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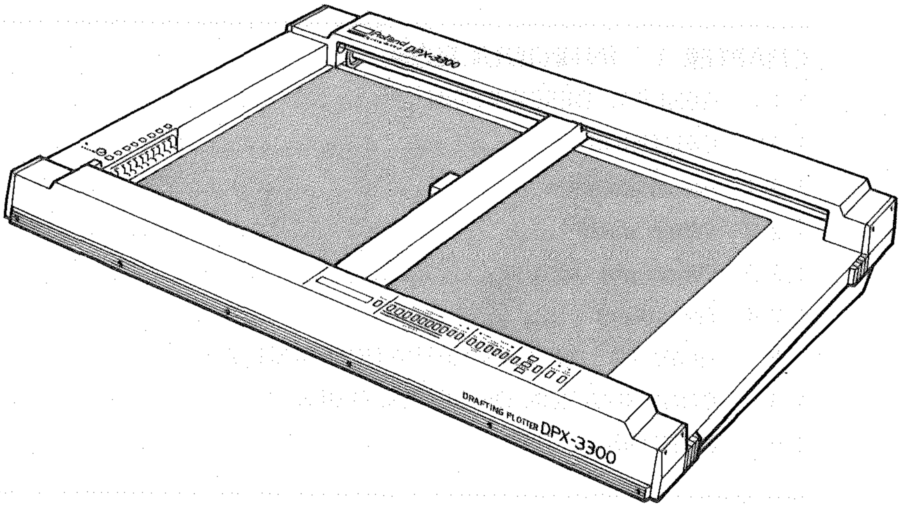
Roland DPX-3300
DRAFTING PLOTTER DPX-3300

DRAFTING PLOTTER
DPX-3300
OPERATION MANUAL

ROLAND DG CORPORATION

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Congratulations on your purchase of the Drafting Plotter [DPX-3300]
Please read and understand this manual well before using the DPX-3300.

TO THE USER

- Do not place objects on the plotter and power cord as this may result in accidents or fires.
- Ensure that the power supply is within ±5% of the rated voltage.
- Locate the plotter in an area with good ventilation and as free as possible from dust and humidity.
- Ensure that the plotter is not subjected to heavy shocks.
- If the panel becomes dirty, wipe it with a cloth dampened with water or neutral detergent. Do not use thinner or alcohol under any circumstances.

INTRODUCTION

1

1.1 GENERAL DESCRIPTION

- **Drawing Speed and Resolution**
  The maximum drawing speed is 450 mm/s in all directions and so is possible to make all-directional high-speed drawings. Also, the mechanical resolution is 12.5 microns (0.0125 mm).

- **Electrostatic Adsorption**
  The electrostatic adsorption system is used for holding a drawing paper to ensure that the paper is set properly in place on the drawing board.

- **Plotting Area**
  The maximum plotting area is 864 mm × 594 mm, which positively covers both ISO standard A1-size (841 mm × 594 mm) and ANSI standard D-size (34 in. × 22 in.) papers, so that a drawing can be done in the whole plotting area.

- **Soft Landing Mechanism**
  For pen-up and -down actions, the soft landing mechanism is provided to ensure that a pen moves up and down smoothly. This can allow for not only a good protection of the pen tip but also for a dramatic reduction of the operation noise.

- **Pen Type Discrimination Function**
  According to what kind of a drawing pen you use, the automatic pen control function is provided to automatically set appropriate values of pen speed and pen force.

- **Automatic Pen Return Function**
  A pen is automatically capped when it returns to the pen stock, so that the pen tip is prevented from drying. Also, in automatic pen control mode, a pen now in use is automatically returned to the pen stock if a drawing instruction is not input in a certain specified period during drawing.

- **X-Y Coordinate Display**
  The LED X-Y coordinate display is provided for seeing X-Y coordinates at a glance. Since this display shows pen positions in 0.1 mm increment, it is easy to set drawing positions and the ratios of extension and contraction, and also debug your program and so forth.

- **Optional Pens**
  Available optional pens are: water base fiber tipped pen, ceramic pen, water base ballpoint pen, pressurized oil-based ball-point pen, oil based fiber tipped pen, drawing ink pen (for paper and film), and maintenance-free tubular plotter pen. You can also choose to use pen colors and tip sizes from a plenty of their variations.

- **Slant of Dedicated Stands**
  The two types of dedicated stands with casters ("DPS-30" and "DPS-35") are available for the DPX-3300. You can adjust the tilt angles up to 60° and fix freely at any angle within the degrees with the two angle adjusting knobs.

1.2.1 For installation

- Place the DPX-3300 on a stable, flat table. When you set the DPX-3300 on a dedicated stand, you can adjust the tilt angle within 0° to 60°.

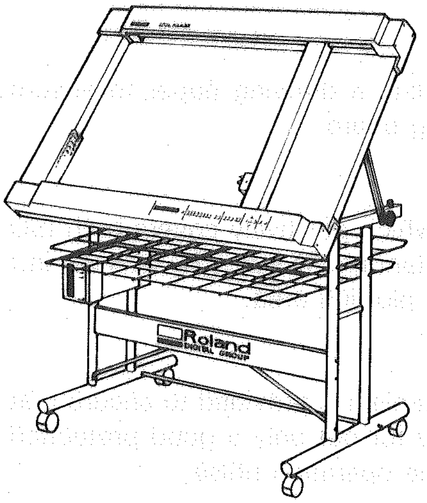

Fig. 1-1 (With dedicated stand)

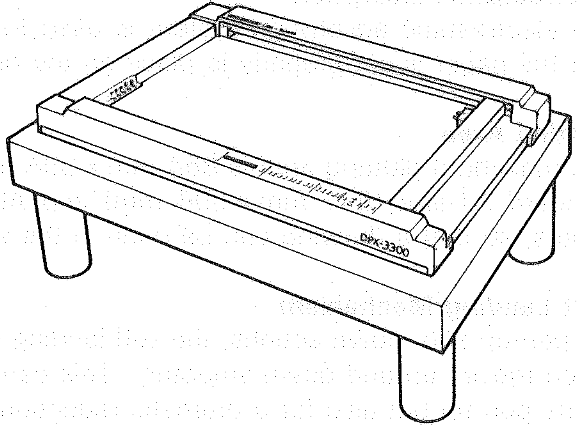

Fig. 1-2 (Without dedicated stand)

- Do not use the DPX-3300 in a place exposed to the direct sun light, with high ambient temperature and humidity, and also in a dusty place.

- To automatically distinguish the type of pen to be used, an infrared-lightused photosensor is equipped. Because of this, a strong external light directed to the photosensor could cause erroneous discrimination of pens, so that the DPX-3300 must be avoided to set in a place where the photosensor is exposed to the direct sun light, spot light and so forth.

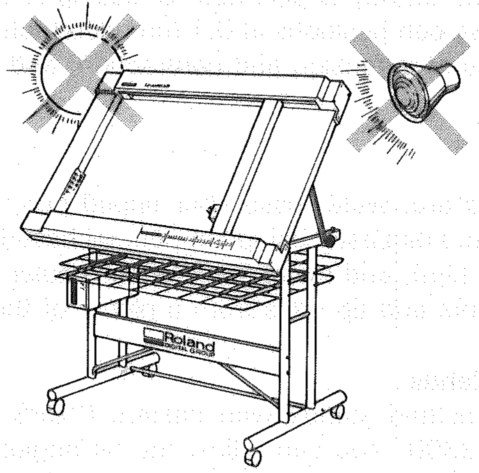

Fig. 1-3

- Do not use the DPX-3300 in a place of strong vibrations and many electrical noise.

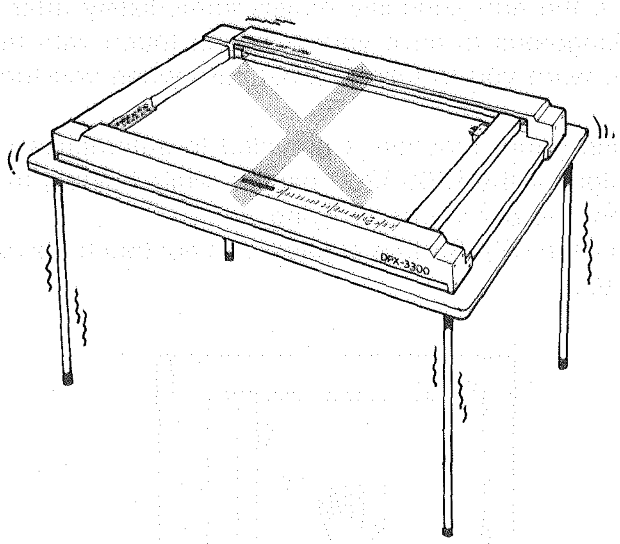

Fig.1-4

- Do not use the DPX-3300 in a place of bad heat radiation efficiency because it generates some heat during operation.

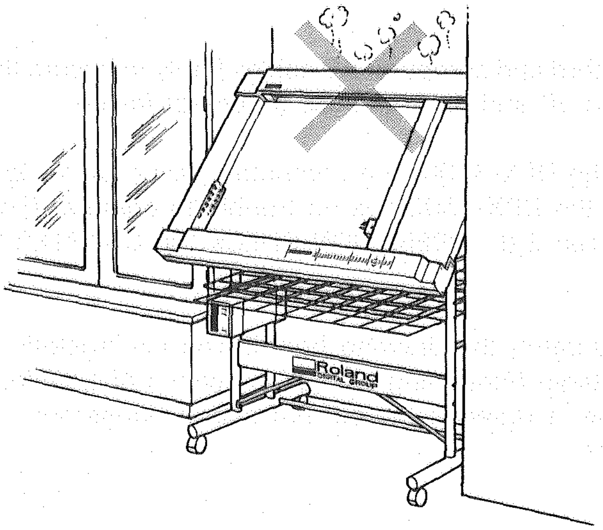
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Fig. 1-5

1.2.2 When used

WARNING

- Remember: Since the arm suddenly moves immediately after power is turned ON, it is extremely dangerous to have your hands in touch with the drawing board and its periphery. So, warn you to take at most care when you ture ON the power.

- The automatic pen return function is provided to automatically return a pen now in use to the pen stock if the DPX-3300 pauses while holding the pen during drawing in order to prevent the pen tip from drying.
  Remember: Even if the DPX-3300 is at pause, do not touch the drawing board because it is still dangerous.

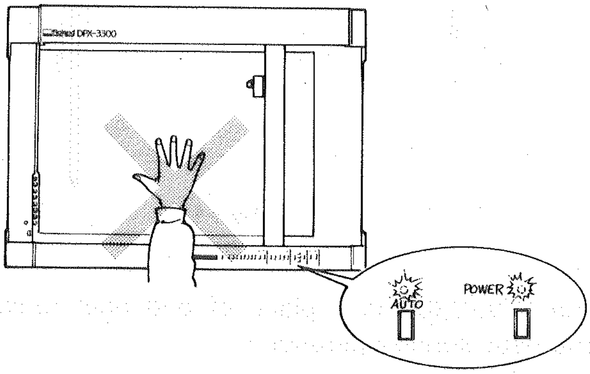

Fig. 1-6

- Connect the power cord and computer I/O cables firmly to ensure that during operation they are not plugged off and do not cause a contact failure.

- Before connecting the DPX-3300 to a computer, never fail to do a self test once to make sure whether the DPX-3300 has no trouble to operate. (For more information about the self test, see 2.6 ''OPERATION CHECK'' in CHAPTER 2.)

WARNING

- Remember: Never scratch the drawing board! The electrostatic adsorption surface is applied a high voltage. Scratching the surface with a drill, knife, screw driver, etc., could cause not only a drawing trouble but also a dangerous situation. So, never make such scratches.

1.2.3 When not used

- If you do not use the DPX-3300 for a long time, remove the pens from the pen stock and pen carriage and also put caps on them.

- Do not forget plugging the power cord off the electric outlet after use.

- Put the accessory dust cover on the DPX-3300 during unused.

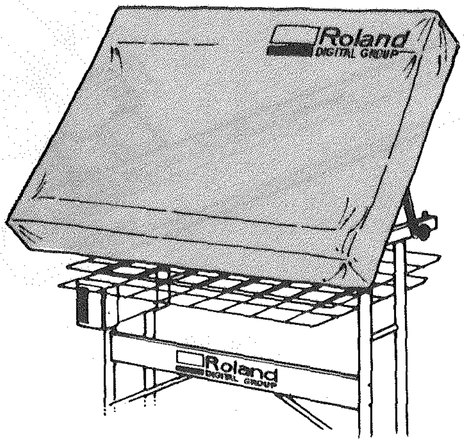
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Fig. 1-7

1.2.4 For others

- Be careful not to place heavy objects on and also not to scratch the drawing board.

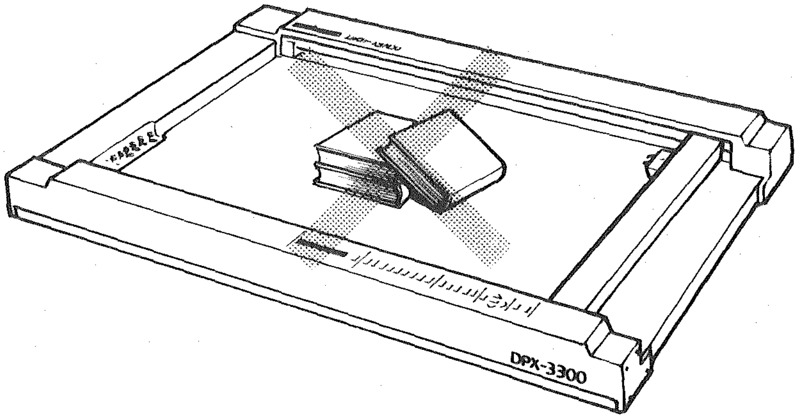


Fig. 1-8

- Do not apply strong force or impact to the arm and pen carriage.
- Do not move the arm and pen carriage with your hands when the power is ON.

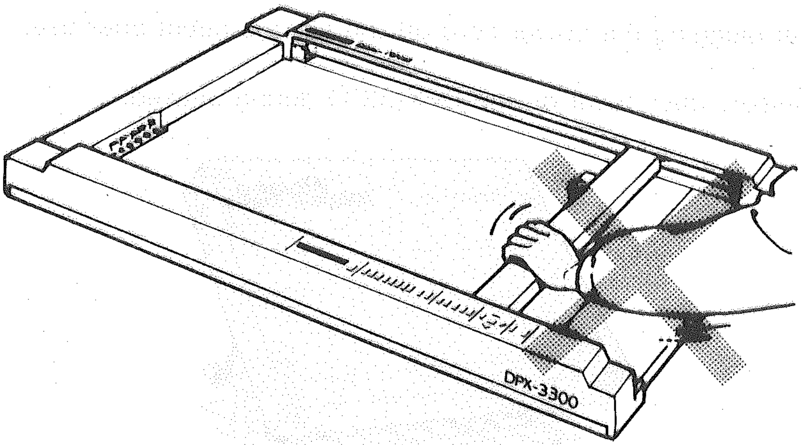


Fig. 1-9

- If the body is dirty, wipe off gently with water or neutral detergent. If the drawing board is dirty, wipe off gently with water or warm water. Do not use thinner and other alcoholic chemicals.
- Never oil the mechanical portions of the DPX-3300.

1.3 HOW TO USE THIS OPERATION MANUAL

For the proper use of the DPX-3300, read this operation manual carefully. This manual is broadly divided into two sections.
The first half of this manual (from CHAPTER 1 to CHAPTER 5) covers the fundamental description and cautious notes necessary for how to use the DPX-3300. To use the DPX-3300 properly, please do not neglect reading these chapters.
The last half (from CHAPTER 6 to CHAPTER 8) includes the operational description of programming for the DPX-3300. If you want to make your own programs, read these chapters with a good deal of time. If not, reading is not necessary, and you will not get any trouble for the use either.
CHAPTER 9 is the summary of trouble-shootings for the DPX-3300. If you have troubles during use, read it carefully to solve them.
After the thorough reading of this entire manual, try to read again each chapter carefully according to your purpose.

- **When You Purchased This DPX-3300**
  Read the cautious notes of CHAPTER 1. Also, make sure that all accessories are correctly furnished and set them in correct places.
  Make sure in CHAPTER 2 that the DPX-3300 operates properly.

- **When Connecting To A Computer**
  After reading CHAPTER 5, select a correct cable and make the settings of the DPX-3300 and computer.
  If you want to know detailed information about how to connect interfaces and a Serial Connector for the handshake, read CHAPTER 8.

- **When You Want To Know The Functions of The DPX-3300 And How To Use It**
  Read CHAPTER 3 which includes the basic functions of the DPX-3300 and information for how to use the control panel.

- **When You Want To Know About How To Handle Pens**
  Read CHAPTER 4 which includes the explanation of pens to be used for your purpose as well as information for how to use them.

- **When You Want To Run The Plotter With Your Own Programs**
  Read CHAPTER 6 and CHAPTER 7 which include the basic concept of the RD-GLII commands provided with the DPX-3300 and the explanation of each command. If you want to make your own programs, you must read these chapters carefully.

1.4 CONFIRMATION OF ACCESSORIES

The following accessories are packed with the DPX-3300. Before using the DPX-3300, make sure whether or not all the following accessories are contained.

(1)	Plotter pens 0.3 mm water based fiber tipped pens XD-4SPB-WNG (black, red, blue, green) 0.2 mm ceramic pens XD-4SPB-CN (black, red, blue, green)	8 pcs.
(2)	Positioning seal	1 sheet
(3)	Rubber seal	1 sheet
(4)	Dust cover	1 pc.
(5)	AC Power cord	1 pc.
(6)	DPX-3300 Operation Manual	1 pc.
(7)	White Pen Caps	8 pcs.
(8)	Gray Pen Caps	8 pcs.
(9)	Tweezers	1 pc.
(10)	Silver stickers with instruction sheets for optional ink pens	1 sheet
(11)	Before Using Your Drafting plotter	1 pc.
(12)	A1-size plotter paper (tracing paper)	5 pcs.

Table 1-1

*The accessories from (1) through (10) are packed in the accessory box of the same package.

Note that the cable to be used for connecting the DPX-3300 to a computer is not furnished as an accessory. If you do not have such a connecting cable, read CHAPTER 5 carefully and select the proper kind of a connecting cable according to the type of a computer you have. Also, note that the pens and plotting papers contained in the package are the accessories provided for checking whether the DPX-3300 can operate properly. Before operating the DPX-3300 for your business, select pens and drawing papers you want to use from separately sold options.

1.5 OPTIONS

Option Name	Product Number	Description
Water based fiber tipped pens	XD-4SPA-WN(G)	0.3 mm 4 black
	XD-4SPB-WN(G)	0.3 mm black, red, blue and green each
	XD-4SPC-WN(G)	0.3 mm orange, pink, brown and purple each
	XD-4SPA-WW(G)	0.6 mm 4 black
	XD-4SPB-WW(G)	0.6 mm black, red, blue and green each
	XD-4SPC-WW(G)	0.6 mm orange, pink, brown and purple each
Thick pens (Water-based)	XD-4SPA-WB(G)	2.0 mm 4 black
	XD-4SPB-WBG	2.0 mm black, red, blue and green each
	XD-4SPC-WBG	2.0 mm orange, pink, brown and purple each
	XD-4SPD-WB(G)	2.0 mm 4 red
	XD-4SPE-WB(G)	2.0 mm 4 blue
	XD-4SPF-WB(G)	2.0 mm 4 green
	XD-4SPG-WB(G)	2.0 mm 4 orange
	XD-4SPH-WB(G)	2.0 mm 4 pink
	XD-4SPI-WB(G)	2.0 mm 4 brown
	XD-4SPJ-WB(G)	2.0 mm 4 violet
Ceramic pens	XD-4SPA-CN	0.2 mm 4 black
	XD-4SPB-CN	0.2 mm black, red, blue and green each
	XD-4SPC-CN	0.2 mm brown, violet, pink, orange
	XD-4SPD-CN	0.2 mm 4 red
	XD-4SPE-CN	0.2 mm 4 blue
	XD-4SPF-CN	0.2 mm green
	XD-4SPA-CM	0.4 mm 4 black
	XD-4SPB-CM	0.4 mm black, red, blue and green each
	XD-4SPC-CM	0.4 mm brown, violet, pink, orange
	XD-4SPD-CM	0.4 mm 4 red
	XD-4SPE-CM	0.4 mm 4 blue
	XD-4SPF-CM	0.4 mm 4 green
	XD-4SPA-CW	0.6 mm 4 black
	XD-4SPB-CW	0.6 mm black, red, blue and green each
	XD-4SPC-CW	0.6 mm brown, violet, pink, orange
Water based ball-point pens	XD-4SPA-BP	4 black
	XD-4SPB-BP	black, red, blue and green each
Pressurized oil-based ball-point pens	XD-BPH	1 pressurized oil-based ball-point pen holder
	XD-3M-BLK	3 sets of black pressurized oil-based ball-point pen
	XD-3M-RED	3 sets of red pressurized oil-based ball-point pen
	XD-3M-BLU	3 sets of blue pressurized oil-based ball-point pen
	XD-3M-GRN	3 sets of green pressurized oil-based ball-point pen
Oil based fiber tipped pens for OHP film	XD-4SPA-ON	0.3 mm 4 black
	XD-4SPB-ON	0.3 mm black, red, blue and green each
	XD-4SPC-ON	0.3 mm orange, yellow, brown and purple each
	XD-4SPA-OW	0.6 mm 4 black
	XD-4SPB-OW	0.6 mm black, red, blue and green each
	XD-4SPC-OW	0.6 mm orange, yellow, brown and purple each

Option Name	Product Number	Description
Ink pens	ST-LPH ST-P25 ST-P35 ST-P50 ST-INK ST-P25F ST-P35F ST-P50F ST-INKF KF-INK	1 ink pen holder (long) 1 ink pen tip for drawing paper, 0.25 mm 1 ink pen tip for drawing paper, 0.35 mm 1 ink pen tip for drawing paper, 0.50 mm 1 black ink for drawing paper 1 ink pen tip for film, 0.25 mm 1 ink pen tip for film, 0.35 mm 1 ink pen tip for film, 0.50 mm 1 black ink for film 1 erasable ink with eraser
Maintenance-free tubular plotter pens (MPP)	XD-4RTH XD-4RT25 XD-4RT35 XD-4RT50 XD-4RTS	1 maintenance-free tubular plotter ink pen holder 4 ink pen tip for drawing paper, 0.25 mm 4 ink pen tip for drawing paper, 0.35 mm 4 ink pen tip for drawing paper, 0.50 mm 4 ink pen tip for drawing paper, 0.25/0.35/0.50/0.70 mm
Overhead Projector Transparency Kit	XY-TRK	50 OHP film 16 Oil based fiber tipped pens (0.3 mm × 8, 0.6 mm × 8)
Dedicated stands	DPS-30 DPS-35	DPX-3300 dedicated stand DPX-3300 dedicated stand with a drawer
Plotter cables for PARALLEL-I/O connector	XY-IPC XY-APL	for IBM-PC, PC/XT, PC/AT with interface for APPLE II
Plotter cables for SERIAL-I/O connectors	XY-RS-11 XY-RS-31 XY-RS-13 XY-RS-33 XY-RS-14 XY-RS-34	1.5 m long, for APPLE II, IIe 3 m long, for APPLE II, IIe 1.5 m long, for IBM-PC, PC/XT 3 m long, for IBM-PC, PC/XT 1.5 m long, for IBM-PC/AT 3 m long, for IBM-PC/AT
(Note) For more information about the cables, see CHAPTER 5, because the computer you want to use may require an interface card.		
Data Buffer	SYA-350	640K byte buffer with a 3.5 in. disk unit and SERIAL PARALLEL input and output data transmission system

PREPARATION FOR DRAWING

2

2.1 COMPONENT

2.1.1 External view

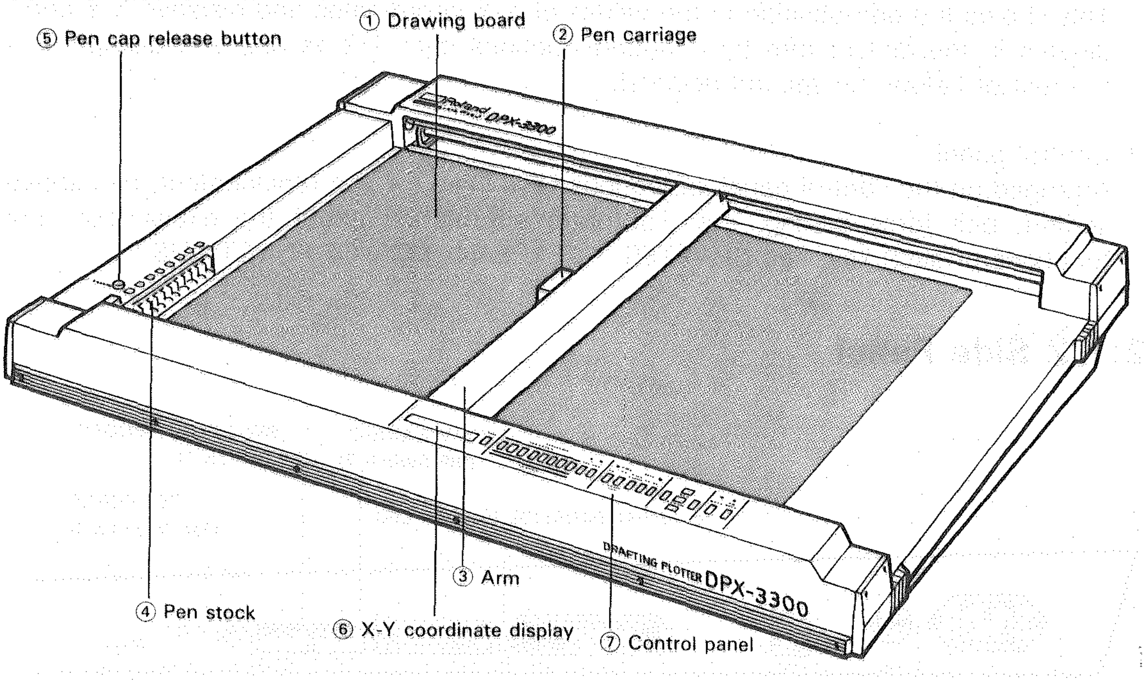

⑤ Pen cap release button
① Drawing board
② Pen carriage
Roland DPX-3300
③ Arm
④ Pen stock
⑥ X-Y coordinate display
⑦ Control panel
DRAFTING PLOTTER DPX-3300

Fig. 2-1

① Drawing board
The electrostatic adsorption is the paper holding system used for this drawing board. Pressing the PAPER HOLD key arranged on the control panel allows for ON/OFF switching of the paper adsorption.

② Pen carriage
The pen carriage holds a pen and moves with it to make drawing on the drawing board by moving the pen up and down.

③ Arm
The arm supports the pen carriage and moves to the left and right. Since it moves at a high speed during drawing, it is very dangerous to have your hands in touch with the drawing board.

④ Pen stock
The pen stock can accommodate eight pens in total. The rubber caps are furnished at the lower portion of the pen stock for preventing the pen tips from drying when the pens are at stock. They should be changed to one another depending on the type of a pen you want to use.

⑤ "PEN CAP RELEASE" (pen cap release button)
Pressing this button allows the pen caps of the pen stock to lower and so is used for pen attachment and pen removal.

⑥ "COORDINATE DISPLAY" (X-Y coordinate display)
This shows the pen position in the values of X-Y coordinates and displays X-Y coordinates in the unit of mm by counting fractions over 1/2 as one and disregarding the rest of below the second decimal.

⑦ Control panel
Arranged on the control panel are various keys used for pen replacement, pen speed setting, pen force setting, etc. For more information about the explanation and functions of each key, see CHAPTER 3 "EXPLANATION OF FUNCTIONS".

2.1.2 Side Panel

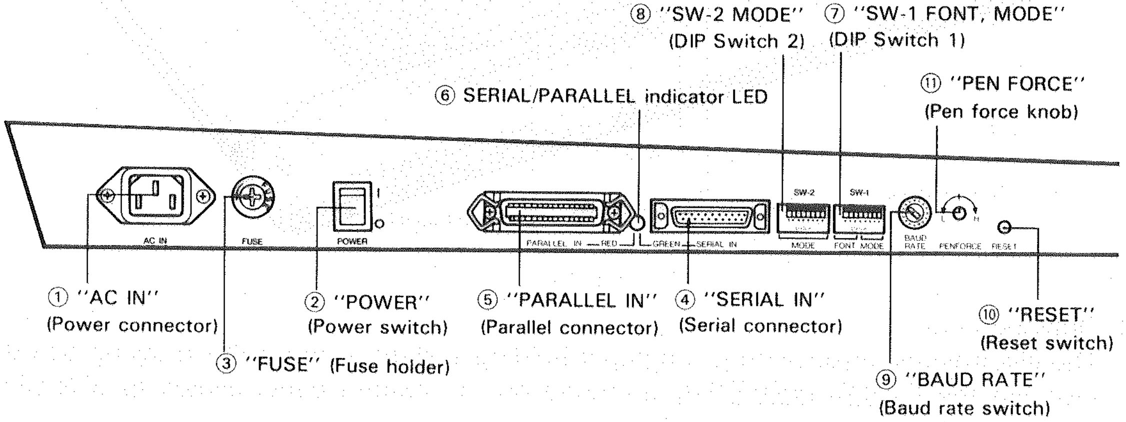

⑧ "SW-2 MODE" (DIP Switch 2)
⑦ "SW-1 FONT, MODE" (DIP Switch 1)
⑥ SERIAL/PARALLEL indicator LED
⑪ "PEN FORCE" (Pen force knob)
AC IN
FUSE
POWER
I
O
PARALLEL IN
RED
GREEN
SERIAL IN
SW-2
SW-1
MODE
FONT MODE
BAUD RATE
L
H
PENFORCE
RESET
① "AC IN" (Power connector)
② "POWER" (Power switch)
⑤ "PARALLEL IN" (Parallel connector)
④ "SERIAL IN" (Serial connector)
⑩ "RESET" (Reset switch)
③ "FUSE" (Fuse holder)
⑨ "BAUD RATE" (Baud rate switch)

Fig. 2-2

① "AC IN" (Power Connector)
This is the connector in which the accessory power cord is plugged.

② "POWER" (Power Switch)
Read 2.3 "TURNING ON POWER". Turning this power switch to the letter "I" makes the power ON. Doing so lights up the "POWER" indicator LED and allows the "X-Y COORDINATE DISPLAY" to show zero values of the X-axis and Y-axis. At the same time, the pen carriage automatically moves to the upper right position.

③ "FUSE" (Fuse Holder)
If a fuse is broken, replacing it is not always enough to get the operation back to normal in many cases. In such a case, you have to find out why the fuse is broken and solve the problem.

④ "SERIAL IN" (Serial Connector)

⑤ "PARALLEL IN" (Parallel Connector)

⑥ SERIAL/PARALLEL Indicator LED

Interface connectors ④ ''SERIAL IN'' and ⑤ ''PARALLEL IN'' are used for the connection of the DPX-3300 and a computer. Either of the connectors is used according to what kind of I/O data transmission system your computer uses. Switching from SERIAL to PARALLEL can be done by setting ⑦ ''SW-1'' (DIP Switch 1). ⑥ SERIAL/PARALLEL Indicator LED lights up in red if setting at PARALLEL and in green if setting at SERIAL.

⑦ ''SW-1 FONT,MODE'' (DIP Switch 1)

This is used for the selection of interfaces (SERIAL/ PARALLEL), the setting of paper size, the setting of font, etc. For more information, see 10.1 ''LIST OF DIP SWITCH SETTINGS'' in CHAPTER 10.

⑧ ''SW-2 MODE'' (DIP Switch 2)

This is used for setting the communication conditions (protocol) of when both SERIAL (RS-232C) interface and PARALLEL (Centronics) interface are used. For more information, see 10.1 ''LIST OF DIP SWITCH SETTINGS'' in CHAPTER 10.

⑨ ''BAUD RATE'' (Baud Rate Switch)

This is used for setting the data transmission speed (baud rate) when an SERIAL (RS-232C) interface is used.

⑩ ''RESET'' (Reset Switch)

Pressing this switch sets the plotter in the initial condition. However, the DPX-3300 in ''PAPER HOLD'', ''AUTO PEN CONTROL'' and ''PAUSE'' conditions is in the same conditions as before the ''RESET'' switch is pressed.

⑪ ''PEN FORCE'' (Pen Force Knob)

Using this knob allows for fine adjustments of pen force imposed to the pen tip when the pen moves down. For more information, see CHAPTER 3 ''EXPLANATION OF FUNCTIONS''.

2.2 INSTALLATION

Read 1.2 "CAUTIONS" in CHAPTER 1 carefully to install the DPX-3300 properly. Using an optional dedicated stand, you can set the DPX-3300 at any angle between 0° and 60°.

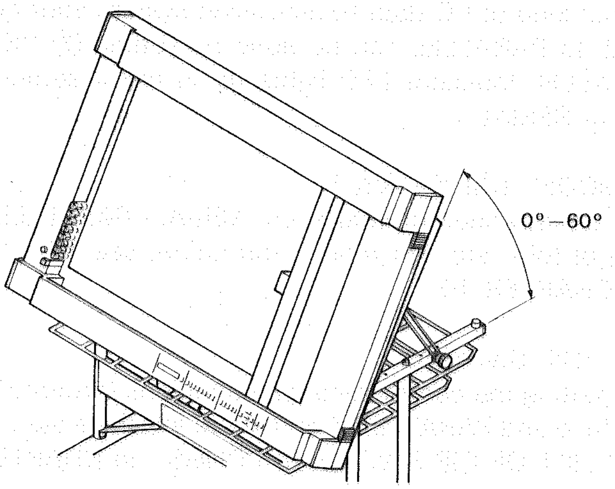


Fig. 2-3

● Installing Optional Dedicated Stands (DPS-30, DPS-35)

① Remove the four stand fixing screws from the bottom of the DPX-3300 with the hex. wrench furnished with the stand.

② Insert the two rubber legs of the front bottom of the DPX-3300 into the two holes drilled at the front frame of the stand and secure the DPX-3300 to the stand with the four stand fixing screws which you have removed.

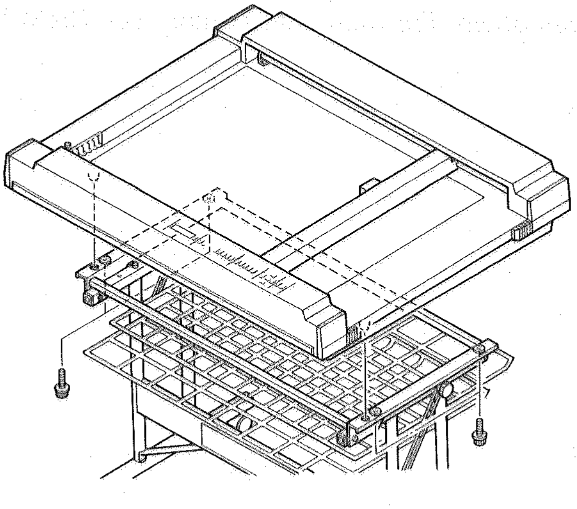


Fig. 2-4

If the dedicated stand is not installed properly, it may become unstable. So, read the ASSEMBLY MANUAL furnished with the stand carefully for proper setting. Note that three setting angles (0° — 20°, 20° — 40° and 40° — 60°) are available, but their setting methods vary from one another.

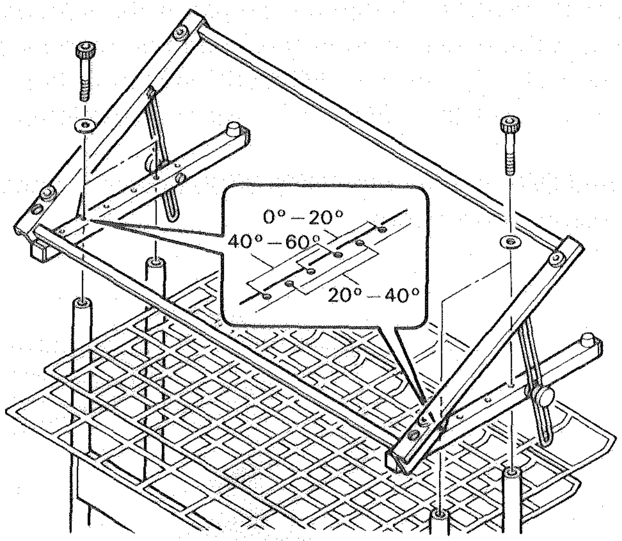


Fig. 2-5

2.3 TURNING ON POWER

WARNING

- **Remember: Since the arm suddenly moves immediately after turning the power ON, it is very dangerous to have your hands in touch with the drawing board and its periphery. So, warn you to take at most care for turning ON the power.**

CAUTION

- Remember: Beside the ''POWER'' switch arranged at the side panel, the letters ''I'' and ''O'' are labeled. If the explanation in this operation manual says something like ''The power is turned ON ...'', set the ''POWER'' switch at the letter ''I'' and ''The power is turned OFF ...'', set the ''POWER'' switch at the letter ''O''.

With the power turned OFF, connect the DPX-3300 power connector to the electrical outlet with the accessory power cord.

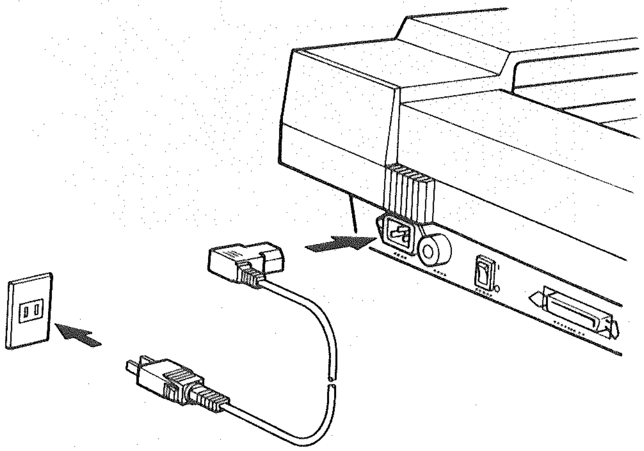


Fig. 2-6

When turning the power ON, the pen carriage moves to and stops at the upper right corner, and the ''X-Y COORDINATE DISPLAY'' shows zero values of the X-axis and Y-axis. But while the ''DOWN'' LED is flashing, the DPX-3300 is under initialization and so does not accept any instructions from the computer and any function-key operations from the control panel.

2.4 SETTING A PLOTTER PAPER

The DPX-3300 uses the electrostatic adsorption system for holding plotter papers and is able to make drawings over standardized papers up to ISO-A1 size (841 mm × 594 mm) and ANSI-D size (34 in. × 22 in.) papers at a maximum.
Remove the protection sheet from the electrostatic adsorption board first; then set a plotting paper on the board.

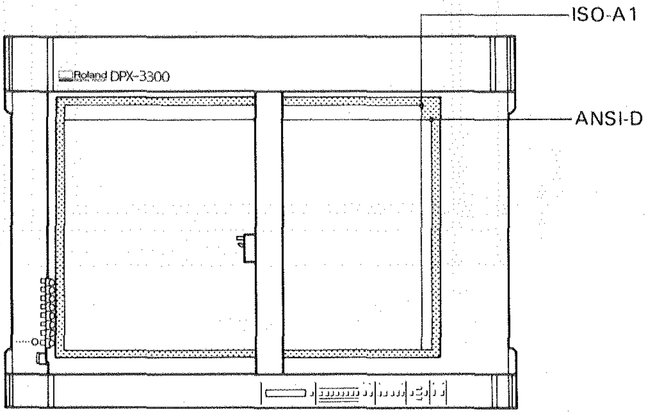


Fig. 2-7

2.4.1 Paper Setting

If a paper is set immediately after taking out of the plotter paper bag, it may contracts due to ambient temperature and humidity, depending on the types of papers you use. As a result, the paper somewhat lifts off in part from the electrostatic adsorption plate. In such a case, before setting to the plotter, let the paper to take to air for 5 to 30 minutes and set it to the plotter.

① Make sure that the power connector is connected to the electrical outlet with the accessory power cord.
② Turn the "POWER" switch ON. The DPX-3300 comes in operation, and the pen carriage automatically moves to the upper right corner.
③ Make sure that the "PAPER HOLD" indicator LED of the control panel is OFF.

④ Set a plotter paper as shown in Fig. 2-8.

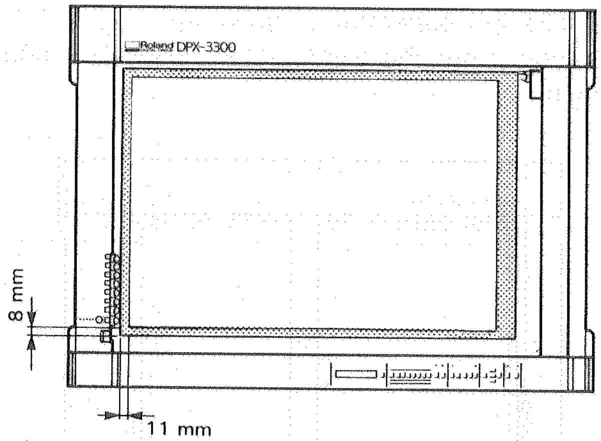

Roland DPX-3300
8 mm
11 mm

Fig. 2-8

It is convenient to have setting if attaching accessory rubber seals and positioning seals at the paper setting position in advance.

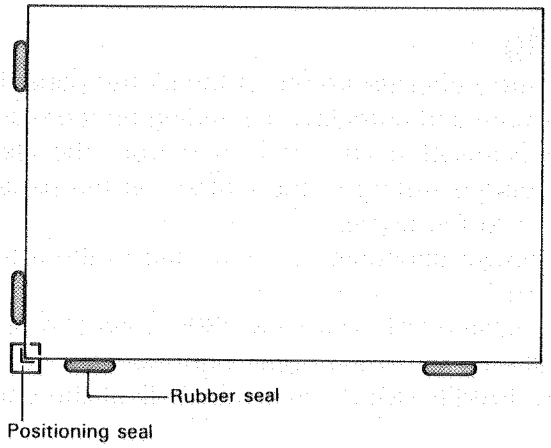

Rubber seal
Positioning seal

Fig. 2-9

⑤ Press the PAPER HOLD key of the control panel to light up the "PAPER HOLD" indicator LED arranged above the key. Fix the plotter paper on the electrostatic adsorption plate.

⑥ As shown in Fig. 2-10, skim the entire plotter paper with a soft cloth to remove wrinkles, if any. Touching the plotter paper directly with your hands may cause ink irregularities in drawing because of the fat of your hands.

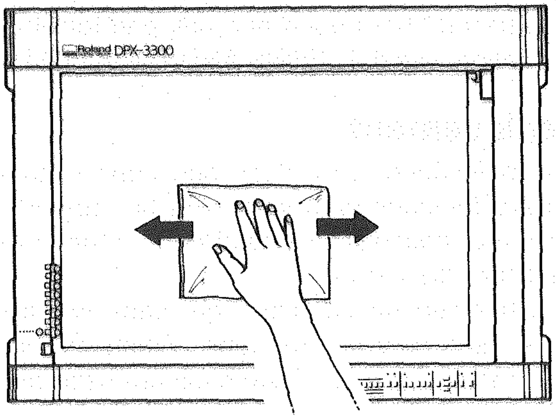


Fig. 2-10

Now, the paper setting is complete.

2.4.2 Paper Removal

① Press the UR key of the control panel.
The pen carriage that have held a pen returns the pen to the pen stock and moves to the upper right corner.

② Press the PAPER HOLD key of the control panel to release the paper holding condition. (At this point, the ''PAPER HOLD'' indicator LED lights off). Remove the plotter paper. Note that some adsorption remains for a while after pressing the PAPER HOLD key.

2.5 PEN ATTACHMENT

Do not attach a pen directly to the pen carriage but attach it to the pen stock on the left side of the plotter body.

Furnished as accessories are water based fiber tipped pen and ceramic pen. Various kinds of pens are available as options: water based ball-point pen, pressurized oil-based ball-point pen, oil based fiber tipped pen, ink pen for plotter paper, ink pen for film, etc. For more information, see 4.1 ''PENS AND THEIR FEATURES'' in CHAPTER 4.

2.5.1 Pen Cap Replacement

The DPX-3300 has been shipped with black pen caps installed in the pen stock. These black pen caps are for pens with large pen tip support and can be used for the Roland DG corp.'s water based fiber tipped pen, ceramic pen, water based ball-point pen and oil based fiber tipped pen.

Other than these pens, white pen caps and gray pen caps are furnished as accessories. The white pen caps are used only for ink pens. When an ink pen is used, always replace with the white pan cap. The gray pen caps are used only for pens with small pen tip support.

If you want to use the Roland DG corp.'s pens, select to use pen caps for them from Fig. 2-11.

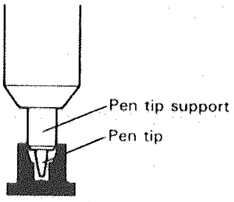
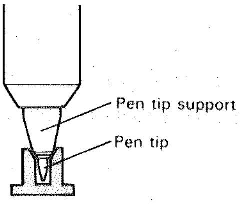
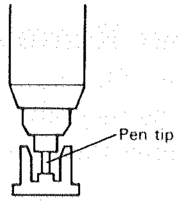
Black pen cap for large pen tip support	Gray pen cap for small pen tip support	White pen cap for ink pen
 **Pens of our brand** Water-Based Fiber-Tipped Pen XD-4SPA~C-WN (G) XD-4SPA~C-WW (G) Thick Pen (Water-based) XD-4SPA~J-WBG Ceramic Pen XD-4SPA~F-CN XD-4SPA~F-CM XD-4SPA~C-CW Water-Based Ball-point Pen XD-4SPA-BP XD-4SPB-BP Oil-Based OHP Pen XD-4SPA~C-ON XD-4SPA~C-OW		 **Pens of our brand** Ink Pen ST-LPH + ST-P25 ST-P35 ST-P50 ST-P25F ST-P35F ST-P50F Maintenance-free Tubular Potter Pen XD-4RTH + XD-4RTS XD-4RT25 XD-4RT35 XD-4RT50

Fig. 2-11

When you want to use pens other than the Roland DG corp.'s pens, take care of the following points and select to use proper pen caps.
When installing a pen to the pen stock other than ink pens, try to avoid the exposure of the pen tip to air. The pen tip support must touch the pen cap. If immoderate force is inadvertently imposed between a pen and its pen cap, pen replacement cannot be done normally.
For ink pens, on the other hand, the pen tip is required to be in light touch with the pen cap.

If an incorrect pen cap is used, ink becomes dry and pen replacement cannot be done properly. Particularly when different types of pens are mix-used, take care to ensure that a incorrect pen cap is not used.

For pen cap replacement, as is shown in Fig. 2-12, press in the pen cap securely to fit into the groove snugly, using the accessory tweezers.

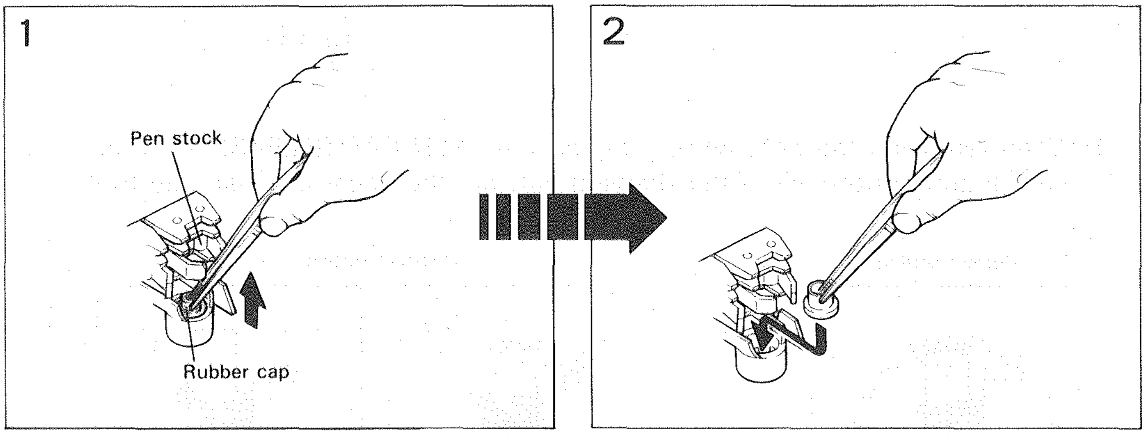


Fig. 2-12

2.5.2 Pen Attachment

Since improper attachment of a pen could cause a trouble, take care to make correct attachment.

① Remove the cap from the pen to be attached. While pressing the "PEN CAP RELEASE" button as shown in Fig. 2-13, press in the pen gently so that the disk portion of the pen snugly fits into the groove of the pen stock.

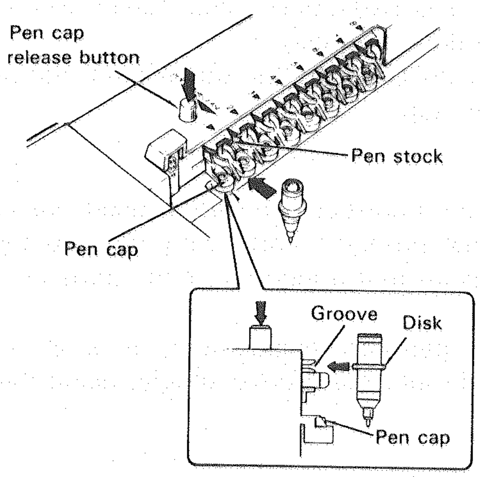

Pen cap release button
Pen stock
Pen cap
Groove
Disk
Pen cap

Fig. 2-13

② When removing the pen, while pressing the "PEN CAP RELEASE" button, draw out the pen horizontally. After drawing out, put the accessory pen cap to it.

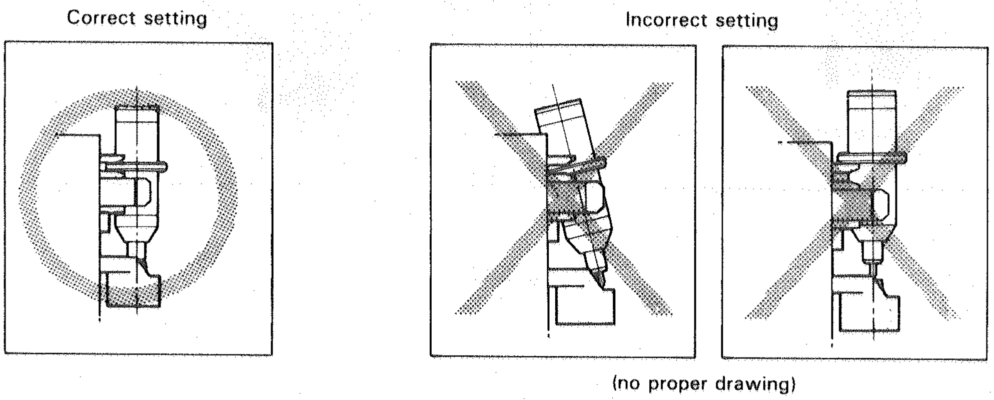

Correct setting
Incorrect setting
(no proper drawing)

Fig. 2-14

- The Roland DG corp.'s pens dedicated for DXY Series Plotter and other commercially available pens can be used. However, the pen functions cannot work properly if commercially available pens are used. (See CHAPTER 3 "EXPLANATION OF FUNCTIONS".)

- A pen should be used for a pen stock in the same color as much as possible. Do not use pens for one particular pen stock. If a different color pen is used for that pen stock, the pen makes mixed color drawing because the previously used ink color may remain in the pen stock in which the pen tip absorbs it. Because of this, when changing a pen to another pen in a different color, clean the inside of the pen cap with a soaked cotton swab and the like.

- Do not lose the pen caps furnished with each pen and keep them in storage. Since the pen caps furnished with the pen stock are for temporary protection of the pens against drying, when the pens are decided not to be used for a long time, always remove the pens from the pen stock and keep them capped with the accessory pen caps furnished with the pens.

2.6 OPERATION CHECK

The DPX-3300 incorporates the self test function you can use to make sure that the DPX-3300 can operate properly. Before connecting the DPX-3300 to a computer, follow the steps below to make sure that it can operate properly. Remember: A plotter paper and a pen are needed for this operation check. For the check, use the accessory A1 size (841 mm × 594 mm) plotter papers and the dedicated pens (four 0.3 mm water based fiber tipped pens and four 0.2 mm ceramic pens each).

① Place the DPX-3300 on a level table or set it on a dedicated stand. Make sure that the power is OFF and connect the accessory power cord to the DPX-3300.

② Turn the power ON. The DPX-3300 is designed to allow the pen carriage to automatically move the upper right corner immediately after turning ON the power. So, never place your hands, paper, objects, etc., on the drawing board.

③ Make sure that the "PAPER HOLD" indicator LED is OFF and set the plotter paper in parallel to the body at the center of the electrostatic adsorption surface. Pressing the PAPER HOLD key allows the plotter paper to be adsorbed on the electrostatic adsorption surface. Skim the plotter paper gently with a soft cloth, if wrinkled. If the plotter paper is actually wrinkled, a proper drawing cannot be done.

④ Remove the caps from the four accessory water based fiber tipped pens (the bodies in gray, XD-4SPB-WN) and the four accessory ceramic pens (the bodies in blue, XD-4SPB-CN). Then, attach them in the pen stock. These eight pens are used for the operation check. When using the ceramic pens, be careful not to apply strong force to the pen tips, otherwise they are broken.

Pen Number	1	2	3	4	5	6	7	8
Pen color	Black	Red	Blue	Green	Black	Red	Blue	Green
Body color	Gray				Blue			

Table 2-1

⑤ Turn the power OFF temporarily.

⑥ While pressing the ENTER key of the control panel, turn the power ON.
Remember: The ENTER key must be kept pressing until the "DOWN" LED ends flashing.

⑦ The DPX-3300 starts operating for the drawing of self test patterns. Make sure of the following points during and after drawing.

1) The "AUTO" LED of the control panel lights up.

2) Drawing patterns appear as shown in Fig. 2-15 after the self test is completed.

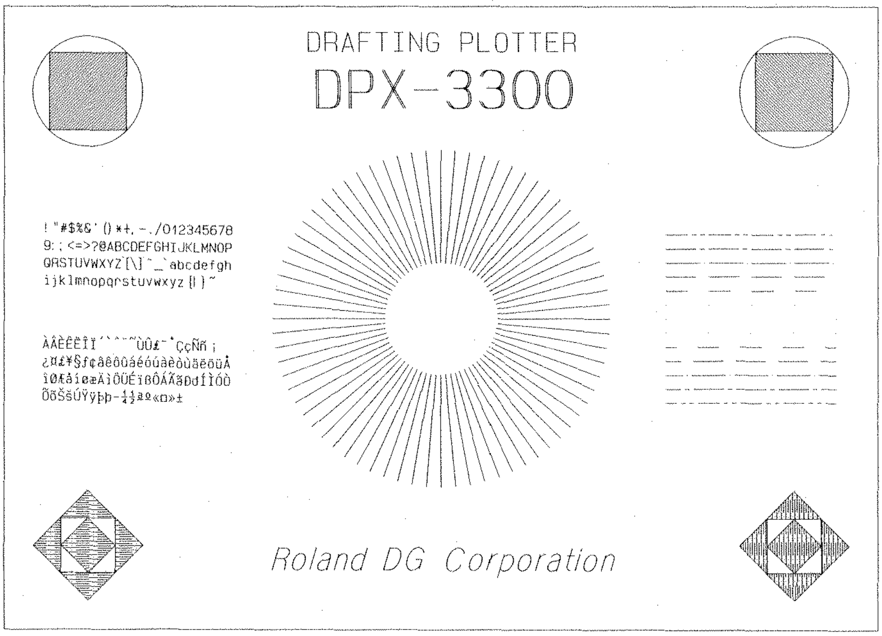

DRAFTING PLOTTER
DPX-3300
! "#$%&' ()*+,-./012345678
9:;<=>?@ABCDEFGHIJKLMNOP
QRSTUVWXYZ[\]^_`abcdefgh
ijklmnopqrstuvwxyz{|}~
ÀÂÈÊËÎÏ´`ˆ¨˜ÙÛ£¯˚ÇçÑñ¡
¿¤£¥§ƒ¢âêôûáéóúàèòùäëöüÅ
îØÆåíøæÄìÖÜÉïßÔÁÃãÐðÍÌÓÒ
ÕõŠšÚŸÿÞþ-¼½ªº«■»±
Roland DG Corporation

Fig. 2-15

You have just completed all the operations. It means that the DPX-3300 must operate properly.

