IT-5300

INSTRUCTION MANUAL

5/30/79

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WARRANTY

The IT-5300 analyzer is fully warrantied against defective materials and workmanship for a period of one year. During the applicable warranty period, repairs will be made without charge, provided that failures are not due to misuse of equipment. NORLAND reserves the right to determine whether equipment has been subject to misuse. All equipment to be repaired will be repaired at NORLAND in Ft. Atkinson, Wisconsin. All equipment to be returned for warranty service must be shipped freight prepaid, and only with prior approval from NORLAND.

GENERAL

INTRODUCTION

The IT-5300 is a highly flexible, compact multichannel analyzer system offering maximum portability and ease of operation. Extensive use of the state-of-the-art circuitry has reduced the size and weight of the IT-5300 analyzer and provides features previously found only in high-cost systems.

The IT-5300 is capable of performing Pulse Height Analysis (PHA) and Multichannel Scaling (MCS) experiments. Accumulated data is displayed on the oscilloscope, and permanent records of data may be made in the following ways:

1) CRT photographs.
2) X-Y recorder readout with line plot or point plot available. The standard system is shipped with line recorder readout. Optional X-Y point plotter readout may be provided prior to shipment or added in the field with the appropriate jumper selection. For additional information, see the Plotter Connector Signal List, I/O Board schematics and Address Board schematic.
3) Either RS232C or 20 mil current loop serial interface supplied as standard.
   A) RS232C interface provides readout and readin from any EIA RS232C-compatible device at selectable baud rates. Typical RS232C readout devices include:
      -Teletype Series 43 Impact Printer
      -Texas Instruments Series 733 and 743 Impact Printers
      -Modem Terminals
      -Computer Interfaces
      -Paper Tape Perforators
   B) 20 mil current loop provides serial ASCII interface to teletype ASR and KSR 33 teletypewriters or to other 20 mil current loop-compatible peripheral.

Optional permanent records may be made by the following methods:

1) Parallel Printer
2) Cassette Recorder
3) Teletype and cassette recorder capable of data readin to the IT-5300 analyzer

UNPACKING INSTRUCTIONS

The IT-5300 is shipped in a fully-operational condition. Included are mating connectors for the rear panel PLOTTER and I/O connectors.

Upon receiving the instrument, carefully inspect for any shipping damage. If damage is found, it is important to notify the carrier immediately to initiate a damage claim.

The shipping containers should be retained to be used in the event of future shipments.

SECTION I
SPECIFICATIONS

AMPLIFIER

Input:
Charge or voltage sensitive (factory set)
Maximum Gain:
4.0V/pico coulomb or (X)100
Stability:
Less than .005% of full scale/^{o}C
Shaping:
Single differential 0.5 to 10 uSec (factory set)

ADC

Input:
0-10V unipolar or positive first bipolar
Rise Time: 0.1 to 20 uSec
Fall Time: 0.1 to 20 uSec
Duration: 0.5 uSec minimum
Impedance: 1K
Coupling: DC or AC with passive restorer
Linearity:
Integral: ±.075% over 99% of range
Differential: ±.75% over 99% of range
Digitizing Rate:
50 MHz, crystal controlled
Resolution:
512, 1024 and 2048 channels
Stability:
Temperature: Less than .005% of full scale/^{o}C
Line Voltage: Less than .05% 105-125V
Lower Level Discriminator Range:
0-100%
Upper Level Discriminator Range:
5-125%
Zero Level:
Range 0-100% of full scale input
Coincidence/Anti-Coincidence input

MEMORY

Channels:
1024
Count Capacity:
10^{6}-1 counts/channel

Memory Cycle Time:
  700ns
Memory Groups:
  Full or half memory
Control:
  Add or subtract data

DISPLAY

Built-in 5.1" CRT display:
  Focus and intensity controls
Character Generation:
  Alphanumeric CRT readout of the following data:
   -Elapsed Time
   -Cursor Channel
   -Total Counts in Cursor Channel
   -Integral of ROI (Region of Interest)
Live Display During PHA Collect
Horizontal:
  Memory Size: Full, first half or second half
  Compare: Overlay display of halves
  Expand: Expansion of X2 or X5
  Position: Roll control to view, any portion of memory intermediate X5 position
Vertical:
  Scale Factor: 100 to $1x10^6$ counts full scale in multiples of 5 and 10

TIME BASE

Oscillator:
  100KC crystal-clock controlled
PHA Mode Preset Stop:
  Live or clock time: 1 to $1x10^5$ seconds with multiplier of 1, 2, 4 or 8
  Counts in any channel of spectra or any channel of interest: 1 to $1x10^5$ counts with multiplier of 1, 2, 4 or 8
MCS Mode:
  Dwell Time: 10 uSec to 1 sec with multiplier of 1, 2, 4 or 8
  Input: Positive TTL pulse, 50ns minimum compatible with SCA output
  Input Count Rate: 10 MHz
  External MCS Channel Advance Standard

OUTPUT

X-Y Plotter:
Analog output 0-5V full scale
Select region(s) may be plotted
Line plot speed selectable via MCS dwell time control
Point plot interface standard
X & Y calibrate full scale standard

PHYSICAL

Dimensions:
10"H x 11 1/8"W x 15"D
Weight:
24 lbs.
Line:
115/230V AC, 50/60 Hz, 90 Watts

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SECTION II
DESCRIPTION OF OPERATING CONTROLS

POWER is an ON/OFF toggle switch for applying AC power to the IT-5300 analyzer.

FOCUS is a one-turn potentiometer for sharpening the display dots.

INTENSITY is a one-turn potentiometer for controlling the brightness of the displayed information.

I/O is a lighted push ON/OFF button for activating the selected function of the MODE control.

MODE is a rotary switch just above the I/O pushbutton. When in the I/O mode, the I/O MODE selects the following functions:

PLOT/PRINT enables the readout device connection to the X-Y recorder connector on the rear panel of the IT-5300. Compatible devices are X-Y recorders, point plotters or parallel printers (optional). For detailed hookup, refer to Section III, System Setup for PLOT and PRINT.

TTO enables the teletype when connected to the rear panel connector. The print format consists of a four-digit address in the left column with five channels of six-digit data per line.

TTI enables a readin to the memory from a teletype ASR-33 punched paper tape, previously readout via the teletype. (For readin factor, see PRESET and MULTIPLIER SWITCH.)

INTEGRATE integrates intensified data area and displays results on the alphanumeric display. With multiple region option, the area to the right of cursor will be integrated and displayed.

VERTICAL SCALE is a nine-position switch which selects a three decade range of the 10^6-1 memory data. Ranges are from 100 to 1,000,000 counts full scale in multiples of 5 and 10.

HORIZONTAL POSITION is a one-turn control, with a position range for moving the right-hand address (1024) to the left side of the display screen. When used in conjunction with the EXPAND (X1), (X2) and (X5) toggle, the following scales are available:

EXPAND (X1) is full horizontal display scale displaying channel zero to channel 1023.

EXPAND (X2) is operated in conjunction with the MEMORY switch. With the MEMORY control set in the 1/2, 2/2 or FULL position, then HORIZ (X2) will display as follows:

MEMORY: 1/2 - (X2) will display the first half of the memory in full horizontal scale.

MEMORY: 2/2 - (X2) will display the second half of the memory in full horizontal scale.

MEMORY: Compare - (X2) overlays first 1/2 on second 1/2.

EXPAND (X5) position expands the horizontal display by a factor of 5. Therefore, any block of 205 channels may be displayed full scale by utilizing the (X5) position in conjunction with the HORIZONTAL POSITION control.

INTEGRATE MODE consists of the following controls: CURSOR, plus the options FLAG, ERASE and START/STOP.

FLAG ERASE/ON/OFF toggle control for clearing the region(s) of integration or any other region that was set up.

START toggle position, when depressed, intensifies the channels to the right of the cursor, defining the start of the region to be intensified.

STOP toggle position, when depressed, de-intensifies the channels to the right of the cursor, defining the stop channel of the ROI.

NOTE: The cursor must be moved between the Start and Stop toggle operation for defining each region. After region is set, cursor is free for other operations, except when multiple ROI option is on. Then, cursor is used to define which ROI is to be integrated or readout. All channels between the Start and Stop locations will be intensified for ease of viewing.

The INTEGRATE MODE function enables the user to select region(s) of interest within an accumulated spectrum for total count determination and readout. (For an explanation of the required procedure in setting up a region of interest, please refer to Section III, MODE: INTG.)

CURSOR is a ten-turn potentiometer which positions the cursor bar for reading the channel number and data information displayed on the CRT. By turning the CURSOR control, the vertical cursor bar is moved along the spectrum and defines any channel. The selected channel number and counts are simultaneously read out on the CRT. This function operates in both the COLLECT and I/O modes. The alphanumerics and cursor may be extinguished by turning the cursor off scale to the right side.

COLLECT is an illuminated push on/off control for activating the two data acquisition functions of PHA and MCS.

PHA/MCS is a two-position toggle switch, which selects either the Pulse Height Analysis (PHA), or the Multichannel Scaling (MCS) modes.

PRESET (A) control operates in conjunction with the (SEC/CTS) toggle and the multiplier PRESET (B) switch. It permits the selection of the desired termination time or count in the PHA mode. This control selects a preset second or count. When used with the PRESET (B), there will be provided intermediate preset seconds or counts up to 800,000 units. (For setup, refer to Section III.) When ROI is selected, termination of counts will be ruled by the first channel to reach the preset value in the ROI.

PRESET controls (with the PHA/MCS toggle switch in the MCS position), selects the appropriate dwell time per channel in the MCS mode. The range is from .01ms to 1 second per channel, with the PRESET (B) of 1, 2, 4 and 8. EXAMPLE: Preset (A) x (B) x 10us = dwell per channel.

LIVE/CLOCK toggle switch allows selection of either CLOCK (real) time or LIVE time for preset time stop, in the PHA mode. In the LIVE position, the time base is activated only when the ADC is capable of accepting an event, and is disabled when the ADC is busy (dead time) analyzing an event.

MEMORY CONTROLS

ADD/SUB is a toggle switch that determines whether new data will be added to or subtracted from information contained in the memory.

ERASE is a momentary toggle switch that has two functions:

DATA position will erase all accumulated data in the memory, together with the elapsed time as displayed alphanumerically on the CRT.

TIME position erases only the elapsed time to zero. It does not alter the memory contents.

FULL, 1/2, 2/2, COMPARE is a four-position toggle for digitally selecting full memory (FULL), first half of memory (1/2), second half of memory (2/2) and comparing the first half of memory with the second half by overlaying. The position selected allows display, readout or data storage only in that area of memory. (See EXPAND (X2) on page 8.)

ANALOG-TO-DIGITAL CONVERTER (ADC)

PASSIVE RESTORER is a two-position toggle for controlling the AC coupling and DC condition on the input of the ADC. These two positions have the following functions:

ON accepts either unipolar or bipolar inputs.

OFF enables a DC connection to the ADC from ADC INPUT BNC.

AMP/DIRECT toggle switch operates in conjunction with the ADC INPUT BNC connector as follows:

AMP directs the ADC INPUT signal to the built-in charge sensitive low-level amplifier, which is designed to accept negative current pulses from a photomultiplier tube. This input operates in conjunction with the ten-turn GAIN potentiometer which provides a gain range of 100:1.

Maximum Gain is 4.0V/pico coulomb.
Rise Time is .1 to 5 uSec.
Fall Time is .1 to 5 uSec.
Pulse Duration is .75 uSec minimum.
Input Impedance is approximately 100KΩ.

DIRECT is the direct input to the ADC from the ADC INPUT BNC and will accept a 0-10V unipolar or positive first bipolar signal.

Rise Time is .1 to 5 uSec.
Fall Time is .1 to 10 uSec. (Fall Time to 30 uSec is permissable, but linearity of the lower 5% of the range will be degraded. Coupling may be either direct or capacitive.)
Signal Duration is 1 uSec minimum.
Input Impedance is approximately 1KΩ.

COINC permits the analyzer to be operated in the coincidence mode. TTL Levels: 0 volts disables, positive enables. Pulse duration must cover leading edge to peak of ADC input pulse.

GAIN control is a ten-turn potentiometer for adjusting the correct amplification of the input signal to the ADC. Maximum gain is 4.0V/pico coulomb, or approximately X100 input signal maximum. NOTE: The GAIN control only operates on the AMP input to the ADC.

