SERVICE BULLETIN NO.64

EDITED BY CUSTOMER ENGINEERING DIVISION

MODEL 2262 X-Y DIGITIZER

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WANG LABORATORIES, INC.

MODEL 2262 X-Y DIGITIZER

1. INTRODUCTION

1.1 GENERAL

A digitizer is a device which is used to locate the positions of points on graphic media such as strip charts, graphs, photos, engineering drawings, and other documents, and convert them into digital information (in the form of cartesian coordinates) which can be transmitted to the computer for storage and analysis. The data generated in this way can be processed and analyzed in the computer, stored out on disk or tape for future use, or used to replot all or part of the original document to any desired scale.

1.2 DESCRIPTION

The Wang Model 2262 X-Y Digitizer consists of a hand-held cursor and pen stylus, either of which may be used to trace the data; a digitizer tablet, on whose surface the document to be digitized is placed; a digitizer chassis, containing the power supply and all necessary electronics for the digitizer; and an Interface Controller Board, used to interface the digitizer to the System 2200. A remote audio annunciator is available as an option; the annunciator emits an audible "beep" each time a point is digitized, thus providing audible verification that the digitizer is operating properly.

The cursor and pen stylus, digitizer tablet and digitizer chassis are manufactured by Summagraphics Corporation of Fairfield, Connecticut. The 2200 interface controller board is a 6592 PC which is the Model 2252A interface.

The 2262 Digitizer is available in three models. The Model 2262-1 provides a digitizing tablet 20 inches x 20 inches (50.8 cm x 50.8 cm) in size; the active digitizing area of 400 square inches (2,810 square centimeters) should prove adequate for most applications. For large-scale applications, two larger models are available. The Model 2262-2 offers an active digitizing area 30 inches x 40 inches (76 cm x 101.6 cm) in size; the Model 2262-3 provides an area 36 inches x 48 inches (91.4 cm x 121.9 cm) in size.

Each digitizer is shipped with two digitizing implements, a hand-held cursor with a bull's eye sight, and a pen stylus. The two implements are designed for different types of applications, the cursor being particularly valuable for jobs which demand a high degree of accuracy, while the pen stylus is most useful for high-speed data entry or rough digitizing work where high-speed manual operator movement is desirable. The pen stylus is activated by depressing it against the tablet surface, causing the inner shaft to retract and activate the digitizer logic. Similarly, the cursor is activated with a Z-axis pushbutton. In addition to the standard Z-axis pushbutton, the cursor provides three special buttons called "flag buttons", which also can be used to digitize points. Each flag button generates a standard readout for the point digitized, but also sets a unique flag bit in the first digit of the readout number. The flag buttons are therefore quite valuable for signalling special conditions or operations to the controlling program, such as rolling the axis, termination of job, pen up or pen down on the plotter, etc.

1.3 MODEL 2262 SPECIFICATIONS

Resolution:	100 lines/inch
Linearity:	.08% of full scale
Accuracy:	Less than .01" (.025 cm)
Repeatability:	Less than .01" (.025 cm)
Stability:	Less than .01" (.025 cm)

Repetition Rate:	200 coordinate pairs maximum
Origin:	Lower left corner
Tablet Sizes:	2262-1 - 20" x 20" (50.8 x 50.8 cm) 2262-2 - 30" x 40" (76.2 x 101.6 cm) 2262-3 - 36" x 48" (91.4 x 121.9 cm)
Electrical Requirements:	115 VAC 60 Hz 220 VAC 50 Hz
Operating Environment:	Temperature 50° to 90°F (10° to 30°C) Humidity 20% to 90% Background Magnetic Field 20 gaus maximum

2. INSTALLATION

Remove the digitizer chassis from its shipping box. Remove both the top cover and the bottom access panel on the chassis. Check that the four ribbon cables have not unplugged during shipment. The two ribbon cables that plug into the top of the motherboard come from the power supply and should be taped to the clock card (card in the rear of the chassis) in such a way as to apply pressure to the connectors on the motherboard. The preamplifier and the pulser amplifier ribbon cables plug into the bottom of the motherboard; they have stress bends in them to keep the pins tight in the connectors. Check that the front panel indicator lights are connected; insure that the connector on the rear of the motherboard is secure.

Remove the tablet and magnet from their boxes; place the tablet on a flat surface. Bias the tablet as follows using Figure 1: (Cover tablet surface with paper to keep magnet from marking.)

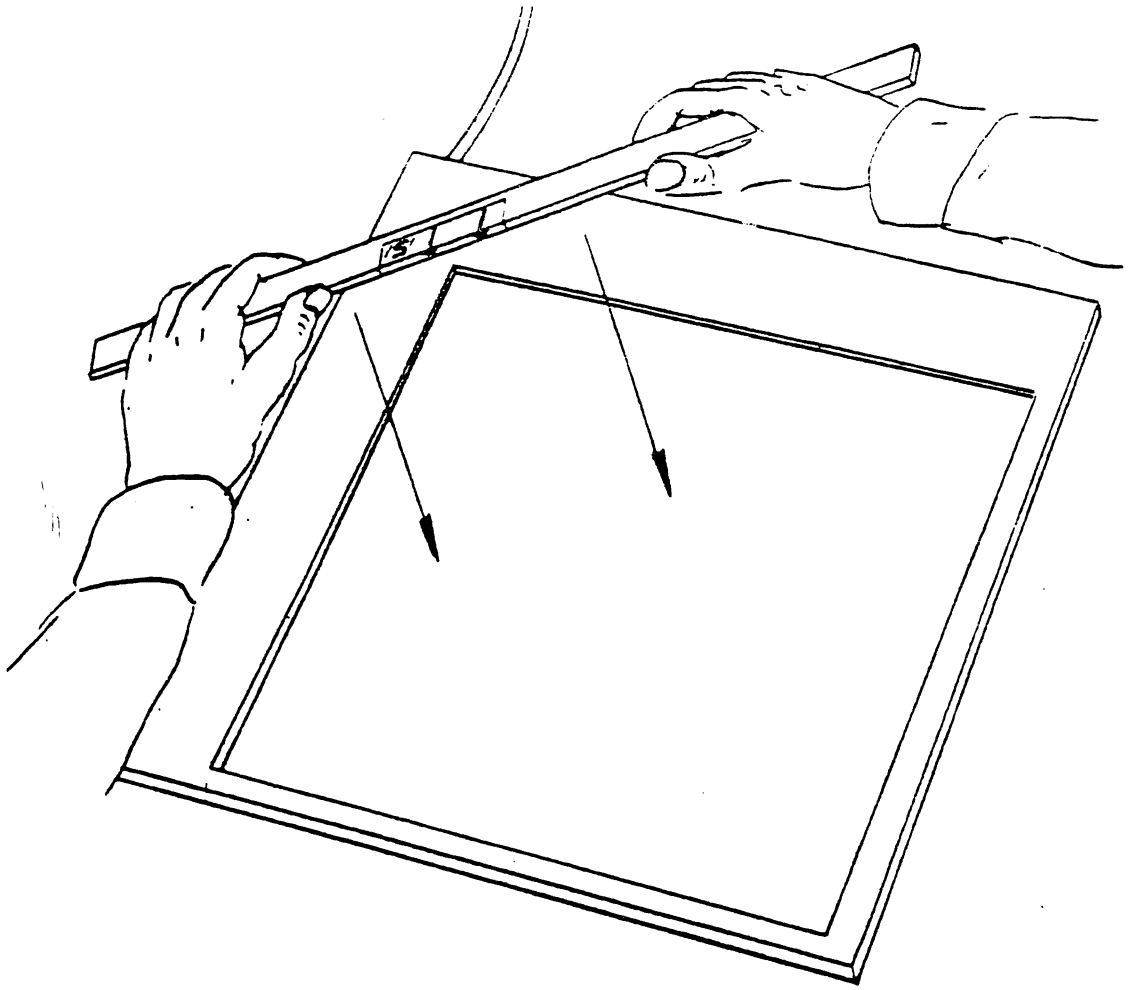


FIGURE 1

1) Hold magnet as shown. Arrows on magnet must point toward the tablet surface.

2) With magnet against surface of tablet, wipe diagonally from upper left to lower right.

3) Once the tablet is biased, the magnet must be removed from the general area of the tablet; do not store magnet near the tablet.

4) Check the 6592 controller board for the proper device address: 5A.

5) Select a 10 digit code by depressing the 8 and 2 data switches on the 6592 board.

6) Select a low input strobe by depressing the IS switch.

7) Insert the 6592 board into an I/O controller slot in the 2200 CPU.

8) Plug the tablet 5 pin male connector into the lower left female connector in the rear of the digitizer chassis.

9) Plug the cursor into the lower right connector on the front of the digitizer chassis.

10) If the annunciator option is included, plug this into the upper left connector on the rear of the chassis.

11) Plug the I/O cable into the 6592 I/O controller and apply power to the digitizer.

12) Run diagnostic test per Section 4.

3. OPERATION

3.1 CONTROLS AND INDICATORS

3.1.1 *Controls*

(a) Power - When pushed in, turns on power.

(b) Single Point, Switch Stream, $\overline{\text{Switch}}$ Stream - Three pushbutton switches used to select one of the three modes of digitizer operation. The switches are ganged so that depressing one button releases one of the others. A brief description of switch operation is:

Single Point - Each depression of the cursor buttons or pen stylus sends one point to the 2200.

Switch Stream - A continuous stream of points is sent to the 2200 when the cursor buttons or pen stylus is depressed.

$\overline{\text{Switch}}$ Stream - A continuous stream of points is sent to the 2200 at all times.

(c) Clear - Momentary pushbutton that resets and clears the digitizer data registers.

(d) Stream Rate Slider Bar - Determines the rate at which the digitizer generates coordinate points when the digitizer is used in the stream modes. In the extreme low position, the rate is approximately 5 points/second; at the extreme high position, the rate is approximately 200 points/second.

3.1.2 *Indicators*

(a) 2200 Ready Light - Illuminates when the 2200 is ready to receive digitizer data. Digitized points cannot be sent to the 2200 unless the light is illuminated.

(b) Range Light - Illuminates when the cursor or pen is positioned to produce a range error. A range error is generated when the cursor or pen is raised more than .25" (.64 cm) from the tablet or positioned on the tablet beyond the extremities of the digitizer grid and an attempt is made to digitize. When a range error is generated, digitizing to the 2200 is inhibited.

(c) Prox Light - The proximity light is the converse of the range light and illuminates when the cursor or pen is within .25" (.64 cm) of the tablet and within the active digitizer grid. The proximity light is inactive in the Single Point Mode.

3.2 DIGITIZING COMPONENTS

3.2.1 *Description*

(a) Four Button Cursor - The cursor contains a bull's eye reticle, a large square Z-axis pushbutton and three smaller FLAG pushbuttons. Single or stream points are primarily digitized by depressing the Z-axis pushbutton. The Flag pushbuttons cause special bits to be transmitted to the 2200 CPU controller along with the digitized data.

(b) Pen Stylus - The pen stylus is similar to a normal pen in shape. The digitizer action is caused by depressing the pen tip against the tablet which causes the inner sensor shaft of the pen to retract 1/32" (.08 cm) and make contact with the digitizer activation logic.

3.2.2 *Physical Characteristics*

The cursor and pen stylus contain a sensing coil which is used to detect changes of flux that occur in the tablet.

3.3 PRINCIPLES OF OPERATION

In order to understand the following explanation of digitizer tablet operation, it is necessary to define several terms that are used in the text.