EXPLANATION OF FUNCTIONS

3

3.1 CONTROL PANEL KEYS

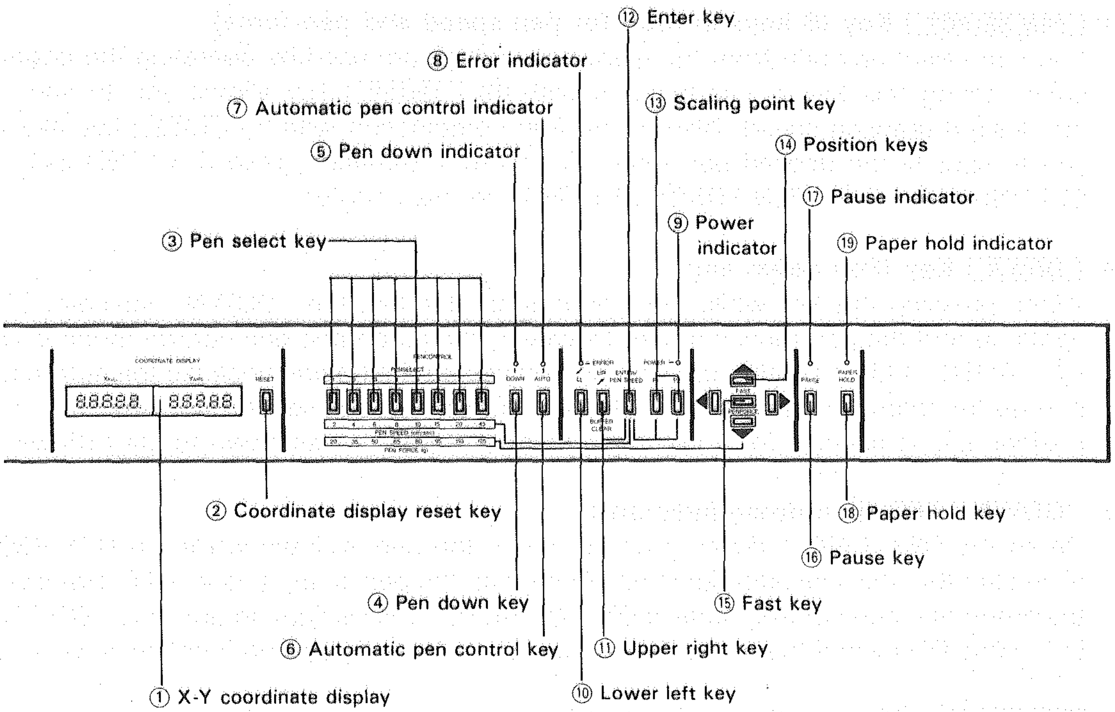

⑫ Enter key
⑧ Error indicator
⑦ Automatic pen control indicator
⑬ Scaling point key
⑤ Pen down indicator
⑭ Position keys
⑰ Pause indicator
⑨ Power indicator
③ Pen select key
⑲ Paper hold indicator
② Coordinate display reset key
⑱ Paper hold key
⑯ Pause key
④ Pen down key
⑮ Fast key
⑥ Automatic pen control key
⑪ Upper right key
① X-Y coordinate display
⑩ Lower left key

Fig. 3-1

① "COORDINATE DISPLAY" (X-Y Coordinate Display)

The X-Y coordinate display shows the pen position in the values of X-Y coordinates and also shows the coordinate values in the unit of mm by counting fractions over 1/2 as one and disregarding the rest of below the second decimal.

After the power is turned ON, the pen carriage moves to and stops at the upper right corner, where the X-Y coordinate display shows (0, 0). This is because the setting of the origin has not been done inside the DPX-3300 at this point. After inputting a drawing command or hitting a cursor key, a pen select key, etc., the DPX-3300 automatically sets the origin first and starts drawing. After the automatic setting of the origin, the X-Y coordinate display begins to show the current coordinates taking the coordinate origin as (0, 0).

② COORDINATE DISPLAY RESET Key

Pressing this key allows the display of the X-Y coordinate display to become zero for both X-axis and Y-axis. Whenever the COORDINATE DISPLAY RESET key is pressed, the X-Y coordinate display shows (0, 0) of X-Y coordinates as the position of a pen. However, this has no effect on the plotter operation.

③ PEN SELECT Key (8 keys in total for pen speed and pen force)

You can select any pen from the eight pens which are used by operating the control panel. Using this key in combination with ⑫ ENTER key allows you to specify the desired drawing speed. Also, using it in combination with ⑮ FAST key allows you to specify the desired pen force. For more information, read 3.3 "PEN SPEED SETTING" and 3.4 "PEN FORCE SETTING" in this chapter.

④ DOWN Key (Pen down key)

When pressing this key while the plotter is on standby, the "DOWN" indicator LED lights up and the pen moves down. However, the automatic pen control mode is ON (⑦ "AUTO" LED is lighting up), the pen moves up right away because the automatic pen-up function is in operation, while ⑤ "DOWN" LED is lighting up. After this, if a position key is pressed for a pen movement, the pen moves down to start drawing.

⑤ "DOWN" LED (Pen down indicator)

When the DPX-3300 is drawing and/or when the pen is down while the DPX-3300 is on standby, this indicator lights up. And when the pen is up, it lights OFF. However, the automatic pen control mode is ON (⑦ "AUTO" LED is lighting up), this "DOWN" LED lights ON even if the pen is up because the automatic pen-up function is working.

⑥ AUTO Key (Automatic pen control key)

Pressing this key allows for ON/OFF switching of the automatic pen control mode. For more information about automatic pen control, see 3.2 "INTELLIGENT FUNCTIONS OF PENS" in this chapter.

⑦ "AUTO" LED (Automatic pen control indicator)

When the automatic pen control mode is ON, this indicator lights up.

⑧ "ERROR" LED (Error indicator)

If an error occurs, this indicator lights up or flashes. For more information about kinds of errors and how to solve those errors, see 9.1 "ERRORS" in CHAPTER 9.

⑨ "POWER" LED (Power indicator)

When the power switch is turned ON, this indicator lights up.

⑩ LL Key (Lower left key)

Pressing this key allows the pen to return to the pen stock and the pen carriage to move to the lower left corner of the drawing board. At the same time, it releases an error.

⑪ UR Key (Upper right key)

Pressing this key allows the pen to return to the pen stock and the pen carriage to move to the upper right corner of the drawing board. The key is also used for paper replacement.
In addition to this, when ⑯ PAUSE key is pressed to stop drawing temporarily, pressing this UR key while pressing ⑫ ENTER key allows you to clear the I/O buffer. Therefore, it is used for the DPX-3300 to restart drawing again after solving troubles. For more information, see 5.3 ''I/O BUFFER'' in CHAPTER 5.

⑫ ENTER / PEN SPEED Key

This key is used in combination with other keys for setting of the scaling points P1 and P2 by operating the control panel, digitization of X-Y coordinates on the drawing board, clearing of the I/O buffer, changing of the pen speed, etc.

⑬ P1, P2 Keys (Scaling point keys)

If the P1 and P2 keys are pressed, the pen moves in the pen-up condition to the scaling points P1 and P2 you have set, respectively.
Also, these keys are used together with ⑫ ENTER key for setting scaling points manually. For more information, see 6.3.1 ''SETTING OF SCALING POINTS P1 AND P2'' in CHAPTER 6.

⑭ ◀, ▲, ▶, ▼ Keys (Position keys)

Pressing these position keys allows for four directional movements of a pen. With these keys, you can move the pen in each direction manually. Also, pressing the two keys next to each other simultaneously allows the pen to move on a slant.

⑮ FAST / PEN FORCE Key

Pressing this key together with one of ⑭ position keys simultaneously makes the pen to move faster than pressing only one position key. It is also used for setting the pen force from the control panel.

⑯ PAUSE Key

If this key is pressed once while the program is under execution, ⑰ ''PAUSE'' LED lights up and the pen carriage stops its movement temporarily. However, the pen carriage keeps moving until the execution of a command is completed. If the key is pressed once again, the pause condition is released and the ⑰ ''PAUSE'' LED lights OFF.

⑰ ''PAUSE'' LED (Pause indicator)

When the DPX-3300 is at pause, this indicator lights up.

⑱ PAPER HOLD Key

This is the key for adsorbing a plotter paper on the drawing board (electrostatic adsorption board). If the key is pressed, ⑲ ''PAPER HOLD'' LED above the key lights up. This means that a plotter paper is now fixedly adsorbed.

⑲ "PAPER HOLD" LED (Paper hold indicator)

When the electrostatic adsorption of the drawing board works, this indicator lights up.

The DPX-3300 has the following four capabilities as intelligent functions for pens.

- Pen attachment discrimination function
- Pen type discrimination function
- Automatic pen-return function
- Automatic pen-up function

The intelligent functions change their working conditions to some degree, depending on ON/OFF switching of the automatic pen control mode.
The automatic pen control mode is ON (''AUTO'' LED lights up) when the power is turned ON. However, you can turn it OFF by pressing the AUTO key on the control panel. (Accordingly the ''AUTO'' indicator LED lights off.)

3.2.1 Pen Attachment Discrimination Function

This function automatically discriminates the presence and absence of pens in the pen stock.
In case the automatic pen control mode is ON, and if the function cannot find the specified pen, it searches in sequence from the next number pen and select the first identified pen to draw.
In case the automatic pen control mode is OFF, the function does not perform pen replacement and works on drawing without pen replaced (regardless of when a pen is held or is not held by the pen carriage).
At a pen return, if a pen has already been in its own pen stock, the function searches in sequence from No. 1 pen stock to find an empty pen stock and returns the pen currently held to the first identified empty pen stock (regardless of when the automatic pen control mode is ON or OFF).

3.2.2 Pen Type Discrimination Function

Finishing quality of drawing greatly varies depending on the combination of a plotter paper and pen you have used. Particularly important, you must set a correct pen speed and pen force according to the type of a pen you want to use.
For this reason, the DPX-3300 has the function to automatically discriminate the type of a pen in use.
Remember: To make use of this function effectively, you must have labeled marker seals on the pens you want to use, depending on their types. The dedicated ''XD Series'' pens sold by Roland DG corp.'s have silver and black marker seals labeled on their tops, and so the discrimination function works to discriminate the pen types. (Although the water based fiber tipped pens and the ink pens have no marker seals labeled, the discrimination function still works to discriminate which pen is now in use.) The relations with the type of pens and markers are listed in Table 3-1 below.

Since a photosensor is used for the discrimination of pen types, strong external light directed to the photosensor may cause erroneous discrimination. For this reason, take at most care for the direct sun light form the windows, spot light and so forth to decide where and in which direction the DPX-3300 is set.

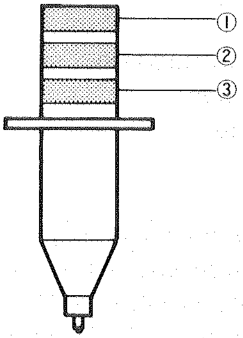


Fig. 3-2

Pen Type	Body	①	②	③	Remark
Water based fiber tipped pen	Gray	(Silver)	(Silver)	(Silver)	Non marker
Thick pen (water-based)	White	(Silver)	(Silver)	(Silver)	Non marker
Ceramic pen	Blue	Black	Silver	Silver	
Water based ball-point pen	Gray	Silver	Black	Silver	
Pressurized oil-based ball-point pen	Black	Black	Silver	Black	
Oil based fiber tipped pen for OHP film	Brown	Black	Black	Silver	
Ink pen	Black	(Black)	(Black)	(Black)	Non marker
Maintenance-free tubular ink pen	Black	(Black)	(Black)	(Black)	Non marker

Table 3-1

The discrimination function automatically sets a pen speed and pen force at proper values according to the types of pens you use. The relations between the types of pens, pen speeds and pen forces are listed in Table 3-2 below.
When the VS command for pen speed setting and the FS command for pen force setting are executed on a program, the automatic pen control has the first priority to make its value when the automatic pen control mode is ON. So there are no changes in the pen speed and pen force. After this, if you turn OFF the automatic pen control mode, the previous values of pen speed and pen force that have been set by those commands are set. If the command VS or FS is executed when the automatic pen control mode is OFF, the values of pen speed or pen force by those commands are set.
Regardless of when the automatic pen control mode is either ON or OFF, the settings of pen speed and pen force made on the control panel are effective. (See 3.3 ''PEN SPEED SETTING'' and 3.4 ''PEN FORCE SETTING''.)

Pen Type	Pen Speed	Pen Force
Water based fiber tipped pen	45 cm/sec	35 g
Thick pen (Water-based)	45 cm/sec	35 g
Ceramic pen	10 cm/sec	20 g
Water based ball-point pen	45 cm/sec	50 g
Pressurized oil-based ball-point pen	45 cm/sec	125 g
Oil based fiber tipped pen for OHP film	10 cm/sec	20 g
Ink pen	20 cm/sec	20 g
Maintenance-free tublar ink pen	20 cm/sec	20 g

Table 3-2

If pens labeled with no marker seals are used other than Roland DG corp.'s maintenance-free tubular plotter pens and water based fiber tipped pens, the discrimination function does not work properly. If you want to use such pens, set a correct pen speed and pen force for them, referring to 3.3 ''PEN SPEED SETTING'' and 3.4 ''PEN FORCE SETTING'' before the DPX-3300 starts drawing after turning ON the power.

3.2.3 Automatic Pen Return Function

If the DPX-3300 is left without any command sent for about one minute during drawing, the automatic pen return function works to automatically return the pen to the pen stock and put the cap to it in order to protect the pen tip against drying. If a drawing command is sent after a pen return, the pen carriage goes to hold the previously held pen, returns to the previous X-Y coordinates and starts the drawing specified by the command.

WARNING:

Remember: The arm suddenly moves in this function. As long as the power is ON, it is very dangerous if you place your hands or objects on the drawing board even when the pen is at rest. So, warn you not to do so.
Remember that this automatic pen return function is effective only when the automatic pen control mode is ON.

3.2.4 Automatic Pen-up Function

Leaving the carriage-held pen in the pen-down state for a long time without sending a command or without moving it with a panel key could cause a ink drop onto the plotter paper from the pen tip. To prevent such inconvenience, the DPX-3300 has the automatic pen-up function to automatically move up the pen if the pen is left down. At this time, the ''DOWN'' indicator LED lights up even if the pen is up.
Remember that this automatic pen-up function is effective only when the automatic pen control mode is ON.

3.3 PEN SPEED SETTING

The DPX-3300 holds a pen and automatically reads the marker labeled on that pen to make drawing at the pen speed best fit to that pen. Sometimes you may want to have a drawing with a new pen speed setting other than the automatically set pen speed, because only little ink is left and because you want to use pens with no markers. In such a case, you can also set a new pen speed from the control panel and/or with a command.

3.3.1 Setting On The Control Panel

Set pen speeds from the control panel with the following procedure.

① Press the [PAUSE] key to light up the PAUSE LED. Even during drawing, press the [PAUSE] key to stop the drawing temporarily.

② Press the [PEN SELECT] key so that the pen carriage holds the pen for which you want to change pen speed. When you want to change pen speeds for all pens, press the [LL] key so that the pen carriage does not hold any pen.

③ While pressing the [ENTER] key, press one of the eight [PEN SELECT] keys ①~⑧ for a pen speed change. The pen speed values set to each [PEN SELECT] key are listed in red below [PEN SELECT].

PEN SELECT No.	1	2	3	4	5	6	7	8
PEN SPEED (cm/sec)	2	4	6	8	10	15	20	45

Table 3-3

Irrespective of computer software, this method allows you to have setting on the plotter side alone. So, it is very convenient to use when you cannot change the program of commercially available computer software. Also, even on the way of drawing, you can change the pen speed by doing the above procedure after pressing the [PAUSE] key. So, when a drawing becomes thin in ink due to only little ink left, you can try to make the pen speed slow with this method for more visual clarity. This method is effective regardless of when the automatic pen control mode is either ON or OFF.

3.3.2 Setting On A Program

Using the pen speed setting command (VS) allows the DPX-3300 to draw while you are changing the pen speed on a program. For setting a pen speed with this command, you can change it by 1 cm/s in a range from 2 cm/s up to 45 cm/s.

However, when the automatic pen control mode is ON (''AUTO'' LED is ON), the automatic pen control mode has the first priority to make its value. So, the pen speed is not changed even if the VS command is sent.

If the VS command is executed when the automatic pen control mode is OFF, the pen speed specified by that command is set.

3.4 PEN FORCE SETTING

The DPX-3300 is able to control the pen force (that is, force with which a pen is pushed against a plotter paper on the drawing board). Pen force should be changed to the optimum value according to various factors such as types and weights of pens, types of plotter papers, setting angles of the plotter, pen speeds, the amount of ink in drawing, ambient temperature and humidity, etc. It is a best practice to set a pen force at the lightest value to a degree which the pen does not show scratchy drawing lines. Setting the pen force too heavy causes unfavorable conditions such as a quick use-up of ink, a quick wear-out of the pen tip, a tear-off of the plotter paper in the worst case and the like.

When the DPX-3300 holds a pen, it automatically reads the marker labeled on the pen to make drawing at the pen force best fit to that pen. Sometimes you may want to have a drawing with a new pen force setting other than the automatically set pen force, or when may you want to use pens labeled with no markers. In such a case, you can make fine adjustments to set the pen force with the following three ways.

3.4.1 Setting On The Control Panel

Set pen forces from the control panel with the following procedure.

① Press the PAUSE key to light up the PAUSE LED. Even during drawing, press the PAUSE key to stop the drawing temporarily.

② Press the PEN SELECT key so that the pen carriage holds the pen for which you want to change pen force. When you want to change pen forces for all pens, press the LL key so that the pen carriage does not hold any pen.

③ While pressing the FAST key, press one of the eight PEN SELECT keys ①—⑧ for a pen force change. The pen force values set to each PEN SELECT key are listed in blue below PEN SELECT.

This setting is effective regardless of whether the automatic pen control mode is ON or OFF.

PEN SELECT No.	1	2	3	4	5	6	7	8
PEN FORCE (g)	20	35	50	65	80	95	110	125

Table 3-4

3.4.2 Setting On A Program

Using the pen force setting command FS allows the DPX-3300 to draw while you are changing the pen force on a program. For setting a pen force by that command, you can set it at any eight steps in a range from 20g up to 125g.

However, when the automatic pen control mode is ON (''AUTO'' LED is ON), the automatic pen control mode has the first priority to make its value. So, the pen force is not changed even if the FS command is sent.

If the FS command is executed when the automatic pen control mode is OFF, the pen force specified by that command is set.

3.4.3 Fine Adjustments By The ''PEN FORCE'' Knob

As explained above, the adjustments of pen force depend on various factors such as setting angles of the DPX-3300, pen speeds, the type and weight of a pen, the amount of ink in drawing, the type of a pen in use, ambient temperature and humidity and so forth. Therefore, even if a pen force is set on a program and/or from the control panel or set by the automatic pen control function, you had better make fine adjustments for better pen force according to the actual drawing condition.

The ''PEN FORCE'' knob of the side panel on the side of the plotter body is used for fine adjustments of pen force. The adjustment range of the knob is about 15%. Turning the knob clockwise makes the pen force heavy and counterclockwise makes the pen force light.

The optimum pen force value means that a pen is able to keep drawing without scratchy lines at the lightest possible pen force. For better drawing, it is desirable to make re-adjustments of the pen force whenever setting and drawing conditions of pens are changed.

This method is effective regardless of when the automatic pen control mode is either ON or OFF.

3.5 LIST OF PANEL KEY FUNCTIONS

PANEL KEY	FUNCTION
COORDINATE DISPLAY RESET	Resets X-Y COORDINATE DISPLAY.
PEN SELECT (1)-(8)	Selects pens (1)-(8). (**)
DOWN	Moves pen up and down. (**)
AUTO	Turns automatic pen control mode ON/OFF.
LL	Moves pen to lower left. (**)
UR	Moves pen to upper right. (**)
P1, P2	Moves pen to P1 and P2. (*)
◀, ▲, ▶, ▼	Moves pen in each direction. (**)
PAUSE	Turns temporary stop ON/OFF.
PAPER HOLD	Turns electrostatic adsorption ON/OFF.
ENTER + P1, P2	Sets P1 and P2. (*)
ENTER + UR	Clears buffer. (**)
ENTER + PEN SELECT	Sets pen speeds. (***)
ENTER + POWER ON	Puts in self test mode.
FAST + ◀, ▲, ▶, ▼	Moves pen in each direction. (*)
FAST + PEN SELECT	Sets pen force. (***)
◀ + POWER ON	Puts in non-buffer mode.

Table-3-5

***Explanation of Table 3-5**

''A'' + ''B'' .... Indicates pressing ''B'' key while pressing ''A'' key.

''A'' + POWER ON ... Indicates turning power ON while pressing ''A'' key.

(*) .... Indicates effective only in manual mode. Manual mode means the condition that no data is sent from a computer and no data is in the I/O buffer.

(**) .... Indicates effective only in manual mode or in pause mode (''PAUSE'' LED is ON). That is, effective when the plotter is in no operation.

(***) .... Indicates effective only in pause mode (''PAUSE'' LED is ON).

If you use a plotting paper smaller than an ANSI-D size or ISO-A1 size paper, the DPX-3300 may make drawing both inside and outside the paper.
Some setting methods of paper sizes by the control panel are given below. Using these methods, you can set any maximum plotting area (paper size) only when a paper is placed at the lower left corner. Also, you can set paper sizes up to a hard-clip area (= longer side of ANSI-D × longer side of ISO-A1) even if the paper sizes you want to use are out of the standards.

① Turn OFF the power of the DPX-3300.
② Switch the DIP Switch 1- ⑦ according to paper sizes. OFF for ISO standard. ON for ANSI standard.
③ Turn ON the power of the DPX-3300.
④ Set a plotting paper at the lower left corner of the electrostatic adsorption board as shown in Fig. 3-3 and press the PAPER HOLD key ("PAPER HOLD" LED lights ON). Set ISO-A4 size, ISO-B5 size and ANSI-A size papers so that their narrow sides are directed to you or up. If the paper sizes you want to use are out of the standards, fit them to the lower left corner.
⑤ Press the PAUSE key. The "PAUSE" LED then lights ON.

ISO A Size

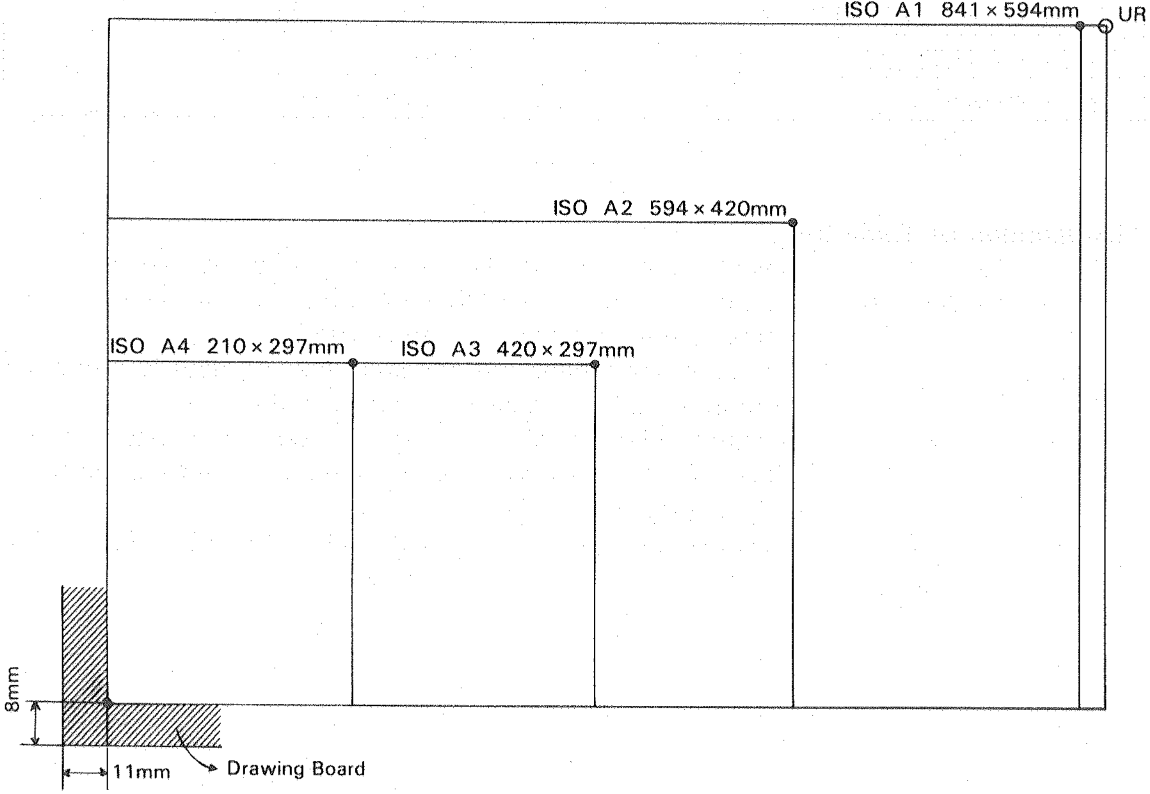


Fig. 3-3 (1)

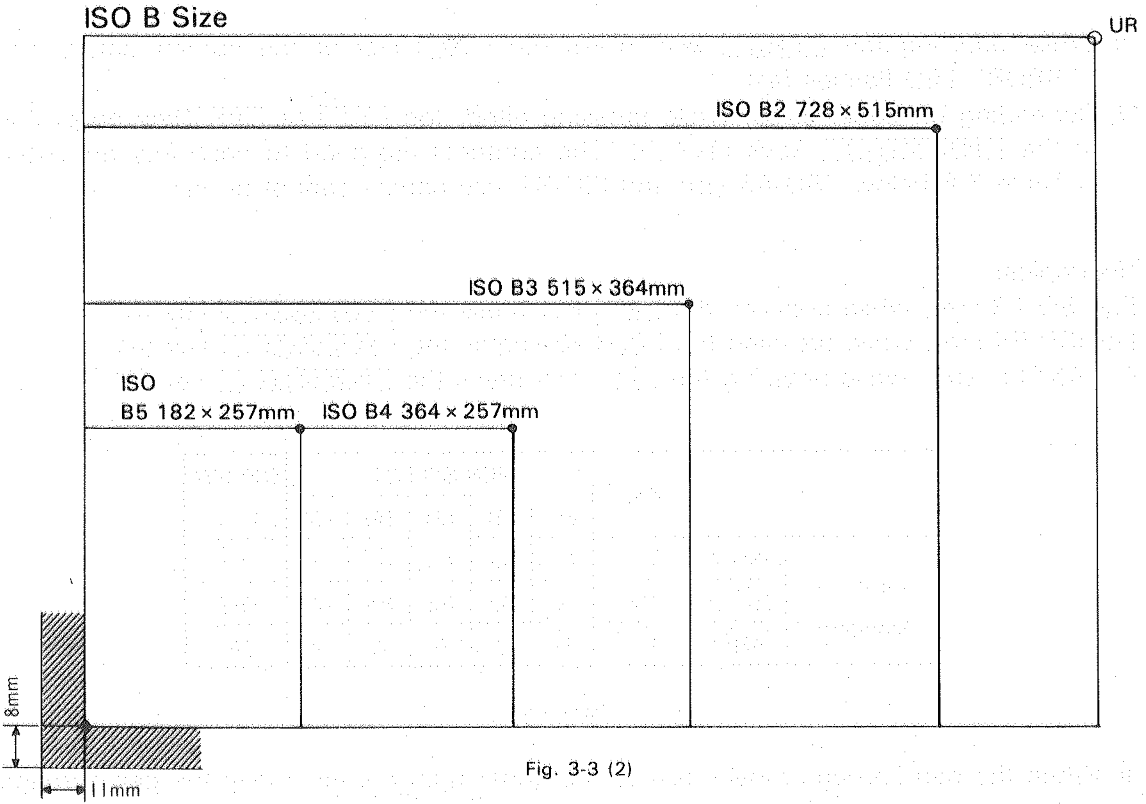

ISO B Size
UR
ISO B2 728 × 515mm
ISO B3 515 × 364mm
ISO
B5 182 × 257mm
ISO B4 364 × 257mm
8mm
11mm

Fig. 3-3 (2)

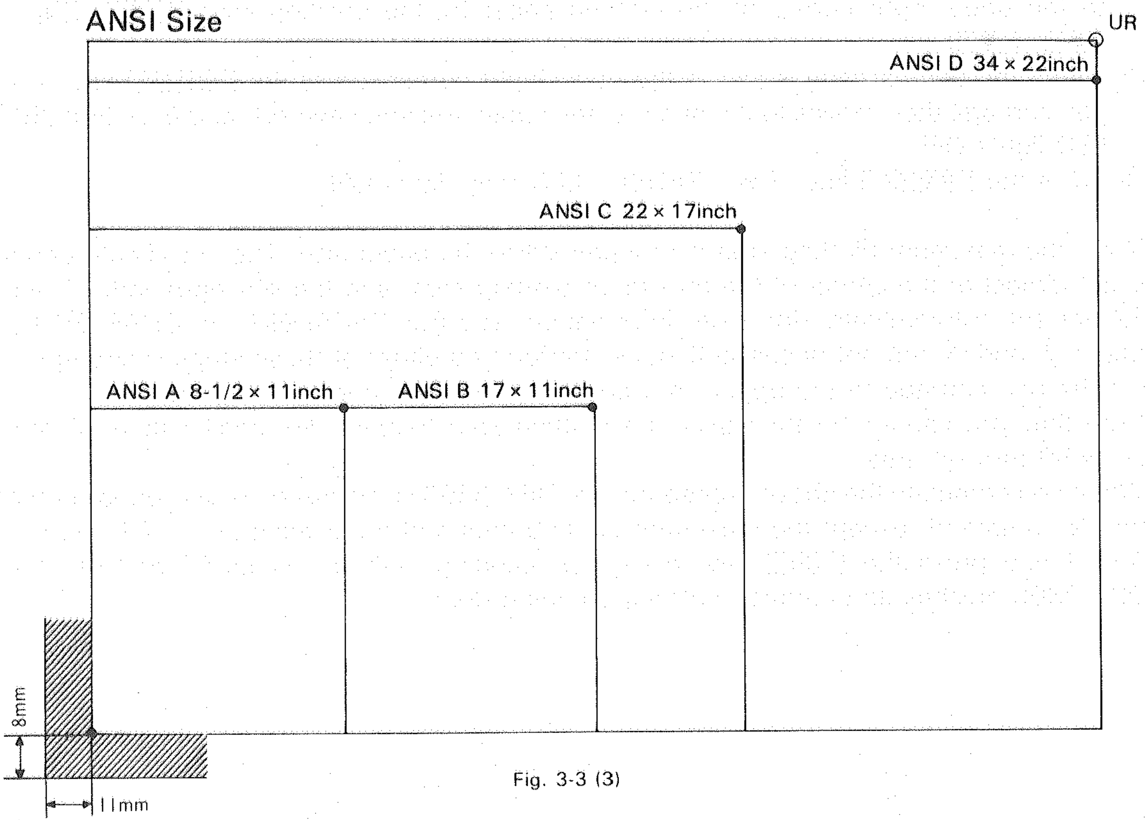

ANSI Size
UR
ANSI D 34 × 22inch
ANSI C 22 × 17inch
ANSI A 8-1/2 × 11inch
ANSI B 17 × 11inch
8mm
11mm

Fig. 3-3 (3)

⑥ While pressing the FAST key, press the P2 key of the control panel. The "ERROR" LED flashes fast.

⑦ Depending on paper sizes, while pressing either the P1 or P2 key press one of the PEN SELECT keys (1)~(5). The contents assigned to each key are listed in Table 3-6 below. ISO-A5 size and ISO-B1 size papers cannot be set.

(Examples)
For ISO-A3 size, while pressing the P1 key press the PEN SELECT key (3).
For ISO-B4 size, while pressing the P2 key press the PEN SELECT key (4).
For ANSI-B size, while pressing the P1 key press the PEN SELECT key (3).

		Key	PEN SELECT					DIP-SW
			(1)	(2)	(3)	(4)	(5)	1-⑦
Paper Standard	ISO A	P1	A1	A2	A3	A4	×	OFF
	ISO B	P2	×	B2	B3	B4	B5	OFF
	ANSI	P1	D	C	B	A	×	ON

Table 3-6

⑧ When the pen carriage moves just to the upper right corner, move the pen carriage to the upper right corner of the plotting paper by the position keys (◀, ▲, ▶, ▼).

⑨ When the pen carriage is just at the upper right corner, press the ENTER key. The pen carriage then moves to the origin of the paper size you have set, and the "ERROR" LED lights OFF.

⑩ Press the PAUSE key. The "PAUSE" LED then lights OFF.

Now, the maximum plotting area is properly set to the paper size. The coordinate origin is set almost at the center of the maximum plotting area, and the scaling points P1 and P2 are set automatically (for more information, see 6.3 "SCALING" in CHAPTER 6). Steps ⑦ and ⑧ are not necessarily done. Performing either of these steps is enough to set the pen carriage to the upper right corner of the maximum plotting area.
Note that you cannot set the maximum plotting area (paper size) smaller than 90 mm (x) × 50 mm (y) area.
When you complete the above procedure, the DPX-3300 is initialized just as you executed the IN command, except the maximum plotting area and the scaling points P1 and P2. And if you press the UR key, except proceeding with the steps ⑦ and ⑧, the DPX-3300 finishes its operation without anything done.

INFORMATION ABOUT PENS

4

Pens and plotter papers are obviously needed for drawing when the plotter is used. Particularly, pens have an important role in the drawing operation of the DPX-3300.

As optional pens for the DPX-3300, various kinds of pens are sold such as water based fiber tipped pen, pressurized oil-based ball-point pen, oil based fiber tipped pen, ink pen and maintenance-free tubular plotter pen. Pens other than ink pens cannot be filled with ink. Also, replaceable ball-points are available for pressurized oil-based ball-point pens. Referring to the instructions below, select the best fit pens in accordance with the drawing purpose and the types of plotting papers for use.

In the DPX-3300, the pen once returned to the pen stock is automatically put with a pen cap, and so the pen tip will never be dry for desirable writing during drawing. But this pen cap is provided for temporary protection against drying. When you decided not to use pens for a long time, always remove them from the pen stock and put the pen caps furnished with the pens to keep them in storage.
Remember: Particularly the ink pen ink is easy to dry and become solid at the pen tip. The DPX-3300 has been shipped with black pen caps attached to the pen stock. Other than these black pen caps, white and gray pen caps are furnished as accessories. Attach pen caps fit in type to each pen. For more information, see 2.5.1 ''Pen Cap Replacement'' in CHAPTER 2.

The pen speed and the pen force are shown at the beginning of each explanation. They are the optimum values for each pen and also the values that will be automatically set when the pen carriage holds each pen.

4.1.1 Water Based Fiber Tipped Pen (Pen speed: 45 cm/sec Pen force: 35 g)

This is the kind of a pen for the easiest use. It has good inking (or smooth ink running) to give high speed drawing. Also, because of good coloring, it is good for colorful illustrations. But the pen tip is made of plastic and so has a disadvantage to wear out gradually and becomes fat if keep using it for a long time.
Eight (black, red, blue, green, brown, purple, pink and orange) colors are available. There are two types of pen tips (0.3 mm and 0.6 mm).

Product Number	Pen tip	Description
XD-4SPA-WN(G)	0.3 mm	4 pie. in black
XD-4SPB-WN(G)	0.3 mm	Black, red, blue and green in each
XD-4SPC-WN(G)	0.3 mm	Brown, purple, pink and orange in each
XD-4SPA-WW(G)	0.6 mm	4 pie. in black
XD-4SPB-WW(G)	0.6 mm	Black, red, blue and green in each
XD-4SPC-WW(G)	0.6 mm	Brown, purple, pink and orange in each

Table 4-1

4.1.2 Thick pen (water-based) (Pen speed: 45 cm/sec Pen force: 35 g)

Although the nature of this pen is the same as that of a water-based pen, its tip size is 2 mm and so is designed for thicker drawing lines. Where clear and uniform drawing lines are required and also when ink is short, sufficient performance many not be given under the above pen speed and pen force. In such a case, change the pen speed to 15 cm/sec and the pen force to somewhere between 95 g and 110 g by referring to ''3.3 Pen speed setting'' and ''3.4 Pen force setting'' in CHAPTER 3.

Product Number	Pen tip	Description
XD-4SPA-WB(G)	2.0 mm	4 black
XD-4SPB-WB(G)	2.0 mm	black, red, blue and green each
XD-4SPC-WB(G)	2.0 mm	orange, pink, brown and purple each
XD-4SPD-WB(G)	2.0 mm	4 red
XD-4SPE-WB(G)	2.0 mm	4 blue
XD-4SPF-WB(G)	2.0 mm	4 green
XD-4SPG-WB(G)	2.0 mm	4 orange
XD-4SPH-WB(G)	2.0 mm	4 pink
XD-4SPI-WB(G)	2.0 mm	4 brown
XD-4SPJ-WB(G)	2.0 mm	4 violet

Table 4-2

4.1.3 Ceramic pen (Pen speed: 10 cm/sec Pen force: 20 g)

Because the pen tip is protected with the use of ceramics, the line size is kept constant from the beginning of drawing to the use-up of ink. Three sizes of pen tips (0.2 mm, 0.4 mm and 0.6 mm) are prepared, so that they can be used for simple, general drawing. The ink is water based and four (black, red, blue and green) colors in total are available.

The pen tip is small in diameter and delicate.

Remember: Particularly when using 0.2 mm-tip ceramic pens, do not drop or hit their tips, otherwise they are broken.

Product Number	Pen tip	Description
XD-4SPA-CN	0.2 mm	4 Black
XD-4SPB-CN	0.2 mm	Black, red, blue and green in each
XD-4SPC-CN	0.2 mm	Brown, violet, pink and orange in each
XD-4SPD-CN	0.2 mm	4 Red
XD-4SPE-CN	0.2 mm	4 Blue
XD-4SPF-CN	0.2 mm	4 Green
XD-4SPA-CM	0.4 mm	4 Black
XD-4SPB-CM	0.4 mm	Black, red, blue and green in each
XD-4SPC-CM	0.4 mm	Brown, violet, pink and orange in each
XD-4SPD-CM	0.4 mm	4 Red
XD-4SPE-CM	0.4 mm	4 Blue
XD-4SPF-CM	0.4 mm	4 Green
XD-4SPA-CW	0.6 mm	4 Black
XD-4SPB-CW	0.6 mm	Black, red, blue and green in each
XD-4SPC-CW	0.6 mm	Brown, violet, pink and orange in each

Table 4-3

4.1.4 Water Based Ball-Point Pen (Pen speed: 45 cm/sec Pen force: 50 g)

This is the kind of a water based ball-point pen for thin lines and relatively suited for high speed drawing. Four colors (black, red, blue and green) are available. The pen tip is made relatively strong and so is easy to use, but do not hit and drop it. Setting the pen speed too slow could cause bad ink running.

Product Number	Description	
XD-4SPA-BP	For thin line	4 Black
XD-4SPB-BP	For thin line	Black, red, blue and green in each

Table 4-4

4.1.5 Pressurized Oil-Based Ball-Point pen (Pen speed: 45 cm/sec Pen force: 125 g)

This is the kind of a special ball-point pen designed with gas filled in the ball-point so that the proper amount of ink is gradually pushed out of the ball-point. The size of lines is very constant to allow for continuous thin lines for high speed drawing. The ink is oil based, and four (black, red, blue and green) color variations are available as replaceable ball-points.
This pressurized oil-based ball-point pen is used with its holder and replaceable ball-point as a set.

Product Number	Description
XD-BPH	Pressurized oil-based ball-point pen holder with a black ball-point
XD-3M-BLK	3 Black replacable ball-point
XD-3M-RED	3 Red replacable ball-point
XD-3M-BLU	3 Blue replacable ball-point
XD-3M-GRN	3 Green replacable ball-point

Table 4-5

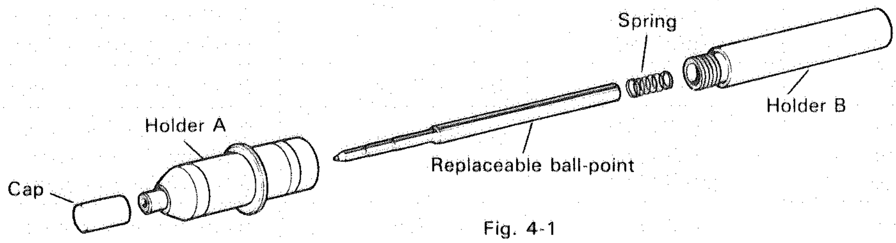


Fig. 4-1

The holder is constructed as shown in Fig. 4-1. When replacing the ball-point, turn the holder B counterclockwise for replacement. At this time, be careful not to lose a spring housed inside the holder B.

4.1.6 Oil Based Fiber Tipped Pen (Pen speed: 10 cm/sec Pen force: 20 g)

This is the kind of an oil based fiber tipped pen used for drawing on a film (OHP film) for an overhead projector. There are many types of OHP films. If a pen does not match with an OHP film, the ink is blurred, the drawing lines become fat, inks in different color next to each other are mixed into a dirty color, and color irregularities occurs at filling a figure. When selecting OHP films, make sure of its matching to a pen.
We have sold optional Overhead Projector Transparency Kit (XY-TRK) dedicated for the DPX-3300. Please purchase to use it as much as possible. Eight pen colors (black, red, blue, green, brown, yellow, orange and purple) are available. Their tips are 0.3 mm and 0.6 mm in two types. For filling a figure, a 0.6 mm tip is useful.

Product Number	Pen tip	Description
XD-4SPA-ON	0.3 mm	4 Black
XD-4SPB-ON	0.3 mm	Black, Red, Blue, Green in each
XD-4SPC-ON	0.3 mm	Brown, Yellow, Orange, Violet in each
XD-4SPA-OW	0.6 mm	4 Black
XD-4SPB-OW	0.6 mm	Black, Red, Blue, Green in each
XD-4SPC-OW	0.6 mm	Brown, Yellow, Orange, Violet in each

Table 4-6

4.1.7 Ink Pen (Pen speed: 20 cm/sec Pen force: 20 g)

[from STAEDTLER of West Germany]

This is the kind of a pen for high quality drawing. As compared to other pens, it gives sharp, clear lines and has no change in line size and ink thickness during long-time drawing. But its construction is very delicate and so requires a full knowledge and good care for its handling and maintenance. If it is the first time to use, read 4.2 ''HOW TO HANDLE INK PENS'' carefully in order to draw out the optimum ink pen performance.

Also, we have sold the short-type ink pen holders (ST-PH) for the DXY-Series. Since these ink pen holders cannot be automatically set with proper pen speed and pen force, set proper values for them by operating the control panel.

Product Number	STAEDTLER Number	Description	
ST-LPH	75PL07H2	Ink Pen Holder Set	Only Pen Holder Set
ST-P25 ST-P35 ST-P50	750PL2CF 750PL3CF 750PL5CF	Ink Pen Tips for Paper	0.25 for Paper in each 0.35 for Paper in each 0.50 for Paper in each
ST-INK	745R-9	Ink for Paper	Black for Paper in each
ST-P25F ST-P35F ST-P50F	757PL2CK 757PL3CF 757PL5CF	Ink Pen Tips for Film	0.25 for Film in each 0.35 for Film in each 0.50 for Film in each
ST-INKF	748PLF	Ink for Film	Black for Film in each

KF-INK			Erasable ink with eraser in each

Table 4-6

4.1.8 Maintenance-free Tubular Plotter Pen (Pen speed: 20 cm/sec Pen force: 20 g)

[from Rotring-werke Riepe KG.]

The feature of this pen is almost the same as the ink pen and suited for high quality drawing. Since it is of maintenance-free type, no ink filling and maintenance are required. For detail, refer 4.3 ''HOW TO HANDLE MAINTENANCE-FREE TUBLAR PLOTTER PENS.''

Product Number	ROTRING Number	Description
XD-4RTH	741926	4 Pen holder for MPP
XD-4RTS	749986	4 Black (For use only with pen holder XD-4RTH) 0.25 mm, 0.35 mm, 0.5 mm, 0.7 mm (1 each)
XD-4RT25	743217	4 Black (For use only with pen holder XD-4RTH) 0.25 mm
XD-4RT35	743317	4 Black (For use only with pen holder XD-4RTH) 0.35 mm
XD-4RT50	743517	4 Black (For use only with pen holder XD-4RTH) 0.50 mm

Table 4-7

4.2.1 Cautions For Ink Pen Handling

- For drawing on high-quality plotter papers, select ink pen tips specially made for papers and inks such as ST-P25, ST-P35, ST-P50, ST-INK and KF-INK. Also, for drawing on films, select ink pen tips specially made for films and inks such as ST-P25F, ST-P35F, ST-P50F, ST-INKF and KF-INK. Using ink pen tips and inks inappropriate for the types of plotter papers you use may cause not only bad drawing effect but also pen tip damage.

- The ink pens largely depend for their drawing performance on the types of plotter papers and films you use.

- For inks, always select to use the dedicated inks ST-INK, ST-INKF and KF-INK. These dedicated inks are prepared especially for the DPX-3300 and differ from commercially available inks for general (hand-writing) ink pens.
  Remember: Using such commercially available inks causes bad ink running, and so do not use them.

- A white pen cap for the ink pen is furnished with the plotter as accessory. Replace the pen cap in the pen stock with it. (See 2.5.1 ''Pen Cap Replacement'' in CHAPTER 2.)

- If ink is dropped to stay in the pen cap, clear lines cannot be drawn. Clean the surface of the pen cap.

- Do not apply strong impact to the ink pens, as for example, dropping them from a high position. Particularly, take care of handling the pen tips.

- Avoid using the ink pens in a place of severe temperature changes. Using them in such a place causes ink leakage.

- Do not disassemble the ink pen tips.

- Making the pen speed too fast may cause scratchy drawing lines, particularly for small pen tips.

4.2.2 Assembly And Ink Filling

The ink pen holder set (ST-LPH) is constructed with the component parts as shown in Fig. 4-2. Try to disassemble it once, but do not disassemble the ink pen tip.
If a STAEDTLER 75PL07HZ is used for the ink pen holder, attach an accessory silver sticker as shown in Fig. 4-3.

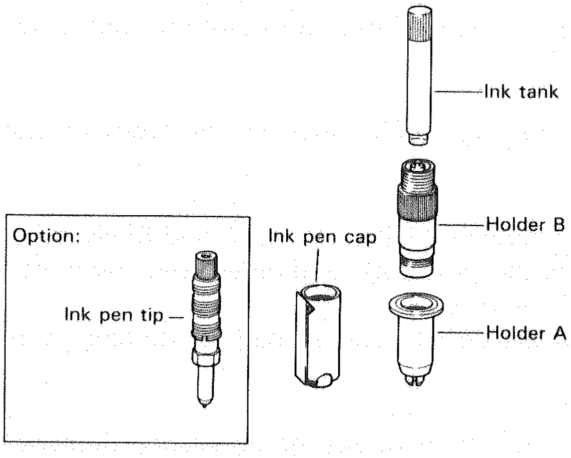


Fig. 4-2

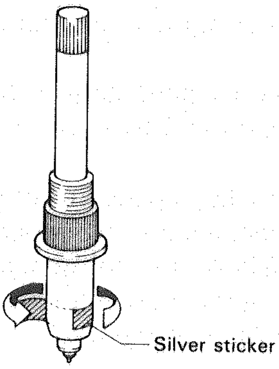


Fig. 4-3

After disassembling the pen holder, take the pen tip out of the plastic case and screw it into the holder B. One end of the plastic case in which the pen tip is stored is made a hex. nut wrench. Using this hex. nut wrench, secure the pen tip firmly.

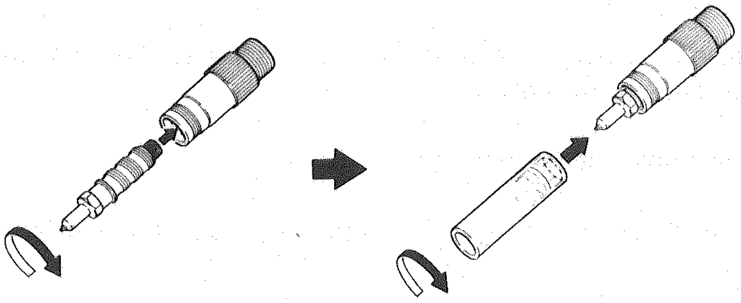


Fig. 4-4

Fill with ink. For a new ink, cut its filling end mouth with a knife. If filling too much ink, ink will flow out when attaching the pen tip to the holder B. Do not fill ink no more than the step of the ink tank.

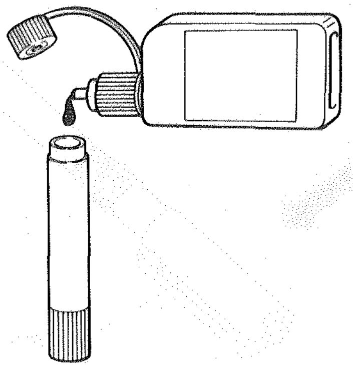


Fig. 4-5

Insert the holder B slowly into the ink tank and shake them strongly once with the pen tip directed downward.

Have a trial writing on a paper or film once to make sure whether or not the ink runs smoothly. If the ink does not run, shake the pen strongly once more. For a trial writing, hold the pen upright and do it gently using the same paper as the one for drawing. After making sure of smooth ink running, screw securely the holder B into which the pen tip and ink tank were assembled into the holder A.

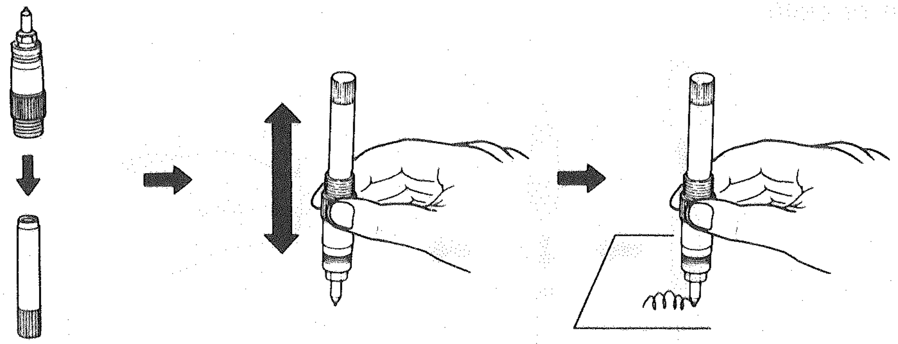


Fig. 4-6

Now, you have just completed the ink pen preparation.
Before attaching to the pen stock, have a trial writing for each pen in order to make sure of smooth ink running whenever pen attachment is performed.

If the pens are decided not to use for a long time after use, disassemble and wash them with water so that no ink is left. And wipe them off with a dry cloth and put them in storage. If the ink is left in the ink tank, the ink at the pen tip may become solid for further proper use. So, take care of it. Also at storage, put the ink pen caps instead of the holder A for protection of the pen tip.

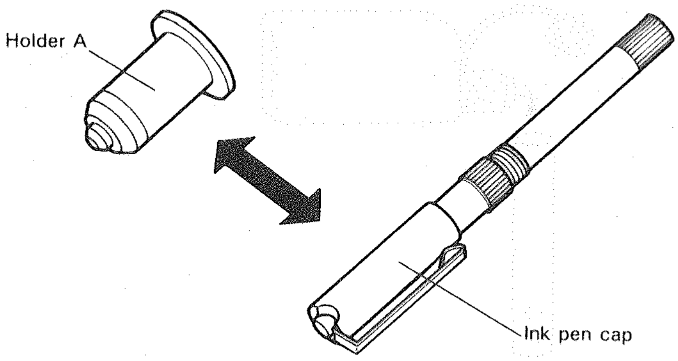


Fig. 4-7

4.2.3 Ink Refilling

Refill the ink tank with ink as early as possible. Too little ink left may cause ink leakage due to the possible air expansion inside the ink tank.

Remove the pens from the pen stock. Directing the pen tip upward, screw the holders A and B slowly out of the ink tank. Since the ink is still left inside the holder B, allow the ink to flow down in such a manner that the pen is hit very gently over a soft paper or cloth.

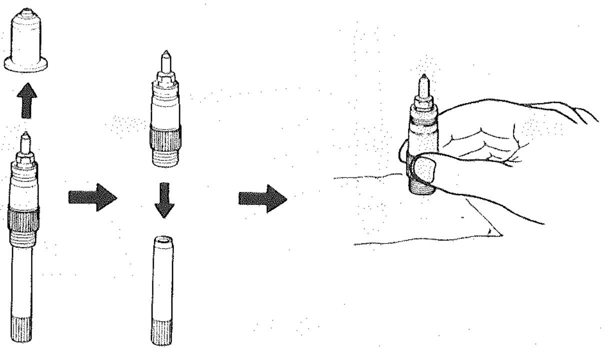


Fig. 4-8

Refill the ink tank with ink. Be careful not to fill with too much ink. If filling too much ink, the ink will flow out when assembling the holder B.
Next, insert the holder B slowly into the ink tank. If inserting quickly, the pressure inside the holders suddenly changes and the ink flows out of the pen tip edge. So, take care of this assembly.

4.2.4 How To Put Ink Pens In Storage

- Drawing within an hour

  It is acceptable to have ink pens set in the pen stock. But before a start, test them for a hand writing.

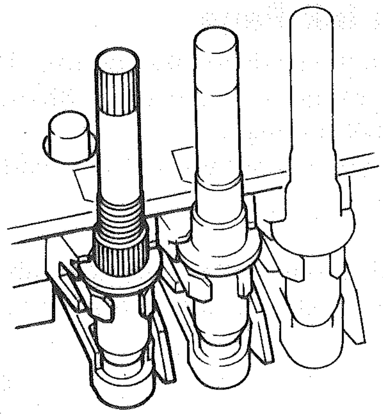


Fig. 4-9

- Using again tomorrow

  Remove the ink pens from the pen stock, remove the holder A and put the pen caps instead of it, and then leave the pen tip upward. Shaking the pen gently at a start of drawing allows it to be usable again.

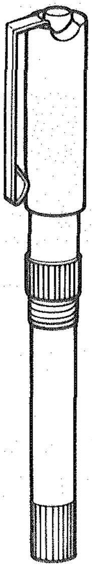


Fig. 4-10

- Leaving more than a day
  The pen tips are very costly. Not to allow for an ink stop, remove the pen tip from the holders and always wash it cleanly.