LLD (Lower Level Discriminator) is a ten-turn potentiometer which sets the lower limit on signals accepted by the ADC. Signals below this lower level are rejected by the ADC and add no significant amount of dead time to the system. The range of the LLD is 0-100% of full scale input.

ULD (Upper Level Discriminator) is a ten-turn potentiometer which sets the upper limit on signals accepted by the ADC. The range of the ULD is 5-125% of full scale input.

ZERO is a 10-turn screwdriver-adjustable potentiometer for calibrating the zero energy intercept of the ADC. The range of the potentiometer is approximately 100% of the full scale input.

DIGITAL OFFSET is a three-position toggle for setting a digital zero of 0 (OFF), 512 or 1024 channels of offset for any converted input signal. NOTE: This control is very useful when ADC conversion is set to 2048 channels of resolution and second 1024 channels of ADC are needed to to be viewed on CRT from memory (use 1024 position on DIGITAL OFFSET). <u>The resolution of the system is doubled in this mode of operation</u>.

GAIN control is a three-position toggle for selecting the conversion range for a full scale input signal of 8 volts. The 512 position should only be used for 1/2 memory modes. The 1024 position is the normal mode for full memory operation. The 2048 position expands the resolution to twice the memory size and must be used in conjunction with the DIGITAL OFFSET switch for storing the first 1024 or second 1024 channels.

SCA output is located on a rear panel connector. (Refer to page ?1 for pin location.) The LLD and ULD (Lower and Upper Level Discriminators) are utilized for SCA and operate at the same level as with the ADC.

SECTION III
SYSTEM THEORY AND SETUP PROCEDURES

PHA THEORY

Pulse Height Analysis (PHA) is a technique for sorting random energy events into a histrogram of energy versus count intensity.

Information from a radioactive material appears as the emission of Gamma radiation, Alpha and Beta particles which are detected by radiation detectors. A typical detector converts the emitted energy into an electrical pulse which has an amplitude proportional to the emitted energy. This is the point at which the INO-TECH 5300 takes over the analysis.

First, each pulse from the detector must be amplified and shaped to be accepted by the IT-5300's ADC. This is accomplished by the internal amp of the IT-5300. If an external amplifier is used, then direct connection is made to the ADC input.

Once the amplified and shaped energy pulse enters the ADC circuitry, the system's purpose is to convert the energy pulse's amplitude to a very accurate digital representation of the energy. This is called energy resolution and is defined as energy per channel. Typically, the more channels available in an analyzer, the better the resolution of the system.

The INO-TECH ADC utilizes the Wilkenson technique for converting the energy pulses. This method monitors the pulse for its peak and once detected, holds the pulse's peak amplitude in a stretcher circuit (storage device such as a capacitor) for further processing. If all of the initial conditions of the ADC are met, such as:

1) Lower Level Discriminator being triggered;
2) Upper Level Discriminator not being triggered;
3) No other event being processed by the ADC.

Then the conversion process is initiated. First a rundown current is switched to the stretcher capacitor and simultaneously a gate is enabled so that the 50 MHz clock can count a binary scaler. This counting continues until the rundown current has discharged the stretcher capacitor to zero volts (energy). At this point, the 50 MHz gate is disabled and the binary scaler now has a digital number in it proportional to the amplitude of the energy pulse. The scaler number, after being stored in the memory section, will then become the channel number seen on the display.

For each of these energy events converted, a memory cycle is requested by the ADC to store one count onto the previous counts, at that channel in the memory. After many random energy events have been recorded, a spectrum will result on the display, from the information stored in the memory. This spectrum will enable the user to identify the radioactive material being presented to the detector.

PHA SETUP OF ADC (Functions)

The procedure described below sets the ADC for direct analysis of the signal range from threshold to full scale. The ZERO level has been factory adjusted for roughly 0-0 intercept, and the LLD is set for maximum sensitivity. (Refer to Section I, Description of Operating Controls for further description of control settings.)

1) Turn on power switch located on the control panel and turn off I/O or COLLECT, if on.
2) Set AMP/DIRECT toggle to the appropriate position.
   A) The AMP INPUT provides maximum gain of 4.0V/ pico coulomb.
   B) The DIRECT INPUT accepts 0-10V input signal. Signal must be unipolar or positive first bipolar.
3) Set the Passive Restorer to ON (AC coupled).
4) Set the Upper Level Discriminator (ULD) full clockwise (1000).
5) Set the Lower Level Discriminator (LLD) approximately one-quarter turn from full counter clockwise position (020).
6) Set the GAIN to 1024.
7) Set the DIGITAL OFFSET toggle to OFF.

PHA SETUP OF CONTROL (Functions)

For ease in calibrating and having an uninterrupted display of incoming information, the following switch settings are recommended:

1) VERTICAL SCALE should be set at 1K initially.
2) Set the HORIZ EXPAND toggle to (X1).
3) MODE should be set at DISPLAY.
4) MEMORY switch should be positioned at FULL and the ADD/SUB switched to ADD.
5) The SEC and CTS toggle should be set for the total elapsed time or counts. The range is from $1\text{-}10^5$ seconds or counts, with multiplier's of 1, 2, 4, 8 or ∞.

6) The LIVE/CLOCK toggle switch should be set at LIVE if corrected time is desired. For (Real) Time, set CLOCK.
7) To collect data, depress the COLL illuminated pushbutton switch. To terminate analysis, depress the COLL pushbutton again.

MCS THEORY

Multichannel Scaling (MCS) is a time sweep of the channels in the IT-5300, with each channel being an interval of time equal to Total Sweep Time/Total Channels Swept.

EXAMPLE:

Sweep Time - 1024 milliseconds
Number of Channels - 1024
Time Per Channel - 1 millisecond

During each channel time interval, the memory contents for that channel (total 10^6-1 count) is available for input data counting in the form of serial digital pulses of either fixed or random rates up to 10 MHz. Thus, the resulting display is a frequency histrogram. The IT-5300 can have time per channels of 10 uSec through 8 seconds.

Typical applications are decay studies, Mossbauer and frequency histrograms. The SCA (Single Channel Analyzer) of the ADC can be used as a count input for decay studies. The most significant address bit is available for driving external equipment in Mossbauer. Digital start command is available for triggered sweeps in frequency histrograms.

MCS SETUP OF CONTROLS

1) Select MCS on PHA/MCS switch.
2) Select time per channel with PRESET (A). (Positions available are 10, 100 uSec, 1, 10, 100 milliseconds and 1 second.) Intermediate steps of 1, 2, 4 and 8 are selected on MULTIPLIER (B) switch.
3) For External Time Base, use EXT on Preset (A) switch. Input for External Time Base is on I/O Connector, Pin 23 and requires a negative pulse (TTL) of 1-5 uSec duration, with a period greater than 10 uSec.
4) Connect Input Count Signal to Pin 22 of Special Signal Connector. The pulses should be positive (TTL) with 50 nanoseconds or greater duration.

5) If SCA output from ADC is used, simply connect Pin 32 to Pin 22 on the Special Signal Connector.
6) To initiate sweep, depress COLL. Sweep will terminate at last channel (1024) and to initiate another sweep, depress COLL again.

I/O THEORY

Once data has been assembled from a PHA or MCS experiment into the memory of the IT-5300, methods must be implemented to readout this data for a permanent record. Methods available are:

1) CRT Display, which gives the operator a visual readout, but not a permanent record.
2) Photographs can be taken of a display which will be a permanent record at a minimal cost.
3) X-Y recorders and plotters will give a permanent record of the display by copying on paper the spectra seen on the CRT.
4) Digital readouts are the most precise form of data retrieval for a permanent record. The IT-5300 is compatible with the ASR Series 33 Teletype, multiple parallel printers and other devices on special request from the customer.

These above mentioned modes are all available in the IT-5300 and are selected by the MODE switch and are activated by the I/O pushbutton.

NOTE: Display flag ERASE/ON/OFF switch must be in the OFF position when there are no flags set.

PLOT SETUP

1) Select PLOT on the MODE switch.
2) If this readout is to recorder or plotter, then the VERTICAL SCALE must be adjusted for spectra size desired on readout. What is seen on the display will be plotted.
3) Set up MEMORY size for FULL, 1/2, 2/2. If 1/2 or 2/2 is used, adjust HORIZ to (X2) for a full display or plot.
4) Connect plotter cable to plotter connector on rear panel of unit. If user is making cable, then connect signals from plotter to match IT-5300 connector signal listing found on Page 22.

5) The IT-5300 has a provision for plotter calibration built into the analyzer. To prevent inadvertent loss of data, the system should be calibrated prior to data collection. Calibration may be performed by:
   A) Set MODE switch to PLOT mode.
   B) Hold I/O pushbutton depressed.
   C) Alternately press and release ERASE DATA switch. This will cause the X and Y plotter signals to switch from 0 to full scale.

PRINT SETUP

1) The IT-5303 Parallel Printer Interface must be connected to the I/O connector located on the rear panel of the IT-5300.
2) The parallel printer must be connected to the printer interface.
3) Select PRINT on the MODE switch.
4) Depress I/O pushbutton on front panel.

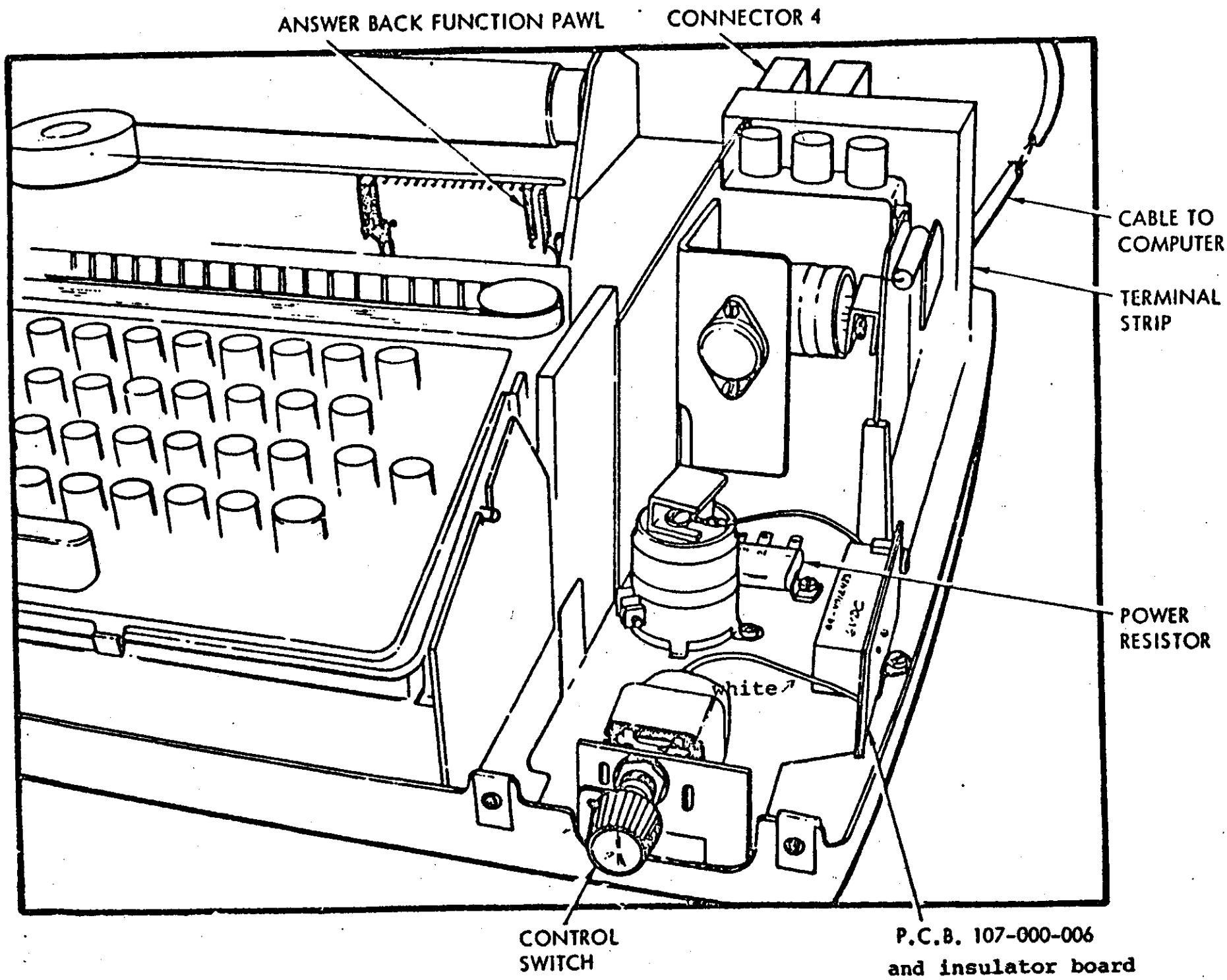
TTY/O SETUP

1) Select TTO MODE switch.
2) Select MEMORY size FULL, 1/2 or 2/2.
3) Connect teletype to teletype connector on rear panel of IT-5300.
4) If teletype was not supplied by INO-TECH, then follow instructions on changes before connecting it to the IT-5300.

