

44217

Instruction Manual

Model SPL-430

X-Y Digital Plotter

(A3 size)

CONTENTS

1. INTRODUCTION	1
2. PRECAUTIONS ON OPERATION	2
3. NOMENCLATURE AND FUNCTIONS OF PARTS	3
4. PREPARATION FOR PLOTTING	8
5. INTERFACE	14
6. COORDINATE SYSTEM OF PLOTTER	23
7. PLOTTER INSTRUCTIONS	27
8. SPECIFICATIONS	56
9. APPENDIX	57

“WARNING – This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will required to take whatever measures may be required to correct the interference.”

1. INTRODUCTION

Thank you for your purchase of our product. Please read this manual thoroughly to obtain the best performance from your plotter for a long time.

This unit is the small-sized pen plotter providing 56 kind of graphic commands and has a capability of A3/B-size and A4/A-size papers. The drawing and printing operation in many colors can be performed according to the drawing command from the various host CPUs. For the plotting method, this unit uses the paper moving system that the paper is moved in perpendicular direction to the moving axis of pen carriage, so that the high-speed drawing is possible.

Included features are described as follows:

- (1) Small-sized, light weight desk-top design with simple construction and high reliability.
- (2) 400 mm/sec in axis direction, 565 mm/sec in composite direction with an acceleration of more than 1G: High-speed drawing is realized.
- (3) High-quality drawing with 0.025 mm step size.
- (4) The plotter is provided with serial interface (conformable to RS232C) as standard and an optional 8-bit parallel (conformable to CENTRONICS) or GP-IB (conformable to IEEE-488) interface.
- (5) Provides the graphic language conforming to HP-GL so that the plotter can be operated with various commercially available application softwares.
- (6) By adapting 6 pens to the pen carousel, pen selection can be performed automatically by the pen select command for drawing in many colors.
- (7) High quality presentation graphics can be drawn on OHP film by using oil base pen.

With these superior features above, we offer the plotter of high cost/performance ratio; for business graphic use, CAD (computer aided designing), laboratory, education (institution) and many other fields.

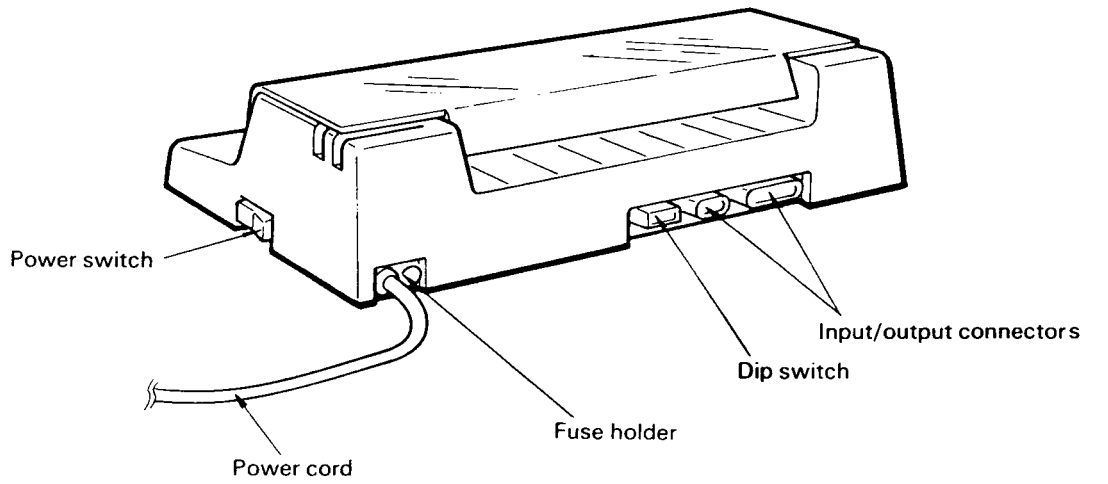
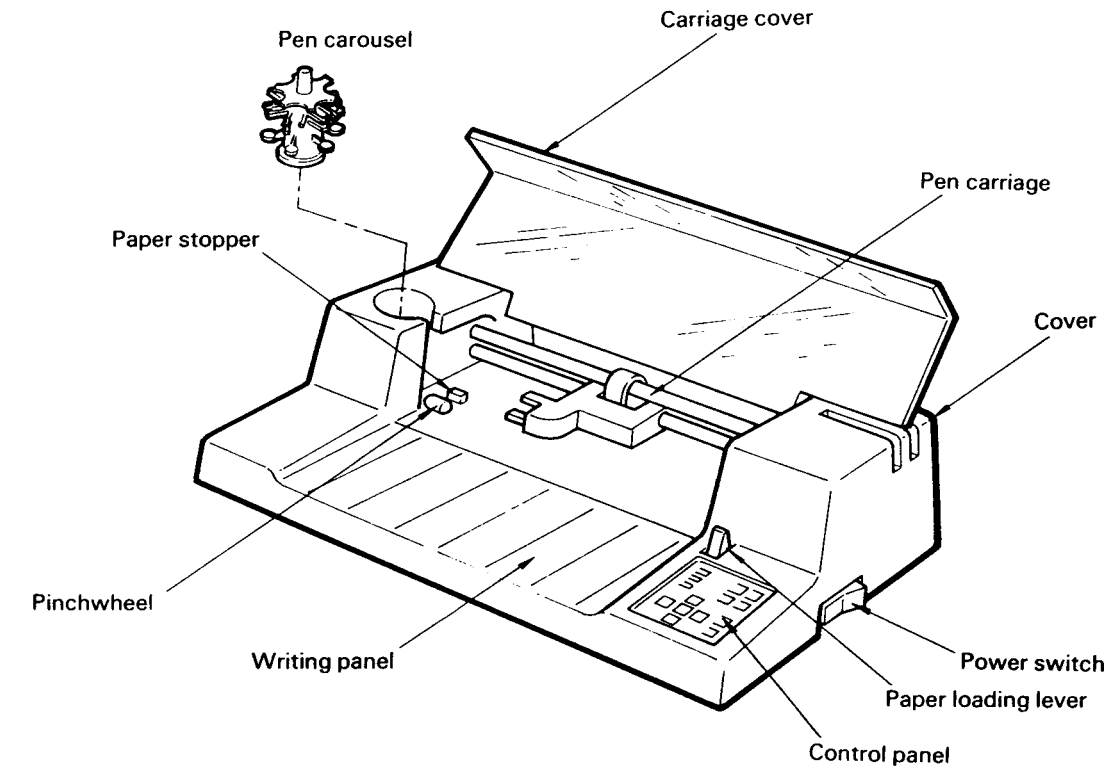
2. PRECAUTIONS ON OPERATION

Pay attention to the following points for safe operation.

- Avoid leaving the plotter in places exposed to direct sunlight, near heaters or with high temperature for a long time.
- Avoid operating the plotter in dusty or humid places.
- Do not lean on the carriage cover or the writing panel or put a heavy thing on there.
- Avoid operating the plotter in places exposed to extreme mechanical vibration or electric noise.
- Before connecting the plotter plug, be sure to check the supply voltage.
- Connect the plugs and connectors securely. If not, it will cause a malfunction.
- Never lubricate the mechanism. It will cause a trouble.

3. NOMENCLATURE AND FUNCTIONS OF PARTS

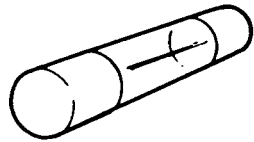
3-1. Nomenclature



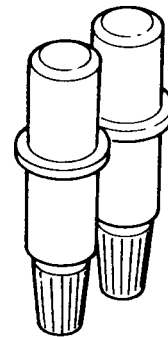
3-2. Standard accessories

Make sure that the following accessories are furnished.

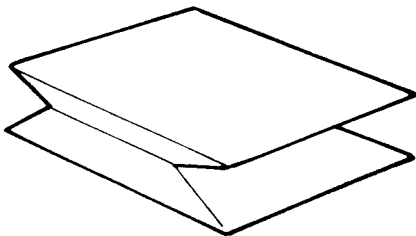
- | | |
|---|--------|
| ① Fuse | 1 |
| ② Fiber pen (aqueous) | |
| Black, red, blue, green, brown and orange | 1 each |
| ③ Soft cover | 1 |
| ④ Instruction manual | 1 |



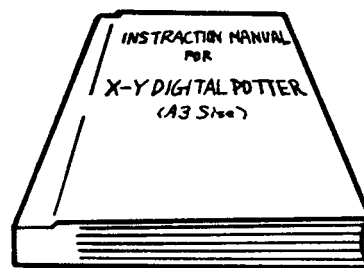
Fuse



Pen



Soft cover



Instruction manual

3-3. Functions

Power switch

Push the "O" mark side to turn on the plotter.

Paper loading lever

Pull this lever to your side. The pinchwheel sinks and holds the paper. Plotting is made in this state.

