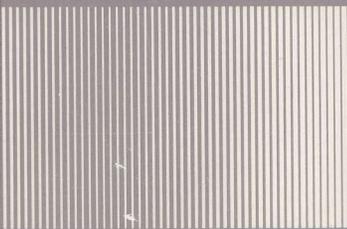




9450A DIGITAL OSCILLOSCOPE

SERVICE MANUAL



LeCroy

Innovators in Instrumentation

9450A DIGITAL OSCILLOSCOPE

SERVICE MANUAL

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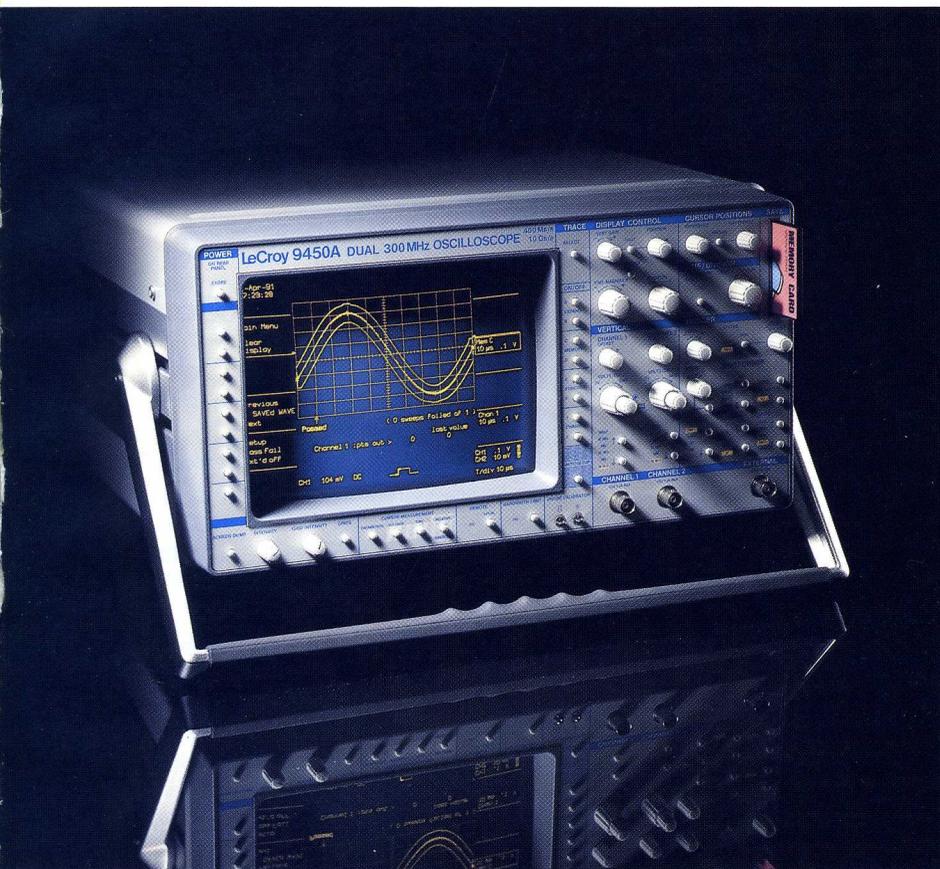
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Chapter 1

SPECIFICATIONS

**MODEL 9450A PORTABLE
DUAL-CHANNEL OSCILLOSCOPE**

9450A 



The 9450A is shown executing a PASS/FAIL test against a tolerance mask. Failing waveforms can be transferred to the optional memory card.

- 50K Memory per Channel
- Automatic PASS/FAIL Testing on Templates and Parameters
- Segmentable Memories with Trigger Point Time Stamps
- FASTGLITCH Trigger Mode
- Signal Processing and FFT Analysis
- Optional High Speed Memory Card
- Unmatched Display Quality

**THE ULTIMATE
INSTRUMENT FOR
DESIGN AND TEST**

The LeCroy 9450A Dual-channel Digital Oscilloscope is a powerful high-resolution instrument for waveform recording and sophisticated analysis.

The LeCroy 9450A provides a bandwidth of 300 MHz, and sampling rates of up to 400 megasamples/sec for transients and 10 gigasamples/sec for repetitive waveforms. The instrument features high-fidelity 8-bit ADCs, 50K of non-volatile acquisition memory per channel, 200K of additional waveform storage memory, extensive pulse parameter analysis, and a highly sophisticated trigger system to capture the most complex signals, including spikes and glitches. It is fully programmable over GPIB or RS-232-C interfaces. Hard copies are made at the touch of a button on a wide range of digital plotters and printers.

FEATURES

High bandwidth – The 9450A portable digital oscilloscope provides 300 MHz bandwidth on two channels. Combined with many other features, this enables you to keep pace with current and future test and measurement requirements.

Automatic PASS/FAIL testing – With this new feature, the oscilloscope can automatically compare a source trace with a tolerance mask, while simultaneously testing a set of parameters against reference values. If the test fails, the oscilloscope can perform up to six actions (hardcopy, storage to memory card, TTL pulse, etc...).

PC Standard Memory Card – A memory card reader can be added to the 9450A for applications requiring high-speed data logging and non-volatile waveform storage. Waveforms and setups can be stored at rates unmatched in the industry onto 128- or 512-Kbyte cards.

High sampling rates – High-resolution 8-bit Flash ADCs provide sampling rates up to 400 megasamples/sec simultaneously over two channels. Repetitive signals are digitized at equivalent rates up to 10 gigasamples/sec in random interleaved sampling mode.

Long non-volatile memories – Two non-volatile 50K acquisition memories, one per channel, store signals. By segmenting the two acquisition memories, non-volatile waveform storage of 1 to 200 waveforms is available. 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 – The 9450A features LeCroy's innovative FASTGLITCH trigger method which enables it to trigger even on non-recurrent glitches less than 2.5 nsec wide, independently of the time-base speed.

Signal processing – The 9450A's 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 twenty signal characteristics (risetime, falltime, RMS voltage, etc.) can be automatically calculated on displayed, stored, expanded and processed waveforms. Exceptional processing power means these values are instantaneously updated with each acquisition.

Waveform expansion – Fine signal details are revealed using LeCroy's exclusive DUAL-ZOOM expansion which can magnify waveforms by as much as 1000 times. Expanded waveforms have improved timing resolution (up to $\pm 0.001\%$ of full scale) and can be analyzed further using the 9450A's signal processing and pulse parameters.

Ease of use, auto-setup – Extensive processing power and familiar analog controls make the 9450A exceptionally responsive and easy to use. Repetitive waveforms are acquired in approximately two seconds with the convenient auto-setup facility. Recurring front-panel setups can be stored and recalled via simple pushbutton controls.

FUNCTIONAL DESCRIPTION

The LeCroy 9450A combines high bandwidth, fast sampling rates, high fidelity, extensive trigger capabilities and signal processing. Aimed at meeting the demands of researchers and engineers working in fields as diverse as telecommunications, electronic design and test, lasers, computers, NDT, physics and defense, the 9450A will rapidly become an indispensable measurement tool in any laboratory.

Like all LeCroy oscilloscopes, the 9450A is designed to serve as a range of different instruments: oscilloscope, transient recorder, counter/timer, frequency meter, signal averager, data logger and digital voltmeter. It offers the highest performing data acquisition and processing system available in any portable instrument.

ANALOG FEEL, DIGITAL PRECISION

The 9450A employs Flash technology in its two high-resolution, 8-bit ADCs (one per channel) which digitize

waveforms with speed and precision. By combining this technology with ease of use, LeCroy's portable instrument provides the best features of both analog and digital oscilloscopes.

The front-panel controls of the 9450A have been laid out in the style of an analog oscilloscope, making it easy to use from the very first moment. The analog feel is enhanced by the rapid instrument response and the fact that waveforms are presented instantly on a bright high-resolution screen. For automated test applications **all** the front-panel controls, including cursor positions and internal functions, are fully programmable over RS-232-C or GPIB interfaces.

Capturing and measuring signals has never been easier. For repetitive signals an auto-setup facility finds and displays signals in less than 2 seconds. For one-time phenomena the 9450A's long 50K memories and extensive triggering capabilities enable signals to be captured the very first time, even when signal speed and duration are uncertain.

LONG NON-VOLATILE MEMORIES

Only long memories allow high-fidelity recording over extended periods of time. On equal time-base settings the 9450A, with 50K of memory per channel, will sample waveforms up to 50 times faster than an oscilloscope with only 1K of memory. Faster sampling means better single-shot bandwidth, better time resolution and the power to expand waveforms up to 1000 times to see details that completely elude other digital oscilloscopes. In addition, when segmented, the 9450A's non-volatile acquisition memories can store up to 200 waveforms/channel (complete with date and time stamps).

TRIGGER

Pushbutton control enables the user to choose the appropriate trigger functions for his signal: standard triggering for basic measurements and advanced triggering to meet highly sophisticated requirements.

The standard trigger facility provides all the conventional trigger functions. Front-panel controls select and adjust parameters such as pre- and post-trigger settings, trigger level, slope, mode and coupling. To help users quickly determine the 9450A's trigger mode and conditions, LeCroy has created a series of illustrative trigger graphics.

SMART triggering offers a solution to even the most intricate triggering problems. For example, FASTGLITCH trigger can be used to locate and reveal glitches and spikes less than 2.5 nsec wide. Time-qualified trigger is ideal for ranging applications and can be used to ignore

unwanted signal reflections. Other trigger features include hold-off (by time or number of events), gated triggering and conditional triggering, qualified trigger, and trigger delayed by time or number of events.

PASS/FAIL

The PASS/FAIL routine enables the oscilloscope to compare a source trace against a tolerance mask while simultaneously testing a set of extracted parameters.

For instance, the oscilloscope can be set up to PASS if:

1. The waveform in Channel 1 is contained in the mask in Memory C (all points inside the mask).
2. The frequency in Channel 2 is less than 10 kHz.
3. The maximum value of Function F is more than 1.45 V.
4. The RMS value in Channel 1 is less than 850 mV.

If any of these four conditions is not satisfied, the test will FAIL

Whether the test PASSES or FAILS, the oscilloscope can, if the user wishes, perform any or all of the following actions:

- Stop the acquisition.
- Make a screen dump.
- Store a trace to Memory D.
- Store the selected traces to the memory card.
- Emit a "beep".
- Send a pulse from the rear-panel accessory port.

The mask envelope can also be generated inside the oscilloscope.

SPECIFICATIONS

VERTICAL ANALOG SECTION

Bandwidth (-3 dB):

@ 50 Ω : DC to 300 MHz.

@ 1 M Ω : DC to 250 MHz typical at the probe tip.

Input impedance: 1 M Ω // 15 pF and 50 Ω \pm 1% .

Channels: Two independent channels; standard BNC connector inputs.

Sensitivity range: 5 mV/div to 2 V/div; continuously variable from 1 to 2.5 times the fixed setting. Fixed settings range from 5 mV/div to 2 V/div (in a 1, 2, 5 sequence).

Vertical expansion: up to 5 times (with averaging, up to 50 times or 100 μ V/div sensitivity).

Scale factors: Probe attenuation factors of $\times 1$, $\times 10$, $\times 100$, $\times 1000$, 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 @ 5 mV/div.

DC accuracy: $\leq \pm 2\%$ full scale.

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

Max input voltage: 250 V (DC + peak AC ≤ 10 kHz) at 1 M Ω , ± 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 400 megasamples/sec for transients, up to 10 gigasamples/sec for repetitive signals, simultaneously on both channels.

Aperture uncertainty: ± 10 psec.

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

Reference memories C and D: 50K, 16-bit word memories which can store one acquired and/or processed waveform, or up to 200 waveforms when segmented.

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 2.5 nsec), are captured and displayed with 100% probability.

Using LeCroy's 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: $\leq \pm 0.002\%$.

Interpolator resolution: 5 psec.

Interpolator accuracy: 20 psec RMS.

Sampling clock output: BNC connector on rear panel.

External clock in: BNC connector on rear panel.

Acquisition Modes

Random Interleaved Sampling (RIS) for repetitive signals from 1 nsec/div to 5 μ sec/div;

Single shot for transient signals and repetitive signals from 10 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: DUAL ZOOM mode allows two different signals or two different sections of the same signal to be expanded up to 1000 times.

Trigger

Pretrigger 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.

External trigger input: 1 M Ω , < 20 pF, 250 V max. (DC + peak AC \leq 10 kHz).

External trigger range: ± 2 V in EXT, ± 20 V in EXT/10.

Rate: Up to 500 MHz using HF trigger coupling.

Timing: Trigger timing (date and time) is logged 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, LINE, EXT, EXT/10. CHAN1, CHAN2 and EXT have independent trigger circuits allowing slope, coupling and level to be set individually for each source.

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 warning 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 10⁹ 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 logic AND of the three sources CHAN1, CHAN2 and EXT, 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 the end (exited) of the specified pattern.

Bi-level: This is a special condition of pattern trigger which allows the 9450A to trigger on any signal that exceeds a certain preset 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 9450A to trigger on any source (CHAN1, CHAN2 or EXT), while requiring that a certain pattern of the other two channels is present or absent. A delay by time or by number of events can be selected from the moment the pattern is valid.

Time/Event qualified: Allows the 9450A to trigger on any source (CHAN1, CHAN2 or EXT), 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 (up to 1500) and field number (up to 8) is possible. Active on EXT only.

DISPLAY

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

Resolution: 4096 \times 4096 points.

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

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

Persistence mode: Plots consecutively acquired traces of up to four sources (CHAN1, CHAN2, MEMORY C or D, FUNCTION E or F and EXPAND A or B) on top of each other, allowing waveform trends and history to be examined. The number of sweeps is selectable from : 1, 2, 5, 10, 20, 50, 100, 200 or INFINITE. Time and voltage cursor measurements are supported in persistence mode.

XY mode: Plots any two sources (CHAN1 and 2, EXPAND A and B, Memories C and D and Functions E and F) against one another. Operates on live waveforms with full cursor readout.

Hard copy: Single or multi-pen digital plotters as well as printers can be used to make hard copies of the display. Screen dumps are activated by a front-panel pushbutton or via remote control. Plotters supported are: the HP 7400 and 7500 series, Philips PM 8151, Graphtek FP 5301, and compatible models. Printers supported are: EPSON and the HP ThinkJet, QuietJet and LaserJet. Plotting can be done in parallel with normal 9450A operation.

Graphics: 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; XY mode; persistence mode; RS-232-C configuration; hardcopy setup; real-time clock setup; averaging; arithmetic; and PASS/FAIL.

Cursors

Relative time: Two cursors provide time measurements with a resolution of $\pm 0.05\%$ 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 $\pm 0.2\%$ of full scale for each trace.

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 provide a stable display for 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 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:

Amplitude	Frequency	Period
Area	Maximum	PulseWidth
Base	Mean	Risetime
Cycles	Minimum	RMS
Delay	Overshoot Negative	Standard Deviation
Duty Cycle	Overshoot Positive	Top
Falltime	Peak-Peak	

Sources: CHAN1, CHAN2, MEMORY C or D, FUNCTION E or F, EXPANSION A or B. Cursors define the measurement zone. With more than 1 pulse present in the measurement zone, averaged results for period, frequency, duty cycle, width, risetime and falltime are presented.

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.

PROBES

Model: Two P9020 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 specified DC and time accuracy .

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.

Shock and vibration: Meets requirements of MIL-STD—810C modified to LeCroy design specifications, and MIL-T-28800C.

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

Dimensions: (HWD) 21 × 37 × 50 cm, (8 1/2 × 14 1/2 × 20 inches).

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

Warranty: 2 years.

ORDERING INFORMATION**Oscilloscope and Options**

Code	Description
9450A	Digital Oscilloscope
9450AWP01	Waveform Processing Option
9450AWP02	FFT Processing Option
9450AMATE	CIIL/MATE Option
9450A-MC01	Card Reader
9450A-MC02	128K Memory Card
9450A-MC04	512K Memory Card

Oscilloscope Accessories

OM9450A	Operator's Manual
94XX-FC	Front Cover

Oscilloscope Accessories (cont'd)

CA9001	Camera (using Polaroid film) and Hood
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
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
94XX-CS01	CALSOFT Automatic Calibration Package

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Milano (02) 2940-5634

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Osaka (06) 330-0961

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Portugal: M.T. Brandao, Lta., (02) 815 680

Singapore: Sing. Electr. and Eng. Ltd (65) 481-8888

South Africa: Westplex Test & Meas., (011) 787 0473

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LeCroy

Innovators in Instrumentation

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TDS 080/002

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

9420/24/50 WP01 



- **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**

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.

**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: $F(E) = \text{Average (CH1-CH2)}$.

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 $\mu\text{V}/\text{division}$.

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 com-

paring 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 $\mu\text{V}/\text{div}$ 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 $\mu\text{V}/\text{div}$ 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 $\mu\text{V}/\text{div}$ 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

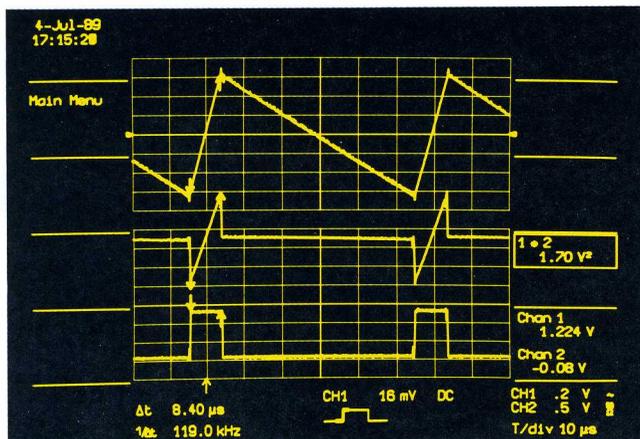
C and D for intermediate results, any number of operations can be chained manually or via remote control.

REMOTE CONTROL

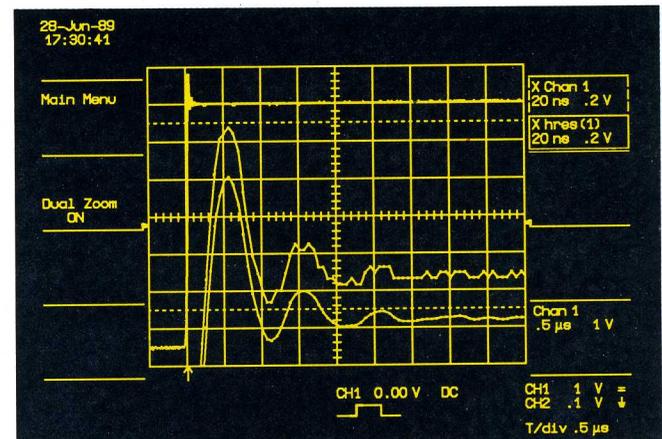
All controls and waveform processing functions are fully programmable using the oscilloscope's GPIB or RS-232-C interfaces. Simple English-like commands are used.

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, subtraction 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.

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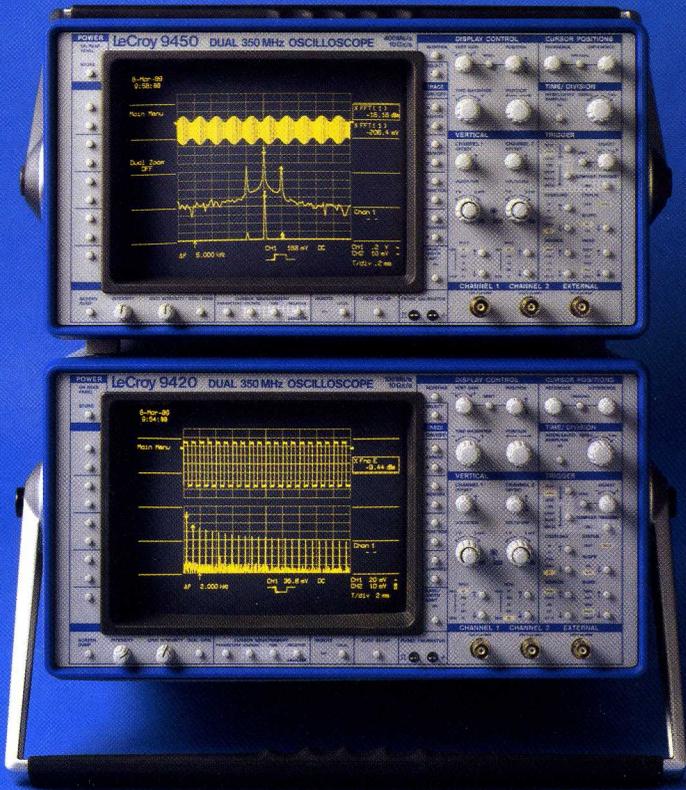
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Other sales and service representatives throughout the world.

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

9420/24/50 WP02



- 50,000 point FFTs over Two (or Four) Channels Simultaneously
- Frequency Range from DC to > 350 MHz
- Frequency Resolution from 20 μ Hz 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!

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).

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 \times 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 ($\pm 2\%$ 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

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).

(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.

Phase range: -180° to $+180^\circ$.

Phase accuracy: $\pm 5^\circ$ (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]
Rectangular	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.

Scalloping loss is the maximum loss of amplitude accuracy of the magnitude spectrum.

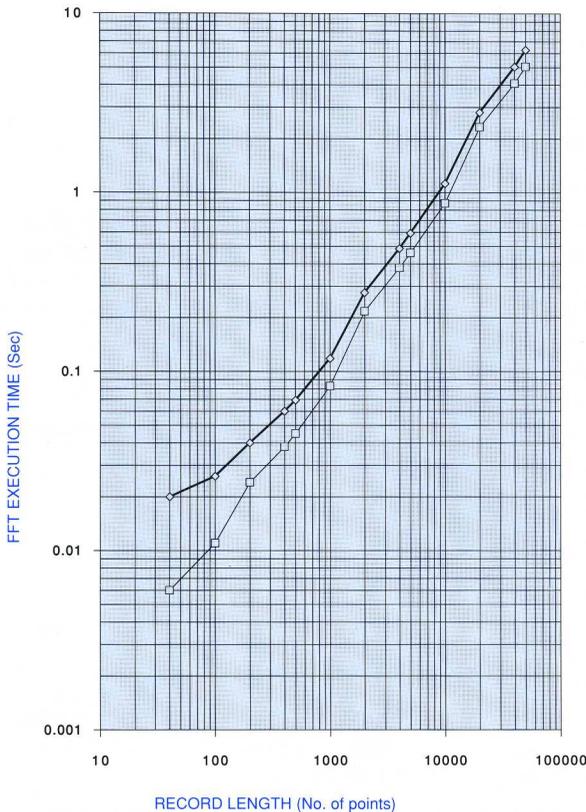
Noise bandwidth is the bandwidth of an equivalent rectangular filter.

CURSORS

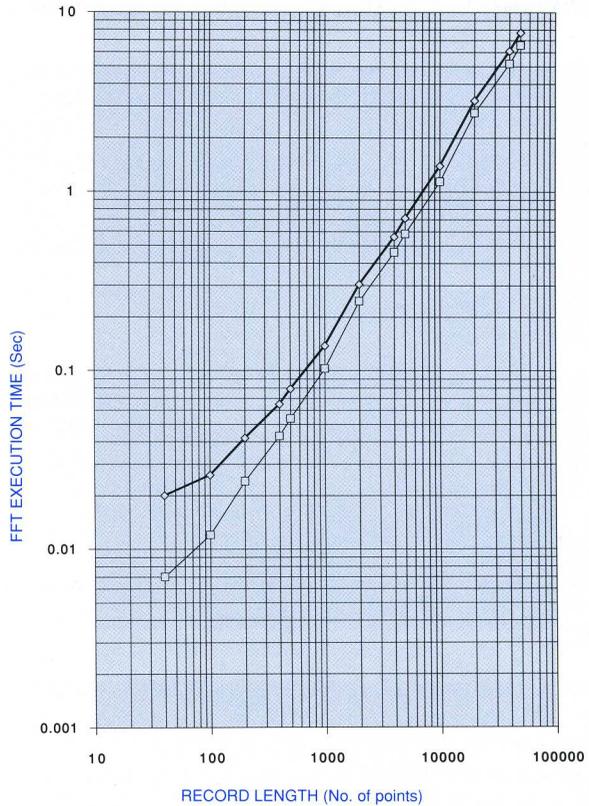
Absolute (crosshair) and relative (arrow) cursors provide frequency and amplitude (phase, power, power density) measurements.

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

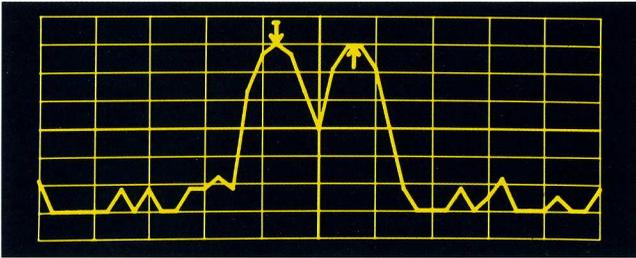
All waveform formats including complex can be read by computer for storage or further processing. Externally generated waveforms can be written into Memories C and D for FFT or other processing.

STORED FRONT PANELS

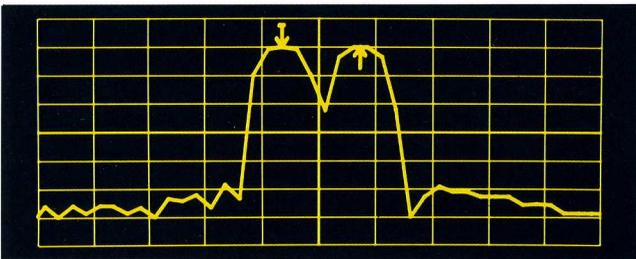
Up to 7 front-panel setups, including WP02 menu settings can be stored in non-volatile memory and recalled by the menu buttons at the left side of the screen.

WP02 INSTALLATION

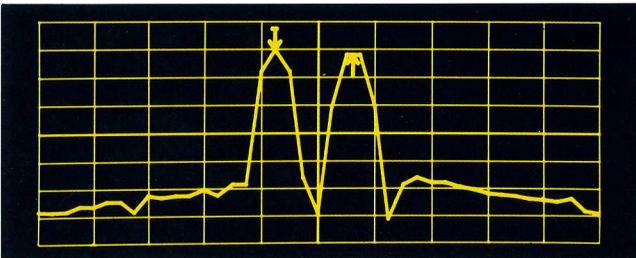
A WP02 package may be retrofitted to a LeCroy 9420/24/50 Digital Oscilloscope.



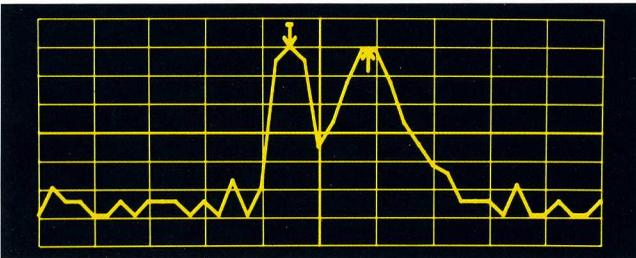
Blackman-Harris



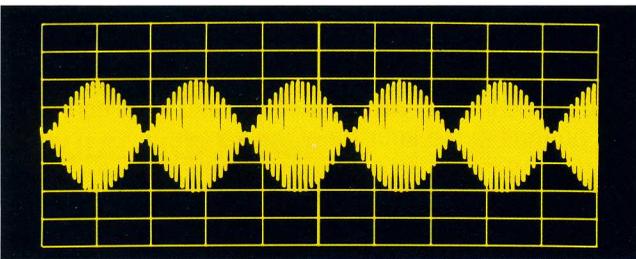
Flattop



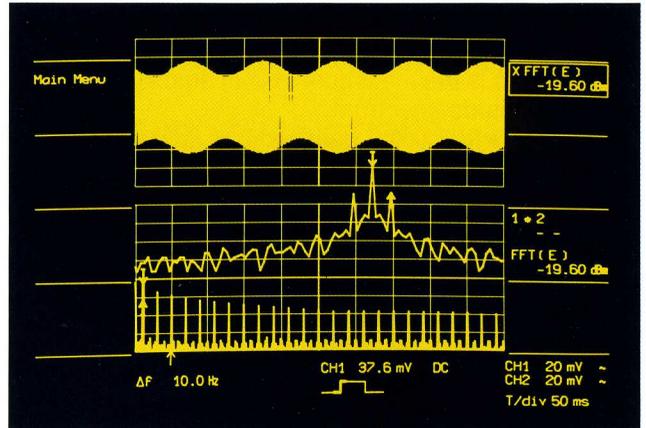
Hamming



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.

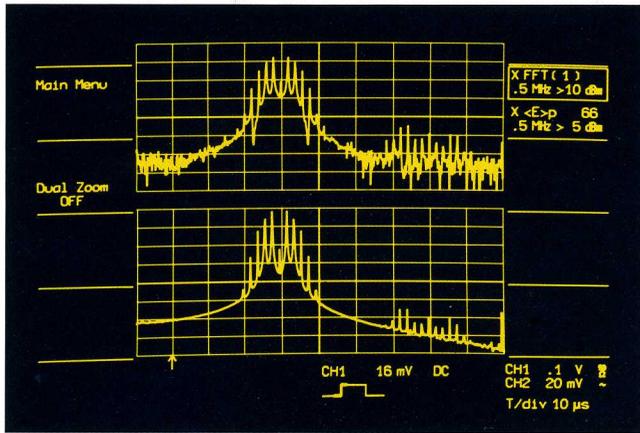
ORDERING INFORMATION

Oscilloscopes and Options

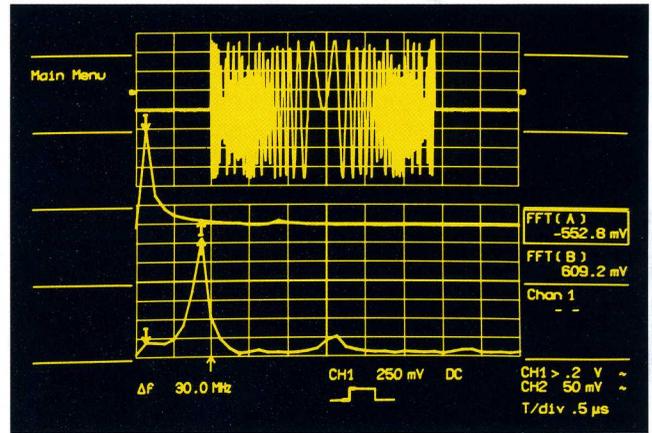
Code	Description
9400A	2-channel, 175 MHz Oscilloscope, 100 Ms/s
9420	2-channel, 350 MHz Oscilloscope, 100 Ms/s
9424	4-channel, 350 MHz Oscilloscope, 100 Ms/s
9450	2-channel, 350 MHz Oscilloscope, 400 Ms/s
9400AWP01	Waveform Processing for 9400A
9420WP01	Waveform Processing for 9420
9424WP01	Waveform 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.

Definition of Function E	
Previous FIELD (R)	Class: Fourier Transform
Next	Type: Power Spectrum
Previous VALUE (D)	Max number of points: 50000
Next	Source: Channel 1
	Multiplication Factor: 1.000 μ^0
	Additive constant: +0.000 μ^0 V
	Window Type: Rectangular
	Zero Suppression: ON
Cancel	
Return	FE = PS (FFT (C1)) For 50000 points Nyquist = 50.0 kHz $\Delta f = 2.00$ Hz

VALUES

- Rectangular
- Van Hann
- Hamming
- Flat-Top
- Blackman-Ha

The FFT menu documents all the relevant parameters.

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**MEMORY CARD SYSTEM
 FOR MODELS 9410, 9414, 9424, 9430
 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) 394-5882

Australia: Scientific Devices Pty. Ltd., (03) 579-3622

Austria: Dewetron Elek.Messgeräte 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, (042) 459 764

Eastern Europe: Elsinco GmbH, Vienna (0222) 812-1751

Finland: Labtronic OY, (90) 847144

France: LeCroy Sarl (01) 69073897

Germany: LeCroy GmbH, (06221) 831 001

Greece: Hellenic S/R Ltd., (01) 721 1140

India: Electronic Ent., (022) 4137096

Israel: Ammo, (03) 453157

Italy: LeCroy S.r.l., Roma (06) 300.97.00

Milano (02) 2940-5634

Japan: LeCroy Japan, Tokyo (03) 3376-9400

Osaka (06) 330 0961

Korea: Samduk Science & Ind., Ltd., (02) 468 049

Mexico: Nucleoelectronica SA, (05) 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) 815680

Singapore: Sing. Electr. and Eng. Ltd (65) 481-8888

Spain: Tempel SA, (03) 323.4278

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) 533 114

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Chapter 2

BASIC OPERATION

AND

BLOCK DIAGRAMS

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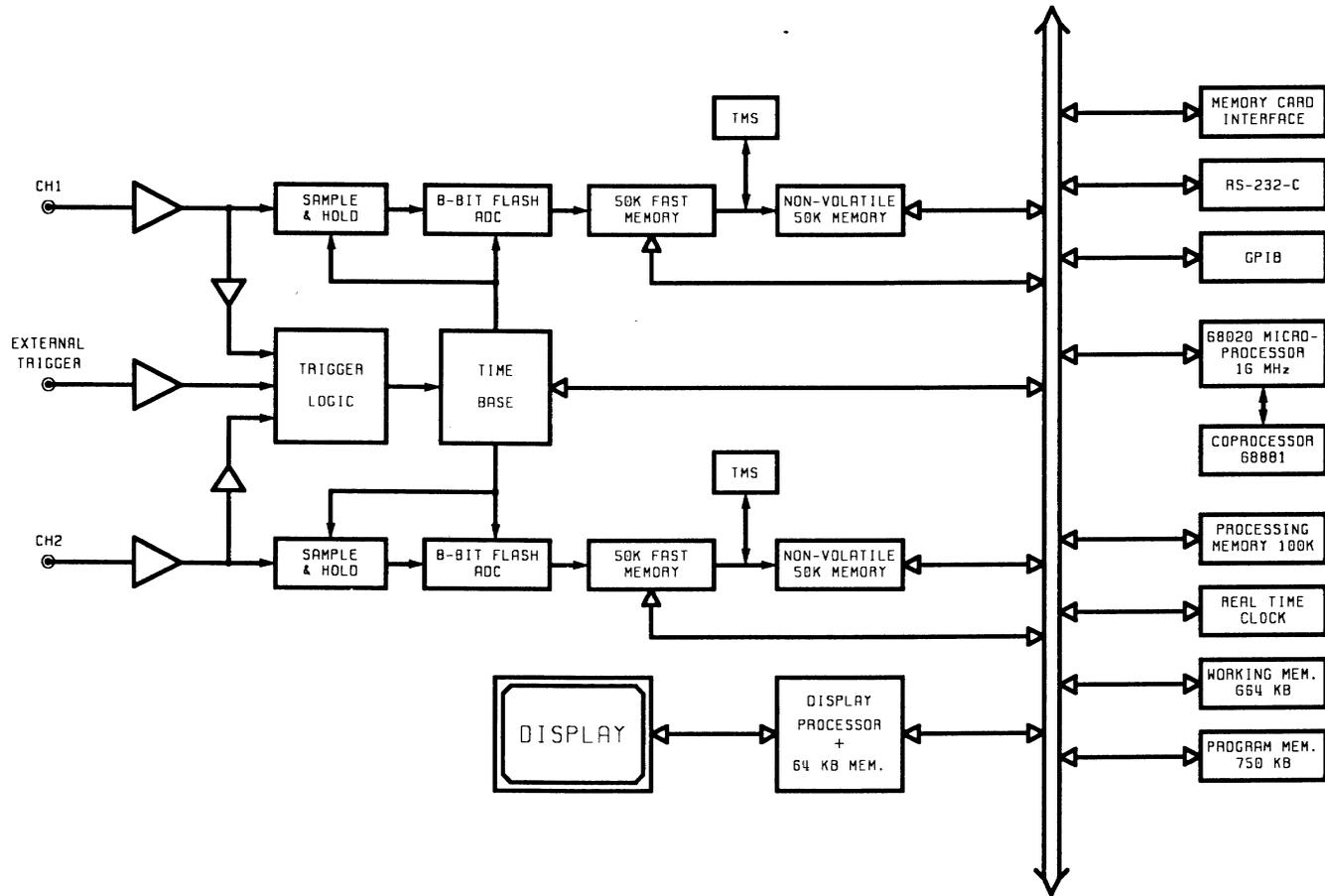
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2.1 9450A Sub-assemblies

F9424-1	Base board
F9451-1	Power supply
F9424-2	Support for Memory card
F9450-2	Display
F9450A-3	Single 400 Ms/s ADC
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F9450A-5	Front panel
F9420-6	Processor
F9450A-7	Dual channel 300 MHz Front end
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F9450A-9	Rear panel
M9424	Mechanical for 9450A

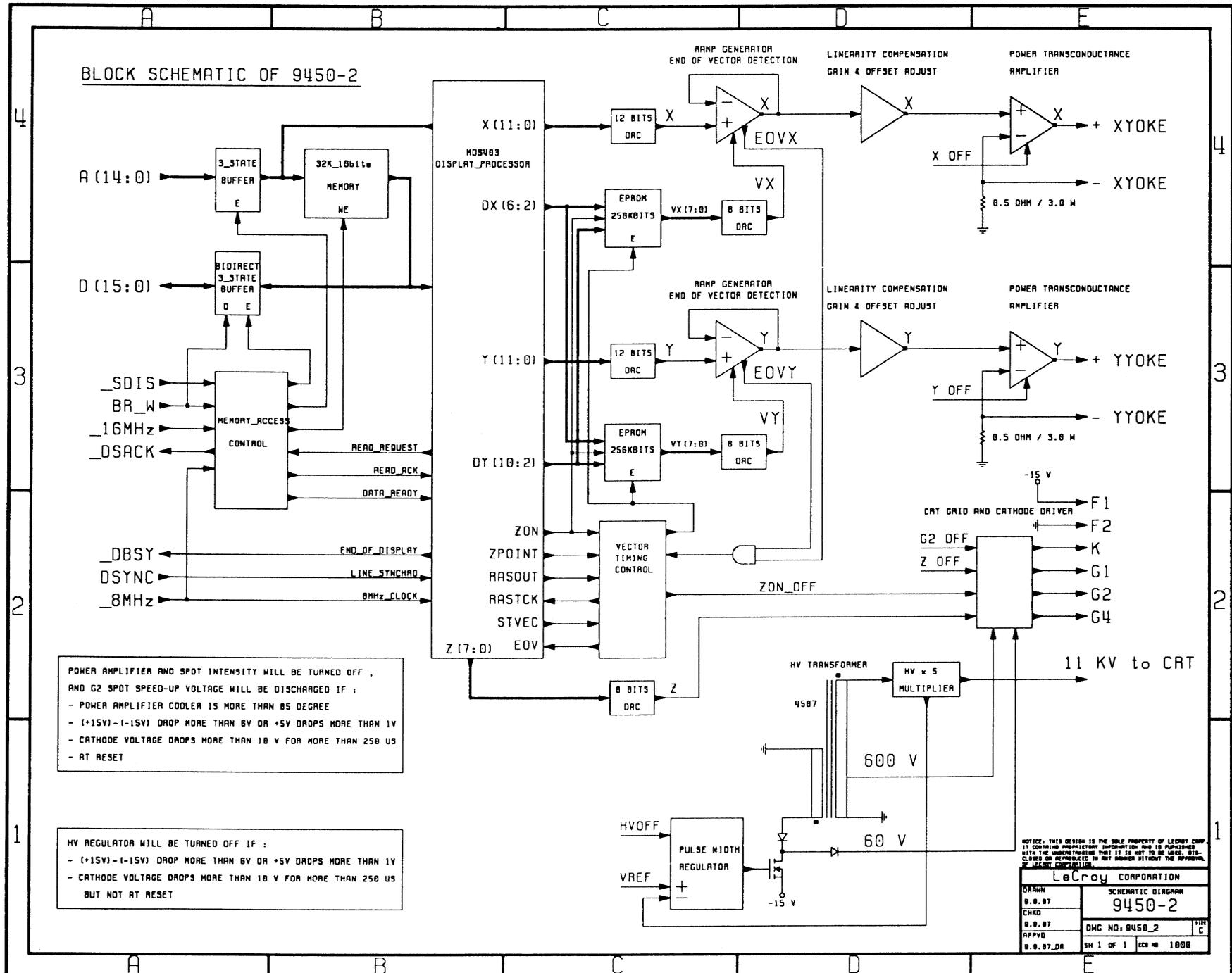
9450A HARDWARE OVERVIEW



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LeCroy CORPORATION

DESIGNER	SCHEMATIC DIAGRAM		
KADLUBSKI-B	9450A OVERVIEW		
CHKD	DWG NO: BLK-DIAGRAM		
SEIGENBOSC-C	REV C		
APPVD	SH 1 OF 1 ECR ME ----		
15-OCT-81			



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 9420-6 into the resident memory via the internal 9450A 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 9450A 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.

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 9450A 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 display 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 9450A 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 F9420-6 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 occurrence 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 signal 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 V_{spot} .

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 V_x and V_y . 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 practice, 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 diaplay 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 V_{out} at the capacitor (C74 and C75 in circuit) represents the current spot position, and V_{in} the final spot position at the end of a vector to be drawn. While V_{in} and V_{out} are different, the capacitor is charged or discharged with a rate given by I_{in} , the integrator current, until V_{out} reaches V_{in} . 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 separate 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 conjunction 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 EOVS 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 9450A 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:

$$R = 0.5 \text{ SQRT } (L/C)$$

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 $189 * 149 \text{ mm}^2$. 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 V 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:

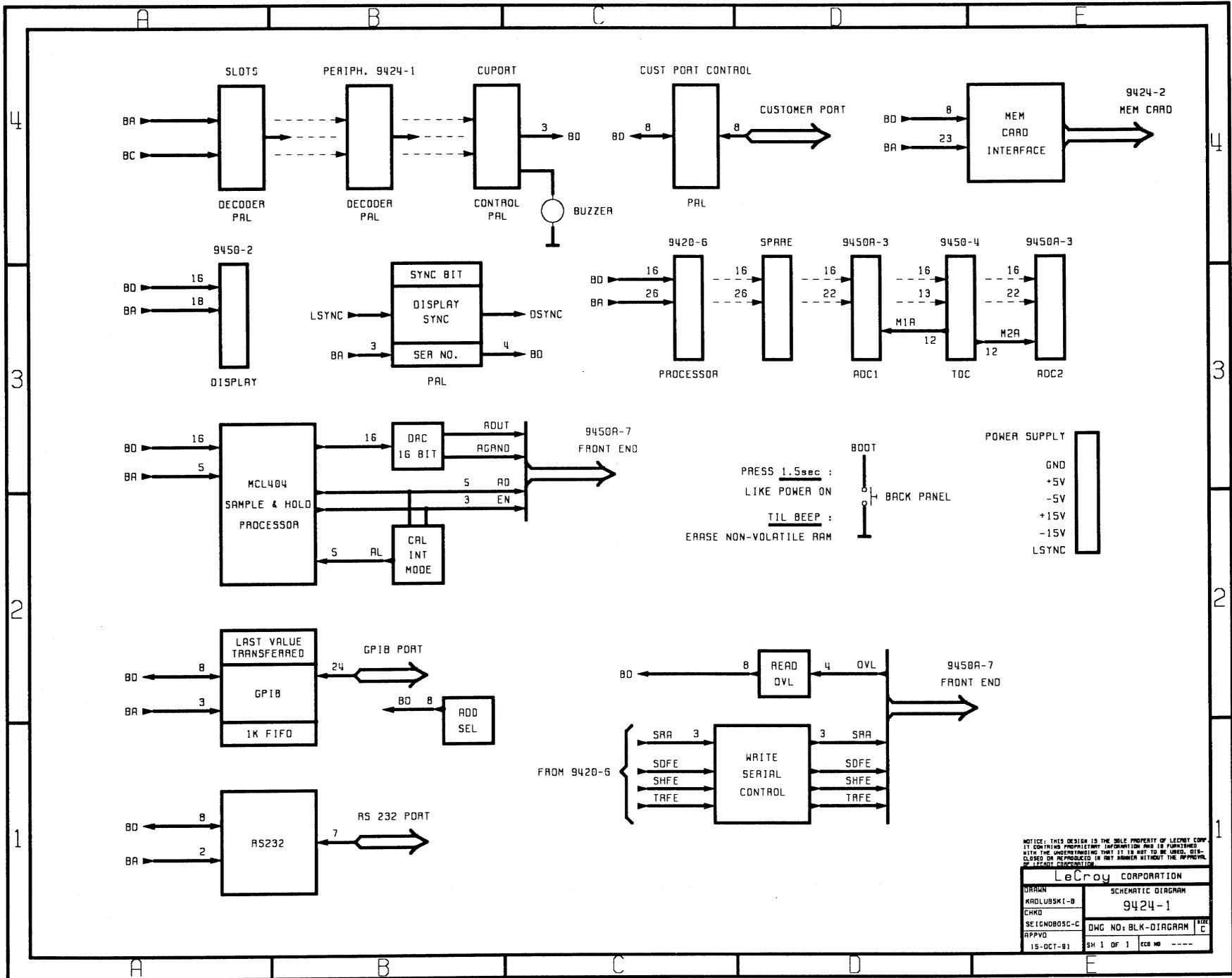
- pin 22 of A22: low if +5 V is less than 4V
- pin 14 of A22: low if +15 V or -15 V drop by more than 6 V
- pin 1 of A22: low if cathode voltage is less than 30 V for more than 300 usec after reset. The time constant is realized by R33, R271, R214 and C1, C131. The input to the comparator, pin 6 of A22,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



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DRWN: KARLUSKI-B	SCHEMATIC DIAGRAM
CHKD:	9424-1
SEICNDOSC-C	DWG NO: BLK-DIAGRAM
APPVD:	SH 1 OF 1 ECD NO: ----
15-OCT-91	

2.4. F9450A-3 ADC board description

2.4.1 Introduction

The board is divided in two parts:

- analog
- digital

Few definitions:

Time base: F9450-4: clocks and trigger
 Front-end: F9450A-7: outside signal receiver
 Analog signal: Signal coming from the front-end

2.4.2 Analog part

The analog signal enters through the SMB connector (J3) into the sample and hold hybrid HMS403A, a differential pair receives a calibration signal (12.403MHz square wave) that can be enable from the timebase.

The analog part is clocked by signals coming from the timebase through the edge connector (J2).

The HMS403A hybrid is a combination of four sample and hold, (numbered 1 to 4) which divide the signal in four branches. Each sample and hold is clocked by a differential signal (SHCKx), the sampling bridge current is calibrated by a potentiometer (P3 to P6), the timing and the offset are voltage controlled by software, using octal 8 bits DACs (BT110), the current outputs are converted to voltage by operational amplifiers (LM324). The HMS403A outputs have external current sources to drive the capacitive inputs of the flash ADC (HADC77200).

Flash ADC references are also controlled by software using another octal 8 bits DAC with operational amplifier to set the gain of the four branches. They are differentially clocked (ACKx).

The four branches (numbered 4, 1, 2 and 3 starting from the top of the board) are 100 Mhz clocked with a delay of 2.5ns between each of them so that we have a 400Ms single-shot ADC. When in RIS only one branch is used (the top one, number 4).

ADC Numbering scheme

		Hard	Soft (Internal Diag)
Reference	==>	4	3
First in time	==>	1	0
		2	1
		3	2

The reference ADC in Single-ADC sampling mode.

2.4.3 Digital part

Acquisition fast memory

The digital output of the flashes is inverted, two's complement coded, this feature of the flashes is enable by two control lines (MINV & LINV). Data must be inverted because the front-end does invert the DSO input signal at some gain setting.

Digital data go to multiplexer (10H158) which switch from four to one branches, control is done with ASEL signal from timebase. This option is used for lower timebase setting.

A connector is available for test purpose (J4A, J4B and J5), jumpers from J4A to J4B should be removed and a flat cable (from 4968-2 tester) connected to J4B and J5 (ground). The tester produces a digital ramp in order to test the fast digital section.

The data then flows through ECL to TTL converter (10125) into the memory demultiplexer (MDX407) where four clocks (DMXCKx) latch them to 4Kx4 SRAM (MHS HMT-65768H-5 or IDT 6168SA-25S0).

Address comes from the timebase during acquisition, directly through high drive buffers (AMD2965) and from the internal bus during read or write test through 3-state buffer (74HCT244). ACQ signal from timebase is on during acquisition, and selects MCE as the write pulse and forces write enable of the SRAMs. When ACQ is off, write pulse is ACE and write enable is R W. The DCK signal is the last demultiplexer clock delayed and shaped (C78), it is used by the timebase to count address and stop acquisition.

The data can also be read on the fly, for roll mode purpose, the timebase gives the right timing.

Reading memories can be done with the 68020 or the TMS320C25 processors through buffers (74HCT244), using the four lower bits of address (74ALS138 and 74F32) to select data from the demultiplexer.

Fast memory data is connected to the internal ADC data bus (ABD), likewise the address is connected to an internal ADC bus (ABA). The internal busses are buffered (74HC245 and 74HCT244) to 68020 main busses).

Computation buffer memory

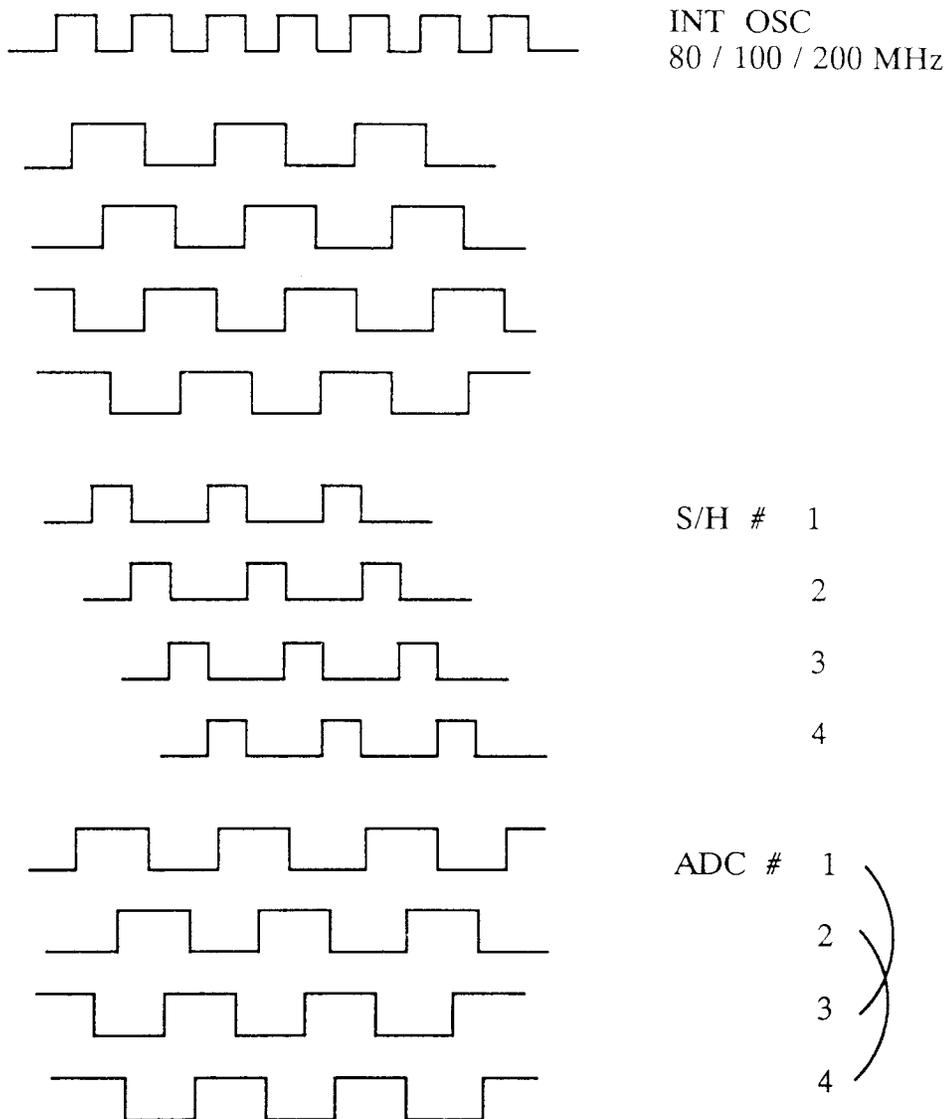
A coprocessor (TMS320C25) does the computation and transfer of data from fast memory to a 63Kx16 buffer memory (four HM62256LP-12). The coprocessor has its own clock signal (F1100-40MHz) and furnishes strobe to a Minmax gate array (MNX401). The minimax can be set to run on read or written data by the TMS320C25.

The coprocessor can only access the internal busses. The 68020 can access the internal busses when the coprocessor is in hold. The coprocessor can be stopped either by the 68020 or by itself.

DACs are directly set by the 68020 and the 8 bits data bus is buffered (74HCT244). DACs are not on the internal busses.

Control lines are decoded by PALs (C16L8L) named ADCSEL for selection, ADCCMD for command, ADCPER for peripherals.

SAMPLING CLK TIMING



2.4.4 Address

All addresses are in hexadecimal.

note on TMS320C25: PS is program space.

DS is data space.

IS is interface space, the address is not decoded and this is the way for the TMS to set itself in hold mode.

It is possible to read the 64K of buffer memory but only 60K of fast memory.

CFND is "configure block as data memory" instruction.

CFNP is "configure block as program memory" instruction.

note on Minmax MNX401: register 0 status
 register 1 minimum value
 register 2 minimum rank
 register 3 maximum value
 register 4 maximum rank
 register 5 rank counter
 register 6 ram address (unused)
 register 7 ram value (unused)

ADC address + 20 0000= Minmax enable (should only be used for read test).

TMS320C25 external flag:

XF	Minmax enable during
high	write cycle
low	read cycle

TMS320C25 command:

bit	set	description
0	high	pulse $\overline{\text{INT0}}$
1	high	sets $\overline{\text{BIO}}$ low
1	low	sets $\overline{\text{BIO}}$ high
7	high	free TMS320C25
7	low	holds TMS320C25

TMS320C25 status:

bit 7 high when TMS320C25 works
bit 7 low when TMS320C25 in hold

Peripherals addresses:

Data are low byte and only write mode is used.

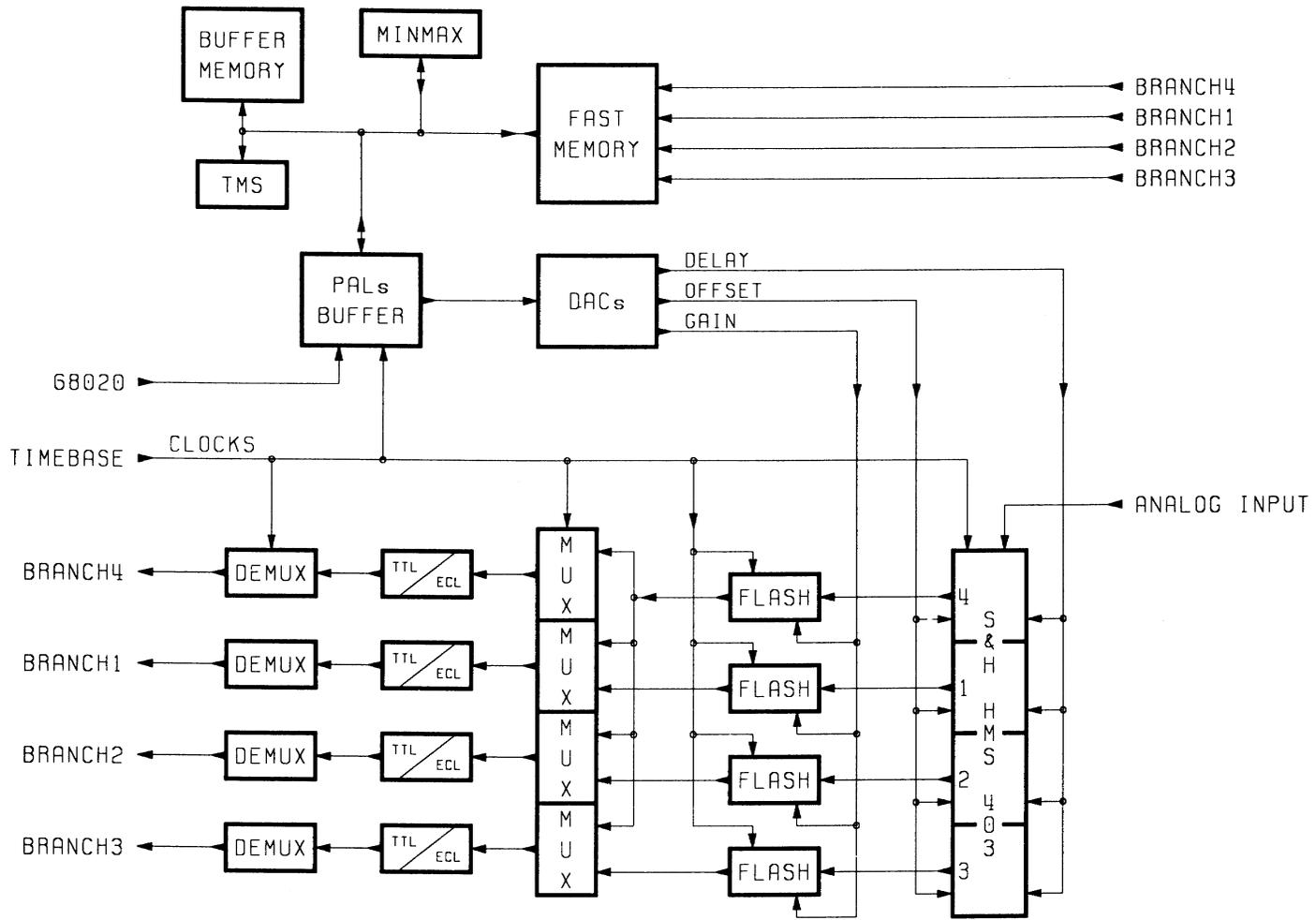
description	ADC1 address	ADC2 address
S&H 1 coarse offset	0188 0000	0190 0000
S&H 2 coarse offset	0188 0002	0190 0002
S&H 3 coarse offset	0188 0004	0190 0004
S&H 4 coarse offset	0188 0006	0190 0006
S&H 1 clock delay	0188 0008	0190 0008
S&H 2 clock delay	0188 000A	0190 000A
S&H 3 clock delay	0188 000C	0190 000C
S&H 4 clock delay	0188 000E	0190 000E
flash 1 gain	0188 0010	0190 0010
flash 2 gain	0188 0012	0190 0012
flash 3 gain	0188 0014	0190 0014
flash 4 gain	0188 0016	0190 0016
S&H 1 fine offset	0188 0018	0190 0018
S&H 2 fine offset	0188 001A	0190 001A
S&H 3 fine offset	0188 001C	0190 001C
S&H 4 fine offset	0188 001E	0190 001E
TMS status & command	0188 0020	0190 0020

Memories addresses:

Data are 16 bits word, which means that addresses will not use bit 0.
 ADC2 address = ADC1 address + 0080 0000

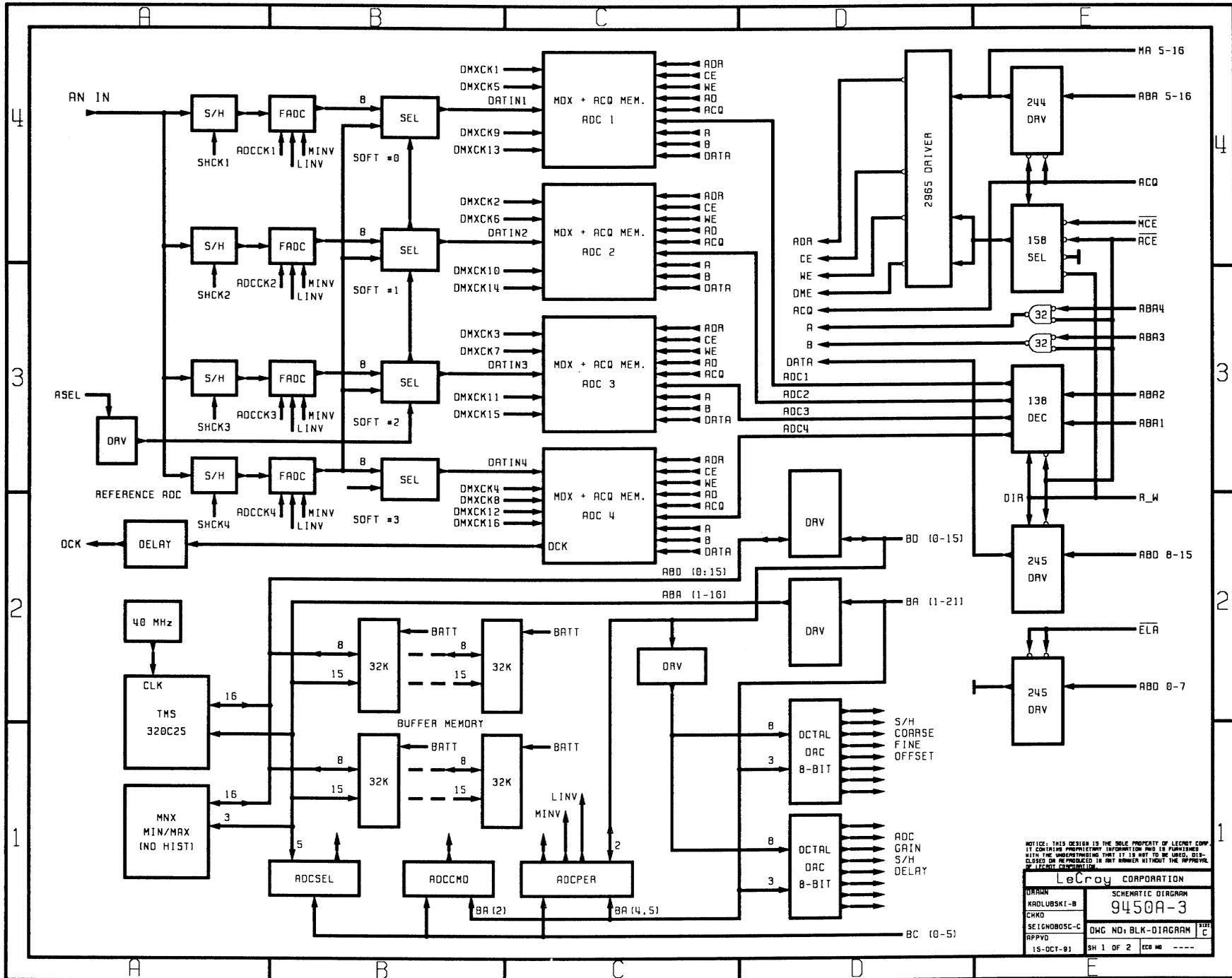
description	TMS note	ADC1 address	TMS address
fast memory		0200 0000 to 0200 1FFE and 0200 2000 to 0201 FDFE and 0201 FE00 to 0201 FFFE	----- ----- PS 1000 to PS FFFF and PS FF00 to PS FFFF or PS FF00 to PS FFFF
TMS block B0	CNFD mode CNFP mode	-----	
buffer memory BCE1	interrupts program data	0202 0000 to 0202 003E and 0202 0040 to 0202 1FFE and 0202 2000 to 0202 FFFE	PS 0000 to PS 001F and PS 0020 to PS 0FFF and DS 1000 to DS 7FFF
" " BCE2		0203 0000 to 0203 FFFE	DS 8000 to DS FFFF
Minmax register 0		0204 0000	DS 0800
Minmax register 1		0204 0002	DS 0801
Minmax register 2		0204 0004	DS 0802
Minmax register 3		0204 0006	DS 0803
Minmax register 4		0204 0008	DS 0804
Minmax register 5		0204 000a	DS 0805
Minmax register 6		0204 000c	DS 0806
Minmax register 7		0204 000e	DS 0807
TMS registers		-----	DS 0000 to DS 0005
TMS reserved		-----	DS 0006 to DS 005F
TMS block B2		-----	DS 0060 to DS 007F
TMS reserved		-----	DS 0080 to DS 01FF
TMS block B0	CNFD mode	-----	DS 0200 to DS 02FF
TMS block B1		-----	DS 0300 to DS 03FF
unused		-----	DS 0400 to DS 07FF

9450A-3 ADC BOARD DESCRIPTION



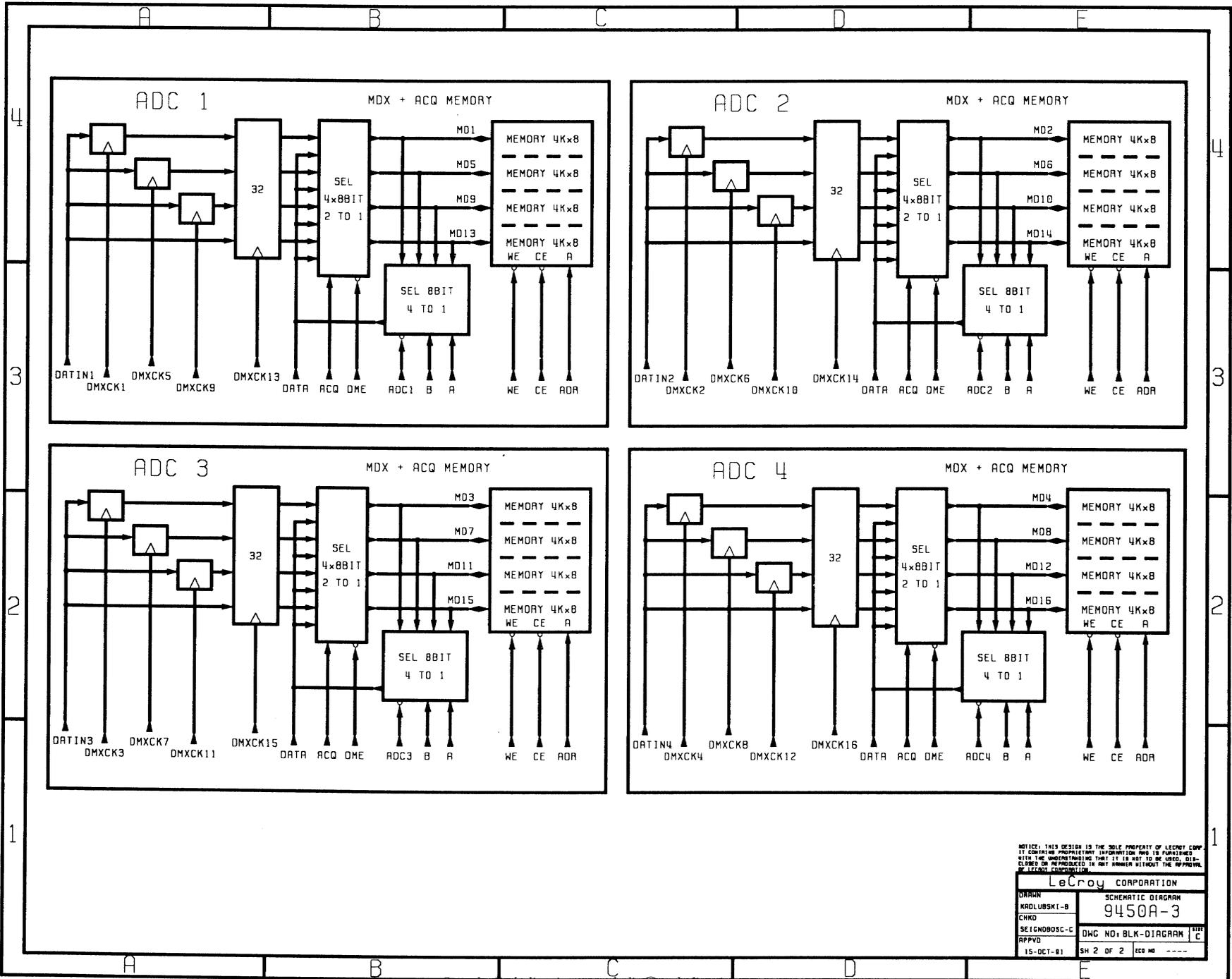
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LeCroy CORPORATION	
DRWN KADLUBSKI-B	SCHEMATIC DIAGRAM
CHKD SEIGNOBOS-C	9450A-3
APPVD 15-OCT-81	DWG NO: BLK-DIAGRAM
	SH 1 OF 1 PCB NO ----



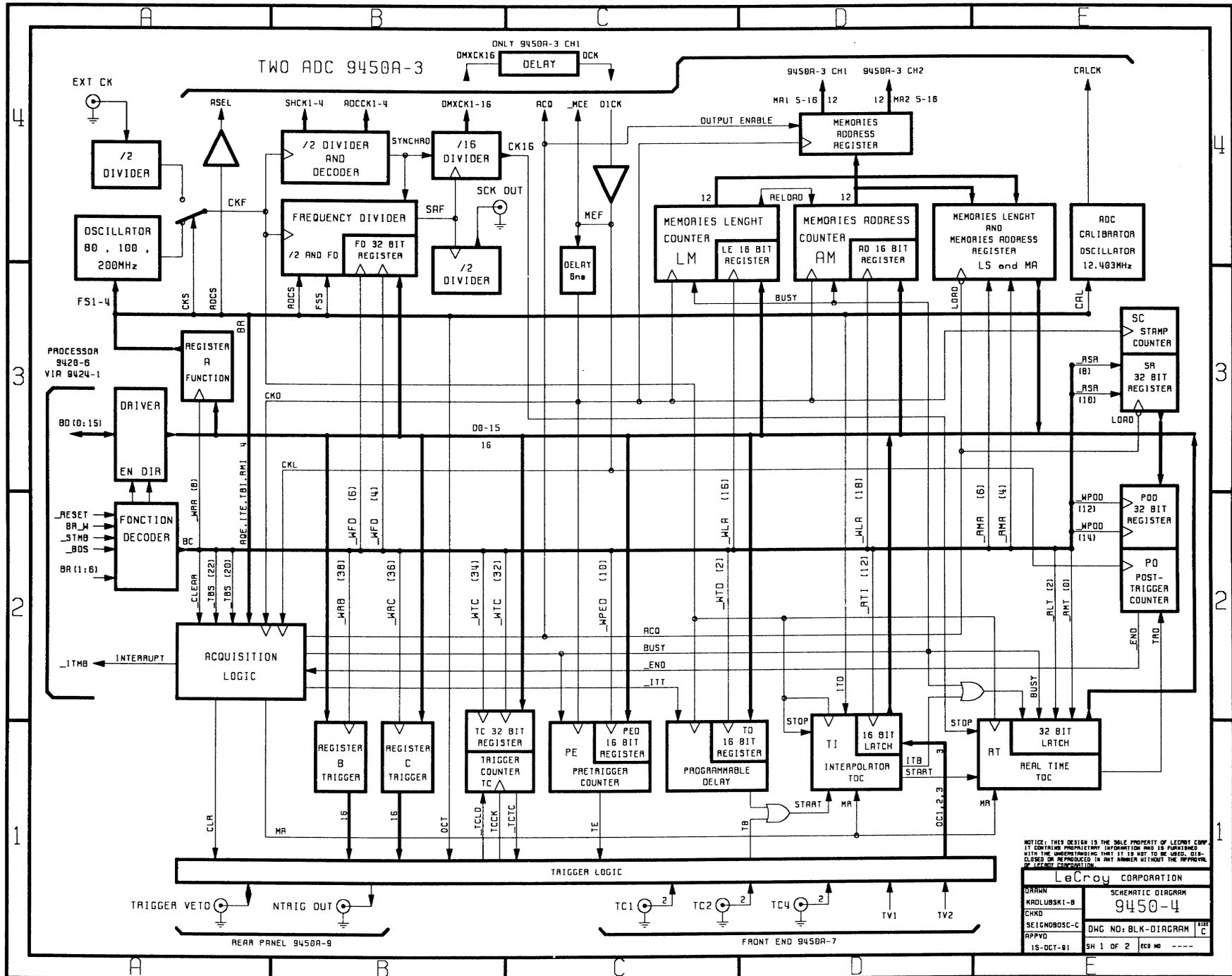
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LeCroy CORPORATION	
DESIGN KADLUBSKI-B	SCHEMATIC DIAGRAM 9450A-3
CHKD	
SEICNOBOSC-C	DWG NO: BLK-DIAGRAM
APPVD	SIZE C
15-OCT-91	SH 1 OF 2 ECD NO: ----



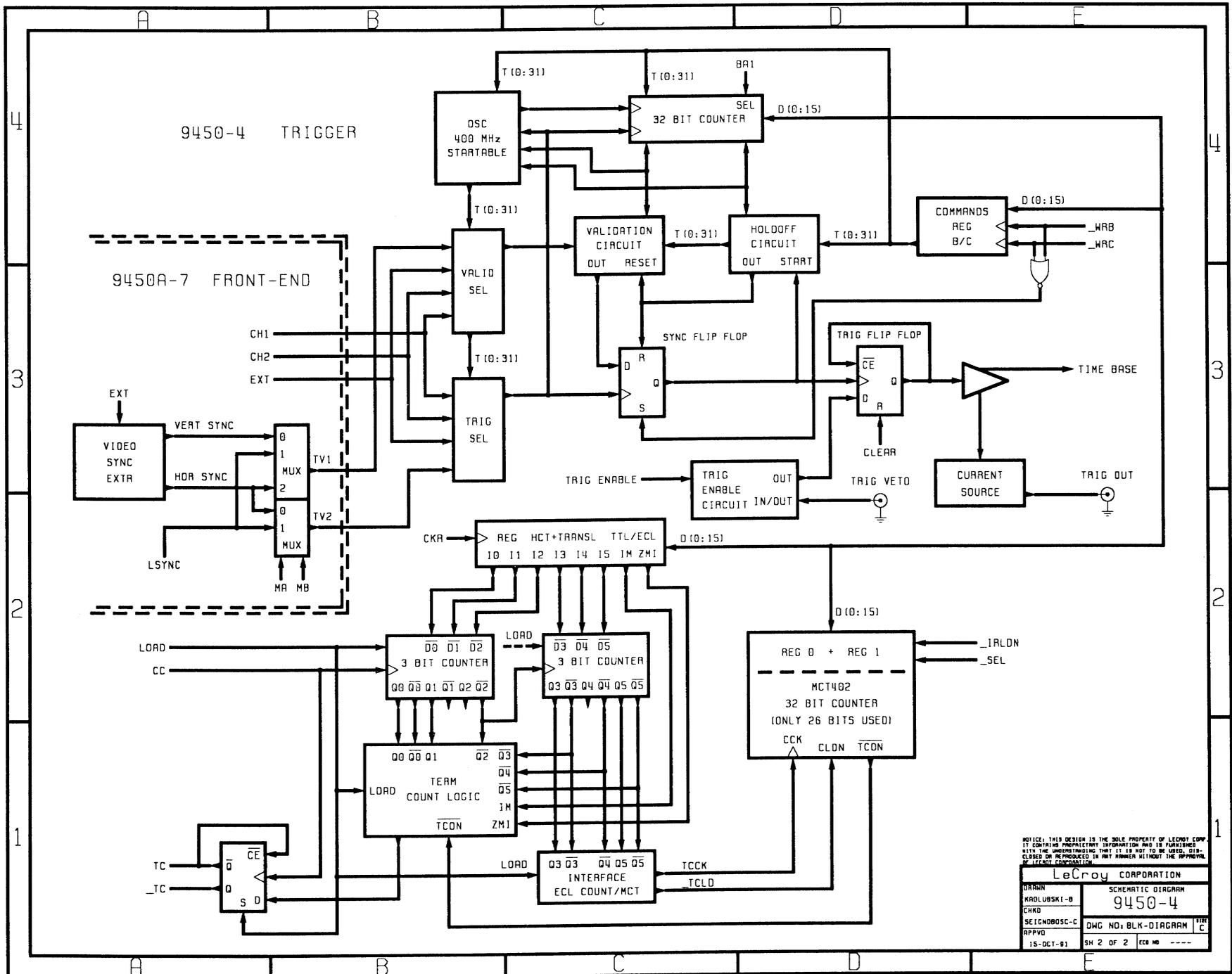
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LeCroy CORPORATION	
DRAWN	SCHEMATIC DIAGRAM
KADLUBSKI-B	9450A-3
CHKD	
SEIGNOBOSC-C	DWG NO. BLK-DIAGRAM
APPVD	SH 2 OF 2
15-OCT-81	ECC NO. ----



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LeCroy CORPORATION	
DRAM	SCHEMATIC DIAGRAM
MADLUBSKI-B	9450-4
CKD	
SEICNDBOSC-C	DKG NO: BLK-DIAGRAM
APPVD	15-OCT-81
	SH 1 OF 2
	ECH NO: ---



9450A SAMPLING CLOCK RATES vs TIME/DIV

Single-shot:

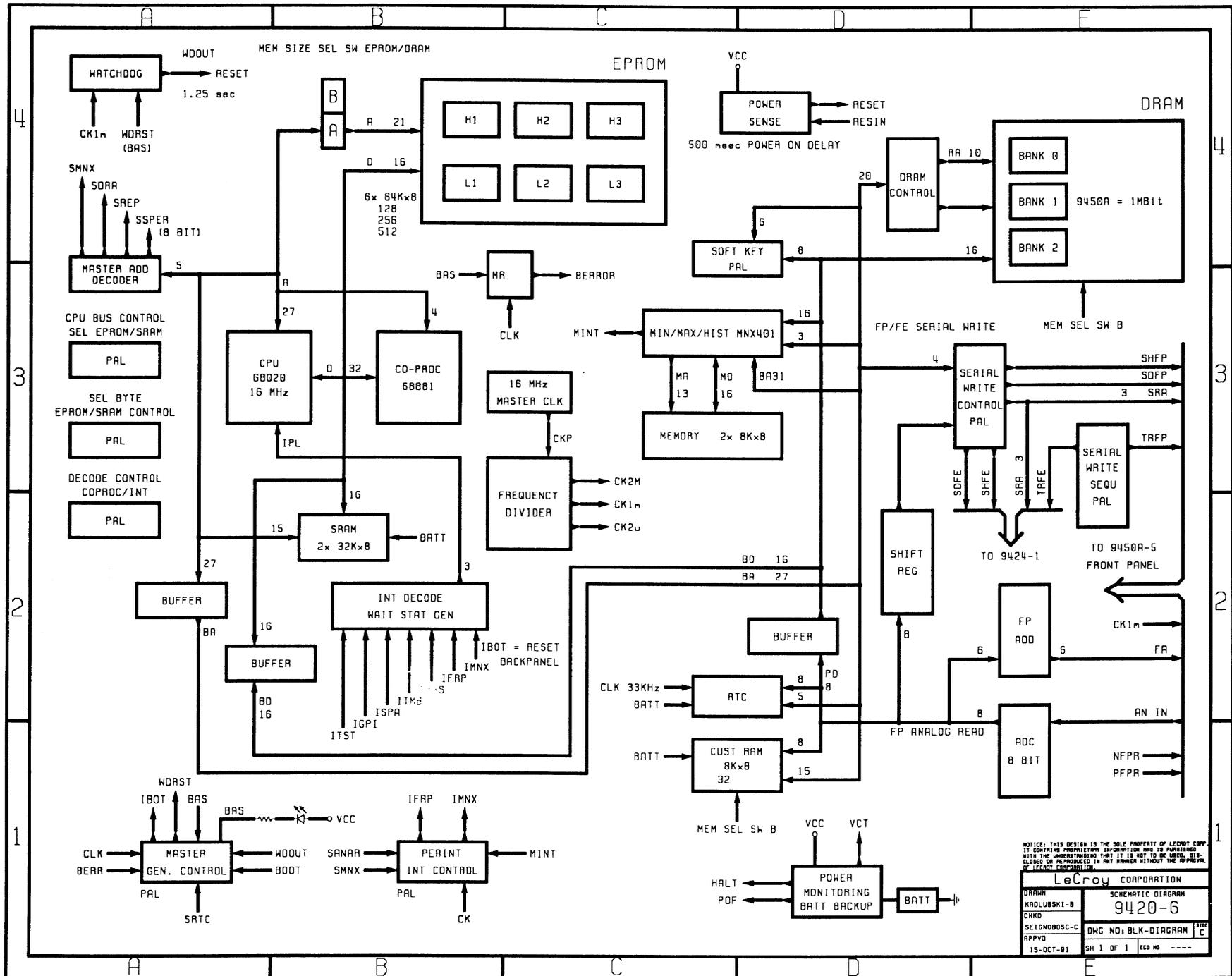
INT OSC MHz	Sampl Rate Ms/sec	Sample Intvl nsec	S/H CLK MHz	# ADC	Time/div
200	400	2.5	100	4	10 nsec
					.
100	200	5.0	50	4	20 μ sec
200	100	10.0	100	1	50 μ sec
80	40	25	40	1	.1 msec
80	20	50	40	1	.2 msec
80	10	100	40	1	.5 msec
80	4	250	40	1	1 msec
80	2	500	40	1	2 msec
80	1	1000	40	1	5 msec
.
.
.
80	1 Hz	1 sec	40	1	5 ksec

RIS:

INT OSC MHz	Sampl Rate Ms/sec	Equiv Rate Gs/sec	Sampl Intvl	S/H CLK MHz	# ADC	Time/div
200	100	10	100 psec	100	1	1 nsec
						.
						.
200	100	4	250 psec	100	1	1 μ sec
200	100	2	500 psec	100	1	2 μ sec
200	100	1	1 nsec	100	1	5 μ sec

TIME BASE		SAMPLING RATE TIME/POINT		DISPLAYED RECORD LENGTH (Points)	
TIME/DIV		RIS	SS	RIS	SS
1	nsec	100 psec	---	100	---
2	nsec	100 psec	---	200	---
5	nsec	100 psec	---	500	---
10	nsec	100 psec	2.5 nsec	1000	40
20	nsec	100 psec	2.5 nsec	2000	80
50	nsec	100 psec	2.5 nsec	5000	200
0.1	µsec	100 psec	2.5 nsec	10000	400
0.2	µsec	100 psec	2.5 nsec	20000	800
0.5	µsec	100 psec	2.5 nsec	50000	2000
1	µsec	250 psec	2.5 nsec	40000	4000
2	µsec	500 psec	2.5 nsec	40000	8000
5	µsec	1 nsec	2.5 nsec	50000	20000
10	µsec	---	2.5 nsec	---	40000
20	µsec	---	5 nsec	---	40000
50	µsec	---	10 nsec	---	50000
0.1	msec	---	25 nsec	---	40000
0.2	msec	---	50 nsec	---	40000
0.5	msec	---	0.1 µsec	---	50000
1	msec	---	0.25 µsec	---	40000
2	msec	---	0.5 µsec	---	40000
5	msec	---	1 µsec	---	50000
10	msec	---	2.5 µsec	---	40000
20	msec	---	5 µsec	---	40000
50	msec	---	10 µsec	---	50000
0.1	sec	---	25 µsec	---	40000
0.2	sec	---	50 µsec	---	40000
ROLL MODE					
0.5	sec	---	0.1 msec	---	50000
1	sec	---	0.25 msec	---	40000
2	sec	---	0.5 msec	---	40000
5	sec	---	1 msec	---	50000
10	sec	---	2.5 msec	---	40000
20	sec	---	5 msec	---	40000
50	sec	---	10 msec	---	50000
100	sec	---	25 msec	---	40000
200	sec	---	50 msec	---	40000
500	sec	---	0.1 sec	---	50000
1	ksec	---	0.25 sec	---	40000
2	ksec	---	0.5 sec	---	40000
5	ksec	---	1 sec	---	50000

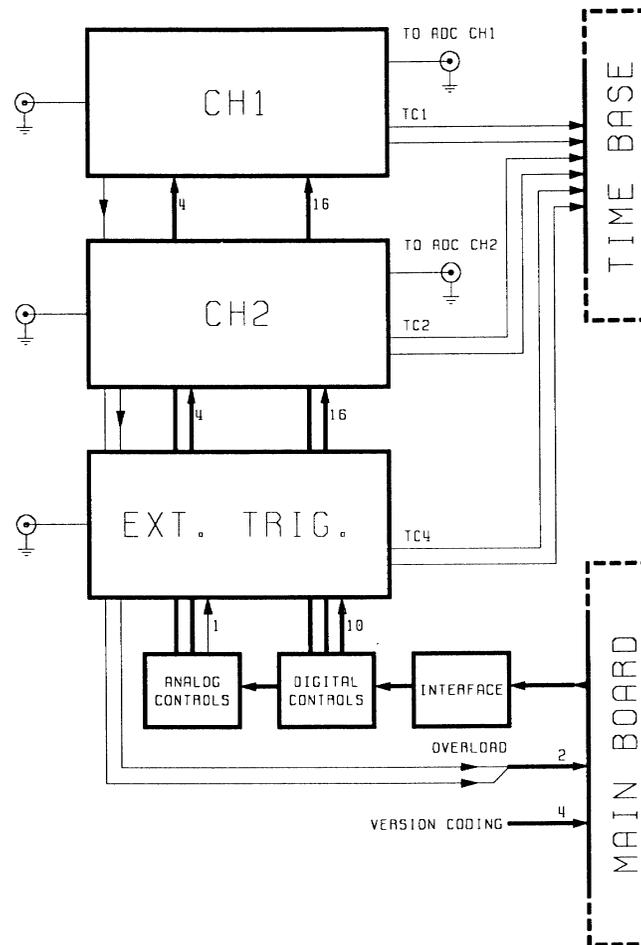
LIST of SAMPLING MODES, SAMPLING RATE,
and DISPLAYED RECORD LENGTH for each TIME-BASE SETTING



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Leonix CORPORATION	
DRWNR KADLUBSKI-B	SCHEMATIC DIAGRAM
CWNR SEIGNOBOSC-C	9420-6
APPVD 15-OCT-81	DWG NO: BLK-DIAGRAM
SH 1 OF 1	ECR NO: ----

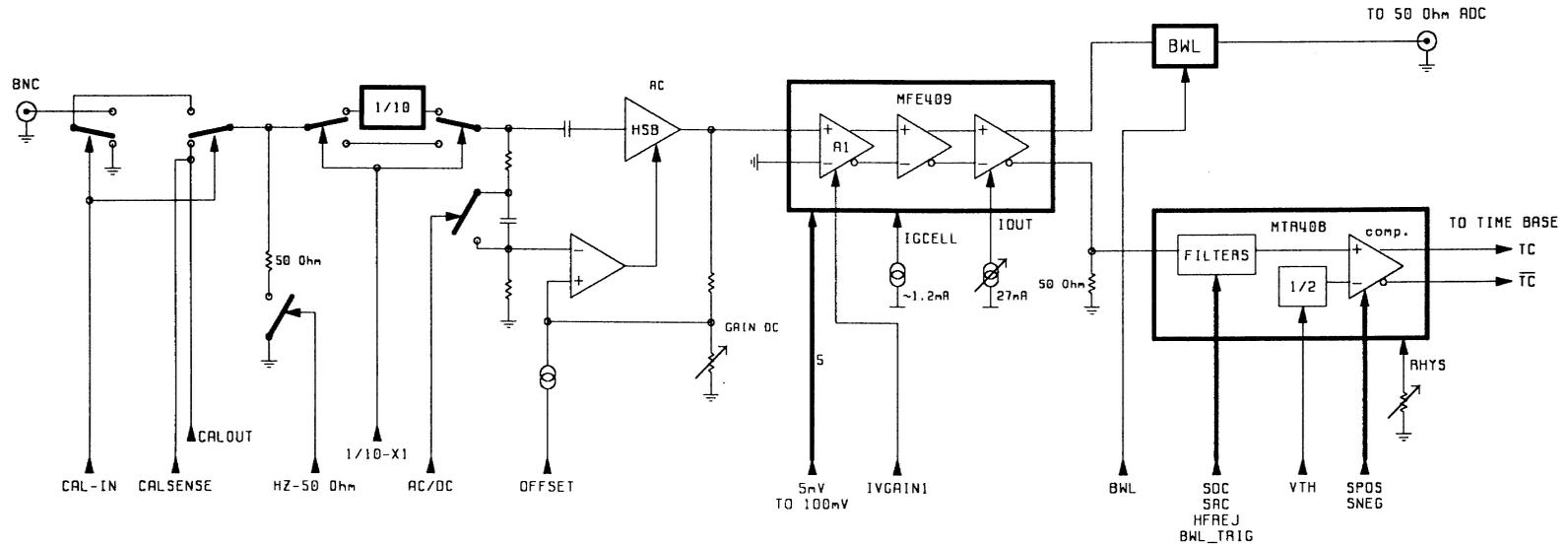
FIG. 1 : FRONT-END BLOCK DIAGRAM



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LeCroy CORPORATION	
DRWNN	MODEL : 9450A-7
KRALUBSKI-B	2 CH. 300MHz FRONTEND
ENKD	DWG NO: BLK-DIAGRAM
SEIGNOBOSC-C	DATE
16-OCT-81	SH 1 OF 3 ECO : ---

FIG.2 : CHANNEL BLOCK DIAGRAM



RANGE DC [mV]	FS [mV]	ATTEN. 1/10	MFE INPUT [mV]	GAIN	MFE COMMAND "ON"
5	+/- 20	NO	+/- 20	X8	5mV
10	40	NO	40	X4	10mV
20	80	NO	80	X2	20mV
50	200	NO	200	X0.8	50mV
100	400	NO	400	X0.4	100mV
200	800	YES	80	X2	20mV
500	2000	YES	200	X0.8	50mV
1000	4000	YES	400	X0.4	100mV

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LeCroy CORPORATION

DRWNR	MODEL : 9450A-7
KRDLUBSKI-B	2 CH. 300MHz FRONTEND
EWK	DWG NO: BLK-DIAGRAM
SEIGNB0505C-C	SH 2 OF 3
DATE	ECO : ---
18-OCT-93	

FIG.3 : EXTERNAL TRIGGER BLOCK DIAGRAM

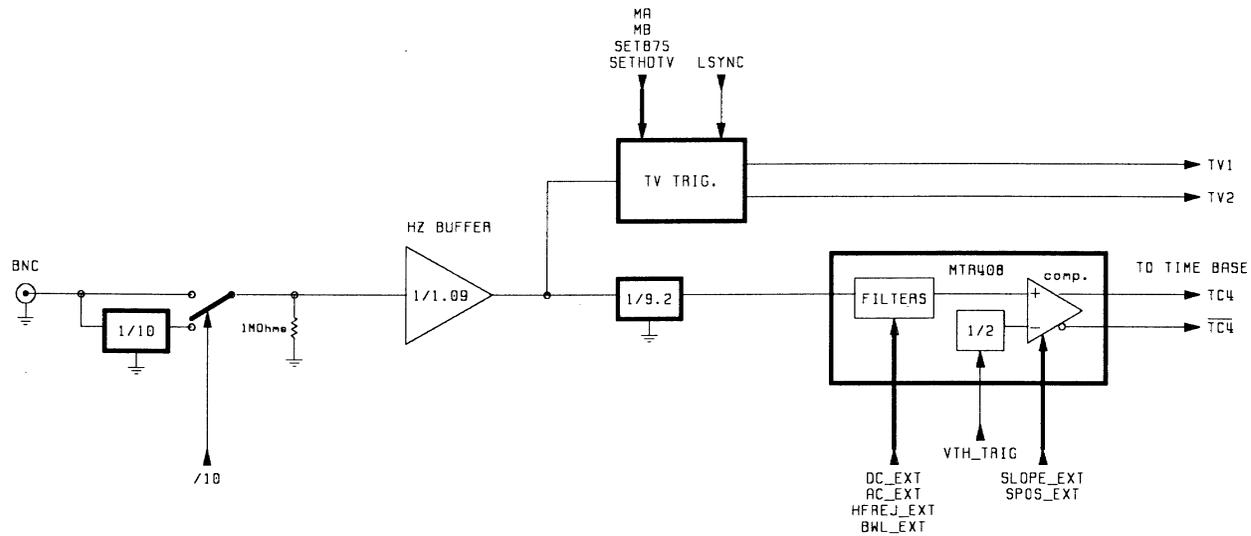


FIG.4 : ANALOG AND DIGITAL CHANNEL CONTROLS

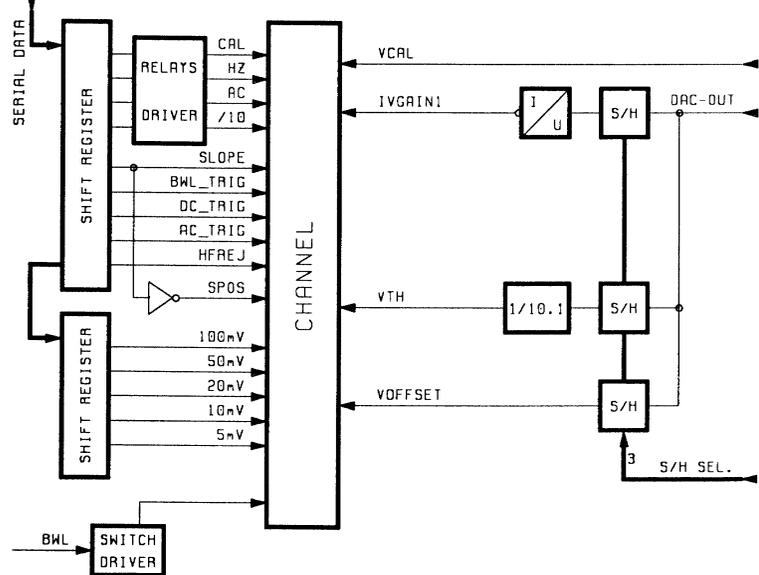
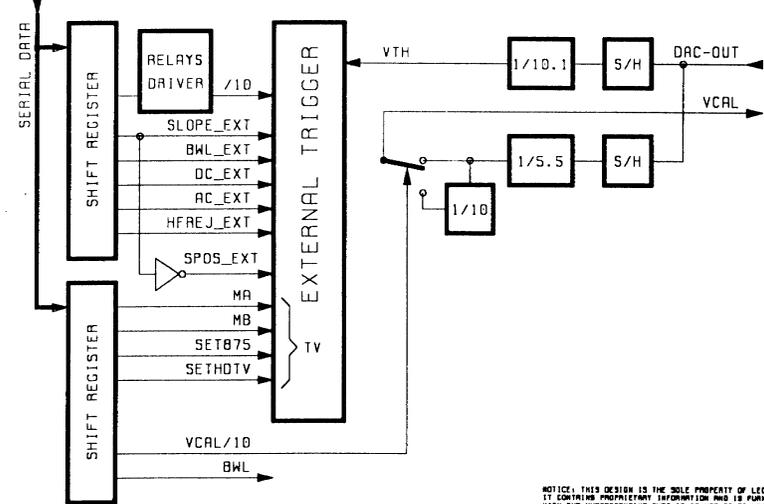


FIG.5 : EXTERNAL TRIGGER AND COMMON CONTROLS



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LeCroy CORPORATION	
DRWNR	MODEL : 9450A-7
KRAULBSKI-B	2 CH. 300MHZ FRONTEND
CHWD	DWG NO: BLK-DIAGRAM
SEIGNOBOSC-C	DATE
18-OCT-81	SH 3 OF 3 ECD : ---

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)

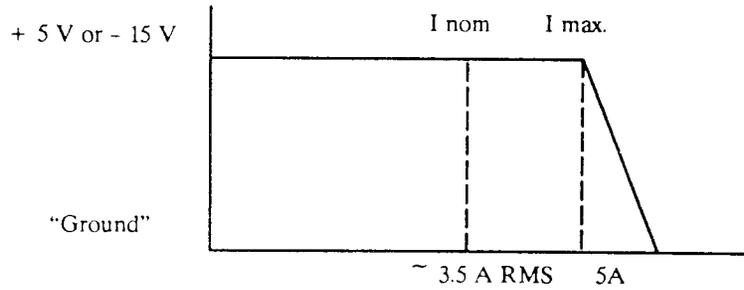
+5 V and -5 V: max. 80 mV_{pp} (100 MHz)

50 Hz output ripple:

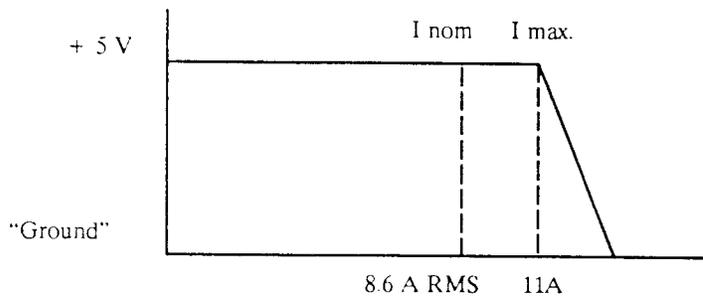
max. 5 mV

Maximum output current:

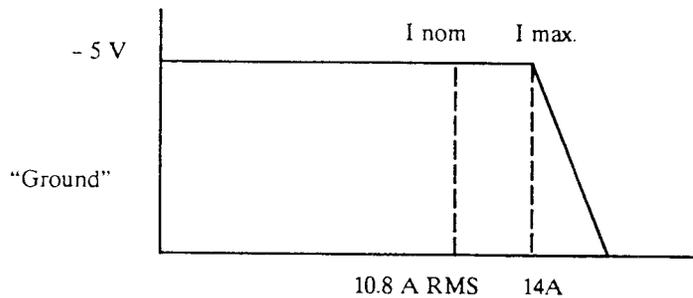
+ 15 V and - 15 V : I max. = 5 A₊₁⁻⁰



+ 5 V : I max. = 11 A₊₁⁻⁰

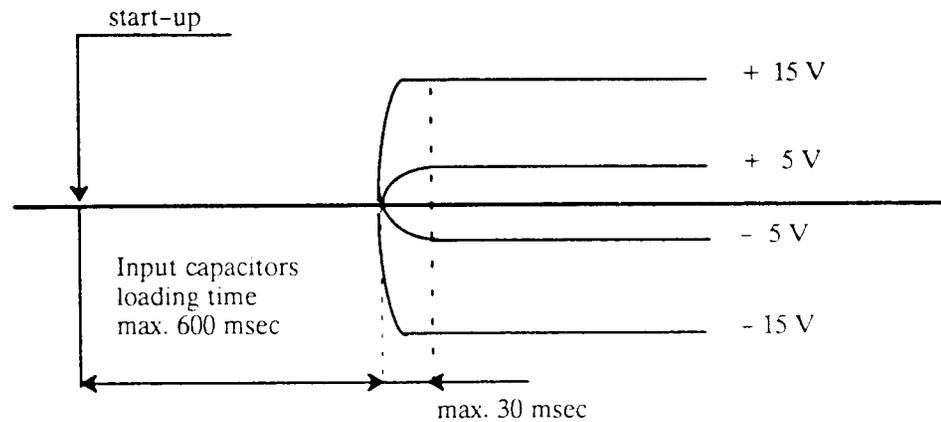


+ 5 V : I max. = 14 A₊₁⁻⁰



Max. output current adjustment: min. $\pm 20\%$

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: $0 = 0\text{ V}$, $1 = +5\text{ V}$

rise and fall time $<100\text{ nsec}$

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

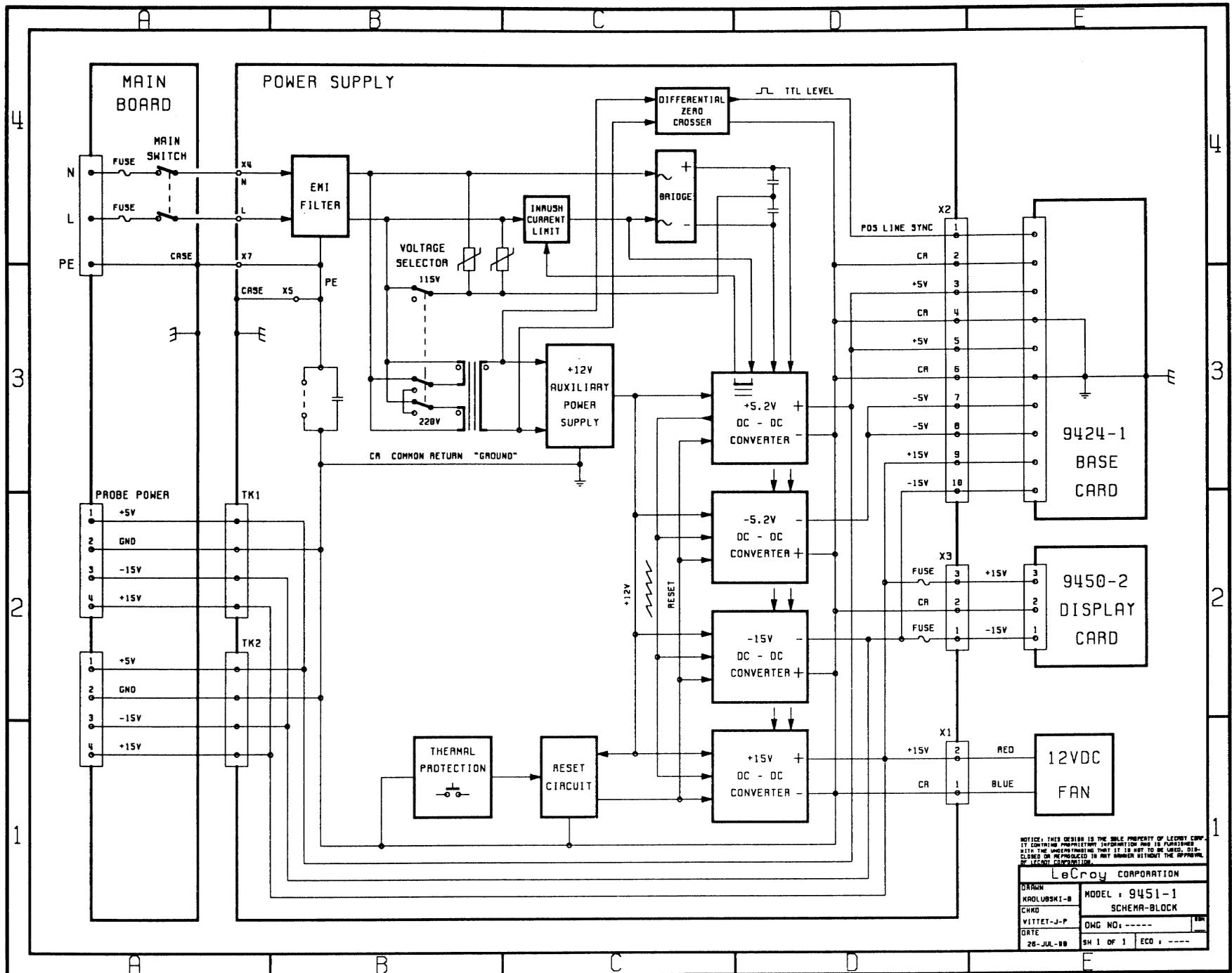
Line input connector: CEE 22/VI (XIV), ASE type 113

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



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LeCroy CORPORATION

DRAWN KROLUBSKI-B	MODEL: 9451-1
CHKD VITTET-J-P	SCHEMA-BLOCK
DATE 26-JUL-98	DWG NO: -----
	SH 1 OF 1 ECO: -----

Chapter 3

BASIC PERFORMANCE TEST PROCEDURE

AND

INTERNAL DIAGNOSTICS AND CALIBRATION

Table of contents:**Section**

- 3.1 Basic Performance Test Procedure
 - 3.1.1 Turn ON
 - 3.1.2 Noise on the inputs
 - 3.1.3 Test of ADC's
 - 3.1.4 OFFSET
 - 3.1.5 Input impedance
 - 3.1.6 Front-end
 - 3.1.7 Bandwidth at 50M Ω Input impedance
 - 3.1.8 Bandwidth at 1M Ω Input impedance
 - 3.1.9 Manual linearity test (NIST traceable calibration)
 - 3.1.10 Trigger level for DC and HFRej.
 - 3.1.11 Bandwidth for Ext trigger
 - 3.1.12 SMART Trigger
 - 3.1.12.1 Trigger on pulse width >, <
 - 3.1.12.2 Trigger on interval width <
 - 3.1.12.3 Trigger on interval width >
 - 3.1.13 Time base accuracy
- 3.2 Internal diagnostic and Calibration
 - 3.2.1 Calibration Error Log
 - 3.2.1.1 Vertical calibration
 - 3.2.2 ADC/TMS state
 - 3.2.3 Trigger calibration

Section

- 3.2.4 TDC calibration
- 3.2.5 Non linearity
- 3.2.6 Internal TDC calibration
- 3.2.7 ADC's calibration
 - 3.2.7.1 Leveling calibration
 - 3.2.7.2 Phase calibration

3.1 Basic Performance Test Procedure for the 9450A digital oscilloscope

3.1.1 Turn-On

Before switching on the digital 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 and CH2
- Grid: single
- Input couplings CH1 and CH2: 1 M Ω DC
- Input gain: 5 mV/div
- Trigger:

SMART Trigger:	OFF
Source:	LINE
Coupling:	AC
Mode:	NORM

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

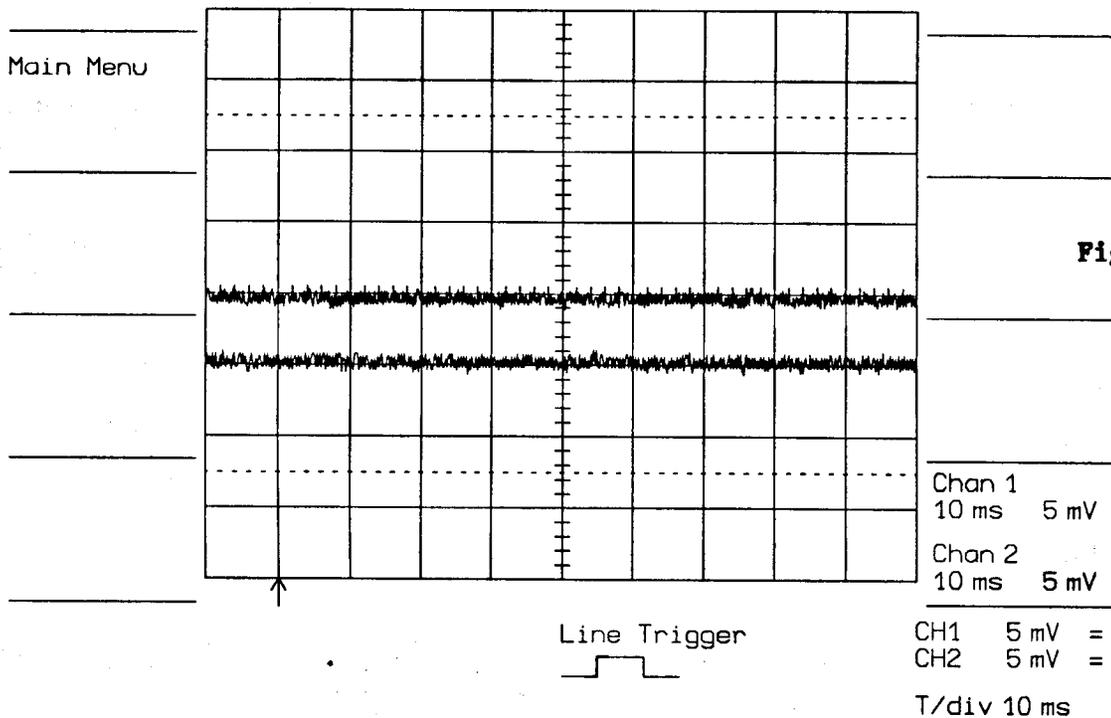
Check:

- displayed waveforms should have a constant band of less than 1 minor division
- there is no discernible periodic structure

See figure 1.

