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Chapter 1 Introduction

1.1 Features

- The DSP-800F is a Vacuum Fluorescent Display which displays 20 columns and 2 lines, and the DSP-900 is a Vacuum Fluorescent Graphic Display which displays 192x16 dots.

- Blue-green fluorescent color is easy on the eyes.

- The display panel is movable so that it can be adjusted for the best viewing angle.

- The customer display have different height by adjusting the support.

- The interface of customer display is RS-232C, with baud rates from 1200 up to 9600 bps.

- The customer display have provided the pass through function to reduce the cable connection.

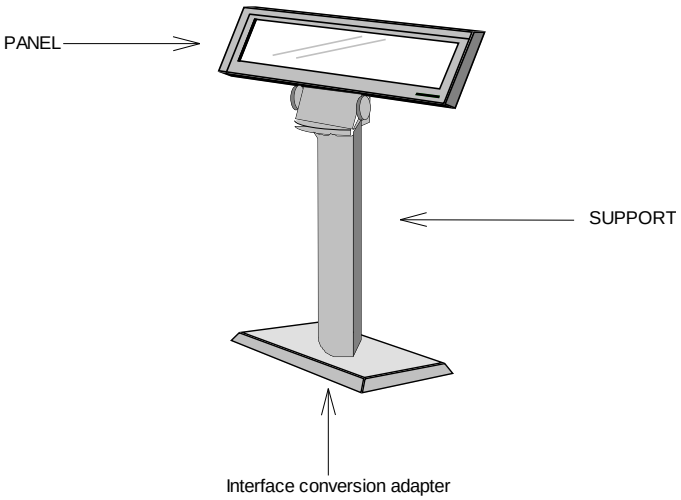
- The selftest function check the circuit board and performs each function for diagnostic purpose.

- The user defined and international character sets are the standard of customer display.

- The DSP-900 has support 512K bytes customer character ROM.

1.2 Outline

The customer display outline have included of three parts: the panel, the support, and the interface adapter



your VFD customer display should has following accessories:

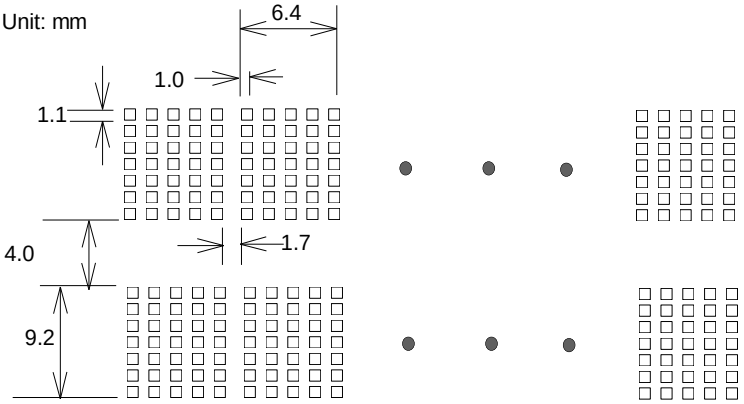
Item	Part Number	Dimension (mm)	Qty	Description
1	MP221R44VFD01		1	Utility Diskette
2	MP150CD200200		1	User Menu
3	MP01FIN5V1AK0*	46 (W) x 71 (D) x 40 (H)	1	Adapter 5V/1A (UL, TUV,CSA)
4	MP53TP308DNI0		4	Screw P3x8 for Interface conv. unit
5	MP53WF3R1FCL0		4	Screw for F3.1x15 interface conv. unit
6	SA02CD2002A00	224 (W) x 92(D) x 48(H)	1	Panel for DSP-800F
7	MP44VFDSUPTS0	88 (H), 25 (dim.)	1	Support (short)
8	MP44VFDSUPTS0	220 (H), 25 (dim.)	1	Support (long)
9	MP07BASE00ICD	182(W)x860(D)x3(H)	1	Metal parts
10	SA01CD2002BV2	186(W)x950(D)x50(H)	1	Interface conversion adapter
11	SA02CD9216A00	224 (W) x 92(D) x 48(H)	1	Panel for DSP-900