Paper stopper

Use this stopper to position the paper when loading it. When the paper loading lever is pulled, this stopper sinks in the hole.

Pen carousel

Holds six pens at a time. It is detachable from the plotter body. Pull it out from the plotter when loading pens.

Control panel

Consists of control keys and indicators. Details of key operation will be described later.

Input/output connector

Provided with an GP-IB interface connector and a serial interface connector. Pin arrangement will be described later.

Dip switch

This is used at changing the paper size or the interface, for example. Details will be shown in the table provided below.

Fuse holder

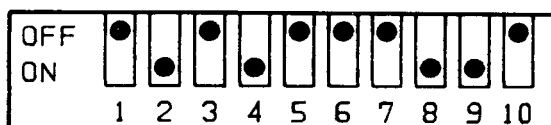
Use a 1 A fuse when the supply voltage is 100/120 V AC. Use a 0.5 A fuse when the supply voltage is 220/240 V AC.

< How to use the Dip switch >

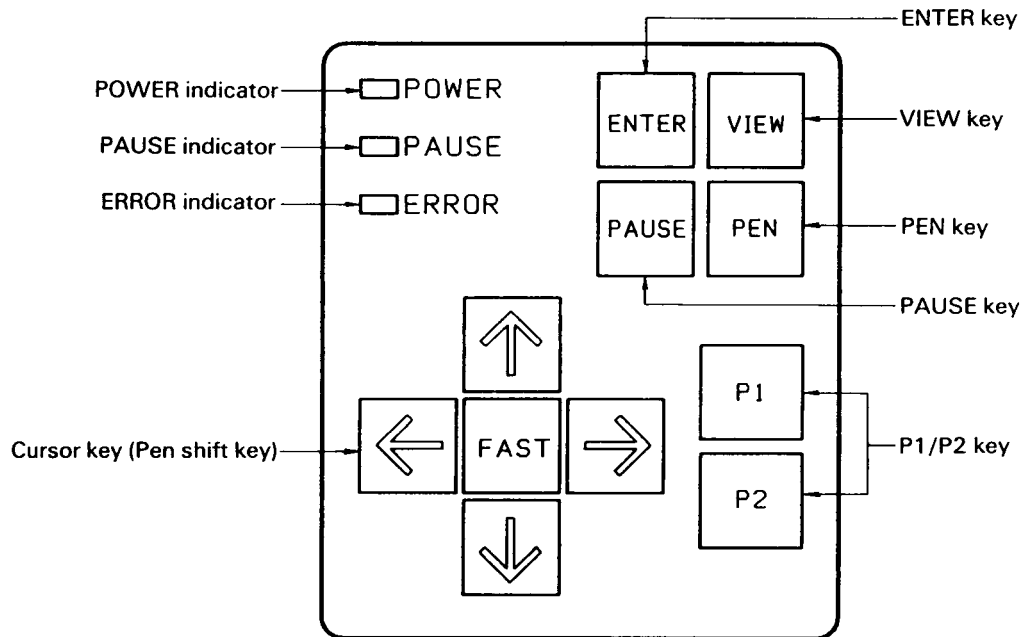
Each bit of the 10-bit Dip switch located on the rear panel of the plotter is used for the following purpose.

No.	Purpose	OFF	ON	State at shipment
1 ~ 3	Baud rate setting	Refer to the "Interface" section.		4800 baud
4	Stop bit	1	2	2
5	Parity	Odd	Even	Odd
6		No	Yes	No
7	Communication mode	Standard	Eaves-drop	Standard
8	Paper size	ISO standard (MET)	ANSI standard (US)	ANSI
9		A4 or A	A3 or B	A3/B
10	Interface	GP-IB	Serial	GP-IB

Setting at shipment is as shown below. Change it before operating the plotter. The switch lever is OFF in the horizontal state and ON when it is moved down.



3-4. Control panel



< Indicators >

POWER indicator (green)

Lights when the power switch is turned ON on the side of the plotter.

PAUSE indicator (orange)

Lights in the following cases:

- (1) The paper loading lever is pushed to the opposite side to release the paper holding.
- (2) The PAUSE key is pressed to pause the plotting operation.
- (3) The VIEW key is pressed to pause the plotting operation.
- (4) In the digitize mode, this indicator blinks to warn to specify the digitize point.

When the cursor key (pen shift key) is operated to move the pen and the ENTER key is pressed, the indicator stops blinking, indicating that the valid digitize point is stored.

ERROR indicator (red)

Lights on at occurrence of error.

(It indicates detection of the I/O error with the error mark not set or the error related to SK-GL.)

< Control keys >

P1/P2 keys

When the P1 key (or P2 key) is pressed, the pen is raised and moved to the P1 (or P2) position being set.

When the ENTER key is pressed together with the P1 key (or P2 key), the pen position of that time is set at the new scaling point P1 (or P2).

For the details, refer to "Manual setting of scaling point" of Coordinate System.

VIEW key

When this key is pressed, the PAUSE indicator is lit. The plotter pauses the plotting operation. The pen is raised and the whole paper is fed forward so that the whole area of plotting is seen.

When this key is pressed again, the PAUSE indicator goes out and the pen returns to the coordinate position where the plotting operation is paused and then, the plotting operation is resumed.

PEN key

Pressing this key reverses the current pen state (up or down).

If the cursor key is operated together with this key, it is permitted to draw a line or digitize a point.

PAUSE key

When this key is pressed, the PAUSE indicator lights and the plotter pauses the plotting operation and raises the pen.

When this key is pressed again, the PAUSE indicator goes out and the plotting operation is resumed.

Cursor keys (Pen shift keys) and FAST key

These five keys are used to move the pen within the plotting area.

- (1) When this key is pressed, the pen moves in the arrow direction marked on the key top.
- (2) When two adjacent keys are pressed simultaneously, the pen moves in the 45° direction.
- (3) When you wish to move the pen quickly, press the center FAST key, too. The pen moves at the speed of approx. four times.

ENTER key

This key does not work even if it is pressed. It works only when it is pressed together with another key. The functions of this key are as follows:

- (1) ENTER key and P1/P2 key
Defines the current pen position as a new P1 (P2 in the case of P2 key) scaling point.
As for the order of setting the scaling point at this time, be sure to set P2 after setting P1.
- (2) ENTER key and FAST key
Rotates the coordinate system 90°. For the details, refer to the "Rotation of coordinate system" of Plotter Instructions.
- (3) ENTER key and PEN key
Returns the pen hold in the pen carriage to the pen carousel. Then, the pen carriage returns to the original state.
- (4) ENTER key and VIEW key
Returns all functions to the initial set state.
This will be the same as when the power is once turned off and turned on again.

< Paper loading lever and PAUSE indicator >

- (1) When the paper loading lever is pushed to the opposite side, the PAUSE indicator is lit and the following operations are executed.
 - The pinchwheel rises and release paper holding.
 - The pen held in the pen carriage is returned to the original position of the pen carousel.
 - The pen carriage moves to the right end.
- (2) When the paper loading lever is pulled to your side, the PAUSE indicator goes out and the following operations reexecuted.
 - The pinchwheel lowers and holds the paper.
 - The plotter recognizes that a new paper is loaded. However, P1 and P2 set before are unchanged from the original positions.
 - If an error caused by the limitation of the paper size occurred before, it is cancelled here.

4. PREPARATION FOR PLOTTING

4-1. Installation of the Plotter

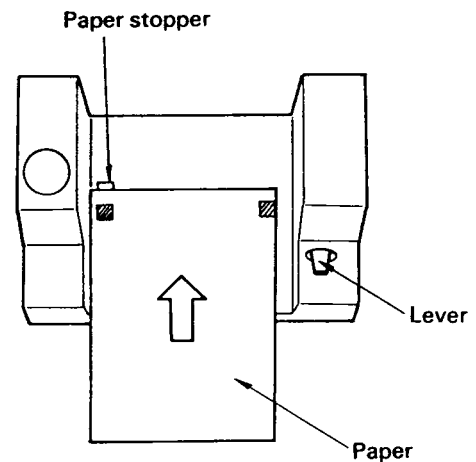
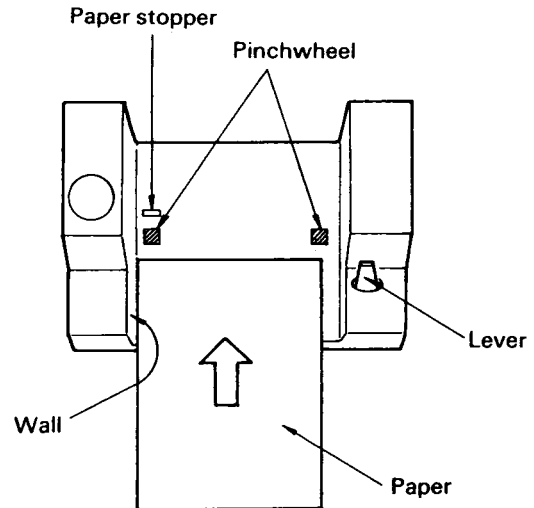
Set the plotter on the flat surface.