TELETYPE INSTALLATION INSTRUCTIONS FOR IT-5300

The standard Teletype ASR-33 Series is wired for 60 milliampere simplex (two-wire) operation. The IT-5300 teletype interface is designed for 20 milliampere duplex operation.

5) If change is to ASR, follow steps outlined below:
   A) Power resistor (see ref. drawing)
      1) Move blue wire on pin 3 to 4
   B) Terminal strip (see ref. drawing)
      1) Move purple wire on pin 8 to 9
      2) Move white and blue wire on pin 4 to pin 5
      3) Move brown and yellow wire on pin 3 to pin 5
   C) Remove answer-back function pawl (see ref. drawing) by first removing spring, allowing pawl to drop, then lift pawl out from rear.
      1) Discard function pawl


ANSWER BACK FUNCTION PAWL
CONNECTOR 4
CABLE TO COMPUTER
TERMINAL STRIP
POWER RESISTOR
white
CONTROL SWITCH
P.C.B. 107-000-006 and insulator board

D) Orange wire on cable goes to terminal block (located under connector block rear to TTY) pin 3
E) White wire on cable goes to terminal block pin 4
F) Green wire on cable goes to terminal block pin 6
G) Blue wire on cable goes to terminal block pin 7

TTY/I SETUP

1) Place previously punched tape into reader head.
2) Select TTI on MODE switch.
3) Select MEMORY size.
4) Select 100 on PRESET (A) switch.
5) Activate I/O mode.
6) Push START/STOP/FREE switch on TTY reader to START position.
7) Strip Function is used only in READIN. The number stripped from or added to the information on tape is determined by position of PRESET (A) switch by the formula:

$$\text{STRIP} = \frac{100}{A}$$

100 = Constant
A = Position of PRESET (A) Switch

8) Background Subtraction:
All TTI functions are the same, except the ADD/SUBTRACT switch, which must be in SUBTRACT position and the PRESET (A) switch must be on the 100 position.

INTG SETUP

1) Place MODE switch to INTG position.
2) Adjust VERTICAL SCALE for best spectra display.
3) If detail of area to be integrated is desired, use (X5) EXPAND and HORIZONTAL POSITION for area setup.
4) ERASE all DISPLAY flags.
5) Turn the control to move the cursor bar to the lower channel of integration region. Momentarily depress DISPLAY START/STOP toggle to START. This will intensify all channels to the right of the cursor bar.
6) Move the cursor bar to the upper channel of integration region. Momentarily depress DISPLAY START/STOP toggle to STOP. This will de-intensify all channels to the right of region. The intensified region will now be the area that the IT-5300 will sum the counts of all channels.

7) To integrate, move cursor to left of intensified region and depress I/O. The integral will appear on the alphanumerics on the display. If multiple regions are set, the unit will only integrate the region directly to the right of the cursor. The cursor must be moved to the left of every region.

IT-5300 PULSE HEIGHT ANALYZER
I/O CONNECTOR
CINCH DE 37S - 37 PIN

PIN	SIGNAL	INTERNAL IT-5300 BACK PANEL NUMBER	DESCRIPTION
1	SERIAL OUT - (GND)	17	
2	SERIAL OUT +	2	20ma loop or RS-232
3	SERIAL IN +	4	20ma loop or RS-232
4	SERIAL IN - (GND)	22	
5	EXT ENA	5	Readout control used with parallel printer interface
6	-12V*	18	Maximum load 25ma
7	+12V*	20	Maximum load 25ma
8	$\overline{\text{PRINT}}$	63	TTL level indicates print mode when at logic Ø
9			
10			
11			
12			
13			
14			
15			
16			
17	$\overline{\text{X BAUD SEL}}$	21	External selection of I/O baud rate. Logic Ø selects high rate.
18			
19			
20	100 KC	3	Output clock signal
21	10 KC	10	Output clock signal
22	MCS INPUT	11	TTL level input for MCS
23	$\overline{\text{EXTMCS}}$ ADV	12	TTL level external sweep advance

IT-5300 PULSE HEIGHT ANALYZER
I/O CONNECTOR
CINCH DE 37S - 37 PIN

PIN	SIGNAL	INTERNAL IT-5300 BACK PANEL NUMBER	DESCRIPTION
24	$\overline{\text{EFMC}}$	13	Memory Erase - GND with switch or open collector for 50ms
25	$\overline{\text{Coll}_C}$	14	TTL level open collector. GND for minimum of 25 uSec to set COLLECT mode.
26	$\overline{\text{Coll}}$		TTL level output COLLECT mode
27	$\overline{\text{I/O}_C}$	16	TTL level open collector. GND for minimum of 25 uSec to set READOUT mode.
28	+5V*	19	Maximum load 100ma
29	$\overline{\text{I/O}}$		TTL level output READOUT mode
30	$\overline{\text{REJ}}$	23	Used with IT-2300 Mixer/Router
31	EXT REJ	26	Used with IT-2300 Mixer/Router
32	SCA	28	Pulse 5 volts high, 1 uSec wide. Pulse polarity optional
33	$\overline{\text{S4}}$	29	Used with IT-2300 Mixer/Router
34	$\overline{\text{S2}}$	30	Used with IT-2300 Mixer/Router
35	$\overline{\text{A9c}}$	31	Used with IT-2300 Mixer/Router
36	$\overline{\text{A8c}}$	32	Used with IT-2300 Mixer/Router
37	GND		System GROUND

*Voltages available in this connector are limited to very low external power drains. Caution should be exercised to prevent overloading or shorting these voltages to other signals.

IT-5300 PULSE HEIGHT ANALYZER
PLOTTER CONNECTOR
CINCH DE9S 9 PIN

PIN	SIGNAL	INTERNAL IT-5300 BACK PANEL NUMBER	DESCRIPTION
1	PLOT COMMAND	9	TTL level signal to point plotter. (± polarity normally in + poisition.) For alternate polarity, see CONTROL schematic.
2	PLOT COMPLETE	8	TTL level signal from point plotter. (+, - or LINE jumper normally in LINE position.) LINE speed is controlled by the MCS time base controls. For alternate jumpers, see CONTROL schematic.
3	PLOT L	6	TTL level signal for PLOT mode. (± polarity normally in - position.)
4	H PLOT (Use twisted pairs)	7	Horizontal analog signal to recorder 0 to +5V nominal levels
5	ANALOG GND (Use twisted pairs)		Ground return for analog signals
6	V PLOT (Use twisted pairs)	1	Vertical analog signal to recorder. 0 to +5V nominal levels.
7	GND		System GND
8			
9			

CRT DISPLAY BOARD

Location:

Directly under CRT.

Purpose:

This board is the interface between the horizontal and vertical circuitry of the 5300 and the CRT.

It contains the following power supplies:

Unregulated	Regulated
+38	+30
-38	-20
+200	+20
+1700	

Schematics for this board are 530B056C-C, sheets 1 and 2.

Refer to Figure 6 for location of the trimpots for the adjustments listed below:

R50 - Dynamic Focus
R57 - Trace Rotation
R60 - H.V. Adjust (normally set at +1700V)
R64 - Geometry
R67 - Dynamic Astig.
R71 - Astig.
R91 - Intensity Range