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

27-Sep-91
13:59:22



3.1.3 Test of the ADCs

This is to verify proper operation of the ADCs at the four nominal sampling frequencies: 400, 200, 100 and 40 Ms/sec.

With both Channel 1 and Channel 2 inputs open, set the DSO as follows:

- turn on the CH1 trace
- Grid normal
- Input couplings CH1 and CH2: 1 MΩ DC
- Input gain 50 mV/div, offset zero
- Trigger:

SMART Trigger:	OFF
Source:	LINE
Coupling:	AC
Mode:	NORM

- Time/div = 10, 20, 50, 100 μsec/div

For each of the four time bases above, check for CH1 and CH2:

- displayed waveform should lie within a band of less than 1 minor division.
- using the offset control, move the trace for CH1 and CH2 slowly through the entire range and check that there is no significant change in the displayed trace. Repeat for channel 2.

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 Trigger:	OFF
Source:	LINE
Coupling:	AC
Mode:	NORM

- Time/div = 50 μ sec/div
- BWL OFF

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

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

Repeat the same test for CH2.

3.1.5 Input Impedance

Set the DSO CH1 input to 1 M Ω DC 50mV/div with any time base.
Check with an ohmmeter:

- input impedance must be 1 M Ω \pm 1%
- repeat 1Mohm test for 200mV/div

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

- input impedance must be 50 Ω \pm 1%

Repeat all impedance checks for CH2.

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 Trigger: OFF
 Source: CH1
 Coupling: DC
 Mode: NORM
 Delay: 50%
 Level: zero

- Time/div = .1 μ sec/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.

- Turn on the pulse parameters, with parameters source on Channel 1
- Press PASS/FAIL mode
- Press Setup PASS/FAIL
- set Channel 1 and Channel 2 parameters on show, over + and rise

30-Sep-91
 15:37:54

PASS / FAIL TEST AND EXTENDED PARAMETERS	
Previous FIELD (R)	SHOW
Next	Channel 1 : over+
Previous VALUE (D)	Channel 1 : rise
Next	Channel 2 : over+
Define Mask	Channel 2 : rise
Cancel	
Return	Overshoot positive

VALUES
Expand A
Expand B
Memory D
Function E
Function F
Channel 1
Channel 2

Figure 2

Check:

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

50 Ω: 4% overshoot

30-Sep-91
15:39:33

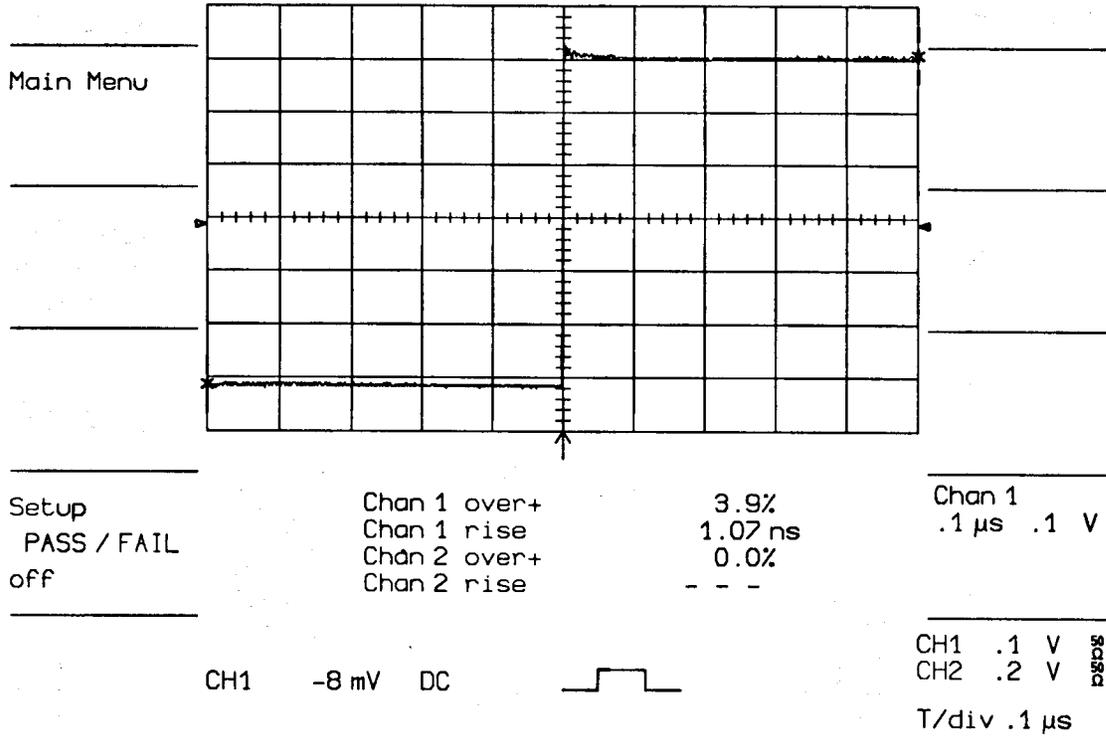


Figure 3

- Check the same at 200 mV/div, input 1.2V p-p
- Typical overshoot: less than 8%

4-Oct-91
16:36:11

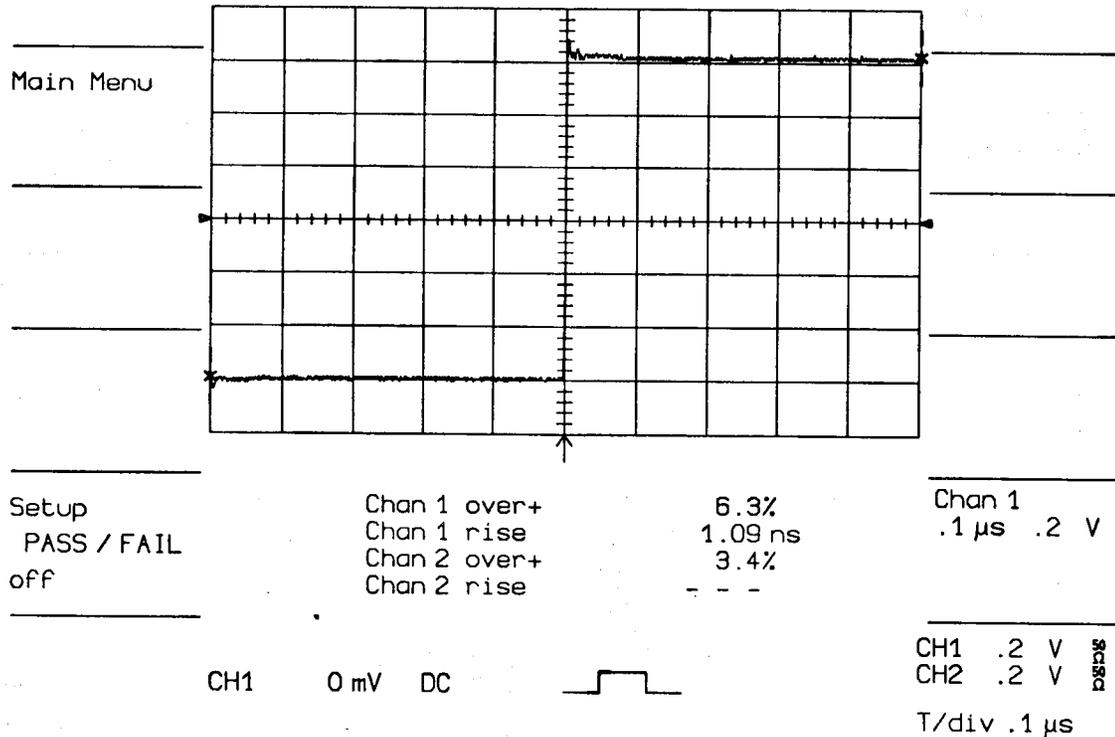


Figure 4

- Repeat the above for CH2, trigger source CH2

3.1.7 Bandwidth at 50 Ω input impedance

The purpose of this test is to ensure that the entire 9450A system has a bandwidth of at least 300 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 Trigger: OFF
 Source: CH1
 Coupl: DC
 Mode: NORM
 Delay: zero
 Level: zero

Set input CH1:

Coupl: 50 Ω
 Gain: 0.1V/div
 Var Gain: 1
 Offset: zero

Set the time base:

-Time/div .5 μ sec/div
 -Interleaved ON

Bandwidth limit: OFF

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

30-Sep-91
 17:06:48

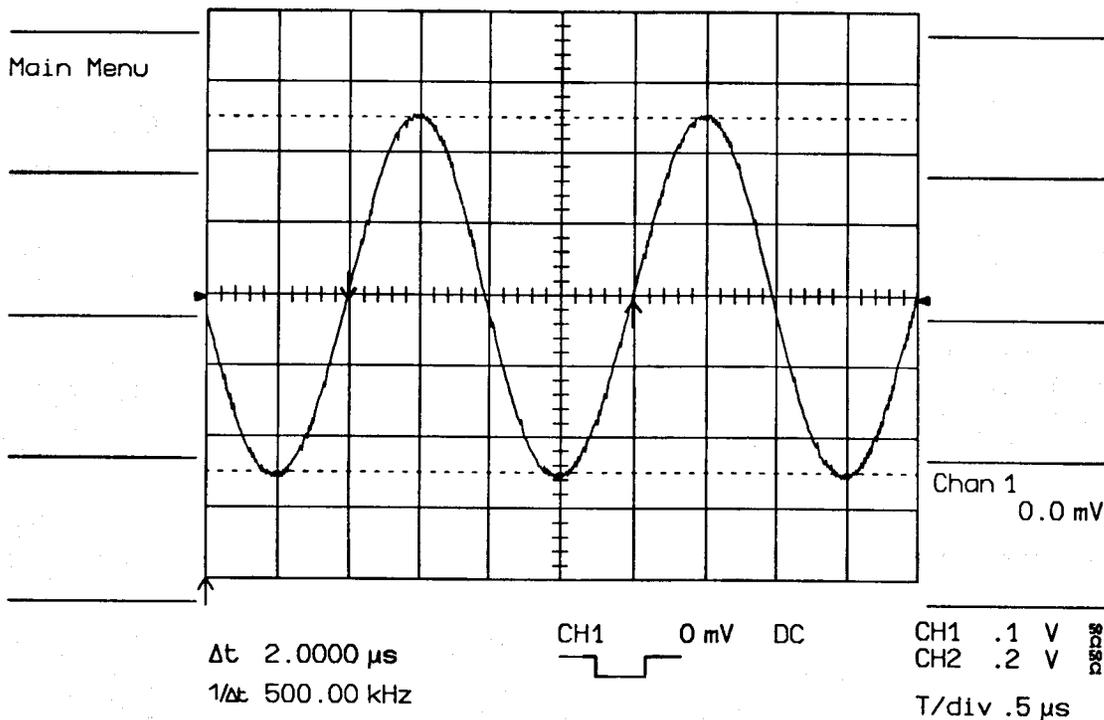


Figure 5

Set the Trigger coupling: HF

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 300 MHz

30-Sep-91
17:09:04

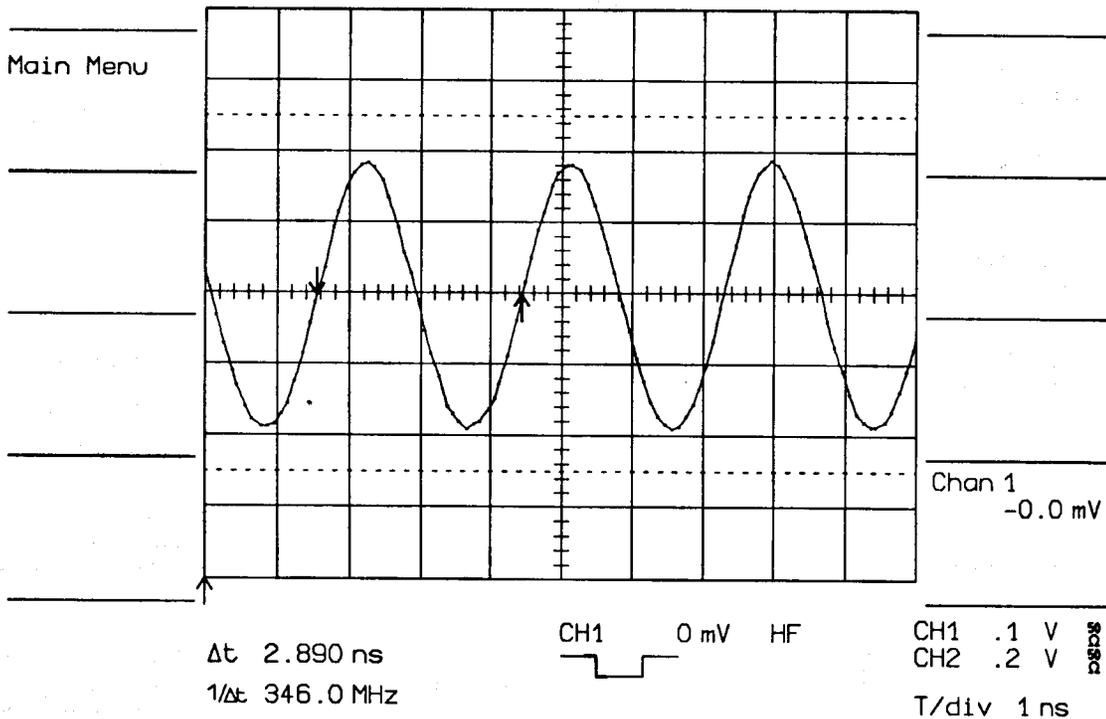


Figure 6

Repeat the above for CH1 and CH2 for input Volts/div = .5V, .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 $80 \text{ MHz} \pm 20\%$

30-Sep-91

17:30:44

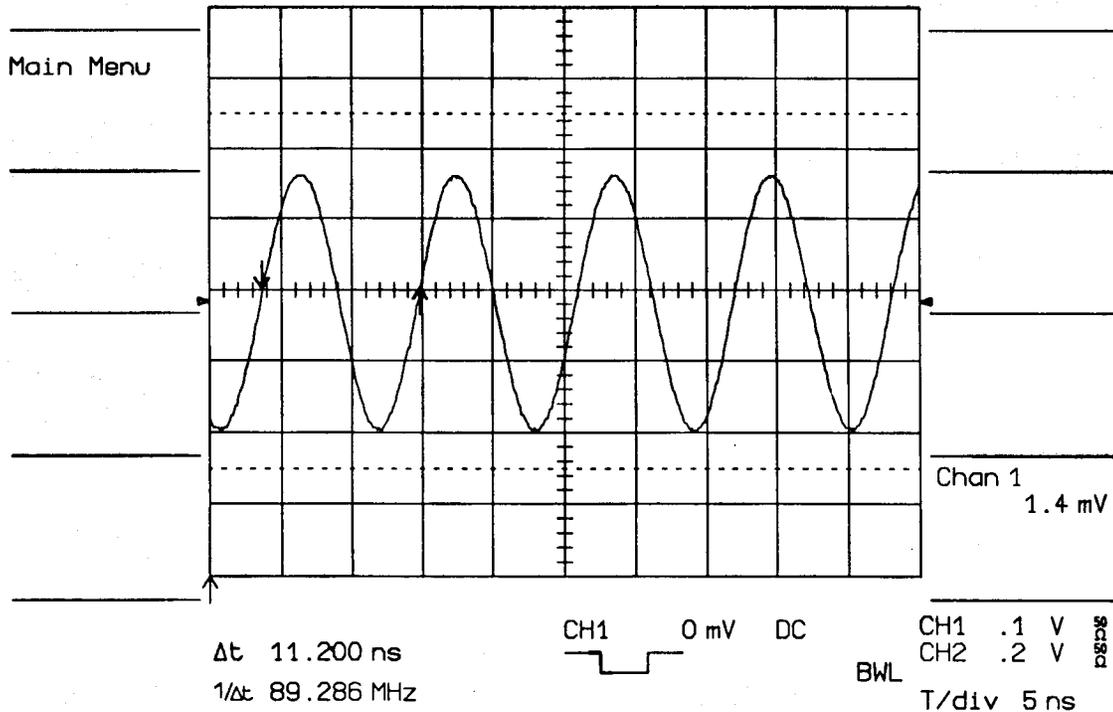


Figure 7

3.1.8 Bandwidth at 1 M Ω Input Impedance (at Probe Tip)

The purpose of this test is to ensure that the entire 9450A system has a bandwidth of at least 250 MHz at probe tip at 1 M Ω 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 10 M Ω /10 probe using the probe tip - BNC jack. Make sure the probe is perfectly adjusted, low frequency and high frequency (see brochure enclosed with probe).

Turn off all the traces except CH1.

Trigger:

SMART Trigger: OFF
 Source: CH1
 Coupl: DC
 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 divisions p-p sine wave.

30-Sep-91
 17:46:37

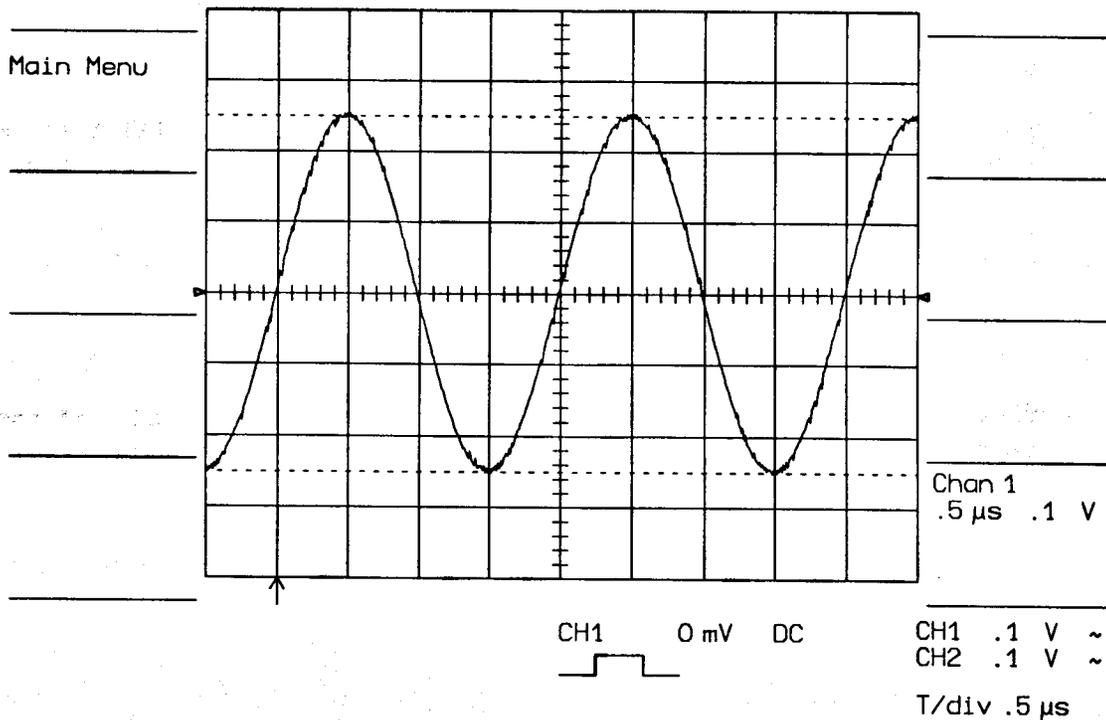


Figure 8

Set the Trigger coupling: HF

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 250 MHz

30-Sep-91
17:51:08

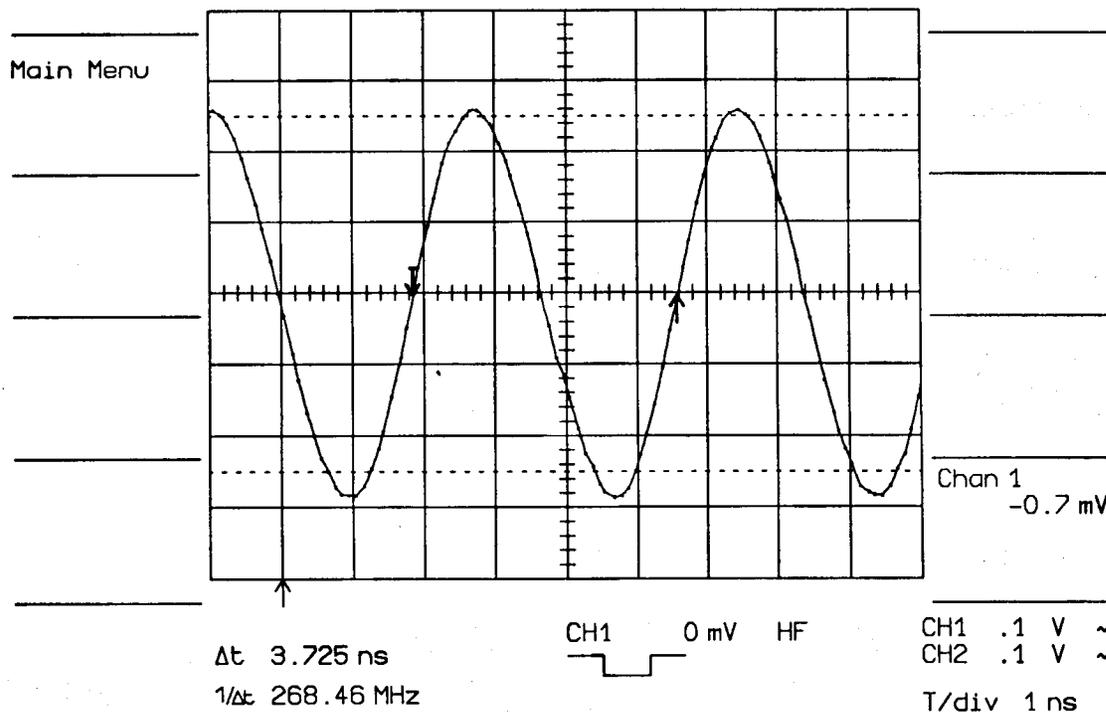


Figure 9

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

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 $80 \text{ MHz} \pm 20\%$

3.1.9 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 9450A 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.

3.1.10 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 EXT input and to CH1 via a coaxial T-connector. The cable length from EXT to CH1 must be short, at most 2 nsec.

Set up the DS0:

Turn off all the traces except CH1.

Set the trigger:

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

Set the input CH1:

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

Set the time base:

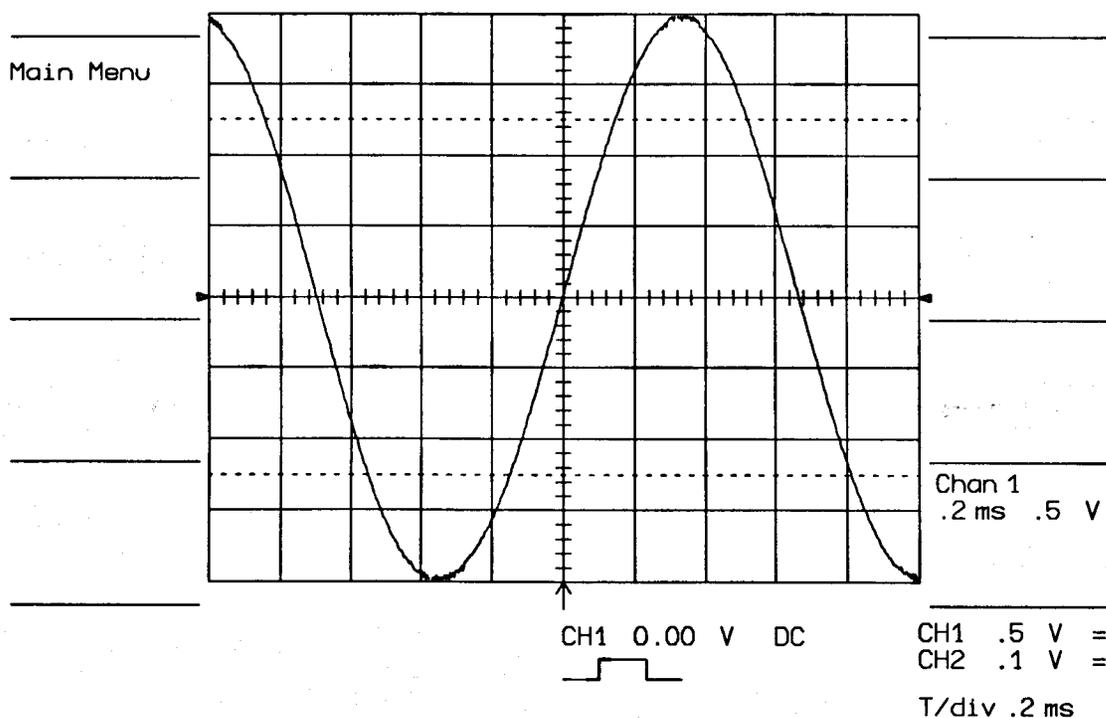
- Time/div:	.2 msec/div
-------------	-------------

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. Later, the test on the EXT trigger level requires that the signal has an absolute range of ± 2 V.

Check:

- the sine wave must pass through the horizontal center of the screen (50% pretrigger line) at the vertical position zero (vertical center) within ± 2 minor divisions

30-Sep-91
18:04:53



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 ± 2 minor divisions

30-Sep-91
18:08:03

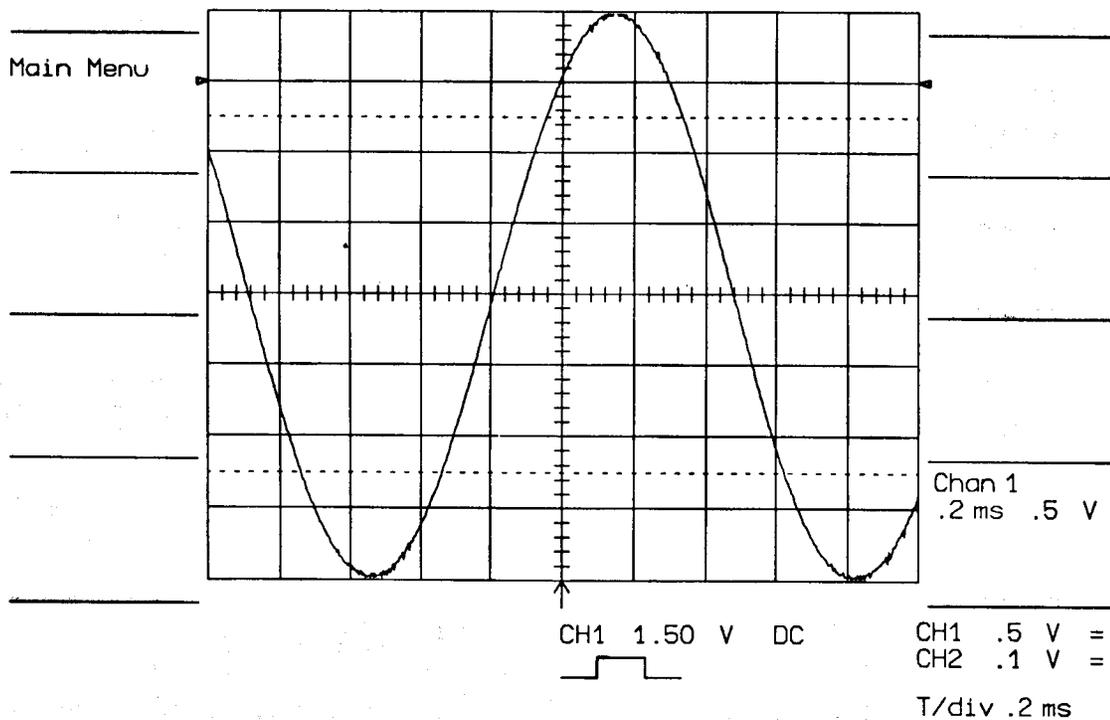


Figure 11

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 ± 2 minor divisions

30-Sep-91
18:09:29

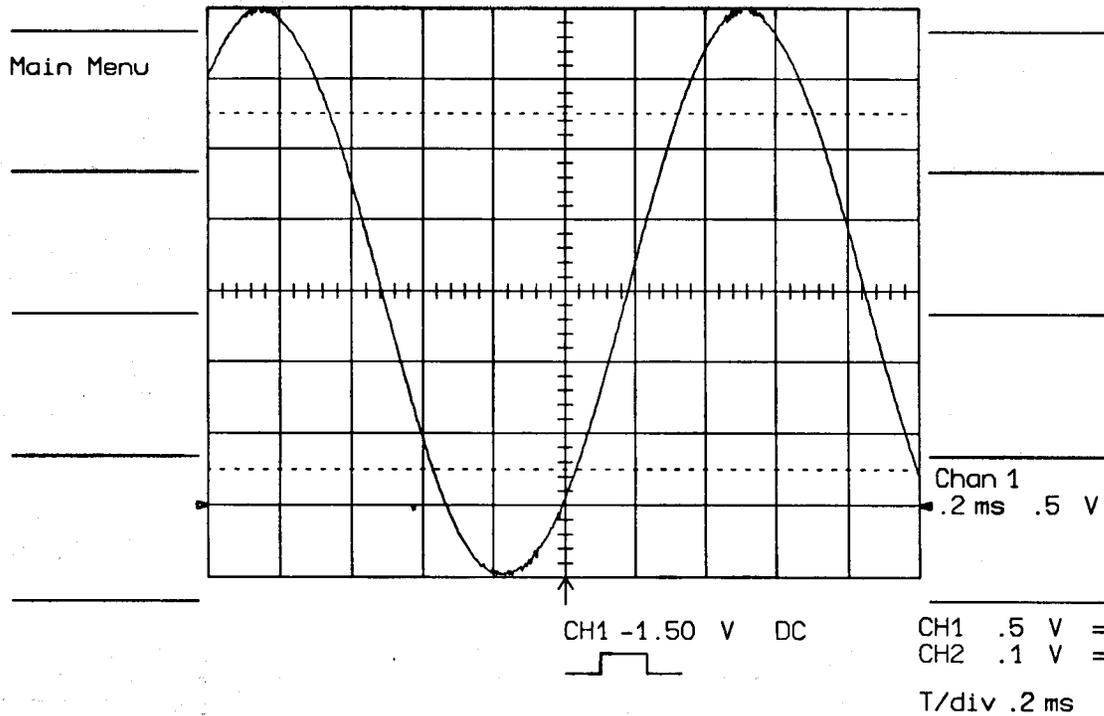


Figure 12

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 M Ω , DC
- Gain: .5 V/div
- Var: Gain 1
- Offset: zero

Set the trigger source to CH2.

Repeat the above check procedure for CH2.

Leave the input connected to CH2, leave the trace of CH2 on.

Set trigger source to EXT.

Repeat the above check procedure for EXT trigger, but observing the effect on CH2. The tolerance for the level crossing is ± 2 minor divisions for the EXT trigger level.

30-Sep-91
18:13:36

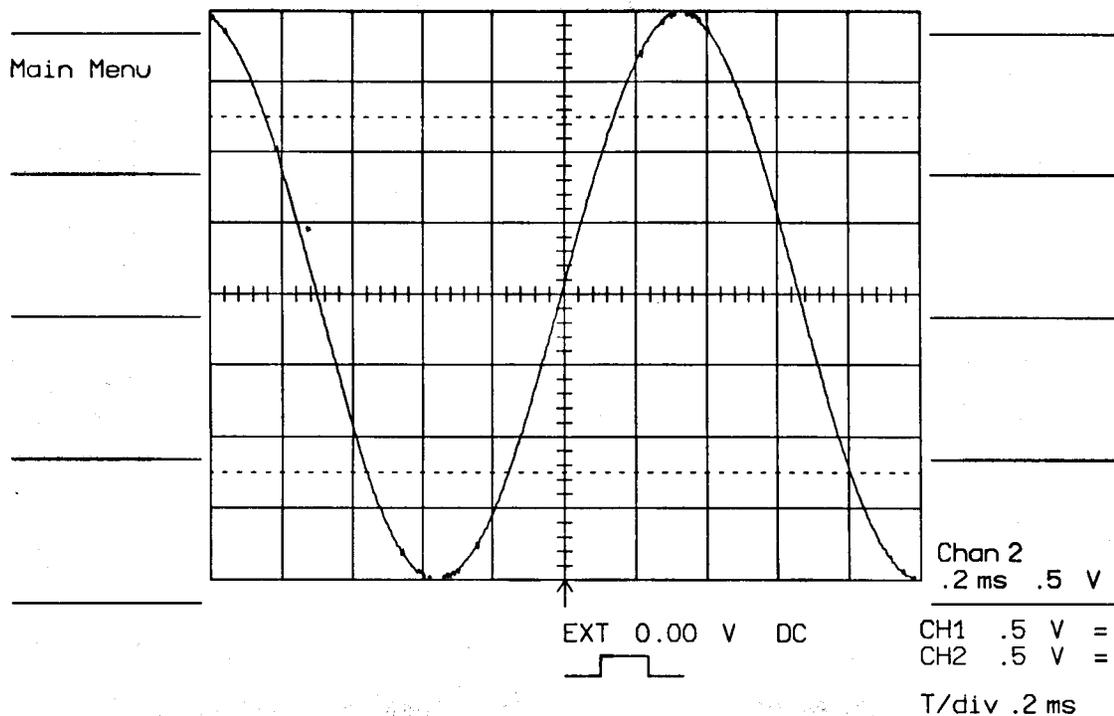


Figure 13

3.1.11 Bandwidth for EXT Trigger

Set up a sine wave generator (for example Marconi 2019A):

- Frequency 300 MHz
- Amplitude 2.8 V p-p (maximum for Marconi)

Connect the output of the generator to EXT input and to CH1 using a coaxial T-connector. The cable length between EXT and CH1 must be short (at most 2 nsec).

Set up the DSO:

Turn off all the traces, except CH1.

Set the trigger:

SMART Trigger: OFF
 Source: EXT
 Coupl: DC
 Mode: NORM
 Delay 50%
 Level zero

Set input CH1:

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

Set time base:

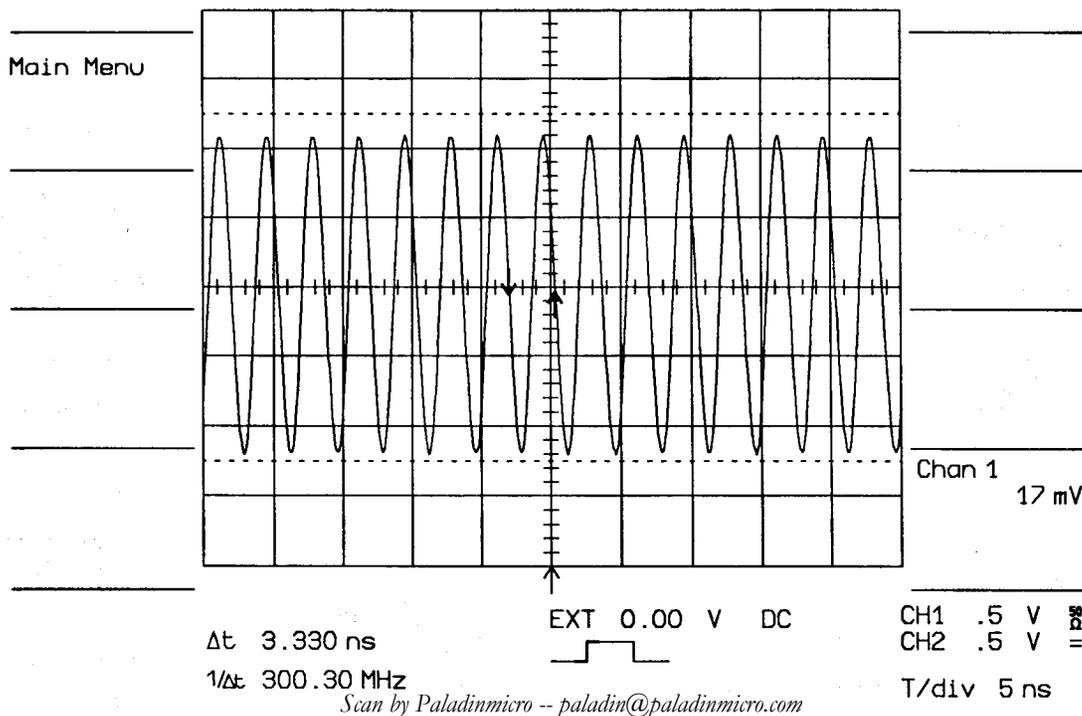
- Time/div 5 nsec/div
 - Interleaved ON

Check:

- The scope must keep triggering in a stable way (i.e., a smooth 300 MHz sine wave must be visible on the display).
- By using HF trigger coupling the scope must trigger up to 500 MHz.

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 9:29:19

Figure 14



3.1.12 Smart Trigger

3.1.12.1 Trigger on Pulse Width >, <

Set up the DS0:

Turn off all the traces except CH1.

Set the trigger:

Smart 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:

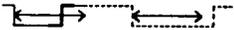
- Coupl: 50 Ω
 - Gain: .5 V/div
 - Var: Gain 1
 - Offset: zero

Set the time base:

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

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 10:06:17

Figure 15

Previous FIELD (R) Next	<p style="text-align: center;"><u>SMART TRIGGER</u></p> Trigger Type : Single Source Width Type : Pulse Width		
Previous VALUE (D) Next	<p style="text-align: center;"><u>Summary</u></p> <div style="text-align: center;">  </div> Trigger on CHAN1 if Pulse Width < 7.5 ns		
Cancel	Pre-trigger Delay 20.0%		
Return	<table border="1" style="width: 100%;"> <tr> <th style="text-align: center;">VALUES</th> </tr> <tr> <td style="text-align: center;">Interval Wi Pulse Width</td> </tr> </table>	VALUES	Interval Wi Pulse Width
VALUES			
Interval Wi Pulse Width			

Apply a sine wave signal 2.8 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

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10:11:32

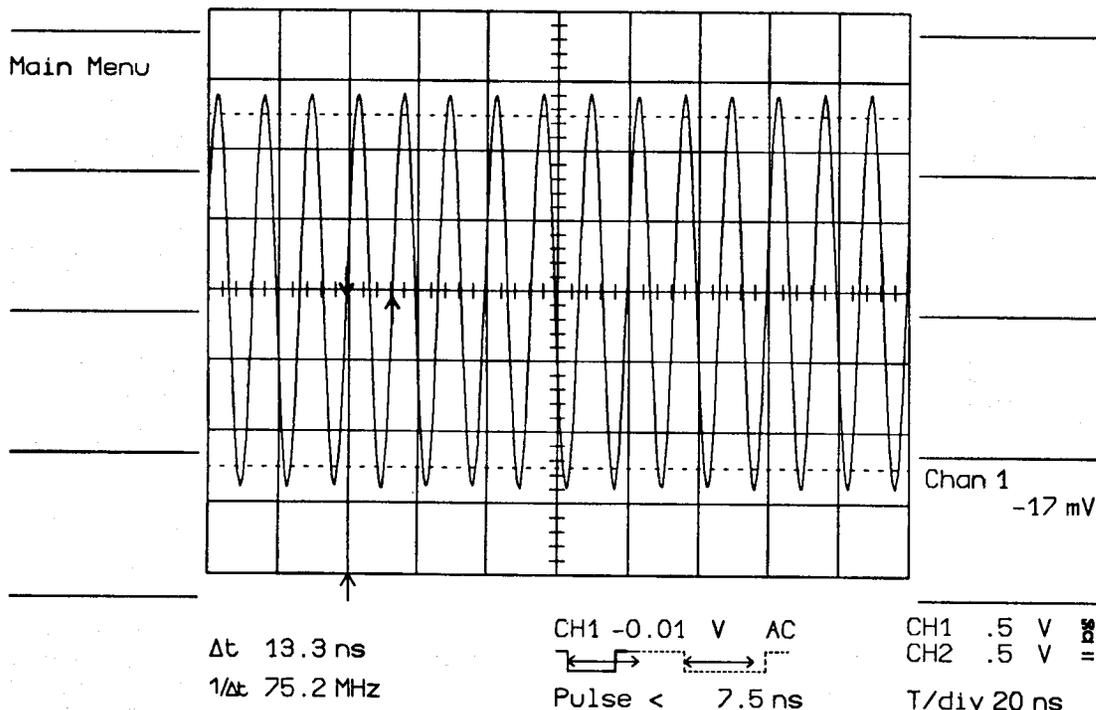


Figure 16

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.

3.1.12.2 Trigger on Interval Width <

Set up the DS0:

Turn off all the traces except CH1.

Set trigger:

- Smart 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

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10:16:37

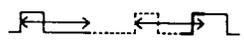
Previous FIELD  Next	<p style="text-align: center;"><u>SMART TRIGGER</u></p> Trigger Type : Single Source Width Type : Interval Width						
Previous VALUE  Next							
Cancel	<p style="text-align: center;"><u>Summary</u></p>  Trigger on CHAN1 if Interval Width < 10.0 ns						
Return	<table border="1" style="width: 100%;"> <tr> <th colspan="2" style="text-align: center;">VALUES</th> </tr> <tr> <td style="width: 60%;">Pre-trigger Delay</td> <td style="text-align: right;">20.0%</td> </tr> <tr> <td>Interval Wi Pulse Width</td> <td></td> </tr> </table>	VALUES		Pre-trigger Delay	20.0%	Interval Wi Pulse Width	
VALUES							
Pre-trigger Delay	20.0%						
Interval Wi Pulse Width							

Figure 17

Apply a sine wave signal 2.8 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

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10:19:42

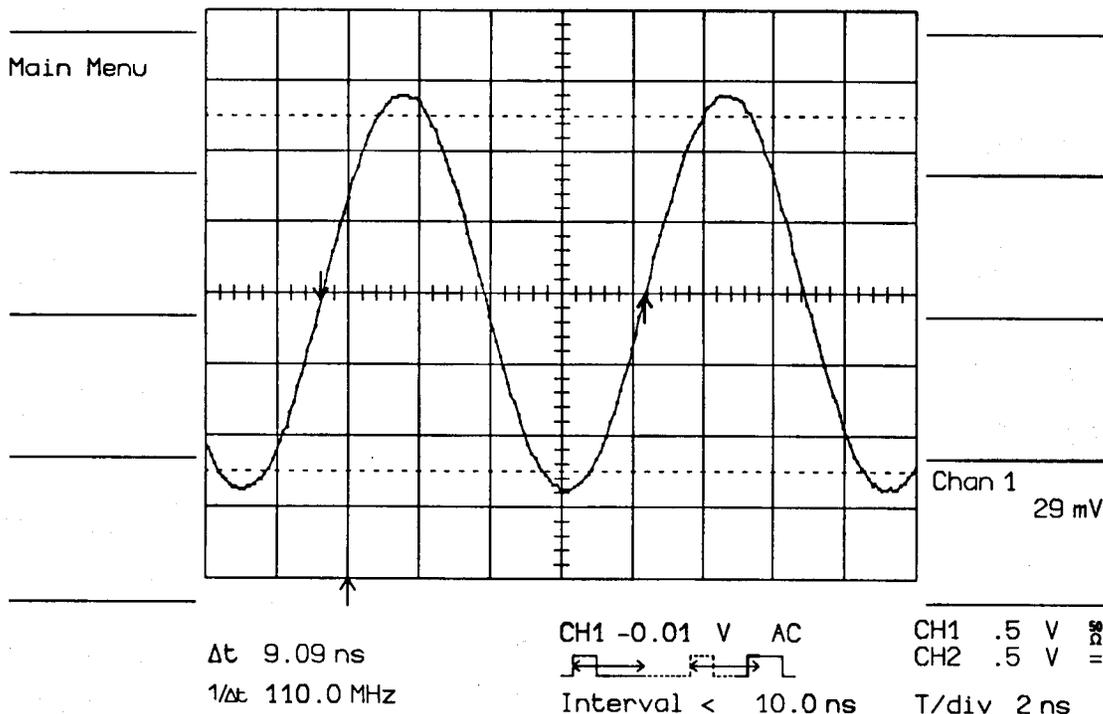


Figure 18

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

3.1.12.3 Trigger on Interval Width >

Set up the DSO:

Turn off all the traces except CH1.

Set the trigger:

- Smart 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 2.8 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

See figure 19.

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10:24:11

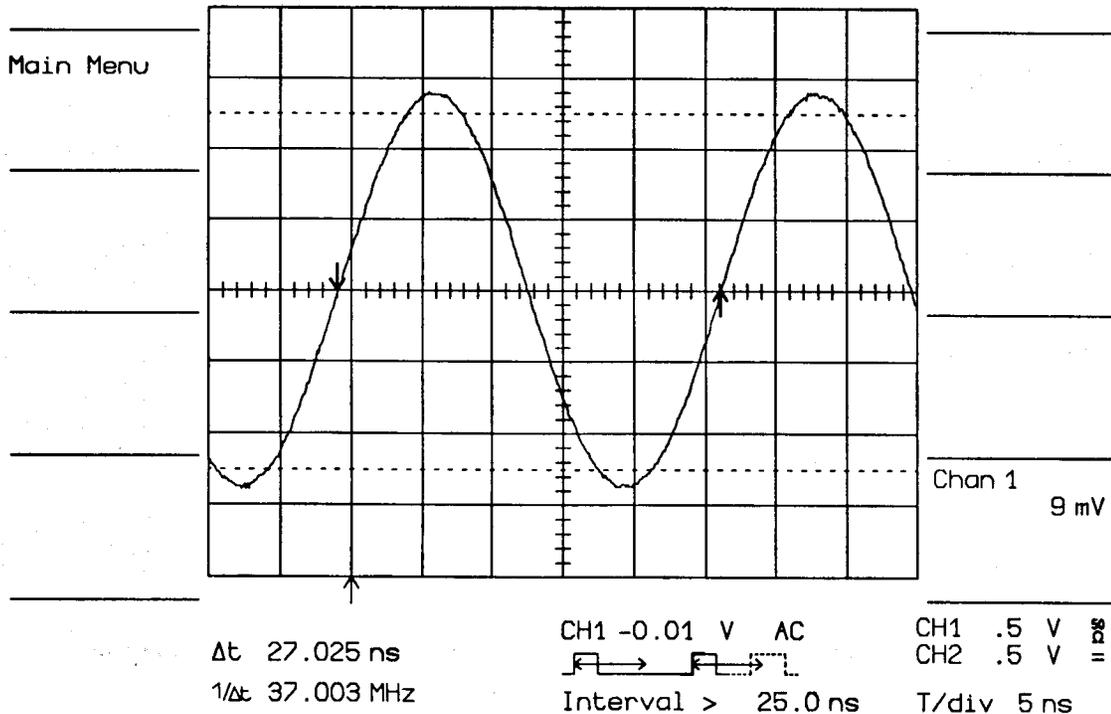


Figure 19

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.

3.1.13 Time Base Accuracy

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 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 μ sec/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 divisions 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 μ sec/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 20.

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10:54:33

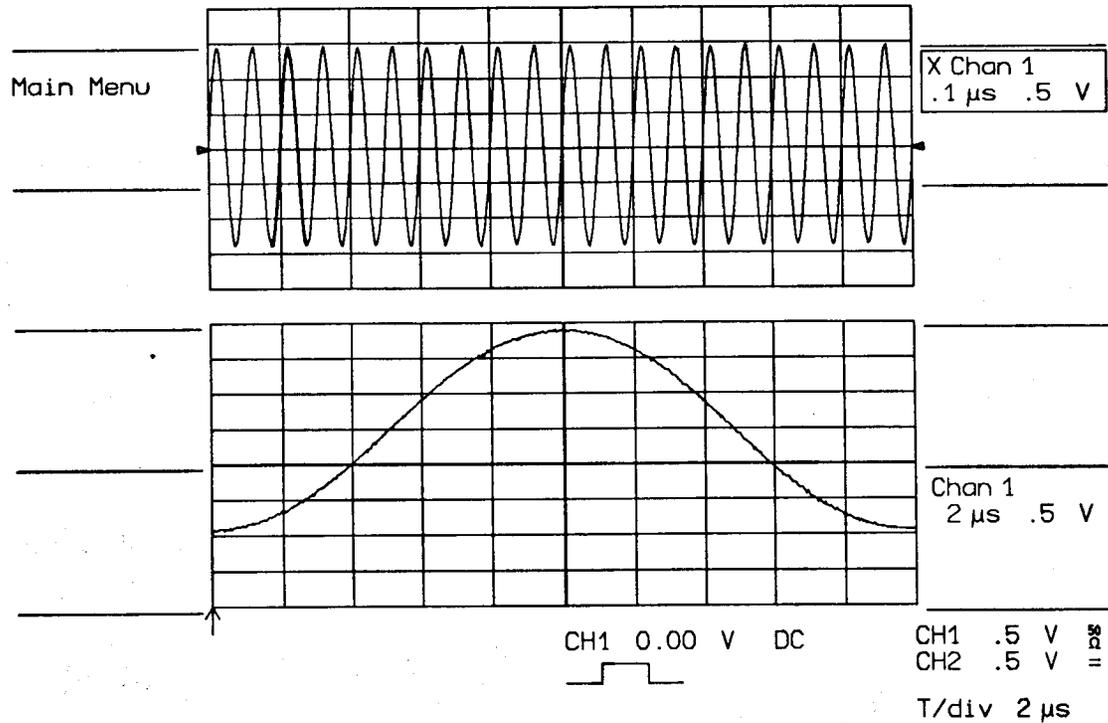


Figure 20: 3rd Period Expanded

Turn ON EXPAND B with CH1 as the source.

Adjust TIME MAGNIFIER to .1 μ sec/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 21.

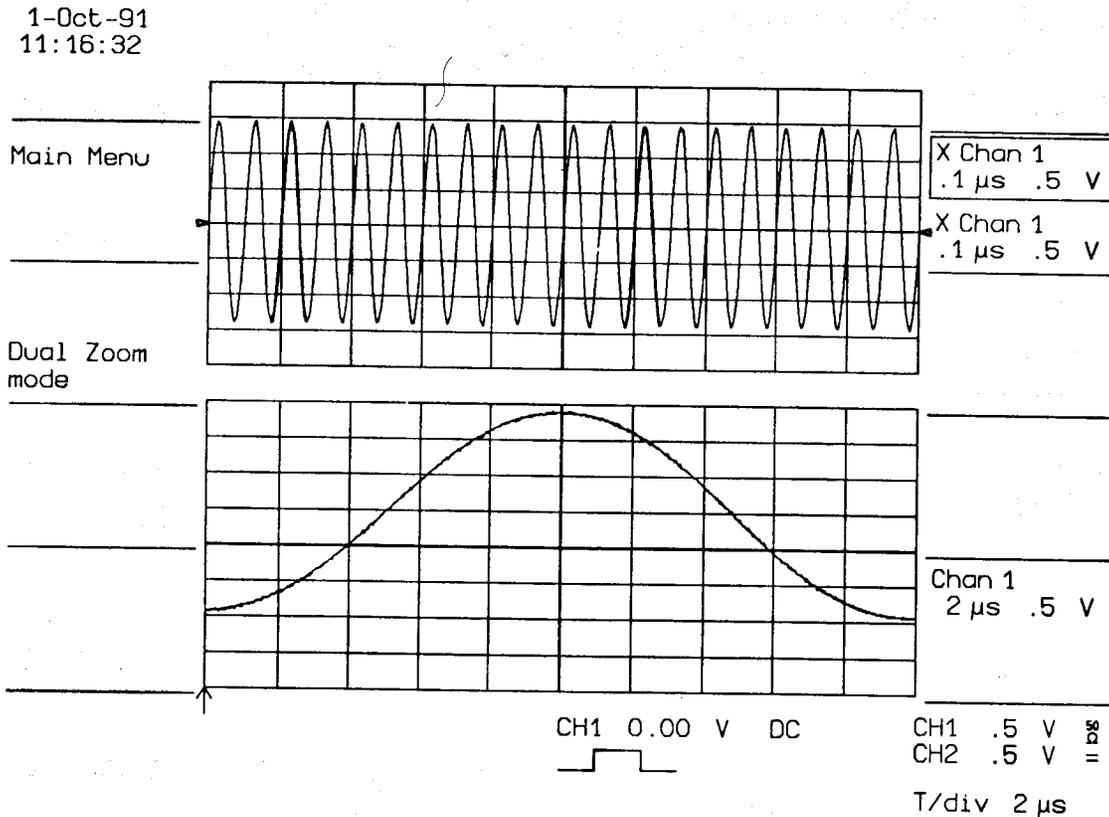


Figure 21: 3rd and 13th period overlaid

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 22.

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11:06:19

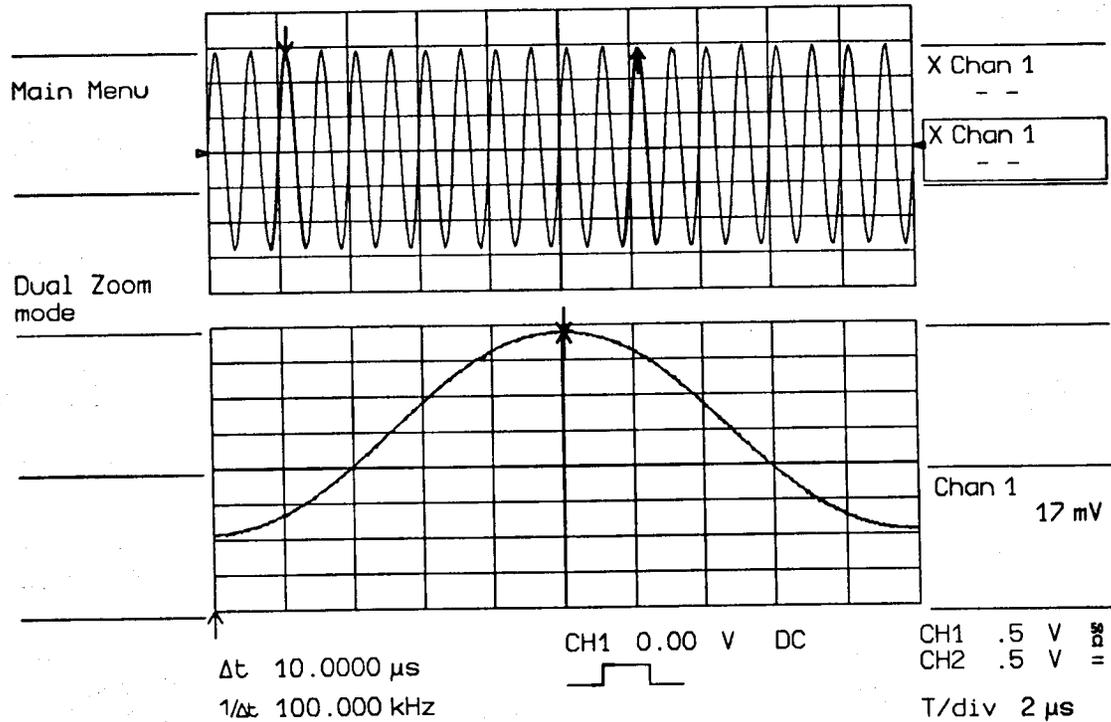


Figure 22: Aligned cursors

Turn DUAL ZOOM ON.

Turn TIME MAGNIFIER (DISPLAY CONTROL) to select the maximum expansion.
Refine adjustment of the two cursors, see Figure 23.

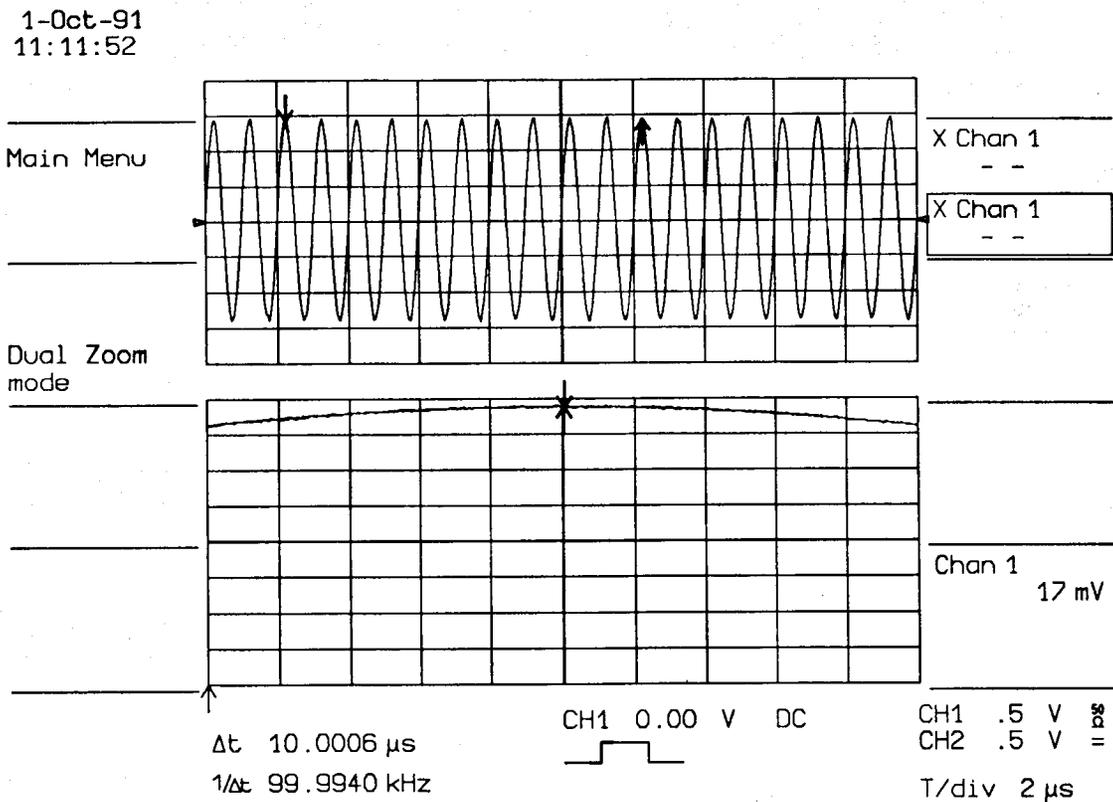


Figure 23: Alignment of cursors with maximum expansion.

Check:

The difference time reading must be within 9.998 and 10.002 μsec

3.2 Internal Diagnostics and Calibration

The 9450A 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, select the secret menu, press the "Calibration Constants" button and press "Full Recalibration" then enter "Calibration Error Log" and check that all the error status codes are zero.

It is advisable to perform this type of check when the scope is in a stable condition, after 20 minutes of warm up.

If you find error codes different from zero, you can find more information on the problem in the interpretation of the Calibration Error Log.

```

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11:18:43

```

CALIBRATION ERROR LOG			
Vertical Calibration			
4 nibbles=(curves) (verify) (high gain) (unused)			
(8=Offset Range, 4=Offset Conv, 2=Gain Range, 1=Gain Conv)			
Chan 1+2		CHAN1	CHAN2
Calib Const	5 mV	0	0
	10 mV	0	0
Chan 1+2	20 mV	0	0
Full Test	50 mV	0	0
	.1 V	0	0
Full Re-calibration	ADC/TMS State	Working	Working
Calibration Error Log	4 nibbles =	(400Ms)	(200Ms) (100Ms) (40Ms)
Manual FE DAC Control	Trigger Cal.	0	0 (2=No BWL, 1=BWL)
	Leveling Cal.	0	0 (2=Offset, 1=Gain Conv.)
More Consts	Phase Cal.	0	0 (4=Limits, 2=Fit, 1=Conv)
Return	TDC Calibration		0

Figure 1 : 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 gain and offset results displayed for CH1 and CH2 are independent of the following conditions :

- 50 Ohm or 1 MOhm input impedance
- BWL ON or OFF
- Variable gain
- Trigger mode and coupling
- Offset

The calibration results depends of the acquisition settings :

- Sampling rate : 40 Ms/s, 100 Ms/s, 200 Ms/s or 400 Ms/s
- Sensitivity : 5mV, 10mV, 20mV, 50mV, 0.1V

Ms/sec	400	200	100	40
µsec/div	_10	20	50	_100
Int. osc. MHz	200	100	200	80
Number of ADC's used	4	4	1	1

The four ranges 0.2V, 0.5V, 1V, 2V are not calibrated because they use an attenuator by 10, which has an accuracy of 1/1000.

3.2.1.1 Vertical calibration

The error conditions are coded into binary bits, each bit set represents a certain error. The error status is represented in a hexadecimal number, for each acquisition condition.

The 4 error bits have the following meaning:

- 1 = Gain Convergence : One or more points of the gain curve can not be measured. The gain curve is the dependence of the front end variable gain on the 16 bit DAC. The 16 bit DAC controls the variable gain. During 5 minutes after the power on or after a full recalibration, the second variable gain IVgain2 use for the 1mV and 2mV range is verified. If one error occurs, the error status gives 0010.

2 = Gain Range

: The control of the variable gain is checked by software to be between < 0.95 and >2.75. see Figure 2 : Calibration constants

DAC 0 : < 0.95
DAC 9 : > 2.75

Push "CH1+2 Calib Const" to see the errors. The result displayed depends of the Sampling Rate selected 40 Ms/s, 100, 200 or 400 Ms/s.

4 = Offset Convergence

: The offset curve cannot be measured. The dependence of the offset as seen by the user on the offset control voltage is described by three parameters.

One or all parameters cannot be determined.

8 = Offset Range

: The maximum offset is + 1.2V and the minimum is - 1.2 V.

The calibration verify that the DAC can reach +/- 1.2 V offset.

The 4 nibbles or columns, where the error status are displayed correspond to the following conditions:

curves	verify	high gain	unused
X000	0X00	00X0	000X
1= Gain Convergence	Fail gain verify	Find high gain	
2= Gain range	Fail offset verify	IVgain2	
4= Offset convergence			
8= Offset Range			

Examples:

error code 8000 : Offset range problem
error code 2000 : Gain range problem
error code 0010 : Calibration problem on the second variable gain (IVgain2) use for the 1mV and 2mV sensitivity

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14:48:13

	<u>Calibration Constants</u>	400Ms/s	10 μ s/div
Chan 1+2	variable gain	C1 (.1 V)	C2 (.1 V)
Calib Const	dac 0 (ffff= 0.8488mA)	0.7336	0.7245
	dac 1 (f332= 0.8000mA)	0.7515	0.7400
	dac 2 (d8f4= 0.7000mA)	0.8006	0.7876
	dac 3 (beb7= 0.6000mA)	0.8676	0.8502
	dac 4 (a47a= 0.5000mA)	0.9605	0.9397
Chan 1+2	dac 5 (8a3c= 0.4000mA)	1.0884	1.0664
Full Test	dac 6 (6fff= 0.3000mA)	1.2835	1.2567
	dac 7 (55c2= 0.2000mA)	1.5937	1.5640
	dac 8 (3b84= 0.1000mA)	2.1461	2.1074
	dac 9 (2148= 0.0000mA)	3.1112	3.0755
Full Re- calibration	offset		
Calibration Error Log	C1 (.1 V) o0:-1.9558 o1: 0.623 o2: 6.10e-05 [0.1038 \pm 1.9973]		
	C2 (.1 V) o0:-1.9356 o1: 0.631 o2: 5.87e-05 [0.0507 \pm 1.9232]		
Manual FE DAC Control	C1 current dac settings (.1 V* 1.00, 0.00e+00; 400Ms/s)		
	high gain 0000 = -0.1576 mA		
	gain adjust 9b5c = 0.4653 mA		
More Consts	offset 79b9 = 9.81e-02 V		
Return	C2 current dac settings (.1 V* 1.00, 0.00e+00; 400Ms/s)		
	high gain 0000 = -0.1576 mA		
	gain adjust 96f5 = 0.4485 mA		
	offset 7cf6 = 4.75e-02 V		

Figure 2 : Calibration Constants

The variable gain or "Calibration Constants" should be for all sensitivities (V/div):

Dac 0: < 0.95 and Dac 9: > 2.75

See F9450A-7 calibration procedure for the variable gain adjustment.

3.2.2 ADC/TMS STATE

The status must be "working", no memory is indicated in the column if the ADC F9450A-3 is not present.

3.2.3 Trigger calibration

The tests report problems for each of the 4 possible sampling rates, 40 Ms/s, 100, 200 and 400. With BWL ON or BWL OFF, selected by the user.

1 = BWL ON

2 = BWL OFF

If the error code is not equal zero, the Hyst of the F9450A-7 front end is not within the correct range 0.15/ 0.30 div, or the board has a complete failure.

See "More Consts" and "Trig Calibr Constants". The adjustment of the trigger level is described in the test and calibration procedure of the F9450A-7 front end.

Examples :

Code 20 : Trigger Calibration problem, BWL OFF, at 100 Ms/s

Code 1 : Trigger Calibration problem at 40 Ms/s, BWL ON

1-Oct-91
15:06:27

	<u>Calibration Constants</u>		200Ms/s	20 μ s/div
Trig Calibr Constants	C1 trigger threshold level			
	HF	t2:-3.91e-04 t1: 12.98	hyst. -0.23	[0.159 \pm -12.82]
	AC	t2:-3.91e-04 t1: 12.98	hyst. -0.23	[0.159 \pm -12.82]
TDC Calibr	LF REJ	t2:-3.79e-04 t1: 12.60	hyst. -0.22	[0.163 \pm -12.43]
	HF REJ	t2: 3.82e-04 t1:-11.53	hyst. 0.22	[0.998 \pm 12.53]
Phase Constants	DC	t2:-3.77e-04 t1: 13.67	hyst. -0.22	[1.325 \pm -12.34]
Recalibrate Trig Counter	C2 trigger threshold level			
	HF	t2:-4.01e-04 t1: 13.29	hyst. -0.23	[0.151 \pm -13.14]
	AC	t2:-4.01e-04 t1: 13.29	hyst. -0.23	[0.151 \pm -13.14]
	LF REJ	t2:-3.95e-04 t1: 13.06	hyst. -0.23	[0.119 \pm -12.94]
Chan 1+2 Gain Test	HF REJ	t2: 3.90e-04 t1:-11.89	hyst. 0.22	[0.906 \pm 12.79]
	DC	t2:-4.00e-04 t1: 14.24	hyst. -0.23	[1.144 \pm -13.09]
SS-FIR Corr ON/OFF				
RIS-FIR Corr ON/OFF				
Return	trigger counter interval 2.569 ns			

Figure 3 : Trigger Calibration Constants

3.2.4 TDC calibration

The TDC interpolator is calibrated at 40 Ms/s, 100 Ms/s and 200 Ms/s. If it is OK, the TDC calibration error code is zero into the calibration error log menu.

Enter "More Consts" and press "TDC Calibr".

Check calibration "OK" at the three sampling frequencies.

1-Oct-91
15:12:52

TDC CALIBRATION ANALYSIS				
	Sampl. Frequency	40 Ms/s	100Ms/s	200Ms/s
Trig Calibr Constants	TDC offset in ns	-13.220	-5.899	-10.880
TDC Calibr	TDC gain in ps/LSB	12.86	5.17	10.35
Phase Constants	# in lower peak	543	220	240
	# in upper peak	457	279	260
Recalibrate Trig Counter	# outside histo	0	1	0
Chan 1+2	1st lower edge	1021	1137	1051
	2nd lower edge	1036	1148	1052
Gain Test	Final lower edge	1028	1142	1051
	Final upper edge	2000	2110	2017
SS-FIR Corr ON/OFF	Calibration	OK	OK	OK
RIS-FIR Corr ON/OFF	RIS FIR Correction Factors			
Return		CHAN1	CHAN2	
		-1.00%	0.00%	

Figure 4: TDC Calibration Constants

3.2.5 Non linearity

The DC non-linearity is analyzed for the sampling rate, BWL ON, BWL OFF 50 Ohm or 1 MOhm input, the user has set.

The test should be done for the 4 possible sampling rates 40 Ms/s, 100 Ms/s, 200 Ms/s or 400 Ms/s.

In order to change the sampling rate one has to leave the menu and set the time/div appropriate to the required sampling rate.

One vertical division represent 1/2 % of the full scale.

At present the variations should stay within +/- 2% or 4 vertical divisions.

2-Oct-91
11:30:13

Non-linearity curve for C1, C2 at 100Ms/s

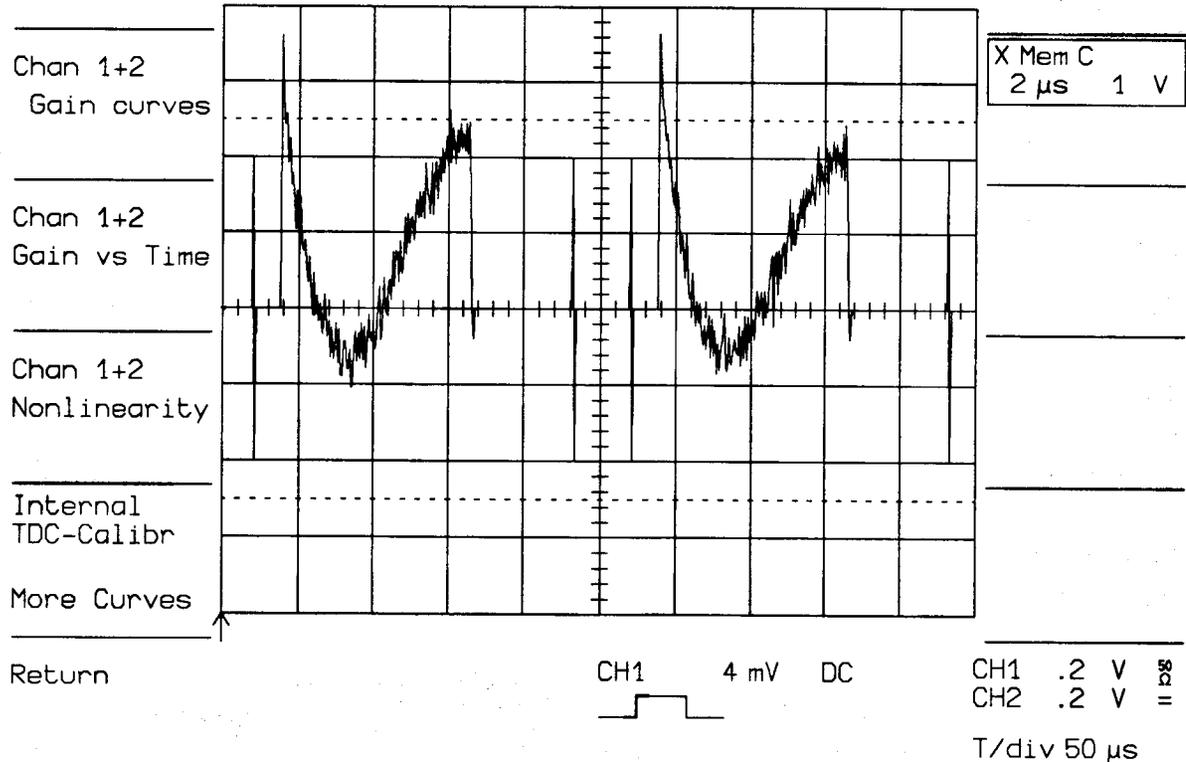


Figure 5 : Non Linearity Curve at 100 Ms/s

3.2.6 Internal TDC calibration

This test allows the user to check the calibration of the time base board F9450-4.

Press "Curves Calibration", and "Internal TDC-Calibr".

Check that the distribution contains two peaks.

The amplitude and the width of the two peaks are not important.

The test should be done for the 4 possible sampling rates.

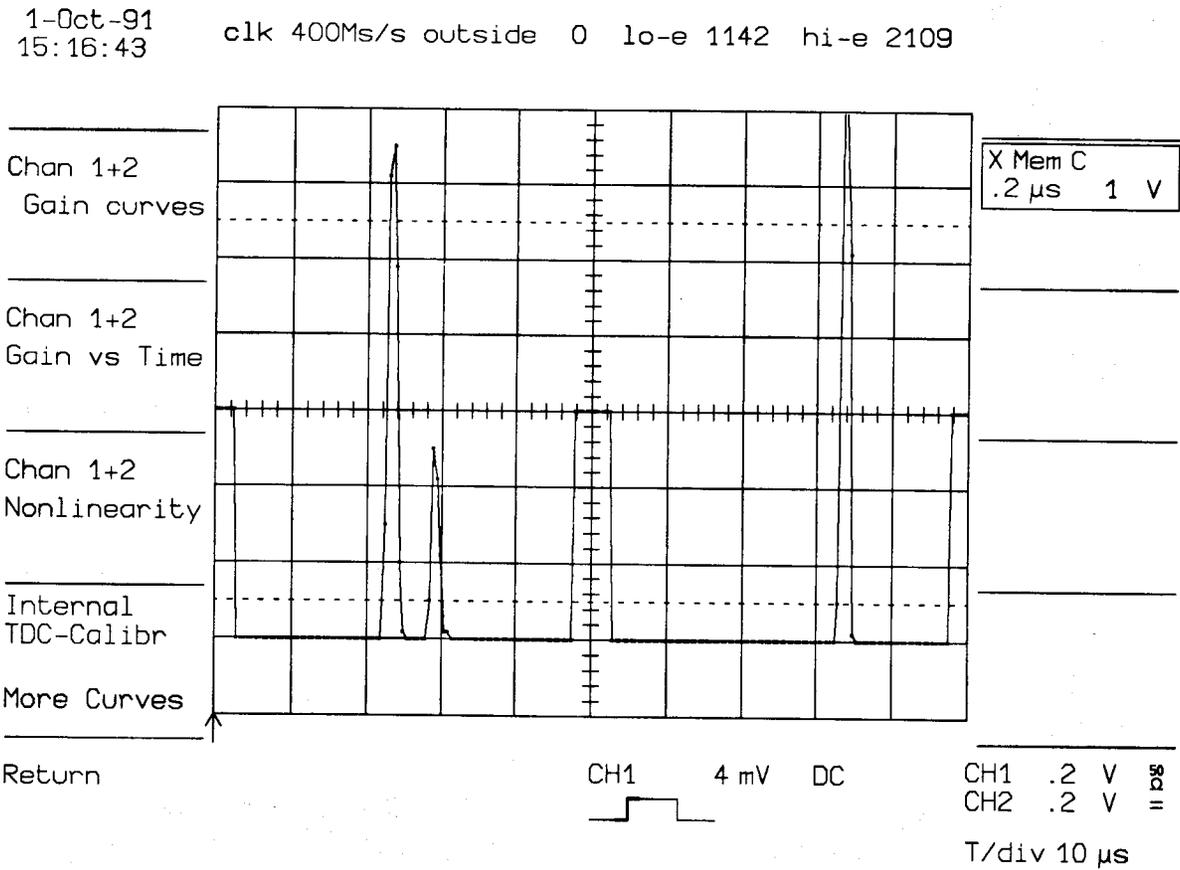


Figure 6 : Internal TDC Calibration at 400Ms/s

1-Oct-91
15:18:50

clk 40 Ms/s outside 0 lo-e 1028 hi-e 1995

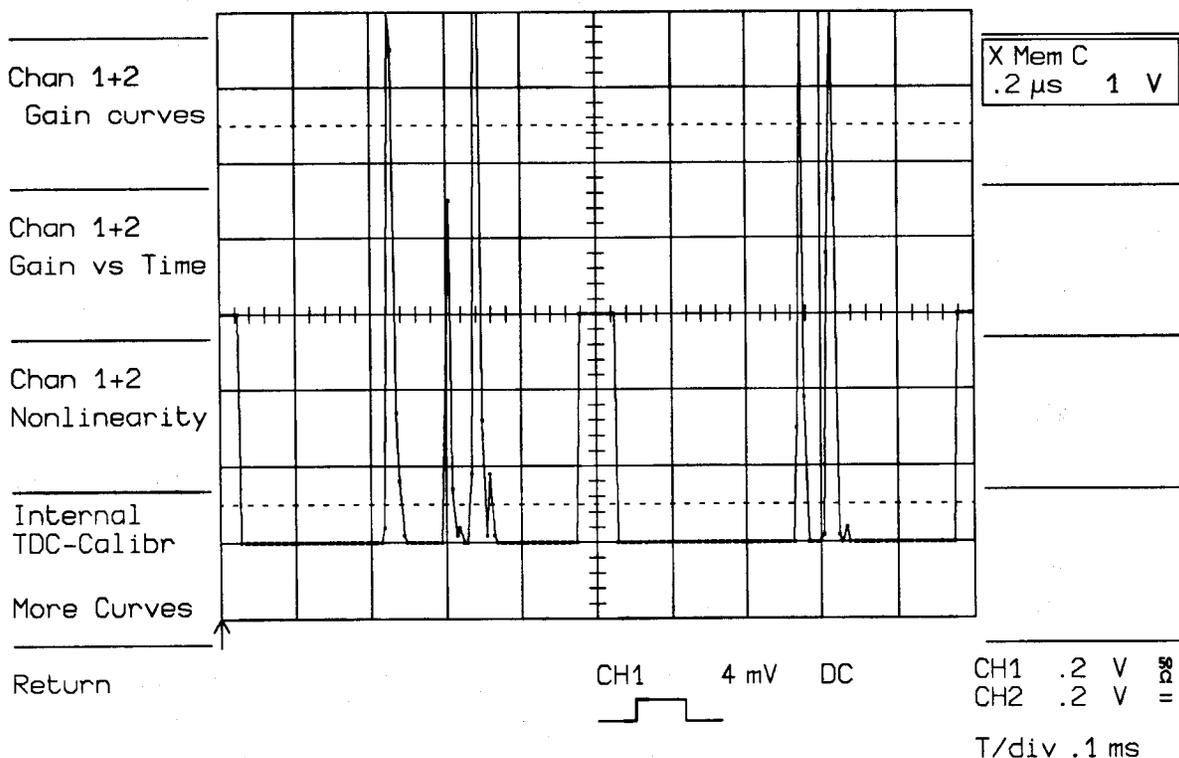


Figure 7 : Internal TDC Calibration at 40 Ms/s

1-Oct-91
15:12:52

TDC CALIBRATION ANALYSIS				
	40 Ms/s	100Ms/s	200Ms/s	
Trig Calibr Constants	40 Ms/s	100Ms/s	200Ms/s	
TDC Calibr	TDC offset in ns	-13.220	-5.899	-10.880
Phase Constants	TDC gain in ps/LSB	12.86	5.17	10.35
Recalibrate Trig Counter	# in lower peak	543	220	240
	# in upper peak	457	279	260
	# outside histo	0	1	0
Chan 1+2 Gain Test	1st lower edge	1021	1137	1051
	2nd lower edge	1036	1148	1052
	Final lower edge	1028	1142	1051
	Final upper edge	2000	2110	2017
SS-FIR Corr ON/OFF	Calibration	OK	OK	OK
RIS-FIR Corr ON/OFF	RIS FIR Correction Factors			
	CHAN1	CHAN2		
Return	-1.00%	0.00%		

Figure 8 : TDC Calibration Analysis

3.2.7 Internal ADC's Calibration

When sampling at either 40 Ms/s or 100 Ms/s, only the reference ADC n^o 3 by soft (numbered 0, 1, 2, 3 for software or 1, 2, 3, 4 for hardware) is used.

When sampling at either 200 Ms/s or 400 Ms/s the four ADC's are used. RIS mode runs always at 100 Ms/s with 1 ADC (ADC n^o 3).

3.2.7.1 Leveling Calibration

The internal calibration levels all ADC's (0, 1, 2) to the reference ADC's n^o 3 (which is always set at 80).

It adjusts the offsets and gains associated to each Sample and Hold, and ADC respectively.

Press "More Consts" and "Phase Constants" button. The "Coars off", "Gain Corr", "Fine off" values, for both CH1 and CH2, are always 80 for the ADC n^o 3 (reference), and should be between 10 and F0 for the ADC's n^o 0, 1 and 2. See figure 9

1-Oct-91
15:21:01

LEVELING + PHASE + DYNAMIC ANALYSIS									
	Time/div 10 µs Corr NONE S-Freq 400Ms/s								
	Leveling + Phase DACs								
	CHAN 1				CHAN 2				
Trig Calibr	Coars Off	88	8b	8d	80	95	95	91	80
Constants	Delays	5d	88	a2	72	4f	83	b0	53
TDC Calibr	Gain Corr	99	95	8f	80	92	8d	9f	80
	Fine Off	6b	72	6f	80	6e	77	6e	80
Phase Constants	Phase Fit & Code								
		CHAN 1			0	CHAN2			0
Recalibrate		0	1	2	3	0	1	2	3
Trig Counter	mean	10.5	9.7	10.0	10.1	3.7	2.9	4.7	2.6
	rms	96.2	96.9	97.7	96.4	97.7	97.9	97.7	98.7
Chan 1+2	d gain	1.007	0.999	0.990	1.004	1.003	1.001	1.003	0.993
Gain Test	d offs	-0.5	0.4	0.2	-0.1	-0.2	0.6	-1.3	0.9
	d phase	-3.7	3.2	4.3	-3.8	-0.0	4.1	3.5	-7.6
	Mean Phase	21.94				19.32			
SS-FIR Corr	Slope	2.5e+04				2.7e+04			
ON/OFF	D-Period	-1.5e-03				-1.5e-03			
RIS-FIR Corr	# Points	351				318			
ON/OFF	Dyn Corr								
Return									
	Phase ps								

Figure 9

Into the "Calibration Error Log" the "Leveling cal" error code should be zero.

1-Oct-91
11:18:43

CALIBRATION ERROR LOG																			
Vertical Calibration																			
4 nibbles=(curves) (verify) (high gain) (unused)																			
(8=Offset Range, 4=Offset Conv, 2=Gain Range, 1=Gain Conv)																			
Chan 1+2 Calib Const	<table border="1"> <thead> <tr> <th></th> <th>CHAN1</th> <th>CHAN2</th> </tr> </thead> <tbody> <tr> <td>5 mV</td> <td>0</td> <td>0</td> </tr> <tr> <td>10 mV</td> <td>0</td> <td>0</td> </tr> <tr> <td>20 mV</td> <td>0</td> <td>0</td> </tr> <tr> <td>50 mV</td> <td>0</td> <td>0</td> </tr> <tr> <td>.1 V</td> <td>0</td> <td>0</td> </tr> </tbody> </table>		CHAN1	CHAN2	5 mV	0	0	10 mV	0	0	20 mV	0	0	50 mV	0	0	.1 V	0	0
	CHAN1	CHAN2																	
5 mV	0	0																	
10 mV	0	0																	
20 mV	0	0																	
50 mV	0	0																	
.1 V	0	0																	
Chan 1+2 Full Test																			
Full Re-calibration	ADC/TMS State Working Working																		
Calibration Error Log	4 nibbles = (400Ms) (200Ms) (100Ms) (40Ms)																		
Manual FE DAC Control	Trigger Cal. 0 0 (2=No BWL, 1=BWL)																		
	Leveling Cal. 0 0 (2=Offset, 1=Gain Conv.)																		
More Consts	Phase Cal. 0 0 (4=Limits, 2=Fit, 1=Conv)																		
Return	TDC Calibration 0																		

figure 10

for more information on the gain and offset calibration:

mean: dc offset, 0.0 ± 20.0

rms: amplitude, adc code = 96 ± 10

d gain: gain variation, 1 ± 0.01

d offs: offset variation, 0 ± 2

3.2.7.2 Phase Calibration

This part of the calibration aligns the timing of the 4 Sample and Hold's, to be better than 20 psec, by using an interactive computing procedure.

The "Delays" for the four ADC's should be between 10 and F0.

The "d phase represents the timing deviation and should be maximum ± 10 psec.

The "phase Cal" error code should be zero.

See figure 9 and 10.

That's all that is required for a quick but complete internal check of the 9450A scope.

Chapter 4

SERVICE INFORMATION

AND

PROCEDURES

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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.

***** W A R N I N G *****

Before removing any parts from the LeCroy 9450A 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)

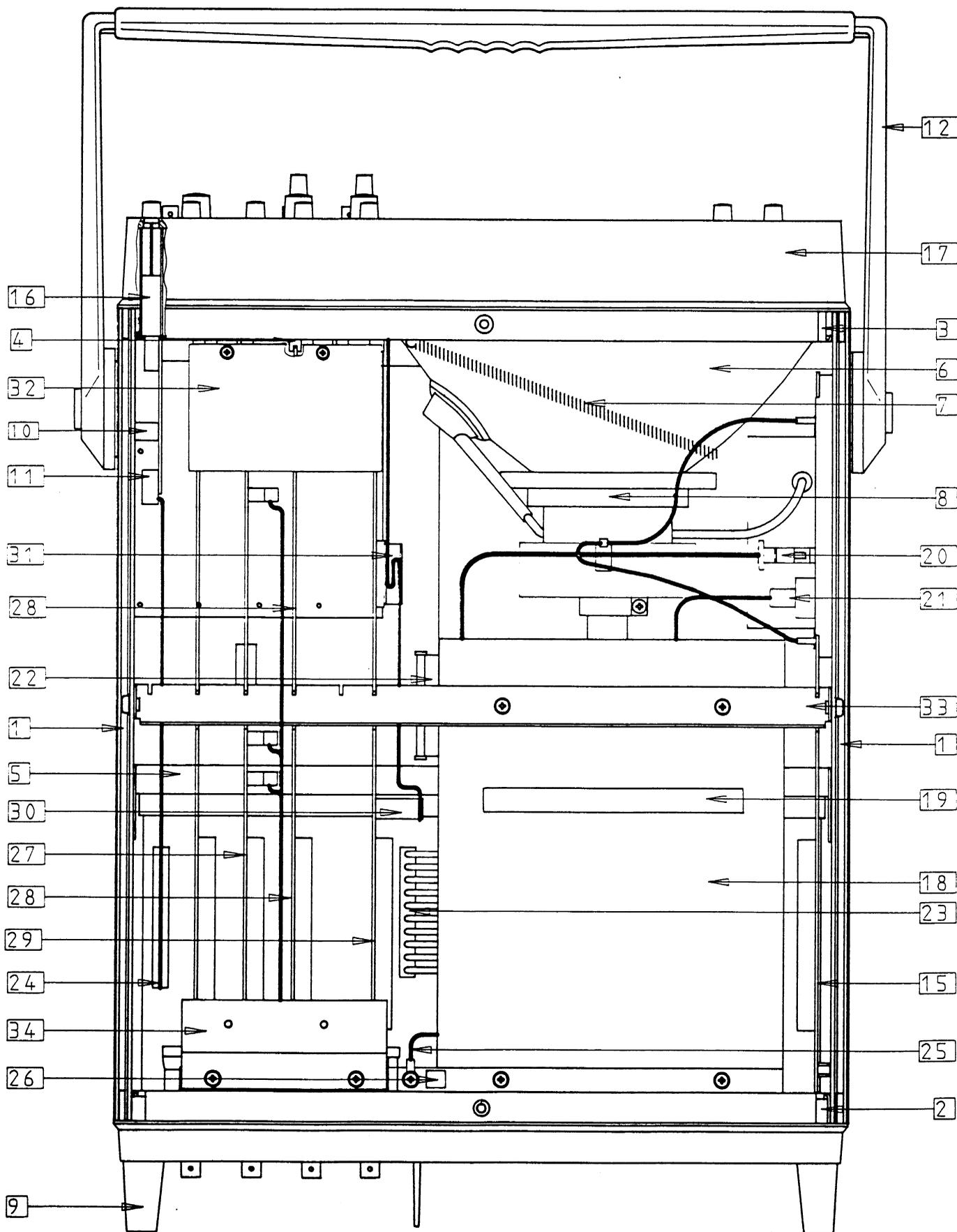


Figure 4.1.

Scan by Paladinmicro -- paladin@paladinmicro.com

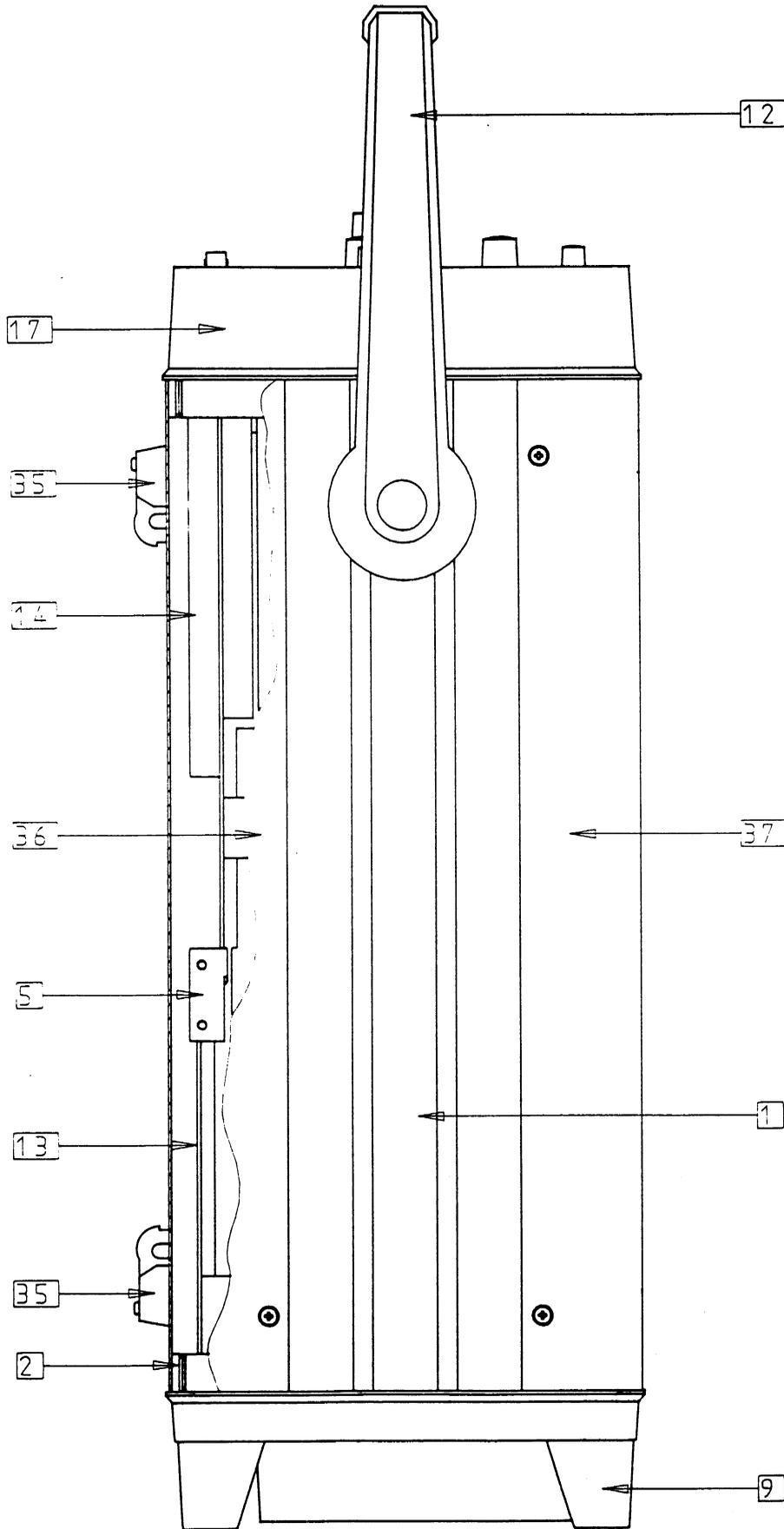


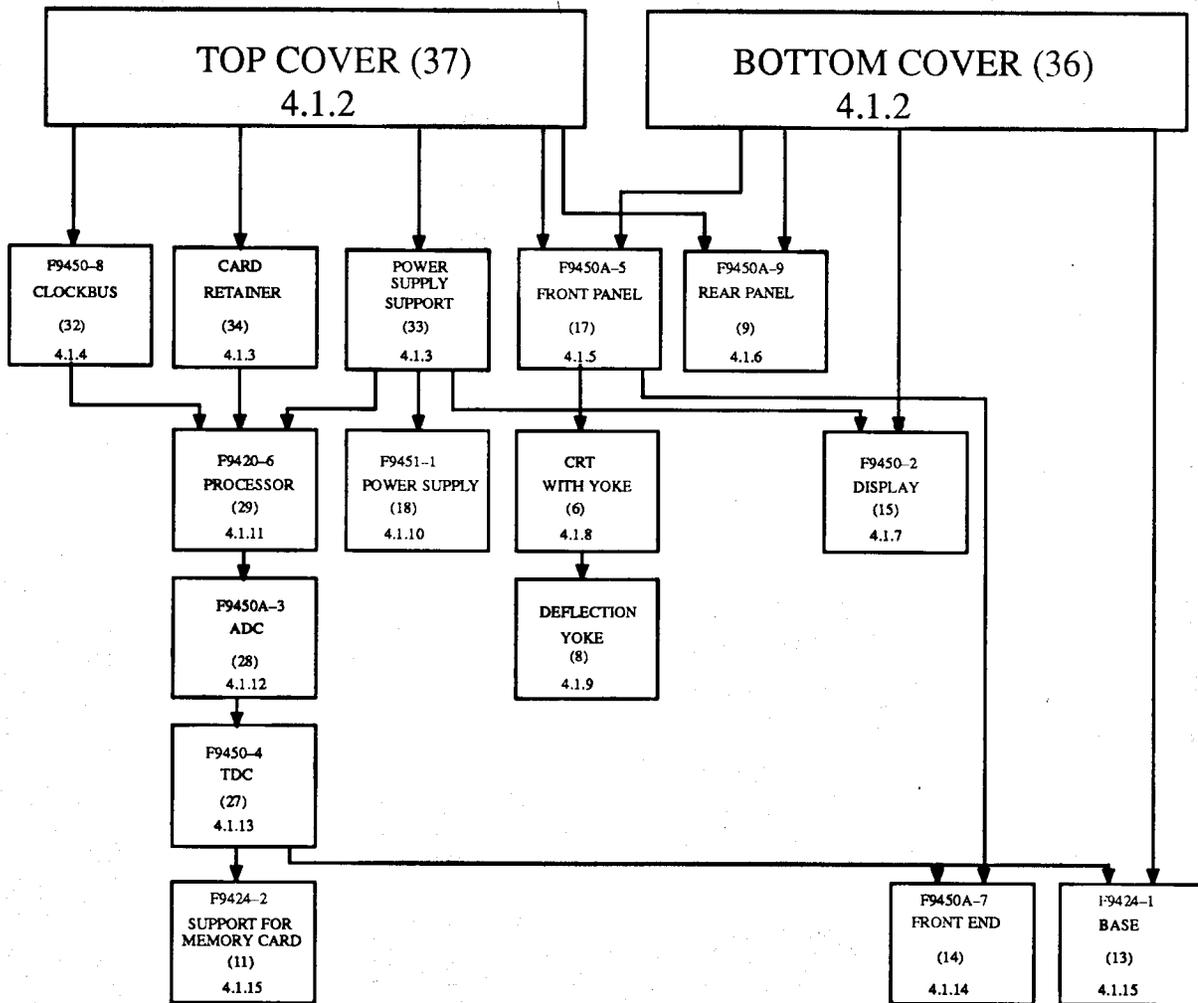
Figure 4.2.

ASSEMBLAGE SEQUENCE OF PARTS				SCREWS		WASHERS		NUTS	
POS	DESCRIPTION	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 9450A	F9450A-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	DUAL CHANNEL FRONTEND	F9450A-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	DUAL CHANNEL FP CARD	F9450A-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	F9450-4	1						
28	SINGLE CHANNEL ADC	F9450A-3	2						
29	PROCESSOR CARD	F9420-6	1						
30	FRONT PANEL CABLE	780 411 236	1						
31	CABLE CLIP AD BACK	594 230 002	1						
32	CLOCK-BUS	F9450-8	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

4.1.1 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.

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
27	-	F9450-4	Time Base
28	-	F9450A-3	Single ADC
29	-	F9420-6	Processor
32	-	F9450-8	Clock Bus

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

13	-	F9424-1	Base
14	-	F9450A-7	Front End

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

9	-	F9450A-9	Rear Panel
17	-	F9450A-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), F9420-6 (29), F9450A-3 (28) F9450-4 (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 F9450-8 Clock Bus

This is the little board (32) at the front right of the DSO across the top of the two ADC's boards (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 F9450A-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 F9420-6 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 DOS. if any parts need to be changed on the board F9450A-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 9430-52 by removing the four screws and washers.

4.1.6 Removal of the F9450A-9 Rear Panel

Remove the 6 screws at the top, bottom, left and right of the plastic rear panel (9), two screws to the F9451-1 power supply.

Disconnect the fan cable from the F9451-1 power supply (18) and the four SMD cables from the TDC board (see 4.1.13 and figure 4.4). the rear panel assembly can be removed from the DS0.

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 (6)

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.

***** W A R N I N G *****

The remaining electric field around the HV cable to the CRT can damage components on the F9420-6 (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
- F9450A-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 bulk
- 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 9450A 4.1.2
- Power supply support 4.1.3
- Two screws from the F9450A-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 F9420-6 Processor Board

Remove the following:

- Top cover 4.1.2
- Power supply support 4.1.3
- Card Retainer 4.1.3
- F9450-8 clock Bus 4.1.4

Disconnect the flat ribbon cable (30) from the F9420-6 processor (29). The board can now be removed vertically from the F9424-1 base board (13).

4.1.12 Removal of the F9450A-3 Dual ADC Boards

Remove the following:

- Top cover 4.1.2
- Power supply support 4.1.3
- Card retainer 4.1.3
- F9450-8 clock Bus 4.1.4
- F9420-6 Processor 4.1.11

4.1.12.1 Channel one ADC Board

Disconnect the signal input cable from the ADC Board (28). The F9450A-3 can be removed vertically from the F9424-1 Base Board (13)

4.1.12.2 Channel Two ADC Board

Remove the TDC Board (see 4.1.13). Disconnect the signal input cable. The second ADC can be removed vertically from the base board.

4.1.13 Removal of the F9450-4 TDC Board

Remove the following:

- Top cover 4.1.2
- Power Supply support 4.1.3
- Card retainer 4.1.3
- F9450-8 clock bus 4.1.4
- F9420-6 Processor 4.1.11
- F9450A-3 ADC's 4.1.12.1 and 4.1.12.2

The 9450A 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, J6, J9 (see figure 4.4: cabling Diagram). Now the F9450-4 can be removed vertically from the F9424-1 base Board (13), and the F9450A-7 Front END (14).

9450-4 CABLING DIAGRAM

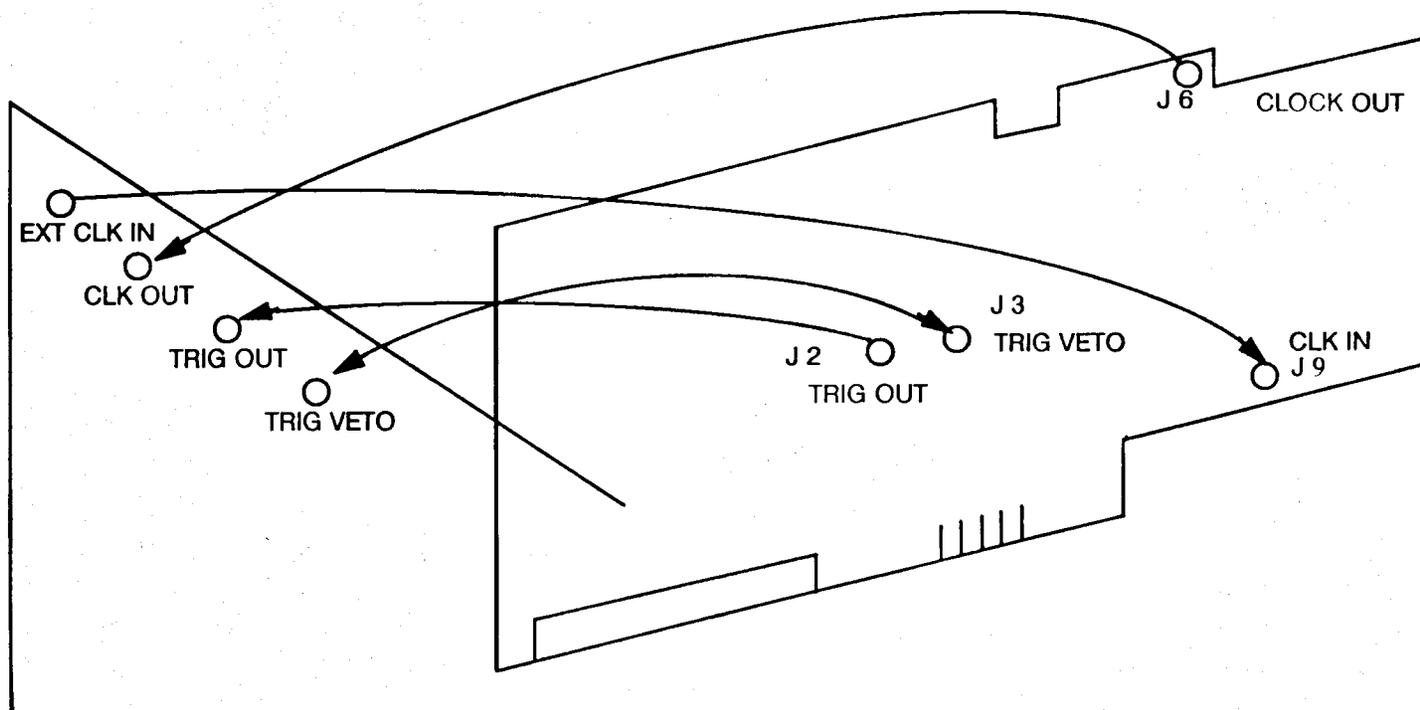


Figure 4.4

4.1.14 Removal of the F9450A-7 Front End

Remove the following:

- Top and bottom covers 4.1.2
- Power supply support 4.1.3
- Card retainer 4.1.3
- F9450-8 clock bus 4.1.4
- F9420-6 Processor 4.1.11
- F9450A-3 ADC's 4.1.12
- F9450-4 TDC 4.1.13
- F9450A-5 Front panel 4.1.5
- Two screws and washers from the Mother Card Support (5)
- One screw and washer which secure the F9450A-7 to the right panel
- Front End Base Cable (22)

Now the Front End can be removed forward.

4.1.15 Removal of the F9424-1 Base Board

Remove following:

- Top bottom covers 4.1.2
- Power supply support 4.1.3
- Card retainer 4.1.3
- F9450-8 clock bus 4.1.4
- F9420-6 processor 4.1.11
- F9450A-3 ADC's 4.1.12
- F9450-4 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 9450A.

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
- F9450-8 clock bus 4.1.4
- F9420-6 processor 4.1.11
- F9450A-3 ADC's 4.1.12
- F9450-4 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 F9450A-5 front panel.

4.2 Software Upgrade Procedure

4.2.1 Changing EPROMs

These six Eproms are on the F9420-6 processor (29) board, and access is possible only by removing the board.

Follow 4.1.11 procedure: removal of the F9420-6 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.

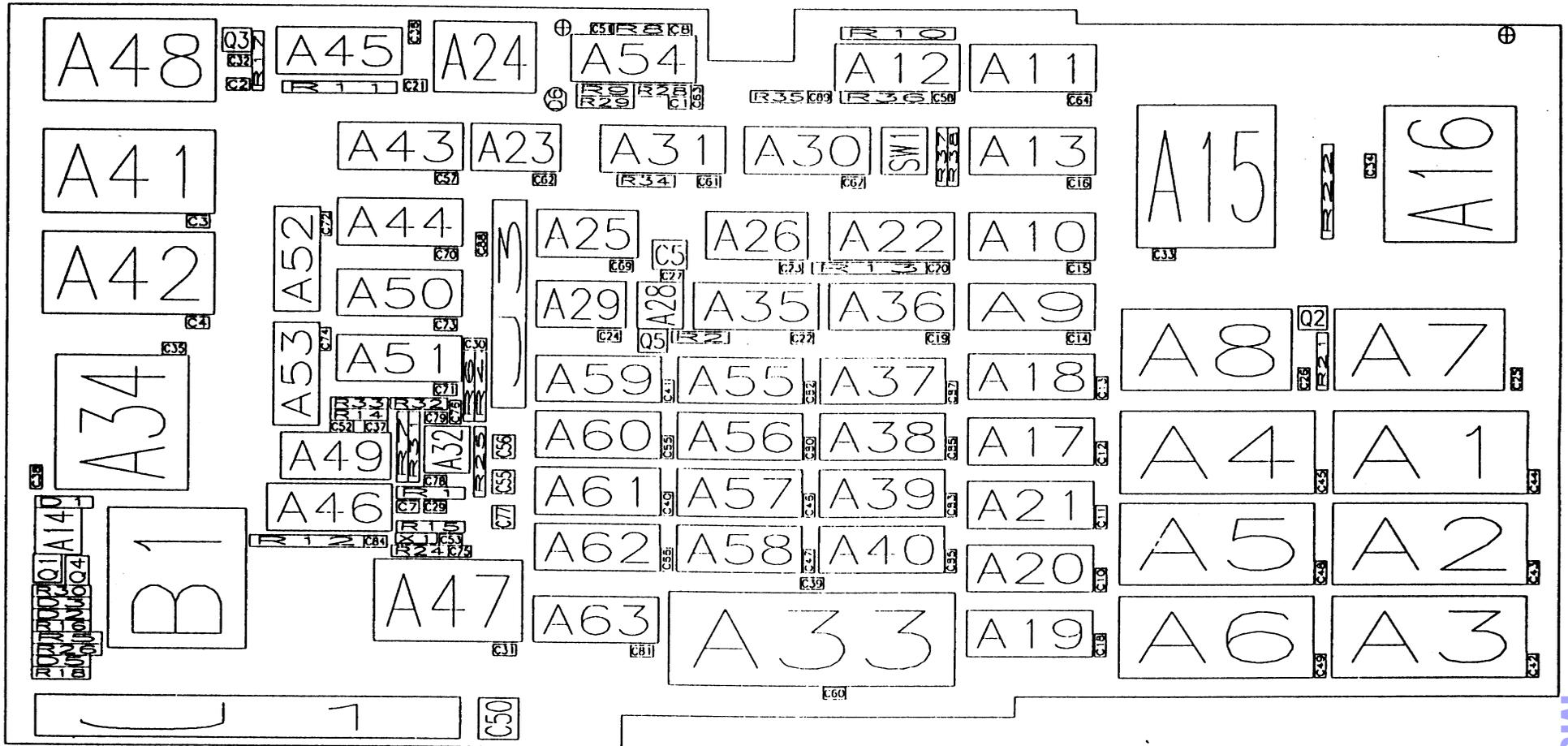
Make sure that the guiding notch in the chip is aligned with the PCB reassemble scope and check that it boots up properly.

