9450A DIGITAL OSCILLOSCOPE

SERVICE MANUAL

LeCroy

Innovators in Instrumentation

9450A DIGITAL OSCILLOSCOPE

SERVICE MANUAL

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Chapter 1

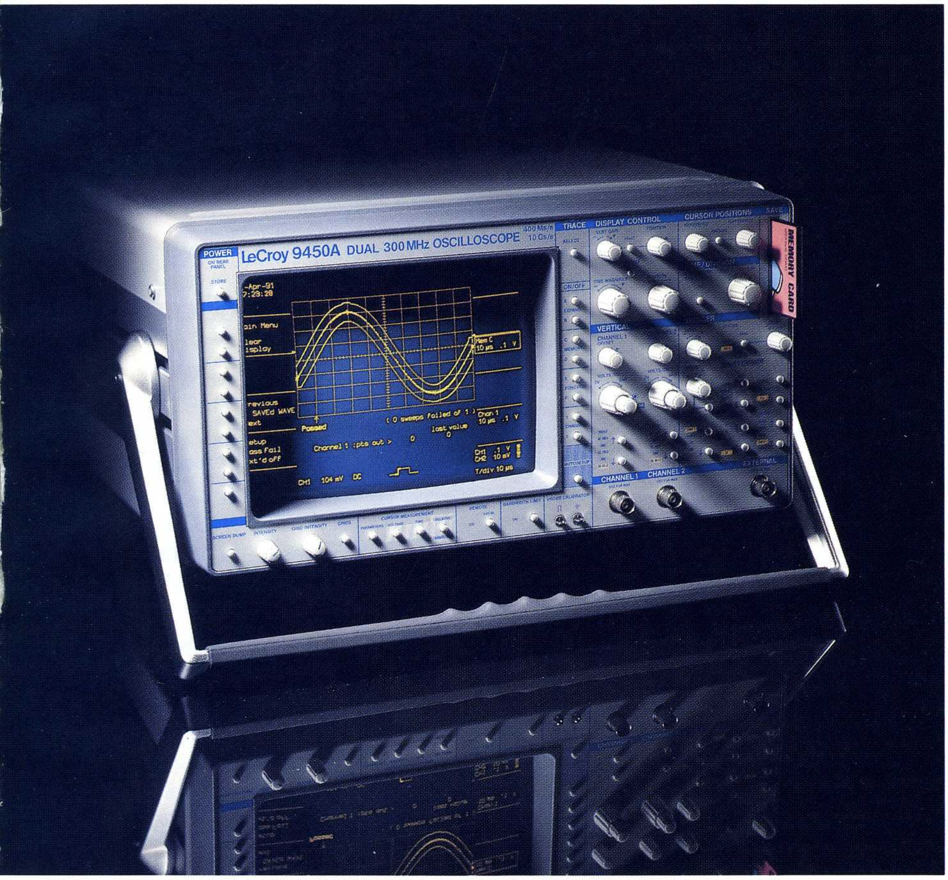
SPECIFICATIONS

DIGITAL OSCILLOSCOPE
300 MHz BANDWIDTH, 400 Ms/s

LeCroy

MODEL 9450A PORTABLE DUAL–CHANNEL OSCILLOSCOPE

9450 A



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 ± 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 than10 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 MΩ: DC to 250 MHz typical at the probe tip.

Input impedance: 1 MΩ // 15 pF and 50 Ω ± 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 μV/div sensitivity).

Scale factors: Probe attenuation factors of ×1, ×10, ×100, ×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: ≤ ± 2% full scale.

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

Max input voltage: 250 V (DC + peak AC ≤10 kHz) at 1 MΩ, ± 5 V DC (500 mW) or 5 V RMS at 50 Ω.

VERTICAL DIGITAL SECTION

ADCs: One per channel, 8–bit flash.

Conversion rate: Up to 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: ≤ ± 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 μsec/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 MΩ, < 20 pF, 250 V max. (DC + peak AC ≤ 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 10^9 events.

Width–based trigger modes:

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

Multi–source trigger operational modes:

Pattern: Triggers on the 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 ×17.5 cm (5 × 7 inches); magnetic deflection; vector type.

Resolution: 4096 × 4096 points.

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

Grid: Internally generated; separate intensity control for grid and waveforms. Single, dual 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 ± 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 ± 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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TDS 080/002

WAVEFORM PROCESSING PACKAGE
AVERAGING, MATHEMATICS, HIGH RESOLUTION

LeCroy

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

9420/24/50 WP01

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

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

FOR SIGNAL CHARACTERIZATION AND ANALYSIS

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

FEATURES

Extensive Signal Averaging – Two operation modes:

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

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

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

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

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

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

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

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

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

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

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

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

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

FUNCTIONAL DESCRIPTION

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

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

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

SIGNAL AVERAGING

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

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

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

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

HIGH RESOLUTION

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

EXTREMA MODE

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

ARITHMETIC

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

MATHEMATICAL FUNCTIONS

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

SPECIFICATIONS

SUMMATION AVERAGING

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

CONTINUOUS AVERAGING

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

ARITHMETIC

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

FUNCTIONS

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

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

HIGH RESOLUTION

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

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

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

EXTREMA

Logs all extreme values of a waveform over a programmable number of sweeps. Maxima and minima can be displayed together, or separately by choosing ROOF or FLOOR traces.

Number of sweeps: 1 to 1,000,000.

Number of input points: 50 to 50,000.

Glitches as short as 0.002% of the time base (down to 2.5 nsec for the 9450, 10 nsec for the 9420 and 9424) are displayed.

Vertical expansion: 5 × maximum.

CHAINING OF OPERATIONS

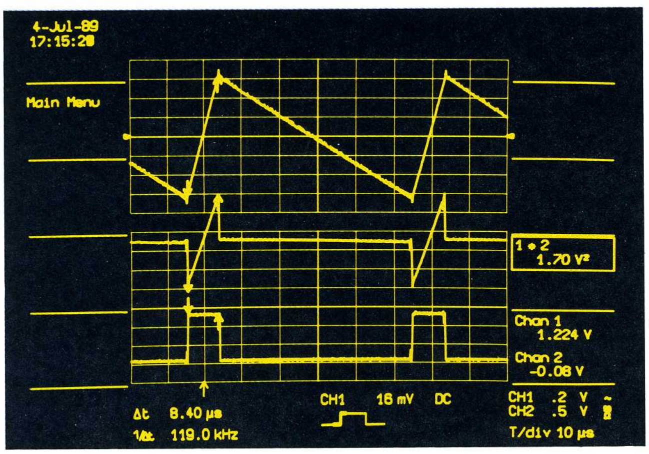
Two functions can be automatically chained using Functions E and F (four functions in the 9424). Using memory C and D for intermediate results, any number of operations can be chained manually or via remote control.

REMOTE CONTROL

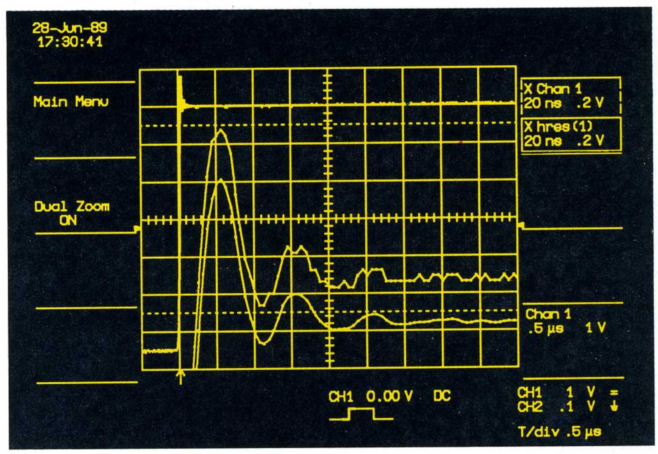
All controls and waveform processing functions are fully programmable using the oscilloscope's GPIB or RS–232–C interfaces. Simple English–like commands are used.

STORED FRONT PANELS

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



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



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

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TDS 045/002

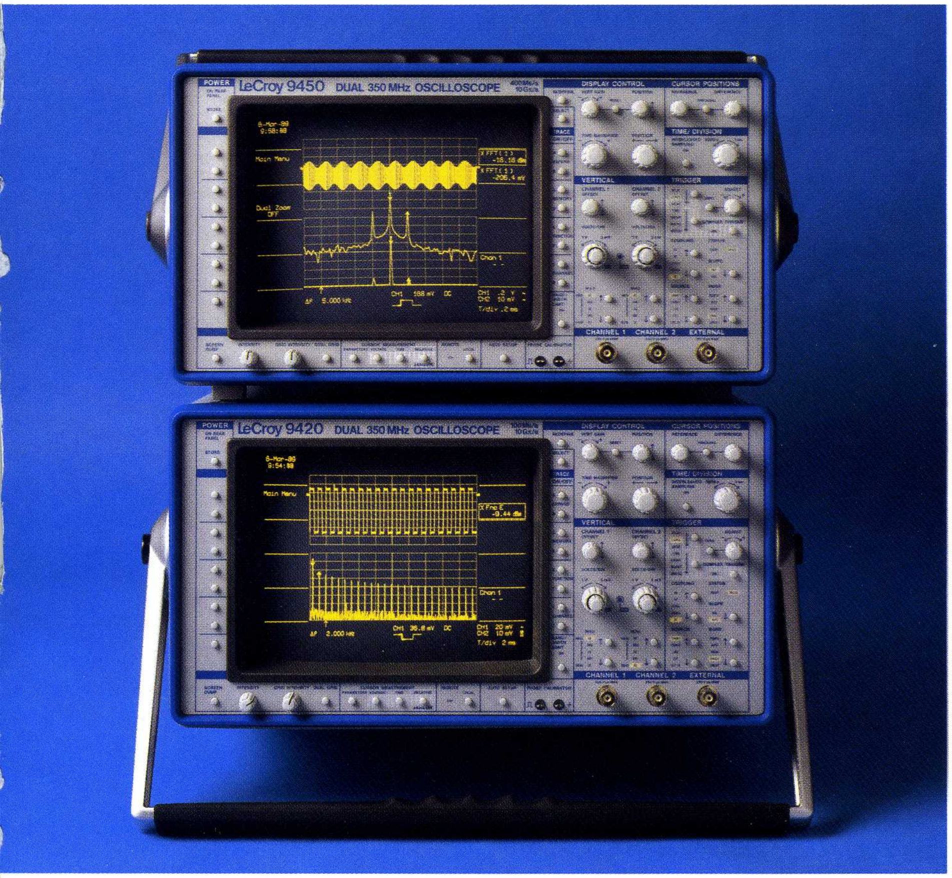
FAST FOURIER PROCESSING PACKAGE

50,000 POINT TRANSFORMS, SPECTRAL AVERAGING

LeCroy

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

9420/24/50 WP02



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

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

FREQUENCY DOMAIN MEASUREMENTS AND ANALYSIS

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

FEATURES

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

FUNCTIONAL DESCRIPTION

FOURIER PROCESSING

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

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

FFT AND LeCROY OSCILLOSCOPES

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

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

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

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

IMPROVED RESOLUTION

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

VERSATILE WINDOW FUNCTIONS

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

SPECIFICATIONS

MEMORIES

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

FREQUENCY

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

AMPLITUDE AND PHASE

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

Spectrum Display Formats and Scaling

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

Frequency Domain Power Averaging

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

Vertical Expansion

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

Window Functions

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

FILTER PASS BAND AND RESOLUTION

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

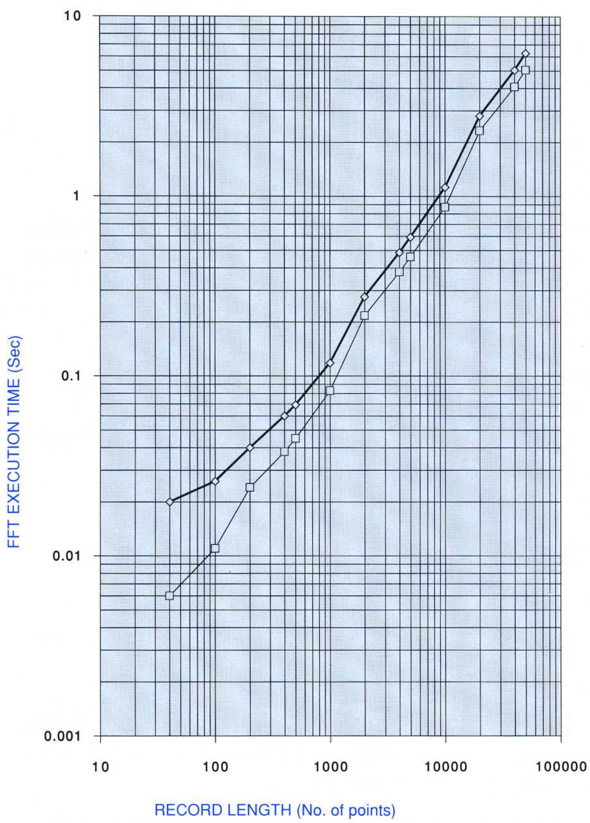
Definitions

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

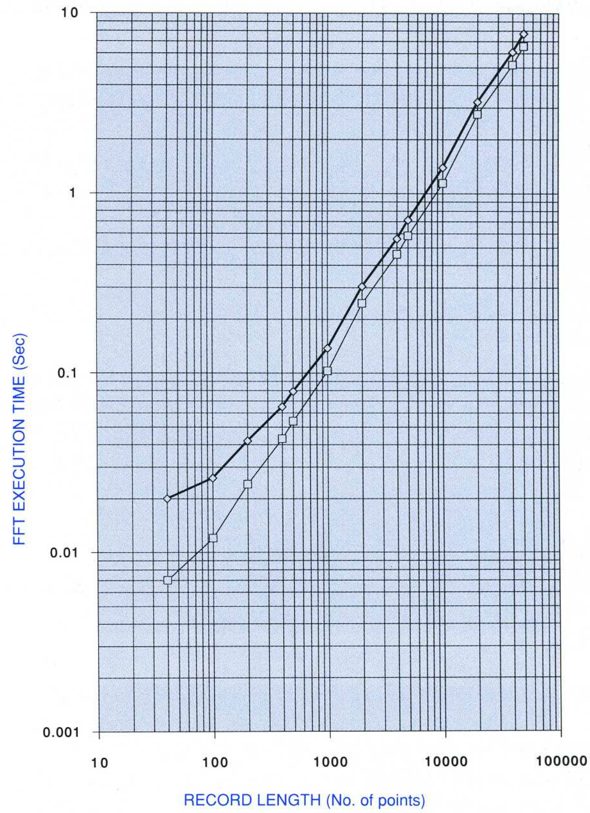
CURSORS

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

FFT EXECUTION TIME



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



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

REMOTE CONTROL

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

Remote read and write

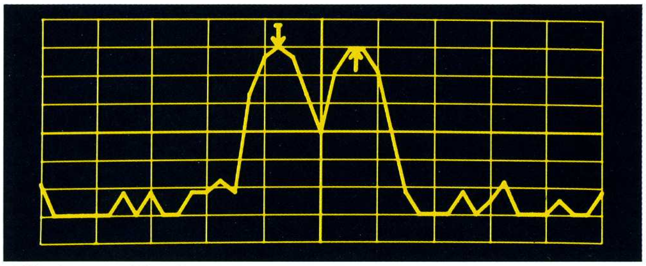
All waveform formats including complex can be read by computer for storage or further processing.
Externally generated waveforms can be written into Memories C and D for FFT or other processing.

STORED FRONT PANELS

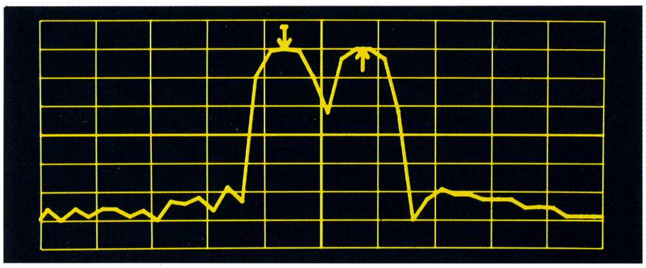
Up to 7 front–panel setups, including WP02 menu settings can be stored in non–volatile memory and recalled by the menu buttons at the left side of the screen.

WP02 INSTALLATION

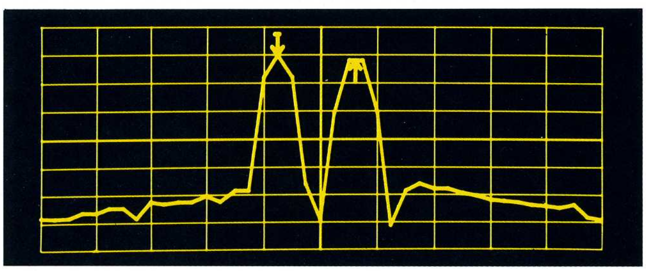
A WP02 package may be retrofitted to a LeCroy 9420/24/50 Digital Oscilloscope.



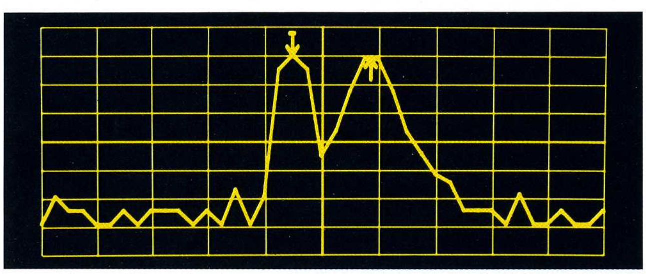
Blackman–Harris



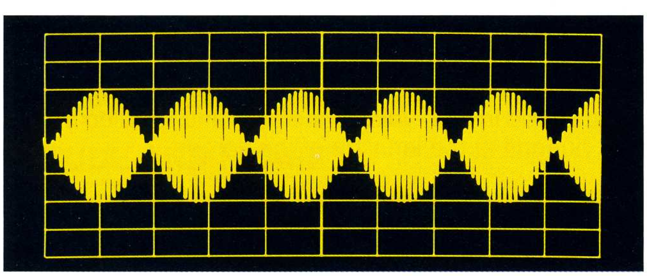
Flattop



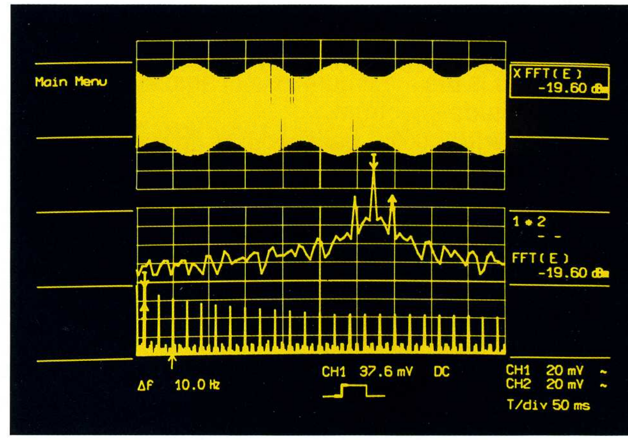
Hamming



von Hann (Hanning)



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



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

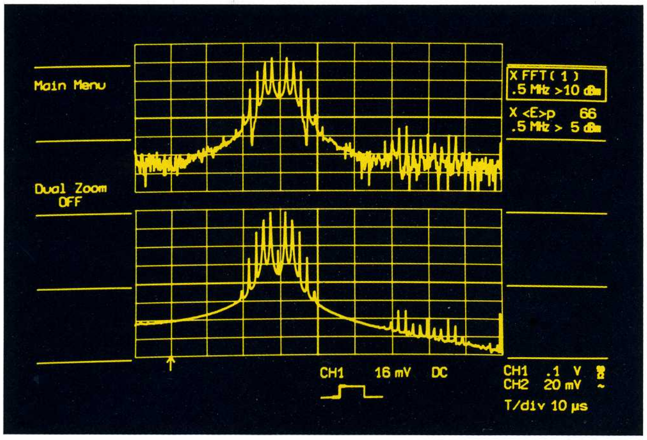
ORDERING INFORMATION

Oscilloscopes and Options

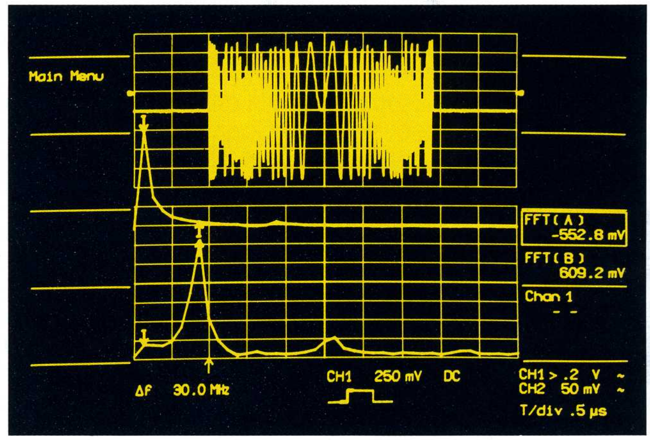
Code	Description
9400A	2–channel, 175 MHz Oscilloscope, 100 Ms/s
9420	2–channel, 350 MHz Oscilloscope, 100 Ms/s
9424	4–channel, 350 MHz Oscilloscope, 100 Ms/s
9450	2–channel, 350 MHz Oscilloscope, 400 Ms/s
9400AWP01	Waveform Processing for 9400A
9420WP01	Waveform Processing for 9420
9424WP01	Waveform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

Oscilloscope Accessories

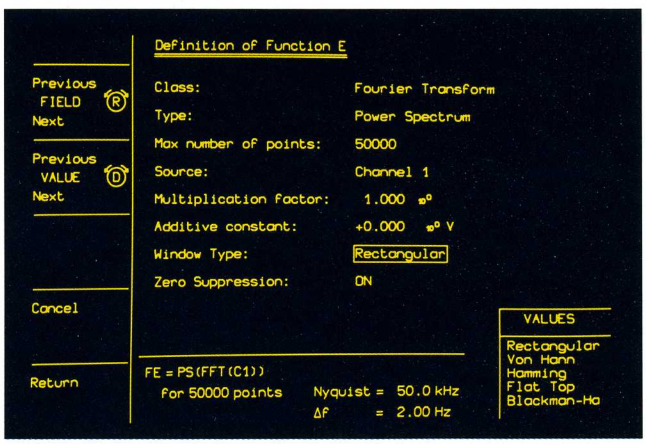
OM 9420/50	Operator's Manual
OM 9424	Operator's Manual
CA9001	Camera (Polaroid film) and Hood
CA9002	Camera Adapter (35mm) with Hood
D9010	High Impedance Divider 10:1
DP9001	Digital Plotter, 8–pen A4 size
DP9003	Epson Printer
OC9001	Oscilloscope Cart
P9010	10:1 Oscilloscope Probe
P9011	10:1/1:1 Oscilloscope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



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



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



The FFT menu documents all the relevant parameters.

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TDS 021/002

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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
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TDS 071/001

Chapter 2

BASIC OPERATION

AND

BLOCK DIAGRAMS

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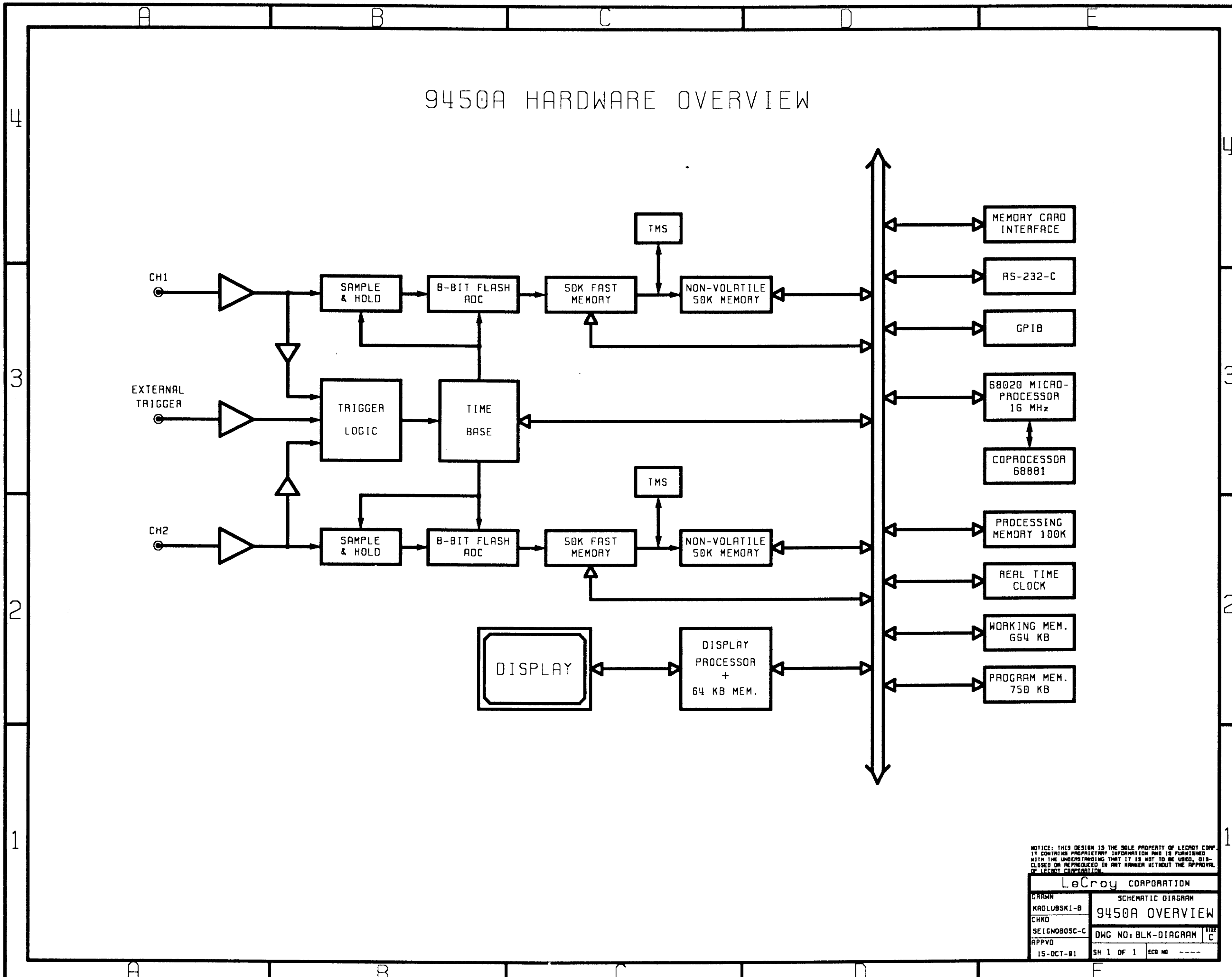
F9451-1	Power supply
F9424-2	Support for Memory card
F9450-2	Display
F9450A-3	Single 400 Ms/s ADC
F9450-4	Time base
F9450A-5	Front panel
F9420-6	Processor
F9450A-7	Dual channel 300 MHz Front end
F9450-8	Clock bus
F9450A-9	Rear panel
M9424	Mechanical for 9450A



9450A HARDWARE OVERVIEW
CH1
EXTERNAL TRIGGER
CH2
SAMPLE & HOLD
8-BIT FLASH ADC
50K FAST MEMORY
TMS
NON-VOLATILE 50K MEMORY
TRIGGER LOGIC
TIME BASE
SAMPLE & HOLD
8-BIT FLASH ADC
50K FAST MEMORY
TMS
NON-VOLATILE 50K MEMORY
DISPLAY
DISPLAY PROCESSOR + 64 KB MEM.
MEMORY CARD INTERFACE
RS-232-C
GPIB
68020 MICRO-PROCESSOR 16 MHz
COPROCESSOR 68881
PROCESSING MEMORY 100K
REAL TIME CLOCK
WORKING MEM. 664 KB
PROGRAM MEM. 750 KB
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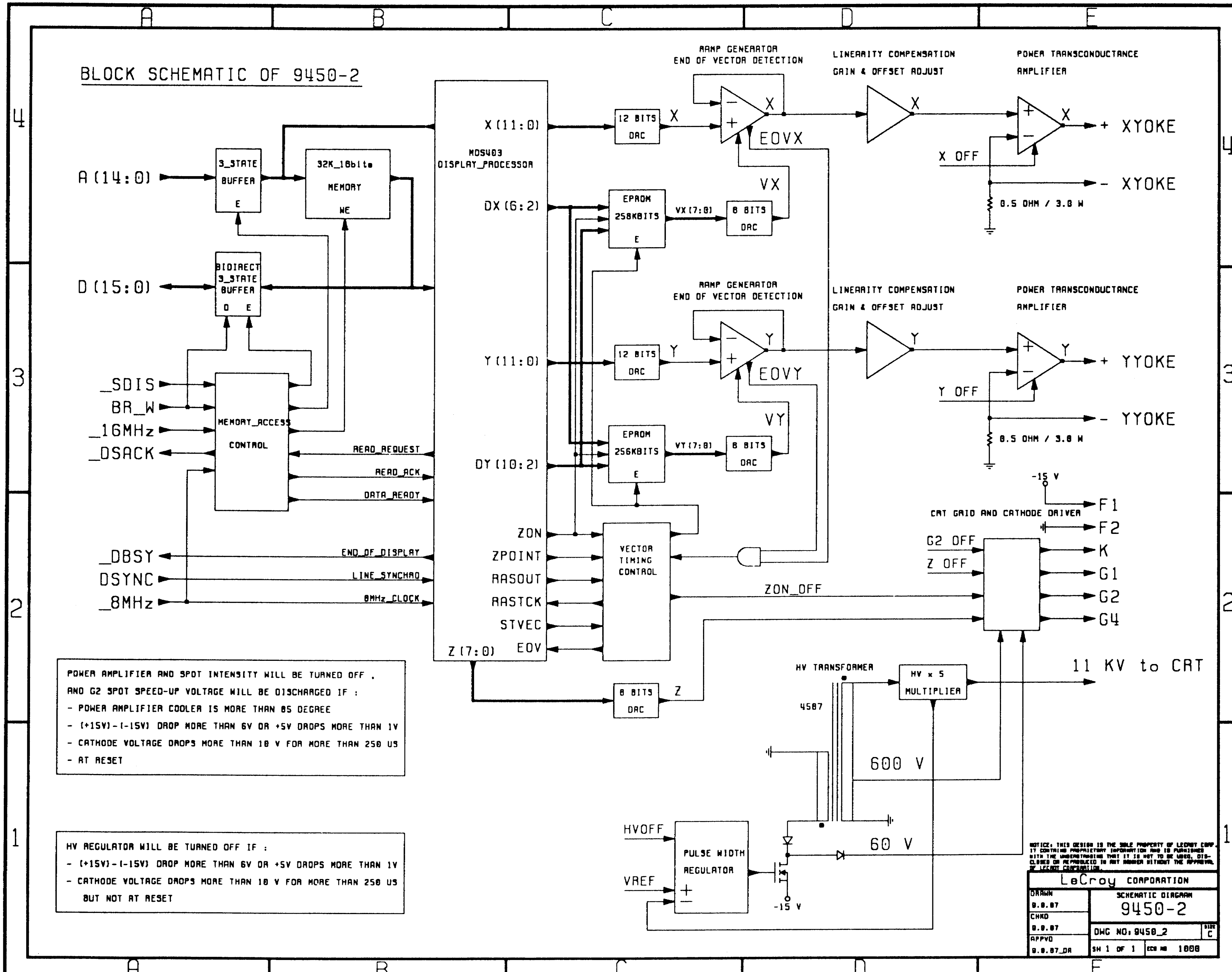
LeCroy CORPORATION
DRAWN KADLUBSKI-B
CHKD SEIGNOBOSC-C
APPVD 15-OCT-91
SCHEMATIC DIAGRAM
9450A OVERVIEW
DWG NO: BLK-DIAGRAM
SIZE C
SH 1 OF 1
ECO NO ----



BLOCK SCHEMATIC OF 9450-2
A (14:0)
D (15:0)
3_STATE BUFFER E
32K_16bits MEMORY WE
BIDIRECT 3_STATE BUFFER D E
_SDIS
BR_W
_16MHz
_DSACK
MEMORY_ACCESS CONTROL
READ_REQUEST
READ_ACK
DATA_READY
_DBSY
DSYNC
_8MHz
END_OF_DISPLAY
LINE_SYNCHRO
8MHz_CLOCK
MOS403 DISPLAY_PROCESSOR
X (11:0)
DX (6:2)
Y (11:0)
DY (10:2)
ZON
ZPOINT
RASOUT
RASTCK
STVEC
EOV
Z (7:0)
12 BITS DAC
EPROM 256KBITS E
VX (7:0)
8 BITS DAC
VY (7:0)
VECTOR TIMING CONTROL
8 BITS DAC
Z
RAMP GENERATOR END OF VECTOR DETECTION
EOVX
VX
EOVY
VY
LINEARITY COMPENSATION GAIN & OFFSET ADJUST
POWER TRANSCONDUCTANCE AMPLIFIER
X OFF
+ XYOKE
- XYOKE
0.5 OHM / 3.0 W
Y OFF
+ YYOKE
- YYOKE
0.5 OHM / 3.0 W
-15 V
F1
F2
CRT GRID AND CATHODE DRIVER
G2 OFF
Z OFF
K
G1
G2
G4
ZON_OFF
11 KV to CRT
HV TRANSFORMER
4587
HV x 5 MULTIPLIER
600 V
60 V
HVOFF
VREF
PULSE WIDTH REGULATOR
-15 V
POWER AMPLIFIER AND SPOT INTENSITY WILL BE TURNED OFF .
AND G2 SPOT SPEED-UP VOLTAGE WILL BE DISCHARGED IF :
- POWER AMPLIFIER COOLER IS MORE THAN 85 DEGREE
- (+15V)-(-15V) DROP MORE THAN 6V OR +5V DROPS MORE THAN 1V
- CATHODE VOLTAGE DROPS MORE THAN 10 V FOR MORE THAN 250 US
- AT RESET
HV REGULATOR WILL BE TURNED OFF IF :
- (+15V)-(-15V) DROP MORE THAN 6V OR +5V DROPS MORE THAN 1V
- CATHODE VOLTAGE DROPS MORE THAN 10 V FOR MORE THAN 250 US
BUT NOT AT RESET
LeCroy CORPORATION
DRAWN 0.0.87
CHKD 0.0.87
APPVD 0.0.87_DA
SCHEMATIC DIAGRAM
9450-2
DWG NO: 9450_2
SIZE C
SH 1 OF 1
1000

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 dispaly processor can only read the memory to control the display.

The PAL (16R4) RAMACC controls the memory access and timing. One of its flip-flop selects the memory user. Priority is given to the 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 occurence of CK8M low, at the trailing edge of BCK.

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

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

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

The signal RREQ returns low when the data are loaded.

b. The memory is in use:

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

2.2.2.4 Reset and Frame Synchronization

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

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

2.2.3 Display Processor

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

2.2.4 Principle of Vector Display

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

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

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

$$di/dt = U/L$$

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

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

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

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

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

2.2.5 Practical Limitation of Two-axis Vectors

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

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

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

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

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

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

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

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

2.2.6 Vector by MDS403

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

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

2.2.7 Spot Intensity Control and Timing Principle

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

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

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

A special hardware feature of the F9450-2 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 Vout at the capacitor (C74 and C75 in circuit) represents the current spot position, and Vin the final spot position at the end of a vector to be drawn. While Vin and Vout are different, the capacitor is charged or discharged with a rate given by Iin, the integrator current, until Vout reaches Vin. The analog X/Y positions are connected to the positive input of the X or Y ramp generator. The analog rate signal XINT and YINT are connected to the current control of the respective ramp generator.

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

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

2.2.9 Vector Timing

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

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

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

2.2.9.1 Timing Diagram for Draw Mode

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

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

2.2.9.2 Timing Diagram for Point Mode

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

2.2.9.3 Raster Mode Timing

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

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

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

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

2.2.10 Velocity and Position: Digital to Analog Correspondence

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

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

For a CRT high voltage of 11 kV.

2.2.11 Deflection Non-Linearity

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

2.2.12 X/Y Power Transconductance Amplifier

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

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

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

The left side panel of the 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:

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

It corresponds to the critical damping.

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

2.2.15 Cathode Ray Tube

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

2.2.16 Screen Protection Circuitry

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

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

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

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

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

2.2.17 Operation Status Lines

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

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

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

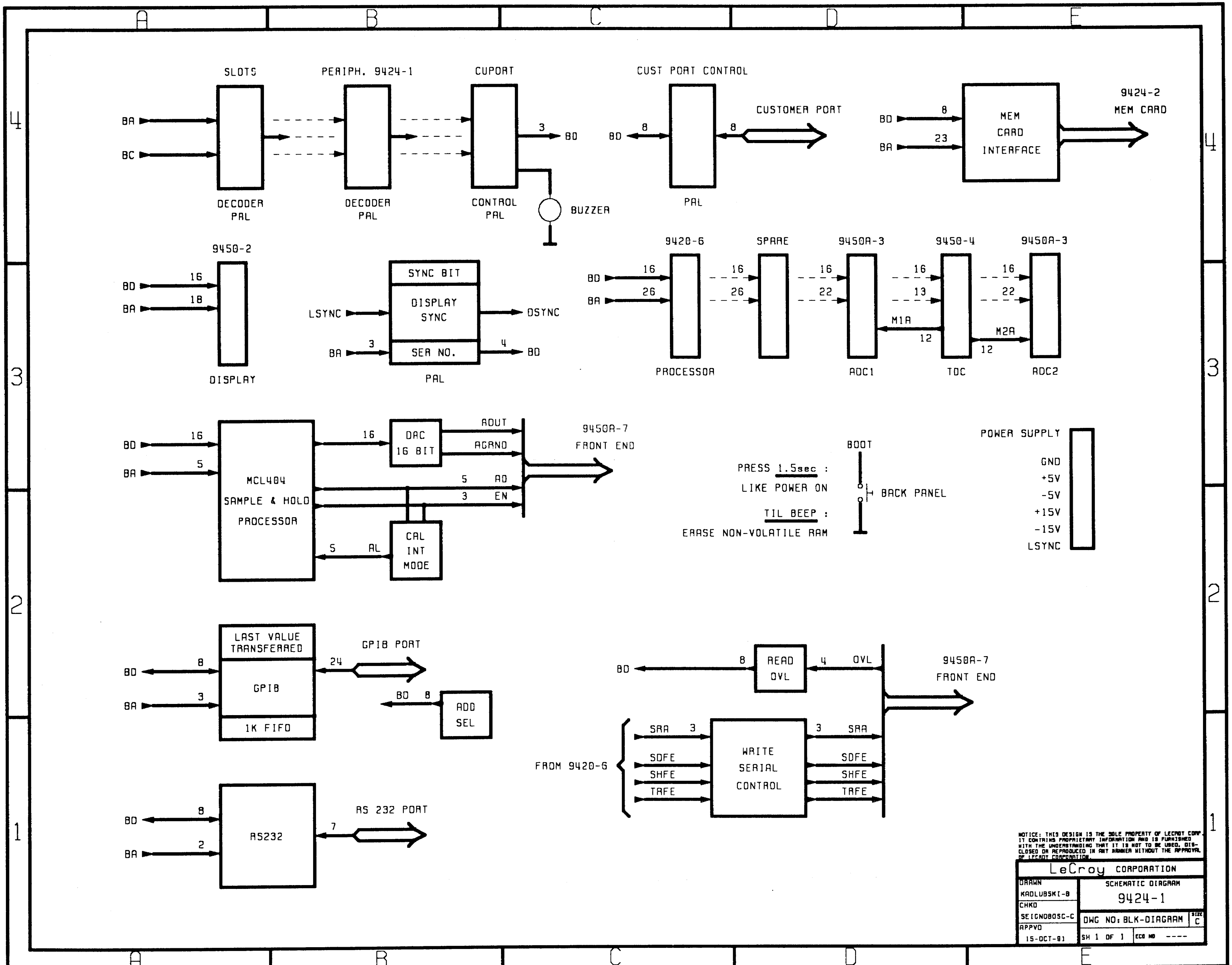
- pin 22 of A22: low if +5 V is less than 4V
- pin 14 of A22: low if +15 V or -15 V drop by more than 6 V
- pin 1 of A22: low if cathode voltage is less than 30 V for more than 300 usec after reset. The time constant is realized by R33, R271, R214 and C1, C131. The input to the comparator, pin 6 of A22,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

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

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

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

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



Scan by Paladinmicro -- paladin@paladinmicro.com

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-25SO).

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

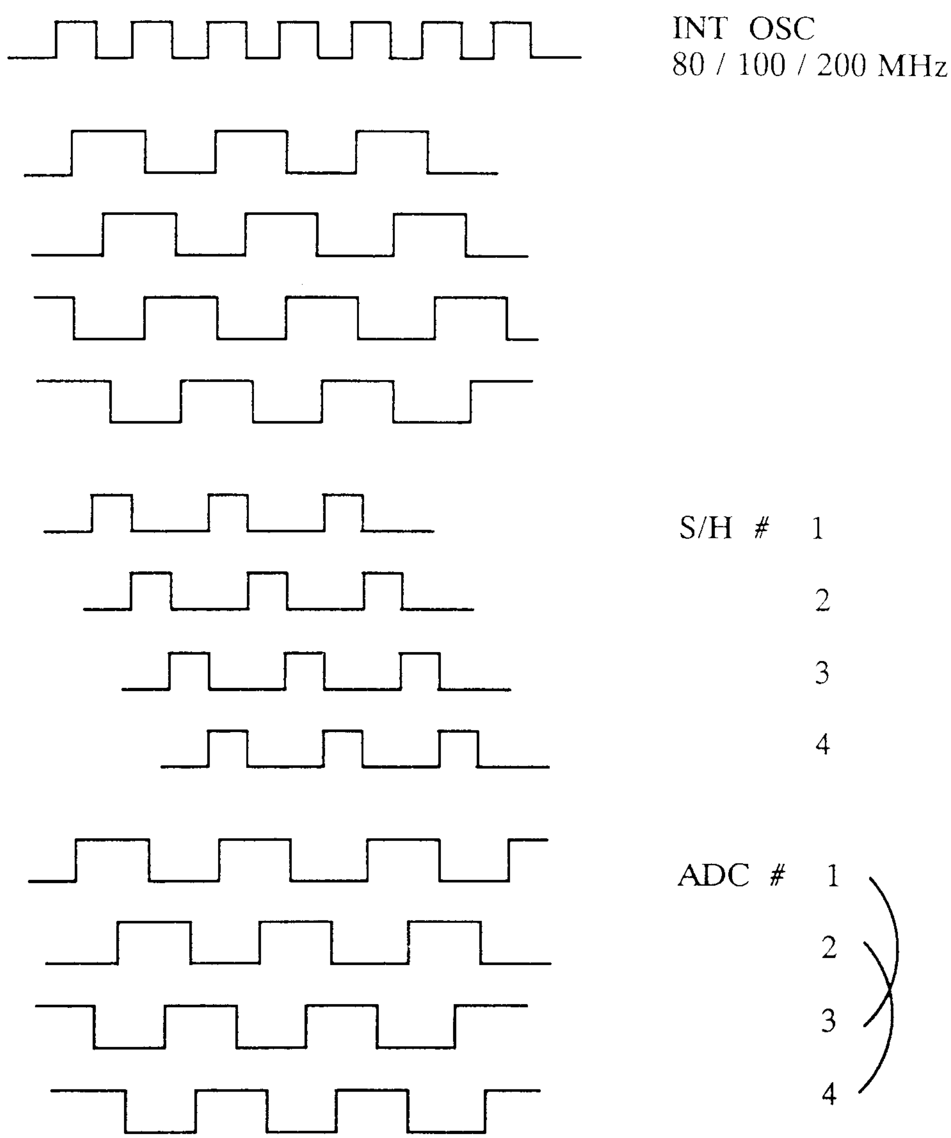
A coprocessor (TMS320C25) does the computation and transfer of data from fast memory to a 63Kx16 buffer memory (four HM62256LP-12). The coprocessor has its own clock signal (F1100-40MHz) and furnishes strobe to a Minmax gate array (MNX401). The minimax can be set to run on read or written data by the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

<u>TMS320C25 external flag:</u>

XF	Minmax enable during
high low	write cycle read cycle

<u>TMS320C25 command:</u>

bit	set	description
0	high	pulse _INT0
1	high	sets _BIO low
1	low	sets _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:

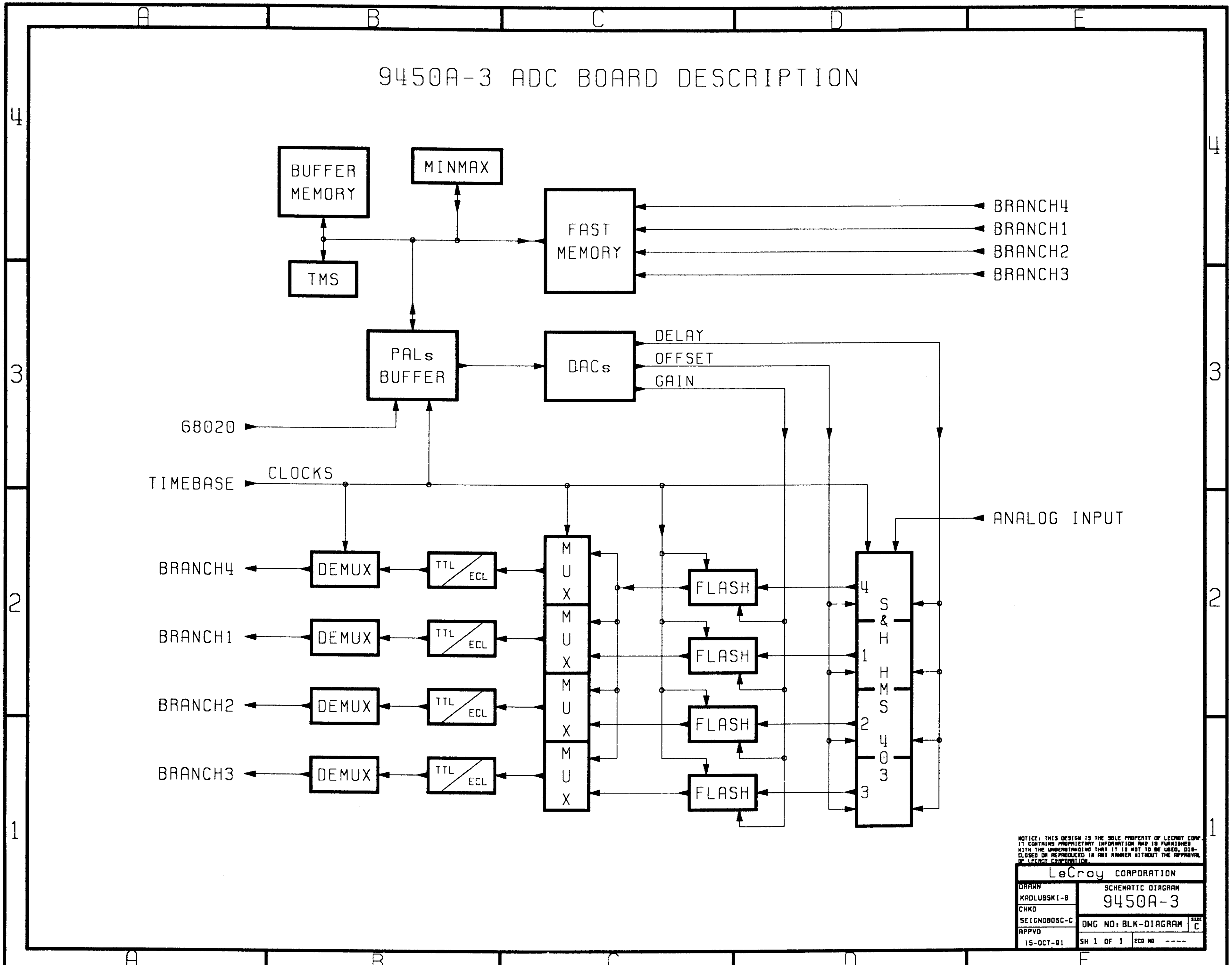
Data are low byte and only write mode is used.

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	PS 1000 to
		0201 FDFE and	PS FEFF and
	CNFD mode	0201 FE00 to	PS FF00 to
		0201 FFFE	PS FFFF or
TMS block B0	CNFP mode	-----	PS FF00 to
			PS FFFF
buffer memory BCE1	interrupts	0202 0000 to	PS 0000 to
		0202 003E and	PS 001F and
	program	0202 0040 to	PS 0020 to
		0202 1FFE and	PS 0FFF and
	data	0202 2000 to	DS 1000 to
		0202 FFFE	DS 7FFF
" " BCE2		0203 0000 to	DS 8000 to
		0203 FFFE	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
BUFFER MEMORY
MINMAX
TMS
FAST MEMORY
BRANCH4
BRANCH1
BRANCH2
BRANCH3
PALs BUFFER
DACs
DELAY
OFFSET
GAIN
68020
TIMEBASE
CLOCKS
ANALOG INPUT
DEMUX
TTL ECL
MUX
FLASH
S&H HMS 403
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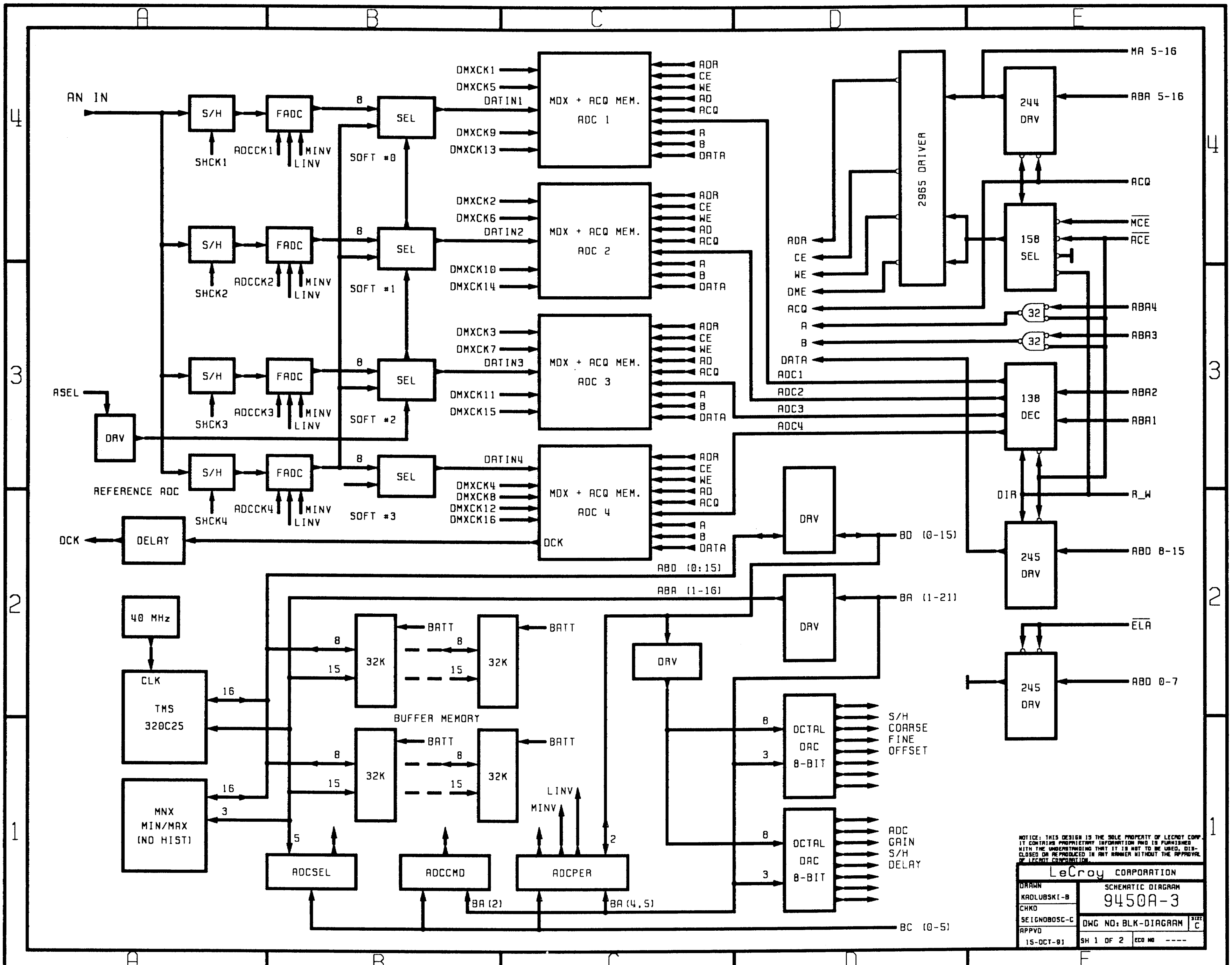
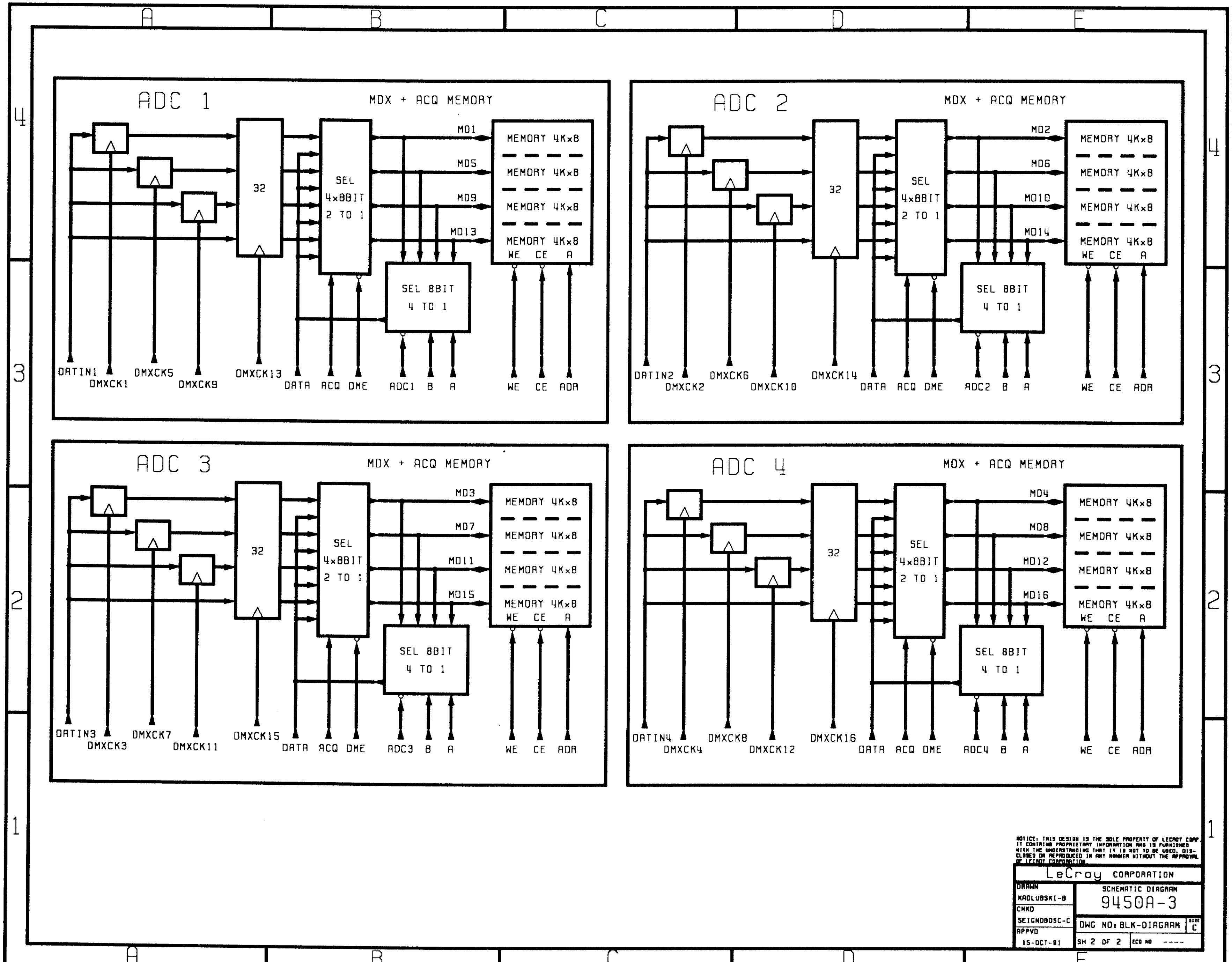
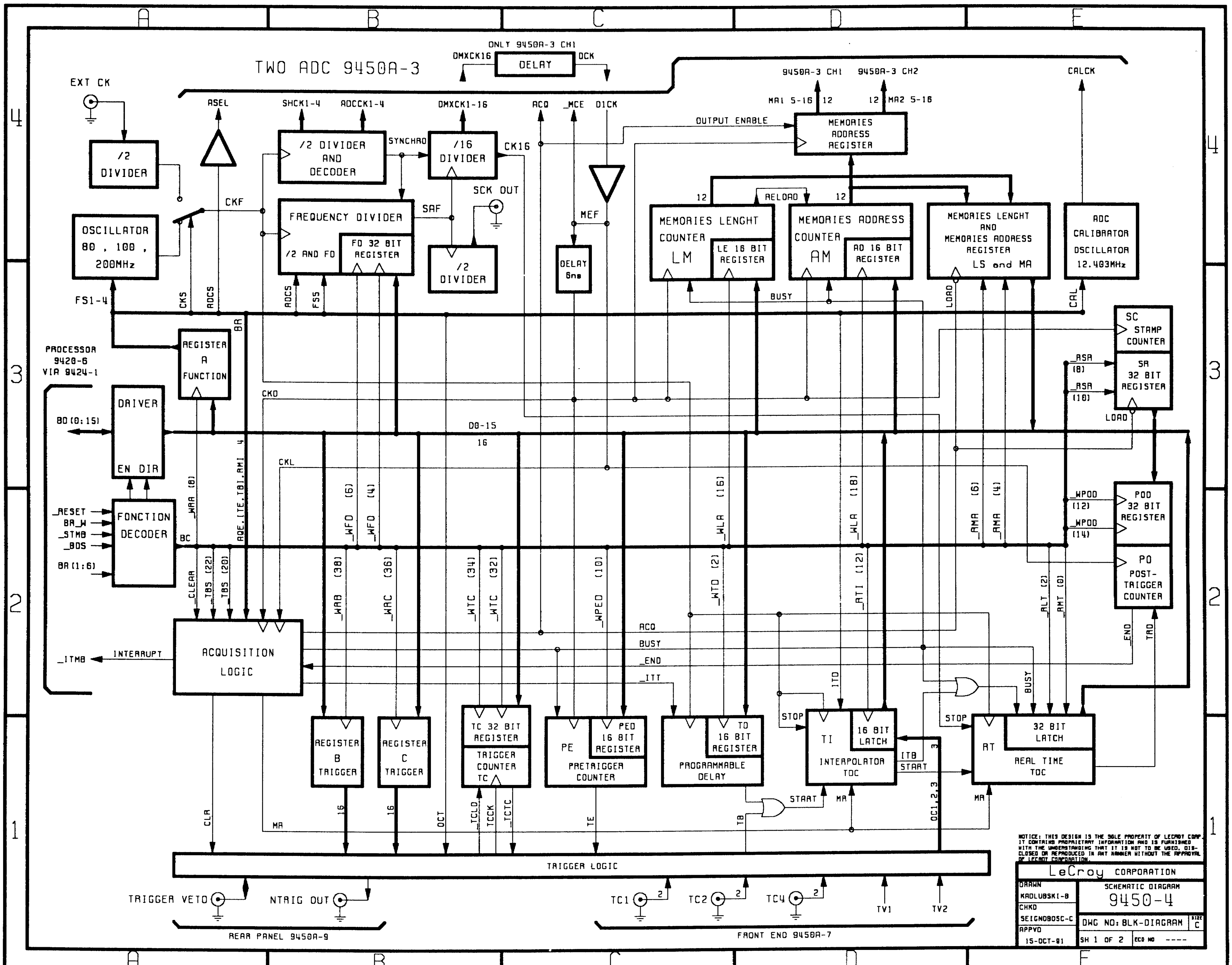
LeCroy CORPORATION
DRAWN KADLUBSKI-B
CHKD SEIGNOBOSC-C
APPVD 15-OCT-91
SCHEMATIC DIAGRAM
9450A-3
DWG NO: BLK-DIAGRAM
SIZE C
SH 1 OF 1
ECO NO ----



Scan by Paladinmicro -- paladin@paladinmicro.com


ADC 1
MDX + ACQ MEMORY
32
SEL 4x8BIT 2 TO 1
SEL 8BIT 4 TO 1
MD1
MD5
MD9
MD13
MEMORY 4Kx8
WE CE A
DATIN1
DMXCK1
DMXCK5
DMXCK9
DMXCK13
DATA ACQ DME
ADC1 B A
WE CE ADR
ADC 2
MDX + ACQ MEMORY
MD2
MD6
MD10
MD14
DATIN2
DMXCK2
DMXCK6
DMXCK10
DMXCK14
ADC2 B A
ADC 3
MDX + ACQ MEMORY
MD3
MD7
MD11
MD15
DATIN3
DMXCK3
DMXCK7
DMXCK11
DMXCK15
ADC3 B A
ADC 4
MDX + ACQ MEMORY
MD4
MD8
MD12
MD16
DATIN4
DMXCK4
DMXCK8
DMXCK12
DMXCK16
ADC4 B A
LeCroy CORPORATION
DRAWN KADLUBSKI-B
CHKD SEIGNOBOSC-C
APPVD 15-OCT-91
SCHEMATIC DIAGRAM
9450A-3
DWG NO: BLK-DIAGRAM
SIZE C
SH 2 OF 2
ECO NO ----


TWO ADC 9450A-3
ONLY 9450A-3 CH1
DMXCK16
DELAY
DCK
EXT CK
/2 DIVIDER
ASEL
SHCK1-4
ADCCK1-4
/2 DIVIDER AND DECODER
SYNCHRO
DMXCK1-16
/16 DIVIDER
CK16
ACQ
_MCE
D1CK
OUTPUT ENABLE
9450A-3 CH1
9450A-3 CH2
MA1 5-16
12
MA2 5-16
MEMORIES ADDRESS REGISTER
CALCK
OSCILLATOR 80, 100, 200MHz
CKF
FREQUENCY DIVIDER
/2 AND FD
FD 32 BIT REGISTER
SAF
SCK OUT
/2 DIVIDER
MEF
DELAY 6ns
RELOAD
MEMORIES LENGHT COUNTER LM
LE 16 BIT REGISTER
MEMORIES ADDRESS COUNTER AM
AD 16 BIT REGISTER
MEMORIES LENGHT AND MEMORIES ADDRESS REGISTER LS and MA
ADC CALIBRATOR OSCILLATOR 12.403MHz
FS1-4
CKS
ADCS
FSS
BUSY
LOAD
CAL
BR
REGISTER A FUNCTION
PROCESSOR 9420-6 VIA 9424-1
SC STAMP COUNTER
_ASA (8)
_ASA (10)
SA 32 BIT REGISTER
CKD
DRIVER
EN DIR
BD (0:15)
D0-15
16
LOAD
CKL
_RESET
BR_W
_STMB
_BDS
BR (1:6)
FONCTION DECODER
BC
_WAA (8)
AQE,ITE,TBI,AMI 4
_WFD (6)
_WFD (4)
_WLA (16)
_WLA (18)
_AMA (6)
_AMA (4)
_WPOD (12)
_WPOD (14)
POD 32 BIT REGISTER
PO POST-TRIGGER COUNTER
_CLEAR
_TBS (22)
_TBS (20)
_WAB (38)
_WAC (36)
_WTC (34)
_WTC (32)
_WPED (10)
_WTD (2)
_ATI (12)
_ALT (2)
_AMT (0)
_END
TRD
ACQ
BUSY
_END
_ITT
_ITMB
INTERRUPT
ACQUISITION LOGIC
ITD
BUSY
REGISTER B TRIGGER
REGISTER C TRIGGER
TC 32 BIT REGISTER
TRIGGER COUNTER TC
PE
PED 16 BIT REGISTER
PRETRIGGER COUNTER
TD 16 BIT REGISTER
PROGRAMMABLE DELAY
STOP
TI
16 BIT LATCH
INTERPOLATOR TDC
ITB
START
3
STOP
RT
32 BIT LATCH
REAL TIME TDC
START
MR
MR
OC1,2,3
CLR
MR
16
16
OCT
TCLD
TCCK
TCTC
TE
TB
TRIGGER LOGIC
TRIGGER VETO
NTRIG OUT
REAR PANEL 9450A-9
TC1
2
TC2
2
TC4
2
TV1
TV2
FRONT END 9450A-7
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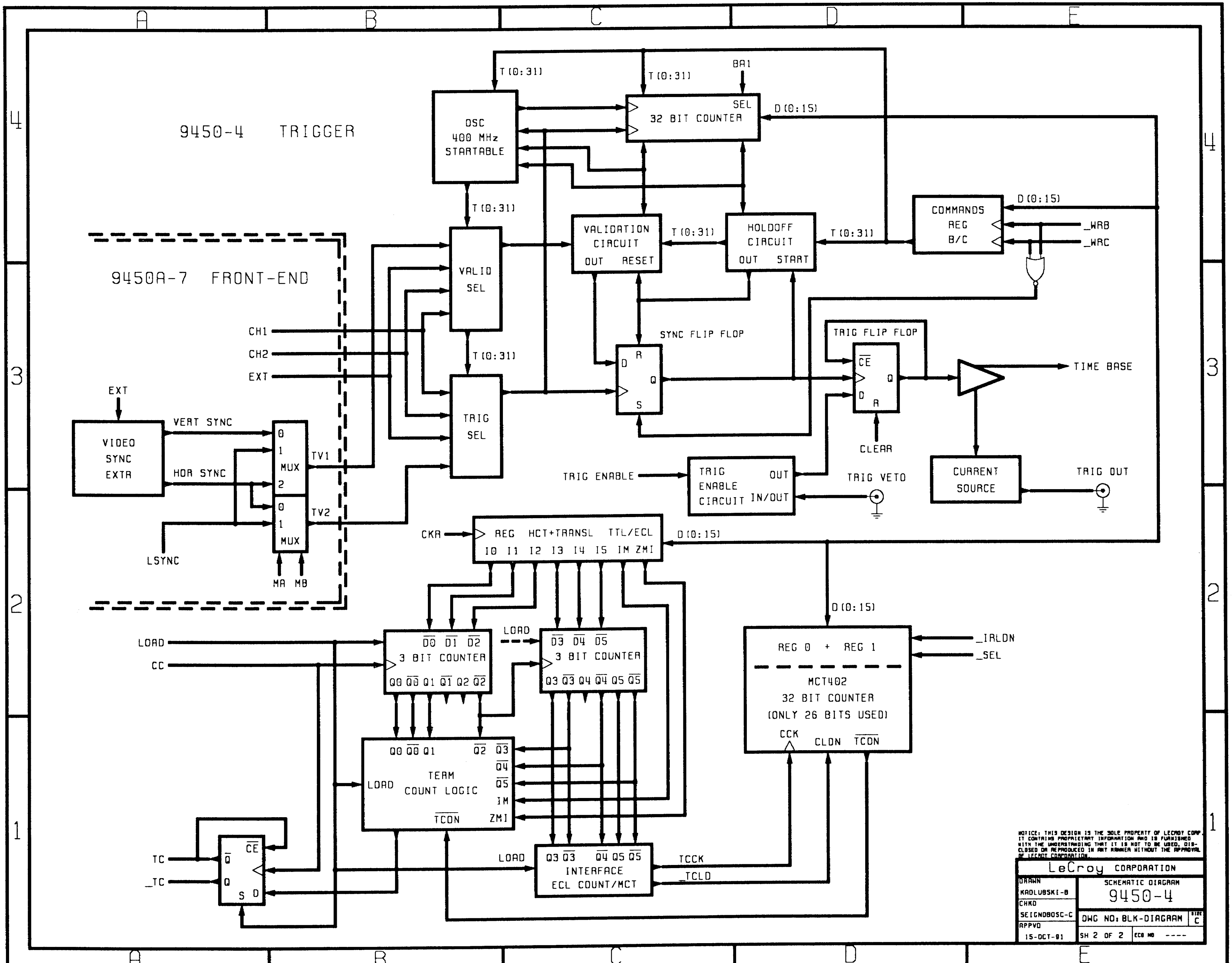
LeCroy CORPORATION
DRAWN KADLUBSKI-B
CHKD SEIGNOBOSC-C
APPVD 15-OCT-81
SCHEMATIC DIAGRAM
9450-4
DWG NO: BLK-DIAGRAM
SIZE C
SH 1 OF 2
ECO NO ----



9450-4 TRIGGER
9450A-7 FRONT-END
OSC 400 MHz STARTABLE
T(0:31)
BA1
SEL
32 BIT COUNTER
D(0:15)
VALIDATION CIRCUIT
OUT RESET
HOLDOFF CIRCUIT
OUT START
COMMANDS REG B/C
_WRB
_WRC
VALID SEL
TRIG SEL
CH1
CH2
EXT
SYNC FLIP FLOP
TRIG FLIP FLOP
CE
CLEAR
TIME BASE
VIDEO SYNC EXTR
VERT SYNC
HOR SYNC
LSYNC
MUX
TV1
TV2
MA MB
TRIG ENABLE
TRIG ENABLE CIRCUIT
OUT IN/OUT
TRIG VETO
CURRENT SOURCE
TRIG OUT
CKR
REG HCT+TRANSL TTL/ECL
I0 I1 I2 I3 I4 I5 IM ZMI
LOAD
CC
3 BIT COUNTER
Q0 Q1 Q2 Q3 Q4 Q5
TERM COUNT LOGIC
TCON
REG 0 + REG 1
MCT402
32 BIT COUNTER
(ONLY 26 BITS USED)
CCK CLDN TCON
_IRLDN
_SEL
TC
_TC
INTERFACE ECL COUNT/MCT
TCCK
_TCLD
LeCroy CORPORATION
SCHEMATIC DIAGRAM
9450-4
DWG NO: BLK-DIAGRAM
SH 2 OF 2
15-OCT-91

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 µsec
200	100	10.0	100	1	50 µsec
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 µsec
200	100	2	500 psec	100	1	2 µsec
200	100	1	1 nsec	100	1	5 µsec

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

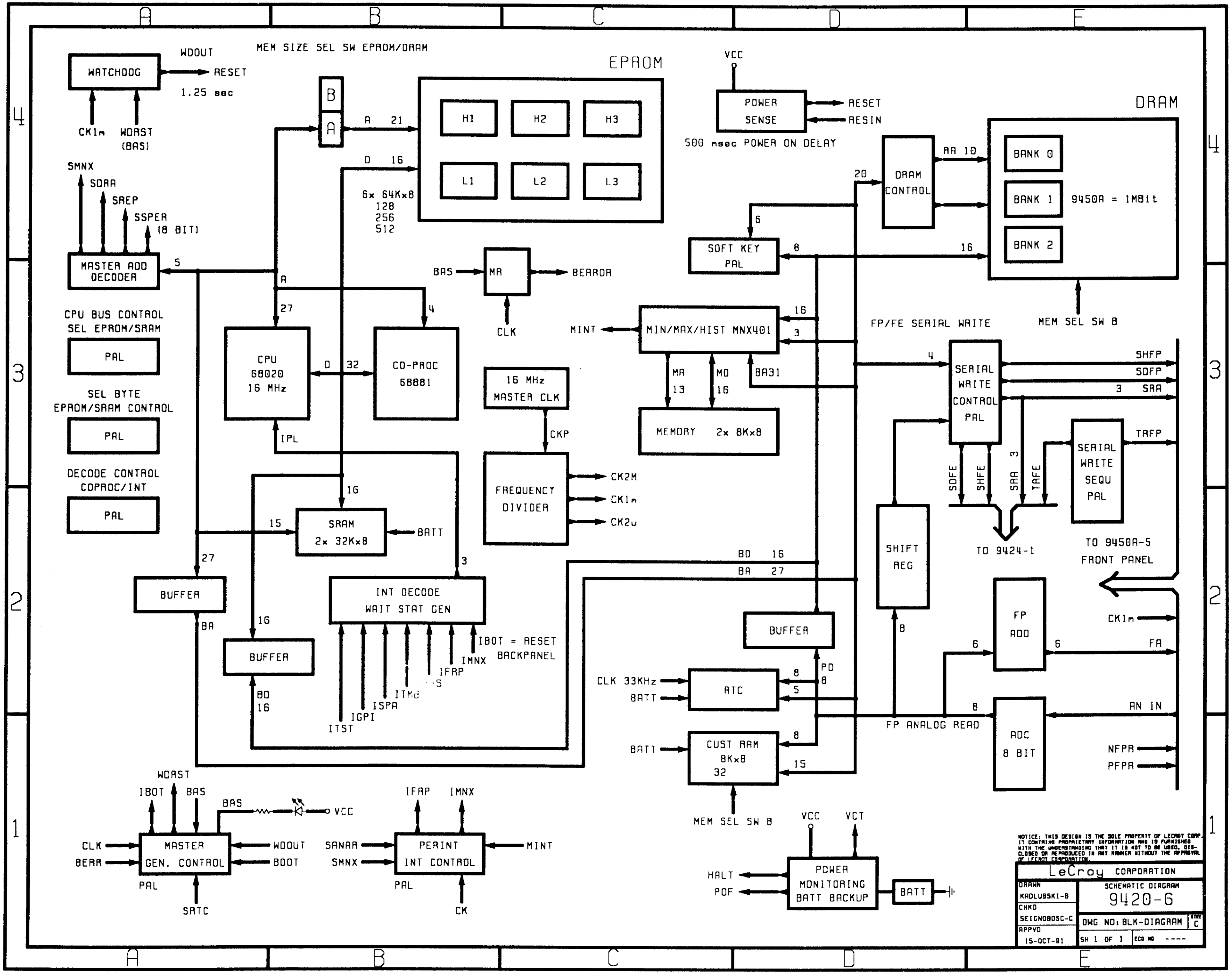
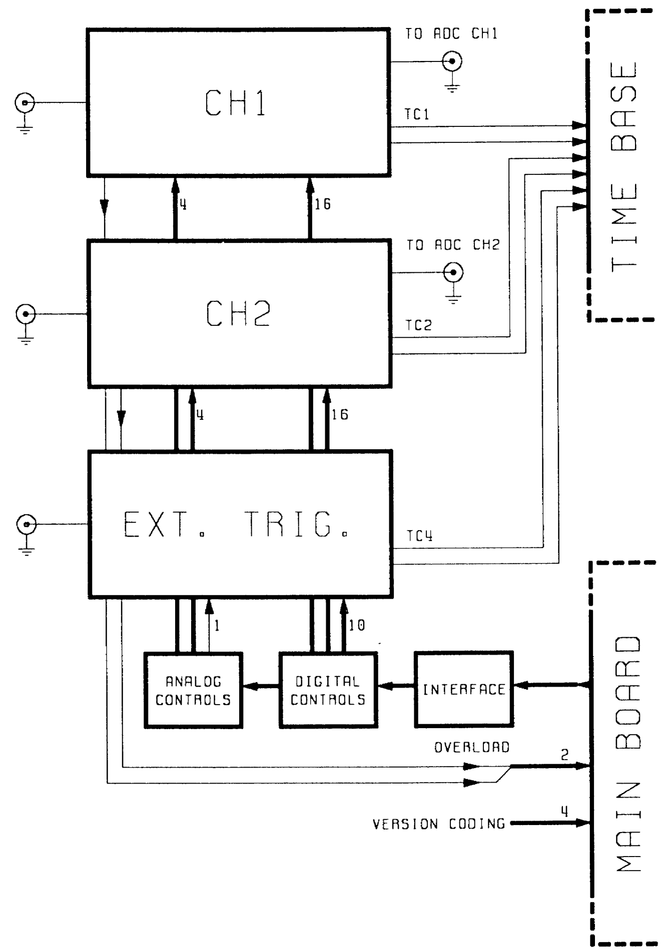
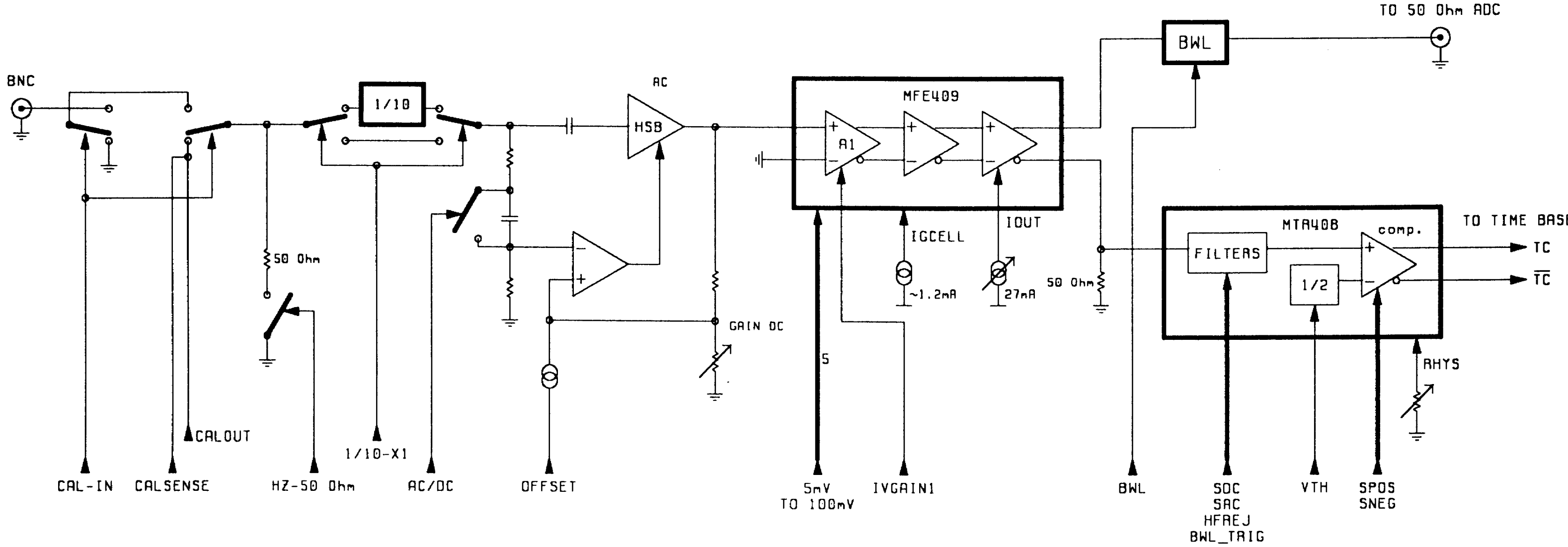

WATCHDOG
WDOUT
RESET
1.25 sec
CK1m
WORST (BAS)
MEM SIZE SEL SW EPROM/DRAM
EPROM
H1
H2
H3
L1
L2
L3
A 21
D 16
6x 64Kx8
128
256
512
VCC
POWER SENSE
RESET
RESIN
500 msec POWER ON DELAY
DRAM
DRAM CONTROL
AA 10
20
BANK 0
BANK 1
BANK 2
9450A = 1MBit
SOFT KEY PAL
MEM SEL SW B
SMNX
SDAA
SAEP
SSPER
(8 BIT)
MASTER ADD DECODER
CPU BUS CONTROL SEL EPROM/SRAM
PAL
SEL BYTE EPROM/SRAM CONTROL
DECODE CONTROL COPROC/INT
CPU 68020 16 MHz
CO-PROC 68881
D 32
IPL
BAS
MA
BERROR
CLK
MINT
MIN/MAX/HIST MNX401
MA 13
MD 16
BA31
MEMORY 2x 8Kx8
16 MHz MASTER CLK
CKP
FREQUENCY DIVIDER
CK2M
CK1m
CK2u
FP/FE SERIAL WRITE
SERIAL WRITE CONTROL PAL
SHFP
SDFP
SAA
TRFP
SERIAL WRITE SEQU PAL
SDFE
SHFE
TAFE
TO 9424-1
TO 9450A-5 FRONT PANEL
SHIFT REG
FP ADD
FA
ADC 8 BIT
AN IN
NFPR
PFPR
FP ANALOG READ
SRAM 2x 32Kx8
BATT
BUFFER
BA
BD 16
BA 27
INT DECODE WAIT STAT GEN
IBOT = RESET BACKPANEL
IMNX
IFRP
ITMR
ISPA
IGPI
ITST
PD
CLK 33KHz
RTC
CUST RAM 8Kx8 32
WORST
IBOT
BAS
MASTER GEN. CONTROL PAL
WDOUT
BOOT
BERR
SRTC
VCC
IFRP
IMNX
SANAA
SMNX
PERINT INT CONTROL PAL
CK
HALT
POF
POWER MONITORING BATT BACKUP
VCT
LeCroy CORPORATION
SCHEMATIC DIAGRAM
9420-6
DRAWN KROLUBSKI-B
CHKD SEIGNOBOSC-C
APPVD 15-OCT-91
DWG NO: BLK-DIAGRAM
SIZE C
SH 1 OF 1

FIG.1 : FRONT-END BLOCK DIAGRAM



LeCroy CORPORATION	
DRAWN KROLUBSKI-B	MODEL : 9450A-7 2 CH. 300MHz FRONTEND
CHKD SEIGNOBOSC-C	DWG NO: BLK-DIAGRAM --
DATE 16-OCT-91	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

LeCroy CORPORATION
DRAWN KADLUBSKI-B
CHKD SEIGNOBOSC-C
DATE 16-OCT-91
MODEL : 9450A-7
2 CH. 300MHz FRONTEND
DWG NO: BLK-DIAGRAM
SH 2 OF 3
ECO : ---

FIG.3 : EXTERNAL TRIGGER BLOCK DIAGRAM

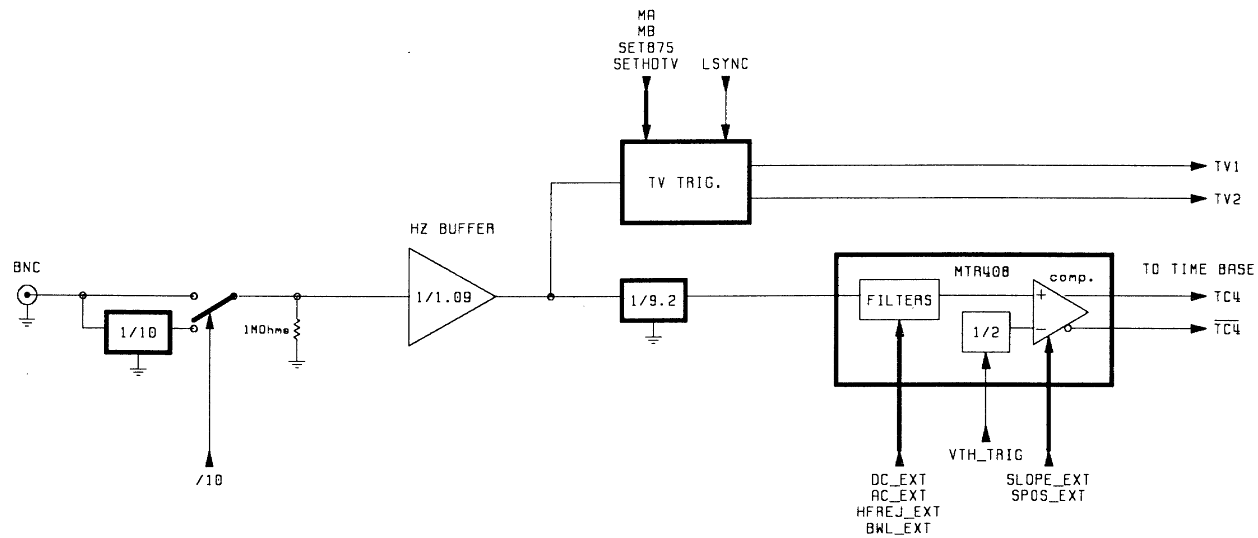


FIG.4 : ANALOG AND DIGITAL CHANNEL CONTROLS

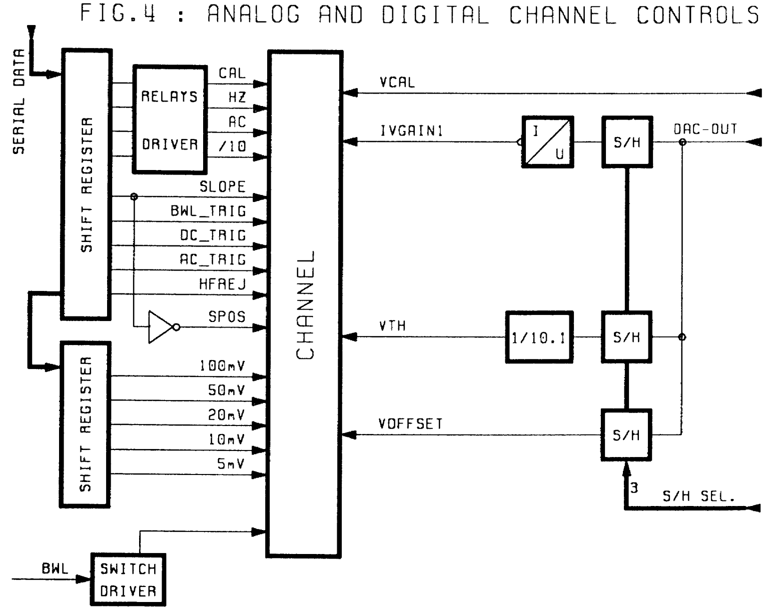
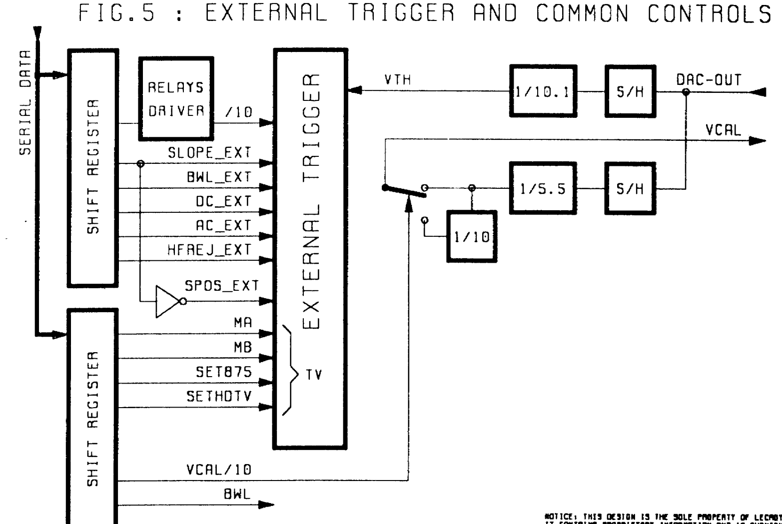


FIG.5 : EXTERNAL TRIGGER AND COMMON CONTROLS



LeCroy CORPORATION	
DRAWN KACLUBSKI-B	MODEL : 9450A-7
CHKD SEIGNOBOSC-C	2 CH. 300MHz FRONTEND
DATE 16-OCT-91	DWG NO: BLK-DIAGRAM
	SH 3 OF 3 ECO : ---

MODEL 9451-1 POWER SUPPLY

Specifications

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

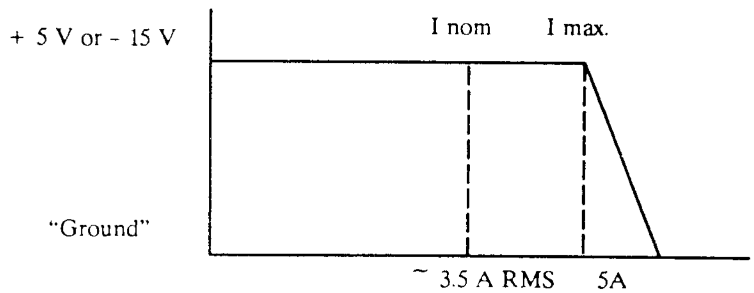
Output ripple and noise: +15 V and -15 V: max. 100 mV_{pp} (100 MHz)

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

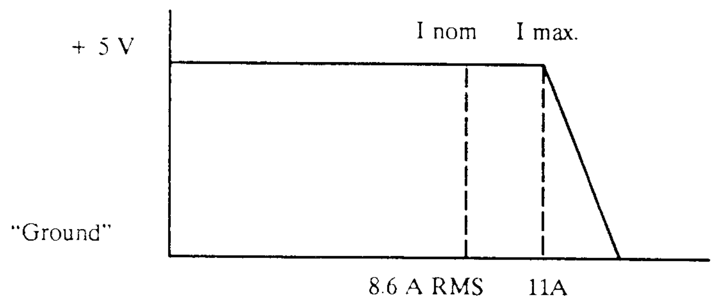
50 Hz output ripple: max. 5 mV

Maximum output current:

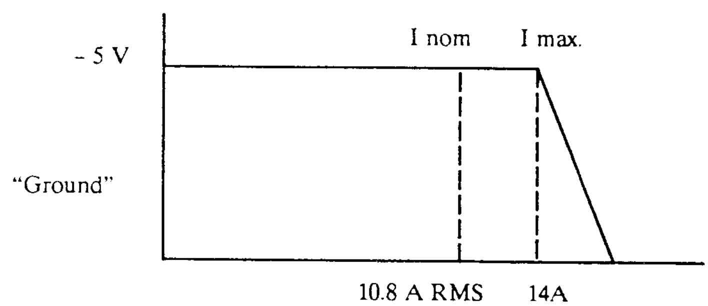
$+15\ V$ and $-15\ V$: $I\ max. = 5\ A^{-0}_{+1}$



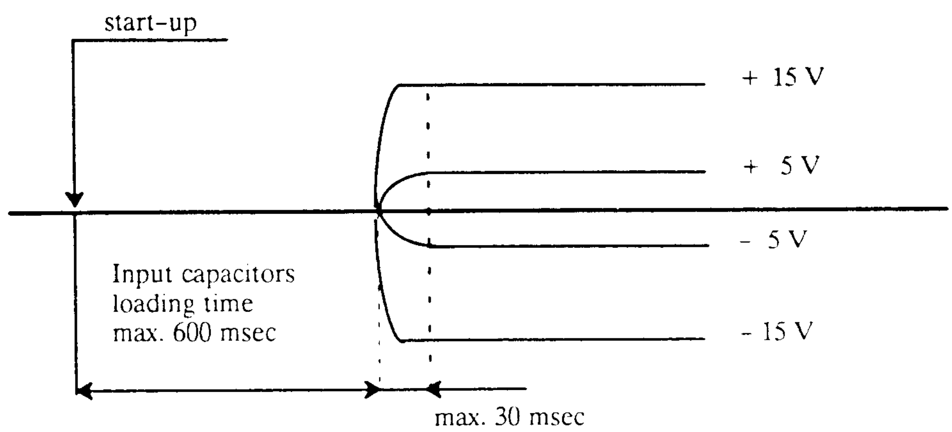
$+5\ V$: $I\ max. = 11\ A^{-0}_{+1}$



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

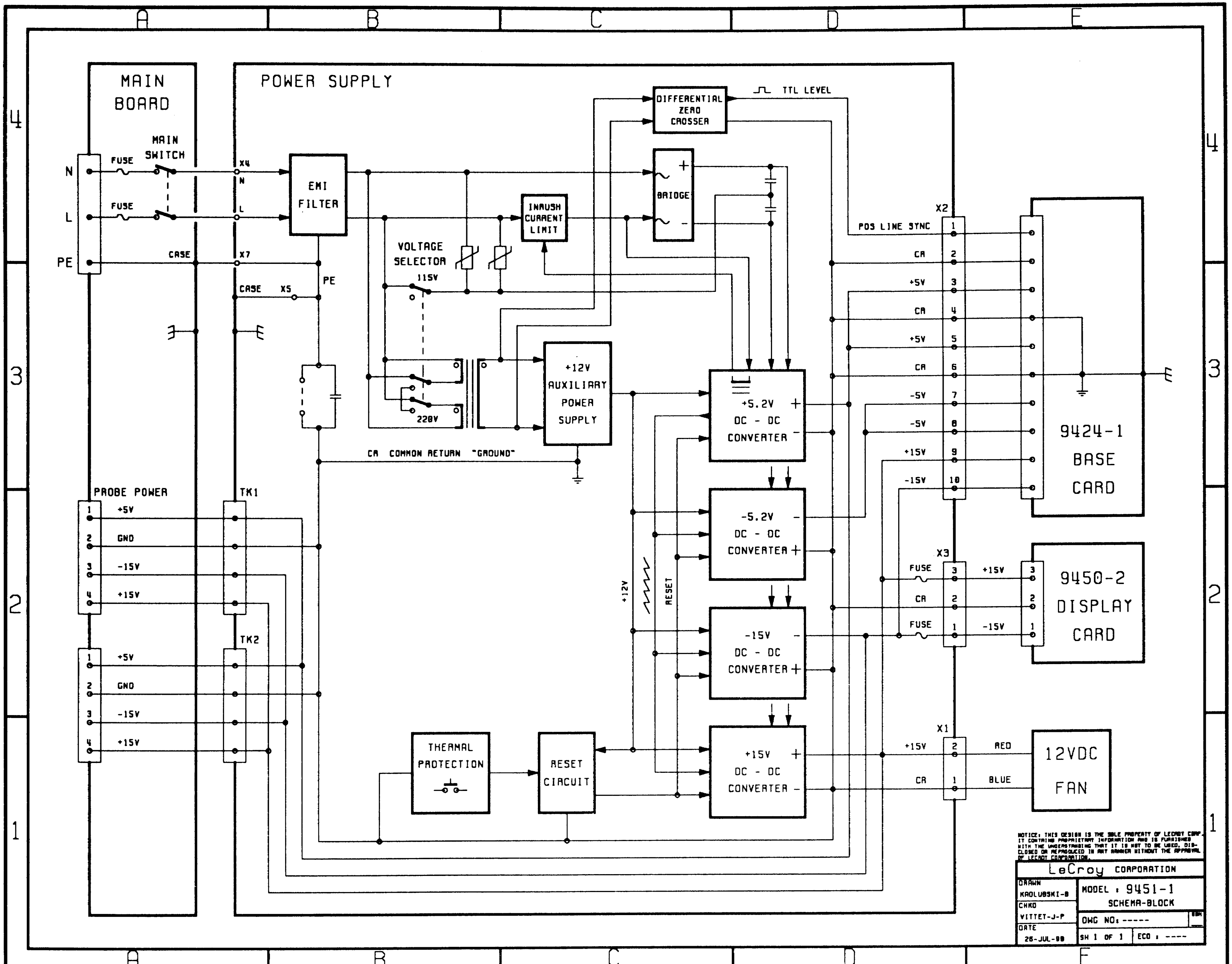


Max. output current adjustment:	min. ±20%
Soft-start:	input 90 V_{AC}, 45 Hz: outputs $I_{nominal}$



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

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



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Chapter 3

BASIC PERFORMANCE TEST PROCEDURE

AND

INTERNAL DIAGNOSTICS AND CALIBRATION

Table of contents:

Section

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 MΩ 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.

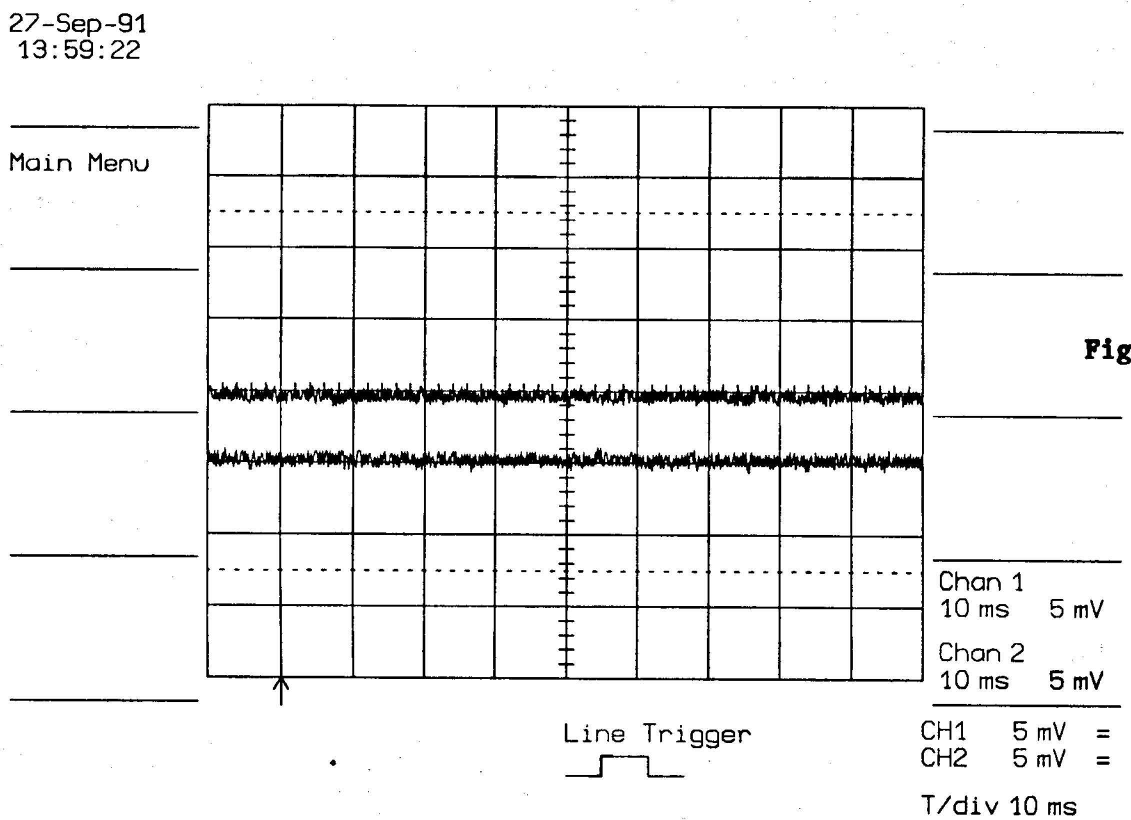


Figure 1

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 µsec/div
- BWL OFF

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

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

Repeat the same test for CH2.

