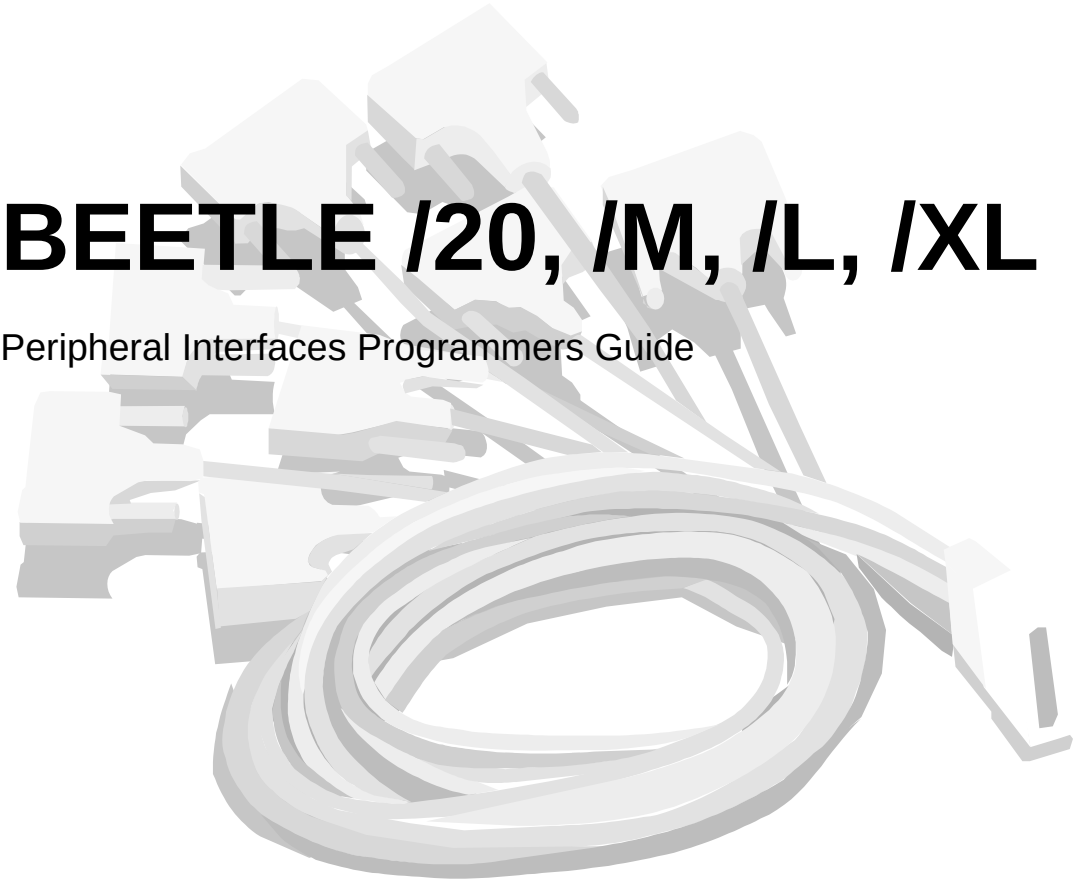
WINCOR
NIXDORF

BEETLE /20, /M, /L, /XL

Peripheral Interfaces Programmers Guide



Published by
Wincor Nixdorf GmbH & Co. KG
D-33094 Paderborn
D-13629 Berlin

Printed in Germany

BEETLE /20, /M, /L, /XL

Peripheral Interfaces Programmers Guide

Edition October 1998

Contents

Introduction **1**

Overview of relevant PC type hardware ports **2**

Interrupt Assignments **4**

Overview of the POS specific CPU ports **5**

Some General Hints at Timer and Keyboard **11**

Customer and Operator Displays **12**
BA63 12
BA66 13
Internal LC-Display (B/20, B/50, B/60) 16
Function of Register 16
Instruction 17
Character Patterns and Character Codes 24
Character Generator RAM (CG RAM) 24
Initialize (Reset) 26
Internal graphical LC-Display B/20 28
Installation 28
Configuration 28
BA69 (VGA/4) 34
What does VGA /4 mean? 34
Hardware design 35
LCD Display 36
Technical Data 37
1/4-Controller 37

Scanner **38**
Mode A 38
Mode B 38
Handshake Timing (RTS / CTS) 39
Transmission Formats (Prefix/Suffix) 39

Cash Drawers **41**

Access to NVRAM **42**

Power Management **44**

Keyboards **46**
TA61 46
Introduction 46
TA85 49
General 49
Keypad 49
LEDs 50
Technical data 50
TA64/TA125 51
General 51
Keypad 51
Self-test 51
Technical data 52
The Key-Lock-Switch 52
DOS Protocol 53
Windows Protocol 53
The Swipe-Card-Reader 60
Keyboard Code Tables 65
Double Size and Quad Size Keys 65
Code Assignment Philosophy 65
TA61 (60 keys) 66
TA84 (84 keys) 67
TA125 / TA64 (125 keys) 68

POS Printers **69**
BEETLE /20 One Station Printer 69
Default Setup 69
Serial Interface 69
Control Sequences of the One Station Printer BEETLE /20 71
BEETLE /20 Two Stations Printer 96
Default Setup 96
Serial Interface 96
Control Sequences of the Two Stations Printer BEETLE /20 98
ND69 142
Default Setup 142
Serial Interface to the System 142
DIP Switches 144
Control Sequences of the ND69 Printer 146
Notation of the Command Description 149
Description of the Control Characters and Sequences 149
AXIOHM 793 188
Commands 188
Command List 188

Command Descriptions....194
Printer Function Commands....194
Print Characteristics Commands....202
Graphics Commands....207
Printer Status Commands....211
Real Time Commands....213
Real Time Status Transmission....216
793 Clear Printer Command....221
Recognizing Data from the Printer....221
Bar Code Commands....222
AXIOHM 756....225
Command List....225
Printer Function Commands....225
Print Characteristics Commands....228
Station Select Commands....229
Graphics Commands....229
Printer Status Commands....229
Real Time Commands....230
Bar Code Commands....230
MICR Reader Commands....231
Command Descriptions....231
Printer Function Commands....232
Print Characteristics Commands....246
Station Select Commands....252
Graphics Commands....254
Printer Status Commands....258
Real Time Commands....260
Bar Code Commands....269
MICR Reader Commands....271

SNIkey DSTN and SNIkey TFT....273
SNIkey DSTN....273
Software Interfaces....273
Touch Screen....274
LCD Flat Screen....274
Automated Logic Diagram (ALD) and Pin Assignments....275
SNIkey TFT....277
Software Interfaces....277
Softkey Codes....278
Touch Screen....279
TFT LCD Flat Screen....279
Automated Logic Diagram (ALD) and Pin Assignments....280
SNIkey Interface....280
Keyboard Controller with Switch....280

Pin Assignments 281
Important Considerations Before Starting Setup....283
Installing the SNIkey controller....283
Resolution and maximum number of colors 283
Considerations about assignment of COM port addresses and interrupts 284
Adding COM ports....287
Using shared interrupts....288
Installing the Touch Screen Software 289

Introduction

This is not the place to describe the industry standard PC architecture from a hardware point of view in full detail, although one should, of course, be familiar with it, when writing a driver. Instead we concentrate on the ports relevant for driving peripherals.