Domain:	A small subelement that exhibits a state of magnetic behavior. When most domains in a ferromagnetic substance are aligned in the same direction, the ferromagnetic substance is said to be magnetized.
Magnetostriction:	A change in the physical dimensions of a ferromagnetic substance brought about by the alignment of domains (magnetization).
Permeability:	The ability of a substance to become magnetized.
Strain Wave:	A mechanical wave of energy which causes a momentary change in the permeability of a substance and propagates through the substance at the speed of sound appropriate to the material.

The digitizer tablet contains a mesh of magnetostrictive wires (mag wires) spaced .1" (25.4 mm) apart. Two "send" wires are placed on the perimeter of the tablet. See Figure 2. One send wire is X and the other is Y. The X send wire is pulsed with a current. This current pulse causes strain waves to be propagated down all the X mag wires at the

speed of sound. If a coil (in this case, the cursor or pen stylus) is within .25" (6.4 mm) of the tablet surface, it will sense the change in the permeability of the mag wires by the strain waves. Since the speed of the strain wave is known, the amount of time between the current pulse and the sensing of the strain wave can be used to determine the position of the coil in the X direction. Immediately after the X coordinate is determined, the Y send wire is pulsed, and as a result, the position of the cursor or pen stylus on the tablet can be determined.

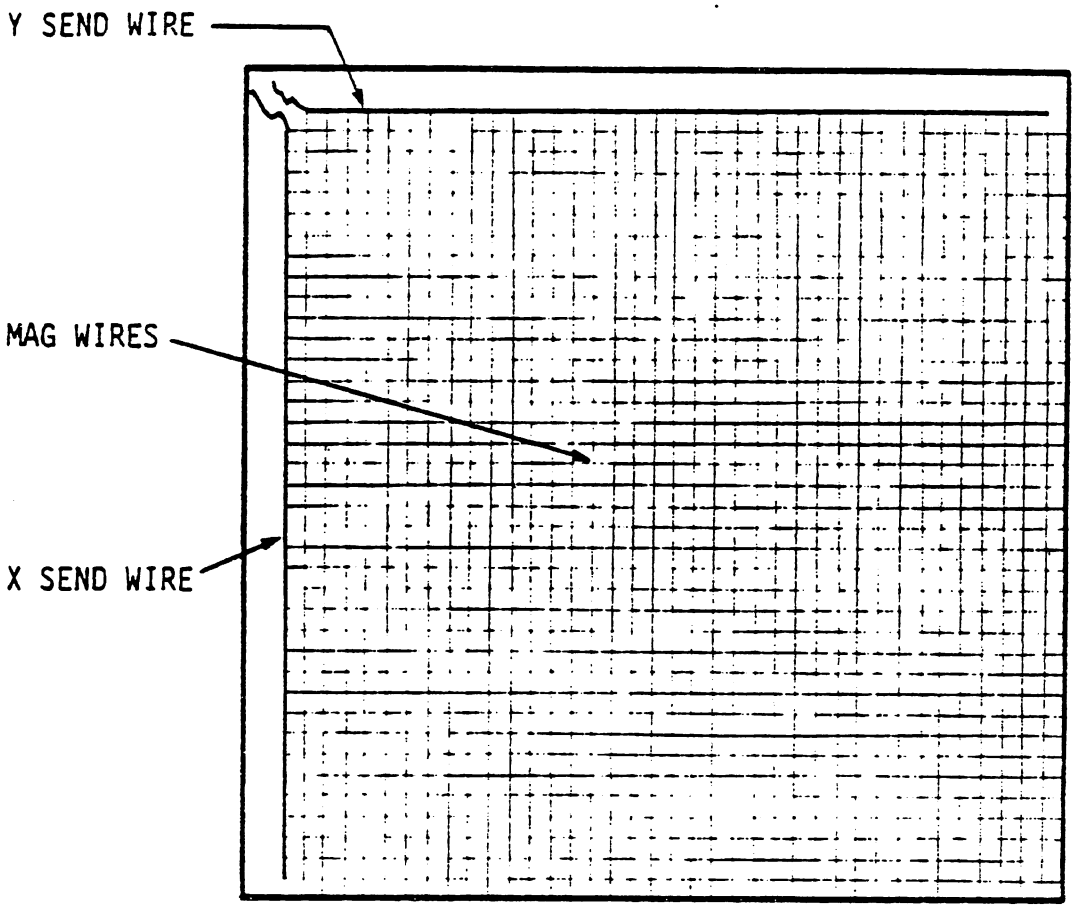


FIGURE 2

3.4 MODES OF OPERATION

The digitizer can be selected to operate in three modes: Single Point, Switch Stream, and Switch Stream. These are selected by depressing one of three ganged pushbuttons on the digitizer chassis front panel. Depressing one button will automatically release the other two. The modes operate as follows:

3.4.1 *Single Point Mode*

When either the Z-axis button, one of the flag buttons, or the pen stylus is depressed, a single point is transmitted to the 2200, if the 2200 is ready. If the 2200 is not ready at this time, the pushbutton or pen must be redepressed when the 2200 becomes ready. The sign of the readout number received will always be plus (+). In addition to the normal X and Y coordinate values, the high order digit of the readout number will be 1, 2, or 4 respectively if the FLAG 1, FLAG 2, or FLAG 3 pushbuttons are depressed on the four button cursor. If the audio annunciator option is available with the system and connected, transmission of the single point to the 2200 will also cause an audio tone. If the cursor or pen stylus is positioned to be in a Range error state, readout of the point is inhibited.

3.4.2 *$\overline{\text{Switch}}$ Stream Mode*

The digitizer will continuously digitize points and attempt to send them to the 2200 at a rate determined by the current setting of the stream rate slider bar (varying from 5 points/second at the low setting to 200 points per second at the high setting). Points will actually be received and processed by the 2200 at a rate determined the control program overhead rate/point. (If a maximum digitize rate is desired, it can be supported with the DATALOAD or DATALOAD BT commands available in the 2200B or the MAT INPUT command available in 2200B option 1.)

In $\overline{\text{switch}}$ stream mode, points will be generated regardless of whether or not the Z-axis/flag pushbuttons or the pen stylus are depressed. They will however, affect the readout data as follows:

1)	Nothing Depressed*	Sign of number always Minus (-).
2)	Z-axis Pushbutton or Pen Stylus Depressed	Sign of number always Plus (+).

*When using the pen stylus, it may often be lifted up more than 1/4" from the tablet. In this case, a range error condition exists and transmission of points is inhibited.

3)	Flag Pushbutton Depressed	Sign of number always Plus (+). In addition the high order digit of the readout number, D0, will be 1, 2 or 4 depending upon whether FLAG 1, FLAG 2, or FLAG 3 is depressed respectively.

NOTE:

The Plus sign or FLAG bits in the D0 digit will remain set as long as the respective pushbutton or pen stylus is held down. Typically, a number of readouts are generally received in this status since the manual action of the pushbutton or stylus is generally much slower than the stream rate.

When the cursor or pen stylus is positioned in a Range error state, the digitizing and readout of points is inhibited. If the audio annunciator option is available with the system and connected, an audio tone will sound each time a point is transmitted to the 2200.

The $\overline{\text{switch}}$ stream mode is a very flexible mode for digitizing curves and other continuous graphical data. One of the advantages of this mode is that readouts are continuously available to the 2200 and cursor action is indicated by the sign change in the readout numbers. Therefore, the 2200 is never hung up awaiting a digitize point. This could be extremely useful if for instance it is desirable to use the special function keys on the 2200 keyboard for auxiliary control functions. (A program loop can test for inputs from both the digitizer and keyboard.)

3.4.3 *Switch Stream Mode*

This mode is similar to $\overline{\text{switch}}$ stream mode in that a continuous stream can be digitized and transmitted to the 2200. It differs, however, in that switch stream is generated *only* when the Z-axis pushbutton, a flag button, or the pen stylus is depressed. The digitized point stream will be available for as long as the pushbutton or stylus remains depressed, and will be inhibited when it is released.

Similar to switch stream mode, the effective rate at which the 2200 accepts and processes points is determined by the overhead rate/point of the 2200 control program. (Again, the maximum stream rate can be supported by use of the DATALOAD BT, DATALOAD and MAT INPUT command.)

In switch stream mode, in addition to the X and Y coordinates of the digitized point sent to the 2200 upon depression of a pushbutton or stylus, the number of readouts will have the following format:

1)	Nothing Depressed	No points transmitted.
2)	Z-axis Pushbutton or Pen Stylus Depressed	Sign of number generally *Plus (+). *NOTE: The sign of the last readout received as the pushbutton or stylus is released may occasionally be Minus (-), because of transient electronic conditions.
3)	Flag Pushbutton Depressed	Sign of number generally *Plus (+) and high order readout digit, D0, generally **1, 2, or 4 depending upon whether FLAG 1, FLAG 2, or FLAG 3 is depressed. **NOTE: The sign may occasionally be Minus (-) and/or the selected flag bit not present on the last readout received as the pushbutton or stylus is released, due to transient electronic conditions.

NOTE:

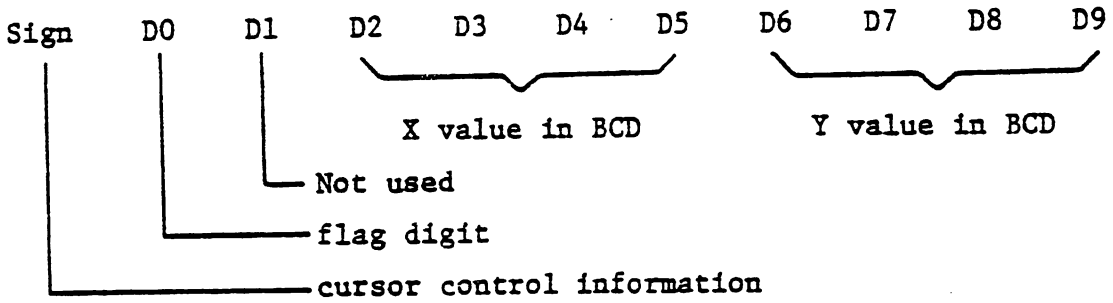
When a Z-axis or flag pushbutton or the pen stylus is depressed, the 2200 will receive a number of readouts since the manual action of the pushbutton or stylus is generally slower than the stream rate.

When the cursor or pen stylus is positioned in a Range error state, the digitizing and readout of points is inhibited, regardless of whether or not they are depressed.

The switch stream mode is useful in digitizing curves and other continuous graphical data when it is desirable that only pertinent digitized points be sent to the 2200.

3.5 DIGITIZED READOUT FORMAT

For digitized output, the 6592 board receives 4 digits for the X value, 4 digits for the Y value, a flag digit and a sign bit. The parallel input to the 6592 interface is as follows:



1. Single point - Always plus (+)
2. Switch stream - Minus (-) when cursor, flag, or pen depressed.
   Plus (+) when cursor, flag, or pen depressed.
3. Switch stream - Always plus (+) except for last point when cursor, flag or pen released.

3.6 TABLET MAGNETIZING

Under normal conditions, it is not necessary to refresh the magnetic bias of the tablet. If a magnet or magnetized article is placed on the tablet, the remanent flux in the mag wires could be altered. This would affect the accuracy of the digitizer. If any inaccuracies should occur, re-bias the tablet per Section 2.

Store the magnet well away from the tablet and any tape cassettes or disk platters.

4. MODEL 2262 DIAGNOSTIC

OPERATING INSTRUCTIONS:

1) Plug cursor into digitizer and place near center of tablet.