3.1.5 Input Impedance

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

- input impedance must be 1 MΩ ± 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 ± 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 µsec/div
- BWL OFF

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

- 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

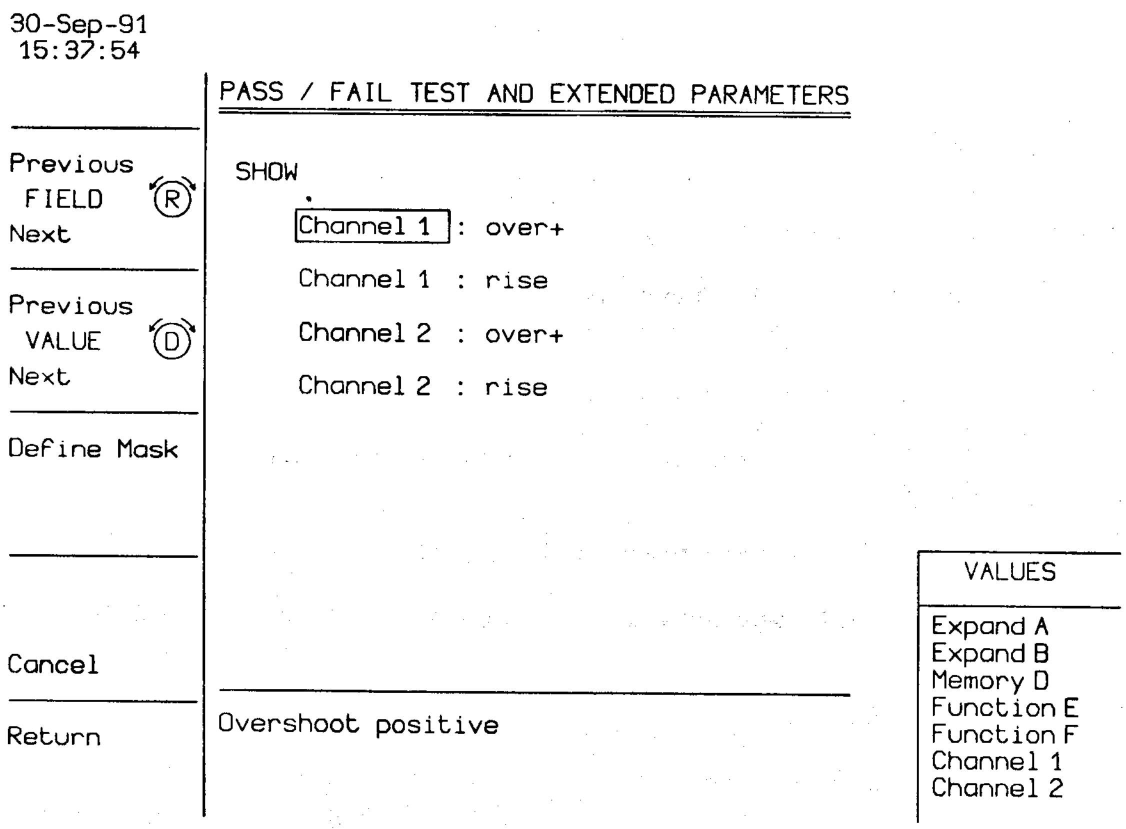


Figure 2

Check:

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

  50 Ω: 4% overshoot

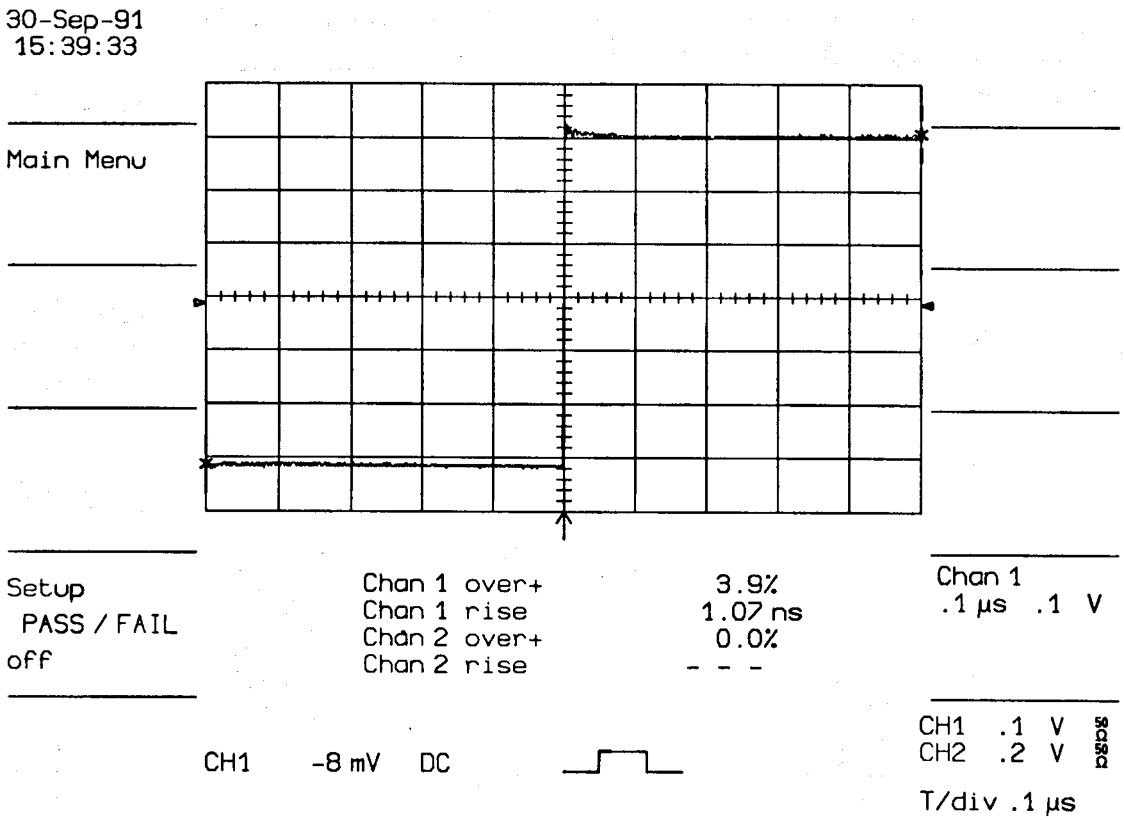


Figure 3

- Check the same at 200 mV/div, input 1.2V p-p

- Typical overshoot: less than 8%

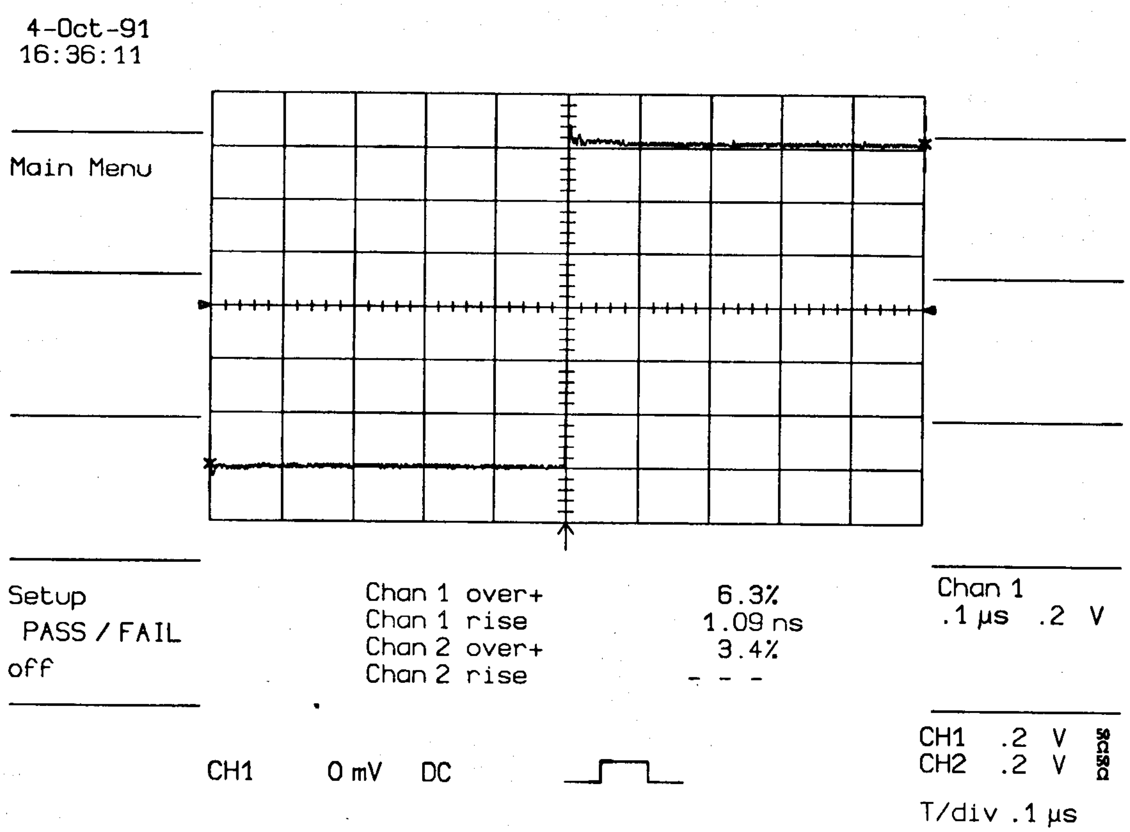


Figure 4

- Repeat the above for CH2, trigger source CH2

3.1.7 Bandwidth at 50Ω input impedance

The purpose of this test is to ensure that the entire 9450A system has a bandwidth of at least 300 MHz at 50Ω 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 µsec/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).

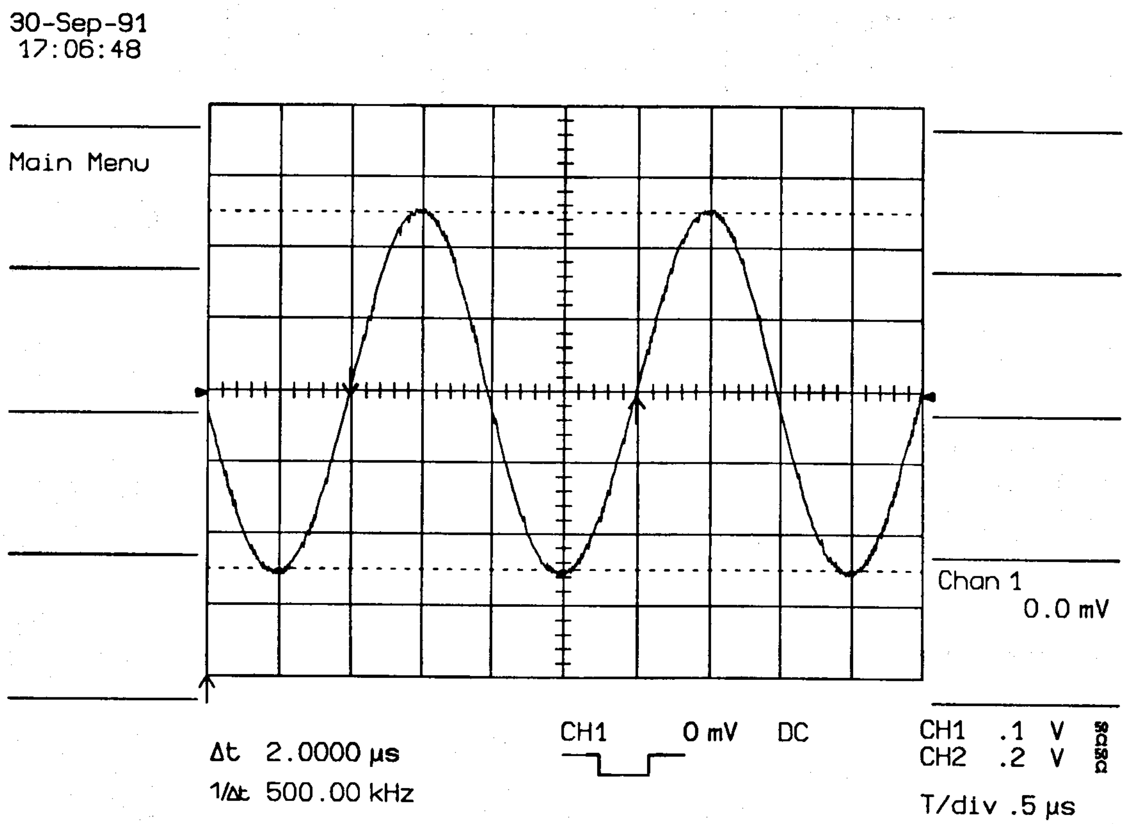


Figure 5

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

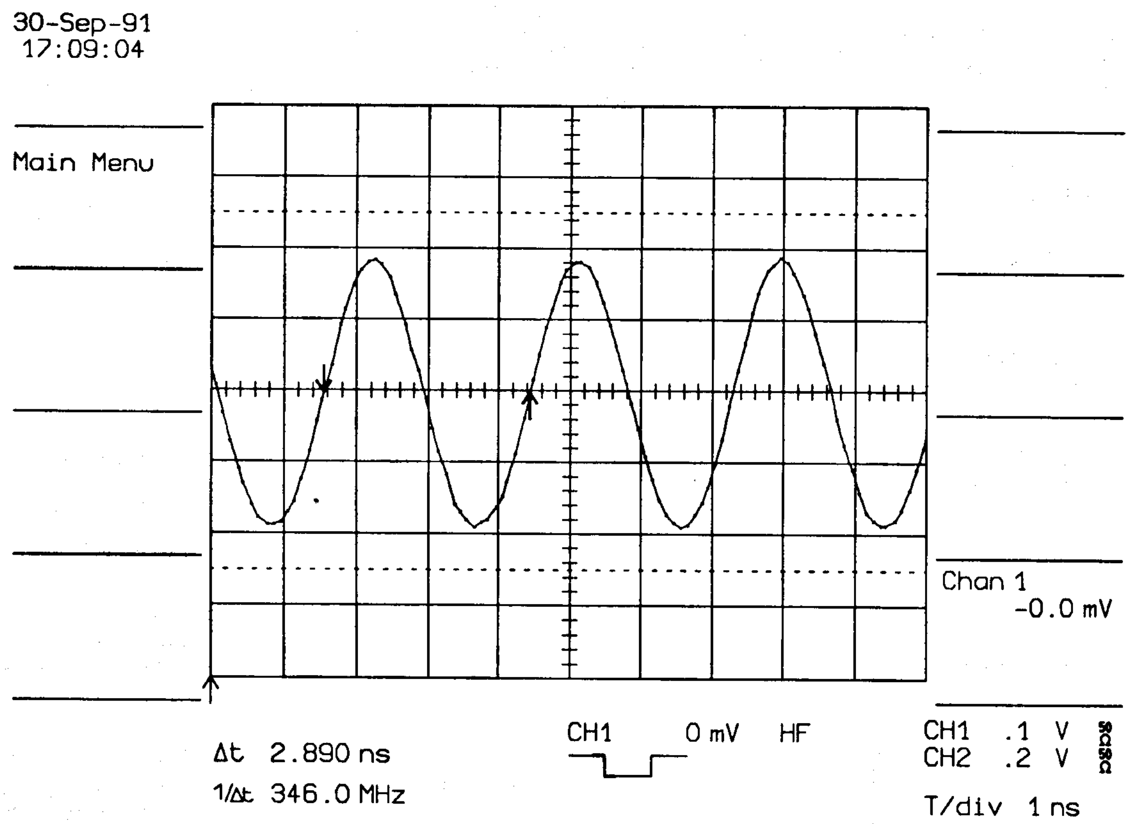


Figure 6

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 MHz ± 20%

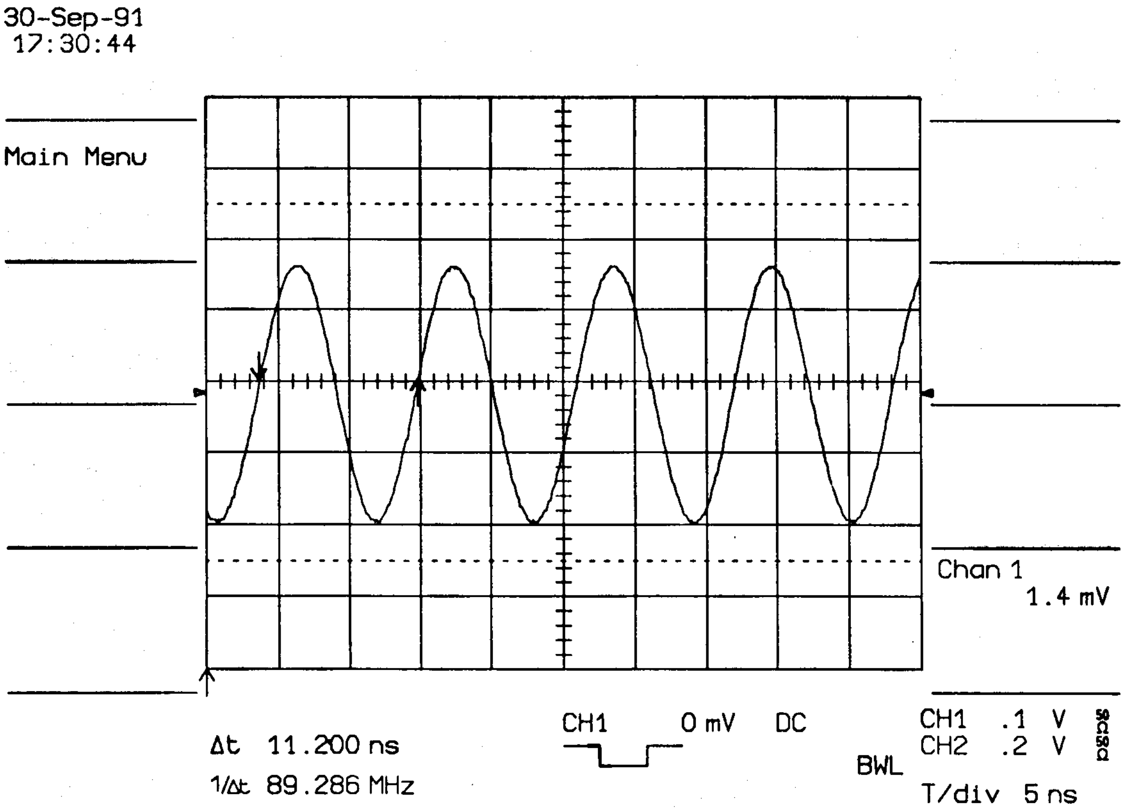


Figure 7

3.1.8 Bandwidth at 1 MΩ 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 MΩ input impedance.

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

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

Terminate the output of the SG 503 via a 50 Ω feedthrough and connect it to the CH1 input through a 10 MΩ /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.

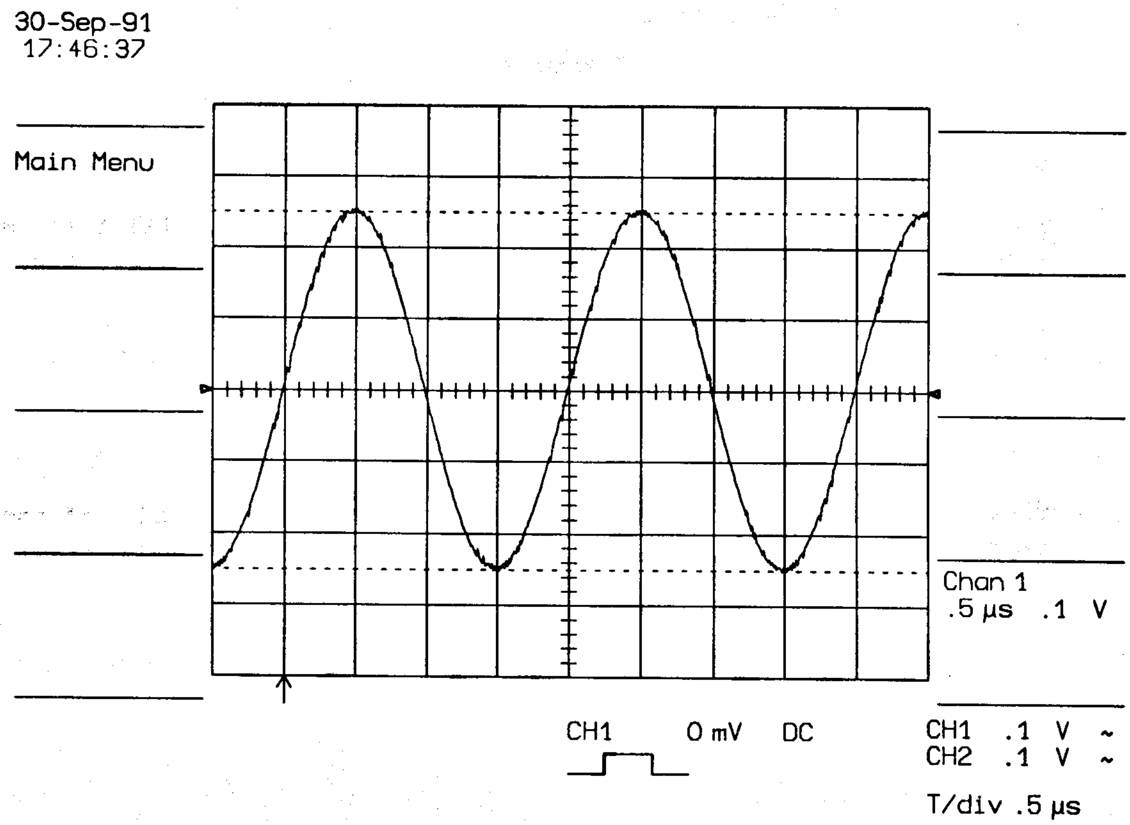


Figure 8

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

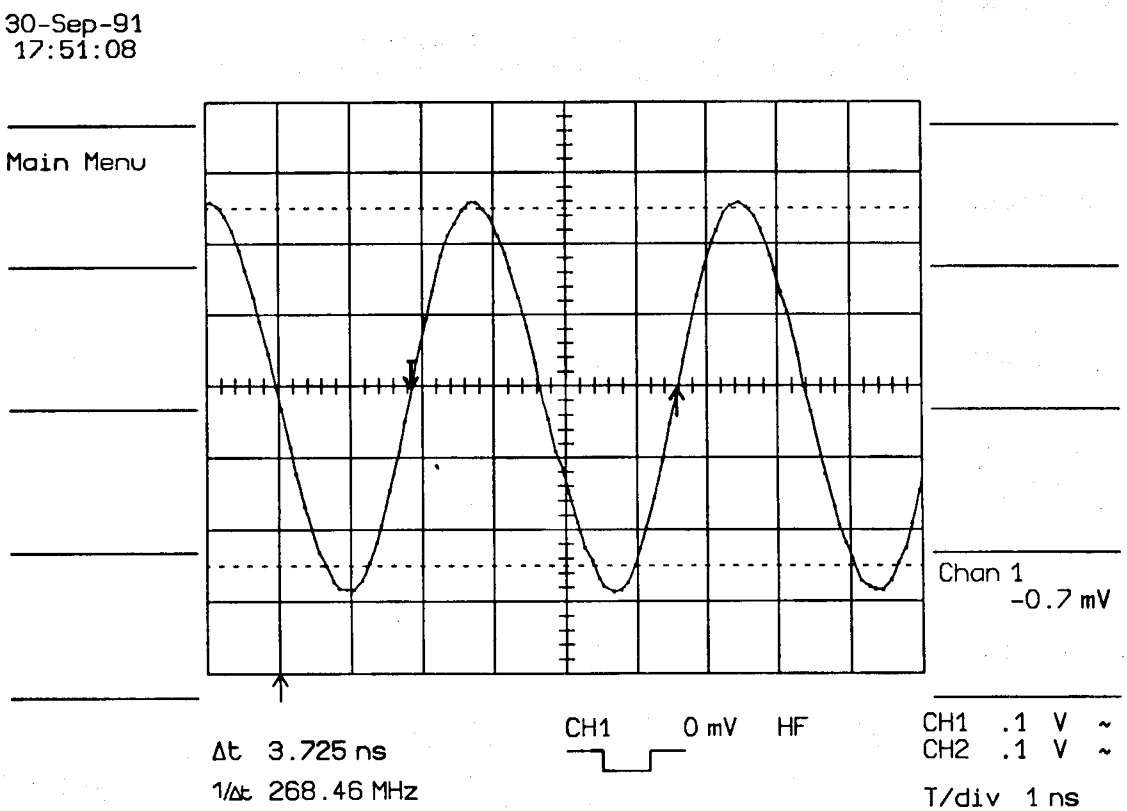


Figure 9

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 MHz ± 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 DSO:

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

Set the time base:

- Time/div:	.2 msec/div

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

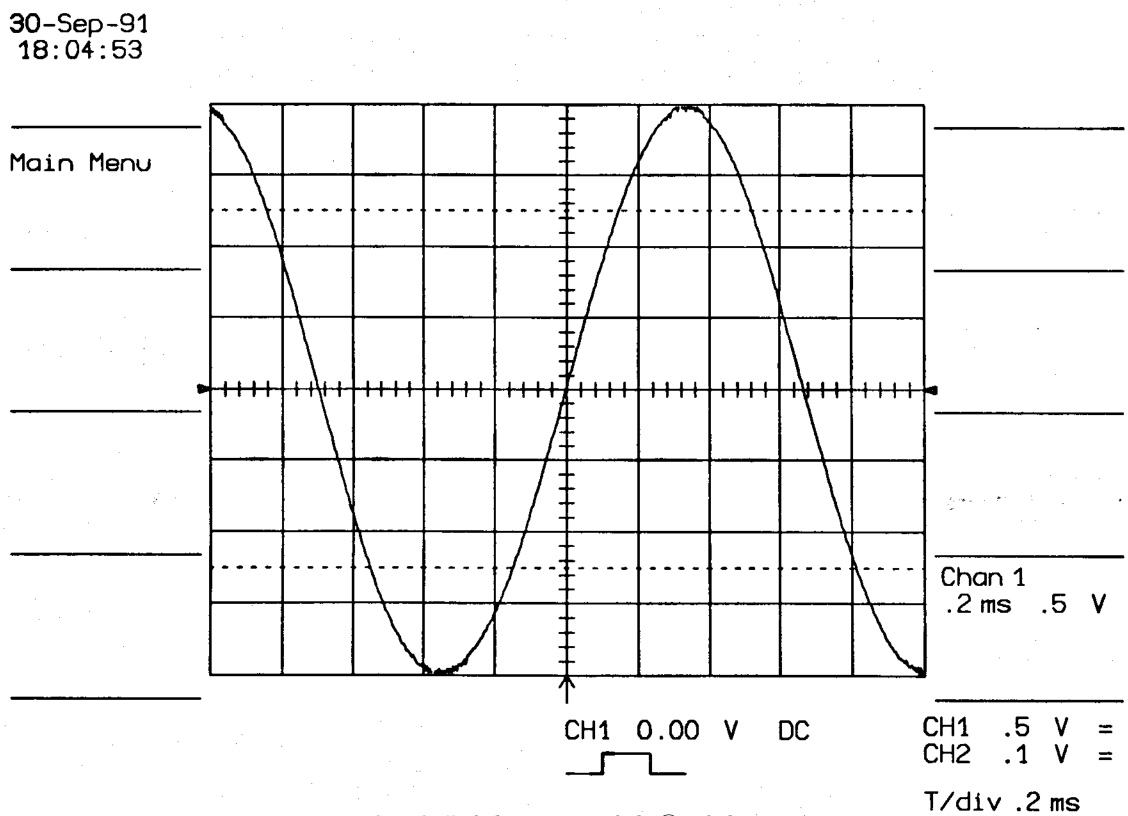


Figure 10

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

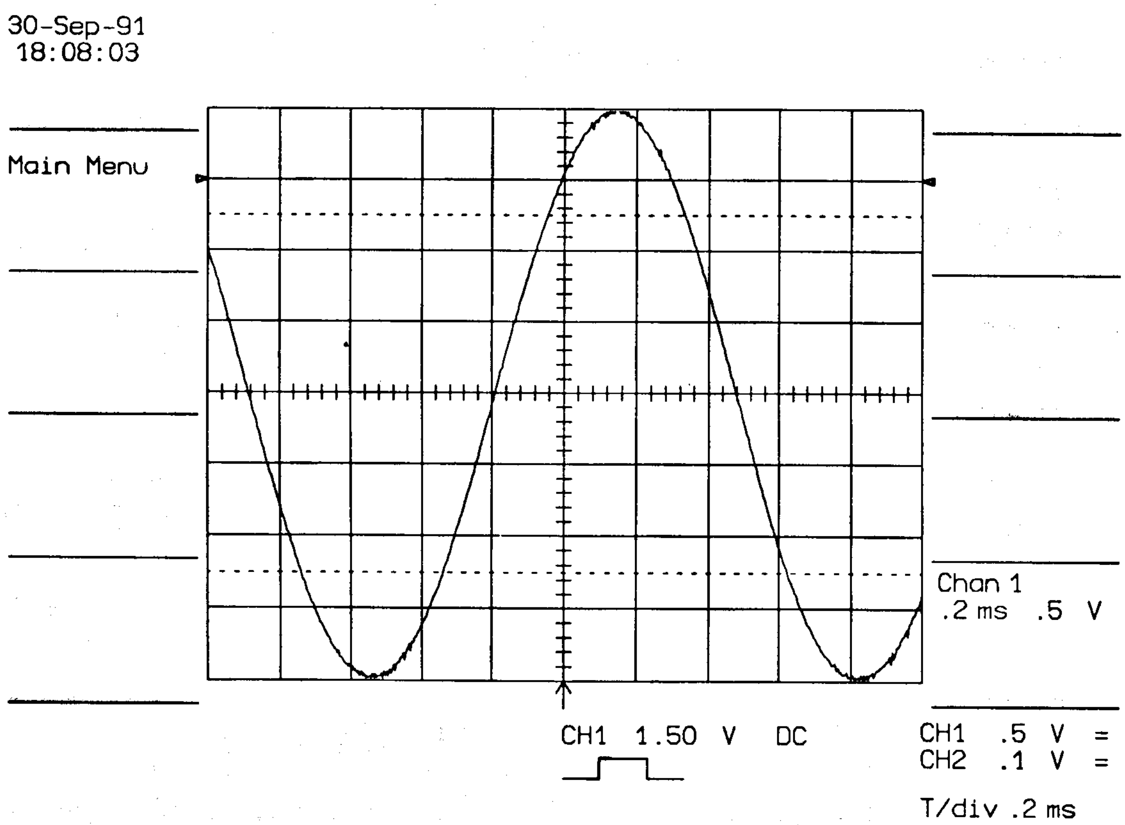


Figure 11

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

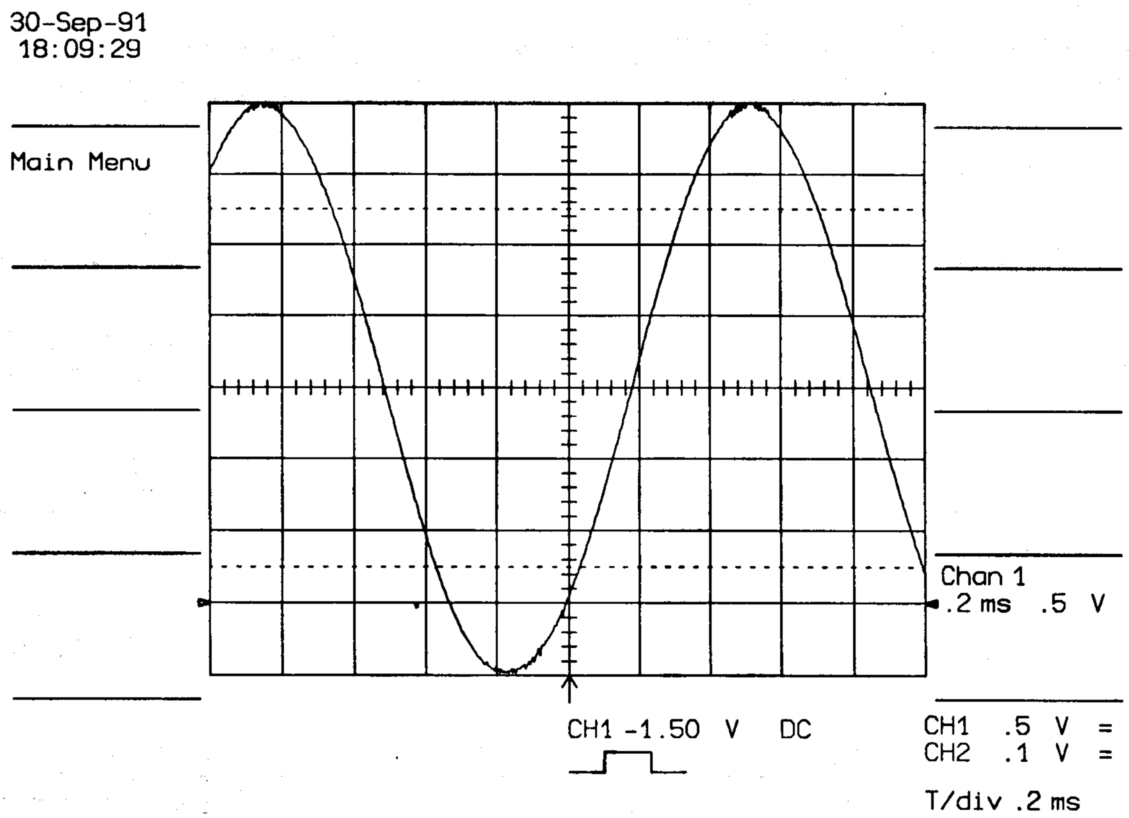


Figure 12

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 MΩ, 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.

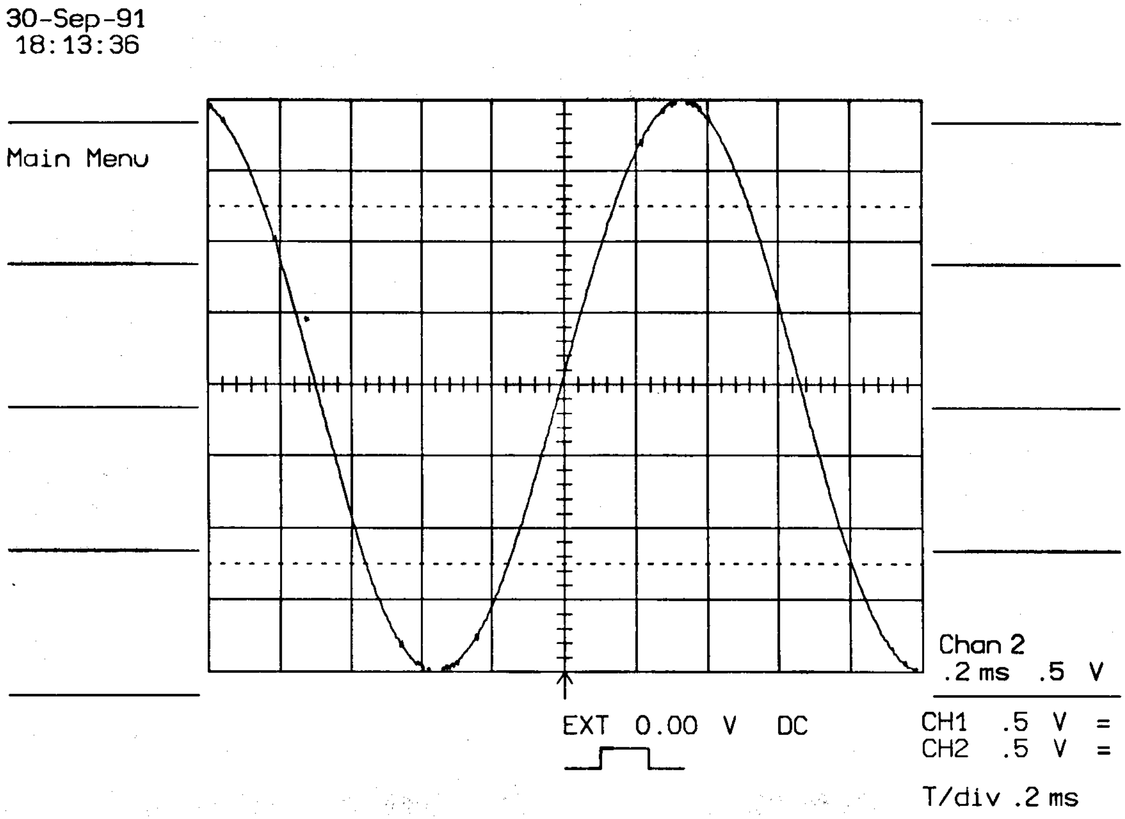


Figure 13

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:

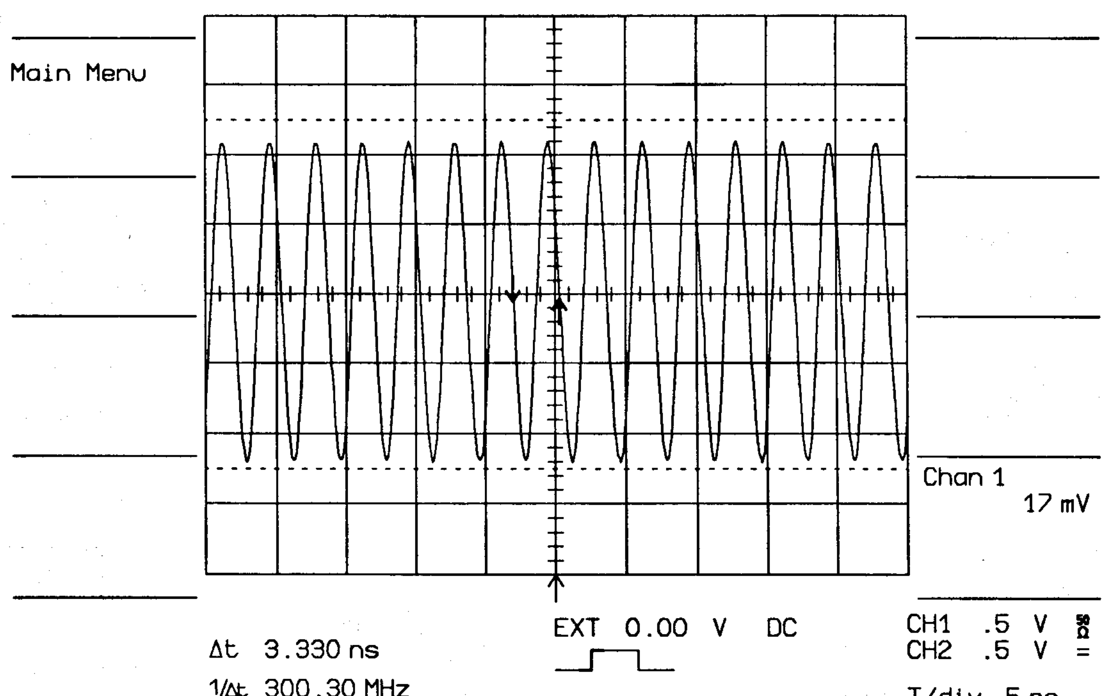
- Time/div	5 nsec/div
- Interleaved ON	

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.

1-Oct-91
9:29:19

Figure 14



3.1.12 Smart Trigger

3.1.12.1 Trigger on Pulse Width >, <

Set up the DSO:

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

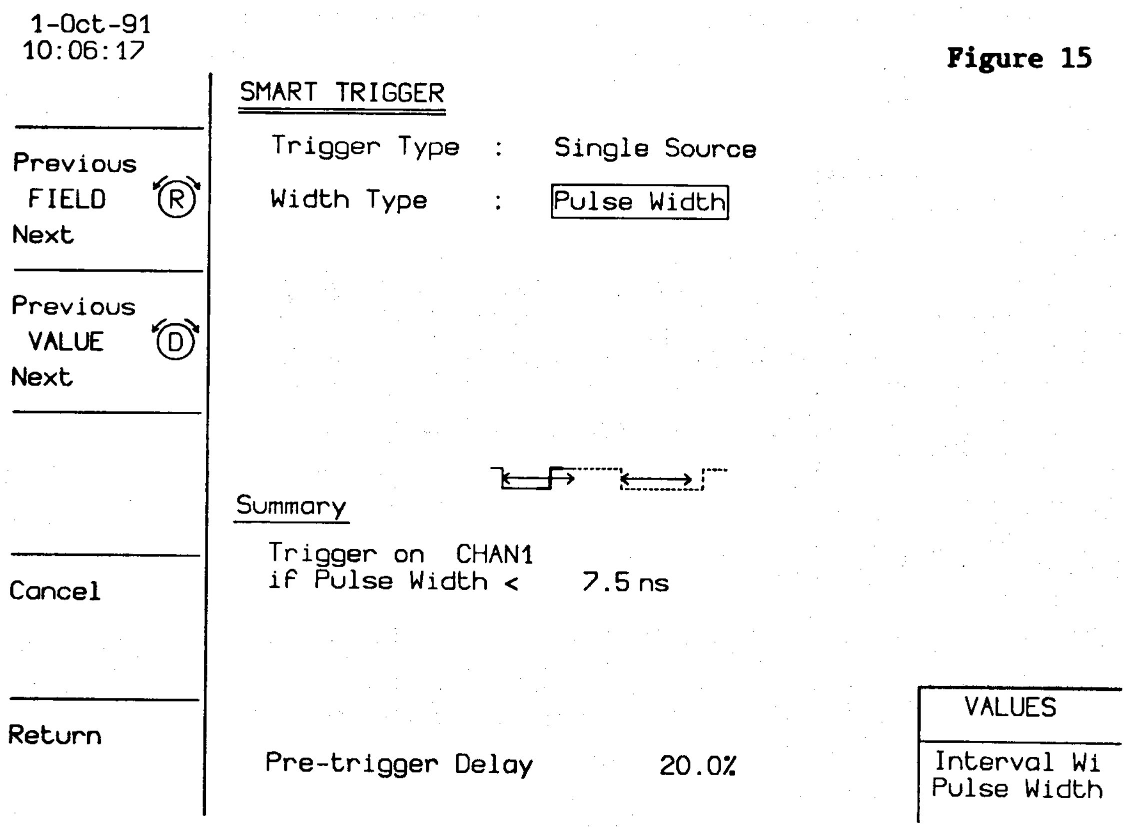


Figure 15

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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**

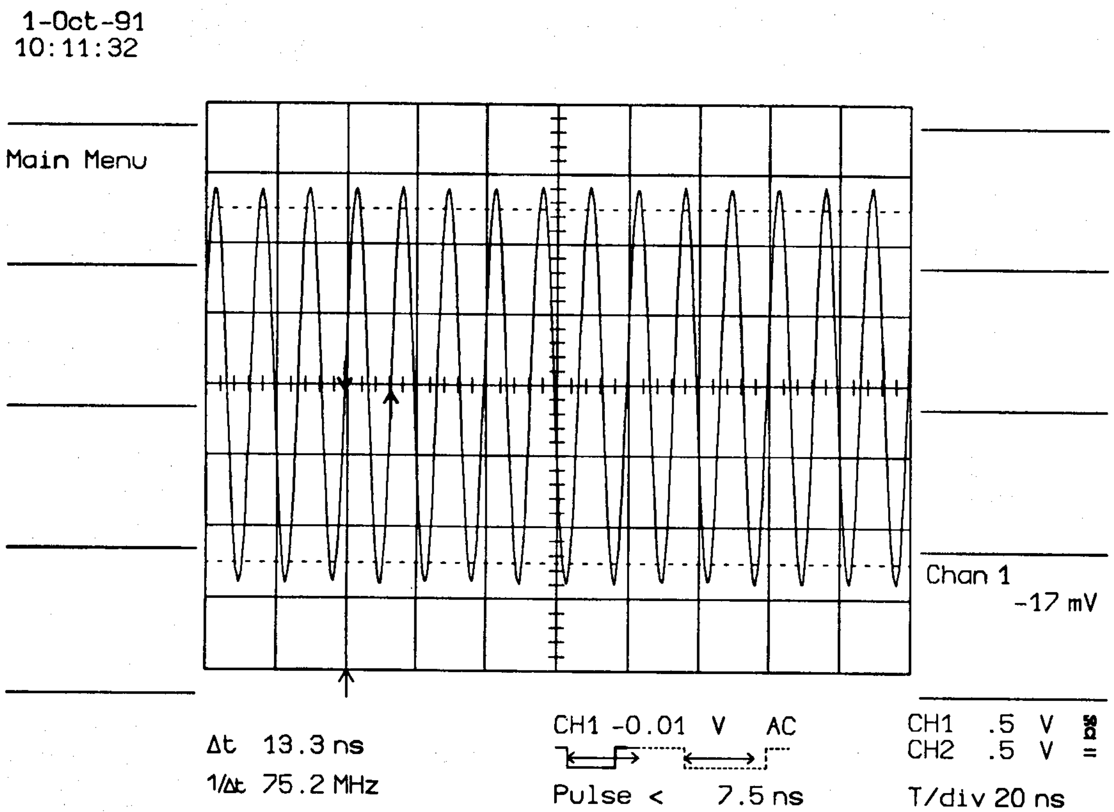


Figure 16

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 DSO:

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	

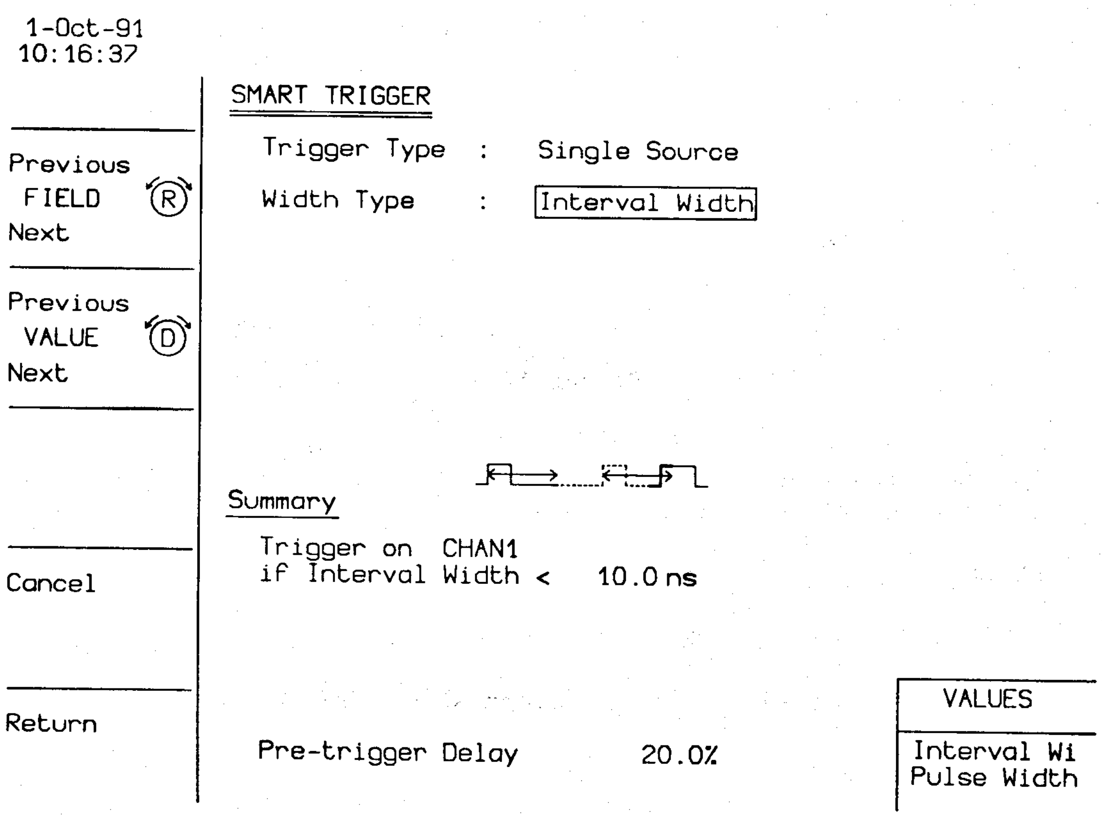


Figure 17

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

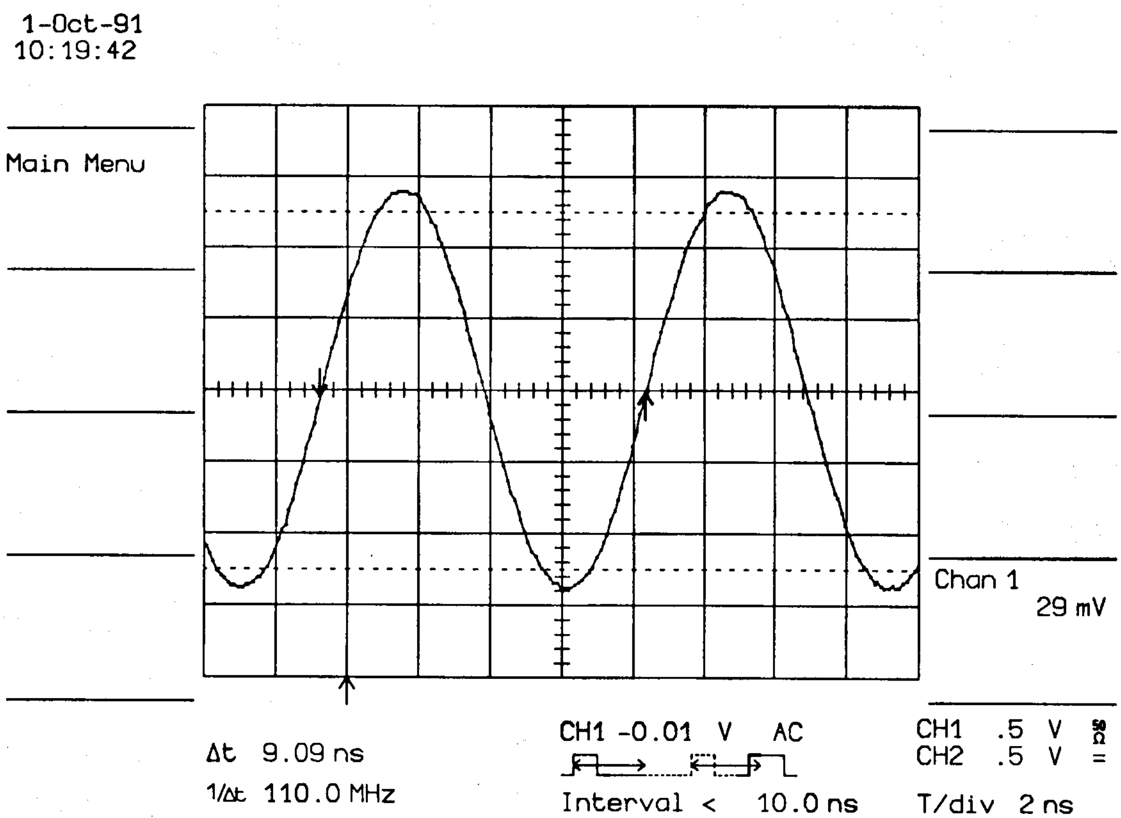


Figure 18

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.

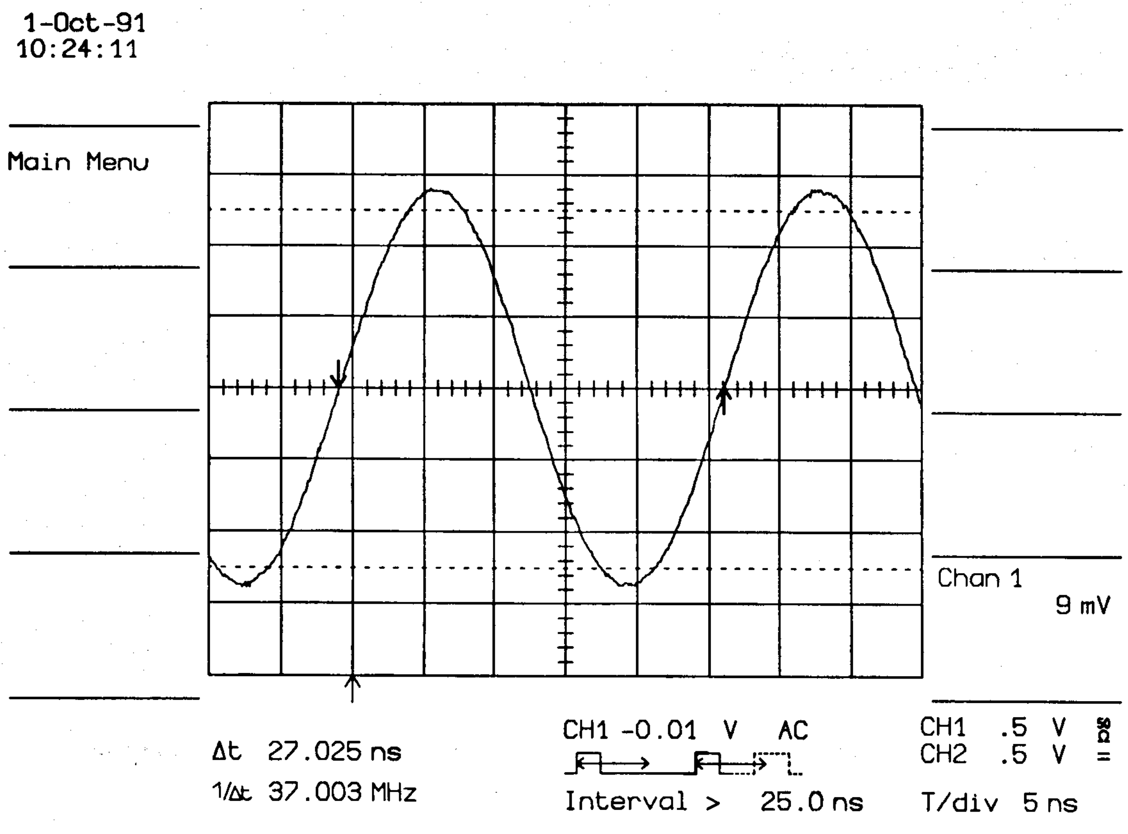


Figure 19

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 μsec/div
- Interleaved	ON

Set the sine wave generator to 1 MHz and put a signal on to CH1. Adjust amplitude to get about a 6 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 μsec/div.

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

Put the expanded trace on the second grid using the vertical POSITION knob, see Figure 20.

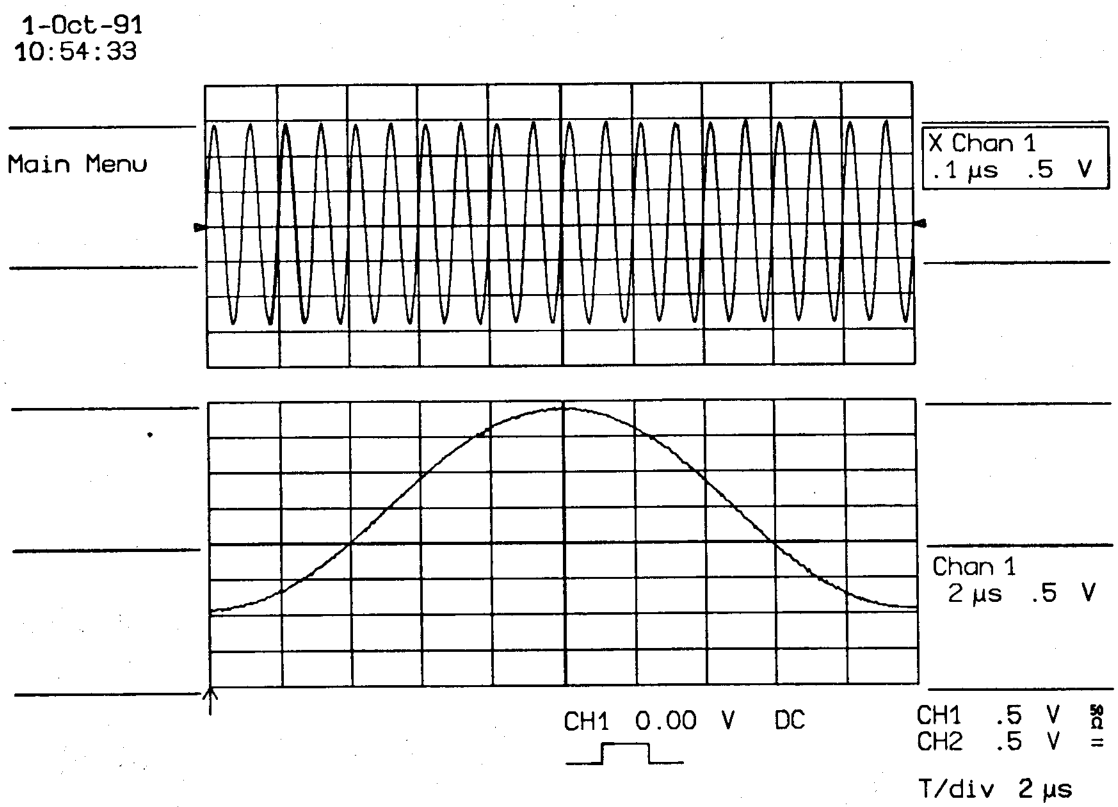


Figure 20: 3rd Period Expanded

Turn ON EXPAND B with CH1 as the source.

Adjust TIME MAGNIFIER to .1 µsec/div.

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

Overlay the 2 expanded traces on the lower grid using vertical and horizontal POSITION knobs on DISPLAY CONTROL, see Figure 21.

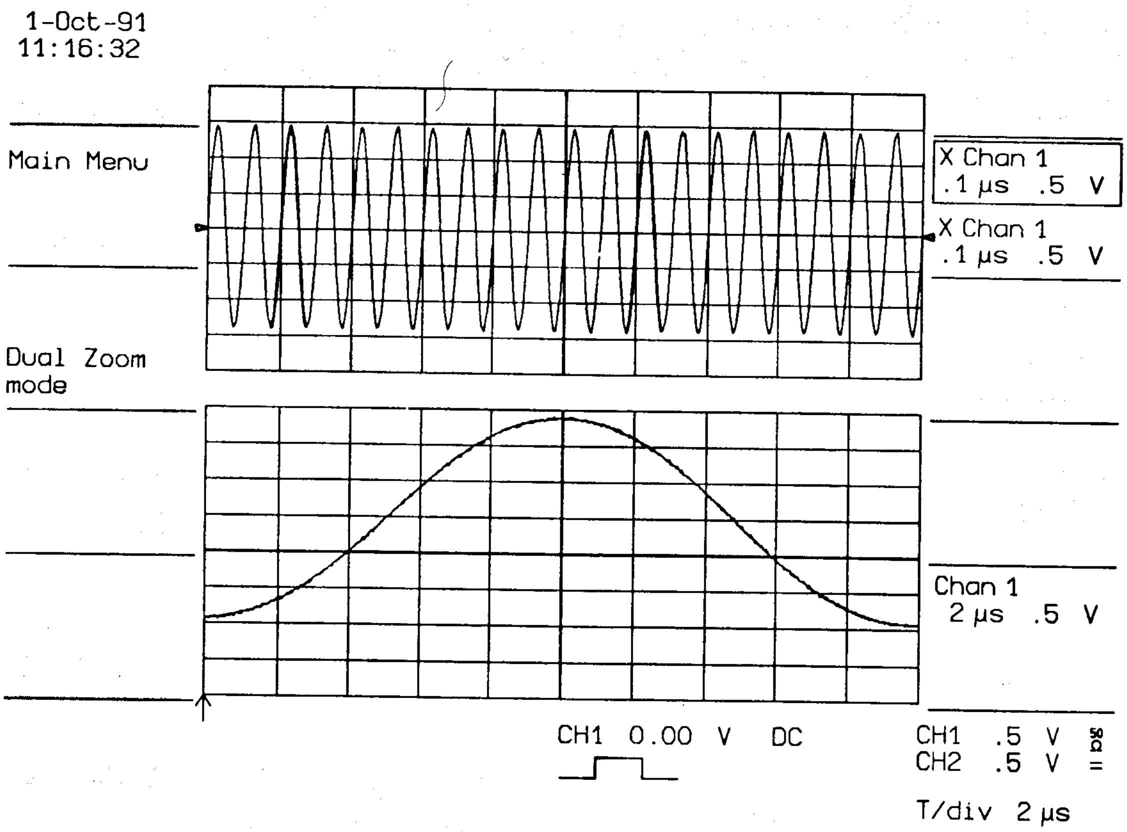


Figure 21: 3rd and 13th period overlaid

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.

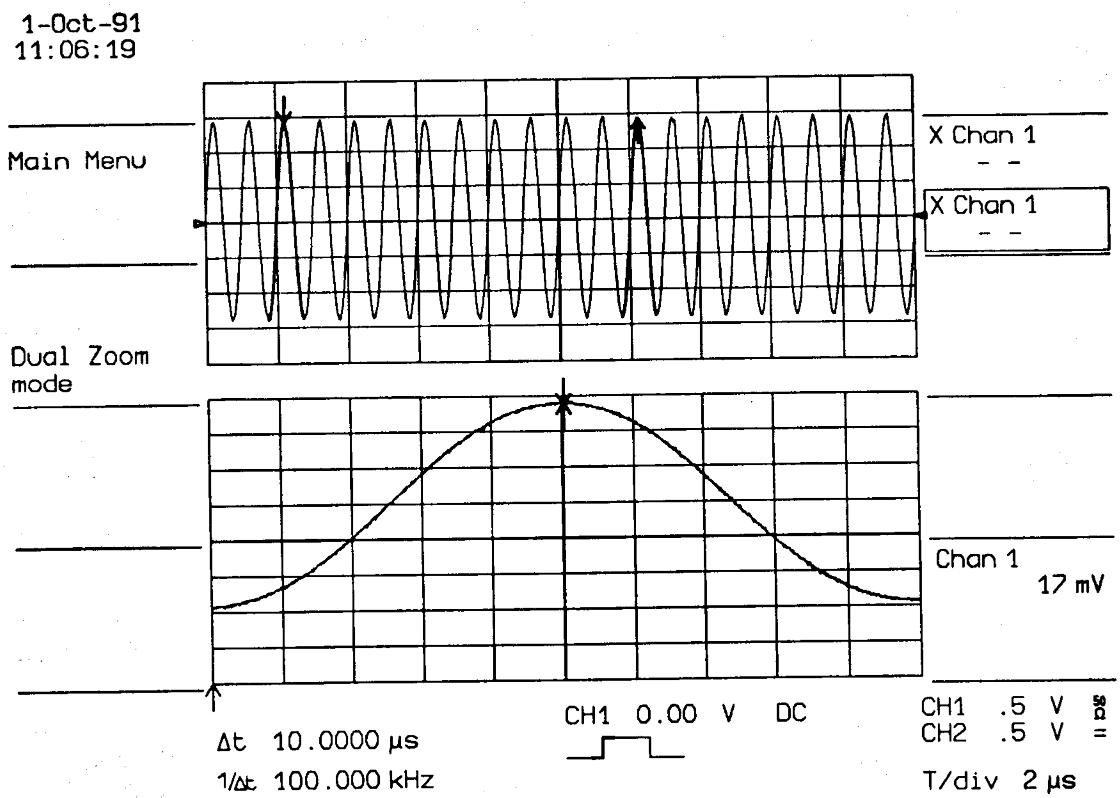


Figure 22: Aligned cursors

Turn DUAL ZOOM ON.

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

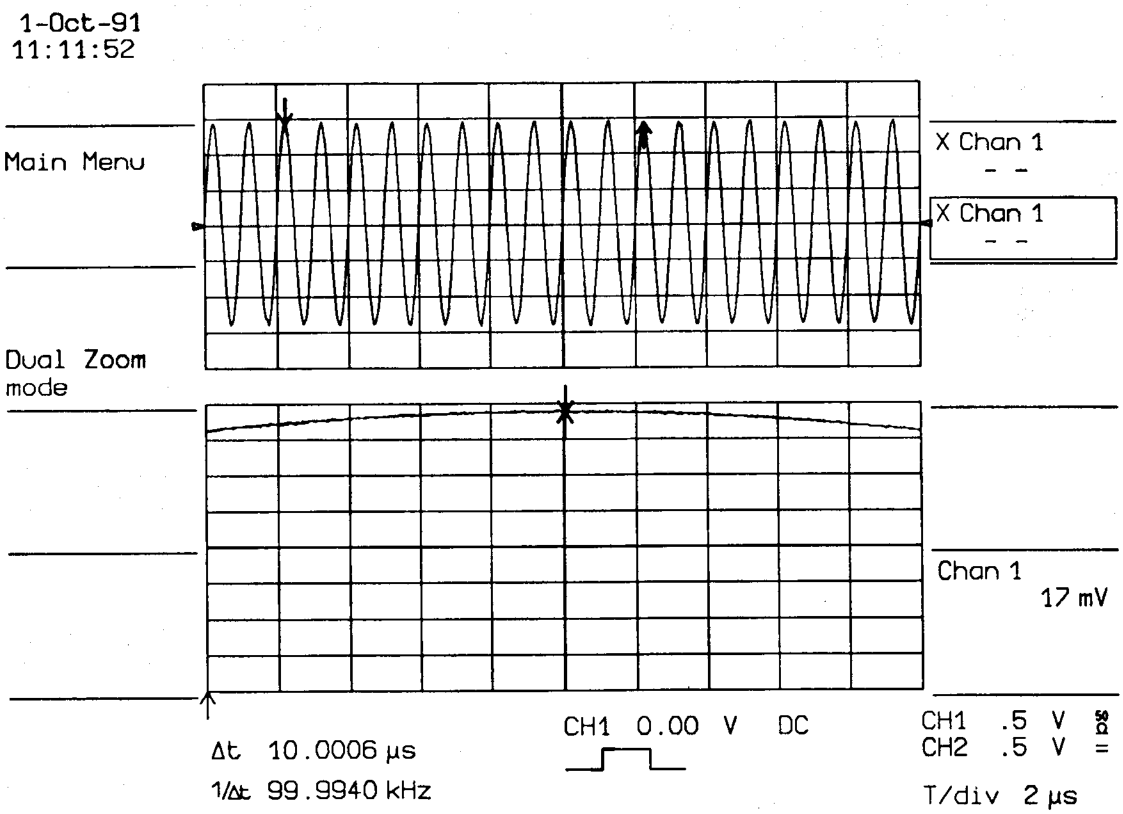


Figure 23: Alignment of cursors with maximum expansion.

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.

```
 1-Oct-91
11:18:43
                  CALIBRATION ERROR LOG
_______________
                  Vertical Calibration
                  4 nibbles=(curves) (verify) (high gain) (unused)
Chan 1+2          (8=Offset Range, 4=Offset Conv, 2=Gain Range, 1=Gain Conv)
 Calib Const
                                 CHAN1      CHAN2
                   5 mV            0          0
_______________   10 mV            0          0
                  20 mV            0          0
Chan 1+2          50 mV            0          0
   Full Test      .1  V            0          0

_______________
Full Re-
calibration       ADC/TMS State  Working    Working

Calibration          4 nibbles = (400Ms) (200Ms) (100Ms) (40Ms)
Error Log
_______________   Trigger Cal.       0          0  (2=No BWL, 1=BWL)
Manual FE
DAC Control       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 X000	verify 0X00	high gain 00X0	unused 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

```
 1-Oct-91
14:48:13
                 Calibration Constants        400Ms/s   10 µs/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
Chan 1+2         dac 4 (a47a= 0.5000mA)          0.9605       0.9397
   Full Test     dac 5 (8a3c= 0.4000mA)          1.0884       1.0664
                 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
                 C1 (.1  V)  o0:-1.9558  o1: 0.623  o2: 6.10e-05  [ 0.1038± 1.9973]
Calibration      C2 (.1  V)  o0:-1.9356  o1: 0.631  o2: 5.87e-05  [ 0.0507± 1.9232]
Error Log
Manual FE        C1 current dac settings (.1 V* 1.00, 0.00e+00; 400Ms/s)
DAC Control         high gain     0000 =   -0.1576 mA
                    gain adjust   9b5c =    0.4653 mA
More Consts         offset        79b9 =  9.81e-02 V

                 C2 current dac settings (.1 V* 1.00, 0.00e+00; 400Ms/s)
Return              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

Calibration Constants 200Ms/s 20 µs/div

C1 trigger threshold level

HF	t2:-3.91e-04	t1: 12.98	hyst. -0.23	[0.159±-12.82]
AC	t2:-3.91e-04	t1: 12.98	hyst. -0.23	[0.159±-12.82]
LF REJ	t2:-3.79e-04	t1: 12.60	hyst. -0.22	[0.163±-12.43]
HF REJ	t2: 3.82e-04	t1:-11.53	hyst. 0.22	[0.998± 12.53]
DC	t2:-3.77e-04	t1: 13.67	hyst. -0.22	[1.325±-12.34]

C2 trigger threshold level

HF	t2:-4.01e-04	t1: 13.29	hyst. -0.23	[0.151±-13.14]
AC	t2:-4.01e-04	t1: 13.29	hyst. -0.23	[0.151±-13.14]
LF REJ	t2:-3.95e-04	t1: 13.06	hyst. -0.23	[0.119±-12.94]
HF REJ	t2: 3.90e-04	t1:-11.89	hyst. 0.22	[0.906± 12.79]
DC	t2:-4.00e-04	t1: 14.24	hyst. -0.23	[1.144±-13.09]

trigger counter interval 2.569 ns

Trig Calibr Constants
TDC Calibr
Phase Constants
Recalibrate Trig Counter
Chan 1+2 Gain Test
SS-FIR Corr ON/OFF
RIS-FIR Corr ON/OFF
Return

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
TDC offset in ns	-13.220	-5.899	-10.880
TDC gain in ps/LSB	12.86	5.17	10.35
# in lower peak	543	220	240
# in upper peak	457	279	260
# outside histo	0	1	0
1st lower edge	1021	1137	1051
2nd lower edge	1036	1148	1052
Final lower edge	1028	1142	1051
Final upper edge	2000	2110	2017
Calibration	OK	OK	OK

RIS FIR Correction Factors

CHAN1	CHAN2
-1.00%	0.00%

Trig Calibr Constants
TDC Calibr

Phase Constants

Recalibrate Trig Counter

Chan 1+2 Gain Test

SS-FIR Corr ON/OFF

RIS-FIR Corr ON/OFF

Return

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.

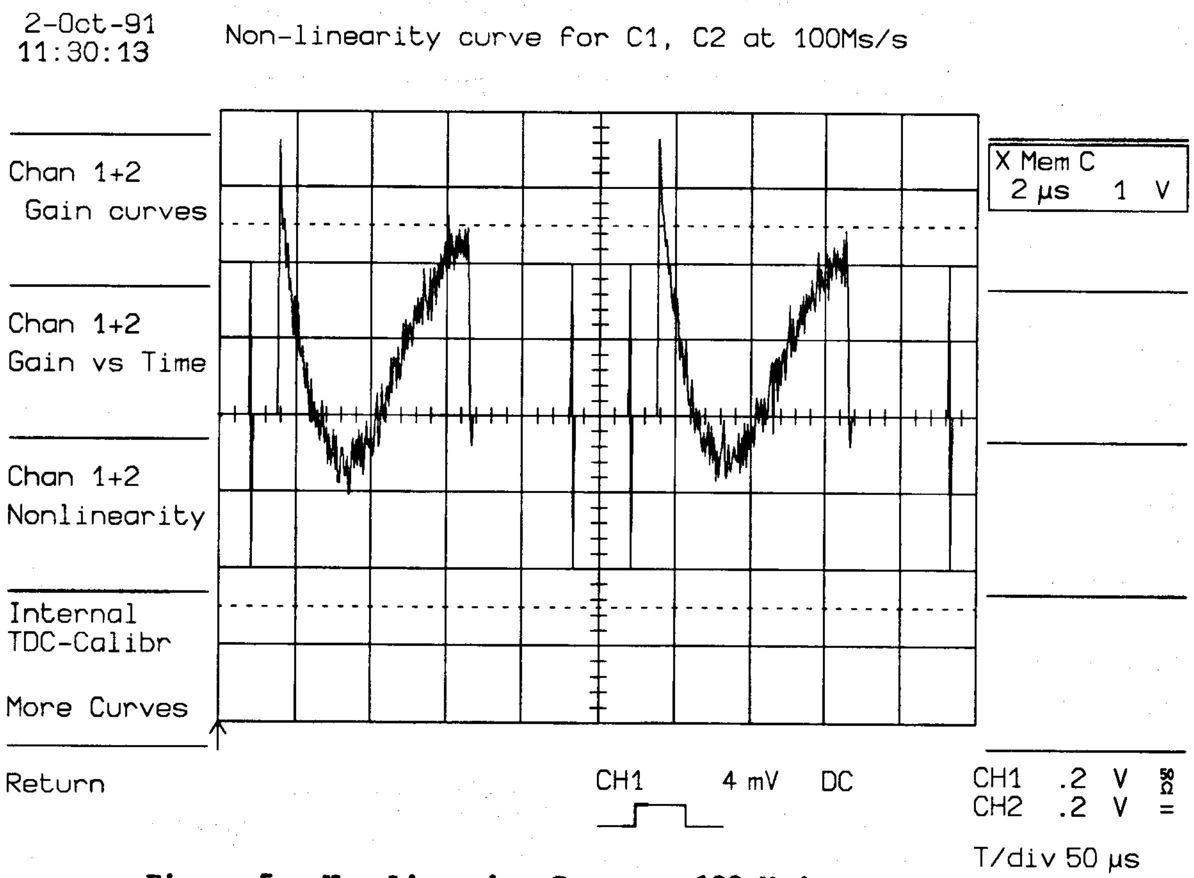


Figure 5 : Non Linearity Curve at 100 Ms/s

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.

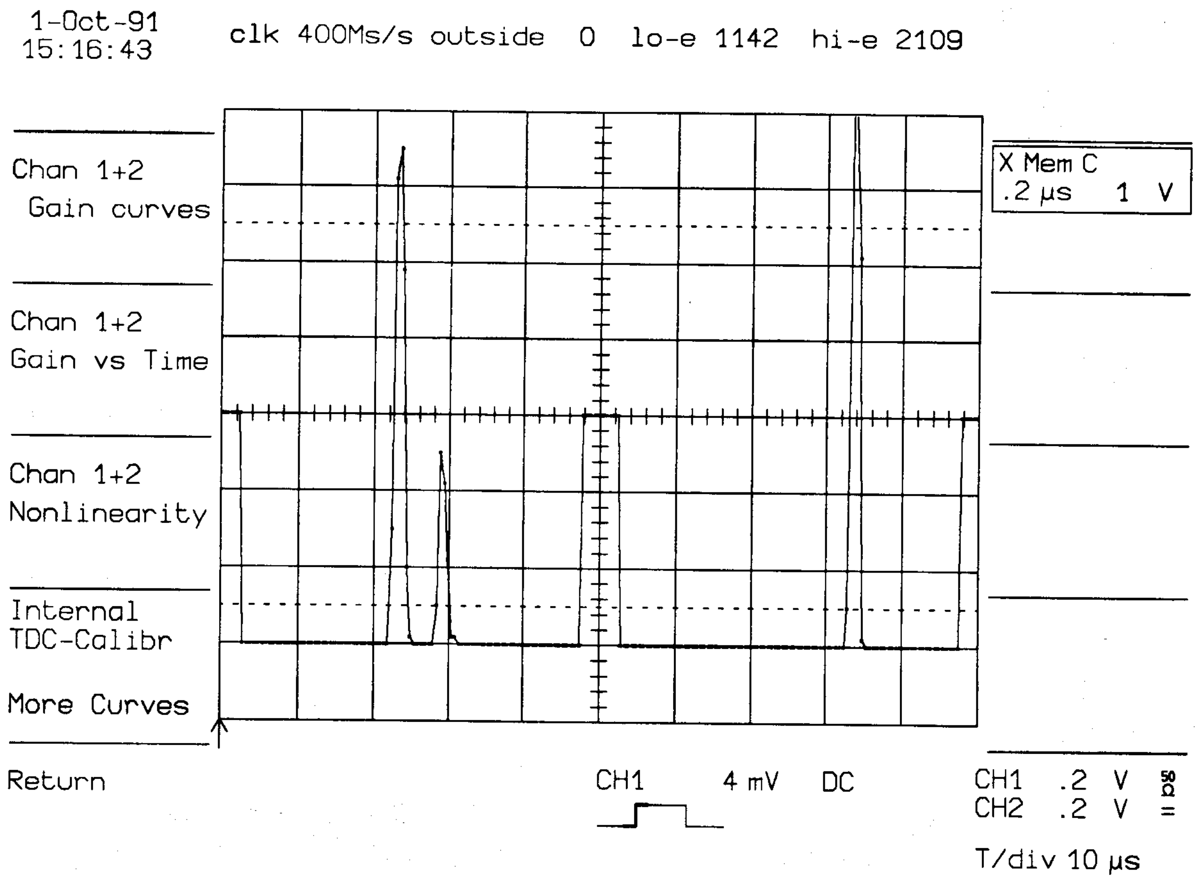


Figure 6 : Internal TDC Calibration at 400Ms/s

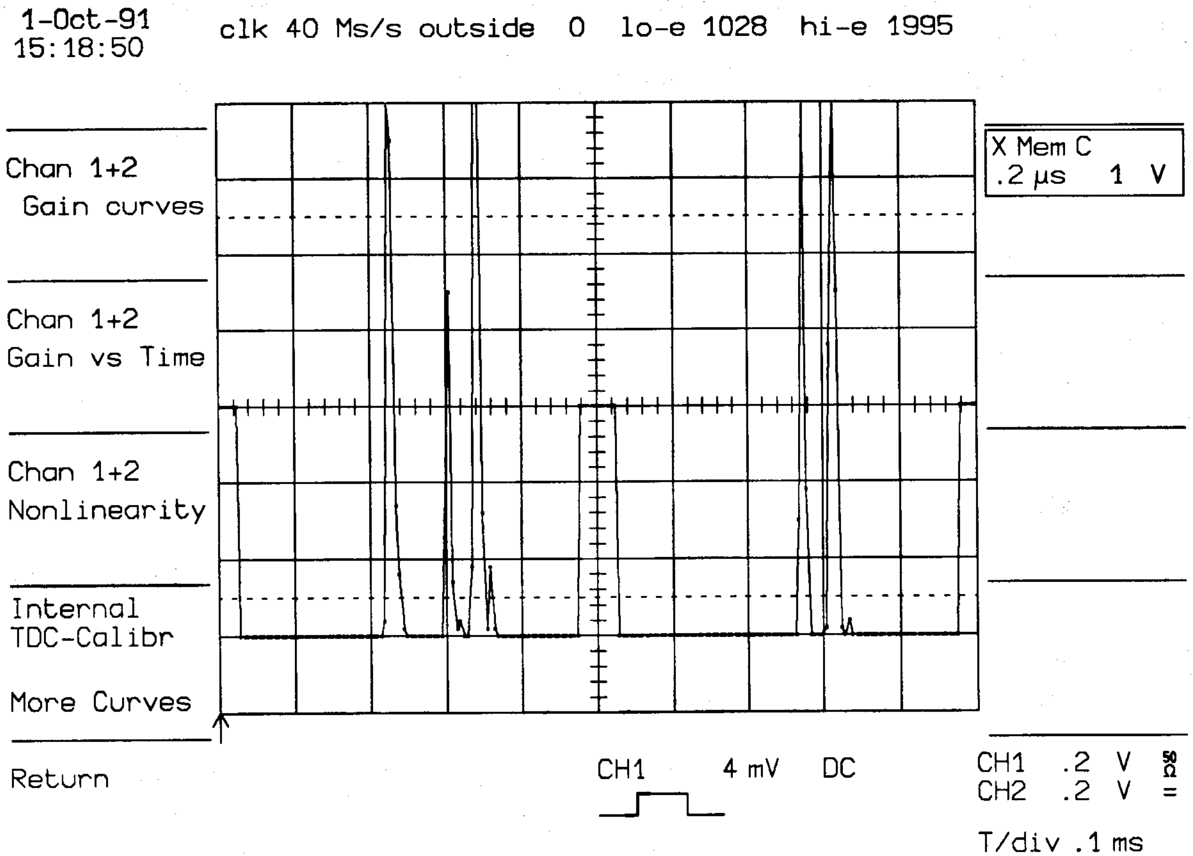


Figure 7 : Internal TDC Calibration at 40 Ms/s

1-Oct-91
15:12:52

Trig Calibr Constants
TDC Calibr
Phase Constants
Recalibrate Trig Counter
Chan 1+2 Gain Test
SS-FIR Corr ON/OFF
RIS-FIR Corr ON/OFF
Return

TDC CALIBRATION ANALYSIS

Sampl. Frequency	40 Ms/s	100Ms/s	200Ms/s
TDC offset in ns	-13.220	-5.899	-10.880
TDC gain in ps/LSB	12.86	5.17	10.35
# in lower peak	543	220	240
# in upper peak	457	279	260
# outside histo	0	1	0
1st lower edge	1021	1137	1051
2nd lower edge	1036	1148	1052
Final lower edge	1028	1142	1051
Final upper edge	2000	2110	2017
Calibration	OK	OK	OK

RIS FIR Correction Factors

CHAN1	CHAN2
-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° 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° 3).

3.2.7.1 Leveling Calibration

The internal calibration levels all ADC's (0, 1, 2) to the reference ADC's n° 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° 3 (reference), and should be between 10 and F0 for the ADC's n° 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
Coars Off	88 8b 8d 80	95 95 91 80
Delays	5d 88 a2 72	4f 83 b0 53
Gain Corr	99 95 8f 80	92 8d 9f 80
Fine Off	6b 72 6f 80	6e 77 6e 80

Phase Fit & Code	CHAN 1			0		CHAN2		0
	0	1	2	3	0	1	2	3
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
d gain	1.007	0.999	0.990	1.004	1.003	1.001	1.003	0.993
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

	CHAN 1	CHAN 2
Mean Phase	21.94	19.32
Slope	2.5e+04	2.7e+04
D-Period	-1.5e-03	-1.5e-03
# Points	351	318

Dyn Corr

Phase ps

Menu:

Trig Calibr Constants
TDC Calibr

Phase Constants

Recalibrate Trig Counter

Chan 1+2 Gain Test

SS-FIR Corr ON/OFF

RIS-FIR Corr ON/OFF

Return

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)
Chan 1+2      (8=Offset Range, 4=Offset Conv, 2=Gain Range, 1=Gain Conv)
 Calib Const
                               CHAN1       CHAN2
               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        4 nibbles = (400Ms) (200Ms) (100Ms) (40Ms)
Error Log
Manual FE     Trigger Cal.       0           0  (2=No BWL, 1=BWL)
DAC Control
              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

TABLE OF CONTENTS

4.1 Disassembly and Assembly Procedure

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

Please study the diagram and figures before attempting disassembly.

***** 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)

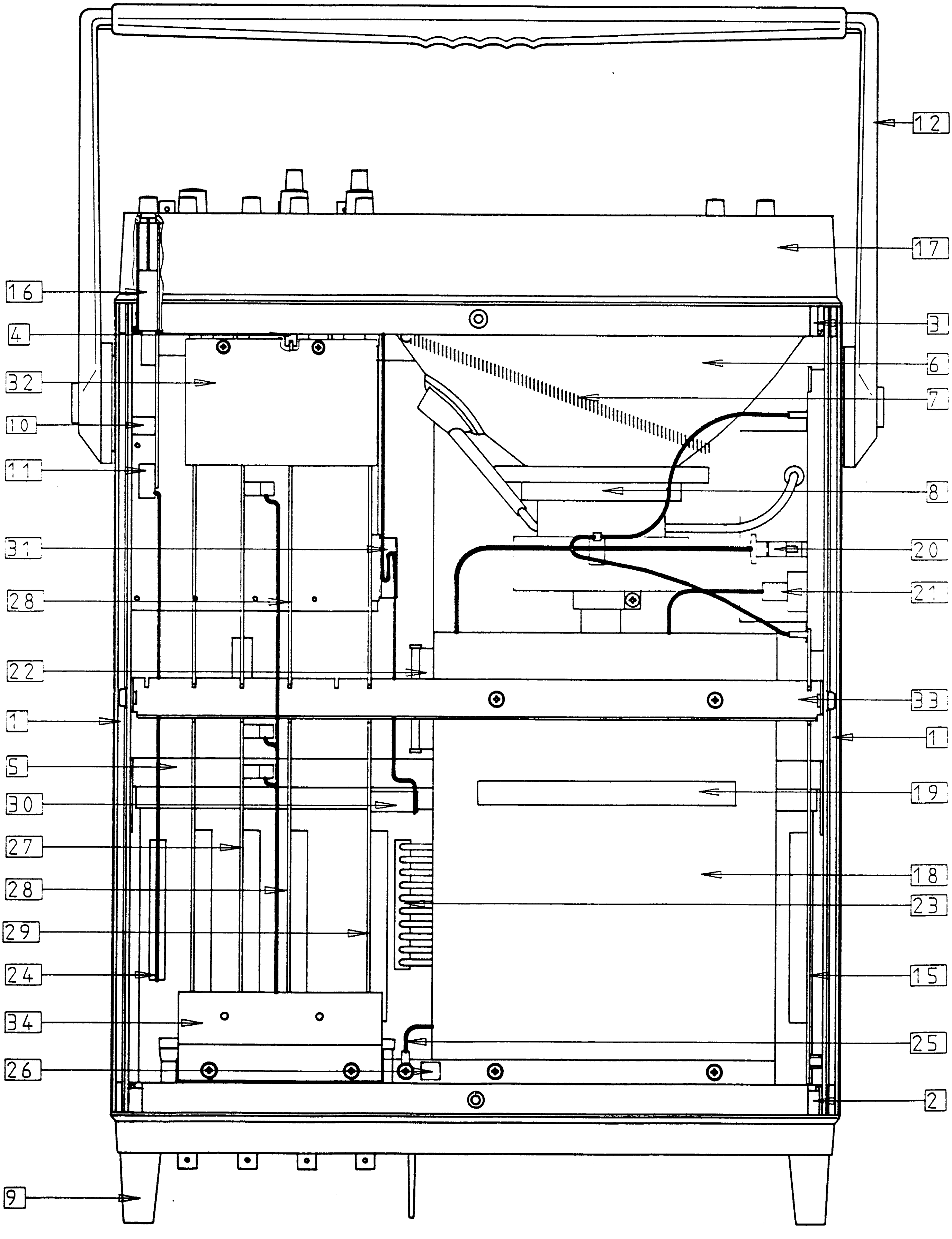

12
17
16
3
4
6
32
7
10
11
8
31
20
28
21
22
33
1
1
5
19
30
27
18
28
23
29
24
15
34
25
26
2
9

Figure 4.1.

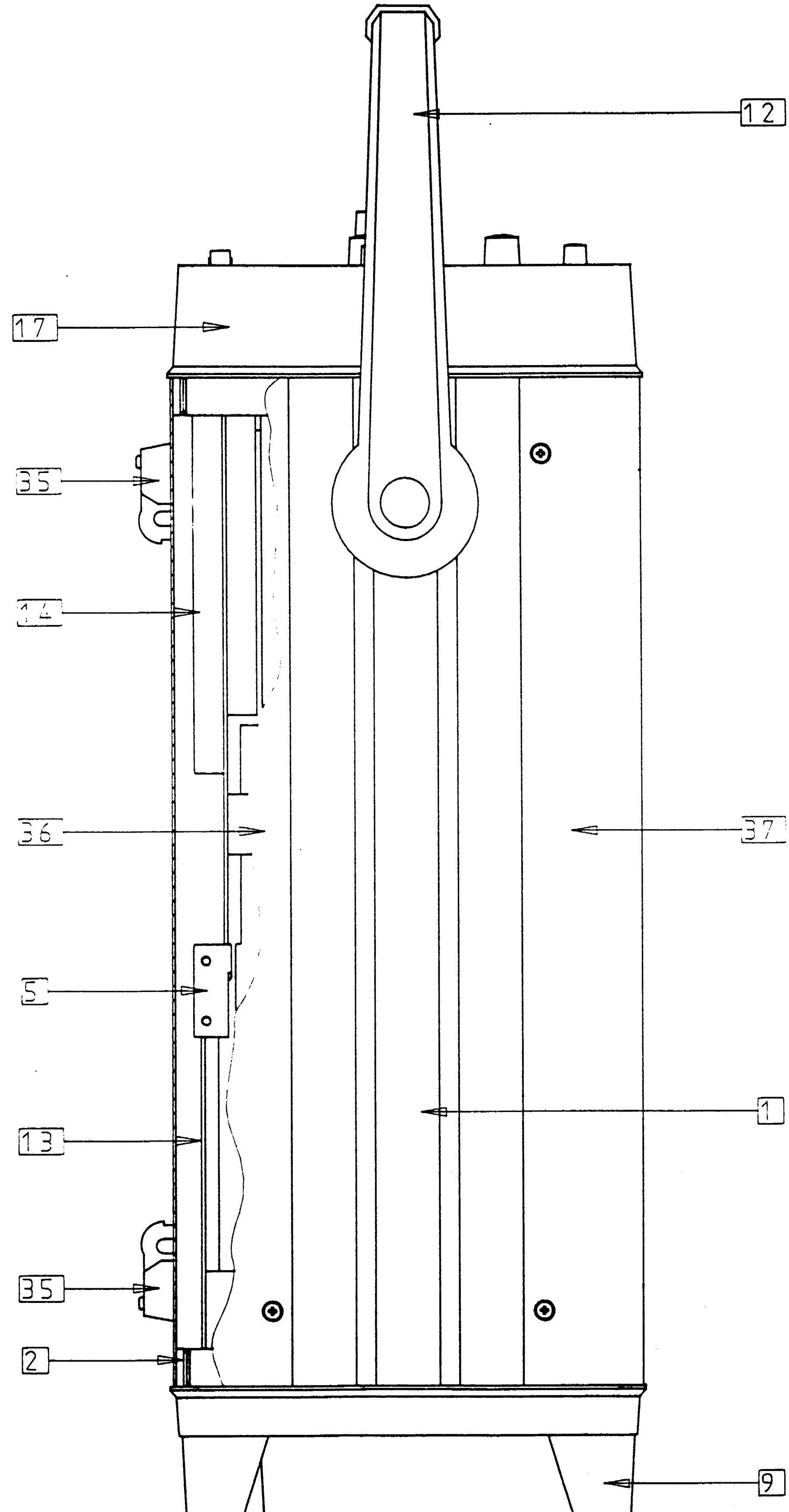


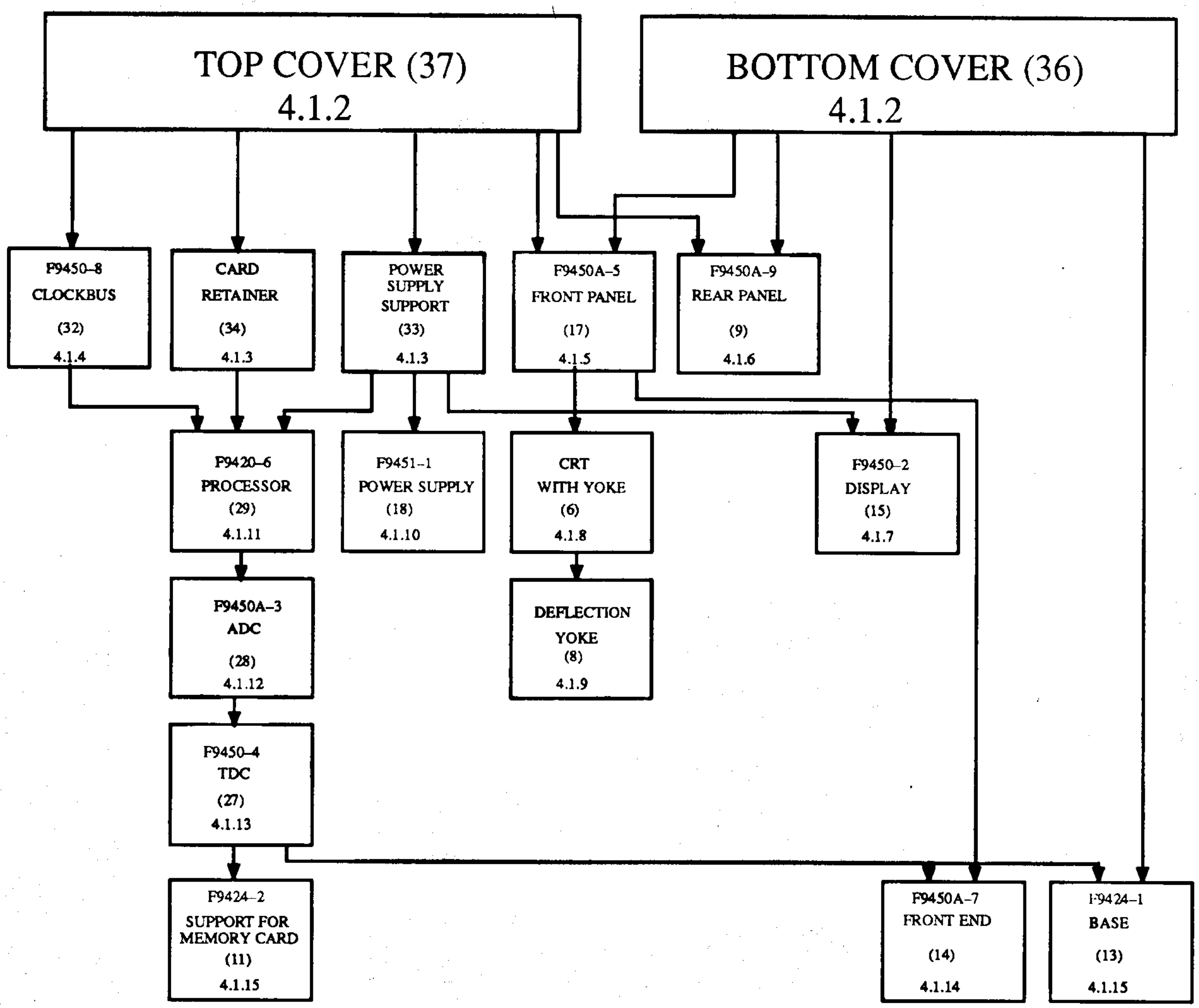
Figure 4.2.

ASSEMBLAGE SEQUENCE OF PARTS				SCREWS		WASHERS		NUTS	
POS	DESCRIPTION	PART NUMBER	QTY	PART NUMBER	QTY	PART NUMBER	QTY	PART NUMBER	QTY
1	SIDE PANEL	709 424 021	2						
2	REAR SUPPORT	709 424 041	1	550 440 108	4	551 440 300	4		
3	DISPLAY SUPPORT	709 424 031	1	550 440 108	4	551 440 300	4		
4	CARD GUIDE	530 410 001	5	550 430 104	10	551 430 300	10		
5	MOTHER CARD SUPPORT	709 424 051	1	550 440 108	4	551 440 300	4		
6	CRT ORANGE	321 220 009	1	550 440 416	4	554 440 202 709 450 071	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 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 DSO.

4.1.7 Removal of the F9450-2 Display Board

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

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

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

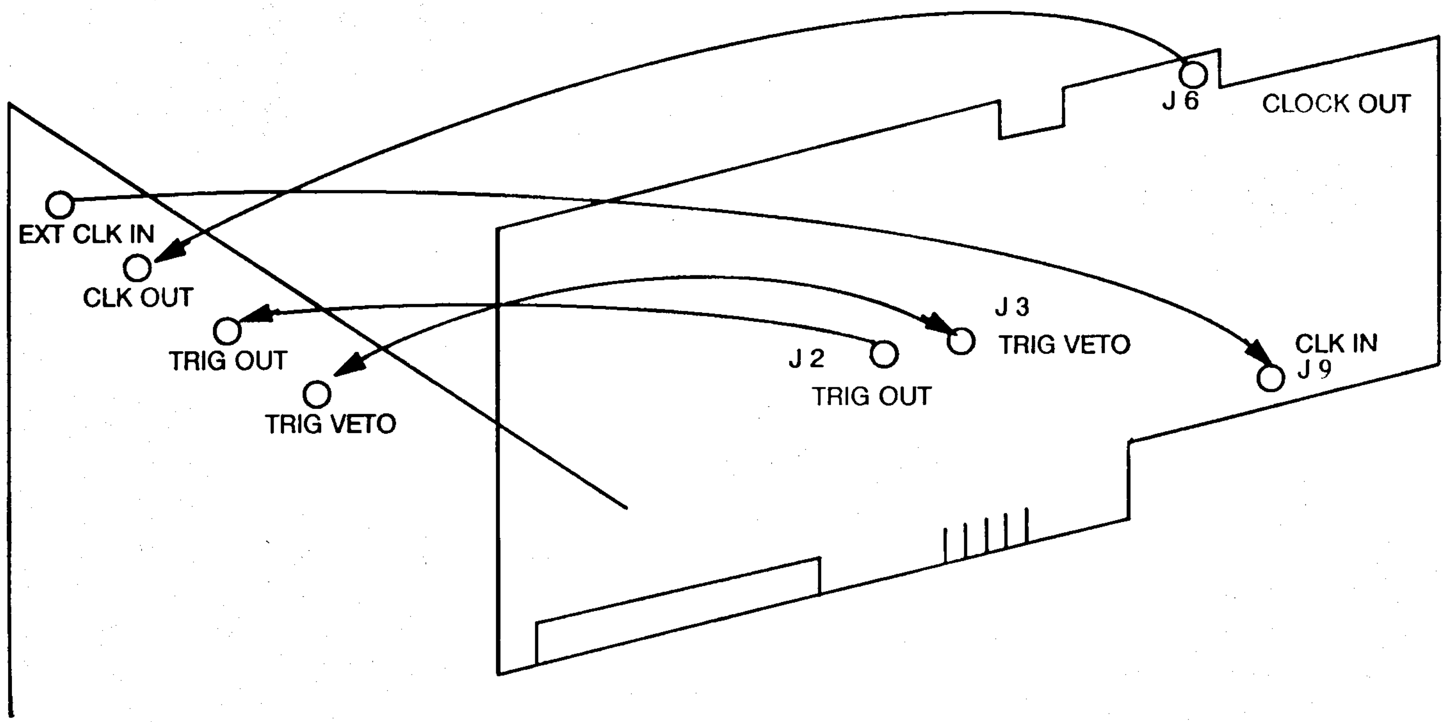


Figure 4.4

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.

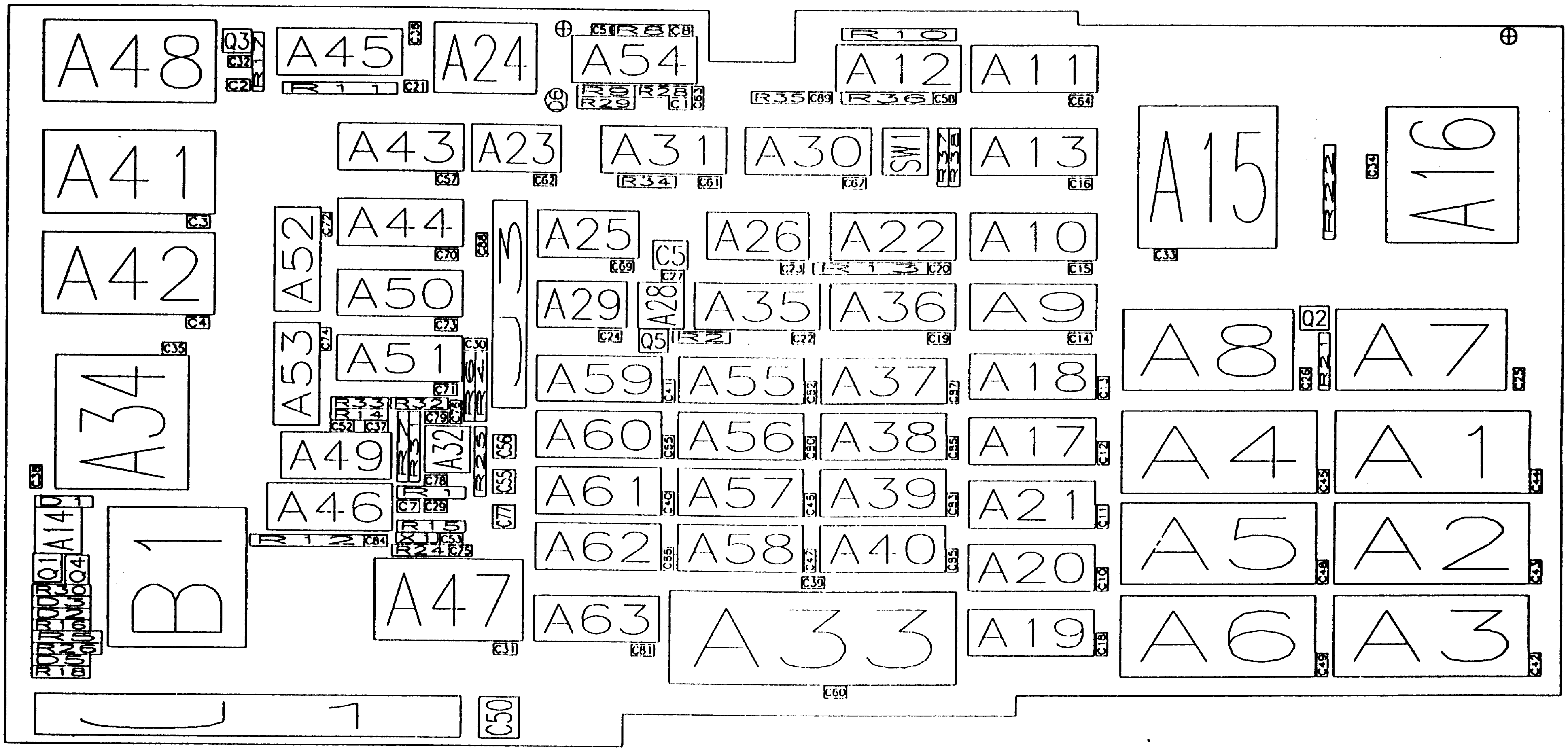
4.2 Software Upgrade Procedure

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.