When you are writing your own drivers instead of using the RDI, you should be aware that:

- you lose the Runtime Diagnostics Support of RDI
- you will maybe have to implement installation utilities too, since those delivered with the RDI either cannot be used at all or only partly
- when writing drivers for only few peripherals, you have to check whether your and the RDI drivers used can coexist
- your drivers may get dependent on hardware changes; this is not a nonsense argument, as this already has happened with the introduction of the latest CPU generation

On the other hand, you may want to write drivers for operating systems other than those supported by RDI.

Considering MS-DOS systems, using other programming languages than Microsoft C should no longer be a reason for deciding to write own drivers, as soon there will be support for Borland C as well as Turbo or Borland PASCAL released, and the technique used will be available to implement interfaces for other compilers, too.

Overview of relevant PC type hardware ports

The RS232 ports used with the BEETLE system are all of the 16550A type, and the reader should be familiar with these types.

COM1 and COM2 are part of the chip set. COM3 and COM4 are implemented by a 16550A type chip on the motherboard, the so-called COM5 is only available if one has that piggy back card.

The port base addresses of COM1..COM4 can be found as usual in the BIOS data area. You also can see here if a port was disabled by the BIOS setup to be able to insert e.g. a modem card. But no consideration was made about whether the firmware of such a modem card would enter something in the BIOS data area!

```
40:0    3F8H  COM1   <--  =0 at boot time, if disabled!!
40:2    2F8H  COM2
40:4    3E8H  COM3
40:6    270H  COM4
```

The BIOS data area provides space for 4 COM port addresses only, so for COM5 the address has to be assumed fixed to 2E8H.

COM2, COM3, COM4, and COM5 have a female connector with power intended to drive connected peripherals. Pin 1 has 12 Volts, pin 9 has 5 Volts. Hence, DCD as well as RI are not available here. Usage of DCD and RI is for communication, and not required for peripherals. To connect a standard peripheral cable, a gender changer can be used. Note, that some rare cables you take off your shelf could have a bridge, so that on the PC side DCD is e.g. connected to CTS. In this case a problem could occur, if CTS flow control is to perform, since CTS would permanently have the same voltage as at the DCD pin, which is 12 Volts.

Note that when peripherals are connected to the system requiring power, the maximum possible power that the power supply provides has to be observed!

COM1 is without power. It has the familiar male connector and all the modem signals are available.

One additional remark should be made in case you write a driver for a COM port. The line status of PC type (16x50) ports provides so-called 'delta signals' for CTS change, DSR change, DCD change. From our experience it is not recommendable to rely on these delta signals without additional checks, because in the Retail environment with conveying belts etc. transients have to be taken into account.

The LPT (Centronics type) port address is 378H.

Interrupt Assignments

The interrupt assignments contain the industry standard plus the POS specific additions. The following table shows the assignments in priority order, highest priority first.

Interrupt request	Assigned to	Standard "S" POS specific "P"
IRQ0	Timer (55 MSc interval for DOS)	S
IRQ1	Keyboard	S
IRQ8	Real-time clock	S
IRQ9	Power fail	P
IRQ10	shared COM3, COM4 (default at delivery) COM3 only (when jumpered this way)	P
IRQ11	COM4 (when jumpered this way)	P
IRQ12	COM5 (Asynchronous piggy back board)	P
IRQ13	not available (for coprocessor only)	S
IRQ14	Hard disk	S
IRQ15	Spare	S
IRQ3	COM2	S
IRQ4	COM1	S
IRQ5	LAN board (recommended)	S
IRQ6	Floppy disk controller	S
IRQ7	Parallel (LPT) interface	S

Overview of the POS specific CPU ports

The boards with WD chip sets had, beside some minor differences, a completely different and much more sophisticated implementation of the External EMS functions. So for the programmer of a driver concerning External EMS now the task becomes much easier. The ports on the CPU board added to the common PC architecture in the following are referred to as the POS specific CPU ports.

The general idea of the implementation of most of the POS specific CPU ports is, that the state of the various ports can be read by the drivers. This is important as there are ports which have control bits to control completely different hardware, e.g. memory card and cash drawer. A driver that wants to access the memory card, however, must not open the cash drawer accidentally by changing the corresponding control bit. So the general regime to do output to these ports is:

- request semaphore if required, e.g. CLI
- first read the state of the control bits from port xyz
- set relevant control bits then write the control bits to same port xyz
- release semaphore if required, e.g. STI

This regime is relevant for ports:

310H	cash drawer, numeric customer display, NVRAM, memory card
318H	flash memory card, flash BIOS, power management
319H	External EMS, i.e. NVRAM and memory card
31AH	External EMS

The intention on the hardware side is to save hardware ports and on the software side to avoid a necessity of communication between drivers written separately. Note, however, that in a case where two drivers do access the same port, and one could be interrupted by the other, a convention for mutual exclusion by a semaphore is required. Of course, if a CLI/STI semaphore mechanism is required, the time between CLI and STI should be very short to avoid loss of interrupts.

310H Input

LAZU2N	LAZU1N	BLKU	<-don't chg->	ROD	<-don't chg->

LAZU1N = 0 Cash drawer 1 closed or not present
LAZU2N = 0 Cash drawer 2 closed or not present
BLKU = 1 no display on numeric (9 digit) customer display

310H Output

KLA2	KLA1	BLKU	<- as read!->	ROD	<- as read!->

KLA1 = 1 Open cash drawer 1
KLA2 = 1 Open cash drawer 2
BLKU = 1 no display on numeric (9 digit) customer display
ROD = 0 Select memory card
1 Select NVRAM / ROM-Disk

314H Input

Operator Display Data

Port to output integrated operator display (4 * 20 chars) data

314H Output

Operator Display Data

Port to allow reading integrated operator display data

315H Input

BSYBE	Operator Display Address counter

BSYBE = 1 Indicator operator display busy, no data can be written

Bits 6..0: operator display address counter

315H Output

Operator Display Command

Port to write commands to the operator display

317H Input

BSYKU	<-- these bits have an undefined value -->

BSYKU = 1 numeric customer display busy, no data can be written

The values of the other bits of this port are undefined.

317H Output

Customer Display Data

Port to write data to the numeric customer display. Some special characters are treated as commands.

318H Input

<-- don't change -->	AKLOW	d. c.	QC	PWGOOD	AKOFF

AKLOW = 1 Battery discharged or not present

This bit doesn't tell too much, so e.g. AKLOW = 0 doesn't say that the battery is well charged. It is also not predictable what the influence of the load will be and how long power can be provided for some given peripheral load.

QC	= 1	Battery currently loaded in quick charge mode, 0 means trickle charge mode
PWGOOD	= 1	Mains voltage and secondary voltage present
AKOFF	= 1	Battery is disconnected

Other bits must not be changed.