4.2.2 Changing software selection PAL

The software option selection PAL is located on the F9420-6 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.

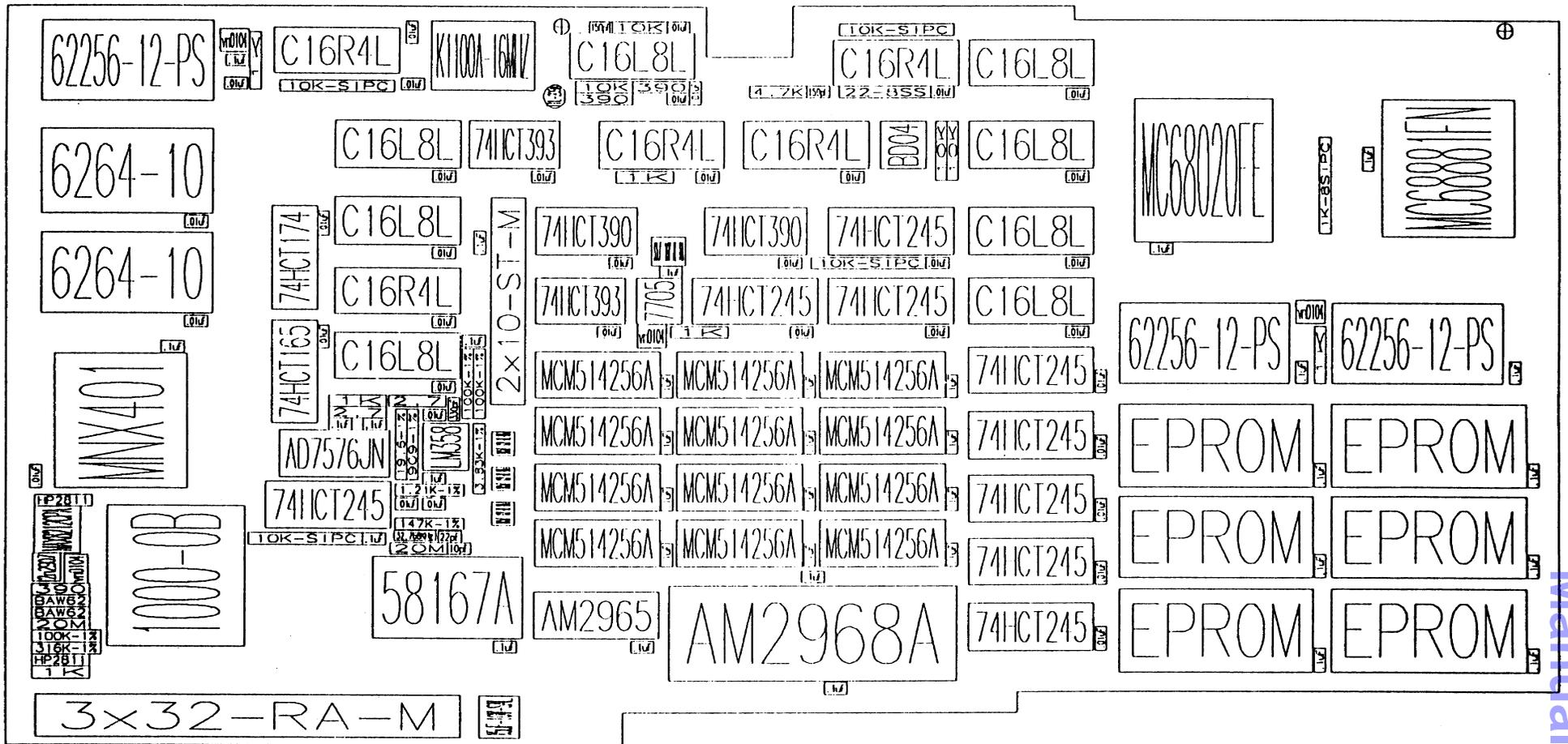
Watch out to match the orientation notch.

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	WPO4	WPO3	WPO2	WPO1	
	-	-	-	-	-	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 F9420-6 processor board

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

see figure 4.4 and 4.5

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 Adjustment Procedure

The +/- 5V, +/- 15 V can be adjusted to the nominal values in the following way. The reference for the measurements are the pins on connector J7 on the F9424-1 Base Board.

From top to bottom

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

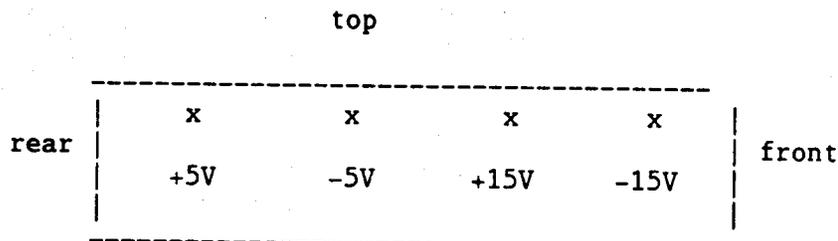
Have the scope turned on. For safety reasons, unplug the mains cable from the outlet without turning the scope off.

Follow the F9451-1 power supply disassembly procedure 4.1.10.

The adjustment potentiometers are situated on the small power supply PCB next to the F9450-2 display board. In order to get access for adjustment, 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 adjustments with a very small screwdriver. The four potentiometers are arranged on the PCB in the following order:



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

+ 15.00 V	+/-	1%
- 15.04 V	+/-	1%
+ 5.07 V	+/-	1%
- 5.16 V	+/-	1%

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

4.6 F9450A-7 Front End Test and Calibration Procedure

4.6.1 Power Supplies

Check with a voltmeter on Test Point TP1 (12 pins), the following voltages :

TP1	Pin 1 - 2 (-)	:	+ 12 V	+/-	0.35 V			
"	Pin 3 - 4 (-)	:	+ 8 V	+/-	0.35 V			
"	Pin 5 - 6 (-)	:	+ 5.1 V	+/-	0.15 V	from Connector	J10	
"	Pin 7 - 8 (-)	:	- 5.1 V	+/-	0.15 V	"	"	"
"	Pin 9 - 10(-)	:	- 8 V	+/-	0.35 V			
"	Pin 11 - 12(-)	:	- 12 V	+/-	0.35 V			

Typical Currents :

+ 15 V	:	I typ =	350 mA
+ 5 V	:	I typ =	350 mA
- 5 V	:	I typ =	300 mA
- 15 V	:	I typ =	250 mA

4.6.2 Input Impedance

Set DS0 CH1 input to 50 Ohm, 200mV/div, DC, with any Time Base
Check with an ohmmeter:

- input impedance must be 50 Ohm +/- 1%

Set DS0 CH1 input to 1 mOhm, DC Coupling, 100 mV/div (divider by 1),
with any Time Base. Check:

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

Repeat 1 mOhm test for 200 mV/div (divider by 10)

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

Repeat all impedance checks for CH2 : +/- 1%

Repeat 1 mOhm test for External Trigger, and External/10 : +/-1%

4.6.3 Leakage Currents

With a high precision DMM, type PM2525 (> 10 Mohm) measure the
leakage currents in 50 Ohm, 1 mOhm (100mv/div), 1 mOhm (200mv/div),
on channel 1 and channel 2. Check also the External Trigger.

Set DS0 to DC coupling, connect the DMM in DC mode to the input,

- reading should not be larger than +/- 200 uV

4.6.4 Variable Gain Adjustment

The following adjustments have to be made after the F9450A-7 Front-End has been mounted into the 9450A oscilloscope.

In the secret menu select " CALIBRATION CONSTANTS ", enter CALIBRATION ERROR LOG, and check that all the error status are zero.

14-Oct-91
14:26:42

CALIBRATION ERROR LOG																			
Vertical Calibration																			
4 nibbles=(curves) (verify) (high gain) (unused)																			
(8=Offset Range, 4=Offset Conv, 2=Gain Range, 1=Gain Conv)																			
Chan 1+2 Calib Const	<table border="1"> <thead> <tr> <th></th> <th>CHAN1</th> <th>CHAN2</th> </tr> </thead> <tbody> <tr> <td>5 mV</td> <td>0</td> <td>0</td> </tr> <tr> <td>10 mV</td> <td>0</td> <td>0</td> </tr> <tr> <td>20 mV</td> <td>0</td> <td>0</td> </tr> <tr> <td>50 mV</td> <td>0</td> <td>0</td> </tr> <tr> <td>.1 V</td> <td>0</td> <td>0</td> </tr> </tbody> </table>		CHAN1	CHAN2	5 mV	0	0	10 mV	0	0	20 mV	0	0	50 mV	0	0	.1 V	0	0
	CHAN1	CHAN2																	
5 mV	0	0																	
10 mV	0	0																	
20 mV	0	0																	
50 mV	0	0																	
.1 V	0	0																	
Chan 1+2 Full Test																			
Full Re-calibration	ADC/TMS State Working Working																		
Calibration Error Log	4 nibbles = (400Ms) (200Ms) (100Ms) (40Ms)																		
Manual FE DAC Control	Trigger Cal. 0 0 (2=No BWL, 1=BWL)																		
More Consts	Leveling Cal. 0 0 (2=Offset, 1=Gain Conv.)																		
	Phase Cal. 0 0 (4=Limits, 2=Fit, 1=Conv)																		
Return	TDC Calibration 0																		

Figure 1 : Calibration Error Log

- Set DSO CH1 and CH2 input to 50 ohm, DC, 5 mV/div, 5usec/div, 400 Ms/s Sampling Rate.
- Enter " CH 1+2 CALIB CONST ",
- Adjust potentiometer R155 on CH1, R255 on CH2, in order to get:
DAC 9 (0.0 mA): C1 = 2.92, C2 = 2.92, (see figure 2)
- Set DSO CH1 and CH2 to 50 mV/div
- Check DAC 0 (0.8488 mA) : C1 < 0.95 , C2 < 0.95 (see figure 3)
- Push " FULL RECALIBRATION " and check for the sensitivities 5mV, 10mV, 20mV, 50mV, 0.1V that the variable Gain is :
DAC 0 (0.8488 mA) : C1 < 0.95, C2 < 0.95,
DAC 9 (0.0000 mA) : C1 > 2.75, C2 > 2.75,
- If necessary, readjust potentiometers R155, and R255.
- Set scope to 40 Ms/s Sampling Rate (0.1 ms/div), and check for the ranges up to 0.1V, that DAC 0 and DAC 9, for C1, C2, are within the limits.
- Readjust the two potentiometers until it pass in all configurations
- The three ranges 0.2V, 0.5V, 1V are not checked by the calibration, they use an attenuator by 10 which has an accuracy of 1/1000.

14-Oct-91
16:21:33

	<u>Calibration Constants</u>		400Ms/s	5 μ s/div
Chan 1+2	variable gain	C1 (5 mV)	C2 (5 mV)	
Calib Const	dac 0 (ffff= 0.8488mA)	0.6702	0.6620	
	dac 1 (f332= 0.8000mA)	0.6822	0.6897	
	dac 2 (d8f4= 0.7000mA)	0.7414	0.7261	
	dac 3 (beb7= 0.6000mA)	0.7916	0.7843	
	dac 4 (a47a= 0.5000mA)	0.8717	0.8649	
Chan 1+2	dac 5 (8a3c= 0.4000mA)	1.0003	0.9872	
Full Test	dac 6 (6fff= 0.3000mA)	1.1647	1.1559	
	dac 7 (55c2= 0.2000mA)	1.4672	1.4565	
	dac 8 (3b84= 0.1000mA)	1.9832	1.9573	
	dac 9 (2148= 0.0000mA)	2.9124	2.9078	
Full Re-calibration	offset			
Calibration Error Log	C1 (5 mV)	o0:-1.9625 o1:-0.404 o2: 5.98e-05	[-0.0038 \pm 1.9607]	
	C2 (5 mV)	o0:-1.9230 o1:-0.669 o2: 5.87e-05	[-0.0027 \pm 1.9237]	
Manual FE DAC Control	C1 current dac settings (5 mV* 1.00, 0.00e+00; 400Ms/s)			
	high gain	0000 =	-0.1576 mA	
	gain adjust	8a4f =	0.4003 mA	
More Consts	offset	8038 =	-3.45e-03 V	
Return	C2 current dac settings (5 mV* 1.00, 0.00e+00; 400Ms/s)			
	high gain	0000 =	-0.1576 mA	
	gain adjust	87ba =	0.3904 mA	
	offset	8029 =	-2.53e-03 V	

Figure 2 : Calibration Constants at 5 mV

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16:34:18

	<u>Calibration Constants</u>		400Ms/s	5 μ s/div
Chan 1+2	variable gain	C1 (50 mV)	C2 (50 mV)	
Calib Const	dac 0 (ffff= 0.8488mA)	0.7395	0.7450	
	dac 1 (f332= 0.8000mA)	0.7575	0.7619	
	dac 2 (d8f4= 0.7000mA)	0.8079	0.8114	
	dac 3 (beb7= 0.6000mA)	0.8776	0.8769	
	dac 4 (a47a= 0.5000mA)	0.9681	0.9686	
Chan 1+2	dac 5 (8a3c= 0.4000mA)	1.0996	1.1006	
Full Test	dac 6 (6fff= 0.3000mA)	1.2955	1.2989	
	dac 7 (55c2= 0.2000mA)	1.6090	1.6129	
	dac 8 (3b84= 0.1000mA)	2.1751	2.1797	
	dac 9 (2148= 0.0000mA)	3.1576	3.1810	
Full Re-calibration	offset			
Calibration Error Log	C1 (50 mV)	o0:-1.9692 o1: 0.580 o2: 6.07e-05	[0.0491 \pm 1.9893]	
	C2 (50 mV)	o0:-1.9271 o1: 0.794 o2: 5.86e-05	[0.0317 \pm 1.9191]	
Manual FE DAC Control	C1 current dac settings (50 mV* 1.00, 0.00e+00; 400Ms/s)			
	high gain	0000 =	-0.1576 mA	
	gain adjust	9d94 =	0.4737 mA	
More Consts	offset	7d0b =	4.62e-02 V	
Return	C2 current dac settings (50 mV* 1.00, 0.00e+00; 400Ms/s)			
	high gain	0000 =	-0.1576 mA	
	gain adjust	9dcb =	0.4745 mA	
	offset	7e13 =	3.01e-02 V	

Figure 3 : Calibration Constants at 50 mV

4.6.5 DAC Calibration

- Set DSO to Single or Normal Trigger, to avoid the Self calibration during the adjustments.
- Enter " CALIBRATION CONSTANTS " go to " MANUAL FE DAC CONTROL "
- Press " CALIBRATION 7FFF "

4.6.5.1 Set code 7FFF with the offset button

DAC 7FFF = 0.00015259 V , TP2 = 27.744 uV

- With a high precision DMM type PM2525 (+/- .1%) check on TP2 :

27 uV +/- 100 uV between pin 1 (+) and pin 2 (-)

14-Oct-91 DAC calibration : 7fff 0.00015259 [V] 2.7744e-05 [V]
 14:07:07
 offset knob
 --> DAC

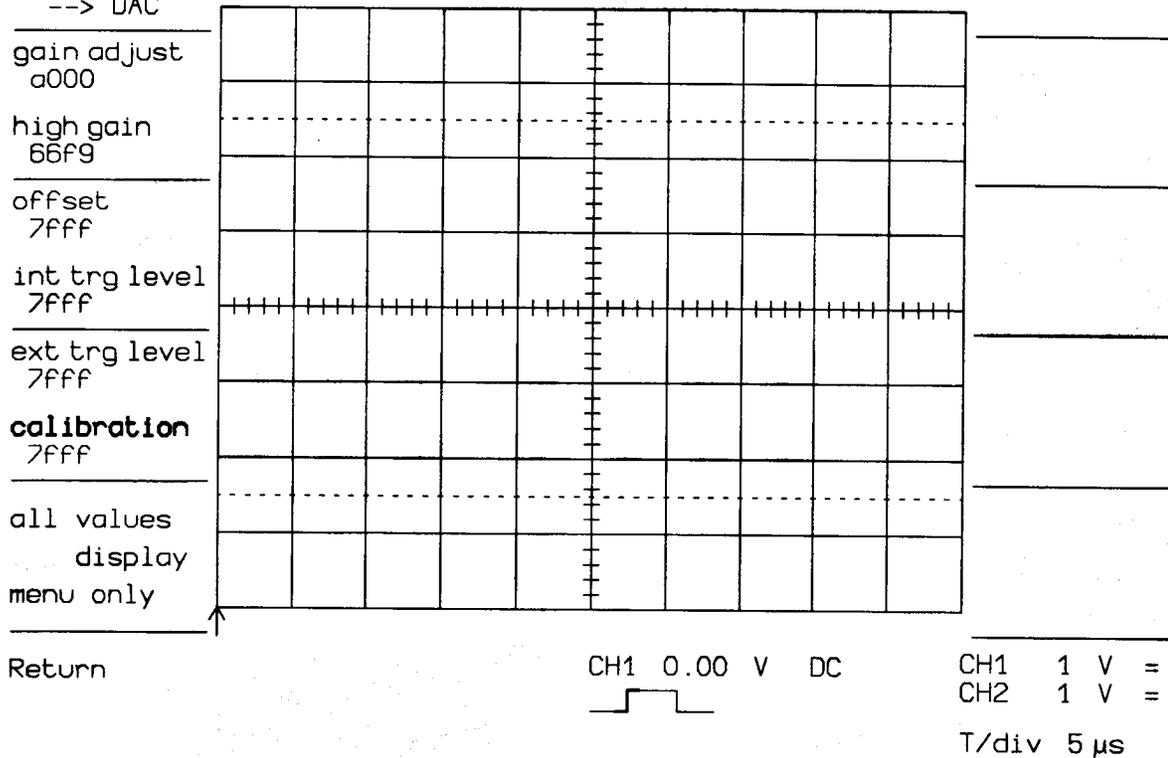


Figure 4 : DAC Calibration code 7FFF

4.6.5.2 Set code 3999 with the offset button

- Code 3999 represents DAC output 5.5 V : + 1V on TP2
- Check : + 1.000V +/- 1 mV between pin 1 and pin 2 of TP2

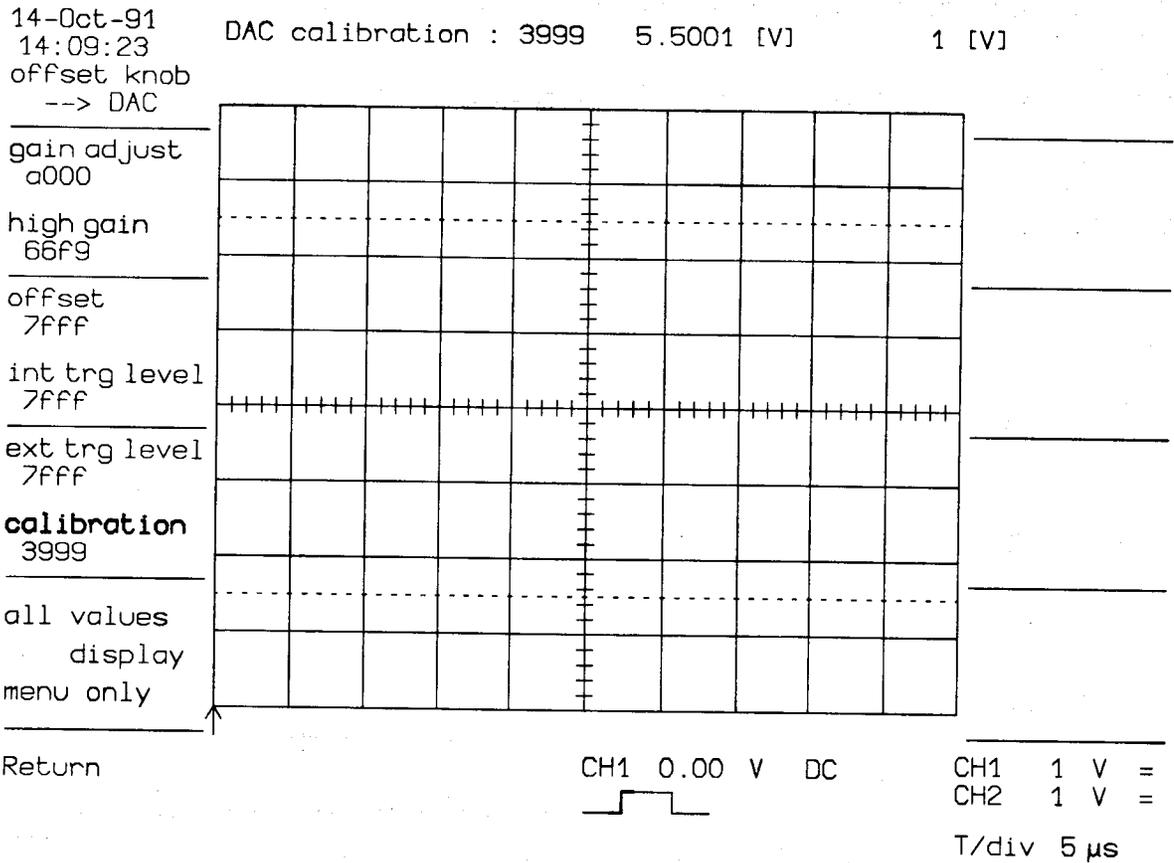


Figure 5 : DAC Calibration code 3999

4.6.5.3 Set code C666 with the offset button

Code C666 represents DAC : - 5.5 V : - 1V on TP2

- Check with a DMM that the reading is :

- 1.000 V +/- 1mV between pin 1 and pin 2 of TP2

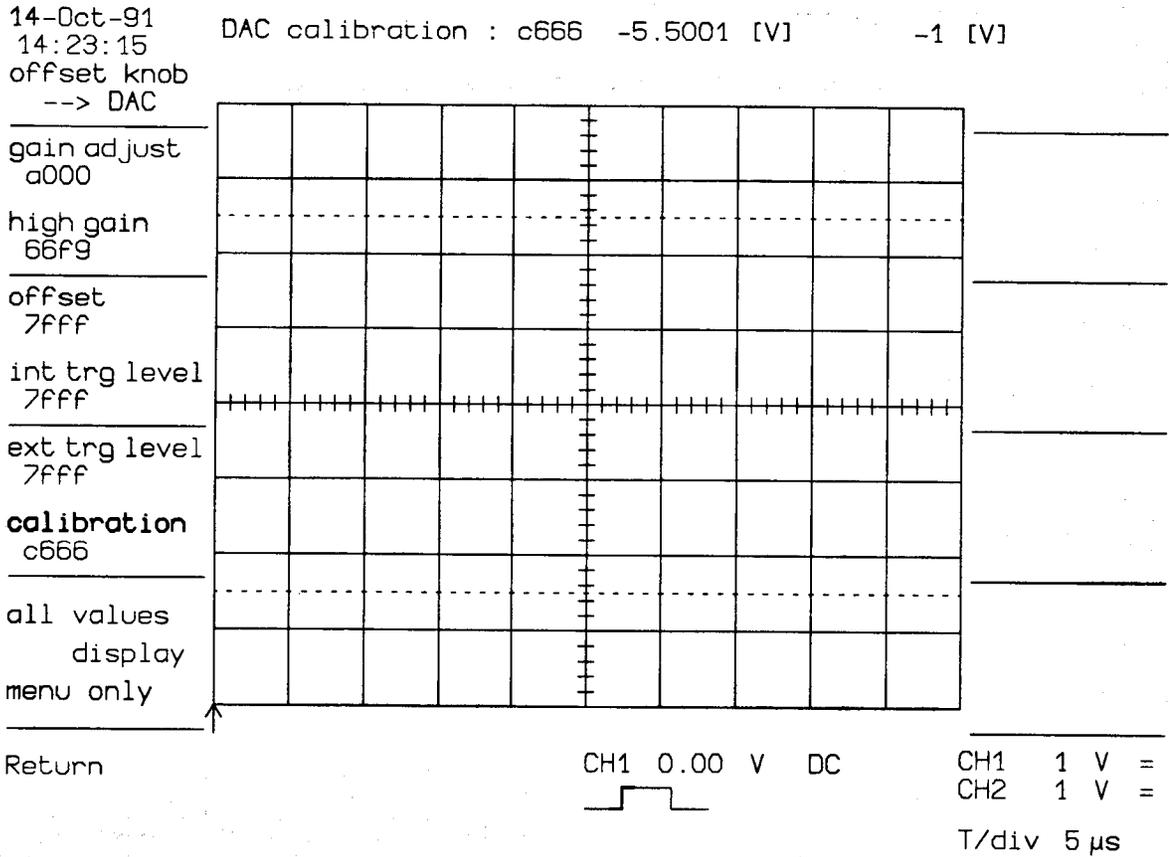


Figure 6 : DAC Calibration code C666

4.6.6 Channel 1 Input Buffer, DC Gain Adjustment

- Apply the fast risetime generator LeCroy 4969 (typical < 700 Psec) to CH1. Set pulser to low frequency (62.5 ms).
- Set DSO to 50 oHm, DC, 100mV, 20us/Div.
- Use Function E in Average mode type Summed or Continuous weight 1:7
- Multiply the vertical gain of the function E, by a factor 10.
- Set trigger to Neg slope, in order to display the trailing edge of the pulse
- Adjust R128 to get at 20 usec, a flat square wave, without overshoot, undershoot.

15-Oct-91
16:02:21

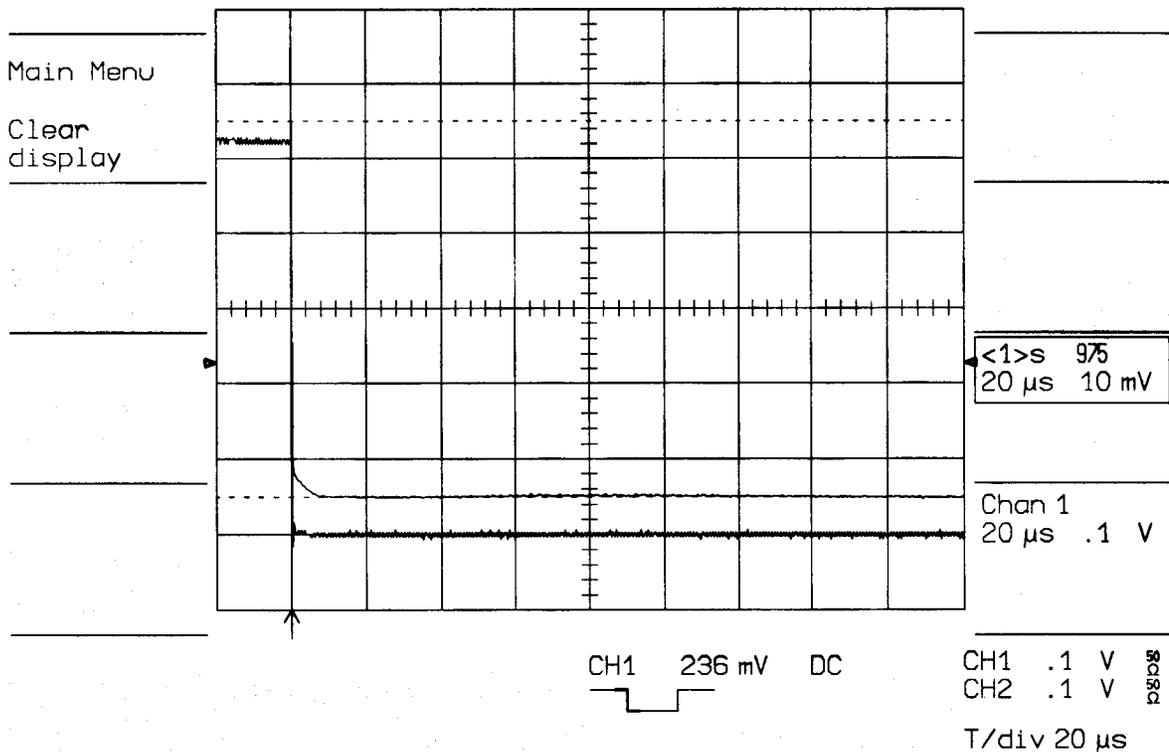


Figure 7 : CH1 Flatness adjustment with R128

4.6.7 Channel 2, Input Buffer DC Gain Adjustment

- Apply the fast risetime generator LeCroy 4969 (typical < 700 Psec) to CH2. Set pulser to low frequency (62.5 ms).
- Set DSO to 50 oHm, DC, 100mV, 20us/Div.
- Use Function F in Average mode type Summed or Continuous weight 1:7
- Multiply the vertical gain of the function F, by a factor 10.
- Set trigger to Neg slope, in order to display the trailing edge of the pulse
- Adjust R228 to get at 20 usec, a flat square wave, without overshoot, undershoot.

14-Oct-91
16:56:36

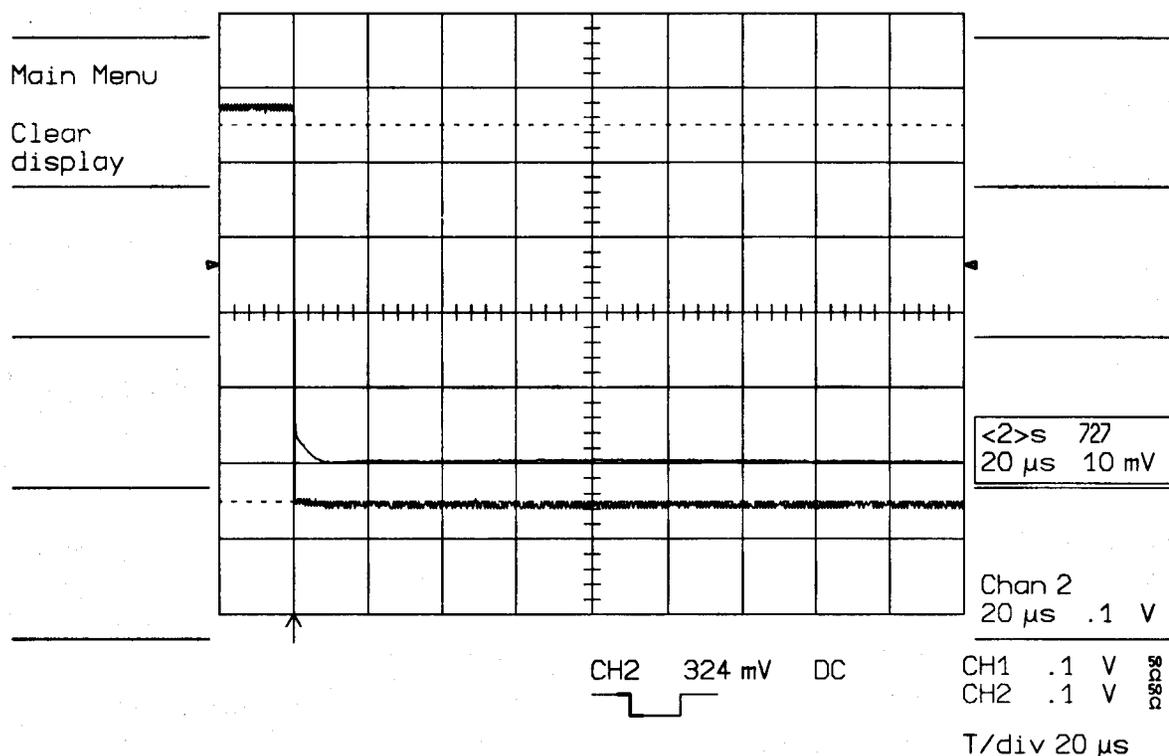


Figure 8 : CH2 Flatness adjustment with R228

4.6.8 Channel 1 HF Compensation

- Apply the fast risetime generator LeCroy 4969 (typical < 700 Psec) to CH1. Set pulser to low frequency (62.5 ms).
- Set DSO to 1 MoHm, DC, 200mV/Div, 10us/Div.
- Use Function E in Average mode type Summed or Continuous weight 1:7
- Multiply the vertical gain of the function E, by a factor 10.
- Set trigger to Neg slope, in order to display the trailing edge of the pulse
- Adjust the variable capacitor C107 to get a flat square wave, See Figure 9.
- This Cap adjust the flatness of the attenuator / 10.

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17:21:31

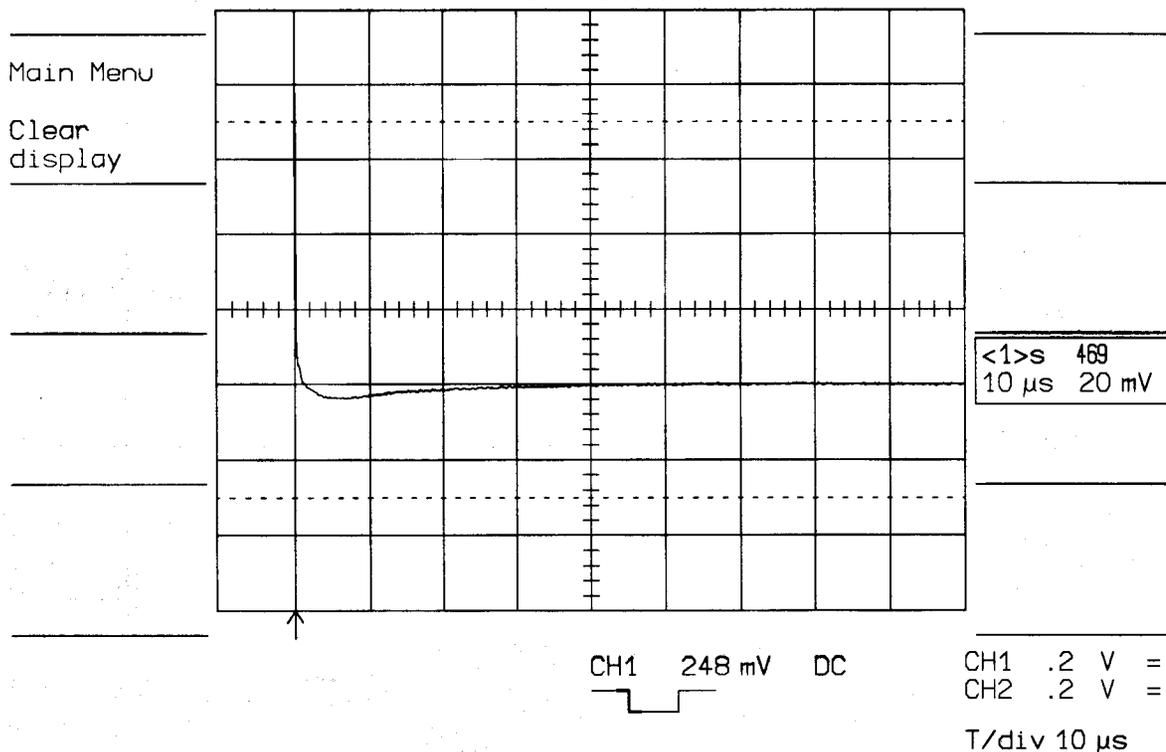


Figure 9 : CH1 Flatness adjustment with C107

4.6.9 Channel 2 HF Compensation

- Apply the fast risetime generator LeCroy 4969 (typical < 700 Psec) to CH2. Set pulser to low frequency (62.5 ms).
- Set DSO to 1 MoHm, DC, 200mV/Div, 10us/Div.
- Use Function F in Average mode type Summed or Continuous weight 1:7
- Multiply the vertical gain of the function F, by a factor 10.
- Set trigger to Neg slope, in order to display the trailing edge of the pulse
- Adjust the variable capacitor C207 to get a flat square wave, See Figure 10.
- This Cap adjust the flatness of the attenuator / 10.

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17:12:57

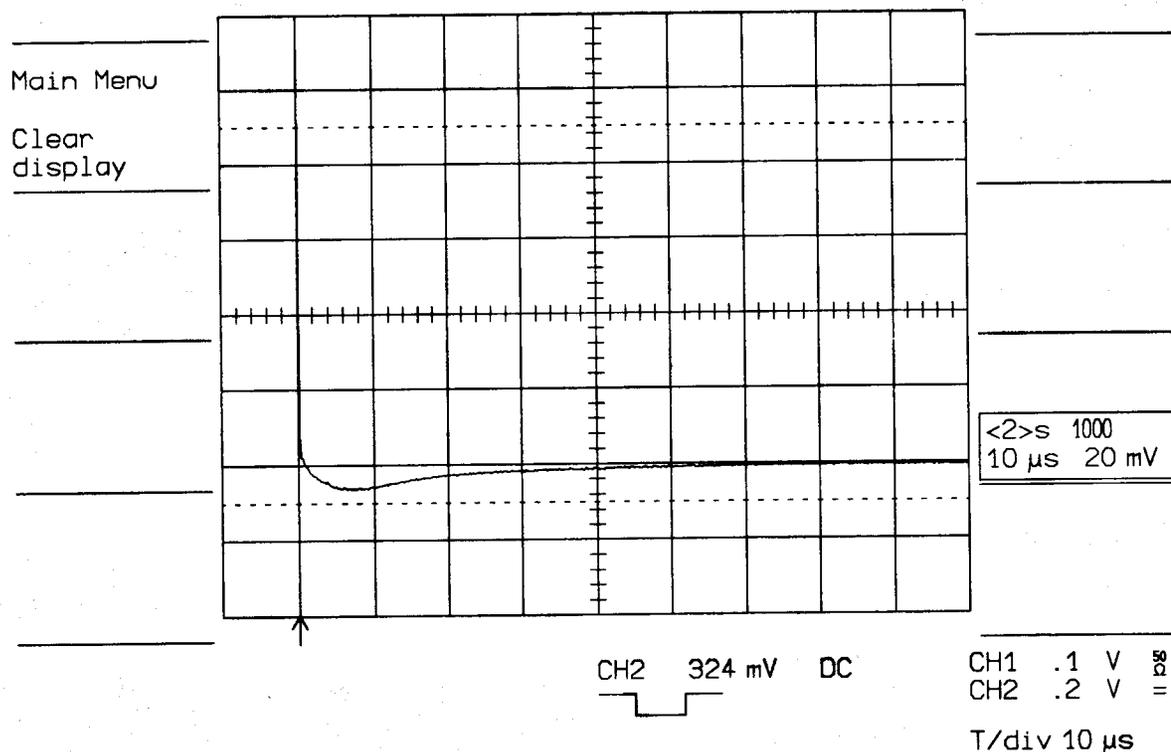


Figure 10 : CH2 Flatness adjustment with C207

4.6.10 CH1 and CH2 Trigger Adjustment

- Set DSO CH1 and CH2 to 50 Ohm, DC, 100 mV/div
- Enter " CALIBRATION CONSTANTS ", press " MORE CONSTS ",
- Go to " TRIG CALIBR CONSTANTS "
- Adjust potentiometer R172 on CH1 and R272 on CH2 in order to get :

Hyst = 0.22

Limits: 0.30 < HYST > 0.15

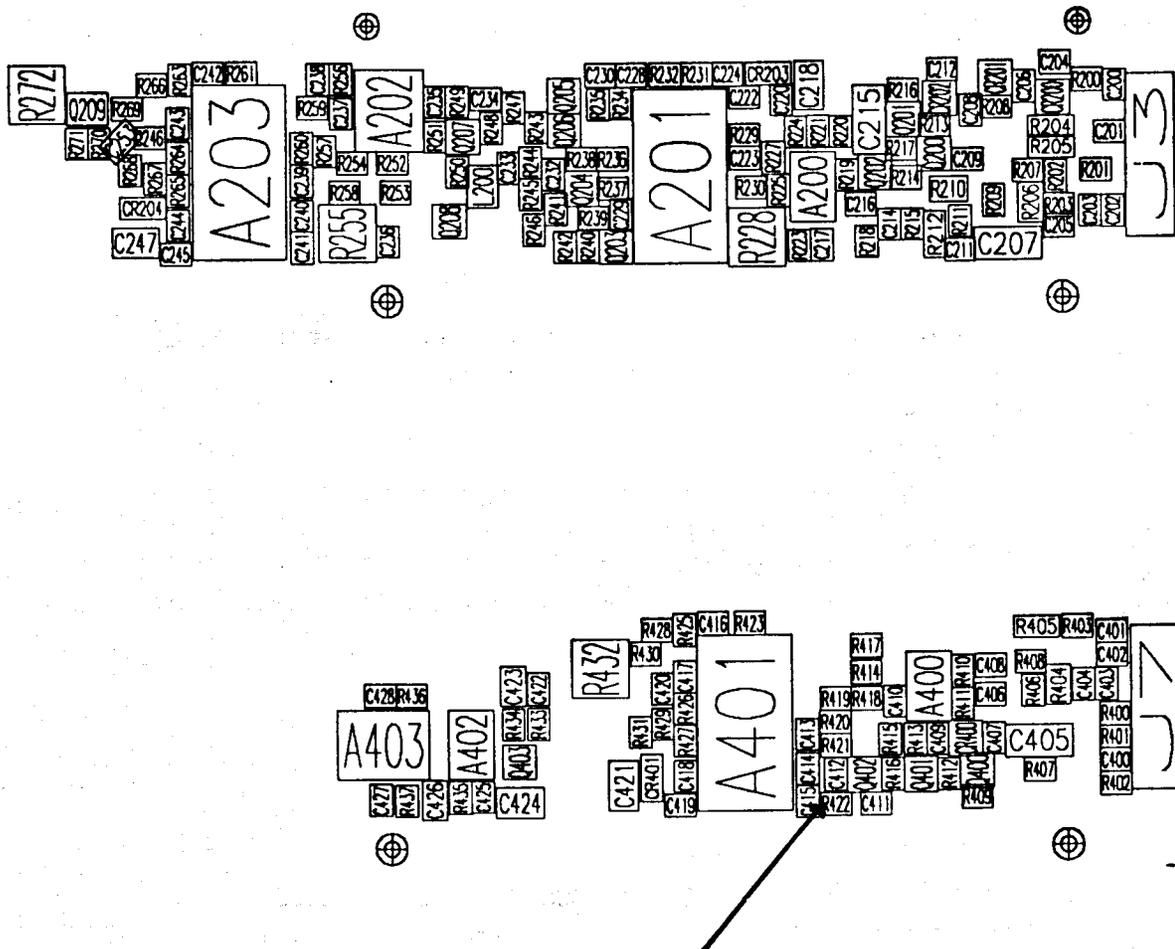
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14:39:13

	Calibration Constants		40 Ms/s	.1 ms/div
Trig Calibr Constants	C1 trigger threshold level			
TDC Calibr	HF	t2:-3.85e-04 t1: 12.85	hyst. -0.23	[0.237±-12.61]
Phase Constants	AC	t2:-3.85e-04 t1: 12.85	hyst. -0.23	[0.237±-12.61]
Recalibrate Trig Counter	LF REJ	t2:-3.79e-04 t1: 12.58	hyst. -0.23	[0.162±-12.42]
Chan 1+2 Gain Test	HF REJ	t2: 3.81e-04 t1:-11.89	hyst. 0.24	[0.606± 12.50]
SS-FIR Corr ON/OFF	DC	t2:-3.77e-04 t1: 13.28	hyst. -0.22	[0.931±-12.34]
RIS-FIR Corr ON/OFF	C2 trigger threshold level			
Return	HF	t2:-4.09e-04 t1: 13.52	hyst. -0.22	[0.112±-13.41]
	AC	t2:-4.09e-04 t1: 13.52	hyst. -0.22	[0.112±-13.41]
	LF REJ	t2:-3.99e-04 t1: 13.19	hyst. -0.22	[0.121±-13.07]
	HF REJ	t2: 3.92e-04 t1:-12.08	hyst. 0.20	[0.769± 12.85]
	DC	t2:-4.06e-04 t1: 14.31	hyst. -0.23	[1.011±-13.30]
	trigger counter interval 2.635 ns			

Figure 11 : Trigger Calibr Constants

4.6.11 External Trigger HF Compensation

- Apply a fast risetime pulse (<700ps), 1KHZ, 5.5 V amplitude to the External Trigger input.
- Set time base to 5 us/div, trigger to Ext, POS slope
- Probe with either DSO CH1 or CH2, and a probe /1 the resistor R422: Test point(TP) and the ground (GND), use a short ground lead. See figure 12.
- Use the Expand.
- Adjust the variable cap C405 to get a slight positive slope, typical 2 %. See figure 13.



TP = Wired point between R422, R421, R420, and Emitter of Q402

Figure 12 : External Trigger Test Points

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16:26:42

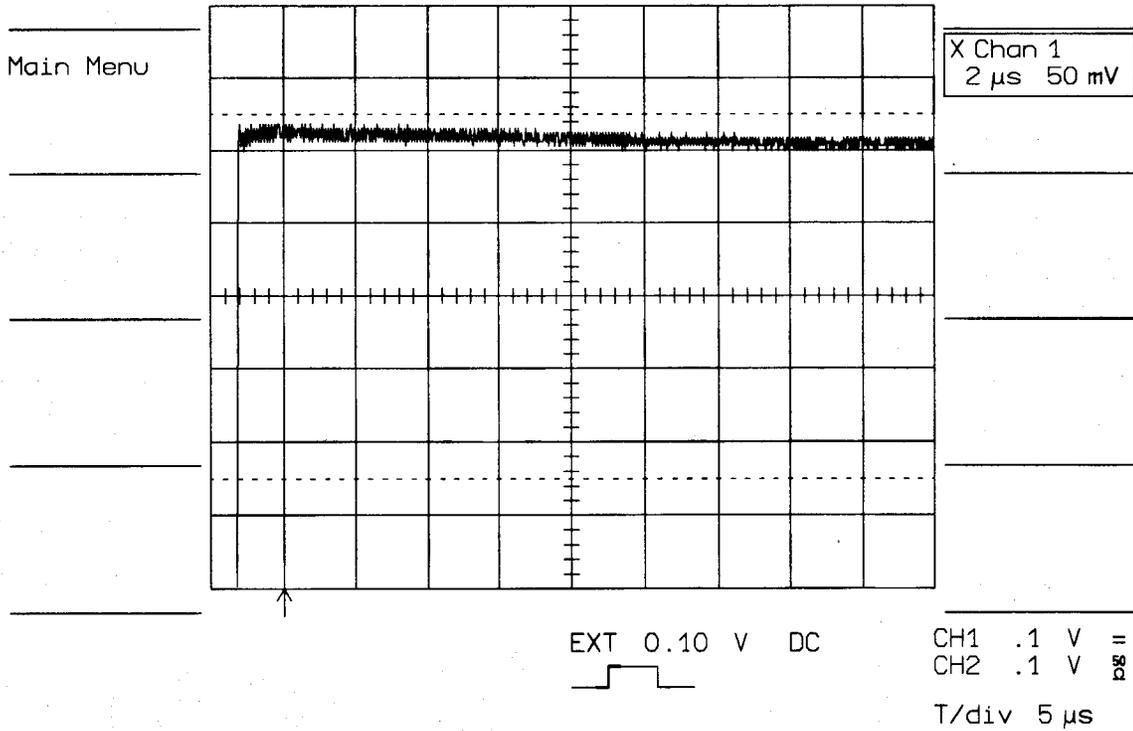


Figure 13 : External Trigger, HF Compensation with C405

- Set External Trigger / 10. Select CH1 20 mV/div,
- Check the positive slope : typical 10%

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16:28:20

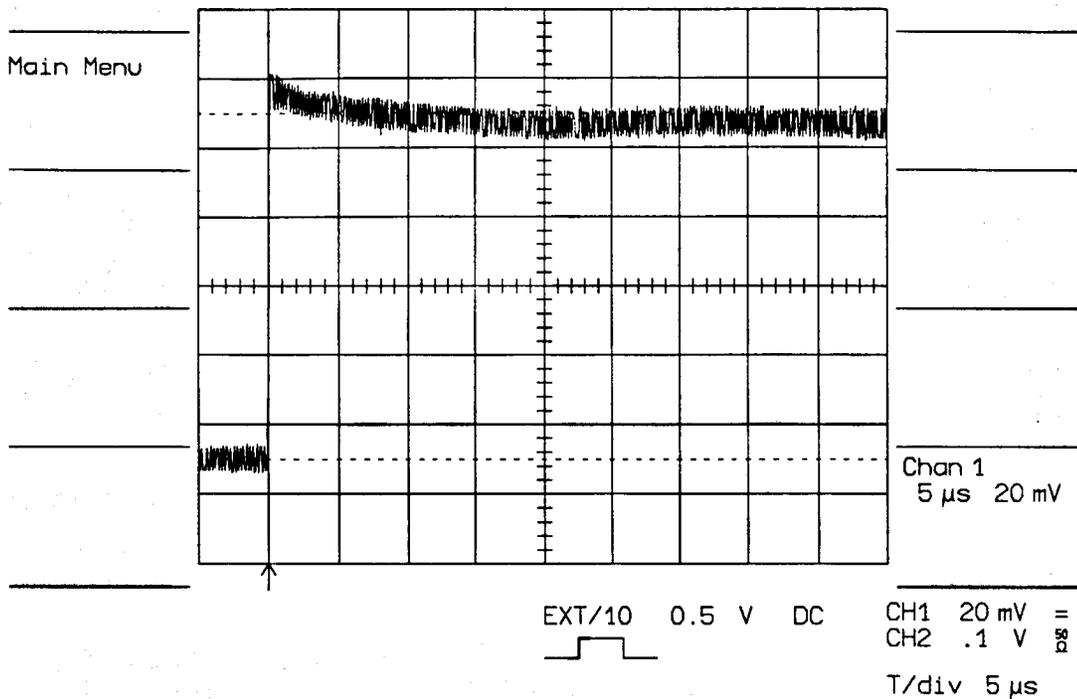


Figure 14 : External Trigger /10

4.6.12 External Trigger level Adjustment

- Set scope to CH1 50 ohm, 0.5 V/div, offset zero, 2us/div, BWL OFF
- Trigger on EXT/10, DC, level 0.0 V, delay 50 %
- Apply 50 KHZ sine wave with zero offset, 2.5 V amplitude, to CH1 through External Trigger input.
- Set External Trigger /10 on POS slope.
- Store Channel 1 in MEM C
- Set External Trigger /10 on NEG slope.
- Using the Voltage Cursor Measurement, compare CH1 Neg slope with MEM C (POS slope).
- Adjust Ext Trigger level with potentiometer R432, in order to get HYST = 0.8 Volt (1.6 divisions) at Trigger point.

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15:02:07

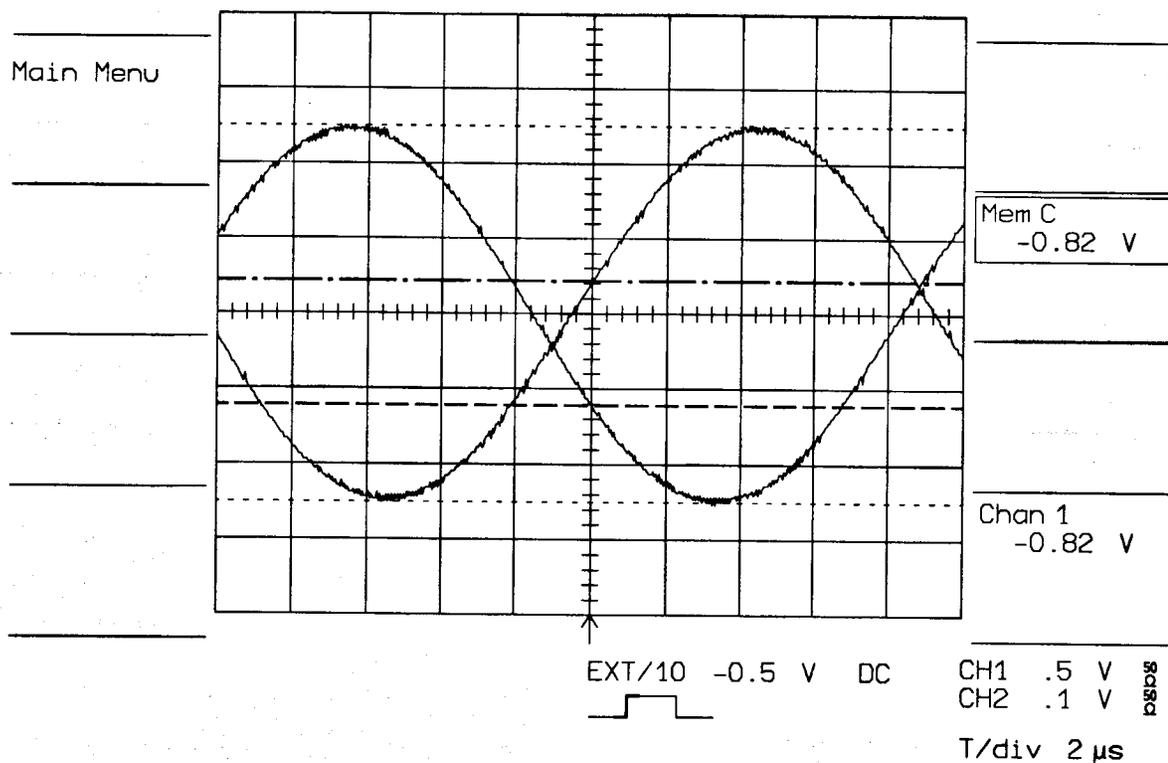


Figure 15 : R432 External Trigger Level Adjustment

4.6.13 50 Ohm Overshoot Compensation

- Apply the LeCroy 4969 pulser to the 50 Ohm input of the 9450A DSO set at 100 mV/div.
- Turn on the pulse parameters.
- Press Pass/Fail mode
- Press Setup Pass/Fail
- Set Channel 1 and Channel 2 parameters on Show, over +, and rise
- Adjust C115 on CH1, C215 on CH2 in order to get less than:
6 % overshoot
- Check the rise time, should be less than 1 ns
- Check the Bandwidth : 300 MHz

15-Oct-91
15:23:42

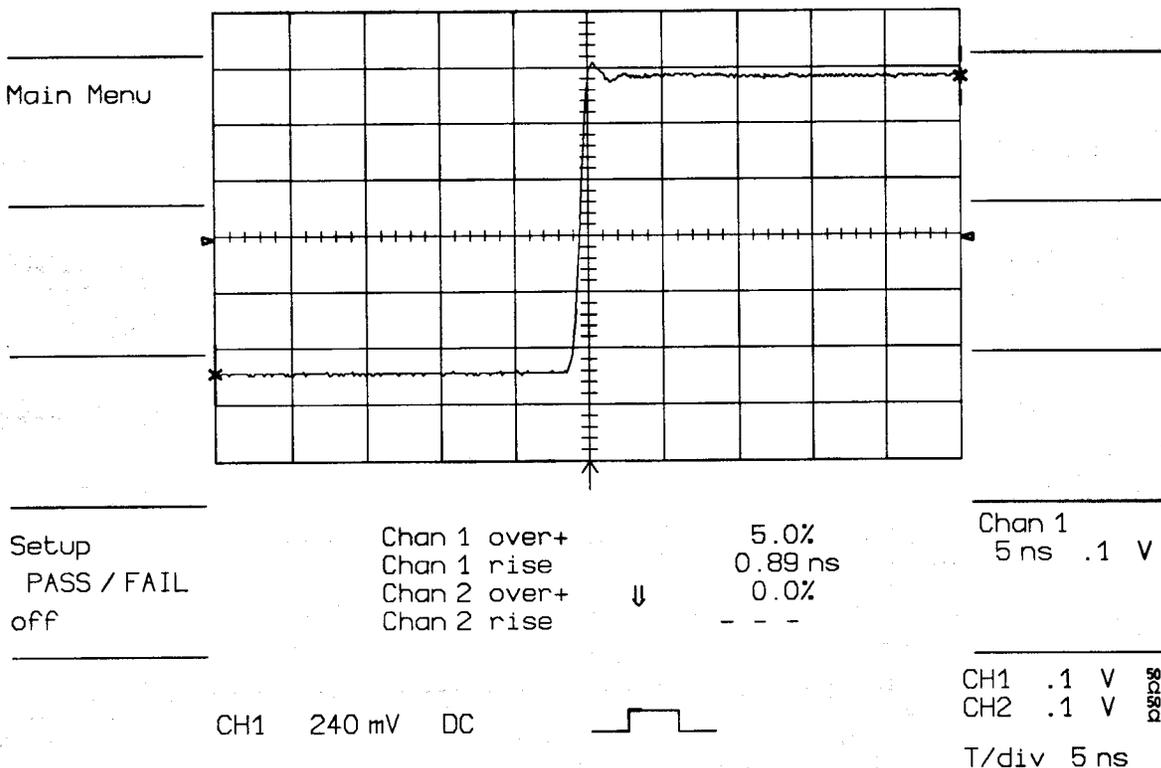


Figure 16 : CH1 Overshoot Compensation with C115

15-Oct-91
15:26:11

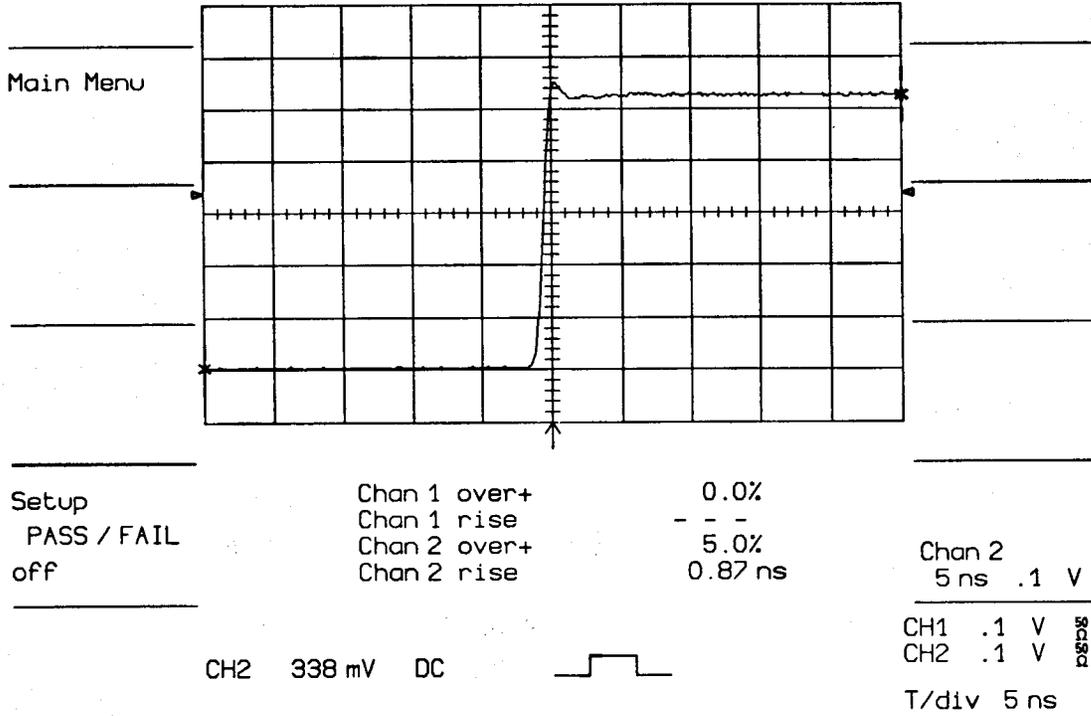


Figure 17 : CH2 Overshoot compensation with C215

- Set input to 200 mV/div, Check typical overshoot : 8 %

15-Oct-91
16:34:05

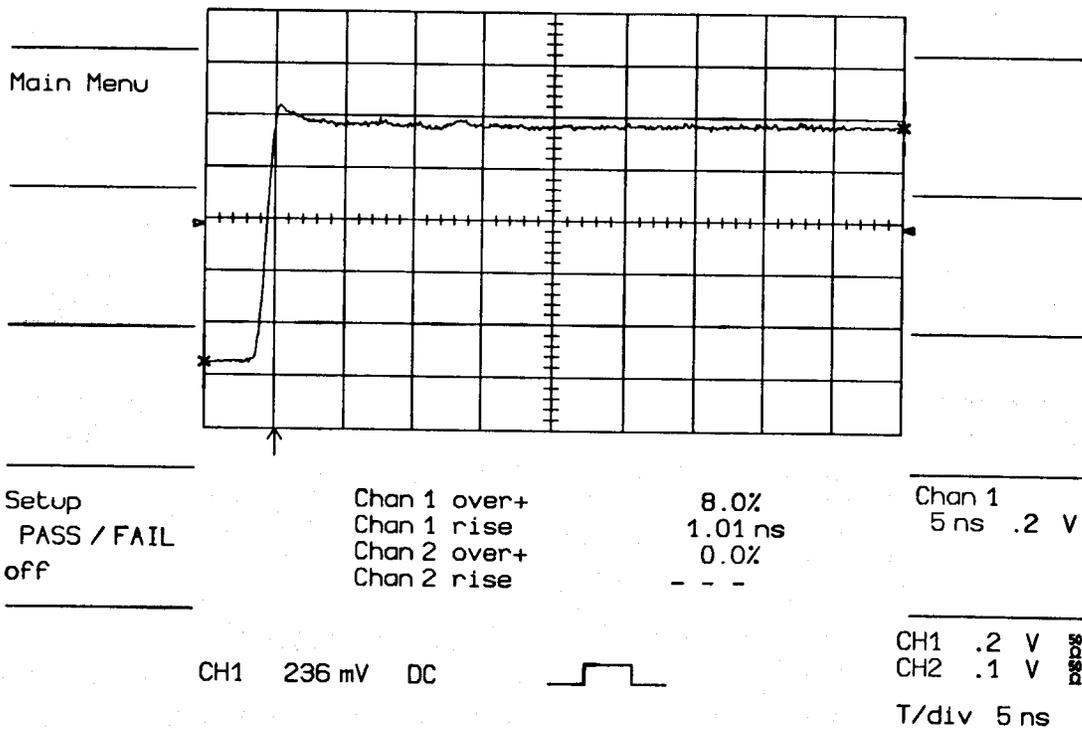


Figure 18 CH1 Overshoot at 200 mV/div

4.6.14 50 Ohm CH1 and CH2, Overload Protection Adjustment

- The front-end has to be in the 9450A 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 R5 (OVL1) for CH1, R14 (OVL2) for CH2, 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.

4.6.15 CH1 and CH2 Non Linearity

- The DC non-linearity is analyzed for the sampling rate, BWL ON, BWL/OFF, 50 Ohm or 1 Mohm input, the user has set.
- The test should be done for the 4 possible sampling rates : 40 Ms/s, 100 Ms/s, 200 Ms/s, or 400 Ms/s
- The variations should stay within +/- 2% of the full scale, (4 vertical divisions).

18-Oct-91
14:56:44

Non-linearity curve for C1, C2 at 100Ms/s

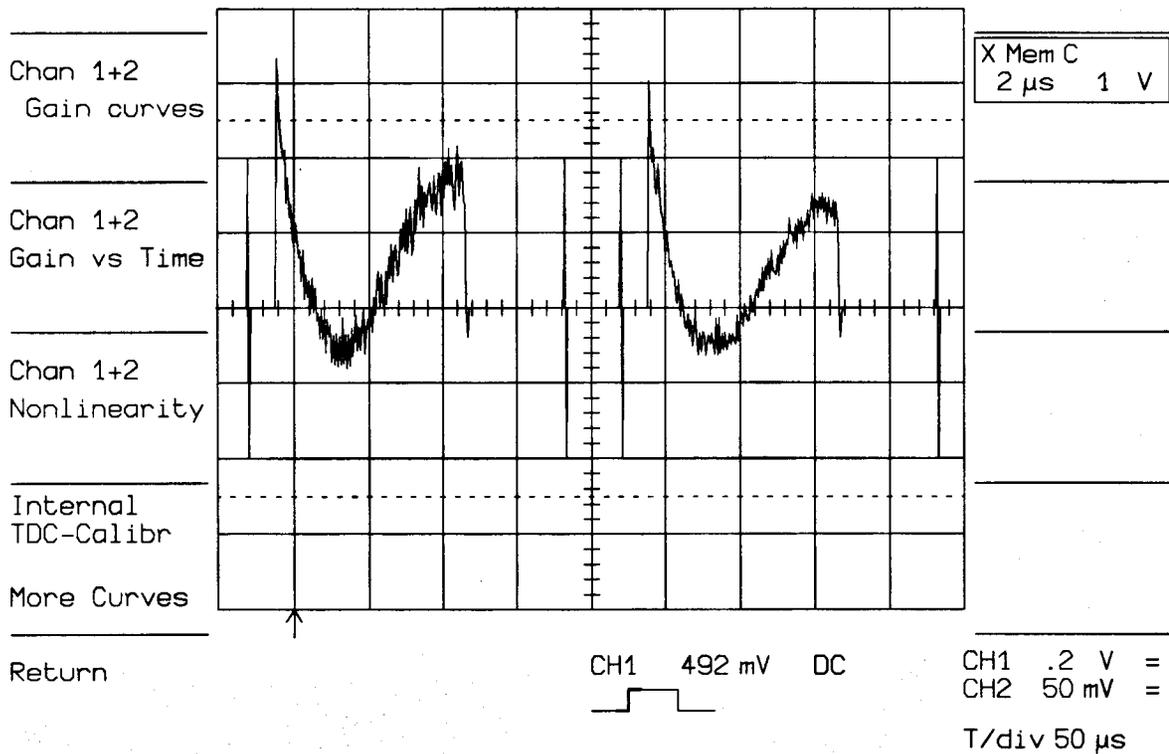


Figure 19 : CH1 and CH2 Non Linearity curve at 100 Ms/s

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.

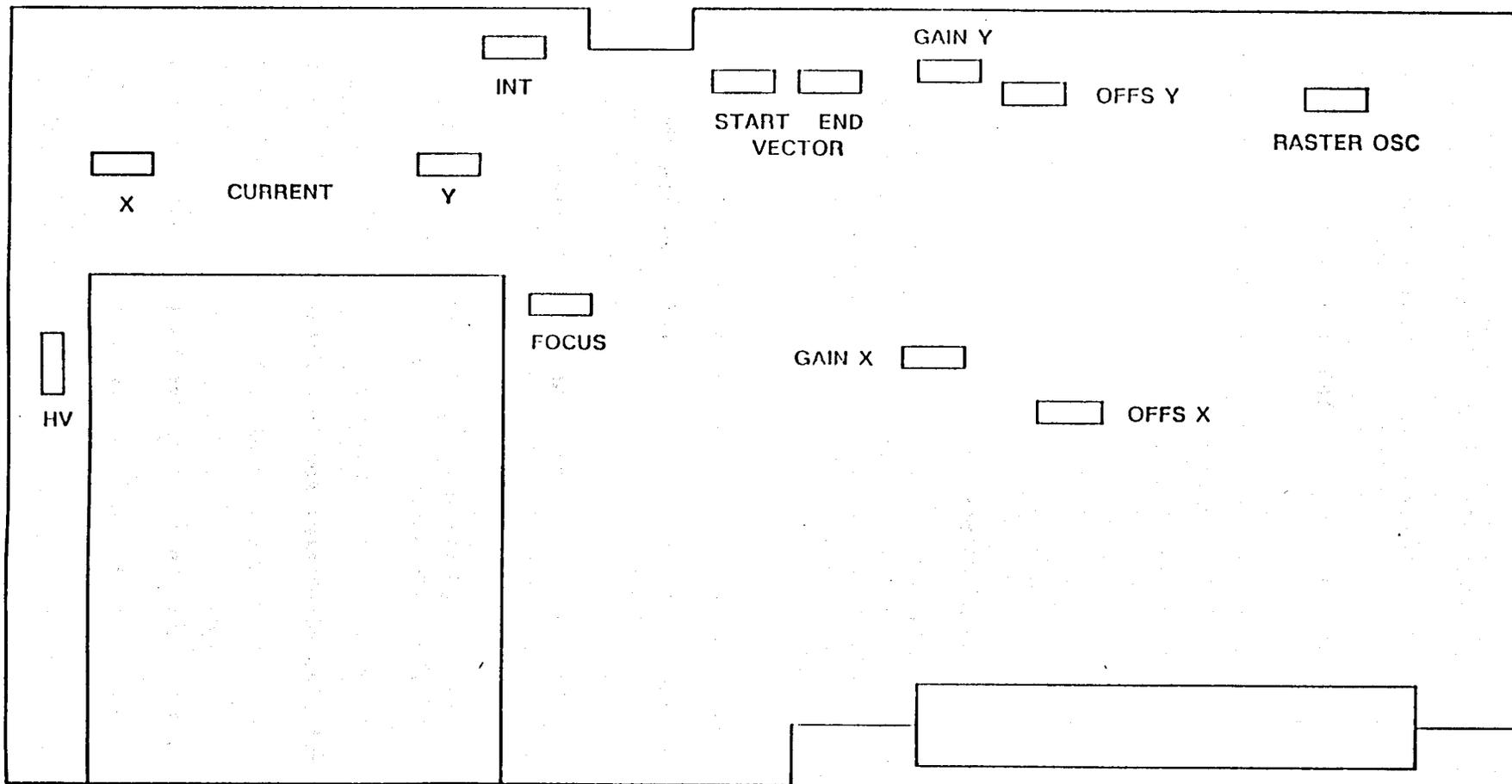
Adjust the size of the display, in order to get 5mm gap between the middle of the image lines (top, bottom, left, right) and the CRT lines.

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.



9450-2 POT LAYOUT

4.7.5 Raster

Set the DSO to 1 M Ω , 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.

21-Oct-91
17:47:22

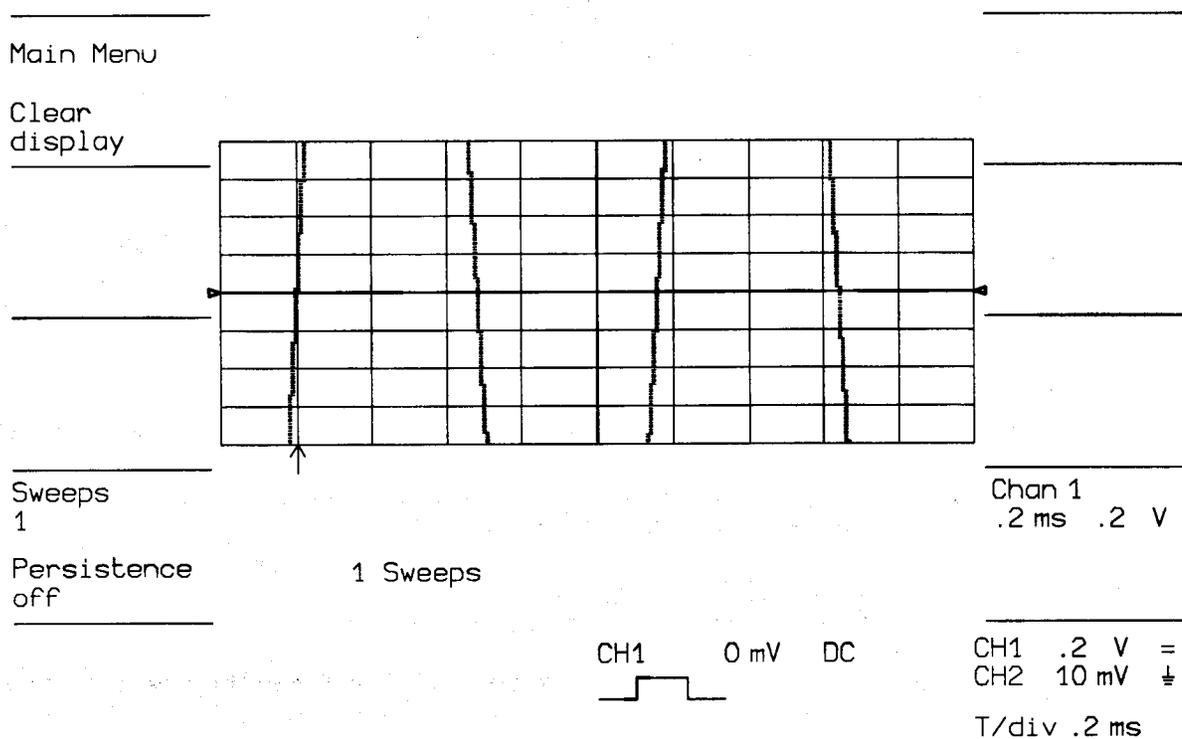


Figure 2 : Raster Oscillator

Chapter 5

TROUBLESHOOTING and FLOW CHARTS

Table of contents:

- 5.1 Introduction
- 5.2 Front panel controls do not operate
- 5.3 Rear panel controls do not operate
- 5.4 No Remote control GPIB or RS-232-C
- 5.5 No display or front panel control
- 5.6 Abnormal image on screen
- 5.7 Basic manual Performance Test Procedure
- 5.8 Recommended service equipment and spare parts

5.1 Introduction

In order to help simplify 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 troubleshoot down to the board level.

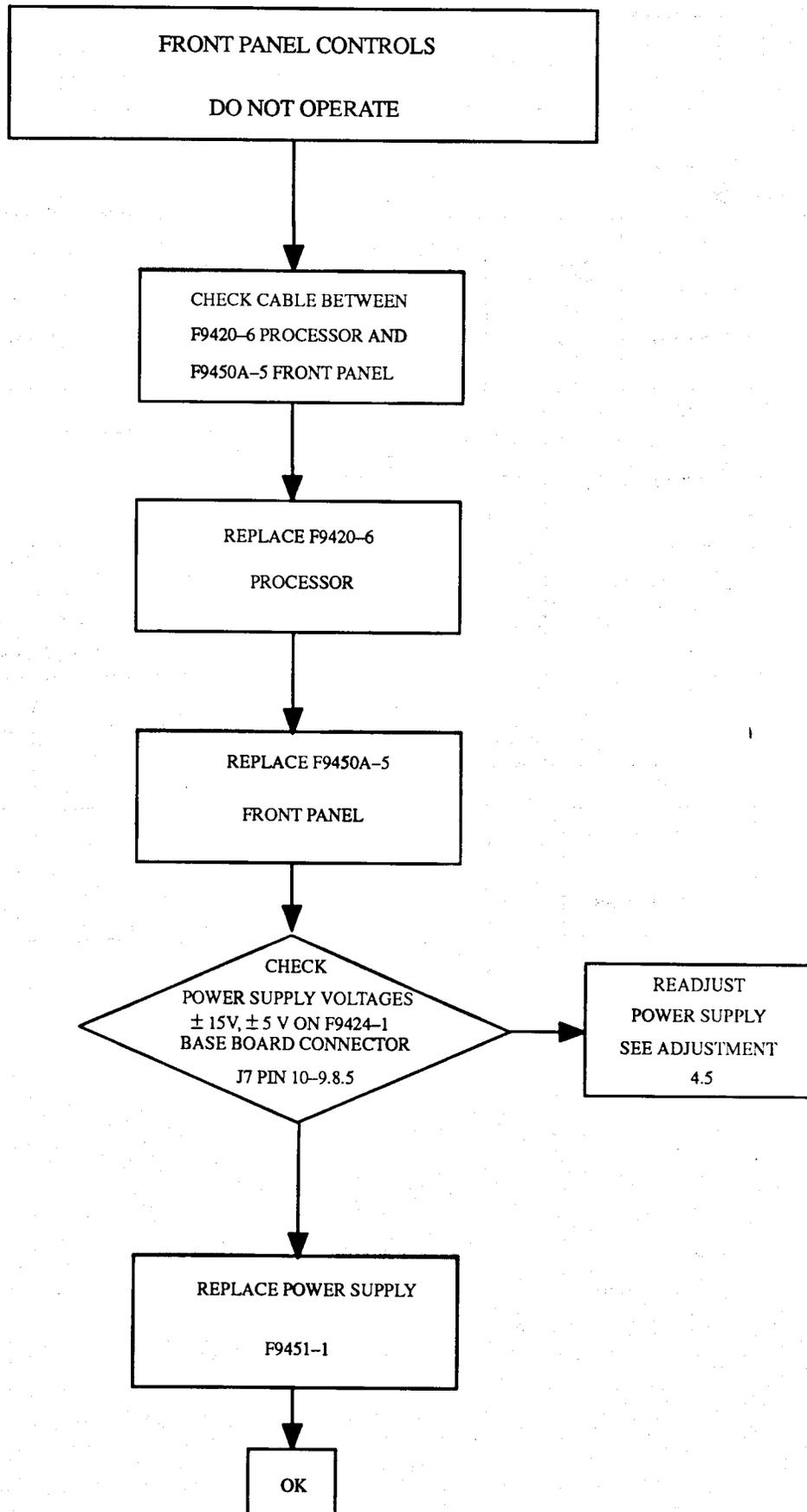
Defective circuit boards will be repaired or exchanged by our regional LeCroy service office .

The first step in troubleshooting is to check for obvious items like blown fuses, voltage selector switch in correct position and loose line cord.

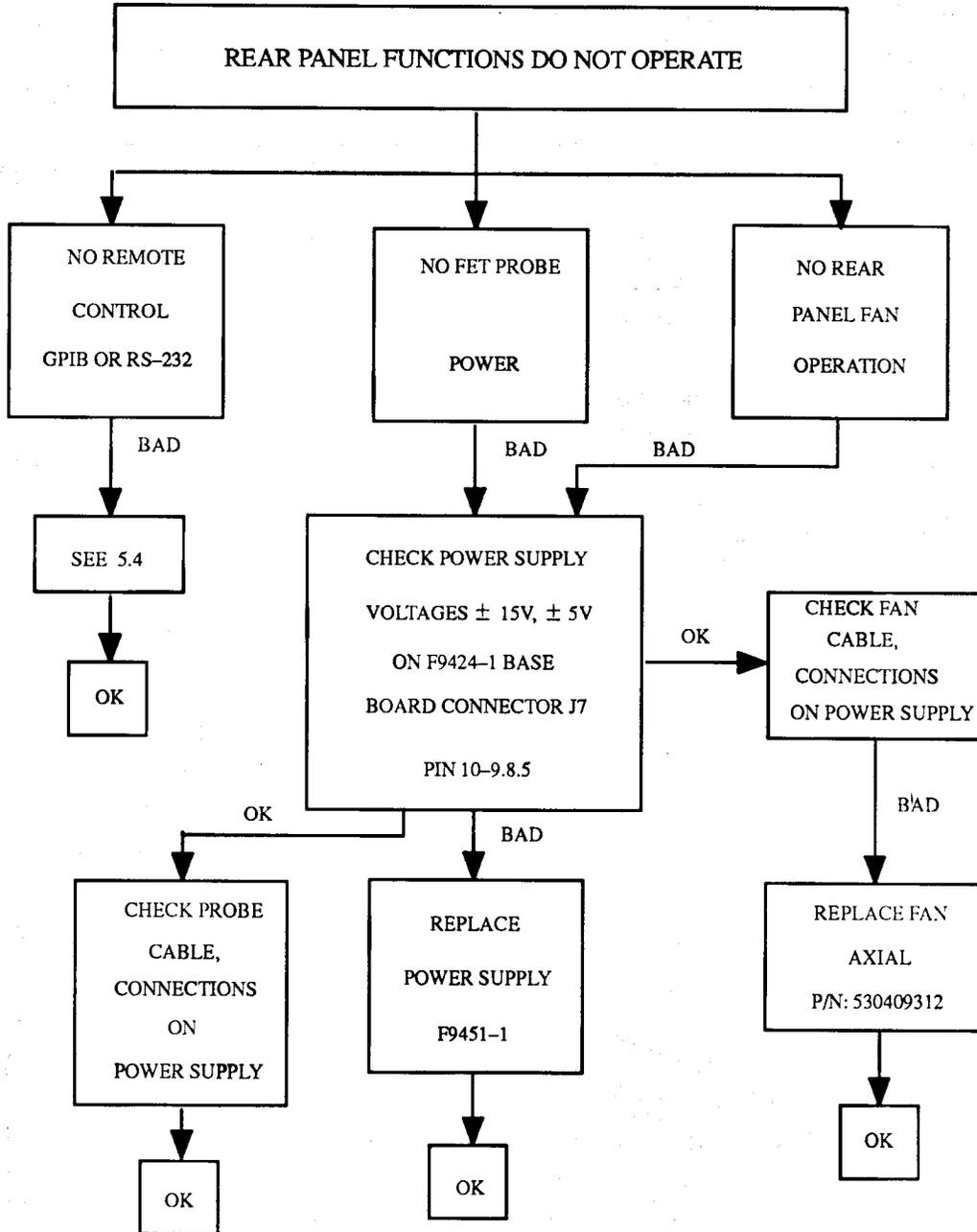
The power supply is the next item to check before proceeding to more detailed troubleshooting.

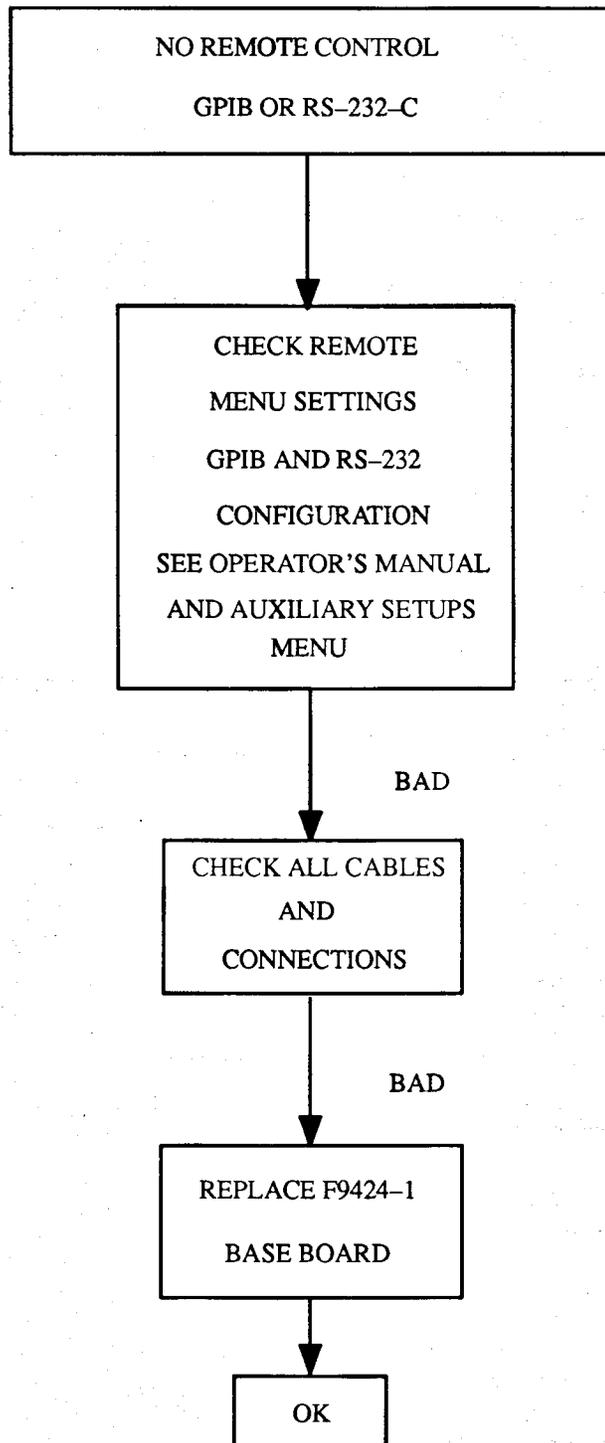
Noisy or low power supply can cause a variety of problems, both digital and analog.

A complete list of recommended service equipment and spare parts is given in section 5.8.

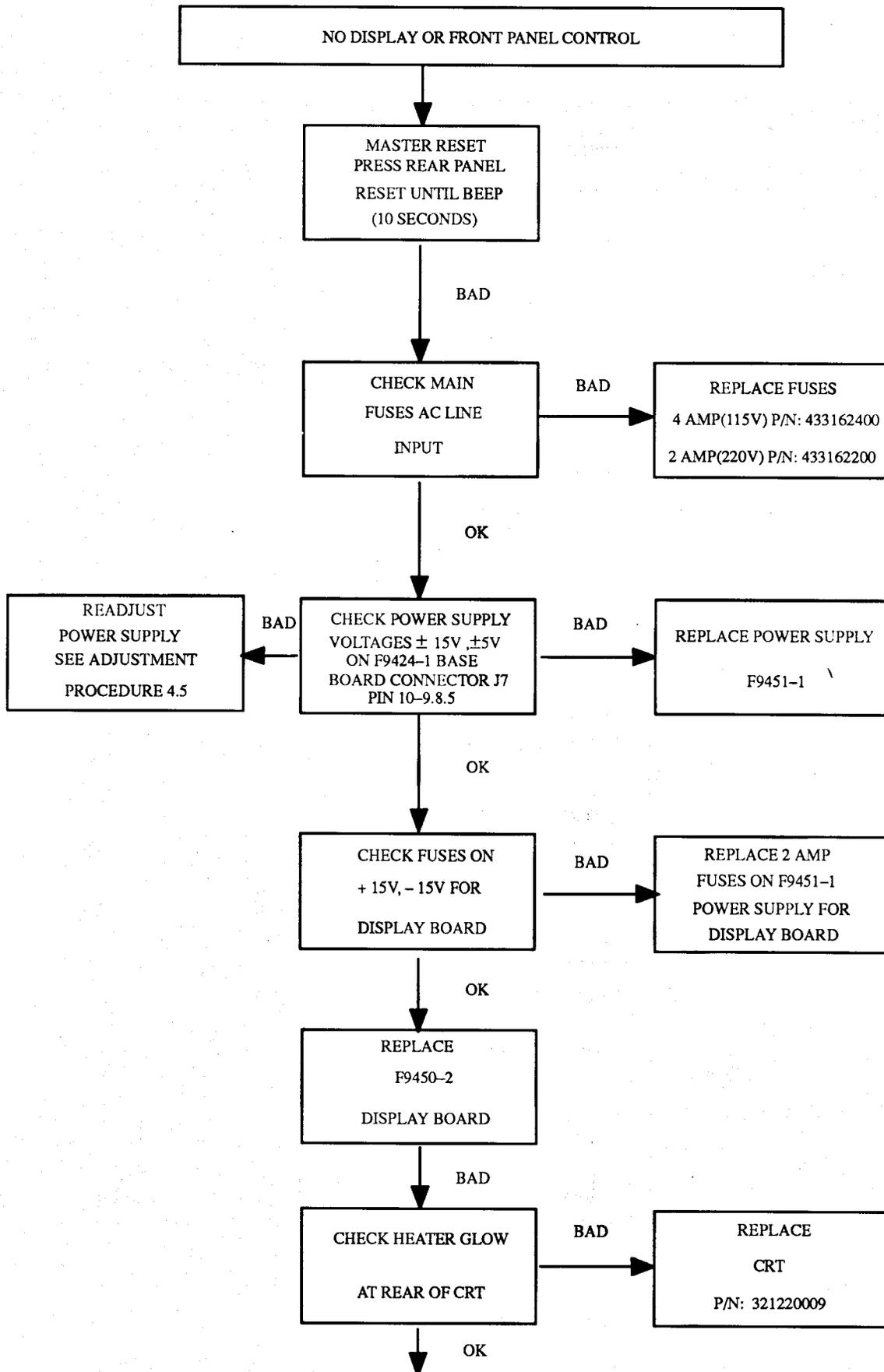


5.3

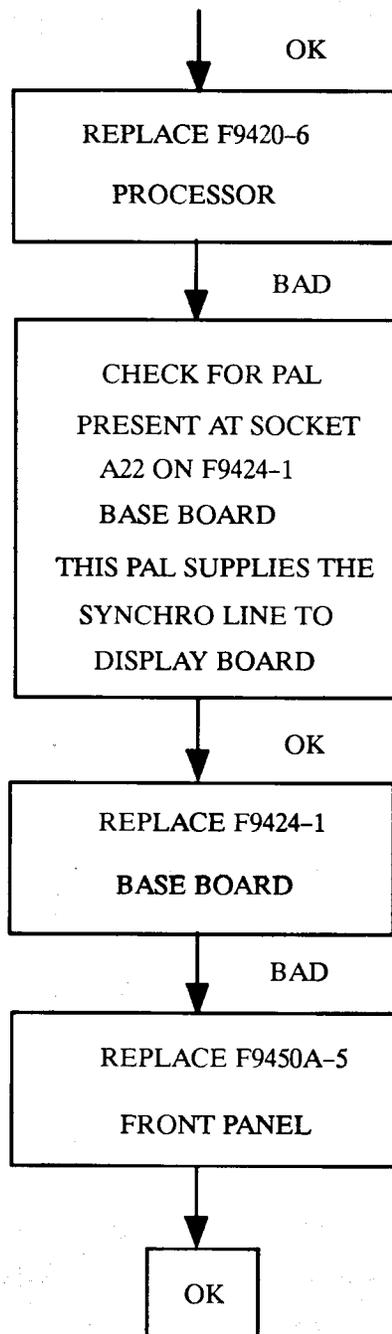




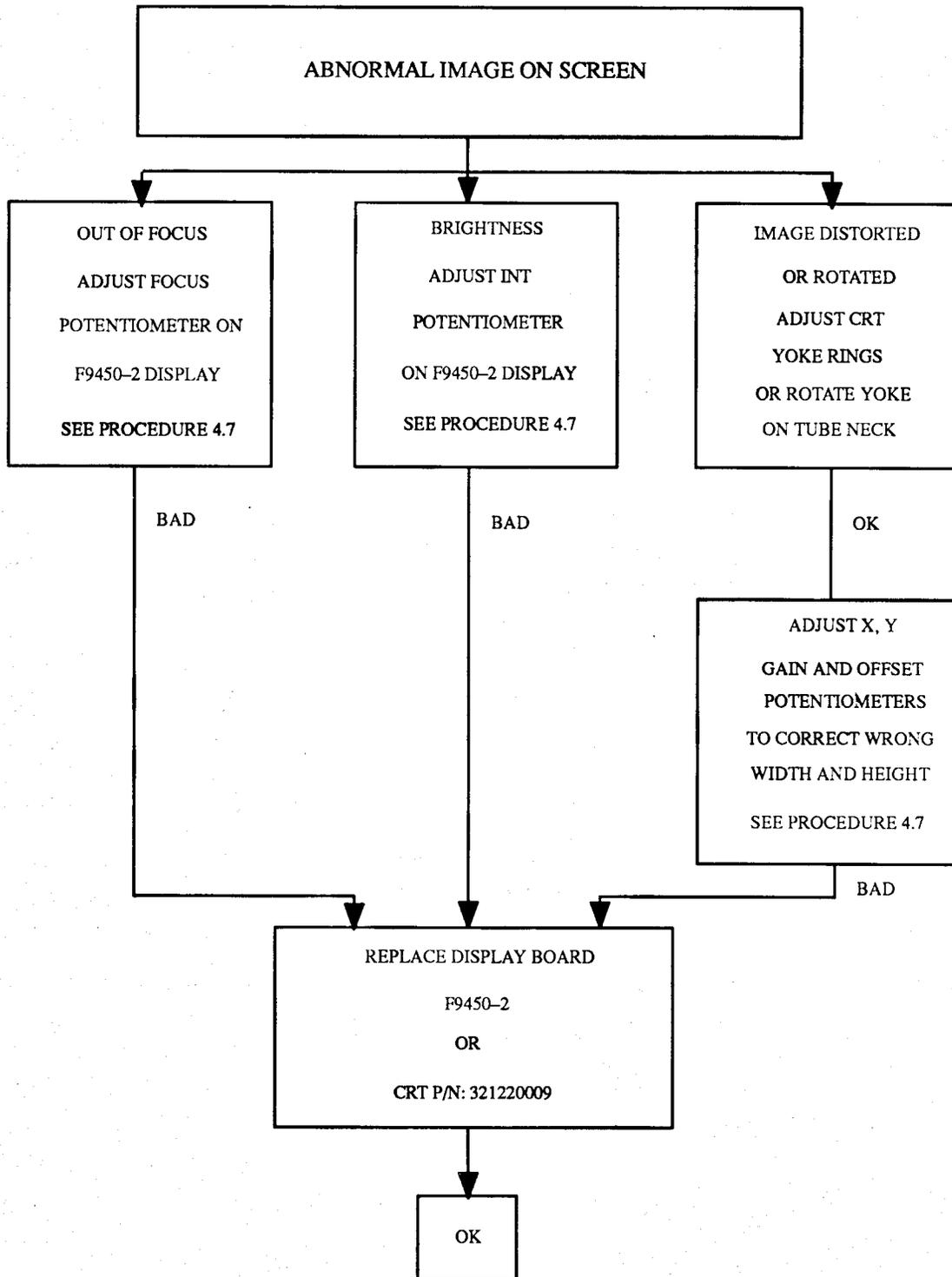
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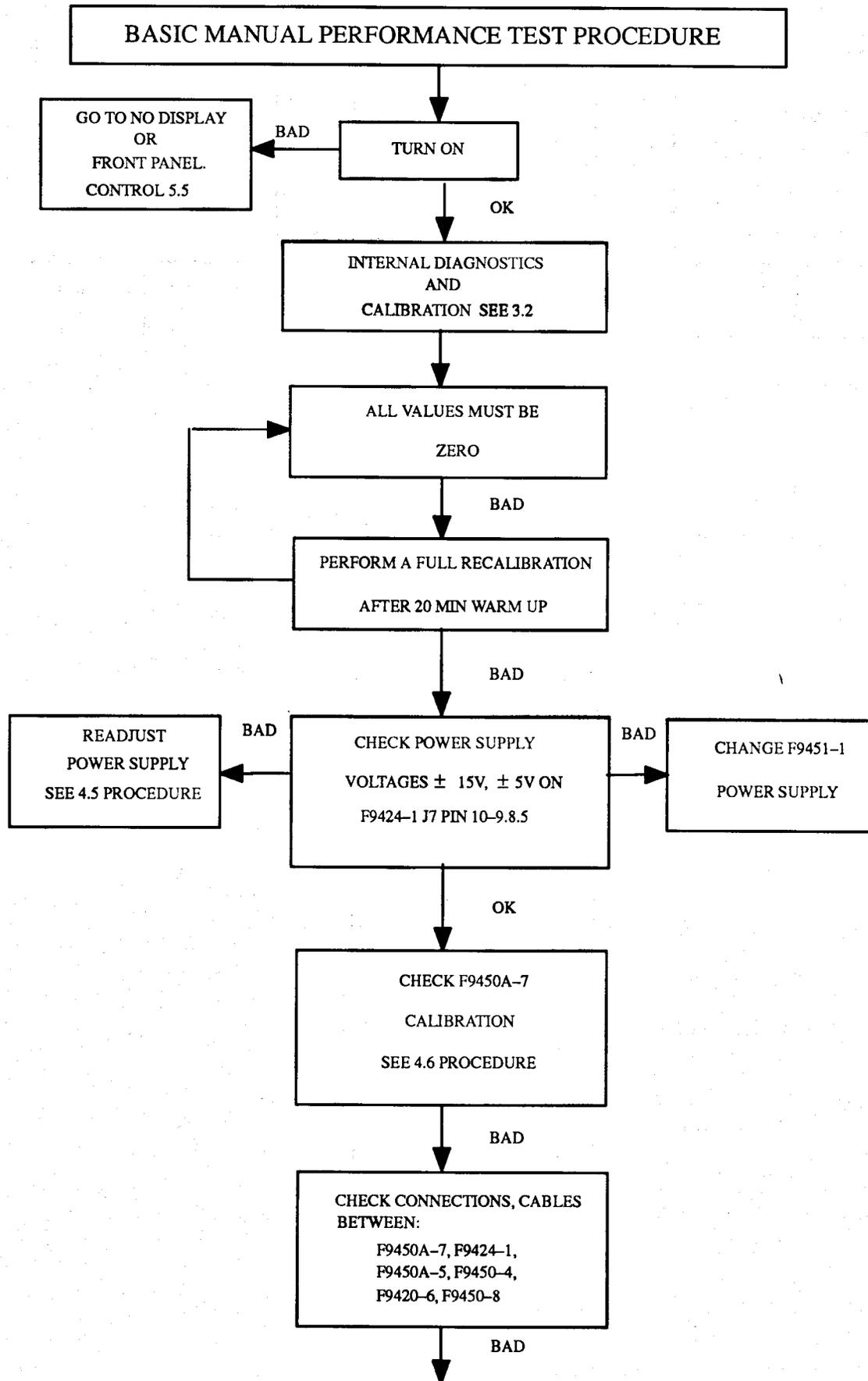
5.5.2



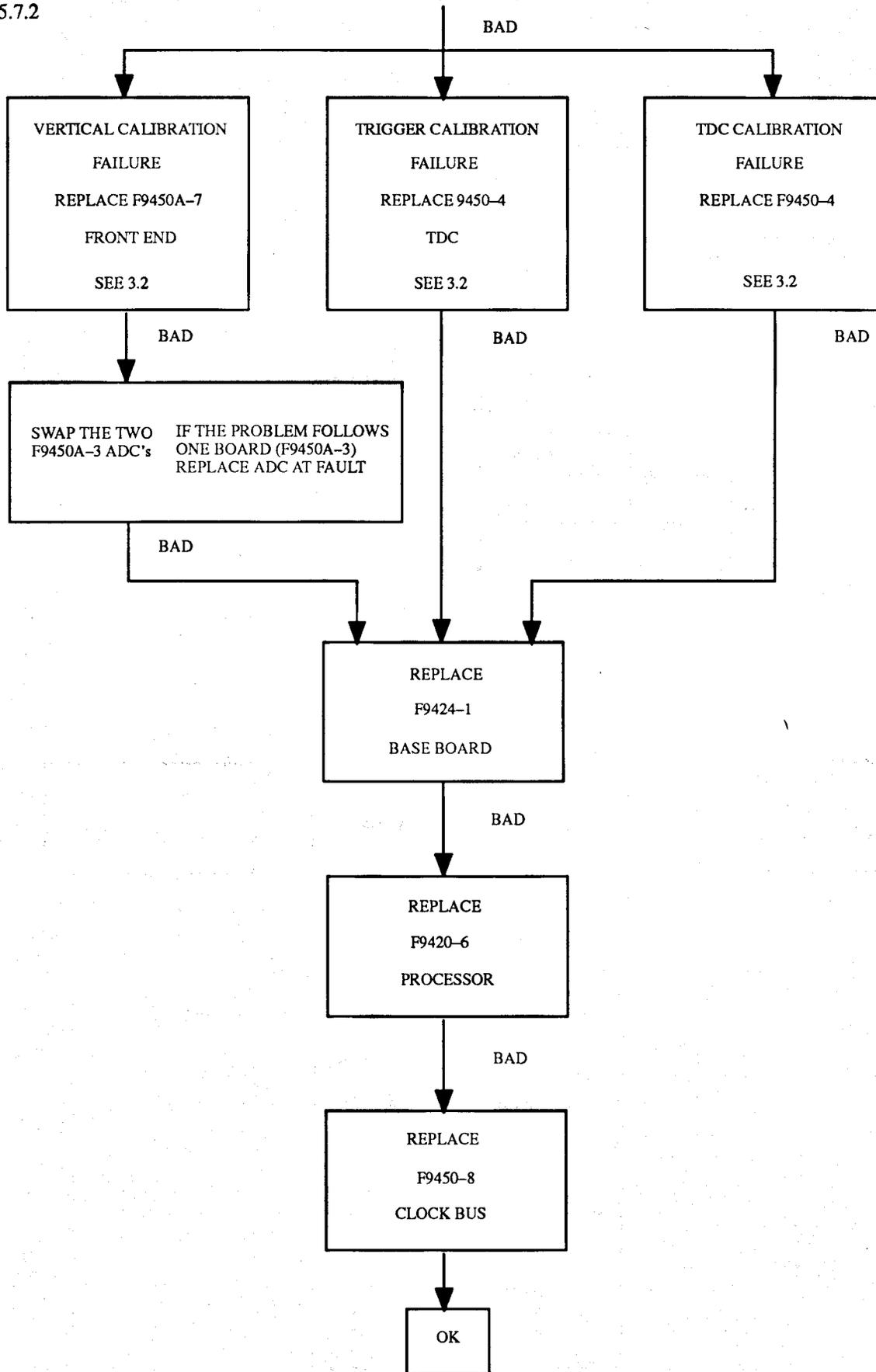
5.6



5.7.1



5.7.2



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 9450A subassemblies during repair and calibration.

- 1- Sine wave generator: Marconi 2019A, 2022C, 2030 or equivalent.
- 2- Sine wave generator: 5volt 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 (5nsec, 2nsec, 1 nsec), adapter T BNC, Adapter BNC - banana, 50 Ω BNC terminator feed through.