4.2.5 How To Wash Ink Pens

Washing methods vary with the kinds of inks you use. This section covers the instruction of how to wash the ink pens in the case where the Roland DG corp.'s inks ST-INK, ST-INKF and KF-INK are used.
Remember: There are inks you cannot wash if you inadvertently used inks other than the Roland DG corp.'s inks.

- With an inverse method of the assembly described above, remove the pen tip from the holder and discard the ink still left inside the ink tank.

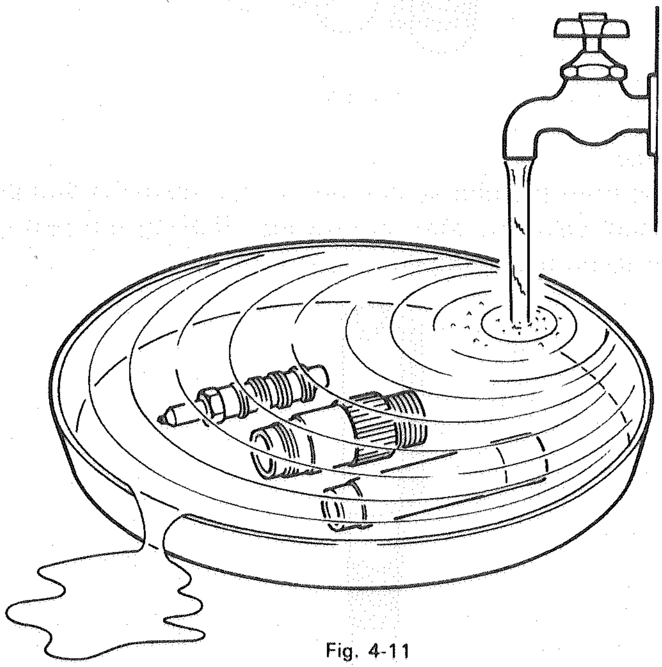


Fig. 4-11

- Shake to wash the pen tip, holder and ink tank in flowing water. Using an ultrasonic washer allows for an effective cleaning. If ink no longer flows out, it means the cleaning is complete.
  Remember: Leaving ink inside the ink tank causes an ink stop. After washing, wipe off water and keep them in storage.

4.2.6 Causes And Countermeasures Against An Ink Stop

- Leaving with ink left
  (Countermeasure) Referring to 4.2.4 ''How To Put The Ink Pens In Storage'', remember a proper leaving time.

- Filthy pen tip with dirt, fiber, etc
  (Countermeasure) As a sign, drawing lines become scratchy. In such a case, stop the DPX-3300 and see 4.2.5 ''How To Wash Ink Pens''.

- Mismatching of the ink pen tip and the ink you used
  (Countermeasure) Wash them by referring to 4.2.5 ''How To Wash Ink Pens'' and use the Roland DG corp.'s inks ST-INK, ST-INKF and KF-INK.

- In case of an ink stop
  Do not shake carelessly to move the needle. Particularly for the needle of a very thin tip ink pen, an ultra-thin wire is used. Careless shaking may cause a bend of the needle. If an ink stop occurs, dip the whole pen tip in the following pen cleaners in a day or two without disassembling, the needle becomes easy to move. After this, wash it cleanly with water by following the procedure described above so that no pen cleaner is left at the pen tip.
  Remember: Leaving pen cleaner at the pen tip causes a drawing failure.

  Pen Cleaners (Ask for a stationer or a drafting goods shop)
  Manufacturer : STAEDTLER
  Product name : Mars water based ink pen cleaner
  Product No. : 74600 for 100 cc
  74625 for 250 cc

A maintenance-free tubular plotter pen has the feature of giving high quality drawing. And because of its maintenance-free feature there are no needs to do ink filling and maintenance.

White pen caps for the pens are furnished with the DPX-3300. Replace the pen caps in the pen stock of the plotter with them. (See 2.5.1 ''Pen Cap Replacement''.) If ink is left in the pen stock, clear lines cannot be drawn. Clean the surface of the pen cap.

Insert the pen tip with its cap attached into a cartridge. Press the cap to open the ink running mouth of the cartridge.

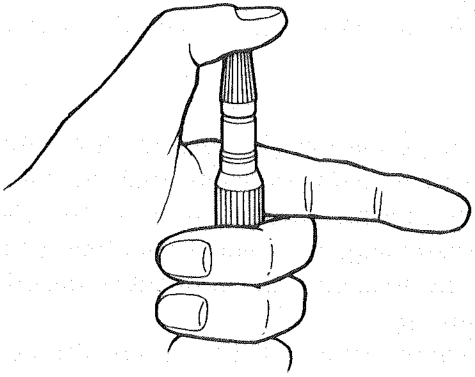


Fig. 4-12

Remove the cap and keep hitting the bottom of the cartridge until ink becomes visible directing the pen tip downward. If an ink flow is seen, make a trial hand writing. If an ink flow is not seen, hit the bottom of the cartridge again. **For the use of a maintenance-free tubular plotter pen, secure it to the pen holder (XD-4RTH) firmly. If a ROTRING 741926 is used, attach an accessory silver sticker as shown in Fig. 4-14.**

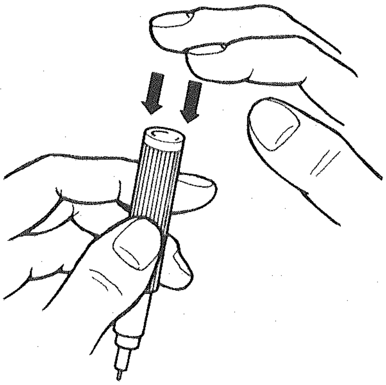


Fig. 4-13

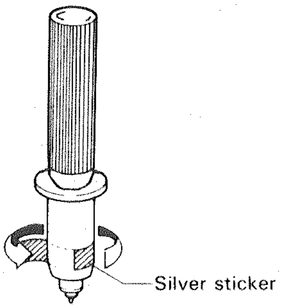


Fig. 4-14

If the maintenance-free tubular plotter pen is decided not to use for a long time, put it with its accessory pen cap and keep them in storage with the pen tip directed upward.

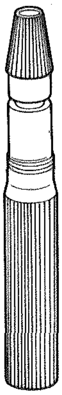


Fig. 4-15

For a re-use of the maintenance-free tubular plotter pen, hit a few times its bottom with the pen tip directed upward in a flat place. But do not add shaking to this hitting. Remove the cap and then make a trial hand writing for reuse.

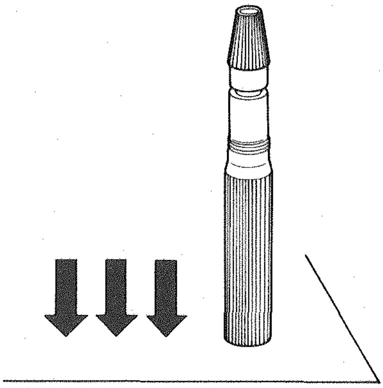
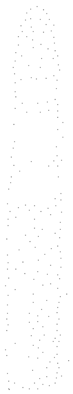
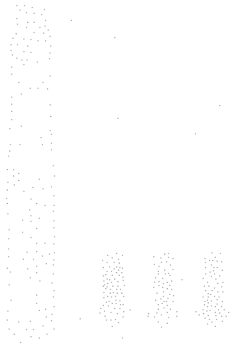


Fig. 4-16

[illegible]



[illegible]



CONNECTION TO A COMPUTER

5

There are the following two ways to make the connection of the DPX-3300 to a computer.

Parallel Interface (Centronics)
Serial Interface (RS-232C)

The DPX-3300 has the two interfaces above. Depending on the types of computer interfaces or in case where commercially available software is used, there is the need to select the types of interfaces appropriate for each software you want to use. Also, according to this connection, the DPX-3300 and a computer must be set properly.

Explanations of how to connect and how to set according to each connection are given below.

5-1 PARALLEL CONNECTION (Centronics)

As an interface for a printer itself, a Parallel Interface is provided with most of the computers. This interface has almost standardized specifications and requires less user-side setting for an easy connection. However, it has the data transmission system in which data are sent only in one direction from a computer to a plotter. Therefore, the capabilities of the DPX-3300 cannot be utilized at a maximum in some cases.

5.1.1 Cable And Connection

Connect the printer connector of a computer and the PARALLEL IN of the DPX-3300 (see Fig. 5-1) with a cable. For the cable, see Table 5-1 to select a cable appropriate for the computer you want to use.

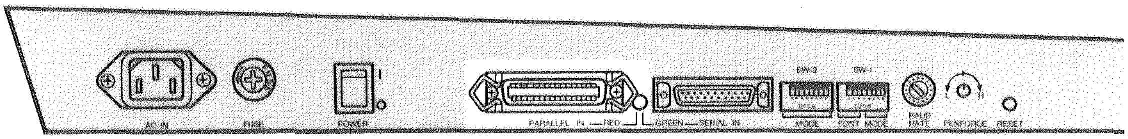

AC IN
FUSE
POWER
PARALLEL IN
RED
GREEN
SERIAL IN
SW-2
SW-1
MODE
FONT
MODE
BAUD RATE
L
H
PENFORCE
RESET

Fig. 5-1

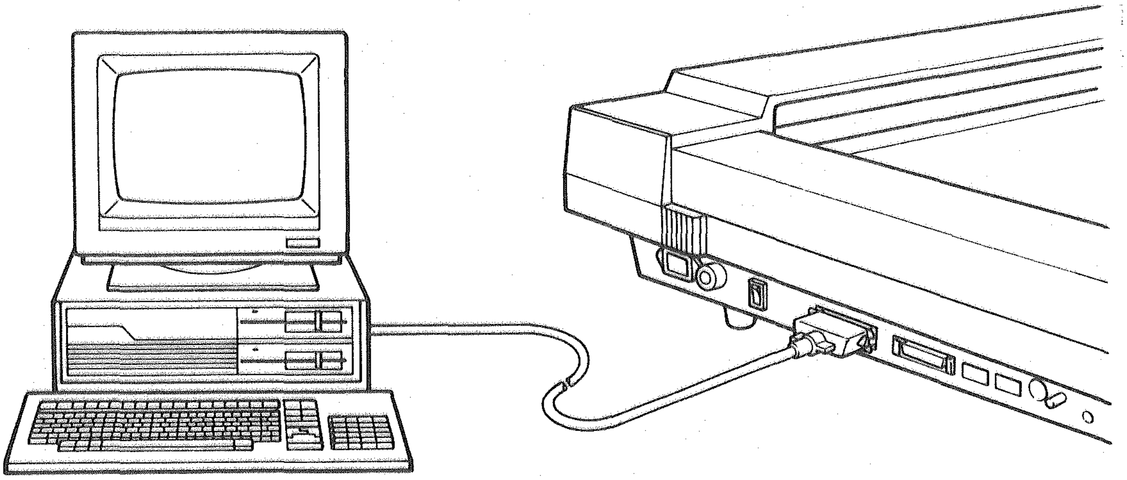


Fig. 5-2

Option	Model No.	Compatible models
Connecting cables: For parallel interface (Centronics)	XY-IPC	IBM PC (5150), PC/XT (5160), PC/AT (5170)
Parallel interface card:	XY-APL	APPLE II, IIe (cable included)

- APPLE II, IIe are trademarks of Apple computer inc.
- IBM PC, PC/XT, PC/AT are trademarks of International Business Machine Corporation

Table 5-1

5.1.2 Setting A Computer

If you want to use commercially available software for which you are only required to select either a Parallel Interface (Centronics) or Serial Interface (RS-232C), select a Parallel Interface for easy handling.
If you want to make your own program, you must use the format with which data are output to the Parallel Interface (the way of data transmission varies with the types of computers). For more information, read the operation manual for your computer.

5.1.3 Setting The Plotter

① Turn OFF the power switch on the side panel of the DPX-3300.

② Turn ON only the DIP Switch 1- ⑦ ("SW-1") and turn OFF all of the DIP Switch 2 ("SW-2"). See Fig. 5-3. It does not matter where the BAUD RATE switch is set.
For the selection of a Parallel Interface is turning OFF the DIP Switch 1- ⑤. Turning ON only the DIP Switch 1- ⑦ for the PARALLEL IN, ANSI-D size for plotter papers, ANSI ASCII (I) for character fonts. For more information, read 10.1 "LIST OF DIP SWITCH SETTING" in CHAPTER 10.
Remember: **For the DIP Switch setting, you must switch the DIP Switch after turning OFF the power, because the DPX-3300 reads the DIP Switch setting at the power turned ON.**

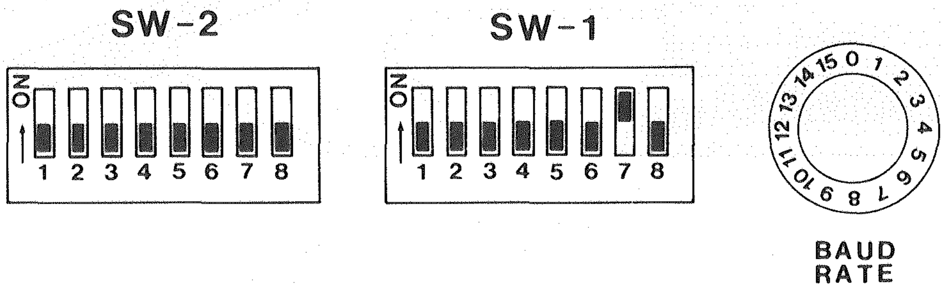


Fig. 5-3

③ Turn ON the power switch.

④ Make sure that the SERIAL/PARALLEL indicator LED is lighting up in "red". This indicator LED is located on the left side of the PARALLEL IN on the side panel of the DPX-3300.

Now, you have just completed the cable connection and the computer and plotter settings. The DPX-3300 is ready for a proper operation. If it cannot operate properly, read again the operation manual for your software and computer carefully.
Also, simple examples of connection checks with BASIC are given in 9.2.1 "Checking Examples Of Connection To Computer" in CHAPTER 9. Do these checks if the DPX-3300 cannot operate properly.

5.2 SERIAL CONNECTION (RS-232C)

5.2.1 Cable And Connection

Connect an RS-232C interface of the computer and the SERIAL IN of the DPX-3300 (see Fig. 5-4) with a cable. For the cable, see Table 5-2 to select a cable appropriate for your computer.

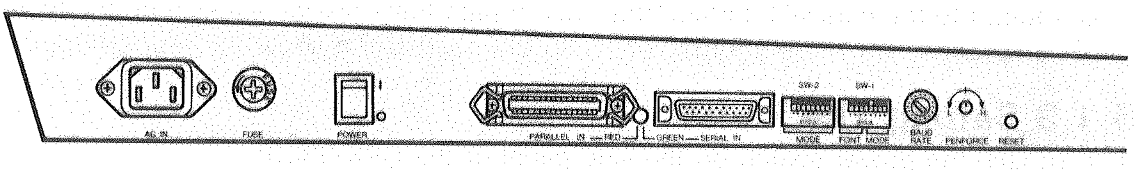

AC IN
FUSE
POWER
PARALLEL IN
RED
GREEN
SERIAL IN
SW-2
SW-1
MODE
FONT MODE
BAUD RATE
PENFORCE
RESET

Fig. 5-4

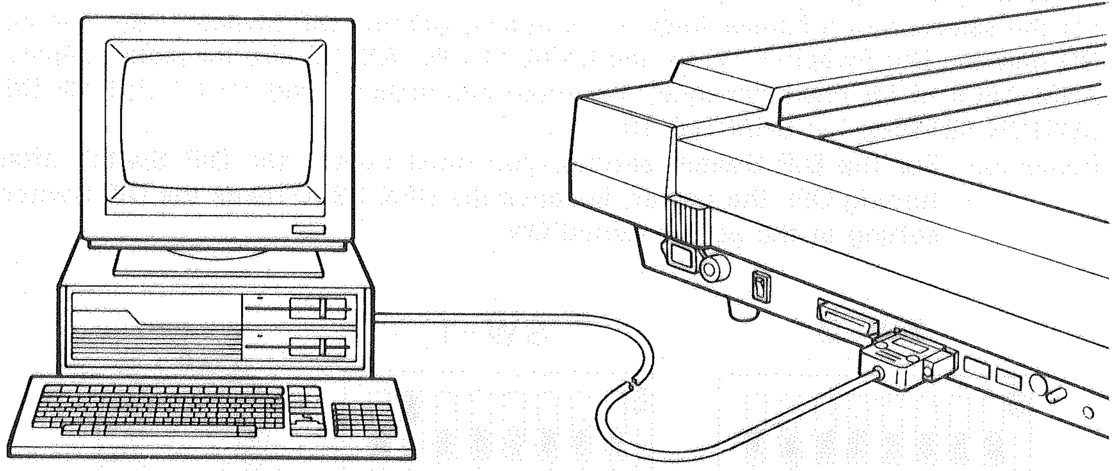


Fig. 5-5

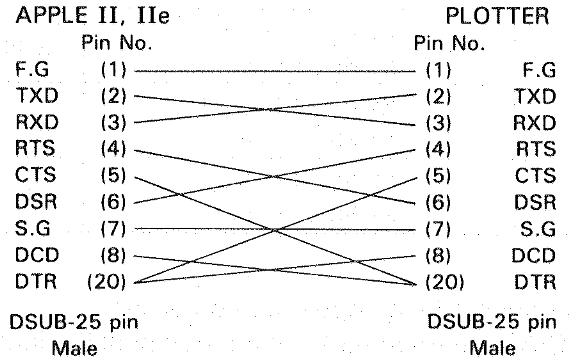
Option	Model No.	Compatible models
Connecting cables: For serial interface (RS-232C)	XY-RS-11 (1.5 m) XY-RS-31 (3 m)	APPLE II, IIe
	XY-RS-13 (1.5 m) XY-RS-33 (3 m)	IBM PC (5150), PC/XT (5160)
	XY-RS-14 (1.5 m) XY-RS-34 (3 m)	IBM PC/AT (5170)

- APPLE II, IIe are trademarks of Apple computer inc.
- IBM PC, PC/XT, PC/AT are trademarks of International Business Machine Corporation.

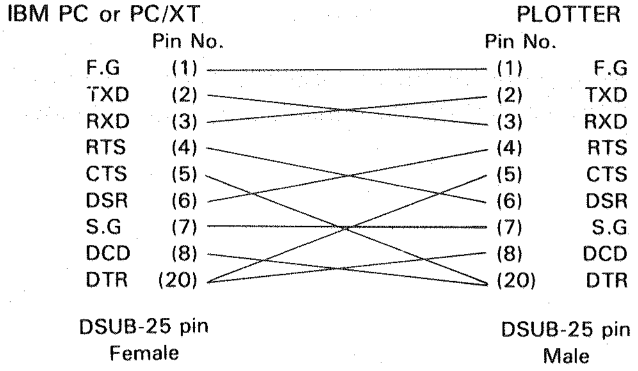
Table 5-2

The internal wiring connections of the Roland DG corp.'s XY-RS-11, XY-RS-31, XY-RS-13, XY-RS-33, XT-RS-14, XY-RS-34 cable are as shown below.

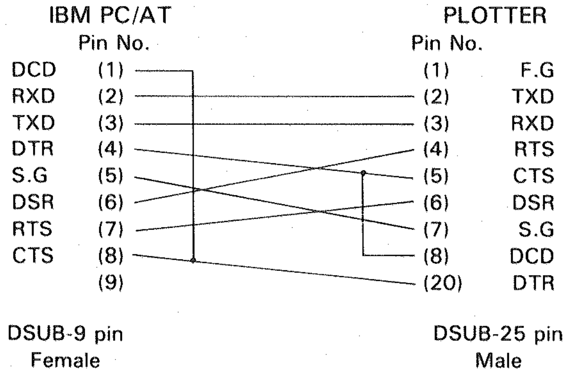
XY-RS-11, XY-RS-31 CABLE


APPLE II, IIe
PLOTTER
Pin No.
Pin No.
F.G (1)
TXD (2)
RXD (3)
RTS (4)
CTS (5)
DSR (6)
S.G (7)
DCD (8)
DTR (20)
(1) F.G
(2) TXD
(3) RXD
(4) RTS
(5) CTS
(6) DSR
(7) S.G
(8) DCD
(20) DTR
DSUB-25 pin
Male
DSUB-25 pin
Male

XY-RS-13, XY-RS-33 CABLE


IBM PC or PC/XT
PLOTTER
Pin No.
Pin No.
F.G (1)
TXD (2)
RXD (3)
RTS (4)
CTS (5)
DSR (6)
S.G (7)
DCD (8)
DTR (20)
(1) F.G
(2) TXD
(3) RXD
(4) RTS
(5) CTS
(6) DSR
(7) S.G
(8) DCD
(20) DTR
DSUB-25 pin
Female
DSUB-25 pin
Male

XY-RS-14, XY-RS-34 CABLE


IBM PC/AT
PLOTTER
Pin No.
Pin No.
DCD (1)
RXD (2)
TXD (3)
DTR (4)
S.G (5)
DSR (6)
RTS (7)
CTS (8)
(9)
(1) F.G
(2) TXD
(3) RXD
(4) RTS
(5) CTS
(6) DSR
(7) S.G
(8) DCD
(20) DTR
DSUB-9 pin
Female
DSUB-25 pin
Male

5.2.2 Setting A Computer

For the Serial Interface (RS-232C), there is the need to change the communication protocol of the computer (software) to match with those of the DPX-3300. The protocol described here includes the following conditions:

- Baud Rate
- Parity Check (Odd, Even, Non)
- Data Bit Length (7 Data Bits, 8 Data Bits)
- Stop Bit Length (1 Stop Bit, 2 Stop Bits)

The DPX-3300 has the following communication protocol although set in parallel connection at the time of its shipping. This protocol is set when the DIP Switch 1-⑤ is turned ON.

Baud Rate	9600
Parity Check	Non
Data Bit Length	8 Bits
Stop Bit Length	1 Bit

If commercially available software specifies the protocol of RS-232C, see the operation manual of the software and set the DPX-3300 with the following instructions.

If the specified protocol differs from the initial settings of the DPX-3300 described above, see 10.1 ''LIST OF DIP SWITCH SETTINGS'' in CHAPTER 10 to change only different conditions.

If commercially available software does not specify the protocol of RS-232C, read the operation manual for the computer or the software and change the protocol of the computer to match with the initial setting described above.

As the ways of setting the RS-232C of the computer, you can set the computer's DIP switch, an interface card or the memory switch.

Remember: If you want to make your own program, you must change the communication protocol of the computer to match with that of the DPX-3300.

Remember: For BASIC, you must give the format with which data are output to the RS-232C (SERIAL) interface. See the sections of ''OPEN'', ''PRINT #'', etc., of BASIC because instruction sentences vary with the types of computers. For more information, read the operation manual for your computer.

5.2.3 Setting The Plotter

① Turn OFF the power switch of the DPX-3300.

② Turn ON the DIP Switch 1- ⑤ and ⑦ by hitting them upward. (Remember: You must do this because they have been turned OFF at the time of shipping.)

Also, at the time of shipping, plotting papers and character fonts have been set at ANSI-D size and ANSI ASCII (I), respectively. And **the baud rate, the data bits, the stop bit and the parity check have been set at 9600 baud, 8 bits, 1 bit and non,** respectively. For settings other than these, see Fig. 5-6 to set the DIP Switch 1 (''SW-1'') and the DIP Switch 2 (''SW-2'') properly. (See 10.1 ''LIST OF DIP SWITCH SETTINGS'' in CHAPTER 10.)

Remember: **For the DIP Switch setting, you must switch the DIP Switches after turning OFF the power, because the DPX-3300 reads the DIP Switch setting at the time of the power turned ON.**

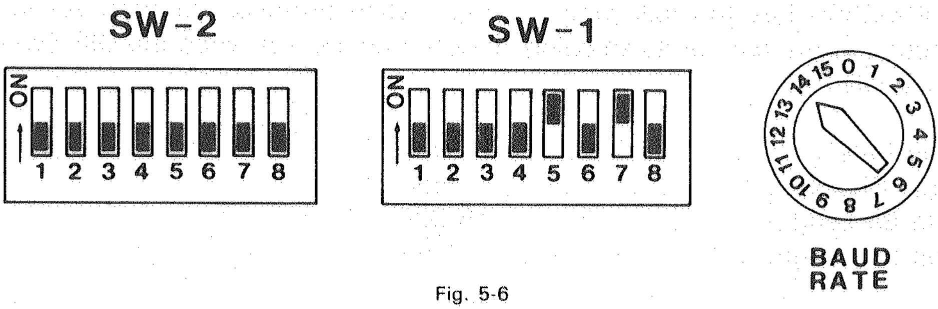


Fig. 5-6

③ Turn ON the power switch.

④ Make sure that the SERIAL/PARALLEL indicator LED is lighting up in ''green''. This indicator LED is located on the left side of the SERIAL IN on the side panel of the DPX-3300.

Now, you have just completed the cable connection and the computer and plotter settings. The DPX-3300 is ready for a proper operation. If it cannot operate properly, read again the operation manuals of the software and the computer carefully.

Also, simple examples of the connection checks with BASIC are given in 9.2.1 ''Checking Examples Of Connection To Computer'' in CHAPTER 9. If the DPX-3300 cannot operate properly, do these checks.

5.3 INFORMATION ABOUT THE I/O BUFFER

The DPX-3300 has its operation speed considerably slower than the computer processing speed. If the DPX-3300 receives a piece of data whenever one processing is completed, the computer cannot finish its program until the DPX-3300 completes its all processing. Because of this, the DPX-3300 has a 1K byte I/O buffer. It can draw while storing in this buffer the data sent from the computer. Even when the DPX-3300 is still in operation, the computer sends all the data to the I/O buffer and finishes all the processing for the DPX-3300. Therefore, the waiting time of the computer can be shortened.
If a Serial Connector is used for the connection to a computer, the capacity of the I/O buffer can be expanded up to 15K bytes. For more information, see ''ESC.T command'' of 8.4.2 ''Status Commands'' in CHAPTER 8.

Although the I/O buffer is useful for shortening the working time of the computer, it may give some inconvenience described below.

(1) On the way of drawing, you stopped the program of the computer because you found out a drawing failure, but the DPX-3300 did not stop drawing.

(2) If an error occurred in operation with your own program, it is not easy to find out the cause of that error.

As countermeasures against those inconvenience, the I/O buffer has the following two functions.

5.3.1 Buffer Clear Function

The inconvenience (1) above is caused by the fact that the DPX-3300 is drawing with the data in the buffer even if it is not receiving any data sent from the computer. To solve this problem, the plotter buffer needs to be cleared. When you want to stop the drawing operation, first, **press the PAUSE key** of the control panel to stop the drawing. (At this point, the data still remains in the buffer. Here, if you press the PAUSE key once more, the drawing starts again.) To clear the buffer, **while pressing the ENTER key of the control panel press the UR key.**

5.3.2 Non-Buffer Mode

It is difficult to find out the cause of such an error described in the inconvenience (2) above, because the DPX-3300 does not stop drawing immediately after the computer stops its processing due to the error. For such an occasion, the DPX-3300 has the mode so as to disable the buffer for further operation.
This is called the ''Non-Buffer Mode''. For correcting the program, turn OFF the power switch once. And, **while pressing the ◄ key of the control panel turn ON the power switch** to turn ON the ''Non-Buffer Mode''. In this mode, the DPX-3300 stops drawing at almost the same time when the computer stops its operation.

RD-GL II COMMAND

6

6.1 GENERAL DESCRIPTION OF THE RD-GL II

6.1.1 Classification Of The RD-GL II

The RD-GL II consists of 75 commands and are broadly classified into the following seven commands:

- INITIALIZATION command for setting the DPX-3300 at the initialize.
- SCALING & WINDOWING command for scaling and windowing.
- PEN CONTROL command for pen-up and -down action, drawing, pen movement, pen replacement, pen speed setting.
- ENHANCEMENT DRAWING command for drawing instructions.
- LABELING command about the drawing of characters.
- OUTPUT command for requiring the data output from the DPX-3300.
- DIGITIZE command when used as a digitizer.

The OUTPUT and DIGITIZE commands are effective only if a RS-232C (Serial) interface is used for the connection of the DPX-3300 to a computer. For the actual drawing, these commands are combined for use to make a program. With regard to the functions of each command, the detailed explanations are given in CHAPTER 7 ''DESCRIPTION OF THE RD-GL II COMMAND''.

6.1.2 Formats For The RD-GL II

The instructions for sending the RD-GL II from a computer to the DPX-3300 are divided into the following four sections:

- Command
- Parameters
- Delimiters
- Terminator

A typical format is shown below.

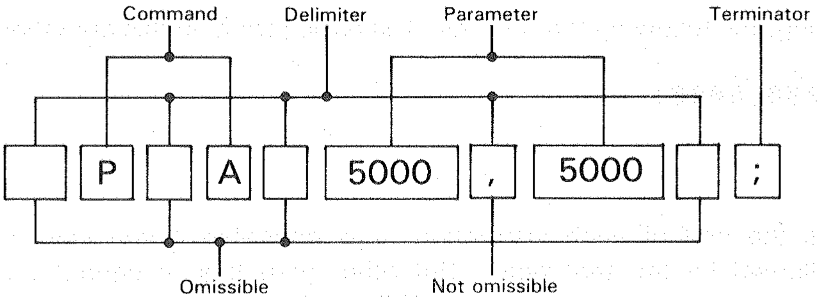


Fig. 6-1

- Command:

It is made up with two alphabets and instructs the DPX-3300 how to operate. The format in Fig. 6-1 indicates that the DPX-3300 moves to the coordinates specified by the parameters followed by the PA command .

- Parameters:

They can be coordinate values and characters that each command requires. The example in Fig. 6-1 indicates that the pen moves to the coordinates (5000, 5000). Depending on each command, parameters have different meaning. There are three types of commands: One without parameter, second requiring parameter and third with omissible parameter.

The allowable range of parameters varies from one command to another. Also, the "+" symbol of a numerical parameter is omissible. If parameter is omitted from a command with omissible parameter, the default value is set.

- Delimiters:

They are used as separations between a command and a parameter and between a parameter and a parameter. If you key in a command and a parameter and also a parameter and a parameter in continuation for one command, the DPX-3300 cannot understand which is one separate parameter, especially when you key in two parameters in continuation. To avoid this, delimiters are used as separation.

For delimiters, either a " " space or a "," comma can be used.

You can omit a delimiter between a command and a parameter because the DPX-3300 is able to discriminate them, but a delimiter between a parameter and a parameter cannot be omitted. Also, any number of delimiters can be used in any place. For example, you can write as follows:

```
P,A,5000,5000;
PA 5000 5000;
PA5000,5000;
PA5000 5000;
```

For easy reading, the following format is used as basic format in this operation manual.

```
PA 5000,5000;
```

- Terminator:

This indicates the end of each instruction. It is omissible if you key in the next command followed by the terminator. But other than this, it cannot be omitted. Usually a ";" semicolon is used. Besides, ETX (CHR$ (3)) is used as label terminator for the LB command (character drawing) because the DPX-3300 discriminate a ";" semicolon as a character.

6.1.3 How To Send The RD-GL II

When you want to send the format of Fig. 6-1 from a computer to the DPX-3300 using BASIC, you can choose either a Parallel Interface or a Serial Interface and write either of the following typical formats:

`LPRINT "PA 5000,5000;"`	Parallel Interface)
`PRINT #1,"PA 5000,5000;"`	Serial Interface)

Remember: For the serial connection, you must have first opened the RS-232C port by using the "OPEN" statement of your computer.

Also, you can change the parameters. For example, if you want to change the following parameters into variables,

```
100  LPRINT "PA 1000,2000;"
```

you can write them as follows:

```
10   X=1000
20   Y=2000
100  LPRINT "PA";X;",";Y;";"
```

Also, you can key in the line 100 as follows:

`100 LPRINT "PA";X;" ";Y;";"`	Use a space " " instead of a comma ",".
`100 LPRINT "PA";X,Y;";"`	Separate variables by a comma.
`100 LPRINT "PA"X,Y";"`	Omit semicolons ";" between the command and variables.

Furthermore, you can key in character parameters as follows:

```
10   B$="ABCDabcd"
100  LPRINT "LB";B$;CHR$(3)
```

ABCDabcd

Fig. 6-2

```
10   X=1000
20   Y=2000
100  LPRINT "LB";X;Y;CHR$(3)
```

1000 2000

Fig. 6-3

However, these character parameters vary with the types of computers and BASIC. For more information, see the operation manuals for your computer and BASIC.

6.2.1 Coordinate System And Maximum Plotting Area

As shown in Fig. 6-4, the coordinate system has X-axis for the horizontal direction and Y-axis for the vertical direction. And it indicates the coordinate values of X-axis and Y-axis like (1000, 2000) when indicating one specific point on the plane surface.

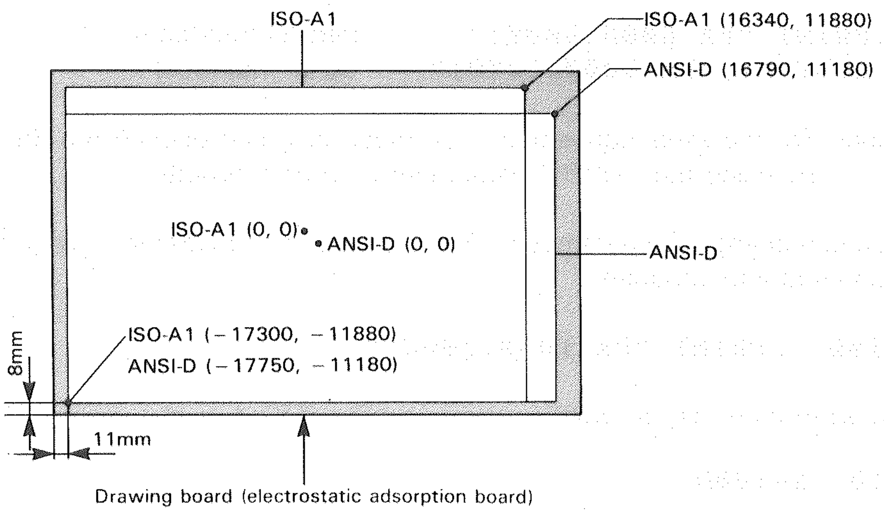


Fig. 6-4

The maximum plotting area (whole area in which drawing can be done) varies from a plotting paper to another. ANSI-D and ISO-A1 in Fig. 6-4 represents the sizes of plotting papers. Switching these paper sizes can be done by setting the DIP Switch 1-⑦. (For more information, see 10.1 "LIST OF DIP SWITCH SETTINGS" in CHAPTER 10.) The maximum plotting area is the same as the sizes of each paper as shown in Table 6-1, and drawing can be done over the entire paper area.
Also, using the paper size setting functions (descried in 3.6 "SETTING FUNCTIONS FOR PAPER SIZES" in CHAPTER 3), you can change the maximum plotting area up to the limit of pen carriage movements including ANSI-D and ISO-A1 sizes.

Paper	Size	Lower left	Upper right	PI default value	P2 default value
ISO AI	**841mm×594mm**	**(−17300, −11880)**	**(16340, 11880)**	**(−15540, −11080)**	**(15540, 11080)**
ISO A2	594mm×420mm	(−12360, −8400)	(11400, 8400)	(−10600, −7600)	(10600, 7600)
ISO A3	420mm×297mm	(−8880, −5940)	(7920, 5940)	(−7120, −5140)	(7120, 5140)
ISO A4	210mm×297mm	(−4680, −5940)	(3720, 5940)	(−2920, −5140)	(2920, 5140)
ISO B2	728mm×515mm	(−15040, −10300)	(14080, 10300)	(−13280, −9500)	(13280, 9500)
ISO B3	515mm×364mm	(−10780, −7280)	(9820, 7280)	(−9020, −6480)	(9020, 6480)
ISO B4	364mm×257mm	(−7760, −5140)	(6800, 5140)	(−6000, −4340)	(6000, 4340)
ISO B5	182mm×257mm	(−4120, −5140)	(3160, 5140)	(−2360, −4340)	(2360, 4340)
ANSI D	**34in.×22in.**	**(−17750, −11180)**	**(16790, 11180)**	**(−15990, −10380)**	**(15990, 10380)**
ANSI C	22in.×17in.	(−11660, −8640)	(10700, 8640)	(−9900, −7840)	(9900, 7840)
ANSI B	17in.×11in.	(−9120, −5590)	(8160, 5590)	(−7360, −4790)	(7360, 4790)
ANSI A	8'1/2in.×11in.	(−4800, −5590)	(3840, 5590)	(−3040, −4790)	(3040, 4790)

Table 6-1

6.2.2 Plotter Coordinate System

The coordinate system can be classified into two: plotter coordinate system and user coordinate system. Here, the coordinate system inherent in the DPX-3300 is explained. User coordinate system will be explained later on.

The plotter coordinate system is a coordinate system set at initialization and has been predetermined by the DPX-3300. So, you cannot change the coordinate unit and its origin using commands and so forth.
As shown in Fig. 6-4, the plotting area varies in size from a paper to another.
The coordinate origin is almost at the center of the drawing board. In the plotter coordinate system, **1 coordinate unit per plotter = 0.025 mm**. If you want to specify 1 mm, you specify 40 plotter coordinate units for the actual drawing (0.025 mm × 40 = 1 mm).

6.2.3 User Coordinate System

User coordinate system is the coordinate system you can use to set any optional coordinate origin and coordinate unit with respect to the plotter coordinate system. Once you set user coordinate system, the coordinate parameters of a command follow the user coordinate system. (For more information, see 6.3 ''SCALING''.)
You can set optional coordinate units, but usable values as coordinates are limited to the following range:

$-(2^{26}-1) \sim +(2^{26}-1)$

Remember: There are coordinate values that come out of the allowable parameter range. If you specify such coordinate values, an error occurs. When setting user coordinate values, you must specify them so that a plotting area does not come out of the allowable parameter range.

6.3 SCALING

Setting user coordinate values to the DPX-3300 is called ''scaling''. Scaling allows you to set, contract and expand coordinate units according to your purpose. Coordinates as parameters of a command follow the plotter coordinate system until they are scaled. After scaling is completed, they follow the user coordinates system to tell the DPX-3300 to draw.

6.3.1 Setting Scaling Points P1 And P2

The scaling points P1 and P2 are the reference points for scaling. You set them at any points within a plotting area. Scaling can be done by setting P1 and P2 at any points and executing the SC command that determines the coordinate values of each point. Note that scaling is not completed at the stage of setting the scaling points P1 and P2, and their coordinate values are still in the plotter coordinate system. There are the following three setting methods of the scaling points P1 and P2.

- Setting from the control panel

  Move the pen to any point using position keys (◀, ▲, ▶, ▼) and **while pressing the ENTER key press the P1 key** to set P1 position. Also, **while pressing the ENTER key press the P2 key** to set P2 position.

  If you set only P1 position, P2 position automatically moves to set at the same distant point as the P1 has moved. It is also possible to set P1 position so that P2 position comes out of the plotting area.

  By pressing either P1 or P2 key, you can check to see the positions of P1 and P2 that have been set when the pen moved. If P2 position is out of a plotting area, the pen moves in the direction of which P2 position has been set and stops at the boundary of the plotting area.

- Setting by the paper size setting functions

  If you set a maximum plotting area using the paper size setting functions, the positions of P1 and P2 are set inside the maximum plotting are as shown in Fig. 6-5. (For more information, see 3.6 ''SETTING FUNCTIONS FOR PAPER SIZES'' in CHAPTER 3.)

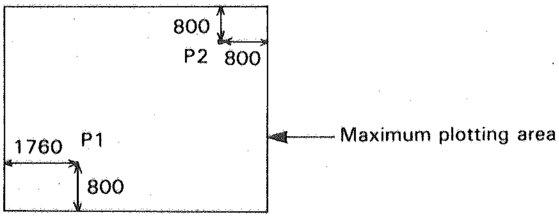


Fig. 6-5

- Setting By IP command

Use of the IP command allows you to set the positions of P1 and P2. For example, if you send instructions below,

```
"IP -4000,-2500,4000,2500;"
```

P1 is set at (−4000, −2500) and P2 at (4000, 2500).

Remember: At this time, the coordinate values of the parameters must have been in the plotter coordinate system. Although the coordinate system is in the user coordinate system when the scaling is performed again, the parameter values are still in the plotter coordinate system.

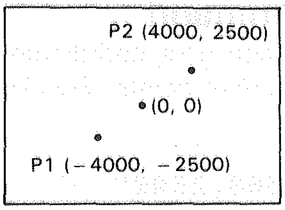


Fig. 6-6

Like setting on the control panel, setting only P1 position by the IP command, P2 position automatically moves to set at the same distant point as the P1 has moved. For example, after executing the instructions above to set P1 and P2 positions, if you send the following instructions,

```
"IP 0,0;"
```

P1 is set at (0, 0) and P2 at (8000, 5000).

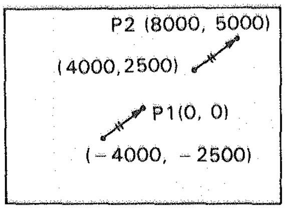


Fig. 6-7

The default values of P1 and P2 are shown in Table 6-2. For setting the default values by the IP command, see "IP Command" in CHAPTER 7 "DESCRIPTION OF THE RD-GL II COMMAND".

DIP SW 1- ⑦	P1	P2
OFF (ISO A1)	(−15540, −11080)	(15540, 11080)
ON (ANSI D)	(−15990, −10380)	(15990, 10380)

Table 6-2

6.3.2 Scaling By SC Command

The SC command determines each user coordinate value of the scaling points P1 and P2 you have set at any optional points. For example, if you send instructions below,

```
"IP -4000,-2500,4000,2500"
"SC 0,1,0,1;"
```

P1 position or the plotter coordinates (−4000, −2500) becomes the user coordinates (0, 0). And P2 position or the plotter coordinate (4000, 2500) becomes the user coordinates (1, 1). (Note: The sequence of keying in the SC command's parameters differs from that of the IP command's parameters.

Of course, you can set the user coordinate values outside the P1 and P2 as shown in Fig. 6-8. For further drawing, the coordinate values follows the user coordinate system.

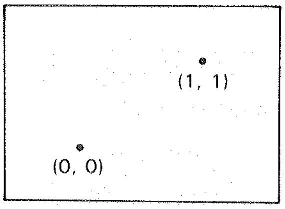


Fig. 6-8

In this manner, scaling P1 and P2 points by combining the IP and SC commands together allows you to set any points at any coordinates. And, setting at useful coordinate values makes the duty of a program light. Furthermore, the setting functions of P1 and P2 from the control panel can be used for expansion and contraction of coordinate units.

6.4 WINDOW

The plotting area set by the IW command is called a "window". Although instructions for drawing out of a window do not cause an error, the drawing attempted outside the window cannot actually be performed. The default value of a window is the same as the maximum plotting area. (For more information, see 6.2 "COORDINATE SYSTEM".)

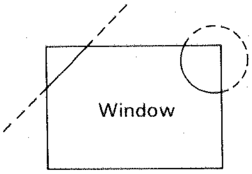


Fig. 6-9

Dotted lines cannot be drawn if drawing is attempted outside the window.

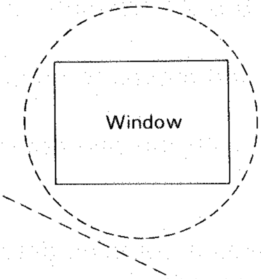


Fig. 6-10

No drawing is performed if drawing is attempted only outside the window.

Here, movement limit, maximum plotting area and plotting area are defined.
The movement limit is the limited area in which the pen carriage can move by controlling position keys (◀, ▲, ▶, ▼) of the control panel. It includes the maximum plotting areas of both ANSI-D and ISO-A1 size papers.
The maximum plotting area is the area determined by setting either with the DIP Switch 1-⑦ or with the paper size setting functions. (For more information, see 3.6 "SETTING FUNCTIONS FOR PAPER SIZES"). It cannot exceed the movement limit.
The plotting area is the area determined by a window and cannot exceed the maximum plotting area.

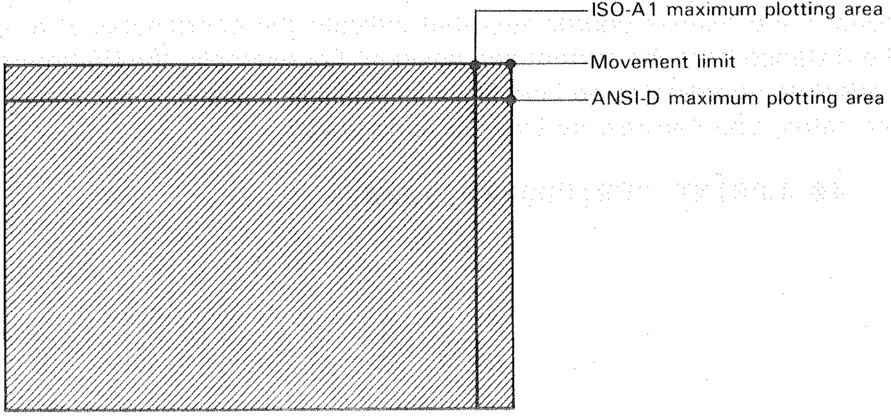


Fig. 6-11

6.5.1 How To Use The Drawing Commands

For a simple drawing, you can use the pen control command alone. The example below is for drawing a straight line between coordinates (1000, 2000) and (4000, 8000).

Example 6-1

```
10 LPRINT "SP1;"
20 LPRINT "PA;"
30 LPRINT "PU1000,2000;"
40 LPRINT "PD4000,8000;"
```

Explanation:

Line 10 Selects pen from the pen stock No.1.

Line 20 Specifies absolute coordinates. (See 6.5.2 ''Absolute Coordinates And Relative Coordinates''.)

Line 30 Holds pen from the pen stock No.1 and moves to coordinates (1000, 2000) with the pen up.

Line 40 Moves to coordinates (4000, 8000) with the pen down.
(For straight line drawing.)

Using such commands with simple instructions makes a complex drawing easy. But the RD-GL II has much more simple drawing commands. For example, when you want to have a rectangle or square, it is much easier to use the rectangle drawing command EA than sending the above commands four times.

In the drawing commands, there are many commands for the actual drawing and also for not actual drawing. For example, the RA command is for filling inside a rectangle, but the FT command is for setting a filling pattern of a rectangle. In other words, you first determine a filling pattern with the FT command (not actual drawing) and let the DPX-3300 to fill the rectangle by the RA command.

6.5.2 Absolute Coordinates And Relative Coordinates

There are two ways of specifying coordinates. One is the absolute coordinates that indicate the coordinates at a specified point in the distance from the origin (0, 0). Second is the relative coordinates that indicate the coordinates at a specified point in the distance from the current pen position. For example, the PA command specifies the absolute coordinates on Line 20 in Example 6-1. Here, if you want to use relative coordinates, you can rewrite Line 40 as follows:

```
40 LPRINT "PR;PD3000,6000;"
```

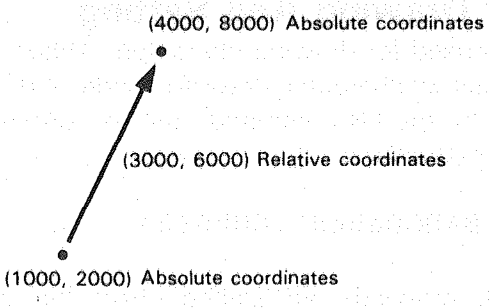

(4000, 8000) Absolute coordinates
(3000, 6000) Relative coordinates
(1000, 2000) Absolute coordinates

Fig. 6-12

The PR command specifies relative coordinates. After this, coordinates are specified in the relative coordinates. The current pen position is at (1000, 2000) on Line 30. To draw up to the absolute coordinates (4000, 8000), you can send relative coordinates (3000, 6000) which are the distance from the current pen position.
Remember: To get back to the absolute coordinates, you must send another PA command again.
In the RD-GL II, only the PA and PR commands can change coordinates after the new PA command was sent in either absolute or relative coordinates. Commands other than these commands remain coordinates unchanged. Note that absolute coordinates are effective at the time of the power turned ON.

6.6 DRAWING CHARACTERS

6.6.1 Character Drawing And Setting

The LB command is used for drawing characters. When you send the LB command, the DPX-3300 comes in character drawing mode and draws a character string or parameter followed by the LB command, just as you keyed in. For example, if you send the following instructions,

```
LPRINT "LBABCDabcd";CHR$(3)
```

the DPX-3300 starts drawing ''ABCDabcd'' from the current pen position. ETX (CHR$ (3)) in the above example is a label terminator, keyed in at the end to release the character drawing mode. If you omit this label terminator, and also if you key in the next command immediately followed by LB command and a character string, the DPX-3300 discriminates the next command as a character string and draws it. To change label terminator, use the DT command.

Character sets used by the LB command are the same as those specified by the DS and IV (CS, SS, CA, SA) commands. And they are characters among the character codes CHR$ (33) to CHR$ (127) of 10.4 ''LIST OF CHARACTER SETS'' in CHAPTER 10. For the selection of character sets, see 6.7 ''SETTING CHARACTER SETS'' in CHAPTER 6.
Among imaginary characters and character codes (CHR$ (0) to CHR$ (32)), there are also characters that have a special role in the character drawing.

ETX (CHR$ (3)) : Terminates character drawing mode.
BS (CHR$ (8)) : Moves pen to left by one character.
HT (CHR$ (9)) : Moves pen to left by 1/2 character.
LF (CHR$ (10)) : Moves pen to one lower space line.
VT (CHR$ (11)) : Moves pen to one upper space line.
CR (CHR$ (13)) : Moves pen to the line head.
SO (CHR$ (14)) : Selects alternate character set.
SI (CHR$ (15)) : Selects standard character set.

With regard to characters to be drawn, you can set in many ways. For example, the SI and SR commands are for specifying character size, the DI and DR commands for specifying drawing direction, the SL command for specifying character slant, the ES command for setting character space and line space, the LO command for setting character origin, etc. For more information, see respective commands in CHAPTER 7 ''DESCRIPTION OF THE RD-GL II COMMAND''.

6.6.2 Character Buffer

For drawing the same character string many times, the LB command can be used. Other than this, you can use the character buffer of the DPX-3300 for the same purpose.
Both BL and LB commands clear the character buffer and write a character string in the character buffer. As shown in 6.6.1 ''Character Drawing And Setting'', the LB command writes a character string in the character buffer and at the same time tells the DPX-3300 to draw it. On the other hand, the BL command only writes a character string in the character buffer.

The PB command reads a character string out of the character buffer and tells the DPX-3300 to draw it. Like the LB command, when you use the PB command for drawing, you can set in many ways by the SI, SR, DI, DR, SL, ES, LO commands, etc.

A character string (including control character and label terminator) up to 150 characters can be written in the character buffer. If you specify more than 150 characters, only first 150 characters are written in the character buffer. Although only 150 characters are written in the character buffer by the LB command, all the drawing is performed. The functions of character sets and control characters written in the character buffer are the same as those for drawing by the LB command.

Example 6-2

```
10  LPRINT "SP1;"
20  LPRINT "BLABCDabcd";CHR$(3)
30  LPRINT "PA;PU -5000,-5000;"
40  LPRINT "PB;"
50  LPRINT "PU -5000,-4000;"
60  LPRINT "PB;"
70  LPRINT "SP0;"
80  END
```

6.6.3 Fonts For Character Sets

The DPX-3300 has 61 types of character sets. These character sets are for drawing characters other than English. Symbols and characters vary from one character set to another.
Although the character sets are 20 types as set, three types of character fonts (form) are prepared for each set. Also, the character set No. 99 is a character set appropriate for drawing and has only one type of font (fixed character width font). Therefore, the DPX-3300 has 20 × 3 + 1 = 61 character sets in total.
For more information about characters of each character set, see 10.4 ''LIST OF CHARACTER SETS'' in CHAPTER 10.
And for more information about how to select character sets for the actual drawing, see 6.7 ''SETTING CHARACTER SETS''.

The character fonts are the following three types:

- Fixed-Space Vector Font
- Variable-Space Arc Font
- Fixed-Space Arc Font

Fixed-Space Font:
The width between all characters are fixed. It is useful because the length of a character string can be previously calculated, like pica pitch.

Variable-Space Font:
The DPX-3300 computes the width between characters and arrange the characters proportionally so as to balance them for a better looking word, like proportional pitch.

Vector Font:
The curved portions of a character are made with many continuous curved lines. Characters are drawn in a simple from, but this font is very suited for high speed drawing.

Arc Font:
The curved portions of a character are made with smooth, flowing curved lines. The drawing speed is comparatively slow to that of the vector font, but this font is good for good looking characters.

Table 6-3 shows the relations between the character fonts, the 20 character sets and the character Nos. but does not include the optimum character width vector font.
The character sets of each character font are listed in Fig. 6-13 through Fig. 6-15.

Fixed-Space Vector Font	Variable-Space Arc Font	Fixed-Space Arc Font	Fixed-Space Vector Font	Variable-Space Arc Font	Fixed-Space Arc Font
0	10	20	30	40	50
1	11	21	31	41	51
2	12	22	32	42	52
3	13	23	33	43	53
4	14	24	34	44	54
5	15	25	35	45	55
6	16	26	36	46	56
7	17	27	37	47	57
8	18	28	38	48	58
9	19	29	39	49	59
			99		

Table 6-3

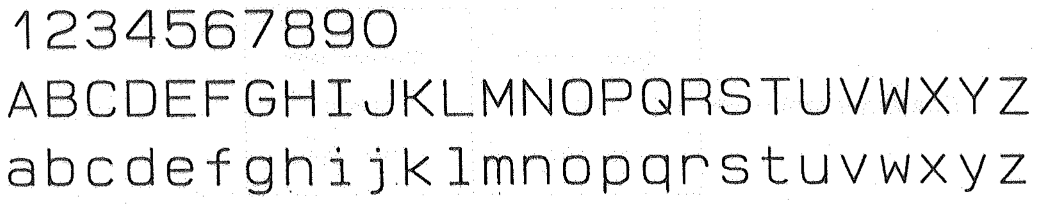

1234567890
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

Fig. 6-13

(Fixed-Space Vector Font Character set No.0)

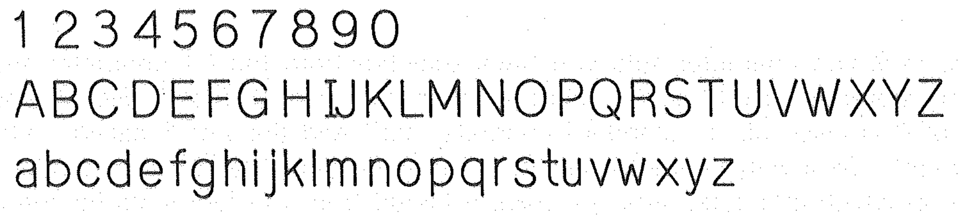

1234567890
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

Fig. 6-14

(Variable-Space Arc Font Character set No.10)

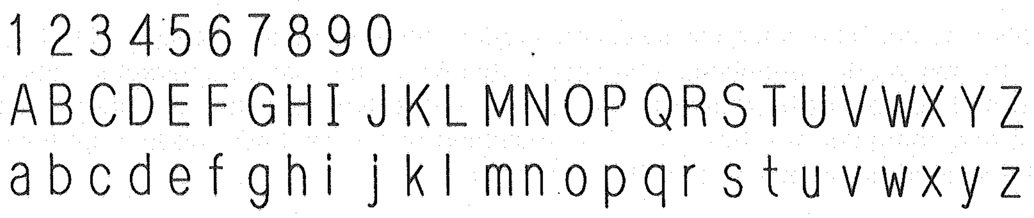

1234567890
ABCDEFGHIJKLMNOPQRSTUVWXYZ
abcdefghijklmnopqrstuvwxyz

Fig. 6-15

(Fixed-Space Arc Font Character set No.20)

6.7 SETTING CHARACTER SETS

The DPX-3300 has four character set selection modes. The basic concept for the selection of character sets is shown in Fig. 6-16.