2) Select the Switch Stream Mode on the control panel.

3) Load the 2262 diagnostic (See APPENDIX C). RESET, RUN, EXECUTE. The following is displayed on the CRT:

2262 TEST			
SIGN BIT (NEG-NO BUTTONS)	FLAG SWITCH (0,1,2,4)	X-VALUE	Y-VALUE
-	0	XXXX	YYYY
		X LIMITS	Y LIMITS
20 x 20 In. Tablet		0000-1999	0001-2001
30 x 40 In. Tablet		0000-2999	0001-4001
36 x 48 In. Tablet		0000-3599	0001-4801
WHEN TEST IS COMPLETE HIT RESET & SPECIAL FUNCTION KEY 15.			

4) The 2200 should be reading coordinates, the 2200 ready light on the digitizer should be flashing and the proximity light should be on.

5) Depress the Z-axis button. Insure that the sign changes from minus to plus and a set of coordinates is constantly being displayed. Release Z-axis button.

6) Depress Flag #1. Check for sign change and that flag bit changes to 1. Release Flag #1 button.

7) Depress Flag #2. Check for sign change and that flag bit changes to 2. Release Flag #2 button.

8) Depress Flag #3. Check for sign change and that flag bit changes to 4. Release Flag #3 button.

9) Place cursor at left margin approximately in the center of the

10) Select the High Stream Rate. Move the cursor very slowly from left to right checking that X begins at coordinate 0000 and counts in units up to 0009. Check all digits from tens to thousands by continuing to move the cursor toward the right margin. The last count in the X direction is 1999 for a 2262-1.

11) Place the cursor at the bottom margin near the center of the tablet. Move the cursor very slowly from the bottom of the tablet to the top checking that the Y begins at coordinate 0001 and counts in units up to 0009. Check all digits from tens to thousands by continuing to move the cursor up the tablet. The last count in the Y direction is 2001 for a 2262-1.

12) Select the Single Point Mode. Digitize about 5 different points on the tablet by depressing the Z-axis and flag switches randomly while moving the cursor. Check that the sign, flag bit and co-ordinates change each time the appropriate switch is depressed.

13) Select the Switch Stream Mode. While depressing the Z-axis switch, move the Stream Rate Slider Switch from low to high range, checking that the number of points being digitized increases as the slider is moved to the high range.

14) Remove the cursor and connect the stylus to the front control panel.

15) Select the $\overline{\text{Switch}}$ Stream Mode. Check that the sign bit changes from minus to plus when the stylus is depressed on the tablet. Check that coordinates are being read by the 2200.

5. ELECTRICAL COMPONENTS AND TROUBLESHOOTING

5.1 COMPONENTS

The Summagraphics digitizer interior chassis contains:

(a) A power supply mounted on the rear of the chassis that supplies +5VR internally, +5VR externally, +15VR, -15VR and +180VUR.

(b) A motherboard consisting of: 1) Four switch filters to prevent switch bounce transients from the cursor or stylus; 2) A switch bracket for mode selection; 3) A slider pot for number of points/second to be digitized; 4) three front panel lights; and 5) Connectors for 4 PC logic boards.

(c) A pulser circuit mounted to the rear of the chassis under the motherboard with a 5 pin female connector for the tablet.

(d) A preamplifier circuit mounted to the front of the chassis under the motherboard with a 5 pin female connector for the cursor or stylus pickup.

(e) Four PC boards for the logic and timing sequences. From the front to the rear of the chassis, the boards are:

1) Control Board #02-024 - A logic board that controls the switches and indicators on the front panel, the switches on the cursor and controls the clock.

The J1 jumpers on the control board must be set up for the correct size tablet:

(a) For tablets from 11" to 30" wire J1 as shown below:

Pin 1 - 16
2 - 15
4 - 13
6 - 11
7 - 10

(b) For tablets from 30" to 48" wire J1 as shown below:

Pin 1 - 16
2 - 15
3 - 14
4 - 13
5 - 12

2) X Counter Board #02-009 - A logic board that counts up from 0 to 1 minus overflow.

The X board must be set up for the proper size tablet. J1 and J2 must be wired as follows:

2262-1	2262-2	2262-3
J-1	J-1	J-1
Jumper Pin 7-10. Tie Pins 1,2,3,4, 5,6,8 together.	Jumper Pins 9-8, 10-7. Tie Pins 1,2,3,4,5, 6 together.	Jumper Pins 9-8, 10-7, 14-3 & 15-2. Tie Pins 1,4,5,6 together.
J-2	J-2	J-2
Tie Pins 9,10,11, 12,13,14,15,16 together.	SAME	SAME

3) Y Counter Board #02-016 - A logic board that counts down to 1 from overflow plus 1.

The Y board must be set up for the proper size tablet. J3 and J4 must be wired as follows:

2262-1	2262-2	2262-3
J-3	J-3	J-3
Tie a 10K 1/8W Res. between Pins 3 and 14. Tie Pins 2,15,16 together. Tie Pins 4 & 13 together. Tie Pins 8,9,10, 11,12 together.	Tie a 10K 1/8W Res. between Pins 3 and 15. Tie Pins 2 & 16 together. Tie Pins 4,13,14 together. Tie Pins 8,9,10, 11,12 together.	Tie a 10K 1/8W Res. Between 3 and 15. Tie a 10K 1/8W Res. between Pins 5 & 12. Tie Pins 2 & 16 together. Tie Pins 4,13,14 together. Tie Pins 8,9,10,11 together.

J-4	J-4	J-4
Tie a 10K 1/8W Res. between Pins 7-9. Tie Pins 4,13,14,15, 16 together. Tie Pins 6,10,11,12 together.	SAME	SAME

4) Clock Board - A logic board containing a 20MHz crystal for pulsing the tablet and clocking the counters.

NOTE:

The digitizing tablet and crystal on the clock card are a matched pair. The bottom of each tablet contains the frequency of a crystal for that tablet. If the tablet becomes defective and must be replaced, the crystal on the clock card must also be removed and replaced with the matched pair of the new crystal and tablet. If the clock card is defective, its crystal must be removed and inserted on a good clock card.

5.2 TROUBLESHOOTING

5.2.1 *Power Supply*

To measure all voltages, turn the digitizer chassis on its left side. Remove bottom access panel and the pulser ribbon cable. Check the following voltage:

(a) +180VUR - Measure on etch labeled "180V" on bottom of motherboard.

(b) Starting at top of power supply ribbon cable connector:

Pin 5 is +15 volts regulated.
Pin 6 is -15 volts regulated.
Pin 7 is +5 volts regulated (internal).
Pin 8 is +5 volts regulated (external for annunciator).

The power supply has two 2.7 ohm 1/4 watt resistors that will burn up if the + or -15 volts becomes shorted. These resistors can be replaced. If the power supply cannot be repaired locally, return the entire chassis with all cards EXCEPT FOR THE CRYSTAL; it must remain with the tablet.

5.2.2 *Tablet*

The tablet should remain trouble free. The X or Y send wires could open or short. If repair is not possible, return tablet WITH CRYSTAL for repair/replacement.

5.2.3 *Stylus And Cursor*

If defective, return to Tewksbury for repair/replacement.

5.2.4 *Chassis And Logic Boards*

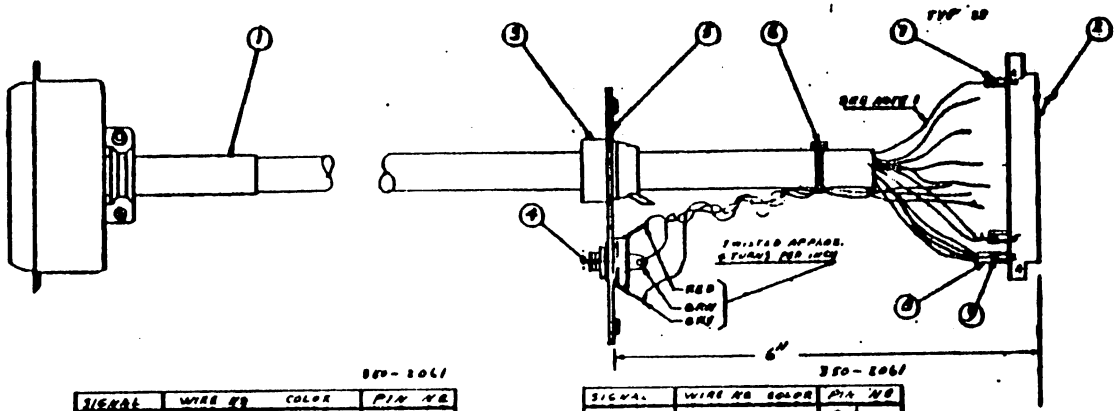
It is possible to determine if an X or Y logic board fails. An obvious symptom would be the dropping of a bit in either the X or Y counters giving incorrect coordinates. The Y board can be inserted into the X connector to determine if the X board is faulty, however, the value of the X coordinates will be reversed in value.

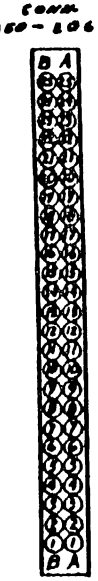
The X board can be inserted into the Y connector to determine if the Y board is faulty but the following procedure must be followed: Pin 14 of the X connector must be momentarily grounded before and after each point is digitized; also, the Y coordinates will be reversed in value.

APPENDIX A - WIRING & SCHEMATICS

The items contained in this appendix are arranged in the following manner:

1. Wang interconnecting cable diagram.
2. Summagraphics motherboard diagram.
3. Summagraphics control board schematic.
4. Summagraphics X board schematic.
5. Summagraphics Y board schematic.
6. Summagraphics Clock board schematic.
7. Summagraphics Power Supply schematic.
8. Summagraphics X & Y pulser schematic.
9. Summagraphics Preamp schematic.
10. Summagraphics motherboard circuits schematic.





REAR VIEW

NOTE:

Pin A1 of Wang connector connects to pin 1 of Summagraphics' motherboard.

Pin B1 of Wang connector connects to pin 2 of Summagraphics' motherboard.

350-6061

SIGNAL	WIRE NO COLOR	PIN NO
		A1
+5 DV	9,19,20,21,22,31,39, GRN	A2
MAG $^{NO}_{1}$	2	A3
		A4
DR	18, GRY	A5
		A6
Z AXIS	17	A7
		A8
		A9
8000	8	A10
4000	7	A11
2000	6	A12
1000	5	A13
800	26	A14
400	25	A15
200	24	A16
100	23	A17
80	12	A18
40	11	A19
20	10	A20
10	9	A21
8	30	A22
4	29	A23
2	28	A24
1	27	A25

MSD X

X

X

X LSD

350-6061

SIGNAL	WIRE NO COLOR	PIN NO
		B1
+5 V	RED	B2
FLAG $^{NO}_{2}$	3	B3
FLAG $^{NO}_{1}$	1	B4
		B5
		B6
		B7
IRQ/INT	37	B8
		B9
8000	16	B10
4000	15	B11
2000	14	B12
1000	13	B13
800	40	B14
400	39	B15
200	38	B16
100	37	B17
80	36	B18
40	35	B19
20	34	B20
10	33	B21
8	45	B23
4	46	B24
2	47	B25
1	48	B22

Y MSD

Y

Y

Y LSD

WANG PART NO	ITEM	QTY	NAME
600-3008		A/R	WIRE
600-3005		A/R	WIRE
600-3002		A/R	WIRE
664-0208	2	A/R	SOLDER
605-0012	8	1	SLEEVE
605-0002	7	39	SLEEVE
605-1008	6	1	CABLE TIE
458-2102	5	1	PANEL
250-3068	4	1	PHONE JACK
655-1201	3	1	BUSHING
250-3061	2	1	CONNECTOR (50 PIN)
220-2620-2	1	1	CABLE ASS'Y TYPE 2

26 GA	GRAY
26 GA	GRN
26 GA	RED
63-37	ALLOY
# TWISTS W/ INCH	
# TWISTS W/ INCH	
PAR-TY MATRIX-M	
86650-2	
WAVE SOLDER TYP-2	

WANG LABORATORIES, INC.

