

HP 7475

TAXAN

X-Y PLOTTER

KPL 710

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1 Introduction

Thank you very much for your purchasing our X-Y Plotter. Prior to operating the Plotter, read the Instruction Manual carefully for correct Plotter Operation.

2 Cautions for operation

In order to fully utilize Plotter functions pay attention to the following:

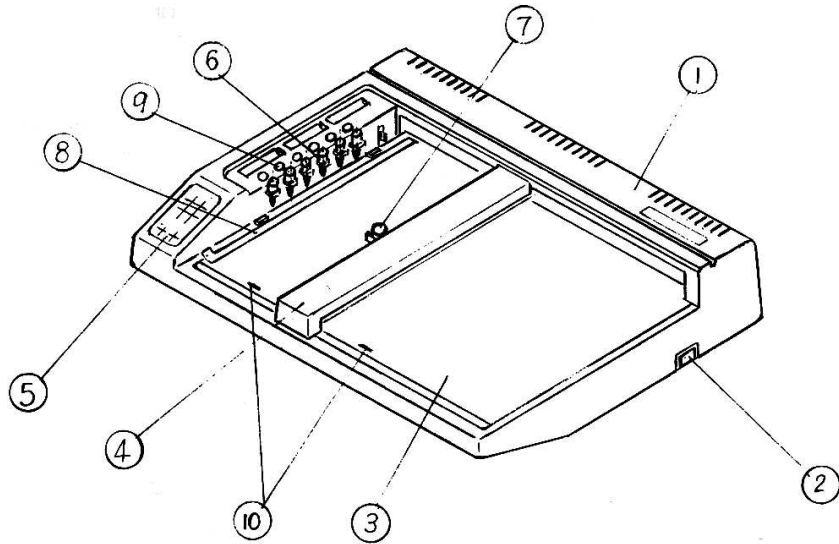
- (1) Do not use or store the Plotter in a place where it is exposed to the direct rays of the sun and/or it is highly heated due to the location of heating appliances in its surroundings.
In addition, do not use or store the Plotter in a place where the temperature suddenly changes, the temperature becomes too low, humidity is high and/or much dust exists. Further, do not apply any bending, torsion and/or strong shock to the Plotter.
- (2) Do not use the Plotter in a place where strong mechanical vibration and/or electric noise exist.
- (3) Do not apply any force on the recording table and arm by hand and/or do not place any heavy load on them.
- (4) Cover a cap on a pen when the pen is not used. The pen tip will be dried if the pen is left without covering the cap.
- (5) Prior to operation, check that connectors and plugs are perfectly connected. Do not disconnect them during operation.
- (6) Do not place the Plotter near magnetic tapes and/or magnetic cards, since a magnet plate (rubber magnet) is used for fixing a plotting paper.

3 Specifications

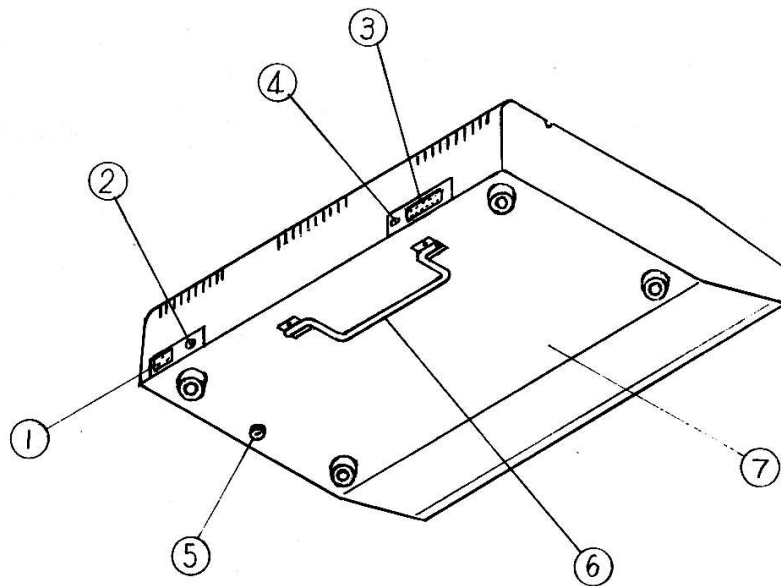
- 1 Effective plotting area: 385 mm x 280 mm
- 2 Maximum plotting speed: 300 mm/sec in axial direction 420 mm/sec max at 45°
- 3 Step size: 0.025 mm
- 4 Plotting accuracy: (Distance accuracy) +0.3% (+0.2 mm) of moving distance
(Repetition accuracy) 0.4 mm or less
(Pen change accuracy) 0.4 mm or less
- 5 Number of pens: 6 (Automatic change)
- 6 Pen types: (Standard) Aqueous fiber pen (6-colors)
(Option) Oily fiber pen (6-colors)
- 7 Paper size: 420 mm x 297 mm (A3 size) or smaller
- 8 Paper holding method: Rubber magnet
- 9 Operation keys: POWER, POSITION, PEN UP/DOWN and PEN SELECT
- 10 Indicating lamps: POWER, ALARM, PEN UP/DOWN and PEN SELECT
- 11 Environmental conditions: (Temperature) +5 to 35 °C
(Humidity) 35 to 75 %RH
- 12 Power requirements: (Voltage) AC-120V, 220V or 240V ±10% (50/60 Hz)
(Power consumption) Less than 30 VA
- 13 Dimensions: 575 mm (W) x 448 mm (D) x 105 mm (H)
- 14 Weight: Approx. 9.5Kg
- 15 Accessories: (Standard) Aqueous fiber pens; 1set (6-colors)
Fuse, Rubber magnets: 1set
(Option) Ceramic pen adapter (for Pentel Ceramicron SRM02-04)
Rotring pen adapter (for Rotring pen No 74910)
- 16 Interface: On Model Parallel = With centronics compatible 8-bit parallel interface.
On Model Serial = With RS-232C serial interface.

4 Name of each section and function

4.1 Appearance

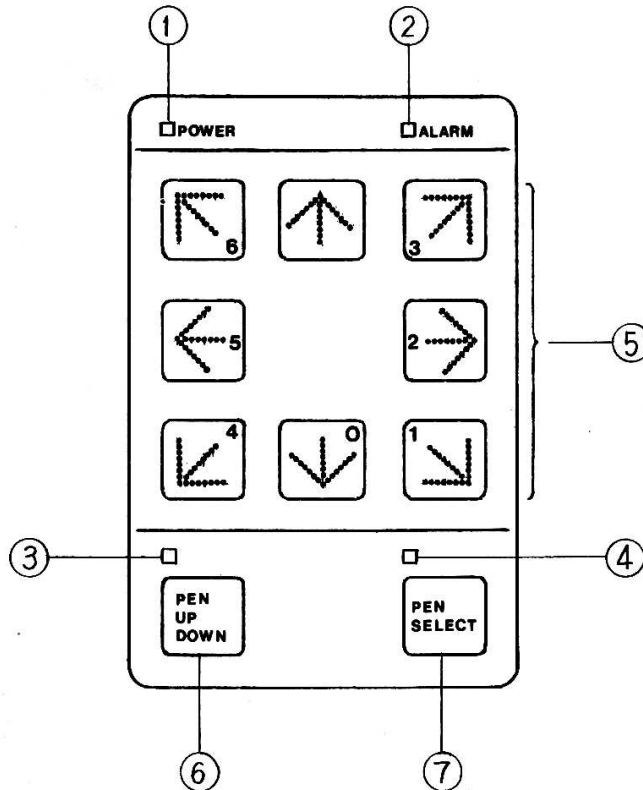


- ① Case ② Power switch ③ Recording table ④ Y slider ⑤ Operation panel
⑥ Pen stocker ⑦ Pen carriage ⑧ Paper holder ⑨ Pen stand ⑩ Paper guide



- ① Inlet (Power cord) ② Grounding terminal ③ Input/output connector
④ Select switch ⑤ Fuse holder ⑥ Stand ⑦ Base plate

4.2 Operation panel

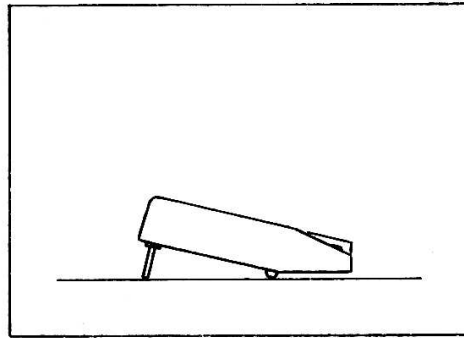
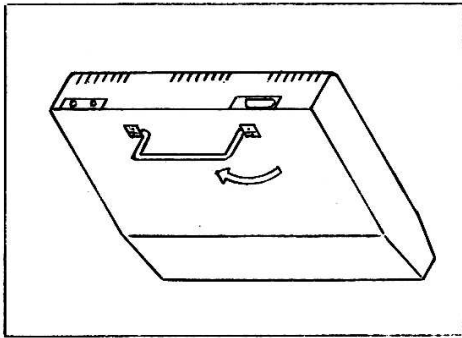


- ① POWER lamp (power ON indication lamp)
When the power is turned on, the red lamp is lit.
- ② ALARM lamp (alarm indication lamp)
Error status is indicated on the red lamp.
- ③ PEN UP/DOWN lamp (Pen up/down indication lamp)
When the pen is lowered, the green lamp is lit.
- ④ PEN SELECT lamp (Pen select mode indication lamp)
The green lamp is lit under the pen select mode.
- ⑤ PEN POSITION (Pen move key)
 - (1) Pressing the key moves the pen in the arrow direction.
Pressing the key for more than 1 sec. moves the pen at high-speed.
 - (2) Pressing this key under the pen select mode selects the pen corresponding to that key NO.
- ⑥ PEN UP/DOWN (Pen UP/DOWN Key)
If this key is pressed when the pen is lowered, the pen is raised, while if it is pressed when the pen is raised, it is lowered.
- ⑦ PEN SELECT (Pen select mode key)
Set to the pen select mode.

