WANG

X-Y DIGITIZER
NOTES

Model: 2262

Customer Engineering
Product Maintenance Manual   729-0536-A

Second Edition (January, 1984)

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SERVICE BULLETIN NO. 64

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EDITED BY CUSTOMER ENGINEERING DIVISION

MODEL 2262 X-Y DIGITIZER

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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.

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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)

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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.)
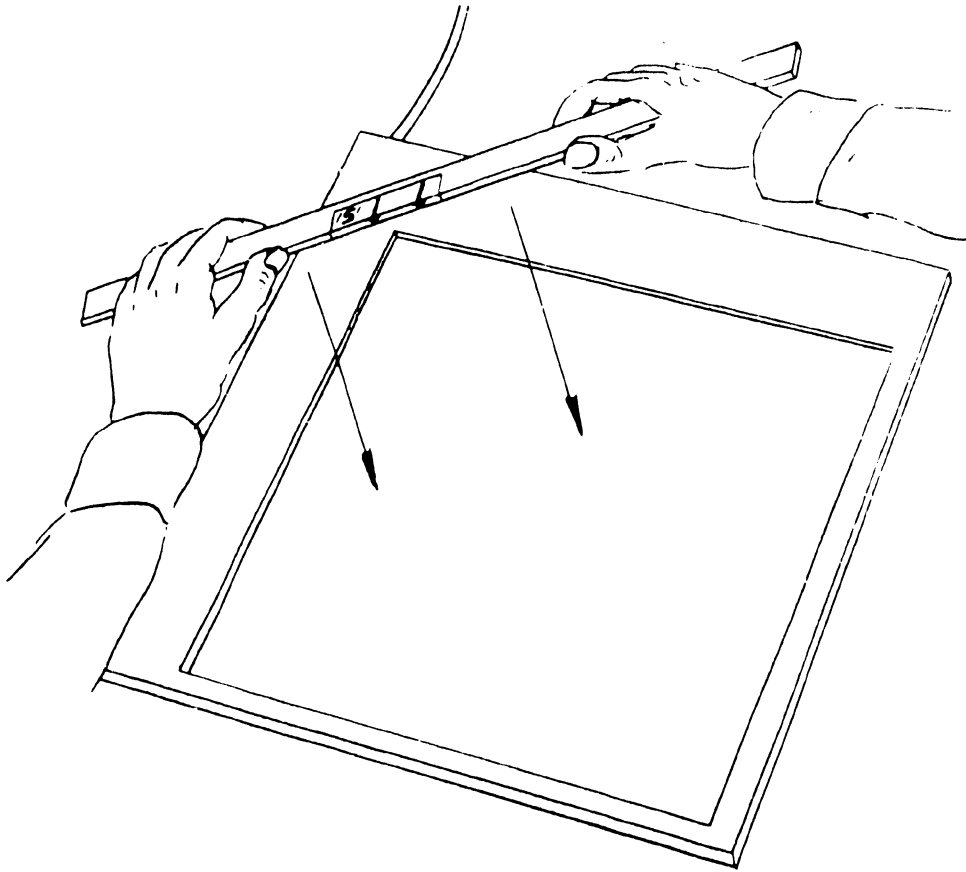
FIGURE 1

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. 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 (+).

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

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

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

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

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

11) 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.

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

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(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.

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(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 sub-
                     stance are aligned in the same direction, the ferro-
                     magnetic 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 propa-
                     gates 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.
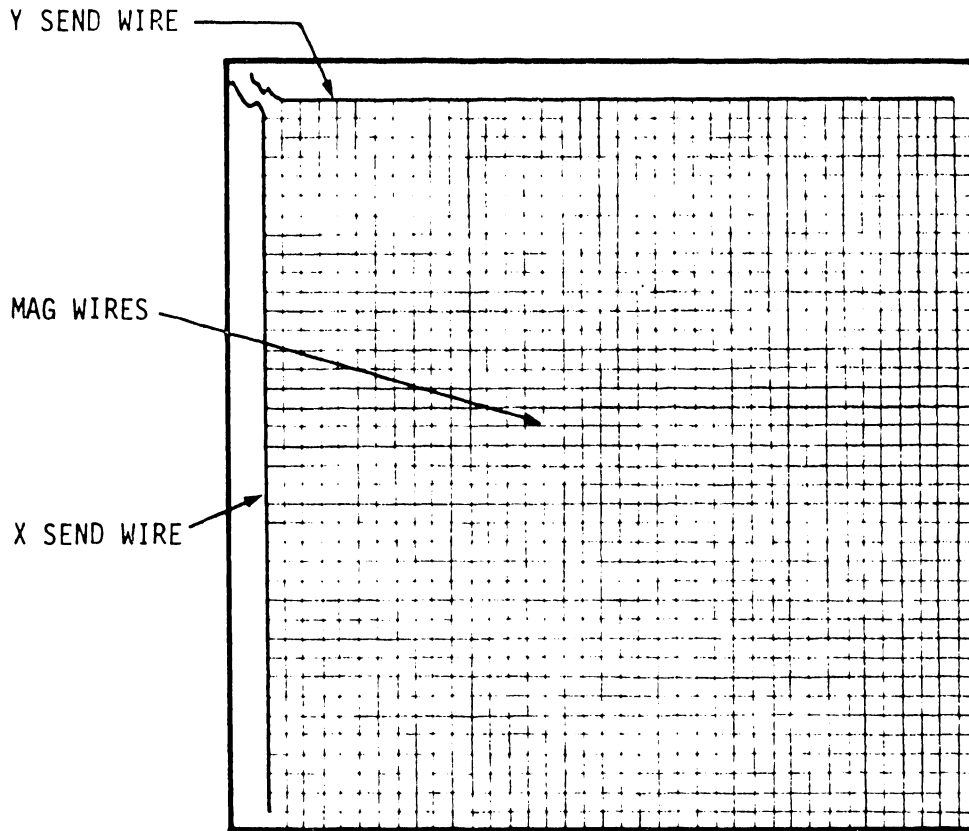

FIGURE 2

3.4 MODES OF OPERATION

The digitizer can be selected to operate in three modes: Single Point, S̄w̄īt̄c̄h̄ 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:

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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 *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 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   Sign of number always Plus (+).
     Depressed