318H Output

<-- output as read -->	SLEEP	0	QC	0	AKOFF

SLEEP = 1 Sleep mode, i.e. disconnect power from external ports and backlight of the operator display, CPU boards with 486DX2 processor (Intel Aries chip set) only

This bit is an exception from the general rule, that bits not to be changed should be output as read before. So SLEEP = 0 should be output normally, unless switch into sleep mode is explicitly required.

319H Input

Page number PN7 .. PN0

The port is used to read the low 8 bits of the currently active external EMS page. The page size is always 16 KB. External EMS is used to map 16 KB of memory card or NVRAM memory down into the 1 MB memory space. The active page is always mapped to address EC00:0, which is the 16 KB memory area just below the BIOS.

319H Output

Page number PN7 .. PN0

PN7 .. PN0

Serves to set the low 8 bits of the currently active EMS page. Before writing a new active page the old page and the state of the EXEMSE bit (see below) must be read and saved. After having completed the actions to a page the saved old page and the state of the EXEMSE bit must be restored.

31AH Input

undefined value	EXEMSE	PN11	PN10	PN9	PN8

EXEMSE = 1 External EMS enabled

Only if this bit is set = 1 a mapping of an external EMS page down to EC00:0 takes place.

PN11 .. PN8 high 4 bits of (maybe) active external EMS page.

31AH Output

0	0	0	EXEMSE	PN11	PN10	PN9	PN8

EXEMSE = 1 Enable External EMS

PN11 .. PN8 high 4 bits of external EMS page to activate

Before writing a new active page number the old page number and the state of the EXEMSE bit must be read and saved. After having completed the actions to a page the saved old page and the state of the EXEMSE bit must be restored.

Some General Hints at Timer and Keyboard

In the DOS environment you often can find people recommending to use INT 1CH for timers. In nearly all cases this is bad. Bad enough that in the PC architecture the timer has the highest interrupt priority! But INT 1CH is called from all BIOS versions known to us before (!) the EOI is given to the interrupt controller. So other interrupts are further disabled during the INT 1CH activity! It is better to implement timers according to the "After you" strategy:

- at installation time of the driver read old IRQ0 vector using INT 21H function 35H and save it
- install timer routine using INT 21H function 25H to enter the address of your timer routine in the IRQ0 vector
- your timer routine, when called, should first do a PUSHF and a far call to the old IRQ0 vector saved and after that do its own things

Another point is access to the keyboard from a TSR by taking over IRQ1 and direct port I/O to the keyboard controller e.g. to implement hot keys. In the old PC/XT days there was no other method available. But PC/XT should be obsolete nowadays. Preferable is to enter the own routine into the INT 15H handler chain in order to look for a function 4FH call.

The method just mentioned is used with the sample program handling the magnetic card reader and key lock for TA61 and TA57 keyboard.

The central part is built by a finite state machine dealing with the processing of magnetic card reader and key lock switch data. The finite state machine is called by the INT 15H, function 4FH handler. The finite state machine returns a flag that tells the handler, whether or not the data are to be processed by the (BIOS or DOS) keyboard handler. For more details see the keyboard description and the sample code.

Customer and Operator Displays

BA63

The alphanumeric customer display BA63 supports the same set of control characters and escape sequences as the operator display.

As mentioned above it makes sense to avoid writing a driver using interrupts for the alphanumeric customer display.

The sample code SENDCOM4.ASM for the customer display is implemented with polling. So it is independent of the jumper configuration for the COM3 and COM4 interrupts. The underlying strategy is, that the BA63 is handled as an output device only. In case of output only serial devices it is possible to do the job with polling. With serial input devices, however, the PC type serial ports architecture will sooner or later lead to loss of data. The same will occur, when using BIOS INT 14H.

If the decision is made to implement an interrupt driven handler for COM4, you should be aware that it leads to the requirement of implementing an interrupt driven handler for COM3 too, unless you want to carry the burden of changing the jumpers during installation and you can afford loosing an IRQ.

Here is not the place to teach programming PC serial ports. So you should be or become either familiar with that material or use a commercial product.

The escape sequences supported are the same as that of the BA66. See above for a short overview and also the BA63 manual or the System Guide.

BA66

The operator display has 4 lines with 20 characters each. There are two types of operator displays. The integrated LCD (with backlight) is accessed by ports 314H and 315H. The external operator display (Vacuum Fluorescence Display, VFD) is always connected to the COM3 RS232 port (with power). The reasons why it has to be COM3 are:

- The BIOS assumes the operator display only at COM3 in case no VGA card was found, then it is needed for BIOS setup and to display BIOS messages
- Systems with MF (Fiscal Memory) require it to be connected to COM3

For BEETLE systems running under MS-DOS there are the drivers POSDISP.SYS for the integrated LCD and POSODCOM.SYS requiring POSCOM.SYS for the external operator display. POSDISP.SYS and POSODCOM.SYS have an MS-DOS character device driver (name "DISP") interface. They offer a small VT100 subset to position the cursor, erase the screen etc. Access is done by:

- DOS file open (INT 21H, function 3DH)
- DOS file write (INT 21H, function 40H)
- DOS file close (INT 21H, function 3EH)

Both POSDISP.SYS and POSODCOM.SYS have the same VT100 subset interface. The application doesn't have to care of which one is connected.

Writing to a DOS file should be possible with every programming language running under MS-DOS and with every DOS Extender.
One additional hint to the "DISP" device should be made. "DISP" doesn't deliver a DOS error, so there is no (!) scrolling message like:

"Error when Writing to device DISP"
"(R)etry, (I)gnore, (F)ail"

So there is also no need for a special handling of DOS INT 24H critical errors in the application because of possible occurrence of such messages. There is also no risk of getting into indefinite loops, when an error should occur while writing to "DISP", which leads to a message to be displayed on "DISP" etc.

In case the "DISP" character device was not installed, output to "DISP" will be written to a file named "DISP" in the current directory.

The following C program example displays "hello" by writing to "DISP":

```
#include <stdio.h>

int main (void)
{
 FILE *fp;
 if ((fp = fopen("DISP","w")) == NULL)          /* open "DISP" for write */
   {
     printf("can't open DISP");
     exit(1);                                   /* something wrong       */
   }
fprintf(fp,"hello");                            /* display "hello"       */
fclose(fp);                                     /* close "DISP"  */
}
```

Having a separate device "DISP" for operator messages is also preferable via a possible BIOS video interrupt INT 10H emulation. It makes testing easier, since operator messages don't disturb the debugger screen. Also, in case a video card is installed which takes over INT 10H, but no display connected, messages displayed by calling INT 10H don't fall into a black hole.
There is, however, an additional point to observe:
Let us assume a configuration with a BEETLE box (/20, /L or /XL), an operator display (BA66) connected to the COM3 port, an alphanumeric customer display (BA63) connected to the COM4 port, which is a Siemens Nixdorf recommendation and a requirement for systems with MF (Fiscal Memory) function. Let us further assume, the POSODCOM.EXE driver in conjunction with POSCOM.EXE driver is used. The BEETLE boxes (/20, /L or /XL) are delivered with a shared IRQ10 for both COM3 and COM4. On the one hand, by changing the jumper configuration, the board may be configured to have a separate interrupt for COM3 (IRQ10) and COM4 (IRQ11). On the other hand, this is considerable effort during installation, especially in large customer configurations. In addition, an IRQ is consumed. So, in most cases, it is desirable to share IRQ10 for both COM3 and COM4. If an OEM customer doesn't want to use RDI for the alphanumeric customer display, he implements his own driver.
If he uses the "DISP" device (as assumed above for operator display) the POSCOM.EXE driver (which then „talks“ to the COM3 port) and the OEM customer display cannot share the same IRQ10 interrupt. In this case it is recommendable to drive the COM4 port without interrupt.
POSCOM.EXE doesn't care about RS232 ports not under his control with the exception of the shared interrupt. A degradation of the system performance has not to be expected by talking to the customer display port through polling, and a driver is much easier to implement. Most of the output is done during a phase when the operator key is in, and keying is buffered anyway.