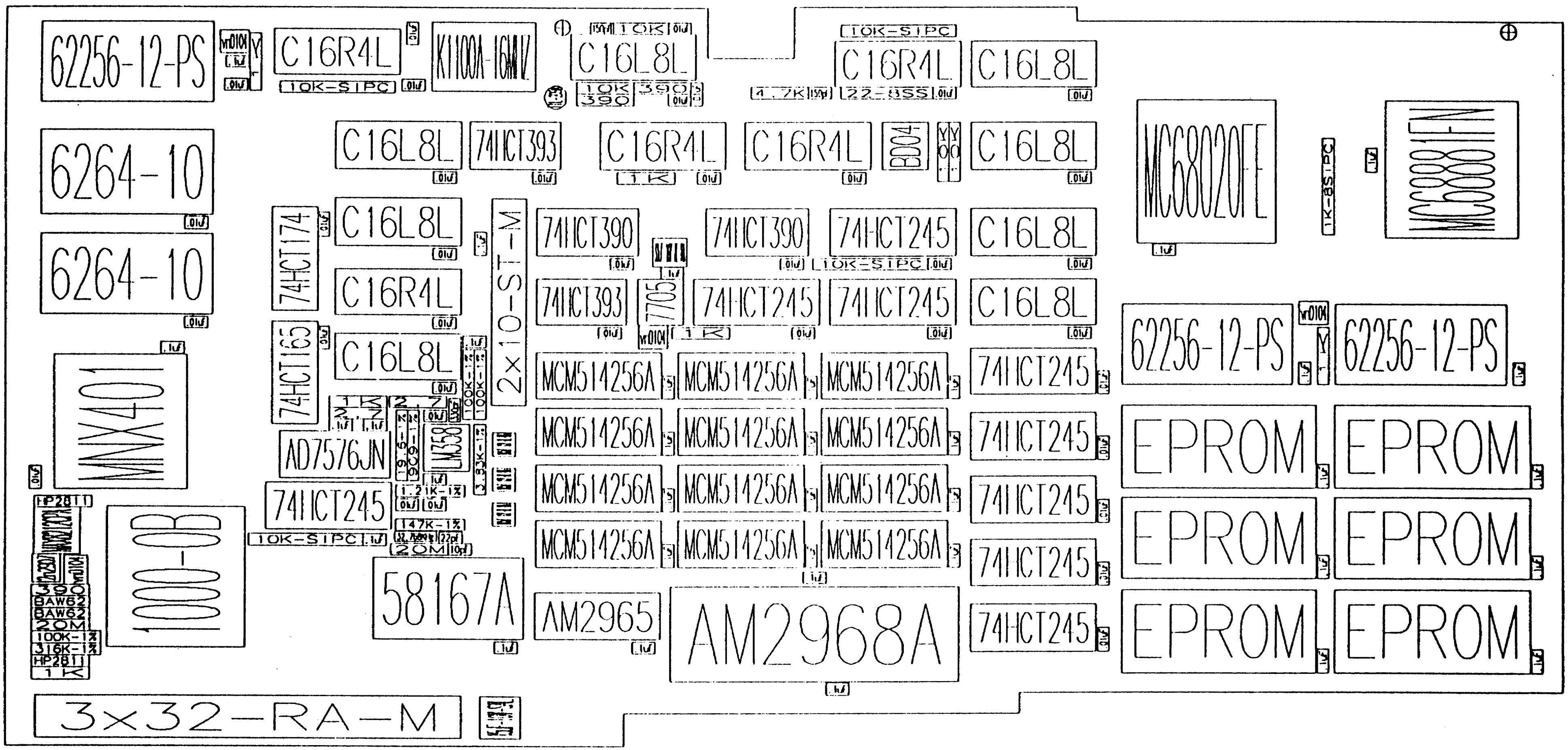
4.2.2 Changing software selection PAL

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

Figure 4.7

4.4 Board exchange procedure

4.4.1 F9424-1 Base board

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

PAL XXXX in location A22
XXXX = DSO serial number

WARNING: The replacement board is supplied without this PAL.