5 Preparation for operation

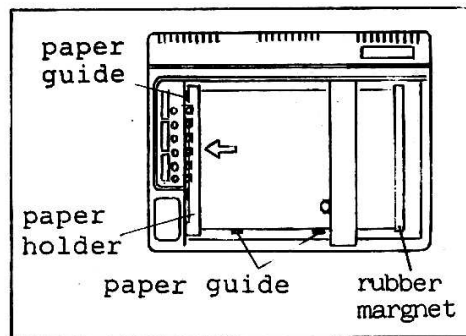
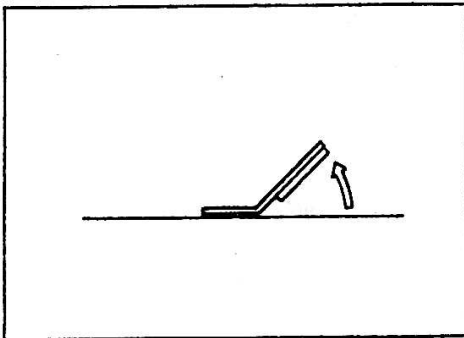
5.1 Plotter setting

This plotter is normally placed horizontally, but it may be placed slantingly depending on its usage. When it is used slantingly, raise the stand on the Plotter rear side.



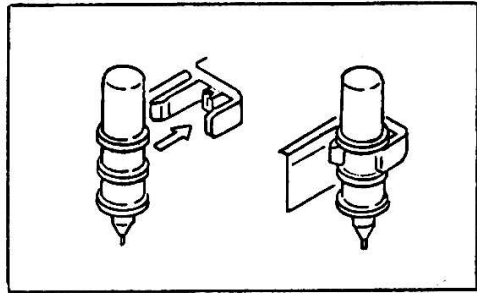
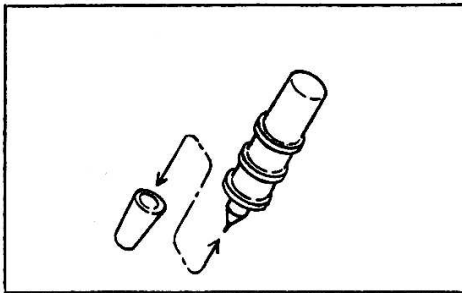
5.2 Paper loading

Pull up the paper holder to inset the paper left end into it. Match the paper left and bottom ends with the paper guide, and then lower the paper holder. Stretch the paper, and then hold the paper right end with a rubber magnet attached as an accessory.



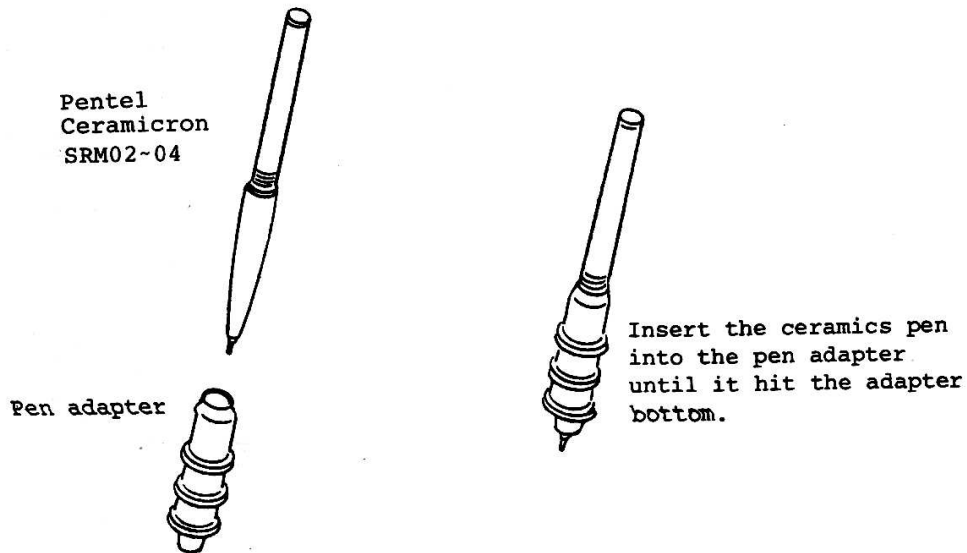
As a plotting paper, any high quality, coat on measuring paper can be used, but a coat paper due to its less blotting is suitable for this purpose. In addition, a film sheet for OHP (overhead projector) can be used. However, in this case use an oily pen.

- 5.3 ① Mounting of plotting pen
Remove the special pen cap (attached as an accessory) from the pen tip, and then load the pen into the pen stocker.



After any plotting will be finished, remove the pen from the pen stocker, and then insert it into the pen stand to prevent its tip from drying. When it is not used for a long time, store it with the pen cap covered.

- ② Use of ceramics pen
When using a ceramics pen instead of the normal pen, set a pen adapter (separately sold) as shown in the following:



5.4 Power connection and trial run

- ① First check that the power switch is turned OFF, and then connect a power cord at the Plotter rear to a power receptacle.
- ② Load a plotting paper and then mount the pen attached on the pen stocker. At this time, do not mount the pen on the pen carriage. If so, error may occur due to pen sensor actuation after the power is turned on.
- ③ Turn ON the power switch to light the POWER LAMP. Thus, the pen carriage moves until it detects the limit positions in the X and Y directions, and then it stops at the origin after picking up No.1 pen.

④ The operation can be checked on the operation panel.

Pressing the PEN UP/DOWN key lights the lamp to lower the pen.


When it is pressed again, the pen is raised to turn off the lamp. If any action is not taken while the pen is lowered, the pen is raised after the lapse of about 4 sec. This is to prevent ink blotting.

Pressing the PEN POSITION key moves the pen to any position or writes a line. First, the pen carriage moves slowly and then speedily after the lapse of about 1 sec. This is to easily set the pen to the writing start position.

Simultaneous push of two keys in the position of 90° moves the pen in the resultant direction of the arrows, while simultaneous push of two keys in the position of 180° stops the pen.

6 Plotter modes

6-1 Self test mode

If the POWER switch is turned ON while pressing the  key on the operation panel, the Plotter becomes the self check mode.

The pen carriage picks up No.1 pen from the pen stocker to plot a self test pattern.

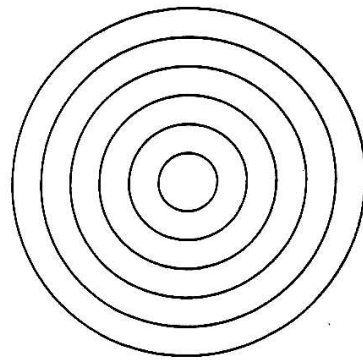
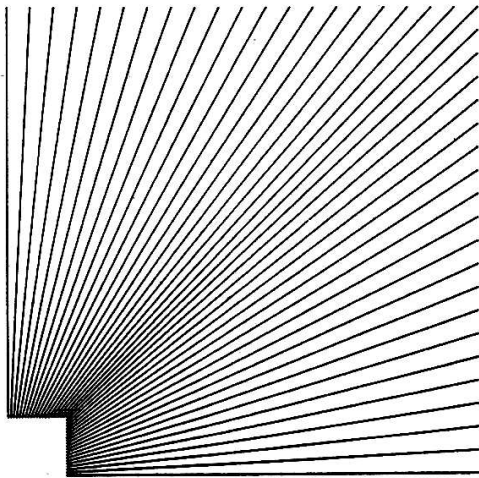
If one pattern has been drawn, the same pattern continues to be repeatedly drawn.

When suspending the self test, turn OFF the POWER switch.

When the POWER switch is turned ON while the pen is held on the pen carriage, the Plotter operation is suspended due to pen sensor actuation. Before the POWER switch is turned ON, return the pen on the pen carriage back to the pen stocker.

Test Pattern

SELF TEST



6-3 Pen Select mode

Pressing the **PEN SELECT** key among the operation keys lights the PEN SELECT LAMP to set the plotter to the Pen Select mode.

Under this condition, if any manual pen key (1 to 6) is pressed, the pen corresponding to the relevant No. is picked up to return to the present position.

If the pen is changed once, the Plotter automatically returns to the mode just before the Pen Select mode.

The Plotter can enter the Pen Select mode. from the print mode or interface mode. Pressing the **↓** key (No.0) stores the pen in the pen stocker to empty the carriage.

Under the pen select mode, data from a computer cannot be accepted.

6-4 Print mode

If the POWER switch is turned ON while pressing the **↑** key among the operation keys, the plotter is set to the print mode to print character codes as they are input.

It performs return operation after line feed by the input of the terminator ODH, OAH, or ODHOAH. However, it draws an underline if any codes without corresponding characters are input.

Plotting start position : Coordinates (888,10800)
Character size : 2.8mm
No. of characters per line : 130 characters
No. of lines per page : 55 lines

If there is no terminator input until 130 characters will be printed, the Plotter continues plotting through its automatic line feed return after 130 characters have been printed. If it receives any terminator after its printing up to 55 lines, it returns back to the initial position, and then stops with the pen raised.

Pressing the **↑** key starts printing. This mode is suspended if the POWER switch is turned OFF.

```

J1M1950,110001950,0,0,0,0,1390,1500,1330
M1500,140000,1400,0,2750,1950,2750,1950,1510
M2050,151002050,2750,3900,2750,3900,1400,2530,1400
M2530,139003900,1330,3900,0,2050,0,2050,1100
B90
J1
M150,150
X1,150,0
M1425,150
D1425,145,1425,150
M1275,150
D1275,145,1275,150
M1125,150
D1125,145,1125,150
M975,150
D975,145,975,150
M825,150
J1
Y2400,1215,35,35,900,2700
I450,0
Y2050,1215,35,35,2700,4500
I-450,0
M2500,1050
D2450,950,2550,950,2570,990,2600,990,2700,950,2000,950,2750,1050,2500,1050
M2400,850
O0,450,-40,5
O1,-200,450,1
M2400,470
O0,450,-40,6
O1,-320,450,1
M2020,470
I0,-160
M3100,150
M 2070 , 2000
J6
D 2050 , 1975
D 2032 , 1950
D 2010 , 1930

```

6-5 Plot mode

This is a normal plot mode under which any graphics can be drawn by the command from a computer. This plot mode can be set by only turning ON the POWER switch, and the pen carriage automatically picks up No.1 pen to move to the HOME position. Thus, the pen carriage waits the command. If the POWER switch is turned ON while the pen carriage holds the pen, the Plotter stops its operation due to pen sensor operation. Before the POWER is turned ON, return the pen on the pen carriage back to the pen stock.