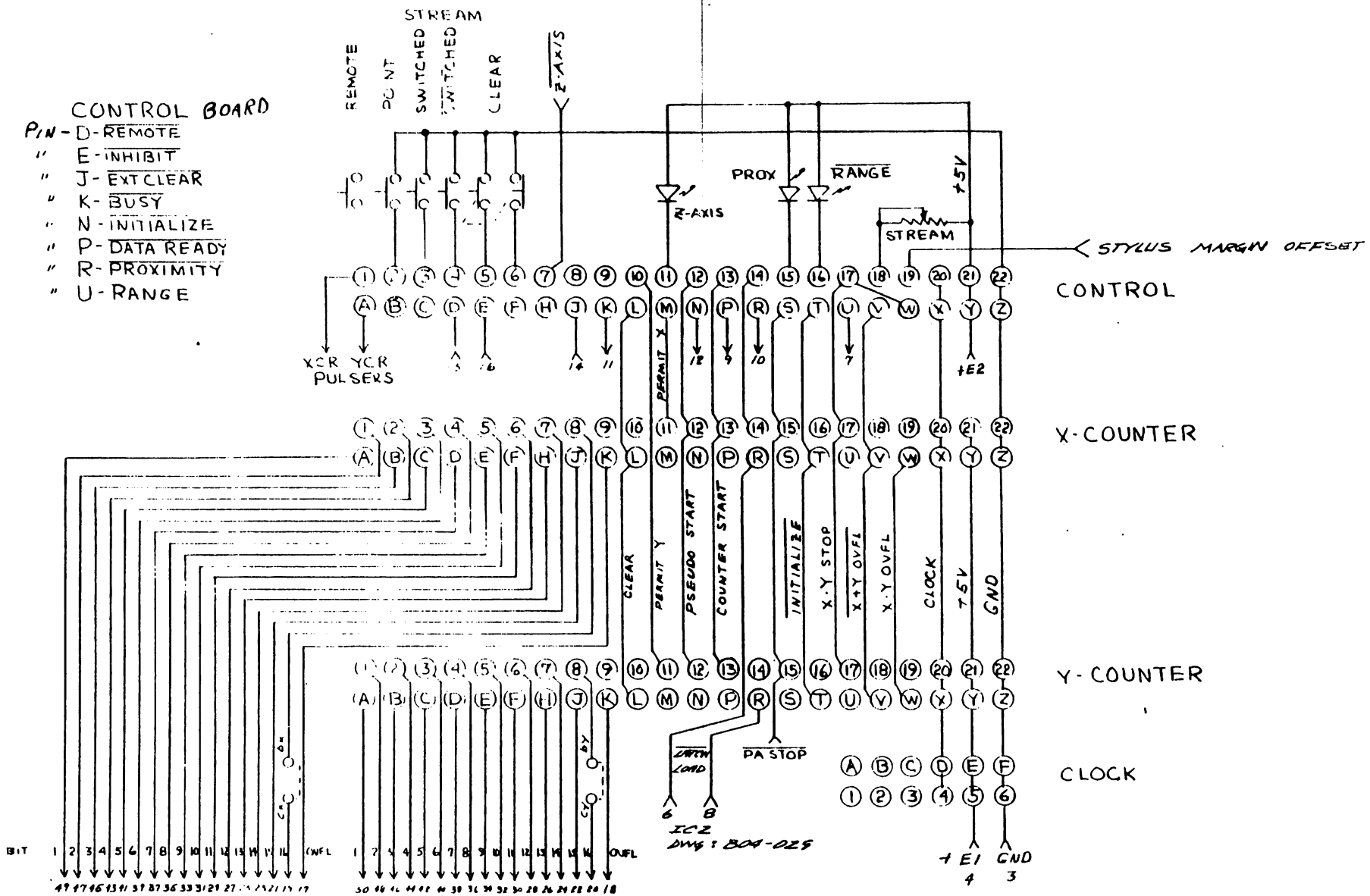
MODEL NO 2262

MATERIAL

FINISH

TITLE CABLE, X-Y DIGITIZER

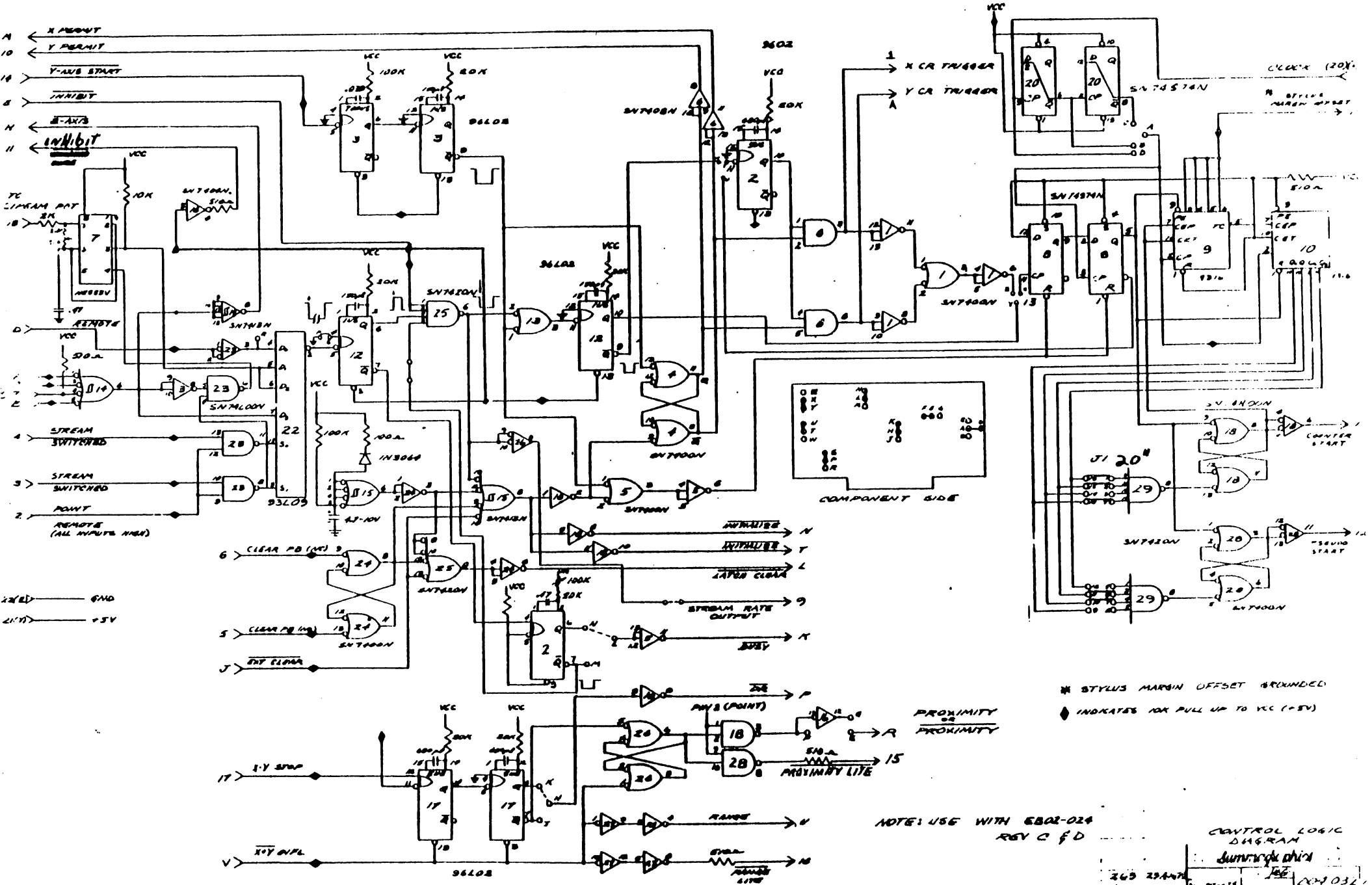
220-0125 | D | 6482-12

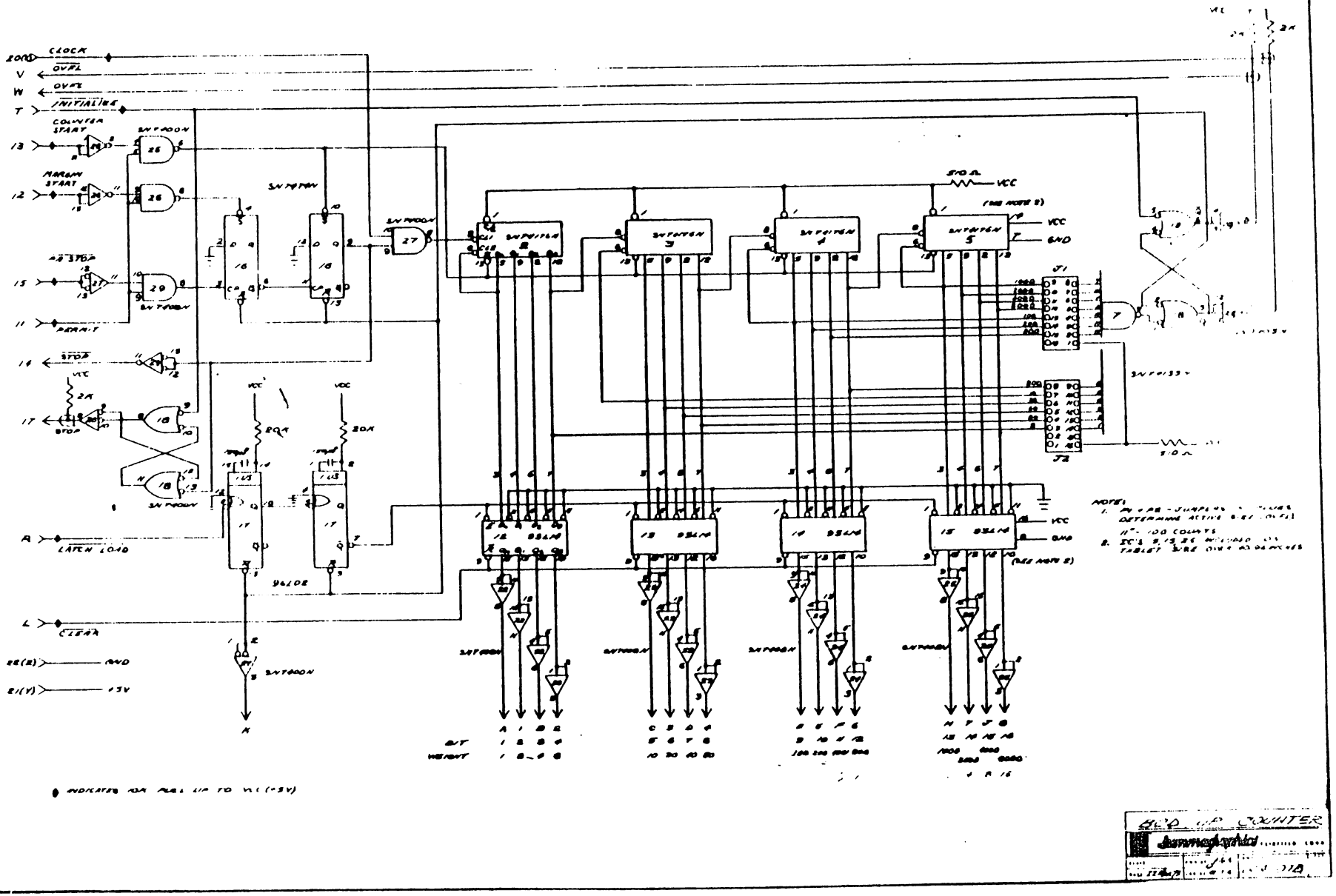


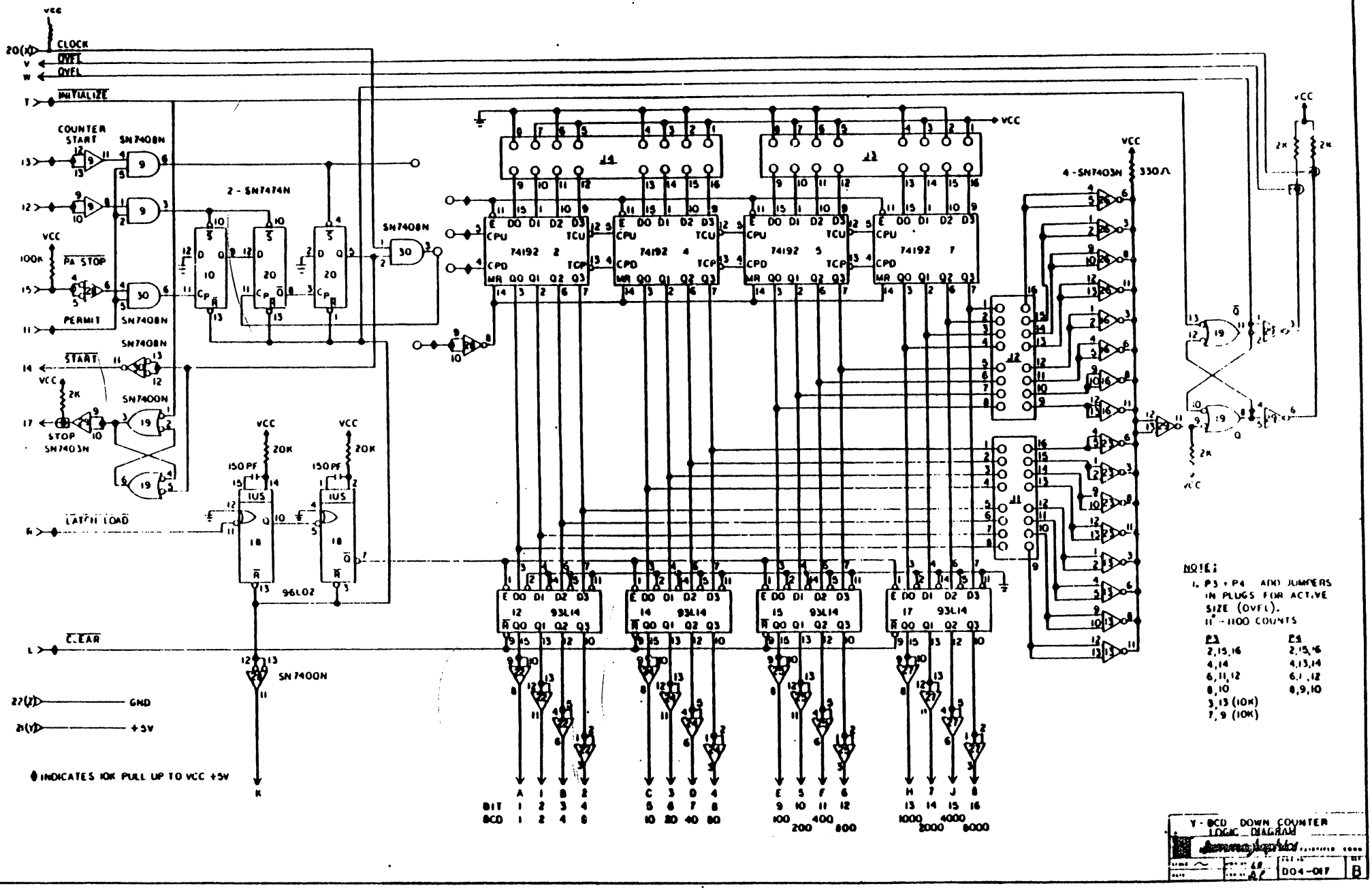
INTERCONNECTION DIAGRAM HVI 1

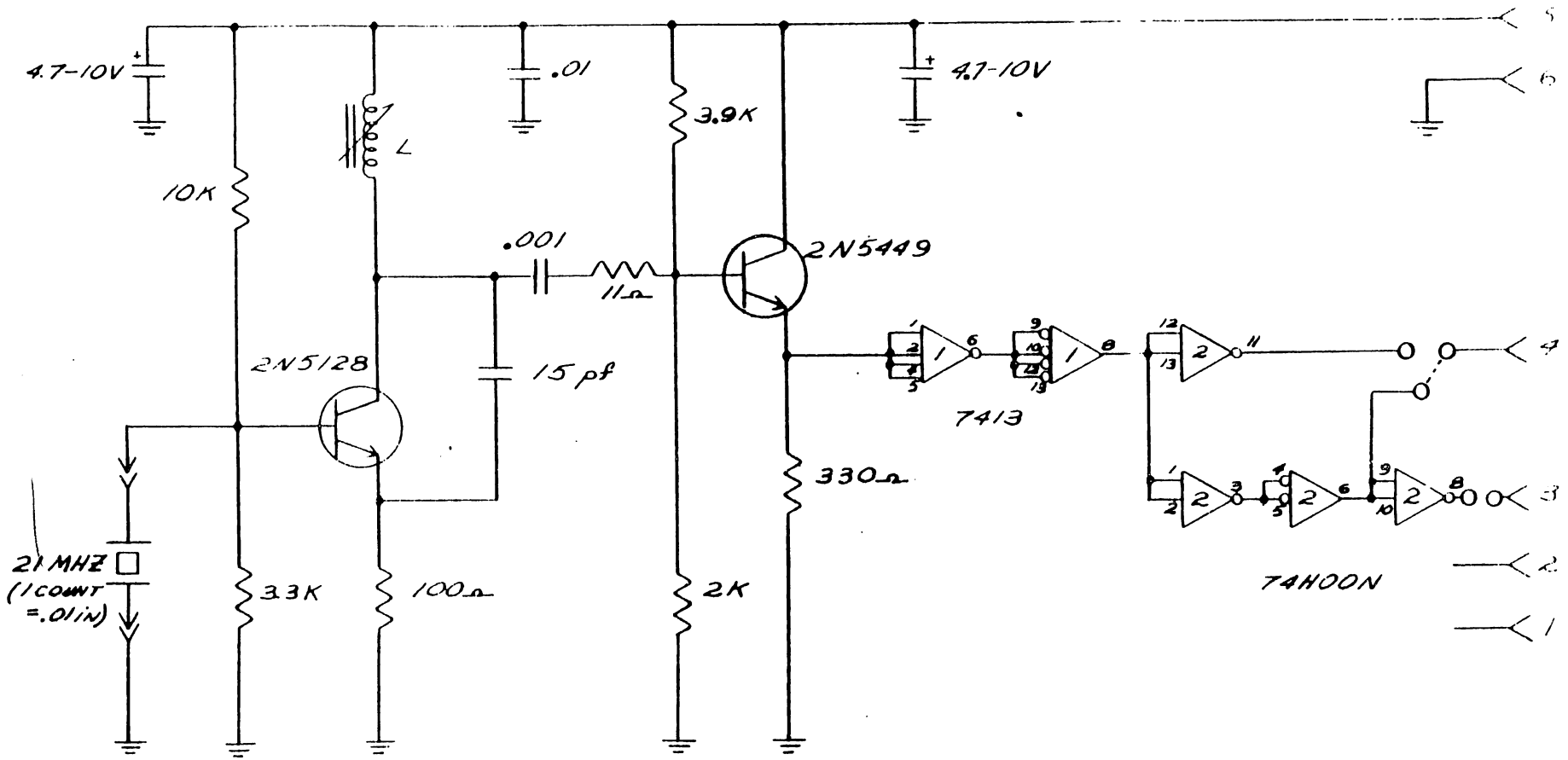
164	19 MAR 73	Dimensions ...
80	13 DEC 73	
M7	13 DEC 73	

12 JAN 73 014


X PERMIT
Y PERMIT
Y-AXIS START
INHIBIT
X-AXIS
INHIBIT
STREAM SWITCHED
STREAM SWITCHED
POINT
REMOTE (ALL INPUTS HIGH)
CLEAR PB (X)
CLEAR PB (Y)
EXT CLEAR
X+Y INPL
GND
+5V
X CR TRIGGER
Y CR TRIGGER
CLOCK (20V)
SN74S74N
SN74S04N
SN74S20N
SN74S00N
SN74S08N
SN74S10N
93L02
93L03
93L08
INHIBIT X
INHIBIT Y
LATCH CLEAR
STREAM RATE OUTPUT
BUSY
PWR (POINT)
PROXIMITY
PROXIMITY
PROXIMITY LITE
RANGE
RANGE LITE