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

4.4.2 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:

```
                         top

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

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

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

Set DSO 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 DSO 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)
Chan 1+2       | (8=Offset Range, 4=Offset Conv, 2=Gain Range, 1=Gain Conv)
 Calib Const   |
               |              CHAN1      CHAN2
               |  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    |    4 nibbles = (400Ms) (200Ms) (100Ms) (40Ms)
Error Log      |
_______________|
Manual FE      | Trigger Cal.    0          0  (2=No BWL, 1=BWL)
DAC Control    |
               | 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

- 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

Chan 1+2 Calib Const | Chan 1+2 Full Test | Full Re-calibration | Calibration Error Log | Manual FE DAC Control | More Consts | Return

Calibration Constants 400Ms/s 5 μs/div

variable gain	C1 (5 mV)	C2 (5 mV)
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
dac 5 (8a3c= 0.4000mA)	1.0003	0.9872
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

offset
C1 (5 mV) o0:-1.9625 o1:-0.404 o2: 5.98e-05 [-0.0038± 1.9607]
C2 (5 mV) o0:-1.9230 o1:-0.669 o2: 5.87e-05 [-0.0027± 1.9237]

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
offset 8038 = -3.45e-03 V

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

14-Oct-91
16:34:18

Chan 1+2 Calib Const | Chan 1+2 Full Test | Full Re-calibration | Calibration Error Log | Manual FE DAC Control | More Consts | Return

Calibration Constants 400Ms/s 5 μs/div

variable gain	C1 (50 mV)	C2 (50 mV)
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
dac 5 (8a3c= 0.4000mA)	1.0996	1.1006
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

offset
C1 (50 mV) o0:-1.9692 o1: 0.580 o2: 6.07e-05 [0.0491± 1.9893]
C2 (50 mV) o0:-1.9271 o1: 0.794 o2: 5.86e-05 [0.0317± 1.9191]

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
offset 7d0b = 4.62e-02 V

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 (-)

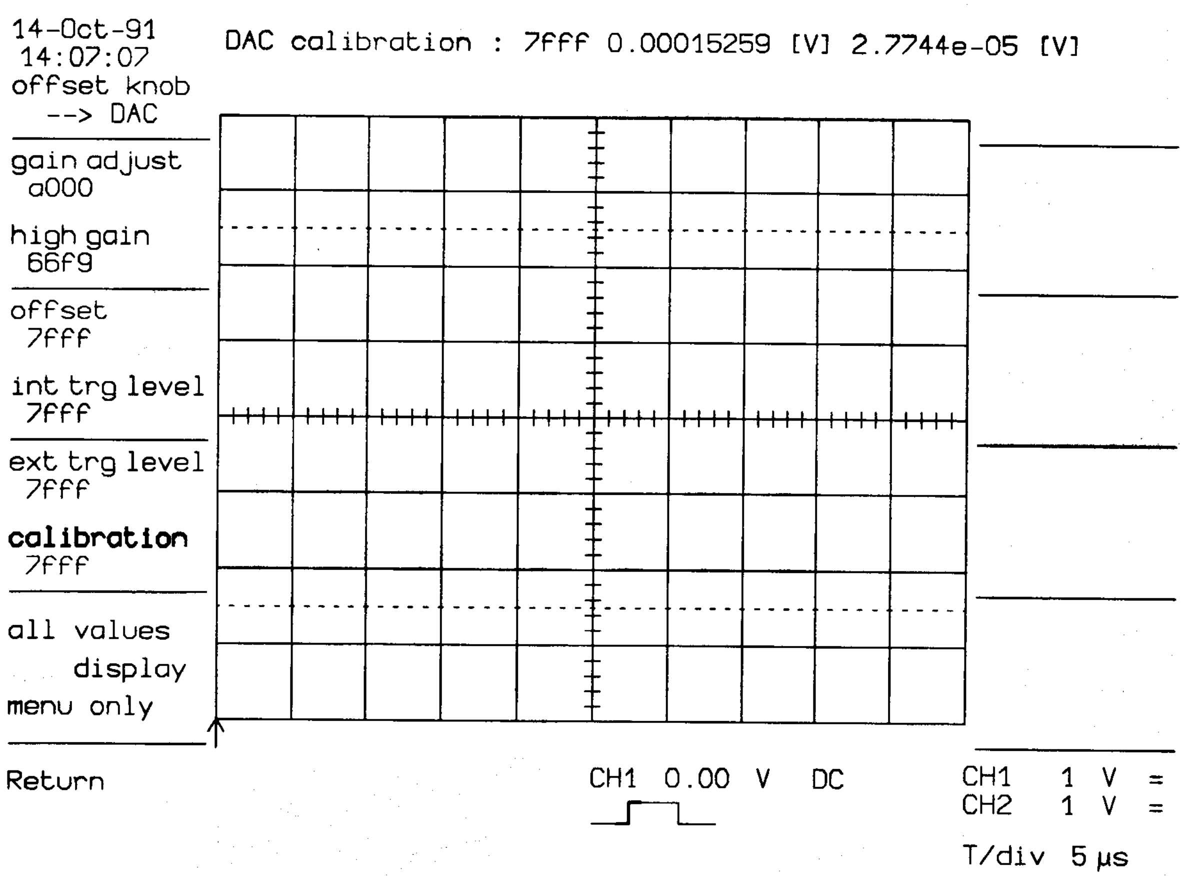


Figure 4 : DAC Calibration code 7FFF

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

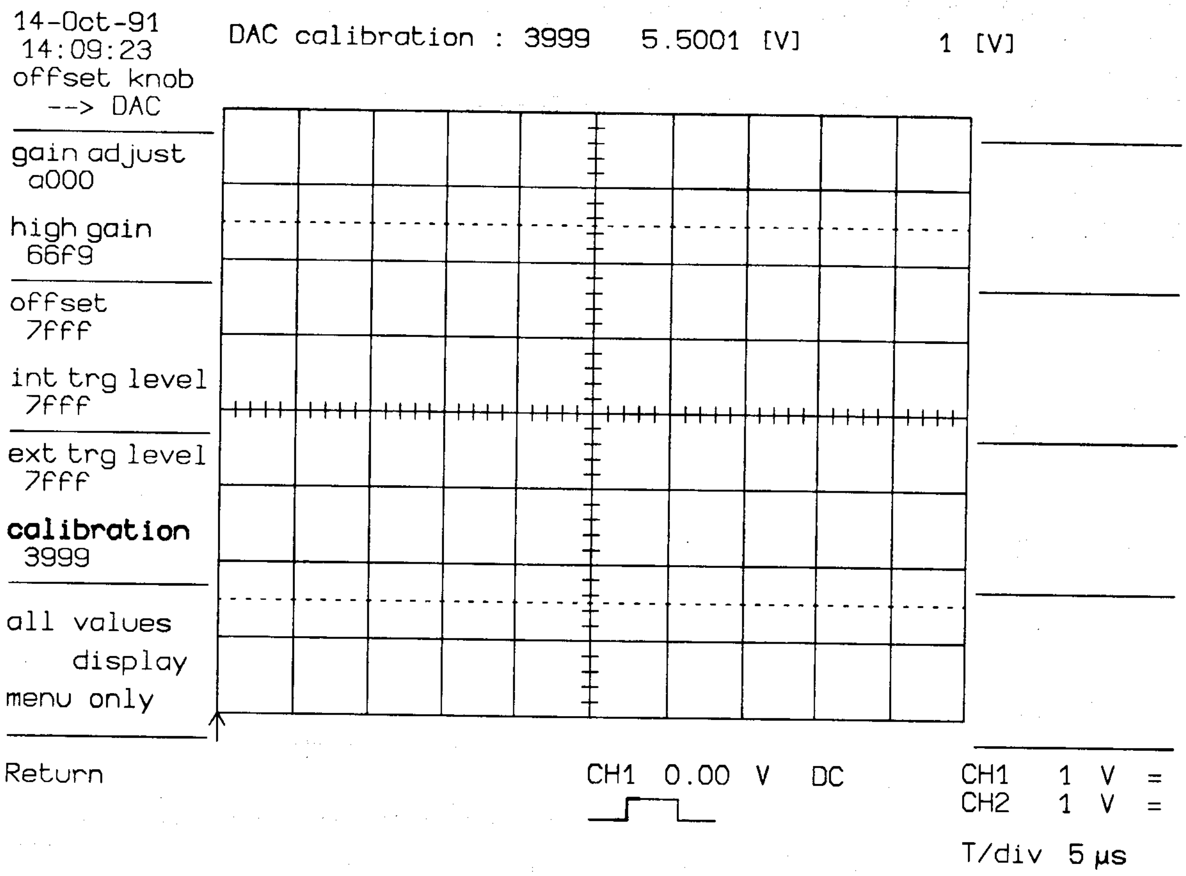


Figure 5 : DAC Calibration code 3999

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 betwwen pin 1 and pin 2 of TP2

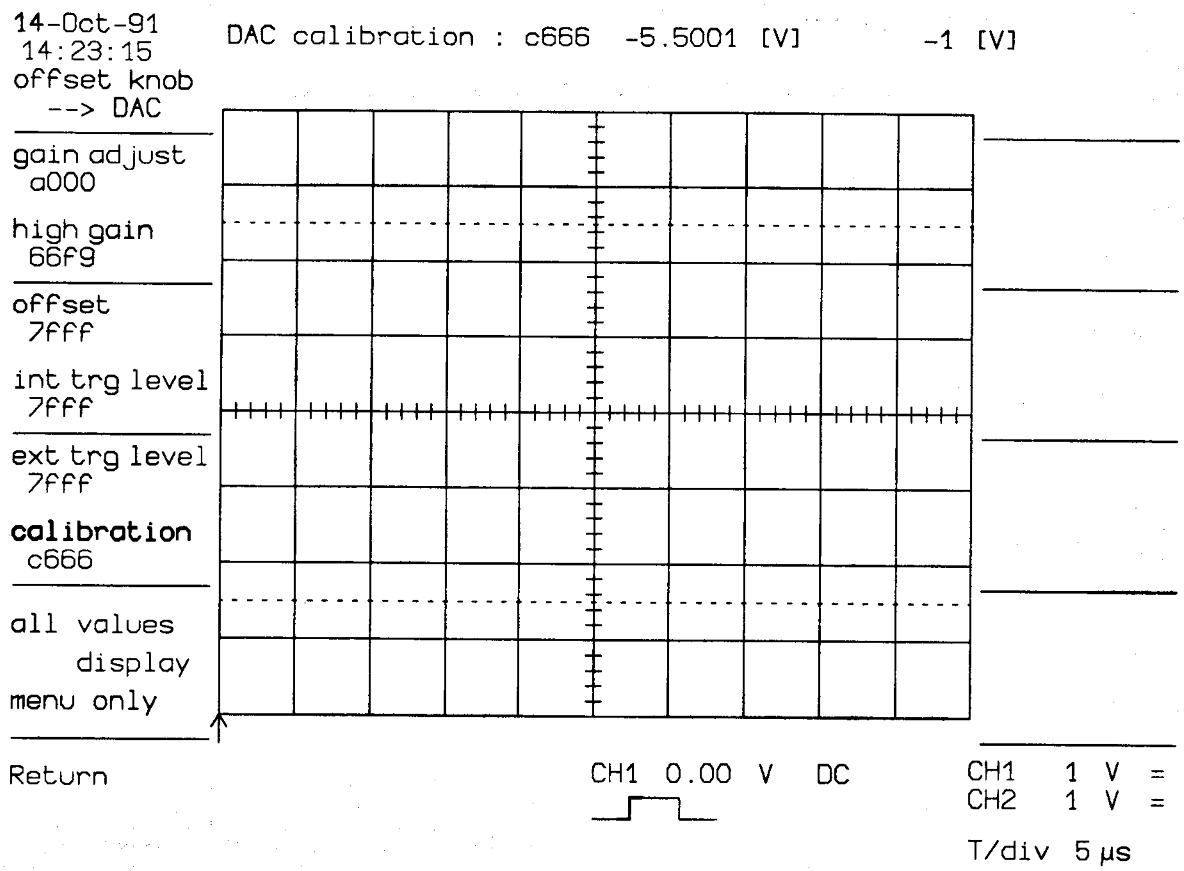


Figure 6 : DAC Calibration code C666

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.**

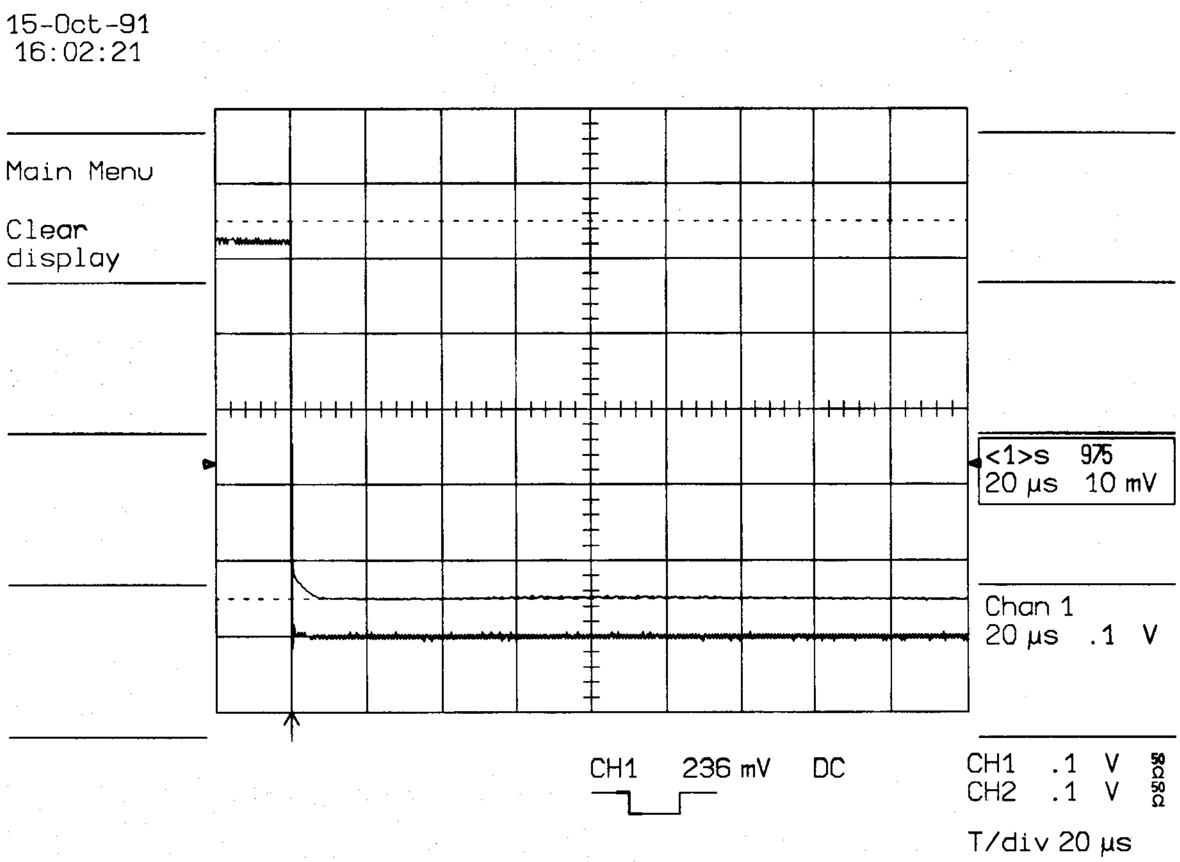


Figure 7 : CH1 Flatness adjustment with R128

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.

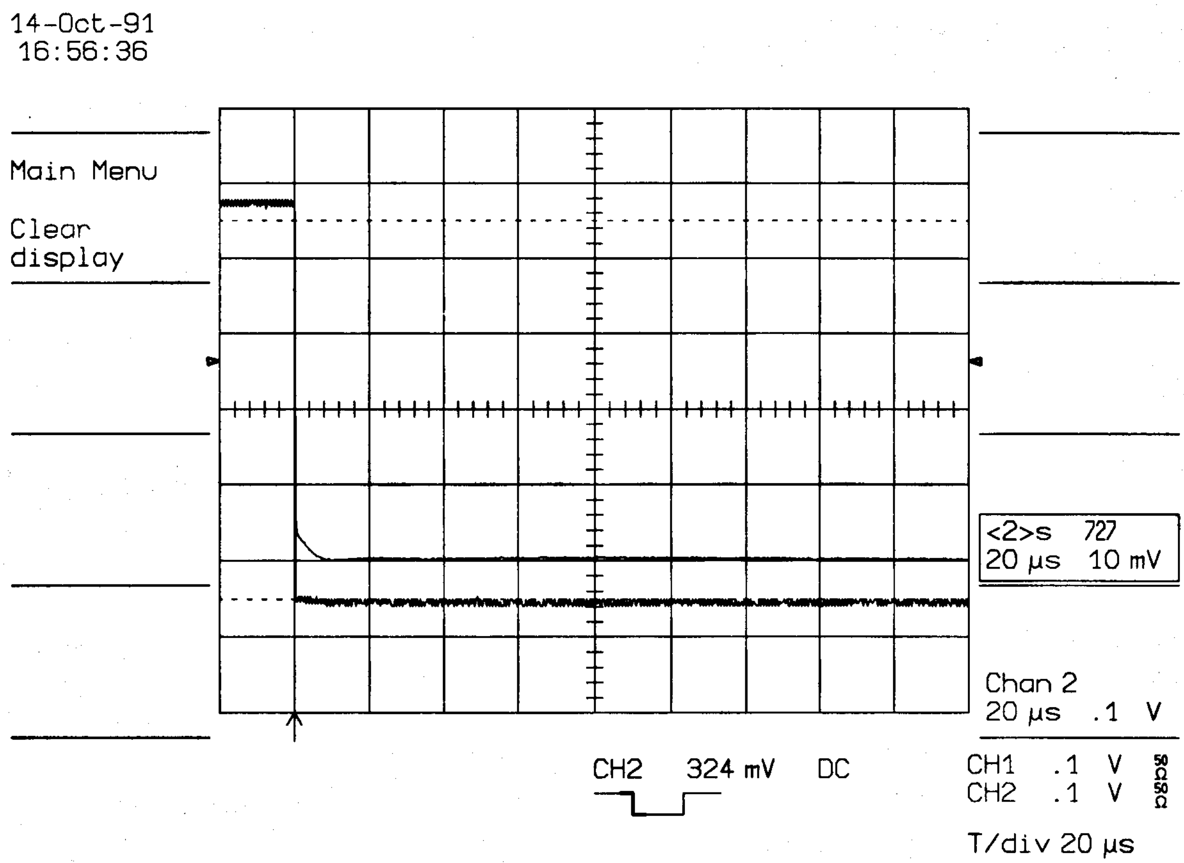


Figure 8 : CH2 Flatness adjustment with R228

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.

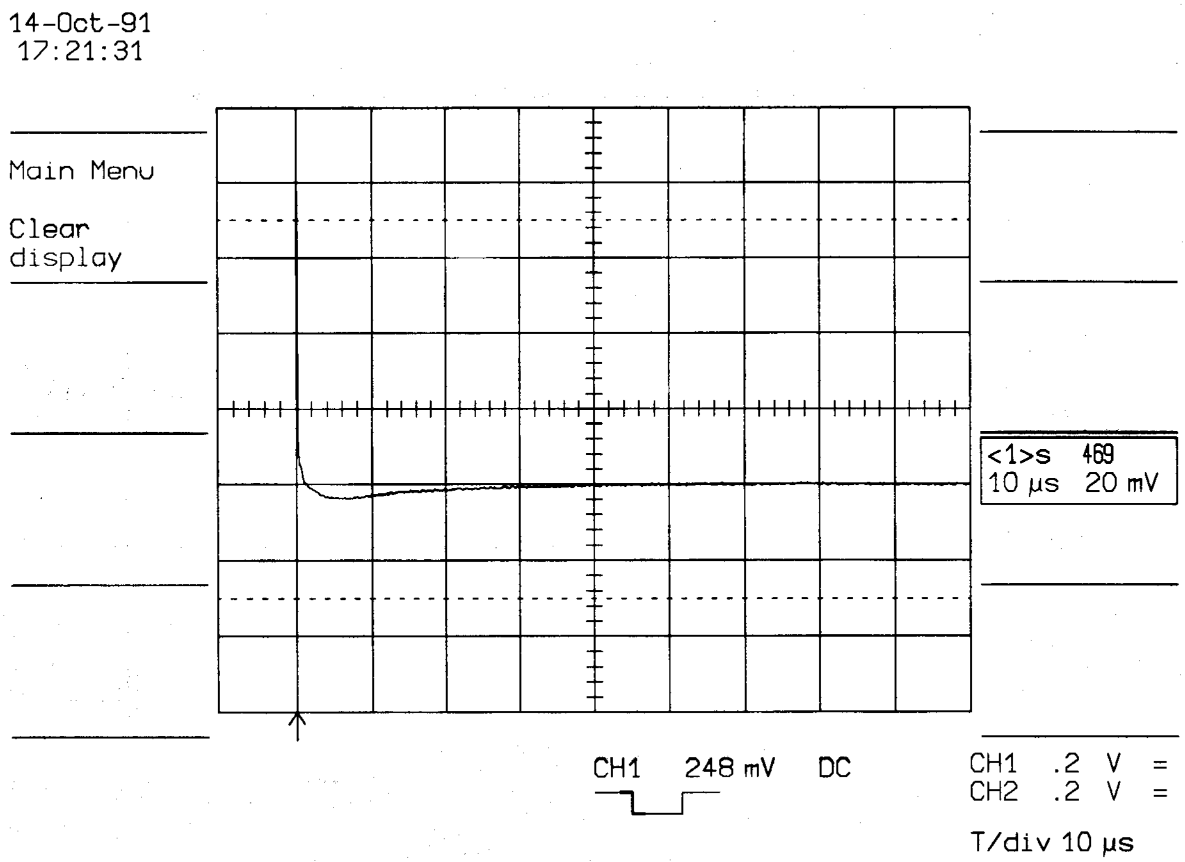


Figure 9 : CH1 Flatness adjustment with C107

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.**

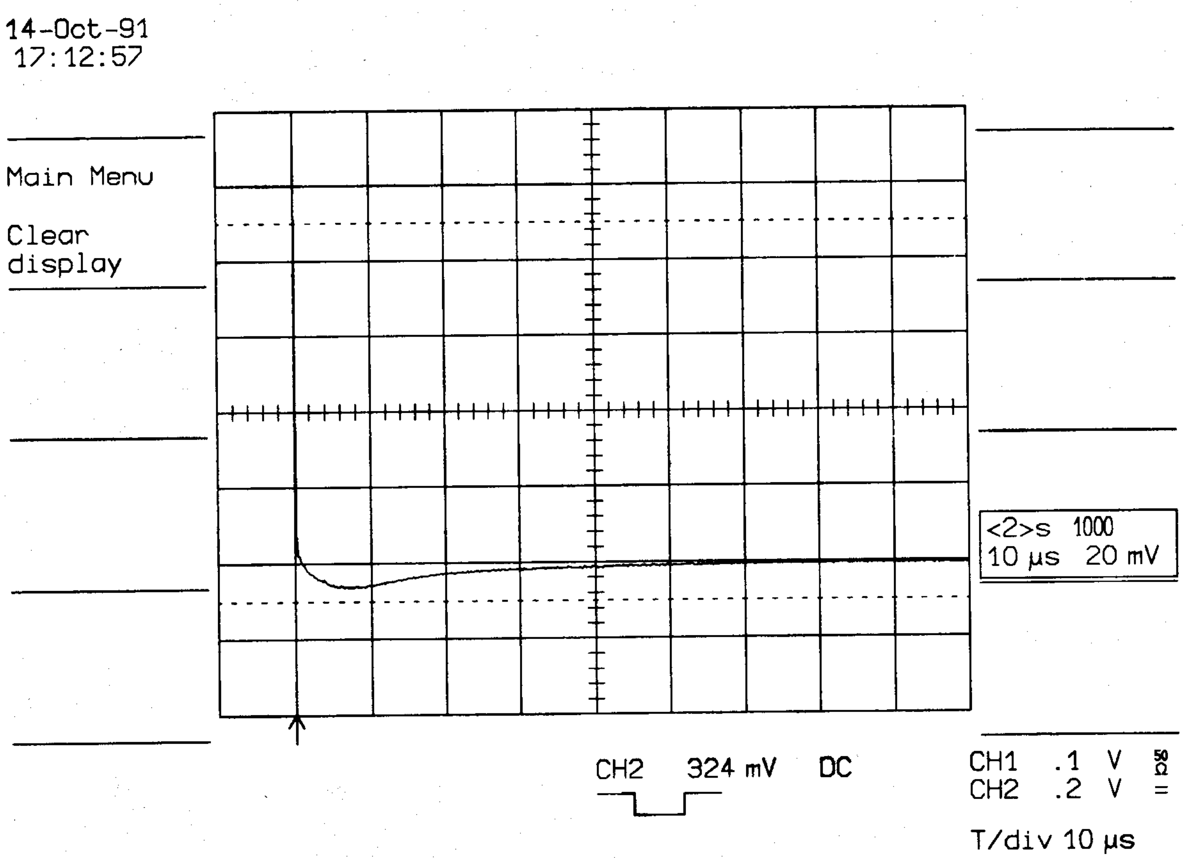


Figure 10 : CH2 Flatness adjustment with C207

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

15-Oct-91
14:39:13

Trig Calibr Constants
TDC Calibr
Phase Constants
Recalibrate Trig Counter
Chan 1+2 Gain Test
SS-FIR Corr ON/OFF
RIS-FIR Corr ON/OFF
Return

Calibration Constants   40 Ms/s   .1 ms/div

C1 trigger threshold level

HF	t2:-3.85e-04	t1: 12.85	hyst. -0.23	[0.237±-12.61]
AC	t2:-3.85e-04	t1: 12.85	hyst. -0.23	[0.237±-12.61]
LF REJ	t2:-3.79e-04	t1: 12.58	hyst. -0.23	[0.162±-12.42]
HF REJ	t2: 3.81e-04	t1:-11.89	hyst. 0.24	[0.606± 12.50]
DC	t2:-3.77e-04	t1: 13.28	hyst. -0.22	[0.931±-12.34]

C2 trigger threshold level

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

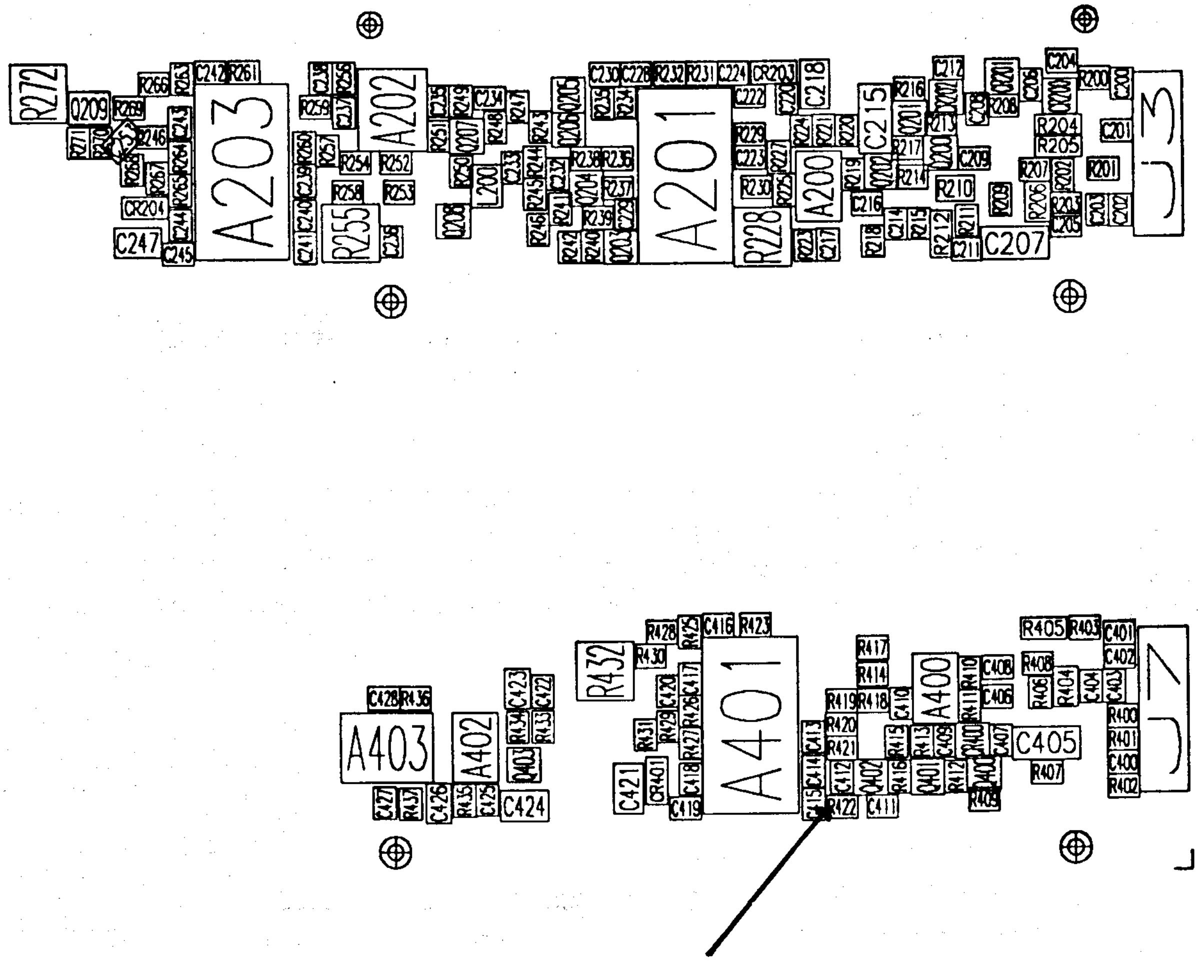
- Apply a fast risetime pulse (<700ps), 1KHZ, 5.5 V amplitude to the External Trigger input.

- 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

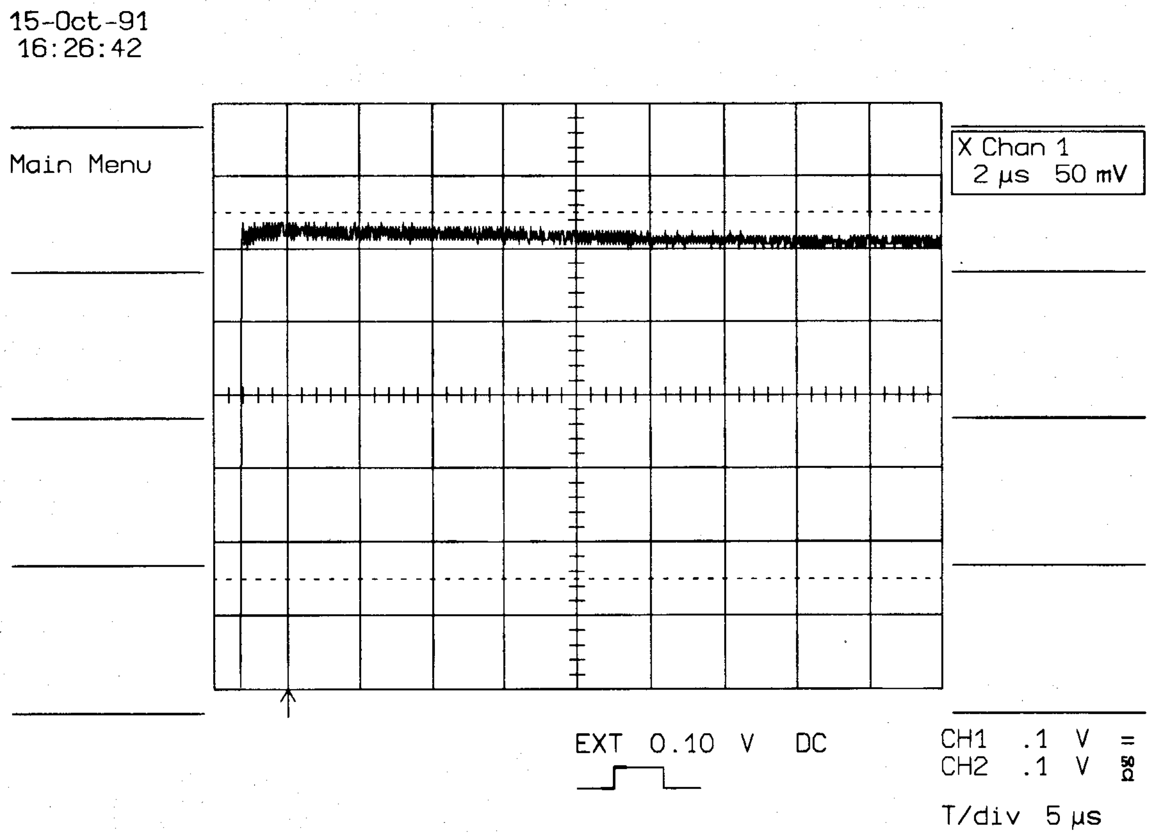


Figure 13 : External Trigger, HF Compensation with C405

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

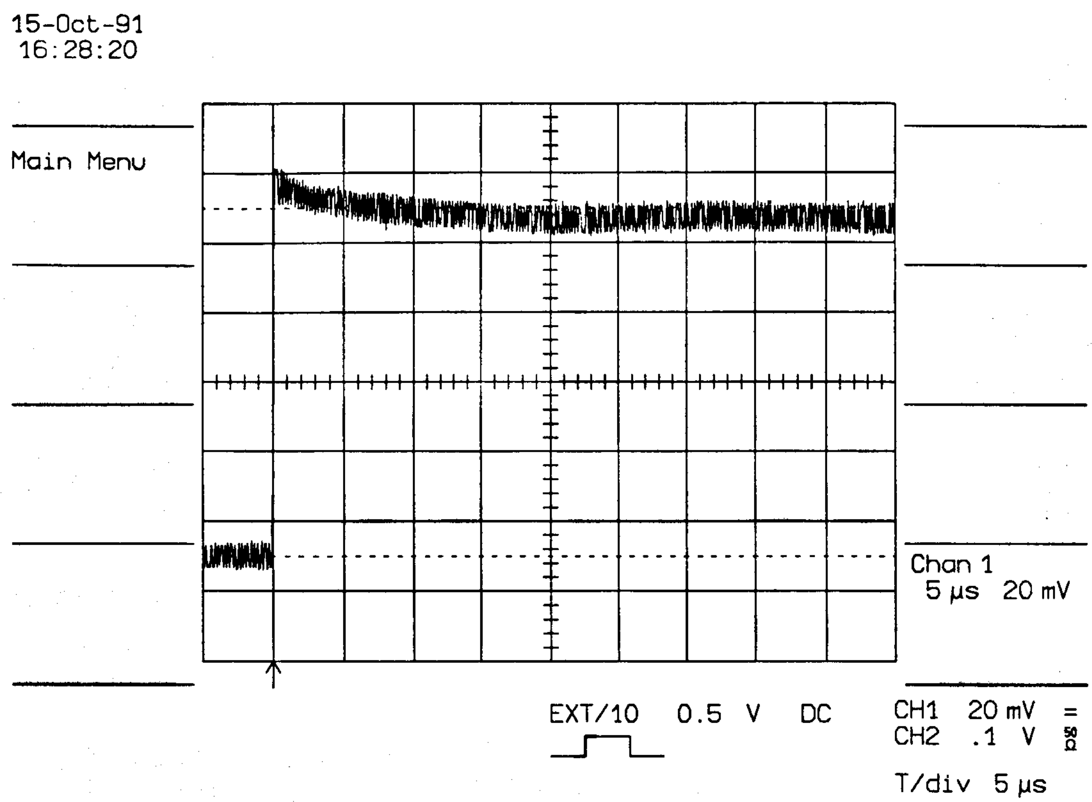


Figure 14 : External Trigger /10

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.

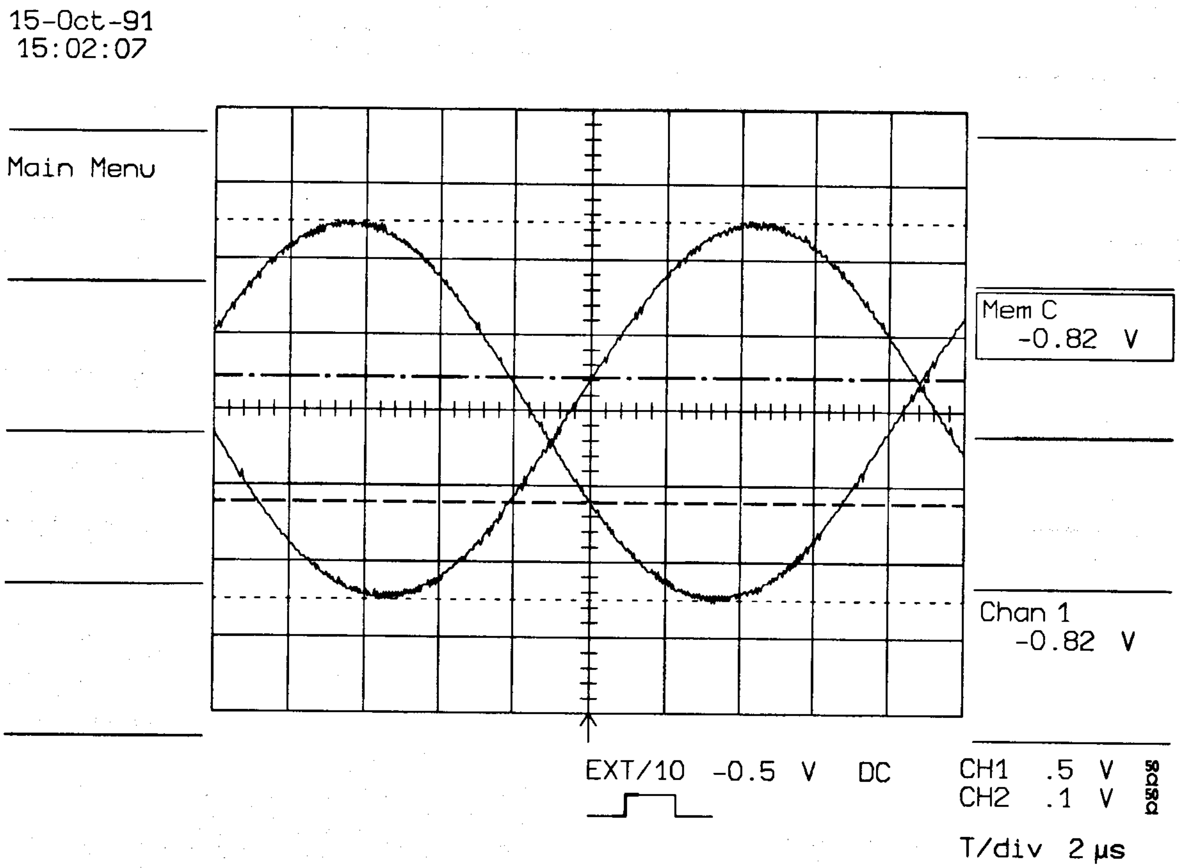


Figure 15 : R432 External Trigger Level Adjustment

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

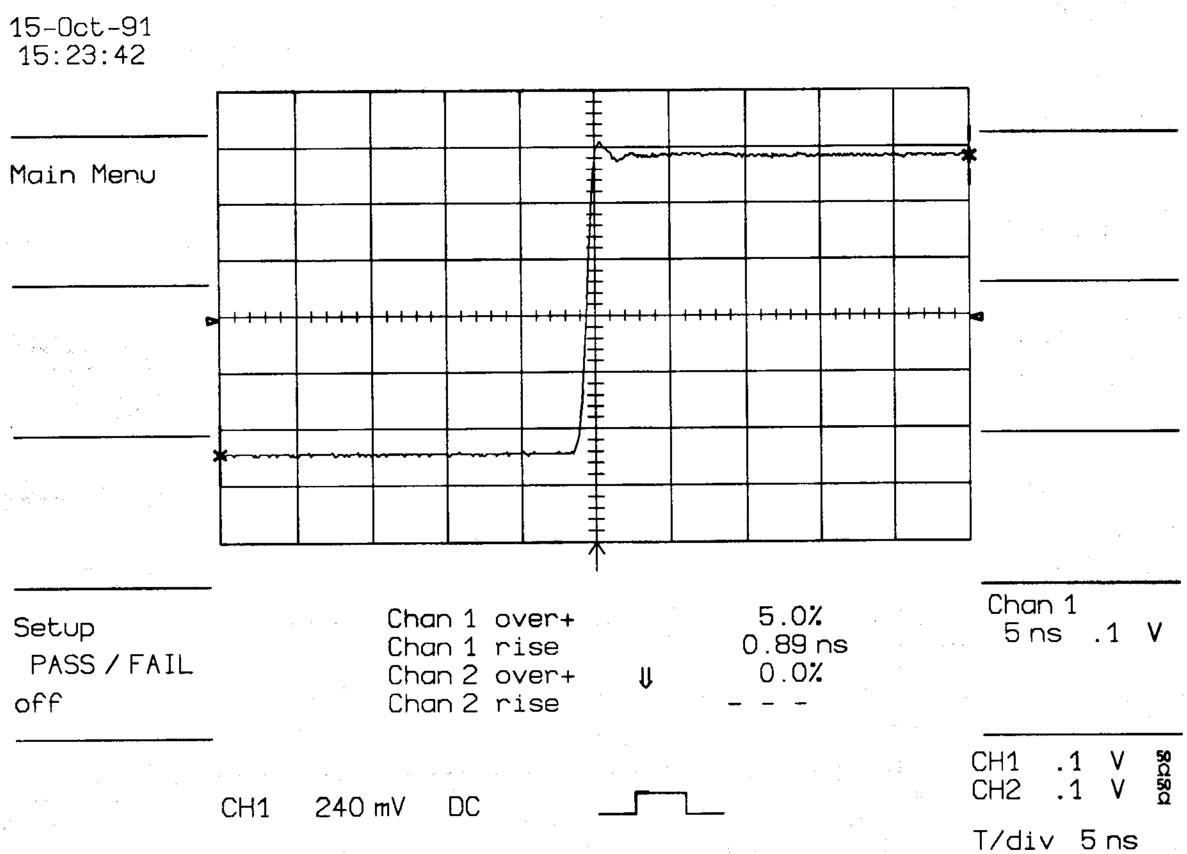


Figure 16 : CH1 Overshoot Compensation with C115

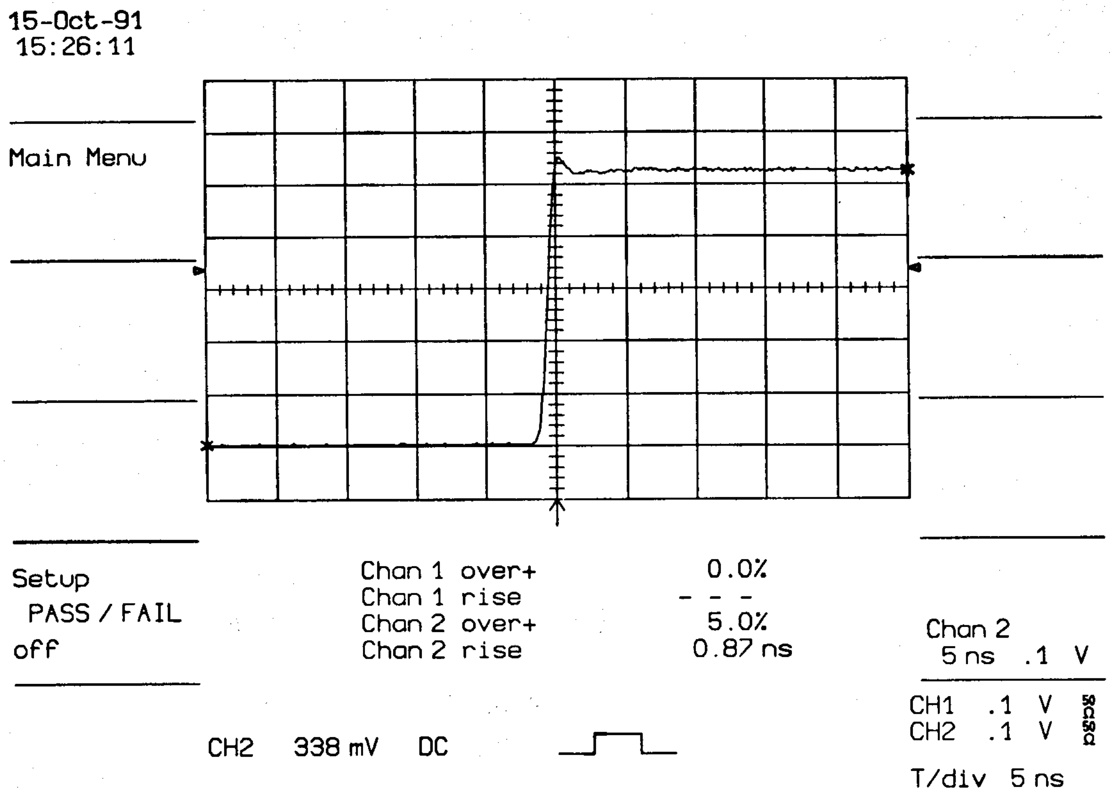


Figure 17 : CH2 Overshoot compensation with C215

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

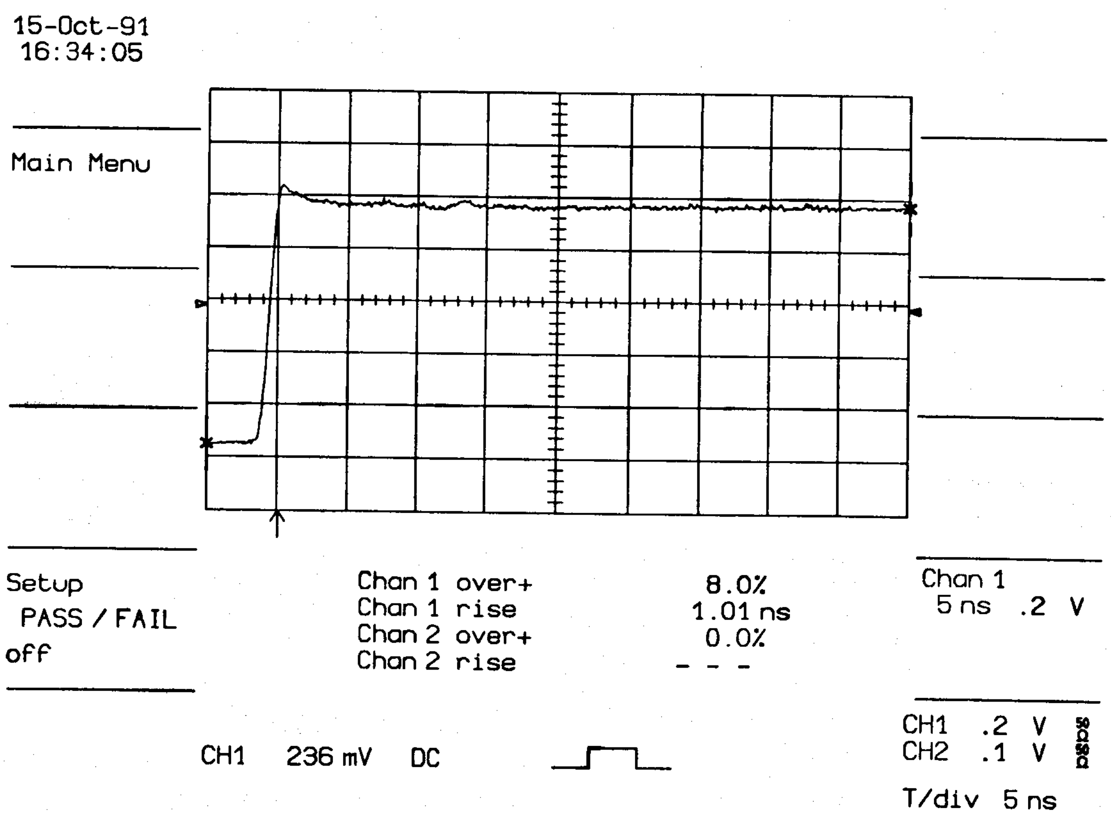


Figure 18 : CH1 Overshoot at 200 mV/div

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).

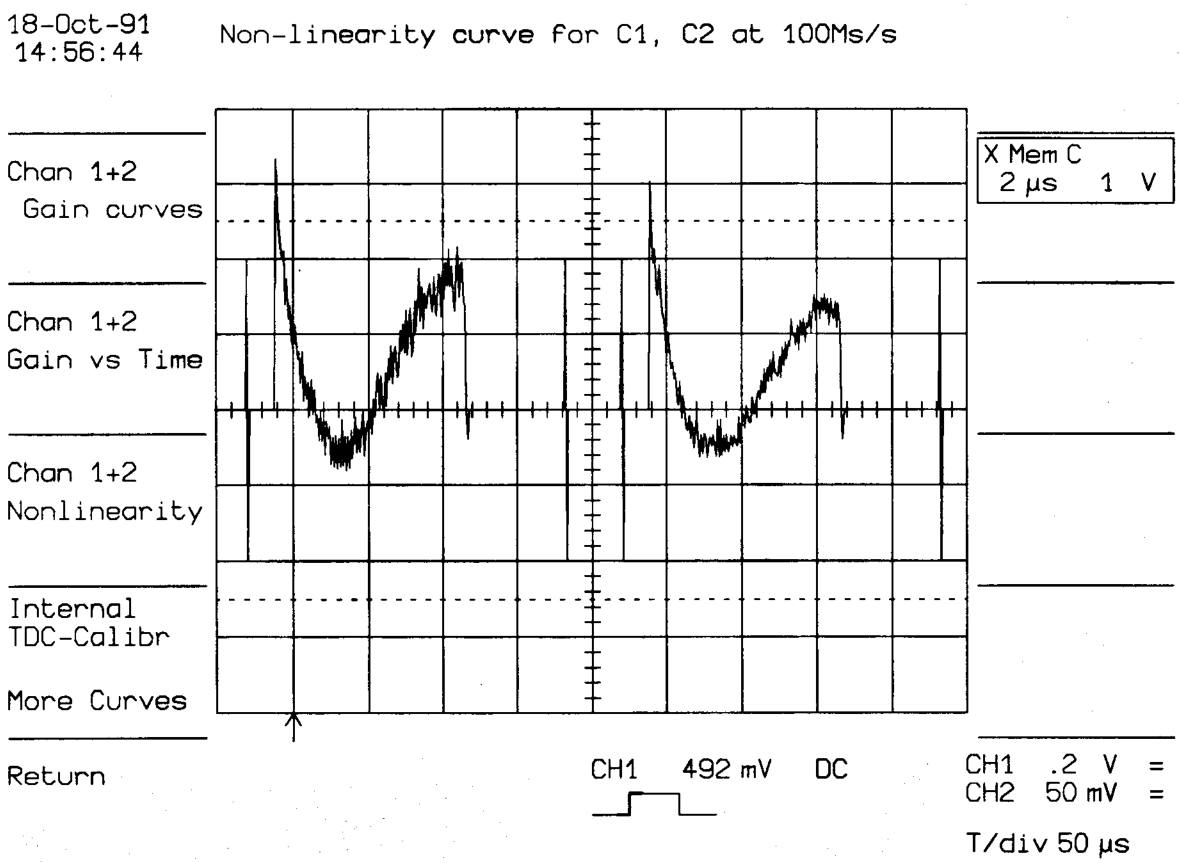


Figure 19 : CH1 and CH2 Non Linearity curve at 100 Ms/s

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.

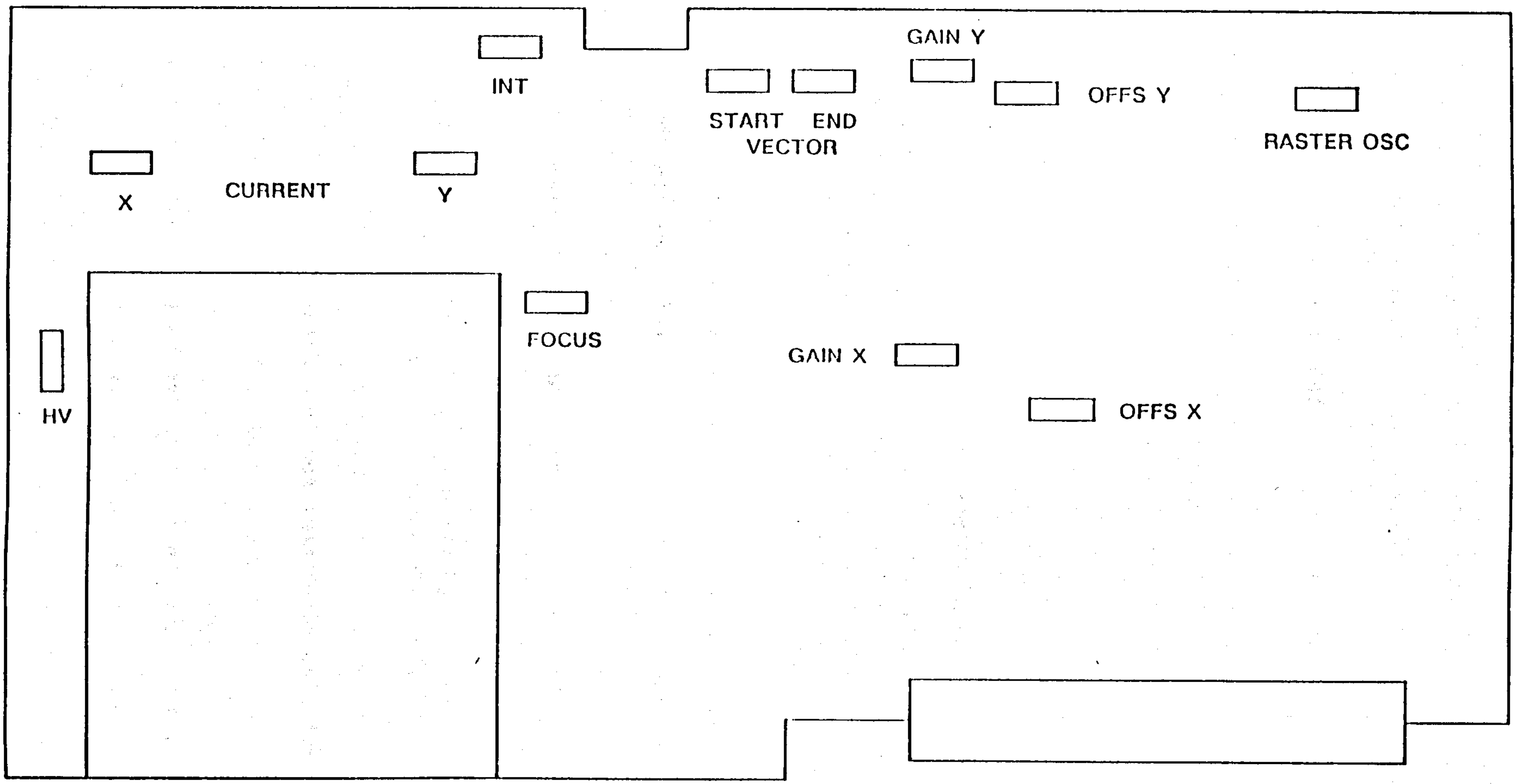
Adjust the size of the display, in order to get 5mm gap between the middle of the image lines (top, bottom, left, right) and the CRT lines.

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

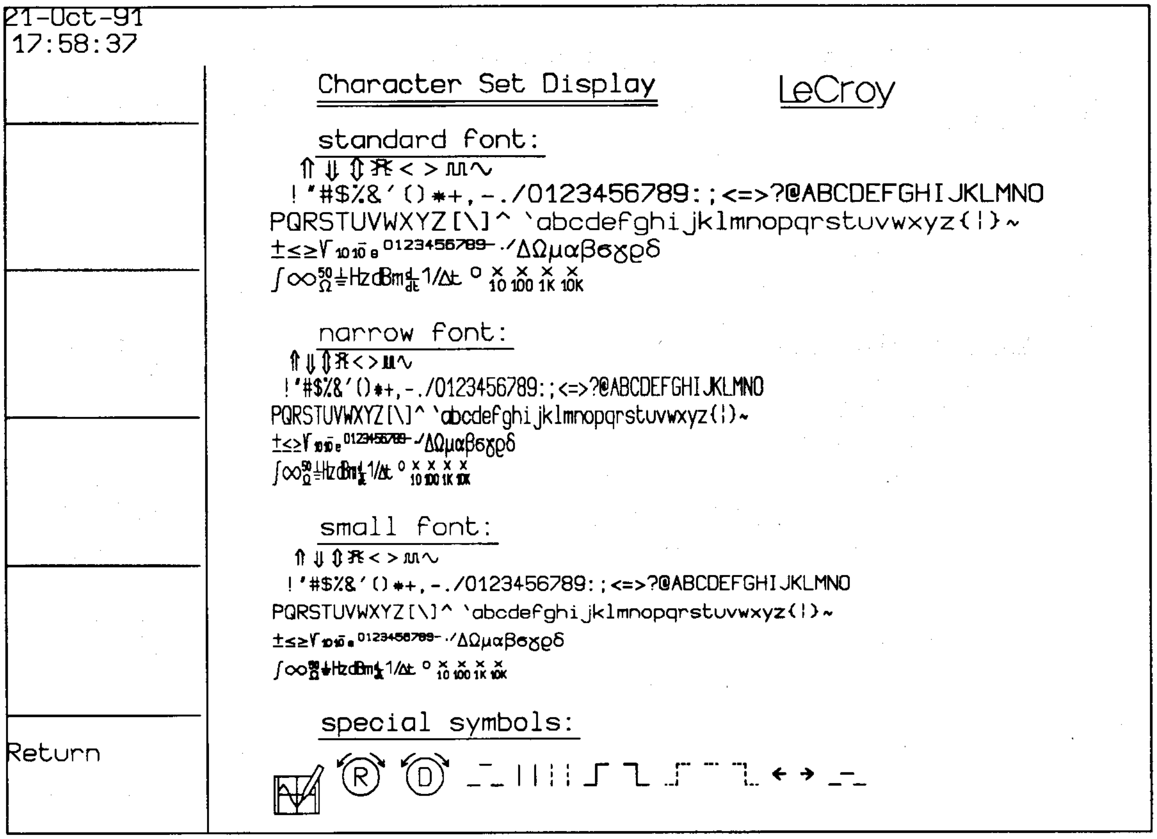


Figure 1 : Character Set Display

4.7.2 Intensity

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

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

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

4.7.3 Focus

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

4.7.4 Vector Joining

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

The characters should be neatly drawn.

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

4.7.5 Raster

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

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

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

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

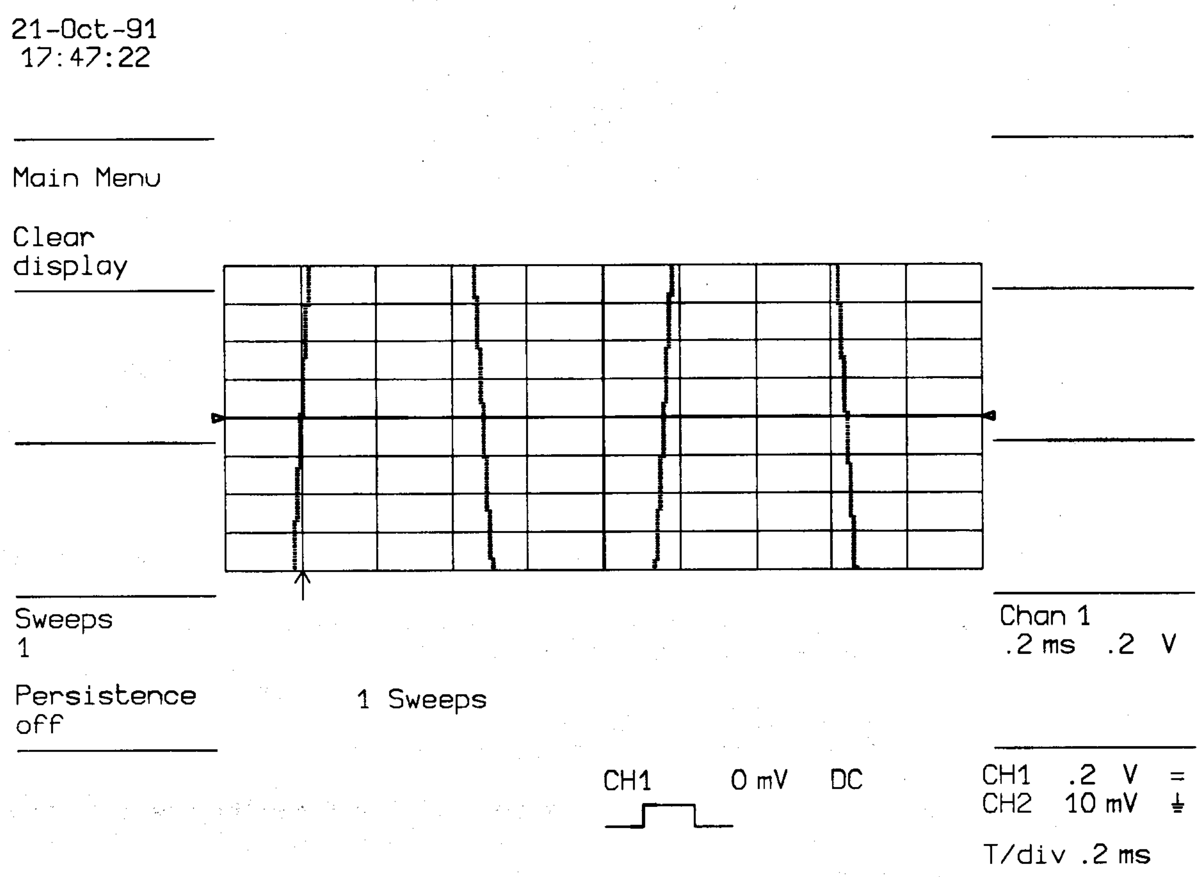


Figure 2 : Raster Oscillator

Chapter 5

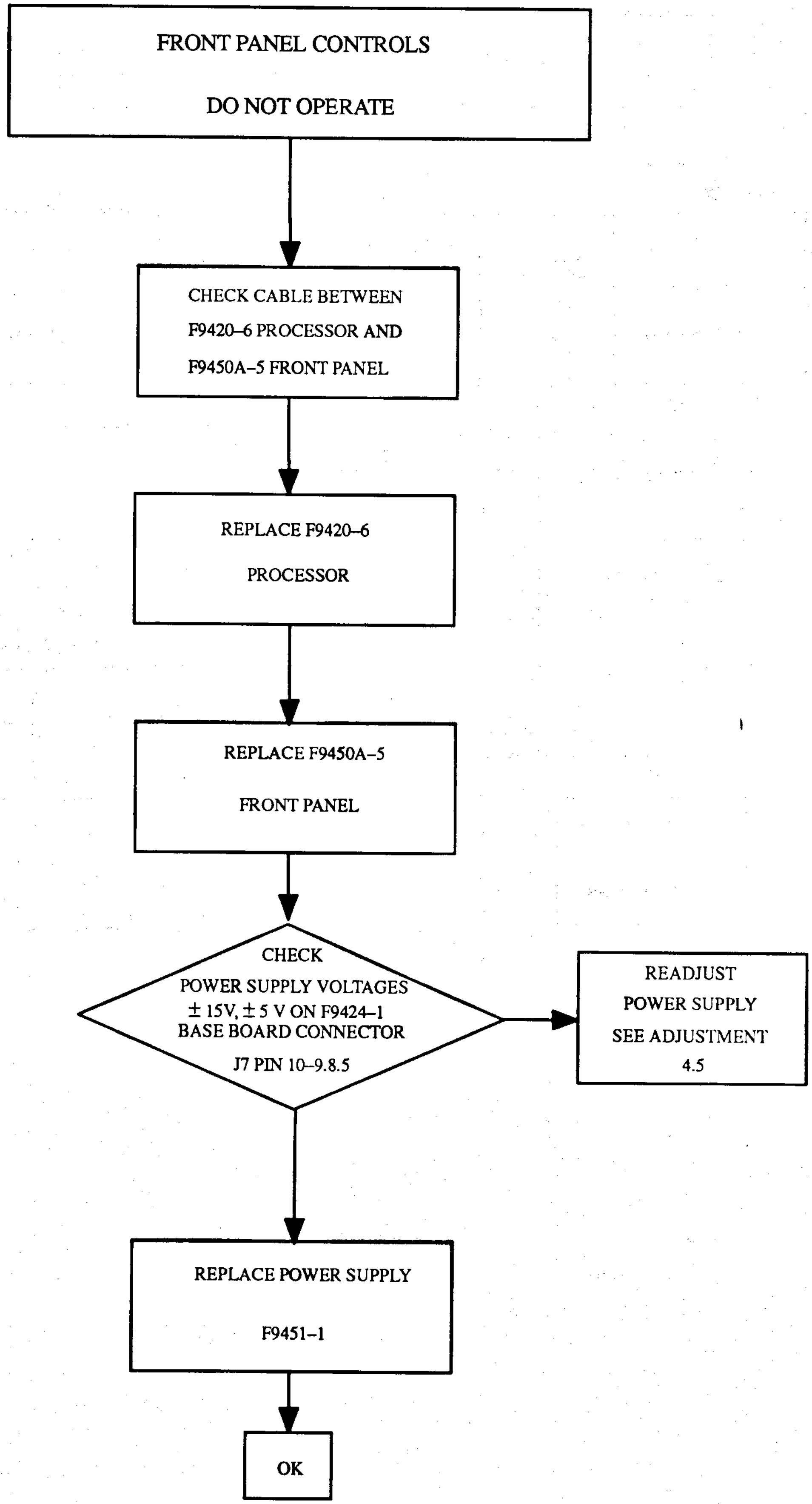
TROUBLESHOOTING and FLOW CHARTS

Table of contents:

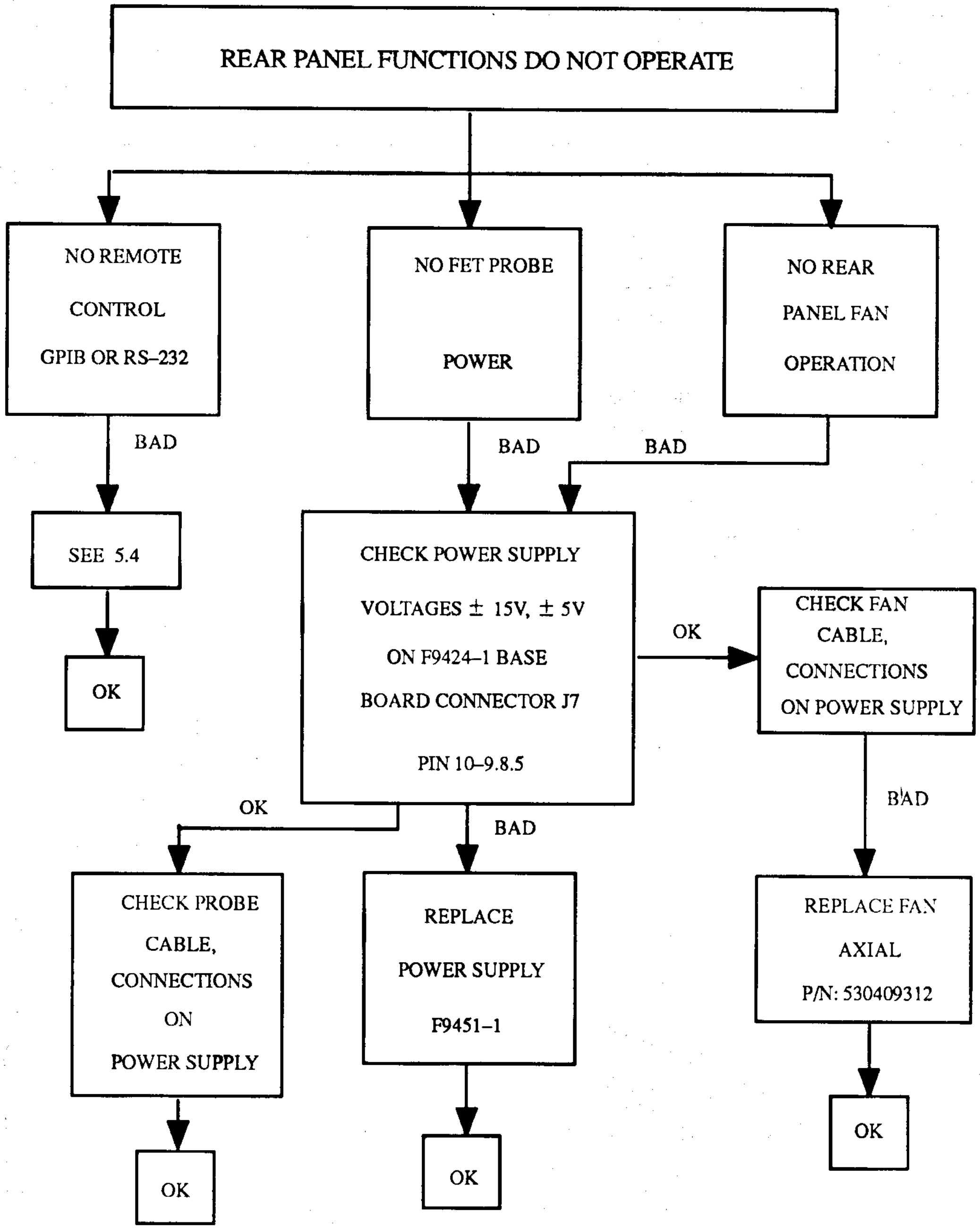
5.1 Introduction

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

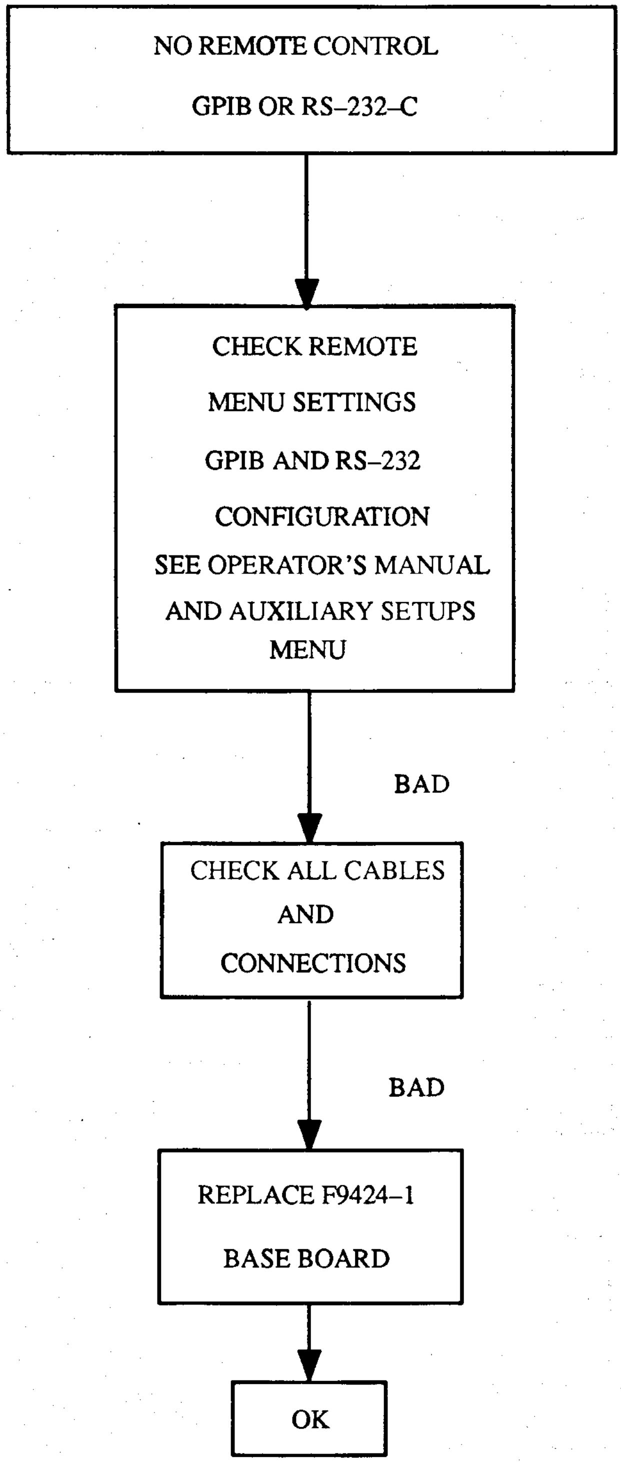
5.2


FRONT PANEL CONTROLS
DO NOT OPERATE
CHECK CABLE BETWEEN
F9420–6 PROCESSOR AND
F9450A–5 FRONT PANEL
REPLACE F9420–6
PROCESSOR
REPLACE F9450A–5
FRONT PANEL
CHECK
POWER SUPPLY VOLTAGES
± 15V, ± 5 V ON F9424–1
BASE BOARD CONNECTOR
J7 PIN 10–9.8.5
READJUST
POWER SUPPLY
SEE ADJUSTMENT
4.5
REPLACE POWER SUPPLY
F9451–1
OK

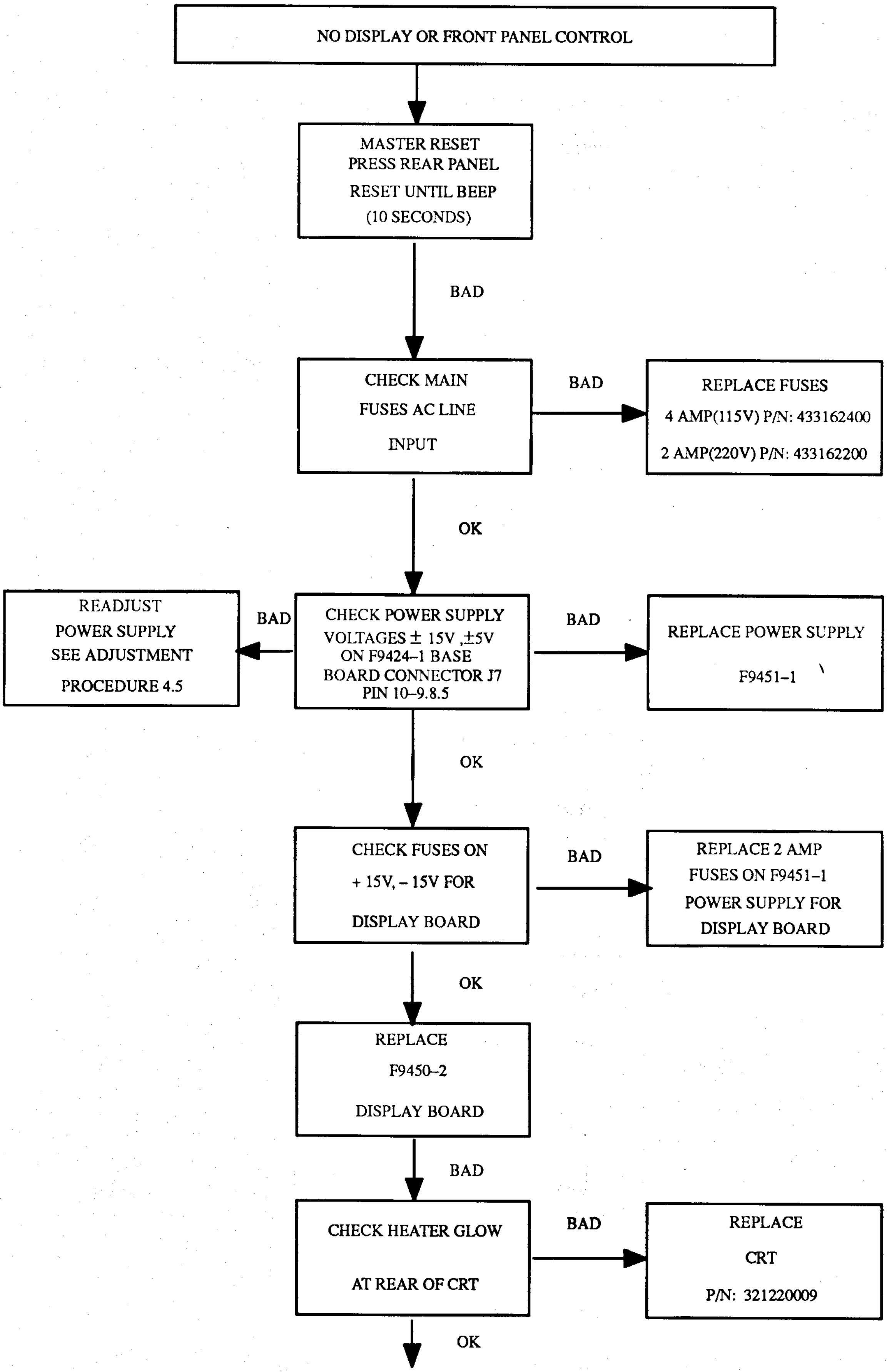
5.3


REAR PANEL FUNCTIONS DO NOT OPERATE
NO REMOTE CONTROL GPIB OR RS-232
NO FET PROBE POWER
NO REAR PANEL FAN OPERATION
BAD
BAD
BAD
SEE 5.4
OK
CHECK POWER SUPPLY VOLTAGES ± 15V, ± 5V ON F9424-1 BASE BOARD CONNECTOR J7 PIN 10-9.8.5
OK
CHECK FAN CABLE, CONNECTIONS ON POWER SUPPLY
BAD
OK
BAD
CHECK PROBE CABLE, CONNECTIONS ON POWER SUPPLY
REPLACE POWER SUPPLY F9451-1
REPLACE FAN AXIAL P/N: 530409312
OK
OK
OK

5.4

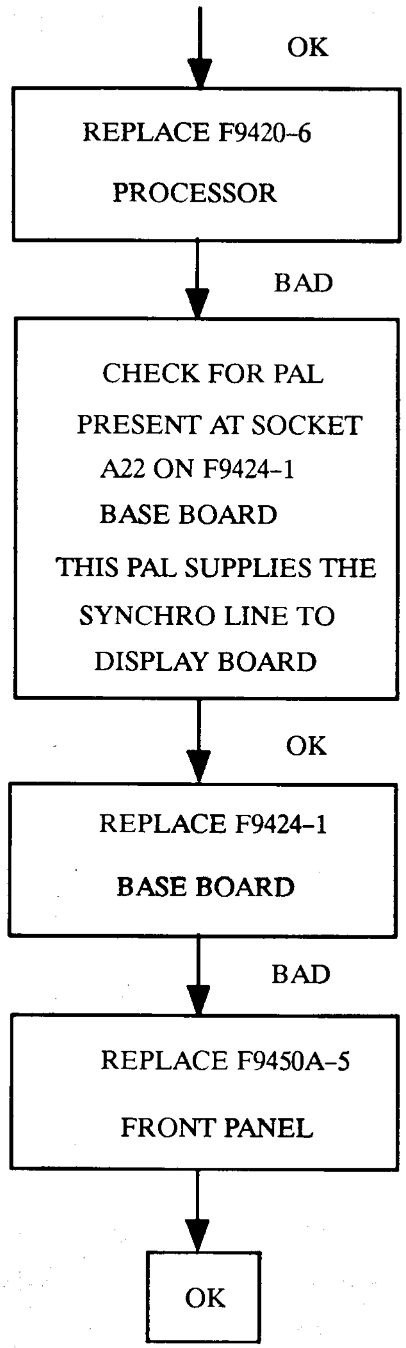

NO REMOTE CONTROL
GPIB OR RS–232–C
CHECK REMOTE
MENU SETTINGS
GPIB AND RS–232
CONFIGURATION
SEE OPERATOR'S MANUAL
AND AUXILIARY SETUPS
MENU
BAD
CHECK ALL CABLES
AND
CONNECTIONS
BAD
REPLACE F9424–1
BASE BOARD
OK

5.5.1

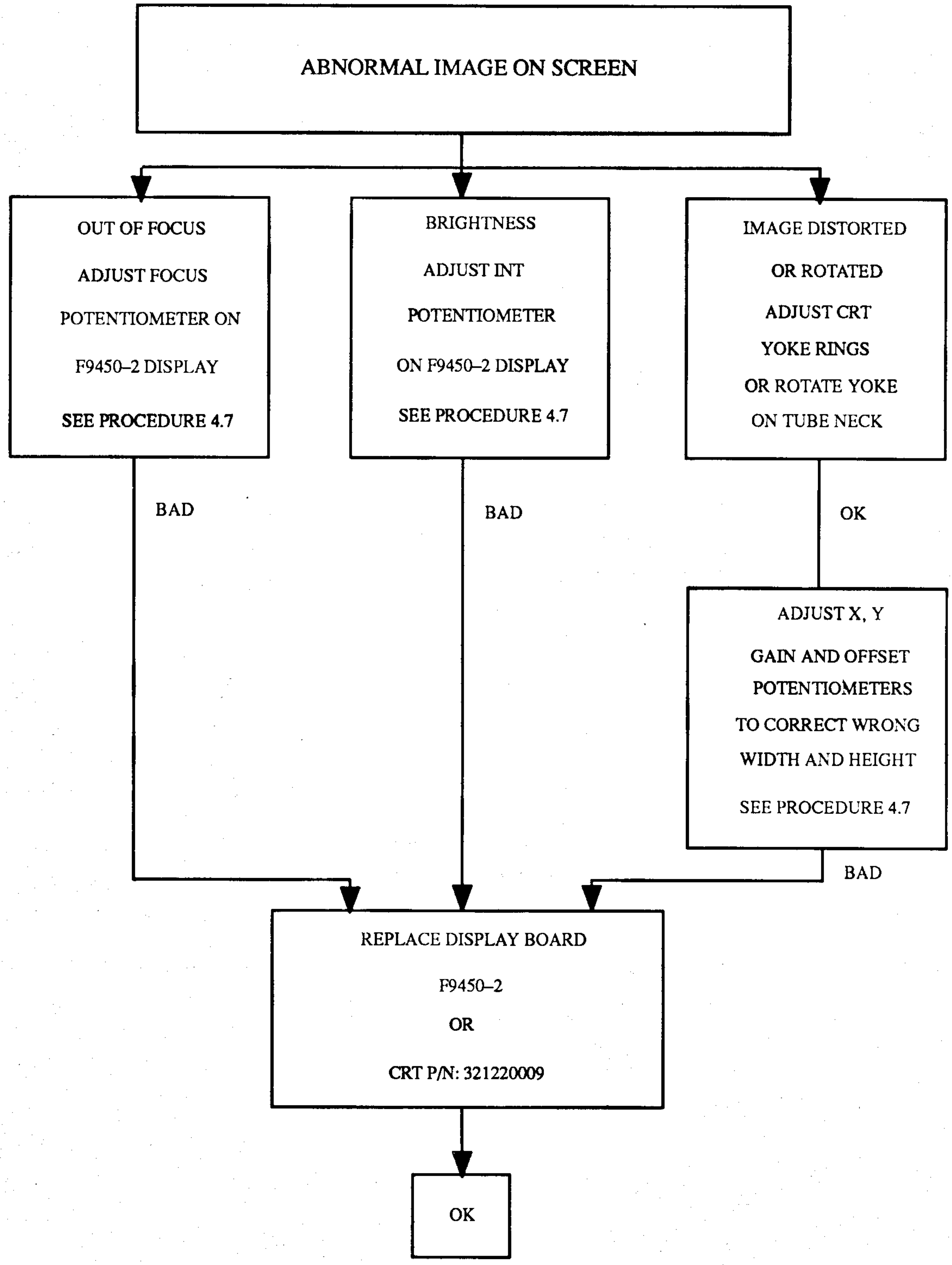


NO DISPLAY OR FRONT PANEL CONTROL
MASTER RESET PRESS REAR PANEL RESET UNTIL BEEP (10 SECONDS)
BAD
CHECK MAIN FUSES AC LINE INPUT
BAD
REPLACE FUSES
4 AMP(115V) P/N: 433162400
2 AMP(220V) P/N: 433162200
OK
READJUST POWER SUPPLY SEE ADJUSTMENT PROCEDURE 4.5
BAD
CHECK POWER SUPPLY VOLTAGES ± 15V ,±5V ON F9424-1 BASE BOARD CONNECTOR J7 PIN 10-9.8.5
BAD
REPLACE POWER SUPPLY F9451-1
OK
CHECK FUSES ON + 15V, - 15V FOR DISPLAY BOARD
BAD
REPLACE 2 AMP FUSES ON F9451-1 POWER SUPPLY FOR DISPLAY BOARD
OK
REPLACE F9450-2 DISPLAY BOARD
BAD
CHECK HEATER GLOW AT REAR OF CRT
BAD
REPLACE CRT P/N: 321220009
OK

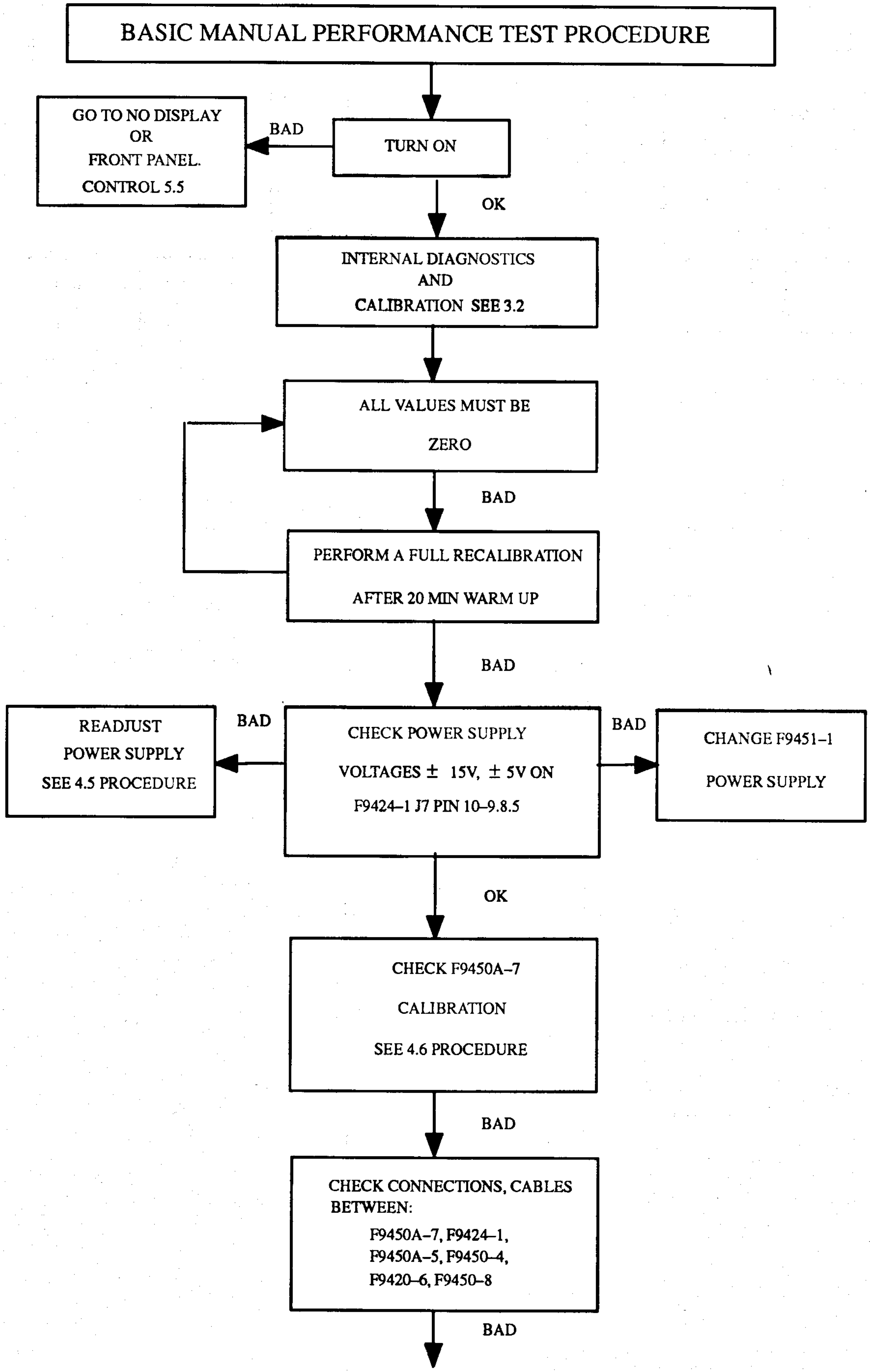
5.5.2


OK
REPLACE F9420-6
PROCESSOR
BAD
CHECK FOR PAL
PRESENT AT SOCKET
A22 ON F9424-1
BASE BOARD
THIS PAL SUPPLIES THE
SYNCHRO LINE TO
DISPLAY BOARD
OK
REPLACE F9424-1
BASE BOARD
BAD
REPLACE F9450A-5
FRONT PANEL
OK

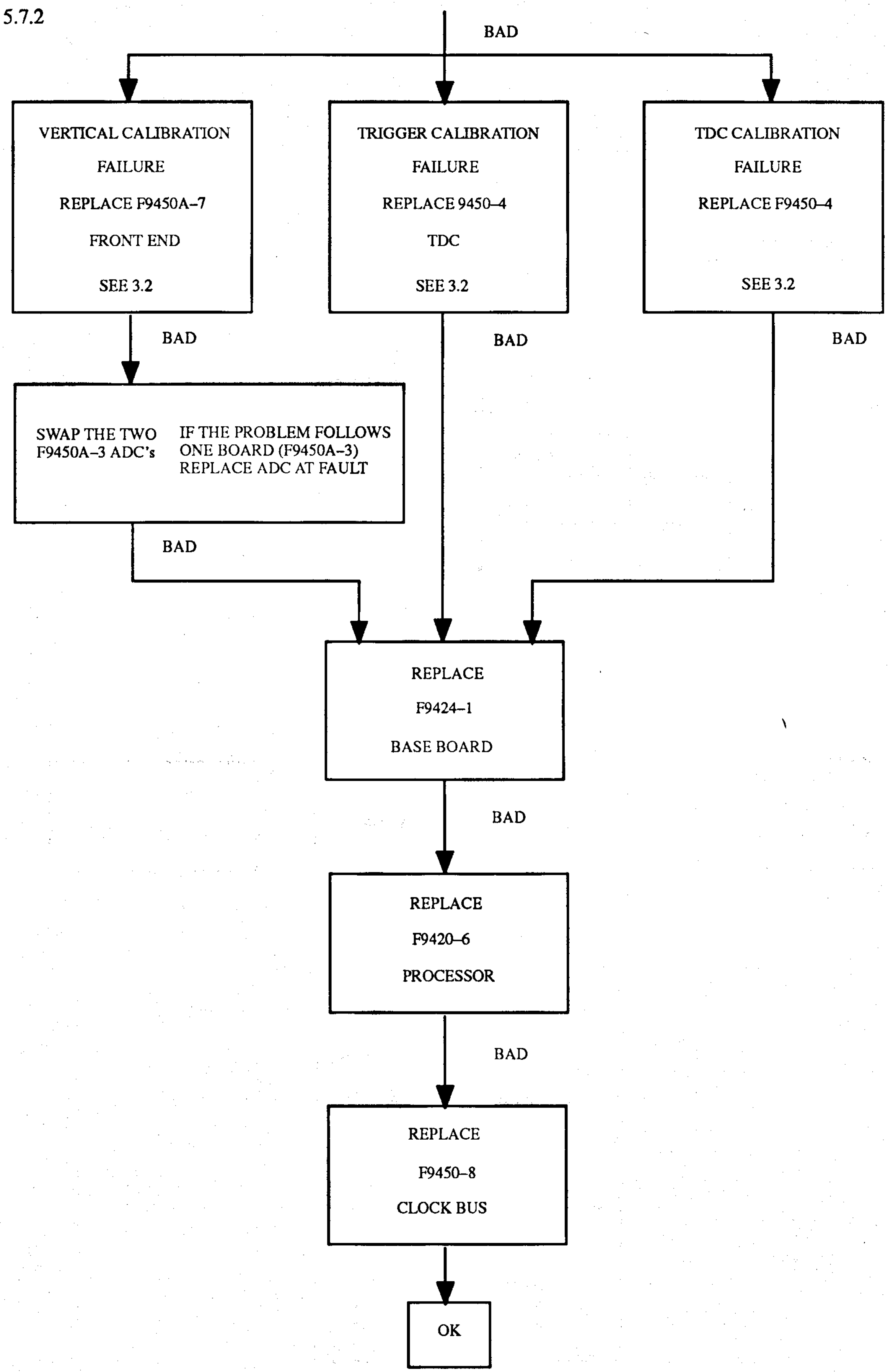
5.6


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

5.7.1


BASIC MANUAL PERFORMANCE TEST PROCEDURE
TURN ON
BAD
GO TO NO DISPLAY
OR
FRONT PANEL.
CONTROL 5.5
OK
INTERNAL DIAGNOSTICS
AND
CALIBRATION SEE 3.2
ALL VALUES MUST BE
ZERO
BAD
PERFORM A FULL RECALIBRATION
AFTER 20 MIN WARM UP
BAD
CHECK POWER SUPPLY
VOLTAGES ± 15V, ± 5V ON
F9424-1 J7 PIN 10-9.8.5
BAD
READJUST
POWER SUPPLY
SEE 4.5 PROCEDURE
BAD
CHANGE F9451-1
POWER SUPPLY
OK
CHECK F9450A-7
CALIBRATION
SEE 4.6 PROCEDURE
BAD
CHECK CONNECTIONS, CABLES
BETWEEN:
F9450A-7, F9424-1,
F9450A-5, F9450-4,
F9420-6, F9450-8
BAD

5.7.2


BAD
VERTICAL CALIBRATION
FAILURE
REPLACE F9450A–7
FRONT END
SEE 3.2
TRIGGER CALIBRATION
FAILURE
REPLACE 9450–4
TDC
SEE 3.2
TDC CALIBRATION
FAILURE
REPLACE F9450–4
SEE 3.2
BAD
BAD
BAD
SWAP THE TWO
F9450A–3 ADC's
IF THE PROBLEM FOLLOWS
ONE BOARD (F9450A–3)
REPLACE ADC AT FAULT
BAD
REPLACE
F9424–1
BASE BOARD
BAD
REPLACE
F9420–6
PROCESSOR
BAD
REPLACE
F9450–8
CLOCK BUS
OK

5.8 Equipment and spare parts recommended for service

5.8.1 Equipment

The following list of equipment are needed to provide the technician access to the 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, 50Ω 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:

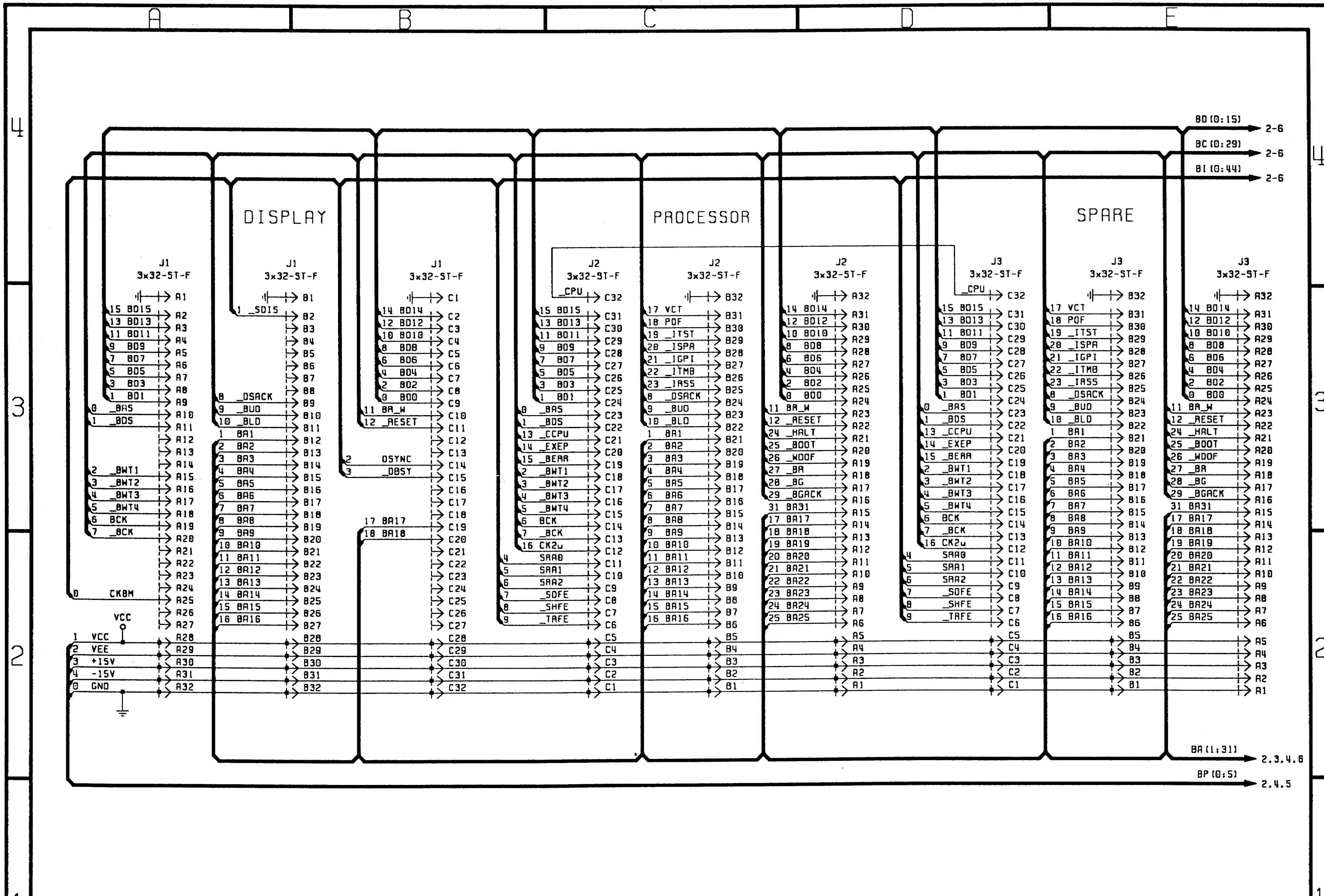
- F9424-1	Base board
- F9450-2	Display board
- F9450A-3	ADC (Analog to Digital Converter)
- F9450-4	TDC (Time to Digital Converter)
- F9450A-5	Front panel
- F9420-6	Processor
- F9450A-7	Front End
- F9450-8	Clock bus
- F9451-1	Power supply

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.

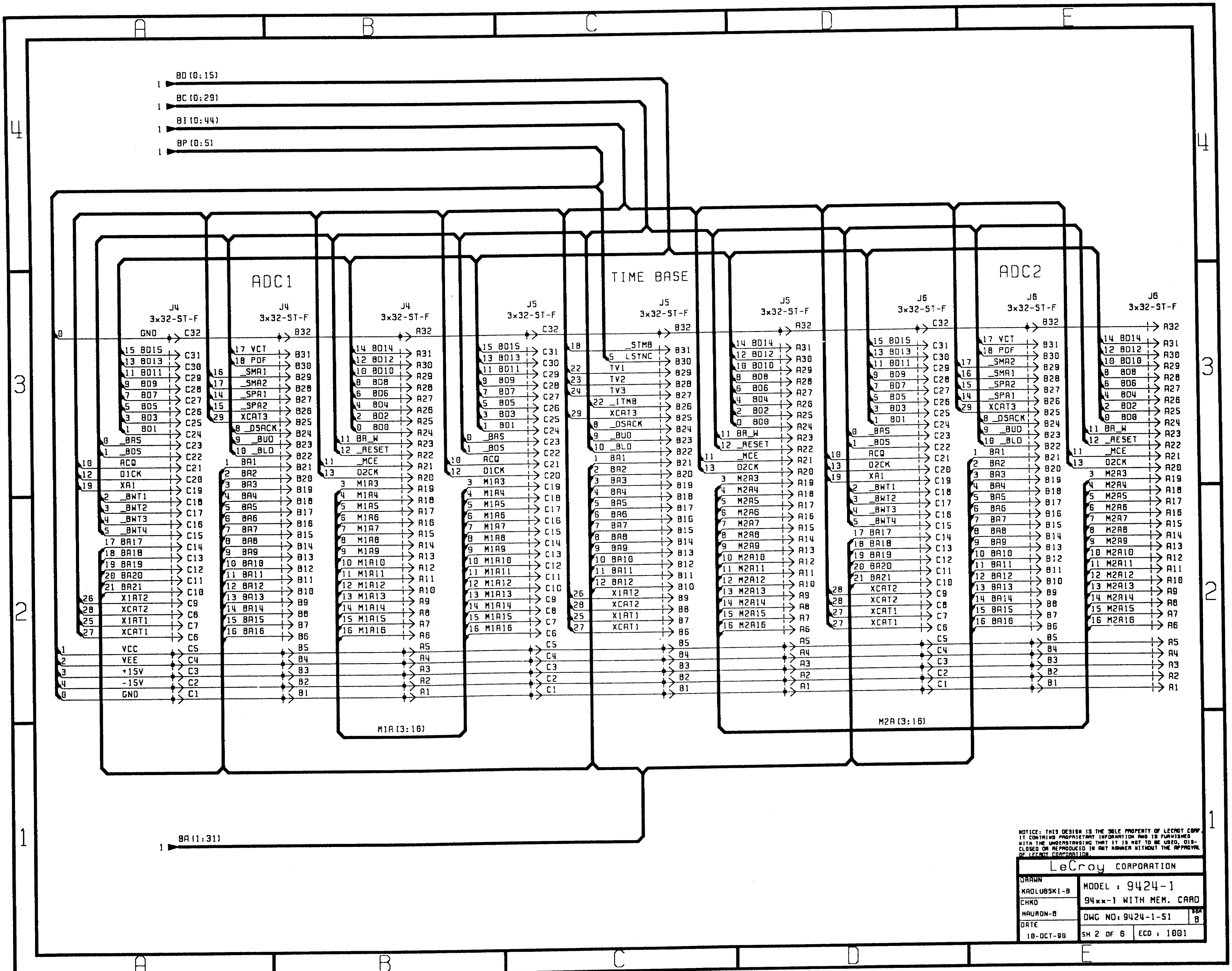
Chapter 6

CIRCUIT DIAGRAMS

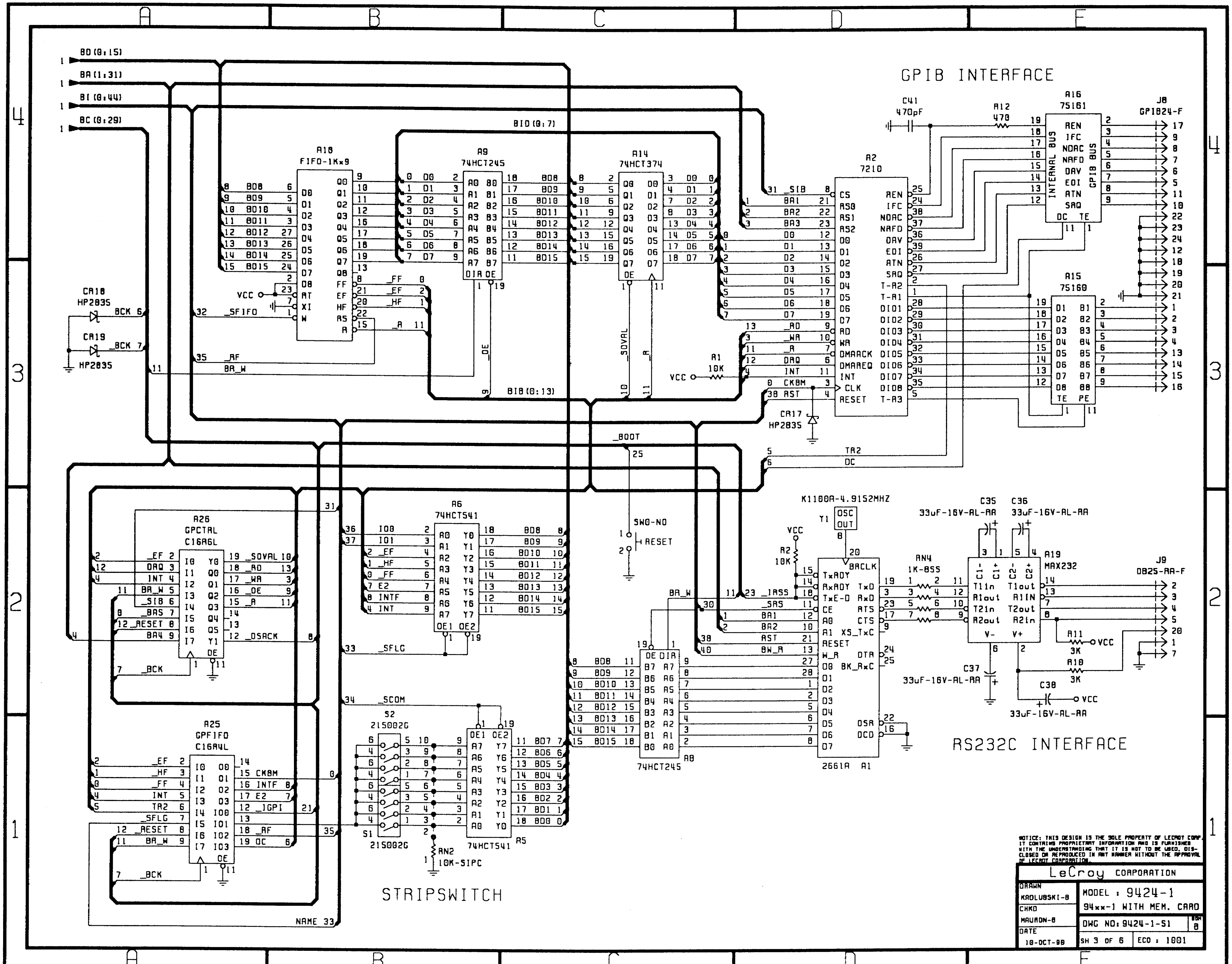
Table of Contents:



LeCroy CORPORATION	
DRAWN KAOLUBSKI-B	MODEL : 9424-1
CHKD NAURON-B	94xx-1 WITH MEM. CARD
DATE 10-OCT-88	DWG NO: 9424-1-S1 BOM B
	SH 1 OF 6 ECO : 1001



BD(0:15)
BC(0:29)
BI(0:44)
BP(0:5)
ADC1
TIME BASE
ADC2
J4 3x32-ST-F
J5 3x32-ST-F
J6 3x32-ST-F
M1A(3:16)
M2A(3:16)
BA(1:31)
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.
LeCroy CORPORATION
DRAWN KAOLUBSKI-B
CHKD MAURON-B
DATE 10-OCT-99
MODEL : 9424-1
94xx-1 WITH MEM. CARD
DWG NO: 9424-1-S1
REV B
SH 2 OF 6
ECO : 1001


GPIB INTERFACE
RS232C INTERFACE
STRIPSWITCH
A18 FIFO-1Kx9
A9 74HCT245
A14 74HCT374
A2 7210
A16 75161
A15 75160
J8 GPIB24-F
A26 GPCTAL C16A6L
A25 GPFIFO C16A4L
A6 74HCT541
A5 74HCT541
A8 74HCT245
A1 2661A
A19 MAX232
J9 DB25-AA-F
K1100A-4.9152MHZ
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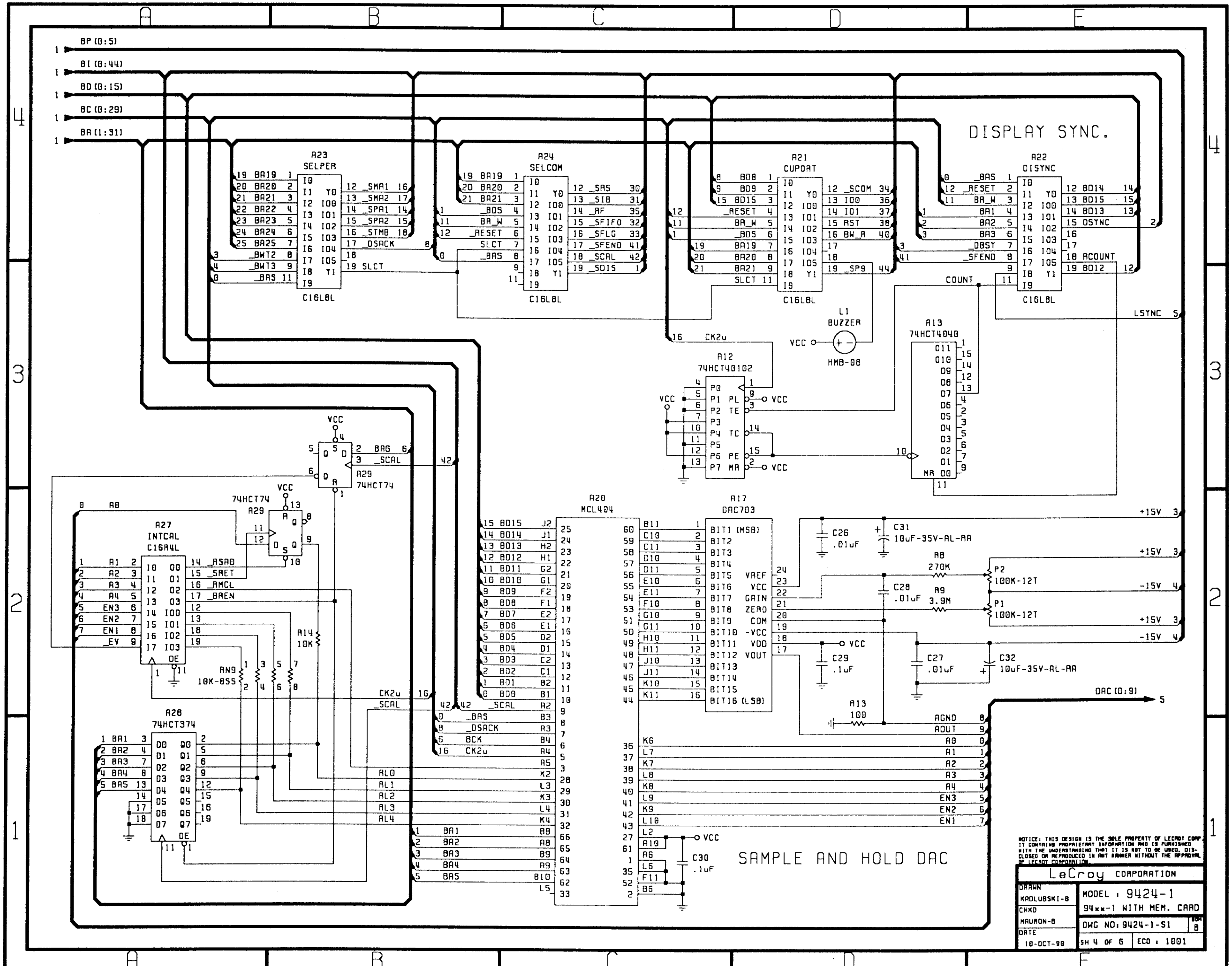
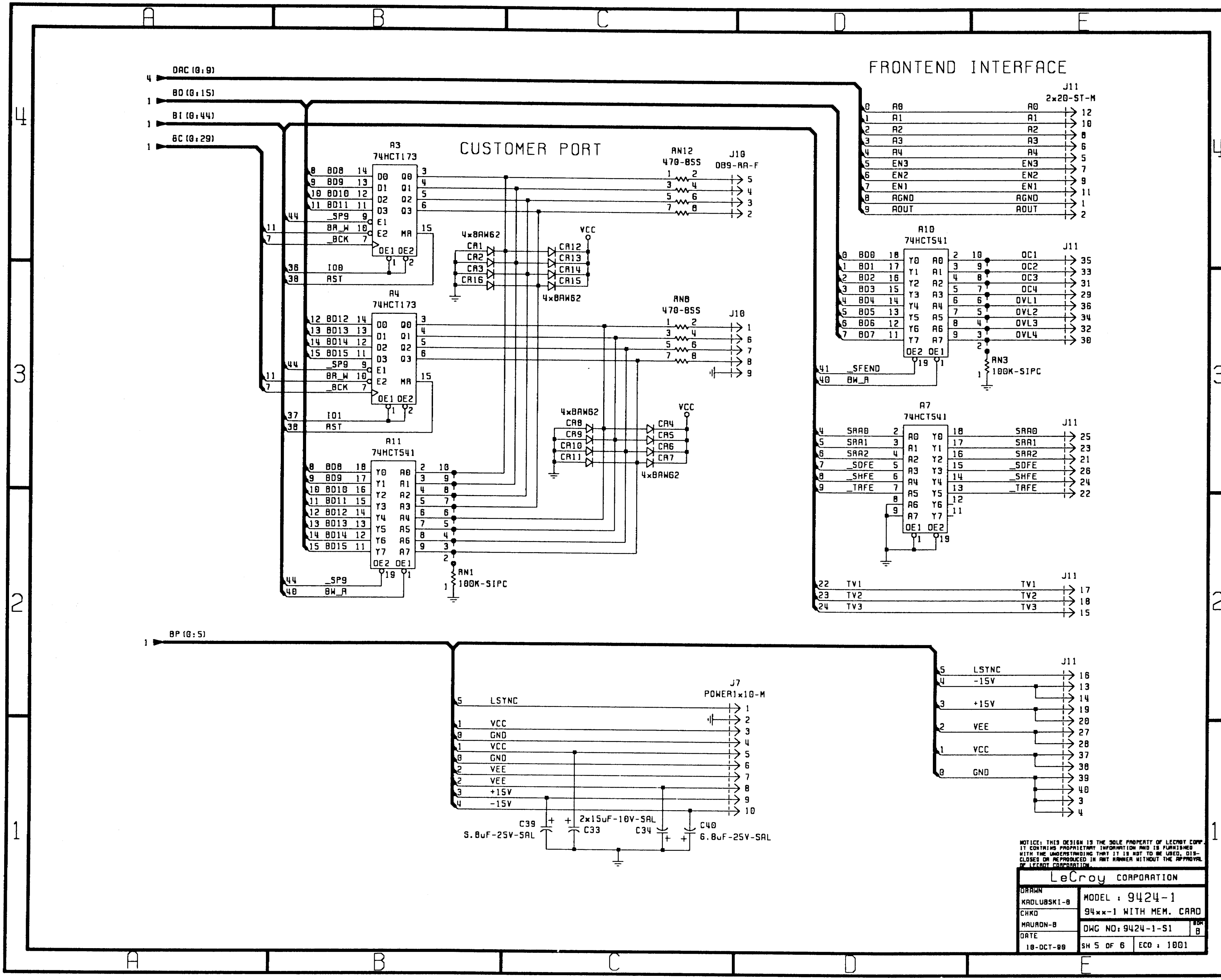
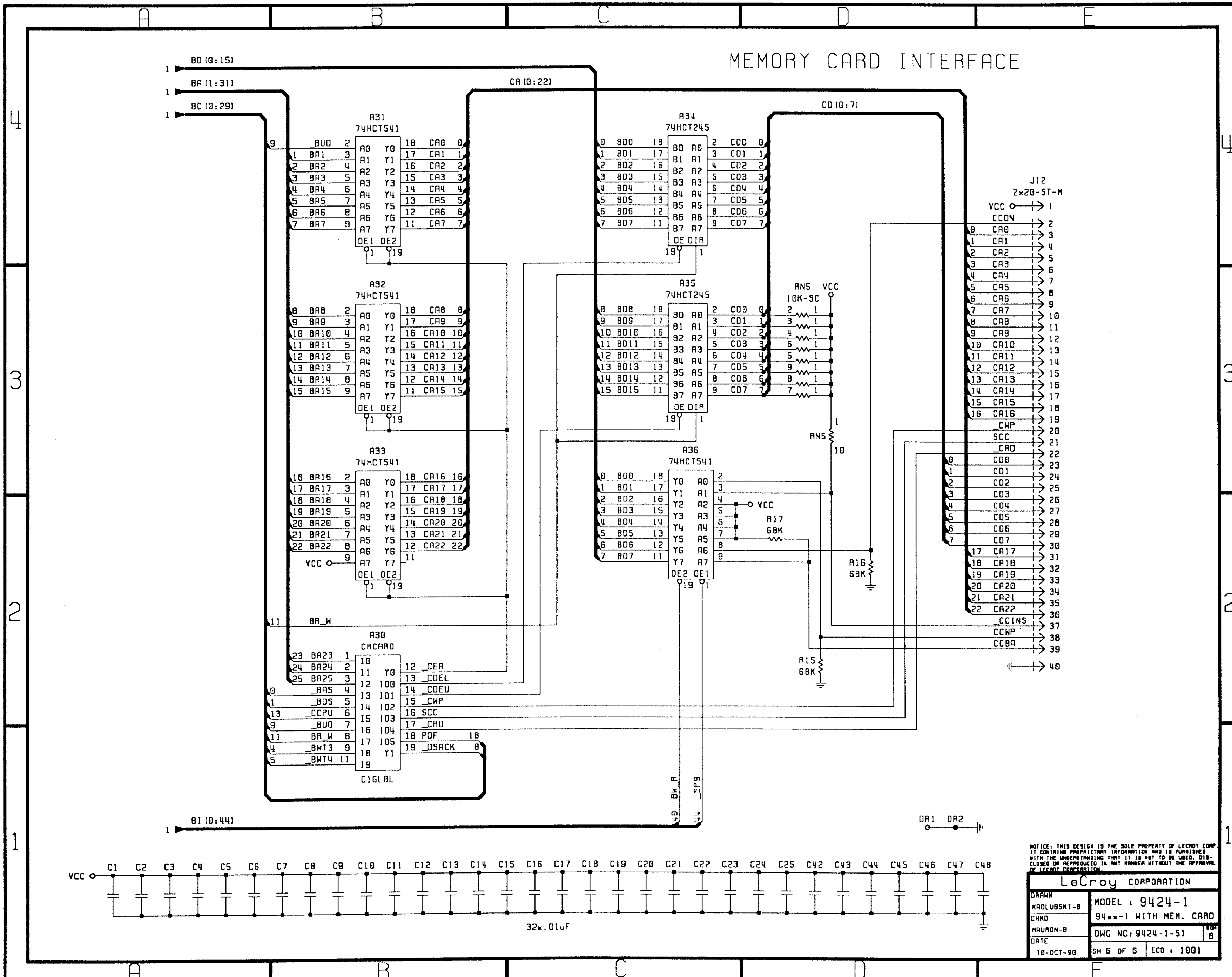
LeCroy CORPORATION
DRAWN KAOLUBSKI-8
CHKD MAURON-8
DATE 18-OCT-90
MODEL : 9424-1
94xx-1 WITH MEM. CARD
DWG NO: 9424-1-S1
SH 3 OF 6
ECO : 1801

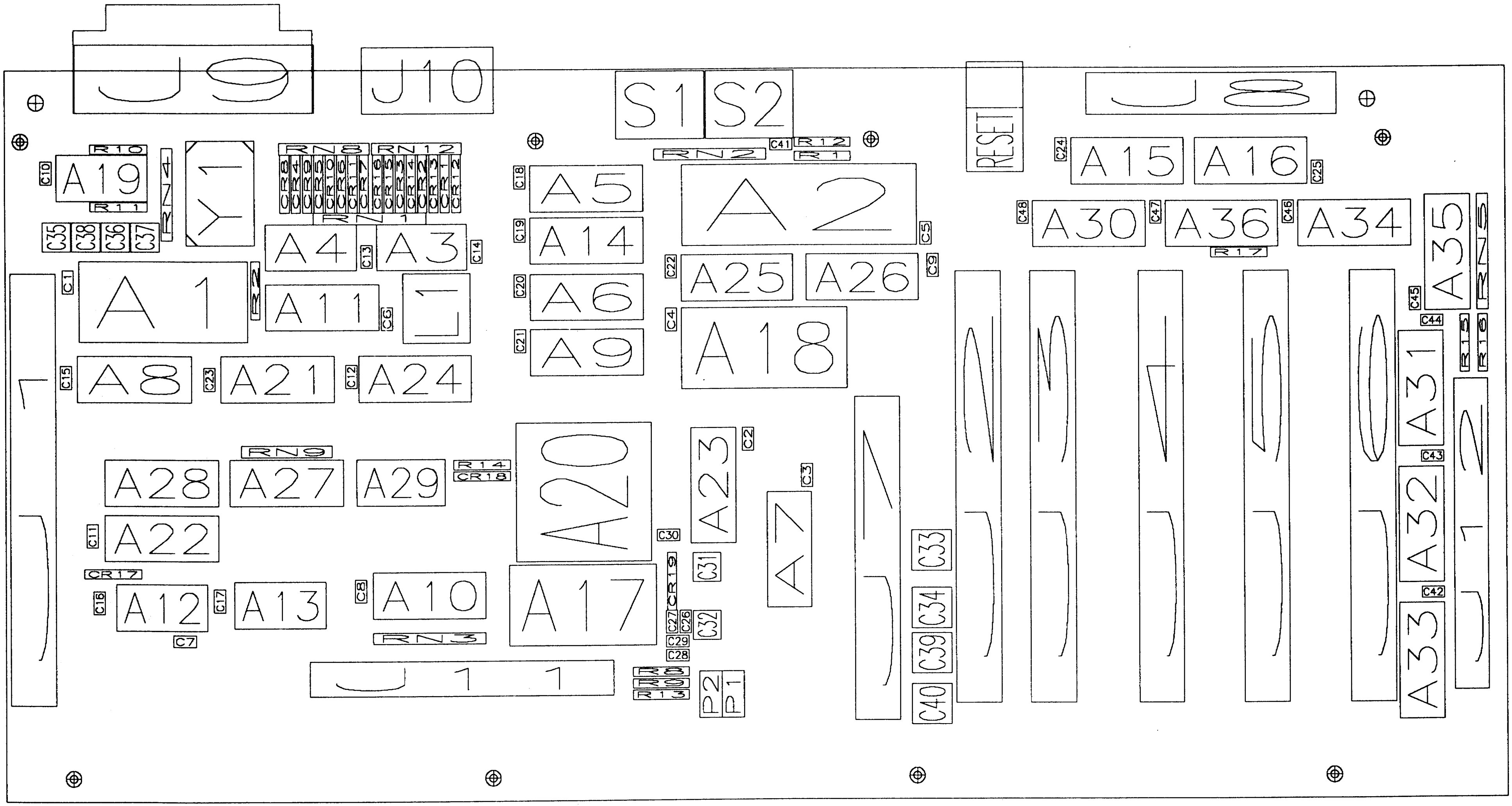


Scan by Paladinmicro -- paladin@paladinmicro.com

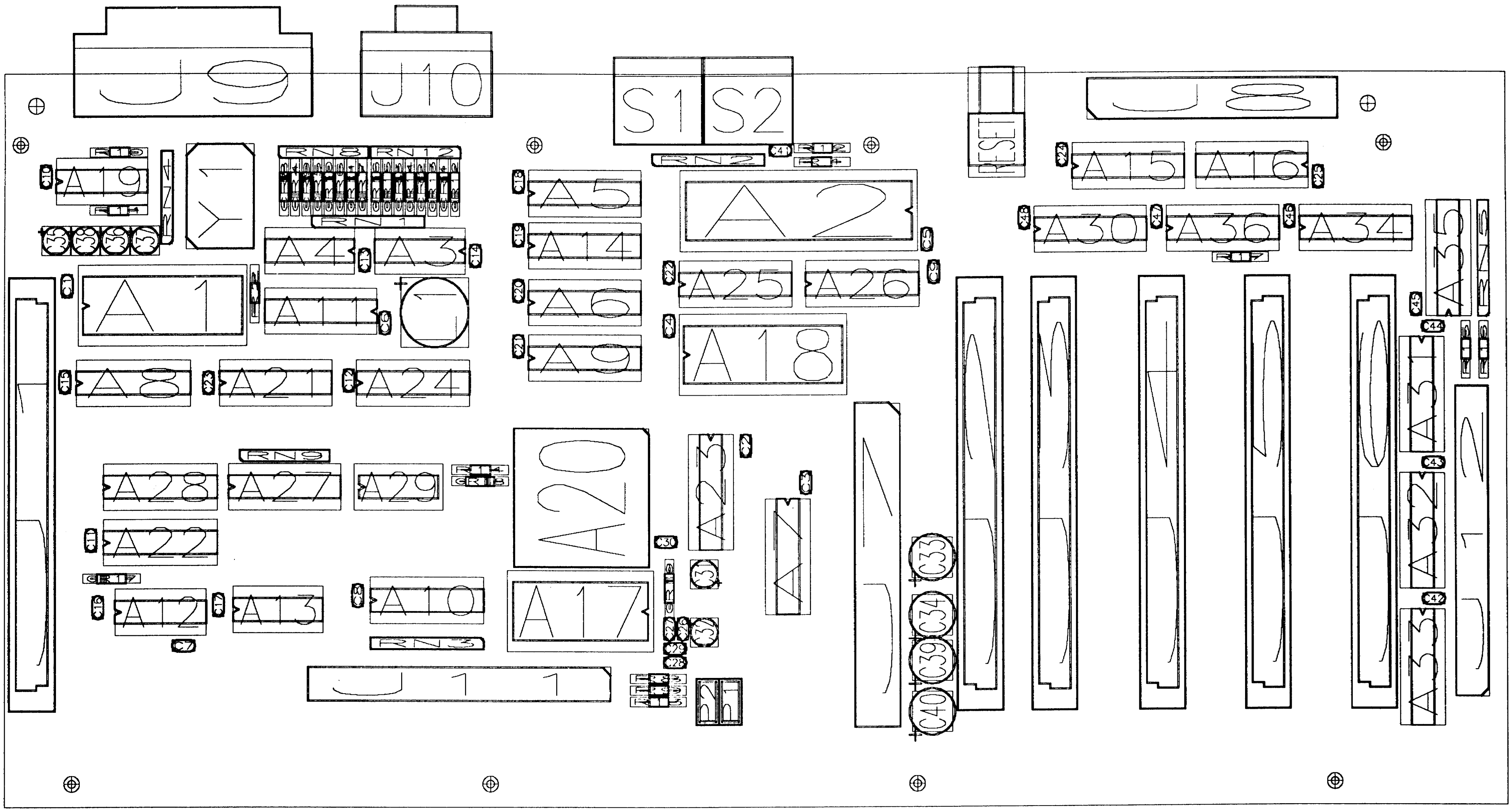

FRONTEND INTERFACE
CUSTOMER PORT
DAC (0:9)
BD (0:15)
BI (0:44)
BC (0:29)
BP (0:5)
A3
74HCT173
A4
74HCT173
A11
74HCT541
A10
74HCT541
A7
74HCT541
AN12
470-8SS
AN8
470-8SS
J10
DB9-RA-F
J11
2x20-ST-M
4xBAW62
AN1
100K-SIPC
AN3
100K-SIPC
J7
POWER1x10-M
C39
5.8uF-25V-SAL
C33
2x15uF-10V-SAL
C34
C40
6.8uF-25V-SAL
LSYNC
VCC
GND
VEE
+15V
-15V
_SFEND
BW_R
TV1
TV2
TV3
NOTICE: THIS DESIGN IS THE SOLE PROPERTY OF LECROY CORP. IT CONTAINS PROPRIETARY INFORMATION AND IS FURNISHED WITH THE UNDERSTANDING THAT IT IS NOT TO BE USED, DISCLOSED OR REPRODUCED IN ANY MANNER WITHOUT THE APPROVAL OF LECROY CORPORATION.
LeCroy CORPORATION
DRAWN KADLUBSKI-B
CHKD MAURON-B
DATE 10-OCT-90
MODEL : 9424-1
94xx-1 WITH MEM. CARD
DWG NO: 9424-1-S1
SH 5 OF 6
ECO : 1001



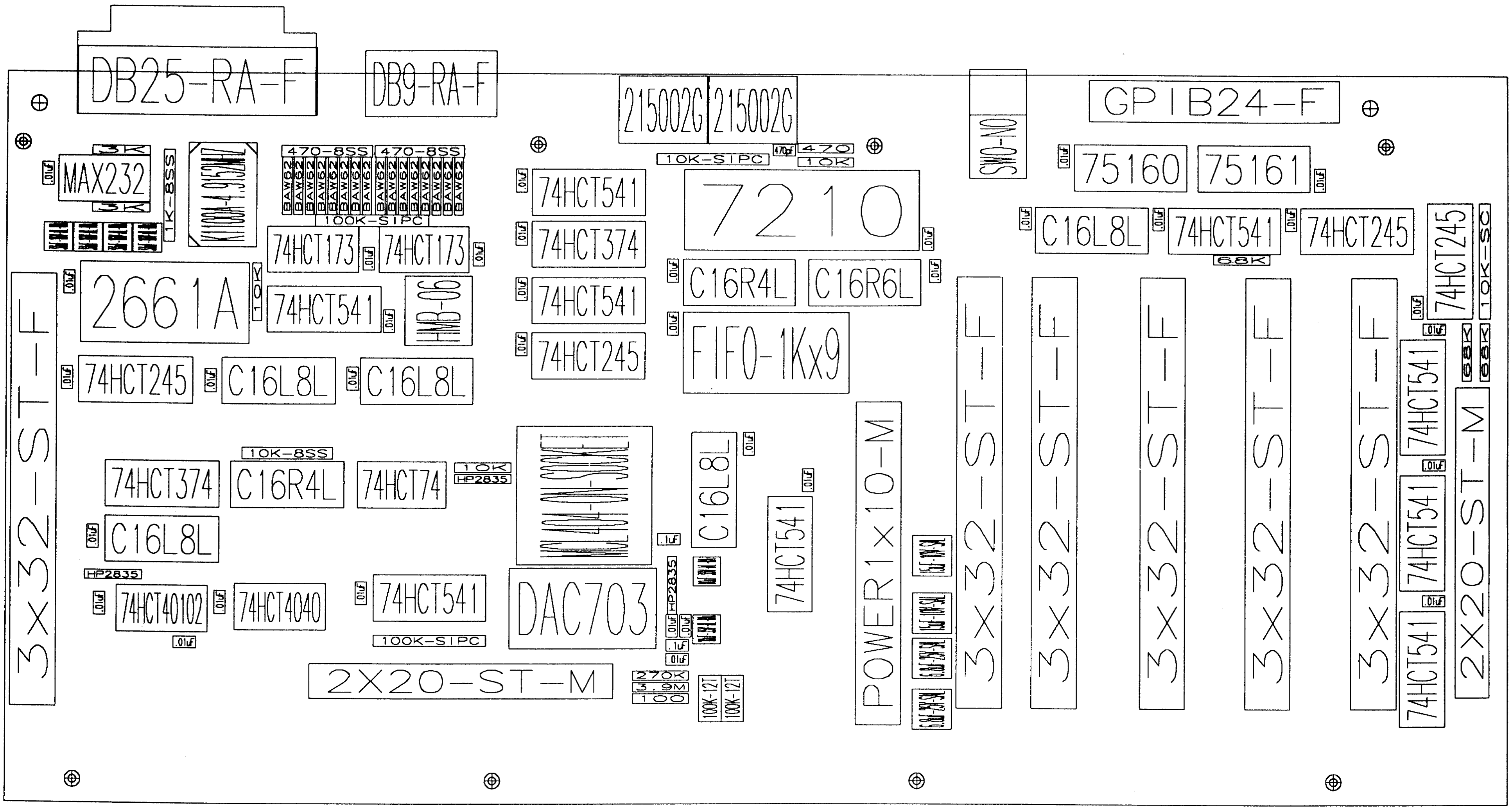
Scan by Paladinmicro -- paladin@paladinmicro.com



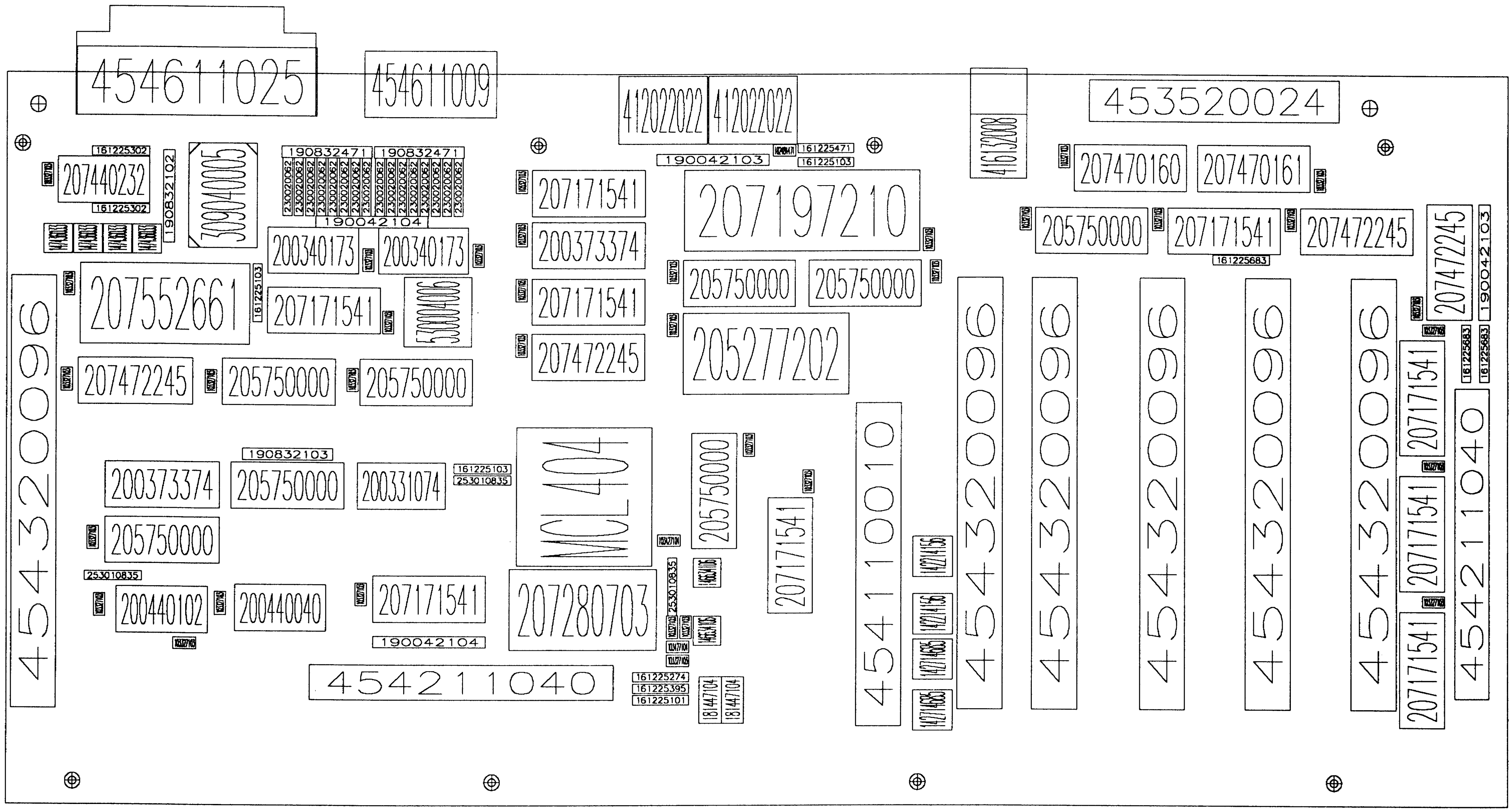
9424_1 PCB Rev:B



9424_1 PCB Rev:B



9424_1 PCB Rev:B

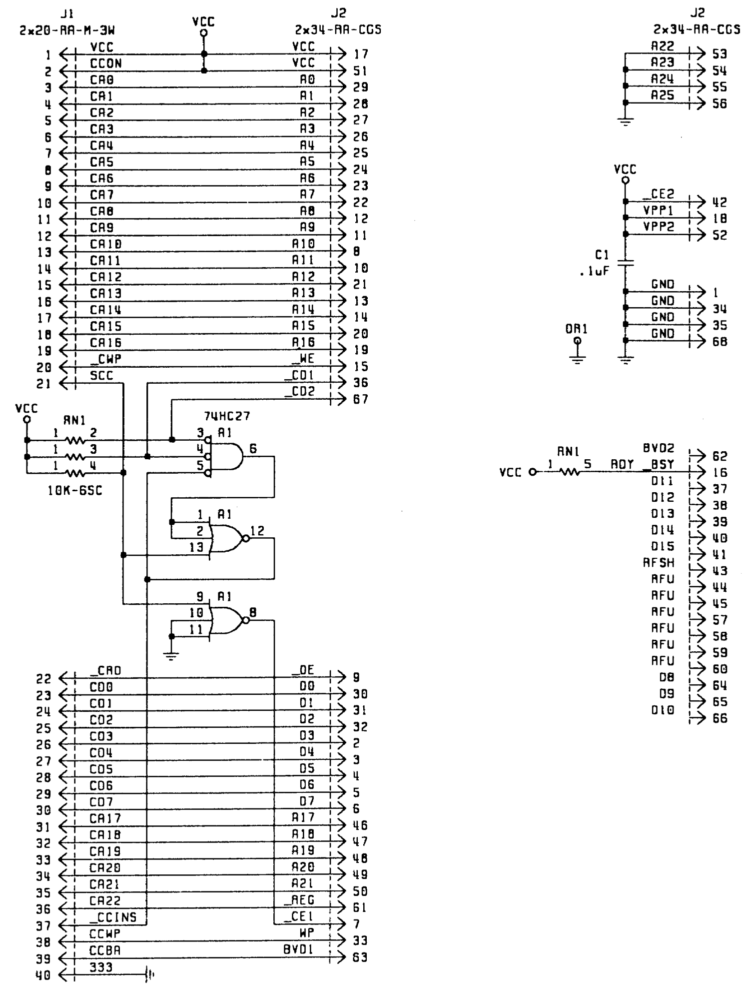


9424_1 PCB Rev:B

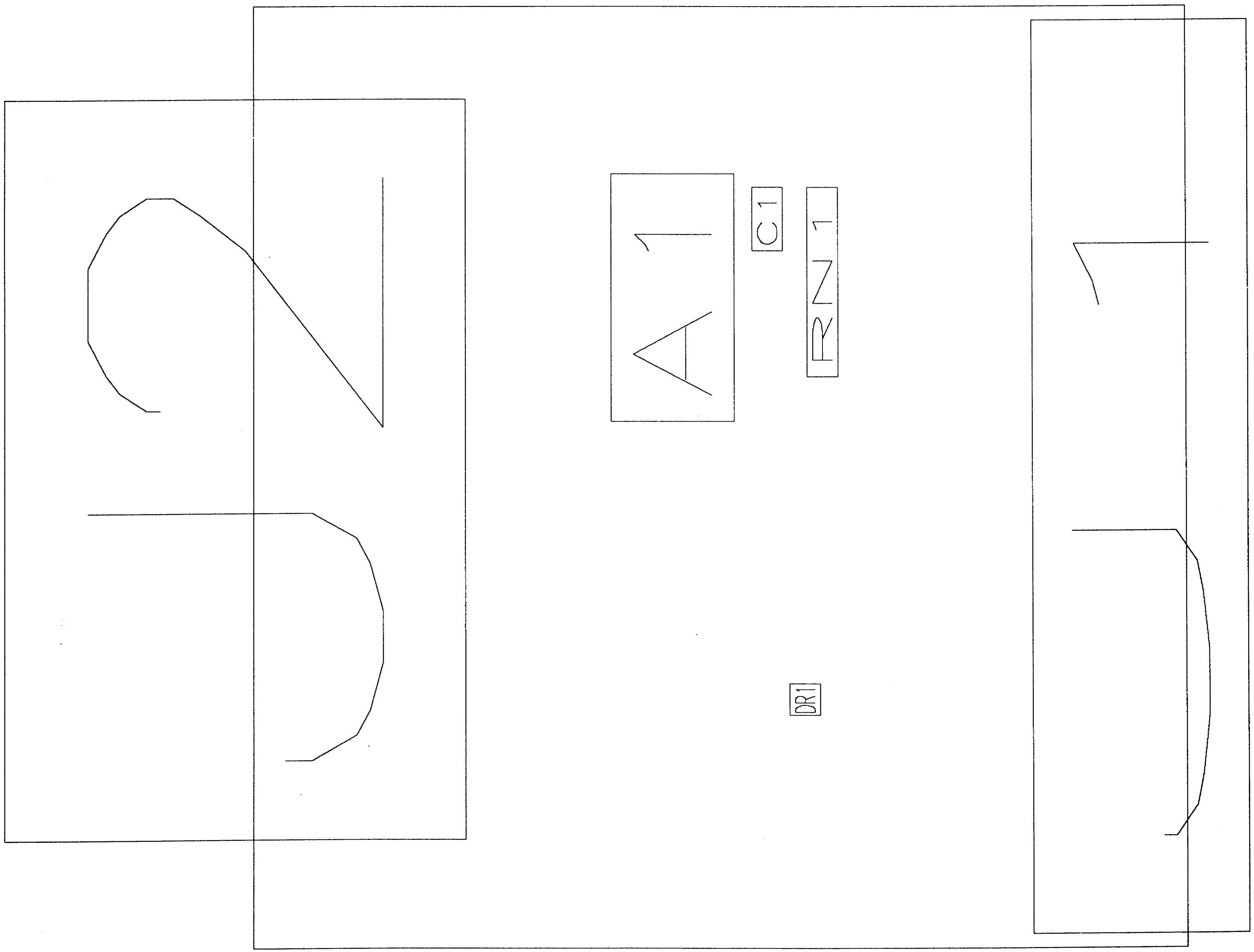
A1	207552661	2661A	DIP28	-13817600	3403600	1	90
A2	207197210	7210	DIP40	4572000	7010400	1	270
A3	200340173	74HCT173	DIP16	-5486400	5740400	1	270
A4	200340173	74HCT173	DIP16	-7975600	5740400	1	270
A5	207171541	74HCT541	DIP20	-3810000	6248400	1	90
A6	207171541	74HCT541	DIP20	-3810000	3860800	1	90
A7	207171541	74HCT541	DIP20	1524000	-203200	1	0
A8	207472245	74HCT245	DIP20	-13970000	2082800	1	90
A9	207472245	74HCT245	DIP20	-3810000	2641600	1	90
A10	207171541	74HCT541	DIP20	-7366000	-2692400	1	90
A11	207171541	74HCT541	DIP20	-7467600	4419600	1	270
A12	200440102	74HCT40102	DIP16	-13106400	-2946400	1	90
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
A31	207171541	74HCT541	DIP20	15798800	3302000	1	0
A32	207171541	74HCT541	DIP20	15798800	304800	1	0
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
C5	103327103	.01uF	SMONOBP	5029200	5486400	1	90
C6	103327103	.01uF	SMONOBP	-7162800	3657600	1	90
C7	103327103	.01uF	SMONOBP	-11582400	-3302000	1	180
C8	103327103	.01uF	SMONOBP	-7772400	-2082800	1	270
C9	103327103	.01uF	SMONOBP	5181600	5029200	1	270
C10	103327103	.01uF	SMONOBP	-14782800	7112000	1	270
C11	103327103	.01uF	SMONOBP	-13766800	-863600	1	270
C12	103327103	.01uF	SMONOBP	-7975600	2641600	1	270
C13	103327103	.01uF	SMONOBP	-7620000	5029200	1	90
C14	103327103	.01uF	SMONOBP	-5130800	5130800	1	90
C15	103327103	.01uF	SMONOBP	-14351000	2616200	1	270
C16	103327103	.01uF	SMONOBP	-13614400	-2590800	1	90
C17	103327103	.01uF	SMONOBP	-10922000	-2540000	1	90
C18	103327103	.01uF	SMONOBP	-4165600	7010400	1	270
C19	103327103	.01uF	SMONOBP	-4165600	5842000	1	270
C20	103327103	.01uF	SMONOBP	-4165600	4622800	1	270
C21	103327103	.01uF	SMONOBP	-4165600	3403600	1	270
C22	103327103	.01uF	SMONOBP	-762000	5029200	1	270
C23	103327103	.01uF	SMONOBP	-11150600	2590800	1	270
C24	103327103	.01uF	SMONOBP	8077200	7569200	1	270
C25	103327103	.01uF	SMONOBP	13868400	6807200	1	90
C26	103327103	.01uF	SMONOBP	-457200	-3048000	1	90
C27	103327103	.01uF	SMONOBP	-762000	-3048000	1	90
C28	103327103	.01uF	SMONOBP	-762000	-3657600	1	0
C29	103427104	.1uF	SMONOBP	-762000	-3352800	1	0
C30	103427104	.1uF	SMONOBP	-711200	-1016000	1	180

C31	146634106	10uF-35V-AL-RA	TCAP	152400	-1727200	1	180
C32	146634106	10uF-35V-AL-RA	TCAP	-101600	-2997200	1	0
C33	142214156	15uF-10V-SAL	LTCAP	5130800	-1625600	1	90
C34	142214156	15uF-10V-SAL	LTCAP	5130800	-2895600	1	90
C35	147436033	33uF-16V-AL-RA	TCAP	-14681200	5588000	1	0
C36	147436033	33uF-16V-AL-RA	TCAP	-13360400	5588000	1	0
C37	147436033	33uF-16V-AL-RA	TCAP	-12700000	5588000	1	0
C38	147436033	33uF-16V-AL-RA	TCAP	-14020800	5588000	1	0
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

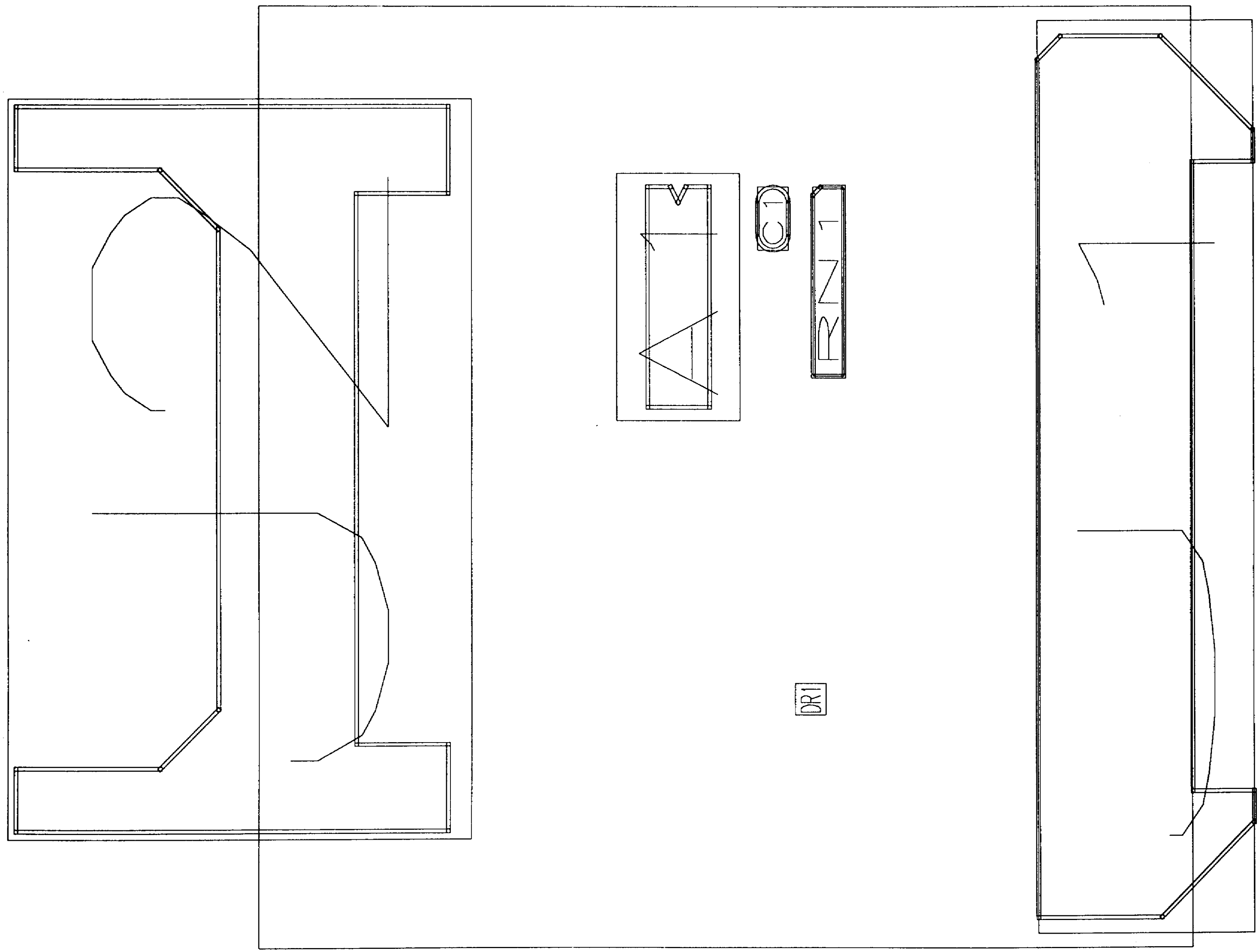
CR19	253010835	HP2835	DO35	-762000	-2540000	1	90
RESET	416132008	SW0-NO	SW0_NO	6598920	6959600	1	270
RN1	190042104	100K-SIPC	SIP10RES	-8686800	5994400	1	90
RN2	190042103	10K-SIPC	SIP10RES	-1016000	7366000	1	90
RN3	190042104	100K-SIPC	SIP10RES	-5080000	-3251200	1	270
RN4	190832102	1K-8SS	SIP8RES	-12090400	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



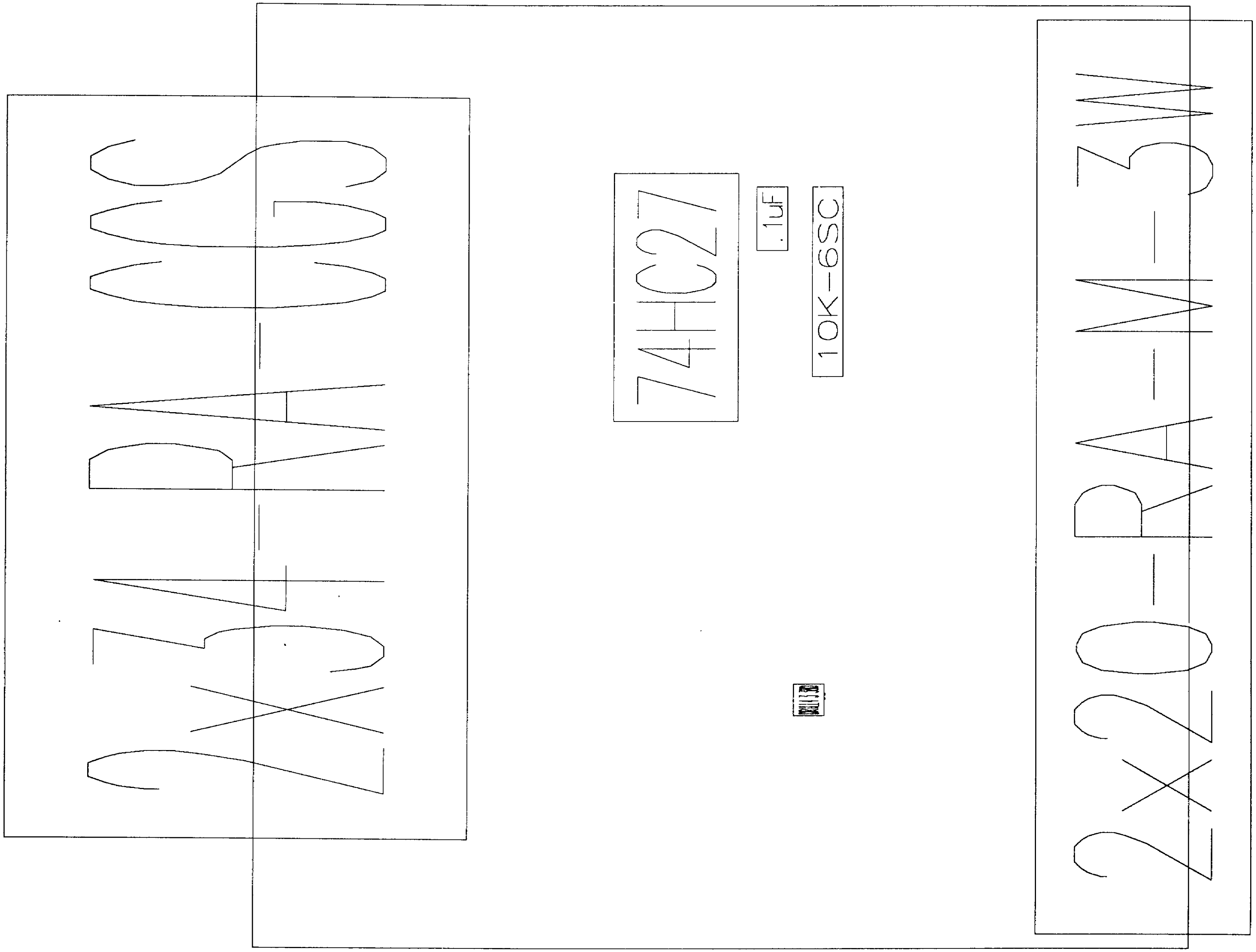
LeCroy CORPORATION	
DRAWN KADLUBSKI-B	MODEL : 9424-2 SUPPORT FOR MEM. CARD
CHKD MAURON-B	DWG NO: 9424-2-S1 — BOM A
DATE 28-JAN-91	SH 1 OF 1 — ECO : 1000



9424-2 REV:E



9424-2 REV:E



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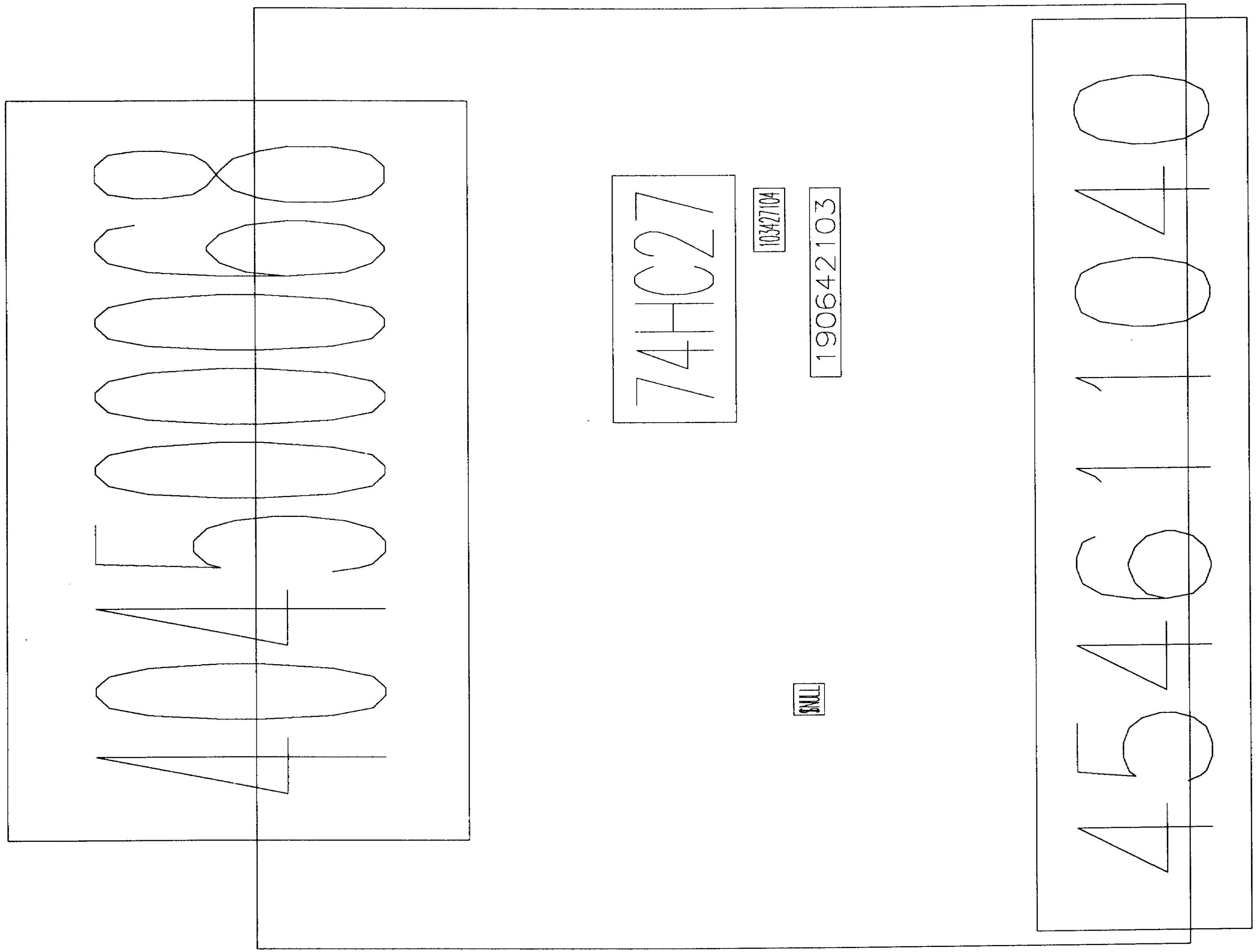
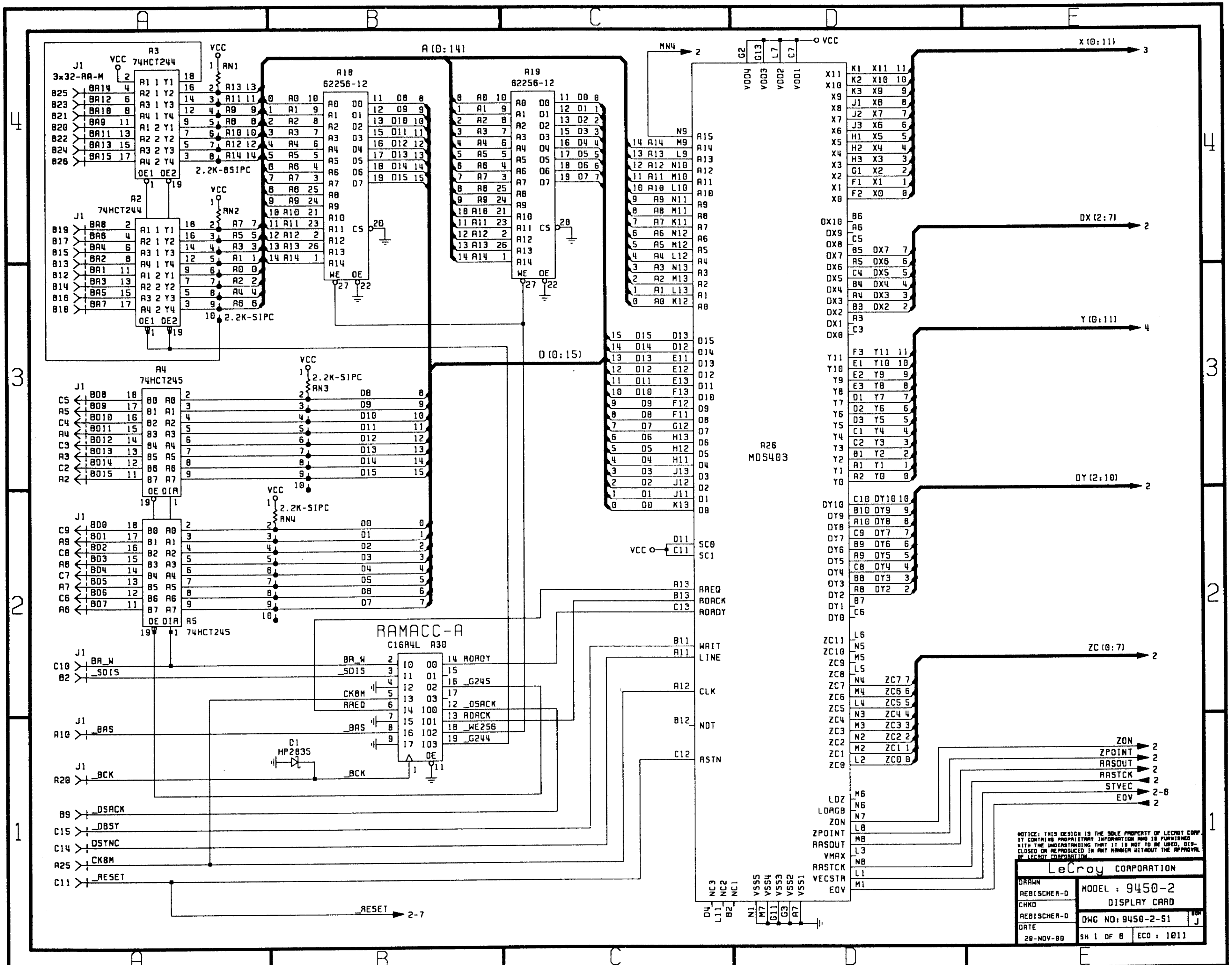


9424-2 REV:E

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



RAMACC-A
C16A4L A30
A26
MD5403
A18
62256-12
A19
62256-12
A3
74HCT244
A2
74HCT244
A4
74HCT245
A5
74HCT245
D1
HP2835
A (0:14)
D (0:15)
X (0:11)
DX (2:7)
Y (0:11)
DY (2:10)
ZC (0:7)
_RESET
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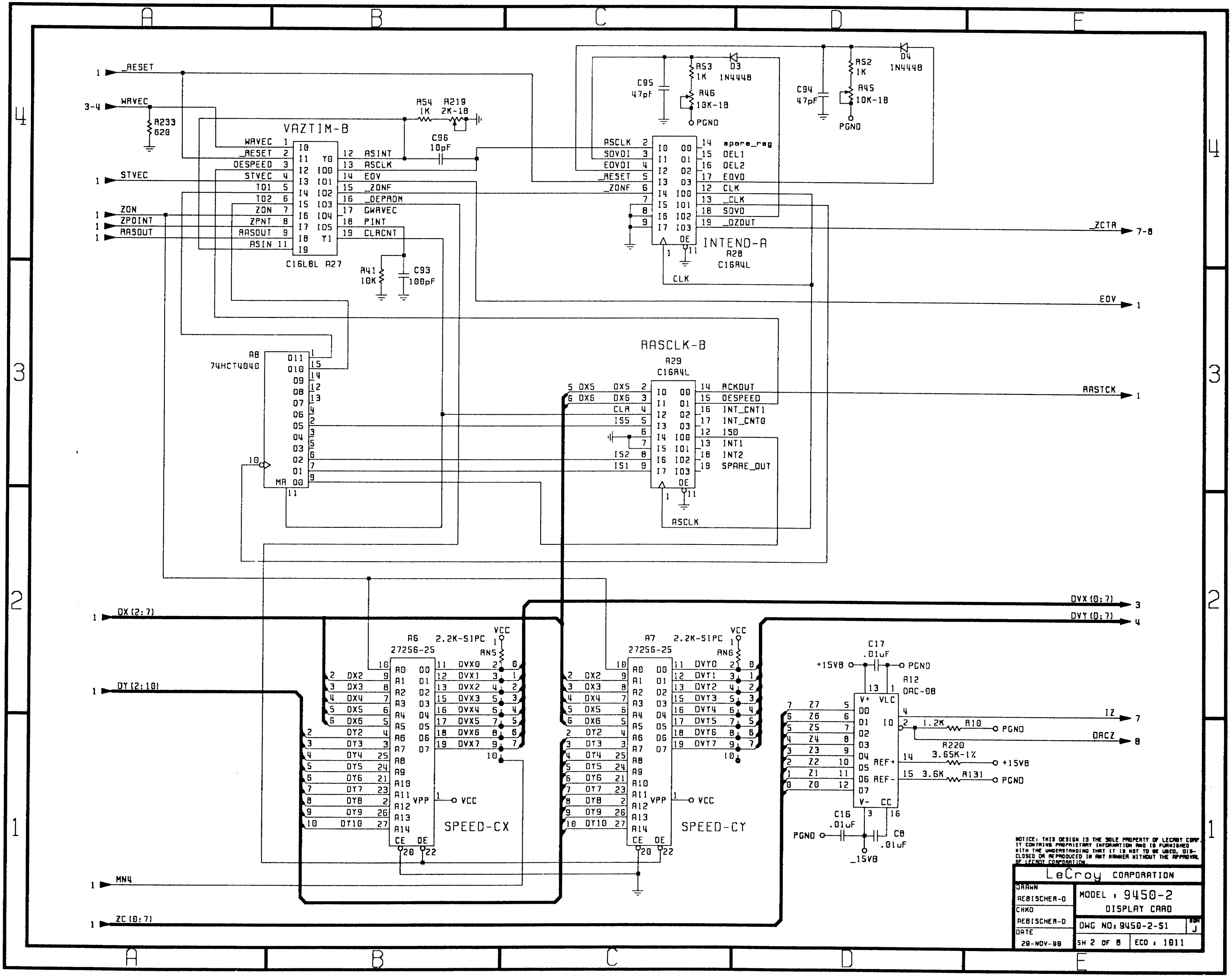
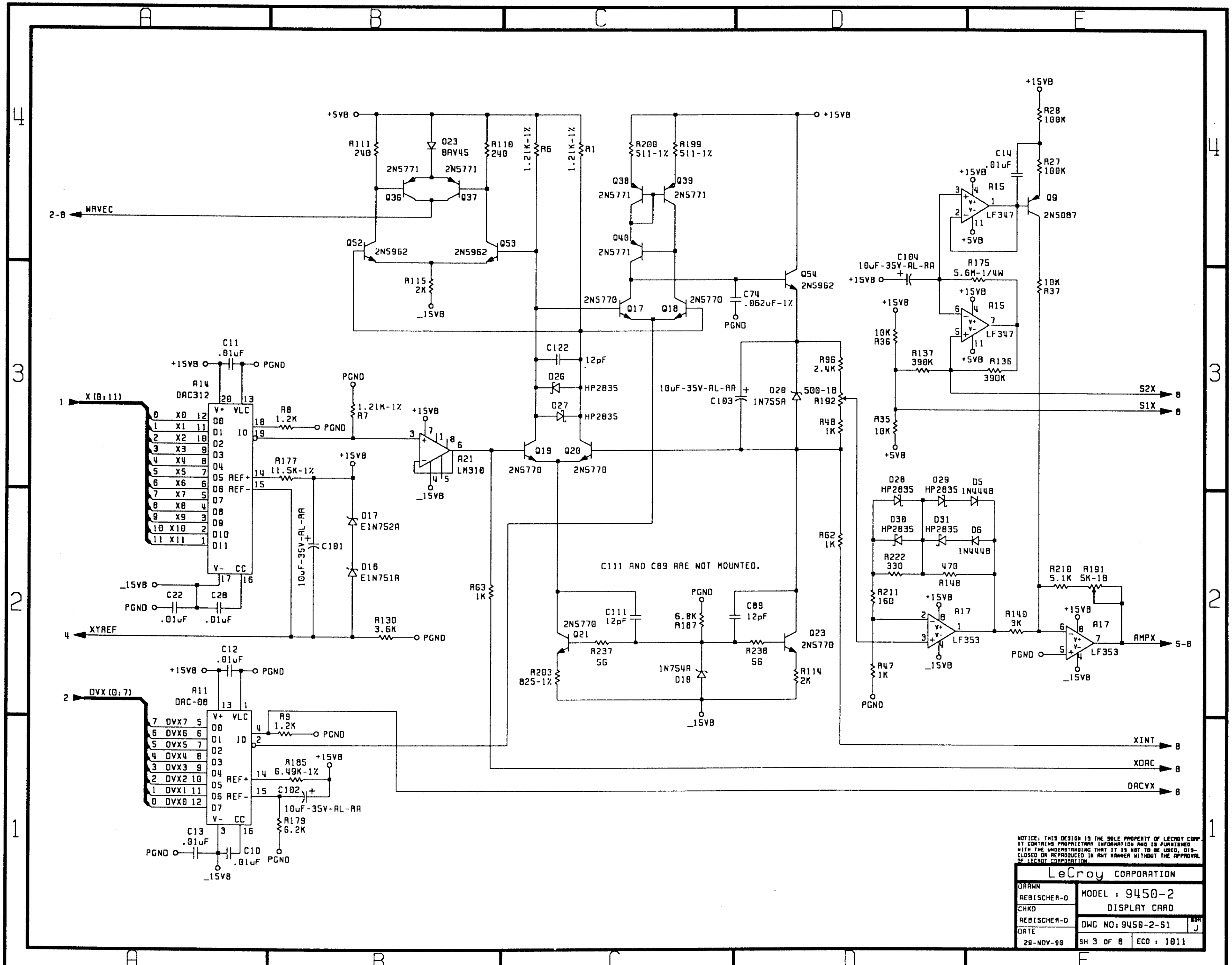
LeCroy CORPORATION
DRAWN
AEBISCHER-D
CHKD
AEBISCHER-D
DATE
28-NOV-90
MODEL : 9450-2
DISPLAY CARD
DWG NO: 9450-2-S1
J
SH 1 OF 8
ECO : 1011



Scan by Paladinmicro -- paladin@paladinmicro.com



+5VB
R111 240
D23 BAV45
R110 240
2N5771
Q36
Q37
WAVEC
2-8
Q52
2N5962
Q53
R115 2K
-15VB
1.21K-1% R6
1.21K-1% R1
R200 511-1%
R199 511-1%
Q38 2N5771
Q39 2N5771
Q40 2N5771
+15VB
Q54 2N5962
C74 .062uF-1%
PGND
2N5770 Q17
Q18 2N5770
C11 .01uF
R14 DAC312
X(0:11)
R8 1.2K
1.21K-1% R7
R177 11.5K-1%
R21 LM310
C122 12pF
D26 HP2835
D27 HP2835
Q19 Q20
2N5770
D17 E1N752A
D16 E1N751A
10uF-35V-AL-AA C101
C103 10uF-35V-AL-AA
D20 1N755A
R96 2.4K
500-10 R192
R48 1K
R62 1K
R63 1K
C22 .01uF
C28 .01uF
XYREF
R130 3.6K
C111 AND C89 ARE NOT MOUNTED.
C111 12pF
C89 12pF
6.8K R187
Q21 2N5770
R237 56
R238 56
Q23 2N5770
R203 825-1%
1N754A D18
R114 2K
C12 .01uF
R11 DAC-08
DVX(0:7)
R9 1.2K
R185 6.49K-1%
C102 10uF-35V-AL-AA
R179 6.2K
C13 .01uF
C10 .01uF
R28 100K
R27 100K
C14 .01uF
R15 LF347
Q9 2N5087
C104 10uF-35V-AL-AA
R175 5.6M-1/4W
10K R37
10K R36
R137 390K
R136 390K
S2X
S1X
R35 10K
D28 HP2835
D29 HP2835
D5 1N4448
D30 HP2835
D31 HP2835
D6 1N4448
R222 330
470 R148
R211 160
R17 LF353
R47 1K
R140 3K
R210 5.1K
R191 5K-10
AMPX 5-8
XINT
XDAC
DACVX
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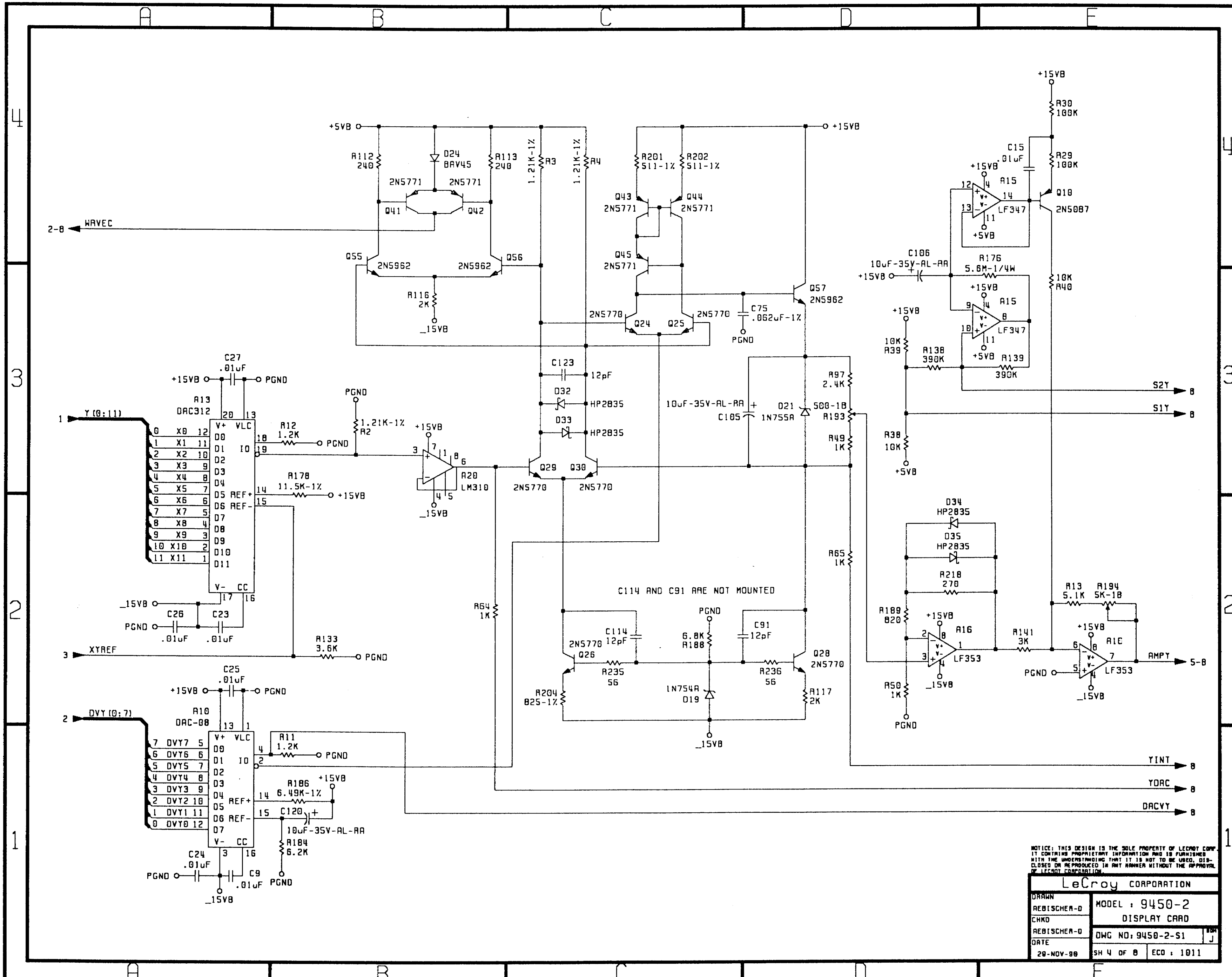
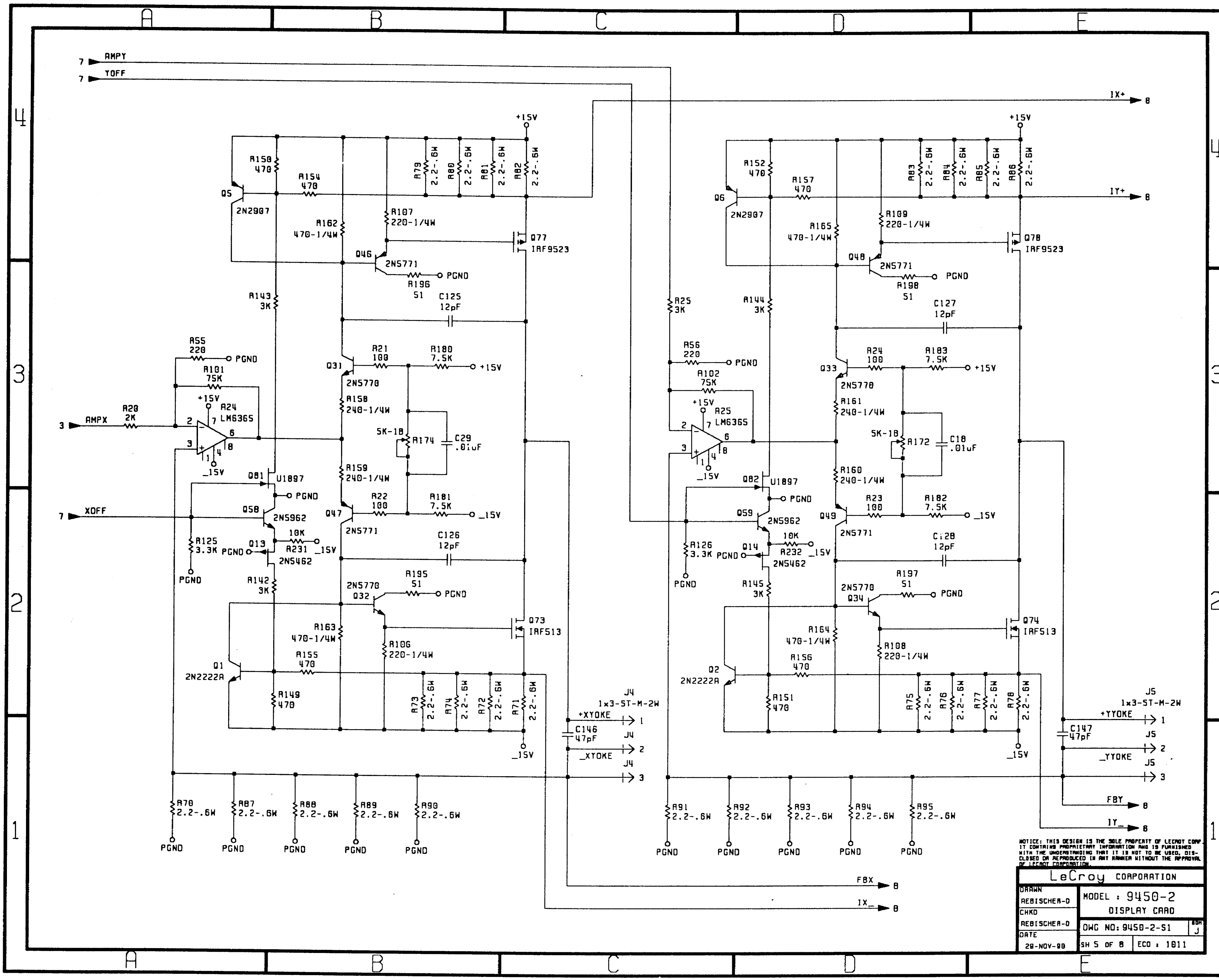
LeCroy CORPORATION
DRAWN REBISCHER-D
CHKD REBISCHER-D
DATE 20-NOV-90
MODEL : 9450-2
DISPLAY CARD
DWG NO: 9450-2-S1
BOM J
SH 3 OF 8
ECO : 1011



LeCroy CORPORATION		
DRAWN REBISCHER-D	MODEL : 9450-2 DISPLAY CARD	
CHKD REBISCHER-D	DWG NO: 9450-2-S1	REV J
DATE 28-NOV-90	SH 4 OF 8	ECO : 1011



AMPY
YOFF
IX+
IY+
+15V
R150 470
R154 470
Q5 2N2907
R79 2.2-.6W
R80 2.2-.6W
R81 2.2-.6W
R82 2.2-.6W
R162 470-1/4W
R107 220-1/4W
Q77 IRF9523
Q46 2N5771
R196 51
PGND
R143 3K
C125 12pF
R55 220
R101 75K
R20 2K
AMPX
R24 LM6365
Q31 2N5770
R21 100
R180 7.5K
R158 240-1/4W
5K-18
R174
C29 .01uF
R159 240-1/4W
Q81 U1897
XOFF
Q58 2N5962
Q47 2N5771
R22 100
R181 7.5K
-15V
R125 3.3K
Q13 2N5462
10K R231
C126 12pF
R142 3K
2N5770 Q32
R195 51
Q73 IRF513
R163 470-1/4W
R106 220-1/4W
Q1 2N2222A
R155 470
R149 470
R73 2.2-.6W
R74 2.2-.6W
R72 2.2-.6W
R71 2.2-.6W
J4 1x3-ST-M-2W
+XYOKE
C146 47pF
-XYOKE
R70 2.2-.6W
R87 2.2-.6W
R88 2.2-.6W
R89 2.2-.6W
R90 2.2-.6W
FBX
IX-
R152 470
Q6 2N2907
R157 470
R83 2.2-.6W
R84 2.2-.6W
R85 2.2-.6W
R86 2.2-.6W
R165 470-1/4W
R109 220-1/4W
Q78 IRF9523
Q48 2N5771
R198 51
R25 3K
R144 3K
C127 12pF
R56 220
R102 75K
R25 LM6365
Q33 2N5770
R24 100
R183 7.5K
R161 240-1/4W
R172
C18 .01uF
R160 240-1/4W
Q82 U1897
Q59 2N5962
Q49 2N5771
R23 100
R182 7.5K
R126 3.3K
Q14 2N5462
10K R232
C128 12pF
R145 3K
2N5770 Q34
R197 51
Q74 IRF513
R164 470-1/4W
R108 220-1/4W
Q2 2N2222A
R156 470
R151 470
R75 2.2-.6W
R76 2.2-.6W
R77 2.2-.6W
R78 2.2-.6W
J5 1x3-ST-M-2W
+YYOKE
C147 47pF
-YYOKE
FBY
IY-
R91 2.2-.6W
R92 2.2-.6W
R93 2.2-.6W
R94 2.2-.6W
R95 2.2-.6W
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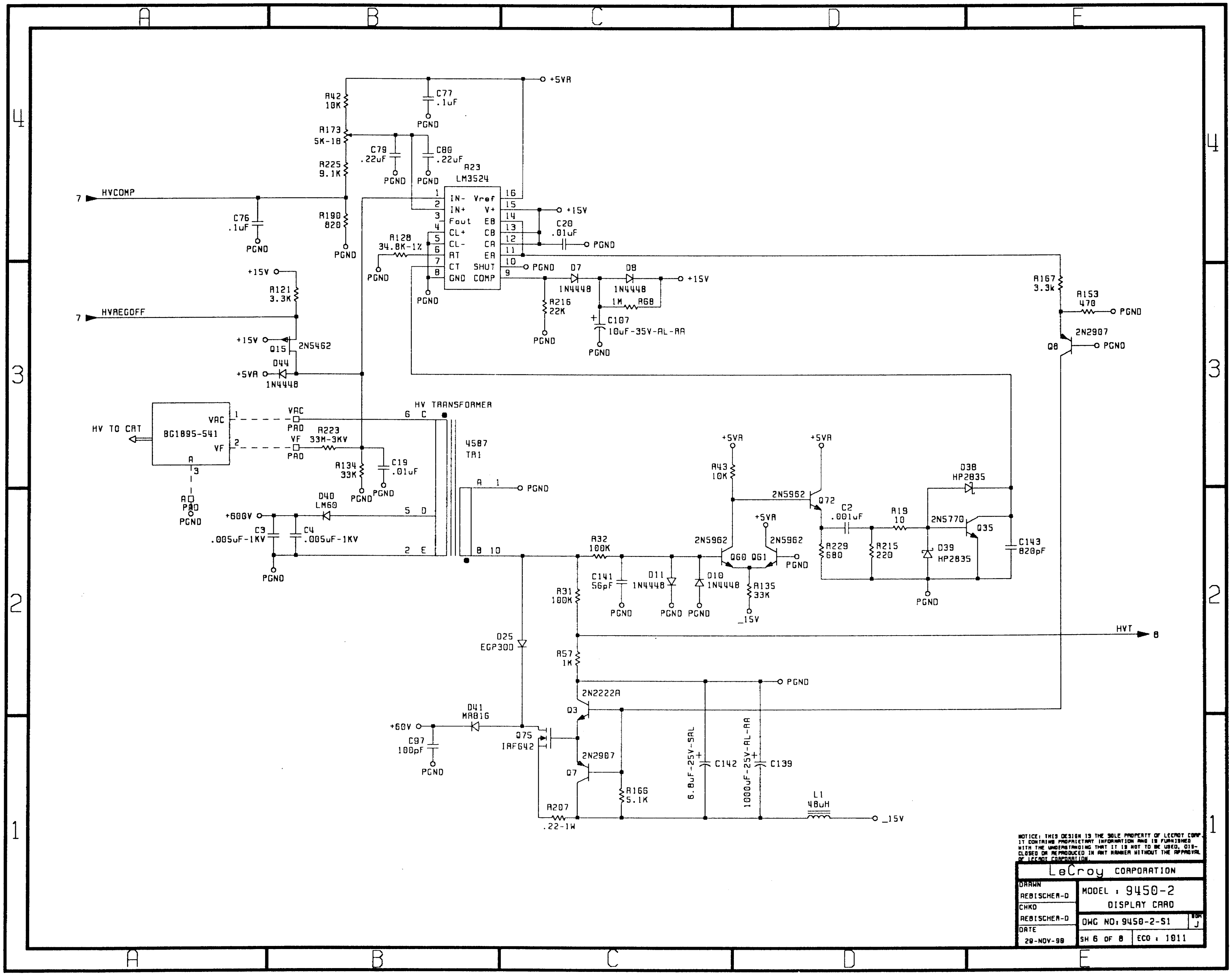
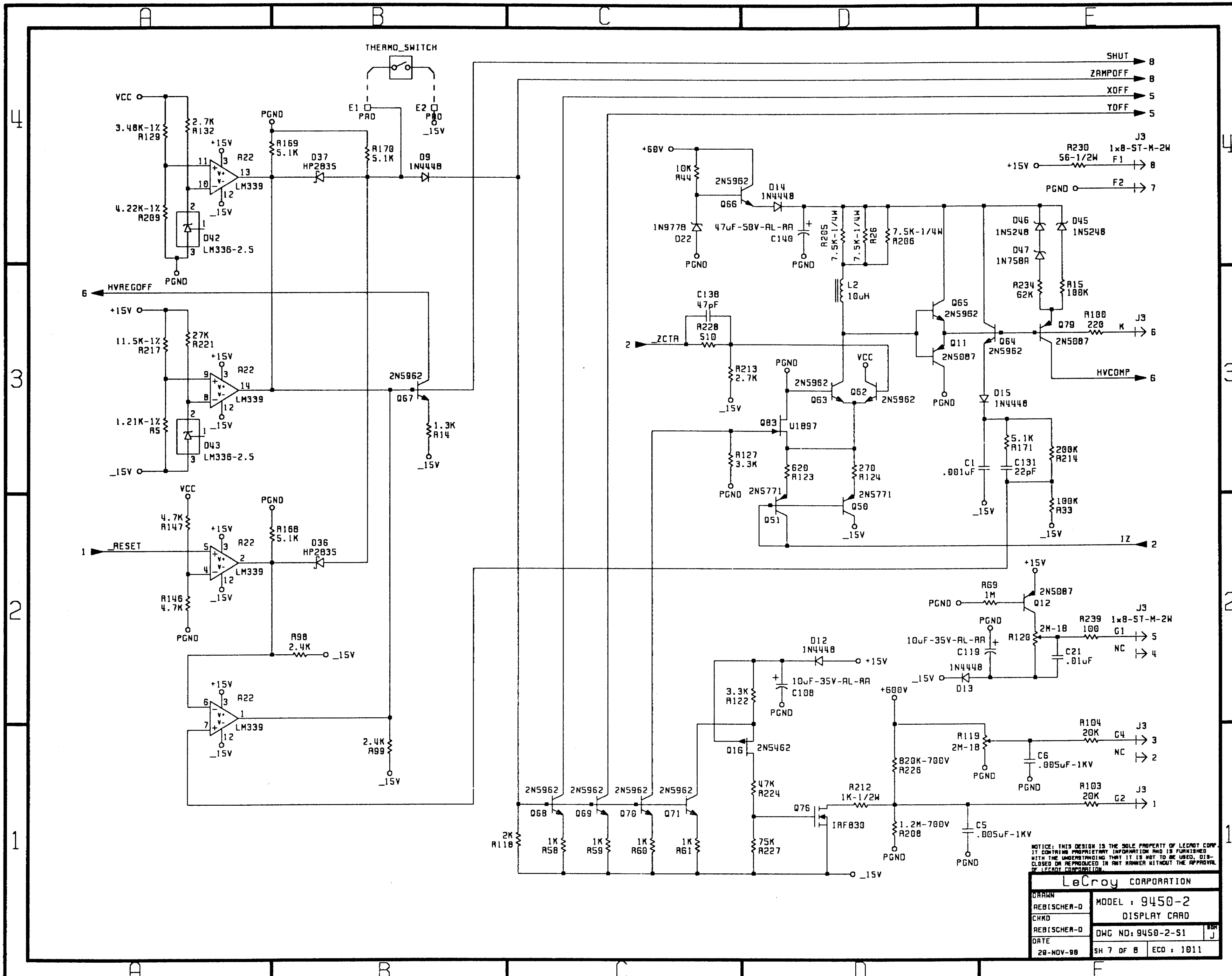
LeCroy CORPORATION
DRAWN REBISCHER-O
CHKD REBISCHER-O
DATE 28-NOV-88
MODEL : 9450-2
DISPLAY CARD
DWG NO: 9450-2-S1
J
SH 5 OF 8
ECO : 1011



Scan by Paladinmicro -- paladin@paladinmicro.com



THERMO_SWITCH
E1 PAD
E2 PAD
SHUT 8
ZAMPOFF 8
XOFF 5
YOFF 5
VCC
3.48K-1% R129
2.7K R132
PGND
+15V
R22
LM339
4.22K-1% R289
D42 LM336-2.5
R169 5.1K
D37 HP2835
R170 5.1K
D9 1N4448
_15V
6 HVREGOFF
11.5K-1% R217
27K R221
1.21K-1% R5
D43 LM336-2.5
2N5962 Q67
1.3K R14
4.7K R147
1 _RESET
R146 4.7K
R168 5.1K
D36 HP2835
R98 2.4K
2.4K R99
+60V
10K R44
2N5962 Q66
D14 1N4448
1N9778 D22
47uF-50V-AL-RA C140
R205 7.5K-1/4W
7.5K-1/4W R26
7.5K-1/4W R206
L2 10uH
C138 47pF
R228 510
2 _ZCTA
R213 2.7K
Q65 2N5962
Q11 2N5087
Q64 2N5962
Q79 2N5087
D46 1N5248
D45 1N5248
D47 1N758A
R234 62K
R15 100K
R100 220
K
J3 6
HVCOMP 6
D15 1N4448
Q63 2N5962
Q62 2N5962
Q83 U1897
R127 3.3K
620 R123
270 R124
2N5771 Q51
2N5771 Q50
5.1K R171
C1 .001uF
C131 22pF
200K R214
100K R33
IZ 2
J3 1x8-ST-M-2W
R230 56-1/2W
F1 8
F2 7
R69 1M
2N5087 Q12
R239 100
G1 5
NC 4
10uF-35V-AL-RA C119
R120 2M-18
C21 .01uF
D12 1N4448
D13 1N4448
3.3K R122
10uF-35V-AL-RA C108