6-6 Reset

Following are the methods to set all conditions to the initial conditions:

- (1) To turn the POWER ON and then OFF. In this case, the pen carriage performs initialize operation to pick up No.1 pen.
- (2) Inputting the INIT.signal from the connector results in the same operation as that in Item (1).
- (3) Pressing the PEN UP/DOWN key simultaneously with the → key results in the same operation as that in Item (1).

This is valid even under the pen select mode.

7. Interface

7-1 Interface, 8-bit parallel method

(Conforming to Centronics)

- (1) Control signal : $\overline{\text{STB}}$ $\overline{\text{BUSY}}$ $\overline{\text{ACK}}$ $\overline{\text{ERROR}}$
- (2) Data input code : 7-bit or 8-bit code
- (3) Input/Output circuit configuration and input/output condition

Signal Name	Configuration	
Input DATA 1 to 8		Input logical level "1"=2.0 to 5V "0"=0 to 0.8V
Input STB		
Output BUSY ACK ERROR		Output logical level "1"=2.7 to 5V "0"=0 to 0.4V

(4) Input/Output signal standard

DATA 1 to 8;

8-bit data signal. Become HIGH when data is "1".

$\overline{\text{STB}}$;

Synchronizing input signal to real DATA 1 to 8.

Reads data before the signal rises from LOW to HIGH.

$\overline{\text{ACK}}$;

Signal to inform the operator of data receive end.

BUSY;

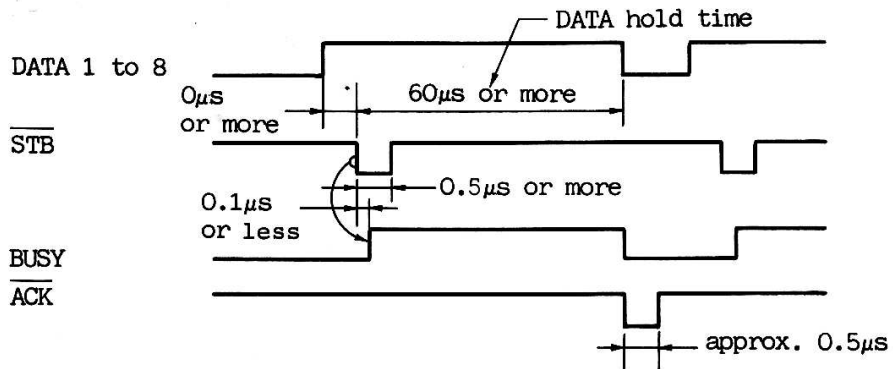
Signal to indicate that the plotter is under the data unreceivable status (BUSY). If the signal is HIGH, no new data can be received. The conditions under which the BUSY signal becomes high are as follows:

- (a) Partial time during data entry
- (b) Time in the X section during printing and head operation.
- (c) When mode is in the pen select mode.
- (d) When one page has been printed in the printer mode.

$\overline{\text{ERROR}}$;

Signal to indicate that the plotter is in the ERROR status.

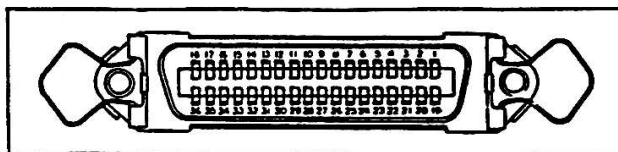
(5) Timing chart



(6) Input connector (Interface conforming to Centronics)

Connector on cable side DDK 36pin (57-30360) or equal
 Connector on plotter side and signal arrangement
 36-pin Amphenol type

PIN	SIGNAL	PIN	SIGNAL
1	STB	19	GND
2	DATA 1	20	GND
3	DATA 2	21	GND
4	DATA 3	22	GND
5	DATA 4	23	GND
6	DATA 5	24	GND
7	DATA 6	25	GND
8	DATA 7	26	GND
9	DATA 8	27	GND
10	ACK	28	GND
11	BUSY	29	GND
12	GND	30	GND
13	PULL UP to +5V.	31	INIT
14	NC	32	ERROR
15	NC	33	GND
16	GND	34	NC
17	CHASSIS GND	35	PULL UP to +5V.
18	Cannot be used	36	NC



7-2 Interface RS232C

- (1) Synchronization: Start-stop
- (2) Communication speed: 75, 150, 300, 600, 1200, 2400, 4800, 9600 BPS
- (3) Communication format: Start bit ... 1 bit
 Data bit7 or 8 bits
 ParityEven or odd number or
 no parity
 Stop bit1 or 2 bits
- (4) Buffer memory size: 1024 bytes
- (5) Signal level:

Signal Type	Signal Name	"1" or ON	"0" or OFF
Data signal	TXD RXD	-3 to -12V "1"	+3 to +12V "0"
Control signal	RTS DTR	+3 to 12V ON	-3 to -12V OFF

- (6) Buffer status flag send
 Sent by DTR signal or X parameter.

Buffer status flag	DTR signal	X parameter *(Recommended code)	Function
Reset	ON	Xon send (DC1)	Buffer memory residual: Large
SET	OFF	Xoff send (DC3)	Buffer memory residual: Small

*X-parameter code can be specified by the RS-232C control command.

- (7) RS-232C connector
 Connector on device side:
 25-pin socket type based on the EIA Standard (DB-25SA-N or equal)
 Adaptable connector:
 25-pin plug type based on the EIA Standard (DB-25P or equal)

(8) Connector pin arrangement

Pin	Signal Symbol	Signal Name	Direction	Function
1	FG	Grounding for safety	-	Chassis ground
2	TXD	Sending data	Output	Serial sending data Sends X parameter.
3	RXD	Receiving data	Input	Serial receiving data
4	RTS	Send request	Output	Always ON (+ potential)
7	SG	Signal ground	-	Signal ground
20	DTR	Data terminal ready	Output	Buffer status send Receivable under ON (+ potential) Always ON under X-parameter control

→3
→3
→2
→5
→7
→6-8

(9) RS-232C control command

This plotter is provided with commands with **ESC** (Escape) to set the RS-232C conditions as described in the following.
 Use ; (semi-colon) as a delimiter of parameters included into each command and : (colon) as a terminator of each command.
 If each command includes the delimiter; without any parameter, the parameter is set to the initial value (default value).

① SET PLOTTER CONFIGURATION command

command type:

ESC . @ (;(<DEC>));

Initial value:

ESC . @; → Set to the DTR control mode.

Function:

When the parameter <DEC> is "0", the DTR signal always becomes + potential to make the DTR control DISABLE, while when it is "1", the DTR control becomes ENABLE.

The plotter is set to the DTR control at the time of power-ON.

Example:

ESC . @ ; 0 : → DTR control DISABLE

② SET HANDSHAKE MODE command

Command type:

`ESC . I [;; (<ASC> (; ... ASC))] :`

Initial value:

`ESC . -` Not in the X-parameter control mode

Function:

The parameter <ASC> sets the Xon trigger character using the ASCII code expressed in decimal equivalence. This parameter can configure the Xon trigger character using up to 10 parameters by separating this parameter with semicolons. The effective code is in the range of 0 to 127, but no 0 is transferred to terminate the succeeding string.

Example:

`ESC . I ;; 17 :` → Xon trigger character is set to DC1.

③ SET X-OFF TRIGGER CHARACTER command

Command type:

`ESC . N [; (<ASC>(; ... ASC))] :`

Initial value:

`ESC . N :` → No Xoff trigger character

Function:

The parameter <ASC> sets the Xoff trigger character using the ASCII code expressed in decimal equivalence. Up to 10 parameters can be used in the same way as the Xon trigger character.

Example:

`ESC . N ; 19 :` → Xoff trigger character is set to DC3.

④ RESET HANDSHAKE command

Command type:

`ESC . R`

Function:

All parameters are reset by this command when the current handshake mode is in the X-parameter control, resulting in the DTR control mode.

- (10) Threshold level of buffer memory
 Buffer memory size 1024 bytes
 Xon threshold level 512 bytes
 Xoff threshold level ... 128 bytes

(11) Communication format setting

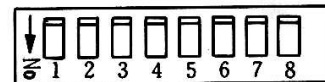
- ① Communication formats prior to factory shipment are set as follows:
 Communication speed: 4800 BPS
 Data bit length: 8 bits
 Parity bit: No
 Stop bit: 2 bits

- ② When changing the communication formats, set the DIP SWs. in accordance with the DIS SW. Setting Table.

