<table>
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<td>0001</td>
<td>WRITEUP FOR THE FOONLY DRAWING PROGRAM, HOW FOR THE COMMANDS YOU CAN GIVE ANYTIME:</td>
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<td>?IX TYPES &quot;WHAT'CHA WANT BOSS??&quot; TO WHICH YOU MAY TYPE ANY</td>
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<td>0004</td>
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<td>MACRO'S:</td>
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<td>HOW TO DO IT -- PC CARDS</td>
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<td>MORE PC CARDS -- PCP</td>
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<td>MISCELLANEOUS</td>
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<tr>
<td>0027</td>
<td>002E</td>
<td>ENDMK</td>
</tr>
</tbody>
</table>

?1:
WRITEUP FOR THE SINGLE DRAWING PROGRAM

THE CHARACTERS "?", "?#", "?&", AND "?(" STAND FOR <CTRL>, <META>, <CTRL><META>, AND <DON'T CARE> RESPECTIVELY, "?"", "?#", AND "?&" ARE ALWAYS INTERPRETED BY THE SCANNER AS THESE THINGS!

THE LETTER "D" PRECEDING ANY DESCRIPTION MEANS THIS IS FOR THE LOGIC DRAWING PROGRAM ONLY, "PC" MEANS PC CARD PROGRAM ONLY, "L" MEANS THIS IS A FEATURE OF THE LAYOUT VERSION ONLY, "R" MEANS THIS IS A FEATURE OF THE ROUTING VERSION ONLY.

THE FOLLOWING ARE THE PROGRAM NAMES FOR THE VARIOUS VERSIONS:

<table>
<thead>
<tr>
<th>NAME</th>
<th>DESCRIPTION</th>
<th>RUNS WITH</th>
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<tr>
<td>D</td>
<td>BASIC DRAWING PROGRAM</td>
<td>ALONE</td>
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<tr>
<td>PC</td>
<td>BASIC PC CARD PROGRAM</td>
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<td>RPC</td>
<td>ROUTING VERSION OF PC</td>
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<td>LD</td>
<td>LAYOUT VERSION OF D (USING FASTBANDS)</td>
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<tr>
<td>LPC</td>
<td>LAYOUT VERSION OF PC (USING FASTBANDS)</td>
<td>LD</td>
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<tr>
<td>TD</td>
<td>LAYOUT VERSION OF D (USING SEGMENTS)</td>
<td>TPC</td>
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<td>TPC</td>
<td>LAYOUT VERSION OF PC (USING SEGMENTS)</td>
<td>TD</td>
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<tr>
<td>LRD</td>
<td>ROUTING AND LAYOUT D (USING FASTBANDS)</td>
<td>LRPC</td>
</tr>
<tr>
<td>LRPC</td>
<td>ROUTING AND LAYOUT PC (USING FASTBANDS)</td>
<td>LRD</td>
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<td>TRD</td>
<td>ROUTING AND LAYOUT D (USING SEGMENTS)</td>
<td>TRPC</td>
</tr>
<tr>
<td>TRPC</td>
<td>ROUTING AND LAYOUT PC (USING SEGMENTS)</td>
<td>TRD</td>
</tr>
</tbody>
</table>

HERE ARE SOME MONITOR LEVEL COMMANDS:

REE  REFRESHES DISPLAY, FLUSHES ANY MACRO'S IN PROGRESS THEN JUMPS TO WHATEVER IS IN JOBOPC.

REEN RESTARTS PROGRAM WITHOUT FLUSHING CURRENT DATA IF POSSIBLE, THIS MAY NOT WORK IF YOU WERE IN THE MIDDLE OF SOMETHING WHEN YOU WENT TO THE MONITOR.

FIRST THE FOUR BASIC MODE SWITCHING COMMANDS:

EACH OF THE FOLLOWING COMMANDS FINDS THE CLOSEST PRIMITIVE IN THE DRAWING AND MAKES IT THE "CLOSEST" PRIMITIVE, IF YOU ARE FINDING BODIES YOU MAY NOT DO OPERATIONS ON POINTS, ETC.

?&P FIND THE CLOSEST POINT, A LARGE P INDICATES THE POINT, IF THE POINT HAS TEXT ON IT A LARGE T IS USED.

?&T SAME AS ?&P EXCEPT THAT THE ONLY POINTS WHICH WILL BE FOUND ARE THOSE WITH TEXT ON THEM.

?&L FIND THE CLOSEST LINE, A LINE IS NOT "CLOSE" TO A POINT UNLESS THE PERPENDICULAR FROM THE POINT TO THE LINE INTERSECTS THE SEGMENT WHICH IS THE LINE, A LARGE L INDICATES THE MIDPOINT OF THE LINE.
FIND THE CLOSEST BODY, A LARGE B IS PLACED AT THE CENTER OF THE BODY.

FIND THE CLOSEST SET, A LARGE S IS PLACED AT THE CENTER OF THE SET. THE CENTER OF A SET IS THE AVERAGE OF THE LOCATIONS OF ITS MEMBERS.

THE FOLLOWING 3 CHARACTERS INDICATE WHICH KIND OF INPUT YOU ARE DOING:

?&b Waiting for single letter command
?&s Waiting for single letter, not command
?&u Waiting in line mode (only used during macros to indicate this, otherwise no character).

SPECIAL CONTROL CHARACTERS AT ALL LEVELS:

?&! Refresh display,
NOW FOR THE COMMANDS YOU CAN GIVE ANYTIME:

?(* THESE OFFSET THE DRAWING LEFT, RIGHT, UP, DOWN,
?(* THE AMOUNT IS DETERMINED BY THE NUMBER OF CONTROL
?(* BITS HELD DOWN,
?(*!

SIZE CONTROLS:

?(* MAKE THE DRAWING SMALLER,
?(* MAKE THE DRAWING LARGER, THE CONTROL BITS AGAIN
?(* DETERMINE THE AMOUNT,

?(* MOVE CURSOR LEFT (ONE GRID SPACE TIMES CONTROL BITS)
?(* MOVE CURSOR LEFT (SIXTEEN GRID SPACES TIMES CONTROL BITS)
?(* MOVE CURSOR RIGHT (ONE GRID SPACE TIMES CONTROL BITS)
?(* MOVE CURSOR RIGHT (SIXTEEN GRID SPACES TIMES CONTROL BITS)
?(* MOVE CURSOR UP (ONE GRID SPACE TIMES CONTROL BITS)
?(* MOVE CURSOR UP (SIXTEEN GRID SPACES TIMES CONTROL BITS)
?(* MOVE CURSOR DOWN (ONE GRID SPACE TIMES CONTROL BITS)
?(* MOVE CURSOR DOWN (SIXTEEN GRID SPACES TIMES CONTROL BITS)

L

?&V IN PC PROG GO TO LOGIC PROG, IN LOGIC PROG GO TO PC PROG,

?&L SET "CURRENT" TO "CURRENT," "CURRENT" IS THE ONE

?&P WHICH GETS THINGS ADDED TO IT BY ?"&,

?&T FIND CLOSEST POINT, SEE ABOVE,

?&L FIND CLOSEST POINT WITH TEXT ON IT, SEE ABOVE,

?&B FIND CLOSEST LINE, SEE ABOVE,

?"C FIND CLOSEST BODY, SEE ABOVE,

?"C MOVE THE CURSOR TO THE PHYSICAL CENTER OF THE SCREEN

?"C MOVES THE CURSOR AND THE POINT IN THE DRAWING AT WHICH IT

?"C RESIDES TO THE PHYSICAL CENTER OF THE SCREEN,

?&C SET THE OFFSET AND THE CURSOR POS TO Ï, (I.E. MOVE THE

?&C CURSOR AND LOGICAL Ï, Ï TO THE CENTER OF THE SCREEN,

D

?&M MASSAGE, TRIES TO MAKE ALL LINES IN THE DRAWING EITHER

?&M HORZ. OR VERT,

D

?&E EDIT (OR CREATE) A BODY, YOU ARE ASKED "BODY TYPE??" THEN

?&E YOU ENTER THE EDITOR WITH IT (OR EMPTY), IF THE BODY DID

?&E NOT EXIST BEFORE IT DOES NOW,

D

?"I INPUT UNITS FROM A DRAWING FILE, THIS ALLOWS YOU TO DEFINE

?"I BODIES ONLY ONCE AND USE THEM IN ALL DRAWINGS,

PC

?"I LIKE ?#1 EXCEPT THAT ANY UNPADDDED DRILL HOLES ARE GIVEN PAD
TYPE 1, BECAUSE UNPADDLED HOLES DON'T WORK,

?#I INPUT A DRAWING.

D ?&I INPUT BODY DEFINITIONS ONLY, WHEN A CONFLICT ARISES (BODY
ALREADY EXISTS), REPLACEMENT IS AUTOMATICALLY EFFECTED BY
A GEOMETRIC MAPPING.

PC ?&I INPUT A ROUTE FILE (FROM WAGNER'S ROUTING PROGRAM), ASKS FOR
FILENAME (DEFAULT EXTENSION IS "DAT"), FILENAME IS USUALLY
FOR21, THERE SHOULD ALREADY BE IN THE DRAWING THE DIPS
WHICH WERE ROUTED TO, IN THE EXACT POSITIONS AS WHEN
THE FILE TO THE ROUTER (FOR20, DAT) WAS WRITTEN.

D ?"L LIST ALL THE BODY TYPES ON THE TTY, FOR LIBRARY BODIES THE
LIBRARY NAME IS ALSO LISTED.

D ?#L LIST ALL THE BODY TYPES ON THE LPT.