4-2. Loading the Paper

Glossy blank paper, coated paper and measurement paper can be used. The coated paper is recommended as it blots minimum.

< Loading procedure >

- (1) Push the paper loading lever to the opposite side and insert the paper under the pinchwheel. Put the paper to the left side as far as possible and insert it in parallel along the wall.
- (2) Insert the paper till it butts against the paper stopper.
- (3) When the paper butts against the paper stopper, pull the paper loading lever to your side. The pinch wheel lowers and holds the paper.

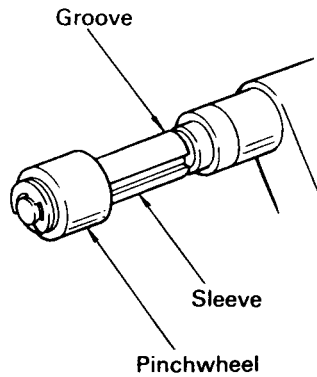


< Paper size and pinchwheel position >

The plotter permits to use both paper of ANSI and ISO standards. However, it is necessary to change the pinchwheel position of the plotter according to the paper size.

Set the pinchwheel at the appropriate position by making reference to the following illustrations.

(1) ANSI paper (A/B)



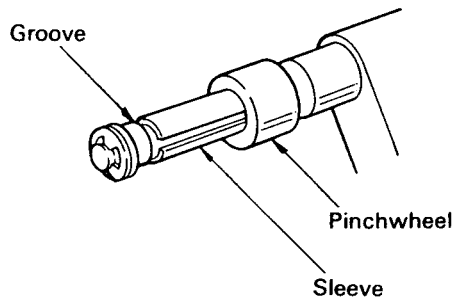
Paper size

A: 216 × 279 (mm) (8.5 × 11 in.)

B: 279 × 432 (mm) (11 × 17 in.)

Fit the pinchwheel securely in the sleeve groove.

(2) ISO paper (A4/A3)



Paper size

A4: 210 × 297 (mm)

A3: 297 × 420 (mm)

Fit the pinchwheel securely in the sleeve groove.

4-3. Loading the Pen Carousel and Pens

The pen carousel contains six pens and automatically rotates in the plotter to provide pens alternately. The pen carousel is detachable from the plotter. Mount and demount the pen carousel from the plotter according to the following procedure.

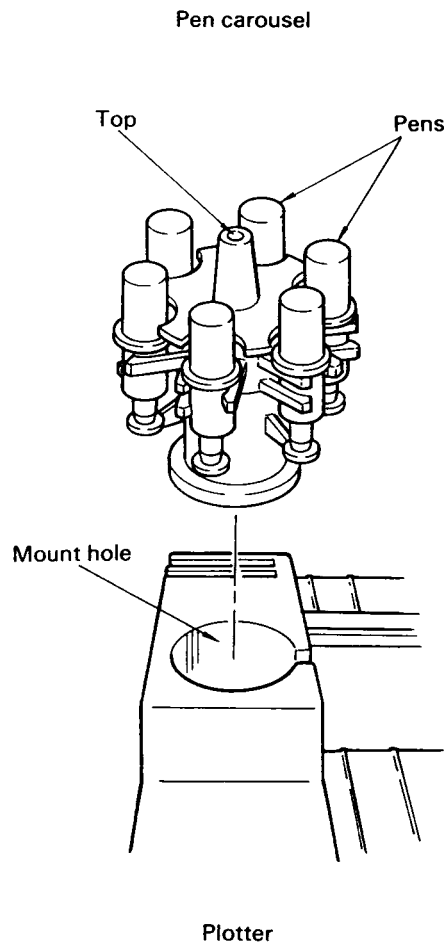
< Mounting the pen carousel >

- (1) Pinch the pen carousel top with your fingers and lower it vertically into the mount hole of the plotter.
- (2) When the pen carousel makes contact with the convex of the hole bottom, rotate it slightly to the left or right.
- (3) When the joint mark coincides during the rotating operation, the pen carousel sinks a little and then stop.
Now the pen carousel has been mounted.

< Demounting the pen carousel >

Pinch the pen carousel top with your fingers and lift it vertically and gently.

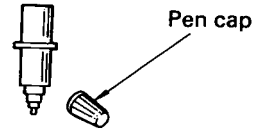
Note: The pen carousel is a highly sophisticated part. It may go out of order if it is exposed to a strong force or dropped on the floor. Be careful when handling it.



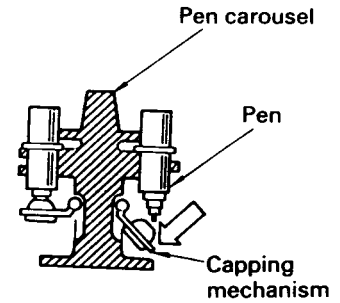
< Loading pens >

All of supplied six pens are used in being loaded in the pen carousel. Load the pens in the following procedure.

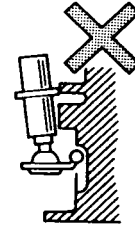
- (1) Remove the pen cap.



- (2) Push the capping mechanism of the pen carousel down.

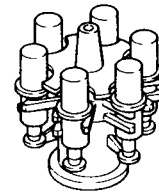


- (3) Push the pen so that pen flange is parallel to the pen holding pawl of the pen carousel.



Example of wrong loading

- (4) Release your hand from the capping mechanism and cap the pen point.



Completed view

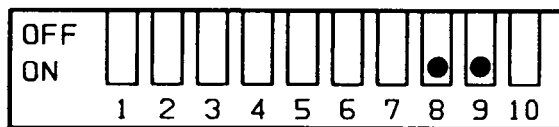
4-4. Setting of Paper and Dip Switch

When the paper size is changed, it is also necessary to change setting of the Dip switch located on the rear panel of the plotter.

Setting of paper size and Dip switch is as follows.

Paper size		Dip switch setting	
		8th bit	9th bit
ANSI standard (US)	A	ON	OFF
	B	ON	ON
ISO standard (MET)	A4	OFF	OFF
	A3	OFF	ON

Before shipment, the Dip switch is set to the ANSI standard and B size.



4-5. Self-test

The plotter has the self-test function to check by itself.

With this function, draw the self-test pattern as shown later. If the test pattern is drawn to the end without any abnormality, the plotter is judged normal. (The interface functions are excluded.)

< Self-test procedure >

- (1) Set six pens in the pen carousel.

At this time, do not set the pen in the pen carriage of the plotter. Pen color and No. are not particularly correlated.

(The pen No. is engraved on the pen holder top.)

- (2) Mount the pen holder on the plotter.
- (3) Load the paper.

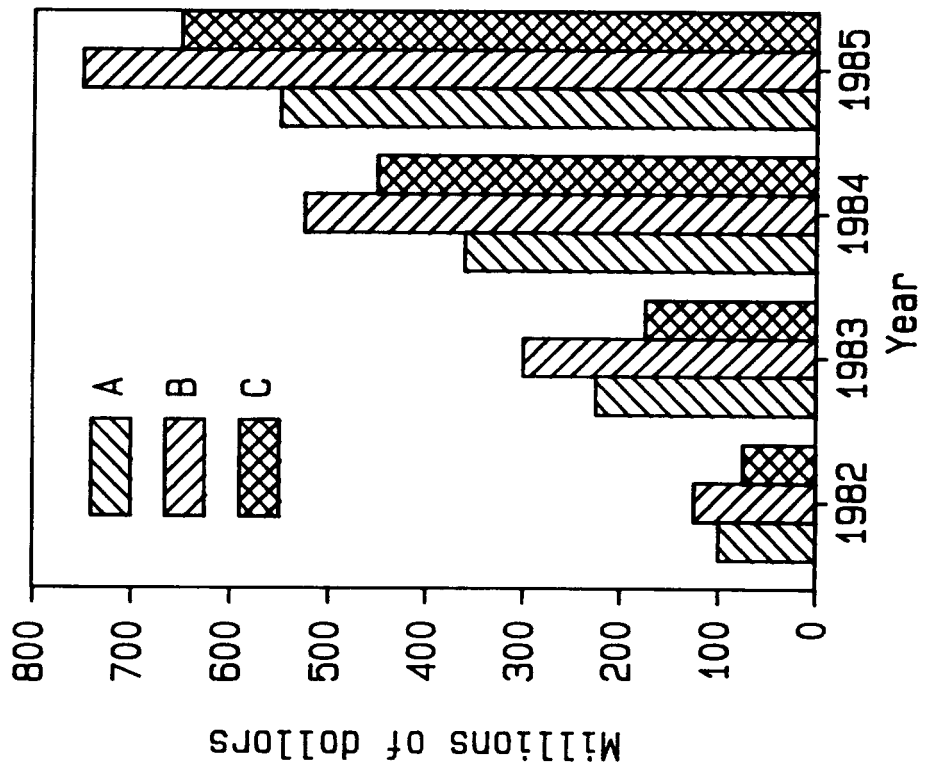
The A3 size paper is optimum.