BIT	1 to 3	4	5	6	7	8
Setting Item	Communication speed	Stop bit	Parity		Data length	
OFF	See attached Table	①	Not provided	ODD	7	Inhibit
ON		2	Provided	EVEN	⑧	Always

Communication speed setting

Communication speed	Bit		
	1	2	3
• 9600 4800	OFF ON	OFF OFF	OFF OFF
2400 1200	OFF ON	ON ON	OFF OFF
600 300	OFF ON	OFF OFF	ON ON
150 75	OFF ON	ON ON	ON ON

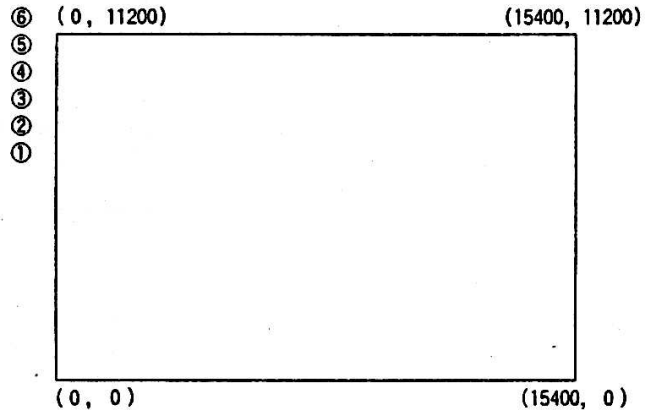


8 Plot mode

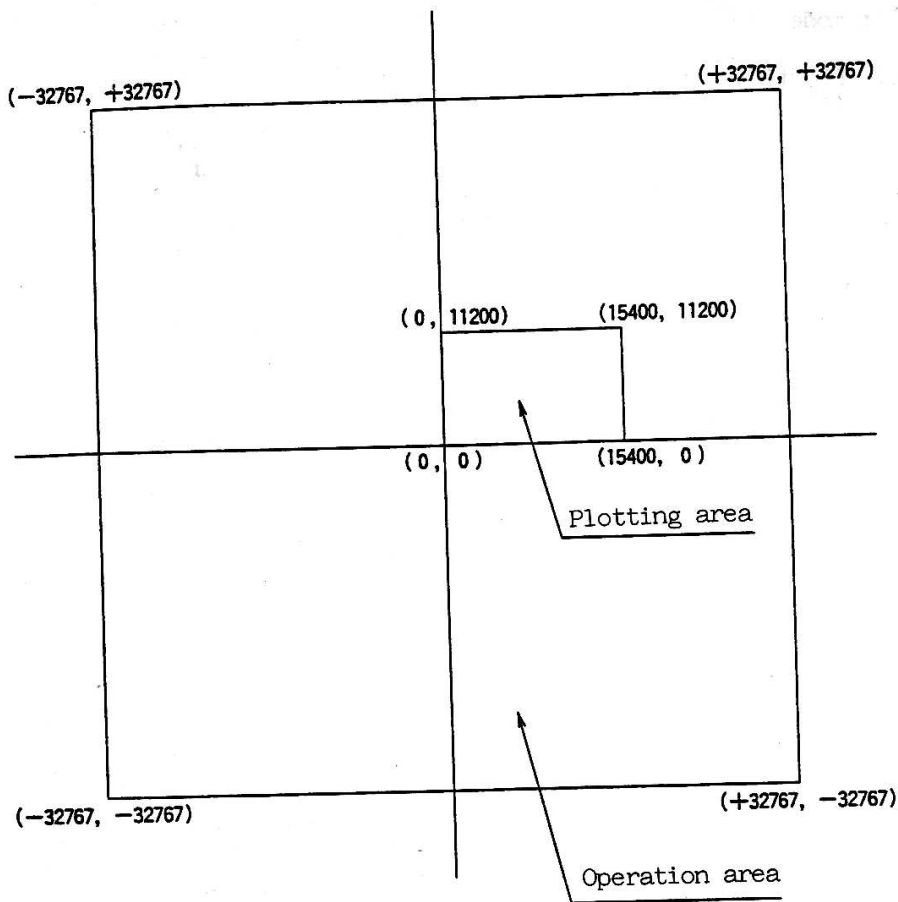
8.1 Plotting area

(1) Plotting area and Pen position

Pens are assigned with numbers of 1,2,3,...6 from the front in this order and the plotting area is as shown in the following Fig. Figures in parentheses show coordinates in steps of 0.025mm when the plotter origin is set to (0,0).



- #### (2) Operation area and off-scale processing
- Even if the input applied as the parameters of commands AA,AR,CI,EA,ER,EW,FT,PA,PD,PU,PR,RA,RR, and WG exceeds the area of A3 size, 15400x11200 shown in the above figure, it becomes valid when it is in the operation area shown in the following figure. However in this case, the pen is off-scale-processed so that it does not move beyond the plotting area. In addition, parameter input exceeding the valid parameter range ($\pm 32767, \pm 32767$) causes error. Thus, the pen continues plotting by the next valid command with that command neglected.



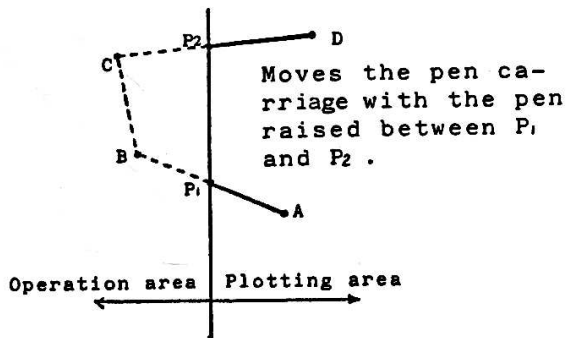
Note: Figures in parentheses show coordinates in steps of 0.025mm when the origin of a plotter is set to (0,0).

(3) Offscale processing

If the plotting locus extends from the plotting area to the operation area, the pen is raised at the point (P₁) which is out of the plotting area as shown in the right Fig. and the movable axis operates as if it is under plotting. In addition, the pen is lowered at the point (P₂) which is located within the plotting area to move it normally. The ERROR LAMP is lit during offscale.

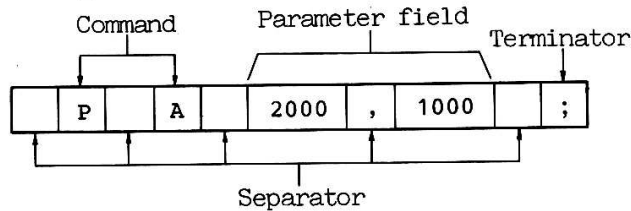
Designation : A → B → C → D

Pen : A → P₁ → P₂ → D



8-2 Plotting command format

- (1) The command set of this plotter consists of 2 alphanumeric (any upper case or lower case letters are acceptable) commands, parameters and a terminator indicating the command end.



- (2) As separators, space and comma (,) can be used, but they can be omitted except the case where the parameter field is configured by several parameters. However, since the SM or DT command determines that the first letter followed by the command is a label or terminator, pay attention to the use of the separators.
- (3) As the terminator of all of the command set other than the LB command, semicolon (;) is used. Although the terminator of the LB command is initially set to ETX. (3 in decimal digit) in ASCII, this terminator can be changed by the DT command, when the terminator is omitted, the command set to terminated by 2 alphabetical characters of the next command set. However, the LB command always requires the terminator.
- (4) For the description of the parameter in each command set, refer to the command description.
(Additional parameter may be added depending on the command set.)
Omit all of the succeeding commands within the command set when the omission is required.
Parameter ranges are limited as follows depending on formats:

Integer type: -32767 to +32767
Real number type: -128.0000 to +127.9999
-32767.0000 to +32767.9999
(When scaling is done)

When no sign is attached, any number is judged to be a positive number.

8-3 Description of plotting command

(1) Initial value of parameter
When the power is turned on, the plotting conditions are initialized as follows:

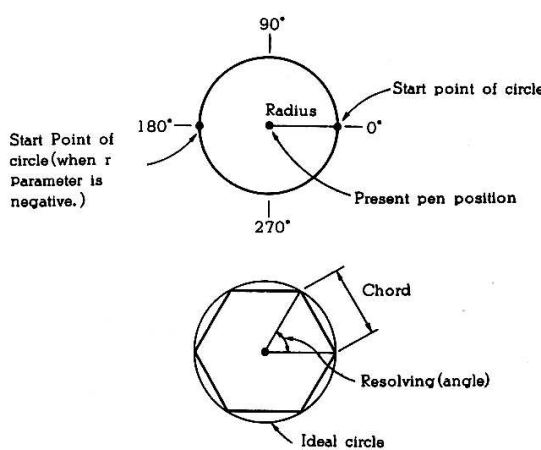
Function	Equivalent command	Initial value
Plotting mode	PA;	Plotted in the system of coordinates.
Plotting direction	DR1, 0 ;	Horizontal direction
Line type	LT;	Solid line
Line pattern length	LT;	Set to 4% of intervals between P1 and P2.
Window	IW;	Maximum plotting area
Character size	SR;	Character width = 0.42% of (P2x-P1x) Character height = 1.12% of (P2y-P1y)
Symbol mode	SM;	Off
Scale length	TL;	Scale on X-axis = 0.5% of (P2y-P1y) Scale on Y-axis = 0.5% of (P2x-P1x)
Standard character set	CSO;	Sets character set to 0.
Auxiliary character set	CAO;	Sets character set to 0.
Character set	SS;	Selects standard character set.
Character inclination	SLO;	Set to 0° .
Masking value	IM233;	Identifies all errors.
Scaling	SC;	No scaling is done.
Pen speed	VS;	Set to 30 cm/s.
Label terminator	DT <u>ETX</u> ;	ETX. (Equivalent decimal digit of ASCII;3)
Arc resolving degree		Set to 5° .
Shading type	FT;	Set to type 1 (Smearing out in both directions)
Shading interval	FT;	Set 1% of intervals between P1 and P2.
Shading angle	FT;	Set to 0° .
Interval of smearing out	PT;	Set to 0.3 mm.
Scaling point	IP;	(P1x, P1y) = (100, 600) (P2x, P2y) = (15300, 10600)
Rotation of system coordinates	RO;	Set to 0° .



(2) On plotter unit

This plotter is based on the plotter unit in the step of 0.025 mm and its plotting range is set by scaling points, P1 and P2. These scaling points can assign the user unit through the execution of the SC command. Therefore, through the execution of the SC command, the response of the commands, AA, AR, CI, EA, ER, EW, FT, PA, PD, PU, PR, RA, RR and WG to the parameter is made in the user unit. During scaling off, the coordinate parameters below the decimal point are cut down.