Chapter 2 General specification

2.1 Tube Display

(i) DSP-800F

Customer display	Vacuum Fluorescent Display Blue green
Display pattern	5 x 7 dot matrix
Brightness	700 cd/m^2
Character type	95 Alphanumeric & 32 international characters
Character size	6.4 mm (W) x 9.2 mm (H)
Character number	20 x 2
Character pitch	Refer the figure 2.1



(ii) DSP-900

Customer display	Vacuum Fluorescent Graphic Display Blue green
Display pattern	8x8 or 16x16 dot matrix
Display Area (X x Y)	140.6 x 35.0 mm
Number of dots (X x Y)	192x16
Dot size (X x Y)	0.4 x 0.4 mm
Luminance	515 cd /m^2
Character type	95 Alphanumeric & 32 international characters (for 8x8 font)

2.2 Electricity

Power source	DC +5V	
Power consumption	15 watts maximum 3 watts average	
Central control unit	CPU ROM RAM	8031 BH 32K flash ROM 32K SRAM
Speed	CPU	11.0592 MHz
Connector	8 pins phone jack, D-SUB 9, and 25 pins (female) connector	

2.3 Overall dimensions

Dimension (panel)	225 mm (W) x 50 mm (D) x 92 mm (H)
Dimension (support)	(382/298/160/74) mm (H) x 33 dia. mm
Dimension (base)	190 mm (W) x 96 mm (D) x 27 mm (H)
Viewing angle	Max. 45°
Horizontal rotation	Max. 340°
Weight	About 0.8 Kg

2.4 Environment

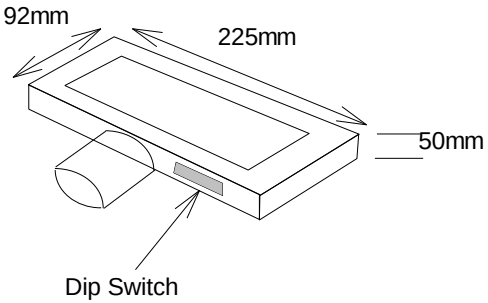
Operating temperature	+10℃ to +40℃
Storage temperature	-10℃to +50℃
Relative humidity	0% to 90% RH

2.5 Driver interface

Driver interface	RS232

2.6 DIP switch settings

The default protocol is 9600 bps, non-parity, 8 data bits, 1 stop bit and with DTR/DSR control.



2.6.1 DSP-800F dip switch setting (Version 3.04)

(i) baud Rate select

SW number SW1	Function description baud rate(bps)
OFF	9600
ON	4800

(ii) command type select

SW number			Function description	Software Defined
SW4	SW3	SW2	Command type	Hex code
OFF	OFF	OFF	DSP-800F	00
OFF	OFF	ON	EPSON Pos D101/D202	01
OFF	ON	OFF	UTC/S	02
OFF	ON	ON	UTC/P	03
ON	OFF	OFF	AEDEX	04
ON	OFF	ON	ULTIMATE	05
ON	ON	OFF	DSP800	06
ON	ON	ON	CD5220	07

(iii) international character set

SW number				Function description	
SW8	**SW7**	**SW6**	**SW5**	INTERNATIONAL CHARACTER SET(CODE 20H-7FH)	**Code table (code 80H-FFH)**
OFF	OFF	OFF	OFF	U.S.A.	PC-437 (USA, standard European)
OFF	OFF	OFF	ON	FRANCE	PC-850(multilingual)
OFF	OFF	ON	OFF	GERMANY	PC-850(multilingual)
OFF	OFF	ON	ON	U.K.	PC-850(multilingual)
OFF	ON	OFF	OFF	DENMARK I	PC-850(multilingual)
OFF	ON	OFF	ON	SWEDEN	PC-850(MULTILINGUAL)
OFF	ON	ON	OFF	ITALY	PC-850(multilingual)
OFF	ON	ON	ON	SPAIN	PC-850(multilingual)
ON	OFF	OFF	OFF	JAPAN	Katakana
ON	OFF	OFF	ON	NORWAY	PC-850(multilingual)
ON	OFF	ON	OFF	DENMARK II	PC-850(multilingual)
ON	OFF	ON	ON	SLAVONIC/RUSSIAN	
ON	ON	OFF	OFF	Factory define	
ON	ON	OFF	ON	Factory define	
ON	ON	ON	OFF	Factory define	
ON	ON	ON	ON	Factory define	