5.8.2 Spare parts

In order to make the repair of 9450A at board level, a minimum stock of boards is at least one each:

- | | |
|------------|-----------------------------------|
| - F9424-1 | Base board |
| - F9450-2 | Display board |
| - F9450A-3 | ADC (Analog to Digital Converter) |
| - F9450-4 | TDC (Time to Digital Converter) |
| - F9450A-5 | Front panel |
| - F9420-6 | Processor |
| - F9450A-7 | Front End |
| - F9450-8 | 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:

F9424-1 Base board

F9424-2 Support for Memory card

F9450-2 Display board

F9450A-3 ADC board

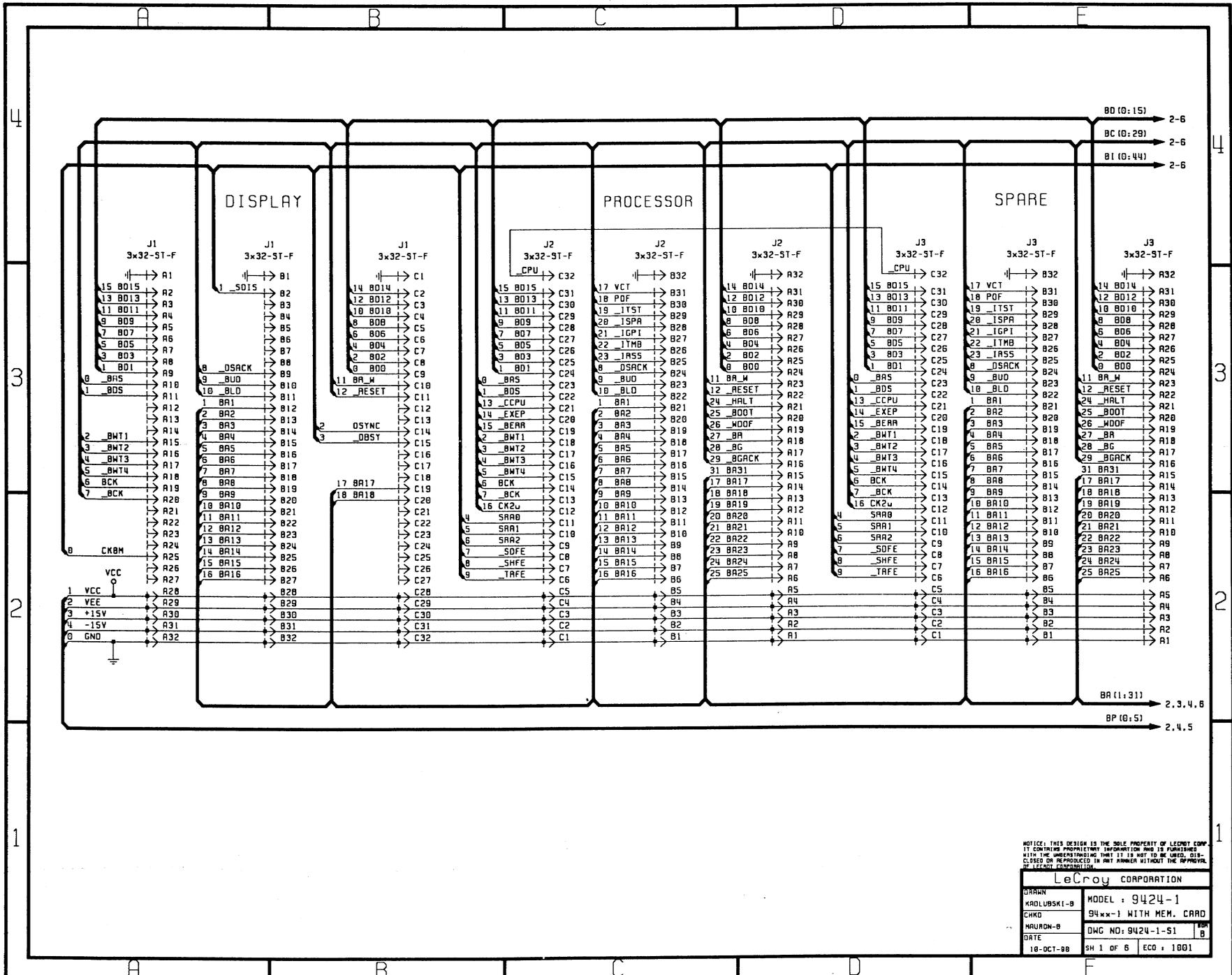
F9450-4 TDC board

F9450A-5 Front panel board

F9420-6 Processor board

F9450A-7 Front END

F9450-8 Clock-Bus

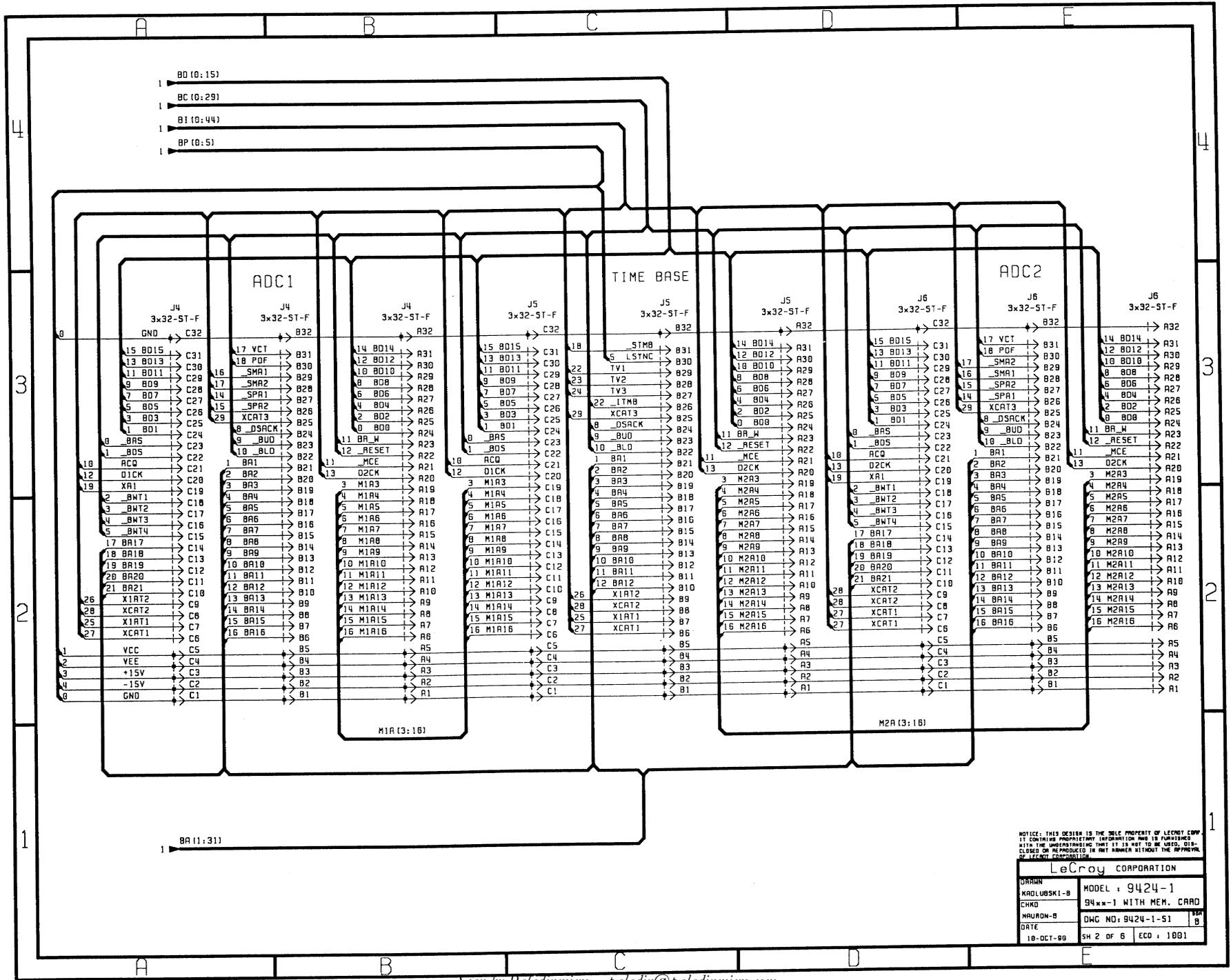


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LeCroy CORPORATION

DRAWN KADLUBSKI-B	MODEL : 9424-1
CHEK MAURON-B	94xx-1 WITH MEM. CARD
DATE 18-OCT-88	DWG NO: 9424-1-S1
	SH 1 OF 6

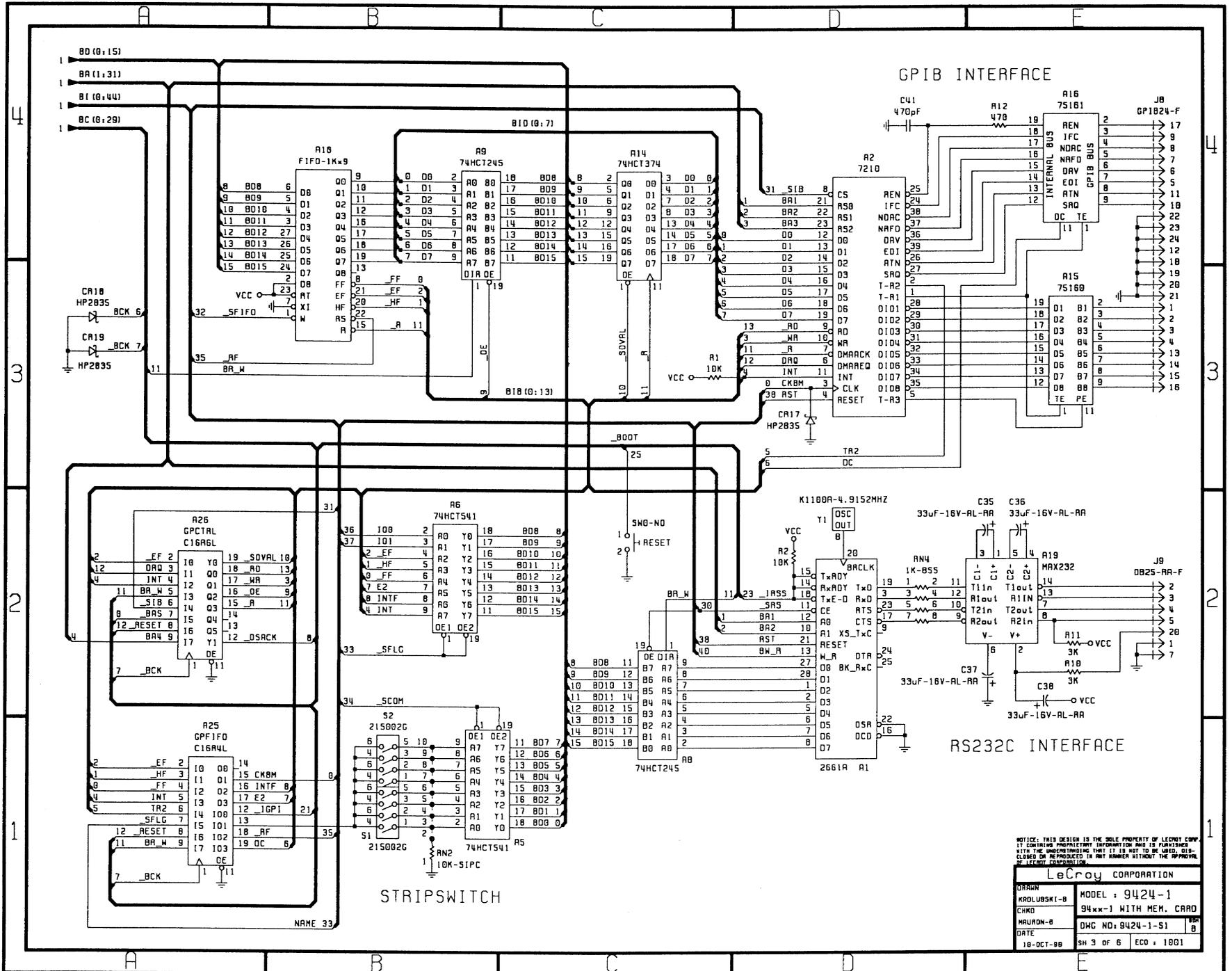
ECC : 1001



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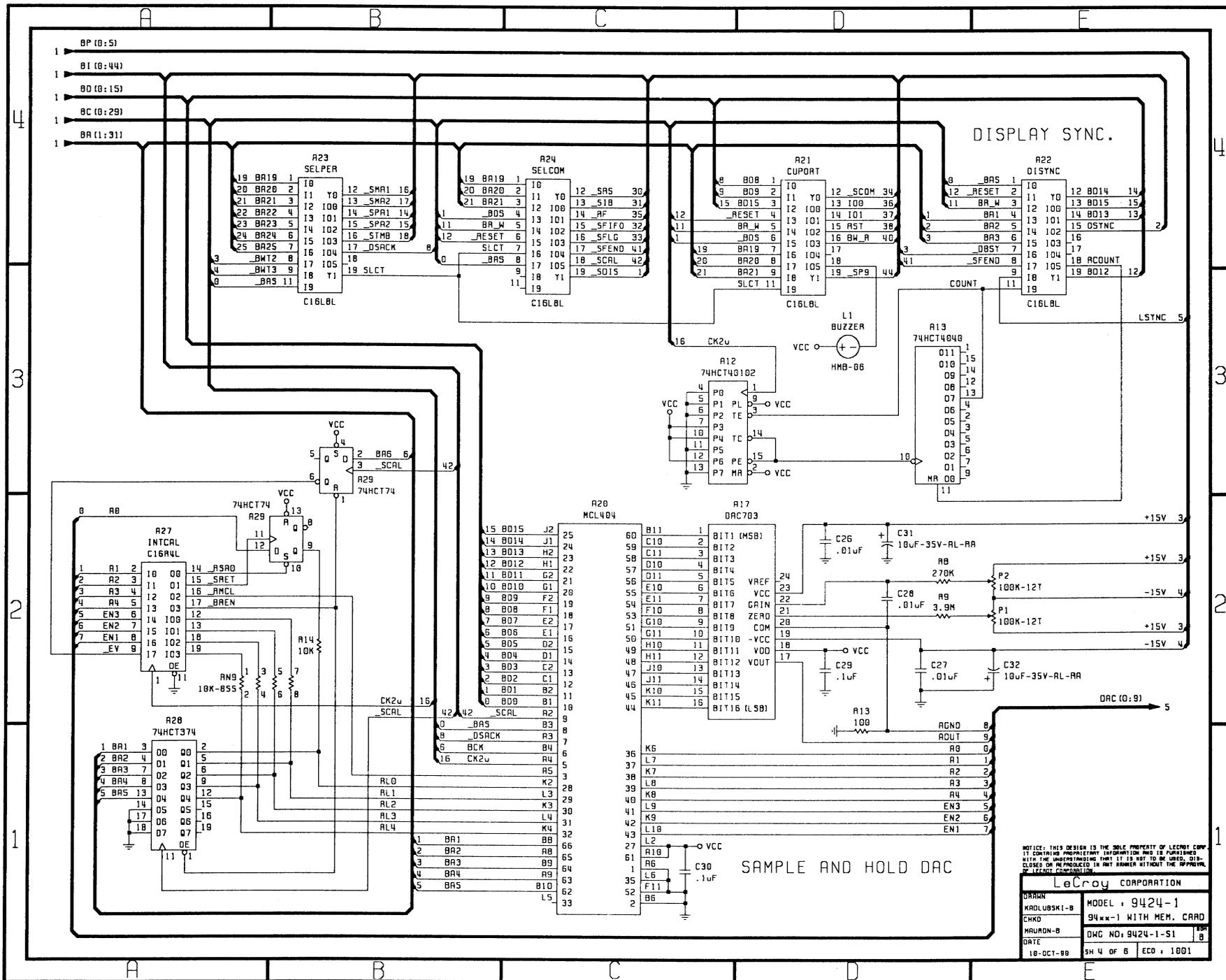
LeCroy CORPORATION

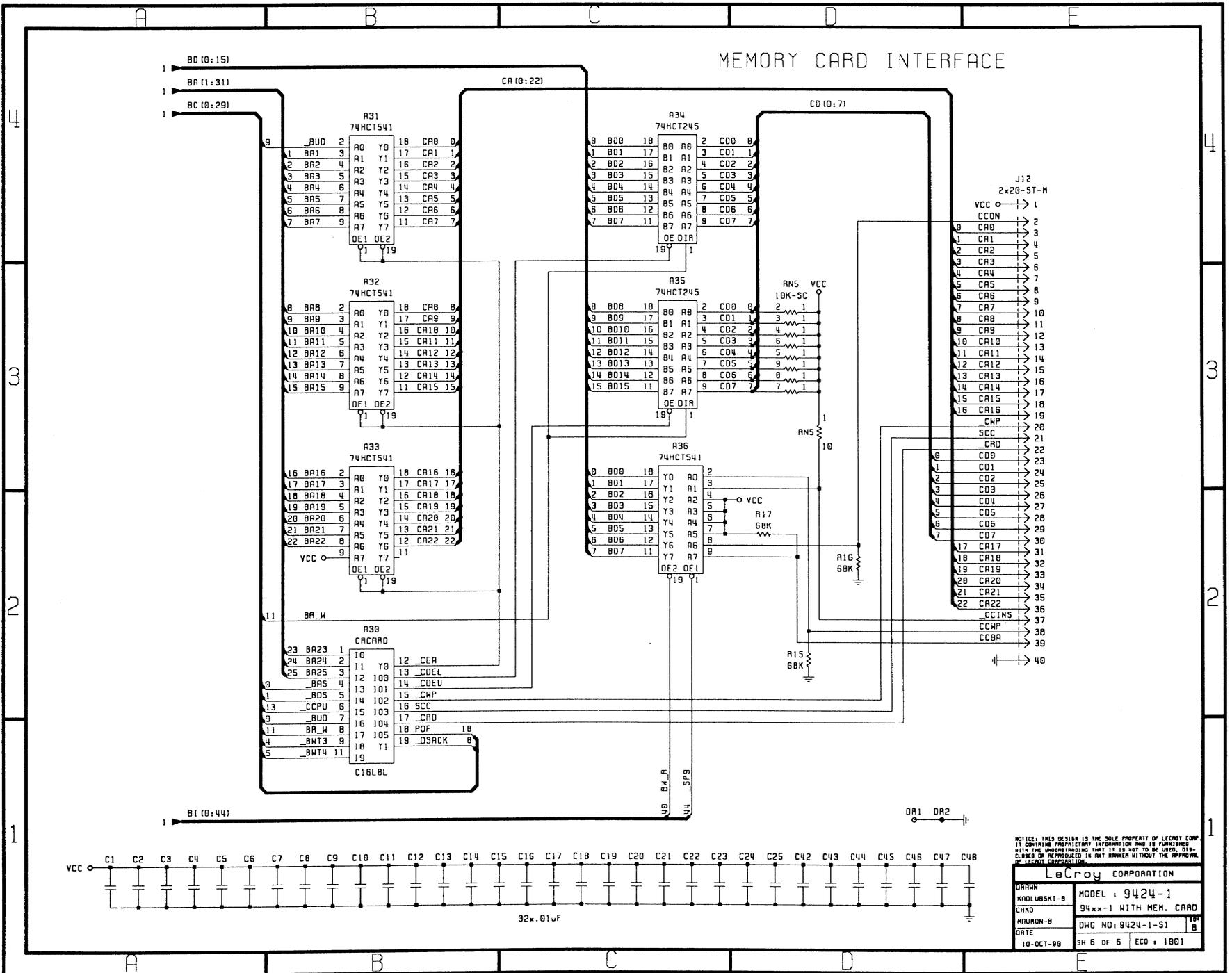
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DESIGNER	94xx-1 WITH MEM. CARD
CHKD	DATE
MAURON-B	DWG NO. 9424-1-51
DATE	SH 2 OF 6 ECD : 1001



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LeCroy CORPORATION	
DRAWN KROLUSSKI-B	MODEL : 9424-1
CHKD MAURON-B	94xx-1 WITH MEM. CARD
DATE 18-OCT-88	DWG NO: 9424-1-S1
	SH 3 OF 6 ECO : 1001

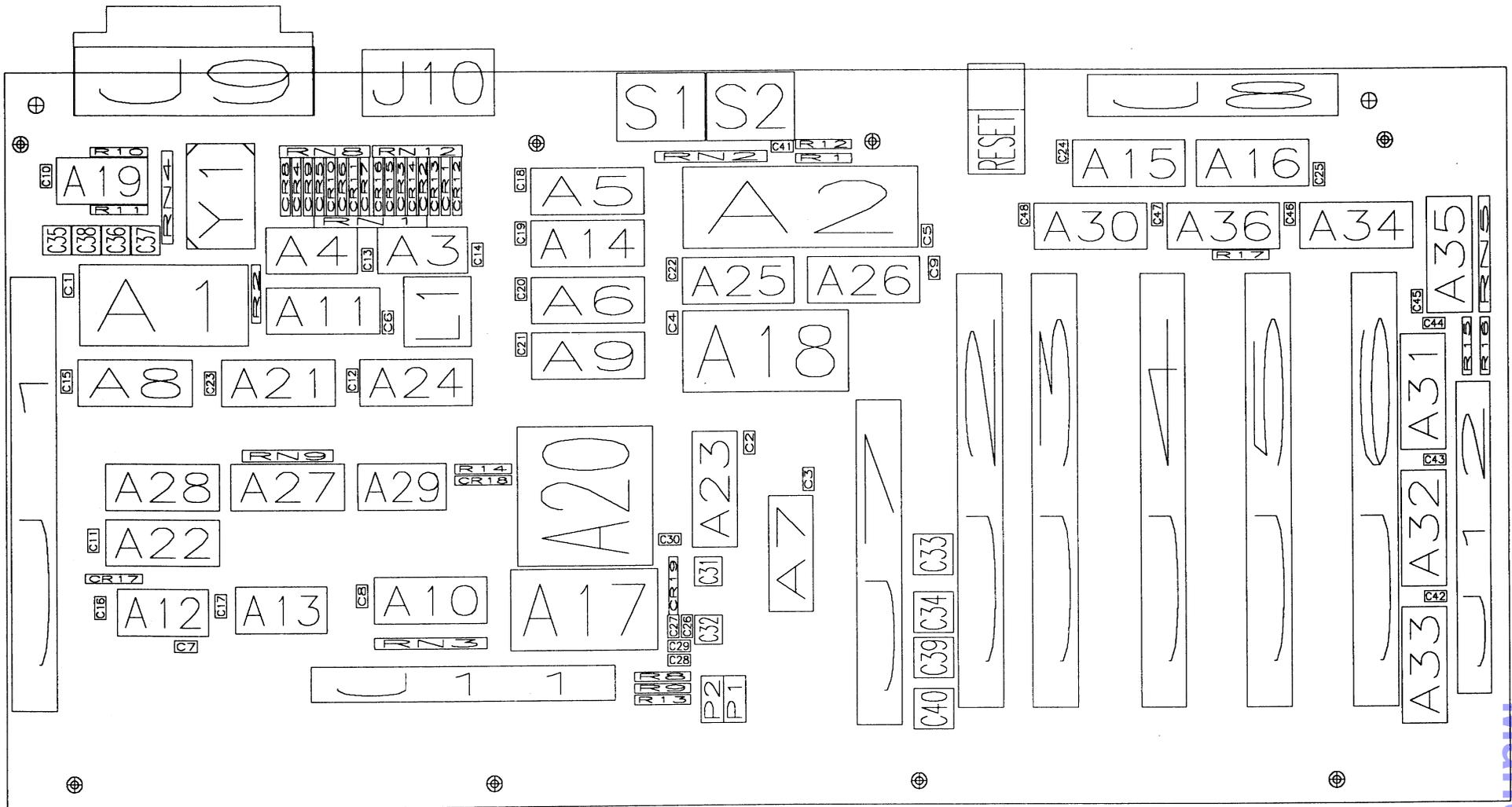




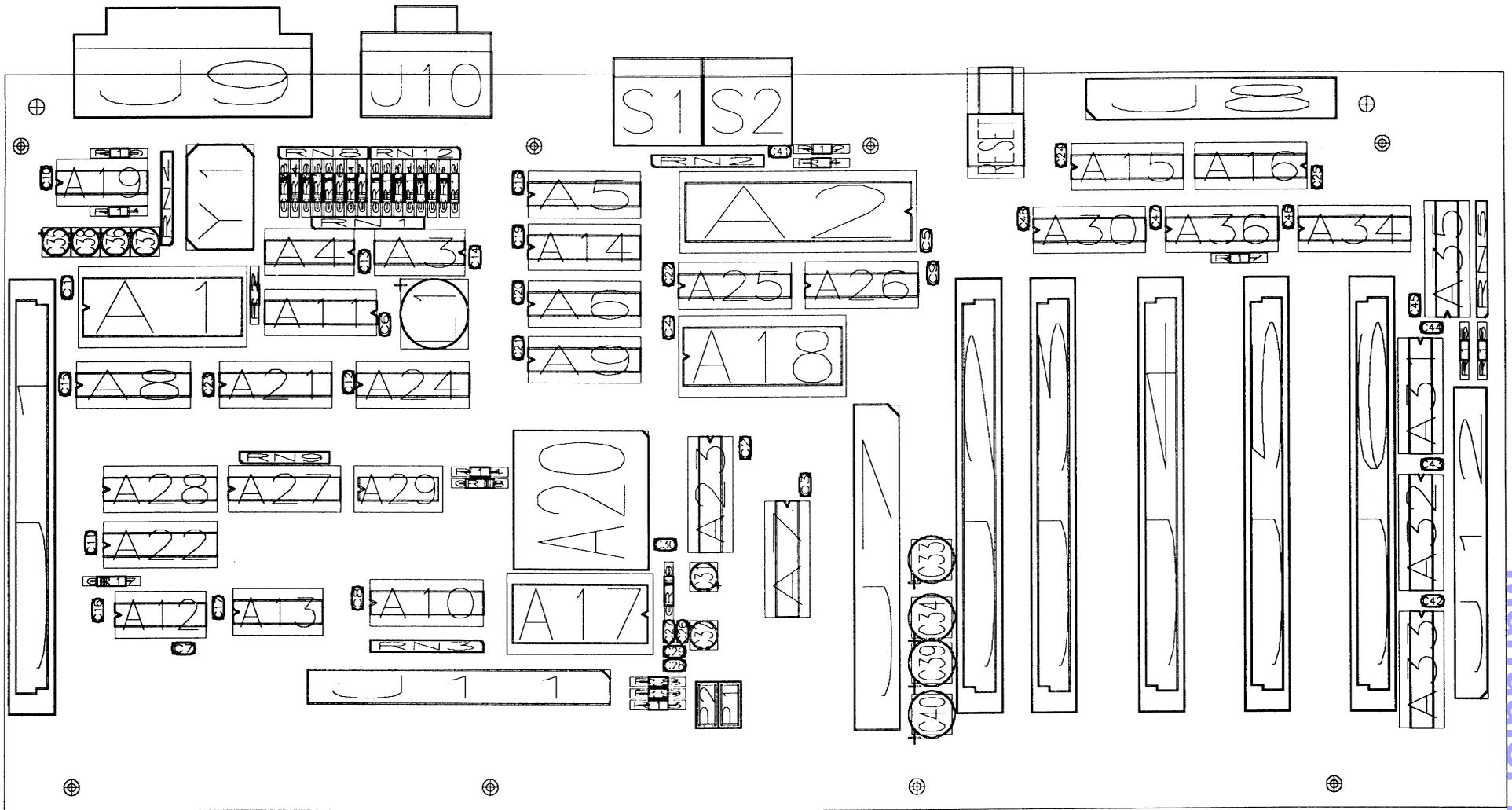
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LeCroy CORPORATION

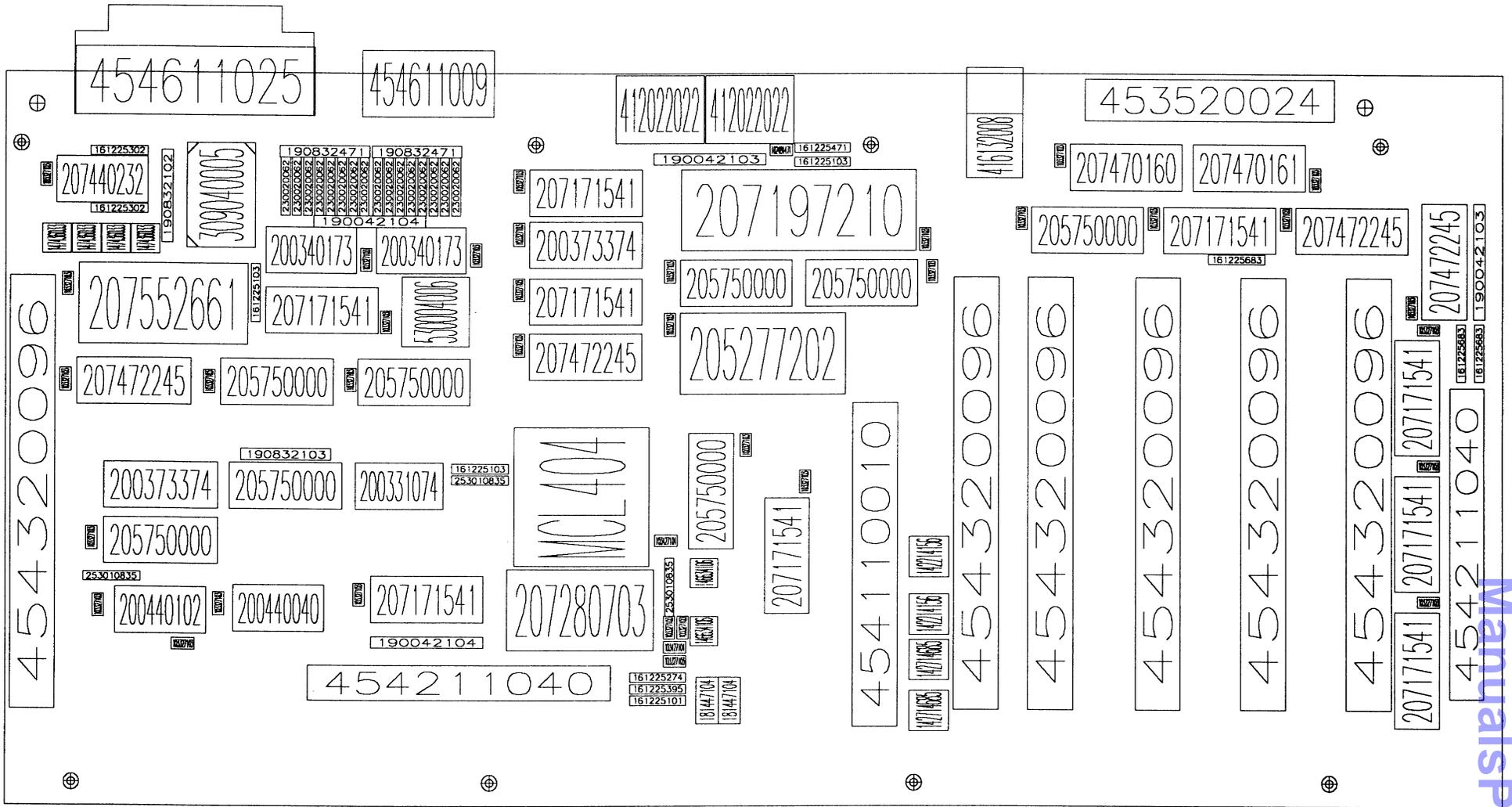
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CHECKD MAURON-B	94xx-1 WITH MEM. CARD
DATE 18-OCT-98	DWG NO: 9424-1-S1
	SH 6 OF 6 ECO: 1001



9424_1 PCB Rev:B



9424_1 PCB Rev:B

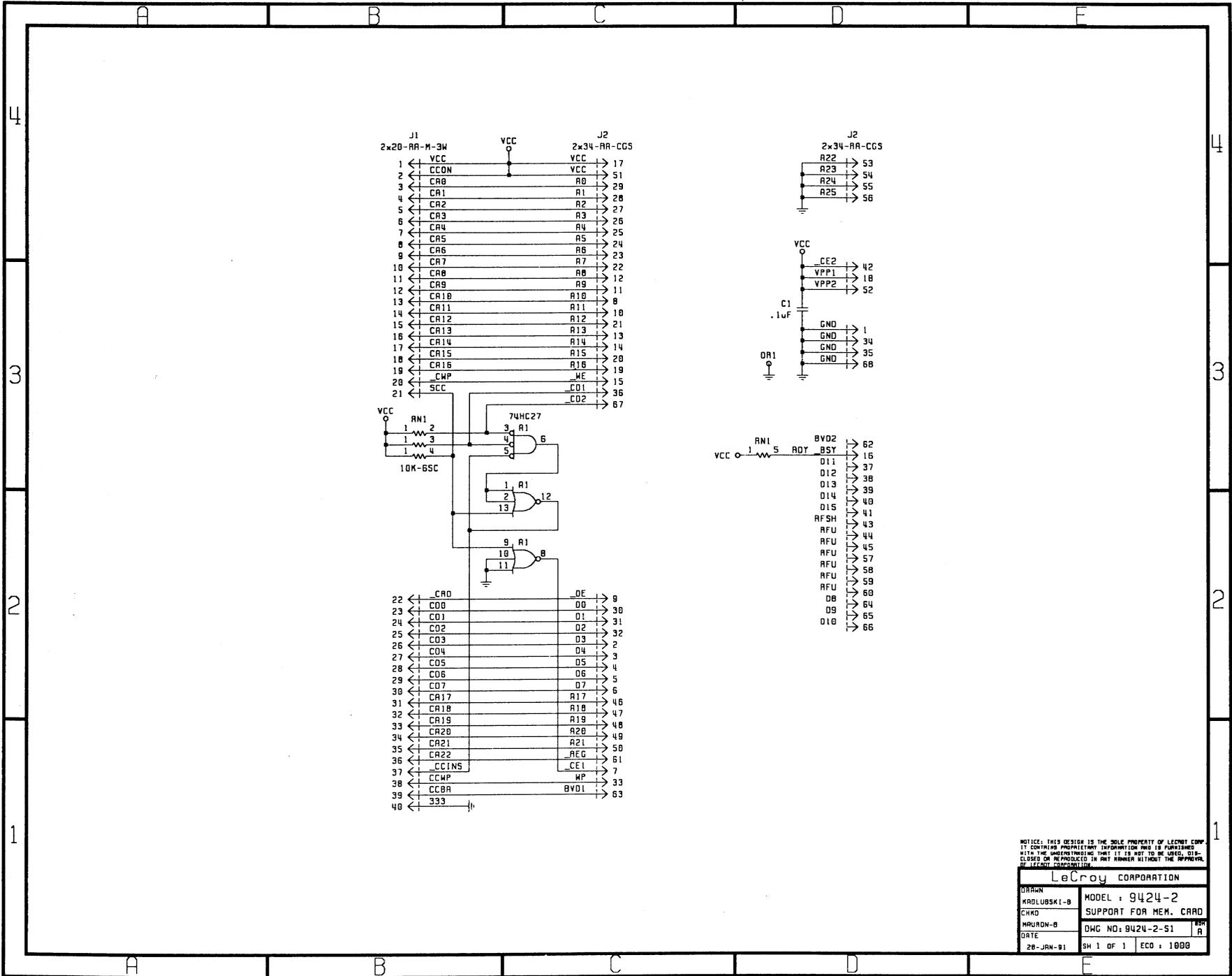


9424_1 PCB Rev:B

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A2	207197210	7210	DIP40	4572000	7010400	1	270
A3	200340173	74HCT173	DIP16	-5486400	5740400	1	270
A4	200340173	74HCT173	DIP16	-7975600	5740400	1	270
A5	207171541	74HCT541	DIP20	-3810000	6248400	1	90
A6	207171541	74HCT541	DIP20	-3810000	3860800	1	90
A7	207171541	74HCT541	DIP20	1524000	-203200	1	0
A8	207472245	74HCT245	DIP20	-13970000	2082800	1	90
A9	207472245	74HCT245	DIP20	-3810000	2641600	1	90
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A13	200440040	74HCT4040	DIP16	-10464800	-2895600	1	90
A14	200373374	74HCT374	DIP20	-3810000	5105400	1	90
A15	207470160	75160	DIP20	8432800	6807200	1	90
A16	207470161	75161	DIP20	13512800	7569200	1	270
A17	207280703	DAC703	DIP24	-1371600	-1778000	1	270
A18	205277202	FIFO-1Kx9	DIP28	-304800	2336800	1	90
A19	207440232	MAX232	DIP16	-14427200	6502400	1	90
A20	MCL404	MCL404-ON-SOCKET	QILE68EX	-1473200	-50800	1	270
A21	205750000	C16L8L	DIP20	-10769600	2082800	1	90
A22	205750000	C16L8L	DIP20	-13360400	-1422400	1	90
A23	205750000	C16L8L	DIP20	-203200	1219200	1	0
A24	205750000	C16L8L	DIP20	-7670800	2082800	1	90
A25	205750000	C16R4L	DIP20	-406400	4267200	1	90
A26	205750000	C16R6L	DIP20	2438400	4267200	1	90
A27	205750000	C16R4L	DIP20	-10566400	-203200	1	90
A28	200373374	74HCT374	DIP20	-13360400	-203200	1	90
A29	200331074	74HCT74	DIP14	-7620000	-203200	1	90
A30	205750000	C16L8L	DIP20	7569200	5435600	1	90
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A33	207171541	74HCT541	DIP20	15798800	-2692400	1	0
A34	207472245	74HCT245	DIP20	13563600	5435600	1	90
A35	207472245	74HCT245	DIP20	17170400	4013200	1	180
A36	207171541	74HCT541	DIP20	10566400	5435600	1	90
C1	103327103	.01uF	SMONOBP	-14300200	4724400	1	270
C2	103327103	.01uF	SMONOBP	965200	1219200	1	270
C3	103327103	.01uF	SMONOBP	2311400	152400	1	90
C4	103327103	.01uF	SMONOBP	-762000	3606800	1	90
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C16	103327103	.01uF	SMONOBP	-13614400	-2590800	1	90
C17	103327103	.01uF	SMONOBP	-10922000	-2540000	1	90
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C23	103327103	.01uF	SMONOBP	-11150600	2590800	1	270
C24	103327103	.01uF	SMONOBP	8077200	7569200	1	270
C25	103327103	.01uF	SMONOBP	13868400	6807200	1	90
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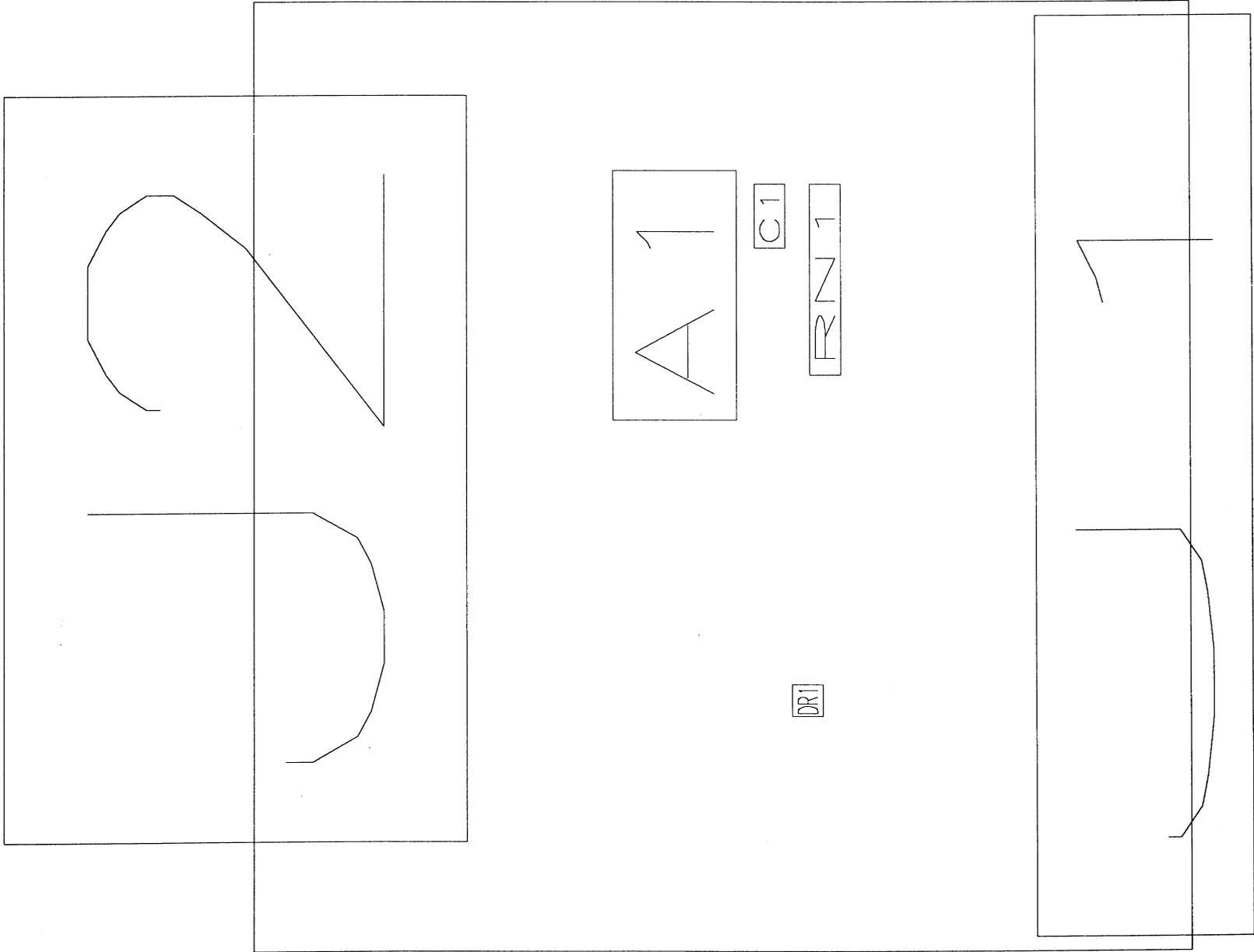
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C39	142714685	6.8uF-25V-SAL	LTCAP	5130800	-3886200	1	90
C40	142714685	6.8uF-25V-SAL	LTCAP	5130800	-5003800	1	90
C41	102484471	470pF	SMONO	1879600	7569200	1	180
C42	103327103	.01uF	SMONOBP	16560800	-2336800	1	180
C43	103327103	.01uF	SMONOBP	16560800	660400	1	180
C44	103327103	.01uF	SMONOBP	16560800	3657600	1	180
C45	103327103	.01uF	SMONOBP	16052800	4013200	1	90
C46	103327103	.01uF	SMONOBP	13208000	6197600	1	270
C47	103327103	.01uF	SMONOBP	10210800	6197600	1	270
C48	103327103	.01uF	SMONOBP	7213600	6197600	1	270
J1	454320096	3x32-ST-F	CONN3X32_ST_F	-15341600	3962400	1	270
J2	454320096	3x32-ST-F	CONN3X32_ST_F	6451600	-3911600	1	90
J3	454320096	3x32-ST-F	CONN3X32_ST_F	8128000	-3911600	1	90
J4	454320096	3x32-ST-F	CONN3X32_ST_F	10566400	-3911600	1	90
J5	454320096	3x32-ST-F	CONN3X32_ST_F	12954000	-3911600	1	90
J6	454320096	3x32-ST-F	CONN3X32_ST_F	15341600	-3911600	1	90
J7	454110010	POWER1x10-M	POWER1X10_M	3911600	1320800	1	270
J8	453520024	GPIB24-F	GPIB24 F	10210800	8534400	1	0
J9	454611025	DB25-RA-F	DB25 RA F	-13174980	8407400	1	180
J10	454611009	DB9-RA-F	DB9 RA F	-6705600	8407400	1	180
J11	454211040	2X20-ST-M	CONN2X20_ST_M	-3098800	-4013200	1	180
J12	454211040	2X20-ST-M	CONN2X20_ST_M	17424400	-3454400	1	90
L1	530004006	HMB-06	HBM 06	-6045200	4013200	1	0
P1	181447104	100K-12T	POT66WR	609600	-4775200	1	90
P2	181447104	100K-12T	POT66WR	101600	-4267200	1	270
R1	161225103	10K	RES05	3200400	7315200	1	180
R2	161225103	10K	RES05	-10109200	3911600	1	90
R8	161225274	270K	RES05	-1524000	-4013200	1	0
R9	161225395	3.9M	RES05	-1524000	-4267200	1	0
R10	161225302	3K	RES05	-13665200	7518400	1	0
R11	161225302	3K	RES05	-12649200	6248400	1	180
R12	161225471	470	RES05	2184400	7620000	1	0
R13	161225101	100	RES05	-1524000	-4521200	1	0
R14	161225103	10K	RES05	-5537200	558800	1	0
R15	161225683	68K	RES05	17170400	2641600	1	90
R16	161225683	68K	RES05	17576800	2641600	1	90
R17	161225683	68K	RES05	11582400	5181600	1	0
S1	412022022	215002G	STRIPSWITCH	-1717040	7993380	1	180
S2	412022022	215002G	STRIPSWITCH	320040	7993380	1	180
Y1	309040005	K1100A-4.9152MHZ	\$1100_QUARTZ	-12801600	5791200	1	90
CR1	230020062	BAW62	DO35	-5842000	6248400	1	90
CR2	230020062	BAW62	DO35	-6350000	6248400	1	90
CR3	230020062	BAW62	DO35	-6858000	6248400	1	90
CR4	230020062	BAW62	DO35	-9194800	7264400	1	270
CR5	230020062	BAW62	DO35	-8686800	7264400	1	270
CR6	230020062	BAW62	DO35	-8178800	7264400	1	270
CR7	230020062	BAW62	DO35	-7670800	7264400	1	270
CR8	230020062	BAW62	DO35	-9448800	6248400	1	90
CR9	230020062	BAW62	DO35	-8940800	6248400	1	90
CR10	230020062	BAW62	DO35	-8432800	6248400	1	90
CR11	230020062	BAW62	DO35	-7924800	6248400	1	90
CR12	230020062	BAW62	DO35	-5588000	7264400	1	270
CR13	230020062	BAW62	DO35	-6096000	7264400	1	270
CR14	230020062	BAW62	DO35	-6604000	7264400	1	270
CR15	230020062	BAW62	DO35	-7112000	7264400	1	270
CR16	230020062	BAW62	DO35	-7366000	6248400	1	90
CR17	253010835	HP2835	DO35	-12801600	-1828800	1	180
CR18	253010835	HP2835	DO35	-5537200	304800	1	0

CR19	253010835	HP2835	DO35	-762000	-2540000	1	90
RESET	416132008	SW0-NO	SW0 NO	6598920	6959600	1	270
RN1	190042104	100K-SIPC	SIP10RES	-8686800	5994400	1	90
RN2	190042103	10K-SIPC	SIP10RES	-1016000	7366000	1	90
RN3	190042104	100K-SIPC	SIP10RES	-5080000	-3251200	1	270
RN4	190832102	1K-8SS	SIP8RES	-12090400	5638800	1	180
RN5	190042103	10K-SC	SIP10RES	17576800	4013200	1	180
RN8	190832471	470-8SS	SIP8RES	-9448800	7518400	1	90
RN9	190832103	10K-8SS	SIP8RES	-10312400	863600	1	90
RN12	190832471	470-8SS	SIP8RES	-5588000	7518400	1	270



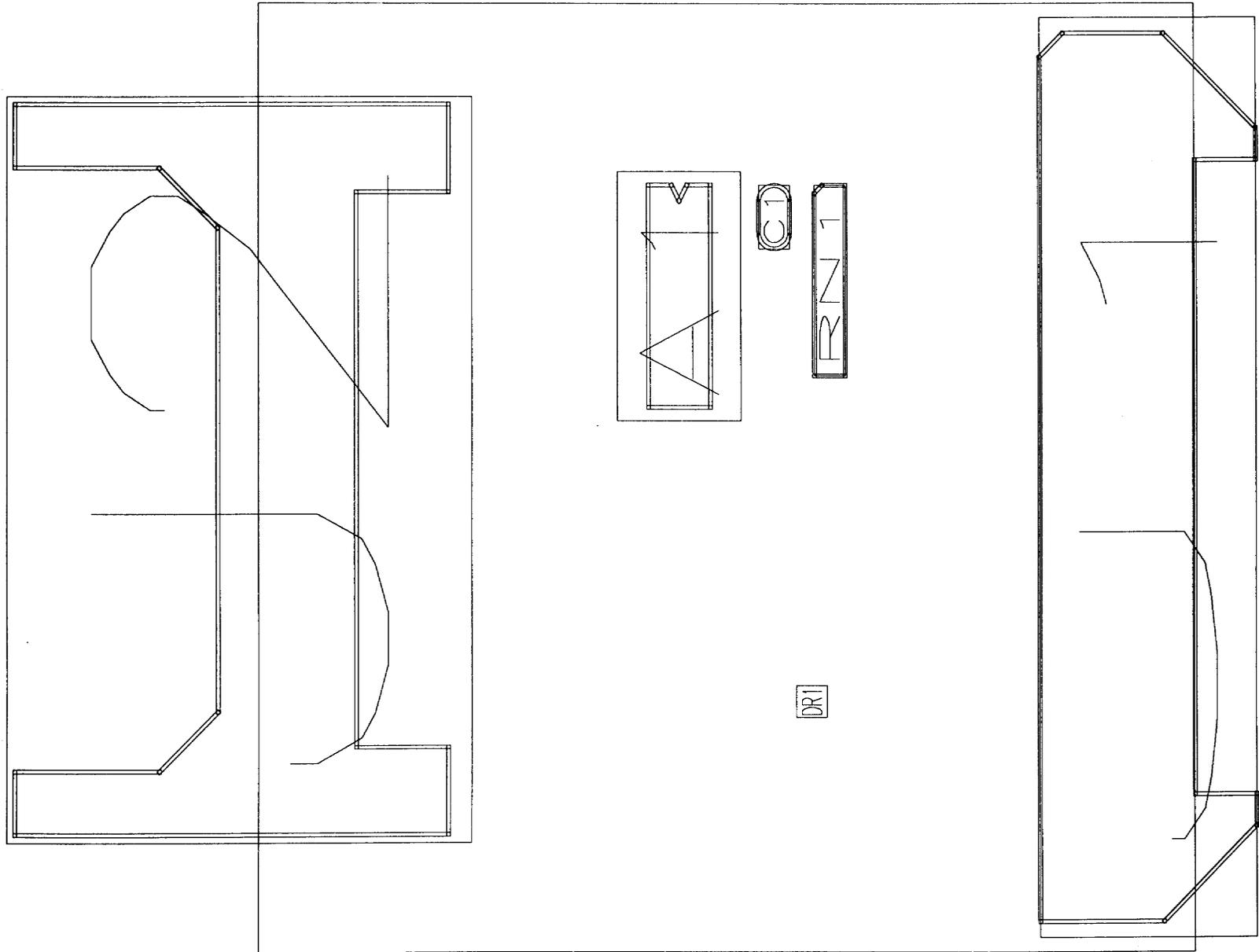
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LeCroy CORPORATION	
DRAWN KADLUBSKI-B	MODEL : 9424-2
CHKD MURRON-B	SUPPORT FOR MEM. CARD
DATE 28-JAN-91	DWG NO: 9424-2-S1
	SH 1 OF 1
	ECC : 1008



9424-2 REV: E

Scan by Paladinmicro -- paladin@paladinmicro.com



9424-2 REV: E

Scan by Paladinmicro -- paladin@paladinmicro.com

2X37-RA-CG

74HC27

.1uF

10K-6SC



2X20-RA-M-3W

9424-2 REV:E

Scan by Paladinmicro -- paladin@paladinmicro.com

40450068

74HC27

10342104

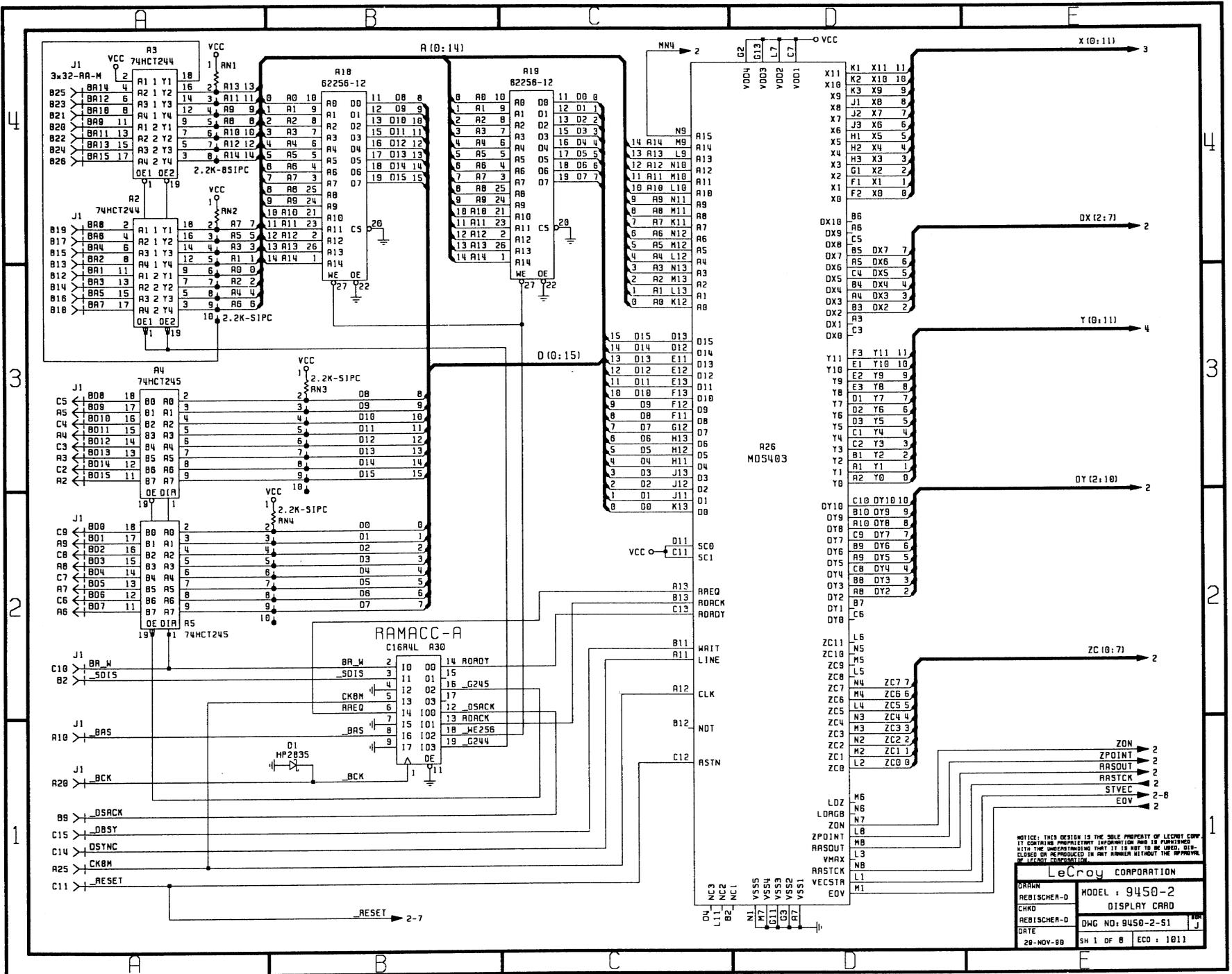
SNLL

190642103

454611040

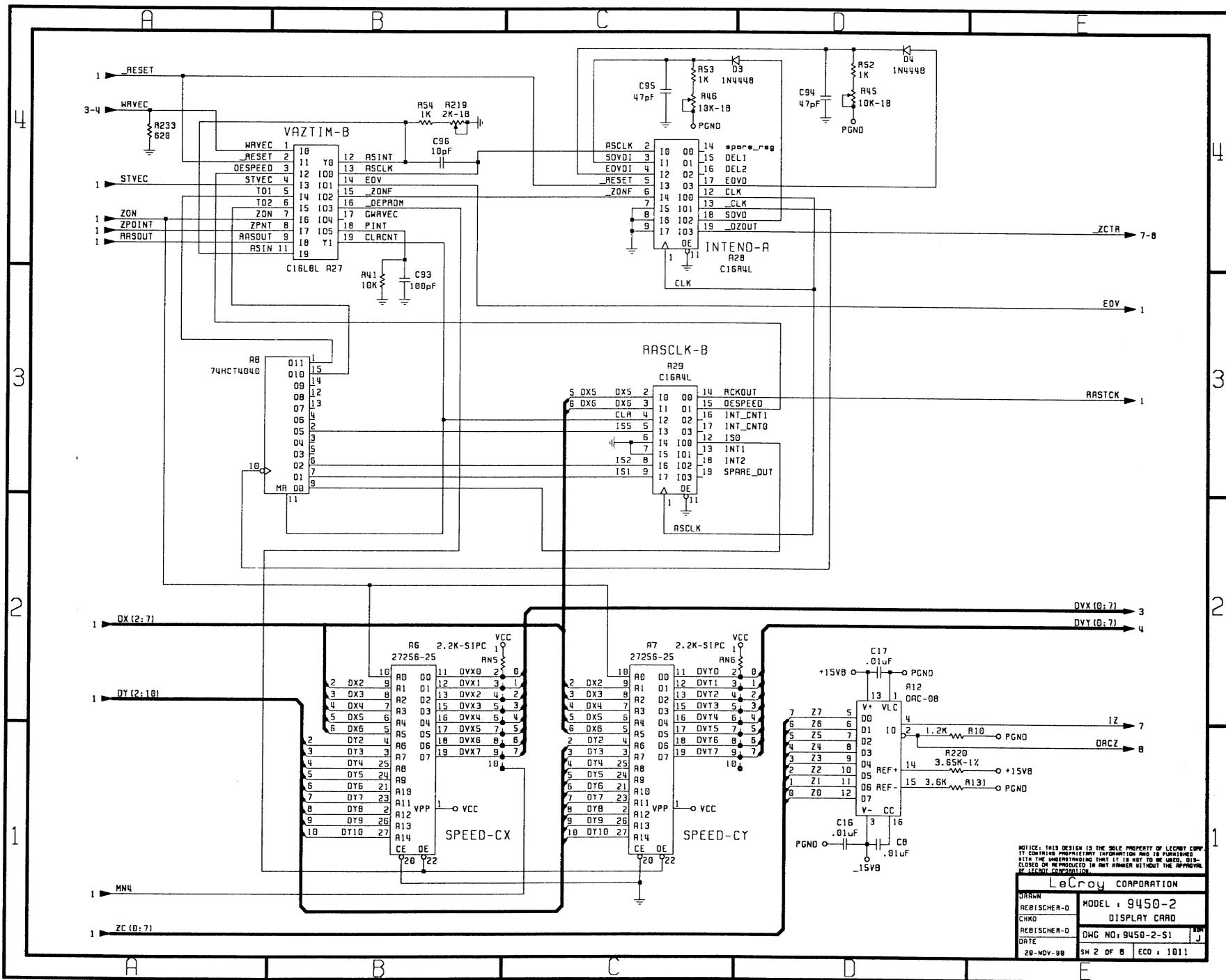
9424-2 REV: E

A1	74HC27	74HC27	DIP14	1524000	50800	1 0
C1	103427104	.1uF	SMONOBP	2692400	50800	1 270
J1	454611040	2x20-RA-M-3W	CONN2X20_RA_M_3W	5130800	254000	1 270
J2	404500068	2x34-RA-CGS	CONN4X17_RA_CGS	0	0	1 90
RN1	190642103	10K-6SC	SIP6RES	3149600	50800	1 0



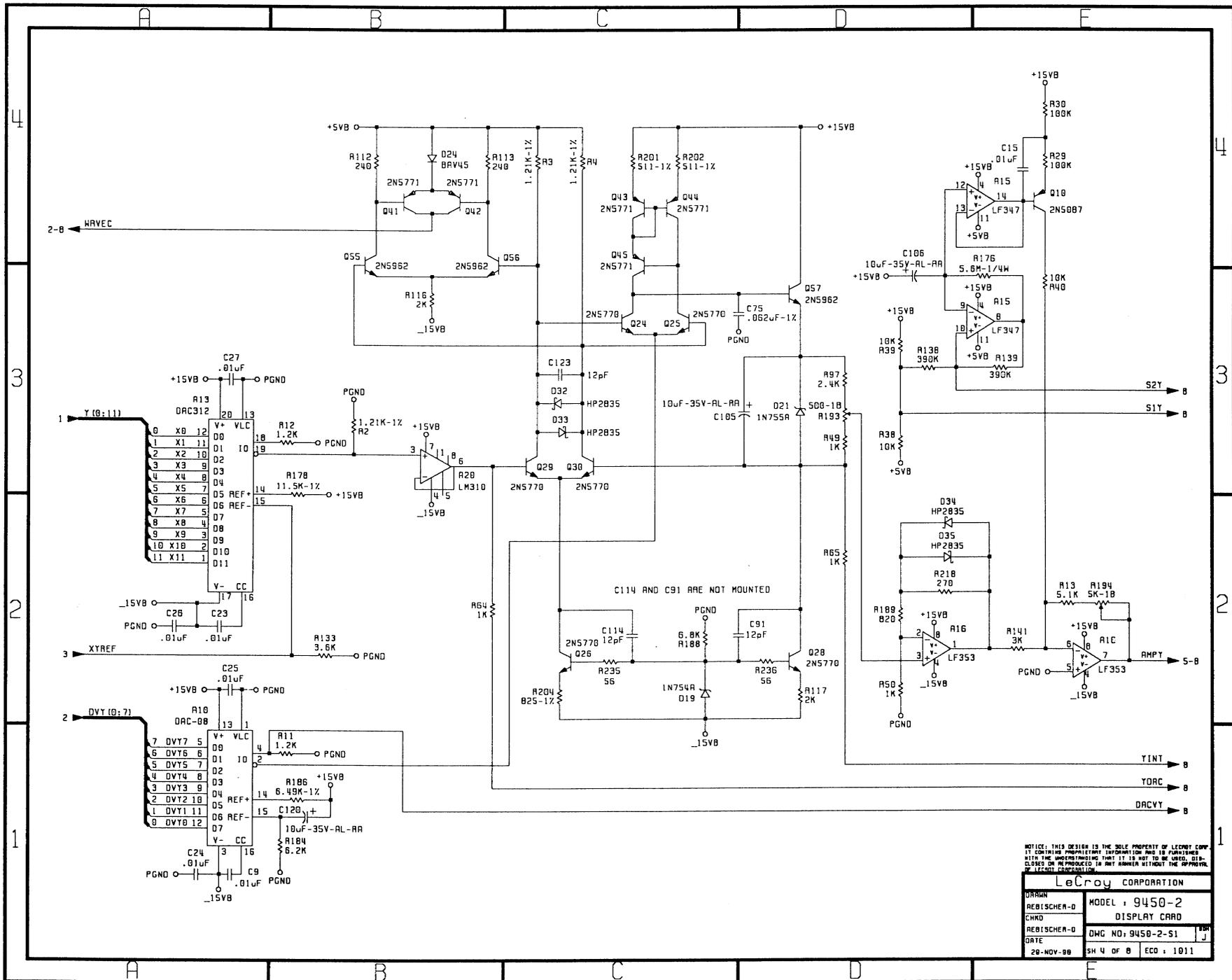
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LeCroy CORPORATION	
DRAWN	MODEL : 9450-2
CHKD	DISPLAY CARD
REBISCHER-D	DWG NO: 9450-2-51
DATE	SH 1 OF 8
28-NOV-89	ECO : 1011



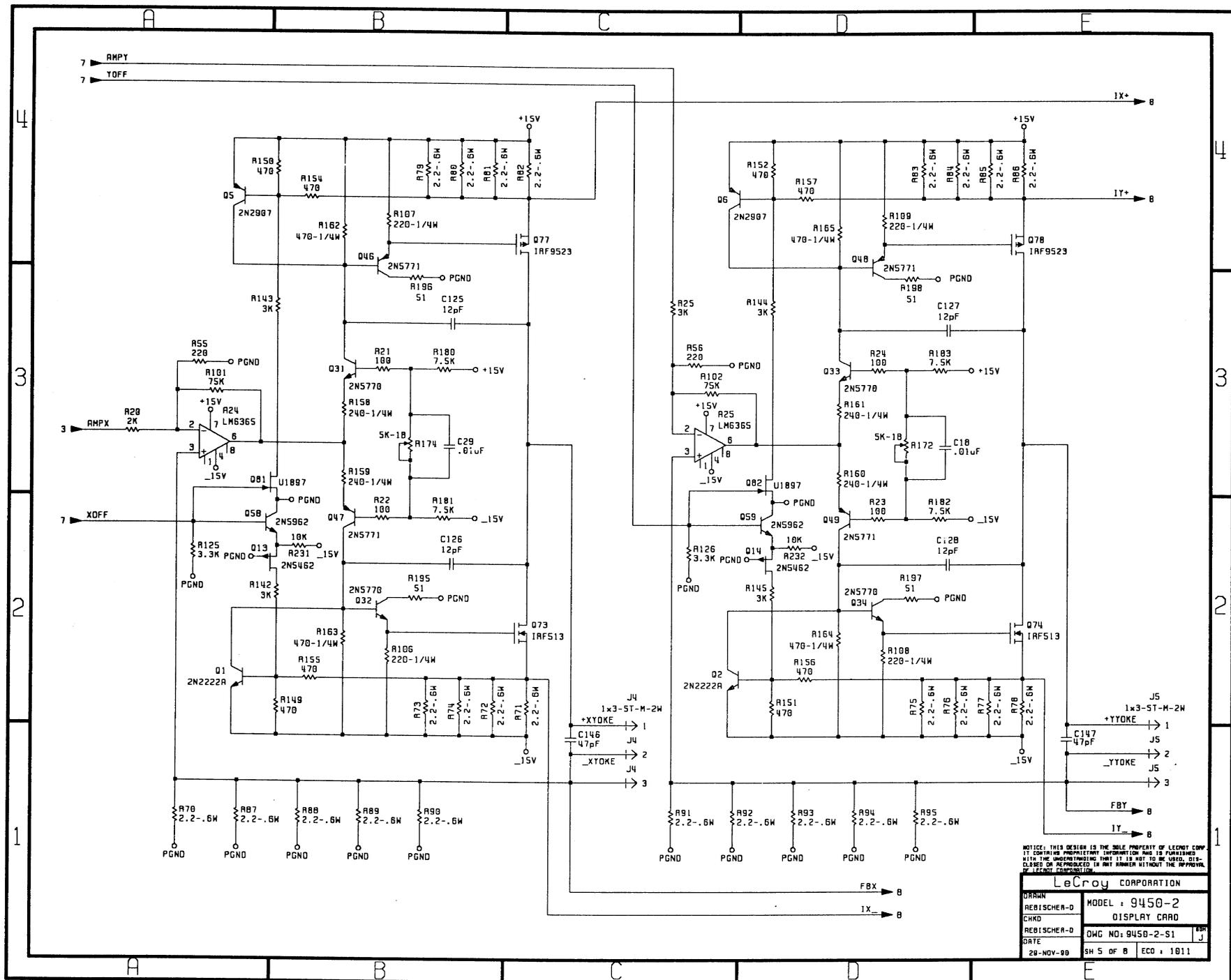
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LeCroy CORPORATION	
DRWN REBISCHER-D	MODEL : 9450-2
CHKD REBISCHER-D	DISPLAY CARD
DATE 28-NOV-88	DWG NO: 9450-2-S1
	SH 2 OF 8
	ECO : 1011



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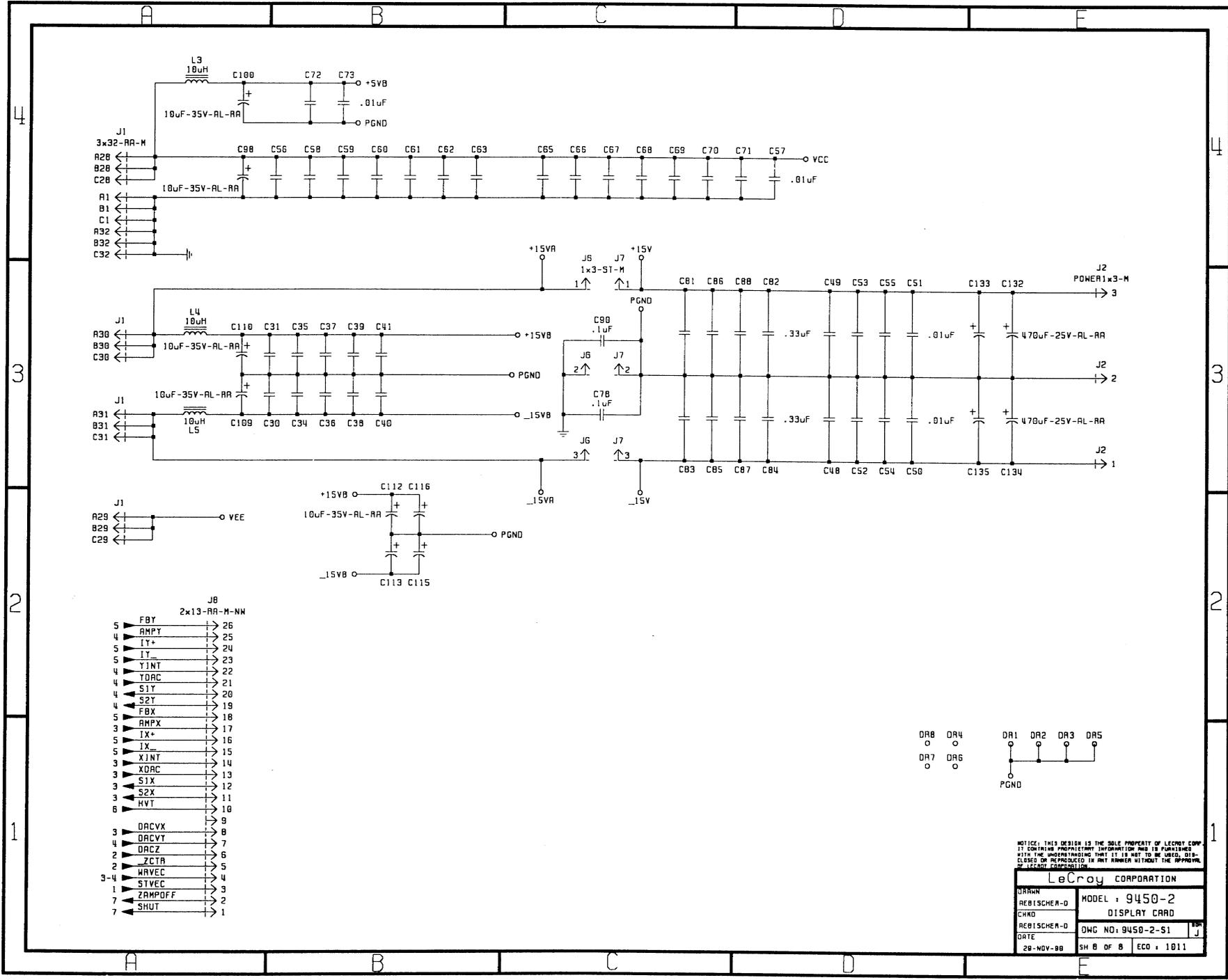
LeCroy CORPORATION	
DRAWN	MODEL : 9450-2
REBISCHER-D	DISPLAY CARD
CHKD	
REBISCHER-D	DMG NO: 9450-2-S1
DATE	SH 4 OF 8
28-NOV-88	ECO : 1811



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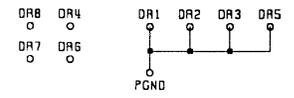
LeCroy CORPORATION

DRAWN	REBISCHER-D	MODEL :	9450-2
CHECK	REBISCHER-D		DISPLAY CARD
DATE	28-NOV-98	DWG NO:	9450-2-S1
		SH 5 OF 8	ECO : 1811



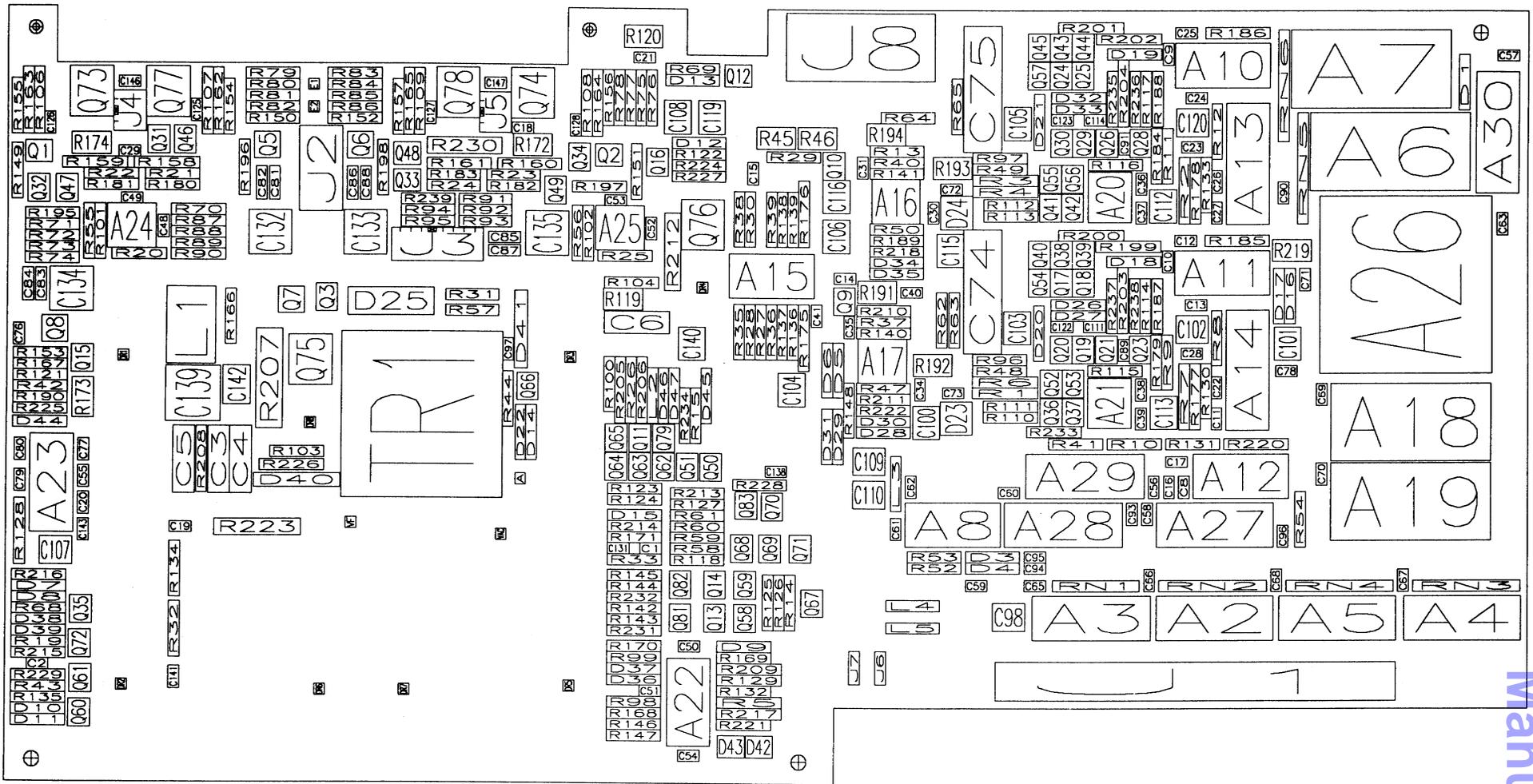
JB
2x13-RA-M-NH

5	FBY	26
4	AMPY	25
5	LY+	24
5	YINT	23
4	YDAC	22
4	S1Y	21
4	S2Y	19
5	FBX	18
3	AMPX	17
5	IX+	16
5	IX-	15
3	XINT	14
3	XDAC	13
3	S1X	12
3	S2X	11
6	HVT	10
		9
3	DACVX	8
4	DACVT	7
2	DACZ	6
	ZCTA	6
2	WAVEC	5
3-4	STVEC	4
1	ZAMPOFF	3
7	SHUT	2
7	SHUT	1

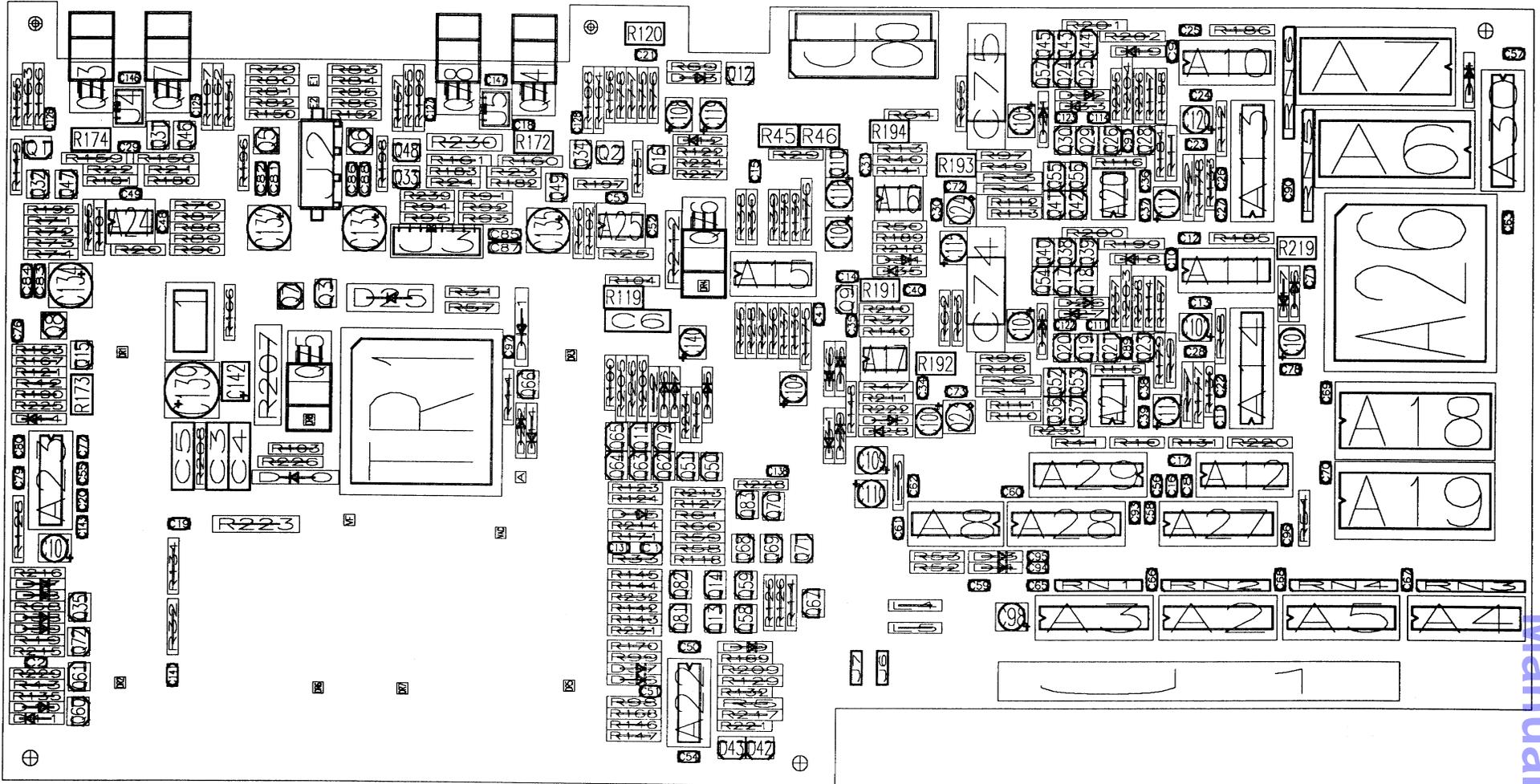


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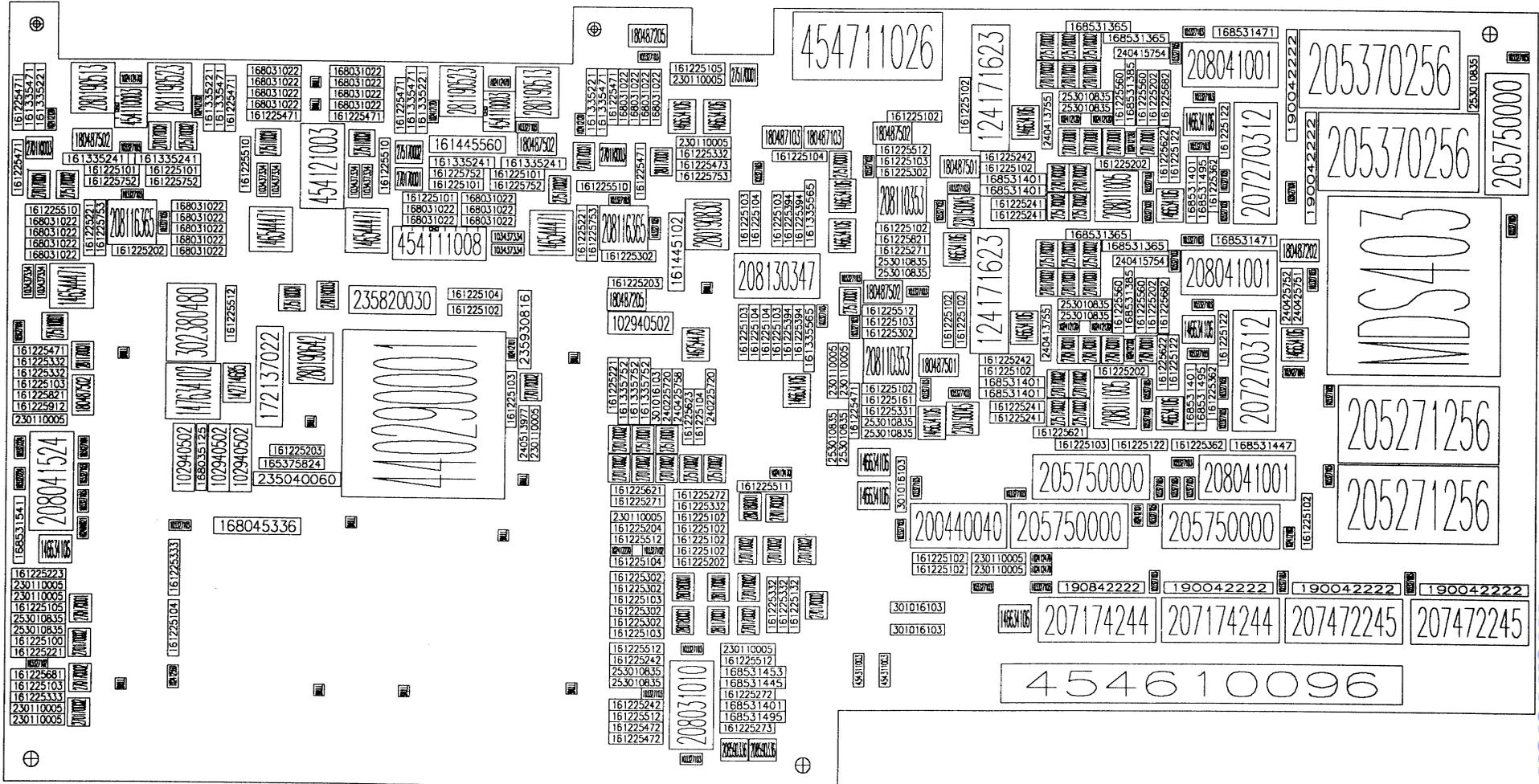
LeCroy CORPORATION	
DRAWN REBISCHER-D	MODEL : 9450-2
CHECKED REBISCHER-D	DISPLAY CARD
DATE 20-NOV-88	DWG NO: 9450-2-S1
	SH 8 OF 8 ECO : 1011



9450-2 Rev:J



9450-2 Rev:J



9450-2 Rev:J

A2	207174244	74HCT244	DIP20	-711200	1676400	1	90
A3	207174244	74HCT244	DIP20	-3606800	1676400	1	90
A4	207472245	74HCT245	DIP20	5130800	1676400	1	90
A5	207472245	74HCT245	DIP20	2184400	1676400	1	90
A6	205370256	27256-25	DIP28	6197600	13512800	1	270
A7	205370256	27256-25	DIP28	5740400	15392400	1	270
A8	200440040	74HCT4040	DIP16	-4826000	4572000	1	270
A10	208041001	DAC-08	DIP16	-304800	14325600	1	90
A11	208041001	DAC-08	DIP16	-304800	9601200	1	90
A12	208041001	DAC-08	DIP16	152400	4927600	1	90
A13	207270312	DAC312	DIP20	1574800	11328400	1	180
A14	207270312	DAC312	DIP20	1574800	6604000	1	180
A15	208130347	LF347	DIP14	-10769600	9499600	1	90
A16	208110353	LF353	DIP8	-7467600	11226800	1	90
A17	208110353	LF353	DIP8	-7772400	7569200	1	90
A18	205271256	62256-12	DIP28	3403600	5791200	1	90
A19	205271256	62256-12	DIP28	3403600	3962400	1	90
A20	208011005	LM310	DIP8	-1676400	11328400	1	180
A21	208011005	LM310	DIP8	-1676400	6604000	1	180
A22	208031010	LM339	DIP14	-12293600	863600	1	0
A23	208041524	LM3524	DIP16	-27279600	5943600	1	0
A24	208116365	LM6365	DIP8	-25450800	10566400	1	90
A25	208116365	LM6365	DIP8	-13970000	10566400	1	90
A26	MDS403	MDS403	GRID121	3403600	11226800	1	0
A27	205750000	C16L8L	DIP20	-711200	3810000	1	90
A28	205750000	C16R4L	DIP20	-4267200	3810000	1	90
A29	205750000	C16R4L	DIP20	-1473200	5689600	1	270
A30	205750000	C16R4L	DIP20	6705600	14325600	1	0
C1	103327102	.001uF	SMONO	-12700000	3606800	1	180
C2	103327102	.001uF	SMONO	-27330400	914400	1	0
C3	102940502	.005uF-1KV	R_P375_L500X200	-23012400	5130800	1	90
C4	102940502	.005uF-1KV	R_P375_L500X200	-22504400	5130800	1	90
C5	102940502	.005uF-1KV	R_P375_L500X200	-23825200	5130800	1	90
C6	102940502	.005uF-1KV	R_P375_L500X200	-12700000	8788400	1	180
C8	103327103	.01uF	SMONOBP	-304800	4927600	1	90
C9	103327103	.01uF	SMONOBP	-698500	14833600	1	90
C10	103327103	.01uF	SMONOBP	-698500	10109200	1	90
C11	103327103	.01uF	SMONOBP	457200	6502400	1	90
C12	103327103	.01uF	SMONOBP	-152400	10718800	1	180
C13	103327103	.01uF	SMONOBP	-152400	9245600	1	0
C14	103327103	.01uF	SMONOBP	-8153400	9829800	1	180
C15	103327103	.01uF	SMONOBP	-10452100	12090400	1	90
C16	103327103	.01uF	SMONOBP	-660400	5181600	1	270
C17	103327103	.01uF	SMONOBP	-355600	5638800	1	180
C18	103327103	.01uF	SMONOBP	-15748000	13208000	1	180
C19	103327103	.01uF	SMONOBP	-23774400	4064000	1	180
C20	103327103	.01uF	SMONOBP	-26162000	4724400	1	270
C21	103327103	.01uF	SMONOBP	-12903200	14833600	1	180
C22	103327103	.01uF	SMONOBP	457200	7213600	1	90
C23	103327103	.01uF	SMONOBP	-254000	12852400	1	0
C24	103327103	.01uF	SMONOBP	-152400	13970000	1	0
C25	103327103	.01uF	SMONOBP	-152400	15443200	1	180
C26	103327103	.01uF	SMONOBP	457200	11938000	1	90
C27	103327103	.01uF	SMONOBP	457200	11226800	1	90
C28	103327103	.01uF	SMONOBP	-254000	8128000	1	0
C29	103327103	.01uF	SMONOBP	-24993600	12649200	1	180
C30	103327103	.01uF	SMONOBP	-6197600	11226800	1	90
C31	103327103	.01uF	SMONOBP	-7874000	12242800	1	90
C34	103327103	.01uF	SMONOBP	-6502400	7416800	1	270
C35	103327103	.01uF	SMONOBP	-8178800	8585200	1	90
C36	103327103	.01uF	SMONOBP	-1320800	12141200	1	270
C37	103327103	.01uF	SMONOBP	-1320800	11226800	1	90
C38	103327103	.01uF	SMONOBP	-1320800	7416800	1	270
C39	103327103	.01uF	SMONOBP	-1320800	6502400	1	90
C40	103327103	.01uF	SMONOBP	-6578600	9525000	1	180
C41	103327103	.01uF	SMONOBP	-8940800	9093200	1	270

C48	103327103	.01uF	SMONOBP	-24333200	10820400	1	90
C49	103327103	.01uF	SMONOBP	-25196800	11582400	1	0
C50	103327103	.01uF	SMONOBP	-11785600	1371600	1	180
C51	103327103	.01uF	SMONOBP	-12700000	355600	1	180
C52	103327103	.01uF	SMONOBP	-12852400	10820400	1	90
C53	103327103	.01uF	SMONOBP	-13817600	11582400	1	0
C54	103327103	.01uF	SMONOBP	-11785600	-1117600	1	180
C55	103327103	.01uF	SMONOBP	-26162000	5334000	1	270
C56	103327103	.01uF	SMONOBP	-1016000	4927600	1	90
C57	103327103	.01uF	SMONOBP	7467600	14935200	1	180
C58	103327103	.01uF	SMONOBP	-1168400	4572000	1	270
C59	103327103	.01uF	SMONOBP	-5029200	2794000	1	180
C60	103327103	.01uF	SMONOBP	-4267200	4927600	1	180
C61	103327103	.01uF	SMONOBP	-7061200	4216400	1	270
C62	103327103	.01uF	SMONOBP	-6705600	4927600	1	90
C63	103327103	.01uF	SMONOBP	7213600	10972800	1	90
C65	103327103	.01uF	SMONOBP	-3657600	2794000	1	180
C66	103327103	.01uF	SMONOBP	-1117600	2794000	1	90
C67	103327103	.01uF	SMONOBP	4876800	2794000	1	90
C68	103327103	.01uF	SMONOBP	1879600	2794000	1	90
C69	103327103	.01uF	SMONOBP	2946400	7315200	1	270
C70	103327103	.01uF	SMONOBP	2946400	5486400	1	270
C71	103327103	.01uF	SMONOBP	2540000	9702800	1	90
C72	103327103	.01uF	SMONOBP	-5638800	11887200	1	180
C73	103327103	.01uF	SMONOBP	-5588000	7213600	1	180
C74	124171623	.062uF-1%	A_P900_L600X350	-5029200	10718800	1	270
C75	124171623	.062uF-1%	A_P900_L600X350	-5041900	15341600	1	270
C76	103427104	.1uF	SMONOBP	-27686000	8585200	1	270
C77	103427104	.1uF	SMONOBP	-26162000	5943600	1	270
C78	103427104	.1uF	SMONOBP	2235200	7721600	1	180
C79	103327224	.22uF	SMONO	-27635200	5232400	1	270
C80	103327224	.22uF	SMONO	-27635200	5689600	1	90
C81	103437334	.33uF	LMONO	-21742400	12192000	1	270
C82	103437334	.33uF	LMONO	-22047200	12192000	1	270
C83	103437334	.33uF	LMONO	-27178000	9347200	1	90
C84	103437334	.33uF	LMONO	-27482800	9347200	1	90
C85	103437334	.33uF	LMONO	-16052800	10718800	1	180
C86	103437334	.33uF	LMONO	-19913600	12192000	1	270
C87	103437334	.33uF	LMONO	-16052800	10414000	1	180
C88	103437334	.33uF	LMONO	-19608800	12192000	1	270
C89	102412120	12pF	SMONO	-1727200	8077200	1	90
C90	103427104	.1uF	SMONOBP	2032000	11684000	1	90
C91	102412120	12pF	SMONO	-1727200	12801600	1	90
C93	102412101	100pF	SMONO	-1524000	4572000	1	270
C94	102412470	47pF	SMONO	-3911600	3200400	1	0
C95	102412470	47pF	SMONO	-3911600	3454400	1	0
C96	102412100	10pF	SMONO	2032000	4064000	1	270
C97	102412101	100pF	SMONO	-16205200	8026400	1	90
C98	146634106	10uF-35V-AL-RA	TCAP	-4267200	2082800	1	180
C100	146634106	10uF-35V-AL-RA	TCAP	-6350000	6654800	1	270
C101	146634106	10uF-35V-AL-RA	TCAP	2133600	8229600	1	90
C102	146634106	10uF-35V-AL-RA	TCAP	0	8686800	1	180
C103	146634106	10uF-35V-AL-RA	TCAP	-4216400	8839200	1	270
C104	146634106	10uF-35V-AL-RA	TCAP	-9525000	7137400	1	90
C105	146634106	10uF-35V-AL-RA	TCAP	-4216400	13512800	1	270
C106	146634106	10uF-35V-AL-RA	TCAP	-8483600	10922000	1	270
C107	146634106	10uF-35V-AL-RA	TCAP	-26670000	3505200	1	180
C108	146634106	10uF-35V-AL-RA	TCAP	-12242800	13360400	1	90
C109	146634106	10uF-35V-AL-RA	TCAP	-7569200	5638800	1	180
C110	146634106	10uF-35V-AL-RA	TCAP	-7823200	4876800	1	0
C111	102412120	12pF	SMONO	-2540000	8737600	1	0
C112	146634106	10uF-35V-AL-RA	TCAP	-812800	11379200	1	90
C113	146634106	10uF-35V-AL-RA	TCAP	-787400	6642100	1	90
C114	102412120	12pF	SMONO	-2540000	13462000	1	0
C115	146634106	10uF-35V-AL-RA	TCAP	-5791200	10363200	1	90
C116	146634106	10uF-35V-AL-RA	TCAP	-8483600	11836400	1	270

C119	146634106	10uF-35V-AL-RA	TCAP	-11430000	13360400	1 90
C120	146634106	10uF-35V-AL-RA	TCAP	0	13411200	1 180
C122	102412120	12pF	SMONO	-3048000	8737600	1 180
C123	102412120	12pF	SMONO	-3048000	13462000	1 180
C125	102412120	12pF	SMONO	-23571200	13716000	1 270
C126	102412120	12pF	SMONO	-26974800	13157200	1 90
C127	102412120	12pF	SMONO	-18084800	13411200	1 90
C128	102412120	12pF	SMONO	-14630400	13157200	1 90
C131	102412220	22pF	SMONO	-13716000	3606800	1 0
C132	146544471	470uF-25V-AL-RA	R_P200_D400	-21844000	11074400	1 270
C133	146544471	470uF-25V-AL-RA	R_P200_D400	-19608800	11074400	1 270
C134	146544471	470uF-25V-AL-RA	R_P200_D400	-26466800	9753600	1 270
C135	146544471	470uF-25V-AL-RA	R_P200_D400	-15290800	11074400	1 270
C138	102412470	47pF	SMONO	-9753600	5384800	1 180
C139	147634102	1000uF-25V-AL-RA	R_P200_D500	-23622000	6858000	1 90
C140	146754470	47uF-50V-AL-RA	TCAP	-11887200	8178800	1 90
C141	102412560	56pF	SMONO	-24028400	762000	1 270
C142	142714685	6.8uF-25V-SAL	LTCAP	-22606000	7061200	1 90
C143	102484821	820pF	SMONO	-26162000	3860800	1 90
C146	102412470	47pF	SMONO	-25247600	14224000	1 0
C147	102412470	47pF	SMONO	-16662400	14224000	1 0
D1	253010835	HP2835	DO35	6299200	13817600	1 90
D3	230110005	1N4448	DO35	-5283200	3454400	1 0
D4	230110005	1N4448	DO35	-5283200	3200400	1 0
D5	230110005	1N4448	DO35	-8432800	7213600	1 90
D6	230110005	1N4448	DO35	-8686800	8229600	1 270
D7	230110005	1N4448	DO35	-27686000	2692400	1 0
D8	230110005	1N4448	DO35	-27686000	2438400	1 0
D9	230110005	1N4448	DO35	-11125200	1371600	1 0
D10	230110005	1N4448	DO35	-27686000	-101600	1 0
D11	230110005	1N4448	DO35	-26670000	-355600	1 180
D12	230110005	1N4448	DO35	-11226800	12903200	1 180
D13	230110005	1N4448	DO35	-12395200	14325600	1 0
D14	230110005	1N4448	DO35	-15646400	6756400	1 270
D15	230110005	1N4448	DO35	-13716000	4368800	1 0
D16	240425751	ELN751A	DO35	2184400	8940800	1 90
D17	240425752	ELN752A	DO35	1930400	9956800	1 270
D18	240415754	1N754A	DO35	-990600	10236200	1 180
D19	240415754	1N754A	DO35	-990600	14960600	1 180
D20	240413755	1N755A	DO35	-3708400	8077200	1 90
D21	240413755	1N755A	DO35	-3708400	12903200	1 90
D22	240513977	1N977B	DO35	-15900400	5740400	1 90
D23	230150045	BAV45	tol18_2L	-5638800	4724400	1 0
D24	230150045	BAV45	tol18_2L	-5638800	9448800	1 0
D25	235820030	EGP30D	A_P600_L400X250	-18237200	9245600	1 180
D26	253010835	HP2835	DO35	-3302000	9245600	1 0
D27	253010835	HP2835	DO35	-2286000	8991600	1 180
D28	253010835	HP2835	DO35	-6858000	6299200	1 180
D29	253010835	HP2835	DO35	-8432800	5689600	1 90
D30	253010835	HP2835	DO35	-7874000	6553200	1 0
D31	253010835	HP2835	DO35	-8686800	6705600	1 270
D32	253010835	HP2835	DO35	-3302000	13970000	1 0
D33	253010835	HP2835	DO35	-2286000	13716000	1 180
D34	253010835	HP2835	DO35	-7569200	10210800	1 0
D35	253010835	HP2835	DO35	-6553200	9956800	1 180
D36	253010835	HP2835	DO35	-13716000	609600	1 0
D37	253010835	HP2835	DO35	-13716000	863600	1 0
D38	253010835	HP2835	DO35	-27686000	1930400	1 0
D39	253010835	HP2835	DO35	-27686000	1676400	1 0
D40	235040060	LM60	A_P600_L400X125	-20421600	5130800	1 180
D41	235930816	MR816	A_P500_L300X120	-15900400	9245600	1 270
D42	208590336	LM336-2.5	TO92	-10058400	-965200	1 180
D43	208590336	LM336-2.5	TO92	-10718800	-965200	1 180
D44	230110005	1N4448	DO35	-26670000	6451600	1 180
D45	240225720	1N5248-DO35	DO35	-11531600	6604000	1 90
D46	240225720	1N5248-DO35	DO35	-12547600	6604000	1 90

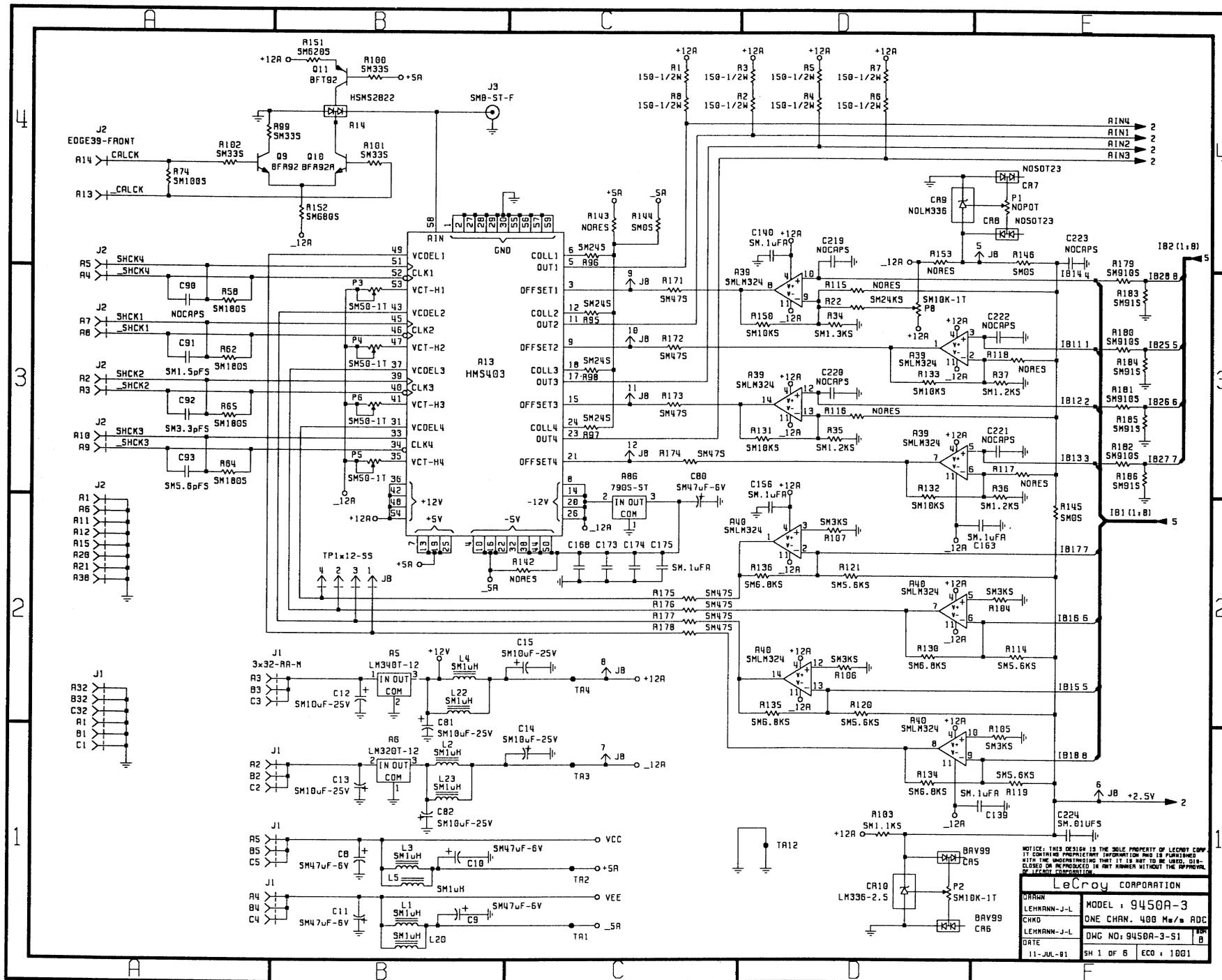
Q54	270170002	2N5962	TO92	-3759200	9550400	1	90
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Q56	270170002	2N5962	TO92	-2870200	12319000	1	270
Q57	270170002	2N5962	TO92	-3784600	14274800	1	90
Q58	270170002	2N5962	TO92	-10668000	1828800	1	90
Q59	270170002	2N5962	TO92	-10668000	2590800	1	90
Q60	270170002	2N5962	TO92	-26162000	0	1	270
Q61	270170002	2N5962	TO92	-26263600	406400	1	90
Q62	270170002	2N5962	TO92	-12598400	5283200	1	90
Q63	270170002	2N5962	TO92	-13157200	5283200	1	90
Q64	270170002	2N5962	TO92	-13716000	5283200	1	90
Q65	270170002	2N5962	TO92	-13716000	5943600	1	90
Q66	270170002	2N5962	TO92	-15798800	7112000	1	90
Q67	270170002	2N5962	TO92	-9093200	2184400	1	90
Q68	270170002	2N5962	TO92	-10617200	3810000	1	270
Q69	270170002	2N5962	TO92	-9956800	3810000	1	270
Q70	270170002	2N5962	TO92	-10033000	4394200	1	90
Q71	270170002	2N5962	TO92	-9245600	3810000	1	270
Q72	270170002	2N5962	TO92	-26162000	1574800	1	270
Q73	280190513	IRF513	TO220	-26263600	13614400	1	90
Q74	280190513	IRF513	TO220	-15900400	13614400	1	90
Q75	280190642	IRF642	TO220	-20624800	8280400	1	270
Q76	280190830	IRF830	TO220	-11379200	11430000	1	270
Q77	281190523	IRF9523	TO220	-24485600	13614400	1	90
Q78	281190523	IRF9523	TO220	-17678400	13614400	1	90
Q79	275170001	2n5087	TO92	-12598400	5943600	1	90
Q81	280180001	U1897	TO92	-12192000	1828800	1	90
Q82	280180001	U1897	TO92	-12192000	2590800	1	90
Q83	280180001	U1897	TO92	-10642600	4419600	1	90
R1	168531401	'1.21K-1%'	RES07	-5130800	7213600	1	0
R2	168531401	'1.21K-1%'	RES07	-304800	11226800	1	90
R3	168531401	'1.21K-1%'	RES07	-5130800	12090400	1	0
R4	168531401	'1.21K-1%'	RES07	-5130800	11836400	1	0
R5	168531401	'1.21K-1%'	RES07	-9855200	101600	1	180
R6	168531401	'1.21K-1%'	RES07	-5130800	7467600	1	0
R7	168531401	'1.21K-1%'	RES07	-304800	6502400	1	90
R8	161225122	1.2K	RES05	457200	7975600	1	90
R9	161225122	1.2K	RES05	-711200	8432800	1	270
R10	161225122	1.2K	RES05	-965200	6045200	1	180
R11	161225122	1.2K	RES05	-711200	13157200	1	270
R12	161225122	1.2K	RES05	457200	12700000	1	90
R13	161225512	5.1K	RES05	-6553200	12750800	1	180
R14	161225132	1.3K	RES05	-9550400	1879600	1	90
R15	161225104	100K	RES05	-11785600	6146800	1	90
R19	161225100	10	RES05	-27686000	1422400	1	0
R20	161225202	2K	RES05	-24384000	10312400	1	180
R21	161225101	100	RES05	-23622000	12141200	1	180
R22	161225101	100	RES05	-26060400	12141200	1	0
R23	161225101	100	RES05	-15595600	12141200	1	180
R24	161225101	100	RES05	-18034000	11887200	1	0
R25	161225302	3K	RES05	-12954000	10312400	1	180
R26	161335752	7.5K-1/4W	RES07	-13309600	7874000	1	270
R27	161225104	100K	RES05	-10261600	9093200	1	270
R28	161225104	100K	RES05	-10515600	8077200	1	90
R29	161225104	100K	RES05	-10007600	12598400	1	0
R30	161225104	100K	RES05	-10515600	10668000	1	90
R31	161225104	100K	RES05	-17576800	9398000	1	0
R32	161225104	100K	RES05	-24028400	2235200	1	270
R33	161225104	100K	RES05	-12700000	3352800	1	180
R35	161225103	10K	RES05	-10769600	8077200	1	90
R36	161225103	10K	RES05	-10007600	8077200	1	90
R37	161225103	10K	RES05	-6858000	8839200	1	180
R38	161225103	10K	RES05	-10769600	11684000	1	270
R39	161225103	10K	RES05	-10007600	11684000	1	270
R40	161225103	10K	RES05	-6553200	12496800	1	180
R41	161225103	10K	RES05	-2336800	6045200	1	180

R42	161225103	10K	RES05	-27686000	7264400	1 0
R43	161225103	10K	RES05	-27686000	406400	1 0
R44	161225103	10K	RES05	-16205200	6502400	1 90
R45	180487103	10K-1B	pot3386x	-10160000	12903200	1 0
R46	180487103	10K-1B	pot3386x	-9194800	12903200	1 0
R47	161225102	1K	RES05	-7874000	7315200	1 0
R48	161225102	1K	RES05	-5130800	7721600	1 0
R49	161225102	1K	RES05	-5130800	12344400	1 0
R50	161225102	1K	RES05	-7569200	10972800	1 0
R52	161225102	1K	RES05	-5638800	3200400	1 180
R53	161225102	1K	RES05	-5638800	3454400	1 180
R54	161225102	1K	RES05	2438400	3810000	1 90
R55	161225221	220	RES05	-26060400	10312400	1 90
R56	161225221	220	RES05	-14579600	10312400	1 90
R57	161225102	1K	RES05	-17576800	9042400	1 0
R58	161225102	1K	RES05	-12242800	3606800	1 0
R59	161225102	1K	RES05	-12242800	3860800	1 0
R60	161225102	1K	RES05	-12242800	4114800	1 0
R61	161225102	1K	RES05	-12242800	4368800	1 0
R62	161225102	1K	RES05	-5994400	8382000	1 90
R63	161225102	1K	RES05	-5689600	8382000	1 90
R64	161225102	1K	RES05	-6299200	13512800	1 180
R65	161225102	1K	RES05	-5638800	13258800	1 90
R68	161225105	1M	RES05	-27686000	2184400	1 0
R69	161225105	1M	RES05	-12395200	14579600	1 0
R70	168031022	2.2-.6W	A_P400_L300X100	-24028400	11328400	1 0
R71	168031022	2.2-.6W	A_P400_L300X100	-26416000	10972800	1 180
R72	168031022	2.2-.6W	A_P400_L300X100	-26416000	10718800	1 180
R73	168031022	2.2-.6W	A_P400_L300X100	-26416000	10464800	1 180
R74	168031022	2.2-.6W	A_P400_L300X100	-26416000	10210800	1 180
R75	168031022	2.2-.6W	A_P400_L300X100	-13106400	14427200	1 270
R76	168031022	2.2-.6W	A_P400_L300X100	-12852400	14427200	1 270
R77	168031022	2.2-.6W	A_P400_L300X100	-13360400	14427200	1 270
R78	168031022	2.2-.6W	A_P400_L300X100	-13614400	14427200	1 270
R79	168031022	2.2-.6W	A_P400_L300X100	-21285200	14427200	1 180
R80	168031022	2.2-.6W	A_P400_L300X100	-21285200	14173200	1 180
R81	168031022	2.2-.6W	A_P400_L300X100	-21285200	13919200	1 180
R82	168031022	2.2-.6W	A_P400_L300X100	-21285200	13665200	1 180
R83	168031022	2.2-.6W	A_P400_L300X100	-20370800	14427200	1 0
R84	168031022	2.2-.6W	A_P400_L300X100	-20370800	14173200	1 0
R85	168031022	2.2-.6W	A_P400_L300X100	-20370800	13919200	1 0
R86	168031022	2.2-.6W	A_P400_L300X100	-20370800	13665200	1 0
R87	168031022	2.2-.6W	A_P400_L300X100	-24028400	11074400	1 0
R88	168031022	2.2-.6W	A_P400_L300X100	-24028400	10820400	1 0
R89	168031022	2.2-.6W	A_P400_L300X100	-24028400	10566400	1 0
R90	168031022	2.2-.6W	A_P400_L300X100	-24028400	10312400	1 0
R91	168031022	2.2-.6W	A_P400_L300X100	-17272000	11582400	1 0
R92	168031022	2.2-.6W	A_P400_L300X100	-17272000	11328400	1 0
R93	168031022	2.2-.6W	A_P400_L300X100	-17272000	11074400	1 0
R94	168031022	2.2-.6W	A_P400_L300X100	-17627600	11328400	1 180
R95	168031022	2.2-.6W	A_P400_L300X100	-17627600	11074400	1 180
R96	161225242	2.4K	RES05	-4114800	7975600	1 180
R97	161225242	2.4K	RES05	-4114800	12598400	1 180
R98	161225242	2.4K	RES05	-12700000	101600	1 180
R99	161225242	2.4K	RES05	-12700000	1117600	1 180
R100	161225221	220	RES05	-13817600	6858000	1 90
R101	161225753	75K	RES05	-25806400	10312400	1 90
R102	161225753	75K	RES05	-14325600	10312400	1 90
R103	161225203	20K	RES05	-20675600	5791200	1 180
R104	161225203	20K	RES05	-12801600	9702800	1 180
R106	161335221	220-1/4W	RES07	-27228800	13157200	1 90
R107	161335221	220-1/4W	RES07	-23317200	14427200	1 270
R108	161335221	220-1/4W	RES07	-14376400	13157200	1 90
R109	161335221	220-1/4W	RES07	-18338800	14427200	1 270
R110	161225241	240	RES05	-4876800	6654800	1 0
R111	161225241	240	RES05	-4876800	6908800	1 0