(3) Function of each command

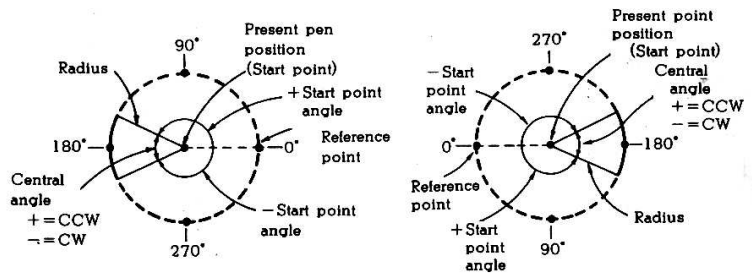
VECTOR group		
NAME	COMMAND TYPE & PARAMETER FUNCTION	
PEN UP	Command type	PU; or PU $x_1, y_1, (, x_2, y_2, \dots x_n, y_n)$;
	Parameter range	$-32767 \leq x_n, y_n \leq 32767$ (During scaling off) $-32767.0000 \leq x_n, y_n \leq 32767.9999$ (During scaling on)
	Function	Lowers the pen in the present position. When the parameter is included in the command, the pen is raised and then moves to the specified position (x_n, y_n).
PEN DOWN	Command type	PD; or PD $x_1, y_1, (, x_2, y_2, \dots x_n, y_n)$;
	Parameter range	$-32767 \leq x_n, y_n \leq 32767$ (During scaling off) $-32767.0000 \leq x_n, y_n \leq 32767.9999$ (during scaling on)
	Function	Loweres the pen in the present position. If the parameter is included in the command, the pen is lowered and then moves to the specified position (x_n, y_n).
PLOT ABSOLUTE	command type	PA; or PA $x_1, y_1 (, x_2, y_2 \dots x_n, y_n)$;
	Parameter range	$-32767 \leq x_n, y_n \leq 32767$ (During scaling off) $-32767.0000 \leq x_n, y_n \leq 32767,9999$ (During scaling on)
	Function	Maintains the present pen up and down conditions, then moves to the absolute coordinates (x_n, y_n). PU and PD can be used as parameters and the PU and PD parameters are interpreted as the PA execution parameters. Always configure coordinate parameters in a pair of values on the x- and y-axis. The execution of PA; is made in the absolute value plotting mode setting with respect to the PU and PD commands.
PLOT RELATIVE	Command type	PR; or PR $\Delta x_1, \Delta y_1 (, \Delta x_2, \Delta y_2, \dots \Delta x_n, \Delta y_n)$;
	Parameter range	$-32767 \leq \Delta x_1, \Delta y_1 \leq 32767$ (During scaling off) $-32767.0000 \leq \Delta x_1, \Delta y_1 \leq 32767.9999$ (During scaling on)
	Function	Maintains the present pen position and then moves the pen by the unit specified by the parameters in the increments x and corresponding to y from the position at that time. Parameter operation is the same as the PA command.

CIRCLE	Command type	CIr (, θc) ;
	Parameter range	$-32767 \leq r \leq 32767$ (During scaling off) $-32767.0000 \leq r \leq 32767.9999$ (During scaling on) $-32767 \leq \theta c \leq 32767$ (However, minus sign is ignored.)
	Function	<p>Draw a circle in a radius specified centering around the present pen position and resolving degree (θc).</p>  <p>If the r parameter is specified by a positive integer, a circle is drawn from the position of 0°, while if it is specified by a negative integer, a circle is drawn from the position of 180°. Since a circle consists of continuous chords, any graphics from polygons to smooth circles can be drawn by changing the parameter of resolving degree. The smoothest circle can be drawn when the parameter of resolving degree is set to 0°, and the circle becomes coarse as the parameter approaches 180°. On the contrary, it becomes smoother as the parameter approaches 360° from 180°, while it becomes smoothest as the parameter is set to 360°. This pattern is sequentially repeated in the parameter range of resolving degree. The initial value is set to 5°. No CI and PD commands are required. The plotter, after receipt of the CI command, raises its pen to move to the start point of a circle and then draws the circle with the pen lowered. Thus, it moves the pen to the center of the circle with the pen raised to return to the pen up/down condition before receipt of the CI command. Each chord of the circle is drawn by the LINE TYPE now specified.</p>

		<p>Sings of the parameters, Δx and Δy in the increments corresponding to X and Y are determined by setting the direction of the arc center position. Thus, the arc center is moved to the positive direction (upper or right) when the sign is plus, while it is moved to the negative direction (lower or left) when the sign is minus. Other parameters than those of Δx and Δy are the same as the AA command.</p>
FILL TYPE	Command type	FT; or FT (t (, s (, θ)));
	Parameter range	$1 \leq t \leq 5$ $0 \leq S \leq 32767$ (During scaling off) $0 \leq S \leq 32767.9999$ (During scaling on) $-32767 \leq \theta \leq 32767$ (However, specified in steps of $\pm 45^\circ$ from 0)
	Function	<p>This command is used with the RA,RR and WG commands to specify shading pattern. The parameter t specifies 1 type from among the following 4 types in the number. When no type is specified, the parameter is set to the initial value 1, or if it selects 5, it is ignored.</p> <ol style="list-style-type: none"> 1. Smearing out in both directions 2. Smearing out in one direction 3. Hatching () 4. Cross hatching () <p>The space parameter S specifies intervals of parallel hatching or cross-hatching lines and the unit becomes that specified at that time. When the S parameter is omitted, the initial value (1% of the distance between P1 and P2) is selected if the FT command is executed for the first time, but for others, the value specified by the command just before the FT command continues. The S parameter of 0 is ignored and the PT command now specified is applied. The S parameter is also neglected, when the shading type is 1 or 2, thus being specified by the PT command.</p> <p>The angle parameter θ specifies shading inclination from the horizontal direction in the step of $\pm 45^\circ$. If it is 0°, horizontal shading is made, for 90° vertical shading and for 45°, shading in the angle of 45°.</p> <p>When no angle parameter is specified, the initial value (0°) is selected when the FT command is executed for the first time, while for others the value specified by the previous FT command continues.</p>

PEN THICKNESS	Command type	PT; or PT p;
	Parameter range	$0.1 \leq p \leq 5.0$
	Function	Used with the FT, RR, RA and WG commands to specify intervals being smeared out in mm corresponding to pen thickness. When no p parameter is specified, the initial value, 0.3 mm is set. The PT command is valid only for the pen now used, and it becomes invalid when the following items are performed. a. A new pen is selected by the SP command or through the operation panel. b. The new PT command is executed.
SHADE RECTANGLE ABSOLUTE	Command type	RA x, y ;
	Parameter range	$-32767 \leq x, y \leq 32767$ (During scaling off) $-32767.0000 \leq x, y \leq 32767.9999$ (During scaling on)
	Function	Draws a rectangle defined by the present pen position and coordinate parameters (x, y). As the parameter unit, the present unit is applied. In addition, if no parameter is specified, the command is ignored but no error occurs. After the command is executed, the pen returns back to the start point to become the pen start before command execution.
EDGE RECTANGLE ABSOLUTE	Command type	EA x, y ;
	Parameter range	$-32767 \leq x, y \leq 32767$ (During scaling off) $-32767.0000 \leq x, y \leq 32767.9999$ (During scaling on)
	Function	Draws a rectangle defined by the present pen position and coordinate parameters (x, y). As the parameter unit, the present unit is applied. In addition, if no parameter is designated, this command is ignored, but not error occurs. After command execution, the pen returns to the start point to be in the pen state before execution.

SHADE RECTANGLE RELATIVE	Command type	RR $\Delta x, \Delta y$;
	Parameter range	$-32767 \leq \Delta x, \Delta y \leq 32767$ (During scaling off) $-32767.0000 \leq \Delta x, \Delta y \leq 32767.9999$ (During scaling on)
	Function	Used with the FT and PT commands to make shading within a rectangle defined by the present pen position and incremental coordinate parameters ($\Delta x, \Delta y$) by setting the above point to a reference. As the parameter unit, the present unit is applied. In addition, if no parameter is specified, the command is ignored but no error occurs. Shading is made by the pen and line type now specified. The pen returns to the start point after the command is executed to set to the pen state before command execution.
EDGE RECTANGLE RELATIVE	Command type	ER $\Delta x, \Delta y$;
	Parameter range	$-32767 \leq \Delta x, \Delta y \leq 32767$ (During scaling off) $-32767.0000 \leq \Delta x, \Delta y \leq 32767.9999$ (During scaling on)
	Function	Draws a rectangle defined by the present pen position and incremental coordinate parameters ($\Delta x, \Delta y$) based on that point. As the parameter unit, the present unit is applied. In addition, if no parameter is specified, the command is ignored but no error occurs. After the command is executed, the pen returns back to the start point to retain the pen state before command execution.
SHADE WEDGE	Command type	WG r, θ_1, θ_2 ($, \theta_c$) ;
	Parameter range	$-32767 \leq r \leq 32767$ (During scaling off) $-32767.0000 \leq r \leq 32767.9999$ (During scaling on) $-32767 \leq \theta_1 \leq 32767$ $-32767 \leq \theta_2 \leq 32767$ $1 \leq \theta_c \leq 120$
	Function	Used with the FT and PT commands to make shading within a sector defined by each parameter. The radius parameter (r) determines sector size and as the unit, the present unit is applied. When the user unit is applied, it follows that in the X-axis direction. The relative position of the reference point (0°) between the present pen position (start point) and start point angle (θ_1) differs depending on the plus or minus sign of the radius.



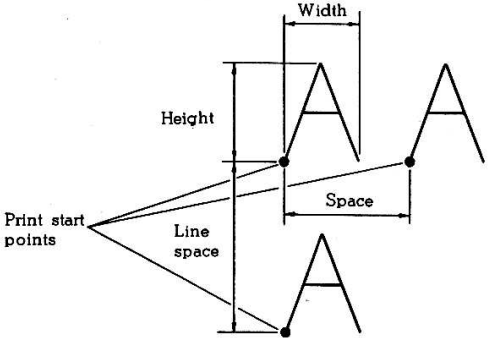
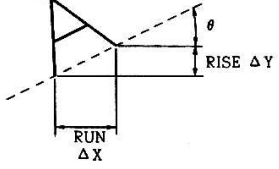
The start point angle parameter (θ_1) is set in the CCW direction when it is plus, while it is set in the CW direction when it is minus. If the parameter larger than $\pm 360^\circ$ is specified, the remainder obtained by dividing the specified angle by 360° is applied. The central angle parameter (θ_2) is set in the CCW direction when it is plus, while it is set in the CW direction when it is minus. If the parameter larger than $\pm 360^\circ$ is specified, it is set to 360° . The resolving degree parameter (θ_c) specifies are smoothness in degree ($^\circ$). The number of chords configuring an arc is limited to 90° or less, and if the resolving degree of less than 4° is specified, a circle is drawn in the resolving degree of 4° . If no resolving angle is specified, it becomes 5° . IN addition, if an angle whose central angle is not divided by an integer is specified, the plotter sets an angle which is divided by the nearest integer. If no parameter is specified, the command is ignored, but no error occurs. Shading is made by the pen and line type now selected. The pen returns back to the start point after the command is executed to be retained to the pen start before command execution.

