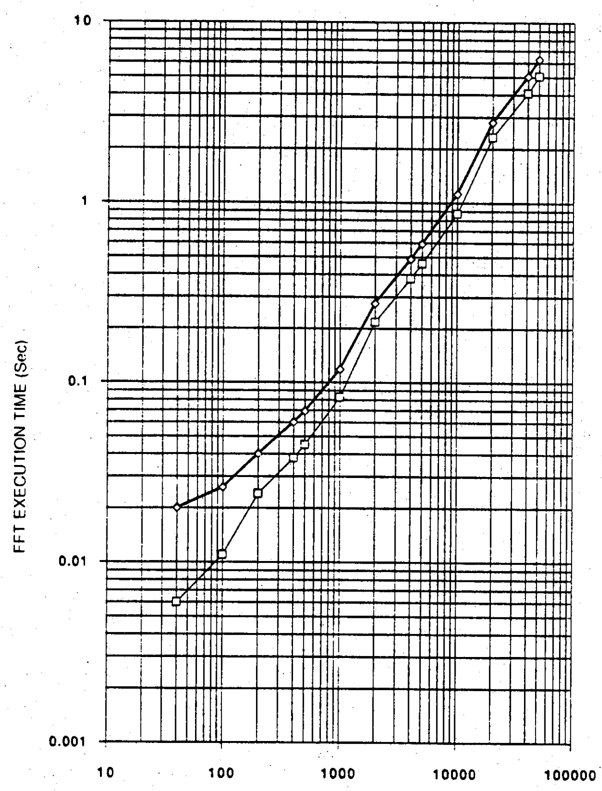
Definitions

Filter bandwidth at –6 dB characterizes the frequency resolution of the filter.
Highest side lobe indicates the reduction in leakage of signal components into neighboring frequency bins.
Scallop loss is the maximum loss of amplitude accuracy of the magnitude spectrum.
Noise bandwidth is the bandwidth of an equivalent rectangular filter.

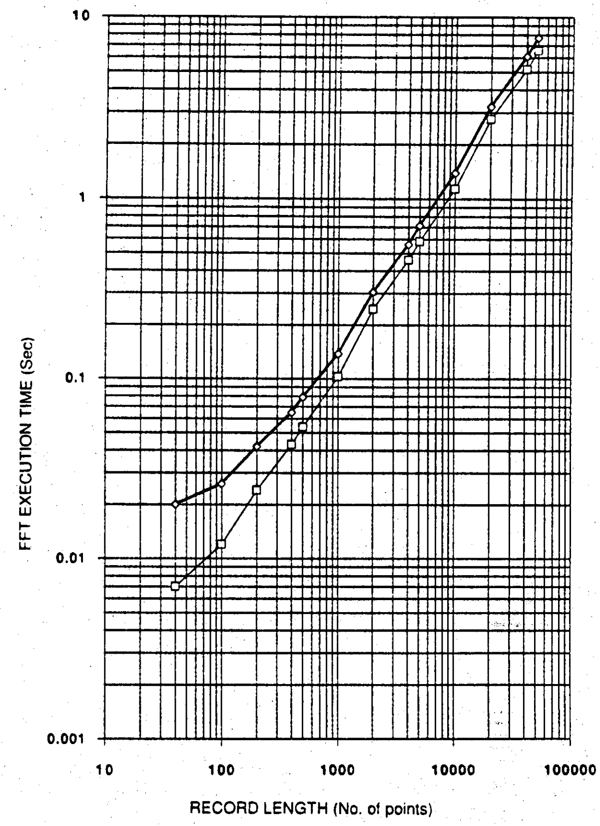
CURSORS

Absolute (crosshair) and relative (arrow) cursors provide frequency and amplitude (phase, power, power density) measurements.
Horizontal bars provide absolute and relative amplitude, and power and power density measurements.

FFT EXECUTION TIME



9424/50 FFT execution time as a function of record length, including window calculations. The top trace is the maximum execution time, i.e. when the FFT definition or the source acquisition conditions have changed. The bottom trace is the repetitive execution time, i.e. when only the input data have changed.



9420 FFT execution time as a function of record length, including window calculations. Same top and bottom trace definition as in the previous graph.

REMOTE CONTROL

All WP02 processing functions are fully programmable via the GPIB and RS–232–C interfaces. Simple English–like commands are used.

Remote read and write

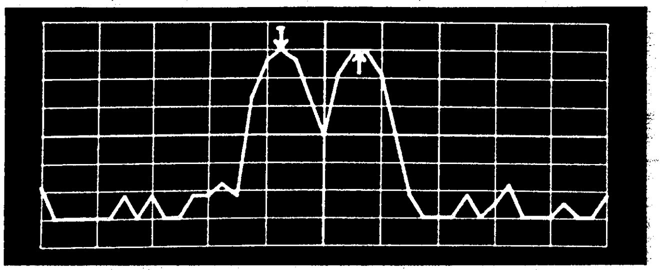
All waveform formats including complex can be read by computer for storage or further processing.
Externally generated waveforms can be written into Memories C and D for FFT or other processing.

STORED FRONT PANELS

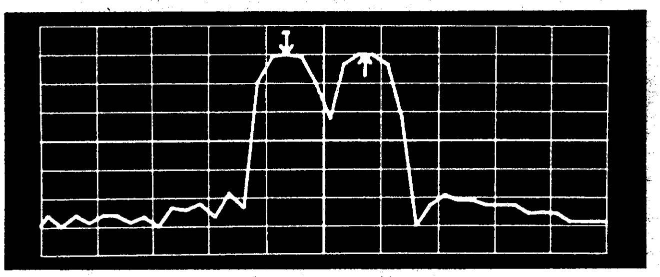
Up to 7 front–panel setups, including WP02 menu settings can be stored in non–volatile memory and recalled by the menu buttons at the left side of the screen.

WP02 INSTALLATION

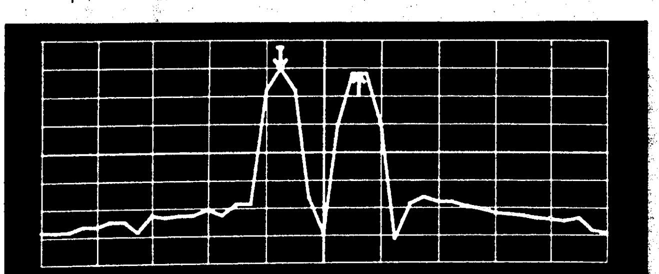
A WP02 package may be retrofitted to a LeCroy 9420/24/50 Digital Oscilloscope.



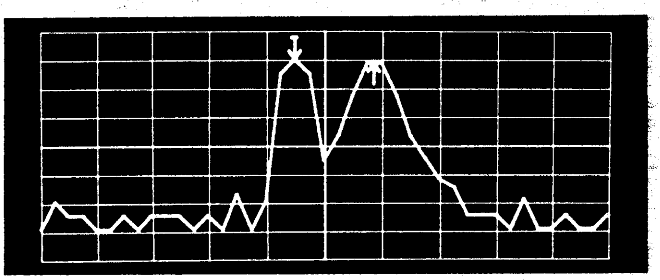
Blackman–Harris



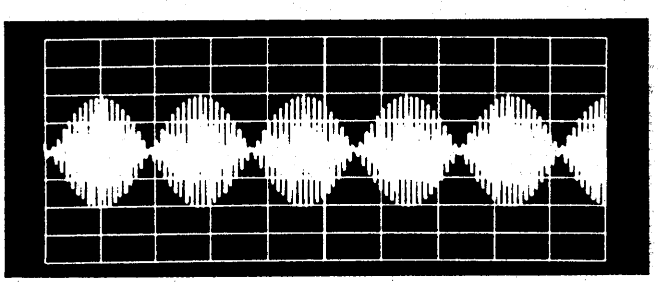
Flattop



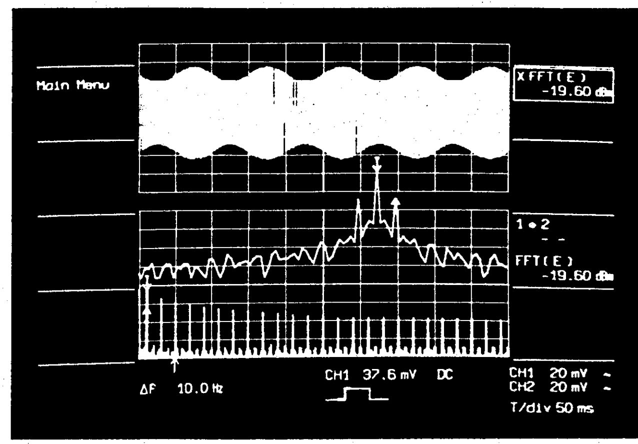
Hamming



von Hann (Hanning)



The sum of two sinusoids of 500 kHz and 527.5 kHz is digitized over 200 points and transformed to the frequency domain. Four different window functions are applied to indicate their effect on leakage suppression and spectral resolution.



Long records give wide frequency span. FFT of a 1000 Hz amplitude modulated square wave, recorded over 50,000 points, shows harmonics up to 51 kHz. Expansion shows side bands at 10 Hz and –19.5 dBm.

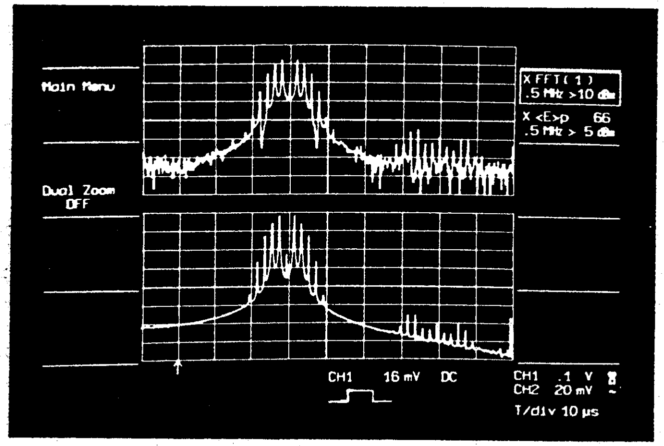
ORDERING INFORMATION

Oscilloscopes and Options

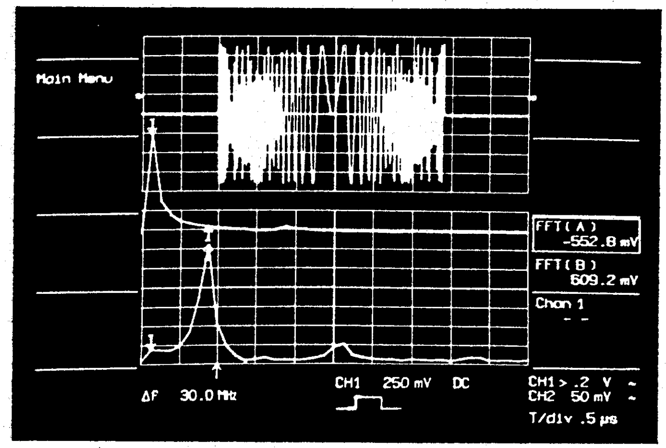
Code	Description
9400A	2–channel, 175 MHz Oscilloscope, 100 Ms/s
9420	2–channel, 350 MHz Oscilloscope, 100 Ms/s
9424	4–channel, 350 MHz Oscilloscope, 100 Ms/s
9450	2–channel, 350 MHz Oscilloscope, 400 Ms/s
9400AWP01	Waveform Processing for 9400A
9420WP01	Waveform Processing for 9420
9424WP01	Waveform Processing for 9424
9450WP01	Waveform Processing for 9450
9400AWP02	FFT Firmware for 9400A
9420WP02	FFT Firmware for 9420
9424WP02	FFT Firmware for 9424
9450WP02	FFT Firmware for 9450

Oscilloscope Accessories

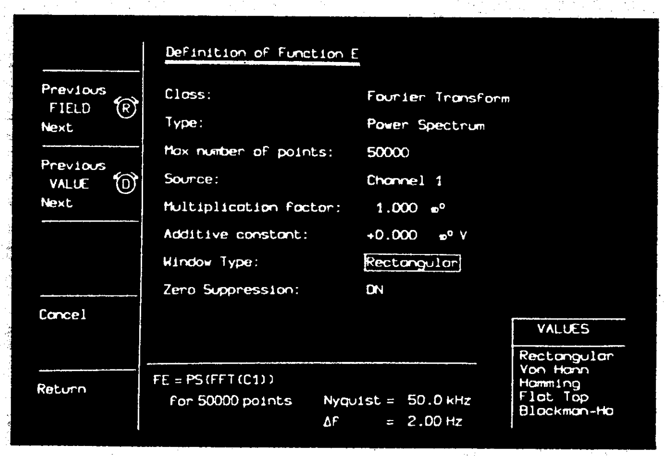
OM 9420/50	Operator's Manual
OM 9424	Operator's Manual
CA9001	Camera (Polaroid film) and Hood
CA9002	Camera Adapter (35mm) with Hood
D9010	High Impedance Divider 10:1
DP9001	Digital Plotter, 8–pen A4 size
DP9003	Epson Printer
OC9001	Oscilloscope Cart
P9010	10:1 Oscilloscope Probe
P9011	10:1/1:1 Oscilloscope Probe
P9010/2	10:1 Oscilloscope Probe – 2m cable
P9020	10:1 Oscilloscope Probe (300 MHz)
P9100	100:1 Oscilloscope Probe
RM9400	Rackmount for portable oscilloscopes
SG9001	High Voltage Protector
TC9001	Transit Case
TC9002	Protective Cover



A 2 MHz signal is frequency modulated with a 99 kHz sine wave. To improve the signal–to–noise ratio on the phase–incoherent FM signal, 66 spectra are averaged (bottom trace). The part of the spectrum at the right–hand side is the 2nd harmonic of the carrier with side bands.



A frequency coded radar signal has been captured in single shot (upper trace). Two time windows have been applied (not visible on the screen) to isolate different portions of the signal, and the respective FFTs have been calculated. The middle and the lower trace show the two amplitude spectra. A frequency shift of 30 MHz is clearly visible.



The FFT menu documents all the relevant parameters.

LeCroy

Innovators in Instrumentation

LeCROY CORPORATE HEADQUARTERS
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977–6499, USA
Telephone: (914) 425–2000
TWX:(710) 577–2832
Fax: (914) 425–8967

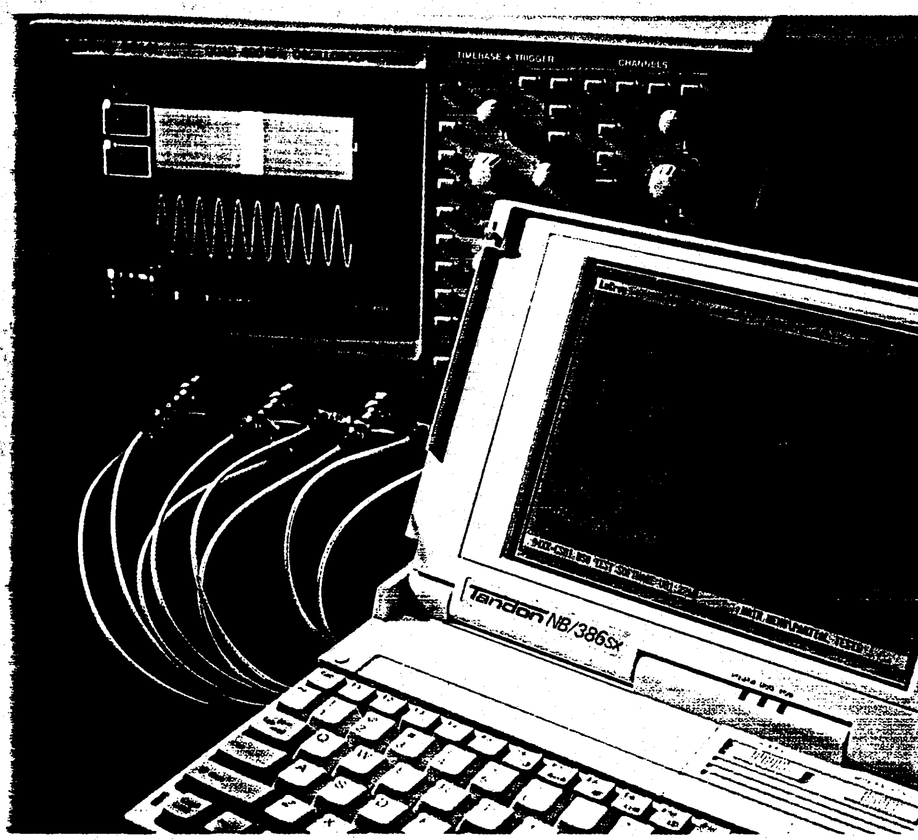
LeCROY EUROPEAN HEADQUARTERS
2, rue Pré–de–la–Fontaine
P.O. Box 341
1217 Meyrin 1–Geneva, Switzerland
Telephone: (022) 719 21 11 Telex: 41 90 58
Fax: (022) 782 39 15

Other sales and service representatives throughout the world.

TDS 021/002

LeCroy
Innovators in Instrumentation

LeCalsoft–Calibration Software for LeCroy Digital Oscilloscopes



The LeCalsoft package enables a fast and thorough verification of all key specifications.

Main Features

- **Traceability to reference standards**
- **Computer check of key specifications**
- **Computer–aided readjustment**
- **Fully automated configurations available**
- **Supports all 93XX and 94XX models**
- **IBM® PC–AT compatible**

General

The LeCroy LeCalsoft (94XXCS05) test and calibration package provides a convenient, unambiguous check of LeCroy oscilloscopes. Designed for users who require traceability to reference standards (NIST, etc.), this package is ideally suited for use in calibration laboratories where the oscilloscopes are checked at fixed intervals.

Results of the calibration check are fully documented on hard copy, or they can be archived on hard disk or diskette.

LeCalsoft works on any PC compatible with the IBM®–AT standard. It controls the oscilloscope and the calibration sources through a National Instruments® GPIB interface.

Features

Calibration Check

All the essential specifications of the Digital Oscilloscope, such as bandwidth, linearity, noise, trigger, timebase and effective–bit count are tested. Deviations from nominal values are calculated and displayed on the screen, printed, or archived on hard disk or diskette.

Comprehensive Documentation of the Test Results

At the end of each calibration check, two types of documentation are available: a long form printout which gives details of the results of all the tests executed, and states whether or not the results are within the specifications, and a short form printout which gives a summary of the test results.

Calibration Traceable to National Standards (NIST, etc.)

By using signal sources traceable to a standard, the calibration will be traceable to the same standard, provided the relevant documentation is maintained.

Manual and Automated Calibration Check

Both manual operation with computer assistance, and automated operation are possible. Automated operation requires programmable multiplexer and signal sources. See the list of supported devices below.

Assisted Adjustment of the Oscilloscope

A computer–aided adjustment procedure is also provided. By following instructions on the screen, the trained technician is guided through the adjustments required to correct the settings of the oscilloscope so that it is within the specifications.

Calibration Certificate

On request, LeCroy will perform calibration traceable to National Standard Organizations. Calibration certificates are provided as part of this service.

Functional Description

Calibration Practice

LeCroy oscilloscopes are auto–calibrating digital oscilloscopes and therefore do not require regular calibration like analog oscilloscopes. However, for users who require traceability to reference standards (such as those provided by the National Institutes of Standards and Technology), and for calibration laboratories which must inspect incoming instruments and perform recalibration at prescribed intervals, the LeCalsoft computer–aided test and calibration packages provide an easy solution.

Under guidance of the LeCalsoft program, some adjustments to the oscilloscope can be made by an electronics technician. However major deviations from specifications usually require repair by a trained service engineer. LeCroy regularly schedules training classes. If no in–house trained person is available, the nearest LeCroy service center can carry out repairs and calibration, and provide traceability to reference standards.

Using the LeCroy LeCalsoft Packages

For calibration checking, digital oscilloscopes have a great advantage over analog oscilloscopes because waveforms can be transferred to a host computer. This simplifies the calibration procedure enormously, makes it potentially faster and allows an extensive range of tests with unambiguous interpretation of the results.

LeCalsoft performs an extensive series of tests which verify the specifications of the oscilloscope. It includes many tests relevant to analog scopes such as Noise and Linearity tests. Although these tests are difficult and time consuming on an analog oscilloscope, they can be computer controlled and are quickly and easily performed on a digital oscilloscope. Tests which are specific to digital oscilloscopes, such as Sinefit tests are also included.

The various test options in LeCalsoft are presented to the operator in the form of a simple menu system. The user has the choice of performing an automated calibration check of the oscilloscope, or individually testing any of the specifications. Some of the tests require the use of high–quality external signal generators. The user receives instructions on the screen when it is necessary to change the cable connections, but apart from this minor intervention, the tests are fully computer controlled when supported GPIB–programmable instruments are used.

Supported Instrumentation

LeCalsoft software works on any AT–compatible equipped with a math coprocessor and a National Instruments GPIB interface. Automated calibration checking is possible using a set of instruments from the following list. (For an automated calibration check, either the LeCroy or Keithley programmable multiplexer is required to feed the calibration signals to the oscilloscope input.)

RF sinewave generators:
- Marconi 2019A, 2022C, 2030, 2031
- Fluke 6060B, 6061A
- Hewlett–Packard 8642A, 8642B
- Rohde & Schwarz SMX

AF sinewave generators:
- Marconi 2019A, 2022C, 2030, 2031
- Hewlett–Packard 8642A, 8642B
- Rohde & Schwarz SMX
- Tektronix FG5010
- LeCroy AFG 9100

DC Precision Power Supply:
- Tektronix PS5004
- Datron 4708 Autocal Multifunction Standard

Fast Pulse Generator:
- Tektronix CG5001/CG551AP

Power Meters:
- Hewlett–Packard HP436A, HP437B

Multiplexers:
- Keithley 199 SYSTEM DMM/ SCANNER with LeCroy interface board.
- LeCroy 4951, 4973–1, 4973–2 Multiplexers.

Frequency standard:
- WWV or HBG1500

Recommended Accessories

A full kit of calibration connectors and interfaces is available from LeCroy. It includes all the necessary cables, adapters, splitters and filters, as well as the Programmable Multiplexer. Also available is a repair package including special tools, board extenders, etc., for computer–aided adjustment.

Use of Other Instruments

It is possible to perform the calibration check with some other unsupported signal sources. However, the user is then required to set up these instruments manually and to perform one measurement at a time. The LeCalsoft package guides the user step by step, and controls the oscilloscope data acquisition and the computation of the results.

LeCalsoft compares the signal measured by the oscilloscope with the signal it would expect to receive from the generator. Warning messages are displayed whenever tolerances are exceeded. Some of the adjustments may be carried out by the user when the test sequence is finished. In this case, the software will guide the user through the correct adjustment procedure. At the end of the calibration check, a printout can be generated to list the results.

Specifications

Computer Required: Any PC compatible with the IBM–AT standard, and equipped with a mathematical coprocessor and a National Instrument Inc. GPIB interface.

Operating System: DOS 3.0 upward

Medium: 3$^1/_2$" 1.44 Mb
5$^1/_4$" 1.2 Mb diskette

Major Tests Supported by LeCalsoft

Internal

To ensure proper calibration of the oscilloscope, internal auto–calibration tests are automatically executed during normal operation. This standard sequence of internal auto calibration tests is initiated by the software and the results are transferred to the PC for analysis.

The tests are:

- Calibration of the resolution of the time–to–digital converter with respect to the system clock
- Determination of the gain constants of the input amplifiers
- Offset compensation versus gain variation
- Global internal non–linearity
- General functionality check

Bandwidth

To calculate the bandwidth, the amplitudes of sine waves of increasing frequencies are measured. The sine wave generator is first set to 500 kHz with an amplitude 75% of full screen, i.e. ±3 vertical divisions. The frequency is then swept up to the point where an amplitude drop of 3 dB is observed. This indicates the bandwidth.

This test is executed on all channels for 1 MΩ and 50 Ω input impedance and for all vertical sensitivities. It requires a sine wave generator with good flatness.

Generators supported under program control are listed on page 2.

Linearity

15 different known voltages, varying from 5% to 95% of full screen, are applied by the external voltage reference source. For each voltage value, a full waveform is acquired, and the mean value is compared to the known input voltage. The linearity is determined through a linear regression fit to the 15 measurements.The slope, the offset and the chi–square of the fit are computed.

With the linearity test, many other related tests are performed: response time of the overload protection of the 50 Ω input, linearity of the variable gain calibration, range and linearity of the offset setting, and quality of the input coupling.

This procedure is executed on all channels for both 1 MΩ and 50 Ω input impedance. The test requires a DC source with a precision and time stability of 0.1%, a voltage range of 0 V to 20 V adjustable in steps of 5 mV, and an output current capability of 300 mA.

Power supplies supported under program control are listed on page 2.

Noise

The noise tests are executed on all channels for both 1MΩ and 50 Ω input impedance, with AC and DC coupling, five different time–base settings, and open inputs. Full waveforms are acquired with different offset values. The peak–to–peak as well as the RMS values of each measurement are computed, and the maximum values are recorded. The program also indicates the occurrence of any "flyers", i.e. short noise peaks generated by the ADC's.

The noise tests also include:

- checking the linearity of the variable offsets of all channels between 2.5% and 97.5% of full screen.
- checking the stability of the ground line when switching the inputs between GROUND and DC coupling modes.

Rise time/Overshoot

Executed on all channels for both 1MΩ and 50 Ω input impedance, these tests measure the rise time of the oscilloscope response to the input voltage step, as well as the amount of pre–shoot and overshoot. They require a voltage step generator with calibrated fast rise–time amplitude.

The Voltage Step Generator supported under program control is the Tektronix CG5001.

Sinefit

The performance of the analog–to–digital converter is evaluated in terms of the number of effective bits (a measure of the signal–to–noise ratio). It is measured on all channels, at a sensitivity of 50 mV/div., by applying a pure sine wave at varying frequencies and timebase settings

This test is a measurement of dynamic linearity. It shows the effect of such errors as noise, non–linearities and aperture jitter.

Timebase

The timebase test compares the internal clock with a very precise and stable external timebase reference (clock generator) such as the WWV standard or HBG 1500.

Trigger

The trigger capabilities are tested for all possible configurations. These include:

- Internal and external trigger sources
- DC, AC, HF–reject, and LF–reject couplings
- Trigger level settings in all slope modes.

ORDERING INFORMATION

LeCalsoft and Options

94XXCS05 Complete LeCalsoft for 93XX and 94XX (software and hardware), incl. cables, switch card, adapters, etc.
94XXCS01 LeCalsoft software for 93XX and 94XX
9400CS01 Calsoft software for 9400A

LeCalsoft Accessories

93XXKCS02 Calibration kit for 93XX and 94XX
9400KCS02 Calibration kit for 9400A

Individual system components available on request

U.S. REGIONAL SALES OFFICES 1 800–5–LeCroy (1–800–553–2769):

automatically connects you to your local sales office.

LeCroy has sales engineers in most major metropolitan areas, coordinated through a system of five Regional Sales and Service Offices:

NORTHEAST: 700 Chestnut Ridge Rd, Chestnut Ridge, NY 10977

SOUTHEAST: 410 Ware Blvd Ste 716, Tampa, FL 33619

FARWEST: 5912 Stoneridge Mall Rd Ste 150, Pleasanton, CA 94588

CENTRAL:

Midwest: 4811 S 76th St Ste 415, Greenfield, WI 53220

Southwest: 14800 Central Ave SE Albuquerque, NM 87123

WORLDWIDE

Argentina: Search SA, (01) 394–5882
Australia: Scientific Devices Pty Ltd, (03) 579–3622
Austria: Dewetron GmbH, (0316) 391804
Benelux: LeCroy BV (0031) 4902–89285
Brazil: ATP–Hi–Tek, (011) 421–5477
Canada: LeCroy Canada Inc, (514) 928–4707
Denmark: Lutronic, (42) 459 764
Eastern Europe: Elsinco GmbH, Vienna, 222 812 1751
Finland: Labtronic OY, (80) 847 144
France: LeCroy Sarl (1) 69 073 897
Germany: LeCroy GmbH, (06221) 831001
Greece: Hellenic S/R Ltd., (01) 721 1140
Hong Kong: Euro Tech (Far East) Ltd, (052) 814–0311
India: Electronic Ent, (022) 4137096
Israel: Ammo, (03) 453157
Italy: LeCroy Srl, Roma (06) 300.97.00 or 331 31 46; Milano (02) 2940 5634
Japan: LeCroy Japan, Tokyo (0081) 33 376 9400; Osaka (0081) 6 330 0961
Korea: WOOJOO Hi–Tech Corp, (02) 449–5472
Mexico: Nucleoelectronica SA, (05) 5593 6043
New Zealand: E.C. Gough Ltd, (03) 798–740
Norway: Avantec AS (02) 630520
Pakistan: Electronuclear Corp, (021) 418087
Portugal: M.T. Brandao, Lta, (02) 815680
Singapore: Sing. Electr. and Eng. Ltd (65) 481–8888
S. Africa: Westplex Test & Meas, (011) 787 0473
Sweden: MSS AB, (0764) 68100
Switzerland: LeCroy SA (064) 51 91 81
Taiwan: Topward El.Inst., Ltd, (02) 601 8801
Thailand: Measuretronix Ltd, (02) 374 2516
United Kingdom: LeCroy Ltd, (0235) 533 14

LeCroy
Innovators in Instrumentation

LeCROY CORPORATE HEADQUARTERS
700 Chestnut Ridge Road
Chestnut Ridge, NY 10977–6499
Phone: (914) 425–2000
TWX: (710) 577–2832
Fax: (914) 425–8967

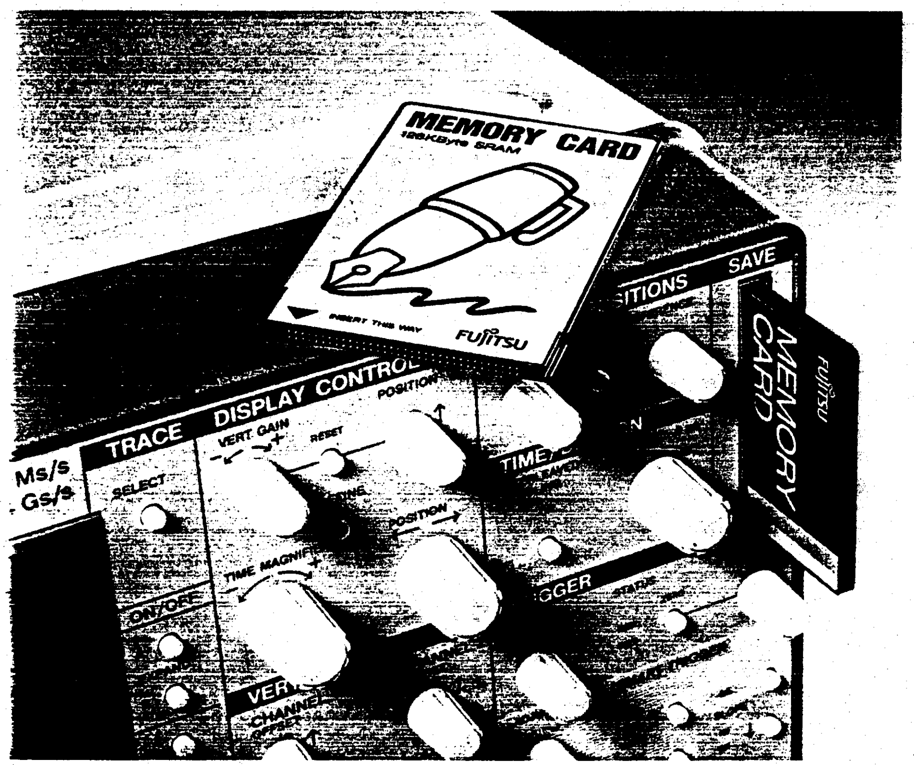
LeCROY EUROPEAN HEADQUARTERS
2, rue du Pré–de–la–Fontaine
P.O.Box 341
1217 Meyrin 1 – Geneva, Switzerland
Telephone: (022) 719–21–11
Fax: (022) 782–39–15

TDS 011/004

LeCroy

The Digital Scope Specialists

MEMORY CARD SYSTEM FOR MODELS 9410, 9414, 9424, 9430 AND 9300–SERIES DIGITAL OSCILLOSCOPES



- Ultra–fast Throughput Rates
- Automatic Waveform Storage
- New PCMCIA Standard (DOS–compatible)
- 128K Byte – or 512K Byte – cards available
- Ideal for automatic PASS/FAIL Testing

FEATURES

Versatility – The memory card is mainly used to save and retrieve either waveforms (acquired or processed) or instrument settings.

Autostore – Waveforms can be automatically stored to the card after every acquisition. The user can choose to stop the automatic storage when the card is full, or to perform "wraparound" storage, discarding the oldest waveforms in a first–in–first out manner.

PASS/FAIL Testing – The oscilloscope's new PASS/FAIL feature allows for automatic storage of failure data to the memory card.

High Efficiency – Select up to 8 different traces (10 traces on 4–channel scopes) to save with just one keystroke. This feature is also available in "Autostore" configurations.

User–friendliness – A convenient "Replay" function helps the user to visualize the waveforms stored on the card.

Fully Featured with Remote Control – All the front–panel commands used to drive the memory card system are available through remote control. This allows testing time to be cut significantly in ATE applications, thanks to the memory card's extremely fast transfer speed.

Standard PCMCIA/JEIDA Format – PCMCIA is the memory card standard agreed upon by all the major PC manufacturers.

SPECIFICATIONS

Formatted MC Size: 506K for MC04, 122K for MC02

Front–Panel File Size: 2K Bytes

Waveform Size: A 10000–points waveform will use 2 bytes per point in word format plus 346 bytes of waveform descriptor, for a total of 20346 bytes.

Template Size: 22K Bytes

Throughput Performance Examples:

Waveform Length	Transfer Time
1000	22 msec
10000	82 msec
50000	322 msec

ORDERING EXAMPLE

To order a memory card system with one 128K card and one 512K card for a Model 9410 oscilloscope:

9410–MC01 for the Memory Card firmware.
9410–MC02 for the 128K Memory Card.
9410–MC04 for the 512K Memory Card.

800–5–LeCroy (1–800–553–2769):

automatically connects you to your local sales office.

WORLDWIDE

Argentina: Search SA, (01) 46 6156
Australia: Scientific Devices Pty Ltd. (03) 579–3622
Austria: Dewetron GmbH, (0316) 391804
Benelux: LeCroy BV (0031) 4902–89285
Brazil: ATP–Hi–Tek, (011) 421–5477
Canada: LeCroy Canada Inc. (514) 928–4707
Denmark: Lutronic, (42) 459 764
Eastern Europe: Elsinco GmbH, Vienna, 222 812 1751
Finland: Labtronic OY, (80) 847 144
France: LeCroy Sarl (16) 907 3897
Germany: LeCroy GmbH, (06221) 831001
Greece: Hellenic S/R Ltd., (01) 721 1140 or (01) 721 3154
Hong Kong: Euro Tech (Far East) Ltd, (052) 814–0311
India: Tata Honeywell, (0212) 670 445
Israel: Ammo, (03) 453157
Italy: LeCroy Srl, Roma (06) 300.97.00
Milano (02) 204 7082 or 2940 5634
Japan: LeCroy Japan, Tokyo (0081) 33 376 9400; Osaka (0081) 6 330 0961
Korea: WOOJOO Hi–Tech Corp, (02) 449–5472
Mexico: Nucleoelectronica SA, (05) 5593 6043
New Zealand: E.C. Gough Ltd, (03) 798–740
Norway: Avantec AS (02) 630520
Pakistan: Electro Tech. Corp, (021) 493–8087
Portugal: M.T. Brandao, Lda, (02) 815680
Singapore: Sing. Electr. and Eng. Ltd, (65) 480.7783
S. Africa: Westplex Test & Meas., (011) 787 0473
Spain: Essa, (01) 359 0088
Sweden: MSS AB, (0764) 68100
Switzerland: LeCroy SA (064) 51 91 81
[illegible] Topward El.Inst., Ltd, (02) 601 8801
[illegible] Measuretronix Ltd, (02) 375 2733–4
[illegible] LeCroy Ltd, (023) 553 3114

LeCroy
The Digital Scope Specialists

LECROY CORPORATE HEADQUARTERS

700 Chestnut Ridge Road
Chestnut Ridge, NY 10977–6499
Phone: (914) 425–2000
TWX: (710) 577–2832
Fax: (914) 425–8967

LECROY EUROPEAN HEADQUARTERS

2, rue du Pré–de–la–Fontaine
P.O.Box 341
1217 Meyrin 1 – Geneva, Switzerland
Telephone: (022) 719–21–11
Telex: 41 90 58
Fax: (022) 782–39–15

TDS 071 002

Chapter 2

BASIC OPERATION

AND

BLOCK DIAGRAMS

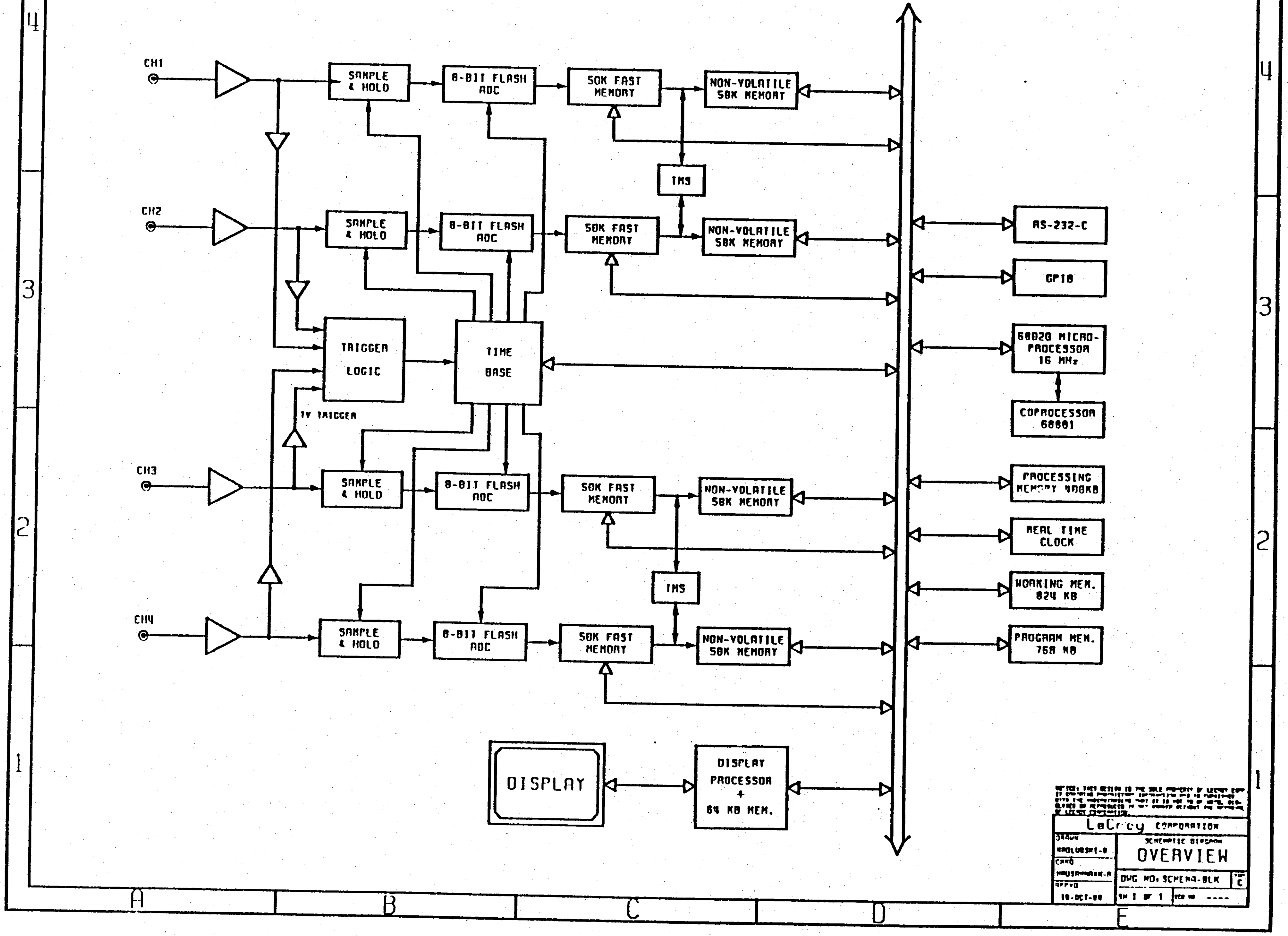
Table of contents

Section

2.1 9424 Sub-assemblies

F9424-1	Base Board
F9451-1	Power Supply
F9424-2	Support for Memory Card
F9450-2	Display
F9420-3	Dual channel ADC
F9420-4	Time Base
F9424E-5	Front Panel
F9424-6	Processor
F9424E-7	Quad channel front end
F9424-8	Clock bus
F9424E-9	Rear panel
M9424E	Mechanical for 9424

9424 HARDWARE OVERVIEW



2.2 F9450-2 Display Board

2.2.1 General Description

This board is designed to display a monochrome 10" CRT image. The image is composed of instructions downloaded from the processor board 9424-6 into the resident memory via the internal 9424 bus.

The image is a vector type display. The principle of a vector display is to move the spot with intensity ON or OFF between two XY positions of the screen. This represents the major use of the display board. For special applications, the capability of a pseudo-raster mode has been added. This mode is realized by turning the beam spot ON or OFF according to a downloaded bit mask while moving the spot in the x-direction.

The spot position is controlled by the monolithic display processor MDS403. It is a LeCroy proprietary gate array. The data and address busses are 16n bits wide. The processor supports instructions like JMP, JSR, RTS, and 12 bit X, Y or XY vector instructions.

The resident display memory is a static 32K*16 RAM. It can be R/W accessed via the internal 9424 bus, or read only by the MDS403.

The digital X, Y coordinates output from the MDS403, are converted to analog signals by two 12-bit DACs.

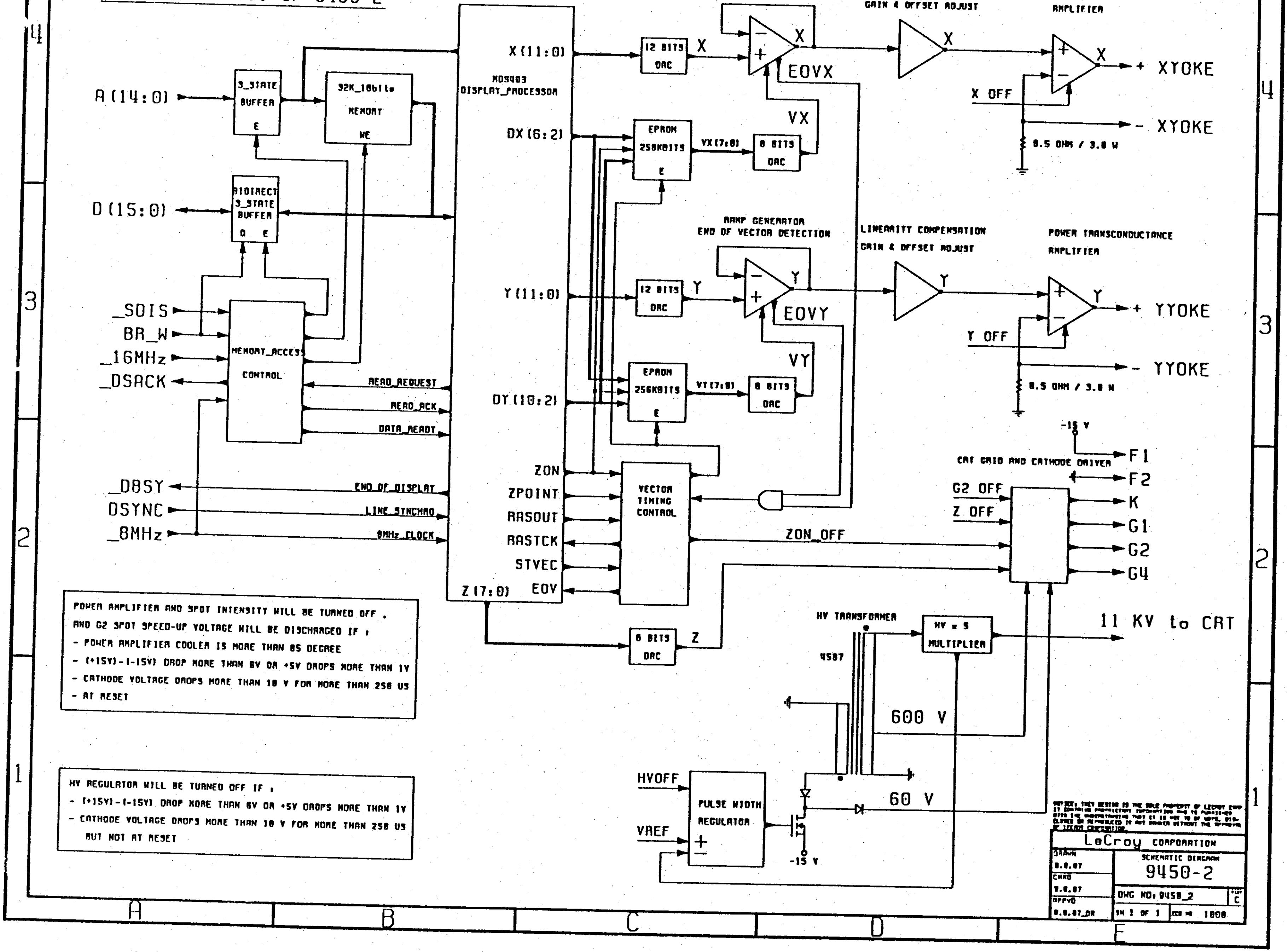
In order to generate a constant spot velocity (intensity) over the screen, there are two rate controlled integrators, one for the X and one for the Y axis. The rate is calculated by table look-up using two EPROMS addressed by delta X and delta Y simultaneously.

For each axis there is a non-linear correction amplifier, one gain and one offset control amplifier, and one transconductance power amplifier to drive the current through the magnetic deflection coil.

The high voltage needed for the CRT is generated with a fly-back mode switching regulator through a high voltage transformer and a diode high voltage multiplier.

Last not least comprehensive protection circuitry is implemented.

BLOCK SCHEMATIC OF 9450-2



POWER AMPLIFIER AND SPOT INTENSITY WILL BE TURNED OFF .
AND G2 SPOT SPEED-UP VOLTAGE WILL BE DISCHARGED IF :
- POWER AMPLIFIER COOLER IS MORE THAN 85 DEGREE
- (+15V)-(-15V) DROP MORE THAN 8V OR +5V DROPS MORE THAN 1V
- CATHODE VOLTAGE DROPS MORE THAN 10 V FOR MORE THAN 250 US
- AT RESET

HV REGULATOR WILL BE TURNED OFF IF :
- (+15V)-(-15V) DROP MORE THAN 8V OR +5V DROPS MORE THAN 1V
- CATHODE VOLTAGE DROPS MORE THAN 10 V FOR MORE THAN 250 US
BUT NOT AT RESET

2.2.2. Input Interface and Display Memory

All data and instructions are written into the resident memory by the main processor via the internal bus. The 9424 main processor can read back the display memory in order to plot the screen contents via the external printer port or for test purposes. The dispaly processor can only read the memory to control the display.

The PAL (16R4) RAMACC controls the memory access and timing. One of its flip-flop selects the memory user. Priority is given to the 9424 main processor. All timings are set for memories with maximum access time of 120 nsec.

2.2.2.1 The PAL RAMACC

The line BCK is the 16 MHZ master clock from the F9424-6 processor board.
CK8M is BCK divided by two. The external bus R/W access are synchronous to the BCK clock. The MDS403 read cycles are synchronous to the CK8M clock.

The line G244 controls the address driver output state. A high level disables the outputs. The line G245 controls the data driver output state. A High level disables the outputs.

The line BR_W controls the direction of data: '1' to read from memory and '0' to write to memory. The line WE256 is set low during a write cycle to enable the memory data load.

The four lines SDIS, BAS, BR_W and DSACK are to control the R/W timing between the external bus and the memory.

The line SDIS is generated on the F9424-1 base board by decoding the address lines BA19 to BA24. The display address space is hex 178xxxx.

The three lines RREQ, RDACK and RDRDY are to control the read cycle of the MDS403.

2.2.2.2 External Bus to Memory Access Timing

a. The memory is available. This is the fastest access:

For a read cycle, the line WE256 will remain high for the entire cycle.

When the external user wants to access the memory, SDIS is set to '0'. The access is given at state A0 of the PAL. If the state is A0 and SDIS low, the state will change to A1 at the next trailing edge BCK.

The states A1, A2, A3 and A4 are always two BCK periods long.

The signal G244 will go low and enable the outputs of the external address driver during states A0 through A3 for SDIS low.

The signal G245 will go low and enable the external data driver, according to BR_W, from A1 through A3

The signal WE256 will go low if the memory access is a write cycle, simultaneously with G245. It will remain high for a read cycle.

The ready answer line DSACK is low during the state A2 and A3.

b. The memory is in use:

All signals will remain high (except for BAS and SDIS) until the PAL comes to state A0. The cycle will then be exactly the same. Therefore the maximum number of wait states is 8.

2.2.2.3 MDS403 Memory Access Timing

a. The memory is available. This is the fastest access:

The gate array has read-only memory access. The entire cycle is minimum 500 nsec (8 BCK clock periods).

When the MDS403 wants to access the memory, it sets RREQ to '1'. Access will be granted at the end of state A0 if the external user is not requesting access. Priority is given to the external user. If the memory is not busy and state is A0, access will be given at the next occurence of CK8M low, at the trailing edge of BCK.

The state will then change to A5 and the signal RDACK will enable the MDS403 to drive the address lines until RREQ returns low.

The states A5 and A6 are always two BCK periods, and the state A7 is always one.

The sigal RDRDY goes high at the beginning of state A6 and returns low at the end of state A7. This signal is synchronized in the MDS403 at the falling edge of CK8M and is named 'Rdys'. 'Rdys' enables the MDS403 to load data at the next trailing edge of CK8M. This is two BCK periods after the beginning of the state A6.

The signal RREQ returns low when the data are loaded.

b. The memory is in use:

All signals except RREQ remain low until access can be granted. The cycle is then exactly the same.

2.2.2.4 Reset and Frame Synchronization

At power-on or reset, the beam intensity is set OFF and the spot is positioned to the screen center. The display processor is set in a wait state. The address bus is internally set to hex0000, but the outputs are put into the high impedance state.

The display processor waits until the user enables it to access the memory by sending the first frame synchro. At this moment the processor starts to read data from memory address hex0000. It is the user's responsibility to make sure that the data in the memory makes sense to the display processor.

2.2.3 Display Processor

The MDS403 is a LeCroy proprietary 3K gate array in a ceramic package with 120 pins.

2.2.4 Principle of Vector Display

A vector is a linear displacement of the beam spot between two X,Y positions: the current position and the position to go. Due to the flatness of the screen, the X,Y position of the spot is proportional to the tangent of the respective X,Y deflection currents. This makes a slightly non-linear behaviour which a good display must account for and correct. This is accomplished in the simplest way by a non-linear correction applied to the analog signal amplifier.

A vector is generated by a composition of two X and Y linear current ramps. The start level of both represent the current X,Y position, and the end level represent the X,Y coordinate to go. Two kind of vectors are distinguished: one-axis vectors where the spot moves only along X or Y direction, and two-axis vectors where the spot moves in both the X and Y direction.

The displacement velocity is limited by the power supply and the inductance of the deflection yoke. If one neglects the losses in the yoke and the yoke driver, the maximum attainable velocity is:

$$di/dt = U/L$$

where U is the applied voltage and L the yoke inductance.

In order to get a constant spot velocity for a constant spot intensity, the rate of the X and Y ramps are not the same for all vectors. They depend on the ratio between X and Y displacement.

The rate for a either one-axis vector is equal to the maximum spot velocity Vspot.

For two-axis vectors, the individual X and Y rates are calculated using look-up tables contained in two EPROMs. They are addressed by both DX and DY combined and output the resulting X and Y velocities Vx and Vy. For this computation the MDS403 always outputs DX and DY, the difference of current to new spot position.

The combined DX/DY address space and the resulting memory size becomes rapidly very large with increasing DX and DY. This limits the length of two-axis vectors possible in pratice, as outlined in the next paragraphe.

2.2.5 Practical Limitation of Two-axis Vectors

The limit is imposed by the size of the EPROM to be used and the desired X, Y velocity accuracy.

If we decide to use the largest possible DX, DY we need 2048*2048 = 4.2 mega times 10 bits for 1 per 1000 precision. This makes 42 megabits of EPROM and is certainly not realistic.

The design of the analog X and Y ramp generator limits the precision to about 1%. Therefore the X and Y rate DAC outputs are chosen 8 bits wide.

The X and Y position DACs are 12 bits. The least significiant bit represents 0.04 mmm on the screen. Therefore the two LSBs are not used.

Two-axis vectors are needed to draw characters which don't require large vectors. For drawing traces, only small DX values are needed. The final choice on the DX/DY size is to use bits 2 to 10 of DY and bits 2 to 6 of DX. This results in the following limitation:

- +/- 31 counts for DX and DY for the instructions MOXY and DRXY (move and draw XY)

- +/- 127 for DX and +/- 2047 for DY, for the four auto X increment instructions (MYAX, DYAX, PYAX and DPYX)

This makes a memory size of 16 Kbytes. As the signal ZON is also input as a memory address, the final EPROM size used is 32 Kbytes, one each for VX and VY rate.

2.2.6 Vector by MDS403

When the beam spot has reached the final XY position, the signal EOV (end of vector) becomes true and the MDS403 is enable to load the next XY position. The strobe VECSTR indicates that a new XY value is loaded. AT the same time it loads the signals DX, DY, VMAX, ZON, ZPOINT and RASOUT.

The signal EOV must be tied to low directly after the signal VECSTR goes high, until the XY position has reached the final value. EOV will be high again, and enables the MDS403 to send a new XY position.

2.2.7 Spot Intensity Control and Timing Principle

Of the 12 bits available for the spot intensity (ZC0 to ZC11), only 8 are used. The ZC register, internal to the MDS403, is not reloaded with a new value until the vector in progress is completed (i.e. EOV high). There is, however, a delay of about 600 nsec between the end of vector at the output of the ramp generator and the actual yoke current change. This is accounted for by adjustable start-of-vector and end-of-vector delays, as described in paragraph 10.

The 8 intensity bits are converted to analog current by an 8-bit DAC. This current controls via an amplifier the cathode voltage of the CRT. It is 42 V for OFF and about 15 V for full intensity (hexff).

The digital ON/OFF control at the beginning and end of vectors is done by the ZCTR signal output from the PAL INTCTR.

A special hardware feature of the F9450-2 display is the "pointed" vectors with an intensified point at the end, used to highlight the actual digitized data points out of the linear interpolation. This is realized by increasing the beam ON control timing by 500 nsec. During this extra time the spot does not move and gives therefore rise to the intensified point.

2.2.8 The Ramp Generator

The X and Y outputs, 12 bits each, from the MDS403 processor are converted to analog voltage by two 12-bit DACs, A13 and A14. The VX and VY outputs of the two rate EPROMs are converted to analog current by two 8-bit DACs, A10 and A11.

The voltage Vout at the capacitor (C74 and C75 in circuit) represents the current spot position, and Vin the final spot position at the end of a vector to be drawn. While Vin and Vout are different, the capacitor is charged or discharged with a rate given by Iin, the integrator current, until Vout reaches Vin. The analog X/Y positions are connected to the positive input of the X or Y ramp generator. The analog rate signal XINT and YINT are connected to the current control of the respective ramp generator.

In order to allow for sufficient look-up time for the VX and VY rates from the EPROMs, a delay of 250 nsec is generated after the new X,Y positions are loaded (VECSTR from MDS403 to the PAL VECTIM, and OESPEED from the PAL to enable the EPROM outputs). During this delay, the analog rates are held at zero which keeps the analog X/Y positions stable.

The analog signal WRVEC, "end of vector", goes low when the spot has reached the final position. In the PAL VECTIM the falling edge of WRVEC gives rise to EOV high which enables the MDS403 processor to load the next X, Y position or intensity value, and, after a seperate delay, turns OFF the intensity (ZCTR). EOV is further delayed if the draw mode "pointed vector" is enabled.

2.2.9 Vector Timing

After the display processor has loaded a new X, Y position, a delay is generated to allow for the EPROM look-up time of the VX, VY rates. After that delay, the vector is drawn on the screen. When the spot reaches its final position, the EOV line goes high and enables the processor to output the next X, Y position. The intensity ON/OFF control line ZCTR is subject to additional delays to account for the inertia of the yoke current changes.

In raster mode, the intensity ON/OFF bits are shifted out of the display processor while the beam is moving, using an extra asynchronous raster clock (C96, R54, R219 next to PAL VECTIM). A divider by two, three or four is used (PAL RASTCK). It is controlled by the size of the possible X-increments, bits DX5 to DX7.

The timing is controlled by the asynchronous clock generated with the PAL VAZTIM in conjonction with a counter (A8) which is reset to 0 at each start of a new vector. The rate enable is OFF from state 0 to state 3 included. At state 4, the rate is enabled and the vector drawn. For "move" vectors, the rate is not set OFF from state 0 to 3. The signal ZON goes low at the same time. It returns high when the signal WRVEC goes low. After a delay defined by the yoke inertia, ZCTR enables the intensity of the spot. For raster vectors, the signal ZON follows inverted the raster intensity control line RASOUT from the MDS403.

2.2.9.1 Timing Diagram for Draw Mode

The two delays SVD and EVD have, in addition to the fixed digital delay, a small analog adjust range provided by potentiometers R45 and R46.

For "move" type vectors, the signal OESPEED remains low and the signal ZON, ZCTR remains high. Both WRVEC and EOV are the same as for draw vectors.

2.2.9.2 Timing Diagram for Point Mode

For "point" vectors, the intensity is set ON at the end of the vector for about 1 usec. The signal EOV goes high after the intensity is OFF again. The extra timing for point vectors is an analog fixed delay in the PAL VAZTIM.

2.2.9.3 Raster Mode Timing

There are three raster steps available. The selection is made by loading the auto-increment register of the gate array. The increment may be positive or negative. For a better display timing, it is preferable to implement a raster display with lines drawn in the positive and negative horizontal direction. In this way there is no time lost by returning the spot to the start of the next line. For a raster command, the first intensity bit out of the gate array is always bit d0, regardless of the direction. (positive or negative horizontal)

The intensity bits are shifted out of the gate array with the clock RCKOUT from PAL RASTCK (A29). This clock gets automatically set to the frequency corresponding to the step selected.

The timing is the same as for the draw mode, except for ZON and ZCTR which follow the intensity bits out of the display processor.

For each raster instruction there are eight clock pulses on the line RCKOUT to output the intensity bits. The period depends on the Xinc step selected.

2.2.10 Velocity and Position: Digital to Analog Correspondence

For all move vectors, the X and Y rates are maximum and equal to 255 hex.

For one-axis draw vectors, the maximum rate is different for X and Y because the length in millimeters on the screen of the same deltaX and deltaY is different. The maximum X rate is CC hex, and the maximum Y rate is FF (1.44 mA and 1.6 mA).

For a CRT high voltage of 11 kV.

2.2.11 Deflection Non-Linearity

In a CRT the deflection angle is proportional to the deflection coil current. On a flat screen, the spot position is proportional to the tangent of the current. This effect is accounted for by two (X and Y) nonlinear amplifiers, using diode characteristics in the feed-back loop.

2.2.12 X/Y Power Transconductance Amplifier

These amplifiers provide the current for the deflection coils. The current is measured through a shunt resistor of 0.44 Ohm.

The bandwidth depends on the transconductance of the output power MOSFET which changes with the drain-source current.

The amplifier is provided with an OFF command to disable it in case of overheat or when the protection circuitry detects a problem.

The left side panel of the 9424 box is used as the heat sink.

2.2.13 High Voltage Power Supply

The switching fly-back regulator generates 3 voltages: 2.2Kv which is divided by 1000 for the feed-back loop, 600 V and 60 V. The 11 kV is made through a high voltage times five multiplier.

In operation, the current drawn from the 11 kV supply (anode current) may be up to 300 uA. The current causes a voltage drop due to the internal output impedance of the multiplier, up to 500 V. The deflection angle depends slightly on the anode voltage. To compensate for this, the reference point of the regulator is increased proportional to the current drawn.

In order to improve the efficiency, the switching frequency of the regulator is automatically adjusted to the self-resonant frequency of the high voltage transformer which is about 80 kHz.

The supply is equipped with an OFF control line to disable its operation when the protection circuitry detects a fault condition (+- 15 V power drop, +5 V power drop, HV supply defective).

2.2.14 Deflection Yoke

The deflection is realized by a symmetrical coil which represents a 250 uH inductance. It's resonant frequency is 1.2 MHz. In parallel a 1 KOhm resistor is added. The value is given by:

R = 0.5 SQRT (L/C)

It corresponds to the critical damping.

Attached to the coil are four permanent magnets to compensate for the pin cushion effect caused by the coil and the CRT.

2.2.15 Cathode Ray Tube

It is a "10", 90 deg rectangular CRT with a 20 mm neck diameter. The screen is antireflecting. The useful area is 189 * 149 mm^2. The phosphor is orange L5C.

2.2.16 Screen Protection Circuitry

In order to prevent damage to the CRT screen, the intensity Control is set OFF, grid 2 speed-up voltage is set to 0 V and the power amplifier is turned off under one of the following conditions:

- power amplifier temperature above 85 deg centigrade
- +15 and -15 V drops by more than 6 V
- +5 V drops by more than 1 V
- cathode voltage drops by more than 10 V for more than 300 usec
- at reset

In addition, the high voltage regulator is turned off under one of the following conditions:

- +15 V or -15 V drop by more than 6 V
- +5 V drops by more than 1 V
- cathode voltage drops by more than 10 V for more than 300 usec

During the time the reset signal is low, the HV regulator is not turned off in order to allow it to come up.

2.2.17 Operation Status Lines

The ON/OFF state of the power amplifier, HV power supply and the intensity and grid 2 voltage is controlled by four comparators (A22). They drive lines SHUT and ZAMPOFF. The signals XOFF, YOFF and INTOFF are the same and controlled by ZAMPOFF through transistors Q68 to Q70. HVREGOFF is controlled by the line SHUT. Therefore there are two different signals which control the status of the board: ZAMPOFF and SHUT.

The signal SHUT has priority over ZAMPOFF. The line SHUT may pull down ZAMPOFF through diodes D37 to D9. The inverse is not possible.

The line SHUT is the wired OR of the three comparator outputs:

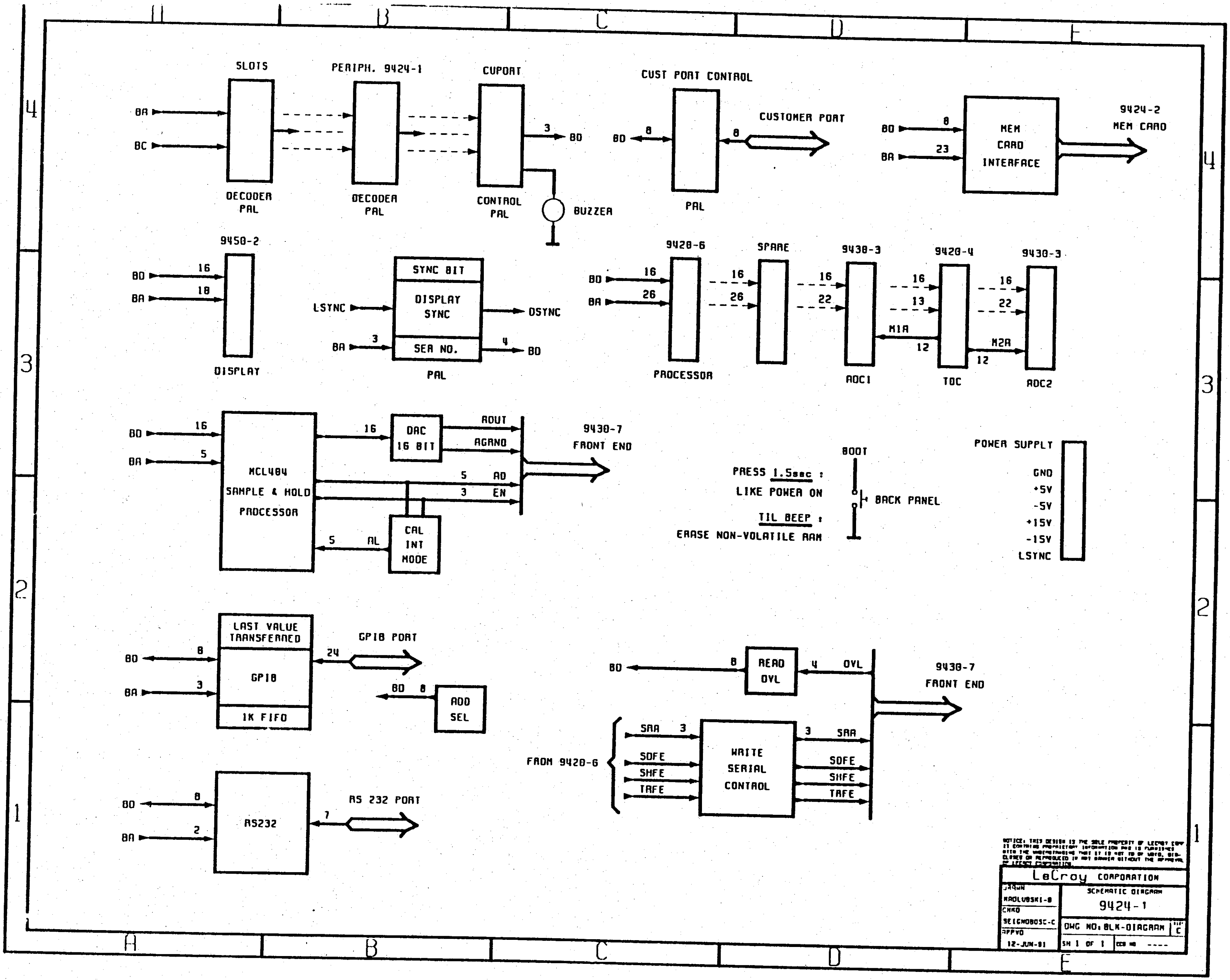
- pin 22 of A22: low if +5 V is less than 4V
- pin 14 of A22: low if +15 V or -15 V drop by more than 6 V
- pin 1 of A22: low if cathode voltage is less than 30 V for more than 300 usec after reset. The time constant is realized by R33, R271, R214 and C1, C131 The input to the comparator, pin 6 of A22, is low at -15 V while the reset is low.

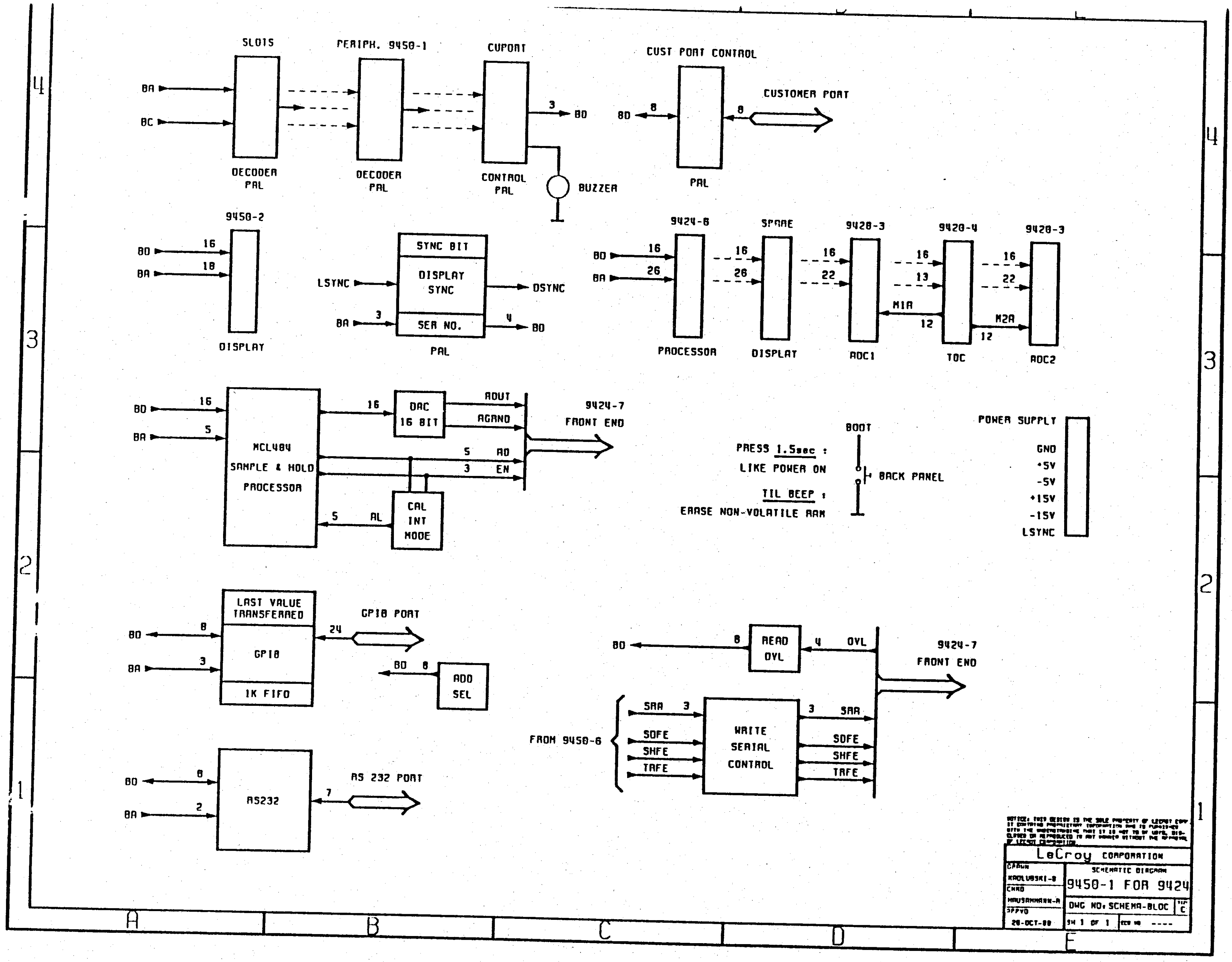
If one of these three lines is low, SHUT is low. If all three lines are high (about -10 V), SHUT is high (-10 V).

The line ZAMPOFF is the wired OR of the three following signals:

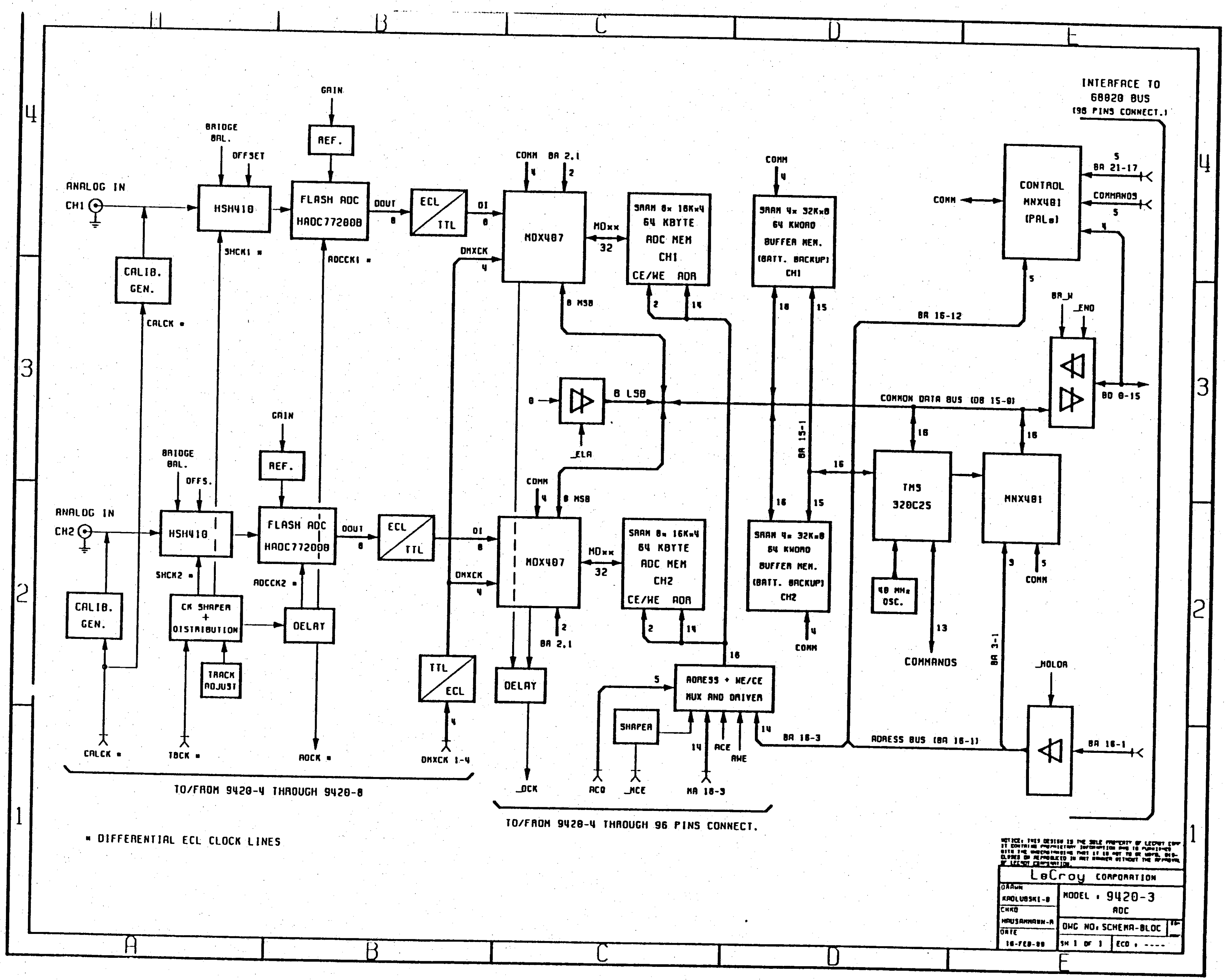
- Thermal switch: pulls down ZAMPOFF if the power amplifier exceeds 85 degree centigrade.
- pin 2 of A22: pulls down ZAMPOFF while reset is low.
- signal SHUT: pulls down ZAMPOFF if low.

If one of these lines is low (-15 V), ZAMPOFF is low. If all three are high (about -10 V), ZAMPOFF is high (about -10 V).


SLOTS
DECODER PAL
PERIPH. 9424-1
DECODER PAL
CUPORT
CONTROL PAL
BUZZER
CUST PORT CONTROL
PAL
CUSTOMER PORT
MEM CARD INTERFACE
9424-2 MEM CARD
9450-2
DISPLAY
SYNC BIT
DISPLAY SYNC
SER NO.
PAL
LSYNC
DSYNC
9420-6
PROCESSOR
SPARE
9430-3
ADC1
9420-4
TDC
9430-3
ADC2
M1A
M2A
MCL484 SAMPLE & HOLD PROCESSOR
DAC 16 BIT
AOUT
AGRND
AD
EN
AL
CAL INT MODE
9430-7 FRONT END
PRESS 1.5sec : LIKE POWER ON
TIL BEEP : ERASE NON-VOLATILE RAM
BOOT
BACK PANEL
POWER SUPPLY
GND
+5V
-5V
+15V
-15V
LSYNC
LAST VALUE TRANSFERRED
GPIB
1K FIFO
GPIB PORT
ADD SEL
RS232
RS 232 PORT
READ OVL
OVL
9430-7 FRONT END
WRITE SERIAL CONTROL
SAA
SOFE
SHFE
TRFE
FROM 9420-6
BD
BA
BC
LeCroy CORPORATION
SCHEMATIC DIAGRAM
9424-1
DWG NO: BLK-DIAGRAM
SH 1 OF 1
12-JUN-81



SLOTS
DECODER PAL
PERIPH. 9450-1
DECODER PAL
CUPORT
CONTROL PAL
BUZZER
CUST PORT CONTROL
PAL
CUSTOMER PORT
9450-2
DISPLAY
SYNC BIT
DISPLAY SYNC
SER NO.
PAL
LSYNC
DSYNC
9424-6
PROCESSOR
SPARE
DISPLAY
9420-3
ADC1
9420-4
TDC
9420-3
ADC2
M1A
M2A
MCL484
SAMPLE & HOLD
PROCESSOR
DAC
16 BIT
AOUT
AGND
AD
EN
CAL
INT
MODE
AL
9424-7
FRONT END
PRESS 1.5sec :
LIKE POWER ON
TIL BEEP :
ERASE NON-VOLATILE RAM
BOOT
BACK PANEL
POWER SUPPLY
GND
+5V
-5V
+15V
-15V
LSYNC
LAST VALUE TRANSFERRED
GPIB
1K FIFO
GPIB PORT
ADD SEL
READ OVL
OVL
9424-7
FRONT END
FROM 9450-6
SAA
SOFE
SHFE
TAFE
WRITE SERIAL CONTROL
RS232
RS 232 PORT
LeCroy CORPORATION
SCHEMATIC DIAGRAM
9450-1 FOR 9424
DWG NO: SCHEMA-BLOC
SH 1 OF 1
28-OCT-88



INTERFACE TO 68020 BUS (96 PINS CONNECT.)
ANALOG IN CH1
ANALOG IN CH2
BRIDGE BAL.
OFFSET
OFFS.
GAIN
REF.
HSH410
FLASH ADC HADC77200B
DOUT
ECL TTL
TTL ECL
DI
MDX487
DMXCK
MDxx 32
SRAM 8x 16Kx4 64 KBYTE ADC MEM CH1 CE/WE ADR
SRAM 8x 16Kx4 64 KBYTE ADC MEM CH2 CE/WE ADR
SRAM 4x 32Kx8 64 KWORD BUFFER MEM. (BATT. BACKUP) CH1
SRAM 4x 32Kx8 64 KWORD BUFFER MEM. (BATT. BACKUP) CH2
CONTROL MNX481 (PAL=)
BA 21-17
COMMANDS
COMM
BA 2,1
8 MSB
8 LSB
_ELA
BA_W
_END
BD 0-15
COMMON DATA BUS (DB 15-0)
BA 16-12
BA 15-1
TMS 320C25
40 MHz OSC.
MNX481
BA 3-1
_HOLDA
BA 16-1
ADRESS BUS (BA 16-1)
BA 16-3
ADRESS + WE/CE MUX AND DRIVER
SHAPER
ACE
AWE
ACQ
_NCE
MA 16-3
DELAY
_DCK
SHCK1 =
SHCK2 =
ADCCK1 =
ADCCK2 =
CALIB. GEN.
CALCK =
CK SHAPER + DISTRIBUTION
TRACK ADJUST
TBCK =
ADCK =
DMXCK 1-4
TO/FROM 9420-4 THROUGH 9420-8
TO/FROM 9420-4 THROUGH 96 PINS CONNECT.
= DIFFERENTIAL ECL CLOCK LINES
LeCroy CORPORATION
DRAWN KROLUBSKI-B
CHKD HAUSAMMANN-A
DATE 16-FEB-88
MODEL : 9420-3
ADC
DWG NO: SCHEMA-BLOC
SH 1 OF 1
ECO : ----

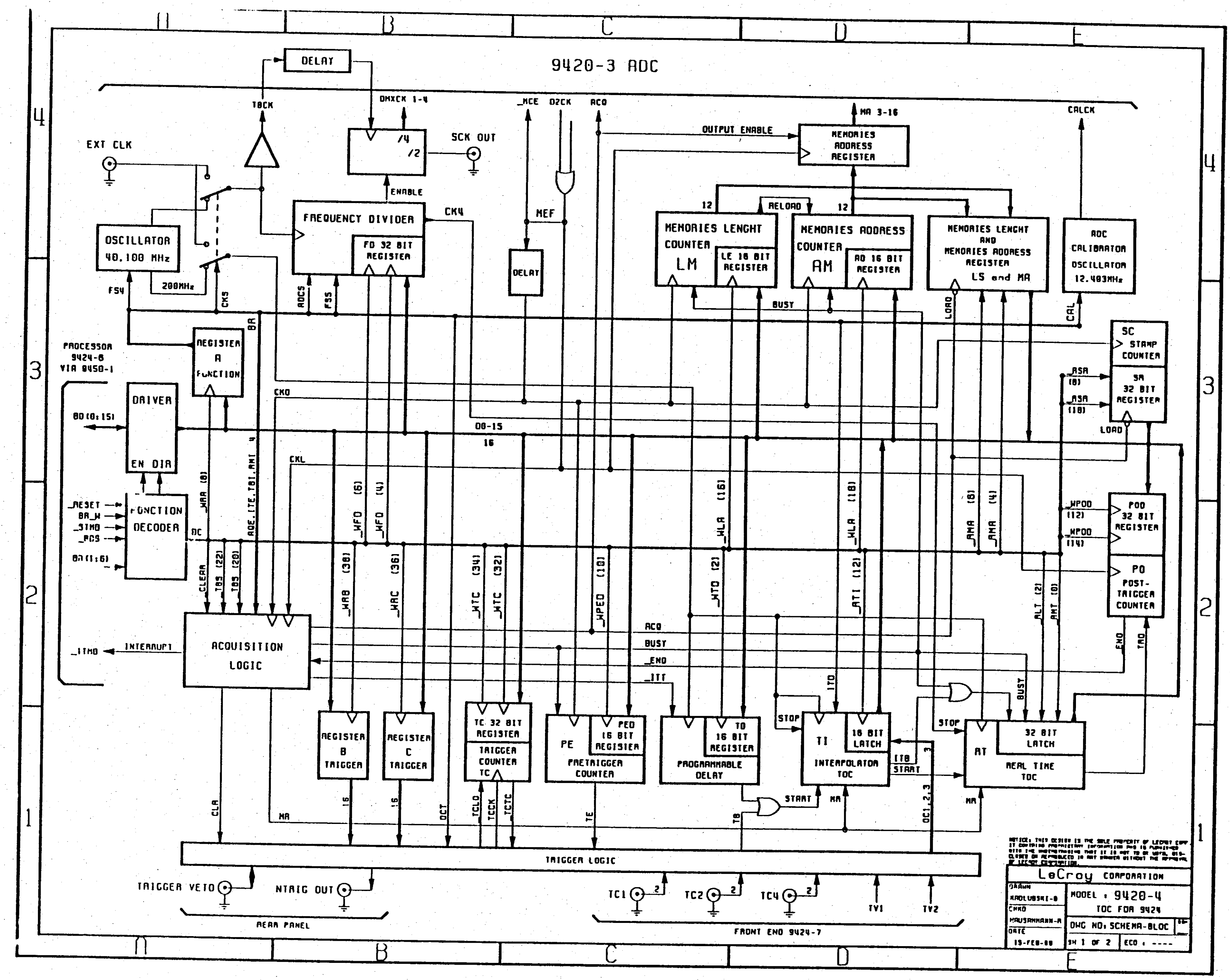
2.5 Sampling Clock Rates vs Time/div

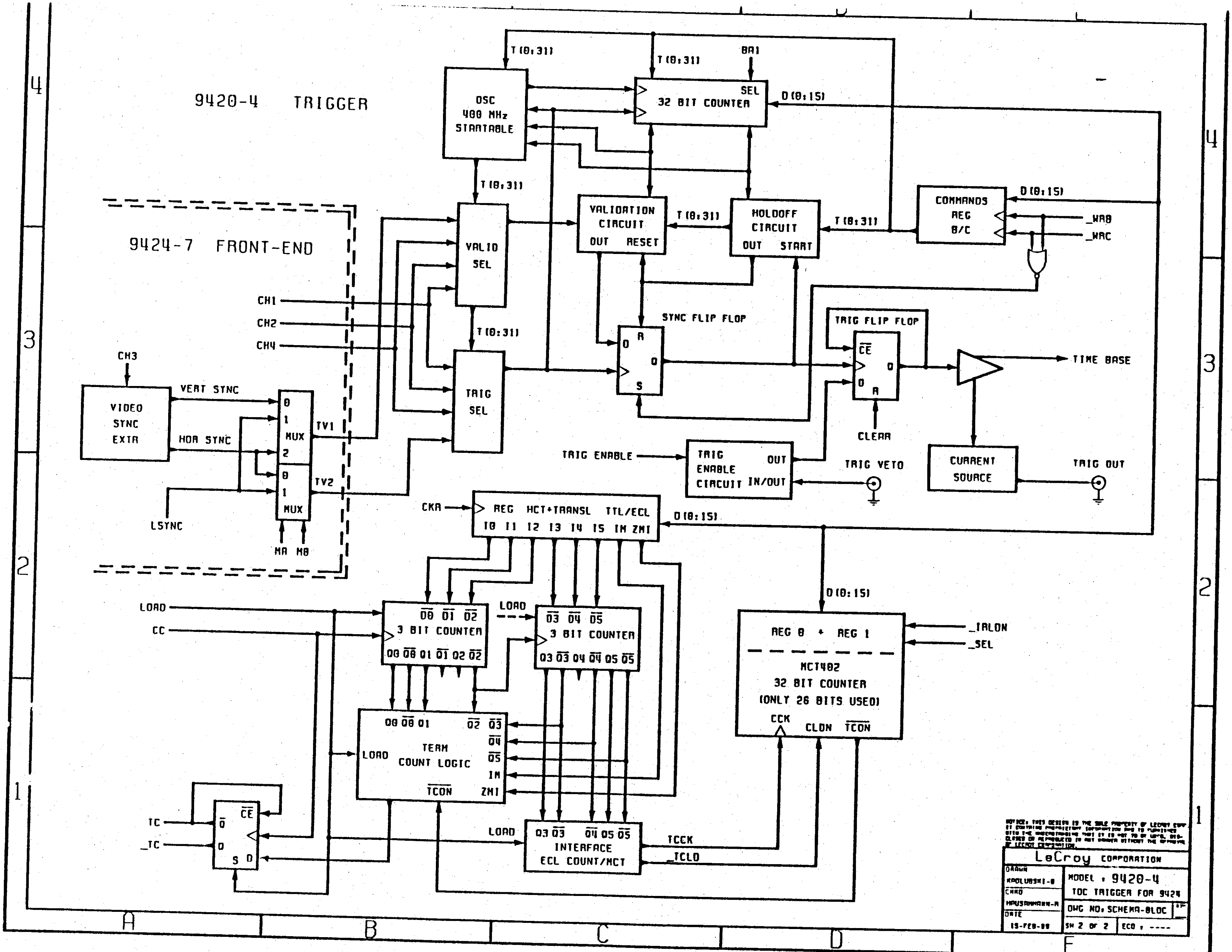
Single-shot:

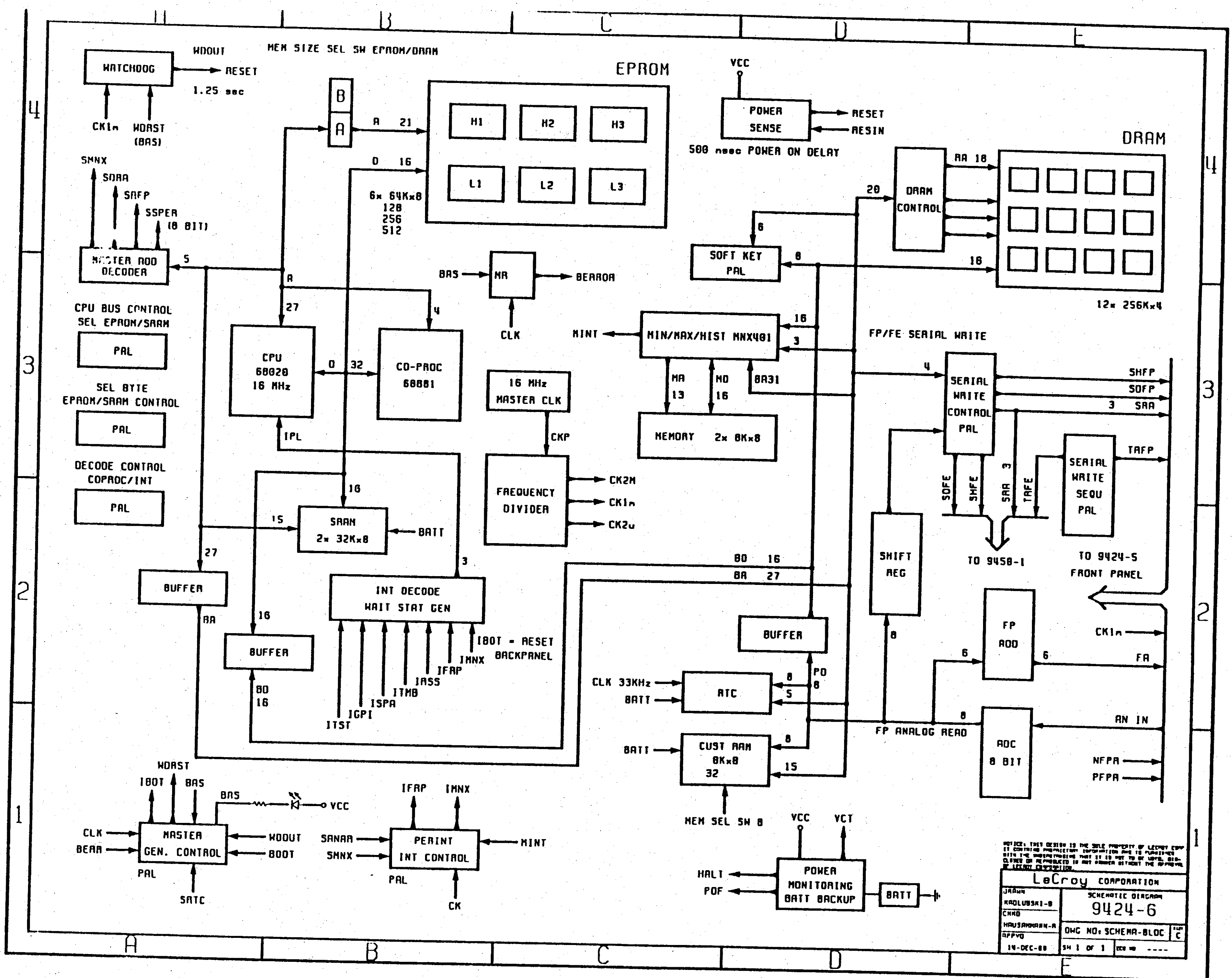
Sampl. Rate Ms/sec	Sample Intvl nsec	Time/div
100	10	50 nsec
		.
		.
100	10.0	50 µsec
40	25	.1 msec
20	50	.2 msec
10	100	.5 msec
4	250	1 msec
2	500	2 msec
1	1000	5 msec
.	.	.
.	.	.
.	.	.
1 Hz	1 sec	5 ksec

RIS:

Sampl. Rate Ms/sec	Equiv. rate Gs/sec	Sample Intvl.	Time/div
100	10	100 psec	1 nsec
			.
			.
100	4	250 psec	1 µsec
100	2	500 psec	2 µsec
100	1	1 nsec	5 µsec
100	.5	2 nsec	10 µsec
100	.2	5 nsec	20 µsec


9420-3 ADC
DELAY
OSCILLATOR 40.100 MHz
FREQUENCY DIVIDER
FD 32 BIT REGISTER
MEMORIES LENGHT COUNTER LM
LE 16 BIT REGISTER
MEMORIES ADDRESS COUNTER AM
AD 16 BIT REGISTER
MEMORIES LENGHT AND MEMORIES ADDRESS REGISTER LS and MA
MEMORIES ADDRESS REGISTER
ADC CALIBRATOR OSCILLATOR 12.483MHz
SC STAMP COUNTER
SA 32 BIT REGISTER
POD 32 BIT REGISTER
PO POST-TRIGGER COUNTER
REGISTER A FUNCTION
DRIVER
EN DIR
FUNCTION DECODER
ACQUISITION LOGIC
REGISTER B TRIGGER
REGISTER C TRIGGER
TC 32 BIT REGISTER
TRIGGER COUNTER TC
PE
PED 16 BIT REGISTER
PRETRIGGER COUNTER
TD 16 BIT REGISTER
PROGRAMMABLE DELAY
TI
16 BIT LATCH
INTERPOLATOR TDC
RT
32 BIT LATCH
REAL TIME TDC
TRIGGER LOGIC
EXT CLK
SCK OUT
TRIGGER VETO
NTRIG OUT
REAR PANEL
TC1
TC2
TC4
TV1
TV2
FRONT END 9424-7
PROCESSOR 9424-8 VIA 9450-1
BD(0:15)
_RESET
BR_W
_STHO
_PCS
BA(1:6)
_ITHD
INTERRUPT
LeCroy CORPORATION
DRAWN KROLUBSKI-B
CHKD HAUSAMMANN-A
DATE 19-FEB-88
MODEL : 9420-4
TDC FOR 9424
DWG NO: SCHEMA-BLOC
SH 1 OF 2
ECO : ----


9420-4 TRIGGER
9424-7 FRONT-END
OSC 400 MHz STARTABLE
32 BIT COUNTER
SEL
BA1
T(0:31)
D(0:15)
VALIDATION CIRCUIT
OUT RESET
HOLDOFF CIRCUIT
OUT START
COMMANDS REG B/C
_WAB
_WAC
VALID SEL
TRIG SEL
SYNC FLIP FLOP
TRIG FLIP FLOP
CE
CLEAR
TIME BASE
CURRENT SOURCE
TRIG OUT
TRIG ENABLE
TRIG ENABLE CIRCUIT
OUT
IN/OUT
TRIG VETO
CH1
CH2
CH4
CH3
VIDEO SYNC EXTR
VERT SYNC
HOR SYNC
LSYNC
MUX
TV1
TV2
MA
MB
CKA
REG HCT+TRANSL TTL/ECL
I0 I1 I2 I3 I4 I5 IM ZM1
LOAD
CC
3 BIT COUNTER
TERM COUNT LOGIC
TCON
INTERFACE ECL COUNT/MCT
TCCK
_TCLO
TC
_TC
REG 0 + REG 1
MC1402
32 BIT COUNTER
(ONLY 26 BITS USED)
CCK
CLON
_IALON
_SEL
LeCroy CORPORATION
DRAWN KPOLUBSKI-B
CHKD HAUSAMANN-R
DATE 15-FEB-89
MODEL : 9420-4
TDC TRIGGER FOR 9424
DWG NO: SCHEMA-BLOC
SH 2 OF 2
ECO : ----



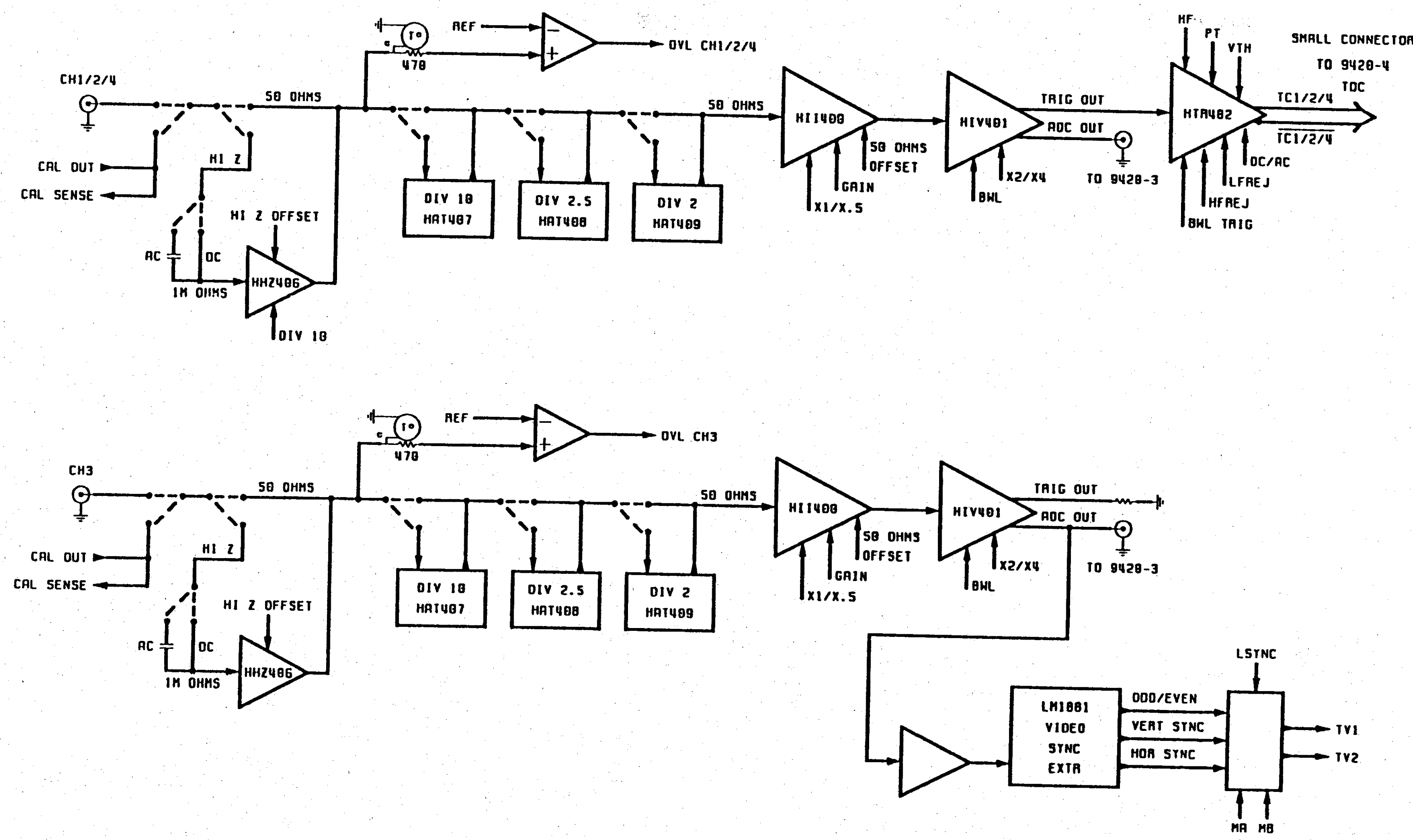
WATCHDOG
WDOUT
RESET
1.25 sec
CK1m
WDRST (BAS)
MEM SIZE SEL SW EPROM/DRAM
EPROM
H1 H2 H3
L1 L2 L3
6x 64Kx8 128 256 512
VCC
POWER SENSE
RESET
RESIN
500 nsec POWER ON DELAY
DRAM
DRAM CONTROL
12x 256Kx4
SOFT KEY PAL
MASTER ADD DECODER
SMNX SDRA SAFP SSPER (8 BIT)
CPU BUS CONTROL SEL EPROM/SRAM
PAL
SEL BYTE EPROM/SRAM CONTROL
PAL
DECODE CONTROL COPROC/INT
PAL
CPU 68020 16 MHz
CO-PROC 68881
IPL
MR
BAS
BERROR
CLK
MINT
MIN/MAX/HIST MNX401
MEMORY 2x 8Kx8
MA 13
MD 16
BA31
16 MHz MASTER CLK
CKP
FREQUENCY DIVIDER
CK2M CK1m CK2u
SRAM 2x 32Kx8
BATT
BUFFER
INT DECODE WAIT STAT GEN
IBOT = RESET BACKPANEL
IMNX IFRP IASS ITMB ISPA IGPI ITST
BD 16
BA 27
BUFFER
RTC
CLK 33KHz
BATT
CUST RAM 8Kx8 32
MEM SEL SW 8
PD
FP/FE SERIAL WRITE
SERIAL WRITE CONTROL PAL
SHFP SDFP SRA
SDFE SHFE SRA TAFE
SERIAL WRITE SEQU PAL
TAFP
TO 9458-1
TO 9424-5 FRONT PANEL
SHIFT REG
FP ADD
FA
CK1m
ADC 8 BIT
AN IN
NFPA PFPA
FP ANALOG READ
MASTER GEN. CONTROL
CLK BERR
WDRST IBOT BAS
WDOUT BOOT
SATC
PAL
VCC
PERINT INT CONTROL
IFRP IMNX
SANAR SMNX
MINT
CK
PAL
POWER MONITORING BATT BACKUP
VCC VCT
HALT POF
BATT
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP
LeCroy CORPORATION
SCHEMATIC DIAGRAM
9424-6
DRAWN KAOLUBSKI-B
CHKD HAUSAMMANN-R
APPVD 14-DEC-88
DWG NO: SCHEMA-BLOC
SH 1 OF 1

HAT 407 · HAT 408 · HAT 409 · HII 400 · HIV 401

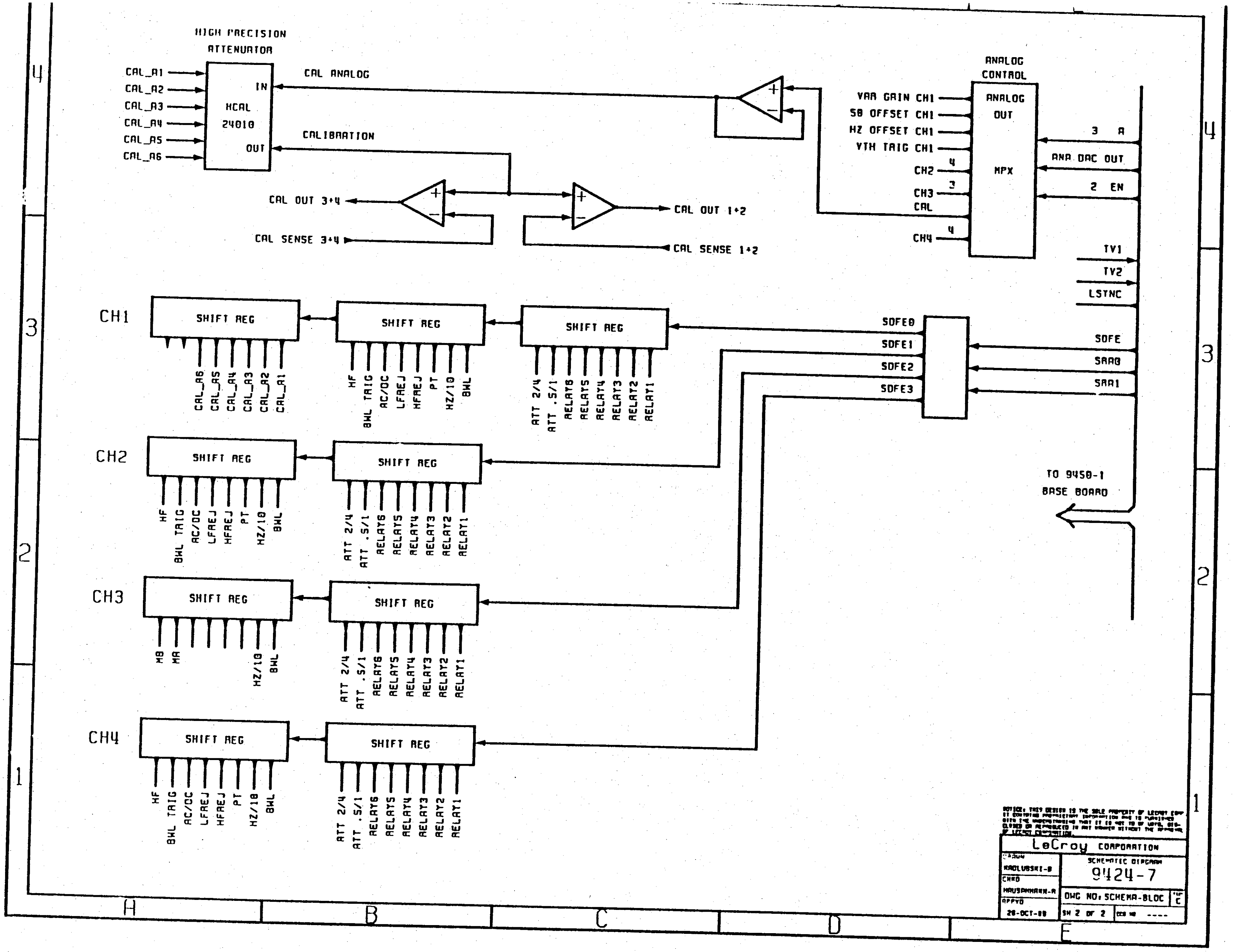
50 Ω

RANGE [mV]	FS [mV]	OFFSET 10v = 600 mV	HAT 407 ÷10	HAT 408 ÷2.5	HAT 409 ÷2	HII 400 input /56Ω	HII 400 x 2		HII 400 ÷2	HII 400 output /37.5 Ω	HIV 401 x 2		HIV 401 ÷2	/37.5 Ω	HIV 401 x 2 / BWL output/25 Ω	GAIN
5	40	± 600 mV				± 20		± 40	OFF	± 40		± 80	OFF	± 80	± 160 mV	8 x
10	80	± 300 mV				± 40		± 80	OFF	± 80		±160	ON			4 x
20	160	± 150 mV				± 80		±160	ON	± 80						2 x
50	400	± 375 mV		ON												0.8
100	800	± 750 mV		ON	ON											0.4
200	1600	± 1500 mV	ON													0.2
500	4000	± 3750 mV	ON	ON												0.08
1000	8000	± 7500 mV	ON	ON	ON											0.04

RANGE [mV]	FS [mV]	HZ÷10	HZ out	HAT 407	HAT 408	HAT 409	HII 400 input				HII 400 output				/37.5 Ω	output/25 Ω	GAIN
50	400	OFF	± 200	OFF	ON		± 80										
100	800	OFF	± 400		ON	ON	± 80				± 80				± 80	± 160	
200	1600	ON	± 80				± 80				± 80				± 80	± 160	
500	4000	ON	± 200		ON		± 80				± 80				± 80	± 160	
1000	8000	ON	± 400		ON	ON	± 80				± 80				± 80	± 160	



LeCroy CORPORATION			
DRAWN KADLUBSKI-B	SCHEMATIC DIAGRAM 9424-7		
CHKD HAUSAMANN-A	DWG NO: SCHEMA-BLOC		C
APPVD 20-OCT-88	SH 1 OF 2	ECO NO ----	


HIGH PRECISION ATTENUATOR
CAL_A1
CAL_A2
CAL_A3
CAL_A4
CAL_A5
CAL_A6
IN
HCAL
24010
OUT
CAL ANALOG
CALIBRATION
CAL OUT 3+4
CAL SENSE 3+4
CAL OUT 1+2
CAL SENSE 1+2
ANALOG CONTROL
ANALOG OUT
MPX
VAR GAIN CH1
SB OFFSET CH1
HZ OFFSET CH1
VTH TRIG CH1
CH2
CH3
CAL
CH4
3 A
ANA DAC OUT
2 EN
TV1
TV2
LSTNC
SOFE
SAA0
SAA1
SOFE0
SOFE1
SOFE2
SOFE3
TO 9450-1 BASE BOARD
CH1
CH2
CH3
CH4
SHIFT REG
CAL_A6
CAL_A5
CAL_A4
CAL_A3
CAL_A2
CAL_A1
HF
BWL TRIG
AC/DC
LFREJ
HFREJ
PT
HZ/10
BWL
ATT 2/4
ATT .5/1
RELAY6
RELAY5
RELAY4
RELAY3
RELAY2
RELAY1
MB
MA
LeCroy CORPORATION
SCHEMATIC DIAGRAM
9424-7
DWG NO: SCHEMA-BLOC
KAOLUBSKI-B
HAUSAMANN-R
20-OCT-88
SH 2 OF 2
C
A
B
C
D
E
1
2
3
4

MODEL 9451-1 POWER SUPPLY

Specifications

Input voltage:	90 to 132 V_{AC}, 180 to 264 V_{AC}, selected by the user
Input frequency:	45 to 440 Hz
Inrush current:	max. 10 A at start-up
Operating temperature range:	0° C to 65° C at full load
Hold-up time:	min. 20 msec, at full load and minimal input
Conducting EMI:	VDE 0871 curve B, IEC 801
Isolation:	VDE 0411/0730/0804/0806, IEC 348/380/435
	3750 V_{AC}, 4000 V_{DC}
	input lines to ground leakage current <5 mA_{AC}, 50 Hz
Input over-voltage protection:	yes
Outputs:	four, with common return (ground)
Output voltage:	out 1, +15 V: +15.00 V ±1%, nom. 3.2 A_{RMS}
	out 2, -15 V: -15.04 V ±1%, nom. 3.8 A_{RMS}
	out 3, +5 V: +5.07 V ±1%, nom. 8.6 A_{RMS}
	out 4, -5 V: -5.16 V ±1%, nom. 10.8 A_{RMS}
Output voltage adjustment:	min. ±5%
Output over-voltage protection:	no
Line regulation:	max. 0.1% at any load
Output voltage regulation:	+15 V and -15 V: ±1% 1.5 A to 4.5 A load
	+5 V: ±1% 6 A to 11 A load
	-5 V: ±1% 9 A to 13 A load
Transient response (100 Hz):	+15 V and -15 V: <0.5 V, 500 µsec: 2 A to 4.5 A
	+ 5 V: <0.2 V, 500 µsec: 6 A to 11 A

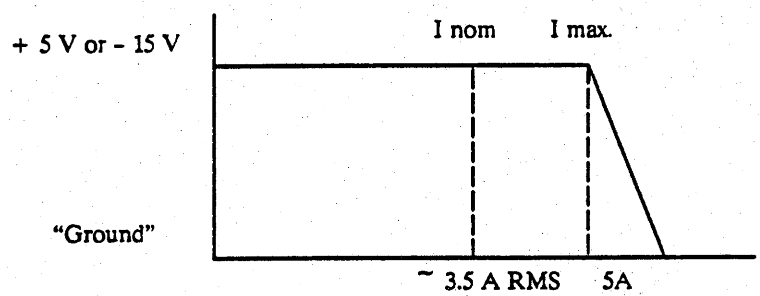
Output ripple and noise: +15 V and -15 V: max. 100 mV_{pp} (100 MHz)

+5 V and -5 V: max. 80 mV_{pp} (100 MHz)

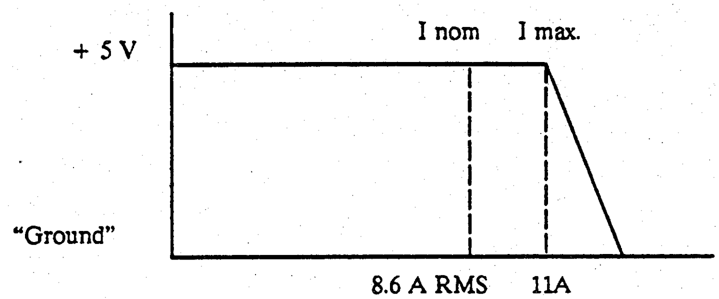
50 Hz output ripple: max. 5 mV

Maximum output current:

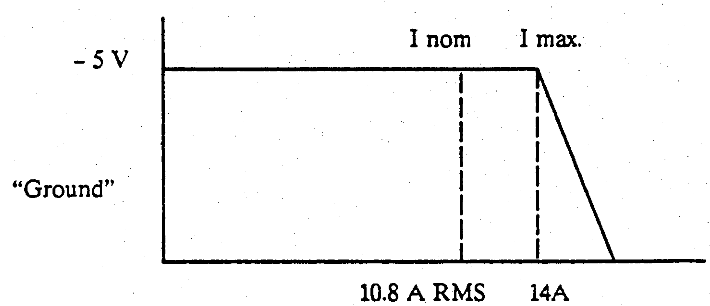
+ 15 V and - 15 V : I max. = 5 A^{-0}_{+1}



+ 5 V : I max. = 11 A^{-0}_{+1}

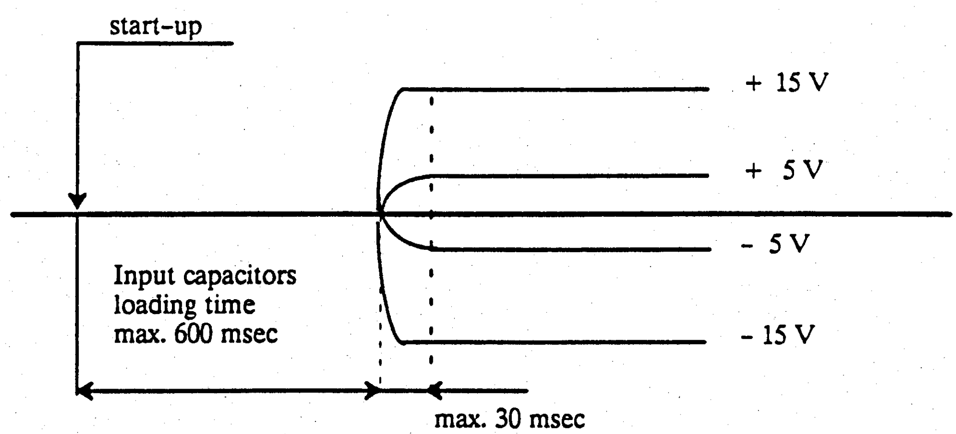


+ 5 V : I max. = 14 A^{-0}_{+1}



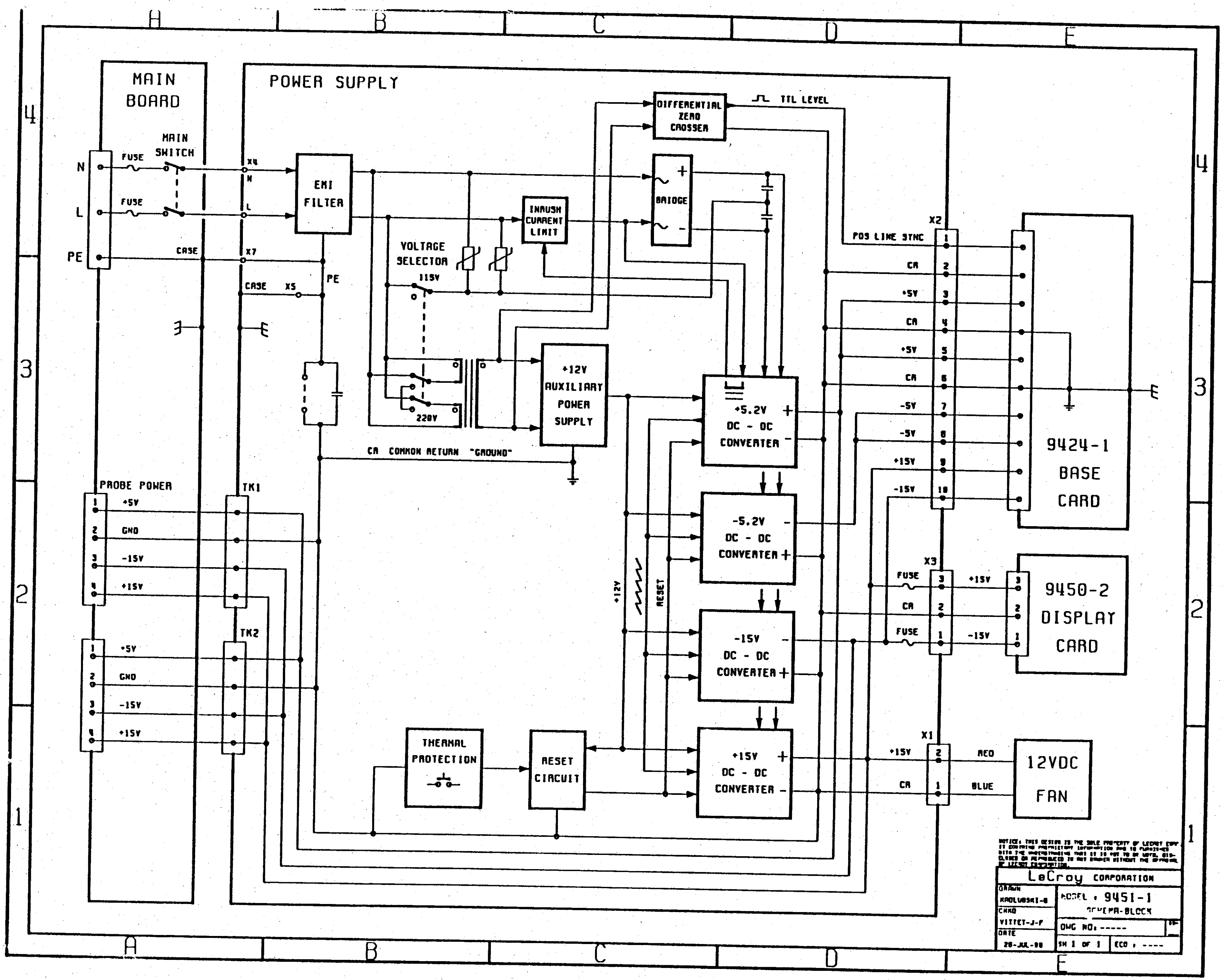
Max. output current adjustment: min. ±20%

Soft-start: input 90 V_{AC}, 45 Hz: outputs $I_{nominal}$



Power output:	nominal 204 W
	maximum 240 W
Line sync output:	square signal, duty cycle 50%, 45 to 440 Hz
	levels: 0 = 0 V , 1 = +5 V
	rise and fall time <100 nsec
	isolation: line-line sync output 2.5 kV_{AC}
Fan power supply output:	15 V_{DC}, max. 0.15 A
Safety:	designed to meet the following international safety requirements: VDE 0411/0730/0804/0806, IEC 348/380/435
Line input connector:	CEE 22/VI (XIV), ASE type 113

X2 Base card connector:	header 10 pins 94V0 material AMP pin assignment 1: positive line sync 2: common return 3 to 5: +5 V 7 to 8: -5 V 4 to 6: common return 9: +15 V 10: -15 V
X3 display cord connector:	header 3 pins, 94V0 material AMP 350789-1 pin assignment 1: -15 V, with fuse slow 2 A 2: common return 3: +15 V, with fuse slow 2 A
X1 Fan connector:	header 2 pins, 94V0 material AMP 350786-1 pin assignment 1: common return 2: +15 V
Probe power connector:	two, located on the switchboard LEMO RA 0304 N pin assignment 1: +5 V 2: ground, common return 3: -15 V 4: +15 V


MAIN BOARD
POWER SUPPLY
MAIN SWITCH
FUSE
N
L
PE
CASE
X4
X7
X5
EMI FILTER
VOLTAGE SELECTOR
115V
220V
INRUSH CURRENT LIMIT
BRIDGE
DIFFERENTIAL ZERO CROSSER
TTL LEVEL
+12V AUXILIARY POWER SUPPLY
CR COMMON RETURN "GROUND"
+5.2V DC - DC CONVERTER
-5.2V DC - DC CONVERTER
-15V DC - DC CONVERTER
+15V DC - DC CONVERTER
+12V
RESET
THERMAL PROTECTION
RESET CIRCUIT
PROBE POWER
+5V
GND
-15V
+15V
TK1
TK2
X2
POS LINE SYNC
CR
-5V
9424-1 BASE CARD
X3
9450-2 DISPLAY CARD
X1
RED
BLUE
12VDC FAN
LeCroy CORPORATION
MODEL : 9451-1
DRAWN
CHKD
DATE
28-JUL-88
DWG NO:
SH 1 OF 1
ECO :

Chapter 3

BASIC PERFORMANCE TEST PROCEDURE

AND

INTERNAL DIAGNOSTICS AND CALIBRATION

Table of contents :

3.1 Basic Performance Test Procedure for the 9424 Digital Oscilloscope

3.1.1 Turn-On

Before switching on the 9424 Digital Storage Oscilloscope (DSO), check that the correct line voltage is set at the rear-panel power selector. Switch on the power using the power switch on the rear panel.
Then check:

- that the display turns on after about 10 seconds
- that the display is stable
- that the range of INTENSITY and GRID INTENSITY is reasonable

Wait for about 20 minutes for the scope to reach a stable operating temperature.