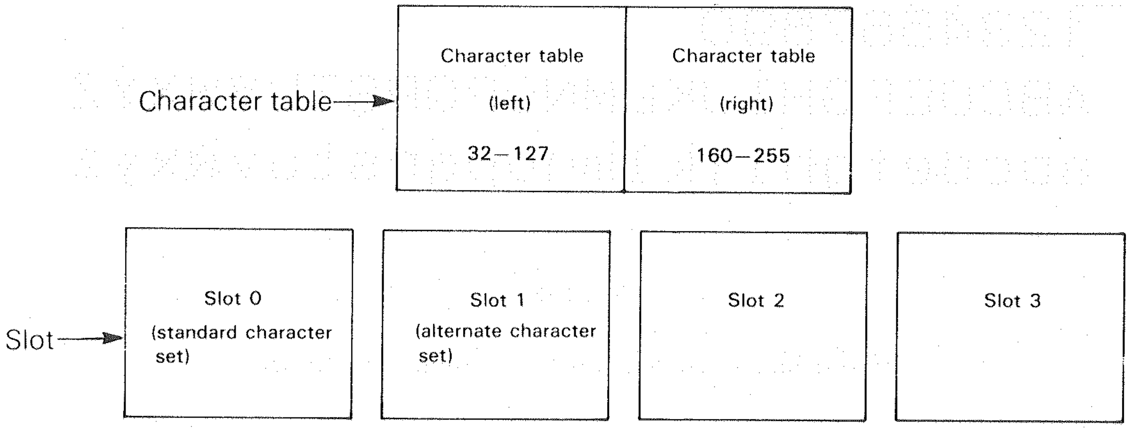

Character table
Character table (left) 32–127
Character table (right) 160–255
Slot
Slot 0 (standard character set)
Slot 1 (alternate character set)
Slot 2
Slot 3

Fig. 6-16

The place in which character sets you have selected from the 61 character sets are temporarily stored is called "slot". There are four slots: Slot 0, Slot 1, Slot 2, and Slot 3. The slot 0 is also called "standard character set" and the slot 1 called "alternate character set". To specify character sets to be put in the slots, the DS command is used. The place in which character sets you have selected from the four slots for the actual use are put is called "character table". There are two tablels: the table (left) for character codes 32 to 127 (8th bit is 0, 7 bits in total) and the table (right) for character codes 160 to 255 (8th bit is 1, 8 bits in total). The IV command is used for specifying character sets placed in the character tables (specifying slots you want to use).
There are four modes for the selection of character sets, which is explained later on. The switching of the character set selection modes is performed with the first parameter of the CM command.

In addition to the character set selection modes, there is what is called "fall back" mode. In this mode, undefined characters (blank) in the list of character sets are ignored and so cannot be drawn in the form of characters, but they are drawn in the form of one-character size box (□). The switching of the fall back mode is performed with the second parameter of the CM command.

6.7.1 RD-7 Bit Mode

The RD-7 bit mode has interchangeability with the RD-GL 1 of Roland DG corp.'s DXY-Series plotters. In this mode, only the slots 0 and 1 are used and also only the left character table is used.

As explained above, the slot 0 is called "standard character set" and the slot 1 called "alternate character set". Commands other than the DS command, you can specify a standard character set by the CS command and an alternate character set by the CA command, respectively. Character set Nos. are specified with the parameters followed by those commands.
In addition to the IV command, you can specify any slot by using the SS or SA command. For example, using the SS command or SI (CHR$ (15)) allows you to select a standard character set. And using the SA command or SO (CHR$ (14)) allows you to select an alternate character set. Also, if the 8th bit of a character code is 1 (from 160 to 255), that bit is ignored.
The above explanation is given in Fig. 6-17 below.

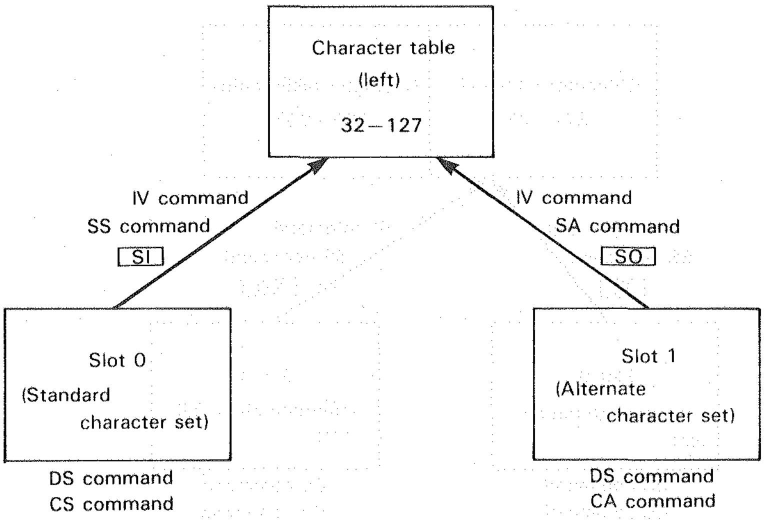

Character table
(left)
32–127
IV command
SS command
SI
IV command
SA command
SO
Slot 0
(Standard
character set)
Slot 1
(Alternate
character set)
DS command
CS command
DS command
CA command

Fig. 6-17

6.7.2 RD-8 Bit Mode

If the 8th bit of a character code is 1 (from 160 to 255), the DPX-3300 draws it in a different form when it is 0 (from 32 to 127).

Remember: If you use a Serial Connection for the connection to a computer, you must set the data bit length at 8 bits.

In the RD-8 bit mode, select a character set -for example, the character set No.6 (ISO ASCII)- for either a standard character set (slot 0) or an alternate character set (slot 1). Next, when you specify the slots by the IV (SS, SA) command, the character set No.8 (JAPANESE) is selected to the character table (left).
However, this combination is limited to only those listed in Table 6-4 below. If you select character sets other than the character set Nos. 0, 10, 20, 6, 16 and 26, all characters in the character table (right) become undefined characters.
The above explanation is given in Fig. 6-18.

Character table (left)	Character table (right)
0 (ANSI ASCII)	7 (ROMAN)
10 (ANSI ASCII)	17 (ROMAN)
20 (ANSI ASCII)	27 (ROMAN)
6 (JIS ASCII)	8 (JAPANESE)
16 (JIS ASCII)	18 (JAPANESE)
26 (JIS ASCII)	20 (JAPANESE)

Table 6-4

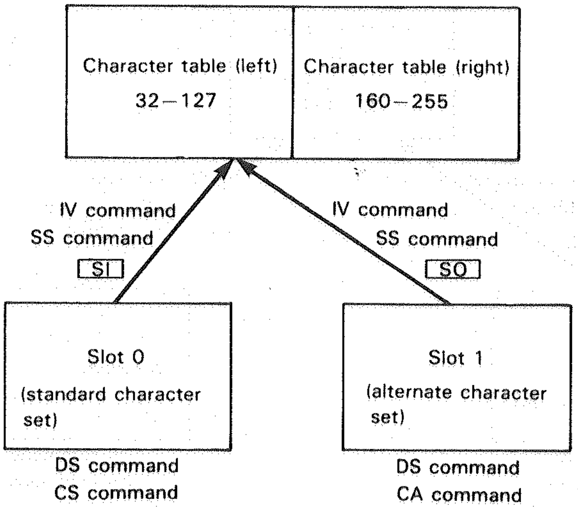

Character table (left)
32—127
Character table (right)
160—255
IV command
SS command
SI
IV command
SS command
SO
Slot 0
(standard character set)
Slot 1
(alternate character set)
DS command
CS command
DS command
CA command

Fig. 6-18

6.7.3 ISO-7 Bit Mode

This ISO-7 bit mode has four slots. You can select different character sets to each slot. Using the DS command, you can select any character set in the character tables. The IV command is useful when you want to use three or four character sets. Also, if the 8th bit of a character code is 1 (from 160 to 255), that bit is ignored. And the DPX-3300 draws the same characters as it is 0 (from 32 to 127). The above explanation is given in Fig. 6-19 below.

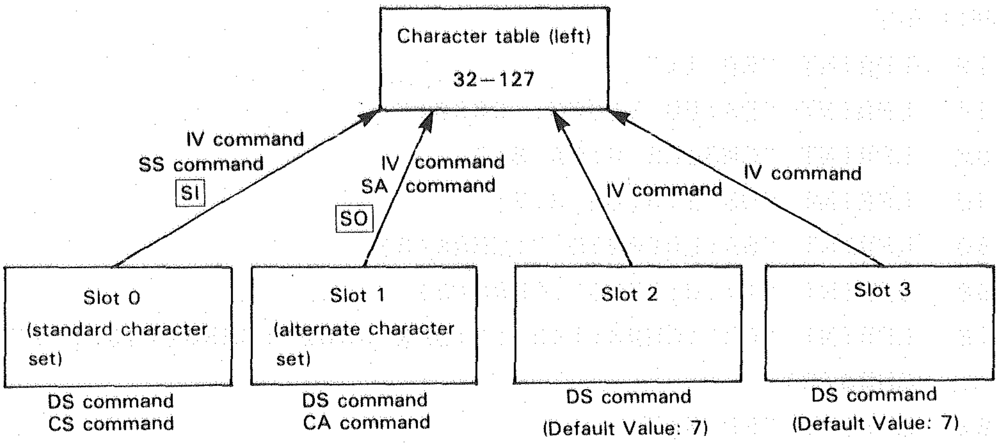

Character table (left)
32–127
IV command
SS command
SI
IV command
SA command
SO
IV command
IV command
Slot 0
(standard character set)
Slot 1
(alternate character set)
Slot 2
Slot 3
DS command
CS command
DS command
CA command
DS command
(Default Value: 7)
DS command
(Default Value: 7)

Fig. 6-19

6.7.4 ISO-8 Bit Mode

This ISO-8 bit mode also has four slots. You can select any different character set to the character tables. The selection method is almost the same as for the ISO-7 bit mode. Using the IV command, you can freely specify which slot to be placed in which character table. Also, if you send SS2 (CHR$ (142)) only at this mode, one character which is sent next becomes one of the characters in the slot 2. And if you send SS3 (CHR$ (143)), one character which is sent next becomes one of the characters in the slot 3. Characters other than these become a character set immediately before the slots.

Remember: If you want to use a Serial Connection for the connection to a computer, you must set the data bit length at 8 bits.
The above explanation is given in Fig. 6-20 below.

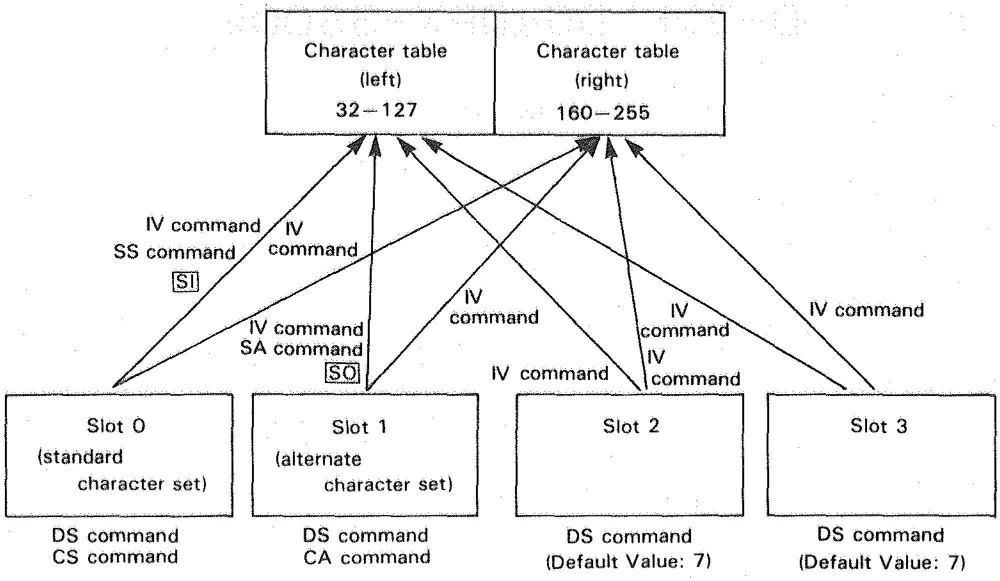

Character table (left)
32–127
Character table (right)
160–255
IV command
SS command
SI
IV command
IV command
SA command
SO
IV command
IV command
IV command
IV command
IV command
IV command
Slot 0
(standard character set)
Slot 1
(alternate character set)
Slot 2
Slot 3
DS command
CS command
DS command
CA command
DS command
(Default Value: 7)
DS command
(Default Value: 7)

Fig. 6-20

EXAMPLE 6-3

```
10   LPRINT "SP 1;"
20   LPRINT "PA;PU -8000,-3000;"
30   LPRINT "CM3;CS 0;CA 8;"
40   LPRINT "DS 2,5;DS 3,7;"
50   LPRINT "SA;LB[0W]D^";CHR$(3)
60   LPRINT "IV 0;LBDG";CHR$(3)
70   LPRINT "LB";CHR$(143);"{DPX-3300";CHR$(143);"}";
     CHR$(3)
80   LPRINT "SP 0;"
90   END
```

Explanation:

Line 30 Sets character selection mode to ISO-8 bit mode. Selects the character set 0 to the slot 0 (standard character set) and the character set 8 to the slot 1 (alternate character set).

Line 40 Selects the character set No.5 to the slot 2 and the character set No.7 to the slot 3.

Line 50 Specifies the slot 1 and draws " ローランド ".

Line 60 Specifies the slot 0 and draws "DG".

Line 70 Calls up the slot 3 with SS3 (CHR$ (143)) and keeps drawing.

ローランド DG«DPX-3300»

Fig. 6-21

The DPX-3300 has a 15K bytes buffer. This buffer consists of three distinctive buffers: the I/O buffer in which data you sent from a computer are stored, the polygon buffer in which polygon data are stored, and the downloadable character buffer in which character data you can create are stored. The storage capacities of each buffer have been determined at the default, but you can changed them if you use a Serial Connection for the connection to a computer. (For more information, see the ''ESC.T command'' of 8.4.2 ''Status Commands'' in CHAPTER 8.)

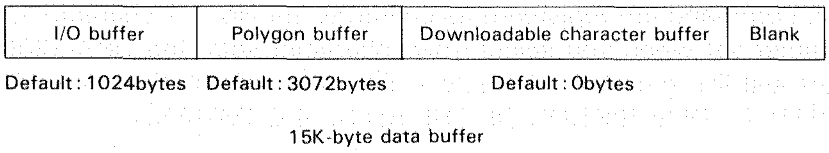


Fig. 6-22 (Simplified buffer diagram)

6.8.1 Polygon Buffer

The RD-GL II has the commands for drawing a rectangle and filling the rectangle. To draw a polygon without using such commands, you first define a polygon and store its data in a buffer called the ''polygon buffer''. It is also used when you want to fill a polygon.

The data of a polygon, in this case, are the coordinate values (apexes or summits) of a polygon. The storage capacity of the polygon buffer at the default is 3072 bytes and is large enough to hold about 250 defined summits of a polygon.

To either set or release the DPX-3300 from polygon input mode, the PM command is used. In this mode, you can write those summit data by the following commands.

PA, PR, PU, PD, AA, AR and CI commands

But in the polygon input mode, when you send these commands, the DPX-3300 does not operate actually, but only the summit data are written in the polygon buffer. For the actual drawing with the date you already wrote in the polygon buffer, send the PM command to release the polygon input mode first. Then, send the EP command for the DPX-3300 to draw the border of a polygon and fill the polygon. For more information, see ''PM Command'', ''EP Command'' and ''FP Command'' of CHAPTER 7 ''DESCRIPTION OF THE RD-GL II COMMAND''.

In addition to this, the RA, RR and WG commands can be used for the same purpose. For example, even when the DPX-3300 is not in the polygon input mode, you can send these commands to clear the polygon buffer and write the summit data of a polygon in the polygon buffer. Doing so allows the DPX-3300 to fill a polygon.

6.8.2 Downloadable Character Buffer (For only serial connection)

You can define characters and symbols which are not included in the character sets and store their data in this downloadable character buffer. Once the data are stored, the DPX-3300 is ready to draw them just like the other characters.

The size of the downloadable character buffer at initialization is 0. In other words, you must keep a storage for the downloadable character buffer by using the ESC.T command. You cannot use the downloadable character buffer unless you use a Serial Connection for the connection to a computer.

To set downloadable characters, the DL command is used. Any characters defined by the DL command are registered as character set No. − 1 characters. If you specify this character set when you select other character sets, the DPX-3300 draws those characters just like the other characters. For more information, see ''DL Command'' in CHAPTER 7 ''DESCRIPTION OF THE RD-GL II COMMAND''.

6.9 OUTPUT COMMANDS (For only serial connection)

When you send an output command to the DPX-3300, the DPX-3300 brings its data corresponding to that command in the condition that the data are ready to output to a computer. These data include coordinate values and pen (UP/DOWN) state at the current position, errors, etc. And the computer reads out these data. To output means in this case that a computer gets the data output from the DPX-3300 only if a Serial Connection is used. In other words, the computer cannot get any output data from the DPX-3300 if a Parallel Connection is used, and so a Parallel Connection cannot be used in this case.
The output commands are used only when your computer requires data from the DPX-3300 for drawing. Simple instruction sentences are given in Example 6-4 below.

Example 6-4

```
100 OPEN "COM1:9600,N,8,1" AS #1
110 PRINT #1,"OP;"
120 INPUT #1,P1X,P1Y,P2X,P2Y
130 PRINT P1X,P1Y,P2X,P2Y
```

Explanation:

Line 100	Opens RS-232C port.
Line 110	Sends OP command, requiring the output coordinate values of scaling points P1 and P2.
Line 120	Reads the coordinate values of each scaling point.
Line 130	Outputs them on the display screen.

6.10 DIGITIZE (For only serial connection)

The DPX-3300 has capabilities not only for a plotter but also for a digitizer. Like the output commands, the digitization is effective only if a Serial Connection is used. A Parallel Connection cannot be used. When the DPX-3300 is in digitize mode, and if you move the pen by controlling the position keys (◀, ▲, ▶, ▼ of the control panel and press the ENTER key, the DPX-3300 retrieves the coordinate values of the pen position determined by the position key control as well as the pen (UP/DOWN) state.

6.10.1 Digitize By Manual Operation

When receiving the DP command, the DPX-3300 comes in the digitize mode. And when you press the ENTER key of the control panel, the DPX-3300 stores both present X-Y coordinate values of pen and pen (UP/DOWN) state in the buffer. You can press the ENTER key as many times as you want, but only the coordinate values at the time of the last press are effective.

Next, sending the OD command enables those data to output in the form of ASCII to your computer.

Simple instruction sentences are shown in Example 6-5 below. On Line 110, the program comes in digitize mode. Here, the program is still at pause on Line 120 until you press the ENTER key of the control panel and the RETURN key of your computer. On Line 140, the computer starts reading the data from the DPX-3300.

Example 6-5

```
100 OPEN "COM1:9600,N,8,1" AS #1
110 PRINT #1,"DP;"
120 INPUT "READY";R
130 PRINT #1,"OD;"
140 INPUT #1,X,Y,P
150 PRINT X,Y,P
160 PRINT #1,"DC;"
170 END
```

6.10.2 Digitize By Status Byte

Remember: In the digitize method of Example 6-5, the program must be kept at pause until you press the ENTER key of the control panel and RETURN key of your computer.

A digitization method using the OS command is explained below.

When you press the ENTER key in digitize mode, the bit 2 (bit value: 4) of 8-bit status byte in the DPX-3300 is set. There is also a program in which the DPX-3300 reads the content of the status byte using the OS command and goes to accept the OD command if the value of bit 2 is 0. Such a program is shown in Example 6-6 below. In the subroutine between Line 1000 and Line 1400, the computer reads the bit-2 value of status byte of the DPX-3300. If the value of bit 2 is 1, it goes back to the main program to read X-Y coordinate values and the pen state. The DPX-3300 enables these data to output on Line 130. And the computer reads the data on Line 140 Because of this, in a program like this, controlling the ENTER key of the control panel alone makes it possible to digitize as many points as you want.

Example 6-6

```
100 OPEN "COM1:9600,N,8,1" AS #1
110 PRINT #1,"DP;"
120 GOSUB 1000
130 PRINT #1,"OD;"
140 INPUT #1,X,Y,P
150 PRINT X,Y,P
160 GOTO 110
```

Main program

```
1000 PRINT #1,"OS;"
1100 INPUT #1,S
1200 S=INT(S/2)
1210 S=INT(S/2)
1220 S=S MOD 2
1300 IF S=0 THEN 1000
1400 RETURN
```

Subroutine

DESCRIPTION OF THE RD-GL II COMMAND

7

In this chapter, individual commands of the RD-GL II command are described in detail. Each command has its own particular function and varies in its allowable ranges of format and parameters from one another.

- All character codes (ASCII code) use the decimal.
- To indicate as a character code, CHR$ (character code) is marked.
- As a control character, for example, [ESC] (CHR$ (27)) or [ESC] is marked.

Parameters parenthesized ( ) inside "● Format" are omissible parameters.

"● Example" shows concrete instruction sentences made with typical BASIC formats.

"● Parameter range" refers to the values that cause an error beyond those values.

Remember: There are values that have no meaning and are ignored even if they are correctly keyed in within the parameter range.

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AA (Arc Absolute) Command

- **Function:**
  The AA command tells the DPX-3300 to draw arcs about any specified point as center.

- **Format:**
  AA x,y,θc (,θd) [Terminator]

- **Example:**
  `LPRINT "AA6000,5000,360,10;"`

- **Parameter range:**

x,y	: coordinates for the center point.	$-(2^{26}-1)$ to $+(2^{26}-1)$
θc	: center angle.	$-(2^{26}-1)°$ to $+(2^{26}-1)°$
θd	: resolution.	$-(2^{26}-1)$ to $+(2^{26}-1)$ (Default value: 5°)

- **Explanation:**
  The DPX-3300 draws arcs about the center point specified by absolute coordinates (x,y) from the current pen position as start point for only the angle specified by θc on the current pen (UP/DOWN) state. This command is useful for drawing arcs in the continuation of a straight line.
  The resolution θd specifies the smoothness of arcs, but it has different parameter meaning depending on resolution modes you have specified by the CT command. Also, the resolution θd is compensated for the value that divides the center angle θc equally.

  As shown in ''Example'' below, the AA command tells the DPX-3300 to draw not only circle and arc but also any form of polygon if you change the value of θd.

Example:

```
100 REM *** AA COMMAND ***
110 LPRINT "PA;PU8000,6000;"
120 FOR I=1 TO 5
130   READ A:D=360/A
140   LPRINT "SP";I;"PD;AA6000,5000,360,";D;";"
150 NEXT I
160 LPRINT "PU;":END
170 DATA 20,12,8,5,3
```

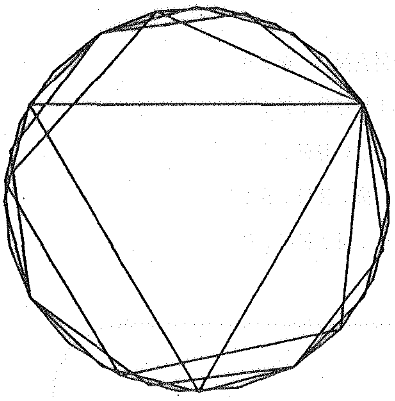


Fig. AA-1

AR (Arc Relative) Command

- **Function:**
  The AR command tells the DPX-3300 to draw arcs about any specified point by relative coordinates from the current pen position as center.

- **Format:**
  AR $\Delta x, \Delta y, \theta c$ (,θd) [Terminator]

- **Example:**

```
LPRINT "AR0,200,360,10;"
```

- **Parameter range:**

$\Delta x, \Delta y$	: relative coordinates up to center point.	$-(2^{26}-1)$ to $+(2^{26}-1)$
θc	: center angle.	$-(2^{26}-1)^{\circ}$ to $+(2^{26}-1)^{\circ}$
θd	: resolution.	$-(2^{26}-1)$ to $+(2^{26}-1)$ (Default value: 5°)

- **Explanation:**
  The DPX-3300 draws arcs about any center point specified by relative coordinates (Δx, Δy) from the current pen position as start point for only the angle specified by θc on the current pen (UP/DOWN) state. This command is useful for drawing arcs in the continuation of a straight line.
  The resolution θd specifies the smoothness of arcs, but it has different parameter meaning depending on resolution modes you have specified by the CT command. Also, the resolution θd is compensated for the value that divides the center angle θc equally.

Example:

```
100 REM *** AR COMMAND ***
110 LPRINT "SP1;PA;PU0,0;"
120 LPRINT "PD;PR0,2000;"
130 LPRINT "AR-500,0,90,5;"
140 LPRINT "PD-2000,0;PU;"
```

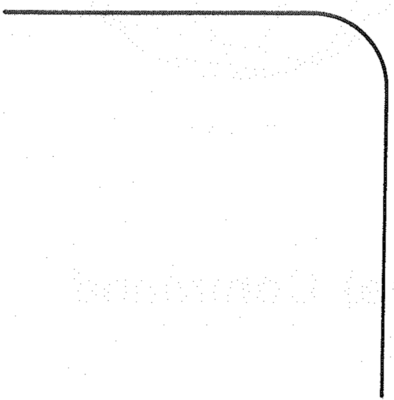


Fig. AR-1

BL (Buffered Label String) Command

- **Function:**
  The BL command writes a character string in its character buffer.

- **Format:**
  BL Character string [Label terminator]
  BL [Label terminator]

- **Example:**

```
LPRINT "BLRolandDG";CHR$(3)
LPRINT "BL";CHR$(3)
```

- **Parameter range:**
  The maximum length of a character string is 150 characters.

- **Explanation:**
  The DPX-3300 writes a character string followed by the BL command and label terminator in the character buffer. This command tells the DPX-3300 to draw the same character string as many times as you want if you use the PB command. The character buffer has the storage capacity to hold up to 150 characters including control characters (label terminator). The label terminator is defined by the DT command and is initialized as ETX (CHR$(3)).
  The content written in the character buffer can be cleared by the DF and IN commands or the LB and BL commands.
  However, the LB and BL commands clear the character buffer once and write character strings followed by the commands in the character buffer.
  Also, the PB command is able to tell the DPX-3300 to draw the content of the character buffer. For more detailed information, see 6.6.1 ''Character Drawing And Setting'' in CHAPTER 6.

CA (Alternate Character Set) Command

- **Function:**
  The CA command specifies a character set the DPX-3300 uses as an alternate character set (slot 1).

- **Format:**
  CA Character set No. [Terminator]

CA [Terminator]

- **Example:**

```
LPRINT "CA1;"
LPRINT "CA;"
```

- **Parameter range:**
  Character set Nos.: −1 , 0 to 59, 99

- **Default value:**
  Values by setting the DIP Switch 1- ① to ④

- **Explanation:**
  There are four modes for the selection of character sets. (For more information, see 6.7 ''SETTING CHARACTER SETS'' in CHAPTER 6.) In all the modes, the CA command is used to specify a character set the DPX-3300 uses as an alternate character set (slot 1). (Also, the DS command can be used for the same purpose.)
  Character set Nos. that can be specified by the CA command are −1, 0 to 59, and 99. Even if any fraction below the decimal point are given, they are cut-off. Any CA command with parameter out of the specified range causes an error and is ignored. Also, if any CA command is keyed in without parameter and in case at the default, the character set specified by setting the DIP Switch of the side panel is set, together with a standard character set (slot 0) and an alternate character set (slot 1).
  To specify an alternate character set (slot 1) in the character table for use in the actual drawing, execute the SA command or send the LB command with SO (CHR$(14)).

CC (Character Chord Angle) Command

- **Function:**
  The CC command specifies the resolution (smoothness) of arc font characters.

- **Format:**
  CC Center angle [Terminator]
  CC [Terminator]

- **Example:**

```
LPRINT "CC10;"
LPRINT "CC;"
```

- **Parameter range:**
  $-(2^{26}-1)^\circ$ to $+(2^{26}-1)^\circ$

- **Default value:**
  5°

- **Explanation:**
  The arc font characters express the curved portions of a character by replacing them with straight lines. The CC command specifies the smoothness of the curves of a character by specifying a center angle for the curves corresponding to the straight lines. Specifying a small center angle allows for much more smooth curves, but it takes longer time to draw. Although the center angle is fixed, the radii of each arc vary depending on what sizes of arcs you want the DPX-3300 to draw, and so the length of each straight line varies accordingly.
  The maximum value of the center angle for arcs is 45°. The prefix of parameter is ignored.

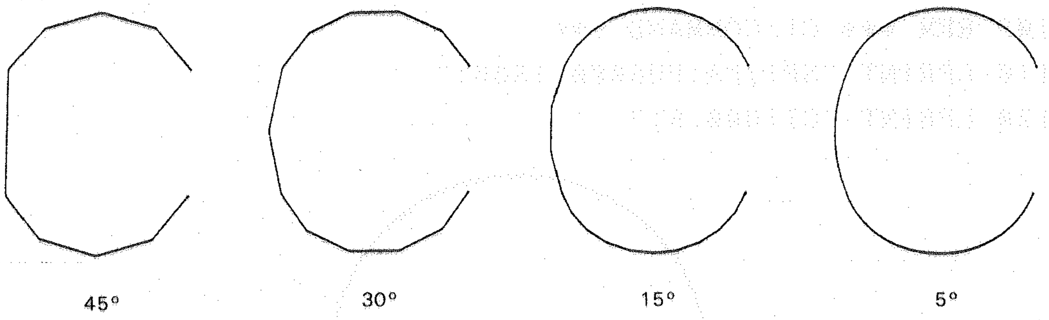


Fig. CC-1

CI (Circle) Command

- **Function:**
  This command tells the DPX-3300 to draw a circle about the current pen position as center.

- **Format:**
  CI r(,θd) [Terminator]

- **Example:**

```
LPRINT "CI 1000;"
```

- **Parameter range:**

r	: radius	$-(2^{26}-1)$ to $+(2^{26}-1)$
θd	: resolution	$-(2^{26}-1)$ to $+(2^{26}-1)$ (Default value: 5°)

- **Explanation:**

The DPX-3300 draws a circle with the radius specified by the parameter r about the current pen position as center. The resolution specifies the smoothness of arcs, but it has different parameter meaning depending on resolution modes you have specified by the CT command. Also, the resolution θd is compensated for the vallue that divides the circle equally.

Also, specifying a particular angle for parameter θd allows the DPX-3300 to draw a polygon. For example, you specify 60° and 45° for parameters, the DPX-3300 draws a hexagon and an octangle, respectively. But if the parameter θd is omitted, 5° (default value) is automatically set.

Example:

```
100 REM *** CI COMMAND ***
110 LPRINT "SP1;PA;PU6000,1500;"
120 LPRINT "CI1000,5;"
```

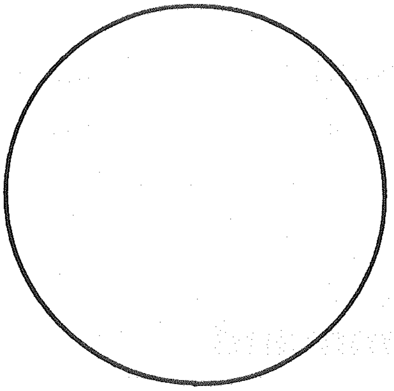


Fig. CI-1

CM (Character Set Mode) Command

- **Function:**

The CM command sets the character set selection mode and the fall back mode.

- **Format:**

CM n1 (,n2) [Terminator]
CM [Terminator]

- **Example:**

```
LPRINT "CM2,1;"
LPRINT "CM;"
```

- **Parameter range:**

n_1 : Character set selection mode (0 to 3)
n_2 : Fall back mode (0 to 1)

- **Default value:**

n_1 : 0
n_2 : 0

- **Explanation:**

The parameter n_1 specifies the character set selection mode. (See 6.7 ''SETTING CHARACTER SETS''.) If you omit these parameters, the DPX-3300 comes in the RD-7 bit mode. And if you execute the CM command, the parameters of the IV and DS commands are set at the default values.

$n_1=0$: RD-7 bit mode
$n_1=1$: RD-8 bit mode
$n_1=2$: ISO-7 bit mode
$n_1=3$: ISO-8 bit mode

The parameter n_2 sets and releases the fall back mode. The DPX-3300 comes in the fall back mode when $n_2=1$. It attempts to draw an undefined character (blank) of the character set table but actually draws an box (□) in the size of the character. On the other hand, when $n_2=0$, the DPX-3300 is released from the fall back mode and ignores the undefined character.

CP (Character Plot) Command

- **Function:**

The CP command tells the DPX-3300 to move the pen for only the specified number of characters.

- **Format:**

CP Number of characters in X-axis direction, Number of characters in Y-axis direction [Terminator]
CP [Terminator]

- **Example:**

```
LPRINT "CP10,-2;"
LPRINT "CP;"
```

- **Parameter range:**

$-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**

The DPX-3300 moves the pen for only the specified number of character cells on the current pen (UP/DOWN) state. By definition, a character cell refers to the area necessary for drawing one character, including the area of one character and the width between characters. For more information about the relation between the character cell and the size of a character, see ''SI Command''.

The maximum number of character parameters is the value of $-(2^{26}-1)$ to $+(2^{26}-1)$. If the value is positive, the pen moves to the right or in the upper direction. If the value is negative, the pen moves to the left or in the lower direction. But these directions vary depending on which directions you have specified the DPX-3300 to draw characters. Also, even if two parameters are the same, the moving distance of the pen gets larger as the sizes of characters increase. Remember: Specifying a moving distance exceeding $(2^{26}-1)$ or a pen movement to coordinates exceeding $-(2^{26}-1)$ to $+(2^{26}-1)$ causes an error.

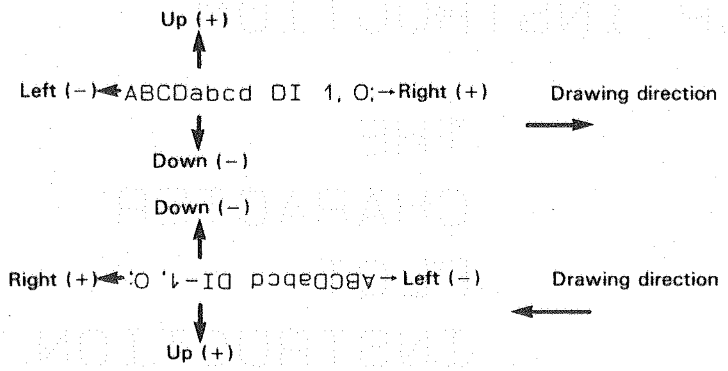

Up (+)
Left (−)
ABCDabcd DI 1, 0;
Right (+)
Drawing direction
Down (−)
Down (−)
Right (+)
ABCDabcd DI−1, 0;
Left (−)
Drawing direction
Up (+)

Fig. CP-1

Any CP command without parameter tells the pen to move from the previous position to a position below one character. (This is the same pen movement as the CR and LF are executed.)

Since the CP command specifies the moving distance of a pen in the number of characters, it is much more convenient for drawing characters than the PA and PR commands.
An example for character drawing with the CP command is shown below.

Example:

```
100 REM *** CP COMMAND ***
110 LPRINT "IN;PA3000,3000;"
120 LPRINT "SP1;SI;"
130 LPRINT "LBCP INSTRUCTION";CHR$(3)
140 LPRINT "CP-7,-2;PR0,0;"
150 LPRINT "LBTHE";CHR$(3)
160 LPRINT "CP;LBCHARACTER";CHR$(3)
170 LPRINT "CP;LBPLOT";CHR$(3)
180 LPRINT "CP;LBCPINSTRUCTION,CP";CHR$(3)
190 LPRINT "SP0;"
```

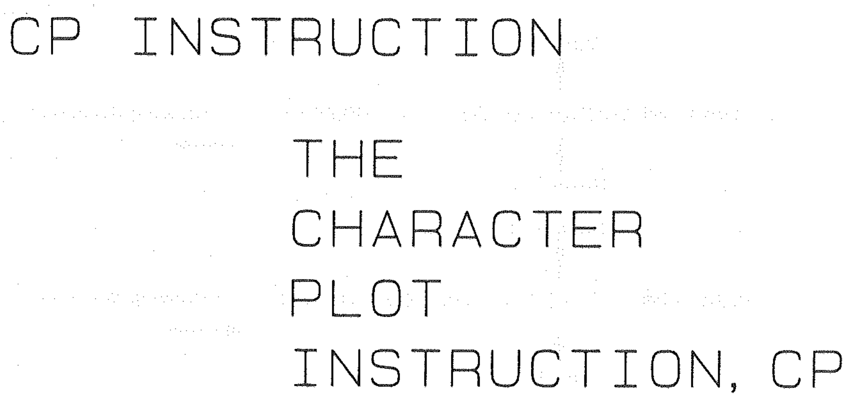


Fig. CP-2

CS (Standard Character Set) Command

- **Function:**
  The CS command specifies a character set the DPX-3300 uses as a standard character set (slot 0).

- **Format:**
  CS Character set No. [Terminator]
  CS [Terminator]

- **Example:**

```
LPRINT "CS1;"
LPRINT "CS;"
```

- **Parameter range:**
  Character set Nos.: −1, 0 to 59, 99

- **Default value:**
  Values given by setting the DIP Switch 1- ① to ④.

- **Explanation:**
  There are four modes for the selection of character sets. (For more information, see 6.7 "SETTING CHARACTER SETS" in CHAPTER 6.) In all the modes, the CS command is used to specify a character set the DPX-3300 uses as a standard character set (slot 0). (The DS command can be used for the same purpose.)
  Character set Nos. that can be specified by the CS command are −1, 0 to 59 and 99. Even if any fractions below the decimal point are given, they are cut-off. Any CS command with parameter out of the specified range causes an error and is ignored. Also, if any CS command is keyed in without parameter and in case at the default,

the character set specified by setting the DIP Switch of the side panel is set, together with a standard character set (slot 0) and an alternate character set (slot 1).
To specify a standard character set (slot 0) in the character table for use in the actual drawing, execute the SS command or send the LB command with SI (CHR$(15)).

CT (Chord Tolerance) Command

- **Function:**
  The CT command specifies resolution modes within the drawing commands for circles and arcs.

- **Format:**
  CTn [Terminator]
  CT [Terminator]

- **Example:**

```
LPRINT "CT1;"
LPRINT "CT;"
```

- **Parameter range:**
  0 or 1

- **Default value:**
  n=0

- **Explanation:**
  There are two resolution modes for specifying the smoothness of circles and arcs: degree mode and deviation mode.

  n=0 : degree mode
  The DPX-3300 is set in the degree mode if the parameter n is 0 or omitted. The degree mode means as follows. When a drawing command for a circle or arc is executed, the resolution parameter of the command are interpreted as degrees for the DPX-3300 to draw a chord as part of an arc. Therefore, the smoothness of an arc decreases as the radius of the arc increases. The unit of the parameter is "°".

  n=1 : deviation mode
  The DPX-3300 is set in the deviation mode if the parameter n is 1. In the deviation mode, this resolution parameter sets the maximum distance between an imaginary arc and the actual chord. The smoothness of the arc remains unchanged as the radius is increased, but it takes longer time to draw. The unit of the parameter is "mm".

Note that changing these modes by the CT command also changes the meaning of the resolution parameters of AA, AR, CI, EW and WG commands.

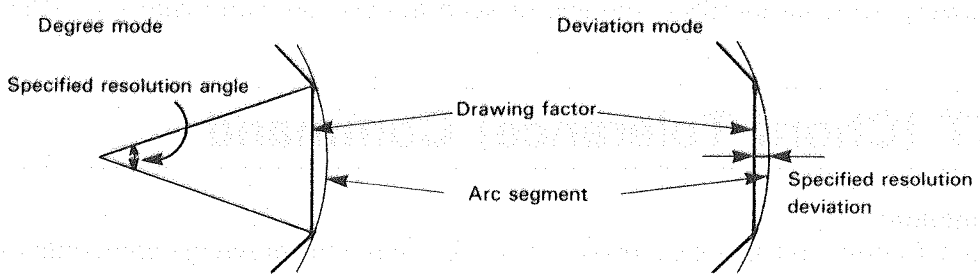

Degree mode
Specified resolution angle
Drawing factor
Arc segment
Deviation mode
Specified resolution deviation

Fig. CT-1

DC (Digitize Clear) Command

(For only serial connection)

- **Function:**

  The DC commands releases the DPX-3300 from the digitize mode.

- **Format:**

  DC [Terminator]

- **Example:**

  `PRINT #1,"DC;"`

- **Explanation:**

  When the DPX-3300 receives the DC command, it is released from the digitize mode. After this, the coordinates for the pen position never be stored. No parameter is required for the DC command. For more detailed information, see 6.10 ''DIGITIZE'' in CHAPTER 6.

DF (Default) Command

- **Function:**

  The DF command sets the DPX-3300 at the default.

- **Format:**

  DF [Terminator]

- **Example:**

```
LPRINT "DF;"
```

- **Explanation:**

Without changing the scaling points P1 and P2, the DF command sets the size and the slant of a character as shown below.

Function	Equivalent Command	Conditions
Plotting mode	PA;	Absolute coordinates
Printing direction	DR;	Right horizontal
Line type	LT;	Solid line
Line pattern length	LT;	4% of diagonal line of P1 and P2
Input Window	IW;	Mechanical limit of plotter
Character size	SI;	Width = 0.285cm Height = 0.375cm
Symbol mode	SM;	Off
Scale length	TL;	x scale + 0.5% of ($P2_x - P1_x$) y scale + 0.5% of ($P2_y - P1_y$)
Standard character set	CS;	Value set by the DIP switch
Alternate character set	CA;	Value set by the DIP switch
Character set	SS;	Standard character set
Character slant	SL;	0°
Digitize mode	DC;	Off
Scaling	SC;	Not scaled
Label terminator	DT CHR$(3)	$\boxed{\text{ETX}}$ (CHR $(3))
Buffered label string	BL CHR$(3)	Cleared
Character chord angle	CC;	5°
Chord tolerance	CT;	Degree mode
Extra space	ES;	0, 0
Fill type	FT;	Type1 1% of P1 − P2
Character set selection mode	CM;	RD-7 bit mode
Error mask value	IM;	223
Label origin	LO;	Lower left
Polygon buffer	PM 0; PM 2;	cleared
Pen thickness	PT;	0.3mm
User defined fill type	UF;	Equal filling line space

DI (Absolute Direction) Command

- **Function:**
  The DI command specifies the drawing direction of characters.

- **Format:**
  DI run, rise [Terminator]
  DI [Terminator]

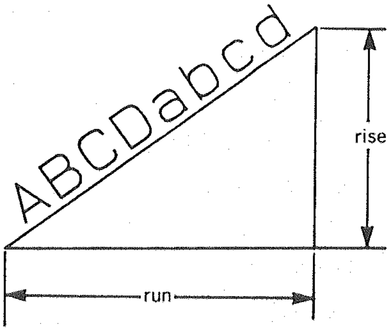
- **Example:**

```
LPRINT "DI1,1;"
LPRINT "DI;"
```

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Default value:**
  ''DI1,0;'' (draws characters horizontally)

- **Explanation:**
  The drawing direction specified by the DI command is the absolute direction. In other words, it is the direction determined independently of the positions of the scaling points P1 and P2. When a drawing direction is specified, two parameters ''run'' and ''rise'' and the drawing direction have the relation as shown in Fig. DI-1. The ''run'' and ''rise'' take the values of $-(2^{26}-1)$ to $+(2^{26}-1)$. If the ''rise'' = 0, the DI command sets a horizontal drawing direction. If the ''run'' = 0, it sets a vertical drawing direction. But if both parameters are 0, an error occurs.



	run	rise
0°	1	0
45°	1	1
90°	0	1
135°	−1	1
180°	−1	0
225°	−1	−1
270°	0	−1
315°	1	−1

Fig. DI-1

When you know the angle θ for a drawing direction, you are only required to execute ''DI'';COSθ;'','','';SINθ;'',''.

Any DI command without parameters specifies a horizontal drawing direction like ''DI1, 0;'' because ''0'' is the default value for the parameter ''rise''. Any DI command with only one parameter or three parameters causes an error. And the last parameter is ignored, if there are three.
The drawing direction designated by the DI command is effective unless the DI and DR commands are executed or the default value is give for parameter by the IN or DF command.
An example with the DI command is shown below.

Example:

```
100 REM **** DI COMMAND ****
110 LPRINT "IN;PA4500,4500;SP2;"
120 LPRINT "DI1,1;LB  -- 45deg--";CHR$(13);CHR$(3)
130 LPRINT "DI0,1;LB  -- 90deg--";CHR$(13);CHR$(3)
140 LPRINT "DI-1,1;LB  --135deg--";CHR$(13);CHR$(3)
150 LPRINT "DI-1,0;LB  --180deg--  ";CHR$(3)
160 LPRINT "DI-1,-1;LB  --225deg--";CHR$(13);CHR$(3)
170 LPRINT "DI0,-1;LB  --270deg--";CHR$(13);CHR$(3)
180 LPRINT "DI1,-1;LB  --315deg--";CHR$(3)
190 LPRINT "DI;LB  --DI COMMAND--";CHR$(3)
```

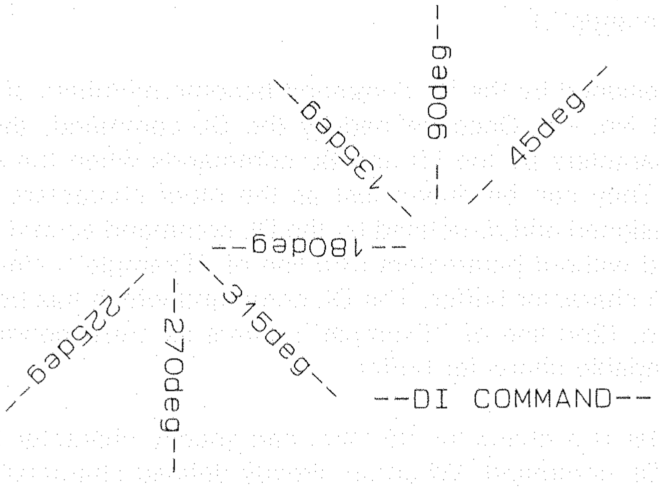


Fig. DI-2

DL (Downloadable Character) Command

(For only serial connection)

- **Function:**

The DL command designs characters which does not exist in the character sets and writes them as characters of the character set No. −1 in the downloadable character buffer.

- **Format:**

DL Character No. (, pen control), X1, Y1, ...(, pen control) ..., Xn, Yn [Terminator]
DL Character No. [Terminator]
DL [Terminator]

- **Example:**

```
PRINT #1,"DL65,10,0,10,30,28,30,28,24;"
PRINT #1,"DL50;"
PRINT #1,"DL;"
```

- **Parameter range:**

Character No. : 33 to 126
Pen control : −128
Xn, Yn : −127 to +127

- **Explanation:**

The DL command stores downloadable characters temporarily in the downloadable character buffer.

Remember: The storage capacity of the downloadable character buffer is set at 0 (default value). Because of this, when you want to use the DL command, you must keep a storage of the downloadable character buffer by the ESC.T command. (See "ESC.T command" of 8.4.2 "Status Commands".)

The characters designed by the DL command become members of the characters of the character set No. −1. Once defined by the DL command, they are written as downloadable characters by the LB and BL commands when the character set No. −1 is selected. They can be drawn just as the other characters are drawn. Also, they can be re-designed and re-defined by the DL command according to your needs. Any DL command without parameters (3rd line of "Example") clears the content of the downloadable character buffer. The DL command which has been specified with only character No. (2nd line of "Example") clears its corresponding character No. from the downloadable character buffer.

Character Nos.:

The first parameter is a character No. You can specify character Nos. between 33 and 126 by the DL command. When an already defined character No. in the buffer is specified, it is replaced with the character No. with a newly designed character.

Pen control:
Only −128 is used as parameter for pen control. This parameter sets a pen-up movement to the position specified by a pair of X-Y coordinates followed by the parameter. Any pair of X-Y coordinate specified without this parameter sets a pen-down movement. There is an exception: The first pair of X-Y coordinates (one followed by the character No.) is only for a pen-up movement. In other words, you cannot set a pen-down movement for the first.

Coordinate values:
Other than the first parameter (character No.) and the pen control −128, parameters are all X-Y coordinate values. They are made in a pair with two parameters for X-axis and Y-axis. These coordinate values are the absolute coordinate values with the origin at the lower left corner of a pen movement design space. This pen movement is designed by using absolute coordinates on a 32 × 32 grid. In the DPX-3300, the same grid is used for the fixed character width font to design a pen movement. Also, coordinate values for both X-axis and Y-axis can be expanded up to +127 per character in order to design downloadable characters for pen movements.

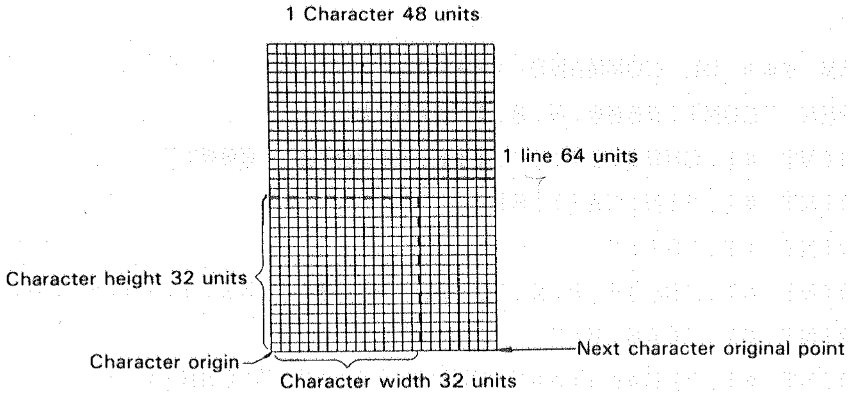


Fig. DL-1

Any DL command with parameters out of the specified range, with over 255 parameters, or an odd number of coordinates causes an error and is ignored.
Remember: The UC command uses relative coordinates, but the DL command uses absolute coordinates. Also, you can set the first pen movement by the UC command. On the other hand, you must always set the first pen movement with the pen UP if the DL command is used.

Keeping a storage for the downloadable character buffer means that the storage capacity of the I/O buffer or of the polygon buffer gets small. Because of this, you had better execute ESC.T command as much as possible before using those buffers for storing your programs.
The downloadable character buffer needs 444 bytes for its least storage capacity. Plus, 1 byte is required per pen control and 2 bytes per pair of X-Y coordinates, respectively. Therefore, the capacity computed by the following formula is necessary.

444 + (the number of pen controls) + 2 × (the number of coordinates)

Remember: If the downloadable character buffer is overflowed, an error occurs to erase all the downloadable characters. Be careful to keep a storage with extra space. The content of the downloadable character buffer is cleared at the time of the power turned ON again , by the IN command, by the DL command without parameters or by ESC.T command. And the characters of the character set No. – 1 are all undefined. The DF command can retain the content of the downloadable character buffer intact and set the other setting values at the default.

Example:

```
100 REM *** DL COMMAND ***
110 OPEN "COM1:9600,N,8,1" AS #1
120 PRINT #1,CHR$(27);".T1024;3072;1000:"
130 PRINT #1,"IN;CA-1;SP4;"
140 PRINT #1,"SI;"
150 PRINT #1,"DL45,0,0,32,32,-128,4,32,4,14,-128,28,18,28,0;"
160 PRINT #1,"PA0,0;"
170 PRINT #1,"LBscale=";CHR$(14);"-";CHR$(3)
180 PRINT #1,"SP0;"
```

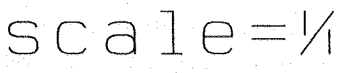


Fig. DL-2

DP (Digitize Point) Command

(For only serial connection)

- **Function:**

The DP command sets the DPX-3300 in digitize mode.

- **Format:**

DP [Terminator]

- **Example:**

```
PRINT #1,"DP;"
```

- **Explanation:**

Once receiving the DP command, the DPX-3300 comes in digitize mode and ready for digitizing data. When you press the ENTER key of the control panel, the present X-Y coordinate values of the pen position and also pen (UP/DOWN) state are stored in the DPX-3300. At the same time, the 2nd bit of status byte is set to enable the data at the digitized points to output by the OD command. No parameters are required. For more information, see 6.10 ''DIGITIZE'' in CHAPTER 6.

(Note) The digitize command is effective only if a Serial Connection is used. If this command is executed with a Parallel Connection used, the data output from the DPX-3300 cannot be received by the computer, so that the DPX-3300 may not receive any further commands. In such a case, turn OFF the power on the plotter side or press the ''RESET'' switch to return the DPX-3300 to the initial condition.

DR (Relative Direction) Command

- **Function:**

The DR command specifies a character drawing direction with percentage (%) with respect to the length of X-axis and Y-axis directions between the scaling points P1 and P2.

- **Format:**

DR run, rise [Terminator]
DR [Terminator]

- **Example:**

```
LPRINT "DR1,0;"
LPRINT "DR;"
```

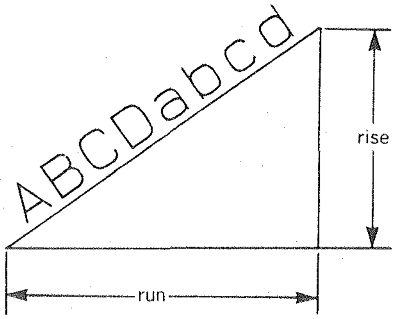
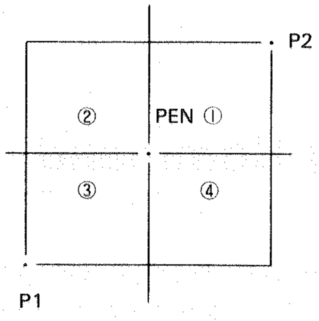


Fig. DR-I

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Default value:**
  ''DR1,0;''

- **Explanation:**
  The parameters ''run'' and ''rise'' of the DR command specify a character drawing direction with percentage (%) with respect to (P2x − P1x) and to (P2y − P1y), respectively. The relation between the parameters ''run'' and ''rise'' is as shown in Fig. DR-1. Remember: Drawing directions vary depending on the positions of P1 and P2.
  The parameters ''run'' and ''rise'' take the values of $-(2^{26}-1)$ to $+(2^{26}-1)$. If the parameter ''rise'' = 0, the DR command sets a horizontal drawing direction. If the parameter ''run'' = 0, the DR command sets a vertical drawing direction. But if both parameters are 0, an error occurs.
  Any DR command without parameters sets a horizontal drawing direction because ''DR1,0;'' is the default. Any DR command keyed in with only one parameter or more than three parameters causes an error. And the last parameter is ignored if there are three.
  The drawing directions set by the DR command are effective unless new DI and DR commands are executed additionally, or the IN or DF command is keyed in to set the default value.
  Parameter prefixes are determined as shown in Fig. DR-2, depending on which drawing direction is set when the current pen position is set as origin.



	run	rise
①	+	+
②	−	+
③	−	−
④	+	−

Fig. DR-2

DS (Designate Character Set) Command

- **Function:**

  The DS command specifies any character sets in each character slot.