EDGE WEDGE	Command type	EW r, θ_1 , θ_2 (, θ_c) ;
	Parameter range	$-32767 \leq r \leq 32767$ (During scaling off) $-32767.0000 \leq r \leq 32767.9999$ (During scaling on) $-32767 \leq \theta_1 \leq 32767$ $-32767 \leq \theta_2 \leq 32767$ $1 \leq \theta_c \leq 120$
	Function	Draws a sector defined by each parameter. Each parameter operation is the same as the WG command. When no parameter is specified, the command is ignored but no error occurs. The plotter draws a graphic using the pen and line type now selected. The pen returns back to the start point after the command is executed to be retained to the pen position before command execution.

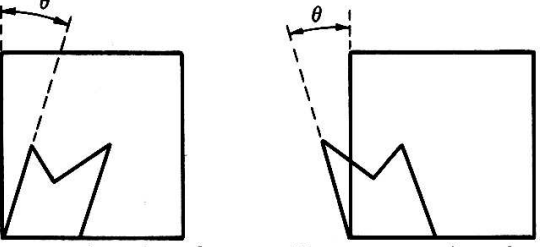
CHARACTER group

This plotter is provided with 19 character sets. for each character set, refer to Character Set Tables attached. Each character enclosed with a shaded rectangle is automatically back-spaced by one character. When putting accent to each character, first write the character, then put the accent.

NAME	COMMAND TYPE & PLOTTING FUNCTION	
DESIGNATE STANDARD CHARACTER SET	Command type	CSn ;
	Parameter range	$0 \leq n \leq 4, 6 \leq n \leq 9, 30 \leq n \leq 39$
	Function	Designates a certain character set as the standard character set. When the standard character set is selected, all characters are written by the character set designated by the CS command. If the CS command is executed without any parameter (CS;), the character set 0 is designated.
DESIGNATE ALTERNATE CHARACTER SET	Command type	CA n ;
	Parameter range	$0 \leq n \leq 4, 6 \leq n \leq 9, 30 \leq n \leq 39$
	Function	Designates a certain character set as the alternate character set. When the alternate character set is selected, all characters are written by the character set designated by the CA command. If the CA command is executed without any parameter (CA;), the character set 0 is designated.
SELECT STANDARD SET	Command type	SS ;
	Parameter range	No parameter
	Function	When any character is written, designates the use of the standard character set selected by the CS command. The standard character set can be similarly selected by sending the control character SHIFT-IN [CHR \$(15)] into the LB command.
SELECT ALTERNATE SET	Command type	SA ;
	Parameter range	NO parameter
	Function	When any character is written, designates the use of the alternate character set selected by the CA command. The alternate character set can be similarly selected by sending the control character SHIFT-OUT [CHR \$(14)] into the LB command.

LABEL	Command type	LB c1 c2 ... cn (t)
	Parameter range	Refer to Character Set Table.
	Function	<p>Writes character string using the character set now designated. (t) is the label terminator and it is always necessary to add the label terminator at the end of character string when the label mode is terminated. The initial value of the label terminator is set to ETX (equivalent value to ASCII decimal digit), but it can be changed by the DT command.</p>  <p>Printing is started from the present pen position. The initial values of character size are set to 0.42% between the scaling points P₂x and P₁x in width, and 1.12% between the scaling points P₂y and P₁y in height. Character size can be changed by the SI and SR commands.</p>
DEFINE TERMINATOR	Command type	DT c;
	Parameter range	$1 \leq c \leq 127$ (Decimal)
	Function	<p>When any character is written, the DT command designates a character used as the label terminator. When using any ASCII character, it is printed at the end of character string. The uninitialized label terminator is (HEX) [CHR \$ (3)] .</p>
ABSOLUTE DIRECTION	Command type	DI ΔX, ΔY ;
	Parameter range	$-128.0000 \leq \Delta X, \Delta Y \leq 127.9999$
	Function	<p>When any character is written, the DI command designates the direction in which the character is written. The character direction is defined in the following relationship.</p>  $\frac{\Delta Y}{\Delta X}$ <p>where, DI, is set to DI 1, 0; (horizontal direction)</p>

RELATIVE DIRECTION	Command type	DR ΔX , ΔY ;
	Parameter range	$-128.0000 \leq \Delta X, \Delta Y \leq 127.9999$
	Function	Designates the direction in which any character is written with respect to the scaling points P1 and P2. The character direction by the DR command is determined in the same way as the DJ command. The parameter ΔX is designated by percentage of $|P2x - P1x|$, while ΔY , by percentage of $|P2y - P1y|$.
USER DEFINED CHARACTER	Command type	UC(p, $\Delta X_1, \Delta Y_1, p(, \Delta X_2, \Delta Y_2 \dots)$);
	Parameter range	$-99 \leq p \leq 99$ $-128.0000 \leq \Delta X, \Delta Y \leq 127.9999$
	Function	Used when any character undefined by the character set is written. Each segment of the character is written on the grid. Each character space area of this grid is divided into 6 in the horizontal direction and 16 in the vertical direction. When the character is necessary to be written in the same size as that being written in the label instruction, design the character within 4 grids in the horizontal direction and 8 grids in the vertical direction starting from the lower left corner of the grid.
ABSOLUTE CHARACTER SIZE	Command type	SI w, h ;
	Parameter range	$-128.0000 \leq w, h \leq 127.9999$
	Function	Designates character size in the unit of cm. When the parameter is added, two parameter of width and height are required. The width and height designated are interpreted in the unit of cm, and their values should be in decimal formats between -128.0000 to 127,9999.
RELATIVE CHARACTER	Command type	SR w, h ;
	Parameter range	$-128.0000 \leq w, h \leq 127.9999$
	Function	Designates character size with respect to the scaling points P1 and P2. Parameter sign is the same as the SI command. The character width parameter is designated by percentage of $|P2x - P1x|$, while the character height, by percentage of $|P2y - P1y|$. SR ; sets character width to 0.42% of $|P2x - P1x|$ and character height, to 1.12% of $|P2y - P1y|$.

CHARACTER SLANT	Command type	SL θ ;
	Parameter range	$-128.0000 \leq \theta \leq 127.9999$
	Function	<p>Designates character slanting. The parameter designates the slanting in tangent angle from the vertical direction.</p>  <p>When parameter is plus. When parameter is minus,</p>
CHARACTER PLOT	Command type	CP w, h ;
	Parameter range	$-128.0000 \leq w, h \leq 127.9999$
	Function	<p>Moves the pen by the number of characters designated. The pen moving direction is related to the direction in which the character is written. CP ; performs the operation of carriage return and line feed.</p>

LINE TYPE group

In the LINE TYPE group, the LT command to designate scale length, the SM command to write a single character centering around the vector end point, the SP command to select the pen and the VS command to determine pen-down speed are included.

NAME	COMMAND TYPE & PLOTTING FUNCTION	
LINE TYPE	Command type	LT t (, ℓ) ;
	Parameter range	-128.0000 ≤ t, ℓ ≤ 127.9999
	Function	<p>Designates line type when any line is drawn by the AA, AR, CI, PA and PR commands. This command is used to draw solid and dotted lines by the PA and PR instructions. Also this command makes easy to draw many different lines and can shade lines and grids. One of line types may produce a dot at each data point.</p> <p>0 - specifies only at the points that are plotted. 1 - 2 - — — — — — 3 - — — — — — 4 - 5 - - - - - - 6 - - - - - -</p> <p>┌──────────┐ — one pattern length No parameter (Default Value)</p> <p>The PD instruction does not physically perform pen-down until the next instruction is executed if the pen stops at the pen-up position of the vector pattern Therefore, the pen is in the pen-down position of the pattern. The Pen-up instruction cancels the carry-over portion.</p>
SYMBOL MODE	Command type	SM c;
	Parameter range	33 ≤ C ≤ 126 (decimal)
	Function	<p>Any character is written centering around the end point of each line segment used with the PA or PR command. If there is the parameter, the character is limited to a single character. When releasing this mode, send SM ;.</p>
PEN SELECT	Command type	SP n ;
	Parameter range	0 ≤ n ≤ 6
	Function	<p>Used when the pen is selected by the program. When the parameter is set to 0 or none, the pen now in the pen holder is housed in the pen stocker.</p>

VELOCITY SELECT	Command type	VS v ;
	Parameter range	$0 \leq v \leq 127.9999$
	Function	Used when the maximum pen speed with the pen lowered by the program is designated. When used without the parameter, pen speed is set to 25 cm/sec and acceleration, to 0.1 G. In addition, if the parameter is added, pen-down speeds in the vertical and horizontal directions are set to those determined by the initial parameter. The DF and IN instructions re-set the speed and acceleration to 25 cm/s. and 0.1 G, respectively.

SET UP group

In the SET UP group, the IP command to set the scaling point, the SC command which allocates the user unit value to the scaling point and the IW command to limit the range of pen movement are included.