2N5462 Q16
47K R224
75K R227
+600V
820K-700V R226
R119 2M-18
R104 20K
G4 3
NC 2
C6 .005uF-1KV
R212 1K-1/2W
Q76 IRF830
1.2M-700V R208
C5 .005uF-1KV
R103 20K
G2 1
2N5962 Q68
2N5962 Q69
2N5962 Q70
2N5962 Q71
2K R118
1K R58
1K R59
1K R60
1K R61
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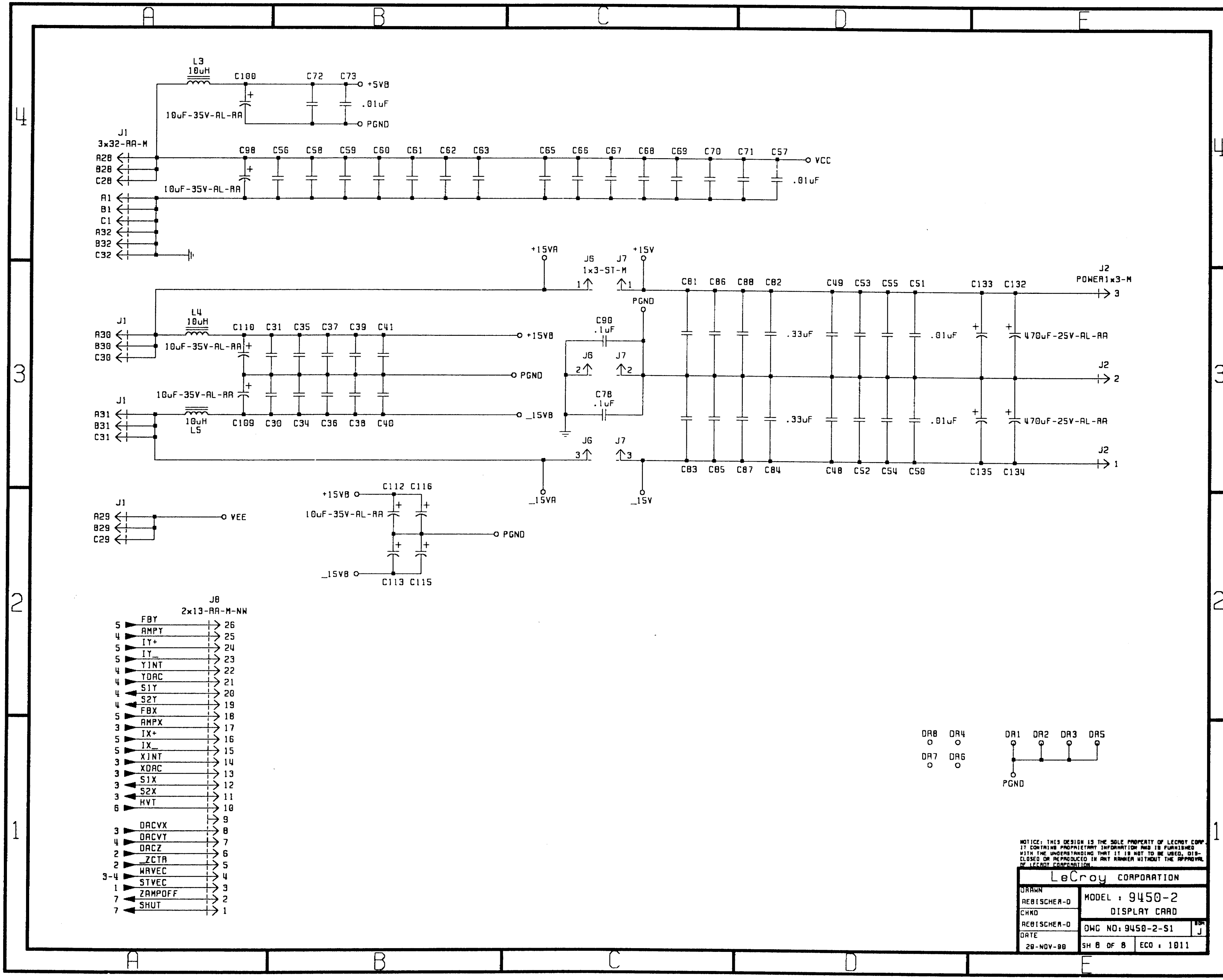
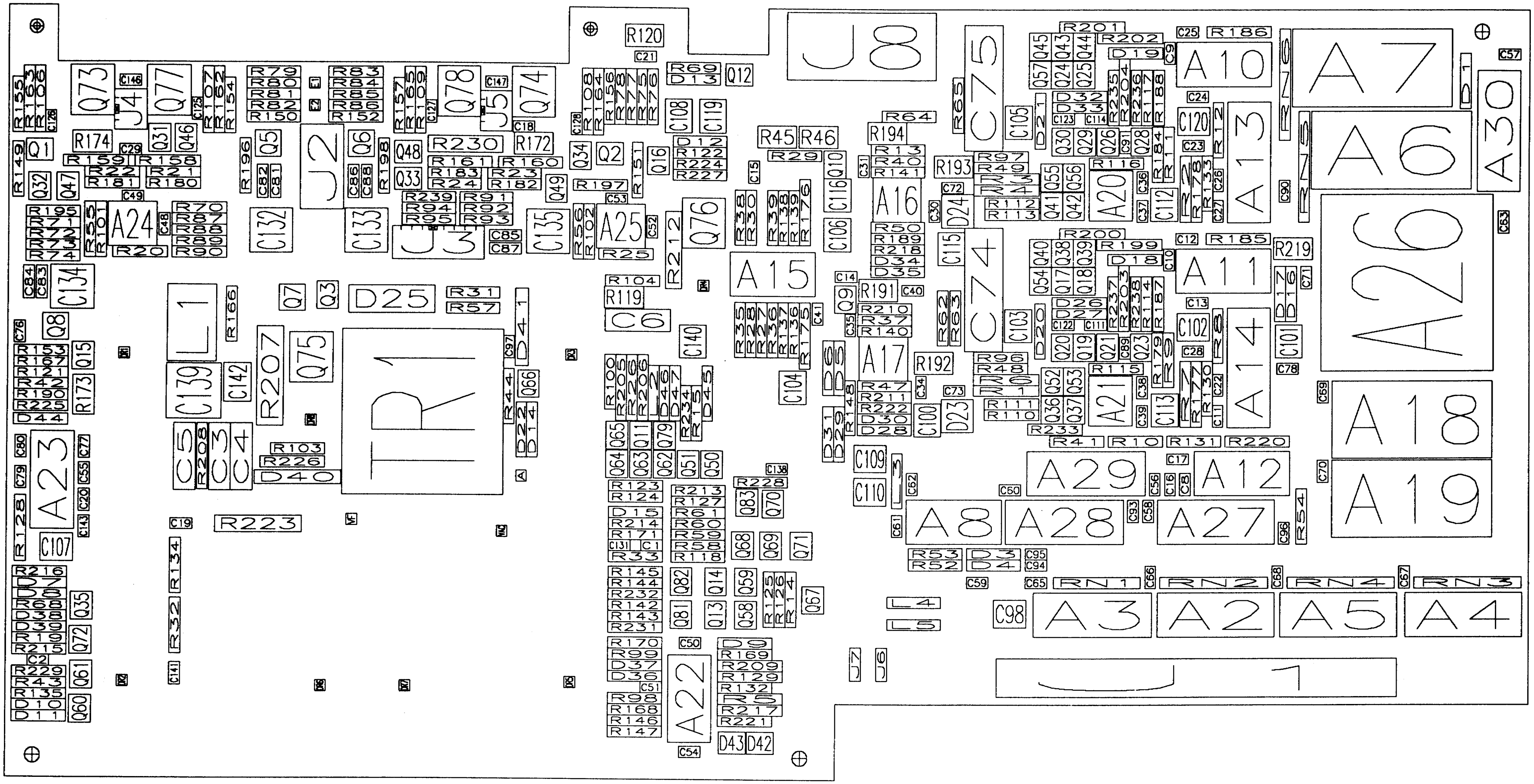
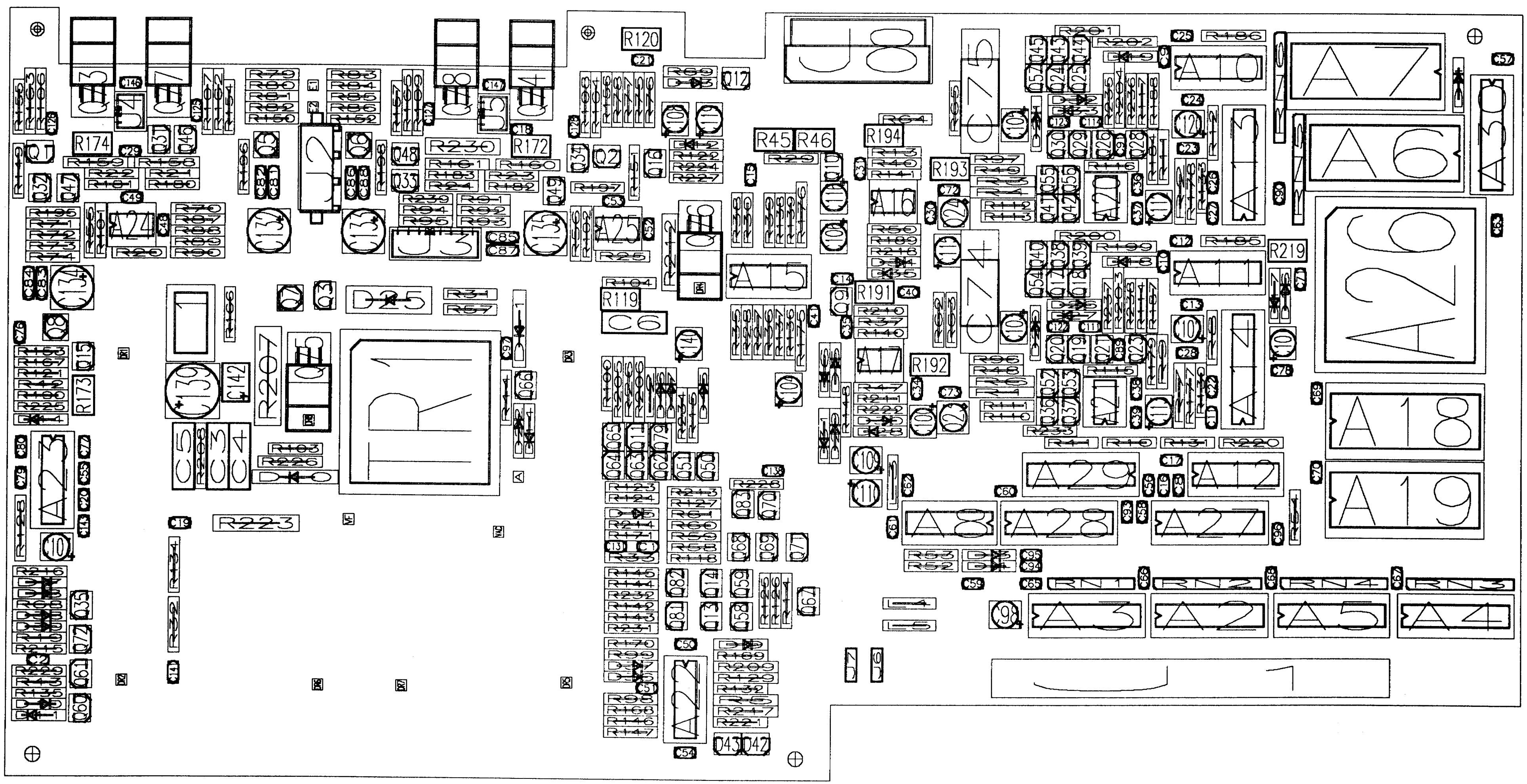
LeCroy CORPORATION
DRAWN REBISCHER-D
CHKD REBISCHER-D
DATE 20-NOV-90
MODEL : 9450-2
DISPLAY CARD
DWG NO: 9450-2-S1
J
SH 7 OF 8
ECO : 1011



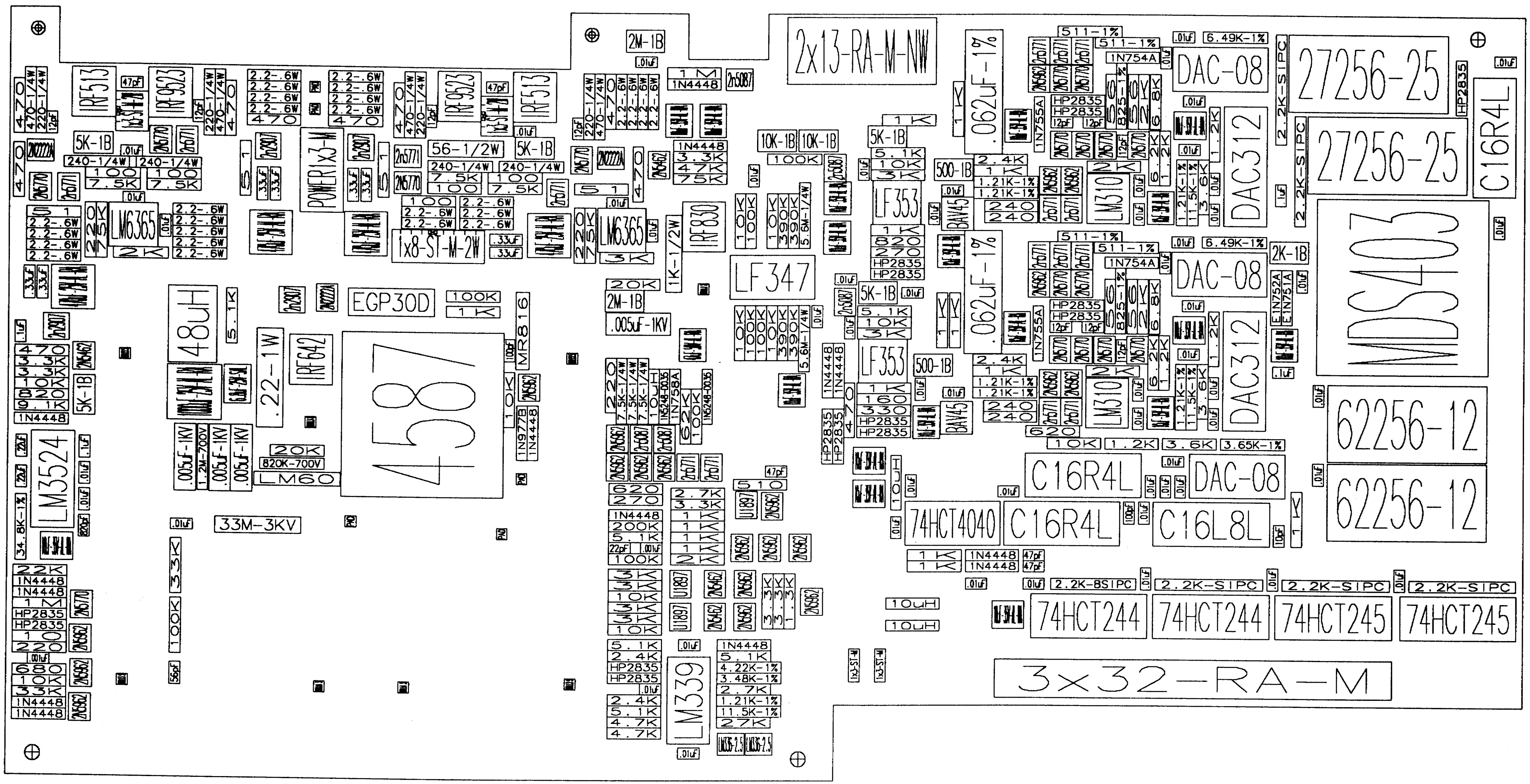
Scan by Paladinmicro -- paladin@paladinmicro.com


J8
A7
A10
A6
A30
A26
A13
A11
A14
A18
A19
A12
A29
A8
A28
A27
A3
A2
A5
A4
J1
TR1
L1
J2
J3
A15
A16
A17
A20
A21
A22
A23
A24
A25
C75
C74
D25
R207
Q75
C6
R223

9450-2 Rev:J

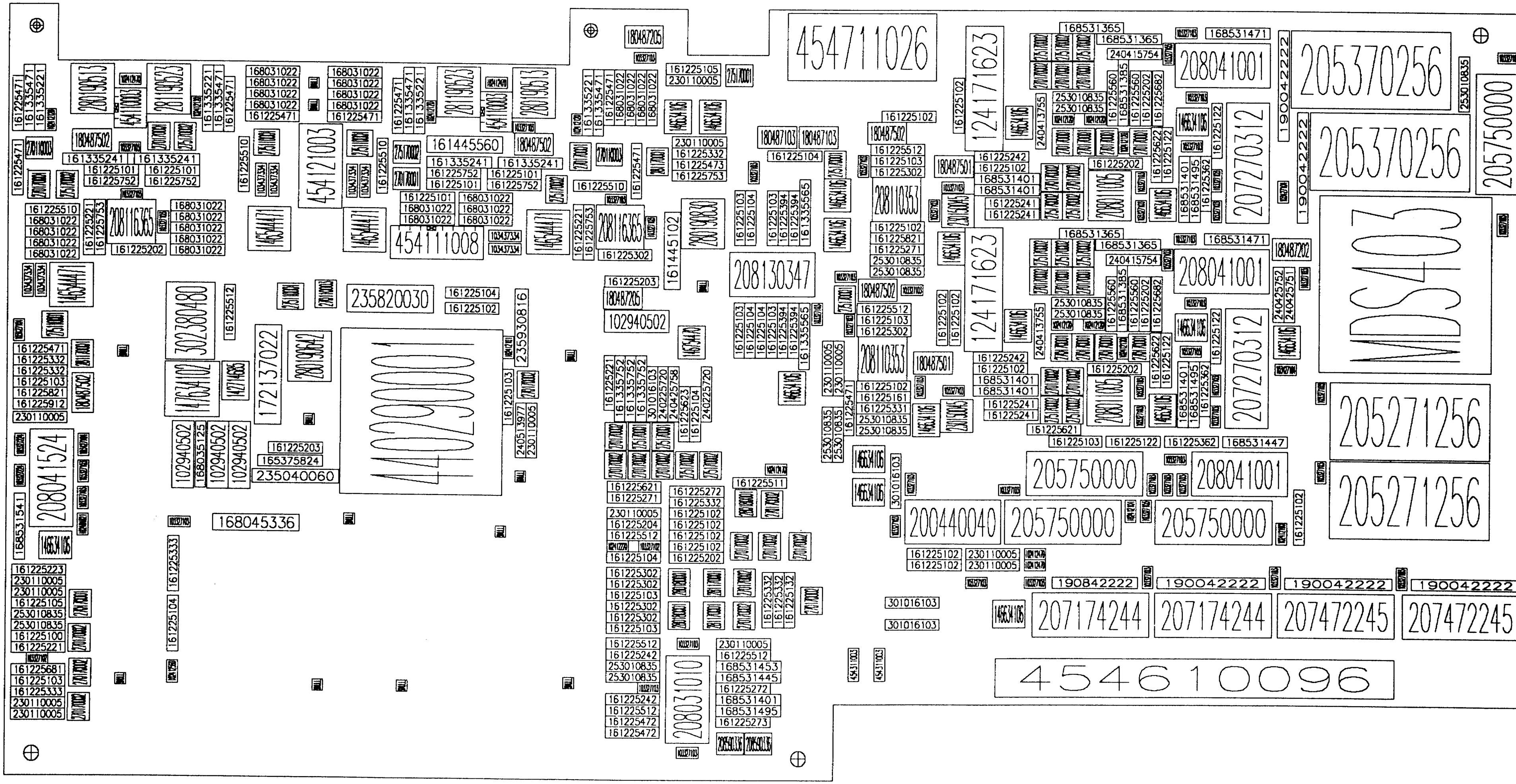


9450-2 Rev:J



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

9450-2 Rev:J



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205750000
MDS403
205271256
208041001
207270312
454121003
454111008
440290001
235820030
208130347
208041524
207174244
207472245
200440040
454610096

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	E1N751A	DO35	2184400	8940800	1	90
D17	240425752	E1N752A	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	to18_2L	-5638800	4724400	1	0
D24	230150045	BAV45	to18_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

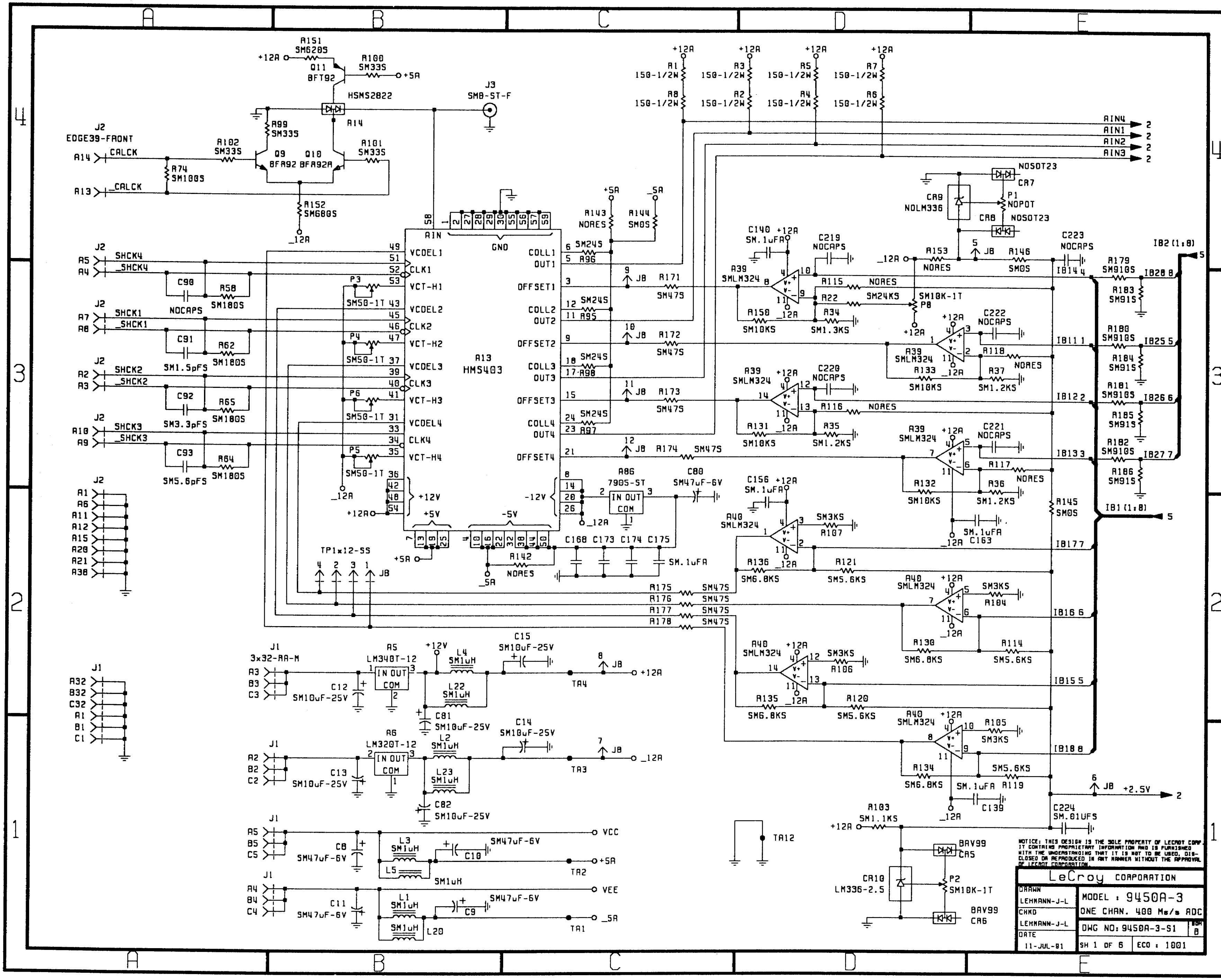
Q54	270170002	2N5962	TO92	-3759200	9550400	1	90
Q55	270170002	2N5962	TO92	-3378200	12319000	1	270
Q56	270170002	2N5962	TO92	-2870200	12319000	1	270
Q57	270170002	2N5962	TO92	-3784600	14274800	1	90
Q58	270170002	2N5962	TO92	-10668000	1828800	1	90
Q59	270170002	2N5962	TO92	-10668000	2590800	1	90
Q60	270170002	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
R147	161225472	4.7K	RES05	-12700000	-660400	1	180
R148	161225471	470	RES05	-8178800	6299200	1	90
R149	161225471	470	RES05	-27736800	12700000	1	270
R150	161225471	470	RES05	-21285200	13411200	1	180
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	SIP10RES	5232400	2794000	1	90
RN4	190042222	2.2K-SIPC	SIP10RES	2235200	2794000	1	90

RN5	190042222	2.2K-SIPC	SIP10RES	2489200	13512800	1	0
RN6	190042222	2.2K-SIPC	SIP10RES	2032000	15392400	1	0
TR1	440290001	4587	TRANSFO_HT	-19507200	7670800	1	0



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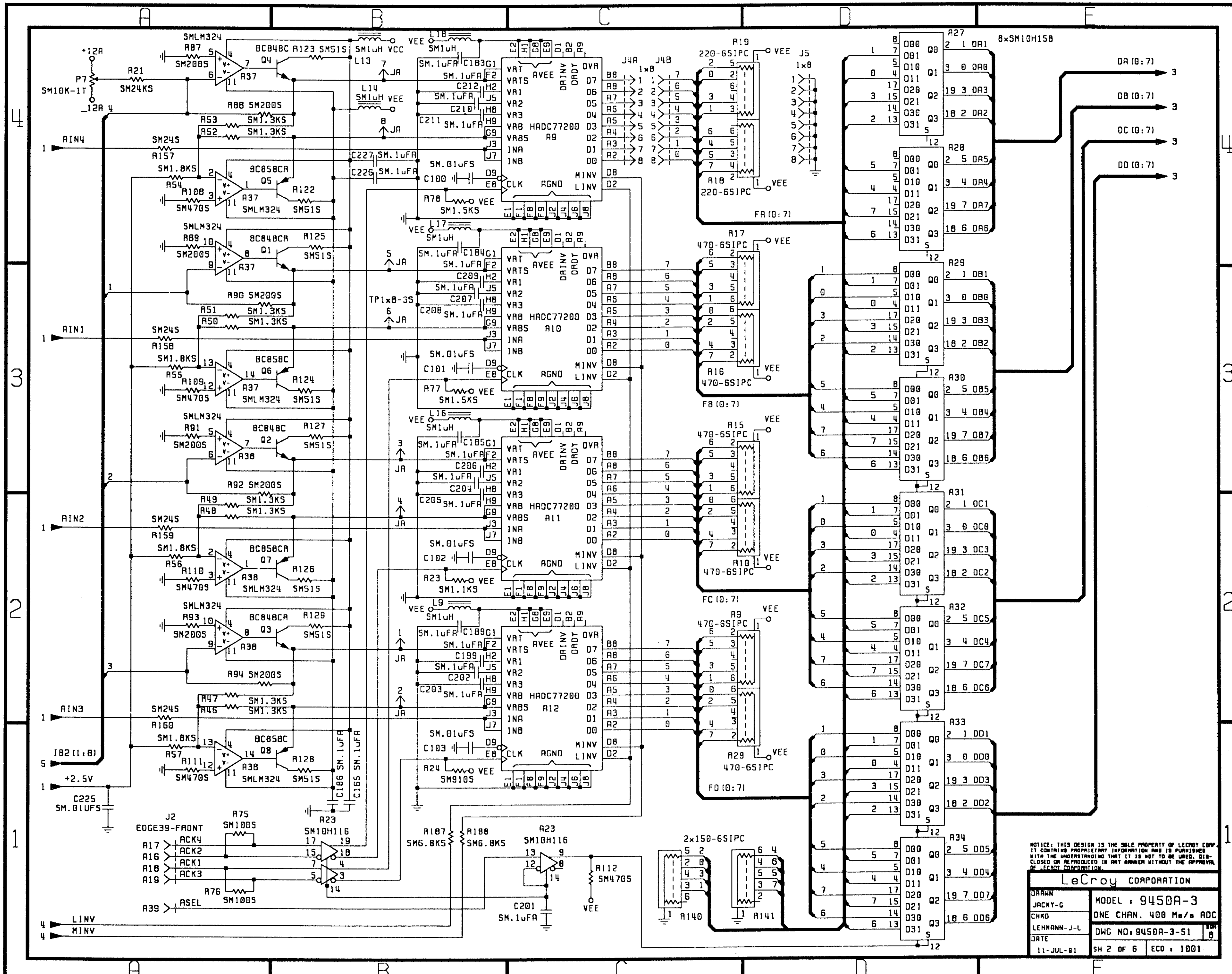
LeCroy CORPORATION
DRAWN LEHMANN-J-L
CHKD LEHMANN-J-L
DATE 11-JUL-91
MODEL : 9450A-3
ONE CHAN. 400 Ms/s ADC
DWG NO: 9450A-3-S1
B
SH 1 OF 6
ECO : 1001
A13
HMS403
J2
EDGE39-FRONT
J3
SMB-ST-F
J1
3x32-RA-M
A5
LM340T-12
A6
LM320T-12
A86
7905-ST
CR9
NOLM336
CR10
LM336-2.5
AIN4
AIN1
AIN2
AIN3
+2.5V
VCC
VEE



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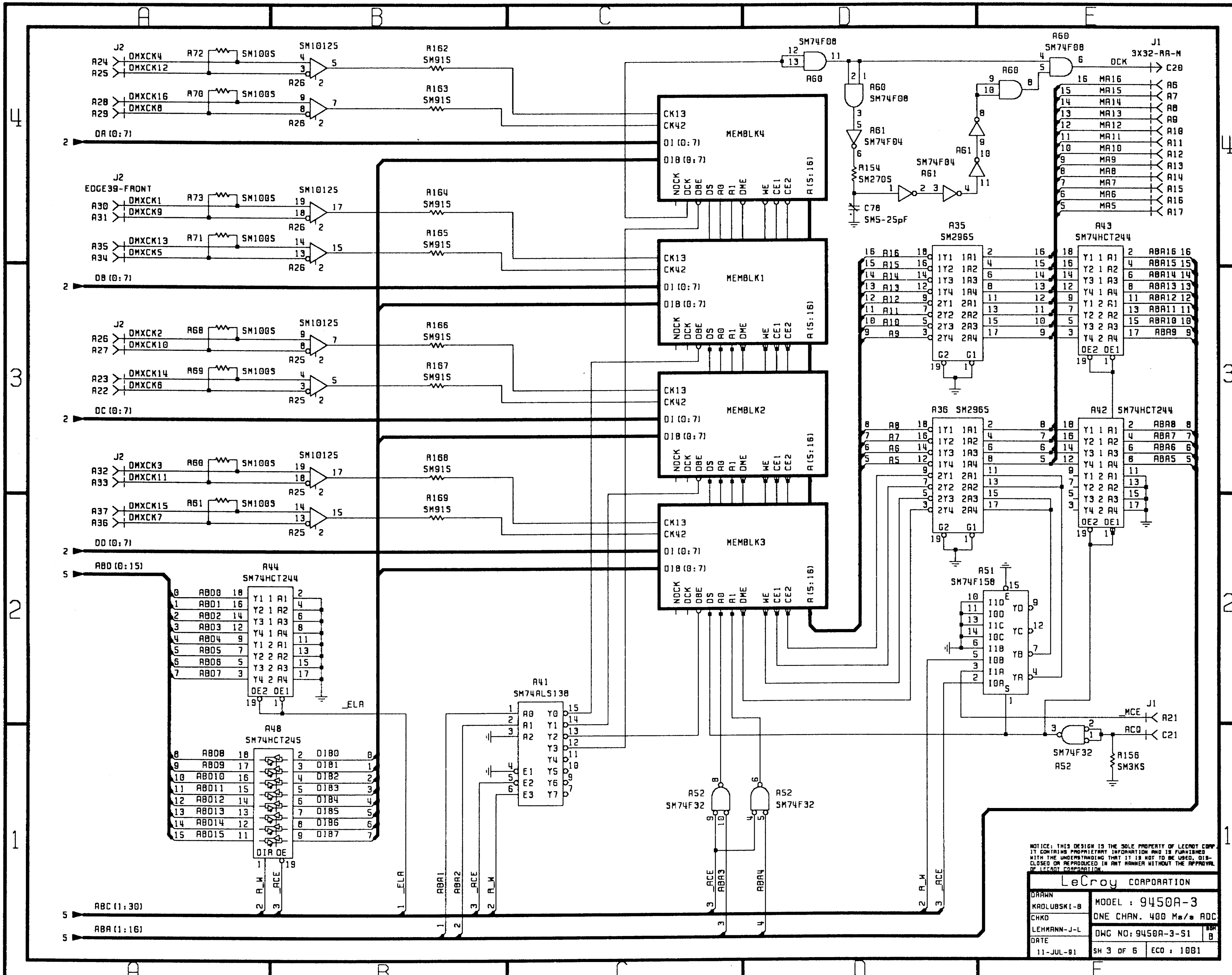
LeCroy CORPORATION	
DRAWN JACKY-G	MODEL : 9450A-3
CHKD LEHMANN-J-L	ONE CHAN. 400 Ms/s ADC
DATE 11-JUL-91	DWG NO: 9450A-3-S1 REV B
	SH 2 OF 6 ECO : 1001


MEMBLK4
MEMBLK1
MEMBLK2
MEMBLK3
CK13 CK42 DI(0:7) DIB(0:7)
NDCK DCK DBE DS A0 A1 OME WE CE1 CE2 A(5:16)
J2
EDGE39-FRONT
DMXCK4 DMXCK12 DMXCK16 DMXCK8 DMXCK1 DMXCK9 DMXCK13 DMXCK5 DMXCK2 DMXCK10 DMXCK14 DMXCK6 DMXCK3 DMXCK11 DMXCK15 DMXCK7
SM10125
SM100S
SM91S
DA(0:7)
DB(0:7)
DC(0:7)
DD(0:7)
ABD(0:15)
A44 SM74HCT244
A48 SM74HCT245
A41 SM74ALS138
A52 SM74F32
A60 SM74F08
A61 SM74F04
R154 SM270S
C78 SM5-25pF
A35 SM2965
A36 SM2965
A43 SM74HCT244
A42 SM74HCT244
A51 SM74F158
R156 SM3KS
J1
3X32-AA-M
DCK
_ELA
_MCE
ACQ
ABC(1:30)
ABA(1:16)
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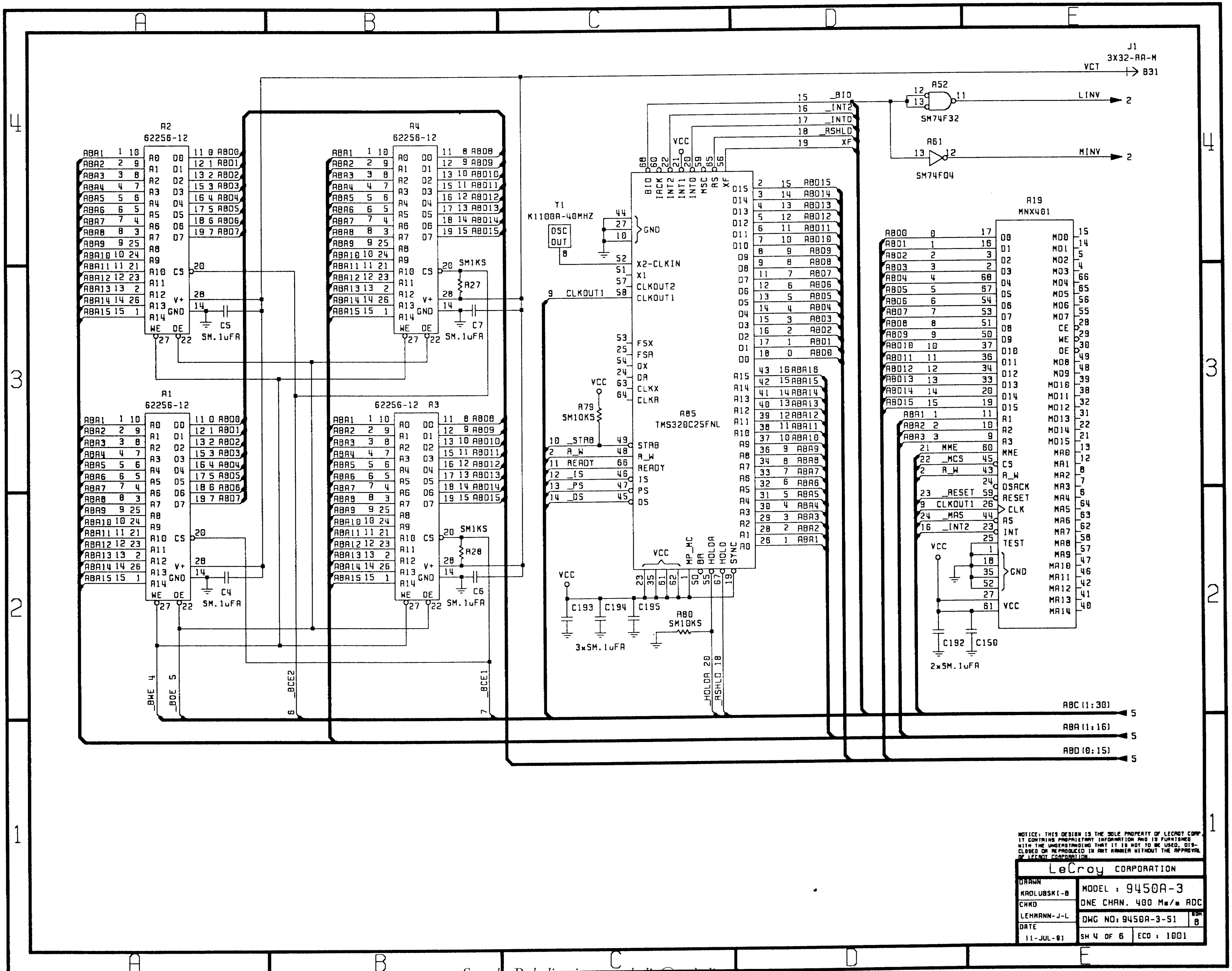
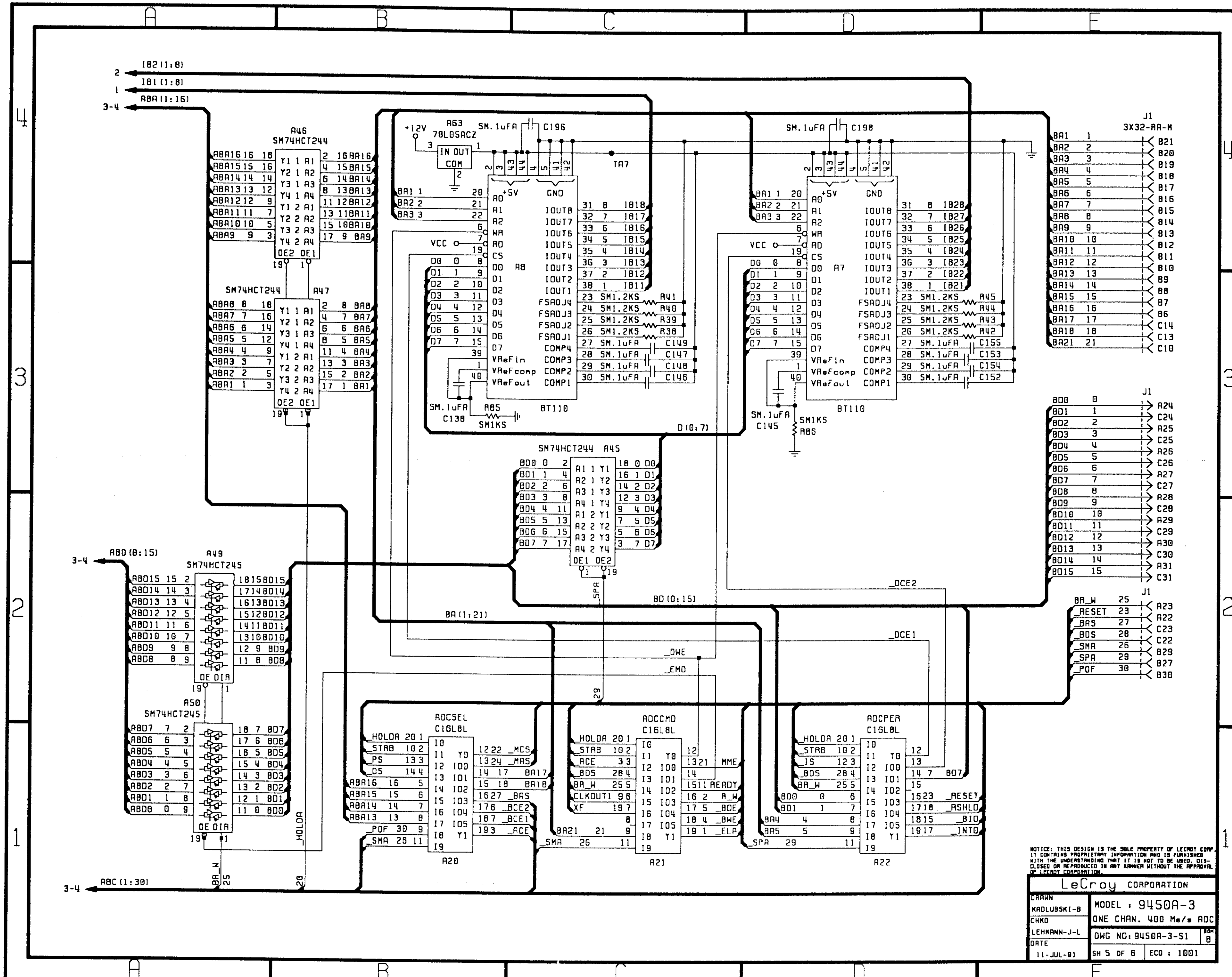
LeCroy CORPORATION
DRAWN KROLUBSKI-B
CHKD LEHMANN-J-L
DATE 11-JUL-91
MODEL : 9450A-3
ONE CHAN. 400 Ms/s ADC
DWG NO: 9450A-3-S1
SH 3 OF 6
ECO : 1081


J1
3X32-AA-M
A2
62256-12
A4
62256-12
A1
62256-12
62256-12 A3
A52
SM74F32
A61
SM74F04
Y1
K1100A-40MHZ
OSC OUT
A85
TMS320C25FNL
A19
MNX401
C5 SM.1uFA
C7 SM.1uFA
C4 SM.1uFA
C6 SM.1uFA
3xSM.1uFA
2xSM.1uFA
ABC(1:30)
ABA(1:16)
ABD(0:15)
LeCroy CORPORATION
DRAWN KAOLUBSKI-B
CHKD LEHMANN-J-L
DATE 11-JUL-91
MODEL : 9450A-3
ONE CHAN. 400 Ms/s ADC
DWG NO: 9450A-3-S1
SH 4 OF 6
ECO : 1001


A46
SM74HCT244
A47
SM74HCT244
A49
SM74HCT245
A50
SM74HCT245
A45
SM74HCT244
A63
78L05ACZ
A8
BT110
A7
BT110
ADCSEL
C16L8L
A20
ADCCMD
C16L8L
A21
ADCPER
C16L8L
A22
J1
3X32-AA-M
IB2(1:8)
IB1(1:8)
ABA(1:16)
ABD(0:15)
ABC(1:30)
BA(1:21)
BD(0:15)
D(0:7)
_DCE2
_DCE1
_DWE
_EMD
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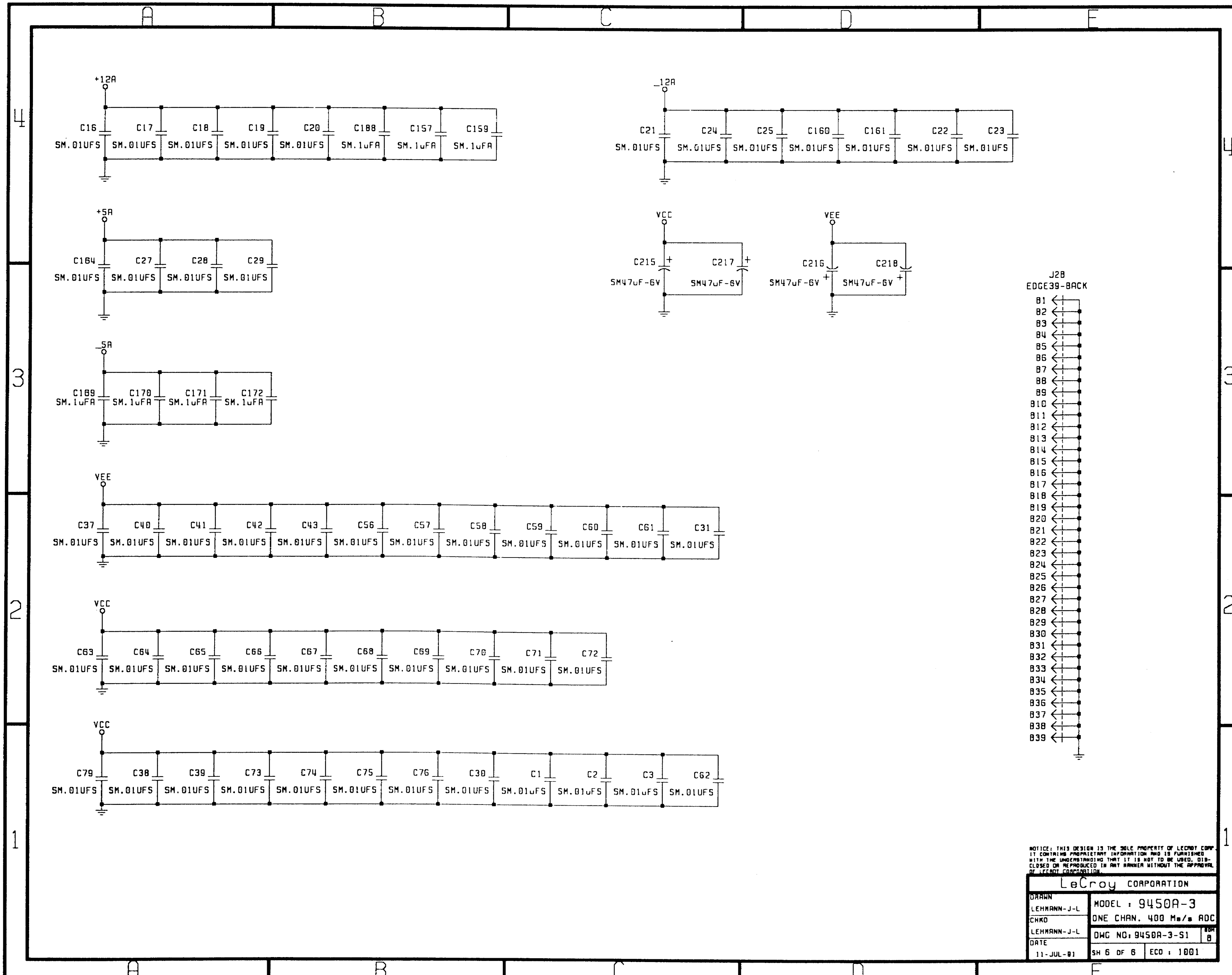
LeCroy CORPORATION
DRAWN KAOLUBSKI-B
CHKD LEHMANN-J-L
DATE 11-JUL-91
MODEL : 9450A-3
ONE CHAN. 400 Ms/s ADC
DWG NO: 9450A-3-S1
SH 5 OF 6
ECO : 1001



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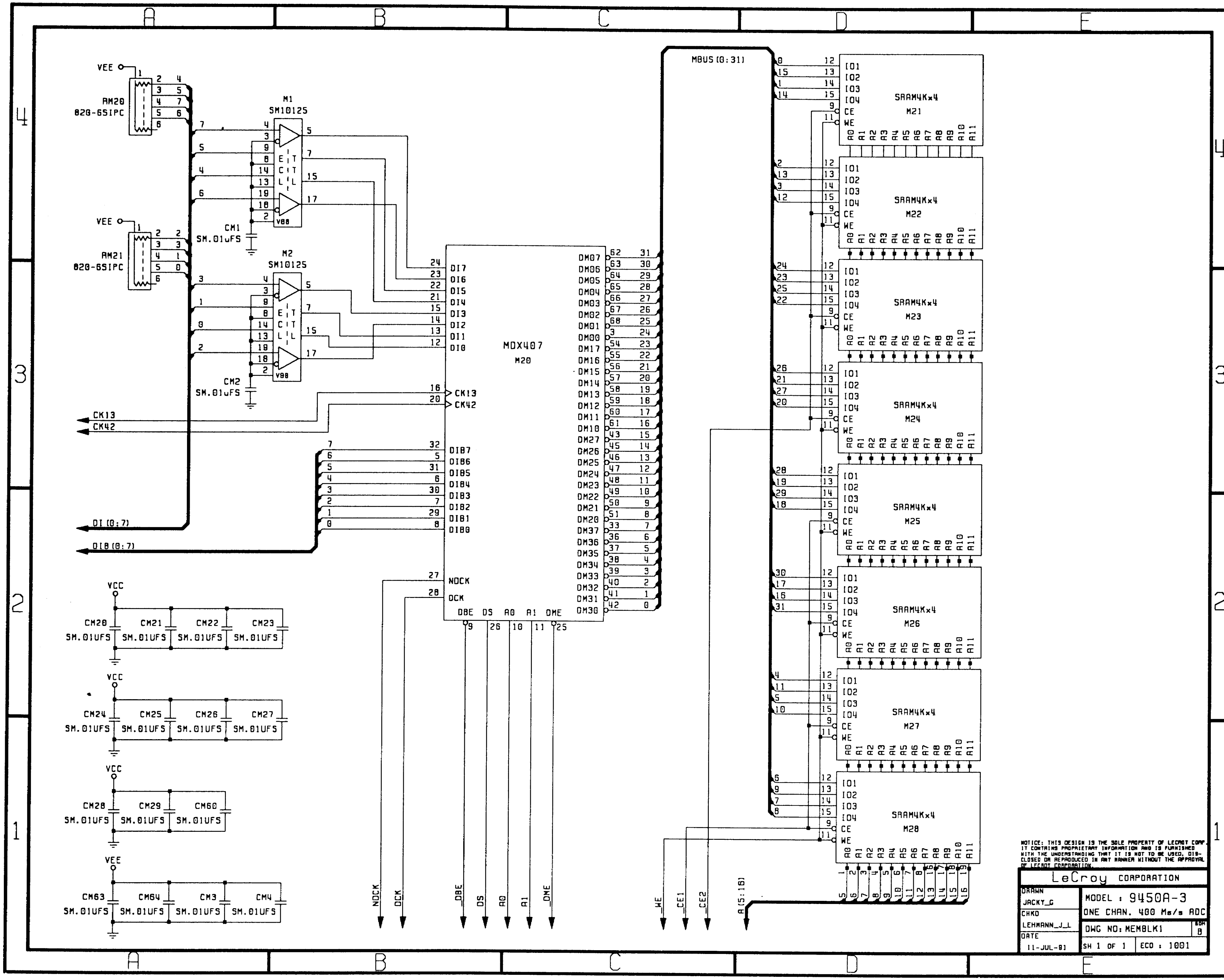
VEE
RM20
820-6SIPC
RM21
820-6SIPC
M1
SM10125
M2
SM10125
CM1
SM.01uFS
CM2
SM.01uFS
CK13
CK42
DI(0:7)
DIB(0:7)
MDX407
M20
MBUS(0:31)
SRAM4Kx4
M21
M22
M23
M24
M25
M26
M27
M28
VCC
CM20 CM21 CM22 CM23
CM24 CM25 CM26 CM27
CM28 CM29 CM60
CM63 CM64 CM3 CM4
SM.01UFS
NDCK
DCK
_DBE
DS
A0
A1
_DME
_WE
_CE1
_CE2
A(5:16)
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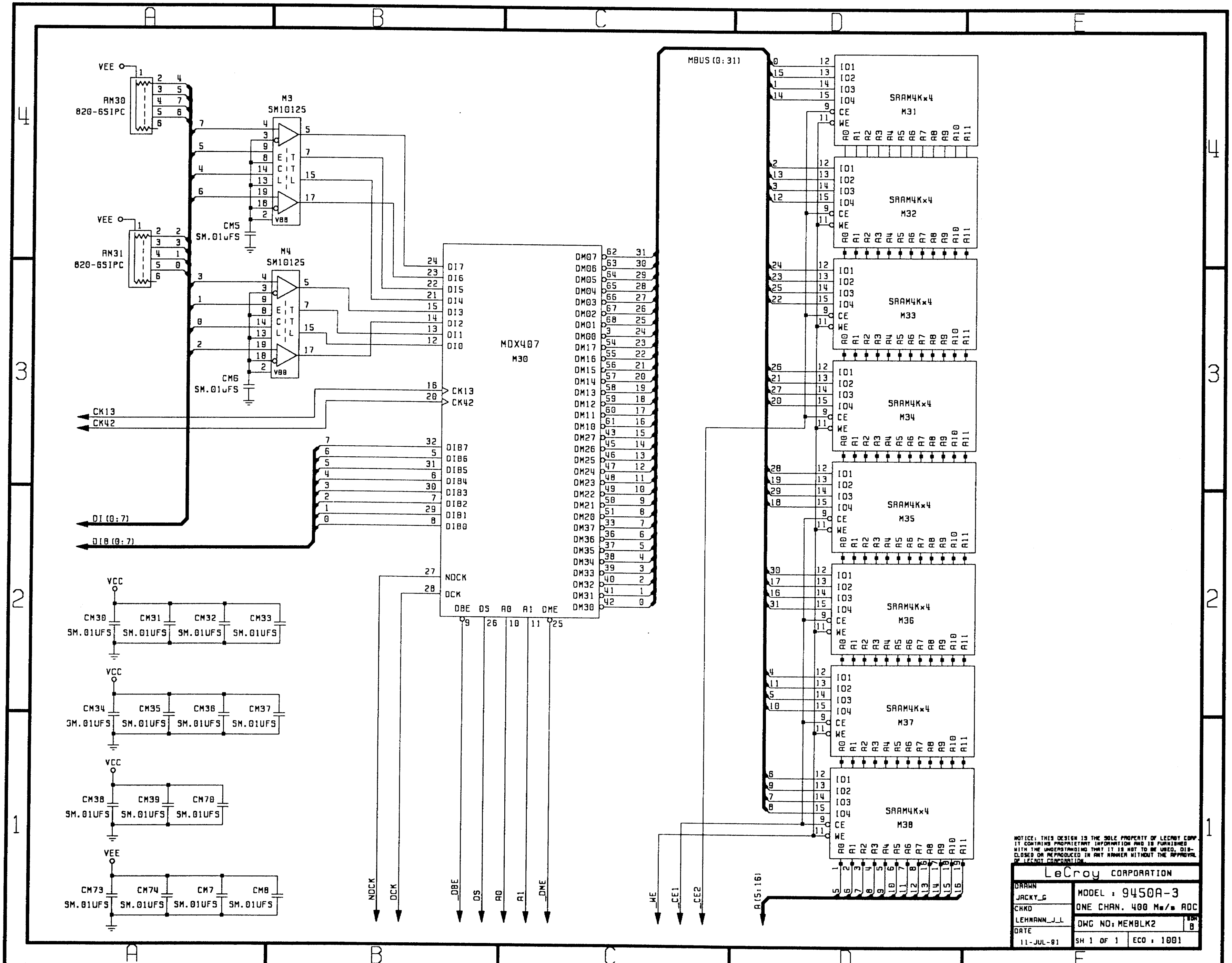
LeCroy CORPORATION
DRAWN JACKY_G
CHKD LEHMANN_J_L
DATE 11-JUL-91
MODEL : 9450A-3
ONE CHAN. 400 Ms/s ADC
DWG NO: MEMBLK1
BOM B
SH 1 OF 1
ECO : 1001



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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-91	DWG NO: MEMBLK2 · REV B
	SH 1 OF 1 · ECO : 1001

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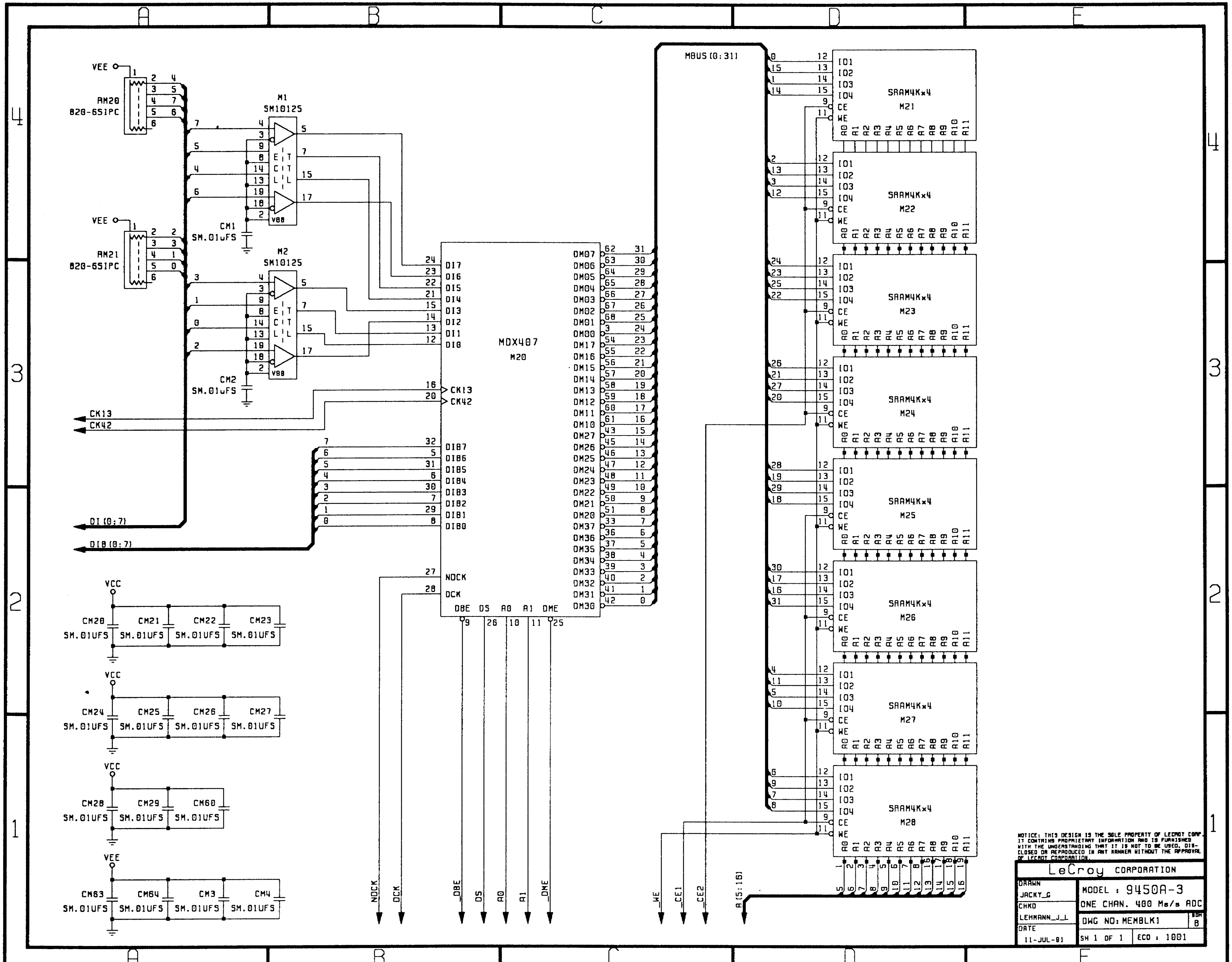

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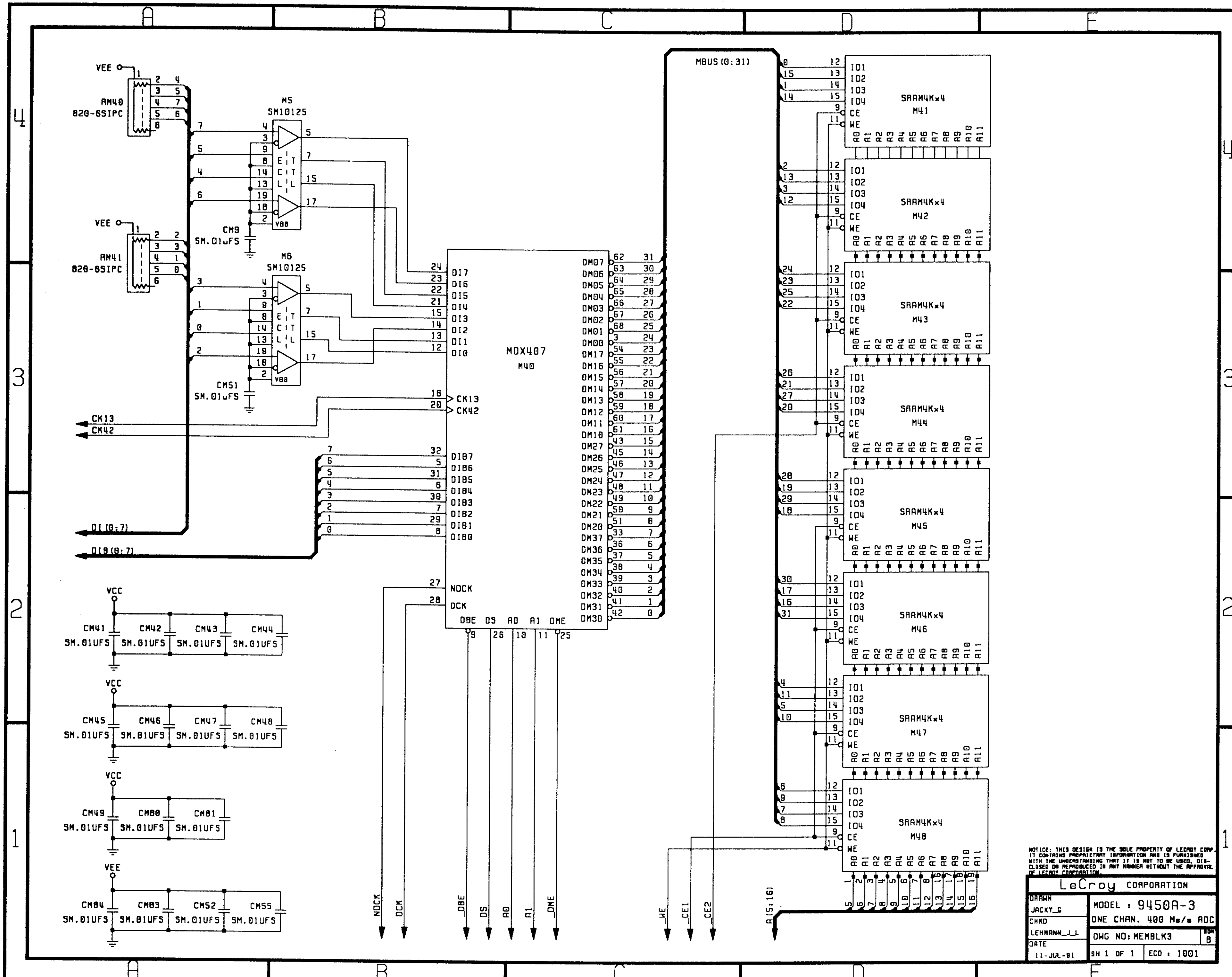

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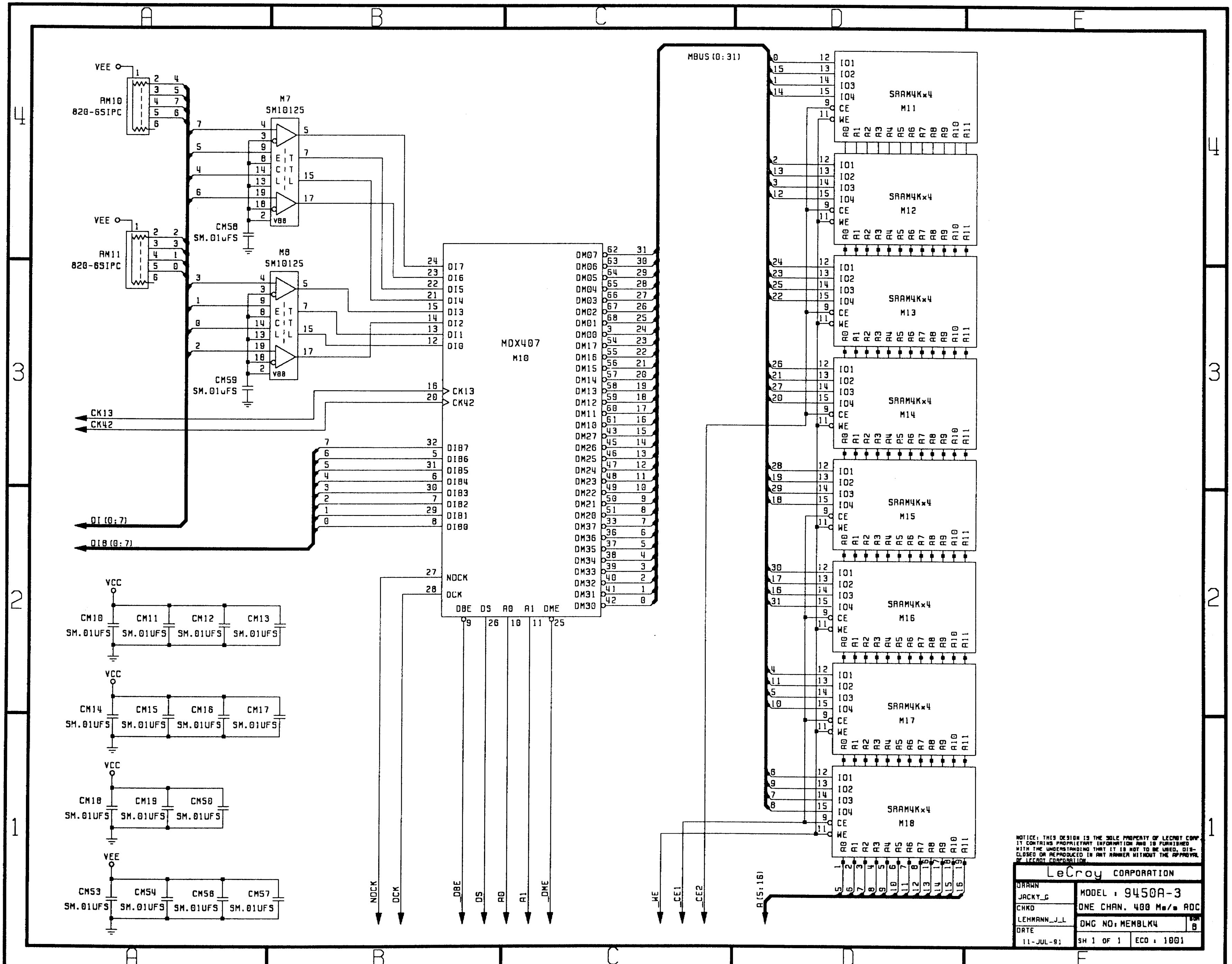

MBUS (0:31)
VEE
RM10
820-6SIPC
RM11
M7
SM10125
M8
CM58
SM.01uFS
CM59
CK13
CK42
DI (0:7)
DIB (0:7)
MDX407
M10
NDCK
DCK
_DBE
DS
A0
A1
_DME
_WE
_CE1
_CE2
A(5:16)
SRAM4Kx4
M11
M12
M13
M14
M15
M16
M17
M18
VCC
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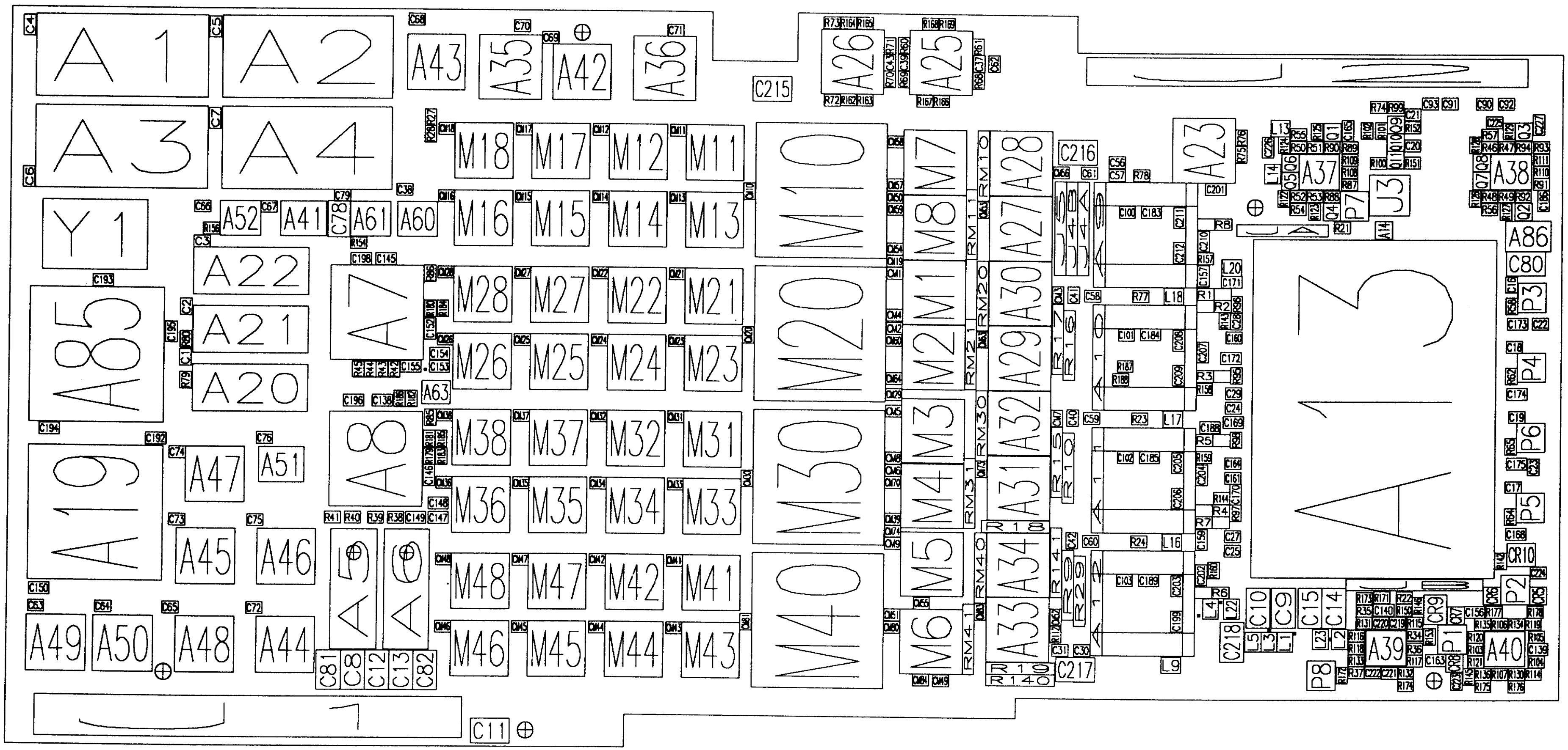
LeCroy CORPORATION
DRAWN JACKY_G
CHKD LEHMANN_J_L
DATE 11-JUL-91
MODEL : 9450A-3
ONE CHAN. 400 Ms/s ADC
DWG NO: MEMBLK4
B
SH 1 OF 1
ECO : 1001



9450A-3 Rev:B

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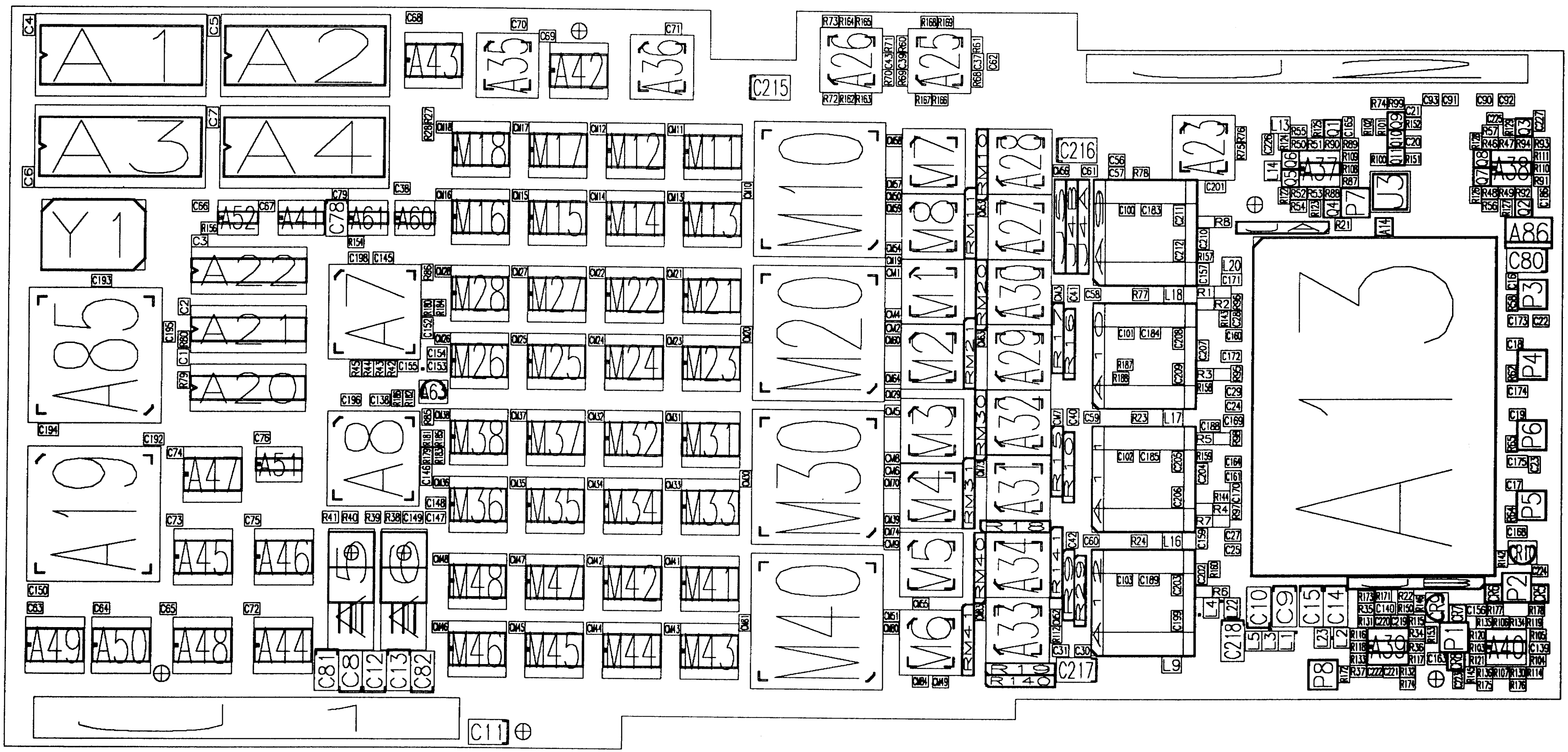
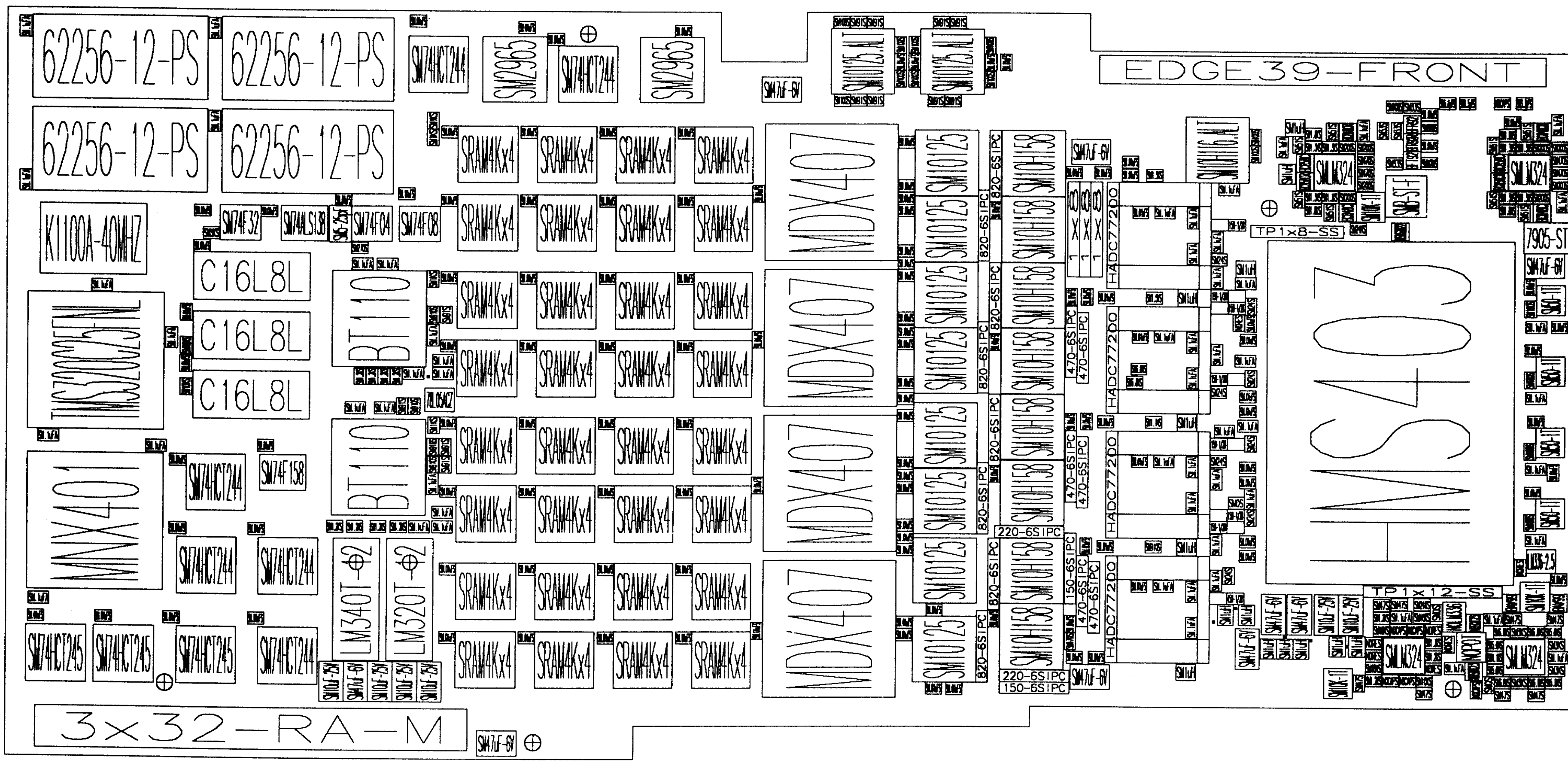
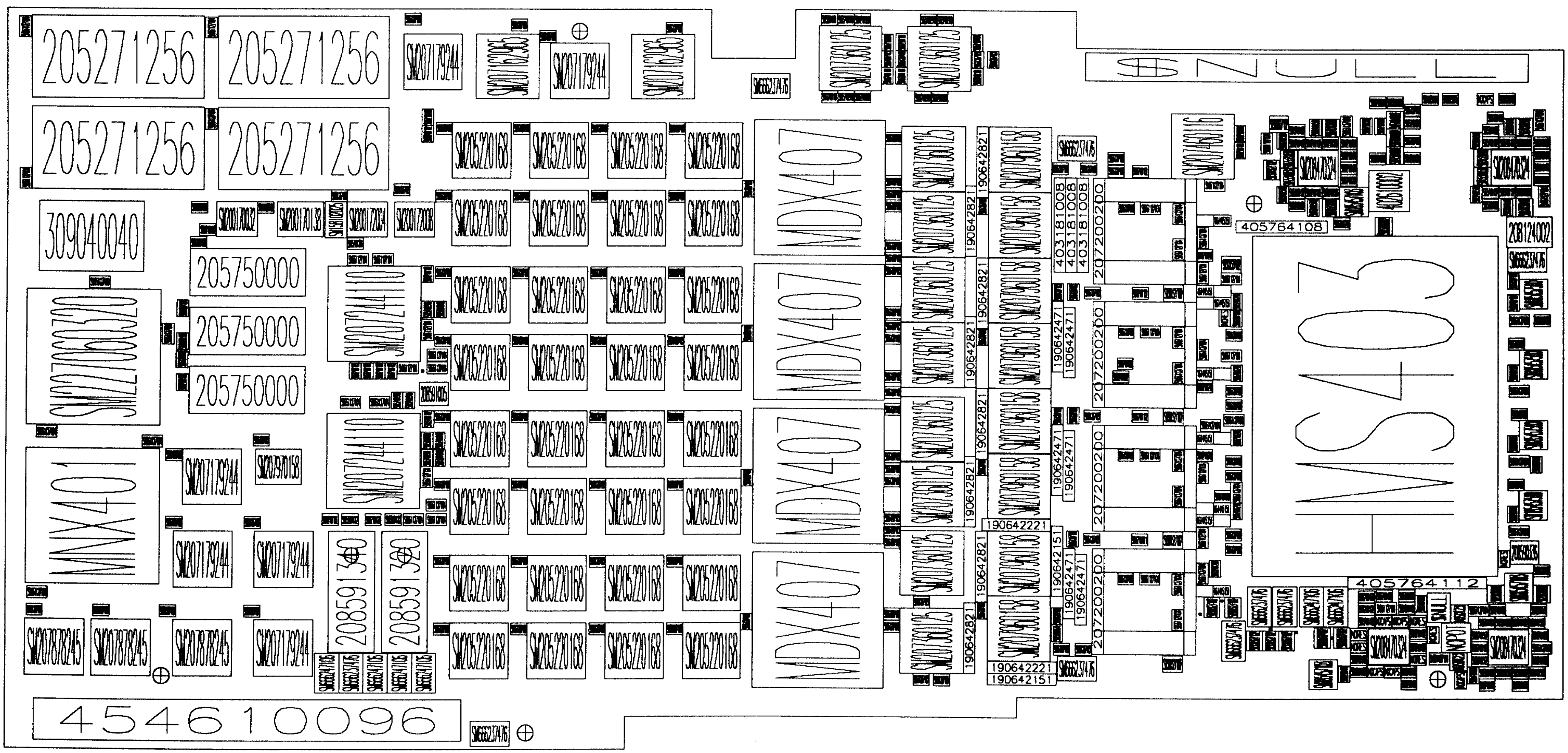

A1
A2
A3
A4
Y1
A85
A19
A7
A8
A13
A22
A21
A20
A47
A51
A45
A46
A49
A50
A48
A44
A43
A35
A42
A36
A26
A25
A23
A28
A27
A30
A29
A32
A31
A34
A33
A37
A38
A39
A40
A41
A52
A61
A60
A63
A86
M18
M17
M12
M11
M16
M15
M14
M13
M28
M27
M22
M21
M26
M25
M24
M23
M38
M37
M32
M31
M36
M35
M34
M33
M48
M47
M42
M41
M46
M45
M44
M43
M10
M20
M30
M40
M7
M8
M1
M2
M3
M4
M5
M6
C215
C216
C217
C218
C11
C80
P1
P2
P3
P4
P5
P6
P7
P8
J3
9450A-3 Rev:B


62256-12-PS
62256-12-PS
62256-12-PS
62256-12-PS
SM74HCT244
SM2965
SM74HCT244
SM2965
EDGE39-FRONT
K1100A-40MHZ
SM74F32
SM74LS138
SM74F04
SM74F08
SRAM4Kx4
MDX4O7
C16L8L
C16L8L
C16L8L
BT110
BT110
MNX4O1
SM74F158
HMS4O3
TP1x8-SS
TP1x12-SS
7905-ST
HADC772DO
820-6SIPC
470-6SIPC
220-6SIPC
150-6SIPC
LM340T-Φ2
LM320T-Φ2
SM74HCT245
SMLM324
3x32-RA-M

9450A-3 Rev:B


205271256
205271256
205271256
205271256
309040040
205750000
205750000
205750000
MNX401
MDX407
MDX407
MDX407
MDX407
HMS403
405764108
405764112
208124002
SNULL
454610096

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
C103	SM661207103	SM.01uFS	SM0805	23456900	2654300	1	180
C138	SM661127104	SM.1uFA	SM1206	6667500	6413500	1	0
C139	SM661127104	SM.1uFA	SM1206	32385000	1181100	1	0
C140	SM661127104	SM.1uFA	SM1206	28956000	2032000	1	0
C145	SM661127104	SM.1uFA	SM1206	6718300	9486900	1	0
C146	SM661127104	SM.1uFA	SM1206	7846060	4665980	1	90
C147	SM661127104	SM.1uFA	SM1206	7937500	3873500	1	0
C148	SM661127104	SM.1uFA	SM1206	7937500	4191000	1	0
C149	SM661127104	SM.1uFA	SM1206	7429500	3873500	1	0
C150	SM661127104	SM.1uFA	SM1206	-825500	2286000	1	0

C152	SM661127104	SM.1uFA	SM1206	7843520	7843520	1	90
C153	SM661127104	SM.1uFA	SM1206	7937500	7150100	1	0
C154	SM661127104	SM.1uFA	SM1206	7937500	7429500	1	0
C155	SM661127104	SM.1uFA	SM1206	7289800	7150100	1	0
C156	SM661127104	SM.1uFA	SM1206	31242000	1993900	1	180
C157	SM661127104	SM.1uFA	SM1206	25019000	9144000	1	90
C159	SM661127104	SM.1uFA	SM1206	25019000	3670300	1	270
C160	SM661207103	SM.01uFS	SM0805	25844500	7937500	1	180
C161	SM661207103	SM.01uFS	SM0805	25844500	4889500	1	180
C163	SM661127104	SM.1uFA	SM1206	30124400	952500	1	0
C164	SM661207103	SM.01uFS	SM0805	25844500	5207000	1	180
C165	SM661127104	SM.1uFA	SM1206	28206700	12573000	1	270
C168	SM661127104	SM.1uFA	SM1206	31877000	3683000	1	0
C169	SM661127104	SM.1uFA	SM1206	25844500	6096000	1	180
C170	SM661127104	SM.1uFA	SM1206	25778460	4404360	1	90
C171	SM661127104	SM.1uFA	SM1206	25781000	9144000	1	180
C172	SM661127104	SM.1uFA	SM1206	25781000	7493000	1	180
C173	SM661127104	SM.1uFA	SM1206	31877000	8255000	1	0
C174	SM661127104	SM.1uFA	SM1206	31877000	6731000	1	0
C175	SM661127104	SM.1uFA	SM1206	31877000	5207000	1	0
C183	SM661127104	SM.1uFA	SM1206	23736300	10655300	1	0
C184	SM661127104	SM.1uFA	SM1206	23736300	7988300	1	0
C185	SM661127104	SM.1uFA	SM1206	23736300	5321300	1	0
C186	SM661127104	SM.1uFA	SM1206	32562800	10795000	1	90
C188	SM661127104	SM.1uFA	SM1206	25069800	5981700	1	0
C189	SM661127104	SM.1uFA	SM1206	23736300	2654300	1	0
C192	SM661127104	SM.1uFA	SM1206	1684020	5557520	1	0
C193	SM661127104	SM.1uFA	SM1206	508000	8986520	1	0
C194	SM661127104	SM.1uFA	SM1206	-381000	5748020	1	180
C195	SM661127104	SM.1uFA	SM1206	2128520	7747000	1	90
C196	SM661127104	SM.1uFA	SM1206	6286500	6413500	1	180
C198	SM661127104	SM.1uFA	SM1206	6426200	9486900	1	180
C199	SM661127104	SM.1uFA	SM1206	24485600	1905000	1	270
C201	SM661127104	SM.1uFA	SM1206	25153620	11163300	1	0
C202	SM661127104	SM.1uFA	SM1206	25019000	2908300	1	270
C203	SM661127104	SM.1uFA	SM1206	24485600	2407920	1	90
C204	SM661127104	SM.1uFA	SM1206	25019000	5080000	1	270
C205	SM661127104	SM.1uFA	SM1206	24485600	5074920	1	90
C206	SM661127104	SM.1uFA	SM1206	24485600	4572000	1	270
C207	SM661127104	SM.1uFA	SM1206	25019000	7747000	1	270
C208	SM661127104	SM.1uFA	SM1206	24485600	7741920	1	90
C209	SM661127104	SM.1uFA	SM1206	24485600	7239000	1	270
C210	SM661127104	SM.1uFA	SM1206	25019000	9900920	1	90
C211	SM661127104	SM.1uFA	SM1206	24485600	10408920	1	90
C212	SM661127104	SM.1uFA	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
C223	NOCAPS	NOCAPS	SM0805	30721300	609600	1	270
C224	SM661207103	SM.01uFS	SM0805	32639000	2844800	1	180
C225	SM661207103	SM.01uFS	SM0805	31343600	12623800	1	0
C226	SM661127104	SM.1uFA	SM1206	26441400	12204700	1	270
C227	SM661127104	SM.1uFA	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	SM1uH	SMSELF	26898600	1206500	1	90

L2	SM300327102	SM1uH	SMSELF	28117800	1270000	1	90
L3	SM300327102	SM1uH	SMSELF	26543000	1206500	1	90
L4	SM300327102	SM1uH	SMSELF	25234900	1917700	1	90
L5	SM300327102	SM1uH	SMSELF	26187400	1206500	1	90
L9	SM300327102	SM1uH	SMSELF	24244300	825500	1	0
L13	SM300327102	SM1uH	SMSELF	26837640	12484100	1	180
L14	SM300327102	SM1uH	SMSELF	26543000	11625580	1	270
L16	SM300327102	SM1uH	SMSELF	24244300	3492500	1	0
L17	SM300327102	SM1uH	SMSELF	24244300	6159500	1	0
L18	SM300327102	SM1uH	SMSELF	24244300	8826500	1	0
L20	SM300327102	SM1uH	SMSELF	25527000	9461500	1	0
L22	SM300327102	SM1uH	SMSELF	25704800	1917700	1	90
L23	SM300327102	SM1uH	SMSELF	27686000	1270000	1	90
M1	SM207360125	SM10125	PLCC_20	19062700	9309100	1	0
M2	SM207360125	SM10125	PLCC_20	19062700	7899400	1	0
M3	SM207360125	SM10125	PLCC_20	19062700	6299200	1	0
M4	SM207360125	SM10125	PLCC_20	19062700	4889500	1	0
M5	SM207360125	SM10125	PLCC_20	19062700	3403600	1	0
M6	SM207360125	SM10125	PLCC_20	19062700	1727200	1	0
M7	SM207360125	SM10125	PLCC_20	19062700	12128500	1	0
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
M15	SM205220168	SRAM4Kx4	SOIC_20	10160000	9906000	1	90
M16	SM205220168	SRAM4Kx4	SOIC_20	8445500	9906000	1	90
M17	SM205220168	SRAM4Kx4	SOIC_20	10160000	11366500	1	90
M18	SM205220168	SRAM4Kx4	SOIC_20	8445500	11366500	1	90
M20	MDX407	MDX407	PLCC_68	16535400	6731000	1	180
M21	SM205220168	SRAM4Kx4	SOIC_20	13589000	8255000	1	90
M22	SM205220168	SRAM4Kx4	SOIC_20	11874500	8255000	1	90
M23	SM205220168	SRAM4Kx4	SOIC_20	13589000	6794500	1	90
M24	SM205220168	SRAM4Kx4	SOIC_20	11874500	6794500	1	90
M25	SM205220168	SRAM4Kx4	SOIC_20	10160000	6794500	1	90
M26	SM205220168	SRAM4Kx4	SOIC_20	8445500	6794500	1	90
M27	SM205220168	SRAM4Kx4	SOIC_20	10160000	8255000	1	90
M28	SM205220168	SRAM4Kx4	SOIC_20	8445500	8255000	1	90
M30	MDX407	MDX407	PLCC_68	16535400	3619500	1	180
M31	SM205220168	SRAM4Kx4	SOIC_20	13589000	5143500	1	90
M32	SM205220168	SRAM4Kx4	SOIC_20	11874500	5143500	1	90
M33	SM205220168	SRAM4Kx4	SOIC_20	13589000	3683000	1	90
M34	SM205220168	SRAM4Kx4	SOIC_20	11874500	3683000	1	90
M35	SM205220168	SRAM4Kx4	SOIC_20	10160000	3683000	1	90
M36	SM205220168	SRAM4Kx4	SOIC_20	8445500	3683000	1	90
M37	SM205220168	SRAM4Kx4	SOIC_20	10160000	5143500	1	90
M38	SM205220168	SRAM4Kx4	SOIC_20	8445500	5143500	1	90
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
M44	SM205220168	SRAM4Kx4	SOIC_20	11874500	571500	1	90
M45	SM205220168	SRAM4Kx4	SOIC_20	10160000	571500	1	90
M46	SM205220168	SRAM4Kx4	SOIC_20	8445500	571500	1	90
M47	SM205220168	SRAM4Kx4	SOIC_20	10160000	2032000	1	90
M48	SM205220168	SRAM4Kx4	SOIC_20	8445500	2032000	1	90
P1	NOPOT	NOPOT	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
P7	SM185457103	SM10K-1T	SMPOT_ST4	28371800	10807700	1	180
P8	SM185457103	SM10K-1T	SMPOT_ST4	27711400	609600	1	90
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
R21	SM652101243	SM24KS	SM0805	28232100	10337800	1	180
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	SM1KS	SM0805	7823200	12687300	1	270
R28	SM652101102	SM1KS	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
R36	SM652101122	SM1.2KS	SM0805	29654500	1191260	1	0
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
R49	SM652101132	SM1.3KS	SM0805	31610300	11023600	1	0
R50	SM652101132	SM1.3KS	SM0805	27241500	12077700	1	180
R51	SM652101132	SM1.3KS	SM0805	27353260	12075160	1	0
R52	SM652101132	SM1.3KS	SM0805	27244040	11013440	1	180
R53	SM652101132	SM1.3KS	SM0805	27353260	11008360	1	0
R54	SM652101182	SM1.8KS	SM0805	26984960	10728960	1	0
R55	SM652101182	SM1.8KS	SM0805	26984960	12354560	1	0
R56	SM652101182	SM1.8KS	SM0805	31242000	10744200	1	0
R57	SM652101182	SM1.8KS	SM0805	31242000	12357100	1	0
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
R64	SM652101181	SM180S	SM0805	31877000	3937000	1	90
R65	SM652101181	SM180S	SM0805	31877000	5461000	1	90
R68	SM652101101	SM100S	SM0805	20015200	13589000	1	270
R69	SM652101101	SM100S	SM0805	18351500	13347700	1	90
R70	SM652101101	SM100S	SM0805	18034000	13601700	1	270
R71	SM652101101	SM100S	SM0805	18034000	14325600	1	270

R72	SM652101101	SM100S	SM0805	16629380	13012420	1	0
R73	SM652101101	SM100S	SM0805	16611600	14681200	1	0
R74	SM652101101	SM100S	SM0805	28765500	12954000	1	0
R75	SM652101101	SM100S	SM0805	25844500	12039600	1	270
R76	SM652101101	SM100S	SM0805	25844500	12407900	1	270
R77	SM652101152	SM1.5KS	SM0805	23505160	8823960	1	0
R78	SM652101152	SM1.5KS	SM0805	23505160	11452860	1	0
R79	SM652101103	SM10KS	SM0805	2446020	6700520	1	90
R80	SM652101103	SM10KS	SM0805	2443480	7846060	1	270
R85	SM652101102	SM1KS	SM0805	7863840	5918200	1	90
R86	SM652101102	SM1KS	SM0805	7838440	9044940	1	90
R87	SM652101201	SM200S	SM0805	28384500	11277600	1	180
R88	SM652101201	SM200S	SM0805	27993340	11013440	1	180
R89	SM652101201	SM200S	SM0805	28384500	12077700	1	180
R90	SM652101201	SM200S	SM0805	27980640	12080240	1	180
R91	SM652101201	SM200S	SM0805	32639000	11290300	1	180
R92	SM652101201	SM200S	SM0805	32232600	11023600	1	180
R93	SM652101201	SM200S	SM0805	32639000	12090400	1	180
R94	SM652101201	SM200S	SM0805	32235140	12092940	1	180
R95	SM652101240	SM24S	SM0805	25781000	6985000	1	90
R96	SM652101240	SM24S	SM0805	25768300	8788400	1	270
R97	SM652101240	SM24S	SM0805	25781000	4000500	1	90
R98	SM652101240	SM24S	SM0805	25781000	5588000	1	90
R99	SM652101330	SM33S	SM0805	29400500	12954000	1	180
R100	SM652101330	SM33S	SM0805	29019500	11747500	1	180
R101	SM652101330	SM33S	SM0805	28956000	12319000	1	90
R102	SM652101330	SM33S	SM0805	28638500	12319000	1	90
R103	SM652101112	SM1.1KS	SM0805	31010860	1178560	1	0
R104	SM652101302	SM3KS	SM0805	32346900	914400	1	0
R105	SM652101302	SM3KS	SM0805	32346900	1447800	1	0
R106	SM652101302	SM3KS	SM0805	31534100	1727200	1	0
R107	SM652101302	SM3KS	SM0805	31544260	645160	1	0
R108	SM652101471	SM470S	SM0805	28384500	11544300	1	180
R109	SM652101471	SM470S	SM0805	28384500	11811000	1	180
R110	SM652101471	SM470S	SM0805	32639000	11557000	1	180
R111	SM652101471	SM470S	SM0805	32639000	11823700	1	180
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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R120	SM652101562	SM5.6KS	SM0805	31269940	1450340	1	180
R121	SM652101562	SM5.6KS	SM0805	31269940	916940	1	180
R122	SM652101510	SM51S	SM0805	26794460	11089640	1	270
R123	SM652101510	SM51S	SM0805	27482800	10553700	1	90
R124	SM652101510	SM51S	SM0805	26797000	11998960	1	90
R125	SM652101510	SM51S	SM0805	27523440	12291060	1	90
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R127	SM652101510	SM51S	SM0805	31737300	10566400	1	90
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R134	SM652101682	SM6.8KS	SM0805	32156400	1727200	1	180
R135	SM652101682	SM6.8KS	SM0805	31419800	1727200	1	180
R136	SM652101682	SM6.8KS	SM0805	31432500	647700	1	180
R140	190642151	150-6SIPC	SIP6RES	20408900	469900	1	90
R141	190642151	150-6SIPC	SIP6RES	21818600	3657600	1	0
R142	NORES	NORES	SM0805	31673800	2971800	1	90
R143	NORES	NORES	SM0805	25501600	8178800	1	90
R144	SM654101000	SM0S	SM0805	25590500	4445000	1	180
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R150	SM652101103	SM10KS	SM0805	29413200	2032000	1	0
R151	SM652101621	SM620S	SM0805	29527500	11747500	1	0
R152	SM652101681	SM680S	SM0805	29527500	12509500	1	0
R153	NORES	NORES	SM0805	30111700	1587500	1	270
R154	SM652101271	SM270S	SM0805	6362700	9829800	1	180
R156	SM652101302	SM3KS	SM0805	2857500	10121900	1	0
R157	SM652101240	SM24S	SM0805	25196800	9652000	1	180
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R159	SM652101240	SM24S	SM0805	25196800	5334000	1	180
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R163	SM652101910	SM91S	SM0805	17614900	13017500	1	180
R164	SM652101910	SM91S	SM0805	16977360	14678660	1	0
R165	SM652101910	SM91S	SM0805	17602200	14681200	1	180
R166	SM652101910	SM91S	SM0805	19062700	13004800	1	0
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R175	SM652101470	SM47S	SM0805	31178500	381000	1	0
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R186	SM652101910	SM91S	SM0805	7175500	6578600	1	270
R187	SM652101682	SM6.8KS	SM0805	23434040	7305040	1	180
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CM4	SM661207103	SM.01uFS	SM0805	18313400	8369300	1	180
CM5	SM661207103	SM.01uFS	SM0805	18313400	6273800	1	180
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CM7	SM661207103	SM.01uFS	SM0805	21818600	6032500	1	90
CM8	SM661207103	SM.01uFS	SM0805	18313400	5257800	1	180
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CM10	SM661207103	SM.01uFS	SM0805	14940280	10888980	1	90
CM11	SM661207103	SM.01uFS	SM0805	13462000	12319000	1	180
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CM74	SM661207103	SM.01uFS	SM0805	18313400	3670300	1	180
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CM83	SM661207103	SM.01uFS	SM0805	20142200	2070100	1	270
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CR5	SM236030099	BAV99	SOT23	32448500	2413000	1	0
CR6	SM236030099	BAV99	SOT23	31432500	2413000	1	0
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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
RM10	190642821	820-6SIPC	SIP6RES	20142200	10985500	1	180
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RM20	190642821	820-6SIPC	SIP6RES	20142200	8166100	1	180
RM21	190642821	820-6SIPC	SIP6RES	19888200	8166100	1	0
RM30	190642821	820-6SIPC	SIP6RES	20142200	5346700	1	180
RM31	190642821	820-6SIPC	SIP6RES	19888200	5143500	1	0
RM40	190642821	820-6SIPC	SIP6RES	20142200	2260600	1	180
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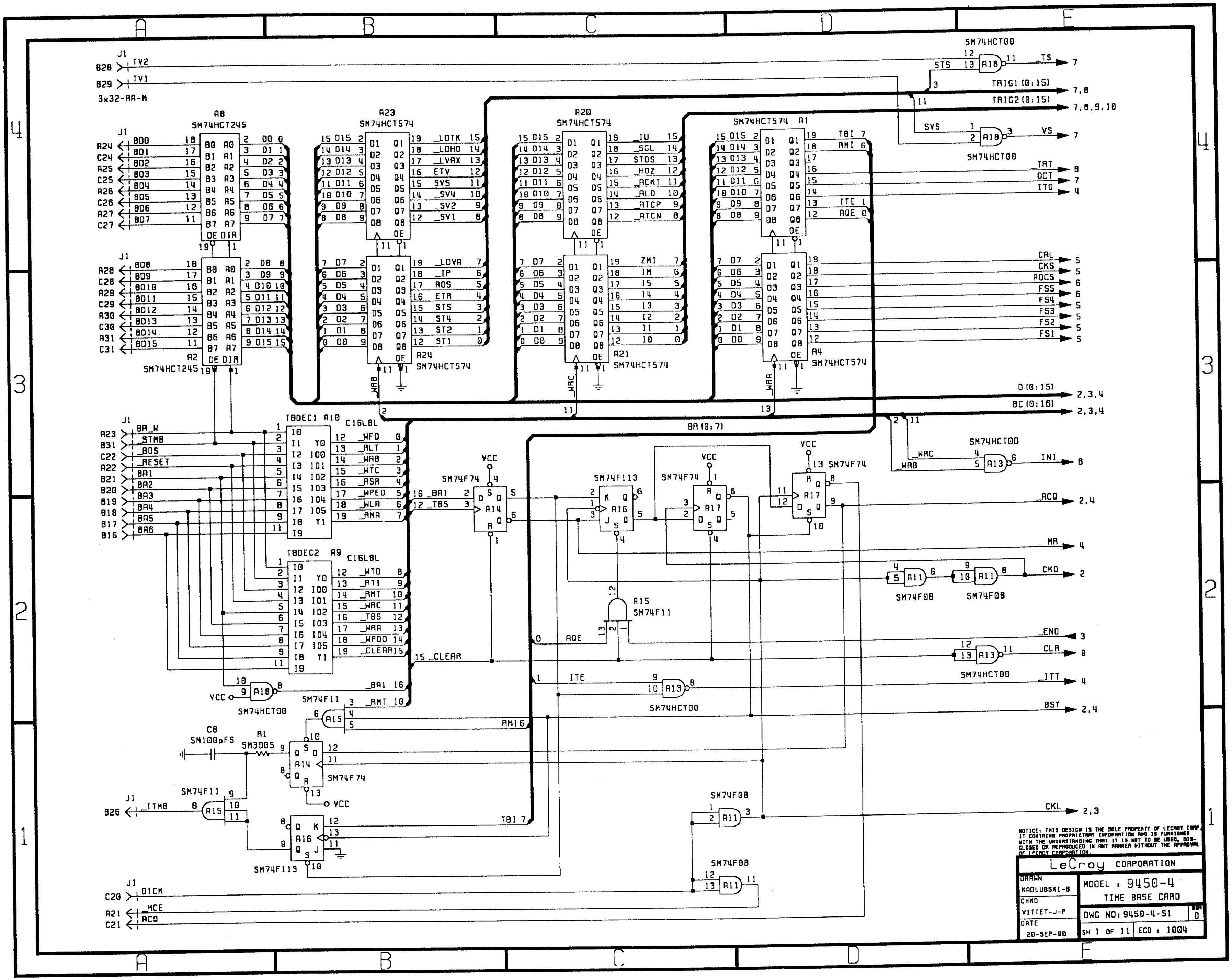