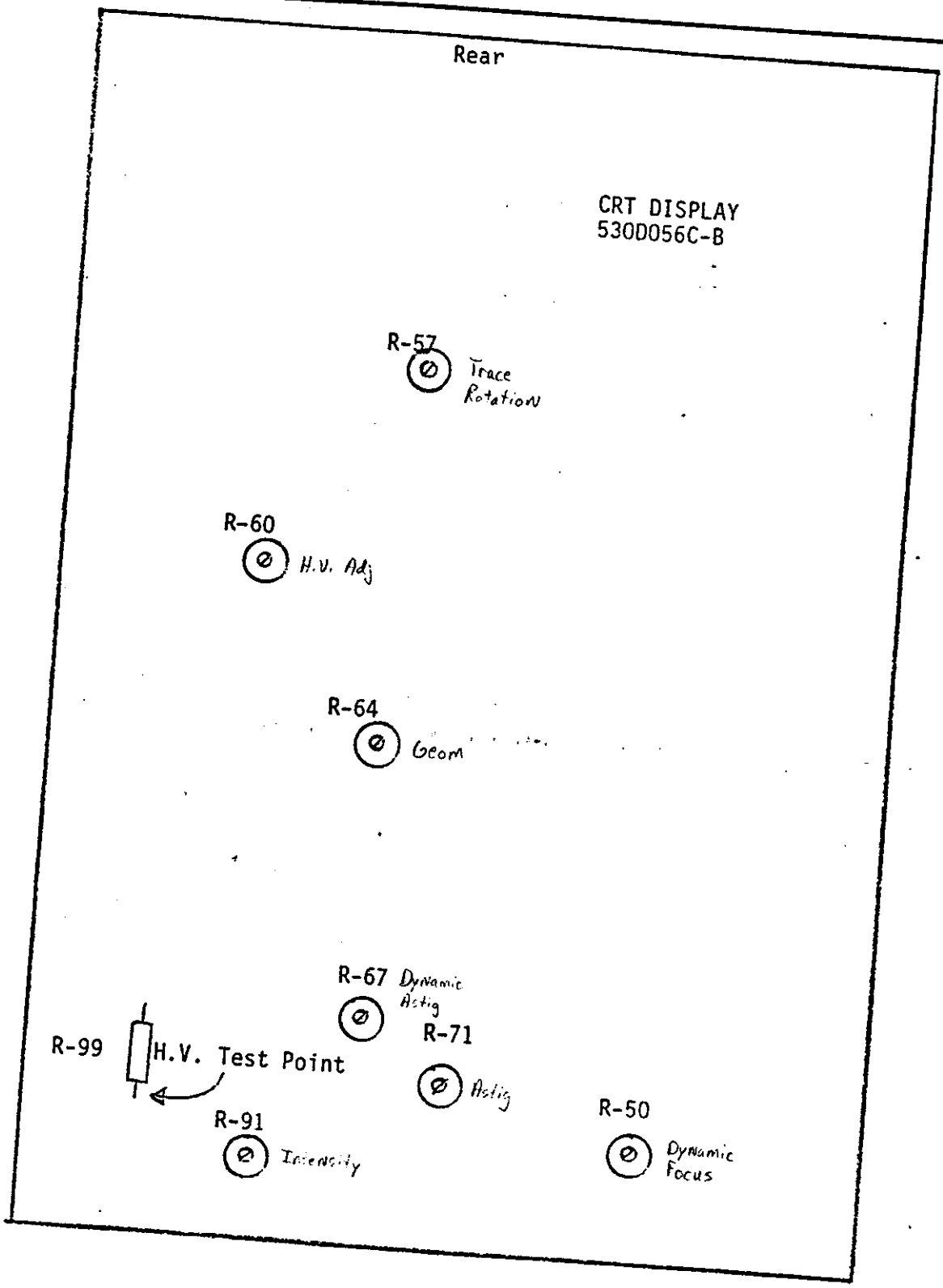
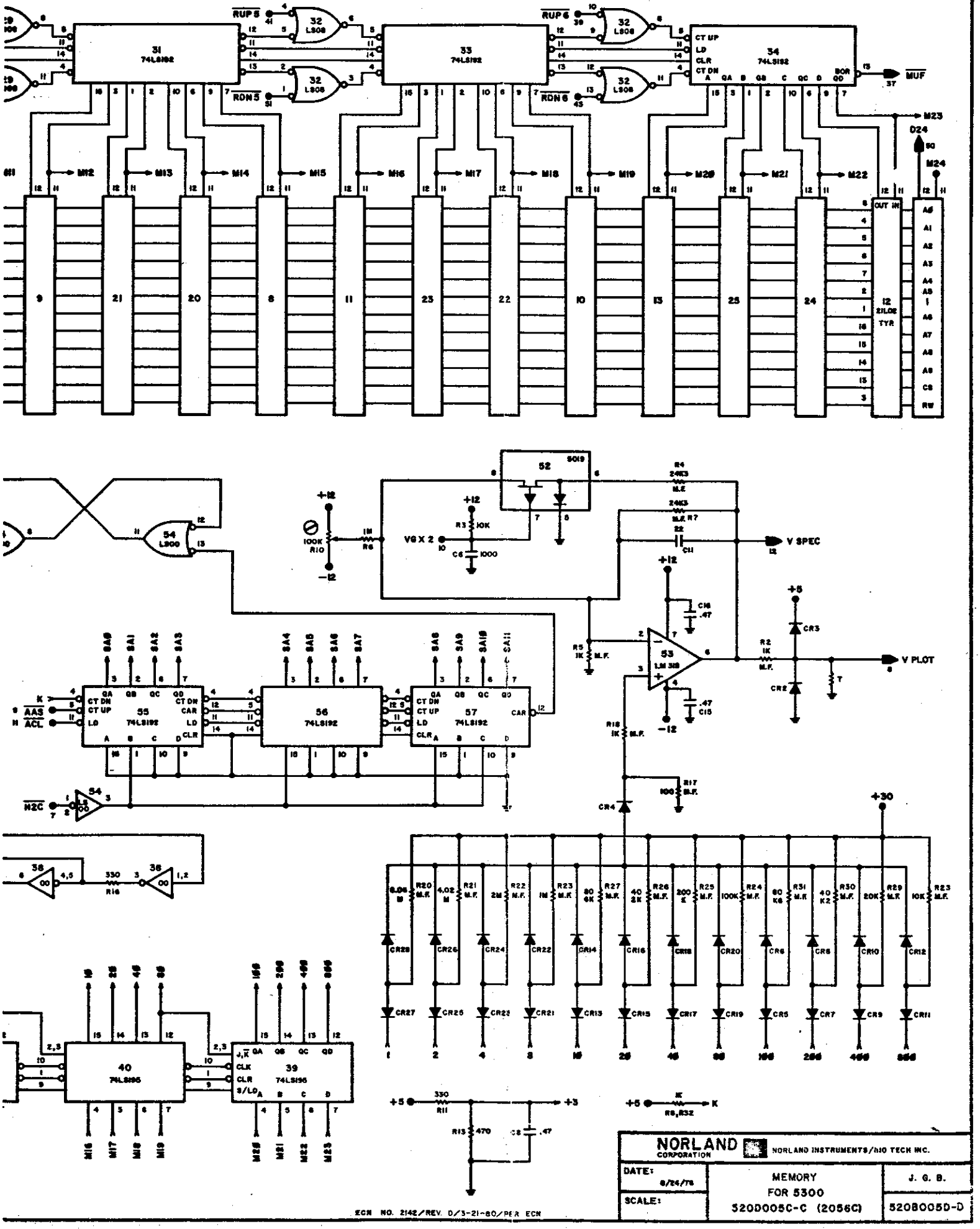
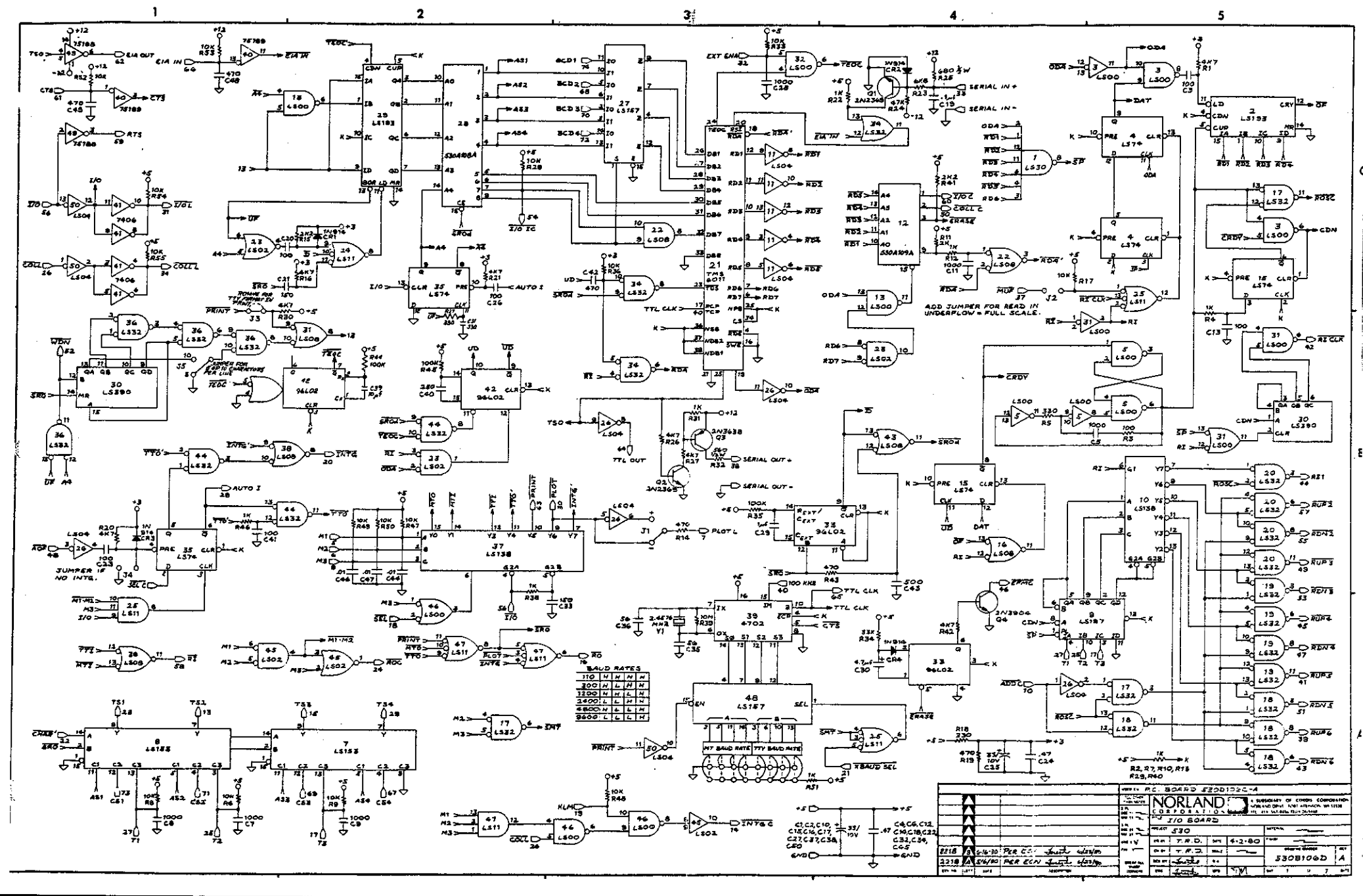

Rear
CRT DISPLAY
530D056C-B
R-57
Trace Rotation
R-60
H.V. Adj
R-64
Geom
R-67 Dynamic Astig
R-71
Astig
R-99
H.V. Test Point
R-91
Intensity
R-50
Dynamic Focus