?"W WRITE OUT A WHOLE DRAWING IF THE FILENAME HAS NO
"," IN IT THE EXTENSION ",DRH" (OR ",PC") WILL BE ATTACHED,
IF YOU SAY "?W" IN PLACE OF THE FILENAME THE LAST ONE USED
ON MAJOR INPUT OR OUTPUT WILL BE USED; IF NO PPN ARE GIVEN,
THEY ALSO WILL BE THE LAST ONES USED ON INPUT, IF OTHER
_THAN THE LAST FILENAME AND PPN USED ON INPUT IS GIVEN,
A CHECK IS MADE TO SEE IF IT EXISTS ALREADY.

?#W WRITE A WIRE LIST FILE, THE EXTENSION ",WD" (OR ",WPC") IS
THE DEFAULT.

?&W WRITE A PLOT FILE, THE EXTENSION ",PLT" (OR ",PCP") WILL BE
USED IF NONE IS SPECIFIED.

PC ?"R CHANGE THE WORKING SIDE OF THE PC CARD TO THE OTHER SIDE.

PC ?#R LEAVE "BOTH SIDES" MODE.

PC ?&R ENTER "BOTH SIDES" MODE, THE CURRENT WORKING SIDE IS
DISPLAYED AT BRIGHTNESS 7 AND THE OTHER SIDE AT CURRENT
BRIGHTNESS.
TYPES "WHAT'CHA WANT BOSS??" TO WHICH YOU MAY TYPE ANY OF THE
COMMANDS IN THE FOLLOWING LIST, SEPARATED BY COMMAS ENDING WITH
<CR>. THE ENTIRE LINE IS SCANNED BEFORE EXECUTING ANY OF THE COMMANDS,

THE EXTENDED SCANNER IS FOR SETTING THE VALUE OF VARIABLES,
TYPE ONE OF THE FOLLOWING TEXT STRINGS:

SLICE       ASKS FOR INITIAL PIN #, FOLLOWED BY WIDTH OF SLICE
            AND CONVERTS [N+M] ETC. TO THE APPROPRIATE NUMBER.

CLEAR       THIS DELETES "ALL" BODIES, POINTS, AND SETS (IN LOGIC
            DRAWING PROG. DEFINITIONS OF BODIES ARE ALSO DELETED.),

PC          THIS IS TO MAKE A "INNER PLANE FILE", IT DELETES ALL
            TEXT, LINES, AND POINTS WHICH ARE NOT DRILL HOLES
            AND PADS ALL DRILL HOLES WITH PAD TYPE ?# (CLEARANCE)
            THIS IS THE NORMAL INPUT TO THE "PPLLOT" COMMAND TO
            MAKE INNER PLANE PLOTS, AFTER GIVING THIS COMMAND
            TEXT AND LINES MAY BE ADDED, PAD TYPES MAY BE CHANGED
            ETC., THE "CURRENT" SIDE IS STILL THE ONE WHICH GETS
            PLOTTED.

DSKIN       ASKS FOR A FILE NAME, THEN USES SAID FILE IN PLACE OF
            TELETYPE INPUT! USE "?=" TO GET ALTMODE AND ?/ TO GET
            CHLP, USE THE ?"??# KLUDGE TO GET CONTROL BITS!
            USE ?( (REALLY LAMRDA) TO CAUSE A TEMPORARY INPUT BREAK,
            INPUT COMES FROM TTY UNTIL A ?&?C IS TYPED.

DSKOUT      ASKS FOR FILE NAME, ALL TELETYPE INPUT IS COPIED TO
            THE OUTPUT FILE, THE FILE IS NOW OF THE FORM TO USE
            WITH "DSKIN",

CLOSE       CLOSES THE FILE ENTERED BY "DSKOUT",

SAVE        ASK FOR A FILENAME, THEN SAVES THE CURRENT CORE IMAGE
            UNDER THAT FILENAME, THE DEFAULT EXTENSION IS DMP,
            THE STARTUP ADDRESS IS SET TO RESTORE THE ACTS AND
            RETURN AS IF YOU HAD JUST GIVEN THE SAVE COMMAND.
            IN LAYOUT VERSIONS, THE DEFAULT EXTENSION IS "DMP",
            (THATS THE ONE YOU RUN), ANOTHER FILE IS ALSO MADE,
            WITH THE SAME NAME AS THE FIRST, EXCEPT WITH THE
            EXTENSION INCREMENTED BY 1, IE. IF YOU GAVE THE
            NAME "FOO", THE TWO FILES WOULD BE "FOO.DMP" AND
            "FOO.DMR"

ESAVE       THIS WRITES OUT THE DRAWING WITH THE REMEMBERED NAME (?O)
            THEN DOES A SAVE WITH THE REMEMBERED NAME.

AUTOSAVE    THIS ASKS "HOW MANY COMMANDS BETWEEN SAVES??" AND
            EVERY TIME THAT MANY TOP LEVEL COMMANDS ARE PROCESSED
            IT DOES AN "ESAVE",

-AUTOSAVE   DISABLE AUTOSAVE,

IMRES       THIS READS A LOGIC DRAWING WIRE LIST (ASKS FOR FILENAME)
            AND BUILDS AND INTERNAL LIST OF POINTERS TO THE APPROPRIATE
            PINS ON THE PC CARD (MUST HAVE ALREADY READ IN THE PC
            CARD DRAWING), THIS COMMAND IS CURRENTLY ONLY USED WITH
THE "WROUTE" COMMAND,

-"WFILES" THIS RELEASES THE STORAGE USED BY THE "WFILES" COMMAND.

"WROUTE" ASKS FOR FILENAME, THEN WRITES THE FILE FOR INPUT TO
MAGNER'S ROUTING PROGRAM. IF THERE IS NO INTERNAL
POINTER LIST, YOU GET AN ERROR MESSAGE; THE NORMAL
FILENAME THAT MAGNER'S PROGRAM USES IS "FOR20".

"MACRO" TYPES THE NAMES OF ALL DEFINED MACRO'S!

"DISP" ENABLE DISPLAYING DURING MACRO'S.

-"DISP" DISABLE DISPLAYING DURING MACRO'S,

THIS ONLY DISABLES MAIN DRAWING DISPLAYING
NOT CURSOR MOVEMENT!

"DPY" ENABLE DISPLAYING,

-"DPY" DISABLE ALL DISPLAYING,

"PINS" ENABLE DISPLAY AND PLOTTING OF PIN #'S,

THIS INCLUDES CONNECTOR PINS,

-"PINS" DISABLE PINS,

"LOCS" ENABLE DISPLAY AND PLOTTING OF LOCATION #'S,

-"LOCS" DISABLE LOCs,

"PINIDS" ENABLE DISPLAYING OF PIN ID'S,

-"PINIDS" DISABLE PINIDS,

"TEXT" ENABLE TEXT,

-"TEXT" DISABLE TEXT,

"PTEXT" ENABLE POINT TEXT SEPARATELY FROM BODY TEXT,

-"PTEXT" DISABLE POINT TEXT SEPARATELY,

"BTEXT" ENABLE BODY TEXT SEPARATELY,

-"BTEXT" DISABLE BODY TEXT SEPARATELY,

"WINDOW" LIMIT OPERATIONS TO THE ON SCREEN PORTION OF THE
DRAWING, (THIS IS THE DEFAULT)

-"WINDOW" ALL OPERATIONS APPLY TO THE ENTIER DRAWING
NOT JUST THOSE THINGS ON SCREEN,

"LWINDOW" ANY LINE SEGMENT WHICH HAS ONE OR MORE ENDPOINTS
OFF SCREEN IS SOFTWARE WINDOWED, THIS CAUSES
A NOTICABLE AMOUNT OF COMPUTING SO BE CAREFUL!

-"LWINDOW" DISABLE LWINDOW (AND SAVE TIME),

"REMID" RE-ALLOCATE ALL BODY AND POINT ID'S, THIS MAY BE
NECESSARY IF A LOT OF SET COPYING AND DELETIONS ARE DONE,
DIAMONDS

ENABLE PLOTTING OF DIAMONDS AT THE INTERSECTION OF FOUR LINE SEGMENTS (NOT SHOWN ON DISPLAY), ASKS IF YOU WANT DIAMONDS AT THE INTERSECTION OF THREE LINES!

-DIAMONDS

DISABLE DIAMONDS

IDENT

ENABLE DISPLAYING OF BODYNAMES NEAR BODIES!

-IDENT

DISABLE SAME.

CURSOR

ENABLE LIGHT PEN TRACKER,

-CURSOR

DISABLE LIGHT PEN TRACKER.

CLOCATE

SHORT DASHED LINES, ONE HORIZONTAL AND ONE VERTICAL INDICATE THE CURRENT CURSOR POSITION.

-CLOCATE

DISABLE CLOCATE.

LOCATE

LONGER DASHED LINES, ONE HORIZONTAL AND ONE VERTICAL

-LOCATE

DISABLE LOCATE.

CENTER

CENTERS BLINKING POINTS(PC PROG) OR LINES(DRAWING PROG) AND SETS APPROPRIATE SCALE FACTOR TO SEE ALL BLINKING PINS, THIS IS DONE WHEN THE BLINKING THINGS ARE FIRST FOUND!

-CENTER

DISABLE CENTERING.

TCENTER

WHEN TEXT IS FOUND WITH THE "?"F" COMMAND, PUT THE POINT AT THE CENTER OF THE SCREEN, EVEN IF IT WAS OFF SCREEN.

-TCENTER

TURN OFF TCENTER.

DDT

ENTERS DOT(RAQD) IF PRESENT, TO RETURN TYPE "RSG".

SCALE

SET SCALE FACTOR,(GUARANTEED TO PUT GRID POINTS ON III POINTS,) ORIGINALLY SCALE=16(2 FOR PC)

PC

STEP

SET THE MINIMUM DISTANCE THE CURSOR WILL MOVE FOR SMALLEST STEP (MUST BE DIVISIBLE BY 5 (MILS)).

