# T.CAD

Computer Assisted Drafting

USER MANUAL

MICRODEX
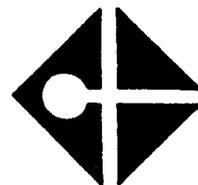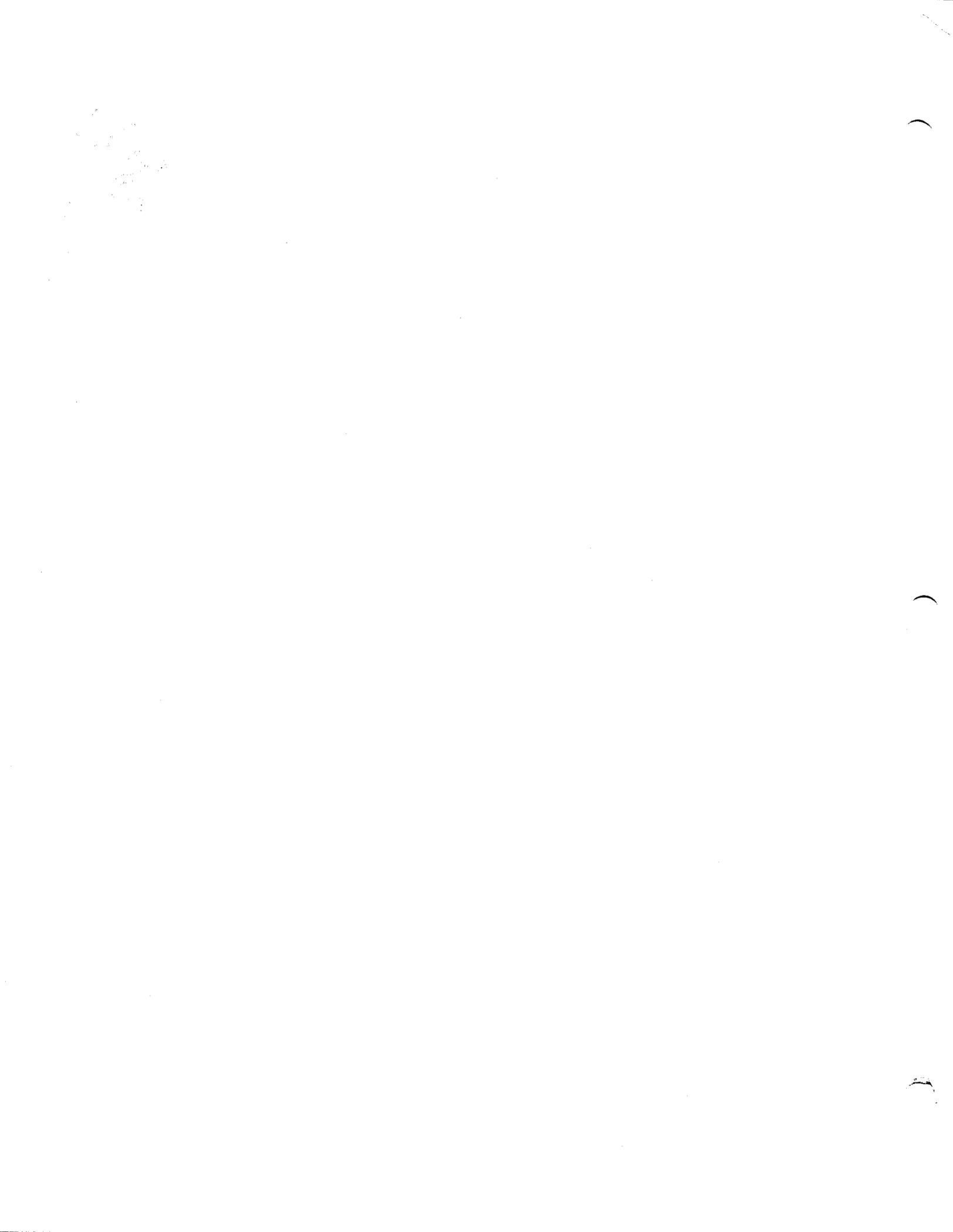
X.T.CAD

Computer Aided Drafting * Reference Manual

MICRODEX
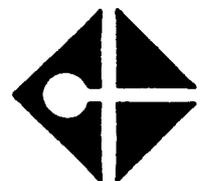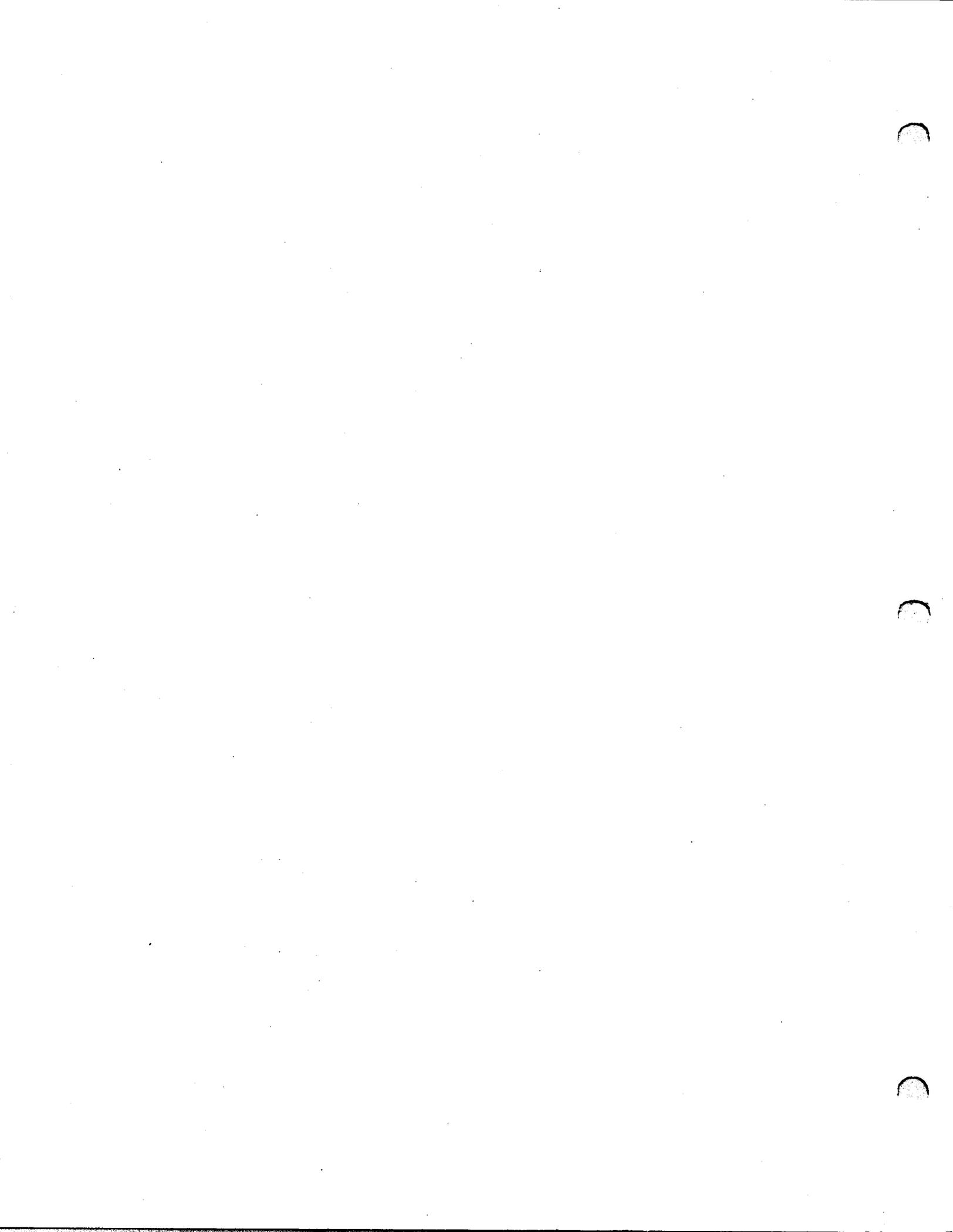
MICRODEX CORPORATION

Note to our Customers:

xT.CAD has been designed to operate on simple, inexpensive, general-purpose hardware. No exotic boards or input devices are required. You can start using it at once. The best way to get acquainted with your xT.CAD is this. First, thoroughly REVIEW the ENTIRE manual. Second, BACKUP the original xT.CAD disk and store it away safely. Third, configure xT.CAD for your hardware. And then just go ahead and experiment with it hands-on. xT.CAD is quite patient: it simply ignores wrong keystrokes, so don't be afraid to drive it hard.

For your protection, please review the copyright, license and warranty conditions in the Appendix, and fill out and mail the registration card TODAY. It is NOT a warranty card. The warranty runs from the date of original purchase, and not from the date you mail the card. But the registration assures that we can reach you in case of changes, corrections or enhancements. If you have problems or questions, you must be registered and give us the serial number stamped on your original xT.CAD disk.

This manual is applicable to all TRSDOS versions of xT.CAD (in the text we may also call it T.CAD which is the same thing). The manual does contain every single bit of information about T.CAD you will ever need. But we generally follow the good draftsman's practice of stating every specification only in one place of the document, without extra verbage. So please do read it all, and when in doubt, re-read one more time before making this quick but expensive long distance call!

However, if you do need assistance, please do not hesitate to contact Microdex. We also sincerely welcome your comments and suggestions: they help us to improve xT.CAD. At the present time, until further notice, there is no charge for registered Customer consultation. Call if you must, but we prefer if you write.
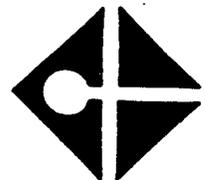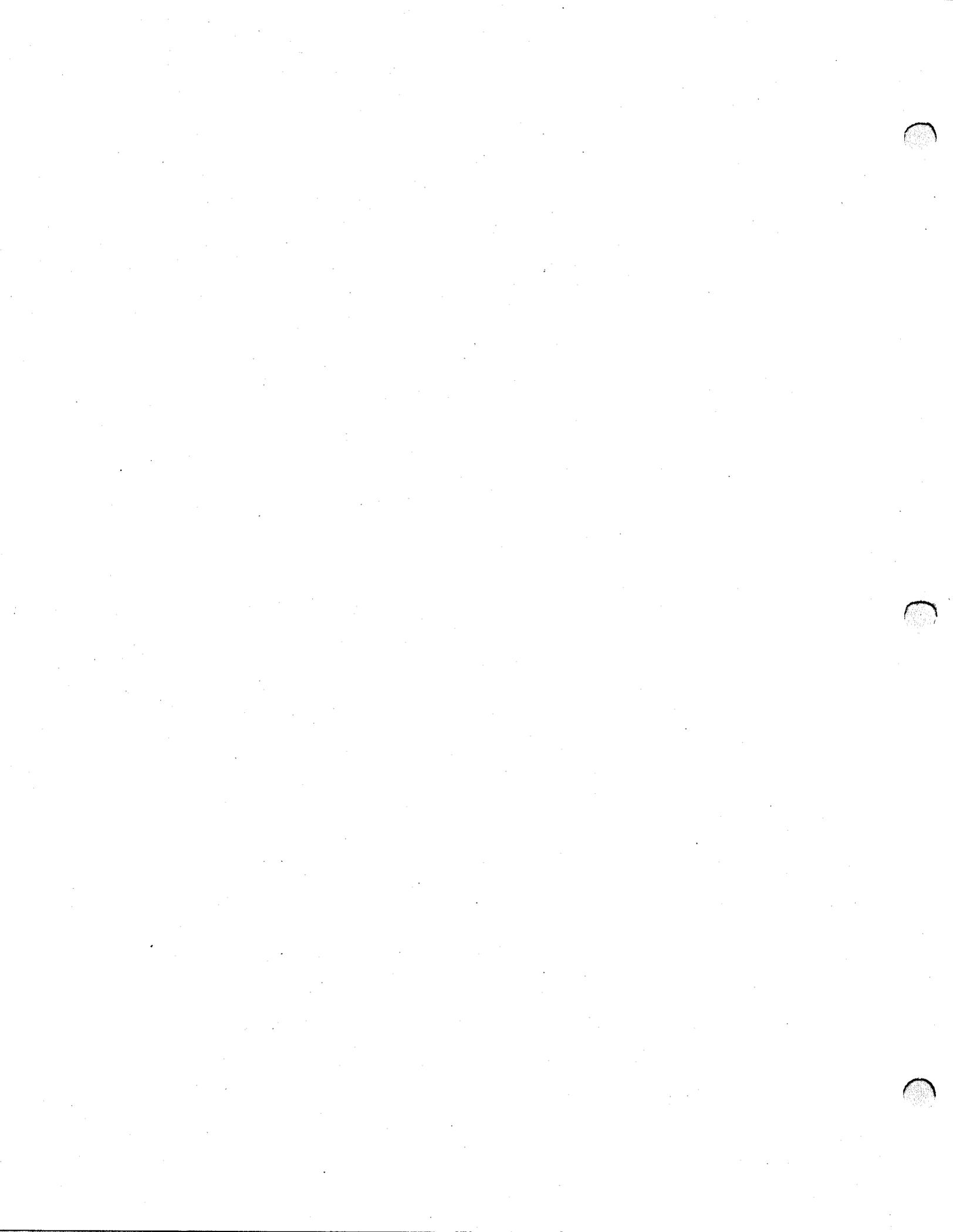
C O N T E N T S

The pages in this manual are numbered sequentially but not
consecutively, i.e. page numbers are skipped between sections.
The user may wish to insert own notes, or we may supply inserts
as could be needed in the future.

NOTE: In daily use you will probably need mostly the reference
pages which for this reason have been placed at the beginning of
this manual. But the appendix does contain additional
information essential for first time users.

Copyright 1985, 1986, 1987 by Microdex Corporation
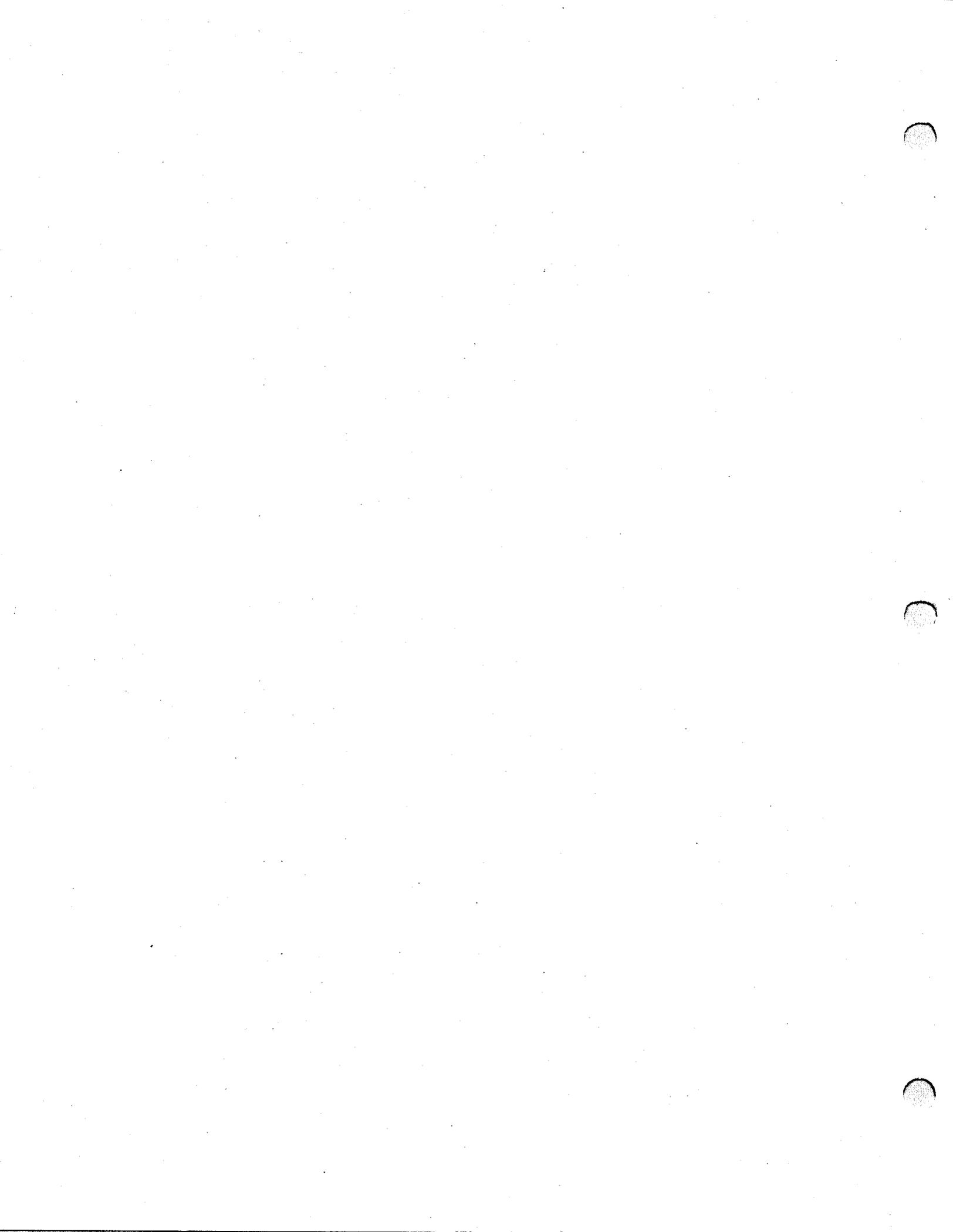
H O W T O R U N T . C A D

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xT.CAD is supplied on a data disk (a disk which does not contain an operating system). Before you actually run xT.CAD you must perform a simple installation routine to match your hardware. Step-by-step instructions for this procedure are described in Appendix Section 100. Once you have installed xT.CAD onto a system disk (floppy or hard), run it as follows:

1. Make sure xT.CAD is on your system drive, usually :0.

2. Reset the computer to re-initialize default conditions. No filters or drivers are required, and they may even interfere with xT.CAD. If your system sets up any such utilities for your other programs, you should disable them before running xT.CAD. Note in particular that xT.CAD manipulates the serial RS-232 interface for plotter and digitizer input/output. If you use your computer with other RS-232 devices (eg. modem) then reset it before and after using xT.CAD to prevent interference.