2.6.2 DSP-900 dip switch setting

(i) baud Rate setting:

SW8	SW7	Baud rate(bps)
OFF*	OFF*	9600
OFF	ON	4800
ON	OFF	2400
ON	ON	1200

(ii) power on string function enable/disable:

SW2	Function description
OFF*	Enable
ON	Disable

(iii) selftest function:

SW1	Function description
OFF*	Disable
ON	Enable

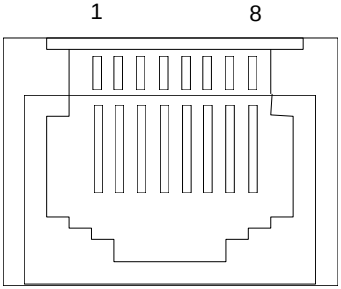
Chapter 3 Interface

3.1 Interface

-Specifications

Data transmission method : Asynchronous Serial.
Handshaking : DTR/DSR control
Default protocol : 9600 bps, non-parity, 8 data bits, 1 stop bit.

-Interface connector (display panel side)
-RJ45 type 8 pin modular jack
-Pin assignment:



-Connector signal assignment

Pin no.		I/O	Description
1	NC		No connection
2	TXD	OUTPUT	Transmit data
3	RXD	INPUT	Receive data
4	DSR	INPUT	Data set ready (from the printer)
5	GROUND		
6	DTR	OUTPUT	Data terminal ready (from the display)

7	Vp		Power supply (+5V)
8	Vgnd		Power supply (GND)

-Communication Protocol

1. Receive data.

The DTR signal is as follows:
[HIGH] This indicates that the display isn't ready to receive data.
It depend on the following conditions:

- ❑ The period from when the power is turned on to when the printer first becomes ready to receive data.
- ❑ When the remaining space in the receive buffer becomes 128 bytes or less.
- ❑ When the DTR signal of the printer is HIGH when the printer is selected using the command.

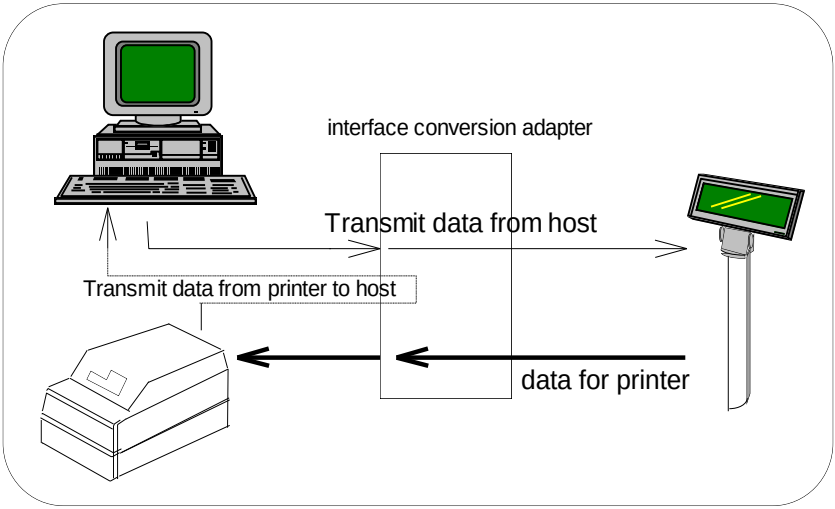
[LOW] This indicates that the display is ready to receive data.
It depend on the following conditions:

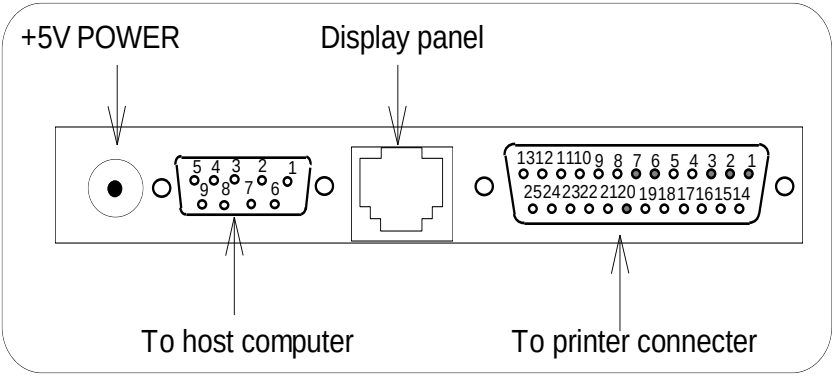
- ❑ When the printer first becomes ready to receive data after power-on.
- ❑ When the remaining space in the receive buffer becomes 128 bytes or more.
- ❑ When the DTR signal of the printer is LOW when the printer is selected using the command.

2. Transmit data.
After confirming the DSR is LOW, data is transmitted to printer.

3.2 Interface conversion adapter

The interface adapter section has connectors for the display panel, the printer, the power supply, and host computer. All the data transmitted from the host computer will be received by the display. If this data is for the display, the data will be processed, and if it is for the printer, it will be transmitted to the printer. Whether the data is for the display or the printer can be switched using the peripheral device selection command.



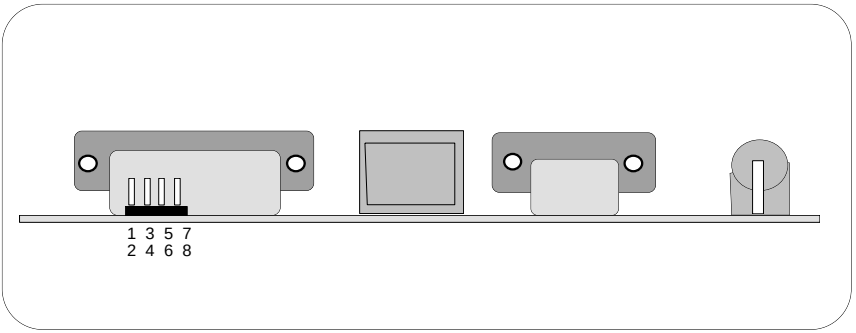


D-sub 25 pin connector signal assignment

Pin no.		I/O	Description
1	N.C.		No Connection
2	TXD	OUTPUT	Transmit Data
3	RXD	INPUT	Receive Data from DB-9 Pin#2
4	By Selection		N.C. or +5V
5	GND		Power GND
6	DSR	INPUT	Data Set Ready
7	GND		Power GND
20	DTR	OUTPUT	Data Terminal Ready from DB-9 Pin#4
22	By Selection		N.C. or +5V

D-sub 9 pin connector signal assignment

Pin no.		I/O	Description
1	NC		No Connection
2	By Pass		Connect with DB-25 Pin#3
3	RXD	INPUT	Receive Data
4	By Pass		Connect with DB-25 Pin#20
5	GND		Power GND
6	DTR	OUTPUT	Data Terminal Ready
7	By Selection		N.C. or +5V
8	GND		Power GND
9	By Selection		N.C. or +5V



D-sub 9 pin & 25 pine Power Source signal assignment

Jumper number	Description
1-2	The +5V power source is assign to No. 9 of 9 pin D-sub
3-4	The +5V power source is assign to No. 7 of 9 pin D-sub
5-6	The +5V power source is assign to No. 22 of 25 pin D-sub
7-8	The +5V power source is assign to No. 4 of 25 pin D-sub

The factory setting for this jumper is NULL, that means the customer display must have the +5V DC adapter. If there has any reason that user doesn't want to use the adapter, the engineer should set this jumper and provide the +5V power source to the correct pin number.