SIZE

TELLS YOU HOW WIDE AND HIGH YOUR DRAWING WILL BE IF PLOTTED AT SCALE OF 2 IN PLOT PROG, ALSO TELLS YOU THE SMALLEST BOARDER WHICH WILL FIT AROUND THIS DRAWING (ASK WHAT SCALE YOU WILL USE!)

PC

SIZE

TELLS YOU HOW WIDE YOUR PC CARD WILL BE (NOT COUNTING THE CARD OUTLINE) WHEN PLOTTED AT A SCALE OF 1 (REAL SIZE),
BRIGHT SETS SCREEN BRIGHTNESS (ONE DIGIT)
CURLBRT SETS CURSOR BRIGHTNESS
PC MOVE MOVES CURSOR X,Y (IN MILS) RELATIVE TO ITS CURRENT POSITION.
XOFF SETS ABSOLUTE X OFFSET.
YOFF SETS ABSOLUTE Y OFFSET.
TITLE ASKS FOR 2 STRINGS, "TITLE LINE 1" AND "TITLE LINE 2".
THESE ARE REMEMBERED AND USED FOR PLOT FILES SO YOU
DON'T HAVE TO TYPE IT TO THE PLOT PROG. IF NULL STRING
IS GIVEN, THE PLOT PROG WILL ASK FOR THAT ONE.

AUTHOR LIKE TITLE BUT SETS STRING TO BE USED FOR "DRAWN BY"
PART OF PLOT.

LTITLE LIST BOTH TITLE STRINGS AND AUTHOR STRINGS ON TTY.

PBOX ASKS FOR BOX SIZE (TYPE SINGLE LETTER A-D),
SCALES DRAWING AND TEXT TO JUST FIT INTO BOX
BUT MAINTAINS RATIO BETWEEN TEXT AND LINES
WHICH YOU SEE ON THE SCREEN, WILL NOT BE SCALED
LARGER THAN THAT WHICH MAKES TEXT LARGER THAN
SIZE 3 ON PLOTTER, TELLS YOU SCALES BEFORE ASKING
FOR FILE NAME.

PLOT AN INNER PLANE, ASKS FOR PLANE NUMBER, DOESN'T PLOT
PADS WHICH TOUCH THE PLANE IN QUESTION, LINES ARE
PLOTTED, WILL ALSO PLOT TEXT.

PLOT FORCES ALL POINTS AND DIPS ONTO GRID POINTS,
THIS IS DONE BY TAKING THE X AND Y LOCATIONS
OF ALL THE DIPS AND POINTS IN THE DRAWING AND
MAKING THEM MULTIPLES OF THE CURRENT STEP SIZE.
IF I'M SET MOUNLY THE CURRENT SET IS MUNGED,
(WONDER WHY I CALLED THIS "MUNG"??)

COUNT TELLS YOU HOW MANY POINTS THERE ARE IN THE ENTIRE
DRAWING, ALSO TELLS YOU HOW MANY OF EACH TYPE OF BODY.
ALSO TELLS YOU HOW MANY OF THE POINTS ARE DRILL HOLES.

DELNULL ASKS IF YOU WISH TO PICK AND CHOOSE OR DELETE
ALL NULL POINTS, THEN DOES THAT, A NULL POINT
IS ONE WITH NO LINES, NO TEXT, AND NO PIN
CONNECTIONS.

DELSET DELETE ALL SETS, DOESN'T DELETE CONTENTS.

TYPDEL ASKS "TYPE BODY NAME" THEN DELETE ALL INSTANCES AND
THE DEFINITION, IF FROM LIBRARY, DEFINITION IS NOT
DELETED.

RENAME ASKS "TYPE BODY NAME" THEN ASKS "TYPE NEW
BODY NAME" THE BODY IS GIVEN THAT NAME IF
IT IS NOT IN USE.

GETLIB ASKS FOR A "LIBRARY FILENAME??" THEN READS THE BODIES
FROM THAT FILE AND MAINTAINS A POINTER TO THE FILE
INSTEAD OF WRITING OUT THE BODY DEFINITIONS EACH TIME,
REDUNDANT LIBRARY REFERENCES ARE IGNORED WHEN POSSIBLE.

DELLIB DELETES ALL REFERENCES TO BODIES IN THE LIBRARY YOU
MENTION, AND FLUSHES THE POINTER TO THE FILE.
TYPLIB  TYPES ALL LIBRARY FILENAMES,

GETBUG  ASK FOR A TYPE NAME, THEN A FILENAME
        THEN TRIES TO READ IT IN USING THE NORMAL
        IO ROUTINES (MAY HAVE TO REPLACE, ETC.),

CARD  ASKS FOR CARD NUMBER, THEN READS IN THE SPECIFIED
        CARD. THE CARD CONTAINS THE CARD IMAGE ALL PINS,
        PIN #'S, CONNECTOR LOC'S, AND SHORTING BARS,
        ANY POINT WHICH IS NOT A FEED THROUGH OR A DIP PIN
        AND IS FOUND AT THE SAME LOCATION AS A CONNECTOR
        PIN WILL BECOME THE CONNECTOR PIN, IF THE NUMBER
        YOU ASK FOR IS THE SAME AS THE CURRENT CARD, THEN
        IT IS MERELY DISPLAYED AGAIN. ARGUMENT OF 0 (OR
        JUST CR,) WILL CAUSE THE CARD TO BE FLUSHED!
        THE CARD NUMBER IS REMEMBERED WHEN THE CARD IS WRITTEN
        OUT!

-CARD  DISABLE DISPLAYING OF CARD, CARD NUMBER IS STILL
        WRITTEN OUT, TO REDISPLAY THE CARD TYPE "X" THEN
        "CARD" CR FOLLOWED BY THE SAME CARD NUMBER AND IT
        WILL BE RE-DISPLAYED.

SETLOC  SET NLH FOR LOCATION OF THIS CARD ON BACK PANEL.

UNL  WILL ASK FOR THE LETTER OF THE UPPERMOST DIP AND
        THE NUMBER OF THE LEFTMOST DIP, THEN IT WILL SLICE
        THE CARD INTO ROWS AND COLUMNS AND ASSIGN DIP
        LOCATIONS.

ROUTE  INITIALIZE ROUTING SYSTEM, THIS MAY BE DONE
        IF YOU THINK THE PROGRAM ISN'T KEEPING THE
        TABLES UP TO DATE, THE PROGRAM WILL TRY TO
        REINITIALIZE THE TABLES WHEN NECESSARY.

RDISP  DISPLAY A POINT IN EACH OCCUPIED SQUARE ON THE
        PC CARD, THIS IS ONLY A DEBUGGING AID.

-RDISP  DISABLE DISPLAYING OF POINTS.

RCODE  ASKS FOR "ROUTE CODE", YOU MAY TYPE A NUMBER
        FROM 0-3, THEY HAVE THE FOLLOWING MEANINGS:

        0  ROUTE ON COMPONENT SIDE ONLY
        1  ROUTE ON SOLDER ONLY
        2  HORIZONTAL ON COMPONENT, VERTICAL ON SOLDER
        3  VERTICAL ON COMPONENT, HORIZONTAL ON SOLDER

        STARTING THE PROG SETS RCODE TO 3!

THE FOLLOWING COMMANDS ALLOW MODIFICATION OF THE ROUTING
ALGORITHM BY CHANGING THE WEIGHTING FACTORS OF CERTAIN
TYPES OF ROUTES, THE COMMAND IS THE VARIABLE NAME,
THIS CAUSES THE OLD VALUE TO BE PRINTED AND THEN
ASK FOR THE NEW VALUE, <NUMBER><CR> SETS THE VARIABLE
TO NUMBER, ANYTHING FUNNY LEAVES THE VARIABLE UNCHANGED
THE FOLLOWING VARIABLES EXIST AND HAVE THE FOLLOWING
MEANINGS:
CNR  THE COST OF MAKING A CORNER (NOT INCLUDING FEED THROUGHs),

FED  THE COST OF MAKING A FEED THROUGH,

RAK  THE COST OF GOING AWAY FROM THE DESTINATION POINT,

SIO  THE COST OF ONE STEP ON THE WRONG SIDE OF THE BOARD (RCODE= 2 OR 3), NOT CHARGED AT CORNER!
POINT MODE:
The following apply if the last primitive search command was ?&P or ?&T
and a point was found:

?"P  PLACE A POINT AT THE CURRENT CURSOR POSITION,

?($) START A RIGHT ANGLE FOLLOWING THE CURSOR FROM THE CLOSEST
POINT, A STAR IS PLACED AT THE CLOSEST POINT EXCLUDING
THE ONE YOU ARE DRAWING FROM,

?($)  (ALTMODE) STOP RIGHT ANGLE WITHOUT PLACING ANY
MORE POINTS AND RETURN TO MAIN SCANNER,

?($)  ATTACH THE RIGHT ANGLE TO THE CLOSEST POINT
(FOUND ABOVE) AND RETURN TO THE MAIN SCANNER,
??????? IS TYPED IF THIS WOULD REQUIRE THE DELETION
OF AN EXISTING LINE, AND NOTHING IS DONE!

