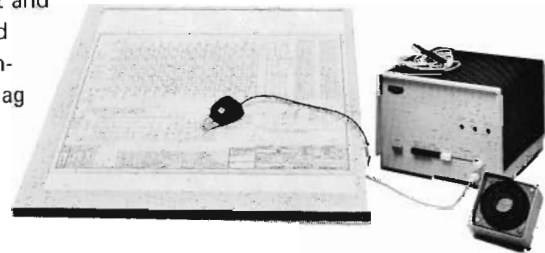


A digitizer is a device which is used to locate the positions of points on graphic media such as strip charts, graphs, photos, engineering drawings, and other documents, and convert them into digital information (in the form of cartesian coordinates) which can be transmitted to the computer for storage 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.

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 2262 Digitizer is available in three models. The Model 2262-1 provides a digitizing tablet 20 inches x 20 inches (51 cm x 51 cm) in size; the active digitizing area of 400 square inches (2,540 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 (75 cm x 100 cm) in size; the Model 2262-3 provides an area 36 inches x 48 inches (90 cm x 120 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 cursor pushbutton. In addition to the standard pushbutton, the cursor provides three special buttons called "flag buttons," which also can be used to digitize points. Each flag button not only 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 useful 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.



2262  
X-Y DIGITIZER

## DIGITIZER OPERATION

The document to be digitized is placed on the digitizer tablet, and the pen tip of the pen stylus or the bull's eye sight of the cursor is used to trace the data. Points are digitized by positioning the cursor sight or pen tip on the point, and depressing the stylus or the cursor pushbutton (or one of the three cursor flag buttons). This action causes a digitizer "readout" to be generated, consisting of a sign character (plus or minus) and ten digits. The first digit of the readout is the "flag digit"; its value is determined by the particular flag button used in digitizing the point (if the pen stylus or cursor pushbutton is used instead of a flag button to digitize the point, this digit is always zero). The second digit is a place holder, which is always set to zero. The remaining eight digits represent the X and Y coordinates (four digits each for the X coordinate and the Y coordinate).

A controlling program in the System 2200 receives, processes, and/or stores the readouts as they are generated by the digitizer. Five BASIC statements are available for receiving digitizer output: INPUT, DATALOAD, DATALOAD BT, KEYIN, and MAT INPUT. The Model 2262 X-Y Digitizer can be operated with a Wang System 2200A, 2200B, 2200C, or 2200S, but not all of the above statements are available on all models of the System 2200.

## MODES OF DIGITIZING

Because different jobs require different types of digitizer operation, the digitizer provides three operating modes: Single Point, Switch Stream, and Stream. For selective sampling of particular points, individual points can be digitized in Single Point mode (one point is digitized each time a cursor pushbutton or the pen stylus is depressed); in this case, the sign of each readout is always plus (+). For operations such as curve tracing, on the other hand, a continuous series of up to 200 points per second can be digitized in either of the two stream modes. In Switch Stream mode, points are digitized continuously as long as the pen stylus or cursor pushbutton (or one of the flag buttons) remains depressed. The sign of each readout is plus (+). In Stream mode, points are digitized continuously while the pen stylus or cursor remains within about 3/16 inch of the tablet surface, irrespective of whether the stylus or a button is depressed. As long as nothing is depressed, the sign is minus (-); when the stylus or a cursor button is depressed, the sign of each readout is plus (+). As in Single Point mode, the cursor flag buttons can be used in Stream and Switch Stream modes to set a flag bit in the high order digit of a series of readouts.

## PRINCIPLE OF DIGITIZER OPERATION

The coordinates of each point on a document are determined by establishing with great accuracy the position of the cursor or stylus at that point on the tablet surface. The position is established electronically on an underlying coordinate grid of X and Y wires embedded beneath the surface of the digitizer tablet. Each point's X and Y coordinates are measured in inches on the coordinate grid, with respect to an absolute origin point located in the lower left-hand corner of the tablet. Throughout the active digitizing surface of the tablet, coordinate measurement is accurate to less than .01 inch. When the coordinates are received in the System 2200, the controlling program can translate the digitizer's "absolute" coordinates into a set of "real" coordinates relative to an origin point located anywhere on the source document by simple subtraction.

## RELIABILITY

The unique method used by the Model 2262 to establish the position of the cursor or pen stylus on the tablet surface is a particularly elegant and efficient one. Because the Model 2262 utilizes a grid of wires embedded *within* the digitizer tablet, it provides extreme accuracy (to less than .01 inch) and repeatability throughout the entire digitizing area. Further, the accuracy is not impaired by the tablet's position, and is unaffected by atmospheric conditions such as temperature and humidity within the specified operating range. Finally, because the Model 2262 employs no moving parts, its reliability and durability are outstanding.



## DIGITIZER UTILITIES

The Wang Digitizer Utility Package, provided free of charge to digitizer owners, is designed to run on the System 2200B, 2200C, or 2200S (Option 22 is required for the 2200S). The package is *not* currently available for use on a System 2200A. Included in the package are utilities which perform the following functions:

- *Scaling Routine* – will enable the user to translate or transform digitizer coordinates into coordinates of a scale and rotation appropriate for his application.
- *Length Calculator Utility* – will compute and display the length and direction of a line lying between two digitized points.
- *Area Calculations Utility* – will compute and display the area of an enclosure which has been defined by digitizing the perimeter either in point mode or stream mode.