3. Finally, still from TRSDOS, simply type

| T | C | ENTER | Model 4 / 4p / 4D

| T | ENTER | Model III

and wait until your drafting screen is ready for your commands.

The xT.CAD data disk contains also some sample sketches named T1SAMPLE, T2SAMPLE, SAMPLE3/TC, etc. You may load and use those drawings for experiments with xT.CAD functions.

Additional i m p o r t a n t information released after this printing may be included on the xT.CAD disk in ASCII files named UPDATE, UPDATE1, etc. Check the disk directory and if it does contain those files, please LIST them to your printer for reference.

F U N C T I O N   S U M M A R Y

`------------------------------------`

Cursor control

arrows	move POINT on screen, hold down for fast repeat
1-10	set speed of POINT in pixels per stroke of arrow
SPACE bar	reset POINT speed to current scaling system
@	set MARK to current POINT position (MARK the POINT)
:	swap MARK with POINT, or reset MARK where it was
T	start tracing mode from digitizer if connected

Drawing functions

/	draw solid line from MARK to POINT
. , ;	dotted, dashed, dot-dashed line as above
O	(letter) circle MARK center, radius to POINT
)	arc MARK center, radius to GHOST, deflect to POINT
(	3-point arc or circle
+	turn on scale grids
-	draw a sketch line/point
%	start digital co-ordinate input mode

Editing functions

?	find POINTed item (line, circle, etc) or help
SHIFT ←	sequential search back through items until "found"
SHIFT →	sequential search forward as above
!	erase current item or the one just "found"
*	block ** define *= copy *: swap *! erase

Display management

CLEAR SPACE	(SPACE CLEAR Model III) clean up screan, redisplay
>	enlarge part of screen framed by MARK and POINT
@ 1-10 >	directly select indicated magnification
<	reduce magnification by one step
SHIFT ENTER	shift (pan) display window across enlarged drawing
SPACE ENTER	display both pages simultaneously
1-2 ENTER	select page 1 or 2 as current 'top' page
CLEAR 1-2	(1-2 CLEAR Model III) redisplay only page 1 or 2

Home functions

SHIFT ↑	home cursors, or return to 'home' display format
A B C D	lock drawing sheet size A through D
$	lock decimal scaling system (10 pixel grid)
"	lock "inch" scaling system (12 pixel grid)
#	lock "pound" scaling system (16 pixel grid)
'	initiate text labeling
S	save drawing to disk
L	load drawing from disk
SHIFT CLEAR	discard page or quit job

Hardcopy

&	start plotter output

C U R S O R   C O N T R O L

Drawing and some other functions are controlled by two cursors:
      POINT: arrow with notched tip to place at an exact location
      MARK: solid square whose upper-left corner marks a pixel.
You can perform functions only when the POINT is 'alive', i.e.
moves when you press arrows. Cursors may freeze or disappear
temporarily during some internal processing phases.

`arrows` or `mouse`   m o v e   p o i n t

`1 - 0`   s p e e d   o f   p o i n t

`SPACE`   r e s e t   s p e e d   o f   p o i n t

Press a number from 1 to 0 sets the speed of POINT in pixels per
arrow stroke (zero returns 10). SPACE bar resets speed to be
equal to the current scaling system (for example, in the 'inch'
scaling system pressing SPACE resets to 12 steps, etc). Current
speed of POINT is shown in the lower-right corner of the screen.

The slowest speed of 1 pixel per arrow stroke is useful for
accurate positioning of the POINT. Faster speeds are for longer
moves across the screen. Speed of the POINT can also be used for
scaling by counting arrow strokes. For example, if one pixel on
the screen represents one foot in real life, then speed 3 will
move the POINT by one 'real' yard each time you press an arrow.

Arrows are fast-repeating: hold one down for a continuous move
of the POINT. If you have the Micro-Labs 'mouse' then any time
you hold down its fire button, the mouse moves the POINT. You
can alternate between the mouse and the arrows anytime: for
example, use the mouse for a long fast move across the screen,
then release and use arrows for final exact position, etc.

`@`   m a r k   t h e   p o i n t

Puts the MARK on top of the current POINT position. If MARK and
POINT are already overlaid, this function is ignored.

`:`   s w a p   m a r k   a n d   p o i n t

If POINT is MARKed, resets MARK back to where it was prior to
its last move. If POINT is not MARKed, swaps POINT with MARK.

```
┌─────┐
│  T  │         t r a c e       ( d i g i t i z e )
└─────┘
```

HOUSTON INSTRUMENT True-Grid digitizers series TG-1000, TG-8000
KURTA Series One digitizers with stylus and xT.CAD menu template
TANDY GT2000 digitizer with stylus and xT.CAD menu template

Before you press <T> which starts this function you must:
     connect and power up the digitizer;
     secure the original drawing to digitizer's active surface;
     move POINT to a location on the screen which will match
some relevant spot (eg. corner or center) of the drawing;
     set stepping rate of POINT to the tolerance at which you
wish to digitize (for example, to digitize a B-size drawing onto
a 2x10 mag B-screen, press <1> for 1/20 inch tolerance, or <2>
for 1/10 inch tolerance, or <5> for 1/4 inch tolerance, etc).

Now press <T> to start tracing and answer the prompts, or press
SPACE at any prompt to exit to the previous step:

     Copy % ... press ENTER to digitize same size. If you want
to reduce or enlarge, type desired percentage and then ENTER.

     Reference POINT ... put the digitizer's cursor as exactly
as you can at the point on the drawing which should match the
current position of the POINT on the screen; fire any button of
the cursor: digitizer and screen are now synchronized;

     Digitize ... simply move the digitizer's cursor around the
original drawing and fire the buttons as follows:
     # 1 moves the POINT   to digitized position
     # 2 MARKs the POINT   (or press <@> on keyboard or menu)
     # 4 swaps/resets MARK   (or press <:> on keyboard or menu).
Firing stylus switch or other buttons (if any) does the same
thing as # 1. If you digitize outside of the area of the current
screen, then the POINT jumps to the lower-right 'out' corner.

To copy the drawing, manipulate POINT and MARK and press the
usual mnemonic keys on the keyboard (or menu area) as noted in
the next section 'Drawing Functions'. For example, to copy a
line, MARK one end, POINT to the other end, and then press </>.
Text labels cannot be digitized.

Kurta/Tandy menu keys represent standard xT.CAD function keys as
shown on the template (copy and tape over menu area). You may
use the keyboard, or press menu key with stylus.

xT.CAD menu template for Kurta Series One and Tandy GT-2000 digitizers

Menu keys F0 - F9 are reserved for future use

D R A W I N G   F U N C T I O N S

Lines, circles, arcs, etc, are called 'items' in this manual.
They are always stored in the computer memory, displayed and
plotted in the same sequence in which they were originally
created or added on.

On the screen diagonal lines and curves appear 'stitched'
because they are approximated by horizontal or vertical
segments. But a plotter draws them without distortions.

/   s o l i d   l i n e

Press the / key to draw a solid line from MARK to POINT. After
the line is drawn, MARK merges over the current POINT position
(MARKs the POINT). Line must be at least one pixel long on the
current screen, otherwise this function is ignored.

.   d o t t e d   l i n e   as above.

,   d a s h e d   l i n e   as above.

;   d o t - d a s h   l i n e   (centerline) as above.

O   c i r c l e

Capital letter <O> draws a circle with center at MARK and radius
equal to the distance from MARK to POINT. Radius must be at
least one pixel long, otherwise this function is ignored.

)   c e n t r a l   a r c   see next page

(3 - p o i n t   a r c   o r   c i r c l e   see next page

When a cicle or arc is displayed on the screen, a single dot
shows its center. This dot remains on the screen even after you
erase the circle or arc, until you perform any function which
clears the screen. The center dot is NOT drawn on the plotter.

) central arc

First MARK the beginning 'B' of arc (see sketches below). Next
MARK center 'C'. Then move POINT from the center to any place
'D' (not necessarily the end 'E') along an imaginary line in the
direction of central angle and press the RIGHT bracket key.

After the arc is drawn, xT.CAD will MARK the end 'E' of the arc.
If that end falls outside of the screen, e.g. when drawing arcs
near the edges, then the arc will be still drawn correctly, but
the cursors will jump to the lower-right 'out' corner of the
screen. Maximum allowed arc is 180 degrees and it will always be
interpreted counterclockwise from 'B' to 'E'. Arcs with odd
angles (i.e. other than multiples of 90 degrees) are difficult
to construct precisely, because data are rounded off.

To draw arcs with radial lines (pieces of a pie) MARK the
beginning, POINT to center and draw first line. Then move POINT
to indicate angle as noted above, and draw the arc. Then press
<:> to reset MARK to center and draw the second radial line.
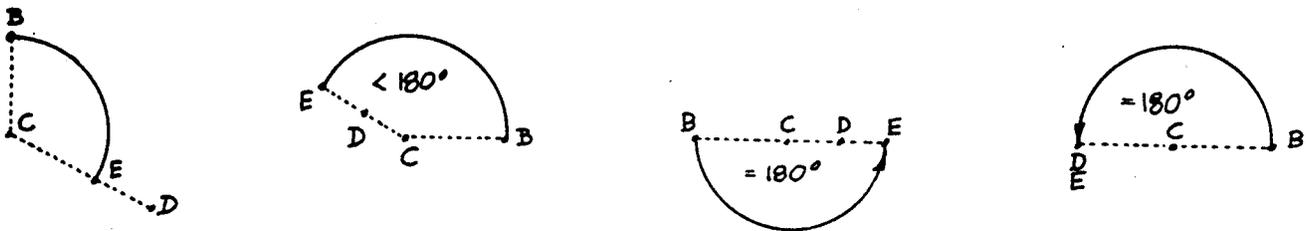
(3 - p o i n t   a r c   o r   c i r c l e

MARK the beginning 'B' of the arc, next MARK the middle 'M',
then POINT to the end 'E' and finally press the LEFT bracket
key. If the resulting central angle is 180 degrees then it will
be always interpreted counterclockwise from 'B' to 'E'. If it is
more than 180 degrees then a circle will be created instead. If
the computed center falls outside of the screen then it will be
forced into the lower-right 'out' corner and the resulting arc
will be different from what you intended. Arcs with odd angles
(i.e. other than multiples of 90 degrees) are seldom accurate.
The accuracy is better in higher zooms.

Drawing functions   1/22/87   Page 20.2
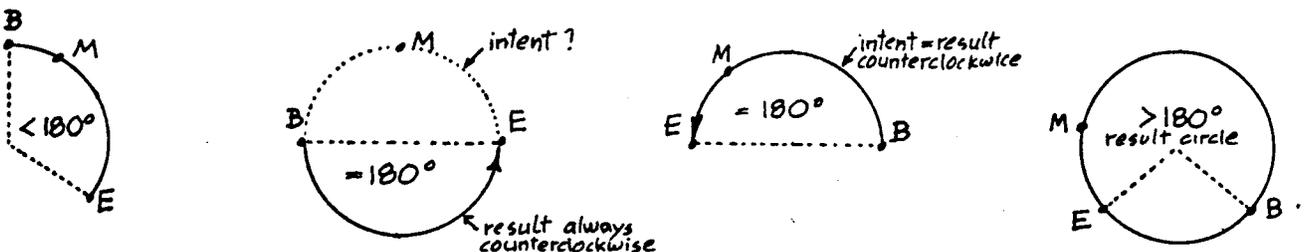
`+` g r i d

Whenever you press <+> plus symbol, the POINT snaps to the
nearest upper-left grid point. If there is no grid on the
screen, draws a grid of dots at one inch intervals at current
magnification. For example, at mag 1x when the maximum drawing
area is displayed, the grid will be spaced every 10 pixels, and
there will be 21 by 30 grid cells. At mag 3x this inch grid will
be spaced every 30 pixels, and there will be 7 by 10 cells on
the screen, and so on.

If the inch grid is already on, draws an intermediate grid
dividing an inch into as many parts as the current magnification
indicates, e.g. at magnification 4 it divides an inch of drawing
into 4 parts, and so on. The spacing of this secondary grid is
thus always equal to the number of pixels corresponding to the
current measuring system in use, e.g. in the decimal system
there will be 10 pixels per secondary grid cell, in foot-inch
12, and so on. Grid remains on the screen until CLEARed.

Secondary grid will not be created when drawing is displayed in
C-format, because the magnification of the C-format display is
1.5x which cannot be divided without confusion.

`-` s k e t c h   l i n e / p o i n t

Minus sign draws a temporary sketch line from MARK to POINT.
This line is not retained in the computer memory, and is used
only for sketching to judge the appearance of a final line, or
to assist in some geometric constructions such as finding a
center for a circle to be inscribed in a square, and so on.

If MARK and POINT are overlaid when this function is executed,
then a single pixel will temporarily mark some point, such as
the beginning of an arc to be drawn later.

The sketch line will remain on the screen until (CLEAR) function
is performed.

`1 - 10`   `P`   p a i n t

POINT to the middle of an area of display enclosed by any shape
made up of continuous solid lines, arcs or circles (paint will
'leak' through gaps in the enclosure). Next, set POINT speed
1-10 and press capital 'P' to paint with a shade pattern from
solid (10) to very light (1). The paint pattern is not retained
in memory, and is removed when you clear the screen. Paint is
ignored by a plotter, but can be reproduced on a dot printer.
Also note that on Model III only one (solid) paint shade is
possible if you run xT.CAD under Radio Shack BASICG.

% start coordinate input

Before you press the percentage sign, MARK any place on the screen as the origin of your Cartesian coordinate system (where you want to assume X=0 Y=0). Then press % key and you will be prompted

    1 INCH =   answer by entering scale in decimal form, up to 8 characters, decimal points OK. The scale can be anything you want (even metric: e.g. if you enter 1 inch = 2.54, then you can input coordinates in centimeters, etc). It is not necessary nor allowed by the computer to specify any units. You only need to keep your subsequent input consistent. For example, if you responded 1 inch = 8 with the intent of drawing at 1/8"=1'0", then all subsequent coordinates should be in feet. If you don't enter any number in response to this prompt, or press an invalid key, the coordinate input function will be terminated.

After the scale is defined, you can keep inputting digital data. Input formats and geometric examples are shown on the next page. The following general rules must be observed:

    For each item (line, arc, etc) you must first press the proper symbol (just press, don't ENTER). Press SPACE, or any other non-symbol key to return to the 1 INCH = prompt (then press SPACE again to exit from the coordinate input function).

    You must ENTER each digital value, 8 characters maximum, including sign and decimal point if any. Backspace and erase typos as usual with left arrow and shifted left arrow. Once ENTERed, the value cannot be corrected. To correct, press SPACE, then press symbol again, and redo.

    For lines, circles and central arcs you may just press ENTER without typing the first two required values (X and Y). In that case, the computer will use the coordinates of the endpoint of the item just previously input (end of line or arc, center of circle) and draw a contiguous item.

    Angles must be input in full degrees. Sign convention is positive counterclockwise, negative clockwise, in respect to zero on the X-axis. Maximum central angle deflection D for arcs (central or tangent) is plus or minus 180 degrees. Half circle is always drawn counterclockwise. Zero deflection is ignored.

    Tangent arcs and tangent lines must be "tangent" to either a line or another arc (central or tangent) just previously input in the current digital input mode, otherwise the results are unpredictable. Tangent arcs and lines always start at the endpoint of such previous item.

    Incorrect inputs or values exceeding the computer's math range are aborted. Press the item symbol again and try better.