- **Format:**

  DS Slot No. (, Character set No.) [Terminator]
  DS [Terminator]

- **Example;:**

```
LPRINT "DS0,8;"
LPRINT "DS;"
```

- **Parameter range:**

  Slot Nos. : 0 to 1 (RD mode)
  0 to 3 (ISO mode)
  Character set Nos. : −1, 0 to 59, 99

- **Default value:**

  Slot No. : 0
  Character set No. : 0

- **Explanation:**

  The DS command designates any optional character sets from the 62 character sets in each slot. (The 62 character sets include downloadable character set No. −1.) To set the actually using character table, an appropriate slot must be designated by the IV command. The parameter range of slot Nos. varies depending on the character selection modes . (See 6.7 ''SETTING CHARACTER SETS'' in CHAPTER 6.)
  The character set Nos. correspond to Nos. of 10.4 ''LIST OF CHARACTER SETS'' in CHAPTER 10. If any slot Nos. and character set Nos. are out of the specified ranges, the DS command is ignored.
  The DS command serves as a CS command if the slot 0 (standard character set) is designated and also as a CA command if the slot 1 (alternate character set) is designated. In other words, ''DS0,3;'' is the same as ''CS3;'', and ''DS1,6;'' is the same as ''CA6;''.

DT (Define Label Terminator) Command

- **Function:**
  The DT command defines the character (symbol) as label terminator that serves to release the DPX-3300 from the character drawing mode.

- **Format:**
  DT Character [Terminator]

- **Example:**

```
LPRINT "DT";CHR$(3);";"
```

- **Explanation:**
  When you cannot use ETX (CHR$(3)) as a default label terminator, you can use the DT command to define another label terminator.
  The DT command is able to define all characters (symbols) as label terminator other than NULL (CHR$(0)), ESC (CHR$(27)), LF (CHR$(10)). In case the control character is used, the original function of this character itself is executed. For a character that can be drawn, the DPX-3300 draws that character. If a character ''Z'' is used as label terminator, the DPX-3300 draws this ''Z'' at the end of a character string together with releasing the character drawing mode. For this reason, normally, you had better designate a control character.

EA (Edge Rectangle Absolute) Command

- **Function:**
  The EA command tells the DPX-3300 to draw a rectangle diagonal to the current pen position and any specified point.

- **Format:**
  EA X, Y [Terminator]

- **Example:**

```
LPRINT "EA2500,3000;"
```

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**

As shown in Fig. EA-1, the DPX-3300 draws a rectangle diagonal to the current pen position as start point and any point specified as X-Y absolute coordinates. After drawing, the pen returns to the start point.

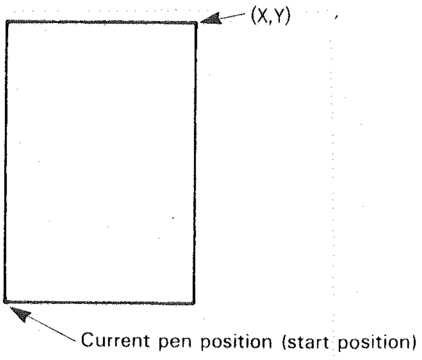

(X,Y)
Current pen position (start position)

Fig. EA-1

Depending on the parameter values for a pen position, the drawing direction and the drawing position vary as shown in Fig. EA-2.

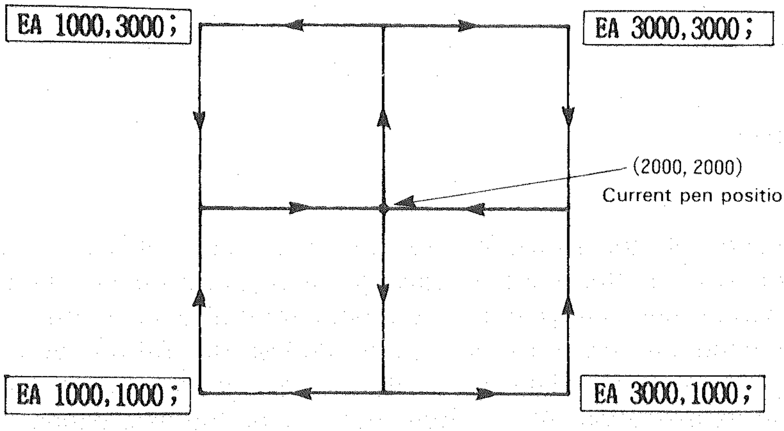

EA 1000,3000;
EA 3000,3000;
(2000, 2000)
Current pen position
EA 1000,1000;
EA 3000,1000;

Fig. EA-2

Example:

```
100 REM *** EA COMMAND ***
110 LPRINT "SP1;PA;PU1000,1000;"
120 LPRINT "EA2000,2000;"
```

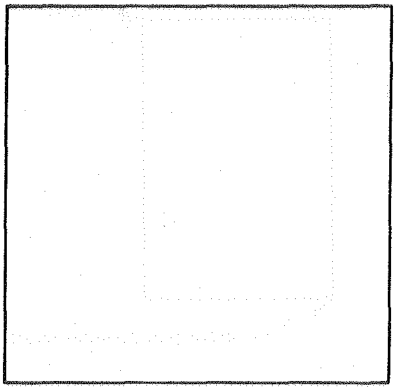


Fig. EA-3

EP (Edge Polygon) Command

- **Function:**
  The EP command tells the DPX-3300 to draw the border of a polygon defined in the polygon buffer.

- **Format:**
  EP [Terminator]

- **Example:**
  `LPRINT "EP;"`

- **Explanation:**
  The EP command tells the DPX-3300 to draw the border of a previously defined polygon in the polygon buffer. For this drawing, the pen now held by the pen carriage is used. For drawing lines, the type of line currently set is also used. Effective polygons by the EP command are only those defined by the PM, RA, RR and WG commands. The EP command reads the data out of the polygon buffer, but it does not clear them even after its execution. Also, it does not change the data either, so the same polygon can be drawn as many times as you want.

The DPX-3300 draws only the summits of a polygon defined at the pen (DOWN) state with the pen now in use. After drawing, the pen returns to the original pen position as well as to the pen (UP/DOWN) state.

When you defined a polygon by the PM, RA, RR and WG commands and if the polygon buffer is overflowed on the way of defining, still the EP command allows for drawing of the polygon border up to the summits until the buffer is overflowed. But the DPX-3300 cannot fill the polygon by the FP command. With regard to data, the data just before an overflow are properly stored in the polygon buffer.

ER (Edge Rectangle Relative) Command

- **Function:**
  The ER command tells the DPX-3300 to draw a rectangle diagonal to the current pen position and any point specified with relative coordinate values.

- **Format:**
  ER Δx, Δy [Terminator]

- **Example:**
  `LPRINT "ER1500,2000;"`

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**
  As shown in Fig. ER-1, the DPX-3300 draws a rectangle diagonal to the current pen position as start point and any point determined with the relative distances of X- and Y-axis directions. After drawing, the pen returns to the start point.

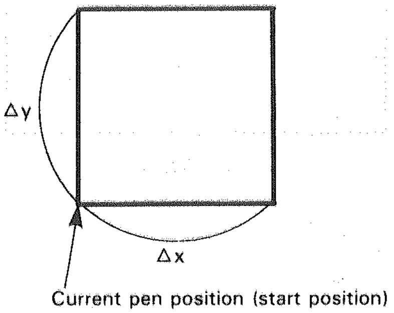


Fig. ER-1

Depending on the parameter values for a pen position, the drawing direction and the drawing position vary as shown in Fig. ER-2.

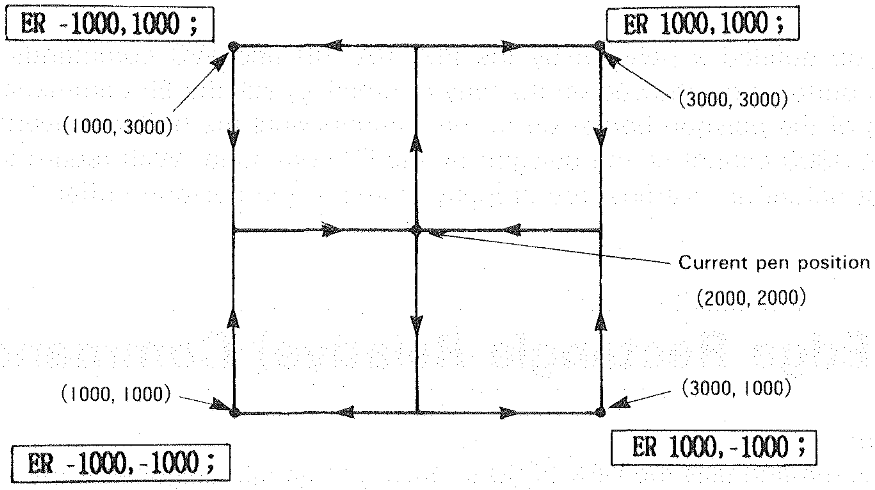

ER -1000,1000 ;
ER 1000,1000 ;
(1000, 3000)
(3000, 3000)
Current pen position
(2000, 2000)
(1000, 1000)
(3000, 1000)
ER -1000,-1000 ;
ER 1000,-1000 ;

Fig. ER-2

Example:

```
100 REM *** ER COMMAND ***
110 LPRINT "PA;PU2000,2000;"
120 LPRINT "ER1000,1000;"
```

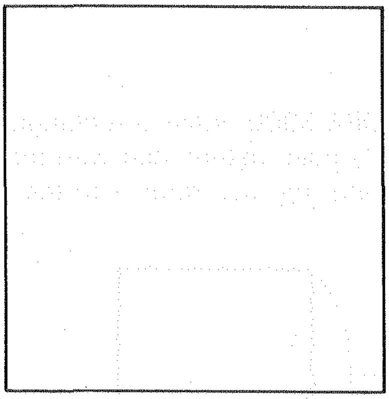


Fig. ER-3

ES (Extra Space) Command

- **Function:**

  The ES command specifies the space between characters (character space) and the space between lines (line space).

- **Format:**

  ES Character space (, Line space) [Terminator]
  ES [Terminator]

- **Example:**

```
LPRINT "ES0.1,0.2;"
```

- **Parameter range:**

  Character space: $-(2^{26}-1)$ to $+(2^{26}-1)$
  Line space : $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Default value:**

  Character space : 0
  Line space : 0

- **Explanation:**

  The parameter for character space specify the space between horizontally arrayed characters. The parameter for line space specify the space between vertically arrayed characters. Assuming the character width and height of one fixed character width font are 1 (size) respectively, the ES command specifies the character space and line space with the multiple of that size.

  When you specify a positive parameter for a character string, the character space and line space get large and the characters become parted away from each other. If you specify a negative parameter for a character string, the characters get close. If the parameter is -1, the characters are superposed. Any ES command without parameters is the same as ''ES0,0;'' (the default values).

  The character space and the line space follow the character size set by the SI and SR commands.

  The example below shows how to use the ES command for large and small character spaces and for the fixed character width font and the optimum character width font, as well as for the actual drawing.

Example:

```
100 REM *** ES COMMAND ***
110 LPRINT "IN;SP3;SI;"
120 LPRINT "PA6500,-5000;"
130 LPRINT "ES;LBCHARACTER SET(0)";CHR$(3)
140 LPRINT "PA6500,-5400;"
150 LPRINT "ES-.2;LBCHARACTER SET(0)";CHR$(3)
160 LPRINT "PA6500,-5800;"
170 LPRINT "ES.5;LBCHARACTER SET(0)";CHR$(3)
180 LPRINT "CS10;"
190 LPRINT "PA6500,-6600;"
200 LPRINT "ES;LBCHARACTER SET (10)";CHR$(3)
210 LPRINT "PA6500,-7000;"
220 LPRINT "ES-.2,0;LBCHARACTER SET (10)";CHR$(3)
230 LPRINT "PA6500,-7400;"
240 LPRINT "ES.5;LBCHARACTER SET (10)";CHR$(3)
250 LPRINT "SP0;"
```

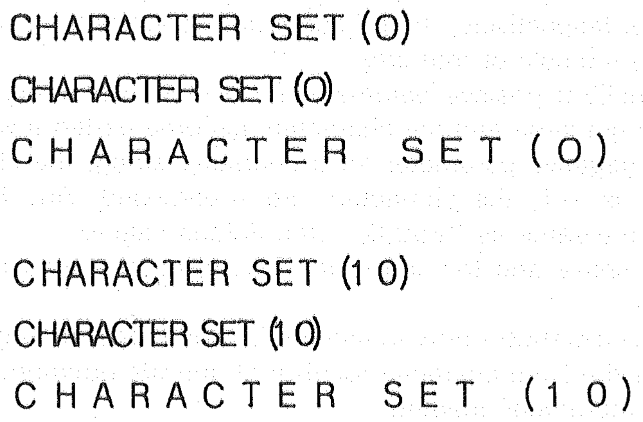

CHARACTER SET (0)
CHARACTER SET (0)
C H A R A C T E R   S E T (0)
CHARACTER SET (1 0)
CHARACTER SET (1 0)
C H A R A C T E R   S E T   (1 0)

Fig. ES-1

EW (Edge Wedge) Command

- **Function:**

The EW command tells the DPX-3300 to draw a wedge.

- **Format:**

EW r, $\theta 1$, θc (, θd) [Terminator]

- **Example:**

```
LPRINT "EW 1000,90,180,5;"
```

- **Parameter range:**

r	: radius	$-(2^{26}-1)$ to $+(2^{26}-1)$
$\theta 1$	: start angle	$-(2^{26}-1)^\circ$ to $+(2^{26}-1)^\circ$
θc	: center angle	$-(2^{26}-1)^\circ$ to $+(2^{26}-1)^\circ$
θd	: resolution	$-(2^{26}-1)$ to $+(2^{26}-1)$ (Default value: 5°)

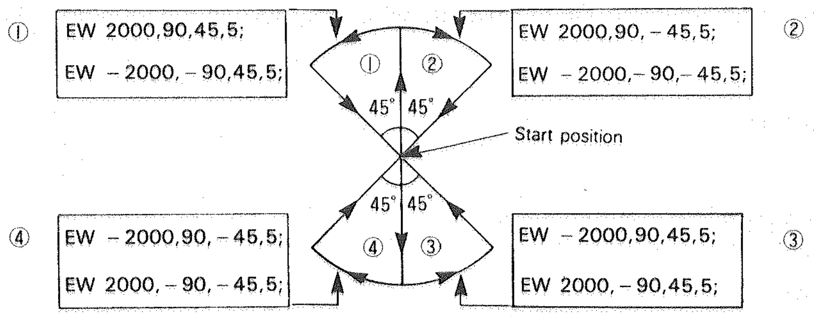
- **Explanation:**

Any EW command without parameters is ignored. After a wedge is drawn, the pen moves back to the start point.

Remember: The position of a reference point varies depending on negative and positive parameters you have used for the value of a radius. Also, depending on negative and positive parameters you have used for the start angle and center angle, the way of taking an angle from the reference point varies.

The resolution specifies the smoothness of an arc, but it has different parameter meaning depending on resolution modes you have specified. The θd is compensated for the value that divides the θc equally.

Depending on parameter prefixes, the drawing direction changes as follows.



① EW 2000,90,45,5;
EW -2000,-90,45,5;

② EW 2000,90,-45,5;
EW -2000,-90,-45,5;

④ EW -2000,90,-45,5;
EW 2000,-90,-45,5;

③ EW -2000,90,45,5;
EW 2000,-90,45,5;

Fig. EW-1

Example:

```
100 REM *** EW COMMAND ***
110 LPRINT "SP1;PA;PU2000,5000;"
120 FOR I=1 TO 4
130   READ A$
140   LPRINT "EW";A$;";"
150 NEXT I
160 DATA "-2000,-90,45,5","-2000,-90,-45,5"
170 DATA "2000,-90,-45,5","2000,-90,45,5"
```

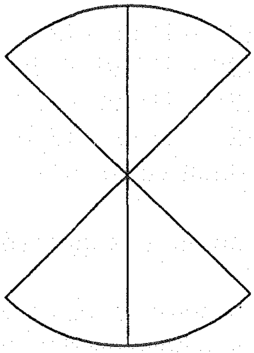


Fig. EW-2

FP (Fill Polygon) Command

- **Function:**
  The FP command tells the DPX-3300 to fill a polygon in the polygon buffer.

- **Format:**
  FP [Terminator]

- **Example:**
  `LPRINT "FP;"`

- **Explanation:**
  The FP command tells the DPX-3300 to fill a previously defined polygon in the polygon buffer. For this drawing, the DPX-3300 uses the pen currently held by the pen carriage. For drawing lines, the type of line currently set is used. Effective polygons by the FP command are only those defined by the PM, RA, RR and WG commands.

The FP command reads the data out of the polygon buffer, but it never clears the data even after its execution. Also, it does not change the content of the data. So, the same polygon can be filled as many times as you want.

In case there are polygons inside a polygon, the range of filling is determined as shown in Fig. FP-1. First, the space between the most outside polygon and the 2nd polygon is filled. Second, ignoring the space between the 2nd and the 3rd polygons, the space between the 3rd and the 4th polygons is filled.

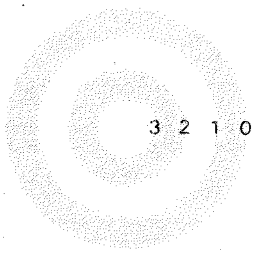


Fig. FP-1

After drawing, the pen moves back to the previous position and the pen (UP/DOWN) state.
When you define a polygon by the PM, RA, RR and WG commands and if the polygon buffer is overflowed on the way of defining, still the EP command allows for drawing of the polygon border up to the summits until the buffer is overflowed. But the DPX-3300 cannot fill the polygon by the FP command.

Example:

```
100 REM *** FP COMMAND ***
110 LPRINT "IN;SP3;"
120 LPRINT "PA-9500,5500;"
130 LPRINT "PM0;PD-9500,7500,-7500,7500,-7500,5500,-9500,
           5500;PM1;"
140 LPRINT "PU-9000,6250;PD-9000,6750,-8000,6750,-8000,
           6250,-9000,6250;
150 LPRINT "PU;PM2;"
160 LPRINT "FT3,50,45;FP;EP;"
```

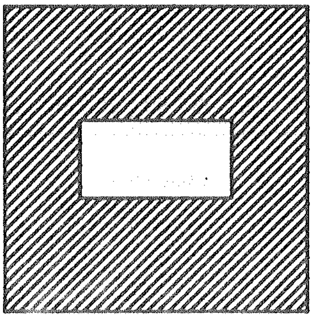


Fig. FP-2

FS (Force Select) Command

- **Function:**
  The FS command sets the pen force during drawing.

- **Format:**
  FS Pen force (, Pen No.) [Terminator]
  FS [Terminator]

- **Example:**

```
LPRINT "FS10,2;"
LPRINT "FS;"
```

- **Parameter range:**
  Pen force: 1 to 16
  Pen No. : 1 to 8

- **Default value:**
  Pen force: 1 (20g)
  Pen No. : for all pens

- **Explanation:**
  Force which the pen tip applies to a plotter paper (or optimum value of pen force) varies depending on various factors such as installation angles of the plotter, pen speeds, types and weight of pens, the amount of ink, types of papers, ambient temperature and humidity, etc. Too light pen force causes scratchy drawing lines. Too heavy pen force causes fast ink running, fast pen tip wearing and, in the worst case, paper tearing.
  The FS command can set and change pen force. Any FS command without parameters sets 20g pen force (the default value). Depending on parameters, pen force can be set in 15g increment from 20g up to 125g. When the parameter is below 1, pen force is set to 1 (20g). When the parameter is over 16, pen force is set to 16 (125g). The relation between the values of parameters and pen force is as shown in Table FS-1.

Value of Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Pen force(g)	20	20	35	35	50	50	65	65	80	80	95	95	110	110	125	125

Table FS-1

Also, specifying pen No. allows for changing of the pen force of a specific pen No. pen. If you omit pen No, new pen forces are set to all pens. But when the automatic pen control mode is ON (''AUTO'' LED lights up), you cannot change the pen force by the FS command. When the automatic pen control mode is OFF (''AUTO'' LED is OFF), you can change the pen force by FS command.

FT (Fill Type) Command

- **Function:**

The FT command specifies the pattern of filling or hatching. It is used together with the RA, RR and WG commands.

- **Format:**

FTn (,d(,θ)) [Terminator]
FT [Terminator]

- **Example:**

```
LPRINT "FT 3;"
LPRINT "FT;"
```

- **Parameter range:**

n	: pattern	1 to 6
d	: hatching line space	0 to $(2^{26}-1)$
θ	: angles	$-(2^{26}-1)^\circ$ to $+(2^{26}-1)^\circ$

- **Default value:**

$n=1$
$d=(P2x-P1x)\times 0.01$
$\theta=0$

- **Explanation:**

n : pattern
There are six patterns that can be designated as follows. Any fractions below the decimal point given to parameters are cut-off.

1: cross directional filling by PT command
2: one directional filling by PT command
3: hatching by parameter d
4: cross hatching by parameter d
5: cross directional hatching by UF command
6: one directional hatching by UF command

When the parameter n is 1 or 2, the parameter d for line space is ignored. Regardless of the presence and absence of scaling, the value specified by the PT command for pen sizes is set for hatching line space.
When the parameter n is 5 or 6, the value specified by the UF command is set. If you do not specify any filling pattern, the default value 1 is set.

d : hatching line space
This is the space between horizontal hatching lines and is specified by the user coordinate unit. Only when the parameter n is 3 or 4, it is effective.
If you do not specify any parameter d, the parameter d you have specified at last by the FT command is set. If you specify parameter d first during programming, it is set to the default value (1% of distance between P2x and P1x). If 0 is specified for d, it is ignored. But the value specified by the PT command at that time is applied.

θ : angle
This specifies the slant of lines for filling or hatching. If you specify 0, 90 and 30, horizontal, vertical and 30° slant lines are drawn in the form of filling or hatching, respectively. If you do not specify any angle, the angle you have specified at last by the FT command are applied. And if you specify an angle first during programming, the angle 0 (horizontal hatching) is set.

GP (Pen Group) Command

- **Function:**
The GP command sets pen groups.

- **Format:**
GP g (, h (, i (, j))) [Terminator]
GP [Terminator]

- **Example:**

```
LPRINT "GP2,2,3;"
LPRINT "GP;"
```

- **Parameter range:**

g : group Nos.	1 to 8
h : pen Nos.	1 to 8
i : number of pens	1 to 8
j : line length	1 to 50000 m

- **Default value:**

g : group Nos. .... same group Nos. as pen Nos.
h : pen Nos. ....
i : number of pens 1
j : line length 100 (m)

- **Explanation:**

You can use the GP command to divide 8 pens into a few groups (less than 8 pens each). When one pen draws at the specified distance, this pen is automatically replaced with another pen in the same group. Pen groups are specified by the SG command.

g : group Nos.
The parameter g specifies any group No. from 8 pen groups. This group No. corresponds to the group No. specified by the SG command. If you omit the parameter g, each pen group No. coincides with their respective pen Nos.

h : pen Nos.
The parameter h specifies the first pen No. included in the pen group specified by the parameter g. If you omit the parameter h, each pen group No. coincides with their respective pen Nos.

i : number of pens
The parameter i specifies the number of pens in the specified pen group. Pens you have added in sequence from the pen No. specified by the parameter h are set as pen group. But if i+h>8, the i is compensated for so that i+h=8. Omitting parameter sets only one pen.

j : line length
The parameter j specifies in the metric unit (m) the distance that one pen of a pen group can draw. When this pen finishes drawing, it is replaced with the next pen in the same group. Omitting parameter sets 100 m for the line length.

Example:

```
100 REM *** GP COMMAND ***
110 LPRINT "IN;"
120 LPRINT "GP1,1,1,800;"
130 LPRINT "GP2,2,3;"
140 LPRINT "GP3,5,4,50;"
```

If the above example is executed, No.1 pen (distance: 800 m) is set to No.1 group, No.2 to No.4 pens (distance: 100 m) are set to No.2 group, and No.5 to No.8 pens (distance: 50 m) are set to No.3 group.

IM (Input Mask) Command

- **Function:**

  The IM command sets the DPX-3300 to the condition that it is able to indicate errors.

- **Format:**

  IM Error mask value [Terminator]
  IM [Terminator]

- **Example:**

```
LPRINT "IM 223;"
LPRINT "IM;"
```

- **Explanation:**

  The value of error mask is the sum of error mask bits (Nos. of Table IM-1) from which the DPX-3300 wants to know the occurrence of an error. If an error of the bits that have been set occurs, the "ERROR" LED of the control panel lights up. For example, the default error mask value 223 (128+64+16+8+4+2+1) lights up the "ERROR" LED if the error has a content excluding the error No. 6. Since the error Nos. 4, 7 and 8 are not used, an error mask value 23 except these error Nos. is the same as the default value 223.

Error mask bit value	Error No.	Meaning
1	1	Unrecognizable command executed
2	2	Wrong number of parameters
4	3	Parameter out of range
8	4	Unused
16	5	Unusable character designated
32	6	Coordinate overflow
64	7	Unused
128	8	Unused

Table IM-1 (Error mask)

You can check to see the above error contents by using the OE command when the "ERROR" LED of the control panel is lighting up. At the default or initialize, the value of error mask bits is set at 223. Also, any IM command without parameter and even IM command with parameter out of the specified range are set to the default value 223.

IN (Initialize) Command

- **Function:**
  The IN command sets the DPX-3300 at the initialize condition as the power is turned ON.

- **Format:**
  IN [terminator]

- **Example:**

```
LPRINT "IN;"
```

- **Explanation:**
  In addition to the same performance as the DF command, the IN command does as follows:
  (1) Moves a pen up (PU;)
  (2) Sets the scaling points P1 an P2 at the default (IP;)
  (3) Clears an error and sets the 3rd bit of status bite
  (4) Sets the rotation of coordinate axes at the default (RO;)
  (5) Sets pen speed and pen force at optimal values for the pen now in use. But they are not changed when the automatic pen control mode is ON. (VS;FS;)
  (6) Clears the data of downloadable character buffer (DL;)
  (7) Clears the settings of pen groups (GP;)

IP (Input P1 & P2) Command

- **Function:**
  The IP command sets the scaling points P1 and P2 in a program.

- **Format:**
  IP P1x,P1y(,P2x,P2y) [Terminator]
  IP [Terminator]

- **Example:**

```
LPRINT "IP0,10,10000,5000;"
LPRINT "IP;"
```

- **Parameter range and default value:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

The default values for parameters are shown in Table IP-1.

	P1x	P1y	P2x	P2y
DIP Switch I-⑦ OFF ISO-A1	−15540	−11080	15540	11080
DIP Switch I-⑦ ON ANSI-D	−15990	−10380	15990	10380

P1 & P2 Default Values
Table IP-1

- **Explanation:**

You specify the coordinates of scaling points P1 and P2 with plotter coordinate values. For this, the P1 and P2 must be within the maximum plotting area.
Any IP command without parameters sets the P1 and P2 at the default values shown in Table IP-1.

The IP command is used to set P1 and P2 at any points and/or set them back to the default values.
The P1 and P2 are the positions that attribute the plotter coordinates inherent in the DPX-3300 with the user coordinates having any user defined scale. The size of the user coordinates is specified by the SC command.
If you omit to specify P2 by the IP command, the P2 automatically moves to the same distant position as the P1 moves. In other words, both values of (P2x-P1x) and (P2y-P1y) are the same as those before and after the IP command omitted to specify P2 was executed.

IV (Invoke Slot) Command

- **Function:**
  The IV command specifies any character slot in the character tables.

- **Format:**
  IV Slot No. (, Character table) [Terminator]
  IV [Terminator]

- **Example:**

```
LPRINT "IV1,1;"
LPRINT "IV;"
```

- **Parameter range;**
  Slot Nos. : 0 to 1 (RD mode)
  0 to 3 (ISO mode)
  Character tables : 0 to 1

- **Default value:**
  Slot No. : 0
  Character table. : 0

- **Explanation:**
  You specify slot Nos. by the IV command and set character tables for use in the actual drawing. For this, you must specify character sets in each slot by the DS command. (See 6.7 ''SETTING CHARACTER SETS'' in CHAPTER 6.)

  Slot Nos.:
  Slots are specified with these parameters. The parameter values correspond the slot Nos. specified by the DS command. The parameter range varies depending on the character selection modes (RD and ISO modes).

  Character tables
  These parameters are used only when the character selection mode is ISO-8 bit mode. When the parameter value is 0, it specifies the character table (left). When the parameter value is 1, it specifies the character table (right).
  In a mode other than the ISO-8 bit mode, this parameter is ignored.

  The IV command serves as an SS command for specifying the slot 0 (standard character set) as well as the SA command for specifying the slot 1 (alternate character set). In other words, ''IV0;'' and ''IV1;'' are the same as ''SS;'' and ''SA;'', respectively.

IW (Input Window) Command

- **Function:**

  The IW command specifies a plotting area. This area is called a ''window''.

- **Format:**

  IW X1 lower left, Y1 lower left, X2 upper right, Y2 upper right [Terminator]
  IW [Terminator]

- **Example:**

```
LPRINT "IW0,0,100,100;"
LPRINT "IW;"
```

- **Parameter range and default value:**

  The default value and range of parameters are the same as the maximum plotting area shown in Table IW-1. They vary with setting the DIP Switch 1- ⑦. Setting parameters out of this range does not cause any errors. Areas out of the maximum plotting area are set to the limit of the maximum plotting area.

	Xmin	Ymin	Xmax	Ymax
DIP Switch I-⑦ OFF JIS-AI	−17300	−11880	16340	11880
DIP Switch I-⑦ ON ANSI-D	−17750	−11180	16790	11180

Table IW-1

- **Explanation:**

  A window follows the values of four parameters. It is set to the default value if no parameters are keyed in.

  If the four parameters have not been scaled, they are discriminated as plotter coordinate values. If scaled, they are discriminated as user coordinate values. Then, they become the X-Y coordinates at the lower left corner and upper right corner of the window. If the value of ''X1 lower left'' is greater than that of ''X2 upper right'' or if the value of ''Y1 lower left'' is greater than that of ''Y2 upper right'', they are replaced with each other so that always X1<X2 and Y1<Y2.

  Any window is set to the default value when the power is turned ON or when the IN or DF command is executed.

  You can use the IW command to set a plotting area in the following situations: When a plotting paper is smaller than the plotting area or in case there are many drawings in the area of one plotting paper and you want the DPX-3300 to draw part of the entire drawing.

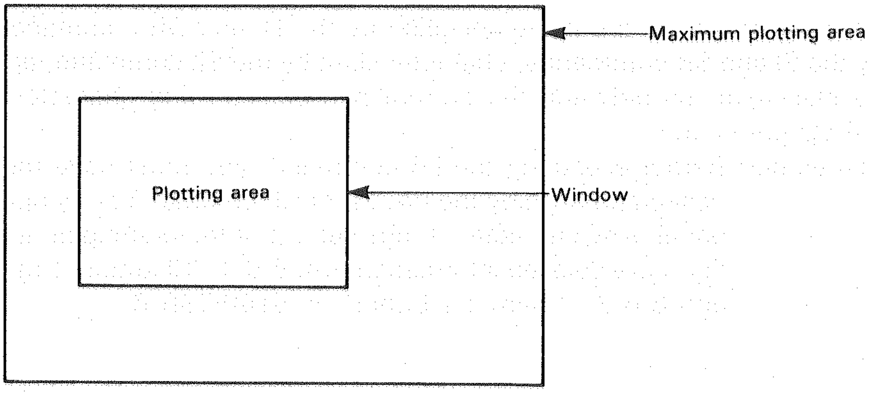


Fig. IW-1

LB (Label) Command

- **Function:**
  Using the currently specified character set, the LB command allows for drawing of a character string up to the label terminator defined by the DT command while writing in the character buffer.

- **Format:**
  LB character string [Terminator]

- **Example:**

```
LPRINT "LB Roland DG";CHR$(3)
LPRINT "LB";A;B;CHR$(3)
```

- **Explanation:**
  The LB command tells the DPX-3300 to come in the character drawing mode. In this mode, the DPX-3300 draws the character string followed by the LB command until receiving the label terminator defined by the DT command while writing in the character buffer.
  If the DT command is omitted, a label terminator is the default ETX (CHR$(3)).
  Remember: If you forget a label terminator at the end of a character string when you use the LB command, any further commands after this are all interpreted as a character string.

  Character sets you want to use by the LB command are those specified by the DS, and IV (CS, SS, CA, SA) commands between CHR$(33) and CHR$(126). For more information about the selection of character sets, see 6.7 "SETTING CHARACTER SETS" in CHAPTER 6.

Drawing directions are those specified by the DI and DR commands, character sizes by the SI and SR commands, character slant by the SL command, and also the relative position relations between the current pen position and characters to be drawn by the LO command.

Remember: Before executing the LB command, you must have moved the pen to a desired position by the PA, PR or CP command or by operating the control panel. Any character strings set out of the plotting area cannot be drawn. For more detailed information, see 6.6.1 ''Character Drawing And Setting'' and 6.6.2 ''Character Buffer'' in CHAPTER 6.

LO (Label Origin) Command

- **Function:**
  The LO command specifies the character origin.

- **Format:**
  LO Position No. [Terminator]
  LO [Terminator]

- **Example:**

```
LPRINT "LO4;"
LPRINT "LT;"
```

- **Parameter range:**
  1 to 9 and 11 to 19

- **Default value:**
  1

- **Explanation:**
  When the DPX-3300 draws characters by the LB and PB commands, the LO command sets origins for those characters.
  Any LO command without parameter is the same as the parameter is 1 and sets the character origin at the default position. The default character origin is at the left corner of a character. This position of the character origin is determined as position No.1.
  As shown in Fig. LO-1, position Nos. 1 to 9 have their own character origins within the space of one character (character cell). The dots in the figure indicate the current pen positions (character origins).

  As shown in Fig. LO-2, position Nos. 11 to 19 have their own character origins away horizontally and vertically from the space of one character (character cell) for just half of the character length.

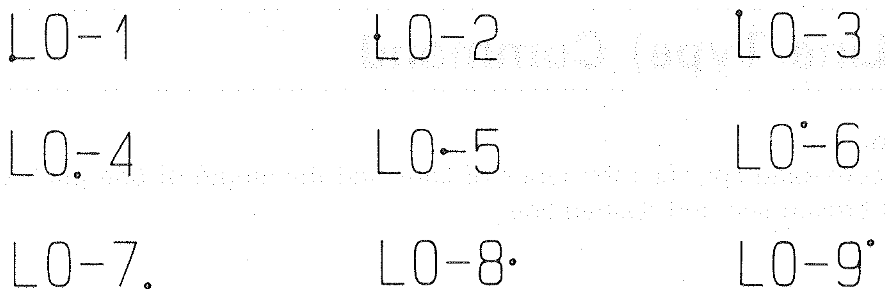


Fig. LO-1

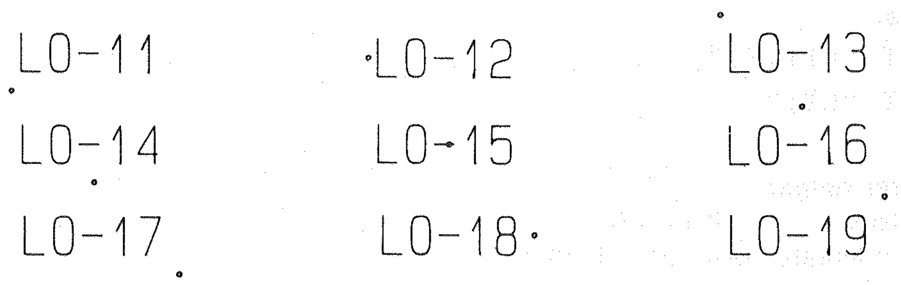


Fig. LO-2

Any character origins set by the LO command are effective until they are reset by the LO command, set to the default by the IN or DF command or until the power is turned ON again.

If the position Nos. 1 to 3 and 11 to 19 have already been specified by the LO command when you want a drawing by the LB command, the DPX-3300 computes the positions of each character, draws the characters as specified and stores them in the character buffer. But if position Nos. 4 to 9 and 14 to 19 have already been specified, you cannot do any positioning until the length of a character string is determined by a carriage return CR (CHR$(13)) or label terminator. In such a case, a character string is stored in the character buffer, but the character drawing is not started until the DPX-3300 receives a carriage return or label terminator.

The pen position is updated for each character drawing, and the pen moves to another character origin for the next character drawing. Keying in a carriage return between a character string and a label terminator allows the pen to move back to the position before the character string is drawn.

LT (Line Type) Command

- **Function:**

  The LT command specifies the types of lines and the length of one pitch when you selected broken line and dashed line.

- **Format:**

  LT Pattern No. (, One pitch length) [Terminator]
  LT [Terminator]

- **Example:**

```
LPRINT "LT1,7;"
LPRINT "LT;"
```

- **Parameter range:**

  Pattern Nos. : -6 to $+6$
  One pitch length : 0 to $(2^{26}-1)$ (%)

- **Default value:**

  Pattern : solid line
  One pitch length : 4%

- **Explanation:**

  Any LT commands without parameters specify solid line. If parameters are keyed in, the LT command specifies the types of lines depending on pattern Nos. as follows.

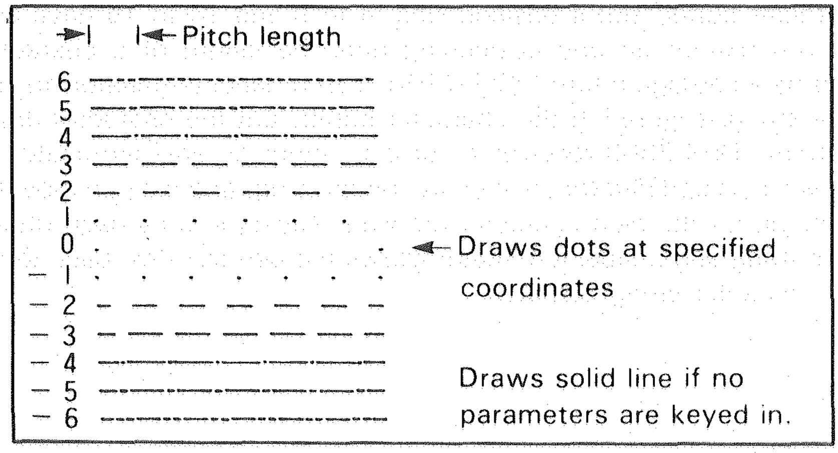

Pitch length
6
5
4
3
2
1
0
Draws dots at specified coordinates
−1
−2
−3
−4
−5
−6
Draws solid line if no parameters are keyed in.

Fig. LT-1

If the pattern No. is negative (−), the DPX-3300 starts drawing from the center of the pattern as shown above. The pitch length is compensated for so that the integer number of patterns enters the specified zone. Any fraction below the decimal point given to parameters are cut-off. An instruction example with different prefixes of the pattern Nos. is shown below.

The parameter for the length of one pitch is expressed by the percentage (%) of diagonal length with respect to the scaling points P1 and P2. If you omit a parameter for the length of one pitch, the length is set at 4% (4 is the default value).

The types of lines selected by the LT command are effective for the following commands.

AA, AR, CI, EA, EP, ER, EW,
FP, PA, PD, PR, RA, RR, WG

Example 1:

```
10  LPRINT "SP1;LT5;"
20  LPRINT "PR;PD2000,0,0,1000,-2000,0,0,-1000;PU;"
```

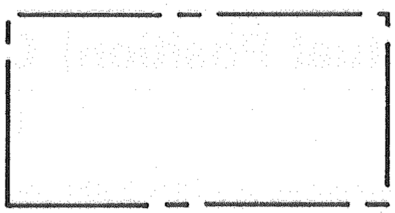


Fig. LT-2

Example 2:

```
10  LPRINT "SP1;LT-5;"
20  LPRINT "PR;PD2000,0,0,1000,-2000,0,0,-1000;PU;"
```

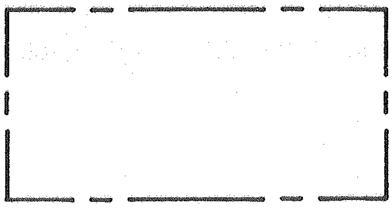


Fig. LT-3

NR (Not Ready) Command

- **Function:**
  The NR command sets the DPX-3300 on pause condition.

- **Format:**
  NR [Terminator]

- **Example:**
  `LPRINT "NR;"`

- **Explanation:**
  There is no parameter for the NR command. When sending the NR command, the pen carriage goes to the UR position and the DPX-3300 pauses (''PAUSE'' LED lights up). The NR command is used when a plotter paper is replaced. The DPX-3300 does not operate even if the next command is sent, but if you press the PAUSE key, it starts drawing from the next command after the NR command.

OA (Output Actual Position) Command

(For only serial connection)

- **Function:**
  When the OA command is executed, the DPX-3300 comes in the condition so that the computer can read the X-Y coordinate values of the current pen position in plotter coordinates and the pen (UP/DOWN) state.

- **Format:**
  OA [Terminator]

- **Example:**
  `PRINT #1,"OA;"`

- **Explanation:**
  When receiving the OA command, the DPX-3300 enables the following three values to output in ASCII.

  X, Y, P [TERM]

  X and Y are integers at the coordinate values in plotter coordinates. The DPX-3300 outputs a minus sign ''−'' for negative coordinates and ignores the first 0 and a plus sign ''+''. When the power is turned ON, the X and Y become the lower left values of the maximum plotting area. And P indicates the pen state and becomes 0 when the pen is up and 1 when the pen is down. [TERM] is the output terminator of RS-232C. For more information, see ''ESC.M Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8.

Using this command allows you to know the coordinates of pen position by moving the pen to that position where you want character and figure drawings. So, it is for easy pen positioning and window setting.

Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OA COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OA;"
40 INPUT #1,X,Y,P
50 PRINT X,Y,P
```

OC (Output Commanded Position) Command

(For only serial connection)

- **Function:**

  When the OC command is executed, the DPX-3300 comes in the condition so that the computer can read the X-Y coordinate values of the current pen position in either plotter or user coordinates as well as the pen state (UP/DOWN).

- **Format:**

  OC [Terminator]

- **Example:**

  `PRINT #1,"OC;"`

- **Explanation:**

  When receiving the OC command, the DPX-3300 enables the following three values to output in ASCII.

  X, Y, P [TERM]

  X and Y are the coordinate values up to the 4th decimal point in either plotter or user coordinates. The DPX-3300 outputs a minus sign ''−'' for negative coordinates and ignores the first 0 and plus sign ''+''. And P indicates the pen state and becomes 0 when the pen is up and 1 when the pen is down. [TERM] is the output terminator of the connected interface. For more information, see ''ESC.M Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8.

When scaled by the IP and SC commands, the X and Y are the coordinate values in the user coordinates. The ranges of both X and Y are real numbers within $-(2^{26}-1)$ to $+(2^{26}-1)$.

Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OC COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OC;"
40 INPUT #1,X,Y,P
50 PRINT X,Y,P
```

OD (Output Digitize) Command

(For only serial connection)

- **Function:**

When the OD command is executed, the DPX-3300 comes in the condition so that the computer can read the X-Y coordinate values of the point digitized first and the pen (UP/DOWN) state.

- **Format:**

OD [Terminator]

- **Example:**

```
PRINT #1,"OD;"
```

- **Explanation:**

When receiving the OD command, the DPX-3300 enables the X-Y coordinates at the point digitized first and the pen (UP/DOWN) state to output in ASCII as follows:

X, Y, P [TERM]

X and Y are integers at the coordinate values in the user coordinates. The DPX-3300 outputs a minus sign ''−'' for negative coordinates and ignores the first 0 and plus sign ''+''. And P is a parameter indicating the pen state and becomes 0 when the pen is up and 1 when the pen is down. [TERM] is the output terminator of RS-232C. For more information, see ''ESC.M Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8. When receiving the OD command, the bit 2 of status byte is cleared (see "OS Command".)

Remember: For the actual use in a program, you must have opened the RS-232C port first by using the "OPEN" statement of the computer.
For more information, see 6.10 "DIGITIZE" in CHAPTER 6.

Example:

```
10 REM *** OD COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OD;"
40 INPUT #1,X,Y,P
50 PRINT X,Y,P
```

OE (Output Error) Command

(For only serial connection)

- **Function:**

  The OE command allows the computer to read the sum of error bits indicating the content of errors which have occurred.

- **Format:**

  OE [Terminator]

- **Example:**

  `PRINT #1,"OE;"`

- **Explanation:**

  When receiving the OE command, the DPX-3300 enables error codes to output in ASCII as follows:

  Error code [TERM]

  [TERM] is the output terminator of RS-232C. For more information, see "ESC.M Command" of 8.4.1 "Handshake Mode Commands" in CHAPTER 8. When the output is completed, the bit 5 of status byte of the DPX-3300 is cleared, and the "ERROR" LED lights OFF.

  Therefore, the OE command is very useful for debugging a program.

  Remember: For the actual use in a program, you must have opened the RS-232C port first by using the "OPEN" statement of the computer.

Error bit value	Error No.	Meaning
0	0	No error
1	1	Unrecognizable command
2	2	Wrong number of parameter
4	3	Unusable parameter
8	4	Unused
16	5	Unusable character set designated
32	6	Coordinate overflow
64	7	Polygon buffer or downloadable character buffer overflow
128	8	Unused

Table OE-1

Example:

```
10 REM *** OE COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OE;"
40 INPUT #1,E
50 PRINT E
```

OF (Output Factor) Command

(For only serial connection)

- **Function:**

The OF command outputs the number of plotter units per 1 mm of both X- and Y-axis directions to the computer. This allows you to know the size of plotter coordinates on software.

- **Format:**

OF [Terminator]

- **Example:**

```
PRINT #1,"OF;"
```

- **Explanation:**

When the OF command is executed, the DPX-3300 outputs the following values all the time.

40,40 [TERM]

These two parameters indicate that the DPX-3300 has 40 plotter units within a 1 mm × 1 mm area of both X- and Y-axis directions. [TERM] is the output terminator of RS-232C. For more information, see ''ESC.M Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8.

Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OF COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OF;"
40 INPUT #1,UX,UY
50 PRINT UX,UY
```

OH (Output Hard-Clip Limits) Command

(For only serial connection)

- **Function:**

The OH command outputs to the computer the coordinate values at the lower left corner (LL) and upper right corner (UR) of the maximum plotting area (hard-clip).

- **Format:**

OH [Terminator]

- **Example:**

```
PRINT #1,"OH;"
```

- **Explanation:**

When receiving the OH command, the DPX-3300 outputs the integer coordinate values of LL and UR in ASCII as follows:

XLL, YLL, XUR, YUR [TERM]

The DPX-3300 outputs a minus sign ''−'' for negative coordinates and ignores the first 0 and plus sign ''+''. The maximum plotting area varies with setting the DIP Switch 1-⑦ (see 3.6 ''SETTING FUNCTIONS FOR PAPER SIZES'' in CHAPTER 3.) The DPX-3300 outputs in real number the values of Table IW-1 shown in the section of ''IW Command''. And using the IW command, you can set a window in the maximum plotting area to determine a plotting area for that window. The IW command has no effect on the content of data output by the OH command. [TERM] is the output terminator of RS-232C. For more information, see ''ESC.M Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8.

Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OH COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OH;"
40 INPUT #1,XLL,YLL,XUR,YUR
50 PRINT XLL,YLL,XUR,YUR
```

OI (Output Identification) Command

(For only serial connection)

- **Function:**

The OI command outputs the model name of a plotter (in this case, ''DPX-3300'') to the computer.

- **Format:**

OI [Terminator]

- **Example:**

```
PRINT #1,"OI;"
```

- **Explanation:**

Using the OI command allows you to know what kind of a plotter is connected to the computer.

Remember: Before using this command in a program, you must have opened the RS-232C port by using the ''OPEN'' statement of the computer. When receiving the OI command, the model name of a plotter is output to the computer as follows:

''DPX-3300'' [TERM]

[TERM] is the output terminator of RS-232C. For more information, see ''ESC.M Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8.

Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OI COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OI;"
40 INPUT #1,DPX$
50 PRINT DPX$
```

OL (Output Label Length) Command

(For only serial connection)

- **Function:**
  The OL command outputs the data stored in the character buffer to the computer.

- **Format:**
  OL [Terminator]

- **Example:**
  `PRINT #1,"OL;"`

- **Explanation:**
  When receiving the OL command, the DPX-3300 outputs the data about characters written by the BL and LB commands in the character buffer to the computer in ASCII. The output data are separated by commas "," as follows:

  Length of a character string, Number of character string, Line feed [TERM]

  With regard to the length of a character string, the DPX-3300 converts the longest length (including spaces) stored in the character buffer into character cells and outputs the number of character cells to the computer. When there are characters in the character buffer, the DPX-3300 outputs them in real number with four digits.
  With regard to the number of a character string, the DPX-3300 outputs the largest number (including spaces) stored in the character buffer in real number. A back space ☐BS☐ (CHR$(8)) is counted as −1, and an overwritten character is counted as 1. (Overwritten character is by that the pen passes through a character cell once and moves back to write a character within the character cell.)
  With regard to the line feed, the DPX-3300 outputs in real number the number of line feeds occurred when a character string stored in the character buffer is actually

drawn. A line feed LF (CHR$(11)) is counted as +1 and VT (CHR$(11) as −1. And when they are the same number, 0 is output.
Usually the OL command is used together with the BL command. But with regard to all character strings stored by either the LB or BL command in the character buffer, the OL command tells the DPX-3300 to output all the information to the computer. If the character buffer has been cleared, three 0's are output.
[TERM] is the output terminator of RS-232C. For more information, ''ESC.M Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8.
Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OL COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"BLABCD";CHR$(10);CHR$(13);"abc";CHR$(3)
40 PRINT #1,"OL;"
50 INPUT #1,C,N,L
60 PRINT C,N,L
```

OO (Output Optional Parameter) Command

(For only serial connection)

- **Function:**
  The OO command tells the DPX-3300 to output eight optional parameters to the computer.

- **Format**
  OO [Terminator]

- **Example:**
  `PRINT #1,"OO;"`

- **Explanation:**
  When receiving the OO command, the DPX-3300 comes in the state that it can output eight real numbers, separated by commas '','', as follows. Two out of the eight parameters are effective and the DPX-3300 always outputs 1.

```
0,1,0,0,1,1,0,1[TERM]
  |   | |   └──indicates a user definable buffer is available.
  |   | └──indicates a polygon can be filled.
  |   └──indicates the presence of a circle or arc command.
  └──indicates pen replacement is possible.
```

[TERM] is the output terminator of RS-232C. For more information, see "ESC.T Command" of 8.4.1 "Handshake Mode Commands" in CHAPTER 8.
Remember: For the actual use in a program, you must have opened the RS-232C port first by using the "OPEN" statement of the computer.

Example:

```
10 REM *** OO COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OO;"
40 INPUT #1,O1,O2,O3,O4,O5,O6,O7,O8
50 PRINT O1,O2,O3,O4,O5,O6,O7,O8
```

OP (Output P1 & P2) Command

(For only serial connection)

- **Function:**
  The OP command tells the DPX-3300 to output the setting values of scaling points P1 and P2 to the computer.

- **Format:**
  OP [Terminator]

- **Example:**
  `PRINT #1,"OP;"`

- **Explanation:**
  When receiving the OP command, the DPX-3300 outputs four coordinates in ASCII as follows:

  P1x,P1y,P2x,P2y [Terminator]

  The values of each coordinate above are integer values in plotter coordinates. For more information, see "IP Command". [TERM] is the output terminator of RS-232C. For more information, see "ESC.T Command" of 8.4.1 "Handshake Mode Commands" in CHAPTER 8.
  When the DPX-3300 completes the output, the bit 1 of status byte is cleared. (See "OS Command".)
  Using this command allows you to know the coordinates of the scaling points P1 and P2 set by operating the control panel. It is useful for setting a window in the area of

P1 and P2 or performing the conversion of the user coordinates to the plotter coordinates.
Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OP COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OP;"
40 INPUT #1,P1X,P1Y,P2X,P2Y
50 PRINT P1X,P1Y,P2X,P2Y
```

OS (Output Status) Command

(For only serial connection)

- **Function:**
  The OS command allows the computer to read the values of status byte.

- **Format:**
  OS [Terminator]

- **Example:**

```
PRINT #1,"OS;"
```

- **Explanation:**
  The OS command is useful for debugging a program and digitizing the DPX-3300. No parameters are required. The DPX-3300 has data to indicate the inside condition of itself. These data consist of eight bits from the bits 0 to 7 which are called ''status byte''. When receiving the OS command, the DPX-3300 converts the values of 8-bit status bite into decimal from 0 to 255 and enables the converted numerals to output in ASCII as follows:

  Status byte (decimal value) [TERM]

  [TERM] is the output terminator of RS-232C. For more information, see ''ESC.T Command'' of 8.4.1 ''Handshake Commands'' in CHAPTER 8.
  Each bit of the status byte is defined as follows.

Bit value	Bit position	Meaning
1	0	Pen down
2	1	P1 or P2 is changed (cleared by "OP")
4	2	Digitized point can be output by the OD command (cleared by "OD")
8	3	Initialized (cleared by "OS")
16	4	Data can be accepted (always 0)
32	5	There is an error (cleared by "OE")
64	6	(Unused, always 0)
128	7	(Unused, always 0)

Table OS-1

The status byte is 26 in decimal when the power is turned ON. This is because the bits 1, 3 and 4 of the status byte are set. In other words, the sum of 2, 8 and 16 is 26. After the OS command is executed, the bit 3 of the status byte is cleared.

Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OS COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OS;"
40 INPUT #1,S
50 PRINT S
```

OT (Output Pen Map) Command

(For only serial connection)

- **Function:**
  The OT command allows the computer to output data about the pens in the pen stock.

- **Format:**
  OT [Terminator]

- **Example:**
  `PRINT #1,"OT;"`

- **Explanation:**

When receiving the OT command, the DPX-3300 outputs in which pen stock pens are stocked in pen-map values.

−1, pen-map values [TERM]

The DPX-3300 outputs two real numbers, but the first real number is always −1. Pen-map values are real numbers in a range from 0 to 255 and the sum of the defined map positions as shown in Table OT-1. They are added where a pen is attached. For example, suppose 15 is added as a pen-map value, 15=1+2+4+8. This means that pens are stocked in the pen stocks No.1 to No.4 but not stocked in the pen stocks No.5 to No.8.
[TERM] is the output terminator of RS-232C. For more information, see ''ESC.T Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8.