(Refer to the "Loading the paper".)

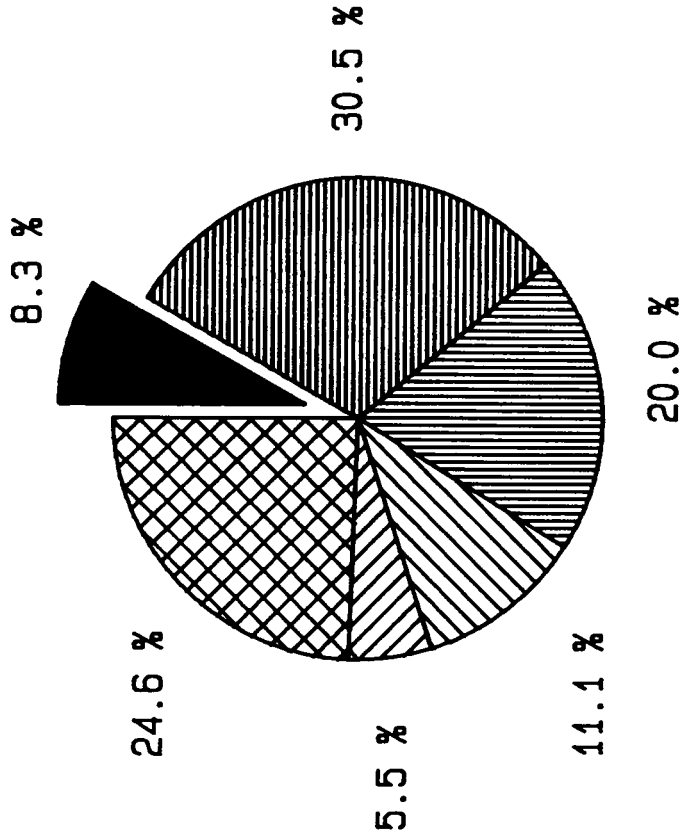
- (4) Turn on the power switch while pressing the [←] key of the cursor key (pen shift key) on the control panel.
- (5) The plotter draws the self-test pattern as shown below.
- (6) After performing self-test, the plotter enters the normal input standby mode.

SPL-430 Self Test

BAR CHART



PIE CHART



5. INTERFACE

5-1. Notes on Connection

- (1) Connect the power cord to an AC outlet and cable to computer securely so that they do not become loose or disconnect during operation.
- (2) To make the plotting operation by connection with a computer make sure that the plotter is normal beforehand by drawing the self-test pattern.
- (3) Before connecting the input/output cable with a computer, read reference books on the computer interface and examine the description on the plotter interface provided below.

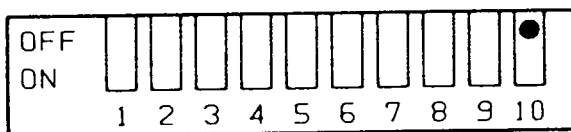
The plotter is provided with serial interface (conformable to RC232C) as standard and an optional 8-bit parallel (conformable to CENTRONICS) or GP-IB (conformable to IEEE-488) interface.

Select the interface according to the interface of the computer to be used.

For selection of interface, set the 10th bit of the DIP switch located on the rear panel of the plotter. Kinds of interface and correlation with the Dip switch are as shown below:

Kind of interface	Setting of Dip switch
	10th bit
8-bit parallel or GP-IB	OFF
Serial	ON

The GP-IB or 8-bit parallel mode is set before shipment.



WARNING

Use the shielded cable for interface connection to avoid interference to radio communications.

5-3. GP-IB Interface (conforming to ANSI/IEEE std. 488-1978)

(1) Functions

Function	Subset	Description
Source Handshake	SH1	Capability of Source Handshake function.
Acceptor Handshake	AH1	Capability of Acceptor Handshake function.
Talker	T6	Capability of Basic Talker function. No capability of Talker Only function. Unaddress if MLA (My Listen Address).
Listener	L3	Capability of Basic Listener function. No capability of Listen Only function. Unaddress if MTA (My Talk Address).
Service Request	SR1	Complete capability of all Service Request functions.
Remote/Local	RL0	No capability of Remote/Local function.
Parallel Poll	PP2	Capability of PP2 function if (address) < 8. PP1 with other addresses, and PPO if Listen Only.
Device Clear	DC1	Complete capability of all Device Clear functions.
Device Trigger	DT0	No capability of Device Trigger function.
Controller	C0	No capability of Controller function.

(2) Signal Levels

Input logic level

Logic "0": +2.0 ~ +5

Logic "1": 0 ~ +0.8V

Output logic level

Logic "0": +2.5 ~ +5V

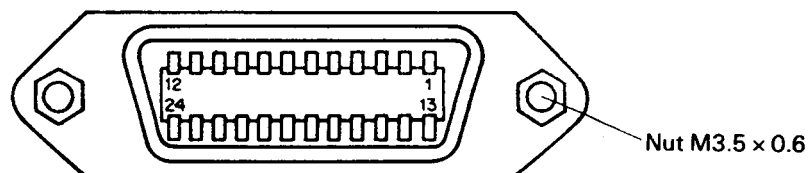
Logic "1": 0 ~ +0.5V

(3) Input/Output connectors

- Connector on cable
DDK 24-pin (57-10240) equivalent
- Connector pin configuration

- Connector on plotter
DDK 24-pin (57-20240) equivalent

Pin	Signal Name	Pin	Signal Name
1	DIO 1	13	DIO 5
2	DIO 2	14	DIO 6
3	DIO 3	15	DIO 7
4	DIO 4	16	DIO 8
5	EOI	17	REN
6	DAV	18	GND (6)
7	NRFD	19	GND (7)
8	NDAC	20	GND (8)
9	IFC	21	GND (9)
10	SRQ	22	GND (10)
11	ATN	23	GND (11)
12	Shielded	24	Logic GND



(4) Address Switch Setting

Plotter addresses can be set using the five-pole switch on the rear of the plotter. When all of the five switches are set to "OFF", the plotter enters the Listen Only mode, receiving all data transferred on the buses. As the plotter cannot be used as a talker in this mode, no response is given to serial poll and parallel poll.

The address code has been factory preset to "05", which corresponds to listen character "%" and talk character "E".

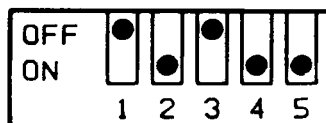
The list of address settings is as shown below.

Address Settings

Address Code	Address Character		Address Switches				
	Listen	Talk	1	2	3	4	5
0	SP	@	ON	ON	ON	ON	ON
1	!	A	OFF	ON	ON	ON	ON
2	"	B	ON	OFF	ON	ON	ON
3	#	C	OFF	OFF	ON	ON	ON
4	\$	D	ON	ON	OFF	ON	ON
(* 1) 5	%	E	OFF	ON	OFF	ON	ON
6	&	F	ON	OFF	OFF	ON	ON
7	'	G	OFF	OFF	OFF	ON	ON
8	(	H	ON	ON	ON	OFF	ON
9	)	I	OFF	ON	ON	OFF	ON
10	*	J	ON	OFF	ON	OFF	ON
11	+	K	OFF	OFF	ON	OFF	ON
12	,	L	ON	ON	OFF	OFF	ON
13	-	M	OFF	ON	OFF	OFF	ON
14	.	N	ON	OFF	OFF	OFF	ON
15	/	O	OFF	OFF	OFF	OFF	ON
16	0	P	ON	ON	ON	ON	OFF
17	1	Q	OFF	ON	ON	ON	OFF
18	2	R	ON	OFF	ON	ON	OFF
19	3	S	OFF	OFF	ON	ON	OFF
20	4	T	ON	ON	OFF	ON	OFF
21	5	U	OFF	ON	OFF	ON	OFF
22	6	V	ON	OFF	OFF	ON	OFF
23	7	W	OFF	OFF	OFF	ON	OFF
24	8	X	ON	ON	ON	OFF	OFF
25	9	Y	OFF	ON	ON	OFF	OFF
26	:	Z	ON	OFF	ON	OFF	OFF
27	;	[	OFF	OFF	ON	OFF	OFF
28	<	\	ON	ON	OFF	OFF	OFF
29	=	]	OFF	ON	OFF	OFF	OFF
30	>	<	ON	OFF	OFF	OFF	OFF
(* 2) 31	?	-	OFF	OFF	OFF	OFF	OFF

(*1) Factory setting

(*2) Listen Only mode



(5) Relationship between Parallel Poll and Plotter Address

The following table shows the relationship between GP-IB data lines which are set during parallel polling and plotter addresses. The PP2 function is available with plotter addresses from 0 to 7.