Chapter 4 Command Description

4.1 DSP-800F command set (Version 3.04)

4.1.1 DSP-800F command mode

Command	Code description(hex)	Function description
HT	09	Move cursor right(only valid in overwrite mode)
BS	08	Move cursor left(only valid in overwrite mode)
CR	0D	Move cursor to left-most position(only valid in overwrite mode)
ESC @	1B 40	Initialize customer display to initial state, clears display buffer, set display mode to shift and sets current display row to upper row
ESC U	1B 55	Select upper row as current row(initial default)
ESC D	1B 44	Select lower row as current row
ESC Aψ	1B 41ψ	Sets customer display disable or enable ψ- 'D'=disable,'E'=enable
ESC C r c	1B 43 r c	Move cursor to specified position(only valid in overwrite mode) -r Row('U'=upper, 'D'=lower -c Column number(range from 1~20)
ESC E rψ	1B 45 rψ	Set special effect or display mode of specified row
ESC R n	1B 52 n	Set international font sets -n international fonts code
ESC = n	1B 3D n n='1'-'3'	Select peripheral -n '1'=printer only, '2'=customer display only, 3=both peripheral

ESC % n	1B 25 n	Set font pattern -n 0=normal font set, 1=user font set
ESC & n s [p]	1b 46 n s data	Define user font pattern -n code for first character -s code for last character -data 5 bytes required for each character

(REMARK)*Using commands "ESC E rψ", the value of parameter

r 58=all rows
55=upper row
44=lower row

ψ special function, the value is one of
30= shift mode(default display mode)
31=rotation mode
32=blink mode
33=clear this row and switch to shift mode
34=overwrite mode
35=vertical mode

***Set international font set**

n	International font set
30h	U.S.A
31h	GERMANY
32h	FRANCE
33h	JAPAN

4.1.2 EPSON command mode

Command	Code description(hex)	Function description
HT	09	Move cursor right
BS	08	Move cursor left
US LF	1F 0A	Move cursor up
LF	0A	Move cursor down
US CR	1F 0D	Move cursor to right-most position
CR	0D	Move cursor to left-most position
HOM	0B	Move cursor to home position
US B	1F 42	Move cursor to bottom position
US $ x y	1F 24 x y x=1-20 y=01,02	Move cursor to specified position
CLR	0C	Clear display screen
CAN	18	Clear cursor line
US X n	1F 58 n 01<=n<=04	Brightness adjustment
US E n	1F 45 n n=00-ff	Blink display screen
ESC @	1B 40	Initialize display
ESC t n	1B 74 n n=00-0f	Select character code table
ESC R n	1B 52 n n=00-0f	Select international character set
US r n	1F 72 n n=00,01	Select/cancel reverse character
US MD1	1F 01	Specify overwrite mode
US MD2	1F 02	Specify vertical scroll mode
US MD3	1F 03	Specify horizontal scroll mode
ESC & s n m [a(pl..pa)x m-n	1B 26 1 n m [a(pl..pa)]x m-n 20<n<=m<=ff	Define download characters 20<n<=m<=ff a=1-5 p1..p5=row1..row5
ESC ? n	1B 3F n n= 20-7e	Cancel user-defined characters
ESC % n	1B 25 n n=00,01	Select/cancel download character set
ESC W n s x1y1x2y2	1b 57 n s x1 y1 x2 y2 n=1,2,3,4 s=0,1	Specify/cancel the window range 1<=x1<=x2<=20 1<=y1<=y2<=2
ESC = n	1B 3D n n=1,31 ,select printer n=2,32 ,select display	Select peripheral device
US :	1F 3A	Set starting/ending position of macro definition
US ^ n m	1F 5E n m 00<=(n,m)<=ff	Execute and quit macro

US @	1f 40	Execute self-test
US T h m	1f 54 h m 0<=h<=17 , 0<=m<=3b	Dispaly time
US U	1F 55	Display time continuously