Bit value when pen is in pen stock	Pen stock No.
1	1
2	2
4	3
8	4
16	5
32	6
64	7
128	8

Table OT-1

Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OT COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OT;"
40 INPUT #1,D,P
50 PRINT D,P
```

OW (Output Window) Command

(For only serial connection)

- **Function:**

The OW command sends the coordinates values at the lower left and upper right corners of a window to the computer.

- **Format:**

OW [Terminator]

- **Example:**

```
PRINT #1,"OW;"
```

- **Explanation:**

When receiving the OW command, the DPX-3300 enables the coordinate values at the lower left and upper right corners of a window set by the IW command to output in ASCII. The coordinate values are plotter coordinates if they were not scaled when the IW command was executed and are user coordinate if they were scaled when the IW command was executed. The sequence of integer coordinate values output from the DPX-3300 is as follows.

X1 lower left, Y1 lower left, X2 upper right, Y2 upper right [Terminator]

[TERM] is the output terminator of RS-232C. For more information, see ''ESC.M Command'' of 8.4.1 ''Handshake Mode Commands'' in CHAPTER 8.
When you want to know the size of a window, execute the OW command to tell the computer to read its value.
Remember: For the actual use in a program, you must have opened the RS-232C port first by using the ''OPEN'' statement of the computer.

Example:

```
10 REM *** OW COMMAND ***
20 OPEN "COM1:9600,N,8,1" AS #1
30 PRINT #1,"OW;"
40 INPUT #1,XLL,YLL,XUR,YUR
50 PRINT XLL,YLL,XUR,YUR
```

PA (Plot Absolute) Command

- **Function:**

  The PA command specifies absolute coordinates. If you key in parameters after the PA command to specify X-Y coordinates, the pen moves to the point of these X-Y coordinates values.

- **Format:**

  PA X1,Y1(,X2,Y2, ...) [Terminator]
  PA [Terminator]

- **Example:**

```
LPRINT "PA;"
LPRINT "PA1000,1000,3000,2000;"
LPRINT "PD;PA1500,1400;PU2000,2000;"
```

- **Parameter range:**

  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**

  Any PA command without parameters is for setting absolute coordinates. The absolute coordinates are to indicate a position at the distance from the coordinate origin (0,0). By this, any further parameters after the PD and PU commands are interpreted as they are indicated in absolute coordinates.
  PA commands with parameters set absolute coordinates together with moving the pen to the specified point by the parameters. At this time, the pen state remains the same as that just before the PA command is received. In other words, the pen only moves if it is up and draws if it is down.

  Parameters X and Y are a pair with two, and a number of pairs can be keyed in in sequence (see line 2 of the example above). If you key in an odd number of parameters, the DPX-3300 interprets them as X-Y coordinates from the first in sequence to move the pen and gives an error indication at the last. (Further drawing is properly done even if the last parameter causes an error.)
  The PA command can be used in combination with the pen control commands PU and PD as shown below.

Example:

```
100 REM *** PA COMMAND ***
110 LPRINT "IN;SP1;"
120 LPRINT "PA3000,1500;PD1000,1500,1000,3500,3000,3500,
    3000,1500;PU3500,1500;"
```

```
130 LPRINT "PA;PD5500,1500,5500,3500,3500,3500,3500,1500;PU;"
140 END
```

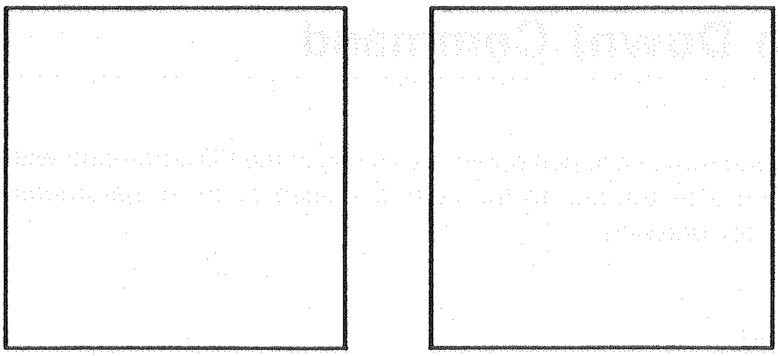


Fig. PA-1

PB (Print Buffered Label) Command

- **Function:**
  The PB command tells the DPX-3300 to draw the content of data that have been stored in the character buffer.

- **Format:**
  PB [Terminator]

- **Example:**

```
LPRINT "PB;"
```

- **Explanation:**
  The PB command tells the DPX-3300 to draw character strings that have been written by the LB and BL commands in the character buffer. The buffered data are never changed after drawing.
  You can change drawing positions of characters, character spaces, drawing directions, character slant and character sizes whenever you want to change. The character strings in the character buffer follow parameters of each effective command (ES, DI, DR, LO, SI, SR and SL) when the PB command is executed and are drawn using the currently selected character sets.
  The capacity of the character buffer is limited within 150 characters including a character string written by the LB or BL command just before the PB command is executed. The character strings in the character buffer are cleared by the DF and IF

commands or by the BL and LB commands with only label terminator.
For more information, see 6.6.1 ''Character Drawing And Setting'' and 6.6.2 ''Character Buffer'' in CHAPTER 6.

PD (Pen Down) Command

- **Function:**

The PD command moves the pen down. By keying in the PD command with parameters, the DPX-3300 moves the pen to the point specified by those parameters on the pen (DOWN) state for drawing.

- **Format:**

PD [Terminator]
PD X1,Y1(,X2,Y2, ...) [Terminator]

- **Example:**

```
LPRINT "PD;"
LPRINT "PD1000,1000,2000,3000;"
```

- **Parameter range:**

$-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**

Any PD command without parameters moves the pen down only. When you key in parameters, the pen moves to the point specified by those parameters. However, this specified point varies from absolute coordinate to relative coordinates. For example, the specified point becomes absolute coordinates if you have already keyed in the PA command and relative coordinates if you have already keyed in the PR command.
When the power is turned ON, or if the default value is set by the DF and IN commands, these points are set to absolute coordinates. Therefore, when you use only the PD command with parameters except the PA and PR commands, the parameters are interpreted as absolute coordinates.
If you specify any points out of a window, the DPX-3300 moves the pen to the boundary of the window and moves it up there.
Even if you send the PD command in polygon mode, the pen does not move down.
Parameters X and Y are a pair with two, and a number of parameters can be keyed in sequence (see line 2 of the above example). If an odd number of parameters are keyed in, the DPX-3300 interprets them as X-Y coordinates from the first in sequence to move the pen and gives an error indication at the last. (Further drawing is properly done if the last parameter causes an error.)

PM (Polygon Mode) Command

- **Function:**
  The PM command sets the DPX-3300 in polygon mode.

- **Format:**
  PMn [Terminator]

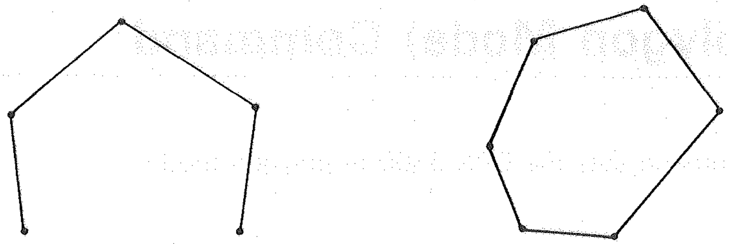
- **Example:**
  `LPRINT "PM1;"`

- **Parameter range:**
  0,1,2

- **Explanation:**
  The PM command sets the DPX-3300 in polygon mode. Polygon means a figure with closed sides, composed of many summits. A polygon cannot be drawn by only the PM command. For the actual drawing of a polygon, use the FP command to fill it or use the EP command to draw the border of it.
  Select one of the following three values for parameter.
  0 : Clears the polygon buffer and enters polygon mode.
  1 : Closes or draw the border of a polygon under drawing.
  2 : Completes the closing of the polygon and gets out of polygon mode.

  In the polygon mode, acceptable commands are as follows: PM, PA, PR, PU, PD, AA, AR, CI and CT commands used when you define polygons. Commands other than these are ignored. But the DPX-3300 does not operate even if you send these commands and stores the polygon data on the polygon buffer.

  Other than this, you can execute the IN (Initialize) command for the same purpose. When you want to define a polygon in polygon mode, define a polygon with closed sides (closed polygon) as shown in Fig. PM-1 (right). If the DPX-3300 gets out of polygon mode before closing, the open sides of a polygon are forced to close by the PM command under execution (''PM1;'' or ''PM2;'') and defined as a closed polygon in the polygon buffer. This closing is done at the current pen (UP/DOWN) state.



Open polygon

Closed polygon

Fig. PM-1

Any PM command with parameters other than 0, 1 or 2 causes an error and is ignored. Also, it is ignored if either "PM1;" or "PM2;" is executed before "PM0;".

As long as in polygon mode, any commands other than the IN, PM, PA, PR, PU, PD, AA, AR, CI and CT commands and also the output commands (OA, OC, OD, OE, OF, OH, OI, OL, OO, OP, OS, OT and OW) cause an error and are ignored.

An example with the PM command is shown below.

Example:

```
100 REM  *** PM COMMAND ***
110 'LOGO G
120 LPRINT "IN;SP1;PA;PU5000,-7000;"
130 LPRINT "PM0;"
140 LPRINT "PR;PD-100,100,0,600,100,100,700,0,0,-200,-600,
    0,0,-400 ,400,0,0,100,-200,0,0,200,400,0,0,-500,-700,0;
    PU;"
150 LPRINT "PM2;"
160 LPRINT "FT4,50,0;FP;SP2;EP;"
200 'LOGO D
210 LPRINT "SP1;PA;PU4000,-7000;"
220 LPRINT "PM0;"
230 LPRINT "PR;PD0,800,700,0,100,-100,0,-600,-100,-100,
    -700,0;PU;"
240 LPRINT "PM1;"
250 LPRINT "PR200,200;PD0,400,400,0,0,-400,-400,0;PU;"
260 LPRINT "PM2;"
270 LPRINT "FP;SP2;EP;"
```

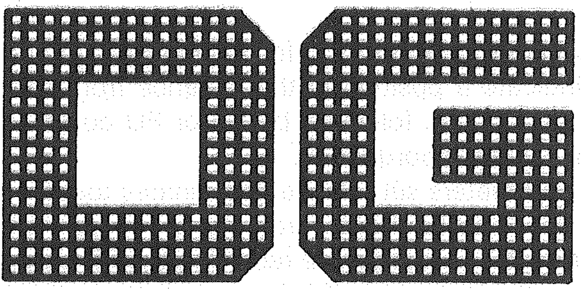


Fig. PM-2

(Note)
The PM command uses the polygon buffer, so that the polygon buffer must have enough storage space for the command. With the default buffer size (3072 bytes), the polygon buffer is able to hold about 250 summits sufficiently. For more information, see 6.8.1 ''Polygon Buffer'' in CHAPTER 6.
If the polygon buffer is overflowed, an error occurs. Any PM command at this error is ignored. When you want to define a much more complex polygon, use ESC.T command to change the capacity of the polygon buffer. Remember: you can use ESC.T command only when an RS-232C interface is used for the connection to the computer. For more information, see ''ESC.T Command'' of 8.4.2 ''Status Commands'' in CHAPTER 8.

PR (Plot Relative) Command

- **Function:**

The PR command sets relative coordinates. If parameters ΔX and ΔY are specified, the pen moves at only the distance indicated by (ΔX,ΔY) from the current pen position.

- **Format:**

```
PR ΔX1,ΔY1(,ΔX2,ΔY2,...) [Terminator]
PR [Terminator]
```

- **Example:**

```
LPRINT "PR;PU1000,500;PD-300,700;"
LPRINT "PR1000,5000,-300,700;"
LPRINT "PR;"
```

- **Parameter range:**

$-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**

Any PR command without parameters is for setting relative coordinates. The relative coordinates are to indicate a position in the distance from the current pen position. By this, any further parameters followed by PD or PU commands are interpreted as they are indicated in relative coordinates.

PR commands with parameters set relative coordinates together with moving the pen at only the distance specified by those parameters. The pen (UP/DOWN) state at this time remains the same as one just before receiving the PR command. In other words, the pen only moves without drawing if it is up and draws if it is down.

The parameters ΔX and ΔY are a pair with two, and a number of pairs can be keyed in in sequence (see line 2 of the above example). If you key in an odd number of parameters, the DPX-3300 interprets them as ΔX and ΔY from the first in sequence to move the pen and gives an error indication at the last. (Further drawing is properly done even if the last parameter causes an error.)

When the power is turned ON or after the execution of IN or DF command, the execution results are the same as the PA command was executed. When you want to set the values of X and Y in the relative coordinate system, you must execute the PR command.

The following example is for drawing a rectangle by the PR command, the same rectangle as that drawn by the PA command. Each corner point of the rectangle indicates X and Y in the relative coordinate system.

Example:

```
100 REM **** PR COMMAND ****
110 LPRINT "IN;SP1;"
120 LPRINT "PA3000,1500;PD;PR-2000,0,0,2000,2000,0,0,-2000
    ;PU500,0;"
130 LPRINT "PD2000,0,0,2000,-2000,0,0,-2000;PU;"
140 END
```

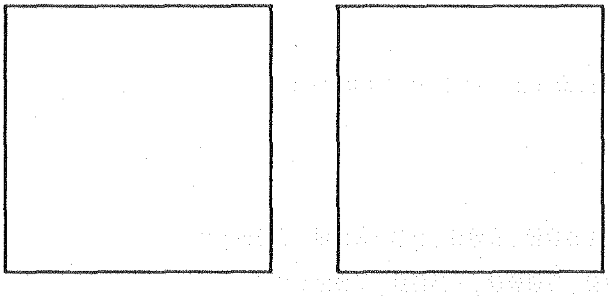


Fig. PR-1

PT (Pen Thickness) Command

- **Function:**
  The PT command sets the appropriate hatching space of a pen used for filling a figure.

- **Format:**
  PTd [Terminator]
  PT [Terminator]

- **Example:**
  ```
  LPRINT "PT0.4;"
  ```

- **Parameter:**
  0.1 to 5.0

- **Default value:**
  ''PT 0.3;''

- **Explanation:**
  The unit of parameter is mm. If you do not specify any pen size, the hatching space is specified to 0.3 mm (0.3 is the default value). When you select a filling pattern by the FT command (FT1, FT2), the setting by this command is effective.
  The PT command is effective only to the currently used pen. If you execute the SP command for pen replacement, the hatching space value specified by the SP command is ineffective and is 0.3 mm (0.3 is the default value) until set again by the PT command.

Example:

```
100 REM *** PT COMMAND ***
110 LPRINT "IN;SP1;"
120 LPRINT "FT1,0,0;"
130 LPRINT "PT0.3;"
140 LPRINT "PA;PU1000,0;"
150 LPRINT "RA1500,500;"
```

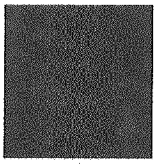


Fig. PT-1

PU (Pen UP) Command

- **Function:**

  The PU command moves the pen up. Keying in parameters followed by the PU command allows the pen to move to the point specified by those parameters.

- **Format:**

  PU X1, Y1 (, X2, Y2, ...) [Terminator]
  PU [Terminator]

- **Example:**

  Example:

```
LPRINT "PU;"
LPRINT "PU1000,1000;"
```

- **Parameter range:**

  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**

  Any PU command without parameter moves the pen up only. If you key in parameters, the pen moves to the point specified by the parameters. But the specified point varies from absolute coordinates to relative coordinates. It becomes absolute coordinates if you have already keyed in the PA command and relative coordinates if you have already keyed in the PR command.
  When the power is turned ON or if the default values were set by the DF and IN commands, the parameters are set at absolute coordinates. Therefore, when you key in the PU command except the DF and IN commands, the parameters are interpreted as absolute coordinates.
  If you specify any points out of a window, the pen moves to the border of the window and stops there.
  The parameters X and Y are a pair with two, and a number of parameters can be keyed in in sequence (see line 2 of the above example). If you key in an odd number of parameters, the DPX-3300 interprets them as X-Y coordinates from the first in sequence to move the pen and gives an error indication at the last. (Further drawing is properly done even if the last parameter causes an error.)

RA (Shake Rectangle Absolute) Command

- **Function:**

  Together with the FT and PT commands, the RA command is used to write a rectangle diagonal to the current pen position and any point specified in the polygon buffer and fill or hatch the rectangle.

- **Format:**

  RAx,y [Terminator]

- **Example:**

```
LPRINT "RR2000,2000;"
```

- **Parameter range:**

  $-(2^{26}-1)$ to $+(2^{26}-1)$

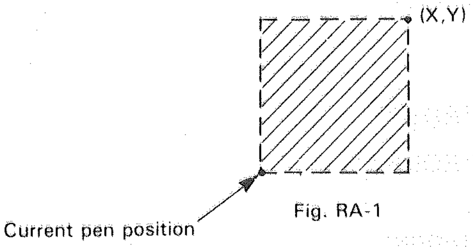


Fig. RA-1

- **Explanation:**

  As shown in Fig. RA-1, the RA command writes in the polygon buffer a rectangle diagonal to the current pen position as start point and any specified point of X-Y coordinate values and fill the rectangle in the form of hatching.

  After the filling (hatching) is completed, the pen moves back to the start point. In case of hatching, the pen movement follows the settings (hatching type, filling space, angles) set by currently effective FT and PT commands. Also, when writing the rectangle in the polygon buffer, the RA command clears the polygon buffer.

Example:

```
100 REM *** RA COMMAND ***
110 LPRINT "SP1;FT3,130,45;"
120 LPRINT "PA;PU1000,1000;"
130 LPRINT "RA2000,2000;"
```

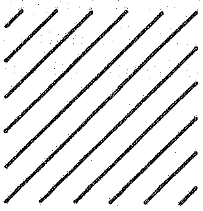


Fig. RA-2

RO (Rotate Coordinate System) Command

- **Function:**

  The RO command rotates X and Y coordinates 90°.

- **Format:**

  RO Rotation angle [Terminator]
  RO [Terminator]

- **Example:**

```
LPRINT "RO;"
LPRINT "RO90;"
```

- **Parameter range:**

  0 and 90

- **Default value:**

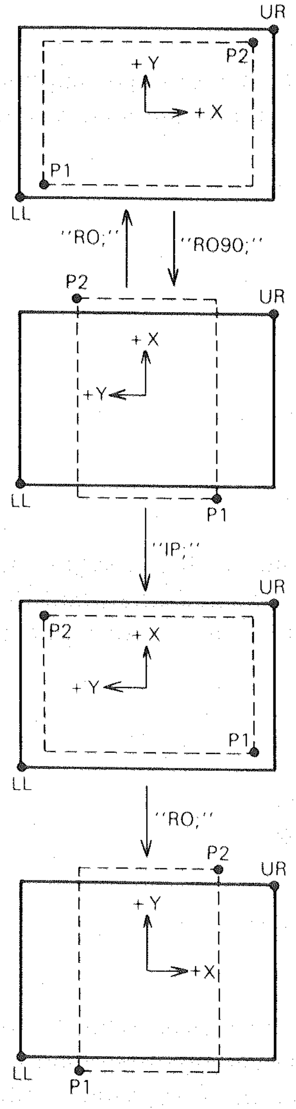
  0°

- **Explanation:**

  Any RO command without parameter is the same as the parameter is 0. 0 and 90 are the only parameters you can use. If you key in 90, both X-axis and Y-axis rotate 90° each as shown in Fig. RO-1.

  The RO command only rotates coordinate axes. The positions of the scaling points P1 and P2 vary whenever the IP command is executed. In Fig. RO-1, if the IP command without parameter is executed in state (2), P1 and P2 come in state (3). From this state (3), if the RO command without parameter is executed, P1 and P2 come in state (4). From the states (2), (3) and (4), P1 and P2 get back to initialize mode (1), but do not get back to it by the DF command.

(Note)
LL and UR indicate the limit of hard-clip.


UR
P2
+Y
+X
P1
LL
"RO;"
"RO90;"
P2
UR
+X
+Y
LL
P1
"IP;"
UR
P2
+X
+Y
P1
LL
"RO;"
P2
UR
+Y
+X
LL
P1

① Initialized.

② "RO 90;" is executed.

③ "IP;" is executed.

④ "RO;" is executed.

Fig. RO-1

(Note)
Even when you rotate the coordinate axes by the RO command, the "X-Y COORDINATE DISPLAY" of the control panel shows the same display as before.

RR (Shade Rectangle Relative) Command

- **Function:**

  The RR command writes in the polygon buffer a rectangle diagonal to the current pen position and any point specified in relative coordinate values and fill or hatch the polygon.

- **Format:**

  RRΔx,Δy [Terminator]

- **Example:**

```
LPRINT "RR2000,2000;"
```

- **Parameter range:**

  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**

  As shown in Fig. RR-1, the RR command writes in the polygon buffer a rectangle diagonal to the current pen position as start point and any point determined by the relative distances of both X- and Y-axis directions and fill or hatch the rectangle.

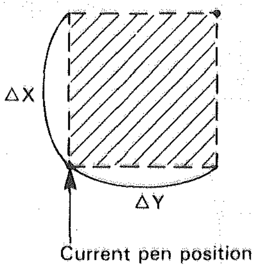


Fig. RR-1

After the filling (hatching) is completed, the pen moves back to the start point. In case of hatching, the pen movement follows the settings (hatching type, filling space, angles) by currently effective FT and PT commands. Also, when writing the rectangle in the polygon buffer, the RR command clears the polygon buffer once.

Example:

```
100 REM *** RR COMMAND ***
110 LPRINT "SP1;FT4,100,90;"
120 LPRINT "PA;PU2000,2000;"
130 LPRINT "RR1000,1000;"
```

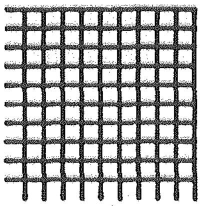


Fig. RR-1

SA (Select Alternate Set) Command

- **Function:**
  The SA command specifies an alternate character set (slot 1) in the character table.

- **Format:**
  SA [Terminator]

- **Example:**
  `LPRINT "SA;"`

- **Explanation:**
  The SA command specifies an alternate character set (slot 1) in the character table. After the SA command is executed, the character set specified by the CA command (DS) is used for the actual drawing. Also, an alternate character set (slot 1) can be specified by sending the LB command with SO (CHR$(14)) and is effective in all the character selection modes.
  This is effective unless you select a standard character set by the SS command or SI (CHR$(15)) or set it to the default by the DF and IN commands. No parameters are required for the SA command.
  The SA command serves as an IV command for the selection of character slots. In other word, "SA;" and "IV1;" are same.
  For more information, see 6.7 "SETTING CHARACTER SETS" in CHAPTER 6.

SC (Scaling) Command

- **Function:**
  The SC command sets user coordinates or returns them from user coordinates to plotter coordinates.

- **Format:**
  SC Xmin, Xmax, Ymin, Ymax [Terminator]
  SC [Terminator]

- **Example:**

```
LPRINT "SC0,10,0,10;"
LPRINT "SC;"
```

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{2}-1)$

- **Default value:**
  Values determined by setting the DIP Switch 1-⑦

- **Explanation:**
  Any SC command with parameters sets user coordinates so that the positions of scaling points P1 and P2 become Xmin, Ymin and Xmax, Ymax respectively. Such user coordinates are effective until they are scaled again by the SC command or returned to plotter coordinates by an SC command without parameters. And the parameters for drawing commands are all interpreted as user coordinates. Also, if Xmin=Xmax or Ymin=Ymax, an error occurs, and these parameters become the previously set values.
  Any SC command keyed in without parameters releases the scaling, and parameters for further drawing commands get back to plotter coordinates. For more information, 6.3 ''SCALING'' in CHAPTER 6.

SG (Select Pen Group) Command

- **Function:**
  The SG command specifies the pen groups set by the GP command.

- **Format:**
  SGg [Terminator]
  SG [Terminator]

- **Example:**

```
LPRINT "SG2;"
LPRINT "SG;"
```

- **Parameter range:**
  g : group Nos. from 0 to 8

- **Default value:**
  0

- **Explanation:**
  The parameter values of the SG command coincide with the group Nos. set by the GP command. When you specify a pen group by the SG command, the pen carriage selects the pen of the lowest pen No. from that group. If the pen is drawing at the specified distance by the GP command, the pen carriage goes to select the next pen from the same pen group.
  If the parameter is 0 or if you key in the SG command without parameter, the pen carriage returns the pen back to its pen stock and moves back to the LL position.

SI (Absolute Character Size) Command

- **Function:**
  The SI command specifies the sizes of characters and symbols in the unit of cm.

- **Format:**
  SI Character width, Character height [Terminator]
  SI [Terminator]

- **Example:**

```
LPRINT "SI10,10;"
LPRINT "SI;"
```

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Default value:**
  Character width : 0.29 (cm)
  Character height : 0.38 (cm)

- **Explanation:**
  By specifying the character width and character height with two parameters, the SI command sets the absolute sizes of characters. The relation between the character width, character height and character cell is shown in Fig. SI-1.

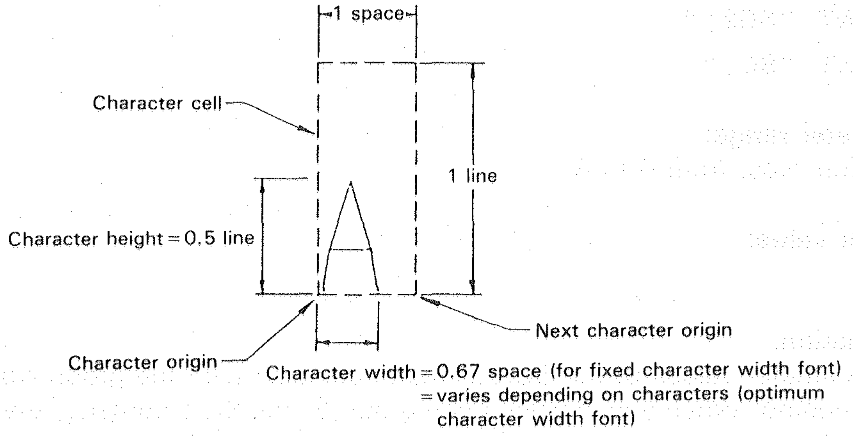

1 space
Character cell
1 line
Character height = 0.5 line
Next character origin
Character origin
Character width = 0.67 space (for fixed character width font)
= varies depending on characters (optimum character width font)

Fig. SI-1

As long as the SI command is used to set a character size, the size of characters to be drawn does not change even if you have scaling done by the IP, SC and IW commands or by operating the control panel.
Any SI command without parameters is the default value. Keying in only one parameter or more than three parameters causes an error. But the character size remains the same.

SL (Character Slant) Command

- **Function:**
  The SL command specifies the slant of characters and symbols to be drawn.

- **Format:**
  SL tan θ [Terminator]
  SL [Terminator]

- **Example:**

```
LPRINT "SL 1;"
LPRINT "SL;"
```

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Default value:**
  ''SL0;''

- **Explanation:**
  As shown in Fig. SL-1, the parameter specifies the slant of a character or symbol to be drawn in the value of tan θ from the perpendicular line. If you key in more than two parameters, parameters other the first parameter are ignored. Any SL command without parameters is the default value without character slant. Although the parameter range is $-(2^{26}-1)$ to $+(2^{26}-1)$, you had better set values between 0.4 to the default characters and between 0.8 to larger characters for better visual clarity.
  The character slant set by the SL command is effective until you execute the IN and DF commands or a new SL command.

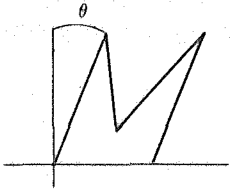


Fig. SL-1

SM (Symbol Mode) Command

- **Function:**
  The SM command tells the DPX-3300 to draw characters or symbols at each point specified by the PA and PR commands as center.

- **Format:**
  SM Character or Symbol [Terminator]
  SM [Terminator]

- **Example:**

```
LPRINT "SMK;"
LPRINT "SM;"
```

- **Default value:**
''SM;'' (releasing the symbol mode)

- **Explanation:**
Parameter is limited to only one character or symbol that can be drawn. If only one character is specified by the SM command, the DPX-3300 draws this specified character at any point specified as center by the PA and PR commands. Once specified, the character is effective unless a new character is specified or until the symbol mode is released. Even if you key in the SM command to specify a new character in the symbol mode, the symbol mode is not released, but only the character to be drawn is changed. To release the symbol mode, execute the SM command without parameter (''SM;'') or the IN and DF commands.
The characters to be drawn are affected by commands used to specify character size (SI and SR), character slant (SL) and drawing direction (DI and DR).
Characters you can specify include those from (CHR$(33)) to (CHR$(126)). Semicolon '';'' and (CHR$(59)) are interpreted as terminator and so cannot be specified as symbol. Also, blanks and control characters cannot be specified as symbol character.
The following example is for drawing a character or a symbol at each point of a polygonal line.

Example:

```
100 REM **** SM COMMAND ****
110 LPRINT "IN;SP1;PA0,0;"
120 LPRINT "PD0,3000,3000,3000,3000,0,0,0;PU;"
130 FOR I=1 TO 3
140   READ S$
150   LPRINT "SM";S$;";"
160   X=500
170   FOR L=1 TO 4
180     READ Y
190     LPRINT "PA";X;",";Y;";PD;"
200     X=X+500
210   NEXT L
220   LPRINT "PU;"
230 NEXT I
```

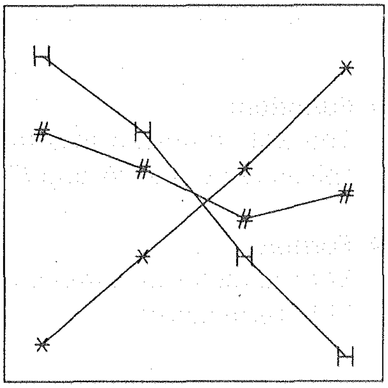


Fig. SM-1

```
240 LPRINT "SM;SP0,0;"
250 END
260 DATA *,500,1300,2000,2700
270 DATA R,1500,1700,1300,1000
280 DATA G,2800,2000,1000,400
```

SP (Pen Select) Command

- **Function:**
The SP command tells the pen carriage to select one of the eight pens from the pen stock or return it to the pen stock.

- **Format:**
SP Pen No. [Terminator]
SP [Terminator]

- **Example:**
`LPRINT "SP1;"`

- **Parameter range:**
0 to 8

- **Default value:**
''SP0;''

- **Explanation:**
Both SP command without parameter and SP command with the parameter 0 allow the pen carriage to return its pen to the pen stock. Then, the pen carriage moves without carrying a pen to the lower left corner (LL position). (Remember: After this, the pen carriage operates without a pen until a pen No. is specified.)
If you key in parameter, the pen carriage selects one of the eight pens depending on the value of that parameter. If any fraction below the decimal point given to parameter is cut-off. Also, any parameters other than 0 to 8 cause an error and are ignored. Even if you execute the SP command with parameter, the SP command alone does not allow the DPX-3300 to operate. But when you send the next drawing command, the pen carriage goes to select a pen.
Even when you have set a pen group by the GP command, the SP command has the first priority. If you specify the same pen No. as that of the pen-carriage-held pen, the SP command is ignored. Also, if there is not a specified pen when the automatic pen control mode is ON (''AUTO'' LED lights up), the pen carriage does not go to

select the pen. When the automatic pen control mode is OFF ("AUTO" LED is OFF), the pen carriage behaves to hold the pen and behaves to draw without pen.

SR (Relative Character Size) Command

- **Function:**
  The SR command specifies the size of a character or symbol in the percentage (%) of the length of X and Y directions between the scaling points P1 and P2.

- **Format:**
  SR Character width, Character height [Terminator]
  SR [Terminator]

- **Example:**

```
LPRINT "SR2.5,3.5;"
LPRINT "SR;"
```

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Default value:**
  Character width : 0.29 (cm)
  Character height : 0.38 (cm)

- **Associated commands:**
  IP, SC and IW

- **Explanation:**
  The SR command is for specifying a relative character size that varies in proportion to the distance between the scaling points P1 and P2. Refer to the following calculation formula.
  Any SR command without parameters is the default. At this time, it is also the default value even if scaled and no matter where the scaling points P1 and P2 are located.
  Keying in only one parameter or more than three parameters causes an error, and the command is not executed.

  Character width = (P2x − P1x) × Width parameter/100
  Character height = (P2y − P1y) × Height parameter/100

SS (Select Standard Set) Command

- **Function:**

  The SS command specifies the DPX-3300 to use a standard character set for drawing characters.

- **Format:**

  SS [Terminator]

- **Example:**

```
LPRINT "SS;"
```

- **Explanation:**

  The SS command specifies a standard character set (slot 0) in the character table. After the SS command is executed, the character set specified by the CS command (DS) are used for drawing characters. Also, you can specify a standard character set (slot 0) by sending the LB command with SI (CHR$(15)). This character set is effective in all the character selection modes.
  Also, this is effective unless you select an alternate character set by sending the SA command or SO (CHR$(14)). No parameter is required for the SS command.
  The SS command serves as an IV command for the selection of character slots. In other words, ''SS;'' and ''IV0;'' are same.
  For more information, see 6.7 ''SETTING CHARACTER SETS'' in CHAPTER 6.

TL (Tick Length) Command

- **Function:**

  The TL command specifies the length of graduations in the percentage (%) of the length of X and Y directions between the scaling points P1 and P2.

- **Format:**

  TL Graduation length in positive direction (,Graduation length in negative direction) [Terminator]
  TL [Terminator]

- **Example:**

```
LPRINT "TL10,25;"
LPRINT "TL;"
```

- **Parameter range:**
  0 to ($2^{26}-1$) (%)

- **Default value:**
  "TL0.5,0.5;"

- **Explanation:**
  Graduations for the positive direction are those for the upper direction on X-axis and also for the right direction on Y-axis. Graduations for the negative direction are those for the lower direction on X-axis and also for the left direction on Y-axis.

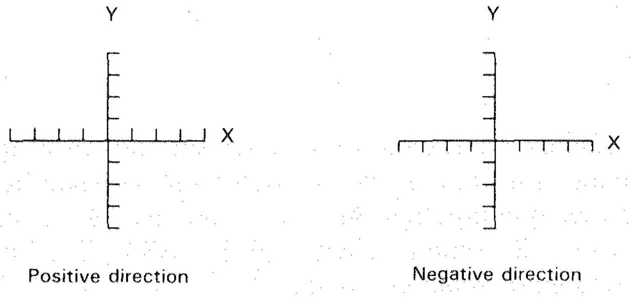


Fig. TL-1

The value of graduation length is the percentage (%) of (P2y-P1y) for the XT command and the percentage (%) of (P2x-P2y) for the YT command. The parameter range is from 0 to ($2^{26}-1$). If you key in 0's for parameters or omit, no graduations are drawn. If you key in 100's for parameters, the DPX-3300 draws graduations of the length between the scaling points P1 and P2 in X and Y directions. The parameter 100 may rather be used as line marks for drawing a table.

Remember: The length of graduations is proportional to the length of X and Y directions set by the scaling points P1 and P2. So, the length of graduations for X-axis and Y-axis varies if the area specified by the P1 and P2 is not a square.

When you initialize by the DF or IN command or if you execute by TL command without parameters, the length of graduations is automatically set at 0.5% of the length of X and Y directions between the scaling points P1 and P2. The length of graduations in the negative direction is not set unless you specify 0's for parameters. The TL command is effective until a new TL command or the IN and DF command are executed.

Specifying negative parameters causes an error.

UC (User Defined Character) Command

- **Function:**
  The UC command is used when you want the DPX-3300 to draw characters that are not stored in the character sets.

- **Format:**
  UC (Pen control value,) ΔX1,ΔY1,(Pen control value,) .... (ΔXn,ΔYn,) .... [Terminator]
  UC [Terminator]

- **Example:**

```
LPRINT "UC-9999,3,9,9999,4,5,9,3;"
LPRINT "UC;"
```

- **Parameter range:**
  $-(2^{26}-1)$ to $+(2^{26}-1)$

- **Explanation:**
  For the UC command, there are three types of parameters: the pen control value, the unit number of pen movement in X direction and the unit number of pen movement in Y direction. The pen control value is for specifying pen (UP/DOWN) movements. The pen moves up when it is below −9999 and moves down when it is over 9999. You had better use both values.

  Because the pen always moves up when the DPX-3300 receives the UC command, the DPX-3300 is not able to draw characters until you key in at least one pen-down parameter within the UC command. Also, after the UC command is executed, the pen moves up and goes to the lower left corner of one right-side character cell. Then, the DPX-3300 gets back to the pen (UP/DOWN) state before the UC command is executed.

  The unit number of pen movements in X and Y directions specifies horizontal or vertical pen movements in the unit of grid number. The unit number of pen movements in X and Y directions is any one from greater than −9999 and smaller than 9999, and a decimal fraction is also permitted to be used.

  The grid units indicating pen movements are a character cell divided as follows: horizontal 28 × vertical 36 for fixed character width font and horizontal 42 × vertical 72 for optimum character width font. As shown in Figs. UC-1 and UC-2, an ordinary character is drawn in the area of dotted lines (horizontal 32 × vertical 32 for fixed character width font, horizontal 28 × vertical 36 for optimum character width font. So, if you define a character so that it enters the above area, the character becomes the same size as an ordinary character. A character defined by the UC command is not necessarily accommodated into a character cell. You can define any size of characters. But after drawing by the UC command, the pen moves to the position of one next character stops there with the pen up. Therefore, if the defined character is not accommodated in one character cell, it may be superposed on the next character. To avoid this, use the PA, PR or CP command to move the pen.

Figs. UC-3 and UC-4 are arrows drawn as example by the UC command. Any UC command without parameters moves the pen back to the first character position of the previously executed LB command.

For fixed character width font:

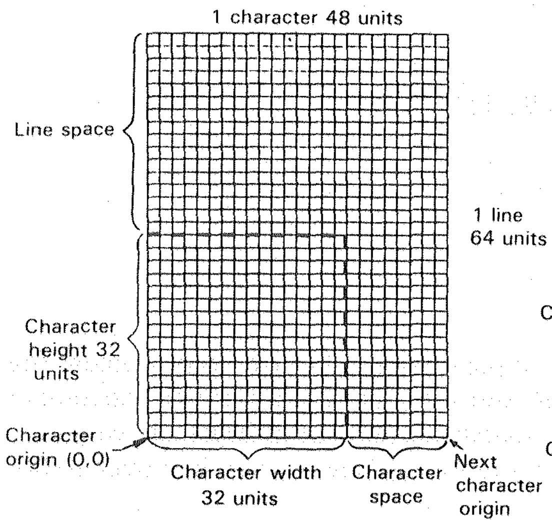

1 character 48 units
Line space
1 line
64 units
Character height 32 units
Character origin (0,0)
Character width 32 units
Character space
Next character origin

Fig. UC-1

For optimum character width font:

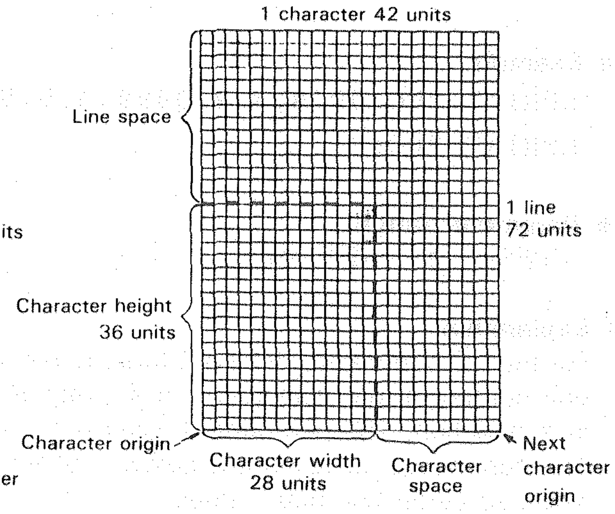
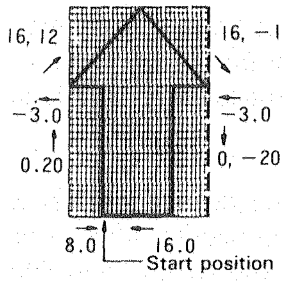

1 character 42 units
Line space
1 line
72 units
Character height
36 units
Character origin
Character width
28 units
Character space
Next character origin

Fig. UC-2

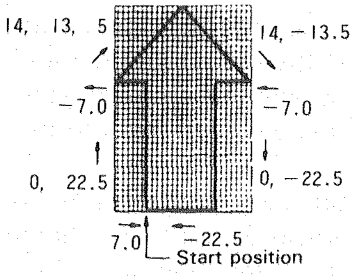
For fixed character width font:


16, 12
16, −12
−3.0
−3.0
0.20
0, −20
8.0
16.0
Start position

When 0−9, 20−39 or 50−59 character sets are specified.

Fig. UC-3

For optimum character width font:


14, 13, 5
14, −13.5
−7.0
−7.0
0, 22.5
0, −22.5
7.0
−22.5
Start position

When 10−19 or 40−49 character sets are specified.

Fig. UC-4

UF (User Defined Fill Type) Command

- **Function:**
  The UF command specifies filling patterns with which the RA, RR, WG and FP commands allow for the actual filling work.

- **Format:**
  UF d_1 (,d_2, ... d_{20}) [Terminator]
  UF [Terminator]

- **Example:**

```
LPRINT "UF1,2,3;"
```

- **Parameter range:**
  0 to $(2^{26} - 1)$

- **Explanation:**
  When the first parameter of the FT command is 5 or 6, you can set any horizontal hatching line space for filling. The line space set with the parameters of the UF command divides the hatching line space set by the FT command. You can key in any number of parameters from 1 up to 20, but each parameter is above 0. Keying in zeros (0) for all parameters causes an error. Any UF command without parameter specifies equal filling line space.
  An example using the UF command is shown below.

Example

```
100 REM *** UF COMMAND ***
110 LPRINT "IN;SP1;"
120 LPRINT "UF1,2,3,4,5;"
130 LPRINT "FT5,500,0;"
140 LPRINT "PA0,0;"
150 LPRINT "RA1000,1000;"
```

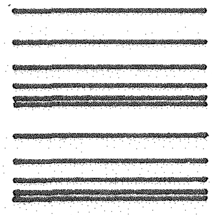


Fig. UF-1

(Note)
Because the filling pattern set by the UF command begins from the origin (0,0) of plotter unit, the start of the filling pattern varies depending on positions where hatching begins.

VS (Velocity Select) Command

- **Function:**
  The VS command sets the pen speed under drawing.

- **Format:**
  VS Pen speed (,Pen No.) [Terminator]
  VS [Terminator]

- **Example:**

```
LPRINT "VS10,1;"
LPRINT "VS;"
```

- **Parameter range:**
  Pen speed: 2 to 45 (cm/sec)
  Pen No. : 1 to 8

- **Default value:**
  Pen speed: 45 (cm/sec)
  Pen No. : for all pens

- **Explanation:**
  Any VS command without parameter sets 45 cm/sec pen speed (45 is the default value). Depending on parameters, you can specify any pen speed in 1 cm/sec increment from 2 to 45 cm/sec. If parameter is below 2, 2 cm/sec pen speed is set. If parameter is over 45, 45 cm/sec pen speed is set.

  Also, by specifying pen No., you can change the pen speed. If you omit parameters for pen Nos., this pen speed is effective for all pens.

  When the automatic pen control mode is OFF (''AUTO'' LED is OFF), pen speed is set to the command value. But when the automatic pen control is ON (''AUTO'' LED lights ON), you cannot change pen speed by the VS command.

  Also, you can use this command to set appropriate pen speeds for pens you want to use. Refer to the table below.

Pen	Pen Speed
Water base fiber tipped pen	45 cm/sec
Thick pen (water-based)	45 cm/sec
Ceramic pen	10 cm/sec
Water based ball-point pen	45 cm/sec
Pressurized oil-based ball-point pen	45 cm/sec
Oil based fiber tipped pen	10 cm/sec
Ink pen	20 cm/sec
Maintenance-free tubular ink pen	20 cm/sec

WG (Shade Wedge) Command

- **Function:**

The WG command writes a wedge around the current pen position as center in the polygon buffer and tells the DPX-3300 to fill or hatch the wedge.

- **Format:**

WG r,θ_1, θ_c (,θd) [Terminator]

- **Example:**

```
LPRINT "WG 1000,90,180;"
```

- **Parameter range:**

r : radius	$-(2^{26}-1)$ to $+(2^{26}-1)$
θ1: start angle	$-(2^{26}-1)^\circ$ to $+(2^{26}-1)^\circ$
θc: center angle	$-(2^{26}-1)^\circ$ to $+(2^{26}-1)^\circ$
θd: resolution	$-(2^{26}-1)$ to $+(2^{26}-1)$ (Default value: 5°)

- **Explanation:**

The WG command writes a wedge around the current pen position as center in the polygon buffer and tells the DPX-3300 to fill or hatch the wedge.

Filling (hatching) pattern, space and angle follow those values set by the FT and PT commands.

Remember: The reference point from which the filling begins varies depending on positive and negative radius values. Also, the way of taking filling angle from the reference point varies depending on positive and negative parameter values for the center angle.

The resolution θd specifies the smoothness of an arc, but it has different parameter meaning depending on resolution modes you have specified by the CT command. Also, the resolution θd is compensated for the value that divides the center angle θc equally.

After the filling (hatching) is completed, the pen moves back to the start point.

When the WG command writes the specified wedge in the polygon buffer, it clears the polygon buffer once.

At the default, you can store up to a 250-summit figure in the polygon buffer. Storing a figure with more than 250 summits causes an error and is ignored. When drawing a circle, specifying resolution below 1.5° causes an error because the number of summits is more than 250.

Example

```
100 REM *** WG COMMAND ***
110 LPRINT "SP1;PA;PU2000,5000;"
120 LPRINT "FT3,40,0;"
130 LPRINT "WG2000,90,45;"
140 LPRINT "FT3,40,45;"
150 LPRINT "WG2000,90,-45;"
160 LPRINT "FT3,40,90;"
170 LPRINT "WG-2000,90,-45;"
180 LPRINT "FT3,40,135;"
190 LPRINT "WG-2000,90,45;"
```

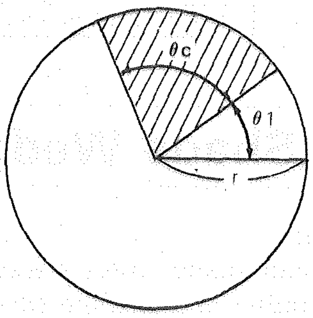


Fig. WG-1

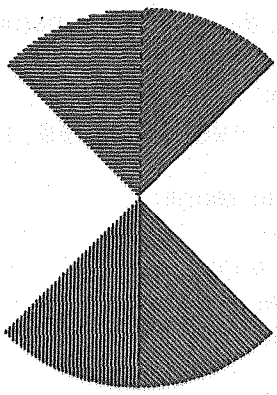


Fig. WG-2

XT (X-Tick) Command

- **Function:**
The XT command tells the DPX-3300 to draw only one graduation of the length specified by the TL command at the current pen position as reference point on X axis.

- **Format:**
XT [Terminator]

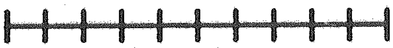
- **Example:**

```
LPRINT "XT;"
```

- **Explanation:**
  No parameter is required. This command tells the DPX-3300 to draw only one graduation at the current pen position as reference point when the pen is either up or down. Although you can change the graduation length by the TL command, the default value of the graduation length in X-axis direction is 0.5% of (P2y-P1y) for both positive and negative directions. Examples using the XT command are shown below. In Example 1, the DPX-3300 draws a graduation while drawing an axis. In Example 2, the drawing results are the same as that of Example 1, but the DPX-3300 draws an axis first and a graduation later.

Example 1

```
100 REM *** XT COMMAND (1) ***
110 LPRINT "IN;SP2;PA0,0;PD;XT;"
120 FOR I=1 TO 10
130   LPRINT "PR200,0;XT;"
140 NEXT I
150 LPRINT "PU;SP0;"
```



Example 2

```
200 REM *** XT COMMAND (2) ***
210 LPRINT "IN;SP2;PA0,1000;PD;"
220 LPRINT "PR2000,0;XT;PU;"
230 FOR I=1 TO 10
240   LPRINT "PR-200,0;XT;"
250 NEXT I
260 LPRINT "SP0;"
```

Fig. XT-1

YT (Y-Tick) Command

- **Function:**
  The YT command tells the DPX-3300 to draw only one graduation of the length specified by the TL command at the current pen position as reference point on Y axis.

- **Format:**
  YT [Terminator]

- **Example:**