?($)  MAKE A SINGLE SEGMENT FROM THE POINT THE RIGHT
ANGLE IS COMING FROM TO THE CLOSEST POINT, (MAY
NOT NECESSARILY BE HORZ, OR VERT, SO STRAIGHTEN
IT),

?($)  MAKE THE CORNER OF THE ANGLE INTO A POINT THEN
START A NEW RIGHT ANGLE FROM THERE,

?($)  (SPACE CAUSES THE SENSE OF THE ANGLE TO CHANGE,

?($) START A LINE FOLLOWING THE CURSOR FROM THE CLOSEST POINT

?($) LEAVE LINE DRAWING MODE WITHOUT PLACING LAST LINE,

?($) ATTACH LINE TO POINT WITH STAR ON IT,

?($) PUT DOWN END OF LINE AT CURSOR POSITION AND START
NEW LINE,

?($) SIMULATES THE FOLLOWING, "+ <ALTMODE> ?"F ?"R +",,
THE BUCKY BITS HAVE THE FOLLOWING EFFECT:

<table>
<thead>
<tr>
<th>BITS</th>
<th>PAD THIS SIDE</th>
<th>PAD OTHER SIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>?&quot;</td>
<td>NO</td>
<td>YES</td>
</tr>
<tr>
<td>?#</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>?$</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>
MAKE THE CLOSEST POINT INTO A FEED THROUGH, CREATE A POINT ON THE OTHER SIDE IF ONE DOES NOT ALREADY EXIST, PAD TYPE # IS SET TO 0.

LEGAL ONLY FOR FEED THROUGHS AND PINS, ATTACHES THE POINT TO THE INTERIOR PLANE SPECIFIED (0-3) AND INDICATES THIS ON THE POINT. A SHOULD BE USED FOR GROUND, 1 FOR TTL SUPPLIES,

LEGAL FOR ALL POINTS, ASKS "PAD TYPE #??" THE NUMBER YOU TYPE IS THE IDENTIFICATION # FOR THE TYPE OF PAD TO PLOT HERE. A IS NO PAD, 1 IS DEFAULT FOR DIP PADS, 2 IS DEFAULT FOR INNER PLANE CLEARANCES, THESE ARE SET ON BOTH SIDES OF DRILL HOLES WHEN THE EXTEND MODE COMMAND "INNER" IS USED, PAD TYPE 3 IS 50 MIL SQUARE USED FOR DIP PIN 1!

MAKE THIS FEED THROUGH NOT A FEED THROUGH,

DETACH THIS POINT FROM ANY INTERIOR PLANES,

DELETE CLOSEST POINT AND ALL LINES DIRECTLY ATTACHED TO IT, IF THE POINT IS A PIN IT DOESN'T REALLY GO AWAY JUST THE LINES, AND TEXT,

SAME AS ?"D" EXCEPT THAT COLINEAR SEGMENTS ARE MERGED, THIS WILL REVERSE A ?"R" OPERATION ON A LINE!

SAME AS ?"D" EXCEPT IN THE CASE WHERE EXACTLY 2 LINES LEAVE THE POINT, IN THIS CASE THE TWO LINES ARE MERGED INTO ONE BETWEEN THE REMAINING 2 POINTS,

PUTS THE CURSOR ON THE CLOSEST POINT, THEN MAKES IT FOLLOW THE CURSOR UNTIL A SPACE IS TYPED, THE LINES ARE MASSAGED AS YOU GO.

PUTS CURSOR AT CURRENT TEXT OFFSET (IF ANY TEXT) AND ALLOWS YOU TO CHANGE IT BY MOVING THE TEXT, IN D THE OFFSET IS RELATIVE TO THE CHARACTER SIZE, IN PC THE OFFSET IS TO AN ABSOLUTE POSITION ON THE CARD.

ATTACH THE CLOSEST POINT TO THE CLOSEST OTHER POINT, A STAR IS PLACED ON THE OTHER POINT AND YOU ARE ASKED "THIS ONE??" YOU ARE NOT AT COMMAND LEVEL WHEN THIS IS ASKED SO YOU SHOULD NOT SAY "Y" IF THE STAR IS NOT ON THE RIGHT ONE, IF YOU WISH TO ATTACH TO A PIN, YOU MUST BE ON THE PIN WHEN YOU SAY "?"A",

PUTS AN "L" ON THE CLOSEST LINE AND ASKS "THIS ONE??" IF YOU SAY "Y" THEN THE CLOSEST POINT WILL BECOME THE MID-POINT OF THE LINE, YOU CAN GIVE THIS COMMAND IN LINE DRAWING MODE AND THE ANGLE WILL BE ATTACHED TO THE MID-POINT OF THE LINE,

ASKS "TEXT??" AND ATTACHES THE STRING TO THE POINT, IF "??" APPEARS IN THE STRING, A CRLF IS INVENTED, IF THE CHARACTER "\" IS THE FIRST IN THE STRING THE FOLLOWING CHARACTER IS INTERPRETED AS THE CHAR SIZE, NEITHER CHARACTER APPEARS IN THE STRING,
IF A "V" APPEARS JUST BEFORE THE CHAR, SIZE THEN THE
TEXT WILL BE PLOTTED VERTICALLY, A POINT IS DISPLAYED
AT THE BEGINNING OF SUCH TEXT;
IF THE POINT PREVIOUSLY HAD NO TEXT IT IS ADDED TO "TXTLST";
UNLESS "TXTLST" IS EMPTY;

?"K
IF THE CLOSEST POINT HAS TEXT ON IT THE TEXT IS DELETED,
POINT IS REMOVED FROM "TXTLST";

?"Z
LOADS THE TEXT INTO THE LINE EDITOR, THEN INPUTS THE
RESULTANT STRING AND REPLACES THE TEXT WITH IT,

?"Q
SAME AS "Z" EXCEPT THE LINE EDITORS CURSOR IS AT THE END
OF THE LINE,

?"N
IF POINT OR CONNECTOR PIN:
SET CONNECTOR PIN NUMBER,
PIN NUMBER IS OF THE FOLLOWING FORM;

MLMLMN
OR
LLN

IF PIN:
JUST TYPE PIN NUMBER.

?#N
FOR CPIN'S ONLY, PUTS YOU AT THE CURRENT OFFSET FOR THE
LOC TEXT AND LETS YOU MOVE IT. OFFSET IS RELATIVE TO CHAR
SIZE OF LOC TEXT NOT PIC SCALE;

?"&
<CURRENT SET>\<CURRENT SET> UNION <CLOSEST POINT>
POINT MAY NOT BE A PIN, IN PC CURRENT POINT MAY NOT BE
A CONNECTOR PIN,

?"#
REMOVE POINT FROM CURRENT SET;

??#
REMOVE POINT FROM ALL SETS;

?"F
CONSIDER POINTS IN TXTLST TO SEE IF THERE IS AN OCCURRENCE
OF "SEARCH STRING" IN ITS TEXT, AFTER CONSIDERING A POINT
IT IS TAKEN OUT OF THE LIST, REGARDLESS OF WETHER THE
"SEARCH STRING" WAS FOUND, IF IT WAS FOUND THE CURSOR
IS PLACED ON THE POINT, TEXT OFF SCREEN IN WINDOW MODE
CANNOT BE FOUND, AND THE POINT IS DISCARDED, IF "TCENTER"
IS IN FORCE THE POINT IS ALSO CENTERED ON SCREEN;

?#F
PUT ALL POINTS WITH TEXT ON THEM IN THE "TXTLST";

?&F
SET "SEARCH STRING", IF ENDED WITH ALTMODE OLD STRING IS
RETAINT, IF NULL ALL STRINGS WILL HAVE IT AS THEIR
SUBSTRINGS,
LU, (PERIOD) TRACE WIRE ATTACHED TO THIS POINT AND FLASH IT, TRACING INCLUDES WIRES WITH SAME SIGNAL NAMES. ALL PINS ARE LOOKED UP ON THE PC CARD AND ARE FLA$$HED THERE WHEN YOU ENTER THE PC PROG.

LPC, LOOKUP THIS PIN IN THE LOGIC DRAWING AND SAVE POINTER, THEN ENTER LOGIC DRAWING PROG AND TRACE WIRE, THEN FLASH WIRE.

LU, ?", SAME AS ";" EXCEPT THE PC PROG IS ENTERED AND ALL THE ASSOCIATED PIN FLASH.

LPC, ?", SAME AS ";" EXCEPT EVENTUALLY RETURN TO PC PROG AND FLASH PINS ON LINE.

LRPC, ?#, EQUIVALENT TO "?"." FOLLOWED BY "?&"," LRD, ?#, EQUIVALENT TO "?&v" FOLLOWED BY "?&"," LRPC, ?& , ENTER ROUTING MODE FOR FLASHING PINS, PROGRAM RESPONDS WITH "ROUTING PAIR = ", YOU WILL NOTICE THAT THE FLASHING PINS HAVE LETTERS ON THEM, TYPING TWO OF THE LETTERS FOLLOWED BY CR, CAUSES THE ROUTING ROUTINE TO BE ENTERED WITH THESE TWO PINS AS THE ENDPOINTS, ALL THE NORMAL COMMANDS APPLY TO THE ROUTING ROUTINE (NORMALLY ENTERED BY "?&e") UP UNTIL THE TIME THAT YOU LEAVE IT, TYPING "ALT MODE" CAUSES YOU TO LEAVE ROUTING MODE, ANYTHING FUNNY GETS YOU THE QUERY AGAIN!

LRD, ?&, EQUIVALENT TO "?&v" FOLLOWED BY "?&"," LRPC, ?(LETTER> FINDS LETTER <LETTER> OF FLASHING PINS AND MOVES CURSOR THERE (IF POSSIBLE), ONLY WORKS WHEN LETTERS ARE BEING SHOWN!

?&A, IF THE CLOSEST POINT HAS TEXT ON IT YOU ENTER ALTER MODE! ALTER MODE IS A TEXT EDITOR DESCRIBED BELOW.