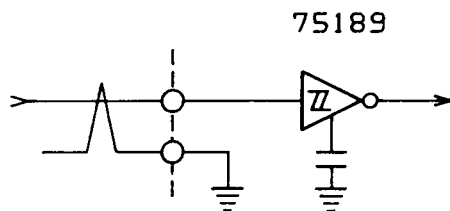
Plotter Address	Parallel Poll Bit Position	No. of GP-IB Data Line
0	7	8
1	6	7
2	5	6
3	4	5
4	3	4
5	2	3
6	1	2
7	0	1

Factory setting

PP1 functions are available with other plotter addresses.

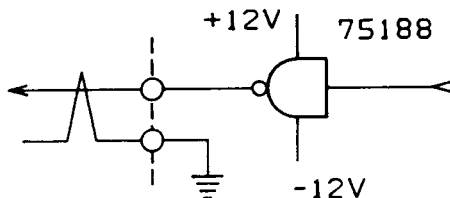
5-4. Serial Interface (Conformable to RS-232-C)

- (1) Synchronizing system
Start-stop system
- (2) Communication speed (Baud rate)
150, 300, 600, 1200, 2400, 4800, 9600 or external clock
- (3) Communication format
Start bit: 1 bit
Data: 8 bits (or 7 bits with parity)
Parity: Even, odd or no parity
Stop bit: 1 or 2 bits
- (4) Buffer memory size
1024 bytes
- (5) Input/output circuit configuration and input/output characteristics
 - RXD, CTS, DSR, Second RXD and External clock



ON (SPACE): +5 ~ +12 V (typ.) "0"
OFF (MARK): -5 ~ -12 V (typ.) "1"

- TXD, RTS, DTR, Second TXD



ON (SPACE): +5 ~ +8 V (typ.) "0"
OFF (MARK): -5 ~ -8 V (typ.) "1"

(6) Input/output connectors

- Connector of cable
EIA standard 25-pin plug type (JAE DB-25P or equivalent)
- Connector of plotter
EIA standard 25-pin socket type (JAE DB-25S or equivalent)

● Pin arrangement of connector

Pin	Signal	Name of signal	Direction	Function
1	FG	Protective ground	—	Frame ground
2	TXD	Transmitted data	Output	Transmit the serial transmission data and X parameter.
3	RXD	Received data	Input	Serial receiving data
4	RTS	Request to send	Output	Usually ON (+ potential)
5	CTS	Clear to send	Input	Permit transmission for the plotter.
6	DSR	Data set ready	Input	—————
7	SG	Signal ground	—	—————
14 (*1)	Second TXD	Secondary transmitted data	Output	Transmission data from the plotter to the terminal
16 (*1)	Second RXD	Secondary received data	Input	Receiving data from the terminal
17 (*2)	External clock	External clock input	Input	Reference clock signal for transmission/reception using an external clock (*3)
20	DTR	Data terminal ready	Output	DTR control signal
23	DSRS	Data signal rate selector	Output	Usually ON (+ potential)

*1. Used in the Eaves-drop mode

(The Eaves-drop mode will be explained later.)

*2 This signal determines the data transmission/reception speed when all of first, second and third bits of the Dip switch located on the rear panel of the plotter are OFF. For the clock frequency, input the value of 16 times larger than the baud rate to be used.

This frequency is limited to 310 kHz maximum.

*3 When an external clock is used, it must be supplied before the plotter power switch is turned on.

(7) Handshake mode

The handshake mode is available in DTR control mode and X parameter control mode. These two modes are selectable at the software level.

When the power switch is turned on, the DTR control mode is automatically set.

DTR signal	X parameter	Function
ON	X on send (DC1)	Much capacity of buffer memory is left.
OFF	X off send (DC3)	Less capacity of buffer memory is left.

Note: The X parameter code is selectable by RS-232-C control command.

(8) Setting of communication format

- Set the communication format in the first to seventh bits of the Dip switch located on the rear panel of the plotter. Setting of the Dip switch is as shown below.

Bit No.	Function	Setting of switch	
		OFF	ON
1, 2, 3	Baud rate	Details are shown in another table.	
4	Stop bit	1	2
5	Parity	ODD	EVEN
6		NO	YES
7	Communication mode	Standard mode	Eaves-drop mode

The baud rate setting is as shown below.

Baud rate	1st bit	2nd bit	3rd bit
150	ON	ON	ON
300	OFF	ON	ON
600	ON	OFF	ON
1200	OFF	OFF	ON
2400	ON	ON	OFF
4800	OFF	ON	OFF
9600	ON	OFF	OFF
External clock	OFF	OFF	OFF

- The format setting is as follows before shipment.

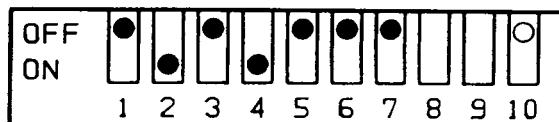
Baud rate: 4800

Stop bit: 2

Parity: No

Communication mode: Standard mode

The interface selector switch is set to the GP-IB mode.



5-5. 8-bit Parallel Interface (Conformable to CENTRONICS)

(1) Control signals

$\overline{\text{STB}}$ BUSY $\overline{\text{ACK}}$ $\overline{\text{ERROR}}$

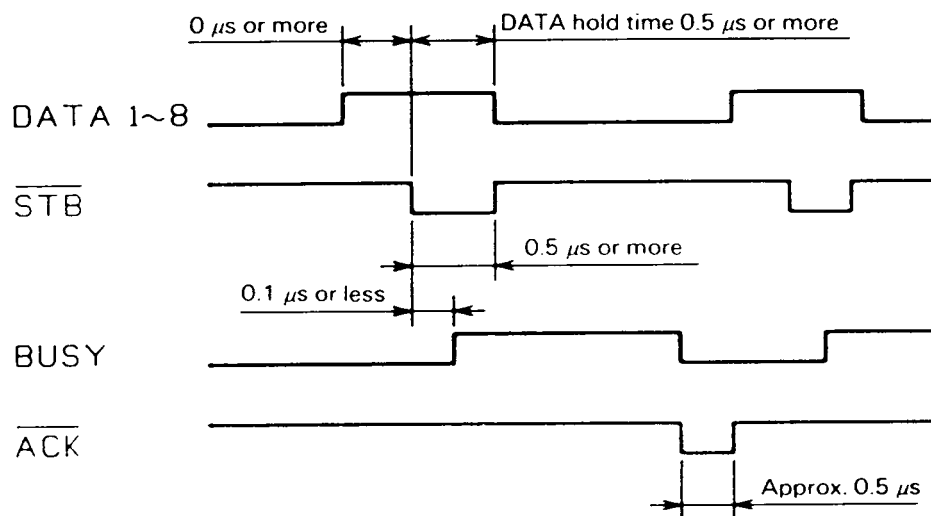
(2) Input data:

· 7 bits or 8 bits

(3) Input circuit configuration and input/output conditions

	Name of signal	Circuit configuration	
Input	DATA 1 ~ 8		Logical input level "1" = 2.0 ~ 5V "0" = 0 ~ 0.8V
Input	$\overline{\text{STB}}$		
Output	BUSY $\overline{\text{ACK}}$ $\overline{\text{ERROR}}$		Logical output level "1" = 2.4 ~ 5V "0" = 0 ~ 0.4V

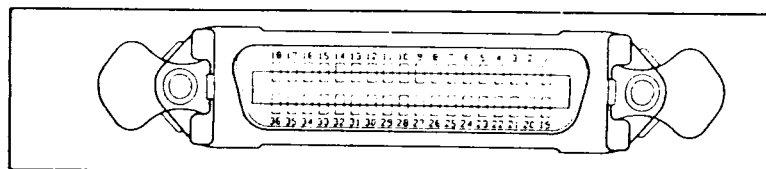
(4) Timing chart



(5) Input connectors

- Connector of cable
36-pin (DDK 57-30360 or equivalent)
- Connector of plotter
36-pin (DDK 57-40360 or equivalent)
- Pin arrangement of connector

Pin	Signal	Direction	Function
1	$\overline{\text{STB}}$	Input	Strobe pulse. The pulse width needs to be 0.5 μs . The signal level is normally "HIGH"; read-in of data is performed at the negative going edge of this signal.
2	DATA1	Input	8-bit data signal. HIGH level at logical "1" and LOW at "0".
3	DATA2	Input	
4	DATA3	Input	
5	DATA4	Input	
6	DATA5	Input	
7	DATA6	Input	
8	DATA7	Input	
9	DATA8	Input	
10	$\overline{\text{ACK}}$	Output	Acknowledge output. The pulse width is about 0.5 μs . It indicates completion of data reception.
11	BUSY	Output	When this signal is HIGH, it indicates that the plotter is in the state disabling data reception. Conditions for change for BUSY to HIGH are: (1) Data input period (2) During the plotting operation
12	GND	—	
13	—	—	PULL UP to 5V
14	—	—	
15	—	—	
16	GND	—	
17	F.G.	—	
18	5V	—	Inhibited to use
19 } 30	GND	—	GND for returning # 1 ~ # 11
31	—	—	
32	$\overline{\text{ERROR}}$	Output	When this signal is LOW level, it indicates that the plotter is in the error state.
33	GND	—	
34	—	—	
35	—	—	
36	—	—	