COMPONENT SIDE
J1 20"
COUNTER START
READOUT START
NOTE: USE WITH 6802-024 REV C & D
CONTROL LOGIC DIAGRAM


CLOCK
OVFL
OVFZ
INITIALIZE
COUNTER START
MARGIN START
ADDER
PERMIT
STOP
LATCH LOAD
CLEAR
VCC
GND
NOTES:
1.
2.


CLOCK
OVFL
OVFL
INITIALIZE
COUNTER START
SN7408N
2 - SN7474N
PA STOP
PERMIT
START
STOP
SN7403N
SN7400N
LATCH LOAD
CLEAR
96L02
150PF
20K
2K
100K
74192
93L14
4 - SN7403N
330Λ
NOTE:
1. P3 + P4 AND JUMPERS IN PLUGS FOR ACTIVE SIZE (OVFL).
11 - 1100 COUNTS
P3: 2,15,16 / 4,14 / 6,11,12 / 8,10 / 3,13 (10K) / 7,9 (10K)
P4: 2,15,16 / 4,13,14 / 6,11,12 / 8,9,10
GND
+5V
INDICATES 10K PULL UP TO VCC +5V
BIT 1 2 3 4
BCD 1 2 4 8
10 20 40 80
100 200 400 800
1000 2000 4000 8000
Y - BCD DOWN COUNTER LOGIC DIAGRAM
D04-087
B



NOTE:
ALL CAPACITORS IN MF UNLESS OTHERWISE SPECIFIED.