R112	161225241	240	RES05	-4876800	11531600	1 0
R113	161225241	240	RES05	-4876800	11277600	1 0
R114	161225202	2K	RES05	-1219200	8712200	1 90
R115	161225202	2K	RES05	-2438400	7721600	1 0
R116	161225202	2K	RES05	-2438400	12446000	1 0
R117	161225202	2K	RES05	-1219200	13436600	1 90
R118	161225202	2K	RES05	-12242800	3352800	1 0
R119	180487205	2M-1B	pot3386x	-13766800	9194800	1 0
R120	180487205	2M-1B	pot3386x	-13309600	15189200	1 0
R121	161225332	3.3K	RES05	-26670000	7518400	1 180
R122	161225332	3.3K	RES05	-11226800	12649200	1 180
R123	161225621	620	RES05	-12700000	4978400	1 180
R124	161225271	270	RES05	-12700000	4724400	1 180
R125	161225332	3.3K	RES05	-10058400	2895600	1 270
R126	161225332	3.3K	RES05	-9804400	2895600	1 270
R127	161225332	3.3K	RES05	-11226800	4622800	1 180
R128	168531541	'34.8K-1%'	RES07	-27635200	3302000	1 90
R129	168531445	'3.48K-1%'	RES07	-11125200	609600	1 0
R130	161225362	3.6K	RES05	203200	7772400	1 270
R131	161225362	3.6K	RES05	406400	6045200	1 180
R132	161225272	2.7K	RES05	-11125200	355600	1 0
R133	161225362	3.6K	RES05	203200	12496800	1 270
R134	161225333	33K	RES05	-24028400	3606800	1 270
R135	161225333	33K	RES05	-26670000	152400	1 180
R136	161225394	390K	RES05	-9499600	9093200	1 270
R137	161225394	390K	RES05	-9753600	8077200	1 90
R138	161225394	390K	RES05	-9753600	11684000	1 270
R139	161225394	390K	RES05	-9499600	10668000	1 90
R140	161225302	3K	RES05	-7874000	8585200	1 0
R141	161225302	3K	RES05	-7569200	12242800	1 0
R142	161225302	3K	RES05	-12700000	2235200	1 180
R143	161225302	3K	RES05	-13716000	1981200	1 0
R144	161225302	3K	RES05	-13716000	2743200	1 0
R145	161225302	3K	RES05	-12700000	2997200	1 180
R146	161225472	4.7K	RES05	-12700000	-406400	1 180
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R148	161225471	470	RES05	-8178800	6299200	1 90
R149	161225471	470	RES05	-27736800	12700000	1 270
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R151	161225471	470	RES05	-13208000	12750800	1 270
R152	161225471	470	RES05	-20370800	13411200	1 0
R153	161225471	470	RES05	-27686000	8026400	1 0
R154	161225471	470	RES05	-22809200	13157200	1 90
R155	161225471	470	RES05	-27736800	13157200	1 90
R156	161225471	470	RES05	-13868400	13411200	1 90
R157	161225471	470	RES05	-18846800	13157200	1 90
R158	161335241	240-1/4W	RES07	-23622000	12395200	1 180
R159	161335241	240-1/4W	RES07	-25298400	12395200	1 180
R160	161335241	240-1/4W	RES07	-16357600	12395200	1 0
R161	161335241	240-1/4W	RES07	-18034000	12395200	1 0
R162	161335471	470-1/4W	RES07	-23063200	14427200	1 270
R163	161335471	470-1/4W	RES07	-27482800	13157200	1 90
R164	161335471	470-1/4W	RES07	-14122400	13157200	1 90
R165	161335471	470-1/4W	RES07	-18592800	14427200	1 270
R166	161225512	5.1K	RES05	-22758400	8382000	1 90
R167	161225332	3.3K	RES05	-26670000	7772400	1 180
R168	161225512	5.1K	RES05	-13716000	-152400	1 0
R169	161225512	5.1K	RES05	-10109200	1117600	1 180
R170	161225512	5.1K	RES05	-13716000	1371600	1 0
R171	161225512	5.1K	RES05	-13716000	3860800	1 0
R172	180487502	5K-1B	pot3386x	-15900400	12700000	1 0
R173	180487502	5K-1B	pot3386x	-26060400	6756400	1 90
R174	180487502	5K-1B	pot3386x	-26263600	12700000	1 0
R175	161335565	5.6M-1/4W	RES07	-9245600	9093200	1 270
R176	161335565	5.6M-1/4W	RES07	-9245600	10668000	1 90
R177	168531495	'11.5K-1%'	RES07	-50800	7772400	1 270

R178	168531495	'11.5K-1%'	RES07	-50800	12496800	1	270
R179	161225622	6.2K	RES05	-965200	8432800	1	270
R180	161225752	7.5K	RES05	-24638000	11887200	1	0
R181	161225752	7.5K	RES05	-25044400	11887200	1	180
R182	161225752	7.5K	RES05	-16611600	11887200	1	0
R183	161225752	7.5K	RES05	-17018000	12141200	1	180
R184	161225622	6.2K	RES05	-965200	13157200	1	270
R185	168531471	'6.49K-1%'	RES07	304800	10718800	1	0
R186	168531471	'6.49K-1%'	RES07	304800	15443200	1	0
R187	161225682	6.8K	RES05	-939800	9728200	1	270
R188	161225682	6.8K	RES05	-939800	14452600	1	270
R189	161225821	820	RES05	-6553200	10718800	1	180
R190	161225821	820	RES05	-27686000	7010400	1	0
R191	180487502	5K-1B	pot3386x	-7772400	9398000	1	0
R192	180487501	500-1B	pot3386x	-6451600	7721600	1	0
R193	180487501	500-1B	pot3386x	-5994400	12242800	1	0
R194	180487502	5K-1B	pot3386x	-7569200	13004800	1	0
R195	161225510	51	RES05	-27432000	11226800	1	0
R196	161225510	51	RES05	-22453600	12801600	1	270
R197	161225510	51	RES05	-14579600	11887200	1	0
R198	161225510	51	RES05	-19202400	12801600	1	270
R199	168531365	'511-1%'	RES07	-990600	10579100	1	180
R200	168531365	'511-1%'	RES07	-1854200	10833100	1	180
R201	168531365	'511-1%'	RES07	-1879600	15557500	1	180
R202	168531365	'511-1%'	RES07	-990600	15303500	1	180
R203	168531385	'825-1%'	RES07	-1752600	8712200	1	90
R204	168531385	'825-1%'	RES07	-1752600	13436600	1	90
R205	161335752	7.5K-1/4W	RES07	-13563600	6604000	1	90
R206	161335752	7.5K-1/4W	RES07	-13055600	6604000	1	90
R207	172137022	.22-1W	RES32	-21844000	8483600	1	270
R208	168035125	1.2M-700V	A P500_L300X100	-23418800	6248400	1	270
R209	168531453	'4.22K-1%'	RES07	-9855200	863600	1	180
R210	161225512	5.1K	RES05	-6858000	9093200	1	180
R211	161225161	160	RES05	-6858000	7061200	1	180
R212	161445102	1K-1/2W	RES20	-12344400	11176000	1	270
R213	161225272	2.7K	RES05	-11226800	4876800	1	180
R214	161225204	200K	RES05	-13716000	4114800	1	0
R215	161225221	220	RES05	-26670000	1168400	1	180
R216	161225223	22K	RES05	-26670000	2946400	1	180
R217	168531495	'11.5K-1%'	RES07	-11125200	-152400	1	0
R218	161225271	270	RES05	-6553200	10464800	1	180
R219	180487202	2K-1B	pot3386x	1981200	10363200	1	0
R220	168531447	'3.65K-1%'	RES07	762000	6045200	1	0
R221	161225273	27K	RES05	-11125200	-406400	1	0
R222	161225331	330	RES05	-6858000	6807200	1	180
R223	168045336	33M-3KV	A P600_L400X150	-21336000	4064000	1	180
R224	161225473	47K	RES05	-11226800	12395200	1	180
R225	161225912	9.1K	RES05	-26670000	6756400	1	180
R226	165375824	820K-700V	A P500_L300X100	-21945600	5486400	1	0
R227	161225753	75K	RES05	-12242800	12141200	1	0
R228	161225511	510	RES05	-9753600	5080000	1	180
R229	161225681	680	RES05	-27686000	660400	1	0
R230	161445560	56-1/2W	RES20	-16510000	12801600	1	180
R231	161225103	10K	RES05	-12700000	1727200	1	180
R232	161225103	10K	RES05	-12700000	2489200	1	180
R233	161225621	620	RES05	-2844800	6324600	1	180
R234	161225623	62K	RES05	-12039600	6146800	1	90
R235	161225560	56	RES05	-2006600	13436600	1	90
R236	161225560	56	RES05	-1473200	14452600	1	270
R237	161225560	56	RES05	-2006600	8712200	1	90
R238	161225560	56	RES05	-1473200	9728200	1	270
R239	161225101	100	RES05	-17627600	11582400	1	180
RN1	190842222	2.2K-8SIPC	SIP8RES	-3251200	2794000	1	90
RN2	190042222	2.2K-SIPC	SIP10RES	-762000	2794000	1	90
RN3	190042222	2.2K-SIPC	SIPI0RES	5232400	2794000	1	90
RN4	190042222	2.2K-SIPC	SIPI0RES	2235200	2794000	1	90

RN5	190042222	2.2K-SIPC	SIPLORES	2489200	13512800	1 0
RN6	190042222	2.2K-SIPC	SIPLORES	2032000	15392400	1 0
TR1	440290001	4587	TRANSFO_HT	-19507200	7670800	1 0

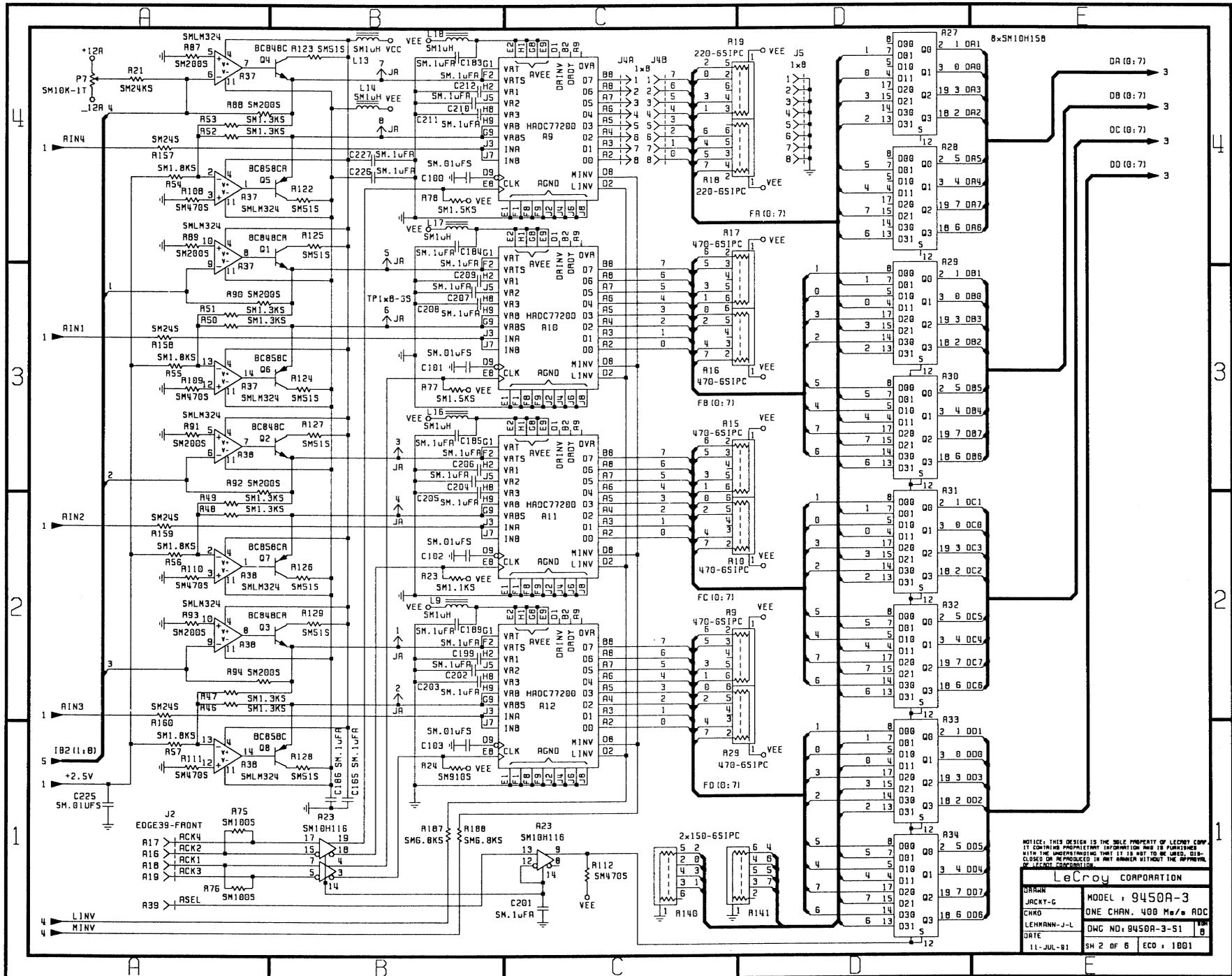


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LeCroy CORPORATION

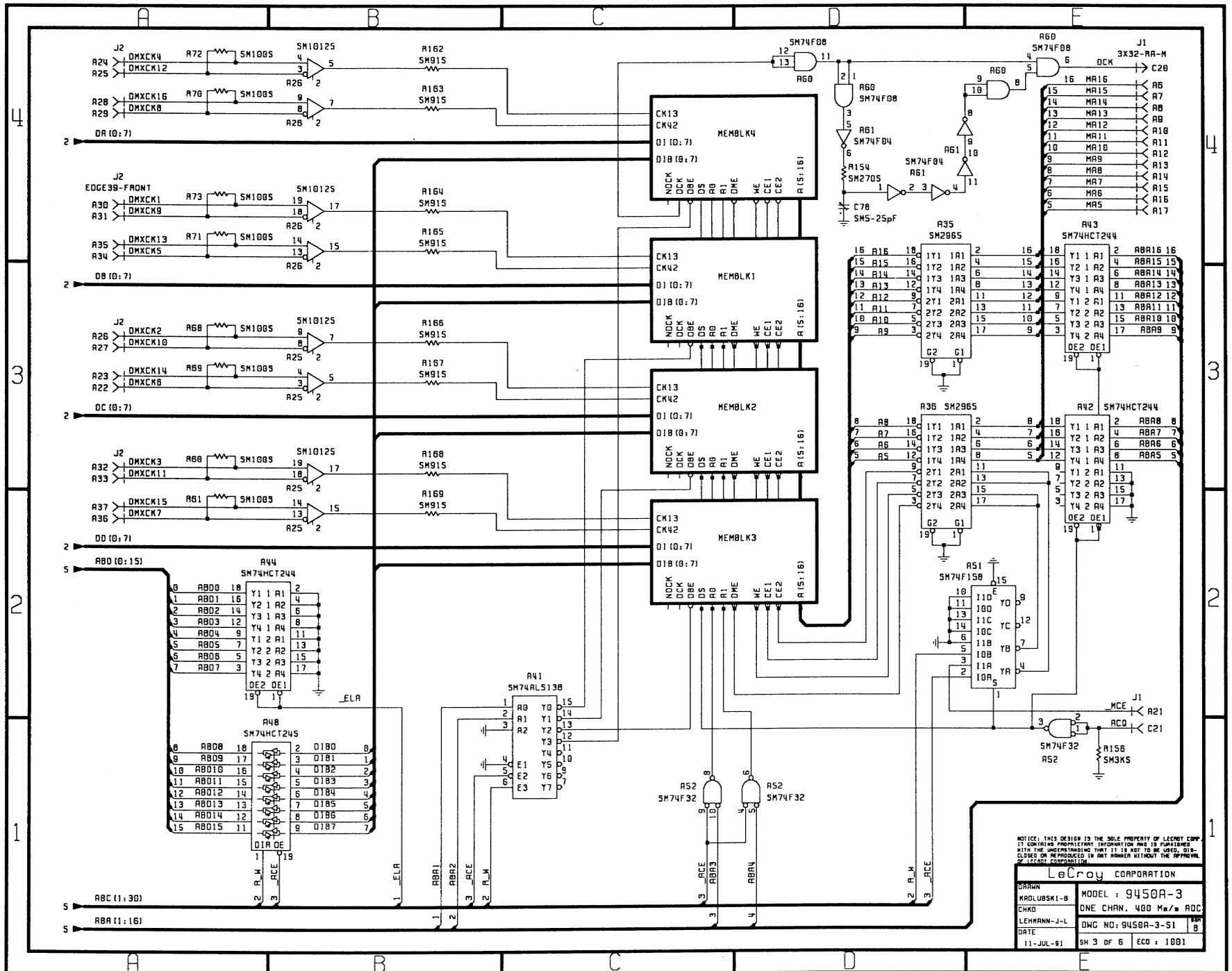
DRAWN: LEHMANN-J-L
 CHECK: LEHMANN-J-L
 DATE: 11-JUL-81

MODEL: 9450A-3
 ONE CHAN. 400 MHz/8 ADC
 DWG NO: 9450A-3-S1
 SH 1 OF 6 ECO: 1001



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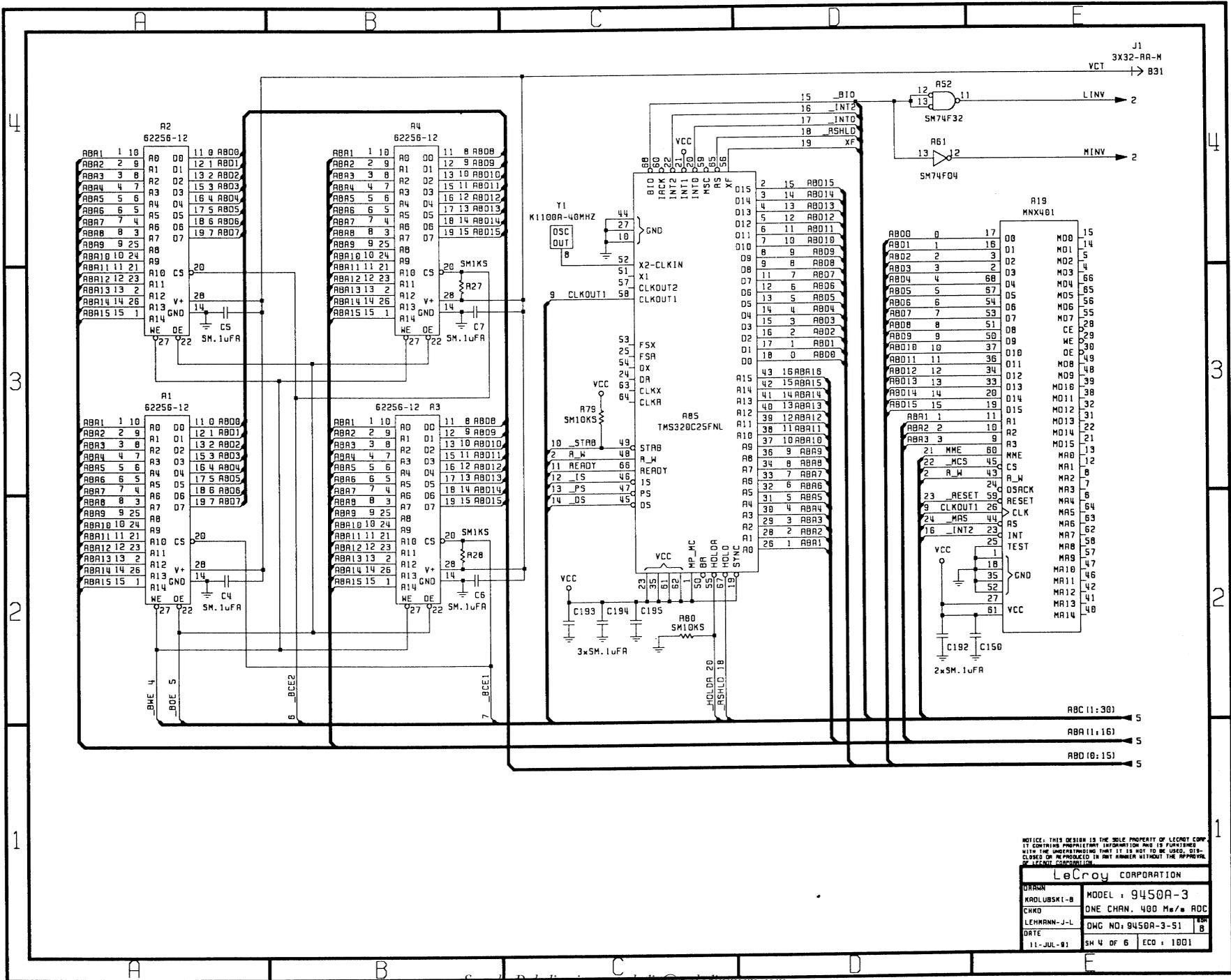
LeCroy CORPORATION	
DRAWN JACKY-G CHECK LEHMANN-J-L DATE 11-JUL-81	MODEL : 9450A-3 ONE CHAN. 400 MHz ADC DWG NO: 9450A-3-51 SHEET 2 OF 6 ECO : 1801



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LeCroy CORPORATION

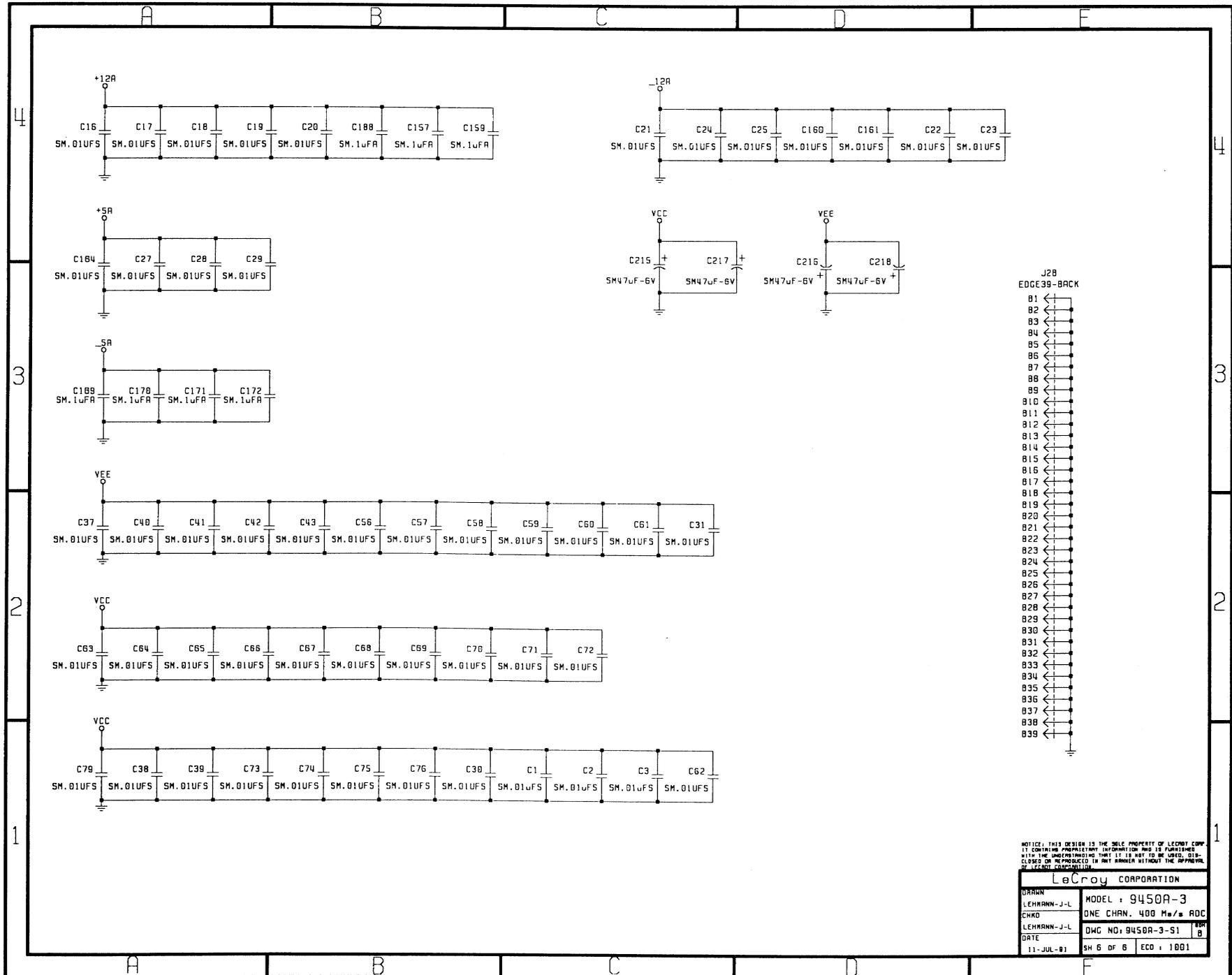
DRAWN	MODEL : 9450A-3
CHKD	ONE CHAN. 400 M#/# ADC
LEHMANN-J-L	DWG NO: 9450A-3-S1
DATE	SH 3 OF 6 ECO : 1001



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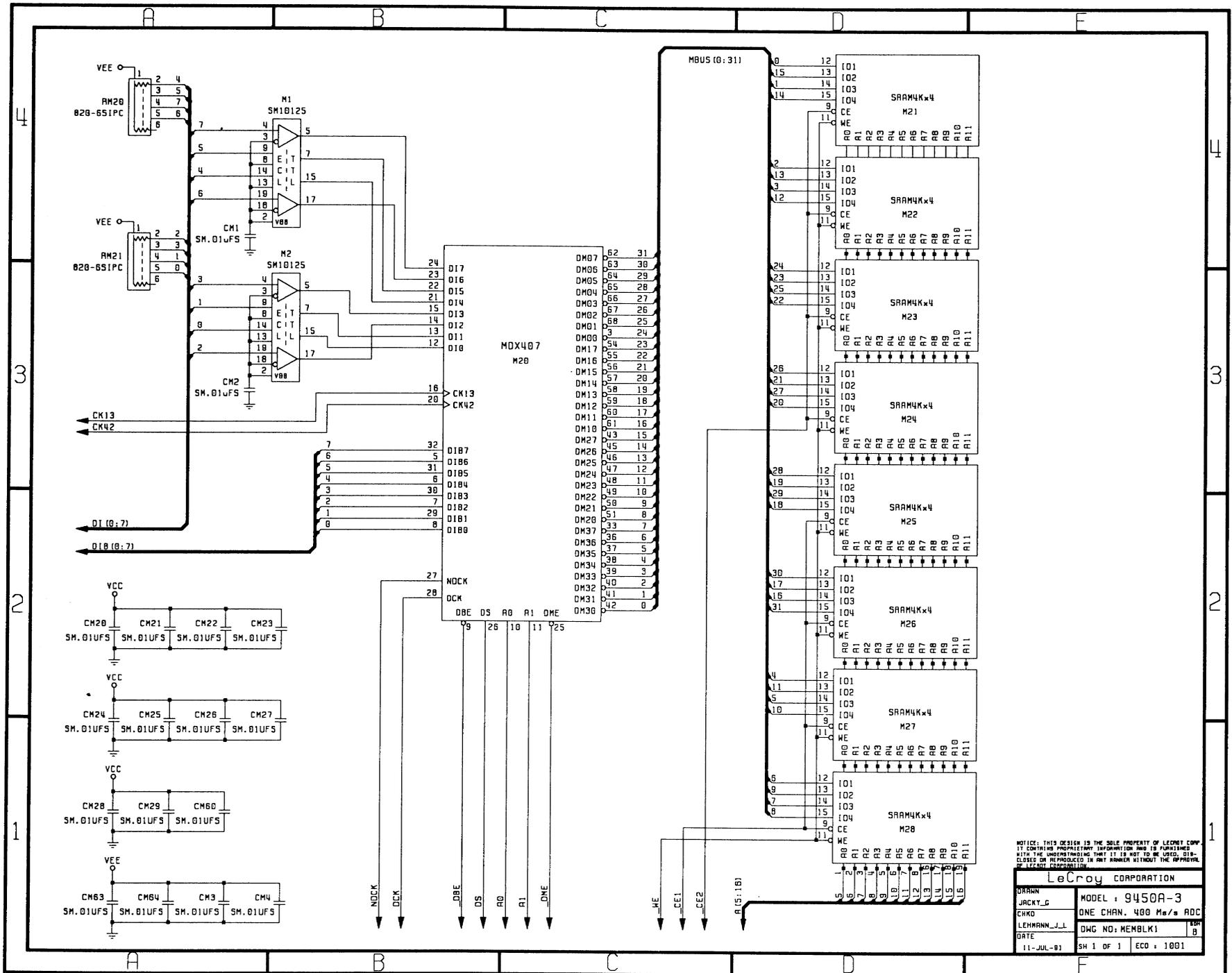
LeCroy CORPORATION

UNAN	MODEL : 9450A-3
KADLUBSKI-B	ONE CHAN., 480 M _z /M ADC
CWKD	DWG NO: 9450A-3-51
LEHMANN-J-L	DATE
11-JUL-81	SH 4 OF 6 ECO : 1001



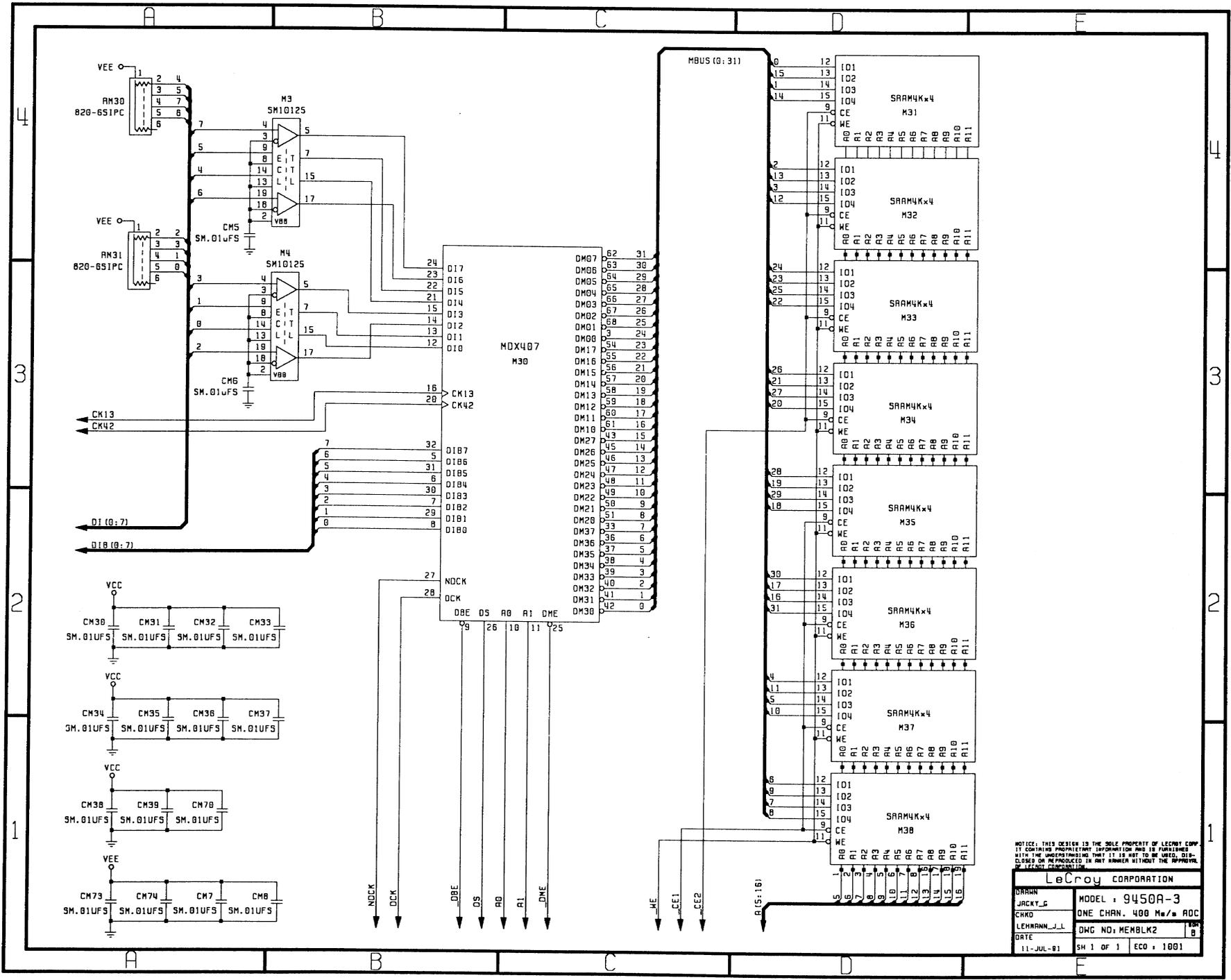
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LeCroy CORPORATION	
DRAWN	MODEL: 9450A-3
LEHMANN-J-L	ONE CHAN. 400 M _μ /s ADC
ENGR	DWG NO: 9450A-3-S1
LEHMANN-J-L	SH 6 OF 6 ECO: 1001
DATE	11-JUL-81



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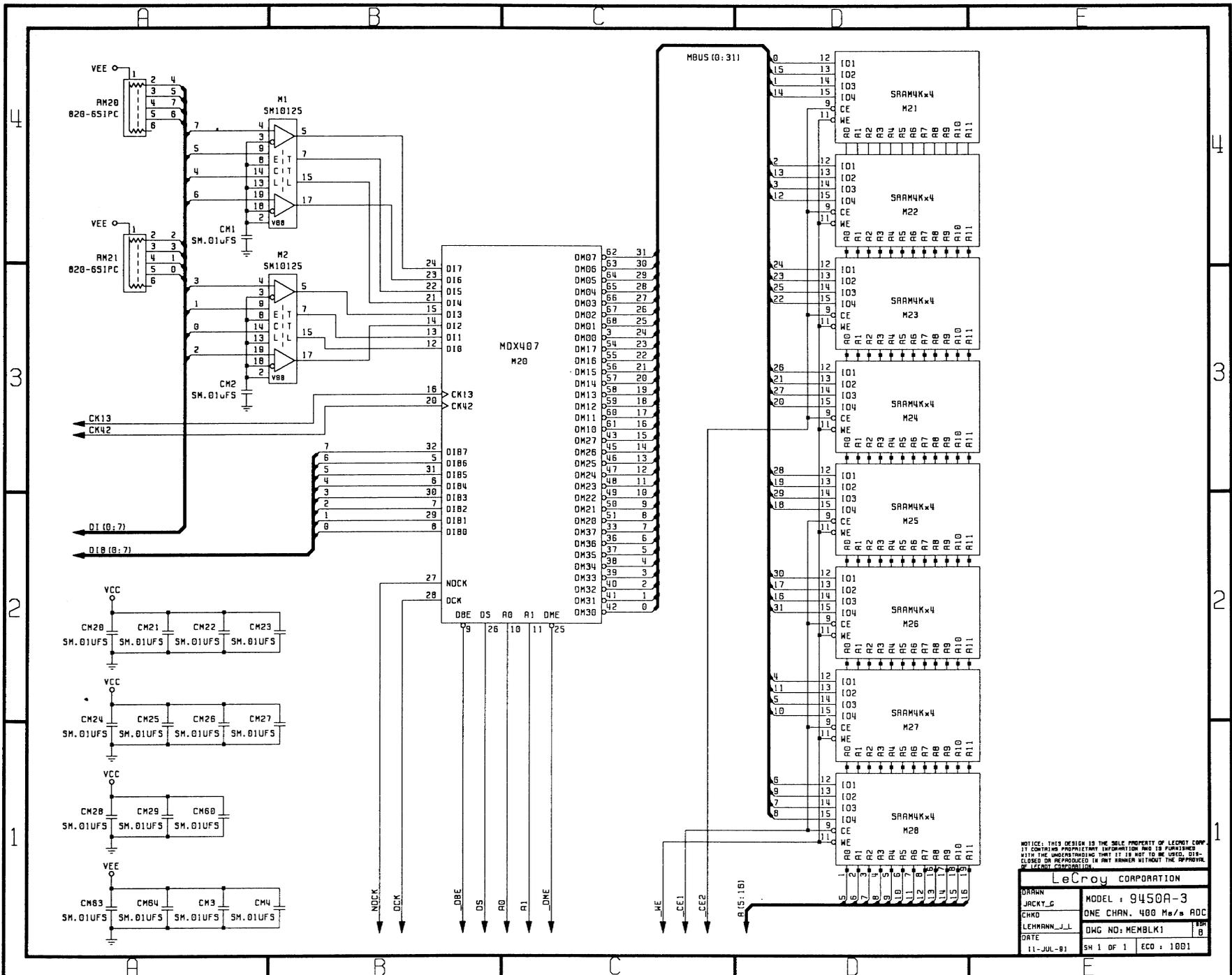
LeCroy CORPORATION	
DRAWN JACKY_G	MODEL : 9450A-3
CHKD LEHMANN_J_L	ONE CHAN. 400 Ms/s ADC
DATE 11-JUL-93	DWG NO: MEMBLK1
	SH 1 OF 1 ECD : 1001



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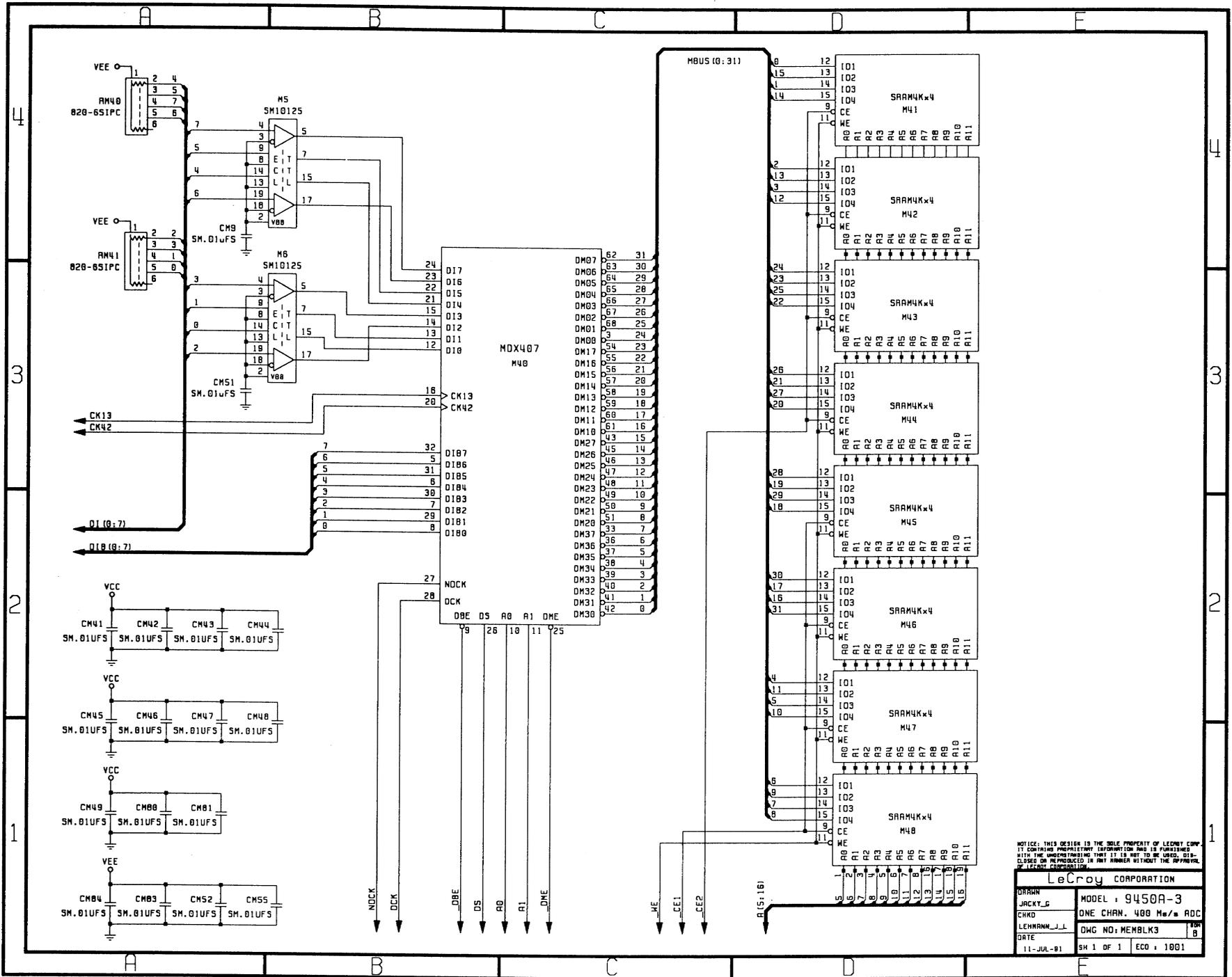
LeCroy CORPORATION

DRAWN JACKY_G	MODEL : 9450A-3
CHEK LEHMANN_J_L	ONE CHAN. 409 Mm/μs ADC
DATE 11-JUL-81	DWG NO: MEMBLK2
	SH 1 OF 1 ECO : 1001



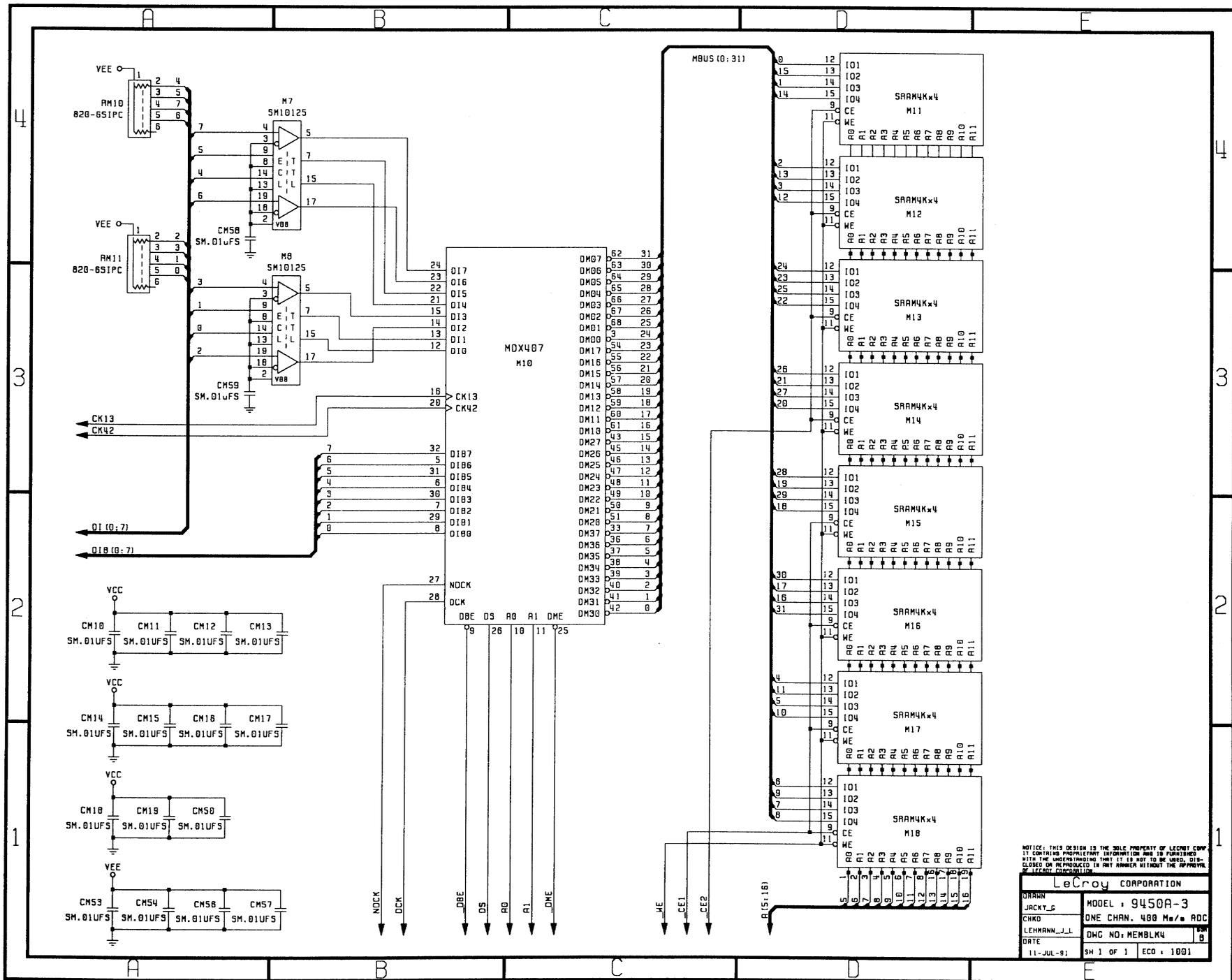
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LeCroy CORPORATION	
WARRANTY	MODEL: 9450A-3
JACKY_G	ONE CHAN. 400 Ms/μs ADC
CHKD	DWG NO: MEMBLK1
LEHMANN_J_L	DATE
11-JUL-81	SH 1 OF 1 ECO: 1001



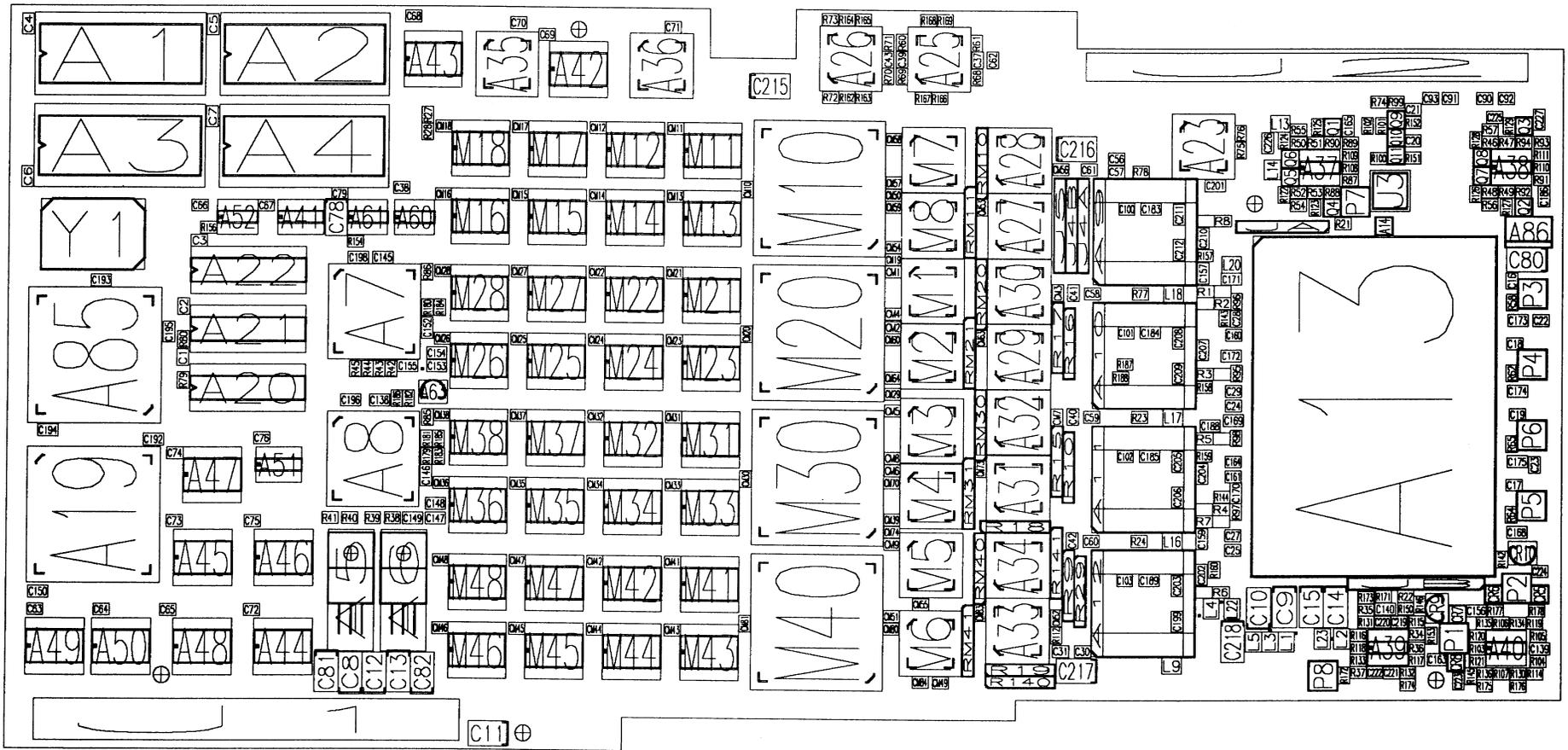
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LeCroy CORPORATION			
DRAWN	JACKY_G	MODEL :	9450A-3
CHKD		ONE CHAN. 400 Ms/s ADC	
LEHMANN_J_L		DWG NO: MEMBLK3	REV B
DATE	11-JUL-81	SH 1 OF 1	ECO : 1001



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LeCroy CORPORATION	
DRAWN JACKY_S	MODEL . 9450A-3
CWKO	ONE CHAN. 400 M/s ADC
LEHANNAN_J_L	DWG NO. MEMBLK4
DATE 11-JUL-83	SH 1 OF 1 ECO . 1001



9450A-3 Rev:B

A1	205271256	62256-12-PS	DIP28	-635000	13081000	1	90
A2	205271256	62256-12-PS	DIP28	3429000	13081000	1	90
A3	205271256	62256-12-PS	DIP28	-635000	11112500	1	90
A4	205271256	62256-12-PS	DIP28	3429000	11112500	1	90
A5	208591340	LM340T-12	TO220	5938520	1206500	1	90
A6	208591320	LM320T-12	TO220	7112000	1206500	1	90
A7	SM207244110	BT110	PLCC_44	6667500	9144000	1	0
A8	SM207244110	BT110	PLCC_44	6667500	5969000	1	0
A9	207200200	HADC77200	PGA_46	22720300	9144000	1	90
A10	207200200	HADC77200	PGA_46	22720300	6477000	1	90
A11	207200200	HADC77200	PGA_46	22720300	3810000	1	90
A12	207200200	HADC77200	PGA_46	22720300	1143000	1	90
A13	HMS403	HMS403	HMS403	26416000	9779000	1	0
A14	SM232022822	HSMS2822	SOT23	29083000	10223500	1	180
A19	MNX401	MNX401	PLCC_68	508000	5143500	1	0
A20	205750000	C16L8L	DIP20	2730500	6286500	1	90
A21	205750000	C16L8L	DIP20	2730500	7556500	1	90
A22	205750000	C16L8L	DIP20	2730500	8826500	1	90
A23	SM207460116	SM10H116.ALT	PLCC_20	25019000	12446000	1	0
A25	SM207360125	SM10125.ALT	PLCC_20	18732500	13843000	1	90
A26	SM207360125	SM10125.ALT	PLCC_20	16764000	13843000	1	90
A27	SM207960158	SM10H158	PLCC_20	20535900	10274300	1	90
A28	SM207960158	SM10H158	PLCC_20	20535900	11684000	1	90
A29	SM207960158	SM10H158	PLCC_20	20535900	7454900	1	90
A30	SM207960158	SM10H158	PLCC_20	20535900	8864600	1	90
A31	SM207960158	SM10H158	PLCC_20	20535900	4635500	1	90
A32	SM207960158	SM10H158	PLCC_20	20535900	6045200	1	90
A33	SM207960158	SM10H158	PLCC_20	20535900	1562100	1	90
A34	SM207960158	SM10H158	PLCC_20	20535900	2959100	1	90
A35	SM207162965	SM2965	PLCC_20	9588500	14097000	1	0
A36	SM207162965	SM2965	PLCC_20	13017500	14097000	1	0
A37	SM208470324	SMLM324	SOIC_14	27203400	11290300	1	90
A38	SM208470324	SMLM324	SOIC_14	31457900	11303000	1	90
A39	SM208470324	SMLM324	SOIC_14	28765500	952500	1	90
A40	SM208470324	SMLM324	SOIC_14	31394400	939800	1	90
A41	SM200170138	SM74ALS138	SOIC_16	4572000	10096500	1	90
A42	SM207179244	SM74HCT244	SOIC_20	10604500	13081000	1	90
A43	SM207179244	SM74HCT244	SOIC_20	7366000	13271500	1	90
A44	SM207179244	SM74HCT244	SOIC_20	4127500	635000	1	90
A45	SM207179244	SM74HCT244	SOIC_20	2349500	2540000	1	90
A46	SM207179244	SM74HCT244	SOIC_20	4127500	2540000	1	90
A47	SM207179244	SM74HCT244	SOIC_20	2540000	4318000	1	90
A48	SM207878245	SM74HCT245	SOIC_20	2349500	635000	1	90
A49	SM207878245	SM74HCT245	SOIC_20	-889000	635000	1	90
A50	SM207878245	SM74HCT245	SOIC_20	571500	635000	1	90
A51	SM207970158	SM74F158	SOIC_16	4127500	4762500	1	90
A52	SM200170032	SM74F32	SOIC_14	3238500	10096500	1	90
A60	SM200172008	SM74F08	SOIC_14	7162800	10096500	1	90
A61	SM200172004	SM74F04	SOIC_14	6121400	10096500	1	90
A63	208591005	78L05ACZ	TO92	7797800	6654800	1	0
A85	SM227060320	TMS320C25FNL	PLCC_68	508000	6159500	1	180
A86	208124002	7905-ST	TO220 ST	32486600	10312400	1	270
C1	SM661207103	SM.01uFS	SM0805	2438400	7200900	1	90
C2	SM661207103	SM.01uFS	SM0805	2451100	8293100	1	90
C3	SM661207103	SM.01uFS	SM0805	2654300	9842500	1	0
C4	SM661127104	SM.1uFA	SM1206	-1016000	14610080	1	270
C5	SM661127104	SM.1uFA	SM1206	3048000	14610080	1	270
C6	SM661127104	SM.1uFA	SM1206	-1003300	11341100	1	270
C7	SM661127104	SM.1uFA	SM1206	3048000	12641580	1	270
C8	SM666237476	SM47uF-6V	SMCAPD	6197600	254000	1	90
C9	SM666237476	SM47uF-6V	SMCAPD	26860500	2382520	1	270
C10	SM666237476	SM47uF-6V	SMCAPD	26289000	1747520	1	90
C11	SM666237476	SM47uF-6V	SMCAPD	9588500	-731520	1	180
C12	SM666247106	SM10uF-25V	SMCAPD	6731000	254000	1	90
C13	SM666247106	SM10uF-25V	SMCAPD	7264400	889000	1	270
C14	SM666247106	SM10uF-25V	SMCAPD	27978100	2387600	1	270

C15	SM666247106	SM10uF-25V	SMCAPD	27444700	2387600	1 270
C16	SM661207103	SM.01uFS	SM0805	31864300	9232900	1 270
C17	SM661207103	SM.01uFS	SM0805	31813500	4699000	1 0
C18	SM661207103	SM.01uFS	SM0805	31813500	7747000	1 0
C19	SM661207103	SM.01uFS	SM0805	31877000	6223000	1 0
C20	SM661207103	SM.01uFS	SM0805	29524960	12125960	1 0
C21	SM661207103	SM.01uFS	SM0805	29524960	12793980	1 0
C22	SM661207103	SM.01uFS	SM0805	32639000	8255000	1 180
C23	SM661207103	SM.01uFS	SM0805	32385000	5270500	1 270
C24	SM661207103	SM.01uFS	SM0805	25844500	6413500	1 180
C25	SM661207103	SM.01uFS	SM0805	25844500	3302000	1 180
C27	SM661207103	SM.01uFS	SM0805	25844500	3619500	1 180
C28	SM661207103	SM.01uFS	SM0805	25768300	8166100	1 90
C29	SM661207103	SM.01uFS	SM0805	25844500	6731000	1 180
C30	SM661207103	SM.01uFS	SM0805	22529800	1130300	1 180
C31	SM661207103	SM.01uFS	SM0805	21793200	1130300	1 0
C37	SM661207103	SM.01uFS	SM0805	20027900	13703300	1 90
C38	SM661207103	SM.01uFS	SM0805	7124700	10985500	1 0
C39	SM661207103	SM.01uFS	SM0805	18351500	13710920	1 90
C40	SM661207103	SM.01uFS	SM0805	22161500	6045200	1 90
C41	SM661207103	SM.01uFS	SM0805	22161500	8712200	1 90
C42	SM661207103	SM.01uFS	SM0805	22161500	3378200	1 90
C43	SM661207103	SM.01uFS	SM0805	18039080	13705840	1 90
C56	SM661207103	SM.01uFS	SM0805	23228300	11734800	1 180
C57	SM661207103	SM.01uFS	SM0805	23228300	11455400	1 180
C58	SM661207103	SM.01uFS	SM0805	22453600	8826500	1 0
C59	SM661207103	SM.01uFS	SM0805	22453600	6159500	1 0
C60	SM661207103	SM.01uFS	SM0805	22453600	3492500	1 0
C61	SM661207103	SM.01uFS	SM0805	22618700	11493500	1 180
C62	SM661207103	SM.01uFS	SM0805	20370800	13703300	1 90
C63	SM661207103	SM.01uFS	SM0805	-889000	1905000	1 0
C64	SM661207103	SM.01uFS	SM0805	571500	1905000	1 0
C65	SM661207103	SM.01uFS	SM0805	2286000	1905000	1 180
C66	SM661207103	SM.01uFS	SM0805	2921000	10604500	1 180
C67	SM661207103	SM.01uFS	SM0805	4381500	10604500	1 180
C68	SM661207103	SM.01uFS	SM0805	7366000	14668500	1 0
C69	SM661207103	SM.01uFS	SM0805	10604500	14300200	1 180
C70	SM661207103	SM.01uFS	SM0805	9715500	14541500	1 0
C71	SM661207103	SM.01uFS	SM0805	13131800	14478000	1 0
C72	SM661207103	SM.01uFS	SM0805	4127500	1905000	1 180
C73	SM661207103	SM.01uFS	SM0805	2413000	3810000	1 180
C74	SM661207103	SM.01uFS	SM0805	2413000	5270500	1 180
C75	SM661207103	SM.01uFS	SM0805	4127500	3810000	1 180
C76	SM661207103	SM.01uFS	SM0805	4064000	5588000	1 0
C78	SM158102025	SM5-25pF	SMCAPVAR2X2	5803900	10624820	1 270
C79	SM661207103	SM.01uFS	SM0805	6002020	10858500	1 180
C80	SM666237476	SM47uF-6V	SMCAPD	32499300	9563100	1 180
C81	SM666247106	SM10uF-25V	SMCAPD	5664200	889000	1 270
C82	SM666247106	SM10uF-25V	SMCAPD	7797800	254000	1 90
C90	NOCAPS	NOCAPS	SM0805	31371540	13032740	1 180
C91	SM661255015	SM1.5pFS	SM0805	30353000	13030200	1 0
C92	SM661255033	SM3.3pFS	SM0805	31597600	13030200	1 0
C93	SM661255056	SM5.6pFS	SM0805	30175200	13030200	1 180
C100	SM661207103	SM.01uFS	SM0805	23456900	10655300	1 180
C101	SM661207103	SM.01uFS	SM0805	23456900	7988300	1 180
C102	SM661207103	SM.01uFS	SM0805	23456900	5321300	1 180
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C138	SM661127104	SM.1uFA	SM1206	6667500	6413500	1 0
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C153	SM661127104	SM.luFA	SM1206	7937500	7150100	1	0
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C156	SM661127104	SM.luFA	SM1206	31242000	1993900	1	180
C157	SM661127104	SM.luFA	SM1206	25019000	9144000	1	90
C159	SM661127104	SM.luFA	SM1206	25019000	3670300	1	270
C160	SM661207103	SM.0luFS	SM0805	25844500	7937500	1	180
C161	SM661207103	SM.0luFS	SM0805	25844500	4889500	1	180
C163	SM661127104	SM.luFA	SM1206	30124400	952500	1	0
C164	SM661207103	SM.0luFS	SM0805	25844500	5207000	1	180
C165	SM661127104	SM.luFA	SM1206	28206700	12573000	1	270
C168	SM661127104	SM.luFA	SM1206	31877000	3683000	1	0
C169	SM661127104	SM.luFA	SM1206	25844500	6096000	1	180
C170	SM661127104	SM.luFA	SM1206	25778460	4404360	1	90
C171	SM661127104	SM.luFA	SM1206	25781000	9144000	1	180
C172	SM661127104	SM.luFA	SM1206	25781000	7493000	1	180
C173	SM661127104	SM.luFA	SM1206	31877000	8255000	1	0
C174	SM661127104	SM.luFA	SM1206	31877000	6731000	1	0
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C183	SM661127104	SM.luFA	SM1206	23736300	10655300	1	0
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C188	SM661127104	SM.luFA	SM1206	25069800	5981700	1	0
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C195	SM661127104	SM.luFA	SM1206	2128520	7747000	1	90
C196	SM661127104	SM.luFA	SM1206	6286500	6413500	1	180
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C199	SM661127104	SM.luFA	SM1206	24485600	1905000	1	270
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C212	SM661127104	SM.luFA	SM1206	24485600	9906000	1	270
C215	SM666237476	SM47uF-6V	SMCAPD	15113000	13241020	1	0
C216	SM666237476	SM47uF-6V	SMCAPD	21917660	11935460	1	0
C217	SM666237476	SM47uF-6V	SMCAPD	22580600	711200	1	180
C218	SM666237476	SM47uF-6V	SMCAPD	25717500	1651000	1	270
C219	NOCAPS	NOCAPS	SM0805	29260800	1752600	1	0
C220	NOCAPS	NOCAPS	SM0805	28892500	1752600	1	0
C221	NOCAPS	NOCAPS	SM0805	29349700	673100	1	180
C222	NOCAPS	NOCAPS	SM0805	28983940	675640	1	180
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C224	SM661207103	SM.0luFS	SM0805	32639000	2844800	1	180
C225	SM661207103	SM.0luFS	SM0805	31343600	12623800	1	0
C226	SM661127104	SM.luFA	SM1206	26441400	12204700	1	270
C227	SM661127104	SM.luFA	SM1206	32448500	12446000	1	90
J1	454610096	3x32-RA-M	CONN3X32 RA M	0	0	1	0
J2	\$NULL	EDGE39-FRONT	EDGE39 FRONT	32131000	13271500	1	0
J3	402610002	SMB-ST-F	SMB ST_F	29146500	11049000	1	270
J5	403181008	1x8	HD1R8P	21856700	9398000	1	90
J2B	\$NULL	EDGE39-BACK	EDGE39 BACK	32133540	13274040	2	0
J4A	403181008	1x8	HD1R8P	22364700	11176000	1	270
J4B	403181008	1x8	HD1R8P	22110700	11176000	1	270
L1	SM300327102	SMLuH	SMSELF	26898600	1206500	1	90

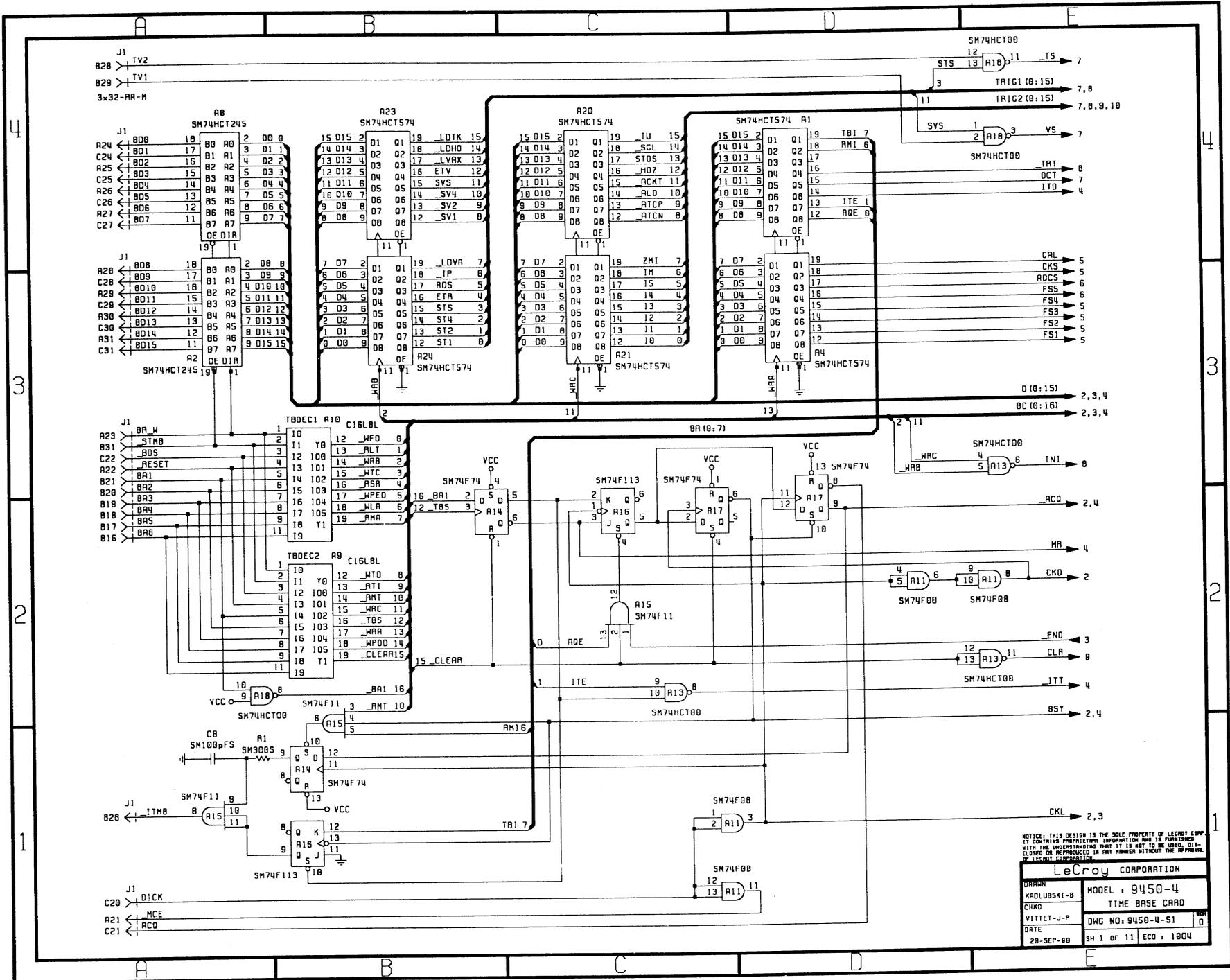
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L5	SM300327102	SMLuH	SMSELF	26187400	1206500	1 90
L9	SM300327102	SMLuH	SMSELF	24244300	825500	1 0
L13	SM300327102	SMLuH	SMSELF	26837640	12484100	1 180
L14	SM300327102	SMLuH	SMSELF	26543000	11625580	1 270
L16	SM300327102	SMLuH	SMSELF	24244300	3492500	1 0
L17	SM300327102	SMLuH	SMSELF	24244300	6159500	1 0
L18	SM300327102	SMLuH	SMSELF	24244300	8826500	1 0
L20	SM300327102	SMLuH	SMSELF	25527000	9461500	1 0
L22	SM300327102	SMLuH	SMSELF	25704800	1917700	1 90
L23	SM300327102	SMLuH	SMSELF	27686000	1270000	1 90
M1	SM207360125	SM10125	PLCC_20	19062700	9309100	1 0
M2	SM207360125	SM10125	PLCC_20	19062700	7899400	1 0
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M4	SM207360125	SM10125	PLCC_20	19062700	4889500	1 0
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M6	SM207360125	SM10125	PLCC_20	19062700	1727200	1 0
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M8	SM207360125	SM10125	PLCC_20	19062700	10718800	1 0
M10	MDX407	MDX407	PLCC_68	16535400	9842500	1 180
M11	SM205220168	SRAM4Kx4	SOIC_20	13589000	11366500	1 90
M12	SM205220168	SRAM4Kx4	SOIC_20	11874500	11366500	1 90
M13	SM205220168	SRAM4Kx4	SOIC_20	13589000	9906000	1 90
M14	SM205220168	SRAM4Kx4	SOIC_20	11874500	9906000	1 90
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M16	SM205220168	SRAM4Kx4	SOIC_20	8445500	9906000	1 90
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M20	MDX407	MDX407	PLCC_68	16535400	6731000	1 180
M21	SM205220168	SRAM4Kx4	SOIC_20	13589000	8255000	1 90
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M23	SM205220168	SRAM4Kx4	SOIC_20	13589000	6794500	1 90
M24	SM205220168	SRAM4Kx4	SOIC_20	11874500	6794500	1 90
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M26	SM205220168	SRAM4Kx4	SOIC_20	8445500	6794500	1 90
M27	SM205220168	SRAM4Kx4	SOIC_20	10160000	8255000	1 90
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M31	SM205220168	SRAM4Kx4	SOIC_20	13589000	5143500	1 90
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M37	SM205220168	SRAM4Kx4	SOIC_20	10160000	5143500	1 90
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M40	MDX407	MDX407	PLCC_68	16535400	508000	1 180
M41	SM205220168	SRAM4Kx4	SOIC_20	13589000	2032000	1 90
M42	SM205220168	SRAM4Kx4	SOIC_20	11874500	2032000	1 90
M43	SM205220168	SRAM4Kx4	SOIC_20	13589000	571500	1 90
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M46	SM205220168	SRAM4Kx4	SOIC_20	8445500	571500	1 90
M47	SM205220168	SRAM4Kx4	SOIC_20	10160000	2032000	1 90
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P1	NOBOT	NOBOT	SMPOT_ST4	30619700	1402080	1 90
P2	SM185457103	SM10K-1T	SMPOT_ST4	32004000	2476500	1 0
P3	SM185457500	SM50-1T	SMPOT_ST4	32321500	8826500	1 180
P4	SM185457500	SM50-1T	SMPOT_ST4	32321500	7302500	1 180
P5	SM185457500	SM50-1T	SMPOT_ST4	32321500	4254500	1 180
P6	SM185457500	SM50-1T	SMPOT_ST4	32321500	5778500	1 180
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Q1	SM270340848	BC848CR	SOT23	27927300	12344400	1 180

Q2	SM270330848	BC848C	SOT23	32054800	10756900	1 0
Q3	SM270340848	BC848CR	SOT23	32181800	12369800	1 180
Q4	SM270330848	BC848C	SOT23	27800300	10744200	1 0
Q5	SM275340858	BC858CR	SOT23	27000200	11404600	1 270
Q6	SM275330858	BC858C	SOT23	27000200	11798300	1 270
Q7	SM275340858	BC858CR	SOT23	31254700	11430000	1 270
Q8	SM275330858	BC858C	SOT23	31254700	11823700	1 270
Q9	SM270030092	BFR92	SOT23	29337000	12509500	1 180
Q10	SM270040092	BFR92R	SOT23	29210000	12255500	1 0
Q11	SM275030092	BFT92	SOT23	29337000	11747500	1 180
R1	161445151	150-1/2W	RES20	25069800	8877300	1 90
R2	161445151	150-1/2W	RES20	25450800	8623300	1 270
R3	161445151	150-1/2W	RES20	25069800	7099300	1 90
R4	161445151	150-1/2W	RES20	25450800	4178300	1 90
R5	161445151	150-1/2W	RES20	25069800	5702300	1 270
R6	161445151	150-1/2W	RES20	25450800	2400300	1 90
R7	161445151	150-1/2W	RES20	25069800	3924300	1 270
R8	161445151	150-1/2W	RES20	25450800	10401300	1 270
R9	190642471	470-6SIPC	SIP6RES	22085300	3175000	1 0
R10	190642471	470-6SIPC	SIP6RES	22072600	5715000	1 0
R15	190642471	470-6SIPC	SIP6RES	21818600	5842000	1 0
R16	190642471	470-6SIPC	SIP6RES	22072600	8382000	1 0
R17	190642471	470-6SIPC	SIP6RES	21818600	8509000	1 0
R18	190642221	220-6SIPC	SIP6RES	20281900	3797300	1 90
R19	190642221	220-6SIPC	SIP6RES	20408900	723900	1 90
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R22	SM652101243	SM24KS	SM0805	29413200	2298700	1 0
R23	SM652101112	SM1.1KS	SM0805	23507700	6159500	1 0
R24	SM652101911	SM910S	SM0805	23505160	3489960	1 0
R27	SM652101102	SMLKS	SM0805	7823200	12687300	1 270
R28	SM652101102	SMLKS	SM0805	7823200	12065000	1 90
R29	190642471	470-6SIPC	SIP6RES	22339300	3048000	1 0
R34	SM652101132	SM1.3KS	SM0805	29654500	1493520	1 0
R35	SM652101122	SM1.2KS	SM0805	28521660	2016760	1 0
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R37	SM652101122	SM1.2KS	SM0805	28359100	673100	1 0
R38	SM652101122	SM1.2KS	SM0805	6985000	3873500	1 0
R39	SM652101122	SM1.2KS	SM0805	6794500	3873500	1 180
R40	SM652101122	SM1.2KS	SM0805	6286500	3873500	1 180
R41	SM652101122	SM1.2KS	SM0805	5842000	3873500	1 180
R42	SM652101122	SM1.2KS	SM0805	7048500	7213600	1 270
R43	SM652101122	SM1.2KS	SM0805	6781800	7213600	1 270
R44	SM652101122	SM1.2KS	SM0805	6515100	7213600	1 270
R45	SM652101122	SM1.2KS	SM0805	6248400	7213600	1 270
R46	SM652101132	SM1.3KS	SM0805	31496000	12090400	1 180
R47	SM652101132	SM1.3KS	SM0805	31610300	12090400	1 0
R48	SM652101132	SM1.3KS	SM0805	31496000	11023600	1 180
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R50	SM652101132	SM1.3KS	SM0805	27241500	12077700	1 180
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R52	SM652101132	SM1.3KS	SM0805	27244040	11013440	1 180
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R58	SM652101181	SM180S	SM0805	31877000	8509000	1 90
R60	SM652101101	SM100S	SM0805	18351500	14071600	1 90
R61	SM652101101	SM100S	SM0805	20002500	14325600	1 270
R62	SM652101181	SM180S	SM0805	31877000	6985000	1 90
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R70	SM652101101	SM100S	SM0805	18034000	13601700	1 270
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R77	SM652101152	SM1.5KS	SM0805	23505160	8823960	1 0
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R79	SM652101103	SM10KS	SM0805	2446020	6700520	1 90
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R85	SM652101102	SM1KS	SM0805	7863840	5918200	1 90
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R103	SM652101112	SM1.1KS	SM0805	31010860	1178560	1 0
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R112	SM652101471	SM470S	SM0805	21818600	1600200	1 270
R114	SM652101562	SM5.6KS	SM0805	32283400	647700	1 0
R115	NORES	NORES	SM0805	29654500	1752600	1 0
R116	NORES	NORES	SM0805	28613100	1473200	1 180
R117	NORES	NORES	SM0805	29654500	932180	1 0
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R119	SM652101562	SM5.6KS	SM0805	32270700	1727200	1 0
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R121	SM652101562	SM5.6KS	SM0805	31269940	916940	1 180
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R129	SM652101510	SM51S	SM0805	31788100	12573000	1 270
R130	SM652101682	SM6.8KS	SM0805	32169100	647700	1 180
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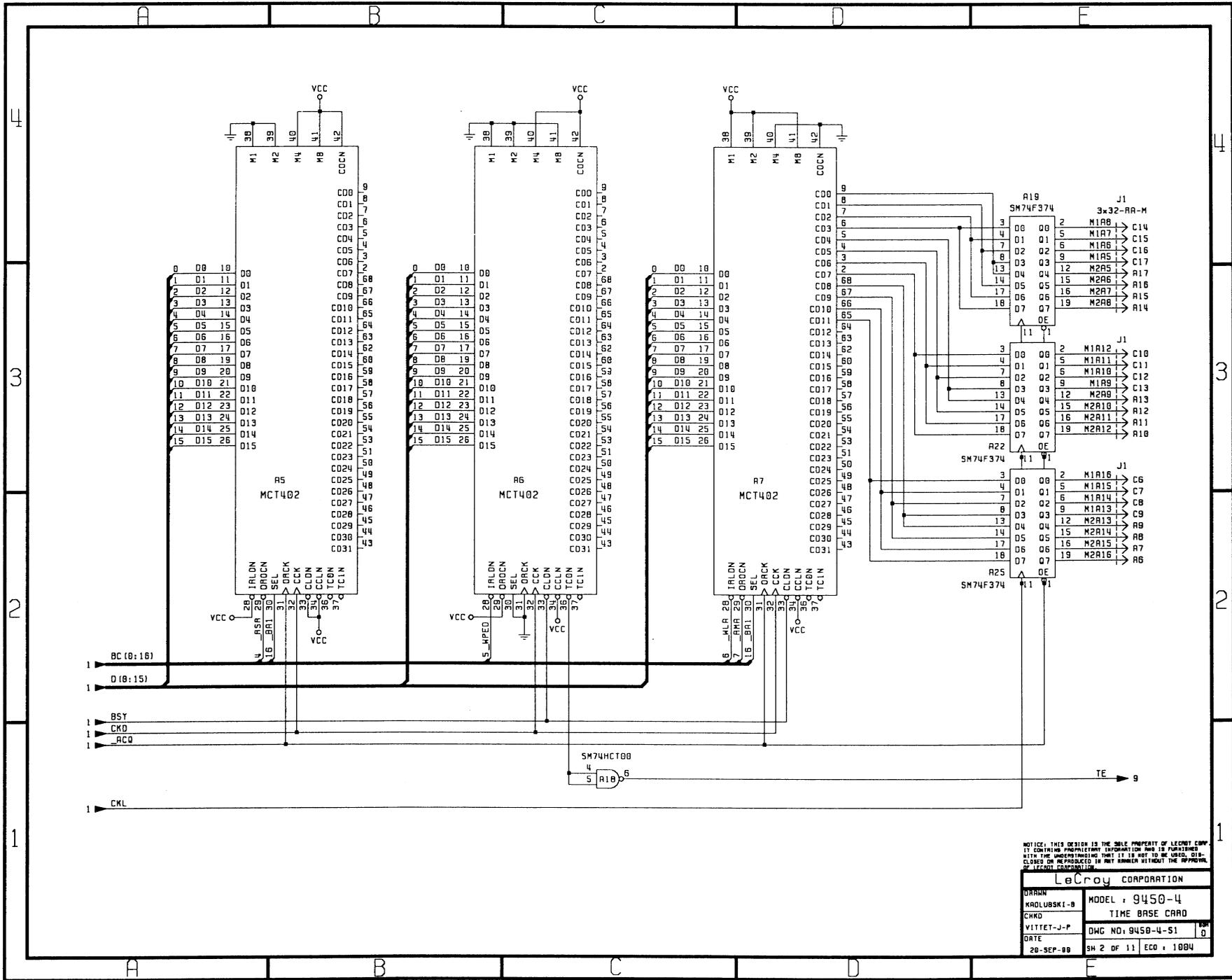
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CM74	SM661207103	SM.0luFS	SM0805	18313400	3670300	1	180
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CM83	SM661207103	SM.0luFS	SM0805	20142200	2070100	1	270
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CR8	NOSOT23	NOSOT23	SOT23	30607000	825500	1	90
CR9	\$NULL	NOLM336	TO92	30175200	1856740	1	90
CR10	208590336	LM336-2.5	TO92	32321500	3175000	1	180
JA	405764108	TP1x8-SS	TP1X8 SS	27660600	10274300	1	180
JB	405764112	TP1x12-SS	TP1X12 SS	31165800	2578100	1	180
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RM31	190642821	820-6SIPC	SIP6RES	19888200	5143500	1	0
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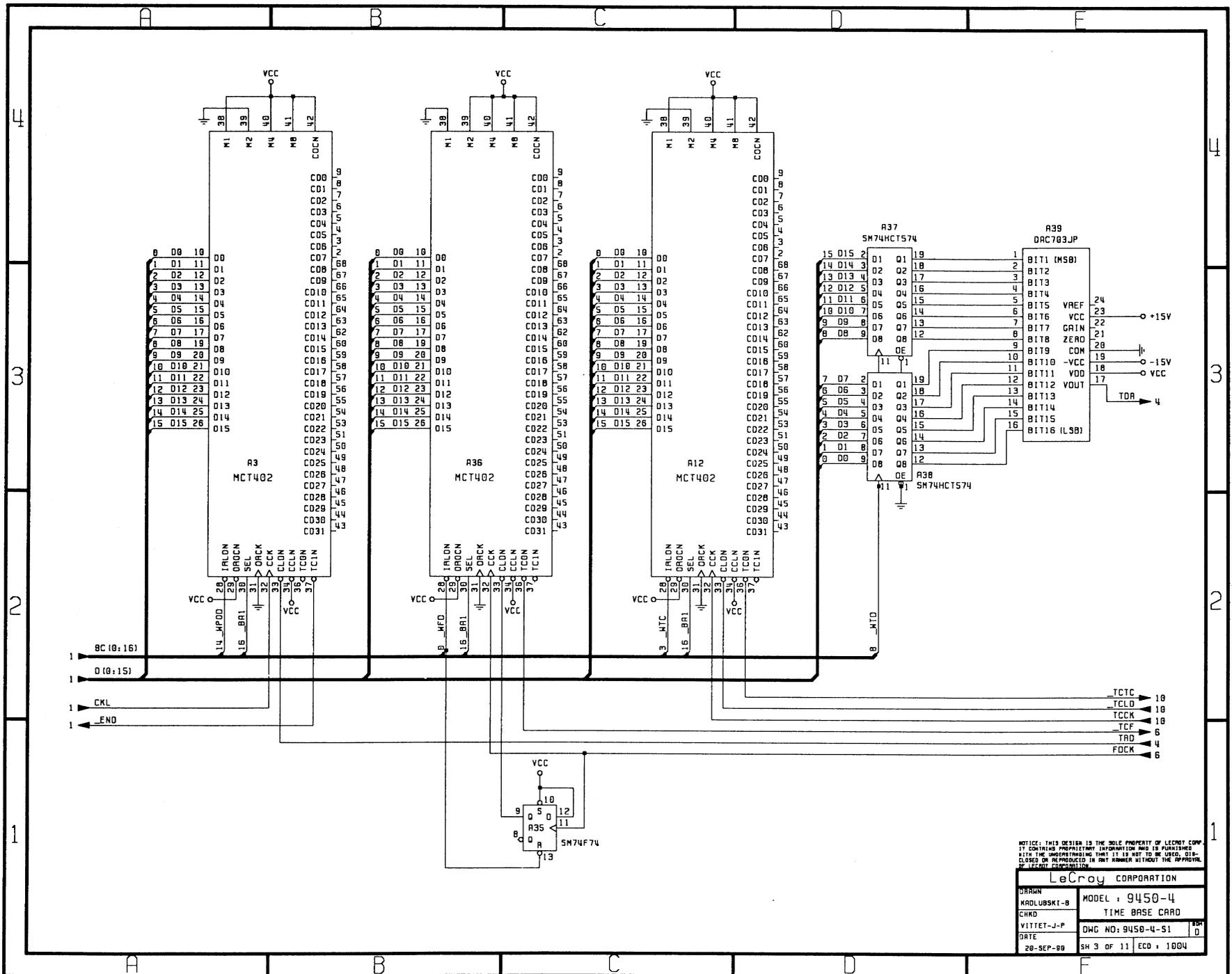
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LeCroy CORPORATION	
URBAN	MODEL : 9450-4
KADLUBSKI-B	TIME BASE CARD
CHKD	YITTET-J-P
DATE	DWG NO: 9450-4-S1
20-SEP-88	SH 1 OF 11 ECO : 1084



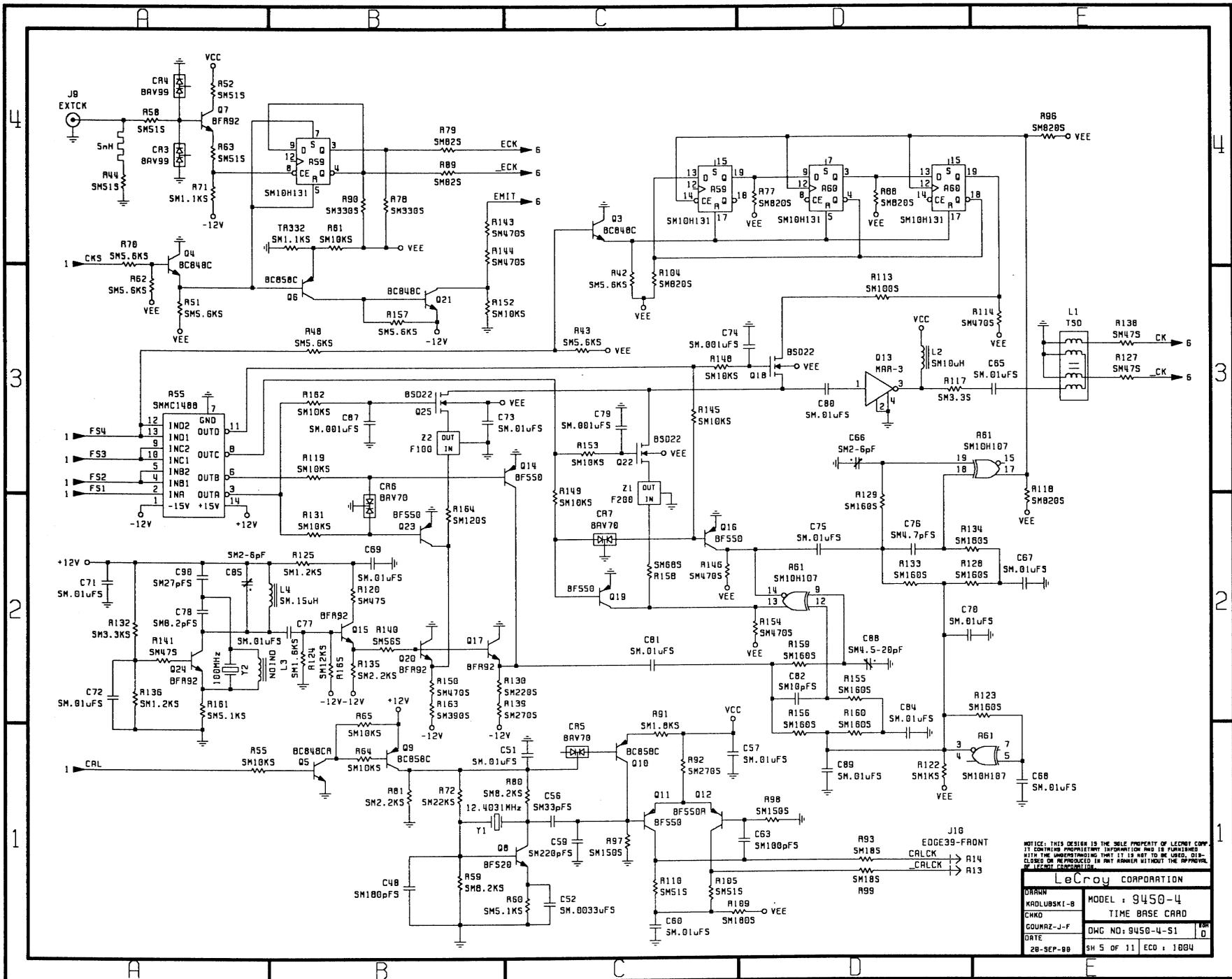
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LeCroy CORPORATION	
DYNAM KADLUSKI-B CKWD YITTIET-J-P DATE 28-SEP-88	MODEL : 9450-4 TIME BASE CARD DWG NO: 9450-4-51 SH 2 OF 11 ECO : 1884



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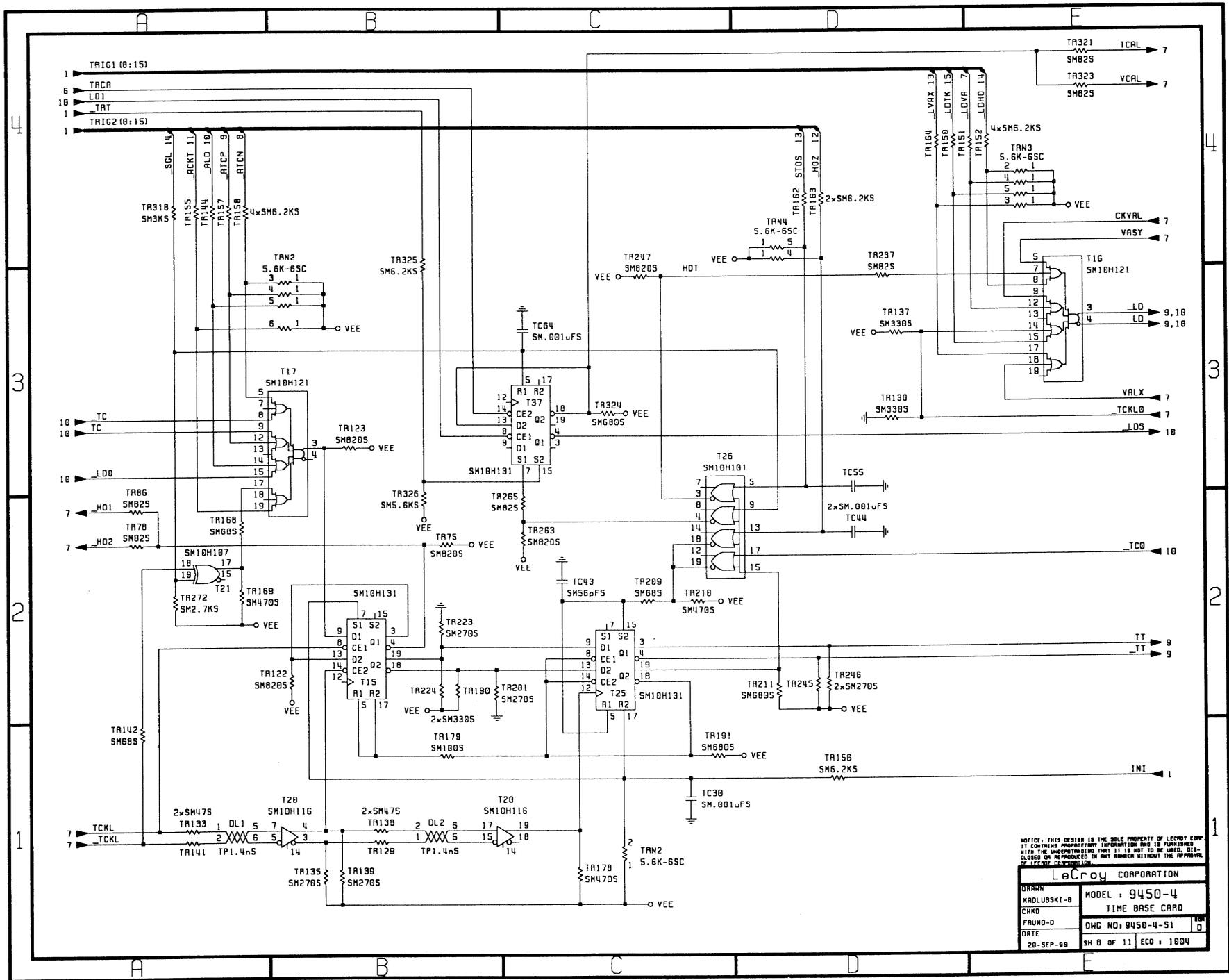
LeCroy CORPORATION	
DESIGN	MODEL : 9450-4
KADLUBSKI-B	TIME BASE CARD
CHWD	DWG NO: 9450-4-51
VITTEF-J-P	DATE
20-SEP-80	SH 3 OF 11 ECO : 1804



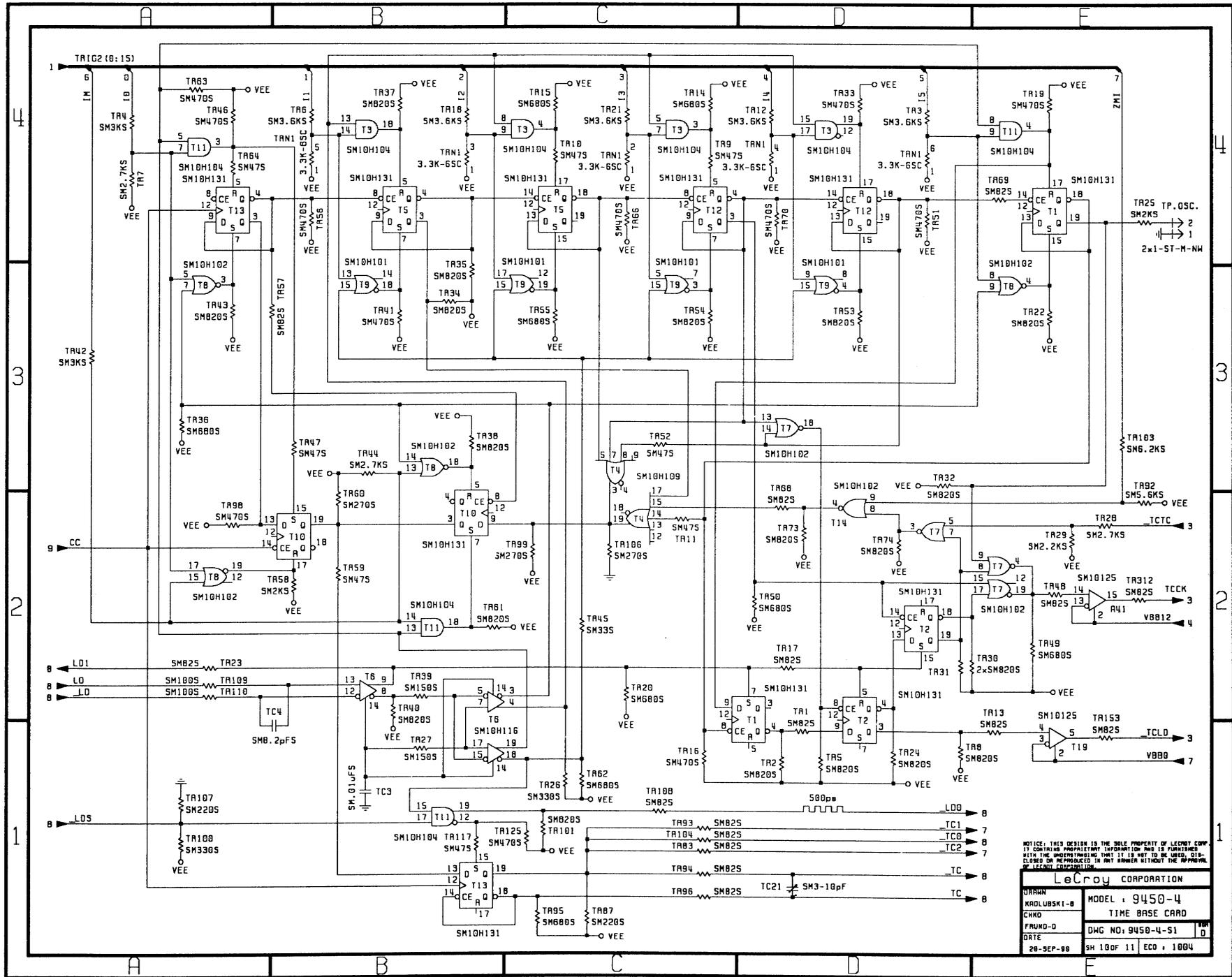
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LeCroy CORPORATION

DESIGN	MODEL : 9450-4
KADLUBSKI-B	TIME BASE CARD
CKWD	DWG NO: 9450-4-51
SOUMAZ-J-F	DATE
28-SEP-88	SH 5 OF 11 ECO : 1884

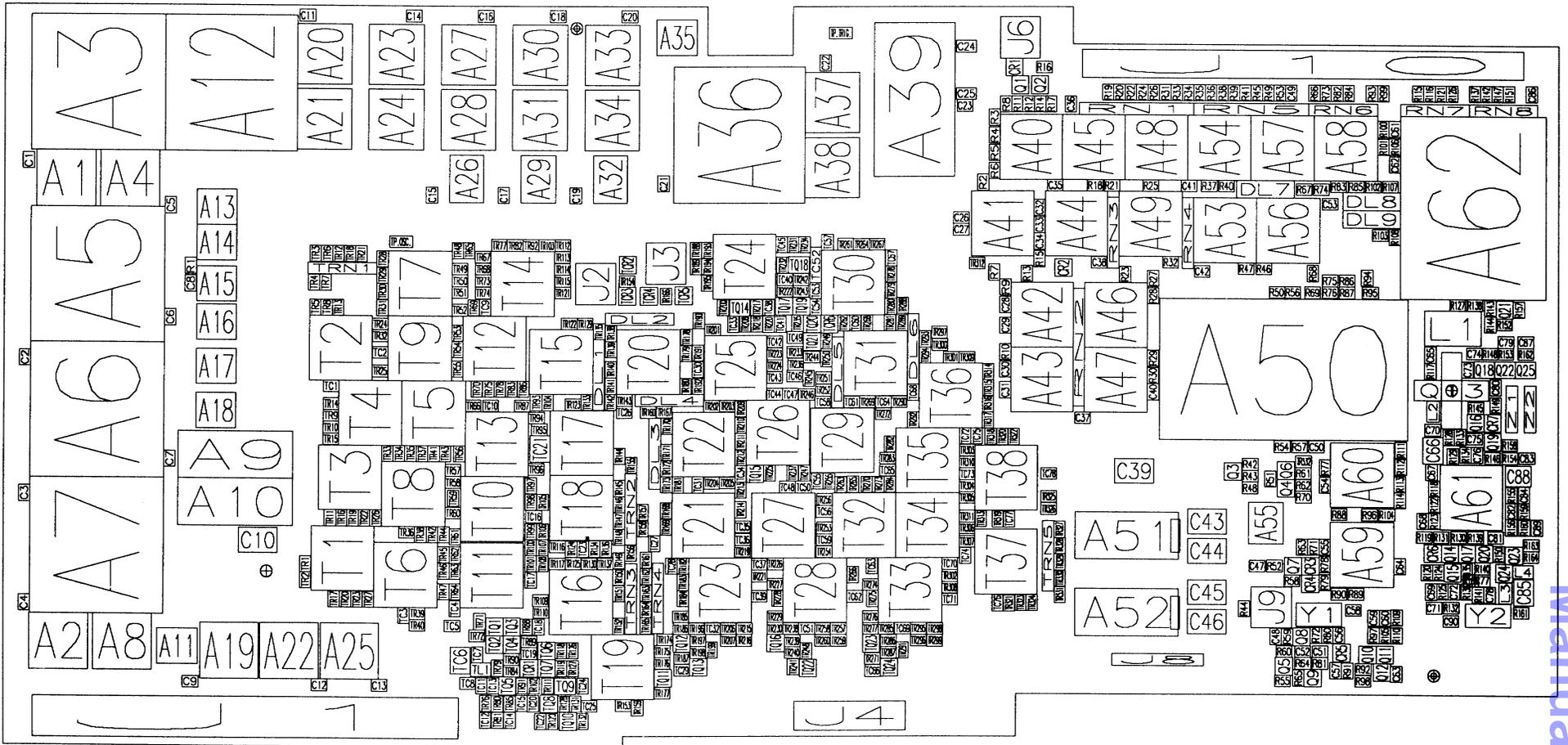


Lectec CORPORATION	
DRAWN KADLUBSKI-B CHKD FRAND-D DATE 20-SEP-80	MODEL: 9450-4 TIME BASE CARD DWG NO: 9450-4-51 SH 8 OF 11 ECD: 1804

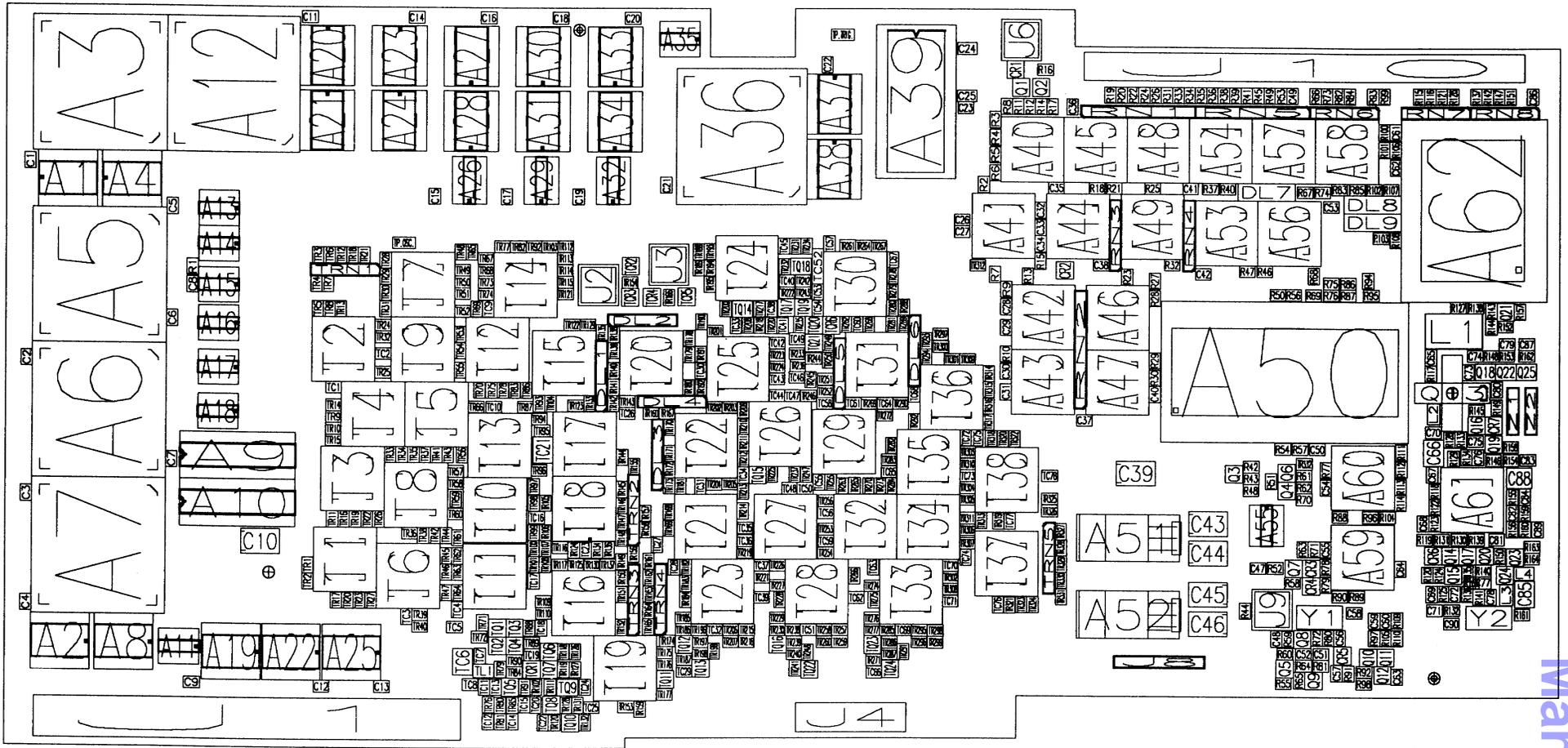


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LeCroy CORPORATION	
DESIGN KRALUBSKI-B	MODEL : 9450-4
CHKD	TIME BASE CARD
FRWMD-D	DWG NO. 9450-4-51
DATE 28-SEP-68	SH 100F 11 ECO : 1004