Coordinate input formats

Each value (except the initial item symbol) must be ENTERed. Values of X and/or Y may be skipped, just press ENTER as noted on the preceding page. All other values must be given. Small 'e' means that you must press ENTER without typing any value.
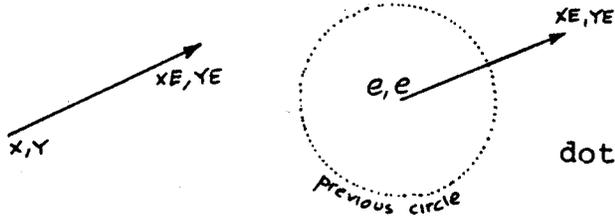
/	X	Y	XE	YE	solid line
.	X	Y	XE	YE	dotted line
,	X	Y	XE	YE	dashed line
;	X	Y	XE	YE	dot-dashed line
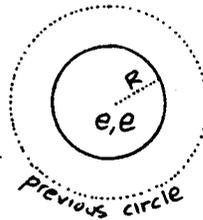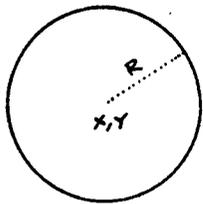
0	X	Y	R	circle
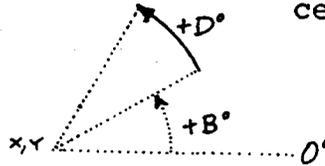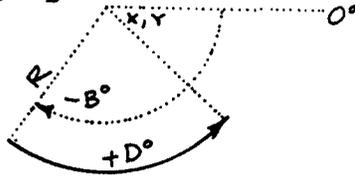
)	X	Y	R	B°	D°	central arc

(	R	D°	tangent arc
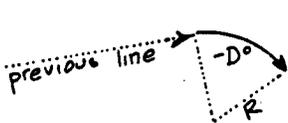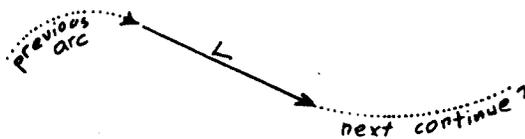
/	e	e	L	e	solid tangent line
.	e	e	L	e	dotted tangent line
,	e	e	L	e	dashed tangent line
;	e	e	L	e	dot-dashed tangent line

Drawing functions   1/22/87   Page 20.5
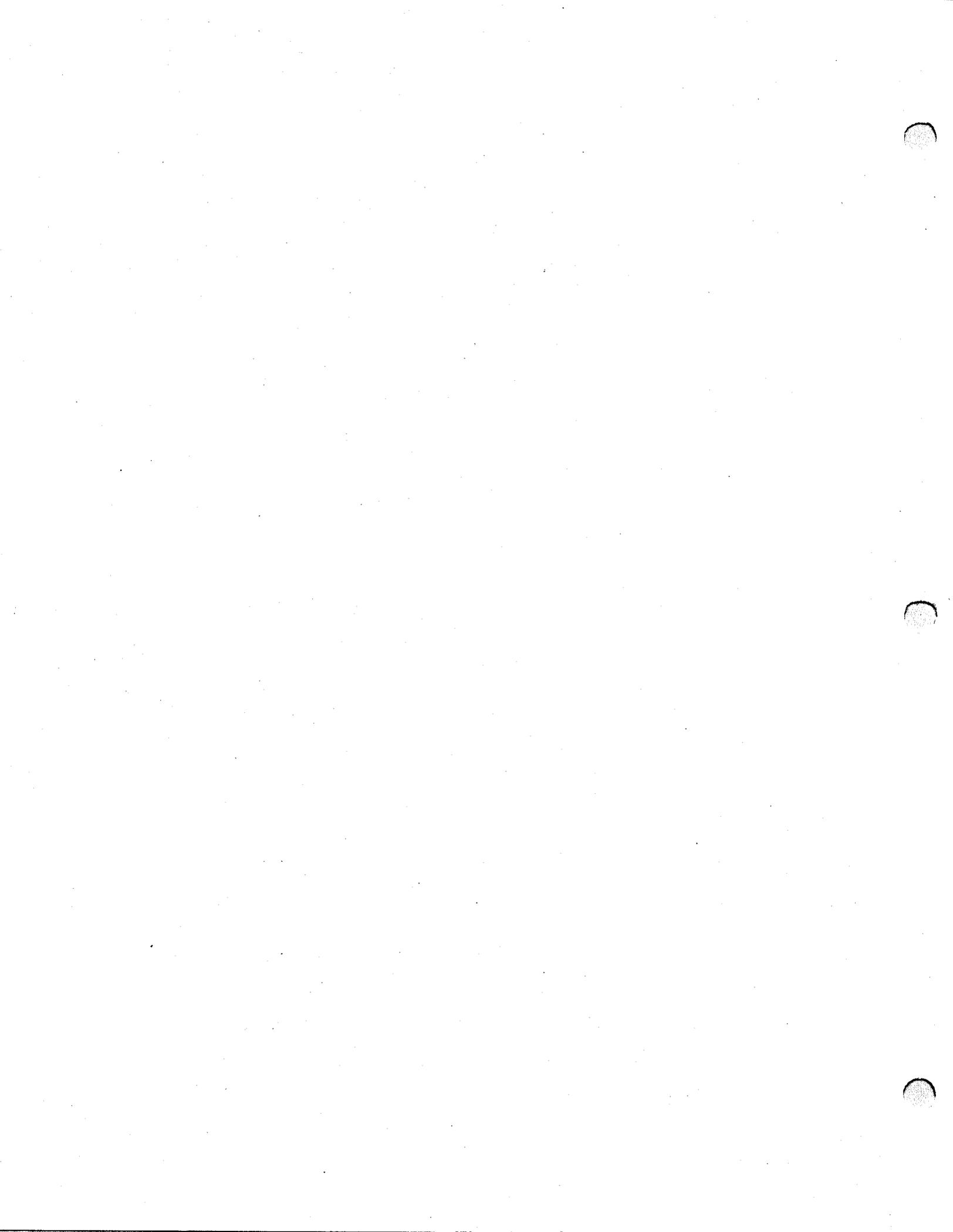
E D I T I N G   F U N C T I O N S

To change an existing drawing, lines or other items previously
drawn can be erased, corrected, moved, added on to, etc. In most
cases it is necessary to 'find' the item in question (for
example the line that needs to be extended, or the center of a
circle, and so on). Three functions permit 'finding' in direct
or sequential manner. When an item is found, MARK and POINT will
merge at its 'origin' (beginning of a line where the MARK was
when originally drawn, center of a circle, etc) to indicate that
the search has been successful. The found item automatically
becomes 'current'. If the item cannot be found, then MARK and
POINT will reappear in the same positions they were before the
search started. Try again.

Only those items which are on the current display should be
searched for. If a found item has its origin outside of the
current display, POINT and MARK will jump to the 'out' position
in the lower-right corner of the screen, outside of the working
area of the display. Reduce magnification or pan as necessary
before searching for an item which extends beyond the display.

[?]   **f i n d   i t e m ,   m e m o r y   s t a t u s ,   h e l p**

Direct finding function. Put the tip of the POINT as close as
possible at the item you want to find - near any part of a line,
circumference of a circle or an arc, beginning of a label. Then
press the key ? followed by the appropriate symbol of the type
of the item being searched for (O for circle, / for line, and
so on) and relax until the computer 'finds' it. If the drawing
contains many items, and you are looking for one drawn quite
late in the sequence, this might take a few seconds.

To "find" a block don't POINT to anything, simply press ?
followed by * and if a block is currently defined, then a box
will outline it. MARK and POINT will jump to its lower-left and
upper-right corners, respectively.

Pressing a second ? instead of an item symbol will display the
memory status, and it is the only way to escape from this
two-key function, otherwise the computer will wait indefinitely
(cursors will not reappear). This message will also appear
automatically any time when no more memory is available, and an
attempt is made to draw another item (see HOME function 'Save'
for packing of memory). Press ? third time to see a 'help'
screen with a summary of all functions of T.CAD, or SPACE to
return to the live screen.

SHIFT LEFT ARROW s e a r c h   b a c k

Hold SHIFT, press LEFT ARROW. Sequential search for lines,
circles, etc, by stepping through all drawn items backwards from
the "current" item. Usually the current item is the last thing
drawn, but it can be also an item just previously "found" (thus
it is possible to browse through any part of the drawing to find
those items which might need changes). This function is fast
repeating. Hold down the SHIFT and LEFT ARROW keys for a
continuous rapid scan through the drawing. The search runs in
"circles". After finding the first item of the drawing, it
starts over from the last, until the keys are released.

You may search for labels even if they are suppressed from
the current display (see also Home Functions Text Labels). When
such an invisible label is found, its text will appear on the
alpha input line at the bottom of the screen.

SHIFT RIGHT ARROW s e a r c h   f o r w a r d

Same as above, but in opposite sequence.

! e r a s e   "c u r r e n t"   i t e m

Erases "current" item (line, circle, etc). Most often the
current item is the one just recently drawn, so this works like
the "correcting key" on some typewriters, and it is handy in
catching any last "typo". You can then erase the immediately
preceding item by executing the "search back" function, pressing
the ! again, and so on. It is actually possible to erase the
entire drawing backwards (or forwards) by repeating this
sequence of functions.

The memory slot of the erased item will not be released until
the drawing is "packed" (see HOME function "Save" for packing).
All items are always stored in the computer memory in the
sequence in which they were created. When you erase an item and
then replace it by another, the replacement will become the
"last" item and it will be always last to be displayed, plotted,
or sequentially searched for.

⌨ `start a block function`

Press asterisk. Cursors will disappear. This is a two-stroke function and __must__ be followed by a second key as shown below, or SPACE bar to cancel.

⌨⌨ `block define`

Prior to defining a block (a rectangular area of your drawing), you must have MARKed its lower-left corner, and POINTed to its upper-right corner, otherwise this function will be ignored. A 'box' will outline the block. All drawing items (except text labels which are excluded from any block operations) having their 'origins' (beginning of line, center of circle or arc) within the box, will become components of the current block. Block remains 'defined' until you erase it, define another block, or perform any function which clears the screen. You may add or erase individual items within a defined block anytime.

⌨⌨ `block erase`

If a block is currently defined in either overlay, all its components will be erased, otherwise this function is ignored. However, the drawing will remain on the screen until cleared. This way you may define and erase several parts of the drawing, and then CLEAR to get a fresh start. Memory occupied by the erased components of a block will not be released until 'packed', as described under Home Function 'Save'.

⌨⌨ `block copy`   see next page

⌨⌨ `block swap copy`

Same as 'block copy' described on the next page. You may reduce, enlarge, rotate or mirror, EXCEPT that

.   copy is always made into the same page in which the original block is defined, regardless whether this page is currently the 'top' page or not;

.   as the copy is made, old contents of the block are erased from memory, though its 'picture' remains on the screen until you perform any function which clears the screen; since the copy replaces the original items, memory status needs to be only 'Free 1 item' for this swap copy.
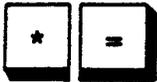
⁕ =   b l o c k   c o p y

Before you copy a block, make sure it is currently defined, otherwise this function will be ignored. Then MARK any useful reference spot within or near the block. Next move POINT to where this spot should appear in the copy. Finally press the asterisk <*> and then equal sign <=> for standard copy (will preserve the original block) or <*> <:> for swap copy (the original block will be removed from memory after the copy is made as noted on the preceding page). Now answer prompts:

Copy %   type percent reduction/enlargement and ENTER it (for example 50 means half original size), or just press ENTER for same size copy; and after that

Rotate   type degrees of copy rotation in respect to original and ENTER it (no negative values, so, for example, enter 330 to rotate -30 degrees, i.e. clockwise), or just press ENTER to copy without rotation.

Instead of rotation you may also create a m i r r o r copy. To do so, specify 'Copy %' as usual, but in response to 'Rotate' don't type anything and don't press ENTER. Instead press an arrow. If you press RIGHT ARROW then copy will be 'flipped' around a vertical axis passing through the reference POINT, as if reflected in a vertical mirror placed on edge against the screen. Press UP ARROW for a copy flipped around a horizontal axis. The sketches below illustrate these principles.

Press SPACE or any other non-valid key to cancel either prompt.

Copy is always made to the current top overlay from the overlay in which the block has been originally defined. If not enough memory is available, only those items which fit will be copied.
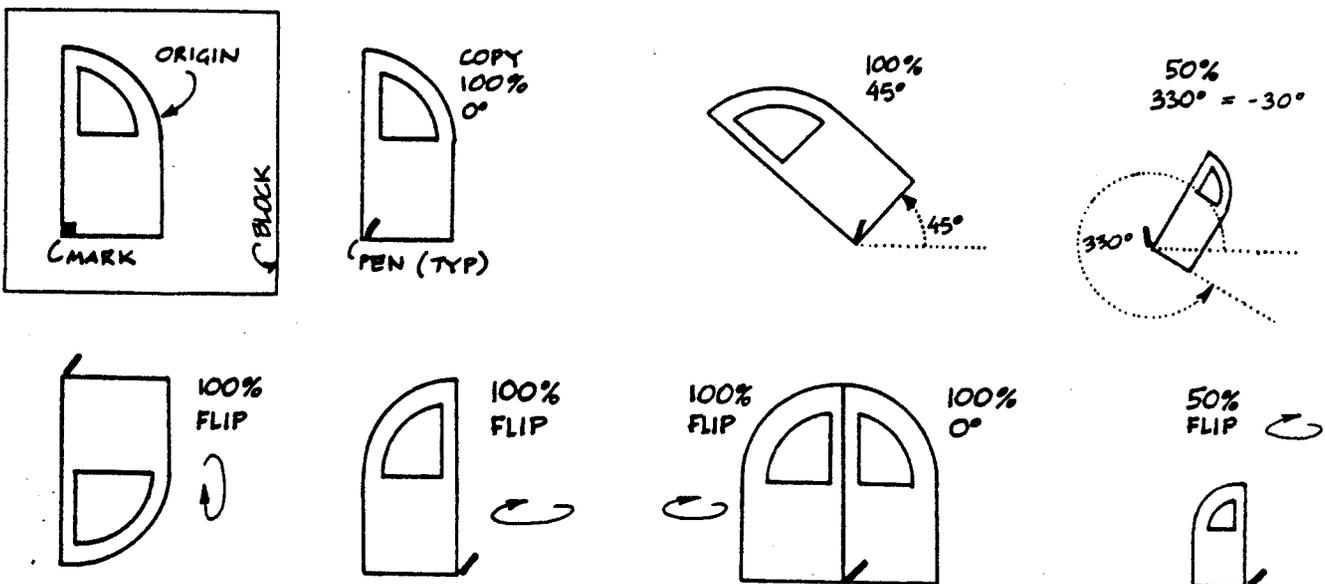
D I S P L A Y   M A N A G E M E N T

> **enlarge** **or** **zoom-in** **frame**

Press the 'greater' symbol to automatically enlarge (up to 10x)
that portion of the current display which is "framed" by MARK
and POINT (for example MARK lower-left corner, then move POINT
to upper-right corner of an area you want to enlarge). If the
'frame' is to big to fit on the screen in the next larger
magnification, then this function is ignored.

In this and other zoom or pan functions, the new display is left
and top justified to the nearest inch grid position. Mag status
is shown in the lower-right corner of the drawing display:

```
1 x     current magnification is 1x
2 x     magnification is 2x, and so on up to maximum 10x
1.x     mag 1.5x (special case for C-size display only)
```

@ **1-10** **>** **select** **magnification**

Press @ to MARK the place you want the upper-left corner of
the enlarged display to be, then set point SPEED equal to the
desired magnification, and then press > . Redisplays drawing
directly at the selected magnification. Ignored if the selected
mag is the same as current.

< **reduce** **or** **zoom-out**

Press the 'smaller' symbol. Reduces the current magnification by
one step at a time. Minimum magnification is 1x.

SHIFT ENTER **shift** **or** **pan** **display**

Hold down SHIFT and press ENTER. Shifts the display "window"
across the drawing in the direction and by the distance from
MARK to POINT. If POINT is MARKed prior to this operation, this
function is ignored. Window will never be shifted beyond the
edges of the computer's E-sheet. Window shift is noted in the
upper right corner of the drawing, for example:

```
T 0     Top of window shifted 0 inches from top edge of sheet
L 3     Left edge of window is 3" from left edge of sheet, etc.
```

`CLEAR SPACE` c l e a n   u p   d i s p l a y

TRSDOS 6   Hold down CLEAR key and press SPACE bar.
TRSDOS 1.3   Press SPACE bar, release, then press CLEAR.

Restores a clean display (removes grids, sketch lines, etc).
Ignored if drawing does not contain at least one 'item'.

`CLEAR 1-2` d i s p l a y   o n l y   t o p   p a g e

TRSDOS 6   hold down CLEAR and press 1 or 2 .
TRSDOS 1.3   press 1 or 2 , release, then press CLEAR.

Clears display, removes all grids, sketch lines, etc, and
redisplays only Page 1 or 2 as selected. If Page 1 has not been
used yet, this function is ignored as in '1-2 ENTER' below.

`1-2` `ENTER`   f l i p   o v e r l a y s

Press 1 or 2 , then press ENTER. Selects Page 1 or 2 to be
the current 'top' working overlay, and adds the contents of this
sheet to the display (if not yet on the screen). Any drawing,
erasing, finding, etc, can be done only on the current top
overlay. This function allows switching back and forth between
the two pages simultaneously resident in the computer memory.

`SPACE` `ENTER`   s h o w   b o t h   p a g e s

Press SPACE bar, then ENTER. Displays both pages one on top of
the other, but leaves the current working overlay in its 'top'
status. If both pages are already displayed, then this function
is ignored.

Page status is shown in the lower-right corner of the drawing in
the following way:

1/   page 1 is the top overlay, page 2 is not displayed
2/   page 2 is the working overlay, page 1 not displayed
1/2   page 1 is on top, page 2 under, both are visible
2/1   page 2 on top, page 1 under, both displayed.

H O M E   F U N C T I O N S

Functions described in this section are best performed in the
'home' format, so that you can return from any zooms or pans,
and see the entire drawing you wish to label, save, erase, etc.
However, you may perform these functions any time, if you wish.

SHIFT UP ARROW   h o m e

Hold SHIFT, press UP ARROW. Puts POINT and MARK in the 'home'
position (upper-left corner of the display) and resets POINT
speed to the number of pixels per arrow stroke equal to the
current scaling system (10 decimal, 12 inch, etc).

If POINT and MARK are already at 'home' then this function
restores display to the last locked home format A, B, C or D.