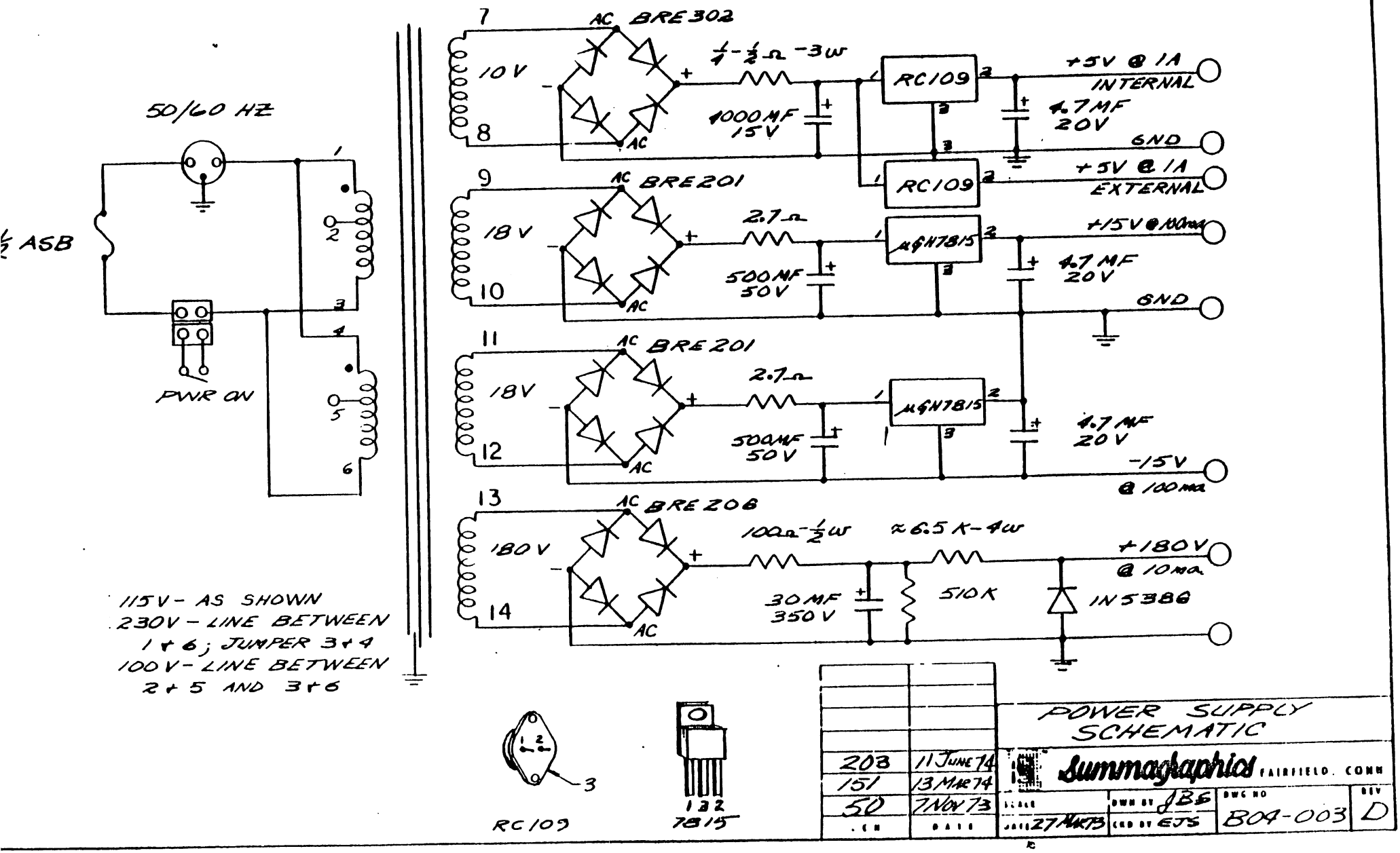
CLOCK SCHEMATIC

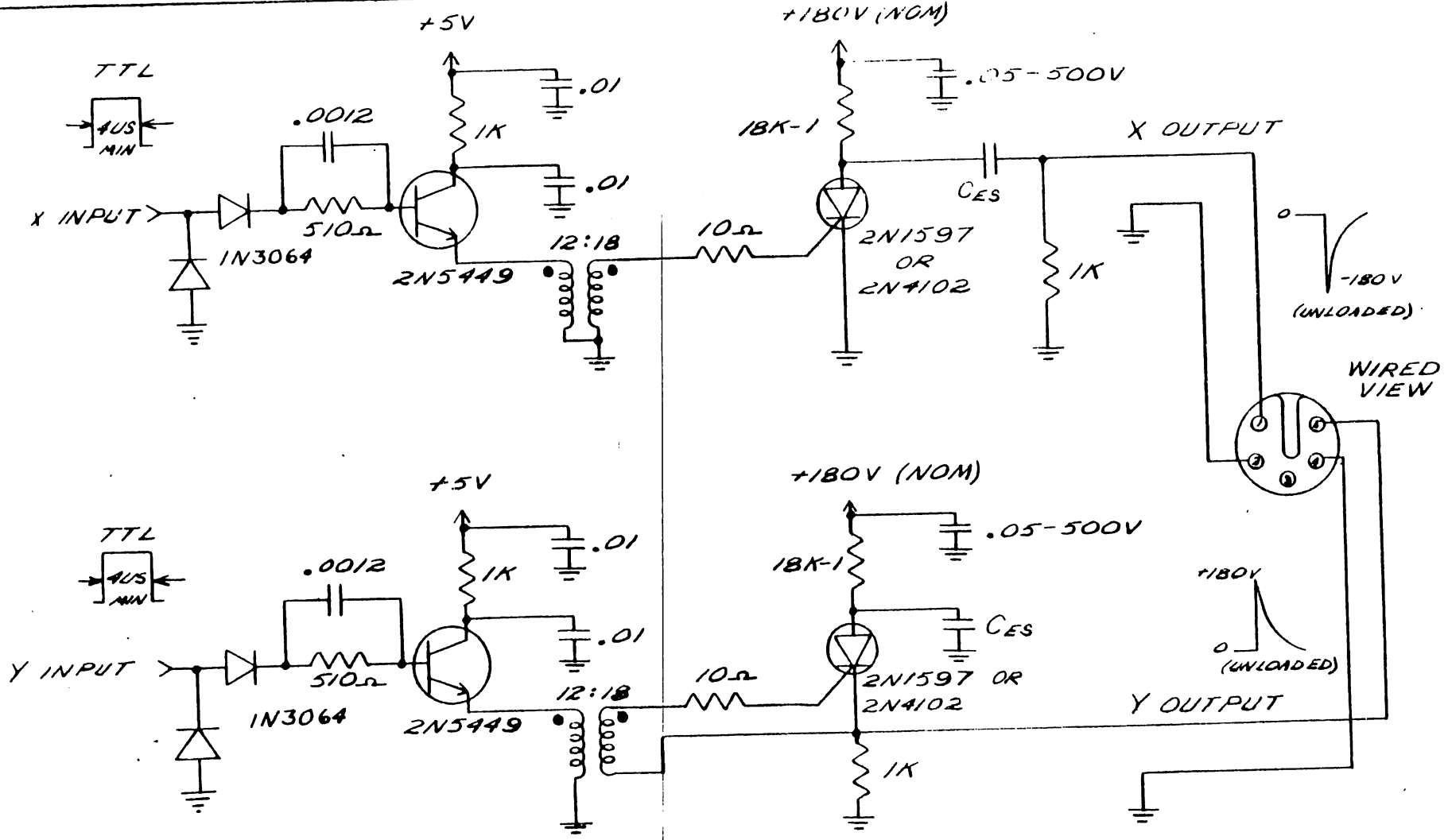
Summagraphics

JBC

EJS

LB MAR 73


50/60 HZ
½ ASB
PWR ON
115V - AS SHOWN
230V - LINE BETWEEN 1 & 6; JUMPER 3 & 4
100V - LINE BETWEEN 2 & 5 AND 3 & 6
7
AC BRE302
10V
8
¼-½Ω -3W
1000MF 15V
RC109
+5V @ 1A INTERNAL
4.7MF 20V
GND
+5V @ 1A EXTERNAL
9
AC BRE201
18V
10
2.7Ω
500MF 50V
µGN7815
+15V @100ma
4.7MF 20V
GND
11
AC BRE201
18V
12
2.7Ω
500MF 50V
µGN7815
4.7MF 20V
-15V @ 100ma
13
AC BRE206
180V
14
100Ω-½W
≈6.5K-4W
30MF 350V
510K
IN5386
+180V @ 10ma
RC109
7815
POWER SUPPLY SCHEMATIC
Summagraphics FAIRFIELD, CONN
208 11 JUNE 74
151 13 MAR 74
50 7 NOV 73
DWN BY JBG
CKD BY EJS
27 MAR 73
DWG NO B04-003
REV D

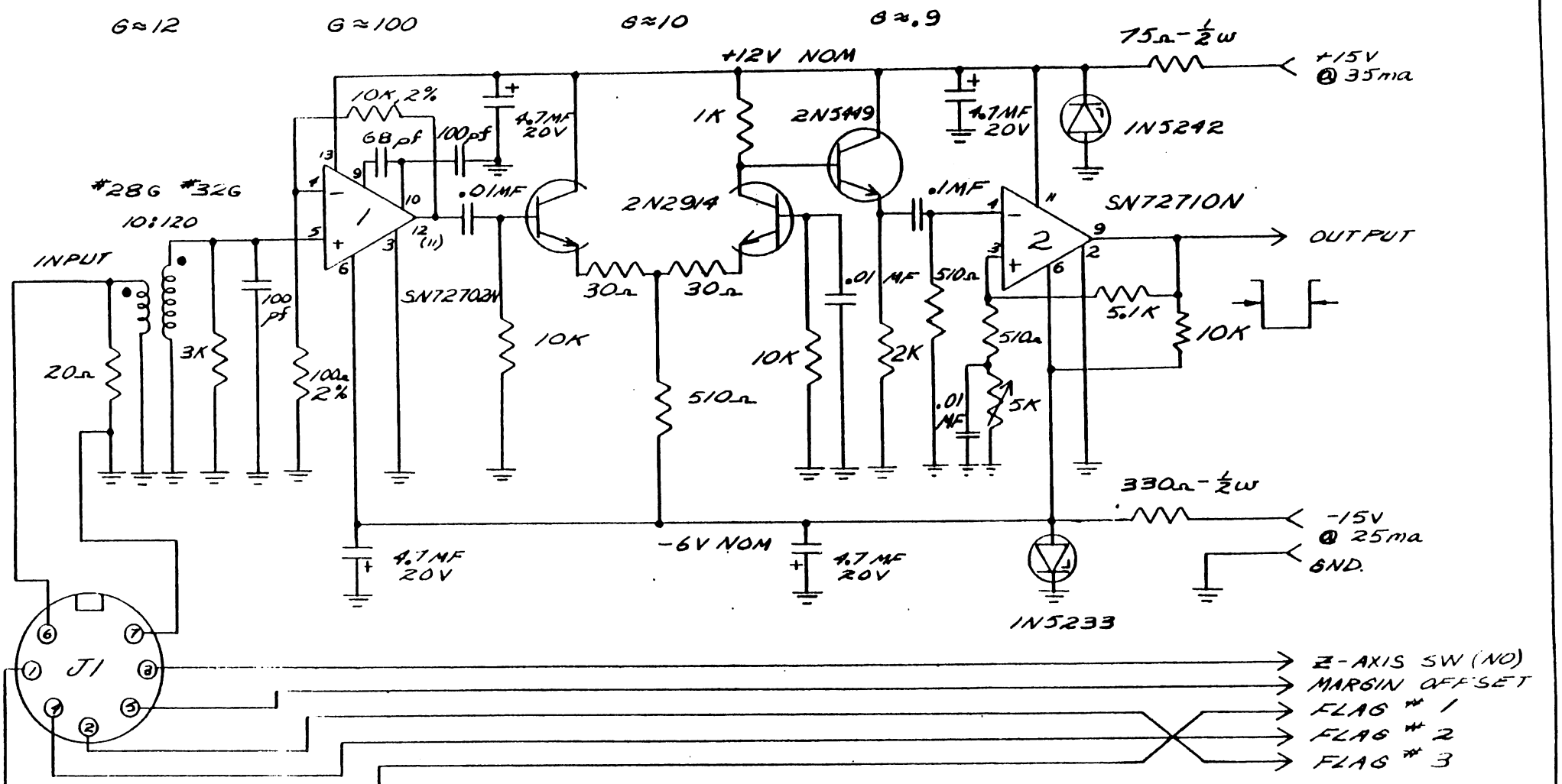


NOTE:
1) ALL CAPACITORS IN MFD.
2) CES TYPICALLY .1 MFD.