RPC, ?"E, SET ENDPOINT ONE FOR ROUTING, A "-" INDICATES ENDPOINT ONE,

RPC, ?#E, SET ENDPOINT TWO FOR ROUTING, A "??" INDICATES ENDPOINT TWO,

RPC, ?&E, MAKE A ROUTE FROM ENDPOINT ONE TO TWO, THE ALGORITHM COMPUTES SCORES FOR ROUTES, IT TRIES TO FIND ROUTES WITH SCORES OF 0 FIRST, THEN 1, ETC. WHEN A ROUTE IS FOUND YOU WILL BE ASKED "HOW ABOUT THIS ONE" AND THE ROUTE WILL BE BLINKED, WIRES ON THE CURRENT SIDE WILL BE GREATER THAN THOSE ON THE OTHER, IF YOU RESPOND "Y" THE ROUTE WILL BE MADE AND MARKED, IF YOU SAY " " (SPACE) THE ROUTE WILL BE DISCARDED AND ANOTHER FOUND, IF YOU SAY "?" " (CTRL SPACE) THE PROGRAM WILL SHIFT TO THE NEXT HIGHEST SCORE AND CONTINUE LOOKING, IF YOU SAY "S" ALT MODE THE PROGRAM WILL JUST QUIT, ANYTHING ELSE WILL GET YOU "?????????" AND THE QUESTION REPEATED, ALT MODE AND CTRL SPACE WILL WORK EVEN WHEN THE PROGRAM IS RUNNING (KEYBOARD INPUT ONLY)!
BODY mode:
THE FOLLOWING COMMANDS APPLY IF THE LAST PRIMITIVE SEARCH COMMAND WAS  
?&R AND A BODY WAS FOUND.
  "P" PLACE A BODY AT THE CURRENT CURSOR POSITION, YOU ARE  
  ASKED "THIS WAY??" AND EACH TIME YOU TYPE SPACE, THE BODY  
  ROTATES 90 DEGREES. WHEN YOU SAY "Y" THE BODY IS PLACED,  
  UP UNTIL YOU SAY "Y", YOU MAY MOVE THE CURSOR AND THE BODY  
  WILL FOLLOW IT.
  PIN 1 GETS PAD TYPE 3 ALL THE OTHERS GET PAD TYPE 1.

PC
D  ?"E" EDIT THE CLOSEST BODY.
D  ?"R" REPLACE THE CLOSEST BODY, YOU WILL BE ASKED FOR NEW BODY  
  NAME THEN THE YOU MAY SET THE REPLACEMENT MODE, IF YOU  
  ANSWER "S" TO THE REQUEST THE CORRESPONDENCE IS PIN#  
  TO PIN#, IF YOU ANSWER "L" TO THE REQUEST, THEN A GEOMETRIC  
  (CLOSEST PIN) MAPPING IS USED, IF YOU ANSWER "C" TO THE  
  REQUEST A GEOMETRIC MAPPING WHICH WORKS FOR DIFFERENT #S  
  OF PINS WILL BE USED, IF YOU ANSWER <CRLF> THEN YOU WILL BE  
  ASKED FOR THE CORRESPONDENCE PIN BY PIN, ANY UNSPECIFIED  
  PINS ON THE OLD BODY ARE DELETED, ANY UNSPECIFIED PINS ON  
  THE NEW BODY ARE CREATED. IN "L" MODE, IF EACH PIN CANNOT  
  BE MATCHED TO ANOTHER YOU WILL BE THROWN OUT!

D  ??R REPLACE SOME, ASKS FOR OLD BODY NAME, THEN NEW BODY NAME,  
  THEN SETS UP CORRESPONDENCE AS IN ?"R", THEN PUTS A "R" ON  
  EACH INSTANCE OF THE OLD BODY AND ASKS "THIS ONE??" IF YOU  
  SAY "Y", IT IS REPLACED, OTHERWISE IT IS NOT, IF YOU SAY  
  ALT/MODE YOU GET BACK TO BODY MODE, THIS ONLY WORKS ON  
  ONSCREEN BODIES,

D  ?&R REPLACE ALL, LIKE REPLACE SOME EXCEPT YOU AREN'T ASKED,
D  ?"D" DELETE THE CLOSEST BODY,
D  ?"M" MOVE THE CLOSEST BODY, THE CURSOR IS PUT AT THE CENTER OF  
  THE BODY, THEN ALL PINS ON THE BODY ARE MASSAGED AS THE  
  BODY IS MOVED, ANY CHARACTER STOPS YOU MOVING.
D  ?"N" "NUMBER" THE CLOSEST BODY, NUMBERS MAY BE OF THE FOLLOWING  
  FORM:

MLMLM
   OR
MLLM

THESE "NUMBERS" ARE USED FOR WIRE LISTING,

?#N LEGAL ONLY IF ?"M DONE PREVIOUSLY, PUTS YOU AT CURRENT  
OFFSET FOR LOC TEXT AND LETS YOU MOVE IT, THIS OFFSET  
IS SCALED BY DRAWING SCALE, NOT CHAR SIZE.

?"O" ROTATE CLOSEST BODY 90 DEGREES COUNTER CLOCKWISE.

D  ?"S" SWAP, ASKS FOR TWO PIN NUMBERS, IF THEY EXIST ON  
THIS BODY ALL LINES, TEXT, AND ANYTHING ELSE ARE  
SWAPPED BETWEEN THESE TWO POINTS.
D  #S  SWAP PIN #’S, ANY PIN #’S ASSOCIATED WITH THE ID’S YOU TYPE WILL BE INTERCHANGED,

D  #P  SET PIN #’S FROM LOW ORDER 9 BITS OF PIN 10,

#&  <CURRENT SET>+<CLOSEST BODY>

#”#  REMOVE BODY FROM CURRENT SET,

##  REMOVE BODY FROM ALL SETS,

#F  PUT ALL PINS OF THIS BODY WITH TEXT ON THEM INTO "IXTLST",

#&F  SET "SEARCH STRING", IF ENDED WITH ALTMODE OLD STRING IS RETAINED, IF NULL ALL STRINGS WILL HAVE IT AS THEIR SUBSTRINGS.
SET MODE:
THE FOLLOWING COMMANDS APPLY IF THE LAST PRIMITIVE SEARCH COMMAND WAS
?&S AND A SET WAS FOUND

?(& DRAW A BOX AROUND THE POINTS AND BODIES YOU WOULD
LIKE IN THE SET, USING + LIKE WITH DRAWING LINES,
SAY - TO CLOSE THE BOX AND THE SET IS DEFINED,
ALL MEMBERS OF THE SET WILL HAVE B'S OR P'S ON THEM,
PSEUDO-CENTER IS INDICATED BY AN S.

?#P MAKES A COPY OF THE CLOSEST SET AT
THE CURRENT CURSOR LOCATION, THEN
PUTS YOU IN MOVE-THE-SET MODE (SEE BELOW),

?"M POSITIONS THE CURSOR ON THE CENTER OF THE
SET, THE SET NOW FOLLOWS THE
CURSOR, THE SET MEMBERS ARE AGAIN INDICATED.

?"D DELETE THE CLOSEST SET,

?#D DELETE ALL ELEMENTS OF THE CLOSEST SET FROM THE PICTURE,

?&D DELETE ANYTHING NOT IN CLOSEST SET,

PC ?"O ROTATE SET 90 DEGREES COUNTER CLOCKWISE,

?#K DELETE ALL TEXT ON POINTS IN SET!

?"& <CURRENT SET>+<CURRENT SET> UNION <CLOSEST SET>
THIS MAKES A NEW SET IF THERE IS NO CURRENT SET,

?#& <CURRENT SET>+??<CLOSEST SET> DOESN'T MAKE NEW SET

?"# REMOVE ALL MEMBERS OF CLOSEST SET FROM CURRENT SET,
ILLEGAL IF CURRENT SET IS CLOSEST,

??# REMOVE ALL MEMBERS OF CLOSEST SET FROM ALL SETS,
THE DELETE CLOSEST SET,

?#F PUT ALL POINT TEXT IN THE CLOSEST SET INTO "TXTLST"

?&F SET "SEARCH STRING", IF ENDED WITH ALTMODE OLD STRING
IS RETAINED, IF NULL ALL STRINGS WILL HAVE IT AS THEIR
SUBSTRINGS,
LINE MODE:
THE FOLLOWING COMMANDS APPLY IF THE LAST PRIMITIVE SEARCH COMMAND WAS ?&L AND A LINE WAS FOUND.

?"D  DELETE THE LINE, DOES NOT AFFECT ITS ENDPOINTS.

?"B  PUTS A BEND ON THE LINE EVEN WITH THE CURSOR (MAKES IT INTO 3 SEGMENTS), YOU ARE THEN MOVING THE MID-POINT.

D  ?#B  PUTS A POINT ON THE LINE EVEN WITH THE CURSOR.

PC ?"J  "JUMPS" SEGMENT TO OTHER SIDE OF PC CARD, CREATING OR DELETING FEED THROUGHS AS NECESSARY.