3.1.2 Noise on the Inputs

This is to verify the proper operation of all front-end components. With no signal connected to the inputs, set the DSO as follows:

- turn on traces CH1, CH2, CH3 and CH4
- Grid: single
- Input couplings : 1 MΩ DC
- Input gain: 5 mV/div
- Trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	LINE
Coupling:	AC
Mode:	NORM

- Time/div:	10 msec/div
- BWL:	OFF

Check:

- displayed waveforms should have a constant band of less than 3 minor divisions
- there is no discernible periodic structure

Repeat the test for Time/div = 5 msec/div, 2 msec/div, 1 msec/div, and .5 msec/div and check as above.

3.1.3 Test of the ADCs

This is to verify proper operation of the ADCs at the two nominal sampling frequencies: 100 and 40 Ms/sec.

With all inputs open, set the DSO as follows:

- turn on the CH1 trace
- Grid normal
- Input coupling CH1: 1 MΩ DC
- Input gain 50 mV/div, offset zero
- Trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	LINE
Coupling:	AC
Mode:	NORM

- Time/div = 50, 100 µsec/div

For each of the two time bases above, check for CH1:

- displayed waveform should lie within a band of less than 3 minor divisions
- using the offset control, move the trace for CH1, slowly through the entire range and check that there is no significant change in the displayed trace. Repeat for channel 2, 3 and 4.

3.1.4 Offset

Set the DSO as follows:

- turn on the trace for CH1
- Grid normal
- Input set to GND
- Input gain 5 mV/div, offset zero
- Trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	LINE
Coupling:	AC
Mode:	NORM

- Time/div = 50 µsec/div
- BWL OFF

Switch between 50 Ω DC and GND, and 1 MΩ DC and GND.
Check:

- the trace should not move more than a minor division or 1 mV

Repeat the same test for CH2, CH3 AND CH4.

3.1.5 Input Impedance

Set the DSO CH1 input to 1 MΩ DC with any time base and gain.
Check with an ohmmeter:

- input impedance must be 1 MΩ ± 2%

Set DSO CH1 input to 50 Ω, 20 mV/div with any time base.
Check:

- input impedance must be 50 Ω ± 2%

Repeat 50 Ω test for 50, 100, 200, 500 and 1000 mV/div.

Repeat all impedance checks for CH2, CH3, CH4.

3.1.6 Front-End

Set the DSO as follows:

- turn on the trace for CH1
- Grid normal
- Input 50 Ω, gain 100 mV/div, offset zero
- Trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	CH1
Coupling:	DC
Mode:	NORM
Delay:	50%
Level:	zero

- Time/div = .1 µsec/div
- BWL OFF

Apply a 600 mV p-p 1 MHz square wave from a fast (less than 1 nsec) risetime function generator (for example TEK PG502) to CH1 input. Press the Interleaved Sampling button on the oscilloscope to turn on the RIS mode.

Check:

- There should be no large overshoot at the rising and falling edge:

  50 Ω: less than 10% overshoot

- Check the same at 10 mV/div, input 60 mV p-p

- Repeat the above test for CH2/3/4 .

3.2 Internal Diagnostics and Calibration

The 9424 Internal Diagnostics and Calibration menu is entered by pressing the "Main Menu" button while keeping the lowest menu button depressed.To quickly check the performance of the scope, press the 'CALIBRATION Constants' button and then press 'Full Recalibration'. It is advisable to perform this type of check when the scope is in a stable condition after about 20 minutes of warm-up. Then enter 'Calibration Error Log' and you get a comprehensive summary of the scope's calibration status. If all the error status codes are zero, it is very likely that everything is OK, except for the linearity which is best checked by 'Chan 1+2/3+4 Full Test'. If you find error codes different from zero, you can find more information on the problem from the other 'Constants' menus or from the various 'Curves' menus. Before we turn to a description of the menus relevant to service, let us give the interpretation of the calibration error log.

3.2.1 Calibration Error Log

This is a handy tool to perform a quick but comprehensive internal performance check, without touching the acquisition settings. Just push 'Full Recalibration', then go to 'Calibration Error Log'. The result displayed is independent of your current time base, sensitivity and other acquisition settings. The conditions to be tested are set automatically during the recalibration. The error conditions are coded into binary bits, i.e. each bit set represents a certain error. The error status is represented in a hexadecimal number (= 4 bits = 1 nibble) for each acquisition condition, see Figure 1.

LeCroy

CALIBRATION ERROR LOG

Vertical Calibration
4 nibbles=(BWL OFF,50Ω) (OFF,1MΩ) (ON,50Ω) (ON,1MΩ)
(8=Offset Range, 4=Offset Conv, 2=Gain Range, 1=Gain Conv)

	CHAN1	CHAN2	CHAN3	CHAN4
5 mV	0	0	0	0
10 mV	0	0	0	0
20 mV	0	0	0	0
50 mV	0	0	0	0
.1 V	0	0	0	0
.2 V	0	0	0	0
.5 V	0	0	0	0
1 V	0	0	0	0
TMS Status	Working		Working	

4 nibbles = (unused) (unused) (100Ms) (40Ms)

Trigger Cal. 0 0 0 0

(2=No BWL, 1=BWL)

TDC Calibration 0

Menu: Chan 1+2 CALIB CONST Chan 3+4 | Chan 1+2 FULL TEST Chan 3+4 | Full Re-calibration | Calibration Error Log | More Consts | Return

Figure 1: Calibration Error Log

Vertical Calibration:

BWL ON/OFF and 50/1M input coupling makes 4 acquisition conditions per channel. The error status of each is represented by a nibble (as explained on the display). The 4 error bits have the following meaning:

1=gain convergence: One or more of the 8 nominal DAC calibration points cannot be reached.

2=gain range: A multiplicative calibration parameter becomes too small (dgain < 0.95) such that there may not be sufficient variable gain. Some older units may show this problem at 1 MΩ due to an imprecise switchable attenuation.

4=offset convergence: One or more of the nominal points to calibrate the offset DAC cannot be reached.

8=offset range: the calibration found may go out of DAC range for certain offset values chosen (this problem should never occur at 5/10 mV)

Examples:

Code 303: Gain range and gain conv. problem at 1 MΩ, BWL ON and OFF

Code 4c6d: Offset conv. problem on all 4 coupling conditions
Offset range problem at 1 MΩ BWL ON and OFF
Gain range problem at 50 Ω BWL ON
Gain conv. problem at 1 MΩ BWL ON

TMS status: Status must be 'working'. 'No memory' is indicated if the ADC board is not present. Other fatal messages may come up, like 'TMS broken'.
The following tests report problems for each of the two possible sampling rates (100 Ms/s and 40 Ms/s).

Trigger Calibration:

1=BWL ON
2=BWL OFF

Example:

Code 31: Problem at BWL ON for the two sampling rates.
Problem BWL OFF at 100 Ms.

TDC Calibration:

The Interpolating TDC is calibrated at 40 and 100 Ms/sec. If it is OK, error code is equal to zero.

Examples:

TDC Calibration Code 10: Calibration problem at 100 Ms.

That's all that is required for a quick but complete internal check of the scope. If there remain error codes (not equal to zero), the following menus may be used to get more detailed information on possible problems and failures.

3.2.2 Chan 1+2/3+4 Full Test

The DC non-linearity is analyzed automatically for BWL ON/OFF, 50/1M coupling and both channels for the sampling rate you have set. The last two lines at the bottom of the table list the largest non-linearities found for 5 mV/div and all other gains. The test should be done for the two possible sampling rates 40 and 100 Ms/sec, i.e. for time bases 100 and 50 µsec/div. However, the current sampling rate is not displayed. In order to change the rate, one has to leave the menu and set the time/div appropriate to the required sampling rate, see table in 7.1. At present, the non-linearities should not be larger than 3% for 5 mV/div, and 2% for > 5 mV/div, see Figure 2 and 3.

Before starting CH 1+2/3+4 Full Test, perform a Full Recalibration.

LeCroy

FULL DC NON-LINEARITY ANALYSIS Srate 100Ms/s

Chan 1+2 CALIB CONST Chan 3+4

Chan 1+2 FULL TEST Chan 3+4

Full Re-calibration

Calibration Error Log

More Consts

Return

BW-Limit	CH1 OFF	CH1 ON	CH2 OFF	CH2 ON
50 Ω: Max. Deviations (in %)				
5 mV	-.6/ .4	-.9/ -.1	-.5/ .4	-.3/ .4
10 mV	-.7/ .2	-.4/ .3	-.5/ .3	-.4/ .2
20 mV	-.5/ .2	-.4/ .2	-.4/ .1	-.4/ .2
50 mV	-.6/ .2	-.4/ .2	-.6/ .0	-.2/ .2
.1 V	-.5/ .2	-.4/ .1	-.6/ .1	-.4/ .4
.2 V	-.6/ .2	-.5/ .2	-.5/ .0	-.2/ .9
.5 V	-.4/ .2	-.3/ .2	-.5/ .1	-.1/ .2
1 V	-.4/ .1	-.2/ .3	-.4/ .4	-.2/ .6
1 MΩ: Max. Deviations (in %)				
5 mV	-1.3/ -.1	-.8/ .4	-.2/ .5	-.3/ .4
10 mV	-.7/ .2	-.7/ .3	-.4/ .2	-.4/ .9
20 mV	-.7/ .9	-.5/ .2	-.4/ .0	-.2/ .2
50 mV	-.6/ .2	-.8/ .3	-.3/ .0	-.3/ .4
.1 V	-.8/ .2	-.5/ .4	-.3/ .1	-.3/ .2
.2 V	-.6/ .2	-.6/ .2	-.6/ .1	-.3/ .4
.5 V	-.6/ .2	-.4/ .2	-.6/ .1	-.3/ .4
1 V	-.6/ .2	-.5/ .4	-.4/ .3	-.2/ .4
Summary 5mV	**	-1.3/ 0.4 **	**	-0.5/ 0.5 **
> 5mV	**	-0.8/ 0.4 **	**	-0.6/ 0.6 **

Figure 2: CH 1+2 Linearity Analysis

LeCroy

FULL DC NON-LINEARITY ANALYSIS Srate 100Ms/s

BW-Limit	CH3 OFF	CH3 ON	CH4 OFF	CH4 ON
50 Ω: Max. Deviations (in %)				
5 mV	-.5/ .9	-.4/ .9	-.4/ .4	-.3/ .4
10 mV	-.5/ .5	-.3/ .6	-.6/ .1	-.6/ .2
20 mV	-.4/ .4	-.2/ .5	-.4/ .3	-.4/ .2
50 mV	-.4/ .3	-.3/ .4	-.5/ .1	-.4/ .1
.1 V	-.4/ .3	-.4/ .5	-.6/ .2	-.5/ .3
.2 V	-.3/ .1	-.2/ .4	-.4/ .1	-.5/ .0
.5 V	-.4/ .3	-.4/ .6	-.5/ .2	-.4/ .2
1 V	-.5/ .4	-.4/ .7	-.7/ .3	-.7/ .3
1 MΩ: Max. Deviations (in %)				
5 mV	-.3/ .7	-.1/ .4	-.5/ .4	-.4/ .3
10 mV	-.4/ .2	-.0/ .3	-.5/ .1	-.3/ .3
20 mV	-.2/ .2	-.1/ .2	-.3/ .1	-.3/ .1
50 mV	-.3/ .1	-.0/ .3	-.5/ .0	-.4/ .1
.1 V	-.3/ .1	-.1/ .2	-.5/ .2	-.3/ .0
.2 V	-.4/ .2	-.1/ .4	-.4/ .2	-.3/ .2
.5 V	-.2/ .2	-.0/ .4	-.4/ .1	-.2/ .1
1 V	-.2/ .3	.0/ .4	-.4/ .2	-.3/ .1
Summary 5mV	**	-0.5/ 0.9	**	** -0.5/ 0.4 **
> 5mV	**	-0.5/ 0.7	**	** -0.7/ 0.3 **

Chan 1+2
CALIB CONST
Chan 3+4

Chan 1+2
FULL TEST
Chan 3+4

Full Re-
calibration

Calibration
Error Log

More Consts

Return

Figure 3: CH 3+4 Linearity Analysis

3.2.3 Chan 1+2/3+4 Gain Curves

The variable gain curve is displayed for two channels for the acquisition parameters set. The center line is at inverse gain 1.75 (e.g. 1.75 V/div total gain for fixed gain at 1 V/div) and vertical units are 0.25/div. So the top border is at 2.75 and the bottom at 0.75. Horizontally the curve goes from DAC -8 V at the left to 0 V at the right. The curves should be smooth and go well above the inverse gain 2.5 and 1.0 limits indicated, where the variable gain is at .4 and 1., see figure 4 and 5.

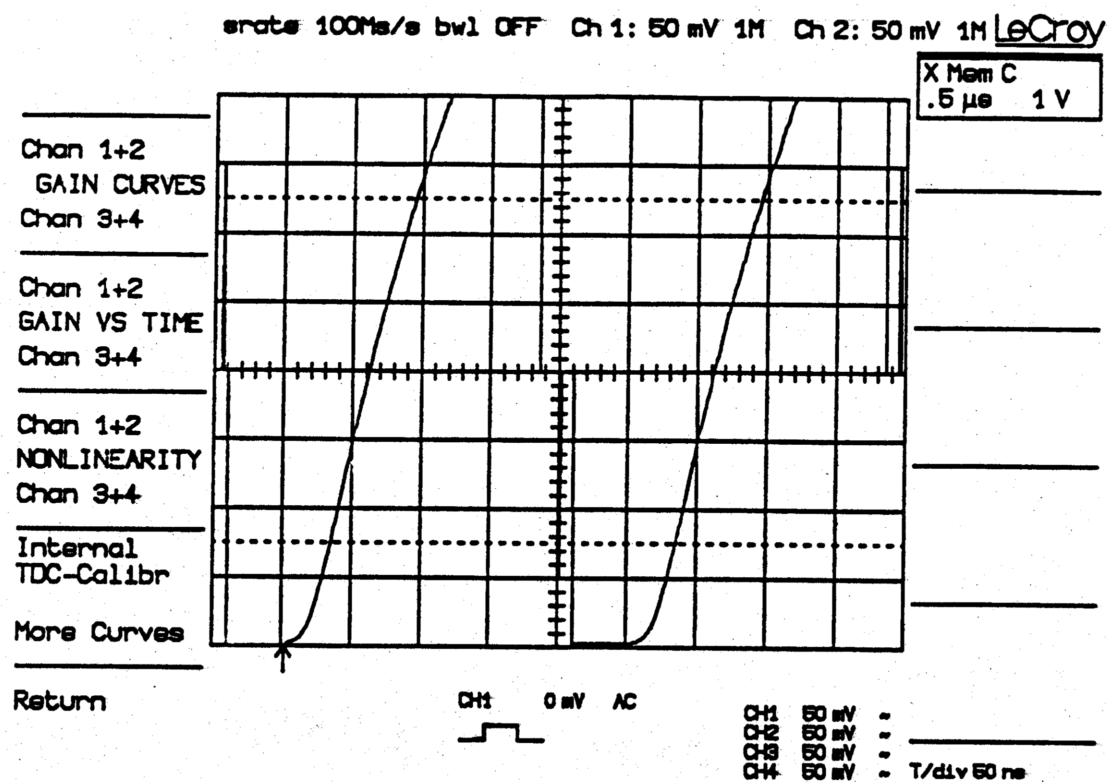


Figure 4: CH 1+2 Gain Curves

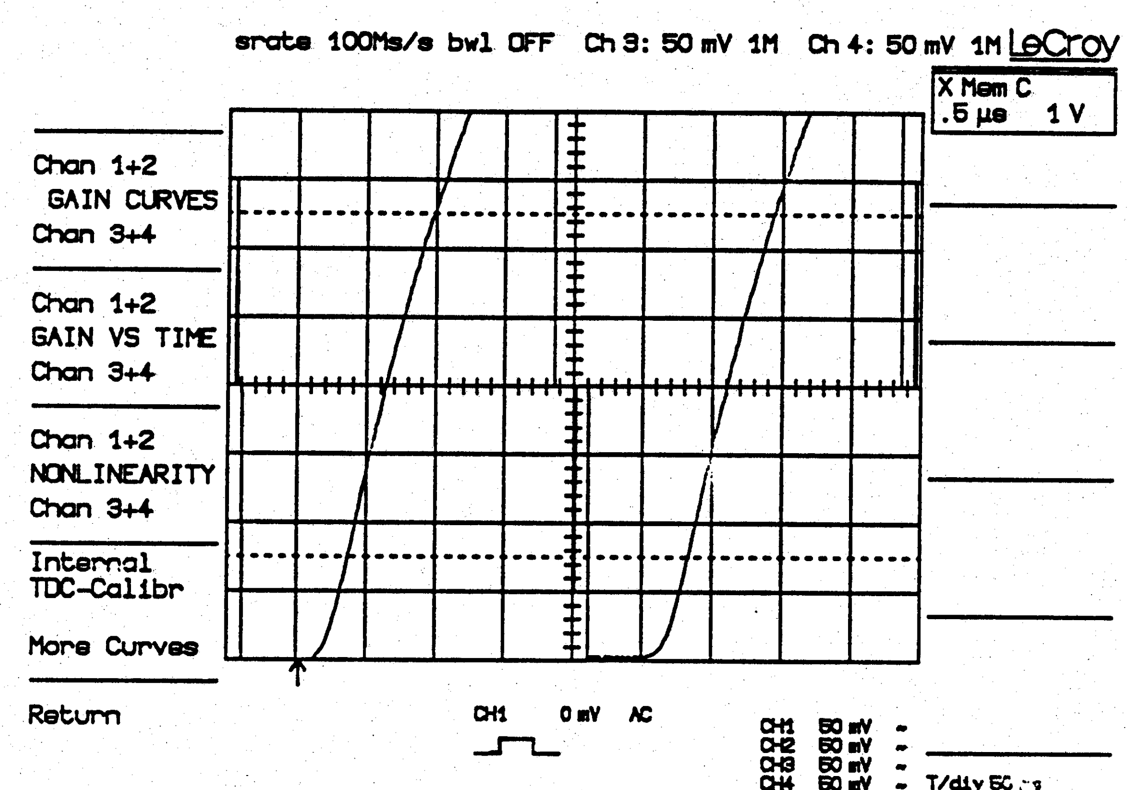


Figure 5: CH 3+4 Gain Curves

3.2.4 Chan 1+2/3+4 Gain vs Time

The gain variations over time are displayed for both channels for the acquisition parameters set. One vertical div is 0.5%. At present, the variations should stay within ± 3%, see Figure 6 and 7.

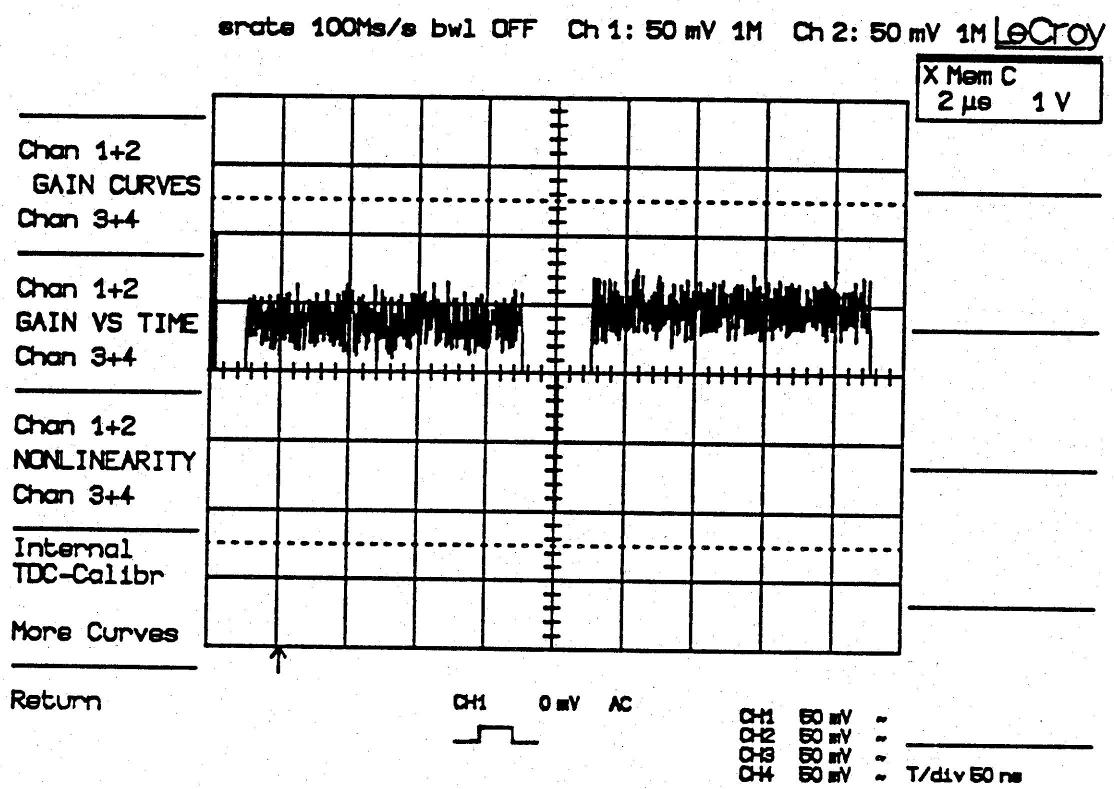


Figure 6: CH 1+2 Gain vs Time

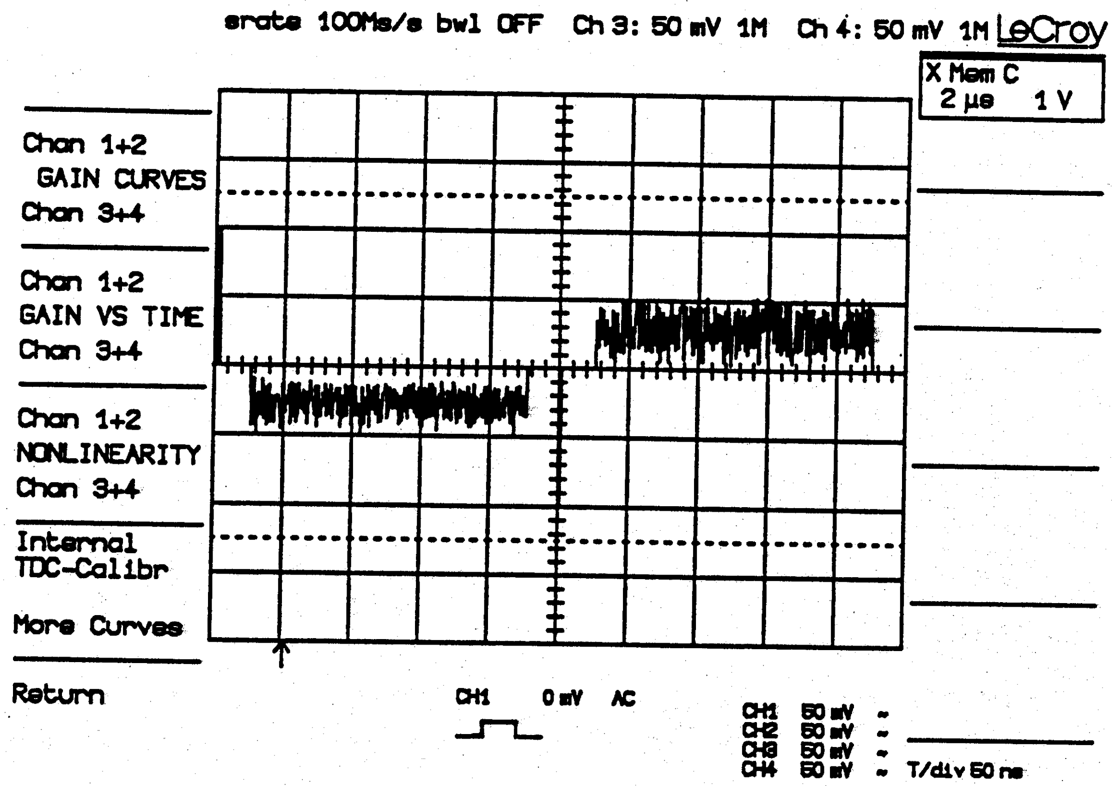


Figure 7: CH 3+4 Gain vs Time

3.3.1 Bandwidth at 50 Ω Input Impedance

The purpose of this test is to ensure that the entire 9424 system has a bandwidth of at least 350 MHz at 50 Ω input impedance.

Set up a Leveled Sine Wave Generator (for example Marconi 2019A):
- Frequency .5 MHz
- Amplitude 2.8 V p-p (maximum for Marconi)

Connect the generator output to CH1 input.

Turn off all the traces, except CH1.

Set the trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	CH1
Coupl:	HF
Mode:	NORM
Delay:	zero
Level:	zero

Set input CH1:

Coupl:	50 Ω
Gain:	1V/div
Var Gain:	1
Offset:	zero

Set the time base:

-Time/div	.5 µsec/div
-Interleaved	ON

Bandwidth limit:	OFF

Adjust the generator output amplitude and CH1 offset to get a 5 division p-p sine wave, or maximum possible from the generator for the large V/div gains (Marconi 2.8 V p-p maximum).

Increase the generator frequency, while decreasing the Time/div until the sine wave p-p amplitude is .7 * 5 divisions = 3.5 divisions (3 dB point), or 70% of the initial amplitude at .5 MHz.

Check:

- the frequency of the generator must be at least 350 MHz

Repeat the above for CH1, CH2, CH3 and CH4 for input Volts/div = .5 V, .2 V, .1 V, 50 mV, 20mV, 10 mV, 5 mV.

Set the bandwidth limiter ON.

Repeat the same test as for the bandwidth limiter OFF.

Check:

- the frequency of the generator at the 3 dB point must be 70 MHz ± 20%

3.3.2 Bandwidth at 1 MΩ Input Impedance (at Probe Tip)

The purpose of this test is to ensure that the entire 9420 system has a bandwidth of at least 200 MHz at probe tip at 1 MΩ input impedance.

Set up a Tektronix SG 503 Leveled Sine Wave Generator or equivalent (note for the Marconi that the maximum amplitude is smaller than 5 V):

- Frequency .5 MHz
- Amplitude 5 V p-p

Terminate the output of the SG 503 via a 50 Ω feedthrough and connect it to the CH1 input through a 300 MHz 10 MΩ /10 probe using the probe tip - BCN jack. Make sure the probe has a 300 MHz bandwidth (for example our model P9020 M15x10HF), and is perfectly adjusted, low frequency and high frequency (see brochure enclosed with probe).

Turn off all the traces except CH1.

Trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	CH1
Coupl:	HF
Mode:	NORM
Delay:	zero
Level:	zero

Set the input of CH1:

- Coupl:	1 MΩ AC
- Gain:	.1 V/div
- Var:	Gain 1
- Offset:	zero

Set the time base:

- Time/div	.5 µsec/div
- Interleaved	ON

Bandwidth limit OFF

Adjust the SG 503 output amplitude and the CH1 offset to provide a 5 division p-p sine wave.

Increase the SG 503 frequency, while decreasing the Time/div until the sine wave p-p amplitude is .7 * 5 divisions = 3.5 divisions (3 dB point).

Check:

- the frequency of the SG 503 must be at least 200 MHz

Repeat the above for CH1, CH2, CH3 and CH4 for input Volts/div = 50 mV, 20 mV, 10 mV, and 5 mV.

Set the bandwidth limiter ON.

Repeat the same test as for bandwidth limiter OFF.

Check:

- the frequency of the SG 503 at the 3 dB point must be 70 MHz ± 20%

3.4 Manual linearity test using an external high precision voltage source.
NIST traceable calibration

In absence of the computer automated calibration system based on CALSOFT2 for the 9424 model oscilloscope, the manual Performance Test Procedure can be followed for establishing an NIST traceable calibration, provided the measurement instruments used are NIST traceable calibrate.

For an NIST calibration, follow the manual linearity test procedure using a calibrated and certified high precision (better than 0.1%) voltage source, for example TEK PS5004 supported by CALSOFT2.

Manual linearity Test Procedure

Set scope to:

Single Grid ON

Ch to be tested ON, offset 0

2 msec/div

BWL ON

Pulse parameters ON

LINE trigger

SMART trigger OFF

For each V/div and both 50 Ohm and 1 M Ohm DC coupling and for all channels separately, check the following:

Apply to the CH to be tested a DC voltage from the high precision voltage source with the following three values one after the other: 0, + 3 major screen divisions, - 3 major screen divisions. For each point, read off the 'Mean' parameter voltage and compare to the digital read-out of the voltage reference.

The difference of the two values in volts should be within 2% of full scale of the scope.

3.5 Trigger Level for DC and HFRej

Set up any sine wave generator, capable of generating sine waves to 500 Hz, for example Intron IFG-422 or Topward TFG-8101:

- frequency 500 Hz

Connect the output of the generator to CH1.

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

SMART (COMPLEX) Trigger:	OFF
Source:	CH1
Coupl:	DC
Mode:	NORM
Delay:	50% Pretrigger
Level:	zero

Set the input CH1:

- Coupl:	1 MΩ, DC
- Gain:	.5 V/div
- Var:	Gain 1
- Offset:	zero

Set the time base:

- Time/div:	.2 msec/div

Adjust the sine wave generator's output amplitude to get 8 divisions p-p, corresponding to a 2 V amplitude. It is important that the offset of the input is set to zero (use Panel Status to verify). Use the offset adjustment of the sine wave generator to center the signal with respect to the screen.

Check:

- the sine wave must pass through the horizontal center of the screen (50% pretrigger line) at the vertical position zero (vertical center) within ± 3 minor divisions

Repeat for the following conditions:

- trigger slope POS and NEG (verify slope at check point)

- trigger coupling DC and HFRej

Set the trigger level to + 1.5 V.

Check:

- the sine wave must pass the horizontal center at + 3 divisions within ± 3 minor divisions

Repeat for the following conditions:

- trigger slope POS and NEG (verify slope at check point)

- trigger coupling DC and HFRej

Set the trigger level to - 1.5 V.

Check:

- the sine wave must pass the horizontal center at - 3 divisions within ± 3 minor divisions

Repeat for the following conditions:

- trigger slope POS and NEG (verify slope at check point)

- trigger coupling DC and HFRej

Disconnect the input from CH1 and connect it to input of CH2.

Turn off all the traces except for CH2.

Set input CH2:

- Coupl:	1 MΩ, DC
- Gain:	.5 V/div
- Var:	Gain 1
- Offset:	zero

Set the trigger source to CH2.

Repeat the above check procedure for CH2 then for CH4.

3.6 Smart/Complex Trigger

3.6.1 Trigger on Pulse Width >, <

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

Smart/Complex Trigger:	ON
Trigger Type:	SINGLE SOURCE
Width Type:	PULSE WIDTH
Source:	CH1
Coupl:	AC
Slope:	+
Level:	zero
Delay:	20% Pretrigger

Set the input of CH1:

- Coupl:	50 Ω
- Gain:	.5 V/div
- Var:	Gain 1
- Offset:	zero

Set the time base:

- Time/div:	20 nsec/div
- Interleaved:	ON

Apply sine wave signal 3 V p-p of 75 MHz. Adjust PULSE Width to 7.5 nsec for both < and >, and switch between WIDTH < and WIDTH >.

Check:

- Width < 7.5 nsec	scope should trigger
- Width > 7.5 nsec	scope should NOT trigger

Set the sine wave generator to 230 MHz. Adjust PULSE WIDTH to 2.5 nsec and switch between WIDTH < and WIDTH >.

Check:

- Width < 2.5 nsec	scope should trigger
- Width > 2.5 nsec	scope should NOT trigger

Repeat the above test for CH2 and CH4.

3.6.2 Trigger on Interval Width <

Set up the DSO:

Turn off all the traces except CH1.

Set trigger:

- Smart/Complex Trigger	ON
- Trigger Type	SINGLE SOURCE
- Width Type	INTERVAL WIDTH
- Source	CH1
- Coupl	AC
- Slope	+
- Level	zero
- Delay	20% Pretrigger

Set the input of CH1:

- Coupl	50 Ω
- Gain	.5 V/div
- Var	Gain 1
- Offset	zero

Set the time base:

- Time/div	2 nsec/div
- Interleaved ON	

Apply a sine wave signal 3 V p-p of 200 MHz to CH1. Turn to INTERVAL Width < and adjust width to 10 nsec.

Check:

- 200 MHz: Width < 10 nsec, scope should trigger

- 110 MHz: Width < 10 nsec, scope should trigger

- 91 MHz: Width < 10 nsec, scope should NOT trigger

Set frequency to 74 MHz and INTERVAL Width to < 15 nsec.

Check:

- 74 MHz: Width < 15 nsec, scope should trigger

- 61 MHz: Width < 15 nsec, scope should NOT trigger

Repeat the above test for CH2 and CH4.

3.6.3 Trigger on Interval Width >

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

- Smart/Complex Trigger	ON
- Trigger Type	SINGLE SOURCE
- Width Type	INTERVAL WIDTH
- Source	CH1
- Coupl	AC
- Slope	+
- Level	zero
- Delay	20% Pretrigger

Set the input of CH1:

- Coupl	50 Ω
- Gain	.5 V/div
- Var	Gain 1
- Offset	zero

Set the time base:

- Time/div	5 nsec/div
- Interleaved	ON

Apply sine wave signal 3 V p-p of 100 MHz to CH1. Turn to INTERVAL Width > and adjust width to 25 nsec.

Check:

- 100 MHz: Width > 25 nsec, scope should NOT trigger

- 44 MHz: Width > 25 nsec, scope should NOT trigger

- 37 MHz: Width > 25 nsec, scope should trigger

Set the frequency to 40 MHz and INTERVAL Width to > 27.5 nsec.

Check:

- 40 MHz: Width > 27.5 nsec, scope should NOT trigger

- 33 MHz: Width > 27.5 nsec, scope should trigger

Repeat the above test for CH2 and CH4.

3.7 Time Base Accuracy

3.7.1 Manual Time Base Test

In order to verify the time base, use a sine wave generator of 1 MHz with a frequency accuracy of better than 10 ppm (for example Marconi 2019A).

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

- SMART (COMPLEX) Trigger	OFF
- Source	CH1
- Coupl	DC
- Mode	NORM
- Slope	+
- Delay	0%
- Level	zero

Set the input of CH1:

- Coupl	50 Ω
- Gain	.5 V/div
- Var	Gain 1
- Offset	zero

Set the time base:

- Time/div	2 μsec/div
- Interleaved	ON

Set the sine wave generator to 1 MHz and put a signal on to CH1. Adjust amplitude to get about a 6 division p-p signal.

Select trigger mode SINGLE (HOLD).

Turn DUAL GRID ON.

Turn ON EXPAND A with CH1 as the source.

Adjust TIME MAGNIFIER to .1 μsec/div.

Turn horizontal POSITION on DISPLAY CONTROL to select the 3rd period of the displayed waveform.

Put the expanded trace on the second grid using the vertical POSITION knob, see Figure 8.

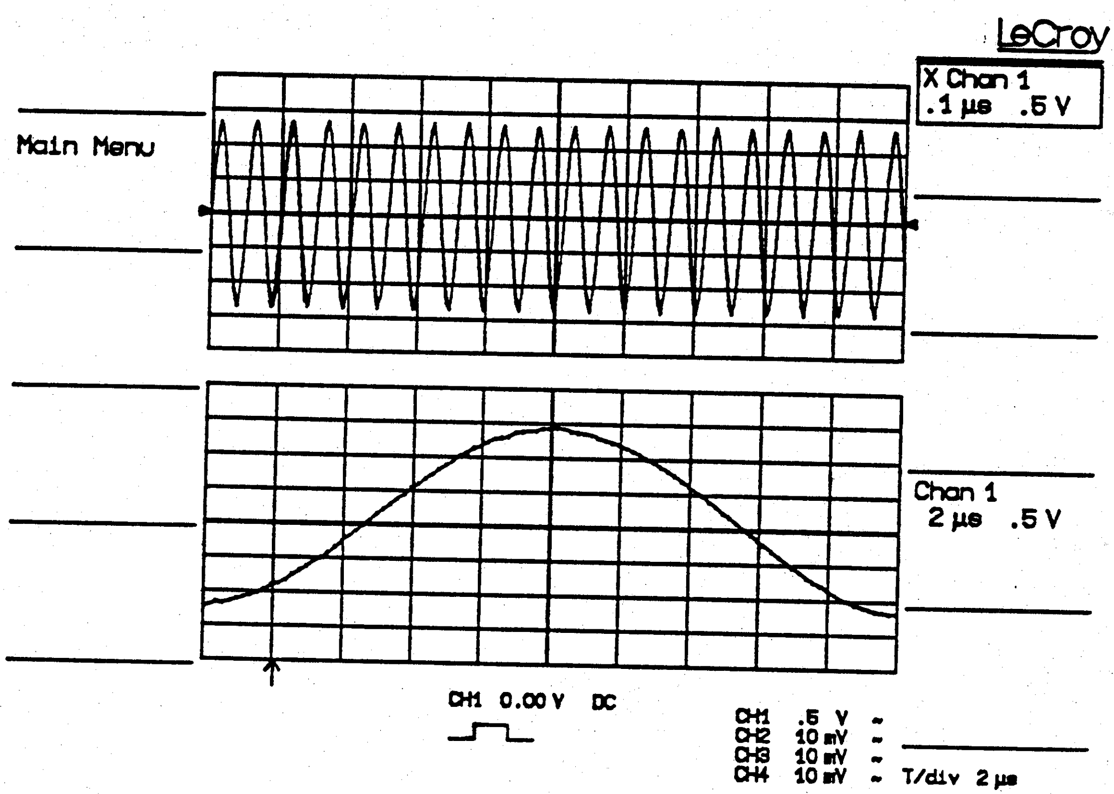


Figure 8: 3rd Period Expanded

Turn ON EXPAND B with CH1 as the source.

Adjust TIME MAGNIFIER to .1 µsec/div.

Turn the horizontal POSITION on DISPLAY CONTROL to select the 13th period.

Overlay the 2 expanded traces on the lower grid using vertical and horizontal POSITION knobs on DISPLAY CONTROL, see Figure 9.

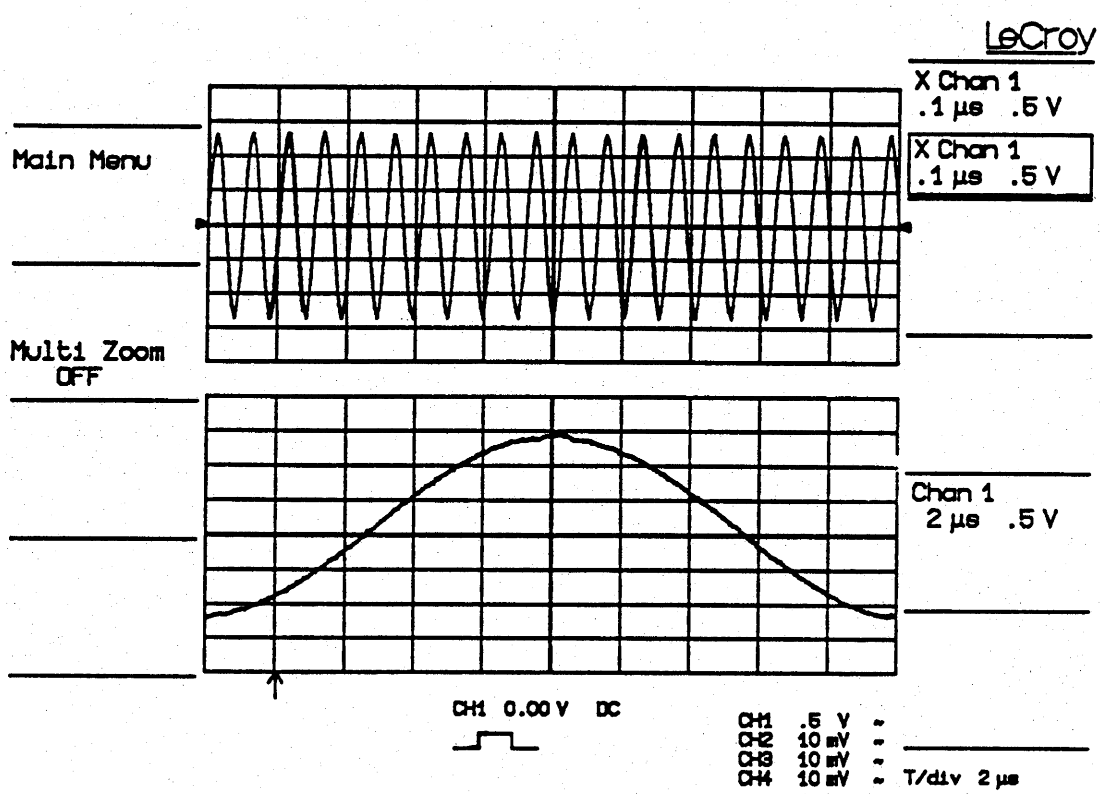


Figure 9: 3rd and 13th period overlaid

Measurement of the time difference:

- turn the RELATIVE TIME CURSORs ON
- put the REFERENCE cursor on top of the 3rd period (check on upper grid)
- Put the DIFFERENCE cursor on top of the 13th period (check on upper grid) and adjust alignment of the two cursors (check on lower grid), see Figure 10.

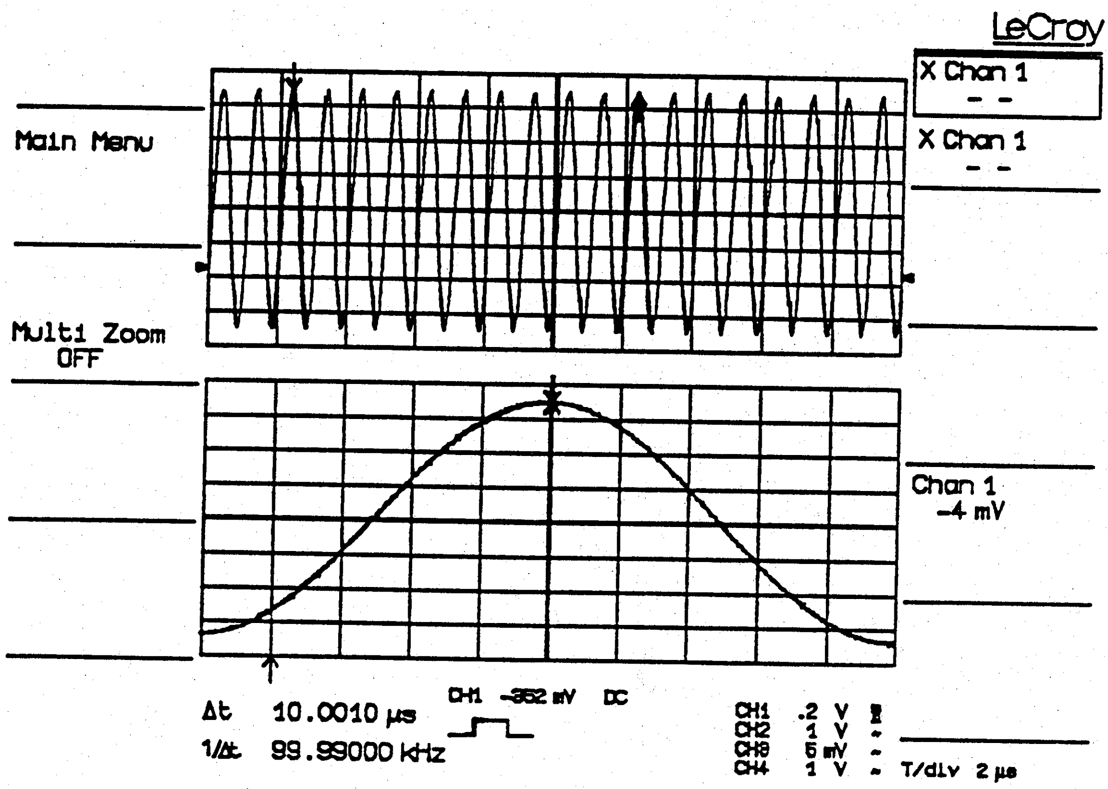


Figure 10: Aligned cursors

Turn DUAL ZOOM ON.

Turn TIME MAGNIFIER (DISPLAY CONTROL) to select the maximum expansion. Refine adjustment of the two cursors, see Figure 11.

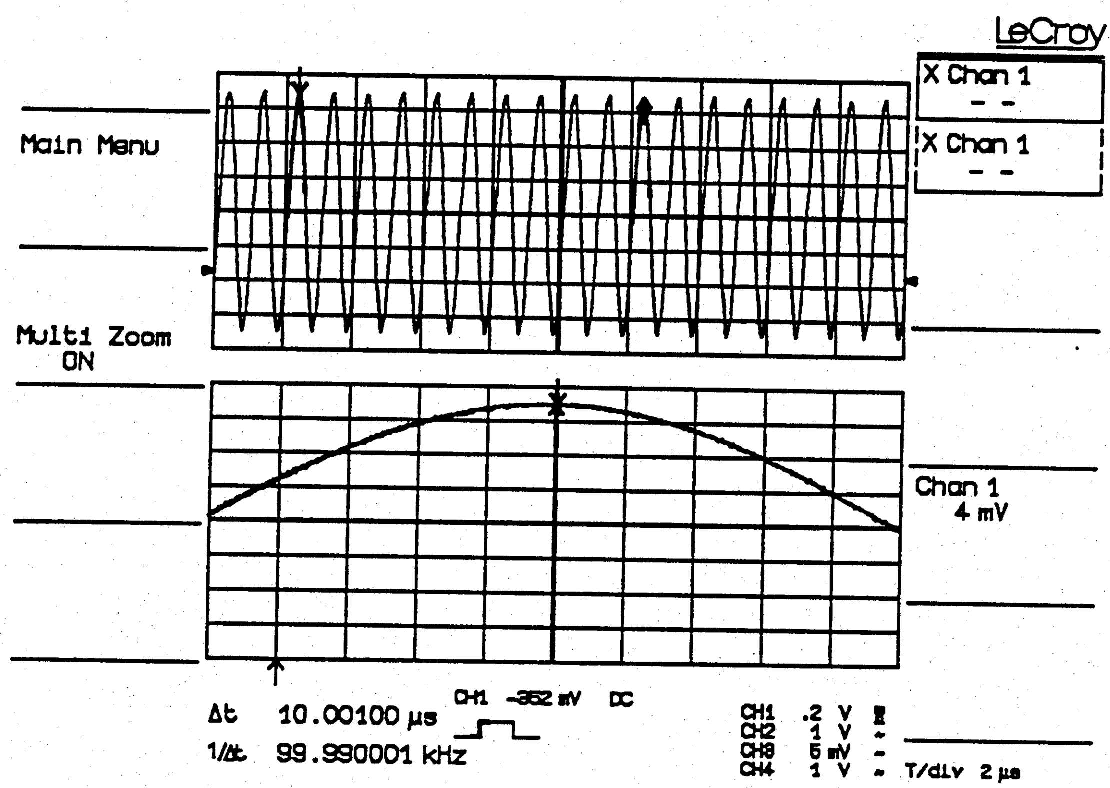


Figure 11: Alignment of cursors with maximum expansion

Check:

- The difference time reading must be within 9.998 and 10.002 µsec

3.7.2 NIST Calibration

In the absence of the computer automated calibration system based on LeCalsoft for the 9424 model oscilloscope, this procedure can be followed for establishing an NIST traceable calibration provided the measurement instruments used are NIST traceable.
For an NIST Calibration use this procedure in place of the Manual Time base Test procedure (3.7.1).

Scope set-up :

Time Base : 10 μsec

RIS MUST BE OFF

Set Trigger to Auto

Smart Trigger OFF

Connect the rear panel SAMPLE CLK OUT BNC to a suitable frequency counter. This output should be terminated 50 Ohm to GND. This is a DC coupled high impedance output which will drive a 50 Ohm load from 0 mV to -800 mV.

This sample clock output delivers a continuous signal at half the sampling frequency, 100 MSample/sec sample rate will read 50 MHz at the clock out.

The accuracy of the sample clock out will reflect the internal clock accuracy, however scopes shipped after December 1988 have a clock accuracy of 0.002%, scopes shipped before this date and not yet modified are 0.01%.

If you have a scope that is fitted with the 0.01% clock accuracy, it can be upgraded to 0.002% at no charge. Please call your local LeCroy service center for details.

The frequency measured at the sample clock out on the 9424 oscilloscopes with 0.01% accuracy will measure 49.995 to 50.005 MHz, 0.002% accuracy will measure 49.999 to 50.001 MHz.

Chapter 4

SERVICE INFORMATION

AND

PROCEDURES

TABLE OF CONTENTS

4.1 Disassembly and Assembly Procedure

The disassembly and assembly procedures detailed below refer to the assembly and disassembly diagram and the view of figure 4.1.,4.2.,4.3.

Please study the diagram and figures before attempting disassembly.

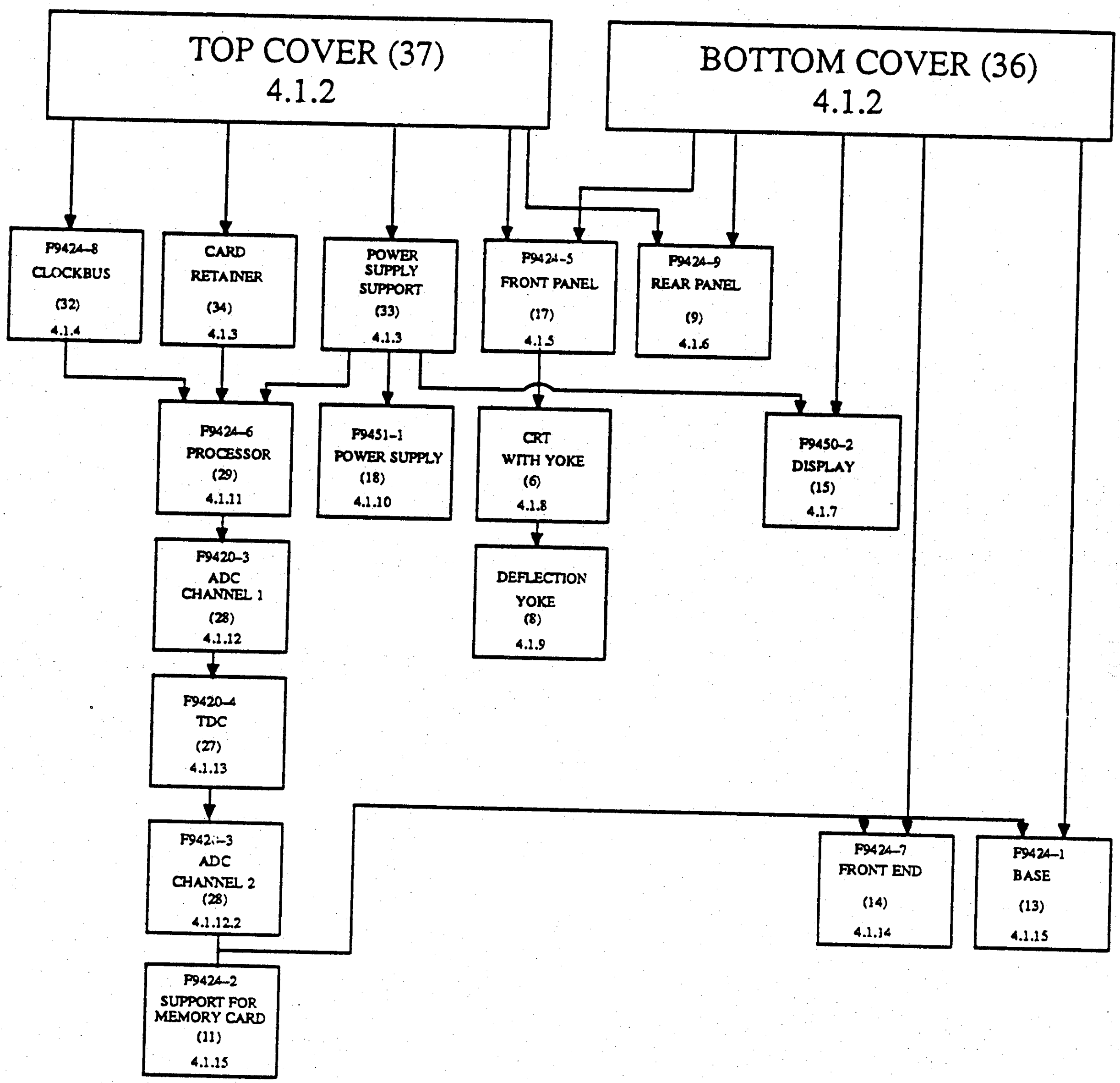
*** C A U T I O N ***

Before removing any parts from the LeCroy 9424 DSO, be sure to read carefully the instructions referring to those parts, noting any precautions needed to avoid problems caused by mechanical behavior, static electricity, high-voltage supplies, etc...

The usual precautions against static electricity are required (antistatic MAT, foam, bag)

4.1.1 Disassembly and Assembly Diagram

Disassembly: Any board can be removed only if any items higher in the diagram and connected by a line are already out.



Assembly: The reassembly procedure is the inverse of the disassembly procedure.

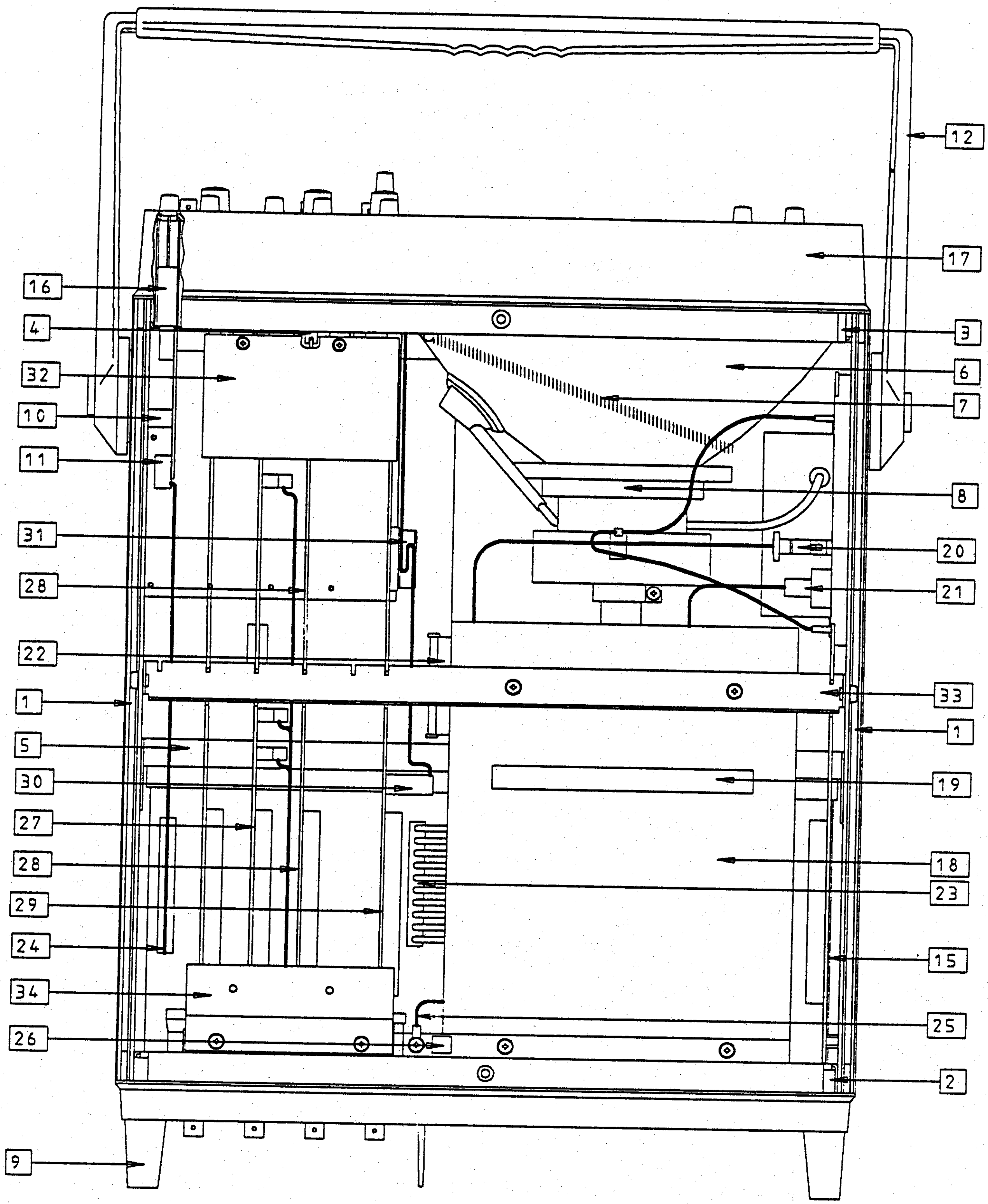

12
17
16
4
3
32
6
10
7
11
8
31
20
28
21
22
33
1
1
5
30
19
27
28
18
23
29
24
15
34
25
26
2
9

Figure 4.1

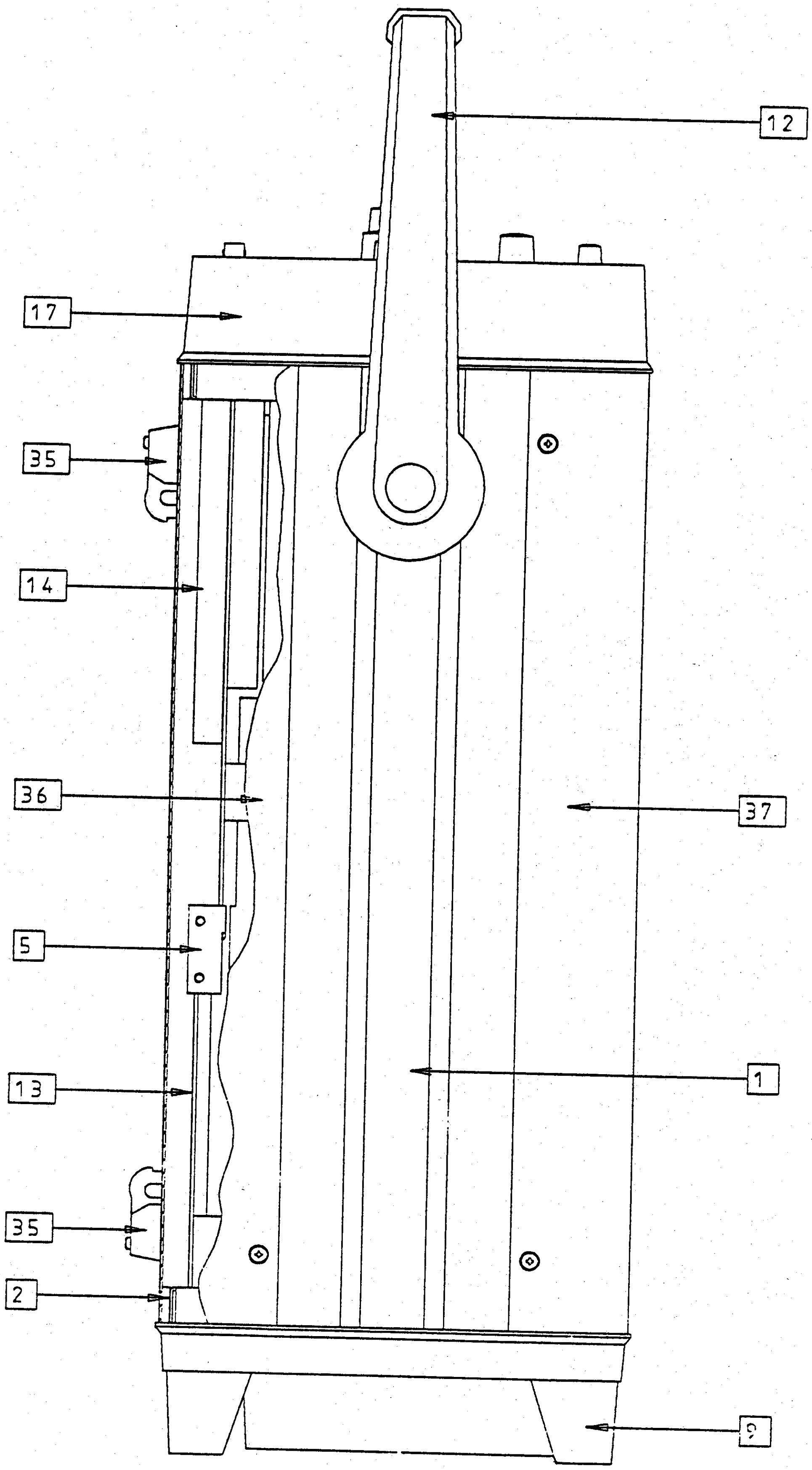


Figure 4.2

ASSEMBLAGE SEQUENCE OF PARTS				SCREWS		WASHERS		NUTS	
POS	DESCRIPTION	PART NUMBER	QTY	PART NUMBER	QTY	PART NUMBER	QTY	PART NUMBER	QTY
1	SIDE PANEL	709 424 021	2						
2	REAR SUPPORT	709 424 041	1	550 440 108	4	551 440 300	4		
3	DISPLAY SUPPORT	709 424 031	1	550 440 108	4	551 440 300	4		
4	CARD GUIDE	530 410 001	5	550 430 104	10	551 430 300	10		
5	MOTHER CARD SUPPORT	709 424 051	1	550 440 108	4	551 440 300	4		
6	CRT ORANGE	321 220 009	1	550 440 416	4	554 440 202	4	552 440 100	4
						709 450 071	4		
7	SPRING EXT TYPE 190mm	554 310 001	1						
8	DEFLECTION YOKE	300 090 001	1						
9	REAR PANEL FOR 9424	F9424-9	1	550 440 406	6				
10	SPACER INSERT GUIDE	709 424 098	1	550 440 120	1	551 440 300	1	709 424 011	1
11	SUPPORT FOR MC	F9424-2	1						
12	HANDLE	530 301 005	1	550 440 120	2			709 424 011	2
13	94XX-1 WITH MC LOGIC	F9424-1	1	550 430 106	4	551 430 300	4		
14	QUAD CHANNEL FRONTEND	F9424-7	1	550 430 106	2	551 430 300	5		
				550 430 108	3				
15	DISPLAY CARD FOR 94XX	F9450-2	1	550 430 106	4	551 430 300	4		
16	INSERTION GUIDE MC	709 424 098	1						
17	QUAD CHANNEL FP CARD	F9424-5	1	550 440 406	6				
18	POWER SUPPLY 9451-1	315 040 015	1	550 440 105	4	551 440 300	4		
				550 440 506	2				
19	LABEL "DANGER---ONLY	377 051 005	1						
20	DISPLAY POWER CABLE	780 210 030	1						
21	CRT CABLE	780 299 025	1						
22	FRONTEND BASE CABLE	780 231 120	1						
23	BASE CARD POWER CABLE	780 220 015	1						
24	MEMORY CARD CABLE	780 231 131	1						
25	GROUND CABLE	780 544 512	1						
26	LABEL GROUND SYMBOL	377 131 001	1						
27	TIMEBASE CARD	F9420-4	1						
28	DUAL CHANNEL ADC	F9420-3	2						
29	PROCESSOR CARD	F9424-6	1						
30	FRONT PANEL CABLE	780 411 236	1						
31	CABLE CLIP AD BACK	594 230 002	1						
32	CLOCK-BUS	F9424-8	1	550 430 106	2	551 430 300	2		
33	POWER SUPPLY SUPPORT	709 424 061	1	550 430 106	2	551 430 300	2		
34	CARD RETAINER	709 424 095	1	550 440 108	2	551 440 300	2		
35	FOOT	530 010 024	4	550 440 110	4	551 440 300	4	552 440 100	4
36	LOWER COVER	709 424 081	1	550 440 708	4	551 440 501	4		
37	UPPER COVER	709 424 071	1	550 440 708	4	551 440 501	4		

Figure 4.3

4.1.2 Removal of upper and lower covers

The top (37) and bottom (36) covers are each secured by four M4X8 screws and washers. To remove the bottom (36) cover turn the handle (12) to the forward position. See figure 4.1 and 4.2

Removal of the top cover (37) gives access to the following boards:

11	-	F9424-2	Support for Memory Card
15	-	F9450-2	Display Board
18	-	F9451-1	Power Supply or 94XX-1701
27	-	F9420-4	Time Base
28	-	F9420-3	Dual ADC
29	-	F9424-6	Processor
32	-	F9424-8	Clock Bus

while removal of the bottom cover (36) gives access to:

13	-	F9424-1	Base
14	-	F9424-7	Front End

when working on the DSO it is useful to remove both covers, also to access to:

9	-	F9424-9	Rear Panel
17	-	F9424-5	Front Panel

4.1.3 Removal of the power supply support and card retainer

The power supply support (33) and the card retainer (34) hold the F9450-2 (15), F9424-6 (29), F9420-3 (28) F9420-4 (27), and the F9451-1 (18) power supply in place and must be removed if any of these boards is to be removed. They are fixed with screws and washers see figure 4.1 and 4.2.

4.1.4 Removal of the F9424-8 clock bus

This is the little board (32) at the front right of the DSO across the top of the ADC board (28) and the TDC board (27). It is attached to the display support (3) with two screws and lock washers. Be careful to replace it after any work on the boards, and make sure that the two connectors are well aligned before pushing it home.

4.1.5 Removal of the F9424-5 front panel

In order to remove this board, first remove both covers (36), (37). (4.1.2)
Next remove the ribbon front panel cable (30) from the F9424-6 processor board (29).

Remove the six screws at the top, bottom, left and right of the front panel (17).

Now the front panel assembly can be removed from the DSO. If any parts need to be changed on the board F9424-5, the plastic front panel must be separated from the board.
All the rotary knobs must be removed, which means taking off all the caps (careful, soft plastic) and loosening the screws and nuts.
Then the 13 screws can be removed which frees the board.
When replacing a push button, take great care to achieve good alignment, to avoid sticking when the button is used.

To change the fine gain potentiometers remove the 9424-52 by removing the four screws and washers.

4.1.6 Removal of the F9424-9 rear panel

Remove the 6 screws at the top, bottom, left and right of the plastic rear panel (9).

Disconnect the fan cable from the F9451-1 power supply (18). The rear panel assembly can be removed from the DSO.

4.1.7 **Removal of the F9450-2 display board**

The display board (15) is situated along the left side of the DSO.

To remove it, first remove the top and bottom covers, and the power supply support (33). There are five cables connected to the F9450-2.

- Remove the two cables which lead to the deflection yoke.
- Remove the display power cable (20)
- Remove the CRT cable (21)
- Remove the EHT plug from the receptable at the right side of the CRT

Touch the free end of the cable to the display support (3), this ensures that no significant charge remains. The CRT must be discharged similarly, using a tool or a long screw driver which is first placed to the metallic display support and on the CRT receptable, repeat until no spark is seen or heard.

Remove the four screws which secure the F9450-2 to the left panel and the board can now be removed vertically from the DSO, making sure that the EHT cable is kept away from boards, as some charge may remain.

*** C A U T I O N ***

The remaining electric field around the HV cable to the CRT can damage components on the F9424-6 (Eproms, 68020 co-processor) and front panel boards when it comes close to the processor board or the flat cable going to the front panel.

For this reason the HV cable has to be led around the top of the CRT as far away as possible from the boards and flat cable.

4.1.8 Removal of the CRT with the deflection yoke

Remove the following:

- Top and bottom covers 4.1.2
- F9424-5 Front panel 4.1.5
- EHT plug, the CRT cable and the two cables which lead to the deflection yoke, from the F9450-2 display board (15).
- Long helical grounding spring (7) which runs diagonally across the back of the bulb.
- Four screws, washers, and nuts on the front.

The tube (6) with the deflection yoke (8) can now, with care, be removed without any other boards having to be moved.

Hold the CRT very carefully or place soft padding under it.

4.1.9 Removal of the deflection yoke

Remove the following:

- Top and Bottom cover 4.1.2
- Front Panel 4.1.5
- CRT 4.1.8

Loosen the screw on the yoke ring holder.

The deflection yoke can be removed from the cathode ray tube.

4.1.10 Removal of the F9451-1 power supply

Ensure the line power cable is disconnected.

Remove the following:

- Top cover of 9424 4.1.2
- Power supply support 4.1.3
- Two screws from the F9424-9 rear panel (9)
- Two screws, washers from the rear support (2)
- One screw, washer, and nut from the ground cable (25)

Disconnect the following:

- Fan power supply cable
- Display power cable (20)
- Base Card power cable (23)

The F9451-1 power supply can be removed from the DSO.

4.1.11 Removal of the F9424-6 processor board

Remove the following:

- Top cover 4.1.2
- Power supply support 4.1.3
- Card retainer 4.1.3
- F9424-8 Clock bus 4.1.4

Disconnect the flat ribbon cable (30) from the F9424-6 processor (29) the board can now be removed vertically from the F9424-1 base board (13).

4.1.12 Removal of the F9420-3 dual ADC board

Remove the following:

- Top cover 4.1.2
- Power supply support 4.1.3
- Card retainer 4.1.3
- F9424-8 Clock bus 4.1.4
- F9424-6 Processor 4.1.11

Disconnect the two signal input cables from the ADC board (28). The F9420-3 can be removed vertically from the F9424-1 base board (13) Remove the TDC board (see 4.1.13) to access to the second ADC board.

4.1.13 Removal of the F9420-4 TDC board

Remove the following:

- Top cover 4.1.2
- Power supply support 4.1.3
- Card retainer 4.1.3
- F9424-8 Clock bus 4.1.4
- F9424-6 Processor 4.1.11
- F9420-3 ADC 4.1.12

The 9424 is equipped with the trigger OUT, trigger VETO, clock IN and clock OUT options. Disconnect the four SMD cables from the TDC board, connectors J2, J3, J7 and J10 (see figure 4.4: cabling diagram). Now the F9420-4 can be removed vertically from the F9424-1 base board (13) and the F9424-7 front end (14).

9420–4 CABLING DIAGRAM

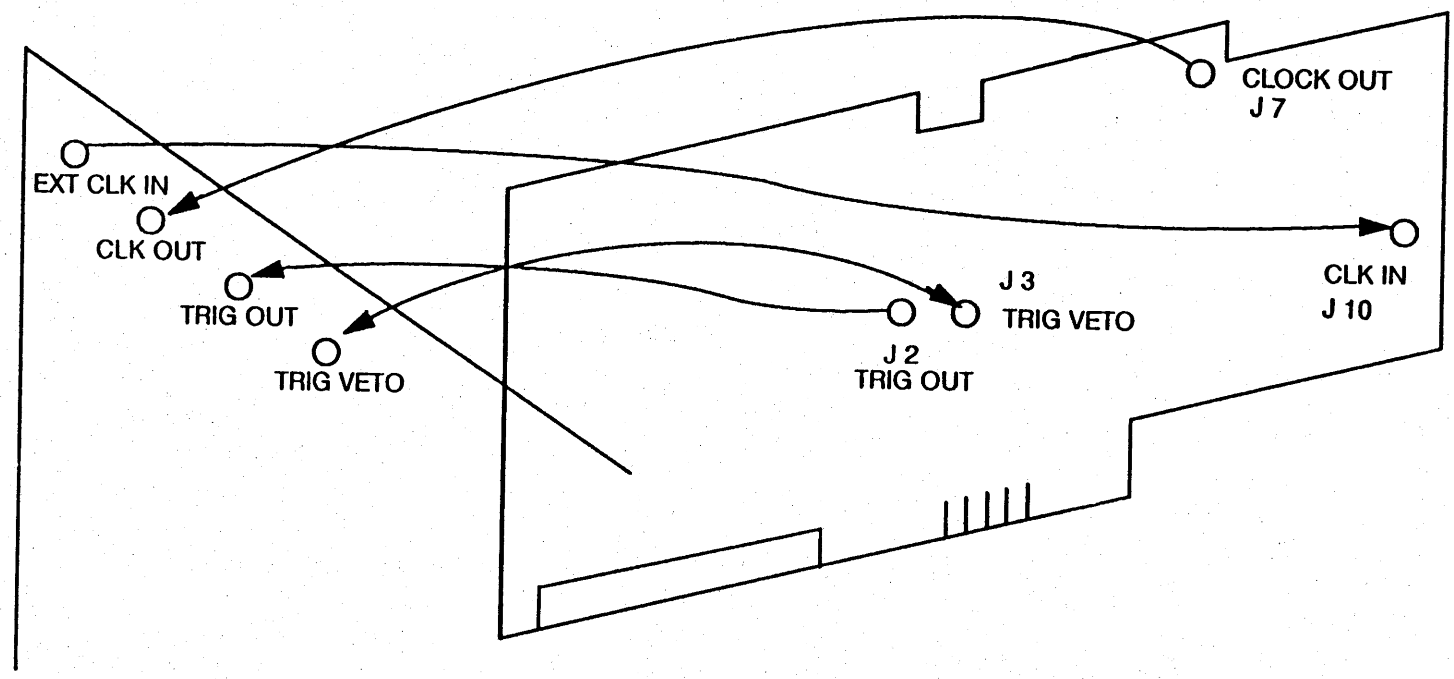


Figure 4.4

4.1.14 Removal of the F9424-7 front end

Remove the following:

- Top and bottom covers 4.1.2
- Power supply support 4.1.3
- Card retainer 4.1.3
- F9424-8 Clock bus 4.1.4
- F9424-6 Processor 4.1.11
- F9420-3 ADC 4.1.12
- F9420-4 TDC 4.1.13
- Two screws and washers from the mother card support (5)
- Three screws and washers which secure the F9424-7 to the right panel.
- Front End Base Cable (22)

If the 9424 is equipped with the external trigger option, disconnect the SMD cable from connector J15.

Now the front end can be removed forward.

4.1.15 Removal of the F9424-1 base board

Remove following:

- Top and bottom covers 4.1.2
- Power supply support 4.1.3
- Card retainer 4.1.3
- F9424-8 Clock bus 4.1.4
- F9424-6 Processor 4.1.11
- F9420-3 ADC 4.1.12
- F9420-4 TDC 4.1.13
- Front End base cable (22)
- Base card cable (23)
- Memory card cable (24)
- Four screws and washers from the mother card support (5)

At this stage the F9424-1 base board can be removed forward from the 9424.

4.1.16 Removal of the F9424-2 support for Memory card

Remove the following:

- Top cover	4.1.2
- Power supply support	4.1.3
- Card retainer	4.1.3
- F9424-8 clock bus	4.1.4
- F9424-6 processor	4.1.11
- F9420-3 ADC	4.1.12
- F9420-4 TDC	4.1.13

Disconnect the memory card cable (24) from the F9424-2 connector. The screws and washers which secure the board to the right panel can be removed.
Slide the board out of the F9424-5 front panel.

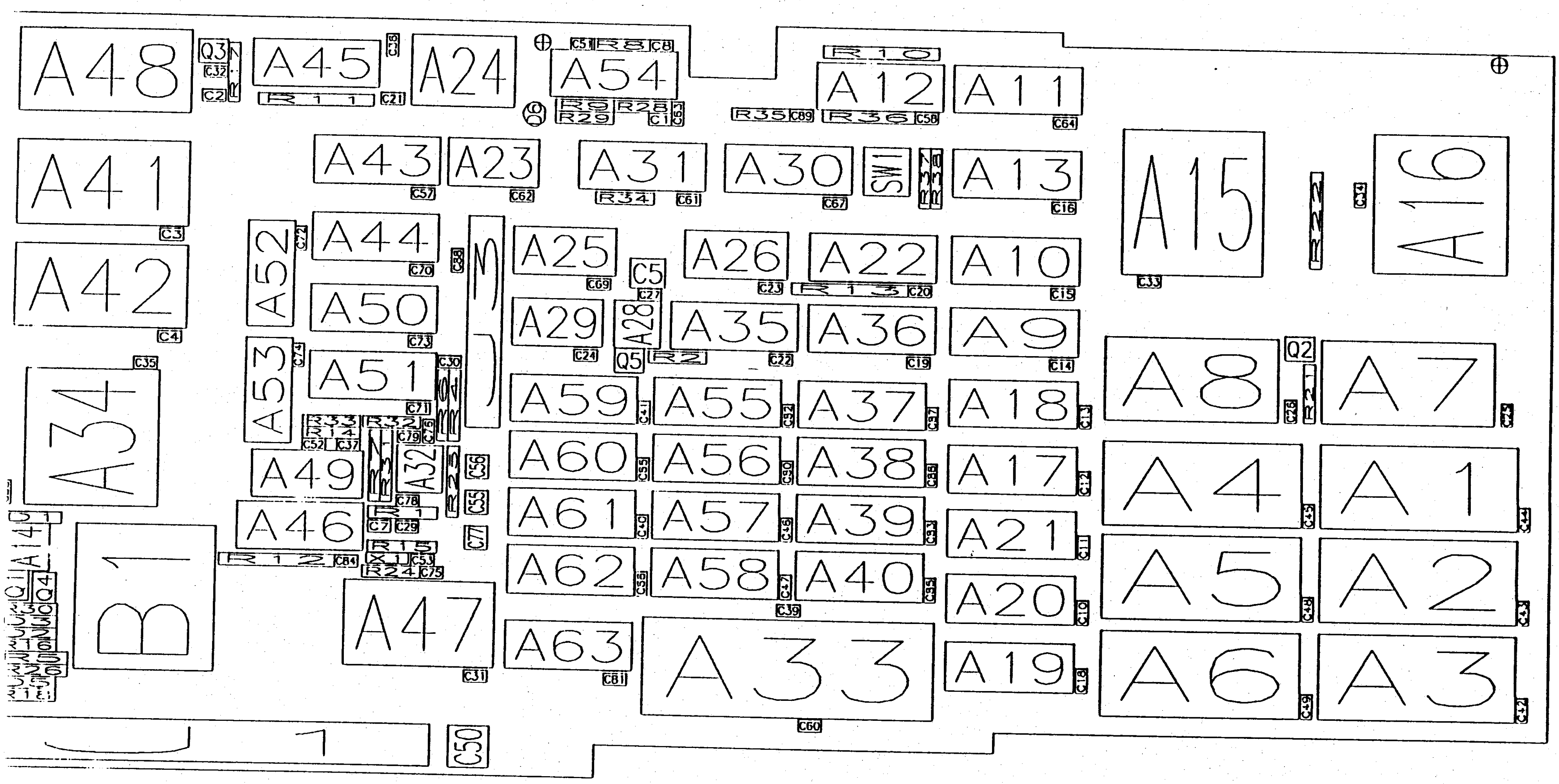
4.2 Software upgrade procedure

4.2.1 Changing Eproms

These six Eproms are on the F9424-6 processor (29) board, and access is possible only by removing the board.
Follow 4.1.11 procedure: removal of the F9424-6 processor board.
The precautions against static electricity are required.
Do not place the solder side of the board directly on an antistatic foam or mat, which are slightly conducting and can discharge the battery.
The Eproms can be removed using an IC extractor.
Replace the Eproms at location A1 to A6 see figure 4.5 and 4.6 with the latest version.
Make sure that the guiding notch in the chip is aligned with the PCB reassemble scope and check that it boots up properly.

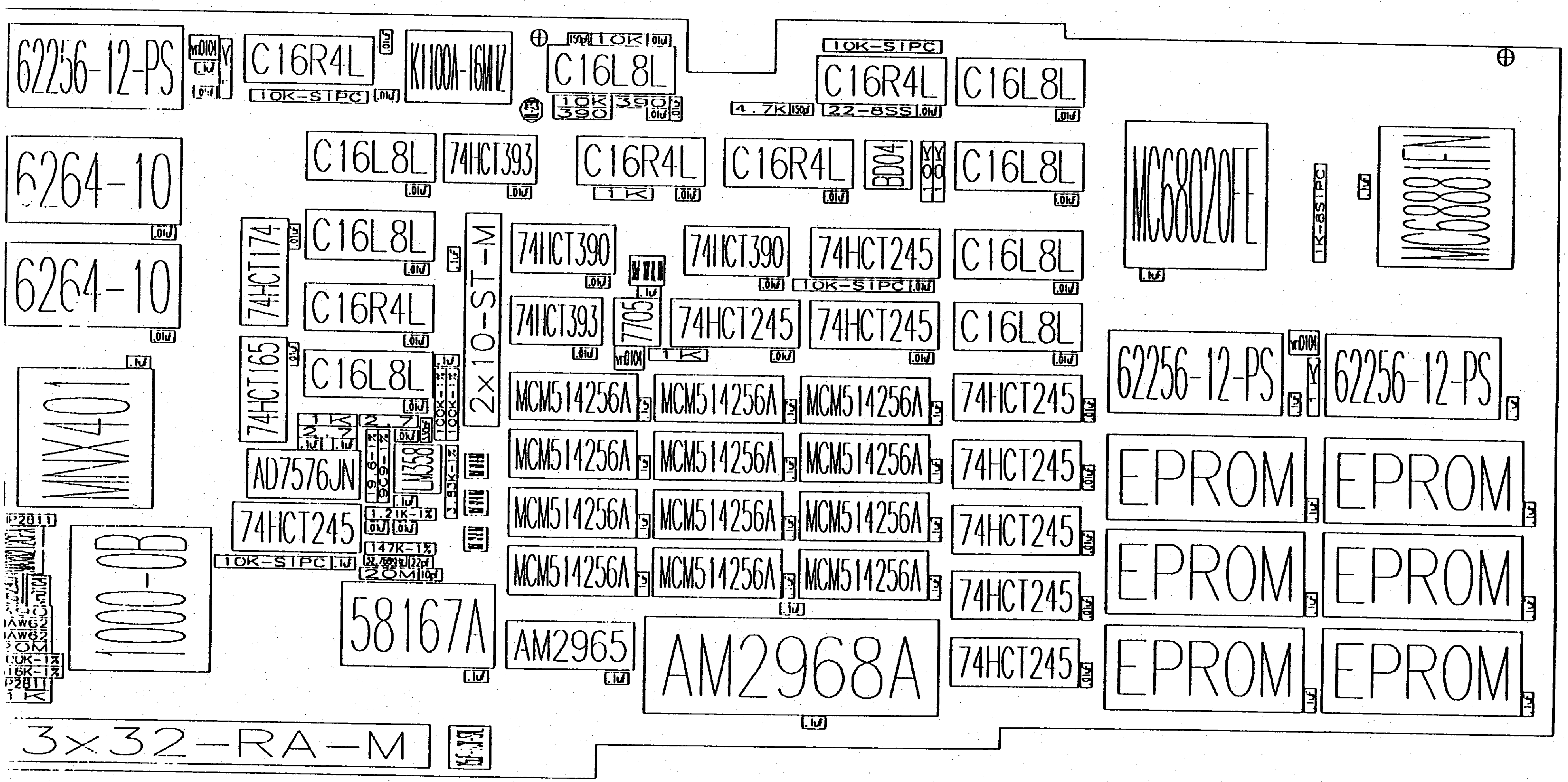
4.2.2 Changing software selection PAL

The software option selection PAL is located on the F9424-6 processor board in socket A45 (top left) see figure 4.5 and 4.6 follow 4.1.11 procedure and 4.2.1. Insert or replace the PAL into location A45.
Watch out to match the orientation notch.
Reassemble the boards and check that the scope boots correctly.



94XX_6 Rev:A

Figure 4.5.



94XX_6 Rev:A

Figure 4.6.

4.3 Software option selection PAL

The available software option selection PAL

0000:	standard:	Pal not necessary
0001:	WP01 :	Basic function package
0002:	WP02 :	Basic FFT package
0004:	WP03 :	Extented pulse parameter and histograms.
0008:	WP04 :	ATE support
0100:	MATE :	MATE remote control
0200:	CARD :	Memory card

See figure 4.7

OPTIONS						PAL Description
MATE	CARD	WP04	WP03	WP02	WP01	
	-	-	-	-	-	Standard PAL not necessary
	-	-	-	-	X	PG0001
	-	-	-	X	-	PG0002
	-	-	-	X	X	PG0003
	-	-	X	-	-	PG0004
	-	-	X	-	X	PG0005
	-	-	X	X	-	PG0006
	-	-	X	X	X	PG0007
	-	X	-	-	-	PG0008
	-	X	-	-	X	PG0009
	-	X	-	X	-	PG000A
	-	X	-	X	X	PG000B
	-	X	X	-	-	PG000C
	-	X	X	-	X	PG000D
	-	X	X	X	-	PG000E
	-	X	X	X	X	PG000F
X		-	-	-	-	PG0100
X		-	-	-	X	PG0101
X		-	-	X	-	PG0102
X		-	-	X	X	PG0103
X		-	X	-	-	PG0104
X		-	X	-	X	PG0105
X		-	X	X	-	PG0106
X		-	X	X	X	PG0107
X		X	-	-	-	PG0108
X		X	-	-	X	PG0109
X		X	-	X	-	PG010A
X		X	-	X	X	PG010B
X		X	X	-	-	PG010C
X		X	X	-	X	PG010D
X		X	X	X	-	PG010E
X		X	X	X	X	PG010F
						PG0100
	X	-	-	-	-	PG0200
	X	-	-	-	X	PG0201
	X	-	-	X	-	PG0202
	X	-	-	X	X	PG0203
	X	-	X	-	-	PG0204
	X	-	X	-	X	PG0205
	X	-	X	X	-	PG0206
	X	-	X	X	X	PG0207
	X	X	-	-	-	PG0208
	X	X	-	-	X	PG0209
	X	X	-	X	-	PG020A
	X	X	-	X	X	PG020B
	X	X	X	-	-	PG020C
	X	X	X	-	X	PG020D
	X	X	X	X	-	PG020E
	X	X	X	X	X	PG020F

Figure 4.7

4.4 Board exchange procedure

4.4.1 F9424-1 Base board

This card carry the programmable array logic (PAL) which is specific to the DSO serial number (S/N):

PAL XXXX in location A22
XXXX = DSO serial number

WARNING: The replacement board is supplied without this PAL.

Therefore you have to transfer the existing PAL from the faulty board to the new board.

4.4.2 F9424-6 Processor board

The processor carry Eproms (LOC A1 to A6) and software option selection PAL (LOC A45).

see figure 4.5 and 4.6

PAL PG XXXX_R

XXXX = software option.
R = release

see figure 4.7

The Eproms and PAL can be removed using an IC extractor. The usual precautions against static electricity are required.

WARNING: The replacement board is supplied without PAL neither Eproms

Therefore you have to transfer the existing PAL and Eproms from the faulty board to the new board.

4.5 F9451-1 Power Supply Adjustement Procedure

The +/- 5V, +/- 15V can be adjusted to the nominal values in the following way. The reference for the measurements are the pins on connector J7 on the 9424-1 Base Board.

From top to bottom

-15v pin 10, +15v pin 9, -5v pin 8, +5v pin 5, Gnd pin 6

Have the scope turned on. For safety reasons, unplug the mains cable from the outlet without turning the scope off.

Follow the F9451-1 power supply disassembly procedure 4.1.10.

The adjustement potentiometers are situated on the small power supply PCB next to the 9450-2 display board.
In order to get access for adjustement, put the scope on its rear feet and pivot the power supply unit slightly away from the display board. Make sure the mains cable stays plugged into the line filter.

Plug the mains cable back into the outlet and wait for the scope to turn on.

Proceed to voltage adjustements with a very small screwdriver.
The four potentiometers are arranged on the PCB in the following order:

```
                         top

           ------------------------------------
  rear    |    x       x       x       x      |   front
          |                                   |
          |   +5V     -5V     +15V    -15V    |
          |                                   |
           ------------------------------------
```

Note the nominal voltages with their tolerances given in the specifications.

+ 15.10 V +/- 1%
- 15.10 V +/- 1%
+ 5.10 V +/- 1%
- 5.10 V +/- 1%

Unplug the mains cable from the outlet. Reassemble the power supply unit to the scope.

4.6 F9424-7 Front End Test and Calibration Procedure

4.6.1 Power Supplies

Adjust potentiometer R65 to get + 6.00 V between pin 3 and 4 of TP1.

Check with a voltmeter on Test Point TP1 (16 pins), the following voltages :

TP1	Pin	1 - 2 (-)	:	+ 12	V	+/-	0.35 V
"	Pin	5 - 6 (-)	:	- 6	V	+/-	0.35 V
"	Pin	7 - 8 (-)	:	- 12	V	+/-	0.35 V
"	Pin	9 - 10(-)	:	+ 5	V	+/-	0.15 V
"	Pin	11 - 12(-)	:	- 5	V	+/-	0.15 V

4.6.2 Input Impedance

Set DSO CH1 input to 50 Ohm, 100mV/div, DC, with any Time Base
Check with an ohmmeter:

- input impedance must be 50 Ohm +/- 2%

Repeat all impedance checks for CH2, CH3, CH4 and External Trigger.

Set DSO CH1 input to 1 mOhm, DC Coupling, 100 mV/div, with any Time Base.

Check:

- input impedance must be 1 mOhm +/- 2%

Repeat all impedance checks for CH2, CH3 and CH4.

4.6.3 External Trigger level Verification

The 9424 model Digital Storage Oscilloscope comes in two different versions : the standard 9424 and the 9424E with an External trigger input from the Trigger Veto (labelled Trig IN on 9424E) connector on the rear panel to the trigger circuit on channel 4.
This option is realized with the front end board F9424-7 at revision E and up.

Ext Trigger input characteristics :

impedance : 50 Ohm

maximum amplitude : +/- 0.8 V

- Set scope to Channel 2, 1 mOhm DC, 0.2 V/div, offset zero,
- Trigger on EXT, DC, level 0 mV, pretrigger delay 50 %,
- Apply 100 HZ sine wave with zero offset, 6 div peak peak amplitude, through 20 dB attenuator to CH2 and External Trigger input.

  Use a T BNC adaptor.
- Set External Trigger on POS slope, and Auto
- Check :

  The sine wave must pass through the horizontal center of the screen (50 % pretrigger) at the vertical position zero, (vertical center) within +/- 2 minor divisions.
- Repeat the test for following conditions :
- Trigger slope NEG (verify slope at check point)
- Trigger coupling AC, HF, HFrej, LFrej

4.6.4 50 Ohm Overshoot Compensation

- Apply the pulse generator LeCroy 4969 (< 700 ps) to 50 Ohm input of the 9424 DSO.

- Set DSO to 50 Ohm, DC, 100 mV/div, 5 ns/div, RIS mode

- Turn on the pulse parameters.

- Press Pass/Fail mode

- Press Setup Pass/Fail

- Set Channel 1, Channel 2, Channel 3, and Channel 4 to parameters on Show, over +, and rise

- Adjust C142 on CH1, C242 on CH2, C342 on CH3, and C442 on CH4 in order to get less than:

  8 % overshoot

  Typically 5 to 7 %

- Check the rise time, should be less than 0.96 ns

- Check the Bandwidth : 350 mHz

4.6.5 50 Ohm CH1, CH2, CH3 and CH4 Overload Protection Adjustment

- The front-end has to be in the 9424 scope with the aluminium covers mounted and the upper DSO cover closed.

- Warm up the unit for 20 minutes.

- Set scope to 50 Ohm, 2s/div, norm, pos

- Apply 7.07 V (1 watt) to the channel to be adjusted.

- Adjust the overload detection, potentiometer R21 (OVL1) for CH1, R20 (OVL2) for CH2, R19 (OVL3) for CH3, and R18 (OVL4) for CH4 such that the overload trips within 10 to 20 seconds.

- Turn the potentiometer clockwise if it's too slow, or counterclockwise if it's too fast.

- Apply 5 V (0.5 watt) to the channel to be tested, and check that the overload doesn't trip after 40 seconds.

4.7 F9450-2 Display Board Calibration Procedure

It is advisable to perform this adjustment when the scope is in a stable condition, after few minutes of warm up.

Also it is important to check the power supplies, and to readjust them to the nominal values.

The reference for the measurements are the pins on connector J7 on the base board F9424-1.

- 15.00 V	: +/- 1%	on pin 10
+ 15.04 V	: +/- 1%	on pin 9
- 5.07 V	: +/- 1%	on pin 8
+ 5.16 V	: +/- 1%	on pin 5
GND	:	on pin 6

4.7.1 Image Position adjustment

If the X,Y Gain amplifiers or X,Y Offset amplifiers are not correctly adjusted, or the image is poorly centered or distorted on the screen, it may be desirable to readjust the four potentiometers on the F9450-2 display board, or the two magnetic rings on the yoke, or the mechanical yoke position.

4.7.1.1 Vertical, Horizontal, Gain and Offset Amplifiers adjustment

By pressing the "Main Menu" button while keeping the lowest menu button depressed, enter into the secret menu, then press the "Software Tests" key, and select "Characters". See figure 1.

With the help of the border lines of the Character set Display, adjust the potentiometers GAIN X, OFFS X, GAIN Y, OFFS Y (see POT LAYOUT) to center the image on the screen.

Adjust the size of the display, in order to get 5mm gap between the middle of the image lines (top, bottom, left, right) and the CRT lines.

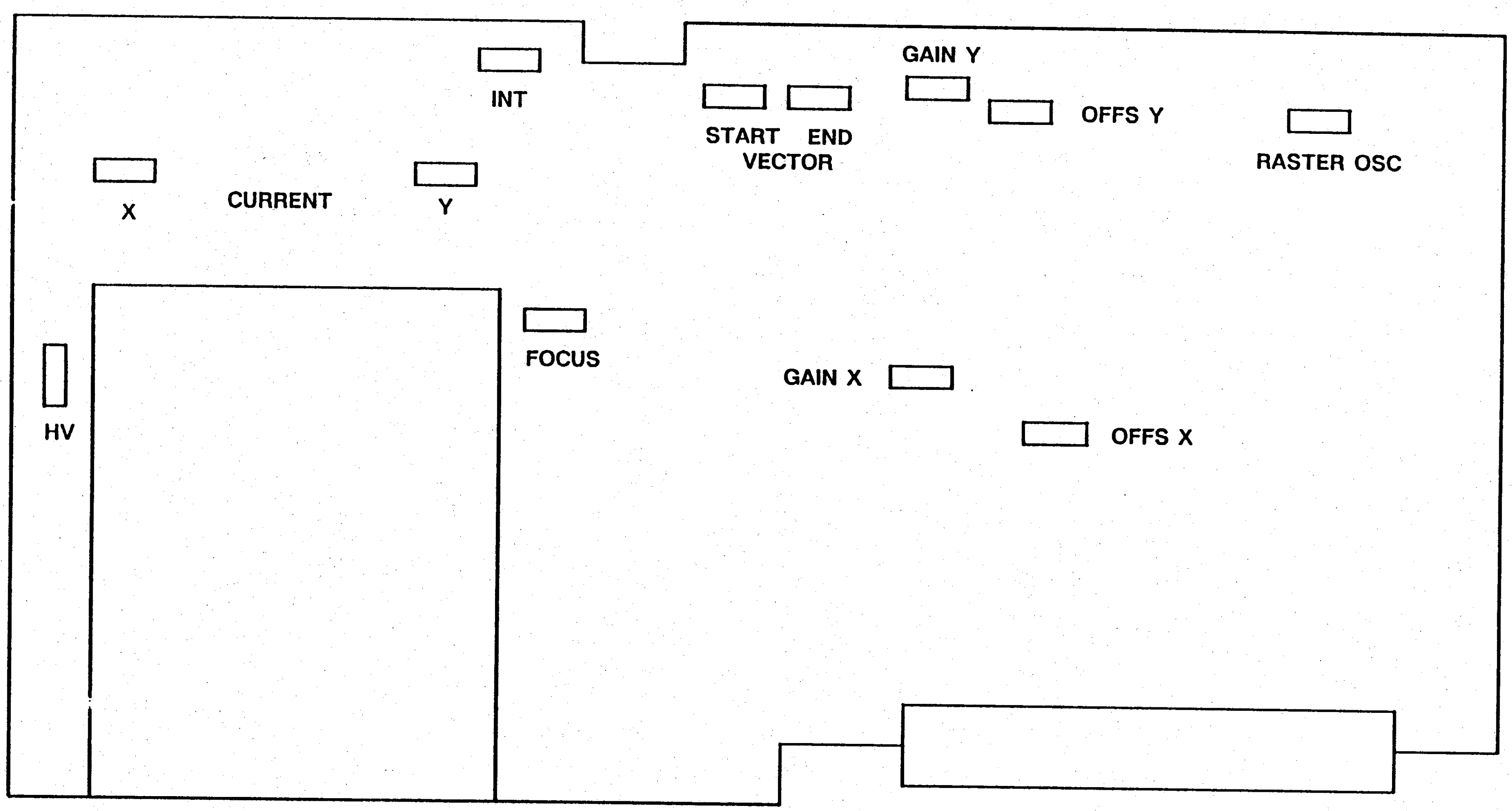
4.7.1.2 Centralizing adjustment and Yoke Rotation

This should be done unless all other sources of offset have been eliminated.

By adjusting the two rings on the Yoke, center the image on the screen.

Loosen the screw on the Yoke ring holder, and rotate the image by turning the mechanical Yoke position.