---

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

3) Flag Pushbutton   Sign of number always Plus (+).
    Depressed   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 re-
                                 spectively.

```
┌─────────────────────────────────────────────────┐
│                    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 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 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.

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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   Sign of number generally *Plus (+).
   Depressed   *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   Sign of number generally *Plus (+)
   Depressed   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
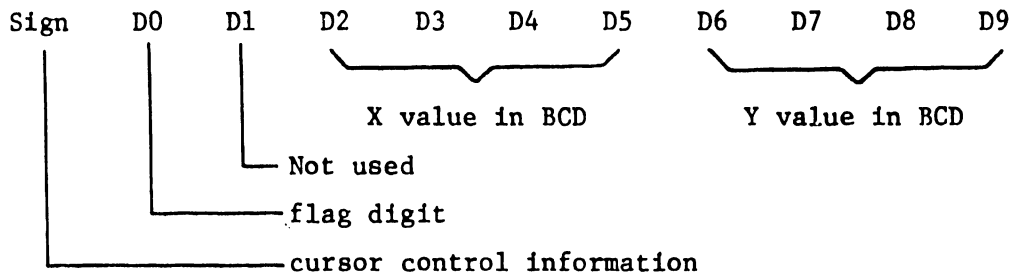   is released, due to transient elec-
                                 tronic conditions.

> 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:

```
Sign    D0      D1      D2    D3    D4    D5      D6    D7    D8    D9
 |       |       |       _____/        _____/
 |       |       |            X value in BCD            Y value in BCD
 |       |       |
 |       |       └── Not used
 |       └────────── flag digit
 └─────────────────── cursor control information
```

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          FLAG SWITCH         X-VALUE          Y-VALUE
   (NEG-NO BUTTONS)      (0,1,2,4)
         -                  0               XXXX             YYYY

                                          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

   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 tablet.

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 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.

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 pin 11 to pin 6. Tie Pins 1,2,3,4,5, 7 and 8 together.	Jumper Pin 11 to pin 6. Jumper Pin 9 to pin 8. Tie Pins 1,2,3,4,5 and 7 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.	Jumper Pin 13 to pin 14 and tie a 10K 1/8W resistor between Pins 14 and 3. Jumper Pin 15 to pin 16 and pin 16 to pin 2. Jumper Pins 8,9,10,11 and 12 together.	Jumper Pin 13 to pin 14 and tie a 10K 1/8W resistor between Pins 14 and 3. Jumper Pin 10 to pin 11 and tie a 10K 1/8W resistor between Pins 10 and 7. Jumper Pin 8 to pin 9, pin 12 to pin 6 and jumper pin 2 to pins 15 and 6.

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

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).

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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.
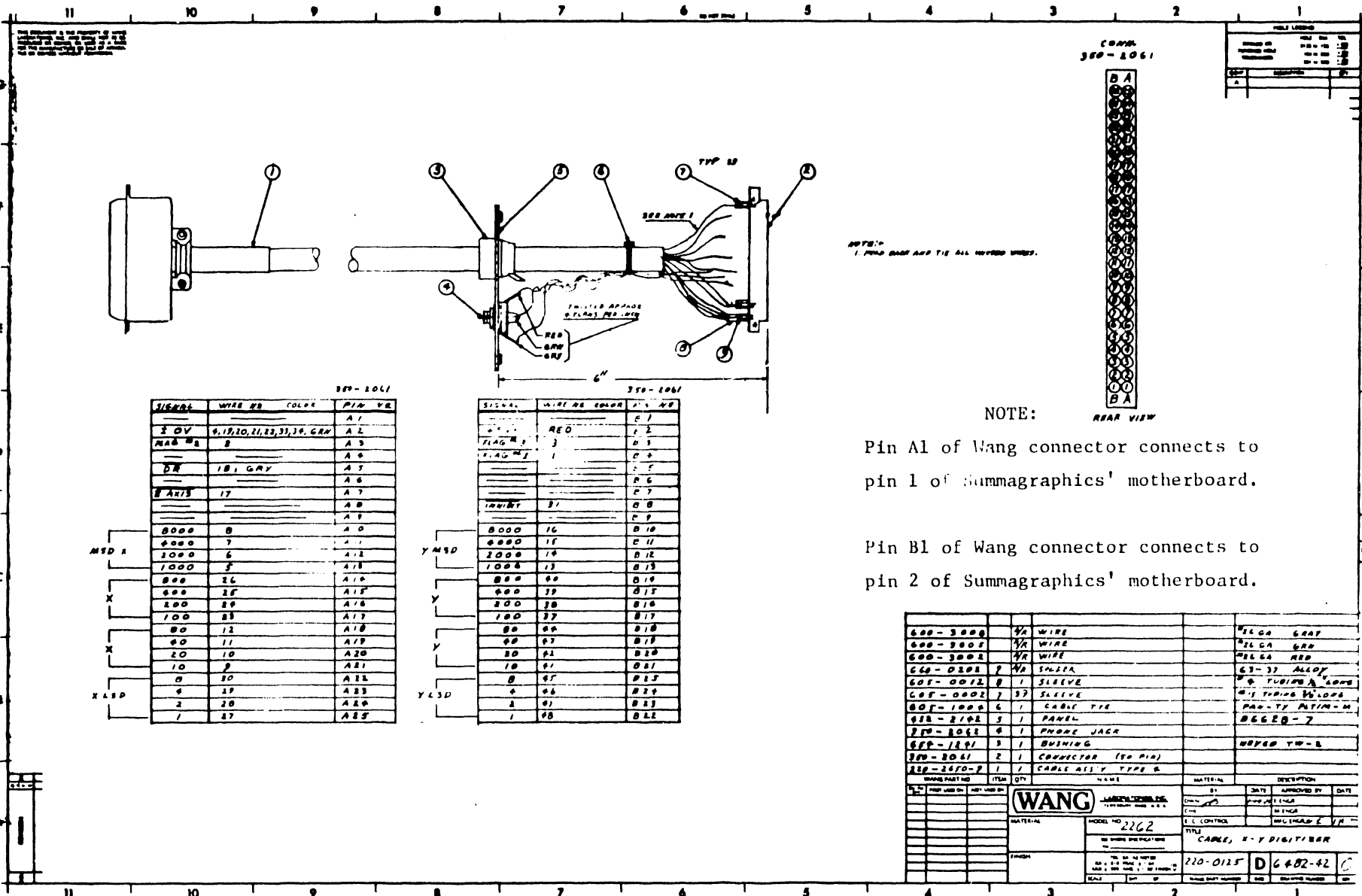
NOTE:

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

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

WANG LABORATORIES, INC.

MODEL NO 2262

TITLE: CABLE, X-Y DIGITIZER

D 6482-42
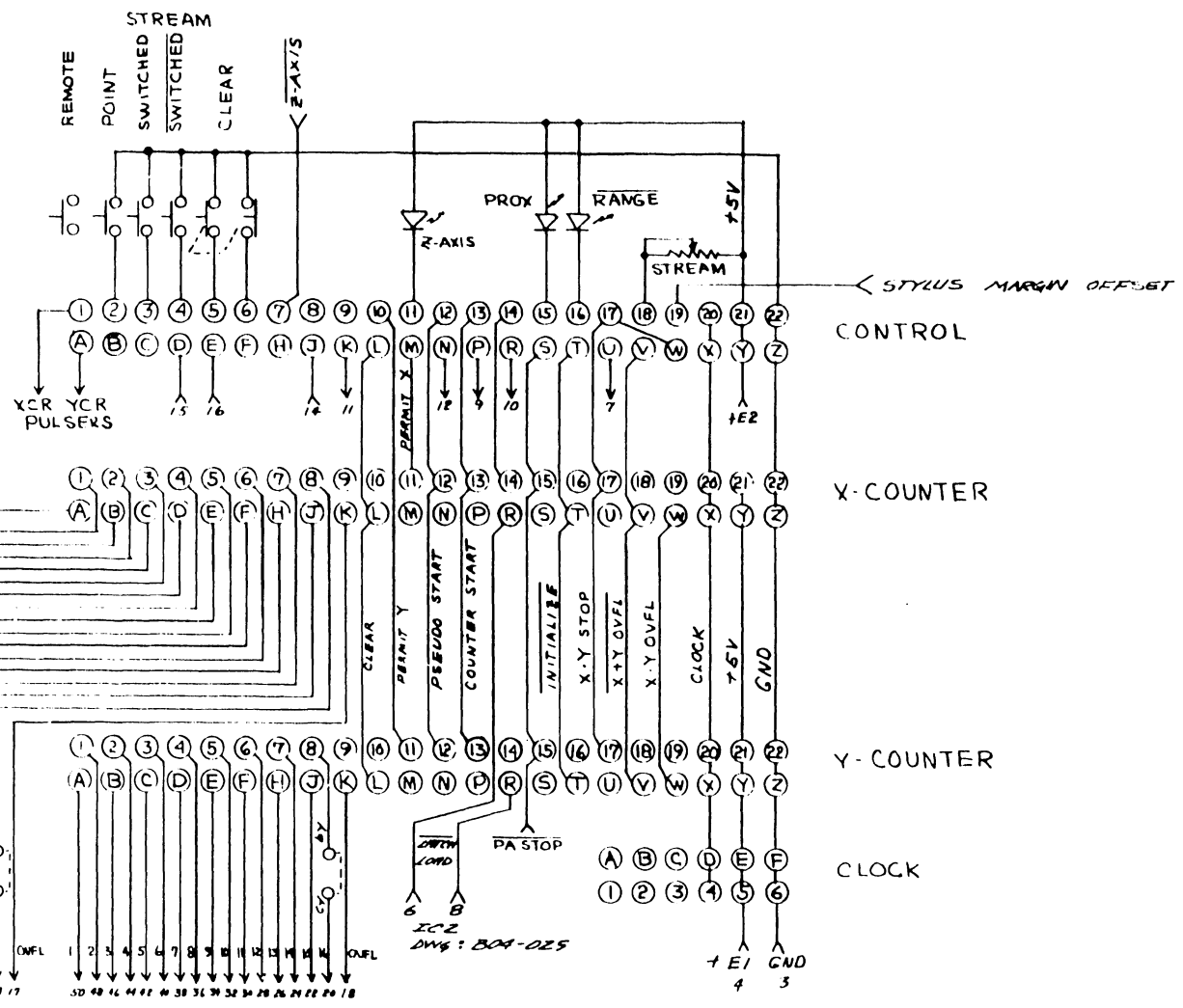
INTERCONNECTION DIAGRAM HW-1

C04-014 E

USE WITH MOTHER BOARD OZ-006 C
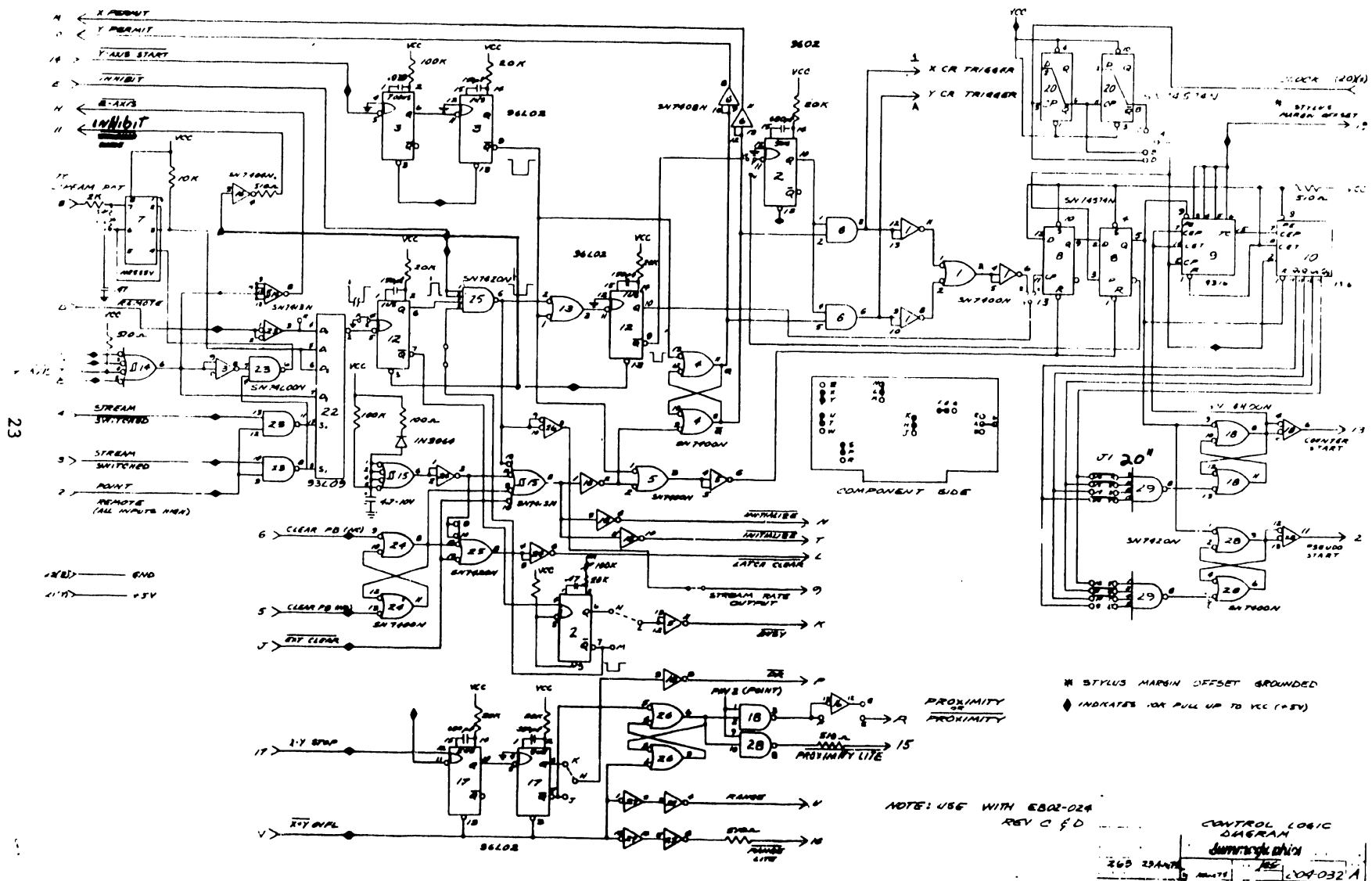
CONTROL LOGIC
DIAGRAM

NOTE: USE WITH EB02-024
REV C & D

COMPONENT SIDE

※ STYLUS MARGIN OFFSET GROUNDED