PC ?#J  "JUMPS" A "WIRE" TO THE OTHER SIDE OF THE PC CARD, CREATING OR DELETING FEED THROUGHS AS NECESSARY, A "WIRE" IS THE CLOSEST SEGMENT TRACED THROUGH ADJOINING SEGMENTS UNTIL ONE OF THE FOLLOWING IS REACHED; A FEED THROUGH, A PIN, OR A JUNCTION!
ALTER MODE:

!=(n-?)(9

NUMBERS ARE REMEMBERED AND USED AS REPEAT FACTORS FOR SOME COMMANDS, THESE COMMANDS ARE PRECEEDED BY <n>,

<n>s<char>

MOVE TO CHAR (END IF NOT FOUND)

<n>d

DELETE N CHARACTERS (NO-OP AT END)

<n><space>

MOVE FORWARD N SPACES (NO-OP AT END OF LINE)

<n><backspace>

MOVE BACKWARD N SPACES (NO-OP AT BEGINNING OF LINE)

i

ASKS "INSERT TEXT?" AND INSERTS THE STRING YOU TYPE, TEXT IS INSERTED BEFORE THE CURRENT CHAR WHICH REMAINS THE CURRENT CHAR,

<n>r

EQUIVALENT TO "ndi",

<altmode>

LEAVE ALTER MODE,

<n>k<char>

DELETE UP TO BUT NOT INCLUDING THE NTH OCCURRENCE OF <char>, NO DELETE IF NOT FOUND BUT LEAVES YOU AT END OF LINE,

<n>n

SEARCH TO NTH NUMBER (A NUMBER IS ANY CONTIGUOUS SEGMENT OF DIGITS), END OF LINE IF NOT FOUND,

<n>u

SEARCH TO NTH NUMBER AND DELETE IT,

<n>f<string><t>

SEARCHES FOR THE NTH OCCURRENCE OF <string> AS A SUBSTRING OF THE CURRENT TEXT, IF FOUND AND T=ALTMODE THEN DELETE THIS OCCURRENCE <string> OTHERWISE DONE, IF T=ALTMODE THEN T MUST = CRLF, IF STRING IS NULL, NO SEARCH IS DONE UNLESS IT IS ALSO NULL IN WHICH CASE NO SEARCH IS DONE,
EDIT MODE;
THE EDITOR STARTS UP IN "EDIT MODE".
LEGAL COMMANDS ANY TIME ARE:

?&P ENTER PIN MODE,
?&T ENTER TEXT MODE,
?"I ENTER INSERT MODE, THE CURRENT POINT IS SET TO THE FIRST
POINT OF THE BODY AND THE CURSOR IS PUT THERE,

$ (ALT MODE) RETURN TO EDIT MODE!

?"P SET A PIN, POSITION THE CURSOR FIRST, YOU WILL BE ASKED
"PIN ID??", TYPE A DECIMAL NUMBER, THE PIN WILL APPEAR AT
THE CURSOR POSITION, IF THE NUMBER IS OF THE FORM:

M(H)

IT WILL BE INTERPRETED AS THE MTH OCCURRENC OF THE PIN
WHOSE ID IS H, THIS IS USEFUL FOR BUSSING THROUGH, AND
IS INTERPRETED AS THE SAME PIN BY THE WIRE LISTER AND THE
LAYOUT STUFF. PIN #1'S ASSOCIATED WITH ANY PIN WHOSE ID IS
M WILL BE KEPT THE SAME, PIN ID'S MAY BE DUPLICATED AT
THIS TIME, BUT YOU MAY NOT LEAVE THE EDITOR UNTIL THEY
ARE UNIQUE.

?"T PLACE BODY TEXT AT THE CURRENT CURSOR POSITION,
THE SIZE KLUDGE IN DRAWING MODE APPLIES HERE.

?"E EXIT THE EDITOR, (RETURN TO DRAWING LEVEL AND MODE LAST
USED THERE.) UNLESS SOME PIN ID'S ARE DUPLICATED!

EDIT MODE COMMANDS:

?#I ENTER INSERT MODE, THE CURRENT POINT IS SET TO
THE POINT WHICH PREVIOUSLY HAD A STAR ON IT,

?"G "GET" A TYPE BY NAME AND ADD IT TO THE END OF THIS BODY,
YOU WILL BE ABLE TO MOVE IT AND ROTATE IT (USING THE
RETRIEVER).

?"D DELETE "CLOSEST" POINT,

?"R CHANGE FLAVOR OF CLOSEST POINT, WAITS FOR + OR -.

INSERT MODE COMMANDS:

? (+ THIS Terminates the current vector following
the cursor, and starts a visible one following it,

? (- SAME AS + BUT AN INVISIBLE VECTOR IS STARTED, (FEAR NOT
YOU CANNOT WASTE SPACE BY PUTTING TWO INVISIBLE VECTORS
TOGETHER.)

?"R WAITS FOR A "+" OR A "-" THEN CHANGES THE VECTOR "LEAVING"
THE CURRENT POINT TO THE CORRESPONDING TYPE,
DELETE THE CURRENT POINT, THIS WILL LEAVE A VECTOR JOINING THE TWO NEIGHBORING POINTS THE TYPE WILL BE THAT OF THE ONE ALREADY ON THE LAST POINT, HOWEVER THE CURSOR IS ON THE NEXT POINT.

SPACE MAKE THE NEXT POINT THE CURRENT ONE.

BACKSPACE MAKE THE PREVIOUS POINT THE CURRENT ONE.
TEXT MODE COMMANDS:

?K DELETE THE TEXT,

?M MOVE THE TEXT; THE TEXT FOLLOWS THE CURSOR UNTIL YOU TYPE A SPACE.

?#M CHANGE TEXT OFFSET FROM TEXT LOC,

PIN MODE COMMANDS:

?D DELETE CLOSEST PIN

?M MOVE THE CLOSEST PIN, CURSOR IS PLACED ON PIN AND PIN FOLLOWS IT UNTIL SPACE IS TYPED.

?N ASKS "NEW PIN ID??", THEN CHANGES THE NUMBER OF THE CLOSEST PIN TO WHAT EVER YOU TYPE, SAME RESTRICTIONS ON NUMBER AS WHEN PLACING NEW PIN,
MACRO'S:

?: MUST HAVE SOME BITS, EQUIVALENT TO ;RO<CR>

?: TELL SCANNER THAT NEXT CHAR IS MACRO COMMAND.

MACRO COMMANDS:

P START TEMPORARY MACRO,

M START PERMANENT MACRO, EVERYTHING FROM HERE TO THE NEXT <CR> WILL BE TAKEN TO BE THE MACRO NAME,

D LIKE M, EXCEPT DOESN'T EXECUTE MACRO DURING DEFINITION, IF REPEAT COUNT IS GREATER THAN 1, THE REST OF THE ITERATIONS WILL BE IGNORED ALSO,

R END MACRO, EVERYTHING FROM HERE TO THE NEXT <CR> WILL BE TAKEN TO BE THE REPEAT FACTOR (INCLUDING DEFINITION OF MACRO), FOR PERMANENT MACRO'S THE REPEAT FACTOR BECOMES PART OF THE DEFINITION,

C CALL MACRO BY NAME, EVERYTHING FROM HERE TO NEXT <CR> WILL BE TAKEN AS THE MACRO NAME,

A FOLLOWED BY:

1, N, M<CR>

SUBSTITUTE AT THIS POINT THE NUMBER N AND INCREMENT BY M EVERY TIME THROUGH THE MACRO I LEVELS UP FROM THE CURRENT ONE, N AND M MAY BE NEGATIVE,

N SAME AS ";A" EXCEPT ALWAYS SIGNS THE NUMBER, EXCEPT FOR ZERO WHICH EXPANDS INTO A NULL STRING

L FOLLOWED BY:

<NUMBER><CR>

ADDS 100 (OCTAL) TO NUMBER AND RETURNS IT AS A LETTER, IF "D" PRECEDES THE NUMBER, G, I, O, AND G ARE SKIPPED, THE "U" STANDS FOR "DEC"

T WILL REQUESTTTY INPUT AT THIS POINT, MUST BE TERMINATED BY ";RO",

F<NAME><FLAG><CR>

<FLAG> ::= <FLAGNAME> ? = <FLAGNAME>

<MACRO LEVEL>

IF <FLAG> IS TRUE, ALL CHARACTERS ARE EATEN UNTIL A MACRO LEVEL <N> LEVELS UP FROM THE CURRENT ONE IS LEFT, THE FOLLOWING FLAGNAMES EXIST;

FALSE ALWAYS FALSE (USE +FALSE FOR TRUE)
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<th>Macro</th>
<th>Description</th>
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<tr>
<td>CLOSES</td>
<td>TRUE IF CLOSE TO SOMETHING</td>
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<tr>
<td>FTXT</td>
<td>TRUE IF LAST &quot;?&quot;F&quot; FOUND SOMETHING</td>
</tr>
<tr>
<td>AEOL</td>
<td>TRUE IF AT END OF LINE IN ALTER MODE</td>
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<tr>
<td>ABOL</td>
<td>TRUE IF AT BEGINNING OF LINE</td>
</tr>
<tr>
<td>EDGE</td>
<td>TRUE IF LAST CURSOR MOVE HIT SCREEN EDGE</td>
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<tr>
<td></td>
<td>(NOT TRUE IF IN -WINDOW MODE)</td>
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MACROS MAY BE NESTED TO A LEVEL OF 102 DECIMAL THE ONLY REQUIREMENT BEING THAT EACH MACRO CONTAIN AN EQUAL NUMBER OF ;P'S AND ;R'S,
HOW TO DO IT -- PC CARDS

START HERE WHEN YOU HAVE COMPLETELY FINISHED WIRING YOUR PC CARD,

YOU ARE NOW IN THE PC PROGRAM, YOU MUST NOW GENERATE 4 PLOT FILES, THE 2 OUTER PLANES (COMPONENT AND SOLDER) AND THE 2 INNER PLANES (POWER AND GROUND).

YOU SHOULD TRY TO USE THE FOLLOWING FORM FOR PLOT FILENAMES, END THE NAME WITH "C" FOR COMPONENT, "S" FOR SOLDER, "P" FOR POWER, AND "G" FOR GROUND.

TO GENERATE THE COMPONENT AND SOLDER PLANE PLOTS GET ON THE APPROPRIATE SIDE AND SAY <CTRL><META>W, THEN TYPE THE FILENAME.

NOW FOR INNER PLANES, IF YOU WANT ANYTHING BUT CLEARANCES IN YOUR INNER PLANES, STOP AND SEE RPH, OTHERWISE YOU NOW TYPE INNER<CR> TO THE EXTENDED SCANNER, THIS DELETES ALL LINES AND POINTS EXCEPT DIP PINS AND FEED THROUGHS, AND SETS THE PAD TYPE FOR THESE TO 2 (CLEARANCES). CURRENTLY THE PLANES AREN'T INDICATED BY THE ABSENCE OF PADS.