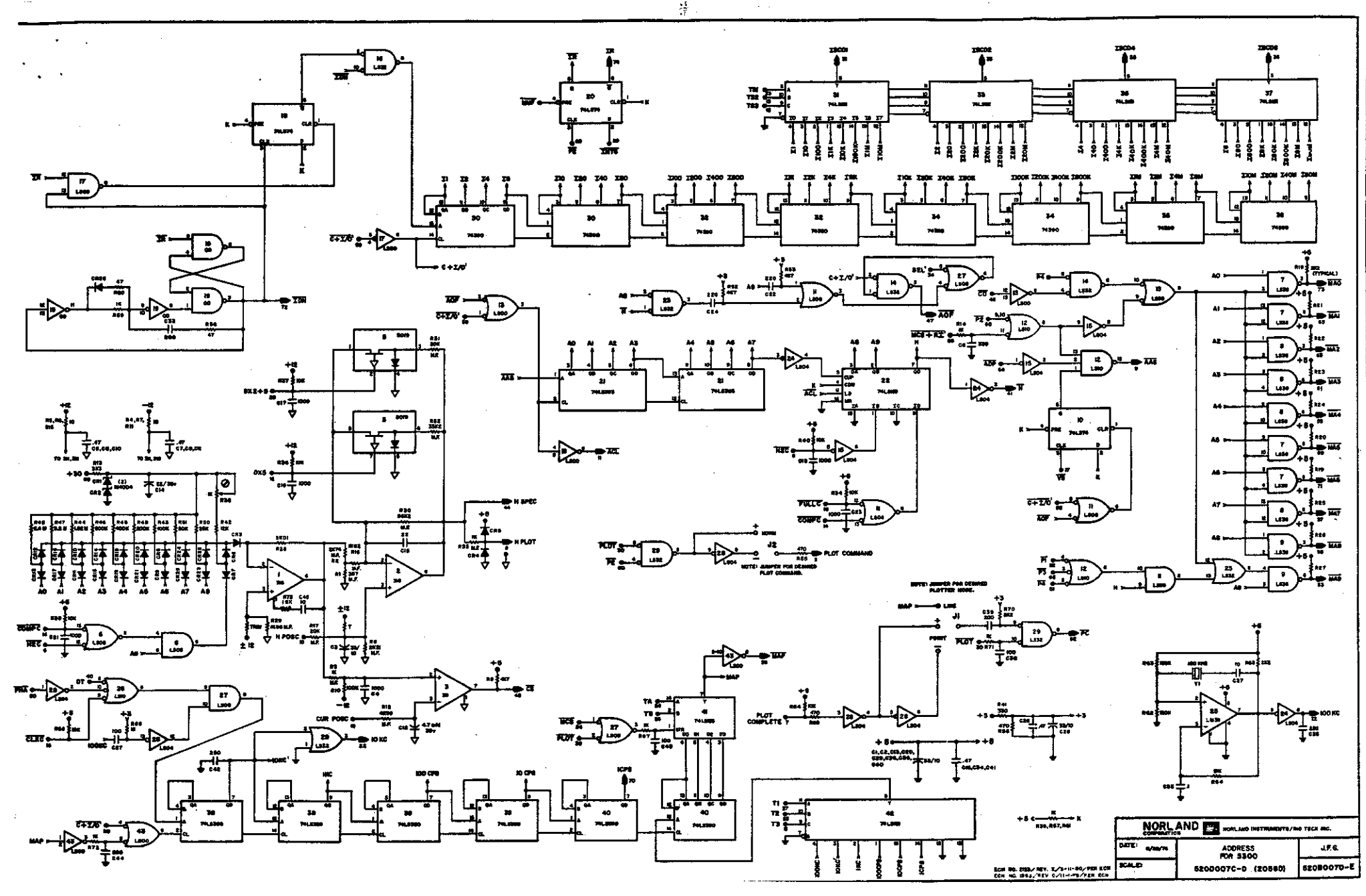
FIGURE 6

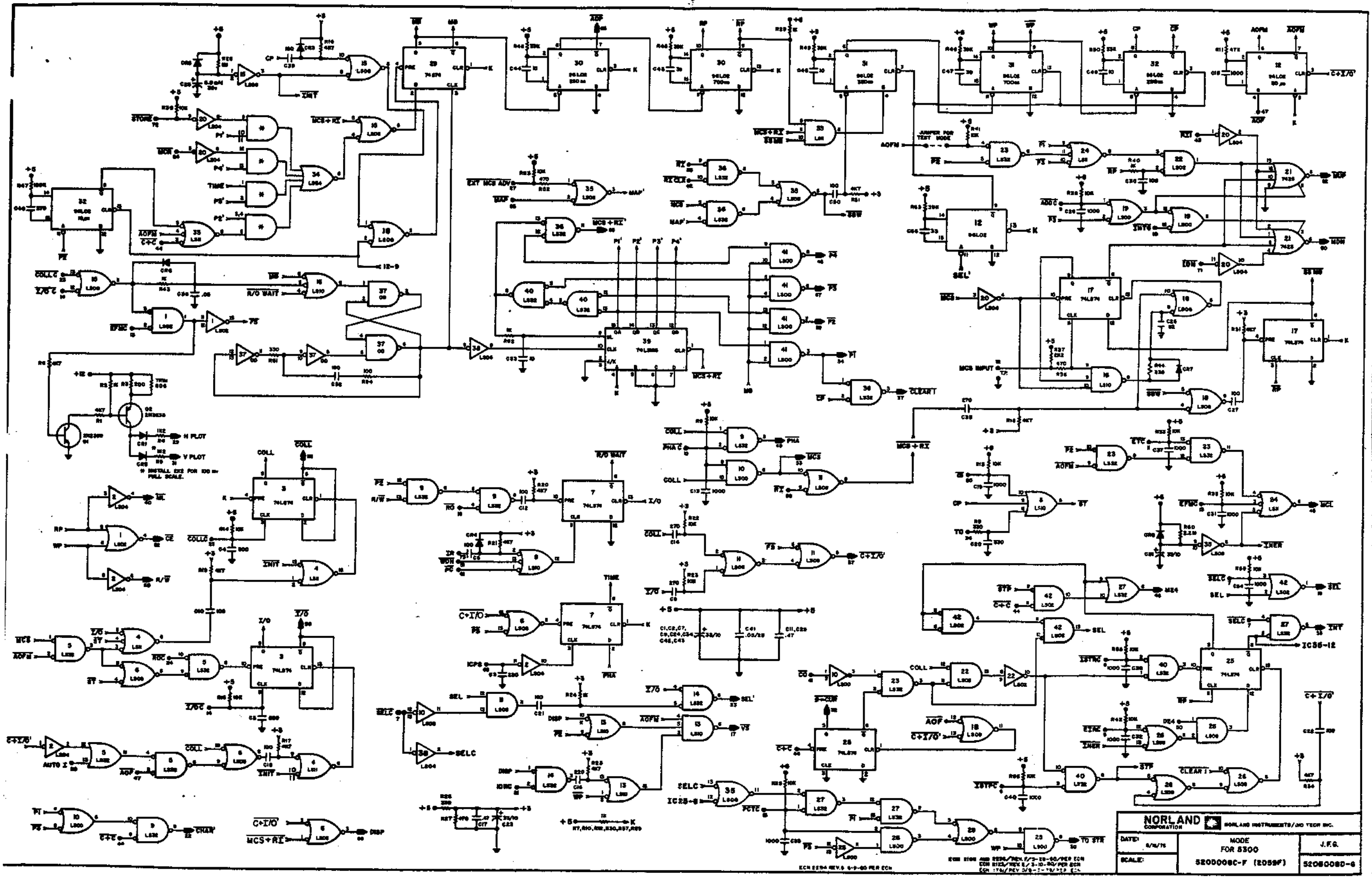


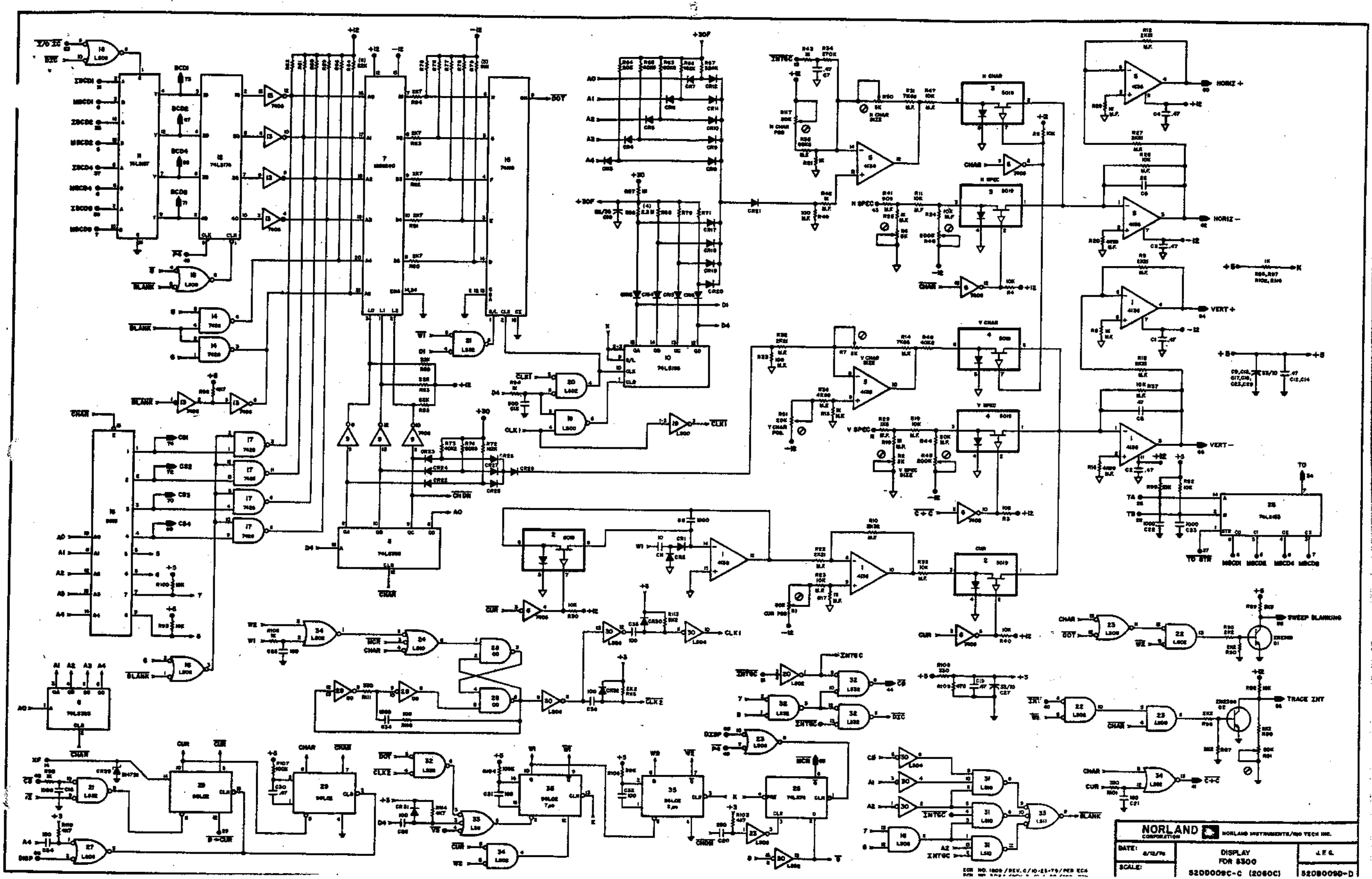
ECN NO. 2142/REV. D/3-21-80/PER ECN

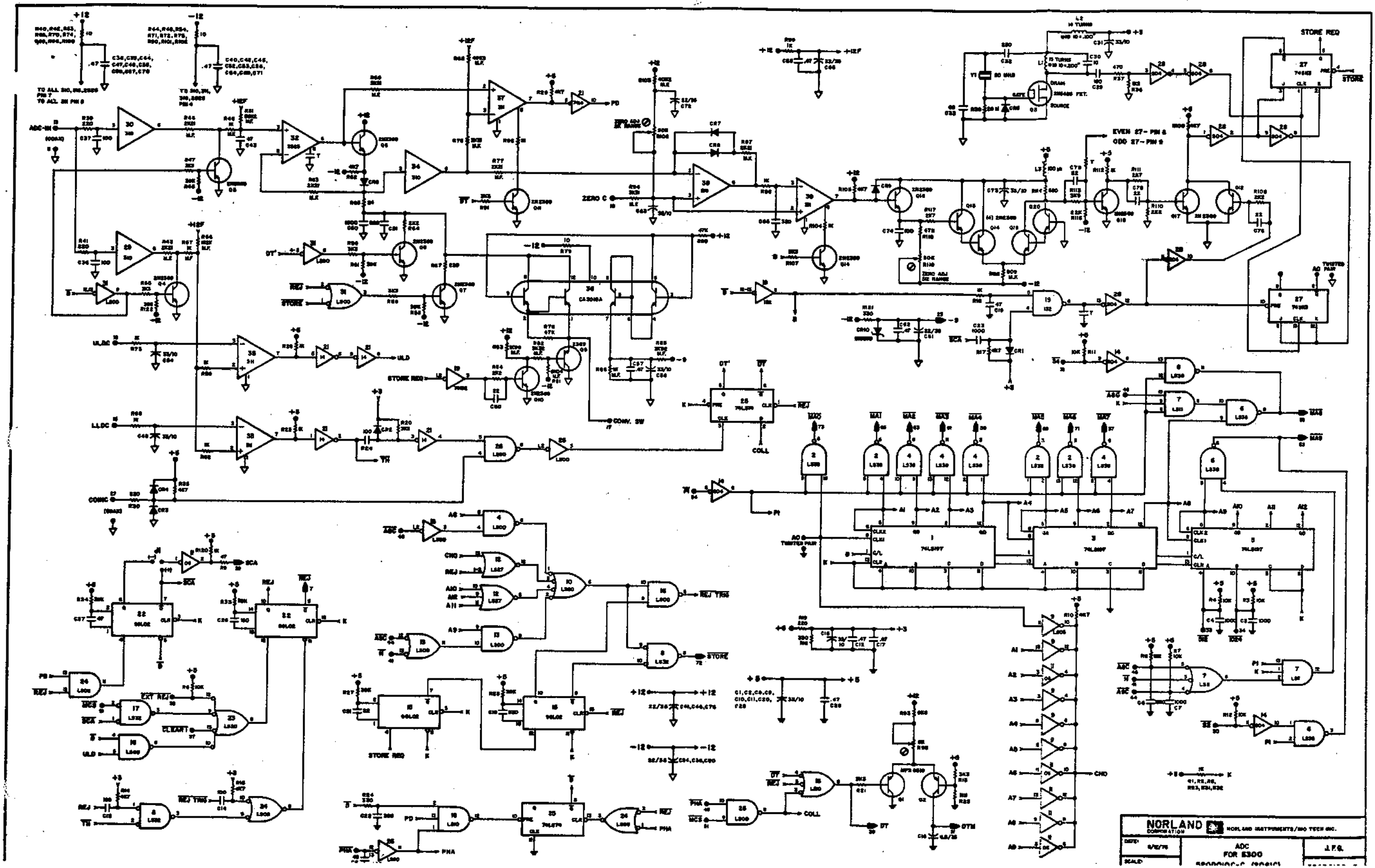
NORLAND CORPORATION — NORLAND INSTRUMENTS/NIO TECH INC.		
DATE: 8/24/78	MEMORY FOR 5300 5200005C-C (2056C)	J. G. B.
SCALE:		5208005D-D