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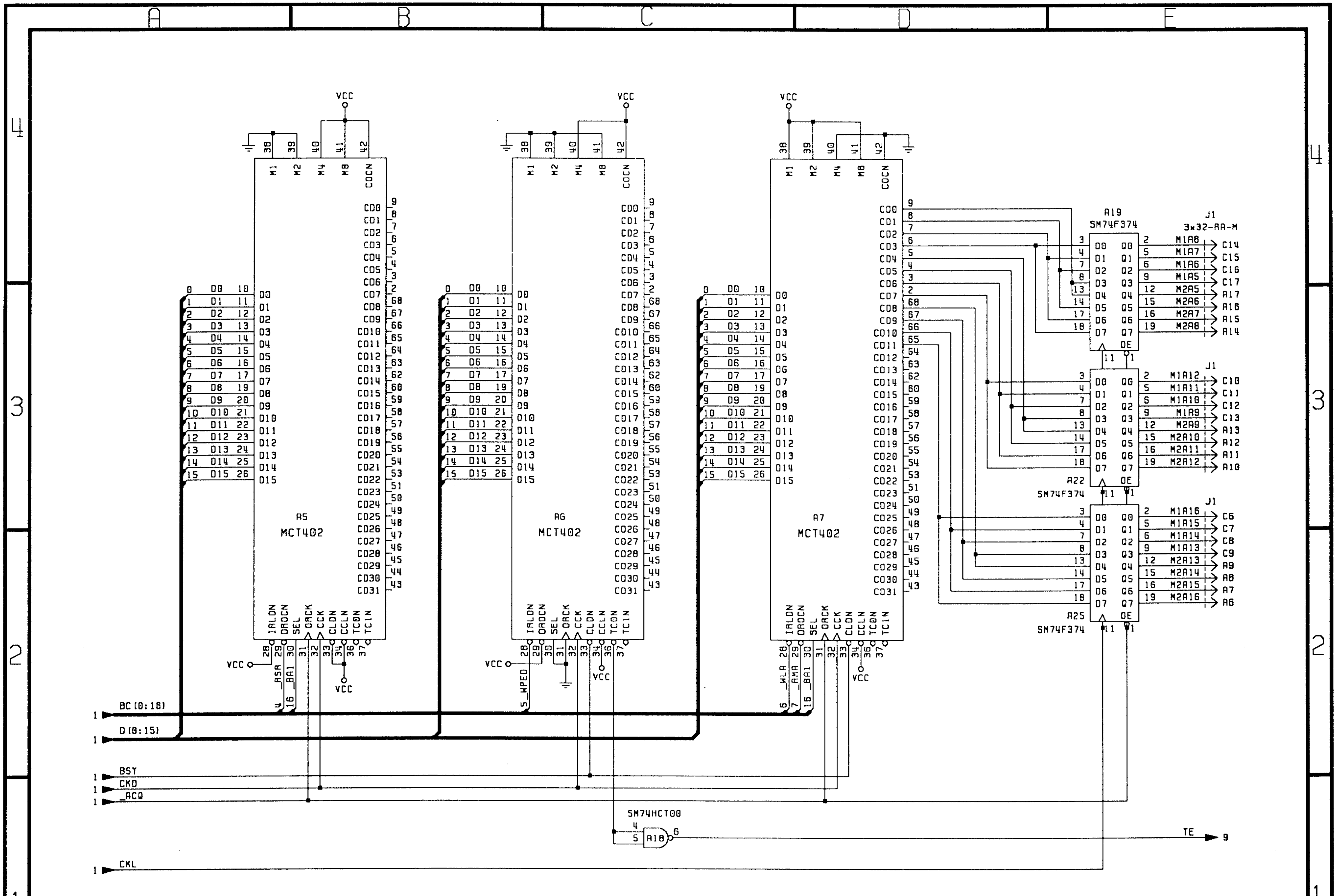
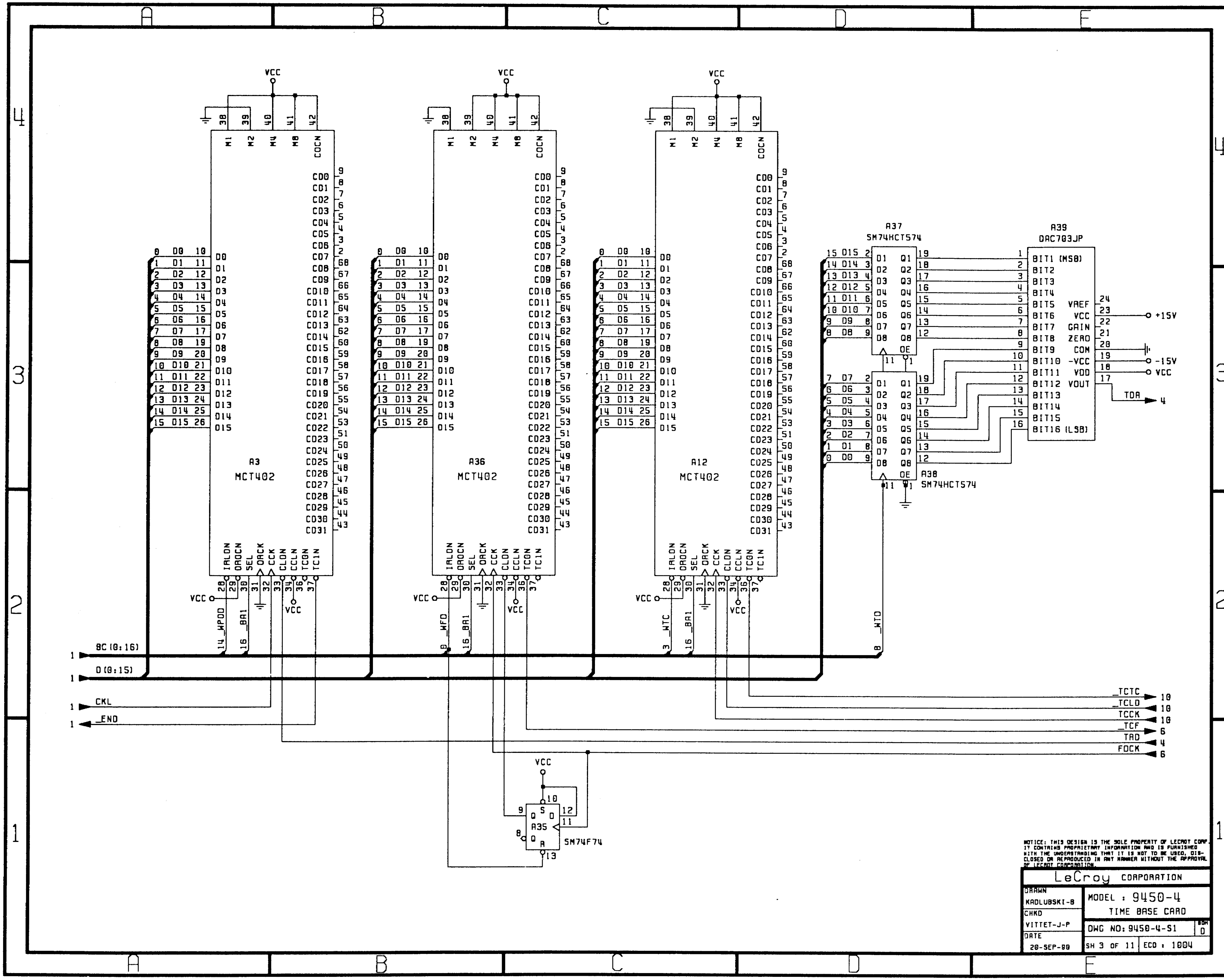


LeCroy CORPORATION		
DRAWN KROLUBSKI-B	MODEL : 9450-4 TIME BASE CARD	
CHKD VITTET-J-P	DWG NO: 9450-4-S1	D
DATE 20-SEP-88	SH 2 OF 11	ECO : 1004



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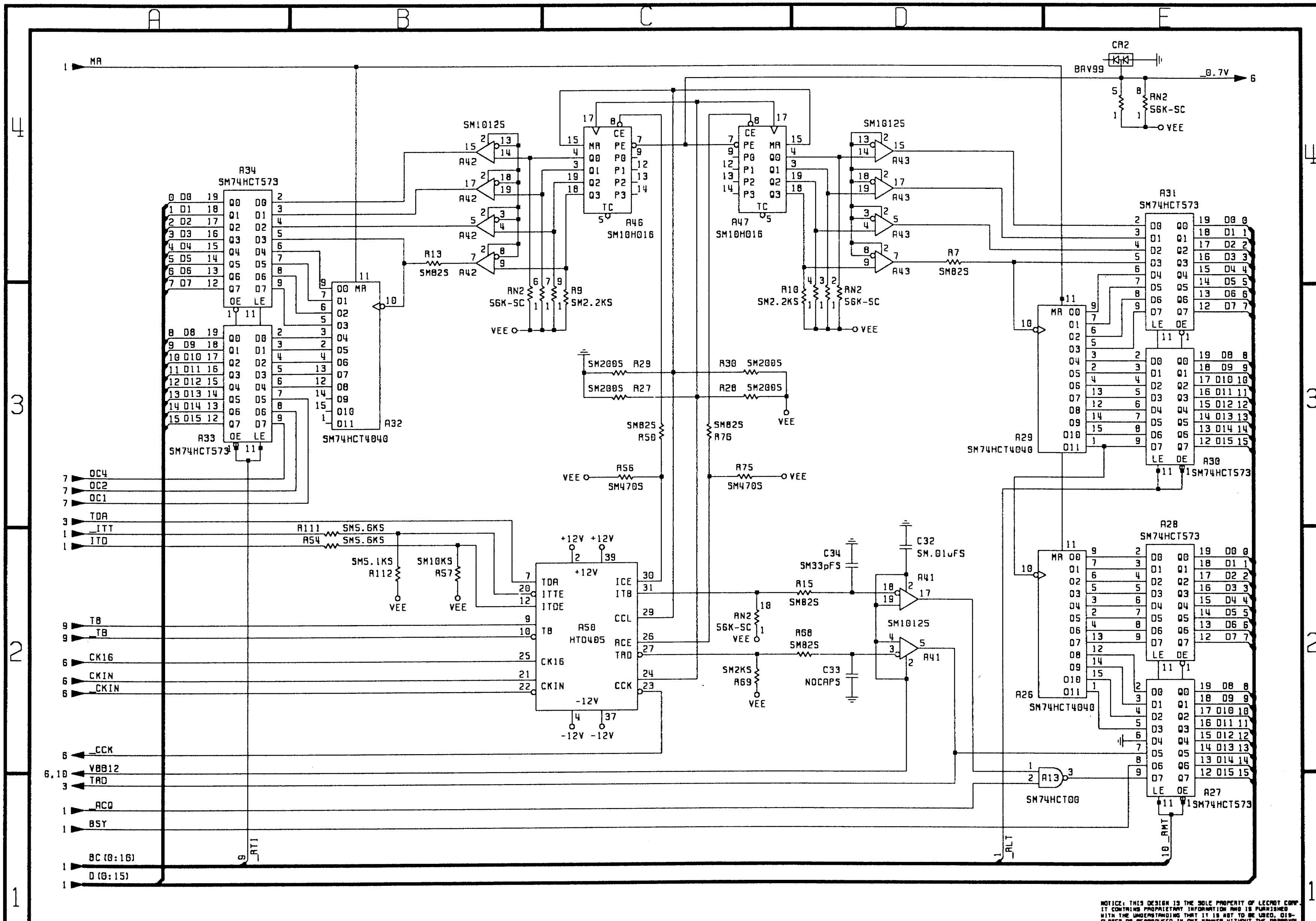

LeCroy CORPORATION	
DRAWN KADLUBSKI-B	MODEL : 9450-4 TIME BASE CARD
CHKD VITTET-J-P	DWG NO: 9450-4-S1 — D
DATE 20-SEP-90	SH 4 OF 11 — ECO : 1004

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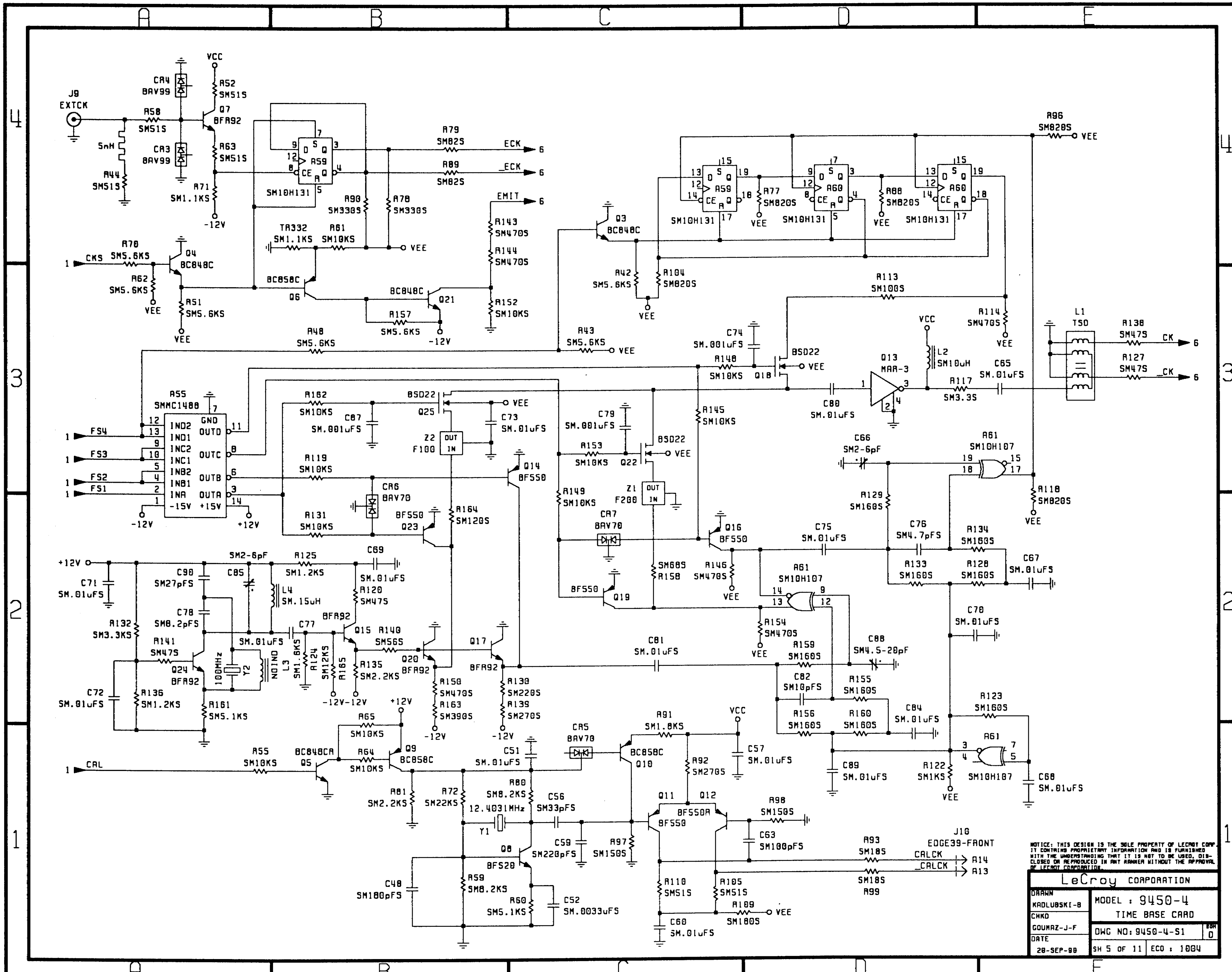

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DRAWN KADLUBSKI-B	MODEL : 9450-4 TIME BASE CARD
CHKD GOUNAZ-J-F	DWG NO: 9450-4-S1 REV 0
DATE 28-SEP-90	SH 5 OF 11 ECO : 1004

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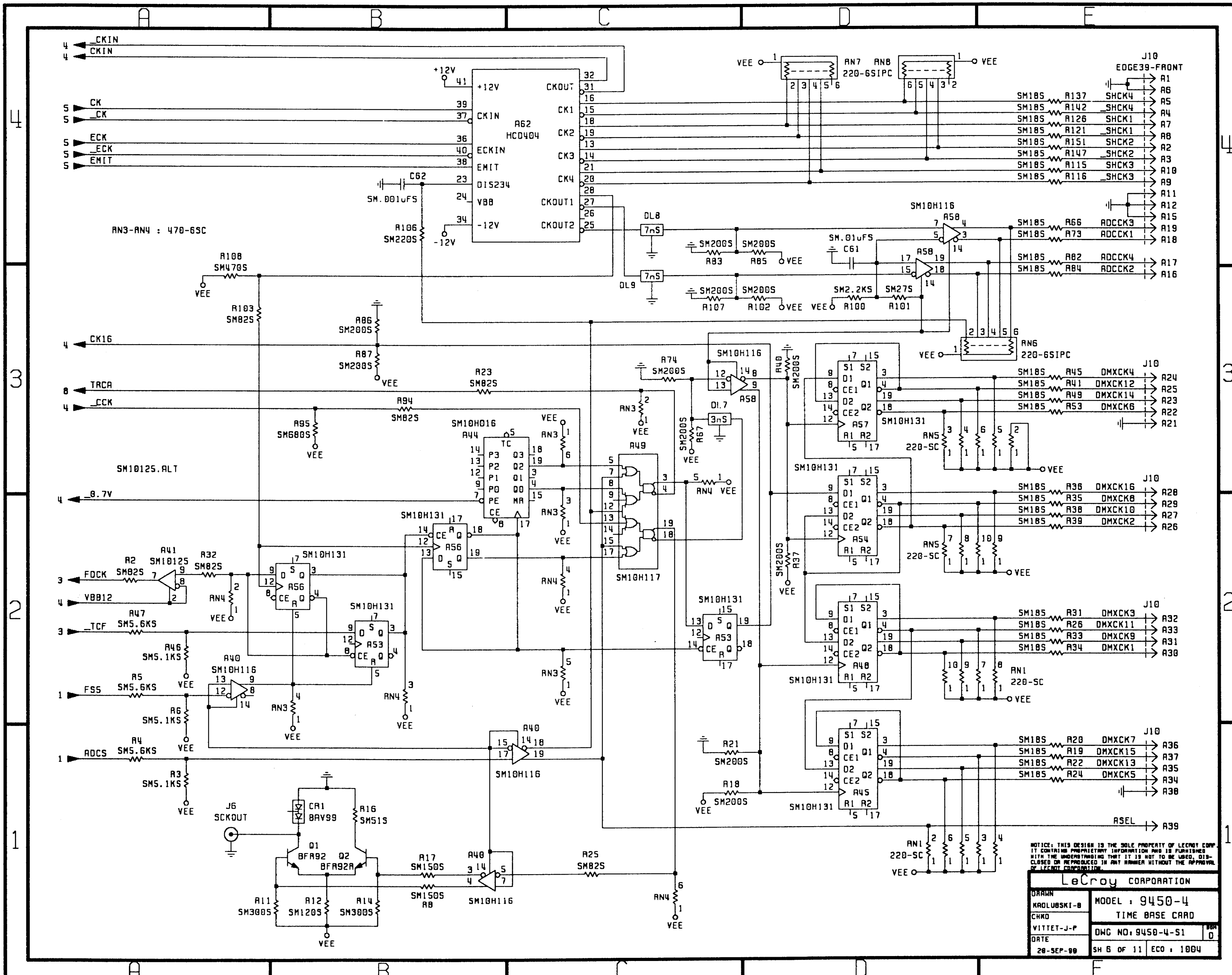

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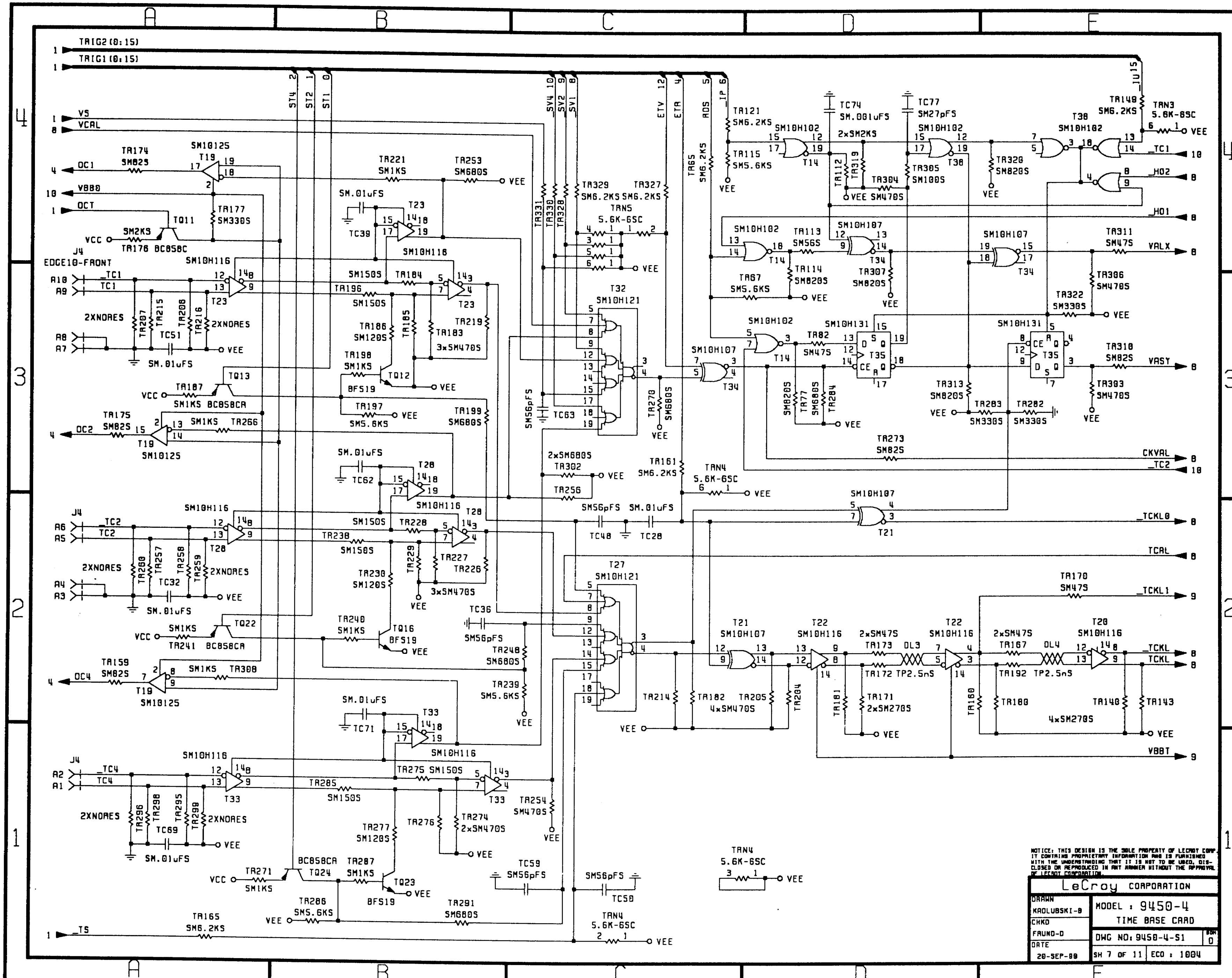
LeCroy CORPORATION	
DRAWN KROLUBSKI-B	MODEL : 9450-4 TIME BASE CARD
CHKD VITTET-J-P	DWG NO: 9450-4-S1
DATE 28-SEP-89	SH 6 OF 11 ECO : 1804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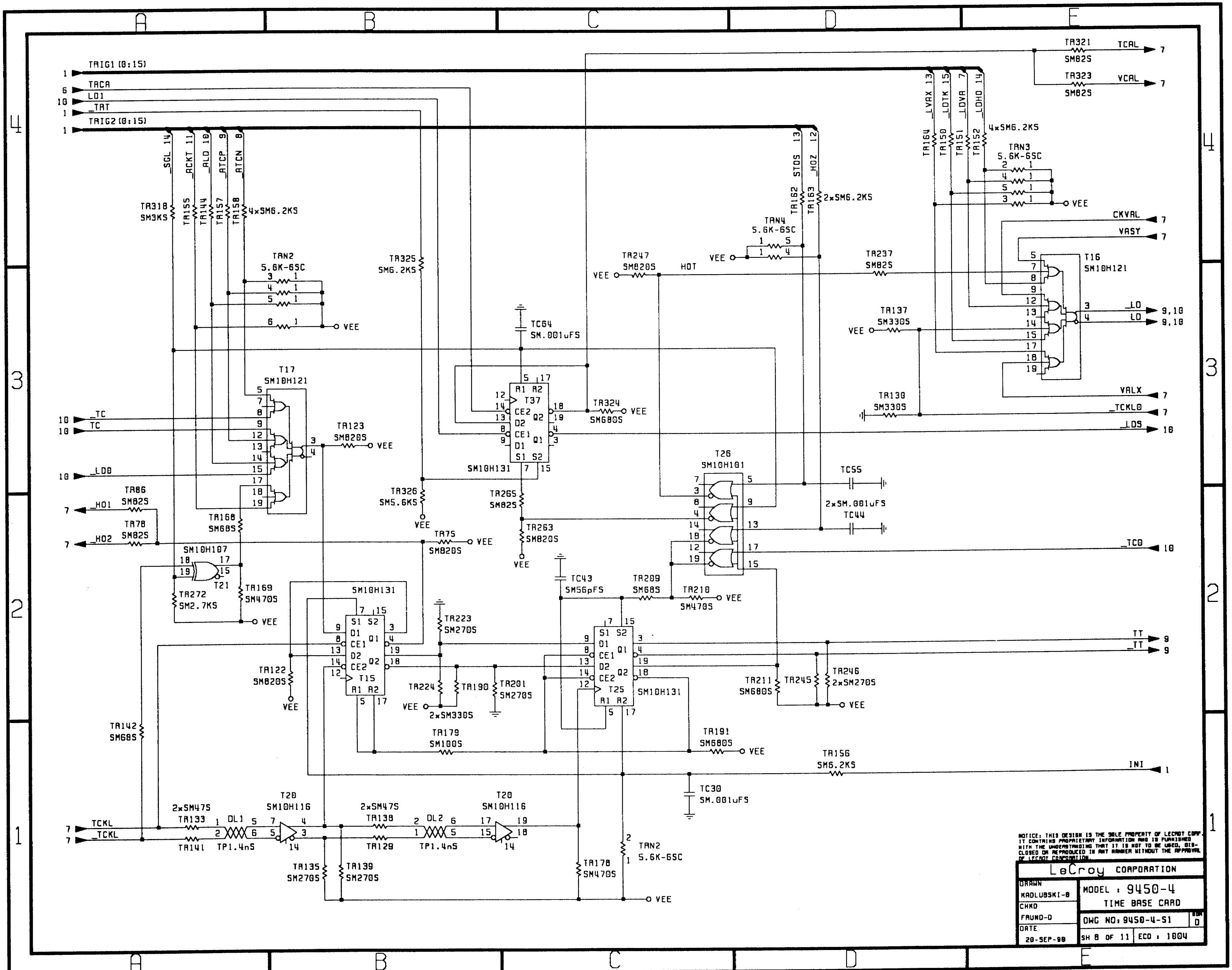
DRAWN KROLUBSKI-B
CHKD
FRAND-D
DATE 20-SEP-89
MODEL : 9450-4
TIME BASE CARD
DWG NO: 9450-4-S1
REV D
SH 7 OF 11
ECO : 1004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LeCroy CORPORATION
DRAWN
KADLUBSKI-B
CHKD
FRUND-D
DATE
20-SEP-90
MODEL : 9450-4
TIME BASE CARD
DWG NO: 9450-4-S1
REV
D
SH 8 OF 11
ECO : 1004
TRIG1 (0:15)
TRIG2 (0:15)
TRCA
LD1
_TAT
_TC
TC
_LD0
_HO1
_HO2
TCKL
_TCKL
TCAL
VCAL
CKVAL
VASY
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_LDS
_TCO
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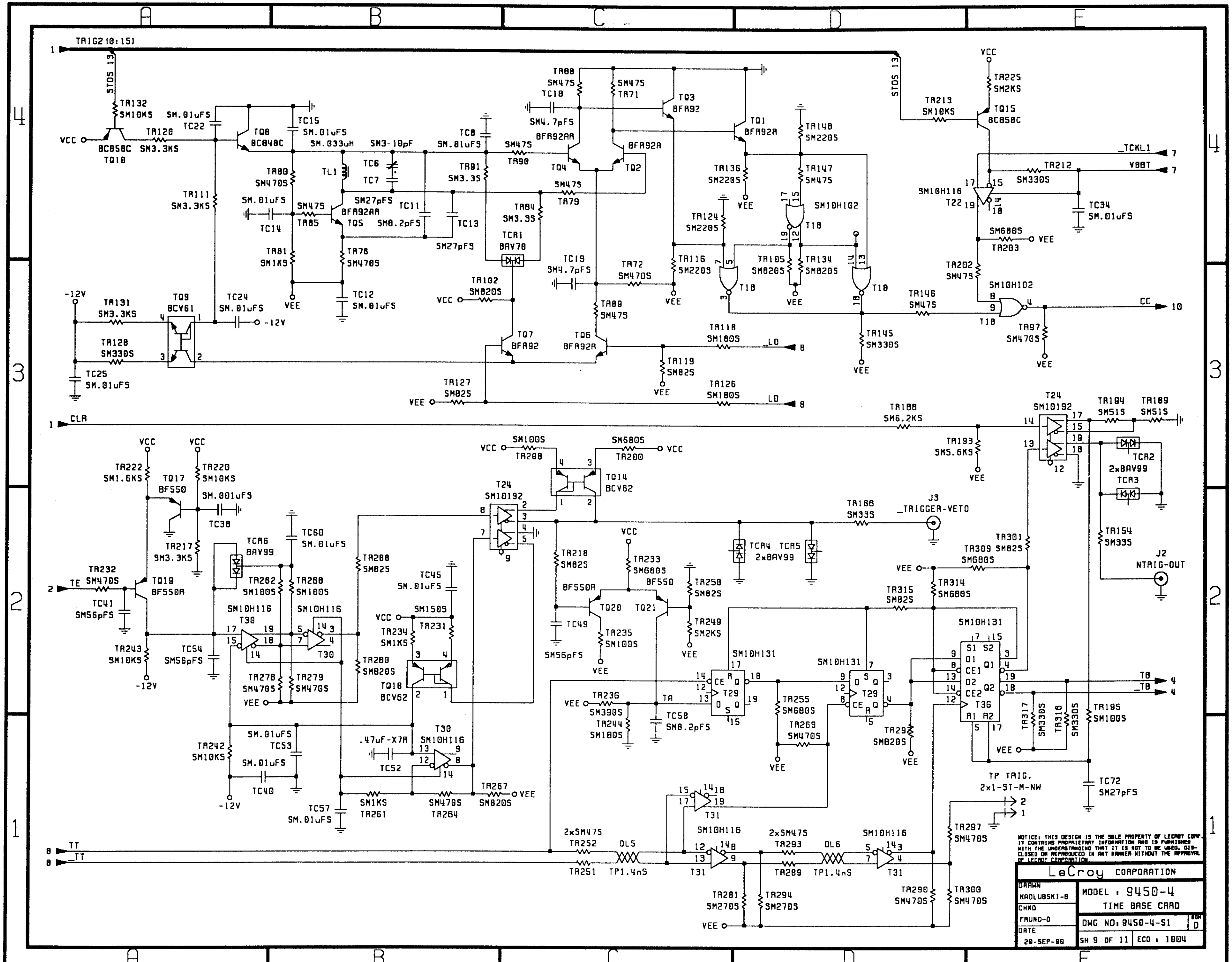
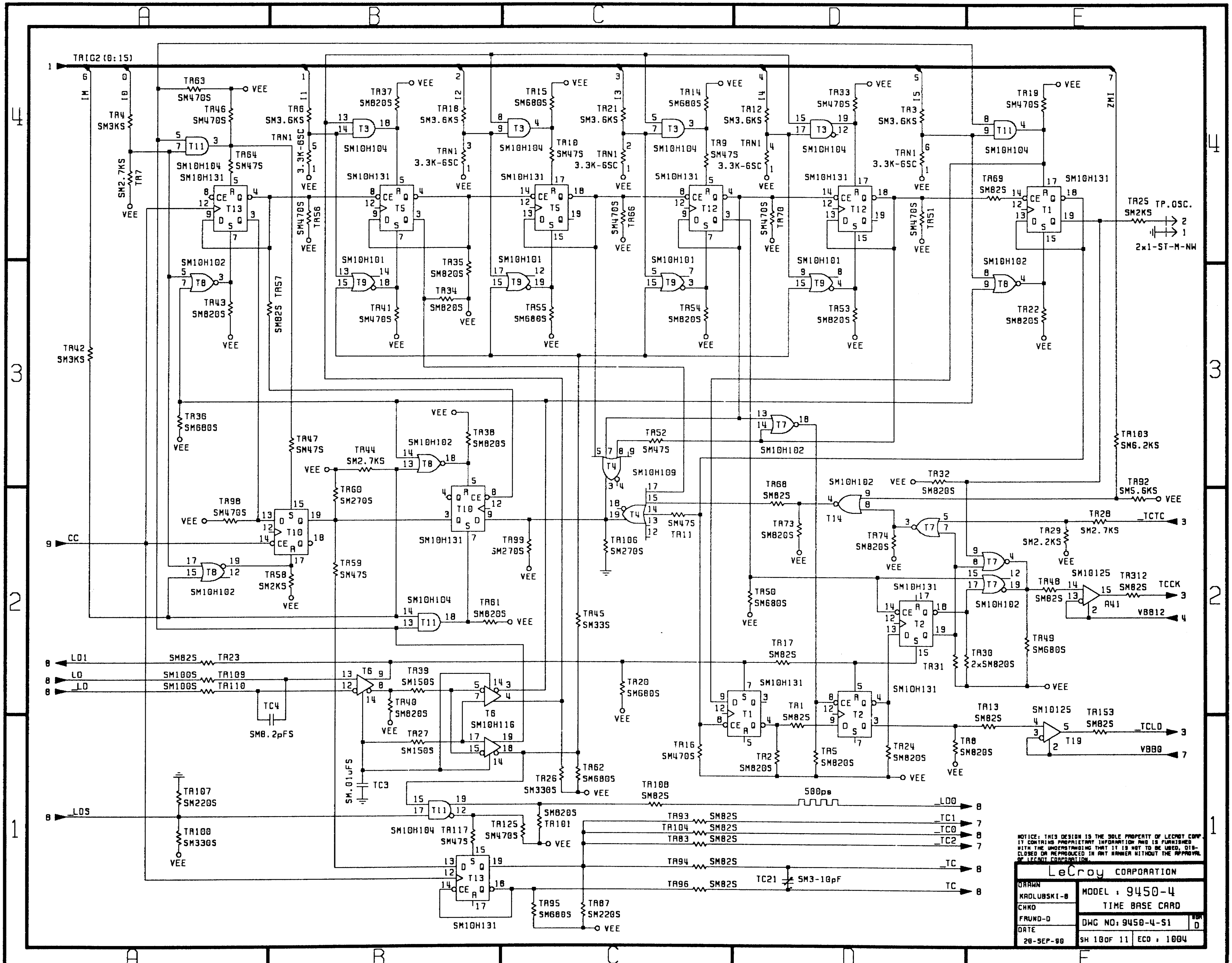
_TT
INI
LD
_LD
HOT
VEE



Scan by Paladinmicro -- paladin@paladinmicro.com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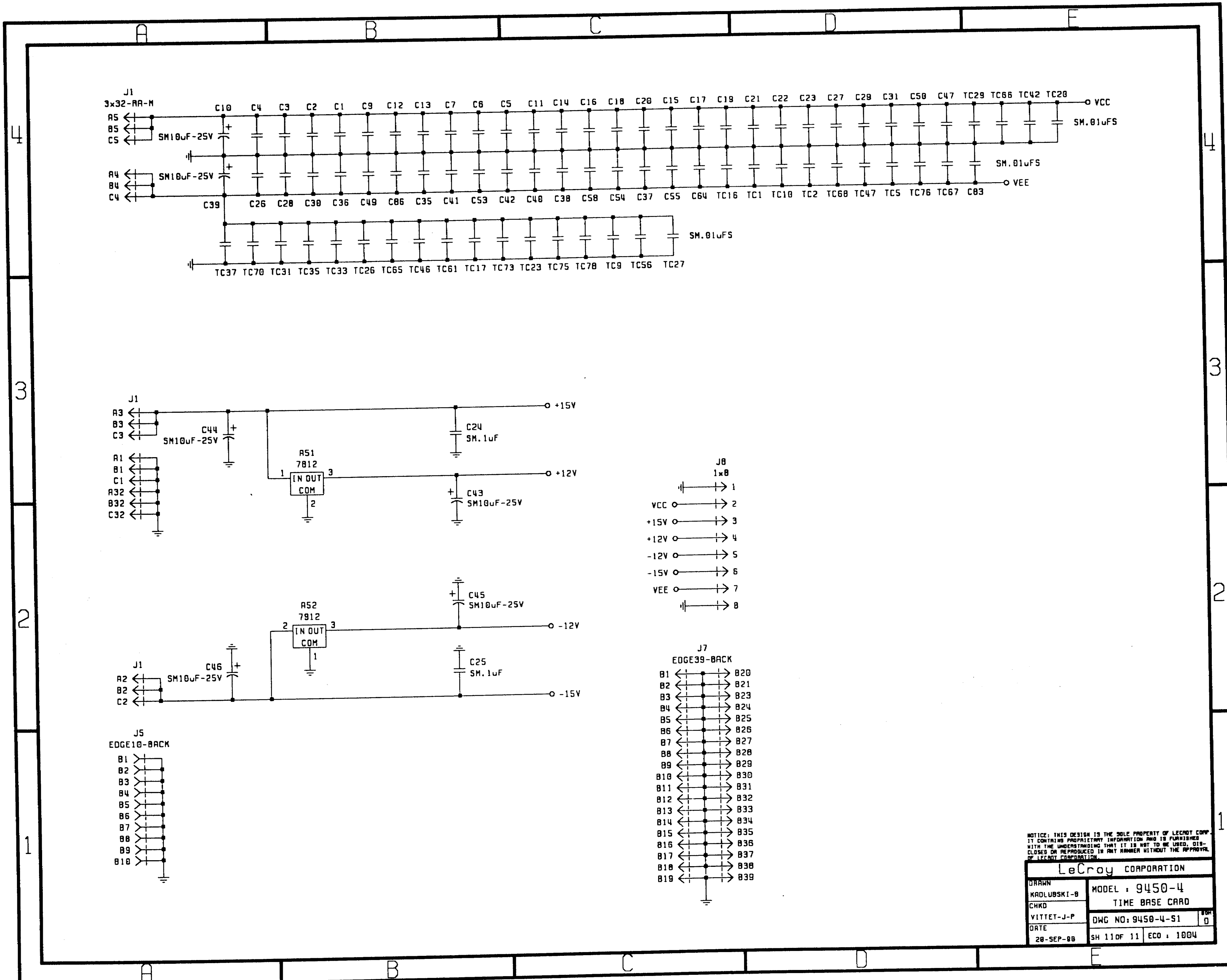
LeCroy CORPORATION
DRAWN KROLUBSKI-B
CHKD FRUND-D
DATE 20-SEP-90
MODEL : 9450-4
TIME BASE CARD
DWG NO: 9450-4-S1
D
SH 1 OF 11
ECO : 1004



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

LeCroy CORPORATION

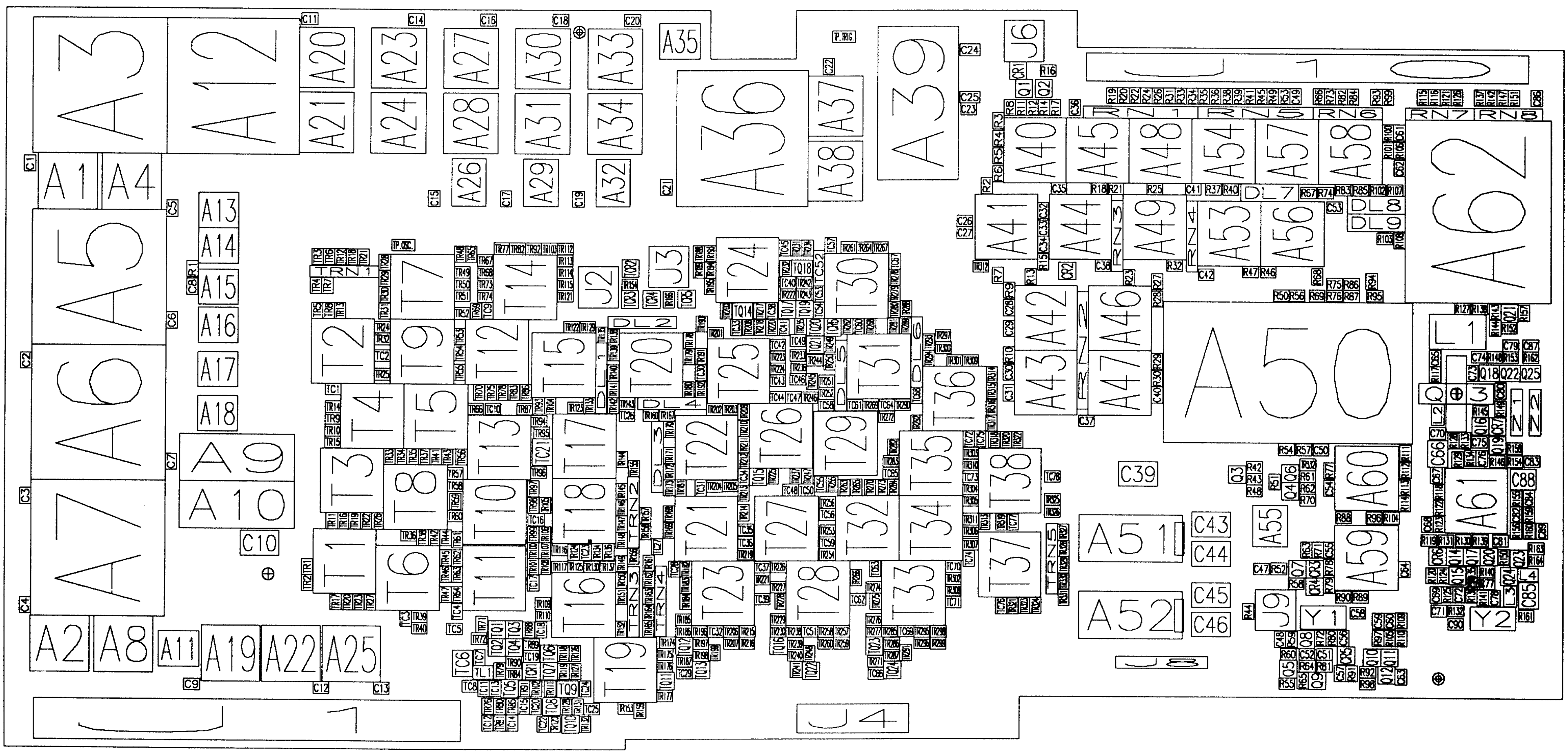
DRAWN KAOLUBSKI-B | CHKD VITTET-J-P | DATE 20-SEP-88

MODEL : 9450-4
TIME BASE CARD

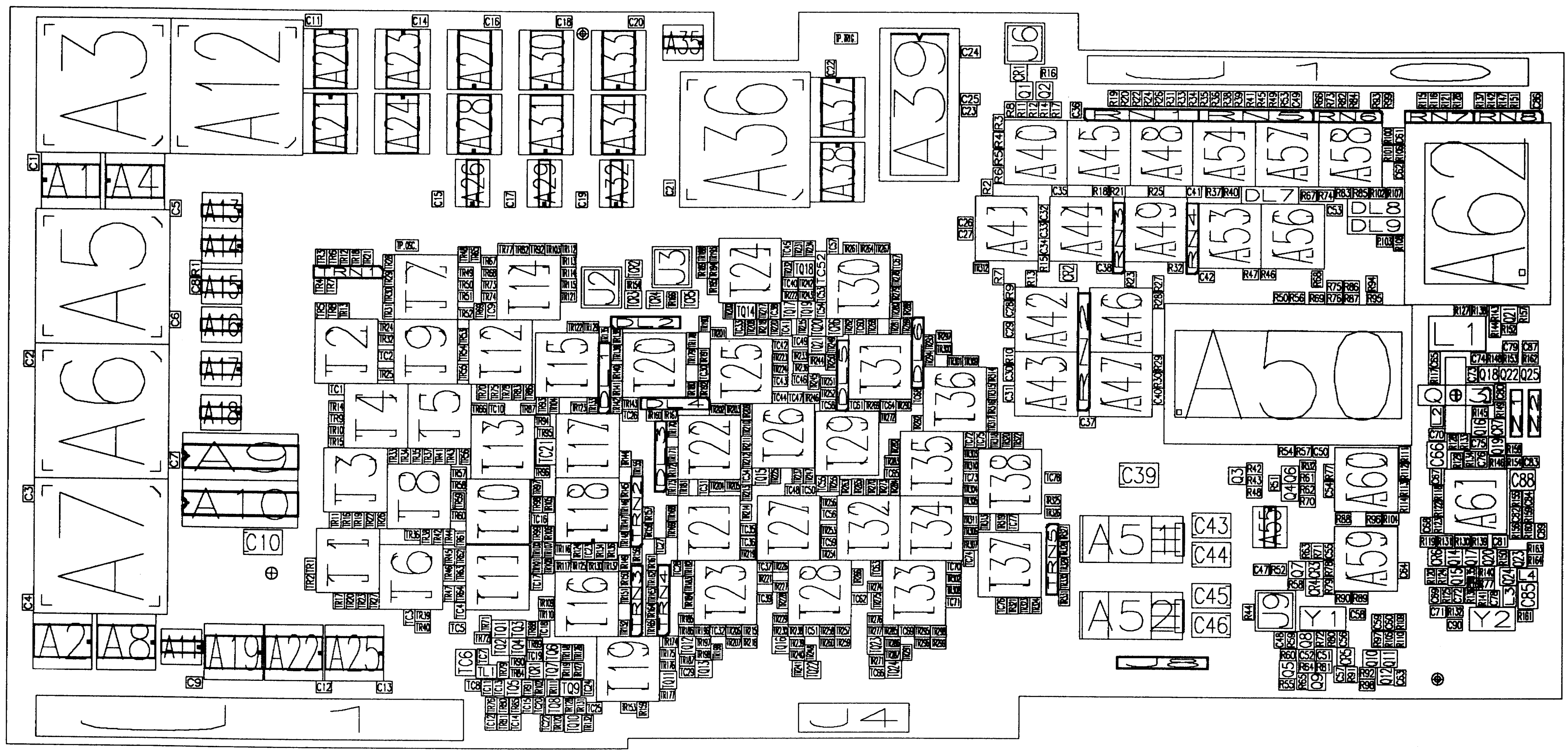
DWG NO: 9450-4-S1 | REV D

SH 11 OF 11 | ECO : 1804

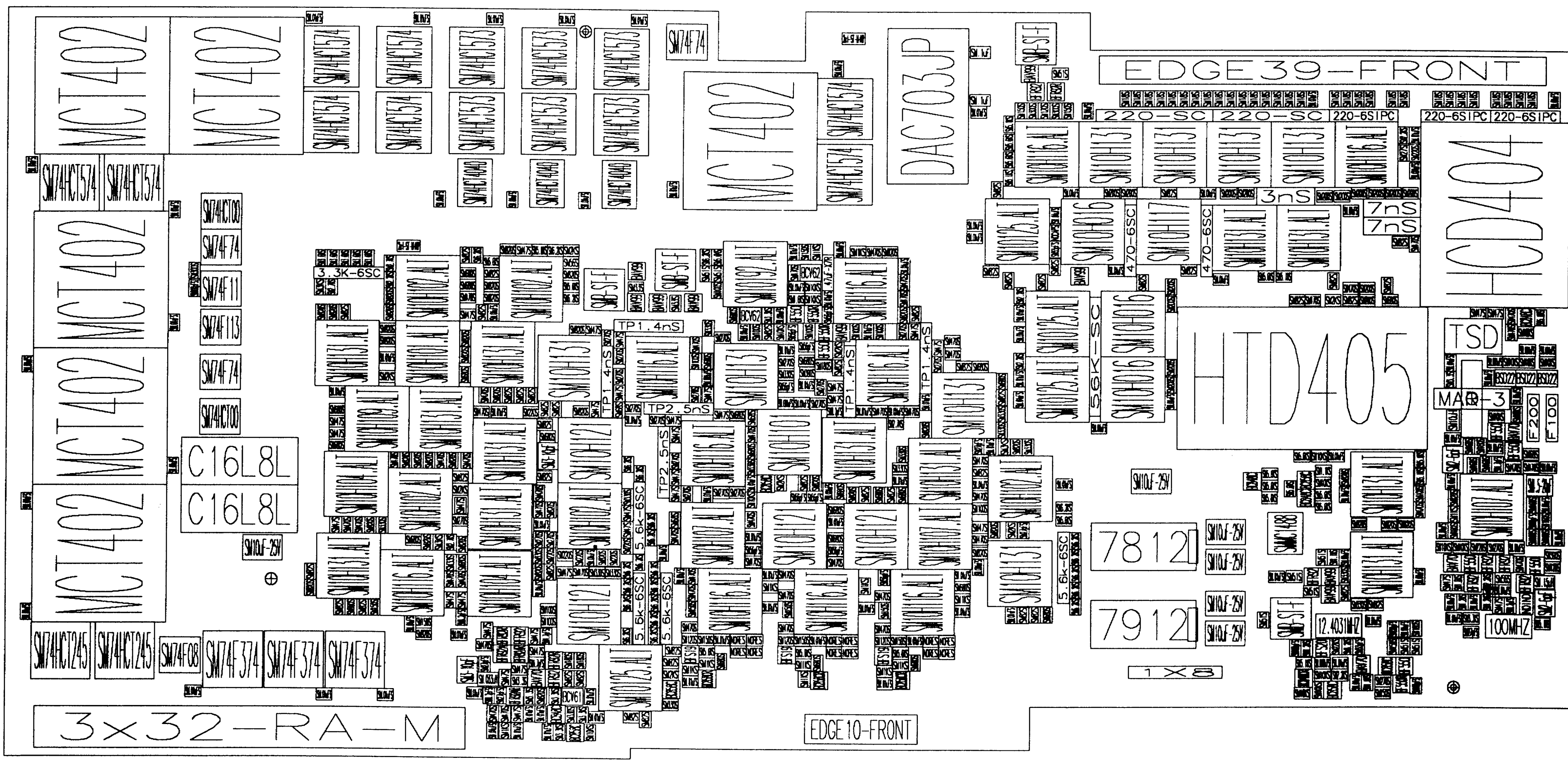
Scan by Paladinmicro -- paladin@paladinmicro.com



$9450_4 Rev:C

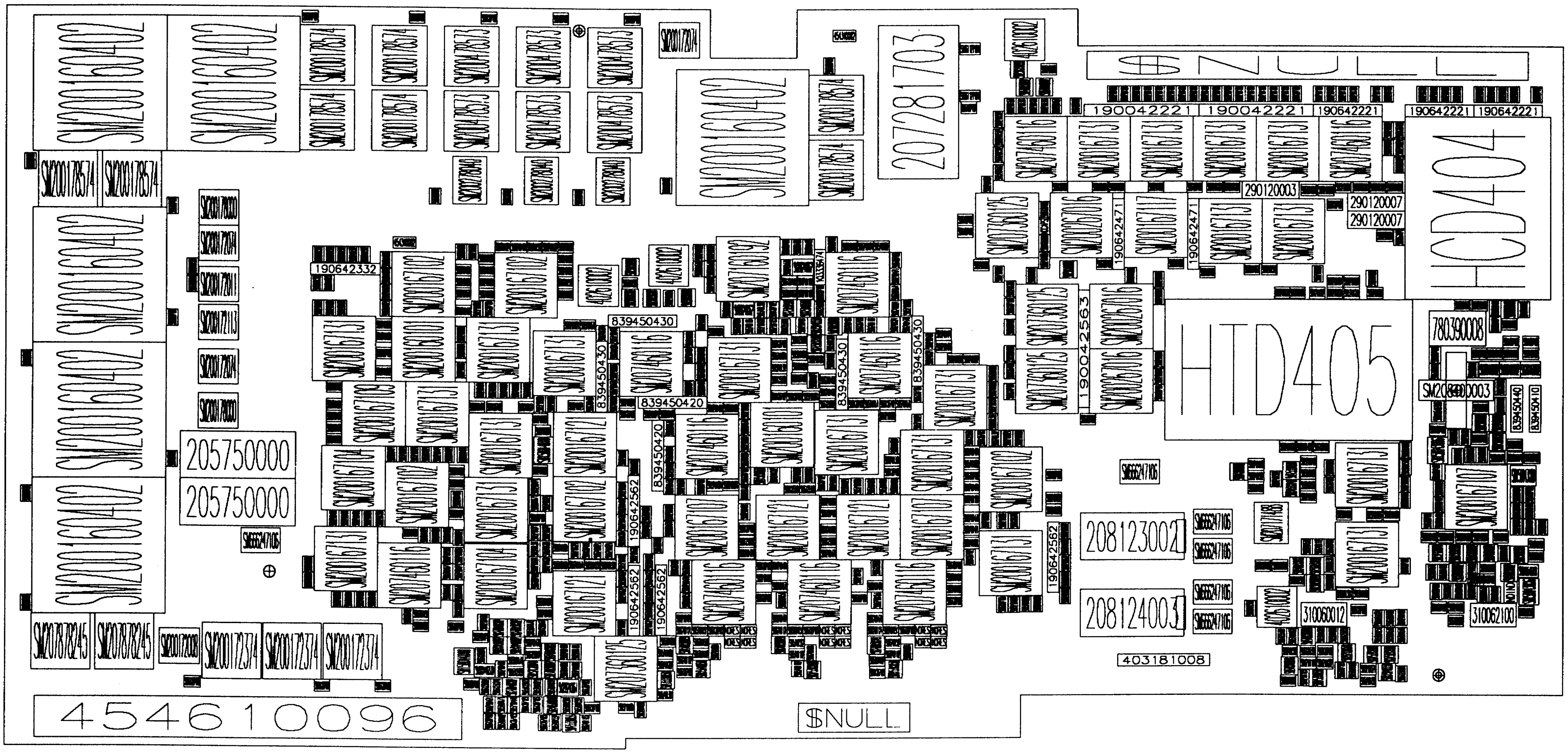


$9450_4 Rev:C



$9450_4 Rev:C

Scan by Paladinmicro -- paladin@paladinmicro.com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205750000
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$9450_4 Rev:C

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A2	SM207878245	SM74HCT245	SOIC_20	381000	1651000	1	270
A3	SM200160402	MCT402	PLCC_68	635000	12001500	1	180
A4	SM200178574	SM74HCT574	SOIC_20	762000	10668000	1	90
A5	SM200160402	MCT402	PLCC_68	1841500	9080500	1	270
A6	SM200160402	MCT402	PLCC_68	1841500	6159500	1	270
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
A10	205750000	C16L8L	DIP20	2540000	3810000	1	90
A11	SM200172008	SM74F08	SOIC_14	2794000	1333500	1	270
A12	SM200160402	MCT402	PLCC_68	3556000	12001500	1	180
A13	SM200178000	SM74HCT00	SOIC_14	3619500	10795000	1	270
A14	SM200172074	SM74F74	SOIC_14	3619500	10033000	1	270
A15	SM200172011	SM74F11	SOIC_14	3619500	9144000	1	270
A16	SM200172113	SM74F113	SOIC_14	3619500	8318500	1	270
A17	SM200172074	SM74F74	SOIC_14	3619500	7366000	1	270
A18	SM200178000	SM74HCT00	SOIC_14	3619500	6413500	1	270
A19	SM200172374	SM74F374	SOIC_20	4127500	1460500	1	270
A20	SM200178574	SM74HCT574	SOIC_20	5143500	14414500	1	0
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A22	SM200172374	SM74F374	SOIC_20	5461000	1460500	1	270
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A25	SM200172374	SM74F374	SOIC_20	6794500	1460500	1	270
A26	SM200278040	SM74HCT4040	SOIC_16	9017000	10731500	1	180
A27	SM200478573	SM74HCT573	SOIC_20	9271000	13271500	1	180
A28	SM200478573	SM74HCT573	SOIC_20	9271000	11874500	1	180
A29	SM200278040	SM74HCT4040	SOIC_16	10604500	10731500	1	180
A30	SM200478573	SM74HCT573	SOIC_20	10858500	13271500	1	180
A31	SM200478573	SM74HCT573	SOIC_20	10858500	11874500	1	180
A32	SM200278040	SM74HCT4040	SOIC_16	12192000	10731500	1	180
A33	SM200478573	SM74HCT573	SOIC_20	12446000	13271500	1	180
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A35	SM200172074	SM74F74	SOIC_14	13779500	14478000	1	270
A36	SM200160402	MCT402	PLCC_68	14795500	10922000	1	180
A37	SM200178574	SM74HCT574	SOIC_20	16383000	13398500	1	0
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A39	207281703	DAC703JP	DIP24	17907000	14287500	1	0
A40	SM207460116	SM10H116.ALT	PLCC_20	21272500	12319000	1	0
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A44	SM200267016	SM10H016	PLCC_20	22288500	10668000	1	0
A45	SM200167131	SM10H131	PLCC_20	22669500	12319000	1	0
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C2	SM661207103	SM.01uFS	SM0805	-952500	7175500	1	90
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C5	SM661207103	SM.01uFS	SM0805	2222500	10477500	1	90
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C7	SM661207103	SM.01uFS	SM0805	2222500	5209540	1	270
C8	SM661255101	SM100pFS	SM0805	2667000	8796020	1	90
C9	SM661207103	SM.01uFS	SM0805	2794000	317500	1	180
C10	SM666247106	SM10uF-25V	SMCAPD	3873500	3365500	1	0
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C12	SM661207103	SM.01uFS	SM0805	5461000	254000	1	0
C13	SM661207103	SM.01uFS	SM0805	6794500	254000	1	0
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C20	SM661207103	SM.01uFS	SM0805	12255500	14668500	1	0
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C24	SM661127104	SM.1uF	SM1206	19939000	14033500	1	180
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C26	SM661207103	SM.01uFS	SM0805	19812000	10350500	1	180
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C28	SM661207103	SM.01uFS	SM0805	20701000	8572500	1	270
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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
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C37	SM661207103	SM.01uFS	SM0805	22352000	6032500	1	0
C38	SM661207103	SM.01uFS	SM0805	22898100	9392920	1	180
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C41	SM661207103	SM.01uFS	SM0805	24892000	11049000	1	180
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C57	SM661207103	SM.01uFS	SM0805	28067000	508000	1	90
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C79	SM661207102	SM.001uFS	SM0805	31719520	7716520	1	0
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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	1X8	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
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Q15	SM270030092	BFR92	SOT23	30703520	2794000	1	270
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Q18	SM280160022	BSD22	SOT143	31338520	7117080	1	180
Q19	SM275030550	BF550	SOT23	31465520	5621020	1	0
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Q21	SM270330848	BC848C	SOT23	31846520	8478520	1	270
Q22	SM280160022	BSD22	SOT143	31795720	7117080	1	180
Q23	SM275030550	BF550	SOT23	31940500	3175000	1	0
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Q25	SM280160022	BSD22	SOT143	32252920	7117080	1	180
R1	SM652101301	SM300S	SM0805	2667000	9177020	1	90
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R3	SM652101512	SM5.1KS	SM0805	20447000	12415520	1	90
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R17	SM652101151	SM150S	SM0805	21717000	12890500	1	270
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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
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R26	SM652101180	SM18S	SM0805	24003000	12954000	1	90
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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
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TC63	SM661255560	SM56pFS	SM0805	17767300	2743200	1 90
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TC67	SM661207103	SM.01uFS	SM0805	18171160	9578340	1 270
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TC73	SM661207103	SM.01uFS	SM0805	19959320	4818380	1 180
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TC76	SM661207103	SM.01uFS	SM0805	20543520	2133600	1 270
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TC78	SM661207103	SM.01uFS	SM0805	21590000	4826000	1 0
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TCR2	SM236030099	BAV99	SOT23	12395200	9398000	1 270
TCR3	SM236030099	BAV99	SOT23	12382500	8724900	1 270
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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
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TQ2	SM270130092	BFR92A	SOT23	9494520	1206500	1 270
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TQ6	SM270040092	BFR92R	SOT23	10637520	952500	1 180
TQ7	SM270030092	BFR92	SOT23	10510520	698500	1 0
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TQ22	SM275340858	BC858CR	SOT23	16431260	576580	1	180
TQ23	SM270030019	BFS19	SOT23	17823180	1231900	1	270
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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
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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
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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
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TR33	SM652101471	SM470S	SM0805	7048500	5156200	1	90
TR34	SM652101821	SM820S	SM0805	7299960	5351780	1	270
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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
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TR41	SM652101471	SM470S	SM0805	8061960	5351780	1	270
TR42	SM652101302	SM3KS	SM0805	8034020	3604260	1	270
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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
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TR52	SM652101470	SM47S	SM0805	8524240	8351520	1	0
TR53	SM652101821	SM820S	SM0805	8572500	7754620	1	90
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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

TR62	SM652101681	SM680S	SM0805	8542020	2974340	1	90
TR63	SM652101471	SM470S	SM0805	8542020	2821940	1	270
TR64	SM652101470	SM47S	SM0805	8542020	2377440	1	270
TR65	SM652101622	SM6.2KS	SM0805	8823960	9733280	1	270
TR66	SM652101471	SM470S	SM0805	8836660	6289040	1	0
TR67	SM652101562	SM5.6KS	SM0805	9034780	9494520	1	0
TR68	SM652101820	SM82S	SM0805	9039860	9237980	1	0
TR69	SM652101820	SM82S	SM0805	8933180	8310880	1	90
TR70	SM652101471	SM470S	SM0805	9004300	6743700	1	270
TR71	SM652101470	SM47S	SM0805	9095740	1734820	1	270
TR72	SM652101471	SM470S	SM0805	8938260	1330960	1	0
TR73	SM652101821	SM820S	SM0805	9232900	8986520	1	180
TR74	SM652101821	SM820S	SM0805	9235440	8724900	1	180
TR75	SM652101821	SM820S	SM0805	9271000	6550660	1	90
TR76	SM652101471	SM470S	SM0805	9237980	-27940	1	270
TR77	SM652101821	SM820S	SM0805	9593580	9751060	1	180
TR78	SM652101820	SM82S	SM0805	9522460	6746240	1	270
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TR80	SM652101471	SM470S	SM0805	9494520	-33020	1	270
TR81	SM652101102	SM1KS	SM0805	9504680	-388620	1	270
TR82	SM652101470	SM47S	SM0805	9748520	9748520	1	0
TR83	SM652101820	SM82S	SM0805	9781540	6550660	1	90
TR84	SM653125033	SM3.3S	SM0805	9715500	571500	1	0
TR85	SM652101470	SM47S	SM0805	9773920	-226060	1	90
TR86	SM652101820	SM82S	SM0805	10035540	6746240	1	270
TR87	SM652101221	SM220S	SM0805	10116820	6289040	1	180
TR88	SM652101470	SM47S	SM0805	10129520	1625600	1	270
TR89	SM652101470	SM47S	SM0805	10096500	1206500	1	0
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TR91	SM653125033	SM3.3S	SM0805	10038080	157480	1	90
TR92	SM652101562	SM5.6KS	SM0805	10292080	9751060	1	180
TR93	SM652101820	SM82S	SM0805	10325100	6266180	1	90
TR94	SM652101820	SM82S	SM0805	10233660	6032500	1	0
TR95	SM652101681	SM680S	SM0805	10302240	5775960	1	0
TR96	SM652101820	SM82S	SM0805	10233660	4919980	1	0
TR97	SM652101471	SM470S	SM0805	10223500	4673600	1	270
TR98	SM652101471	SM470S	SM0805	10223500	4122420	1	90
TR99	SM652101271	SM270S	SM0805	10223500	3683000	1	270
TR100	SM652101331	SM330S	SM0805	10220960	3139440	1	90
TR101	SM652101821	SM820S	SM0805	10223500	2791460	1	90
TR102	SM652101821	SM820S	SM0805	10292080	160020	1	90
TR103	SM652101622	SM6.2KS	SM0805	10642600	9751060	1	180
TR104	SM652101820	SM82S	SM0805	10576560	6461760	1	270
TR105	SM652101821	SM820S	SM0805	10477500	4318000	1	270
TR106	SM652101271	SM270S	SM0805	10477500	3683000	1	270
TR107	SM652101221	SM220S	SM0805	10474960	3335020	1	270
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TR111	SM652101332	SM3.3KS	SM0805	10604500	160020	1	90
TR112	SM652101202	SM2KS	SM0805	10795000	9753600	1	0
TR113	SM652101560	SM56S	SM0805	10789920	9494520	1	0
TR114	SM652101821	SM820S	SM0805	10789920	9240520	1	0
TR115	SM652101562	SM5.6KS	SM0805	10795000	8986520	1	0
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TR117	SM652101470	SM47S	SM0805	10899140	2890520	1	180
TR118	SM652101181	SM180S	SM0805	10891520	922020	1	90
TR119	SM652101820	SM82S	SM0805	10891520	731520	1	270
TR120	SM652101332	SM3.3KS	SM0805	10703560	-604520	1	90
TR121	SM652101622	SM6.2KS	SM0805	10990580	8735060	1	180
TR122	SM652101821	SM820S	SM0805	10942320	8064500	1	0
TR123	SM652101821	SM820S	SM0805	11038840	6319520	1	0
TR124	SM652101221	SM220S	SM0805	11112500	3111500	1	90
TR125	SM652101471	SM470S	SM0805	11056620	2893060	1	0
TR126	SM652101181	SM180S	SM0805	11145520	922020	1	90
TR127	SM652101820	SM82S	SM0805	11153140	538480	1	90

TR128	SM652101331	SM330S	SM0805	10955020	-33020	1	270
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TR132	SM652101103	SM10KS	SM0805	11371580	-607060	1	90
TR133	SM652101470	SM47S	SM0805	11435080	6464300	1	270
TR134	SM652101821	SM820S	SM0805	11617960	3307080	1	270
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TR136	SM652101221	SM220S	SM0805	11871960	3307080	1	270
TR137	SM652101331	SM330S	SM0805	11762740	2887980	1	0
TR138	SM652101470	SM47S	SM0805	11968480	7762240	1	90
TR139	SM652101271	SM270S	SM0805	11971020	7411720	1	90
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TR142	SM652101680	SM68S	SM0805	11965940	6464300	1	270
TR143	SM652101271	SM270S	SM0805	12171680	6410960	1	0
TR144	SM652101622	SM6.2KS	SM0805	12161520	5308600	1	270
TR145	SM652101331	SM330S	SM0805	12164060	4414520	1	90
TR146	SM652101470	SM47S	SM0805	12161520	4259580	1	270
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TR148	SM652101221	SM220S	SM0805	12164060	3365500	1	90
TR149	SM652101622	SM6.2KS	SM0805	12161520	3058160	1	270
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TR151	SM652101622	SM6.2KS	SM0805	12166600	2146300	1	90
TR152	SM652101622	SM6.2KS	SM0805	12161520	1445260	1	90
TR153	SM652101820	SM82S	SM0805	12179300	-165100	1	0
TR154	SM652101330	SM33S	SM0805	12415520	8983980	1	180
TR155	SM652101622	SM6.2KS	SM0805	12425680	5110480	1	270
TR156	SM652101622	SM6.2KS	SM0805	12425680	3025140	1	90
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TR159	SM652101820	SM82S	SM0805	12585700	-312420	1	90
TR160	SM652101271	SM270S	SM0805	12900660	6156960	1	180
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TR165	SM652101622	SM6.2KS	SM0805	12763500	1651000	1	270
TR166	SM652101330	SM33S	SM0805	13182600	8559800	1	90
TR167	SM652101470	SM47S	SM0805	13060680	6156960	1	0
TR168	SM652101680	SM68S	SM0805	13200380	4127500	1	270
TR169	SM652101471	SM470S	SM0805	13200380	3774440	1	270
TR170	SM652101470	SM47S	SM0805	13208000	5951220	1	270
TR171	SM652101271	SM270S	SM0805	13208000	5196840	1	90
TR172	SM652101470	SM47S	SM0805	13208000	5039360	1	270
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TR174	SM652101820	SM82S	SM0805	13286740	1254760	1	180
TR175	SM652101820	SM82S	SM0805	13230860	1000760	1	180
TR176	SM652101202	SM2KS	SM0805	13230860	746760	1	180
TR177	SM652101331	SM330S	SM0805	13230860	99060	1	180
TR178	SM652101471	SM470S	SM0805	13639800	7683500	1	90
TR179	SM652101101	SM100S	SM0805	13627100	7518400	1	270
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TR181	SM652101271	SM270S	SM0805	13462000	4686300	1	270
TR182	SM652101471	SM470S	SM0805	13583920	2936240	1	270
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TR184	SM652101151	SM150S	SM0805	13586460	2044700	1	90
TR185	SM652101471	SM470S	SM0805	13634720	1747520	1	180
TR186	SM652101121	SM120S	SM0805	13637260	1493520	1	180
TR187	SM652101102	SM1KS	SM0805	13464540	853440	1	0
TR188	SM652101622	SM6.2KS	SM0805	13840460	9745980	1	270
TR189	SM652101510	SM51S	SM0805	13840460	9202420	1	90
TR190	SM652101331	SM330S	SM0805	13906500	8229600	1	270
TR191	SM652101681	SM680S	SM0805	13893800	7340600	1	90
TR192	SM652101470	SM47S	SM0805	13901420	6814820	1	270
TR193	SM652101562	SM5.6KS	SM0805	14094460	9552940	1	90

TR194	SM652101510	SM51S	SM0805	14091920	9398000	1	270
TR195	SM652101101	SM100S	SM0805	14094460	8849360	1	90
TR196	SM652101151	SM150S	SM0805	13985240	1490980	1	180
TR197	SM652101562	SM5.6KS	SM0805	14018260	1236980	1	180
TR198	SM652101102	SM1KS	SM0805	14018260	977900	1	180
TR199	SM652101681	SM680S	SM0805	14221460	932180	1	90
TR200	SM652101681	SM680S	SM0805	14447520	8318500	1	90
TR201	SM652101271	SM270S	SM0805	14312900	7937500	1	180
TR202	SM652101470	SM47S	SM0805	14302740	6286500	1	180
TR203	SM652101681	SM680S	SM0805	14460220	6286500	1	0
TR204	SM652101271	SM270S	SM0805	14307820	4627880	1	180
TR205	SM652101271	SM270S	SM0805	14462760	4627880	1	0
TR206	NORES	NORES	SM0805	14691360	1490980	1	180
TR207	NORES	NORES	SM0805	14693900	1236980	1	180
TR208	SM652101101	SM100S	SM0805	14945360	7962900	1	90
TR209	SM652101680	SM68S	SM0805	14859000	6136640	1	90
TR210	SM652101471	SM470S	SM0805	14859000	5778500	1	90
TR211	SM652101681	SM680S	SM0805	14859000	5621020	1	270
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TR213	SM652101103	SM10KS	SM0805	14864080	4376420	1	90
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TR244	SM652101181	SM180S	SM0805	16324580	7345680	1	0
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TR318	SM652101302	SM3KS	SM0805	20378420	5722620	1	270
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TR325	SM652101622	SM6.2KS	SM0805	21783040	4328160	1	180

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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
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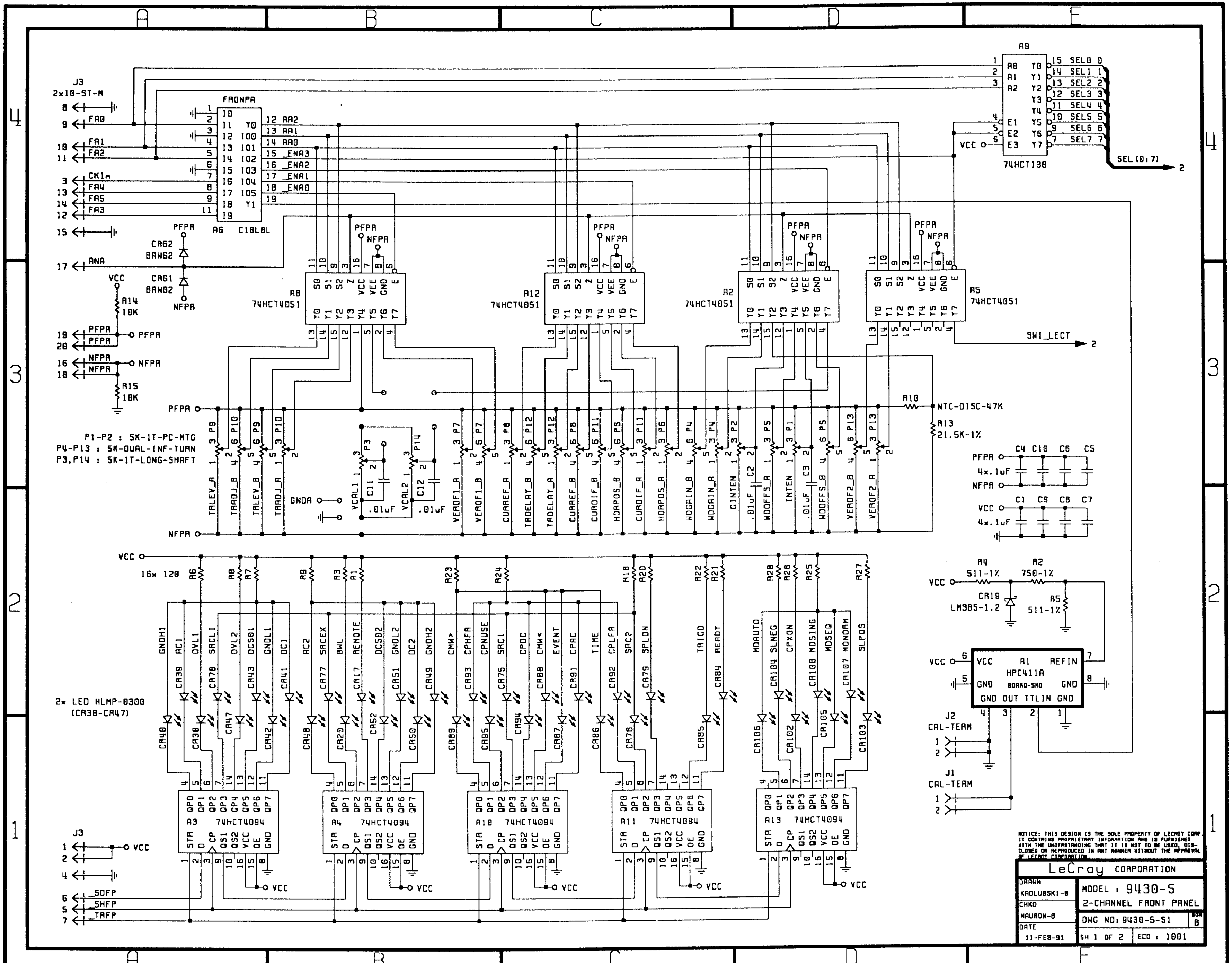
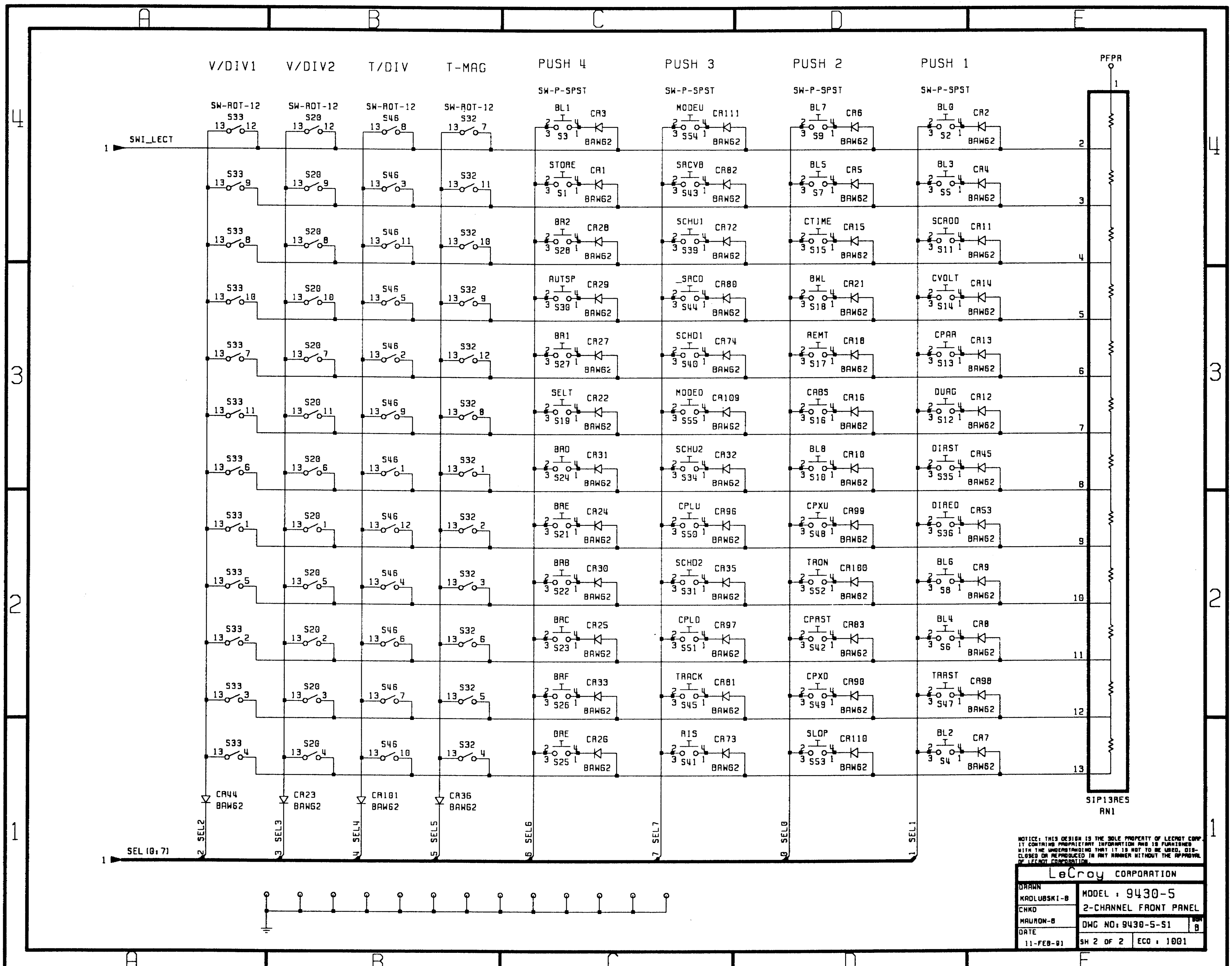
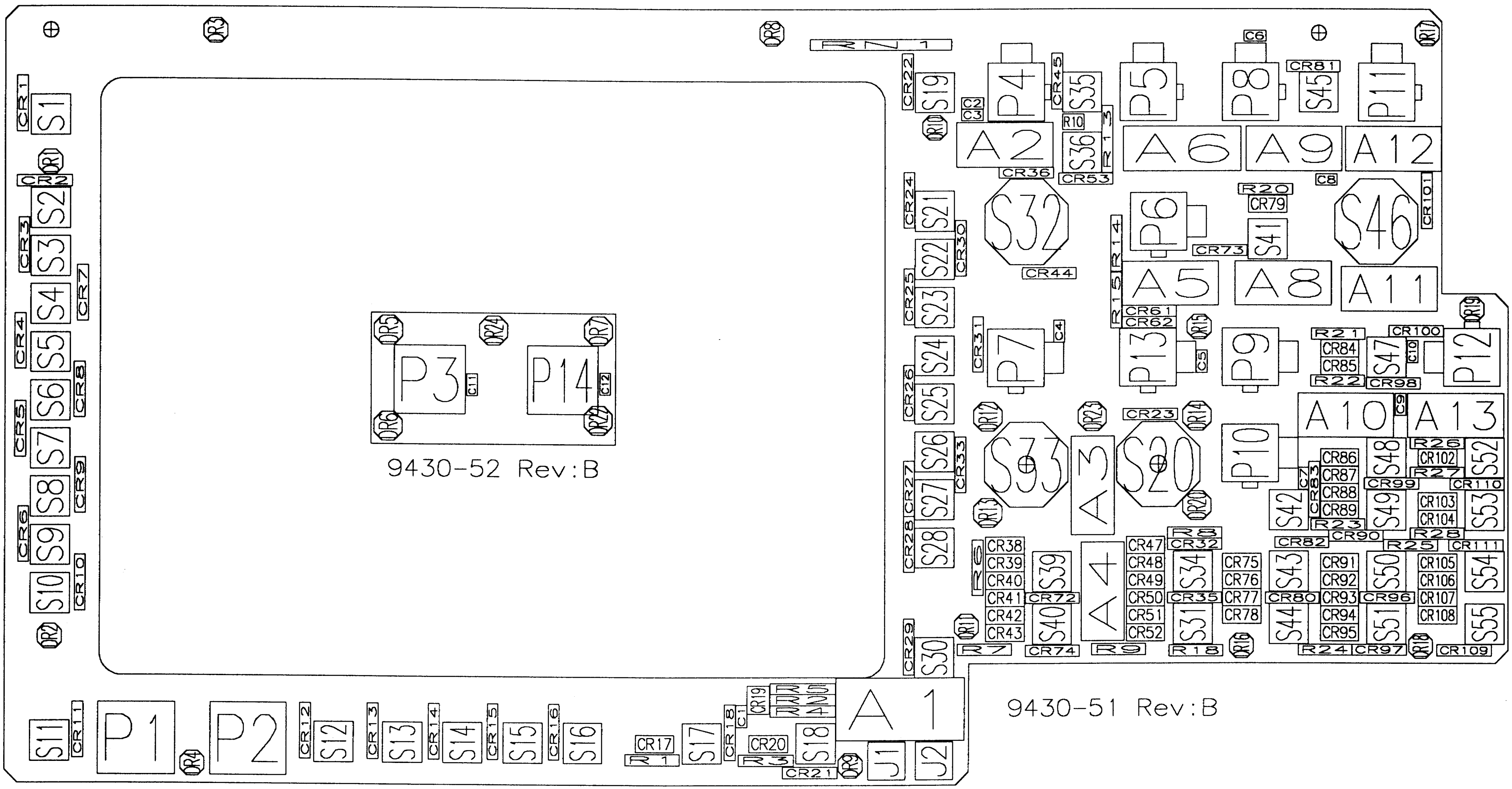


Scan by Paladinmicro -- paladin@paladinmicro.com



Scan by Paladinmicro -- paladin@paladinmicro.com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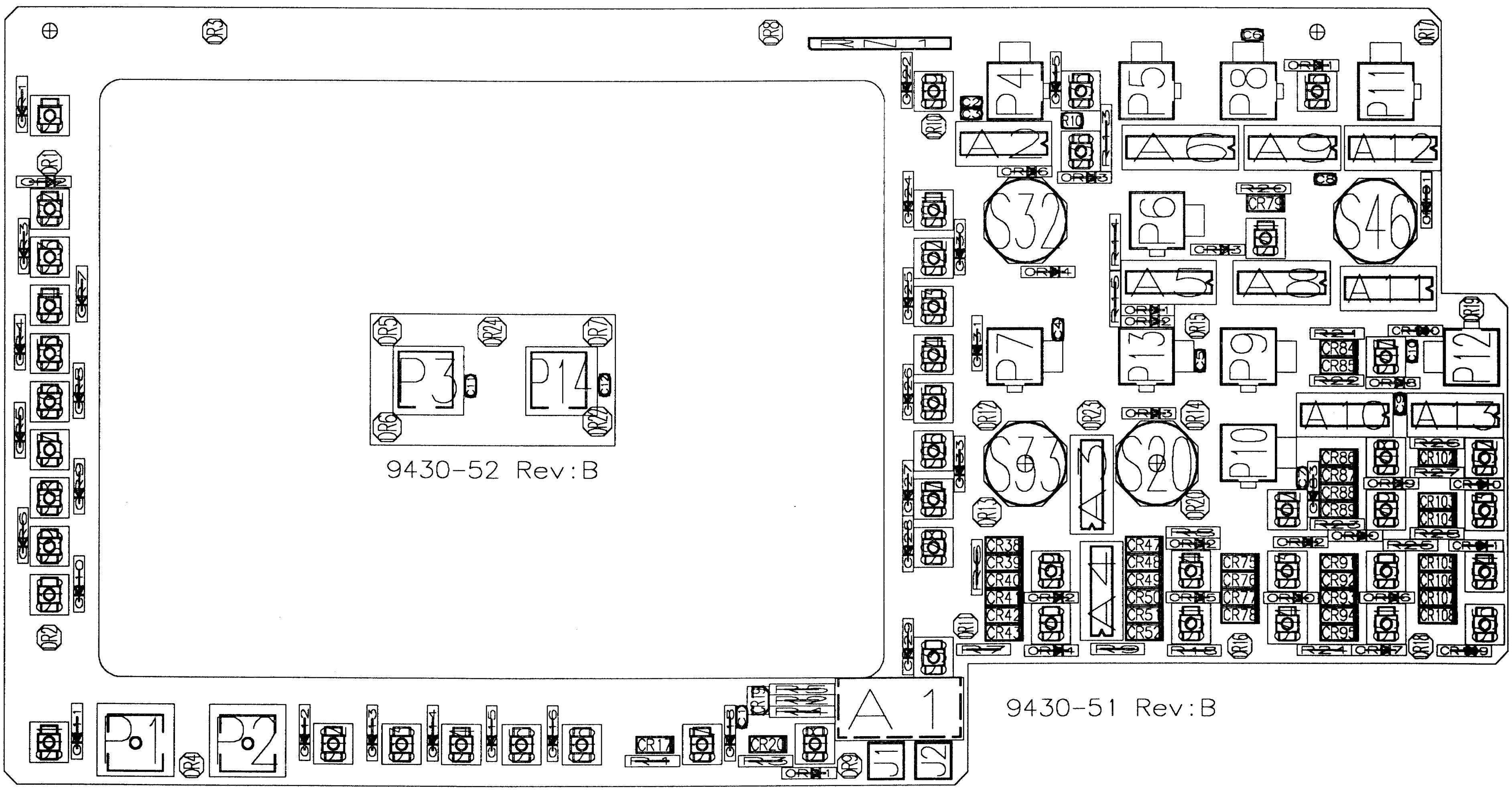
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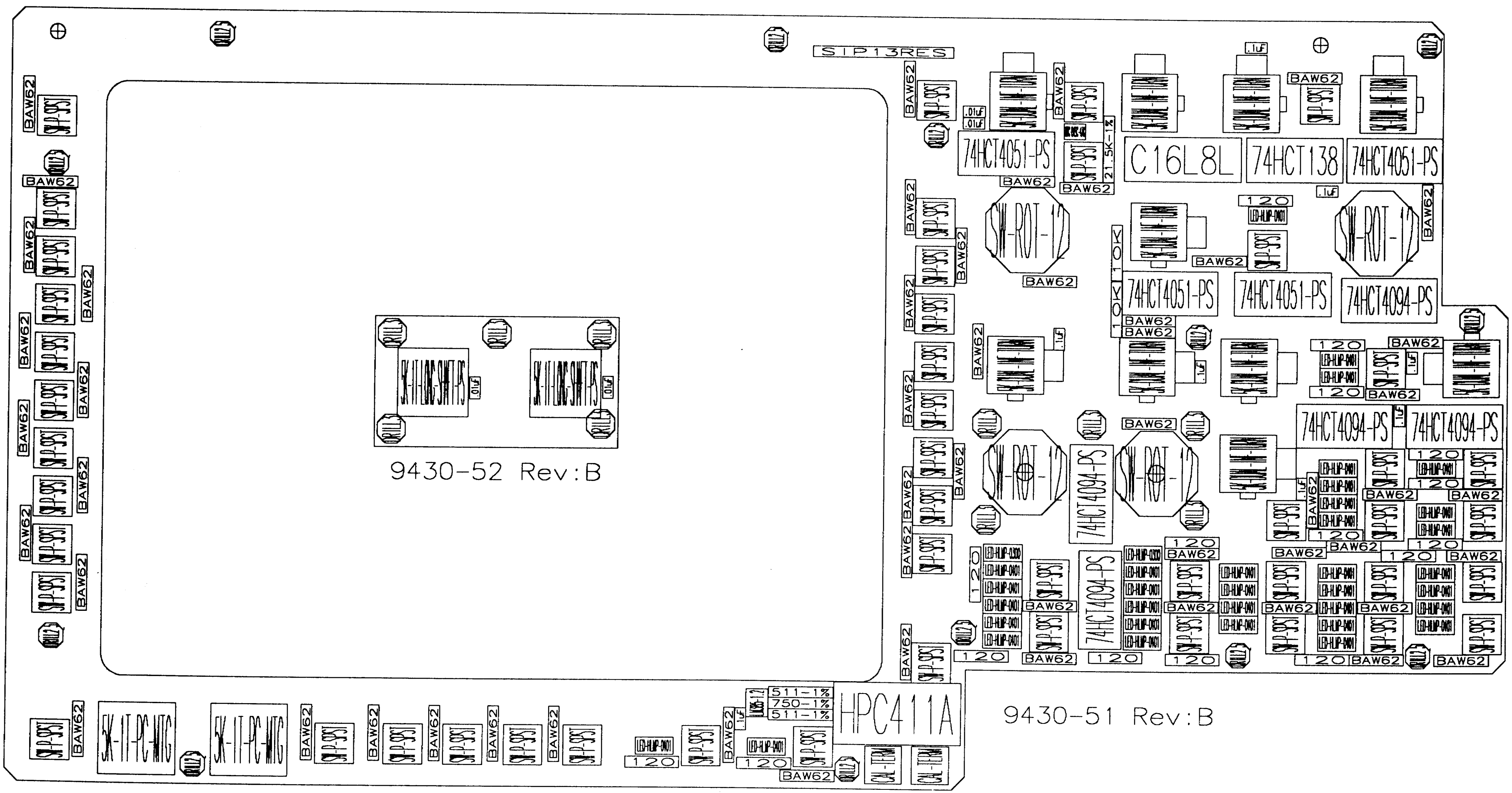
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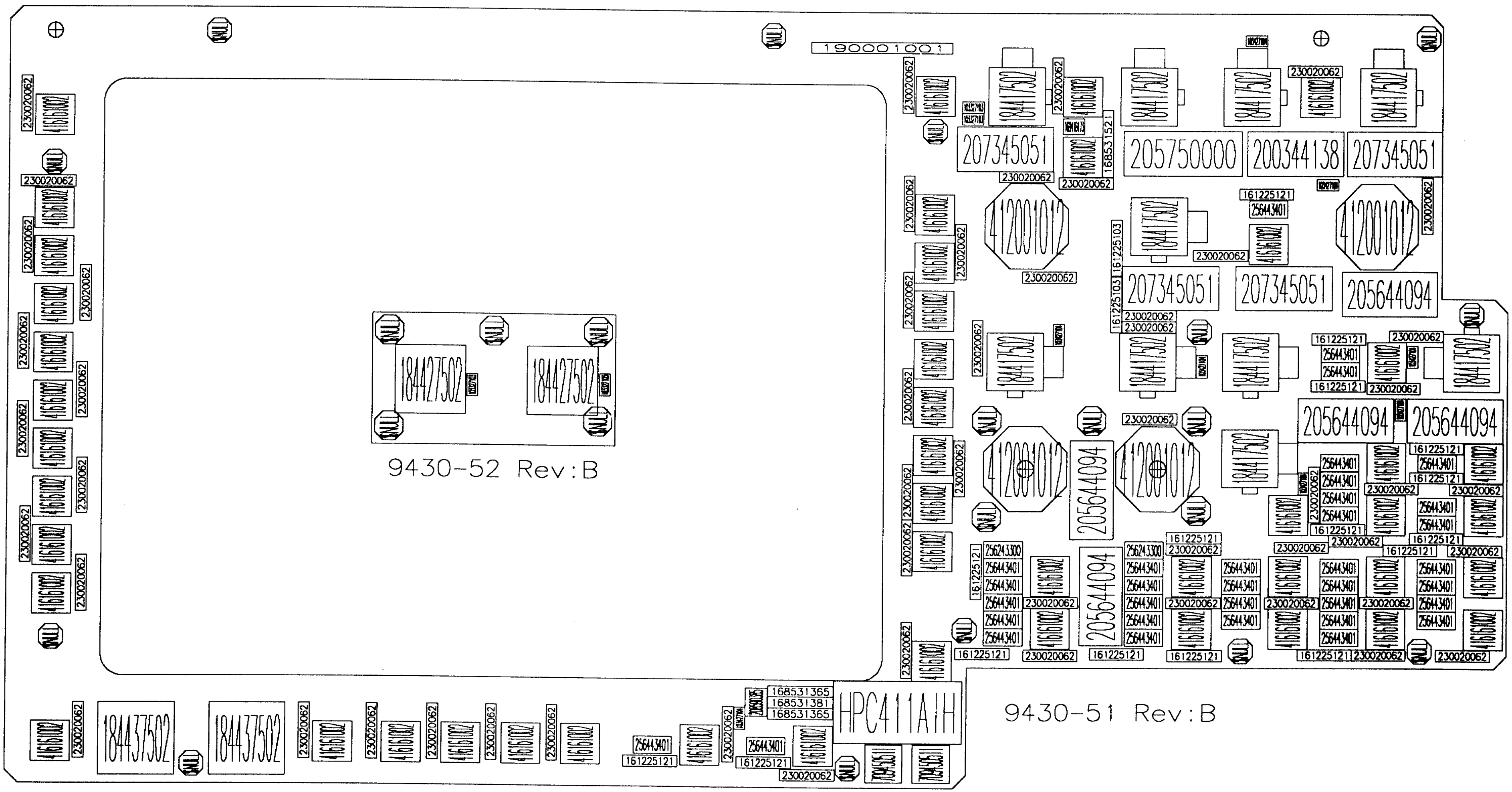

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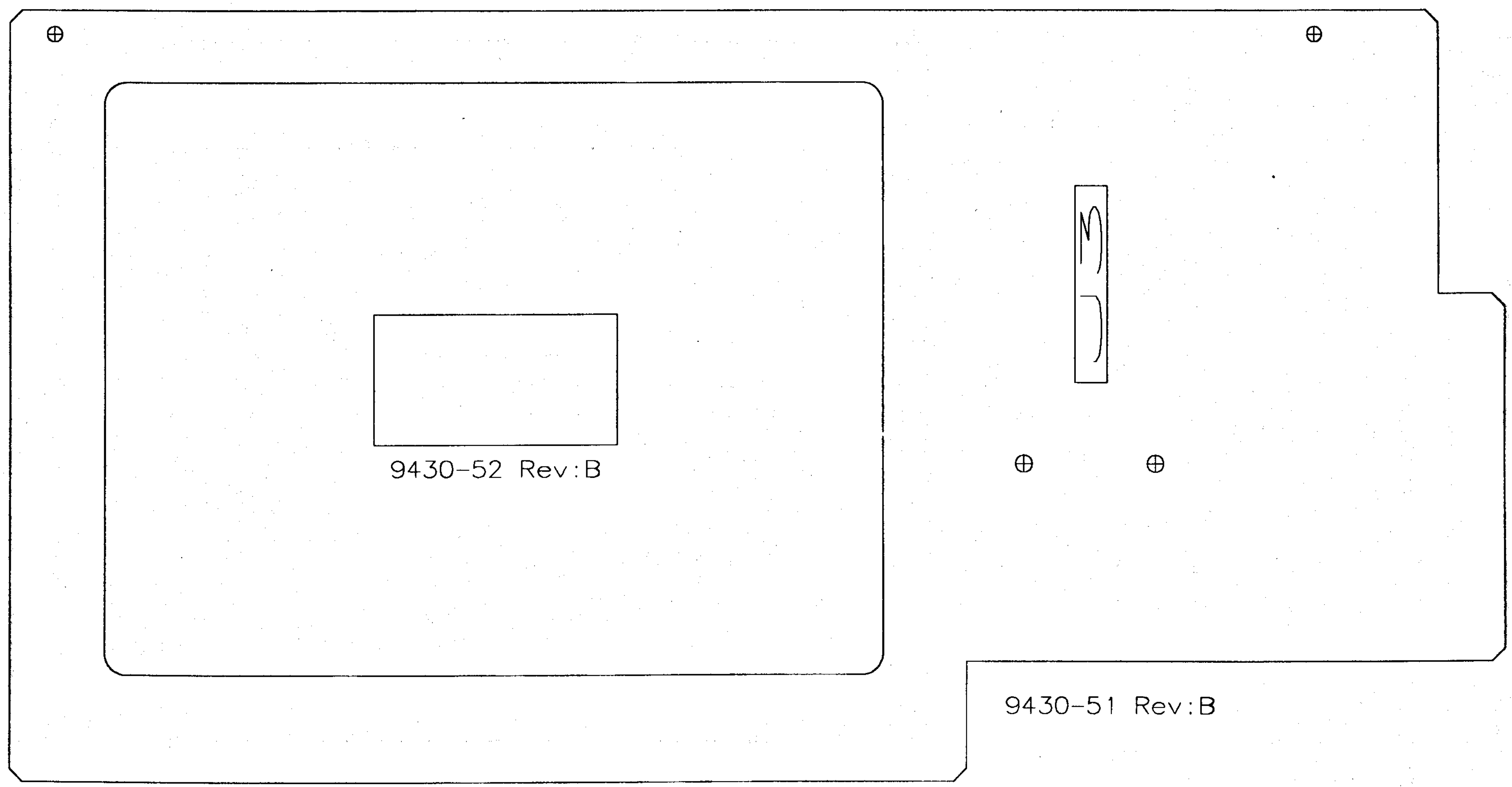
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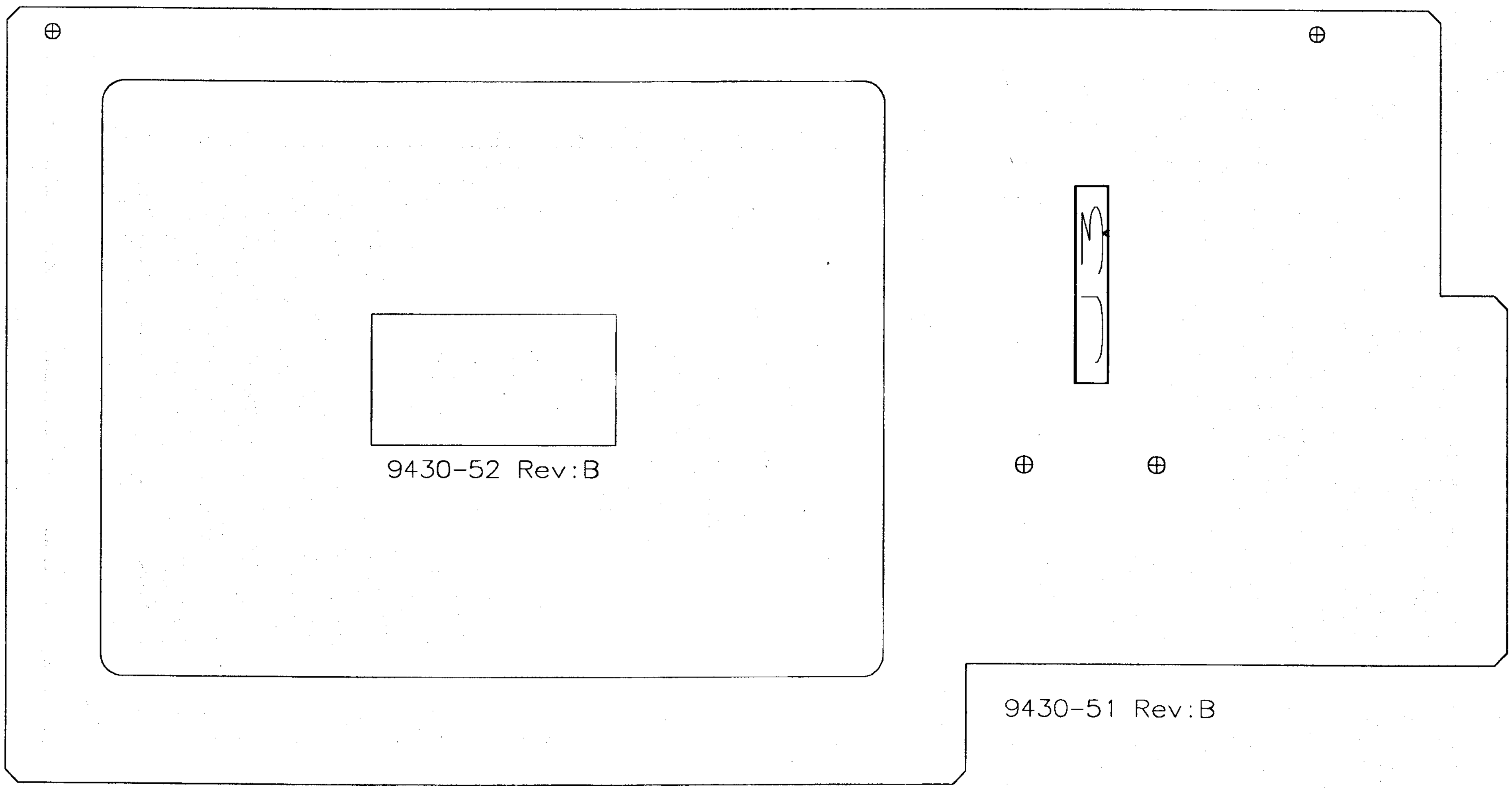
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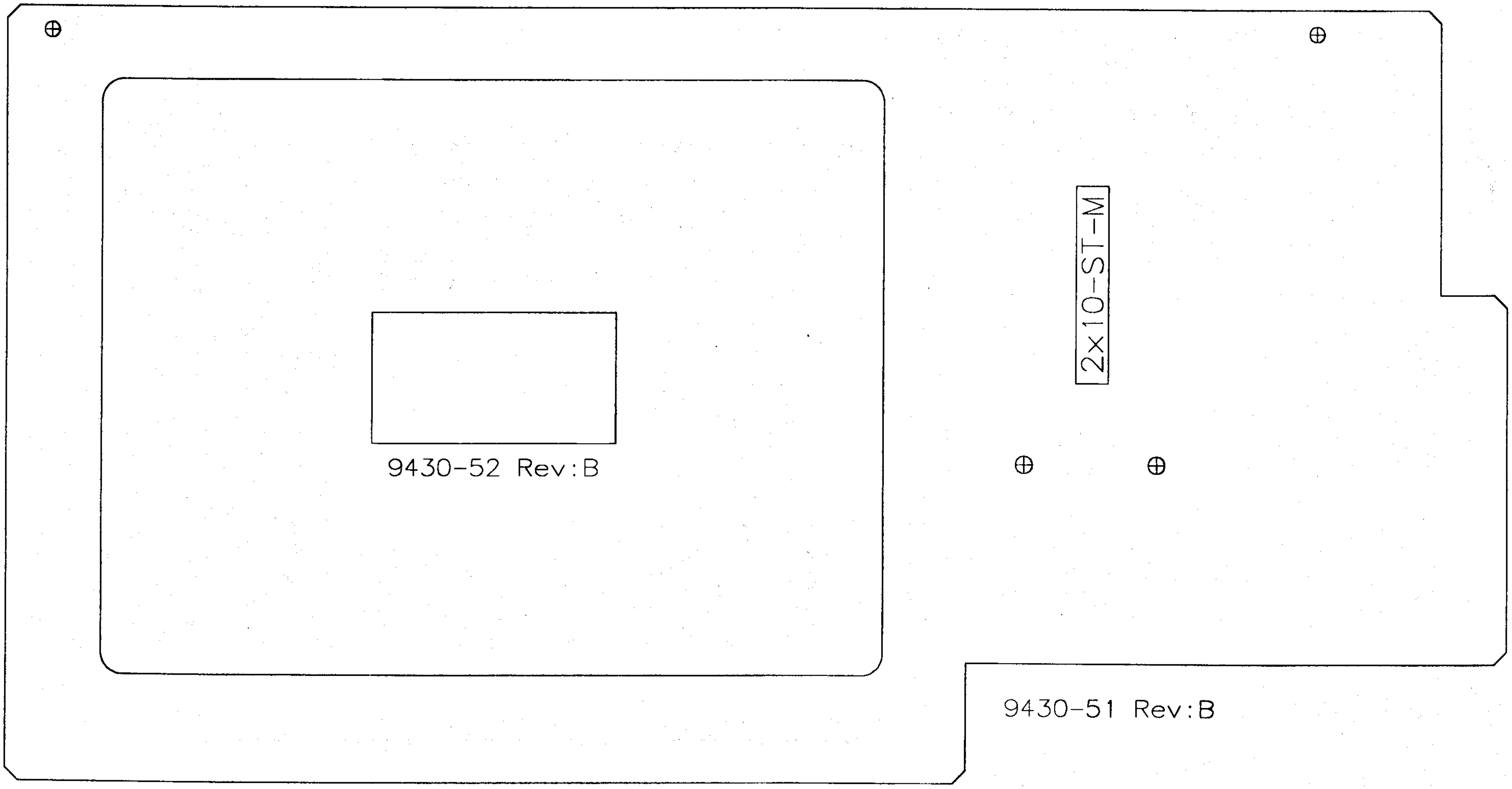
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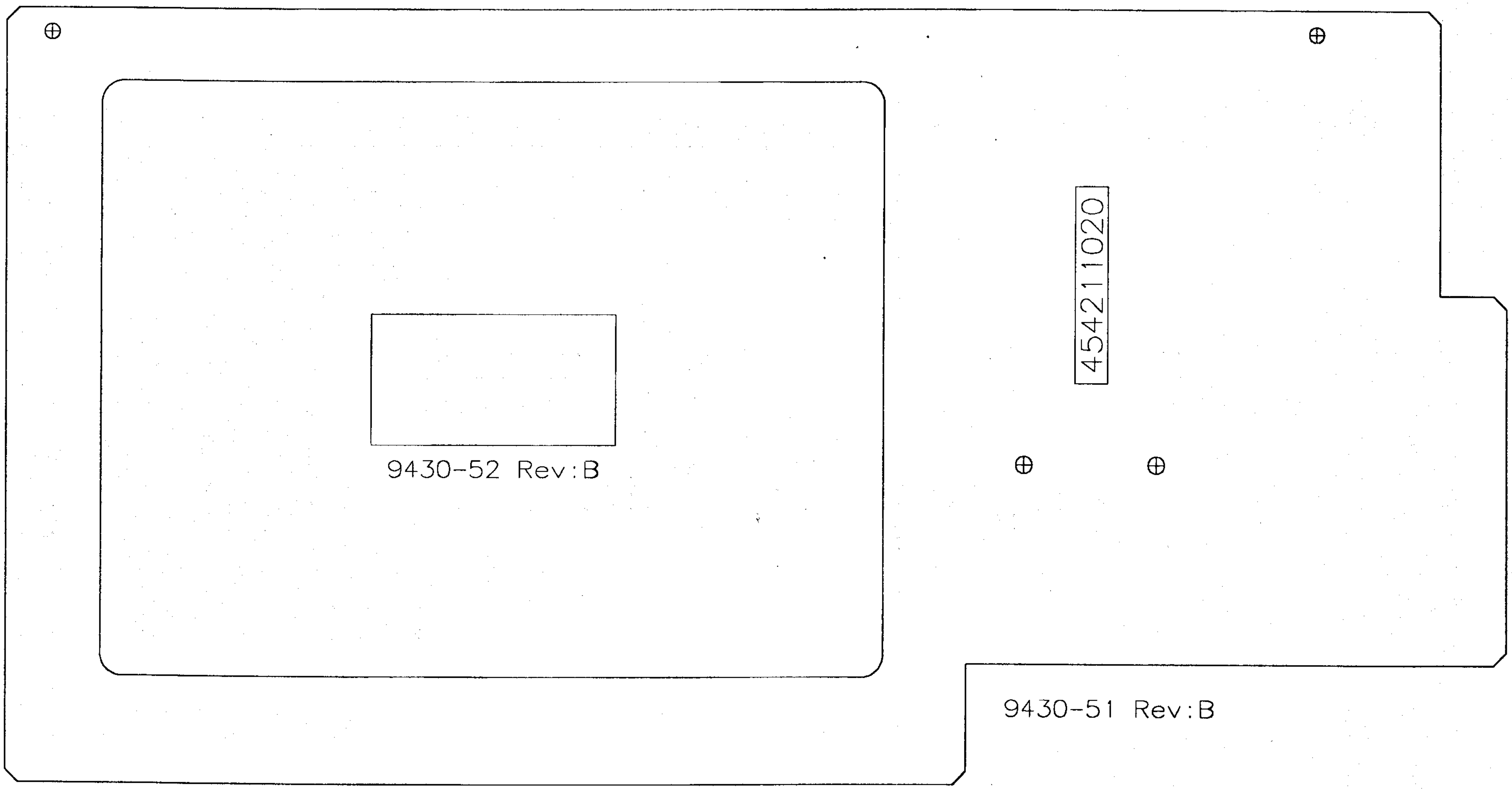
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A1	HPC411AIH	HPC411A	HPC411	2166620	-7754620	1	0
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A3	205644094	74HCT4094-PS	DIP16	8191500	-2921000	1	180
A4	205644094	74HCT4094-PS	DIP16	8420100	-5346700	1	180
A5	207345051	74HCT4051-PS	DIP16	10515600	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
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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
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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
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R28	161225121	120	RES05	16395700	-3136900	1	180
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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
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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