TO MAKE THE INNER PLANE PLOTS, USE THE EXTENDED MODE PLOT COMMAND, WHICH ASKS FOR THE PLANE NUMBER, THEN THE FILENAME. THE PLANE NUMBER IS THE SAME AS THE ONE YOU GAVE TO ATTACH TO THE PLANE IN THE FIRST PLACE.
MORE PC CARDS => PCP
NOW YOU HAVE 4 PLOT FILES (IF NOT SEE RPH), NOW RUN PCP;

THE FOLLOWING INDICATES PROGRAM PROMPTS IN UPPER CASE,
THEN A DESCRIPTION OF YOUR RESPONSE IN LOWER CASE,
IT IS SUGGESTED THAT YOU RUN PCP ON A TELETYPE WHEN DOING A TRW
PLOT, AND SAVE THE OUTPUT FOR TRANSFERING TO A PLANNING SHEET,

TRW PLOT TAPE??

IF YOU WANT TO MAKE ARTWORK AT TRW SAY YES,
IF YOU SAY NO, THE FOLLOWING SEQUENCE WILL BE OMITTED,

ADD SYMBOL DEFINITIONS??

IF YOU ARE USING ANY CHARACTERS NOT IN THE TRW
STANDARD CHARACTER SET (SEE RPH FOR CHARACTER
SET), SAY Y<CR>, IF YOU SAY Y, THE FOLLOWING
WILL BE ASKED:

SYMBOL DEFINITIONS LIVE FOR EVER (IN THIS CORE IMAGE),
BE SURE TO MAKE A SKETCH OF THE SYMBOL INDICATING THE "D" CODE,
D60??

TYPE THE SINGLE CHARACTER FOR THIS CODE (NO <CR>),
ANY PREVIOUSLY ASSIGNED CODES WILL BE PRINTED FOLLOWED
THEIR CHARACTER, THE YOU WILL BE ASKED TO ASSIGN THE
FIRST UNASSIGNED CODE,
D61??

THIS WILL CONTINUE UNTIL YOU ANSWER <CR>,

FR-80 PLOT TAPE??

THIS WILL MAKE AN FR80 FILE WHICH MAY BE SENT TO LOCKHEED
AND TURNED INTO MICROFILM AND SMALL PRINTS,
IF YOU ANSWER Y<CR> THE FOLLOWING QUESTIONS ARE ASKED;

OPTIMIZE PLOT??

IF YOU ARE ONLY MAKING AN FR80 TAPE, YOU SHOULD ANSWER
N<CR>, THIS SUPPRESS THE ORDERING OF LINES, ETC,
WHICH TAKES AT LOT OF COMPUTING A PRESENT, BUT THE
FR80 DOESN'T CARE SO MUCH ABOUT ORDERING,

AT FR80 SCALE OF 3.7 FRAME IS ABOUT 22X17;
FR80 SCALE#10 ??

THIS IS EXACTLY WHAT IT SEEMS, IF YOUR CARD IS SOMEWHAT
SMALLER THAN THIS, YOU MAY USE A LARGER SCALE, USE AID
TO CALCULATE THE APPROPRIATE SCALE, <CR> WILL GET YOU
SCALE OF 37 (3.7);

FR80 FRAME IS 22X17,

THIS WILL BE PRINTED IF YOU GIVE A SCALE OTHER THAN 37,
SCALE??

SCALE OF 1 IS REAL SIZE (YOU GET THIS IF YOU TYPE <CR> ALONE),
DON'T USE ANYTHING ELSE IF YOU ARE MAKING A TRW PLOT OR AN FR80
PLOT, THIS MAY BE USED TO MAKE DETAIL PLOTS.

POSITIVE X, Y OFFSET (IN INCHES, DECIMAL POINT OK!)??

THIS MUST BE USED TO GENERATE TRW PLOT TAPES, AND CINCH DRILL TAPES, BOTH SYSTEMS HAVE 0,0 AT THE LOWER LEFT. THE STANDARD FILM WE ARE USING AT TRW IS 24 X 20 INCHES, THUS THE OFFSET SHOULD BE 12,10<CR>, THE CINCH DRILL FRAME SIZE WE WILL USE IS 20 X 20 INCHES, SO USE 10,10 FOR DRILL TAPE, IF <CR> IS TYPED, AND YOU ARE MAKING A TRW PLOT, 12,10 WILL BE USED, OTHERWISE 0,0 IS USED, THIS OFFSET IS NOT USED FOR FR80 OUTPUT, FR80 OUTPUT IS CENTERED AUTOMATICALLY.

IF FR80 OR TRW PLOT WAS SPECIFIED, THE FOLLOWING QUESTION IS ASKED:

CALCOMP PLOT??

THIS ALLOWS YOU TO SUPPRESS THE CALCOMP PLOT, THE CALCOMP PLOT MAY ALSO BE SUPPRESSED BY REENTERING INSTEAD OF STARTING THE PROGRAM.

THE PRECEDING INFORMATION IS ASKED ONLY ONCE EVERY TIME THE PROGRAM IS STARTED, THE REST IS ASKED IN A LOOP STARTING HERE, WHEN DONE TYPE 'C' (CALL).

FILENAME??

TYPE THE PLOT FILENAME, DEFAULT EXTENSION IS "PCP".

CHAR   "M"     HEIGHT
SCALE  CODE   (IN MILS)
0       M50    120
1       M51
2       M52
3       M53
4       M54

THIS CONTROLS THE CHARACTER SIZE, THE TYPEOUT ACTUALLY STOPS AT THE END OF EACH LINE, <CR> SUPPRESSES TEXT OF THIS SCALE, IF THIS IS A TRW TAPE, THE HEIGHT MUST BE DIVISIBLE BY 15, OTHERWISE IT MUST BE DIVISIBLE BY 5, THIS NUMBER IS THE HEIGHT AND SPACING OF THE CHARACTERS OF THAT SCALE, SCALE 0 (M50) IS USED FOR THE MESSAGES, WHICH ARE PLOTTED ACROSS THE BOTTOM OF THE FILM.

PUT PEN AT 0;0.
LINES, TEXT, AND PADS MAX X = 0,000 MIN X = 0,000 MAX Y = 0,000 MIN Y = 0,000

THIS INFORMATION IS CALCULATED FROM THE PLOT FILE, AND DOES NOT INCLUDE THE CARD OUTLINE, IF ANY OF THE NUMBERS ARE ABNORMALLY LARGE, STOP AND GET RPH IMMEDIATELY.

IS THIS A DRILL PLOT??

IF YOU ANSWER Y<CR> TO THIS ALL LINES AND TEXT AND PADS WILL BE SUPPRESSED AND DONUT PADES WILL BE PLOTTED FOR EACH DRILL HOLE, ALSO THE CARD OUTLINE WILL BE PLOTTED WITH TARGETS
BUT NO FINGERS, SAYING YES HERE GETS YOU THE FOLLOWING
QUESTION:

CINCH DRILL TAPE??

SAYING Y<CR> WILL CAUSE A TAPE FILE FOR CINCH'S NUMERICALLY
CONTROLLED DRILL MACHINE TO BE WRITTEN IN A FILE.

DRILL TAPE FILENAME??

THIS IS THE NAME IT WILL USE (DEFAULT EXTENSION IS "DRL").

IF THIS IS A TRW PLOT TAPE THE FOLLOWING IS ASKED:

OPERATOR MESSAGES, 40 CHARs PER LINE (MAX), END WITH <CR>,
STANFORD A1, FULLY GROUP, <ALREADY ON TAPE>

THIS PUTS MESSAGES ON THE TAPE WHICH ARE TYPED
TO THE OPERATOR AT TRW AT THIS POINT IN THE PLOT,
THESE MESSAGES ARE ALSO PLOTTED ACROSS THE BOTTOM
OF THE FILM FOR IDENTIFICATION PURPOSES,
THE FIRST LINE ALWAYS IDENTIFIES US, SUBSEQUENT
LINES SHOULD IDENTIFY THE PLANE NUMBER (0 TO 4,
TOP TO BOTTOM) AND WHAT IT IS, END WITH A BLANK
LINE.

IF THIS IS AN FR80 PLOT:

FR80 FILENAME??

THIS SETS THE FILENAME TO USE FOR THE FR80 PLOT
THE DEFAULT EXTENSION IS "F80"; "?80" MAY BE USED
IN WHICH CASE THE PLOT FILENAME WILL BE USED,
THESE FILES MUST BE SUBSEQUENTLY COPIED ONTO
A MAGTAPE, BUT I DIGRESS.

IF THIS IS NOT A DRILL PLOT (PADS FOR DRILL HOLES ONLY), THE FOLLOWING
QUESTION IS ASKED:

SKIP PLOTTING OF ALL PADS??

THIS IS ONLY USEFUL ON CALCOMP FOR OVERLAYING PLOTS WITH THE SAME
PADS,

NOW THE PROGRAM WILL SPEW OUT VARIOUS THINGS ABOUT HOW FAR ALONG IT IS,
IF THE CARD NUMBER WAS AVAILABLE WHEN THE PLOT FILES WERE WRITTEN, IT
WAS PASSED IN THE FILE, IF NOT, THE FOLLOWING QUESTION WILL BE ASKED:

CARD NUMBER??

HERE YOU TYPE THE NUMBER OF THE CARD YOU WANT TO USE,
IF YOU TYPE 0<CR> OR JUST <CR>, NO CARD WILL BE DONE.