\$9450_4 Rev:C



\$9450_4 Rev:C

A1	SM200178574	SM74HCT574	SOIC_20	-635000	10668000	1 90
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A7	SM200160402	MCT402	PLCC_68	1841500	3238500	1 270
A8	SM207878245	SM74HCT245	SOIC_20	1778000	1651000	1 270
A9	205750000	C16L8L	DIP20	2540000	4826000	1 90
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A13	SM200178000	SM74HCT00	SOIC_14	3619500	10795000	1 270
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A15	SM200172011	SM74F11	SOIC_14	3619500	9144000	1 270
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A17	SM200172074	SM74F74	SOIC_14	3619500	7366000	1 270
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A41	SM207360125	SM10125.ALT	PLCC_20	21082000	10223500	1 270
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A43	SM207360125	SM10125.ALT	PLCC_20	21971000	6858000	1 270
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A48	SM200167131	SM10H131	PLCC_20	24066500	12319000	1 0
A49	SM200167117	SM10H117	PLCC_20	23939500	10668000	1 0
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C4	SM661207103	SM.01uFS	SM0805	-952500	2095500	1 270

C5	SM661207103	SM.01uFS	SM0805	2222500	10477500	1	90
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C7	SM661207103	SM.01uFS	SM0805	2222500	5209540	1	270
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C13	SM661207103	SM.01uFS	SM0805	6794500	254000	1	0
C14	SM661207103	SM.01uFS	SM0805	7683500	14668500	1	180
C15	SM661207103	SM.01uFS	SM0805	8001000	10731500	1	90
C16	SM661207103	SM.01uFS	SM0805	9080500	14668500	1	0
C17	SM661207103	SM.01uFS	SM0805	9588500	10731500	1	90
C18	SM661207103	SM.01uFS	SM0805	10668000	14668500	1	0
C19	SM661207103	SM.01uFS	SM0805	11176000	10731500	1	90
C20	SM661207103	SM.01uFS	SM0805	12255500	14668500	1	0
C21	SM661207103	SM.01uFS	SM0805	13114020	10985500	1	90
C22	SM661207103	SM.01uFS	SM0805	16700500	13779500	1	270
C23	SM661207103	SM.01uFS	SM0805	19685000	12763500	1	0
C24	SM661127104	SM.1uF	SM1206	19939000	14033500	1	180
C25	SM661127104	SM.1uF	SM1206	19939000	13017500	1	180
C26	SM661207103	SM.01uFS	SM0805	19812000	10350500	1	180
C27	SM661207103	SM.01uFS	SM0805	19812000	10096500	1	180
C28	SM661207103	SM.01uFS	SM0805	20701000	8572500	1	270
C29	SM661207103	SM.01uFS	SM0805	20701000	8128000	1	270
C30	SM661207103	SM.01uFS	SM0805	20701000	7175500	1	270
C31	SM661207103	SM.01uFS	SM0805	20701000	6731000	1	270
C32	SM661207103	SM.01uFS	SM0805	21463000	10472420	1	90
C33	NOCAPS	NOCAPS	SM0805	21463000	10096500	1	90
C34	SM661255330	SM33pFS	SM0805	21463000	9939020	1	270
C35	SM661207103	SM.01uFS	SM0805	21717000	11049000	1	0
C36	SM661207103	SM.01uFS	SM0805	22161500	12700000	1	90
C37	SM661207103	SM.01uFS	SM0805	22352000	6032500	1	0
C38	SM661207103	SM.01uFS	SM0805	22898100	9392920	1	180
C39	SM666247106	SM10uF-25V	SMCAPD	23274020	4889500	1	0
C40	SM661207103	SM.01uFS	SM0805	24005540	6697980	1	270
C41	SM661207103	SM.01uFS	SM0805	24892000	11049000	1	180
C42	SM661207103	SM.01uFS	SM0805	24988520	9207500	1	0
C43	SM666247106	SM10uF-25V	SMCAPD	24892000	3810000	1	0
C44	SM666247106	SM10uF-25V	SMCAPD	24892000	3175000	1	0
C45	SM666247106	SM10uF-25V	SMCAPD	25527000	2286000	1	180
C46	SM666247106	SM10uF-25V	SMCAPD	25527000	1651000	1	180
C47	SM661207103	SM.01uFS	SM0805	26416000	2857500	1	180
C48	SM661255181	SM180pFS	SM0805	26736040	1239520	1	90
C49	SM661207103	SM.01uFS	SM0805	27051000	12954000	1	90
C50	SM661207103	SM.01uFS	SM0805	27528520	5430520	1	0
C51	SM661207103	SM.01uFS	SM0805	27622500	1016000	1	0
C52	SM661205332	SM.0033uFS	SM0805	27432000	1016000	1	180
C53	SM661207103	SM.01uFS	SM0805	27813000	10668000	1	0
C54	SM661207103	SM.01uFS	SM0805	27813000	4699000	1	270
C55	SM661207103	SM.01uFS	SM0805	27813000	3175000	1	90
C56	SM661255330	SM33pFS	SM0805	28130500	1270000	1	90
C57	SM661207103	SM.01uFS	SM0805	28067000	508000	1	90
C58	SM661207103	SM.01uFS	SM0805	28354020	1905000	1	0
C59	SM661255221	SM220pFS	SM0805	28892500	1841500	1	270
C60	SM661207103	SM.01uFS	SM0805	29146500	1841500	1	270
C61	SM661207103	SM.01uFS	SM0805	29337000	12192000	1	90
C62	SM661207102	SM.001uFS	SM0805	29337000	11620500	1	270
C63	SM661255101	SM100pFS	SM0805	29400500	635000	1	270
C64	SM661207103	SM.01uFS	SM0805	29464000	2954020	1	270
C65	SM661207103	SM.01uFS	SM0805	30132020	7332980	1	90
C66	SM158043006	SM2-6pF	SMCAPVAR	30195520	5557520	1	270
C67	SM661207103	SM.01uFS	SM0805	30162500	4988560	1	270
C68	SM661207103	SM.01uFS	SM0805	29972000	3937000	1	270
C69	SM661207103	SM.01uFS	SM0805	30162500	2413000	1	270
C70	SM661207103	SM.01uFS	SM0805	30289500	5811520	1	180

C71	SM661207103	SM.01uFS	SM0805	30322520	1968500	1	180
C72	SM661207103	SM.01uFS	SM0805	30670500	2222500	1	90
C73	SM661207103	SM.01uFS	SM0805	30960060	7213600	1	270
C74	SM661207102	SM.001uFS	SM0805	31211520	7462520	1	180
C75	SM661207103	SM.01uFS	SM0805	31216600	5621020	1	180
C76	SM661250047	SM4.7pFS	SM0805	31178500	5176520	1	90
C77	SM661207103	SM.01uFS	SM0805	31402020	2573020	1	180
C78	SM661250082	SM8.2pFS	SM0805	31465520	2161540	1	90
C79	SM661207102	SM.001uFS	SM0805	31719520	7716520	1	0
C80	SM661207103	SM.01uFS	SM0805	31589980	6832600	1	270
C81	SM661207103	SM.01uFS	SM0805	31496000	3492500	1	0
C82	SM661255100	SM10pFS	SM0805	31940500	4160520	1	270
C83	SM661207103	SM.01uFS	SM0805	32191960	5209540	1	0
C84	SM661207103	SM.01uFS	SM0805	32227520	4318000	1	90
C85	SM158043006	SM2-6pF	SMCAPVAR	32227520	2509520	1	270
C86	SM661207103	SM.01uFS	SM0805	32385000	12954000	1	90
C87	SM661207102	SM.001uFS	SM0805	32354520	7716520	1	180
C88	SM158043020	SM4.5-20pF	SMCAPVAR	32291020	4826000	1	180
C89	SM661207103	SM.01uFS	SM0805	32512000	3810000	1	270
C90	SM661255270	SM27pFS	SM0805	30507940	1681480	1	0
J1	454610096	3x32-RA-M	CONN3X32_RA_M	0	0	1	0
J2	402610002	SMB-ST-F	SMB_ST_F	11620500	8928100	1	90
J3	402610002	SMB-ST-F	SMB_ST_F	13174980	9367520	1	90
J4	\$NULL	EDGE10-FRONT	EDGE10_FRONT	16129000	-386080	1	180
J5	\$NULL	EDGE10-BACK	EDGE10_BACK	18417540	-386080	2	180
J6	402610002	SMB-ST-F	SMB_ST_F	21018500	14224000	1	0
J7	\$NULL	EDGE39-BACK	EDGE39_BACK	32133540	13655040	2	0
J8	403181008	LX8	HD1R8P	25019000	825500	1	180
J9	402610002	SMB-ST-F	SMB_ST_F	26639520	1968500	1	0
J10	\$NULL	EDGE39-FRONT	EDGE39_FRONT	32131000	13652500	1	0
L1	780390008	TSD	TSD	30132020	8255000	1	270
L2	SM300546103	SM10uH	SMSELF	30195520	6065520	1	90
L3	NOIND	NOIND	SMSELF	31813500	2159000	1	90
L4	SM300546151	SM.15uH	SMSELF	32354520	2763520	1	180
Q1	SM270030092	BFR92	SOT23	21082000	13144500	1	180
Q2	SM270040092	BFR92R	SOT23	21526500	13144500	1	180
Q3	SM270330848	BC848C	SOT23	25844500	4953000	1	270
Q4	SM270330848	BC848C	SOT23	26888440	4599940	1	0
Q5	SM270340848	BC848CR	SOT23	26860500	635000	1	90
Q6	SM275330858	BC858C	SOT23	27015440	4853940	1	180
Q7	SM270030092	BFR92	SOT23	27178000	2921000	1	270
Q8	SM270030020	BFS20	SOT23	27241500	1270000	1	90
Q9	SM275330858	BC858C	SOT23	27495500	381000	1	90
Q10	SM275330858	BC858C	SOT23	28702000	889000	1	90
Q11	SM275030550	BF550	SOT23	29083000	889000	1	90
Q12	SM275040550	BF550R	SOT23	29019500	508000	1	90
Q13	SM208400003	MAR-3	SMVV105	30607000	6667500	1	180
Q14	SM275030550	BF550	SOT23	30640020	3081020	1	180
Q15	SM270030092	BFR92	SOT23	30703520	2794000	1	270
Q16	SM275030550	BF550	SOT23	31084520	6032500	1	0
Q17	SM270030092	BFR92	SOT23	31021020	3208020	1	270
Q18	SM280160022	BSD22	SOT143	31338520	7117080	1	180
Q19	SM275030550	BF550	SOT23	31465520	5621020	1	0
Q20	SM270030092	BFR92	SOT23	31402020	3081020	1	180
Q21	SM270330848	BC848C	SOT23	31846520	8478520	1	270
Q22	SM280160022	BSD22	SOT143	31795720	7117080	1	180
Q23	SM275030550	BF550	SOT23	31940500	3175000	1	0
Q24	SM270030092	BFR92	SOT23	31846520	2667000	1	180
Q25	SM280160022	BSD22	SOT143	32252920	7117080	1	180
R1	SM652101301	SM300S	SM0805	2667000	9177020	1	90
R2	SM652101820	SM82S	SM0805	20193000	11209020	1	270
R3	SM652101512	SM5.1KS	SM0805	20447000	12415520	1	90
R4	SM652101562	SM5.6KS	SM0805	20447000	12225020	1	270
R5	SM652101562	SM5.6KS	SM0805	20447000	11653520	1	90
R6	SM652101512	SM5.1KS	SM0805	20447000	11463020	1	270
R7	SM652101820	SM82S	SM0805	20447000	9271000	1	270

R8	SM652101151	SM150S	SM0805	20701000	12890500	1	270
R9	SM652101222	SM2.2KS	SM0805	20701000	8953500	1	270
R10	SM652101222	SM2.2KS	SM0805	20701000	7556500	1	270
R11	SM652101301	SM300S	SM0805	20955000	12890500	1	270
R12	SM652101121	SM120S	SM0805	21209000	12890500	1	270
R13	SM652101820	SM82S	SM0805	21178520	9050020	1	90
R14	SM652101301	SM300S	SM0805	21463000	12890500	1	270
R15	SM652101820	SM82S	SM0805	21463000	9367520	1	90
R16	SM652101510	SM51S	SM0805	21653500	13589000	1	180
R17	SM652101151	SM150S	SM0805	21717000	12890500	1	270
R18	SM652101201	SM200S	SM0805	22606000	11049000	1	0
R19	SM652101180	SM18S	SM0805	22987000	12954000	1	90
R20	SM652101180	SM18S	SM0805	23241000	12954000	1	90
R21	SM652101201	SM200S	SM0805	23177500	11049000	1	180
R22	SM652101180	SM18S	SM0805	23495000	12954000	1	90
R23	SM652101820	SM82S	SM0805	23380700	9037320	1	90
R24	SM652101180	SM18S	SM0805	23749000	12954000	1	90
R25	SM652101820	SM82S	SM0805	23845520	11049000	1	0
R26	SM652101180	SM18S	SM0805	24003000	12954000	1	90
R27	SM652101201	SM200S	SM0805	24003000	9144000	1	270
R28	SM652101201	SM200S	SM0805	24003000	8572500	1	90
R29	SM652101201	SM200S	SM0805	24003000	7429500	1	270
R30	SM652101201	SM200S	SM0805	24003000	6858000	1	90
R31	SM652101180	SM18S	SM0805	24257000	12954000	1	90
R32	SM652101820	SM82S	SM0805	24287480	9398000	1	0
R33	SM652101180	SM18S	SM0805	24511000	12954000	1	90
R34	SM652101180	SM18S	SM0805	24765000	12954000	1	90
R35	SM652101180	SM18S	SM0805	25019000	12954000	1	90
R36	SM652101180	SM18S	SM0805	25273000	12954000	1	90
R37	SM652101201	SM200S	SM0805	25336500	11049000	1	180
R38	SM652101180	SM18S	SM0805	25527000	12954000	1	90
R39	SM652101180	SM18S	SM0805	25781000	12954000	1	90
R40	SM652101201	SM200S	SM0805	25717500	11049000	1	180
R41	SM652101180	SM18S	SM0805	26035000	12954000	1	90
R42	SM652101562	SM5.6KS	SM0805	26068020	5046980	1	0
R43	SM652101562	SM5.6KS	SM0805	26068020	4792980	1	0
R44	SM652101510	SM51S	SM0805	26035000	2032000	1	270
R45	SM652101180	SM18S	SM0805	26289000	12954000	1	90
R46	SM652101512	SM5.1KS	SM0805	26352500	9271000	1	0
R47	SM652101562	SM5.6KS	SM0805	26162000	9271000	1	180
R48	SM652101562	SM5.6KS	SM0805	26258520	4538980	1	180
R49	SM652101180	SM18S	SM0805	26543000	12954000	1	90
R50	SM652101820	SM82S	SM0805	26639520	8763000	1	0
R51	SM652101562	SM5.6KS	SM0805	26606500	4632960	1	90
R52	SM652101510	SM51S	SM0805	26606500	2857500	1	0
R53	SM652101180	SM18S	SM0805	26797000	12954000	1	90
R54	SM652101562	SM5.6KS	SM0805	26766520	5430520	1	0
R55	SM652101103	SM10KS	SM0805	26797000	381000	1	0
R56	SM652101471	SM470S	SM0805	26987500	8763000	1	0
R57	SM652101103	SM10KS	SM0805	27147520	5430520	1	0
R58	SM652101510	SM51S	SM0805	26987500	2540000	1	0
R59	SM652101822	SM8.2KS	SM0805	26987500	1430020	1	270
R60	SM652101512	SM5.1KS	SM0805	27020520	1016000	1	180
R61	SM652101103	SM10KS	SM0805	27238960	4856480	1	0
R62	SM652101562	SM5.6KS	SM0805	27238960	4599940	1	0
R63	SM652101510	SM51S	SM0805	27305000	3175000	1	90
R64	SM652101103	SM10KS	SM0805	27241500	762000	1	0
R65	SM652101103	SM10KS	SM0805	27241500	541020	1	270
R66	SM652101180	SM18S	SM0805	27559000	12954000	1	90
R67	SM652101201	SM200S	SM0805	27432000	10985500	1	180
R68	SM652101820	SM82S	SM0805	27528520	9271000	1	270
R69	SM652101202	SM2KS	SM0805	27622500	8763000	1	180
R70	SM652101562	SM5.6KS	SM0805	27434540	4348480	1	180
R71	SM652101112	SM1.1KS	SM0805	27559000	3365500	1	270
R72	SM652101223	SM22KS	SM0805	27622500	1270000	1	90
R73	SM652101180	SM18S	SM0805	27813000	12954000	1	90

R74	SM652101201	SM200S	SM0805	27813000	10985500	1	180
R75	SM652101471	SM470S	SM0805	27813000	9017000	1	0
R76	SM652101820	SM82S	SM0805	27813000	8763000	1	0
R77	SM652101821	SM820S	SM0805	27813000	5080000	1	270
R78	SM652101331	SM330S	SM0805	27813000	2794000	1	90
R79	SM652101820	SM82S	SM0805	27813000	2603500	1	270
R80	SM652101822	SM8.2KS	SM0805	27876500	1270000	1	90
R81	SM652101222	SM2.2KS	SM0805	27813000	762000	1	180
R82	SM652101180	SM18S	SM0805	28067000	12954000	1	90
R83	SM652101201	SM200S	SM0805	28003500	11049000	1	0
R84	SM652101180	SM18S	SM0805	28321000	12954000	1	90
R85	SM652101201	SM200S	SM0805	28384500	11049000	1	0
R86	SM652101201	SM200S	SM0805	28384500	9017000	1	180
R87	SM652101201	SM200S	SM0805	28194000	8760460	1	0
R88	SM652101821	SM820S	SM0805	28229560	3972560	1	180
R89	SM652101820	SM82S	SM0805	28412440	2258060	1	0
R90	SM652101331	SM330S	SM0805	28227020	2258060	1	180
R91	SM652101182	SM1.8KS	SM0805	28321000	698500	1	270
R92	SM652101271	SM270S	SM0805	28575000	635000	1	0
R93	SM652101180	SM18S	SM0805	28829000	12954000	1	90
R94	SM652101820	SM82S	SM0805	28735020	8986520	1	90
R95	SM652101681	SM680S	SM0805	28704540	8763000	1	0
R96	SM652101821	SM820S	SM0805	28892500	3970020	1	180
R97	SM652101151	SM150S	SM0805	28892500	1270000	1	90
R98	SM652101151	SM150S	SM0805	28765500	381000	1	180
R99	SM652101180	SM18S	SM0805	29083000	12954000	1	90
R100	SM652101222	SM2.2KS	SM0805	29083000	12382500	1	270
R101	SM652101270	SM27S	SM0805	29083000	12001500	1	270
R102	SM652101201	SM200S	SM0805	28956000	11049000	1	180
R103	SM652101820	SM82S	SM0805	29116020	10002520	1	180
R104	SM652101821	SM820S	SM0805	29083000	3970020	1	0
R105	SM652101510	SM51S	SM0805	29146500	1270000	1	90
R106	SM652101221	SM220S	SM0805	29337000	11811000	1	90
R107	SM652101201	SM200S	SM0805	29337000	11049000	1	180
R108	SM652101471	SM470S	SM0805	29337000	10066020	1	270
R109	SM652101181	SM180S	SM0805	29400500	1651000	1	90
R110	SM652101510	SM51S	SM0805	29400500	1270000	1	90
R111	SM652101562	SM5.6KS	SM0805	29484320	5468620	1	270
R112	SM652101512	SM5.1KS	SM0805	29484320	5100320	1	270
R113	SM652101101	SM100S	SM0805	29464000	4726940	1	270
R114	SM652101471	SM470S	SM0805	29464000	4376420	1	270
R115	SM652101180	SM18S	SM0805	29845000	12954000	1	90
R116	SM652101180	SM18S	SM0805	30099000	12954000	1	90
R117	SM653125033	SM3.3S	SM0805	30132020	6985000	1	90
R118	SM652101821	SM820S	SM0805	30223460	4640580	1	270
R119	SM652101103	SM10KS	SM0805	30099000	3492500	1	180
R120	SM652101470	SM47S	SM0805	30068520	2636520	1	90
R121	SM652101180	SM18S	SM0805	30353000	12954000	1	90
R122	SM652101102	SM1KS	SM0805	30226000	4097020	1	90
R123	SM652101161	SM160S	SM0805	30226000	3937000	1	270
R124	SM652101162	SM1.6KS	SM0805	30322520	2633980	1	90
R125	SM652101122	SM1.2KS	SM0805	30416500	2222500	1	90
R126	SM652101180	SM18S	SM0805	30607000	12954000	1	90
R127	SM652101470	SM47S	SM0805	30640020	8509000	1	0
R128	SM652101161	SM160S	SM0805	30543500	5748020	1	270
R129	SM652101161	SM160S	SM0805	30640020	5143500	1	90
R130	SM652101221	SM220S	SM0805	30670500	3492500	1	0
R131	SM652101103	SM10KS	SM0805	30480000	3492500	1	180
R132	SM652101332	SM3.3KS	SM0805	30513020	1971040	1	0
R133	SM652101161	SM160S	SM0805	30800040	5557520	1	90
R134	SM652101161	SM160S	SM0805	30924500	5176520	1	90
R135	SM652101222	SM2.2KS	SM0805	30957520	2857500	1	270
R136	SM652101122	SM1.2KS	SM0805	30957520	2222500	1	90
R137	SM652101180	SM18S	SM0805	31115000	12954000	1	90
R138	SM652101470	SM47S	SM0805	31021020	8509000	1	0
R139	SM652101271	SM270S	SM0805	31051500	3492500	1	0

R140	SM652101560	SM56S	SM0805	31211520	2827020	1 0
R141	SM652101470	SM47S	SM0805	31211520	2161540	1 90
R142	SM652101180	SM18S	SM0805	31369000	12954000	1 90
R143	SM652101471	SM470S	SM0805	31465520	8542020	1 270
R144	SM652101471	SM470S	SM0805	31465520	8191500	1 270
R145	SM652101103	SM10KS	SM0805	31247080	6289040	1 180
R146	SM652101471	SM470S	SM0805	31427420	5204460	1 0
R147	SM652101180	SM18S	SM0805	31623000	12954000	1 90
R148	SM652101103	SM10KS	SM0805	31559500	7462520	1 180
R149	SM652101103	SM10KS	SM0805	31592520	6446520	1 270
R150	SM652101471	SM470S	SM0805	31668720	3040380	1 90
R151	SM652101180	SM18S	SM0805	31877000	12954000	1 90
R152	SM652101103	SM10KS	SM0805	31877000	8097520	1 180
R153	SM652101103	SM10KS	SM0805	31910020	7462520	1 180
R154	SM652101471	SM470S	SM0805	31813500	5207000	1 0
R155	SM652101161	SM160S	SM0805	31943040	4315460	1 90
R156	SM652101161	SM160S	SM0805	31940500	3812540	1 270
R157	SM652101562	SM5.6KS	SM0805	32100520	8318500	1 90
R158	SM652101680	SM68S	SM0805	32004000	5494020	1 180
R159	SM652101161	SM160S	SM0805	32227520	3967480	1 90
R160	SM652101161	SM160S	SM0805	32230060	3614420	1 90
R161	SM652101512	SM5.1KS	SM0805	32067500	1871980	1 0
R162	SM652101103	SM10KS	SM0805	32354520	7462520	1 180
R163	SM652101391	SM390S	SM0805	32291020	3335020	1 0
R164	SM652101121	SM120S	SM0805	32481520	3081020	1 180
R165	SM652101123	SM12KS	SM0805	31148020	2573020	1 180
T1	SM200167131	SM10H131.ALT	PLCC_20	5621020	2984500	1 90
T2	SM200167131	SM10H131.ALT	PLCC_20	6002020	7967980	1 0
T3	SM200167104	SM10H104.ALT	PLCC_20	6223000	5173980	1 0
T4	SM200167109	SM10H109.ALT	PLCC_20	7109460	6126480	1 270
T5	SM200167131	SM10H131.ALT	PLCC_20	7617460	6126480	1 90
T6	SM207460116	SM10H116.ALT	PLCC_20	7462520	3078480	1 0
T7	SM200167102	SM10H102.ALT	PLCC_20	7747000	9364980	1 0
T8	SM200167102	SM10H102.ALT	PLCC_20	8064500	4381500	1 270
T9	SM200160101	SM10H101.ALT	PLCC_20	8191500	7523480	1 270
T10	SM200167131	SM10H131.ALT	PLCC_20	8923020	4064000	1 90
T11	SM200167104	SM10H104.ALT	PLCC_20	8923020	2633980	1 90
T12	SM200167131	SM10H131.ALT	PLCC_20	9398000	7967980	1 0
T13	SM200167131	SM10H131.ALT	PLCC_20	9458960	5905500	1 0
T14	SM200167102	SM10H102.ALT	PLCC_20	10015220	9367520	1 0
T15	SM200167131	SM10H131	PLCC_20	10424160	7239000	1 90
T16	SM200167121	SM10H121	PLCC_20	10891520	2062480	1 90
T17	SM200167121	SM10H121	PLCC_20	11336020	5935980	1 0
T18	SM200167102	SM10H102.ALT	PLCC_20	11336020	4538980	1 0
T19	SM207360125	SM10125.ALT	PLCC_20	11811000	665480	1 90
T20	SM207460116	SM10H116.ALT	PLCC_20	12796520	7683500	1 0
T21	SM200167107	SM10H107.ALT	PLCC_20	13589000	3713480	1 90
T22	SM207460116	SM10H116.ALT	PLCC_20	14033500	5905500	1 0
T23	SM207460116	SM10H116.ALT	PLCC_20	14411960	2760980	1 0
T24	SM207160192	SM10192.ALT	PLCC_20	14922500	8856980	1 180
T25	SM200167131	SM10H131	PLCC_20	14732000	6667500	1 180
T26	SM200160101	SM10H101	PLCC_20	15684500	5270500	1 180
T27	SM200167121	SM10H121	PLCC_20	15811500	4157980	1 0
T28	SM207460116	SM10H116.ALT	PLCC_20	16515080	2760980	1 0
T29	SM200167131	SM10H131.ALT	PLCC_20	17106900	5102860	1 180
T30	SM207460116	SM10H116.ALT	PLCC_20	17335500	8509000	1 180
T31	SM207460116	SM10H116.ALT	PLCC_20	17830800	6761480	1 180
T32	SM200167121	SM10H121	PLCC_20	18034000	3713480	1 270
T33	SM207460116	SM10H116.ALT	PLCC_20	18610580	2755900	1 0
T34	SM200167107	SM10H107.ALT	PLCC_20	18986500	4157980	1 0
T35	SM200167131	SM10H131.ALT	PLCC_20	19431000	5110480	1 270
T36	SM200167131	SM10H131	PLCC_20	19939000	6507480	1 270
T37	SM200167131	SM10H131	PLCC_20	20734020	3365500	1 0
T38	SM200167102	SM10H102.ALT	PLCC_20	21178520	4732020	1 270
Y1	310060012	12.4031MHZ	CRYSTAL_NC18	27432000	1811020	1 0
Y2	310062100	100MHZ	CRYSTAL_NC18	31178500	1811020	1 0

Z1	839450440	F200	F100	31953200	5892800	1	180
Z2	839450410	F100	F100	32359600	6654800	1	0
CR1	SM236030099	BAV99	SOT23	20955000	13525500	1	180
CR2	SM236030099	BAV99	SOT23	21940520	9207500	1	90
CR3	SM236030099	BAV99	SOT23	27432000	2794000	1	90
CR4	SM236030099	BAV99	SOT23	27432000	2413000	1	90
CR5	SM232120070	BAV70	SOT23	28257500	1049020	1	270
CR6	SM232120070	BAV70	SOT23	30259020	3208020	1	270
CR7	SM232120070	BAV70	SOT23	31592520	5905500	1	180
DL1	839450430	TP1.4nS	SIP6RES	11696700	6324600	1	180
DL2	839450430	TP1.4nS	SIP6RES	11965940	8166100	1	90
DL3	839450420	TP2.5nS	SIP6RES	12951460	4627880	1	180
DL4	839450420	TP2.5nS	SIP6RES	13901420	6410960	1	270
DL5	839450430	TP1.4nS	SIP6RES	17000220	6383020	1	180
DL6	839450430	TP1.4nS	SIP6RES	18661380	8153400	1	0
DL7	290120003	3nS	BEL_DELAY	26162000	10985500	1	180
DL8	290120007	7nS	BEL_DELAY	29146500	10731500	1	0
DL9	290120007	7nS	BEL_DELAY	29146500	10350500	1	0
RN1	190042221	220-SC	SIP10RES	22479000	12700000	1	90
RN2	190042563	56K-SC	SIP10RES	22352000	6413500	1	180
RN3	190642471	470-6SC	SIP6RES	23114000	9398000	1	180
RN4	190642471	470-6SC	SIP6RES	24765000	9398000	1	180
RN5	190042221	220-SC	SIP10RES	27305000	12700000	1	270
RN6	190642221	220-6SIPC	SIP6RES	28829000	12700000	1	270
RN7	190642221	220-6SIPC	SIP6RES	30861000	12700000	1	270
RN8	190642221	220-6SIPC	SIP6RES	32385000	12700000	1	270
TC1	SM661207103	SM.01uFS	SM0805	5887720	6697980	1	180
TC2	SM661207103	SM.01uFS	SM0805	6972300	7429500	1	180
TC3	SM661207103	SM.01uFS	SM0805	7419340	1856740	1	270
TC4	SM661250082	SM8.2pFS	SM0805	8539480	2006600	1	270
TC5	SM661207103	SM.01uFS	SM0805	8585200	1544320	1	180
TC6	SM158044010	SM3-10pF	SMCAPVAR	8669020	985520	1	270
TC7	SM661255270	SM27pFS	SM0805	9050020	828040	1	90
TC8	SM661207103	SM.01uFS	SM0805	8938260	309880	1	180
TC9	SM661207103	SM.01uFS	SM0805	9187180	8506460	1	270
TC10	SM661207103	SM.01uFS	SM0805	9222740	6289040	1	0
TC11	SM661250082	SM8.2pFS	SM0805	9144000	160020	1	90
TC12	SM661207103	SM.01uFS	SM0805	9232900	-388620	1	270
TC13	SM661255270	SM27pFS	SM0805	9398000	160020	1	90
TC14	SM661207103	SM.01uFS	SM0805	9773920	-586740	1	90
TC15	SM661207103	SM.01uFS	SM0805	10030460	-27940	1	270
TC16	SM661207103	SM.01uFS	SM0805	10187940	3903980	1	0
TC17	SM661207103	SM.01uFS	SM0805	10228580	2440940	1	90
TC18	SM661250047	SM4.7pFS	SM0805	10396220	1620520	1	270
TC19	SM661250047	SM4.7pFS	SM0805	10292080	955040	1	180
TC20	SM661207103	SM.01uFS	SM0805	10287000	-223520	1	90
TC21	SM158044010	SM3-10pF	SMCAPVAR	10414000	5173980	1	90
TC22	SM661207103	SM.01uFS	SM0805	10447020	-414020	1	270
TC23	SM661207103	SM.01uFS	SM0805	11366500	3111500	1	90
TC24	SM661207103	SM.01uFS	SM0805	11371580	157480	1	90
TC25	SM661207103	SM.01uFS	SM0805	11417300	-182880	1	0
TC26	SM661207103	SM.01uFS	SM0805	12174220	6154420	1	0
TC27	SM661207103	SM.01uFS	SM0805	12943840	3421380	1	270
TC28	SM661207103	SM.01uFS	SM0805	13327380	2933700	1	270
TC29	SM661207103	SM.01uFS	SM0805	13464540	594360	1	0
TC30	SM661207102	SM.001uFS	SM0805	13893800	6985000	1	90
TC31	SM661207103	SM.01uFS	SM0805	13906500	4490720	1	90
TC32	SM661207103	SM.01uFS	SM0805	14338300	1490980	1	180
TC33	SM661207103	SM.01uFS	SM0805	14678660	8150860	1	270
TC34	SM661207103	SM.01uFS	SM0805	14859000	4922520	1	270
TC35	SM661207103	SM.01uFS	SM0805	15006320	3685540	1	180
TC36	SM661255560	SM56pFS	SM0805	15006320	3408680	1	180
TC37	SM661207103	SM.01uFS	SM0805	15186660	2877820	1	0
TC38	SM661207102	SM.001uFS	SM0805	15468600	8509000	1	270
TC39	SM661207103	SM.01uFS	SM0805	15382240	2189480	1	180
TC40	SM661207103	SM.01uFS	SM0805	15730220	9019540	1	0

TC41	SM661255560	SM56pFS	SM0805	15725140	8143240	1	270
TC42	SM661207103	SM.01uFS	SM0805	15704820	7675880	1	180
TC43	SM661255560	SM56pFS	SM0805	15509240	6903720	1	0
TC44	SM661207102	SM.001uFS	SM0805	15509240	6543040	1	0
TC45	SM661207103	SM.01uFS	SM0805	15748000	9672320	1	90
TC46	SM661207103	SM.01uFS	SM0805	15951200	6931660	1	0
TC47	SM661207103	SM.01uFS	SM0805	15859760	6540500	1	0
TC48	SM661255560	SM56pFS	SM0805	15994380	4538980	1	180
TC49	SM661255560	SM56pFS	SM0805	16151860	7769860	1	180
TC50	SM661255560	SM56pFS	SM0805	16347440	4538980	1	180
TC51	SM661207103	SM.01uFS	SM0805	16433800	1488440	1	180
TC52	103336474	.47uF-X7R	LMONO	16510000	9588500	1	270
TC53	SM661207103	SM.01uFS	SM0805	16510000	8874760	1	270
TC54	SM661255560	SM56pFS	SM0805	16510000	8526780	1	270
TC55	SM661207102	SM.001uFS	SM0805	16555720	4762500	1	270
TC56	SM661207103	SM.01uFS	SM0805	16616680	4013200	1	0
TC57	SM661207103	SM.01uFS	SM0805	16764000	9730740	1	90
TC58	SM661250082	SM8.2pFS	SM0805	16774160	6377940	1	180
TC59	SM661255560	SM56pFS	SM0805	16814800	3406140	1	180
TC60	SM661207103	SM.01uFS	SM0805	17381220	8176260	1	270
TC61	SM661207103	SM.01uFS	SM0805	17406620	6377940	1	180
TC62	SM661207103	SM.01uFS	SM0805	17487900	2181860	1	180
TC63	SM661255560	SM56pFS	SM0805	17767300	2743200	1	90
TC64	SM661207102	SM.001uFS	SM0805	17909540	6375400	1	0
TC65	SM661207103	SM.01uFS	SM0805	18008600	4897120	1	0
TC66	SM661207103	SM.01uFS	SM0805	17889220	579120	1	180
TC67	SM661207103	SM.01uFS	SM0805	18171160	9578340	1	270
TC68	SM661207103	SM.01uFS	SM0805	18663920	6482080	1	90
TC69	SM661207103	SM.01uFS	SM0805	18544540	1485900	1	180
TC70	SM661207103	SM.01uFS	SM0805	19583400	2882900	1	180
TC71	SM661207103	SM.01uFS	SM0805	19583400	2115820	1	180
TC72	SM661255270	SM27pFS	SM0805	19814540	5537200	1	90
TC73	SM661207103	SM.01uFS	SM0805	19959320	4818380	1	180
TC74	SM661207102	SM.001uFS	SM0805	19824700	2954020	1	90
TC75	SM661207103	SM.01uFS	SM0805	20068540	5537200	1	90
TC76	SM661207103	SM.01uFS	SM0805	20543520	2133600	1	270
TC77	SM661255270	SM27pFS	SM0805	20802600	3746500	1	90
TC78	SM661207103	SM.01uFS	SM0805	21590000	4826000	1	0
TCR1	SM232120070	BAV70	SOT23	10129520	571500	1	90
TCR2	SM236030099	BAV99	SOT23	12395200	9398000	1	270
TCR3	SM236030099	BAV99	SOT23	12382500	8724900	1	270
TCR4	SM236030099	BAV99	SOT23	12865100	8597900	1	180
TCR5	SM236030099	BAV99	SOT23	13639800	8610600	1	180
TCR6	SM236030099	BAV99	SOT23	16743680	7998460	1	90
TL1	SM300446330	SM.033uH	SMSELF	8986520	604520	1	0
TP.OSC.	454340002	2x1-ST-M-NW	CONN2X1_ST_M_NW	7198360	9819640	1	0
TP.TRIG.	454340002	2x1-ST-M-NW	CONN2X1_ST_M_NW	16908780	14320520	1	0
TQ1	SM270040092	BFR92R	SOT23	9367520	1460500	1	90
TQ2	SM270130092	BFR92A	SOT23	9494520	1206500	1	270
TQ3	SM270030092	BFR92	SOT23	9875520	1587500	1	270
TQ4	SM270140092	BFR92AR	SOT23	9748520	1079500	1	90
TQ5	SM270140092	BFR92AR	SOT23	9781540	190500	1	180
TQ6	SM270040092	BFR92R	SOT23	10637520	952500	1	180
TQ7	SM270030092	BFR92	SOT23	10510520	698500	1	0
TQ8	SM270330848	BC848C	SOT23	10574020	-63500	1	0
TQ9	SM289240061	BCV61	SOT143	10985500	254000	1	0
TQ10	SM275330858	BC858C	SOT23	10985500	-444500	1	0
TQ11	SM275330858	BC858C	SOT23	13086080	482600	1	0
TQ12	SM270030019	BFS19	SOT23	13619480	1236980	1	270
TQ13	SM275340858	BC858CR	SOT23	13865860	594360	1	90
TQ14	SM289240062	BCV62	SOT143	14825980	8412480	1	0
TQ15	SM275330858	BC858C	SOT23	15247620	4759960	1	180
TQ16	SM270030019	BFS19	SOT23	15717520	1236980	1	270
TQ17	SM275030550	BF550	SOT23	15875000	8509000	1	270
TQ18	SM289240062	BCV62	SOT143	16131540	9334500	1	180
TQ19	SM275040550	BF550R	SOT23	16129000	8382000	1	90

TQ20	SM275040550	BF550R	SOT23	16489680	8001000	1	180
TQ21	SM275030550	BF550	SOT23	16362680	7744460	1	0
TQ22	SM275340858	BC858CR	SOT23	16431260	576580	1	180
TQ23	SM270030019	BFS19	SOT23	17823180	1231900	1	270
TQ24	SM275340858	BC858CR	SOT23	18094960	586740	1	90
TR1	SM652101820	SM82S	SM0805	5240020	2763520	1	90
TR2	SM652101821	SM820S	SM0805	5234940	2611120	1	270
TR3	SM652101362	SM3.6KS	SM0805	5430520	9652000	1	270
TR4	SM652101302	SM3KS	SM0805	5394960	9029700	1	270
TR5	SM652101821	SM820S	SM0805	5430520	8300720	1	90
TR6	SM652101362	SM3.6KS	SM0805	5684520	9652000	1	270
TR7	SM652101272	SM2.7KS	SM0805	5651500	8834120	1	90
TR8	SM652101821	SM820S	SM0805	5684520	8300720	1	90
TR9	SM652101470	SM47S	SM0805	5694680	6062980	1	0
TR10	SM652101470	SM47S	SM0805	5694680	5808980	1	0
TR11	SM652101470	SM47S	SM0805	5778500	3954780	1	270
TR12	SM652101362	SM3.6KS	SM0805	5938520	9652000	1	270
TR13	SM652101820	SM82S	SM0805	5938520	8300720	1	90
TR14	SM652101681	SM680S	SM0805	5890260	6316980	1	180
TR15	SM652101681	SM680S	SM0805	5887720	5557520	1	180
TR16	SM652101471	SM470S	SM0805	6032500	3759200	1	90
TR17	SM652101820	SM82S	SM0805	5872480	2009140	1	90
TR18	SM652101362	SM3.6KS	SM0805	6192520	9652000	1	270
TR19	SM652101471	SM470S	SM0805	6283960	3954780	1	270
TR20	SM652101681	SM680S	SM0805	6123940	2204720	1	270
TR21	SM652101362	SM3.6KS	SM0805	6446520	9652000	1	270
TR22	SM652101821	SM820S	SM0805	6540500	3759200	1	90
TR23	SM652101820	SM82S	SM0805	6380480	2009140	1	90
TR24	SM652101821	SM820S	SM0805	6776720	8044180	1	0
TR25	SM652101202	SM2KS	SM0805	6776720	7028180	1	0
TR26	SM652101331	SM330S	SM0805	6791960	3954780	1	270
TR27	SM652101151	SM150S	SM0805	6634480	2009140	1	90
TR28	SM652101272	SM2.7KS	SM0805	6921500	9354820	1	90
TR29	SM652101222	SM2.2KS	SM0805	6918960	9192260	1	270
TR30	SM652101821	SM820S	SM0805	6921500	8648700	1	90
TR31	SM652101821	SM820S	SM0805	6918960	8493760	1	270
TR32	SM652101821	SM820S	SM0805	6972300	7792720	1	180
TR33	SM652101471	SM470S	SM0805	7048500	5156200	1	90
TR34	SM652101821	SM820S	SM0805	7299960	5351780	1	270
TR35	SM652101821	SM820S	SM0805	7556500	5351780	1	270
TR36	SM652101681	SM680S	SM0805	7383780	3553460	1	0
TR37	SM652101821	SM820S	SM0805	7810500	5156200	1	90
TR38	SM652101821	SM820S	SM0805	7782560	3411220	1	90
TR39	SM652101151	SM150S	SM0805	7622540	1805940	1	0
TR40	SM652101821	SM820S	SM0805	7622540	1549400	1	0
TR41	SM652101471	SM470S	SM0805	8061960	5351780	1	270
TR42	SM652101302	SM3KS	SM0805	8034020	3604260	1	270
TR43	SM652101821	SM820S	SM0805	8318500	5156200	1	90
TR44	SM652101272	SM2.7KS	SM0805	8288020	3411220	1	90
TR45	SM652101330	SM33S	SM0805	8288020	3169920	1	270
TR46	SM652101471	SM470S	SM0805	8288020	2819400	1	270
TR47	SM652101470	SM47S	SM0805	8288020	2377440	1	270
TR48	SM652101820	SM82S	SM0805	8572500	9537700	1	90
TR49	SM652101681	SM680S	SM0805	8526780	9237980	1	0
TR50	SM652101681	SM680S	SM0805	8529320	8983980	1	0
TR51	SM652101471	SM470S	SM0805	8526780	8729980	1	0
TR52	SM652101470	SM47S	SM0805	8524240	8351520	1	0
TR53	SM652101821	SM820S	SM0805	8572500	7754620	1	90
TR54	SM652101821	SM820S	SM0805	8572500	7597140	1	270
TR55	SM652101681	SM680S	SM0805	8572500	6979920	1	90
TR56	SM652101471	SM470S	SM0805	8630920	5151120	1	90
TR57	SM652101820	SM82S	SM0805	8397240	4892040	1	0
TR58	SM652101202	SM2KS	SM0805	8590280	4635500	1	180
TR59	SM652101470	SM47S	SM0805	8501380	4193540	1	90
TR60	SM652101271	SM270S	SM0805	8592820	3972560	1	180
TR61	SM652101821	SM820S	SM0805	8542020	3368040	1	90

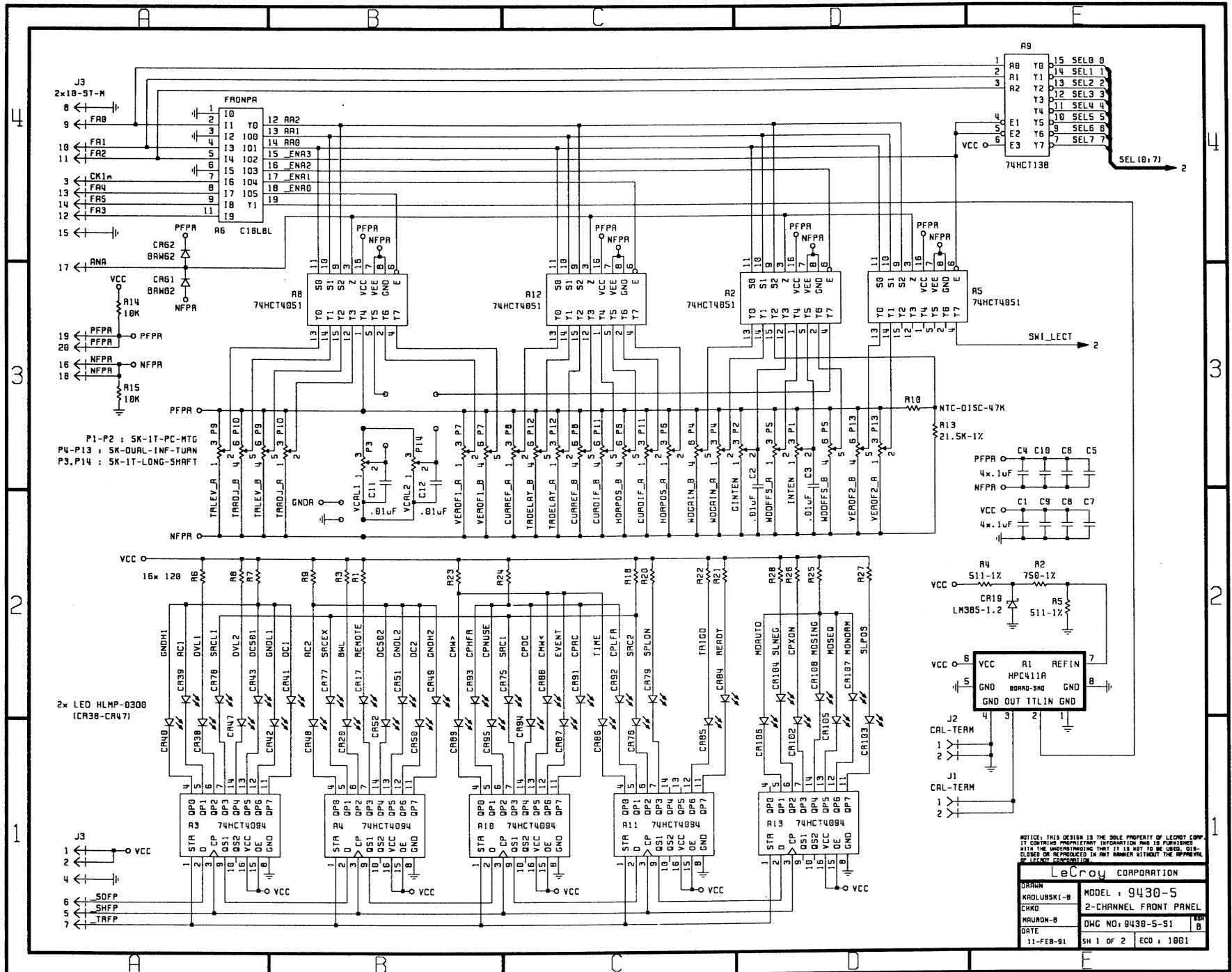
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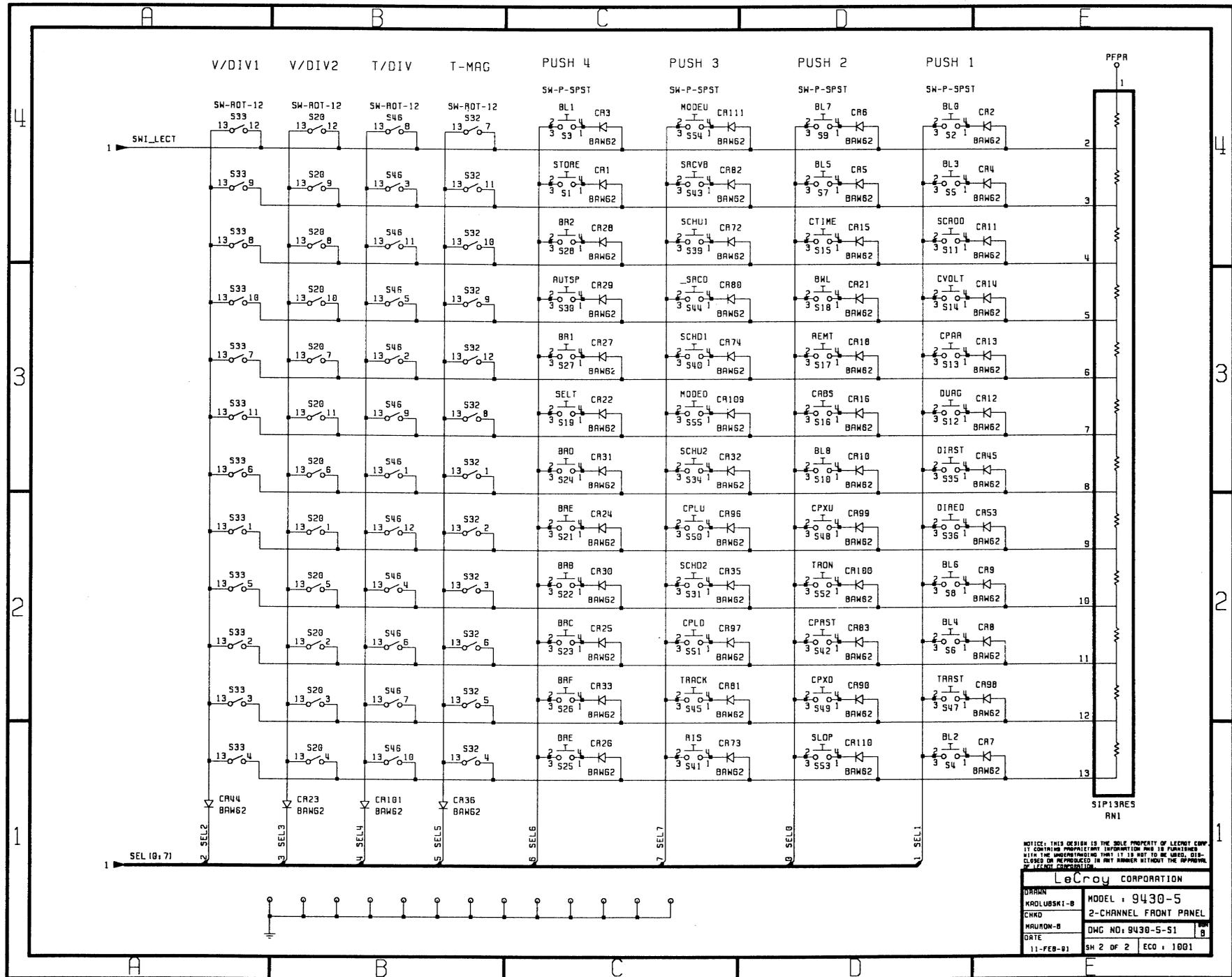
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TR322	SM652101331	SM330S	SM0805	20899120	5524500	1	90
TR323	SM652101820	SM82S	SM0805	21064220	1945640	1	90
TR324	SM652101681	SM680S	SM0805	21318220	1943100	1	90
TR325	SM652101622	SM6.2KS	SM0805	21783040	4328160	1	180

TR326	SM652101562	SM5.6KS	SM0805	21590000	4064000	1	0
TR327	SM652101622	SM6.2KS	SM0805	21935440	3716020	1	270
TR328	SM652101622	SM6.2KS	SM0805	21937980	3368040	1	270
TR329	SM652101622	SM6.2KS	SM0805	21940520	3017520	1	270
TR330	SM652101622	SM6.2KS	SM0805	21945600	2667000	1	270
TR331	SM652101622	SM6.2KS	SM0805	21945600	2120900	1	90
TR332	SM652101112	SM1.1KS	SM0805	27434540	5113020	1	180
TRN1	190642332	3.3k-6SC	SIP6RES	6664960	9237980	1	270
TRN2	190642562	5.6k-6SC	SIP6RES	12425680	3434080	1	180
TRN3	190642562	5.6k-6SC	SIP6RES	12433300	1498600	1	180
TRN4	190642562	5.6k-6SC	SIP6RES	13030200	1511300	1	180
TRN5	190642562	5.6k-6SC	SIP6RES	21678900	3683000	1	0



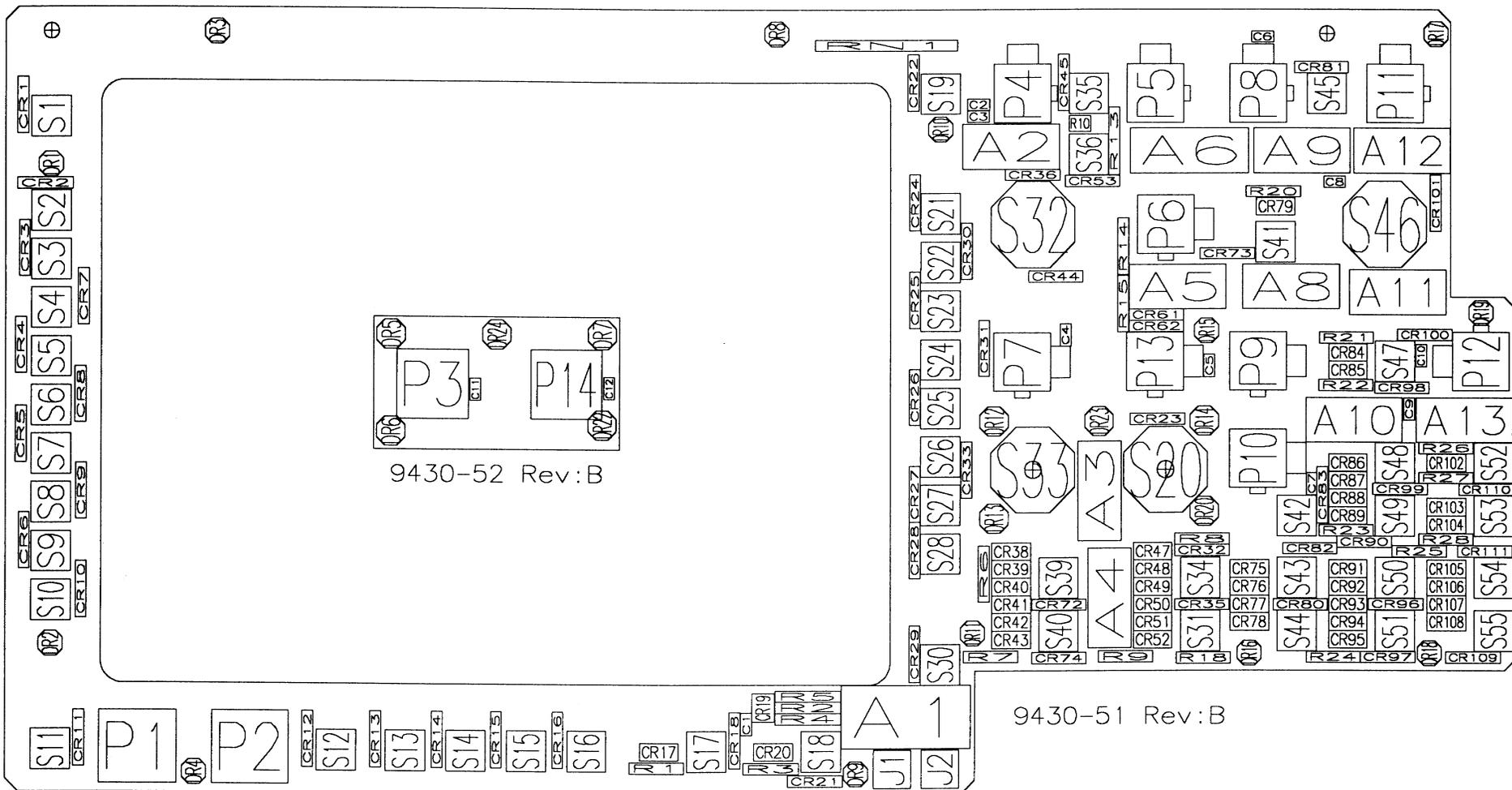
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Leicroy Corporation			
Drawn	KADLUBSKI-B	MODEL :	9430-5
Checked	MAURON-B		2-CHANNEL FRONT PANEL
DATE	11-FEB-91	DWG NO :	9430-5-S1
		SH 1 OF 2	ECO : 1001



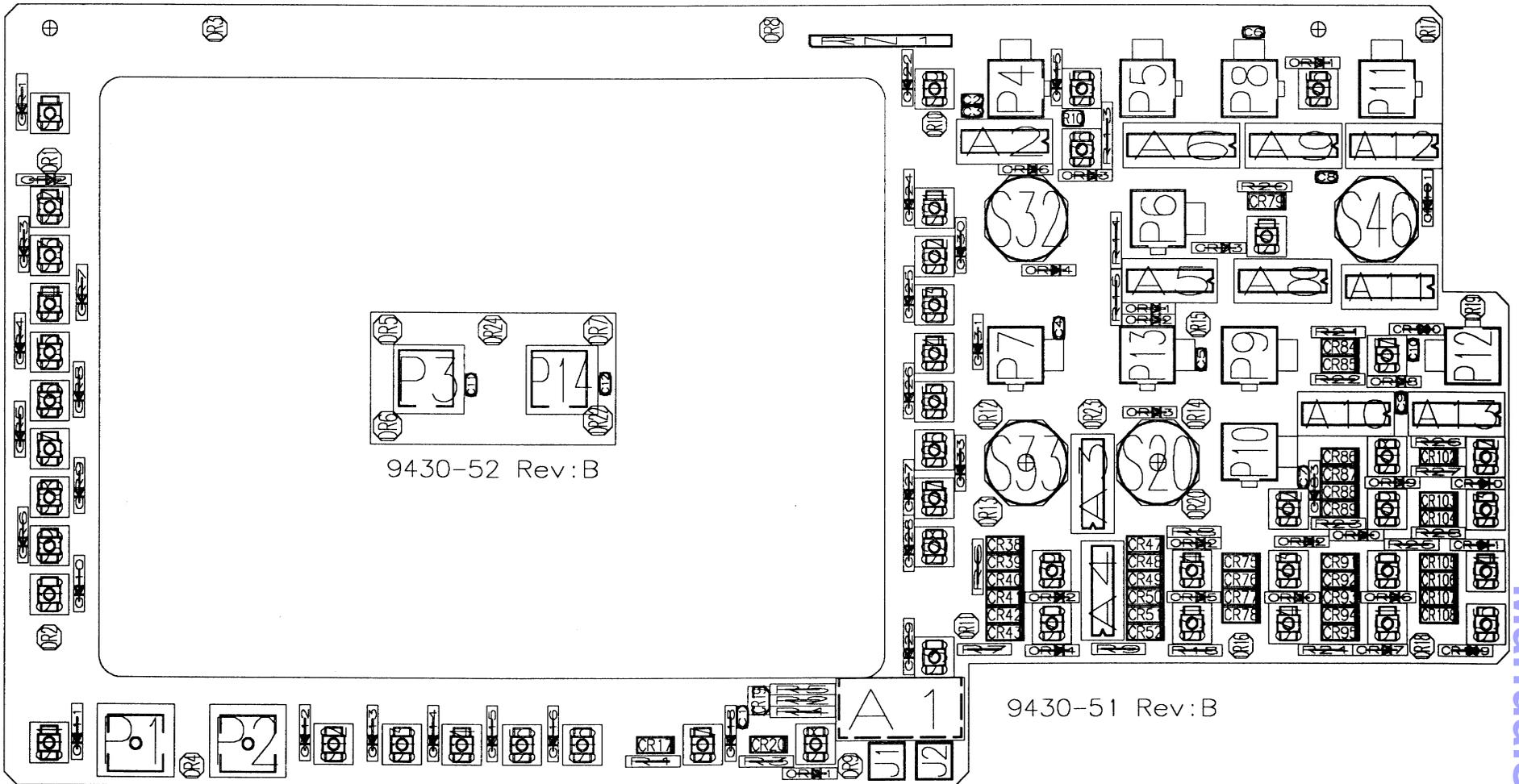
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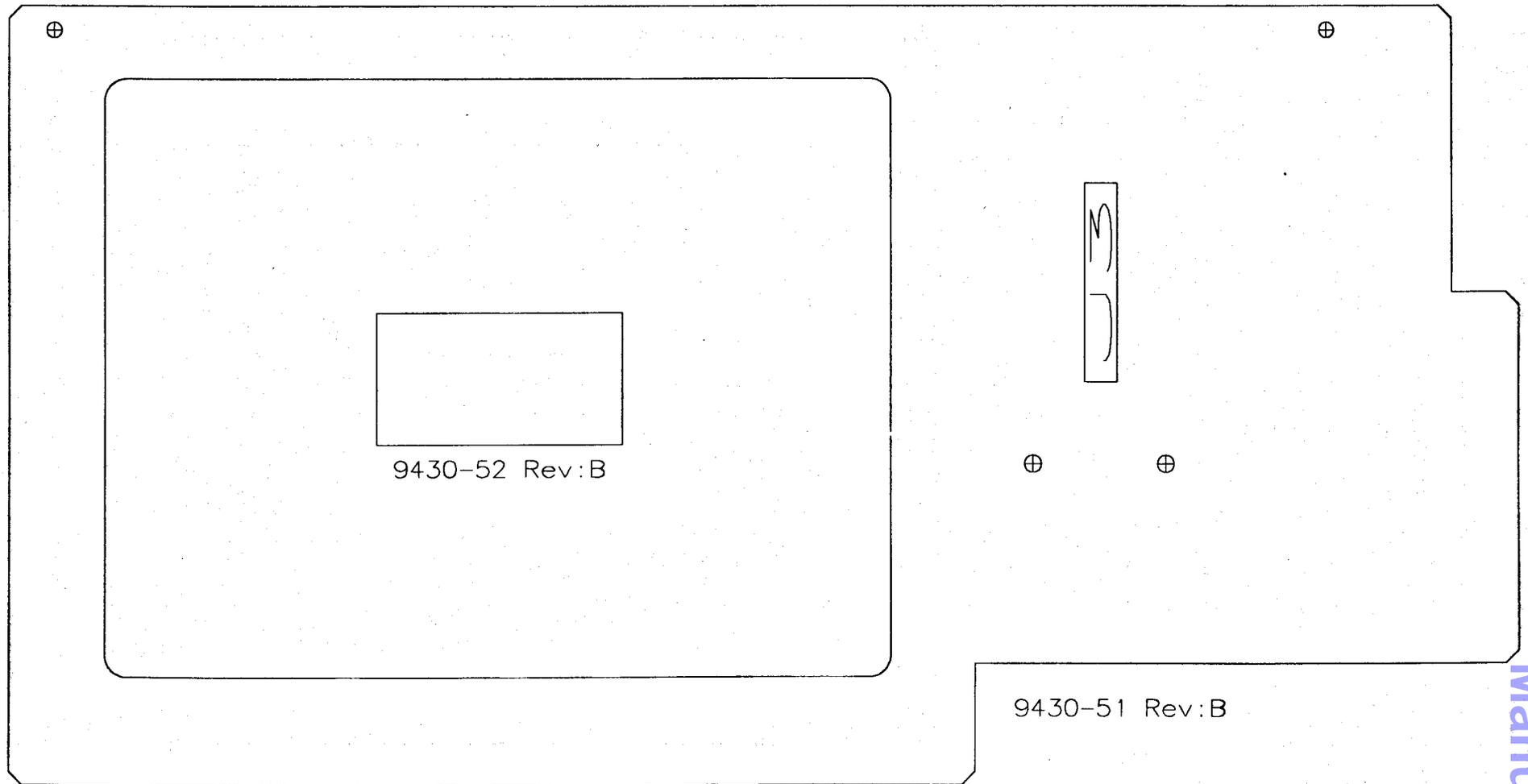
LeCroy CORPORATION	
DRAWN KADLUBSKI-B	MODEL: 9430-5
ENGR MAURON-B	2-CHANNEL FRONT PANEL
DATE 11-FEB-91	DWG NO: 9430-5-S1
	SH 2 OF 2
	ECC: 1001



9430-52 Rev:B

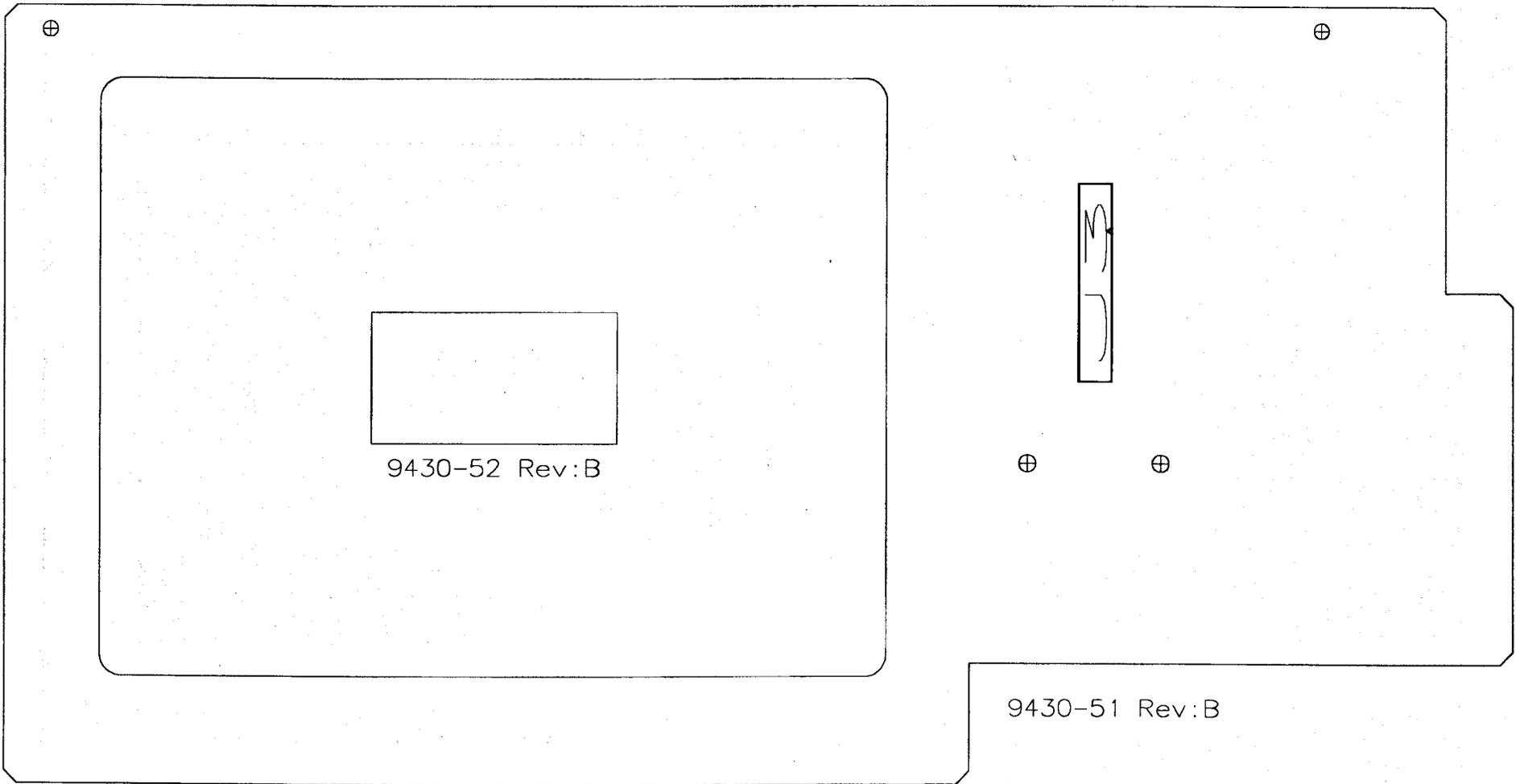
9430-51 Rev:B





9430-52 Rev:B

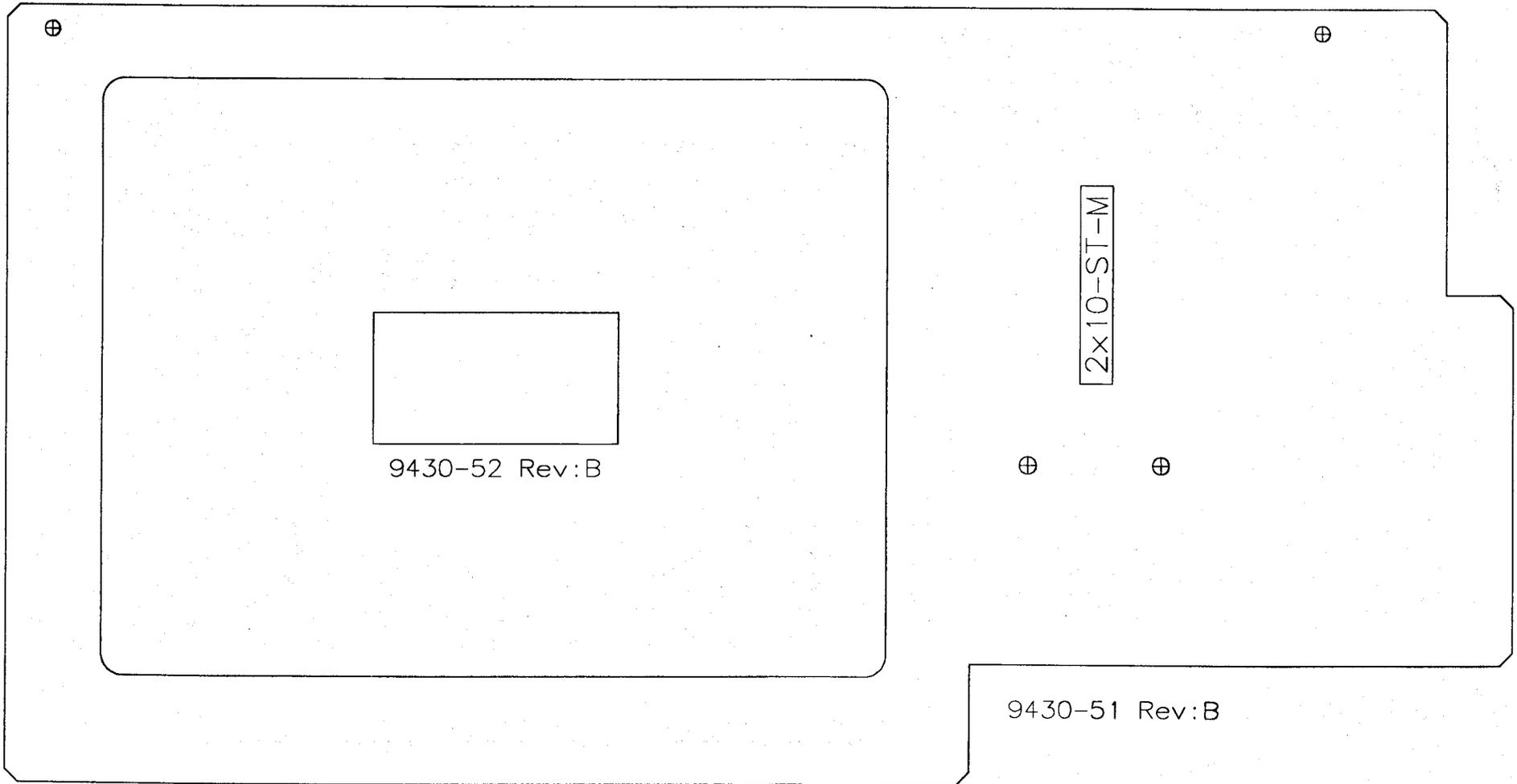
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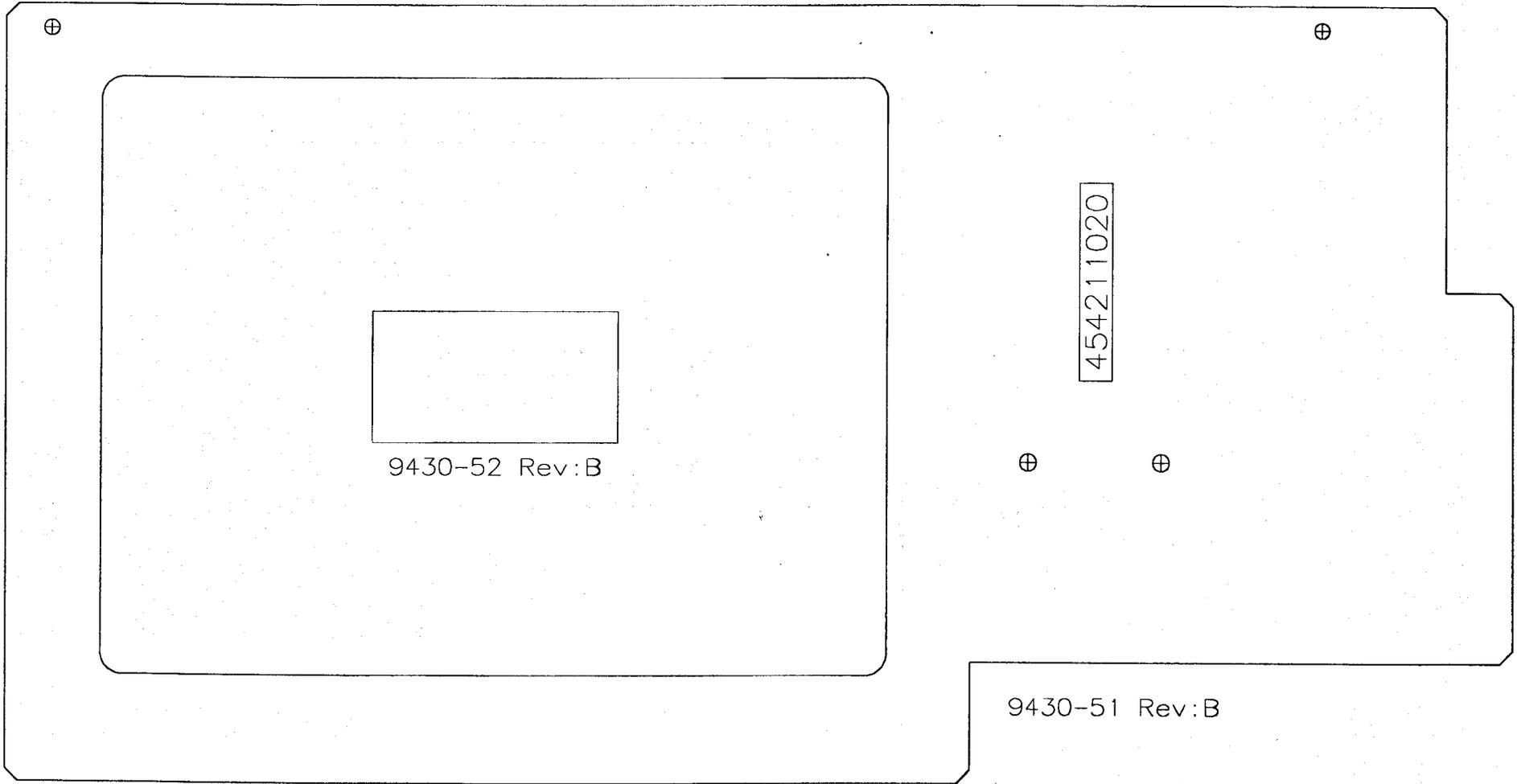


9430-52 Rev:B

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9430-51 Rev:B





9430-52 Rev:B

454211020

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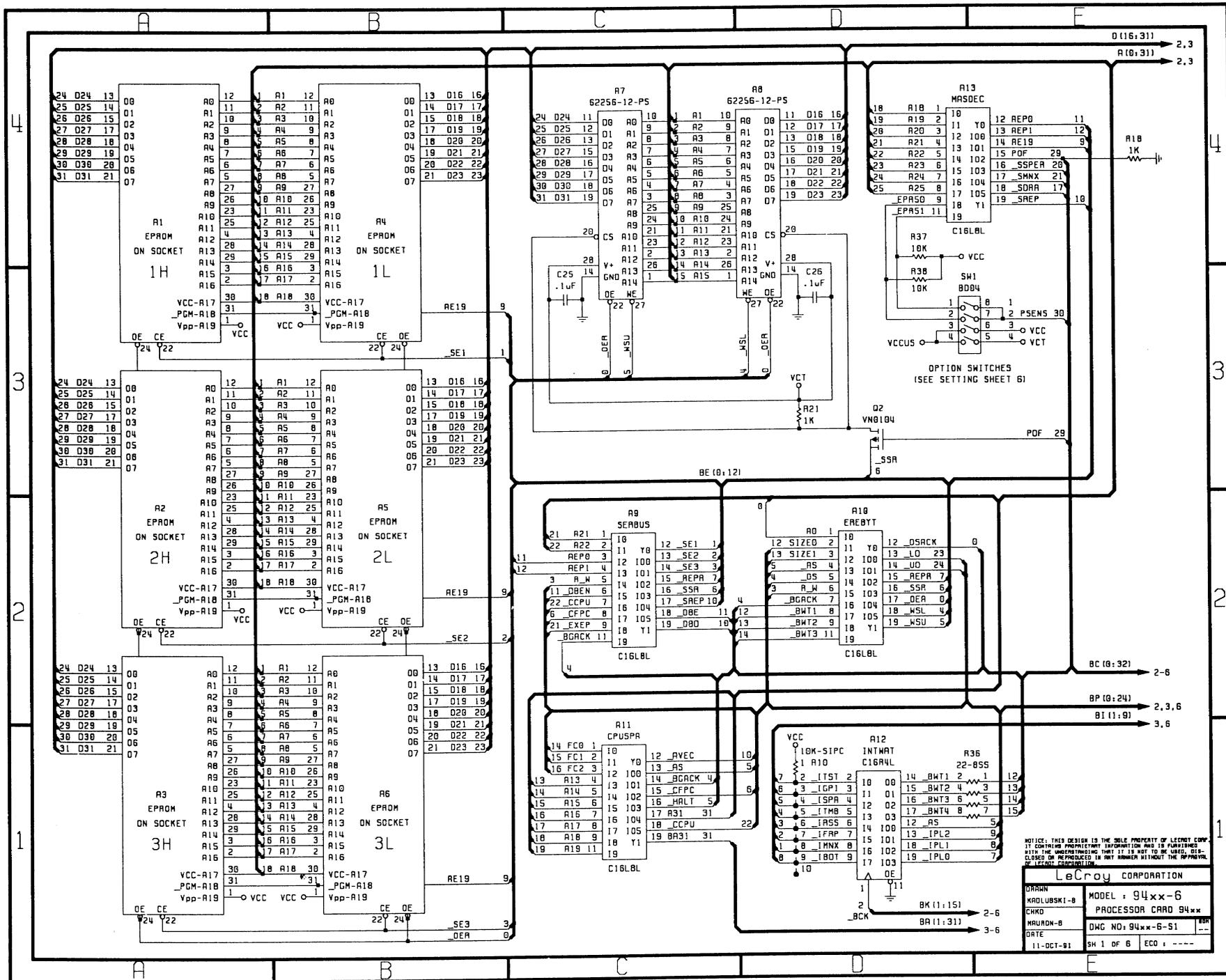
9430-51 Rev:B

A1	HPC411AIH	HPC411A	HPC411	2166620	-7754620	1	0
A2	207345051	74HCT4051-PS	DIP16	6629400	6134100	1	270
A3	205644094	74HCT4094-PS	DIP16	8191500	-2921000	1	180
A4	205644094	74HCT4094-PS	DIP16	8420100	-5346700	1	180
A5	207345051	74HCT4051-PS	DIP16	10515600	2971800	1	270
A6	205750000	C16L8L	DIP20	11036300	6045200	1	270
A8	207345051	74HCT4051-PS	DIP16	13157200	2971800	1	270
A9	200344138	74HCT138	DIP16	13411200	6045200	1	270
A10	205644094	74HCT4094-PS	DIP16	14630400	-50800	1	270
A11	205644094	74HCT4094-PS	DIP16	15646400	2844800	1	270
A12	207345051	74HCT4051-PS	DIP16	15748000	6045200	1	270
A13	205644094	74HCT4094-PS	DIP16	17208500	-50800	1	270
C1	103427104	.1uF	SMONOBP	-368300	-7404100	1	90
C2	103327103	.01uF	SMONOBP	5107940	6703060	1	180
C3	103327103	.01uF	SMONOBP	5105400	6433820	1	180
C4	103427104	.1uF	SMONOBP	7010400	1384300	1	90
C5	103427104	.1uF	SMONOBP	10363200	927100	1	270
C6	103427104	.1uF	SMONOBP	11468100	8229600	1	0
C7	103427104	.1uF	SMONOBP	12750800	-2006600	1	90
C8	103427104	.1uF	SMONOBP	13411200	4953000	1	180
C9	103427104	.1uF	SMONOBP	15024100	-304800	1	90
C10	103427104	.1uF	SMONOBP	15303500	901700	1	90
C11	103327103	.01uF	SMONOBP	-6700520	383540	1	270
C12	103327103	.01uF	SMONOBP	-3589020	414020	1	270
J1	709450511	CAL-TERM	CAL_TERMINAL	2745740	-8298180	1	0
J2	709450511	CAL-TERM	CAL_TERMINAL	3845560	-8298180	1	0
J3	454211020	2x10-ST-M	CONN2X10_ST M	7950200	3746500	2	270
P1	184437502	5K-1T-PC-MTG	POT_9400_5_M5	-14244320	-7137400	1	0
P2	184437502	5K-1T-PC-MTG	POT_9400_5_M5	-11645900	-7137400	1	0
P3	184427502	5K-1T-LONG-SHAFT-PS	POT_9400_5_M4	-6987540	144780	1	270
P4	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	6253480	7711440	1	0
P5	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	9354820	7711440	1	0
P6	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	10111740	3746500	1	270
P7	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	6761480	645160	1	270
P8	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	11752580	7711440	1	0
P9	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	12260580	645160	1	270
P10	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	12260580	-1554480	1	270
P11	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	14952980	7711440	1	0
P12	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	15938500	1153160	1	90
P13	184417502	5K-DUAL-INF-TURN	POT_9400_5_M3	9860280	645160	1	270
P14	184427502	5K-1T-LONG-SHAFT-PS	POT_9400_5_M4	-3886200	144780	1	270
R1	161225121	120	RES05	-1953260	-8270240	1	180
R2	168531381	750-1%	RES07	406400	-6908800	1	0
R3	161225121	120	RES05	-314960	-8280400	1	0
R4	168531365	511-1%	RES07	1676400	-7162800	1	180
R5	168531365	511-1%	RES07	1676400	-6654800	1	180
R6	161225121	120	RES05	5113020	-4414520	1	90
R7	161225121	120	RES05	4762500	-5778500	1	0
R8	161225121	120	RES05	10706100	-3124200	1	180
R9	161225121	120	RES05	7907020	-5778500	1	0
R10	169416473	NTC-DISC-47K	NTC_DISC	7467600	6273800	1	180
R13	168531521	21.5K-1%	RES07	8140700	6515100	1	270
R14	161225103	10K	RES05	8356600	4013200	1	270
R15	161225103	10K	RES05	8356600	1701800	1	90
R18	161225121	120	RES05	9715500	-5811520	1	0
R20	161225121	120	RES05	12357100	4737100	1	180
R21	161225121	120	RES05	14071600	1435100	1	180
R22	161225121	120	RES05	14058900	355600	1	180
R23	161225121	120	RES05	14071600	-2933700	1	180
R24	161225121	120	RES05	13766800	-5791200	1	180
R25	161225121	120	RES05	14757400	-3403600	1	0
R26	161225121	120	RES05	16395700	-1066800	1	180
R27	161225121	120	RES05	16395700	-1739900	1	180
R28	161225121	120	RES05	16395700	-3136900	1	180
S1	416161002	SW-P-SPST	SW_P_SPST	-16880840	6118860	1	0
S2	416161002	SW-P-SPST	SW_P_SPST	-16880840	3995420	1	0

S3	416161002	SW-P-SPST	SW P SPST	-16880840	2895600	1 0
S4	416161002	SW-P-SPST	SW P SPST	-16880840	1795780	1 0
S5	416161002	SW-P-SPST	SW P SPST	-16880840	695960	1 0
S6	416161002	SW-P-SPST	SW P SPST	-16880840	-403860	1 0
S7	416161002	SW-P-SPST	SW P SPST	-16880840	-1503680	1 0
S8	416161002	SW-P-SPST	SW P SPST	-16880840	-2603500	1 0
S9	416161002	SW-P-SPST	SW P SPST	-16880840	-3703320	1 0
S10	416161002	SW-P-SPST	SW P SPST	-16880840	-4803140	1 0
S11	416161002	SW-P-SPST	SW P SPST	-16880840	-8153400	1 0
S12	416161002	SW-P-SPST	SW P SPST	-10279380	-8153400	1 0
S13	416161002	SW-P-SPST	SW P SPST	-8679180	-8153400	1 0
S14	416161002	SW-P-SPST	SW P SPST	-7279640	-8153400	1 0
S15	416161002	SW-P-SPST	SW P SPST	-5880100	-8153400	1 0
S16	416161002	SW-P-SPST	SW P SPST	-4480560	-8153400	1 0
S17	416161002	SW-P-SPST	SW P SPST	-1678940	-8153400	1 0
S18	416161002	SW-P-SPST	SW P SPST	967740	-8153400	1 0
S19	416161002	SW-P-SPST	SW P SPST	3718560	6695440	1 0
S20	412001012	SW-ROT-12	SW ROT 12	9347200	-899160	1 0
S21	416161002	SW-P-SPST	SW P SPST	3718560	3995420	1 0
S22	416161002	SW-P-SPST	SW P SPST	3718560	2895600	1 0
S23	416161002	SW-P-SPST	SW P SPST	3718560	1795780	1 0
S24	416161002	SW-P-SPST	SW P SPST	3718560	695960	1 0
S25	416161002	SW-P-SPST	SW P SPST	3718560	-403860	1 0
S26	416161002	SW-P-SPST	SW P SPST	3718560	-1503680	1 0
S27	416161002	SW-P-SPST	SW P SPST	3718560	-2603500	1 0
S28	416161002	SW-P-SPST	SW P SPST	3718560	-3703320	1 0
S30	416161002	SW-P-SPST	SW P SPST	3718560	-6202680	1 0
S31	416161002	SW-P-SPST	SW P SPST	9768840	-5453380	1 0
S32	412001012	SW-ROT-12	SW ROT 12	6248400	4650740	1 0
S33	412001012	SW-ROT-12	SW ROT 12	6248400	-899160	1 0
S34	416161002	SW-P-SPST	SW P SPST	9768840	-4254500	1 0
S35	416161002	SW-P-SPST	SW P SPST	7167880	6695440	1 0
S36	416161002	SW-P-SPST	SW P SPST	7167880	5321300	1 0
S39	416161002	SW-P-SPST	SW P SPST	6466840	-4254500	1 0
S40	416161002	SW-P-SPST	SW P SPST	6466840	-5453380	1 0
S41	416161002	SW-P-SPST	SW P SPST	11518900	3345180	1 0
S42	416161002	SW-P-SPST	SW P SPST	12019280	-2854960	1 0
S43	416161002	SW-P-SPST	SW P SPST	12019280	-4254500	1 0
S44	416161002	SW-P-SPST	SW P SPST	12019280	-5453380	1 0
S45	416161002	SW-P-SPST	SW P SPST	12717780	6695440	1 0
S46	412001012	SW-ROT-12	SW ROT 12	14450060	4650740	1 0
S47	416161002	SW-P-SPST	SW P SPST	14317980	645160	1 0
S48	416161002	SW-P-SPST	SW P SPST	14317980	-1653540	1 0
S49	416161002	SW-P-SPST	SW P SPST	14317980	-2854960	1 0
S50	416161002	SW-P-SPST	SW P SPST	14317980	-4254500	1 0
S51	416161002	SW-P-SPST	SW P SPST	14317980	-5453380	1 0
S52	416161002	SW-P-SPST	SW P SPST	16619220	-1653540	1 0
S53	416161002	SW-P-SPST	SW P SPST	16619220	-2854960	1 0
S54	416161002	SW-P-SPST	SW P SPST	16619220	-4254500	1 0
S55	416161002	SW-P-SPST	SW P SPST	16619220	-5453380	1 0
CR1	230020062	BAW62	DO35	-17145000	7137400	1 270
CR2	230020062	BAW62	DO35	-17145000	4864100	1 0
CR3	230020062	BAW62	DO35	-17106900	3911600	1 270
CR4	230020062	BAW62	DO35	-17195800	1714500	1 270
CR5	230020062	BAW62	DO35	-17195800	-292100	1 270
CR6	230020062	BAW62	DO35	-17119600	-2692400	1 270
CR7	230020062	BAW62	DO35	-15760700	2819400	1 270
CR8	230020062	BAW62	DO35	-15824200	609600	1 270
CR9	230020062	BAW62	DO35	-15811500	-1574800	1 270
CR10	230020062	BAW62	DO35	-15811500	-3797300	1 270
CR11	230020062	BAW62	DO35	-15849600	-7137400	1 270
CR12	230020062	BAW62	DO35	-10566400	-7137400	1 270
CR13	230020062	BAW62	DO35	-8991600	-7137400	1 270
CR14	230020062	BAW62	DO35	-7569200	-7137400	1 270
CR15	230020062	BAW62	DO35	-6197600	-7137400	1 270
CR16	230020062	BAW62	DO35	-4775200	-7137400	1 270

CR17	256443401	LED-HLMP-0401	LED_RECT	-2527300	-7899400	1 0
CR18	230020062	BAW62	DO35	-640080	-7137400	1 270
CR19	208590385	LM385-1.2	TO92	76200	-6718300	1 270
CR20	256443401	LED-HLMP-0401	LED_RECT	121920	-7899400	1 0
CR21	230020062	BAW62	DO35	703580	-8564880	1 0
CR22	230020062	BAW62	DO35	3467100	7708900	1 270
CR23	230020062	BAW62	DO35	8648700	-406400	1 0
CR24	230020062	BAW62	DO35	3505200	5003800	1 270
CR25	230020062	BAW62	DO35	3505200	2806700	1 270
CR26	230020062	BAW62	DO35	3505200	609600	1 270
CR27	230020062	BAW62	DO35	3505200	-1587500	1 270
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CR32	230020062	BAW62	DO35	9690100	-3378200	1 0
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CR35	230020062	BAW62	DO35	9685020	-4605020	1 0
CR36	230020062	BAW62	DO35	5727700	5118100	1 0
CR38	256243300	LED-HLMP-0300	LED_RECT	5621020	-3403600	1 0
CR39	256443401	LED-HLMP-0401	LED_RECT	5621020	-5820380	1 0
CR40	256443401	LED-HLMP-0401	LED_RECT	5621020	-4201160	1 0
CR41	256443401	LED-HLMP-0401	LED_RECT	5621020	-4599940	1 0
CR42	256443401	LED-HLMP-0401	LED_RECT	5621020	-4998720	1 0
CR43	256443401	LED-HLMP-0401	LED_RECT	5621020	-5397500	1 0
CR44	230020062	BAW62	DO35	6273800	2832100	1 0
CR45	230020062	BAW62	DO35	6959600	7708900	1 270
CR47	256243300	LED-HLMP-0300	LED_RECT	8920480	-3403600	1 0
CR48	256443401	LED-HLMP-0401	LED_RECT	8920480	-3802380	1 0
CR49	256443401	LED-HLMP-0401	LED_RECT	8920480	-4201160	1 0
CR50	256443401	LED-HLMP-0401	LED_RECT	8920480	-4599940	1 0
CR51	256443401	LED-HLMP-0401	LED_RECT	8920480	-4998720	1 0
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CR53	230020062	BAW62	DO35	7124700	4978400	1 0
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CR72	230020062	BAW62	DO35	6350000	-4605020	1 0
CR73	230020062	BAW62	DO35	10274300	3340100	1 0
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CR75	256443401	LED-HLMP-0401	LED_RECT	11173460	-3802380	1 0
CR76	256443401	LED-HLMP-0401	LED_RECT	11173460	-4201160	1 0
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CR80	230020062	BAW62	DO35	11976100	-4610100	1 0
CR81	230020062	BAW62	DO35	12458700	7543800	1 0
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CR83	230020062	BAW62	DO35	13004800	-1625600	1 270
CR84	256443401	LED-HLMP-0401	LED_RECT	13472160	1097280	1 0
CR85	256443401	LED-HLMP-0401	LED_RECT	13472160	698500	1 0
CR86	256443401	LED-HLMP-0401	LED_RECT	13472160	-1402080	1 0
CR87	256443401	LED-HLMP-0401	LED_RECT	13472160	-1800860	1 0
CR88	256443401	LED-HLMP-0401	LED_RECT	13472160	-2199640	1 0
CR89	256443401	LED-HLMP-0401	LED_RECT	13472160	-2598420	1 0
CR90	230020062	BAW62	DO35	13474700	-3187700	1 0
CR91	256443401	LED-HLMP-0401	LED_RECT	13472160	-3802380	1 0
CR92	256443401	LED-HLMP-0401	LED_RECT	13472160	-4201160	1 0
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CR95	256443401	LED-HLMP-0401	LED_RECT	13472160	-5397500	1 0
CR96	230020062	BAW62	DO35	14211300	-4597400	1 0
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CR98	230020062	BAW62	DO35	14351000	304800	1 0
CR99	230020062	BAW62	DO35	14312900	-1993900	1 0
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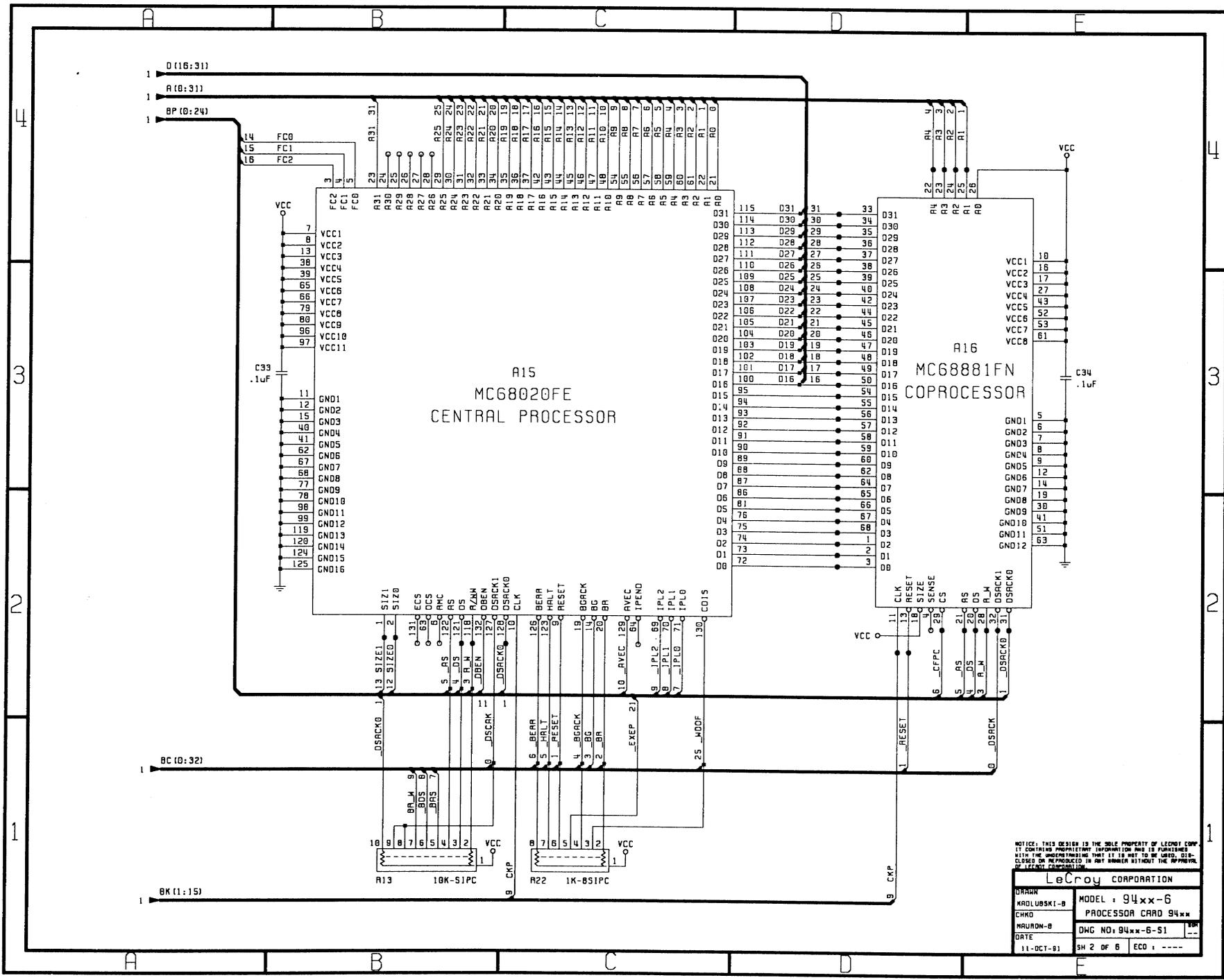
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CR104	256443401	LED-HLMP-0401	LED_RECT	15773400	-2799080	1	0
CR105	256443401	LED-HLMP-0401	LED_RECT	15773400	-3802380	1	0
CR106	256443401	LED-HLMP-0401	LED_RECT	15773400	-4201160	1	0
CR107	256443401	LED-HLMP-0401	LED_RECT	15773400	-4599940	1	0
CR108	256443401	LED-HLMP-0401	LED_RECT	15773400	-4998720	1	0
CR109	230020062	BAW62	DO35	16012160	-5798820	1	0
CR110	230020062	BAW62	DO35	16319500	-2006600	1	0
CR111	230020062	BAW62	DO35	16294100	-3403600	1	0
RN1	190001001	SIP13RES	SIP13RES	1320800	8039100	1	90



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LeCroy CORPORATION

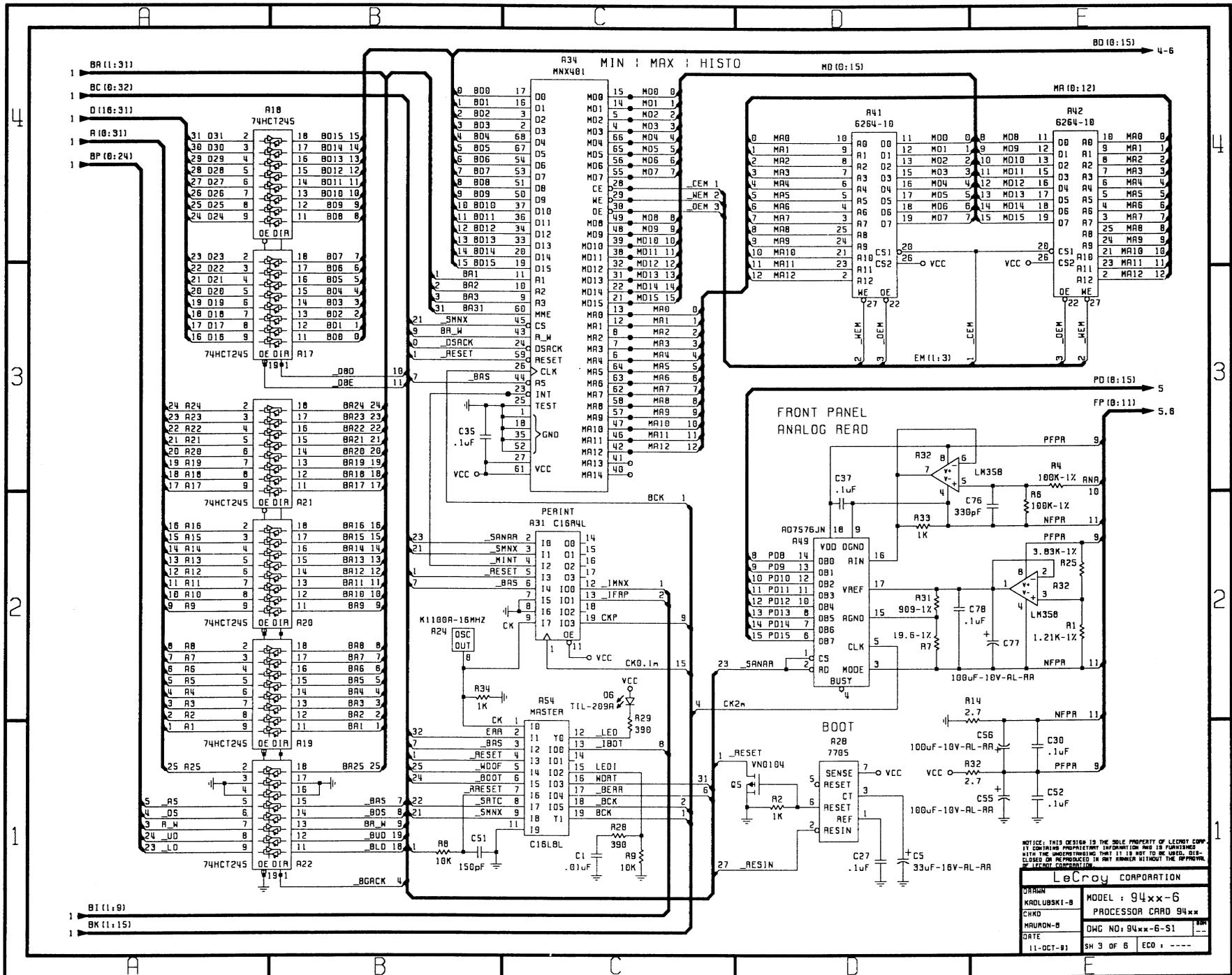
DRAWN KADLUBSKI-B	MODEL : 94xx-6
CKWD MAURON-B	PROCESSOR CARD 94xx
DATE 11-OCT-91	DWG NO: 94xx-6-S1
	SH 1 OF 6 ECO : ---



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LeCroy CORPORATION

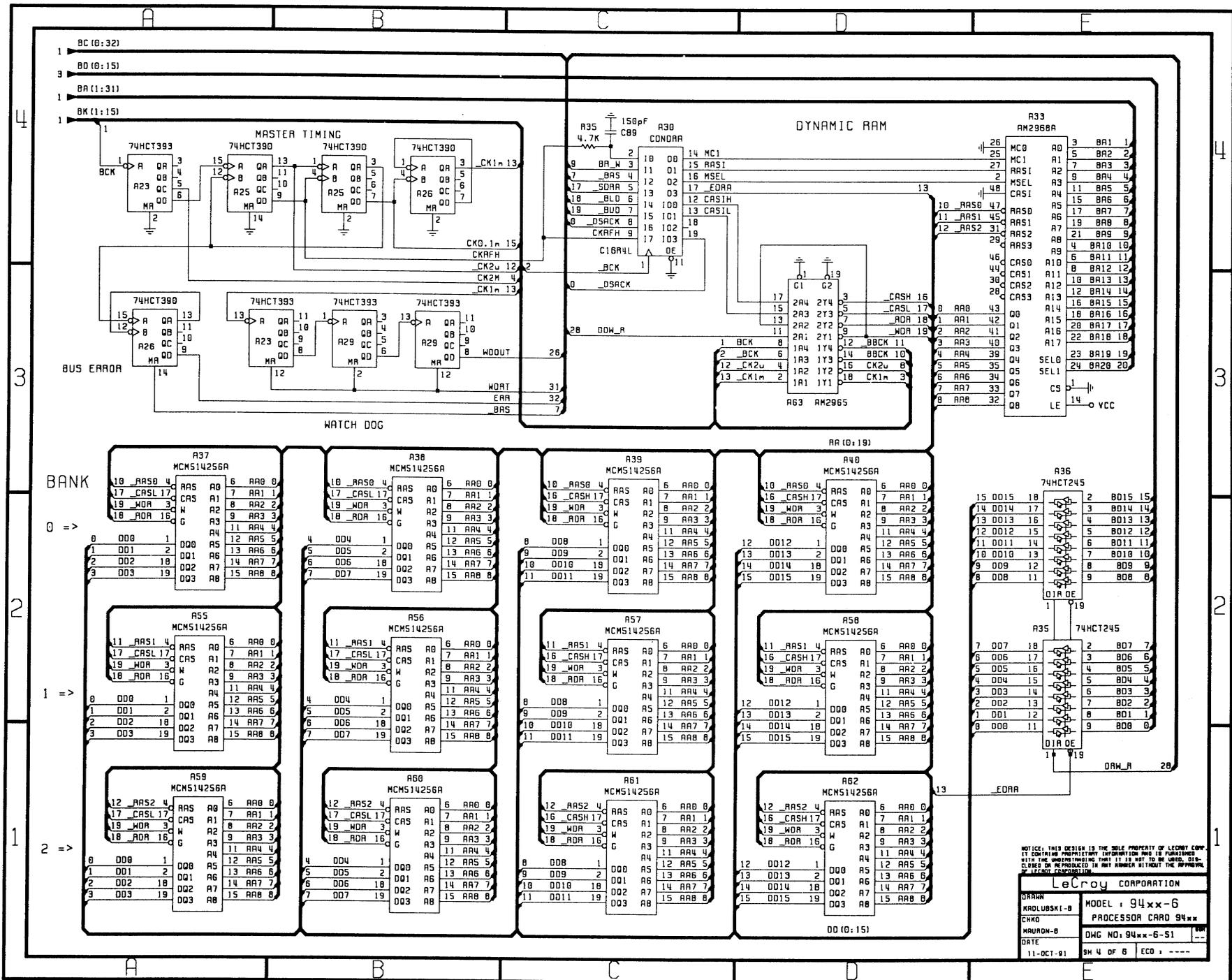
URAHN	MODEL : 94xx-6
KRDLUBSKI-B	PROCESSOR CARD 94xx
CHRD	
MAURON-B	DWG NO: 94xx-6-51
DATE	11-OCT-91
	SH 2 OF 6 ECD : ----



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LeCroy CORPORATION

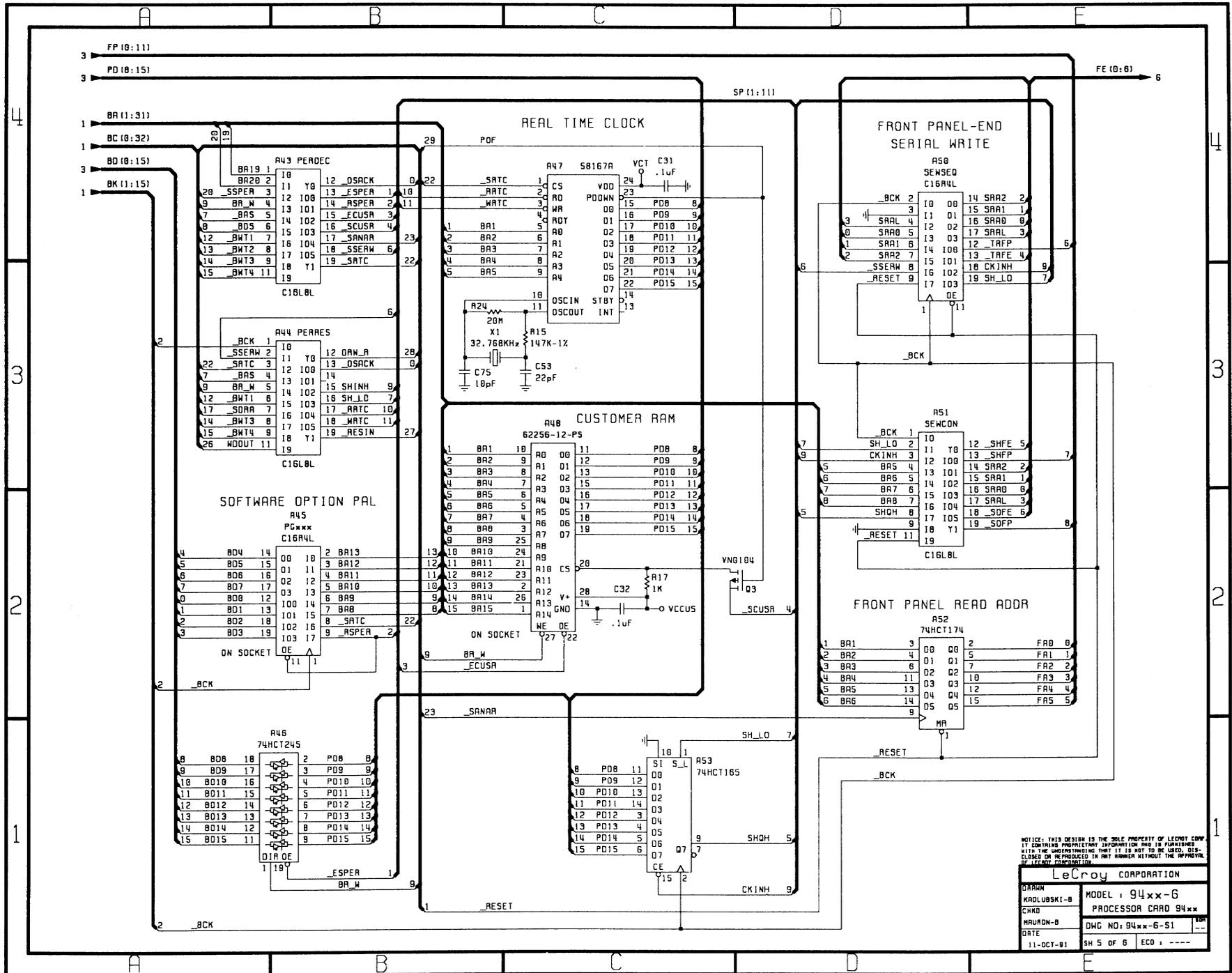
DRAWN	MODEL : 94xx-6
KADLUBSKI-B	PROCESSOR CARD 94xx
CKWD	
MARUNO-B	DWG NO: 94xx-6-51
DATE	SH 3 OF 6 ECO : ----
11-OCT-91	



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Leadco CORPORATION

DRAWN	MODEL: 94xx-6
CHKD	PROCESSOR CARD 94xx
MADE IN	DWG NO: 94xx-6-S1
DATE	SH 4 OF 6 ECO: ----
11-OCT-81	



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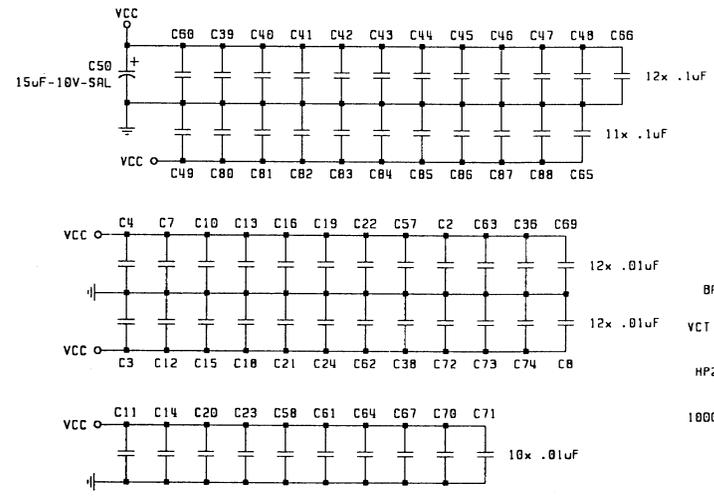
LeCroy CORPORATION

DRAWN	KRADLOUSKI-B	MODEL :	94xx-6
CHKD	HAURON-B	PROCESSOR CARD	94xx
DATE	11-OCT-91	DWG NO :	94xx-6-S1
		SH 5 OF 6	ECD : ----

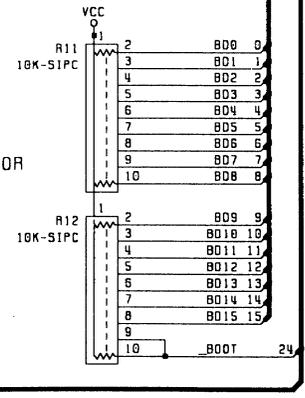
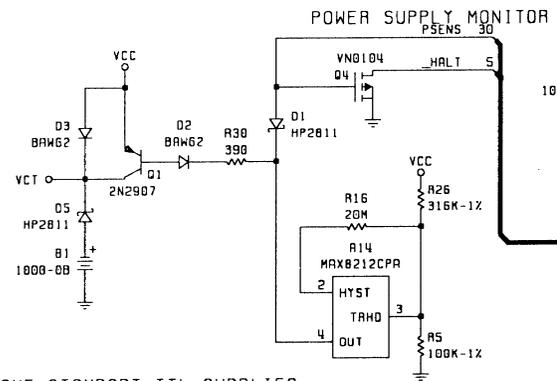
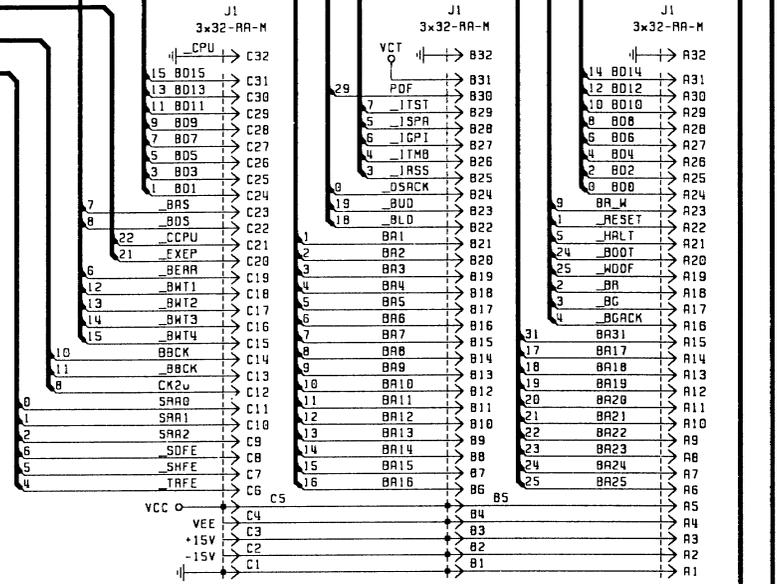
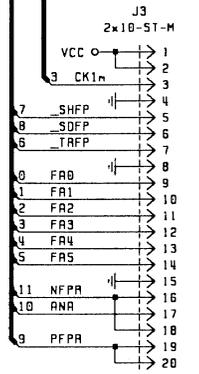
SWITCH NUMBER :

1	2	3	4
EPROM :	0	1	--
2 Mbit	1	0	--
4 Mbit	1	1	--
CUST RAM :	--	0	1
STATIC	--	0	1
EEPROM	--	1	0

WARNING ! Switches must be set before power-on (short circuit)

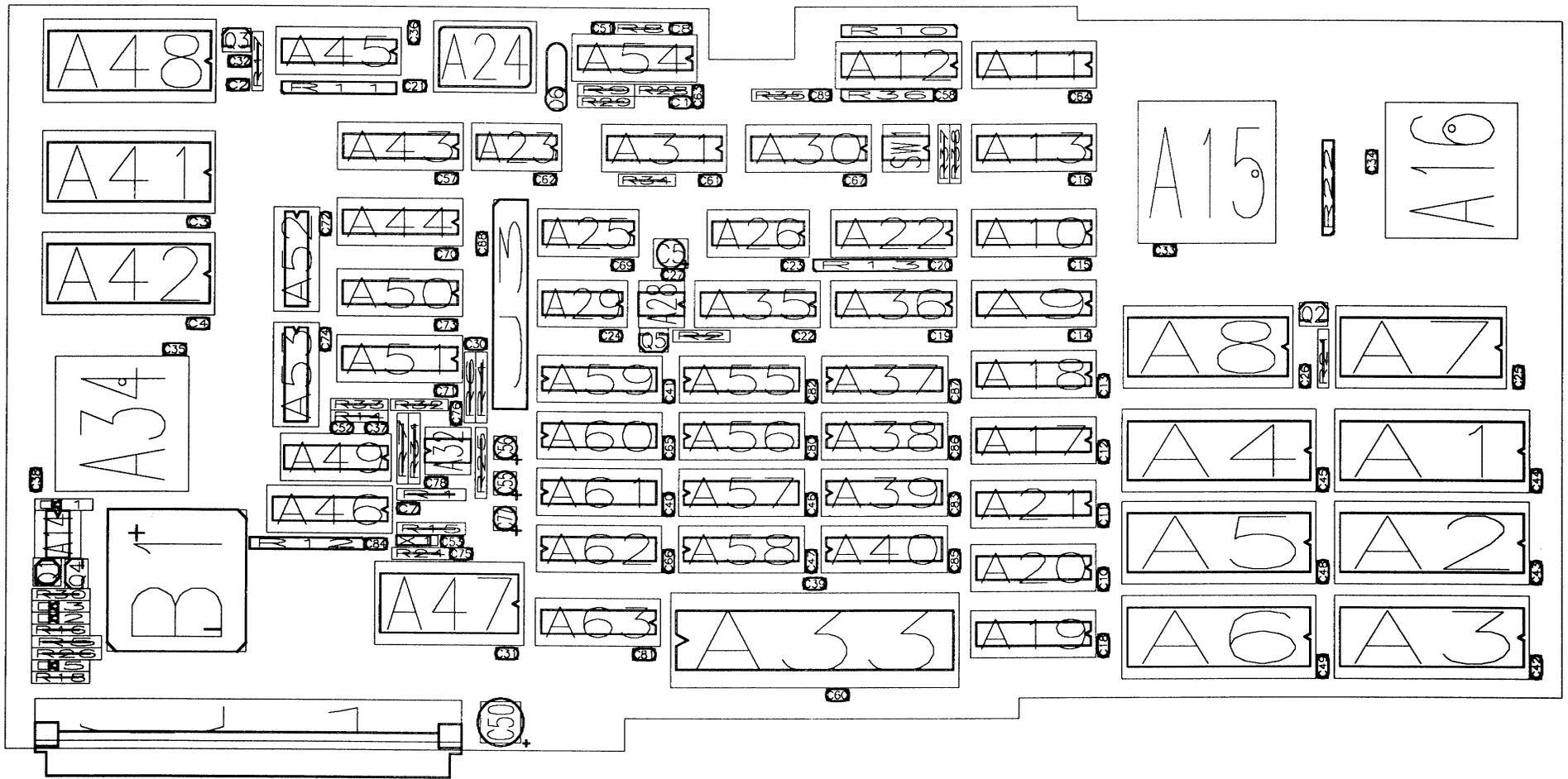


ALL ICs WITH NO POWER SUPPLY SHOWN ON SCHEMATIC HAVE STANDART TTL SUPPLIES .