A B C D E   l o c k   h o m e   p a g e   f o r m a t

Press A, B, C, D or E (caps). Any existing drawing will remain
where it is on the page, but its visible portion will be
expanded or cut down depending on the choice. Scaling system is
not affected, except that
     E-format automatically also locks a 'half-pound' scaling
system with 8 pixels per grid unit, so that a drawing area
larger than 21" by 30" can be visible on the screen.
     D-format automatically resets decimal scaling system.

$ "   #   l o c k   s c a l i n g   s y s t e m

Press one of these three symbols to lock scale as follows:
$ 10 pixels per grid unit (default on start-up)
"   12 pixels per grid unit
16 pixels per grid unit

Existing drawing is not affected, only the display appearance
expands or contracts slightly. The selected system remains in
effect throughout any zooms or pans until reset. Current status
of the scaling system is shown in the lower-right corner of the
screen, right after magnification, as follows:

1x10   mag 1x, decimal system
2x12   mag 2x, inch system, and so on.

The alternate scaling systems are useful for drafting in such
scales as 1"=1'0" or 1/4"=1'0" and similar 'customary' series.
For example, if you draw a floor plan at a scale 1/8"=1'0", then
in the 'pound' system at mag 1x each pixel represents 6 inches,
at mag 2x a pixel represents 3 inches, and so on (see also
Section 10 about 'ticking off' with arrow strokes).

▐ ' ▌ s t a r t   t e x t   l a b e l i n g

POINT to the desired beginning of a label, then press the apostrophe. A prompt LABEL > will appear on the alpha input line (bottom of the drawing). Then proceed as follows:

1.   If there are no previous labels on the current overlay, then go to Step 3 below.

2.   If there are any labels in the alpha memory, then the text of the "last" one (i.e. last created, found, duplicated, erased) will appear after the prompt. When it appears, you may:

     go straight to Step 4 below to "duplicate" that "last" text in the new position (specify any size and direction in Step 4).

     or: press DOWN ARROW to scan "down-the-list" for any other labels available for duplication, until the correct one appears (if it exists). This scan works like the "search forward" (see Editing Aids) but it scans only alpha memory.

     or: go to Step 3 to backspace and/or type: you may thus re-use part of the "last" label, or completely erase input line to start an entirely different text.

3.   Type text just as you would type any standard input on your Model III/4/4P. LEFT ARROW backspaces, SHIFT LEFT ARROW erases input line as usual (but right arrow does not tab, see Step 4). If you try to type more than 64 characters, the computer will ignore it and wait until you backspace or go to Step 4.

4.   You must press one of the following to terminate label input:

     SHIFT CLEAR: cancel label input, exit to live drawing
     RIGHT ARROW: small letters, horizontal line (left to right)
     UP ARROW: small letters, vertical line (bottom to top)
     SHIFT and RIGHT ARROW: large letters, horizontal line
     SHIFT and UP ARROW: large letters, vertical line
     ENTER: small letters, horizontal line; if there is room on the display, POINT moves down to the next line (i.e. performs "carriage return") and you go back directly to Step 1 (don't press apostrophe). This locks you into "typewriter-style" input of left-justified text lines for typing of legends, general notes, etc. Unlock by pressing any other terminating key.

See also appendix Section 170 about labels.

S **s a v e   d r a w i n g   t o   d i s k**

Press capital 'S' and answer self-explanatory prompts. Each 'S' command saves only the current top page. Flip overlays to save the other page. Filespecs must follow the rules of TRSDOS (see your TRSDOS manual).

Saving a drawing which had many items erased during a session will 'pack' it. When such packed drawing is re-loaded back to the same page, extra memory will be gained. Drawings should be saved often during a session to prevent accidental loss of data.

L **l o a d   d r a w i n g   f r o m   d i s k**

Press capital 'L' to initiate file loading dialogue similar to 'save'. If drawing is loaded onto a page which is already in use, its previous contents will be removed from memory. Make sure to save that other drawing before loading a new one. After a drawing is loaded, it is diplayed on top of any other drawings visible on the screen. This way you can load several overlays, for example to see how they match. But once you performa any function which clears the screen, only the two active overlays will remain in the computer memory and on the screen.

Drawing is always loaded into current 'top' page. If not enough memory is available because it is occupied by the other overlay, you will be so notified, and the drawing cannot be loaded until that other overlay is removed or packed.

SHIFT CLEAR **d i s c a r d   p a g e   /   q u i t   j o b**

Hold SHIFT, press CLEAR. Answer self-explanatory prompts. If you request the current page to be erased, or job terminated, then data will be wiped out. Save drawings on disk before performing this function.
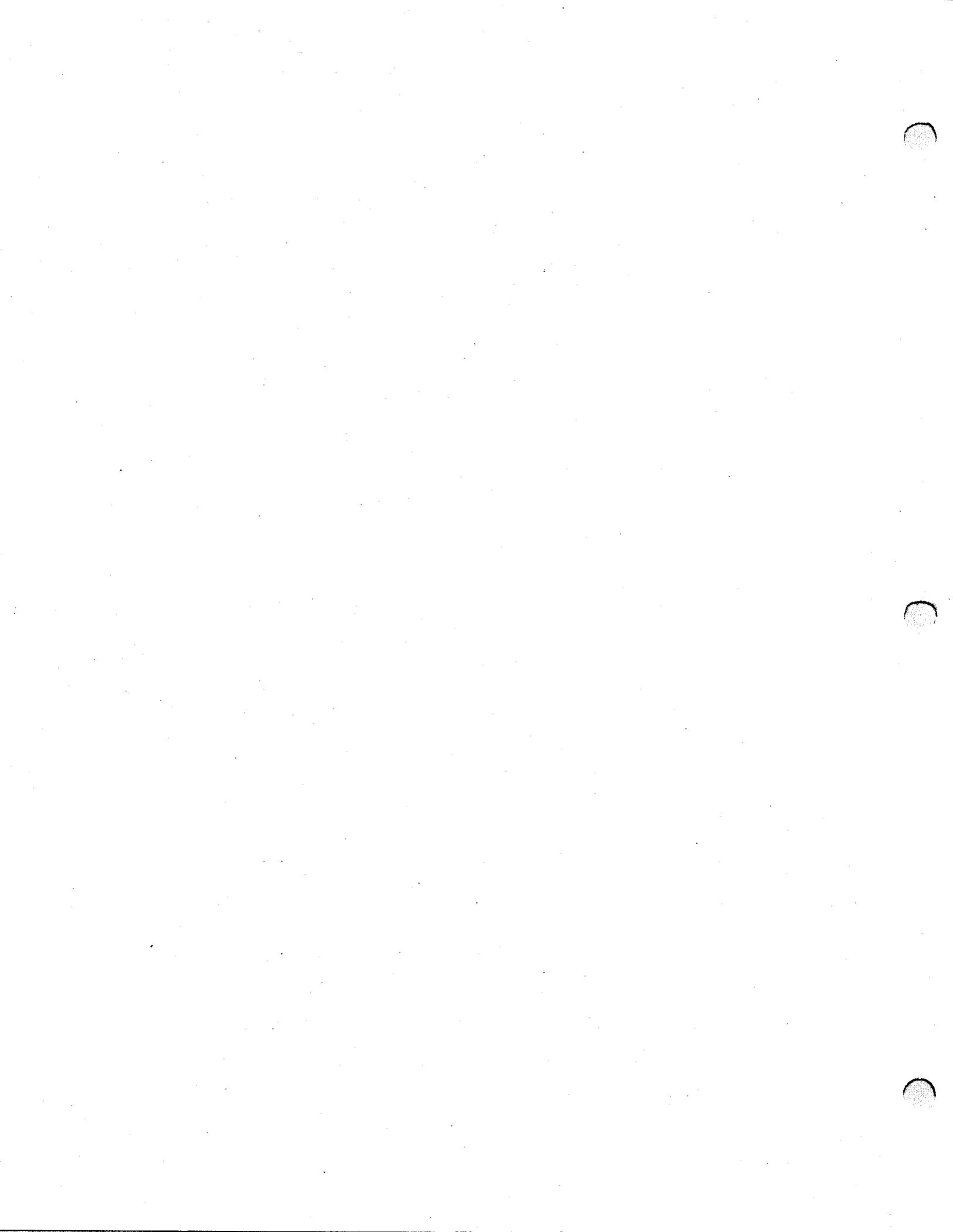
H A R D C O P Y

&   s t a r t   p l o t t e r   o u t p u t

r TANDY Cat.26-2830   PC-695
r HOUSTON INSTRUMENT   PC-595, 695
r HOUSTON INSTRUMENT   DMP-29, 40, 41, 42, 51, 52, 56, etc
r HEWLETT PACKARD   HP-7470A*, 7475A, ColorPro**

r use 'RS-232 serial' interface
* HP-7470A must have serial prefix #2308A or higher
** ColorPro must have the 'graphic cartridge'

You may plot the whole drawing or any part of it (clip) anytime.
In any case, always MARK the lower-left corner, and POINT to the
upper-right corner of the area to be plotted before executing
this function, otherwise it is ignored.

Now press the (&) ampersand key. The cursors will disappear and
a box will outline the plot window you defined as noted above.
Answer the prompt PLOT % as follows, <u>in</u> <u>this</u> <u>order</u>:

1.   IF you wish text labels to be plotted, press apostrophe <'>

2.   IF you desire reduction/enlargement, type (don't ENTER)
percentage. No decimal points, 4 digits max, eg. 50 reduces by
half, 200 enlarges twice, and so on. Don't type anything if you
want 100% plot where 1" of display grid = 1" on paper.

3.   Finally, depending on the paper size in the plotter, press
A,B,C or D (caps) to start plotter running.
      NOTE: for HP-7470A press ENTER instead of A

4.   Answer next prompt PEN # by pressing a digit <1>-<8> valid
for your plotter. On single-pen plotters press <1>. This prompt
will appear separately for each page active on the screen.

Pressing SPACE bar at any of the above steps cancels hardcopy
and returns to the live display. You may also tap SPACE bar in
the middle of a running plot, if you want to cancel it (plotter
may continue for a while until its own memory buffer is empty).
You will know that the plot is completed or canceled, when the
'window' box disappears and 'live' cursors return to display.

      NOTE: PC-series plotters render 'centerline' (dot-dash
line) as dash-dash line.

See also appendix Section 180 about plotters.

r   TANDY Cat.26-1191   6-pen
c   ROLAND DG   DXY-101, 800

r   use 'RS-232 serial' interface
c   use 'Centronics parallel' interface

You may plot the entire drawing anytime, but you CAN'T plot 'clips' (portions of drawing) or proportionally reduce/enlarge text labels as on most newer plotters. Prior to activating the plot function, move POINT to the lower-left corner of your drawing, and MARK it (otherwise this function is ignored).

Now press the (&) ampersand key. The cursors will disappear. Answer the prompt PLOT % as follows, in this order:

1.   IF you wish text labels to be plotted, press apostrophe <'>

2.   IF you desire reduction/enlargement, type (don't ENTER) percentage. No decimal points, 4 digits max, eg. 50 reduces by half, 200 enlarges twice, and so on. Don't type anything if you want 100% plot where 1" of display grid = 1" on paper. Remember that regardless of percentage, the size of text labels will NOT be reduced or enlarged in proportion to the linework (as is the case on most newer plotters). Also observe that Roland text labels are about 8% shorter than on the screen.

3.   Finally, depending on the plotter size, press A or B (caps). Now a box will outline on display that part of your drawing which will fit on the plotter's active area. Make sure all items of the drawing are within this box, otherwise erratic plotter behavior may result (you can't plot 'clips' as on most newer plotters). You may use a smaller percentage in step 2 to 'squeeze' the drawing into the box, but remember that the size of text labels will not be reduced.

4.   Answer next prompt PEN # by pressing a digit <1>-<8> valid for your plotter. On single-pen plotters press <1>. This prompt will appear separately for each page active on the screen.
        NOTE: for Roland DXY-101 press ENTER instead of 1

Pressing SPACE bar at any of the above steps cancels hardcopy and returns to the live display. You may also tap SPACE bar in the middle of a running plot, if you want to cancel it (plotter may continue for a while until its own memory buffer is empty). You will know that the plot is completed or aborted, when the 'window' box disappears and 'live' cursors return to display.

        NOTE: Roland plotters render 'centerline' (dot-dash line) as long dash-dash line.

D o t - m a t r i x   p r i n t e r s

xT.CAD is specifically designed for pen plotter output. TRSDOS versions support graphic printers as a "rough sketch" option only. Depending on the printer, the image is more or less true to scale and proportion. Text labels are rendered as illegible black bars, so for a clean printout first CLEAR the screen then print. For professional hardcopy with text labels use a plotter.

On Model 4 this option is incorporated in the main program and works identically on either Radio Shack or Micro-Labs boards. Printer selection is made during the INSTALL procedure. If you change printers, you must re-install xT.CAD on Model 4.

On Model III this option is only available if you install xT.CAD on standard BASIC system disk as noted in Section 100 of this manual, but printer selection is made at the beginning of each drafting session, every time you boot-up xT.CAD on Model III.

Supported printers connect to the standard 'line-printer' or 'parallel' port of your computer. The following options are available when xT.CAD asks you to make printer selection:

```
0 or try 3   Radio Shack DMP-series dot matrix printers
1            Epson, Star Micronics (Gemini) printers
2            Enhanced Epson, Star Micronics (Gemini)
3 or try 0   Radio Shack LP-VII, LP-VIII
4 (Model 4)  Okidata Microline 82A, 83A with Okigraph, 84 step 2
4            IDS 445G, 460G, 560G
5            Centronics 739
6 (Model 3)  Okidata Microline 82A, 83A with Okigraph
6            Okidata Microline 92, 93
7            Anadex 9500, 9501
8            C.Itoh Prowriter I (8510A), NEC PC-8023
9            Okidata Microline 84
```

[M]   m a t r i x   p r i n t o u t

Press capital 'M'. Duplicates (dumps) the screen image on a dot matrix printer. If you didn't select any printer then this function is ignored. If you did specify printer, but it is not on line when 'M' is pressed, xT.CAD freezes without error message (cursors disappear). To recover, proceed as follows:

Model 4: tap SPACE bar to return to live screen. Then turn on the printer and try again (you may also tap SPACE in the middle of running printout to cancel it and return to live screen).