NAME	COMMAND TYPE & PLOTTING FUNCTION	
INPUT P1 AND P2	Command type	IP P1x, P1y, P2x, P2y ;
	Parameter range	$0 \leq X, Y \leq +32767$
	Function	<p>Sets the scaling points by the program. This command has the following functions: Moves the scaling points P1 and P2 from the present position. Reduces or extends user unit size. Changes character size and direction due to their relative relation. Returns P1 and P2 to their initialized values.</p> <div data-bbox="715 898 1193 1151" style="border: 1px solid black; padding: 10px; margin: 10px auto; width: fit-content;"> <p style="text-align: center;">P2 · (5000, 5000)</p> <p>P1 · (3000, 2000)</p> </div>
SCALE	Command type	SC X min, X max, Y min, Y max ;
	Parameter range	$-32767 \leq X, Y \leq 32767$
	Function	<p>Used when user unit values are assigned to the scaling points P1 and P2. The parameters X min and Y min define the user unit coordinate value of P1, while X max and Y max define the user unit coordinate value of P2. P1 and P2 become two diagonal points of a rectangle. P1 and P2 hold their user unit coordinate values assigned until the scaling mode are released or they are redefined by the other SC instruction.</p>
INPUT WINDOW	Command type	Iw XLL, YLL, XUR, YUR ;
	Parameter range	$-32767 \leq X, Y \leq 32767$
	Function	<p>Used when the range of pen movement is limited by the program. The area set is called "Window". The parameter is always interpreted by the plotter unit. When the instruction includes for parameters, the window is set according to these parameters. The window is set to the maximum plotting area by the execution of the IN or DF instruction.</p>

CONFIGURATION ASN STATUS group

In the CONFIGURATION AND STATUS group, the DF command to set the plotter to the standard state, the IN command to initialize the plotter, the IM command to control the condition code causing error and the R0 command to rotate the system of coordinates of the plotter unit/user unit by 90° .

NAME	COMMAND TYPE & PLOTTING FUNCTION																																				
DEFAULT	Command type	DF ;																																			
	Parameter range	No parameter																																			
	Function	Sets the plotter to the standard state. Used for restoring the plotter to the known state while the settings of P1 and P2 are equal. As a result, the unnecessary parameters such as character size, slant and scaling are not succeeded from other program.																																			
INITIALIZE	Command type	IN ;																																			
	Parameter range	No parameter																																			
	Function	Sets the plotter to the same state by the program as that where its power is turned on : initialized state. The unnecessary parameters are not succeeded from the program. P1 and P2 are set to the positions when the power is turned on. <div style="display: flex; justify-content: space-around; margin-top: 5px;"> P1 A3, 100, 600 P2 15300, 10600 </div>																																			
INPUT MASK	Command type	IM e(MASK VALUE) ;																																			
	Parameter range	0 < e ≤ 255																																			
	Function	<p>The IM instruction controls the condition code which may becomes error. As the parameter, designates the E MASK VALUE. If other parameters than the E MASK VALUE are designated, they are ignored but do not cause error.</p> <table border="1" data-bbox="679 1496 1430 1832" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>E-MASK BIT VALUE</th> <th>BIT</th> <th>ERROR NUMBER</th> <th>MEANING</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>0</td> <td>1</td> <td>Underfind instruction</td> </tr> <tr> <td>2</td> <td>1</td> <td>2</td> <td>No, of parameters abnormal</td> </tr> <tr> <td>4</td> <td>2</td> <td>3</td> <td>Parameter abnormal</td> </tr> <tr> <td>8</td> <td>3</td> <td>4</td> <td>Unused</td> </tr> <tr> <td>16</td> <td>4</td> <td>5</td> <td>Undefined character set</td> </tr> <tr> <td>32</td> <td>5</td> <td>6</td> <td>Position overflow</td> </tr> <tr> <td>64</td> <td>6</td> <td>7</td> <td>Unused</td> </tr> <tr> <td>128</td> <td>7</td> <td>8</td> <td>Unused</td> </tr> </tbody> </table>	E-MASK BIT VALUE	BIT	ERROR NUMBER	MEANING	1	0	1	Underfind instruction	2	1	2	No, of parameters abnormal	4	2	3	Parameter abnormal	8	3	4	Unused	16	4	5	Undefined character set	32	5	6	Position overflow	64	6	7	Unused	128	7	8
E-MASK BIT VALUE	BIT	ERROR NUMBER	MEANING																																		
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16	4	5	Undefined character set																																		
32	5	6	Position overflow																																		
64	6	7	Unused																																		
128	7	8	Unused																																		

ROTATE COORDINATE SYSTEM	Command type	RO n ;
	Parameter range	n = 0 or 90
	Function	<p>Rotates the system of plotter unit/user unit coordinates by 90°. Sets plotting in the vertical and horizontal direction regardless of the paper setting state.</p> <p>(0, 11200) (15400, 11200) (0, 0) (0, 15400)</p> <p>(0, 0) (15400, 0) (11200, 0) (11200, 15400)</p> <p>However, re-set the coordinate values of window area and scaling points P1 and P2, since they are not changed.</p>

AXES group

NAME	COMMAND TYPE & PLOTTING FUNCTION	
X TICK AND Y TICK	Command type	XT ; YT ;
	Parameter range	No parameter
	Function	The plotter plots the X scale in the vertical direction at the present location by the XT command, while it plots the Y scale in the horizontal direction at the same location by the YT command. Scale length is specified by the TL command. If no scale length is specified, the respective scale length of XT and YT are set to 0.5% of (P2x - P1x) and 0.5% of (P2y - P1y). ERROR 2 is set with the numeric parameter added, but the command is executed.
TICK LENGTH	Command type	TL tp (, tn) ; or TL ;
	Parameter range	$-128.0000 \leq tp, tn \leq 127.9999$
	Function	<p>The TL command is used when scale length is specified. Thus, the scale length is specified in the ratio of horizontal to vertical distance between scaling points P1 and P2.</p> <p>In addition, tp determines the length at the upper part drawn along the X-axis and that at the right part drawn along the Y-axis, supposing that P1 is the point at the left corner, while tn determines the length at the lower part drawn along the X-axis and that at the left part drawn along the Y-axis. The value specified by tp and tn becomes the ratio of (P2y - P1y) to the vertical distance when the XT command is used, while it becomes the ratio of (P2x - P1x) to the horizontal distance when the YT command is used. When the plotter is initialized, it automatically sets the scale length to 5.0% of (P2y - P1y) and (P2x - P1x). Similarly, they are set to the same values when TL is executed without parameter.</p> <p>The TL command is actually retained until the other command is executed, or IN or DF command is executed.</p>

9. Alarm processing

(1) Alarm display

The conditions under which the ALARM lamp on the operation panel is lit to inform the operator of errors are as follows:

- ① When any recognizable command is executed.
- ② When parameter values are incorrect.
- ③ When unuseable parameters are used.
- ④ When an unuseable character set is specified.
- ⑤ When off-scale occurs.

The conditions of ① to ④ can be marked by the input mask command (IM), respectively. In addition, an error may not occur under the above conditions depending on commands. Therefore, refer to the description of each command.

(2) Error signal

ERROR signal turns ON when the ALARM lamp is lit under the conditions of ① to ④. However, it turns OFF when the lamp is extinguished.

The ERROR signal does not turn ON even in pen off-scale if the parameter is specified in the operation area.

(3) Error recovery

The conditions under which the alarm display disappears and the ERROR status is recovered are as follows:

- ① When the initialize command (IN) is entered. In this case, each parameter is initialized.
- ② When the manual pen key is operated. In this case, the pen operators according to that key, and the ALARM lamp is extinguished.
- ③ When the ALARM lamp is lit due to off-scale, it is automatically extinguished if the pen returns back within the plotting area.

10 Appendix

10-1 Table of commands

Command	Format	Description
AA	AAx,y,a(,c);	Draws a circular arc centering around the specified point.
AR	ARΔx, Δy,a(,c);	Draws a circular arc centering around the point relatively positioned with respect to the present pen position.
CA	CAn;	Specifies one character among character set as alternate pen position.
CI	CIr(,c);	Draws a circle with the specified radius and chord angle.
CP	CPw,h;	Moves the pen by the specified number in the character space.
CS	CSn;	Specifies one character among character set as standard character set.
DF	DF;	Initializes the specific plotter function.
DI	DIΔx, Δy;	Changes a character direction to the specified absolute direction.
DR	DRΔx, Δy;	Changes a character direction to the specified relative direction.
DT	DTC;	Changes the label terminator from its initial value.
EA	EAx,y;	Draws a rectangular frame defined on the absolute coordinates.
ER	ERΔx,Δy;	Draws a rectangular frame defined on the relative coordinates.
EW	EWr,s,a,(,c);	Draws a circular arc with the specified radius.
FT	FT(t,(,S(,a)));	Specifies hatching type.
IM	IMe;	Specifies an error mask code.
IN	IN;	Returns the graphic condition back to that at the time of power-ON.
IP	IPP1x,P1y, P2x,P2y;	Specifies the coordinates of scaling points P1 and P2.
IW	IWxLL,yLL, xUR,yUR;	Specifies the window area.
LB	LBc1,c2...(ETx)	Prints out the text and characters.
LT	LT(,ℓ);	Specifies scale length.

PA	PAX1,y1(x2,y2);	Moves the pen to the point specified by the coordinates of X and Y.
PD	PDx1,y1(x2,y2);	Lowers the pen during plotting.
PR	PRx1,y1(x2,y2);	Moves the pen by the amount of movement relatively specified with respect to the present position.
PT	PTt;	Determines the distance being smeared away.
PU	PU;	Lifts the pen during plotting.
RA	RAX,y;	Defines the square used with the absolute coordinates and makes hatching.
RO	RO 0(or 90);	Rotates a system of plotter unit/user unit coordinates by 90 .
RR	RRAx,Δy;	Defines the square used with the relative coordinates and makes hatching.
SA	SA;	Selects alternate character set.
SC	SCxmin,ymin, xmax,ymax ;	Sets a system of user unit coordinates.
SI	SIw,h;	Specifies character and symbol sizes.
SL	SLa;	Specifies inclination of each character.
SM	SMc;	Draws a character centering around the vector end point.
SP	SPn;	Selects and stores the pen.
SR	SRw,h,	Specifies character and symbol sizes at the distance ratio of P1 to P2.
SS	SS;	Selects standard character set.
TL	TLtp(,tn);	Specifies scale length.
UC	UC(p,ΔX1,ΔY1, p(,ΔX2,ΔY2...));	Draws a user character.
VS	VSv;	Specifies pen-down speed.
WG	WGr,s,a(,c);	Makes hatching in a circular arc with the specified radius.
XT	XT;	Draws the scale on the X-axis in the vertical direction at the present location.
YT	YT;	Draws the scale on the Y-axis in the horizontal direction at the present location.