TOP



9450-2 POT LAYOUT

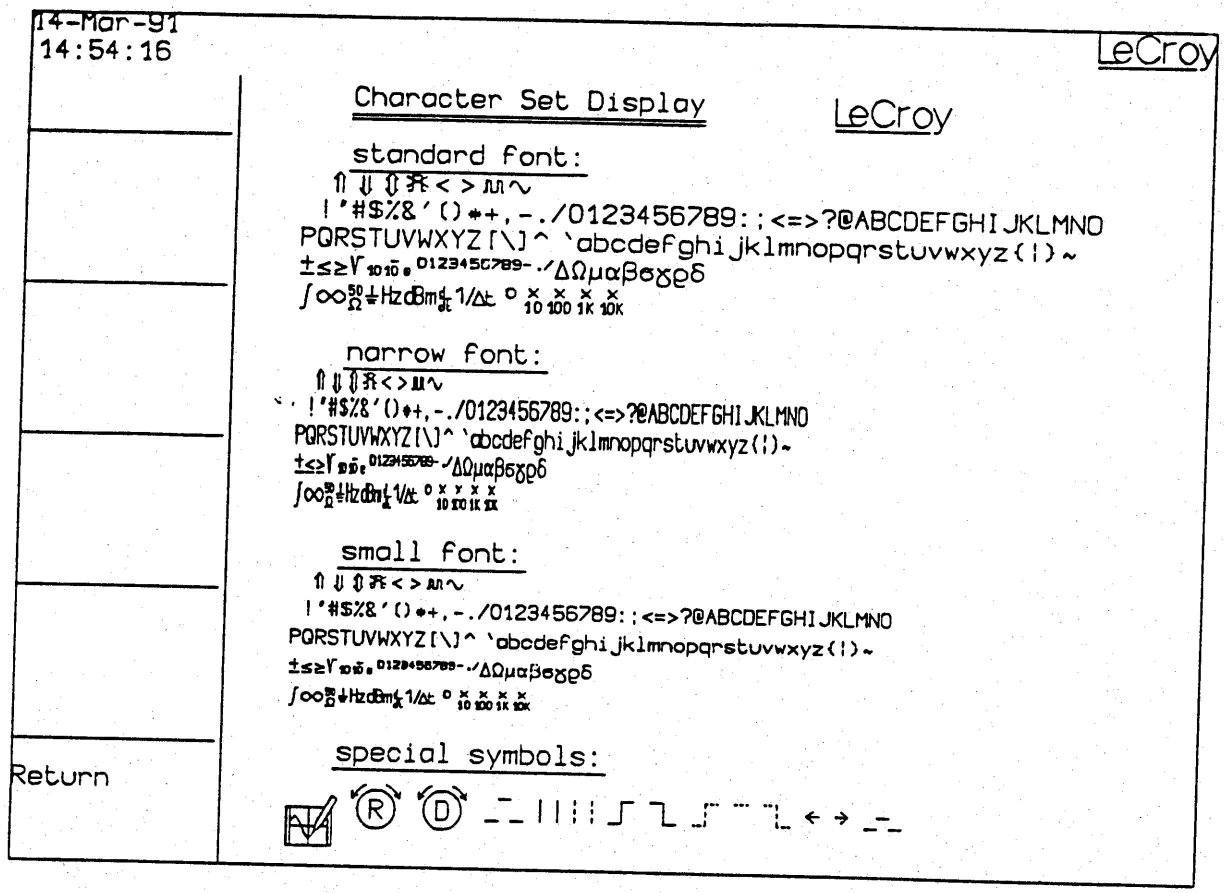


Figure 1 : Character Set Display

4.7.2 Intensity

Set DSO to 1 MOhm, 5mV/div, .2ms/div, CH1 auto trigger.
Turn on Expand A (X Chan 1), and make an expand of only few horizontal divisions of the trace.

On the Front Panel turn the Grid Intensity and the Intensity to minimum.

On the display board, adjust the potentiometer INT until the expanded trace just appears on the screen.

4.7.3 Focus

With the help of the characters set Display (see figure 1), adjust the Focus potentiometer on the display board to optimize the characters and the image.

4.7.4 Vector Joining

On the display board adjust the vectors with the help of the START and END vector potentiometers

The characters should be neatly drawn.

Check that there are neither gaps nor ovelaps in the letters.

4.7.5 Raster

Set the DSO to 1 MOhm, DC, .2V/div, .2ms/div, auto trigger on CH1

Send a 1 kHz sine wave or square wave to channel 1, adjust the signal amplitude to 6 V peak to peak.

Turn on the persistence mode, set 1 sweep, and make a single trigger.

With the RASTER OSC potentiometer on the display board, adjust the vertical alignment of the dots. See figure 2.

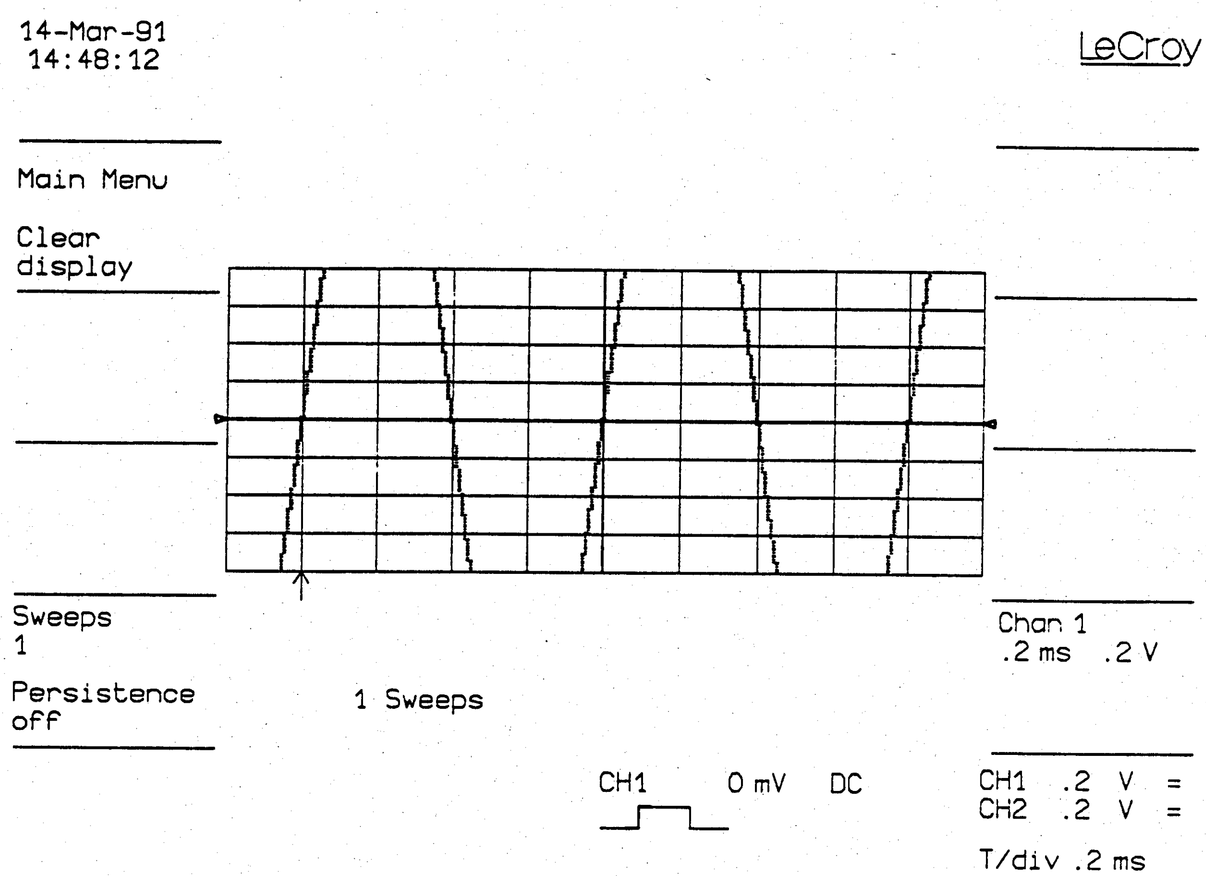


Figure 2 : Raster Oscillator

Chapter 5

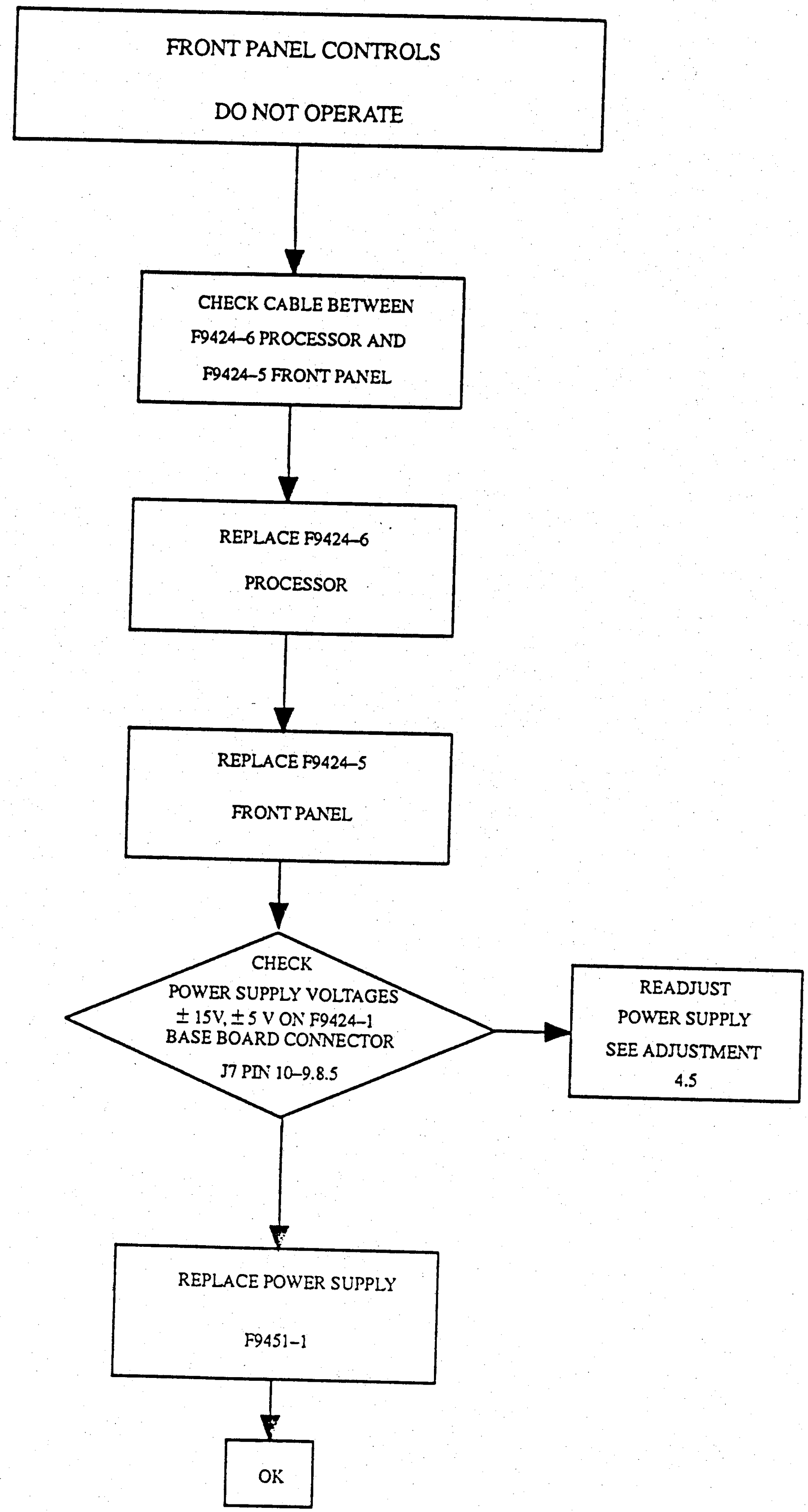
TROUBLESHOOTING and FLOW CHARTS

Table of contents:

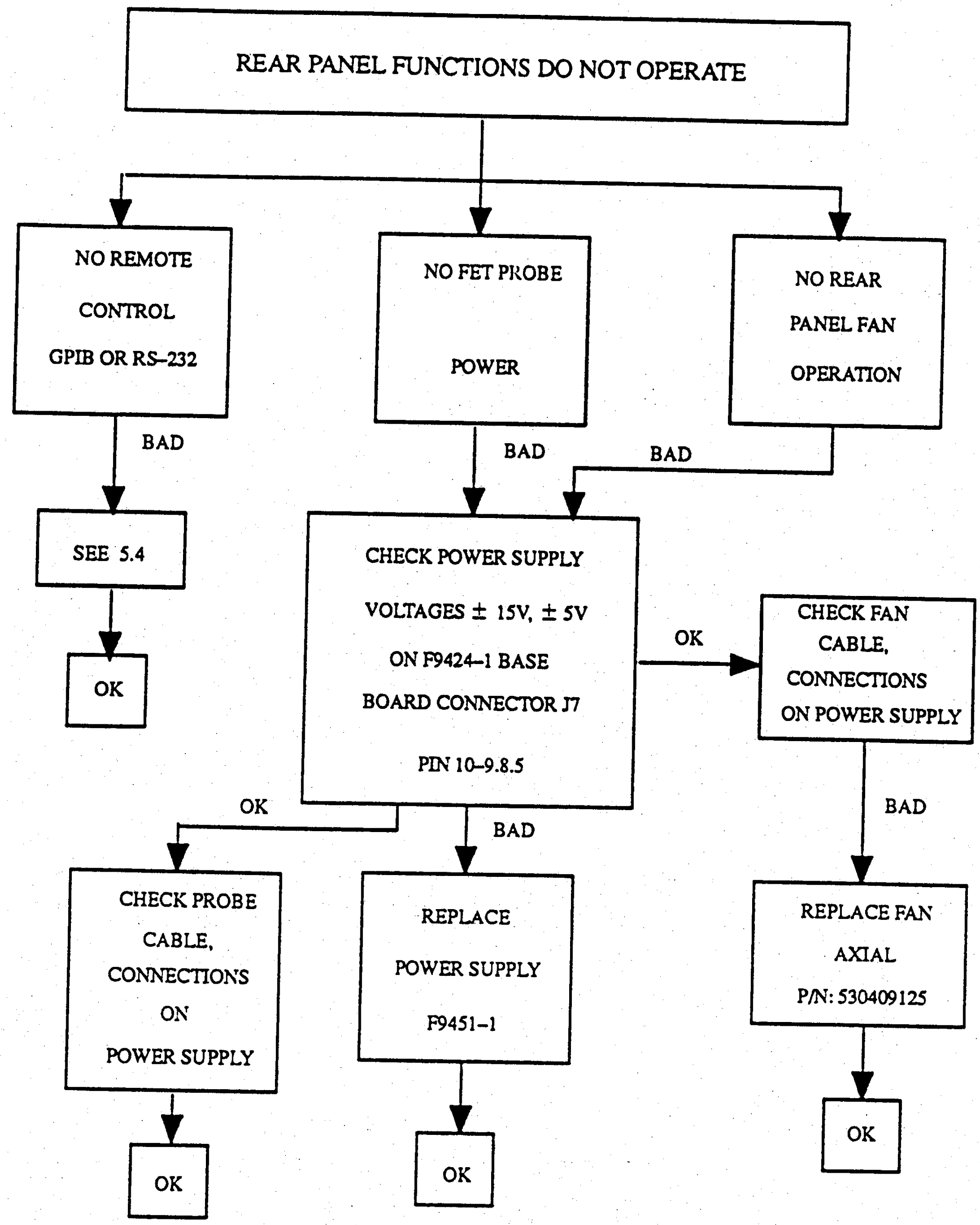
5.1 Introduction

In order to help simply servicing and minimize downtime, the following list of possible symptoms, likely causes, and troubleshooting steps have been prepared. Most procedures in this section will allow a technician to troubleshooting down to the board level.
Defective circuit boards will be repaired or exchanged by our regional LeCroy service office .
The first step in troubleshooting is to check for obvious items like blown fuses, voltage selector switch in correct position and loose line cord.
The power supply is the next item to check before proceeding to more detailed troubleshooting.
Noisy or low power supply can cause a variety of problems, both digital and analog.
A complete list of recommended service equipment and spare parts is given in section 5.8.

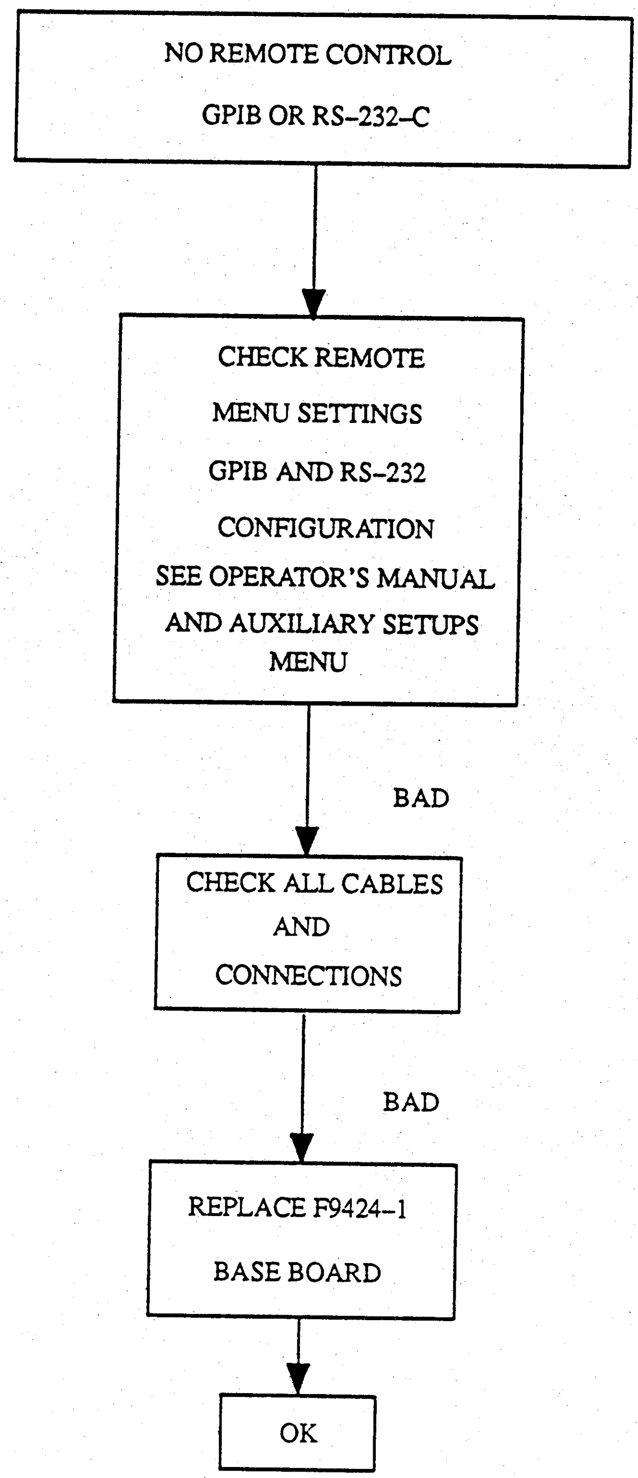
5.2


FRONT PANEL CONTROLS
DO NOT OPERATE
CHECK CABLE BETWEEN
F9424–6 PROCESSOR AND
F9424–5 FRONT PANEL
REPLACE F9424–6
PROCESSOR
REPLACE F9424–5
FRONT PANEL
CHECK
POWER SUPPLY VOLTAGES
± 15V, ± 5 V ON F9424–1
BASE BOARD CONNECTOR
J7 PIN 10–9.8.5
READJUST
POWER SUPPLY
SEE ADJUSTMENT
4.5
REPLACE POWER SUPPLY
F9451–1
OK

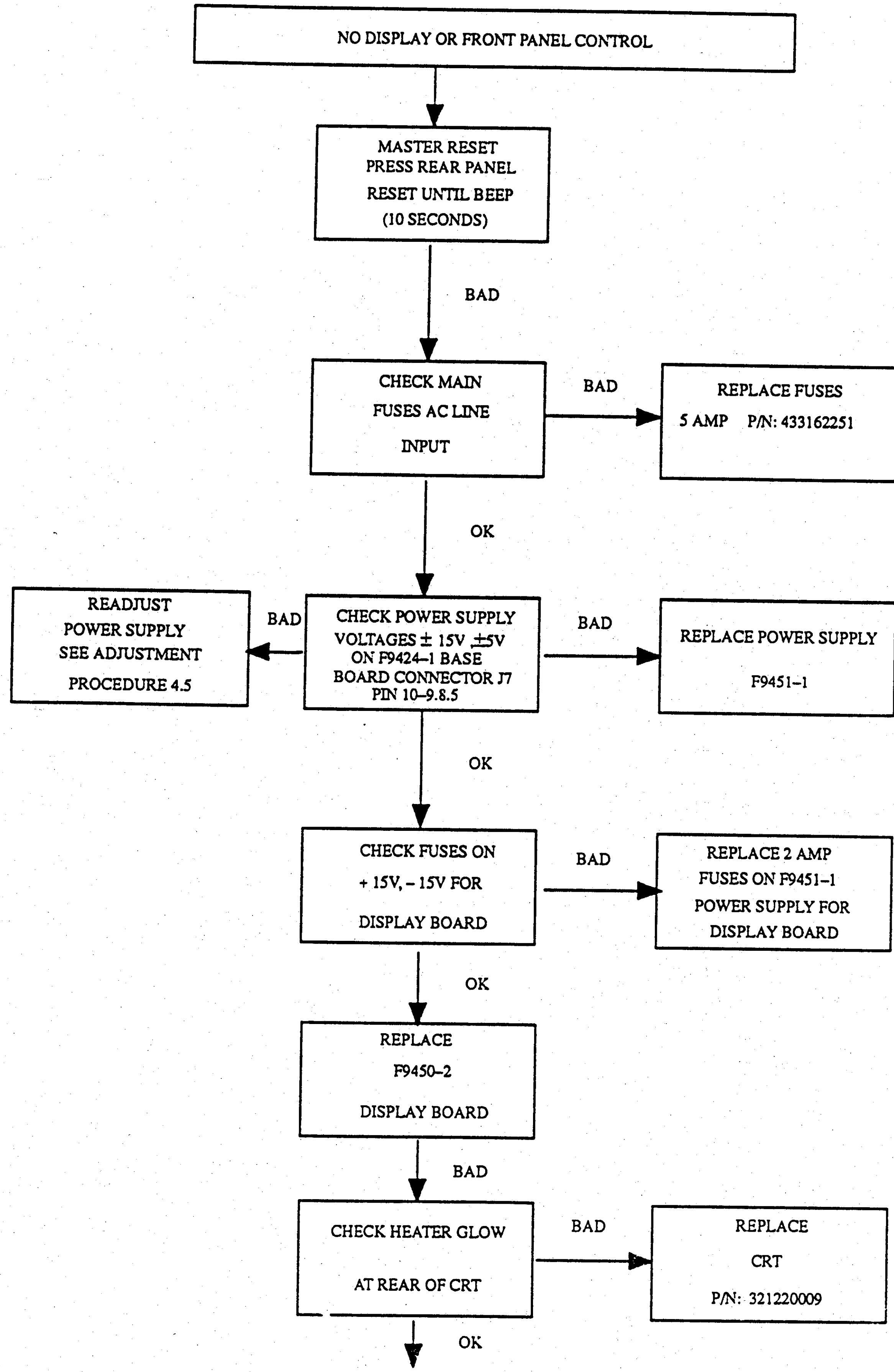
5.3


REAR PANEL FUNCTIONS DO NOT OPERATE
NO REMOTE CONTROL GPIB OR RS-232
NO FET PROBE POWER
NO REAR PANEL FAN OPERATION
BAD
BAD
BAD
SEE 5.4
OK
CHECK POWER SUPPLY VOLTAGES ± 15V, ± 5V ON F9424-1 BASE BOARD CONNECTOR J7 PIN 10-9.8.5
OK
CHECK FAN CABLE, CONNECTIONS ON POWER SUPPLY
OK
BAD
BAD
CHECK PROBE CABLE, CONNECTIONS ON POWER SUPPLY
REPLACE POWER SUPPLY F9451-1
REPLACE FAN AXIAL P/N: 530409125
OK
OK
OK

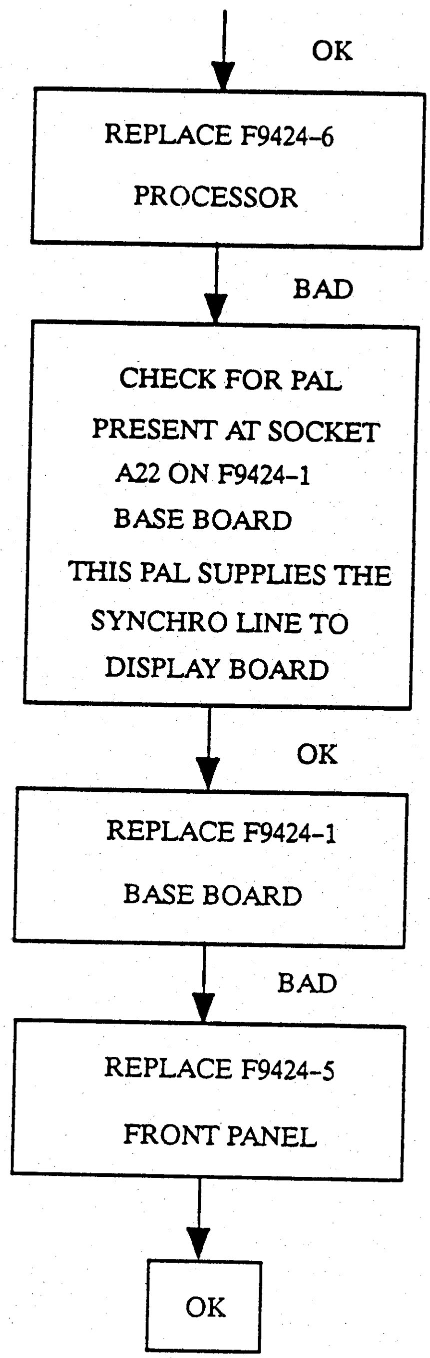
5.4


NO REMOTE CONTROL
GPIB OR RS-232-C
CHECK REMOTE
MENU SETTINGS
GPIB AND RS-232
CONFIGURATION
SEE OPERATOR'S MANUAL
AND AUXILIARY SETUPS
MENU
BAD
CHECK ALL CABLES
AND
CONNECTIONS
BAD
REPLACE F9424-1
BASE BOARD
OK

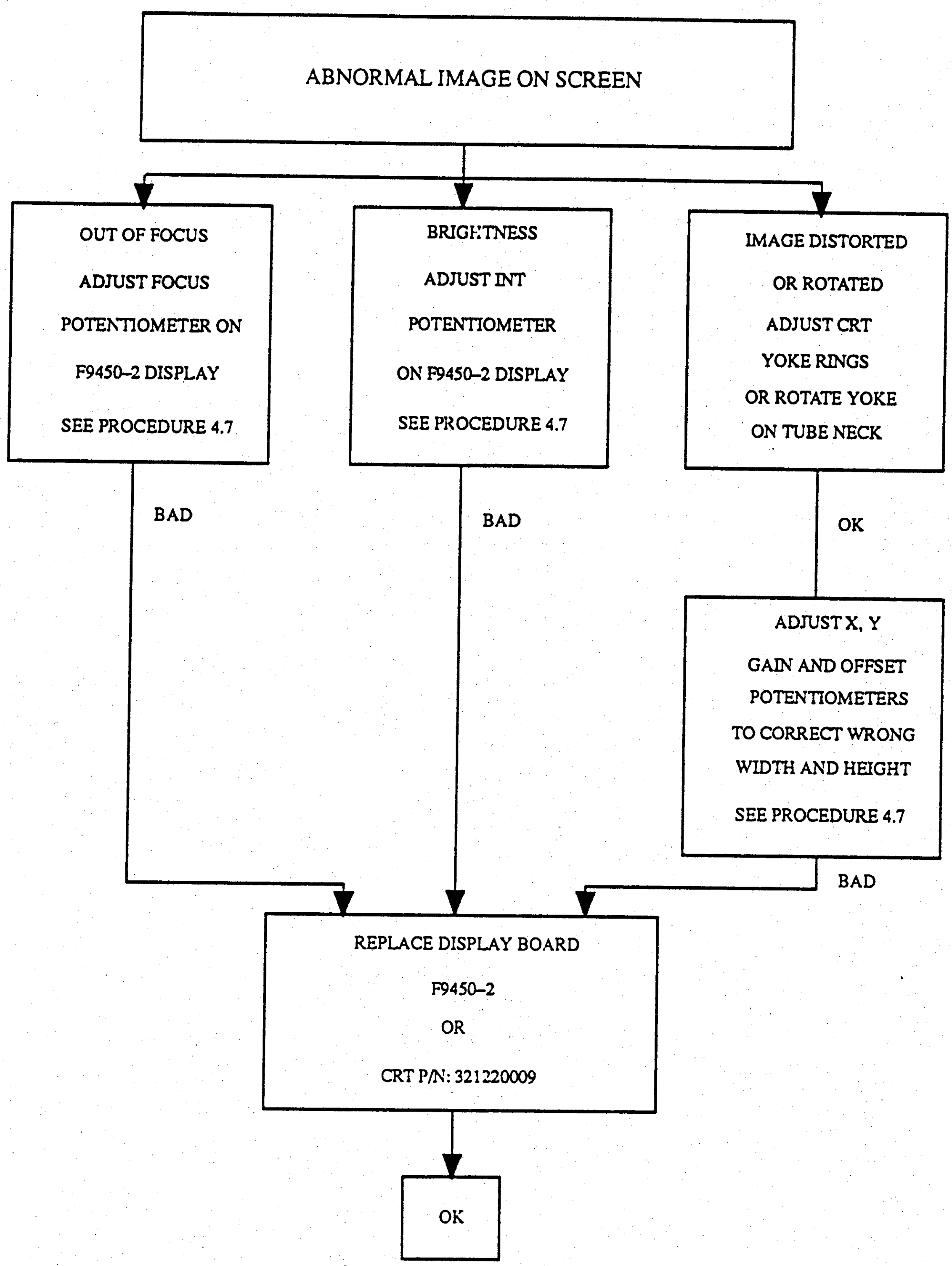
5.5.1


NO DISPLAY OR FRONT PANEL CONTROL
MASTER RESET PRESS REAR PANEL RESET UNTIL BEEP (10 SECONDS)
BAD
CHECK MAIN FUSES AC LINE INPUT
BAD
REPLACE FUSES 5 AMP P/N: 433162251
OK
READJUST POWER SUPPLY SEE ADJUSTMENT PROCEDURE 4.5
BAD
CHECK POWER SUPPLY VOLTAGES ± 15V ,±5V ON F9424–1 BASE BOARD CONNECTOR J7 PIN 10–9.8.5
BAD
REPLACE POWER SUPPLY F9451–1
OK
CHECK FUSES ON + 15V, – 15V FOR DISPLAY BOARD
BAD
REPLACE 2 AMP FUSES ON F9451–1 POWER SUPPLY FOR DISPLAY BOARD
OK
REPLACE F9450–2 DISPLAY BOARD
BAD
CHECK HEATER GLOW AT REAR OF CRT
BAD
REPLACE CRT P/N: 321220009
OK

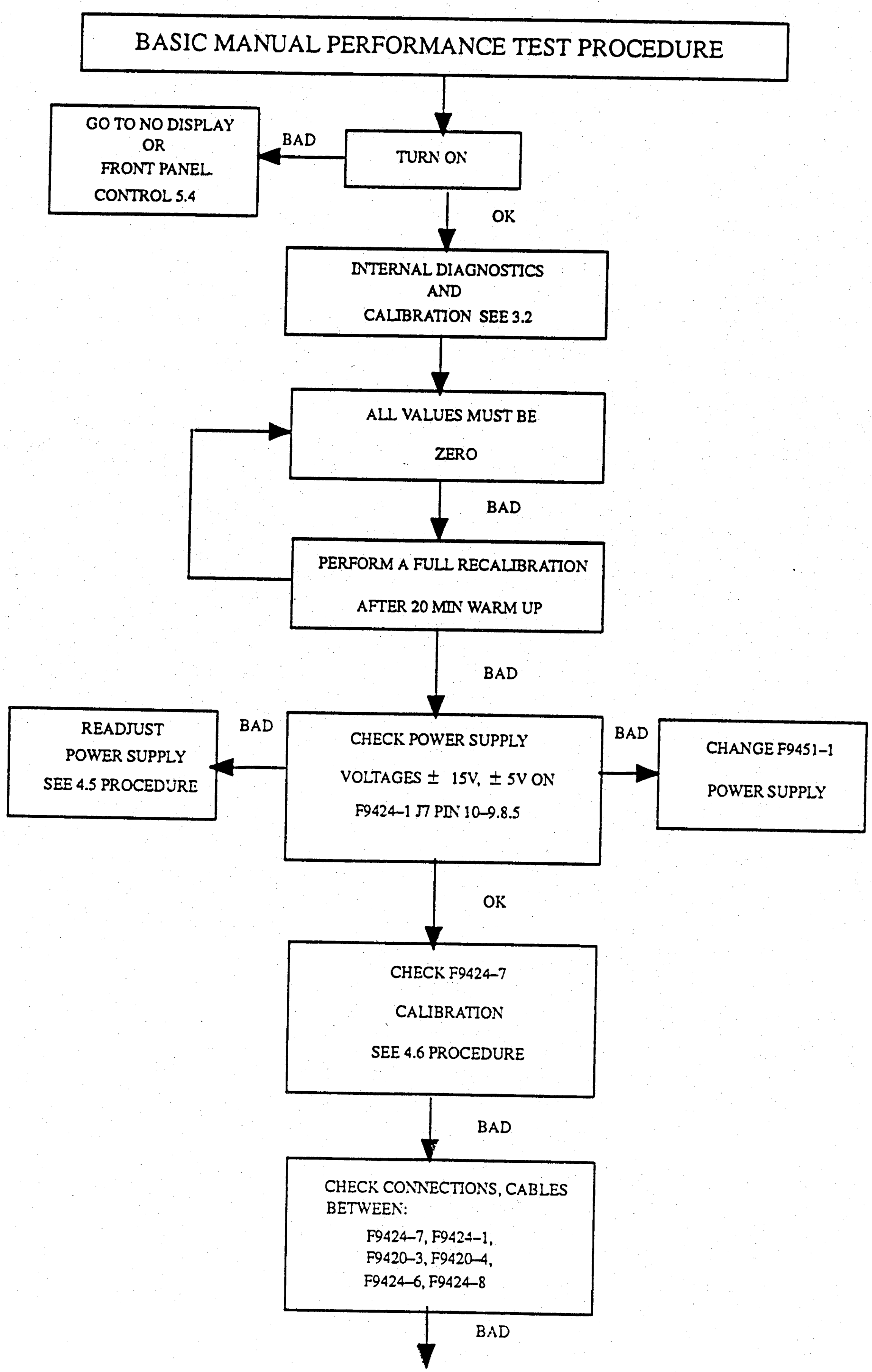
5.5.2


OK
REPLACE F9424-6
PROCESSOR
BAD
CHECK FOR PAL
PRESENT AT SOCKET
A22 ON F9424-1
BASE BOARD
THIS PAL SUPPLIES THE
SYNCHRO LINE TO
DISPLAY BOARD
OK
REPLACE F9424-1
BASE BOARD
BAD
REPLACE F9424-5
FRONT PANEL
OK

5.6

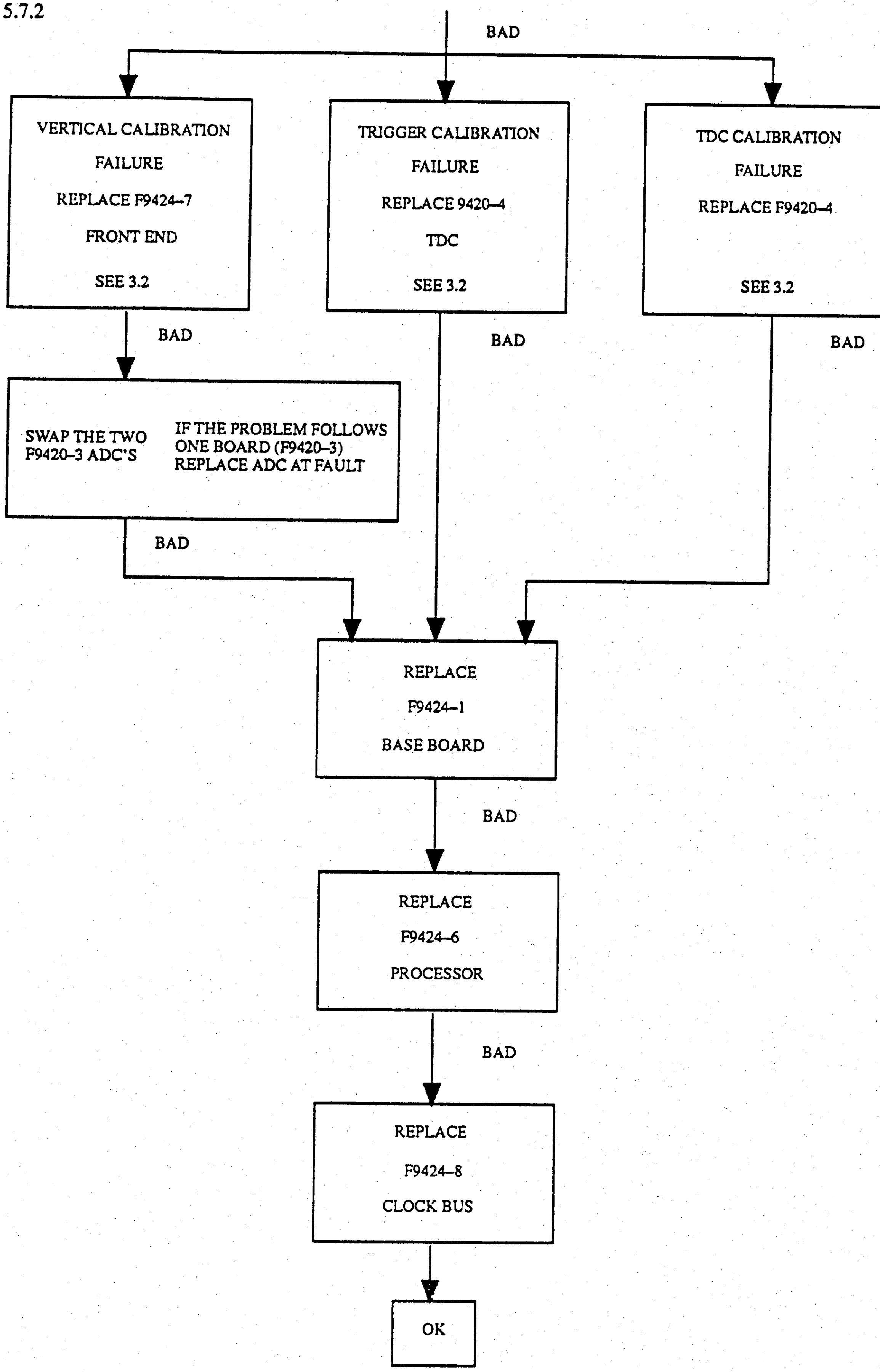

ABNORMAL IMAGE ON SCREEN
OUT OF FOCUS
ADJUST FOCUS
POTENTIOMETER ON
F9450–2 DISPLAY
SEE PROCEDURE 4.7
BRIGHTNESS
ADJUST INT
POTENTIOMETER
ON F9450–2 DISPLAY
SEE PROCEDURE 4.7
IMAGE DISTORTED
OR ROTATED
ADJUST CRT
YOKE RINGS
OR ROTATE YOKE
ON TUBE NECK
BAD
BAD
OK
ADJUST X, Y
GAIN AND OFFSET
POTENTIOMETERS
TO CORRECT WRONG
WIDTH AND HEIGHT
SEE PROCEDURE 4.7
BAD
REPLACE DISPLAY BOARD
F9450–2
OR
CRT P/N: 321220009
OK

5.7.1

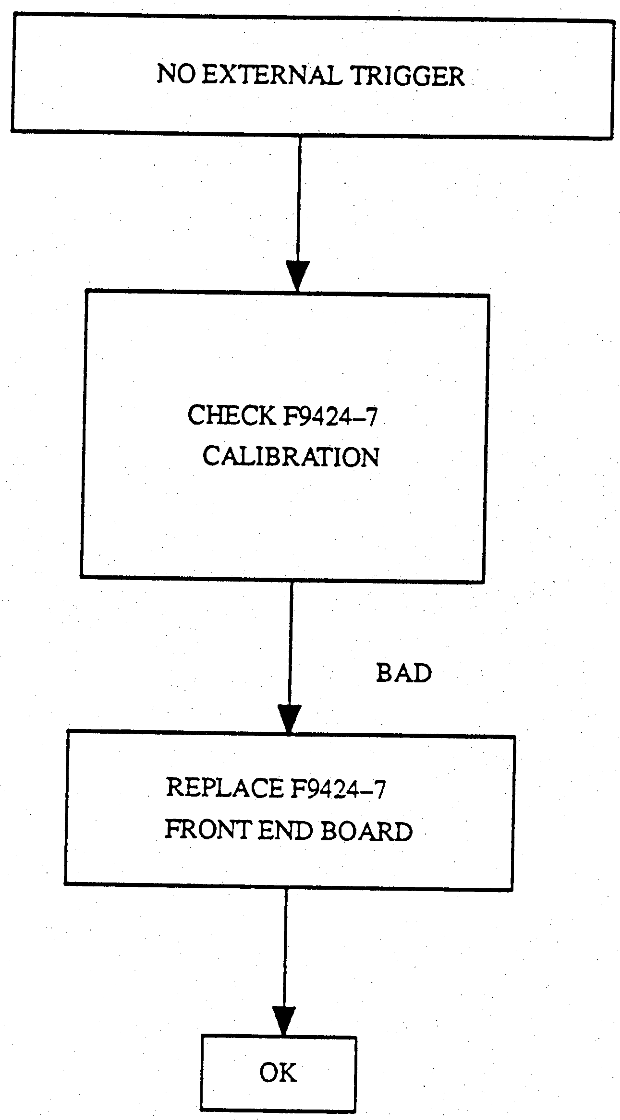


BASIC MANUAL PERFORMANCE TEST PROCEDURE
TURN ON
BAD
GO TO NO DISPLAY OR FRONT PANEL CONTROL 5.4
OK
INTERNAL DIAGNOSTICS AND CALIBRATION SEE 3.2
ALL VALUES MUST BE ZERO
BAD
PERFORM A FULL RECALIBRATION AFTER 20 MIN WARM UP
BAD
CHECK POWER SUPPLY VOLTAGES ± 15V, ± 5V ON F9424–1 J7 PIN 10–9.8.5
BAD
READJUST POWER SUPPLY SEE 4.5 PROCEDURE
BAD
CHANGE F9451–1 POWER SUPPLY
OK
CHECK F9424–7 CALIBRATION SEE 4.6 PROCEDURE
BAD
CHECK CONNECTIONS, CABLES BETWEEN: F9424–7, F9424–1, F9420–3, F9420–4, F9424–6, F9424–8
BAD

5.7.2


BAD
VERTICAL CALIBRATION FAILURE REPLACE F9424–7 FRONT END SEE 3.2
TRIGGER CALIBRATION FAILURE REPLACE 9420–4 TDC SEE 3.2
TDC CALIBRATION FAILURE REPLACE F9420–4 SEE 3.2
BAD
BAD
BAD
SWAP THE TWO F9420–3 ADC'S
IF THE PROBLEM FOLLOWS ONE BOARD (F9420–3) REPLACE ADC AT FAULT
BAD
REPLACE F9424–1 BASE BOARD
BAD
REPLACE F9424–6 PROCESSOR
BAD
REPLACE F9424–8 CLOCK BUS
OK

5.7.3


NO EXTERNAL TRIGGER
CHECK F9424–7 CALIBRATION
BAD
REPLACE F9424–7 FRONT END BOARD
OK

5.8 Equipment and spare parts recommended for service

5.8.1 Equipment

The following list of equipment are needed to provide the technician access to the 9424 subassemblies during repair and calibration.

1- Sine wave generator: Marconi 2019A, 2022C, 2030 or equivalent.

2- Sine wave generator: 5 volt peak to peak amplitude type SG503 or equivalent.

3- DC precision power supply: Tektronix PS5004 or equivalent.

4- Digital Multimeter: Philips PM2525 or equivalent.

5- Digital scope 350 MHz bandwidth: LeCroy 9450 or equivalent.

6- Fast rise time pulser: LeCroy 4969 (<700PS) or equivalent.

7- BNC coaxial cables (5 nsec, 2 nsec, 1 nsec), adapter T BNC, Adapter BNC - banana, 50Ω BNC terminator feed through.

5.8.2 Spare parts

In order to make the repair of 9424 at board level, a minimum stock of boards is at least one each:

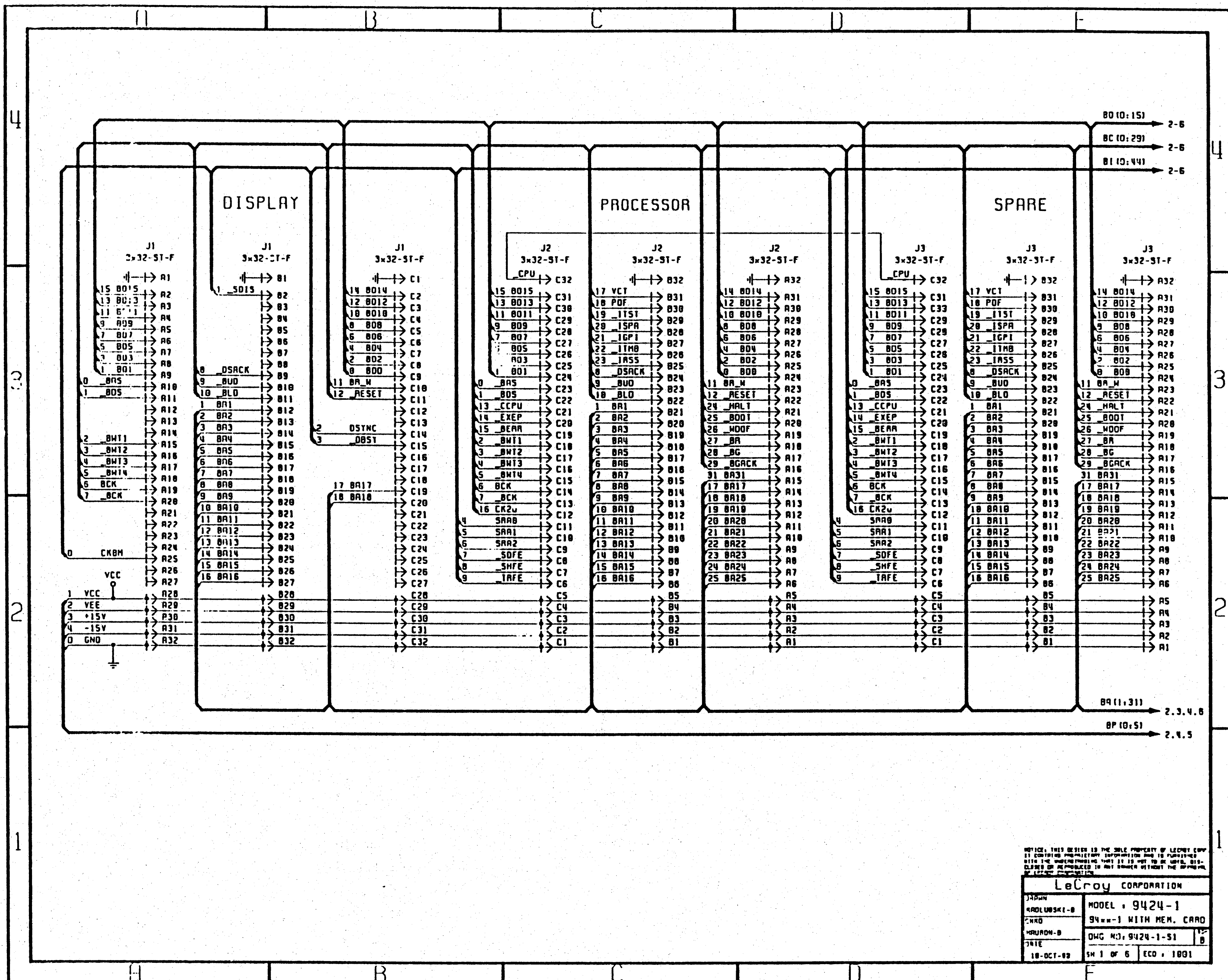
- F9424-1 Base board
- F9450-2 Display board
- F9420-3 ADC (Analog to Digital Converter)
- F9420-4 TDC (Time to Digital Converter)
- F9424-5 Front panel
- F9424-6 Processor
- F9424-7 Front End
- F9424-8 Clock bus
- F9451-1 Power supply

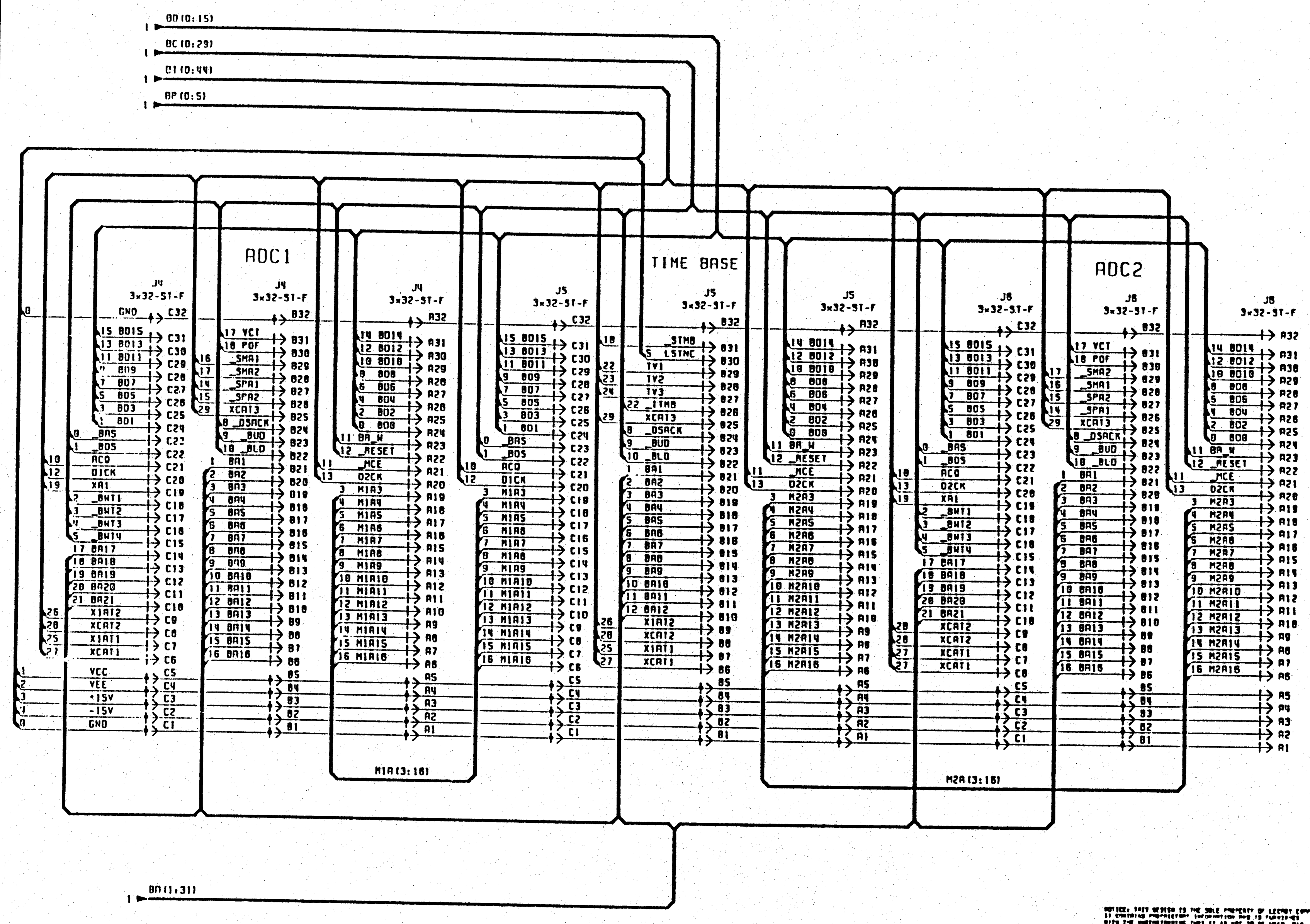
The display tube, yoke and fan are very reliable parts. Their failure rate is extremely low. Also a few other parts (scope handle, metal enclosure case and back panel) are not on the above list.

Chapter 6

CIRCUIT DIAGRAMS

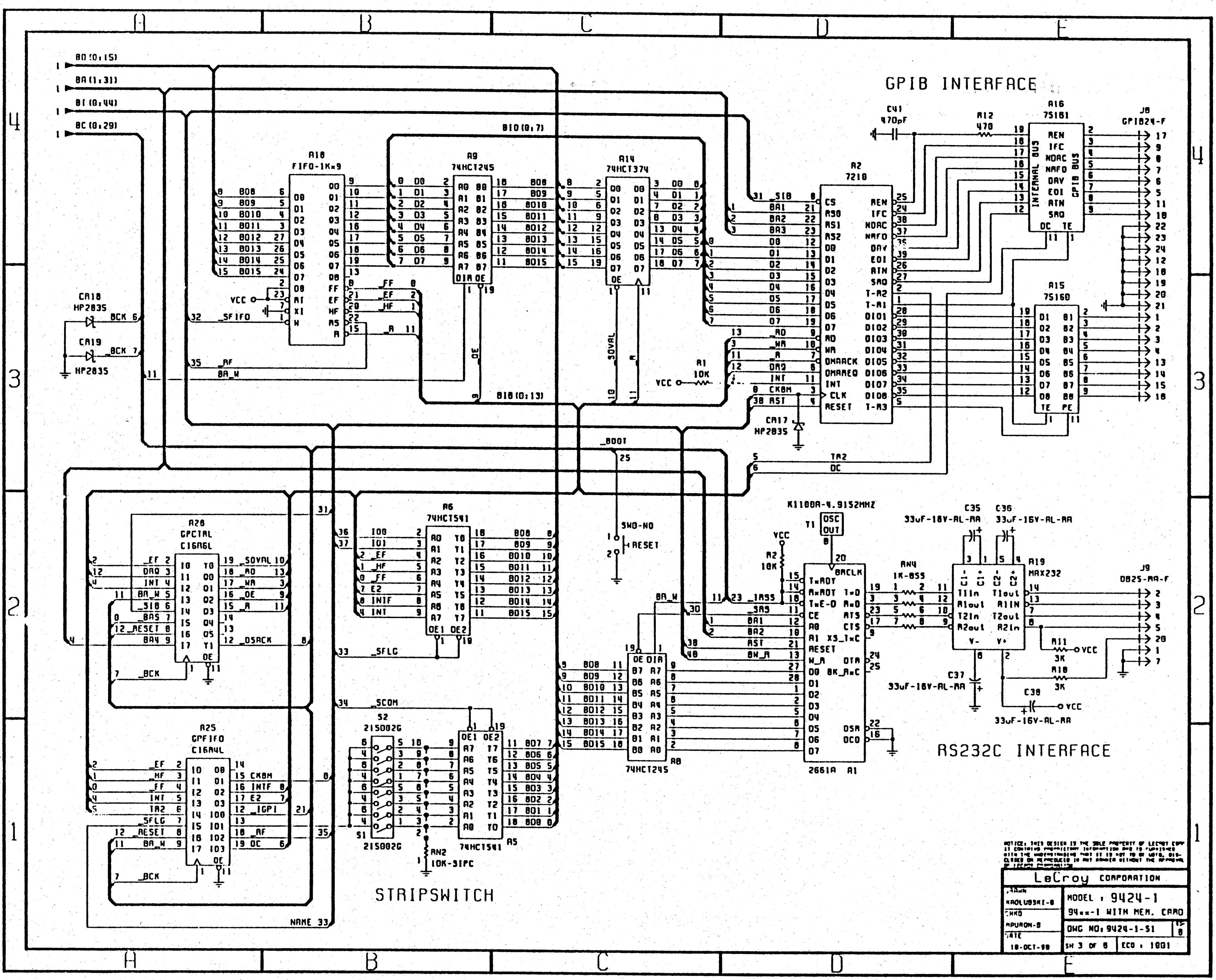
Table of Contents:

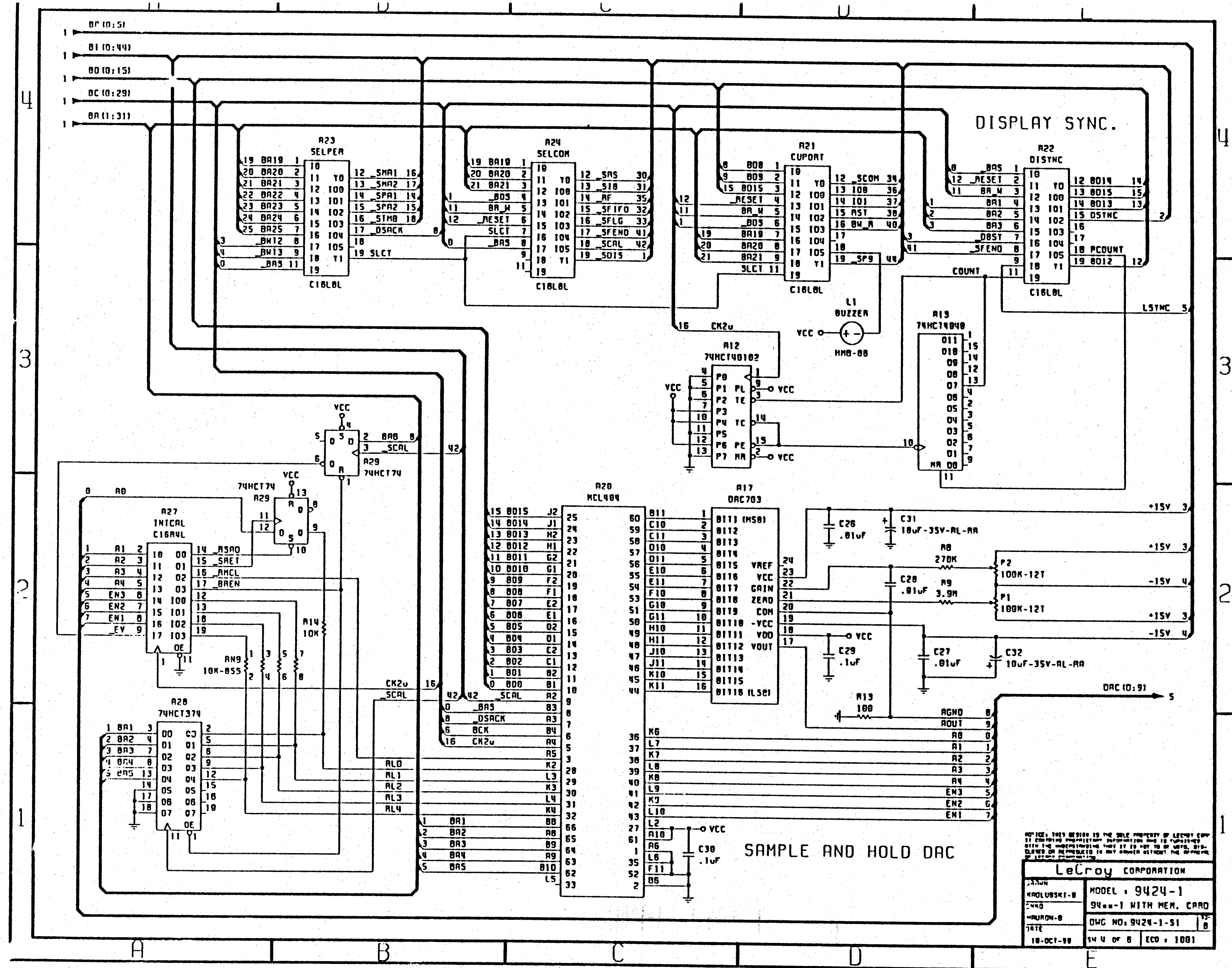

DISPLAY
PROCESSOR
SPARE
J1 3x32-ST-F
J2 3x32-ST-F
J3 3x32-ST-F
BD(0:15) 2-6
BC(0:29) 2-6
BI(0:44) 2-6
BA(1:31) 2,3,4,6
BP(0:5) 2,4,5
VCC
LeCroy CORPORATION
MODEL : 9424-1
94xx-1 WITH MEM. CARD
DWG NO: 9424-1-S1
SH 1 OF 6
ECO : 1001
18-OCT-89

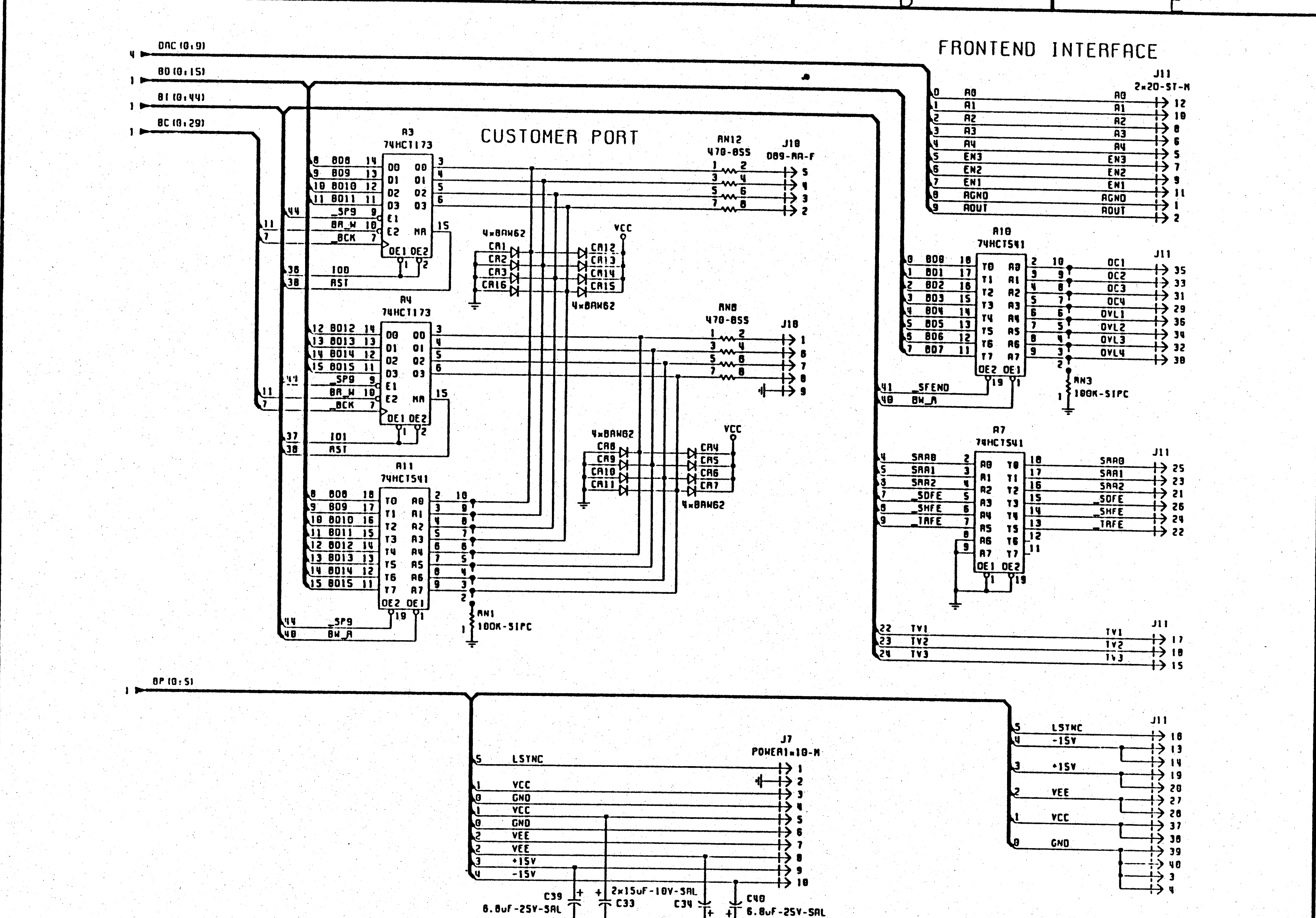


NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE COPIED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.

LeCroy CORPORATION	
DRAWN KROLUBSKI-B	MODEL : 9424-1
CHKD MURDOW-B	94xx-1 WITH MEM. CARD
DATE 18-OCT-88	DWG NO: 9424-1-S1 REV B
	SH 2 OF 6 ECO : 1001

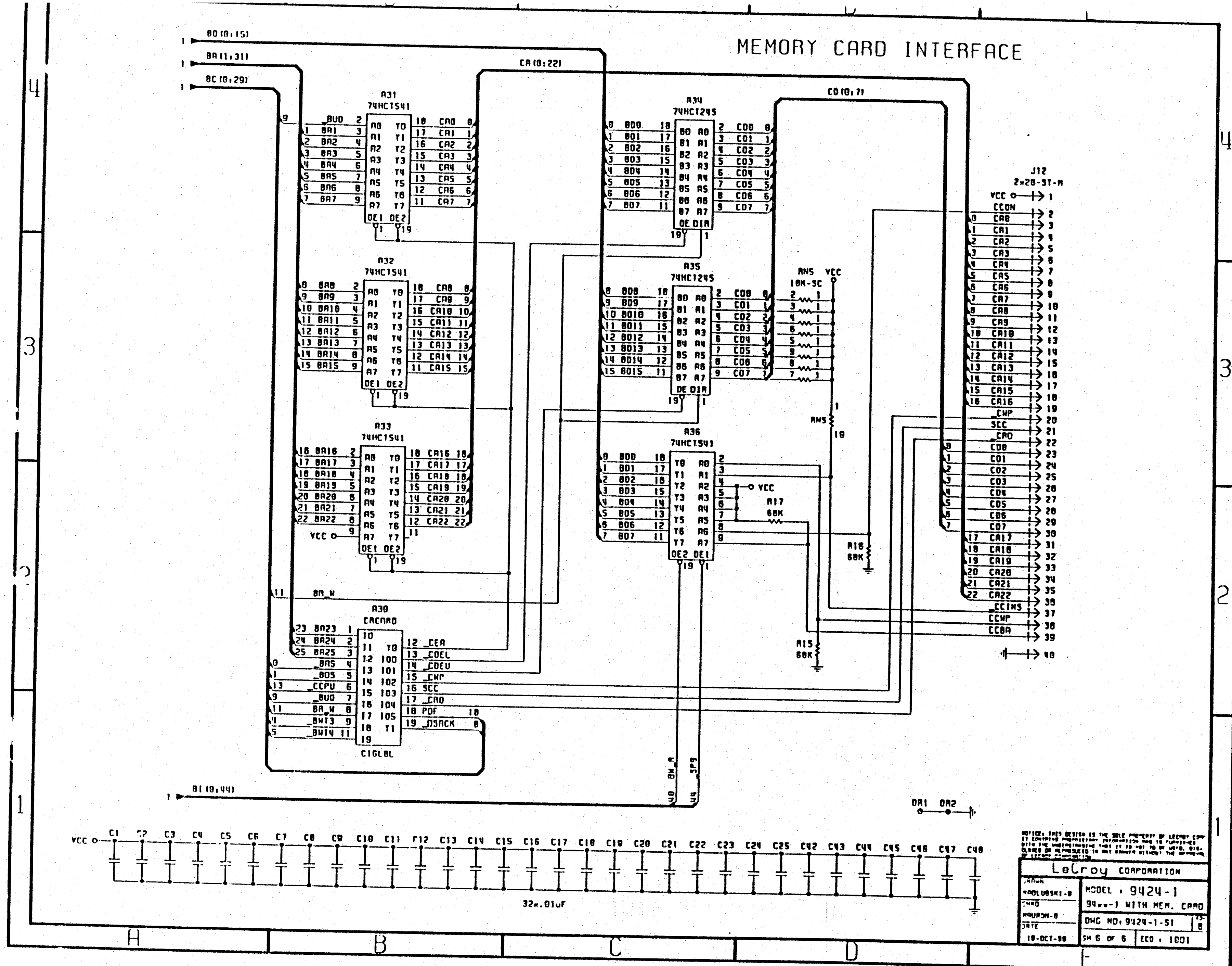

GPIB INTERFACE
RS232C INTERFACE
STRIPSWITCH
A18 FIFO-1Kx9
A9 74HCT245
A14 74HCT374
A2 7210
A16 75161
A15 75160
J8 GP1824-F
C41 470pF
R12 470
A6 74HCT541
A5 74HCT541
A8 74HCT245
A1 2661A
A19 MAX232
J9 DB25-MA-F
RN4 1K-BSS
R1 10K
R2 10K
R11 3K
R10 3K
C35 33uF-16V-AL-AA
C36 33uF-16V-AL-AA
C37 33uF-16V-AL-AA
C38 33uF-16V-AL-AA
K1100A-4.9152MHZ
T1
SW0-NO RESET
A28 GPCTAL C16A6L
A25 GPFIFO C16A4L
S1 215002G
S2 215002G
RN2 10K-SIPC
CA17 HP2835
CA18 HP2835
CA19 HP2835
BD(0:15)
BA(1:31)
BI(0:44)
BC(0:29)
BID(0:7)
BIB(0:13)
NAME 33
LeCroy CORPORATION
DRAWN KAOLUBSKI-B
CHKD APURON-B
DATE 18-OCT-88
MODEL : 9424-1
94xx-1 WITH MEM. CARD
DWG NO: 9424-1-S1
SH 3 OF 8
ECO : 1881

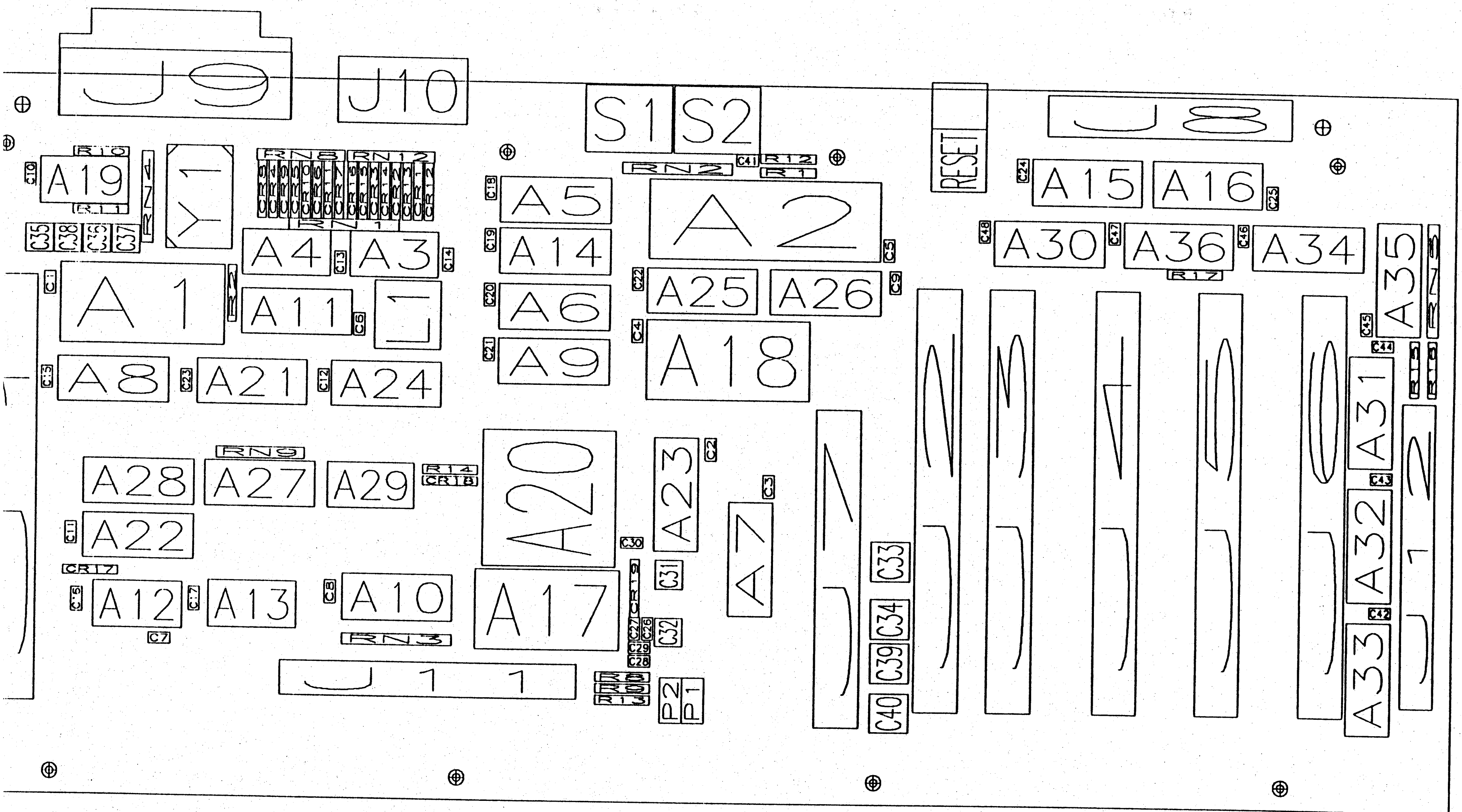

DISPLAY SYNC.
SAMPLE AND HOLD DAC
LeCroy CORPORATION
MODEL : 9424-1
94xx-1 WITH MEM. CARD
DWG NO: 9424-1-S1
SH 4 OF 6
ECO : 1081
KAOLUBSKI-B
MAURON-B
10-OCT-90



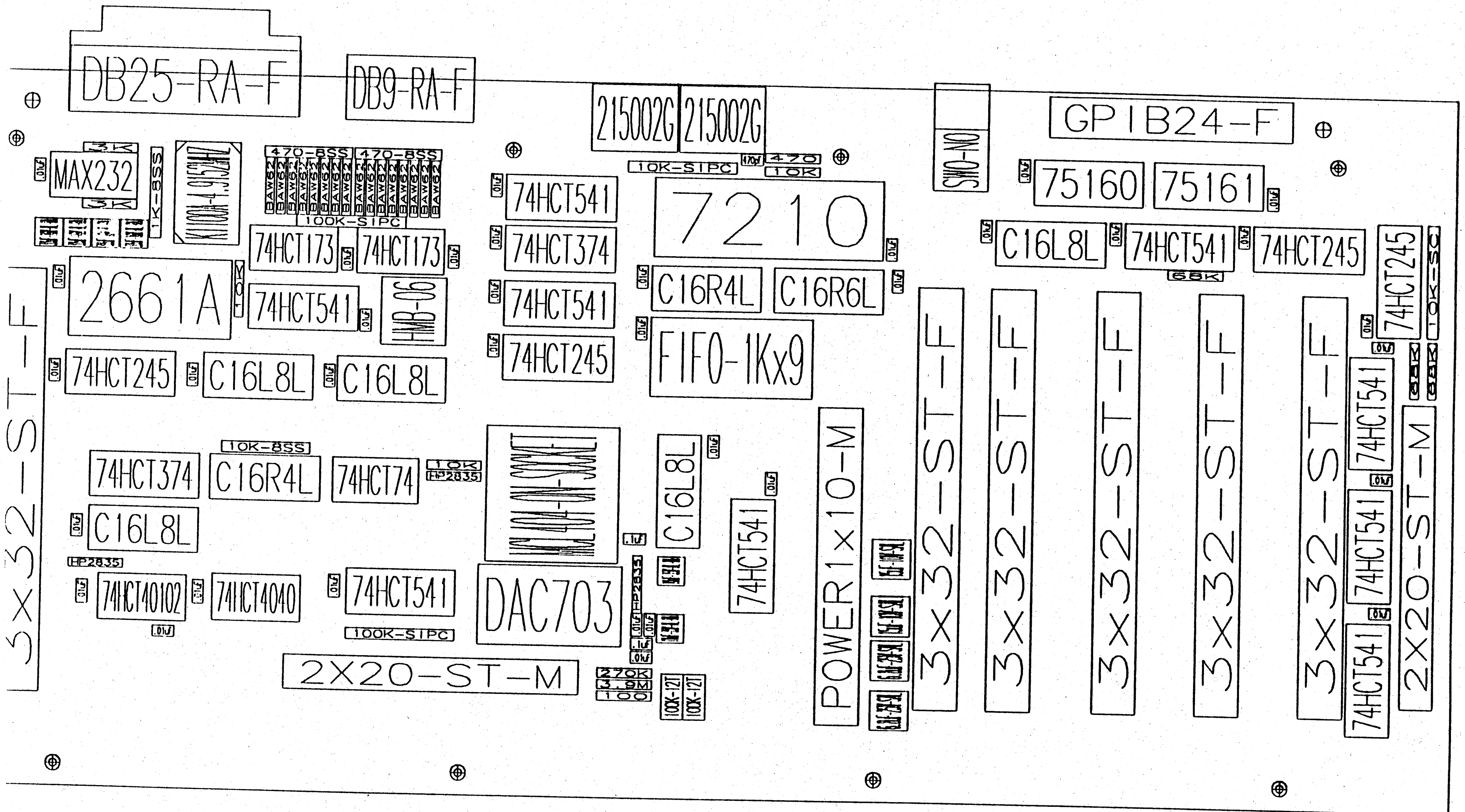
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.

LeCroy CORPORATION	
DRAWN KADLUBSKI-B	MODEL : 9424-1
CHKD	94xx-1 WITH MEM. CARD
MAURON-B	DWG NO: 9424-1-S1 REV B
DATE 18-OCT-89	SH 5 OF 8 ECO : 1001

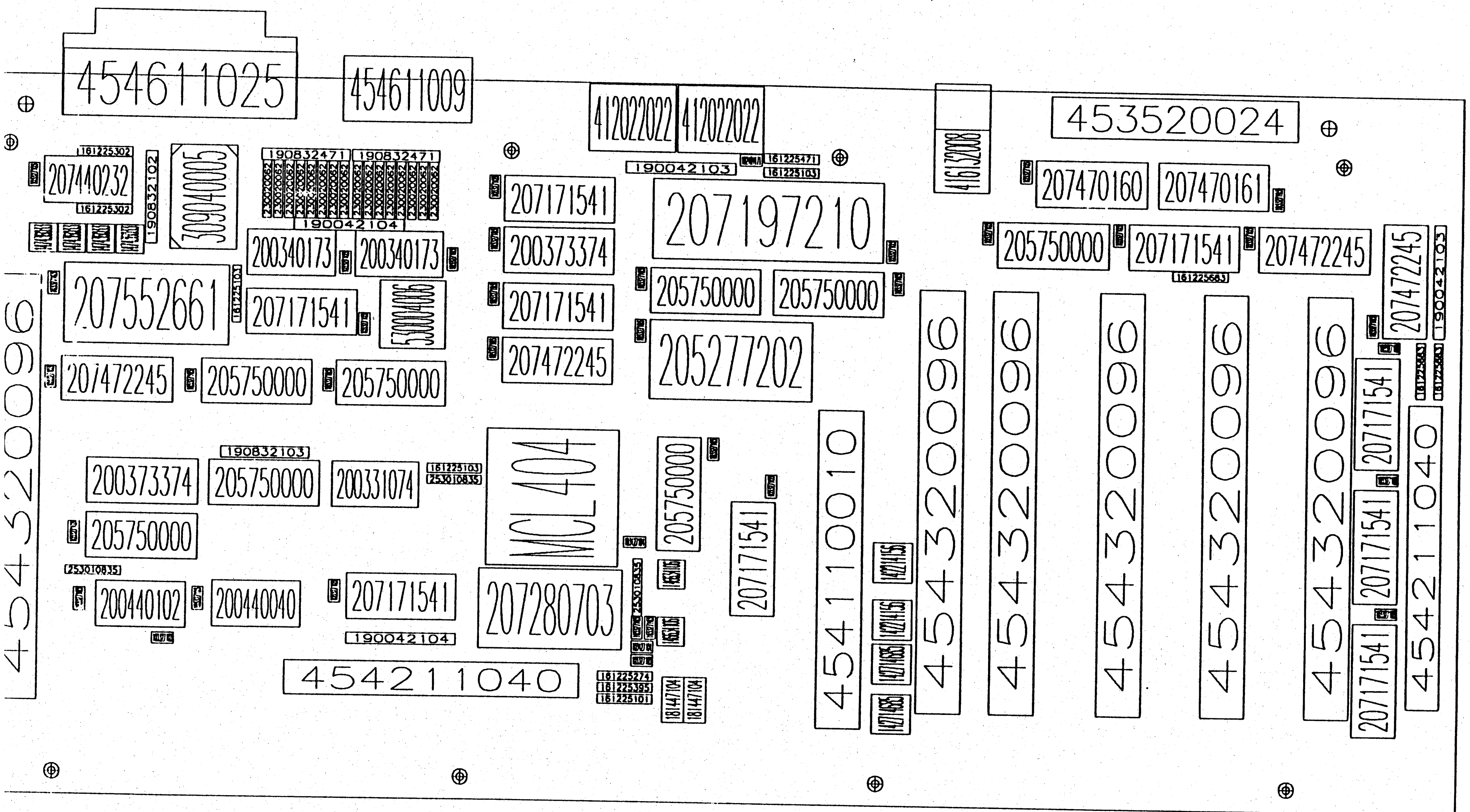

MEMORY CARD INTERFACE
BD(0:15)
BA(1:31)
BC(0:29)
BI(0:44)
CA(0:22)
CD(0:7)
A31 74HCT541
A32 74HCT541
A33 74HCT541
A34 74HCT245
A35 74HCT245
A36 74HCT541
A30 CACARD C16L8L
J12 2x20-ST-M
RN5 10K-SC
R15 68K
R16 68K
R17 68K
VCC
_CEA
_CDEL
_CDEU
_CWP
SCC
_CRD
POF
_DSACK
CCON
_CCINS
CCWP
CCBA
BA_W
_SP9
DR1 DR2
32x.01uF
LeCroy CORPORATION
MODEL : 9424-1
94xx-1 WITH MEM. CARD
DWG NO: 9424-1-S1
SH 6 OF 8
ECO : 1001
18-OCT-88



9124_1 PCB Rev:B



9424_1 PCB Rev:B

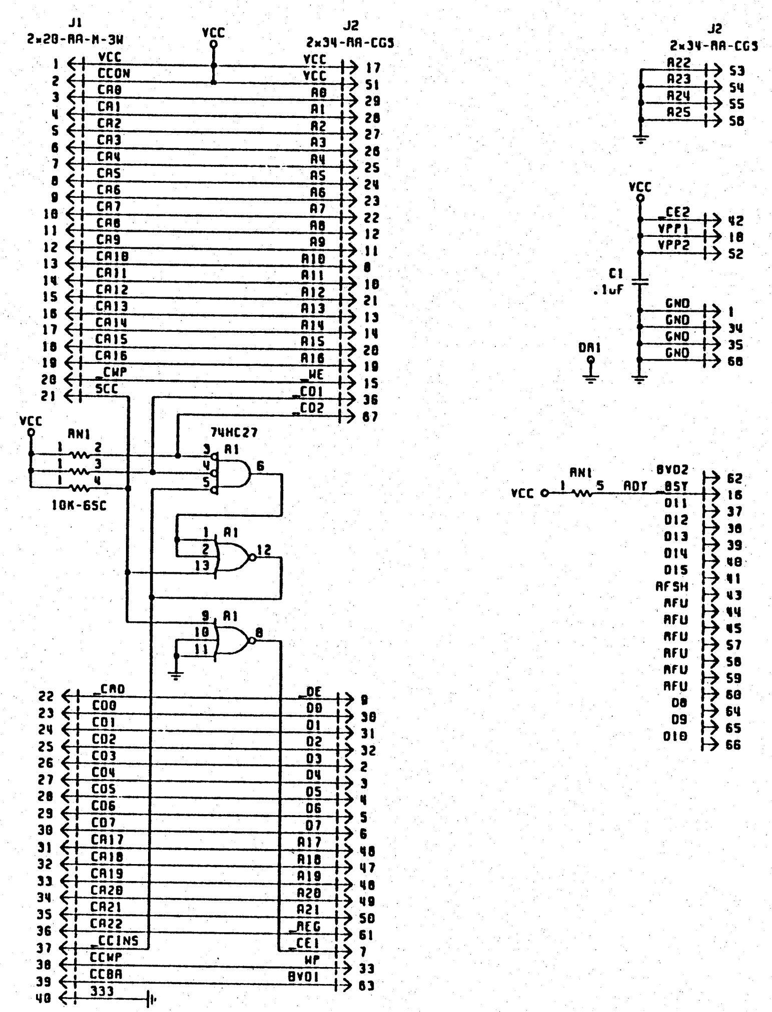


9424_1 PCB Rev:B

A1	207552661	2661A	DIP28
A2	207197210	7210	DIP40
A3	200340173	74HCT173	DIP16
A4	200340173	74HCT173	DIP16
A5	207171541	74HCT541	DIP20
A6	207171541	74HCT541	DIP20
A7	207171541	74HCT541	DIP20
A8	207472245	74HCT245	DIP20
A9	207472245	74HCT245	DIP20
A10	207171541	74HCT541	DIP20
A11	207171541	74HCT541	DIP20
A12	200440102	74HCT40102	DIP16
A13	200440040	74HCT4040	DIP16
A14	200373374	74HCT374	DIP20
A15	207470160	75160	DIP20
A16	207470161	75161	DIP20
A17	207280703	DAC703	DIP24
A18	205277202	FIFO-1Kx9	DIP28
A19	207440232	MAX232	DIP16
A20	MCL404	MCL404-ON-SOCKET	QILE68EX
A21	205750000	C16L8L	DIP20
A22	205750000	C16L8L	DIP20
A23	205750000	C16L8L	DIP20
A24	205750000	C16L8L	DIP20
A25	205750000	C16R4L	DIP20
A26	205750000	C16R6L	DIP20
A27	205750000	C16R4L	DIP20
A28	200373374	74HCT374	DIP20
A29	200331074	74HCT74	DIP14
A30	205750000	C16L8L	DIP20
A31	207171541	74HCT541	DIP20
A32	207171541	74HCT541	DIP20
A33	207171541	74HCT541	DIP20
A34	207472245	74HCT245	DIP20
A35	207472245	74HCT245	DIP20
A36	207171541	74HCT541	DIP20
C1	103327103	.01uF	SMONOBP
C2	103327103	.01uF	SMONOBP
C3	103327103	.01uF	SMONOBP
C4	103327103	.01uF	SMONOBP
C5	103327103	.01uF	SMONOBP
C6	103327103	.01uF	SMONOBP
C7	103327103	.01uF	SMONOBP
C8	103327103	.01uF	SMONOBP
C9	103327103	.01uF	SMONOBP
C10	103327103	.01uF	SMONOBP
C11	103327103	.01uF	SMONOBP
C12	103327103	.01uF	SMONOBP
C13	103327103	.01uF	SMONOBP
C14	103327103	.01uF	SMONOBP
C15	103327103	.01uF	SMONOBP
C16	103327103	.01uF	SMONOBP
C17	103327103	.01uF	SMONOBP
C18	103327103	.01uF	SMONOBP
C19	103327103	.01uF	SMONOBP
C20	103327103	.01uF	SMONOBP

C21	103327103	.01uF	SMONOBP
C22	103327103	.01uF	SMONOBP
C23	103327103	.01uF	SMONOBP
C24	103327103	.01uF	SMONOBP
C25	103327103	.01uF	SMONOBP
C26	103327103	.01uF	SMONOBP
C27	103327103	.01uF	SMONOBP
C28	103327103	.01uF	SMONOBP
C29	103427104	.1uF	SMONOBP
C30	103427104	.1uF	SMONOBP
C31	146634106	10uF-35V-AL-RA	TCAP
C32	146634106	10uF-35V-AL-RA	TCAP
C33	142214156	15uF-10V-SAL	LTCAP
C34	142214156	15uF-10V-SAL	LTCAP
C35	147436033	33uF-16V-AL-RA	TCAP
C36	147436033	33uF-16V-AL-RA	TCAP
C37	147436033	33uF-16V-AL-RA	TCAP
C38	147436033	33uF-16V-AL-RA	TCAP
C39	142714685	6.8uF-25V-SAL	LTCAP
C40	142714685	6.8uF-25V-SAL	LTCAP
C41	102484471	470pF	SMONO
C42	103327103	.01uF	SMONOBP
C43	103327103	.01uF	SMONOBP
C44	103327103	.01uF	SMONOBP
C45	103327103	.01uF	SMONOBP
C46	103327103	.01uF	SMONOBP
C47	103327103	.01uF	SMONOBP
C48	103327103	.01uF	SMONOBP
CR1	230020062	BAW62	DO35
CR2	230020062	BAW62	DO35
CR3	230020062	BAW62	DO35
CR4	230020062	BAW62	DO35
CR5	230020062	BAW62	DO35
CR6	230020062	BAW62	DO35
CR7	230020062	BAW62	DO35
CR8	230020062	BAW62	DO35
CR9	230020062	BAW62	DO35
CR10	230020062	BAW62	DO35
CR11	230020062	BAW62	DO35
CR12	230020062	BAW62	DO35
CR13	230020062	BAW62	DO35
CR14	230020062	BAW62	DO35
CR15	230020062	BAW62	DO35
CR16	230020062	BAW62	DO35
CR17	253010835	HP2835	DO35
CR18	253010835	HP2835	DO35
CR19	253010835	HP2835	DO35
DR1	$NULL	DRILL4_3	DRILL4_3
DR2	$NULL	DRILL4_3	DRILL4_3
J1	454320096	3x32-ST-F	CONN3X32_ST_F
J2	454320096	3x32-ST-F	CONN3X32_ST_F
J3	454320096	3x32-ST-F	CONN3X32_ST_F
J4	454320096	3x32-ST-F	CONN3X32_ST_F
J5	454320096	3x32-ST-F	CONN3X32_ST_F
J6	454320096	3x32-ST-F	CONN3X32_ST_F
J7	454110010	POWER1x10-M	POWER1X10_M

J8	453520024	GPIB24-F	GPIB24_F
J9	454611025	DB25-RA-F	DB25_RA_F
J10	454611009	DB9-RA-F	DB9_RA_F
J11	454211040	2X20-ST-M	CONN2X20_ST_M
J12	454211040	2X20-ST-M	CONN2X20_ST_M
L1	530004006	HMB-06	HBM_06
P1	181447104	100K-12T	POT66WR
P2	181447104	100K-12T	POT66WR
R1	161225103	10K	RES05
R2	161225103	10K	RES05
R8	161225274	270K	RES05
R9	161225395	3.9M	RES05
R10	161225302	3K	RES05
R11	161225302	3K	RES05
R12	161225471	470	RES05
R13	161225101	100	RES05
R14	161225103	10K	RES05
R15	161225683	68K	RES05
R16	161225683	68K	RES05
R17	161225683	68K	RES05
RN1	190042104	100K-SIPC	SIP10RES
RN2	190042103	10K-SIPC	SIP10RES
RN3	190042104	100K-SIPC	SIP10RES
RN4	190832102	1K-8SS	SIP8RES
RN5	190042103	10K-SC	SIP10RES
RN8	190832471	470-8SS	SIP8RES
RN9	190832103	10K-8SS	SIP8RES
RN12	190832471	470-8SS	SIP8RES
RESET	416132008	SW0-NO	SW0_NO
S1	412022022	215002G	STRIPSWITCH
S2	412022022	215002G	STRIPSWITCH
Y1	309040005	K1100A-4.9152MHZ	$1100_QUARTZ



NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.

LeCroy CORPORATION	
DRAWN KROLUBSKI-B	MODEL : 9424-2
CHKD MAURON-B	SUPPORT FOR MEM. CARD
DATE 28-JAN-91	DWG NO: 9424-2-S1 — A
	SH 1 OF 1 — ECO : 1000

9424-2 Rev:E

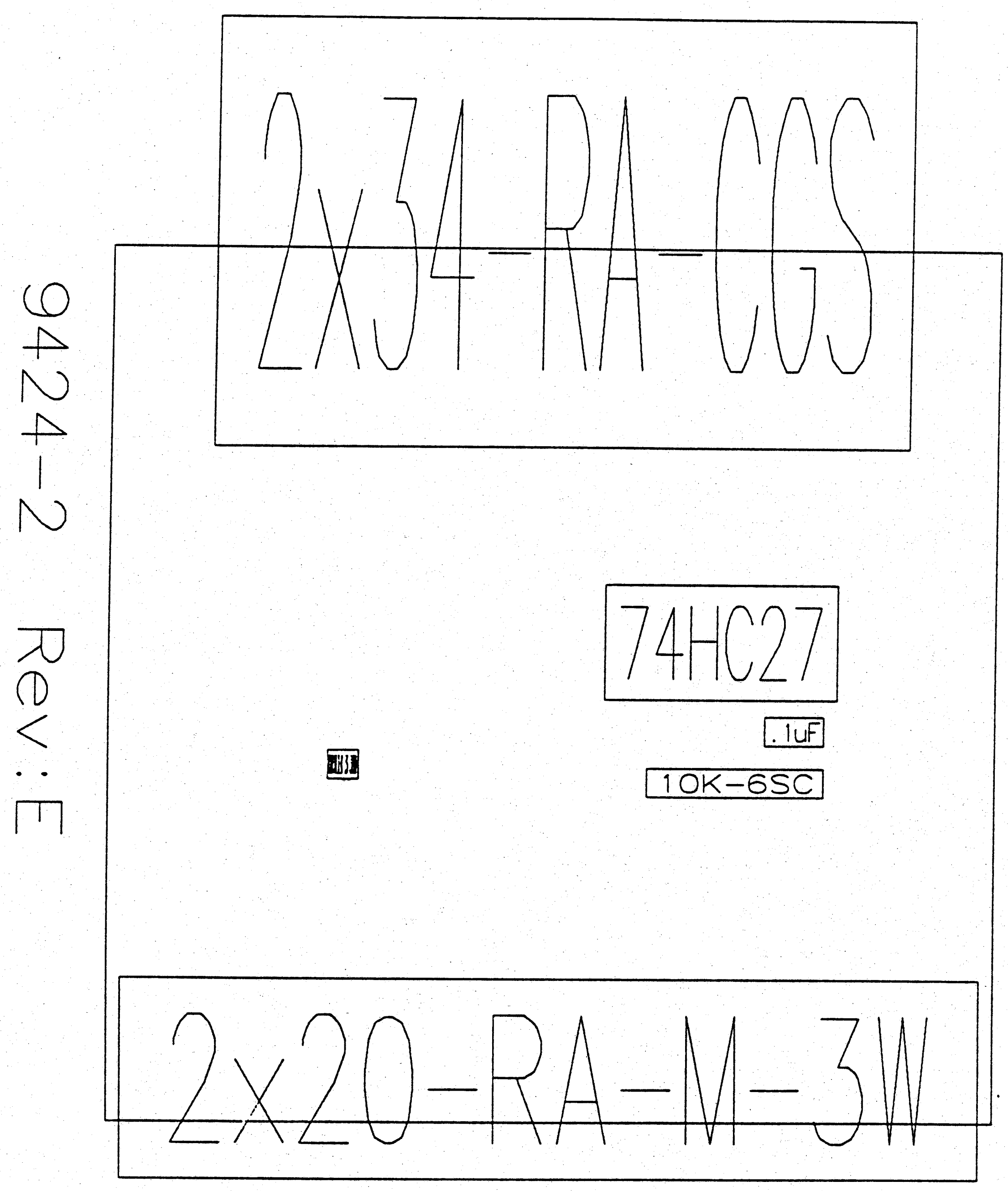
40450068

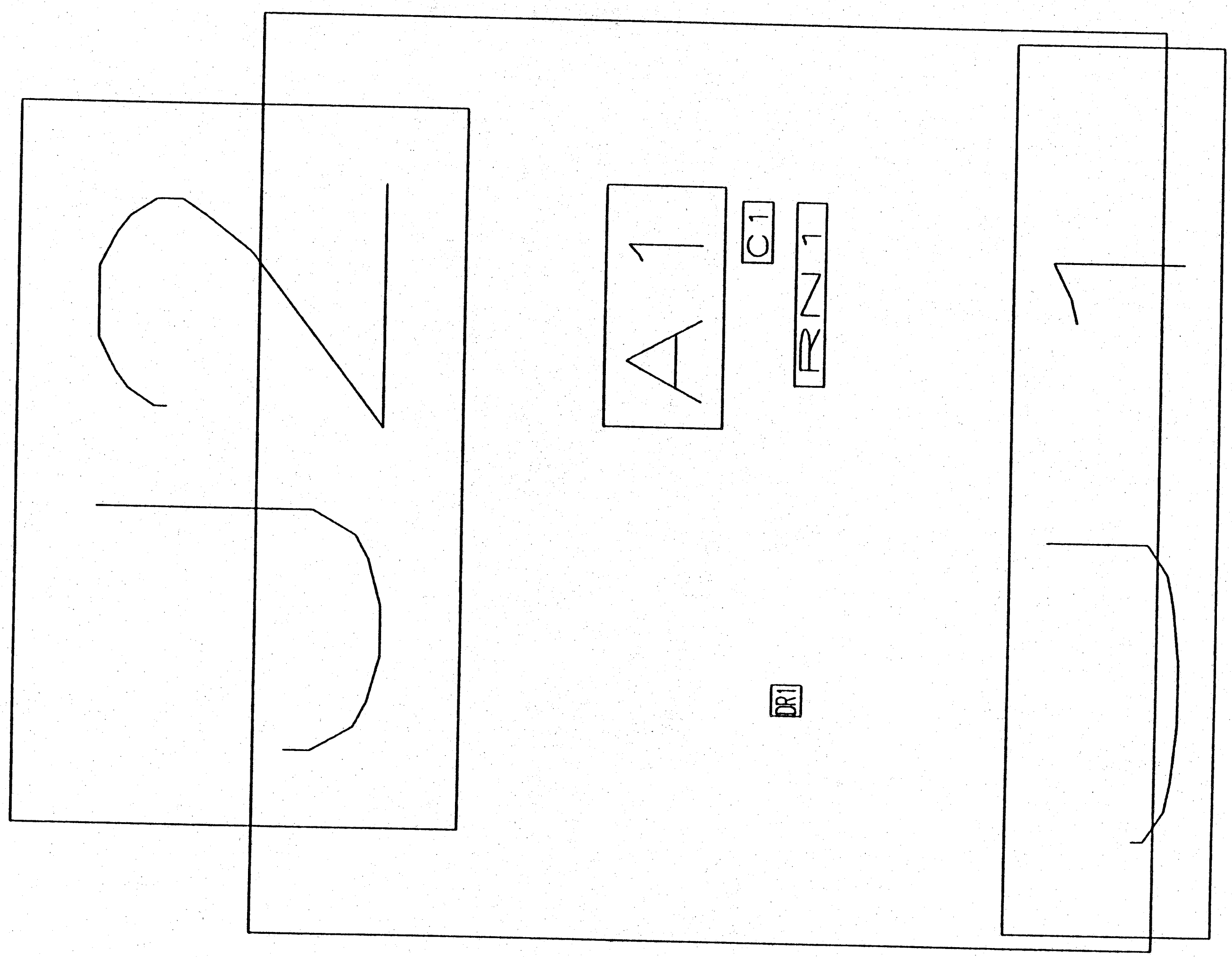
74HC27

103427104

190642103

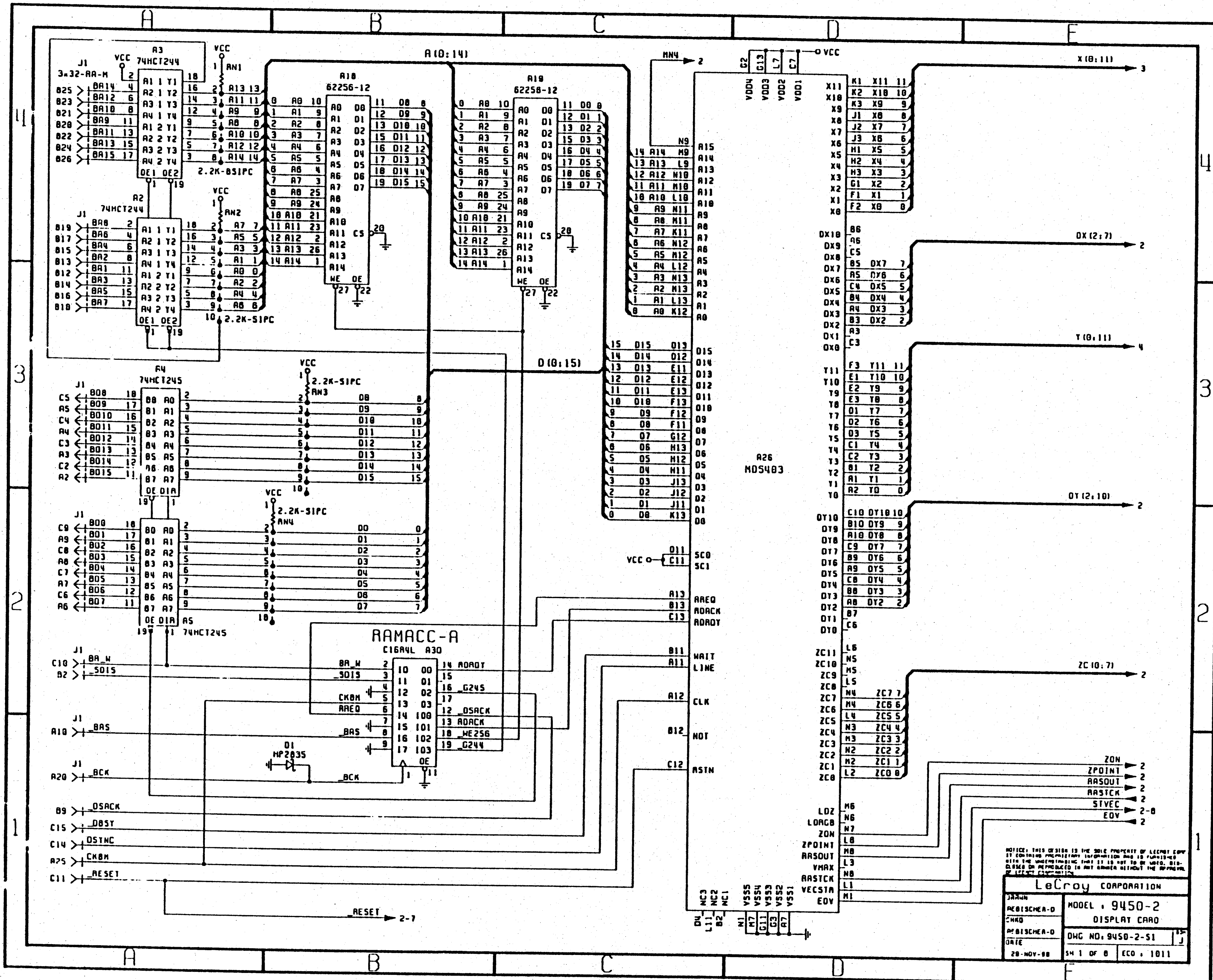
45611040

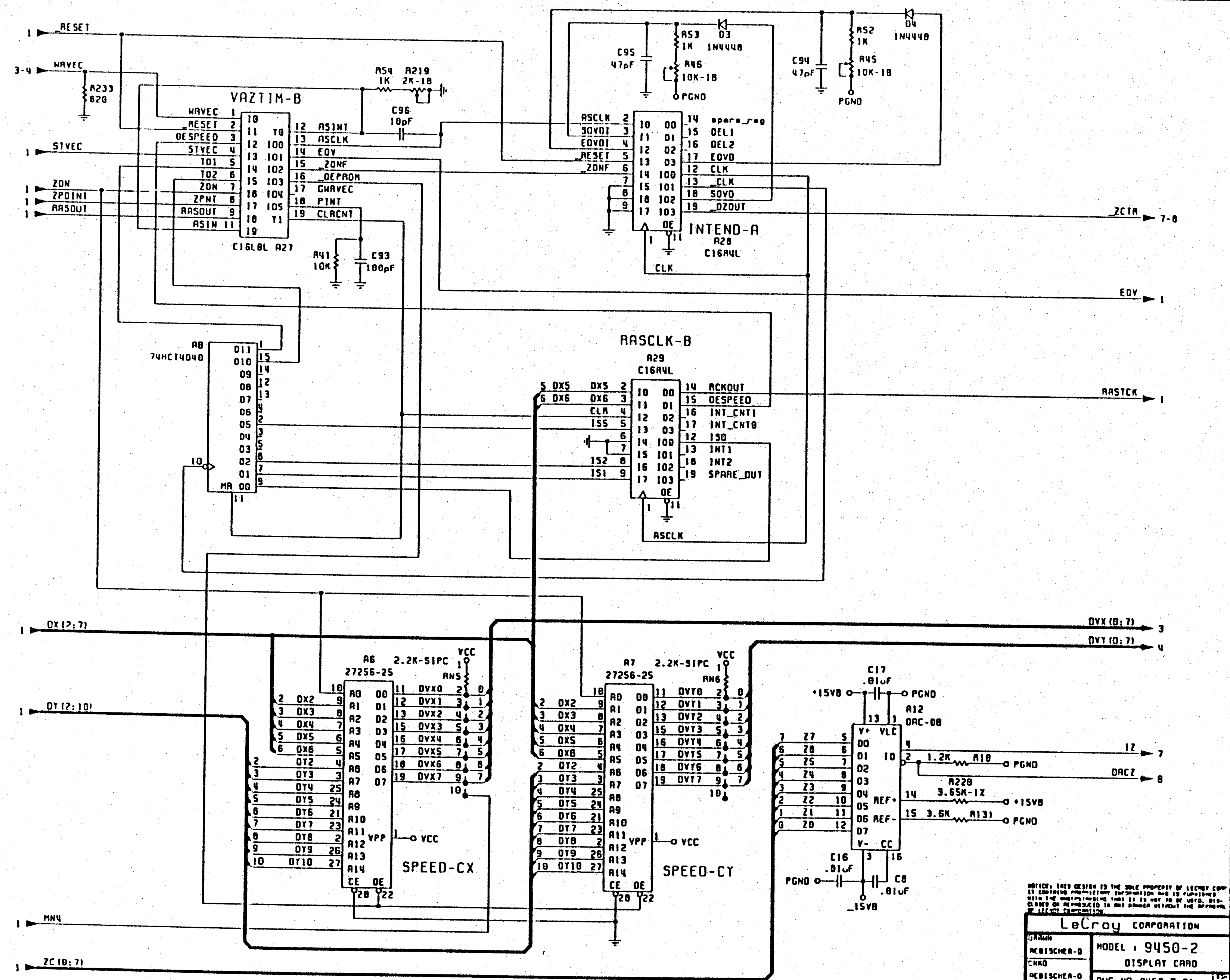

9424-2 Rev:E
2x34-RA-CGS
74HC27
.1uF
10K-6SC
2x20-RA-M-3W



9424-2 Rev:E

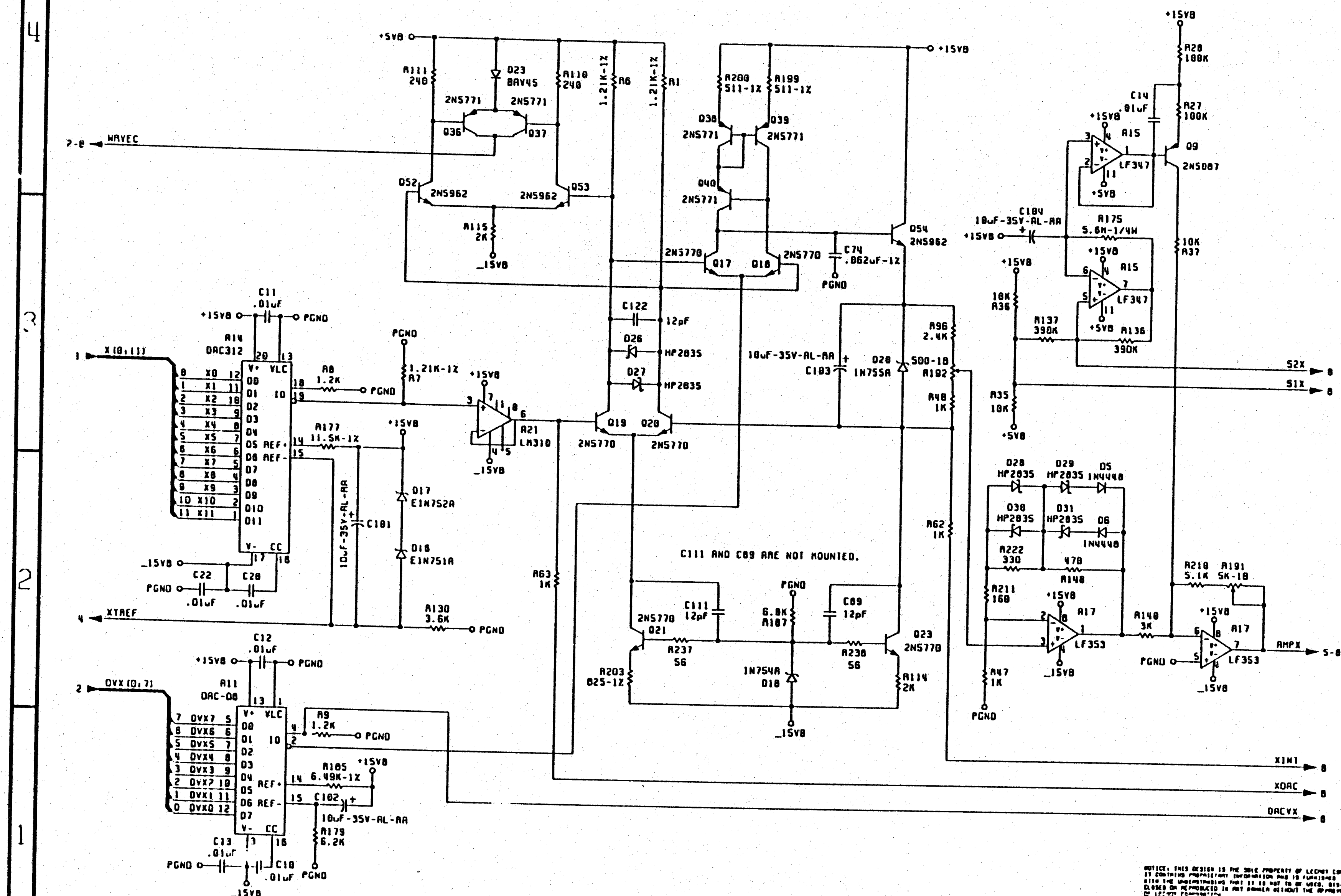
A1	74HC27	74HC27	DIP14
C1	103427104	.1uF	SMONOBP
DR1	$NULL	DRILL4_3_380	DRILL4_3_380
J1	454611040	2x20-RA-M-3W	CONN2X20_RA_M_3W
J2	404500068	2x34-RA-CGS	CONN4X17_RA_CGS
RN1	190642103	10K-6SC	SIP6RES


RAMACC-A
C16V4L A30
A18 62256-12
A19 62256-12
A3 74HCT244
A2 74HCT244
A4 74HCT245
A5 74HCT245
A26 MD5483
D1 HP2835
A(0:14)
D(0:15)
X(0:11)
DX(2:7)
Y(0:11)
DY(2:10)
ZC(0:7)
RESET
LeCroy CORPORATION
MODEL : 9450-2
DISPLAY CARD
DWG NO: 9450-2-S1
SH 1 OF 8
ECO : 1011
28-NOV-88



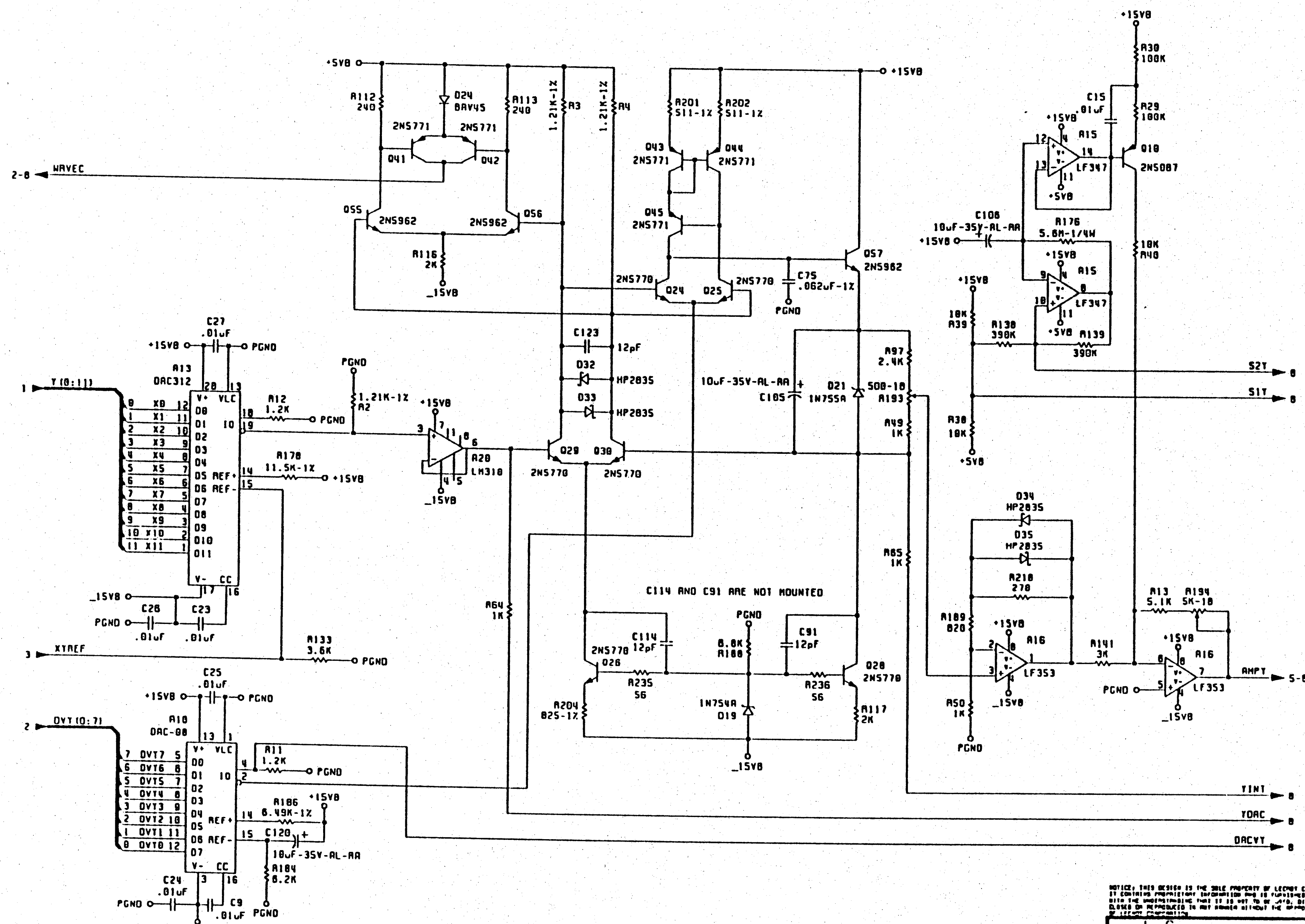
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.