◆ INDICATES 10K PULL UP TO VCC (+5V)
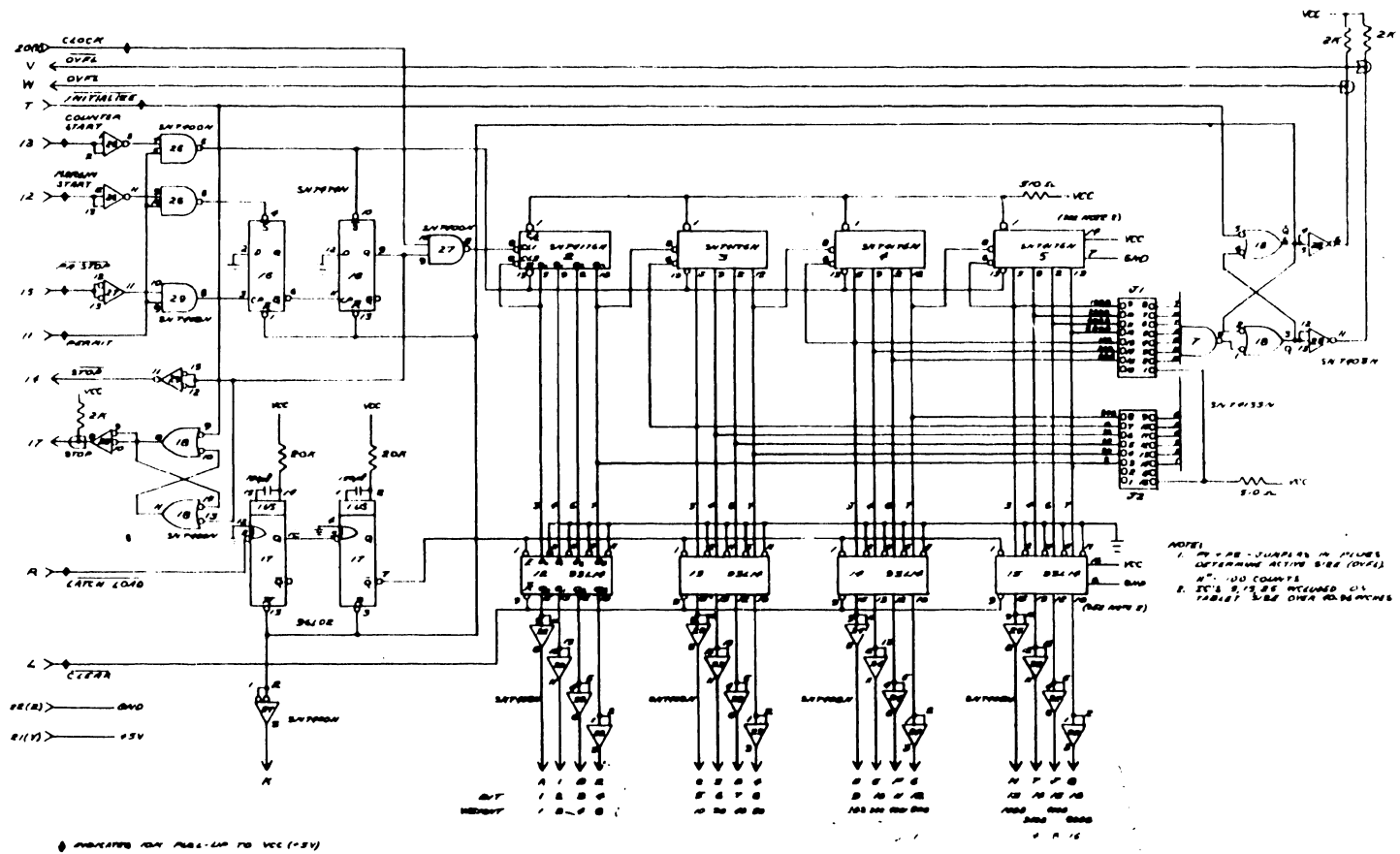
960 UP COUNTER
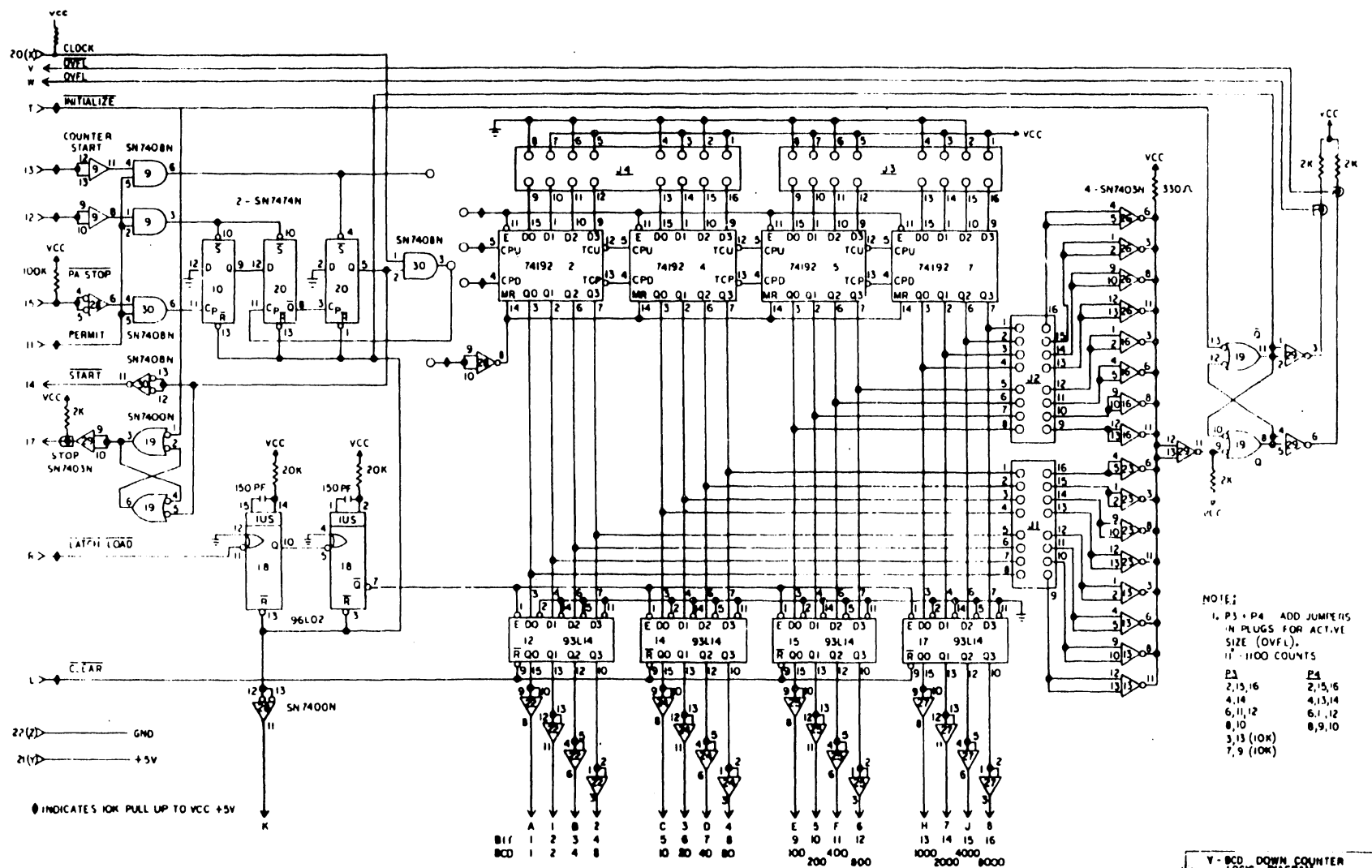
V - BCD DOWN COUNTER
LOGIC DIAGRAM

D04-017 B
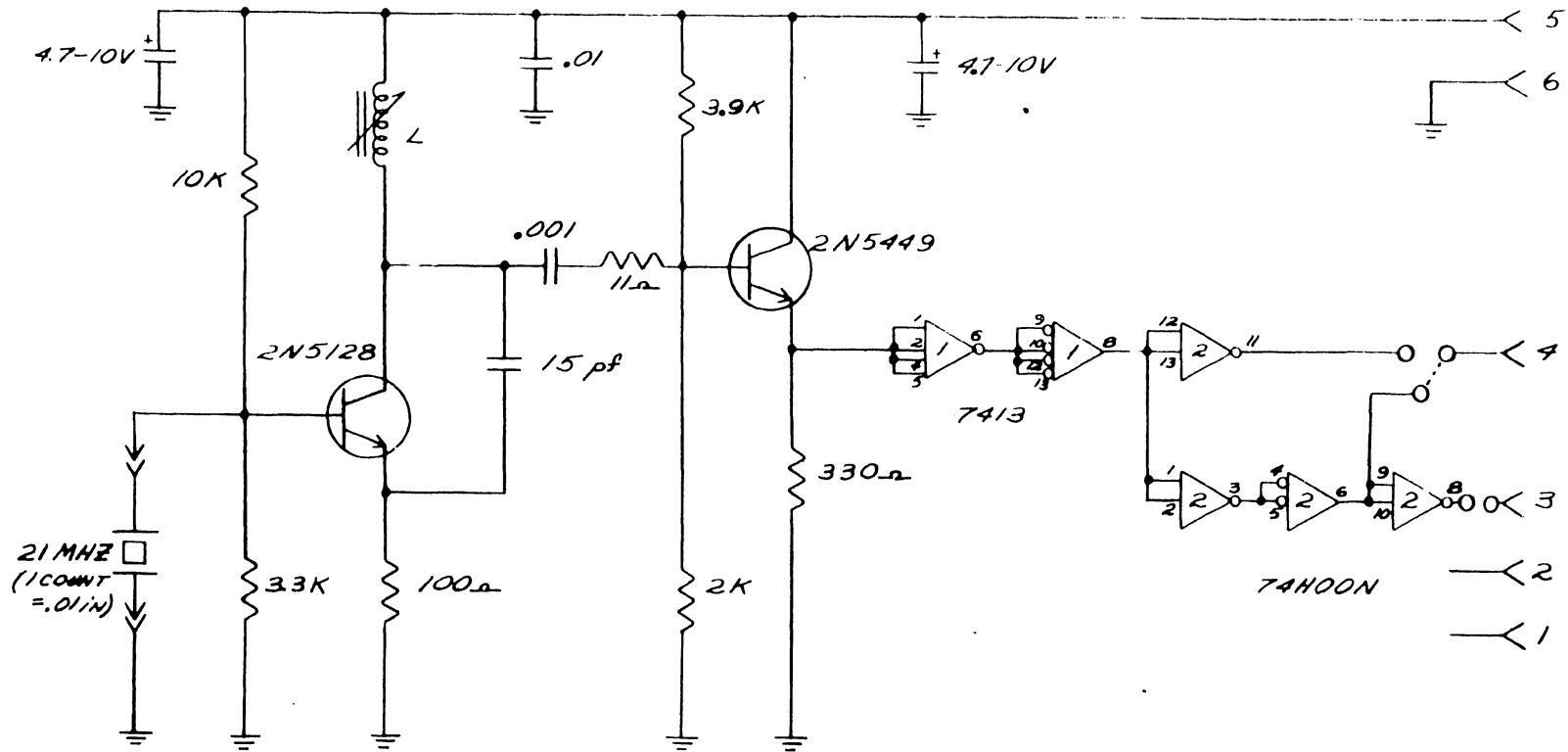
NOTE:
ALL CAPACITORS IN MF UNLESS OTHERWISE SPECIFIED.

CLOCK SCHEMATIC

Summagraphics

JBC
28 Mar 73   EJS E09-007 A

50/60 HZ

½ ASB

PWR ON
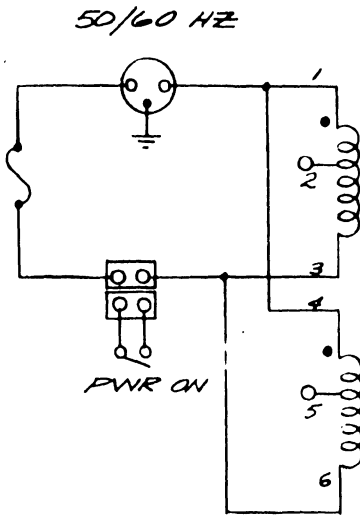
115V - AS SHOWN
230V - LINE BETWEEN
1 + 6; JUMPER 3 + 4
100V - LINE BETWEEN
2 + 5 AND 3 + 6
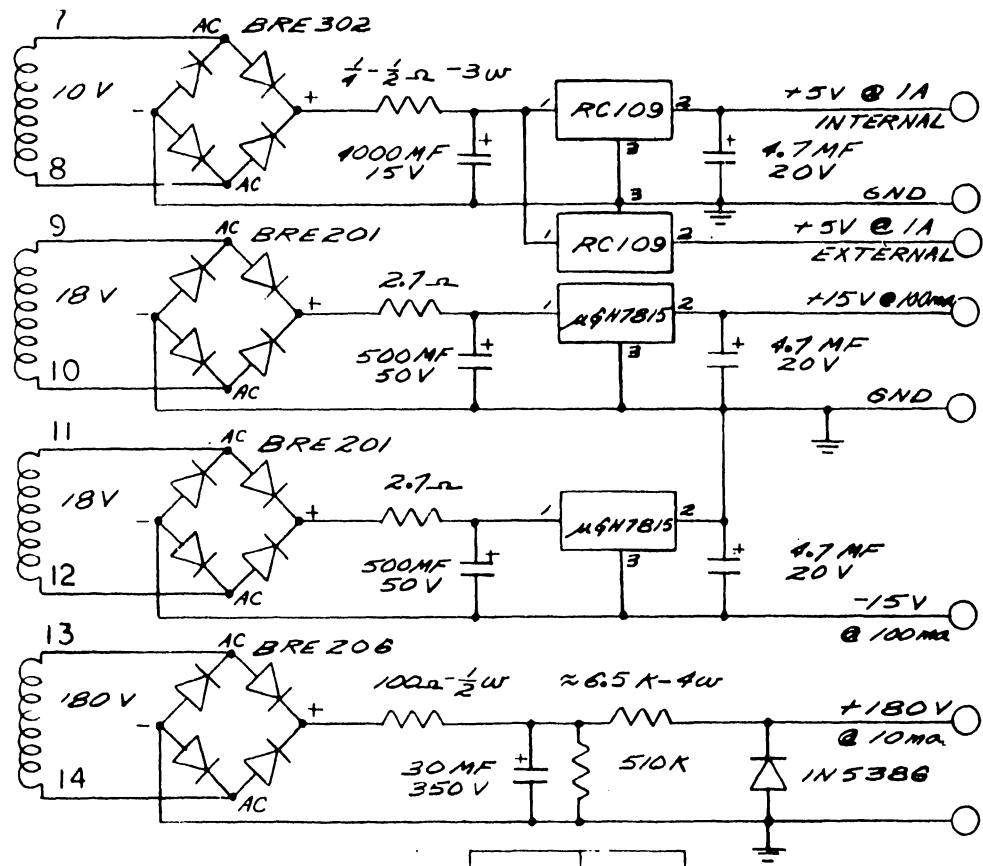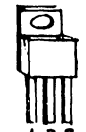
1
2
3
4
5
6

7
10 V
8

AC BRE302
$1 - \frac{1}{2}\Omega -3w$
1000 MF
15 V
RC109
+5V @ 1A
INTERNAL
4.7 MF
20V
GND

9
18 V
10

AC BRE201
2.7Ω
500 MF
50 V
RC109
+5V @ 1A
EXTERNAL
µ GH7815
+15V @ 100ma
4.7 MF
20V
GND

11
18 V
12

AC BRE201
2.7Ω
500 MF
50 V
µ GH7815
4.7 MF
20V
-15V
@ 100ma

13
180 V
14

AC BRE206
$100\Omega -\frac{1}{2}w$
≈ 6.5 K - 4w
30 MF
350 V
510K
+180V
@ 10ma
1N5386

RC109
3

1 32
7815

203	11 JUNE 74	Summagraphics FAIRFIELD, CONN.		
151	13 MAR 74	POWER SUPPLY SCHEMATIC		