The control characters and escape sequences supported are listed below in short. For more details see the “ BEETLE System Guide” or the BA66 operator display manual.

BS	Backspace: The cursor is moved one place to the left without erasing the character at that position.		
LF	Line feed		
CR	Carriage return		
ESC [2J	Erase display		
ESC [Py;PxH	Position cursor	Py line:	$1 \leq Py \leq 4$ 0 treated like 1
		Px column:	$1 \leq Px \leq 20$ 0 treated like 1
ESC [0K	Erase to end of line: All characters from the current cursor position up to the end of line are erased. The cursor position remains unchanged.		
ESC Rn	Select country dependent characters. n binary!		

Country code	Character set
00	USA
01	France
02	Germany
03	Great Britain
04	Denmark 1
05	Sweden
06	Italy
07	Spain 1
08	Japan
09	Norway
0A	Denmark 2
0B	Spain 2
0C	Latin America

The display uses no wrap mode. Characters exceeding a line overwrite the last character in the line.

Internal LC-Display (B/20, B/50, B/60)

Function of Register

Instruction Register and Data Register

The LCD module built-in controller has two 8-bit registers, an Instruction Register (IR) and a Data Register (DR). IR stores instruction codes such as display clear and cursor shift, address information of display data RAM (DD RAM) and character generator RAM (CG RAM).
IR can be written by CPU, but CPU cannot read IR. DR temporarily stores data to be written into the DD RAM or the CG RAM. Data written into DR is automatically sent to the DD RAM or CG RAM as an internal operation. DR is also used for data storage for reading data from the DD RAM or the CG RAM. When address information is written into IR, data is transferred to DR from the DD RAM or the CG RAM as an internal operation. Then, CPU reads DR and data transfer is completed. After the CPU reads DR, data of the DD RAM or the CG RAM at the next address is sent to DR for the next reading.
Register selector (RS) signals select these two registers.

Register Selection

RS	R/W	Function
L	L	IR write
L	H	Read of a Busy flag and address counter
H	L	DR write
H	H	DR read

Busy flag (BF)

When the busy flag is „H“, the LCD module is in the internal operation mode and the next instruction is not accepted at this time. As shown in the table the Busy flag is shown in DB7 when RS=L and R/W=H. The next instruction must be written after checking that the Busy flag is „L“.

Address counter (ADC)

The address counter (ADC) assigns DD and CG RAM address. When an instruction for address setting is written in IR, the address information is sent from IR to ADC.
Selection of either DD or CG RAM is also determined by the instruction. After writing into (or reading from) DD or CG RAM display data ADC, is automatically incremented by 1

or decremented by 1. Data in address counters (ADC) are in DB6 to DB0 when RS=L and R/W=H.

Display data RAM (DD RAM)

The display data RAM (DD RAM) stores display data represented in 8-bit character codes. Relationship between DD RAM address and display position on LCD Display is shown in the following table.

	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1-Line	00	01	02	03	04	05	06	07	08	09	0A	0B	0C	0D	0E	0F	10	11	12	13
2-Line	40	41	42	43	44	45	46	47	48	49	4A	4B	4C	4D	4E	4F	50	51	52	53
3-Line	14	15	16	17	18	19	1A	1B	1C	1D	1E	1F	20	21	22	23	24	25	26	27
4-Line	54	55	56	57	58	59	5A	5B	5C	5D	5E	5F	60	61	62	63	64	65	66	67

Instruction

The instruction code refers to the signal through which LCD module is accessed through the CPU. The LCD module begins operation upon receipt of the code input. As the internal processing operation of LCD module is started with a timing that does not affect the LCD display, the busy status continues longer than the CPU cycle time.

Under the busy status (when the busy flag is set to „H"), the LCD module does not execute any instructions other than the busy flag read.

For this reason, the CPU has to verify that the busy flag is set to „L" prior to the input of the instruction code.

The following table shows the instructions and the execution times for the instructions. The instructions can be divided into the following 4 types.

- Instruction that designates the module functions such as display format, data length, etc.
- Instruction that gives internal RAM addresses
- Instruction that performs data transfer with internal RAM
- Other instructions

Display clear

Instruction Code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	L	L	L	L	L	L	L	L	H

When this instruction is executed, the LCD display is cleared. When the cursor and blink are in display, the blinking position moves to the left end of the LCD (the left end of the line in the 2-line display mode).

Note: All DD RAM data goes „20“ (hex.), while the address counter (ADC) goes to „00“ (hex.). The execution time, when the OSC oscillation frequency is 250 kHz, is 1.64 ms (max.).

Cursor home

Instruction Code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	L	L	L	L	L	L	L	H	X

X: Irrespective of H/L

When this instruction is executed, the blinking position moves to the left end of the LCD (to the left end of the first line in the 2-line display mode) when the cursor and blink are being displayed. When the display is in shift, the display returns to its original position before shifting.

Note: The address counter (ADC) goes to „00“ (hex.). The execution time, when the OSC oscillation frequency is 250 kHz, is 1.64 ms (max.).

Shift mode set

Instruction Code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	L	L	L	L	L	L	H	I/D	SH

When the I/D is set, 8-bit character code is written or read to and from the DD RAM, the cursor and blink shift to the right by 1 character position (I/D=H increment) or to the left by 1 character position (I/D=L decrement).

The address counter is incremented (I/D=H) or decremented (I/D=L) by 1 at this time. Even after the character pattern code is written or read to and from the CG RAM, the address counter (ADC) is incremented (I/D=H) or decremented (I/D=L) by 1.

When SH=H is set, the character code is written to the DD RAM and then the cursor and blink stops and the entire display shifts to the left (I/D=H) or to the right (I/D=L) by 1 character position. When the character is read from the DD RAM, when SH=H is set or when the character pattern data is written or read to or from the CG RAM when SH=H is set, the entire display does not shift, but normal write/read is performed (the entire display does not shift, but the cursor and blink shift to the right (I/D=H) or to the left (I/D=L) by 1 character position.

When SH=L is set, the display does not shift, but normal write/read is performed. The execution time when the OSC oscillation frequency is 250 kHz, is 40 µs.

Display mode set

Instruction code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	L	L	L	L	L	H	DI	C	B

The DI bit controls whether the character pattern is displayed or extinguished. When DI is „H“ this bit makes the LCD to display the character pattern. When DI is „L“, this bit distinguishes the LCD character pattern. The cursor and blink are also cancelled at this time.