LeCroy CORPORATION		
DRAWN: ACBISCHEA-O	MODEL : 9450-2 DISPLAY CARD	
CHKD: ACBISCHEA-O	DWG NO: 9450-2-S1	J
DATE: 28-NOV-88	SH 2 OF 8	ECO : 1011



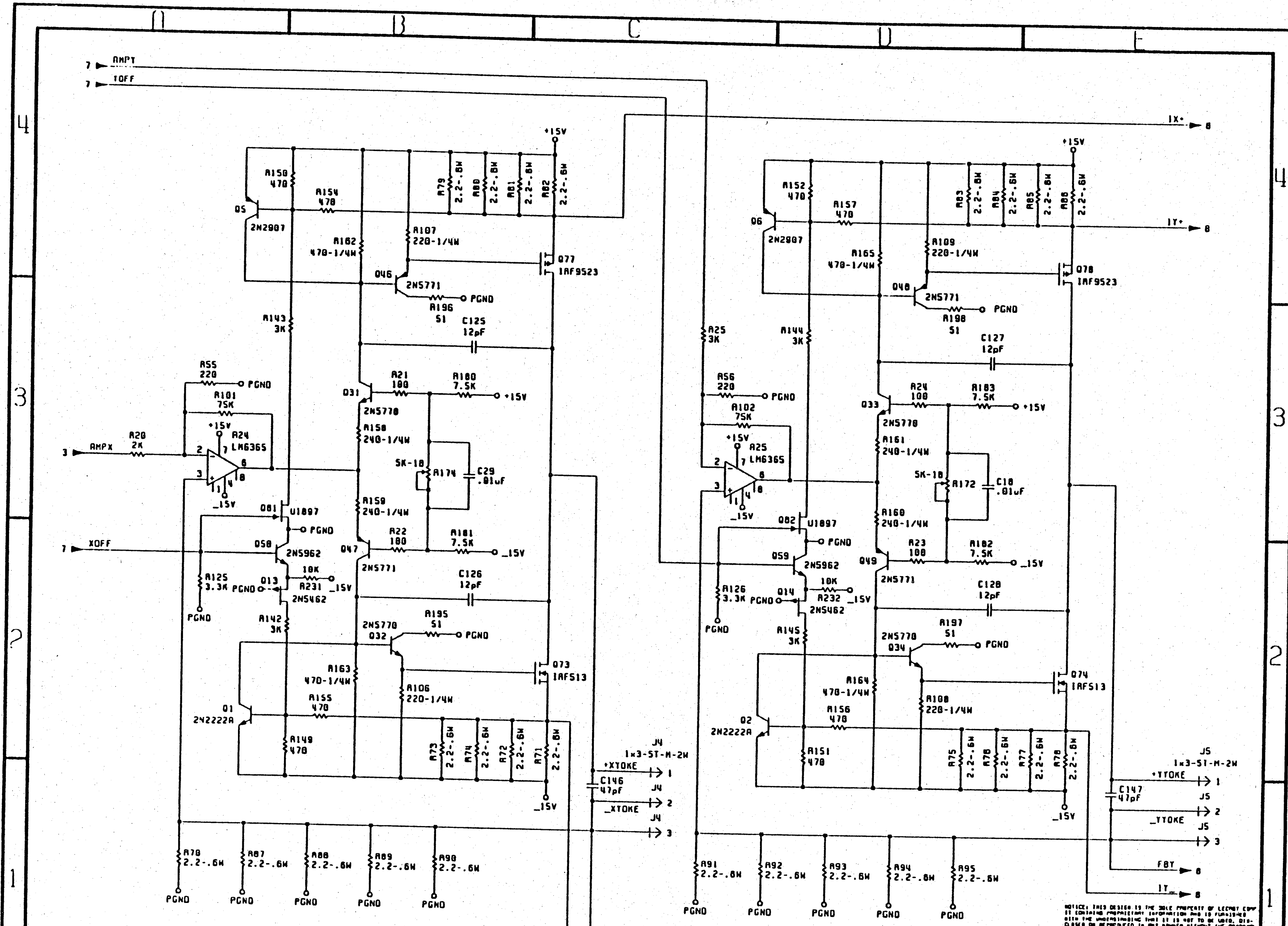
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.

LeCroy CORPORATION	
DRAWN: REBISCHER-D	MODEL : 9450-2
CHKD: REBISCHER-D	DISPLAY CARD
DATE: 28-NOV-88	DWG NO: 9450-2-S1
	SH 3 OF 8
	ECO : 1811



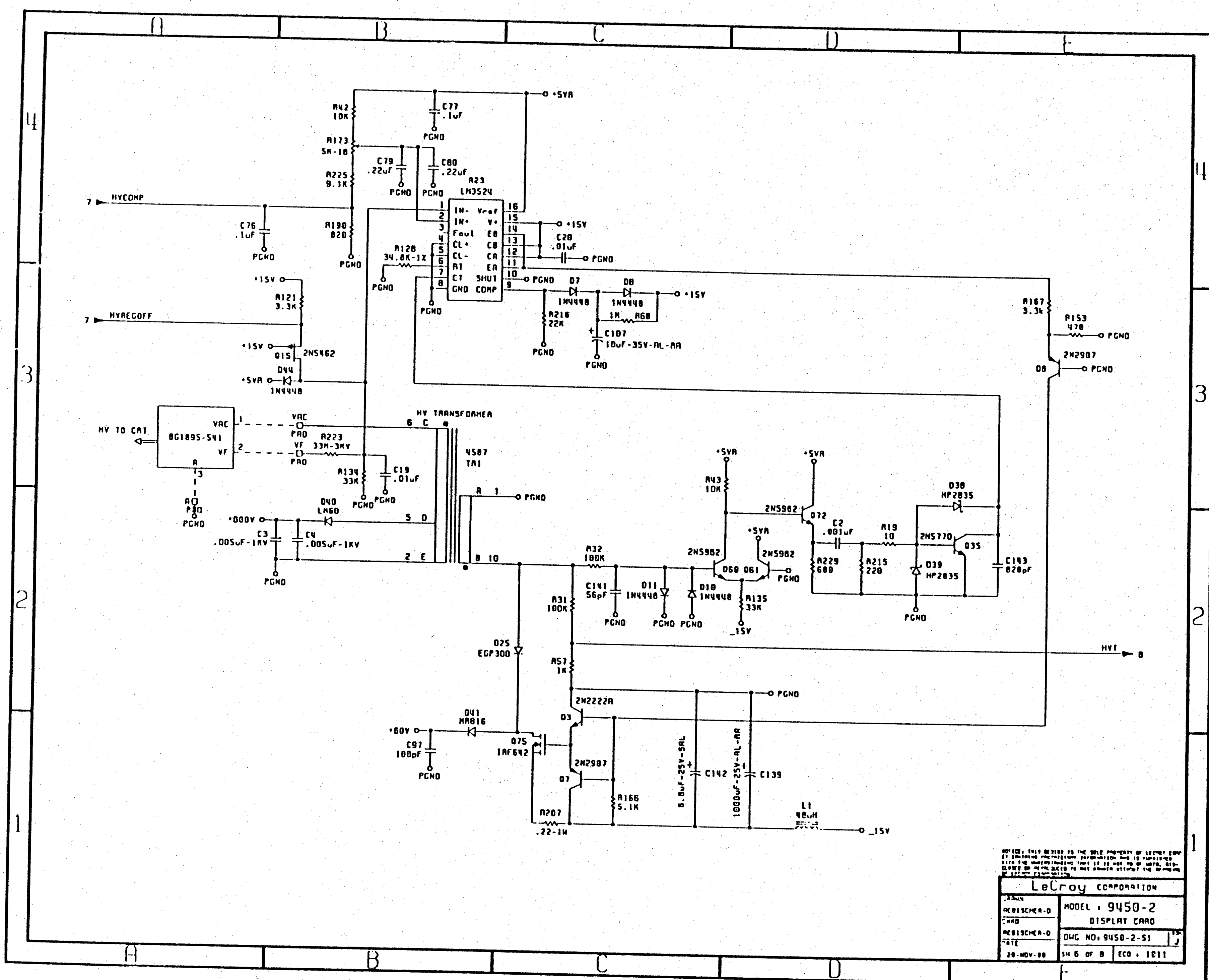
LeCroy CORPORATION

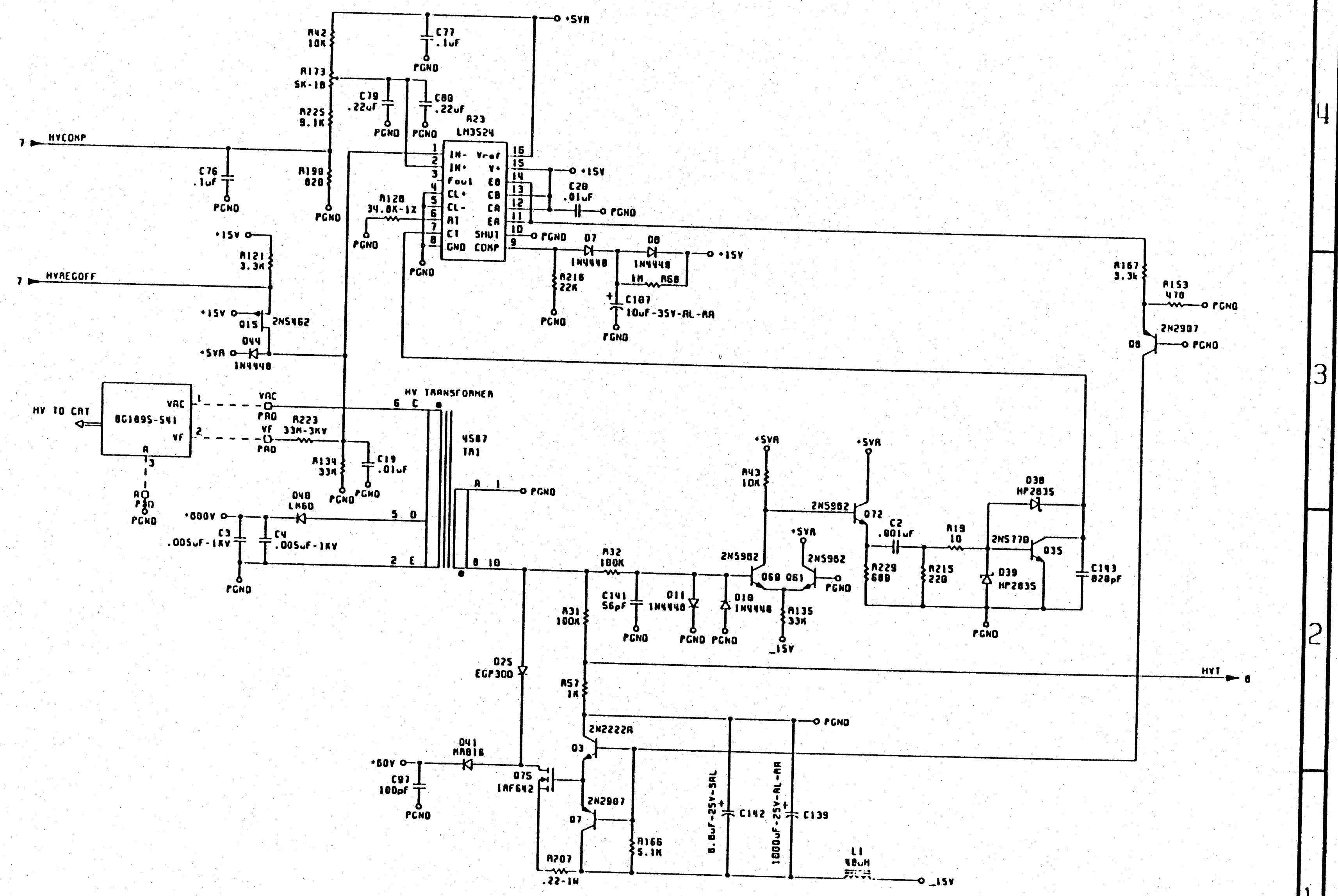
DRAWN REBISCHER-O	MODEL : 9450-2 DISPLAY CARD
CHKD REBISCHER-O	DWG NO: 9450-2-S1 J
DATE 28-NOV-88	SH 4 OF 8 ECO : 1011



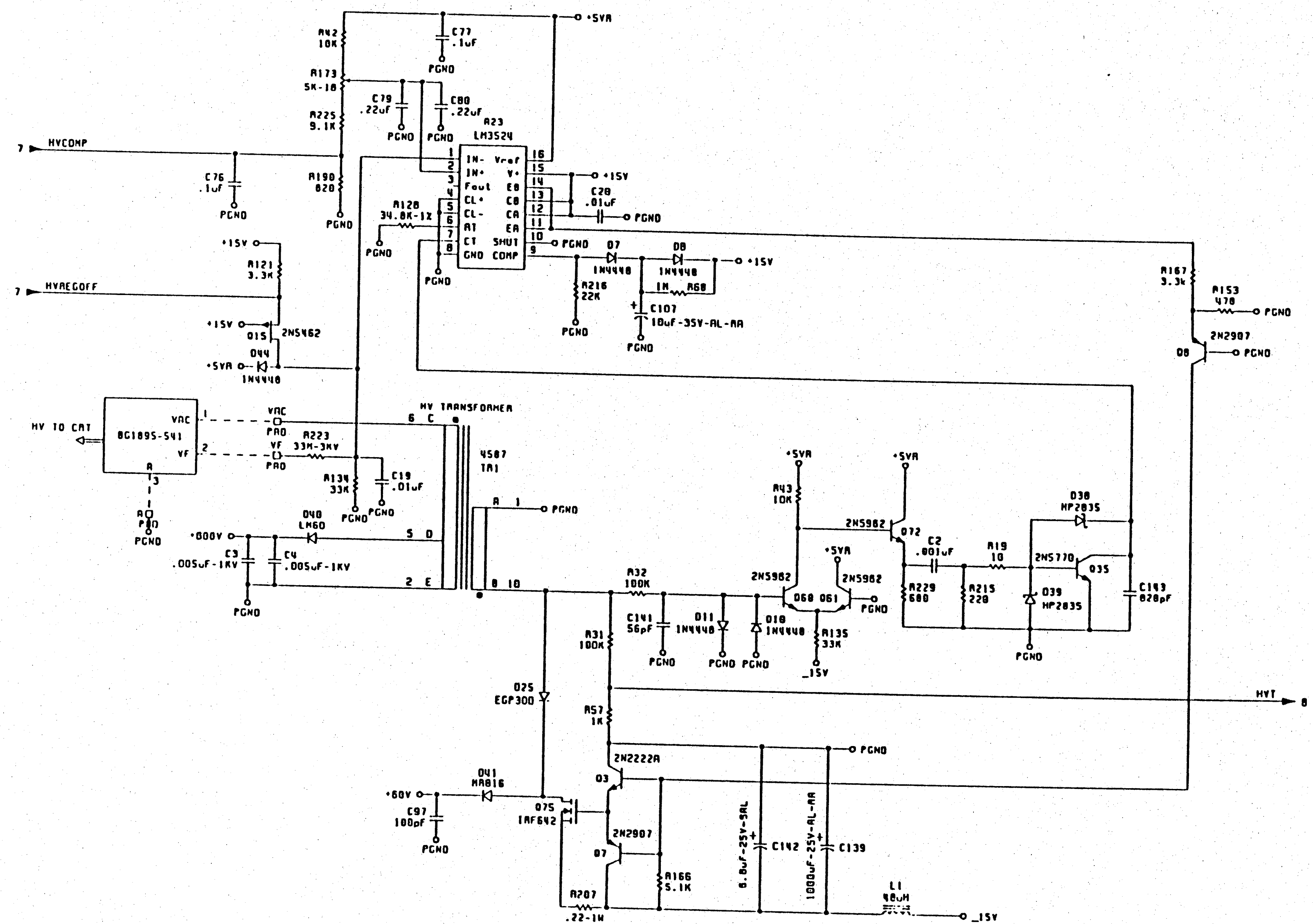
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.

LeCroy CORPORATION	
DRAWN AEBISCHER-O	MODEL : 9450-2 DISPLAY CARD
CHKD AEBISCHER-O	DWG NO: 9450-2-S1 REV J
DATE 28-NOV-88	SH 5 OF 8 ECO : 1811


HVCOMP
HVREGOFF
HV TO CRT
BG1895-S41
VAC
VF
A
LM3524
A23
IN-
IN+
Fout
CL+
CL-
RT
CT
GND
Vref
V+
EB
CB
CA
EA
SHUT
COMP
R42 10K
R173 5K-18
R225 9.1K
R190 820
C76 .1uF
C77 .1uF
C79 .22uF
C80 .22uF
C28 .01uF
R128 34.8K-1%
R121 3.3K
Q15 2N5462
D44 1N4448
D7 1N4448
D8 1N4448
R216 22K
1M R68
C107 10uF-35V-AL-AA
R167 3.3k
R153 470
Q8 2N2907
HV TRANSFORMER
4507
TA1
R223 33M-3KV
R134 33K
C19 .01uF
D40 LM60
C3 .005uF-1KV
C4 .005uF-1KV
+800V
R32 100K
C141 56pF
D11 1N4448
D10 1N4448
R135 33K
R43 10K
2N5962
Q60 Q61
Q72
C2 .001uF
R19 10
R229 680
R215 220
D38 HP2835
D39 HP2835
2N5770
Q35
C193 820pF
R31 100K
D25 EGP300
R57 1K
HVT
2N2222A
Q3
D41 MR816
C97 100pF
+60V
Q75 IRF642
2N2907
Q7
R166 5.1K
R207 .22-1W
6.8uF-25V-SAL
C142
1000uF-25V-AL-AA
C139
L1 48uH
+5VA
+15V
_15V
PGND
PAD
LeCroy CORPORATION
REBISCHER-D
28-NOV-88
MODEL : 9450-2
DISPLAY CARD
DWG NO: 9450-2-S1
SH 6 OF 8
ECO : 1011



LeCroy CORPORATION	
DRAWN REBISCHKA-D	MODEL : 9450-2
CHKD REBISCHKA-D	DISPLAY CARD
DATE 28-NOV-88	DWG NO: 9450-2-S1
	SH 6 OF 8 / ECO : 1011



LeCroy CORPORATION

MODEL : 9450-2

DISPLAY CARD

DRAWN: REBISCHER-D

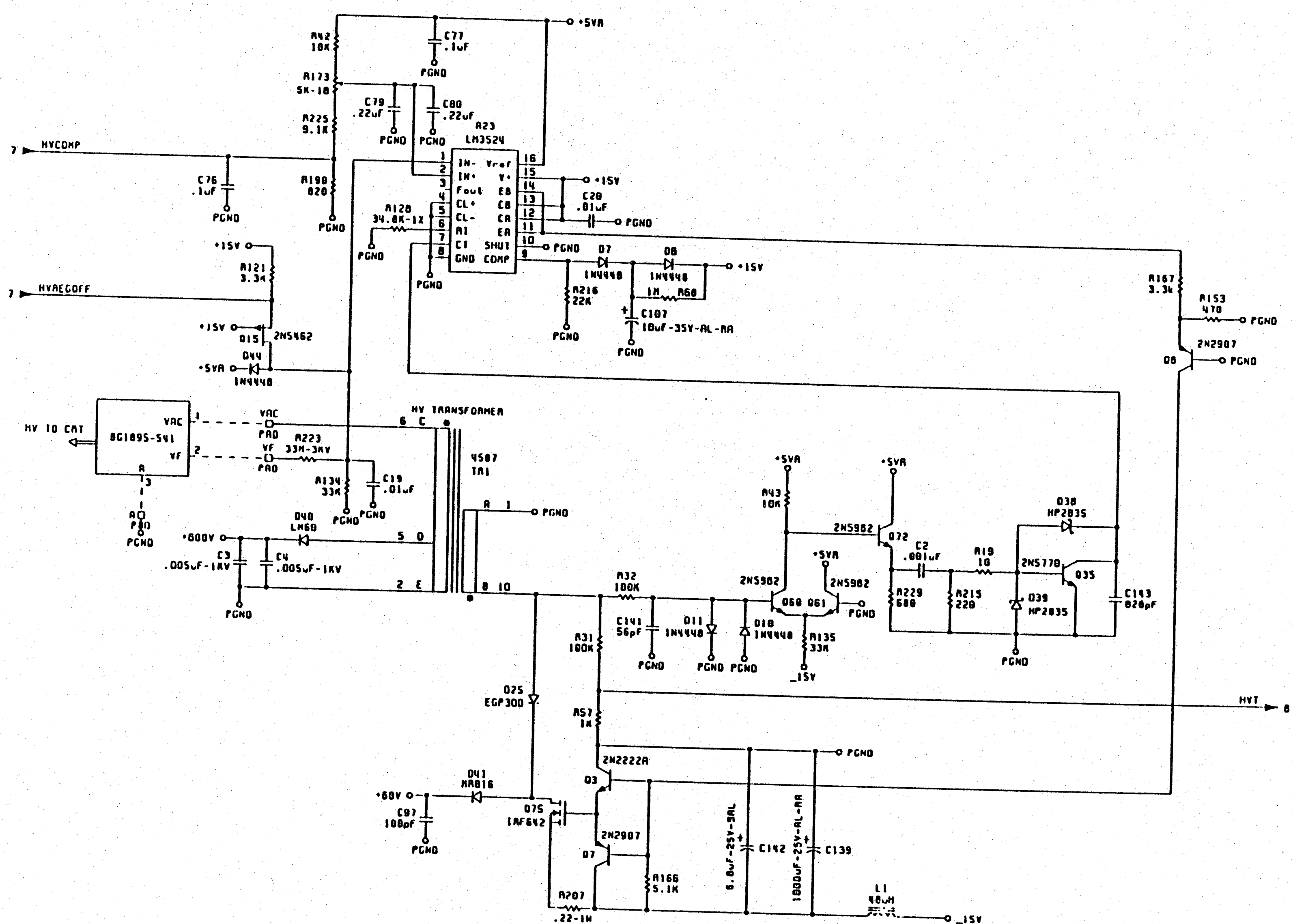
CHKD: REBISCHER-D

DATE: 28-NOV-88

DWG NO: 9450-2-S1

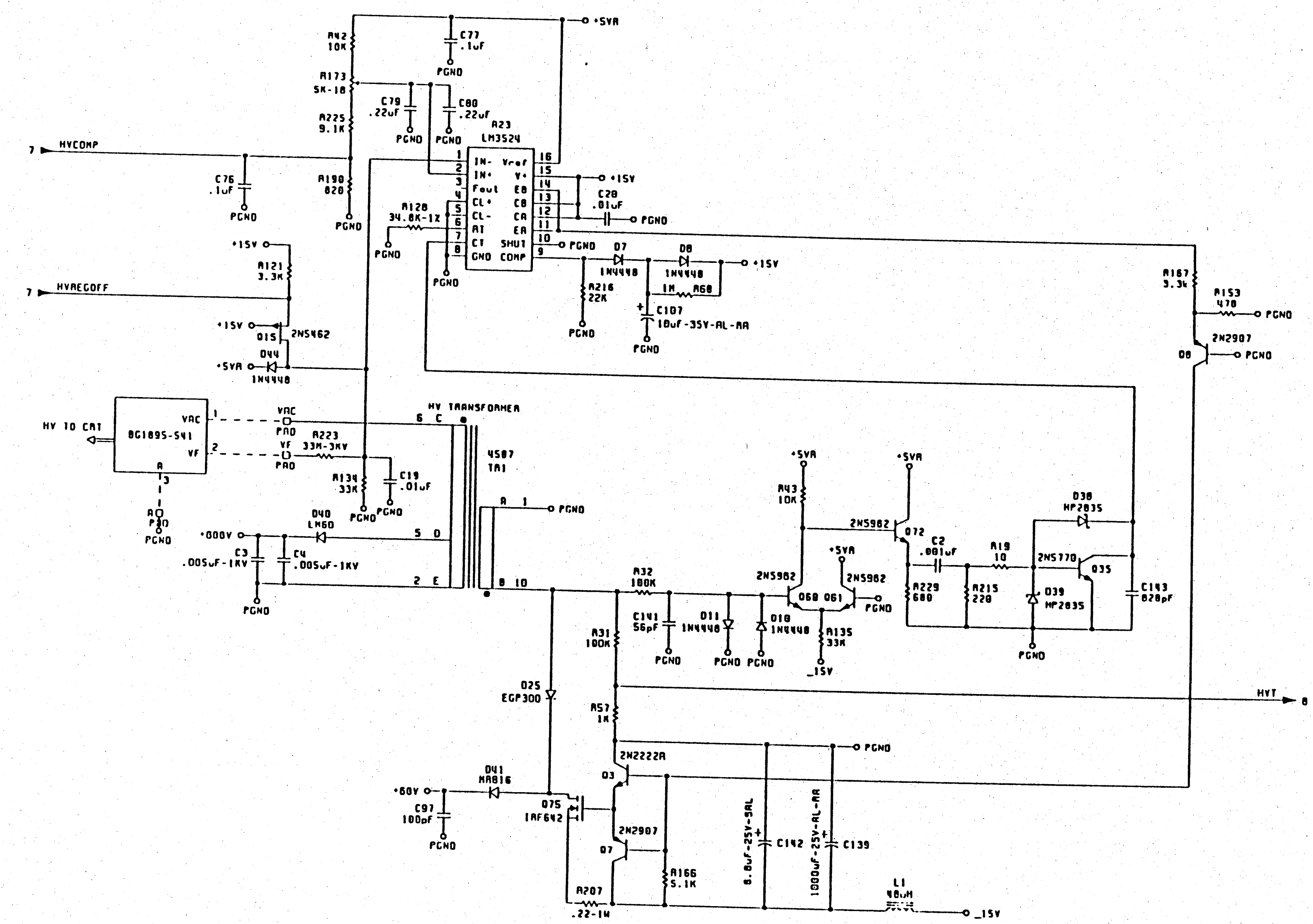
SH 6 OF 8

ECO : 1011



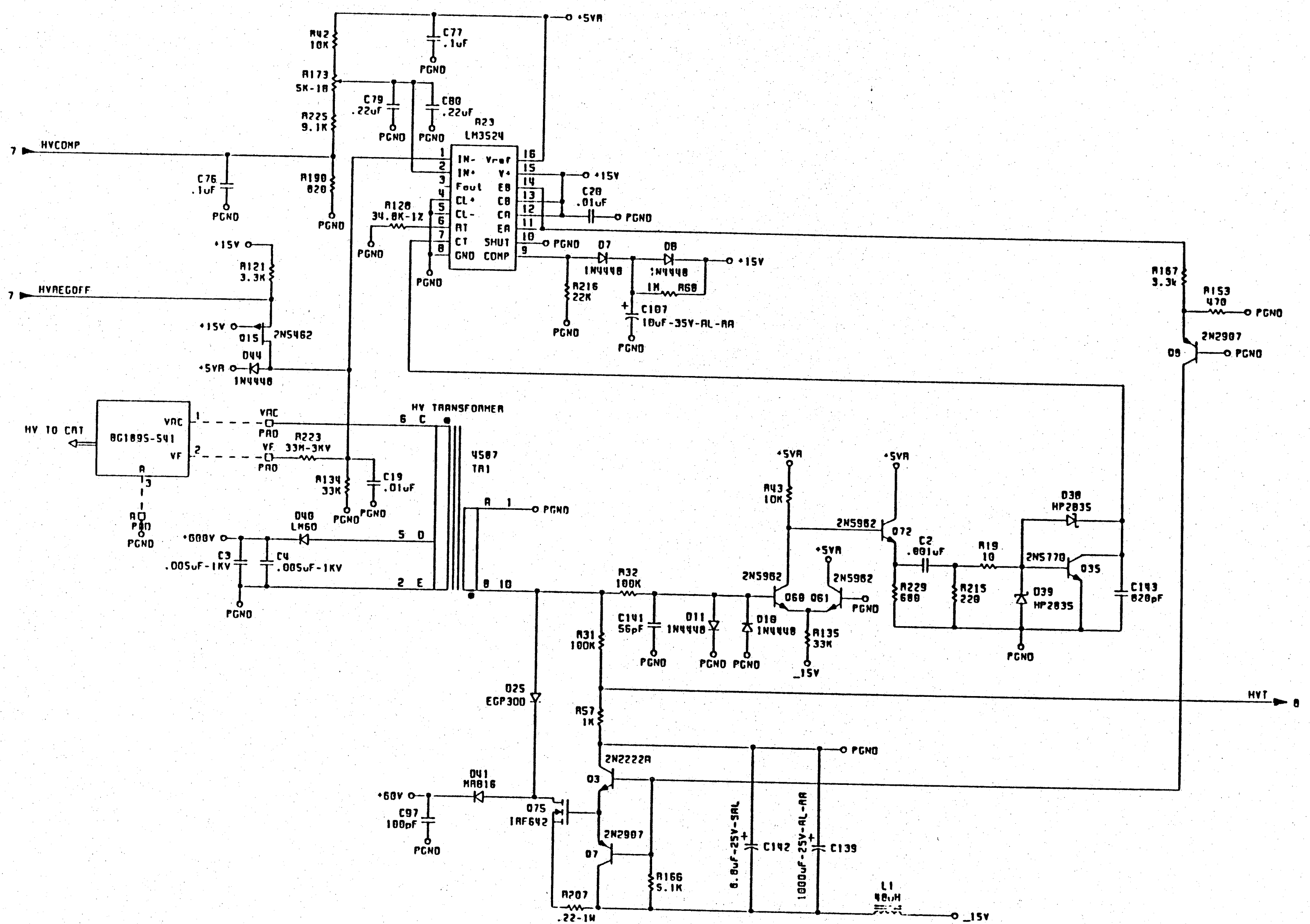
LeCroy CORPORATION

DRAWN REISCHER-D	MODEL : 9450-2 DISPLAY CARD
CHKD REISCHER-D	DWG NO: 9450-2-S1
DATE 28-NOV-88	SH 6 OF 8 · ECO : 1011

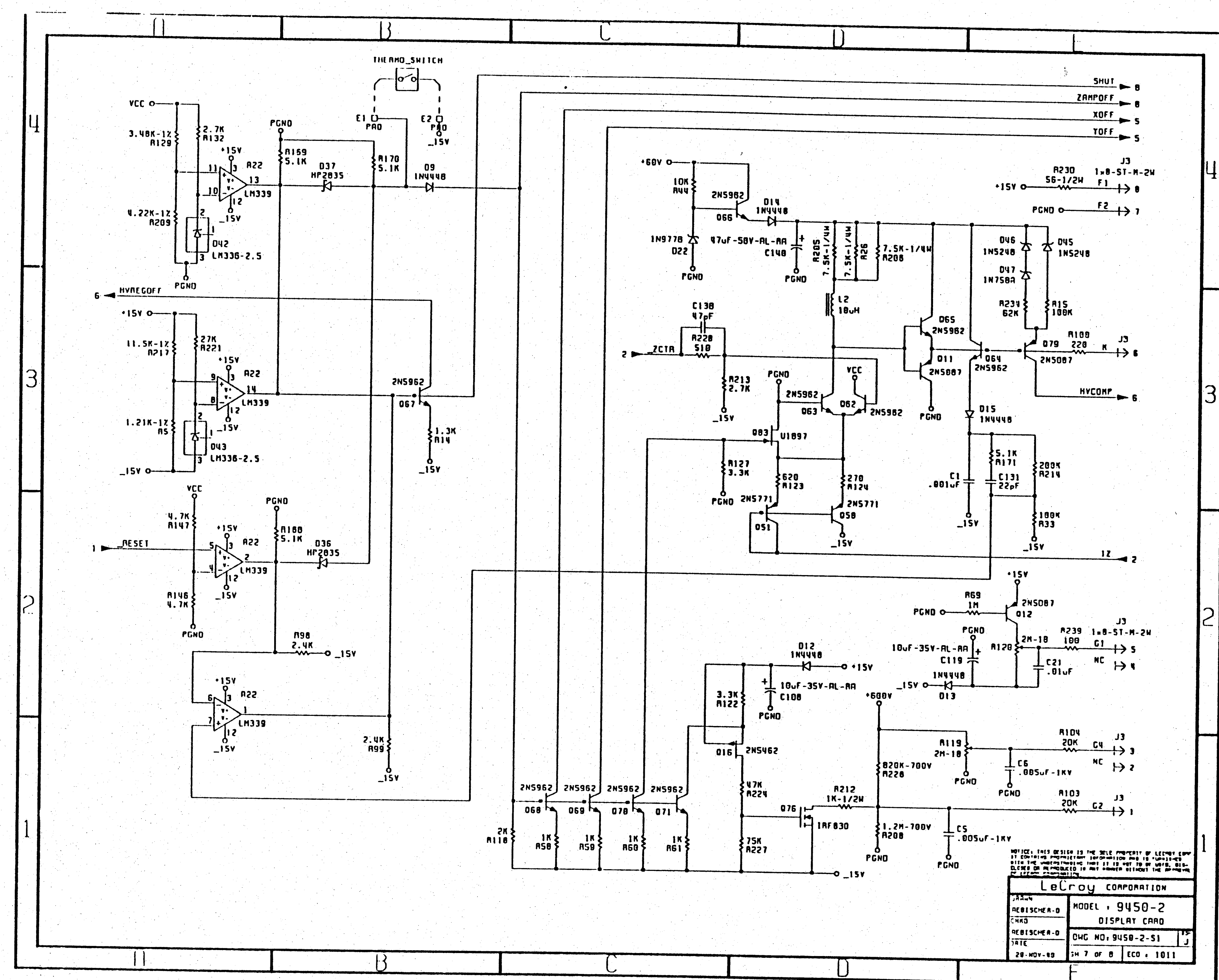


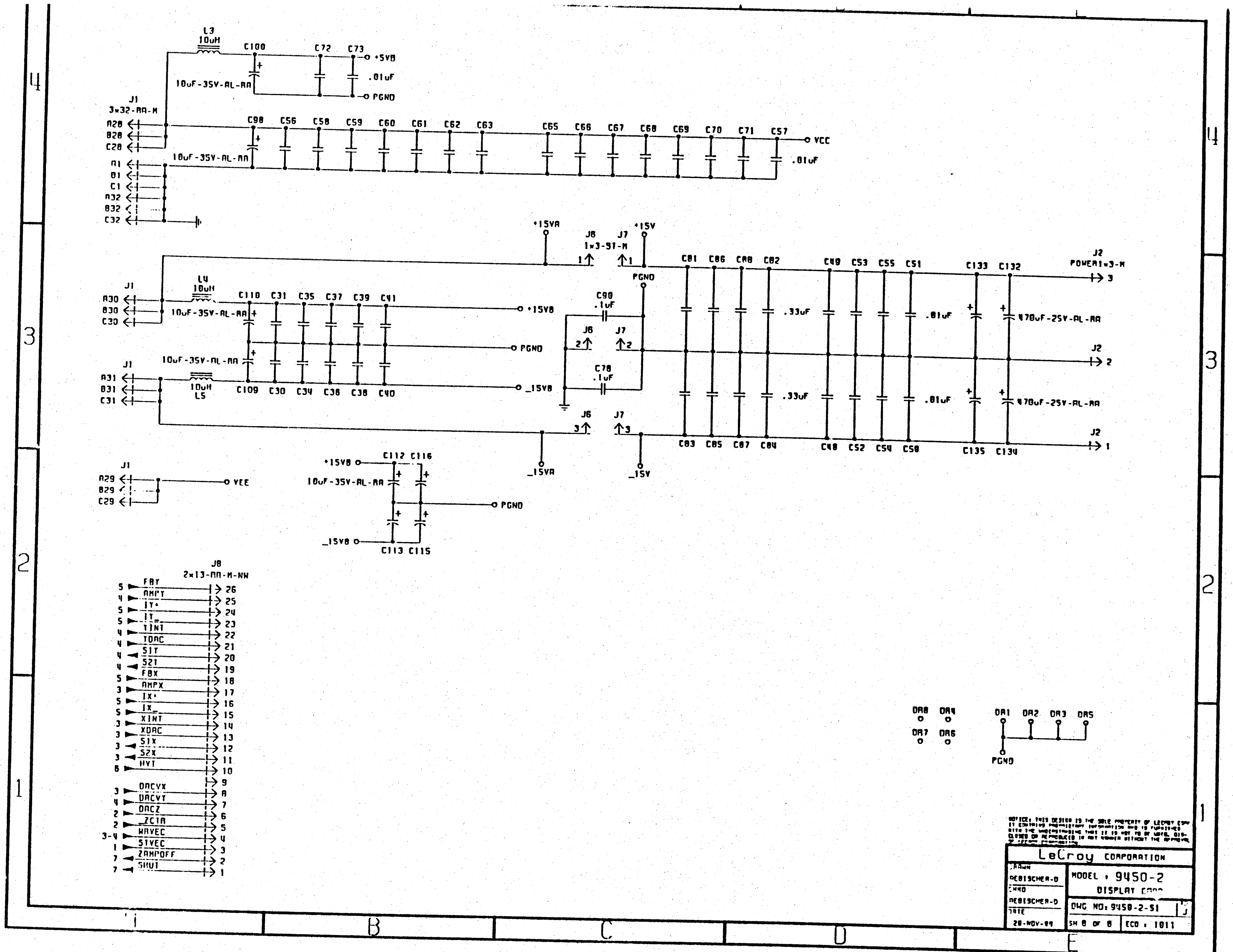
LeCroy CORPORATION

DRAWN AEBISCHER-O	MODEL : 9450-2 DISPLAY CARD
CHKD AEBISCHER-O	DWG NO: 9450-2-S1
DATE 28-NOV-88	SH 6 OF 8 ECO : 1211

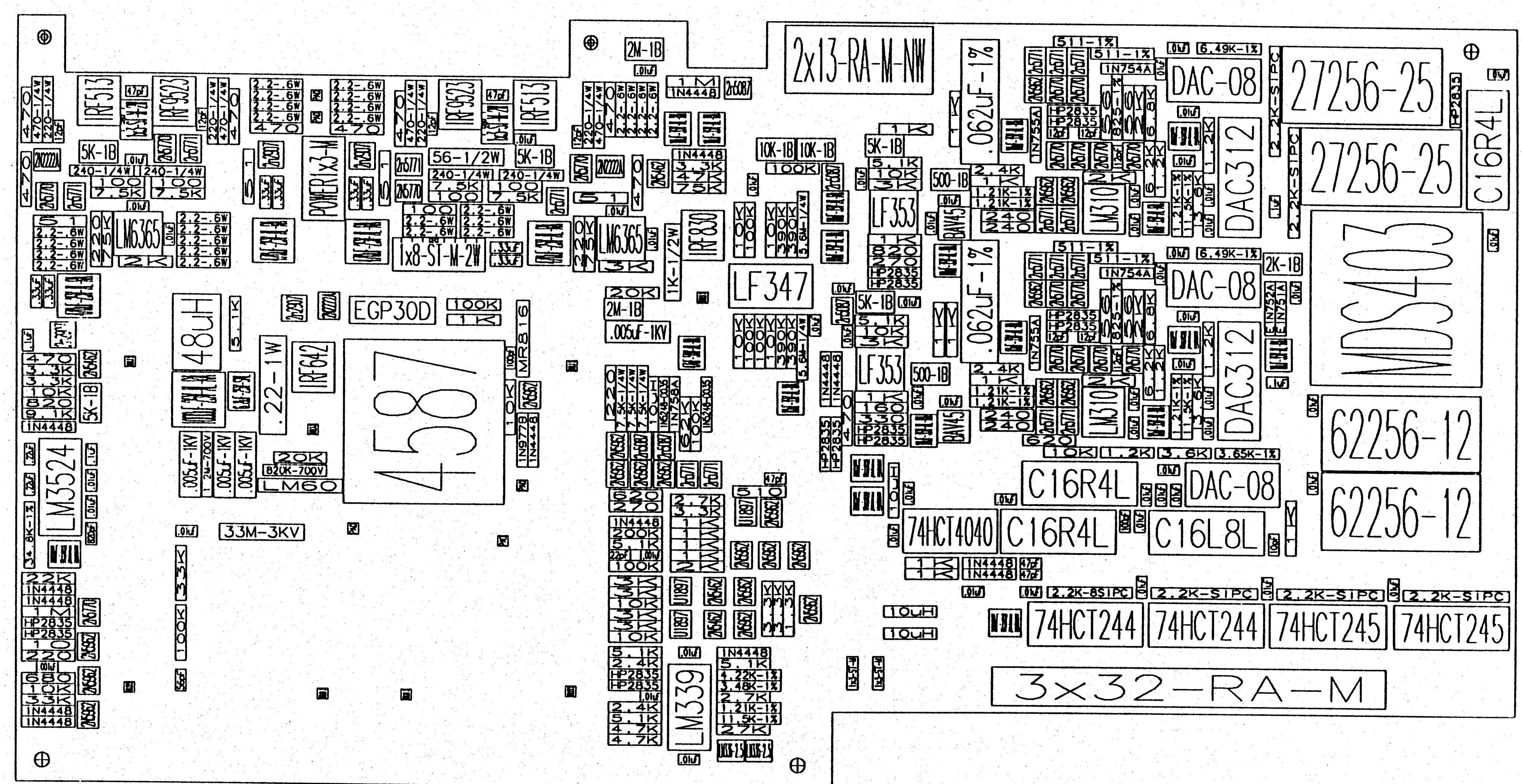


LeCroy CORPORATION	
DRAWN RCBISCHER-D	MODEL : 9450-2 DISPLAY CARD
CHKD RCBISCHER-D	DWG NO: 9450-2-S1 J
DATE 28-NOV-90	SH 6 OF 8 ECO : 1011

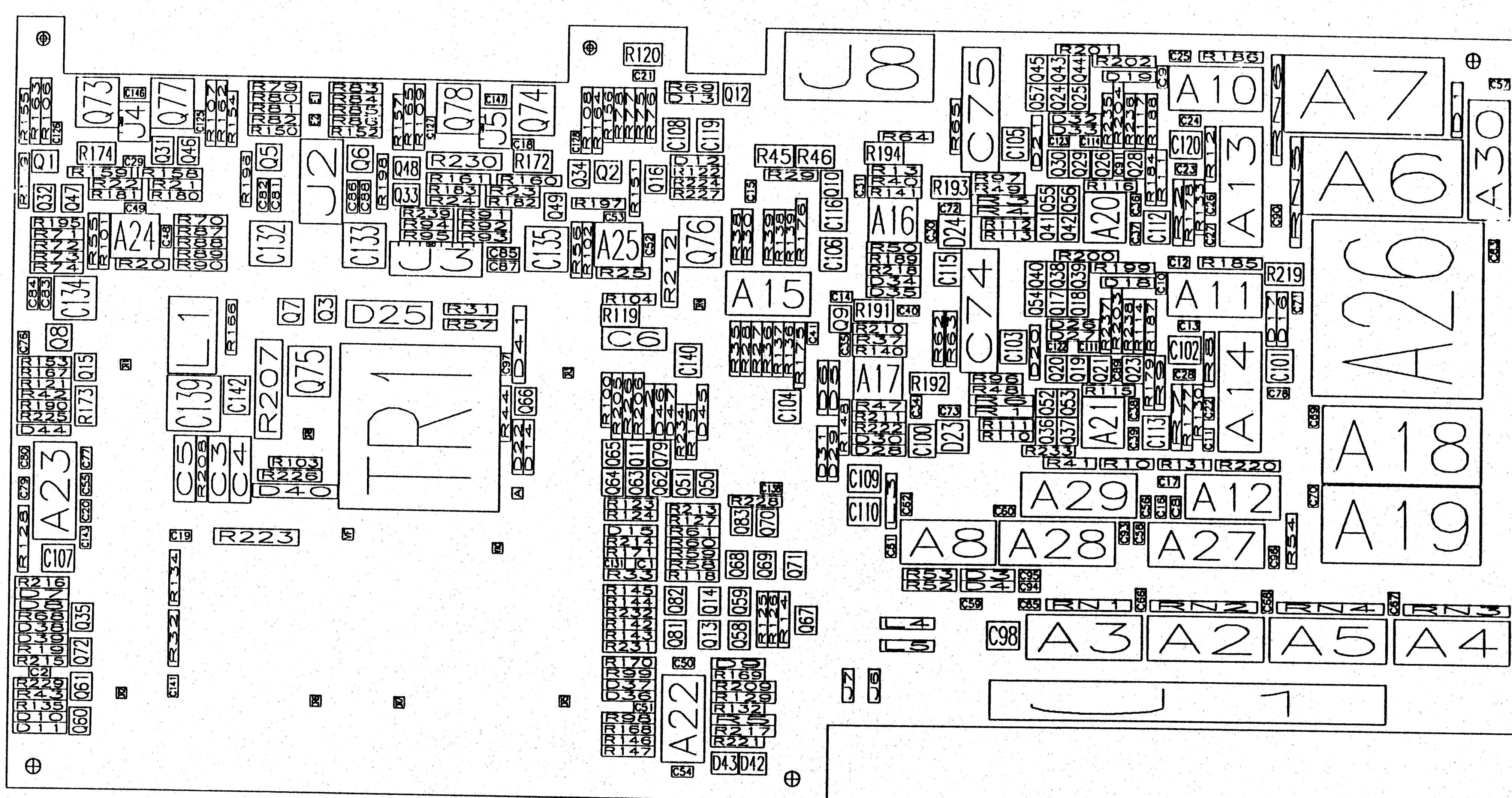

LeCroy CORPORATION
MODEL : 9450-2
DISPLAY CARD
DWG NO: 9450-2-S1
SH 7 OF 8
ECO : 1011
REBISCHER-D
20-NOV-89



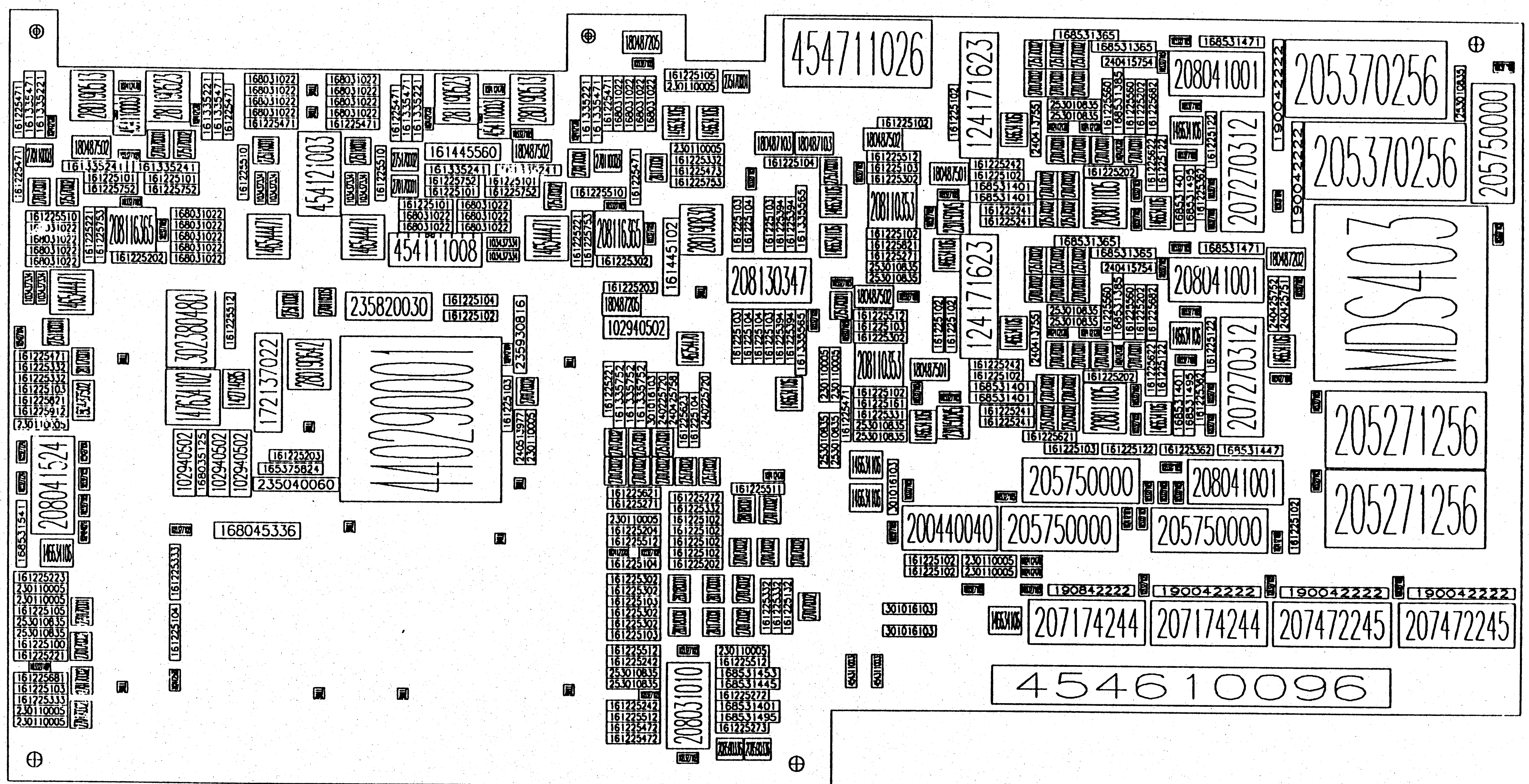
LeCroy CORPORATION
MODEL : 9450-2
DISPLAY CARD
DWG NO: 9450-2-S1
SH 8 OF 8
ECO : 1011
DRAWN REBISCHER-D
CHKD REBISCHER-D
DATE 28-NOV-89
J1 3x32-AA-M
J2 POWER1x3-M
J6 1x3-ST-M
J8 2x13-AA-M-NW
L3 10uH
L4 10uH
L5 10uH
10uF-35V-AL-AA
470uF-25V-AL-AA
.01uF
.33uF
.1uF
+5VB
VCC
VEE
PGND
+15V
-15V
+15VA
-15VA
+15VB
-15VB
FBY
AMPY
IY+
IY-
YINT
YDAC
S1Y
S2Y
FBX
AMPX
IX+
IX-
XINT
XDAC
S1X
S2X
HVY
DACVX
DACVY
DACZ
ZCIA
WAVEC
S1VEC
ZAMPOFF
SHUT


27256-25
27256-25
MDS403
62256-12
62256-12
DAC-08
DAC312
DAC-08
DAC312
DAC-08
C16R4L
C16R4L
C16R4L
C16L8L
74HCT4040
74HCT244
74HCT244
74HCT245
74HCT245
3x32-RA-M
2x13-RA-M-NW
.062uF-1%
.062uF-1%
LF353
LF353
LF347
LM310
LM310
LM339
IRF830
IRF513
IRF9523
IRF9523
IRF513
POWER1x3-M
LM6365
LM6365
1x8-ST-M-2W
EGP30D
4587
MR816
IRF642
48uH
LM60
33M-3KV
LM3524

9450-2 Rev:J


J8
C75
C74
A7
A6
A26
A30
A10
A13
A11
A14
A16
A17
A15
A20
A21
A12
A29
A27
A28
A8
A18
A19
A3
A2
A5
A4
J1
J2
J3
J4
J5
TR1
L1
A23
A24
A25
A22
C6
D25
Q73
Q77
Q78
Q74
Q76
Q75
R207
R223
C139
C132
C133
C134
C135
C5
C3
C4
D40

9450-2 Rev:J


454711026
124171623
205370256
205370256
205750000
208041001
207270312
208041001
207270312
MDS403
205271256
205271256
205750000
208041001
200440040
205750000
205750000
207174244
207174244
207472245
207472245
454610096
208130347
454121003
454111008
235820030
440290001
302380480
172137022
208041524
208031010
168045336

9450-2 Rev: J

A	$NULL	PAD	TESTPAD
A2	207174244	74HCT244	DIP20
A3	207174244	74HCT244	DIP20
A4	207472245	74HCT245	DIP20
A5	207472245	74HCT245	DIP20
A6	205370256	27256-25	DIP28
A7	205370256	27256-25	DIP28
A8	200440040	74HCT4040	DIP16
A10	208041001	DAC-08	DIP16
A11	208041001	DAC-08	DIP16
A12	208041001	DAC-08	DIP16
A13	207270312	DAC312	DIP20
A14	207270312	DAC312	DIP20
A15	208130347	LF347	DIP14
A16	208110353	LF353	DIP8
A17	208110353	LF353	DIP8
A18	205271256	62256-12	DIP28
A19	205271256	62256-12	DIP28
A20	208011005	LM310	DIP8
A21	208011005	LM310	DIP8
A22	208031010	LM339	DIP14
A23	208041524	LM3524	DIP16
A24	208116365	LM6365	DIP8
A25	208116365	LM6365	DIP8
A26	MDS403	MDS403	GRID121
A27	205750000	C16L8L	DIP20
A28	205750000	C16R4L	DIP20
A29	205750000	C16R4L	DIP20
A30	205750000	C16R4L	DIP20
C1	103327102	.001uF	SMONO
C2	103327102	.001uF	SMONO
C3	102940502	.005uF-1KV	R_P375_L500X200
C4	102940502	.005uF-1KV	R_P375_L500X200
C5	102940502	.005uF-1KV	R_P375_L500X200
C6	102940502	.005uF-1KV	R_P375_L500X200
C8	103327103	.01uF	SMONOBP
C9	103327103	.01uF	SMONOBP
C10	103327103	.01uF	SMONOBP
C11	103327103	.01uF	SMONOBP
C12	103327103	.01uF	SMONOBP
C13	103327103	.01uF	SMONOBP
C14	103327103	.01uF	SMONOBP
C15	103327103	.01uF	SMONOBP
C16	103327103	.01uF	SMONOBP
C17	103327103	.01uF	SMONOBP
C18	103327103	.01uF	SMONOBP
C19	103327103	.01uF	SMONOBP
C20	103327103	.01uF	SMONOBP
C21	103327103	.01uF	SMONOBP
C22	103327103	.01uF	SMONOBP
C23	103327103	.01uF	SMONOBP
C24	103327103	.01uF	SMONOBP
C25	103327103	.01uF	SMONOBP
C26	103327103	.01uF	SMONOBP
C27	103327103	.01uF	SMONOBP
C28	103327103	.01uF	SMONOBP

C29	103327103	.01uF	SMONOBP
C30	103327103	.01uF	SMONOBP
C31	103327103	.01uF	SMONOBP
C34	103327103	.01uF	SMONOBP
C35	103327103	.01uF	SMONOBP
C36	103327103	.01uF	SMONOBP
C37	103327103	.01uF	SMONOBP
C38	103327103	.01uF	SMONOBP
C39	103327103	.01uF	SMONOBP
C40	103327103	.01uF	SMONOBP
C41	103327103	.01uF	SMONOBP
C48	103327103	.01uF	SMONOBP
C49	103327103	.01uF	SMONOBP
C50	103327103	.01uF	SMONOBP
C51	103327103	.01uF	SMONOBP
C52	103327103	.01uF	SMONOBP
C53	103327103	.01uF	SMONOBP
C54	103327103	.01uF	SMONOBP
C55	103327103	.01uF	SMONOBP
C56	103327103	.01uF	SMONOBP
C57	103327103	.01uF	SMONOBP
C58	103327103	.01uF	SMONOBP
C59	103327103	.01uF	SMONOBP
C60	103327103	.01uF	SMONOBP
C61	103327103	.01uF	SMONOBP
C62	103327103	.01uF	SMONOBP
C63	103327103	.01uF	SMONOBP
C65	103327103	.01uF	SMONOBP
C66	103327103	.01uF	SMONOBP
C67	103327103	.01uF	SMONOBP
C68	103327103	.01uF	SMONOBP
C69	103327103	.01uF	SMONOBP
C70	103327103	.01uF	SMONOBP
C71	103327103	.01uF	SMONOBP
C72	103327103	.01uF	SMONOBP
C73	103327103	.01uF	SMONOBP
C74	124171623	'.062uF-1%'	A_P900_L600X350
C75	124171623	'.062uF-1%'	A_P900_L600X350
C76	103427104	.1uF	SMONOBP
C77	103427104	.1uF	SMONOBP
C78	103427104	.1uF	SMONOBP
C79	103327224	.22uF	SMONO
C80	103327224	.22uF	SMONO
C81	103437334	.33uF	LMONO
C82	103437334	.33uF	LMONO
C83	103437334	.33uF	LMONO
C84	103437334	.33uF	LMONO
C85	103437334	.33uF	LMONO
C86	103437334	.33uF	LMONO
C87	103437334	.33uF	LMONO
C88	103437334	.33uF	LMONO
C89	102412120	12pF	SMONO
C90	103427104	.1uF	SMONOBP
C91	102412120	12pF	SMONO
C93	102412101	100pF	SMONO
C94	102412470	47pF	SMONO

C95	102412470	47pF	SMONO
C96	102412100	10pF	SMONO
C97	102412101	100pF	SMONO
C98	146634106	10uF-35V-AL-RA	TCAP
C100	146634106	10uF-35V-AL-RA	TCAP
C101	146634106	10uF-35V-AL-RA	TCAP
C102	146634106	10uF-35V-AL-RA	TCAP
C103	146634106	10uF-35V-AL-RA	TCAP
C104	146634106	10uF-35V-AL-RA	TCAP
C105	146634106	10uF-35V-AL-RA	TCAP
C106	146634106	10uF-35V-AL-RA	TCAP
C107	146634106	10uF-35V-AL-RA	TCAP
C108	146634106	10uF-35V-AL-RA	TCAP
C109	146634106	10uF-35V-AL-RA	TCAP
C110	146634106	10uF-35V-AL-RA	TCAP
C111	102412120	12pF	SMONO
C112	146634106	10uF-35V-AL-RA	TCAP
C113	146634106	10uF-35V-AL-RA	TCAP
C114	102412120	12pF	SMONO
C115	146634106	10uF-35V-AL-RA	TCAP
C116	146634106	10uF-35V-AL-RA	TCAP
C119	146634106	10uF-35V-AL-RA	TCAP
C120	146634106	10uF-35V-AL-RA	TCAP
C122	102412120	12pF	SMONO
C123	102412120	12pF	SMONO
C125	102412120	12pF	SMONO
C126	102412120	12pF	SMONO
C127	102412120	12pF	SMONO
C128	102412120	12pF	SMONO
C131	102412220	22pF	SMONO
C132	146544471	470uF-25V-AL-RA	R_P200_D400
C133	146544471	470uF-25V-AL-RA	R_P200_D400
C134	146544471	470uF-25V-AL-RA	R_P200_D400
C135	146544471	470uF-25V-AL-RA	R_P200_D400
C138	102412470	47pF	SMONO
C139	147634102	1000uF-25V-AL-RA	R_P200_D500
C140	146754470	47uF-50V-AL-RA	TCAP
C141	102412560	56pF	SMONO
C142	142714685	6.8uF-25V-SAL	LTCAP
C143	102484821	820pF	SMONO
C146	102412470	47pF	SMONO
C147	102412470	47pF	SMONO
D1	253010835	HP2835	DO35
D3	230110005	1N4448	DO35
D4	230110005	1N4448	DO35
D5	230110005	1N4448	DO35
D6	230110005	1N4448	DO35
D7	230110005	1N4448	DO35
D8	230110005	1N4448	DO35
D9	230110005	1N4448	DO35
D10	230110005	1N4448	DO35
D11	230110005	1N4448	DO35
D12	230110005	1N4448	DO35
D13	230110005	1N4448	DO35
D14	230110005	1N4448	DO35
D15	230110005	1N4448	DO35

D16	240425751	E1N751A	DO35
D17	240425752	E1N752A	DO35
D18	240415754	1N754A	DO35
D19	240415754	1N754A	DO35
D20	240413755	1N755A	DO35
D21	240413755	1N755A	DO35
D22	240513977	1N977B	DO35
D23	230150045	BAV45	to18_2L
D24	230150045	BAV45	to18_2L
D25	235820030	EGP30D	A_P600_L400X250
D26	253010835	HP2835	DO35
D27	253010835	HP2835	DO35
D28	253010835	HP2835	DO35
D29	253010835	HP2835	DO35
D30	253010835	HP2835	DO35
D31	253010835	HP2835	DO35
D32	253010835	HP2835	DO35
D33	253010835	HP2835	DO35
D34	253010835	HP2835	DO35
D35	253010835	HP2835	DO35
D36	253010835	HP2835	DO35
D37	253010835	HP2835	DO35
D38	253010835	HP2835	DO35
D39	253010835	HP2835	DO35
D40	235040060	LM60	A_P600_L400X125
D41	235930816	MR816	A_P500_L300X120
D42	208590336	LM336-2.5	TO92
D43	208590336	LM336-2.5	TO92
D44	230110005	1N4448	DO35
D45	240225720	1N5248-DO35	DO35
D46	240225720	1N5248-DO35	DO35
D47	240425758	1N758A	DO7
DR1	$NULL	DRILL3_5	DRILL3_5
DR2	$NULL	DRILL3_5	DRILL3_5
DR3	$NULL	DRILL3_5	DRILL3_5
DR4	$NULL	DRILL3_2	DRILL3_2
DR5	$NULL	DRILL3_5	DRILL3_5
DR6	$NULL	DRILL4_3	DRILL4_3
DR7	$NULL	DRILL4_3	DRILL4_3
DR8	$NULL	DRILL3_2	DRILL3_2
E1	$NULL	PAD	TESTPAD
E2	$NULL	PAD	TESTPAD
J1	454610096	3x32-RA-M	CONN3X32_RA_M
J2	454121003	POWER1x3-M	POWER1X3_M
J3	454111008	1x8-ST-M-2W	CONN1X8_ST_M_2W
J4	454110003	1x3-ST-M-2W	CONN1X3_ST_M_2W
J5	454110003	1x3-ST-M-2W	CONN1X3_ST_M_2W
J6	454311003	1x3-ST-M	CONN1X3_ST_M
J7	454311003	1x3-ST-M	CONN1X3_ST_M
J8	454711026	2x13-RA-M-NW	CONN2X13_RA_M_NW
L1	302380480	48uH	E106
L2	301016103	10uH	IND07
L3	301016103	10uH	IND07
L4	301016103	10uH	IND07
L5	301016103	10uH	IND07
Q1	270110003	2N2222A	TO92

Q2	270110003	2N2222A	TO92
Q3	270110003	2N2222A	TO92
Q5	275110001	2n2907	TO18
Q6	275110001	2n2907	TO18
Q7	275110001	2n2907	TO18
Q8	275110001	2n2907	TO18
Q9	275170001	2n5087	TO92
Q10	275170001	2n5087	TO92
Q11	275170001	2n5087	TO92
Q12	275170001	2n5087	TO92
Q13	281170001	2N5462	TO92
Q14	281170001	2N5462	TO92
Q15	281170001	2N5462	TO92
Q16	281170001	2N5462	TO92
Q17	270170001	2N5770	TO92
Q18	270170001	2N5770	TO92
Q19	270170001	2N5770	TO92
Q20	270170001	2N5770	TO92
Q21	270170001	2N5770	TO92
Q23	270170001	2N5770	TO92
Q24	270170001	2N5770	TO92
Q25	270170001	2N5770	TO92
Q26	270170001	2N5770	TO92
Q28	270170001	2N5770	TO92
Q29	270170001	2N5770	TO92
Q30	270170001	2N5770	TO92
Q31	270170001	2N5770	TO92
Q32	270170001	2N5770	TO92
Q33	270170001	2N5770	TO92
Q34	270170001	2N5770	TO92
Q35	270170001	2N5770	TO92
Q36	275170002	2n5771	TO92
Q37	275170002	2n5771	TO92
Q38	275170002	2n5771	TO92
Q39	275170002	2n5771	TO92
Q40	275170002	2n5771	TO92
Q41	275170002	2n5771	TO92
Q42	275170002	2n5771	TO92
Q43	275170002	2n5771	TO92
Q44	275170002	2n5771	TO92
Q45	275170002	2n5771	TO92
Q46	275170002	2n5771	TO92
Q47	275170002	2n5771	TO92
Q48	275170002	2n5771	TO92
Q49	275170002	2n5771	TO92
Q50	275170002	2n5771	TO92
Q51	275170002	2n5771	TO92
Q52	270170002	2N5962	TO92
Q53	270170002	2N5962	TO92
Q54	270170002	2N5962	TO92
Q55	270170002	2N5962	TO92
Q56	270170002	2N5962	TO92
Q57	270170002	2N5962	TO92
Q58	270170002	2N5962	TO92
Q59	270170002	2N5962	TO92
Q60	270170002	2N5962	TO92

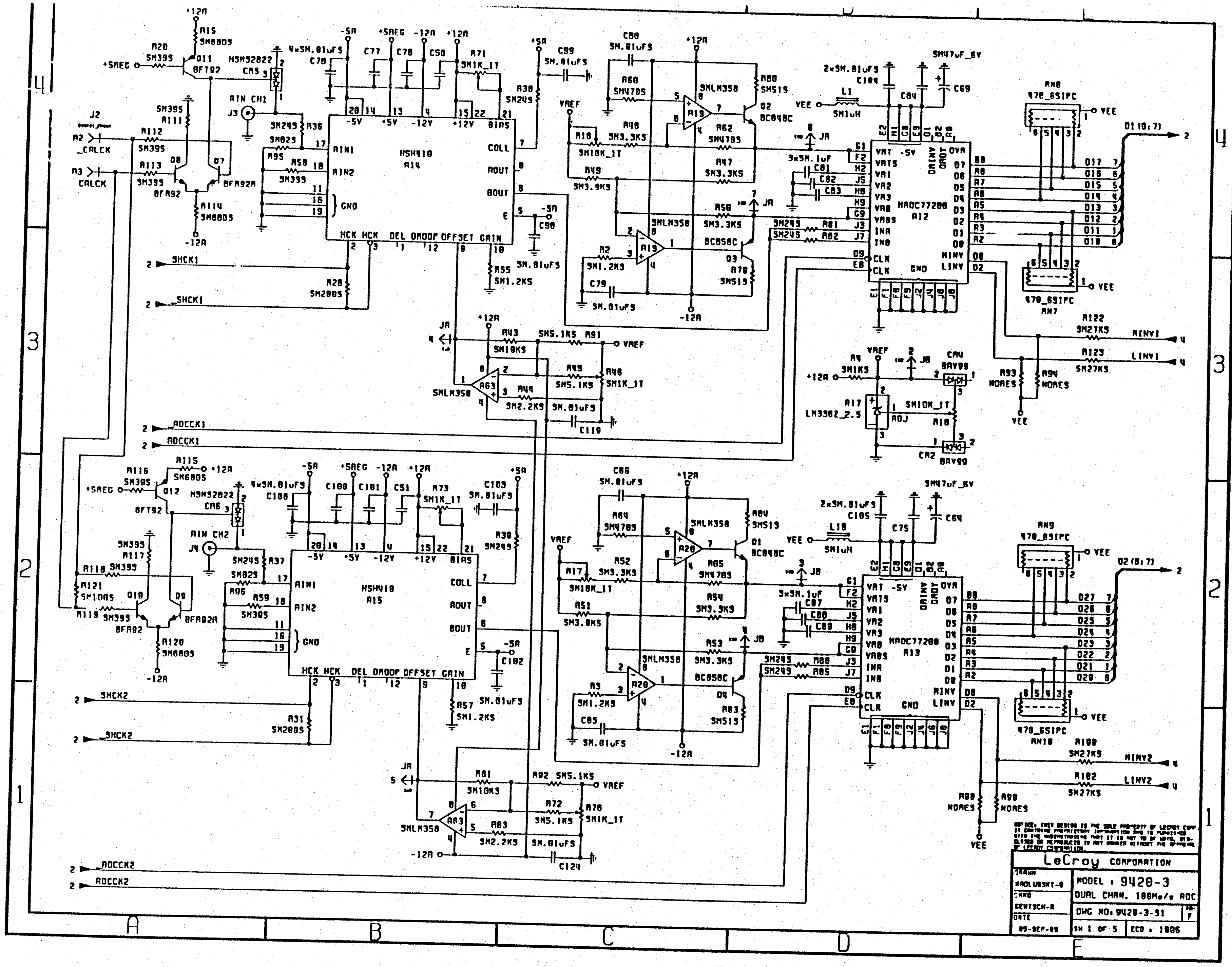
Q61	270170002	2N5962	TO92
Q62	270170002	2N5962	TO92
Q63	270170002	2N5962	TO92
Q64	270170002	2N5962	TO92
Q65	270170002	2N5962	TO92
Q66	270170002	2N5962	TO92
Q67	270170002	2N5962	TO92
Q68	270170002	2N5962	TO92
Q69	270170002	2N5962	TO92
Q70	270170002	2N5962	TO92
Q71	270170002	2N5962	TO92
Q72	270170002	2N5962	TO92
Q73	280190513	IRF513	TO220
Q74	280190513	IRF513	TO220
Q75	280190642	IRF642	TO220
Q76	280190830	IRF830	TO220
Q77	281190523	IRF9523	TO220
Q78	281190523	IRF9523	TO220
Q79	275170001	2n5087	TO92
Q81	280180001	U1897	TO92
Q82	280180001	U1897	TO92
Q83	280180001	U1897	TO92
R1	168531401	'1.21K-1%'	RES07
R2	168531401	'1.21K-1%'	RES07
R3	168531401	'1.21K-1%'	RES07
R4	168531401	'1.21K-1%'	RES07
R5	168531401	'1.21K-1%'	RES07
R6	168531401	'1.21K-1%'	RES07
R7	168531401	'1.21K-1%'	RES07
R8	161225122	1.2K	RES05
R9	161225122	1.2K	RES05
R10	161225122	1.2K	RES05
R11	161225122	1.2K	RES05
R12	161225122	1.2K	RES05
R13	161225512	5.1K	RES05
R14	161225132	1.3K	RES05
R15	161225104	100K	RES05
R19	161225100	10	RES05
R20	161225202	2K	RES05
R21	161225101	100	RES05
R22	161225101	100	RES05
R23	161225101	100	RES05
R24	161225101	100	RES05
R25	161225302	3K	RES05
R26	161335752	7.5K-1/4W	RES07
R27	161225104	100K	RES05
R28	161225104	100K	RES05
R29	161225104	100K	RES05
R30	161225104	100K	RES05
R31	161225104	100K	RES05
R32	161225104	100K	RES05
R33	161225104	100K	RES05
R35	161225103	10K	RES05
R36	161225103	10K	RES05
R37	161225103	10K	RES05
R38	161225103	10K	RES05

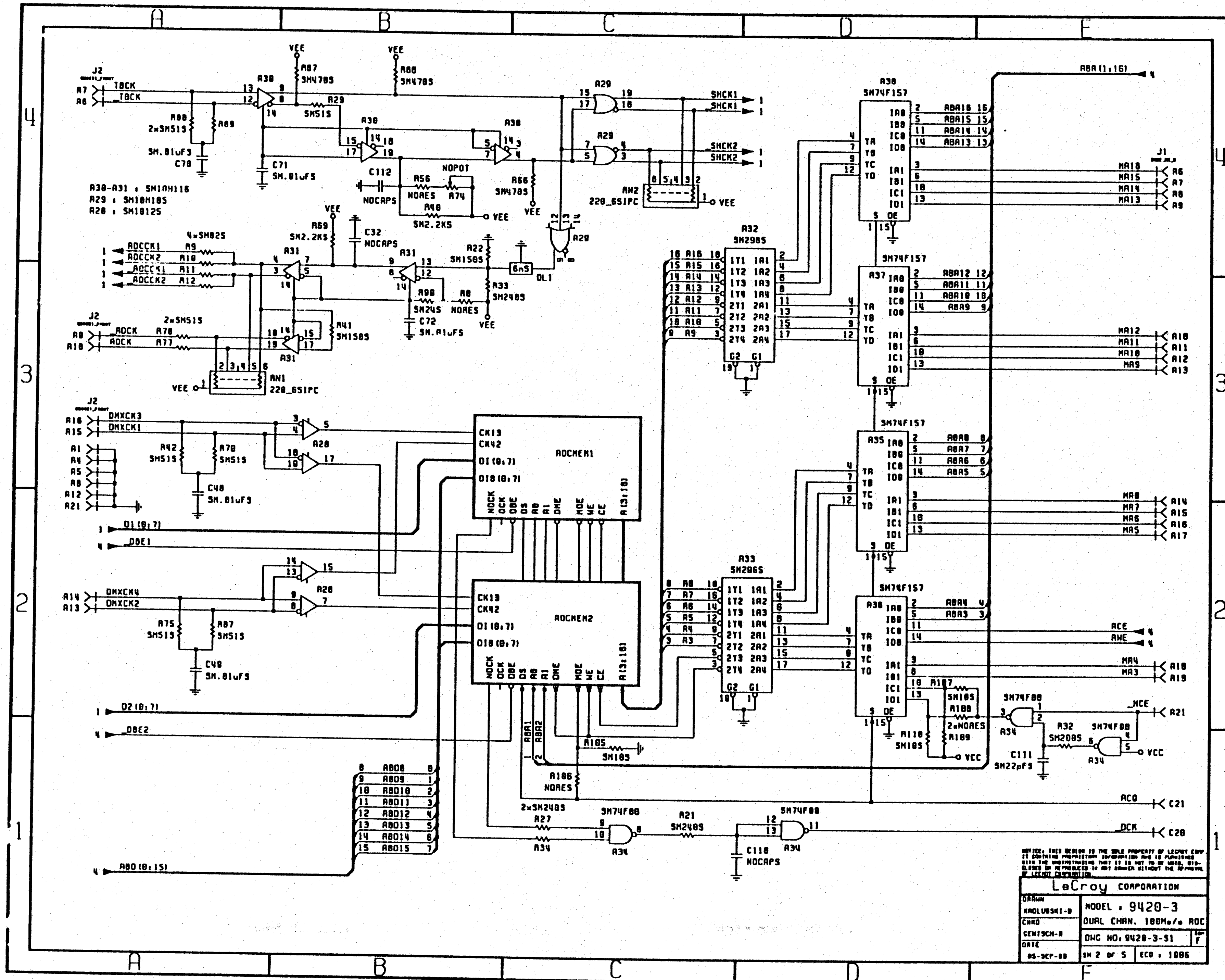
R39	161225103	10K	RES05
R40	161225103	10K	RES05
R41	161225103	10K	RES05
R42	161225103	10K	RES05
R43	161225103	10K	RES05
R44	161225103	10K	RES05
R45	180487103	10K-1B	pot3386x
R46	180487103	10K-1B	pot3386x
R47	161225102	1K	RES05
R48	161225102	1K	RES05
R49	161225102	1K	RES05
R50	161225102	1K	RES05
R52	161225102	1K	RES05
R53	161225102	1K	RES05
R54	161225102	1K	RES05
R55	161225221	220	RES05
R56	161225221	220	RES05
R57	161225102	1K	RES05
R58	161225102	1K	RES05
R59	161225102	1K	RES05
R60	161225102	1K	RES05
R61	161225102	1K	RES05
R62	161225102	1K	RES05
R63	161225102	1K	RES05
R64	161225102	1K	RES05
R65	161225102	1K	RES05
R68	161225105	1M	RES05
R69	161225105	1M	RES05
R70	168031022	2.2-.6W	A_P400_L300X100
R71	168031022	2.2-.6W	A_P400_L300X100
R72	168031022	2.2-.6W	A_P400_L300X100
R73	168031022	2.2-.6W	A_P400_L300X100
R74	168031022	2.2-.6W	A_P400_L300X100
R75	168031022	2.2-.6W	A_P400_L300X100
R76	168031022	2.2-.6W	A_P400_L300X100
R77	168031022	2.2-.6W	A_P400_L300X100
R78	168031022	2.2-.6W	A_P400_L300X100
R79	168031022	2.2-.6W	A_P400_L300X100
R80	168031022	2.2-.6W	A_P400_L300X100
R81	168031022	2.2-.6W	A_P400_L300X100
R82	168031022	2.2-.6W	A_P400_L300X100
R83	168031022	2.2-.6W	A_P400_L300X100
R84	168031022	2.2-.6W	A_P400_L300X100
R85	168031022	2.2-.6W	A_P400_L300X100
R86	168031022	2.2-.6W	A_P400_L300X100
R87	168031022	2.2-.6W	A_P400_L300X100
R88	168031022	2.2-.6W	A_P400_L300X100
R89	168031022	2.2-.6W	A_P400_L300X100
R90	168031022	2.2-.6W	A_P400_L300X100
R91	168031022	2.2-.6W	A_P400_L300X100
R92	168031022	2.2-.6W	A_P400_L300X100
R93	168031022	2.2-.6W	A_P400_L300X100
R94	168031022	2.2-.6W	A_P400_L300X100
R95	168031022	2.2-.6W	A_P400_L300X100
R96	161225242	2.4K	RES05
R97	161225242	2.4K	RES05

R98	161225242	2.4K	RES05
R99	161225242	2.4K	RES05
R100	161225221	220	RES05
R101	161225753	75K	RES05
R102	161225753	75K	RES05
R103	161225203	20K	RES05
R104	161225203	20K	RES05
R106	161335221	220-1/4W	RES07
R107	161335221	220-1/4W	RES07
R108	161335221	220-1/4W	RES07
R109	161335221	220-1/4W	RES07
R110	161225241	240	RES05
R111	161225241	240	RES05
R112	161225241	240	RES05
R113	161225241	240	RES05
R114	161225202	2K	RES05
R115	161225202	2K	RES05
R116	161225202	2K	RES05
R117	161225202	2K	RES05
R118	161225202	2K	RES05
R119	180487205	2M-1B	pot3386x
R120	180487205	2M-1B	pot3386x
R121	161225332	3.3K	RES05
R122	161225332	3.3K	RES05
R123	161225621	620	RES05
R124	161225271	270	RES05
R125	161225332	3.3K	RES05
R126	161225332	3.3K	RES05
R127	161225332	3.3K	RES05
R128	168531541	'34.8K-1%'	RES07
R129	168531445	'3.48K-1%'	RES07
R130	161225362	3.6K	RES05
R131	161225362	3.6K	RES05
R132	161225272	2.7K	RES05
R133	161225362	3.6K	RES05
R134	161225333	33K	RES05
R135	161225333	33K	RES05
R136	161225394	390K	RES05
R137	161225394	390K	RES05
R138	161225394	390K	RES05
R139	161225394	390K	RES05
R140	161225302	3K	RES05
R141	161225302	3K	RES05
R142	161225302	3K	RES05
R143	161225302	3K	RES05
R144	161225302	3K	RES05
R145	161225302	3K	RES05
R146	161225472	4.7K	RES05
R147	161225472	4.7K	RES05
R148	161225471	470	RES05
R149	161225471	470	RES05
R150	161225471	470	RES05
R151	161225471	470	RES05
R152	161225471	470	RES05
R153	161225471	470	RES05
R154	161225471	470	RES05

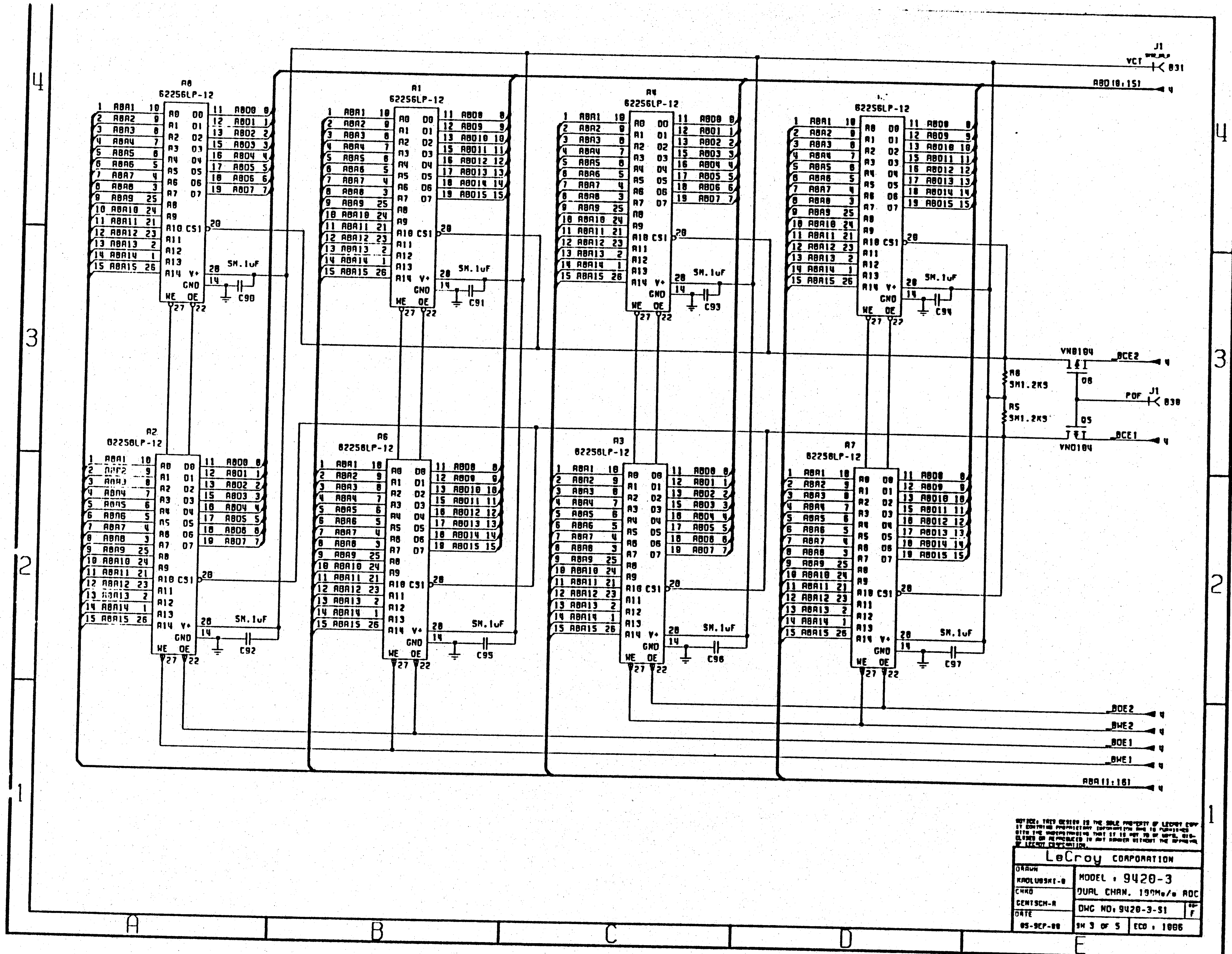
R155	161225471	470	RES05
R156	161225471	470	RES05
R157	161225471	470	RES05
R158	161335241	240-1/4W	RES07
R159	161335241	240-1/4W	RES07
R160	161335241	240-1/4W	RES07
R161	161335241	240-1/4W	RES07
R162	161335471	470-1/4W	RES07
R163	161335471	470-1/4W	RES07
R164	161335471	470-1/4W	RES07
R165	161335471	470-1/4W	RES07
R166	161225512	5.1K	RES05
R167	161225332	3.3K	RES05
R168	161225512	5.1K	RES05
R169	161225512	5.1K	RES05
R170	161225512	5.1K	RES05
R171	161225512	5.1K	RES05
R172	180487502	5K-1B	pot3386x
R173	180487502	5K-1B	pot3386x
R174	180487502	5K-1B	pot3386x
R175	161335565	5.6M-1/4W	RES07
R176	161335565	5.6M-1/4W	RES07
R177	168531495	'11.5K-1%'	RES07
R178	168531495	'11.5K-1%'	RES07
R179	161225622	6.2K	RES05
R180	161225752	7.5K	RES05
R181	161225752	7.5K	RES05
R182	161225752	7.5K	RES05
R183	161225752	7.5K	RES05
R184	161225622	6.2K	RES05
R185	168531471	'6.49K-1%'	RES07
R186	168531471	'6.49K-1%'	RES07
R187	161225682	6.8K	RES05
R188	161225682	6.8K	RES05
R189	161225821	820	RES05
R190	161225821	820	RES05
R191	180487502	5K-1B	pot3386x
R192	180487501	500-1B	pot3386x
R193	180487501	500-1B	pot3386x
R194	180487502	5K-1B	pot3386x
R195	161225510	51	RES05
R196	161225510	51	RES05
R197	161225510	51	RES05
R198	161225510	51	RES05
R199	168531365	'511-1%'	RES07
R200	168531365	'511-1%'	RES07
R201	168531365	'511-1%'	RES07
R202	168531365	'511-1%'	RES07
R203	168531385	'825-1%'	RES07
R204	168531385	'825-1%'	RES07
R205	161335752	7.5K-1/4W	RES07
R206	161335752	7.5K-1/4W	RES07
R207	172137022	.22-1W	RES32
R208	168035125	1.2M-700V	A_P500_L300X100
R209	168531453	'4.22K-1%'	RES07
R210	161225512	5.1K	RES05

R211	161225161	160	RES05
R212	161445102	1K-1/2W	RES20
R213	161225272	2.7K	RES05
R214	161225204	200K	RES05
R215	161225221	220	RES05
R216	161225223	22K	RES05
R217	168531495	'11.5K-1%'	RES07
R218	161225271	270	RES05
R219	180487202	2K-1B	pot3386x
R220	168531447	'3.65K-1%'	RES07
R221	161225273	27K	RES05
R222	161225331	330	RES05
R223	168045336	33M-3KV	A_P600_L400X150
R224	161225473	47K	RES05
R225	161225912	9.1K	RES05
R226	165375824	820K-700V	A_P500_L300X100
R227	161225753	75K	RES05
R228	161225511	510	RES05
R229	161225681	680	RES05
R230	161445560	56-1/2W	RES20
R231	161225103	10K	RES05
R232	161225103	10K	RES05
R233	161225621	620	RES05
R234	161225623	62K	RES05
R235	161225560	56	RES05
R236	161225560	56	RES05
R237	161225560	56	RES05
R238	161225560	56	RES05
R239	161225101	100	RES05
RN1	190842222	2.2K-8SIPC	SIP8RES
RN2	190042222	2.2K-SIPC	SIP10RES
RN3	190042222	2.2K-SIPC	SIP10RES
RN4	190042222	2.2K-SIPC	SIP10RES
RN5	190042222	2.2K-SIPC	SIP10RES
RN6	190042222	2.2K-SIPC	SIP10RES
TR1	440290001	4587	TRANSFO_HT
VF	$NULL	PAD	TESTPAD
VAC	$NULL	PAD	TESTPAD

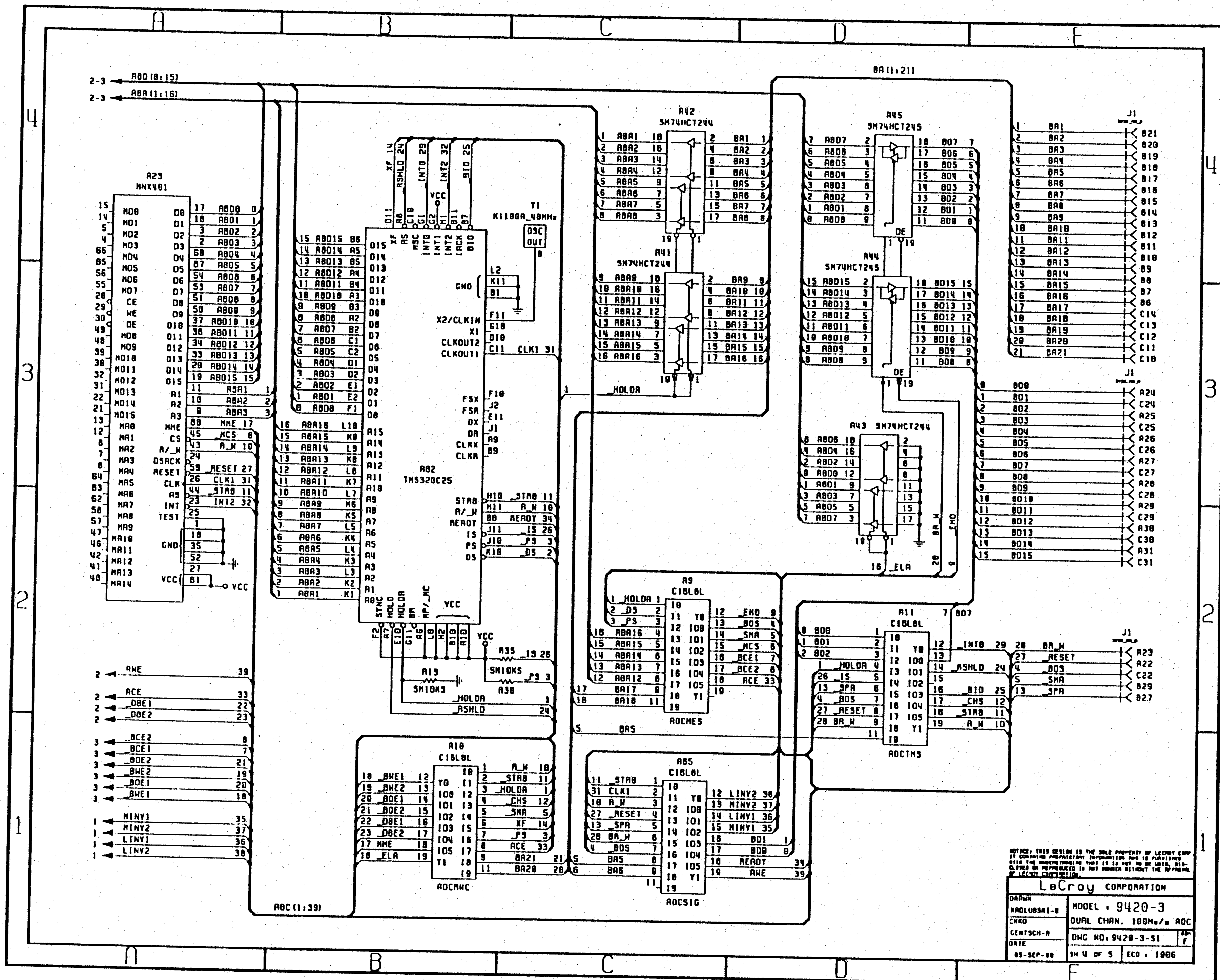

HSH410
A14
HSH410
A15
HADC77200
A12
HADC77200
A13
AIN CH1
AIN CH2
SHCK1
_SHCK1
SHCK2
_SHCK2
_ADCCK1
ADCCK1
_ADCCK2
ADCCK2
_CALCK
CALCK
D1(0:7)
D2(0:7)
MINV1
LINV1
MINV2
LINV2
LM336Z_2.5
LeCroy CORPORATION
MODEL : 9420-3
DUAL CHAN. 100Ms/s ADC
DWG NO: 9420-3-S1
SH 1 OF 5
ECO : 1006
05-SEP-89

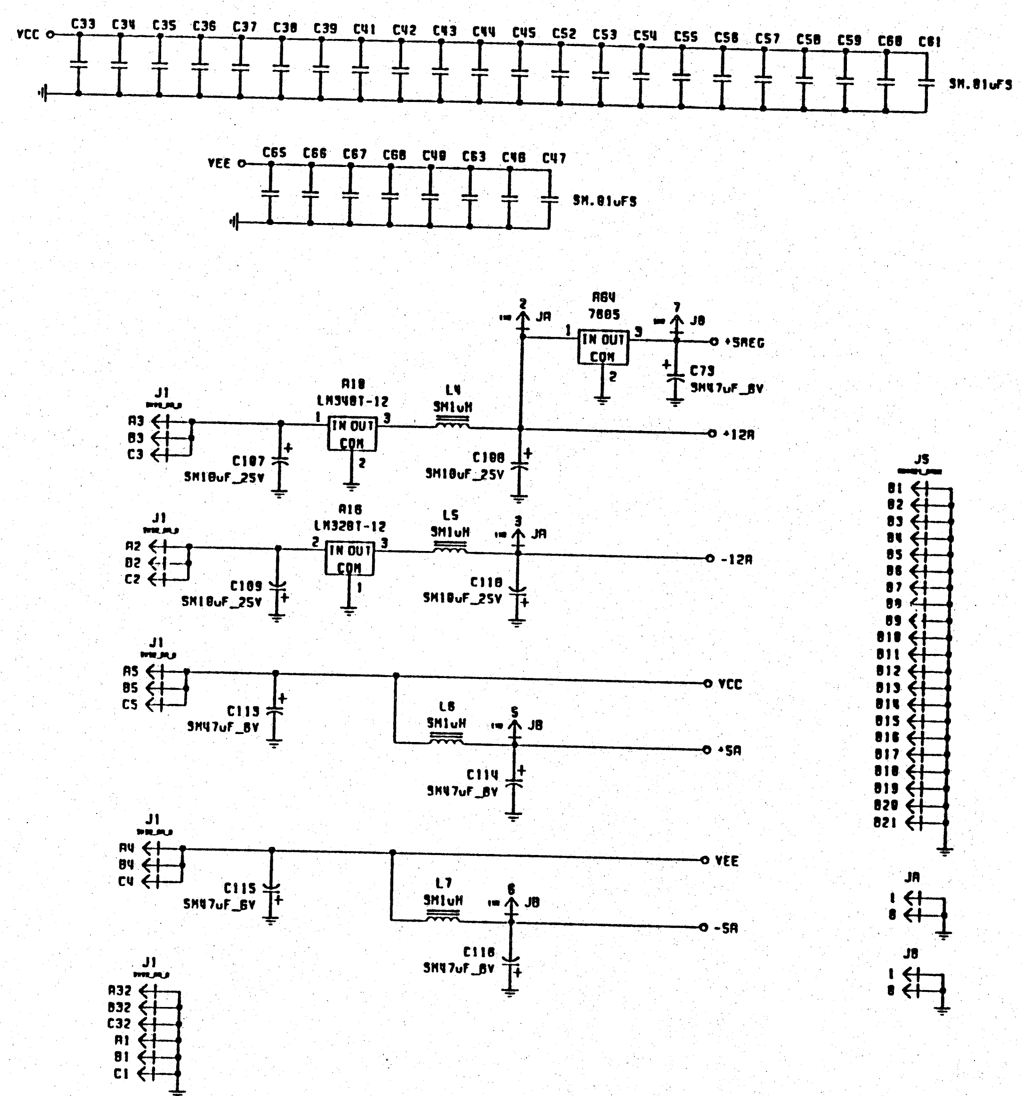


ADCMEM1
ADCMEM2
A32 SN2965
A33 SN2965
A35 SN74F157
A36 SN74F157
A37 SN74F157
A38 SN74F157
A30-A31 : SN10H116
A29 : SN10H105
A28 : SN10125
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.
LeCroy CORPORATION
DRAWN KADLUBSKI-B
CHKD GENISCH-A
DATE 05-SEP-88
MODEL : 9420-3
DUAL CHAN. 100Ms/s ADC
DWG NO: 9420-3-S1
SH 2 OF 5
ECO : 1086
F

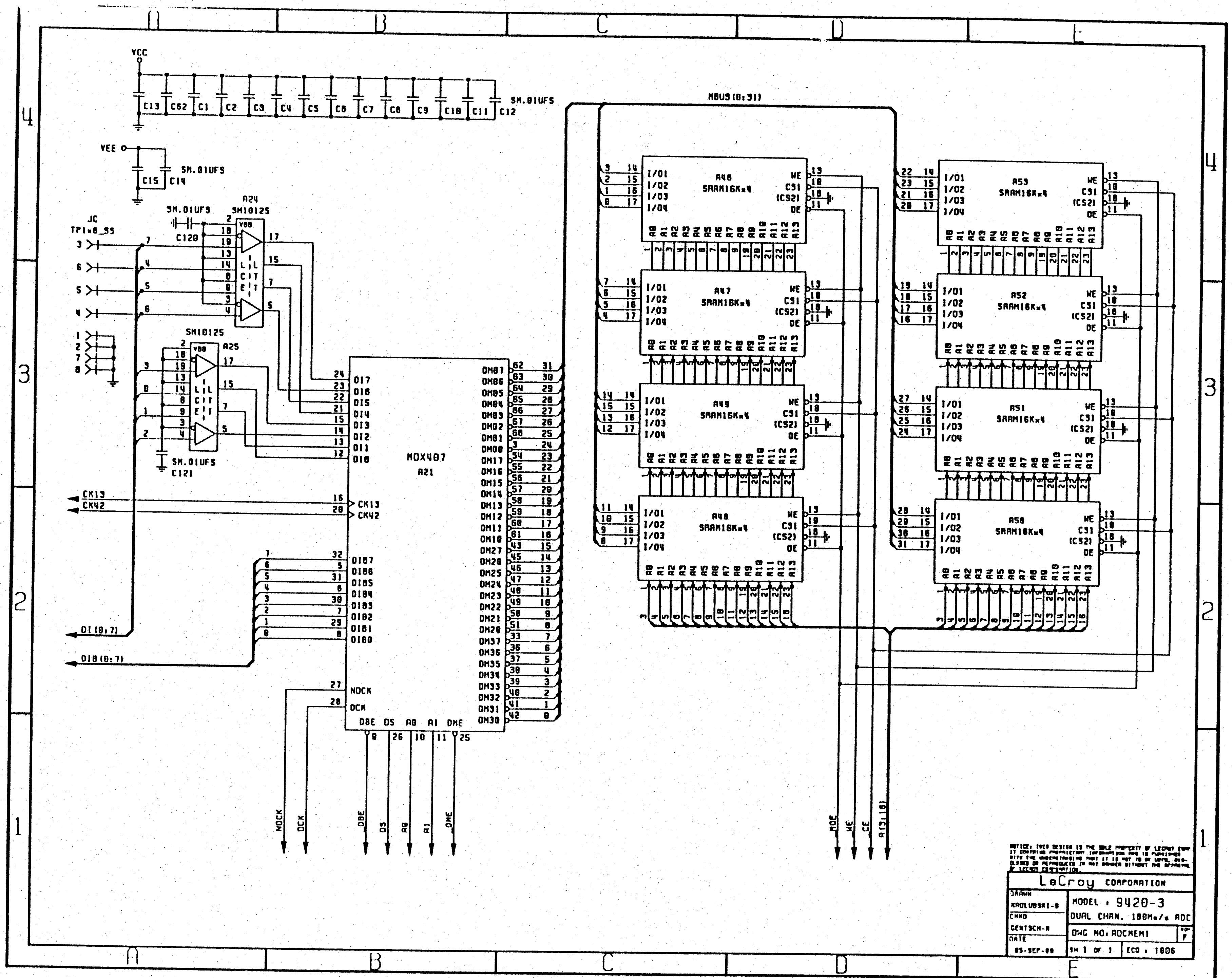


LeCroy CORPORATION
MODEL : 9420-3
DUAL CHAN. 100Ms/s ADC
DWG NO: 9420-3-S1
F
SH 3 OF 5
ECO : 1086
DRAWN KAOLUBSKI-B
CHKD GENTSCH-R
DATE 05-SEP-88
62256LP-12
VCT
POF
J1
ABD[0:15]
ABA[1:16]
_BCE2
_BCE1
_BOE2
_BWE2
_BOE1
_BWE1
VN0104
SM1.2K5
SM.1uF

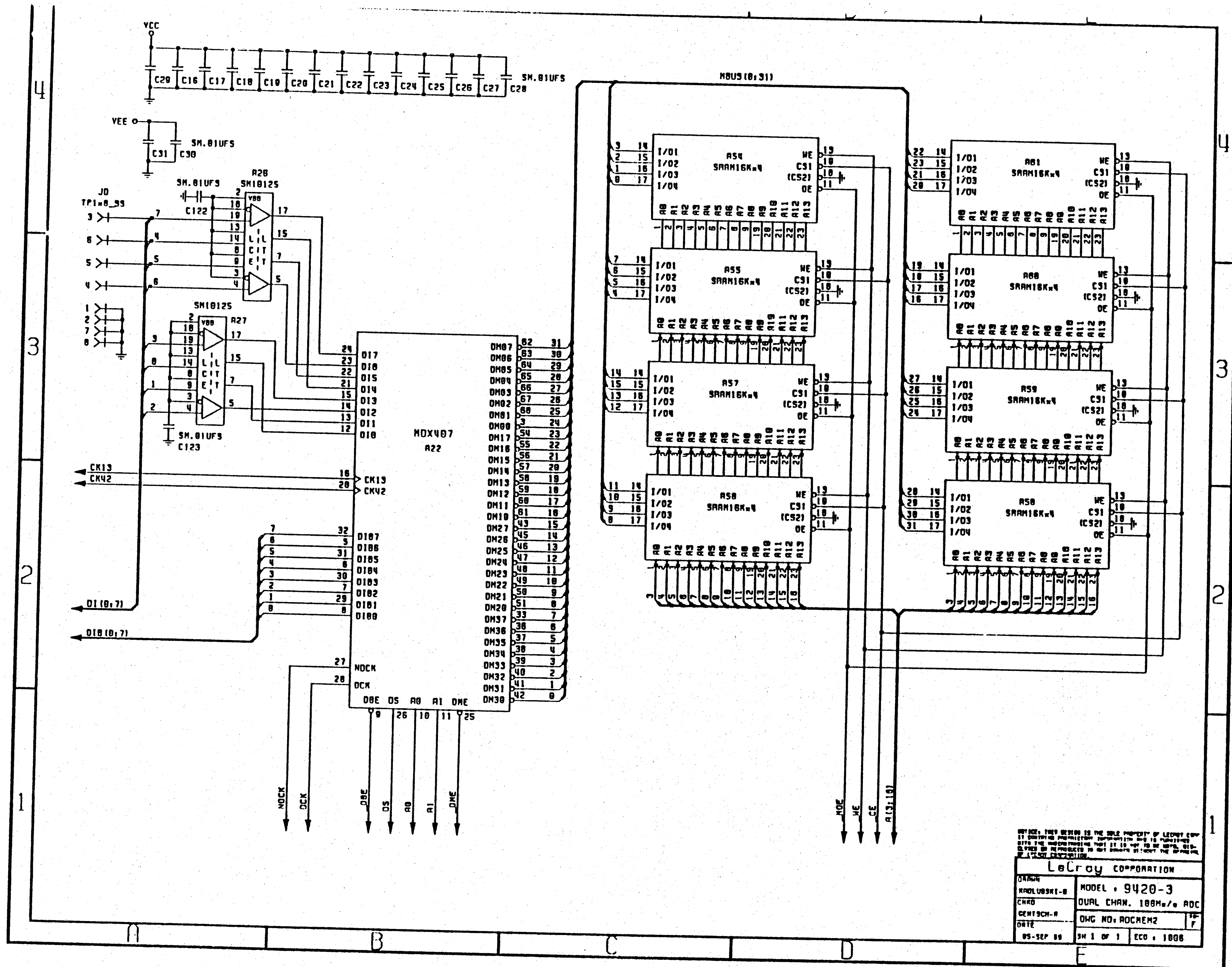

A23
MNX401
A02
TMS320C25
A42
SN74HCT244
A41
SN74HCT244
A45
SN74HCT245
A44
SN74HCT245
A43
SN74HCT244
Y1
K1100A_40MHz
A9
C16L8L
ADCMES
A11
C16L8L
ADCTMS
A10
C16L8L
ADCMWC
A05
C16L8L
ADCSIG
ABD(0:15)
ABA(1:16)
BA(1:21)
ABC(1:39)
J1
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.
LeCroy CORPORATION
DRAWN
KADLUBSKI-B
CHKD
GENTSCH-A
DATE
05-SEP-88
MODEL: 9420-3
DUAL CHAN. 100Ms/s ADC
DWG NO: 9420-3-S1
F
SH 4 OF 5
ECO: 1086