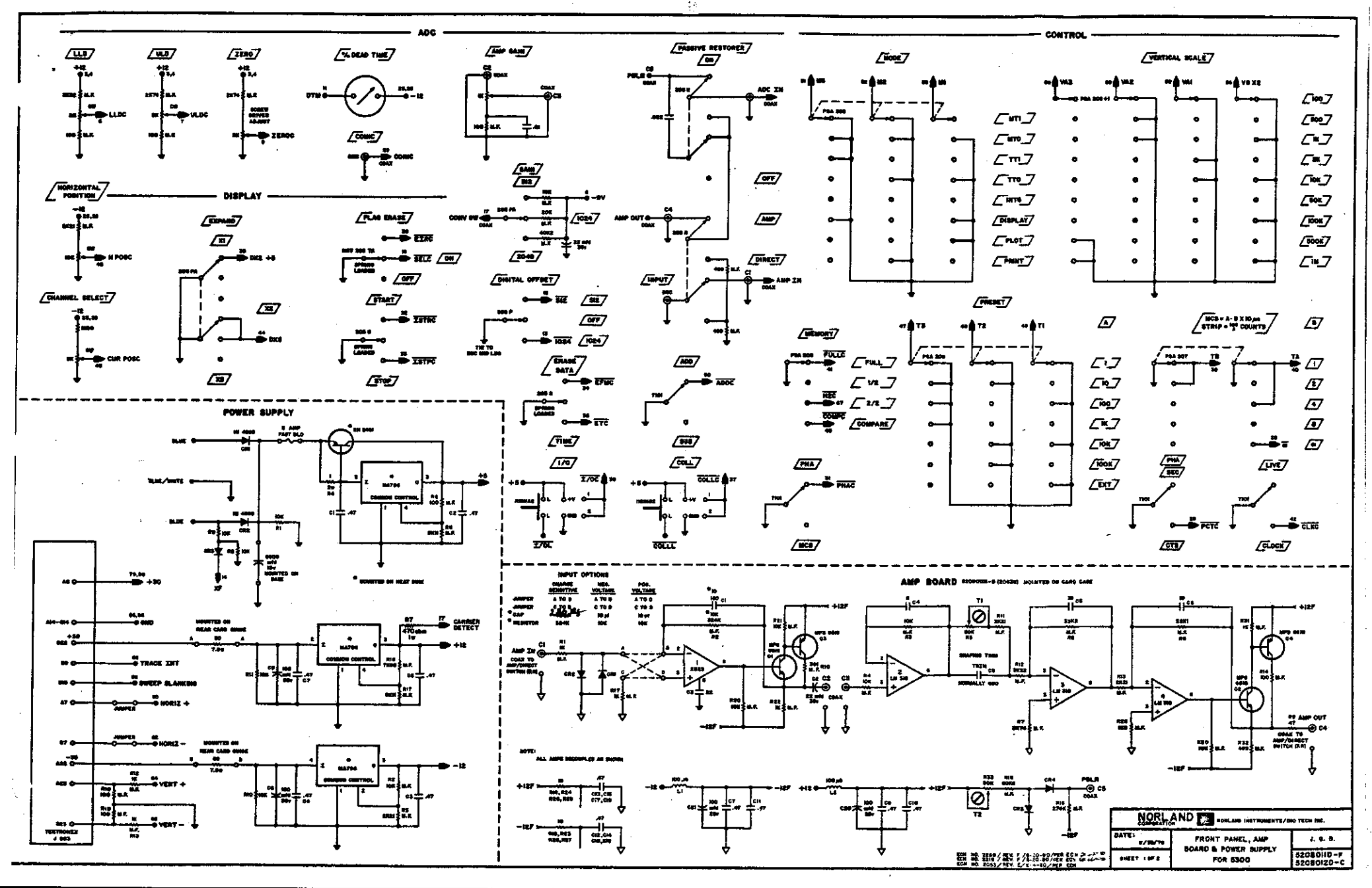

1
2
3
4
5
BAUD RATES
110 H H H H
300 H L H H
1200 H L H L
3400 L L H L
4800 H L L H
9600 L L L H
NORLAND CORPORATION
I/O BOARD
530
T.R.D.
4-2-80
530B10@D
A
PER ECN
PER ECN
ADD JUMPER FOR READ IN UNDERFLOW = FULL SCALE.
JUMPER IF NO INTR.


NORLAND
NORLAND INSTRUMENTS/RAD TECH INC.
ADDRESS
FOR 5300
5200007C-D (20580)
5200007D-E
J.F.G.
DATE:
SCALED:
ECN NO. 2128/ REV. E/9-11-80/PER ECN
ECN NO. 2142/REV C/11-19-80/PER ECN
NOTE: JUMPER FOR DESIRED PLOTTER MODE.
NOTE: JUMPER FOR DESIRED PLOT COMMAND.
PLOT COMMAND
H SPEC
H PLOT
H POSC
CUR POSC
10 KC
100 KC
100SEC
10SEC
1SEC
100 CPS
10 CPS
1CPS
INC
PLOT COMPLETE


NORLAND
CORPORATION
MODE
FOR 5300
DATE:
SCALE:
J.F.G.


HORIZ +
HORIZ −
VERT +
VERT −
SWEEP BLANKING
TRACE INT
NORLAND CORPORATION
NORLAND INSTRUMENTS/RIO TECH INC.
DATE:
SCALE:
DISPLAY
FOR 5300
J. F. G.


NORLAND
CORPORATION
NORLAND INSTRUMENTS/BIO TECH INC.
ADC
FOR 5300
J.F.Q.
ULDC
LLDC
ADC-IN
CONIC
STORE REQ


ADC
CONTROL
DISPLAY
POWER SUPPLY
AMP BOARD
LLD
ULD
ZERO
% DEAD TIME
AMP GAIN
PASSIVE RESTORER
HORIZONTAL POSITION
EXPAND
CHANNEL SELECT
FLAG ERASE
START
STOP
DIGITAL OFFSET
ERASE DATA
TIME
I/O
ADD
SUB
COLL
MODE
VERTICAL SCALE
MEMORY
PRESET
PHA
MCB
INPUT OPTIONS
NORLAND CORPORATION
FRONT PANEL, AMP BOARD & POWER SUPPLY FOR 5300
J. G. B.
5208011D-F
5208012D-C

ADC

Pin		
2	GND	GND
4	+5	+5
6	ANA GND	-
8	ANA GND	REJ
10	+12	ANA GND
12	-12	-
14	ANA GND	ADC-IN
16	ULDC	LLDC
18	ZERO C.	CONV. SW.
20	-	-
22	-	DTM
24	·	-9
26	-	ANA GND
28	ANA GND	COINC
30	S2	SCA
32	EXT REJ	S4
34	1024	512
36	GND	GND
38	-	CLEAR1
40	-	DT
42	-	H
44	A9C	-
46	ABC	-
48	-	-
50	-	PHA
52	-	MCS
54	PI	MA9
56	-	MA8
58	-	MA7
60	·	MA4
62	·	MA3
64	-	MA2
66		MA1
68	-	-
70	-	MA5
72	STORE	MA6
74	-	MAØ
76	-12	-12
78	+12	+12
80	+30	+30
82	GND P.	GND P.
84	+5	+5
86	GND	GND

BOARD 520D010C-C (2061C)

DISPLAY

		Pin
GND	GND	1
+5	+5	3
MBCD1	MBCD2	5
MBCD4	MBCD8	7
SELC	-	9
V SPEC	-	11
XF	INTGC	13
·	-	15
·	VS	17
-	-	19
·	-	21
·		23
TA	-	25
TB	TO STR	27
-	Ø→CUR	29
-	IBCD1	31
TO	IBCD2	33
GND	GND	35
-	IBCD4	37
INT	IBCD8	39
-	C+C	41
CO	H SPEC	43
-	CS	45
-	-	47
·	P4	49
·	-	51
-	I/O IC	53
TRACE INT	·	55
S. BLANKING		57
HORIZ +	·	59
HORIZ -		61
VERT +	MCR	63
VERT -	DISP	65
CS4	BCD2	67
CS3	BCD4	69
CS2	BCD8	71
CS1	BCD1	73
-12	-12	75
+12	+12	77
+30	+30	79
GND P.	GND P.	81
+5	+5	83
GND	GND	85

BOARD 520D009C-C (2060C)

MODE

GND	GND
+5	+5
ISTPC	EIRC
ISTRC	SELC
PHAC	ADDC
MCS INPUT	ETC
I/OC	EFMC
RO	PCTC
SEL	VS
CS	INTG
CHAR'	10KC
ROC	COLLC
COLL	COLL
AUTO I	EXT. MCS ADV.
TO STR	H PLOT
Ø→CUR	V PLOT
TO	SEL'
GND	GND
INT	CLEAR1
ML	·
RI CLK	CO
C+C	RI1
MCL	P4
M24	AOP
D24	PHA
CE	WDN
PI	MCS
I/O	MAP
RI	C+I/O'
MDN	P2
MUP	PC
MCR	ADP
DISP	MCS+RI'
R/W	P3
	1CPS
STORE	IDN
	IR
-12	-12
+12	+12
+30	+30
GND P.	GND P.
+5	+5
GND	GND

BOARD 520D008C-E (2059E)

ADDRESS

Pin		
2	GND	GND
4	+5	+5
6	H2C	PLOT COMM.
8	H PLOT	PLOT COMP.
10	H POSC	AAS
12	DX5	ACL
14	COMPC	TS2
16	CLKC	TS3
18	FULLC	VS
20	INTG	CUR POSC
22	10KC	T3
24	TA	TS1
26	TB	T2
28	DX2+5	T1
30	PLOT	-
32	-	IBCD1
34	SEL'	IBCD2
36	GND	IBCD4
38	IBCD8	MUP
40	DT	100KC
42		H
44	H SPEC	-
46	CO	CS
48	AOP	AOF
50	PHA	-
52	PI	P4
54	MCS	MA9
56	MAP	MA8
58	C+I/O'	MA7
60	P2	MA4
62	PC	MA3
64	ADP	MA2
66	MCS+RI'	MA1
68	P3	
70	1CPS	MA5
72	IDN	MA6
74	IR	MAØ
76	-12	-12
78	+12	+12
80	+30	+30
82	GND.P.	GND P.
84	+5	+5
86	GND	- GND

BOARD 520D007C-D (2058D)

I/O

GND	GND
+5	+5
M2	M1
M3	PLOTL
ADDC	SELC
V SPEC	V SPEC
INTGC	TS2
RO	TS3
SEL	T3
INTG	KLM
CHAR'	X BAUD SEL
ROC	TS1
COLL	T2
AUTO I	T1
PLOT	TS4
EXT ENA	I/OL
COLLL	SERIAL IN +
GND	GND
SERIAL OUT +	MUF
100KC	RUP6
RI CLK	RUP5
RI1	RDN6
EFMC	RUP4
AOF	RDN4
COLLC	RUP3
WDN	RDN5
I/O IC	RDN3
I/O	RDN2
RI	RUP2
I/OC	RTS
EIA OUT	CTS
TTL OUT	PRINT
EIA IN	TTL CLK
BCD2	CS4
BCD4	CS3
BCD8	CS2
BCD1	CS1
-12	-12
+12	+12
+30	+30
GND P.	GND P.
+5	+5
GND	GND

• BOARD 520D006C-E (2057E)

MEMORY

		Pin
GND	GND	1
+5	+5	3
GND P.	GND P.	5
V PLOT	H2C	7
VG X2	AAS	9
V SPEC	ACL	11
	TS2	13
	TS3	15
	VS	17
	MBCD4	19
	MBCD8	21
	TS1	23
	MBCD2	25
	MBCD1	27
	TS4	29
GND P.	GND P.	31
VA1	VA2	33
GND	GND	35
VA3	MUF	37
ML	RUP6	39
	RUP5	41
	RDN6	43
MCL	RUP4	45
M24	RDN4	47
D24	RUP3	49
CE	RDN5	51
MA9	RDN3	53
MA8	RDN2	55
MA7	RUP2	57
MA4	MDN	59
MA3	MUP	61
MA2		63
MA1		65
R/W		67
MA5		69
MA6		71
MAØ	GND P.	73
-12	-12	75
+12	+12	77
+30	+30	79
GND P.	GND P.	81
+5	+5	83
GND	GND	85

BOARD 520D005C-C (2056C)

FRONT PANEL CONNECTOR

Pin	Signal	Pin	Signal
2	GND	1	
4	+12	3	+12
6	-9	5	LLDC
8		7	ULDC
10	GND	9	ZEROC
12		11	DTM
14	V. SPEC	13	1024
16		15	512
18	V SPEC	17	V SPEC
20		19	SELC
22	+5	21	GND
24	GND	23	GND
26	-12	25	-12
28	S8	27	SPEC'
30	I/OC	29	PCTC
32	ISTRC	31	PHAC
34	EFMC	33	ISTPC
36	EIRC	35	ETC
38	DX2 +5	37	COLLC
40	TA	39	TB
42	CLKC	41	FULLC
44	DX5	43	COMPC
46	CUR POSC	45	H POSC
48	T2	47	T3
50	ADDC	49	T1
52	M2	51	M3
54	COLLL	53	M1
56	VG X2	55	I/OL
58	VA1	57	H2C
60	VA3	59	VA2

I/O CONNECTOR

I.D. GND.