HERE PROGRESS ON THE CARD IS INDICATED,
NOW THE PROGRAM WILL TYPE:

ACTUAL MAX X = 0.000 MIN X = 0.000 MAX Y = 0.000 MIN Y = 0.000
THESE NUMBERS INCLUDE THE CARD OUTLINE AS WELL AS LINES, TEXT, ETC.
THEY MUST BE COPIED TO THE TRW PLANNING SHEET IF THIS IS A TRW PLOT.

THEN IT SAYS:

PLOT DONE!

AND HERE WE LOOP BACK TO THE PLOT FILENAME PROMPT!

AT COMPLETION OF PLOTS, THE FOLLOWING COMMAND SHOULD BE TYPED TO
GENERATE AN FR80 TAPE:

COPY MTAØ:FO0-STANFO,FR80[F,RPH],[ALL YOUR FR80 FILES, SPECIFYING PPN],STANFO,F80]

TO PUNCH PAPER TAPE FROM AN XXX,ORL FILE, RUN TD[F,RPH] AND TYPE THE FILENAME
XXX, THIS IS A SEPARATE PROGRAM BECAUSE THE TAPE MUST BE PUNCHED IN BINARY.

FIN
HOW TO RUN THE WIRE LISTER

OR

EASY LITTLE STEPS FOR MUDDY LITTLE FEET

COMMANDS:

I<Wire List ID><CR>

THE WIRE LIST ID IS ANY STRING INCLUDING NULL, IT IS USED TO IDENTIFY DIFFERENT WIRE LISTS, IF THIS IS A NEW WIRE LIST, YOU WILL BE ASKED:

NEW WIRE LIST,
WIRE LIST TITLE??

THE STRING YOU TYPE WILL BE PRINTED AT THE TOP OF YOUR LISTINGS,

IF THIS IS AN OLD WIRE LIST, PROGRAM WILL TYPE;

OLD WIRE LIST,
NOW YOU WILL BE ASKED;

FILENAME??

YOU MAY TYPE A FILENAME (DEFAULT EXTENSION IS "WD") OR @FILENAME (DEFAULT EXTENSION IS "DIR"), THE FORMAT OF A "DIR" FILE WILL BE EXPLAINED LATER.

THE FILE(S) ARE READ, SIGNAL NAMES ARE COMPARED AND THE WIRE LIST IS BUILT;

U<Wire List ID><CR>

THE WIRE LIST ID MUST EXIST, ELSE YOU GET AN ERROR MESSAGE, THEN YOU ARE ASKED:

FILENAME??

SAME AS FOR I EXCEPT INSTEAD OF "WD", "UML" IS USED, THIS SETS UP THE CORRESPONDENCE BETWEEN DIPS AND BODY NAMES OR LOCATIONS, THE FORMAT OF A UML FILE WILL BE DESCRIBED LATER;

L<Wire List ID><CR>

THIS LISTS A WIRE LIST ON THE LINE PRINTER, ALL SORTS OF NEAT THINGS ARE INDICATED ON THE WIRE LIST, THE BEST WAY TO FIND OUT WHAT THEY ARE IS TO MAKE ONE, ANY UNNAMED SIGNALS ARE GIVEN UNIQUE NUMBERS
WHICH ARE PRINTED PRECEDED BY A "#".

THIS MAKES THE FOLLOWING SUMMARIES:

SUMMARIZES ALL DIP TYPES USED IN THIS WIRE LIST TOTALING THE DIFFERENT BODY NAMES AND TOTAL NUMBER OF SECTIONS USED,

UNGENERATED SIGNALS

UNUSED INPUTS

UNUSED OUTPUTS

UNATTACHED SIGNAL NAMES

Each of these categories is listed, only one of the names of a wire fitting the category is listed, unnamed signals are given the same name as in a regular listing.

THIS WRITES A CARD TESTER FILE FOR P, PETIT'S SIMULATOR, THE DEFAULT EXTENSION IS "TST".
UML FILE FORMATS

IN THIS PART:

<>  SYNTACTIC ENTITY
<L>  SINGLE LETTER
<N>  1 OR MORE DIGITS

"UML" FILES:

BY NAME<CRLF>

OR

BY LOCATION<CRLF>

THE "BY NAME" FORMAT TELLS WHICH BODIES FROM LOGIC DRAWING PROG CORRESPOND TO WHICH DIPS.

THE "BY LOCATION" FORMAT TELLS WHICH DIPS LIVE IN WHICH LOCATIONS.

"DIR" FILES:


THIS IS A LIST OF FILES TO READ FOR "I" OR "U" COMMANDS.
THE <L> <N> (  <N> ?I  <N> ?I  )  CONSTRUCT IS FOR AUTOMATIC SLICING.
HOWEVER SOME OF THIS MAY CHANGE SOON SO SEE RPH,
RUNNING MAGGOT

MAGGOT READS MAGTAPE ON MTAO AND SIMULATES GERBER
PLOTTER PACKAGE ON CALCOMP, ALSO MAKES LINE PRINTER LISTING.

ASKS IF YOU WANT A CALCOMP PLOT
ASKS IF YOU WANT A LINE PRINTER LISTING

THE FIRST TIME ANY SCALE IDENTIFIER IS ENCOUNTERED YOU
WILL BE ASKED TO TYPE ITS HEIGHT.
RUNNING PDRILL

PDRILL READS PAPER TAPE AND PLOTS X’S ON CALCOMP FOR EACH DRILL HOLE, ALSO LISTS X,Y’S OF HOLES ON LINE PRINTER.

ASKS IF YOU WANT A CALCOMP PLOT
ASKS IF YOU WANT A LINE PRINTER LISTING
ASK YOU TO LOAD TAPE BEFORE STARTING
RUNNING FR80

ASKS IF YOU WANT A CALCOMP PLOT;
ASKS IF YOU WANT LPT OUTPUT;
ASKS FOR A FILENAME, (DEFAULT EXT IS "F80")
MAKES PLOT AND LISTING IF APPROPRIATE,
MISCELLANEOUS
DRAWING PITFALLS:

1. LINES WHICH APPEAR TO TOUCH MAY NOT INTERSECT IN THE DATA STRUCTURE; TO INSURE CONTINUITY YOU MUST EITHER:
   A. USE THE "-" METHOD TO HAVE A LINE YOU ARE DRAWING INTERSECT A POINT YOU CAN SEE,
   B. USE THE "?A" OR "?#A" METHOD TO ATTACH TO A POINT OR LINE RESP.

   (IN CASE OF DIFFICULTY, LEARN THE "?B" AND "?#B" FUNCTIONS.)

2. LABELS (LOGICAL NAMES) MAY APPEAR NEAR A WIRE AND NOT BE ASSOCIATED WITH IT, TO FORCE ASSOCIATION, YOU MUST:
   A. GET ON THE POINT AT THE END OF THE WIRE AND PLACE THE TEXT THERE, MOVE THE WIRE IF THE TEXT GETS CARBAGED BY SOME NEARBY OBJECT,

   (YOU MIGHT USE THE "?A" FUNCTION TO ATTACH SOME TEXT TO THE NEAREST POINT)

PC CARD LAYOUT RESTRICTIONS (BY MCGUIRE):

THE FOLLOWING LAYOUT TECHNIQUES ARE TO BE CONSIDERED MANDATORY UNTIL PROVEN OTHERWISE:

THE STANDARD STEP SIZE (50 MILS) WILL BE USED IN ALL PC CARDS EXCEPT FOR SPECIAL PURPOSE ONES, THIS ALLOWS EXACTLY ONE WIRE TO PASS DIRECTLY BETWEEN TWO PADS,

WIRES BETWEEN PADS SHOULD BE WITHIN 15 DEGREES OF STRAIGHT THROUGH TO ALLOW 18 MILS OF CLEARANCE BETWEEN WIRE AND PAD, 30 DEGREES GIVES 15 MILS OF CLEARANCE, STRAIGHT THROUGH GIVES 20 MILS OF CLEARANCE.

WIRES BETWEEN PADS ARE ALLOWED ONLY ON THE TOP (DIP INSERTION) SIDE OF PC CARDS OWING TO TROUBLE WITH SOLDER BRIDGING ON THE BOTTOM.

SPACING BETWEEN WIRES MAY BE THE MINIMUM, THAT IS 50 MILS, CONSIDER PADS AND FEED THROUGH TO BE 52 MILS IN DIAMETER AND WIRES TO BE 10 MILS WIDE (AFTER ETCHING).

IF A FEED THROUGH IS TO BE PLACED BETWEEN TWO WIRES THE WIRES MUST BE AT LEAST 100 MILS APART IN ORDER THAT THE 20 MILS CLEARANCE BE MAINTAINED AROUND THE FEED THROUGH.

IN ORDER TO KEEP MOST OF THE LINES VISIBLE AT HIGH MAGNIFICATION NO LINE SHOULD BE LONGER THAN 1 INCH, LONGER LINES MAY BE MADE UP OF A NUMBER OF 1 INCH SEGMENTS.

PLANE DESIGNATIONS:

IN ORDER TO AVOID CONFUSION THE FOLLOWING PLANE DESIGNATIONS WILL BE USED IN ALL PC CARDS:

<table>
<thead>
<tr>
<th>PLANE</th>
<th>USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>GROUND PLANE,</td>
</tr>
<tr>
<td>1</td>
<td>FIRST POWER PLANE (USE THIS IF ONLY ONE)</td>
</tr>
</tbody>
</table>
2 SECOND POWER PLANE (USE THIS AND 1 IF TWO POWER PLANES)
3 THIRD POWER PLANE;

IF SOMEBODY NEEDS MORE THAN 4 PLANES, HE IS CRAZY AND SHOULD SEE RPH FOR TREATMENT;

EXTERIOR PLANES!!!!!!!

THE SIDE OF THE BOARD INTO WHICH DIPS ARE INSERTED WILL BE REFERED TO AS THE TOP, THE OTHER SIDE WILL BE REFERED TO AS THE OTHER SIDE.