```
LPRINT "YT;"
```

- **Explanation:**

No parameter is required. This command tells the DPX-3300 to draw only one graduation at the current pen position as reference point when the pen is either up or down. Although you can change the graduation length by the TL command, the default value of the graduation length in Y axis is 0.5% of (P2x-P1x) for both positive and negative directions.
See ''XT Command''.

INFORMATION ABOUT INTERFACES

8

This chapter explains the specifications of interfaces and handshakes.

8.1 PARALLEL (Centronics) CONNECTION

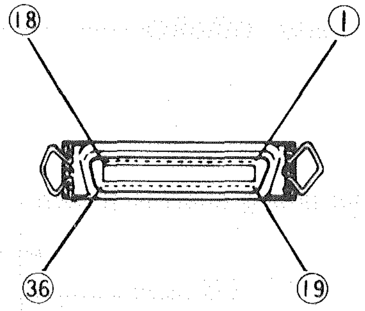
The parallel input connector of the DPX-3300 complies with the specifications of Centronics and so is used by connecting to almost any printer cables and computers. For more information about how to connect the DPX-3300 to each computer, see the cable list of 5.1 "PARALLEL CONNECTION (Centronics)" in CHAPTER 5.

8.1.1 Parallel Interface Specifications

- **Connectors**

  Select DDK 57-30360, AMP 552235-1 or equivalents for this connection. The DPX-3300 has a BURNDY MRD-36SB-18 or equivalent.

NC	36	18	HIGH※※※
HIGH ※	35	17	GND
NC	34	16	GND
GND	33	15	NC
$\overline{\text{ERROR}}$	32	14	NC
HIGH ※※	31	13	HIGH ※※
GND	30	12	LOW
	29	11	BUSY
	28	10	$\overline{\text{ACK}}$
	27	9	D 7
	26	8	D 6
	25	7	D 5
	24	6	D 4
	23	5	D 3
	22	4	D 2
	21	3	D 1
	20	2	D 0
	19	1	$\overline{\text{STROBE}}$



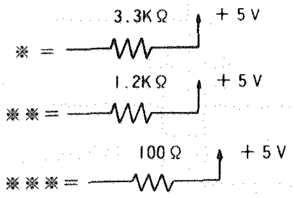


Fig. 8-1

- **I/O signal cable**

  How each connector inputs and outputs data is shown in Fig. 8-2. The IC used here is as shown below or equivalent.

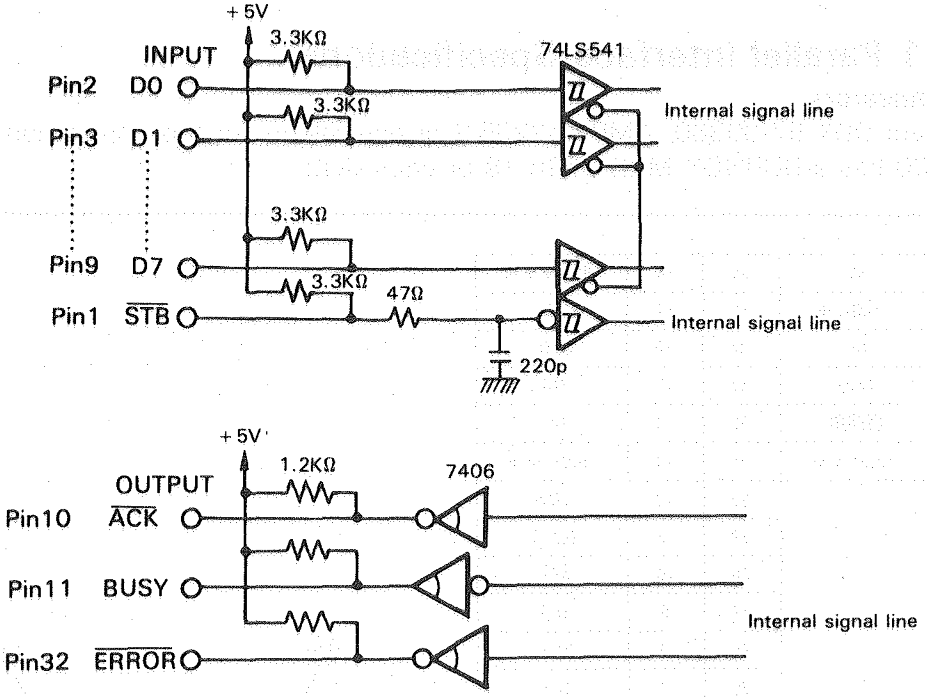

+5V
3.3KΩ
INPUT
74LS541
Pin2 D0
3.3KΩ
Internal signal line
Pin3 D1
3.3KΩ
Pin9 D7
3.3KΩ
47Ω
Pin1 STB
Internal signal line
220p
+5V
1.2KΩ
7406
OUTPUT
Pin10 ACK
Pin11 BUSY
Internal signal line
Pin32 ERROR

Fig. 8-2

- I/O signal timing chart is shown in Fig. 8-3.

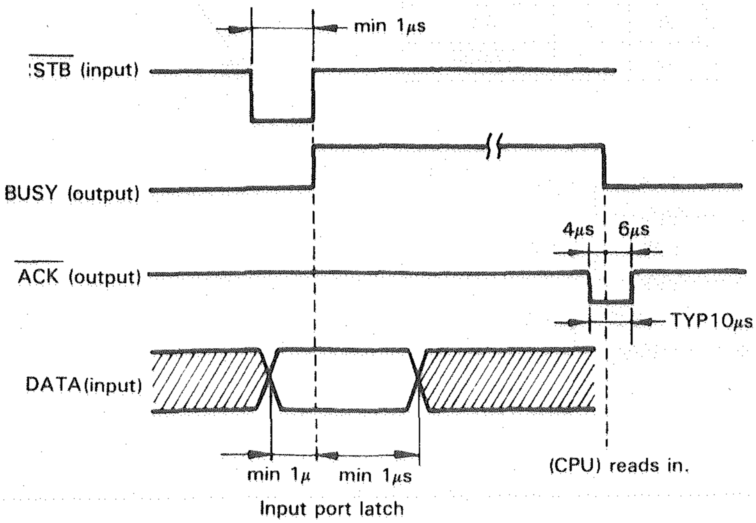

min 1μs
STB (input)
BUSY (output)
4μs
6μs
ACK (output)
TYP10μs
DATA(input)
min 1μ
min 1μs
(CPU) reads in.
Input port latch

Fig. 8-3

8.2 SERIAL (RS-232C) CONNECTION

When you select a Serial (RS-232C) interface for the connection of the DPX-3300 to a computer, follow the cable list of ''SERIAL CONNECTION (RS-232C)'' in CHAPTER 5. If you use your computer and interfaces with different conditions other than those described in CHAPTER 5, refer to the explanation below.
Also, for the handshake of an RS-232C interface, see 8.3 ''INFORMATION ABOUT HANDSHAKE''.

8.2.1 Serial Interface Specifications

- **Connectors**

  Select a JAE DB-25pA-XX or equivalent. The DPX-3300 has a BURNDY MDS25SB-115 or equivalent.

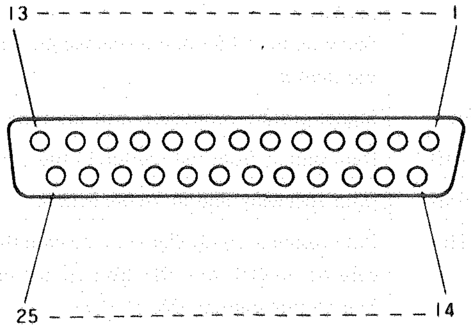
Terminal No.	Signal	Pin connection
1	FG	
2	TXD	
3	RXD	
4	RTS	
5	CTS	
6	DSR	
7	SG	
8	NC	
9	NC	
10	NC	
11	NC	
12	NC	
13	NC	
14	S.TXD	
15	NC	
16	S.RXD	
17	NC	
18	NC	
19	NC	
20	DTR	
21	NC	
22	NC	
23	NC	
24	NC	
25	NC	

Fig. 8-4

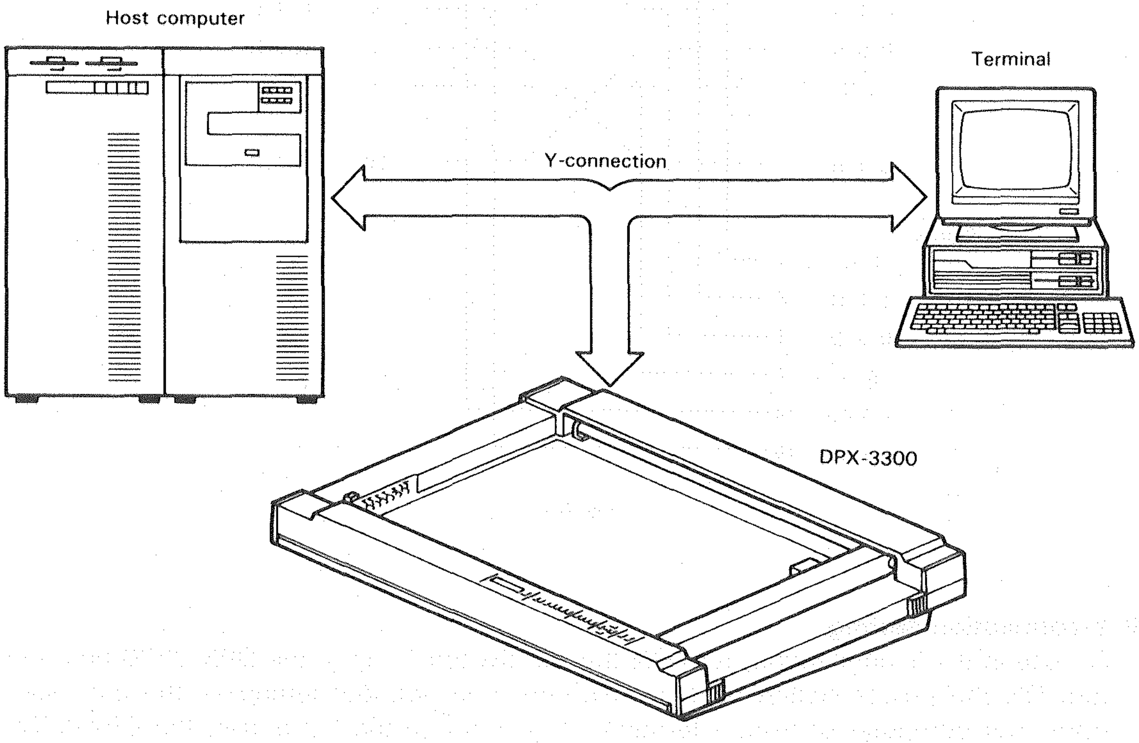
- Signal lines are shown in Fig. 8-5.

Pin No.	Abbrev.	Description	I/O
1	FG	Security line which is normally connected with the computer frame. Connected to the plotter frame.	[Com]
2	TXD	Transmit data. Data output from the plotter to the computer. Connected to the receive data line of the computer. SPACE = "0" = + 12V MARK = "1" = − 12V	[Output]
3	RXD	Receive data. Data receive line of the plotter from the computer. Connected to the transmit data line of the computer. SPACE = "0" = +3V to +25V MARK = "1" = −3V to −25V	[Input]
4	RTS	Request to send. Output from the plotter to the computer. Always ON (+ 12V) is output	[Output]
5	CTS	Clear to send. Input from the computer to the plotter. When the signal line is ON (+ 3V to +25V), the plotter is ready to output data, or when the line is OFF (− 3V to −25V), no data will be output. When unconnected, the plotter operates with its always ON status.	[Input]
6	DSR	Data set ready. Normally this line is connected with a line to indicate ready-to-operate status of a modem. Input from the computer to the plotter. Same as for CTS when unconnected, with no problem normal operation of the plotter.	[Input]
7	SG	Signal ground connected with the internal ground line in the plotter.	[Com]
14	S. TXD	Data output from the plotter to the computer in Y-connection.	[Output]
16	S. RXD	Data receiving line in Y-connection.	[Input]
20	DTR	Data terminal ready signal to indicate that the system is ready to communicate As in RTS, with DIP SW1-⑤ set to ON (to serial). The plotter outputs ON (+ 12V) When hardware handshake is enabled by the ESC . @, the plotter controls DTR ON (+ 12V) or DTR OFF (− 12V) according to the remaining capacity of the buffer. When hardware handshake is set to disable by the ESC . @ command, DTR is always + 12V. DTR can be connected with CTS or DSR of the computer for handshaking, provided that the computer should have a function to monitor the above signal line and stop the data output.	[Output]

Fig. 8-5

8.2.2 Y-Connection

This Y-connection is applicable if the DPX-3300 is connected with an RS-232C interface to your computer. The Y-connection can do as follows: Outputs any data from the computer to the DPX-3300 connector, inputs these data in the DPX-3300 for drawing, and allows the connector to do data monitoring while the DPX-3300 is drawing. Such connection is called the ''Y-connection''.



(Simple Y-connection diagram)

Fig. 8-6

Cables used for Y-connection are shown in Fig. 8-7

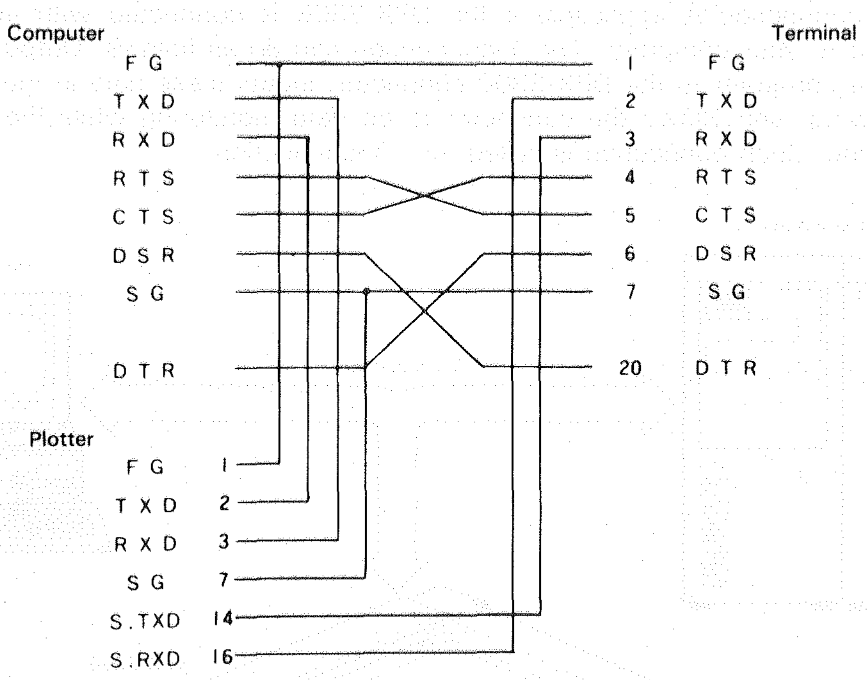


Fig. 8-7

- **Y-connection setting**

For use in the Y-connection, turn ON the DIP Switch 1- ⑥ of the DPX-3300 first and turn ON the power switch next. In this condition, without letting all the data sent from your computer or from a terminal to go through the I/O buffer, the DPX-3300 transmits them to the terminal or to the computer. At this time, the DPX-3300 only transmits the data but does not operate drawing.

When receiving the ESC.Y or ESC.(command, the DPX-3300 stores data in the I/O buffer and starts drawing following the data. Obviously the data being transmitted here must be drawing data. And they can be output to the terminal. The way the drawing data are output to a terminal varies from the 2nd bit to 3rd bit of the second parameter of ESC.@ command as shown in Table 8-1. (Monitor mode is OFF, monitor mode 1, monitor mode 2)

The way your computer responds to a request of the DPX-3300 varies depending on requests of the RD-GL II command and the device control commands. In fact, it varies from the 2nd bit to 3rd bit of the second parameter of ESC.@ command as shown in Table 8-1. In this condition, the data from the terminal can be sent to the computer. But when the DPX-3300 is in response to the computer, this response has the first priority and the data from the terminal are ignored.

Also, when receiving the ESC.Z or ESC.) command, the DPX-3300 comes in the same condition as before it receives the ESC.Y command or ESC.(command.

		Monitor mode OFF	Monitor mode 1	Monitor mode 2
	2nd parameter of ESC.@ command	00000000 ESC. @;0: or 00000100 ESC. @;4:	00001000 ESC .@;8:	00001100 ESC .@;12:
	Before receiving ESC. Y or ESC.(, or after receiving ESC. Z or ESC.).	Including device control commands, output all data to a terminal. {Output ESC. Y and ESC. (too.}		
	After receiving ESC. Y or ESC.(.	Does not output to a terminal.	Output data other than those of device control commands to a terminal ❶.	Output data, including those of device control commands, to a terminal ❷.
How to output a response to the asking of device control commands.		Output data to a host computer.		
How to output a response to the asking of RD-GL II commands.		Output data to a host computer.	Output data to both host computer and terminal.	
Command can be used to give equivalent settings.		ESC . P0: ESC . Q0:	ESC . Q1:	ESC . Q2:

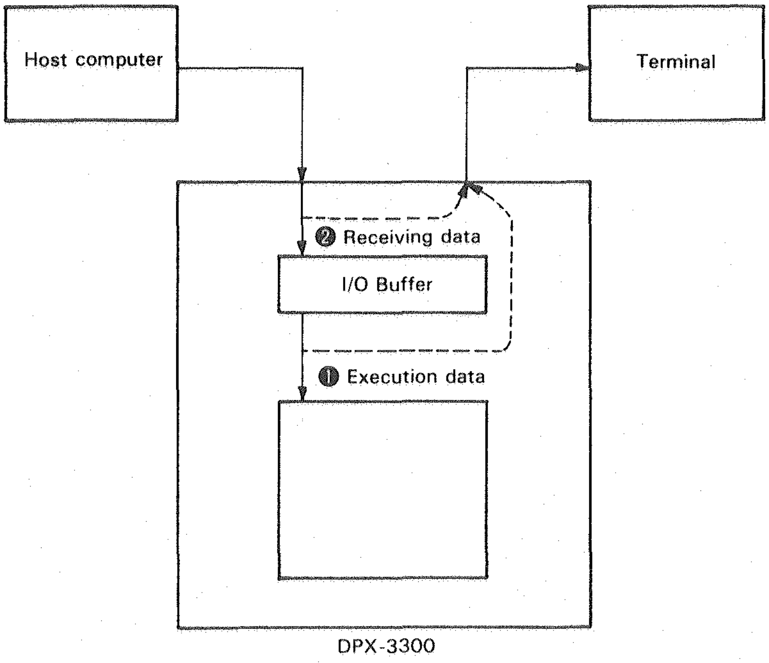


Table 8-1

When a BREAK signal that lowers the RXD pin (No.3 pin) of the DPX-3300 below 150 m/sec enters from the connector after receiving the ESC .Y or ESC .(command, the DPX-3300 sends this BREAK signal to the computer and comes in the same condition as it receives the ESC .Z or ESC .) command.

Remember: Since data go through the internal circuit of the DPX-3300 to a terminal, you must have turned ON the power of the DPX-3300 for data communication between the computer and the DPX-3300 even when you are not using the DPX-3300.

8.3 INFORMATION ABOUT HANDSHAKE

This section explains the handshakes for a Serial (RS-232C) interface. In case the DPX-3300 has its processing speed lower than the speed of data transmission, it may have a chance to miss some data if you do not give some preventive action. To receive all the data perfectly, the DPX-3300 determines whether data transmission is acceptable according to the remaining capacity of the I/O buffer. This data transmission system is called a "handshake".

The DPX-3300 supports three handshake modes: hardware handshake, Xon/Xoff handshake and ENQ/ACK handshake.

The hardware handshake uses the DTR pin of an RS-232C and lets the computer know whether it is ready to receive data from the DPX-3300. Other than this, the DPX-3300 does handshake by sending a particular character from the same pin as used for data.

Here, together with the above three handshake modes, it is explained the software checking handshake that sends data, using the device control commands, while checking the remaining buffer capacity from the computer.

(Note)

- In examples below, typical BASIC languages are used to indicate concrete programs. Also, PRINT #1 and INPUT #1 indicate input and output of data when an RS-232C is used. In this case, you must have opened the RS-232C port.
- All character codes (ASCII codes) use the decimal.
- CHR$ (character code) is marked to indicate character code.
- As control character, for example, ESC (CHR$(27)) or ESC is marked.

For information about device control commands, see 8.4 "DESCRIPTION OF DEVICE CONTROL COMMANDS".

8.3.1 Hardware Handshake

The DPX-3300 has the function to switch the DTR pin of an RS-232C interface from "High" to "Low" according to the remaining buffer capacity. The DTR pin is No. 20 pin of the RS-232C.

In case your computer has the function to stop the output of data when the input is low at the CTS or DSR pin of the RS-232C, a handshake by the hardware is available. An connection example for a hardware handshake is shown in Fig. 8-8. Do this connection for IBM-PC.

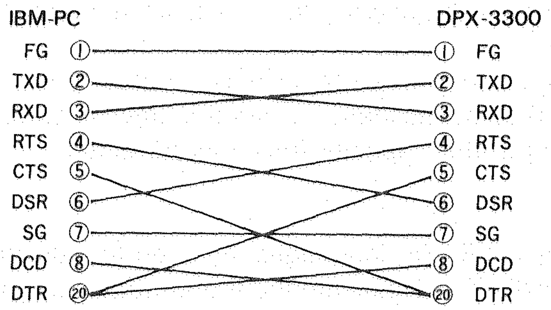

IBM-PC
DPX-3300
FG ①
TXD ②
RXD ③
RTS ④
CTS ⑤
DSR ⑥
SG ⑦
DCD ⑧
DTR ⑳
① FG
② TXD
③ RXD
④ RTS
⑤ CTS
⑥ DSR
⑦ SG
⑧ DCD
⑳ DTR

Fig. 8-8

The cables shown in the cable list of 5.2 "SERIAL CONNECTION" in CHAPTER 5 are all usable for a hardware handshake.

How the hardware handshake changes the remaining buffer capacity is shown in Fig. 8-9.

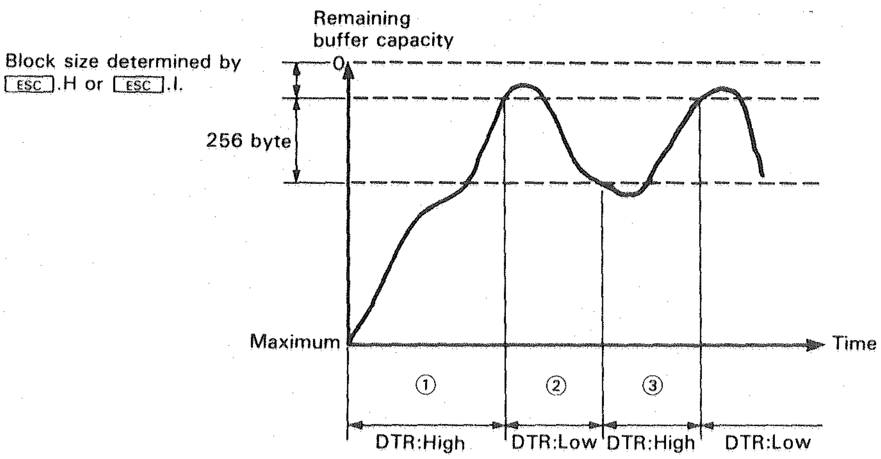


Fig. 8-9

① If transmitting data to the DPX-3300 with the DTR pin "High" when the full buffer capacity (empty now) is available, the remaining buffer capacity gradually decreases because the data transmission speed is faster than the drawing speed.

② If the remaining buffer capacity is less than the block size (80 bytes are the default value) determined by the 1st parameter of ESC.H or ESC.I command, the DPX-3300 brings the DTR pin to "Low". And the remaining buffer capacity increases gradually because of no data transmission from the computer.

③ If the remaining buffer capacity is larger than the block size determined by the 1st parameter of ESC.H or ESC.I command plus 256 bytes, the DPX-3300 brings the DTR pin to "High". And the computer transmits the data again.

The default after the power is turned ON means you are ready to use this hardware handshake.
No matter what kind of handshake you set other than above, the DPX-3300 switches the DTR pin form "High" to "Low" and vice versa according to the remaining buffer capacity. If you feel inconvenience on this, you can fix the DTR pin at "High" by the 1st parameter of ESC.@ command.

8.3.2 Software Checking Handshake

The DPX-3300 has the function to output the remaining buffer capacity to a computer. By means of this function, the DPX-3300 sends data while checking the remaining buffer capacity.

Example of the software checking handshake:

```
100 ' DPX-3300 RS-232C DEVICE CONTROL COMMAND
110 ' SAMPLE PROGRAM FOR SOFTWARE HANDSHAKE
120 OPEN "COM1:9600,N,8,1,CS65535" AS #1
130 PRINT #1,CHR$(27);".M100;;;13:";
140 'MAIN PROGRAM

          GOSUB 1000

          GOSUB 1000

             END
1000 ' SUBROUTINE FOR BUFFER CHECK
1010   PRINT #1,CHR$(27);".B";
1020   INPUT #1,B
1030   PRINT "Buffer space :";B
1040   IF B>=1500 THEN RETURN
1050   GOTO 1010
```

Main program for drawing

Explanation:

Line 120	Opens the RS-232C port. Grammar varies depending on computers.
Line 130	When the computer asks the DPX-3300 to output, taking the delay time the DPX-3300 takes to respond to the computer as 100 m/sec, sets the terminator for data output from the DPX-3300 to CR (CHR$(13)).
Line 1010	Commands the DPX-3300 so as to output the remaining buffer capacity to the computer.
Line 1020 to Line 1050	Checks the remaining buffer capacity and commands the DPX-3300 so as to wait for data transmission.

In this sample program, the DPX-3300 checks the remaining buffer capacity and controls the data transmission between Line 1000 and Line 1050. Because of this, GOSUB 1000 must be executed to check the remaining buffer capacity, as needed, in the main program. In other words, GOSUB 1000 must be executed so that coming data do not overflow the rest of the remaining buffer capacity before the next GOSUB 1000 is executed.

8.3.3 Xon/Xoff Handshake

In this handshake mode, the DPX-3300 outputs the character determined as an Xoff character to the computer when the remaining buffer capacity is below a certain value. And also it outputs the character determined as an Xon character to the computer when the remaining buffer capacity is above a certain value. The computer stops the data transmission if an Xoff character is sent and starts the data transmission if an Xon character is sent.

This Xon character is determined by the ESC.I command and this Xoff character by the ESC.N command. The remaining buffer capacity to output the Xon character is determined by the ESC.I command. The remaining buffer capacity to output an Xoff character is the remaining buffer capacity to output the Xoff character plus 128 bytes.

A sample program for the Xon/Xoff handshake and how it works are shown in Fig. 8-10.

Sample program:

```
100 ' DPX-3300 RS-232C DEVICE CONTROL COMMAND
110 ' SAMPLE PROGRAM FOR Xon/Xoff HANDSHAKE
120 OPEN "COM1:9600,N,8,1" AS #1
130 ON COM GOSUB 1000
140   PRINT #1,CHR$(27);".M0;0;0;13;0;0:";
150   PRINT #1,CHR$(27);".I150;0;17:";
160   PRINT #1,CHR$(27);".N;19:";
170   PRINT #1,CHR$(27);".@;0:";
180   COM ON
190 ' MAIN PROGRAM                   ─┐
                                      │Program for drawing
            END                       │
1000 ' INTERRUPT Xon/Xoff            ─┘
1010    IF LOC(1)=0 THEN RETURN
1020    A$=INPUT$(1,#1)
1030    IF A$=CHR$(19) THEN PRINT "Xoff  "
1040    PRINT "wait !!"
1050    A$=INPUT$(1,#1)
1060    IF A$=CHR$(17) THEN PRINT "Xon    ":COM ON:RETURN
1070    PRINT "ILLEGAL Xon !!"
1080    RETURN
```

Explanation:

Line 120	Opens the RS-232C port. Grammar varies depending on computers.
Line 140	Sets terminator for data output from the DPX-3300 to $\boxed{\text{CR}}$ (CHR$(13)).
Line 150	Taking the limit of the remaining buffer capacity as 150 bytes, sets Xon character to $\boxed{\text{DC1}}$ (CHR$(17)).
Line 160	Sets Xoff character to $\boxed{\text{DC3}}$ (CHR$(19)).
Line 170	Sets the DTR pin to "High". In other words, does not allow for hardware handshake to operate.
Line 1000 to Line 1060	Processes interruption signals from the DPX-3300. The computer stops the data transmission if $\boxed{\text{DC3}}$ is sent and starts it again if $\boxed{\text{DC1}}$ is sent from the DPX-3300.

By setting Line 140 to Line 170, the DPX-3300 operates as follows:

(1) Outputs DC3 as Xoff character if the remaining buffer capacity is below 150 bytes. (The computer stops the data transmission.)

(2) Outputs DC1 as Xon character if the remaining buffer character is over 150 plus 256 bytes. (The computer starts the data transmission.)

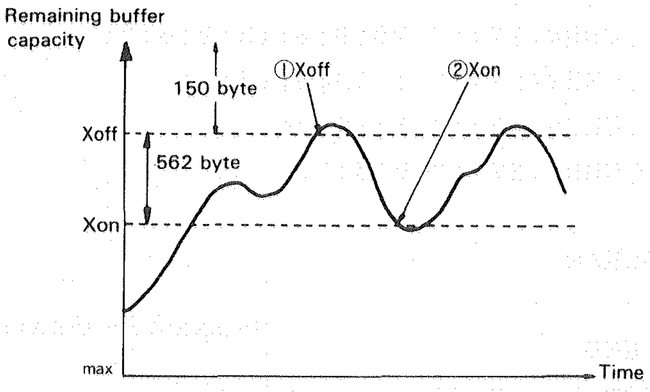


Fig. 8-10

In this program, the handshake is performed using interruption under the computer execution and so does not work properly unless the computer has the function to accept interruption. If interruption is accepted, the computer jumps from Line 1000 to Line 1080 and waits until an Xon signal is input if an interruption signal is Xoff.

Also, you can set Xon/Xoff handshake by setting the DIP Switch when turning ON the power or resetting the computer. When the DIP Switch 2-⑤ is OFF, the computer operates hardware handshake. When the DIP Switch 2-⑤ is ON, the computer operates Xon/Xoff handshake and comes in the same condition as Line 140 to Line 170 are executed.

8.3.4 ENQ/ACK Handshake

First of all, in this handshake, the computer sends the character specified as an ENQ character to the DPX-3300 and asks whether it can transmit a certain amount of a data block. In response to this, the DPX-3300 tells whether data transmission is acceptable by the character specified as an ACK character if the remaining buffer capacity is more than the above block data amount.

Furthermore, the ENQ/ACK handshake is divided into three: Mode 1, Mode 2 and Dummy. The mode 1 is set by the ESC.H command, the mode 2 set by ESC.I command, and the dummy set by ESC.H command without any parameter.

In the dummy ENQ/ACK, especially if you do not set any ENQ or ACK character, the DPX-3300 returns the ACK character to the computer unconditionally when receiving the ENQ character.

The difference between the mode 1 and the mode 2 is as shown in Fig. 8-11. If handshake outputs (such as output trigger character, echo terminator character and output terminator) have been set in the mode 1, they are sent with the procedure shown in Fig. 8-11. Even if these handshake outputs have been set in the mode 2, they are ignored. For more information, see 8.3.5 ''Handshake Output Specifications''.

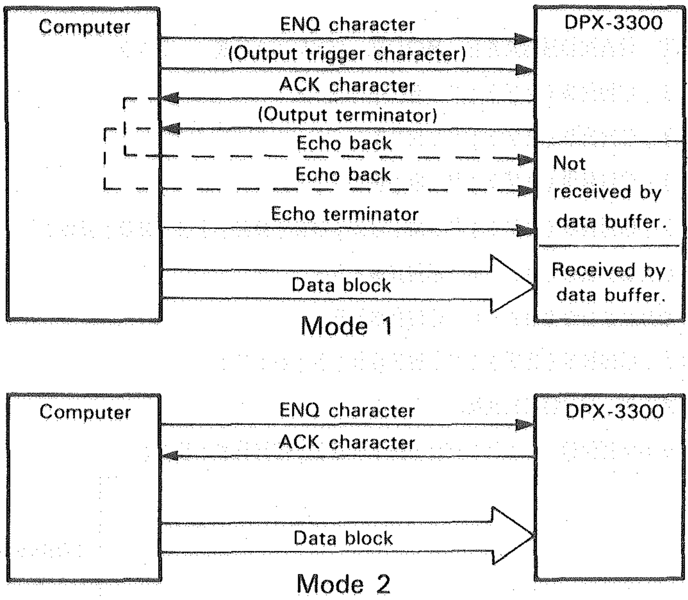

Computer
ENQ character
(Output trigger character)
ACK character
(Output terminator)
Echo back
Echo back
Echo terminator
Data block
DPX-3300
Not received by data buffer.
Received by data buffer.
Mode 1
Computer
ENQ character
ACK character
Data block
DPX-3300
Mode 2

Fig. 8-11

A program example of ''ENQ/ACK Handshake Mode 1'' is shown below.

First of all, without outputting drawing data to the DPX-3300, this program writes those data in a data file called ''DATA1''. Next, it opens the DATA1 to execute Example 2.
''Tasks other than DATA1'' refers to those other than the drawing task of a computer done using a spare time caused by buffering the DPX-3300.

Example 1:

```
10 OPEN "1:DATA1" FOR OUTPUT AS #1
20 PRINT #1,"........."          ┐
                                 │ Data for the DPX-3300
1000 END                         ┘
```

Example 2:

```
100 ' DPX-3300 RS-232C DEVICE CONTROL COMMAND
110 '  SAMPLE PROGRAM FOR ENQ/ACK HANDSHAKE
```

```
120 '
130 OPEN "COM1:9600,N,8,1,CS65535" FOR OUTPUT AS #1 : OPEN
    "DATA1" FOR INPUT AS #2
140 ON COM (1) GOSUB 1000
150 COM (1) ON
160 '<<<  SET HANDSHAKE MODE ENQ/ASK  >>>
170  PRINT #1,CHR$(27);".K";
180  PRINT #1,CHR$(27);".R";
190  PRINT #1,CHR$(27);".@;0:";
200  PRINT #1,CHR$(27);".M100;00;00;13;00;00:";
210  '  ENQ character = CHR$(5)
220  '  ACK character = CHR$(6)
230  PRINT #1,CHR$(27);".H256;5;6:";
240  '<<<  MAIN PROGRAM  >>>
250  PRINT "***ENQ !!":PRINT #1,CHR$(5);
.                                               ┐
.                                               │ Tasks other than DATA1
.                                               │
END                                             ┘
1000 '<<< BLOCK TRANSFER >>>
1010 COM (1) OFF
1020  PRINT "ACK !!":INPUT #1,ACK$
1030  IF ACK$<>CHR$(6) THEN COM (1) ON:RETURN
1040  FOR I=1 TO 256
1050    IF EOF(2) THEN GOTO 1120
1060    A$=INPUT$(1,#2)
1070    PRINT #1,A$;
1080    PRINT A$;
1090  NEXT I
1100 COM ON
1110  PRINT "***ENQ !!":PRINT #1,CHR$(5);:RETURN
1120  PRINT "DATA END !!":RETURN
```

Explanation:

Line 130	Opens two files. For file open, change according to each computer.
Line 140 to Line 150	Sets interruption processing.
Line 170	Clears buffer data of the DPX-3300.
Line 180	Initialize settings about handshake.
Line 190	Sets both monitor mode and hardware handshake mode to OFF.
Line 200	Taking the delay time of until the DPX-3300 starts outputting as 100 m/sec, sets the output terminator to $\boxed{\text{CR}}$ (CHR$(13)).
Line 230	Taking the ENQ code as $\boxed{\text{ENQ}}$ (CHR$(5)) and the ACK code as $\boxed{\text{ACK}}$ (CHR$(6)), sets the data block to 256 bytes.
Line 1000 to Line 1120	Gets out of the main program by interruption with an ACK signal from the DPX-3300. And sets the DATA1 data to a 256 byte data block to output them to the DPX-3300.

With the setting of Line 230, the computer sends the $\boxed{\text{ENQ}}$ (CHR$(5)) to the DPX-3300. Then the DPX-3300 returns the $\boxed{\text{ACK}}$ (CHR$(6)) as an ACK character to the computer if the remaining buffer capacity is more than 256 bytes.

In this program, the computer checks what the DPX-3300 waits for somewhere in the main program and outputs one block (256 byte plotter data) using interruption if the buffer still has extra space. If the buffer has no extra space or no output data in it, the computer processes ''Tasks other than DATA1''.

8.3.5 Handshake Output Specifications

The Xon/Xoff and the ENQ/ACK handshake have different output specifications from each other, depending on settings of the device control commands, as shown in Table 8-2.

'' ○ '' indicates effective output specifications, but '' × '' indicates ineffective output specifications even if they have been set. Also, these output specifications may be affected if they are output by the RD-GL II output commands.

Output specifications	ENQ/ACK		Xon/Xoff	Output by RD-GL II	Setting Command (Parameter)
	mode1	mode2			
Delay time	○	○	×	○	ESC .M(P1)
Output trigger character	○	×	×	○	ESC .M(P2)
Echo terminator	○	×	×	○	ESC .M(P3)
Output terminator	○	×	×	○	ESC .M(P4,P5)
Output initiator	×	×	×	○	ESC .M(P6)
Intercharacter delay	○	○	○	○	ESC .N(P1)
Immediate response character	○	○	×	×	ESC .N(P2,P11)

Delay time:
This is the delay time (m/sec) of until the DPX-3300 starts outputting when the computer asks the DPX-3300 to do so, preventing the data transmission from the DPX-3300 before the computer is ready to receive data.

Output trigger character:
This is the character sent at last, followed by an output command the computer sends to the DPX-3300. Even if you set this character, the DPX-3300 does not output until the character is sent. For this, DC1 (CHR$(17)) is often used. The default value is 0 (for nothing set).

Echo terminator:
This is used for the computer to echo data sent from the DPX-3300 back to the DPX-3300 again. If you set this echo terminator so that the reception of echoback data does not cause an error, the DPX-3300 ignores inputting until receiving this character. For this, LF (CHR$(10)) is often used. The default value is 0 (for nothing set).

Output terminator:
This is the character sent at last, followed by all the data the DPX-3300 outputs. The default value is CR (CHR$(13)).

Output initiator:
This is the character output at first, preceded by data the DPX-3300 sends to the computer. Depending on computers, one may be required to send this character as sign for the DPX-3300 is ready to do data transmission before sending data. For this, STX (CHR$(2)) is often used. The default value is 0 (for nothing set).

Intercharacter delay:
This is the delay time (m/sec) between characters within a character string the DPX-3300 outputs to the computer. Depending on computers, one may not be able to do data transmission if there is not enough delay time between characters the DPX-3300 outputs. In such a case, this character is set. The default value is 0 (m/sec).

Immediate response character:
When the ENQ/ACK handshake is set, this character is output before the ACK character. Depending on computers, one may ask the DPX-3300 to give an immediate response after sending the ENQ character. In such a case, if you set this character, the computer returns the character back immediately after receiving the ENQ character. For this, DC3 (CHR$(19)) is often used. The default value is 0 (for nothing set).

Table 8-2

8.4 DEVICE CONTROL COMMAND

The device control command is used to determine the communication protocol between a computer with an RS-232C interface and the DPX-3300 and let the computer know the current status of the DPX-3300. Also, there are device control commands used to set the output specifications of RD-GL II commands.
The device control command is made up with three characters such as ESC (CHR$ (27)), "." and one capital alphabet. And it is divided into two kinds: one with parameters and the other without parameter.
Parameters are omissible. As delimiter for separation between parameters, a semicolon ";" is used. A semicolon ";" without parameters indicates that parameters are omitted. For the device control command with parameters, you are required to key in terminator at the end of an instruction sentence. For terminator, a colon ":" is used and this cannot be omitted.

8.4.1 Handshake Mode Commands

These are the same device control commands as described in 8.3 "INFORMATION ABOUT HANDSHAKE".

ESC.B Command	Remaining buffer capacity output command

- **Format:**
  ESC.B

- **Explanation:**
  This command tells the DPX-3300 to output the current ramaining buffer capacity to the computer. Since the computer knows the remaining buffer capacity with this command, it can output data below this capacity to the DPX-3300. Therefore, using this command allows you to prevent the buffer from an overflow. See "Example" of 8.3.1 "Software Checking Handshake".

ESC.M Command	Set handshake output specification command (1)

- **Format:**
  ESC.M P1;P2;P3;P4;P5;P6:

- **Explanation:**
  This command sets the output specifications of handshakes.

P1:

When the computer asks the DPX-3300 to output, the parameter P1 sets the delay time of until the DPX-3300 starts outputting. The parameter range is from 0 to 32767. The unit is m/sec.
(Default value: 0)

Example: `PRINT #1,CHR$(27);".M100:";`

This command sets an about 100 m/sec delay time.

P2:

The parameter P2 sets an output trigger character. For more information about the output trigger character, see 8.3.5 ''Handshake Output Specifications''. This character is also applicable to the output of RD-GL II output commands.
(Default value: 13(CR))

Example: `PRINT #1,CHR$(27);".M;13:";`

The P1 is set at 0 (default value). The output trigger character is the carriage return CR (CHR$(13)). For example, if you send the ESC.B command to the DPX-3300 and the carriage return CR thereafter, the DPX-3300 outputs the remaining buffer capacity to the computer.

P3:

The parameter P3 sets an echo terminator. For more information about the echo terminator, see 8.3.5 ''Handshake Output Specifications''. The echo terminator is also applicable to the output of RD-GL II output commands.
(Default value: 0)

Example: `PRINT #1,CHR$(27);".M;;10:";`

In this case, the parameters P1 and P2 are the default values and the echo terminator is the line feed LF (CHR$(10)). So, the computer must output the line feed LF at the end of echoeback data so that the DPX-3300 accepts inputting.

P4 and P5:

These parameters set an output terminator. The output terminator is the character sent at last, followed by data the DPX-3300 outputs, and is made up with one or two characters. This terminator is also applicable to the output of RD-GL II output commands.
(Default value: 13(CR) for P4 and 0 for P5)

Example:

```
(1) PRINT #1,CHR$(27);".M;;;13:";
(2) PRINT #1,CHR$(27);".M;;;13;10;0:";
```

(1) outputs the CR (CHR$(13)) as output terminator and (2) the CR and LF (CHR$(10)). But in case of two characters like (2), you must set P6 at 0 (default value).

P6:

This parameter sets an output initiator. For more information about the output initiator, see 8.3.5 ''Handshake Output Specifications''. When you set the output initiator, you must set the parameter P5 at 0 (default value). The output initiator is also applicable to the output of RD-GL II output commands.
(Default value: 0)

Example: `PRINT #1,CHR$(27);".M;;;13;0;33:";`

This program outputs an exclamation ''!'' (CHR$(33)) before the data sent by the DPX-3300 to the computer.

ESC.N Command

Set handshake output specification command (2)

- **Format:**
  ESC.N P1;P2; ....;P11:

- **Explanation:**
  This command sets an intercharacter delay and also sets an Xoff character for the Xon/Xoff handshake.

P1:

This parameter sets an intercharacter delay. The parameter range is from 0 to 32767. The unit is m/sec. For more information about the intercharacter delay, see 8.3.5 ''Handshake Output Specifications''. This setting is also applicable to the handshake modes and output of RD-GL II output commands.
(Default value: 0)

Example: `PRINT #1,CHR$(27);".N10:";`

For example, when you send ESC.L command to the DPX-3300, the DPX-3300 outputs as ''1 0 2 4 CHR$(13)'' at the interval of each 10 m/sec delay time to the computer.

P2 to P11:

These parameters set an Xoff character when the Xon/Xoff handshake has been set (see ESC.I Command).
When the ENQ/ACK handshake has been set, the parameters also set an immediate response character each. For more information about the immediate response character, see 8.3.5 ''Handshake Output Specifications''.
You can set up to 10 characters.
(Default value: 0 for all parameters)

ESC.H Command

Set ENQ/ACK handshake mode 1 command

- **Format:**

ESC.H P1;P2;P3; ....;P12:

- **Explanation:**

This command does settings in the ENQ/ACK handshake Mode 1. When the computer sends the ENQ character set by the parameter P1 to the DPX-3300, the DPX-3300 outputs the ACK character set by the parameter P3 only if the remaining buffer capacity is above the values set by the P1. After the ACK character is sent back, the computer becomes able to send collectively to the computer the data equivalent to the number of bytes set by the P1.
If you omit all the parameters (in case you send ESC.H command), the hand shake is not available. But when the computer sends an ENQ character to the DPX-3300, the DPX-3300 always outputs an ACK character regardless of the remaining buffer capacity. This is called a ''dummy handshake''.

P1:

This parameter sets the byte number of a data block sent from the computer to the DPX-3300. When receiving an ENQ character, the DPX-3300 outputs an ACK character if the remaining buffer capacity is above the values set by the P1. The parameter range of P1 is from 0 to 15358.
(Default value: 80)

P2:

This parameter sets an ENQ character. For this character, usually ENQ (CHR$(5)) is used. But if you specify 0, the ENQ/ACK handshake is not set.
(Default value: 0)

P3 to P12:

These parameters set an ACK character only if you set P2. You can set up to 10 characters. For this character, usually ACK (CHR$(6)) is used. If you specify 0, any ACK character is not output, but only the output terminator set by the ESC.M command is output.
(Default value: 0)

Example: `PRINT #1,CHR$(27);".H 128;5;6:";`

In this case, the byte number of a data block becomes 128. The ENQ character is ENQ (CHR(5)) and the ACK character is ACK (CHR$(6)).

ESC.I Command

Set Xon/Xoff handshake and ENQ/ACK handshake mode 2 command

- **Format:**
  ESC.I P1;P2;P3; ....;P12:

- **Explanation:**
  This command is used when you want the Xon/Xoff handshake and the ENQ/ACK handshake mode 2. If you omit all the parameters (in case you send ESC.I:), handshakes are not available. If the computer sends an ENQ character to the DPX-3300, the DPX-3300 always outputs an ACK character. This is also called a ''dummy handshake''.

P1:

For the Xon/Xoff handshake, this parameter sets the limit of the remaining buffer capacity. If the remaining buffer capacity is below the values set by the parameter P1, the DPX-3300 outputs an Xoff character.
For the ENQ/ACK handshake mode 2, the parameter P1 sets the size of a data block. The parameter range is from 10 to 15358.
(Default value: 80)

Example: `PRINT #1,CHR$(27);".I100;;17:" ; CHR$(27);".N;19:";`

If the remaining buffer capacity reaches 100 bytes, the DPX-3300 outputs an Xoff character (DC1).

P2:

For the ENQ/ACK handshake mode 2, the parameter P2 sets an ENQ character. If you specify 0 for this parameter, nothing can be sent. For the Xon/Xoff handshake, set 0 for the parameter.
(Default value: 0)

Example:

```
PRINT #1,CHR$(27);".I;0;17:";
PRINT #1,CHR$(27);".N;19:";
```

P3 to P12:

For the Xon/Xoff handshake, these parameters set an Xon character.
For the ENQ/ACK handshake mode 2, these parameter set an ACK character.
You can set up to 10 characters, each separated by semicolon ";". Any terminator set by the ESC .M command cannot be output. Specifying 0 sends nothing.
(Default value: 0 for all parameters)

Example: `PRINT #1,CHR$(27);".I;5;6:";`

This program does the ENQ/ACK handshake. The ENQ character is set to ENQ (CHR$(5)), the ACK character to ACK (CHR$(6)) and the data block size to 80 bytes, respectively.

Example: `PRINT #1,CHR$(27);".I80;0;17:" ; CHR$(27);".N;19:";`

This program does the Xon/Xoff handshake. The Xon character is set to DC1 (CHR(17)), the Xoff character to DC3 (CHR$(19)) and the limit of the remaining buffer capacity to 80 bytes, respectively.

ESC.P Commands

Select handshake mode command

- **Format:**

ESC .Pn:

- **Explanation:**

This is the command used to select any handshake mode from the four handshakes.

n:

The parameter n indicates the types of handshakes. The types of handshakes and the settings by equivalent device control commands are shown in Table 8-3. For more information about the handshakes, see each handshake section.
(Default value: 0)

Parameter n	Handshake Type	Equivalent
0	ENQ/ACK(Dummy)	ESC . I : ESC .M: ESC .N: ESC .@:
1	Xon/Xoff	ESC . I 80; ;17: ESC .M50; ;10;13: ESC .N10;19: ESC .@;2:
2	ENQ/ACK(mode2)	ESC . I 80;5;6: ESC .M;17;10;13: ESC .N: ESC .@;2:
3	Hardwire	ESC . I : ESC .M: ESC .N: ESC .@;3:

Table 8-3

8.4.2 Status Commands

ESC.A Command

(Output model name command)

- **Format:**
  ESC.A

- **Explanation:**
  This is the command for the DPX-3300 to output the plotter model name to a computer. When receiving ESC.A command, the DPX-3300 outputs as ''DPX-3300''.

ESC.O Command

Output plotter status command

- **Format:**
  ESC.O

- **Explanation:**
  This command outputs to the computer the presence and absence of data in the buffer as well as the status of the DPX-3300 according to the codes shown in Table 8-4.

Code	Buffer capacity status
0	Buffer is not empty
8	Buffer is empty
16	Buffer is not empty, and Plotter is on standby*
24	Buffer is empty, and Plotter is on standby*

*The PAUSE indicator lights ON.

Table 8-4

ESC.E Command

Output error code command

- **Format:**

ESC.E

- **Explanation:**

When receiving this command, the DPX-3300 outputs the error codes about the RS-232C interface, shown in Table 8-5. At the same time, errors are cleared.

Error codes	Error contents
0	An I/O error has not occurred.
10	While an output request is executed, another command requesting output is received, but only the first command is valid.
11	A device control command error has occurred.
12	When a device control command parameter is unsuitable. (The parameter causing the error is set to default value.)
13	When a parameter has overflowed.
14	When too many parameter is input, or parameter is not terminated by " : ".
15	When a framing error, parity error, or overrun error has occurred during reception of data.
16	When the I/O buffer has overflowed. (In this case normal drawing operation is impossible.)

Table 8-5

ESC.L Command

(Output I/O buffer size command)

- **Format:**

ESC.L

- **Explanation:**

When receiving this command, the DPX-3300 outputs the current size of the I/O buffer to the computer, usually outputting 1024 bytes. But you can change the size of the I/O buffer in a range from 0 to 15358 by either ESC.T or ESC.@ command.

ESC.T Command | Set buffer size command

- **Format:**

ESC.T P1;P2;P3:

- **Explanation:**

By defining the parameters P1, P2 and P3, this command assigns a 15K-byte data buffer to the I/O buffer, polygon buffer and downloadable character buffer. For more information about the polygon buffer and downloadable character buffer, see 6.8 ''POLYGON BUFFER AND DOWNLOADABLE CHARACTER BUFFER'' in CHAPTER 6.
Any (ESC.T:) command without parameters assigns 1024 bytes to the I/O buffer, 3072 bytes to the polygon buffer and 0 byte to the downloadable character buffer while clearing all the data from the buffers.
Any total values of the three parameters exceeding 15358 bytes causes an error and sets the default value.

P1:

This parameter specifies the physical size of the I/O buffer. The physical buffer size differs from the logical buffer size set by the ESC.@ command. It is the size that is occupied on the buffer. The logical buffer size is the size that can actually be used as a buffer.
(Default value: 1024)

P2:

This parameter specifies the current size of the polygon buffer.
(Default value: 3072)

P3:

This parameter specifies the current size of the downloadable character buffer. Since the downloadable character buffer is set at 0 (0 is the default value), you must have kept a storage in the downloadable character buffer by the ESC.T command before using the DL command.
Also, setting an odd-number value sets an even-number value added with +1.
(Default value: 0)

The minimum values, maximum values and default values of each buffer are shown in Table 8-6. Specifying values more than the maximum values sets the maximum values. Specifying any values below the minimum values other than 0 sets the minimum values. Specifying 0's sets the I/O buffer to 2 and both polygon and downloadable character buffers to 0.

Parameter	Minimum	Maximum	Default
Physical I/O Buffer	2	15360	1024
Polygon Buffer	2	15358	3072
Downloadable Character Buffer	444	15358	0

Table 8-6

ESC.S Command

Output buffer size command

- **Format:**

ESC .Sn:

- **Explanation:**

This command tells the DPX-3300 to output the currently set capacity of a user-definable buffer to the computer.

n:

The parameter n specifies the types of buffers. Omitting parameter allows (ESC .S:) command to output the whole capacity of the user-defined buffer.
(Default value: 0)

n	Buffer types
0	Entire data buffer size.
1	I/O buffer size at the current point in time.
2	Polygon buffer size at the current point in time.
3	Downloadable Character Buffer size at the current point in time.

Table 8-7

8.4.3 Abort Commands

ESC.J Command

Abort device control command

- **Format:**

ESC .J

- **Explanation:**
  This command aborts the device control commands under execution.

ESC.K Command

Abort RD-GL II command

- **Format:**
  ESC.K

- **Explanation:**
  This command aborts any new incoming RD-GL II commands other than one under execution even if they are sent and clears the data buffer.

ESC.R Command

Reset device control command

- **Format:**
  ESC.R

- **Explanation:**
  This command sets all the settings by the device control commands to the default values.
  When executing the ESC.R, the execution results are the same as the device control commands below are executed.
  ESC.J
  ESC.K
  ESC.P:
  ESC.T:

8.4.4 Monitor Mode Commands

The DPX-3300 is capable of outputting data sent form the computer to a terminal and so forth. Cables used for this purpose should be wired as shown in 8.2.2 ''Y-connection'', Fig. 8-7 with the DIP Switch 1-⑥ turned ON (Y-connection).

ESC.Y Command
ESC.(Command

Plotter ON command

- **Format:**
  ESC.Y or ESC.(

- **Explanation:**
  In the monitor mode (DIP Switch 1- ⑥ is ON) and after the power is turned ON, the DPX-3300 ignores all the data until receiving this command. The ignored data are output through the pin No. 14 of the RS-232C connector to a terminal.

ESC.Z Command
ESC.) Command

Plotter OFF command

- **Format:**
  ESC.Z or ESC.)

- **Explanation:**
  When receiving this command, the DPX-3300 ignores further data.

ESC.@ Command

Set monitor mode and DTR control command

- **Format:**
  ESC.@P1;P2:

- **Explanation:**
  P1:

  This parameter specifies the logical buffer size. Specifying any value exceeding the physical buffer size sets the logical buffer size to the physical buffer size and causes an error. Although the size occupied on the buffer is the physical buffer size, the size you can actually use is the logical buffer size.
  (Default value: 1024)

P2:

When the control of DTR signals (pin No.20 of the RS-232C connector) and the DIP Switch 1- ⑥ are ON (Y-connection), this parameter sets the monitor mode. For more information about the DTR signals and the monitor mode, see 8.3.1 "Hardware Handshake" and 8.2.2 "Y-connection", respectively.
The parameter range is from 0 to 255. The parameter value is the sum of bit values shown in Table 8-8.
(Default value: 1)

Bit No.	Bit value	Contents
0	1	When this bit is 0, no hardware handshake is done. DTR signal is always at "High". When this bit is 1, hardware handshake is performed.
1	2	Ignored.
2	4	When this bit is 0, sets monitor mode 1. When this bit is 1, sets monitor mode 2.
3	8	When this bit is 0, turns monitor mode OFF. When this bit is 1, turns monitor mode ON.
4 5 6 7	16 32 64 128	Ignored.

Table 8-8

Example 1 `PRINT #1,CHR$(27);".@;0:";`

This command sets the monitor mode to OFF and DTR signals to ON. At this time, any data after the ESC .Y command are taken into the DPX-3300 and so are not output to a terminal. Also, handshake is not available.

Example 2 `PRINT #1,CHR$(27);".@;8:";`

When the DIP Switch 1-⑥ is ON (Y-connection), this command sets the monitor mode to ON and in Mode 1. In this time, the DPX-3300 outputs the data currently under execution to a terminal.

Example 3 `PRINT #1,CHR$(27);".@;12:";`

When the DIP Switch 1- ⑥ is ON (Y-connection), this command sets the monitor mode to ON and in Mode 2. In this mode, the DPX-3300 output the data received from the computer to a terminal.

ESC.Q Command

Set monitor mode command

- **Format:**

ESC.Qn:

- **Explanation:**

This ESC.Q command serves as settings by the bits 2 and 3 of the second parameter of the ESC.@ command.

n:

The value for this parameter n is either of 0, 1 and 2, as shown in Table 8-9. For more information, see 8.2.2 ''Y-connection''.
(Default value: 0)

n	Contents
0	Turns monitor mode OFF.
1	Sets monitor mode 1.
2	Sets monitor mode 2.

Table 8-9

TROUBLES AND TROUBLESHOOTING

9

This chapter summarizes causes of troubles and explains how to solve them. If you are in trouble, read this chapter carefully.

The DPX-3300 indicates errors if it cannot continue to operate properly, if the communication protocol for a Serial Interface has not been properly set, etc. In such case, the DPX-3300 lights up or flashes the "ERROR" LED quickly to show something wrong. Depending on errors, the DPX-3300 keeps executing incoming commands, but it cannot execute the commands at the time of errors and so does not assure of further drawings. In such a case, you are required to find what has caused an error and solve them.

9.1.1 Kinds Of Errors And Judgment

Errors are classified into the following 5 kinds.

① Command error:
Wrong commands or parameters out of the specified range have been sent.
② Device control command error:
Wrong device control commands or parameters out of the specified range have been sent.
③ Communication protocol error:
Wrong communication protocol for the serial connection has been set.
④ Pen carriage displacement error:
Immoderate external force has caused the pen carriage to move out of its proper place, and so normal pen replacement cannot be done.
⑤ Hardware error:
The DPX-3300 itself fails to operate.

To check for what kind of error has occurred, follow the judgments below. Then, remove the causes referring to 9.1.2 "Removing Errors" in CHAPTER 9.

- The "ERROR" LED of the control panel is flashing, indicating the errors ④ and ⑤ above and the DPX-3300 cannot continue to operate.
Turn OFF the power switch and wait a few seconds to turn ON it again. Then if the "ERROR" LED stops flashing, it is the error ④. If this flashing does not stop, it is the hardware error ⑤. In such a case, see your local store or call our sales office for support.

- The "ERROR" LED is lighting up, indicating either of the errors ①, ② and ③.

In this case, if you are using commercially available software, make sure again about the checking procedures below.

- Set your software properly for the DPX-3300. The DPX-3300 uses the RD-GL II command compatible with the Hewlett-Packard HP-7580B. Select software supporting either DPX-3300 or HP-7580B or both. If a wrong plotter is specified, totally different commands are sent to cause the command error ① or the device control command error ②.

- If you have connected your computer to the DPX-3300 with a Serial Interface, match the communication protocol of the DPX-3300 with that of your software. This can be done by setting the DIP Switch 1-⑤, 2-①~④ and the baud rate switch of the DPX-3300. For more information, see 10. 4 ''LIST OF DIP SWITCH SETTINGS'' in CHAPTER 10.
  Also, make sure whether the connector cable is compatible with your computer and the DPX-3300, referring to the list of connector cables in CHAPTER 5 ''CONNECTION TO A COMPUTER''.

  If above is not enough to find out causes, check again following 9.2.1 ''Checking Examples Of Connection To Computer''. If this checking is enough, it means software setting is not matched with plotter setting. So, check your software again.

9.1.2 Removing Errors

- Command Error
  Command errors may include the following.
  - Characters other than the specified letters for commands have been sent.
  - Commands have been sent with other than the specified procedures.
  - Parameters other than those in the specified range have been sent.

  You may have caused one of the above command errors in your programming. If so, debug the program reading CHAPTER 6 and 7 carefully.

  If you have used a Serial Interface, you can remove errors and know the content of errors by executing the OE command. For more information about the error content, see ''OE Command'' in CHAPTER 7 ''DESCRIPTION OF THE RD-GL II COMMAND''. Also, you can remove errors by pressing the LL key of the control panel.

- Device control command error
  If you have used a Serial Interface for the connection to your computer and in case of a wrong device control command, you can remove errors and know the content of errors by executing the ESC .E command. For more information, see ESC .E Command'' of 8.4 ''DEVICE CONTROL COMMAND'' in CHAPTER 8.
  Also, you can remove errors by pressing the LL key of the control panel.

- Communication protocol error

  If you have used a Serial Interface for the connection to your computer, wrong communication protocol (baud rate, etc) between the DPX-3300 and your computer (software) causes this kind of error. Set a proper communication protocol reading 10.1 ''LIST OF DIP SWITCHES'' in CHAPTER 10 and the operation manual for the computer (software).

  You can also remove this error by pressing the [LL] key of the control panel. **But to change the communication protocol by setting the DIP Switch of the DPX-3300, turn ON the power switch of the DPX-3300 again or press the ''RESET'' switch of the side panel. Otherwise you cannot change it.**

- Pen carriage displacement error

  If your hands or objects inadvertently touch the pen carriage or the arm during drawing, the pen carriage may move out of its proper place. At this moment, the ''ERROR'' LED flashes. The DPX-3300 does not indicate an error when the pen carriage is displaced but indicates this error at the first time it finds pen replacement could not be done.

  Such displacement also causes complete coordinate displacement. To correct this for a new drawing, turn OFF the power switch of the DPX-3300 and turn ON it again or press the ''RESET'' switch of the side panel.

The DPX-3300 has the self test function to make sure that it can operate properly. If something wrong happens, do the self test described in 2.6 ''OPERATION CHECK'' in CHAPTER 2. If this test shows nothing wrong, the DPX-3300 is normal in most of parts.

The operation check is correct, but the DPX-3300 does not operate completely. In such a case, the connection to the computer may be wrong. Make sure of this connection referring to CHAPTER 5 ''CONNECTION TO A COMPUTER'' or 9.2.1 ''Checking Examples Of Connection To Computer''. If this check shows no problem, the connection between the DPX-3300 and the computer is correct. In such a case, check your software and program.

9.2.1 Checking Examples Of Connection To Computer

Simple checking examples with BASIC are given below.
If these checks show no problem, the connector cable as well as interface between the DPX-3300 and the computer are correct. In such a case, make sure of software connection reading the software operation manual carefully.

The self test of 2.6 ''OPERATION CHECK'' in CHAPTER 2 is correct, but this connection check is not correct. In such a case, the connector cable or interface may be wrong.

Note that DIP Switch setting of the DPX-3300 described below are only for this particular checking. If you use commercially available software, reset it according to the software manual.

- Plotter setting
  For parallel connection:
  Turn OFF (lower) all of the DIP Switches of the side panel and turn ON the power. Make sure that the SERIAL/PARALLEL indicator LED is lighting up in ''RED''.

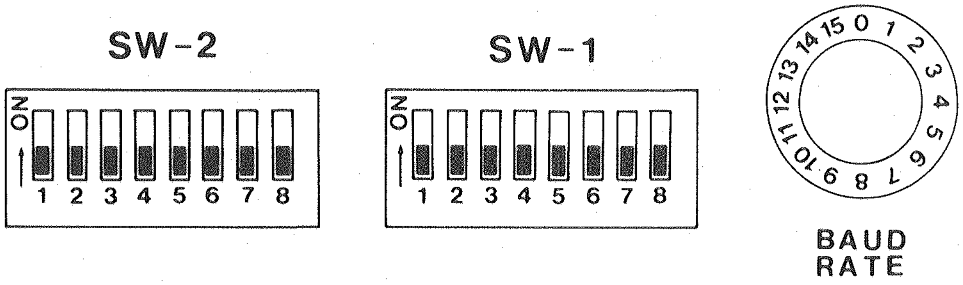


Fig. 9-1

For serial connection:
Turn ON the DIP Switch 1-⑤ and OFF the rest. Dial the baud rate switch to No.14 and turn ON the power switch. Make sure that the SERIAL/PARALLEL indicator LED is lighting up in "GREEN".

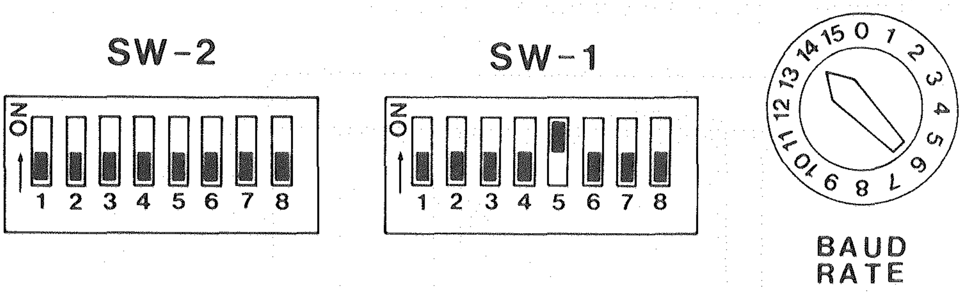


Fig. 9-2

- Computer setting
  This setting varies depending on computer connections. Also, since BASIC format varies depending on types of computers, see the BASIC manual for the computer.

  Checking examples with popular computers are given below.

- **IBM PC (5150), PC/XT (5160), PC/AT (5170)**

For parallel connection:
① Start up BASIC.
② Execute the direct statement below.