5-6. Others

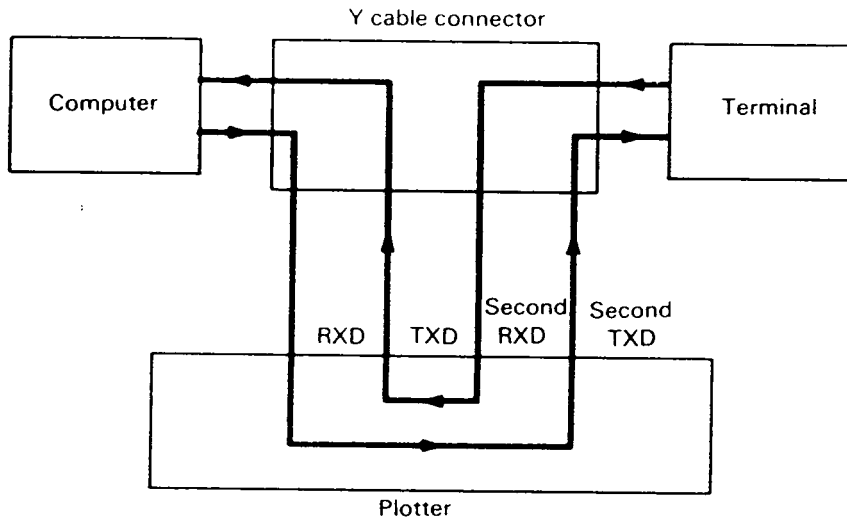
(1) EAVES-DROP mode

This mode is selected by the Dip switch located on the rear panel of the plotter. Turn on the No.7 switch of the Dip switch to set this mode.

This mode is effective to control the plotter and terminal with one serial line from the computer.

In the standard mode, data is transferred between the plotter and computer. In the EAVES-DROP mode, data is transferred between the computer and terminal. At this time, the Y cable connector is used.

The conception of the EAVES-DROP mode is diagrammatically shown below.



6. COORDINATE SYSTEM OF PLOTTER

6-1. Coodinate System

The area in which the pen moves and draw graphics on the paper is called a plotting area of the plotter. This area is a two-dimensional rectangular coordinates, which is divided into fine grids. Each crossing point of grids is expressed as a coordinates of X and Y taking the coordinate origin ($X = 0, Y = 0$) as a reference. Namely, the plotter draws graphics by moving the pen following the coordinate points (X,Y) determined based on the numeric values specified as parameters of plotting command.

< The plotter unit and user unit >

The coordinate system is available in the "plotter unit" where the grid interval (resolution) is fixed, and the "user unit" where it is variable by the software. The numeric value range given as parameters of the plotting command and understood by the plotter is $-32767 \sim 32767$ in both coordinates. The minimum unit (resolution) of position specification is 0.025 mm (25 microns) in both coordinates.

- The plotter unit

The grid interval within the plotting area is set to 0.025 mm (25 microns). When a decimal is specified as a parameter of the plotting command, it is handled as an integer by discarding fractions.

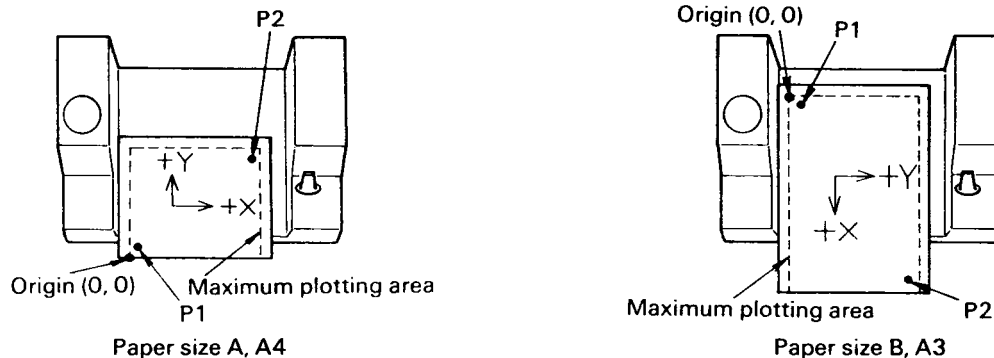
- User units

This coordinate system is set by the "SC" instruction utilizing the scaling point P1/P2. The grid interval is then not necessarily same in X and Y direction. Namely, plotting is possible by setting each direction as different standards. This coordinate system permits to use a decimal number having a decimal of 4 digits maximum as a parameter of the plotting instruction.

6-2. Direction of Coordinate System

Position of the coordinate origin (0,0) and direction of the X/Y axis of the plotter coordinates are different according to the paper size as shown below. These direction are automatically set when the paper size is determined by the Dip switch on the rear panel of the plotter.

< Coordinate system and initial setting of scaling point P1/P2 for different paper size >



6-3. Effective Plotting Area (Window)

The area in which the pen is movable on the paper is called an effective plotting area.

The maximum effective plotting area (plot limit) is limited according to paper size as shown in the following table and automatically set when the paper size is selected by the Dip switch on the rear panel of the plotter.

The effective plotting area is variable by the "IW" instruction at the software level within the maximum effective plotting area. When the power switch is turned on, the effective plotting area (window) is set to the same as the maximum effective plotting area (plot limit).

Paper size	Dip switch		Maximum effective plotting area (Plot limit)	
	8-bit	9-bit	X axis	Y axis
ANSI A (216 × 279 mm)	ON	OFF	0 ~ 10365 (259.1 mm)	0 ~ 7962 (199.1 mm)
ANSI B (279 × 432 mm)	ON	ON	0 ~ 16640 (416 mm)	0 ~ 10365 (259.1 mm)
ISO A4 (210 × 297 mm)	OFF	OFF	0 ~ 11040 (276 mm)	0 ~ 7721 (193 mm)
ISO A3 (297 × 420 mm)	OFF	ON	0 ~ 16158 (403.9 mm)	0 ~ 11040 (276 mm)

6-4. Scaling Point P1/P2

Two points (P1 and P2) called scaling points are provided to facilitate use of the user units.

These points are located in the opposing diagonal direction.

Note that initial setting positions of these points (P1 and P2) are different as follows according to the paper size.

When the paper size is A or A4, P1 is at the left below corner and P2 is at the right above corner.

When the paper size is B or A3, P1 is at the left above corner and P2 is at the right below corner.

Initial setting values of these scaling points are shown in the following table. (The values are the coordinate values of the plotter unit system.)

Paper size	Initial value of scaling point	
	P1x, P1y	P2x, P2y
A	250, 596	10250, 7796
A4	603, 521	10603, 7721
B	522, 259	15277, 10259
A3	170, 602	15370, 10602

Positions of scaling point P1 and P2 are variable by the "IP" instruction at the software level.

They are also variable by the key operation on the front panel. To restore the P1/P2 position set once to the initial setting position, do any one of the following method.

- Turn on the power switch again.
- Execute "IN" or "IP" instruction without parameters.
- Key operation on the front panel.

(Press ENTER and VIEW keys simultaneously.)

6-5. Manual Setting of Scaling Point

To set the scaling point P1/P2 by the key operation on the front panel, do it in the following procedure. As P2 is also moved when P1 is moved at this time, be sure to set P1 first and then, set P2.