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LeCroy CORPORATION	
DRAWN	MODEL : 94xx-6
MAXLUBSKI-B	PROCESSOR CARD 94xx
CHKD	DWG NO: 94xx-6-51
MAURON-B	DATE
11-OCT-91	SH 6 OF 6 ECO : ----

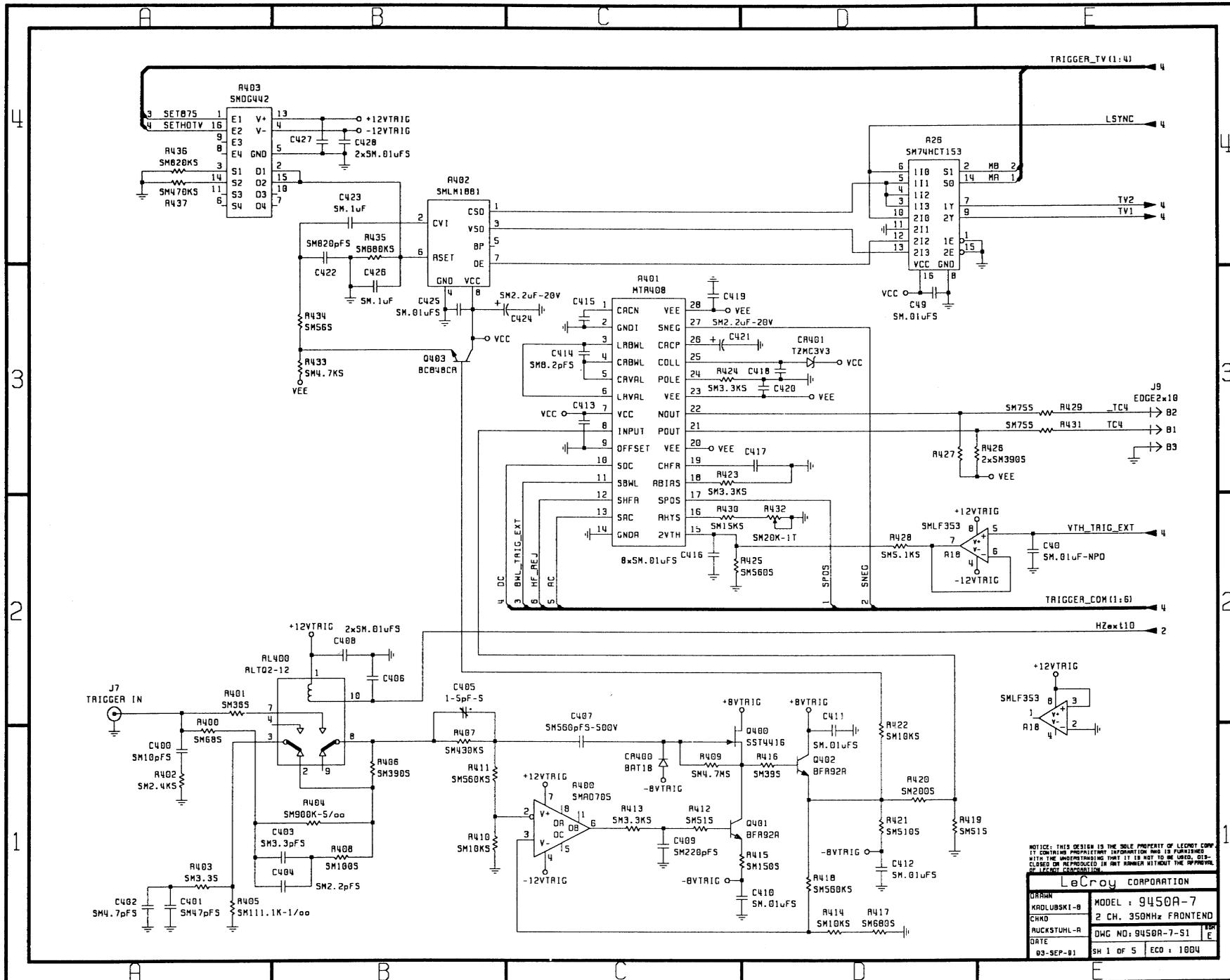


94XX_6 Rev:A

A1	EPROM	EPROM	DIP32	33426400	7162800	1 270
A2	EPROM	EPROM	DIP32	33426400	5181600	1 270
A3	EPROM	EPROM	DIP32	33426400	3149600	1 270
A4	EPROM	EPROM	DIP32	28702000	7162800	1 270
A5	EPROM	EPROM	DIP32	28702000	5181600	1 270
A6	EPROM	EPROM	DIP32	28702000	3149600	1 270
A7	205271256	62256-12-PS	DIP28	32918400	9398000	1 270
A8	205271256	62256-12-PS	DIP28	28194000	9398000	1 270
A9	205750000	C16L8L	DIP20	23825200	9956800	1 270
A10	205750000	C16L8L	DIP20	23825200	11480800	1 270
A11	205750000	C16L8L	DIP20	23825200	15087600	1 270
A12	205750000	C16R4L	DIP20	20828000	15087600	1 270
A13	205750000	C16L8L	DIP20	23825200	13309600	1 270
A14	208618212	MAX8212CPA	DIP8	762000	4927600	1 0
A15	SM207668020	MC68020FE	QUAD_FP_132P	27838400	12395200	1 270
A16	SM207668881	MC68881FN	PLCC_68	31940500	13652500	1 0
A17	207472245	74HCT245	DIP20	23825200	7010400	1 270
A18	207472245	74HCT245	DIP20	23825200	8432800	1 270
A19	207472245	74HCT245	DIP20	23825200	2844800	1 270
A20	207472245	74HCT245	DIP20	23825200	4267200	1 270
A21	207472245	74HCT245	DIP20	23825200	5638800	1 270
A22	207472245	74HCT245	DIP20	20726400	11480800	1 270
A23	200430393	74HCT393	DIP14	11988800	13309600	1 270
A24	309041016	K1100A-16MHZ	\$1100_QUARTZ	9753600	16764000	1 0
A25	200440390	74HCT390	DIP16	13716000	11480800	1 270
A26	200440390	74HCT390	DIP16	17475200	11480800	1 270
A28	208517705	7705	DIP8	14833600	9956800	1 270
A29	200430393	74HCT393	DIP14	13462000	9956800	1 270
A30	205750000	C16R4L	DIP20	18846800	13309600	1 270
A31	205750000	C16R4L	DIP20	15646400	13309600	1 270
A32	208011007	LM358	DIP8	9347200	5994400	1 90
A33	227792968	AM2968A	DIP48	14935200	1574800	1 90
A34	MNX401	MNX401	PLCC_68	2540000	8128000	1 0
A35	207472245	74HCT245	DIP20	17729200	9956800	1 270
A36	207472245	74HCT245	DIP20	20726400	9956800	1 270
A37	205254256	MCM514256A	DIP20	18237200	7569200	1 90
A38	205254256	MCM514256A	DIP20	18237200	6350000	1 90
A39	205254256	MCM514256A	DIP20	18237200	5130800	1 90
A40	205254256	MCM514256A	DIP20	18237200	3911600	1 90
A41	205272064	6264-10	DIP28	4318000	13106400	1 270
A42	205272064	6264-10	DIP28	4318000	10922000	1 270
A43	205750000	C16L8L	DIP20	9804400	13309600	1 270
A44	205750000	C16L8L	DIP20	9804400	11684000	1 270
A45	205750000	C16R4L	DIP20	8432800	15341600	1 270
A46	207472245	74HCT245	DIP20	8280400	5486400	1 270
A47	200480167	58167A	\$DIP24	11176000	3860800	1 270
A48	205271256	62256-12-PS	DIP28	4318000	15494000	1 270
A49	207367576	AD7576JN	DIP18	8280400	6604000	1 270
A50	205750000	C16R4L	DIP20	9804400	10160000	1 270
A51	205750000	C16L8L	DIP20	9804400	8737600	1 270
A52	200344174	74HCT174	DIP16	5994400	11379200	1 0
A53	205640165	74HCT165	DIP16	5994400	8890000	1 0
A54	205750000	C16L8L	DIP20	14986000	15240000	1 270
A55	205254256	MCM514256A	DIP20	15087600	7569200	1 90
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A57	205254256	MCM514256A	DIP20	15087600	5130800	1 90
A58	205254256	MCM514256A	DIP20	15087600	3911600	1 90
A59	205254256	MCM514256A	DIP20	11938000	7569200	1 90
A60	205254256	MCM514256A	DIP20	11938000	6350000	1 90
A61	205254256	MCM514256A	DIP20	11938000	5130800	1 90
A62	205254256	MCM514256A	DIP20	11938000	3911600	1 90
A63	207172965	AM2965	DIP20	14224000	3098800	1 270
B1	312660030	1000-0B	BAT_1000	2489200	4826000	1 0
C1	103327103	.01uF	SMONOBP	14732000	13919200	1 0
C2	103327103	.01uF	SMONOBP	5181600	14224000	1 180
C3	103327103	.01uF	SMONOBP	4318000	11277600	1 180

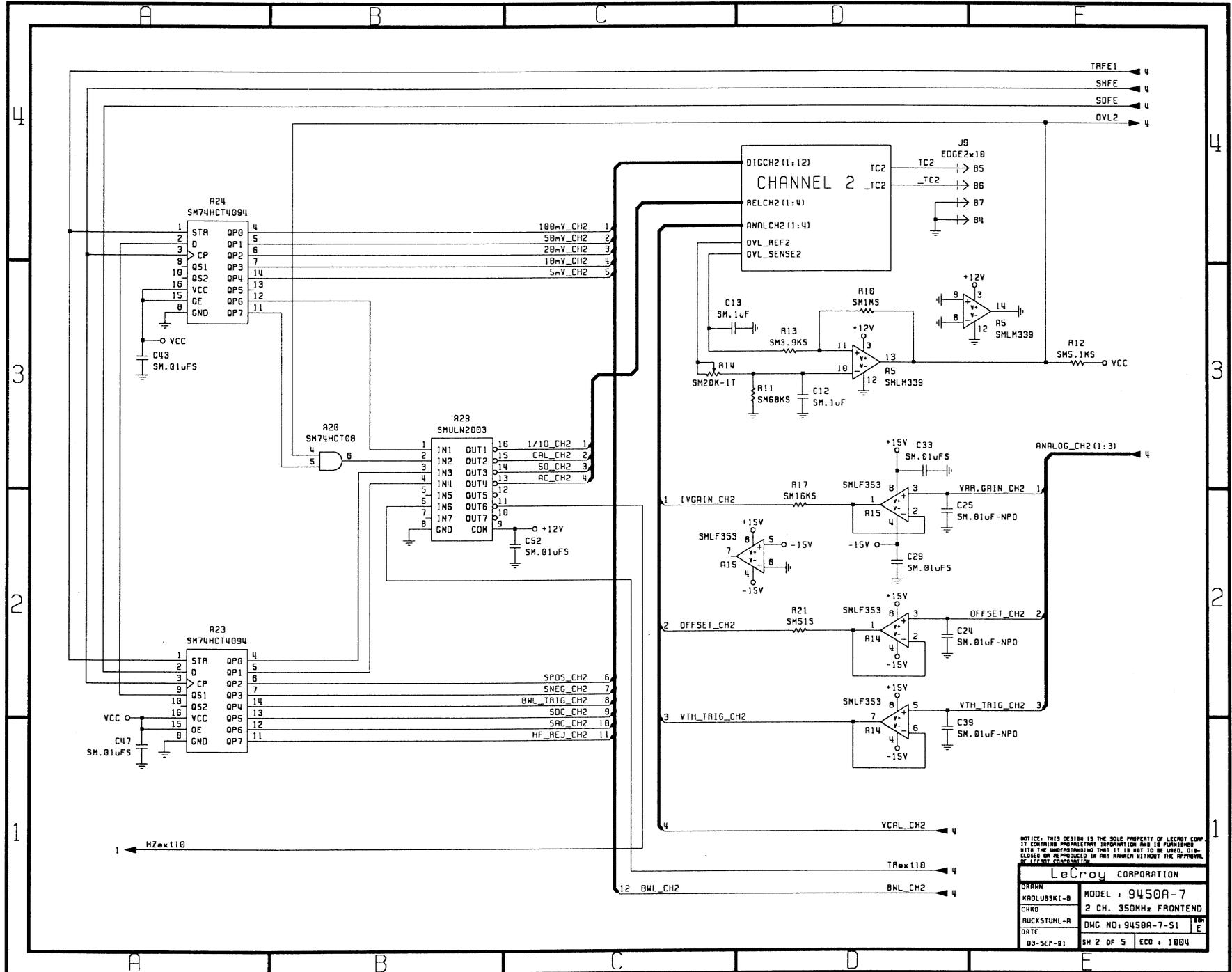
C4	103327103	.01uF	SMONOBP	4318000	9093200	1 180
C5	147436033	33uF-16V-AL-RA	TCAP	14782800	10668000	1 180
C7	103327103	.01uF	SMONOBP	8991600	5130800	1 180
C8	103327103	.01uF	SMONOBP	14986000	15494000	1 180
C10	103327103	.01uF	SMONOBP	24231600	3505200	1 90
C11	103327103	.01uF	SMONOBP	24231600	4876800	1 90
C12	103327103	.01uF	SMONOBP	24231600	6248400	1 90
C13	103327103	.01uF	SMONOBP	24231600	7670800	1 90
C14	103327103	.01uF	SMONOBP	23825200	8890000	1 180
C15	103327103	.01uF	SMONOBP	23825200	10414000	1 180
C16	103327103	.01uF	SMONOBP	23825200	12242800	1 180
C18	103327103	.01uF	SMONOBP	24231600	2082800	1 90
C19	103327103	.01uF	SMONOBP	20726400	8890000	1 180
C20	103327103	.01uF	SMONOBP	20726400	10414000	1 180
C21	103327103	.01uF	SMONOBP	8839200	14224000	1 0
C22	103327103	.01uF	SMONOBP	17729200	8890000	1 180
C23	103327103	.01uF	SMONOBP	17475200	10414000	1 180
C24	103327103	.01uF	SMONOBP	13462000	8890000	1 180
C25	103427104	.luF	SMONOBP	33426400	7874000	1 90
C26	103427104	.luF	SMONOBP	28702000	7874000	1 90
C27	103427104	.luF	SMONOBP	14579600	10210800	1 0
C30	103427104	.luF	SMONOBP	10210800	8686800	1 0
C31	103427104	.luF	SMONOBP	11176000	2032000	1 180
C32	103427104	.luF	SMONOBP	4953000	14732000	1 0
C33	103427104	.luF	SMONOBP	25704800	10718800	1 180
C34	103427104	.luF	SMONOBP	30175200	12750800	1 270
C35	103427104	.luF	SMONOBP	3556000	8534400	1 0
C36	103327103	.01uF	SMONOBP	8940800	15240000	1 90
C37	103427104	.luF	SMONOBP	8026400	6858000	1 0
C38	103327103	.01uF	SMONOBP	660400	5842000	1 270
C39	103427104	.luF	SMONOBP	17983200	3556000	1 180
C40	103427104	.luF	SMONOBP	14630400	5130800	1 90
C41	103427104	.luF	SMONOBP	14630400	7569200	1 90
C42	103427104	.luF	SMONOBP	33832800	1625600	1 90
C43	103427104	.luF	SMONOBP	33832800	3657600	1 90
C44	103427104	.luF	SMONOBP	33832800	5638800	1 90
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C47	103427104	.luF	SMONOBP	17780000	3911600	1 90
C48	103427104	.luF	SMONOBP	29108400	3657600	1 90
C49	103427104	.luF	SMONOBP	29108400	1625600	1 90
C50	142214156	15uF-10V-SAL	LTCAP	10922000	304800	1 90
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C53	102412220	22pF	SMONO	9702800	4419600	1 0
C55	146354107	100uF-10V-AL-RA	TDCAP	11125200	5689600	1 180
C56	146354107	100uF-10V-AL-RA	TDCAP	11125200	6451600	1 180
C57	103327103	.01uF	SMONOBP	9804400	12242800	1 180
C58	103327103	.01uF	SMONOBP	20828000	14071600	1 180
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C61	103327103	.01uF	SMONOBP	15646400	12242800	1 180
C62	103327103	.01uF	SMONOBP	11988800	12242800	1 180
C63	103327103	.01uF	SMONOBP	15240000	14173200	1 270
C64	103327103	.01uF	SMONOBP	23825200	14020800	1 180
C65	103427104	.luF	SMONOBP	14630400	6350000	1 90
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C67	103327103	.01uF	SMONOBP	18846800	12242800	1 180
C69	103327103	.01uF	SMONOBP	13716000	10414000	1 180
C70	103327103	.01uF	SMONOBP	9804400	10617200	1 180
C71	103327103	.01uF	SMONOBP	9804400	7670800	1 180
C72	103327103	.01uF	SMONOBP	7010400	11379200	1 270
C73	103327103	.01uF	SMONOBP	9804400	9093200	1 180
C74	103327103	.01uF	SMONOBP	7010400	8890000	1 270
C75	102412100	10pF	SMONO	9906000	4165600	1 0
C76	102412331	330pF	SMONO	9906000	7061200	1 90
C77	146354107	100uF-10V-AL-RA	TDCAP	11125200	4927600	1 180

C78	103427104	.1uF	SMONOBP	9347200	5689600	1 0
C80	103427104	.1uF	SMONOBP	17780000	6350000	1 90
C81	103427104	.1uF	SMONOBP	14224000	2032000	1 180
C82	103427104	.1uF	SMONOBP	17780000	7569200	1 90
C83	103427104	.1uF	SMONOBP	20929600	5130800	1 90
C84	103427104	.1uF	SMONOBP	8280400	4368800	1 180
C85	103427104	.1uF	SMONOBP	20929600	3911600	1 90
C86	103427104	.1uF	SMONOBP	20929600	6350000	1 90
C87	103427104	.1uF	SMONOBP	20929600	7569200	1 90
C88	103427104	.1uF	SMONOBP	10464800	10718800	1 90
C89	102412151	150pF	SMONO	18084800	14071600	1 180
D1	253010811	HP2811	DO35	1778000	5181600	1 180
D2	230020062	BAW62	DO35	1727200	2743200	1 180
D3	230020062	BAW62	DO35	1727200	2997200	1 180
D5	253010811	HP2811	DO35	1727200	1727200	1 180
D6	256233209	TIL-209A	\$LED 1	11988800	13970000	1 90
J1	454610096	3x32-RA-M	CONN3X32_RA_M	9296400	508000	1 180
J3	454211020	2x10-ST-M	CONN2X10_ST_M	10972800	10718800	1 270
Q1	275110001	2N2907	TO18	914400	3606800	1 90
Q2	280170104	VN0104	TO92	28702000	9398000	1 0
Q3	280170104	VN0104	TO92	4826000	15240000	1 0
Q4	280170104	VN0104	TO92	1498600	3505200	1 90
Q5	280170104	VN0104	TO92	14478000	8737600	1 180
R1	168531401	1.21K-1%	RES07	10007600	5435600	1 180
R2	161225102	1K	RES05	14833600	8890000	1 0
R4	168531585	100K-1%	RES07	10464800	8382000	1 270
R5	168531585	100K-1%	RES07	711200	2235200	1 0
R6	168531585	100K-1%	RES07	10210800	8382000	1 270
R7	168531229	19.6-1%	RES07	8737600	7061200	1 270
R8	161225103	10K	RES05	13462000	15494000	1 0
R9	161225103	10K	RES05	13716000	14173200	1 180
R10	190042103	10K-SIPC	SIPI0RES	20828000	15443200	1 270
R11	190042103	10K-SIPC	SIPI0RES	6146800	14173200	1 90
R12	190042103	10K-SIPC	SIPI0RES	7772400	4368800	1 270
R13	190042103	10K-SIPC	SIPI0RES	17932400	10414000	1 90
R14	161225027	2.7	RES05	7264400	7112000	1 0
R15	168531601	147K-1%	RES07	8737600	4699000	1 0
R16	161225206	20M	RES05	711200	2489200	1 0
R17	161225102	1K	RES05	5486400	14224000	1 90
R18	161225102	1K	RES05	1727200	1473200	1 180
R21	161225102	1K	RES05	29108400	7874000	1 90
R22	190842102	1K-8SIPC	SIP8RES	29210000	11176000	1 180
R24	161225206	20M	RES05	8636000	4165600	1 0
R25	168531449	3.83K-1%	RES07	10464800	6756400	1 270
R26	168531633	316K-1%	RES07	1981200	1981200	1 180
R28	161225391	390	RES05	14986000	14173200	1 180
R29	161225391	390	RES05	12700000	13919200	1 0
R30	161225391	390	RES05	1727200	3251200	1 180
R31	168531389	909-1%	RES07	8991600	5791200	1 90
R32	161225027	2.7	RES05	9601200	7366000	1 180
R33	161225102	1K	RES05	8280400	7366000	1 180
R34	161225102	1K	RES05	13614400	12242800	1 0
R35	161225472	4.7K	RES05	16560800	14071600	1 0
R36	190832220	22-8SS	SIP8RES	18542000	14071600	1 90
R37	161225103	10K	RES05	20675600	12293600	1 90
R38	161225103	10K	RES05	20929600	13309600	1 270
X1	310111032	32.768KHz	MX 1V	9448800	4521200	1 270
SW1	411430002	BD04	DIP8	20218400	13309600	1 270



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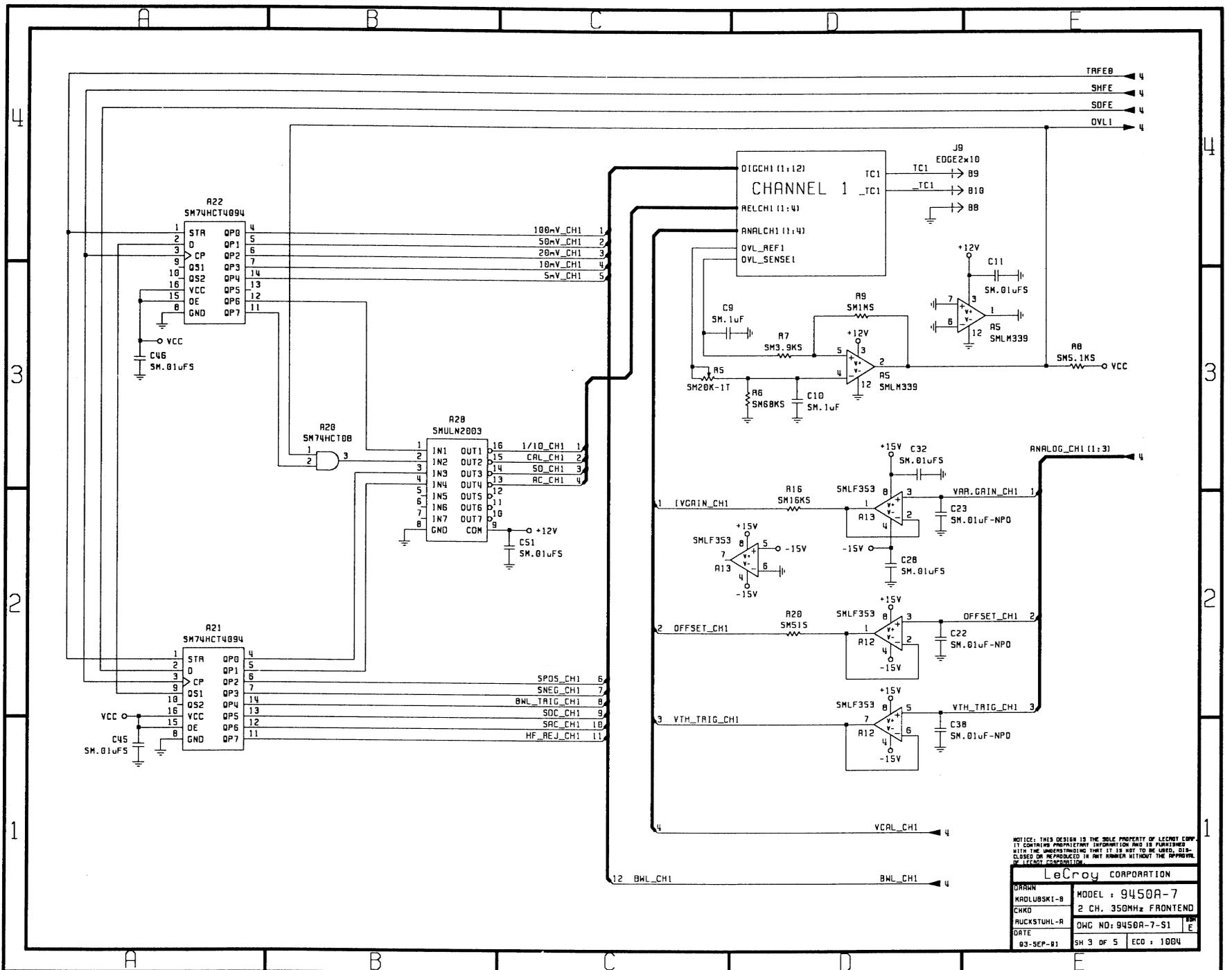
LeCroy CORPORATION	
DRWNR	MODEL : 9450A-7
CHKD	2 CH. 350MHZ FRONTEND
AUCKSTUHL-R	DWG NO: 9450A-7-S1
DATE	SH 1 OF 5
03-SEP-81	ECO : 1804



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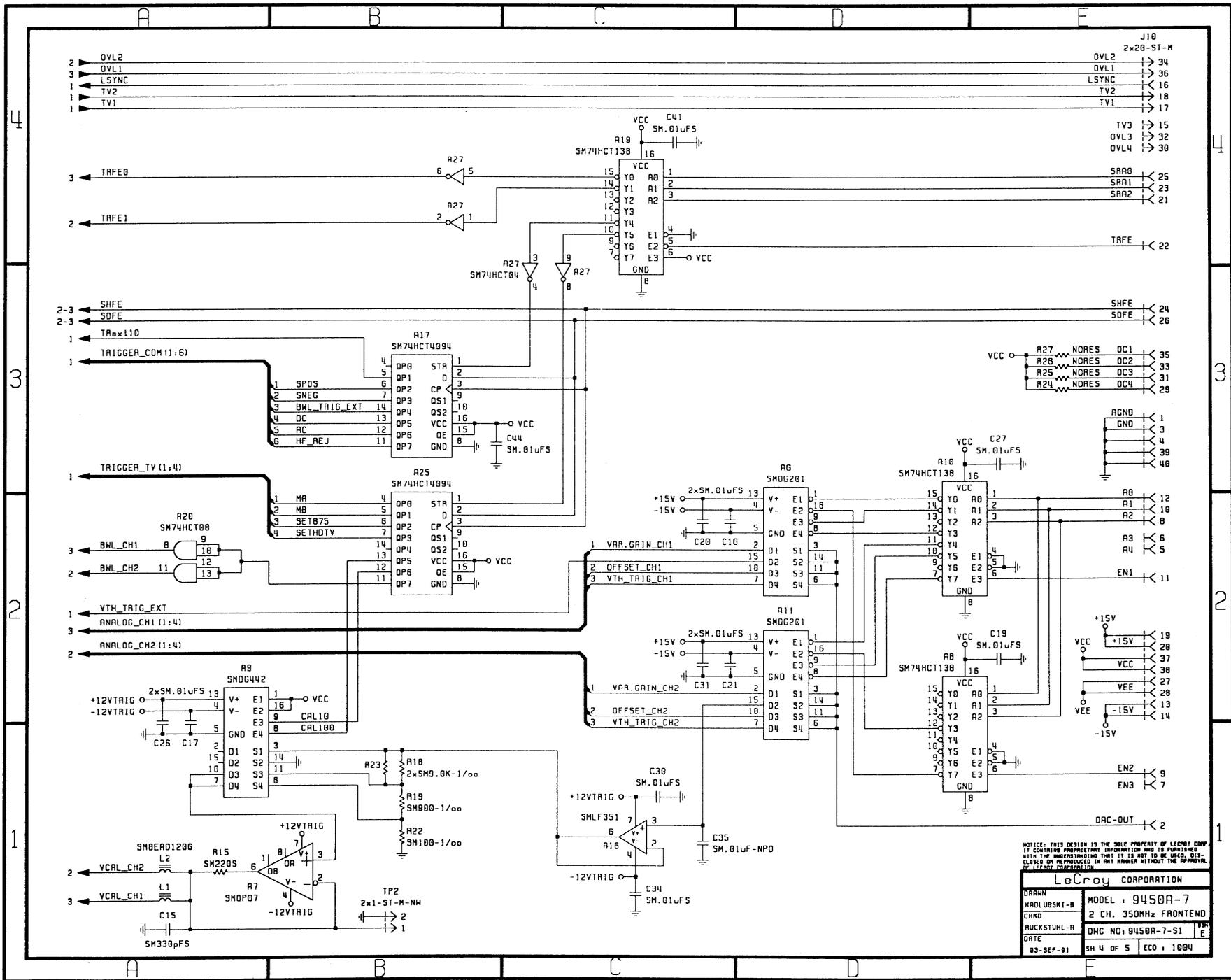
LeCroy CORPORATION

DRAWN	MODEL : 9450A-7
CHECK	2 CH. 350MHZ FRONTEND
RUCKSTUHL-A	DWG NO: 9450A-7-S1
DATE	SH 2 OF 5
83-SEP-81	ECC + 180U

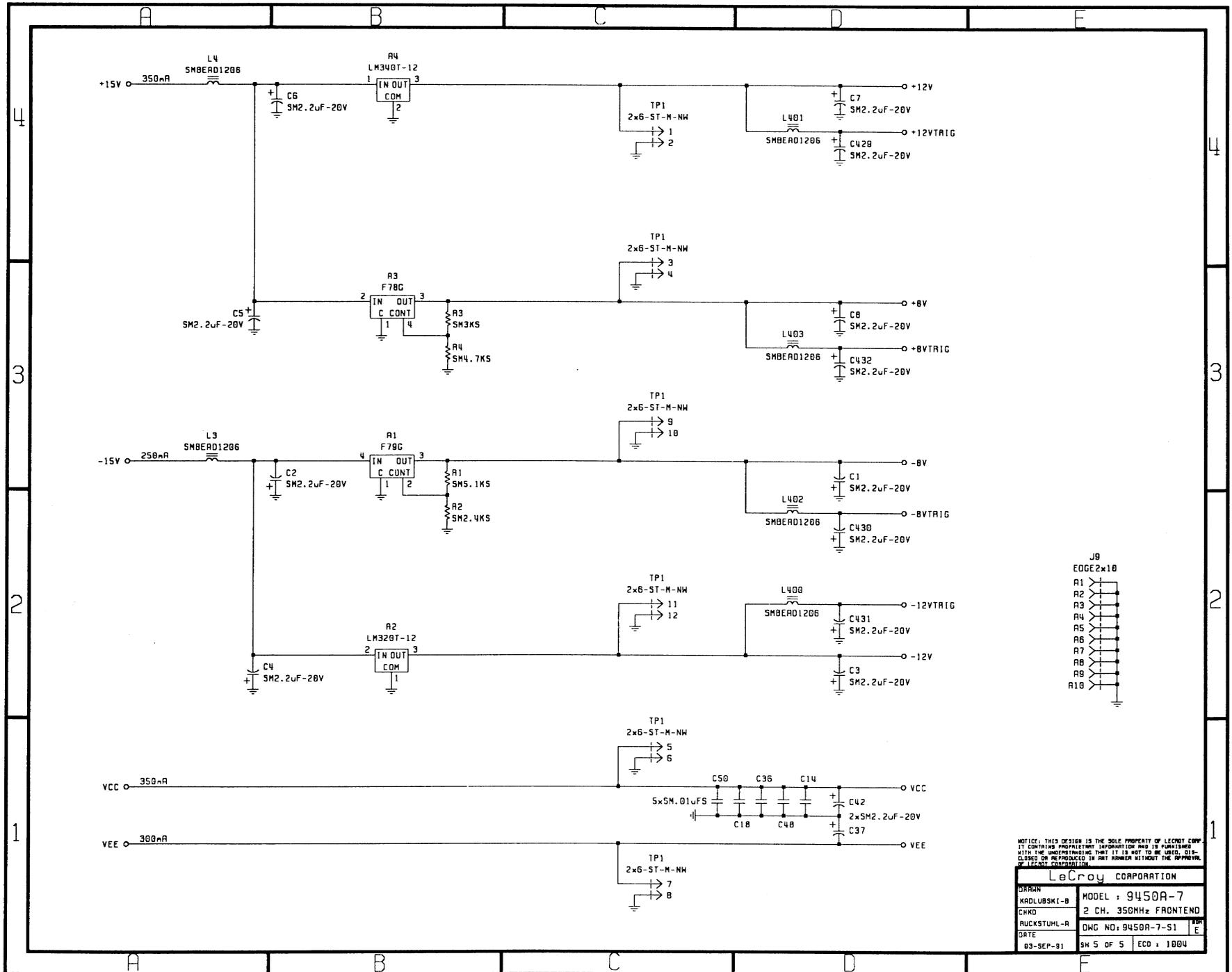


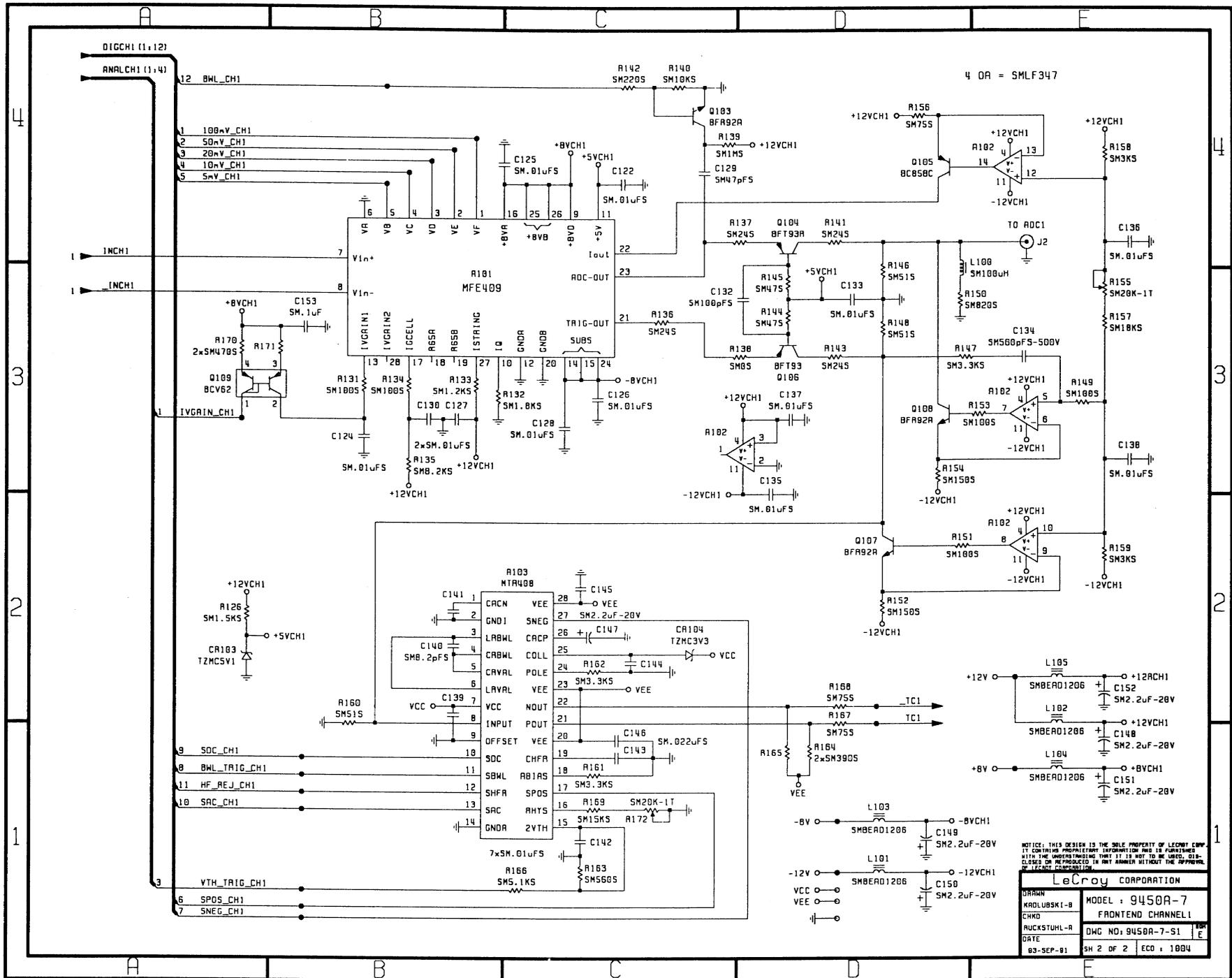
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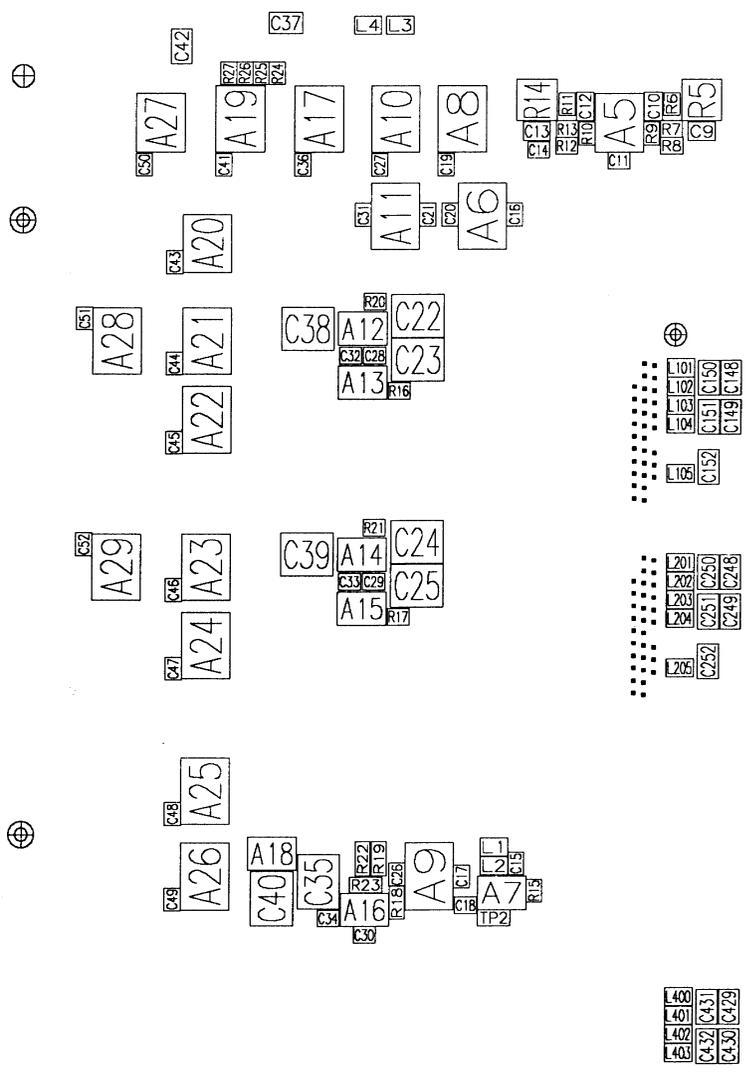
LeCroy CORPORATION	
DRAWN KRZLUBSKI-B CKRD RUCKSTUHL-R DATE 03-SEP-81	MODEL : 9450A-7 2 CH. 350MHZ FRONTEND DWG NO: 9450A-7-S1 SH 3 OF 5 ECO : 1004



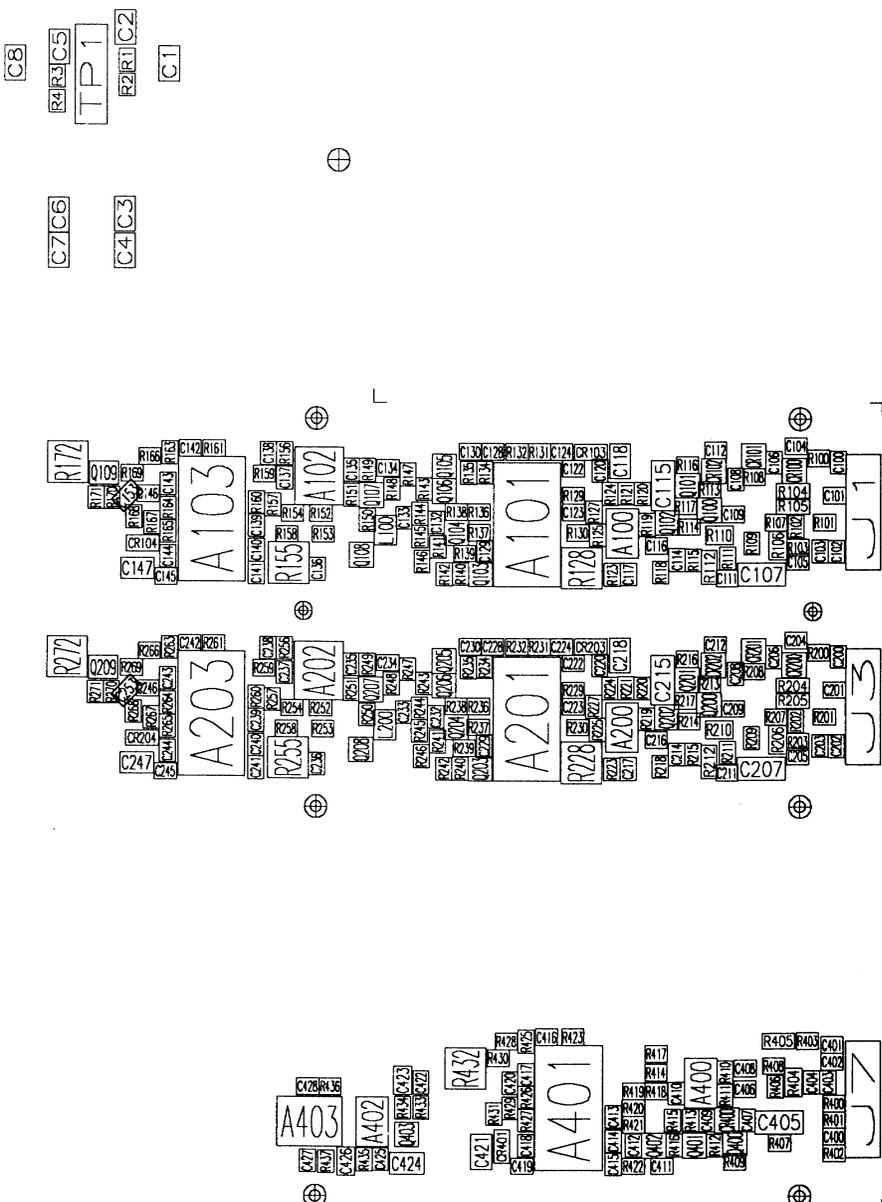
LeCroy CORPORATION	
DRAWN KADLUBSKI-B CKWD RUCKSTUHL-R DATE 83-SEP-81	MODEL : 9450A-7 2 CH. 350MHz FRONTEND DWG NO. 9450A-7-S1 SH 4 OF 5 ECO + 1884

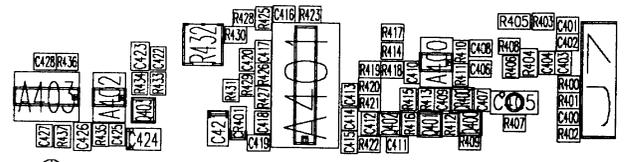
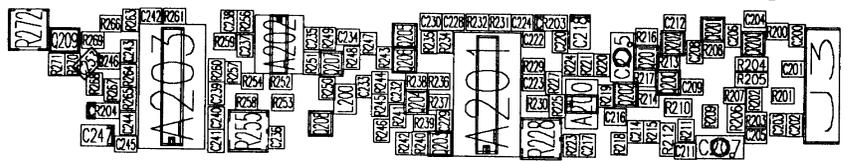
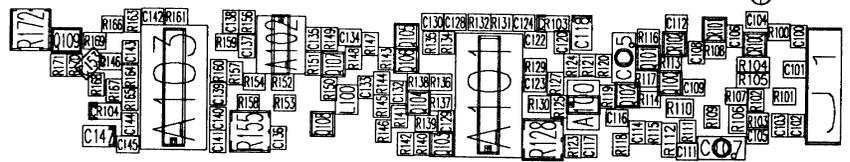
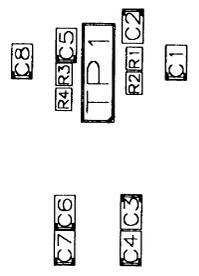
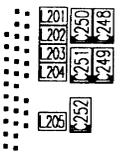
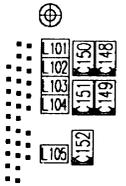
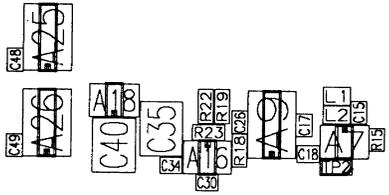
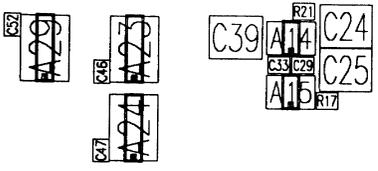
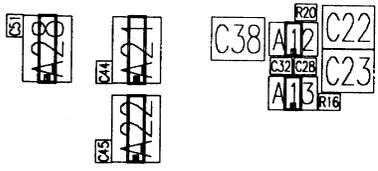
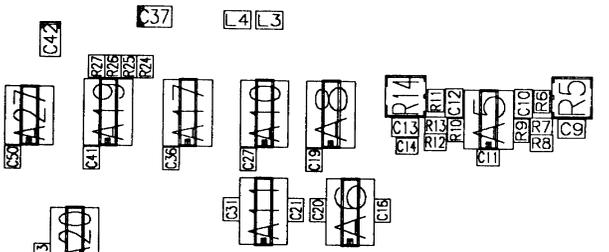




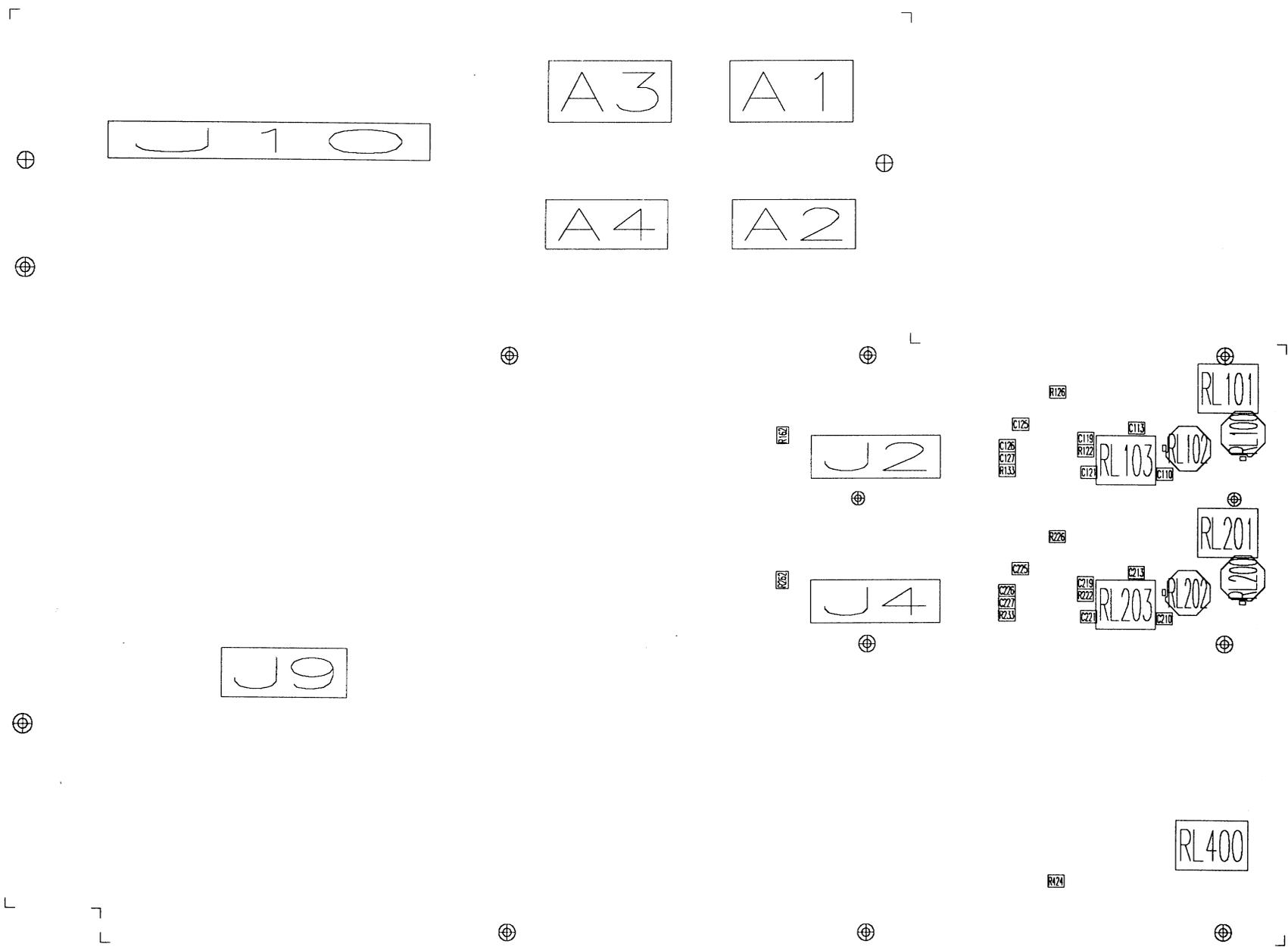


9450A_7 Rev:G



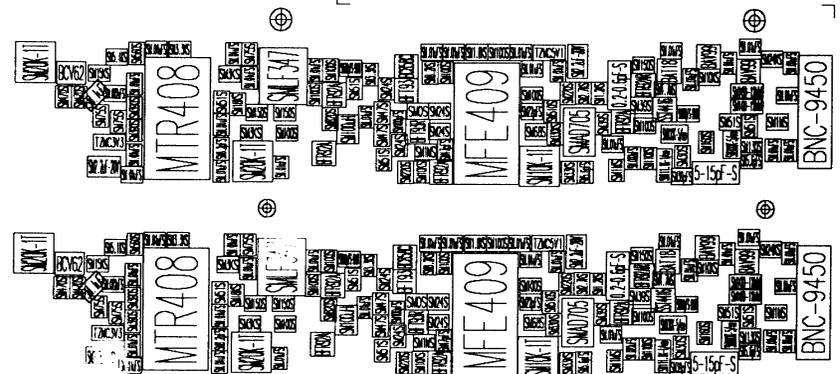
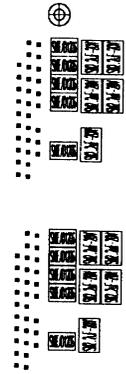
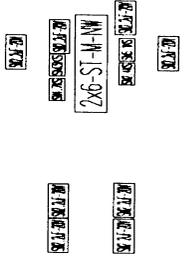
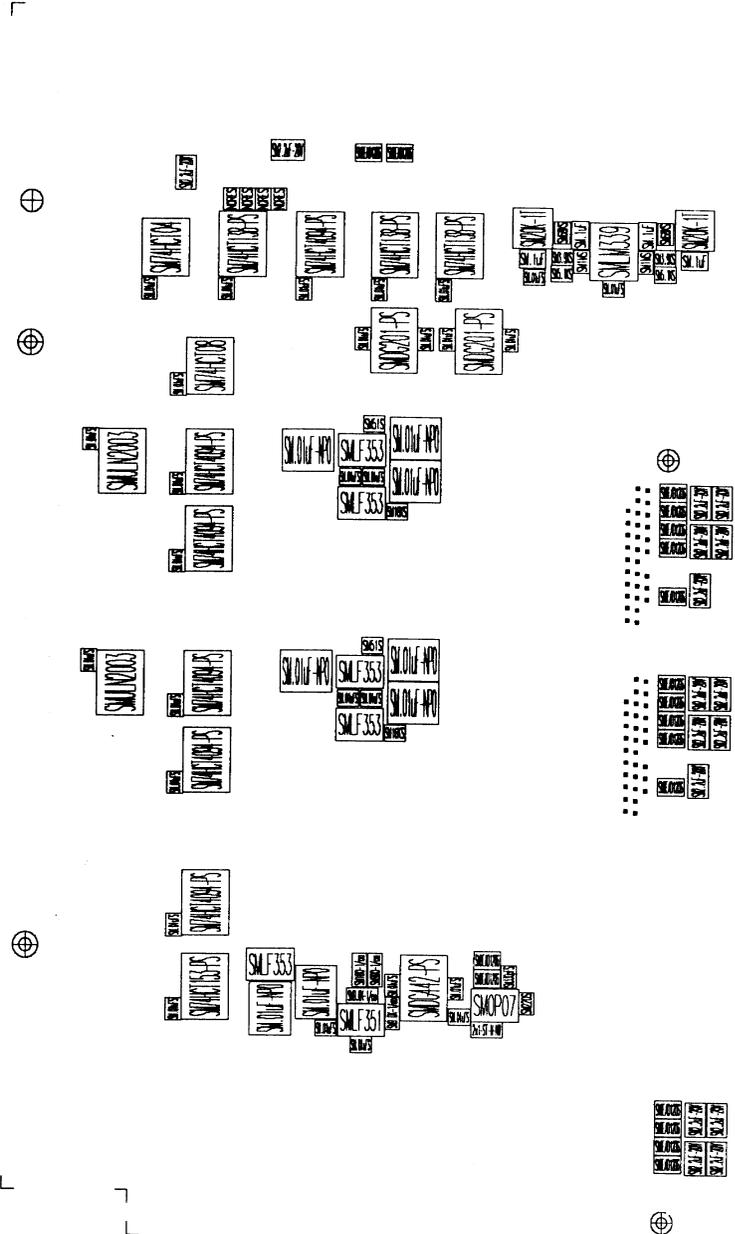


9450A_7 Rev:G



9450A_7 Rev:G

9450A_7 Rev:G



J10

A3

A1

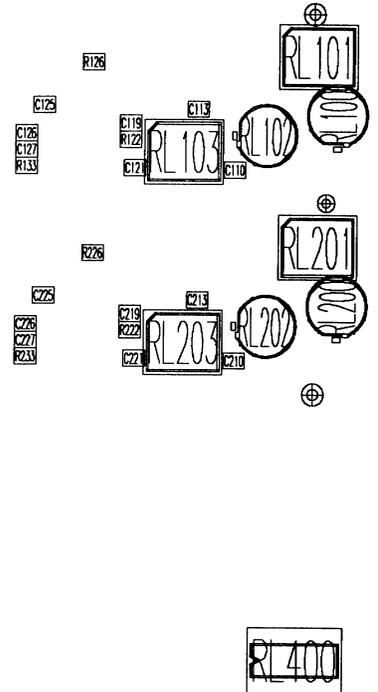
A4

A2

J9

J2

J4



9450A_7 Rev:G

2x20-ST-M

F78G

F79G

LM340T-12

LM320T-12

EDGE2x10

SMB-RA-FE

SMB-RA-FE

RL-FBR21-ALT

RL-FBR21-ALT

RL-TQ2-12-ALT

9450A_7 Rev:G

454211040

208144001

208144002

208591340

208591320

454150010

780261129

780261129

430430001

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430430001

430490003

9450A_7 Rev:G

J10

A3

A1

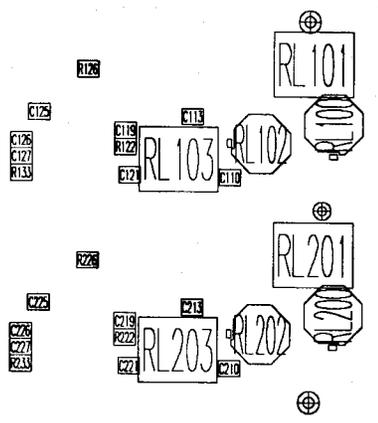
A4

A2

J9

J2

J4



9450A_7 Rev:G

J10

A3

A1

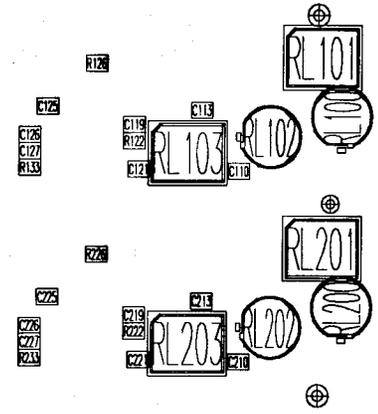
A4

A2

J9

J2

J4



RL400

9450A_7 Rev:G

2x20-ST-M

F78G

F79G

LM340T-12

LM320T-12

EDGE2x10

SMB-RA-FE

SMB-RA-FE

RL-FBR21-ALT

RL-FBR21-ALT

RL-FBR21-ALT

RL-FBR21-ALT

RLTQ2-12-ALT

9450A_7 Rev:G

454211040

208144001

208144002

208591340

208591320

454150010

780261129

780261129

430430001

430430001

430430001

430430001

430490003

9450A_7 Rev:G

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A2	208591320	LM320T-12	TO220	-11366500	3873500	2 180
A3	208144001	F78G	TO202_8Z	-13112750	7239000	2 270
A4	208591340	LM340T-12	TO220	-13112750	4381500	2 0
A5	SM208870339	SMLM339	SOIC_14	-16922750	4286250	1 180
A6	SM207770201	SMDG201-PS	SOIC_16	-19081750	2794000	1 180
A7	SM208470007	SMOP07	SOIC_8	-19240500	-6921500	1 0
A8	SM200178138	SM74HCT138-PS	SOIC_16	-19399250	4286250	1 180
A9	SM207770442	SMDG442-PS	SOIC_16	-19875500	-7302500	1 180
A10	SM200178138	SM74HCT138-PS	SOIC_16	-20447000	4286250	1 180
A11	SM207770201	SMDG201-PS	SOIC_16	-20447000	2794000	1 180
A12	SM208470353	SMLF353	SOIC_8	-20955000	1333500	1 180
A13	SM208470353	SMLF353	SOIC_8	-20955000	508000	1 180
A14	SM208470353	SMLF353	SOIC_8	-20955000	-2127250	1 180
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A26	SM207978153	SM74HCT153-PS	SOIC_16	-23399750	-7302500	1 180
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A29	SM289772003	SMULN2003	SOIC_16	-24796750	-2571750	1 180
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A102	SM208470347	SMLF347	SOIC_14	-8890000	920750	1 0
A103	MTR408	MTR408	SOJ_28	-9969500	-952500	1 180
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A202	SM208470347	SMLF347	SOIC_14	-8890000	-2063750	1 0
A203	MTR408	MTR408	SOJ_28	-9969500	-3937000	1 180
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A401	MTR408	MTR408	SOJ_28	-4349750	-9937750	1 180
A402	SM208971881	SMLM1881	SOIC_8	-7588250	-9080500	1 270
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C3	SM666327225	SM2.2uF-20V	SMCAPETD2	-11715750	4508500	1 90
C4	SM666327225	SM2.2uF-20V	SMCAPETD2	-11715750	4000500	1 270
C5	SM666327225	SM2.2uF-20V	SMCAPETD2	-12763500	7112000	1 270
C6	SM666327225	SM2.2uF-20V	SMCAPETD2	-12763500	4540250	1 270
C7	SM666327225	SM2.2uF-20V	SMCAPETD2	-12763500	4000500	1 270
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C21	SM661207103	SM.01uFS	SM0805	-20193000	3365500	1 270
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C23	SM661726103	SM.01uF-NPO	SM2220	-20066000	1047750	1 180
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C25	SM661726103	SM.01uF-NPO	SM2220	-20066000	-2413000	1 180

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C144	SM661207103	SM.01uFS	SM0805	-11017250	-603250	1	270
C145	SM661207103	SM.01uFS	SM0805	-11144250	-1016000	1	0
C146	SM661207223	SM.022uFS	SM0805	-11430000	254000	1	0
C147	SM666327225	SM2.2uF-20V	SMCAPETD2	-11525250	-889000	1	0
C148	SM666327225	SM2.2uF-20V	SMCAPETD2	-15398750	793750	1	270
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C153	SM661127104	SM.1uF	SM1206	-11747500	127000	1	45
C200	SM661207103	SM.01uFS	SM0805	-476250	-2317750	1	90
C201	SM661207103	SM.01uFS	SM0805	-635000	-2730500	1	0
C202	SM661207103	SM.01uFS	SM0805	-508000	-3492500	1	270
C203	SM661207103	SM.01uFS	SM0805	-762000	-3683000	1	90
C204	SM661207103	SM.01uFS	SM0805	-1238250	-1968500	1	0
C205	SM661255056	SM5.6pFS	SM0805	-1016000	-3746500	1	180
C206	SM661207103	SM.01uFS	SM0805	-1492250	-2127250	1	270
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C217	SM661255056	SM5.6pFS	SM0805	-3778250	-4032250	1	90
C218	SM666327225	SM2.2uF-20V	SMCAPETD2	-3905250	-2222500	1	90
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C234	SM661495561	SM560pFS-500V	SM0805	-7651750	-2317750	1	0
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C236	SM661207103	SM.01uFS	SM0805	-8667750	-3968750	1	90
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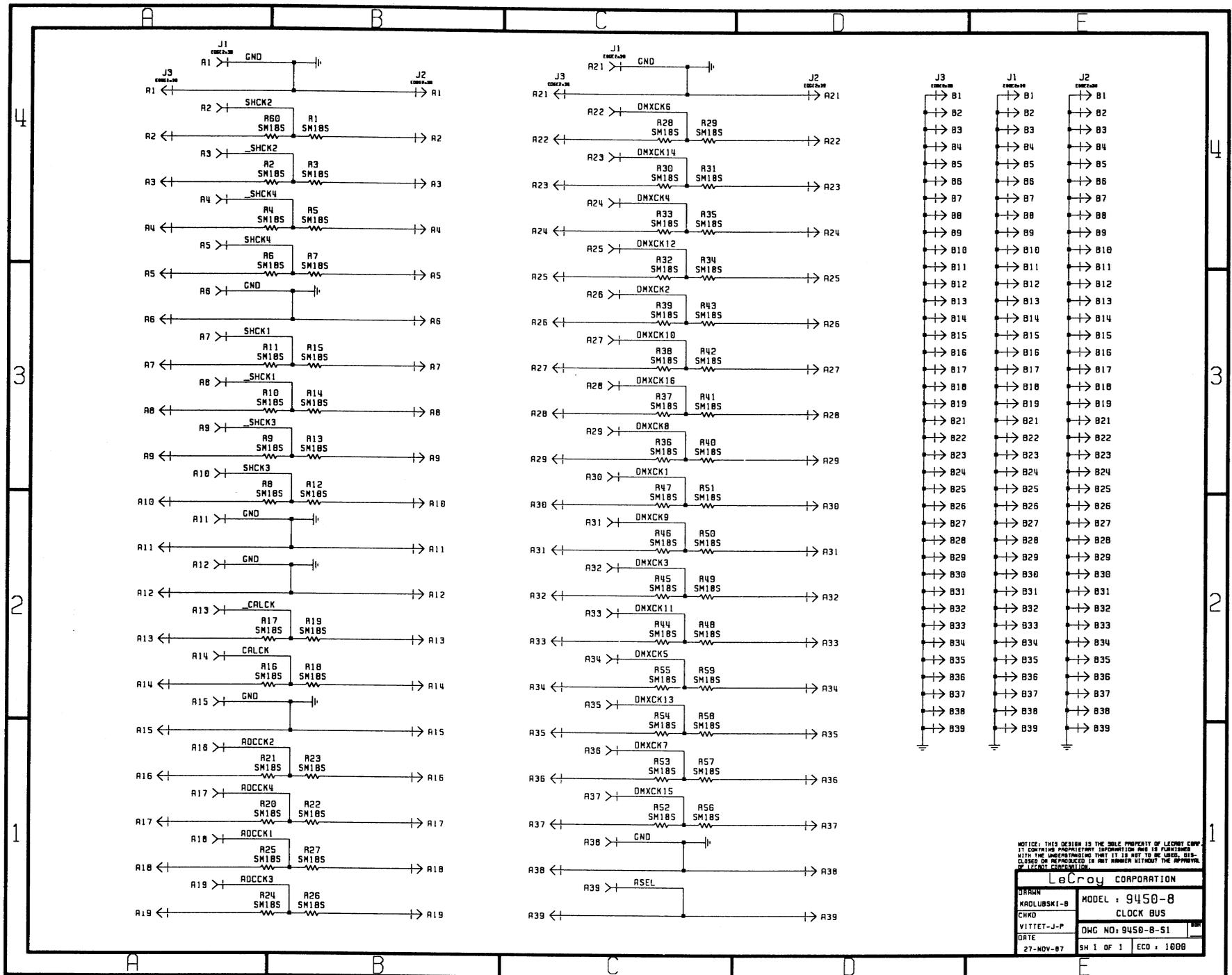
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C410	SM661207103	SM. 01uFS	SM0805	-3016250	-8794750	1	270
C411	SM661207103	SM. 01uFS	SM0805	-3143250	-10001250	1	180
C412	SM661207103	SM. 01uFS	SM0805	-3683000	-9779000	1	90
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J2	780261129	SMB-RA-FE	SMB_RT_F	-7588250	-666750	2	0
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L100	SM300486104	SM100uH	SM1210	-7588250	-412750	1	90
L101	SM301502001	SMBEAD1206	SM1206	-16319500	920750	1	0
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Q100	SM280124416	SST4416	SOT23	-2603500	127000	1	90
Q101	SM270140092	BFR92AR	SOT23	-2952750	508000	1	90
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R1	SM652101512	SM5.1KS	SM0805	-11684000	6985000	1	270
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R3	SM652101302	SM3KS	SM0805	-12795250	6731000	1	270
R4	SM652101472	SM4.7KS	SM0805	-12795250	6350000	1	270
R5	SM185457203	SM20K-1T	SMPOT_ST4	-16065500	5143500	1	270
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R7	SM652101392	SM3.9KS	SM0805	-16256000	4572000	1	180
R8	SM652101512	SM5.1KS	SM0805	-16446500	4318000	1	0
R9	SM652101105	SM1MS	SM0805	-16668750	4603750	1	270
R10	SM652101105	SM1MS	SM0805	-17684750	4603750	1	270
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R15	SM652101221	SM220S	SM0805	-18478500	-7175500	1	90
R16	SM652101163	SM16KS	SM0805	-20732750	571500	1	0
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R19	SM168659004	SM900-1/∞	SMRES_MINIMELF	-20923250	-6731000	1	90
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R23	SM168659002	SM9.0K-1/∞	SMRES_MINIMELF	-21272500	-6985000	1	0
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R27	NORES	NORES	SM0805	-23336250	5524500	1	270
R100	SM652101243	SM24KS	SM0805	-889000	825500	1	0
R101	SM652101105	SM1MS	SM0805	-793750	-158750	1	0
R102	SM652101510	SM51S	SM0805	-1143000	-127000	1	270
R103	SM652101131	SM130S	SM0805	-1016000	-539750	1	180
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R108	SM652101103	SM10KS	SM0805	-1905000	539750	1	0
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R115	SM652101114	SM110KS	SM0805	-2762250	-635000	1	270
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R117	SM652101390	SM39S	SM0805	-2984500	95250	1	0
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R123	SM652101333	SM33KS	SM0805	-4032250	-857250	1	270
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R202	SM652101510	SM51S	SM0805	-1143000	-3111500	1	270
R203	SM652101131	SM130S	SM0805	-1016000	-3524250	1	180
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R209	SM652101161	SM160S	SM0805	-1841500	-3365500	1	270
R210	SM652110904	SM900K-5/∞	SM1206	-2222500	-3333750	1	180
R211	SM652101300	SM30S	SM0805	-2222500	-3587750	1	270
R212	SM168659006	SM111.1K-1/∞	SMRES_MINIMELF	-2508250	-3683000	1	270

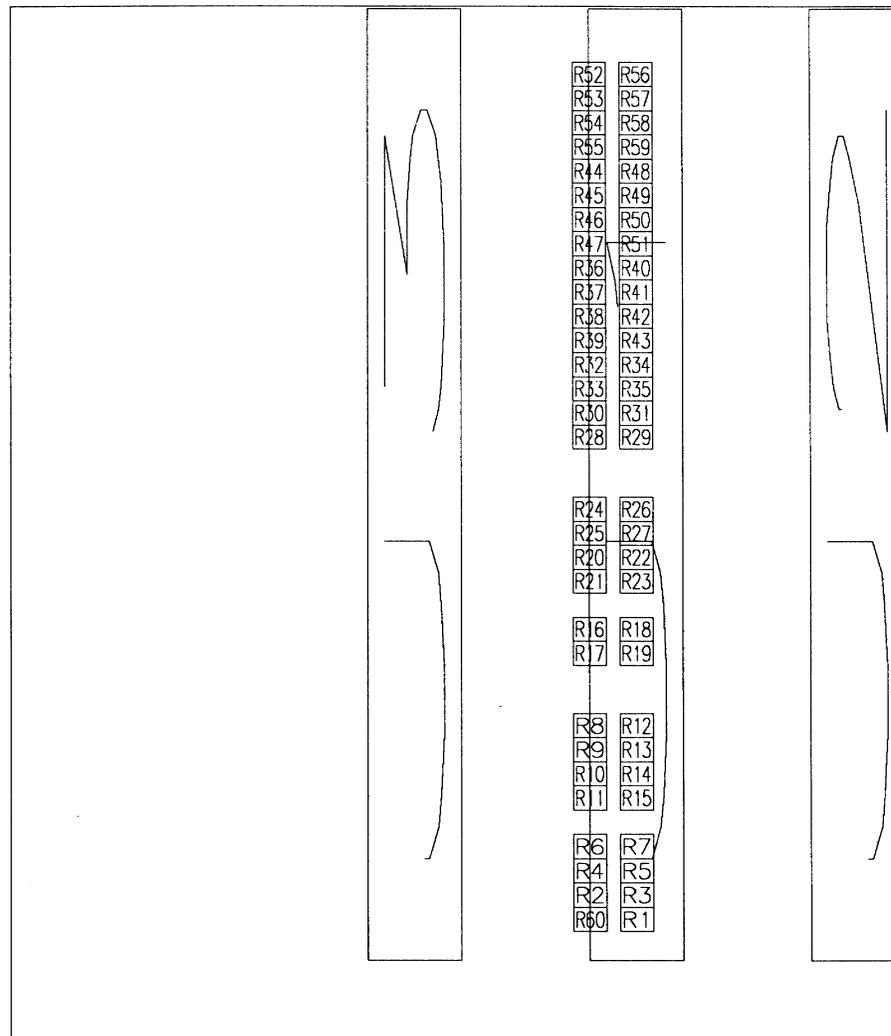
R213	SM652101475	SM4.7MS	SM0805	-2603500	-2635250	1	0
R214	SM652101101	SM100S	SM0805	-2730500	-3206750	1	180
R215	SM652101114	SM110KS	SM0805	-2762250	-3619500	1	270
R216	SM652101151	SM150S	SM0805	-2952750	-2254250	1	0
R217	SM652101390	SM39S	SM0805	-2984500	-2889250	1	0
R218	SM652101105	SM1MS	SM0805	-3270250	-4000500	1	90
R219	SM652101390	SM39S	SM0805	-3492500	-3270250	1	90
R220	SM652101122	SM1.2KS	SM0805	-3556000	-2603500	1	270
R221	SM652101272	SM2.7KS	SM0805	-3810000	-2794000	1	90
R222	SM652101185	SM1.8MS	SM0805	-3937000	-3524250	2	0
R223	SM652101333	SM33KS	SM0805	-4032250	-3841750	1	270
R224	SM652101221	SM220S	SM0805	-4064000	-2603500	1	270
R225	SM652101334	SM330KS	SM0805	-4254500	-3238500	1	270
R226	SM652101152	SM1.5KS	SM0805	-4540250	-2317750	2	0
R227	SM652101511	SM510S	SM0805	-4318000	-3079750	1	90
R228	SM185457103	SM10K-1T	SMPOT_ST4	-4318000	-3968750	1	90
R229	SM652101101	SM100S	SM0805	-4730750	-2730500	1	0
R230	SM652101680	SM68S	SM0805	-4667250	-3302000	1	0
R231	SM652101101	SM100S	SM0805	-5270500	-2063750	1	0
R232	SM652101182	SM1.8KS	SM0805	-5429250	-2063750	1	180
R233	SM652101122	SM1.2KS	SM0805	-5810250	-3937000	2	180
R234	SM652101101	SM100S	SM0805	-6032500	-2476500	1	90
R235	SM652101822	SM8.2KS	SM0805	-6286500	-2286000	1	270
R236	SM652101240	SM24S	SM0805	-6223000	-2984500	1	0
R237	SM652101240	SM24S	SM0805	-6223000	-3302000	1	0
R238	SM654101000	SM0S	SM0805	-6572250	-2984500	1	0
R239	SM652101105	SM1MS	SM0805	-6445250	-3619500	1	0
R240	SM652101103	SM10KS	SM0805	-6413500	-4032250	1	90
R241	SM652101240	SM24S	SM0805	-6762750	-3619500	1	90
R242	SM652101221	SM220S	SM0805	-6667500	-3841750	1	270
R243	SM652101240	SM24S	SM0805	-6985000	-2730500	1	90
R244	SM652101470	SM47S	SM0805	-7048500	-3111500	1	90
R245	SM652101470	SM47S	SM0805	-7048500	-3460750	1	90
R246	SM652101510	SM51S	SM0805	-7016750	-3651250	1	270
R247	SM652101332	SM3.3KS	SM0805	-7239000	-2317750	1	270
R248	SM652101510	SM51S	SM0805	-7493000	-2540000	1	270
R249	SM652101101	SM100S	SM0805	-7874000	-2444750	1	90
R250	SM652101821	SM820S	SM0805	-7874000	-3016250	1	270
R251	SM652101101	SM100S	SM0805	-8128000	-2825750	1	90
R252	SM652101151	SM150S	SM0805	-8509000	-3016250	1	180
R253	SM652101101	SM100S	SM0805	-8667750	-3333750	1	0
R254	SM652101151	SM150S	SM0805	-8953500	-3016250	1	180
R255	SM185457203	SM20K-1T	SMPOT_ST4	-8921750	-3905250	1	90
R256	SM652101750	SM75S	SM0805	-9175750	-2000250	1	270
R257	SM652101183	SM18KS	SM0805	-9366250	-2984500	1	90
R258	SM652101302	SM3KS	SM0805	-9239250	-3333750	1	0
R259	SM652101302	SM3KS	SM0805	-9398000	-2413000	1	180
R260	SM652101510	SM51S	SM0805	-9620250	-2952750	1	90
R261	SM652101332	SM3.3KS	SM0805	-10191750	-2032000	1	180
R262	SM652101332	SM3.3KS	SM0805	-10477500	-3111500	2	270
R263	SM652101561	SM560S	SM0805	-10985500	-2000250	1	270
R264	SM652101391	SM390S	SM0805	-11017250	-3048000	1	90
R265	SM652101391	SM390S	SM0805	-11017250	-3206750	1	270
R266	SM652101512	SM5.1KS	SM0805	-11207750	-2159000	1	180
R267	SM652101750	SM75S	SM0805	-11271250	-3270250	1	90
R268	SM652101750	SM75S	SM0805	-11557000	-2984500	1	270
R269	SM652101153	SM15KS	SM0805	-11684000	-2413000	1	0
R270	SM652101471	SM470S	SM0805	-11906250	-2889250	1	90
R271	SM652101471	SM470S	SM0805	-12160250	-2889250	1	90
R272	SM185457203	SM20K-1T	SMPOT_ST4	-12477750	-2063750	1	180
R400	SM652101680	SM68S	SM0805	-444500	-9048750	1	180
R401	SM652101360	SM36S	SM0805	-444500	-9302750	1	180
R402	SM652101242	SM2.4KS	SM0805	-635000	-9810750	1	0
R403	SM653125033	SM3.3S	SM0805	-857250	-8096250	1	180
R404	SM652110904	SM900K-5/∞	SM1206	-1174750	-8604250	1	270
R405	SM168659006	SM111.1K-1/∞	SMRES_MINIMELF	-1270000	-8096250	1	180

R406	SM652101391	SM390S	SM0805	-1460500	-8890000	1	90
R407	SM652101434	SM430KS	SM0805	-1492250	-9652000	1	0
R408	SM652101101	SM100S	SM0805	-1587500	-8477250	1	0
R409	SM652101475	SM4.7MS	SM0805	-2000250	-9937750	1	180
R410	SM652101103	SM10KS	SM0805	-2254250	-8667750	1	90
R411	SM652101564	SM560KS	SM0805	-2254250	-9017000	1	90
R412	SM652101510	SM51S	SM0805	-2413000	-9588500	1	270
R413	SM652101332	SM3.3KS	SM0805	-2794000	-9207500	1	270
R414	SM652101103	SM10KS	SM0805	-3238500	-8572500	1	180
R415	SM652101151	SM150S	SM0805	-3079750	-9398000	1	90
R416	SM652101390	SM39S	SM0805	-3048000	-9779000	1	90
R417	SM652101681	SM680S	SM0805	-3429000	-8286750	1	0
R418	SM652101564	SM560KS	SM0805	-3429000	-8858250	1	0
R419	SM652101510	SM51S	SM0805	-3778250	-8858250	1	0
R420	SM652101201	SM200S	SM0805	-3587750	-9112250	1	180
R421	SM652101511	SM510S	SM0805	-3778250	-9366250	1	0
R422	SM652101103	SM10KS	SM0805	-3587750	-10001250	1	180
R423	SM652101332	SM3.3KS	SM0805	-4540250	-8032750	1	180
R424	SM652101332	SM3.3KS	SM0805	-4540250	-9429750	2	0
R425	SM652101561	SM560S	SM0805	-5365750	-8001000	1	270
R426	SM652101391	SM390S	SM0805	-5365750	-9048750	1	90
R427	SM652101391	SM390S	SM0805	-5365750	-9207500	1	270
R428	SM652101512	SM5.1KS	SM0805	-5778500	-8096250	1	0
R429	SM652101750	SM75S	SM0805	-5619750	-9017000	1	270
R430	SM652101153	SM15KS	SM0805	-5905500	-8350250	1	0
R431	SM652101750	SM75S	SM0805	-5873750	-9302750	1	90
R432	SM185457203	SM20K-1T	SMPOT ST4	-6191250	-8318500	1	180
R433	SM652101472	SM4.7KS	SM0805	-7016750	-9207500	1	90
R434	SM652101560	SM56S	SM0805	-7302500	-9017000	1	270
R435	SM652101684	SM680KS	SM0805	-7905750	-9810750	1	270
R436	SM652101824	SM820KS	SM0805	-8540750	-8794750	1	0
R437	SM652101474	SM470KS	SM0805	-8509000	-9842500	1	270
CR100	SM236030099	BAV99	SOT23	-1079500	730250	1	0
CR101	SM236030099	BAV99	SOT23	-1714500	762000	1	270
CR102	SM252023018	BAT18	SOT23	-2349500	730250	1	0
CR103	SM240050051	TZMC5V1	SMDIO_MINIMELF	-4222750	920750	1	180
CR104	SM240050033	TZMC3V3	SMDIO_MINIMELF	-11271250	-508000	1	180
CR200	SM236030099	BAV99	SOT23	-1079500	-2254250	1	0
CR201	SM236030099	BAV99	SOT23	-1714500	-2222500	1	270
CR202	SM252023018	BAT18	SOT23	-2349500	-2254250	1	0
CR203	SM240050051	TZMC5V1	SMDIO_MINIMELF	-4222750	-2063750	1	180
CR204	SM240050033	TZMC3V3	SMDIO_MINIMELF	-11271250	-3492500	1	180
CR400	SM252023018	BAT18	SOT23	-2317750	-9398000	1	180
CR401	SM240050033	TZMC3V3	SMDIO_MINIMELF	-5746750	-9556750	1	270
RL100	430440732	RL732-12.ALT	RELAYS732_12	-698500	-158750	2	180
RL101	430430001	RL-FBR21.ALT	RL FBR20	-1397000	1016000	2	270
RL102	430440732	RL732-12.ALT	RELAYS732_12	-1841500	-476250	2	270
RL103	430430001	RL-FBR21.ALT	RL FBR20	-3556000	-476250	2	270
RL200	430440732	RL732-12.ALT	RELAYS732_12	-698500	-3143250	2	180
RL201	430430001	RL-FBR21.ALT	RL FBR20	-1397000	-1968500	2	270
RL202	430440732	RL732-12.ALT	RELAYS732_12	-1841500	-3460750	2	270
RL203	430430001	RL-FBR21.ALT	RL FBR20	-3556000	-3460750	2	270
RL400	430490003	RLTQ2-12.ALT	DIP10	-1841500	-8286750	2	270
TP1	454340012	2x6-ST-M-NW	CONN2X6_ST M NW	-12128500	6032500	1	90
TP2	454340002	2x1-ST-M-NW	CONN2X1_ST M NW	-18986500	-7493000	1	90



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LeCroy CORPORATION	
DRAWN KRALUBSKI-B CHECK VITTET-J-P DATE 27-NOV-87	MODEL : 9450-8 CLOCK BUS DHC NO: 9450-8-51 SH 1 OF 1 ECO * 1008



9450-8 REV: B

J1	454150039	EDGE2x39	EDGE2X39	31750	4000	1 0
J2	454150039	EDGE2x39	EDGE2X39	41200	4000	1 0
J3	454150039	EDGE2x39	EDGE2X39	22300	4000	1 0
R1	SM652101180	SM18S	SM0805	26380	5000	1 0
R2	SM652101180	SM18S	SM0805	24380	6000	1 0
R3	SM652101180	SM18S	SM0805	26380	6000	1 0
R4	SM652101180	SM18S	SM0805	24380	7000	1 0
R5	SM652101180	SM18S	SM0805	26380	7000	1 0
R6	SM652101180	SM18S	SM0805	24380	8000	1 0
R7	SM652101180	SM18S	SM0805	26380	8000	1 0
R8	SM652101180	SM18S	SM0805	24380	13000	1 0
R9	SM652101180	SM18S	SM0805	24380	12000	1 0
R10	SM652101180	SM18S	SM0805	24380	11000	1 0
R11	SM652101180	SM18S	SM0805	24380	10000	1 0
R12	SM652101180	SM18S	SM0805	26380	13000	1 0
R13	SM652101180	SM18S	SM0805	26380	12000	1 0
R14	SM652101180	SM18S	SM0805	26380	11000	1 0
R15	SM652101180	SM18S	SM0805	26380	10000	1 0
R16	SM652101180	SM18S	SM0805	24380	17000	1 0
R17	SM652101180	SM18S	SM0805	24380	16000	1 0
R18	SM652101180	SM18S	SM0805	26380	17000	1 0
R19	SM652101180	SM18S	SM0805	26380	16000	1 0
R20	SM652101180	SM18S	SM0805	24380	20000	1 0
R21	SM652101180	SM18S	SM0805	24380	19000	1 0
R22	SM652101180	SM18S	SM0805	26380	20000	1 0
R23	SM652101180	SM18S	SM0805	26380	19000	1 0
R24	SM652101180	SM18S	SM0805	24380	22000	1 0
R25	SM652101180	SM18S	SM0805	24380	21000	1 0
R26	SM652101180	SM18S	SM0805	26380	22000	1 0
R27	SM652101180	SM18S	SM0805	26380	21000	1 0
R28	SM652101180	SM18S	SM0805	24380	25000	1 0
R29	SM652101180	SM18S	SM0805	26380	25000	1 0
R30	SM652101180	SM18S	SM0805	24380	26000	1 0
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R34	SM652101180	SM18S	SM0805	26380	28000	1 0
R35	SM652101180	SM18S	SM0805	26380	27000	1 0
R36	SM652101180	SM18S	SM0805	24380	32000	1 0
R37	SM652101180	SM18S	SM0805	24380	31000	1 0
R38	SM652101180	SM18S	SM0805	24380	30000	1 0
R39	SM652101180	SM18S	SM0805	24380	29000	1 0
R40	SM652101180	SM18S	SM0805	26380	32000	1 0
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R42	SM652101180	SM18S	SM0805	26380	30000	1 0
R43	SM652101180	SM18S	SM0805	26380	29000	1 0
R44	SM652101180	SM18S	SM0805	24380	36000	1 0
R45	SM652101180	SM18S	SM0805	24380	35000	1 0
R46	SM652101180	SM18S	SM0805	24380	34000	1 0
R47	SM652101180	SM18S	SM0805	24380	33000	1 0
R48	SM652101180	SM18S	SM0805	26380	36000	1 0
R49	SM652101180	SM18S	SM0805	26380	35000	1 0
R50	SM652101180	SM18S	SM0805	26380	34000	1 0
R51	SM652101180	SM18S	SM0805	26380	33000	1 0
R52	SM652101180	SM18S	SM0805	24380	40000	1 0
R53	SM652101180	SM18S	SM0805	24380	39000	1 0
R54	SM652101180	SM18S	SM0805	24380	38000	1 0
R55	SM652101180	SM18S	SM0805	24380	37000	1 0
R56	SM652101180	SM18S	SM0805	26380	40000	1 0
R57	SM652101180	SM18S	SM0805	26380	39000	1 0
R58	SM652101180	SM18S	SM0805	26380	38000	1 0
R59	SM652101180	SM18S	SM0805	26380	37000	1 0
R60	SM652101180	SM18S	SM0805	24380	5000	1 0

Chapter 7

MECHANICAL PARTS

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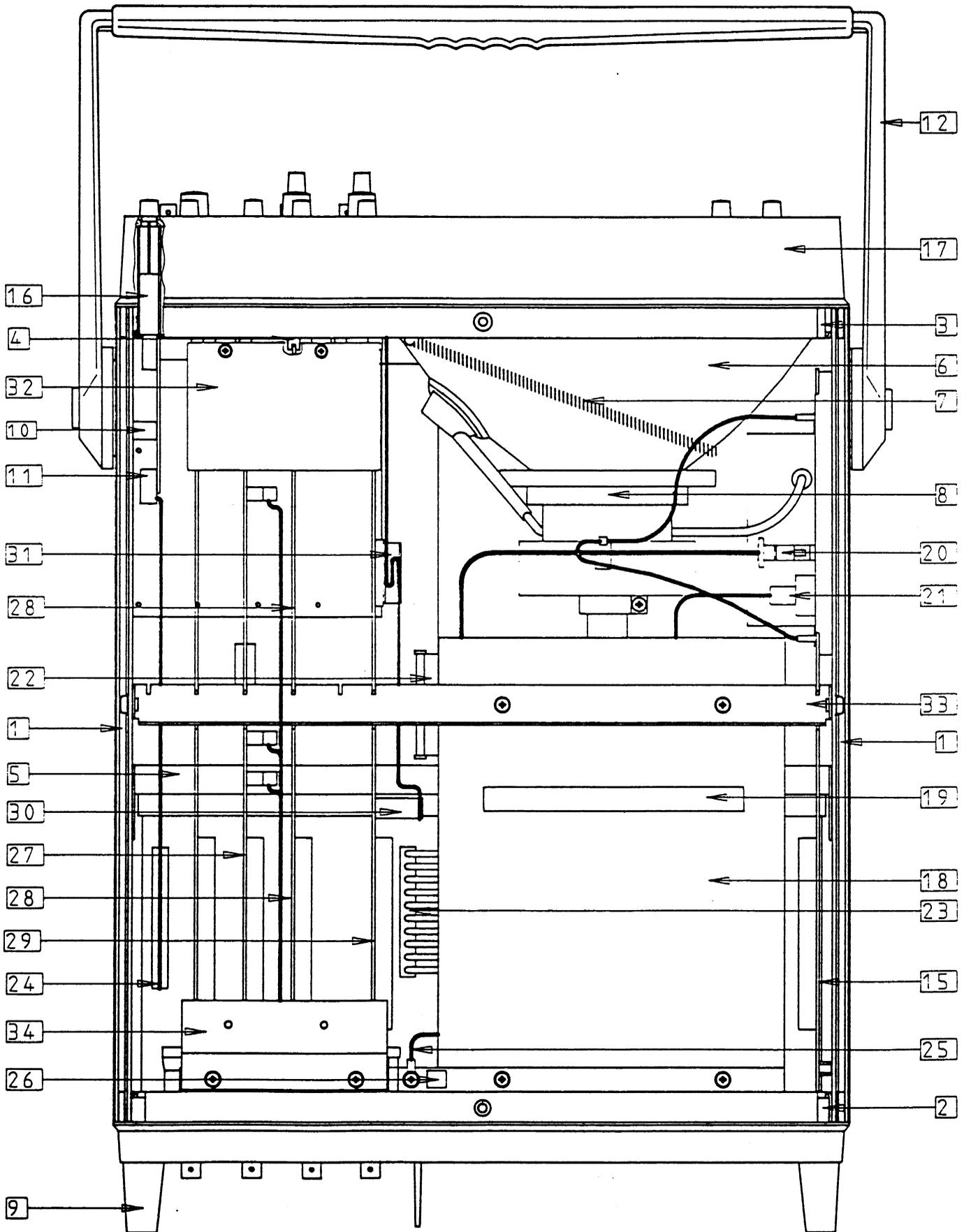


Figure 7.1

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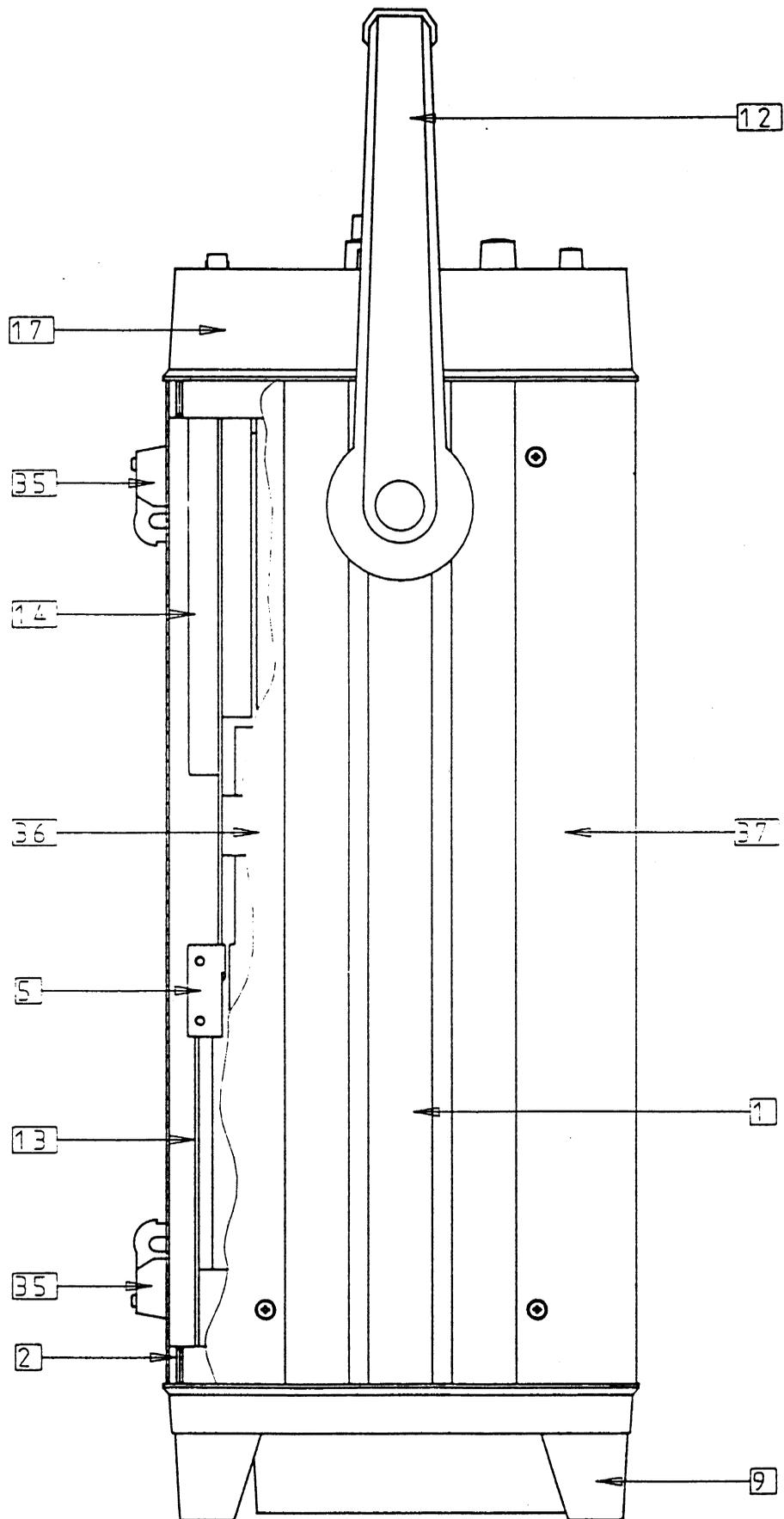


Figure 7.2

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	554 440 202 709 450 071	4 4	552 440 100	4
7	SPRING EXT TYPE 190mm	554 310 001	1						
8	DEFLECTION YOKE	300 090 001	1						
9	REAR PANEL FOR 9450A	F9450A-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	DUAL CHANNEL FRONTEND	F9450A-7	1	550 430 106 550 430 108	2 3	551 430 300	5		
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	DUAL CHANNEL FP CARD	F9450A-5	1	550 440 406	6				
18	POWER SUPPLY 9451-1	315 040 015	1	550 440 105 550 440 506	4 2	551 440 300	4		
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	F9450-4	1						
28	SINGLE CHANNEL ADC	F9450A-3	2						
29	PROCESSOR CARD	F9420-6	1						
30	FRONT PANEL CABLE	780 411 236	1						
31	CABLE CLIP AD BACK	594 230 002	1						
32	CLOCK-BUS	F9450-8	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