```
LPRINT "PA 0,0,5000,5000;"↵
```

The connection between the DPX-3300 and the computer is correct with the following two:
(a) the pen carriage operates as shown in Fig. 9-3 and
(b) the "ERROR" LED of the control panel is OFF.

For serial connection:
① Start up BASIC.
② Execute a program below.

```
100 OPEN "COM1:9600,N,8,1" AS #1
110 PRINT #1,"PA 0,0,5000,5000;"
120 PRINT #1,"OI;"
130 INPUT #1,DPX$
140 PRINT DPX$
150 END
```

The connection between the DPX-3300 and the computer is correct with the following three:

(a) ''DPX-3300'' appears on the display screen of the computer,
(b) the pen carriage operates as shown in Fig. 9-3 and
(c) the ''ERROR'' LED of the control panel is Off.

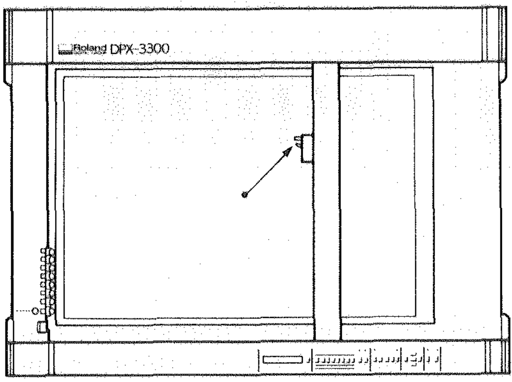


Fig. 9-3

• Apple II, IIe

For parallel connection:

① Set the switch of Roland DG corp.'s interface card "XY-APL" as shown in Fig. 9-4 below.

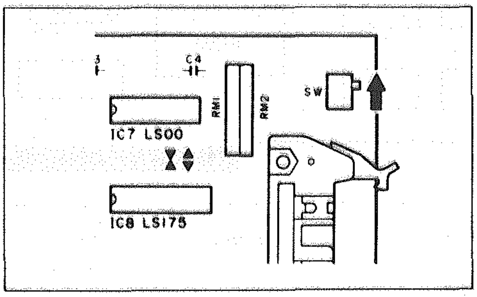


Fig. 9-4

② Insert the XY-APL into the computer.
③ Start up BASIC.
④ Execute the program below.

```
100 PR #2
110 PRINT "PA 0,0,5000,5000;"
120 PR #0
130 END
```

The connection between the DPX-3300 and the computer is correct with the following two:
(a) the pen carriage operates as shown in Fig. 9-3 and
(b) the "ERROR" LED of the control panel is OFF.

For serial connection:

① An RS-232C interface card (Apple II Super Serial Card) is required.
② Set the DIP Switch of Apple II Super Serial Card as shown in Fig. 9-5 below.
③ Set the jumper block of Apple II Super Serial Card so that a triangle is as shown in Fig. 9-5 below.

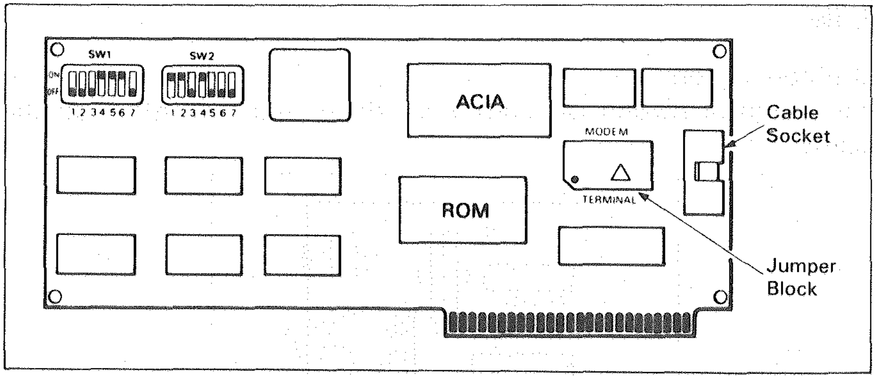

SW1
SW2
ON
OFF
1 2 3 4 5 6 7
1 2 3 4 5 6 7
ACIA
ROM
MODEM
TERMINAL
Cable Socket
Jumper Block

Fig. 9-5

④ Insert the card into #2 slot of the computer.
⑤ Connect the computer to the DPX-3300 with Roland DG corp.'s cable ''XY-RS-11'' or ''XY-RS-31''.
⑥ Start up BASIC.
⑦ Execute the program below.

```
100 PR #2:IN #2
110 PRINT "PA 0,0,5000,5000;"
120 PRINT "OI;"
130 PR #0
140 INPUT DPX$
150 PRINT DPX$
160 IN #0
170 END
```

The connection between the DPX-3300 and the computer is correct with the following three:
(a) ''DPX-3300'' appears on the display screen of the computer,
(b) the pen carriage operates as shown in Fig. 9-3 and
(c) the ''ERROR'' LED of the control panel is OFF.

9.3 COMPUTER DEVICE TIMEOUT ERROR

If the computer cannot be allowed to transmit any data to its peripheral equipment for a long time, it may judge no peripheral equipment is connected to itself and interrupt the program. This is called a ''device timeout error''.

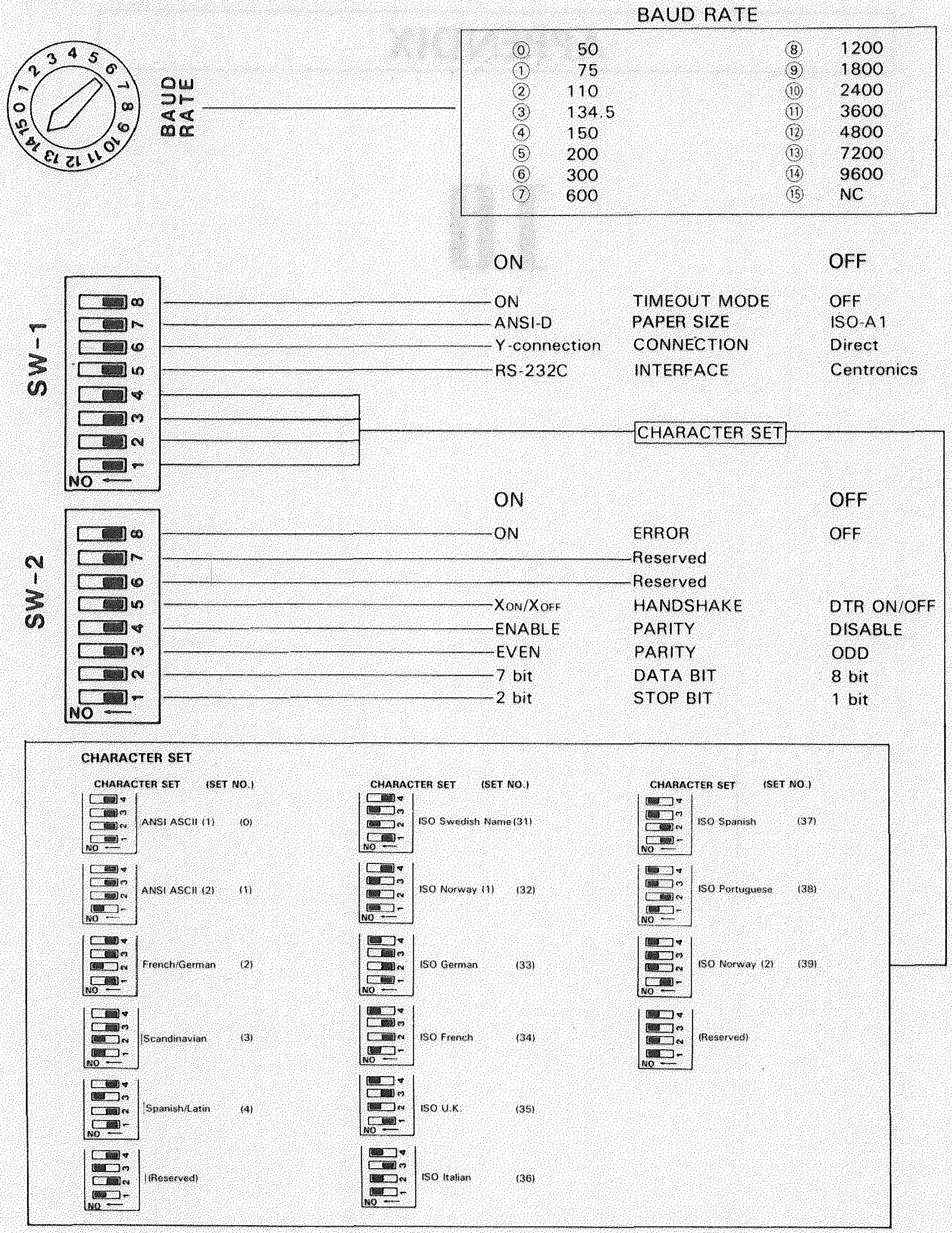
In case the computer stops its operation while the DPX-3300 is drawing, there is a device timeout error causing such a problem, other than the errors caused by your own program.
Although the DPX-3300 has a data buffer, since the computer has the data transmission speed much faster than the plotter processing speed, the DPX-3300 lets the computer to wait until its processing is done. Depending on types of computers, some computers may place a limit on this waiting time. In such a case, the computer may judge it is not connected to the DPX-3300 then display an error message and interrupt the program. To solve this problem, the DPX-3300 has a mode called ''timeout mode''. If **you turn ON the DIP Switch 1- ⑧ and turn ON the power switch**, the timeout mode is turned ON. In this mode, if the remaining buffer capacity is below 512 bytes, the DPX-3300 receives data for 1 byte at a certain time interval. This means the computer keeps sending data to the DPX-3300, and therefore the timeout is not easy to occur.

APPENDIX

10

10.1 LIST OF DIP SWITCH SETTINGS

When the power is turned ON, the DPX-3300 reads whether the DIP Switch and baud rate switch have already been set. So, after turning OFF the power, do proper switching of each switch, then turn ON the power again.



BAUD RATE

⓪	50	⑧	1200
①	75	⑨	1800
②	110	⑩	2400
③	134.5	⑪	3600
④	150	⑫	4800
⑤	200	⑬	7200
⑥	300	⑭	9600
⑦	600	⑮	NC

SW-1

	ON		OFF
8	ON	TIMEOUT MODE	OFF
7	ANSI-D	PAPER SIZE	ISO-A1
6	Y-connection	CONNECTION	Direct
5	RS-232C	INTERFACE	Centronics
4–1		CHARACTER SET	

SW-2

	ON		OFF
8	ON	ERROR	OFF
7		Reserved	
6		Reserved	
5	XON/XOFF	HANDSHAKE	DTR ON/OFF
4	ENABLE	PARITY	DISABLE
3	EVEN	PARITY	ODD
2	7 bit	DATA BIT	8 bit
1	2 bit	STOP BIT	1 bit

CHARACTER SET

CHARACTER SET	(SET NO.)	CHARACTER SET	(SET NO.)	CHARACTER SET	(SET NO.)
ANSI ASCII (1)	(0)	ISO Swedish Name	(31)	ISO Spanish	(37)
ANSI ASCII (2)	(1)	ISO Norway (1)	(32)	ISO Portuguese	(38)
French/German	(2)	ISO German	(33)	ISO Norway (2)	(39)
Scandinavian	(3)	ISO French	(34)	(Reserved)	
Spanish/Latin	(4)	ISO U.K.	(35)		
(Reserved)		ISO Italian	(36)		

Fig. 10-1 (DIP Switch-1 & -2, Baud rate switch)

SW-1:	
①~④	The DPX-3300 has 61 types of character sets, and character set Nos. are placed beside each character set (see 10.4 "LIST OF CHARACTER SETS" in CHAPTER 10). Use these switch to select 7 character sets from the 61 character sets and do their initial settings (see 6.7 "SETTING CHARACTER SETS" in CHAPTER 6).
⑤	Select either of RS-232C or Centronics Interface for the connection of the DPX-3300 to your computer. Set this switch for one you selected.
⑥	Use this switch to select a proper connection mode for the RS-232C. For this, usually "Direct" is selected. If you want to use Y-connection, select Y-connection. For more information, see 8.2.3 "Y-Connection" in CHAPTER 8. This switch has nothing to do with a parallel connection.
⑦	Use this switch to a paper size standard for the plotting paper you want to use. The DPX-3300 is able to draw over the entire areas of both ISO-A1 side and ANSI-D size papers. If you do not set this switch to match with either of these standards, not only the DPX-3300 does not draw over the entire area but also the plotting area comes out of the plotting paper.
⑧	This switch is used for setting the timeout mode. Since the DPX-3300 has a large capacity buffer, you can store large amounts of data at once, but it takes a long time to process drawing data. This lets the computer to wait in the meanwhile. Depending on computers, one may place a limit on this waiting time. In this case, the computer judges it is not connected to the DPX-3300 and outputs an error message to interrupt the program. To cope with such a problem, the timeout mode is provided. When the timeout mode is ON and in case the remaining buffer capacity is below 512 bytes, the DPX-3300 receives data for 1 byte at a certain time interval. When the timeout mode is OFF, the DPX-3300 stops receiving data if the remaining buffer capacity is below 80 bytes and does not start receiving any data until the remaining buffer capacity is below 336 bytes again.
SW-2:	
①~④	This switch is used to set a communication protocol when you selected a Serial (RS-232C) Interface for the connection of the DPX-3300 to your computer. It has nothing to do with a parallel connection.
⑤	This switch is used to determine a handshake mode when you selected a Serial (RS-232C) Interface. When the switch is OFF, the hardware handshake is available. When it is ON, the Xon/Xoff handshake is available. For more information, see 8.3.3 "Xon/Xoff Handshake" in CHAPTER 8.
⑥, ⑦	These switches are not used. Keep them turned OFF all time.
⑧	This switch is used to determine whether it outputs the error content of the DPX-3300 to the pin No.32 in case you selected a Parallel (Centronics) Interface for the connection to your computer. When the switch is OFF, nothing is output. When it is ON, and if the DPX-3300 causes an error, the pen No. 32 becomes "Low", telling the computer that the DPX-3300 is causing an error. When this switch is OFF, the pin No. 32 is always "High". It has nothing to do with a serial connection.
Baud Rate Switch:	
This switch is used to set data transmission speed (baud rate) when you have selected a Serial (RS-232C) Interface for the connection to your computer. No. 15 is NC (unused). This has nothing to do with a Parallel (Centronics) Interface.	

10.2 LIST OF MODES

Self Test Mode

Function	How to set (release)
This mode is used to check whether the DPX-3300 can operate properly, without connecting to the computer. Use this mode when it is the first time to operate the DPX-3300 and/or when you want to check whether some failure is caused by either the DPX-3300 or the computer, if any. (For more information, see 2.6 "OPERATION CHECK" in CHAPTER 2.)	While pressing the ENTER key of the control panel, turn ON the power switch. (When the self test is over, the DPX-3300 comes in the normal mode.)

Non-buffer Mode

Function	How to set (release)
This mode brings the DPX-3300 to the non-buffer mode that has no I/O buffer. It is useful for debugging a program. The DPX-3300 has a 1K-byte I/O buffer and draws while storing coming data from the computer in the I/O buffer. This shortens the computer waiting time as well as the time required for data processing. On the other hand, when a program is debugged, there is a time lag between data transmission from the computer and an error caused by the DPX-3300. This may cause some inconvenience. As long as this mode is ON, when you stop the computer, the DPX-3300 also stops at the almost same time, so that it is easy to find out what is causing an error.	While pressing the ◀ key of the control panel, turn ON the power switch. (Turn OFF the power switch and then ON.)

Automatic Pen Control Mode

Function	How to set (release)
This mode protects the automatically set pen force and speed for the pen in the pen carriage so that they cannot be canceled by commands. Also it makes the automatic pen cap and automatic pen return functions effective.	Press the AUTO key of the control panel to light up the "AUTO" LED (red). (Press the AUTO key of the control panel to light off the "AUTO" LED (red).)

Timeout Mode

Function	How to set (release)
Although the DPX-3300 has a 1K-byte I/O buffer, if you store large amount of data at once, it takes a long time to process drawing data. This lets the DPX-3300 to wait in the meanwhile. Depending on computers, one may place a limit on this waiting time. In this case, the computer may judge it is not connected to the DPX-3300 and outputs an error indication to interrupt the program. To cope with this, the timeout mode is provided. When the timeout mode is ON and in case the remaining buffer capacity is below 256 bytes, the DPX-3300 receives data for 1 byte at a certain time interval (until the timeout occurs). When the timeout mode is OFF, the DPX-3300 stops receiving data if the remaining buffer capacity is below 80 bytes and does not start receiving any data until the remaining buffer capacity is below 336 bytes again.	Turn ON the DIP Switch 1-⑧, then turn ON the power switch. (Turn OFF the DIP Switch 1-⑧, then turn ON the power switch.)

Digitize Mode

Function	How to set (release)
This mode uses the DPX-3300 as a digitizer. When the digitize mode is ON, it enables the DPX-3300 to output to the computer the X-Y coordinates of the pen carriage set by pressing the ENTER key of the control panel as well as its pen (UP/DOWN) state. This digitize mode is usable only for a Serial (RS-232C) Interface but not for a Parallel (Centronics) Interface.	Send the DP command during programming. (Press the ENTER key of the control panel or send the DC command.)

Rotate Mode

Function	How to set (release)
This mode rotates the axial directions of X-Y coordinates counterclockwise by In this mode, the DPX-3300 draws 90° rotated figures.	Send the RO90; command (Send the RO0; or IN commands.)

Symbol Mode

Function	How to set (release)
In this mode, the DPX-3300 draws characters (symbol) at the point specified by the PA and PR commands as center. But semicolon ";" cannot be specified as a symbol.	Send the SM symbol [terminator]. (Send "SM [terminator]" or IN and DF commands.)

Character Drawing Mode

Function	How to set (release)
In this mode, the DPX-3300 draws a character string using the currently specified character set. This mode is not released until the DPX-3300 receives the label terminator defined by the DT command. For this, you can also use character variables instead of a character string.	Send the LB command. (Send the label terminator.)

Polygon Mode

Function	How to set (release)
Although the DPX-3300 does not draw further if it enters this mode, the polygon buffer data become effective. After this, sending the EP and FP commands allows the DPX-3300 to draw. But sending commands other than the particular commands (IN, PM, PA, PR, PU, PD, AA, AR, CI, CT and output command) causes an error.	Send the PM (PM0;) command. (Send "PM2;" or "IN;".)

10.3.1 List of control characters

For more information about the range of character codes from 33 to 126 (decimal), see 10.4 ''LIST OF CHARACTERS SETS''

Decimal Value	Hex	ASCII Character	All Sets
0	00	NULL	Unused
1	01	SOH	Unused
2	02	STX	Unused
3	03	ETX	End Label Commnand
4	04	ETO	Unused
5	05	ENQ	RS-232C
6	06	ACK	RS-232C
7	07	BEL	Unused
8	08	BS	Backspace
9	09	HT	Half Back Left
10	0A	LF	Line Feed
11	0B	VT	Inverse Line Feed
12	0C	FF	Unused
13	0D	CR	Carriage Return
14	0E	SO	Select Alternate Character Set
15	0F	SI	Select Stndard Character Set
16	10	DLE	Unused
17	11	DC1	Unused
18	12	DC2	Unused
19	13	DC3	Unused
20	14	DC4	Unused
21	15	NAK	Unused
22	16	SYN	Unused
23	17	ETB	Unused
24	18	CAN	Unused
25	19	EM	Unused
26	1A	SUB	Unused
27	1B	ESC	Unused
28	1C	FS	Unused
29	1D	GS	Unused
30	1E	RS	Unused
31	1F	US	Unused
32	20	SP	Space
127	7F	DEL	Unused
142	8E	SS2	Invoke the slot 2
143	8F	SS3	Invoke the slot 3

Hexa-decimal	Decimal	Character Set No.																													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
21	33	!	!	!	!	!	!	!	À	。	!	!	!	!	!	!	!	!	À	。	!	!	!	!	!	!	!	!	À	。	!
22	34	"	"	"	"	"	"	"	Â	「	"	"	"	"	"	"	"	"	Â	「	"	"	"	"	"	"	"	"	Â	「	"
23	35	#	#	£	£	¿	#	#	È	」	#	#	#	£	£	¿	#	#	È	」	#	#	#	£	£	¿	#	#	È	」	#
24	36	$	$	$	$	$	$	$	Ê	、	¤	$	$	$	$	$	$	$	Ê	、	¤	$	$	$	$	$	$	$	Ê	、	¤
25	37	%	%	%	%	%	%	%	Ë	・	%	%	%	%	%	%	%	%	Ë	・	%	%	%	%	%	%	%	%	Ë	・	%
26	38	&	&	&	&	&	&	&	Î	ヲ	&	&	&	&	&	&	&	&	Î	ヲ	&	&	&	&	&	&	&	&	Î	ヲ	&
27	39	'	'	´	'	´	'	'	Ï	ァ	'	'	'	´	'	´	'	'	Ï	ァ	'	'	'	´	'	´	'	'	Ï	ァ	'
28	40	(	(	(	(	(	(	(	´	ィ	(	(	(	(	(	(	(	(	´	ィ	(	(	(	(	(	(	(	(	´	ィ	(
29	41	)	)	)	)	)	)	)	`	ゥ	)	)	)	)	)	)	)	)	`	ゥ	)	)	)	)	)	)	)	)	`	ゥ	)
2A	42	*	*	*	*	*	*	*	^	ェ	*	*	*	*	*	*	*	*	^	ェ	*	*	*	*	*	*	*	*	^	ェ	*
2B	43	+	+	+	+	+	+	+	¨	ォ	+	+	+	+	+	+	+	+	¨	ォ	+	+	+	+	+	+	+	+	¨	ォ	+
2C	44	,	,	,	,	,	,	,	~	ャ	,	,	,	,	,	,	,	,	~	ャ	,	,	,	,	,	,	,	,	~	ャ	,
2D	45	-	-	-	-	-	-	-	Ù	ュ	-	-	-	-	-	-	-	-	Ù	ュ	-	-	-	-	-	-	-	-	Ù	ュ	-
2E	46	.	.	.	.	.	.	.	Û	ョ	.	.	.	.	.	.	.	.	Û	ョ	.	.	.	.	.	.	.	.	Û	ョ	.
2F	47	/	/	/	/	/	/	/	£	ッ	/	/	/	/	/	/	/	/	£	ッ	/	/	/	/	/	/	/	/	£	ッ	/
30	48	0	0	0	0	0	0	0	¯	ー	0	0	0	0	0	0	0	0	¯	ー	0	0	0	0	0	0	0	0	¯	ー	0
31	49	1	1	1	1	1	1	1		ア	1	1	1	1	1	1	1	1		ア	1	1	1	1	1	1	1	1		ア	1
32	50	2	2	2	2	2	2	2		イ	2	2	2	2	2	2	2	2		イ	2	2	2	2	2	2	2	2		イ	2
33	51	3	3	3	3	3	3	3	˚	ウ	3	3	3	3	3	3	3	3	˚	ウ	3	3	3	3	3	3	3	3	˚	ウ	3
34	52	4	4	4	4	4	4	4	Ç	エ	4	4	4	4	4	4	4	4	Ç	エ	4	4	4	4	4	4	4	4	Ç	エ	4
35	53	5	5	5	5	5	5	5	ç	オ	5	5	5	5	5	5	5	5	ç	オ	5	5	5	5	5	5	5	5	ç	オ	5
36	54	6	6	6	6	6	6	6	Ñ	カ	6	6	6	6	6	6	6	6	Ñ	カ	6	6	6	6	6	6	6	6	Ñ	カ	6
37	55	7	7	7	7	7	7	7	ñ	キ	7	7	7	7	7	7	7	7	ñ	キ	7	7	7	7	7	7	7	7	ñ	キ	7
38	56	8	8	8	8	8	8	8	¡	ク	8	8	8	8	8	8	8	8	¡	ク	8	8	8	8	8	8	8	8	¡	ク	8
39	57	9	9	9	9	9	9	9	¿	ケ	9	9	9	9	9	9	9	9	¿	ケ	9	9	9	9	9	9	9	9	¿	ケ	9
3A	58	:	:	:	:	:	:	:	¤	コ	:	:	:	:	:	:	:	:	¤	コ	:	:	:	:	:	:	:	:	¤	コ	:
3B	59	;	;	;	;	;	;	;	£	サ	;	;	;	;	;	;	;	;	£	サ	;	;	;	;	;	;	;	;	£	サ	;
3C	60	<	<	<	<	<	<	<	¥	シ	<	<	<	<	<	<	<	<	¥	シ	<	<	<	<	<	<	<	<	¥	シ	<
3D	61	=	=	=	=	=	=	=	§	ス	=	=	=	=	=	=	=	=	§	ス	=	=	=	=	=	=	=	=	§	ス	=
3E	62	>	>	>	>	>	>	>	ƒ	セ	>	>	>	>	>	>	>	>	ƒ	セ	>	>	>	>	>	>	>	>	ƒ	セ	>
3F	63	?	?	?	?	?	?	?	¢	ソ	?	?	?	?	?	?	?	?	¢	ソ	?	?	?	?	?	?	?	?	¢	ソ	?
40	64	@	@	@	@	@	@	@	â	タ	@	@	@	@	@	@	@	@	â	タ	@	@	@	@	@	@	@	@	â	タ	@

Character	Character Set No.		
	Fixed-Space Vector Font	Variable-Space Arc Font	Fixed-Space Arc Font
ANSI ASCII (1)	0	10	20
ANSI ASCII (2)	1	11	21
French/German	2	12	22
Scandinavian	3	13	23
Spanish/Latin	4	14	24
Special	5	15	25
JIS ASCII	6	16	26
Roman	7	17	27
Katakana	8	18	28
ISO I.R.V.	9	19	29

⬚ Automatic backspace.

Hexa-decimal	Decimal	Character Set No.																													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
41	65	A	A	A	A	A	⊡	A	ê	チ	A	A	A	A	A	A	⊡	A	ê	チ	A	A	A	A	A	A	⊡	A	ê	チ	A
42	66	B	B	B	B	B	⌽	B	ô	ツ	B	B	B	B	B	B	⌽	B	ô	ツ	B	B	B	B	B	B	⌽	B	ô	ツ	B
43	67	C	C	C	C	C	△	C	û	テ	C	C	C	C	C	C	△	C	û	テ	C	C	C	C	C	C	△	C	û	テ	C
44	68	D	D	D	D	D	+	D	á	ト	D	D	D	D	D	D	+	D	á	ト	D	D	D	D	D	D	+	D	á	ト	D
45	69	E	E	E	E	E	X	E	é	ナ	E	E	E	E	E	E	X	E	é	ナ	E	E	E	E	E	E	X	E	é	ナ	E
46	70	F	F	F	F	F	◇	F	ó	ニ	F	F	F	F	F	F	◇	F	ó	ニ	F	F	F	F	F	F	◇	F	ó	ニ	F
47	71	G	G	G	G	G	↑	G	ú	ヌ	G	G	G	G	G	G	↑	G	ú	ヌ	G	G	G	G	G	G	↑	G	ú	ヌ	G
48	72	H	H	H	H	H	X̄	H	à	ネ	H	H	H	H	H	H	X̄	H	à	ネ	H	H	H	H	H	H	X̄	H	à	ネ	H
49	73	I	I	I	I	I	Z	I	è	ノ	I	I	I	I	I	I	Z	I	è	ノ	I	I	I	I	I	I	Z	I	è	ノ	I
4A	74	J	J	J	J	J	Y	J	ò	ハ	J	J	J	J	J	J	Y	J	ò	ハ	J	J	J	J	J	J	Y	J	ò	ハ	J
4B	75	K	K	K	K	K	Ж	K	ù	ヒ	K	K	K	K	K	K	Ж	K	ù	ヒ	K	K	K	K	K	K	Ж	K	ù	ヒ	K
4C	76	L	L	L	L	L	✳	L	ä	フ	L	L	L	L	L	L	✳	L	ä	フ	L	L	L	L	L	L	✳	L	ä	フ	L
4D	77	M	M	M	M	M	⧗	M	ë	ヘ	M	M	M	M	M	M	⧗	M	ë	ヘ	M	M	M	M	M	M	⧗	M	ë	ヘ	M
4E	78	N	N	N	N	N	ǀ	N	ö	ホ	N	N	N	N	N	N	ǀ	N	ö	ホ	N	N	N	N	N	N	ǀ	N	ö	ホ	N
4F	79	O	O	O	O	O	✡	O	ü	マ	O	O	O	O	O	O	✡	O	ü	マ	O	O	O	O	O	O	✡	O	ü	マ	O
50	80	P	P	P	P	P	_	P	Å	ミ	P	P	P	P	P	P	_	P	Å	ミ	P	P	P	P	P	P	_	P	Å	ミ	P
51	81	Q	Q	Q	Q	Q	,	Q	î	ム	Q	Q	Q	Q	Q	Q	,	Q	î	ム	Q	Q	Q	Q	Q	Q	,	Q	î	ム	Q
52	82	R	R	R	R	R	R	R	Ø	メ	R	R	R	R	R	R	R	R	Ø	メ	R	R	R	R	R	R	R	R	Ø	メ	R
53	83	S	S	S	S	S	S	S	Æ	モ	S	S	S	S	S	S	S	S	Æ	モ	S	S	S	S	S	S	S	S	Æ	モ	S
54	84	T	T	T	T	T	T	T	å	ヤ	T	T	T	T	T	T	T	T	å	ヤ	T	T	T	T	T	T	T	T	å	ヤ	T
55	85	U	U	U	U	U	U	U	í	ユ	U	U	U	U	U	U	U	U	í	ユ	U	U	U	U	U	U	U	U	í	ユ	U
56	86	V	V	V	V	V	V	V	ø	ヨ	V	V	V	V	V	V	V	V	ø	ヨ	V	V	V	V	V	V	V	V	ø	ヨ	V
57	87	W	W	W	W	W	W	W	æ	ラ	W	W	W	W	W	W	W	W	æ	ラ	W	W	W	W	W	W	W	W	æ	ラ	W
58	88	X	X	X	X	X	X	X	Ä	リ	X	X	X	X	X	X	X	X	Ä	リ	X	X	X	X	X	X	X	X	Ä	リ	X
59	89	Y	Y	Y	Y	Y	Y	Y	ì	ル	Y	Y	Y	Y	Y	Y	Y	Y	ì	ル	Y	Y	Y	Y	Y	Y	Y	Y	ì	ル	Y
5A	90	Z	Z	Z	Z	Z	Z	Z	Ö	レ	Z	Z	Z	Z	Z	Z	Z	Z	Ö	レ	Z	Z	Z	Z	Z	Z	Z	Z	Ö	レ	Z
5B	91	[	[	[	Ø	[	[	[	Ü	ロ	[	[	[	[	Ø	[	[	[	Ü	ロ	[	[	[	[	Ø	[	[	[	Ü	ロ	[
5C	92	\	√	ç	Æ	¡	\	¥	É	ワ	\	\	√	ç	Æ	¡	\	¥	É	ワ	\	\	√	ç	Æ	¡	\	¥	É	ワ	\
5D	93	]	]	]	ø	]	]	]	ï	ン	]	]	]	]	ø	]	]	]	ï	ン	]	]	]	]	ø	]	]	]	ï	ン	]
5E	94	^	↑	⬚^	æ	⬚^	^	^	ß	゛	^	^	↑	⬚^	æ	⬚^	^	^	ß	゛	^	^	↑	⬚^	æ	⬚^	^	^	ß	゛	^
5F	95	_	⬚_	⬚_	⬚_	⬚_	_	_	Ô	゜	_	_	⬚_	⬚_	⬚_	⬚_	_	_	Ô	゜	_	_	⬚_	⬚_	⬚_	⬚_	_	_	Ô	゜	_
60	96	ˋ	⬚ˋ	⬚ˋ	ˋ	ˋ	ˋ	ˋ	Á		ˋ	ˋ	⬚ˋ	⬚ˋ	ˋ	ˋ	ˋ	ˋ	Á		ˋ	ˋ	⬚ˋ	⬚ˋ	ˋ	ˋ	ˋ	ˋ	Á		ˋ

Character	Character Set No.		
	Fixed-Space Vector Font	Variable-Space Arc Font	Fixed-Space Arc Font
ANSI ASCII (1)	0	10	20
ANSI ASCII (2)	1	11	21
French/German	2	12	22
Scandinavian	3	13	23
Spanish/Latin	4	14	24
Special	5	15	25
JIS ASCII	6	16	26
Roman	7	17	27
Katakana	8	18	28
ISO I.R.V.	9	19	29

Hexa-decimal	Decimal	Character Set No.																													
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
61	97	a	a	a	a	a	∩	a	Ã		a	a	a	a	a	a	∩	a	Ã		a	a	a	a	a	a	∩	a	Ã		a
62	98	b	b	b	b	b	⊃	b	ã		b	b	b	b	b	b	⊃	b	ã		b	b	b	b	b	b	⊃	b	ã		b
63	99	c	c	c	c	c	⊂	c	Đ		c	c	c	c	c	c	⊂	c	Đ		c	c	c	c	c	c	⊂	c	Đ		c
64	100	d	d	d	d	d	∪	d	đ		d	d	d	d	d	d	∪	d	đ		d	d	d	d	d	d	∪	d	đ		d
65	101	e	e	e	e	e	‾	e	Í		e	e	e	e	e	e	‾	e	Í		e	e	e	e	e	e	‾	e	Í		e
66	102	f	f	f	f	f	≡	f	Ì		f	f	f	f	f	f	≡	f	Ì		f	f	f	f	f	f	≡	f	Ì		f
67	103	g	g	g	g	g	≅	g	Ó		g	g	g	g	g	g	≅	g	Ó		g	g	g	g	g	g	≅	g	Ó		g
68	104	h	h	h	h	h	≈	h	Ò		h	h	h	h	h	h	≈	h	Ò		h	h	h	h	h	h	≈	h	Ò		h
69	105	i	i	i	i	i	~	i	Õ		i	i	i	i	i	i	~	i	Õ		i	i	i	i	i	i	~	i	Õ		i
6A	106	j	j	j	j	j	≤	j	õ		j	j	j	j	j	j	≤	j	õ		j	j	j	j	j	j	≤	j	õ		j
6B	107	k	k	k	k	k	≥	k	Š		k	k	k	k	k	k	≥	k	Š		k	k	k	k	k	k	≥	k	Š		k
6C	108	l	l	l	l	l	≠	l	š		l	l	l	l	l	l	≠	l	š		l	l	l	l	l	l	≠	l	š		l
6D	109	m	m	m	m	m	Δ	m	Ú		m	m	m	m	m	m	Δ	m	Ú		m	m	m	m	m	m	Δ	m	Ú		m
6E	110	n	n	n	n	n	Π	n	Ÿ		n	n	n	n	n	n	Π	n	Ÿ		n	n	n	n	n	n	Π	n	Ÿ		n
6F	111	o	o	o	o	o	Σ	o	ÿ		o	o	o	o	o	o	Σ	o	ÿ		o	o	o	o	o	o	Σ	o	ÿ		o
70	112	p	p	p	p	p	±	p	Þ		p	p	p	p	p	p	±	p	Þ		p	p	p	p	p	p	±	p	Þ		p
71	113	q	q	q	q	q	∓	q	þ		q	q	q	q	q	q	∓	q	þ		q	q	q	q	q	q	∓	q	þ		q
72	114	r	r	r	r	r	→	r			r	r	r	r	r	r	→	r			r	r	r	r	r	r	→	r			r
73	115	s	s	s	s	s	↑	s			s	s	s	s	s	s	↑	s			s	s	s	s	s	s	↑	s			s
74	116	t	t	t	t	t	←	t			t	t	t	t	t	t	←	t			t	t	t	t	t	t	←	t			t
75	117	u	u	u	u	u	↓	u			u	u	u	u	u	u	↓	u			u	u	u	u	u	u	↓	u			u
76	118	v	v	v	v	v	∫	v	—		v	v	v	v	v	v	∫	v	—		v	v	v	v	v	v	∫	v	—		v
77	119	w	w	w	w	w	÷	w	¼		w	w	w	w	w	w	÷	w	¼		w	w	w	w	w	w	÷	w	¼		w
78	120	x	x	x	x	x	*	x	½		x	x	x	x	x	x	*	x	½		x	x	x	x	x	x	*	x	½		x
79	121	y	y	y	y	y	∇	y	ª		y	y	y	y	y	y	∇	y	ª		y	y	y	y	y	y	∇	y	ª		y
7A	122	z	z	z	z	z	°	z	º		z	z	z	z	z	z	°	z	º		z	z	z	z	z	z	°	z	º		z
7B	123	{	π	◌̈	◌̈	◌̃	{	{	«		{	{	π	◌̈	◌̈	◌̃	{	{	«		{	{	π	◌̈	◌̈	◌̃	{	{	«		{
7C	124	|	⊢	◌̇	◌̇	◌̃	|	|	□		|	|	⊢	◌̇	◌̇	◌̃	|	|	□		|	|	⊢	◌̇	◌̇	◌̃	|	|	□		|
7D	125	}	→	◌̈	◌̈	◌̃	}	}	»		}	}	→	◌̈	◌̈	◌̃	}	}	»		}	}	→	◌̈	◌̈	◌̃	}	}	»		}
7E	126	~	◌̃	'	◌̇	◌̃	~	~	±		‾	~	◌̃	'	◌̇	◌̃	~	~	±		‾	~	◌̃	'	◌̇	◌̃	~	~	±		‾

Character	Character Set No.		
	Fixed-Space Vector Font	Variable-Space Arc Font	Fixed-Space Arc Font
ANSI ASCII (1)	0	10	20
ANSI ASCII (2)	1	11	21
French/German	2	12	22
Scandinavian	3	13	23
Spanish/Latin	4	14	24
Special	5	15	25
JIS ASCII	6	16	26
Roman	7	17	27
Katakana	8	18	28
ISO I.R.V.	9	19	29

Hexa-decimal	Decimal	Character Set No.																															
		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	70	80	99
21	33	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!	!
22	34	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"
23	35	#	#	#	#	£	£	£	£	#	#	#	#	#	#	£	£	£	£	#	§	#	#	#	#	£	£	£	£	#	§	£	£	£	¢
24	36	¤	¤	$	$	$	$	$	$	$	$	¤	¤	$	$	$	$	$	$	$	$	¤	¤	$	$	$	$	$	$	$	$	$	$	$	$
25	37	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%	%
26	38	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&	&
27	39	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'	'
28	40	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(	(
29	41	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)	)
2A	42	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
2B	43	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
2C	44	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,	,
2D	45	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2E	46	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
2F	47	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
30	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	49	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
32	50	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
33	51	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
34	52	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
35	53	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
36	54	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
37	55	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
38	56	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
39	57	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
3A	58	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
3B	59	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;	;
3C	60	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<	<
3D	61	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=	=
3E	62	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>
3F	63	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
40	64	@	É	@	§	à	@	§	§	§	@	@	É	@	§	à	@	§	§	§	@	@	É	@	§	à	@	§	§	§	@	à	à	à	@

Character	Character Set No.		
	Fixed-Space Vector Font	Variable-Space Arc Font	Fixed-Space Vector Font
ISO Swedish	30	40	50
ISO Swedish Name	31	41	51
ISO Norway (1)	32	42	52
ISO German	33	43	53
ISO French (1)	34	44	54
ISO U.K.	35	45	55
ISO Italian	36	46	56
ISO Spanish	37	47	57
ISO Portuguese	38	48	58
ISO Norway (2)	39	49	59
ISO French (2)	60	70	80
Drafting Set	99		

Hexa-decimal	Decimal	Character Set No.																																	
		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	70	80	99
41	65	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
42	66	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
43	67	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
44	68	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
45	69	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E	E
46	70	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
47	71	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G	G
48	72	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
49	73	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I
4A	74	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J	J
4B	75	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
4C	76	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
4D	77	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
4E	78	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
4F	79	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
50	80	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
51	81	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q
52	82	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R
53	83	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
54	84	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
55	85	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
56	86	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
57	87	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
58	88	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
59	89	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
5A	90	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
5B	91	Ä	Ä	Æ	Ä	°	[	°	¡	Ã	[	Ä	Ä	Æ	Ä	°	[	°	¡	Ã	Æ	Ä	Ä	Æ	Ä	°	[	°	¡	Ã	Æ	°	°	°	[
5C	92	Ö	Ö	Ø	Ö	ç	\	ç	Ñ	Ç	\	Ö	Ö	Ø	Ö	ç	\	ç	Ñ	Ç	Ø	Ö	Ö	Ø	Ö	ç	\	ç	Ñ	Ç	Ø	ç	ç	ç	Ø
5D	93	Å	Å	Å	Ü	§	]	é	¿	Õ	]	Å	Å	Å	Ü	§	]	é	¿	Õ	Å	Å	Å	Å	Ü	§	]	é	¿	Õ	Å	§	§	§	]
5E	94	^	Ü	^	^	^	^	^	^	^	^	^	Ü	^	^	^	^	^	^	^	^	^	Ü	^	^	^	^	^	^	^	^	^	^	^	⊥
5F	95	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_
60	96	`	é	`	`	`	`	ù	`	`	`	`	é	`	`	`	`	ù	`	`	`	`	é	`	`	`	`	ù	`	`	`	µ	µ	µ	`

Character	Character Set No.		
	Fixed-Space Vector Font	Variable-Space Arc Font	Fixed-Space Vector Font
ISO Swedish	30	40	50
ISO Swedish Name	31	41	51
ISO Norway (1)	32	42	52
ISO German	33	43	53
ISO French (1)	34	44	54
ISO U.K.	35	45	55
ISO Italian	36	46	56
ISO Spanish	37	47	57
ISO Portuguese	38	48	58
ISO Norway (2)	39	49	59
ISO French (2)	60	70	80
Drafting Set	99		

Hexa-decimal	Decimal	Character Set No.																																	
		30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	70	80	99
61	97	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
62	98	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b	b
63	99	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c	c
64	100	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d	d
65	101	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e	e
66	102	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
67	103	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g	g
68	104	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h	h
69	105	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i	i
6A	106	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j	j
6B	107	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k	k
6C	108	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l	l
6D	109	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m	m
6E	110	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n	n
6F	111	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o	o
70	112	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p	p
71	113	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q	q
72	114	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r	r
73	115	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
74	116	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t	t
75	117	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u
76	118	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
77	119	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w	w
78	120	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
79	121	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y	y
7A	122	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z	z
7B	123	ä	ä	æ	ä	é	{	à	°	ã	{	ä	ä	æ	ä	é	{	à	°	ã	æ	ä	ä	æ	ä	é	{	à	°	ã	æ	é	é	é	µ
7C	124	ö	ö	ø	ö	ù	|	ò	ñ	ç	|	ö	ö	ø	ö	ù	|	ò	ñ	ç	ø	ö	ö	ø	ö	ù	|	ò	ñ	ç	ø	ù	ù	ù	°
7D	125	å	å	å	ü	è	}	è	ç	õ	}	å	å	å	ü	è	}	è	ç	õ	å	å	å	å	ü	è	}	è	ç	õ	å	è	è	è	∞
7E	126	¯	ü	¯	ß	¨	¯	ì	~	°	~	¯	ü	¯	ß	¨	¯	ì	˜	°	~	¯	ü	¯	ß	¨	¯	ì	˜	°	~	¨	¨	¨	~

Character	Character Set No.		
	Fixed-Space Vector Font	Variable-Space Arc Font	Fixed-Space Vector Font
ISO Swedish	30	40	50
ISO Swedish Name	31	41	51
ISO Norway (1)	32	42	52
ISO German	33	43	53
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ISO U.K.	35	45	55
ISO Italian	36	46	56
ISO Spanish	37	47	57
ISO Portuguese	38	48	58
ISO Norway (2)	39	49	59
ISO French (2)	60	70	80
Drafting Set	99		

10-5

LIST OF RD-GL II COMMANDS

10.5 LIST OF RD-GL II COMMANDS

Command		Format	Parameters
AA	Arc Absolute	AA x, y, θc (,θd);	x : X coordinate of center y : Y coordinate of center θc: Center angle θd: Resolution
AR	Arc Relative	AR Δx, Δy, θc(,θd);	Δx: Difference of X center coordinates Δy: Difference of Y center coordinates θc: Center angle θd: Resolution
BL	Buffered Label String	BL C1 C2 C3 .... Cn CHR$(3)	C: Character string
CA	Alternate Character Set	CAn; CA;	n : Character set number
CC	Character Chord Angle	CCn; CC;	n : Resolution
CI	Circle	CIr(,θd);	r : Radius θd: Resolution
CM	Character Set Mode	CMn_1(,n_2); CM;	n1 : Character set selection mode n2 : Fall back mode
CP	Character Plot	CPnx, ny; CP;	nx: Number of characteres in X direction ny: Number of characters in Y direction
CS	Standard Character Set	CSn; CS;	n : Character set number
CT	Chord Tolerance	CTn; CT;	n = 0 : Degrees mode n = 1 : Deviation mode
DC	Digitize Clear	DC;	
DF	Default	DF;	
DI	Absolute Direction	DI run, rise; DI;	run = 0 : Vertical printing rise = 0 : Horizontal printing
DL	Downloadable Character	DL Cn(,p),x_1,y_1 (,...xn,yn),(,p); DL;	Cn : Character number P : Pen control Xn: X coordinates Yn : Y coordinates
DP	Digitize Point	DP;	
DR	Relative Direction	DR run, rise; DR;	run = 0 : Vertical printing rise = 0: Horizontal printing
DS	Designate Character Set	DSn_1(,n_2); DS;	n1 : Slot nubmer n2 : Characer set number
DT	Define Label Terminator	DTc;	c : Character

	Function	Page
	Draws an arc centered at X, Y	7-6
	Draws an arc centered at the relative coordinates ΔX, ΔY	7-7
	Stores a character strings upto 150 characters in the character buffer	7-9
	Designates the alternate character set	7-9
	Designates the resolution of arc font characters	7-10
	Draws a circle centered on the current pen position	7-11
	Sets the character set selection mode and the fall back mode	7-13
	The pen is moved by the number of characters	7-14
	Designates the standard character set	7-16
	Designates the kind of parameter concerned with resolution of AA, AR and CI commands	7-17
	Digitize end command	7-18
	Dafault	7-18
	Designates absolute printing direction	7-20
	Downloadable character drawing	7-22
	Digitize command	7-25
	Designates relative printing direction	7-25
	Designates any character sets in each character slot	7-27
	Defines the label terminator	7-28

Command		Format	Parameters
EA	Edge Rectangle Absolute	EA X, Y;	X: X Absolute coordinate of corner Y: Y Absolute coordinate of corner
EP	Edge Polygon	EP;	
ER	Edge Rectangle Relative	ER Δx, Δy;	Δx: Relative coordinate of corner Δy: Relative coordinate of corner
ES	Extra Space	ESs(,ℓ); ES;	s: Character interval ℓ: Line Interval
EW	Edge Wedge	EWr, θ1,θc(,θd);	r : Radius θ1: Start angle θc: Center angle θd: Resolution
FP	Fill Polygon	FP;	
FS	Force Select	FSf(,n);	f : Pen force n: Pen number
FT	Fill Type	FTn(,d(,θ)); FT;	n = Pattern d = Distance μ = Angle
GP	Pen Group	GPg(,h(,i(,j))); GP;	g: Group number h: Pen number i : Number of pens j : Line length
IM	Input Mask	IMe; IM;	e: Error mask value
IN	Initialize	IN;	
IP	Input P_1 & P_2	IP P_1x, P_1y(,P_2x,P_2y);	X and Y coordinates of P_1 and P_2
IV	Invoke Slot	IVn(,c); IV;	n: Slot number c: Character table
IW	Input Window	IW X_1, Y_1, X_2, Y_2; IW;	X_1 and Y_1 are coordinates of the lower left corner of the drawing area, X_2 and Y_2 are coordinates of the upper right corner.
LB	Label	LBc_1c_2 ....c_n CHR$(3);	c: Character string
LO	Label Origin	LOn; LO;	n: Position number
LT	Line Type	LTn(,p); LT;	n: Pattern number p: Pitch (%)
NR	Not Ready	NR;	

Function	Page
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Command		Format	Parameters
OA	Output Actual Position	OA;	
OC	Output Commanded Position	OC;	
OD	Output Digitize	OD;	
OE	Output Error	OE;	
OF	Output Factors	OF;	
OH	Output Hard-Clip Limits	OH;	
OI	Output Identification	OI;	
OL	Output Label Length	OL;	
OO	Output Options	OO;	
OP	Output P_1 and P_2	OP;	
OS	Output Status	OS;	
OT	Output Pen Map	OT;	
OW	Output Window	OW;	
PA	Plot Absolute	PAx_1, y_1 ....xn, yn; PA;	Absolute X and Y coordinates
PB	Print Buffered Label	PB;	
PD	Pen Down	PDx_1, y_1 ....xn, yn; PD;	X and Y coordinates
PM	Polygon Mode	PMn; PM;	n = 0 : Enters Polygon Mode n = 1 : Closes Current Polygon n = 2 : Exits Polygon Mode
PR	Plot Relative	PRx_1, y_1, ...xn, yn; PR;	Relative X and Y coordinates
PT	Pen Thickness	PTd; PT;	d : Filling spacing (mm)
PU	Pen Up	PUx_1, y_1, ...xn, yn; PU;	X and Y coordinates
RA	Shade Rectangle Absolute	RAx, y;	X: X coordinate of corner Y: Y coordinate of corner
RO	Rotate Coordinate System	ROn; RO;	n: Degree
RR	Shade Rectangle Relative	RR Δx, Δy;	Δx: X Relative coordinate of corner Δy: Y Relative corodinate of corner
SA	Select Alternate Set	SA;	
SC	Scaling	SC xmin, xmax, ymin, ymax; SC;	xmin, ymin : User coordinates of P_1 xmax, ymax : User coordinates of P_2

	Function	Page
	Outputs X and Y coordinates of pen position and pen condition (for plotter coordinates only)	7-52
	Outputs X and Y coordinates of pen position and pen condition (for user coordinates only)	7-53
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	Outputs the number of plotter unit per milimeter in the X- and Y-Axes	7-56
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	Outputs the information of the characters contained in the buffer	7-59
	Outputs eight option parameters	7-60
	Outputs P_1 and P_2	7-61
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	Outputs coordinates of lower left corner and upper right corner of window	7-65
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	Fills a rectangle	7-75
	Rotate X and Y coordinates by 90°	7-76
	Fills a rectangle using relative coordinates	7-78
	Selects alternate character set	7-79
	Sets user coordinates	7-80

Command		Format	Parameters
SG	Select Pen Group	SGg; SG;	g : Group numbers
SI	Absolute Character Size	SIw, h; SI;	w: Character width (cm) h : Character height (cm)
SL	Character Slant	SL tan θ; SL;	tan θ: Character slant
SM	Symbol Mode	SMk; SM;	k : Character or symbol
SP	Pen Select	SPn; SP;	n: Pen number
SR	Relative Character Size	SRw, h; SR;	w: Character width (%) h : Character height (%)
SS	Select Standard Set	SS;	
TL	Tick Length	TLℓ; TL;	ℓ: Tick length (%)
UC	User Defined Character	UC(P,)Δx_1, Δy_1 ....(P,)Δxn, Δyn; UC;	Δxn: Number of X grids Δyn: Nubmer of Y grids P : Pen control
UF	User Defined Fill Type	UF d_1(,d_2 ....dn)	dn: Filling Interval
VS	Velocity Select	VSs(,n); VS;	s: Pen speed (cm/sec) n: Pen number
WG	Shade Wedge	WGr,θ_1,θc(,θd);	r : Radius θ_1: Start angle θc: Center angle θd: Resolution
XT	X-tick	XT;	
YT	Y-tick	YT;	

	Function	Page
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10.6 DPX-3300 SPECIFICATIONS

Plotting area	X axis: 864 mm, Y axis: 594 mm (ANSI D/ISO A1 size)
Plotting speed	450 mm/sec. in all directions
Pen up/down speed	20 times/sec.
Mechanical resolution	0.0125 mm (12.5µ)/step
Software resolution (position where command enables stop)	0.025 mm
Distance accuracy	± 0.2% of traveling distance or ± 0.1mm, whichever is larger
Repeatability	Below ± 0.10mm for same pen. Below ± 0.25mm for different pen.
Switches	COORDINATE DISPLAY RESET, PEN SELECT 1-8, DOWN, AUTO, LL, UR, ENTER, P1, P2, ◀, ▲, ▶, ▼, FAST, PAUSE, PAPER HOLD, PEN FORCE, RESET, BAUD RATE, DIP SW1, DIP SW2, POWER
LED indicators	ERROR, POWER, AUTO, PEN DOWN, PAUSE, PAPER HOLD, PARALLEL/SERIAL, COORDINATE DISPLAY
Interfaces	Parallel (Centronics) Serial (RS-232C)
Moving speeds by position keys	SLOW 15mm/sec, FAST 60mm/sec.
Number of pens	8
Paper setting	Electrostatic paper holder
Power consumption	120W
Dimensions	46-1/12'' (W) × 33-7/12'' (H) × 6-11/12'' (D) (1170 × 852 × 175 mm)
Weight	87.2 lbs (40 kg) (main unit only)
Operating temperature	5°C to 40°C
Operating humidity	35 to 80% (no dew forming)
Input/output signals	
Parallel	Centronics STROBE (1 bit), DATA (8 bits), BUSY (1 bit), ACK (1 bit) TTL level, asynchronous
Serial	RS-232C Transfer system: asynchronous, full-duplex data communication Baud rate: 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600 (selected by Baud rate switch) Stop bit: 1 or 2 bits (selected by DIP switch) Parity check: odd, even, none (selected by DIP switch) Data bits: 7 or 8 bits (selected by DIP switch) Connector: DB-25S

* Specifications are subject to change without notice.

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