50	7 NOV 73	SCALE	DWN BY JBS	DWG NO
.CN	DATE	DATE 27 MAR 73	CKD BY EJS	B09-003	REV D
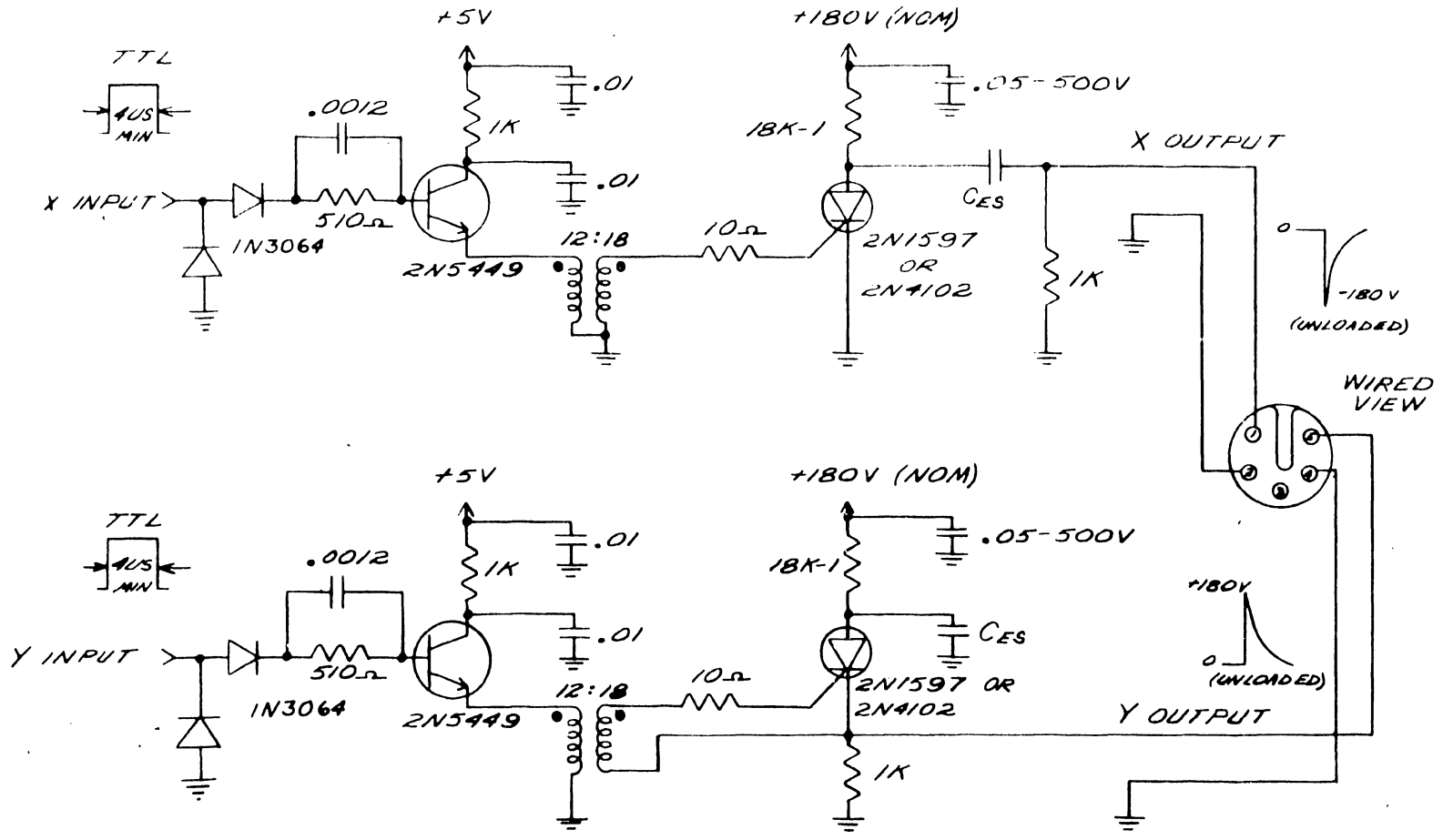
X & Y PULSER

NOTE:
1) ALL CAPACITORS IN MFD.
2) C_{ES} TYPICALLY .1 MFD.

Summagraphics

27 MAR 73   EJS   E09-008 A

$G \approx 12$ $G \approx 100$ $G \approx 10$ $G \approx .9$

+12V NOM   75Ω - ½W   +15V @ 35ma

10K 2%   1K   2N5449   4.7MF 20V   1N5242

68pf   100pf   4.7MF 20V

#28G #32G   13   9   10   SN7271ON

10:120   1   10   .01MF   2N2914   2   9   11

INPUT   5   3   (11)   1   3   2   OUTPUT

6   +   .1MF   6

100pf   SN72702N   30Ω   30Ω   .01MF   510Ω   5.1K   10K

20Ω   3K   100Ω 2%   10K   510Ω   2K   510Ω   5K   .01MF

510Ω   .01 MF

4.7MF 20V   -6V NOM   4.7MF 20V   330Ω - ½W   -15V @ 25ma   GND.

1N5233

J1   Z-AXIS SW (NO)   MARGIN OFFSET   FLAG #1   FLAG #2   FLAG #3
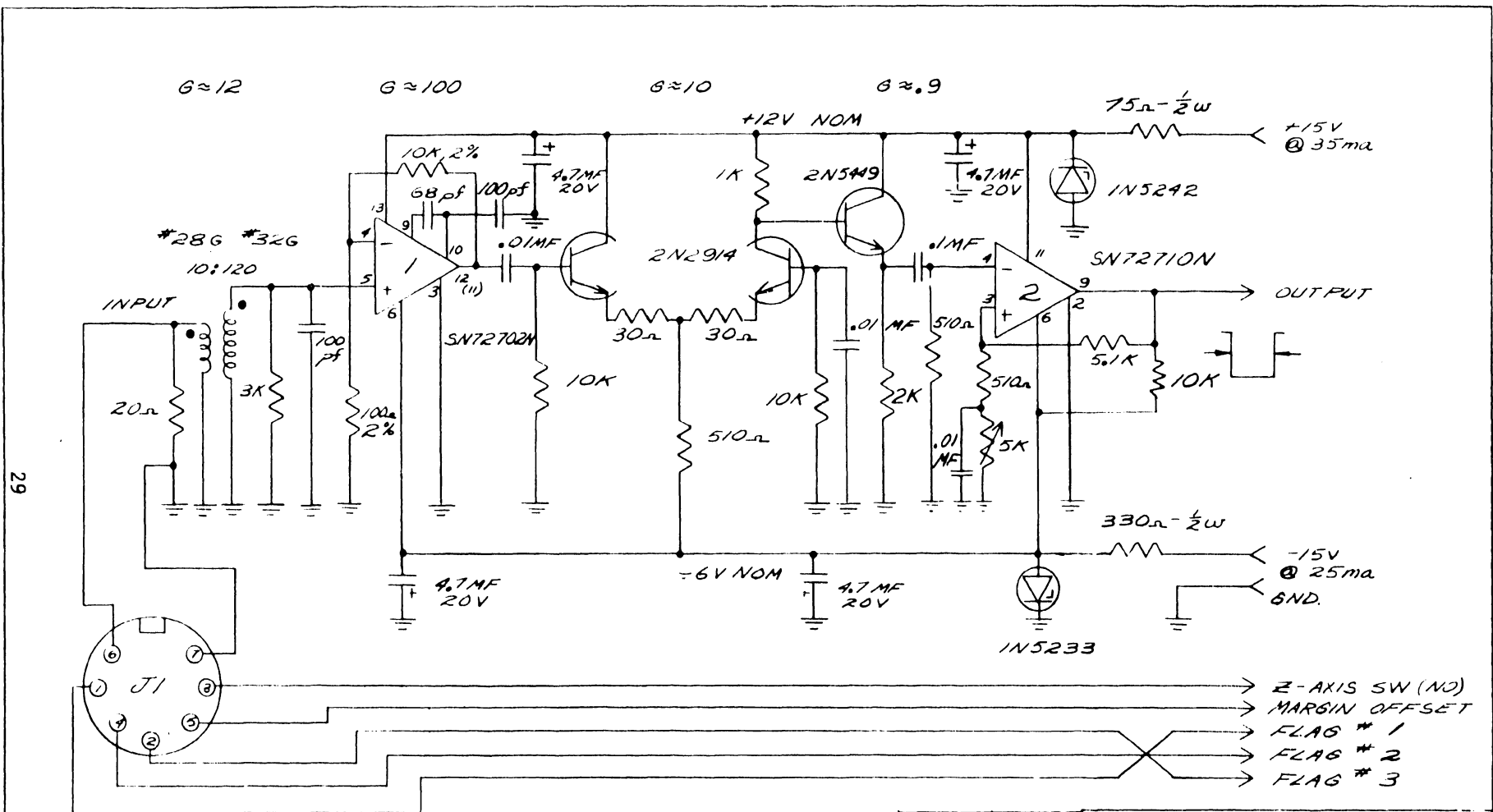
WIRED VIEW

NOTE: EB02-003 & EB02-020A

PREAMP SCHEMATIC

Summagraphics FAIRFIELD CONN.

137   13 FEB 74   SCALE   DWN BY JBS   DWG NO
DATE   28 MAR 73   CKD BY EJS   B09-005 B

CONTROL
X-Y COUNTERS   17