Model III: either reset computer (data will be lost) or turn the printer on; this first printout may be hopelessly distorted, but you will not lose data and can reprint it better on second try (SPACE bar will not stop a running printout on Model III).
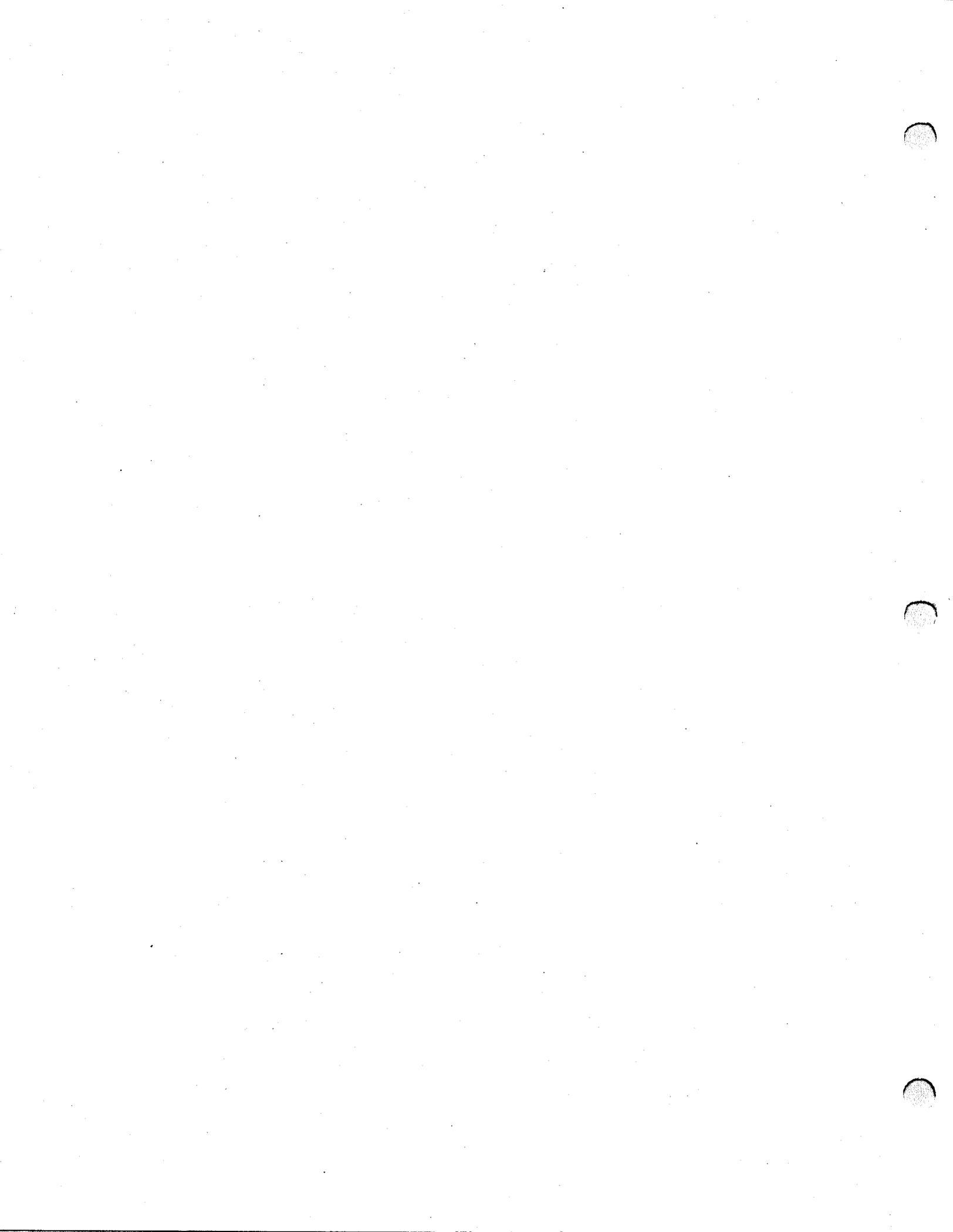
Appendix
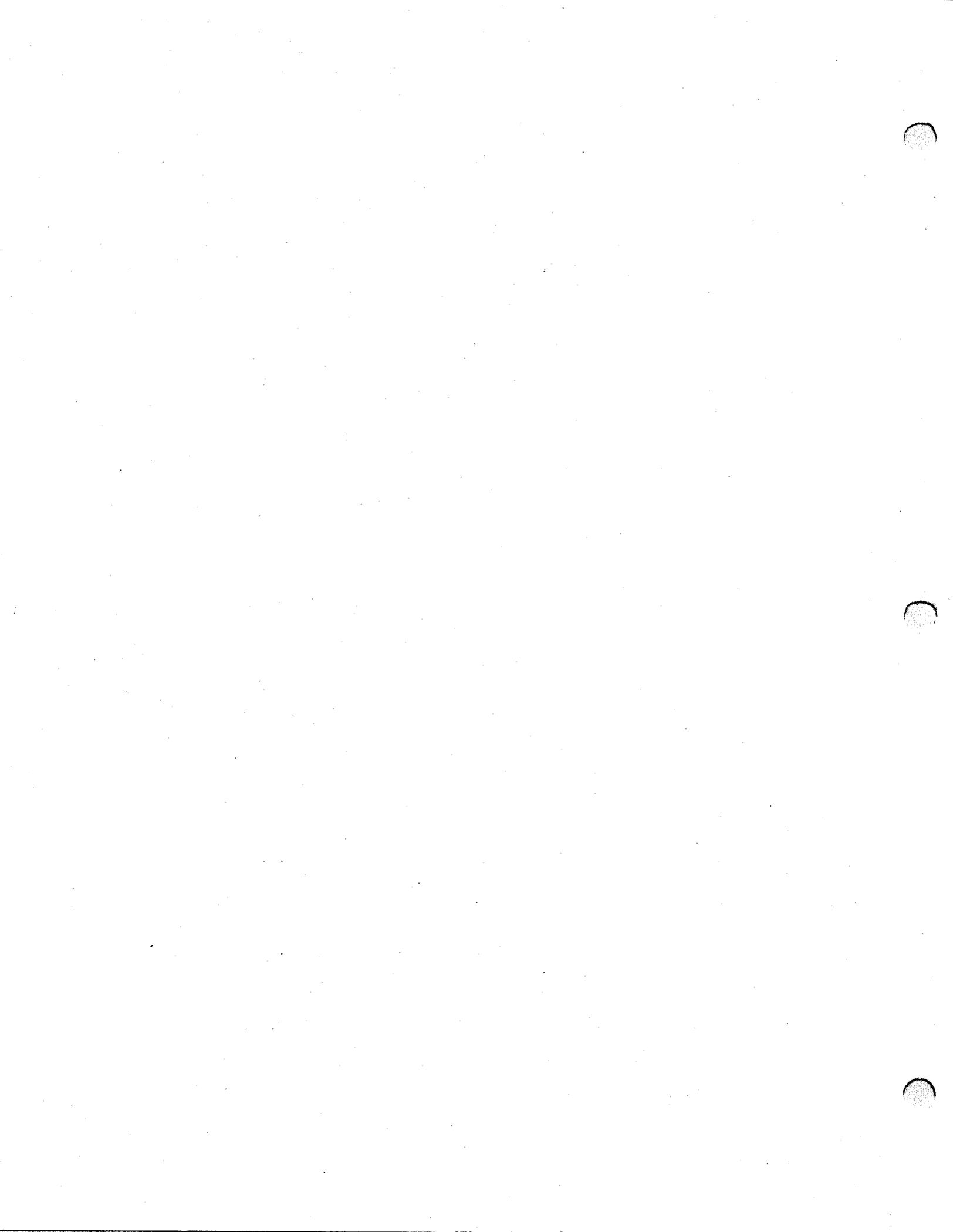
H O W   T O   I N S T A L L   T . C A D

S y s t e m   r e q u i r e m e n t s

Computer: Model 4/4p/4D   64K, 2 disks (floppy or hard), RS-232
            Model III   48K, 2 disks (floppy only), RS-232

Graphics: Radio Shack High-Resolution board, or
            Grafyx Solution board from Micro-Labs

System: Model 4/4p/4D   TRSDOS 6.2 or LS-DOS 6.3
            Model III   TRSDOS 1.3

Language: Model 4/4p/4D   machine language (no BASIC required)
            Model III   requires BASIC or BASICG

P l o t t e r   s u p p o r t

Currently supported plotters are listed elsewhere in this manual
and selected by user during xT.CAD installation. If you switch
to a different plotter, you must re-install xT.CAD.

M o u s e / d i g i t i z e r   s u p p o r t

Micro-Labs mouse interface together with Tandy Color Mouse
26-3025 may be optionally used to control cursor movements as
noted in other Sections of this manual.

Digitizers are optional input devices and may be used any time
as described in other Sections of this manual.

Installation procedure

1.   First of all make a duplicate of the original xT.CAD disk
using TRSDOS commands FORMAT and BACKUP. If you are prompted for
password, just press 'enter' (there is no disk password). From
now on use only this duplicate.

2a. M o d e l   4 : If you install on hard disk, make sure it
has at least 90.00K free space, and skip to step 3. If you
install on a floppy, put a duplicate of your original TRSDOS or
LS-DOS system disk in drive 0, reset computer, and use the
system command PURGE :0 (INV) to remove all files, except
FORMAT/CMD, BACKUP/CMD and any /SYS files. Now skip to step 3.

2b. M o d e l   I I I : In your system drive (usually :0) place
a duplicate of your original TRSDOS 1.3 system disk with either
BASICG (Cat. 26-1125, if you have Tandy hi-res board) or with
standard BASIC (Cat. 26-0312, a little slower, but you MUST use
it if you have Micro-Labs board or desire dot printer support on
either board, otherwise the installation will fail). This system
disk must have at least 35 grans free disk space. If you are
installing xT.CAD on Tandy BASICG graphic system disk then you
may have to purge GPICTURE, HRGTEST/CMD, GRPLIB/CMD and all
files with extension /GRA.

If you are re-installing on a Model III system disk which
already contains some xT.CAD files from previous installation,
then you MUST first purge those old files using the system
command PURGE T:system drive (INV), otherwise the installation
will fail with a message 'file exists' or 'access denied'.

3.   In the second drive (usually :1) insert a duplicate of the
original xT.CAD disk included in this package. Make sure this
disk is NOT write protected (peel off any write-protect sticker
from edge of disk). This is ESSENTIAL.

4.   Reset computer. This is also ESSENTIAL.

5.   Type   INSTALL (enter)   Model 4
                        TCAD/NEW (enter)   Model III

and follow self-explanatory prompts. If your selections are
acceptable then after a few minutes of disk whirling the message
will say 'TRSDOS or LSDOS ready' and your system disk is ready
to run xT.CAD as noted is Section 1. If there are problems, you
will be so notified with an appropriate message.

Additional information

It doesn't work ... Well, it does. But first of all we assume that you are familiar with the operation of your system. If not, please review your system operating manuals and xT.CAD manual now, before making panic calls to Microdex (but if you do call, we'll try to help). For special tips on plotter or digitizer interface with xT.CAD see other Sections of this manual.

Model III / Model 4 compatibility

Model III versions of xT.CAD can be used either on Model III or on Model 4 in Model III mode. If you own both models and wish to run xT.CAD on both, you may consider using those versions if you don't mind the slower speed.

You cannot CONVert the xT.CAD program from TRSDOS 1.3 to TRSDOS 6 -- it will not run at all. You must get the current version of xT.CAD for TRSDOS 6. Registered users may purchase it directly from Microdex at a nominal backup fee.

But you can convert your drawing data files created under TRSDOS 1.3 version of T.CAD, to run with the TRSDOS 6 version. To convert, simply use the TRSDOS 6 CONV utility.

Model 4 Microlabs support

Model 4 xT.CAD runs as-is in fast machine language without any difference in speed or functions on either Radio Shack or Micro-Labs hi-res boards. It does not require BASIC or GBASIC.

Model III Microlabs support

If you have Micro-Labs hi-res board, or wish to use dot-printer option on either Radio Shack or Micro-Labs board, you MUST install xT.CAD on standard BASIC system disk. In that case a special licensed GBASIC file will be automatically added to your system disk during the installation procedure and it will modify your standard BASIC to support xT.CAD. Do not use any other Micro-Labs GBASIC you might have, and make sure your standard BASIC is NOT modified by third parties (e.g. Plus, etc).

Note that screen resolution of Model III with Microlabs board is lower than with Radio Shack board and cuts xT.CAD drawing area by some 20% (on Models 4 both boards have the same resolution). Also, some xT.CAD functions run slower under Microlabs GBASIC.

A B O U T   U S I N G   xT. C A D
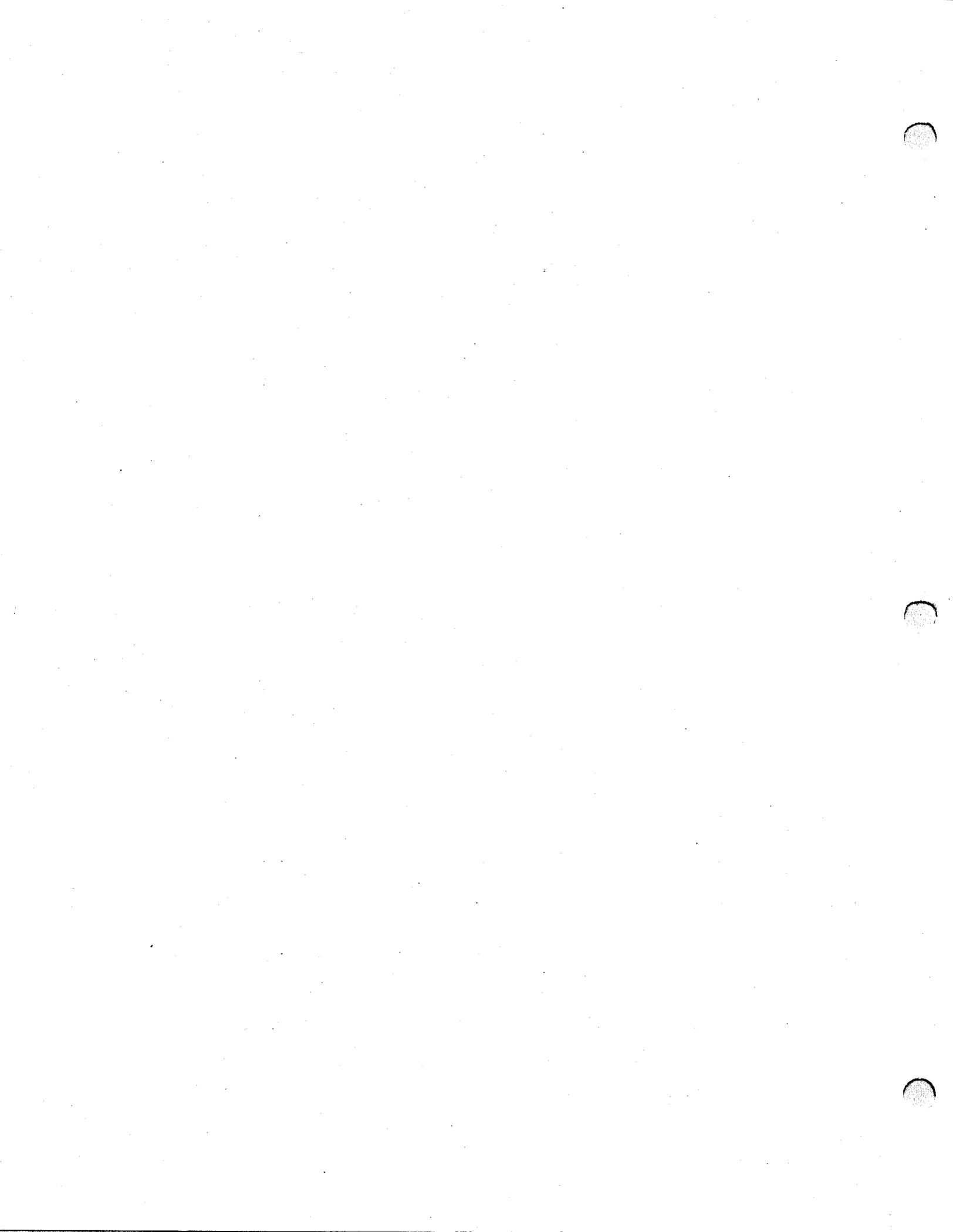
This manual is not a CAD-tutorial. But don't worry: it's all
really common sense. A computer drawing is still just a drawing.
On the other hand don't expect instant miracles because the
computer cannot think for you. Especially at the beginning, you
may feel that it might be easier and faster to make a drawing
the traditional way. Some first time CAD users make the mistake
of giving up because of that. Don't! The benefits multiply fast
when you reuse and adapt previous drawings to new jobs, just by
making a few required changes. Therefore, perhaps the main
difference between a CAD and the conventional drafting is the
need for a good setup of drafting procedures. Standard drawing
sizes, scales, filing codes, etc, should be well thought out
before putting a CAD on the full production line. Experiment
with xT.CAD for a while at your leisure and you will soon get
the idea how to best adapt it to your production needs.

xT. C A D   o p e r a t i o n s

Drawing is controlled by two 'cursors'

POINT = an arrow: its tip points to an exact screen position
MARK = solid square: its corner marks a screen position

which can be moved anywhere on the screen. Press any arrow on
the keyboard to move the POINT to a specific position. Press the
@ key to put the MARK at the current POINT location. Other
functions swap and reset the cursors. On start-up, POINT moves
at the maximum speed of 10 steps per stroke of an arrow. Press
the <1> key to slow down to 1 step per stroke for accurate
positioning, and so on for any speed from 1 to 10. Speed of the
POINT can be also used for scaling. For example, if one step on
the screen represents 1 foot in the real world, then set the
speed to 3 and each stroke of the arrow will move the POINT by
one 'real-world' yard, and so on.

Lines, circles, arcs, and other 'items' of the drawing are
created by pressing a function symbol, in most cases only a
single key. Just press the key, do not ENTER it, unless
specifically required. Functions are executed immediately after
the key is pressed (for standard upper-case symbols hold down
SHIFT key). Other control functions work in a similar way. All
functions will be learned best by simply trying them out and
observing the results on the screen. When in doubt, press <????>
three times to see a summary of all functions.

xT. C A D   d r a w i n g   a r e a

Imagine the computer as holding two 24" x 36" tracing sheets or
'pages'. On start-up, the computer is in the 'home' position and
displays its entire drawing area of Page 1. Zoom functions
described elsewhere permit enlargement of any part of that
sheet. Grids can be turned on/off to assist in scale drafting.
Formats from A(8.5"x11") to D(24"x36") can be locked as the
'home' size. Plotter hardcopy of the whole page or any portion
of it can be made any time, same size, reduced or enlarged.

xT. C A D   z o o m

On start-up, the mag is 1x with 10 pixels per inch, which allows
drafting with the accuracy of 1/10 of an inch, or 1/12 or 1/16
if an alternate scaling system has been previously selected.
When you zoom in, you see only an enlarged part of your drawing.
For example, at mag 4x you see an area of 6"x9" which is about
the size of the monitor tube. The higher the zoom, the smaller
details you can draw. For example, at mag 10x drawing can be
done with the accuracy of 1/100 of an inch which is less than
the thickness of a standard drafting pen. Various combinations
of scaling systems and zooms permit drawing with any practical
accuracy in all common engineering or architectural scales.

xT. C A D   s c a l i n g   s y s t e m s

On start-up, the computer assumes a decimal system, where one
'inch' on the screen is divided into 10 parts called 'pixels'. A
pixel defines the accuracy of the current display -- it is the
smallest unit of the video monitor resolution, where a point can
be located. Sometimes it is convenient to use other fractions.
Two alternate systems can be switched from the 'home' position.
Press <"> to switch to the 'inch' system with 12 pixels per inch
to draw at 1"=1'0" and similar 'detail' scales. Press <#> for
the 'pound" system with 16 pixels per inch, to work at 1/4"=1"0"
or other 'customary' building scale series. The decimal system
is reset by pressing <$> key. System switching does not affect
the drawing, only the screen appearance changes slightly.

D i s k   d a t a   f o r m a t

This information is provided for experienced users who wish to
write their own programs for custom applications, such as
dumping drawings to plotters not supported by xT.CAD, or
transfering drawings to other computers or to different CAD
systems. We strongly discourage tampering with xT.CAD itself.
All xT.CAD variables and routines have memory-saving multiple
meaning interacting across all modules. Modification of one
program segment usually 'bombs' the rest.