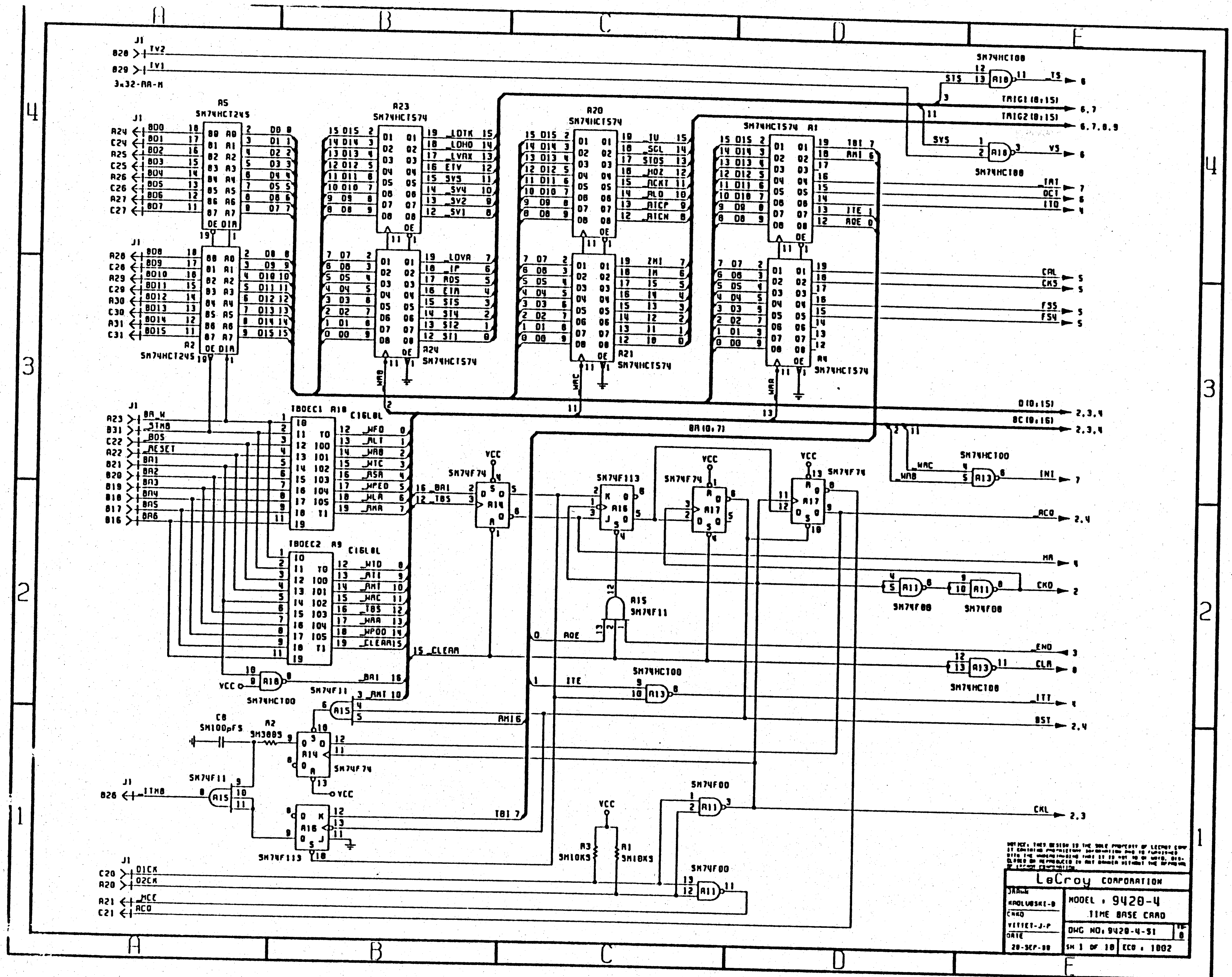


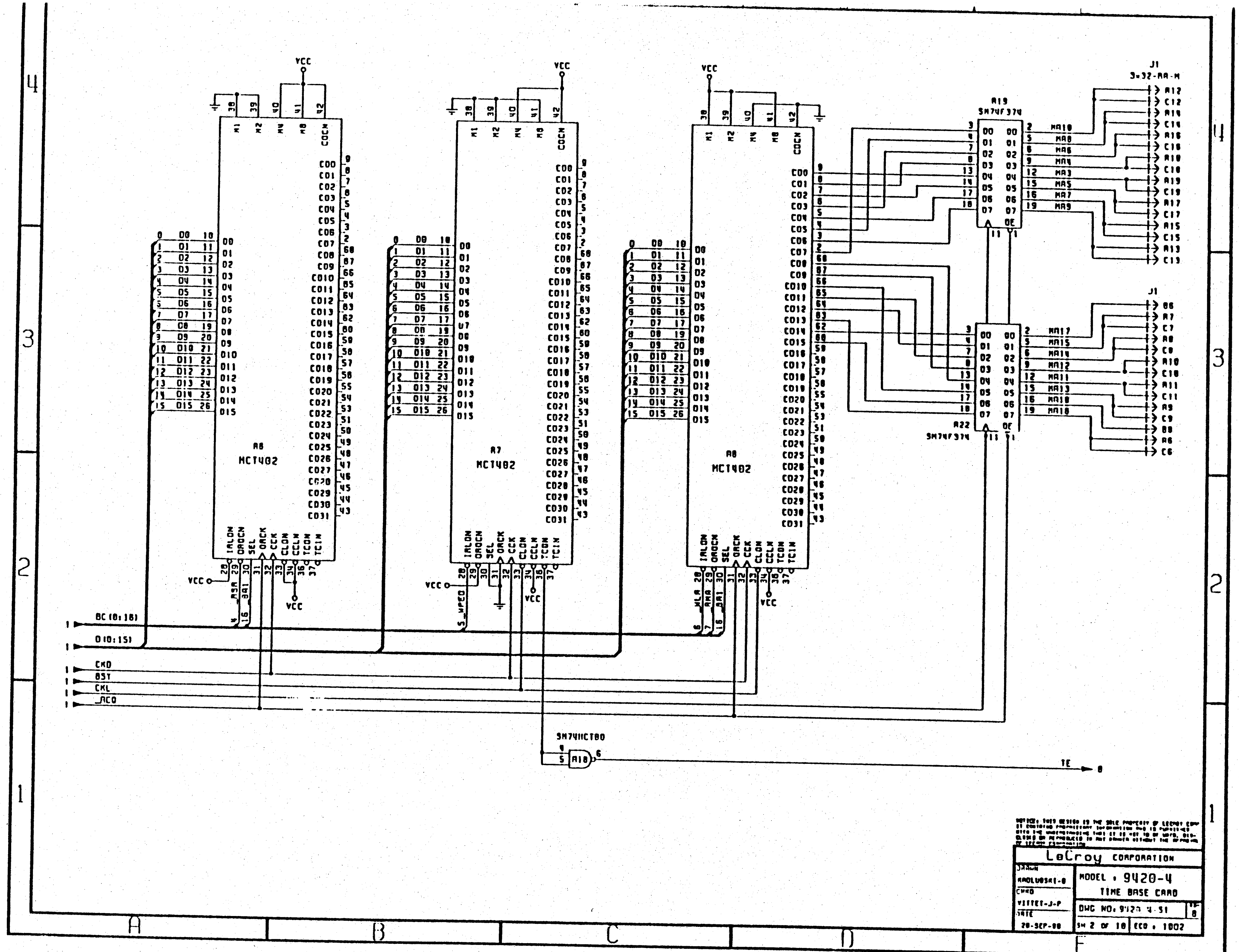
LeCroy CORPORATION	
DRAWN RADLUBSKI-B	MODEL : 9420-3
CHKD GENTSCH-A	DUAL CHAN. 100Ms/s ADC
DATE 05-SEP-88	DWG NO: 9420-3-S1 REV F
	SH 5 OF 5 ECO : 1006



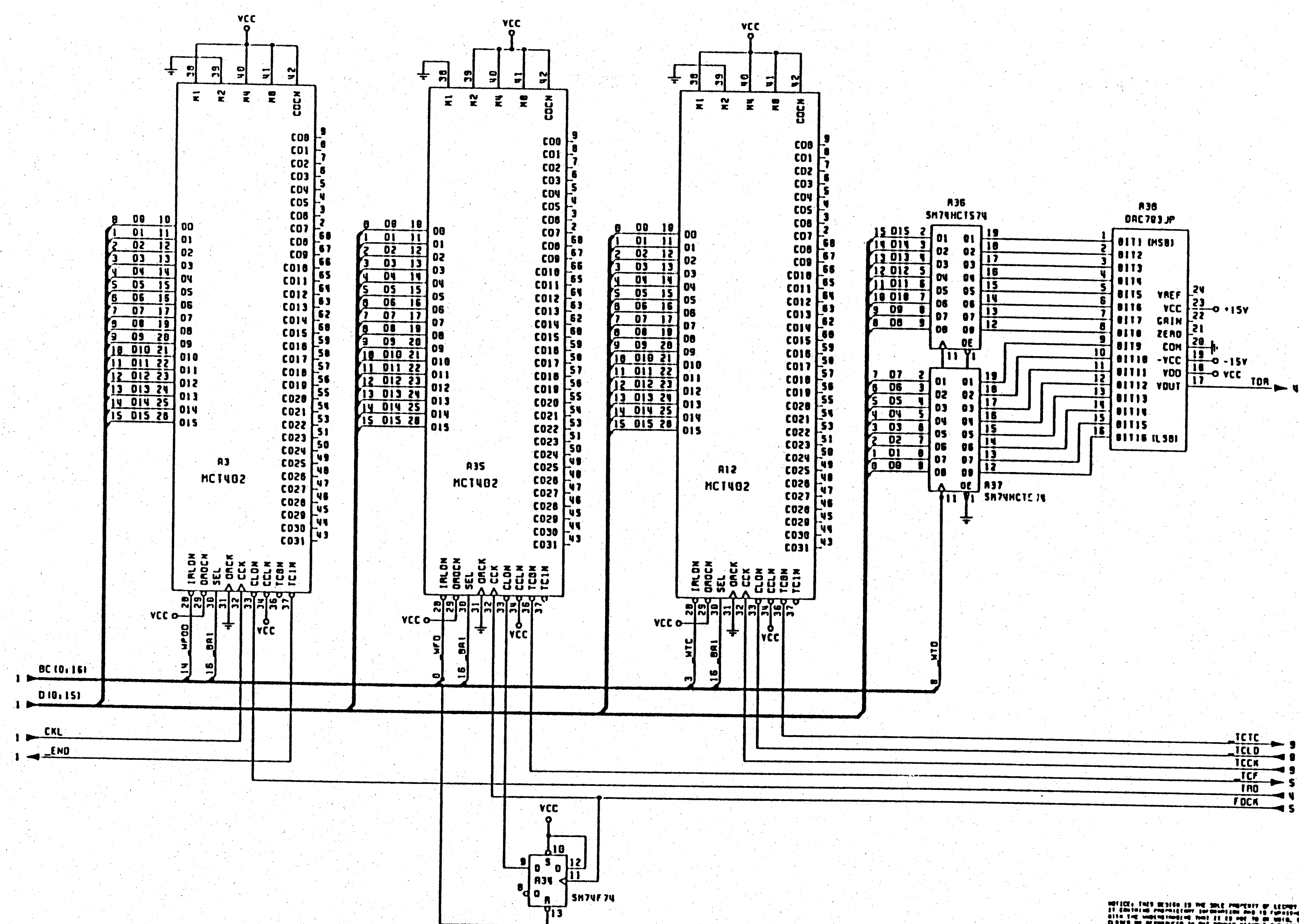
VCC
VEE
SM.01UFS
JC
TP1=0_55
SM10125
A24
A25
MOX407
A21
SRAM16Kx4
A46
A47
A49
A48
A53
A52
A51
A50
MBUS(0:31)
CK13
CK42
DI(0:7)
DI0(0:7)
NOCK
OCK
OBE
DS
A0
A1
OME
MOE
WE
CE
A(3:10)
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE COPIED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.
LeCroy CORPORATION
DRAWN KROLUBSKI-B
CHKD GENTSCH-A
DATE 05-SEP-88
MODEL : 9420-3
DUAL CHAN. 100Ms/s ADC
DWG NO: ADCMEM1
SH 1 OF 1
ECO : 1806


LeCroy CORPORATION
DRAWN KAOLUBSKI-B
CHKD GENTSCH-A
DATE 05-SEP 89
MODEL : 9420-3
DUAL CHAN. 100Ms/s ADC
DWG NO: ADCMEM2
SH 1 OF 1
ECO : 1006
MDX407
A22
SRAM16Kx4
A54
A55
A57
A58
A61
A60
A59
A50
MBUS(0:31)
SM10125
A28
A27
JD
TP1=8_9S
VCC
VEE
SM.01UFS
CK13
CK42
DI(0:7)
DI0(0:7)
NOCK
OCK
OBE
OS
A0
A1
OME
MOE
WE
CE
A(13:0)


LeCroy CORPORATION
MODEL : 9420-4
TIME BASE CARD
DWG NO: 9420-4-S1
SH 1 OF 10
ECO : 1802
28-SEP-88

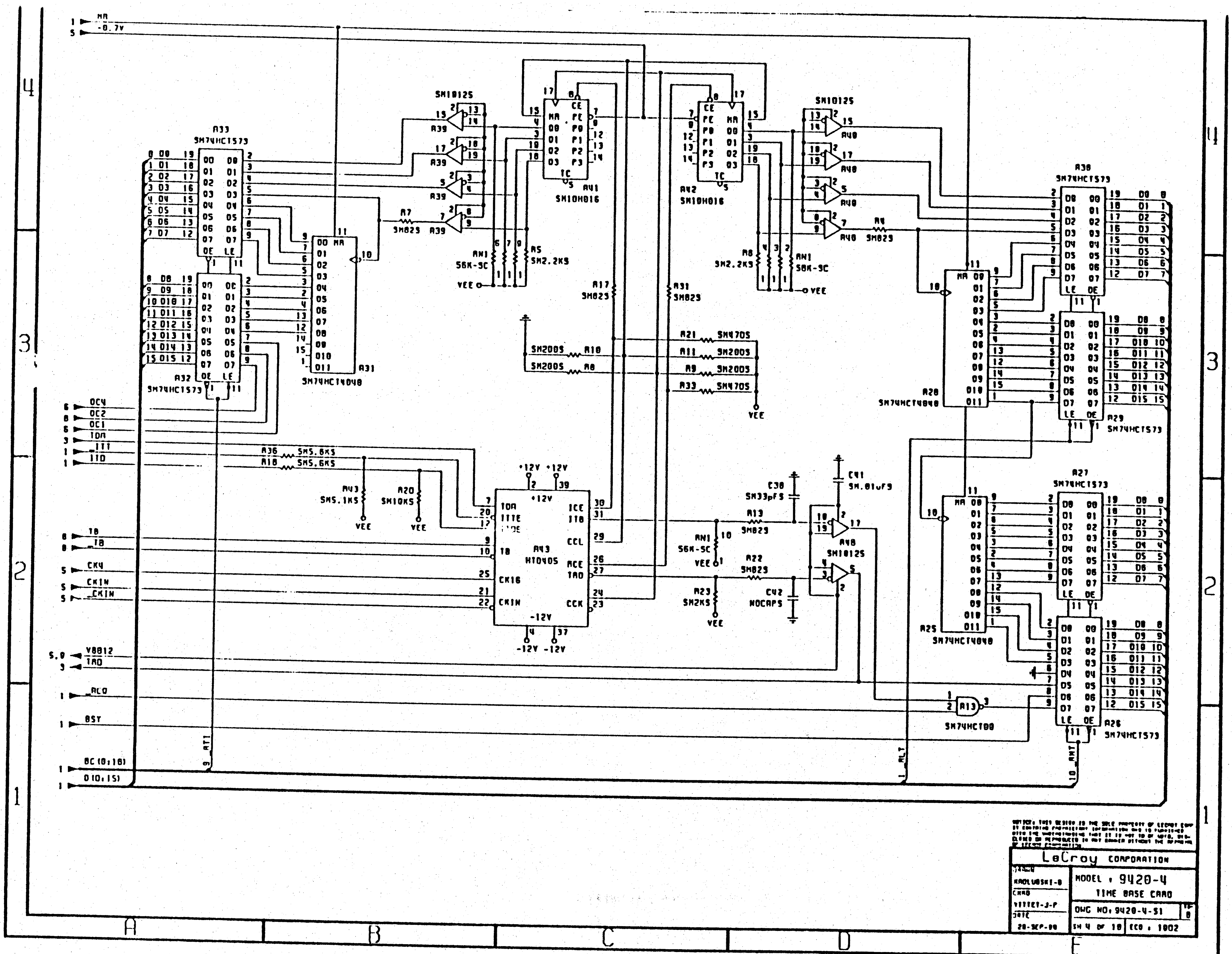


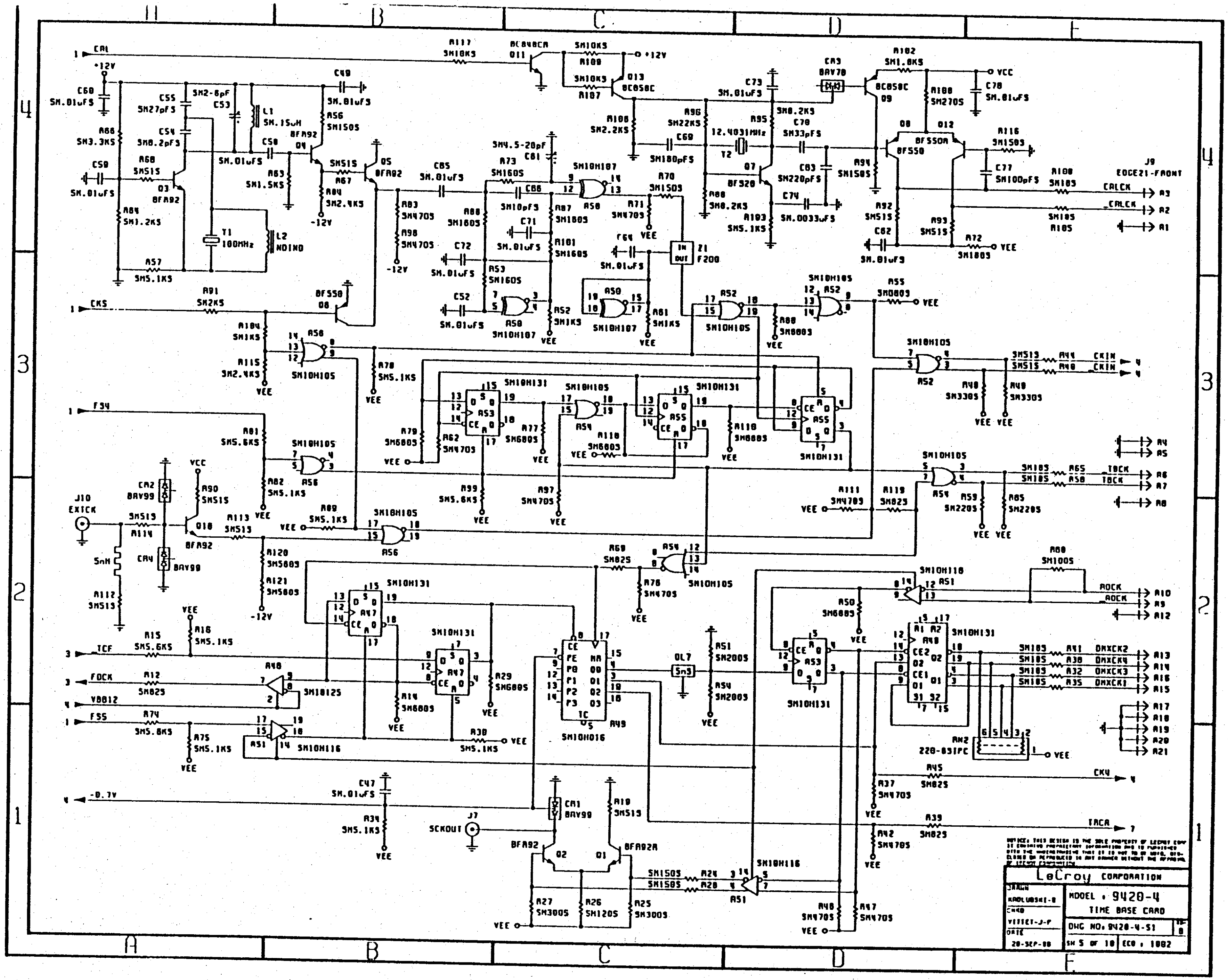
LeCroy CORPORATION
MODEL : 9420-4
TIME BASE CARD
DRAWN KAOLUOSKI-D
CHKD VITTET-J-P
DATE 20-SEP-88
DWG NO: 9420-4-S1
SH 2 OF 10
ECO : 1002
R8 MC1402
R7 MC1402
R19 SN74F374
R22 SN74F374
SN74HCT00
J1 3x32-AA-M
BC(0:18)
D(0:15)
CKD
BST
CKL
_ACQ
TE
VCC

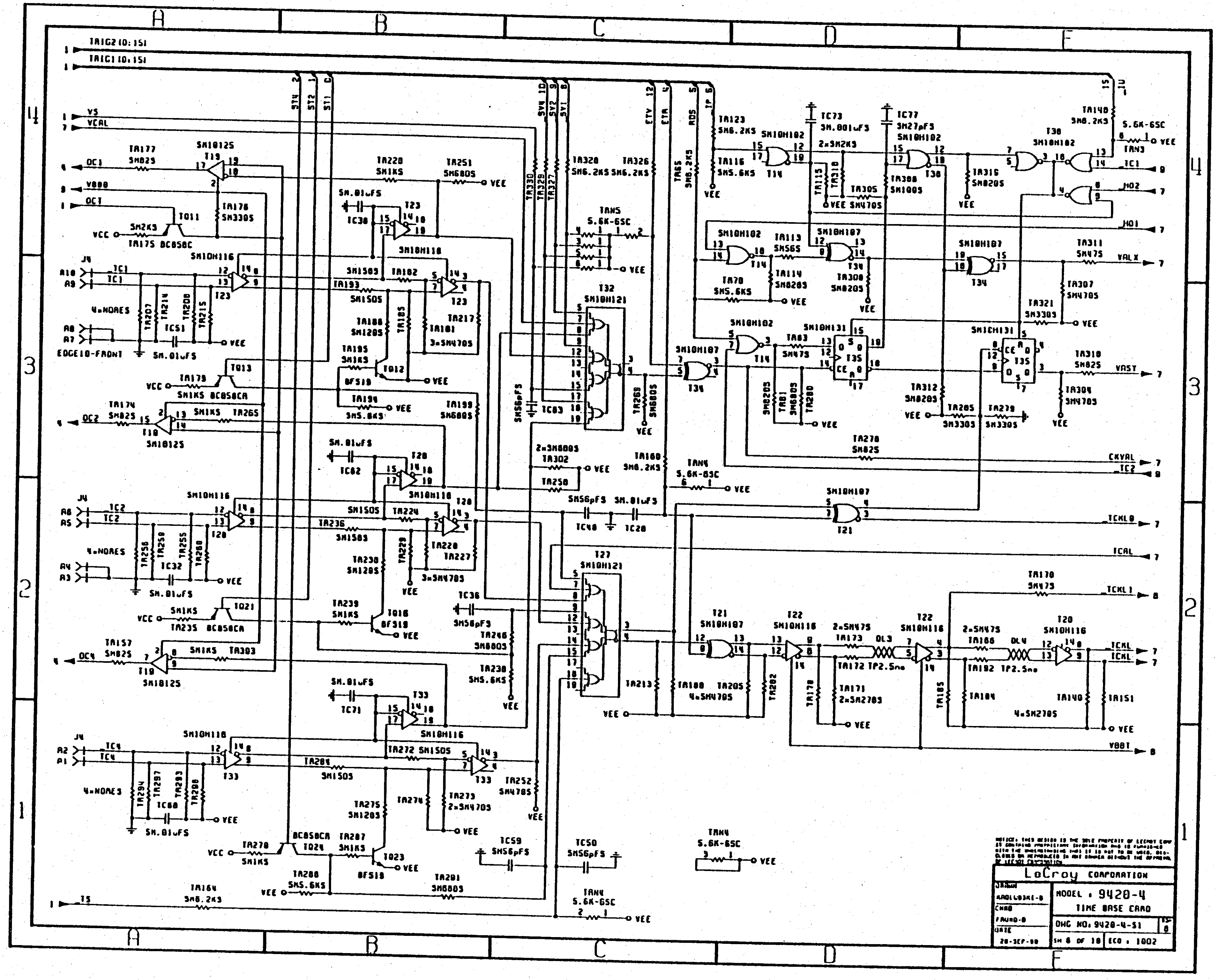


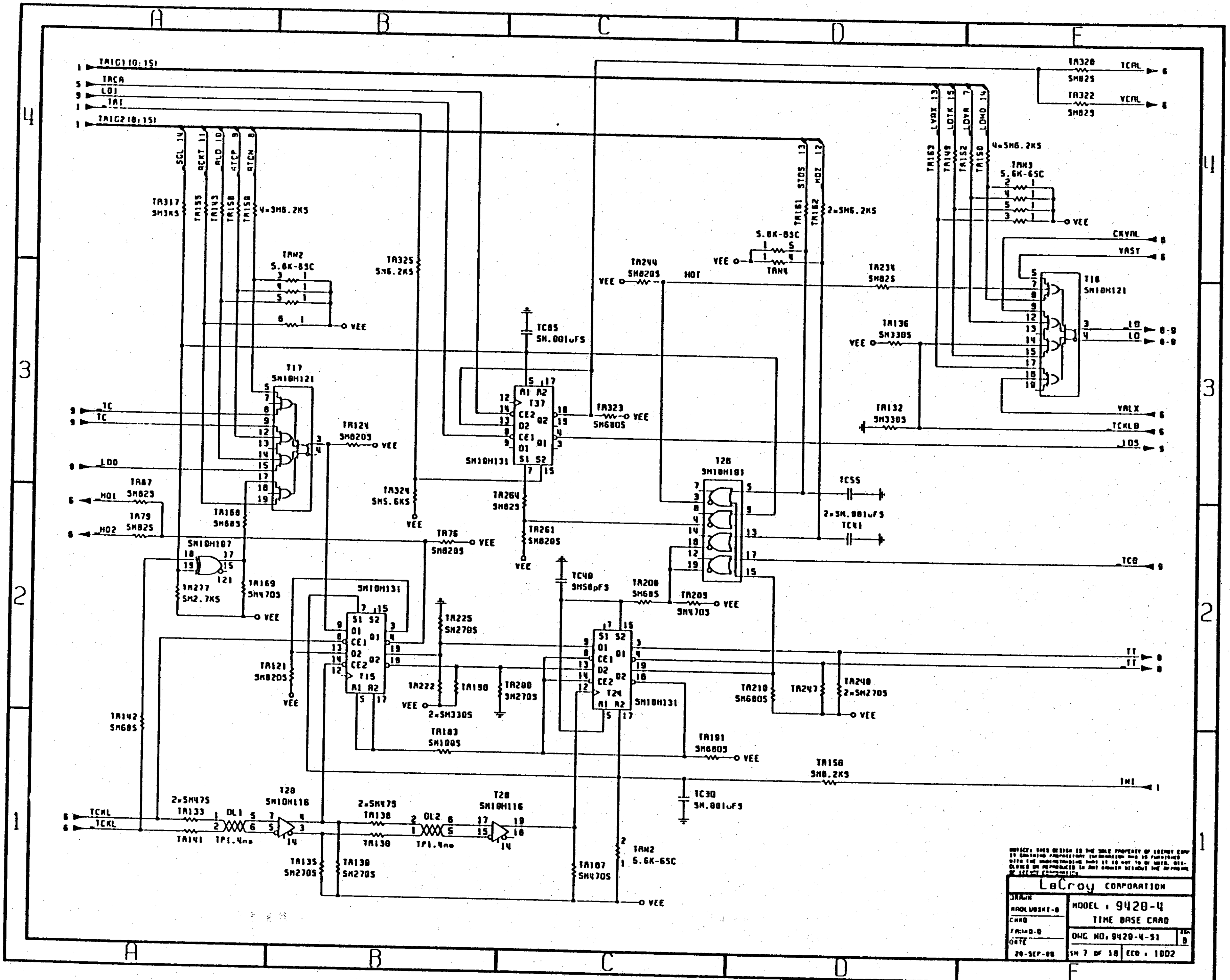
LeCroy CORPORATION

DRAWN KROLUOSKI-B	MODEL : 9420-4 TIME BASE CARD
CHKD VITTET-J-P	DWG NO: 9420-4-S1
DATE 28-SEP-90	SH 3 OF 18 — ECO : 1882

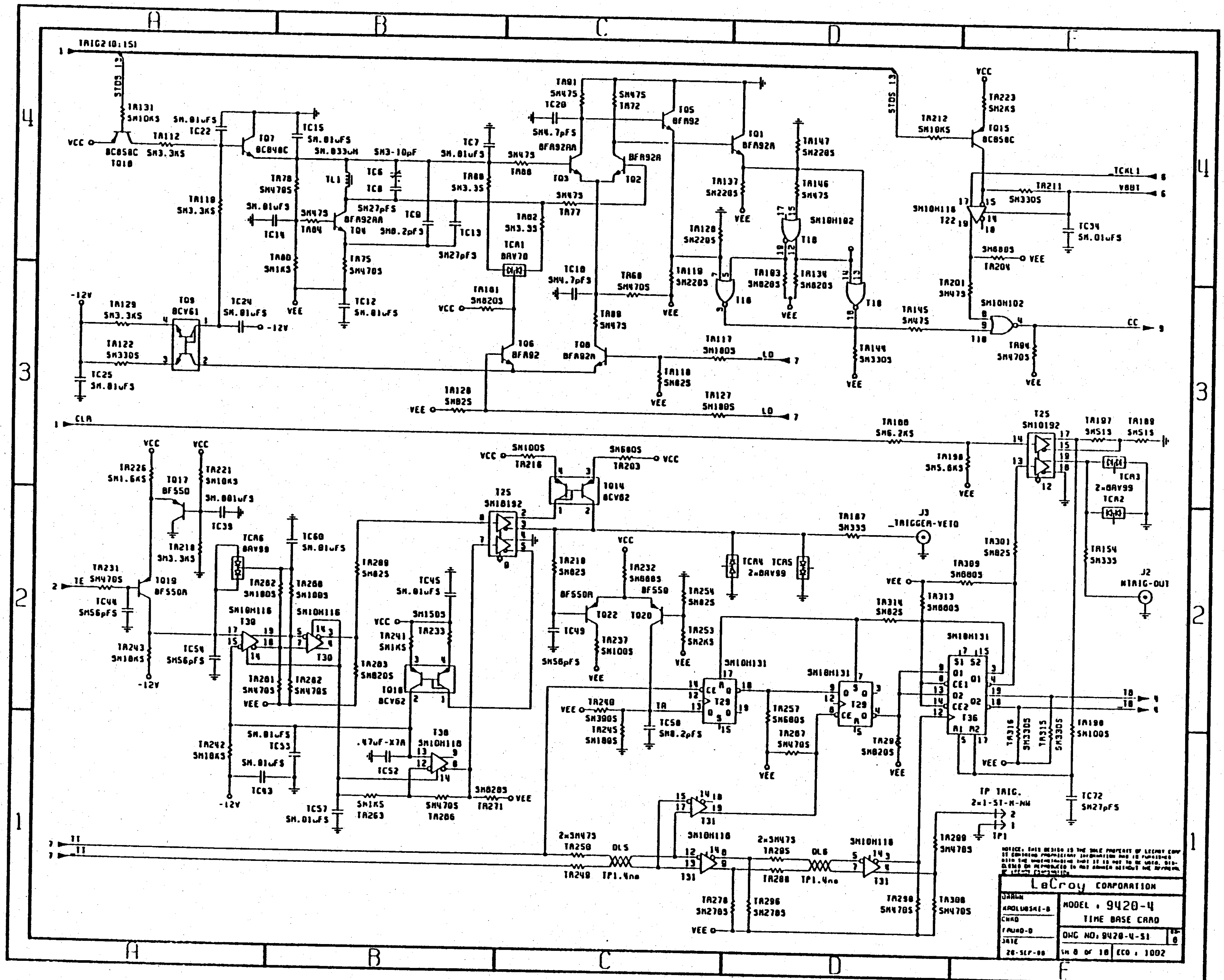

LeCroy CORPORATION
MODEL : 9420-4
TIME BASE CARD
DWG NO: 9420-4-S1
SH 4 OF 10
ECO : 1002
KADLUBSKI-B
VITTET-J-P
28-SEP-88
A
B
C
D
E
1
2
3
4
A33 SN74HCT573
A32 SN74HCT573
A31 SN74HCT4040
A41 SN10H016
A42 SN10H016
A39 SN10125
A40 SN10125
A43 HT0405
A30 SN74HCT573
A29 SN74HCT573
A28 SN74HCT4040
A27 SN74HCT573
A26 SN74HCT573
A25 SN74HCT4040
A13 SN74HCT08
A48 SN10125
C38 SM33pFS
C41 SM.01uFS
C42 NOCAPS
MR
-0.7V
OC4
OC2
OC1
IDA
_ITT
IID
IB
_IB
CK4
CKIN
_CKIN
V8812
IAD
_RCO
BST
BC(0:10)
D10:15)
VEE
+12V
-12V

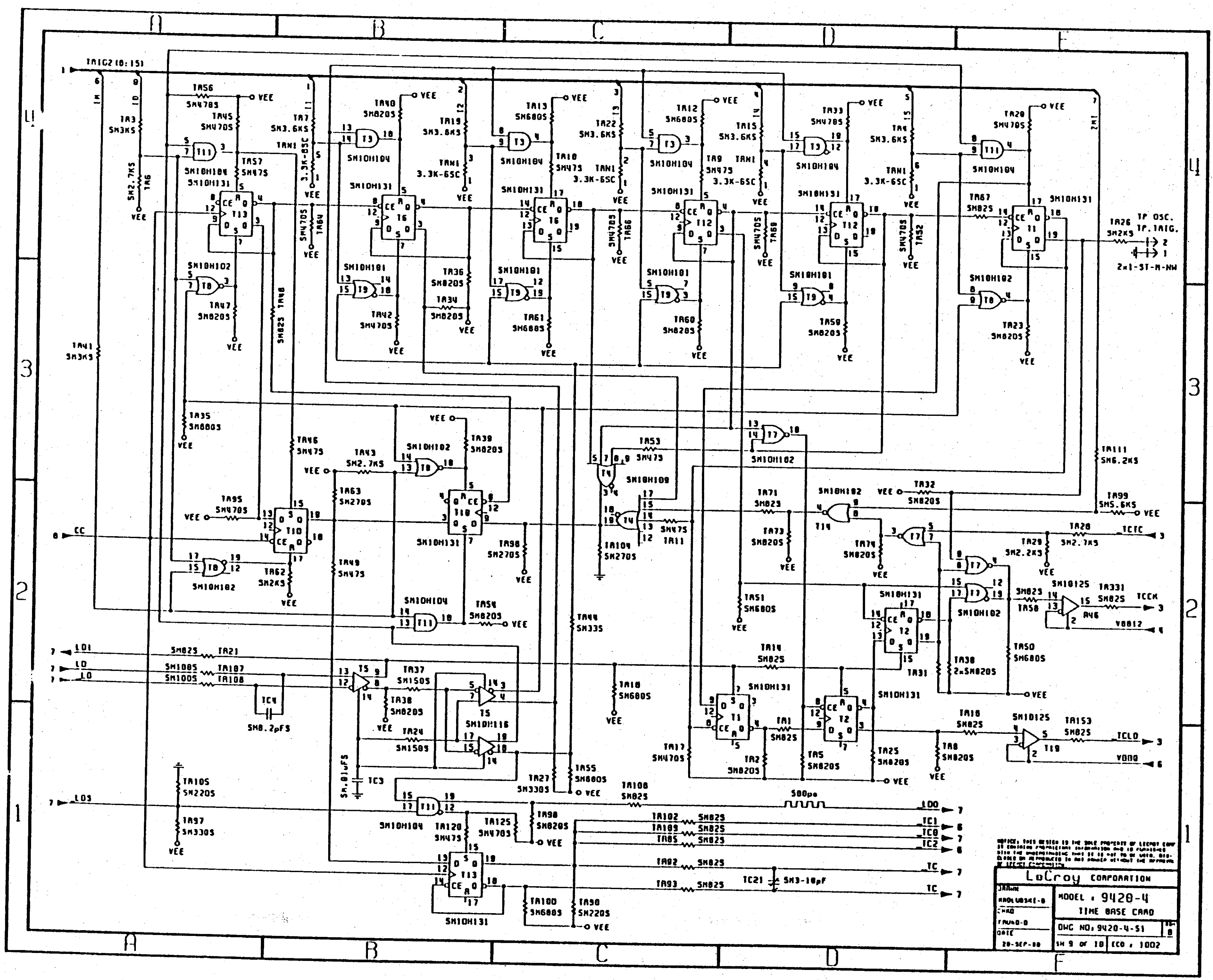

LeCroy CORPORATION
MODEL : 9420-4
TIME BASE CARD
DWG NO: 9420-4-S1
SH 5 OF 10
ECO : 1082
20-SEP-88

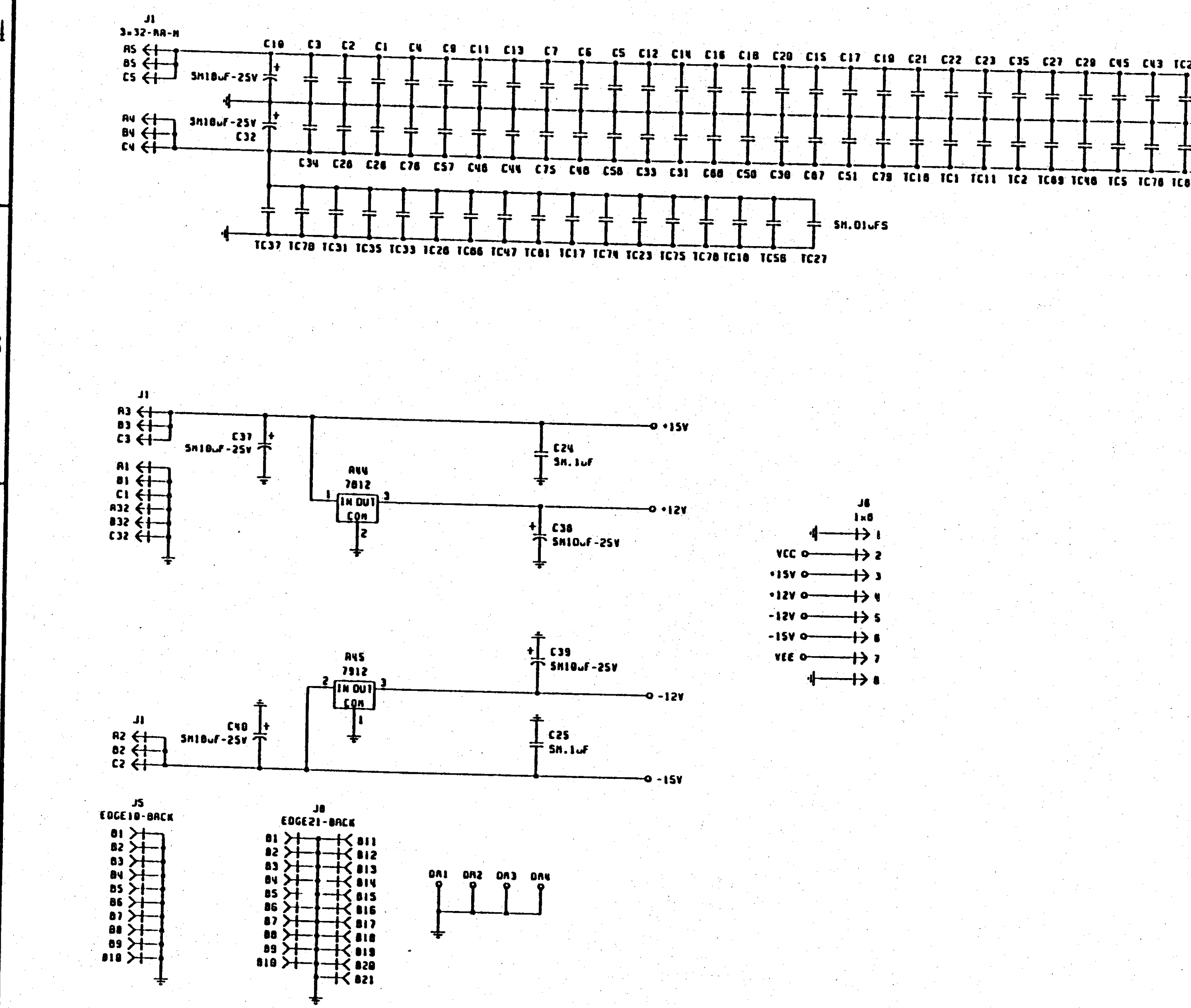

LeCroy CORPORATION
MODEL : 9420-4
TIME BASE CARD
DWG NO: 9420-4-S1
SH 8 OF 10
ECO : 1002



LeCroy CORPORATION
MODEL : 9420-4
TIME BASE CARD
DWG NO. 9420-4-S1
SH 7 OF 18
ECO : 1002
DATE 20-SEP-88
TRIG1(0:15)
TRCA
LD1
TRI
TRIG2(8:15)
SGL
ACKT
ALD
ATCP
ATCN
STOS
HOZ
LVAX
LDTK
LDVA
LDHO
TCAL
VCAL
CKVAL
VAST
VALX
TCKLB
LD5
TCD
TNI
TCKL
HO1
HO2
LDD
TC
LD
TT
HOT
VEE
T17 SN10H121
T18 SN10H121
T37 SN10H131
T15 SN10H131
T24 SN10H131
T28 SN10H181
T20 SN10H116
SN10H107
DL1
DL2
TP1.4ns


TRIG2(0:15)
CLR
TRIGGER-VETO
TRIG-OUT
TP TRIG.
2x1-ST-M-NW
LeCroy CORPORATION
DRAWN
KROLWOSKI-B
CHKD
FAWAD-D
DATE
28-SEP-88
MODEL : 9420-4
TIME BASE CARD
DWG NO: 9420-4-S1
B
SH 8 OF 10
ECO : 1002


NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORPORATION
LeCroy CORPORATION
DRAWN
KAOLUBSKI-B
CHKD
FRUND-B
DATE
20-SEP-88
MODEL : 9420-4
TIME BASE CARD
DWG NO: 9420-4-S1
SH 9 OF 10
ECO : 1002
B

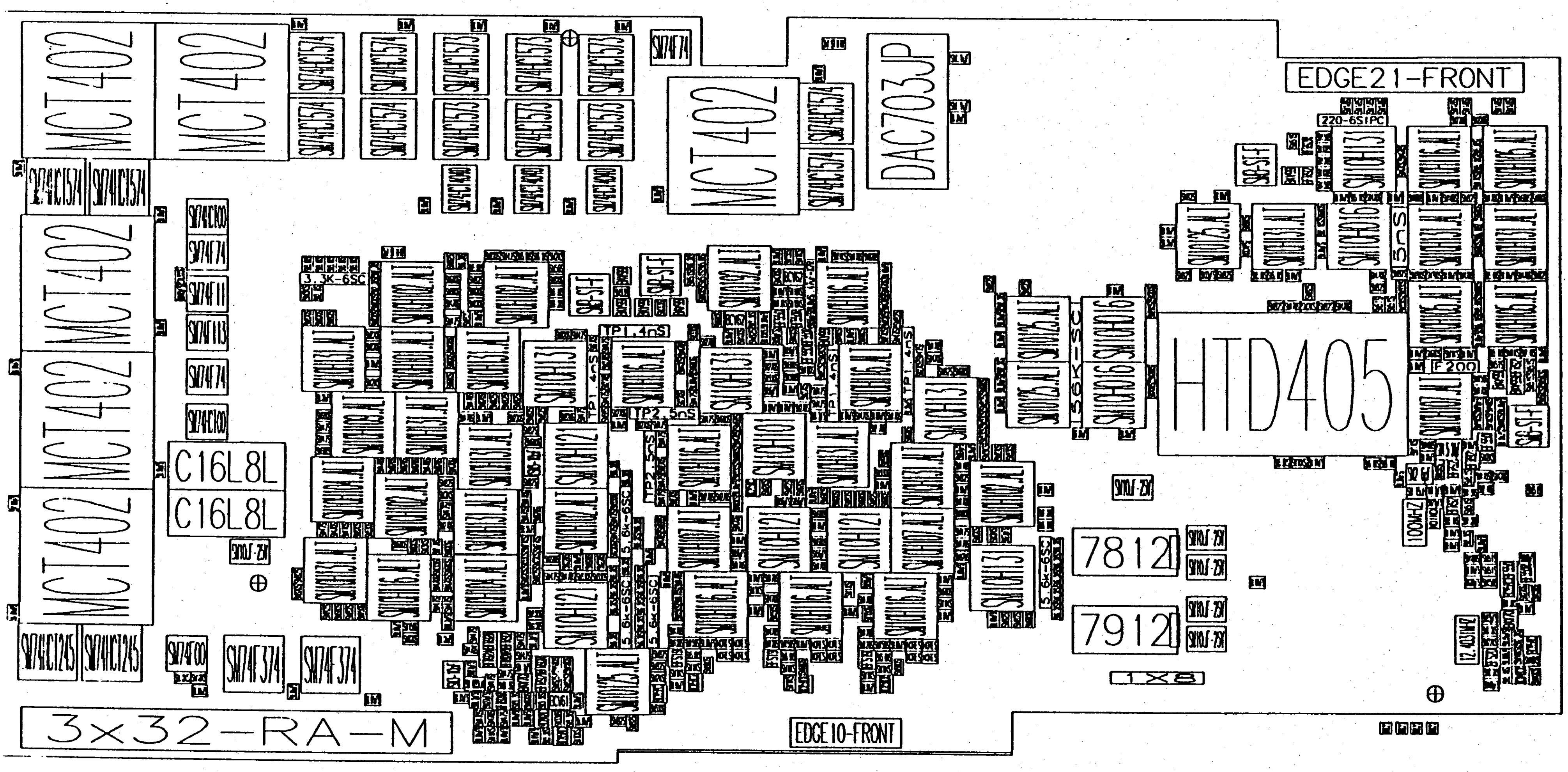


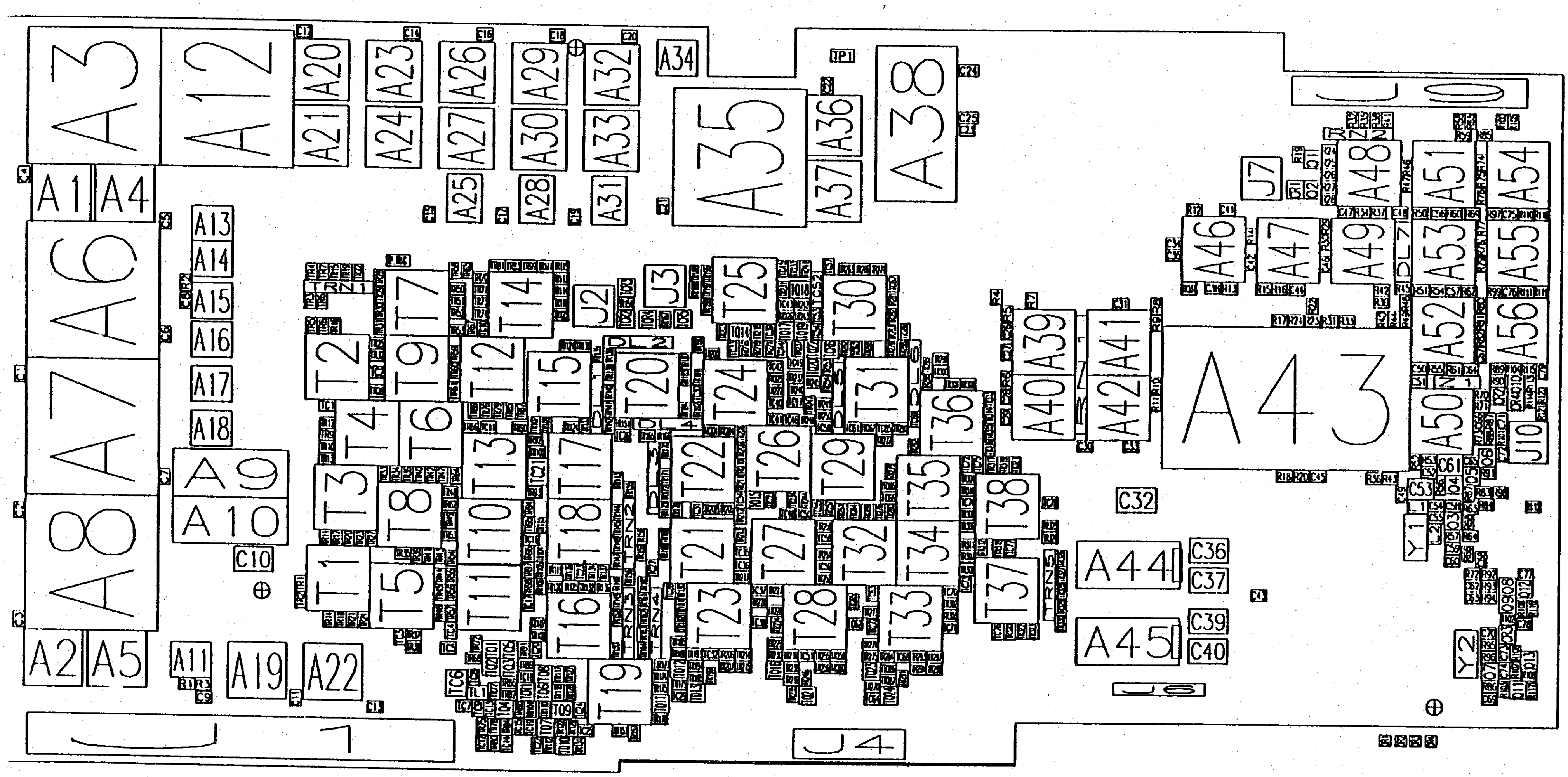
LeCroy CORPORATION

MODEL : 9420-4
TIME BASE CARD

DRAWN: KROLWSKI-B
CHKD: VITTET-J-P
DATE: 20-SEP-88

DWG NO. 9420-4-S1
SH 10 OF 18
ECO : 1802


3x32-RA-M
MCT402
C16L8L
DAC703JP
HTD405
EDGE21-FRONT
EDGE10-FRONT
7812
7912
1X8
9420_4 Rev:B


A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
A14
A15
A16
A17
A18
A19
A20
A21
A22
A23
A24
A25
A26
A27
A28
A29
A30
A31
A32
A33
A34
A35
A36
A37
A38
A39
A40
A41
A42
A43
A44
A45
A46
A47
A48
A49
A50
A51
A52
A53
A54
A55
A56
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
T13
T14
T15
T16
T17
T18
T19
T20
T21
T22
T23
T24
T25
T26
T27
T28
T29
T30
T31
T32
T33
T34
T35
T36
T37
T38
J2
J3
J4
J7
J10
C10
C32
C36
C37
C39
C40
C53
C61
Y1
Y2
TRN1
TRN2
TRN5
DL2
DL7
TP1

9420_4 Rev:B

A1	SM200178574	SM74HCT574	SOIC_20
A2	SM207878245	SM74HCT245	SOIC_20
A3	SM200160402	MCT402	PLCC_68
A4	SM200178574	SM74HCT574	SOIC_20
A5	SM207878245	SM74HCT245	SOIC_20
A6	SM200160402	MCT402	PLCC_68
A7	SM200160402	MCT402	PLCC_68
A8	SM200160402	MCT402	PLCC_68
A9	205750000	C16L8L	DIP20
A10	205750000	C16L8L	DIP20
A11	SM200172000	SM74F00	SOIC_14
A12	SM200160402	MCT402	PLCC_68
A13	SM200178000	SM74HCT00	SOIC_14
A14	SM200172074	SM74F74	SOIC_14
A15	SM200172011	SM74F11	SOIC_14
A16	SM200172113	SM74F113	SOIC_14
A17	SM200172074	SM74F74	SOIC_14
A18	SM200178000	SM74HCT00	SOIC_14
A19	SM200172374	SM74F374	SOIC_20
A20	SM200178574	SM74HCT574	SOIC_20
A21	SM200178574	SM74HCT574	SOIC_20
A22	SM200172374	SM74F374	SOIC_20
A23	SM200178574	SM74HCT574	SOIC_20
A24	SM200178574	SM74HCT574	SOIC_20
A25	SM200278040	SM74HCT4040	SOIC_16
A26	SM200478573	SM74HCT573	SOIC_20
A27	SM200478573	SM74HCT573	SOIC_20
A28	SM200278040	SM74HCT4040	SOIC_16
A29	SM200478573	SM74HCT573	SOIC_20
A30	SM200478573	SM74HCT573	SOIC_20
A31	SM200278040	SM74HCT4040	SOIC_16
A32	SM200478573	SM74HCT573	SOIC_20
A33	SM200478573	SM74HCT573	SOIC_20
A34	SM200172074	SM74F74	SOIC_14
A35	SM200160402	MCT402	PLCC_68
A36	SM200178574	SM74HCT574	SOIC_20
A37	SM200178574	SM74HCT574	SOIC_20
A38	207281703	DAC703JP	DIP24
A39	SM207360125	SM10125.ALT	PLCC_20
A40	SM207360125	SM10125.ALT	PLCC_20
A41	SM200267016	SM10H016	PLCC_20
A42	SM200267016	SM10H016	PLCC_20
A43	HTD405	HTD405	HTD405
A44	208570812	7812	TO220
A45	208570912	7912	TO220
A46	SM207360125	SM10125.ALT	PLCC_20
A47	SM200167131	SM10H131.ALT	PLCC_20
A48	SM200167131	SM10H131	PLCC_20
A49	SM200267016	SM10H016	PLCC_20
A50	SM200167107	SM10H107.ALT	PLCC_20
A51	SM207460116	SM10H116.ALT	PLCC_20
A52	SM200167105	SM10H105.ALT	PLCC_20
A53	SM200167131	SM10H131.ALT	PLCC_20
A54	SM200167105	SM10H105.ALT	PLCC_20
A55	SM200167131	SM10H131.ALT	PLCC_20
A56	SM200167105	SM10H105.ALT	PLCC_20

C1	SM661207103	SM.01uFS	SM0805
C2	SM661207103	SM.01uFS	SM0805
C3	SM661207103	SM.01uFS	SM0805
C4	SM661207103	SM.01uFS	SM0805
C5	SM661207103	SM.01uFS	SM0805
C6	SM661207103	SM.01uFS	SM0805
C7	SM661207103	SM.01uFS	SM0805
C8	SM661255101	SM100pFS	SM0805
C9	SM661207103	SM.01uFS	SM0805
C10	SM666247106	SM10uF-25V	SMCAPD
C11	SM661207103	SM.01uFS	SM0805
C12	SM661207103	SM.01uFS	SM0805
C13	SM661207103	SM.01uFS	SM0805
C14	SM661207103	SM.01uFS	SM0805
C15	SM661207103	SM.01uFS	SM0805
C16	SM661207103	SM.01uFS	SM0805
C17	SM661207103	SM.01uFS	SM0805
C18	SM661207103	SM.01uFS	SM0805
C19	SM661207103	SM.01uFS	SM0805
C20	SM661207103	SM.01uFS	SM0805
C21	SM661207103	SM.01uFS	SM0805
C22	SM661207103	SM.01uFS	SM0805
C23	SM661207103	SM.01uFS	SM0805
C24	SM661127104	SM.1uF	SM1206
C25	SM661127104	SM.1uF	SM1206
C26	SM661207103	SM.01uFS	SM0805
C27	SM661207103	SM.01uFS	SM0805
C28	SM661207103	SM.01uFS	SM0805
C29	SM661207103	SM.01uFS	SM0805
C30	SM661207103	SM.01uFS	SM0805
C31	SM661207103	SM.01uFS	SM0805
C32	SM666247106	SM10uF-25V	SMCAPD
C33	SM661207103	SM.01uFS	SM0805
C34	SM661207103	SM.01uFS	SM0805
C35	SM661207103	SM.01uFS	SM0805
C36	SM666247106	SM10uF-25V	SMCAPD
C37	SM666247106	SM10uF-25V	SMCAPD
C38	SM661255330	SM33pFS	SM0805
C39	SM666247106	SM10uF-25V	SMCAPD
C40	SM666247106	SM10uF-25V	SMCAPD
C41	SM661207103	SM.01uFS	SM0805
C42	NOCAPS	NOCAPS	SM0805
C43	SM661207103	SM.01uFS	SM0805
C44	SM661207103	SM.01uFS	SM0805
C45	SM661207103	SM.01uFS	SM0805
C46	SM661207103	SM.01uFS	SM0805
C47	SM661207103	SM.01uFS	SM0805
C48	SM661207103	SM.01uFS	SM0805
C49	SM661207103	SM.01uFS	SM0805
C50	SM661207103	SM.01uFS	SM0805
C51	SM661207103	SM.01uFS	SM0805
C52	SM661207103	SM.01uFS	SM0805
C53	SM158043006	SM2-6pF	SMCAPVAR
C54	SM661250082	SM8.2pFS	SM0805
C55	SM661255270	SM27pFS	SM0805
C56	SM661207103	SM.01uFS	SM0805

C57	SM661207103	SM.01uFS	SM0805
C58	SM661207103	SM.01uFS	SM0805
C59	SM661207103	SM.01uFS	SM0805
C60	SM661207103	SM.01uFS	SM0805
C61	SM158043020	SM4.5-20pF	SMCAPVAR
C62	SM661207103	SM.01uFS	SM0805
C63	SM661255221	SM220pFS	SM0805
C64	SM661207103	SM.01uFS	SM0805
C65	SM661207103	SM.01uFS	SM0805
C66	SM661255100	SM10pFS	SM0805
C67	SM661207103	SM.01uFS	SM0805
C68	SM661207103	SM.01uFS	SM0805
C69	SM661255181	SM180pFS	SM0805
C70	SM661255330	SM33pFS	SM0805
C71	SM661207103	SM.01uFS	SM0805
C72	SM661207103	SM.01uFS	SM0805
C73	SM661207103	SM.01uFS	SM0805
C74	SM661205332	SM.0033uFS	SM0805
C75	SM661207103	SM.01uFS	SM0805
C76	SM661207103	SM.01uFS	SM0805
C77	SM661255101	SM100pFS	SM0805
C78	SM661207103	SM.01uFS	SM0805
C79	SM661207103	SM.01uFS	SM0805
CR1	SM236030099	BAV99	SOT23
CR2	SM236030099	BAV99	SOT23
CR3	SM232120070	BAV70	SOT23
CR4	SM236030099	BAV99	SOT23
DL1	839450430	TP1.4nS	SIP6RES
DL2	839450430	TP1.4nS	SIP6RES
DL3	839450420	TP2.5nS	SIP6RES
DL4	839450420	TP2.5nS	SIP6RES
DL5	839450430	TP1.4nS	SIP6RES
DL6	839450430	TP1.4nS	SIP6RES
DL7	290120005	5nS	BEL_DELAY
DR1	$NULL	DRILL2_2	DRILL2_2
DR2	$NULL	DRILL2_2	DRILL2_2
DR3	$NULL	DRILL2_2	DRILL2_2
DR4	$NULL	DRILL2_2	DRILL2_2
J1	454610096	3x32-RA-M	CONN3X32_RA_M
J2	402610002	SMB-ST-F	SMB_ST_F
J3	402610002	SMB-ST-F	SMB_ST_F
J4	$NULL	EDGE10-FRONT	EDGE10_FRONT
J5	$NULL	EDGE10-BACK	EDGE10_BACK
J6	403181008	1X8	HD1R8P
J7	402610002	SMB-ST-F	SMB_ST_F
J8	$NULL	EDGE21-BACK	EDGE21_BACK
J9	$NULL	EDGE21-FRONT	EDGE21_FRONT
J10	402610002	SMB-ST-F	SMB_ST_F
L1	SM300546151	SM.15uH	SMSELF
L2	NOIND	NOIND	SMSELF
Q1	SM270040092	BFR92R	SOT23
Q2	SM270030092	BFR92	SOT23
Q3	SM270030092	BFR92	SOT23
Q4	SM270030092	BFR92	SOT23
Q5	SM270030092	BFR92	SOT23
Q6	SM275030550	BF550	SOT23

Q7	SM270030020	BFS20	SOT23
Q8	SM275030550	BF550	SOT23
Q9	SM275330858	BC858C	SOT23
Q10	SM270030092	BFR92	SOT23
Q11	SM270340848	BC848CR	SOT23
Q12	SM275040550	BF550R	SOT23
Q13	SM275330858	BC858C	SOT23
R1	SM652101103	SM10KS	SM0805
R2	SM652101301	SM300S	SM0805
R3	SM652101103	SM10KS	SM0805
R4	SM652101820	SM82S	SM0805
R5	SM652101222	SM2.2KS	SM0805
R6	SM652101222	SM2.2KS	SM0805
R7	SM652101820	SM82S	SM0805
R8	SM652101201	SM200S	SM0805
R9	SM652101201	SM200S	SM0805
R10	SM652101201	SM200S	SM0805
R11	SM652101201	SM200S	SM0805
R12	SM652101820	SM82S	SM0805
R13	SM652101820	SM82S	SM0805
R14	SM652101681	SM680S	SM0805
R15	SM652101562	SM5.6KS	SM0805
R16	SM652101512	SM5.1KS	SM0805
R17	SM652101820	SM82S	SM0805
R18	SM652101562	SM5.6KS	SM0805
R19	SM652101510	SM51S	SM0805
R20	SM652101103	SM10KS	SM0805
R21	SM652101471	SM470S	SM0805
R22	SM652101820	SM82S	SM0805
R23	SM652101202	SM2KS	SM0805
R24	SM652101151	SM150S	SM0805
R25	SM652101301	SM300S	SM0805
R26	SM652101121	SM120S	SM0805
R27	SM652101301	SM300S	SM0805
R28	SM652101151	SM150S	SM0805
R29	SM652101681	SM680S	SM0805
R30	SM652101512	SM5.1KS	SM0805
R31	SM652101820	SM82S	SM0805
R32	SM652101180	SM18S	SM0805
R33	SM652101471	SM470S	SM0805
R34	SM652101512	SM5.1KS	SM0805
R35	SM652101180	SM18S	SM0805
R36	SM652101562	SM5.6KS	SM0805
R37	SM652101471	SM470S	SM0805
R38	SM652101180	SM18S	SM0805
R39	SM652101820	SM82S	SM0805
R40	SM652101510	SM51S	SM0805
R41	SM652101180	SM18S	SM0805
R42	SM652101471	SM470S	SM0805
R43	SM652101512	SM5.1KS	SM0805
R44	SM652101510	SM51S	SM0805
R45	SM652101820	SM82S	SM0805
R46	SM652101471	SM470S	SM0805
R47	SM652101471	SM470S	SM0805
R48	SM652101331	SM330S	SM0805
R49	SM652101331	SM330S	SM0805

R50	SM652101681	SM680S	SM0805
R51	SM652101201	SM200S	SM0805
R52	SM652101102	SM1KS	SM0805
R53	SM652101161	SM160S	SM0805
R54	SM652101201	SM200S	SM0805
R55	SM652101681	SM680S	SM0805
R56	SM652101151	SM150S	SM0805
R57	SM652101512	SM5.1KS	SM0805
R58	SM652101180	SM18S	SM0805
R59	SM652101221	SM220S	SM0805
R60	SM652101101	SM100S	SM0805
R61	SM652101102	SM1KS	SM0805
R62	SM652101471	SM470S	SM0805
R63	SM652101152	SM1.5KS	SM0805
R64	SM652101122	SM1.2KS	SM0805
R65	SM652101180	SM18S	SM0805
R66	SM652101332	SM3.3KS	SM0805
R67	SM652101510	SM51S	SM0805
R68	SM652101510	SM51S	SM0805
R69	SM652101820	SM82S	SM0805
R70	SM652101151	SM150S	SM0805
R71	SM652101471	SM470S	SM0805
R72	SM652101181	SM180S	SM0805
R73	SM652101161	SM160S	SM0805
R74	SM652101562	SM5.6KS	SM0805
R75	SM652101512	SM5.1KS	SM0805
R76	SM652101471	SM470S	SM0805
R77	SM652101681	SM680S	SM0805
R78	SM652101512	SM5.1KS	SM0805
R79	SM652101681	SM680S	SM0805
R80	SM652101681	SM680S	SM0805
R81	SM652101562	SM5.6KS	SM0805
R82	SM652101512	SM5.1KS	SM0805
R83	SM652101471	SM470S	SM0805
R84	SM652101242	SM2.4KS	SM0805
R85	SM652101221	SM220S	SM0805
R86	SM652101822	SM8.2KS	SM0805
R87	SM652101161	SM160S	SM0805
R88	SM652101161	SM160S	SM0805
R89	SM652101512	SM5.1KS	SM0805
R90	SM652101510	SM51S	SM0805
R91	SM652101202	SM2KS	SM0805
R92	SM652101510	SM51S	SM0805
R93	SM652101510	SM51S	SM0805
R94	SM652101151	SM150S	SM0805
R95	SM652101822	SM8.2KS	SM0805
R96	SM652101223	SM22KS	SM0805
R97	SM652101471	SM470S	SM0805
R98	SM652101471	SM470S	SM0805
R99	SM652101562	SM5.6KS	SM0805
R100	SM652101180	SM18S	SM0805
R101	SM652101161	SM160S	SM0805
R102	SM652101182	SM1.8KS	SM0805
R103	SM652101512	SM5.1KS	SM0805
R104	SM652101102	SM1KS	SM0805
R105	SM652101180	SM18S	SM0805

R106	SM652101222	SM2.2KS	SM0805
R107	SM652101103	SM10KS	SM0805
R108	SM652101271	SM270S	SM0805
R109	SM652101103	SM10KS	SM0805
R110	SM652101681	SM680S	SM0805
R111	SM652101471	SM470S	SM0805
R112	SM652101510	SM51S	SM0805
R113	SM652101510	SM51S	SM0805
R114	SM652101510	SM51S	SM0805
R115	SM652101242	SM2.4KS	SM0805
R116	SM652101151	SM150S	SM0805
R117	SM652101103	SM10KS	SM0805
R118	SM652101681	SM680S	SM0805
R119	SM652101820	SM82S	SM0805
R120	SM652101561	SM560S	SM0805
R121	SM652101561	SM560S	SM0805
RN1	190042563	56K-SC	SIP10RES
RN2	190642221	220-6SIPC	SIP6RES
T1	SM200167131	SM10H131.ALT	PLCC_20
T2	SM200167131	SM10H131.ALT	PLCC_20
T3	SM200167104	SM10H104.ALT	PLCC_20
T4	SM200167109	SM10H109.ALT	PLCC_20
T5	SM207460116	SM10H116.ALT	PLCC_20
T6	SM200167131	SM10H131.ALT	PLCC_20
T7	SM200167102	SM10H102.ALT	PLCC_20
T8	SM200167102	SM10H102.ALT	PLCC_20
T9	SM200160101	SM10H101.ALT	PLCC_20
T10	SM200167131	SM10H131.ALT	PLCC_20
T11	SM200167104	SM10H104.ALT	PLCC_20
T12	SM200167131	SM10H131.ALT	PLCC_20
T13	SM200167131	SM10H131.ALT	PLCC_20
T14	SM200167102	SM10H102.ALT	PLCC_20
T15	SM200167131	SM10H131	PLCC_20
T16	SM200167121	SM10H121	PLCC_20
T17	SM200167121	SM10H121	PLCC_20
T18	SM200167102	SM10H102.ALT	PLCC_20
T19	SM207360125	SM10125.ALT	PLCC_20
T20	SM207460116	SM10H116.ALT	PLCC_20
T21	SM200167107	SM10H107.ALT	PLCC_20
T22	SM207460116	SM10H116.ALT	PLCC_20
T23	SM207460116	SM10H116.ALT	PLCC_20
T24	SM200167131	SM10H131	PLCC_20
T25	SM207160192	SM10192.ALT	PLCC_20
T26	SM200160101	SM10H101	PLCC_20
T27	SM200167121	SM10H121	PLCC_20
T28	SM207460116	SM10H116.ALT	PLCC_20
T29	SM200167131	SM10H131.ALT	PLCC_20
T30	SM207460116	SM10H116.ALT	PLCC_20
T31	SM207460116	SM10H116.ALT	PLCC_20
T32	SM200167121	SM10H121	PLCC_20
T33	SM207460116	SM10H116.ALT	PLCC_20
T34	SM200167107	SM10H107.ALT	PLCC_20
T35	SM200167131	SM10H131.ALT	PLCC_20
T36	SM200167131	SM10H131	PLCC_20
T37	SM200167131	SM10H131	PLCC_20
T38	SM200167102	SM10H102.ALT	PLCC_20

TA1	$NULL	AREA	AREA
TC1	SM661207103	SM.01uFS	SM0805
TC2	SM661207103	SM.01uFS	SM0805
TC3	SM661207103	SM.01uFS	SM0805
TC4	SM661250082	SM8.2pFS	SM0805
TC5	SM661207103	SM.01uFS	SM0805
TC6	SM158044010	SM3-10pF	SMCAPVAR
TC7	SM661207103	SM.01uFS	SM0805
TC8	SM661255270	SM27pFS	SM0805
TC9	SM661250082	SM8.2pFS	SM0805
TL1	SM300446330	SM.033uH	SMSELF
TP1	454340002	2x1-ST-M-NW	CONN2X1_ST_M_NW
TQ1	SM270040092	BFR92R	SOT23
TQ2	SM270130092	BFR92A	SOT23
TQ3	SM270140092	BFR92AR	SOT23
TQ4	SM270140092	BFR92AR	SOT23
TQ5	SM270030092	BFR92	SOT23
TQ6	SM270030092	BFR92	SOT23
TQ7	SM270330848	BC848C	SOT23
TQ8	SM270040092	BFR92R	SOT23
TQ9	SM289240061	BCV61	SOT143
TR1	SM652101820	SM82S	SM0805
TR2	SM652101821	SM820S	SM0805
TR3	SM652101302	SM3KS	SM0805
TR4	SM652101362	SM3.6KS	SM0805
TR5	SM652101821	SM820S	SM0805
TR6	SM652101272	SM2.7KS	SM0805
TR7	SM652101362	SM3.6KS	SM0805
TR8	SM652101821	SM820S	SM0805
TR9	SM652101470	SM47S	SM0805
TC10	SM661207103	SM.01uFS	SM0805
TC11	SM661207103	SM.01uFS	SM0805
TC12	SM661207103	SM.01uFS	SM0805
TC13	SM661255270	SM27pFS	SM0805
TC14	SM661207103	SM.01uFS	SM0805
TC15	SM661207103	SM.01uFS	SM0805
TC16	SM661207103	SM.01uFS	SM0805
TC17	SM661207103	SM.01uFS	SM0805
TC18	SM661250047	SM4.7pFS	SM0805
TC19	SM661207103	SM.01uFS	SM0805
TC20	SM661250047	SM4.7pFS	SM0805
TC21	SM158044010	SM3-10pF	SMCAPVAR
TC22	SM661207103	SM.01uFS	SM0805
TC23	SM661207103	SM.01uFS	SM0805
TC24	SM661207103	SM.01uFS	SM0805
TC25	SM661207103	SM.01uFS	SM0805
TC26	SM661207103	SM.01uFS	SM0805
TC27	SM661207103	SM.01uFS	SM0805
TC28	SM661207103	SM.01uFS	SM0805
TC29	SM661207103	SM.01uFS	SM0805
TC30	SM661207102	SM.001uFS	SM0805
TC31	SM661207103	SM.01uFS	SM0805
TC32	SM661207103	SM.01uFS	SM0805
TC33	SM661207103	SM.01uFS	SM0805
TC34	SM661207103	SM.01uFS	SM0805
TC35	SM661207103	SM.01uFS	SM0805

TC36	SM661255560	SM56pFS	SM0805
TC37	SM661207103	SM.01uFS	SM0805
TC38	SM661207103	SM.01uFS	SM0805
TC39	SM661207102	SM.001uFS	SM0805
TC40	SM661255560	SM56pFS	SM0805
TC41	SM661207102	SM.001uFS	SM0805
TC42	SM661207103	SM.01uFS	SM0805
TC43	SM661207103	SM.01uFS	SM0805
TC44	SM661255560	SM56pFS	SM0805
TC45	SM661207103	SM.01uFS	SM0805
TC46	SM661207103	SM.01uFS	SM0805
TC47	SM661207103	SM.01uFS	SM0805
TC48	SM661255560	SM56pFS	SM0805
TC49	SM661255560	SM56pFS	SM0805
TC50	SM661255560	SM56pFS	SM0805
TC51	SM661207103	SM.01uFS	SM0805
TC52	103336474	.47uF-X7R	LMONO
TC53	SM661207103	SM.01uFS	SM0805
TC54	SM661255560	SM56pFS	SM0805
TC55	SM661207102	SM.001uFS	SM0805
TC56	SM661207103	SM.01uFS	SM0805
TC57	SM661207103	SM.01uFS	SM0805
TC58	SM661250082	SM8.2pFS	SM0805
TC59	SM661255560	SM56pFS	SM0805
TC60	SM661207103	SM.01uFS	SM0805
TC61	SM661207103	SM.01uFS	SM0805
TC62	SM661207103	SM.01uFS	SM0805
TC63	SM661255560	SM56pFS	SM0805
TC64	SM661207103	SM.01uFS	SM0805
TC65	SM661207102	SM.001uFS	SM0805
TC66	SM661207103	SM.01uFS	SM0805
TC67	SM661207103	SM.01uFS	SM0805
TC68	SM661207103	SM.01uFS	SM0805
TC69	SM661207103	SM.01uFS	SM0805
TC70	SM661207103	SM.01uFS	SM0805
TC71	SM661207103	SM.01uFS	SM0805
TC72	SM661255270	SM27pFS	SM0805
TC73	SM661207102	SM.001uFS	SM0805
TC74	SM661207103	SM.01uFS	SM0805
TC75	SM661207103	SM.01uFS	SM0805
TC76	SM661207103	SM.01uFS	SM0805
TC77	SM661255270	SM27pFS	SM0805
TC78	SM661207103	SM.01uFS	SM0805
TCR1	SM232120070	BAV70	SOT23
TCR2	SM236030099	BAV99	SOT23
TCR3	SM236030099	BAV99	SOT23
TCR4	SM236030099	BAV99	SOT23
TCR5	SM236030099	BAV99	SOT23
TCR6	SM236030099	BAV99	SOT23
TQ10	SM275330858	BC858C	SOT23
TQ11	SM275330858	BC858C	SOT23
TQ12	SM270030019	BFS19	SOT23
TQ13	SM275340858	BC858CR	SOT23
TQ14	SM289240062	BCV62	SOT143
TQ15	SM275330858	BC858C	SOT23
TQ16	SM270030019	BFS19	SOT23

TQ17	SM275030550	BF550	SOT23
TQ18	SM289240062	BCV62	SOT143
TQ19	SM275040550	BF550R	SOT23
TQ20	SM275030550	BF550	SOT23
TQ21	SM275340858	BC858CR	SOT23
TQ22	SM275040550	BF550R	SOT23
TQ23	SM270030019	BFS19	SOT23
TQ24	SM275340858	BC858CR	SOT23
TR10	SM652101470	SM47S	SM0805
TR11	SM652101470	SM47S	SM0805
TR12	SM652101681	SM680S	SM0805
TR13	SM652101681	SM680S	SM0805
TR14	SM652101820	SM82S	SM0805
TR15	SM652101362	SM3.6KS	SM0805
TR16	SM652101820	SM82S	SM0805
TR17	SM652101471	SM470S	SM0805
TR18	SM652101681	SM680S	SM0805
TR19	SM652101362	SM3.6KS	SM0805
TR20	SM652101471	SM470S	SM0805
TR21	SM652101820	SM82S	SM0805
TR22	SM652101362	SM3.6KS	SM0805
TR23	SM652101821	SM820S	SM0805
TR24	SM652101151	SM150S	SM0805
TR25	SM652101821	SM820S	SM0805
TR26	SM652101202	SM2KS	SM0805
TR27	SM652101331	SM330S	SM0805
TR28	SM652101272	SM2.7KS	SM0805
TR29	SM652101222	SM2.2KS	SM0805
TR30	SM652101821	SM820S	SM0805
TR31	SM652101821	SM820S	SM0805
TR32	SM652101821	SM820S	SM0805
TR33	SM652101471	SM470S	SM0805
TR34	SM652101821	SM820S	SM0805
TR35	SM652101681	SM680S	SM0805
TR36	SM652101821	SM820S	SM0805
TR37	SM652101151	SM150S	SM0805
TR38	SM652101821	SM820S	SM0805
TR39	SM652101821	SM820S	SM0805
TR40	SM652101821	SM820S	SM0805
TR41	SM652101302	SM3KS	SM0805
TR42	SM652101471	SM470S	SM0805
TR43	SM652101272	SM2.7KS	SM0805
TR44	SM652101330	SM33S	SM0805
TR45	SM652101471	SM470S	SM0805
TR46	SM652101470	SM47S	SM0805
TR47	SM652101821	SM820S	SM0805
TR48	SM652101820	SM82S	SM0805
TR49	SM652101470	SM47S	SM0805
TR50	SM652101681	SM680S	SM0805
TR51	SM652101681	SM680S	SM0805
TR52	SM652101471	SM470S	SM0805
TR53	SM652101470	SM47S	SM0805
TR54	SM652101821	SM820S	SM0805
TR55	SM652101681	SM680S	SM0805
TR56	SM652101471	SM470S	SM0805
TR57	SM652101470	SM47S	SM0805

TR58	SM652101820	SM82S	SM0805
TR59	SM652101821	SM820S	SM0805
TR60	SM652101821	SM820S	SM0805
TR61	SM652101681	SM680S	SM0805
TR62	SM652101202	SM2KS	SM0805
TR63	SM652101271	SM270S	SM0805
TR64	SM652101471	SM470S	SM0805
TR65	SM652101622	SM6.2KS	SM0805
TR66	SM652101471	SM470S	SM0805
TR67	SM652101820	SM82S	SM0805
TR68	SM652101471	SM470S	SM0805
TR69	SM652101471	SM470S	SM0805
TR70	SM652101562	SM5.6KS	SM0805
TR71	SM652101820	SM82S	SM0805
TR72	SM652101470	SM47S	SM0805
TR73	SM652101821	SM820S	SM0805
TR74	SM652101821	SM820S	SM0805
TR75	SM652101471	SM470S	SM0805
TR76	SM652101821	SM820S	SM0805
TR77	SM652101470	SM47S	SM0805
TR78	SM652101471	SM470S	SM0805
TR79	SM652101820	SM82S	SM0805
TR80	SM652101102	SM1KS	SM0805
TR81	SM652101821	SM820S	SM0805
TR82	SM653125033	SM3.3S	SM0805
TR83	SM652101470	SM47S	SM0805
TR84	SM652101470	SM47S	SM0805
TR85	SM652101820	SM82S	SM0805
TR86	SM652101470	SM47S	SM0805
TR87	SM652101820	SM82S	SM0805
TR88	SM653125033	SM3.3S	SM0805
TR89	SM652101470	SM47S	SM0805
TR90	SM652101221	SM220S	SM0805
TR91	SM652101470	SM47S	SM0805
TR92	SM652101820	SM82S	SM0805
TR93	SM652101820	SM82S	SM0805
TR94	SM652101471	SM470S	SM0805
TR95	SM652101471	SM470S	SM0805
TR96	SM652101271	SM270S	SM0805
TR97	SM652101331	SM330S	SM0805
TR98	SM652101821	SM820S	SM0805
TR99	SM652101562	SM5.6KS	SM0805
TRN1	190642332	3.3K-6SC	SIP6RES
TRN2	190642562	5.6k-6SC	SIP6RES
TRN3	190642562	5.6k-6SC	SIP6RES
TRN4	190642562	5.6k-6SC	SIP6RES
TRN5	190642562	5.6k-6SC	SIP6RES
TR100	SM652101681	SM680S	SM0805
TR101	SM652101821	SM820S	SM0805
TR102	SM652101820	SM82S	SM0805
TR103	SM652101821	SM820S	SM0805
TR104	SM652101271	SM270S	SM0805
TR105	SM652101221	SM220S	SM0805
TR106	SM652101820	SM82S	SM0805
TR107	SM652101101	SM100S	SM0805
TR108	SM652101101	SM100S	SM0805

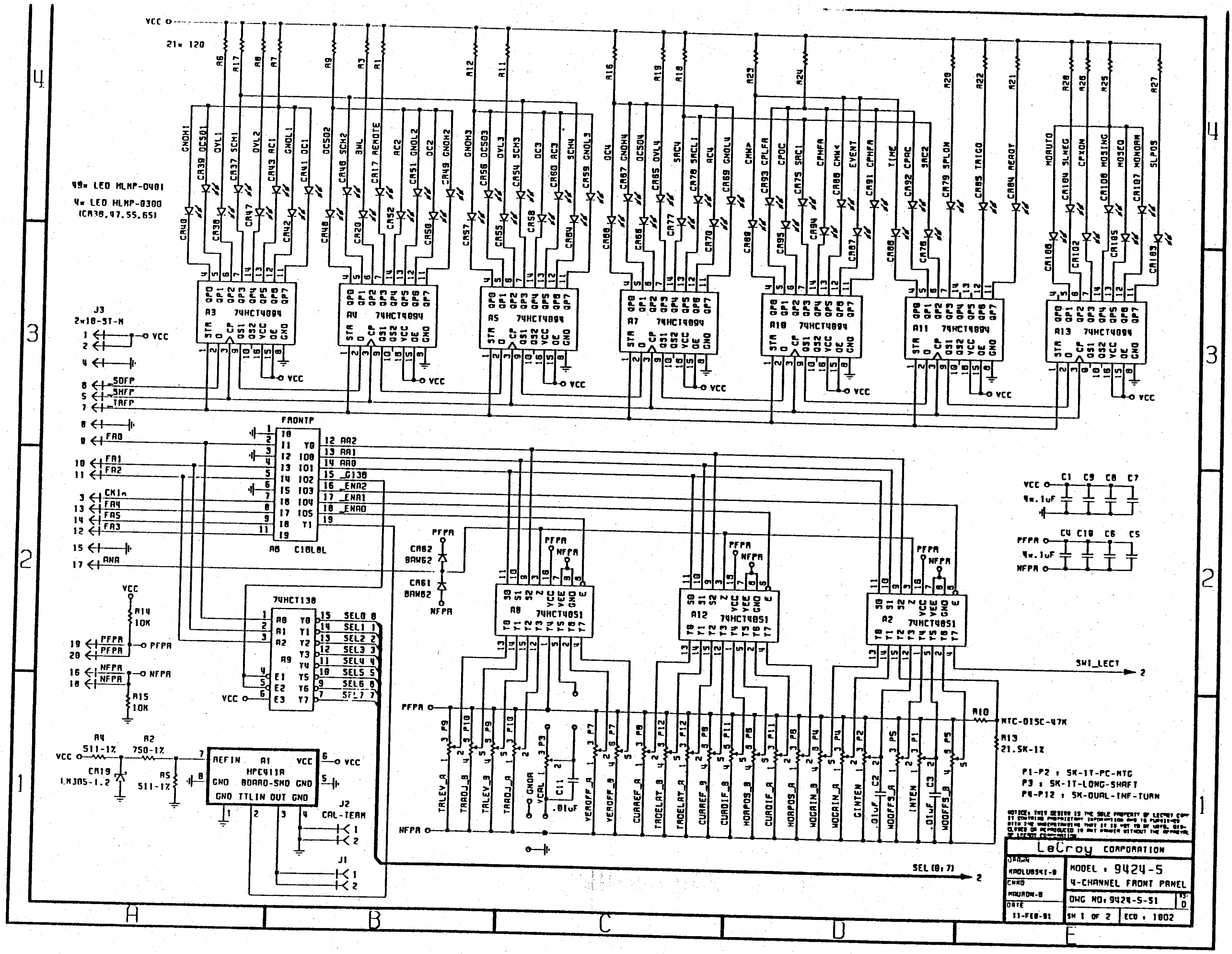
TR109	SM652101820	SM82S	SM0805
TR110	SM652101332	SM3.3KS	SM0805
TR111	SM652101622	SM6.2KS	SM0805
TR112	SM652101332	SM3.3KS	SM0805
TR113	SM652101560	SM56S	SM0805
TR114	SM652101821	SM820S	SM0805
TR115	SM652101202	SM2KS	SM0805
TR116	SM652101562	SM5.6KS	SM0805
TR117	SM652101181	SM180S	SM0805
TR118	SM652101820	SM82S	SM0805
TR119	SM652101221	SM220S	SM0805
TR120	SM652101470	SM47S	SM0805
TR121	SM652101821	SM820S	SM0805
TR122	SM652101331	SM330S	SM0805
TR123	SM652101622	SM6.2KS	SM0805
TR124	SM652101821	SM820S	SM0805
TR125	SM652101471	SM470S	SM0805
TR126	SM652101221	SM220S	SM0805
TR127	SM652101181	SM180S	SM0805
TR128	SM652101820	SM82S	SM0805
TR129	SM652101332	SM3.3KS	SM0805
TR130	SM652101470	SM47S	SM0805
TR131	SM652101103	SM10KS	SM0805
TR132	SM652101331	SM330S	SM0805
TR133	SM652101470	SM47S	SM0805
TR134	SM652101821	SM820S	SM0805
TR135	SM652101271	SM270S	SM0805
TR136	SM652101331	SM330S	SM0805
TR137	SM652101221	SM220S	SM0805
TR138	SM652101470	SM47S	SM0805
TR139	SM652101271	SM270S	SM0805
TR140	SM652101271	SM270S	SM0805
TR141	SM652101470	SM47S	SM0805
TR142	SM652101680	SM68S	SM0805
TR143	SM652101622	SM6.2KS	SM0805
TR144	SM652101331	SM330S	SM0805
TR145	SM652101470	SM47S	SM0805
TR146	SM652101470	SM47S	SM0805
TR147	SM652101221	SM220S	SM0805
TR148	SM652101622	SM6.2KS	SM0805
TR149	SM652101622	SM6.2KS	SM0805
TR150	SM652101622	SM6.2KS	SM0805
TR151	SM652101271	SM270S	SM0805
TR152	SM652101622	SM6.2KS	SM0805
TR153	SM652101820	SM82S	SM0805
TR154	SM652101330	SM33S	SM0805
TR155	SM652101622	SM6.2KS	SM0805
TR156	SM652101622	SM6.2KS	SM0805
TR157	SM652101820	SM82S	SM0805
TR158	SM652101622	SM6.2KS	SM0805
TR159	SM652101622	SM6.2KS	SM0805
TR160	SM652101622	SM6.2KS	SM0805
TR161	SM652101622	SM6.2KS	SM0805
TR162	SM652101622	SM6.2KS	SM0805
TR163	SM652101622	SM6.2KS	SM0805
TR164	SM652101622	SM6.2KS	SM0805

TR165	SM652101271	SM270S	SM0805
TR166	SM652101470	SM47S	SM0805
TR167	SM652101330	SM33S	SM0805
TR168	SM652101680	SM68S	SM0805
TR169	SM652101471	SM470S	SM0805
TR170	SM652101470	SM47S	SM0805
TR171	SM652101271	SM270S	SM0805
TR172	SM652101470	SM47S	SM0805
TR173	SM652101470	SM47S	SM0805
TR174	SM652101820	SM82S	SM0805
TR175	SM652101202	SM2KS	SM0805
TR176	SM652101331	SM330S	SM0805
TR177	SM652101820	SM82S	SM0805
TR178	SM652101271	SM270S	SM0805
TR179	SM652101102	SM1KS	SM0805
TR180	SM652101471	SM470S	SM0805
TR181	SM652101471	SM470S	SM0805
TR182	SM652101151	SM150S	SM0805
TR183	SM652101101	SM100S	SM0805
TR184	SM652101271	SM270S	SM0805
TR185	SM652101471	SM470S	SM0805
TR186	SM652101121	SM120S	SM0805
TR187	SM652101471	SM470S	SM0805
TR188	SM652101622	SM6.2KS	SM0805
TR189	SM652101510	SM51S	SM0805
TR190	SM652101331	SM330S	SM0805
TR191	SM652101681	SM680S	SM0805
TR192	SM652101470	SM47S	SM0805
TR193	SM652101151	SM150S	SM0805
TR194	SM652101562	SM5.6KS	SM0805
TR195	SM652101102	SM1KS	SM0805
TR196	SM652101562	SM5.6KS	SM0805
TR197	SM652101510	SM51S	SM0805
TR198	SM652101101	SM100S	SM0805
TR199	SM652101681	SM680S	SM0805
TR200	SM652101271	SM270S	SM0805
TR201	SM652101470	SM47S	SM0805
TR202	SM652101271	SM270S	SM0805
TR203	SM652101681	SM680S	SM0805
TR204	SM652101681	SM680S	SM0805
TR205	SM652101271	SM270S	SM0805
TR206	NORES	NORES	SM0805
TR207	NORES	NORES	SM0805
TR208	SM652101680	SM68S	SM0805
TR209	SM652101471	SM470S	SM0805
TR210	SM652101681	SM680S	SM0805
TR211	SM652101331	SM330S	SM0805
TR212	SM652101103	SM10KS	SM0805
TR213	SM652101471	SM470S	SM0805
TR214	NORES	NORES	SM0805
TR215	NORES	NORES	SM0805
TR216	SM652101101	SM100S	SM0805
TR217	SM652101471	SM470S	SM0805
TR218	SM652101332	SM3.3KS	SM0805
TR219	SM652101820	SM82S	SM0805
TR220	SM652101102	SM1KS	SM0805

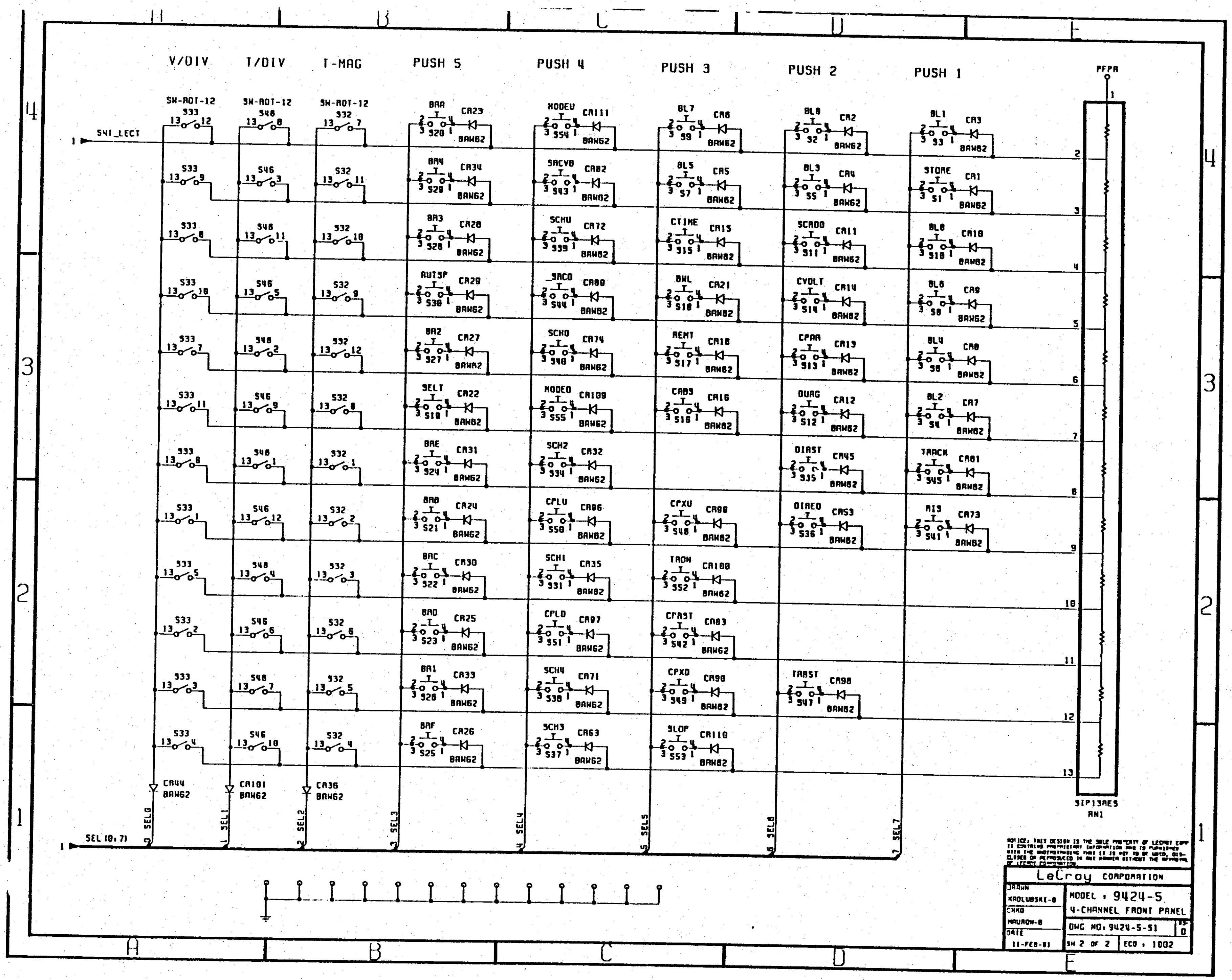
TR221	SM652101103	SM10KS	SM0805
TR222	SM652101331	SM330S	SM0805
TR223	SM652101202	SM2KS	SM0805
TR224	SM652101151	SM150S	SM0805
TR225	SM652101271	SM270S	SM0805
TR226	SM652101162	SM1.6KS	SM0805
TR227	SM652101471	SM470S	SM0805
TR228	SM652101471	SM470S	SM0805
TR229	SM652101471	SM470S	SM0805
TR230	SM652101121	SM120S	SM0805
TR231	SM652101471	SM470S	SM0805
TR232	SM652101681	SM680S	SM0805
TR233	SM652101151	SM150S	SM0805
TR234	SM652101820	SM82S	SM0805
TR235	SM652101102	SM1KS	SM0805
TR236	SM652101151	SM150S	SM0805
TR237	SM652101101	SM100S	SM0805
TR238	SM652101562	SM5.6KS	SM0805
TR239	SM652101102	SM1KS	SM0805
TR240	SM652101391	SM390S	SM0805
TR241	SM652101102	SM1KS	SM0805
TR242	SM652101103	SM10KS	SM0805
TR243	SM652101103	SM10KS	SM0805
TR244	SM652101821	SM820S	SM0805
TR245	SM652101181	SM180S	SM0805
TR246	SM652101681	SM680S	SM0805
TR247	SM652101271	SM270S	SM0805
TR248	SM652101271	SM270S	SM0805
TR249	SM652101470	SM47S	SM0805
TR250	SM652101470	SM47S	SM0805
TR251	SM652101681	SM680S	SM0805
TR252	SM652101471	SM470S	SM0805
TR253	SM652101202	SM2KS	SM0805
TR254	SM652101820	SM82S	SM0805
TR255	NORES	NORES	SM0805
TR256	NORES	NORES	SM0805
TR257	SM652101681	SM680S	SM0805
TR258	SM652101681	SM680S	SM0805
TR259	NORES	NORES	SM0805
TR260	NORES	NORES	SM0805
TR261	SM652101821	SM820S	SM0805
TR262	SM652101101	SM100S	SM0805
TR263	SM652101102	SM1KS	SM0805
TR264	SM652101820	SM82S	SM0805
TR265	SM652101102	SM1KS	SM0805
TR266	SM652101471	SM470S	SM0805
TR267	SM652101471	SM470S	SM0805
TR268	SM652101101	SM100S	SM0805
TR269	SM652101681	SM680S	SM0805
TR270	SM652101102	SM1KS	SM0805
TR271	SM652101821	SM820S	SM0805
TR272	SM652101151	SM150S	SM0805
TR273	SM652101471	SM470S	SM0805
TR274	SM652101471	SM470S	SM0805
TR275	SM652101121	SM120S	SM0805
TR276	SM652101820	SM82S	SM0805

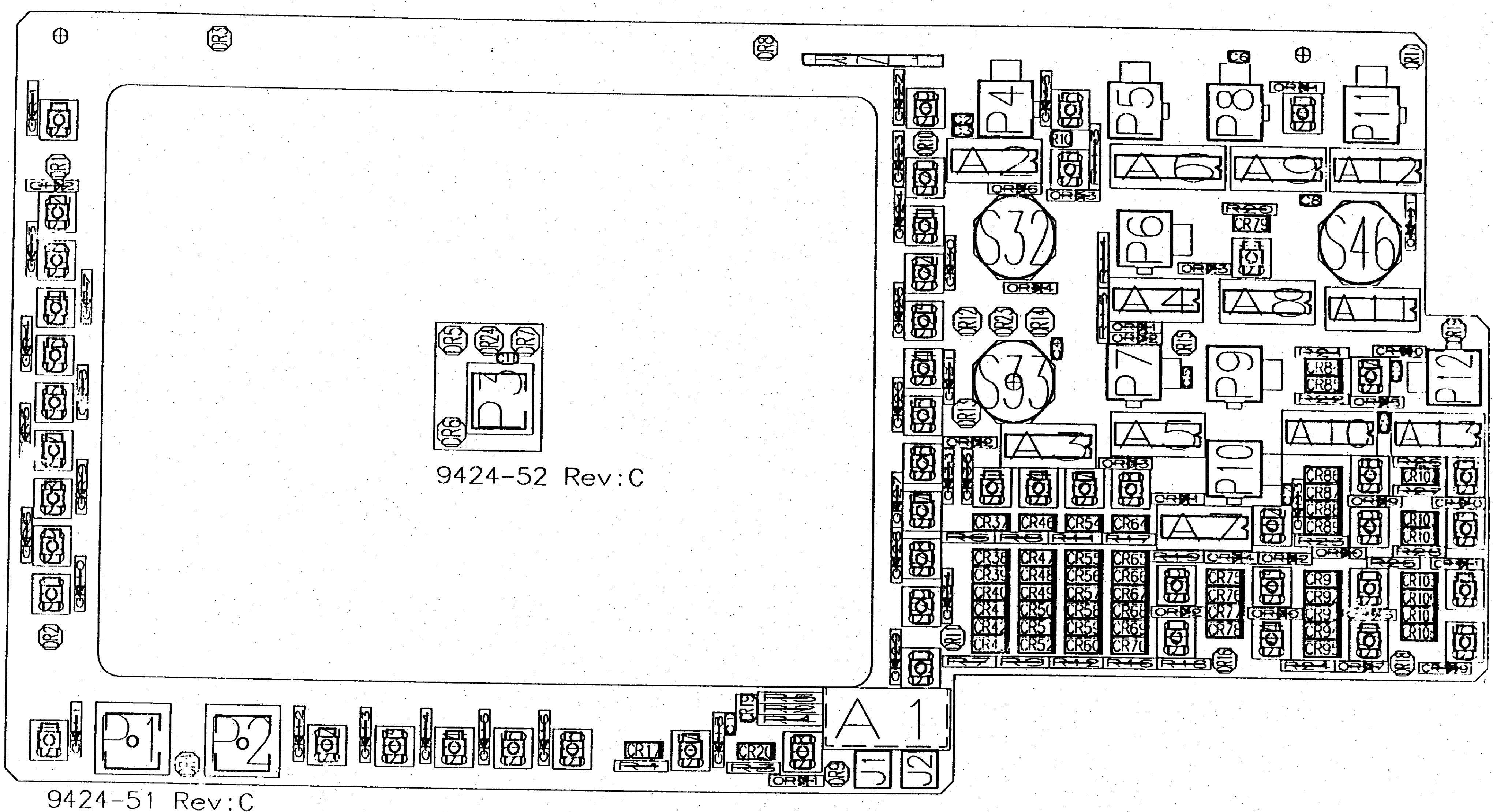
TR277	SM652101272	SM2.7KS	SM0805
TR278	SM652101271	SM270S	SM0805
TR279	SM652101331	SM330S	SM0805
TR280	SM652101681	SM680S	SM0805
TR281	SM652101471	SM470S	SM0805
TR282	SM652101471	SM470S	SM0805
TR283	SM652101821	SM820S	SM0805
TR284	SM652101151	SM150S	SM0805
TR285	SM652101331	SM330S	SM0805
TR286	SM652101562	SM5.6KS	SM0805
TR287	SM652101102	SM1KS	SM0805
TR288	SM652101470	SM47S	SM0805
TR289	SM652101820	SM82S	SM0805
TR290	SM652101471	SM470S	SM0805
TR291	SM652101681	SM680S	SM0805
TR292	SM652101821	SM820S	SM0805
TR293	NORES	NORES	SM0805
TR294	NORES	NORES	SM0805
TR295	SM652101470	SM47S	SM0805
TR296	SM652101271	SM270S	SM0805
TR297	NORES	NORES	SM0805
TR298	NORES	NORES	SM0805
TR299	SM652101471	SM470S	SM0805
TR300	SM652101471	SM470S	SM0805
TR301	SM652101820	SM82S	SM0805
TR302	SM652101681	SM680S	SM0805
TR303	SM652101102	SM1KS	SM0805
TR304	SM652101471	SM470S	SM0805
TR305	SM652101471	SM470S	SM0805
TR306	SM652101101	SM100S	SM0805
TR307	SM652101471	SM470S	SM0805
TR308	SM652101821	SM820S	SM0805
TR309	SM652101681	SM680S	SM0805
TR310	SM652101820	SM82S	SM0805
TR311	SM652101470	SM47S	SM0805
TR312	SM652101821	SM820S	SM0805
TR313	SM652101681	SM680S	SM0805
TR314	SM652101820	SM82S	SM0805
TR315	SM652101331	SM330S	SM0805
TR316	SM652101331	SM330S	SM0805
TR317	SM652101302	SM3KS	SM0805
TR318	SM652101202	SM2KS	SM0805
TR319	SM652101821	SM820S	SM0805
TR320	SM652101820	SM82S	SM0805
TR321	SM652101331	SM330S	SM0805
TR322	SM652101820	SM82S	SM0805
TR323	SM652101681	SM680S	SM0805
TR324	SM652101562	SM5.6KS	SM0805
TR325	SM652101622	SM6.2KS	SM0805
TR326	SM652101622	SM6.2KS	SM0805
TR327	SM652101622	SM6.2KS	SM0805
TR328	SM652101622	SM6.2KS	SM0805
TR329	SM652101622	SM6.2KS	SM0805
TR330	SM652101622	SM6.2KS	SM0805
TR331	SM652101820	SM82S	SM0805
TP.TRIG.	454340002	2x1-ST-M-NW	CONN2X1_ST_M_NW

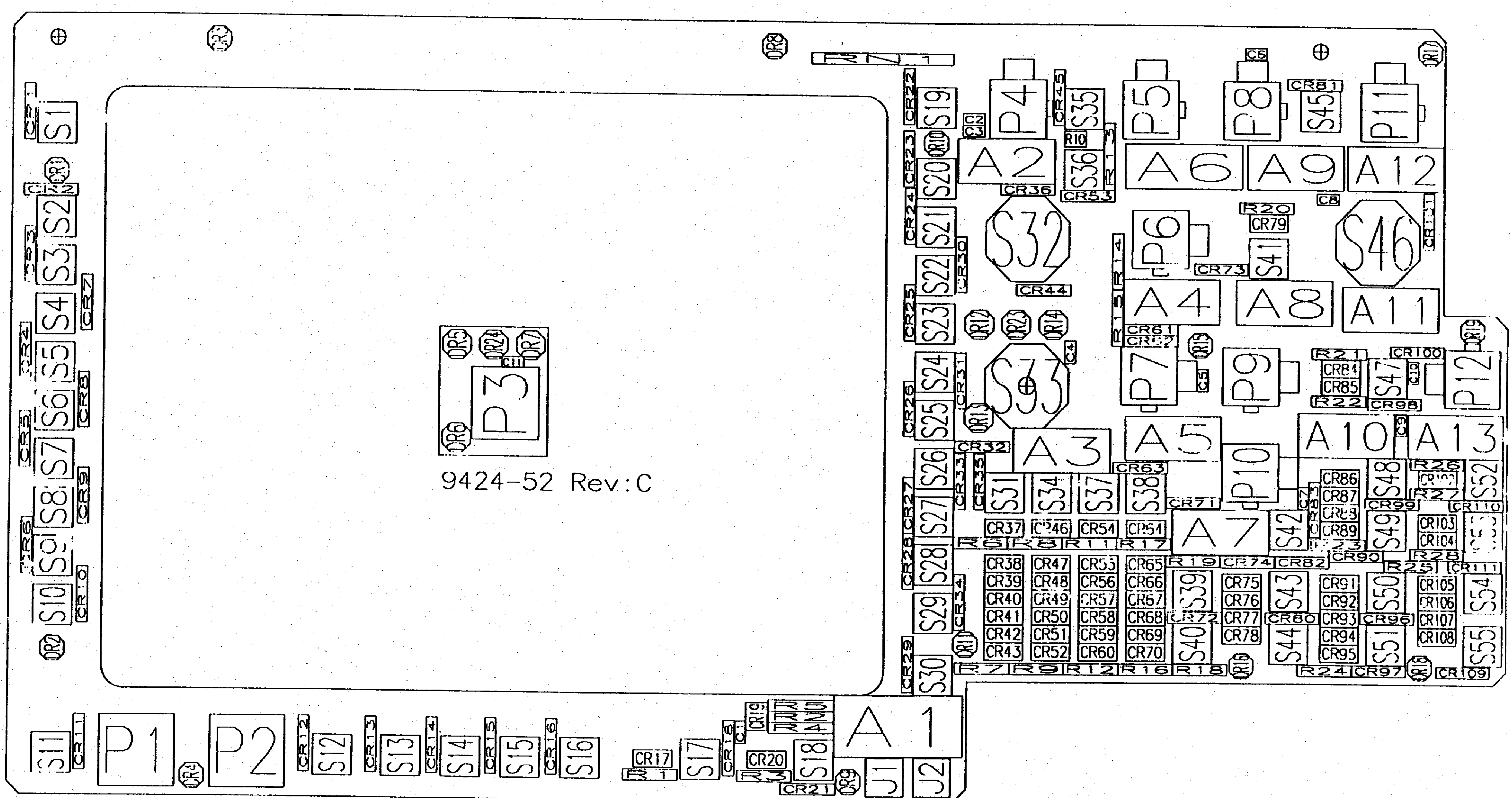
Y1	310062100	100MHZ	CRYSTAL_NC18
Y2	310060012	12.4031MHZ	CRYSTAL_NC18
Z1	839450440	F200	F100