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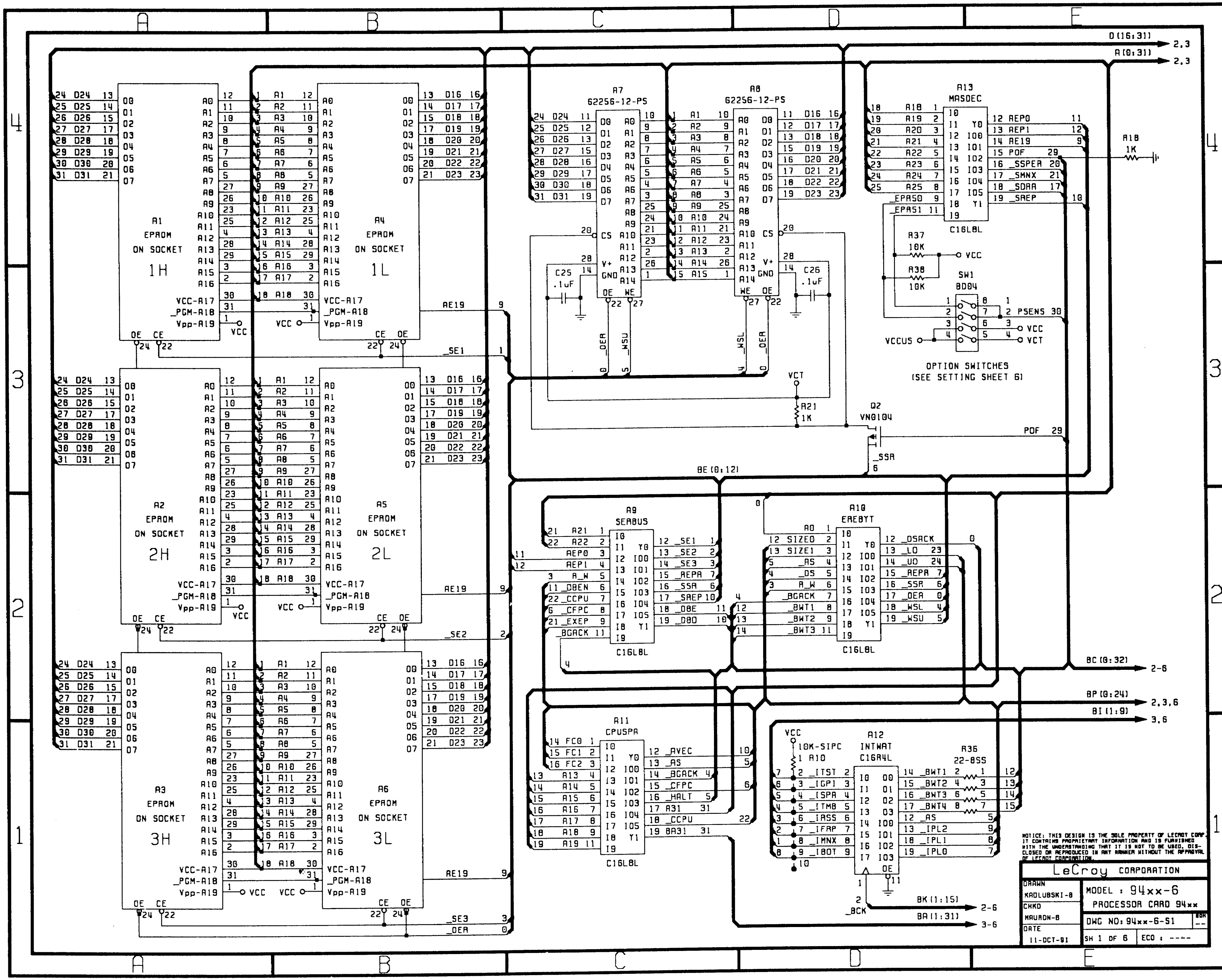
S24	416161002	SW-P-SPST	SW_P_SPST	3718560	695960	1	0
S25	416161002	SW-P-SPST	SW_P_SPST	3718560	-403860	1	0
S26	416161002	SW-P-SPST	SW_P_SPST	3718560	-1503680	1	0
S27	416161002	SW-P-SPST	SW_P_SPST	3718560	-2603500	1	0
S28	416161002	SW-P-SPST	SW_P_SPST	3718560	-3703320	1	0
S30	416161002	SW-P-SPST	SW_P_SPST	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
CR28	230020062	BAW62	DO35	3505200	-2857500	1	270
CR29	230020062	BAW62	DO35	3505200	-5194300	1	270
CR30	230020062	BAW62	DO35	4711700	3911600	1	270
CR31	230020062	BAW62	DO35	5118100	1714500	1	270
CR32	230020062	BAW62	DO35	9690100	-3378200	1	0
CR33	230020062	BAW62	DO35	4711700	-1041400	1	270
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	-3802380	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
CR52	256443401	LED-HLMP-0401	LED_RECT	8920480	-5397500	1	0
CR53	230020062	BAW62	DO35	7124700	4978400	1	0
CR61	230020062	BAW62	DO35	8623300	1955800	1	0
CR62	230020062	BAW62	DO35	8623300	1701800	1	0
CR72	230020062	BAW62	DO35	6350000	-4605020	1	0
CR73	230020062	BAW62	DO35	10274300	3340100	1	0
CR74	230020062	BAW62	DO35	6350000	-5811520	1	0
CR75	256443401	LED-HLMP-0401	LED_RECT	11173460	-3802380	1	0
CR76	256443401	LED-HLMP-0401	LED_RECT	11173460	-4201160	1	0
CR77	256443401	LED-HLMP-0401	LED_RECT	11173460	-4599940	1	0
CR78	256443401	LED-HLMP-0401	LED_RECT	11173460	-4998720	1	0
CR79	256443401	LED-HLMP-0401	LED_RECT	11772900	4399280	1	0
CR80	230020062	BAW62	DO35	11976100	-4610100	1	0
CR81	230020062	BAW62	DO35	12458700	7543800	1	0
CR82	230020062	BAW62	DO35	12204700	-3340100	1	0
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
CR93	256443401	LED-HLMP-0401	LED_RECT	13472160	-4599940	1	0
CR94	256443401	LED-HLMP-0401	LED_RECT	13472160	-4998720	1	0
CR95	256443401	LED-HLMP-0401	LED_RECT	13472160	-5397500	1	0
CR96	230020062	BAW62	DO35	14211300	-4597400	1	0
CR97	230020062	BAW62	DO35	14020800	-5791200	1	0
CR98	230020062	BAW62	DO35	14351000	304800	1	0
CR99	230020062	BAW62	DO35	14312900	-1993900	1	0
CR100	230020062	BAW62	DO35	14884400	1498600	1	0
CR101	230020062	BAW62	DO35	15646400	4991100	1	270

CR102	256443401	LED-HLMP-0401	LED_RECT	15773400	-1399540	1	0
CR103	256443401	LED-HLMP-0401	LED_RECT	15773400	-2400300	1	0
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


LeCroy CORPORATION
MODEL : 94xx-6
PROCESSOR CARD 94xx
DRAWN KADLUBSKI-8
CHKD MAURON-8
DATE 11-OCT-91
DWG NO: 94xx-6-S1
SH 1 OF 6
ECO : ----
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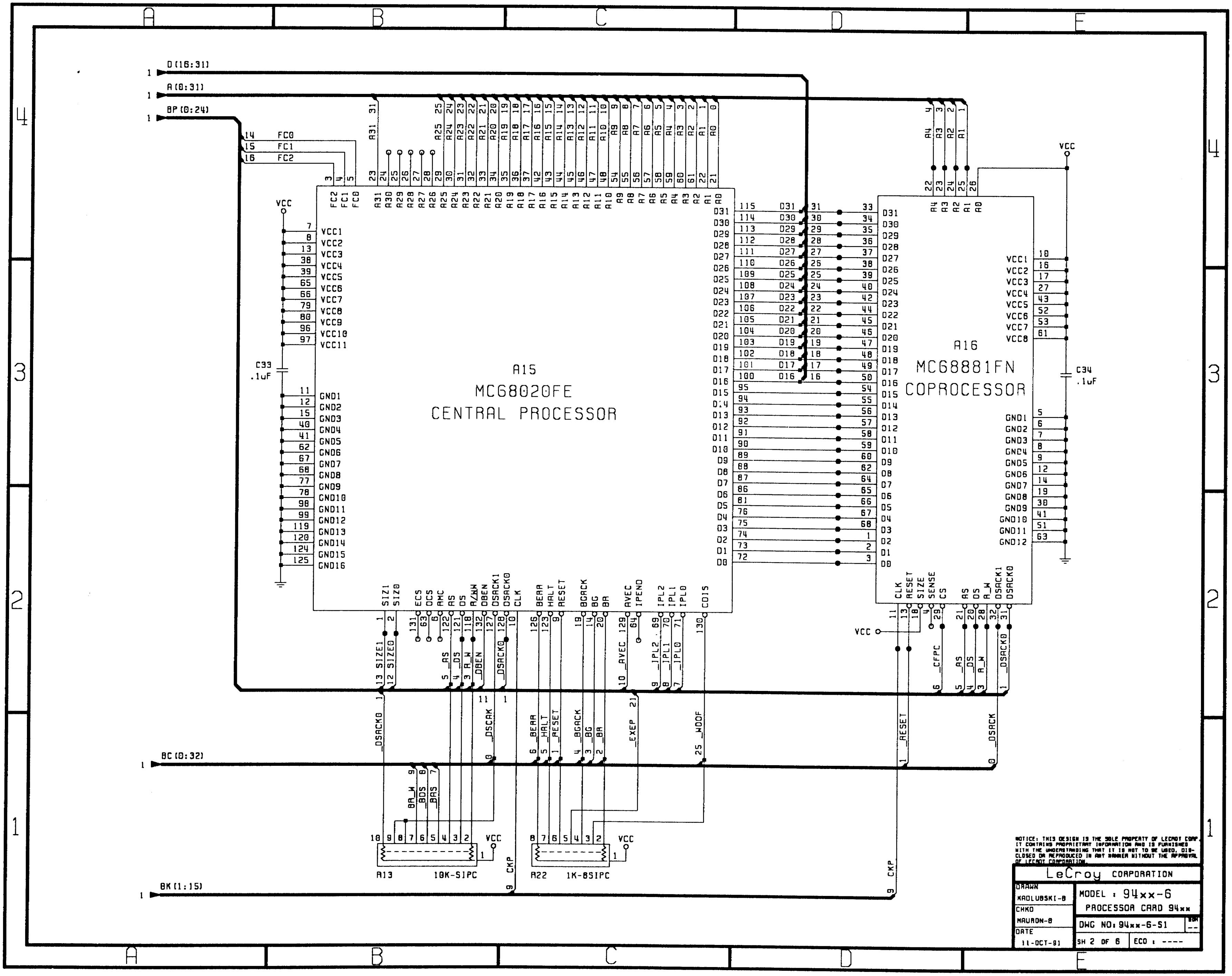
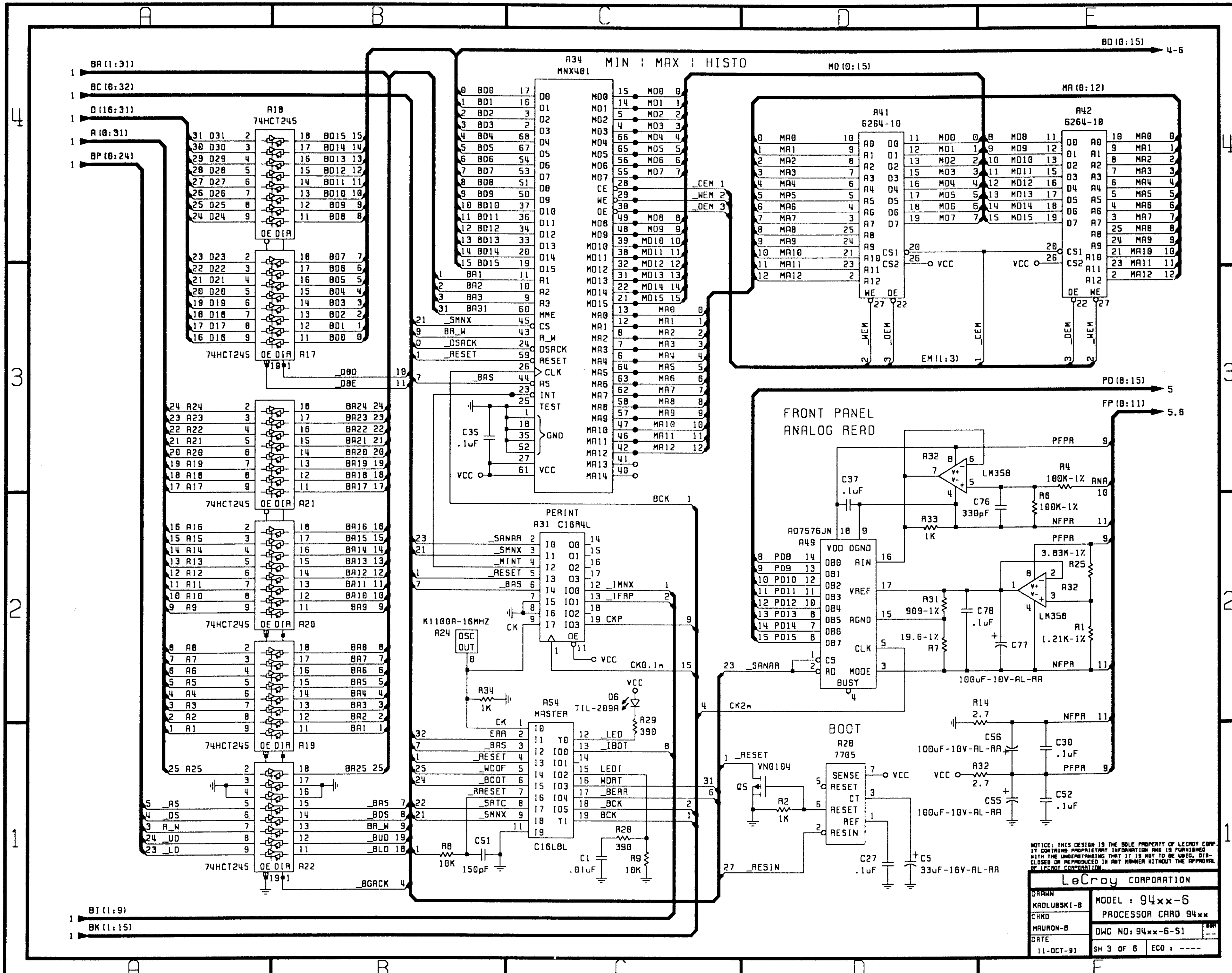
A1 EPROM ON SOCKET 1H
A4 EPROM ON SOCKET 1L
A2 EPROM ON SOCKET 2H
A5 EPROM ON SOCKET 2L
A3 EPROM ON SOCKET 3H
A6 EPROM ON SOCKET 3L
A7 62256-12-PS
A8 62256-12-PS
A13 MASDEC C16L8L
A9 SEABUS C16L8L
A10 EAEBYT C16L8L
A11 CPUSPA C16L8L
A12 INTWAT C16R4L
R36 22-8SS
SW1 8D04
OPTION SWITCHES (SEE SETTING SHEET 6)
Q2 VN0104
D(16:31) 2,3
A(0:31) 2,3
BC(0:32) 2-6
BP(0:24) 2,3,6
BI(1:9) 3,6
BK(1:15) 2-6
BA(1:31) 3-6



Scan by Paladinmicro -- paladin@paladinmicro.com



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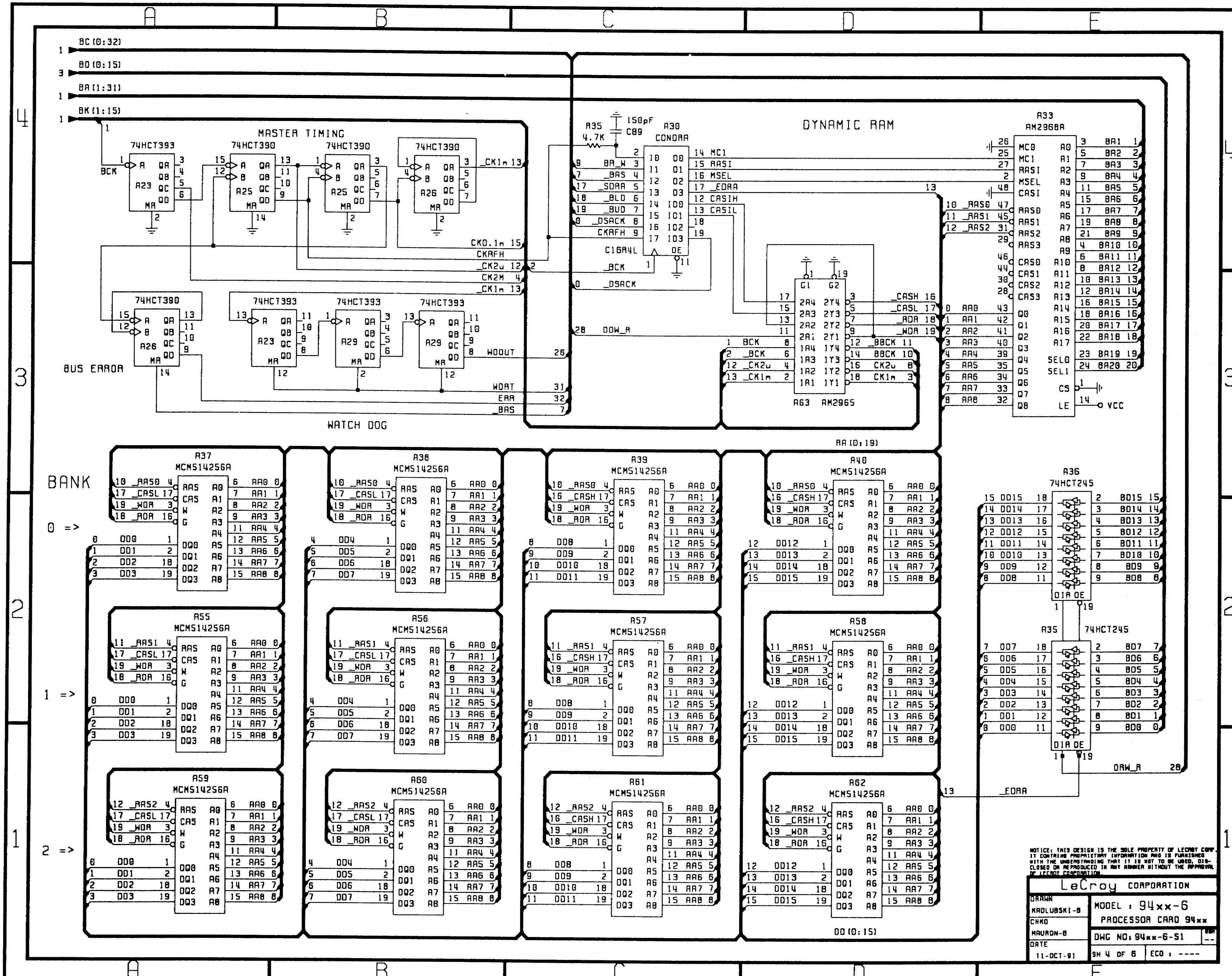
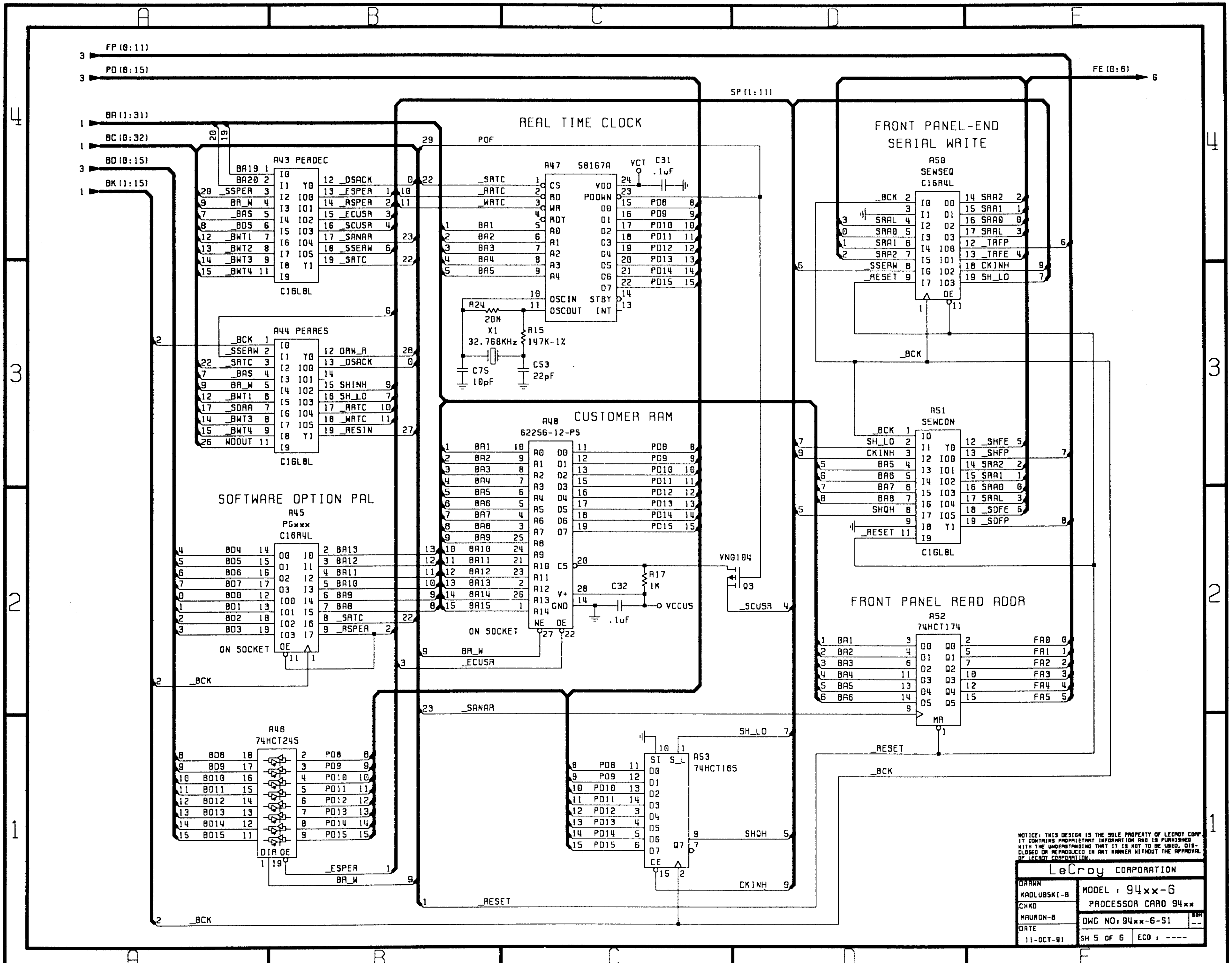
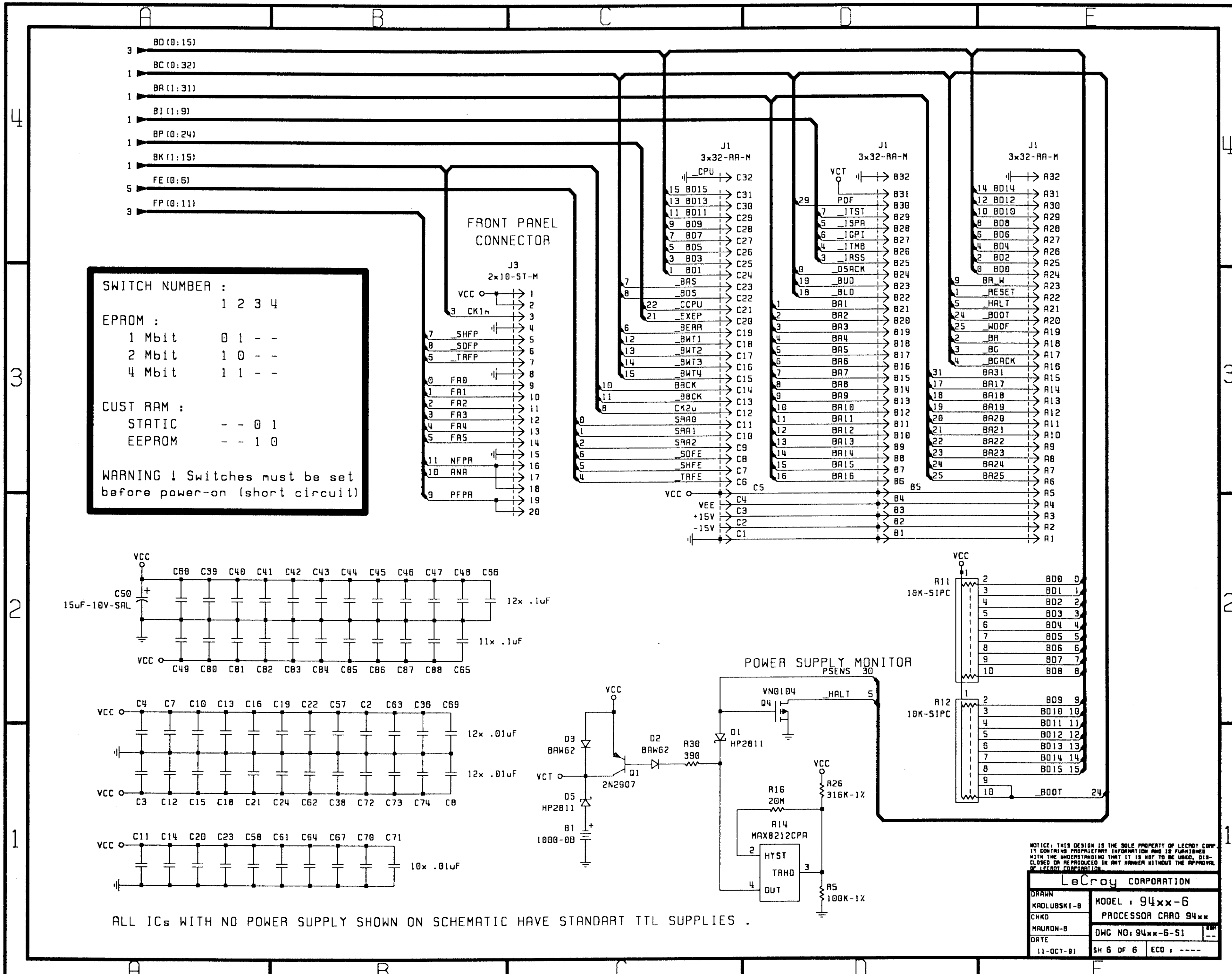
LeCroy CORPORATION	
DRAWN KAOLUBSKI-B	MODEL : 94xx-6
CHKD MAURON-B	PROCESSOR CARD 94xx
DATE 11-OCT-91	DWG NO: 94xx-6-S1
	SH 3 OF 6 ECO : ----


MASTER TIMING
BUS ERROR
WATCH DOG
DYNAMIC RAM
BANK
0 =>
1 =>
2 =>
LeCroy CORPORATION
MODEL : 94xx-6
PROCESSOR CARD 94xx
DWG NO: 94xx-6-S1
SH 4 OF 6
DATE
11-OCT-91



Scan by Paladinmicro -- paladin@paladinmicro.com



BD(0:15)
BC(0:32)
BA(1:31)
BI(1:9)
BP(0:24)
BK(1:15)
FE(0:6)
FP(0:11)
FRONT PANEL CONNECTOR
J3 2x10-ST-M
J1 3x32-RA-M
SWITCH NUMBER : 1 2 3 4
EPROM :
1 Mbit 0 1 - -
2 Mbit 1 0 - -
4 Mbit 1 1 - -
CUST RAM :
STATIC - - 0 1
EEPROM - - 1 0
WARNING ! Switches must be set before power-on (short circuit)
POWER SUPPLY MONITOR
12x .1uF
11x .1uF
12x .01uF
12x .01uF
10x .01uF
15uF-10V-SAL
R11 10K-SIPC
R12 10K-SIPC
MAX8212CPA
2N2907
VN0104
HP2811
BAW62
ALL ICs WITH NO POWER SUPPLY SHOWN ON SCHEMATIC HAVE STANDART TTL SUPPLIES .
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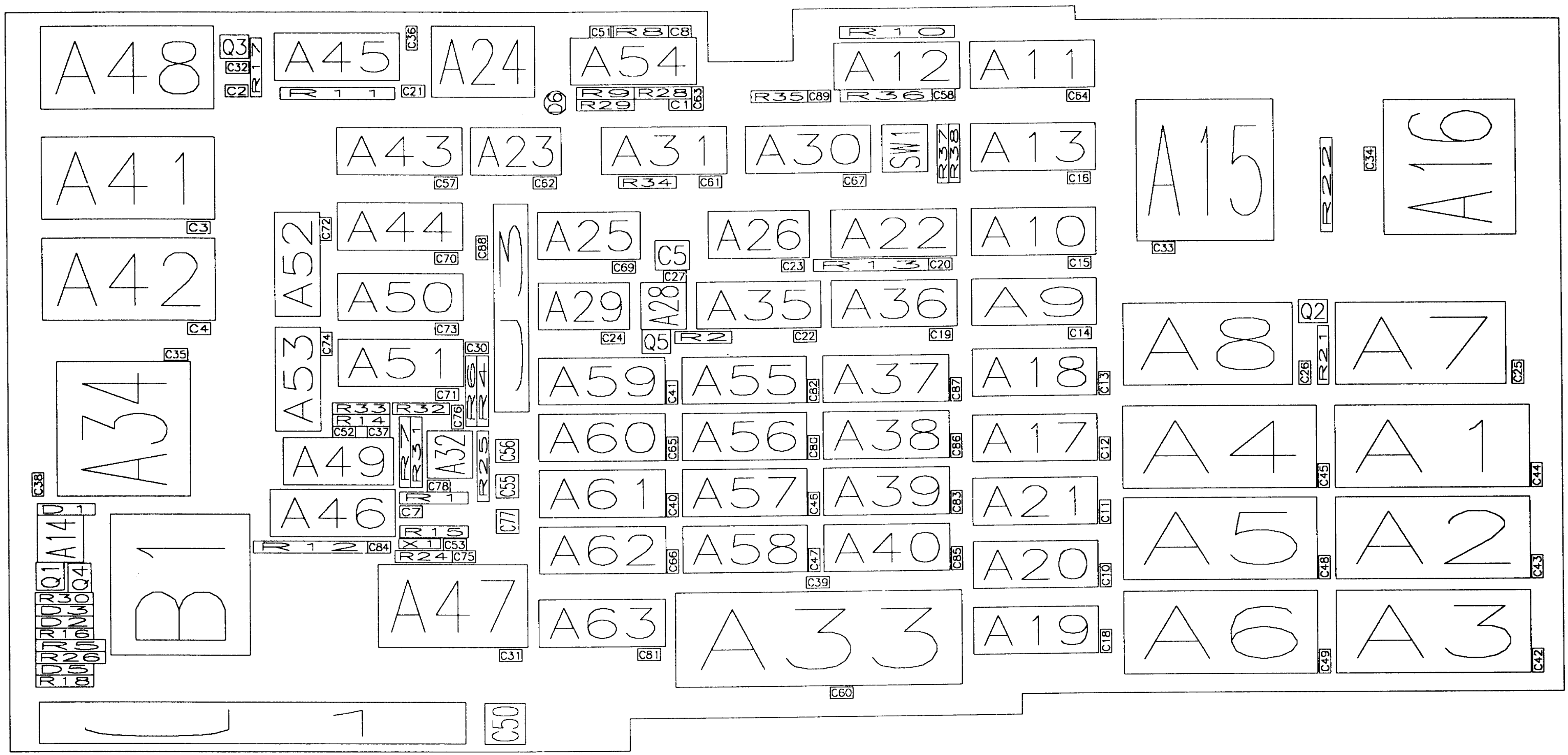
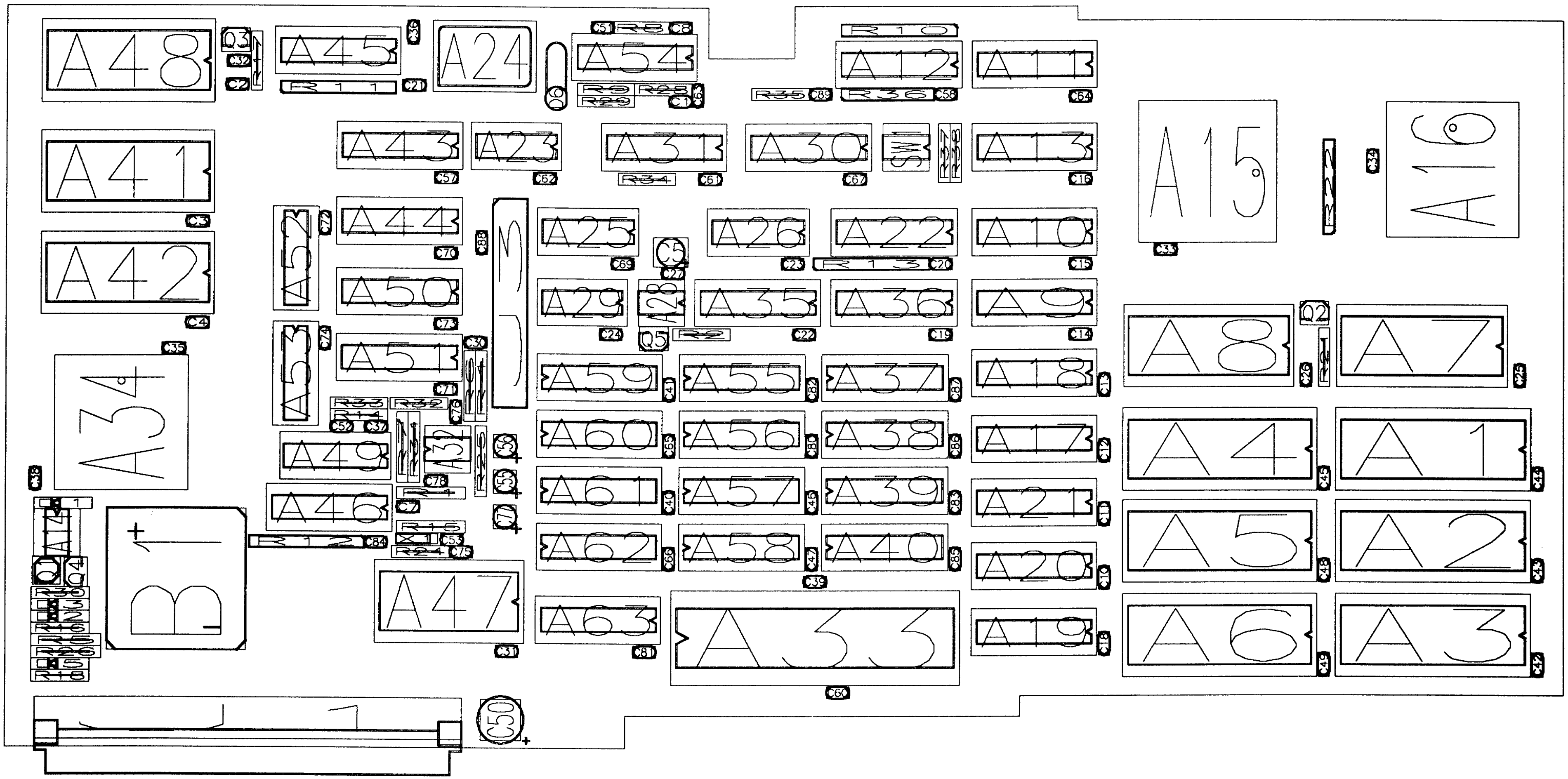
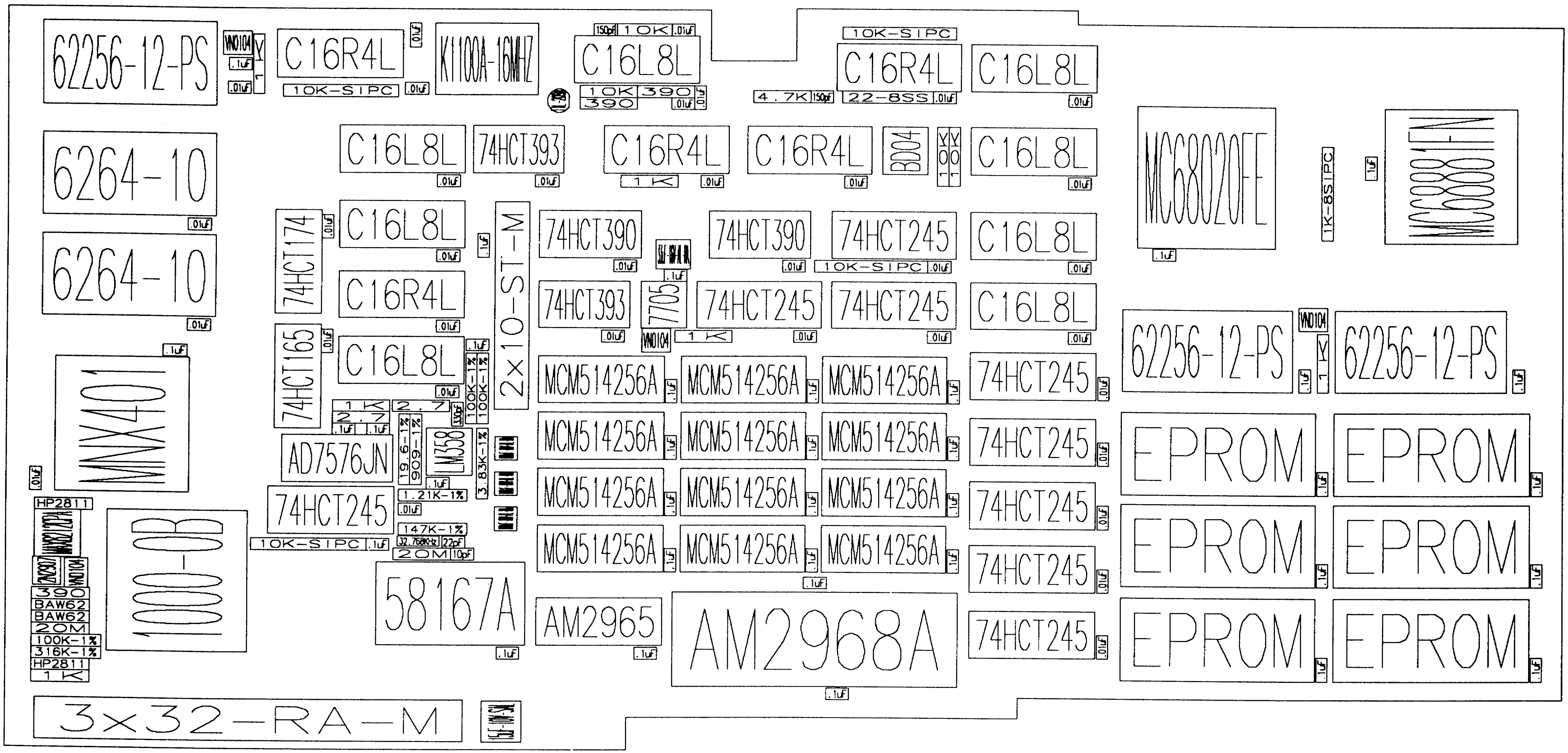
LeCroy CORPORATION
DRAWN KROLUBSKI-B
CHKD MAURON-B
DATE 11-OCT-91
MODEL : 94xx-6
PROCESSOR CARD 94xx
DWG NO: 94xx-6-S1
SH 6 OF 6
ECO : ----



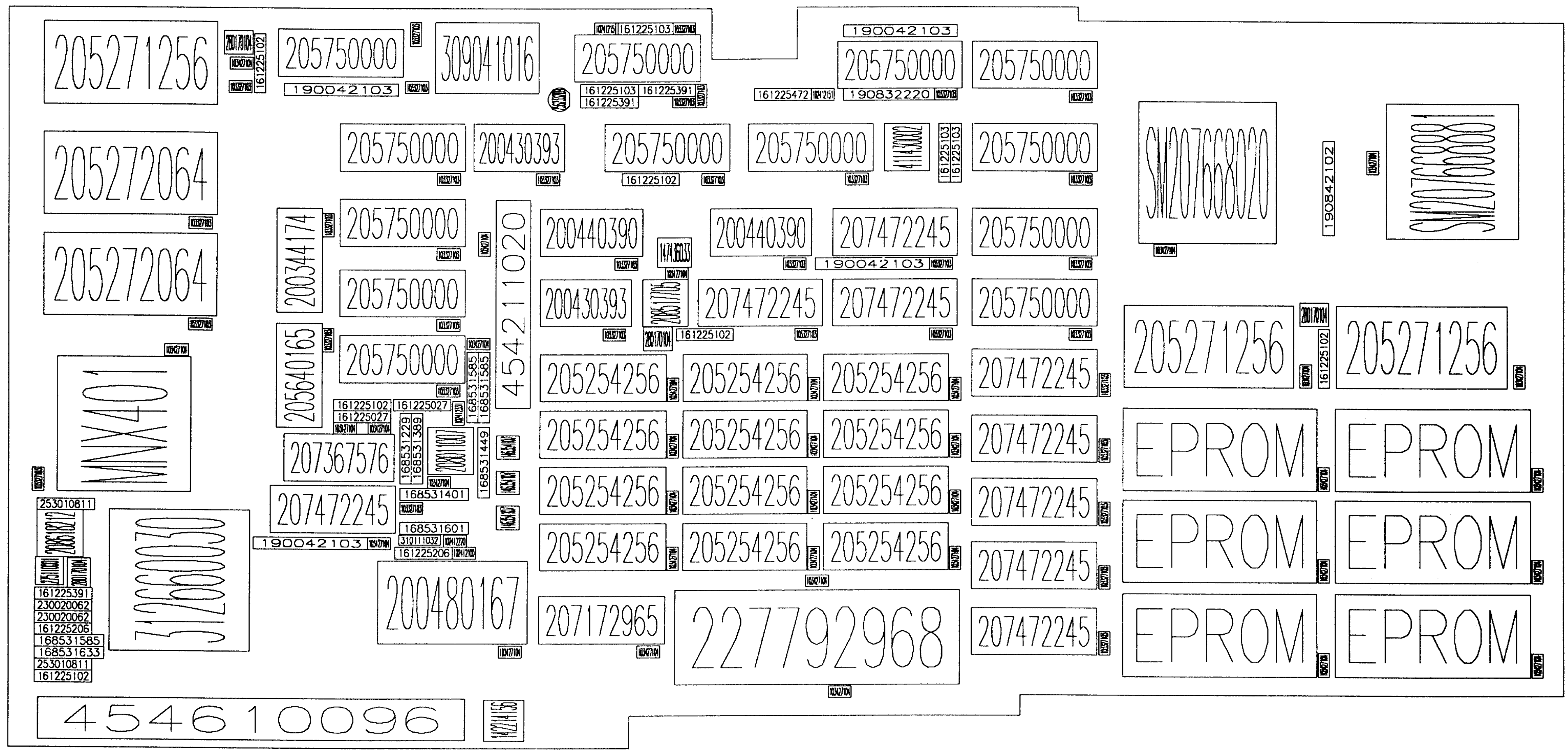
94XX_6 Rev:A



94XX_6 Rev:A


62256-12-PS
C16R4L
K1100A-16MHZ
C16L8L
10K-SIPC
C16R4L
C16L8L
6264-10
C16L8L
74HCT393
C16R4L
C16R4L
BD04
C16L8L
MC68020FE
6264-10
74HCT174
C16L8L
74HCT390
74HCT390
74HCT245
C16L8L
C16R4L
2x10-ST-M
74HCT393
7705
74HCT245
74HCT245
C16L8L
74HCT165
C16L8L
62256-12-PS
62256-12-PS
MNX401
MCM514256A
MCM514256A
MCM514256A
74HCT245
AD7576JN
LM358
MCM514256A
MCM514256A
MCM514256A
74HCT245
EPROM
EPROM
74HCT245
MCM514256A
MCM514256A
MCM514256A
74HCT245
1000-0B
EPROM
EPROM
MCM514256A
MCM514256A
MCM514256A
74HCT245
58167A
AM2965
AM2968A
74HCT245
EPROM
EPROM
3x32-RA-M

94XX_6 Rev:A


205271256
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205272064
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190042103
309041016
205750000
161225103
161225391
161225102
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205750000
190832220
161225472
205750000
205750000
200430393
205750000
161225102
205750000
161225103
161225103
205750000
SM207668020
190842102
200344174
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454211020
200440390
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190042103
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200430393
207472245
207472245
205750000
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205271256
161225102
205271256
205640165
205750000
168531585
168531585
MNX401
161225102
161225027
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168531449
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EPROM
EPROM
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205254256
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312660030
190042103
168531601
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205254256
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207472245
EPROM
EPROM
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230020062
161225206
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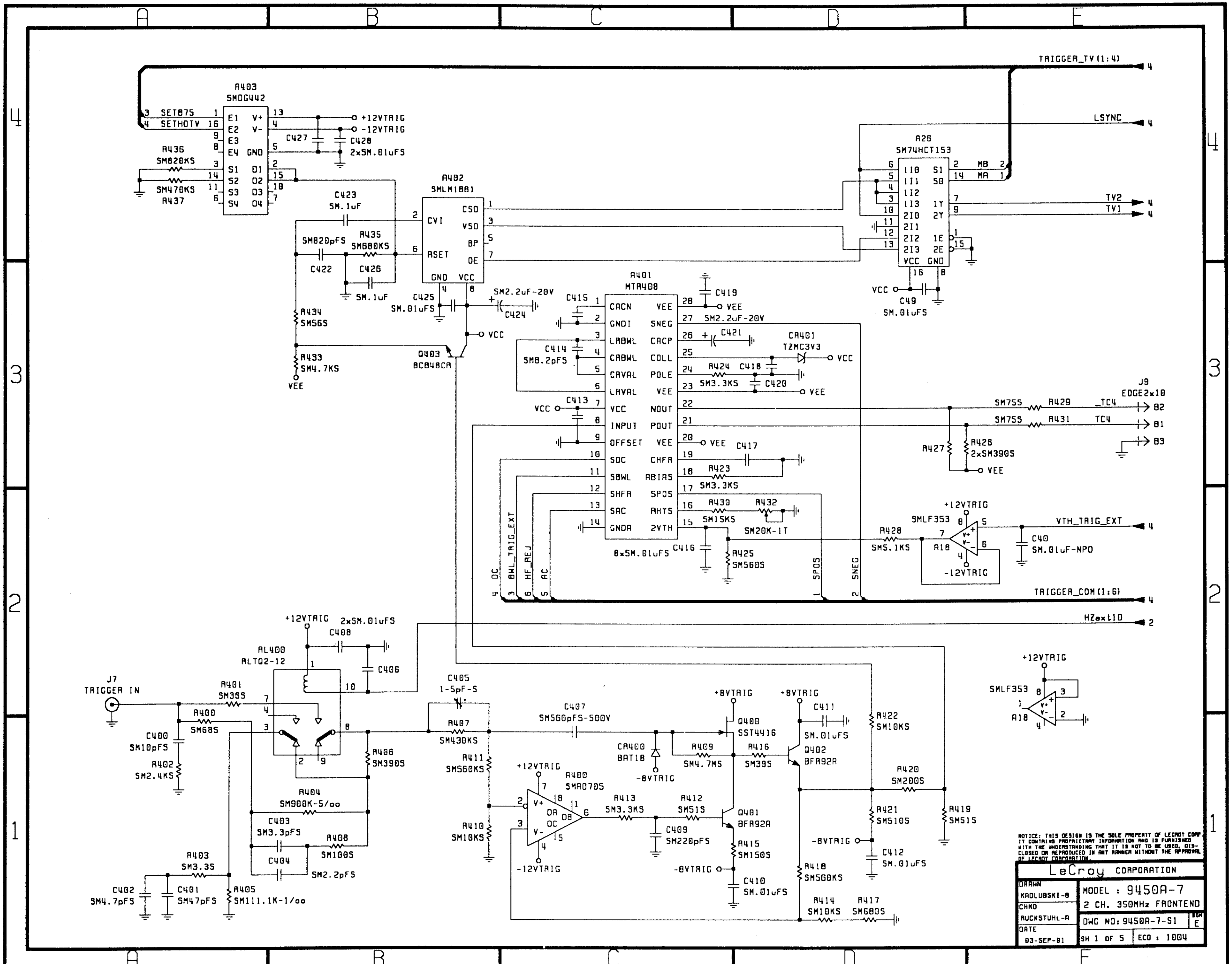
168531633
253010811
161225102
200480167
207172965
227792968
207472245
EPROM
EPROM
454610096

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
A56	205254256	MCM514256A	DIP20	15087600	6350000	1 90
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	.1uF	SMONOBP	33426400	7874000	1	90
C26	103427104	.1uF	SMONOBP	28702000	7874000	1	90
C27	103427104	.1uF	SMONOBP	14579600	10210800	1	0
C30	103427104	.1uF	SMONOBP	10210800	8686800	1	0
C31	103427104	.1uF	SMONOBP	11176000	2032000	1	180
C32	103427104	.1uF	SMONOBP	4953000	14732000	1	0
C33	103427104	.1uF	SMONOBP	25704800	10718800	1	180
C34	103427104	.1uF	SMONOBP	30175200	12750800	1	270
C35	103427104	.1uF	SMONOBP	3556000	8534400	1	0
C36	103327103	.01uF	SMONOBP	8940800	15240000	1	90
C37	103427104	.1uF	SMONOBP	8026400	6858000	1	0
C38	103327103	.01uF	SMONOBP	660400	5842000	1	270
C39	103427104	.1uF	SMONOBP	17983200	3556000	1	180
C40	103427104	.1uF	SMONOBP	14630400	5130800	1	90
C41	103427104	.1uF	SMONOBP	14630400	7569200	1	90
C42	103427104	.1uF	SMONOBP	33832800	1625600	1	90
C43	103427104	.1uF	SMONOBP	33832800	3657600	1	90
C44	103427104	.1uF	SMONOBP	33832800	5638800	1	90
C45	103427104	.1uF	SMONOBP	29108400	5638800	1	90
C46	103427104	.1uF	SMONOBP	17780000	5130800	1	90
C47	103427104	.1uF	SMONOBP	17780000	3911600	1	90
C48	103427104	.1uF	SMONOBP	29108400	3657600	1	90
C49	103427104	.1uF	SMONOBP	29108400	1625600	1	90
C50	142214156	15uF-10V-SAL	LTCAP	10922000	304800	1	90
C51	102412151	150pF	SMONO	13004800	15494000	1	0
C52	103427104	.1uF	SMONOBP	7264400	6858000	1	0
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
C60	103427104	.1uF	SMONOBP	18237200	1168400	1	0
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	.1uF	SMONOBP	14630400	6350000	1	90
C66	103427104	.1uF	SMONOBP	14630400	3911600	1	90
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	SIP10RES	20828000	15443200	1	270
R11	190042103	10K-SIPC	SIP10RES	6146800	14173200	1	90
R12	190042103	10K-SIPC	SIP10RES	7772400	4368800	1	270
R13	190042103	10K-SIPC	SIP10RES	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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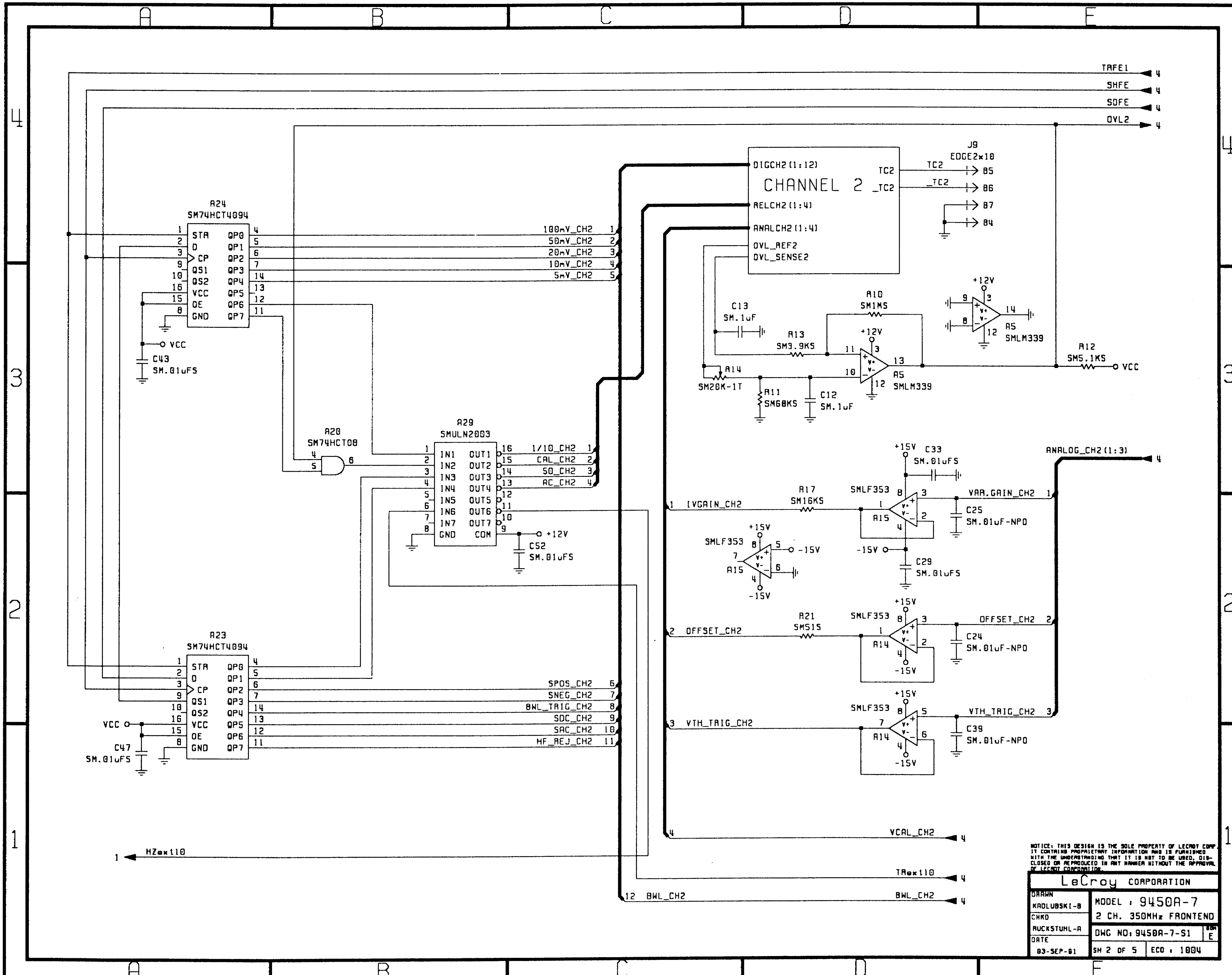
TRFE1
SHFE
SDFE
OVL2
J9
EDGE2x10
CHANNEL 2
DIGCH2(1:12)
RELCH2(1:4)
ANALCH2(1:4)
OVL_REF2
OVL_SENSE2
TC2
_TC2
A24
SM74HCT4094
STR
D
CP
QS1
QS2
VCC
OE
GND
QP0
QP1
QP2
QP3
QP4
QP5
QP6
QP7
100mV_CH2
50mV_CH2
20mV_CH2
10mV_CH2
5mV_CH2
C43
SM.01uFS
C13
SM.1uF
R13
SM3.9KS
R10
SM1MS
R14
SM20K-1T
R11
SM68KS
C12
SM.1uF
A5
SMLM339
R12
SM5.1KS
+12V
VCC
A28
SM74HCT08
A29
SMULN2003
IN1
IN2
IN3
IN4
IN5
IN6
IN7
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
COM
1/10_CH2
CAL_CH2
50_CH2
AC_CH2
C52
SM.01uFS
ANALOG_CH2(1:3)
+15V
-15V
C33
SM.01uFS
SMLF353
A15
R17
SM16KS
IVGAIN_CH2
VAR.GAIN_CH2
C25
SM.01uF-NPO
C29
SM.01uFS
R21
SM51S
A14
OFFSET_CH2
C24
SM.01uF-NPO
VTH_TRIG_CH2
C39
SM.01uF-NPO
A23
SM74HCT4094
SPOS_CH2
SNEG_CH2
BWL_TRIG_CH2
SDC_CH2
SAC_CH2
HF_REJ_CH2
C47
SM.01uFS
VCAL_CH2
HZext10
TRext10
BWL_CH2
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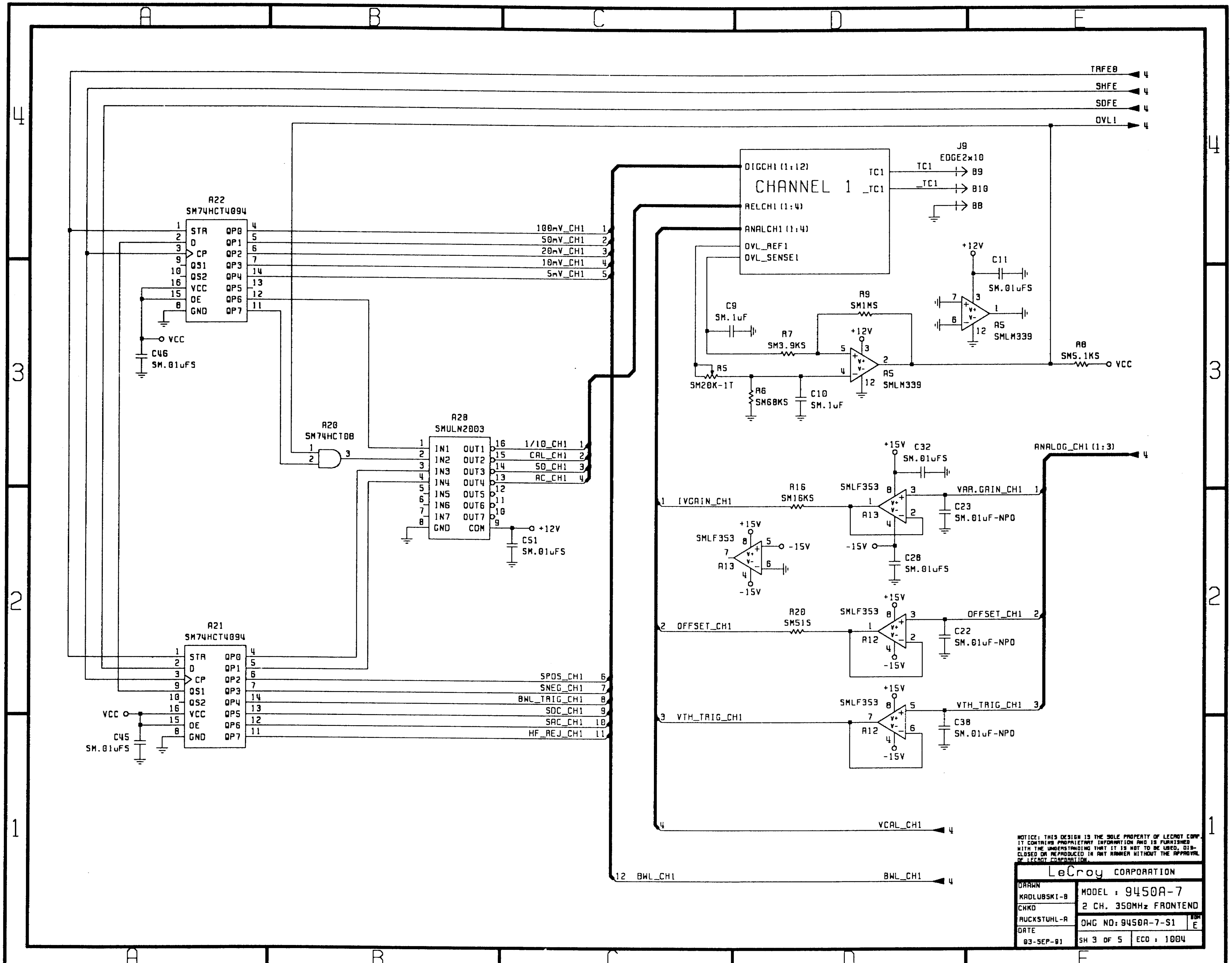
LeCroy CORPORATION
DRAWN
KADLUBSKI-B
CHKD
RUCKSTUHL-A
DATE
03-SEP-91
MODEL : 9450A-7
2 CH. 350MHz FRONTEND
DWG NO: 9450A-7-S1
E
SH 2 OF 5
ECO : 1804


TRFE0
SHFE
SDFE
OVL1
J9
EDGE2x10
CHANNEL 1
DIGCH1(1:12)
RELCH1(1:4)
ANALCH1(1:4)
OVL_REF1
OVL_SENSE1
TC1
_TC1
B9
B10
B8
A22
SM74HCT4094
STR
D
CP
QS1
QS2
VCC
OE
GND
QP0
QP1
QP2
QP3
QP4
QP5
QP6
QP7
100mV_CH1
50mV_CH1
20mV_CH1
10mV_CH1
5mV_CH1
C46
SM.01uFS
C9
SM.1uF
R7
SM3.9KS
R9
SM1MS
+12V
C11
SM.01uFS
A5
SMLM339
R8
SM5.1KS
VCC
R5
SM20K-1T
R6
SM68KS
C10
SM.1uF
A20
SM74HCT08
A28
SMULN2003
IN1
IN2
IN3
IN4
IN5
IN6
IN7
OUT1
OUT2
OUT3
OUT4
OUT5
OUT6
OUT7
COM
1/10_CH1
CAL_CH1
50_CH1
AC_CH1
C51
SM.01uFS
ANALOG_CH1(1:3)
+15V
C32
SM.01uFS
R16
SM16KS
SMLF353
IVGAIN_CH1
VAR.GAIN_CH1
A13
C23
SM.01uF-NPO
-15V
C28
SM.01uFS
R20
SM51S
OFFSET_CH1
A12
C22
SM.01uF-NPO
VTH_TRIG_CH1
C38
SM.01uF-NPO
A21
SM74HCT4094
SPOS_CH1
SNEG_CH1
BWL_TRIG_CH1
SDC_CH1
SAC_CH1
HF_REJ_CH1
C45
SM.01uFS
VCAL_CH1
BWL_CH1
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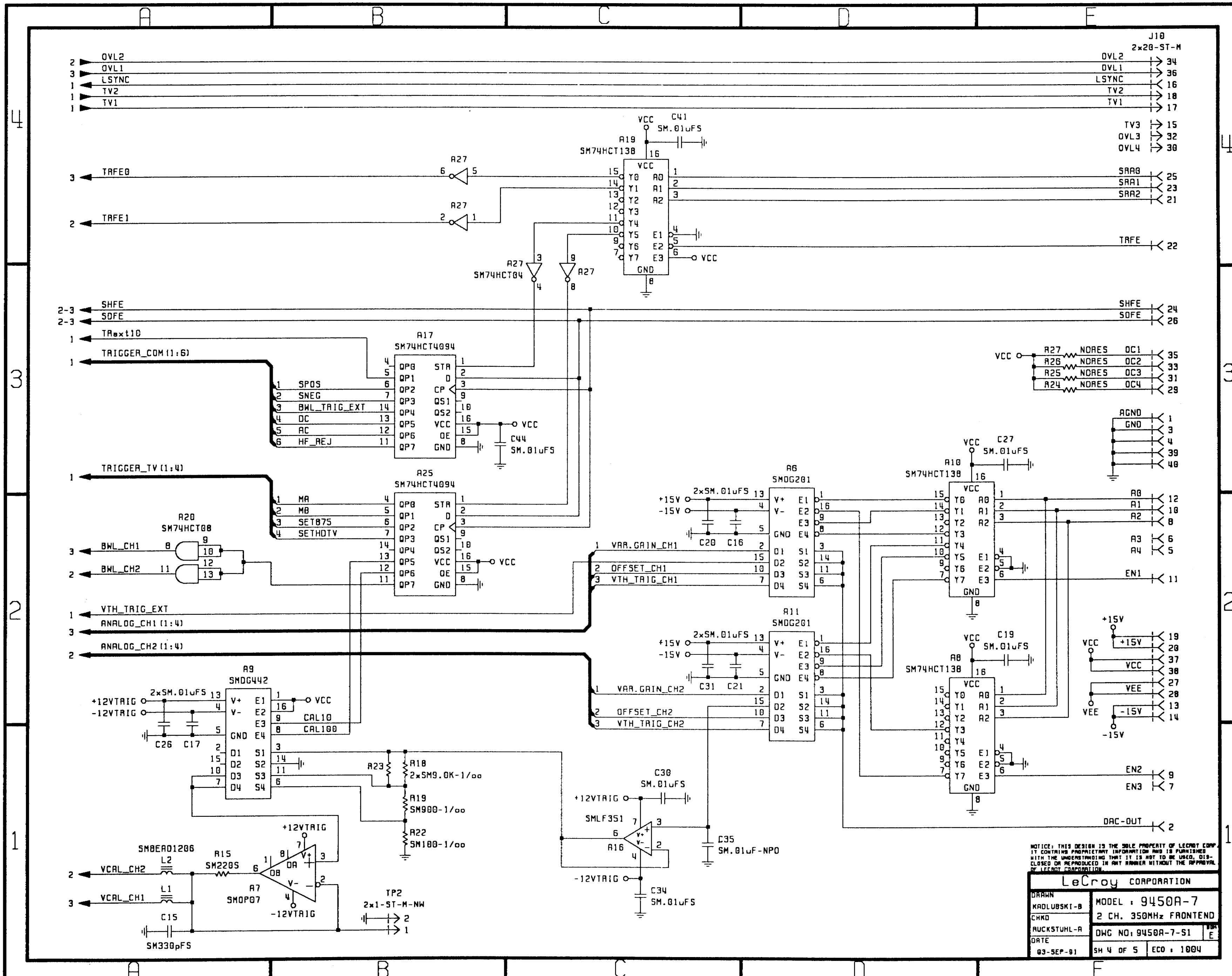
LeCroy CORPORATION
DRAWN
KADLUBSKI-B
CHKD
RUCKSTUHL-R
DATE
03-SEP-91
MODEL : 9450A-7
2 CH. 350MHz FRONTEND
DWG NO: 9450A-7-S1
E
SH 3 OF 5
ECO : 1004



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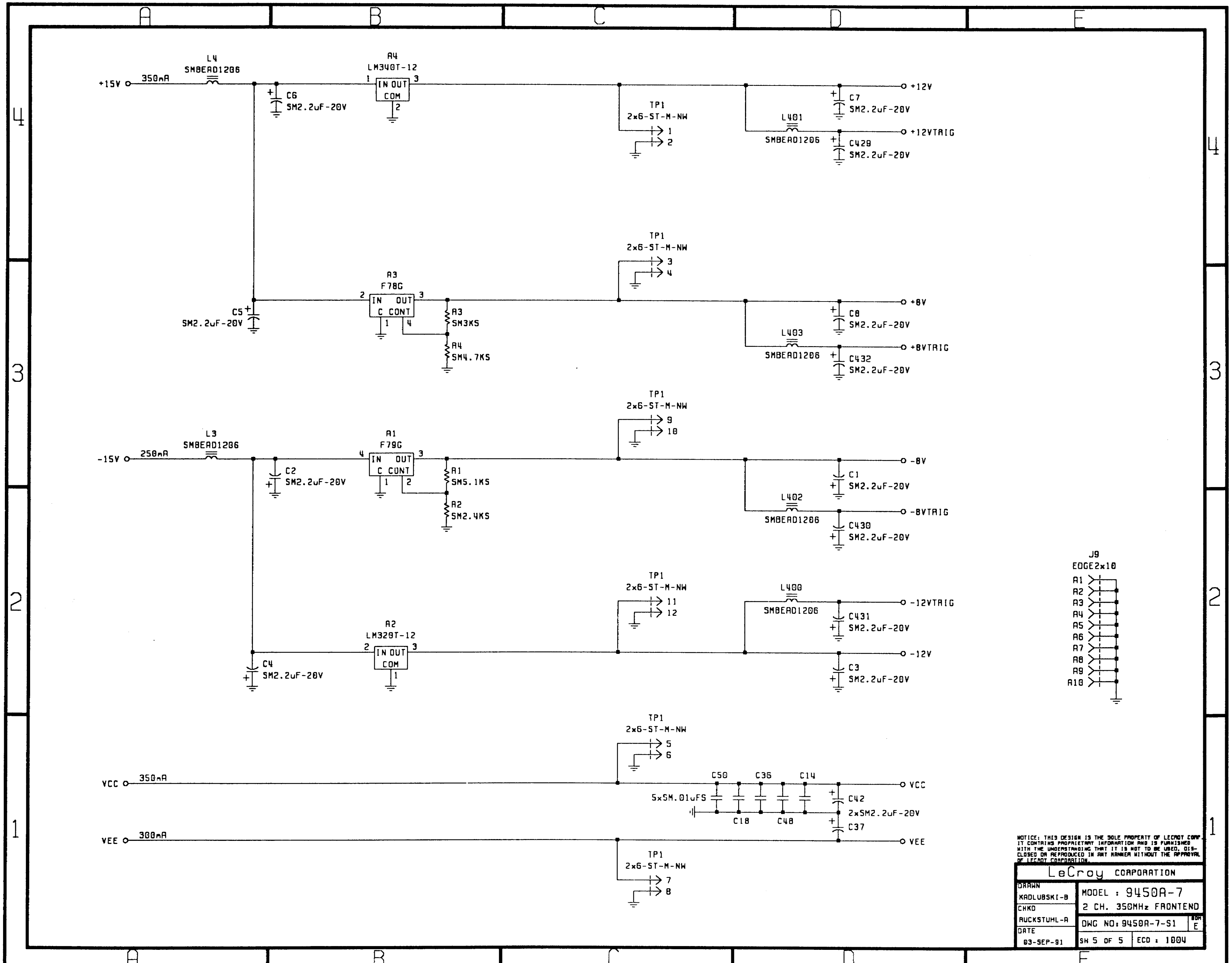

+15V
350mA
L4
SMBEAD1206
A4
LM340T-12
IN OUT
COM
C6
SM2.2uF-20V
TP1
2x6-ST-M-NW
+12V
C7
SM2.2uF-20V
L401
SMBEAD1206
+12VTRIG
C429
SM2.2uF-20V
A3
F78G
IN OUT
C CONT
C5
SM2.2uF-20V
R3
SM3KS
R4
SM4.7KS
+8V
C8
SM2.2uF-20V
L403
SMBEAD1206
+8VTRIG
C432
SM2.2uF-20V
-15V
250mA
L3
SMBEAD1206
A1
F79G
C2
SM2.2uF-20V
R1
SM5.1KS
R2
SM2.4KS
-8V
C1
SM2.2uF-20V
L402
SMBEAD1206
-8VTRIG
C430
SM2.2uF-20V
J9
EDGE2x10
A1 A2 A3 A4 A5 A6 A7 A8 A9 A10
L400
SMBEAD1206
-12VTRIG
C431
SM2.2uF-20V
A2
LM320T-12
C4
SM2.2uF-20V
-12V
C3
SM2.2uF-20V
VCC
350mA
C50 C36 C14
5xSM.01uFS
C42
2xSM2.2uF-20V
C18 C48
C37
VEE
300mA
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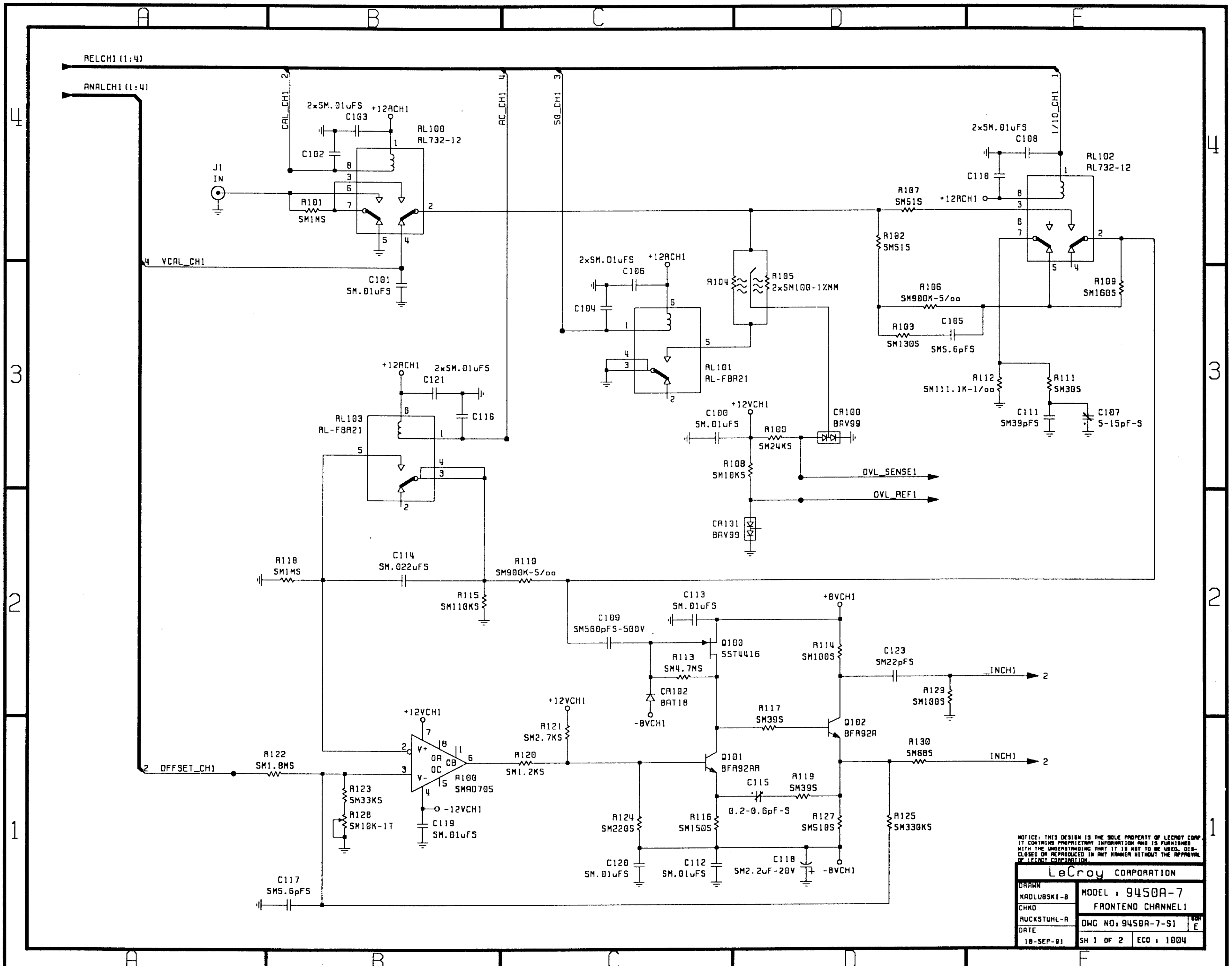
LeCroy CORPORATION
DRAWN
KADLUBSKI-B
CHKD
RUCKSTUHL-A
DATE
03-SEP-91
MODEL : 9450A-7
2 CH. 350MHz FRONTEND
DWG NO: 9450A-7-S1
E
SH 5 OF 5
ECO : 1004



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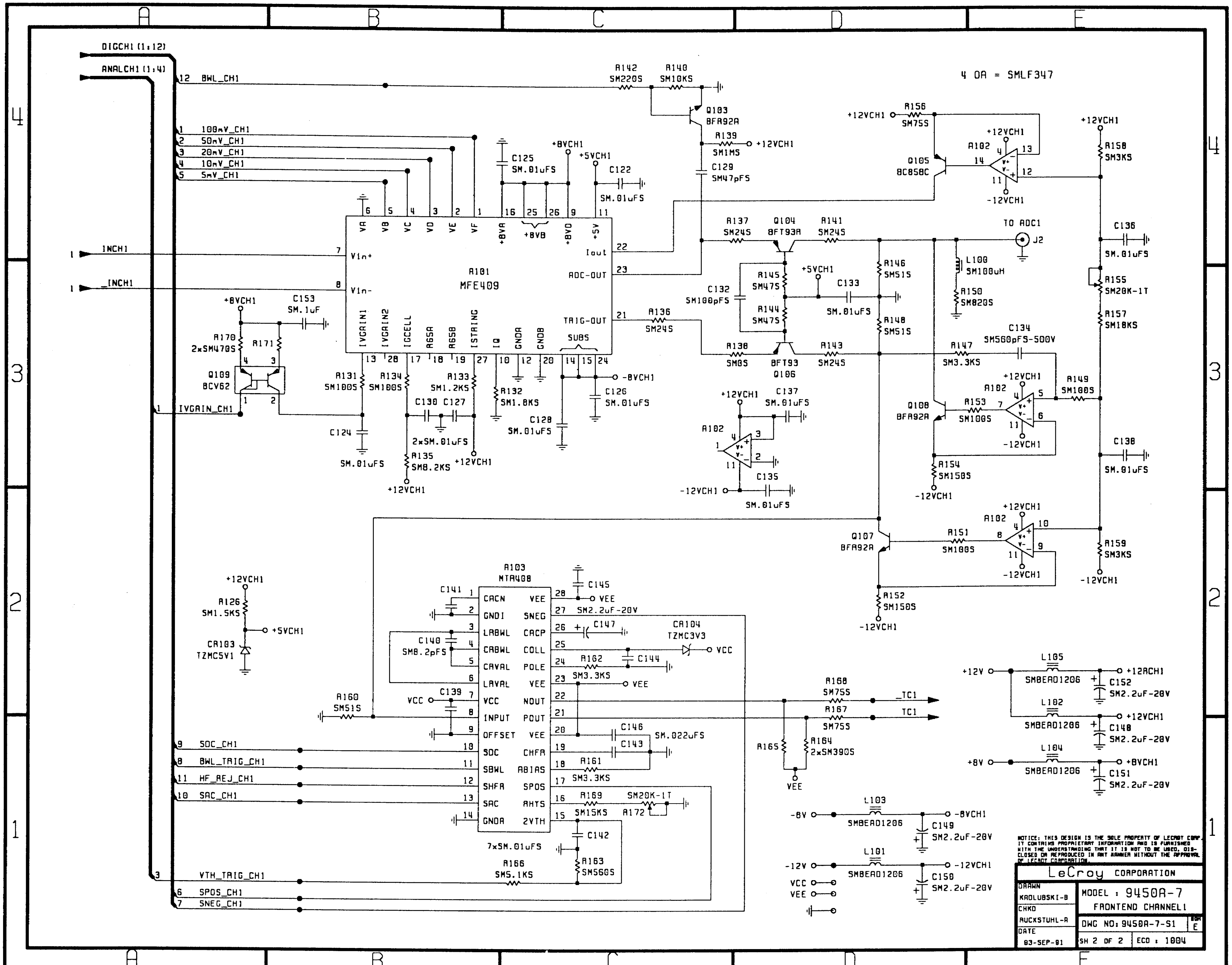
4 OA = SMLF347
R101
MFE409
R103
MTA408
TO ADC1
J2
DIGCH1 (1:12)
ANALCH1 (1:4)
INCH1
_INCH1
BWL_CH1
100mV_CH1
50mV_CH1
20mV_CH1
10mV_CH1
5mV_CH1
IVGAIN_CH1
SOC_CH1
BWL_TRIG_CH1
HF_REJ_CH1
SAC_CH1
VTH_TRIG_CH1
SPOS_CH1
SNEG_CH1
_TC1
TC1
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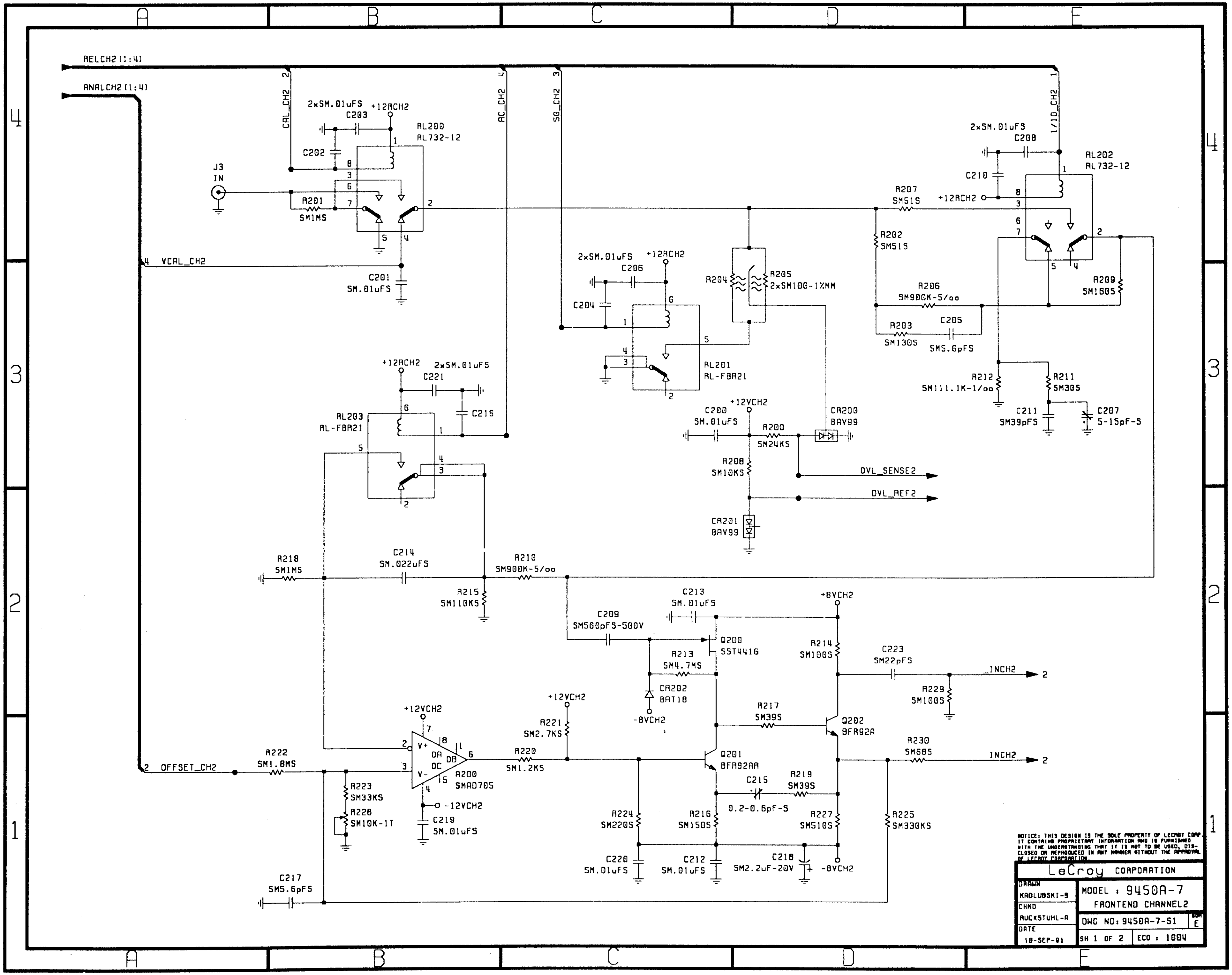
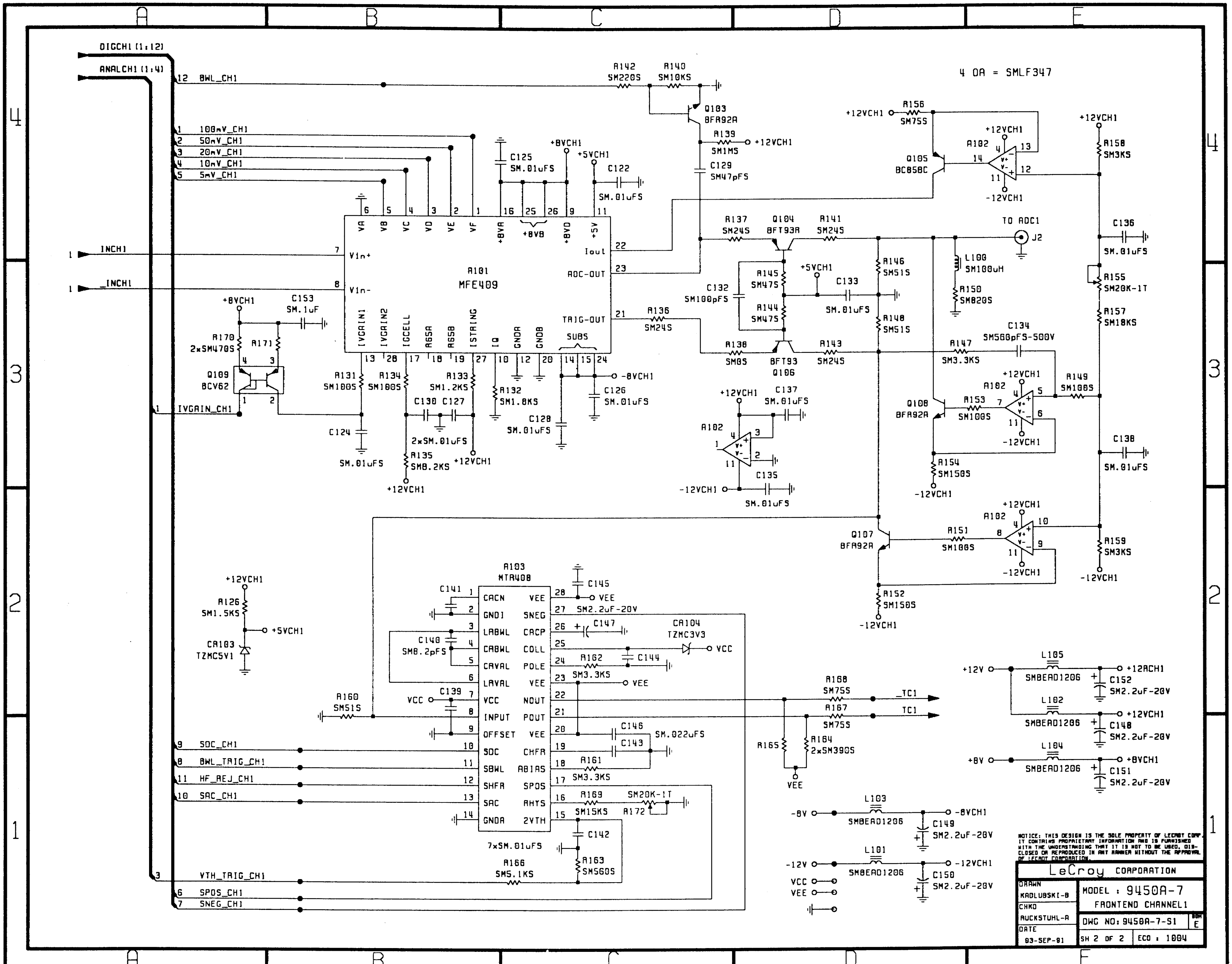
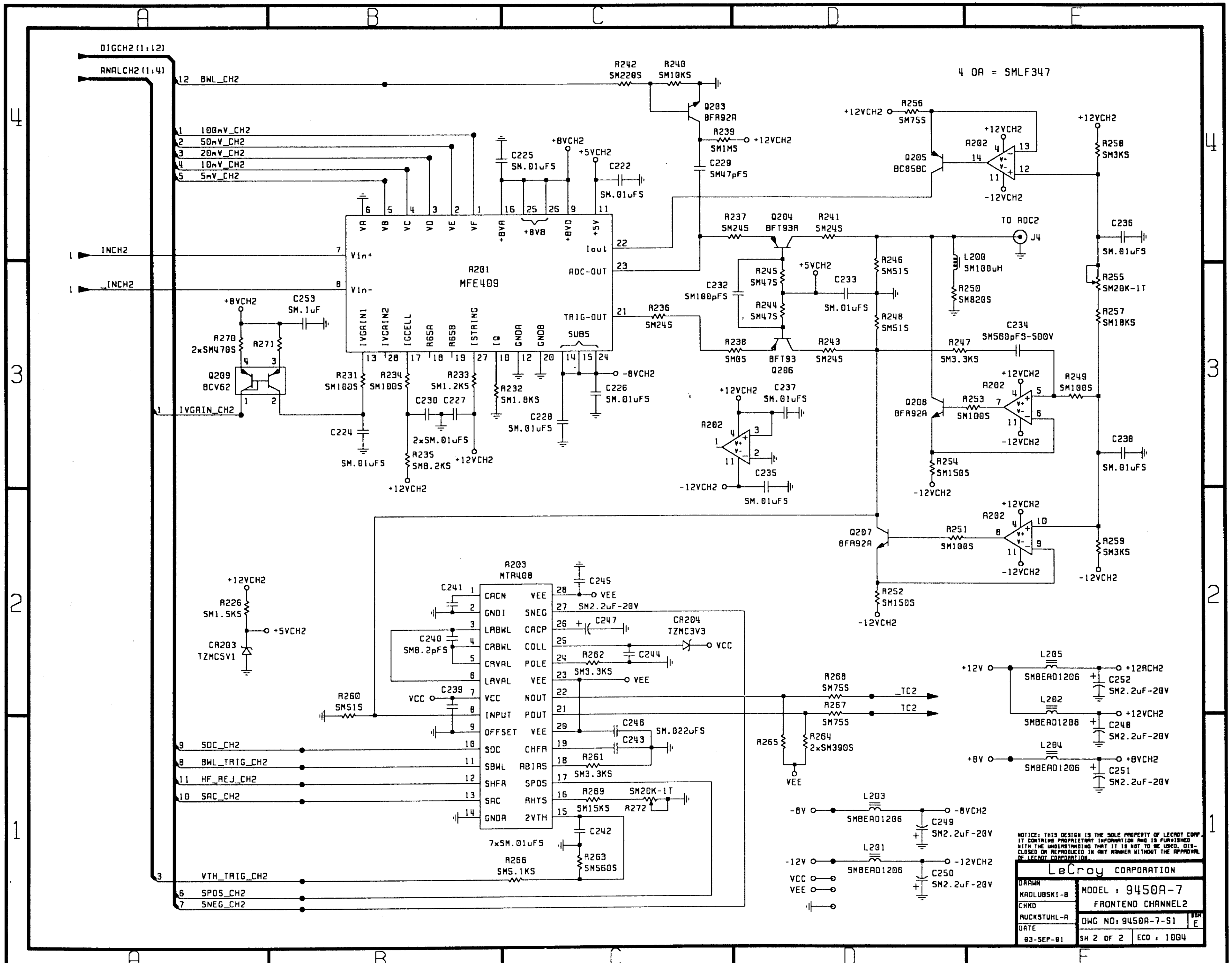
LeCroy CORPORATION
DRAWN
KAOLUBSKI-B
CHKD
RUCKSTUHL-A
DATE
03-SEP-91
MODEL : 9450A-7
FRONTEND CHANNEL1
DWG NO: 9450A-7-S1
E
SH 2 OF 2
ECO : 1004



Scan by Paladinmicro -- paladin@paladinmicro.com



Scan by Paladinmicro -- paladin@paladinmicro.com



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Scan by Paladinmicro -- paladin@paladinmicro.com


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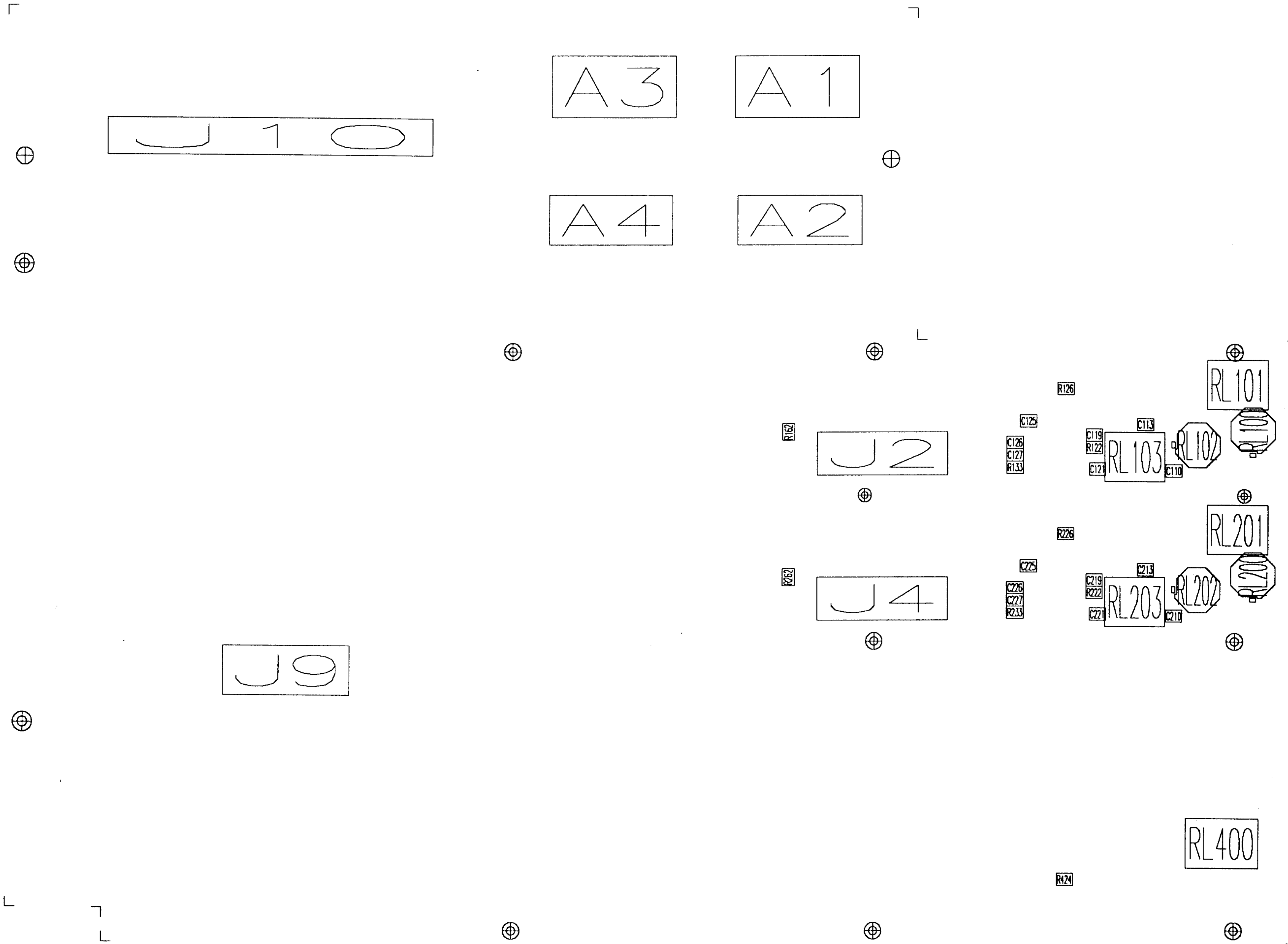
9450A_7 Rev:G

9450A_7 Rev:G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C121
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RL102
C110
RL201
R226
C225
C213
R262
J4
C226
C227
R233
C219
R222
C221
RL203
RL202
C210
J9
RL400
R424

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2x6-ST-M-N/W
MTR408
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BNC-9450
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BNC-9450
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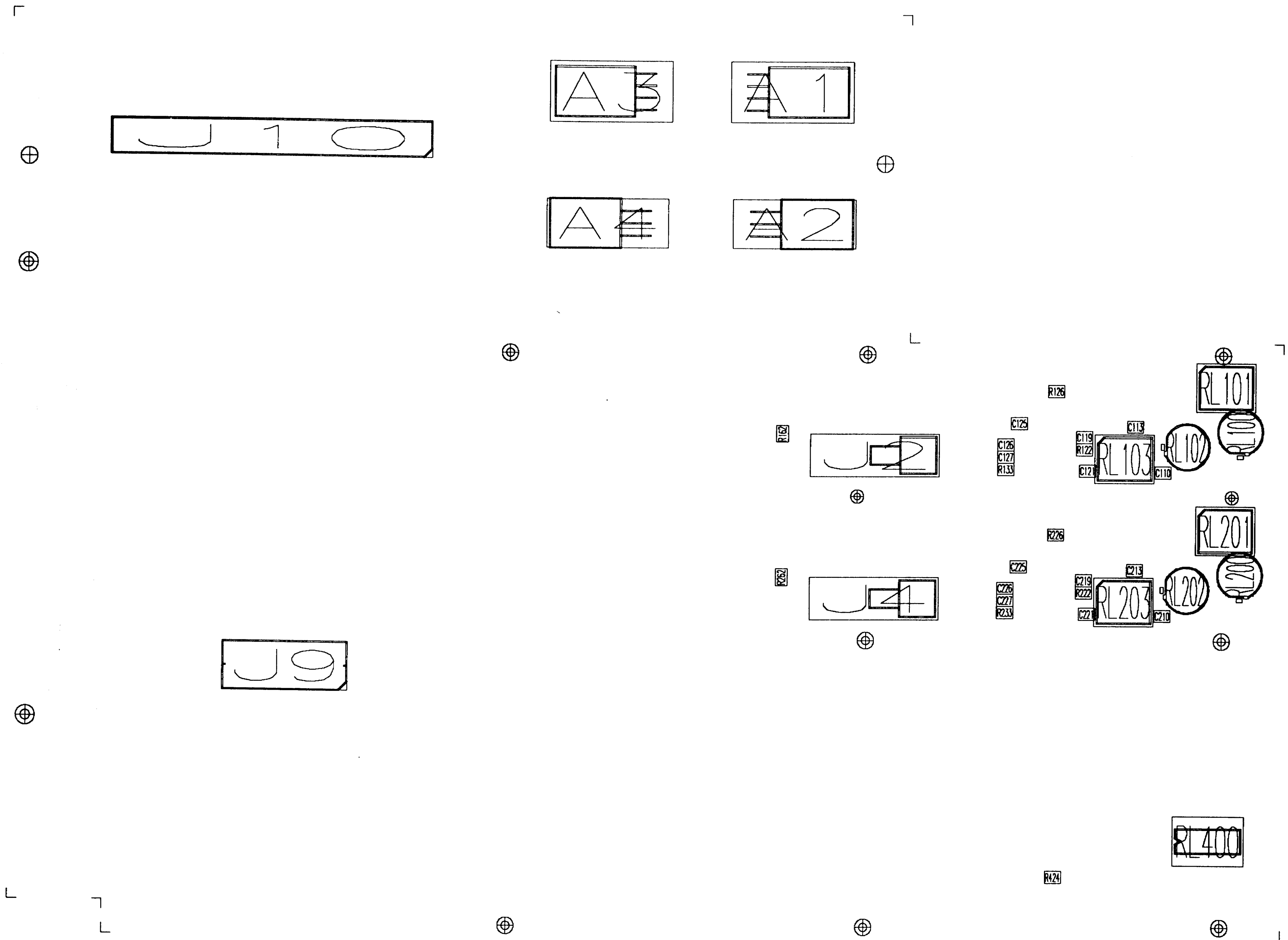
1-5pF-S

9450A_7 Rev:G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101
R262
J4
R226
C225
C226
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RL400
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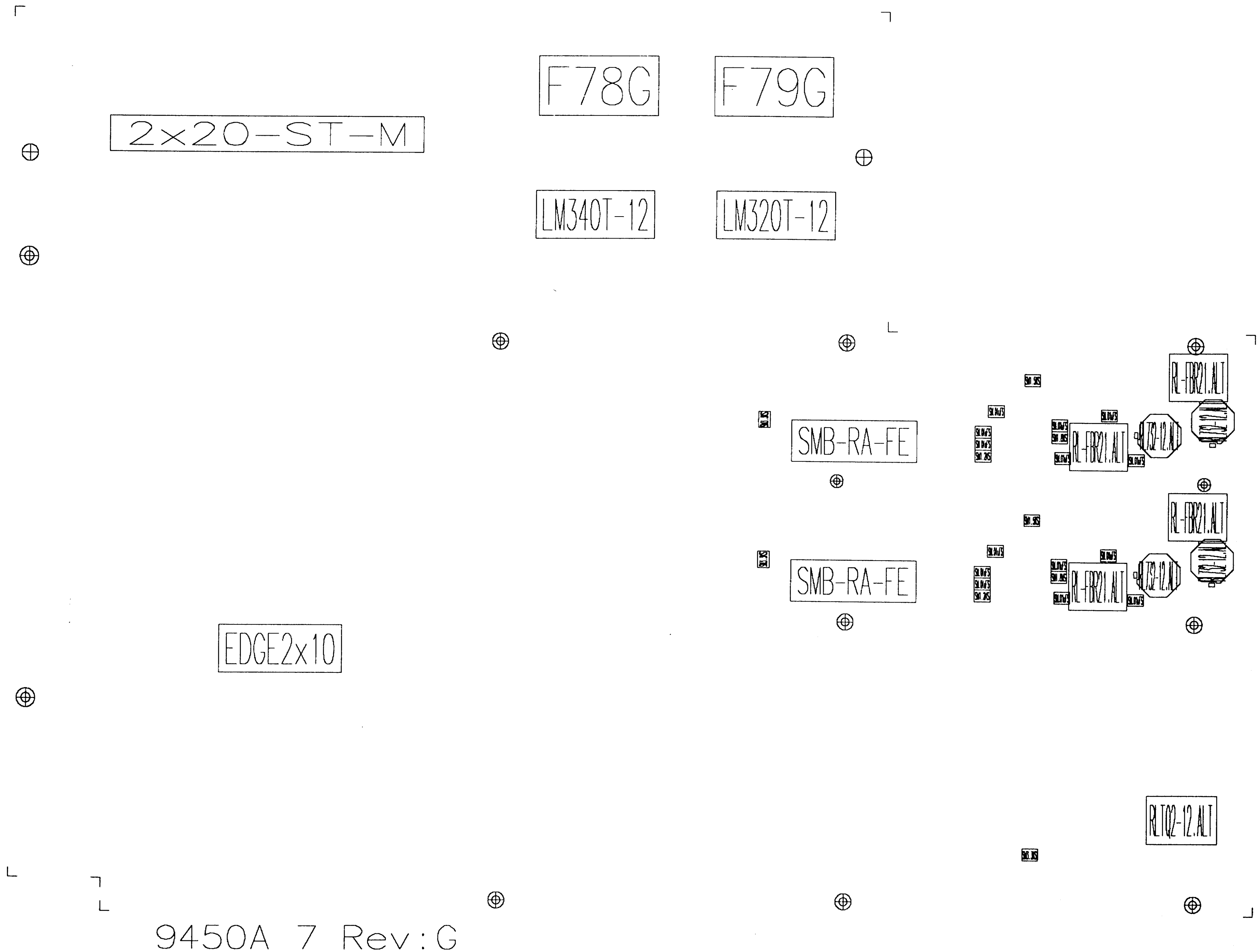
9450A_7 Rev:G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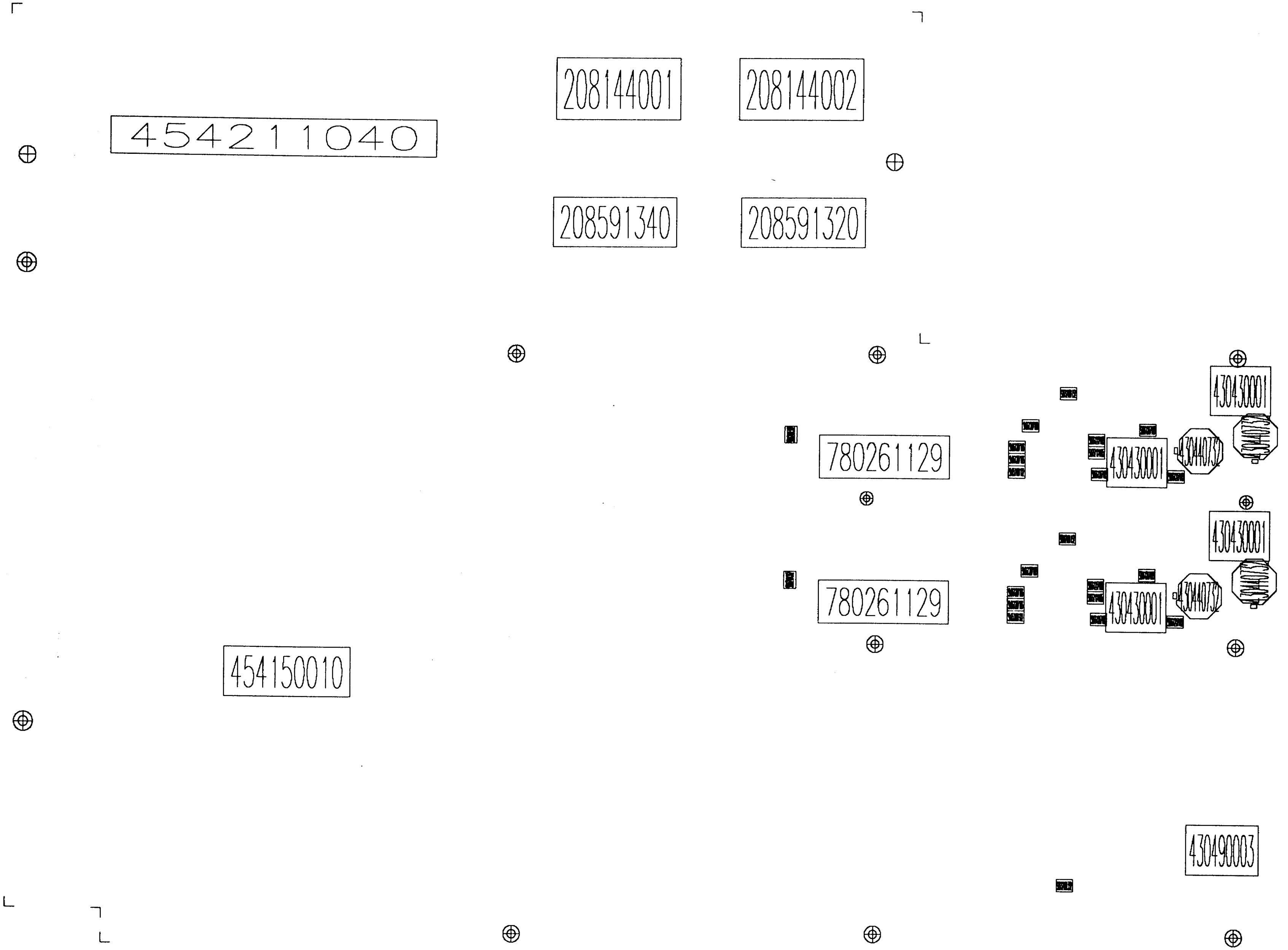
9450A_7 Rev:G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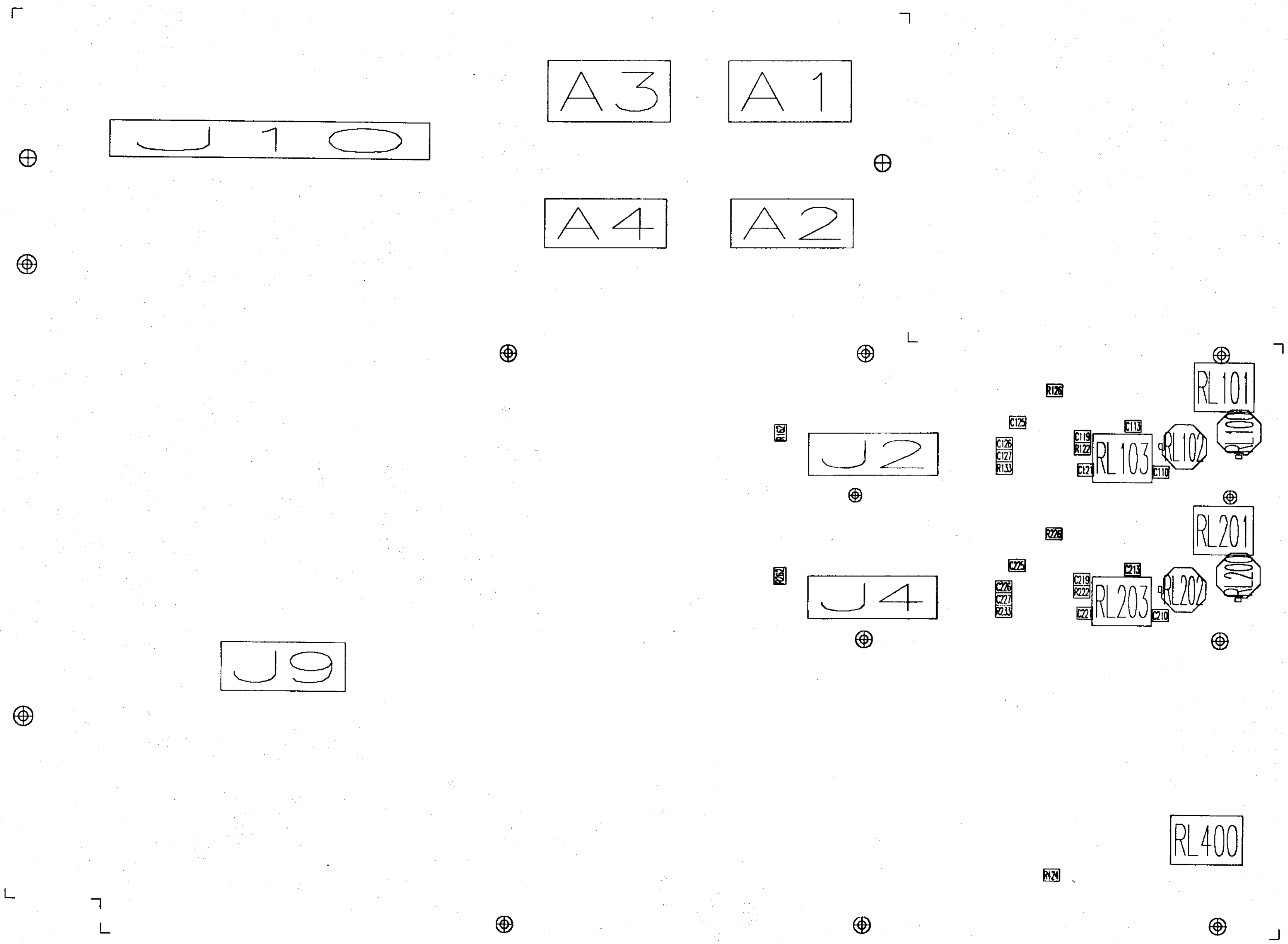
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RL203
RL202
J9
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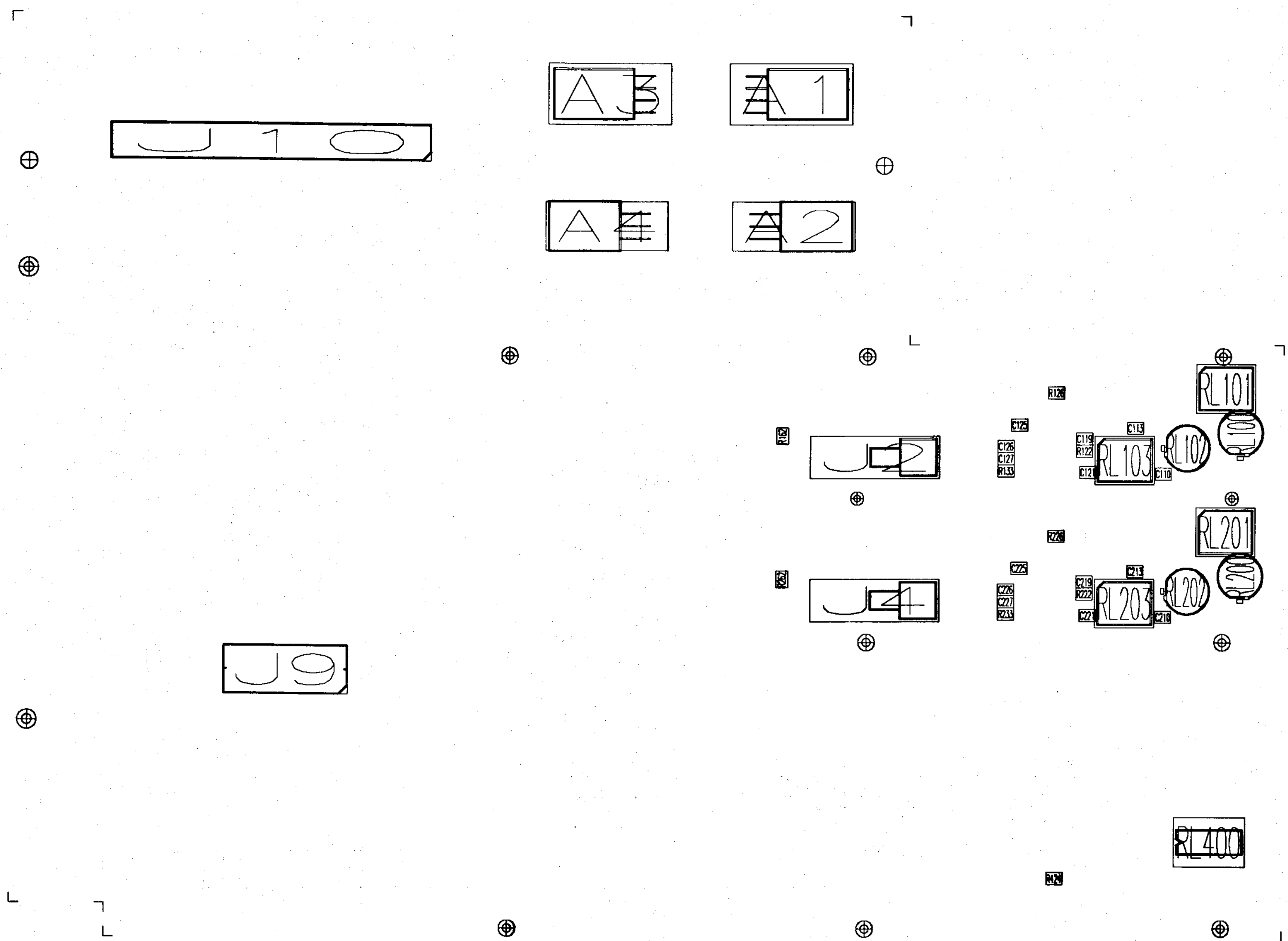
9450A_7 Rev:G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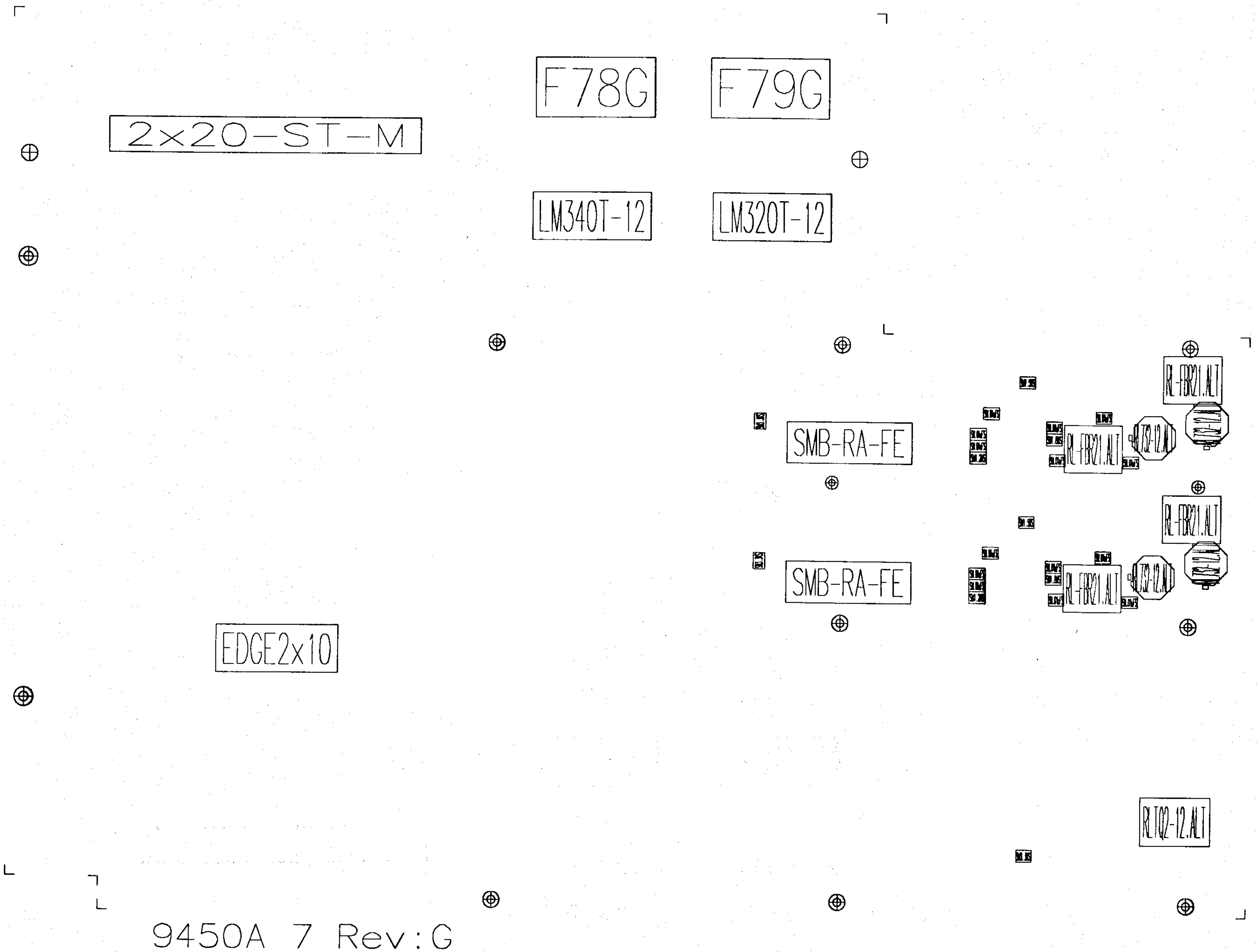
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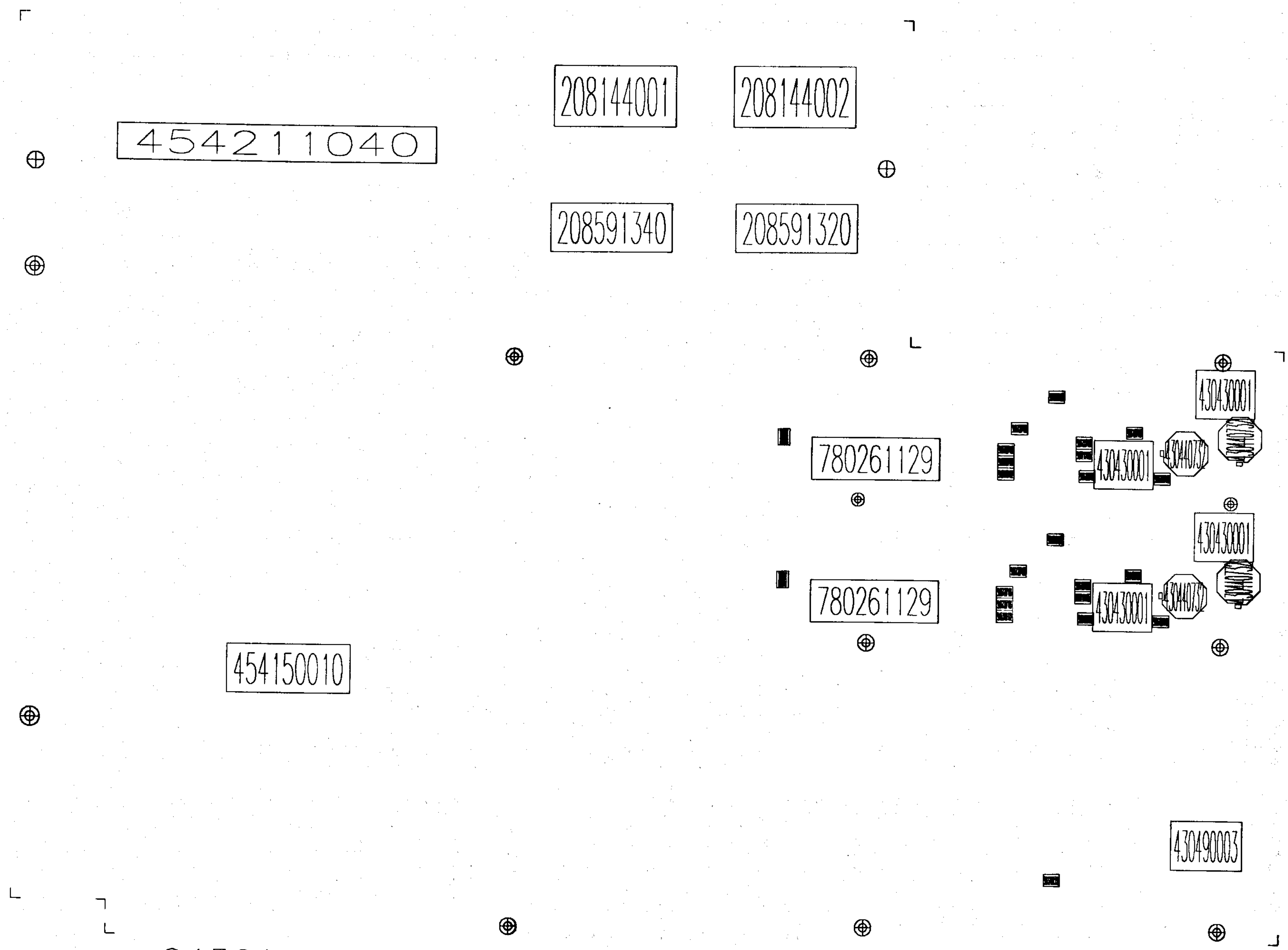
RLTQ2-12.ALT
9450A_7 Rev:G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9450A_7 Rev:G

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C227	SM661207103	SM.01uFS	SM0805	-5810250	-3683000	2	180
C228	SM661207103	SM.01uFS	SM0805	-6000750	-2063750	1	0
C229	SM661255470	SM47pFS	SM0805	-6032500	-3492500	1	270
C230	SM661207103	SM.01uFS	SM0805	-6159500	-2063750	1	180
C232	SM661255101	SM100pFS	SM0805	-6794500	-3048000	1	270
C233	SM661207103	SM.01uFS	SM0805	-7302500	-3175000	1	90
C234	SM661495561	SM560pFS-500V	SM0805	-7651750	-2317750	1	0
C235	SM661207103	SM.01uFS	SM0805	-8128000	-2444750	1	90
C236	SM661207103	SM.01uFS	SM0805	-8667750	-3968750	1	90
C237	SM661207103	SM.01uFS	SM0805	-9175750	-2571750	1	90
C238	SM661207103	SM.01uFS	SM0805	-9429750	-2000250	1	270
C239	SM661207103	SM.01uFS	SM0805	-9620250	-3111500	1	270
C240	SM661250082	SM8.2pFS	SM0805	-9620250	-3683000	1	90
C241	SM661207103	SM.01uFS	SM0805	-9620250	-4032250	1	90
C242	SM661207103	SM.01uFS	SM0805	-10763250	-2032000	1	0
C243	SM661207103	SM.01uFS	SM0805	-11017250	-2476500	1	270
C244	SM661207103	SM.01uFS	SM0805	-11017250	-3587750	1	270
C245	SM661207103	SM.01uFS	SM0805	-11144250	-4000500	1	0
C246	SM661207223	SM.022uFS	SM0805	-11430000	-2730500	1	0
C247	SM666327225	SM2.2uF-20V	SMCAPETD2	-11525250	-3873500	1	0
C248	SM666327225	SM2.2uF-20V	SMCAPETD2	-15398750	-2190750	1	270
C249	SM666327225	SM2.2uF-20V	SMCAPETD2	-15398750	-2794000	1	270
C250	SM666327225	SM2.2uF-20V	SMCAPETD2	-15748000	-2190750	1	270
C251	SM666327225	SM2.2uF-20V	SMCAPETD2	-15748000	-2794000	1	270
C252	SM666327225	SM2.2uF-20V	SMCAPETD2	-15748000	-3556000	1	270

C253	SM661127104	SM.1uF	SM1206	-11747500	-2857500	1	45
C400	SM661255100	SM10pFS	SM0805	-444500	-9556750	1	180
C401	SM661255470	SM47pFS	SM0805	-666750	-8159750	1	0
C402	SM661250047	SM4.7pFS	SM0805	-666750	-8413750	1	0
C403	SM661255033	SM3.3pFS	SM0805	-635000	-8826500	1	90
C404	SM661255022	SM2.2pFS	SM0805	-889000	-8826500	1	90
C405	158849010	1-5pF-S	CAPS_S	-1397000	-9334500	1	0
C406	SM661207103	SM.01uFS	SM0805	-1841500	-8826500	1	180
C407	SM661495561	SM560pFS-500V	SM0805	-1905000	-9207500	1	270
C408	SM661207103	SM.01uFS	SM0805	-2032000	-8509000	1	0
C409	SM661255221	SM220pFS	SM0805	-2540000	-9207500	1	270
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
C413	SM661207103	SM.01uFS	SM0805	-4000500	-9144000	1	270
C414	SM661250082	SM8.2pFS	SM0805	-4000500	-9715500	1	90
C415	SM661207103	SM.01uFS	SM0805	-4000500	-9874250	1	270
C416	SM661207103	SM.01uFS	SM0805	-5143500	-8032750	1	0
C417	SM661207103	SM.01uFS	SM0805	-5365750	-8509000	1	270
C418	SM661207103	SM.01uFS	SM0805	-5365750	-9588500	1	270
C419	SM661207103	SM.01uFS	SM0805	-5524500	-10001250	1	0
C420	SM661207103	SM.01uFS	SM0805	-5619750	-8636000	1	270
C421	SM666327225	SM2.2uF-20V	SMCAPETD2	-6064250	-9810750	1	90
C422	SM661255821	SM820pFS	SM0805	-7016750	-8826500	1	90
C423	SM661127104	SM.1uF	SM1206	-7302500	-8572500	1	270
C424	SM666327225	SM2.2uF-20V	SMCAPETD2	-7207250	-9969500	1	180
C425	SM661207103	SM.01uFS	SM0805	-7651750	-10001250	1	90
C426	SM661127104	SM.1uF	SM1206	-8191500	-10064750	1	90
C427	SM661207103	SM.01uFS	SM0805	-8794750	-10033000	1	90
C428	SM661207103	SM.01uFS	SM0805	-8890000	-8794750	1	0
C429	SM666327225	SM2.2uF-20V	SMCAPETD2	-15398750	-8826500	1	270
C430	SM666327225	SM2.2uF-20V	SMCAPETD2	-15398750	-9429750	1	270
C431	SM666327225	SM2.2uF-20V	SMCAPETD2	-15748000	-8826500	1	270
C432	SM666327225	SM2.2uF-20V	SMCAPETD2	-15748000	-9429750	1	270
J1	402110302	BNC-9450	BNC_9450	-63500	0	1	0
J2	780261129	SMB-RA-FE	SMB_RT_F	-7588250	-666750	2	0
J3	402110302	BNC-9450	BNC_9450	-63500	-2984500	1	0
J4	780261129	SMB-RA-FE	SMB_RT_F	-7588250	-3651250	2	0
J7	402110302	BNC-9450	BNC_9450	-63500	-8985250	1	0
J9	454150010	EDGE2x10	EDGE2X10	-19875500	-5397500	2	0
J10	454211040	2x20-ST-M	CONN2X20_ST_M	-18986500	5683250	2	0
L1	SM301502001	SMBEAD1206	SM1206	-19240500	-6413500	1	0
L2	SM301502001	SMBEAD1206	SM1206	-19240500	-6699250	1	0
L3	SM301502001	SMBEAD1206	SM1206	-20510500	6159500	1	180
L4	SM301502001	SMBEAD1206	SM1206	-21272500	6159500	1	0
L100	SM300486104	SM100uH	SM1210	-7588250	-412750	1	90
L101	SM301502001	SMBEAD1206	SM1206	-16319500	920750	1	0
L102	SM301502001	SMBEAD1206	SM1206	-16319500	635000	1	0
L103	SM301502001	SMBEAD1206	SM1206	-16319500	349250	1	0
L104	SM301502001	SMBEAD1206	SM1206	-16319500	63500	1	0
L105	SM301502001	SMBEAD1206	SM1206	-16319500	-698500	1	0
L200	SM300486104	SM100uH	SM1210	-7588250	-3397250	1	90
L201	SM301502001	SMBEAD1206	SM1206	-16319500	-2063750	1	0
L202	SM301502001	SMBEAD1206	SM1206	-16319500	-2349500	1	0
L203	SM301502001	SMBEAD1206	SM1206	-16319500	-2635250	1	0
L204	SM301502001	SMBEAD1206	SM1206	-16319500	-2921000	1	0
L205	SM301502001	SMBEAD1206	SM1206	-16319500	-3683000	1	0
L400	SM301502001	SMBEAD1206	SM1206	-16319500	-8699500	1	0
L401	SM301502001	SMBEAD1206	SM1206	-16319500	-8985250	1	0
L402	SM301502001	SMBEAD1206	SM1206	-16319500	-9271000	1	0
L403	SM301502001	SMBEAD1206	SM1206	-16319500	-9556750	1	0
Q100	SM280124416	SST4416	SOT23	-2603500	127000	1	90
Q101	SM270140092	BFR92AR	SOT23	-2952750	508000	1	90
Q102	SM270130092	BFR92A	SOT23	-3270250	-63500	1	90
Q103	SM270130092	BFR92A	SOT23	-6191250	-1047750	1	180
Q104	SM275040093	BFT93R	SOT23	-6381750	-222250	1	0

Q105	SM275330858	BC858C	SOT23	-6762750	793750	1	90
Q106	SM275030093	BFT93	SOT23	-6762750	222250	1	180
Q107	SM270130092	BFR92A	SOT23	-7905750	349250	1	90
Q108	SM270130092	BFR92A	SOT23	-8064500	-571500	1	90
Q109	SM289240062	BCV62	SOT143	-12033250	571500	1	0
Q200	SM280124416	SST4416	SOT23	-2603500	-2857500	1	90
Q201	SM270140092	BFR92AR	SOT23	-2952750	-2476500	1	90
Q202	SM270130092	BFR92A	SOT23	-3270250	-3048000	1	90
Q203	SM270130092	BFR92A	SOT23	-6191250	-4032250	1	180
Q204	SM275040093	BFT93R	SOT23	-6381750	-3206750	1	0
Q205	SM275330858	BC858C	SOT23	-6762750	-2190750	1	90
Q206	SM275030093	BFT93	SOT23	-6762750	-2762250	1	180
Q207	SM270130092	BFR92A	SOT23	-7905750	-2635250	1	90
Q208	SM270130092	BFR92A	SOT23	-8064500	-3556000	1	90
Q209	SM289240062	BCV62	SOT143	-12033250	-2413000	1	0
Q400	SM280124416	SST4416	SOT23	-2190750	-9556750	1	90
Q401	SM270130092	BFR92A	SOT23	-2635250	-9588500	1	0
Q402	SM270130092	BFR92A	SOT23	-3270250	-9588500	1	0
Q403	SM270340848	BC848CR	SOT23	-7334250	-9429750	1	90