Note: Different from the display clear, the character code is absolutely not rewritten.

The cursor goes off when C = L and it is displayed when DI = H and C =H.
The blink is cancelled when B = L and it is executed when DI = H and B = H. In the blink mode all dots (including the cursor) displaying character pattern and cursor are displayed alternately at 409.6 ms (in 5 x 7 dots character font), when the OSC oscillation frequency is 250 kHz, is 40 µs.

Cursor and display shift

Instruction code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	L	L	L	L	H	D/C	R/L	X	X

X: Irrespective of H/L

When D/C =L and R/L =L, the cursor position is shifted to the left (ADC is then decremented by 1).
When D/C =L and R/L =H, the cursor position is shifted to the right (ADC is then incremented by 1).
When D/C =H and R/L =L, the entire display is shifted to the left. The cursor positions are also shifted with the display (ADC remains unchanged).
When D/C =H and R/L =H, the entire display is shifted to the right.
The cursor positions are also shifted with the display (ADC remains unchanged).
The execution time, when the OSC oscillation frequency is 250 kHz, is 40 µs.

Initial set

Instruction code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	L	L	L	H	8B/4B	N	F	X	X

X: Irrespective of L/0

When the 8B/4B=H, the data input/output to and from the CPU is carried out simultaneously by means of 8 bits DB_7 to DB_0.
When the 8B/4B=L, the data input/output to and from the CPU is carried out in two steps by means of 4 bits DB_7 to DB_4.

The 2-line display mode of the LCD is selected when N=H, while the 1-line display mode is selected when N=L.
The 5x7 dots character font is selected when F=L, while the 5x10 dots character font is selected when F=H and N=L.

CG RAM address set

Instruction code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	L	L	H	C_5	C_4	C_3	C_2	C_1	C_0

When CG RAM address, bit C_5 to C_0 (binary), are set, the CG RAM is specified until the DD RAM address is set.
Write/read of the character pattern to and from the CPU begins with address bit C_5 to C_0 starting from CG RAM selection.
The execution time with an OSC oscillation frequency of 250 kHz, is 40 µs.

DD RAM address set

Instruction code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	L	H	D_6	D_5	D_4	D_3	D_2	D_1	D_0

When DD RAM address bit D_6 to D_0 (binary), are selected, the DD RAM is specified until the DD RAM address is set.
Write/read of the character code to and from the CPU begins with address bit D_6 to D_0 starting from DD RAM selection.
Likewise in the 2-line mode (N=H) D_6 to D_0 (binary) must be set to one of the values between „00“ ~ „27“ (hex.) in the first line and between „40“ ~ „67“ in the second line.
When any value other than the above is input, it is impossible to make a normal write/read of character codes to and from the DD RAM.
The execution time, when the OSC oscillation frequency is 250 kHz, is 40 µs.

DD RAM and CG RAM data write

Instruction code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
L	H	E_7	E_6	E_5	E_4	E_3	E_2	E_1	E_0

Write binary 8-bit data E_7 to E_0 (binary) to CG RAM or the DD RAM. Whether the CG RAM or the DD RAM is to be written is determined by the previous designation (CG RAM address or DD RAM address setting). After writing the address is automatically incremented or decremented by 1 according to entry mode. Display shift also follows the entry mode.
The execution time, when the OSC oscillation frequency is 250 kHz, is 40 µs.

Busy flag and address counter read

Instruction code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
H	L	BF	O_6	O_5	O_4	O_3	O_2	O_1	O_0

Read Busy Flag (BF) and the value of the address counter. BF=1 indicates that internal operation is going on the next command is not accepted until BF becomes „L“. It is necessary to check the BF status before the next write operation. The address counter is used for CG RAM or DD RAM address.

DD RAM and CG RAM data read

Instruction code

R/W	RS	DB_7	DB_6	DB_5	DB_4	DB_3	DB_2	DB_1	DB_0
H	H	P_7	P_6	P_5	P_4	P_3	P_2	P_1	P_0

Character codes (bit P7 to P0) are read from the DD RAM while character patterns (P7 to P0) are read from the CG RAM.

Selection of DD RAM or CG RAM is decided by the address previously set. After reading those data, the address counter (ADC) is incremented or decremented by 1 as set by the shift mode mentioned in item „shift mode set“. The execution time, when the OSC oscillation frequency is 250 kHz, is 40 µs.

Note

Conditions for the reading of correct data:

- When the DD RAM address set or CG RAM address set is input before inputting this instruction.
- When the cursor/display shift is input before inputting this instruction in case the character code is read.
- Data after the second reading from RAM when read more than 2 times. Correct data is not output in any other case.

Character Patterns and Character Codes

Character Generator ROM (CG ROM)

The character generator ROM generates 5 x 7 dot (160 kinds) character patterns or 5 x 10 dot (32 kinds) character patterns from an 8-bit DD RAM character code signal. When the 8-bit character code of the CG ROM is written into the DD RAM the character pattern of the CG ROM corresponding to the code is displayed on the LCD display position corresponding to the DD RRAM address. The following table shows the relation between character patterns and character codes.

Character Generator RAM (CG RAM)

The character generator RAM is used for original character patterns other than for the CG ROM. The CG RAM has the capacity (64 bytes=512 bits) to write 8 kinds for 5x7 dots and for 5x10 dots. Displaying character patterns stored in the CG RAM writing 8-bit character codes (00 to 07 or 02 to 0F; hex) on the left side is shown in the following table.
The next table shows the relation between CG RAM address and data display patterns for 5x7 dots.

ROM List

Address Binary	Hex	Bit Pattern Hex	Bit Pattern Binary
0 0 1 0 0 1 0 1 0 0 0	128	18	✶ ✶
0 0 1 0 0 1 0 1 0 0 1	129	19	✶ ✶ ✶
0 0 1 0 0 1 0 1 0 1 0	12A	02	✶
0 0 1 0 0 1 0 1 0 1 1	12B	04	✶
0 0 1 0 0 1 0 1 1 0 0	12C	08	✶
0 0 1 0 0 1 0 1 1 0 1	12D	13	✶ ✶ ✶
0 0 1 0 0 1 0 1 1 1 0	12E	03	✶ ✶

Character Code

Selected

Non-Selected

Relation between CG RAM Address and Character Code (DD RAM) and Character Pattern (CG RAM data)

For 5 x 7 dots character patterns:

Character Code (DD RAM Data) 7 6 5 4 3 2 1 0	CG RAM Address 5 4 3 2 1 0	Character Pattern (CG RAM Data) 7 6 5 4 3 2 1 0
0 0 0 0 ✶ 0 0 0	0 0 0 0 0 1 0 1 0 0 0 0 0 1 1 1 0 0 1 0 1 1 1 0 1 1 1	✶ ✶ ✶ 0 0 0 0 0 ✶ ✶ ✶ 0 0 0 0 0 ✶ ✶ ✶ 0 1 0 0 1 ✶ ✶ ✶ 1 0 1 0 1 ✶ ✶ ✶ 1 0 0 1 0 ✶ ✶ ✶ 1 0 0 1 0 ✶ ✶ ✶ 0 1 1 0 1 ✶ ✶ ✶ 0 0 0 0 0
0 0 0 0 ✶ 0 0 1	0 0 0 0 0 1 0 1 0 0 0 1 0 1 1 1 0 0 1 0 1 1 1 0 1 1 1	✶ ✶ ✶ 0 0 0 0 0 ✶ ✶ ✶ 0 0 0 0 0 ✶ ✶ ✶ 0 1 1 1 0 ✶ ✶ ✶ 1 0 0 0 1 ✶ ✶ ✶ 1 0 0 0 1 ✶ ✶ ✶ 0 1 0 1 0 ✶ ✶ ✶ 1 1 0 1 1 ✶ ✶ ✶ 0 0 0 0 0

✶ = Don´t care

Note

- Character code bits 0 to 2 correspond to CG RAM address bits 3 to 5 (3-bit: 8types).
- CG RAM address bits 0 to 2 designate character pattern line position. The 8th line is the cursor position and display is performed in logical OR with cursor.
- Character pattern now positions correspond to CG RAM data bits 0 to 4, as shown in the figure (bit 4 being at the left end). Since CG RAM data bits 5 to 7 are not used for display, they can be used as general data RAM.
- As shown in table 4.3. CG RAM character patterns are selected when character code bits 4 to 7 are all „0“ . However, since character pattern, for example is selected by character code „00“ or „08“ .
- „1“ for CG RAM data corresponds to selection for display and „0“ for non-selection.

Initialize (Reset)

The LCD module is automatically initialized when the poser is turned on. During initialization the busy flag (BF) holds „H“ and does not accept instructions (other than the busy flag read). The busy flag goes to „H“ for 15 ms after VDD reaches 4.5V or more. During initialization the LCD module executes the following instructions:

- Display clear
- Data length of interface with CPU: 8 bits (8B/4B = H)
- LCD: 1-line display (N=L)
- Character font: 5 x 7 dots (F=L)
- ADC: Increment (I/D=H)
- No display shift (SH=L)
- Display: Off (DI=L)
- Cursor: Off (C=L)
- No blink (B=L)

When the built-in reset circuit is used, it is required to satisfy the follwing power supply conditions. As the built-in reset circuit does not operate normally unless these power supply conditions are met, initialize the LCD module by instruction through the CPU. When a battery is used as supply voltage source, it is required to initialize the instruction.

Address Hex

▪ = x

Internal graphical LC-Display B/20

The instruction (registers, instruction codes, character patterns and codes) of the internal graphical LC-display are corresponding to those of the internal LC-display (see the previous chapter internal LC-Display). In addition to this instruction it is very important to load drivers to get specific functions of graphical depiction.

The drivers, the RDI external libraries and font files of the two installation diskettes are to provide environment to display or print one and two bytes code graphics characters.

Installation

Installation on DOS shell, key in:

cd \retail <Enter>
konfbd <Enter>
Select menu 'Asia setup' to install the whole package to hard disk.

Installation on Retail shell, key in:

51 <Enter>
51.bat contains change directory to '\retail' and konfbd.exe command. This batch file is specially used if keyboards do not have alphabetical keys.

Configuration

1. In KONFBD environment, select "Retail Configuration".
2. For setting up internal graphic cashier display, select "Asian" in the "4*20 cashier display" menu item.
3. To setup Asian country code, choose "Asia font group" menu item.
4. To setup VGA, select "Asia VGA" menu item to choose "Not installed" or "Installed".

Note

1. The default state of "Asia VGA" menu item is "Not installed." We suggest you to use "Not installed" mode normally. When you want to use this driver, you can include "POSVGA [-Cnn/nnn] [-Vnn] [-Dnn]" command and "POSVGA -U" command in your application batch file to load this driver and to release this driver.
2. POSVGA.EXE driver cannot work in retail shell(RETSH.COM) if the system has no cashier display device.

RETAIL\KONFBD.EXE

The 'konfbd' utility provide a 'ASIA setup' service that will install the LCD, VGA and font drivers, font header and setup utilities, RDI external libraries and also selected font files in the default directory C:\RETAIL\ASIA. To change any items in the 'Retail Configuration' service option, the user has to exit from the 'konfbd' utility and restart the utility from the c:\retail directory.

ASIASET.EXE & ASIACONF.EXE

The above mentioned files are used by the 'konfbd' utility.

POSFONT.SYS

This driver will load the font files specified in the POSFONT.INI file from disk to high memory. The loaded font files are to provide graphics character's bitmap for VGA, LCD drivers and RDI external libraries. If there is not enough memory available in the system, the driver will display the following message:

Not enough extended memory to load [filename] file to high memory
Press any key to continue...

This driver must be included in CONFIG.SYS. The syntax is as follows:

DEVICEHIGH=[path]POSFONT.SYS [path]POSFONT.INI

parameter:
[path] - The full path name of the "POSFONT.SYS" file or "POSFONT.INI" file.

POSFONT.INI˝

This initialization file will specify the required font files selected during setup or configuration option in the SETUP utility. It can be modified manually or by selecting the required language in the configuration option in the SETUP utility. The syntax is as follows:

[path][font file name] [-Mxxxx]

parameters:
[path] - Full directory path name
[font file name] - The font file name with extension .SNI

[-Mxxxx] - Memory size. Only xxxx Kilobytes of the font file will be loaded into the high memory. If -M is not included, the whole file will be loaded into the memory.

POSGDISP.SYS

This driver supports one and two bytes codes and display graphics characaters on graphic LCD. If there is no graphics LCD installed in the system, the driver will be ignored and will not be included in the CONFIG.SYS file. The syntax is as follows:

DEVICEHIGH=[path]POSGDISP.SYS [-Cnn/nnn]

parameter:
[path] - The full path name of the "POSGDISP.SYS" file.
-Cnn/nnn - nn/nnn specify the country code. Two digits (nn) denote the country code in hexadecimal format or, three digits (nnn) denote the country code or PC Code Page in decimal format. Default is 00 or 000.

POSVGA.EXE

This driver supports one or two bytes codes and display graphics characters on VGA screen. If there is no VGA card installed in the system, the driver will be ignored. Before you run the driver, the POSFONT.SYS driver must be loaded into the memory. That means POSFONT.SYS must be included in the CONFIG.SYS file. The driver can be activated on DOS prompt or be included in the AUTOEXEC.BAT. It can also be released from the memory after activated.The syntax is as follows:

C>[path]POSVGA [-Cnn/nnn] [-Vnn] [-Dnn]

parameters:
[path] - The full path name of the "POSVGA.EXE" file.
-Cnn/nnn - Setup country code when this driver is loaded. Two digits (nn) denote the country code in hexadecimal format or, three digits (nnn) denote the country code or PC Code Page in decimal format. Default is 00.
-Vnn - Simulate video mode to graphic 640*480*16 color (AH=0, AL=12H, INT 10H) mode that can display one or two bytes codes graphic charcters. nn denotes video mode in hexadecimal format. Default is 12 (HEX).
-Dnn - Set video mode when this driver is loaded. nn denotes video mode in hexadecimal format. Default is 12 (HEX).