4.1.3 UTC/S command mode(UTC standard mode)

Command	Code description(hex)	Function description
BS	08	Back space
HT	09	Horizontal tab
LF	0A	Line feed
CR	0D	Carriage return
DLE	0F	Display position
DC1	11	Over write display mode
DC2	12	Vertical scroll mode
DC3	13	Cursor on
DC4	14	Cursor off
ESC d	1B 64	Change to UTC enhanced mode
US	1F	Clear display

4.1.4 UTC/P command mode(UTC enhanced mode)

Command	Code description(hex)	Function description
ESC u A_.CR	1B 75 41 [data x 40]0D	Upper line display
ESC u B_.CR	1B 75 42 [data x 40]0D	Bottom line display
ESC u D_.CR	1B 75 44 [data x 40]0D	Upper line message scroll continuously
ESC u E_.CR	1B 75 45 hh ':' mm o 0D h,m='0'-'9'	Display time
ESC u F_.CR	1B 75 46 [data x 40]0D	Upper line message scroll once pass
ESC u H_.CR	1B 75 48 n m 0D 20h<=n,m	Change attention code
ESC u 1_.CR	1B 75 49 [data x 40]0D	Two line display
ESC RS_.CR	1B 0F 0D	Change to UTC standard mode

4.1.5 AEDEX command mode

Command	Code description(hex)	Function description
! # 1_.CR	21 23 31 [data x 40]0D	Upper line display
! # 2_.CR	21 23 32 [data x 40]0D	Bottom line display
! # 4_.CR	21 23 34 [data x 40]0D	Upper line message scroll continuously
! # 5_.CR	21 23 35 hh ':' mm o 0D h,m='0'-'9'	Display time
! # 6_.CR	21 23 36 [data x 40]0D	Upper line message scroll once pass
! # 8_.CR	1B 75 48 n m 0D 20h<=n,m	Change attention code
! # 9_.CR	21 23 39 [data x 40]0D	Two line display

4.1.6 ULTIMATE command mode

(1) Line Feeding

Command	Code description(hex)	Function description
Cntrl	0A	DC 1 Mode The cursor moves up or down to another row staying on the same line. DC 2 Mode When the cursor is in the second row the character displayed there, is shifted up to the first row, leaving the cursor at its present position, then the second row is cleared. When the cursor is in the first row, the cursor moves down to the second row.
Cntrl M	0D	The cursor moves to the least significant position of the same row.
Cntrl P	10	Instead of writing a character in the current position, the write-in

		starting position can be pointed by using this function. After writing 10HEX to prepare module for this command, another HEX byte is written to specify the position desired. A third byte reprexenting data is then sent.

ROW CHARACTER POSITION CHART (HEX)

1	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
2	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27

(2) Normal Display Mode (DC 1)

Command	Code description(hex)	Function description
Cntrl Q	11	After writing a character, the cursor is shifted to the right one position automatically. When the cursor is on the most significant position of the first row. The cursor moves to the least significant position of the second row, when the cursor is on the most significant position of the second row, the cursor moves to the least significant position of the first row.

(3) Vertical Scroll Mode (DC 2)

Command	Code description(hex)	Function description
Cntrl R	12	After writing the characters up to the most significant position of the second row, all characters displayed in the second row are shifted to the upper row (first row), clearing the second row. When the power is turned on, this DC 2 Mode is selected, and will be held until another mode is

		selected.
Cntrl --	1F	Resetting the module. All characters displayed are erased, then the write-in position (cursor position) is set on the least.

4.1.7 DSP800 command mode

Command	Code description(hex)	Function description
EOT SOH I n ETB	04 01 49 n 17	Select international character set.
EOT SOH P n ETB	04 01 50 n 17 n=31-58	Move cursor to specified position
EOT SOH C n m ETB	04 01 43 n m 17 31<=n<=m<=58	Clear display range from n position to m position and move cursor to n position.
EOT SOH S n ETB	04 01 53 n 17 n=31-33	Save the current displaying data to n layer for demo display
EOT SOH D n m ETB	04 01 44 n 17 n=31-37 m=31-33	Display the saved data
EOT SOH A n ETB	04 01 41 n 17 n=31-34	Brightness adjustment
EOT SOH F n ETB	04 01 46 n 17 00<=n<=FF	Blink display screen
EOT SOH = n ETB	04 01 3D n 17 n='1','2'	Select peripheral device N='1,', printer n='2', display
EOT SOH % ETB	04 01 25 17	Initialize display
EOT SOH @ ETB	04 01 40 17	Execute self-test