Drawings are saved on disk in ASCII format. After loading into
xT.CAD the data are decoded into program-specific storage areas.
Average disk space usage is about 25 bytes per 'item' (line,
circle, etc).

The first numerical value in the file is the number of 'items'
contained in the file. The remaining data define the items
themselves. Each item is described by 5 values:

Position >	1	2	3	4	5
Circle	1	X-center	Y-center	Radius	Reserved
Solid line	2	X-start	Y-start	X-end	Y-end
Dotted line	3	X-start	Y-start	X-end	Y-end
Dashed line	4	X-start	Y-start	X-end	Y-end
Dot-dash line	5	X-start	Y-start	X-end	Y-end
Text label	9	X-start	Y-start	*	**
Arc	100-728***	X-center	Y-center	Radius	100-728****

```
*     Direction and size of text label encoded as D * 10 + S
      Direction  D = 1  left to right   D = 4  bottom to top
      Size       S = 1  0.1" (small)    S = 2  0.2" (large)

**    Pointer to alpha storage location when loaded into T.CAD
      On the disk alpha text is stored immediately after pointer

***   Starting angle of arc encoded as RADIANS * 100 + 100
      Zero angle on positive X-axis, positive counterclockwise

****  End angle of arc encoded as above. Resulting arc deflection
      always interpreted counterclockwise from start to end
```

Coordinates X and Y and radii are expressed in 1/200-ths of an
inch. Origin of coordinates is in the upper left corner of the
sheet. X-values increase from left to right, Y-values from top
to bottom (i.e. opposite to conventional Cartesian system). For
example X=200 Y=600 defines a point 1 inch to the right from the
left margin and 3 inches down from the top margin.
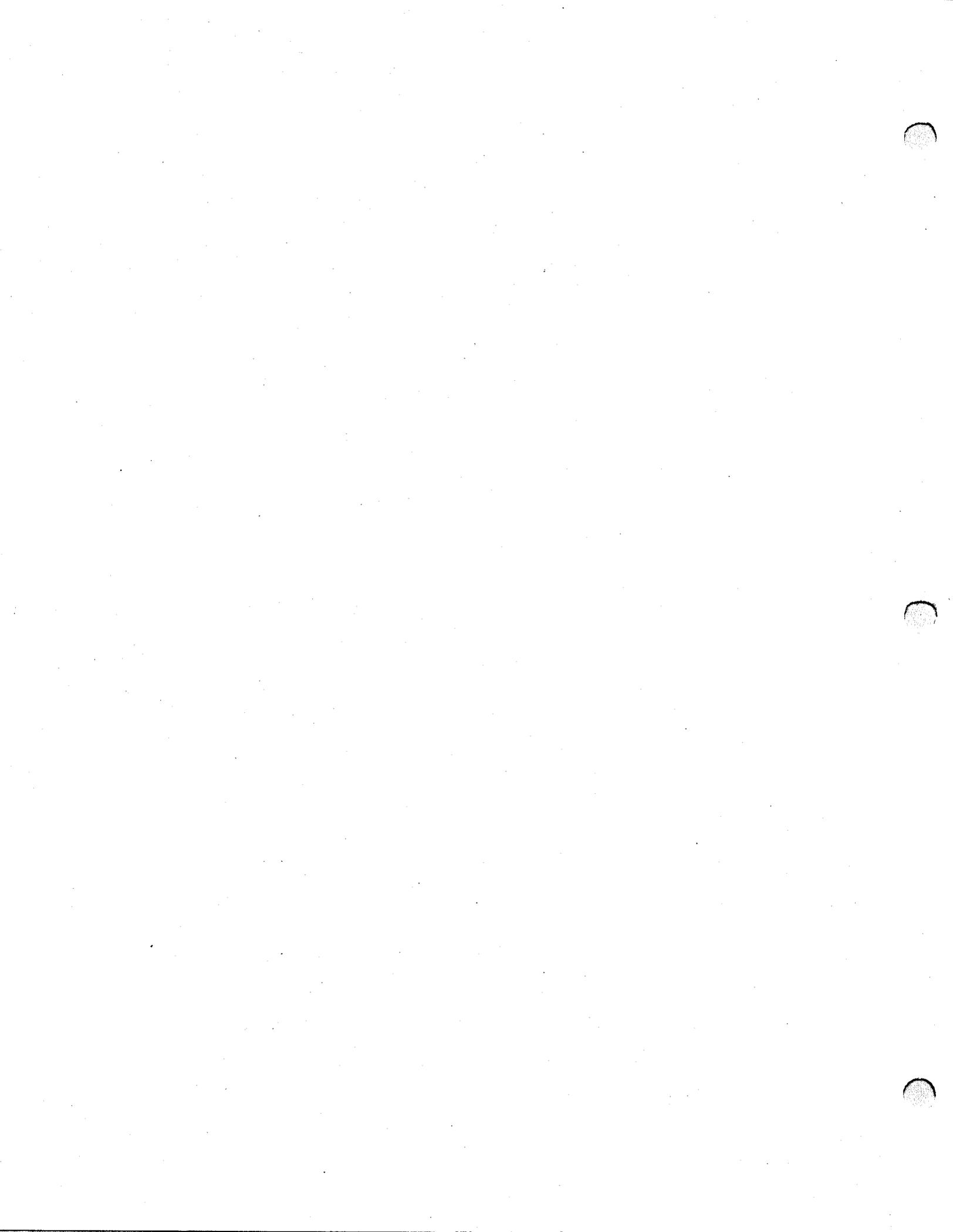
A B O U T   D I S P L A Y

When you load a drawing from disk, clear, home, zoom, pan or
change scaling systems, the entire drawing must be re-displayed
by the computer. If you are familiar with large mainframe CAD's,
you won't be impressed by a micro such as Model III or even
Model 4. Although the plotting on the screen is done by fast
machine-language subroutines, there are other limitations of the
system. As an average rule of thumb, Model III xT.CAD needs
about 15 seconds to display 100 items on a drawing. On standard
Model 4 xT.CAD runs much faster in straight machine language
which has been optimized for speed and will typically redisplay
100 items in less than 3 seconds, which to most users will
actually 'feel' quite fast. Some 'speed-up' kits available for
Model 4 from non-Tandy vendors may improve even this timing
considerably, but you should be sure that their installation
will not otherwise interfere with xT.CAD (Microdex does not
guarantee that xT.CAD will run on modified computers).

When the drawing is very complex and contains several hundreds
of items, this can begin to look rather slow (see 'about
overlays' regarding the advantages of splitting a large drawing
into smaller parts). Generally expect the following:

- horizontal or vertical lines run faster than diagonals;
- circles and arcs are much slower than lines;
- large items are slower than small ones (especially huge
circles or arcs seem to take forever on Model III).

When you zoom in on a part of a larger drawing, then the screen
shows only that part, but the entire drawing is evaluated in the
computer memory. If the invisible part contains many items which
were created earlier in the sequence than the visible portion,
you may have to wait a bit before anything starts to appear in
your current 'window'. At very large magnifications, especially
if invisible large circles are involved, you may even think that
the computer hangs up on you. Not much can be done about that,
so use the pause to get a cup of coffee, and to think if such
large zoom is really necessary next time.

Typical elements of xT.CAD screen display are simulated on the
next page. Naturally, on the screen black lines will be white
(or green) and the background black!

POINT moved down

LABEL > THIS SHOWS ELEMENTS OF T.CAD SCREEN DISPLAY
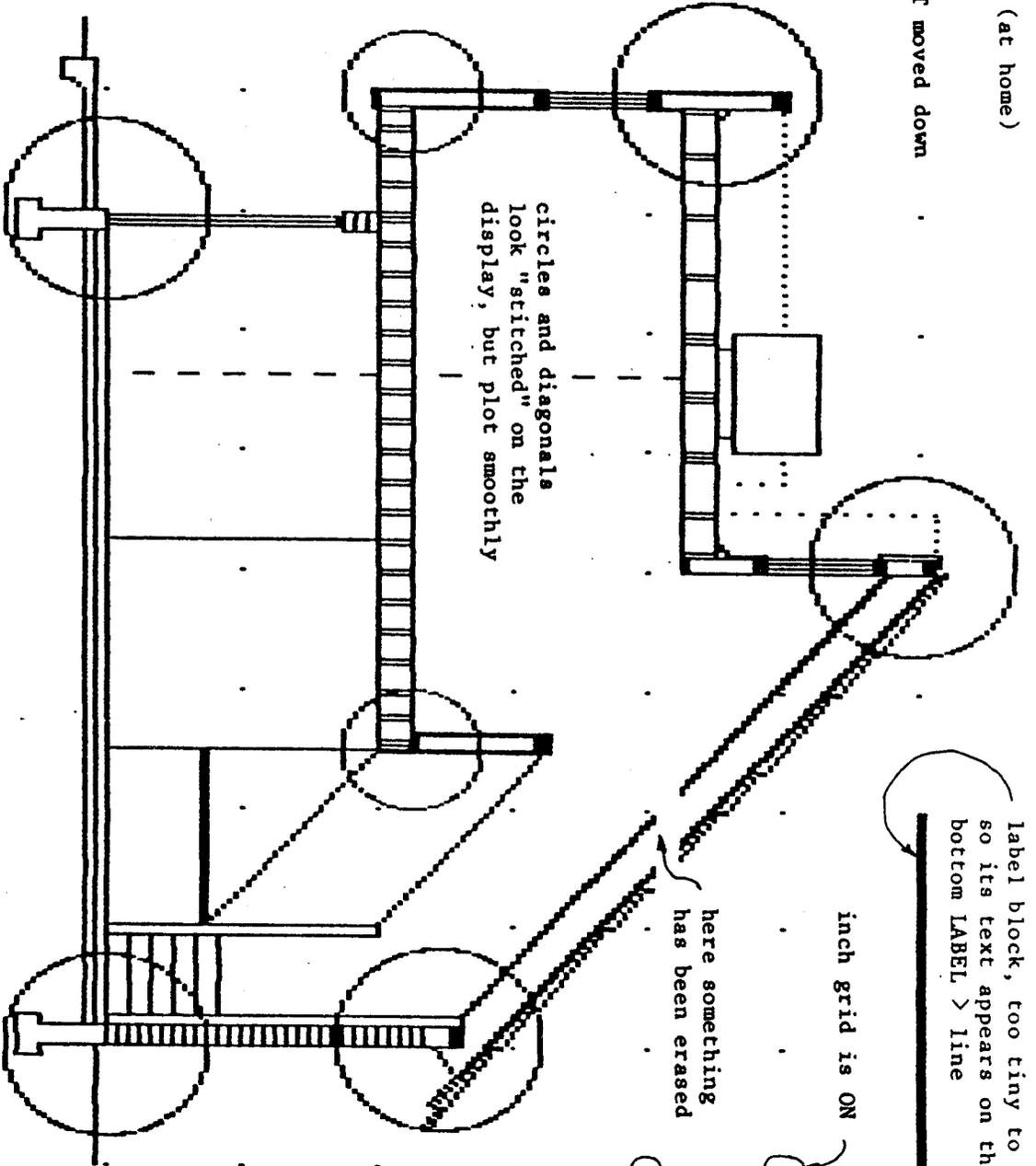
circles and diagonals
look "stitched" on the
display, but plot smoothly

this is the text of the
label blocked above

label block, too tiny to read,
so its text appears on the
bottom LABEL > line

inch grid is ON

here something
has been erased

this distance
represents one inch

zoom is 2x
scaling system is "inch", so
there are 2x12=24 pixels per inch

A B O U T   C O O R D I N A T E   I N P U T

Coordinate input function of extended T.CAD is an alternative method to create a drawing from digital data. For example, a subdivision plot could be drawn this way from calculated survey data. Or a highly irregular shape may be created, which would be too difficult to determine by the usual techniques of drawing directly on the screen. You may also want to use this function to 'digitize' (without digitizer!) paper drawings or sketches from sources other than T.CAD (place a transparent grid overlay on the drawing, read coordinate values, and punch them into xT.CAD). This function also features the only way to create all kinds of arcs and lines tangent to each other for continuous smooth shapes not always possible to create otherwise.

You make invoke the coordinate input method any time by defining any point on the screen as the coordinate origin (X=0 Y=0), and selecting any convenient scale and unit of input. However, remember two rules:

     an attempt to create items smaller than the internal drawing accuracy (1/200 of an inch) may result in rejection of your input values; and

     you are responsible for input values such that the resulting drawing will fit on your page. You should never input values which would create items beyond the edges of the maximum accessible page size (24" by 36"). The computer may accept such values, the items will occupy memory, but you will never be able to see or plot them. The only way to 'get rid' of such unwanted phantom items (other than simply discarding the page) is this:

     go back to 'home' E-format to display the largest possible extent of the drawing area, and start a sequential search to scan through all items, as described in the Section 30 of this manual. Whenever cursors jump to the 'out' position, you will know that an item has been 'found' somewhere beyond the edges of the page. Press the ! key to erase it, and keep scanning until all done. Then save the rest on disk to 'pack' it, re-load, and start over.
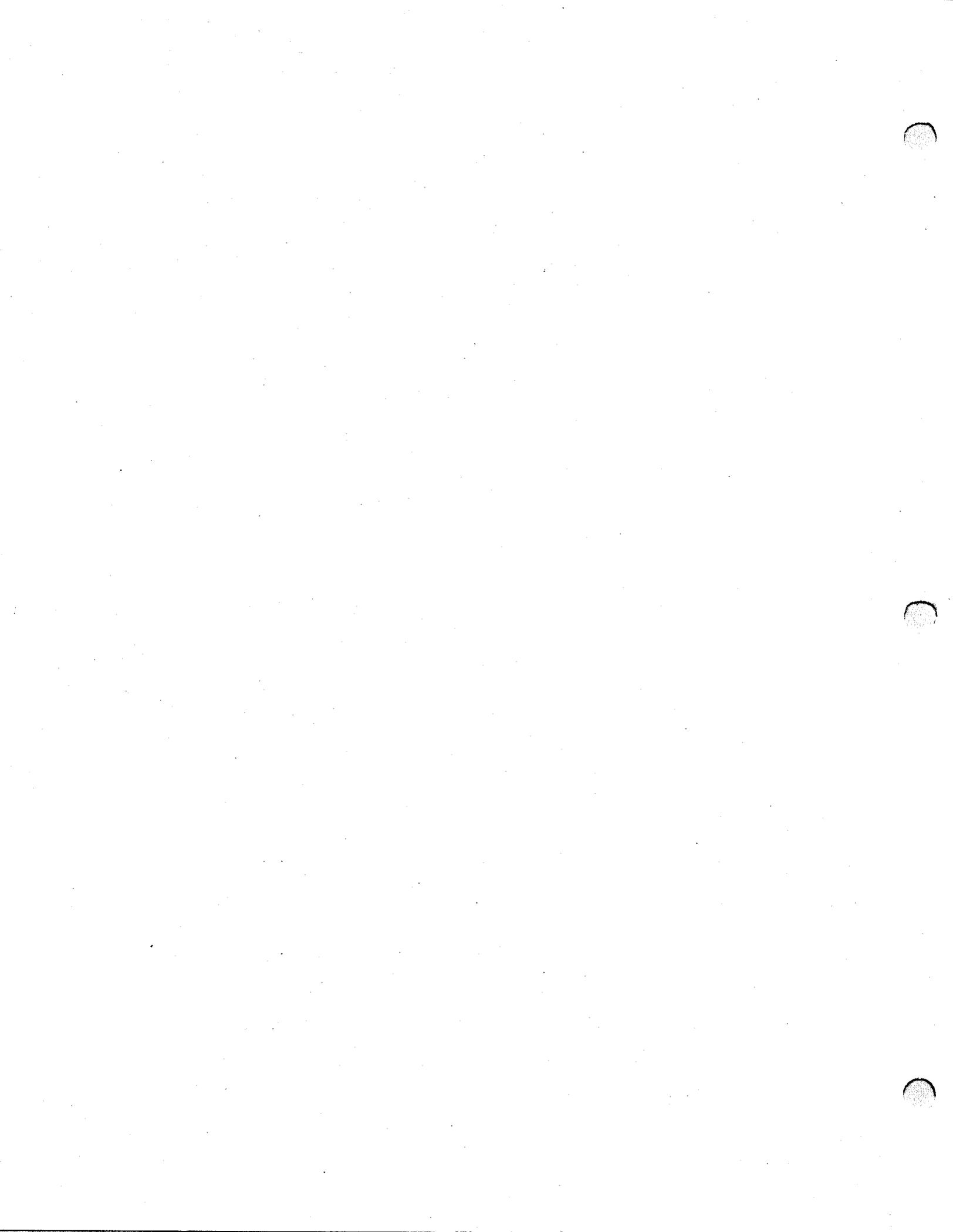
Block functions can be used for a variety of purposes. Erasing, duplicating and rotating are but the basic applications. Other uses, limited only to the extent of the total available memory, could be:

Moving blocks between pages. A block always refers to the page in which it has been originally defined, but is always copied to the current top page. Therefore, if you define a block on Page 1, for example, and switch to Page 2 (but don't CLEAR, use 2-ENTER function), then you may copy this block from Page 1 to Page 2. Or the other way.

Merging of pages. Suppose you define the entire area of Page 1 as a block, and copy it to Page 2 where you have some other drawing: then Page 2 will contain a merged drawing which can be saved and loaded as such. But check memory first: total free memory must be at least equal to the memory used in the Page you are going to copy from.