Video mode (0-FF HEX)	Text	Graphics resolution	Color	Display 2 bytes code characters
00	40*25		16	Yes
01	40*25		16	Yes
0E	80*25	640*200	16	Yes
11	80*25	640*480	2	Yes
12	80*25	640*480	16	Yes
Simulate mode	80*25	640*480	16	Yes
Other mode				No

To release POSVAG.EXE from memory, key in:

C>[path]POSVAG -U

APRINTx.LIB

These RDI external libraries support one or two bytes code and provide the feature of printing graphics characters on BEETLE/60 or ND69 POS printer in RDI environment. There are APRINTS.LIB, APRINTM.LIB, APRINTC.LIB and APRINTL.LIB for small, medium, compact and large model respectively to be linked with different memory model of application programs. New escape sequence 'ESC G nn' is introduced for different mode of graphics printing. The header file 'RDIPRT.H' has to be included in the application program.

HEADER.EXE

The utility provides the service of create header, modify header and view header of the font files. Note that all the font files 'filename.SNI' have a header of 1024 bytes that is attached to the beginning of the file. The header includes the information of file identity, country code, character size, code range etc. The font files used in the one or two bytes code environment to display or print graphics characters must have the header that furnish the information required.

ASIAPRT.COM

This is a new DOS device driver that provides the feature for printing ASIA graphic characters. It serves the same function as the external RDI library but without the RDI interface. This device driver is loaded in the memory by including the following line in the CONFIG.SYS file:

DEVICE=[path]ASIAPRT.COM [-Pnn] [-Cnn] [-Gn]

Syntax:

-Pn Printer port. It supports printer port (LPT) range from 1 to 3. The default value is 1 (LPT1)

-Cnn Country code. Refer to the specification for the supported country codes. The value specified must be in hexadecimal format. Example '-CA0' denotes Korean's country code. The default value is 00 (USA).

-Gn Graphic mode. Refer to the specification for the available graphic mode. Same as '-Cnn', the value represents the hexadecimal format. The default value is 0 which is non-graphic mode.

Note that to use this device driver, the 'POSFONT.SYS' must be loaded before. Also the 'POSPRT.EXE' driver in RETAIL.BAT should be turned off to prevent conflict with the RDI device driver.

Quick Reference Table for International Language Support

Country Code		Country	PC Code Page (Microsoft)	Country Code* (Microsoft)
HEX	DEC			
00	000	USA		
01	001	France		
02	002	Germany		
03	003	UK		
04	004	Denmark 1		
05	005	Sweden		
06	006	Italy		
07	007	Spain 1		
08	008	Japan (1 byte code)		
09	009	Norway		
0A	010	Denmark 2		
0B	011	Spain 2		
0C	012	Latinamerica		
2E	046	Vietnam (VISCII)		
2F	047	Hungary 2 (ISO 8859-2)		
30	048	Standard	437	
31	049	Latin 1 (ISO 8859-1)	850	
32	050	Latin 2 (ISO 8859-2)	852	
33	051	Latin 5 (ISO 8859-9)	857	
34	052	Latin/Arabic	864	

35	053	Latin/Cyrillic	866	
36	054	Latin/Greek II	737	
37	055	Latin/Hebrew (ISO 8859-8)	862	
40	064	Poland/Hungary	852	048
41	065	Russian	866	007
42	066	Greek	869	030
62	098	Korean (1 byte code)		
63	099	Katakana		
80	128	Shift JIS		
81	129	JIS		
90	144	GB Jianti		
91	145	GB Fanti		
92	146	BIG 5		
A0	160	Korean (2 bytes code)		

*The country code is not supported now.

BA69 (VGA/4)

The BA69 liquid-crystal display is a tailor-made customer and operator display for modern cash-register applications with a graphic user interface.

The BA69 has a 5.7" screen for black/white presentation and is designed with STN technology.

The flat screen provides standard VGA compatibility in the 1/4-format of a standard screen. As a result, graphic user interfaces are presented with a high information content that is easily viewed for both customers and operators. Graphics capability and different fonts make the configuration of the information which is presented a pleasure.

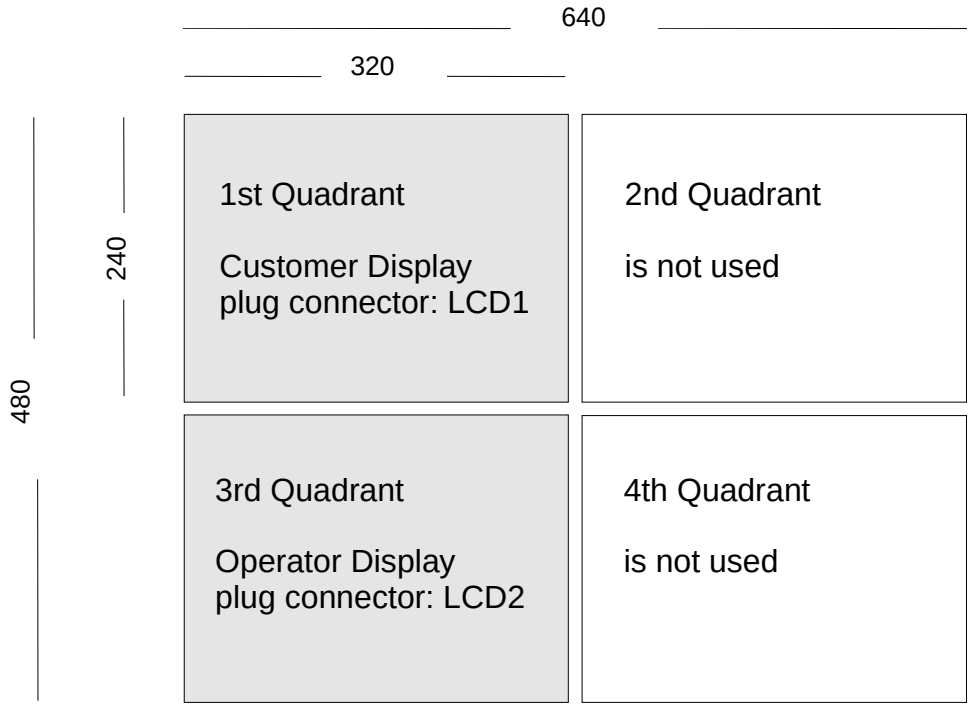
The display can be integrated into your cash-register system in different ways. You may select between the version with its own base stand, a tube assembly, or assembly on the TA85 keyboard.

For connecting the display, you will need a free PCI slot for the controller. Similarly, you can connect two BA69s to this controller. In this configuration, one is operated for the customer display and the other provides the operator display.

You can connect the BA69 display to any BEETLE cash-register system with a Pentium processor.

What does VGA /4 mean?

VGA /4 means that a quarter of a full screen is utilized for every display. The illustration shows the arrangement of the VGA quadrants (320x240 picture elements) for the operator and customer displays in the standard for a VGA screen with a resolution of 640x480 picture elements.