(REMARK)* About the command display the saved data

n	lay select	n	lay select	m	show mode
bit 0=1	lay 1	bit 3=1	lay 4	bit 0=1	show mode 1
bit 1=1	lay 2	bit 4=0	lay 5	bit 1=1	show mode 2
bit 2=1	lay 3				

4.1.8 CD5220 command mode

Command	Code description(hex)	Function description
ESC DC1	1B 11	Overwrite mode
ESC DC2	1B 12	Vertical scroll mode
ESC DC3	1B 13	Horizontal scroll mode
ESC Q A CR	1B 51 41 [N]x20 0D	Set the string display mode, write string to upper line
ESC Q B CR	1B 51 42 [N]x20 0D	Set the string display mode, write string to lower line
ESC Q D CR	1B 51 44 [N]xm20 0D m<40	Upper line message scroll continuously
ESC [D	1B 5B 44	Move cursor left
BS	08	Move cursor left
ESC [C	1B 5B 43	Move cursor right
HT	09	Move cursor right
ESC [A	1B 5B 41	Move cursor up
ESC [B	1B 5B 42	Move cursor down
LF	0A	Move cursor down
ESD [H	1B 5B 48	Move cursor to home position
HOM	0B	Move cursor to home position
ESC [L	1B 5B 4C	Move cursor to left-most position
CR	0D	Move cursor to left-most position
ESC [R	1B 5B 52	Move cursor to right-most position
ESC [K	1B 5B 4B	Move cursor to bottom position
ESC l x y	1B 6C x y 1<=x<=20, y=1,2	Move cursor to specified position
ESC @	1B 40	Initialize display
ESC W s x1 x2 y	1B 57 1 x1 x2 y 1<=x1<=x2<=20 y=1,2	Set or cancel the window range at horizontal scroll mode
CLR	0C	clear display screen, and clear string mode
CAN	18	clear cursor line, and clear string mode
ESC * n	1B 2A n 1<=n<=4	brightness adjustment

ESC & s n m [a(pl..pa)]x (m-n+1)	1b 26 1 n m [a(pl..pa)]x (m-n+1) 20<=n<=m<=7F	define download characters a=1-5 p1..p5=row1..row5

ESC ? n	1B 3F n 20<=n<=7F	delete download characters
ESC % n	1B 25 n n=1,0	select/cancel download character set.
ESC _ n	1B 5F n n=1,0	set cursor ON/OFF
ESC f n	1B 66 n	select international fonts set
ESC c n	1B 63 n	select fonts, ASCII code or JIS code
ESC = n	1B 3D n n=1,2,3,31,32,33	select peripheral device, Display or Printer

(REMARK)

*While using command “ESC QA” or “ESC QB”, these two commands could using combine with terminal printer—TP 2688 or TP3688

* If using commands “ESC QA” or “ESC QB”, others commands cannot be used except using command “CLR” or “CAN” to change operating mode.

* If using commands “ESC QD”, upper line message move continuously, till receive a new command, and clear upper line and move cursor to upper line left-most position.

Set international font set

n	International font set	n	International font set
A	U.S.A	N	NORWAY
G	GERMANY	W	SWEDEN
I	ITALY	D	DENMARK I
J	JAPAN	E	DENMARK II
U	U.K.	L	SLAVONIC
F	FRANCE	R	RUSSIA
S	SPAIN		Reserved

Select code Table

n	International
A	compliance with ASCII code
J	compliance with JIS cocde
R	compliance with RUSSIA code
L	compliance with SLAVONIC code