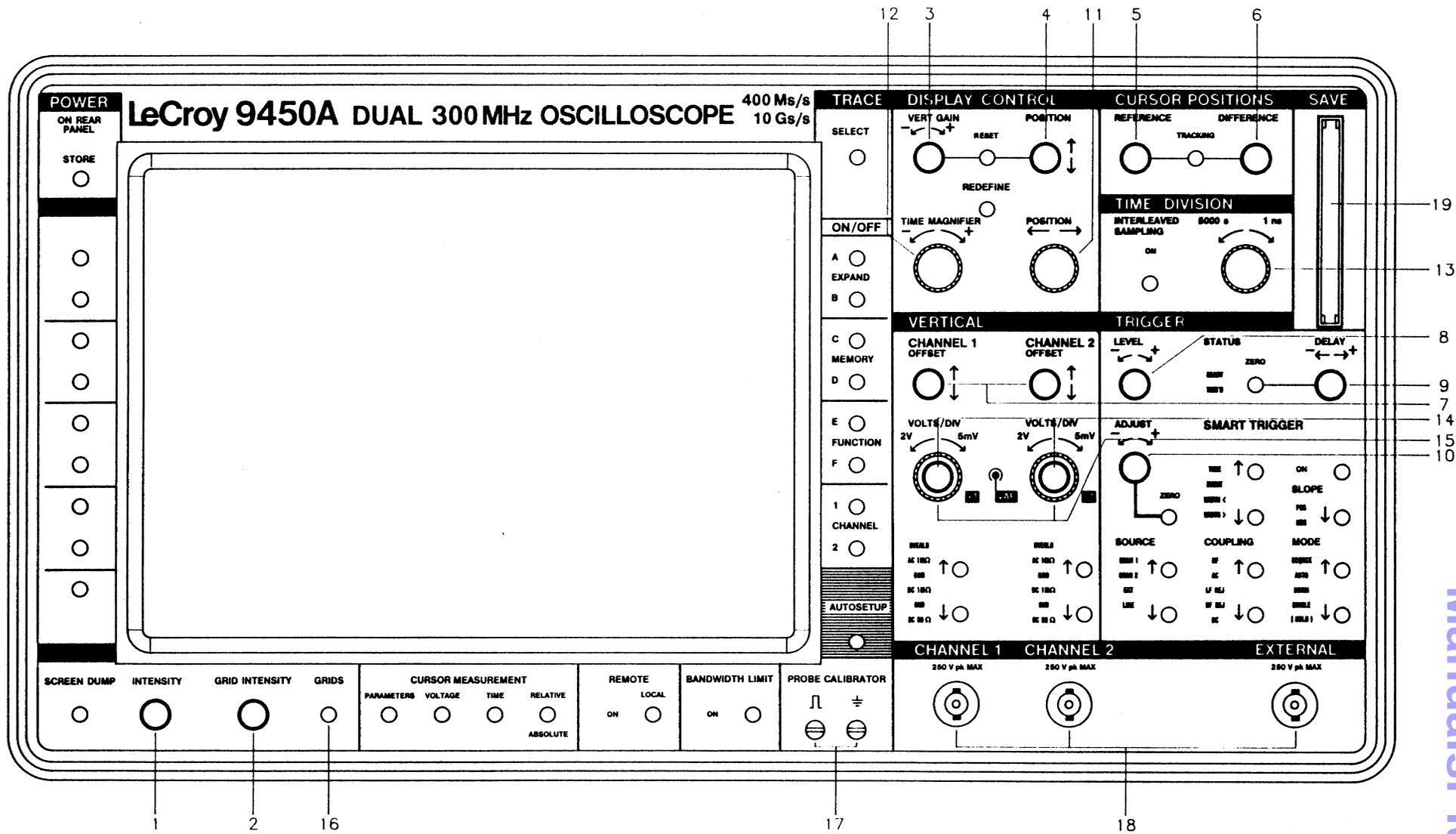


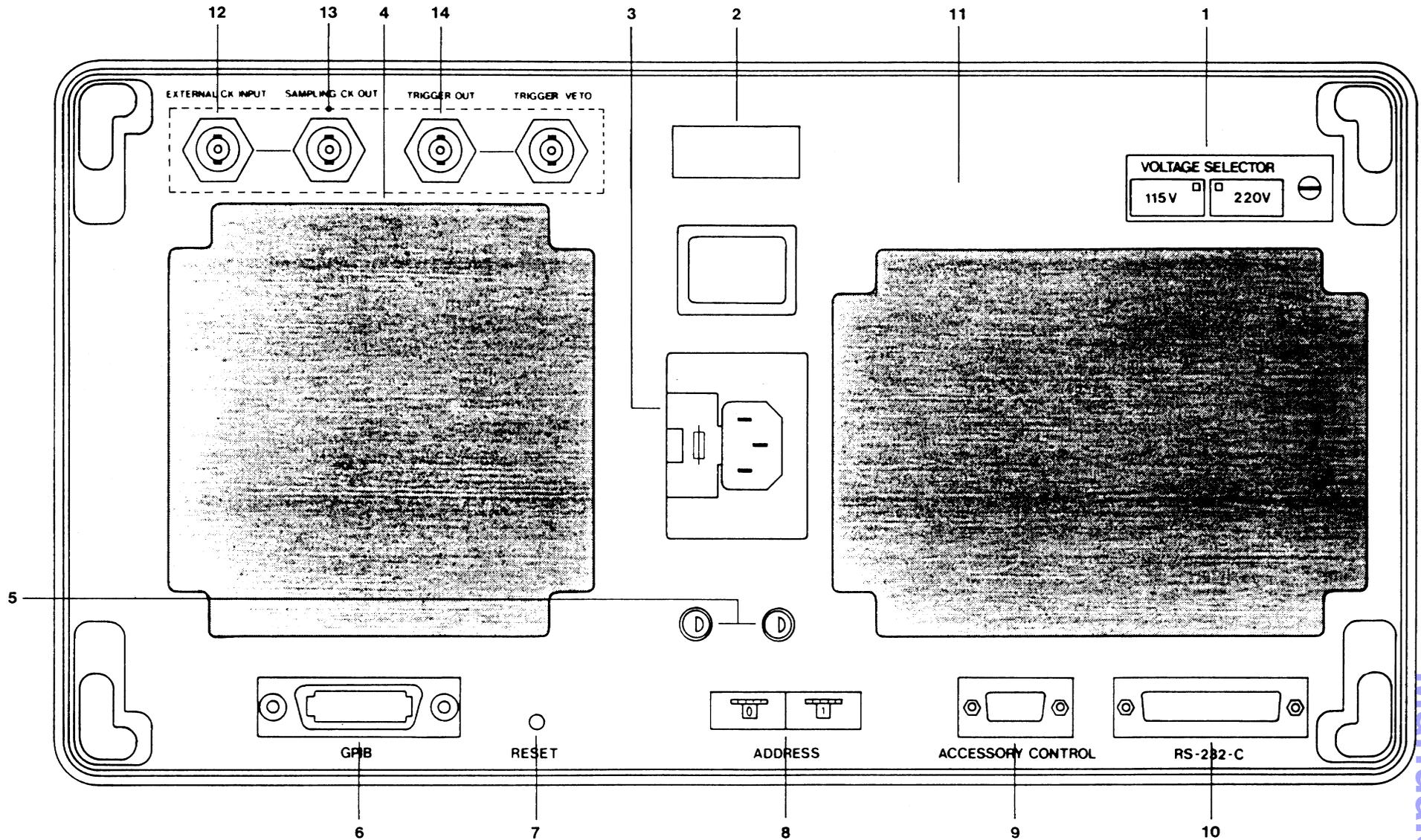
Figure A: 9450A Front Panel

Figure 7.4
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7.5 Front panel description and part number

	<u>Function:</u>	<u>Description:</u>	<u>Part number:</u>
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 and CH2	idem.	
8)	Trigger level	idem.	
9)	Trigger delay	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)	CH1 and CH2 volts/div variable gain	RES VARI cond plastic 5K knob for 1/8" shaft CAP for knob 020-2215	184 427 502 536 068 002 536 068 003
15)	CH1 and CH2 Volts/div	Switch ROT M/stop 12 pins	412 001 012
16)	Grids idem for all the other push button	Switch push button SPST Push switch extender	416 161 002 709 450 523

17)	Probe calibration		HPC 411 AIH
18)	Ch1/CH2	COMM CO.AX	402 110 302
	External input	PC MTG BNC	
19)	Memory card option:		
	- 94XX-MC02	128K Memory card	334 049 070
		Lithium battery	312 682 325
	- 94XX-MC04	512K Memory card	334 049 090



9450A Rear Panel

Figure 7.6

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 SLOW BLOW 250V/2A	433 162 200	1
	FUSE SLOW BLOW 250V/4A	433 162 400	1
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	2
13	BNC HEADER	709 424 951	1
14	BNC-SMD CABLE 27	780 259 927	2

Figure 7.7

Chapter 8

Parts List

CLASS CODE: 1

FINISHED GOODS--MANUFACTURED

PART: 9450A

DESC: 300 MHZ DUAL CH. 400 MS/S DSO UOM: EA SC: M REV: 1

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV	NUMBR	SC	UM ASSEMBLY
F9424-1	94xx-1 WITH MEMORY CARD LOGIC	B	1	R	EA 1.00
F9450-2	DISPLAY CARD FOR 94xx	J	2	R	EA 1.00
F9450A-3	SINGLE 400 MS/S ADC DATA INV.	B	3	R	EA 2.00
F9450-4	TIMEBASE CARD	D	4	R	EA 1.00
F9450A-5	DUAL CHANNEL FRONT PANEL CARD	A	5	R	EA 1.00
F9420-6	PROCESSOR CARD	D	6	R	EA 1.00
F9450A-7	DUAL CHANNEL 300 MHZ FRONTEND	E	7	R	EA 1.00
F9450-8	CLOCK-BUS	A	8	R	EA 1.00
F9450A-9	REAR PANEL FOR 9450A	B	9	R	EA 1.00
M9424	MECHANICAL FOR 9424	C	10	R	EA 1.00
ACCESSORIES-9450A	ACCESSORIES FOR 9450A	A	11	R	EA 1.00
F9424-2	SUPPORT FOR MEMORY CARD	A	12	R	EA 1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9424-1

DESC: 94xx-1 WITH MEMORY CARD LOGIC UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY PER
		RV NUMBER	SC		
102484471	CAP CERA DISC 100V 470 PF	1	P	EA	1.00
103307103	CAP CERA MONO 50V .01 UF	2	P	EA	35.00
103427104	CAP CERA MONO 100V .1 UF	3	P	EA	2.00
142214156	CAP TANT DIP CASE 15 UF	4	P	EA	2.00
142714685	CAP TANT DIP CASE 6.8UF	5	P	EA	2.00
146634106	CAP MINI ALUM 20% 10 UF	6	P	EA	2.00
147436033	CAP ALUM METAL CAN 33 UF	7	P	EA	4.00
161225101	RES COMP 1/8W 5% 100 OHMS	8	P	EA	1.00
161225103	RES COMP 1/8W 5% 10 K	9	P	EA	3.00
161225274	RES CARBON FILM 270 K	10	P	EA	1.00
161225302	RES COMP 1/8W 5% 3 K	11	P	EA	2.00
161225395	RES CARBON FILM 3.9 MEG	12	P	EA	1.00
161225471	RES COMP 1/8W 5% 470 OHMS	13	P	EA	1.00
161225683	RES COMP 1/8W 5% 68 K	62	P	EA	3.00
181447104	RES VARI CERMET 100 K	14	P	EA	2.00
190042103	RESISTOR NETWORK 10 K	15	P	EA	2.00
190042104	RESISTOR NETWORK 100K	16	P	EA	2.00
190832102	RES NETWORK 1 K	17	P	EA	1.00
190832103	RESISTOR NETWORK 10K	18	P	EA	1.00
190832471	RESISTOR NETWORK 470 OHMS	19	P	EA	2.00
200331074	IC DUAL FLOP 74HCT74	20	P	EA	1.00
200340173	IC D-TYP FLOP HCT173	21	P	EA	2.00
200373374	IC D-TYP FLOP 74HCT374	22	P	EA	2.00
200440040	IC12-ST BIN COUNT HCT4040	23	P	EA	1.00
200440102	IC COWN COUNT. 74HCT40102	24	P	EA	1.00
205277202	FIFO 1024X9 BITS	25	P	EA	1.00
205750000	IC AND-OR GATE ARRAY 16V8	300	P	EA	7.00
207171541	IC BUFFER/LINE DRI.HCT541	29	P	EA	9.00
207197210	IC BUS INTERF CONTR 7210	30	P	EA	1.00
207280703	IC 16-BIT DAC 703	31	P	EA	1.00
207440232	IC XMTR/RCVR MAX 232	32	P	EA	1.00
207470160	IC OCTAL BUS XCVR 75160A	33	P	EA	1.00
207470161	IC OCTL BUS XCEIR 75161A	34	P	EA	1.00
207472245	IC BUS TRANSCVR HCT245	35	P	EA	4.00
207552661	IC INTERFACE 2661A	36	P	EA	1.00
230020062	DIODE SWITCHING BAW62	37	P	EA	16.00
253010835	DIODE HOT CARRIER HP2835	38	P	EA	3.00
309040005	CRYSTAL OSCIL. 4.9152MHZ	39	P	EA	1.00
400331020	SOCKET IC ST DIP-20	40	P	EA	1.00
400412068	IC SOCKET GRID TYP 68-PIN	41	P	EA	1.00
403950002	POLARIZING KEY	42	P	EA	4.00
412022022	SWITCH ROTARY BCD-1248	43	P	EA	2.00
416132008	SWITCH PUSHBUT (MOM) SPDT	44	P	EA	1.00
453520024	RTANGLE PCB CONN. FEM.24	45	P	EA	1.00
454110010	HDR SOLD TAIL/MALE PIN 10	46	P	EA	1.00
454211040	HDR SOLD TAIL TO MALE 40	47	P	EA	2.00
454320096	HDR DIP SOLD TO FEM 96	48	P	EA	6.00
454611009	HDR SOLD TAIL/MALE 9	49	P	EA	1.00
454611025	HDR SOLD TAIL/MALE 25	50	P	EA	1.00
455980001	MOUNT. HDW FOR CONN SHELL	51	P	EA	2.00
530040006	BUZZER 85DB 4 TO 7V	52	P	EA	1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9424-1

DESC: 94xx-1 WITH MEMORY CARD LOGIC UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV NUMBER	SC	UM	ASSEMBLY
550130108	SCREW CYL HD M3X8		53 P	EA	6.00
551430400	WASHER SHAKEPROOF M3		61 P	EA	6.00
554630100	THREADED INSERT M3X1.5		60 P	EA	6.00
585252236	RIVET HOLLOW 2.5X6MM		57 P	EA	12.00
719424103	PC BD PREASS'Y 9424-1	B	58 B	EA	1.00
MCL404	IC MEM GATE ARRAY MCL404		59 P	EA	1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450-2

DESC: DISPLAY CARD FOR 94xx

UOM: EA SC: R REV: J

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY PER
		RV	SC		
102412100	CAP CERA DISC 100V 10 PF	168	P	EA	1.00
102412101	CAP CERA DISC 100V 100PF	164	P	EA	2.00
102412120	CAP CERA DISC 100V 12 PF	165	P	EA	10.00
102412220	CAP CERA DISC 100V 22 PF	4	P	EA	1.00
102412470	CAP CERA DISC 100V 47 PF	5	P	EA	5.00
102412560	CAP CERA DISC 100V 56 PF	6	P	EA	1.00
102484821	CAP CERA DISC 100V 820 PF	7	P	EA	1.00
102940502	CAP CERA DISC 1KV .005 UF	8	P	EA	4.00
103307103	CAP CERA MONO 50V .01 UF	9	P	EA	57.00
103327102	CAP CERA MONO 50V .001 UF	10	P	EA	2.00
103327224	CAP CERA MONO 50V .22UF	11	P	EA	2.00
103427104	CAP CERA MONO 100V .1 UF	12	P	EA	4.00
103437334	CAP CERA MONO 100V .33 UF	13	P	EA	8.00
124171623	CAP POLYSTYR 1% .062 UF	14	P	EA	2.00
142714685	CAP TANT DIP CASE 6.8UF	15	P	EA	1.00
146544471	CAP MINI ALUM 20% 470UF	16	P	EA	4.00
146634106	CAP MINI ALUM 20% 10 UF	17	P	EA	18.00
146754470	CAP MINI ALUM 20% 47 UF	18	P	EA	1.00
147634102	CAP MINI ALUM 20% 1000 UF	19	P	EA	1.00
161335100	RES COMP 1/4W 5% 10 OHMS	20	P	EA	1.00
161335101	RES COMP 1/4W 5% 100 OHMS	21	P	EA	5.00
161335102	RES COMP 1/4W 5% 1 K	22	P	EA	16.00
161335103	RES COMP 1/4W 5% 10 K	23	P	EA	12.00
161335104	RES COMP 1/4W 5% 100 K	24	P	EA	8.00
161335105	RES COMP 1/4W 5% 1 MEG	25	P	EA	2.00
161335122	RES COMP 1/4W 5% 1.2 K	26	P	EA	5.00
161335132	RES COMP 1/4W 5% 1.3 K	27	P	EA	1.00
161335161	RES COMP 1/4W 5% 160 OHMS	28	P	EA	1.00
161335202	RES COMP 1/4W 5% 2 K	29	P	EA	6.00
161335203	RES COMP 1/4W 5% 20 K	30	P	EA	2.00
161335204	RES COMP 1/4W 5% 200 K	31	P	EA	1.00
161335221	RES COMP 1/4W 5% 220 OHMS	32	P	EA	8.00
161335223	RES COMP 1/4W 5% 22 K	33	P	EA	1.00
161335241	RES COMP 1/4W 5% 240 OHMS	34	P	EA	8.00
161335242	RES COMP 1/4W 5% 2.4 K	35	P	EA	4.00
161335271	RES COMP 1/4W 5% 270 OHMS	36	P	EA	2.00
161335272	RES COMP 1/4W 5% 2.7 K	37	P	EA	2.00
161335273	RES COMP 1/4W 5% 27 K	38	P	EA	1.00
161335302	RES COMP 1/4W 5% 3 K	39	P	EA	7.00
161335331	RES COMP 1/4W 5% 330 OHMS	40	P	EA	1.00
161335332	RES COMP 1/4W 5% 3.3 K	160	P	EA	6.00
161335333	RES COMP 1/4W 5% 33 K	42	P	EA	2.00
161335362	RES COMP 1/4W 5% 3.6 K	43	P	EA	3.00
161335394	RES COMP 1/4W 5% 390 K	44	P	EA	4.00
161335471	RES COMP 1/4W 5% 470 OHMS	45	P	EA	14.00
161335472	RES COMP 1/4W 5% 4.7 K	46	P	EA	2.00
161335473	RES COMP 1/4W 5% 47 K	47	P	EA	1.00
161335510	RES COMP 1/4W 5% 51 OHMS	48	P	EA	4.00
161335511	RES COMP 1/4W 5% 510 OHMS	49	P	EA	1.00
161335512	RES COMP 1/4W 5% 5.1 K	161	P	EA	7.00
161335560	RES COMP 1/4W 5% 56 OHMS	163	P	EA	4.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450-2

DESC: DISPLAY CARD FOR 94xx

UOM: EA SC: R REV: J

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER
		RV NUMBER	SC	
161335565	RES COMP 1/4W 5% 5.6 MEG	51	P	EA 2.00
161335621	RES COMP 1/4W 5% 620 OHMS	52	P	EA 2.00
161335622	RES COMP 1/4W 5% 6.2 K	53	P	EA 2.00
161335623	RES COMP 1/4W 5% 62 K	54	P	EA 1.00
161335681	RES COMP 1/4W 5% 680 OHMS	55	P	EA 1.00
161335682	RES COMP 1/4W 5% 6.8 K	56	P	EA 2.00
161335752	RES COMP 1/4W 5% 7.5 K	57	P	EA 7.00
161335753	RES COMP 1/4W 5% 75 K	58	P	EA 3.00
161335821	RES COMP 1/4W 5% 820 OHMS	59	P	EA 2.00
161335912	RES COMP 1/4W 5% 9.1 K	60	P	EA 1.00
161445102	RES COMP 1/2W 5% 1K	61	P	EA 1.00
161445560	RES CARBON FILM 56 OHMS	62	P	EA 1.00
165375824	RES METAL FILM HV 820 K	63	P	EA 1.00
168031022	RES METAL FILM 2.2 OHMS	64	P	EA 26.00
168035125	RES METAL FILM HV 1.2 MEG	65	P	EA 1.00
168045336	RES HV 33M	66	P	EA 1.00
168531365	RES PREC RN55D 511 OHMS	67	P	EA 4.00
168531385	RES PREC RN55D 825 OHMS	68	P	EA 2.00
168531401	RES PREC RN55D 1.21 K	69	P	EA 7.00
168531445	RES PREC RN55D 3.48K	70	P	EA 1.00
168531447	RES PREC RN55D 3.65 K	71	P	EA 1.00
168531453	RES PREC RN55D 4.22 K	72	P	EA 1.00
168531471	RES PREC RN55D 6.49 K	169	P	EA 2.00
168531495	RES PREC RN55D 11.5K	74	P	EA 3.00
168531541	RES PREC RN55D 34.8 K	75	P	EA 1.00
172137022	RES WIREWOUND .22 OHMS	76	P	EA 1.00
180487103	RES VARI CERMET 10K	77	P	EA 2.00
180487202	RES VARI CERMET 2K	78	P	EA 1.00
180487205	RES VARI CERMET 2 MEG	79	P	EA 2.00
180487501	RES VARI CERMET 500 OHMS	80	P	EA 2.00
180487502	RES VARI CERMET 5K	81	P	EA 5.00
190042222	RESISTOR NETWORK 2.2 K	82	P	EA 5.00
190842222	RESISTOR NETWORK 2.2 K	83	P	EA 1.00
200440040	IC12-ST BIN COUNT HCT4040	84	P	EA 1.00
205271256	IC 32K X 8 RAM 62256-12	85	P	EA 2.00
205370256	IC UV E-PROM 27256G-25	86	P	EA 2.00
205750000	IC AND-OR GATE ARRAY 16V8	300	P	EA 4.00
207174244	IC OCTAL BUFFER HCT244	89	P	EA 2.00
207270312	IC 12-BIT C/A CONV DAC312	90	P	EA 2.00
207472245	IC BUS TRANSCVR HCT245	91	P	EA 2.00
208011005	IC VOLT FOLLOWER LM310N	92	P	EA 2.00
208031010	IC QUAD DIFF COMP LM339N	93	P	EA 1.00
208041001	IC 8-BIT DAC MONODAC-08EQ	94	P	EA 3.00
208041524	IC PULSE WIDTH MODUL 3524	95	P	EA 1.00
208110353	IC DUAL OP AMP LF353N	96	P	EA 2.00
208116365	IC OP AMP LM6365	97	P	EA 2.00
208130347	IC QUAD JFET OP AMP LF347	98	P	EA 1.00
208590336	IC VOLT REFERENCE LM336	99	P	EA 2.00
230110005	DIODE SWITCHING 1N4448	100	P	EA 14.00
230150045	DIODE PICOAMPERE BAV 45	101	P	EA 2.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450-2

DESC: DISPLAY CARD FOR 94xx

UOM: EA SC: R REV: J

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER		
		RV NUMBER	SC	UM	ASSEMBLY	
232990641	DIODE ARRAY (HV CASCADE)	102	P	EA	1.00	
235040060	DIODE RECTIFIER LM60	103	P	EA	1.00	
235820030	DIODE RECTIFIER EGP30D	104	P	EA	1.00	
235930816	DIODE RECTIFIER 1A MR816	105	P	EA	1.00	
240225720	DIODE ZENER 18V 1N720A	106	P	EA	2.00	
240413755	DIODE ZENER 7.5V 1N755A	108	P	EA	2.00	
240415754	DIODE ZENER 6.8V 1N754A	107	P	EA	2.00	
240425751	DIODE ZENER 5.1V 1N751A	109	P	EA	1.00	
240425752	DIODE ZENER 5.6V 1N752A	110	P	EA	1.00	
240425758	DIODE ZENER 10V 1N758A	111	P	EA	1.00	
240513977	DIODE ZENER 47V 1N977B	112	P	EA	1.00	
253010835	DIODE HOT CARRIER HP2835	113	P	EA	15.00	
270110003	TRANSISTOR NPN PN2222A	162	P	EA	3.00	
270170001	TRANSISTOR NPN 2N5770	115	P	EA	17.00	
270170002	TRANSISTOR NPN 2N5962	116	P	EA	21.00	
275110001	TRANSISTOR PNP 2N2907A	117	P	EA	4.00	
275170001	TRANSISTOR PNP 2N5087	118	P	EA	5.00	
275170002	TRANSISTOR PNP 2N5771	119	P	EA	16.00	
280180001	TRANSISTOR FET "N" U1897	120	P	EA	3.00	
280190513	TRANSISTOR FET "N" IRF513	121	P	EA	2.00	
280190642	TRANSISTOR FET "N" IRF642	122	P	EA	1.00	
280190830	TRANSISTOR FET "N" IRF830	123	P	EA	1.00	
281170001	TRANSISTOR FET "P" 2N5462	124	P	EA	4.00	
281190523	TRANSISTOR FET "P" 9523	125	P	EA	2.00	
301016103	INDUCTOR MOLDED 10 UH	126	P	EA	4.00	
302380480	FILTER CHOKE 2 AMP 48 UH	127	P	EA	1.00	
377051004	LABEL "DANGER HI VOLTAGE"	128	P	EA	1.00	
400360028	SOCKET IC ST DIP-28	129	P	EA	2.00	
400410121	IC SOCKET GRID TYP 121PIN	130	P	EA	1.00	
429220001	SWITCH THERMAL 1A N.O.	131	P	EA	1.00	
440290001	TRANSFORMER HV SWITCHING	132	B	EA	1.00	
454110003	HDR SOLD TAIL/MALE PIN 3	133	P	EA	2.00	
454111008	HDR SOLD TAIL/MALE PIN 8	134	P	EA	1.00	
454121003	BLOC FOR SOCKETS 3-PIN	135	P	EA	1.00	
454311003	HDR DIP SOLDER TO MALE 3	136	P	EA	2.00	
454610096	HDR DIP SOLD TO MALE 96	137	P	EA	1.00	
454711026	HDR DBL ROW RT ANGL 26	138	P	EA	1.00	
454902001	KEYING PLUG (SNAP IN) BLK	139	P	EA	3.00	
485011001	GROMMET 10MM OD 5MM ID	140	P	EA	1.00	
500110001	TRANSIPAD "SMALL"	148	P	EA	2.00	
500460005	MOUNTING KIT FOR TO-220	141	P	EA	6.00	
550430105	SCREW CYL HD PHIL M3X5	142	P	EA	7.00	
550430106	SCREW CYL HD PHIL M3X6	166	P	EA	4.00	
550440106	SCREW CYL HD PHIL M4X6	144	P	EA	2.00	
550440108	SCREW CYL HD PHIL M4X8	145	P	EA	2.00	
551430300	WASHER SHAKEPROOF M3	146	P	EA	11.00	
551440300	WASHER SHAKEPROOF M4	147	P	EA	4.00	
554435401	RIVET "RIVSCREW" M 3.5	167	P	EA	2.00	
560440004	SCREW PHILIPS 4-40X1/4	150	P	EA	6.00	
585252354	RIVET HOLLOW 2,5X9MM	151	P	EA	2.00	
709400231	HV MULTIPLIER SUPPORT	A	152	B	EA	1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450-2

DESC: DISPLAY CARD FOR 94xx

UOM: EA SC: R REV: J

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER		
		RV NUMBER	SC	UM	ASSEMBLY	
709450201	HV UPPER COVER	154	B	EA	1.00	
709450211	HV LOWER COVER	155	B	EA	1.00	
709450221	FET SUPPORT	156	B	EA	1.00	
709450231	SPACER HEX M3X6MM	157	B	EA	3.00	
719450203	PC BD PREASS'Y 9450-2	J	158	B	EA	1.00
MDS403	DISPLAY PROCESSOR MDS403	159	B	EA	1.00	

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450A-3

DESC: SINGLE 400 MS/S ADC DATA INV. UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV	NUMBER	SC	UM ASSEMBLY
161445151	RES CARBON FILM 150 OHMS	1	P	EA	8.00
190642151	RESISTOR NETWORK 150	2	P	EA	2.00
190642221	RESISTOR NETWORK 220 OHMS	3	P	EA	2.00
190642471	RESISTOR NETWORK 470 OHMS	4	P	EA	6.00
190642821	RESISTOR NETWORK 820 OHMS	5	P	EA	8.00
205271256	IC 32K X 8 RAM 62256-12	6	P	EA	4.00
205750000	IC AND-OR GATE ARRAY 16V8	7	P	EA	3.00
207200200	IC 8-BIT FLASH ADC 77200	8	P	EA	4.00
208124002	IC VOLT REG -5V UA7905UC	9	P	EA	1.00
208590336	IC VOLT REFERENCE LM336	10	P	EA	1.00
208591005	IC VOLT REG +5 78L05	92	P	EA	1.00
208591320	IC NEG VOLT REG LM320	11	P	EA	1.00
208591340	IC POS VOLT REG LM340	12	P	EA	1.00
309040040	CRYSTAL OSCILLATOR 40MHZ	14	P	EA	1.00
385351009	INSULATING STOCK	1000	P	EA	1.00
400410046	IC SOCKET GRID TYP 46	15	P	EA	4.00
402610002	CONN CO-AX PC MTG SMB	16	P	EA	1.00
402912077	MOUNTING INSULATOR SMB	17	P	EA	1.00
403181008	HEADER STRT BREAKAW 8-PIN	18	P	EA	3.00
405764108	SOCKET SINGLE WIRE 8-POS	19	P	EA	1.00
405764112	SOCKET SINGLE WIRE 12-POS	20	P	EA	1.00
454370002	SHUNT 2 POS	21	P	EA	8.00
454610096	HDR DIP SOLD TO MALE 96	22	P	EA	1.00
500460006	INSULATOR THERMAFILM	23	P	EA	2.00
550430104	SCREW CYL HD PHIL M3X4	1001	P	EA	1.00
550430106	SCREW CYL HD PHIL M3X6	1002	P	EA	4.00
551430300	WASHER SHAKEPROOF M3	1003	P	EA	1.00
554435401	RIVET "RIVSCREW" M 3.5	24	P	EA	2.00
554900201	SHOULDER WASHER	1004	P	EA	4.00
585252354	RIVET HOLLOW 2,5X9MM	25	P	EA	2.00
709424941	SCREW FOR SELECTOR COVER	A	1005	B EA	2.00
709450301	SPACER	B	1006	B EA	1.00
709450311	HEAT SINK	E	1007	B EA	1.00
709450321	HEAT SINK FOR FADC	A	26	B EA	4.00
709450331	SPIRAL SPRING	A	1008	B EA	2.00
709450341	SPRING CONTACT	A	1009	B EA	1.00
719450323	PC BE PREASS'Y 9450A-3	B	27	B EA	1.00
CH599011061	ADHESIVE (THERMAL COND) 709		28	P ML	0.08
HMS403C	HYB SAMPLE/HOLD HMS403C	B	29	B EA	1.00
MDX407	IC DEMULTIPLEXER MDX407		30	P EA	4.00
MNX401	ICMIN MAX GATEARR. MNX401		31	B EA	1.00
SM158102025	CAP VARIABLE 5 - 25 PF		32	P EA	1.00
SM185457103	RES VARI CERMET 10 K		33	P EA	3.00
SM185457500	RES VARI CERMET 50 OHMS		34	P EA	4.00
SM200170032	IC 2-IN OR GATE 74F32		35	P EA	1.00
SM200170138	IC DECODER 74ALS138		36	P EA	1.00
SM200172004	IC HEX INVERTER 74F04		37	P EA	1.00
SM200172008	IC AND GATE 74F08		38	P EA	1.00
SM205220168	IC 16K SRAM 6168SO-25		39	P EA	32.00
SM207162965	IC MEMORY DRIVER 2965		40	P EA	2.00
SM207179244	IC BUF/LINE DRIV HCT244		41	P EA	6.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450A-3

DESC: SINGLE 400 MS/S ADC DATA INV. UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV NUMBER	SC	UM	ASSEMBLY
161445151	RES CARBON FILM 150 OHMS	1	P	EA	8.00
190642151	RESISTOR NETWORK 150	2	P	EA	2.00
190642221	RESISTOR NETWORK 220 OHMS	3	P	EA	2.00
190642471	RESISTOR NETWORK 470 OHMS	4	P	EA	6.00
190642821	RESISTOR NETWORK 820 OHMS	5	P	EA	8.00
205271256	IC 32K X 8 RAM 62256-12	6	P	EA	4.00
205750000	IC AND-OR GATE ARRAY 16V8	7	P	EA	3.00
207200200	IC 8-BIT FLASH ADC 77200	8	P	EA	4.00
208124002	IC VOLT REG -5V UA7905UC	9	P	EA	1.00
208590336	IC VOLT REFERENCE LM336	10	P	EA	1.00
208591005	IC VOLT REG +5 78L05	92	P	EA	1.00
208591320	IC NEG VOLT REG LM320	11	P	EA	1.00
208591340	IC POS VOLT REG LM340	12	P	EA	1.00
309040040	CRYSTAL OSCILLATOR 40MHZ	14	P	EA	1.00
385351009	INSULATING STOCK	1000	P	EA	1.00
400410046	IC SOCKET GRID TYP 46	15	P	EA	4.00
402610002	CONN CO-AX PC MTG SMB	16	P	EA	1.00
402912077	MOUNTING INSULATOR SMB	17	P	EA	1.00
403181008	HEADER STRT BREAKAW 8-PIN	18	P	EA	3.00
405764108	SOCKET SINGLE WIRE 8-POS	19	P	EA	1.00
405764112	SOCKET SINGLE WIRE 12-POS	20	P	EA	1.00
454370002	SHUNT 2 POS	21	P	EA	8.00
454610096	HDR DIP SOLD TO MALE 96	22	P	EA	1.00
500460006	INSULATOR THERMAFILM	23	P	EA	2.00
550430104	SCREW CYL HD PHIL M3X4	1001	P	EA	1.00
550430106	SCREW CYL HD PHIL M3X6	1002	P	EA	4.00
551430300	WASHER SHAKEPROOF M3	1003	P	EA	1.00
554435401	RIVET "RIVSCREW" M 3.5	24	P	EA	2.00
554900201	SHOULDER WASHER	1004	P	EA	4.00
585252354	RIVET HOLLOW 2,5X9MM	25	P	EA	2.00
709424941	SCREW FOR SELECTOR COVER	A	1005	B EA	2.00
709450301	SPACER	B	1006	B EA	1.00
709450311	HEAT SINK	E	1007	B EA	1.00
709450321	HEAT SINK FOR FADC	A	26	B EA	4.00
709450331	SPIRAL SPRING	A	1008	B EA	2.00
709450341	SPRING CONTACT	A	1009	B EA	1.00
719450323	PC BE PREASS'Y 9450A-3	B	27	B EA	1.00
CH599011061	ADHESIVE (THERMAL COND) 709		28	P ML	0.08
HMS403C	HYB SAMPLE/HOLD HMS403C	B	29	B EA	1.00
MDX407	IC DEMULTIPLEXER MDX407		30	P EA	4.00
MNX401	ICMIN MAX GATEARR. MNX401		31	B EA	1.00
SM158102025	CAP VARIABLE 5 - 25 PF		32	P EA	1.00
SM185457103	RES VARI CERMET 10 K		33	P EA	3.00
SM185457500	RES VARI CERMET 50 OHMS		34	P EA	4.00
SM200170032	IC 2-IN OR GATE 74F32		35	P EA	1.00
SM200170138	IC DECODER 74ALS138		36	P EA	1.00
SM200172004	IC HEX INVERTER 74F04		37	P EA	1.00
SM200172008	IC AND GATE 74F08		38	P EA	1.00
SM205220168	IC 16K SRAM 6168SO-25		39	P EA	32.00
SM207162965	IC MEMORY DRIVER 2965		40	P EA	2.00
SM207179244	IC BUF/LINE DRIV HCT244		41	P EA	6.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450A-3

DESC: SINGLE 400 MS/S ADC DATA INV. UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY PER
		RV	SC		
SM207244110	IC 8-BIT DAC BT110	42	P	EA	2.00
SM207360125	IC TRANSLATO MC10125	43	P	EA	10.00
SM207460116	IC LINE RECEIVER 10H116	44	P	EA	1.00
SM207878245	IC BUS TRANSCVR HCT 245	45	P	EA	3.00
SM207960158	IC 2-IN MPX 10H158	46	P	EA	8.00
SM207970158	IC 2-IN MPX 74F158A	47	P	EA	1.00
SM208470324	IC OP AMP LM324M	48	P	EA	4.00
SM227060320	IC DIG SIG PROC 320C25	49	P	EA	1.00
SM232022822	DIODE ARRAY SCHTTKY 2822	50	P	EA	1.00
SM236030099	DIODE SO-PKG BAV99	51	P	EA	2.00
SM270030092	TRANSISTOR NPN BFR92	52	P	EA	1.00
SM270040092	TRANSISTOR NPN BFR92R	53	P	EA	1.00
SM270330848	TRANSISTOR NPN BC848C	54	P	EA	2.00
SM270340848	TRANSISTOR NPN 848CR	55	P	EA	2.00
SM275030092	TRANSISTOR PNP BFT92	56	P	EA	1.00
SM275330858	TRANSISTOR PNP BC858C	57	P	EA	2.00
SM275340858	TRANSISTOR PNP 858CR	58	P	EA	2.00
SM300327102	INDUCTOR WOUND FERRITE 1UH	59	P	EA	14.00
SM652101101	RES CHIP (E24) 1% 100 OHM	60	P	EA	11.00
SM652101102	RES CHIP (E24) 1% 1 K	61	P	EA	4.00
SM652101103	RES CHIP (E24) 1% 10 K	62	P	EA	6.00
SM652101112	RES CHIP (E24) 1% 1.1 K	63	P	EA	2.00
SM652101122	RES CHIP (E24) 1% 1.2 K	64	P	EA	11.00
SM652101132	RES CHIP (E24) 1% 1.3 K	65	P	EA	9.00
SM652101152	RES CHIP (E24) 1% 1.5 K	66	P	EA	2.00
SM652101181	RES CHIP (E24) 1% 180 OHM	67	P	EA	4.00
SM652101182	RES CHIP (E24) 1% 1.8 K	68	P	EA	4.00
SM652101201	RES CHIP (E24) 1% 200 OHM	69	P	EA	8.00
SM652101240	RES CHIP (E24) 1% 24 OHMS	70	P	EA	8.00
SM652101243	RES CHIP (E24) 1% 24 K	71	P	EA	2.00
SM652101271	RES CHIP (E24) 1% 270 OHM	72	P	EA	1.00
SM652101302	RES CHIP (E24) 1% 3 K	73	P	EA	5.00
SM652101330	RES CHIP (E24) 1% 33 OHMS	74	P	EA	4.00
SM652101470	RES CHIP (E24) 47 OHMS	75	P	EA	8.00
SM652101471	RES CHIP (E24) 1% 470 OHM	76	P	EA	5.00
SM652101510	RES CHIP (E24) 1% 51 OHMS	77	P	EA	8.00
SM652101562	RES CHIP (E24) 1% 5.6 K	78	P	EA	4.00
SM652101621	RES CHIP (E24) 1% 620 OHM	79	P	EA	1.00
SM652101681	RES CHIP (E24) 1% 680 OHM	80	P	EA	1.00
SM652101682	RES CHIP (E24) 1% 6.8 K	81	P	EA	6.00
SM652101910	RES CHIP (E24) 1% 91 OHMS	82	P	EA	12.00
SM652101911	RES CHIP (E24) 1% 910 OHM	83	P	EA	5.00
SM654101000	CHIP JUMPER ZERO OHMS	84	P	EA	3.00
SM661127104	CAP CERA CHIP 20% .1 UF	85	P	EA	57.00
SM661207103	CAP CERA CHIP 20% .01UF	86	P	EA	124.00
SM661255015	CAP CERA CHIP 1.5 PF	87	P	EA	1.00
SM661255033	CAP CERA CHIP 3.3 PF	88	P	EA	1.00
SM661255056	CAP CERA CHIP 5.6 PF	89	P	EA	1.00
SM666237476	CAP MOLD TANT CHIP 47 UF	90	P	EA	9.00
SM666247106	CAP MOLD TANT CHIP 10 UF	91	P	EA	6.00

CLASS CODE: 2
 SUBASSEMBLIES
 PART: F9450-4
 DESC: TIMEBASE CARD

UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER ASSEMBLY
		RV NUMBR	SC UM	
103336474	CAP CERA MONO 50V .47UF	1	P EA	1.00
190042221	RESISTOR NETWORK 220 OHMS	7	P EA	2.00
190042563	RESISTOR NETWORK 56K	8	P EA	1.00
190642221	RESISTOR NETWORK 220 OHMS	9	P EA	3.00
190642332	RESISTOR NETWORK 3.3 K	10	P EA	1.00
190642471	RESISTOR NETWORK 470 OHMS	11	P EA	2.00
190642562	RESISTOR NETWORK 5.6 K	12	P EA	4.00
205750000	IC AND-OR GATE ARRAY 16V8	300	P EA	2.00
207281703	IC MONO DAC 16 BIT 703JP	35	P EA	1.00
208123002	IC +12 VOLT REG LM340T-12	41	P EA	1.00
208124003	IC VOLT REG NEG LM320T-12	39	P EA	1.00
290120003	DELAY LINE 3 N-SEC	59	P EA	1.00
290120007	DELAY LINE 7 N-SEC	60	P EA	2.00
300330350	FERRITE CORE	61	P EA	0.00
310060012	CRYSTAL 10PPM 12.4031MHZ	68	P EA	1.00
310062100	CRYSTAL 10PPM 100MHZ	69	P EA	1.00
402610002	CONN CO-AX PC MTG SMB	70	P EA	4.00
403181008	HEADER STRT BREAKAW 8-PIN	71	P EA	1.00
454340002	HDR MALE PIN TO WW 02	72	P EA	2.00
454610096	HDR DIP SOLD TO MALE 96	73	P EA	1.00
554435401	RIVET "RIVSCREW" M 3.5	74	P EA	2.00
585252354	RIVET HOLLOW 2,5X9MM	78	P EA	2.00
690000000	PINS/CLIP ON	165	P EA	6.00
690681001	PIN EDGE CLIP STRAIGHT	166	P EA	36.00
719450403	PC BD PREASS'Y 9450-4	D	142 B EA	1.00
719450413	PC BD PREASS'Y 9450-41	B	167 B EA	2.00
719450423	PC BD PREASS'Y 9450-42	C	145 B EA	2.00
719450433	PC BD PREASS'Y 9450-43	C	146 B EA	4.00
780390008	TRANSFO FOR 9450-4		147 B EA	1.00
HCD404	HYB CLOCK DIVIDER HCD404		148 B EA	1.00
HTD405	HYBID TIME DIGIT. HTD405	A	149 B EA	1.00
SM158043006	CAP VARIABLE 2 - 6 PF		2 P EA	2.00
SM158043020	CAP VARIABLE 4.5-20 PF		4 P EA	2.00
SM158044010	CAP VARIABLE 3-10PF		6 P EA	3.00
SM200160101	IC OR/NOR GATE 10H101		13 P EA	2.00
SM200160402	IC 16-BIT SCALER MCT402		14 P EA	6.00
SM200167102	IC NOR GATE 10H102		15 P EA	5.00
SM200167104	IC 2-IN AND GATE 10H104		16 P EA	2.00
SM200167107	IC 2-IN EXCL OR/NOR10H107		17 P EA	3.00
SM200167109	IC 4-5 IN OR/NOR 10H109		18 P EA	1.00
SM200167117	IC OR-AND/O-A-INV 10H117		19 P EA	1.00
SM200167121	IC OR-AND/O-A-INV 10H121		20 P EA	4.00
SM200167131	IC M-S TYP D FLOP 10H131		21 P EA	20.00
SM200172008	IC AND GATE 74F08		22 P EA	1.00
SM200172011	IC 3-INPUT AND 74F11		23 P EA	1.00
SM200172074	IC D-TYP FLOP 74F74		24 P EA	3.00
SM200172113	IC J-K TYP FLOP 74F113		25 P EA	1.00
SM200172374	IN D-TYP FLOP 74F374		26 P EA	3.00
SM200178000	IC 2-INPUT NAND HCT00		27 P EA	2.00
SM200178574	IC D-TYP FLOP HCT 574		28 P EA	8.00
SM200267016	IC BINARY COUNTER 10H016		29 P EA	3.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450-4

DESC: TIMEBASE CARD

UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY PER
		RV	NUMBER SC		
SM200278040	IC COUNTER HCT4040	30	P	EA	3.00
SM200478573	IC D-TYP LATCH 74HCT573	31	P	EA	6.00
SM207160192	IC BUS DRIV MC10192	33	P	EA	1.00
SM207171488	IC QUAD LINE DRIVER 1488	34	P	EA	1.00
SM207360125	IC TRANSLATO MC10125	36	P	EA	4.00
SM207460116	IC LINE RECEIVER 10H116	37	P	EA	10.00
SM207878245	IC BUS TRANSCVR HCT 245	38	P	EA	2.00
SM208400003	IC RF/IF AMPLIFIER MAR-3	40	P	EA	1.00
SM232120070	DIODE ARRAY BAV70	42	P	EA	4.00
SM236030099	DIODE SO-PKG BAV99	43	P	EA	9.00
SM270030019	TRANSISTOR NPN BFS19	44	P	EA	3.00
SM270030020	TRANSISTOR NPN BFS20	45	P	EA	1.00
SM270030092	TRANSISTOR NPN BFR92	46	P	EA	8.00
SM270040092	TRANSISTOR NPN BFR92R	47	P	EA	3.00
SM270130092	TRANSISTOR NPN BFR92A	48	P	EA	1.00
SM270140092	TRANSISTOR NPN BFR92AR	49	P	EA	2.00
SM270330848	TRANSISTOR NPN BC848C	50	P	EA	4.00
SM270340848	TRANSISTOR NPN 848CR	51	P	EA	1.00
SM275030550	TRANSISTOR PNP BF550	52	P	EA	7.00
SM275040550	TRANSISTOR PNP BF550R	53	P	EA	3.00
SM275330858	TRANSISTOR PNP BC858C	54	P	EA	6.00
SM275340858	TRANSISTOR PNP 858CR	55	P	EA	3.00
SM280160022	TRANSISTOR FET N-CH BSD22	56	P	EA	3.00
SM289240061	TRANSISTOR NPN BCV61	57	P	EA	1.00
SM289240062	TRANSISTOR ARRAY BCV62	58	P	EA	2.00
SM300446150	INDUCTOR .015UH	62	P	EA	2.00
SM300446330	INDUCTOR .033 UH	64	P	EA	3.00
SM300546103	INDUCTOR 10 UH	65	P	EA	1.00
SM300546151	INDUCTOR .15 UH	66	P	EA	1.00
SM652101101	RES CHIP (E24) 1% 100 OHM	79	P	EA	10.00
SM652101102	RES CHIP (E24) 1% 1 K	80	P	EA	13.00
SM652101103	RES CHIP (E24) 1% 10 K	81	P	EA	18.00
SM652101112	RES CHIP (E24) 1% 1.1 K	82	P	EA	2.00
SM652101121	RES CHIP (E24) 1% 120 OHM	151	P	EA	5.00
SM652101122	RES CHIP (E24) 1% 1.2 K	84	P	EA	2.00
SM652101123	RES CHIP (E24) 1% 12 K	150	P	EA	1.00
SM652101151	RES CHIP (E24) 1% 150 OHM	152	P	EA	13.00
SM652101161	RES CHIP (E24) 1% 160 OHM	86	P	EA	9.00
SM652101162	RES CHIP (E24) 1% 1.6 K	153	P	EA	2.00
SM652101180	RES CHIP (E24) 1% 18 OHMS	88	P	EA	30.00
SM652101181	RES CHIP (E24) 1% 180 OHM	154	P	EA	4.00
SM652101182	RES CHIP (E24) 1% 1.8 K	90	P	EA	1.00
SM652101201	RES CHIP (E24) 1% 200 OHM	155	P	EA	16.00
SM652101202	RES CHIP (E24) 1% 2 K	92	P	EA	8.00
SM652101221	RES CHIP (E24) 1% 220 OHM	156	P	EA	8.00
SM652101222	RES CHIP (E24) 1% 2.2 K	94	P	EA	6.00
SM652101223	RES CHIP (E24) 1% 22 K	95	P	EA	1.00
SM652101270	RES CHIP (E24) 1% 27 OHMS	96	P	EA	1.00
SM652101271	RES CHIP (E24) 1% 270 OHM	157	P	EA	21.00
SM652101272	RES CHIP (E24) 1% 2.7 K	98	P	EA	4.00
SM652101301	RES CHIP (E24) 1% 300 OHM	99	P	EA	3.00

CLASS CODE: 2
 SUBASSEMBLIES
 PART: F9450-4
 DESC: TIMEBASE CARD

UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY PER
		RV	SC		
SM652101302	RES CHIP (E24) 1% 3 K	100	P	EA	3.00
SM652101330	RES CHIP (E24) 1% 33 OHMS	101	P	EA	3.00
SM652101331	RES CHIP (E24) 1% 330 OHM	158	P	EA	17.00
SM652101332	RES CHIP (E24) 1% 3.3 K	103	P	EA	5.00
SM652101362	RES CHIP (E24) 1% 3.6 K	104	P	EA	5.00
SM652101391	RES CHIP (E24) 1% 390 OHM	159	P	EA	2.00
SM652101470	RES CHIP (E24) 47 OHMS	160	P	EA	36.00
SM652101471	RES CHIP (E24) 1% 470 OHM	161	P	EA	50.00
SM652101510	RES CHIP (E24) 1% 51 OHMS	108	P	EA	9.00
SM652101512	RES CHIP (E24) 1% 5.1 K	109	P	EA	6.00
SM652101560	RES CHIP (E24) 1% 56 OHM	110	P	EA	2.00
SM652101562	RES CHIP (E24) 1% 5.6 K	111	P	EA	20.00
SM652101622	RES CHIP (E24) 1% 6.2 K	112	P	EA	24.00
SM652101680	RES CHIP (E24) 1% 68 OHMS	162	P	EA	4.00
SM652101681	RES CHIP (E24) 1% 680 OHM	114	P	EA	27.00
SM652101820	RES CHIP (E24) 1% 82 OHMS	116	P	EA	48.00
SM652101821	RES CHIP (E24) 1% 820 OHM	117	P	EA	41.00
SM652101822	RES CHIP (E24) 1% 8.2 K	118	P	EA	2.00
SM653125033	RES THICK FILM 5% 3.3 OHM	163	P	EA	3.00
SM661127104	CAP CERA CHIP 20% .1 UF	120	P	EA	2.00
SM661186180	CAP CERA CHIP 10% 18 PF	121	P	EA	2.00
SM661186470	CAP CERA CHIP 10% 47 PF	122	P	EA	2.00
SM661205332	CAP CERA CHIP 5% 3300 PF	134	P	EA	1.00
SM661207102	CAP CERA CHIP 10% .001UF	123	P	EA	10.00
SM661207103	CAP CERA CHIP 20% .01UF	124	P	EA	114.00
SM661250047	CAP CERA CHIP 4.7 PF	125	P	EA	3.00
SM661250082	CAP CERA CHIP .1% 8.2 PF	126	P	EA	4.00
SM661255100	CAP CERA CHIP 10PF	127	P	EA	1.00
SM661255101	CAP CERA CHIP 5% 100 PF	128	P	EA	2.00
SM661255181	CAP CERA CHIP 5% 180 PF	130	P	EA	1.00
SM661255221	CAP CERA CHIP 5% 220 PF	131	P	EA	1.00
SM661255270	CAP CERA CHIP 27PF	164	P	EA	5.00
SM661255330	CAP CERA CHIP 5% 33 PF	133	P	EA	2.00
SM661255560	CAP CERA CHIP 56PF	135	P	EA	9.00
SM666247106	CAP MOLD TANT CHIP 10 UF	136	P	EA	6.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450-4

DESC: TIMEBASE CARD

UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER
		RV	SC	
SM200278040	IC COUNTER HCT4040	30	P	EA 3.00
SM200478573	IC D-TYP LATCH 74HCT573	31	P	EA 6.00
SM207160192	IC BUS DRIV MC10192	33	P	EA 1.00
SM207171488	IC QUAD LINE DRIVER 1488	34	P	EA 1.00
SM207360125	IC TRANSLATO MC10125	36	P	EA 4.00
SM207460116	IC LINE RECEIVER 10H116	37	P	EA 10.00
SM207878245	IC BUS TRANSCVR HCT 245	38	P	EA 2.00
SM208400003	IC RF/IF AMPLIFIER MAR-3	40	P	EA 1.00
SM232120070	DIODE ARRAY BAV70	42	P	EA 4.00
SM236030099	DIODE SO-PKG BAV99	43	P	EA 9.00
SM270030019	TRANSISTOR NPN BFS19	44	P	EA 3.00
SM270030020	TRANSISTOR NPN BFS20	45	P	EA 1.00
SM270030092	TRANSISTOR NPN BFR92	46	P	EA 8.00
SM270040092	TRANSISTOR NPN BFR92R	47	P	EA 3.00
SM270130092	TRANSISTOR NPN BFR92A	48	P	EA 1.00
SM270140092	TRANSISTOR NPN BFR92AR	49	P	EA 2.00
SM270330848	TRANSISTOR NPN BC848C	50	P	EA 4.00
SM270340848	TRANSISTOR NPN 848CR	51	P	EA 1.00
SM275030550	TRANSISTOR PNP BF550	52	P	EA 7.00
SM275040550	TRANSISTOR PNP BF550R	53	P	EA 3.00
SM275330858	TRANSISTOR PNP BC858C	54	P	EA 6.00
SM275340858	TRANSISTOR PNP 858CR	55	P	EA 3.00
SM280160022	TRANSISTOR FET N-CH BSD22	56	P	EA 3.00
SM289240061	TRANSISTOR NPN BCV61	57	P	EA 1.00
SM289240062	TRANSISTOR ARRAY BCV62	58	P	EA 2.00
SM300446150	INDUCTOR .015UH	62	P	EA 2.00
SM300446330	INDUCTOR .033 UH	64	P	EA 3.00
SM300546103	INDUCTOR 10 UH	65	P	EA 1.00
SM300546151	INDUCTOR .15 UH	66	P	EA 1.00
SM652101101	RES CHIP (E24) 1% 100 OHM	79	P	EA 10.00
SM652101102	RES CHIP (E24) 1% 1 K	80	P	EA 13.00
SM652101103	RES CHIP (E24) 1% 10 K	81	P	EA 18.00
SM652101112	RES CHIP (E24) 1% 1.1 K	82	P	EA 2.00
SM652101121	RES CHIP (E24) 1% 120 OHM	151	P	EA 5.00
SM652101122	RES CHIP (E24) 1% 1.2 K	84	P	EA 2.00
SM652101123	RES CHIP (E24) 1% 12 K	150	P	EA 1.00
SM652101151	RES CHIP (E24) 1% 150 OHM	152	P	EA 13.00
SM652101161	RES CHIP (E24) 1% 160 OHM	86	P	EA 9.00
SM652101162	RES CHIP (E24) 1% 1.6 K	153	P	EA 2.00
SM652101180	RES CHIP (E24) 1% 18 OHMS	88	P	EA 30.00
SM652101181	RES CHIP (E24) 1% 180 OHM	154	P	EA 4.00
SM652101182	RES CHIP (E24) 1% 1.8 K	90	P	EA 1.00
SM652101201	RES CHIP (E24) 1% 200 OHM	155	P	EA 16.00
SM652101202	RES CHIP (E24) 1% 2 K	92	P	EA 8.00
SM652101221	RES CHIP (E24) 1% 220 OHM	156	P	EA 8.00
SM652101222	RES CHIP (E24) 1% 2.2 K	94	P	EA 6.00
SM652101223	RES CHIP (E24) 1% 22 K	95	P	EA 1.00
SM652101270	RES CHIP (E24) 1% 27 OHMS	96	P	EA 1.00
SM652101271	RES CHIP (E24) 1% 270 OHM	157	P	EA 21.00
SM652101272	RES CHIP (E24) 1% 2.7 K	98	P	EA 4.00
SM652101301	RES CHIP (E24) 1% 300 OHM	99	P	EA 3.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450A-5

DESC: DUAL CHANNEL FRONT PANEL CARD UOM: EA SC: R REV: A

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER
		RV NUMBR	SC	
103327103	CAP CERA MONO 50V .01 UF	1	P	EA 4.00
103427104	CAP CERA MONO 100V .1 UF	2	P	EA 8.00
161225103	RES COMP 1/8W 5% 10 K	3	P	EA 2.00
161225121	RES COMP 1/8W 5% 120 OHMS	4	P	EA 16.00
168531365	RES PREC RN55D 511 OHMS	5	P	EA 2.00
168531381	RES PREC RN55D 750 OHMS	6	P	EA 1.00
168531521	RES PREC RN55D 21.5 K	7	P	EA 1.00
169416473	RESISTOR DISC NTC 47 K	8	P	EA 1.00
184417502	RES VARI COND PLASTIC 5 K	9	P	EA 10.00
184427502	RES VARI COND PLASTIC 5 K	10	P	EA 2.00
184437502	RES VARI COND PLASTIC 5 K	11	P	EA 2.00
190001001	RES NETWORK SPECIAL	12	P	EA 1.00
200344138	IC DECODER 3TO8 74HCT138	13	P	EA 1.00
205644094	IC 8-BIT SHIFT REGHCT4094	14	P	EA 5.00
205750000	IC AND-OR GATE ARRAY 16V8	300	P	EA 1.00
207345051	IC MUX/DEMUX HCT4051	16	P	EA 4.00
208590385	IC VOLT REF LM385	17	P	EA 1.00
230020062	DIODE SWITCHING BAW62	18	P	EA 54.00
256243300	DIODE LED RED HLMP-0300	19	P	EA 2.00
256443421	DIODE LED YEL HLMP-0421	20	P	EA 35.00
403950002	POLARIZING KEY	21	P	EA 2.00
412001012	SWITCH ROT N/STOP 12-PINS	22	P	EA 4.00
416161003	SWITCH PUSHBUTTON SPST	23	P	EA 48.00
454211020	HDR SOLD TAIL TO MALE 20	24	P	EA 1.00
536068001	KNOB FOR 6MM SHAFT	1002	P	EA 4.00
536068002	KNOB FOR 3MM SHAFT	1003	P	EA 2.00
536068003	CAP (FOR KNOB 020-2215)	1004	P	EA 11.00
536068005	CAP FOR 020-3215 OR -3415	1005	P	EA 3.00
536068006	CAP FOR 021-1110 OR -2215	1006	P	EA 2.00
536168001	KNOB FOR 1/8" SHAFT	1007	P	EA 9.00
536168002	KNOB FOR 1/8" SHAFT	1008	P	EA 1.00
536168003	KNOB FOR 1/8" SHAFT	1009	P	EA 2.00
550430106	SCREW CYL HD PHIL M3X6	25	P	EA 8.00
551430300	WASHER SHAKEPROOF M3	26	P	EA 8.00
553230108	SPACER HEX M3X8MM	27	P	EA 4.00
554422004	SCREW SELF TAPPING PHIL HD	1010	P	EA 13.00
709400511	LED COVER 9400-5	A	28	B EA 37.00
709450511	CALIBR.TERMIN. 9450-5		29	B EA 2.00
709450523	PUSH SWITCH EXTENDER	D	30	B EA 48.00
719430503	PC BD PREASS'Y 9430-51	A	31	B EA 1.00
719430513	PC BD PREASS'Y 9430-52	A	32	B EA 1.00
729424521	SPRING CONTACT		33	P EA 1.00
FP9450A-5	COMPLETED FRONT PANEL	A	1000	R EA 1.00
HPC411A1H	PROBE CALIBRATOR	A	34	R EA 1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9420-6

DESC: PROCESSOR CARD

UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY PER
		RV	SC		
102412100	CAP CERA DISC 100V 10 PF	4	P	EA	1.00
102412220	CAP CERA DISC 100V 22 PF	6	P	EA	1.00
103307103	CAP CERA MONO 50V .01 UF	1	P	EA	35.00
103427104	CAP CERA MONO 100V .1 UF	2	P	EA	35.00
103506331	CAP CERA MONO 100V 330 PF	7	P	EA	1.00
103625151	CAP CERA MONO 100V 150 PF	5	P	EA	2.00
142214156	CAP TANT DIP CASE 15 UF	8	P	EA	1.00
146354107	CAP MINI ALUM 20% 100 UF	9	P	EA	3.00
147436033	CAP ALUM METAL CAN 33 UF	10	P	EA	1.00
161225027	RES COMP 1/8W 5% 2.7 OHMS	3	P	EA	2.00
161225102	RES COMP 1/8W 5% 1 K	11	P	EA	6.00
161225103	RES COMP 1/8W 5% 10 K	12	P	EA	4.00
161225206	RES CARBON FILM 20 MEG	13	P	EA	2.00
161225391	RES COMP 1/8W 5% 390 OHMS	14	P	EA	3.00
161225472	RES COMP 1/8W 5% 4.7 K	15	P	EA	1.00
168531229	RES PREC RN55D 19.6 OHMS	16	P	EA	1.00
168531389	RES PREC RN55D 909 OHMS	17	P	EA	1.00
168531401	RES PREC RN55D 1.21 K	18	P	EA	1.00
168531449	RES PREC RN55D 3.83 K	19	P	EA	1.00
168531585	RES PREC RN55D 100 K	20	P	EA	3.00
168531601	RES PREC RN55D 147 K	21	P	EA	1.00
168531633	RES PREC RN55D 316 K	22	P	EA	1.00
190042103	RESISTOR NETWORK 10 K	23	P	EA	4.00
190832220	RESISTOR NETWORK 22 OHMS	24	P	EA	1.00
190842102	RES NETWORK 1 K	25	P	EA	1.00
200344174	IC HEX D-FLOP 74HCT174	26	P	EA	1.00
200430393	IC BIN COUNTER HCT393	27	P	EA	2.00
200440390	IC DEC COUNTER 74HCT390	28	P	EA	2.00
200480167	IC REAL TIME CLOCK 58167	29	P	EA	1.00
205254256	IC 256 X 4 RAM 424256C	65	P	EA	8.00
205271256	IC 32K X 8 RAM 62256-12	30	P	EA	2.00
205272064	IC8192X8 RAM 6264LP-10	31	P	EA	2.00
205301000	UV E-PROM CMOS 1MBIT	32	P	EA	6.00
205640165	IC SHIFT REG HCT165	33	P	EA	1.00
205750000	IC AND-OR GATE ARRAY 16V8	300	P	EA	12.00
207172965	IC MEMORY DRIVER 2965	66	P	EA	1.00
207367576	IC 8-BIT ADC AD7576	36	P	EA	1.00
207472245	IC BUS TRANSVR HCT245	37	P	EA	9.00
208011007	IC DUAL OP AMP LM358N	38	P	EA	1.00
208517705	IC VOLTAGE REG 7705	39	P	EA	1.00
208618212	IC VOLT DETECTOR 8212	40	P	EA	1.00
227792968	IC RAM CONTROLLER 2968A	64	P	EA	1.00
230020062	DIODE SWITCHING BAW62	45	P	EA	2.00
253010811	DIODE SCHOTTKY BAR HP2811	43	P	EA	2.00
256233209	DIODE LED (RED) TIL209A	44	P	EA	1.00
275110001	TRANSISTOR PNP 2N2907A	46	P	EA	1.00
280170104	TRANSISTOR FET N VN0104N3	47	P	EA	4.00
309041016	CRYSTAL OSCILLATOR 16MHZ	48	P	EA	1.00
310111032	CRYSTAL RESONATOR 32KH	49	P	EA	1.00
312660030	BATTERY PC MTG LITH 3V	50	P	EA	1.00
400331020	SOCKET IC ST DIP-20	51	P	EA	1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9420-6

DESC: PROCESSOR CARD

UOM: EA SC: R REV: D

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV	NUMBR	SC	UM ASSEMBLY
400360028	SOCKET IC ST DIP-28	52	P	EA	1.00
400360032	SOCKET IC ST DIP-32	53	P	EA	6.00
403950002	POLARIZING KEY	57	P	EA	2.00
411430002	SWITCH ROCKER PC MTG (4)	58	P	EA	1.00
454211020	HDR SOLD TAIL TO MALE 20	59	P	EA	1.00
454610096	HDR DIP SOLD TO MALE 96	60	P	EA	1.00
585252354	RIVET HOLLOW 2,5X9MM	61	P	EA	2.00
7194XX603	PC BD PREASS'Y 94xx-6	A	62	B EA	1.00
MNX401	ICMIN MAX GATEARR. MNX401		63	B EA	1.00
SM207668020	IC 32-BIT U-PROC 68020		41	P EA	1.00
SM207668881	IC CO-PROCESSOR 68881		42	P EA	1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450A-7

DESC: DUAL CHANNEL 300 MHZ FRONTEND UOM: EA SC: R REV: E

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV	NUMBR SC	UM	ASSEMBLY
158849010	CAP VARIABLE 1 - 5 PF		2 P	EA	1.00
158849012	CAP VARIABLE 5.0-15 PF		3 P	EA	2.00
158899002	CAP VARIABLE .2 - .6 PF		1 P	EA	2.00
208144001	IC ADJ POS VOLT REG UA78G		6 P	EA	1.00
208144002	IC ADJ NEG VOLT REG UA79G		7 P	EA	1.00
208591320	IC NEG VOLT REG LM320		8 P	EA	1.00
208591340	IC POS VOLT REG LM340		9 P	EA	1.00
402110302	CONN CO-AX PC MTG BNC		10 P	EA	3.00
403950002	POLARIZING KEY		11 P	EA	2.00
430430001	RELAY 1 FROM C SPDT		5 P	EA	4.00
430440732	RELAY 2 FORM C DPDT		12 P	EA	4.00
430490003	RELAY 2 FORM C DPDT		13 P	EA	1.00
454150010	HDR SOLD TAIL/PC EDG10		14 P	EA	1.00
454211040	HDR SOLD TAIL TO MALE 40		15 P	EA	1.00
454340002	HDR MALE PIN TO WW 02		16 P	EA	1.00
454340012	HDR MALE PIN TO WW 12		17 P	EA	1.00
550425106	SCREW CYL HD PHIL M2.5X6		1000 P	EA	5.00
550425520	SCREW FLAT HD PHIL 2,5X20		1001 P	EA	8.00
554435401	RIVET "RIVSCREW" M 3.5		18 P	EA	4.00
709424731	FRONT RF SHIELD	A	1003 B	EA	1.00
709451711	LOWER RF SHIELD	A	1004 B	EA	1.00
709451721	UPPER RF SHIELD	A	1002 B	EA	1.00
719450723	PC BD PREASS'Y 9450A-7	G	19 B	EA	1.00
780261129	SMB-SMC CABLE 29		20 B	EA	2.00
MFE409	MONOL. DSO FRONT END (500MHZ)		21 B	EA	2.00
MTR408	TRIGGER COUPLING & COMPARATOR		22 B	EA	3.00
SM168651297	RES METAL FILM 1% 100 OHMS		23 P	EA	4.00
SM168659002	RES METAL FILM .1% 9.00K		24 P	EA	2.00
SM168659004	RES METAL FILM .1% 900 OHMS		25 P	EA	1.00
SM168659006	RES METAL FILM .1% 111.1 K		27 P	EA	3.00
SM168659297	RES METAL FILM .1% 100 OHMS		28 P	EA	1.00
SM185457103	RES VARI CERMET 10 K		29 P	EA	2.00
SM185457203	RES VARI CERMET 20 K		30 P	EA	7.00
SM200178004	IC HEX INVERTER HCT04		31 P	EA	1.00
SM200178008	IC 2-INPUT AND HCT08		32 P	EA	1.00
SM200178138	IC 3-8 LINE DECOD HCT 138		33 P	EA	3.00
SM205616094	IC 8-ST.SHIFT REG HCT4094		34 P	EA	6.00
SM207770201	IC ANALOG SWITCH DG201		35 P	EA	2.00
SM207770442	IC ANALOG SWITCH DG442		36 P	EA	2.00
SM207978153	IC 4-INPUT MUX HCT153		37 P	EA	1.00
SM208470007	IC OP AMP OP-07		38 P	EA	1.00
SM208470347	IC J-FET OP AMP 347		39 P	EA	2.00
SM208470351	IC J-FET OP AMP 351		40 P	EA	1.00
SM208470353	IC DUAL OP AMP 353		41 P	EA	5.00
SM208470705	IC OP AMP PICOAMP INPUT AD705		44 P	EA	3.00
SM208870339	IC VOLT COMPARATOR 339		42 P	EA	1.00
SM208971881	IC VIDEO SYNC SEPARATOR LM1881		43 P	EA	1.00
SM236030099	DIODE SO-PKG BAV99		45 P	EA	4.00
SM240050033	DIODE ZENER TZM-C-3V3		46 P	EA	3.00
SM240050051	DIODE ZENER TZM-C-5V1		47 P	EA	2.00
SM252023018	DIODE PIN BAT 18		48 P	EA	3.00

CLASS CODE: 2
 SUBASSEMBLIES
 PART: F9450A-7
 DESC: DUAL CHANNEL 300 MHZ FRONTEND UOM: EA SC: R REV: E

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY PER
		RV	SC		
SM270130092	TRANSISTOR NPN BFR92A	50	P	EA	10.00
SM270140092	TRANSISTOR NPN BFR92AR	51	P	EA	2.00
SM270340848	TRANSISTOR NPN 848CR	52	P	EA	1.00
SM275030093	TRANSISTOR PNP BFT93	53	P	EA	2.00
SM275040093	TRANSISTOR PNP BFT93R	54	P	EA	2.00
SM275330858	TRANSISTOR PNP BC858C	55	P	EA	2.00
SM280124416	TRANSISTOR JFET N-CH SST4416	56	P	EA	3.00
SM289240062	TRANSISTOR ARRAY BCV62	57	P	EA	2.00
SM289772003	TRANSISTOR ARRAY 2003	58	P	EA	2.00
SM300486104	INDUCTOR WOUND 100uH	61	P	EA	2.00
SM301502001	BEAD (FERRITE CHIP)	60	P	EA	18.00
SM652101101	RES CHIP (E24) 1% 100 OHM	62	P	EA	15.00
SM652101103	RES CHIP (E24) 1% 10 K	63	P	EA	7.00
SM652101105	RES CHIP (E24) 1% 1 M	64	P	EA	8.00
SM652101114	RES CHIP (E24) 1% 110 K	74	P	EA	2.00
SM652101122	RES CHIP (E24) 1% 1.2 K	66	P	EA	4.00
SM652101131	RES CHIP (E24) 1% 130 OHM	67	P	EA	2.00
SM652101151	RES CHIP (E24) 1% 150 OHM	68	P	EA	7.00
SM652101152	RES CHIP (E24) 1% 1.5 K	69	P	EA	2.00
SM652101153	RES CHIP (E24) 1% 15 K	86	P	EA	3.00
SM652101161	RES CHIP (E24) 1% 160 OHM	132	P	EA	2.00
SM652101163	RES CHIP (E24) 1% 16 K	70	P	EA	2.00
SM652101182	RES CHIP (E24) 1% 1.8 K	72	P	EA	2.00
SM652101183	RES CHIP (E24) 1% 18 K	73	P	EA	2.00
SM652101185	RES CHIP (E24) 1% 1.8 M	75	P	EA	2.00
SM652101201	RES CHIP (E24) 1% 200 OHM	78	P	EA	1.00
SM652101221	RES CHIP (E24) 1% 220 OHM	76	P	EA	5.00
SM652101240	RES CHIP (E24) 1% 24 OHMS	77	P	EA	8.00
SM652101242	RES CHIP (E24) 1% 2.4 K	79	P	EA	2.00
SM652101243	RES CHIP (E24) 1% 24 K	80	P	EA	2.00
SM652101272	RES CHIP (E24) 1% 2.7 K	82	P	EA	2.00
SM652101300	RES CHIP (E24) 1% 30 OHMS	95	P	EA	2.00
SM652101302	RES CHIP (E24) 1% 3 K	81	P	EA	5.00
SM652101332	RES CHIP (E24) 1% 3.3 K	83	P	EA	9.00
SM652101333	RES CHIP (E24) 1% 33 K	84	P	EA	2.00
SM652101334	RES CHIP (E24) 1% 330 K	85	P	EA	2.00
SM652101360	RES CHIP (E24) 1% 36 OHM	107	P	EA	1.00
SM652101390	RES CHIP (E24) 1% 39 OHMS	87	P	EA	5.00
SM652101391	RES CHIP (E24) 1% 390 OHM	88	P	EA	7.00
SM652101392	RES CHIP (E24) 1% 3.9 K	89	P	EA	2.00
SM652101434	RES CHIP (E24) 1% 430 K	90	P	EA	1.00
SM652101470	RES CHIP (E24) 47 OHMS	91	P	EA	4.00
SM652101471	RES CHIP (E24) 1% 470 OHM	92	P	EA	4.00
SM652101472	RES CHIP (E24) 1% 4.7 K	93	P	EA	2.00
SM652101474	RES CHIP (E24) 1% 470 K	94	P	EA	1.00
SM652101475	RES CHIP (E24) 1% 4.7 M	108	P	EA	3.00
SM652101510	RES CHIP (E24) 1% 51 OHMS	96	P	EA	14.00
SM652101511	RES CHIP (E24) 1% 510 OHM	97	P	EA	3.00
SM652101512	RES CHIP (E24) 1% 5.1 K	98	P	EA	6.00
SM652101560	RES CHIP (E24) 1% 56 OHM	99	P	EA	1.00
SM652101561	RES CHIP (E24) 1% 560 OHM	100	P	EA	3.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450A-7

DESC: DUAL CHANNEL 300 MHZ FRONTEND UOM: EA SC: R REV: E

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY PER
		RV NUMBER	SC		
SM652101564	RES CHIP (E24) 1% 560 K	101	P	EA	2.00
SM652101680	RES CHIP (E24) 1% 68 OHMS	110	P	EA	3.00
SM652101681	RES CHIP (E24) 1% 680 OHM	111	P	EA	1.00
SM652101683	RES CHIP (E24) 1% 68 K	102	P	EA	2.00
SM652101684	RES CHIP (E24) 1% 680 K	103	P	EA	1.00
SM652101750	RES CHIP (E24) 1% 75 OHMS	104	P	EA	8.00
SM652101821	RES CHIP (E24) 1% 820 OHM	71	P	EA	2.00
SM652101822	RES CHIP (E24) 1% 8.2 K	105	P	EA	2.00
SM652101824	RES CHIP (E24) 1% 820 K	106	P	EA	1.00
SM652110904	RES CHIP 900K 0.5%	26	P	EA	5.00
SM653125033	RES THICK FILM 5% 3.3 OHM	109	P	EA	1.00
SM654101000	CHIP JUMPER ZERO OHMS	133	P	EA	2.00
SM661127104	CAP CERA CHIP 20% .1 UF	112	P	EA	8.00
SM661207103	CAP CERA CHIP 20% .01UF	113	P	EA	108.00
SM661207223	CAP CERA CHIP 20% .022 UF	114	P	EA	4.00
SM661250047	CAP CERA CHIP 4.7 PF	123	P	EA	1.00
SM661250082	CAP CERA CHIP .1% 8.2 PF	115	P	EA	3.00
SM661255022	CAP CERA CHIP 2.2 PF	124	P	EA	1.00
SM661255033	CAP CERA CHIP 3.3 PF	128	P	EA	1.00
SM661255056	CAP CERA CHIP 5.6 PF	116	P	EA	4.00
SM661255100	CAP CERA CHIP 10PF	117	P	EA	1.00
SM661255101	CAP CERA CHIP 5% 100 PF	118	P	EA	2.00
SM661255220	CAP CERA CHIP 5% 22 PF	131	P	EA	2.00
SM661255221	CAP CERA CHIP 5% 220 PF	119	P	EA	1.00
SM661255331	CAP CERA CHIP 5% 330 PF	120	P	EA	1.00
SM661255390	CAP CERA CHIP 5% 39 PF	121	P	EA	2.00
SM661255470	CAP CERA CHIP 47PF	122	P	EA	3.00
SM661255821	CAP CERA CHIP 5% 820 PF	125	P	EA	1.00
SM661495561	CAP CERA CHIP 5% 560 PF	126	P	EA	5.00
SM661726103	CAP CERA CHIP 10% .01 UF	129	P	EA	8.00
SM666327225	CAP MOLD TANT CHIP 2.2 UF	130	P	EA	30.00

CLASS CODE: 2
SUBASSEMBLIES
PART: F9450-8
DESC: CLOCK-BUS

UOM: EA SC: R REV: A

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV	NUMBR SC	UM	ASSEMBLY
454150039	HDR SOLD TAIL/PC EDG 39	1	P	EA	3.00
719450803	PC BD PREASS'Y 9450-8	B	2	B EA	1.00
9450-8-SUB	SUBCONTRACTOR BOM FOR F9450-8	3	R	EA	0.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9450A-9

DESC: REAR PANEL FOR 9450A

UOM: EA SC: R REV: B

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV	NUMBR	SC	UM ASSEMBLY
205750000	IC AND-OR GATE ARRAY 16V8		300	P	EA 2.00
455021018	CONNECTOR PIN (FEMALE)		1003	P	EA 2.00
455210002	BLOCK FOR CRIMP MALE PIN2		1004	P	EA 1.00
530409125	FAN AXIAL 12V DC		1005	P	EA 1.00
550440412	SCREW CYL INT HEX		1016	P	EA 4.00
551440100	FLAT WASHER M4		1012	P	EA 4.00
551440400	WASHER SHAKEPROOF M4		1013	P	EA 4.00
554500001	TAPPING SCREW W/U-THREAD		1018	P	EA 2.00
709424911	VOLTAGE SELECTOR COVER	A	1001	B	EA 1.00
709424941	SCREW FOR SELECTOR COVER	A	1014	B	EA 1.00
709424951	BNC HEADER	A	1019	B	EA 1.00
709450913	SERIAL NUMBER PLATE	B	1002	B	EA 1.00
780249945	BNC-SMD CABLE 45		1020	B	EA 2.00
780259927	BNC-SMB CABLE 27		1021	B	EA 2.00
RP94XX-9	REAR PANEL 94XX-9	A	1000	R	EA 1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: M9424

DESC: MECHANICAL FOR 9424

UOM: EA SC: R REV: C

COMPONENT PART	DESCRIPTION	ITEM RV NUMBER	SC	ST UM	QTY PER ASSEMBLY
300090001	DEFLECTION YOKE	1	P	EA	1.00
315040015	POWER SUPPLY 9451-1	1043	B	EA	1.00
321220009	CRT ORANGE 90 DEG DEFL 9"	1019	P	EA	1.00
377051005	LABEL "DANGER-----ONLY"	A 1020	B	EA	1.00
377131001	LABEL (GROUND SYMBOL)	1041	P	EA	1.00
389000000	ADHESIVE APENFIX	1049	P	ME	0.10
433162200	FUSE SLO-BLO 250V 2AMP	7	P	EA	2.00
433162400	FUSE SLO-BLO 250V 4 AMP	6	P	EA	2.00
455020001	CONNECTOR PIN (FEMALE)	2	P	EA	4.00
455121003	CONNECTOR HOUSING 3	3	P	EA	2.00
455950002	CLAMP WITH STRAIN RELIEF	4	P	EA	2.00
485023008	BUMPER (FOOT) BLACK RUBBER	1046	P	EA	4.00
530010024	FOOT FOR COMPAC ENCLOSURE	1032	P	EA	4.00
530301005	HANDLE (U-SHAPE)	1021	B	EA	1.00
530410001	CARD GUIDE NON METALLIC	1022	P	EA	5.00
544310001	SPRING EXT TYPE 190 MM	1023	B	EA	1.00
550425505	SCREW FLAT HD PHIL M2.5X5	1044	P	EA	1.00
550430104	SCREW CYL HD PHIL M3X4	1013	P	EA	10.00
550430106	SCREW CYL HD PHIL M3X6	1011	P	EA	14.00
550430108	SCREW CYL HD PHIL M3X8	1012	P	EA	3.00
550440105	SCREW CYL HD PHIL M4X5	1038	P	EA	4.00
550440108	SCREW CYL HD PHIL M4X8	1037	P	EA	15.00
550440110	SCREW CYL HD PHIL M4X10	1033	P	EA	5.00
550440120	SCREW CYL HD PHIL	1035	P	EA	3.00
550440120	SCREW CYL HD PHIL	1053	P	EA	1.00
550440406	SCREW CYL INT HEX M4X6	1007	P	EA	12.00
550440416	CYL INT HEX M4X16	1024	P	EA	4.00
550440506	SCREW FLAT HD PHIL M4X6	1045	P	EA	2.00
550440708	SCREW LARGE HEAD M4X8	1010	P	EA	8.00
551430300	WASHER SHAKEPROOF M3	1016	P	EA	27.00
551440300	WASHER SHAKEPROOF M4	1039	P	EA	24.00
551440300	WASHER SHAKEPROOF M4	1054	P	EA	1.00
551440400	WASHER SHAKEPROOF M4	1040	P	EA	2.00
551440501	WASHER FLAT (SPRING) M4	1025	P	EA	8.00
552440100	NUT HEX M4	1015	P	EA	10.00
554440202	FLAT WASHER M4	1018	P	EA	4.00
594120003	TIEWRAP	5	P	EA	2.00
594120003	TIEWRAP	1026	P	EA	3.00
594230002	CABLE CLIP ADHESIVE BACK	1047	P	EA	1.00
709424011	NUT FOR HANDLE	A 1034	B	EA	3.00
709424021	SIDE PANEL	C 1000	B	EA	2.00
709424031	DIPLAY SUPPORT	B 1001	B	EA	1.00
709424041	REAR SUPPORT	B 1002	B	EA	1.00
709424051	MOTHER CARD SUPPORT	B 1003	B	EA	1.00
709424061	POWER SUPPLY SUPPORT	A 1004	B	EA	1.00
709424071	UPPER COVER	B 1005	B	EA	1.00
709424081	LOWER COVER	B 1006	B	EA	1.00
709424095	CARD RETAINER	C 1048	B	EA	1.00
709424096	INSERTION GUIDE FOR MC	E 1050	B	EA	1.00
709424098	SPACER FOR INSERTION GUIDE	A 1051	B	EA	1.00
709450071	NEOPRENE WASHER	A 1014	B	EA	4.00

CLASS CODE: 2

SUBASSEMBLIES

PART: M9424

DESC: MECHANICAL FOR 9424

UOM: EA SC: R REV: C

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV	NUMBR	SC	UM ASSEMBLY
780210030	DISPLAY POWER CABLE	A	1028	B	EA 1.00
780220015	BASE CARD POWER CABLE	A	1029	B	EA 1.00
780231120	FRONT END BASE CABLE	B	1030	B	EA 1.00
780231131	MEMORY CARD CABLE	A	1052	B	EA 1.00
780299025	CRT CABLE	B	1031	B	EA 1.00
780411236	FRONT PANEL CABLE	A	1027	B	EA 1.00
780544512	GROUND CABLE	A	1042	B	EA 1.00

CLASS CODE: 2

SUBASSEMBLIES

PART: ACCESSORIES-9450A

DESC: ACCESSORIES FOR 9450A

UOM: EA SC: R REV: A

COMPONENT PART	DESCRIPTION	ITEM		ST QTY PER	
		RV NUMBR	SC	UM	ASSEMBLY
407099008	PLUG FOR AC LINE -ENGLAND	10	P	EA	0.05
433162200	FUSE SLO-BLO 250V 2AMP	11	P	EA	2.00
433162400	FUSE SLO-BLO 250V 4 AMP	12	P	EA	2.00
589202100	AC CORD/PLUG FOR FRANCE	8	P	EA	0.10
589202200	AC CORD/PLUG FOR GERMANY	9	P	EA	0.25
589203100	AC CORD/"SEV-ASE" PLUG	7	P	EA	0.10
589203218	AC CORD/US-CANADA PLUG	6	P	EA	0.50
597940011	SHIPPING CARTON 9400	2	B	EA	1.00
597940014	PLASTIC BAG FOR 9400	4	P	EA	2.00
597940015	MANUAL/ACCESSORY CTN 9400	5	B	EA	2.00
597942403	SHIPPING INSERT (REAR) 9424	3	B	EA	2.00
709424091	DSO COVER 9424	D	13	B EA	1.00
9450-OM-E	9450 OPERATORS MANUAL - E	14	B	EA	1.00
9450-OM-F	9450 OPERATORS MANUAL - F	15	B	EA	0.10
94XX-RCM-E	94XX SERIES REMOTE CONTROL MAN	17	B	EA	1.00
P9020	PROBE DC-300MHZ 10:1 (TESTED)	1	R	EA	2.00

CLASS CODE: 2

SUBASSEMBLIES

PART: F9424-2

DESC: SUPPORT FOR MEMORY CARD

UOM: EA SC: R REV: A

COMPONENT PART	DESCRIPTION	ITEM		ST	QTY	PER
		RV	NUMBR			
103427104	CAP CERA MONO 100V .1 UF	1	P	EA	1.00	
190642103	RESISTOR NETWORK 10 K	6	P	EA	1.00	
200331027	IC 3-IN POS-NOR 74HC27	7	P	EA	1.00	
403950002	POLARIZING KEY	5	P	EA	2.00	
404500068	CONN BD TO BD 68 POS	4	P	EA	1.00	
454611040	HDR DIP SOLD TO MALE 40	2	P	EA	1.00	
550130108	SCREW CYL HD M3X8	8	P	EA	2.00	
552130101	NUT HEX M3	9	P	EA	2.00	
585252354	RIVET HOLLOW 2,5X9MM	10	P	EA	2.00	
719424203	PC BD PREASS'Y 9424-2	E	3	B EA	1.00	

Chapter 9

**Connecting the 9450A to a
plotter or a printer.**

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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 9450A 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 9450A generation DSO support HP plotters of two types. They may however, despite these changes, work with HPGL compatible plotters from other manufacturers.

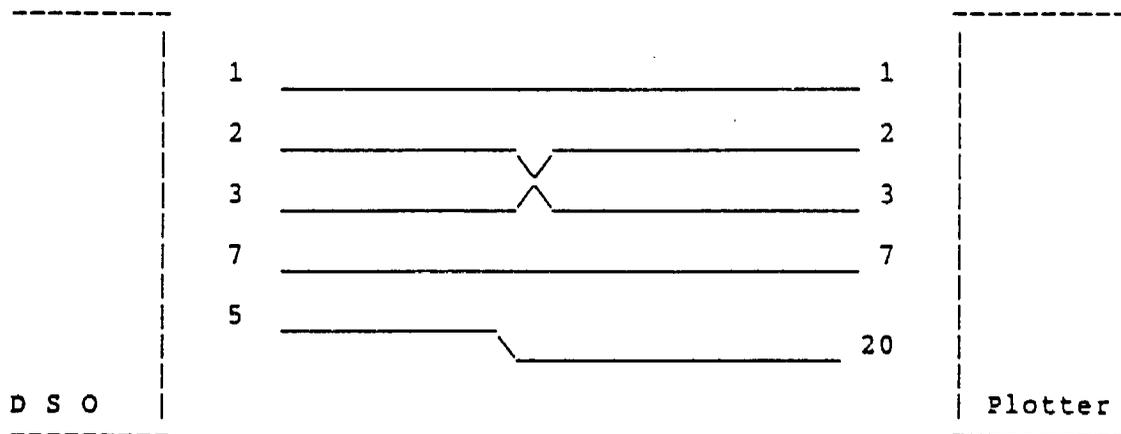
Before connecting a plotter to a DSO, do not forget to select the appropriate settings in the plotter menu and the RS-232 menu pages.

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	0	0	0	1	0	0	0
	(1)							

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

S3: 1 2 3 4 5 6
 V24 free 8 bits 1 stop no par. not used

S4: 1 2 5 6
 OFF free Auto buff. free
 mess. enable
 (no kaut)

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.

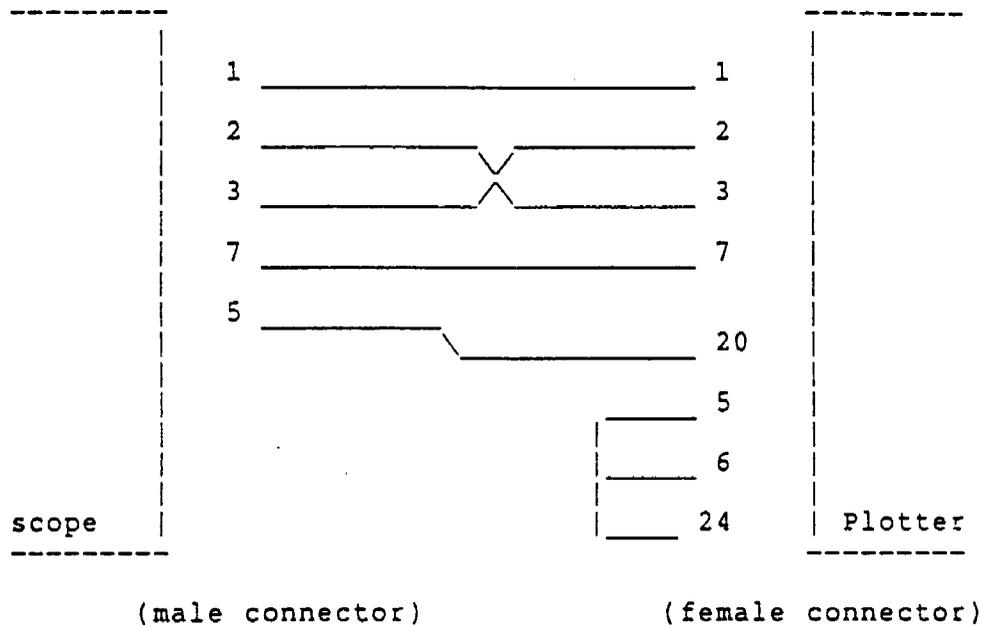
9.1.6 Philips PM 8153

PM 8153 B/1 (GPIB) and PM 8153 S/1 are PM 8151 compatible while PM 8153 B/6 and PM m8153 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:



This cable must be plugged into the plotter's MODEM port.

9.2 Printers

Only the 9450A generation of DSO will support printers. EXception: the 9400 with the Raster Printer option (option OPO3) 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 9450A, 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 9450A.
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 9450A.

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 9450A. 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 9450A:

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 9450A, 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	0	0	0	0
			1: 12" page length				

- RS-232 switch:

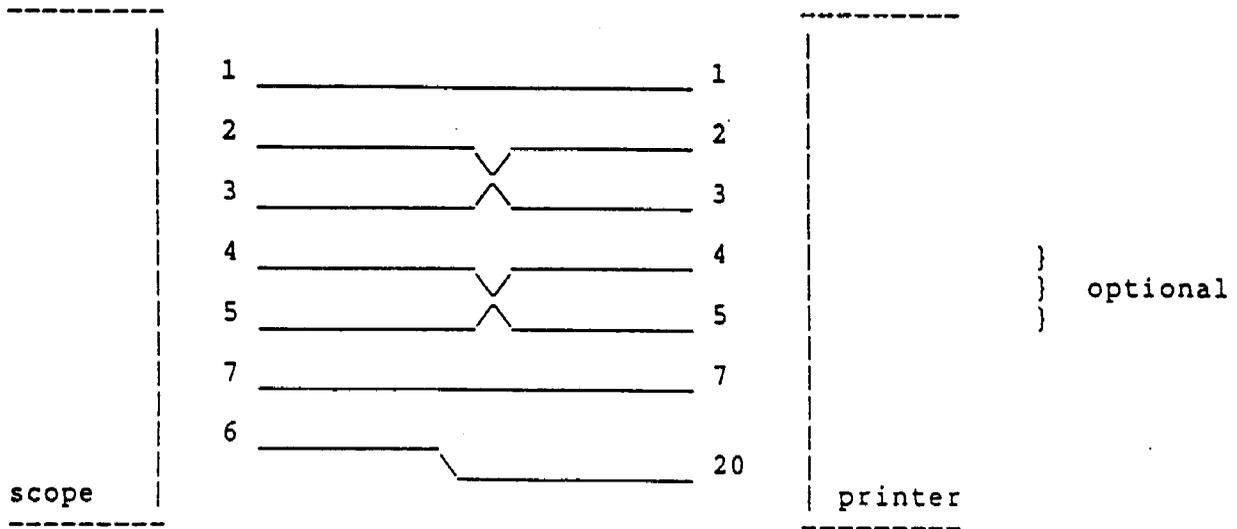
1	2	3	4	5
1	0	0	0	0
(use DTR Handshake)	(8 bits, parity none)		(9600 bauds)	

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	OFF	ON	OFF
				12": ON			

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 9450A 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.

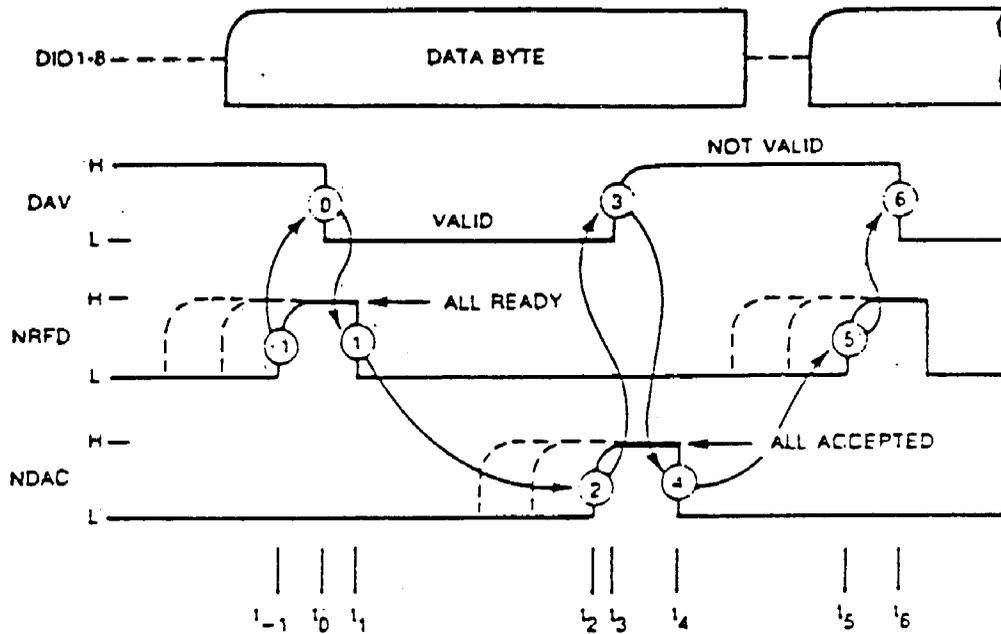
The bus management lines functions as follows:

- 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.

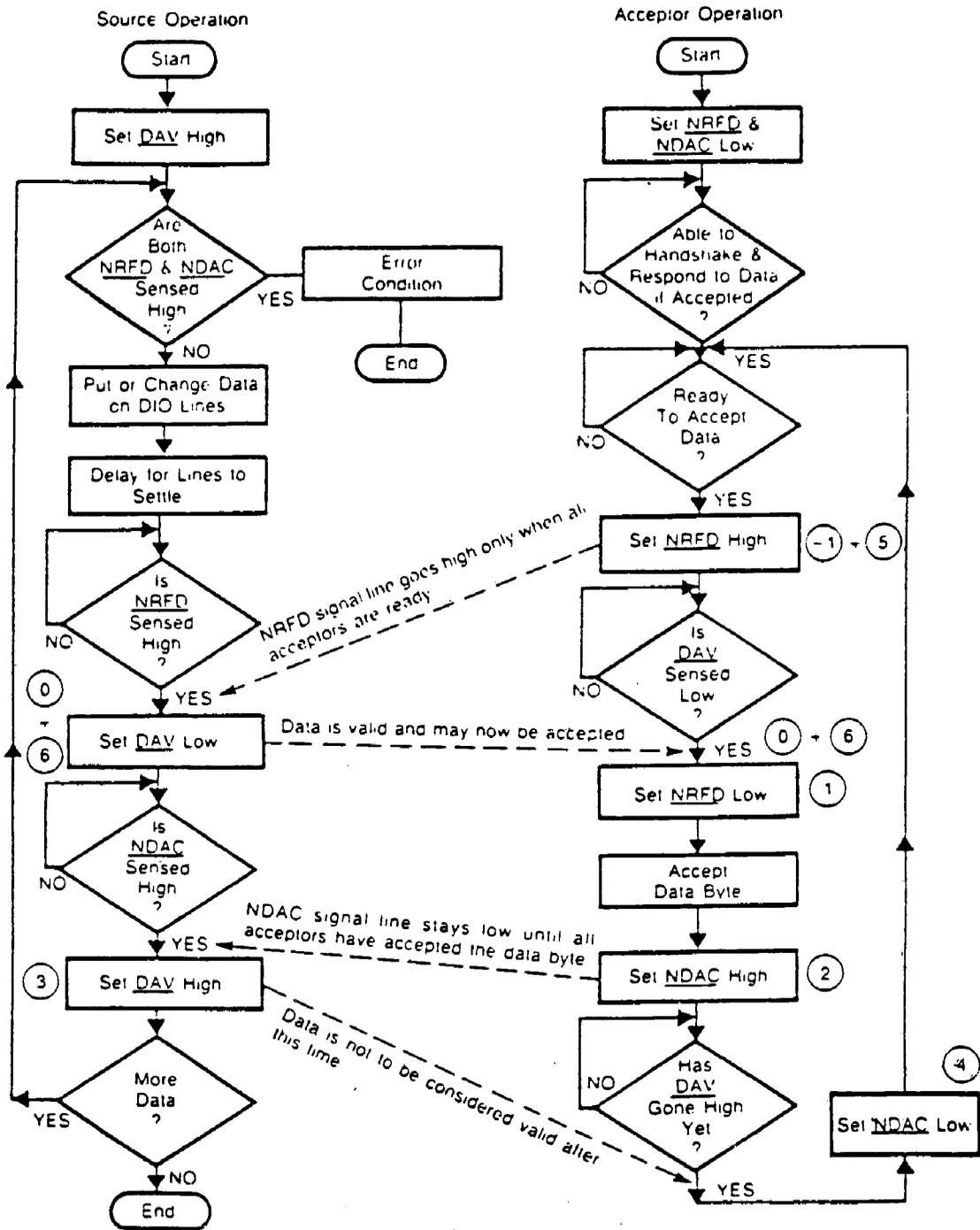


DATA BYTE TRANSFER IN GPIB IEEE-488

Figure 9.1

The handshake timing sequence proceeds as follows:

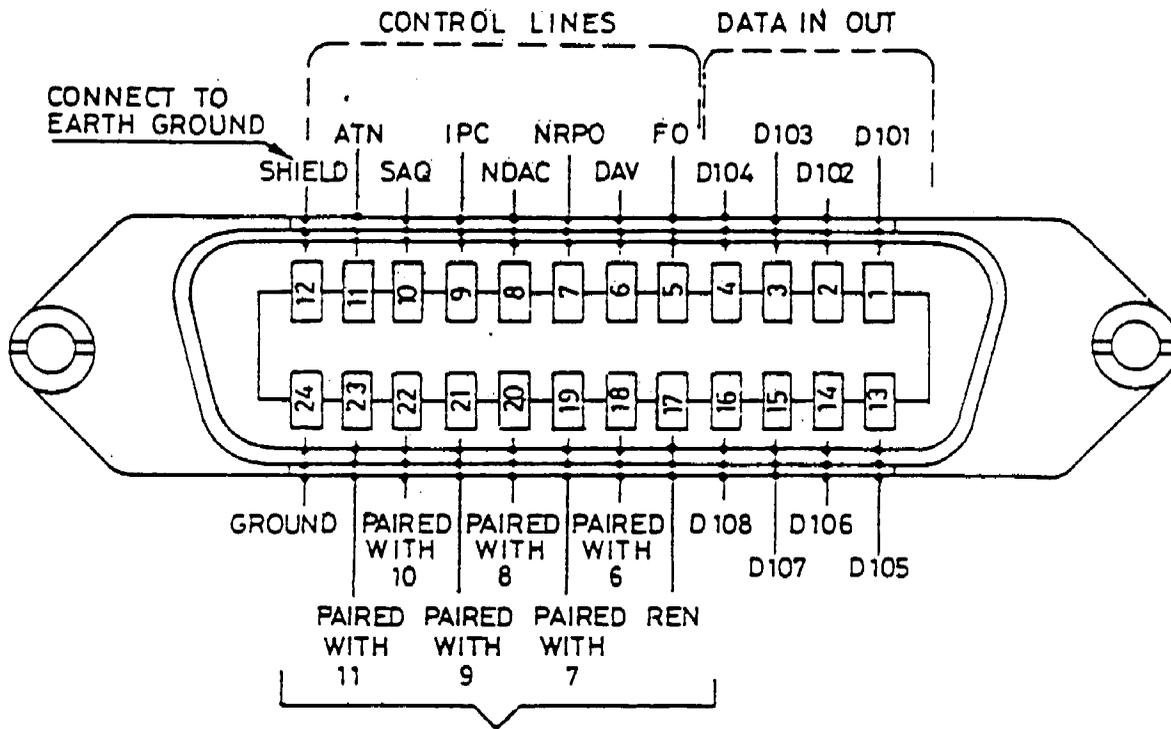
- Preliminary** The source checks for presence of listeners and places the next data byte on the data lines DI01-8.
- t-1** Acceptors one by one become ready for byte. Last one allows NRFD to go high.
- t0** Sources pulls down DAV to validate data.
- t1** The first listener to accept the data pulls down 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.



Logical flow of events for Source and Acceptor when transferring data using the handshake process

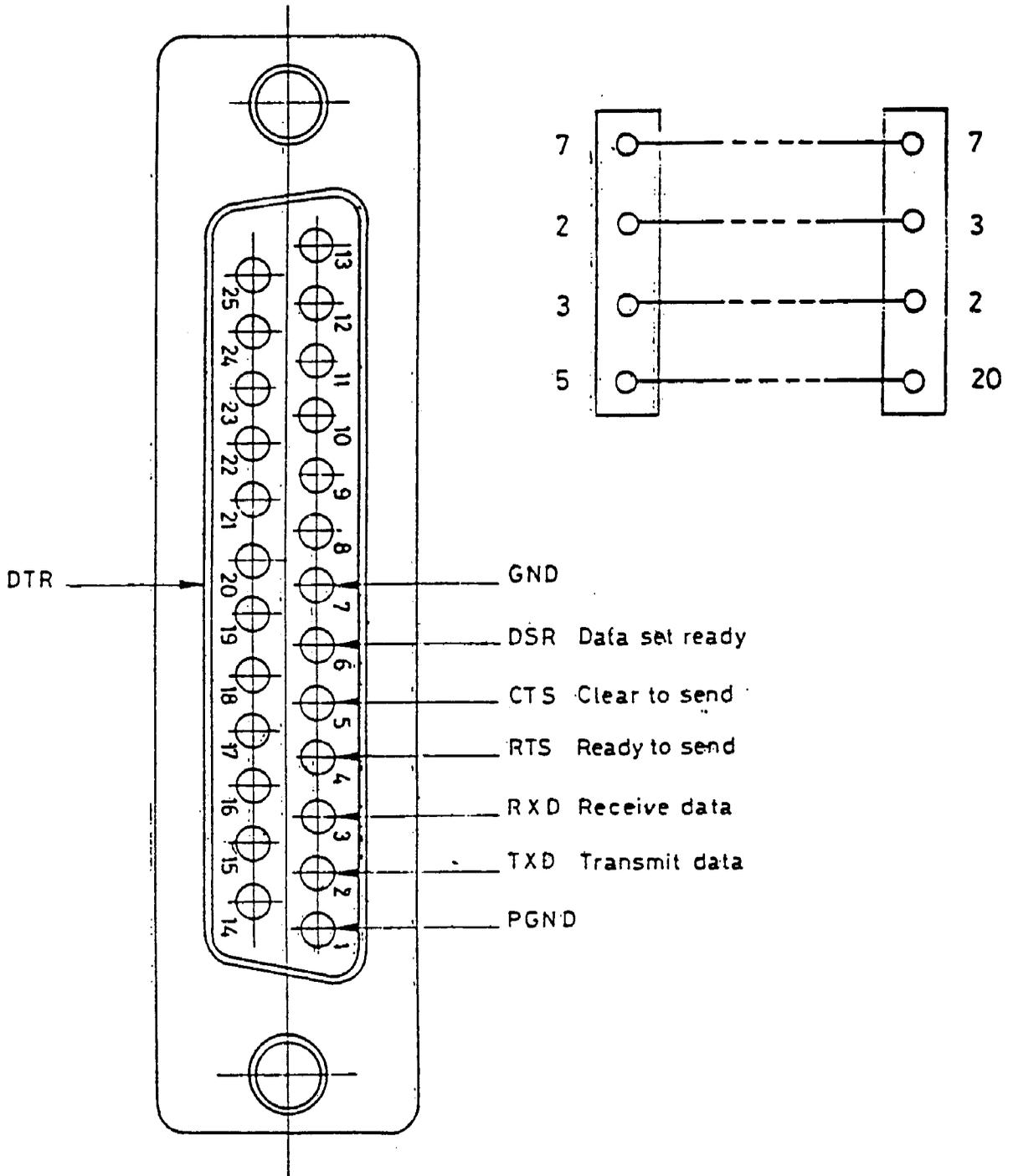
HANDSHAKE TIMING SEQUENCE IN GPIB IEEE-488

Figure 9.2



Part of twisted pair with opposing pins to be grounded near termination of other wire

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		ç	
135	87		ç	
136	88		è	
137	89		è	
138	8A		è	
139	8B		i	

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		Û	
155	9B		Ç	
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		•	
167	A7		•	
168	A8		¿	
169	A9		¡	
170	AA		¬	
171	AB		½	
172	AC		¼	
173	AD		ı	
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	

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
235	EB		δ	
236	EC		8	
237	ED		φ	
238	EE		ε	
239	EF		∩	
240	F0		≡	
241	F1		+	
242	F2		∇	
243	F3		≤	
244	F4		∫	
245	F5		∫	
246	F6		+	
247	F7		≈	
248	F8		•	
249	F9		•	
250	FA		•	
251	FB		√	
252	FC		η	
253	FD		ˆ	
254	FE		•	
255	FF			

LeCroy