Pin	Signal
1	SERIAL OUT +
2	SERIAL OUT -
3	SERIAL IN +
4	SERIAL IN -
5	EXT ENA
6	-12
7	+12
8	PRINT
9	
10	
11	
12	
13	
14	
15	
16	
17	X BAUD SEL
18	TTL CLOCK
19	TTL DATA
20	100 KC
21	10KC
22	MCS INPUT
23	EXT. MCS ADV
24	EFMC
25	COLLC
26	COLL
27	I/OC
28	+5
29	I/O
30	REJ
31	EXT REJ
32	SCA
33	S4
34	S2
35	A9C
36	ABC
37	GND

PLOTTER CONNECTOR

I.D. (9) (8) (6) (7) (1)

Pin	Signal
1	PLOT COMM.
2	PLOT COMP.
3	PLOT L
4	H PLOT T.P.
5	GND. T.P.
6	V PLOT T.P.
7	GND.
8	
9	

EIA CONNECTOR

Pin	Signal
1	
2	TRANSMIT DATA
3	RECEIVE DATA
4	REQUEST TO SEND
5	CLEAR TO SEND
6	DATA SET READY
7	SIGNAL GROUND
8	CARRIER DETECT
9	
10	
11	
12	
13	BAUD SEL
14	
15	
16	
17	
18	
19	CASSETTE START
20	DATA TERM. RDY.
21	
22	
23	
24	
25	

1821 C 10-18-73 PER ECN, SHT. 2 ONLY

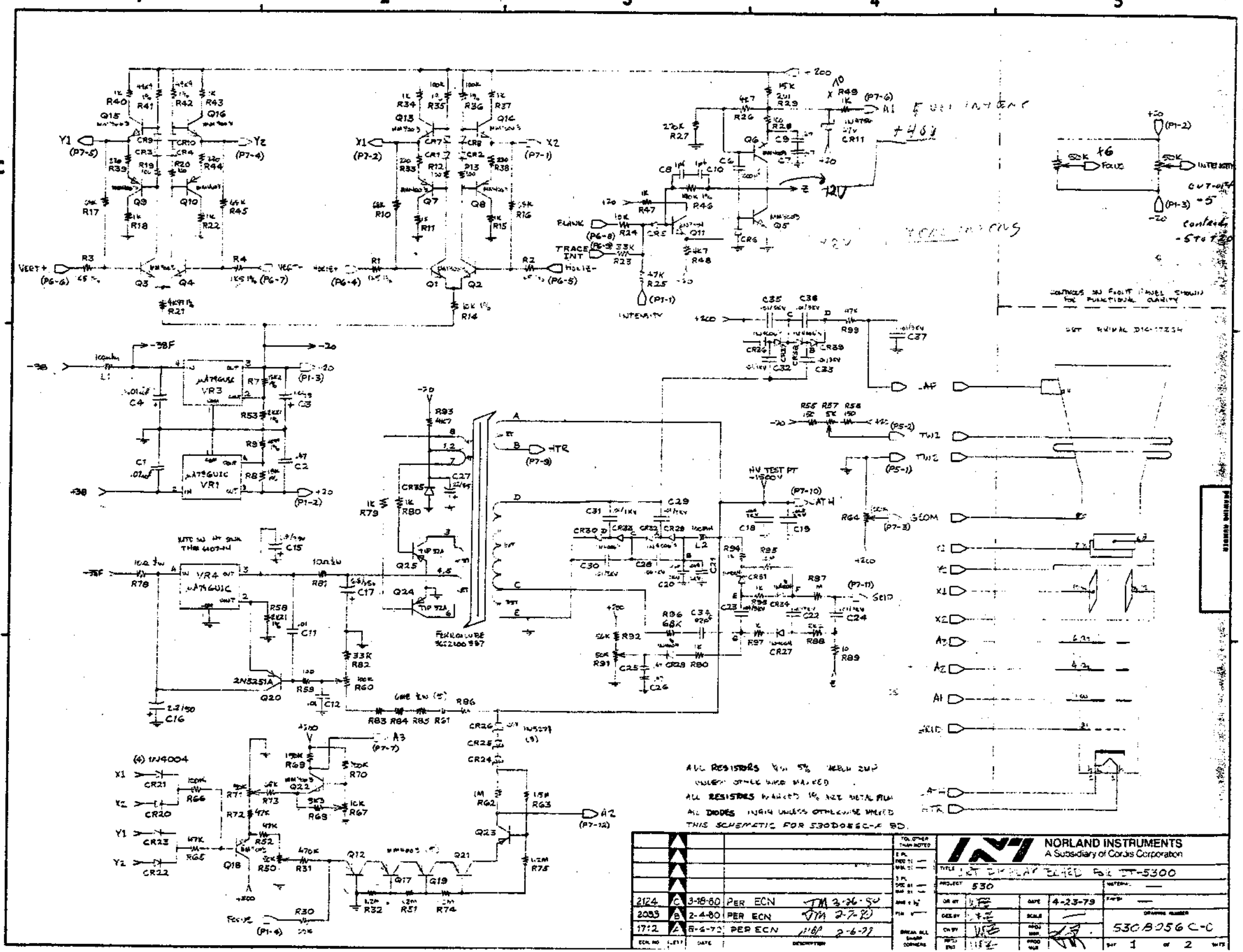
NORLAND INSTRUMENTS
A Subsidiary of Cordis Corporation

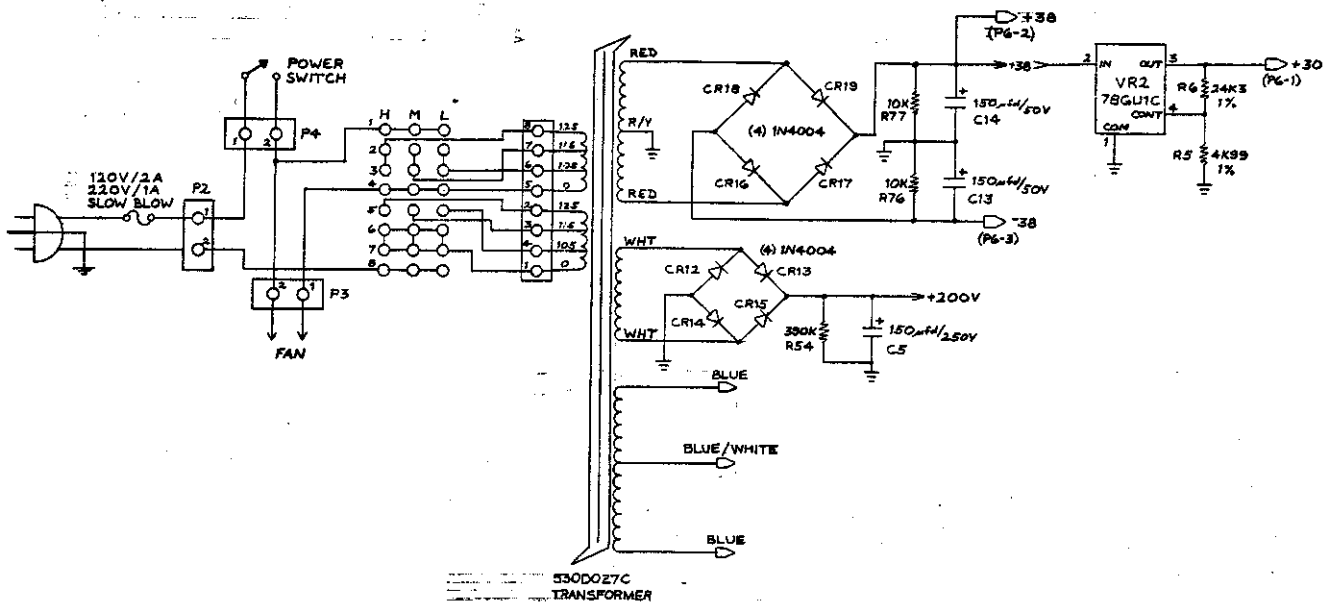
BACK PLANE LISTING FOR 5300

PROJECT 530 — J.P.G. 5-7-73

520B011D-F

SHEET 2 OF 2


1
2
3
4
5
C
B
A
Y1
(P7-5)
Y2
(P7-4)
X1
(P7-2)
X2
(P7-1)
VERT+
(P6-6)
VERT-
(P6-7)
HORIZ+
(P6-4)
HORIZ-
(P6-5)
BLANK
(P6-8)
TRACE INT
(P6-9)
INTENSITY
(P1-1)
+200
+20
-20
-38
-38F
+38
(P1-2)
(P1-3)
(P1-4)
VR1
VR3
VR4
μA78GU1C
FERRACUBE
HTR
(P7-9)
CATH
(P7-10)
HV TEST PT
-1500V
G2
G1
TW1
TW2
GEOM
(P7-3)
(P5-1)
(P5-2)
(P7-11)
(P7-12)
(P7-6)
(P7-7)
A1
A2
A3
X1
X2
Y1
Y2
FOCUS
(4) 1N4004
2N5251A
Q20
Q23
Q18
Q22
Q25
Q24
TIP 32A
ALL RESISTORS 1/4W 5% CARBON COMP
UNLESS OTHERWISE MARKED
ALL RESISTORS MARKED 1% ARE METAL FILM
ALL DIODES 1N914 UNLESS OTHERWISE NOTED
THIS SCHEMATIC FOR 530D056C-A BD.
CONTROLS ON FRONT PANEL SHOWN FOR FUNCTIONAL CLARITY
2124 C 3-18-80 PER ECN
2033 B 2-4-80 PER ECN
1712 A 8-6-79 PER ECN
NORLAND INSTRUMENTS
A Subsidiary of Cordis Corporation
CRT DISPLAY BOARD FOR IT-5300
530
4-23-79
530B056 C-C
1 of 2



USED ON 5300056C-4 B.D.

NORLAND CORPORATION
A SUBSIDIARY OF CODDIS CORPORATION
NORLAND DRIVE FORT ATKINSON, WI 53538
TEL (414) 563-6456 TELEX 26-5448

TITLE CRT DISPLAY BOARD FOR IT-5300

PROJECT 530

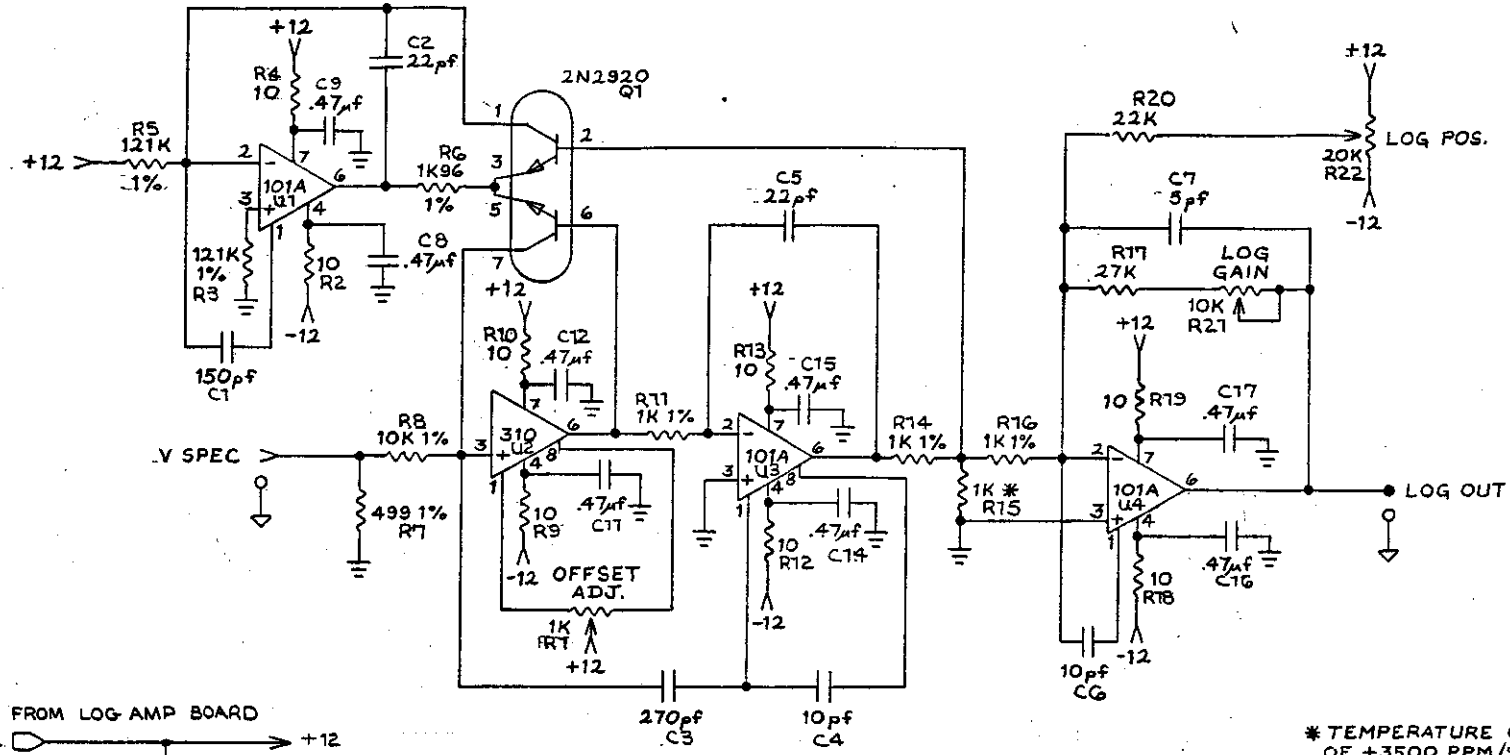
DR BY	T.R.D.	DATE	4-23-79
CH BY		SCALE	NTS
DES BY		O.S.	
ENG		MFG	

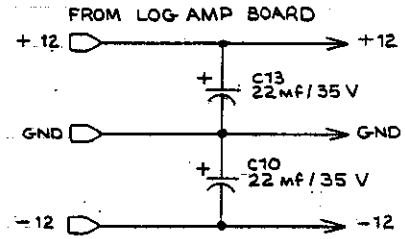
5300056C REV. C

SHT. 2 OF 2 SHTS

UNLESS OTHERWISE NOTED: DIMENSIONS ARE IN INCHES; TOLERANCES: 2 PL. ±, DEC 3 PL. ±, ANG ±°, FIN √; BREAK ALL SHARP CORNERS

ECN NO.	LET'R	DATE	DESCRIPTION





* TEMPERATURE COEFFICIENT OF +3500 PPM/°C

ECN. NO.	LETT	DATE	DESCRIPTION
2125	B	3-11-80	PER ECN
1642	A	7-12-79	PER ECN

USED ON: 530D060A BOARD

TOL. OTHER THAN NOTED
2 PL. DEC ±( ) MM ±( )
3 PL. DEC ±( ) MM ±( )
ANG. ± ½°
FIN. √
BREAK ALL SHARP CORNERS

NORLAND CORPORATION
A SUBSIDIARY OF CORDIS CORPORATION
NORLAND DRIVE FORT ATKINSON, WI 53538
TEL (414) 563-8456 TELEX 26-5448

TITLE: LOG DISPLAY BOARD

PROJECT	530			MATERIAL	
DR. BY	T.R.D	DATE	5-17-79	FINISH	
CH. BY		SCALE		DRAWING NUMBER	REV.
DES. BY		Q.A.		530B060B	B
ENG.		MFG.		SHT. 1 OF 1	SHTS.