4.2 DSP-900 command set

Command	Code description(hex)	Function description
HT	09	Move cursor right(only valid in overwrite mode)
BS	08	Move cursor left(only valid in overwrite mode)
CR	0D	Move cursor to left-most position(only valid in overwrite mode)
ESC @	1B 40	Initialize customer display to initial state, clears display buffer, set display mode to shift and sets current display row to upper row
ESC U	1B 55	Select upper row as current row(initial default)
ESC D	1B 44	Select lower row as current row
ESC Aψ	1B 41ψ	Sets customer display disable or enable ψ- 'D'=disable, 'E'=enable
ESC C r c	1B 43 r c	Move cursor to specified position(only valid in overwrite mode) -r Row('U'=upper,' D'=lower -c Column number(range from 1~20)
ESC E rψ	1B 45 rψ	Set special effect or display mode of specified row
ESC R n	1B 52 n	Set international font sets -n international fonts code
ESC = n	1B 3D n n='1'-'3'	Select peripheral -n '1'=printer only, '2'=customer display only '3'=both peripheral
ESC % n	1B 25 n	Set font pattern -n 0=normal font set 1=user font set 2=chinese character font
ESC & n s [p]	1b 46 n s data	Define user font pattern -n code for first character -s code for last character -data 5 bytes required for each character

ESC * x y w h [b]	1b 2A x y w h [b]	-x Initial upper left x position(0 to 191) -y Initial upper left x position(0/1) -w bit image width (1 to 192) -h bit image height(1/2) -[b] bit image string

(REMARK)

*Display Chinese font

step 1: send “ESC % 2” to let DSP-900 enter Chinese mode

step 2: send any ‘BIG 5’ code to DSP-900 for Chinese character display

*Using commands “ESC E rψ”, the value of parameter

r 58=all rows
55=upper row
44=lower row

-ψ special function, the value is one of
30=shift mode(default display mode)
31=rotation mode
32=blink mode
33=clear this row and switch to shift mode
34=overwrite mode
35=vertical mode

*Set international font set

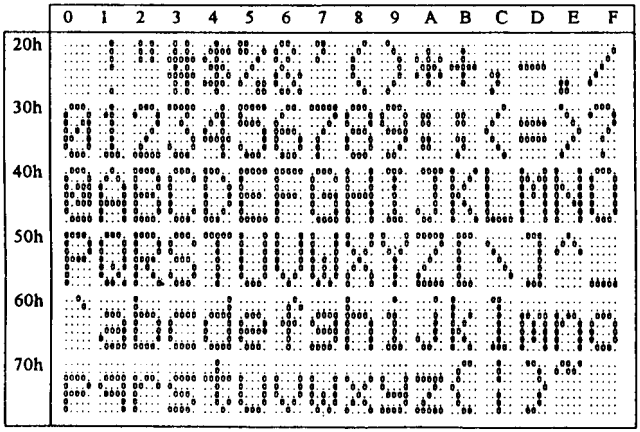
n	International font set
30h	W. S.A
31h	GERMANY
32h	FRANCE
33h	JAPAN

Chapter 5 Character Set

(1)Control code set

HEX	CODE	HEX	CODE
00H	NULL	10H	DLE
01H	MD1	11H	DC1
02H	MD2	12H	DC2
03H	MD3	13H	DC3
04H	MD4	14H	DC4
05H	MD5	15H	
06H	MD6	16H	
07H	MD7	17H	
08H	BS,MD8	18H	CAN
09H	HT	19H	
0AH	LF	1AH	
0BH	HOM	1BH	ESC
0CH	CLR	1CH	
0DH	CR	1DH	
0EH	SLE1	1EH	SF1
0FH	RS,SLE2	1EH	US,SF2

(2)U.S.A font set



(3)International character selection(Indicated character selection by dip switch or command)

ASCII CODE

No.	International	23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
0	USA												
1	FRANCE												
2	GERMANY												
3	U.K.												
4	DENMARK I												
5	SWEDEN												
6	ITALY												
7	SPAIN												
8	JAPAN												
9	NORWAY												
10	DENMARK II												
11	SLAVONIC												
12	RUSSIA												

CHAPTER 6 INSTALLATION GUIDE