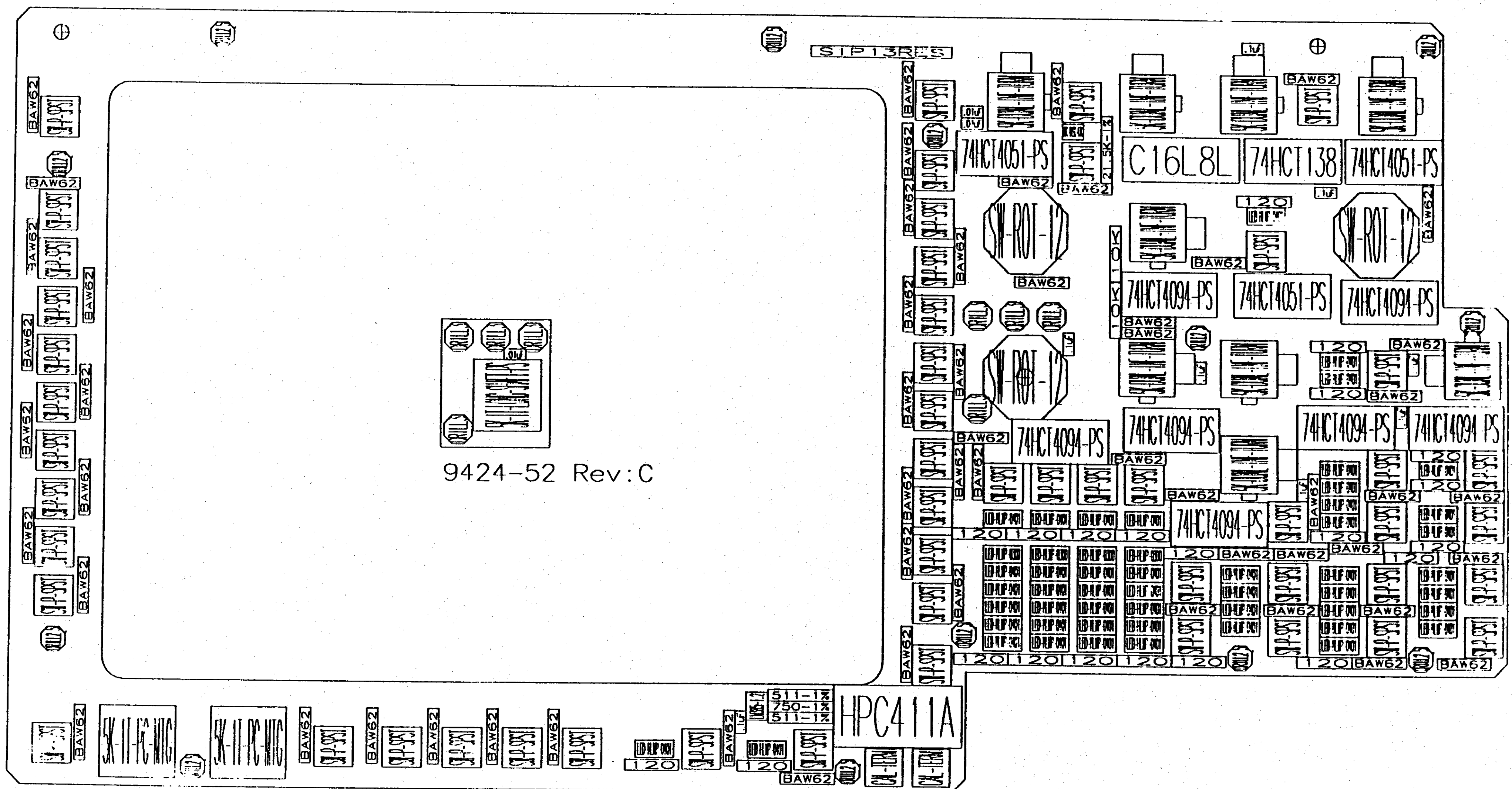
LeCroy CORPORATION
MODEL : 9424-5
4-CHANNEL FRONT PANEL
DWG NO: 9424-5-S1
SH 1 OF 2
ECO : 1802
DRAWN KROLUBSKI-B
CHKD MAURON-B
DATE 11-FEB-91
P1-P2 : SK-1T-PC-MTG
P3 : SK-1T-LONG-SHAFT
P4-P12 : SK-DUAL-INF-TURN
49x LED HLMP-D401
4x LED HLMP-0300
(CR38,47,55,65)
21x 120
J3
2x10-ST-M
FRONTP
A8 C18L8L
74HCT138
74HCT4094
74HCT4051
HPC411A
REFIN
BOARD-GND
TTLIN OUT
CAL-TERM
LM385-1.2
NTC-DISC-47K
SEL(0:7)
SWI_LECT


V/DIV
T/DIV
T-MAG
PUSH 5
PUSH 4
PUSH 3
PUSH 2
PUSH 1
PFPR
SW-ROT-12
S41_LECT
SEL(0:7)
SIP13RES
RN1
LeCroy CORPORATION
MODEL : 9424-5
4-CHANNEL FRONT PANEL
DWG NO: 9424-5-S1
SH 2 OF 2
ECO : 1002
DRAWN KROLUBSKI-B
CHKD MAURON-B
DATE 11-FEB-81

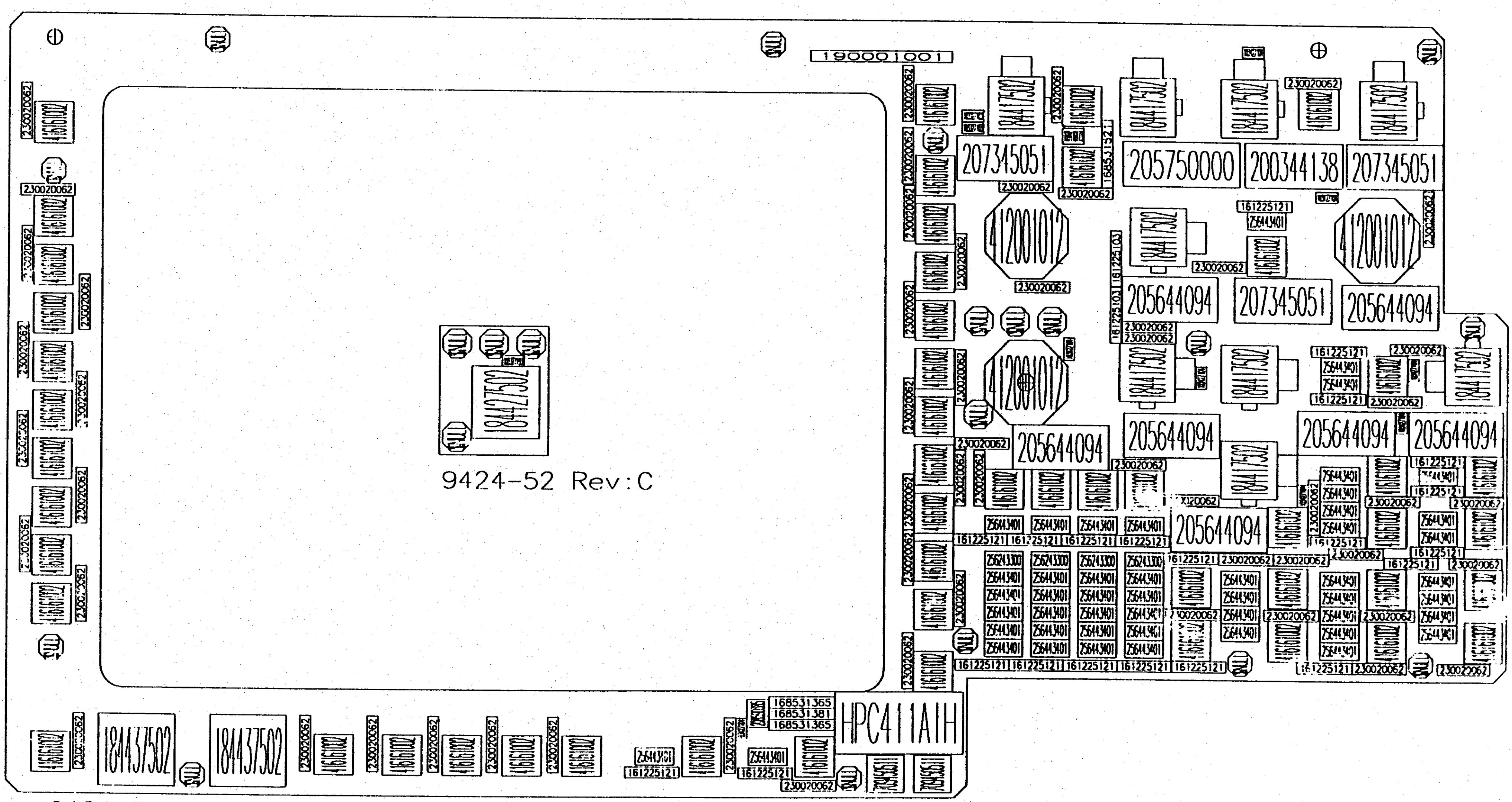

9424-52 Rev:C
9424-51 Rev:C
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
S32
S33
S46
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
J1
J2


9424-52 Rev:C
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
A13
J1
J2
S32
S33
S46
RN1

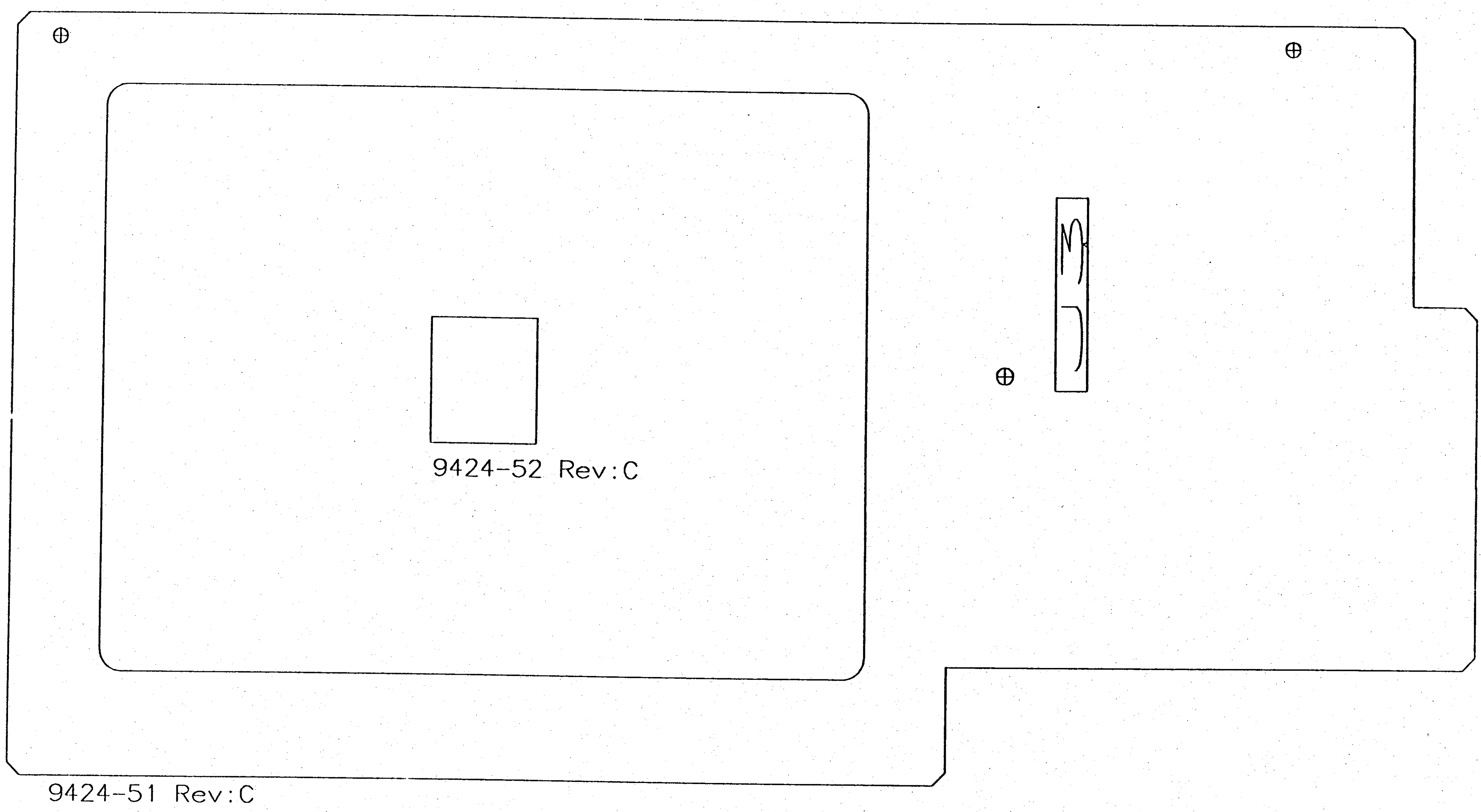
9424-51 Rev:C

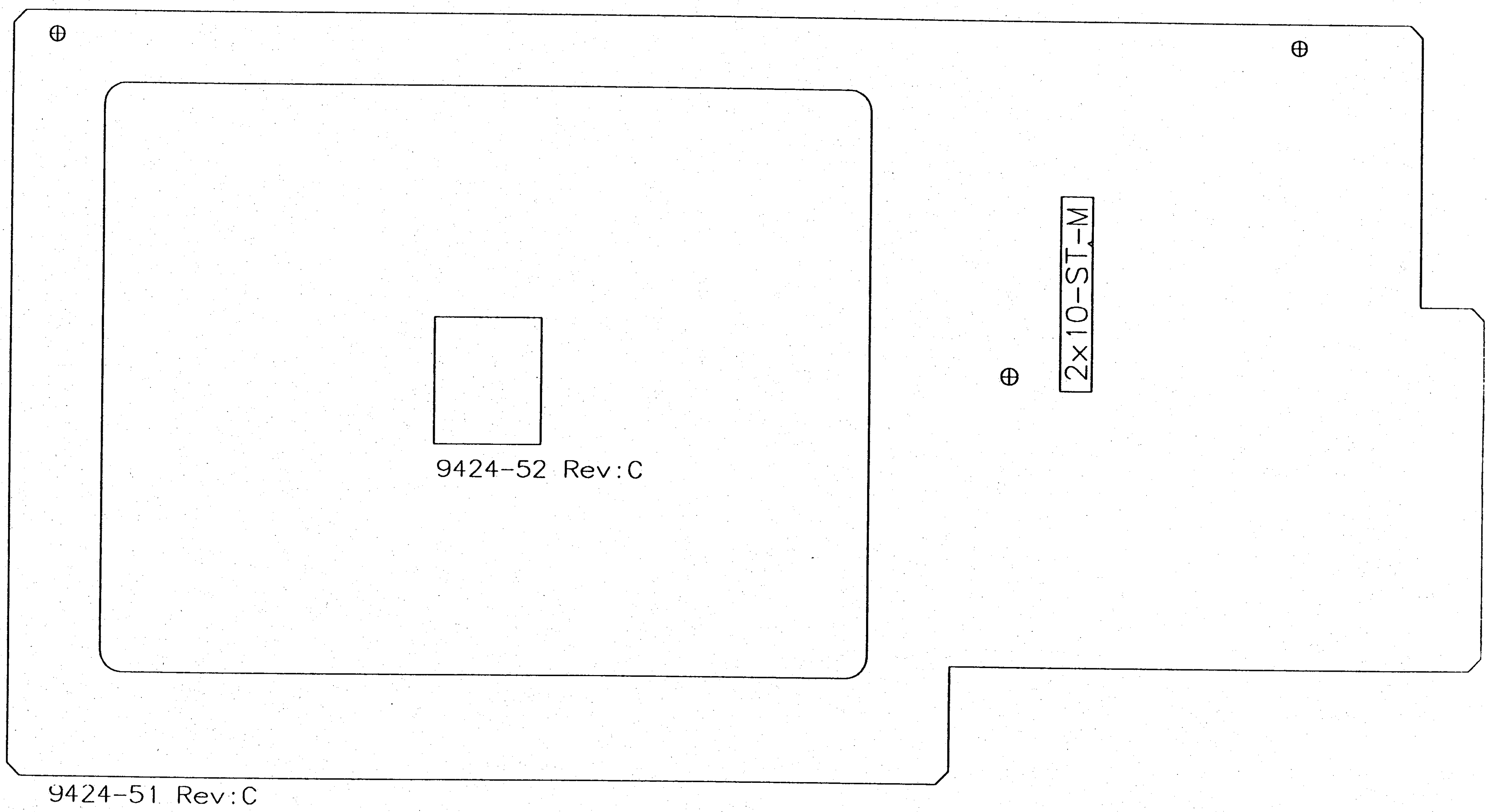

SIP13RES
C16L8L
74HCT138
74HCT4051-PS
74HCT4094-PS
SW-ROT-12
HPC411A
511-1%
750-1%
BAW62
120
9424-52 Rev:C

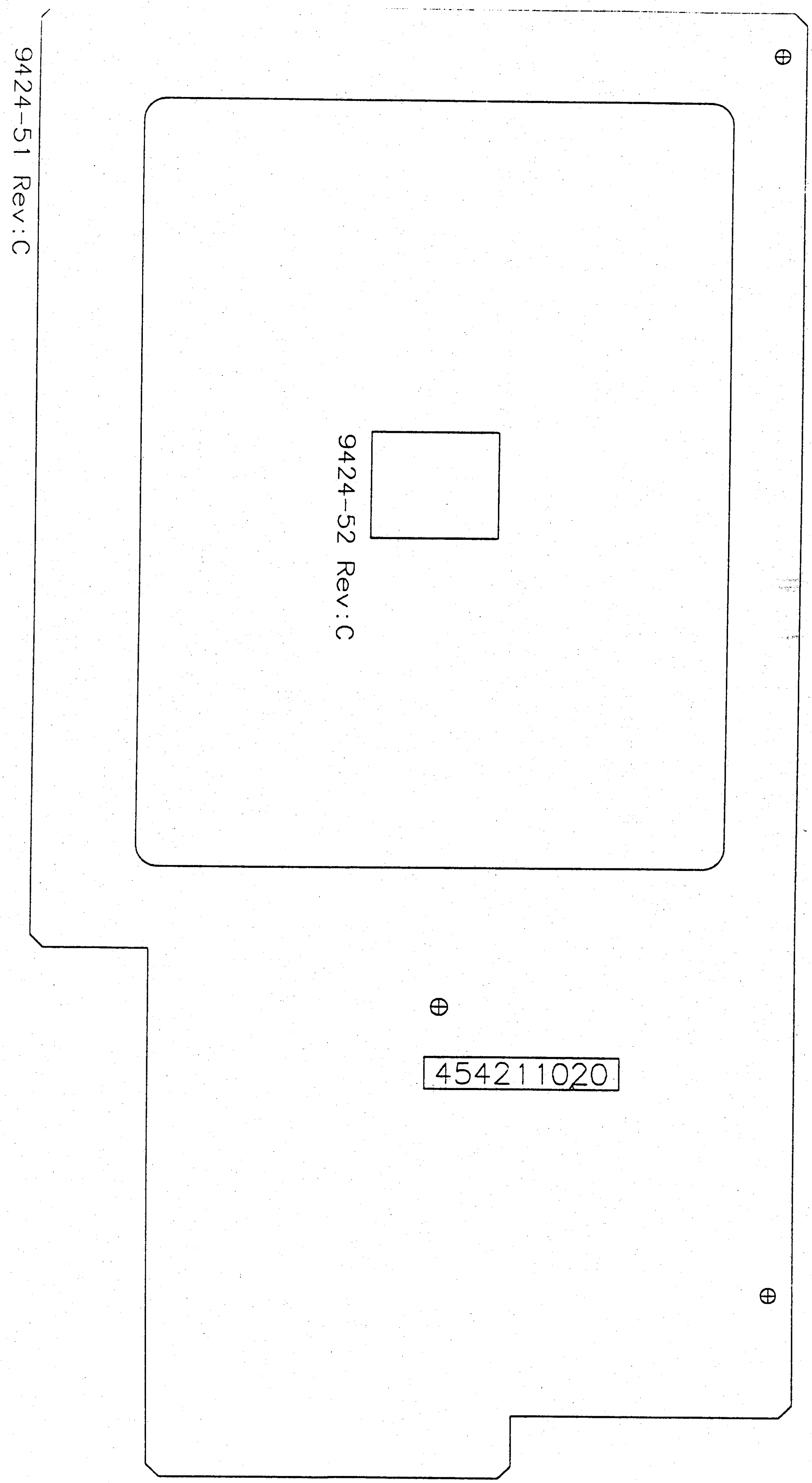
9424-51 Rev:C



9424-51 Rev:C


9424-52 Rev:C
9424-51 Rev:C


9424-52 Rev:C
2x10-ST-M
9424-51 Rev:C

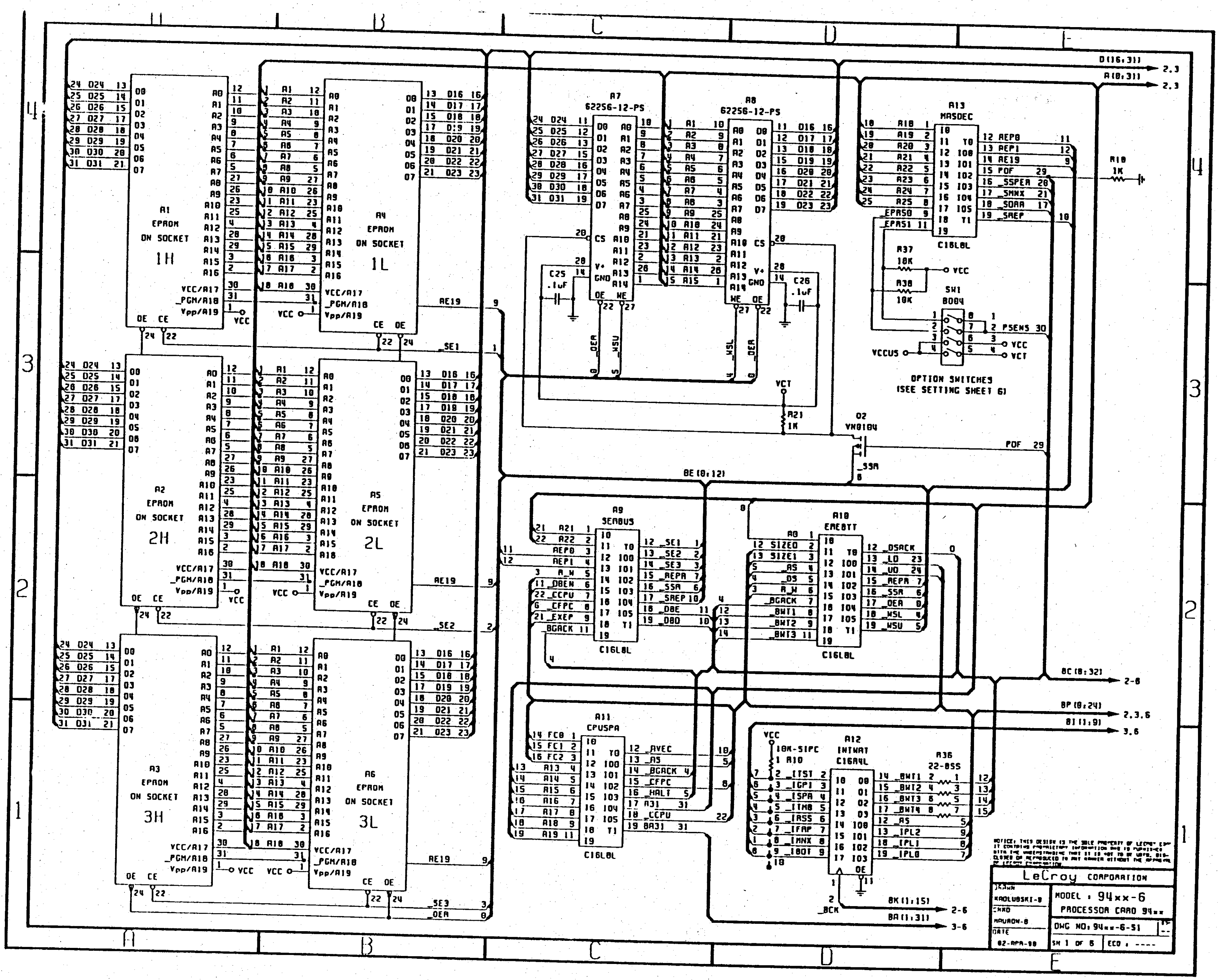

9424-51 Rev:C
9424-52 Rev:C
454211020

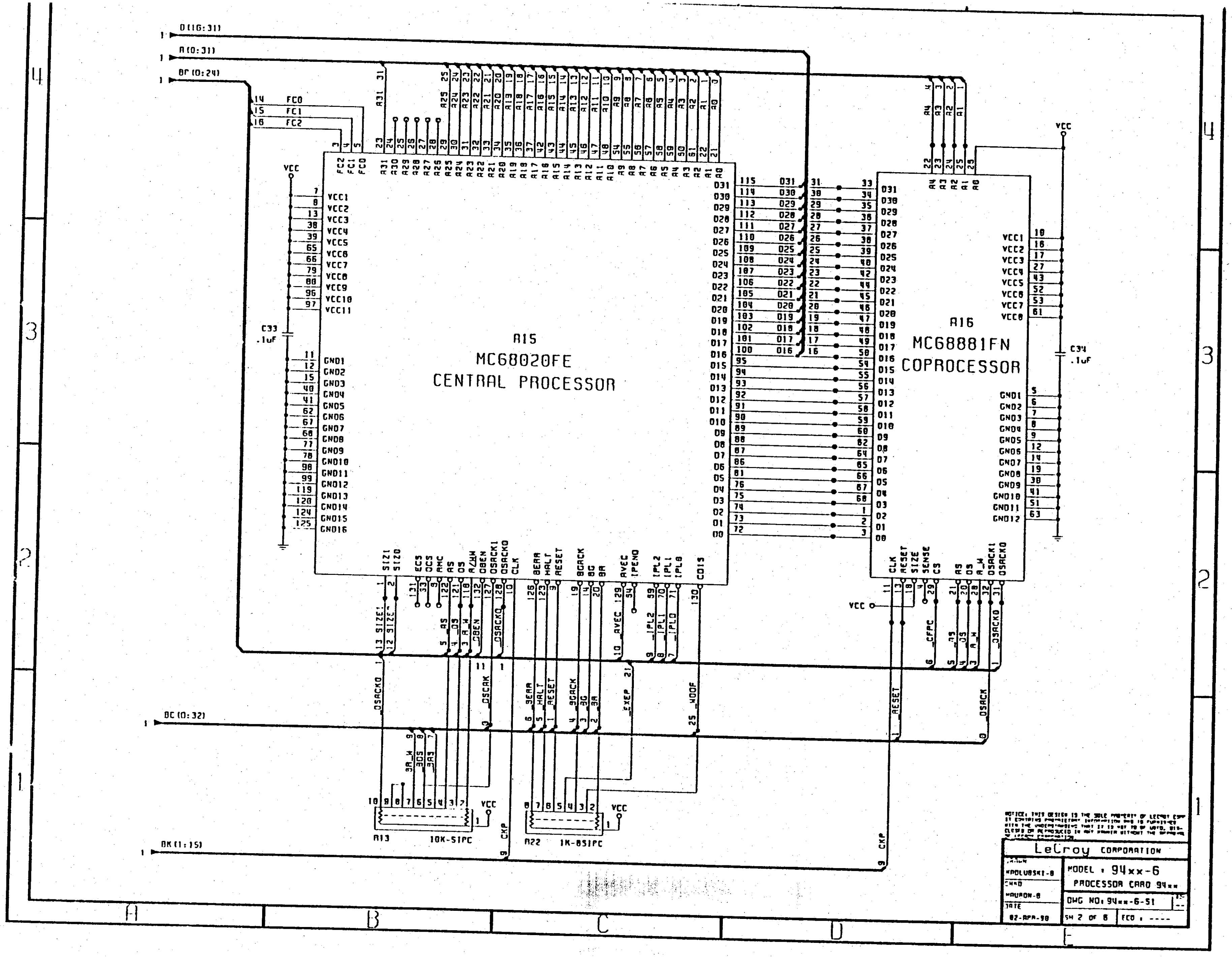
A1	HPC411AIH	HPC411A	HPC411	2166620 -7754620 1
A2	207345051	74HCT4051-PS	DIP16	6629400 6134100 1
A3	205644094	74HCT4094-PS	DIP16	7962900 -452120 1
A4	205644094	74HCT4094-PS	DIP16	10515600 2971800 1
A5	205644094	74HCT4094-PS	DIP16	10566400 -152400 1
A6	205750000	C16L8L	DIP20	11036300 6045200 1
A7	205644094	74HCT4094-PS	DIP16	11686540 -2283460
A8	207345051	74HCT4051-PS	DIP16	13157200 2971800 1
A9	200344138	74HCT138	DIP16	13411200 6045200 1
A10	205644094	74HCT4094-PS	DIP16	14630400 -50800 1
A11	205644094	74HCT4094-PS	DIP16	15646400 2844800 1
A12	207345051	74HCT4051-PS	DIP16	15748000 6045200 1
A13	205644094	74HCT4094-PS	DIP16	17208500 -50800 1
C1	103427104	.1uF	SMONOBP	-368300 -7404100 1
C2	103327103	.01uF	SMONOBP	5107940 6703060 1
C3	103327103	.01uF	SMONOBP	5105400 6433820 1
C4	103427104	.1uF	SMONOBP	7264400 1295400 1
C5	103427104	.1uF	SMONOBP	10363200 927100 1
C6	103427104	.1uF	SMONOBP	11468100 8229600 1
C7	103427104	.1uF	SMONOBP	12750800 -2006600
C8	103427104	.1uF	SMONOBP	13411200 4953000 1
C9	103427104	.1uF	SMONOBP	15024100 -304800 1
C10	103427104	.1uF	SMONOBP	15303500 901700 1
C11	103327103	.01uF	SMONOBP	-5880100 1066800 1
J1	709450511	CAL-TERM	CAL_TERMINAL	2745740 -8298180 1
J2	709450511	CAL-TERM	CAL_TERMINAL	3845560 -8298180 1
J3	454211020	2x10-ST-M	CONN2X10_ST_M	7950200 3746500 2
P1	184437502	5K-1T-PC-MTG	POT_9400_5_M5	-14244320 -7137400
P2	184437502	5K-1T-PC-MTG	POT_9400_5_M5	-11645900 -7137400
P3	184427502	5K-1T-LONG-SHAFT-PS	POT_9400_5_M4	-5689600 830580 1
P4	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	6253480 7711440 1
P5	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	9354820 7711440 1
P6	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	10111740 3746500 1
P7	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	9862820 645160 1 2
P8	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	11752580 7711440 1
P9	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	12260580 645160 1
P10	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	12260580 -1554480
P11	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	14952980 7711440 1
P12	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	15938500 1153160 1
R1	161225121	120	RES05	-1953260 -8270240
R2	168531381	'750-1%'	RES07	406400 -6908800 1
R3	161225121	120	RES05	-314960 -8280400 1
R4	168531365	'511-1%'	RES07	1676400 -7162800 1
R5	168531365	'511-1%'	RES07	1676400 -6654800 1
R6	161225121	120	RES05	4686300 -2946400 1
R7	161225121	120	RES05	4737100 -5791200 1
R8	161225121	120	RES05	5956300 -2946400 1
R9	161225121	120	RES05	6007100 -5791200 1
R10	169416473	NTC-DISC-47K	NTC_DISC	7467600 6273800 1
R11	161225121	120	RES05	7226300 -2946400 1
R12	161225121	120	RES05	7277100 -5791200 1
R13	168531521	'21.5K-1%'	RES07	8140700 6515100 1
R14	161225103	10K	RES05	8356600 4013200 1
R15	161225103	10K	RES05	8356600 1701800 1
R16	161225121	120	RES05	8547100 -5791200 1
R17	161225121	120	RES05	9512300 -2946400 1
R18	161225121	120	RES05	9829800 -5791200 1
R19	161225121	120	RES05	10650220 -3337560
R20	161225121	120	RES05	12357100 4737100 1
R21	161225121	120	RES05	14071600 1435100 1
R22	161225121	120	RES05	14058900 355600 1
R23	161225121	120	RES05	14071600 -2933700
R24	161225121	120	RES05	13766800 -5791200
R25	161225121	120	RES05	14757400 -3403600
R26	161225121	120	RES05	16395700 -1066800
R27	161225121	120	RES05	16395700 -1739900

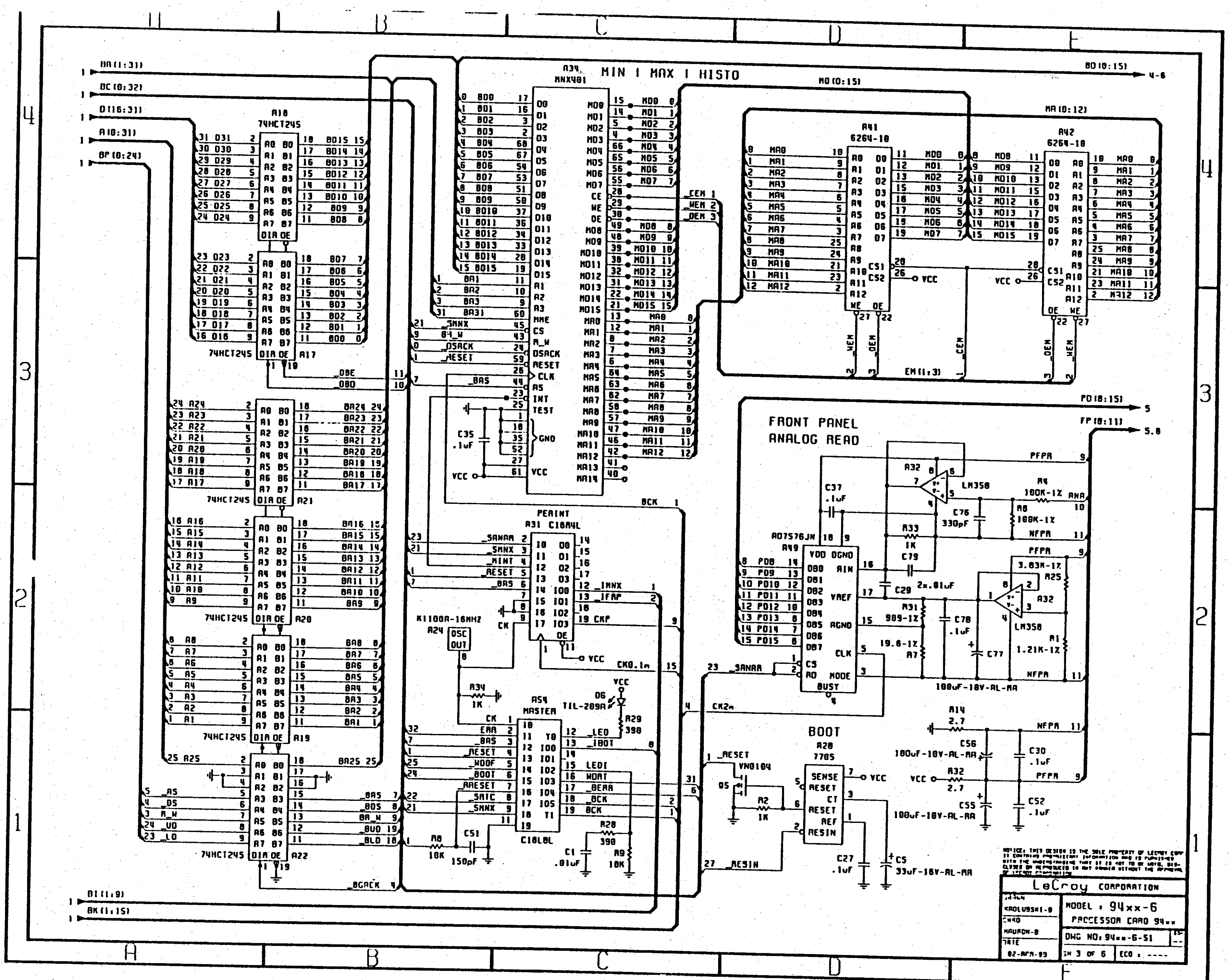
R28	161225121	120	RES05	16395700	-3136900	
S1	416161002	SW-P-SPST	SW_P_SPST	-16880840	6118860	
S2	416161002	SW-P-SPST	SW_P_SPST	-16880840	3995420	
S3	416161002	SW-P-SPST	SW_P_SPST	-16880840	2895600	
S4	416161002	SW-P-SPST	SW_P_SPST	-16880840	1795780	
S5	416161002	SW-P-SPST	SW_P_SPST	-16880840	695960	1
S6	416161002	SW-P-SPST	SW_P_SPST	-16880840	-403860	
S7	416161002	SW-P-SPST	SW_P_SPST	-16880840	-1503680	
S8	416161002	SW-P-SPST	SW_P_SPST	-16880840	-2603500	
S9	416161002	SW-P-SPST	SW_P_SPST	-16880840	-3703320	
S10	416161002	SW-P-SPST	SW_P_SPST	-16880840	-4803140	
S11	416161002	SW-P-SPST	SW_P_SPST	-16880840	-8153400	
S12	416161002	SW-P-SPST	SW_P_SPST	-10279380	-8153400	
S13	416161002	SW-P-SPST	SW_P_SPST	-8679180	-8153400	
S14	416161002	SW-P-SPST	SW_P_SPST	-7279640	-8153400	
S15	416161002	SW-P-SPST	SW_P_SPST	-5880100	-8153400	
S16	416161002	SW-P-SPST	SW_P_SPST	-4480560	-8153400	
S17	416161002	SW-P-SPST	SW_P_SPST	-1678940	-8153400	
S18	416161002	SW-P-SPST	SW_P_SPST	967740	-8153400	1
S19	416161002	SW-P-SPST	SW_P_SPST	3718560	6695440	1
S20	416161002	SW-P-SPST	SW_P_SPST	3718560	5095240	1
S21	416161002	SW-P-SPST	SW_P_SPST	3718560	3995420	1
S22	416161002	SW-P-SPST	SW_P_SPST	3718560	2895600	1
S23	416161002	SW-P-SPST	SW_P_SPST	3718560	1795780	1
S24	416161002	SW-P-SPST	SW_P_SPST	3718560	695960	1
S25	416161002	SW-P-SPST	SW_P_SPST	3718560	-403860	1
S26	416161002	SW-P-SPST	SW_P_SPST	3718560	-1503680	1
S27	416161002	SW-P-SPST	SW_P_SPST	3718560	-2603500	1
S28	416161002	SW-P-SPST	SW_P_SPST	3718560	-3703320	1
S29	416161002	SW-P-SPST	SW_P_SPST	3718560	-4803140	1
S30	416161002	SW-P-SPST	SW_P_SPST	3718560	-6202680	1
S31	416161002	SW-P-SPST	SW_P_SPST	5369560	-2052320	1
S32	412001012	SW-ROT-12	SW_ROT_12	6248400	4650740	1
S33	412001012	SW-ROT-12	SW_ROT_12	6248400	1300480	1
S34	416161002	SW-P-SPST	SW_P_SPST	6469380	-2052320	1
S35	416161002	SW-P-SPST	SW_P_SPST	7167880	6695440	1
S36	416161002	SW-P-SPST	SW_P_SPST	7167880	5321300	1
S37	416161002	SW-P-SPST	SW_P_SPST	7569200	-2052320	1
S38	416161002	SW-P-SPST	SW_P_SPST	8669020	-2052320	1
S39	416161002	SW-P-SPST	SW_P_SPST	9768840	-4254500	1
S40	416161002	SW-P-SPST	SW_P_SPST	9768840	-5453380	1
S41	416161002	SW-P-SPST	SW_P_SPST	11518900	3345180	1
S42	416161002	SW-P-SPST	SW_P_SPST	12019280	-2854960	
S43	416161002	SW-P-SPST	SW_P_SPST	12019280	-4254500	
S44	416161002	SW-P-SPST	SW_P_SPST	12019280	-5453380	
S45	416161002	SW-P-SPST	SW_P_SPST	12717780	6695440	1
S46	412001012	SW-ROT-12	SW_ROT_12	14450060	4650740	1
S47	416161002	SW-P-SPST	SW_P_SPST	14317980	645160	1
S48	416161002	SW-P-SPST	SW_P_SPST	14317980	-1653540	
S49	416161002	SW-P-SPST	SW_P_SPST	14317980	-2854960	
S50	416161002	SW-P-SPST	SW_P_SPST	14317980	-4254500	
S51	416161002	SW-P-SPST	SW_P_SPST	14317980	-5453380	
S52	416161002	SW-P-SPST	SW_P_SPST	16619220	-1653540	
S53	416161002	SW-P-SPST	SW_P_SPST	16619220	-2854960	
S54	416161002	SW-P-SPST	SW_P_SPST	16619220	-4254500	
S55	416161002	SW-P-SPST	SW_P_SPST	16619220	-5453380	
CR1	230020062	BAW62	DO35	-17145000	7137400	
CR2	230020062	BAW62	DO35	-17145000	4864100	
CR3	230020062	BAW62	DO35	-17106900	3911600	
CR4	230020062	BAW62	DO35	-17195800	1714500	
CR5	230020062	BAW62	DO35	-17195800	-292100	
CR6	230020062	BAW62	DO35	-17119600	-2692400	
CR7	230020062	BAW62	DO35	-15760700	2819400	
CR8	230020062	BAW62	DO35	-15824200	609600	1
CR9	230020062	BAW62	DO35	-15811500	-1574800	
CR10	230020062	BAW62	DO35	-15811500	-3797300	

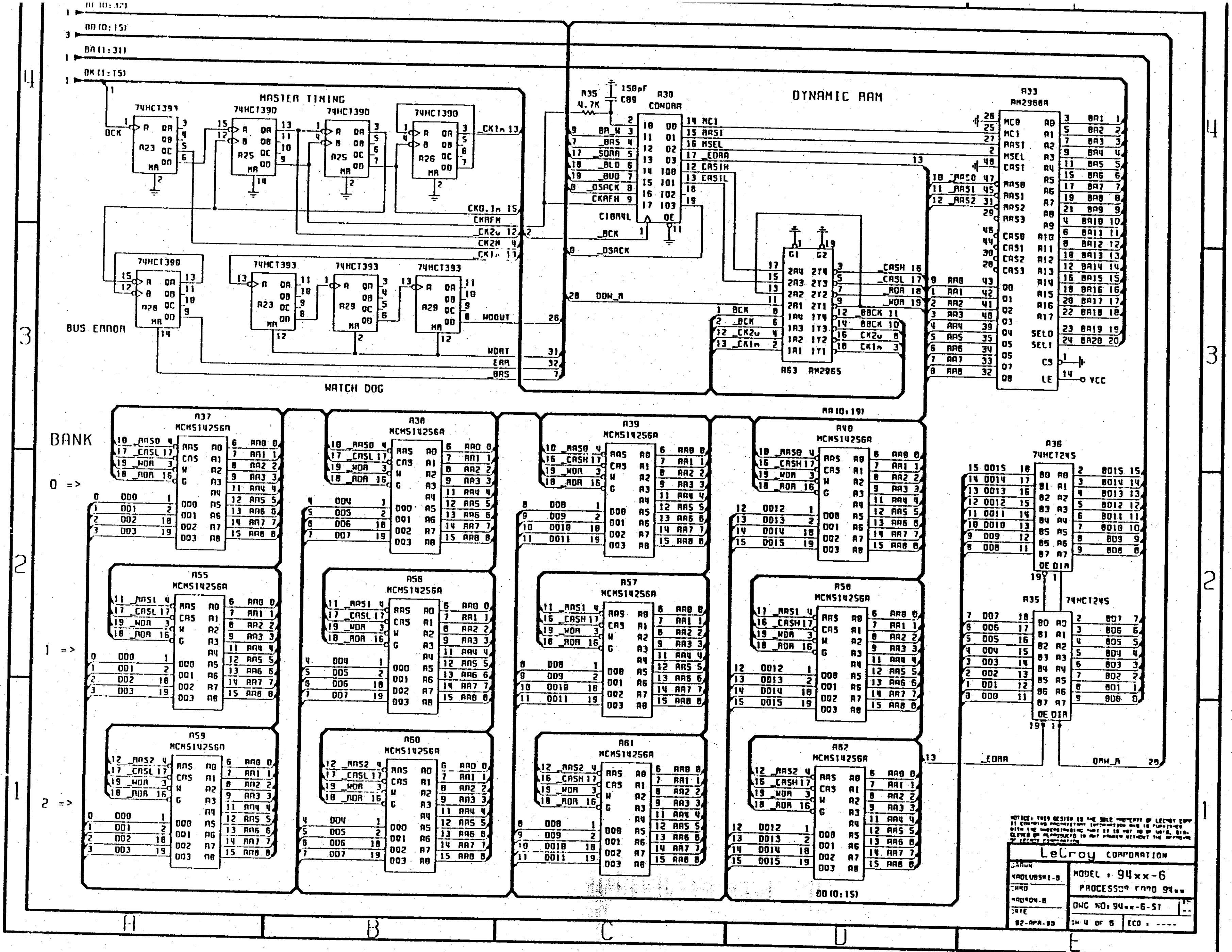
CR11	230020062	BAW62	DO35	-15849600	-7137400	
CR12	230020062	BAW62	DO35	-10566400	-7137400	
CR13	230020062	BAW62	DO35	-8991600	-7137400	
CR14	230020062	BAW62	DO35	-7569200	-7137400	
CR15	230020062	BAW62	DO35	-6197600	-7137400	
CR16	230020062	BAW62	DO35	-4775200	-7137400	
CR17	256443401	LED-HLMP-0401	LED_RECT	-2527300	-7899400	
CR18	230020062	BAW62	DO35	-640080	-7137400	1
CR19	208590385	LM385-1.2	TO92	76200	-6718300	1 2
CR20	256443401	LED-HLMP-0401	LED_RECT	121920	-7899400	1
CR21	230020062	BAW62	DO35	703580	-8564880	1
CR22	230020062	BAW62	DO35	3467100	7708900	1
CR23	230020062	BAW62	DO35	3467100	6299200	1
CR24	230020062	BAW62	DO35	3505200	5003800	1
CR25	230020062	BAW62	DO35	3505200	2806700	1
CR26	230020062	BAW62	DO35	3505200	609600	1 2
CR27	230020062	BAW62	DO35	3505200	-1587500	1
CR28	230020062	BAW62	DO35	3505200	-2857500	1
CR29	230020062	BAW62	DO35	3505200	-5194300	1
CR30	230020062	BAW62	DO35	4711700	3911600	1
CR31	230020062	BAW62	DO35	4711700	1257300	1
CR32	230020062	BAW62	DO35	4711700	-762000	1
CR33	230020062	BAW62	DO35	4711700	-1041400	1
CR34	230020062	BAW62	DO35	4711700	-3784600	1
CR35	230020062	BAW62	DO35	5156200	-1041400	1
CR36	230020062	BAW62	DO35	5727700	5118100	1
CR37	256443401	LED-HLMP-0401	LED_RECT	5623560	-2600960	1
CR38	256243300	LED-HLMP-0300	LED_RECT	5623560	-3403600	1
CR39	256443401	LED-HLMP-0401	LED_RECT	5623560	-3802380	1
CR40	256443401	LED-HLMP-0401	LED_RECT	5623560	-4201160	1
CR41	256443401	LED-HLMP-0401	LED_RECT	5623560	-4599940	1
CR42	256443401	LED-HLMP-0401	LED_RECT	5623560	-4998720	1
CR43	256443401	LED-HLMP-0401	LED_RECT	5623560	-5397500	1
CR44	230020062	BAW62	DO35	6121400	2832100	1
CR45	230020062	BAW62	DO35	6959600	7708900	1
CR46	256443401	LED-HLMP-0401	LED_RECT	6723380	-2600960	1
CR47	256243300	LED-HLMP-0300	LED_RECT	6723380	-3403600	1
CR48	256443401	LED-HLMP-0401	LED_RECT	6723380	-3802380	1
CR49	256443401	LED-HLMP-0401	LED_RECT	6723380	-4201160	1
CR50	256443401	LED-HLMP-0401	LED_RECT	6723380	-4599940	1
CR51	256443401	LED-HLMP-0401	LED_RECT	6723380	-4998720	1
CR52	256443401	LED-HLMP-0401	LED_RECT	6723380	-5397500	1
CR53	230020062	BAW62	DO35	7124700	4978400	1
CR54	256443401	LED-HLMP-0401	LED_RECT	7823200	-2600960	1
CR55	256243300	LED-HLMP-0300	LED_RECT	7823200	-3403600	1
CR56	256443401	LED-HLMP-0401	LED_RECT	7823200	-3802380	1
CR57	256443401	LED-HLMP-0401	LED_RECT	7823200	-4201160	1
CR58	256443401	LED-HLMP-0401	LED_RECT	7823200	-4599940	1
CR59	256443401	LED-HLMP-0401	LED_RECT	7823200	-4998720	1
CR60	256443401	LED-HLMP-0401	LED_RECT	7823200	-5397500	1
CR61	230020062	BAW62	DO35	8623300	1955800	1
CR62	230020062	BAW62	DO35	8623300	1701800	1
CR63	230020062	BAW62	DO35	8407400	-1206500	1
CR64	256443401	LED-HLMP-0401	LED_RECT	8923020	-2600960	1
CR65	256243300	LED-HLMP-0300	LED_RECT	8923020	-3403600	1
CR66	256443401	LED-HLMP-0401	LED_RECT	8923020	-3802380	1
CR67	256443401	LED-HLMP-0401	LED_RECT	8923020	-4201160	1
CR68	256443401	LED-HLMP-0401	LED_RECT	8923020	-4599940	1
CR69	256443401	LED-HLMP-0401	LED_RECT	8923020	-4998720	1
CR70	256443401	LED-HLMP-0401	LED_RECT	8923020	-5397500	1
CR71	230020062	BAW62	DO35	9652000	-2006600	1
CR72	230020062	BAW62	DO35	9690100	-4610100	1
CR73	230020062	BAW62	DO35	10274300	3340100	1
CR74	230020062	BAW62	DO35	10922000	-3340100	
CR75	256443401	LED-HLMP-0401	LED_RECT	11173460	-3802380	
CR76	256443401	LED-HLMP-0401	LED_RECT	11173460	-4201160	

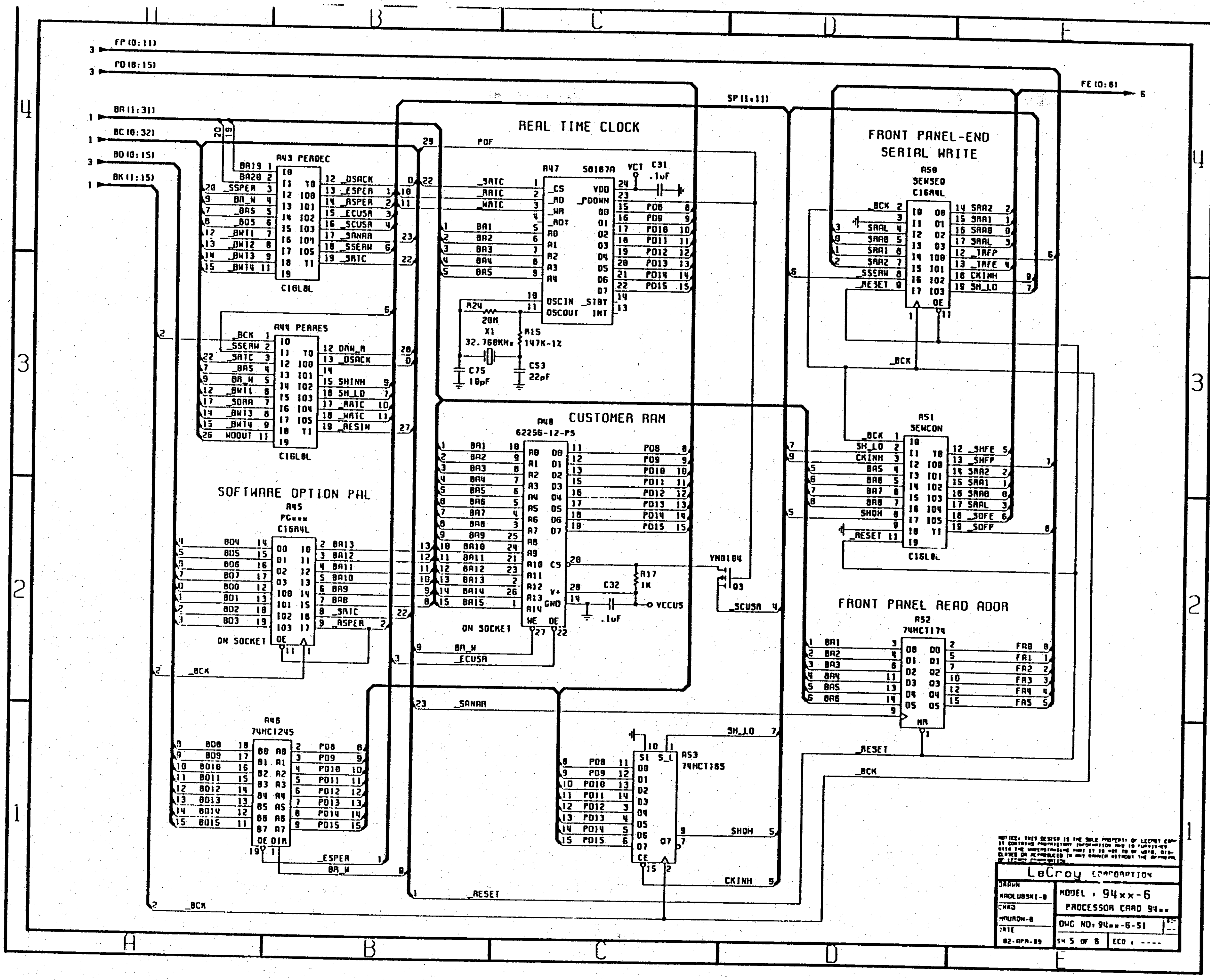
CR77	256443401	LED-HLMP-0401	LED_RECT	11173460	-4599940	
CR78	256443401	LED-HLMP-0401	LED_RECT	11173460	-4998720	
CR79	256443401	LED-HLMP-0401	LED_RECT	11772900	4399280	1
CR80	230020062	BAW62	DO35	11976100	-4610100	
CR81	230020062	BAW62	DO35	12458700	7543800	1
CR82	230020062	BAW62	DO35	12204700	-3340100	
CR83	230020062	BAW62	DO35	13004800	-1625600	
CR84	256443401	LED-HLMP-0401	LED_RECT	13472160	1097280	1
CR85	256443401	LED-HLMP-0401	LED_RECT	13472160	698500	1
CR86	256443401	LED-HLMP-0401	LED_RECT	13472160	-1402080	
CR87	256443401	LED-HLMP-0401	LED_RECT	13472160	-1800860	
CR88	256443401	LED-HLMP-0401	LED_RECT	13472160	-2199640	
CR89	256443401	LED-HLMP-0401	LED_RECT	13472160	-2598420	
CR90	230020062	BAW62	DO35	13474700	-3187700	
CR91	256443401	LED-HLMP-0401	LED_RECT	13472160	-3802380	
CR92	256443401	LED-HLMP-0401	LED_RECT	13472160	-4201160	
CR93	256443401	LED-HLMP-0401	LED_RECT	13472160	-4599940	
CR94	256443401	LED-HLMP-0401	LED_RECT	13472160	-4998720	
CR95	256443401	LED-HLMP-0401	LED_RECT	13472160	-5397500	
CR96	230020062	BAW62	DO35	14211300	-4597400	
CR97	230020062	BAW62	DO35	14020800	-5791200	
CR98	230020062	BAW62	DO35	14351000	304800	1
CR99	230020062	BAW62	DO35	14312900	-1993900	
CR100	230020062	BAW62	DO35	14884400	1498600	1
CR101	230020062	BAW62	DO35	15646400	4991100	1
CR102	256443401	LED-HLMP-0401	LED_RECT	15773400	-1399540	
CR103	256443401	LED-HLMP-0401	LED_RECT	15773400	-2400300	
CR104	256443401	LED-HLMP-0401	LED_RECT	15773400	-2799080	
CR105	256443401	LED-HLMP-0401	LED_RECT	15773400	-3802380	
CR106	256443401	LED-HLMP-0401	LED_RECT	15773400	-4201160	
CR107	256443401	LED-HLMP-0401	LED_RECT	15773400	-4599940	
CR108	256443401	LED-HLMP-0401	LED_RECT	15773400	-4998720	
CR109	230020062	BAW62	DO35	16012160	-5798820	
CR110	230020062	BAW62	DO35	16319500	-2006600	
CR111	230020062	BAW62	DO35	16294100	-3403600	
DR1	$NULL	DRILL2_5	DRILL2_5	-16499840	5298440	
DR2	$NULL	DRILL2_5	DRILL2_5	-16499840	-5527040	
DR3	$NULL	DRILL2_5	DRILL2_5	-12700000	8298180	
DR4	$NULL	DRILL2_5	DRILL2_5	-13200380	-8399780	
DR5	$NULL	DRILL3	DRILL3	-7061200	1465580	1
DR6	$NULL	DRILL3	DRILL3	-7063740	-668020	1
DR7	$NULL	DRILL3	DRILL3	-5334000	1465580	1
DR8	$NULL	DRILL2_5	DRILL2_5	299720	8298180	1
DR9	$NULL	DRILL2_5	DRILL2_5	2148840	-8399780	1
DR10	$NULL	DRILL2_5	DRILL2_5	4099560	6149340	1
DR11	$NULL	DRILL2_5	DRILL2_5	4848860	-5247640	1
DR12	$NULL	DRILL3	DRILL3	5130800	2047240	1
DR13	$NULL	DRILL3	DRILL3	5130800	-86360	1
DR14	$NULL	DRILL3	DRILL3	6858000	2047240	1
DR15	$NULL	DRILL2_5	DRILL2_5	10299700	1597660	1
DR16	$NULL	DRILL2_5	DRILL2_5	11297920	-5699760	
DR17	$NULL	DRILL2_5	DRILL2_5	15648940	8298180	1
DR18	$NULL	DRILL2_5	DRILL2_5	15499080	-5699760	
DR19	$NULL	DRILL2_5	DRILL2_5	16697960	1998980	1
DR23	$NULL	DRILL3	DRILL3	5994400	2047240	1
DR24	$NULL	DRILL3	DRILL3	-6197600	1465580	1
RN1	190001001	SIP13RES	SIP13RES	1320800	8039100	1

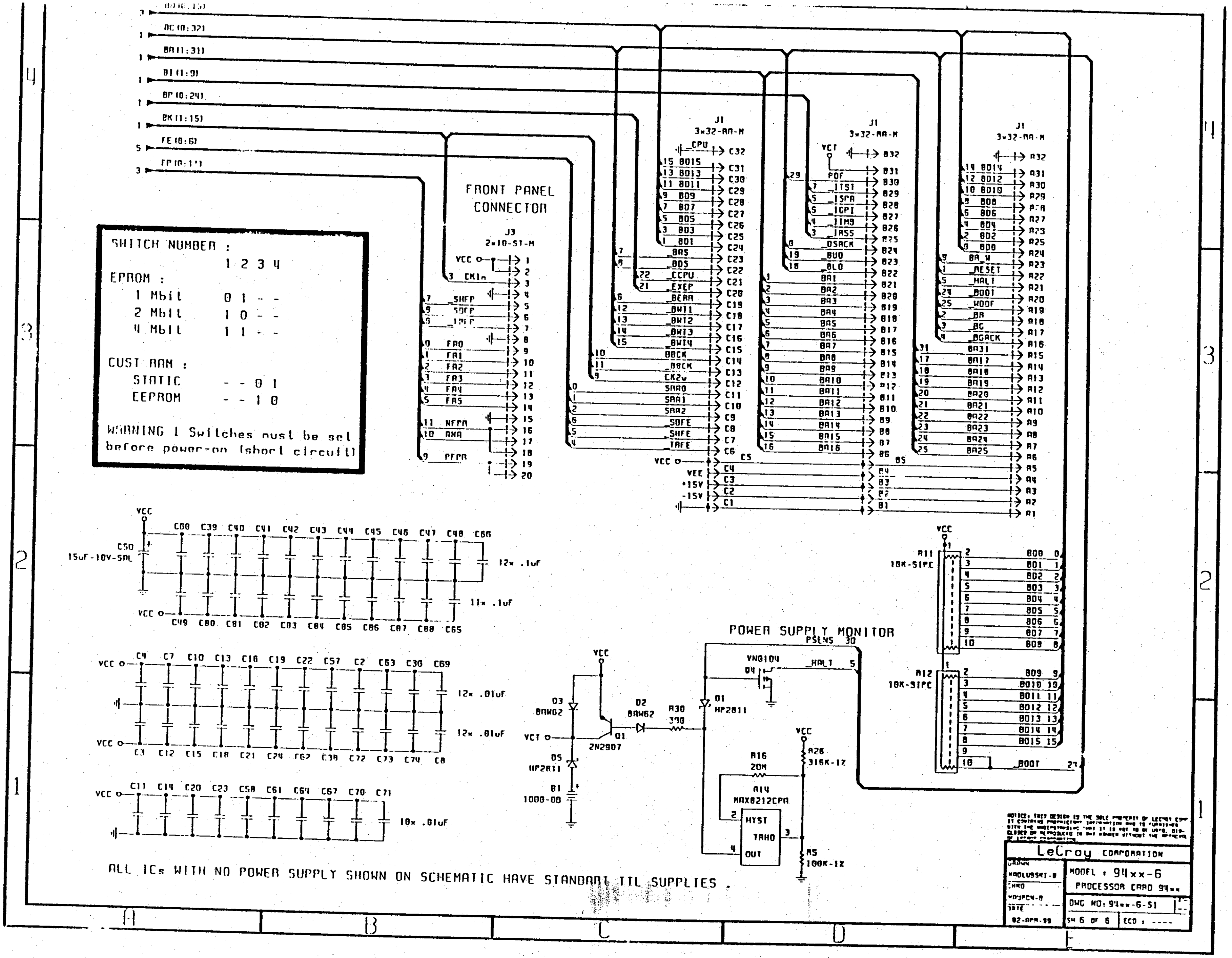

A1
EPROM
ON SOCKET
1H
A4
EPROM
ON SOCKET
1L
A2
EPROM
ON SOCKET
2H
A5
EPROM
ON SOCKET
2L
A3
EPROM
ON SOCKET
3H
A6
EPROM
ON SOCKET
3L
A7
62256-12-PS
A8
62256-12-PS
A13
MASDEC
C16L8L
SW1
8004
OPTION SWITCHES
(SEE SETTING SHEET 6)
Q2
VN0104
A9
SENBUS
C16L8L
A10
EMEBTT
C16L8L
A11
CPUSPA
C16L8L
A12
INTWAT
C16R4L
A36
22-8SS
D(16:31)
A(0:31)
BE(0:12)
BC(0:32)
BP(0:24)
BI(1:9)
BK(1:15)
BA(1:31)
LeCroy CORPORATION
MODEL : 94xx-6
PROCESSOR CARD 94xx
DWG NO: 94xx-6-S1
SH 1 OF 6
ECO : ----
DRAWN
KAOLUBSKI-B
CHKD
MAURON-B
DATE
02-APR-90


A15
MC68020FE
CENTRAL PROCESSOR
A16
MC68881FN
COPROCESSOR
D(16:31)
A(0:31)
BF(0:24)
BC(0:32)
BK(1:15)
R13 10K-SIPC
R22 1K-8SIPC
C33 .1uF
C34 .1uF
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE WRITTEN CONSENT OF LECROY CORPORATION.
LeCroy CORPORATION
MODEL : 94xx-6
PROCESSOR CARD 94xx
DWG NO: 94xx-6-S1
SH 2 OF 8
ECO : ----
DATE 02-APR-90

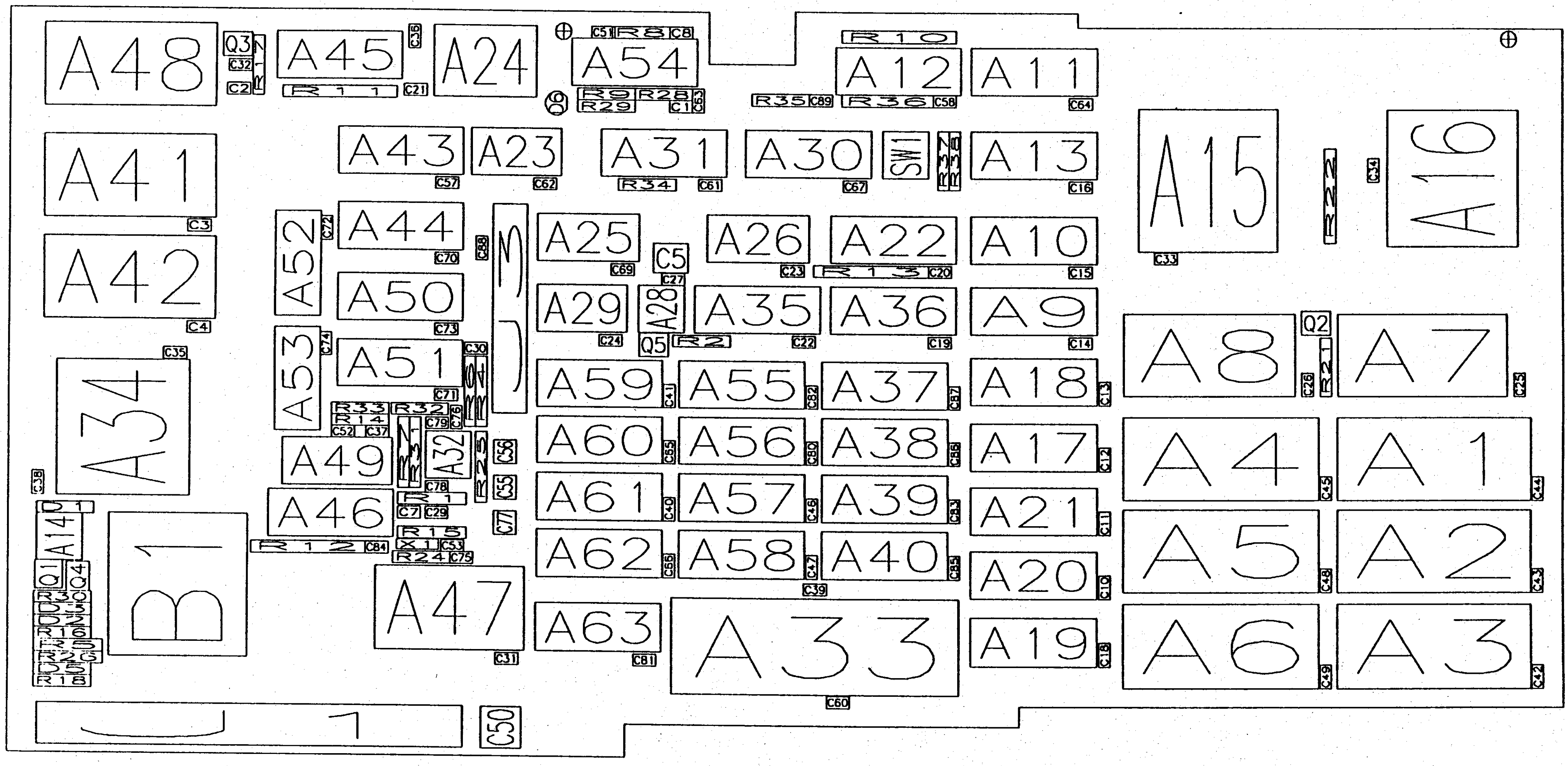

MIN I MAX I HISTO
FRONT PANEL
ANALOG READ
BOOT
LeCroy CORPORATION
MODEL : 94xx-6
PROCESSOR CARD 94xx
DWG NO: 94xx-6-S1
SH 3 OF 6
02-APR-93


DYNAMIC RAM
MASTER TIMING
WATCH DOG
BUS ERROR
BANK
0 =>
1 =>
2 =>
LeCroy CORPORATION
MODEL : 94xx-6
DWG NO: 94xx-6-51

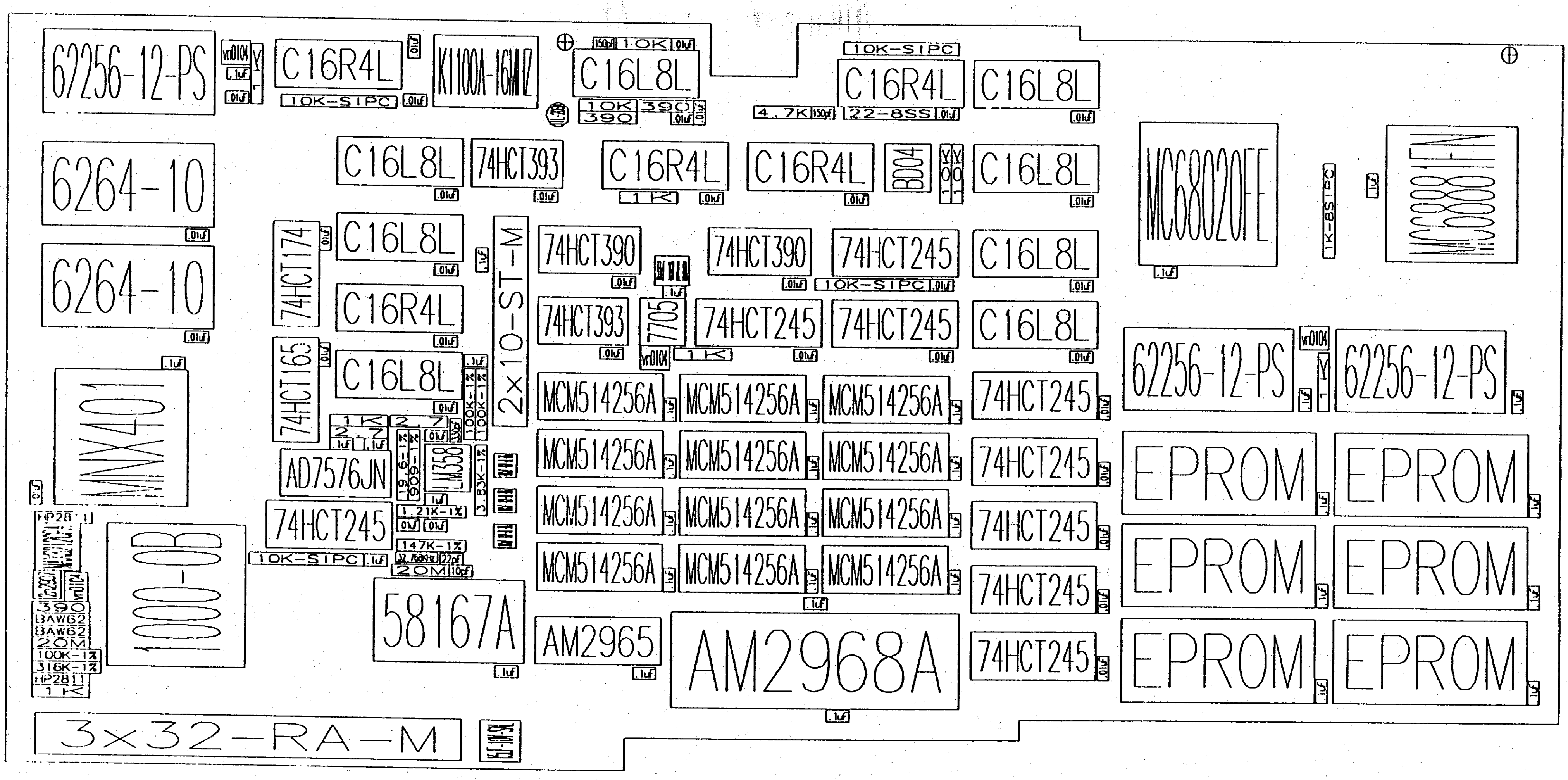

REAL TIME CLOCK
CUSTOMER RAM
FRONT PANEL-END
SERIAL WRITE
FRONT PANEL READ ADDR
SOFTWARE OPTION PAL
A43 PEADEC
A44 PEARES
A45 PC**
C16V4L
A46 74HCT245
A47 58187A
A48 62256-12-P5
A50 SENSED
A51 SEMCON
A52 74HCT174
A53 74HCT165
VN0104
ON SOCKET
32.768KHz
FP(0:11)
PD(8:15)
BA(1:31)
BC(0:32)
BD(0:15)
BK(1:15)
FE(0:6)
SP(1:11)
LeCroy CORPORATION
MODEL : 94xx-6
PROCESSOR CARD 94**
DWG NO: 94**-6-S1
SH 5 OF 6
ECO : ----
KAOLUBSKI-B
MAURON-B
02-APR-99



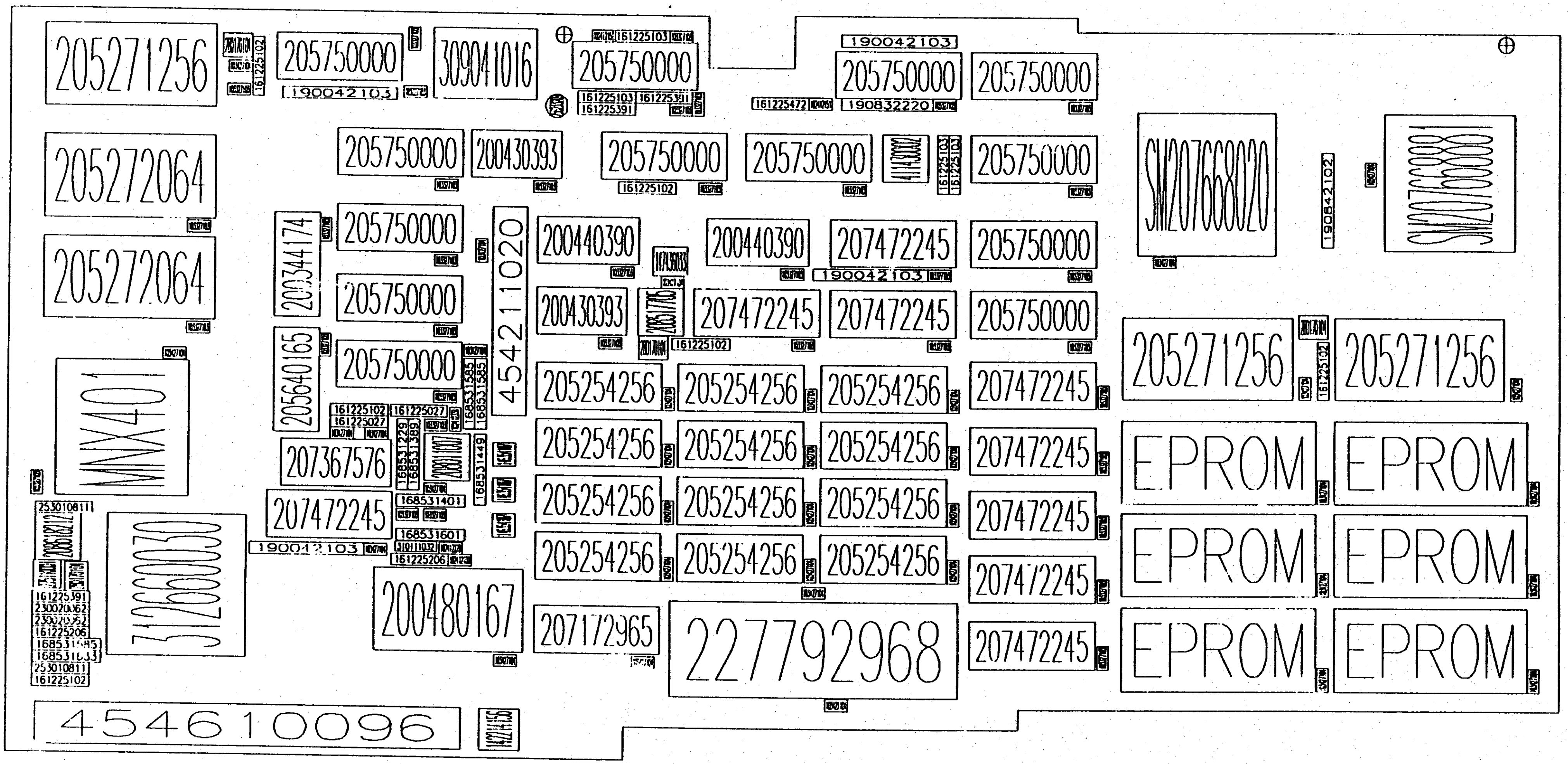
FRONT PANEL CONNECTOR
J3 2x10-ST-M
J1 3x32-RA-M
SWITCH NUMBER : 1 2 3 4
EPROM :
1 Mbit 0 1 - -
2 Mbit 1 0 - -
4 Mbit 1 1 - -
CUST RAM :
STATIC - - 0 1
EEPROM - - 1 0
WARNING ! Switches must be set before power-on (short circuit)
POWER SUPPLY MONITOR
ALL ICs WITH NO POWER SUPPLY SHOWN ON SCHEMATIC HAVE STANDARD TTL SUPPLIES .
LeCroy CORPORATION
MODEL : 94xx-6
PROCESSOR CARD 94xx
DWG NO: 94xx-6-S1
SH 6 OF 6
ECO : ----


A48
A45
A24
A54
A12
A11
A41
A43
A23
A31
A30
SW1
A13
A15
A16
A44
A25
A26
A22
A10
A52
A50
A29
A28
A35
A36
A9
A8
A7
A53
A51
A59
A55
A37
A18
A34
A49
A32
A60
A56
A38
A17
A4
A1
A46
A61
A57
A39
A21
B1
A14
A62
A58
A40
A20
A5
A2
A47
A63
A33
A19
A6
A3
C50

94XX_6 Rev:A


62256-12-PS
C16R4L
K1100A-16MHZ
C16L8L
10K-SIPC
C16R4L
C16L8L
6264-10
6264-10
C16L8L
74HCT393
C16R4L
C16R4L
BD04
MC68020FE
MC68881FN
74HCT174
C16L8L
2×10-ST-M
74HCT390
74HCT390
74HCT245
C16L8L
C16R4L
74HCT393
7705
74HCT245
74HCT245
C16L8L
62256-12-PS
62256-12-PS
MNX401
74HCT165
C16L8L
MCM514256A
MCM514256A
MCM514256A
74HCT245
AD7576JN
LM358
MCM514256A
MCM514256A
MCM514256A
74HCT245
EPROM
EPROM
74HCT245
MCM514256A
MCM514256A
MCM514256A
74HCT245
1000-0B
MCM514256A
MCM514256A
MCM514256A
74HCT245
EPROM
EPROM
58167A
AM2965
AM2968A
74HCT245
EPROM
EPROM
1K-8SIPC
3×32-RA-M

94XX_6 Rev:A


205271256
205750000
309041016
205750000
190042103
205750000
205750000
205272064
205750000
200430393
205750000
205750000
205750000
SM20766802O
SM20766888I
205272064
200344174
205750000
454211020
200440390
200440390
207472245
205750000
205750000
200430393
207472245
207472245
205750000
205271256
205271256
MNX401
205640165
205750000
205254256
205254256
205254256
207472245
207367576
205254256
205254256
205254256
207472245
EPROM
EPROM
207472245
205254256
205254256
205254256
207472245
312660030
205254256
205254256
205254256
207472245
EPROM
EPROM
200480167
207172965
227792968
207472245
EPROM
EPROM
454610096

94XX_6 Rev:A

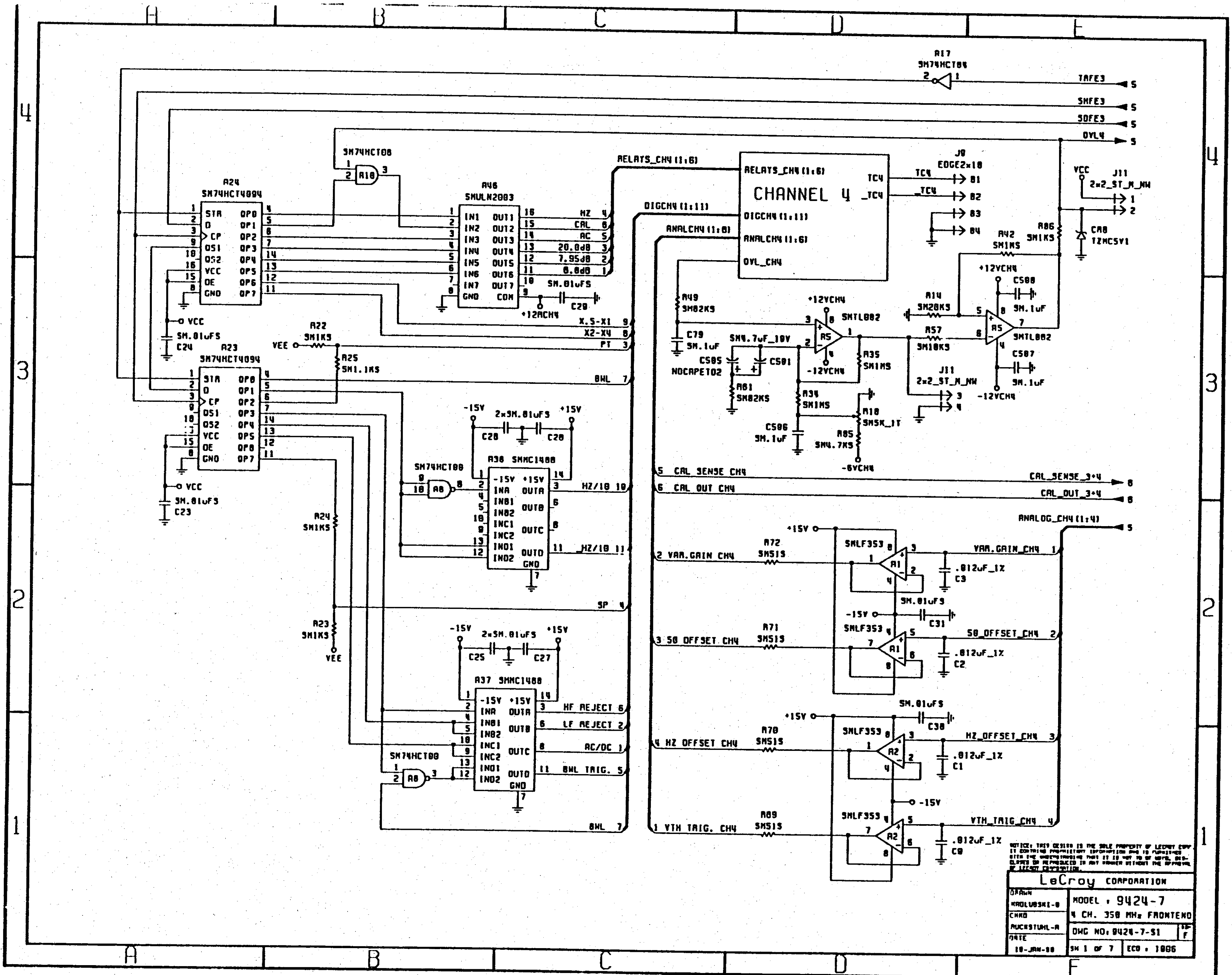
A1	EPROM	EPROM	DIP32
A2	EPROM	EPROM	DIP32
A3	EPROM	EPROM	DIP32
A4	EPROM	EPROM	DIP32
A5	EPROM	EPROM	DIP32
A6	EPROM	EPROM	DIP32
A7	205271256	62256-12-PS	DIP28
A8	205271256	62256-12-PS	DIP28
A9	205750000	C16L8L	DIP20
A10	205750000	C16L8L	DIP20
A11	205750000	C16L8L	DIP20
A12	205750000	C16R4L	DIP20
A13	205750000	C16L8L	DIP20
A14	208618212	MAX8212CPA	DIP8
A15	SM207668020	MC68020FE	QUAD_FP_132P
A16	SM207668881	MC68881FN	PLCC_68
A17	207472245	74HCT245	DIP20
A18	207472245	74HCT245	DIP20
A19	207472245	74HCT245	DIP20
A20	207472245	74HCT245	DIP20
A21	207472245	74HCT245	DIP20
A22	207472245	74HCT245	DIP20
A23	200430393	74HCT393	DIP14
A24	309041016	K1100A-16MHZ	$1100_QUARTZ
A25	200440390	74HCT390	DIP16
A26	200440390	74HCT390	DIP16
A28	208517705	7705	DIP8
A29	200430393	74HCT393	DIP14
A30	205750000	C16R4L	DIP20
A31	205750000	C16R4L	DIP20
A32	208011007	LM358	DIP8
A33	227792968	AM2968A	DIP48
A34	MNX401	MNX401	PLCC_68
A35	207472245	74HCT245	DIP20
A36	207472245	74HCT245	DIP20
A37	205254256	MCM514256A	DIP20
A38	205254256	MCM514256A	DIP20
A39	205254256	MCM514256A	DIP20
A40	205254256	MCM514256A	DIP20
A41	205272064	6264-10	DIP28
A42	205272064	6264-10	DIP28
A43	205750000	C16L8L	DIP20
A44	205750000	C16L8L	DIP20
A45	205750000	C16R4L	DIP20
A46	207472245	74HCT245	DIP20
A47	200480167	58167A	$DIP24
A48	205271256	62256-12-PS	DIP28
A49	207367576	AD7576JN	DIP18
A50	205750000	C16R4L	DIP20
A51	205750000	C16L8L	DIP20
A52	200344174	74HCT174	DIP16
A53	205640165	74HCT165	DIP16
A54	205750000	C16L8L	DIP20
A55	205254256	MCM514256A	DIP20
A56	205254256	MCM514256A	DIP20
A57	205254256	MCM514256A	DIP20

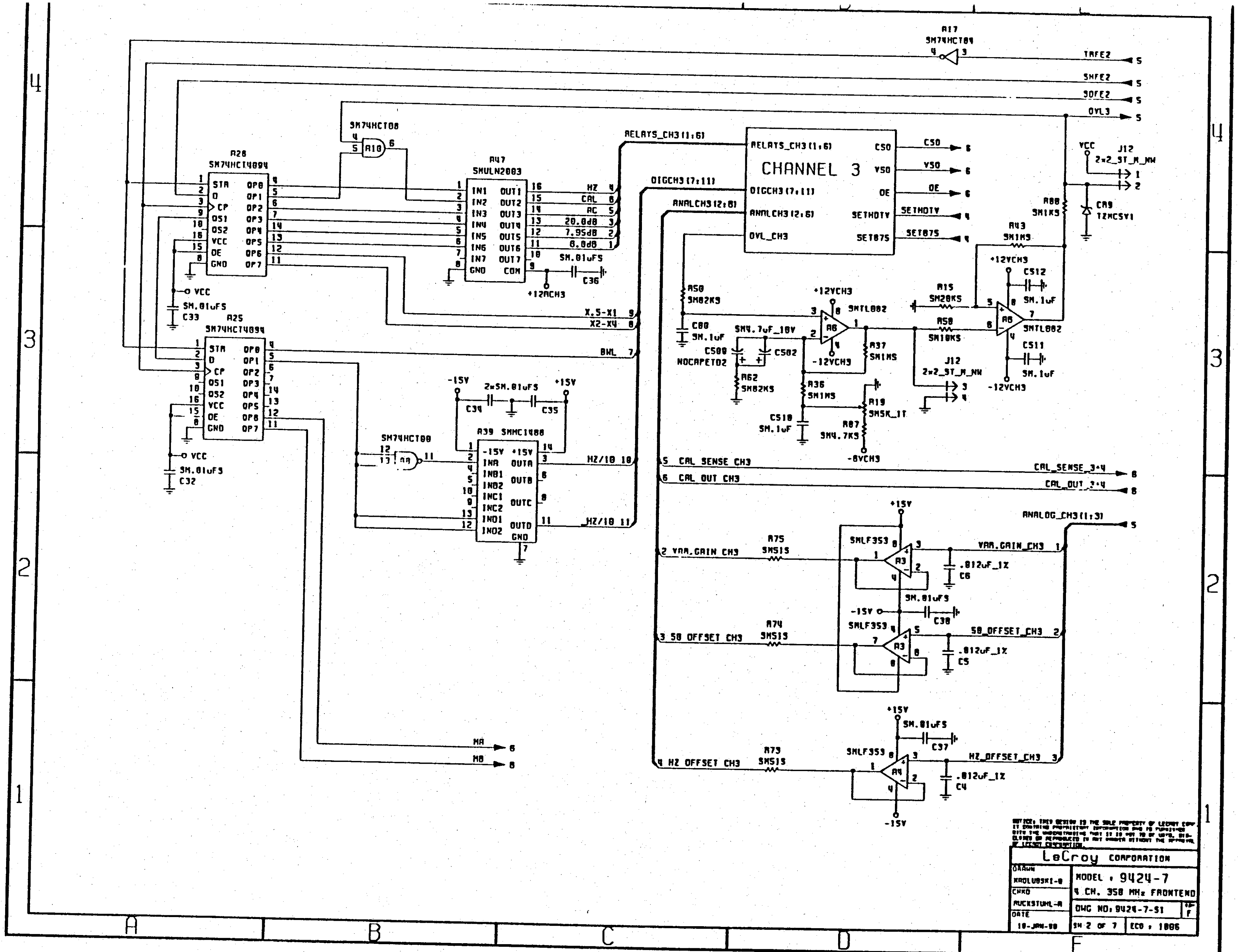
A58	205254256	MCM514256A	DIP20
A59	205254256	MCM514256A	DIP20
A60	205254256	MCM514256A	DIP20
A61	205254256	MCM514256A	DIP20
A62	205254256	MCM514256A	DIP20
A63	207172965	AM2965	DIP20
A_1	$NULL	ICT	ICT
A_2	$NULL	ICT	ICT
A_3	$NULL	ICT	ICT
A_4	$NULL	ICT	ICT
A_26	$NULL	ICT	ICT
A_27	$NULL	ICT	ICT
A_28	$NULL	ICT	ICT
A_29	$NULL	ICT	ICT
A_30	$NULL	ICT	ICT
B1	312660030	1000-0B	BAT_1000
C1	103327103	.01uF	SMONOBP
C2	103327103	.01uF	SMONOBP
C3	103327103	.01uF	SMONOBP
C4	103327103	.01uF	SMONOBP
C5	147436033	33uF-16V-AL-RA	TCAP
C7	103327103	.01uF	SMONOBP
C8	103327103	.01uF	SMONOBP
C10	103327103	.01uF	SMONOBP
C11	103327103	.01uF	SMONOBP
C12	103327103	.01uF	SMONOBP
C13	103327103	.01uF	SMONOBP
C14	103327103	.01uF	SMONOBP
C15	103327103	.01uF	SMONOBP
C16	103327103	.01uF	SMONOBP
C18	103327103	.01uF	SMONOBP
C19	103327103	.01uF	SMONOBP
C20	103327103	.01uF	SMONOBP
C21	103327103	.01uF	SMONOBP
C22	103327103	.01uF	SMONOBP
C23	103327103	.01uF	SMONOBP
C24	103327103	.01uF	SMONOBP
C25	103427104	.1uF	SMONOBP
C26	103427104	.1uF	SMONOBP
C27	103427104	.1uF	SMONOBP
C29	103327103	.01uF	SMONOBP
C30	103427104	.1uF	SMONOBP
C31	103427104	.1uF	SMONOBP
C32	103427104	.1uF	SMONOBP
C33	103427104	.1uF	SMONOBP
C34	103427104	.1uF	SMONOBP
C35	103427104	.1uF	SMONOBP
C36	103327103	.01uF	SMONOBP
C37	103427104	.1uF	SMONOBP
C38	103327103	.01uF	SMONOBP
C39	103427104	.1uF	SMONOBP
C40	103427104	.1uF	SMONOBP
C41	103427104	.1uF	SMONOBP
C42	103427104	.1uF	SMONOBP
C43	103427104	.1uF	SMONOBP
C44	103427104	.1uF	SMONOBP

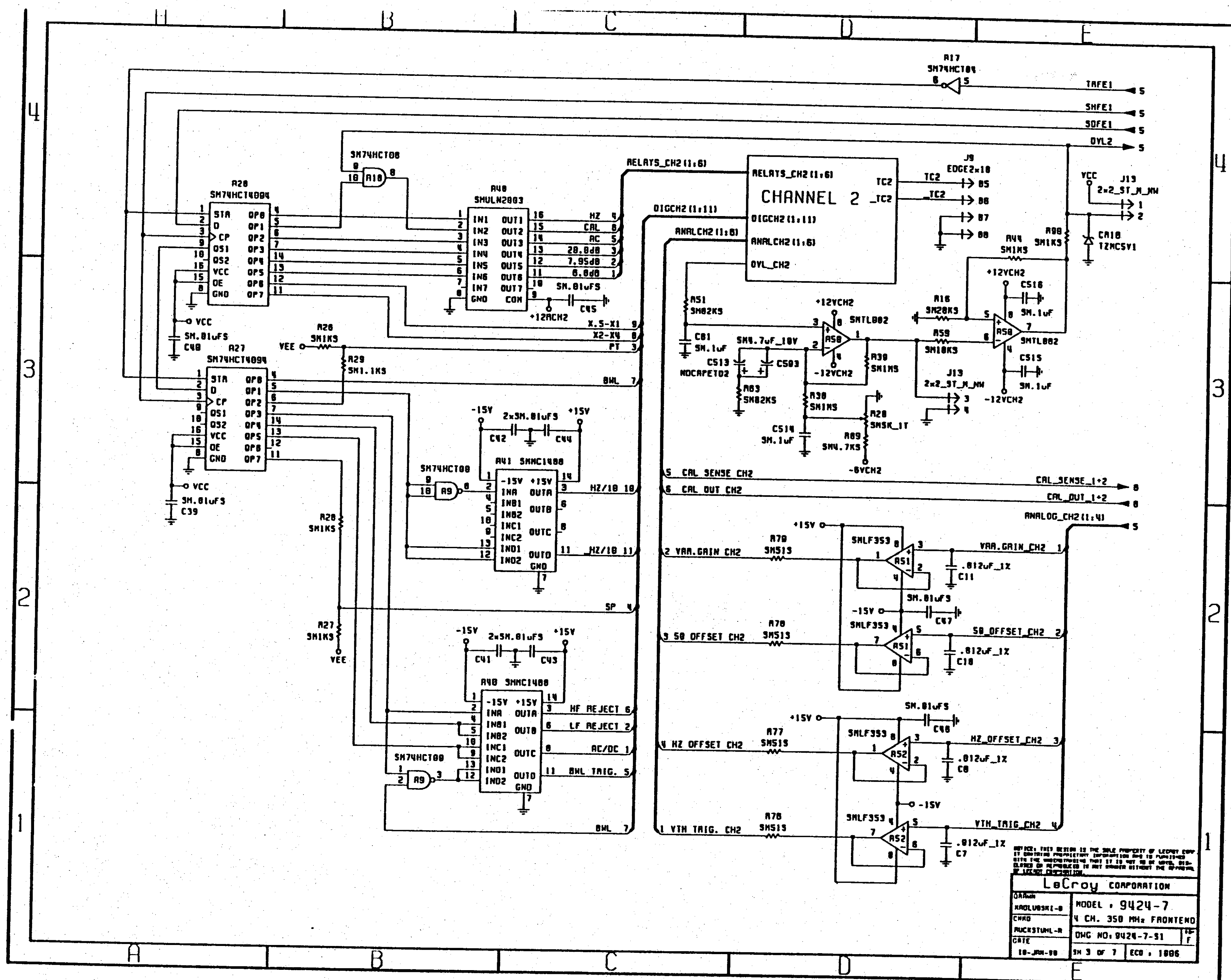
C45	103427104	.1uF	SMONOBP
C46	103427104	.1uF	SMONOBP
C47	103427104	.1uF	SMONOBP
C48	103427104	.1uF	SMONOBP
C49	103427104	.1uF	SMONOBP
C50	142214156	15uF-10V-SAL	LTCAP
C51	102412151	150pF	SMONO
C52	103427104	.1uF	SMONOBP
C53	102412220	22pF	SMONO
C55	146354107	100uF-10V-AL-RA	TDCAP
C56	146354107	100uF-10V-AL-RA	TDCAP
C57	103327103	.01uF	SMONOBP
C58	103327103	.01uF	SMONOBP
C60	103427104	.1uF	SMONOBP
C61	103327103	.01uF	SMONOBP
C62	103327103	.01uF	SMONOBP
C63	103327103	.01uF	SMONOBP
C64	103327103	.01uF	SMONOBP
C65	103427104	.1uF	SMONOBP
C66	103427104	.1uF	SMONOBP
C67	103327103	.01uF	SMONOBP
C69	103327103	.01uF	SMONOBP
C70	103327103	.01uF	SMONOBP
C71	103327103	.01uF	SMONOBP
C72	103327103	.01uF	SMONOBP
C73	103327103	.01uF	SMONOBP
C74	103327103	.01uF	SMONOBP
C75	102412100	10pF	SMONO
C76	102412331	330pF	SMONO
C77	146354107	100uF-10V-AL-RA	TDCAP
C78	103427104	.1uF	SMONOBP
C79	103327103	.01uF	SMONOBP
C80	103427104	.1uF	SMONOBP
C81	103427104	.1uF	SMONOBP
C82	103427104	.1uF	SMONOBP
C83	103427104	.1uF	SMONOBP
C84	103427104	.1uF	SMONOBP
C85	103427104	.1uF	SMONOBP
C86	103427104	.1uF	SMONOBP
C87	103427104	.1uF	SMONOBP
C88	103427104	.1uF	SMONOBP
C89	102412151	150pF	SMONO
CKP	$NULL	ICT	ICT
D1	253010811	HP2811	DO35
D2	230020062	BAW62	DO35
D3	230020062	BAW62	DO35
D5	253010811	HP2811	DO35
D6	256233209	TIL-209A	$LED_1
DS	$NULL	ICT	ICT
D_0	$NULL	ICT	ICT
D_1	$NULL	ICT	ICT
D_2	$NULL	ICT	ICT
D_3	$NULL	ICT	ICT
D_4	$NULL	ICT	ICT
D_5	$NULL	ICT	ICT
D_6	$NULL	ICT	ICT

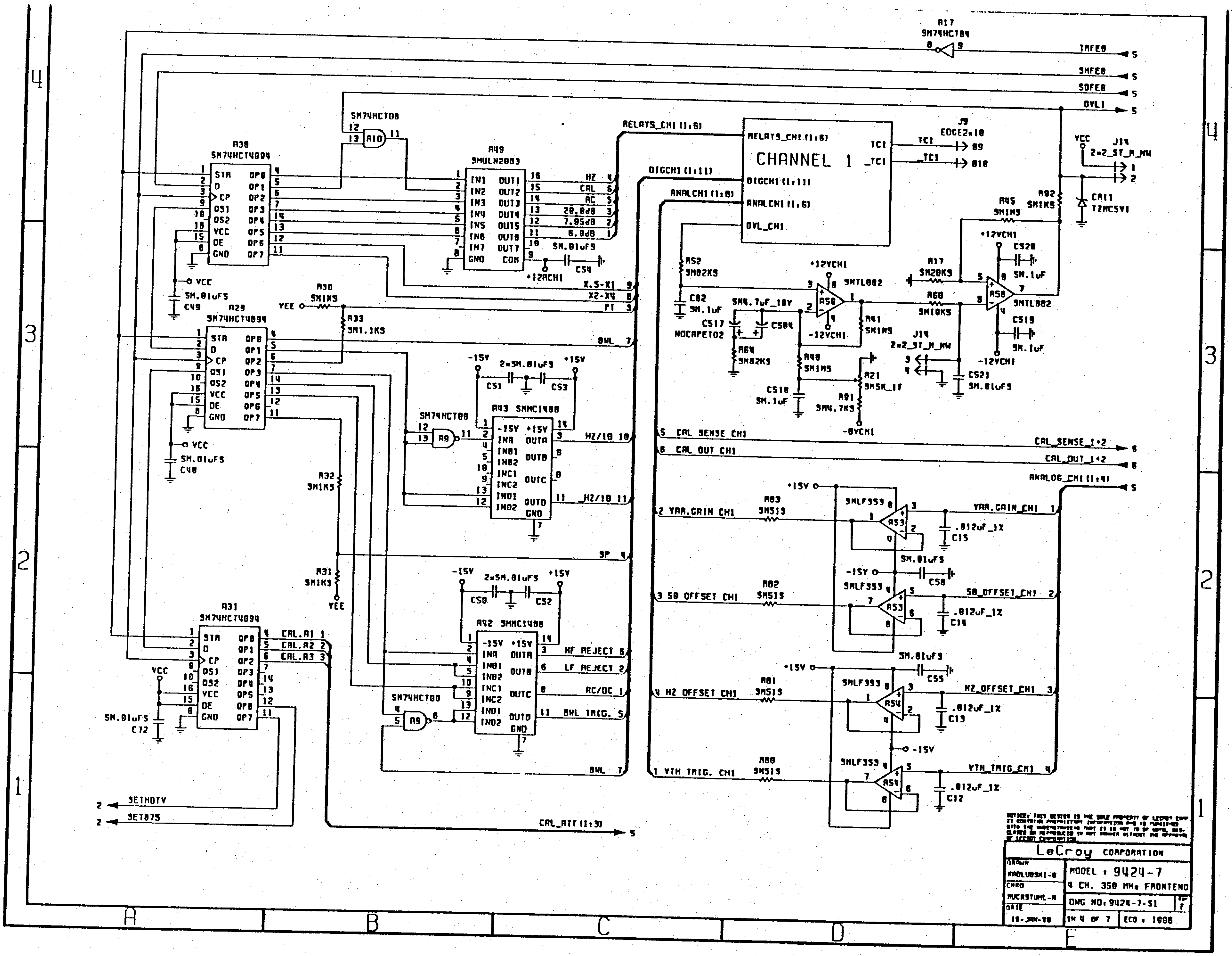
D_7	$NULL	ICT	ICT
D_8	$NULL	ICT	ICT
D_9	$NULL	ICT	ICT
D_10	$NULL	ICT	ICT
D_11	$NULL	ICT	ICT
D_12	$NULL	ICT	ICT
D_13	$NULL	ICT	ICT
D_14	$NULL	ICT	ICT
D_15	$NULL	ICT	ICT
D_16	$NULL	ICT	ICT
D_17	$NULL	ICT	ICT
D_18	$NULL	ICT	ICT
D_19	$NULL	ICT	ICT
D_20	$NULL	ICT	ICT
D_21	$NULL	ICT	ICT
D_22	$NULL	ICT	ICT
D_23	$NULL	ICT	ICT
D_24	$NULL	ICT	ICT
D_25	$NULL	ICT	ICT
D_26	$NULL	ICT	ICT
D_27	$NULL	ICT	ICT
D_28	$NULL	ICT	ICT
D_29	$NULL	ICT	ICT
D_30	$NULL	ICT	ICT
D_31	$NULL	ICT	ICT
DSACK0	$NULL	ICT	ICT
J1	454610096	3x32-RA-M	CONN3X32_RA_M
J3	454211020	2x10-ST-M	CONN2X10_ST_M
MA0	$NULL	ICT	ICT
MA1	$NULL	ICT	ICT
MA2	$NULL	ICT	ICT
MA3	$NULL	ICT	ICT
MA4	$NULL	ICT	ICT
MA5	$NULL	ICT	ICT
MA6	$NULL	ICT	ICT
MA7	$NULL	ICT	ICT
MA8	$NULL	ICT	ICT
MA9	$NULL	ICT	ICT
MD0	$NULL	ICT	ICT
MD1	$NULL	ICT	ICT
MD2	$NULL	ICT	ICT
MD3	$NULL	ICT	ICT
MD4	$NULL	ICT	ICT
MD5	$NULL	ICT	ICT
MD6	$NULL	ICT	ICT
MD7	$NULL	ICT	ICT
MD8	$NULL	ICT	ICT
MD9	$NULL	ICT	ICT
MA10	$NULL	ICT	ICT
MA11	$NULL	ICT	ICT
MA12	$NULL	ICT	ICT
MA13	$NULL	ICT	ICT
MA14	$NULL	ICT	ICT
MD10	$NULL	ICT	ICT
MD11	$NULL	ICT	ICT
MD12	$NULL	ICT	ICT

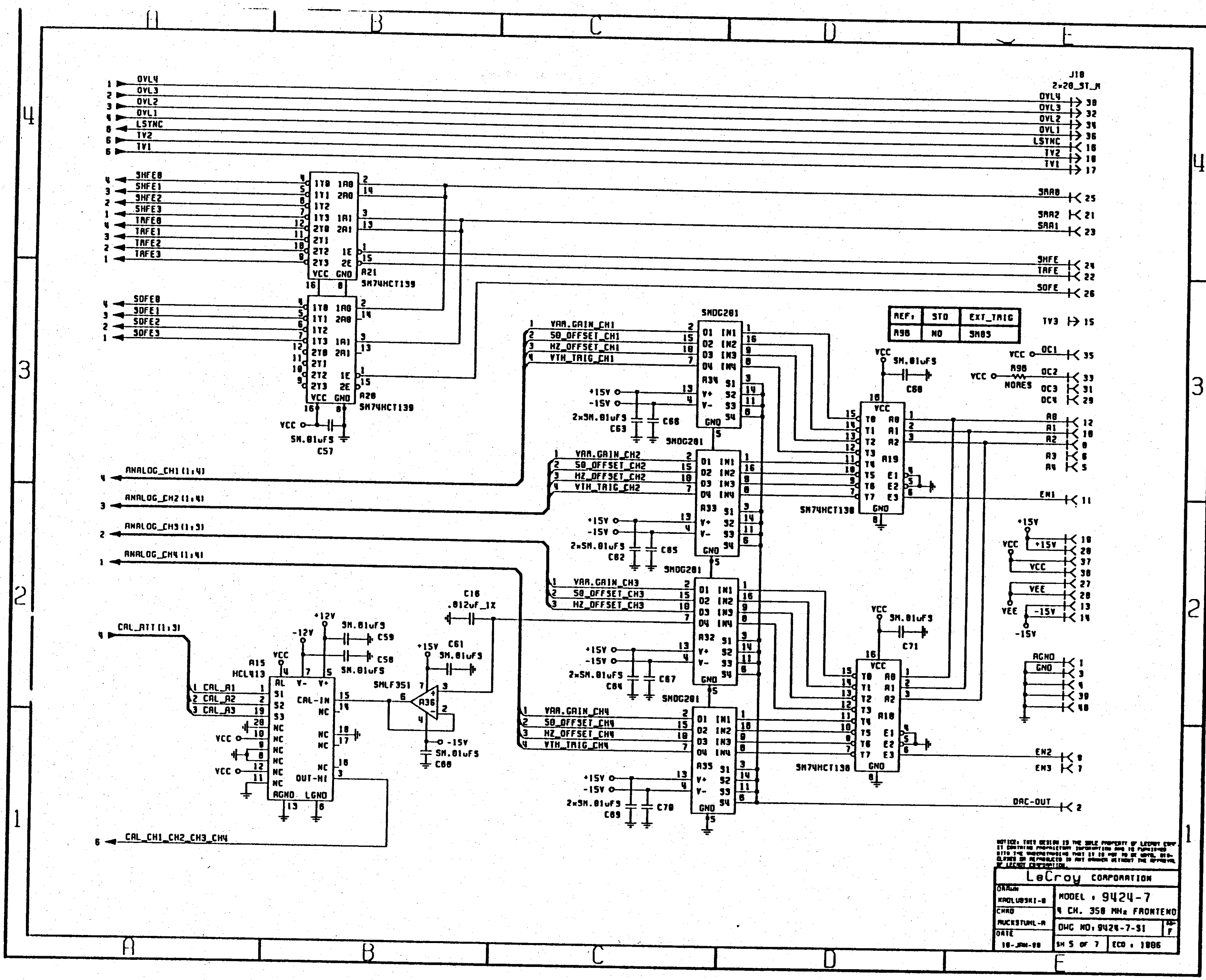
MD13	$NULL	ICT	ICT
MD14	$NULL	ICT	ICT
MD15	$NULL	ICT	ICT
Q1	275110001	2n2907	TO18
Q2	280170104	vn0104	TO92
Q3	280170104	vn0104	TO92
Q4	280170104	vn0104	TO92
Q5	280170104	vn0104	TO92
R1	168531401	'1.21K-1%'	RES07
R2	161225102	1K	RES05
R4	168531585	'100K-1%'	RES07
R5	168531585	'100K-1%'	RES07
R6	168531585	'100K-1%'	RES07
R7	168531229	'19.6-1%'	RES07
R8	161225103	10K	RES05
R9	161225103	10K	RES05
RW	$NULL	ICT	ICT
R10	190042103	10K-SIPC	SIP10RES
R11	190042103	10K-SIPC	SIP10RES
R12	190042103	10K-SIPC	SIP10RES
R13	190042103	10K-SIPC	SIP10RES
R14	161225027	2.7	RES05
R15	168531601	'147K-1%'	RES07
R16	161225206	20M	RES05
R17	161225102	1K	RES05
R18	161225102	1K	RES05
R21	161225102	1K	RES05
R22	190842102	1K-8SIPC	SIP8RES
R24	161225206	20M	RES05
R25	168531449	'3.83K-1%'	RES07
R26	168531633	'316K-1%'	RES07
R28	161225391	390	RES05
R29	161225391	390	RES05
R30	161225391	390	RES05
R31	168531389	'909-1%'	RES07
R32	161225027	2.7	RES05
R33	161225102	1K	RES05
R34	161225102	1K	RES05
R35	161225472	4.7K	RES05
R36	190832220	22-8SS	SIP8RES
R37	161225103	10K	RES05
R38	161225103	10K	RES05
R_W	$NULL	ICT	ICT
SW1	411430002	BD04	DIP8
SIZE0	$NULL	ICT	ICT
SIZE1	$NULL	ICT	ICT
X1	310111032	32.768KHz	MX_1V
_AS	$NULL	ICT	ICT
_DS	$NULL	ICT	ICT
_CEM	$NULL	ICT	ICT
_ECS	$NULL	ICT	ICT
_EOS	$NULL	ICT	ICT
_OEM	$NULL	ICT	ICT
_RMC	$NULL	ICT	ICT
_WEM	$NULL	ICT	ICT
_CFPC	$NULL	ICT	ICT


CHANNEL 4
LeCroy CORPORATION
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: 9424-7-S1
SH 1 OF 7
ECO : 1006
DRAWN KROLUBSKI-B
CHKD RUCKSTUHL-R
DATE 18-JAN-88
SN74HCT4094
SNULN2003
SNMC1488
SNLF353
SNTL082
RELAYS_CH4 (1:6)
DIGCH4 (1:11)
ANALCH4 (1:8)
ANALOG_CH4 (1:4)
CAL_SENSE_3+4
CAL_OUT_3+4
TAFE3
SHFE3
SDFE3
OVL4