< P1/P2 setting procedure >

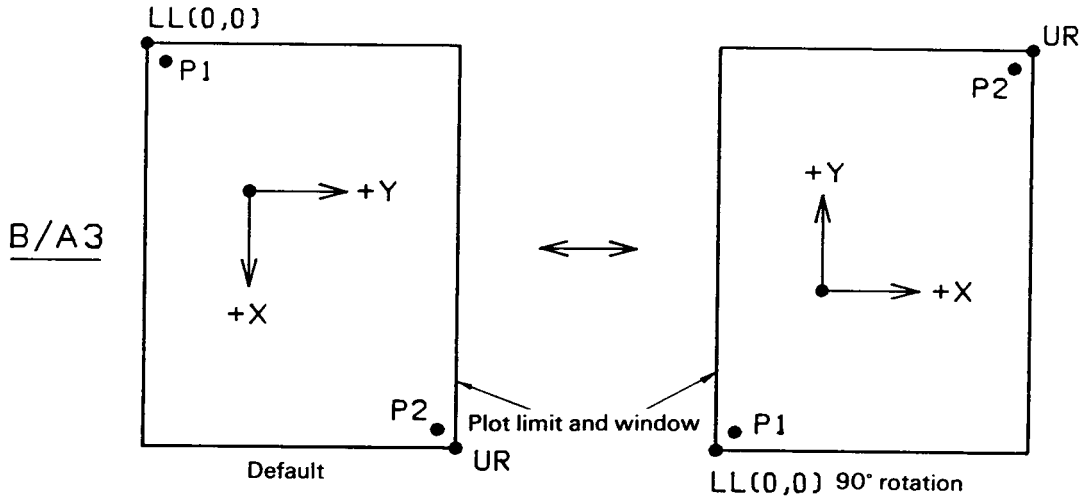
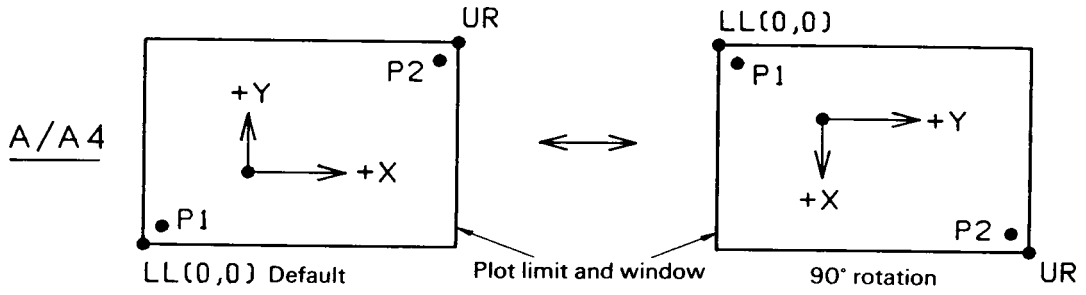
- (1) Operate the cursor key (pen shift key) to move the pen to the new P1 position.
- (2) Press ENTER and P1 keys simultaneously to set the new P1 position.
- (3) Operate the cursor key (pen shift key) to move the pen to the new P2 position.
- (4) Press ENTER and P2 keys simultaneously to set the new P2 position.
- (5) To make sure that the scaling points are correctly set, press P1 and P2 keys alternately to confirm that the pen moves to the desired position.

6-6. Rotating the Coordinate System

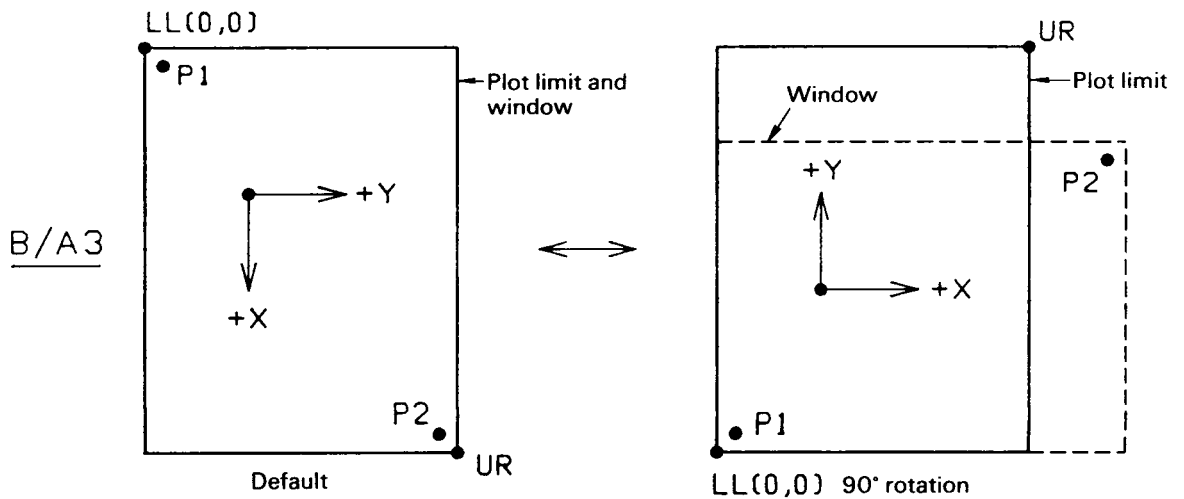
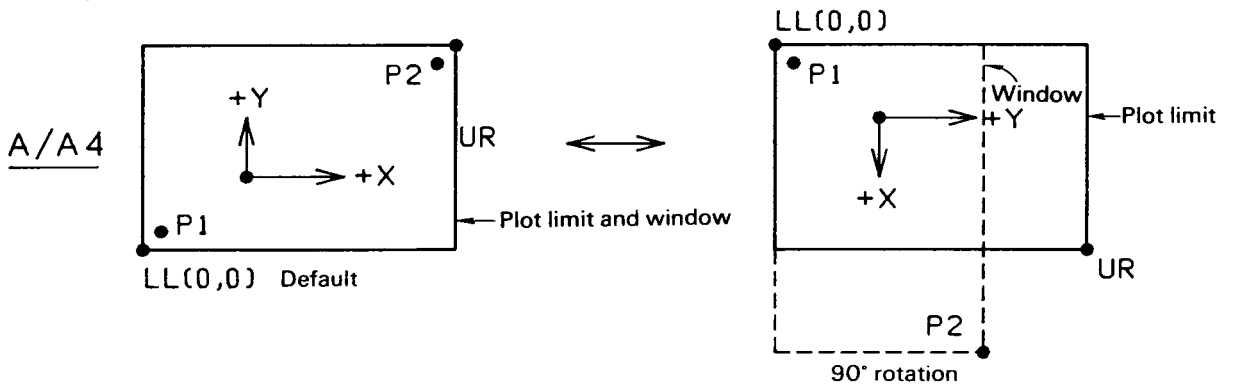
The coordinate system can be rotated 90° in either case of plotter units or user units. It should be noted however that the rotating direction is different according to the paper size. This function can be executed by the "RO" instruction at the software level. It is also executed by pressing ENTER and FAST keys on the front panel. In either method, the rotation angle is not accumulated and the direction of the coordinate system is changed alternately.

It is noted that P1/P2 scaling point and the physical size of the plotting area are different in the software method and the manual method by the key operation. The difference is diagrammatically shown below.

< 90° rotation by front panel operation >



< 90° rotation by RO instruction >



7-2. Plotter Instruction Set

INSTRUCTION	DESCRIPTION	Page
AA X[i/sd], Y[i/sd], arc angle [i] (,chord angle [i])	Arc absolute	36
AR X[i/sd], Y[i/sd], arc angle [i] (,chord angle[i])	Arc relative.	36
CA n[i]	Designate alternate set n.	42
CI radiys[i/sd] (,chord angle[i])	Circle.	35
CP spaces[d], lines[d]	Character plot.	46
CS n[i]	Designate standard set n.	42
DC	Degitize clear.	48
DF	Set default values.	28
DI run[d], rise[d]	Absolute direction.	45
DP	Degitize point.	47
DR run[d], rise[d]	Relative direction.	45
DT c[c]	Difine label terminator.	43
EA X[i/sd], Y[i/sd]	Edge rectangle absolute.	38
ER X[i/sd], Y[i/sd]	Edge rectangle relative.	39
EW radius[i/sd], start angle[i], sweep angle[i] (,chord angle[i])	Edge Wedge.	40
FT type[i] (,spacing[sd] (; angle[i]))	Fill type.	37
IM e[i]	Input error mask.	29
IN	Initialize.	29
IP P _{1x} [i], P _{1y} [i], (,P _{2x} [i], P _{2y} [i])	Input P1 and P2.	30
IW X _o [i], Y _o [i], (,X _h [i], Y _h [i])	Input window.	31
LB c . . . c[c]	Label ASCII string.	44
LT t[d] (,l[d])	Designate line type and length.	41
OA [i return]	Output actual position and pen status.	48
OC [i/sd return]	Output commanded position and pen status.	48
OD [i return]	Output Degitize point and pen status.	48
OE [i return]	Output error.	49
OF [i return]	Output factors.	49
OH [i return]	Output hard-clip limits.	32
OI [i return]	Output identification.	49

INSTRUCTION	DESCRIPTION	Page
OO [i return]	Output options.	49
OP [i return]	Output P1 and P2.	30
OS [i return]	Output status.	50
OW [i return]	Output window.	31
PA X[i/sd], Y[i/sd] (, . . .)	Plot absolute.	34
PD (X[i/sd], Y[i/sd] (, . . .)	Pen down.	33
PR X[i/sd], Y[i/sd] (, . . .)	Plot relative.	35
PS paper size[i]	Paper size.	30
PT thickness[d]	Pen thickness.	37
PU (X[i/sd], Y[i/sd] (, . . .)	Pen up.	33
RA X[i/sd], Y[i/sd]	Shade rectangle absolute.	38
RO n[i]	Rotate coordinate system.	32
RR X[i/sd], Y[i/sd]	Shade rectangle relative.	38
SA	Select alternate character set.	43
SC X _{min} [i], X _{max} [i], Y _{min} [i], Y _{max} [i]	Scale	31
SI width[d], height[d]	Absolute character size.	46
SL tanφ[d]	Absolute character slant (from vertical).	46
SM c[c]	Symbol mode.	41
SP n[i]	Select pen.	33
SR width[d], height[d]	Relative character size.	46
SS	Select standard character set.	42
TL t _o [d] (, t _n [d])	Tick length.	40
UC (pen[i],) X[d], Y[d], pen[i] (, . . .)	User defined character.	47
VS v[d]	Select velocity v.	33
WG radius[i/sd], start angle[i], sweep angle[i] (, chord angle[i])	Shade wedge.	39
XT	X-axis tick.	40
YT	Y-axis tick.	40

[c] = Character format.