Selective saving of parts of drawing. Define a block in one Page, take a 'clean' second page and copy the block to it. Then save that other page to disk in the usual manner. This disk file will now contain that part of the original drawing which you 'cut out' as a block.

Re-scaling or rotating of the entire drawing. As above, but specify percentage reduction/enlargement and desired rotation.

Drawing small details without zoom. On a free spot of your drawing create a design at a large scale convenient for accurate drafting. Then copy at properly reduced size and rotation where you need it. After all needed copies are made, erase the original block.

Note: as in the coordinate input, you must specify a reasonable scale and rotation of a block copy, otherwise it could become so small that the computer would ignore it, or so large that it would 'blow out' of the accessible screen. See Section 130 about coordinate input for ways of correcting such overruns. Also remember that, naturally, block reducing results in a copy more accurate than if you enlarge it.

Block copy is a relatively slow function (though considerably faster on Model 4 than on Model III) because of the required complicated math. So just relax, knowing that it is probably still many times faster, more accurate, and less boring than drawing repetitive items one at a time.
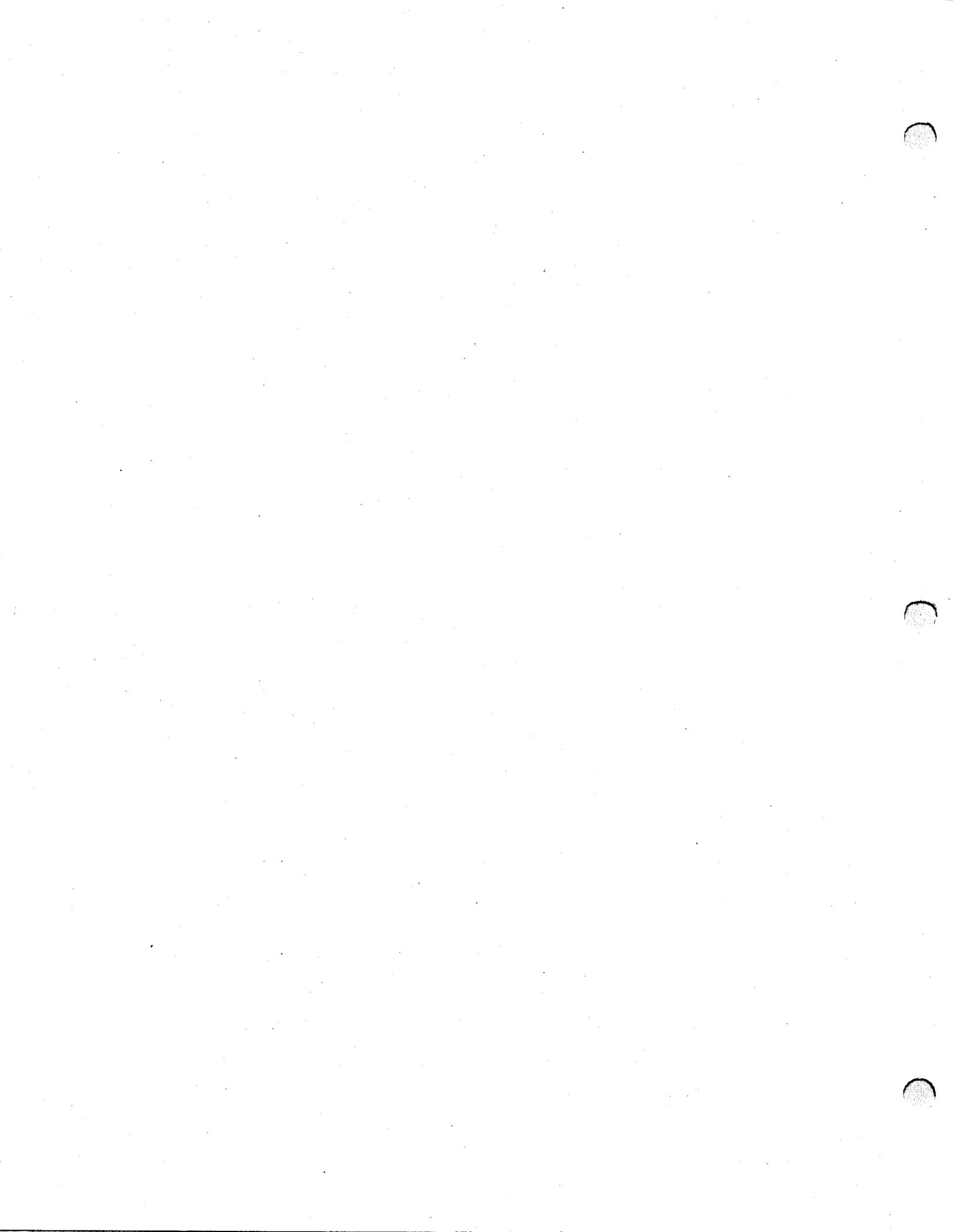
A B O U T   Z O O M

Zoom helps to overcome the relatively coarse grain of a micro monitor, and permits drafting of intricate details. However, it should be used only when actually needed. With time, you will realize what works best. Meanwhile observe these tips:

1.   Always use the lowest magnifiction sufficient for your drawing. Don't attempt to be more accurate than necessary, or to draw with more precision than the final xerox or blueprint of your drawing can reproduce.

2.   Generally start drawing in the selected 'home' format which should be the same as the size of the intended hardcopy. All lines which can be created in this low resolution should be laid out first. This is especially important for long lines. After that is done, proceed to zoom onto smaller details.

3.   Preferably draw any such zoomed details as self-contained units. This will assure a correct precise match of lines. To understand the potential problems which may result from mixing zooms, do this exercise: in magnification 4x draw several horizontal lines at 1/8" intervals on the screen (use the grid). They will be displayed accurately, because at this zoom there are 40 pixels per inch, so that lines will be spaced evenly every 5 pixels. Then switch down to 2x mag. An inch on the screen is now divided into 20 pixels, and only the lines on 1/4" intervals can be displayed accurately at every 5 pixels. The others will appear shifted, because the screen must round off the 2.5-pixel intervals to the nearest full number (the internal computer data will not be affected, however, and the display will be again OK when you zoom back to 4x mag). So now draw a series of new lines, extending the old ones. They seem to match just fine, but when you enlarge this to 4x mag, you will see that some of them don't match at all!

4.   Editing (erasing, replacing, adding) of drawing items should therefore be done at the same magnification at which they were originally created.

5.   The same applies even more to switching between scaling systems. As you can realize, lines drawn at 1/16 inch intervals cannot be evenly spaced when the display is switched to 10 pixels per inch (again, the internal drawing data always remain correct, only the display must round them off). Generally a drawing locked in a particular scaling system should not be manipulated in another.

6.   Even though the computer will automatically zoom onto a 'framed' part of the drawing, you may prefer to select the magnification deliberately to avoid odd pixel spacing.
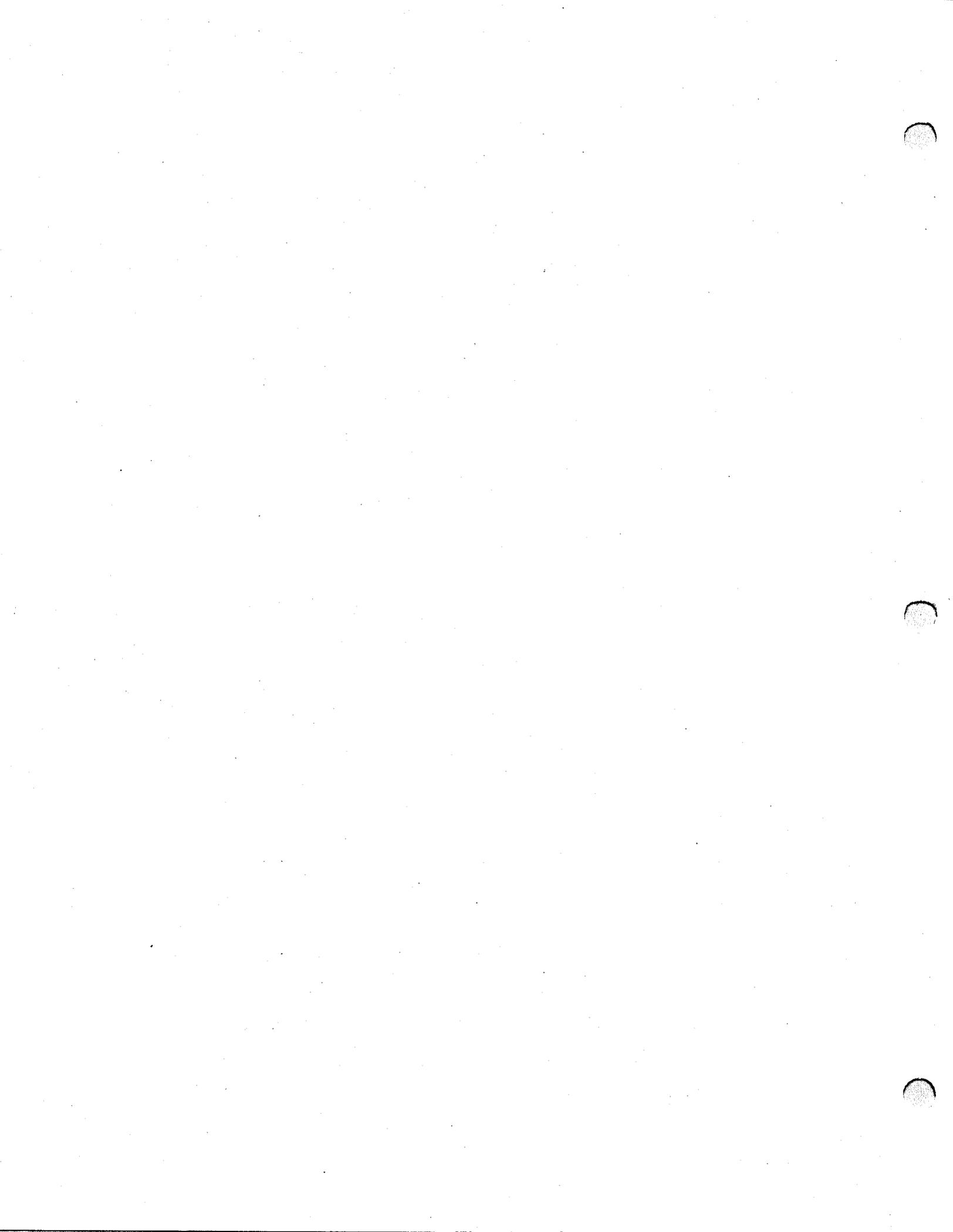
A B O U T   O V E R L A Y S

Overlays are available in the xT.CAD Professional. Any number of
overlays can be stored on the disk and displayed simultaneously
as described in Section 50. However, only two 'active' overlays
can be manipulated simultaneously in the computer memory.
Overlays offer numerous opportunities to expand the efficiency
of T.CAD. Among other things, they help to overcome the
relatively slow speed of the microcomputer. Instead of loading
and displaying a complex drawing every time you need to work on
it, you can deliberately define those parts which can be handled
independently as smaller sub-units. For example, labels could be
on an overlay separate from linework, framing plan separate from
wall outlines, title block separate from subject drawings, etc.
You could then load, display and compare the overlays only when
you need to see if they match, but otherwise you could just work
on one at a time.

By plotting each overlay separately, you can also change pens
and so create multi-colored hardcopy on a single pen plotter!

Another typical use of overlays is similar to the conventional
way of drawing such things as cross sections of a plan view. Put
the plan view in one overlay, draw those cross-sectional lines
which must match on a 'top' overlay, then clear the plan view
and proceed with the section. You can redisplay the plan from
time to time, to make sure that the section drawing proceeds OK,
but otherwise you don't need to slow down the work by having to
redisplay both drawings every time you need to change zoom, etc.

Generally think of CAD overlays as pieces of inexpensive tracing
paper, and maximize their use. However, in order to get the most
out of this feature and not get mixed up, some good advance
planning of overlays, their names and codes, and so on, should
precede their full application. Those who are familiar with 'pin
drafting' will have no trouble applying their experience to CAD,
because the principles are the same.
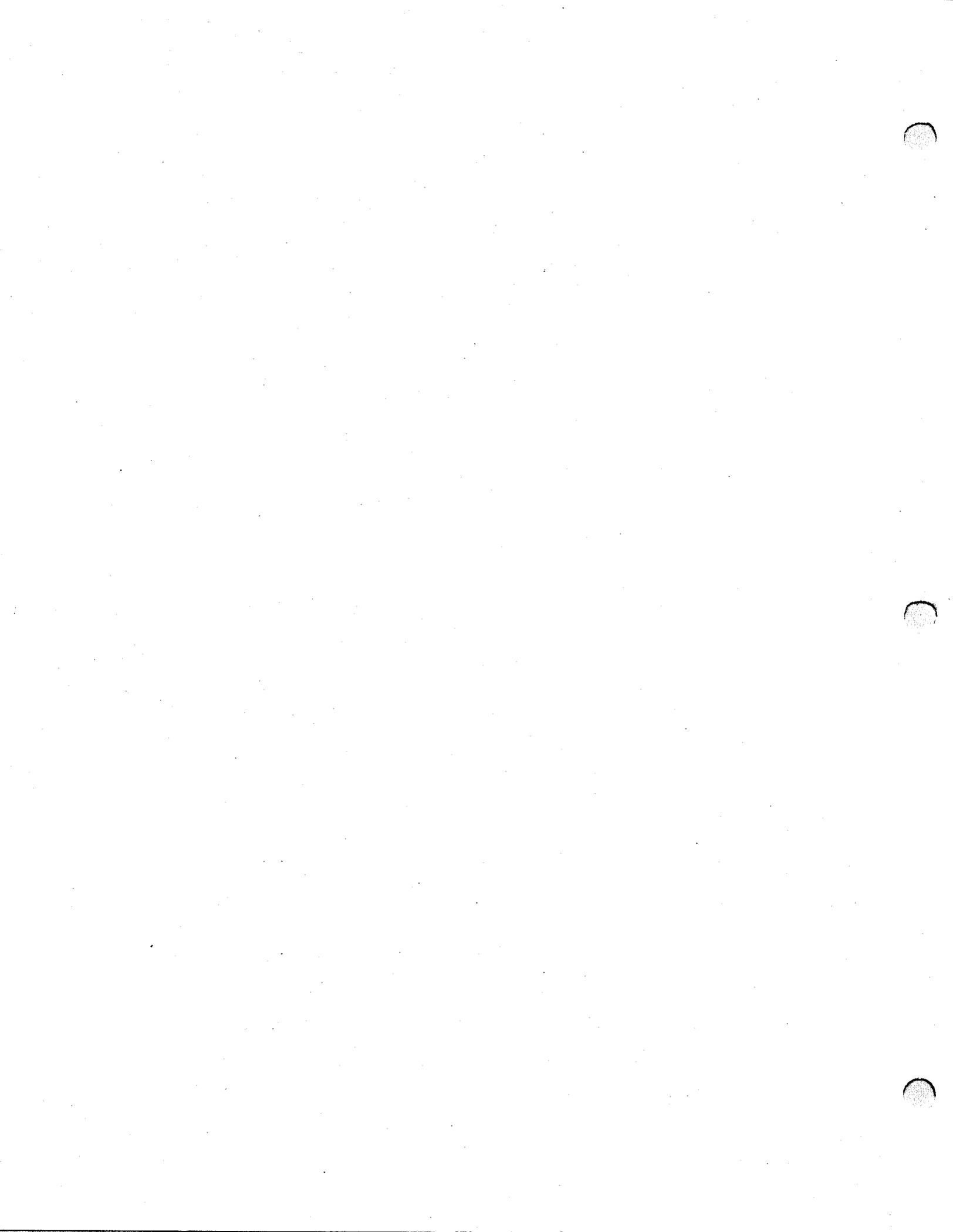
A B O U T   T E X T   L A B E L S

T.CAD is not a good 'word processor', but it does provide
practical means to put labels and descriptive legends on the
drawing. Features include:
        full upper and lower case ASCII character set
        two lettering sizes (1/10" and 1/5")
        two line directions (horizontal and vertical)
        typewriter-style left justified blocks of text
        automatic label duplication.

Especially the duplication feature expands the labeling range
beyond the computer's limited memory. Depending on your version
of T.CAD, you may have up to 100 different labels with a total
of 1000 characters per each overlay. But sometimes this is not
enough. In technical drafting it is common to use identical text
in different places of the drawing (as on a floor plan to label
several 'private offices', or repeating the same dimension
dozens of times, and so on). Each duplicate label counts as one
'item', but it does not use alpha memory, does not require
retyping and saves disk space.

Labels can be created, displayed, 'found' or erased anytime. But
they are automatically suppressed any time you perform one of
the functions which clear the screen, and are re-displayed again
upon return to 'home' format. This way your drawing is not
cluttered with labels. We recommend labeling in a home format.

Regardless of zoom or scaling system, labels are displayed on
the screen in proper position and scale as solid blocks. In most
zooms they would be too tiny to read anyway, so instead when you
deal with a label, its text appears on the alpha line in a
legible size. The user is responsible for typing text such that
it will fit on the drawing. To estimate the length of a text
label, count eleven (11) characters per inch for small letters.
Large size labels are double that size.

Labels are normally suppressed from the hardcopy plot. Plotting
text is slower than line drawing. However, you may plot labels
any time, whether they are displayed on the current screen or
not, as explained in Section 60. On most plotters, when you plot
a reduced or enlarged hardcopy, the labels are also
proportionally reduced or enlarged.