R1	SM652101512	SM5.1KS	SM0805	-11684000	6985000	1	270
R2	SM652101242	SM2.4KS	SM0805	-11684000	6604000	1	270
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
R6	SM652101683	SM68KS	SM0805	-16351250	4857750	1	90
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
R11	SM652101683	SM68KS	SM0805	-18002250	4857750	1	90
R12	SM652101512	SM5.1KS	SM0805	-17907000	4318000	1	180
R13	SM652101392	SM3.9KS	SM0805	-18097500	4572000	1	0
R14	SM185457203	SM20K-1T	SMPOT_ST4	-18288000	4889500	1	90
R15	SM652101221	SM220S	SM0805	-18478500	-7175500	1	90
R16	SM652101163	SM16KS	SM0805	-20732750	571500	1	0
R17	SM652101163	SM16KS	SM0805	-20732750	-2889250	1	0
R18	SM168659002	SM9.0K-1/oo	SMRES_MINIMELF	-20637500	-7397750	1	90
R19	SM168659004	SM900-1/oo	SMRES_MINIMELF	-20923250	-6731000	1	90
R20	SM652101510	SM51S	SM0805	-21113750	1936750	1	0
R21	SM652101510	SM51S	SM0805	-21113750	-1524000	1	0
R22	SM168659297	SM100-1/oo	SMRES_MINIMELF	-21177250	-6445250	1	270
R23	SM168659002	SM9.0K-1/oo	SMRES_MINIMELF	-21272500	-6985000	1	0
R24	NORES	NORES	SM0805	-22574250	5524500	1	270
R25	NORES	NORES	SM0805	-22828250	5524500	1	270
R26	NORES	NORES	SM0805	-23082250	5524500	1	270
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
R104	SM168651297	'SM100-1%MM'	SMRES_MINIMELF	-1333500	317500	1	0
R105	SM168651297	'SM100-1%MM'	SMRES_MINIMELF	-1333500	95250	1	0
R106	SM652110904	SM900K-5/oo	SM1206	-1428750	-635000	1	90
R107	SM652101510	SM51S	SM0805	-1555750	-158750	1	0
R108	SM652101103	SM10KS	SM0805	-1905000	539750	1	0
R109	SM652101161	SM160S	SM0805	-1841500	-381000	1	270
R110	SM652110904	SM900K-5/oo	SM1206	-2222500	-349250	1	180
R111	SM652101300	SM30S	SM0805	-2222500	-603250	1	270
R112	SM168659006	SM111.1K-1/oo	SMRES_MINIMELF	-2508250	-698500	1	270
R113	SM652101475	SM4.7MS	SM0805	-2603500	349250	1	0
R114	SM652101101	SM100S	SM0805	-2730500	-222250	1	180
R115	SM652101114	SM110KS	SM0805	-2762250	-635000	1	270
R116	SM652101151	SM150S	SM0805	-2952750	730250	1	0
R117	SM652101390	SM39S	SM0805	-2984500	95250	1	0
R118	SM652101105	SM1MS	SM0805	-3270250	-1016000	1	90
R119	SM652101390	SM39S	SM0805	-3492500	-285750	1	90

R120	SM652101122	SM1.2KS	SM0805	-3556000	381000	1	270
R121	SM652101272	SM2.7KS	SM0805	-3810000	190500	1	90
R122	SM652101185	SM1.8MS	SM0805	-3937000	-539750	2	0
R123	SM652101333	SM33KS	SM0805	-4032250	-857250	1	270
R124	SM652101221	SM220S	SM0805	-4064000	381000	1	270
R125	SM652101334	SM330KS	SM0805	-4254500	-254000	1	270
R126	SM652101152	SM1.5KS	SM0805	-4540250	666750	2	0
R127	SM652101511	SM510S	SM0805	-4318000	-95250	1	90
R128	SM185457103	SM10K-1T	SMPOT_ST4	-4318000	-984250	1	90
R129	SM652101101	SM100S	SM0805	-4730750	254000	1	0
R130	SM652101680	SM68S	SM0805	-4667250	-317500	1	0
R131	SM652101101	SM100S	SM0805	-5270500	920750	1	0
R132	SM652101182	SM1.8KS	SM0805	-5429250	920750	1	180
R133	SM652101122	SM1.2KS	SM0805	-5810250	-952500	2	180
R134	SM652101101	SM100S	SM0805	-6032500	508000	1	90
R135	SM652101822	SM8.2KS	SM0805	-6286500	698500	1	270
R136	SM652101240	SM24S	SM0805	-6223000	0	1	0
R137	SM652101240	SM24S	SM0805	-6223000	-317500	1	0
R138	SM654101000	SM0S	SM0805	-6572250	0	1	0
R139	SM652101105	SM1MS	SM0805	-6445250	-635000	1	0
R140	SM652101103	SM10KS	SM0805	-6413500	-1047750	1	90
R141	SM652101240	SM24S	SM0805	-6762750	-635000	1	90
R142	SM652101221	SM220S	SM0805	-6667500	-857250	1	270
R143	SM652101240	SM24S	SM0805	-6985000	254000	1	90
R144	SM652101470	SM47S	SM0805	-7048500	-127000	1	90
R145	SM652101470	SM47S	SM0805	-7048500	-476250	1	90
R146	SM652101510	SM51S	SM0805	-7016750	-666750	1	270
R147	SM652101332	SM3.3KS	SM0805	-7239000	666750	1	270
R148	SM652101510	SM51S	SM0805	-7493000	444500	1	270
R149	SM652101101	SM100S	SM0805	-7874000	539750	1	90
R150	SM652101821	SM820S	SM0805	-7874000	-31750	1	270
R151	SM652101101	SM100S	SM0805	-8128000	158750	1	90
R152	SM652101151	SM150S	SM0805	-8509000	-31750	1	180
R153	SM652101101	SM100S	SM0805	-8667750	-349250	1	0
R154	SM652101151	SM150S	SM0805	-8953500	-31750	1	180
R155	SM185457203	SM20K-1T	SMPOT_ST4	-8921750	-920750	1	90
R156	SM652101750	SM75S	SM0805	-9175750	984250	1	270
R157	SM652101183	SM18KS	SM0805	-9366250	0	1	90
R158	SM652101302	SM3KS	SM0805	-9239250	-349250	1	0
R159	SM652101302	SM3KS	SM0805	-9398000	571500	1	180
R160	SM652101510	SM51S	SM0805	-9620250	31750	1	90
R161	SM652101332	SM3.3KS	SM0805	-10191750	952500	1	180
R162	SM652101332	SM3.3KS	SM0805	-10477500	-127000	2	270
R163	SM652101561	SM560S	SM0805	-10985500	984250	1	270
R164	SM652101391	SM390S	SM0805	-11017250	-63500	1	90
R165	SM652101391	SM390S	SM0805	-11017250	-222250	1	270
R166	SM652101512	SM5.1KS	SM0805	-11207750	825500	1	180
R167	SM652101750	SM75S	SM0805	-11271250	-285750	1	90
R168	SM652101750	SM75S	SM0805	-11557000	0	1	270
R169	SM652101153	SM15KS	SM0805	-11684000	571500	1	0
R170	SM652101471	SM470S	SM0805	-11906250	95250	1	90
R171	SM652101471	SM470S	SM0805	-12160250	95250	1	90
R172	SM185457203	SM20K-1T	SMPOT_ST4	-12477750	920750	1	180
R200	SM652101243	SM24KS	SM0805	-889000	-2159000	1	0
R201	SM652101105	SM1MS	SM0805	-793750	-3143250	1	0
R202	SM652101510	SM51S	SM0805	-1143000	-3111500	1	270
R203	SM652101131	SM130S	SM0805	-1016000	-3524250	1	180
R204	SM168651297	'SM100-1%MM'	SMRES_MINIMELF	-1333500	-2667000	1	0
R205	SM168651297	'SM100-1%MM'	SMRES_MINIMELF	-1333500	-2889250	1	0
R206	SM652110904	SM900K-5/oo	SM1206	-1428750	-3619500	1	90
R207	SM652101510	SM51S	SM0805	-1555750	-3143250	1	0
R208	SM652101103	SM10KS	SM0805	-1905000	-2444750	1	0
R209	SM652101161	SM160S	SM0805	-1841500	-3365500	1	270
R210	SM652110904	SM900K-5/oo	SM1206	-2222500	-3333750	1	180
R211	SM652101300	SM30S	SM0805	-2222500	-3587750	1	270
R212	SM168659006	SM111.1K-1/oo	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
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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
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R405	SM168659006	SM111.1K-1/oo	SMRES_MINIMELF	-1270000	-8096250	1	180

R406	SM652101391	SM390S	SM0805	-1460500	-8890000	1	90
R407	SM652101434	SM430KS	SM0805	-1492250	-9652000	1	0
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R409	SM652101475	SM4.7MS	SM0805	-2000250	-9937750	1	180
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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
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R422	SM652101103	SM10KS	SM0805	-3587750	-10001250	1	180
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R424	SM652101332	SM3.3KS	SM0805	-4540250	-9429750	2	0
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R427	SM652101391	SM390S	SM0805	-5365750	-9207500	1	270
R428	SM652101512	SM5.1KS	SM0805	-5778500	-8096250	1	0
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R430	SM652101153	SM15KS	SM0805	-5905500	-8350250	1	0
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R434	SM652101560	SM56S	SM0805	-7302500	-9017000	1	270
R435	SM652101684	SM680KS	SM0805	-7905750	-9810750	1	270
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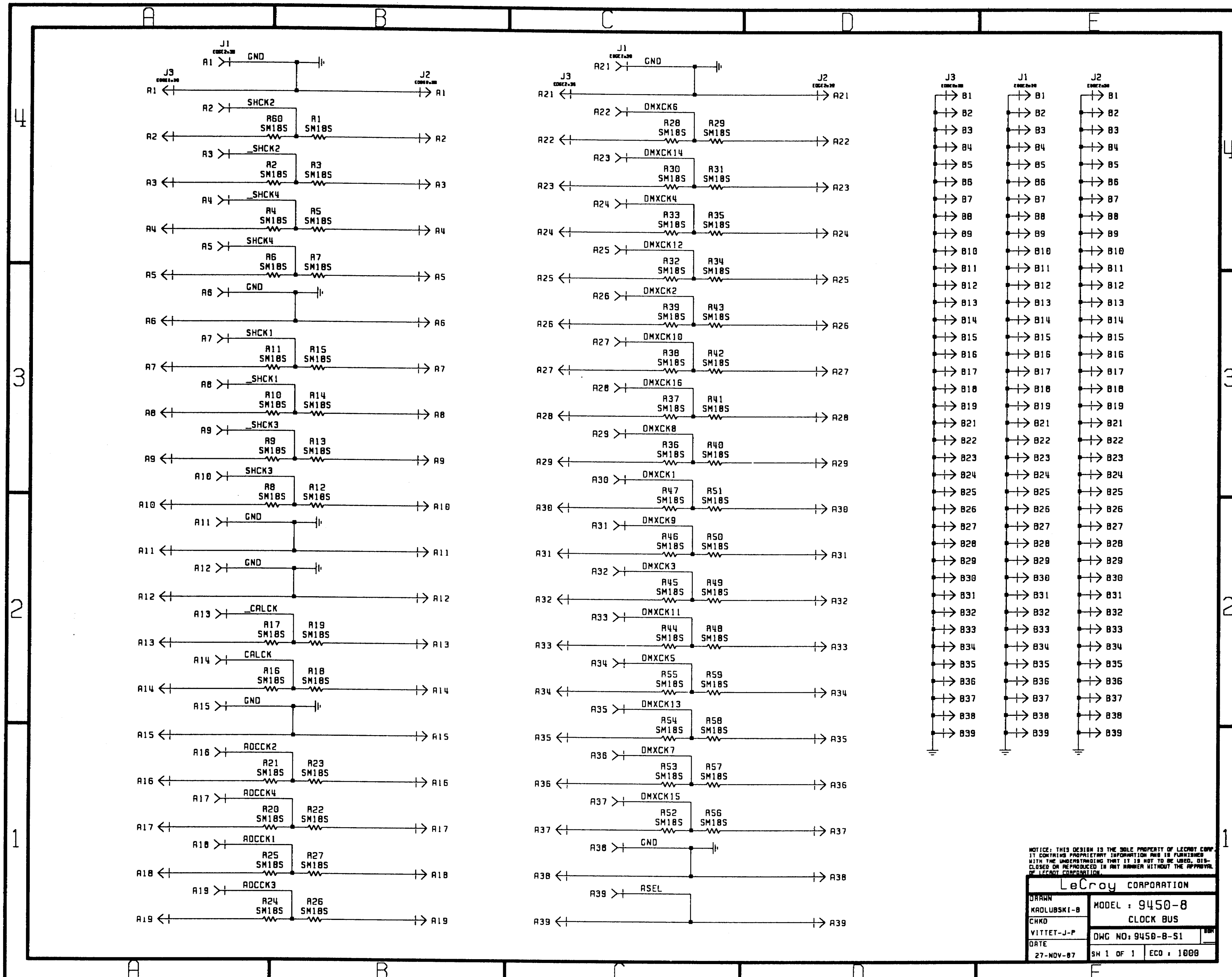
CR100	SM236030099	BAV99	SOT23	-1079500	730250	1	0
CR101	SM236030099	BAV99	SOT23	-1714500	762000	1	270
CR102	SM252023018	BAT18	SOT23	-2349500	730250	1	0
CR103	SM240050051	TZMC5V1	SMDIO_MINIMELF	-4222750	920750	1	180
CR104	SM240050033	TZMC3V3	SMDIO_MINIMELF	-11271250	-508000	1	180
CR200	SM236030099	BAV99	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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J2
J3
GND
SHCK2
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_SHCK4
SHCK4
SHCK1
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_CALCK
CALCK
ADCCK2
ADCCK4
ADCCK1
ADCCK3
DMXCK6
DMXCK14
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DMXCK1
DMXCK9
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DMXCK5
DMXCK13
DMXCK7
DMXCK15
ASEL
SM18S
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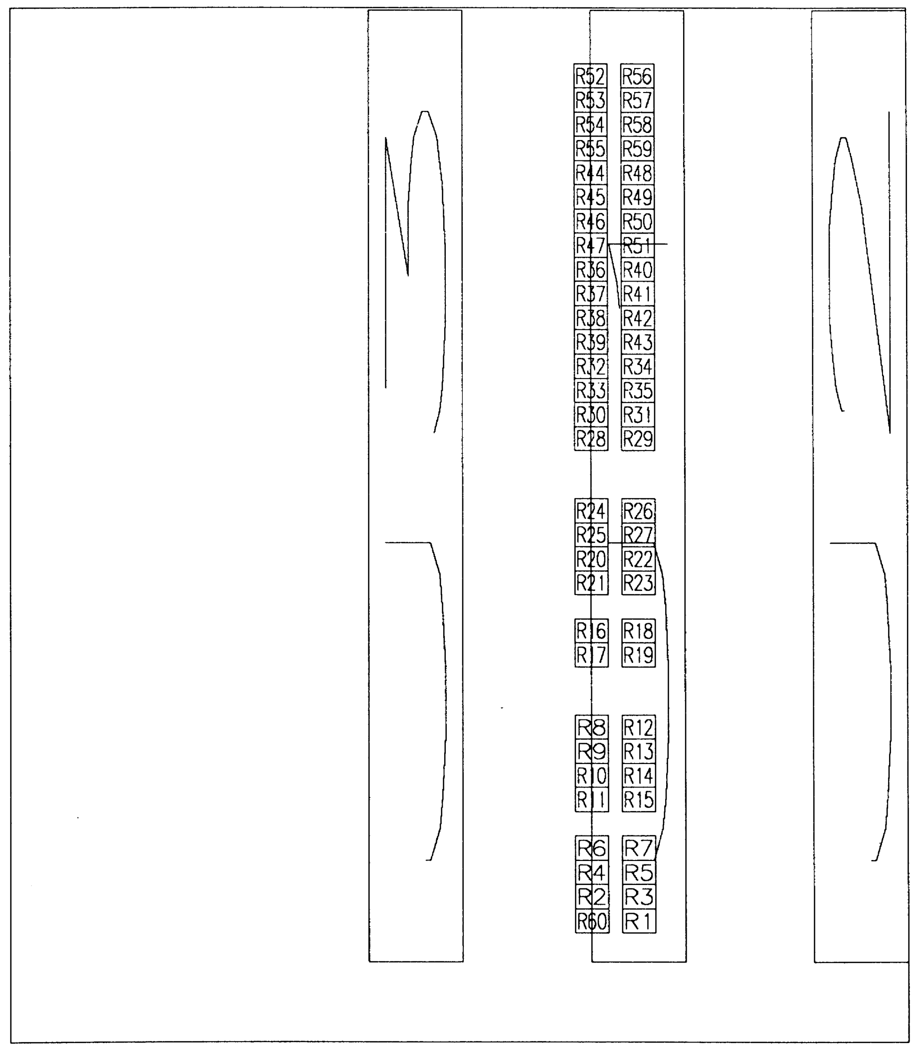
LeCroy CORPORATION
DRAWN KADLUBSKI-B
CHKD VITTET-J-P
DATE 27-NOV-87
MODEL : 9450-8
CLOCK BUS
DWG NO: 9450-8-S1
SH 1 OF 1
ECO : 1000



R52 R56
R53 R57
R54 R58
R55 R59
R44 R48
R45 R49
R46 R50
R47 R51
R36 R40
R37 R41
R38 R42
R39 R43
R32 R34
R33 R35
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R8 R12
R9 R13
R10 R14
R11 R15
R6 R7
R4 R5
R2 R3
R60 R1

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
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R5	SM652101180	SM18S	SM0805	26380	7000	1	0
R6	SM652101180	SM18S	SM0805	24380	8000	1	0
R7	SM652101180	SM18S	SM0805	26380	8000	1	0
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R12	SM652101180	SM18S	SM0805	26380	13000	1	0
R13	SM652101180	SM18S	SM0805	26380	12000	1	0
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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
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R40	SM652101180	SM18S	SM0805	26380	32000	1	0
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R50	SM652101180	SM18S	SM0805	26380	34000	1	0
R51	SM652101180	SM18S	SM0805	26380	33000	1	0
R52	SM652101180	SM18S	SM0805	24380	40000	1	0
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R54	SM652101180	SM18S	SM0805	24380	38000	1	0
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R59	SM652101180	SM18S	SM0805	26380	37000	1	0
R60	SM652101180	SM18S	SM0805	24380	5000	1	0

Chapter 7

MECHANICAL PARTS

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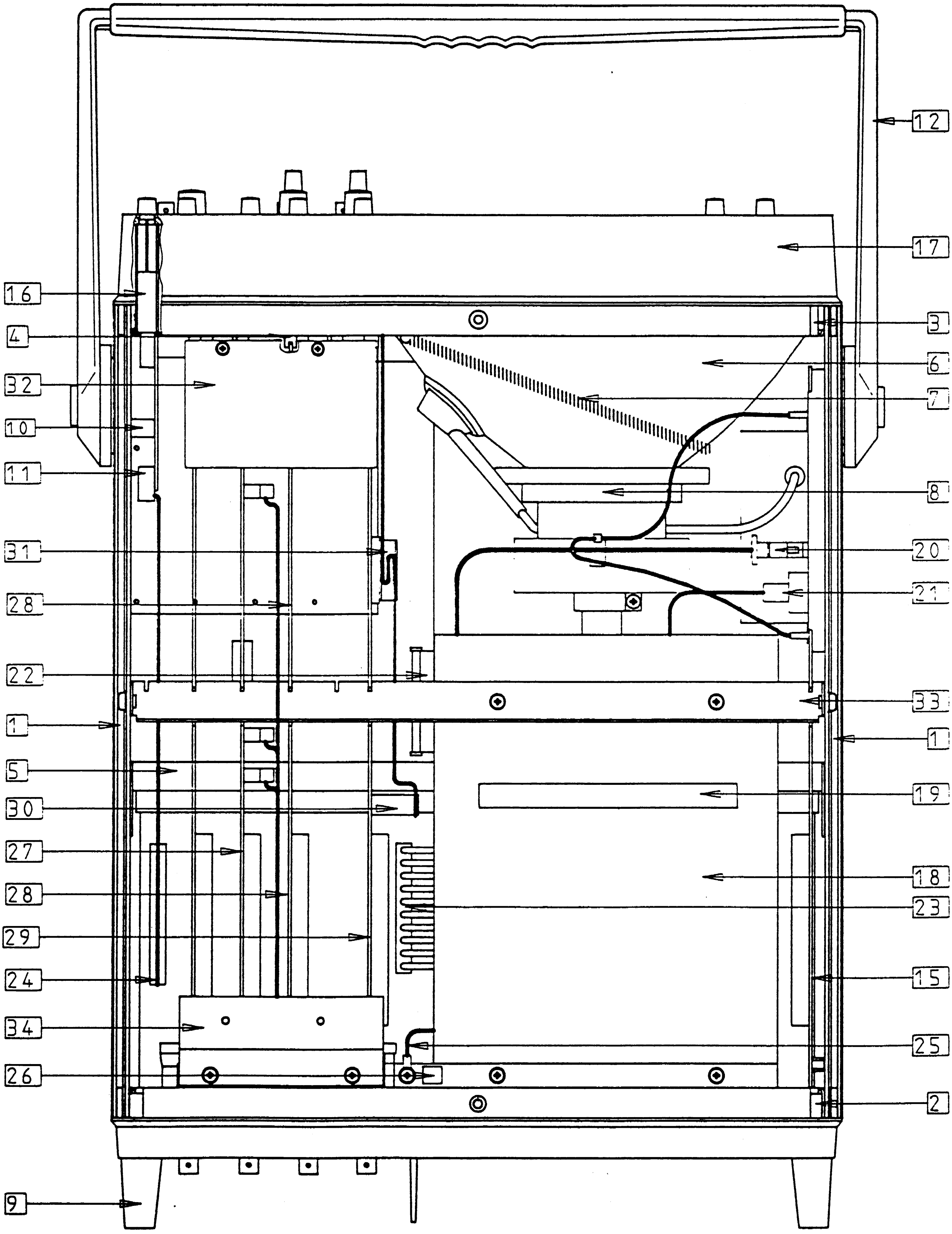
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Figure 7.1

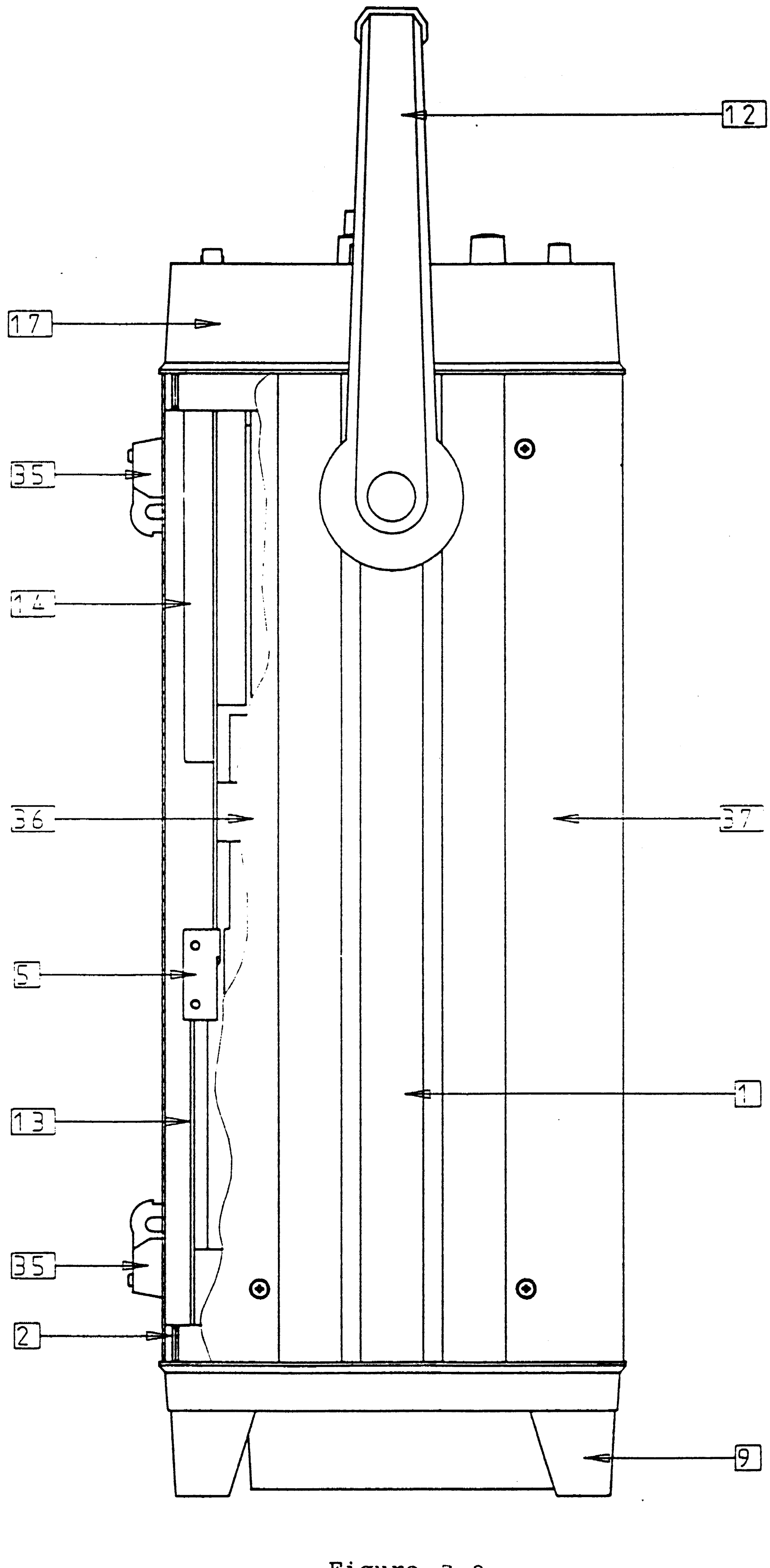


Figure 7.2

ASSEMBLAGE SEQUENCE OF PARTS				SCREWS		WASHERS		NUTS	
POS	DESCRIPTION	PART NUMBER	QTY	PART NUMBER	QTY	PART NUMBER	QTY	PART NUMBER	QTY
1	SIDE PANEL	709 424 021	2						
2	REAR SUPPORT	709 424 041	1	550 440 108	4	551 440 300	4		
3	DISPLAY SUPPORT	709 424 031	1	550 440 108	4	551 440 300	4		
4	CARD GUIDE	530 410 001	5	550 430 104	10	551 430 300	10		
5	MOTHER CARD SUPPORT	709 424 051	1	550 440 108	4	551 440 300	4		
6	CRT ORANGE	321 220 009	1	550 440 416	4	554 440 202 709 450 071	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

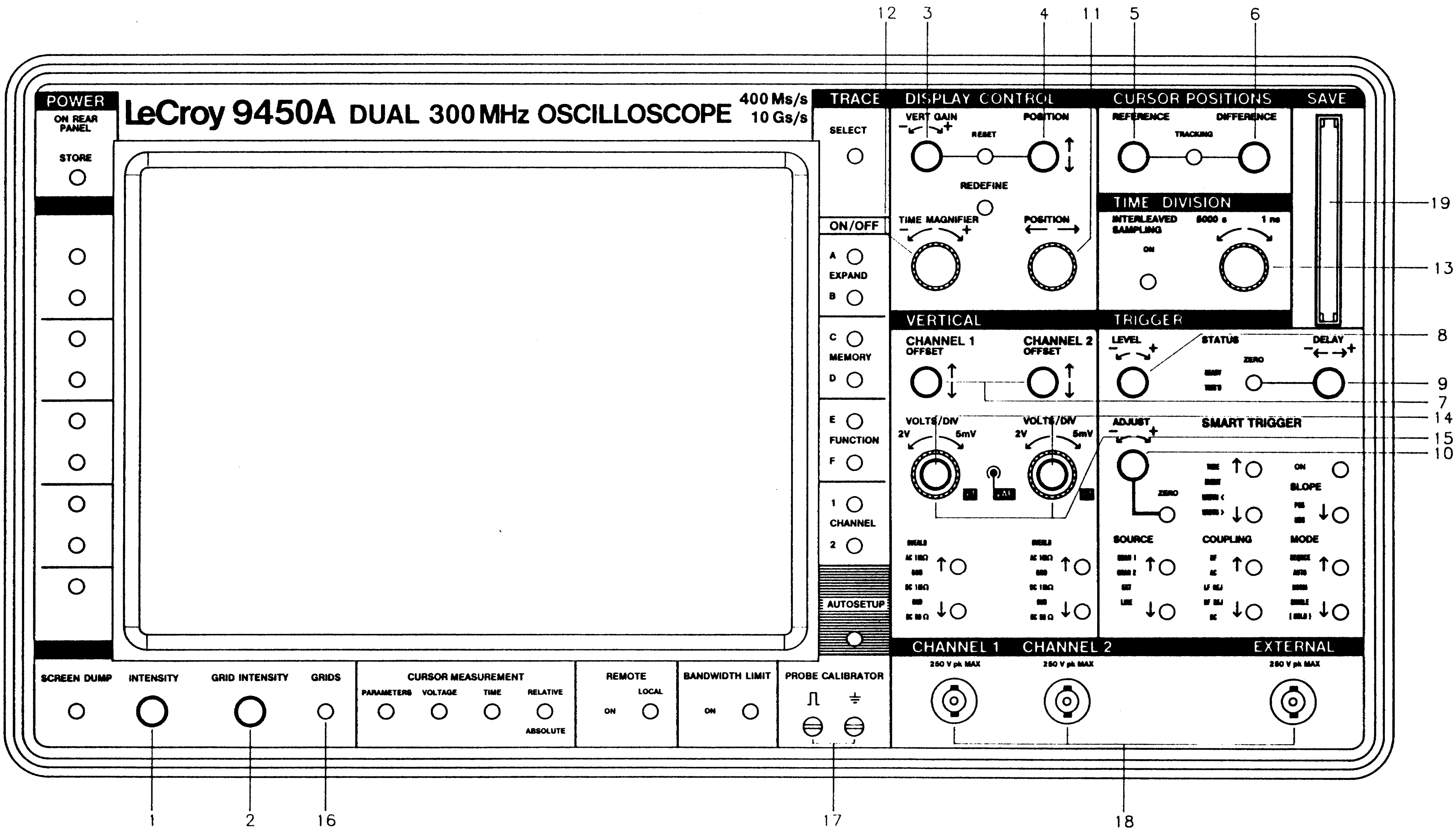


Figure A: 9450A Front Panel

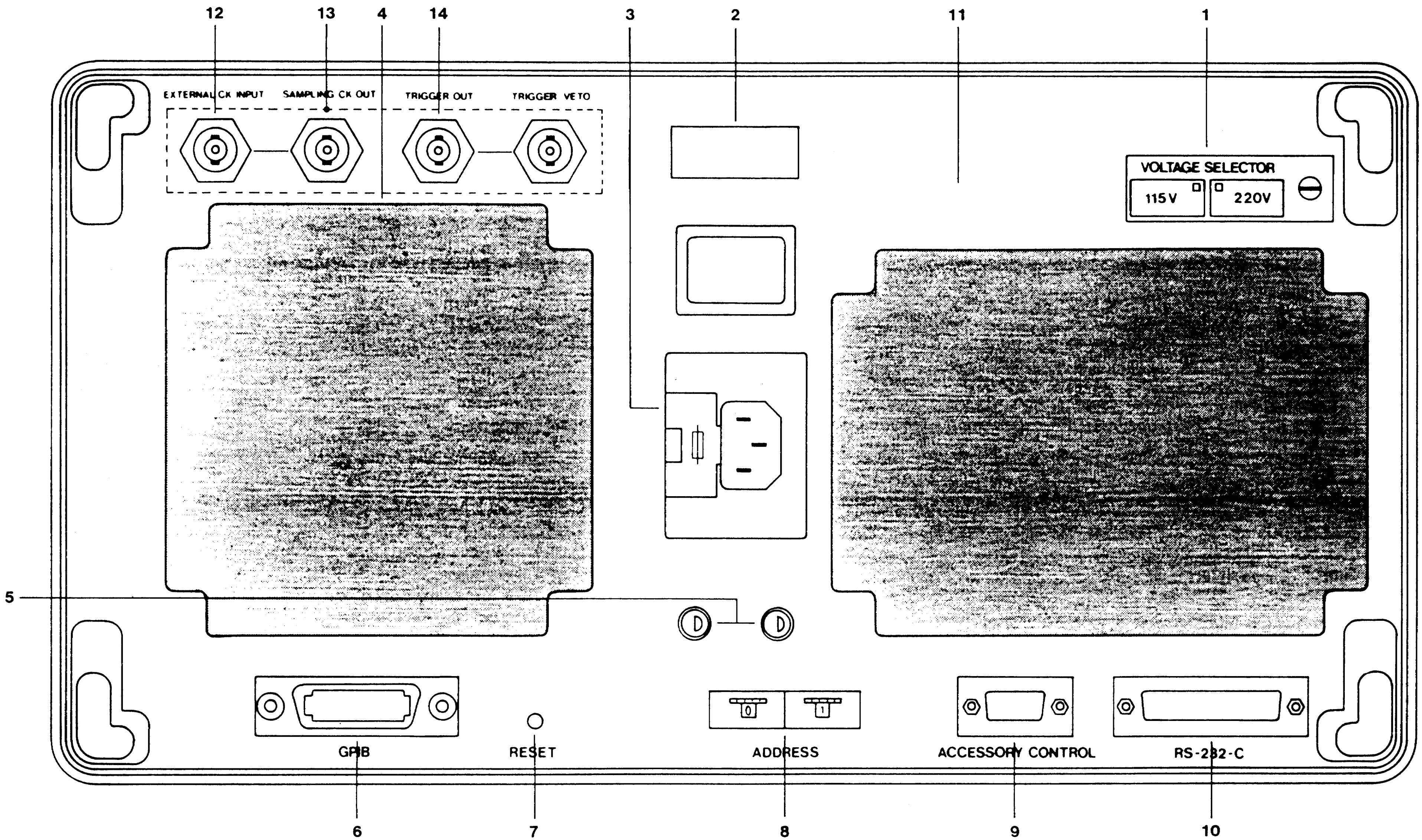
Figure 7.4

Scan by Paladinmicro -- paladin@paladinmicro.com

7.5 Front panel description and part number

	Function:	Description:	Part number:
1)	Intensity	RES VAR cond plastic 5K	184 437 502
		knob for 1/8" shaft	536 168 003
		CAP for 021-1110 or 2215	536 068 006
2)	Grid intensity	idem.	
3)	Vert gain	RES VAR cond plastic 5K	184 417 502
		knob for 1/8" shaft	536 168 001
		CAP for knob 020-2215	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	184 417 502
		knob for 1/8" shaft	536 168 002
		CAP for 020-3215 or 3415	536 068 005
12)	Time magnifier	Switch ROT M/stop 12 pins	412 001 012
		knob for 1/8" shaft	536 068 001
		CAP for knob 020-3215 or 3415	536 068 005
13)	Time/division	idem.	
14)	CH1 and CH2	RES VARI cond plastic 5K	184 427 502
	volts/div	knob for 1/8" shaft	536 068 002
	variable gain	CAP for knob 020-2215	536 068 003
15)	CH1 and CH2 Volts/div	Switch ROT M/stop 12 pins	412 001 012
16)	Grids	Switch push button SPST	416 161 002
	idem for all the other push button	Push switch extender	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

Scan by Paladinmicro -- paladin@paladinmicro.com

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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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
HPC411AIH	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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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 TRANSCVR 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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER 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	RV	ITEM NUMBR	SC	ST UM	QTY PER ASSEMBLY
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.

Table of contents

9. Introduction

LeCroy oscilloscopes are supplied with a list of plotters and printers known to work with them. This list is not final, so any suggestions are welcome.

While the 9400 oscilloscope can only be connected to plotters, the 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.

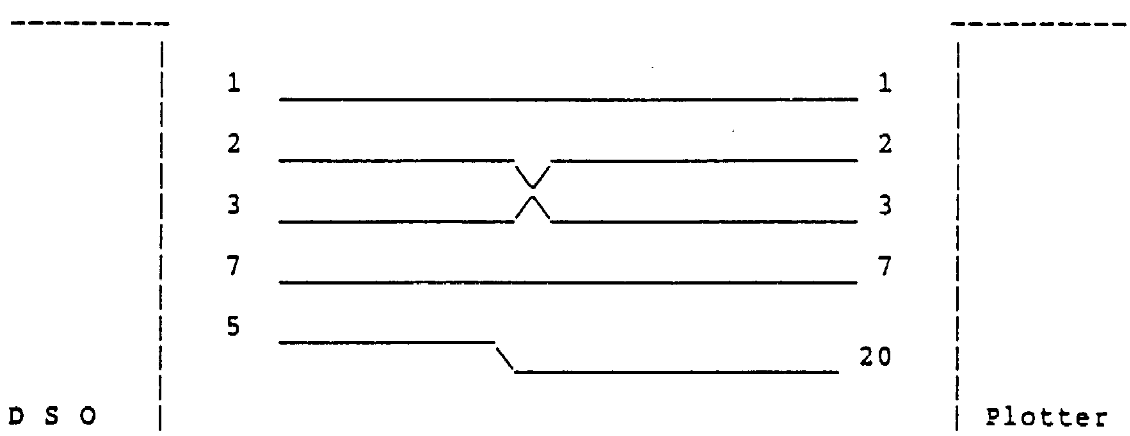
RS-232 connection:

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 (1)	0	0	0	1	0	0	0

Switch S3:	1	2	3	4	5	6	7	8
	1	1	1	1	1	0	1	1

- GPIB Connection:

Switch S1:	1	2	3	4	5	6	7	8
	0	0	0	0	0	1	0	1

Switch S2:	1-2	3-4	5-6	7-8	9-10
	0	0	1	1	1

Switch S3: LISTEN ONLY or ADDRESSABLE

Notes:
- (1) select a baud rate factor of 1/16.
- FP5301-UM-151 has an internal switch that select step size. Select .1 mm per step.

9.1.5 Philips PM 8151

- RS-232 Connection:

The cable must be connected to the MODEM (ON LINE) port.

The baud rate will be 2400 baud.

Switches:

S1: OFF (No time sharing)

S2: 2400 bauds

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. mess. (no kaut)	free enable

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.

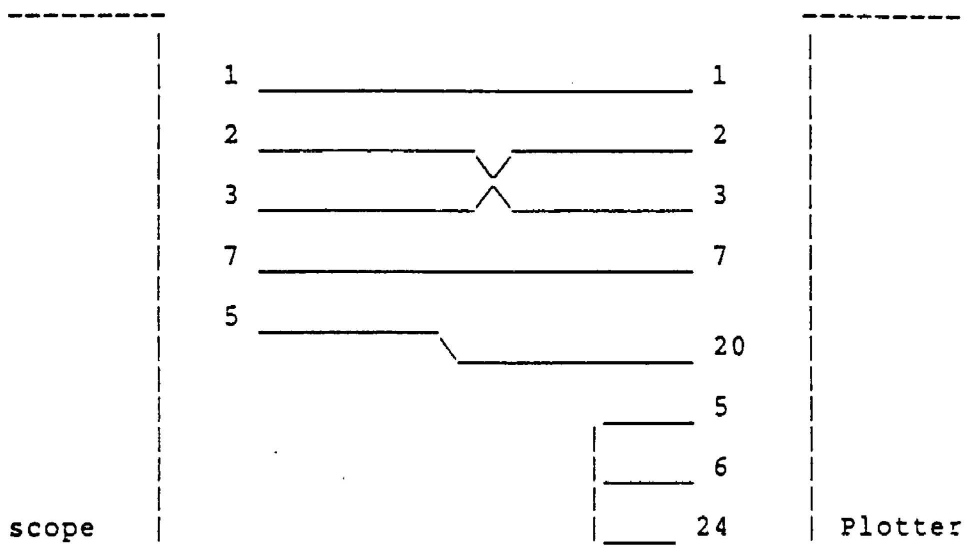
9.1.6 Philips PM 8153

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:



(male connector) (female connector)

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 0P03) 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:

	Printer	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:

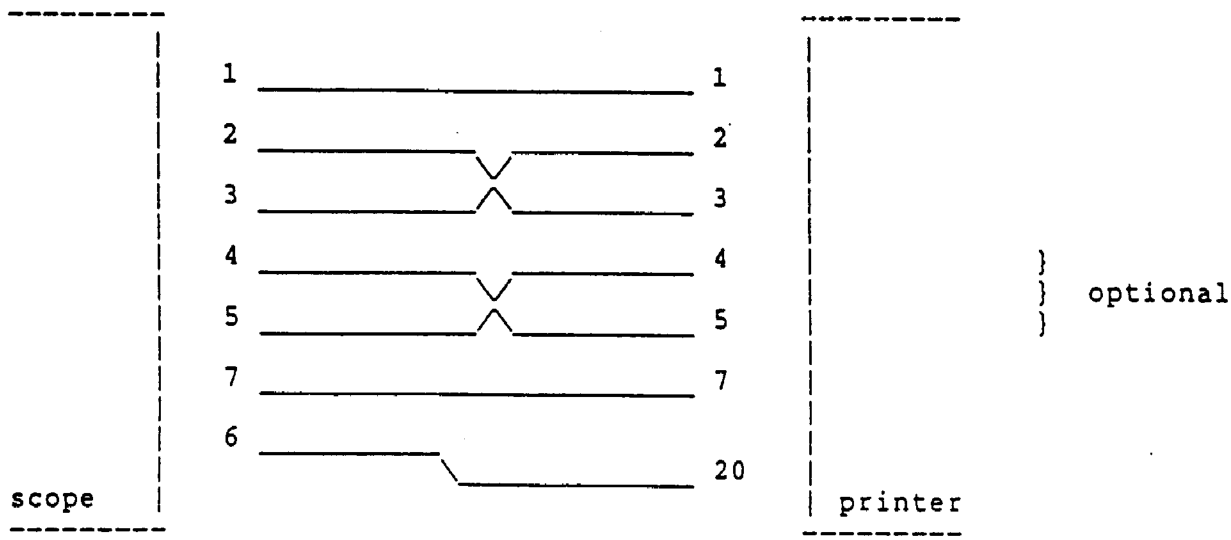
1	2	3	4	5
1	0	0	0	0
(use DTR Handshake)	(8 bits, parity none)		(9600 bauds)	

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.

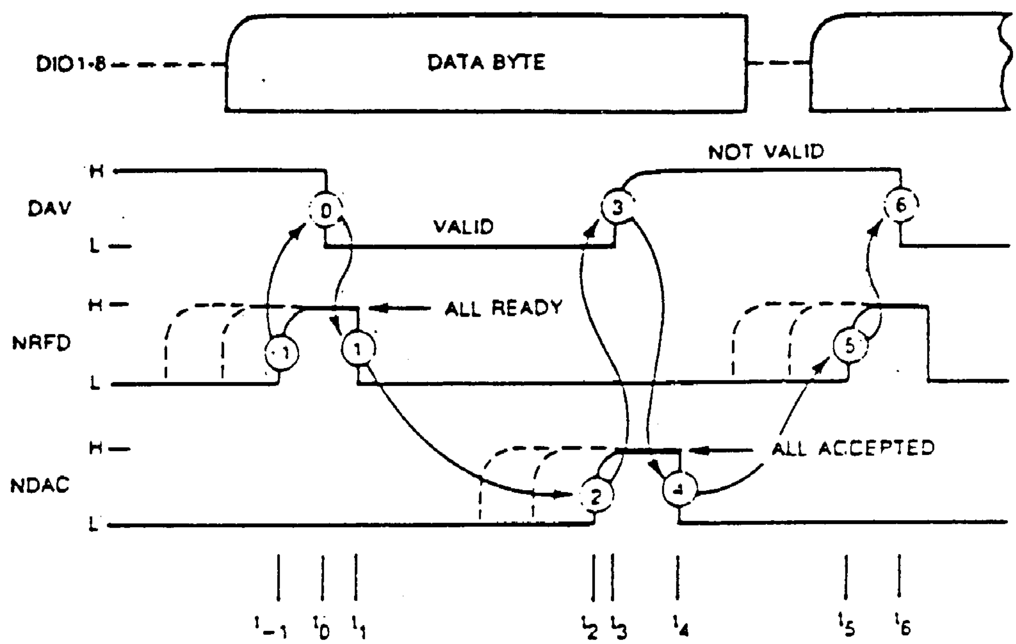
- ATN Attention; controller sends this to specify whether DIO lines are to be used for interface messages, e.g., addressing, or for data.

- 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.

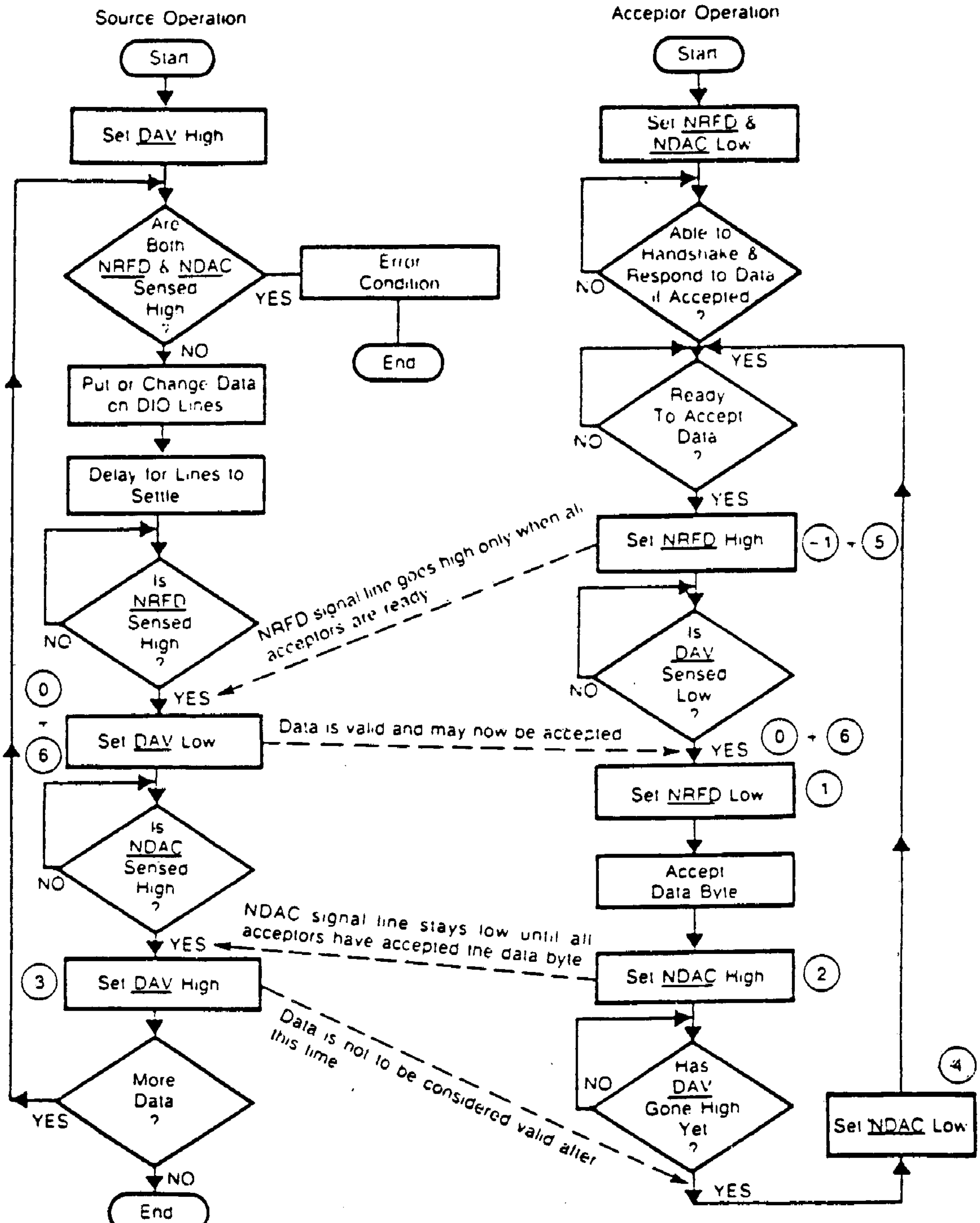


DATA BYTE TRANSFER IN GPIB IEEE-488

Figure 9.1

The handshake timing sequence proceeds as follows:

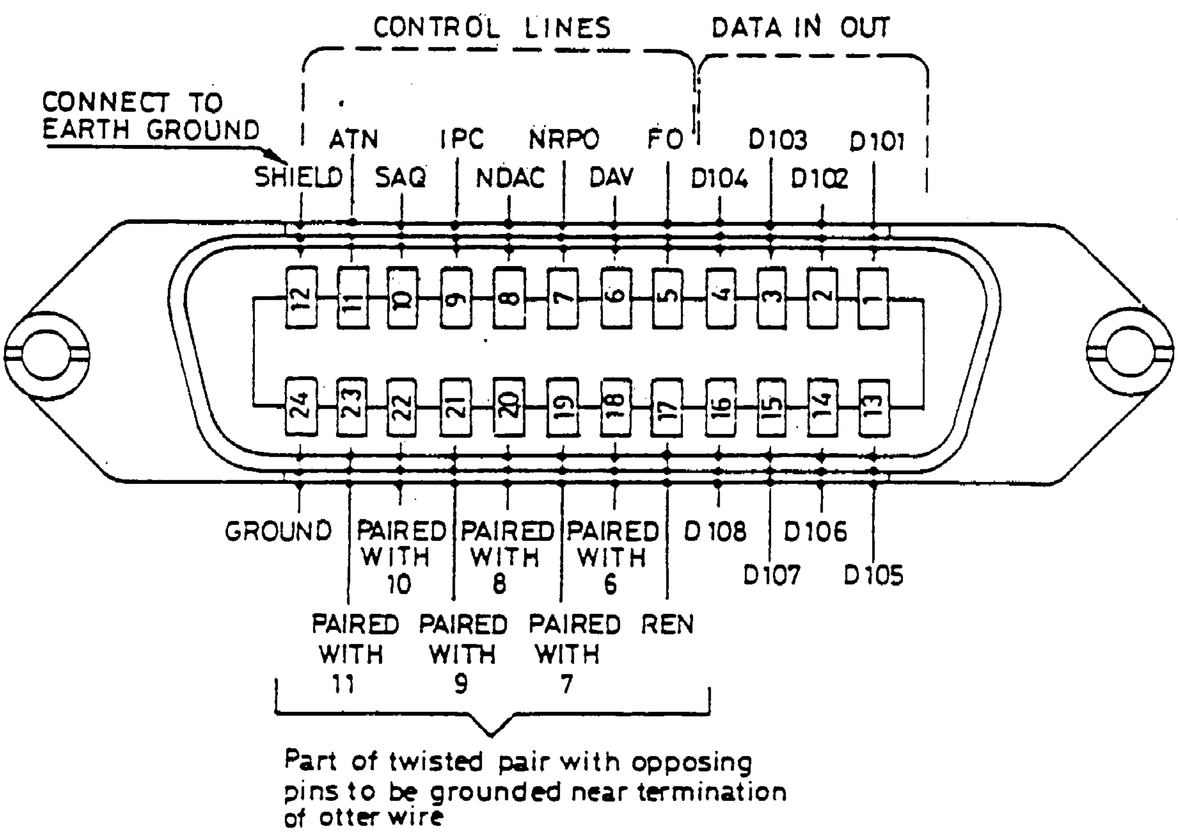
Preliminary	The source checks for presence of listeners and places the next data byte on the data lines DI01-8.
t-1	Acceptors one by one become ready for byte. Last one allows NRFD to go high.
t0	Sources pulls down DAV to validate data.
t1	The first litener to accept the data pulls down NRFD to show it is no longer ready for a new byte.
t2	The listeners one by one accept the data, and the last one lets NDAC go high.
t3	The source sets DAV high to show this byte is no longer valid.
t4	The listeners one by one accept this, the first one puling NDAC low for the next cycle.
t5	As for t-1.



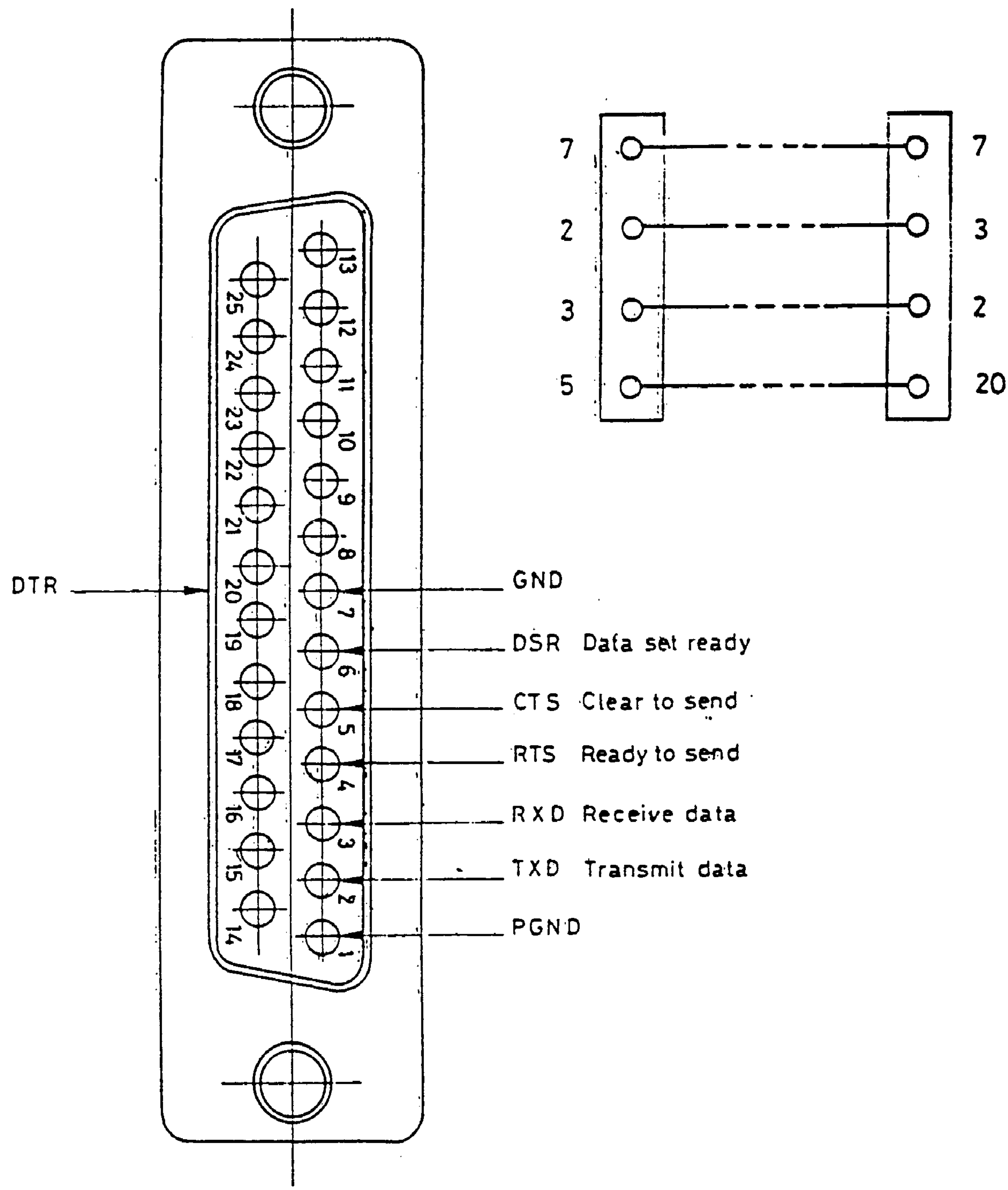
Logical flow of events for Source and Acceptor when transferring data using the handshake process

HANDSHAKE TIMING SEQUENCE IN GPIB IEEE-488

Figure 9.2



GPIB / IEEE-488 INTERFACE



RS232-C INTERFACE

APPENDIX A

Dec	Hex	ASCI char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
0	00	NUL		
1	01	SOH	^A	GTL - Go To Local
2	02	STX	^B	
3	03	ETX	^C	
4	04	EOT	^D	SDC - Selected Device Clear
5	05	ENQ	^E	PPC - Parallel Poll Configure
6	06	ACK	^F	
7	07	BEL		
8	08	BS		GET - Group Execute Trigger
9	09	HT		TCT - Take Control
10	0A	LF		
11	0B	VT		
12	0C	FF		
13	0D	CR		
14	0E	SO	^N	
15	0F	SI	^O	
16	10	DLE	^P	
17	11	DC1	^Q	LLO - Local Lock Out
18	12	DC2	^R	
19	13	DC3	^S	
20	14	DC4	^T	DCL - Device Clear
21	15	NAK	^U	PPU - Parallel Poll Unconfigure
22	16	SYN	^V	
23	17	ETB	^W	
24	18	CAN	^X	SPE - Serial Poll Enable
25	19	EM	^Y	SPD - Serial Poll Disable
26	1A	SUB		
27	1B	ESC	^[	
28	1C	FS	^\	
29	1D	GS	^]	
30	1E	RS	^^	
31	1F	US	^_	
32	20	SP		MLA - My Listen Address (listen 0)
33	21	!	!	MLA - My Listen Address (listen 1)
34	22	"	"	MLA - My Listen Address (listen 2)
35	23	#	#	MLA - My Listen Address (listen 3)
36	24	$	$	MLA - My Listen Address (listen 4)
37	25	%	%	MLA - My Listen Address (listen 5)
38	26	&	&	MLA - My Listen Address (listen 6)
39	27	'	'	MLA - My Listen Address (listen 7)
40	28	(	(	MLA - My Listen Address (listen 8)
41	29	)	)	MLA - My Listen Address (listen 9)
42	2A	*	*	MLA - My Listen Address (listen 10)
43	2B	+	+	MLA - My Listen Address (listen 11)
44	2C	,	,	MLA - My Listen Address (listen 12)
45	2D	-	-	MLA - My Listen Address (listen 13)

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
46	2E	.	.	MLA - My Listen Address (listen 14)
47	2F	/	/	MLA - My Listen Address (listen 15)
48	30	0	0	MLA - My Listen Address (listen 16)
49	31	1	1	MLA - My Listen Address (listen 17)
50	32	2	2	MLA - My Listen Address (listen 18)
51	33	3	3	MLA - My Listen Address (listen 19)
52	34	4	4	MLA - My Listen Address (listen 20)
53	35	5	5	MLA - My Listen Address (listen 21)
54	36	6	6	MLA - My Listen Address (listen 22)
55	37	7	7	MLA - My Listen Address (listen 23)
56	38	8	8	MLA - My Listen Address (listen 24)
57	39	9	9	MLA - My Listen Address (listen 25)
58	3A	:	:	MLA - My Listen Address (listen 26)
59	3B	;	;	MLA - My Listen Address (listen 27)
60	3C	<	<	MLA - My Listen Address (listen 28)
61	3D	=	=	MLA - My Listen Address (listen 29)
62	3E	>	>	MLA - My Listen Address (listen 30)
63	3F	?	?	UNL - Unlisten
64	40	@	@	MTA - My Talk Address (talk 0)
65	41	A	A	MTA - My Talk Address (talk 1)
66	42	B	B	MTA - My Talk Address (talk 2)
67	43	C	C	MTA - My Talk Address (talk 3)
68	44	D	D	MTA - My Talk Address (talk 4)
69	45	E	E	MTA - My Talk Address (talk 5)
70	46	F	F	MTA - My Talk Address (talk 6)
71	47	G	G	MTA - My Talk Address (talk 7)
72	48	H	H	MTA - My Talk Address (talk 8)
73	49	I	I	MTA - My Talk Address (talk 9)
74	4A	J	J	MTA - My Talk Address (talk 10)
75	4B	K	K	MTA - My Talk Address (talk 11)
76	4C	L	L	MTA - My Talk Address (talk 12)
77	4D	M	M	MTA - My Talk Address (talk 13)
78	4E	N	N	MTA - My Talk Address (talk 14)
79	4F	O	O	MTA - My Talk Address (talk 15)
80	50	P	P	MTA - My Talk Address (talk 16)
81	51	Q	Q	MTA - My Talk Address (talk 17)
82	52	R	R	MTA - My Talk Address (talk 18)
83	53	S	S	MTA - My Talk Address (talk 19)
84	54	T	T	MTA - My Talk Address (talk 20)
85	55	U	U	MTA - My Talk Address (talk 21)
86	56	V	V	MTA - My Talk Address (talk 22)
87	57	W	W	MTA - My Talk Address (talk 23)
88	58	X	X	MTA - My Talk Address (talk 24)
89	59	Y	Y	MTA - My Talk Address (talk 25)
90	5A	Z	Z	MTA - My Talk Address (talk 26)
91	5B	[	[	MTA - My Talk Address (talk 27)
92	5C	\	\	MTA - My Talk Address (talk 28)

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
93	5D	]	]	MTA - My Talk Address (talk 29)
94	5E	^	^	MTA - My Talk Address (talk 30)
95	5F	_	_	UNT - Untalk
96	60	`	`	
97	61	a	a	
98	62	b	b	
99	63	c	c	
100	64	d	d	
101	65	e	e	
102	66	f	f	
103	67	g	g	
104	68	h	h	
105	69	i	i	
106	6A	j	j	
107	6B	k	k	
108	6C	l	l	
109	6D	m	m	
110	6E	n	n	
111	6F	o	o	
112	70	p	p	
113	71	q	q	
114	72	r	r	
115	73	s	s	
116	74	t	t	
117	75	u	u	
118	76	v	v	
119	77	w	w	
120	78	x	x	
121	79	y	y	
122	7A	z	z	
123	7B	{	{	
124	7C	|	|	
125	7D	}	}	
126	7E	~	~	
127	7F	NUL		
128	80		Ç	
129	81		ü	
130	82		é	
131	83		â	
132	84		ä	
133	85		à	
134	86		å	
135	87		ç	
136	88		ê	
137	89		ë	
138	8A		è	
139	8B		ï	

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
140	8C		î	
141	8D		ì	
142	8E		Ä	
143	8F		Å	
144	90		É	
145	91		æ	
146	92		Æ	
147	93		ô	
148	94		ö	
149	95		ò	
150	96		û	
151	97		ù	
152	98			
153	99		Ö	
154	9A		Ü	
155	9B		¢	
156	9C		£	
157	9D		¥	
158	9E		₧	
159	9F		ƒ	
160	A0		á	
161	A1		í	
162	A2		ó	
163	A3		ú	
164	A4		ñ	
165	A5		Ñ	
166	A6		ª	
167	A7		º	
168	A8		¿	
169	A9		⌐	
170	AA		¬	
171	AB		½	
172	AC		¼	
173	AD		¡	
174	AE		«	
175	AF		»	
176	B0			
177	B1		▒	
178	B2		▓	
179	B3		│	
180	B4		┤	
181	B5		╡	
182	B6		╢	
183	B7		╖	
184	B8		╕	
185	B9		╣	
186	BA		║	
187	BB		╗	

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
188	BC		╝	
189	BD		╜	
190	BE		╛	
191	BF		┐	
192	C0		└	
193	C1		┴	
194	C2		┬	
195	C3		├	
196	C4		─	
197	C5		┼	
198	C6		╞	
199	C7		╟	
200	C8		╚	
201	C9		╔	
202	CA		╩	
203	CB		╦	
204	CC		╠	
205	CD		═	
206	CE		╬	
207	CF		╧	
208	D0		╨	
209	D1		╤	
210	D2		╥	
211	D3		╙	
212	D4		╘	
213	D5		╒	
214	D6		╓	
215	D7		╫	
216	D8		╪	
217	D9		┘	
218	DA		┌	
219	DB		█	
220	DC		▄	
221	DD		▌	
222	DE		▐	
223	DF		▀	
224	E0		α	
225	E1		β	
226	E2		Γ	
227	E3		π	
228	E4		Σ	
229	E5		σ	
230	E6		μ	
231	E7		τ	
232	E8		Φ	
233	E9			
234	EA		Ω	

Dec	Hex	ASCII char	IBM-PC char	IEEE-488 Multiline Interface Message (Sent with Attention true)
235	EB		δ	
236	EC		∞	
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		²	
254	FE		▪	
255	FF			

LeCroy