+5V   20K   SN7400N

Y COUNTER   8
3M INTERNAL   20

680 pf   20K

2.7Ω-¼w   R OF Y COUNTER

X COUNTER   8
3M INTERNAL   19

GND

2.7Ω-¼w   R OF X COUNTER

FLAG #3   J1 PA   1.5M   +5V   INTERNAL   DESCRIPTION
2   5.1K   2N5308   Control 3M   FLAG #3
330Ω   100 MF   F   B

FLAG #2   1.5M   +5V   Control   C
1   5.1K   2N5308   FLAG #2
330Ω   100 MF   SN7414N   5

FLAG #1   1.5M   +5V   Control   B
1   5.1K   2N5308   FLAG #1
330Ω   100 MF   6

1.5M   +5V   .01 MF   SN7413N
3   5.1K   2N5308   PIN 7   Z-AXIS
330Ω   100 MF   CONTROL
Z-AXIS SWITCH   +4V   +0V   3   3   B

NOTE: CIRCUITS LOCATED ON
MOTHER BOARD 02-006 C

X,Y FREEZE LOGIC; Z-AXIS;
FLAG LOGIC DIAGRAM

Summagraphics   FAIRFIELD CONN

/44   8 MAR 74   SCALE   DWG BY   C04-050   B
8 MAR 74

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.

$\overline{\text{Ext}}$ $\overline{\text{Clear}}$ 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.
$\overline{Y}$ $\overline{Axis}$ $\overline{Start}$	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.