X & Y PULSER

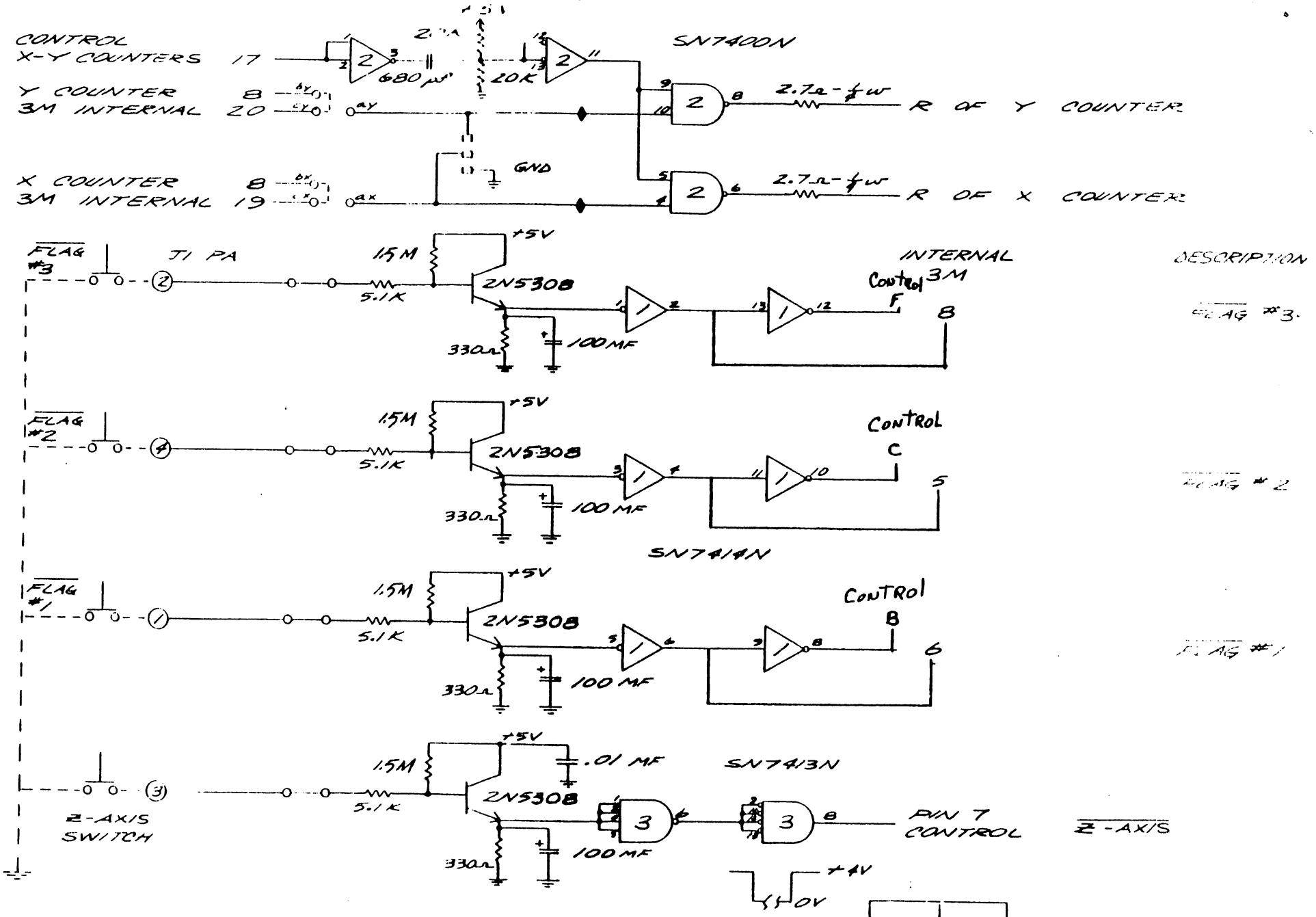
Summagraphics

27 Mar 73 EJS E004-005



NOTE: EB02-003 &
EB02-020A

		PREAMP SCHEMATIC	
		Summagraphics FAIRFIELD CONN.	
137	13 FEB 74	SCALE	DWN BY JBS / DWG NO B04-005 B
ECO	DATE	DATE 28 MAR 73 / CAD EJS	


CONTROL
X-Y COUNTERS 17
Y COUNTER 8
3M INTERNAL 20
X COUNTER 8
3M INTERNAL 19
680 μμF
20K
GND
SN7400N
2.7K-½W
R OF Y COUNTER
2.7K-½W
R OF X COUNTER
FLAG #3
J1 PA
1.5M
5.1K
2N5308
+5V
330Ω
100MF
INTERNAL 3M Control F
8
FLAG #2
C
5
SN7414N
FLAG #1
B
6
.01 MF
SN7413N
Z-AXIS SWITCH
PIN 7 CONTROL
Z-AXIS
+4V
0V
NOTE: CIRCUITS LOCATED ON MOTHER BOARD W/ XDG C
DESCRIPTION
FLAG #3.
FLAG #2
FLAG #1
XY FREEZE
FLAG LOGIC
Summagraphics
8 MAR 74
DATE 8 MAR 74

APPENDIX B - SIGNAL MNEMONICS

Clear PB	Switch on front panel to clear latches loaded with BCD count on X and Y counter boards.
Clock	20 MHz crystal clock generated by clock card.
Counter Start	Delay which disables the pickup coil from digitizing a point which is outside the active area of the tablet.
$\overline{\text{Ext Clear}}$	Not used.
$\overline{\text{inhibit}}$	Stops digitization process by inhibiting Z-axis signal when 2200 is not ready.
Latch clear	Sent to X and Y counters to clear data.
PA stop	Pulse from pickup coil on cursor or stylus to stop counters.
Point Switch	Switch on front panel.
Pseudo Start	Keeps counters from starting on any pulse except the first if pickup coil is not within the active area of the tablet.
$\overline{\text{Remote}}$	Not used.
Stream Switch	Switch on front panel.
Stream $\overline{\text{Switched}}$	Switch on front panel.

Stylus Margin Offset	Preset for counter which makes up the difference between the pickup coil in the cursor and stylus.
X CR Trigger	Pulse sent to pulse amplifier to fire X SCR and pulse X send wire.
X input	Same as X CR trigger.
X permit	Enable for X counters.
X-Y OVFL	Pulse generated when counters run to overflow to turn on range light and turn off proximity light.
$\overline{\text{Y Axis Start}}$	Pulse generated by X counter stop to start Y counters.
Y CR Trigger	Pulse sent to pulse amplifier to fire Y SCR and pulse Y send wire.
Y input	Same as Y CR trigger.
Y permit	Enable for Y counters.
X-Y Stop	Stop pulse for X and Y counters used to turn proximity light on and keep range light off.
$\overline{\text{Z-axis}}$	Pulse from cursor or stylus switches which starts the digitization process by starting counters and phase locking clock to pulser.
$\overline{\text{Z-axis}}$ light	2200 Ready light tied to $\overline{\text{inhibit}}$ line.

```
10 REM 2262 DIAGNOSTIC TEST
20 REM 01/20/75
30 REM WANG CUSTOMER ENGINEERING DIVISION
40 DIM A$12
50 SELECT PRINT 205, INPUT 65A, CO 65A
60 PRINT HEX(030A0A0A);"                                    2262  TEST"
70 PRINT HEX(0A0A);"    SIGN BIT       FLAG SWITCH       X-VALUE       Y-VALUE"
80 PRINT HEX(0A);   " (NEG-NO BUTTONS)  (0,1,2,4) "
90 PRINT HEX(0A0A0A);    "                                        X-LIMITS      Y-LIMITS"
100 PRINT HEX(0A);       "          20 X 20 IN.    TABLET      0000-1999     0001-2001"
110 PRINT HEX(0A);       "          30 X 40 IN.    TABLET      0000-2999     0001-4001"
120 PRINT HEX(0A);       "          36 X 48 IN.    TABLET      0000-3599     0001-4801"
130 PRINT HEX(0A0A)
140 PRINT HEX(0A);" WHEN TEST IS COMPLETE HIT RESET & SPECIAL FUNCTION KEY 15. "
150 INPUT A$
160 PRINT HEX(010A0A0A0A0A0A0A)
170 PRINTUSING 180, STR(A$,1,1), STR(A$,2,1), STR(A$,4,4), STR(A$,8,4)
180                %       #                  #              ####          ####
190 GOTO 150
200 DEFFN'15
210 SELECT PRINT 005, TAPE 10A
220 PRINT HEX(030A0A)
230 SELECT INPUT 001, CO 005
240 STOP " END OF PROGRAM"
250 REM $
```

L T I - L E V E L B I L L O F M A T E R I A L AS OF RUN DATE: 03/24/81 PAG

ER 177-2262-2 - - LEGEND
ON 2262-2 X-Y DIGITIZER(30"X40" TABLET 1: P=PHANTOM; 2: ITEM MASTER DELY CODE; 3: *=TAGGED OUT OF KIT(PI