Labels can be used to create bills of materials, parts lists,
invoices, etc. If you need such applications, you may want to
order xT.CAD 'BILL of Materials' software from Microdex.
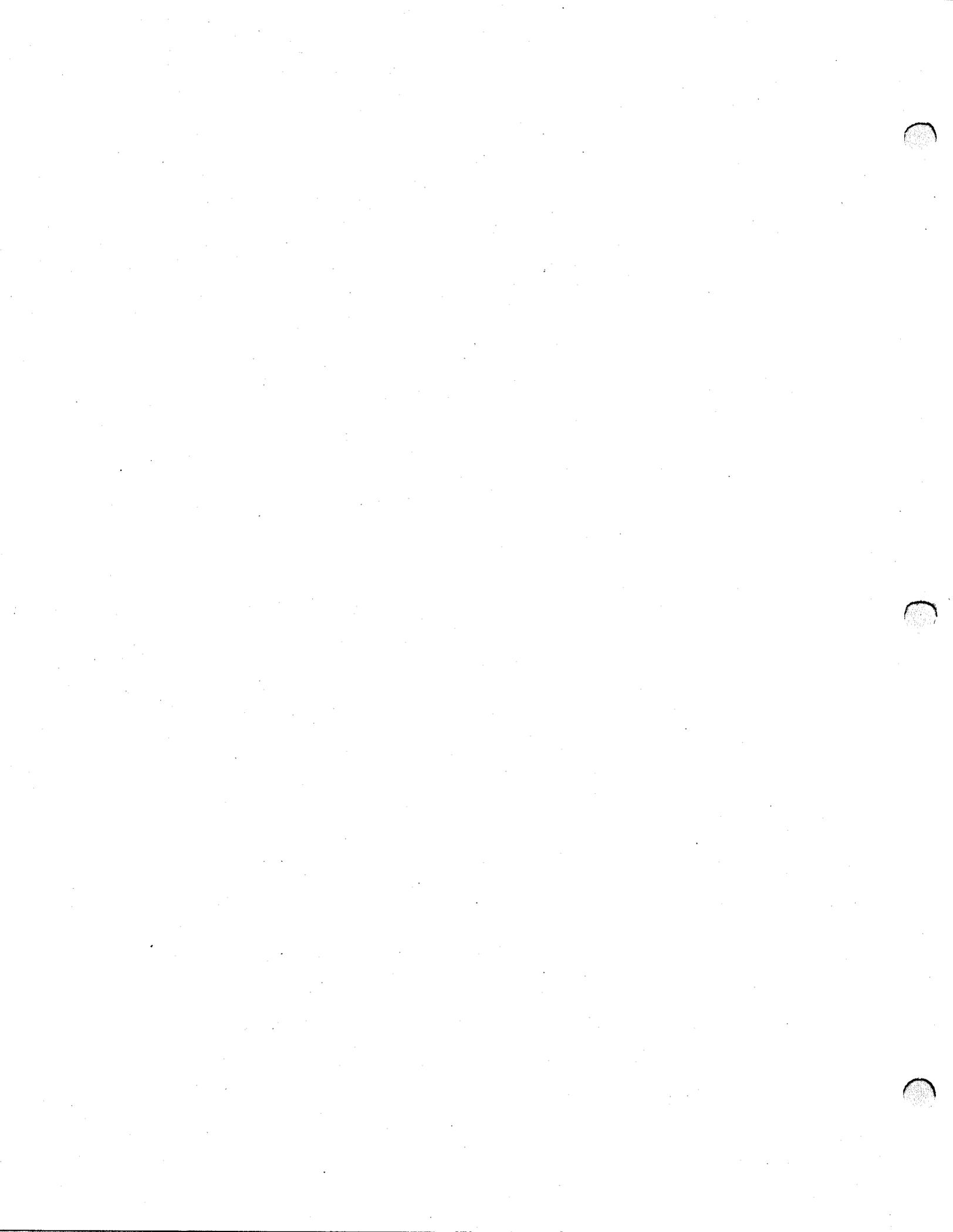
A B O U T   P L O T T E R S

Plotters specified for 'RS-232 serial interface' in Section 60 (except PC-plotters, see below) can be connected through a standard flat RS-232 cable and 'null modem'. To match sockets with pins a 'gender adapter' might be also needed (male-male or female-female). Radio Shack has those items. Or make your own 'null modem cable' as follows (6+20 indicates jumpered pins):

Computer pin number	1	2	3	4	5	6+20	7	8
Plotter pin number	1	3	2	5	4	8	7	6+20

PC-595/695 plotters use a 'telephone' cable. Often you must wire your own 25-pin connector (DB-25P) at the computer end as shown below. Some cables supplied with PC-plotters may not work with xT.CAD. Try it first and if necessary rewire:

Computer pin number	2	3		7
PC-plotter pin number	3	2		4
wire color	red	black		green

If the plotter has any "hard" toggle switches, set as follows:

Baud rate	2400	Programmable/remote	ON
Parity	none	Local/eavesdrop	OFF
Word length	8 bits		
Stop bits	2 bits		
Bit 8	try 1 or 0		

Plotters specified in Section 60 for 'Centronics parallel interface' should be simply connected by a standard cable to your computer's 'line-printer' port.

Once all cables and switches are set, simply power-up the plotter (manually reset initial 'error' light, if any). xT.CAD takes care of the rest, but plotter MUST be ON-LINE BEFORE you start plotting, otherwise results are unpredictable.

About size and enlargement: if you request a plot larger than your plotter can handle then the result may be erratic plotter 'pecking', distorted image, even hung-up computer (also note that curves begin to look like polygons when the enlargement percentage is high). Try to tap SPACE to cancel, or reset system. On some plotters an 'error' light may alert you to such oversize plots: in that case manually reset the plotter, check the drawing for any distortions, and redo smaller if necessary.

When in doubt if your plot will fit on plotter paper, turn on the 'inch' grid before plotting. For example, if the area you want to plot is 24 'grid-inches' wide, but the plotter's active area is 21 inches wide, then reduce at least 21/24 = 87%. Check also drawing height and use the smaller of the two percentages.
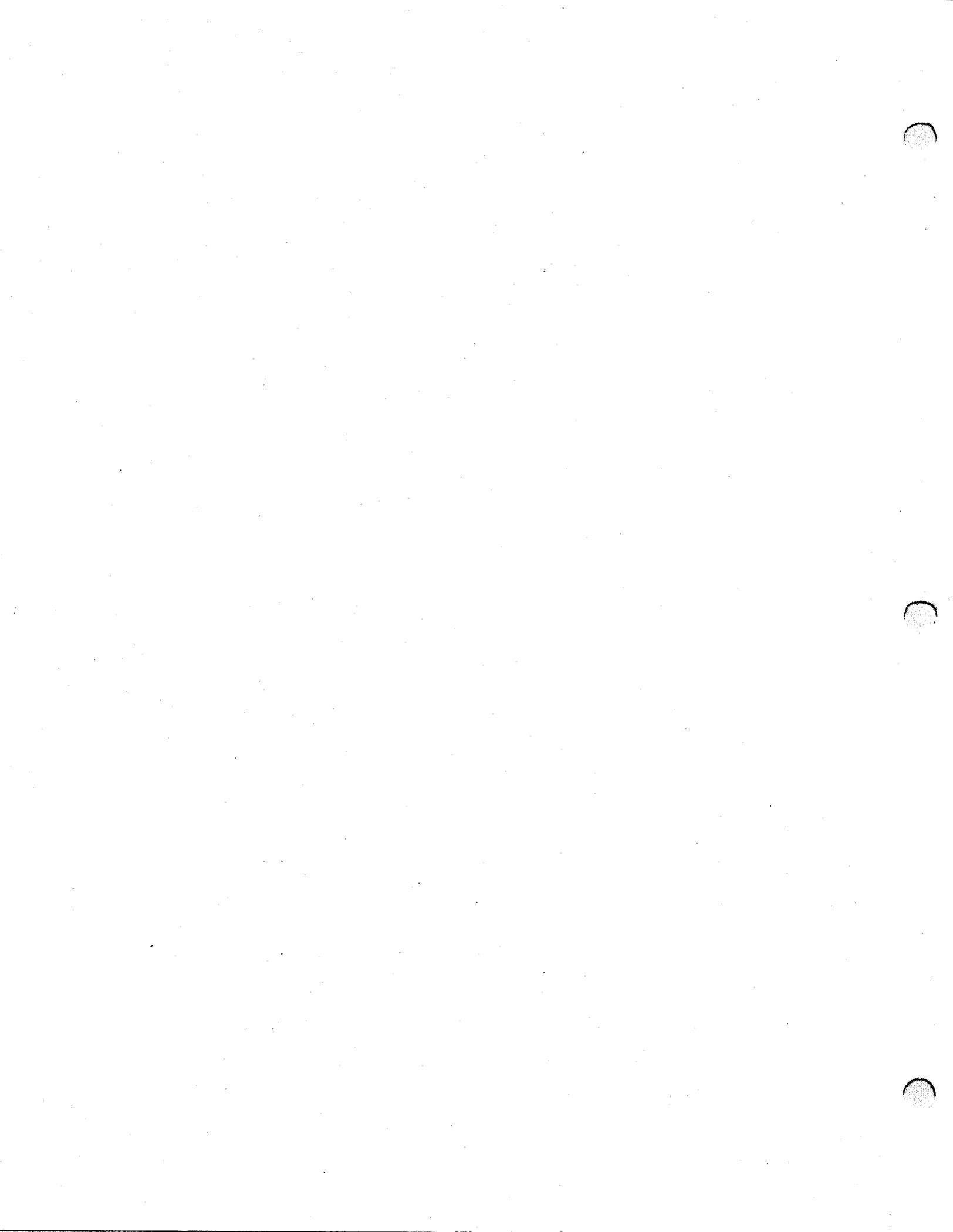
A B O U T   D I G I T I Z E R S   A N D   M I C E
----

xT.CAD supports Tandy GT2000 digitizer, Kurta Series One
digitizers, and all Houston Instrument True-Grid digitizers
Series 1000 and 8000. Connect to the 'RS-232 serial' port.

Kurta/Tandy digitizers: use the standard cable supplied with the
digitizer, or any 25-pin flat cable (e.g. Tandy Cat.26-1408).
Set toggle switches as follows:
```
     Program    "ON" 1, 2, 6      "OFF" 3, 4, 5, 7, 8
     Mode       "ON" 1, 3, 4      "OFF" 2
```

True-Grid digitizers: use a 'null-modem' cable (same as you need
for plotters, see Section 180). Most cables supplied by Houston
Instrument with their digitizers will also work with xT.CAD. If
the cable is a 'telephone'-type then make sure pin #1 is NOT
connected. Use any transducer available for those digitizers
(stylus, one-button or multi-button crosshair). Set toggle
switches as follows:
```
     Baud rate    2400        Default coding          ASCII
     Parity       none        Default data format     String
     Stop bits    2 bits      Default operating mode  Point
     Bit 8        zero
```

Once all cables and switches are set, power-up the digitizer.
xT.CAD takes care of the rest, but digitizer should be on-line
before you press (T), otherwise results are unpredictable. If
this happens and xT.CAD seems to 'freeze' then you can usually,
but not always, regain control by tapping SPACE bar. Otherwise
you must reset computer which will erase your data in memory.
Then double check all switches and connections and try again.

Securely tape the drawing to the digitizer's active surface.
Horizontal or vertical lines must be aligned parallel with the
edges of the digitizer to assure true and plumb copy on the
screen. The 'tolerance' of digitizing depends on the speed of
POINT as explained in the white pages 'Cursor Control'. Use
'loose' tolerance (eg. 1/4 of an inch) to 'snap' the lines of a
rough sketch and 'tight' tolerance for fine details. Generally a
tolerance under about 1/20 of an inch requires a very steady
hand and after a while may get quite tiresome to the eyes.

The Micro-Labs 'mouse' can be used with xT.CAD any time. Connect
as instructed in its manual. It is not a digitizer but simply an
optional device for moving the POINT on the screen. It is only
active when you hold down its 'fire' button. Fire the mouse only
when the POINT is visible and 'alive' i.e. when it does also
respond to keyboard arrows.
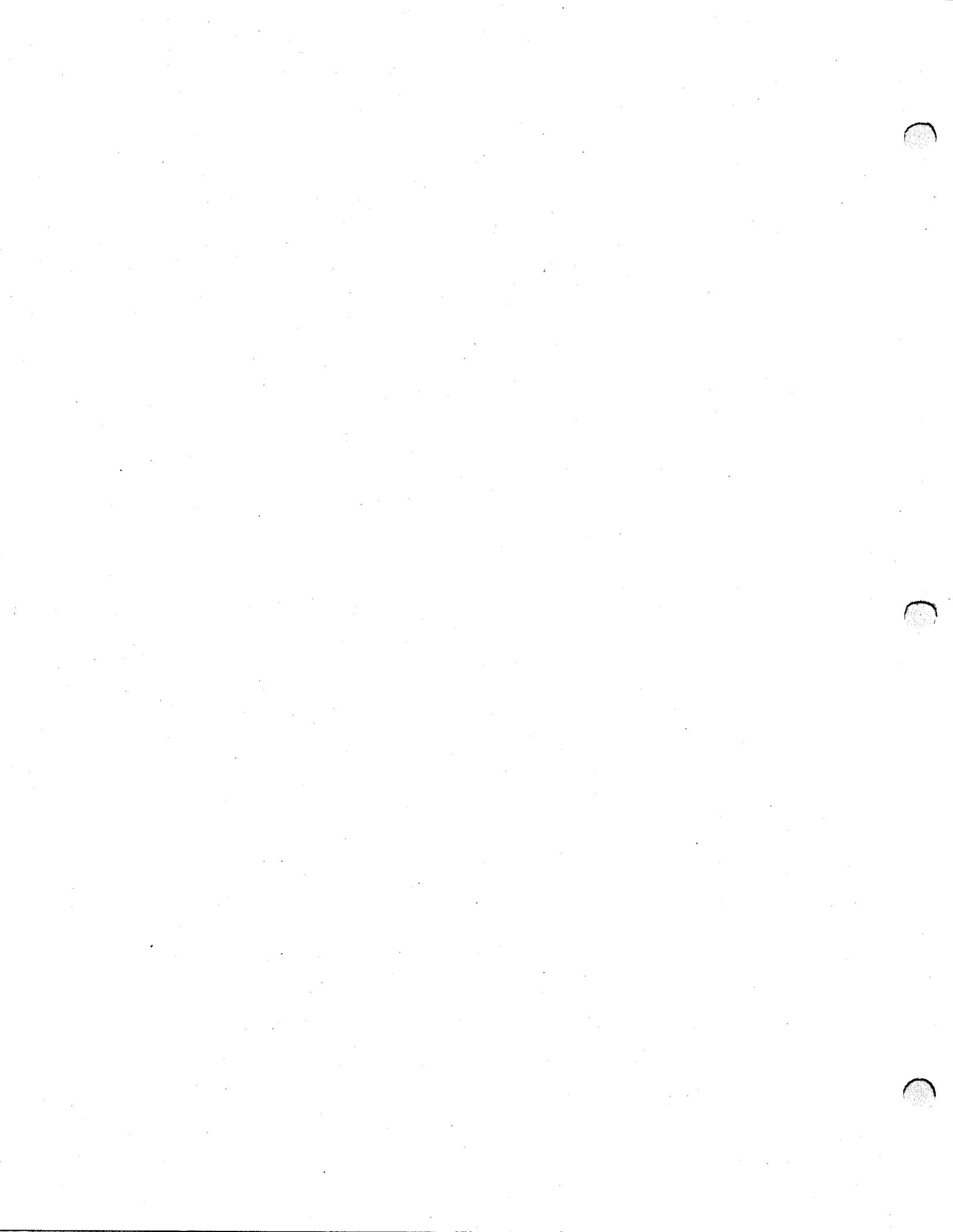
A B O U T   P R O B L E M S

Some common problems can be avoided by following simple rules:

1.   Please review the entire manual before running xT.CAD.

2.   Make sure your hardware, and especially disk drives are in
good condition. Use fresh disks. If you get floppy disk errors,
then try another disk, or re-FORMAT disk and try again, or clean
drive heads with a disk drive head cleaning kit. We also suggest
that you get a magnetic bulk eraser from an electronic supply
store, and periodically erase floppy disks before re-formatting
(but absolutely NEVER bulk-erase hard disks!). This inexpensive
gadget does wonders to keeping your floppies error free. But if
you still get disk errors often, your computer may need service.

3.   If your graphic screen picture displays stray lines or
other distortions, check your hardware and disk operating
system, and have it serviced if necessary. xT.CAD does not
affect hardware operation in any way.

4.   Always keep your configured xT.CAD system disk on the
system default drive (floppy or hard) when running.

5.   If you intend to use plotter, digitizer or mouse during a
session, it must be hooked up and powered before you run xT.CAD.

6.   Please do not attempt to modify, 'improve' or otherwise
tamper with xT.CAD. We do not accept any responsibility for
problems which might result.

E r r o r   h a n d l i n g

To conserve memory, xT.CAD does not have many error messages.
Wrong commands are usually ignored without message. Double-check
the function description in the manual if the program is 'alive'
but you don't seem to be getting the expected results.

In the unlikely case of fatal errors ('bugs') in the program
code xT.CAD closes all files, displays a message and exits to
DOS. Follow the instructions in the message and report to
Microdex, regardless whether your software is still under
warranty or not.