WORK ORDER

ELECTRONIC DEPARTMENT

Date: 1 Feb 1984

Budget #: 1172

Work Order #: 3074

Description of Work:

Adequate drawings must be included with all Work Orders.

Design + construct adapter for Norland IT-5300 analyzer to allow repetetive (external) triggering of multi-channel scaling mode (MCS).

Submitted by S. Miller

Approved

****

Brief Description: Adapter for Norland

Estm'd Man-Hrs

ENG :X: 8

DOC : :

FABR :X:

Date Req'd: 13 Feb 1984

Date Cmplt'd:

Done by:

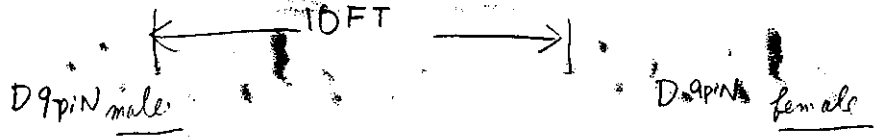
31 Jan 1984

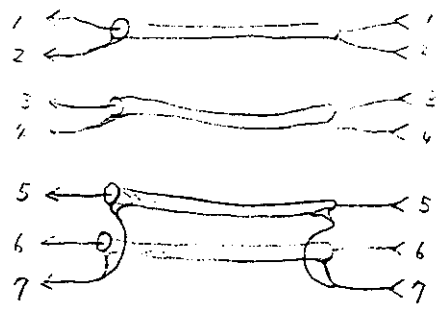
Design + make an adapter for multichannel scaler operation of Norland IT-5300 analyzer.

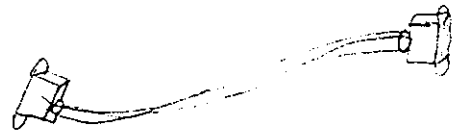
Functions:

- Repetetive sweep triggered by external trigger positive pulse from ion source pulser (BNC connector)
- Count input (BNC connector) Jumper 32-22 Use Front panel BNC input.
- External/internal trigger switch. (Internal trigger from pressing COLL. button on analyzer.)

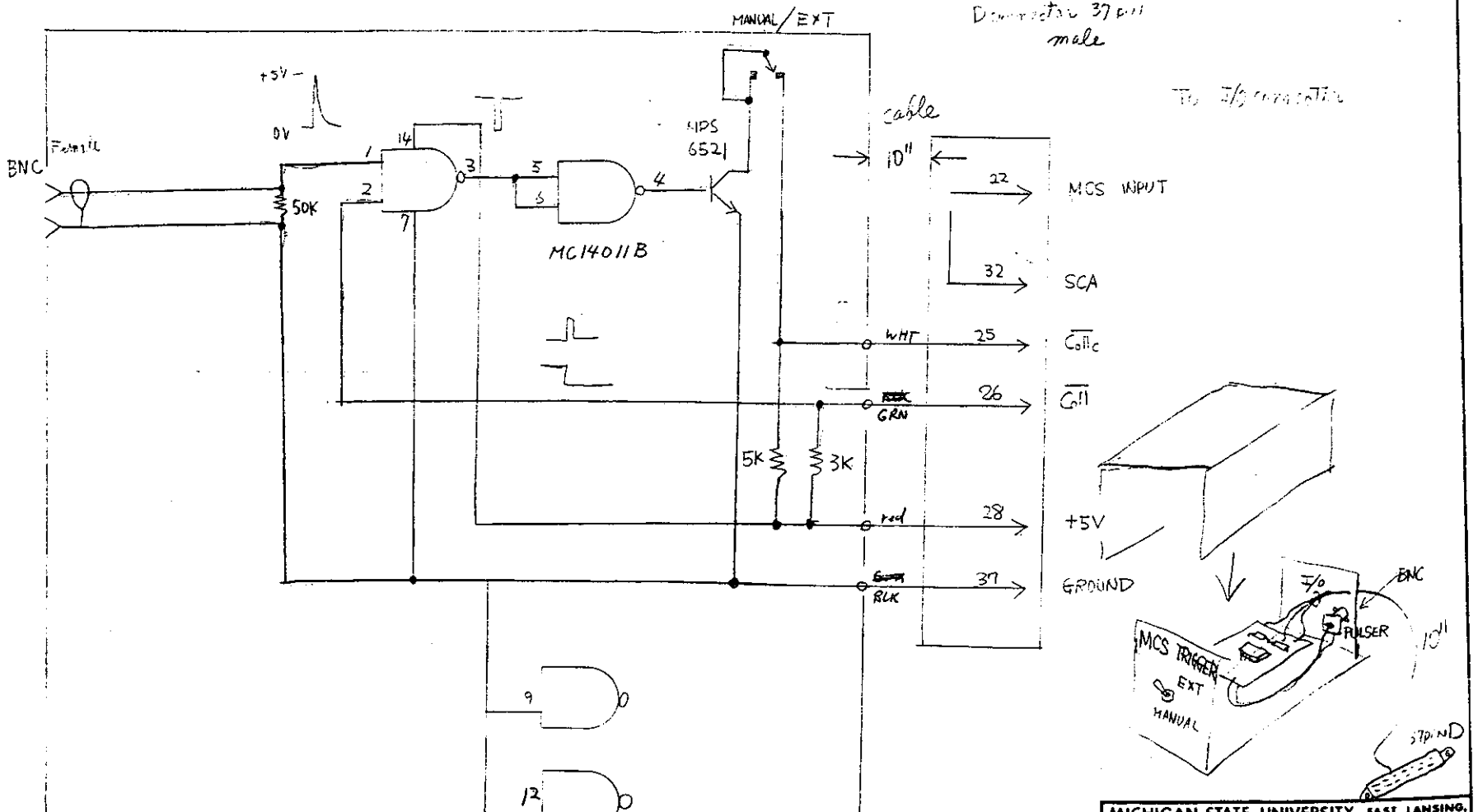
Refer to pp. 14, 15, 20 and 21 of analyzer manual for relevant information.







MICHIGAN STATE UNIVERSITY -CYCLOTRON LABORATORY-		EAST LANSING, MICHIGAN
	SCALE	DSN BY H.H APP'D
TITLE: Shielded Cable		
DATE: 2-7-84	SHEET: 3 of 3	DRAWING NO.

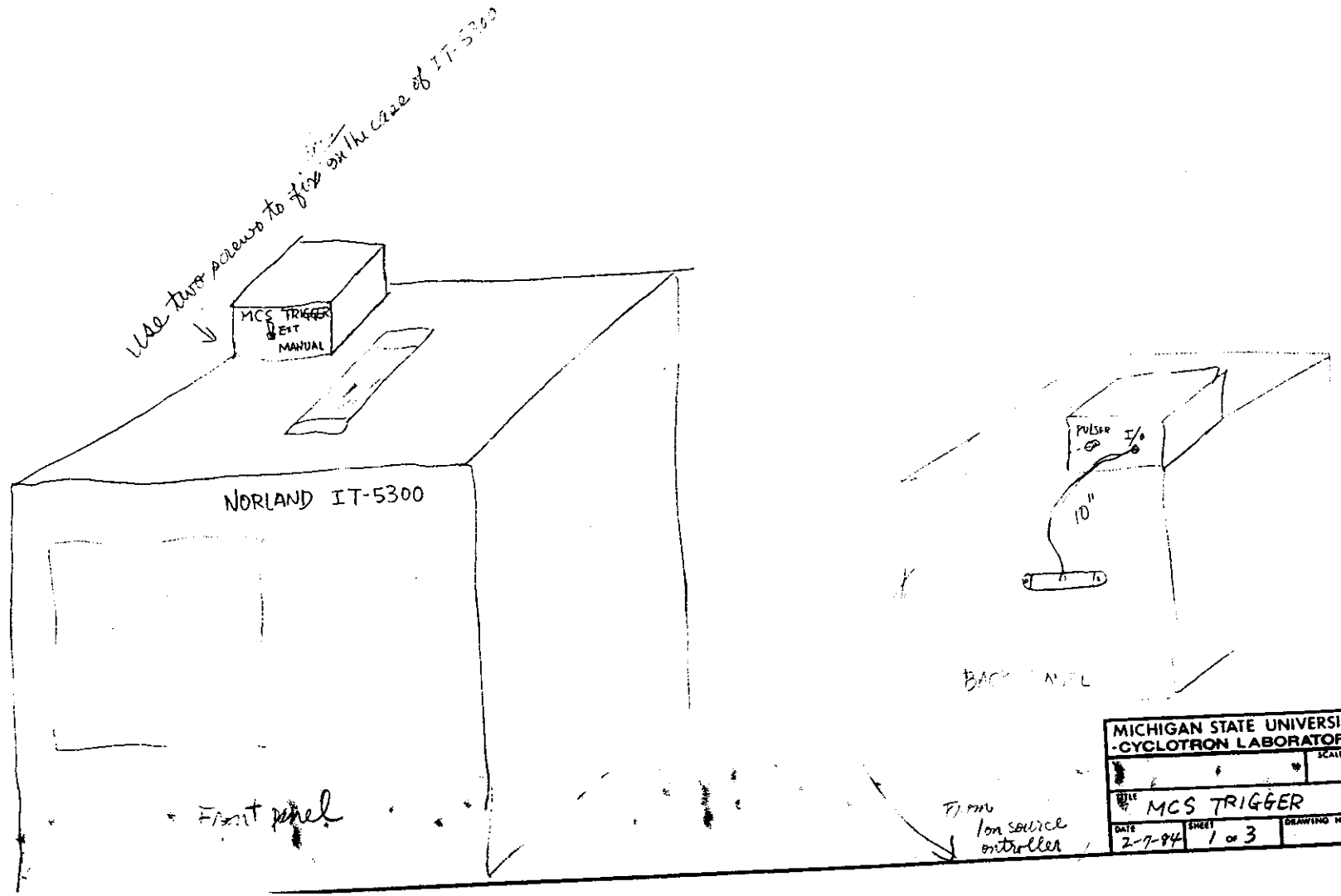


Connector 37 pin male

To I/O connector

MICHIGAN STATE UNIVERSITY -CYCLOTRON LABORATORY- EAST LANSING, MICHIGAN			
SHEMATIC	SCALE	DSN BY HH / APP'D	
TITLE MCS TRIGGER			
DATE 2-7-84	SHEET 2 of 3	DRAWING NO.	REV.

BRUNING 40-22 45265



MICHIGAN STATE UNIVERSITY -CYCLOTRON LABORATORY- EAST LANSING, MICHIGAN

SCALE

DRN BY H.H

APP'D

TITLE MCS TRIGGER

DATE 2-7-84

SHEET 1 OF 3

DRAWING NO.

REV.