$\overline{Z-axis}$	Pulse from cursor or stylus switches which starts the digitization process by starting counters and phase locking clock to pulser.
$\overline{Z-axis}$ light	2200 Ready light tied to $\overline{inhibit}$ line.

```
10 REM 2262 DIAGNOSTIC TEST
20 REM 01/20/75
30 REM WANG CUSTOMER ENGINEERING DIVISION
40 DIM A$12
50 SELECT PRINT 205, INPUT 65A, CO 65A
60 PRINT HEX(030A0A0A); "                                    2262   TEST"
70 PRINT HEX(0A0A); "      SIGN BIT       FLAG SWITCH        X-VALUE        Y-VALUE"
80 PRINT HEX(0A);   " (NEG-NO BUTTONS)   (0,1,2,4) "
90 PRINT HEX(0A0A0A);      "                                    X-LIMITS       Y-LIMITS"
100 PRINT HEX(0A);          "          20 X 20 IN.    TABLET    0000-1999      0001-2001"
110 PRINT HEX(0A);          "          30 X 40 IN.    TABLET    0000-3999      0001-3001"
120 PRINT HEX(0A);          "          36 X 48 IN.    TABLET    0000-4799      0001-3601"
130 PRINT HEX(0A0A)
140 PRINT HEX(0A); " WHEN TEST IS COMPLETE HIT RESET & SPECIAL FUNCTION KEY 15. "
150 INPUT A$
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 $
```

END