10.2 Code table

DECIMAL VALUE	SET																		
	0	1	2	3	4	6	7	8	9	30	31	32	33	34	35	36	37	38	39
33	|	|	|	|	|	|	λ	.	|	|	|	|	|	|	|	|	|	|	|
34	"	"	"	"	"	"	∧	∩	"	"	"	"	"	"	"	"	"	"	"
35	#	#	£	£	£	#	E	J	#	#	#	#	#	£	£	£	£	#	S
36	\$	\$	\$	\$	\$	\$	E	∩	□	□	□	\$	\$	\$	\$	\$	\$	\$	\$
37	x	x	x	x	x	x	E	.	x	x	x	x	x	x	x	x	x	x	x
38	℞	℞	℞	℞	℞	℞	∩	∩	℞	℞	℞	℞	℞	℞	℞	℞	℞	℞	℞
39	.	.	.	.	.	.	Y	∩	.	.	.	.	.	.	.	.	.	.	.
40	<	<	<	<	<	<	∩	∩	<	<	<	<	<	<	<	<	<	<	<
41	>	>	>	>	>	>	∩	∩	>	>	>	>	>	>	>	>	>	>	>
42	*	*	*	*	*	*	∩	∩	*	*	*	*	*	*	*	*	*	*	*
43	+	+	+	+	+	+	∩	∩	+	+	+	+	+	+	+	+	+	+	+
44	.	.	.	.	.	.	∩	∩	.	.	.	.	.	.	.	.	.	.	.
45	-	-	-	-	-	-	0	∩	-	-	-	-	-	-	-	-	-	-	-
46	.	.	.	.	.	.	0	∩	.	.	.	.	.	.	.	.	.	.	.
47	/	/	/	/	/	/	∩	∩	/	/	/	/	/	/	/	/	/	/	/
48	0	0	0	0	0	0	-	-	0	0	0	0	0	0	0	0	0	0	0
49	1	1	1	1	1	1	∩	∩	1	1	1	1	1	1	1	1	1	1	1
50	2	2	2	2	2	2	∩	∩	2	2	2	2	2	2	2	2	2	2	2
51	3	3	3	3	3	3	.	∩	3	3	3	3	3	3	3	3	3	3	3
52	4	4	4	4	4	4	∩	∩	4	4	4	4	4	4	4	4	4	4	4
53	5	5	5	5	5	5	∩	∩	5	5	5	5	5	5	5	5	5	5	5
54	6	6	6	6	6	6	∩	∩	6	6	6	6	6	6	6	6	6	6	6
55	7	7	7	7	7	7	∩	∩	7	7	7	7	7	7	7	7	7	7	7
56	8	8	8	8	8	8	∩	∩	8	8	8	8	8	8	8	8	8	8	8
57	9	9	9	9	9	9	∩	∩	9	9	9	9	9	9	9	9	9	9	9
58	:	:	:	:	:	:	∩	∩	:	:	:	:	:	:	:	:	:	:	:
59	:	:	:	:	:	:	∩	∩	:	:	:	:	:	:	:	:	:	:	:
60	∧	∧	∧	∧	∧	∧	∩	∩	∧	∧	∧	∧	∧	∧	∧	∧	∧	∧	∧
61	∩	∩	∩	∩	∩	∩	S	S	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩
62	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩
63	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩
64	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩	∩

DECIMAL VALUE	SET																			
	0	1	2	3	4	6	7	8	9	30	31	32	33	34	35	36	37	38	39	
65	A	A	A	A	A	A	Б	т	A	A	A	A	A	A	A	A	A	A	A	
66	B	B	B	B	B	B	В	щ	B	B	B	B	B	B	B	B	B	B	B	
67	C	C	C	C	C	C	С	ч	C	C	C	C	C	C	C	C	C	C	C	
68	D	D	D	D	D	D	Д	ц	D	D	D	D	D	D	D	D	D	D	D	
69	E	E	E	E	E	E	Е	ц	E	E	E	E	E	E	E	E	E	E	E	
70	F	F	F	F	F	F	Ф	ц	F	F	F	F	F	F	F	F	F	F	F	
71	G	G	G	G	G	G	Г	х	G	G	G	G	G	G	G	G	G	G	G	
72	H	H	H	H	H	H	Н	х	H	H	H	H	H	H	H	H	H	H	H	
73	I	I	I	I	I	I	И	/	I	I	I	I	I	I	I	I	I	I	I	
74	J	J	J	J	J	J	Д	\	J	J	J	J	J	J	J	J	J	J	J	
75	K	K	K	K	K	K	К	с	K	K	K	K	K	K	K	K	K	K	K	
76	L	L	L	L	L	L	Л	ц	L	L	L	L	L	L	L	L	L	L	L	
77	M	M	M	M	M	M	М	>	M	M	M	M	M	M	M	M	M	M	M	
78	N	N	N	N	N	N	Н	*	N	N	N	N	N	N	N	N	N	N	N	
79	O	O	O	O	O	O	О	х	O	O	O	O	O	O	O	O	O	O	O	
80	P	P	P	P	P	P	Р	с	P	P	P	P	P	P	P	P	P	P	P	
81	Q	Q	Q	Q	Q	Q	Т	\	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	Q	
82	R	R	R	R	R	R	Р	х	R	R	R	R	R	R	R	R	R	R	R	
83	S	S	S	S	S	S	С	с	S	S	S	S	S	S	S	S	S	S	S	
84	T	T	T	T	T	T	Т	т	T	T	T	T	T	T	T	T	T	T	T	
85	U	U	U	U	U	U	У	ц	U	U	U	U	U	U	U	U	U	U	U	
86	V	V	V	V	V	V	В	ш	V	V	V	V	V	V	V	V	V	V	V	
87	W	W	W	W	W	W	В	ш	W	W	W	W	W	W	W	W	W	W	W	
88	X	X	X	X	X	X	Х	/	X	X	X	X	X	X	X	X	X	X	X	
89	Y	Y	Y	Y	Y	Y	У	/	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
90	Z	Z	Z	Z	Z	Z	З	/	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	
91	Г	Г	Г	Г	Г	Г	У	□	Г	Х	Х	Е	Х	.	Г	.	и	Х	Е	
92	/	г	Ф	Е	и	*	Е	ц	/	У	В	В	В	Ф	/	Ф	И	С	В	
93	]]	]]	]]	]]	]]	]]	У	/]]]]]]]]]]]]]]]]]]]]]]	
94	'	↑	'	'	'	'	В	"	'	'	У	'	'	'	'	'	'	'	'	
95	—	—	—	—	—	—	В	·	—	—	—	—	—	—	—	—	—	—	—	
96	\	\	\	\	\	\	А	·	\	\	Б	\	\	\	\	\	\	\	\	

DECIMAL VALUE	SET																			
	0	1	2	3	4	5	6	7	8	9	30	31	32	33	34	35	36	37	38	39
97	a	a	a	a	a	a	X			a	a	a	a	a	a	a	a	a	a	a
98	b	b	b	b	b	b	a			b	b	b	b	b	b	b	b	b	b	b
99	c	c	c	c	c	c	b			c	c	c	c	c	c	c	c	c	c	c
100	d	d	d	d	d	d	a			d	d	d	d	d	d	d	d	d	d	d
101	e	e	e	e	e	e	i			e	e	e	e	e	e	e	e	e	e	e
102	f	f	f	f	f	f	i			f	f	f	f	f	f	f	f	f	f	f
103	g	g	g	g	g	g	o			g	g	g	g	g	g	g	g	g	g	g
104	h	h	h	h	h	h	o			h	h	h	h	h	h	h	h	h	h	h
105	i	i	i	i	i	i	o			i	i	i	i	i	i	i	i	i	i	i
106	j	j	j	j	j	j	a			j	j	j	j	j	j	j	j	j	j	j
107	k	k	k	k	k	k	a			k	k	k	k	k	k	k	k	k	k	k
108	l	l	l	l	l	l	a			l	l	l	l	l	l	l	l	l	l	l
109	m	m	m	m	m	m	o			m	m	m	m	m	m	m	m	m	m	m
110	n	n	n	n	n	n	y			n	n	n	n	n	n	n	n	n	n	n
111	o	o	o	o	o	o	y			o	o	o	o	o	o	o	o	o	o	o
112	p	p	p	p	p	p	v			p	p	p	p	p	p	p	p	p	p	p
113	q	q	q	q	q	q	v			q	q	q	q	q	q	q	q	q	q	q
114	r	r	r	r	r	r				r	r	r	r	r	r	r	r	r	r	r
115	s	s	s	s	s	s				s	s	s	s	s	s	s	s	s	s	s
116	t	t	t	t	t	t				t	t	t	t	t	t	t	t	t	t	t
117	u	u	u	u	u	u				u	u	u	u	u	u	u	u	u	u	u
118	v	v	v	v	v	v	-			v	v	v	v	v	v	v	v	v	v	v
119	w	w	w	w	w	w	#			w	w	w	w	w	w	w	w	w	w	w
120	x	x	x	x	x	x	#			x	x	x	x	x	x	x	x	x	x	x
121	y	y	y	y	y	y	a			y	y	y	y	y	y	y	y	y	y	y
122	z	z	z	z	z	z	a			z	z	z	z	z	z	z	z	z	z	z
123	<	;	:	:	|	<	<			<	;	;	;	;	<	<	.	.	.	.
124	|	T	.	.	|	|	|			|	;	;	;	;	;	;	;	;	;	;
125	>	;	:	:	|	>	>			>	;	;	;	;	;	;	;	;	;	;
126	~	~	.	.	|	~	#			~	;	;	;	;	;	;	;	;	;	;
127																				

“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 cause the user at his own expense will required to take whatever measures may be required to correct the interference.”

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