GEND 2 3	COMPONENT PART NUMBER	DESCRIPTION	E C N	QUANTITY PER ASSY	U/M	L/T
IN	187-2262-2 - -	2262-2 X-Y DIGITIZER(30"X40"TABLET)	E11008	1.0000	EACH	00010
IN	000-0005- - -	LABOR PRODUCTION SYSTEMS		2.3990		00000
IN	000-0011- - -	LABOR QUALITY CONTROL		.4800		00000
IN	210-6592 - -	PCA 2252A PARALLEL INTERFACE		1.0000	EACH	00023
IN	000-0001- - -	LABOR CIRCUIT SYSTEMS		2.0000		00000
IN	000-0005- - -	LABOR PRODUCTION SYSTEMS		.2140		00000
IN	000-0011- - -	LABOR QUALITY CONTROL		.4000		00000
IN	300-1470- - -	CAP 470 PF 10% 500 V CERAMIC DISC		3.0000	EACH	
IN	300-1680- - -	CAP 680 PF 10% 500 V CERAMIC DISC		2.0000	EACH	
IN	300-1903- - -	CAP .01 UF +80-20% 25 V CERAMIC D		8.0000	EACH	
IN	300-1904- - -	CAP .02 UF +80-20% 25 V CERAMIC D	EC4952	1.0000	EACH	
FS	300-4022-R - -	CAP 15.0 UF 20V 10% TANT AXIAL T&R	E15690	2.0000	EACH	
IN	325-1503- - -	SWITCH SLIDE SPST 8 POS DIL		1.0000	EACH	
IN	325-2222-M - -	4 POS SWITCH(MOD.FROM 325-2222)		1.0000	EACH	
IN	325-2222- - -	5 POS PUSH ON/OFF SWITCH B6422-226		1.0000	EACH	
IN	325-2225- - -	6 POS PUSH ON/OFF SWITCH B6422-265		6.0000	EACH	
IN	325-5015- - -	700 PUSH BUTTON GRAY J52303		4.0000	EACH	
IN	325-5018- - -	100 PUSH BUTTON WHITE J52303		13.0000	EACH	
FS *	330-3010- - -	RES 1K OHM 1/4W 10% FIXED COMP		54.0000	EACH	
FS *	330-3047- - -	RES 4.7K OHM 1/4W 10% FIXED COMP		3.0000	EACH	
FS *	330-4033- - -	RES 33K OHM 1/4W 10% FIXED COMP		1.0000	EACH	
IN	350-2097- - -	CONN RECEPT.50 SLD CUP W/O FLCAT	E16766	2.0000	EACH	
IN	376-0002- - -	IC 7400N 4 2 IN POS NAND GATE		1.0000	EACH	
IN	376-0003- - -	IC 7410N 3 3 IN POS NAND GATE		1.0000	EACH	
IN	376-0004- - -	IC 7420N 2 4 IN POS NAND GATE		2.0000	EACH	
IN	376-0006- - -	IC 7474N 2 D EDGE TRIG FLIP-FLOP		1.0000	EACH	
IN	376-0008- - -	IC 7442N 4 LINE-10 LINE DECODER		3.0000	EACH	
IN	376-0010- - -	IC 7404N HEX INVERTER	EC4952	12.0000	EACH	
IN	376-0028- - -	IC 7403N 4 2 IN POS NAND GATE		1.0000	EACH	
IN	376-0036- - -	IC 7486N 4 2 IN EXCLUSIVE OR GATE		1.0000	EACH	
IN	376-0053- - -	IC 74193 SYN 4 BIT UP DOWN COUNTER		1.0000	EACH	
IN	376-0055- - -	IC 7406 HEX INV BUF DRIVERS HV OUT		1.0000	EACH	
IN	376-0056- - -	IC 7407 HEX BUF DRIVER HV OUTPUT		1.0000	EACH	
IN	376-0080- - -	IC 74123 RETRIGGER MONOSTABLE MVB	EC4952	2.0000	EACH	
IN	376-0081- - -	IC 7408 4 2 IN POS AND GATE				

U L T I - L E V E L B I L L O F M A T E R I A L AS OF RUN DATE: 03/24/81 PA

BER 177-2262-2 - - LEGEND
ION 2262-2 X-Y DIGITIZER(30"X40" TABLET 1: P=PHANTOM; 2: ITEM MASTER DELY CODE; 3: *=TAGGED OUT OF KIT(F

EGEND 2 3	COMPONENT PART NUMBER	DESCRIPTION	E C N	QUANTITY PER ASSY	U/M	L/T
IN	000-0011- - -	LABOR QUALITY CONTROL		.6000		00000
IN	220-2650-9 - -	CABLE ASSY T4 C6482-4(50 COND 9"L)		1.0000	EACH	00010
IN	000-0004- - -	LABOR SUB-SYSTEMS		.2910	EACH	00000
IN	000-0011- - -	LABOR QUALITY CONTROL		.0580		00000
IN	350-2083- - -	CONN 25-50 CABLE TO CABLE PLUG	EC6407	1.0000	EACH	
IN	350-4229-G - -	STRAIN RELIEF CVR 50 POS 180DEG GRV	EC8484	1.0000	EACH	00005
IN	350-4229-T - -	STRAIN RELIEF CVR 50 POS 180DEG TNG	EC8484	1.0000	EACH	00005
IN	350-4234- - -	4-40X3/8 CAPT SCR FOR SCR MT CONNS.	EC6407	2.0000	EACH	
FS	420-0052- - -	50 COND 26 GA SHIELDED CABLE J308-1	EC6407	9.5000	FEET	
IN	458-0361- - -	GROUND STRAP C6815-28	EC6407	1.0000	EACH	
FS	606-2650-9 - -	CBL MARKER WH/BK 2215 220-2650-9	EC9129	1.0000	EACH	00001
FS	605-0139- - -	TUBING 1/2 WH SHRINK POLYOLEFIN		.1140	FEET	
IN	350-2061- - -	50 PIN CONNECTOR VIKING 3VH25-1JN5		1.0000	EACH	
IN	350-2062- - -	PHONE JACK 3 COND(F)SW CRAFT 12B		1.0000	EACH	
IN	452-2142- - -	PLATE,CONNECTOR(2262)B6628-7		1.0000	EACH	
FS	600-3002- - -	WIRE 26 GA RED		.5000	FEET	
FS	600-3009- - -	WIRE 26 GA WHITE		1.0000	FEET	
FS	600-3005- - -	WIRE 26 GA GREEN		.5000	FEET	
FS	600-3009- - -	WIRE 26 GA WHITE		1.0000	FEET	
FS	600-3008- - -	WIRE 26 GA GRAY		.5000	FEET	
FS	600-3009- - -	WIRE 26 GA WHITE		1.0000	FEET	
FS	605-0002- - -	TUBING #15 CLEAR	EC8399	1.0000	FEET	
FS	605-0012- - -	TUBING #4 CLEAR		.0400	FEET	
FS *	605-1004- - -	CABLE TYE, PAN-TY PLTIM-M		1.0000	EACH	
IN	615-1268-52- -	OBS 2252 CA CONN LABEL A5300-1072	EC5402	1.0000	EACH	
IN	654-1241- - -	HEYCO STRAIN RELIEF SR7W-2		1.0000	EACH	
IN	220-1041- - -	WIRE & LUG ASSY D6482-12		1.0000	EACH	00010
IN	000-0004- - -	LABOR SUB-SYSTEMS		.0070	EACH	00000
IN	000-0011- - -	LABOR QUALITY CONTROL		.0010		00000
FS	600-0054- - -	WIRE 18 GA GREEN/YELLOW UL		.3300	FEET	
FS	600-0055- - -	WIRE 18 GA WHITE UL		1.0000	FEET	

L T I - L E V E L B I L L OF M A T E R I A L AS OF RUN DATE: 03/24/81 PAG

ER 177-2262-2 - - LEGEND
CN 2262-2 X-Y DIGITIZER(30"X40" TABLET 1: P=PHANTOM; 2: ITEM MASTER DELY CODE; 3: *=TAGGED OUT OF KIT(PR

GEND 2 3	COMPONENT PART NUMBER	DESCRIPTION	E C N	QUANTITY PER ASSY	U/M	L/T
FS	650-3401- - -	SCR 6-32 1 1/4 PHIL PH MS SS		1.0000	EACH	
FS	650-4127- - -	8-32 X 3/8 PAN HD PHL MS BK OX		4.0000	EACH	
FS	650-6081- - -	SCR 10-32 1/4 PHIL FLAT H MS SS		4.0000	EACH	
FS	651-0401- - -	RIVET,POP 1/8 X 3/16 AD42ABS		4.0000	EACH	
FS	653-4001- - -	WASH 8 .176ID .336OD INT T ST		4.0000	EACH	
IN	655-0208- - -	FEET WHITE GREENE BH-2184		4.0000	EACH	
IN	725-0050-95- -	30 X 40 WRITING TABLET & CONTROLLER		1.0000	EACH	

80-A

725-0050-94 20 x 20
725-0050-95 30 x 40
725-0050-96 36 x 48

CRAIG KLEIN WEST ~~PALM~~ PALM BEACH

305-627-5361

IMMEDIATE SERVICE NOTICE

NO. 90 | DATE: 9/4/75

ITEM(S) / PRODUCT(S):

ADDENDUM/CORRECTIONS FOR SERVICE BULLETIN #64 (2262)

Incorporate the following changes/additions into Service Bulletin 64:

a) Add to item (5) on page 5:

"No other switches should be depressed at this time; however, note that if the SIGN switch is depressed, the sign of the point being digitized will be *plus* (+)".

b) Delete item (6).

c) Page 14, item (3) should display limits as follows:

	X Limits	Y Limits
20 x 20 IN. TABLET	0000-1999	0001-2001
30 x 40 IN. TABLET	0000-3999	0001-3001
36 x 48 IN. TABLET	0000-4799	0001-3601

d) Page 15, item (12); change to read as follows:

Select the Single Point Mode. Digitize approximately 5 random points on the tablet by depressing the Z axis and Flag Switches while moving the cursor. Ensure that the Flag bit and coordinates change each time the appropriate switch is depressed. The SIGN bit should change only the first time a button is depressed.

e) Page 17, item (2); under 2262-2, J-1 must be changed to:

J-1

Jumper Pin 11 to pin 6

Tie Pins 1, 2, 3, 4, 5, 7 and 8 together.

Under 2262-3 J-1 must be changed to read:

J-1

Jumper pin 11 to pin 6, and jumper pin 9 to pin 8

Tie Pins 1, 2, 3, 4, 5 and 7 together.

f) Page 17, item (3); under 2262-2, J-3 must be changed to read:

J-3

Jumper Pin 13 to pin 14 and tie A 10KΩ 1/8 W resistor between Pin 14 and Pin 3.

Jumper Pin 15 to pin 16 and then jumper those to Pin 2.

Jumper Pins 8, 9, 10, 11 and 12 together.

Under 2262-3, J-3 must be changed to read:

J-3

Jumper Pin 13 to pin 14 and tie A 10KΩ 1/8 W resistor between Pin 14 and Pin 3.

Jumper Pin 10 to pin 11 and tie A 10KΩ 1/8 W resistor between Pin 10 and Pin 7

Jumper Pin 8 to pin 9, pin 12 to pin 6 and jumper Pin 2 to Pins 15 and 6.

g) Page 33, Appendix C, 2262 Diagnostic;

Statement #110 should read:

```
110 PRINT HEX(0A);     "    30 x 40 IN. TABLET 0000-3999 0001-3001"
```

Statement #120 should read:

```
120 PRINT HEX(0A);     "    36 x 48 IN. TABLET 0000-4799 0001-3601"
```

DIGITIZ CALL

CONTROL NUMBER 04042007

CONTACT NAME BILL ROSTER POSITION OF
ROB # 3411 TOK # PHONE # EXT #

SYSTEM TYPE 3000 MP DEVICE TYPE 2282-3
UTILITY NAME SOFTWARE LEVEL

METHOD OF CALL P T = TELEX, P = PHONE, M = MEMO, S = SMS
HAS THE AREA OR DISTRICT BEEN CONTACTED
N A = AREA, D = DISTRICT, B = BOTH, N = NONE
IS THIS INQUIRY PERTAINING TO A NATIONAL ACCOUNT ?
N Y = YES, N = NO, U = UNKNOWN

USE THE FOLLOWING AREA TO DESCRIBE THE SITE THAT CREATED THIS REQUEST
CUST/OFFICE NAME US DEPT OF AGRICULT. PHONE # 301 344 4401
ADDRESS 94 CITY BELTSVILLE STATE MD
ON SITE CONTACT NAME

PROBLEM (*) SOLUTION (+)

*NEED TO KNOW THE SWITCH SETTINGS ON THE 2252A CONTROLLER
*BOARD.
08/29/84:

IN THE DIGITIZER DIAGNOSTICS THE ADDRESS SWITCH IS
TO BE SET AT X5A THIS IS SWITCHES 1,4,6 AND 8 ON.ALL
OTHERS OFF.

WJ.

09/06/84:

LEFT A BEEPCALLBACK FOR DE.OR CALLED BACK AND HAD A
726-0956 CONTROLLER PCA ON ORDER.

WJ.