[d] = Decimal format, -128.0000 ~ +127.9999

[i] = Integer format, -32,767 ~ +32,767

[sd] = Scaled decimal format, -32,767.0000 ~ +32,767.9999

7-3. SK-GL Instructions

DF	The Default Instruction
-----------	-------------------------

Format: DF terminator

Description: The DF instruction initializes the following plotter function.

Function	Equivalent instructions	Conditions
Plotting mode	PA;	Plotting in the absolute coordinate system
Relative character direction	DR1, 0;	Horinzontal direction
Line type	LT;	Solid line
Line pattern length	LT;	4% of (P1 - P2)
Input window	IW;	Maximum plotting area
Relative character size	SR;	Width = 0.42% of (P2x - P1x) Height = 1.12% of (P2y - P1y)
Symbol mode	SM;	OFF
Tick length	TL;	X-axis scale = 0.5% of (P2y - P1y) Y-axis scale = 0.5% of (P2x - P1x)
Standard character set	CS0;	Character set 0
Alternate character set	CA0;	Character set 0
Character set selected	SS;	Select the standard character set.
Character slant	SLO;	0°
Mask value	IM223, 0, 0;	Detect all errors.
Scale	SC;	OFF
Digitize clear	DC;	OFF
Pen velocity	VS;	40 cm/s (15.7 in/s)
Label terminator	DT ETX	ETX (3 in decimal ASCII)
Chord angle	—	5°
Fill type	FT;	Type 1 (bidirectional solid fill)
Fill spacing	FT;	1% of (P1 - P2)
Fill angle	FT;	0°
Pen thickness	PT;	0.3 mm

Note: No influence upon the following plotter functions.

- Positions of P1 and P2 scaling points.
- Pen state and position.
- 90° rotation of coordinate system.
- RS-232-C handshaking method.

IN	The Initialize Instruction
-----------	----------------------------

Format: IN terminator
Description: The IN instruction executes the following functions as well as setting equivalent to execution of the DF instruction.

- Pen up
- Clear all errors.
Set the 3rd bit of the output status byte to indicate that the plotter is initialized.
- Set rotation of coordinate system to 0°.
- Set the coordinates of P1 and P2 scaling points as shown below.

Paper size	P1	P2
A	250 , 596	10250 , 7796
A4	603 , 521	10603 , 7721
B	522 , 259	15722 , 10259
A3	170 , 602	15370 , 10602

IM	The Input Mask Instruction
-----------	----------------------------

Format: IM E-mask value (, S-mask value (, P-mask value)) terminator or IM terminator
Description: The IM instruction sets the error occurring condition with the E-mask value, GP-IB Service Request message occurring condition with the S-mask value, and GP-IB parallel poll response condition with the P-mask value. When the RS-232-C interface is used, the S-mask and P-mask values are not required, and are ignored even when they have been set. The E-mask value is used with both interfaces. The E-mask value is the sum of the combination of bit values as shown below.

Bit value	Bit	Error No.	Content
1	0	1	Undefined instruction
2	1	2	Abnormal number of parameters
4	2	3	Abnormal parameter
8	3	4	Not used
16	4	5	Undefined character set
32	5	6	Position overflow
64	6	7	Not used
128	7	8	Vector or «PD» received when the pinch wheel is up

When an error occurs, the bit in the mask corresponding to the error No. is tested in order to determine if it is necessary to set error bit (b5) of the status byte. If it is set, the ERROR LED on the front panel lights. In consequence, there is no means to determine if an error occurs when the corresponding bit has not been set.

The S-mask value is the sum of the bit values as shown below.

Bit Value	Bit	Content
1	0	Pen down
2	1	P1 or P2 modified
4	2	Digitized point effective
8	3	Initialized
16	4	Data reception possible (with pinch wheel down)
32	5	Error

For example, with S-mask value "4" the Service Request message is sent when the digitized point is effective (when bit 2 is set).

The P-mask value is also the sum of the bit values as shown below. It is used to indicate the state of the status byte which gives response in Logic 1 to the parallel poll of the GP-IB.

Bit Value	Bit	Content
1	0	Pen down
2	1	P1 or P2 modified
4	2	Digitized point effective
8	3	Initialized
16	4	Data reception possible (with pinch wheel down)
32	5	Error

The initial values of the parameters are set as follows:
IM223, 0, 0;

PS	The Paper Size Instruction
-----------	----------------------------

Format: PS paper size terminator

Description: The PS instruction changes the paper size, A and B or A4 and A3.

A new paper size is determined by the parameter and the paper size switch provided on the rear panel.

- 0 ~ 3: Set to B or A3.

- 4 ~ 127: Set to A or A4.

The parameters out of the range results in the error 3 and the instruction is ignored.

- It is impossible to change from US size to MET size by the PS instruction.

IP	The Input P1 and P2 Instruction
-----------	---------------------------------

Format: IP P1x, P1y (, P2x, P2y) terminator or IP terminator

Description: The IP instruction resets the coordinates of P1 P2 scaling points.

New coordinates of P1 and P2 are designated by the plotter unit and must be within the effective plotting area. When the parameter designates out of the maximum effective plotting area, the error 3 is set and the instruction is ignored. The coordinates of P2 are omissible, but when it is omitted, the coordinates of P2 are changed according to P1 without changing the relative position.

When the IP instruction is executed without parameter, the coordinates of P1 and P2 are set at the initial positions corresponding to the current paper size.

When the valid IP instruction is received, set the bit 1 of the output status byte.

OP	The Output P1 and P2 Instruction
-----------	----------------------------------

Format: OP terminator

Description: The OP instruction outputs current coordinates of P1 and P2 by the plotter unit.

The output is a 4-digit integer of ASCII. The format is as shown below.

TERM is the output terminator for the user system.

P1x,P1y,P2x,P2y TERM

The output value is limited by the maximum effective plotting area of the current selected paper size.

After completion of output, the bit 1 of the output status byte is cleared.

SC	The Scale Instruction
-----------	-----------------------

Format: SC Xmin, Xmax, Ymin, Ymax terminator or SC terminator

Description: The SC instruction sets the user unit coordinate system by allocating values on P1 and P2 scaling points.

When the user unit is set by execution of the SC instruction having parameters, the decimal part of the plotting instruction becomes effective. When it is executed without parameters, the scaling mode is reset and the parameters input thereafter will be interpreted as a plotter unit.

Parameters Xmin and Ymin define the user unit coordinate value of P1.

Parameters Xmax and Ymax define the user unit coordinate value of P2. When the parameter becomes $X_{max} = X_{min}$ or $Y_{max} = Y_{min}$ or smaller than -32,767 but larger than 32,767, the error 3 is set and the instruction is ignored.

When more than four parameters are input, the first four are executed and then, the error 2 is set and the remaining parameters are ignored.

IW	The Input Window Instruction
-----------	------------------------------

Format: IW Xlower left, Ylower left, Xupper right, Yupper right terminator or IW terminator

Description: The IW instruction sets the area called a window and limits the pen movable range.

Parameters are always interpreted as a plotter unit. When four parameters are included in the instruction, the window is set according to these parameters. However, when there is no parameter, it is set to the current maximum plotting area.

Each of four parameters designates the coordinates at the left below corner and right above corner of the window.

An effective parameter is a positive integer and within the maximum effective plotting area. However, parameters between -32,767 and 0 is set as 0. Parameters larger than the plotting area and smaller than 32,767 are set within the maximum effective plotting area.

When the coordinates at the left below corner is larger than that at the right above corner, it is automatically replaced.

By returning on the power switch, resetting of the front panel or execution of IN or DF instruction, the window is set within the current hard clip limit or the maximum plotting area.

OW	The Output Window Instruction
-----------	-------------------------------

Format: OW terminator

Description: The OW instruction outputs the coordinates of the window area in which plotting is under executed.

The format is as shown below. Each is an integer value of ASCII.

Xlower left, Ylower left, Xupper right, Yupper right TERM

TERM is the output terminator for the user system.

The integer value range is limited by the effective plotting area of the current selected paper size.