- *Image Storing Utility* – will allow points to be digitized in point or stream mode, checked for resolution, and stored in a file on disk along with control information for future processing.
- *Image Plotting Utility* – will recall the image stored by Image Storing and plot to any scale.
- *Menu Definition Utility* – will enable the user to define a "menu" whose coordinates are associated with designated items of data.
- *Interpolation Utility* – will interpolate the value of a point lying between two digitized points on a line.
- *Regression Analysis Utility* – will complete a best fit line and automatically plot the resultant line; at the same time, the equation defining the line will be computed and displayed. Both linear and polynomial regression analysis are possible.

## SOME APPLICATIONS OF THE MODEL 2262 X-Y DIGITIZER

### Analysis of Irregular Shapes

Analyzes irregularly shaped plots of land or bodies of water to determine area, perimeter length, and centroid. Computes volumes of irregular solids from drawings, photos, or X-rays.

### Analysis of Irregular Waveforms

Calculates area under curves, computes fourier coefficients, etc., in analysis of strip charts and oscilloscope tracing photographs.

### Analysis of Photos

Analyzes aerial photos for mapping, as well as microscopic photos and X-rays.

### Statistical Analysis

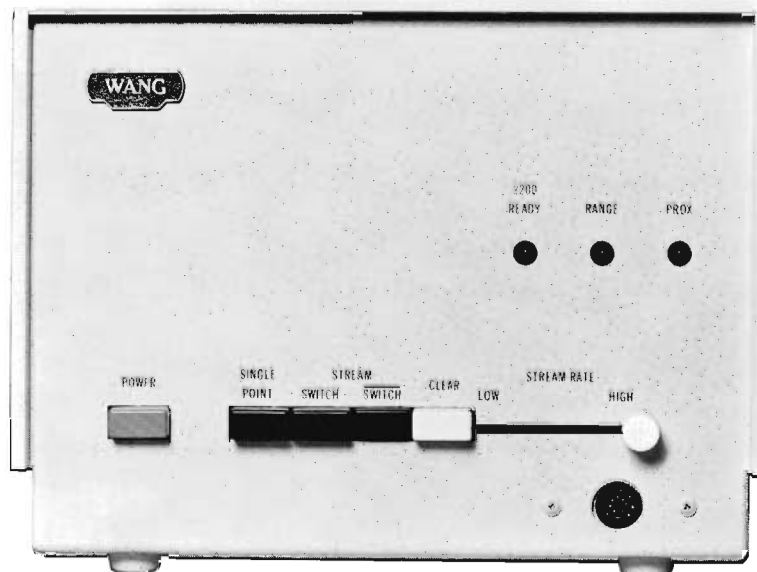
Mathematical modelling of curves, curve fitting, regression analysis, and integration.

### Scaling with Plotter

Digitize original curve, smooth the data, and replot to any desired scale.

### Menu Selection

Data entry applications which involve form filling can be automated by using a "menu" which consists of a number of boxes containing item names, quantities, etc. Coordinates of each box are defined in the controlling program, so that digitizing a particular box generates a specific data input. Similar techniques can be used to enter engineering symbols for automated drafting applications.



# DATA SHEET

## DIGITIZER SPECIFICATIONS

### TECHNICAL DATA

#### Resolution

100 lines/inch. Number of bits depends on tablet size.

#### Linearity

.08% of full scale.

#### Accuracy

Less than .01 inch.

#### Repeatability

Less than .01 inch.

#### Stability

Less than .01 inch.

#### Repetition Rate

Continuously variable up to 200 coordinate pairs per second.\*

#### Coding

BCD

#### Coordinate Origin

Lower-left corner (first quadrant operations).

#### Coordinates

Absolute

#### Operating Modes

Point — single coordinate pair transmitted by depressing pen or cursor button.

Stream — coordinate pairs transmitted continuously while pen or cursor within legal range.

Switch Stream — coordinate pairs updated continuously while pen or a cursor button depressed.

#### Controls

Pushbutton selection of Point, Stream, or Switched Stream. Slider bar selection of stream rate.

Three special flag buttons on the cursor for special control functions.

#### Indicator Lights

RANGE — lights when cursor or pen outside active digitizing area.

2200 READY — lights when the System 2200 is ready to receive points.

PROXIMITY — lights when stylus or cursor within 1/4" of the active tablet surface area (i.e., within legal digitizing range).

\*Maximum stream rate is a function of controlling program in the System 2200.

#### Digitizer Tablet Sizes

2262-1 . . . . . 20 in. x 20 in.

2262-2 . . . . . 30 in. x 40 in.

2262-3 . . . . . 36 in. x 48 in.

#### Digitizing Elements

Standard 4-button cursor with black bull's eye sight. Standard pen stylus.

#### Power Requirements

0.3A, 115 VAC, 60 Hz

0.15A, 220 VAC, 50 Hz

#### Operating Environment

Background Magnetic Field — 20 gauss max.

Temperature — 50°F to 90°F (10°C to 30°C)

Humidity — 20% to 80%

### ORDERING SPECIFICATIONS

A digitizer capable of converting discrete points on a document into cartesian coordinate pairs, and transmitting the coordinates to the System 2200 for storage or processing. The standard digitizer tablet must provide an active digitizing area 20 in. x 20 in. (51 cm x 51 cm) in size. Other models should be available with tablet sizes of 30 in. x 40 in. (75 cm x 100 cm) and 36 in. x 48 in. (90 cm x 120 cm). Both a four-button cursor with bull's eye sight and a pen stylus must be provided as standard equipment. Both must be capable of digitizing and transmitting individual points or a continuous series of points. Accuracy throughout the digitizing area must be less than .01 inch, and accuracy should be unaffected by the tablet's position, or by ambient temperature or humidity which do not exceed the specified operating ranges.

*Wang Laboratories reserves the right to change specifications without prior notice.*



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Printed in U.S.A.  
700-3567  
1-75-15M