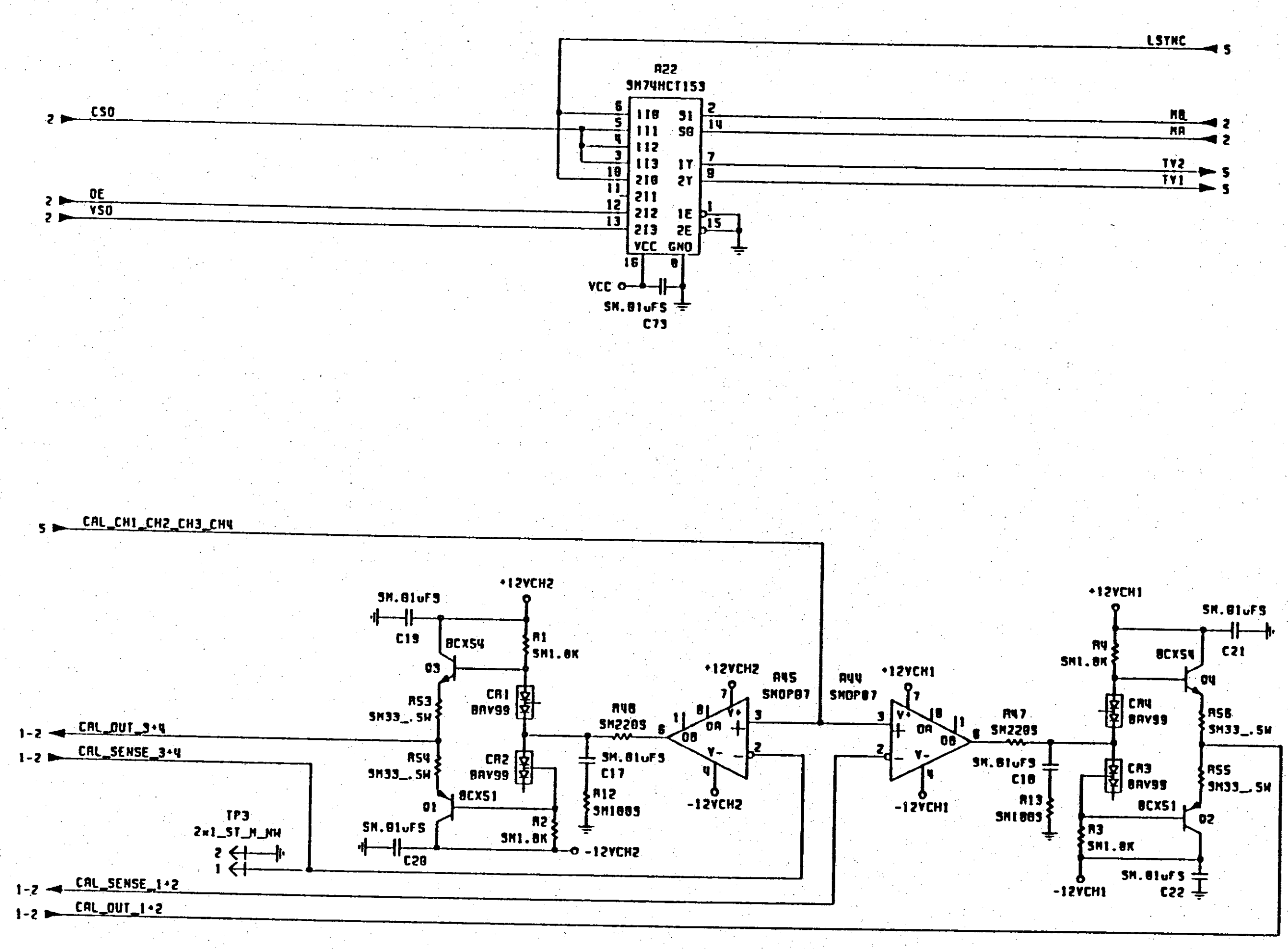

LeCroy CORPORATION
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: 9424-7-S1
F
SH 2 OF 7
ECO : 1086
DRAWN KROLUBSKI-B
CHKD RUCKSTUHL-R
DATE 10-JAN-90
CHANNEL 3
RELAYS_CH3(1:6)
DIGCH3(7:11)
ANALCH3(2:6)
OVL_CH3
CS0
VS0
OE
SETHDIV
SET075
TRFE2
SHFE2
SDFE2
OVL3
CAL_SENSE_3-4
CAL_OUT_3-4
ANALOG_CH3(1:3)
VAR.GAIN_CH3
50_OFFSET_CH3
HZ_OFFSET_CH3
CAL SENSE CH3
CAL OUT CH3
VAR.GAIN CH3
50 OFFSET CH3
HZ OFFSET CH3
HZ/10 10
HZ/10 11
X.5-X1
X2-X4
BWL
MA
MB
SM74HCT4094
SMULN2083
SMMC1488
SM74HCT08
SM74HCT04
SMTL082
SMLF353
CHANNEL 3


CHANNEL 2
RELAYS_CH2(1:6)
DIGCH2(1:11)
ANALCH2(1:6)
OVL_CH2
TC2
_TC2
J9 EDGE2x18
J13 2x2_ST_M_MH
CR18 TZMCSV1
TAFE1
SHFE1
SDFE1
OVL2
R17 SM74HCT04
R20 SM74HCT4094
R27 SM74HCT4094
R40 SMULN2003
R41 SMMC1488
R48 SMMC1488
SM74HCT08
HZ
CAL
AC
20.0dB
7.95dB
6.0dB
X.5-X1
X2-X4
PT
BWL
SP
HZ/10
_HZ/10
HF REJECT
LF REJECT
AC/DC
BWL TRIG.
CAL_SENSE_1+2
CAL_OUT_1+2
ANALOG_CH2(1:4)
5 CAL SENSE CH2
6 CAL OUT CH2
2 VAR.GAIN CH2
3 50 OFFSET CH2
4 HZ OFFSET CH2
1 VTH TRIG. CH2
VAR.GAIN_CH2
50_OFFSET_CH2
HZ_OFFSET_CH2
VTH_TRIG_CH2
SMLF353
SMTL082
+12VCH2
-12VCH2
-8VCH2
+12RCH2
VCC
VEE
+15V
-15V
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.
LeCroy CORPORATION
DRAWN KAOLUBSKI-D
CHKD RUCKSTUHL-R
DATE 10-JAN-90
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: 9424-7-S1
REV F
SH 3 OF 7
ECO : 1086

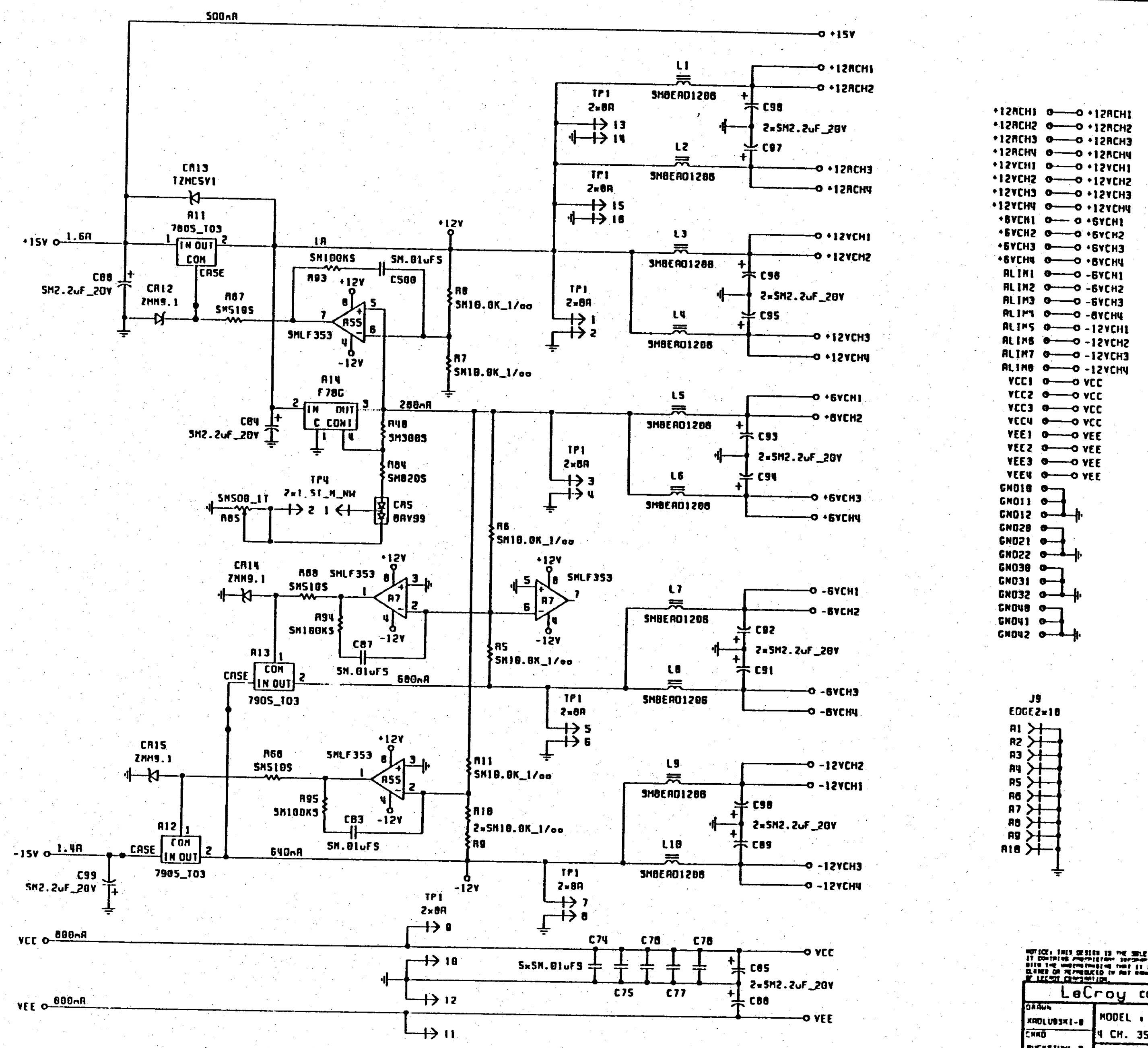

CHANNEL 1
RELAYS_CH1 (1:6)
DIGCH1 (1:11)
ANALCH1 (1:6)
OVL_CH1
TC1
_TC1
J9 EDGE2=10
J14 2=2_ST_M_MW
CR11 T2MC5V1
TRFE0
SHFE0
SOFE0
OVL1
A17 SM74HCT04
A30 SM74HCT4094
A29 SM74HCT4094
A31 SM74HCT4094
A49 SMULN2003
A10 SM74HCT08
A9 SM74HCT08
A43 SMMC1488
A42 SMMC1488
A56 SMTL082
A58 SMTL082
A53 SMLF353
A54 SMLF353
HZ
CAL
AC
20.0dB
7.95dB
6.0dB
X.5-X1
X2-X4
PT
BWL
HZ/10
SP
HF REJECT
LF REJECT
AC/DC
BWL TRIG.
CAL.A1
CAL.A2
CAL.A3
CAL_ATT (1:3)
SETHOTV
SET075
CAL SENSE CH1
CAL OUT CH1
CAL_SENSE_1+2
CAL_OUT_1+2
ANALOG_CH1 (1:4)
VAR.GAIN CH1
VAR.GAIN_CH1
50 OFFSET CH1
50_OFFSET_CH1
HZ OFFSET CH1
HZ_OFFSET_CH1
VTH TRIG. CH1
VTH_TRIG_CH1
+12VCH1
-12VCH1
-8VCH1
+12ACH1
+15V
-15V
VCC
VEE
LeCroy CORPORATION
DRAWN KAOLUBSKI-B
CHKD MUCKSTUHL-R
DATE 19-JAN-88
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: 9424-7-S1
F
SH 4 OF 7
ECO : 1006



J18
2x20_ST_M
OVL4
OVL3
OVL2
OVL1
LSYNC
TV2
TV1
SHFE0
SHFE1
SHFE2
SHFE3
TAFE0
TAFE1
TAFE2
TAFE3
SOFE0
SOFE1
SOFE2
SOFE3
SAA0
SAA2
SAA1
SHFE
TAFE
SOFE
A21
SN74HCT139
A20
SN74HCT139
VCC
5M.01uFS
C57
ANALOG_CH1(1:4)
ANALOG_CH2(1:4)
ANALOG_CH3(1:3)
ANALOG_CH4(1:4)
CAL_ATT(1:3)
CAL_CH1_CH2_CH3_CH4
SMDG201
VAR.GAIN_CH1
50_OFFSET_CH1
HZ_OFFSET_CH1
VTH_TRIG_CH1
VAR.GAIN_CH2
50_OFFSET_CH2
HZ_OFFSET_CH2
VTH_TRIG_CH2
VAR.GAIN_CH3
50_OFFSET_CH3
HZ_OFFSET_CH3
VAR.GAIN_CH4
50_OFFSET_CH4
HZ_OFFSET_CH4
VTH_TRIG_CH4
A34
A33
A32
A35
+15V
-15V
2x5M.01uFS
C63
C66
C62
C65
C64
C67
C69
C70
A19
A18
SN74HCT138
C68
C71
REF. | STD | EXT_TRIG
A98 | NO | SM05
TV3
OC1
OC2
OC3
OC4
A98
NORES
A0
A1
A2
A3
A4
EN1
EN2
EN3
DAC-OUT
VEE
AGND
GND
C16
.012uF_1%
+12V
-12V
C59
C58
A15
HCL413
CAL_A1
CAL_A2
CAL_A3
CAL-IN
OUT-HI
AGND
LGND
SMLF351
A36
C61
C60
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE COPIED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.
LeCroy CORPORATION
DRAWN KAOLUBSKI-B
CHKD RUCKSTUHL-R
DATE 18-JAN-88
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: 9424-7-S1
REV F
SH 5 OF 7
ECO : 1086

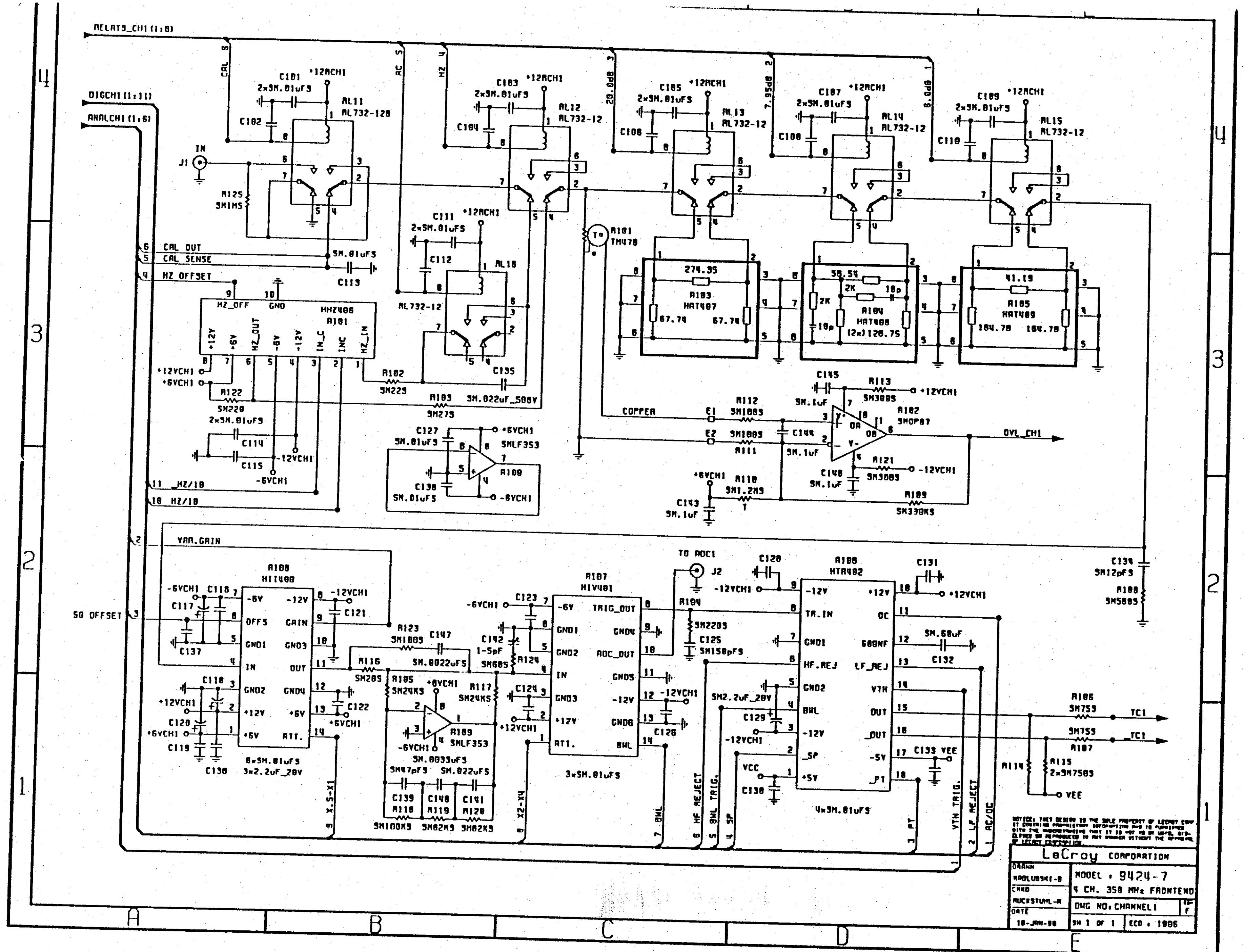


LeCroy CORPORATION	
DRAWN KAOLUBSKI-B	MODEL : 9424-7
CHKD RUCKSTUHL-A	4 CH. 350 MHz FRONTEND
DATE 10-JAN-90	DWG NO: 9424-7-S1
SH 8 OF 7	ECO : 1956

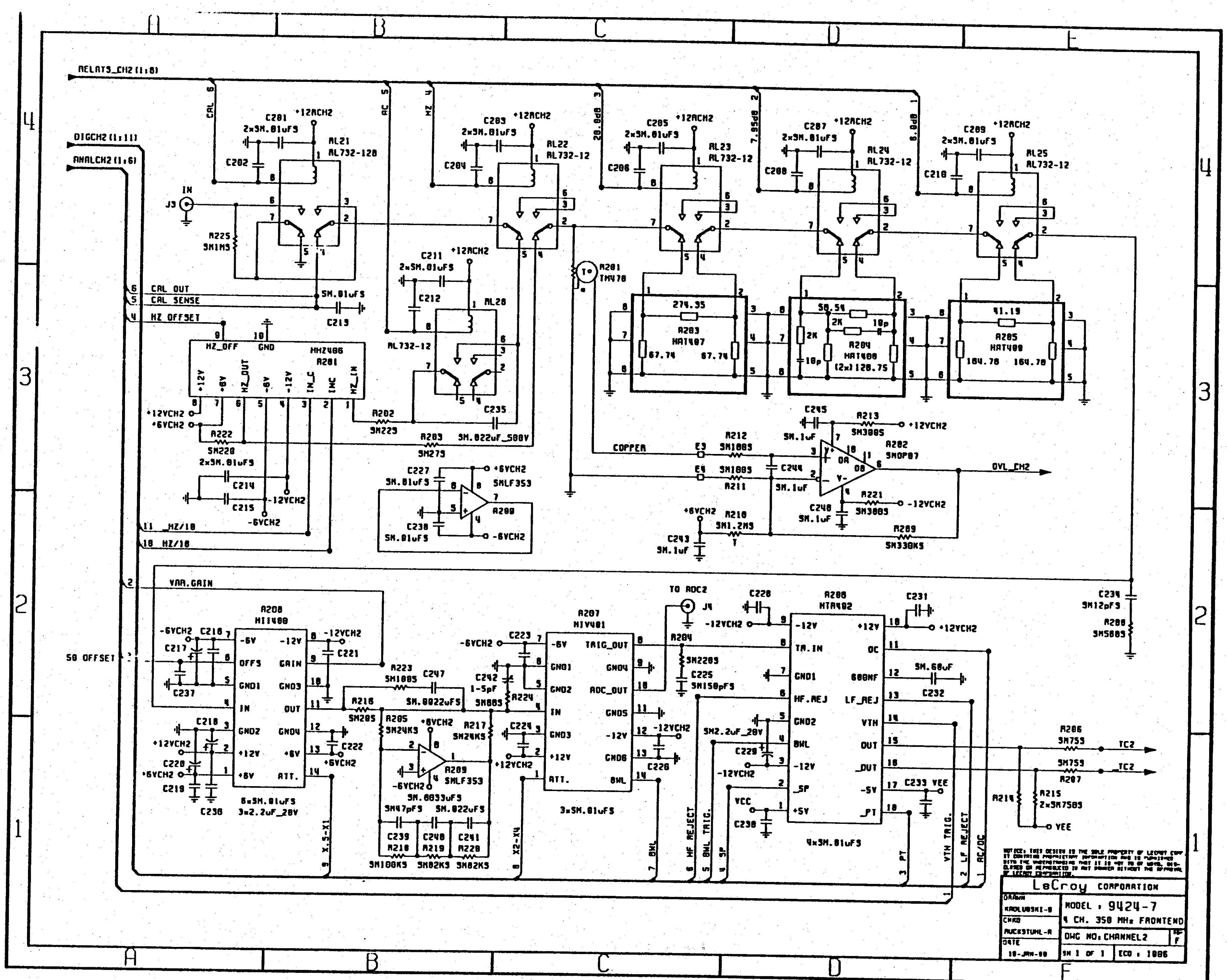


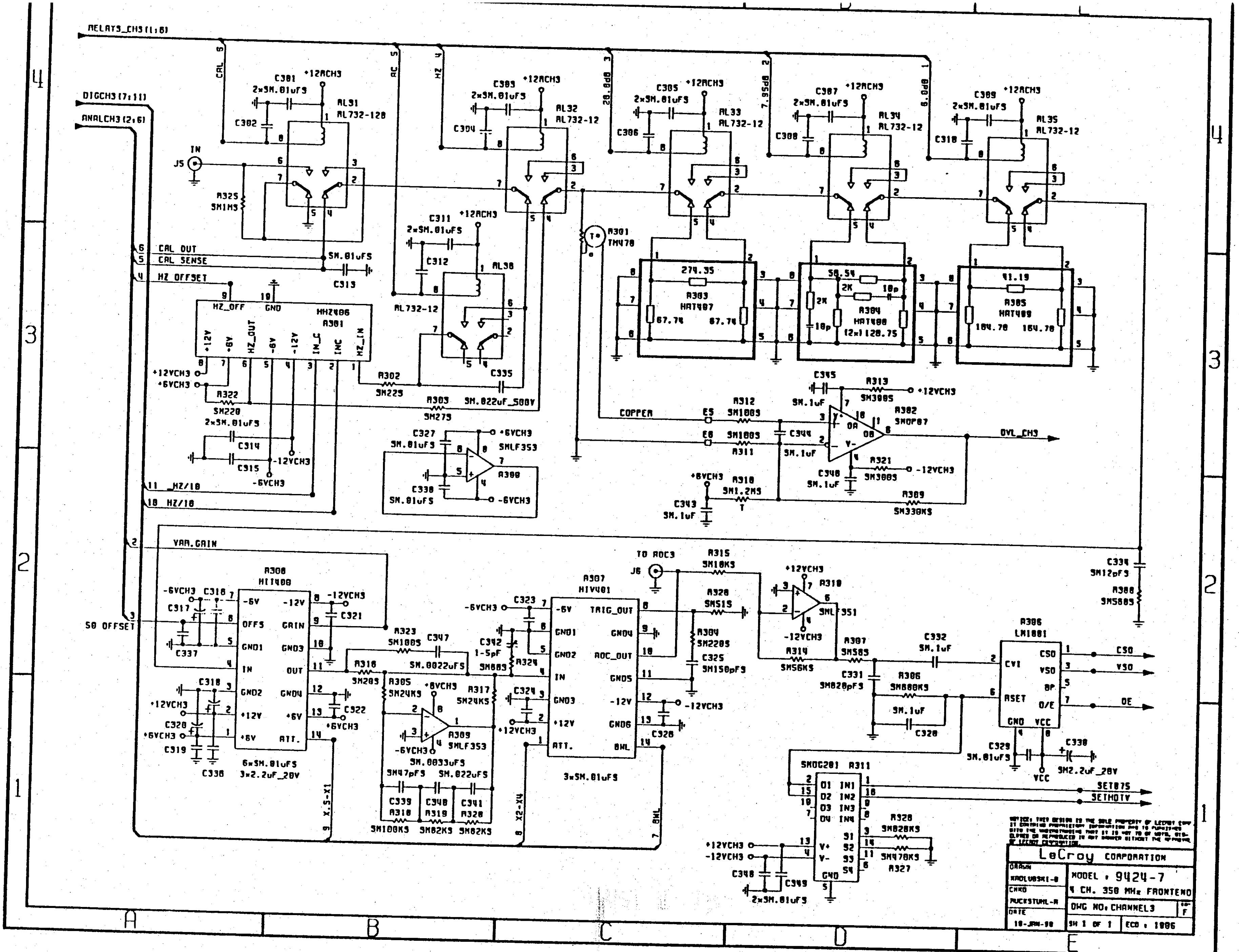
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE COPIED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.

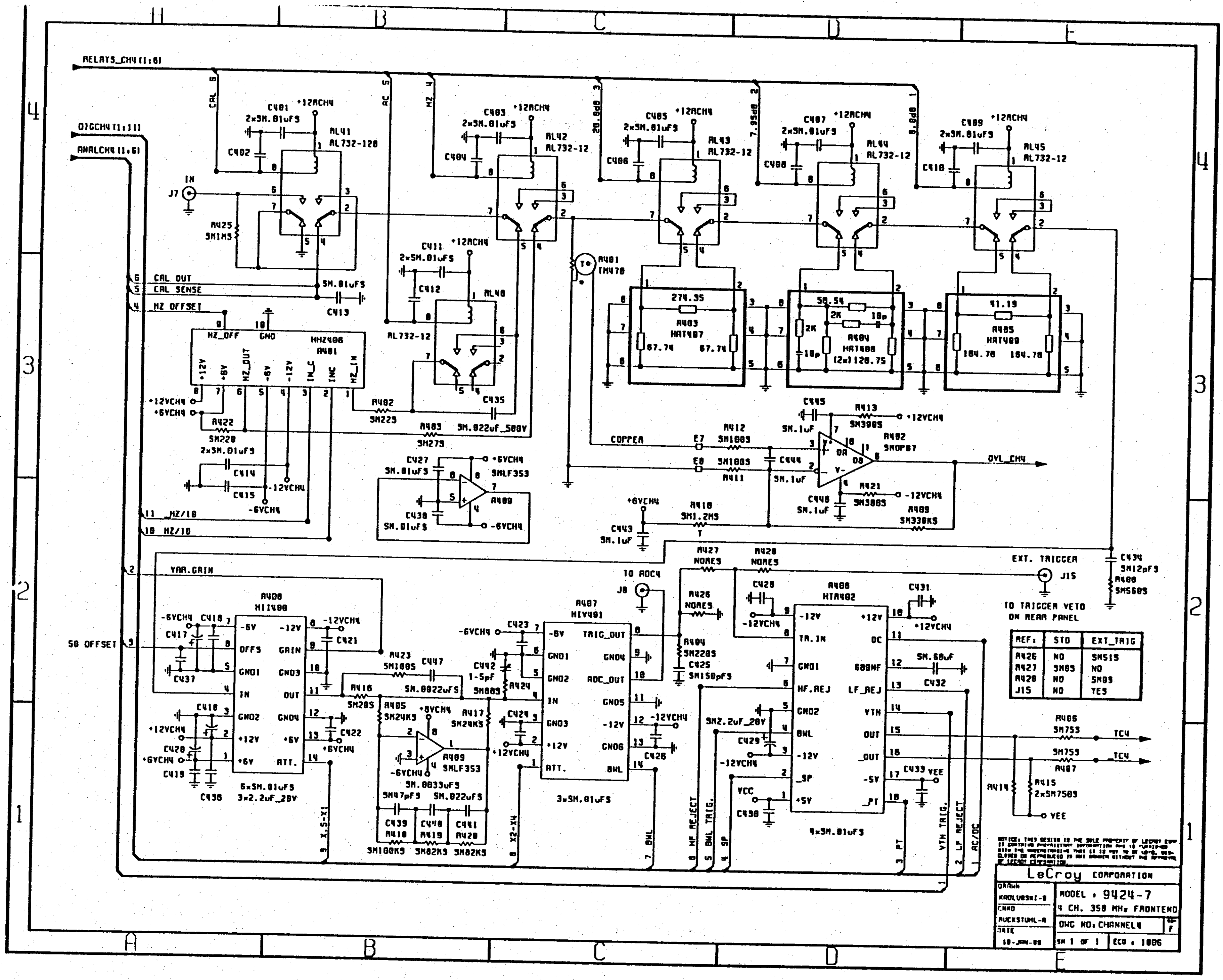
LeCroy CORPORATION	
DRAWN KAOLUBSKI-B	MODEL : 9424-7
CHKD RUCKSTUHL-R	4 CH. 350 MHz FRONTEND
DATE 18-JAN-88	DWG NO: 9424-7-S1 F
	SH 7 OF 7 ECO : 1006



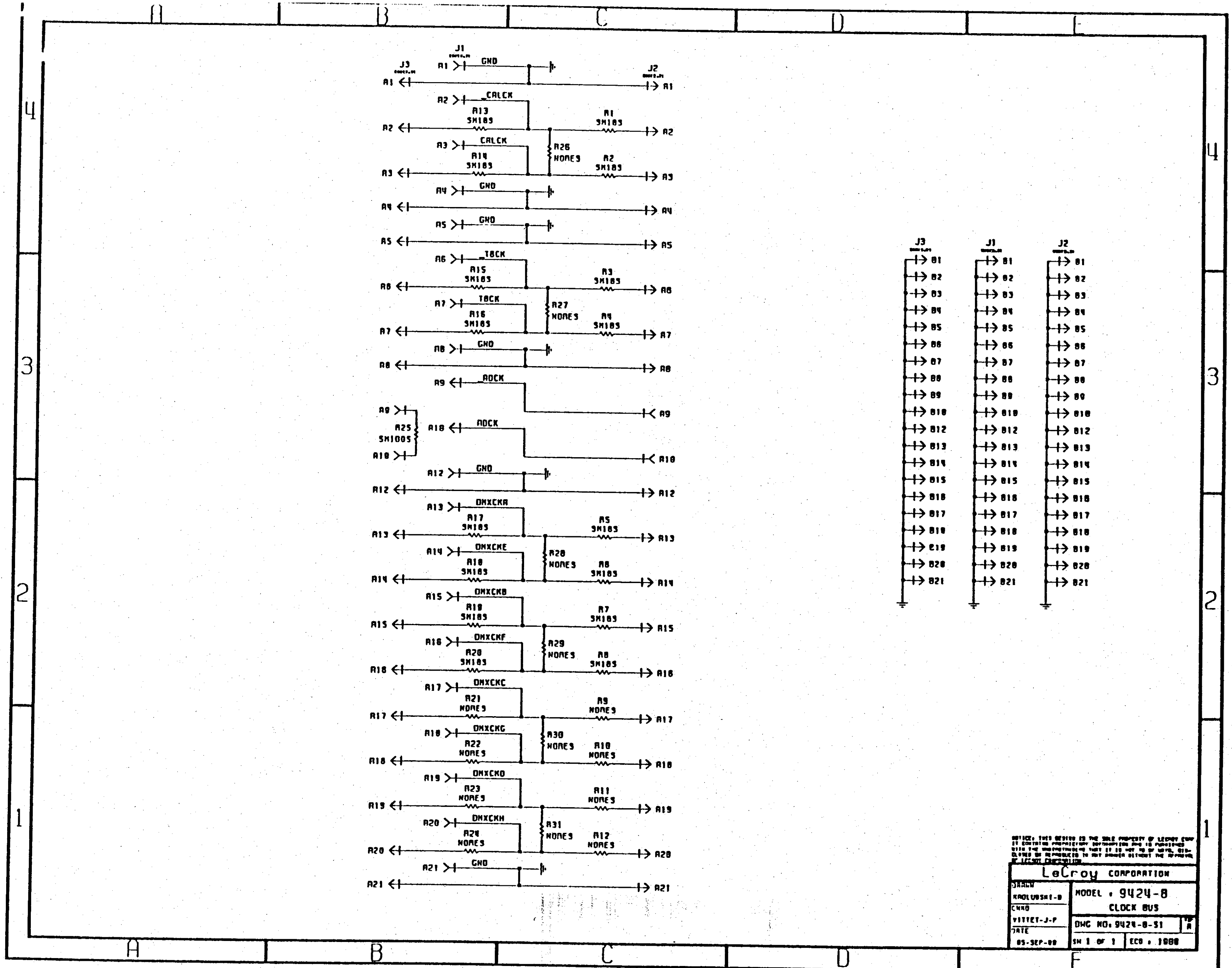
LeCroy CORPORATION
DRAWN KAOLUBSKI-B
CHKD AUCKSTUHL-A
DATE 18-JAN-90
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: CHANNEL1
SH 1 OF 1
ECO : 1806


LeCroy CORPORATION
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: CHANNEL2
SH 1 OF 1
ECO : 1086
DRAWN KAOLUBSKI-G
CHKD RUCKSTUHL-R
DATE 18-JAN-88
RELAYS_CH2(1:8)
DIGCH2(1:11)
ANALCH2(1:6)
IN
J3
TO ADC2
J4
CAL OUT
CAL SENSE
HZ OFFSET
VAR.GAIN
50 OFFSET
OVL_CH2
COPPER
TC2
_TC2
VEE
VCC

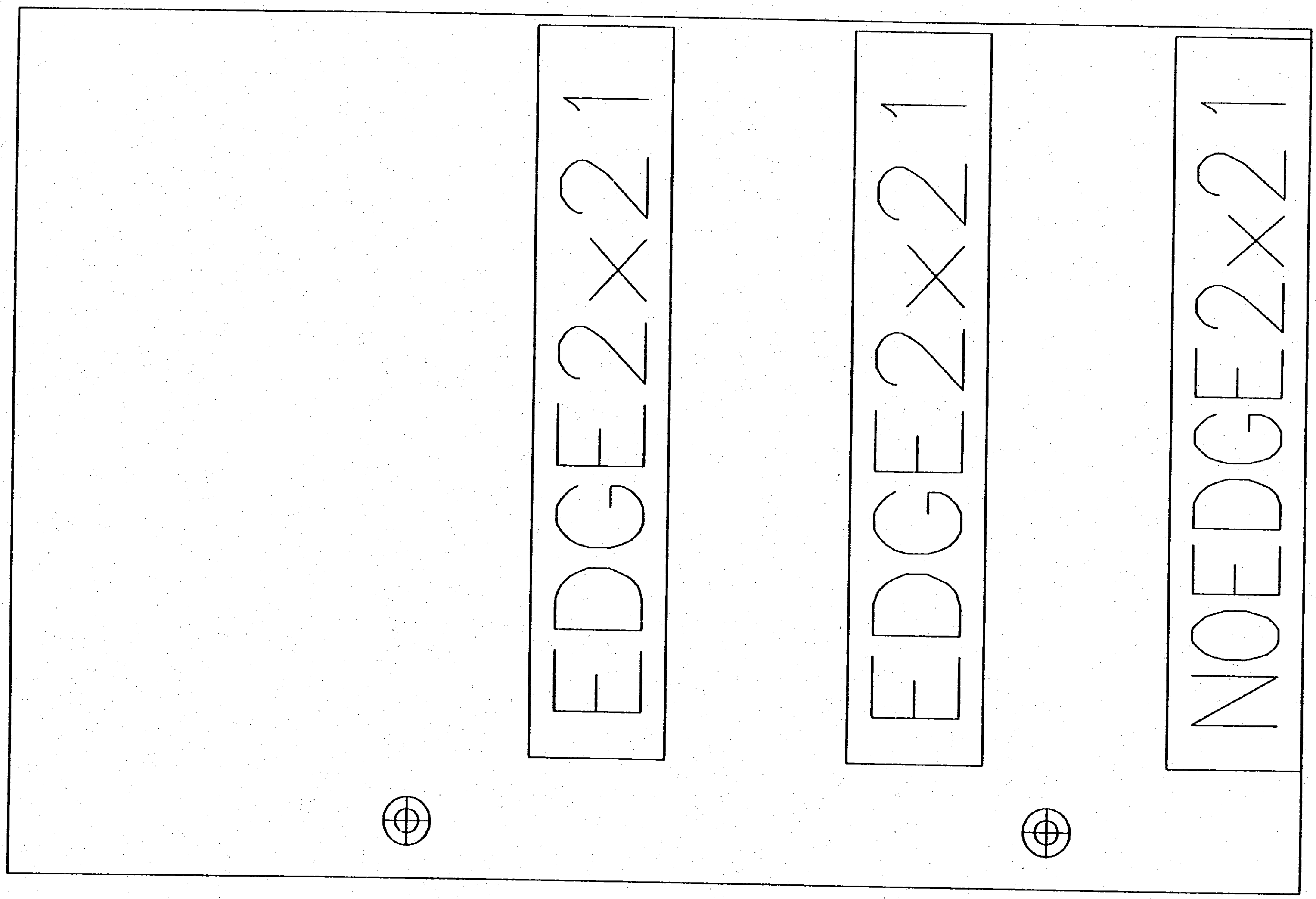

LeCroy CORPORATION
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: CHANNEL3
SH 1 OF 1
ECO : 1086
DRAWN KROLUBSKI-B
CHKD RUCKSTUHL-R
DATE 18-JAN-88



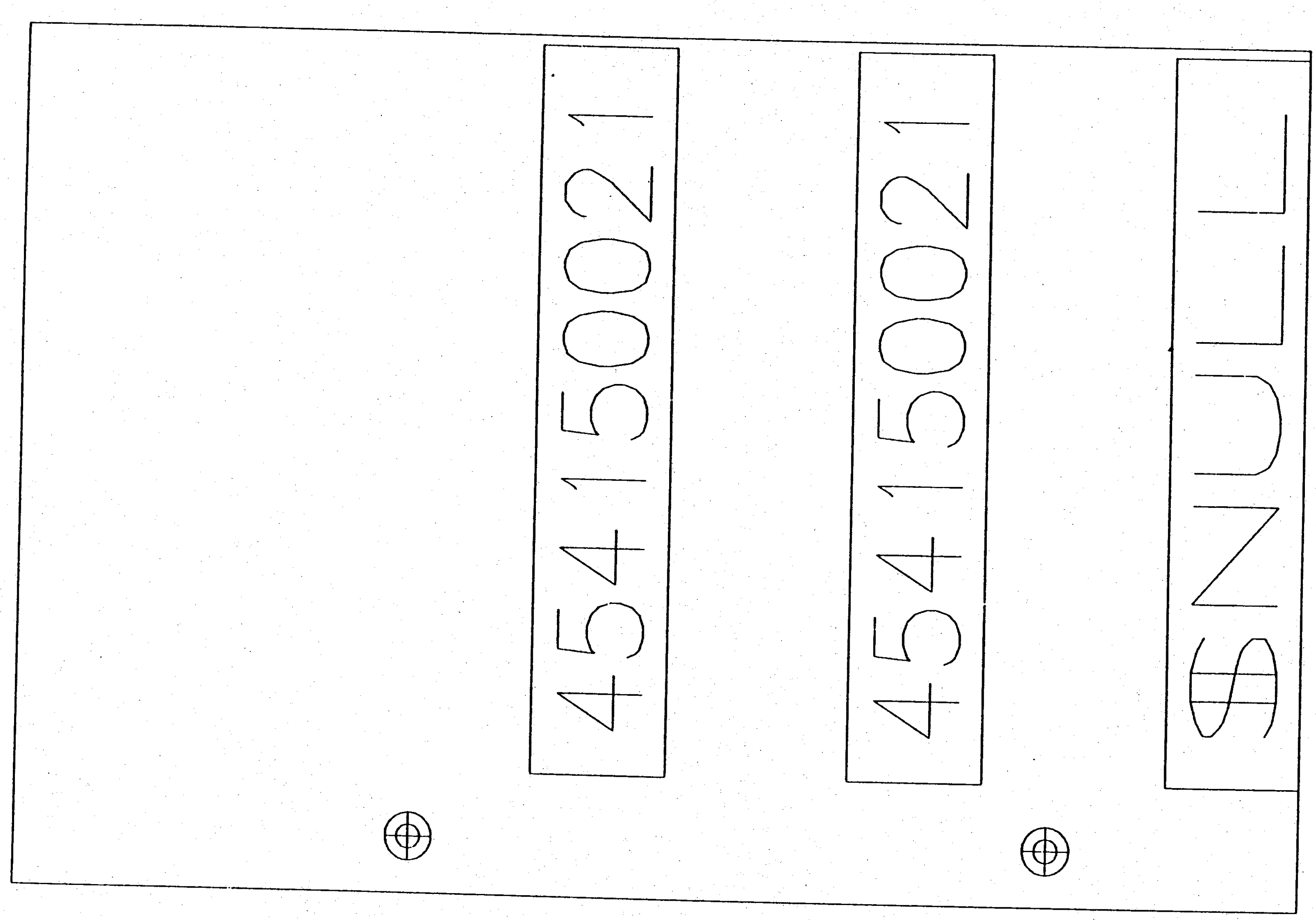
RELAYS_CH4(1:6)
DIGCH4(1:11)
ANALCH4(1:6)
50 OFFSET
TO ADC4
EXT. TRIGGER
TO TRIGGER VETO ON REAR PANEL
OVL_CH4
TC4
_TC4
LeCroy CORPORATION
MODEL : 9424-7
4 CH. 350 MHz FRONTEND
DWG NO: CHANNEL4
SH 1 OF 1
ECO : 1006



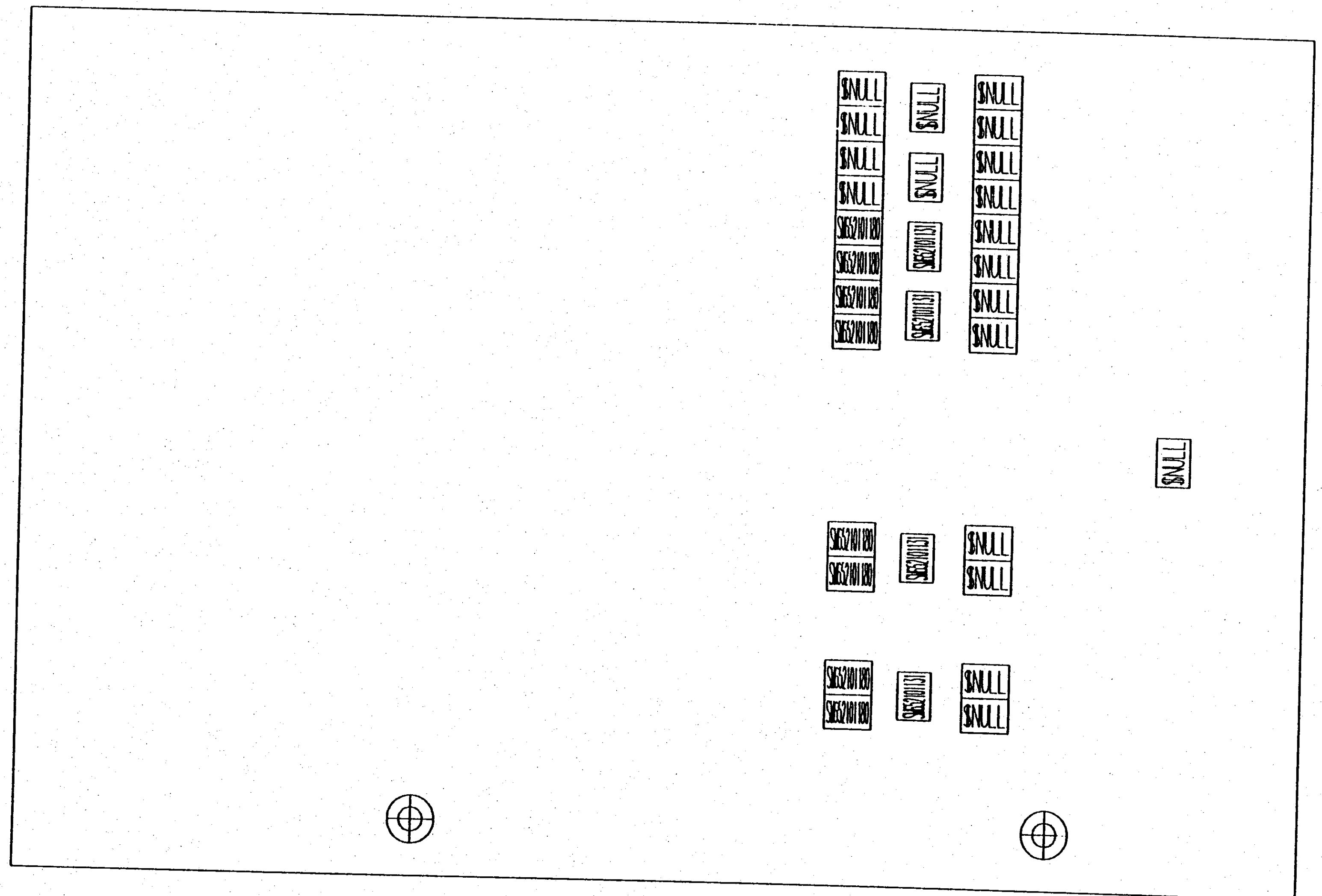
J1
J2
J3
GND
_CALCK
CALCK
_TBCK
TBCK
_ADCK
ADCK
DMXCKA
DMXCKE
DMXCKB
DMXCKF
DMXCKC
DMXCKG
DMXCKD
DMXCKH
R25
5M100S
NOMES
5M18S
LeCroy CORPORATION
DRAWN
CHKD
VITTET-J-P
DATE
05-SEP-88
MODEL : 9424-8
CLOCK BUS
DWG NO: 9424-8-51
A
SH 1 OF 1
ECO : 1888



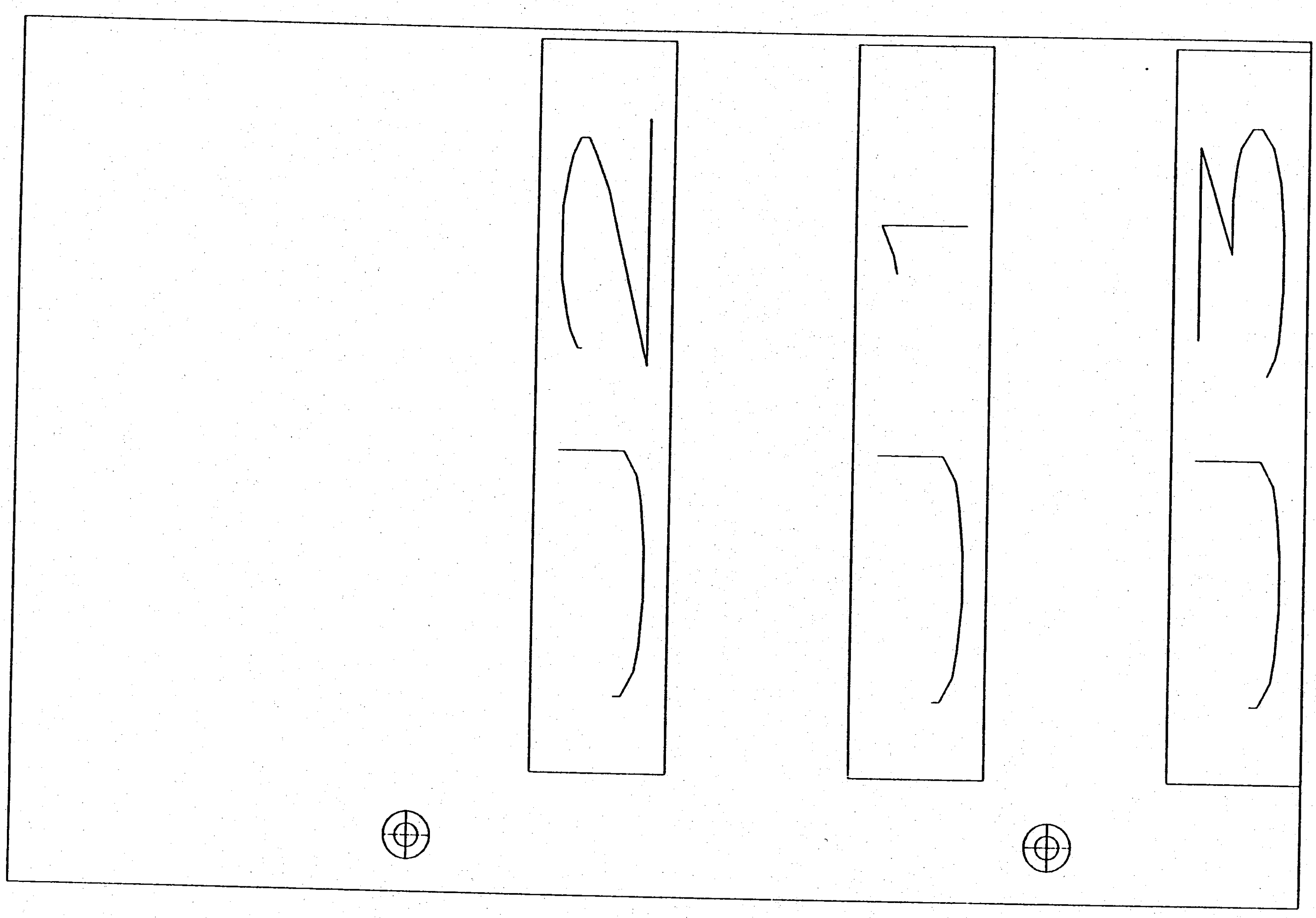
$9420_8 Rev:B



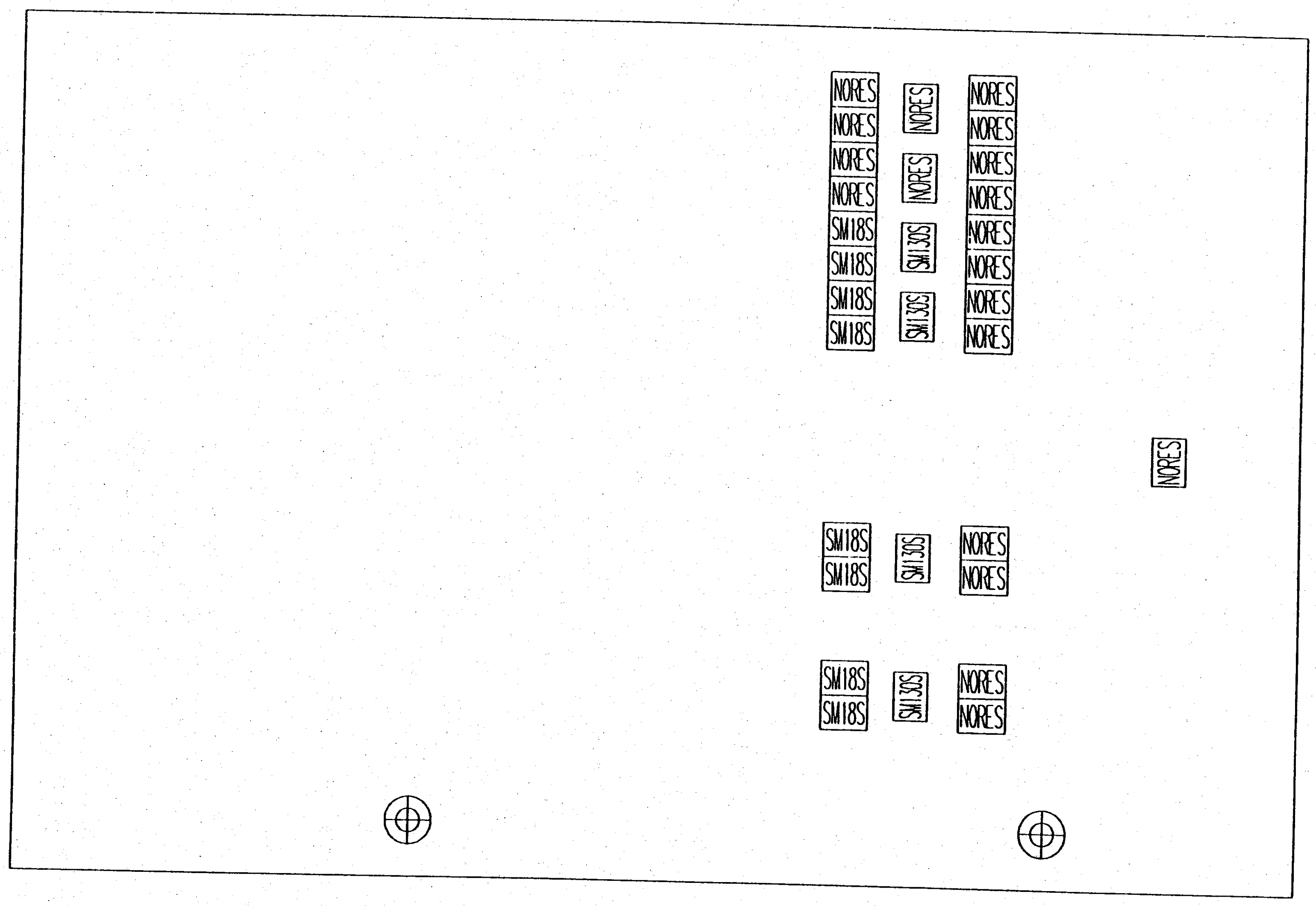
$9420_8 Rev:B


$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL
$NULL

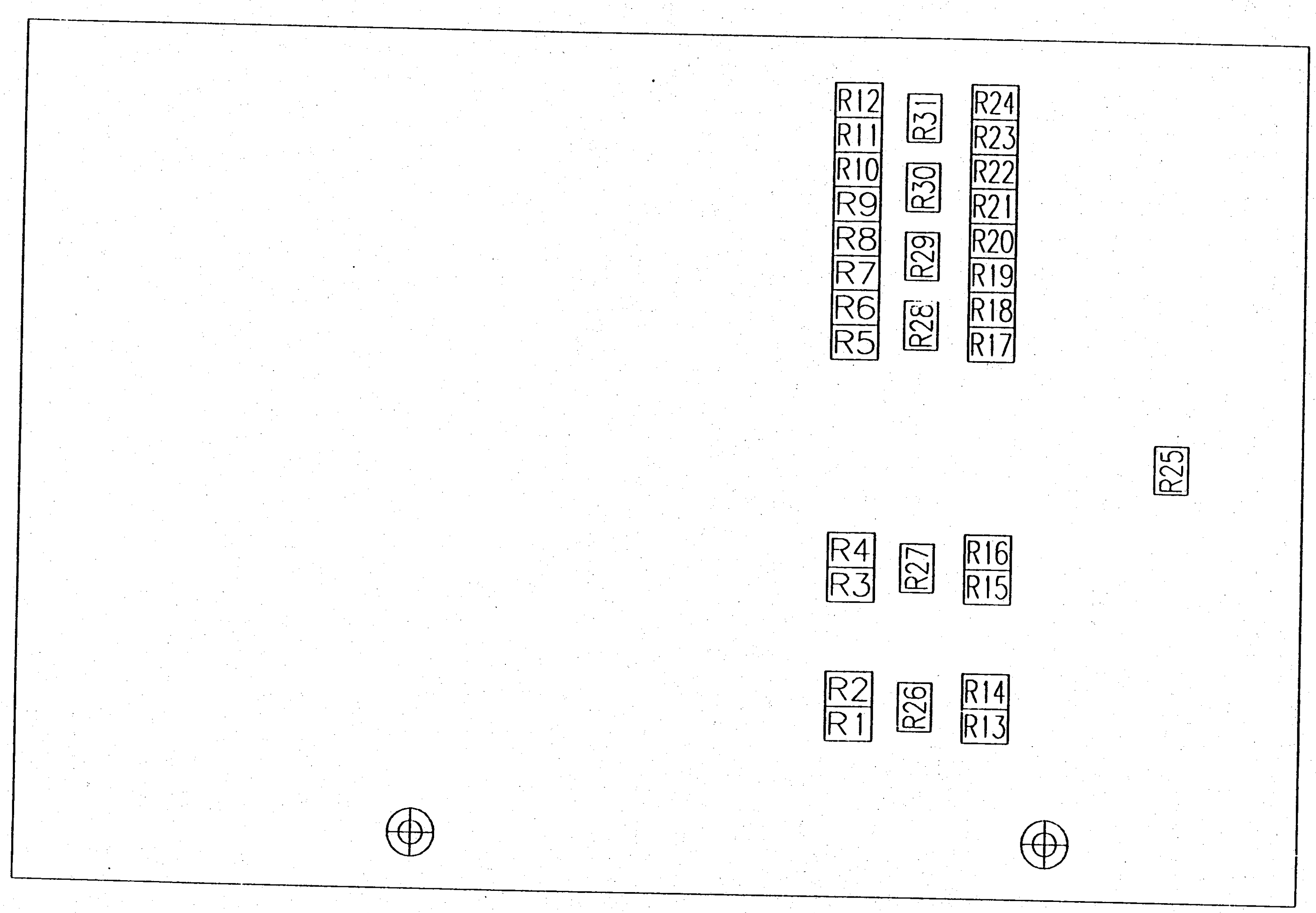
$9420_8 Rev:B



S9420_8 Rev:B



$9420_8 Rev:B


R12
R11
R10
R9
R8
R7
R6
R5
R31
R30
R29
R28
R24
R23
R22
R21
R20
R19
R18
R17
R25
R4
R3
R27
R16
R15
R2
R1
R26
R14
R13

S9420_8 Rev:B

J1	454150021	EDGE2x21	EDGE2X21
J2	454150021	EDGE2x21	EDGE2X21
J3	$NULL	NOEDGE2x21	EDGE2X21
R1	SM652101180	SM18S	SM0805
R2	SM652101180	SM18S	SM0805
R3	SM652101180	SM18S	SM0805
R4	SM652101180	SM18S	SM0805
R5	SM652101180	SM18S	SM0805
R6	SM652101180	SM18S	SM0805
R7	SM652101180	SM18S	SM0805
R8	SM652101180	SM18S	SM0805
R9	$NULL	NORES	SM0805
R10	$NULL	NORES	SM0805
R11	$NULL	NORES	SM0805
R12	$NULL	NORES	SM0805
R13	$NULL	NORES	SM0805
R14	$NULL	NORES	SM0805
R15	$NULL	NORES	SM0805
R16	$NULL	NORES	SM0805
R17	$NULL	NORES	SM0805
R18	$NULL	NORES	SM0805
R19	$NULL	NORES	SM0805
R20	$NULL	NORES	SM0805
R21	$NULL	NORES	SM0805
R22	$NULL	NORES	SM0805
R23	$NULL	NORES	SM0805
R24	$NULL	NORES	SM0805
R25	$NULL	NORES	SM0805
R26	SM652101131	SM130S	SM0805
R27	SM652101131	SM130S	SM0805
R28	SM652101131	SM130S	SM0805
R29	SM652101131	SM130S	SM0805
R30	$NULL	NORES	SM0805
R31	$NULL	NORES	SM0805

Chapter 7

MECHANICAL PARTS

Table of contents:

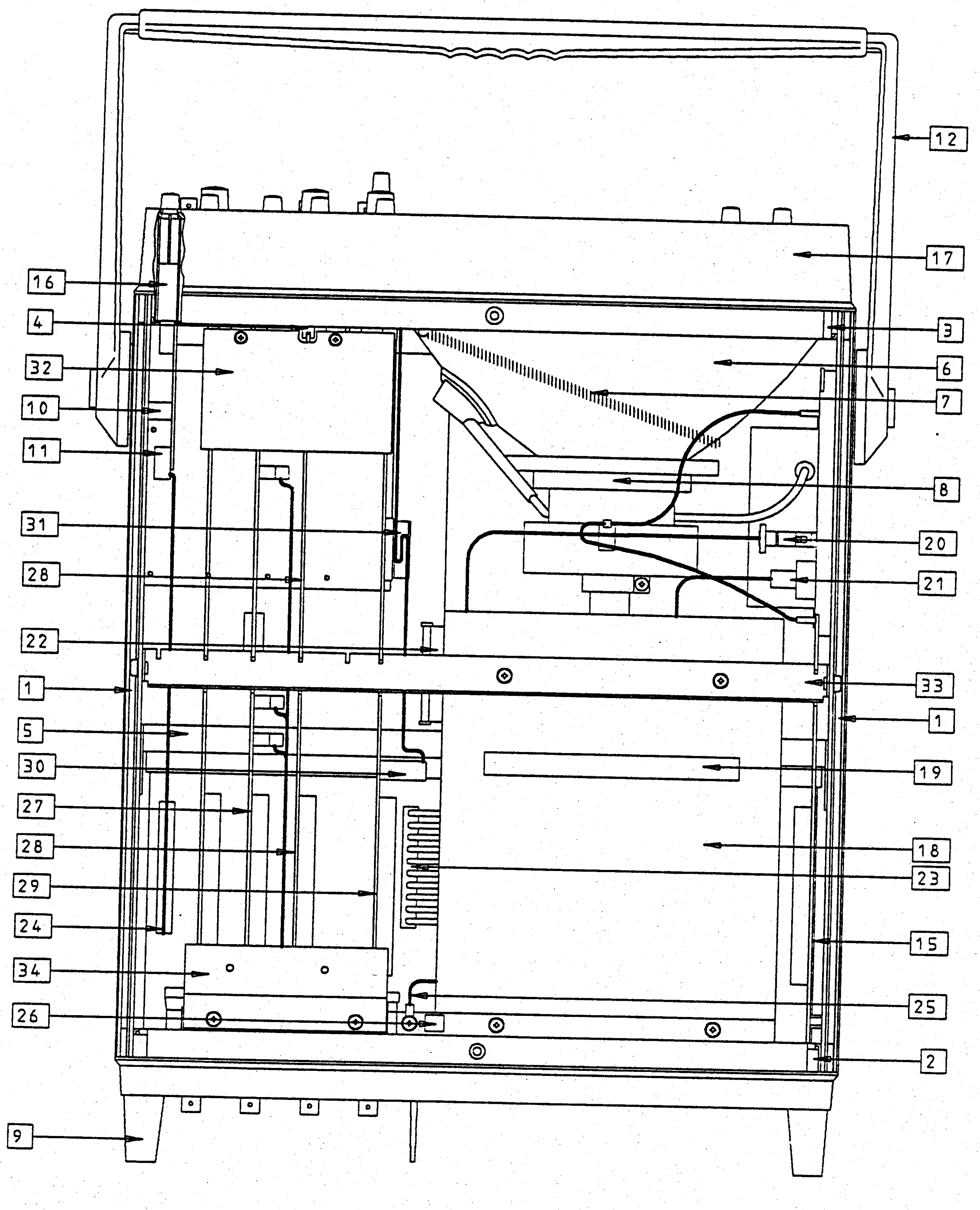

12
17
16
4
3
6
32
7
10
11
8
31
20
28
21
22
33
1
1
5
19
30
27
18
28
23
29
24
15
34
25
26
2
9

Figure 7.1

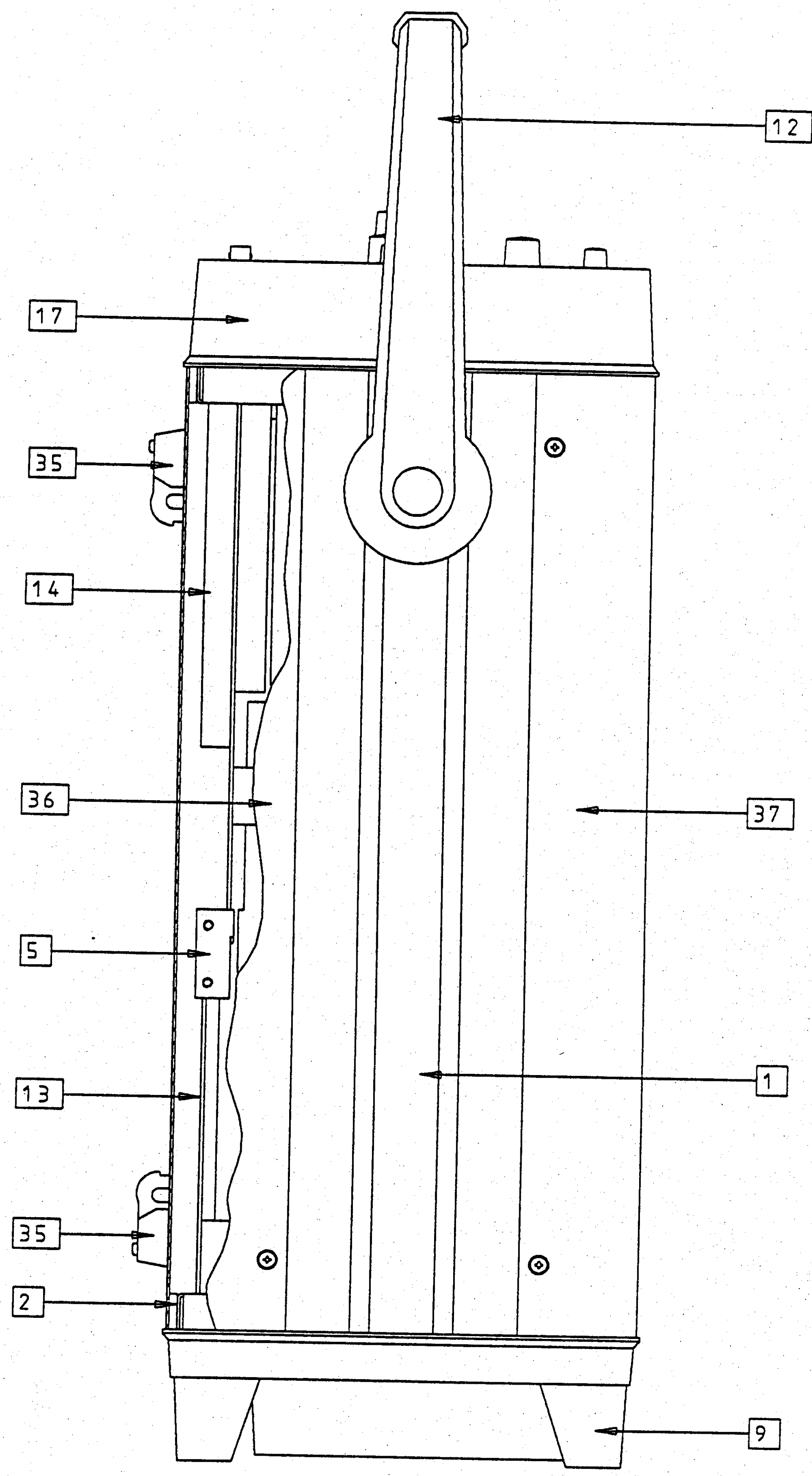
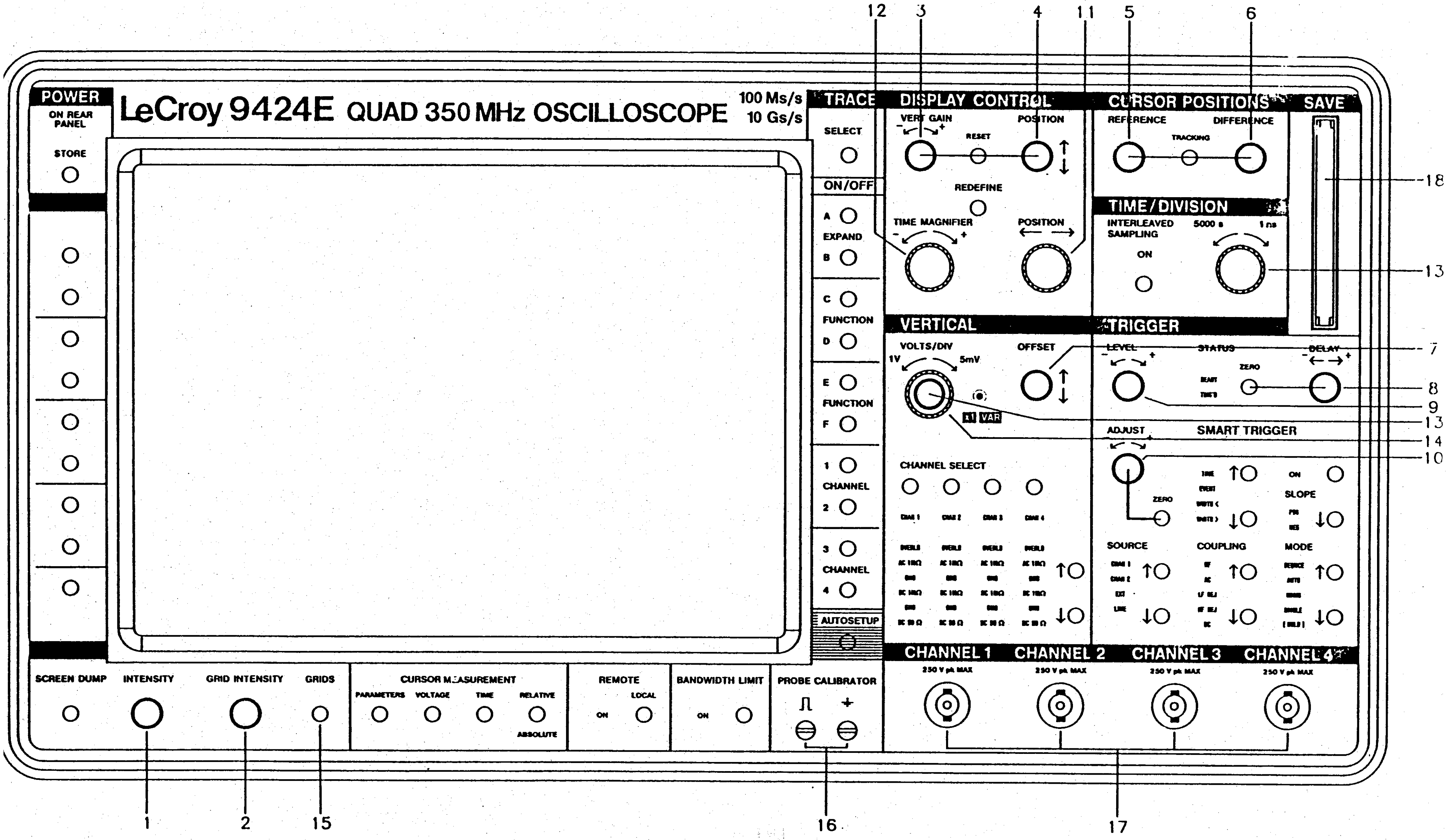


Figure 7.2

ASSEMBLAGE SEQUENCE OF PARTS				SCREWS		WASHERS		NUTS	
POS	DESCRIPTION	PART NUMBER	QTY	PART NUMBER	QTY	PART NUMBER	QTY	PART NUMBER	QTY
1	SIDE PANEL	709 424 021	2						
2	REAR SUPPORT	709 424 041	1	550 440 108	4	551 440 300	4		
3	DISPLAY SUPPORT	709 424 031	1	550 440 108	4	551 440 300	4		
4	CARD GUIDE	530 410 001	5	550 430 104	10	551 430 300	10		
5	MOTHER CARD SUPPORT	709 424 051	1	550 440 108	4	551 440 300	4		
6	CRT ORANGE	321 220 009	1	550 440 416	4	554 440 202	4	552 440 100	4
						709 450 071	4		
7	SPRING EXT TYPE 190mm	554 310 001	1						
8	DEFLECTION YOKE	300 090 001	1						
9	REAR PANEL FOR 9424	F9424-9	1	550 440 406	6				
10	SPACER INSERT GUIDE	709 424 098	1	550 440 120	1	551 440 300	1	709 424 011	1
11	SUPPORT FOR MC	F9424-2	1						
12	HANDLE	530 301 005	1	550 440 120	2			709 424 011	2
13	94XX-1 WITH MC LOGIC	F9424-1	1	550 430 106	4	551 430 300	4		
14	QUAD CHANNEL FRONTEND	F9424-7	1	550 430 106	2	551 430 300	5		
				550 430 108	3				
15	DISPLAY CARD FOR 94XX	F9450-2	1	550 430 106	4	551 430 300	4		
16	INSERTION GUIDE MC	709 424 098	1						
17	QUAD CHANNEL FP CARD	F9424-5	1	550 440 406	6				
18	POWER SUPPLY 9451-1	315 040 015	1	550 440 105	4	551 440 300	4		
				550 440 506	2				
19	LABEL "DANGER---ONLY	377 051 005	1						
20	DISPLAY POWER CABLE	780 210 030	1						
21	CRT CABLE	780 299 025	1						
22	FRONTEND BASE CABLE	780 231 120	1						
23	BASE CARD POWER CABLE	780 220 015	1						
24	MEMORY CARD CABLE	780 231 131	1						
25	GROUND CABLE	780 544 512	1						
26	LABEL GROUND SYMBOL	377 131 001	1						
27	TIMEBASE CARD	F9420-4	1						
28	DUAL CHANNEL ADC	F9420-3	2						
29	PROCESSOR CARD	F9424-6	1						
30	FRONT PANEL CABLE	780 411 236	1						
31	CABLE CLIP AD BACK	594 230 002	1						
32	CLOCK-BUS	F9424-8	1	550 430 106	2	551 430 300	2		
33	POWER SUPPLY SUPPORT	709 424 061	1	550 430 106	2	551 430 300	2		
34	CARD RETAINER	709 424 095	1	550 440 108	2	551 440 300	2		
35	FOOT	530 010 024	4	550 440 110	4	551 440 300	4	552 440 100	4
36	LOWER COVER	709 424 081	1	550 440 708	4	551 440 501	4		
37	UPPER COVER	709 424 071	1	550 440 708	4	551 440 501	4		

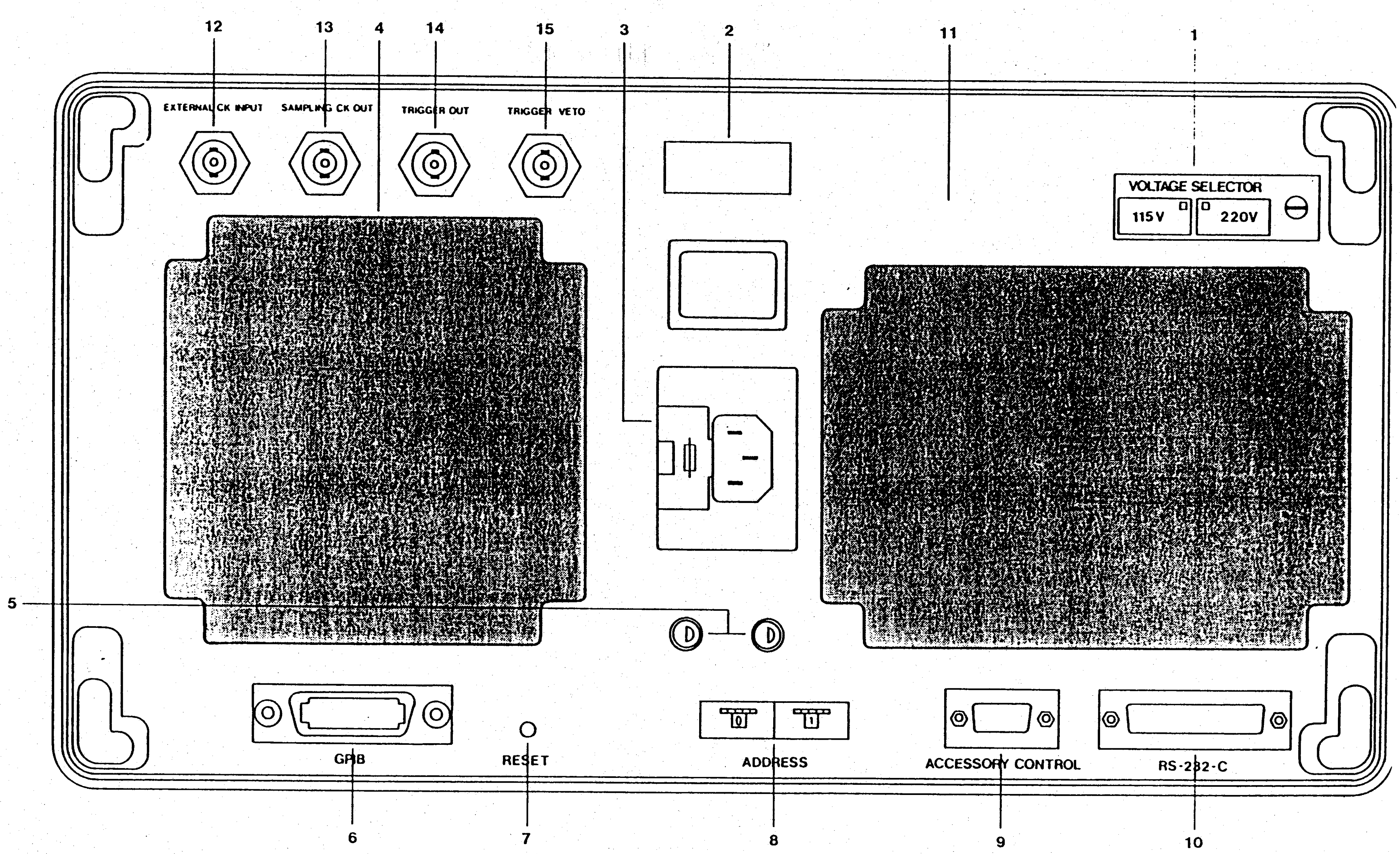
Figure 7.3


LeCroy 9424E QUAD 350 MHz OSCILLOSCOPE
100 Ms/s
10 Gs/s
POWER
ON REAR PANEL
STORE
TRACE
SELECT
ON/OFF
A
EXPAND
B
C
FUNCTION
D
E
FUNCTION
F
1
CHANNEL
2
3
CHANNEL
4
AUTOSETUP
DISPLAY CONTROL
VERT GAIN
RESET
POSITION
REDEFINE
TIME MAGNIFIER
POSITION
CURSOR POSITIONS
REFERENCE
TRACKING
DIFFERENCE
SAVE
TIME/DIVISION
INTERLEAVED SAMPLING
5000 s
1 ns
ON
VERTICAL
VOLTS/DIV
1V
5mV
OFFSET
x1 VAR
CHANNEL SELECT
TRIGGER
LEVEL
STATUS
DELAY
ZERO
ADJUST
SMART TRIGGER
ON
SLOPE
SOURCE
COUPLING
MODE
CHANNEL 1
CHANNEL 2
CHANNEL 3
CHANNEL 4
250 V pk MAX
SCREEN DUMP
INTENSITY
GRID INTENSITY
GRIDS
CURSOR MEASUREMENT
PARAMETERS
VOLTAGE
TIME
RELATIVE
ABSOLUTE
REMOTE
ON
LOCAL
BANDWIDTH LIMIT
ON
PROBE CALIBRATOR
1
2
3
4
5
6
7
8
9
10
11
12
13
13
14
15
16
17
18

7.5 Front Panel description and part number

	Function:	Description:	Part number:
1)	Intensity	RES VAR cond plastic 5K knob for 1/8" shaft CAP for 021-1110 or 2215	184 437 502 536 168 003 536 068 006
2)	Grid intensity	Idem	
3)	Vert gain	RES VAR cond plastic 5K knob for 1/8" shaft CAP for knob 020-2215	184 417 502 536 168 001 536 068 003
4)	Position	Idem	
5)	Reference	Idem	
6)	Difference	Idem	
7)	Ch1, Ch2, Ch3, Ch4 offset	Idem	
8)	Delay	Idem	
9)	Level	Idem	
10)	Adjust	Idem	
11)	Position	RES VAR cond plastic 5K knob for 1/8" shaft CAP for 020-3215 or 3415	184 417 502 536 168 002 536 068 005
12)	Time magnifier	Switch ROT M/stop 12 pins knob for 1/8" shaft CAP for knob 020-3215 or 3415	412 001 012 536 068 001 536 068 005
13)	Time/division	Idem	
14)	Channel volts/div variable gain	RES VARI cond plastic 5K knob 1/8" shaft CAP for knob 020-2215 Switch Rot M/stop 12 pins	184 427 502 536 068 002 536 068 003 412 001 012
15)	Grids idem for all the other push button	Switch push button SPST Push switch extender	416 161 002 709 450 523

16)	Probe calibrator		HPC 411 AIH
17)	Ch1,Ch2,Ch3,Ch4	COMM CO.AX	402 110 302
18)	Memory card option:	128K Memory card option	334 049 070
	- 94XX-MC02	Lithium battery	312 682 325
	- 94XX-MC04	512K Memory card	334 049 090


12
13
4
14
15
3
2
11
1
EXTERNAL CK INPUT
SAMPLING CK OUT
TRIGGER OUT
TRIGGER VETO
VOLTAGE SELECTOR
115V
220V
5
GPIB
RESET
ADDRESS
ACCESSORY CONTROL
RS-232-C
6
7
8
9
10

Rear Panel

REAR PANEL DESCRIPTION AND PART NUMBER			
POS	DESCRIPTION	PART NUMBER	QTY
1	VOLTAGE SELECTOR COVER	709 424 911	1
	SCREW SELECTOR COVER	709 424 941	1
2	SERIAL NUMBER PLATE	709 450 913	1
	TAPPING SCREWS W/U-TREAD	554 500 001	2
3	FUSE NORMAL BLOWING 250V/5A	433 162 251	2
4	FAN AXIAL 12V	530 409 125	1
	SCREWS CYL INT HEX M4x12	550 440 412	4
	FLAT WASHERS M4	551 440 100	4
	WASHERS SHAKEPROOF M4	551 440 400	4
5	POWER SUPPLY F9451-1	315 040 015	1
	SCREWS FLAT HD PHIL M4x6	550 440 506	2
6	RTANGLE PCB CONN FEM 24	453 520 024	1
7	SWITCH PUSHBUT (MON) SPDT	416 132 008	1
8	SWITCHES ROTARY BCD-1248	412 022 022	2
9	HDR SOLD TAIL/MALE 9	454 611 009	1
10	HDR SOLD TAIL/MALE 25	454 611 025	1
11	REAR PANEL 94XX-9	709 424 901	1
12	BNC-SMD CABLE 45	780 249 945	1
13	BNC-SMD CABLE 45	780 249 945	1
14	BNC-SMD CABLE 27	780 259 927	1
15	BNC-SMD CABLE 27	780 259 927	1

Chapter 8

Parts List

Chapter 8

Parts List

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:42

PLANT CODE: ITI_GVA   REQUESTER: CHRISTIA
PAGE NO:

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 1
FINISHED GOODS-MANUFACTURED
PART: 9424
DESC: 350 MHz QUAD CH. 100 Ms/s DSO UOM: EA SC: M REV: B

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
ACCESSORIES-9424	ACCESSORIES FOR 9424	D	11	R	EA	1.00	1.000	02/05/89	99/99/99	
F9420-3	DUAL CHANNEL 100 Ms/s ADC	E	3	R	EA	2.00	1.000	00/00/00	99/99/99	
F9420-4	TIMEBASE CARD	B	4	R	EA	1.00	1.000	00/00/00	99/99/99	
F9424-1	94xx-1 WITH MEMORY CARD LOGIC	C	1	R	EA	1.00	1.000	05/10/90	99/99/99	
F9424-2	SUPPORT FOR MEMORY CARD	A	12	R	EA	1.00	1.000	11/01/91	99/99/99	
F9424-5	QUAD CHANNEL FRONT PANEL CARD	E	5	R	EA	1.00	1.000	00/00/00	99/99/99	
F9424-6	PROCESSOR CARD	D	6	R	EA	1.00	1.000	02/06/89	99/99/99	
F9424-8	CLOCK-BUS	A	8	R	EA	1.00	1.000	17/02/89	99/99/99	
F9424E-7	QUAD CHANNEL 350 MHz FRONTEND	G	7	R	EA	1.00	1.000	16/05/90	99/99/99	
F9424E-9	REAR PANEL FOR 9424E	D	9	R	EA	1.00	1.000	16/05/90	99/99/99	
F9450-2	DISPLAY CARD FOR 94xx	K	2	R	EA	1.00	1.000	00/00/00	99/99/99	
M9424E	MECHANICAL FOR 9424E	C	10	R	EA	1.00	1.000	16/05/90	99/99/99	

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: ACCESSORIES-9424
DESC: ACCESSORIES FOR 9424 UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
407099008	PLUG FOR AC LINE -ENGLAND		10	P	EA	0.05	1.000	00/00/00	99/99/99	
433162251	FUSE SLOW BLOW 250V 5A		18	P	EA	2.00	1.000	13/08/92	99/99/99	
589202100	AC CORD/PLUG FOR FRANCE		8	P	EA	0.20	1.000	00/00/00	99/99/99	
589202200	AC CORD/PLUG FOR GERMANY		9	P	EA	0.25	1.000	00/00/00	99/99/99	
589203100	AC CORD/"SEV-ASE" PLUG		7	P	EA	0.05	1.000	00/00/00	99/99/99	
589203218	AC CORD/US-CANADA PLUG		6	P	EA	0.45	1.000	00/00/00	99/99/99	
597940011	SHIPPING CARTON 9400		2	B	EA	1.00	1.000	01/03/90	99/99/99	
597940014	PLASTIC BAG FOR 94XX & 93XX		4	B	EA	2.00	1.000	00/00/00	99/99/99	
597940015	MANUAL/ACCESSORY CTN 9400		5	B	EA	2.00	1.000	07/12/89	99/99/99	
597942403	SHIPPING INSERT (REAR) 9424		12	B	EA	2.00	1.000	01/03/90	99/99/99	
709424091	DSO COVER 9424	D	14	B	EA	1.00	1.000	31/01/90	99/99/99	
9424-OM-E	9424 OPERATOR'S MANUAL - ENG.		15	B	EA	1.00	1.000	14/06/90	99/99/99	
94XX-RCM-E	94XX SERIES REMOTE CONTROL MAN		17	B	EA	1.00	1.000	20/11/90	99/99/99	
P9020	PROBE DC-300MHZ 10:1 (TESTED)		1	R	EA	4.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:46

PLANT CODE: ITI_GVA REQUESTER: CHRISTIAN
PAGE NO:

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9420-3
DESC: DUAL CHANNEL 100 Ms/s ADC UOM: EA SC: R REV: E

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
190642221	RESISTOR NETWORK 220 OHMS		4	P	EA	2.00	1.000	00/00/00	99/99/99	
190642471	RESISTOR NETWORK 470 OHMS		5	P	EA	4.00	1.000	00/00/00	99/99/99	
205271256	IC 32K X 8 RAM 62256-12		10	P	EA	8.00	1.000	00/00/00	99/99/99	
205750000	IC AND-OR GATE ARRAY 16V8		300	P	EA	3.00	1.000	03/05/90	99/99/99	SEE PAL PROG. PROGRAMM ON PC
207200200	IC 8-BIT FLASH ADC 77200		14	P	EA	2.00	1.000	00/00/00	99/99/99	
208122002	IC VOLT REG POS UA7805		20	P	EA	1.00	1.000	00/00/00	99/99/99	
208123002	IC +12 VOLT REG LM340T-12		24	P	EA	1.00	1.000	00/00/00	99/99/99	
208124003	IC VOLT REG NEG LM320T-12		23	P	EA	1.00	1.000	00/00/00	99/99/99	
208590336	IC VOLT REFERENCE LM336		22	P	EA	1.00	1.000	00/00/00	99/99/99	
280170104	TRANSISTOR FET N VN0104N3		33	P	EA	2.00	1.000	00/00/00	99/99/99	
290120006	DELAY LINE 6 N-SEC		34	P	EA	1.00	1.000	00/00/00	99/99/99	
309040040	CRYSTAL OSCILLATOR 40MHZ		36	P	EA	1.00	1.000	00/00/00	99/99/99	
400410046	IC SOCKET GRID TYP 46		76	P	EA	2.00	1.000	10/05/89	99/99/99	
400412068	IC SOCKET GRID TYP 68-PIN		37	P	EA	1.00	1.000	09/01/89	99/99/99	
402610002	CONN CO-AX PC MTG SMB		38	P	EA	2.00	1.000	00/00/00	99/99/99	
403181008	HEADER STRT BREAKAW 8-PIN		39	P	EA	2.00	1.000	00/00/00	99/99/99	
454610096	HDR DIP SOLD TO MALE 96		41	P	EA	1.00	1.000	00/00/00	99/99/99	
500460006	INSULATOR THERMAFILM		42	P	EA	3.00	1.000	00/00/00	99/99/99	
550430104	SCREW CYL HD PHIL M3X4		44	P	EA	3.00	1.000	00/00/00	99/99/99	
585252354	RIVET HOLLOW 2,5X9MM		45	P	EA	2.00	1.000	00/00/00	99/99/99	
590681001	PIN EDGE CLIP STRAIGHT		72	P	EA	6.00	1.000	01/01/88	99/99/99	
709450321	HEAT SINK FOR FADC	A	77	B	EA	2.00	1.000	27/06/89	99/99/99	
719420303	PC BD PREASS'Y 9420-3	B	69	B	EA	1.00	1.000	00/00/00	99/99/99	
719450423	PC BD PREASS'Y 9450-42	C	73	B	EA	1.00	1.000	01/01/88	99/99/99	
H599011061	ADHESIVE (THERMAL COND) 709		78	P	ML	0.04	1.000	27/06/89	99/99/99	
HSH410	HYB SAMPLE & HOLD HSH410	C	70	B	EA	2.00	1.000	00/00/00	99/99/99	
DX407	IC DEMULTIPLEXER MDX407		18	P	EA	2.00	1.000	00/00/00	99/99/99	
NX401	ICMIN MAX GATEARR. MNX401		71	B	EA	1.00	1.000	00/00/00	99/99/99	
M185457102	RES VARI CERMET 1 K		74	P	EA	2.00	1.000	28/02/89	99/99/99	
M185457103	RES VARI CERMET 10 K		1	P	EA	3.00	1.000	00/00/00	99/99/99	
M185457202	RES VARI CERMET 2 K		2	P	EA	3.00	1.000	00/00/00	99/99/99	
M200167105	IC 2-3-2 OR/NOR 10H105		6	P	EA	1.00	1.000	00/00/00	99/99/99	
M200172000	IC 2-INPUT NAND 74F00		7	P	EA	1.00	1.000	00/00/00	99/99/99	
M200178002	IC 2-INPUT NOR HCT02		8	P	EA	1.00	1.000	00/00/00	99/99/99	
M205217198	IC 16KX4BIT SRAM 7198S35		9	P	EA	16.00	1.000	00/00/00	99/99/99	
M207162965	IC MEMORY DRIVER 2965		12	P	EA	2.00	1.000	00/00/00	99/99/99	
M207179244	IC BUF/LINE DRIV HCT244		13	P	EA	3.00	1.000	00/00/00	99/99/99	
M207360125	IC TRANSLATO MC10125		15	P	EA	5.00	1.000	00/00/00	99/99/99	
M207460116	IC LINE RECEIVER 10H116		16	P	EA	2.00	1.000	00/00/00	99/99/99	
M207878245	IC BUS TRANSCVR HCT 245		17	P	EA	2.00	1.000	00/00/00	99/99/99	
M207972157	IC DATA SEL/MUX 74F157A		19	P	EA	4.00	1.000	00/00/00	99/99/99	
M208470358	IC DUAL OP AMP 358D		21	P	EA	3.00	1.000	00/00/00	99/99/99	
M227060320	IC DIG SIG PROC 320C25		25	P	EA	1.00	1.000	09/01/89	99/99/99	
M232022822	DIODE ARRAY SCHTTKY 2822		26	P	EA	2.00	1.000	00/00/00	99/99/99	
M236030099	DIODE SO-PKG BAV99		27	P	EA	3.00	1.000	00/00/00	99/99/99	
M270030092	TRANSISTOR NPN BFR92		28	P	EA	2.00	1.000	00/00/00	99/99/99	
M270040092	TRANSISTOR NPN BFR92R		29	P	EA	2.00	1.000	00/00/00	99/99/99	
M270330848	TRANSISTOR NPN BC848C		30	P	EA	2.00	1.000	00/00/00	99/99/99	
M275030092	TRANSISTOR PNP BFT92		31	P	EA	2.00	1.000	00/00/00	99/99/99	
M275330858	TRANSISTOR PNP BC858C		32	P	EA	2.00	1.000	00/00/00	99/99/99	
M300327102	INDUCTOR WOUND FERRITE 1UH		35	P	EA	6.00	1.000	00/00/00	99/99/99	

BILL OF MATERIALS REPORT

PLANT CODE: ITI_GVA REQUESTER: CHRISTIAN
PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9420-3
DESC: DUAL CHANNEL 100 Ms/s ADC UOM: EA SC: R REV: E

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
SM652101100	RES CHIP (E24) 1% 10 OHMS		46	P	EA	3.00	1.000	00/00/00	99/99/99	
SM652101101	RES CHIP (E24) 1% 100 OHM		47	P	EA	3.00	1.000	00/00/00	99/99/99	
SM652101103	RES CHIP (E24) 1% 10 K		48	P	EA	4.00	1.000	00/00/00	99/99/99	
SM652101122	RES CHIP (E24) 1% 1.2 K		49	P	EA	7.00	1.000	00/00/00	99/99/99	
SM652101151	RES CHIP (E24) 1% 150 OHM		50	P	EA	4.00	1.000	00/00/00	99/99/99	
SM652101201	RES CHIP (E24) 1% 200 OHM		51	P	EA	3.00	1.000	00/00/00	99/99/99	
SM652101222	RES CHIP (E24) 1% 2.2 K		52	P	EA	2.00	1.000	00/00/00	99/99/99	
SM652101240	RES CHIP (E24) 1% 24 OHMS		53	P	EA	9.00	1.000	00/00/00	99/99/99	
SM652101241	RES CHIP (E24) 1% 240 OHM		54	P	EA	2.00	1.000	00/00/00	99/99/99	
SM652101272	RES CHIP (E24) 1% 2.7 K		55	P	EA	2.00	1.000	00/00/00	99/99/99	
SM652101332	RES CHIP (E24) 1% 3.3 K		56	P	EA	6.00	1.000	00/00/00	99/99/99	
SM652101390	RES CHIP (E24) 1% 39 OHMS		57	P	EA	10.00	1.000	00/00/00	99/99/99	
SM652101392	RES CHIP (E24) 1% 3.9 K		58	P	EA	2.00	1.000	00/00/00	99/99/99	
SM652101471	RES CHIP (E24) 1% 470 OHM		59	P	EA	8.00	1.000	00/00/00	99/99/99	
SM652101510	RES CHIP (E24) 1% 51 OHMS		60	P	EA	10.00	1.000	00/00/00	99/99/99	
SM652101681	RES CHIP (E24) 1% 680 OHM		61	P	EA	4.00	1.000	00/00/00	99/99/99	
SM652101820	RES CHIP (E24) 1% 82 OHMS		62	P	EA	6.00	1.000	00/00/00	99/99/99	
SM652101821	RES CHIP (E24) 1% 820 OHM		75	P	EA	1.00	1.000	03/04/89	99/99/99	
SM661127104	CAP CERA CHIP 20% .1 UF		63	P	EA	34.00	1.000	26/06/89	99/99/99	
SM661207103	CAP CERA CHIP 20% .01UF		64	P	EA	69.00	1.000	00/00/00	99/99/99	
SM661255220	CAP CERA CHIP 5% 22 PF		65	P	EA	1.00	1.000	00/00/00	99/99/99	
SM666237476	CAP MOLD TANT CHIP 47 UF		66	P	EA	7.00	1.000	00/00/00	99/99/99	
SM666247106	CAP MOLD TANT CHIP 10 UF		67	P	EA	4.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:47

BILL OF MATERIALS REPORT

PLANT CODE: ITI_GVA REQUESTER: CHRISTIAN
PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9420-4
DESC: TIMEBASE CARD UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
103336474	CAP CERA MONO 50V .47UF		1	P	EA	1.00	1.000	00/00/00	99/99/99	
190042563	RESISTOR NETWORK 56K		6	P	EA	1.00	1.000	00/00/00	99/99/99	
190642221	RESISTOR NETWORK 220 OHMS		7	P	EA	1.00	1.000	00/00/00	99/99/99	
190642332	RESISTOR NETWORK 3.3 K		8	P	EA	1.00	1.000	00/00/00	99/99/99	
190642562	RESISTOR NETWORK 5.6 K		9	P	EA	4.00	1.000	00/00/00	99/99/99	
205750000	IC AND-OR GATE ARRAY 16V8		300	P	EA	2.00	1.000	03/05/90	99/99/99	SEE PAL PROG. PROGRAMM ON PC
207281703	IC MONO DAC 16 BIT 703JP		31	P	EA	1.00	1.000	00/00/00	99/99/99	
208123002	IC +12 VOLT REG LM340T-12		36	P	EA	1.00	1.000	20/09/90	99/99/99	
208124003	IC VOLT REG NEG LM320T-12		35	P	EA	1.00	1.000	00/00/00	99/99/99	
290120005	DELAY LINE 5NS		53	P	EA	1.00	1.000	00/00/00	99/99/99	
310060012	CRYSTAL 10PPM 12.4031MHZ		58	P	EA	1.00	1.000	00/00/00	99/99/99	
310062100	CRYSTAL 10PPM 100MHZ		59	P	EA	1.00	1.000	00/00/00	99/99/99	
402610002	CONN CO-AX PC MTG SMB		60	P	EA	4.00	1.000	00/00/00	99/99/99	
403181008	HEADER STRT BREAKAW 8-PIN		61	P	EA	1.00	1.000	00/00/00	99/99/99	
454340002	HDR MALE PIN TO WW 02		62	P	EA	2.00	1.000	00/00/00	99/99/99	
454610096	HDR DIP SOLD TO MALE 96		63	P	EA	1.00	1.000	00/00/00	99/99/99	
554435401	RIVET "RIVSCREW" M 3.5		64	P	EA	2.00	1.000	28/11/89	99/99/99	
585252354	RIVET HOLLOW 2,5X9MM		68	P	EA	2.00	1.000	00/00/00	99/99/99	
690000000	PINS/CLIP ON		125	P	EA	3.00	1.000	00/00/00	99/99/99	
690681001	PIN EDGE CLIP STRAIGHT		127	P	EA	36.00	1.000	14/11/88	99/99/99	
719420403	PC BD PREASS'Y 9420-4	B	129	B	EA	1.00	1.000	00/00/00	99/99/99	
719450413	PC BD PREASS'Y 9450-41	B	130	B	EA	1.00	1.000	00/00/00	99/99/99	
719450423	PC BD PREASS'Y 9450-42	C	131	B	EA	2.00	1.000	14/11/88	99/99/99	
719450433	PC BD PREASS'Y 9450-43	C	132	B	EA	4.00	1.000	14/11/88	99/99/99	
HTD405	HYBID TIME DIGIT. HTD405	A	133	B	EA	1.00	1.000	00/00/00	99/99/99	
SM158043006	CAP VARIABLE 2 - 6 PF		2	P	EA	1.00	1.000	00/00/00	99/99/99	
SM158043020	CAP VARIABLE 4.5-20 PF		3	P	EA	1.00	1.000	00/00/00	99/99/99	
SM158044010	CAP VARIABLE 3-10PF		5	P	EA	1.00	1.000	00/00/00	99/99/99	
SM200160101	IC OR/NOR GATE 10H101		10	P	EA	3.00	1.000	00/00/00	99/99/99	
SM200160402	IC 16-BIT SCALER MCT402		11	P	EA	2.00	1.000	00/00/00	99/99/99	
SM200167102	IC NOR GATE 10H102		12	P	EA	6.00	1.000	00/00/00	99/99/99	
SM200167104	IC 2-IN AND GATE 10H104		13	P	EA	5.00	1.000	00/00/00	99/99/99	
SM200167105	IC 2-3-2 OR/NOR 10H105		14	P	EA	2.00	1.000	00/00/00	99/99/99	
SM200167107	IC 2-IN EXCL OR/NOR10H107		15	P	EA	3.00	1.000	00/00/00	99/99/99	
SM200167109	IC 4-5 IN OR/NOR 10H109		16	P	EA	3.00	1.000	00/00/00	99/99/99	
SM200167121	IC OR-AND/O-A-INV 10H121		17	P	EA	1.00	1.000	00/00/00	99/99/99	
SM200167131	IC M-S TYP D FLOP 10H131		18	P	EA	4.00	1.000	00/00/00	99/99/99	
SM200172000	IC 2-INPUT NAND 74F00		19	P	EA	16.00	1.000	00/00/00	99/99/99	
SM200172011	IC 3-INPUT AND 74F11		20	P	EA	1.00	1.000	00/00/00	99/99/99	
SM200172074	IC D-TYP FLOP 74F74		21	P	EA	1.00	1.000	00/00/00	99/99/99	
SM200172113	IC J-K TYP FLOP 74F113		22	P	EA	3.00	1.000	00/00/00	99/99/99	
SM200172374	IN D-TYP FLOP 74F374		23	P	EA	1.00	1.000	00/00/00	99/99/99	
SM200178000	IC 2-INPUT NAND HCT00		24	P	EA	2.00	1.000	00/00/00	99/99/99	
SM200178574	IC D-TYP FLOP HCT 574		25	P	EA	2.00	1.000	00/00/00	99/99/99	
SM200267016	IC BINARY COUNTER 10H016		26	P	EA	8.00	1.000	00/00/00	99/99/99	
SM200278040	IC COUNTER HCT4040		27	P	EA	3.00	1.000	00/00/00	99/99/99	
SM200478573	IC D-TYP LATCH 74HCT573		28	P	EA	3.00	1.000	00/00/00	99/99/99	
SM207160192	IC BUS DRIV MC10192		30	P	EA	6.00	1.000	00/00/00	99/99/99	
SM207360125	IC TRANSLATO MC10125		32	P	EA	1.00	1.000	00/00/00	99/99/99	
SM207460116	IC LINE RECEIVER 10H116		33	P	EA	4.00	1.000	00/00/00	99/99/99	
SM207878245	IC BUS TRANSCVR HCT 245		34	P	EA	9.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:47

BILL OF MATERIALS REPORT

PLANT CODE: ITI_GVA REQUESTER: CHRISTIA
PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9420-4
DESC: TIMEBASE CARD UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
SM232120070	DIODE ARRAY BAV70		37	P	EA	2.00	1.000	00/00/00	99/99/99	
SM236030099	DIODE SO-PKG BAV99		38	P	EA	8.00	1.000	00/00/00	99/99/99	
SM270030019	TRANSISTOR NPN BFS19		39	P	EA	3.00	1.000	00/00/00	99/99/99	
SM270030020	TRANSISTOR NPN BFS20		40	P	EA	1.00	1.000	00/00/00	99/99/99	
SM270030092	TRANSISTOR NPN BFR92		41	P	EA	7.00	1.000	00/00/00	99/99/99	
SM270040092	TRANSISTOR NPN BFR92R		42	P	EA	3.00	1.000	00/00/00	99/99/99	
SM270130092	TRANSISTOR NPN BFR92A		43	P	EA	1.00	1.000	00/00/00	99/99/99	
SM270140092	TRANSISTOR NPN BFR92AR		44	P	EA	2.00	1.000	00/00/00	99/99/99	
SM270330848	TRANSISTOR NPN BC848C		45	P	EA	1.00	1.000	00/00/00	99/99/99	
SM270340848	TRANSISTOR NPN 848CR		46	P	EA	1.00	1.000	00/00/00	99/99/99	
SM275030550	TRANSISTOR PNP BF550		47	P	EA	4.00	1.000	00/00/00	99/99/99	
SM275040550	TRANSISTOR PNP BF550R		48	P	EA	3.00	1.000	00/00/00	99/99/99	
SM275330858	TRANSISTOR PNP BC858C		49	P	EA	5.00	1.000	00/00/00	99/99/99	
SM275340858	TRANSISTOR PNP 858CR		50	P	EA	3.00	1.000	00/00/00	99/99/99	
SM289240061	TRANSISTOR NPN BCV61		51	P	EA	1.00	1.000	00/00/00	99/99/99	
SM289240062	TRANSISTOR ARRAY BCV62		52	P	EA	2.00	1.000	00/00/00	99/99/99	
SM300446150	INDUCTOR .015UH		54	P	EA	2.00	1.000	00/00/00	99/99/99	
SM300446330	INDUCTOR .033 UH		55	P	EA	1.00	1.000	00/00/00	99/99/99	
SM300546151	INDUCTOR .15 UH		56	P	EA	1.00	1.000	00/00/00	99/99/99	
SM652101101	RES CHIP (E24) 1% 100 OHM		69	P	EA	10.00	1.000	20/09/90	99/99/99	
SM652101102	RES CHIP (E24) 1% 1 K		70	P	EA	15.00	1.000	00/00/00	99/99/99	
SM652101103	RES CHIP (E24) 1% 10 K		71	P	EA	11.00	1.000	00/00/00	99/99/99	
SM652101121	RES CHIP (E24) 1% 120 OHM		72	P	EA	4.00	1.000	00/00/00	99/99/99	
SM652101122	RES CHIP (E24) 1% 1.2 K		73	P	EA	1.00	1.000	00/00/00	99/99/99	
SM652101151	RES CHIP (E24) 1% 150 OHM		74	P	EA	15.00	1.000	00/00/00	99/99/99	
SM652101152	RES CHIP (E24) 1% 1.5 K		134	P	EA	1.00	1.000	21/11/88	99/99/99	
SM652101161	RES CHIP (E24) 1% 160 OHM		75	P	EA	5.00	1.000	00/00/00	99/99/99	
SM652101162	RES CHIP (E24) 1% 1.6 K		76	P	EA	1.00	1.000	00/00/00	99/99/99	
SM652101180	RES CHIP (E24) 1% 18 OHMS		77	P	EA	8.00	1.000	00/00/00	99/99/99	
SM652101181	RES CHIP (E24) 1% 180 OHM		78	P	EA	4.00	1.000	00/00/00	99/99/99	
SM652101182	RES CHIP (E24) 1% 1.8 K		79	P	EA	1.00	1.000	00/00/00	99/99/99	
SM652101201	RES CHIP (E24) 1% 200 OHM		80	P	EA	6.00	1.000	00/00/00	99/99/99	
SM652101202	RES CHIP (E24) 1% 2 K		81	P	EA	9.00	1.000	00/00/00	99/99/99	
SM652101221	RES CHIP (E24) 1% 220 OHM		82	P	EA	8.00	1.000	00/00/00	99/99/99	
SM652101222	RES CHIP (E24) 1% 2.2 K		83	P	EA	4.00	1.000	00/00/00	99/99/99	
SM652101223	RES CHIP (E24) 1% 22 K		84	P	EA	1.00	1.000	00/00/00	99/99/99	
SM652101242	RES CHIP (E24) 1% 2.4 K		85	P	EA	2.00	1.000	01/01/88	99/99/99	
SM652101271	RES CHIP (E24) 1% 270 OHM		86	P	EA	20.00	1.000	00/00/00	99/99/99	
SM652101272	RES CHIP (E24) 1% 2.7 K		87	P	EA	4.00	1.000	00/00/00	99/99/99	
SM652101301	RES CHIP (E24) 1% 300 OHM		88	P	EA	3.00	1.000	00/00/00	99/99/99	
SM652101302	RES CHIP (E24) 1% 3 K		89	P	EA	3.00	1.000	00/00/00	99/99/99	
SM652101330	RES CHIP (E24) 1% 33 OHMS		90	P	EA	3.00	1.000	00/00/00	99/99/99	
SM652101331	RES CHIP (E24) 1% 330 OHM		91	P	EA	17.00	1.000	00/00/00	99/99/99	
SM652101332	RES CHIP (E24) 1% 3.3 K		92	P	EA	5.00	1.000	00/00/00	99/99/99	
SM652101362	RES CHIP (E24) 1% 3.6 K		93	P	EA	5.00	1.000	00/00/00	99/99/99	
SM652101391	RES CHIP (E24) 1% 390 OHM		136	P	EA	1.00	1.000	21/11/88	99/99/99	
SM652101470	RES CHIP (E24) 47 OHMS		94	P	EA	32.00	1.000	20/09/90	99/99/99	
SM652101471	RES CHIP (E24) 1% 470 OHM		95	P	EA	54.00	1.000	00/00/00	99/99/99	
SM652101510	RES CHIP (E24) 1% 51 OHMS		96	P	EA	13.00	1.000	00/00/00	99/99/99	
SM652101512	RES CHIP (E24) 1% 5.1 K		97	P	EA	10.00	1.000	00/00/00	99/99/99	
SM652101560	RES CHIP (E24) 1% 56 OHM		98	P	EA	1.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:47

BILL OF MATERIALS REPORT

PLANT CODE: ITI_GVA

REQUESTER: CHRISTIA
PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9420-4
DESC: TIMEBASE CARD

UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
SM652101561	RES CHIP (E24) 1% 560 OHM		99	P	EA	2.00	1.000	00/00/00	99/99/99	
SM652101562	RES CHIP (E24) 1% 5.6 K		100	P	EA	14.00	1.000	20/09/90	99/99/99	
SM652101622	RES CHIP (E24) 1% 6.2 K		101	P	EA	24.00	1.000	00/00/00	99/99/99	
SM652101680	RES CHIP (E24) 1% 68 OHMS		102	P	EA	3.00	1.000	20/09/90	99/99/99	
SM652101681	RES CHIP (E24) 1% 680 OHM		103	P	EA	35.00	1.000	00/00/00	99/99/99	
SM652101820	RES CHIP (E24) 1% 82 OHMS		105	P	EA	45.00	1.000	20/09/90	99/99/99	
SM652101821	RES CHIP (E24) 1% 820 OHM		106	P	EA	36.00	1.000	00/00/00	99/99/99	
SM652101822	RES CHIP (E24) 1% 8.2 K		107	P	EA	2.00	1.000	00/00/00	99/99/99	
SM653125033	RES THICK FILM 5% 3.3 OHM		108	P	EA	2.00	1.000	01/01/88	99/99/99	
SM661127104	CAP CERA CHIP 20% .1 UF		109	P	EA	2.00	1.000	26/06/89	99/99/99	
SM661186180	CAP CERA CHIP 10% 18 PF		110	P	EA	2.00	1.000	00/00/00	99/99/99	
SM661205332	CAP CERA CHIP 10% 3300 PF		122	P	EA	1.00	1.000	20/09/90	99/99/99	
SM661207102	CAP CERA CHIP 10% .001UF		111	P	EA	6.00	1.000	00/00/00	99/99/99	
SM661207103	CAP CERA CHIP 20% .01UF		112	P	EA	109.00	1.000	00/00/00	99/99/99	
SM661250047	CAP CERA CHIP 4.7 PF		113	P	EA	2.00	1.000	00/00/00	99/99/99	
SM661250082	CAP CERA CHIP .1% 8.2 PF		114	P	EA	4.00	1.000	00/00/00	99/99/99	
SM661255100	CAP CERA CHIP 10PF		115	P	EA	1.00	1.000	00/00/00	99/99/99	
SM661255101	CAP CERA CHIP 5% 100 PF		116	P	EA	2.00	1.000	00/00/00	99/99/99	
SM661255181	CAP CERA CHIP 5% 180 PF		118	P	EA	1.00	1.000	00/00/00	99/99/99	
SM661255221	CAP CERA CHIP 5% 220 PF		119	P	EA	1.00	1.000	00/00/00	99/99/99	
SM661255270	CAP CERA CHIP 27PF		120	P	EA	5.00	1.000	00/00/00	99/99/99	
SM661255330	CAP CERA CHIP 5% 33 PF		121	P	EA	2.00	1.000	00/00/00	99/99/99	
SM661255560	CAP CERA CHIP 56PF		123	P	EA	9.00	1.000	00/00/00	99/99/99	
SM666247106	CAP MOLD TANT CHIP 10 UF		124	P	EA	6.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:48

BILL OF MATERIALS REPORT

PLANT CODE: ITI_GVA REQUESTER: CHRISTIA

PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424-1
DESC: 94xx-1 WITH MEMORY CARD LOGIC UOM: EA SC: R REV: C

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
102484471	CAP CERA DISC 100V 470 PF		1	P	EA	1.00	1.000	00/00/00	99/99/99	
103327103	CAP CERA MONO 50V .01 UF		2	P	EA	35.00	1.000	14/02/92	99/99/99	
103427104	CAP CERA MONO 100V .1 UF		3	P	EA	2.00	1.000	00/00/00	99/99/99	
142214156	CAP TANT DIP CASE 15 UF		4	P	EA	2.00	1.000	00/00/00	99/99/99	
142714685	CAP TANT DIP CASE 6.8UF		5	P	EA	2.00	1.000	00/00/00	99/99/99	
146634106	CAP MINI ALUM 20% 10 UF		6	P	EA	2.00	1.000	00/00/00	99/99/99	
147436033	CAP ALUM METAL CAN 33 UF		7	P	EA	4.00	1.000	00/00/00	99/99/99	
161225101	RES COMP 1/8W 5% 100 OHMS		8	P	EA	1.00	1.000	00/00/00	99/99/99	
161225103	RES COMP 1/8W 5% 10 K		9	P	EA	3.00	1.000	15/10/90	99/99/99	
161225274	RES CARBON FILM 270 K		10	P	EA	1.00	1.000	00/00/00	99/99/99	
161225302	RES COMP 1/8W 5% 3 K		11	P	EA	2.00	1.000	00/00/00	99/99/99	
161225395	RES CARBON FILM 3.9 MEG		12	P	EA	1.00	1.000	00/00/00	99/99/99	
161225471	RES COMP 1/8W 5% 470 OHMS		13	P	EA	1.00	1.000	00/00/00	99/99/99	
161225683	RES COMP 1/8W 5% 68 K		62	P	EA	3.00	1.000	15/10/90	99/99/99	
181447104	RES VARI CERMET 100 K		14	P	EA	2.00	1.000	00/00/00	99/99/99	
190042103	RESISTOR NETWORK 10 K		15	P	EA	2.00	1.000	00/00/00	99/99/99	
190042104	RESISTOR NETWORK 100K		16	P	EA	2.00	1.000	00/00/00	99/99/99	
190832102	RES NETWORK 1 K		17	P	EA	1.00	1.000	00/00/00	99/99/99	
190832103	RESISTOR NETWORK 10K		18	P	EA	1.00	1.000	00/00/00	99/99/99	
190832471	RESISTOR NETWORK 470 OHMS		19	P	EA	2.00	1.000	00/00/00	99/99/99	
200331074	IC DUAL FLOP 74HCT74		20	P	EA	1.00	1.000	00/00/00	99/99/99	
200340173	IC D-TYP FLOP HCT173		21	P	EA	2.00	1.000	00/00/00	99/99/99	
200373374	IC D-TYP FLOP 74HCT374		22	P	EA	2.00	1.000	00/00/00	99/99/99	
200440040	IC12-ST BIN COUNT HCT4040		23	P	EA	1.00	1.000	00/00/00	99/99/99	
200440102	IC COWN COUNT. 74HCT40102		24	P	EA	1.00	1.000	00/00/00	99/99/99	
205277202	FIFO 1024X9 BITS		25	P	EA	1.00	1.000	00/00/00	99/99/99	
205750000	IC AND-OR GATE ARRAY 16V8		300	P	EA	7.00	1.000	03/05/90	99/99/99	SEE PAL PROG. PROGRAMM ON PC
207171541	IC BUFFER/LINE DRI.HCT541		29	P	EA	9.00	1.000	00/00/00	99/99/99	
207197210	IC BUS INTERF CONTR 7210		30	P	EA	1.00	1.000	00/00/00	99/99/99	
207280703	IC 16-BIT DAC 703		31	P	EA	1.00	1.000	00/00/00	99/99/99	
207440232	IC XMTR/RCVR MAX 232		32	P	EA	1.00	1.000	00/00/00	99/99/99	
207470160	IC OCTAL BUS XCVR 75160A		33	P	EA	1.00	1.000	00/00/00	99/99/99	
207470161	IC OCTL BUS XCEIR 75161A		34	P	EA	1.00	1.000	00/00/00	99/99/99	
207472245	IC BUS TRANSCVR HCT245		35	P	EA	4.00	1.000	00/00/00	99/99/99	
207552661	IC INTERFACE 2661A		36	P	EA	1.00	1.000	00/00/00	99/99/99	
230020062	DIODE SWITCHING BAW62		37	P	EA	16.00	1.000	00/00/00	99/99/99	
253010835	DIODE HOT CARRIER HP2835		38	P	EA	3.00	1.000	00/00/00	99/99/99	
309040005	CRYSTAL OSCIL. 4.9152MHZ		39	P	EA	1.00	1.000	00/00/00	99/99/99	
400331020	SOCKET IC ST DIP-20		40	P	EA	1.00	1.000	00/00/00	99/99/99	
400412068	IC SOCKET GRID TYP 68-PIN		41	P	EA	1.00	1.000	00/00/00	99/99/99	
403950002	POLARIZING KEY		42	P	EA	4.00	1.000	00/00/00	99/99/99	
412022022	SWITCH ROTARY BCD-1248		43	P	EA	2.00	1.000	00/00/00	99/99/99	
416132008	SWITCH PUSHBUT (MOM) SPDT		44	P	EA	1.00	1.000	00/00/00	99/99/99	
453521024	CONN RT ANGLE IEEE FEM 24		45	P	EA	1.00	1.000	06/11/91	99/99/99	
454110010	HDR SOLD TAIL/MALE PIN 10		46	P	EA	1.00	1.000	00/00/00	99/99/99	
454211040	HDR SOLD TAIL TO MALE 40		47	P	EA	2.00	1.000	00/00/00	99/99/99	
454320096	HDR DIP SOLD TO FEM 96		48	P	EA	6.00	1.000	00/00/00	99/99/99	
454510009	CONN RT ANGLE MALE W/UNC 9		49	P	EA	1.00	1.000	23/11/92	99/99/99	
454510025	CONN RT ANGLE MALE W/INC 25		50	P	EA	1.00	1.000	23/11/92	99/99/99	
530040006	BUZZER 85DB 4 TO 7V		52	P	EA	1.00	1.000	00/00/00	99/99/99	
550130108	SCREW CYL HD M3X8		53	P	EA	6.00	1.000	26/06/90	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:48

PLANT CODE: ITI_GVA REQUESTER: CHRISTIA
PAGE NO:

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424-1
DESC: 94xx-1 WITH MEMORY CARD LOGIC UOM: EA SC: R REV: C

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
551430400	WASHER SHAKEPROOF M3		61	P	EA	4.00	1.000	06/11/91	99/99/99	
554630100	THREADED INSERT M3X1.5		60	P	EA	4.00	1.000	06/11/91	99/99/99	
585252236	RIVET HOLLOW 2.5X6MM		57	P	EA	12.00	1.000	00/00/00	99/99/99	
719424103	PC BD PREASS'Y 9424-1	B	58	B	EA	1.00	1.000	00/00/00	99/99/99	
MCL404	IC MEM GATE ARRAY MCL404		59	P	EA	1.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2   LeCroy Division ITI Production Database
23-DEC-1992 08:48

PLANT CODE: ITI_GVA   REQUESTER: CHRISTIA
PAGE NO:

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424-2
DESC: SUPPORT FOR MEMORY CARD   UOM: EA SC: R REV: A

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
103427104	CAP CERA MONO 100V .1 UF		1	P	EA	1.00	1.000	00/00/00	99/99/99	
190642103	RESISTOR NETWORK 10 K		6	P	EA	1.00	1.000	07/11/90	99/99/99	
200331027	IC 3-IN POS-NOR 74HC27		7	P	EA	1.00	1.000	12/11/90	99/99/99	
403950002	POLARIZING KEY		5	P	EA	2.00	1.000	11/04/90	99/99/99	
404500068	CONN BD TO BD 68 POS		4	P	EA	1.00	1.000	07/11/90	99/99/99	
454611040	HDR DIP SOLD TO MALE 40		2	P	EA	1.00	1.000	00/00/00	99/99/99	
550130108	SCREW CYL HD M3X8		8	P	EA	2.00	1.000	07/12/90	99/99/99	
552130101	NUT HEX M3		9	P	EA	2.00	1.000	07/12/90	99/99/99	
585252354	RIVET HOLLOW 2,5X9MM		10	P	EA	2.00	1.000	07/12/90	99/99/99	
719424203	PC BD PREASS'Y 9424-2	E	3	B	EA	1.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:49

PLANT CODE: ITI_GVA REQUESTER: CHRISTIA:
PAGE NO:

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424-5
DESC: QUAD CHANNEL FRONT PANEL CARD UOM: EA SC: R REV: E

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
103327103	CAP CERA MONO 50V .01 UF		13	P	EA	3.00	1.000	06/02/89	99/99/99	
103427104	CAP CERA MONO 100V .1 UF		14	P	EA	8.00	1.000	24/01/89	99/99/99	
161225103	RES COMP 1/8W 5% 10 K		15	P	EA	2.00	1.000	24/01/89	99/99/99	
161225121	RES COMP 1/8W 5% 120 OHMS		16	P	EA	21.00	1.000	24/01/89	99/99/99	
168531365	RES PREC RN55D 511 OHMS		17	P	EA	2.00	1.000	24/01/89	99/99/99	
168531381	RES PREC RN55D 750 OHMS		18	P	EA	1.00	1.000	24/01/89	99/99/99	
168531521	RES PREC RN55D 21.5 K		19	P	EA	1.00	1.000	24/01/89	99/99/99	
169416473	RESISTOR DISC NTC 47 K		20	P	EA	1.00	1.000	24/01/89	99/99/99	
184417502	RES VARI COND PLASTIC 5 K		21	P	EA	9.00	1.000	24/01/89	99/99/99	
184427502	RES VARI COND PLASTIC 5 K		22	P	EA	1.00	1.000	24/01/89	99/99/99	
184437502	RES VARI COND PLASTIC 5 K		23	P	EA	2.00	1.000	24/01/89	99/99/99	
190001001	RES NETWORK SPECIAL		24	P	EA	1.00	1.000	24/01/89	99/99/99	
200344138	IC DECODER 3TO8 74HCT138		25	P	EA	1.00	1.000	24/01/89	99/99/99	
205644094	IC 8-BIT SHIFT REGHCT4094		26	P	EA	7.00	1.000	24/01/89	99/99/99	
205750000	IC AND-OR GATE ARRAY 16V8		300	P	EA	1.00	1.000	03/05/90	99/99/99	SEE PAL PROG. PROGRAMM ON PC
207345051	IC MUX/DEMUX HCT4051		28	P	EA	3.00	1.000	24/01/89	99/99/99	
208590385	IC VOLT REF LM385		29	P	EA	1.00	1.000	24/01/89	99/99/99	
230020062	DIODE SWITCHING BAW62		30	P	EA	57.00	1.000	24/01/89	99/99/99	
256243300	DIODE LED RED HLMP-0300		31	P	EA	4.00	1.000	24/01/89	99/99/99	
256443421	DIODE LED YEL HLMP-0421		32	P	EA	49.00	1.000	24/01/89	99/99/99	
403950002	POLARIZING KEY		44	P	EA	2.00	1.000	06/02/89	99/99/99	
412001012	SWITCH ROT N/STOP 12-PINS		33	P	EA	3.00	1.000	24/01/89	99/99/99	
416161003	SWITCH PUSHBUTTON SPST		34	P	EA	52.00	1.000	24/01/89	99/99/99	
454211020	HDR SOLD TAIL TO MALE 20		35	P	EA	1.00	1.000	24/01/89	99/99/99	
536068001	KNOB FOR 6MM SHAFT		1001	P	EA	3.00	1.000	02/05/89	99/99/99	
536068002	KNOB FOR 3MM SHAFT		1002	P	EA	1.00	1.000	02/05/89	99/99/99	
536068003	CAP (FOR KNOB 020-2215)		1003	P	EA	9.00	1.000	02/05/89	99/99/99	
536068005	CAP FOR 020-3215 OR -3415		1004	P	EA	3.00	1.000	02/05/89	99/99/99	
536068006	CAP FOR 021-1110 OR -2215		1005	P	EA	2.00	1.000	02/05/89	99/99/99	
536168001	KNOB FOR 1/8" SHAFT		1006	P	EA	8.00	1.000	03/05/89	99/99/99	
536168002	KNOB FOR 1/8" SHAFT		1007	P	EA	1.00	1.000	02/05/89	99/99/99	
536168003	KNOB FOR 1/8" SHAFT		1008	P	EA	2.00	1.000	02/05/89	99/99/99	
550430106	SCREW CYL HD PHIL M3X6		36	P	EA	8.00	1.000	01/03/92	99/99/99	
551430300	WASHER SHAKEPROOF M3		37	P	EA	8.00	1.000	01/03/92	99/99/99	
553230108	SPACER HEX M3X8MM		38	P	EA	4.00	1.000	01/03/92	99/99/99	
554422004	SCREW SELF TAPPING PHIL HD		1009	P	EA	13.00	1.000	01/03/90	99/99/99	
709400511	LED COVER 9400-5	A	39	B	EA	53.00	1.000	24/01/89	99/99/99	
709450511	CALIBR.TERMIN. 9450-5		40	B	EA	2.00	1.000	24/01/89	99/99/99	
709450523	PUSH SWITCH EXTENDER	D	41	B	EA	52.00	1.000	24/01/89	99/99/99	
719424513	PC BD PREASS'Y 9424-51	C	42	B	EA	1.00	1.000	24/01/89	99/99/99	
719424523	PC BD PREASS'Y 9424-52	C	43	B	EA	1.00	1.000	24/01/89	99/99/99	
729424521	SPRING CONTACT		45	P	EA	1.00	1.000	14/08/89	99/99/99	
F9424-5	COMPLETED FRONT PANEL 9424-5	B	1000	R	EA	0.75	1.000	16/05/90	99/99/99	
F9424E-5	COMPLETED FRONT PANEL 9424E-5	B	1010	R	EA	0.25	1.000	16/05/90	99/99/99	
PC411AIH	PROBE CALIBRATOR	A	1	R	EA	1.00	1.000	02/05/89	99/99/99	

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424-6
DESC: PROCESSOR CARD UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
102412100	CAP CERA DISC 100V 10 PF		4	P	EA	1.00	1.000	00/00/00	99/99/99	
102412220	CAP CERA DISC 100V 22 PF		6	P	EA	1.00	1.000	00/00/00	99/99/99	
103327103	CAP CERA MONO 50V .01 UF		1	P	EA	35.00	1.000	14/02/92	99/99/99	
103427104	CAP CERA MONO 100V .1 UF		2	P	EA	35.00	1.000	00/00/00	99/99/99	
103506331	CAP CERA MONO 100V 330 PF		7	P	EA	1.00	1.000	00/00/00	99/99/99	
103625151	CAP CERA MONO 100V 150 PF		5	P	EA	2.00	1.000	00/00/00	99/99/99	
142214156	CAP TANT DIP CASE 15 UF		8	P	EA	1.00	1.000	00/00/00	99/99/99	
146354107	CAP MINI ALUM 20% 100 UF		9	P	EA	3.00	1.000	00/00/00	99/99/99	
147436033	CAP ALUM METAL CAN 33 UF		10	P	EA	1.00	1.000	00/00/00	99/99/99	
161225027	RES COMP 1/8W 5% 2.7 OHMS		3	P	EA	2.00	1.000	00/00/00	99/99/99	
161225102	RES COMP 1/8W 5% 1 K		11	P	EA	6.00	1.000	27/11/89	99/99/99	
161225103	RES COMP 1/8W 5% 10 K		12	P	EA	4.00	1.000	00/00/00	99/99/99	
161225206	RES CARBON FILM 20 MEG		13	P	EA	2.00	1.000	00/00/00	99/99/99	
161225391	RES COMP 1/8W 5% 390 OHMS		14	P	EA	3.00	1.000	00/00/00	99/99/99	
161225472	RES COMP 1/8W 5% 4.7 K		15	P	EA	1.00	1.000	00/00/00	99/99/99	
168531229	RES PREC RN55D 19.6 OHMS		16	P	EA	1.00	1.000	00/00/00	99/99/99	
168531389	RES PREC RN55D 909 OHMS		17	P	EA	1.00	1.000	00/00/00	99/99/99	
168531401	RES PREC RN55D 1.21 K		18	P	EA	1.00	1.000	00/00/00	99/99/99	
168531449	RES PREC RN55D 3.83 K		19	P	EA	1.00	1.000	00/00/00	99/99/99	
168531585	RES PREC RN55D 100 K		20	P	EA	3.00	1.000	00/00/00	99/99/99	
168531601	RES PREC RN55D 147 K		21	P	EA	1.00	1.000	00/00/00	99/99/99	
168531633	RES PREC RN55D 316 K		22	P	EA	1.00	1.000	00/00/00	99/99/99	
190042103	RESISTOR NETWORK 10 K		23	P	EA	4.00	1.000	00/00/00	99/99/99	
190832220	RESISTOR NETWORK 22 OHMS		24	P	EA	1.00	1.000	00/00/00	99/99/99	
190842102	RES NETWORK 1 K		25	P	EA	1.00	1.000	00/00/00	99/99/99	
200344174	IC HEX D-FLOP 74HCT174		26	P	EA	1.00	1.000	00/00/00	99/99/99	
200430393	IC BIN COUNTER HCT393		27	P	EA	2.00	1.000	00/00/00	99/99/99	
200440390	IC DEC COUNTER 74HCT390		28	P	EA	2.00	1.000	00/00/00	99/99/99	
200480167	IC REAL TIME CLOCK 58167		29	P	EA	1.00	1.000	00/00/00	99/99/99	
205254256	IC 256 X 4 RAM 424256C		65	P	EA	12.00	1.000	00/00/00	99/99/99	
205271256	IC 32K X 8 RAM 62256-12		30	P	EA	2.00	1.000	00/00/00	99/99/99	
205272064	IC8192X8 RAM 6264LP-10		31	P	EA	2.00	1.000	00/00/00	99/99/99	
205301000	UV E-PROM CMOS 1MBIT		32	P	EA	6.00	1.000	00/00/00	99/99/99	SEE EPROM PROG. PROGRAMM ON PC
205640165	IC SHIFT REG HCT165		33	P	EA	1.00	1.000	00/00/00	99/99/99	
205750000	IC AND-OR GATE ARRAY 16V8		300	P	EA	12.00	1.000	03/05/90	99/99/99	SEE PAL PROG. PROGRAMM ON PC
207172965	IC MEMORY DRIVER 2965		66	P	EA	1.00	1.000	00/00/00	99/99/99	
207367576	IC 8-BIT ADC AD7576		36	P	EA	1.00	1.000	00/00/00	99/99/99	
207472245	IC BUS TRANSCVR HCT245		37	P	EA	9.00	1.000	00/00/00	99/99/99	
208011007	IC DUAL OP AMP LM358N		38	P	EA	1.00	1.000	00/00/00	99/99/99	
208517705	IC VOLTAGE REG 7705		39	P	EA	1.00	1.000	00/00/00	99/99/99	
208618212	IC VOLT DETECTOR 8212		40	P	EA	1.00	1.000	00/00/00	99/99/99	
227792968	IC RAM CONTROLLER 2968A		64	P	EA	1.00	1.000	00/00/00	99/99/99	
230020062	DIODE SWITCHING BAW62		45	P	EA	2.00	1.000	00/00/00	99/99/99	
253010811	DIODE SCHOTTKY BAR HP2811		43	P	EA	2.00	1.000	00/00/00	99/99/99	
256233209	DIODE LED (RED)		44	P	EA	1.00	1.000	00/00/00	99/99/99	
275110001	TRANSISTOR PNP 2N2907A		46	P	EA	1.00	1.000	00/00/00	99/99/99	
280170104	TRANSISTOR FET N VN0104N3		47	P	EA	4.00	1.000	27/11/89	99/99/99	
309041016	CRYSTAL OSCILLATOR 16MHZ		48	P	EA	1.00	1.000	00/00/00	99/99/99	
310111032	CRYSTAL RESONATOR 32KH		49	P	EA	1.00	1.000	00/00/00	99/99/99	
312660030	BATTERY PC MTG LITH 3V		50	P	EA	1.00	1.000	00/00/00	99/99/99	
400331020	SOCKET IC ST DIP-20		51	P	EA	1.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:50

PLANT CODE: ITI_GVA

REQUESTER: CHRISTIAN

PAGE NO:

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424-6
DESC: PROCESSOR CARD UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
100360028	SOCKET IC ST DIP-28		52	P	EA	1.00	1.000	00/00/00	99/99/99	
100360032	SOCKET IC ST DIP-32		53	P	EA	6.00	1.000	00/00/00	99/99/99	
103950002	POLARIZING KEY		57	P	EA	2.00	1.000	00/00/00	99/99/99	
111430002	SWITCH ROCKER PC MTG (4)		58	P	EA	1.00	1.000	00/00/00	99/99/99	
154211020	HDR SOLD TAIL TO MALE 20		59	P	EA	1.00	1.000	00/00/00	99/99/99	
154610096	HDR DIP SOLD TO MALE 96		60	P	EA	1.00	1.000	00/00/00	99/99/99	
585252354	RIVET HOLLOW 2,5X9MM		61	P	EA	2.00	1.000	00/00/00	99/99/99	
7194XX603	PC BD PREASS'Y 94xx-6	A	62	B	EA	1.00	1.000	14/06/90	99/99/99	
MNX401	ICMIN MAX GATEARR. MNX401		63	B	EA	1.00	1.000	00/00/00	99/99/99	
SM207668020	IC 32-BIT U-PROC 68020		41	P	EA	1.00	1.000	14/06/90	99/99/99	
SM207668881	IC CO-PROCESSOR 68881		42	P	EA	1.00	1.000	14/06/90	99/99/99	

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424-8
DESC: CLOCK-BUS

UOM: EA SC: R REV: A

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
454150021	HDR SOLD TAIL/PC EDG21		1	P	EA	3.00	1.000	00/00/00	99/99/99	
719420803	PC BD PREASS'Y 9420-8	B	2	B	EA	1.00	1.000	00/00/00	99/99/99	
SM652101101	RES CHIP (E24) 1% 100 OHM		4	P	EA	1.00	1.000	18/09/92	99/99/99	
SM652101180	RES CHIP (E24) 1% 18 OHMS		5	P	EA	16.00	1.000	18/09/92	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database PLANT CODE: ITI_GVA REQUESTER: CHRISTIAN_
23-DEC-1992 08:51 BILL OF MATERIALS REPORT PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424E-7
DESC: QUAD CHANNEL 350 MHz FRONTEND UOM: EA SC: R REV: G

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
124471123	CAP POLYPROP 1% .012 UF		3	P	EA	16.00	1.000	00/00/00	99/99/99	
158849010	CAP VARIABLE 1 - 5 PF		4	P	EA	4.00	1.000	00/00/00	99/99/99	
161335560	RES COMP 1/4W 5% 56 OHMS		76	P	EA	1.00	1.000	27/11/91	99/99/99	
208144001	IC ADJ POS VOLT REG UA78G		5	P	EA	1.00	1.000	00/00/00	99/99/99	
208197805	IC VOLT REG POS 7805		6	P	EA	1.00	1.000	00/00/00	99/99/99	
208197905	IC VOLT REG NEG 7905		7	P	EA	2.00	1.000	00/00/00	99/99/99	
208911881	IC SYNC SEPARATOR 1881		9	P	EA	1.00	1.000	00/00/00	99/99/99	
402110302	CONN CO-AX PC MTG BNC		1	P	EA	4.00	1.000	10/08/89	99/99/99	
402610002	CONN CO-AX PC MTG SMB		100	P	EA	1.00	1.000	26/01/90	99/99/99	
403950002	POLARIZING KEY		2	P	EA	2.00	1.000	00/00/00	99/99/99	
430441732	RELAY 2 FORM CDPDT		10	P	EA	24.00	1.000	14/02/92	99/99/99	
454150010	HDR SOLD TAIL/PC EDG10		11	P	EA	1.00	1.000	00/00/00	99/99/99	
454211040	HDR SOLD TAIL TO MALE 40		12	P	EA	1.00	1.000	00/00/00	99/99/99	
454312004	HDR MALE PIN TO WW (2X2)4		13	P	EA	4.00	1.000	00/00/00	99/99/99	
454314016	HDR DIP SOLD TO MALE 16		14	P	EA	1.00	1.000	00/00/00	99/99/99	
454340002	HDR MALE PIN TO WW 02		15	P	EA	2.00	1.000	00/00/00	99/99/99	
500360204	INSULATOR FOR TO-3		1007	P	EA	3.00	1.000	02/05/89	99/99/99	
500560001	INSULATOR MICA FOR TO-220		75	P	EA	1.00	1.000	13/12/89	99/99/99	
500860442	INSULATOR FOR TO-3		1008	P	EA	3.00	1.000	02/05/89	99/99/99	
550425106	SCREW CYL HD PHIL M2.5X6		1004	P	EA	5.00	1.000	02/05/89	99/99/99	
550425520	SCREW FLAT HD PHIL 2,5X20		1005	P	EA	15.00	1.000	02/05/89	99/99/99	
550430105	SCREW CYL HD PHIL M3X5		1009	P	EA	1.00	1.000	13/12/89	99/99/99	
555440514	THREADED INSERT 4-40X1/16		17	P	EA	6.00	1.000	00/00/00	99/99/99	
560440008	SCREW PHILIPS 4-40X1/2		1006	P	EA	6.00	1.000	02/05/89	99/99/99	
709424711	UPPER RF SHIELD	A	1000	B	EA	1.00	1.000	02/05/89	99/99/99	
709424721	LOWER RF SHIELD	A	1001	B	EA	1.00	1.000	02/05/89	99/99/99	
709424731	FRONT RF SHIELD	A	1002	B	EA	1.00	1.000	02/05/89	99/99/99	
709424741	HEAT SINK	A	1003	B	EA	1.00	1.000	02/05/89	99/99/99	
709450771	THERMO-COUPLE 2	A	69	B	EA	4.00	1.000	07/06/89	99/99/99	
719424703	PC BD PREASS'Y 9424-7	E	19	B	EA	1.00	1.000	00/00/00	99/99/99	
780261129	SMB-SMC CABLE 29		20	B	EA	4.00	1.000	00/00/00	99/99/99	
·424E-7-SUB	SUBCONTRACTOR BOM FOR F9424E-7	A	28	R	EA	0.00	1.000	00/00/00	99/99/99	
:AT407	HYBRID ATTENUATOR HAT407		21	B	EA	4.00	1.000	00/00/00	99/99/99	
:AT408	HYBRID ATTENUATOR HAT408		22	B	EA	4.00	1.000	00/00/00	99/99/99	
:AT409	HYBRID ATTENUATOR HAT409		23	B	EA	4.00	1.000	00/00/00	99/99/99	
:CL413-IH	COMPLETED BOARD HCL413-IH	A	8	R	EA	1.00	1.000	18/05/90	99/99/99	
:HZ406A	HYBRID AMPLIFIER HHZ406A	F	24	R	EA	4.00	1.000	00/00/00	99/99/99	
:II400A-S	HYB AMP HII400A-S ITI	B	25	B	EA	4.00	1.000	00/00/00	99/99/99	
:IV401A-S	HYB AMP HIV401A-S ITI	A	26	B	EA	4.00	1.000	00/00/00	99/99/99	
:TR402-S	HYBRID TRIGGER HTR402-S ITI	D	27	B	EA	3.00	1.000	00/00/00	99/99/99	
:M168659489	RES METAL FILM .1% 10 K		29	P	EA	7.00	1.000	00/00/00	99/99/99	
:M185457501	RES VARI CERMET 500 OHMS		31	P	EA	1.00	1.000	00/00/00	99/99/99	
:M185457502	RES VARI CERMET 5 K		71	P	EA	4.00	1.000	03/11/89	99/99/99	
M200178000	IC 2-INPUT NAND HCT00		32	P	EA	2.00	1.000	00/00/00	99/99/99	
M200178004	IC HEX INVERTER HCT04		33	P	EA	1.00	1.000	00/00/00	99/99/99	
M200178008	IC 2-INPUT AND HCT08		34	P	EA	1.00	1.000	00/00/00	99/99/99	
M200178138	IC 3-8 LINE DECOD HCT 138		35	P	EA	2.00	1.000	00/00/00	99/99/99	
M200178139	IC 2-TO-4-LINE DEC HCT139		36	P	EA	2.00	1.000	00/00/00	99/99/99	
M205616094	IC 8-ST.SHIFT REG HCT4094		37	P	EA	9.00	1.000	00/00/00	99/99/99	
M207171488	IC QUAD LINE DRIVER 1488		38	P	EA	7.00	1.000	00/00/00	99/99/99	
M207770201	IC ANALOG SWITCH DG201		39	P	EA	5.00	1.000	03/11/89	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:51

PLANT CODE: ITI_GVA

REQUESTER: CHRISTIAN
PAGE NO:

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424E-7
DESC: QUAD CHANNEL 350 MHz FRONTEND UOM: EA SC: R REV: G

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
SM207978153	IC 4-INPUT MUX HCT153		40	P	EA	1.00	1.000	00/00/00	99/99/99	
SM208470007	IC OP AMP 0P-07		41	P	EA	6.00	1.000	00/00/00	99/99/99	
SM208470082	IC J-FET OP AMP 082C		42	P	EA	4.00	1.000	00/00/00	99/99/99	
SM208470351	IC J-FET OP AMP 351		43	P	EA	2.00	1.000	00/00/00	99/99/99	
SM208470353	IC DUAL OP AMP 353		44	P	EA	14.00	1.000	00/00/00	99/99/99	
SM236030099	DIODE SO-PKG BAV99		45	P	EA	5.00	1.000	00/00/00	99/99/99	
SM240050051	DIODE ZENER TZM-C-5V1		47	P	EA	5.00	1.000	00/00/00	99/99/99	
SM240050091	DIODE ZENER ZMM9.1		48	P	EA	3.00	1.000	00/00/00	99/99/99	
SM270080054	TRANSISTOR NPN BCX54		49	P	EA	2.00	1.000	00/00/00	99/99/99	
SM275080051	TRANSISTOR PNP BCX51		50	P	EA	2.00	1.000	00/00/00	99/99/99	
SM289772003	TRANSISTOR ARRAY 2003		51	P	EA	4.00	1.000	00/00/00	99/99/99	
SM301502001	BEAD (FERRITE CHIP)		52	P	EA	10.00	1.000	00/00/00	99/99/99	
SM653185182	RES THICK FILM 1.8 K		53	P	EA	4.00	1.000	00/00/00	99/99/99	
SM653185221	RES THICK FILM 220 OHMS		74	P	EA	4.00	1.000	04/12/89	99/99/99	
SM653505330	RES THICK FILM 33 OHMS		54	P	EA	4.00	1.000	00/00/00	99/99/99	
SM654101000	CHIP JUMPER ZERO OHMS		73	P	EA	2.00	1.000	26/01/90	99/99/99	
SM661127104	CAP CERA CHIP 20% .1 UF		55	P	EA	34.00	1.000	26/06/89	99/99/99	
SM661205222	CAP CERA CHIP 5% 2200 PF		67	P	EA	4.00	1.000	00/00/00	99/99/99	
SM661205332	CAP CERA CHIP 10% 3300 PF		58	P	EA	4.00	1.000	00/00/00	99/99/99	
SM661207103	CAP CERA CHIP 20% .01UF		56	P	EA	185.00	1.000	03/11/89	99/99/99	
SM661207223	CAP CERA CHIP 20% .022 UF		57	P	EA	4.00	1.000	00/00/00	99/99/99	
SM661255151	CAP CERA CHIP 5% 150 PF		66	P	EA	4.00	1.000	00/00/00	99/99/99	
SM661255470	CAP CERA CHIP 47PF		65	P	EA	4.00	1.000	00/00/00	99/99/99	
SM661255821	CAP CERA CHIP 5% 820 PF		59	P	EA	1.00	1.000	00/00/00	99/99/99	
SM661256120	CAP CERA CHIP 10% 12 PF		60	P	EA	4.00	1.000	00/00/00	99/99/99	
SM661486223	CAP CERA CHIP 10 % .022UF		61	P	EA	4.00	1.000	00/00/00	99/99/99	
SM661506684	CAP CERA CHIP 10% .68UF		62	P	EA	3.00	1.000	00/00/00	99/99/99	
SM666317475	CAP MOLD TANT CHIP 4.7 UF		68	P	EA	4.00	1.000	07/06/89	99/99/99	
SM666327225	CAP MOLD TANT CHIP 2.2 UF		64	P	EA	31.00	1.000	00/00/00	99/99/99	

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9424E-9
DESC: REAR PANEL FOR 9424E UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
205750000	IC AND-OR GATE ARRAY 16V8		300	P	EA	2.00	1.000	03/05/90	99/99/99	SEE PAL PROG. PROGRAMM ON PC
455021018	CONNECTOR PIN (FEMALE)		1003	P	EA	2.00	1.000	00/00/00	99/99/99	
455210002	BLOCK FOR CRIMP MALE PIN2		1004	P	EA	1.00	1.000	00/00/00	99/99/99	
530409125	FAN AXIAL 12V DC		1005	P	EA	1.00	1.000	13/07/89	99/99/99	
550440412	SCREW CYL INT HEX		1016	P	EA	4.00	1.000	02/05/89	99/99/99	
551440100	FLAT WASHER M4		1012	P	EA	4.00	1.000	00/00/00	99/99/99	
551440400	WASHER SHAKEPROOF M4		1013	P	EA	4.00	1.000	00/00/00	99/99/99	
554500001	TAPPING SCREW W/U-THREAD		1018	P	EA	2.00	1.000	02/05/89	99/99/99	
709424903	LABEL 9424E-9	A	1019	B	EA	1.00	1.000	26/01/90	99/99/99	
709424911	VOLTAGE SELECTOR COVER	A	1001	B	EA	1.00	1.000	00/00/00	99/99/99	
709424933	SERIAL NUMBER PLATE	A	1002	B	EA	1.00	1.000	24/01/91	99/99/99	
709424941	SCREW FOR SELECTOR COVER	A	1014	B	EA	1.00	1.000	02/05/89	99/99/99	
709424951	BNC HEADER	A	1015	B	EA	1.00	1.000	02/05/89	99/99/99	
7094XX903	LABEL FUSE 5A FOR 94XX	D	1020	B	EA	1.00	1.000	13/08/92	99/99/99	
780249945	BNC-SMD CABLE 45		1006	B	EA	3.00	1.000	26/01/90	99/99/99	
780259927	BNC-SMB CABLE 27		1007	B	EA	1.00	1.000	26/01/90	99/99/99	
RP94XX-9	REAR PANEL 94XX-9	A	1000	R	EA	1.00	1.000	26/12/90	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:53

PLANT CODE: ITI_GVA REQUESTER: CHRISTIAN

BILL OF MATERIALS REPORT

PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9450-2
DESC: DISPLAY CARD FOR 94xx UOM: EA SC: R REV: K

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
102412100	CAP CERA DISC 100V 10 PF		168	P	EA	1.00	1.000	03/07/90	99/99/99	
102412101	CAP CERA DISC 100V 100PF		164	P	EA	2.00	1.000	31/05/89	99/99/99	
102412120	CAP CERA DISC 100V 12 PF		165	P	EA	10.00	1.000	31/05/89	99/99/99	
102412220	CAP CERA DISC 100V 22 PF		4	P	EA	1.00	1.000	00/00/00	99/99/99	
102412470	CAP CERA DISC 100V 47 PF		5	P	EA	5.00	1.000	00/00/00	99/99/99	
102412560	CAP CERA DISC 100V 56 PF		6	P	EA	1.00	1.000	00/00/00	99/99/99	
102484821	CAP CERA DISC 100V 820 PF		7	P	EA	1.00	1.000	00/00/00	99/99/99	
102940502	CAP CERA DISC 1KV .005 UF		8	P	EA	5.00	1.000	30/01/92	99/99/99	
103327102	CAP CERA MONO 50V .001 UF		10	P	EA	2.00	1.000	00/00/00	99/99/99	
103327103	CAP CERA MONO 50V .01 UF		9	P	EA	56.00	1.000	14/02/92	99/99/99	
103327224	CAP CERA MONO 50V .22UF		11	P	EA	2.00	1.000	00/00/00	99/99/99	
103427104	CAP CERA MONO 100V .1 UF		12	P	EA	4.00	1.000	00/00/00	99/99/99	
103437334	CAP CERA MONO 100V .33 UF		13	P	EA	8.00	1.000	00/00/00	99/99/99	
124171623	CAP POLYSTYR 1% .062 UF		14	P	EA	2.00	1.000	00/00/00	99/99/99	
142714685	CAP TANT DIP CASE 6.8UF		15	P	EA	1.00	1.000	00/00/00	99/99/99	
146544471	CAP MINI ALUM 20% 470UF		16	P	EA	4.00	1.000	00/00/00	99/99/99	
146634106	CAP MINI ALUM 20% 10 UF		17	P	EA	18.00	1.000	00/00/00	99/99/99	
146754470	CAP MINI ALUM 20% 47 UF		18	P	EA	1.00	1.000	00/00/00	99/99/99	
147634102	CAP MINI ALUM 20% 1000 UF		19	P	EA	1.00	1.000	00/00/00	99/99/99	
161030000	RES COMP ZERO OHM		170	P	EA	1.00	1.000	30/01/92	99/99/99	
161335100	RES COMP 1/4W 5% 10 OHMS		20	P	EA	1.00	1.000	00/00/00	99/99/99	
161335101	RES COMP 1/4W 5% 100 OHMS		21	P	EA	4.00	1.000	30/01/92	99/99/99	
161335102	RES COMP 1/4W 5% 1 K		22	P	EA	16.00	1.000	00/00/00	99/99/99	
161335103	RES COMP 1/4W 5% 10 K		23	P	EA	12.00	1.000	00/00/00	99/99/99	
161335104	RES COMP 1/4W 5% 100 K		24	P	EA	8.00	1.000	00/00/00	99/99/99	
161335105	RES COMP 1/4W 5% 1 MEG		25	P	EA	2.00	1.000	00/00/00	99/99/99	
161335122	RES COMP 1/4W 5% 1.2 K		26	P	EA	5.00	1.000	00/00/00	99/99/99	
161335132	RES COMP 1/4W 5% 1.3 K		27	P	EA	1.00	1.000	00/00/00	99/99/99	
161335161	RES COMP 1/4W 5% 160 OHMS		28	P	EA	1.00	1.000	00/00/00	99/99/99	
161335202	RES COMP 1/4W 5% 2 K		29	P	EA	6.00	1.000	00/00/00	99/99/99	
161335203	RES COMP 1/4W 5% 20 K		30	P	EA	2.00	1.000	00/00/00	99/99/99	
161335204	RES COMP 1/4W 5% 200 K		31	P	EA	1.00	1.000	00/00/00	99/99/99	
161335221	RES COMP 1/4W 5% 220 OHMS		32	P	EA	8.00	1.000	00/00/00	99/99/99	
161335223	RES COMP 1/4W 5% 22 K		33	P	EA	1.00	1.000	00/00/00	99/99/99	
161335241	RES COMP 1/4W 5% 240 OHMS		34	P	EA	8.00	1.000	00/00/00	99/99/99	
161335242	RES COMP 1/4W 5% 2.4 K		35	P	EA	4.00	1.000	00/00/00	99/99/99	
161335271	RES COMP 1/4W 5% 270 OHMS		36	P	EA	2.00	1.000	00/00/00	99/99/99	
161335272	RES COMP 1/4W 5% 2.7 K		37	P	EA	2.00	1.000	00/00/00	99/99/99	
161335273	RES COMP 1/4W 5% 27 K		38	P	EA	1.00	1.000	00/00/00	99/99/99	
161335302	RES COMP 1/4W 5% 3 K		39	P	EA	7.00	1.000	00/00/00	99/99/99	
161335331	RES COMP 1/4W 5% 330 OHMS		40	P	EA	1.00	1.000	00/00/00	99/99/99	
161335332	RES COMP 1/4W 5% 3.3 K		160	P	EA	6.00	1.000	12/04/89	99/99/99	
161335333	RES COMP 1/4W 5% 33 K		42	P	EA	2.00	1.000	00/00/00	99/99/99	
161335362	RES COMP 1/4W 5% 3.6 K		43	P	EA	3.00	1.000	00/00/00	99/99/99	
161335394	RES COMP 1/4W 5% 390 K		44	P	EA	4.00	1.000	00/00/00	99/99/99	
161335471	RES COMP 1/4W 5% 470 OHMS		45	P	EA	14.00	1.000	00/00/00	99/99/99	
161335472	RES COMP 1/4W 5% 4.7 K		46	P	EA	2.00	1.000	00/00/00	99/99/99	
161335473	RES COMP 1/4W 5% 47 K		47	P	EA	1.00	1.000	00/00/00	99/99/99	
161335510	RES COMP 1/4W 5% 51 OHMS		48	P	EA	4.00	1.000	00/00/00	99/99/99	
161335511	RES COMP 1/4W 5% 510 OHMS		49	P	EA	1.00	1.000	00/00/00	99/99/99	
161335512	RES COMP 1/4W 5% 5.1 K		161	P	EA	7.00	1.000	12/04/89	99/99/99	

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9450-2
DESC: DISPLAY CARD FOR 94xx   UOM: EA   SC: R   REV: K

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
161335560	RES COMP 1/4W 5% 56 OHMS		163	P	EA	4.00	1.000	30/05/89	99/99/99	
161335565	RES COMP 1/4W 5% 5.6 MEG		51	P	EA	2.00	1.000	00/00/00	99/99/99	
161335621	RES COMP 1/4W 5% 620 OHMS		52	P	EA	2.00	1.000	00/00/00	99/99/99	
161335622	RES COMP 1/4W 5% 6.2 K		53	P	EA	2.00	1.000	00/00/00	99/99/99	
161335623	RES COMP 1/4W 5% 62 K		54	P	EA	1.00	1.000	00/00/00	99/99/99	
161335681	RES COMP 1/4W 5% 680 OHMS		55	P	EA	1.00	1.000	00/00/00	99/99/99	
161335682	RES COMP 1/4W 5% 6.8 K		56	P	EA	2.00	1.000	00/00/00	99/99/99	
161335752	RES COMP 1/4W 5% 7.5 K		57	P	EA	7.00	1.000	00/00/00	99/99/99	
161335753	RES COMP 1/4W 5% 75 K		58	P	EA	3.00	1.000	00/00/00	99/99/99	
161335821	RES COMP 1/4W 5% 820 OHMS		59	P	EA	2.00	1.000	00/00/00	99/99/99	
161335912	RES COMP 1/4W 5% 9.1 K		60	P	EA	1.00	1.000	00/00/00	99/99/99	
161445102	RES COMP 1/2W 5% 1K		61	P	EA	1.00	1.000	00/00/00	99/99/99	
161445560	RES CARBON FILM 56 OHMS		62	P	EA	1.00	1.000	00/00/00	99/99/99	
165375824	RES METAL FILM HV 820 K		63	P	EA	1.00	1.000	00/00/00	99/99/99	
168031022	RES METAL FILM 2.2 OHMS		64	P	EA	26.00	1.000	00/00/00	99/99/99	
168035125	RES METAL FILM HV 1.2 MEG		65	P	EA	1.00	1.000	00/00/00	99/99/99	
168045336	RES HV 33M		66	P	EA	1.00	1.000	00/00/00	99/99/99	
168531365	RES PREC RN55D 511 OHMS		67	P	EA	4.00	1.000	00/00/00	99/99/99	
168531385	RES PREC RN55D 825 OHMS		68	P	EA	2.00	1.000	00/00/00	99/99/99	
168531401	RES PREC RN55D 1.21 K		69	P	EA	7.00	1.000	00/00/00	99/99/99	
168531445	RES PREC RN55D 3.48K		70	P	EA	1.00	1.000	00/00/00	99/99/99	
168531447	RES PREC RN55D 3.65 K		71	P	EA	1.00	1.000	00/00/00	99/99/99	
168531453	RES PREC RN55D 4.22 K		72	P	EA	1.00	1.000	00/00/00	99/99/99	
168531471	RES PREC RN55D 6.49 K		169	P	EA	2.00	1.000	03/07/90	99/99/99	
168531495	RES PREC RN55D 11.5K		74	P	EA	3.00	1.000	00/00/00	99/99/99	
168531541	RES PREC RN55D 34.8 K		75	P	EA	1.00	1.000	00/00/00	99/99/99	
172137022	RES WIREWOUND .22 OHMS		76	P	EA	1.00	1.000	00/00/00	99/99/99	
180487103	RES VARI CERMET 10K		77	P	EA	2.00	1.000	00/00/00	99/99/99	
180487202	RES VARI CERMET 2K		78	P	EA	1.00	1.000	00/00/00	99/99/99	
180487205	RES VARI CERMET 2 MEG		79	P	EA	2.00	1.000	00/00/00	99/99/99	
180487501	RES VARI CERMET 500 OHMS		80	P	EA	2.00	1.000	00/00/00	99/99/99	
180487502	RES VARI CERMET 5K		81	P	EA	5.00	1.000	00/00/00	99/99/99	
190042222	RESISTOR NETWORK 2.2 K		82	P	EA	5.00	1.000	00/00/00	99/99/99	
190842222	RESISTOR NETWORK 2.2 K		83	P	EA	1.00	1.000	00/00/00	99/99/99	
200440040	IC12-ST BIN COUNT HCT4040		84	P	EA	1.00	1.000	00/00/00	99/99/99	
205271256	IC 32K X 8 RAM 62256-12		85	P	EA	2.00	1.000	00/00/00	99/99/99	
205370256	IC UV E-PROM 27256G-25		86	P	EA	2.00	1.000	00/00/00	99/99/99	PROGRAMMED WITH SPEED_CX
										PROGRAMMED WITH SPEED_CY
205750000	IC AND-OR GATE ARRAY 16V8		300	P	EA	4.00	1.000	03/05/90	99/99/99	SEE PAL PROG. PROGRAMM ON PC
207174244	IC OCTAL BUFFER HCT244		89	P	EA	2.00	1.000	00/00/00	99/99/99	
207270312	IC 12-BIT C/A CONV DAC312		90	P	EA	2.00	1.000	00/00/00	99/99/99	
207472245	IC BUS TRANSCVR HCT245		91	P	EA	2.00	1.000	00/00/00	99/99/99	
208011005	IC VOLT FOLLOWER LM310N		92	P	EA	2.00	1.000	00/00/00	99/99/99	
208031010	IC QUAD DIFF COMP LM339N		93	P	EA	1.00	1.000	00/00/00	99/99/99	
208041001	IC 8-BIT DAC MONODAC-08EQ		94	P	EA	3.00	1.000	00/00/00	99/99/99	
208041524	IC PULSE WIDTH MODUL 3524		95	P	EA	1.00	1.000	00/00/00	99/99/99	
208110353	IC DUAL OP AMP LF353N		96	P	EA	2.00	1.000	00/00/00	99/99/99	
208116365	IC OP AMP LM6365		97	P	EA	2.00	1.000	00/00/00	99/99/99	
208130347	IC QUAD JFET OP AMP LF347		98	P	EA	1.00	1.000	00/00/00	99/99/99	
08590336	IC VOLT REFERENCE LM336		99	P	EA	2.00	1.000	00/00/00	99/99/99	
30110005	DIODE SWITCHING 1N4448		100	P	EA	14.00	1.000	00/00/00	99/99/99	

BILL OF MATERIALS REPORT

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9450-2
DESC: DISPLAY CARD FOR 94xx UOM: EA SC: R REV: K

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
230150045	DIODE PICOAMPERE BAV 45		101	P	EA	2.00	1.000	00/00/00	99/99/99	
232990641	DIODE ARRAY (HV CASCADE)		102	P	EA	1.00	1.000	00/00/00	99/99/99	
235040060	DIODE RECTIFIER LM60		103	P	EA	1.00	1.000	00/00/00	99/99/99	
235820030	DIODE RECTIFIER EGP30D		104	P	EA	1.00	1.000	00/00/00	99/99/99	
235930816	DIODE RECTIFIER 1A MR816		105	P	EA	1.00	1.000	00/00/00	99/99/99	
240225720	DIODE ZENER 18V 1N720A		106	P	EA	2.00	1.000	00/00/00	99/99/99	
240413755	DIODE ZENER 7.5V 1N755A		108	P	EA	2.00	1.000	26/10/90	99/99/99	
240415754	DIODE ZENER 6.8V 1N754A		107	P	EA	2.00	1.000	00/00/00	99/99/99	
240425751	DIODE ZENER 5.1V 1N751A		109	P	EA	1.00	1.000	00/00/00	99/99/99	
240425752	DIODE ZENER 5.6V 1N752A		110	P	EA	1.00	1.000	00/00/00	99/99/99	
240425758	DIODE ZENER 10V 1N758A		111	P	EA	1.00	1.000	00/00/00	99/99/99	
240513977	DIODE ZENER 47V 1N977B		112	P	EA	1.00	1.000	00/00/00	99/99/99	
253010835	DIODE HOT CARRIER HP2835		113	P	EA	15.00	1.000	00/00/00	99/99/99	
270110003	TRANSISTOR NPN PN2222A		162	P	EA	3.00	1.000	12/04/89	99/99/99	
270170001	TRANSISTOR NPN 2N5770		115	P	EA	17.00	1.000	00/00/00	99/99/99	
270170002	TRANSISTOR NPN 2N5962		116	P	EA	21.00	1.000	00/00/00	99/99/99	
275110001	TRANSISTOR PNP 2N2907A		117	P	EA	4.00	1.000	00/00/00	99/99/99	
275170001	TRANSISTOR PNP 2N5087		118	P	EA	5.00	1.000	00/00/00	99/99/99	
275170002	TRANSISTOR PNP 2N5771		119	P	EA	16.00	1.000	00/00/00	99/99/99	
280180001	TRANSISTOR FET "N" U1897		120	P	EA	3.00	1.000	00/00/00	99/99/99	
280190513	TRANSISTOR FET "N" IRF513		121	P	EA	2.00	1.000	00/00/00	99/99/99	
280190642	TRANSISTOR FET "N" IRF642		122	P	EA	1.00	1.000	00/00/00	99/99/99	
280190830	TRANSISTOR FET "N" IRF830		123	P	EA	1.00	1.000	00/00/00	99/99/99	
281170001	TRANSISTOR FET "P" 2N5462		124	P	EA	4.00	1.000	00/00/00	99/99/99	
281190523	TRANSISTOR FET "P" 9523		125	P	EA	2.00	1.000	00/00/00	99/99/99	
301016103	INDUCTOR MOLDED 10 UH		126	P	EA	4.00	1.000	00/00/00	99/99/99	
302380480	FILTER CHOKE 2 AMP 48 UH		127	P	EA	1.00	1.000	00/00/00	99/99/99	
377051004	LABEL "DANGER HI VOLTAGE"		128	P	EA	1.00	1.000	00/00/00	99/99/99	
400360028	SOCKET IC ST DIP-28		129	P	EA	2.00	1.000	00/00/00	99/99/99	
400410121	IC SOCKET GRID TYP 121PIN		130	P	EA	1.00	1.000	00/00/00	99/99/99	
429220001	SWITCH THERMAL 1A N.O.		131	P	EA	1.00	1.000	00/00/00	99/99/99	
440290001	TRANSFORMER HV SWITCHING		132	B	EA	1.00	1.000	00/00/00	99/99/99	
454110003	HDR SOLD TAIL/MALE PIN 3		133	P	EA	2.00	1.000	00/00/00	99/99/99	
454111008	HDR SOLD TAIL/MALE PIN 8		134	P	EA	1.00	1.000	00/00/00	99/99/99	
454121003	BLOC FOR SOCKETS 3-PIN		135	P	EA	1.00	1.000	00/00/00	99/99/99	
454311003	HDR DIP SOLDER TO MALE 3		136	P	EA	2.00	1.000	00/00/00	99/99/99	
454610096	HDR DIP SOLD TO MALE 96		137	P	EA	1.00	1.000	00/00/00	99/99/99	
454711026	HDR DBL ROW RT ANGL 26		138	P	EA	1.00	1.000	00/00/00	99/99/99	
454902001	KEYING PLUG (SNAP IN) BLK		139	P	EA	3.00	1.000	00/00/00	99/99/99	
485011001	GROMMET 10MM OD 5MM ID		140	P	EA	1.00	1.000	00/00/00	99/99/99	
500110001	TRANSIPAD "SMALL"		148	P	EA	2.00	1.000	01/03/89	99/99/99	
500460005	MOUNTING KIT FOR TO-220		141	P	EA	6.00	1.000	00/00/00	99/99/99	
550430105	SCREW CYL HD PHIL M3X5		142	P	EA	6.00	1.000	23/10/91	99/99/99	
550430106	SCREW CYL HD PHIL M3X6		166	P	EA	4.00	1.000	10/10/89	99/99/99	
550440106	SCREW CYL HD PHIL M4X6		144	P	EA	2.00	1.000	00/00/00	99/99/99	
550440108	SCREW CYL HD PHIL M4X8		145	P	EA	2.00	1.000	00/00/00	99/99/99	
551430300	WASHER SHAKEPROOF M3		146	P	EA	10.00	1.000	23/10/91	99/99/99	
551440300	WASHER SHAKEPROOF M4		147	P	EA	4.00	1.000	00/00/00	99/99/99	
554435401	RIVET "RIVSCREW" M 3.5		167	P	EA	2.00	1.000	10/10/89	99/99/99	
560440004	SCREW PHILIPS 4-40X1/4		150	P	EA	6.00	1.000	00/00/00	99/99/99	
585252354	RIVET HOLLOW 2,5X9MM		151	P	EA	2.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:53

PLANT CODE: ITI_GVA REQUESTER: CHRISTIA

BILL OF MATERIALS REPORT

PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: F9450-2
DESC: DISPLAY CARD FOR 94xx UOM: EA SC: R REV: K

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
709400231	HV MULTIPLIER SUPPORT	A	152	B	EA	1.00	1.000	00/00/00	99/99/99	
709450201	HV UPPER COVER		154	B	EA	1.00	1.000	00/00/00	99/99/99	
709450211	HV LOWER COVER		155	B	EA	1.00	1.000	00/00/00	99/99/99	
709450221	FET SUPPORT		156	B	EA	1.00	1.000	00/00/00	99/99/99	
709450231	SPACER HEX M3X6MM		157	B	EA	2.00	1.000	23/10/91	99/99/99	
719450203	PC BD PREASS'Y 9450-2	J	158	B	EA	1.00	1.000	31/05/89	99/99/99	
MDS403	DISPLAY PROCESSOR MDS403		159	B	EA	1.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2 LeCroy Division ITI Production Database
23-DEC-1992 08:53

PLANT CODE: ITI_GVA REQUESTER: CHRISTIA

BILL OF MATERIALS REPORT

PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: M9424E
DESC: MECHANICAL FOR 9424E UOM: EA SC: R REV: C

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
300090001	DEFLECTION YOKE		1	P	EA	1.00	1.000	02/05/89	99/99/99	
315040015	POWER SUPPLY 9451-1		1043	B	EA	1.00	1.000	03/05/89	99/99/99	
321220009	CRT ORANGE 90 DEG DEFL 9"		1019	P	EA	1.00	1.000	00/00/00	99/99/99	
377051005	LABEL "DANGER————ONLY"	A	1020	P	EA	1.00	1.000	00/00/00	99/99/99	
377131001	LABEL (GROUND SYMBOL)		1041	P	EA	1.00	1.000	01/05/89	99/99/99	
389000000	ADHESIVE APENFIX		1049	P	ME	0.10	1.000	16/11/90	99/99/99	
455020001	CONNECTOR PIN (FEMALE)		2	P	EA	4.00	1.000	02/05/89	99/99/99	
455121003	CONNECTOR HOUSING 3		3	P	EA	2.00	1.000	02/05/89	99/99/99	
455950002	CLAMP WITH STRAIN RELIEF		4	P	EA	2.00	1.000	02/05/89	99/99/99	
485023008	BUMPER (FOOT) BLACK RUBBER		1046	P	EA	4.00	1.000	29/05/89	99/99/99	
530010024	FOOT FOR COMPAC ENCLOSURE		1032	P	EA	4.00	1.000	01/03/89	99/99/99	
530301005	HANDLE (U-SHAPE)		1021	B	EA	1.00	1.000	00/00/00	99/99/99	
530410001	CARD GUIDE NON METALLIC		1022	P	EA	5.00	1.000	00/00/00	99/99/99	
544310001	SPRING EXT TYPE 190 MM		1023	B	EA	1.00	1.000	00/00/00	99/99/99	
550425505	SCREW FLAT HD PHIL M2.5X5		1044	P	EA	1.00	1.000	03/05/89	99/99/99	
550430104	SCREW CYL HD PHIL M3X4		1013	P	EA	10.00	1.000	00/00/00	99/99/99	
550430106	SCREW CYL HD PHIL M3X6		1011	P	EA	14.00	1.000	00/00/00	99/99/99	
550430108	SCREW CYL HD PHIL M3X8		1012	P	EA	3.00	1.000	00/00/00	99/99/99	
550440105	SCREW CYL HD PHIL M4X5		1038	P	EA	4.00	1.000	06/11/89	99/99/99	
550440108	SCREW CYL HD PHIL M4X8		1037	P	EA	15.00	1.000	16/11/90	99/99/99	
550440110	SCREW CYL HD PHIL M4X10		1033	P	EA	5.00	1.000	21/12/90	99/99/99	
550440120	SCREW CYL HD PHIL		1035	P	EA	3.00	1.000	00/00/00	99/99/99	
550440120	SCREW CYL HD PHIL		1053	P	EA	1.00	1.000	18/09/91	99/99/99	
550440406	SCREW CYL INT HEX M4X6		1007	P	EA	12.00	1.000	00/00/00	99/99/99	
550440416	CYL INT HEX M4X16		1024	P	EA	4.00	1.000	00/00/00	99/99/99	
550440506	SCREW FLAT HD PHIL M4X6		1045	P	EA	2.00	1.000	03/05/89	99/99/99	
550440708	SCREW LARGE HEAD M4X8		1010	P	EA	8.00	1.000	00/00/00	99/99/99	
551430300	WASHER SHAKEPROOF M3		1016	P	EA	27.00	1.000	00/00/00	99/99/99	
551440300	WASHER SHAKEPROOF M4		1039	P	EA	24.00	1.000	21/12/90	99/99/99	
551440300	WASHER SHAKEPROOF M4		1054	P	EA	1.00	1.000	18/09/91	99/99/99	
551440400	WASHER SHAKEPROOF M4		1040	P	EA	2.00	1.000	06/11/89	99/99/99	
551440501	WASHER FLAT (SPRING) M4		1025	P	EA	8.00	1.000	00/00/00	99/99/99	
552440100	NUT HEX M4		1015	P	EA	10.00	1.000	00/00/00	99/99/99	
554440202	FLAT WASHER M4		1018	P	EA	4.00	1.000	00/00/00	99/99/99	
594120003	TIEWRAP		5	P	EA	2.00	1.000	02/05/89	99/99/99	
594120003	TIEWRAP		1026	P	EA	5.00	1.000	26/01/90	99/99/99	
594230002	CABLE CLIP ADHESIVE BACK		1047	P	EA	1.00	1.000	04/08/89	99/99/99	
709424011	NUT FOR HANDLE	A	1034	B	EA	3.00	1.000	21/12/90	99/99/99	
709424021	SIDE PANEL	C	1000	B	EA	2.00	1.000	00/00/00	99/99/99	
709424031	DIPLAY SUPPORT	E	1001	B	EA	1.00	1.000	00/00/00	99/99/99	
709424041	REAR SUPPORT	C	1002	B	EA	1.00	1.000	00/00/00	99/99/99	
709424051	MOTHER CARD SUPPORT	B	1003	B	EA	1.00	1.000	00/00/00	99/99/99	
709424061	POWER SUPPLY SUPPORT	A	1004	B	EA	1.00	1.000	00/00/00	99/99/99	
709424071	UPPER COVER	B	1005	B	EA	1.00	1.000	00/00/00	99/99/99	
709424081	LOWER COVER	B	1006	B	EA	1.00	1.000	00/00/00	99/99/99	
709424095	CARD RETAINER	C	1048	B	EA	1.00	1.000	16/11/90	99/99/99	
709424096	INSERTION GUIDE FOR MC	E	1050	B	EA	1.00	1.000	21/12/90	99/99/99	
709424098	SPACER FOR INSERTION GUIDE	A	1051	B	EA	1.00	1.000	21/12/90	99/99/99	
709450071	NEOPRENE WASHER	A	1014	B	EA	4.00	1.000	00/00/00	99/99/99	
780210030	DISPLAY POWER CABLE	A	1028	B	EA	1.00	1.000	00/00/00	99/99/99	
780220015	BASE CARD POWER CABLE	A	1029	B	EA	1.00	1.000	00/00/00	99/99/99	

MFG,RE,290,2   LeCroy Division ITI Production Database   PLANT CODE: ITI_GVA   REQUESTER: CHRISTIA
23-DEC-1992 08:53   BILL OF MATERIALS REPORT   PAGE NO:

SORTED BY ASSEMBLY PART NUMBER, COMPONENT PART NUMBER
AS OF 23/12/92

CLASS CODE: 2
SUBASSEMBLIES
PART: M9424E
DESC: MECHANICAL FOR 9424E   UOM: EA   SC: R   REV: C

COMPONENT PART	DESCRIPTION	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY	YIELD FACTR	EFFECTIV DATE	INACTIVE DATE	REFERENCE INFORMATION
780231120	FRONT END BASE CABLE	B	1030	B	EA	1.00	1.000	00/00/00	99/99/99	
780231131	MEMORY CARD CABLE	A	1052	B	EA	1.00	1.000	21/12/90	99/99/99	
780299025	CRT CABLE	B	1031	B	EA	1.00	1.000	00/00/00	99/99/99	
780411236	FRONT PANEL CABLE	A	1027	B	EA	1.00	1.000	23/02/89	99/99/99	
780544512	GROUND CABLE	A	1042	B	EA	1.00	1.000	01/05/89	99/99/99	

Chapter 9

Connecting the 9424 to a plotter or a printer.

Table of contents

9. Introduction

LeCroy oscilloscopes are supplied with a list of plotters and printers known to work with them. This list is not final, so any suggestions are welcome.

While the 9400 oscilloscope can only be connected to plotters, the 9424 and all other instruments of the same generation can be with some printers. Possible differences will be described.

HP plotter responses to some RS-232 configuration commands have been modified. Consequently, the 9424 generation DSO support HP plotters of two types. They may however, despite these changes, work with HPGL compatible plotters from other manufacturers.

Before connecting a plotter to a DSO, do not forget to select the appropriate settings in the plotter menu and the RS-232 menu pages.

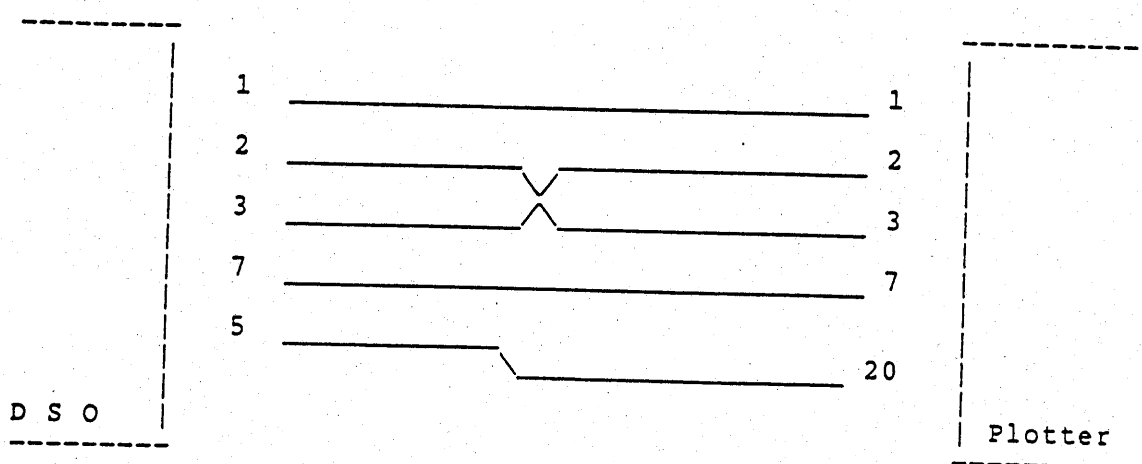
RS-232 connection:

The following settings are assumed for the scope:

Baud rate:	9600
Character:	8 bits
Parity:	none
Stop bits:	1

Any exceptions will be mentioned.

A cable with the following pinout can be used in almost every cases:



The cable has D25 connectors with male pins on both sides.

GPIB connection:

To have a plot done through GPIB initiated with the front-panel SCREEN DUMP push-button, you must set the DSO in TALK ONLY mode (by positioning the back-panel switches at an address above 31) and the plotter in LISTEN ONLY mode (see below) before powering on both machines. No controller is needed in this mode.

If a computer controls the GPIB bus, both the scope and the plotter must be set in ADDRESSED mode. The address switches must be under 31 on the scope. In the following list, plotter address 7 is given as an example. Remember that manual plotting is impossible in this mode, only the controller can initiate a plot.

Remark: the listen only mode does not work on some old HP plotters such as HP7585B or HP7475. The plotter must be set to listener before being able to receive any commands, which is a violation of the GPIB standard.

9.1 Plotters

9.1.1 HP 7470A Plotter

Switch setting:

- RS-232 Connection:
  S1 and S2: 0 0
  Y/D: D
  A4/US: user selectable
  B4 to B1: 1 0 1 0

- GPIB LISTEN ONLY:
  A4/US: user selectable
  16 to 1: 1 1 1 1 1

- GPIB Addressed:
  A4/US: user selectable
  16 to 1: 0 0 1 1 1

9.1.2 HP 7550A Plotter

Responses to some ESC characters commands are not the same in this plotter as in older HP models like the 7470A. In fact, ESC sequences of commands which give excellent results in the 7470A can prevent any handshake in RS-232.

Problems of this kind have been reported in the case of ESC.R and ESC.@ commands. When combined with ESC.I and ESC.N, ESC.@ breaks up all handshakes.

- RS-232 configuration:
  - Enter into display 5 (HP-IB MONITOR...)
  - Select STANDARD OF STANDARD/ENHANCED
  - Enter into SERIAL sub-menu (display 6)
  - For DATA_FLOW, select REMOTE. Either STANDALONE or EAVESDROP may be chosen.
  - Enter into display 7 (DUPLEX, PARITY, BAUD).
  - Select FULL duplex.
  - Configuration PARITY and BAUD rate to the same values as on the DSO.

A standard cable may be used, provided it has a female connector on the plotter side.

Do not start a plot while a sheet of paper is being loaded!

- GPIB configuration:
  If the scope is in TALK ONLY, the plotter must be in LISTEN ONLY.
  Selection will be done at Display 5.

- Note:
  It seems that the plotter must be powered off, then on again, to take any configuration change into account.

9.1.3 Hitachi 672 Graph Plotter (or NSA 672)

As this plotter is compatible with the 7470A, select this mode on the plotter menu page.

Switch settings:

- RS-232 Connection:

Sw. A, 1 and 2:	1 1	(ISO A3)	or (ISO A4)
Sw. A, 3 to 8:	1 0 1 1 0 1		
Sw. B:	1 1 1 1		

- Note:
  When switches are set to ISO A4, the pen must be manually repositioned at the top of the page (or the plotter reset by powering it off and on) before loading a new sheet of paper.

9.1.4 Graphtec FP5301

Switch setting:

- RS-232 Connection:

Switch S1:	1	2	3	4	5	6	7	8
	0	0	0	0/1	0	0	0	0
Switch S2:	1	2	3	4	5	6	7	8
	1/0 (1)	0	0	0	1	0	0	0

Switch S3:	1	2	3	4	5	6	7	8
	1	1	1	1	1	0	1	1

- GPIB Connection:

Switch S1:	1	2	3	4	5	6	7	8
	0	0	0	0	0	1	0	1

Switch S2:	1-2	3-4	5-6	7-8	9-10
	0	0	1	1	1

Switch S3: LISTEN ONLY or ADDRESSABLE

Notes:
- (1) select a baud rate factor of 1/16.
- FP5301-UM-151 has an internal switch that select step size. Select .1 mm per step.

9.1.5 Philips PM 8151

- RS-232 Connection:
The cable must be connected to the MODEM (ON LINE) port.

The baud rate will be 2400 baud.

Switches:

S1: OFF (No time sharing)

S2: 2400 bauds

	1	2	3	4	5	6
S3:	V24	free	8 bits	1 stop	no par.	not used

	1	2	5	6
S4:	OFF	free	Auto buff. mess. enable (no kaut)	free

3 and 4 are not used

- GPIB Connection:
Switches:

A6: Select LISTEN ONLY (LON) or ADDRESSED MODE (no LON).

A5	A4	A3	A2	A1
0	0	1	1	1

PP2 and P1 to P3: user selectable.

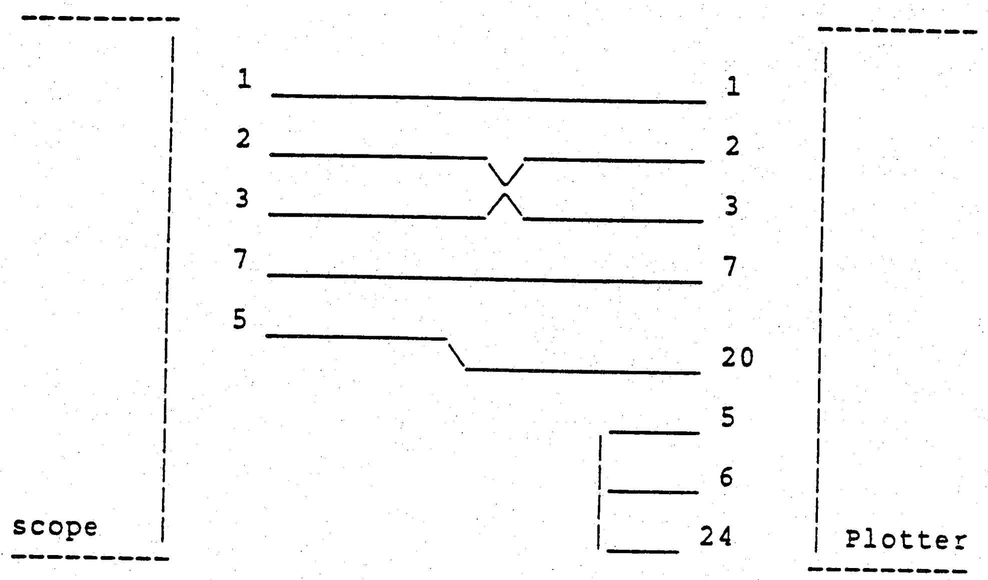
9.1.6 Philips PM 8153

PM 8153 B/1 (GPIB) and PM 8153 S/1 are PM 8151 compatible while PM 8153 B/6 and PM 8153 S/6 are HP 7470A compatible. Select the appropriate mode on the plotter menu page.

9.1.7 Gould computagraph

As the Gould plotter is compatible with the HP 7470A, select this mode on the plotter menu page.

For an RS-232 connection, a special cable is necessary:



(male connector) (female connector)

This cable must be plugged into the plotter's MODEM port.

9.2 Printers

Only the 9424 generation of DSO will support printers. Exception: the 9400 with the Raster Printer option (option OP03) denoted by a 'P' in its identification string does support the HP ThinkJet.
Interfacing is possible through RS-232, GPIB directly and via adapter through CENTRONICS.

9.2.1 CENTRONICS Printers

Most printers use a Centronics Parallel connection which makes direct interconnection impossible. To further confude the issue most PC computers use a 25-pin D connector for both the serial and parallel connections. The only difference being that one connector is equipped with male pins and the other with female pins.

The standard cable supplied between IBM computers and parallel printers has one 25-pin D connector on one end and a Centronics connector on the other end. Because the computer end of the cable is the same as the connector on the 9410, you and your customers might assume they are ready to connect and print .... NOT TRUE .... they can connect, but may not be able to print.

Here are some Hints and Things to look for:

1. If the printer has a 25-pin D connector on it then you can be 99% sure it's a serial printer and ready for a direct straight through cable to the 9424.

2. If the printer has a Centronics connector on it then you can be 99% sure it's a parallel printer and will require a Serial to Parallel converter.

   The SP-100 Serial to Parallel converter is distributed by:

   MICRO MEDIA CORP.
   3241 Amber Street
   Philadelphia, PA 19134
   Telex: (215) 739-0888
   Fax: (215) 739- 6466
   Cost: $45.00 (Retail Single Quantity)

   and by DISTRELEC in Switzerland.

It has been tested and found to be perfectly suited to converting your customer's parallel printer to work with the 9424.

The converter plugs directly into the Centronics connector on the printer. The other end of this small box (approx. 1" x 3" x 3") has the 25-pin RS-232 connector to allow the connection of a straight through RS-232 cable (male to female) to the 9424. The SP-100 is supplied with a 9-volt power supply that plugs into the Ac power line and converter power input connector. The 8-position Dip-Switch on the side of the converter should be set as follows:

SP-100 Switch 2, 3, 6, 8 ON (Down Position-Toward numbers) others OFF.

The following hard-copy parameters are required on the 9424:

Select Main Menu, Auxiliary Setups, Hardcopy.
Hard Copy:
Select device type: EPSON FX80 OR COMPATIBLE printer.
Hardcopy port: RS-232 (must use 8 bits with printers).
Graphics Density and Plot size are menu selectable.

Select RS-232
RS-232 Remote Control Port Settings:
Baud rate:9600
Characters length (bits): 8
Parity: none
Number of stop bits: 1

The following printers and printer switch positions have been tested:

		Switch 1	Switch 2
1.	Epson LQ-1000	1, 2, 3, 4 ON	2, 6, 7 ON
2.	Diconix 150P	1 ON	2, 6, 7 On
3.	HP-ThinkJet 2225C	2, 4, 5 ON	

Note: All Epson and Epson Compatible printers are likely to work if the switches are set properly. (Some experimentation may be required).

The customer must purchase his own accessories since we do not supply them.

Some other available Serial to Parallel converters need power through the RS-232 lines. Do not use them, as we do not guaranty that the serial port is able to furnish enough power.

9.3 RS-232 Printers

9.3.1 Epson FX80

It is possible to use the standard RS-232 cable. Such a printer has the optional RS-232 interface "# 8143" installed. The configuration that follows is valid for the default scope setting. The standard cable is usable.

In the particular case of an FX850:

- the main switches SW1 SW2 remain at the factory configuration:

SW1	1	2	3	4	5	6	7	8
	OFF	OFF	ON	OFF	OFF	ON	ON	ON

SW2	1	2	3	4
	ON	OFF	OFF	OFF

- the 8143 switches are set to:

1	2	3	4	5	6	7	8
ON	OFF	OFF	OFF	n/a	OFF	OFF	ON

- the 8143 jumpers remain at the factory settings:

J1	J2	J3	J4	J5	JC	JNOR	JRVE	JF	JX
OFF	OFF	OFF	OFF	ON	OFF	ON	OFF	ON	OFF

Note: Epson printers only support XON/XOFF support handshake if they have a print buffer. Such printers are:
FX, FX+, JX-80, LQ-800/1000, EX-800 and LQ-25000.
Otherwise, use DTR/RTS handshake.

9.3.2 HP QUIETjet

9.3.3 CITIZEN 120D

To use this printer with the default RS-232 settings and the default Plotter setting of the 9424, select the following switch configuration:

Dip switch bank 1: all OFF except 3 and 8.
Dip switch bank 2: all OFF.

9.3.4 HP LaserJet (will be supported as of release 2,6)

Make sure that Page Feed is ON in the Plotter menu to use the LaserJet.

It is advisable to start out in single density with a size of A5. Then, depending upon the internal buffer size on the LaserJet, the image size and/or density can be increased. At one point, the internal buffer size of the DSO is also reached. The image is simply truncated, indicating that either density or size have to be reduced.

9.3.5 HP ThinkJet (HP 2225D)

To use printer with the default RS-232 settings and with the default cable select the following switch configuration:

- mode switch:

1	2	3	4	5	6	7	8
0	0	0	0: 11" page length 1: 12" page length	0	0	0	0

- RS-232 switch:

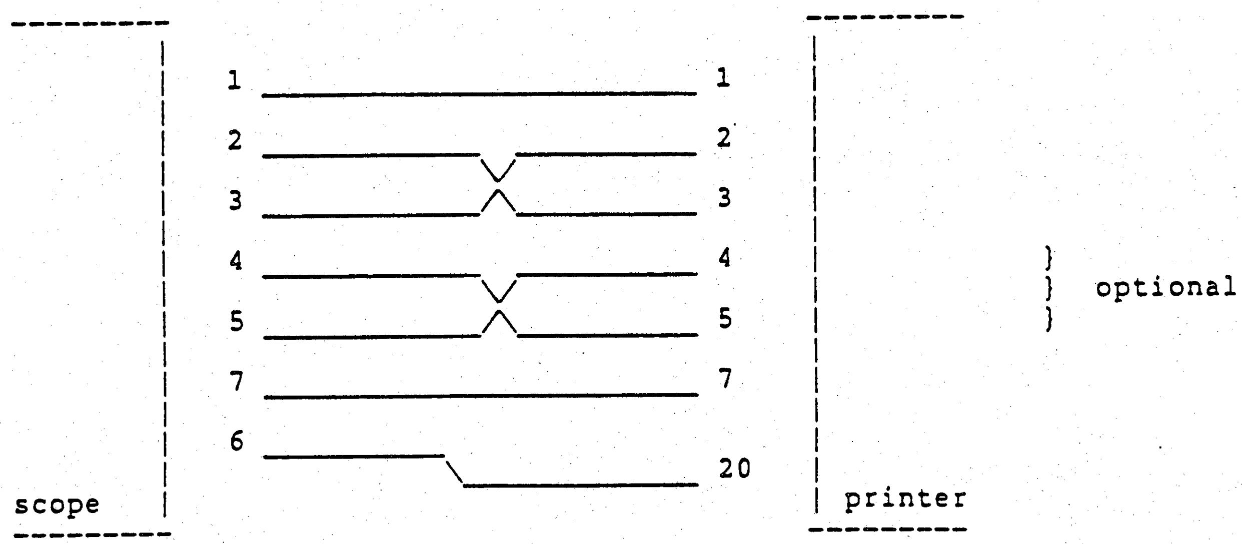
1	2	3	4	5
1	0	0	0	0
(use DTR Handshake)	(8 bits, parity none)		(9600 bauds)	

Note: it may be possible that old ThinkJet recognize only the Epson protocol. If it is the case use the EPSON.

9.3.6 Brother printers

The Brother M-1509 and M-1709 have been tested with a serial connection. On the oscilloscope select "EPSON FX-80 or compatible printer".

Use a cable with 2 male plugs like the following one:



The switch settings are identical for both the printers:

- SW1:

1	2	3	4	5	6	7	8
ON	ON	ON	OFF	ON	n/a	n/a	ON

- SW1:

1	2	3	4	5	6	7	8
< ----------- ALL OFF ------------ >							

- SW1:

1	2	3	4	5	6	7	8
OFF	OFF	OFF	OFF	11": OFF 12": ON	OFF	ON	OFF

9.4 GPIB Printers

9.4.1 HP QUIETJet

Make sure the dip switches on the backplane of the printer are set to

- SRQ Enable: 0

- GPIB LISTEN ONLY:
  LISTEN ALWAYS: 1
  A5 to A1: 0 0 1 1 1

- GPIB Addressed:
  LISTEN ALWAYS: 0
  A5 to A1: 0 0 1 1 1

9.4.2 HP THINKJet (HP 2225A)

Make sure the dip switches on the backplane of the printer are set to
- SRQ Enable: 0

- GPIB LISTEN ONLY:
  LISTEN ALWAYS: 1
  A5 to A1: 0 0 1 1 1

- GPIB Addressed:
  LISTEN ALWAYS: 0
  A5 to A1: 0 0 1 1 1

9.4.3 HP PaintJet (black/white only)

Make sure the dip switches near the GPIB connector are set to:
- GPIB LISTEN ONLY:

NORM/SCS	: NORM
A3 to A1	: 1 1 1
PC8/ROM8	: N/A
ENG/MET	: has to match paper size ENG = 11" MET = 12"

- GPIB addressed:

NORM/SCS	: NORM
A3 to A1	: any combination except 1 1 1 (correspond to add. 0-6)
PC8/ROM8	: N/A
ENG/MET	: has to match paper size ENG = 11" MET = 12"

9.5 Information on GPIB

9.5.1 Introduction

This section is a simple description of the GPIB interface as an aid to understanding the interface in the 9424 DSO: it is not intended as a complete specification of the system.

The GPIB system is designed for the interaction of a number of interacting devices, which may transmit or receive information as required. The system includes data lines over which the actual data are sent, bus management lines for control, and handshake lines to ensure correct acceptance of data at the right destination. The main features of the bus are summarized below:

Maximum number of devices	15
Maximum bus length	20 meters or 2 meters per device, whichever is less
Connection	star or chain

Note that more than half of any connected devices must be powered up, even if they will not be used.

Data lines		8 DIO 1 to 8
Handshake lines	DAV	Data available
	NRFD	Not ready for data
	NDAC	not data accepted
Bus management lines	EOI	End or identity
	IFC	Interface clear
	SRQ	Service request
	ATN	Attention
	REN	Remote enable

Active level	+0,4 V
Inactive level	+3,3 V

Note that all signal lines are active low, and that they are wire ORed to allow participation by all devices.

In addition, there are 8 ground lines, making a total of 24 lines.

9.5.2 Functions in the GPIB

In order to allow satisfactory interconnection of several devices the following functions must be provided

- Enabling any device to transmit data
- Preventing any device from transmitting data
- Enabling any device to receive data
- Preventing any device to receive data
- Transmitting data to a specific device
- Ensuring that only one device is transmitting
- Ensuring that transmitting takes place only when reception is possible
- Enabling any device to request servicing
- Identify type of data to be sent

Any device can be activated into the "talk" or "listen" state, and can be de-activated by the commands "untalk" and "unlisten". Also a device can be a "controller".

Maximum number of current talkers	1
Maximum number of current listeners	14
maximum number of current controllers	1

Function of bus lines:

- DAV Data available; talker says the data on the line are valid.

- NRFD Not ready for data; listener says it is not ready for more data. All listeners must release the NRFD line, i.e., let it go high, before talker can send.

- NDAC Not data accepted; listener says it has not yet accepted the data. Talker must hold all data lines steady until all listeners have released this line, i.e., it goes high.

Clearly, the NRFD and NDAC are easy to implement by a wired OR system, so that any one device asserting the signal prevents progress to the next step. Progress is made at the speed of the slowest listener. A simple timing diagram is given in figure 9.1, and another way of presenting the system is given in figure 9.2.

The bus management lines functions as follows:

- EOI End Or Identify; talker sends this with last byte of a block transfer to indicate last byte. Also used with ATN to parallel poll devices for their status bit.

- IFC InterFace Clear; places the GPIB system into a quiescent state.

- SRQ Service ReQuest; any device can send it to the controller to indicate need for attention, and to request interruption of current operations.

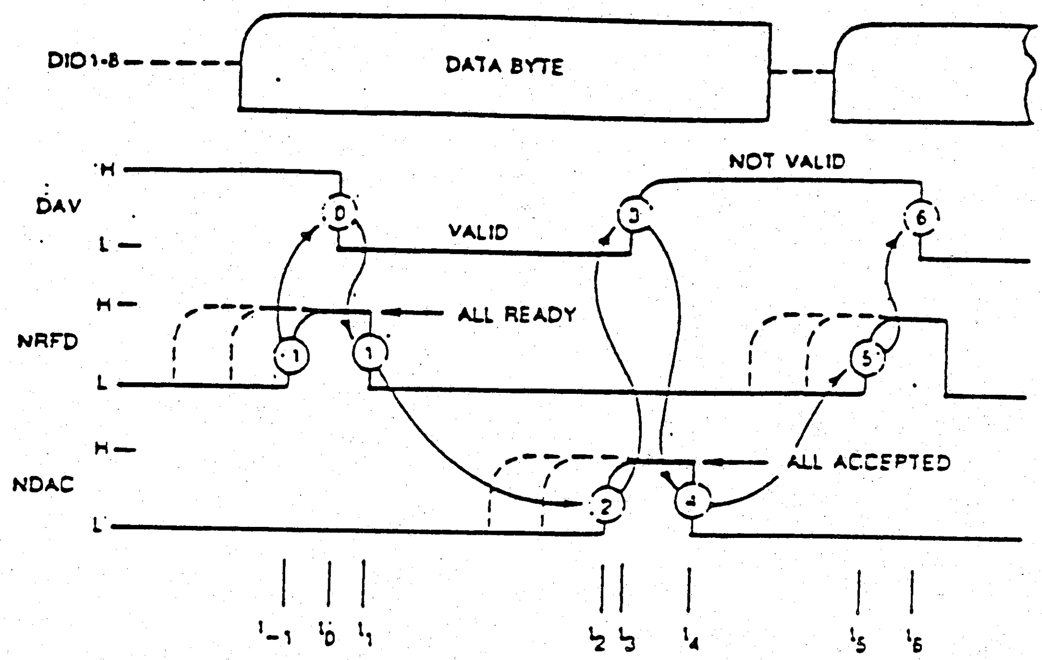
- ATN Attention; controller sends this to specify whether DIO lines are to be used for interface messages, e.g., addressing, or for data.

- REN Remote ENable; selects a device as being under local or remote control.

Addressing of the devices on the GPIB bus consult a specialized GPIB-IEEE488 document.

The principles of GPIB are quite simple - the system must wait for all users, and lines are wire ORed so that all can pull the lines down.

The handshake sequence is illustrated in two ways. In figure 9.1 the signal waveforms are sketched, while figure 9.2 is a flowchart.

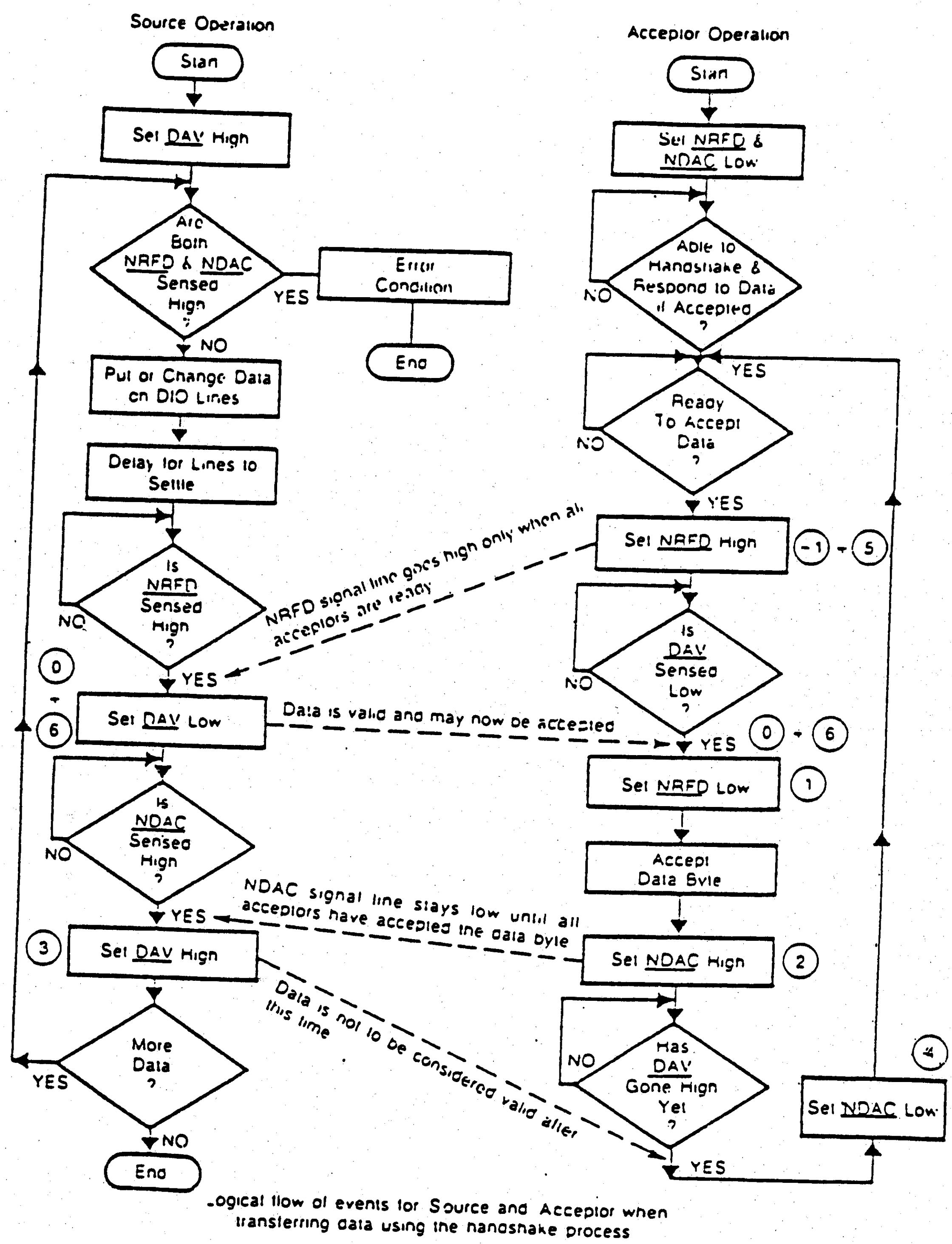


DATA BYTE TRANSFER IN GPIB IEEE-488

Figure 9.1

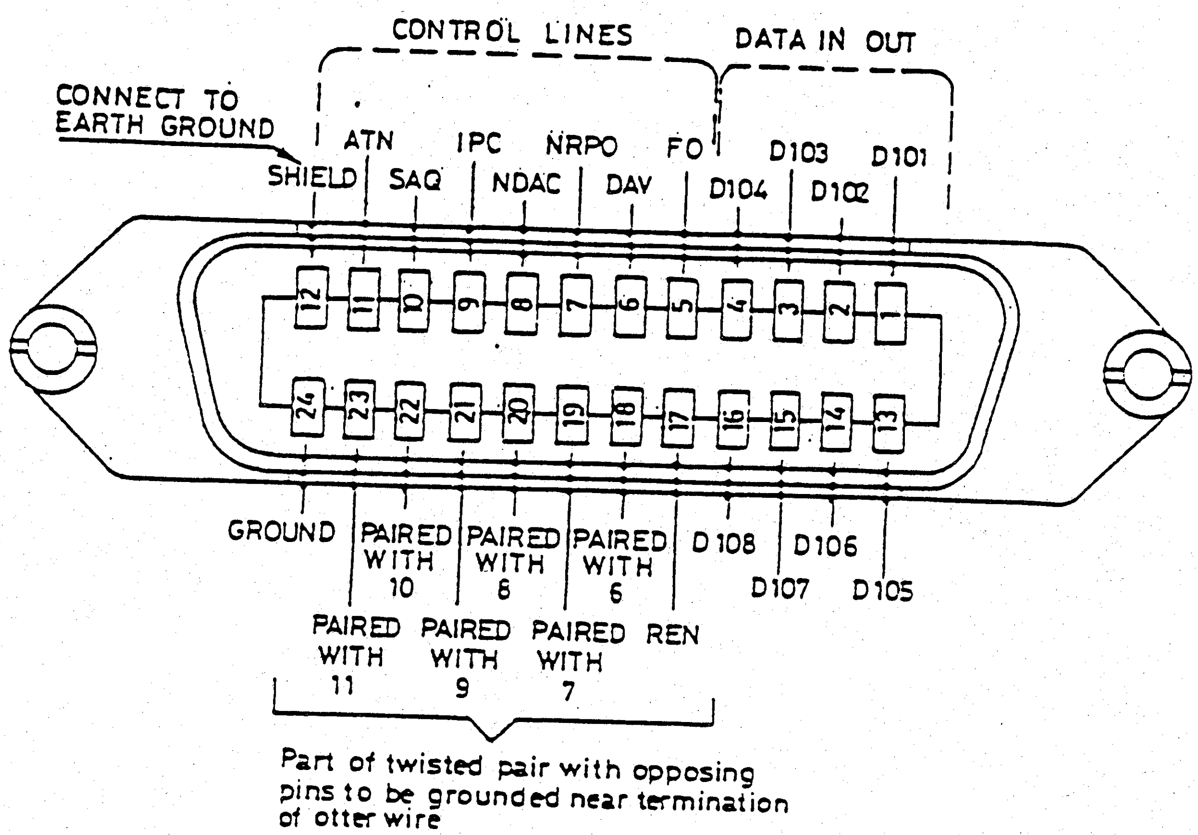
The handshake timing sequence proceeds as follows:

Preliminary	The source checks for presence of listeners and places the next data byte on the data lines DI01-8.
t-1	Acceptors one by one become ready for byte. Last one allows NRFD to go high.
t0	Sources pulls down DAV to validate data.
t1	The first litener to accept the data pulls down NRFD to show it is no longer ready for a new byte.
t2	The listeners one by one accept the data, and the last one lets NDAC go high.
t3	The source sets DAV high to show this byte is no longer valid.
t4	The listeners one by one accept this, the first one pulling NDAC low for the next cycle.
t5	As for t-1.

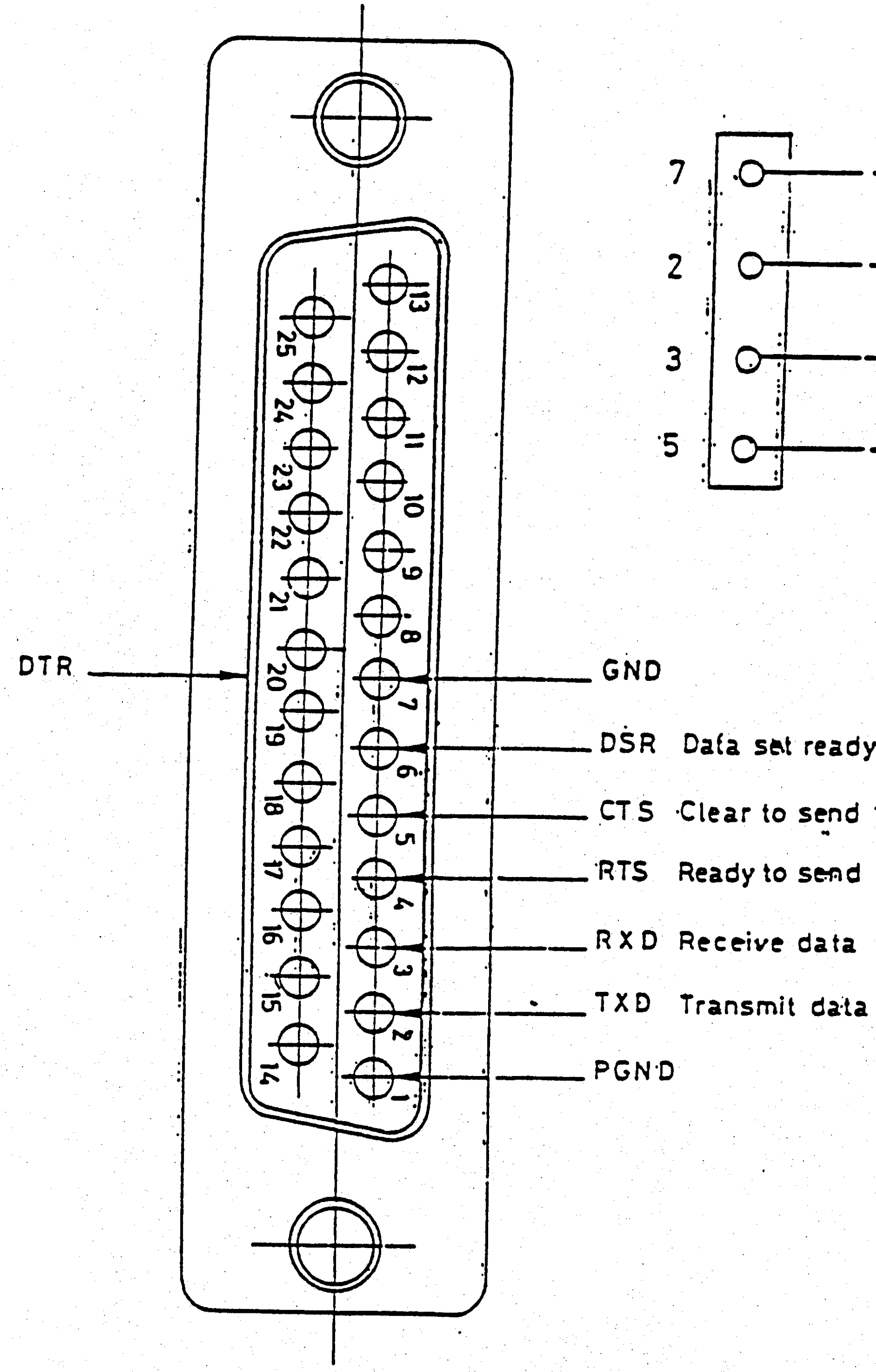


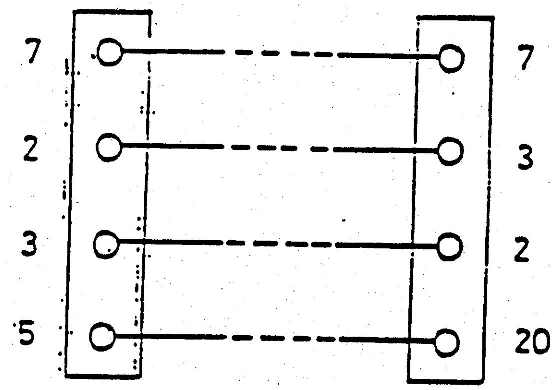
HANDSHAKE TIMING SEQUENCE IN GPIB IEEE-488

Figure 9.2



GPIB / IEEE-488 INTERFACE





RS232-C INTERFACE

APPENDIX A

Dec	Hex	ASCI char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
0	00	NUL		
1	01	SOH	^A	GTL - Go To Local
2	02	STX	^B	
3	03	ETX	^C	
4	04	EOT	^D	SDC - Selected Device Clear
5	05	ENQ	^E	PPC - Parallel Poll Configure
6	06	ACK	^F	
7	07	BEL		
8	08	BS		GET - Group Execute Trigger
9	09	HT		TCT - Take Control
10	0A	LF		
11	0B	VT		
12	0C	FF		
13	0D	CR		
14	0E	SO	^N	
15	0F	SI	^O	
16	10	DLE	^P	
17	11	DC1	^Q	LLO - Local Lock Out
18	12	DC2	^R	
19	13	DC3	^S	
20	14	DC4	^T	DCL - Device Clear
21	15	NAK	^U	PPU - Parallel Poll Unconfigure
22	16	SYN	^V	
23	17	ETB	^W	
24	18	CAN	^X	SPE - Serial Poll Enable
25	19	EM	^Y	SPD - Serial Poll Disable
26	1A	SUB		
27	1B	ESC	^[	
28	1C	FS	^\	
29	1D	GS	^]	
30	1E	RS	^^	
31	1F	US	^_	
32	20	SP		MLA - My Listen Address (listen 0)
33	21	!	!	MLA - My Listen Address (listen 1)
34	22	"	"	MLA - My Listen Address (listen 2)
35	23	#	#	MLA - My Listen Address (listen 3)
36	24	$	$	MLA - My Listen Address (listen 4)
37	25	%	%	MLA - My Listen Address (listen 5)
38	26	&	&	MLA - My Listen Address (listen 6)
39	27	'	'	MLA - My Listen Address (listen 7)
40	28	(	(	MLA - My Listen Address (listen 8)
41	29	)	)	MLA - My Listen Address (listen 9)
42	2A	*	*	MLA - My Listen Address (listen 10)
43	2B	+	+	MLA - My Listen Address (listen 11)
44	2C	,	,	MLA - My Listen Address (listen 12)
45	2D	-	-	MLA - My Listen Address (listen 13)

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
46	2E	.	.	MLA - My Listen Address (listen 14)
47	2F	/	/	MLA - My Listen Address (listen 15)
48	30	0	0	MLA - My Listen Address (listen 16)
49	31	1	1	MLA - My Listen Address (listen 17)
50	32	2	2	MLA - My Listen Address (listen 18)
51	33	3	3	MLA - My Listen Address (listen 19)
52	34	4	4	MLA - My Listen Address (listen 20)
53	35	5	5	MLA - My Listen Address (listen 21)
54	36	6	6	MLA - My Listen Address (listen 22)
55	37	7	7	MLA - My Listen Address (listen 23)
56	38	8	8	MLA - My Listen Address (listen 24)
57	39	9	9	MLA - My Listen Address (listen 25)
58	3A	:	:	MLA - My Listen Address (listen 26)
59	3B	;	;	MLA - My Listen Address (listen 27)
60	3C	<	<	MLA - My Listen Address (listen 28)
61	3D	=	=	MLA - My Listen Address (listen 29)
62	3E	>	>	MLA - My Listen Address (listen 30)
63	3F	?	?	UNL - Unlisten
64	40	@	@	MTA - My Talk Address (talk 0)
65	41	A	A	MTA - My Talk Address (talk 1)
66	42	B	B	MTA - My Talk Address (talk 2)
67	43	C	C	MTA - My Talk Address (talk 3)
68	44	D	D	MTA - My Talk Address (talk 4)
69	45	E	E	MTA - My Talk Address (talk 5)
70	46	F	F	MTA - My Talk Address (talk 6)
71	47	G	G	MTA - My Talk Address (talk 7)
72	48	H	H	MTA - My Talk Address (talk 8)
73	49	I	I	MTA - My Talk Address (talk 9)
74	4A	J	J	MTA - My Talk Address (talk 10)
75	4B	K	K	MTA - My Talk Address (talk 11)
76	4C	L	L	MTA - My Talk Address (talk 12)
77	4D	M	M	MTA - My Talk Address (talk 13)
78	4E	N	N	MTA - My Talk Address (talk 14)
79	4F	O	O	MTA - My Talk Address (talk 15)
80	50	P	P	MTA - My Talk Address (talk 16)
81	51	Q	Q	MTA - My Talk Address (talk 17)
82	52	R	R	MTA - My Talk Address (talk 18)
83	53	S	S	MTA - My Talk Address (talk 19)
84	54	T	T	MTA - My Talk Address (talk 20)
85	55	U	U	MTA - My Talk Address (talk 21)
86	56	V	V	MTA - My Talk Address (talk 22)
87	57	W	W	MTA - My Talk Address (talk 23)
88	58	X	X	MTA - My Talk Address (talk 24)
89	59	Y	Y	MTA - My Talk Address (talk 25)
90	5A	Z	Z	MTA - My Talk Address (talk 26)
91	5B	[	[	MTA - My Talk Address (talk 27)
92	5C	\	\	MTA - My Talk Address (talk 28)

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
93	5D	]	]	MTA - My Talk Address (talk 29)
94	5E	^	^	MTA - My Talk Address (talk 30)
95	5F	_	_	UNT - Untalk
96	60	`	`	
97	61	a	a	
98	62	b	b	
99	63	c	c	
100	64	d	d	
101	65	e	e	
102	66	f	f	
103	67	g	g	
104	68	h	h	
105	69	i	i	
106	6A	j	j	
107	6B	k	k	
108	6C	l	l	
109	6D	m	m	
110	6E	n	n	
111	6F	o	o	
112	70	p	p	
113	71	q	q	
114	72	r	r	
115	73	s	s	
116	74	t	t	
117	75	u	u	
118	76	v	v	
119	77	w	w	
120	78	x	x	
121	79	y	y	
122	7A	z	z	
123	7B	{	{	
124	7C	|	|	
125	7D	}	}	
126	7E	~	~	
127	7F	NUL		
128	80		Ç	
129	81		ü	
130	82		é	
131	83		â	
132	84		ä	
133	85		à	
134	86		å	
135	87		ç	
136	88		ê	
137	89		ë	
138	8A		è	
139	8B		ï	

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
140	8C		î	
141	8D		ì	
142	8E		Ä	
143	8F		Å	
144	90		É	
145	91		æ	
146	92		Æ	
147	93		ô	
148	94		ö	
149	95		ò	
150	96		û	
151	97		ù	
152	98			
153	99		Ö	
154	9A		Ü	
155	9B		¢	
156	9C		£	
157	9D		¥	
158	9E		₧	
159	9F		ƒ	
160	A0		á	
161	A1		í	
162	A2		ó	
163	A3		ú	
164	A4		ñ	
165	A5		Ñ	
166	A6		ª	
167	A7		º	
168	A8		¿	
169	A9		⌐	
170	AA		¬	
171	AB		½	
172	AC		¼	
173	AD		¡	
174	AE		«	
175	AF		»	
176	B0			
177	B1		░	
178	B2		▒	
179	B3		│	
180	B4		┤	
181	B5		╡	
182	B6		╢	
183	B7		╖	
184	B8		╕	
185	B9		╣	
186	BA		║	
187	BB		╗	

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
188	BC		╝	
189	BD		╜	
190	BE		╛	
191	BF		┐	
192	C0		└	
193	C1		┴	
194	C2		┬	
195	C3		├	
196	C4		─	
197	C5		┼	
198	C6		╞	
199	C7		╟	
200	C8		╚	
201	C9		╔	
202	CA		╩	
203	CB		╦	
204	CC		╠	
205	CD		═	
206	CE		╬	
207	CF		╧	
208	D0		╨	
209	D1		╤	
210	D2		╥	
211	D3		╙	
212	D4		╘	
213	D5		╒	
214	D6		╓	
215	D7		╫	
216	D8		╪	
217	D9		┘	
218	DA		┌	
219	DB		█	
220	DC		▄	
221	DD		▌	
222	DE		▐	
223	DF		▀	
224	E0		α	
225	E1		β	
226	E2		Γ	
227	E3		π	
228	E4		Σ	
229	E5		σ	
230	E6		µ	
231	E7		τ	
232	E8		Φ	
233	E9			
234	EA		Ω	