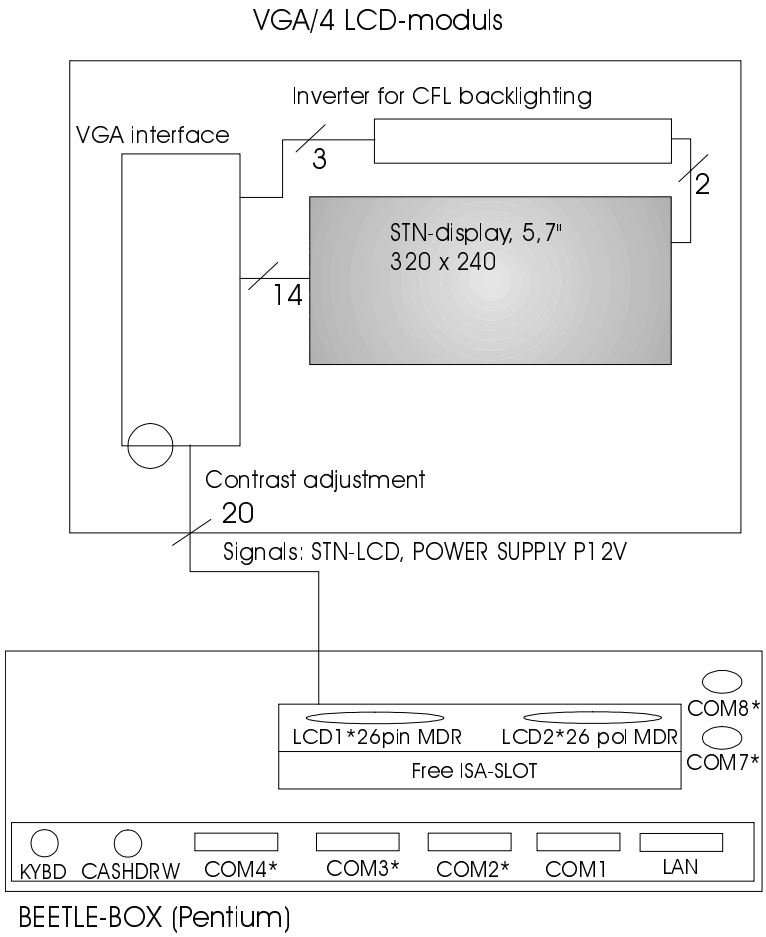


It should be noted here that, in comparison with a standard VGA screen, the entire right half of the screen is not visible. As a result, standard applications cannot be represented on the BA69.

You can only use software which has been appropriately adapted.

Hardware design

The block diagram depicts the functions and the internal and external connections of the BA69.



LCD Display

The 5.7-inch monochrome display with STN technology has a resolution of 320 x 240 picture elements. The size of the data interface is 4 bits.

Technical Data

Technology	**STN (Super Twisted Nematic)**
Type	1/4 VGA monochrome
Size	5,7"
Resolution	320 (H) x 240 (V) pixel
Visible area	120 (H) x 89 (V) mm
Pixel format	0,36 x 0,36 mm
Contrast	ca. 20
Current consumption	Controller
Mounting	Base, tube , keyboard
Mode	VGA Standard with 16 grey levels
Climatic category	JEC 721-3-3- class 3K3

1/4-Controller

System interface	PCI
PCI-Frequency	max. 33 MHz
Bus	32 Bit
VGA Standard	Fully compatible
Connectors at bracket	1. 26pol MDR for LCD1 with power supply 12 V 2. 26pol MDR für LCD2 with power supply 12 V
Current consumption	210 mA +12 V
Cable	Length: 2.50 m oder 1.50 m 20pol. twisted pair, EMC-shielded

Scanner

The following refers only to the scanner interface defined by Siemens Nixdorf for use in conjunction with Retail systems.

The Siemens Nixdorf scanner interface has been defined to use the line parameters:

baudrate	9600 Baud
data bits	8
parity	ODD
start bit	1
stop bit	1
handshake	RTS / CTS (see below)

The scanners can operate in one of two modes:

Mode A

- the scanner is able to decode right after power up
- the scanner is able to buffer one additional label (not default, only as an option)
- the scanner requests to send the data by an active RTS signal
- the control of data transmission is performed by the host using the CTS signal

Mode B

- the scanner is able to decode after power up only when additionally the CTS signal is detected in an active state
- once decoded one label the scanner is disabled to decode an additional label
- after data transmission and the CTS signal in an active state, the scanner is able to decode the next label

Handshake Timing (RTS / CTS)

The following statements refer to the input/output RS232 signals of the scanner:

TXD:	Scanner output. Data transmission depends on the CTS signal.
RTS:	Scanner output. If RTS is "high", the scanner signals that data is ready for transmission to the host.
CTS:	Scanner input. If CTS is "high" the host is able to receive data. If "low" the host is unable to receive data. The scanner is disabled to decode when set in mode B. If CTS "high" becomes "low" a current data transmission has to be interrupted. After returning to "high" data transmission continues. It must be assured that there will be no data loss.
DTR:	Scanner output. If DTR is "high" the host detects that a scanner actually is connected and can be operated.

The scanners are connected to the system with a null-modem type cable.

Transmission Formats (Prefix/Suffix)

The end of a label transmission is terminated by a Carriage Return (CR) suffix. If a CR may be embedded in a bar code it has to be substituted by a 60H character before transmission to the host.

The data format is Standard ASCII (8 bit).

The prefixes are defined as the following table shows. Note, that the scanners usually support only a subset of the formats specified below!

Codes	Prefix	Remarks
UPC-A	A	UPC-A like EAN-13 with 13 digits (leading 0)
UPC-A +2, +5	A	ditto
UPC-E	C	UPC-E with 7 digits (leading 0)
UPC-E +2, +5	C	ditto
UPC-D1	D1	
UPC-D2	D2	
UPC-D3	D3	
UPC-D4	D4	
UPC-D5	D5	
EAN-13	A	
EAN-13 +2, +5	A	
EAN-8	B	
EAN-8 +2, +5	B	
Code 39	M	
Codabar	N	
Standard 2 of 5	H	
I 2/5	I	
Code 93	L	
Code 128	K	
Plessey	O	
EAN 128	P	
Nixdorf	R	
OCR A	F	
OCR B	G	
SW Version Y	Y	All kinds of Info Data Output
- - -	Z	Jump

Note, that the input data formats of the RDI library are somewhat different compared with the input format of the scanners, although you find the prefixes there too!

The sample program doesn't use interrupts. It is really a sample to show the principle. In general there is a risk of data loss using drivers with polling for input devices, especially for 9600 Baud. So, a real driver would have to be interrupt driven.

Cash Drawers

A maximum of 2 cash drawers can be connected to the system. If two cash drawers are connected, the second cash drawer is connected to the output connector of the first, but only few cash drawer models have two connectors to plug in the cable of the second drawer.

Port 310H is used to control the drawers. Status bits (LAZU1N and LAZU2N) and command bits (KLA1 and KLA2) are placed properly, so that the sequence:

- read port 310H
- set the bit KLAx for the drawer to open
- write the result to 310H

works fine. The cash drawer has a large capacitor, which provides the energy to open the drawer. This capacitor has to be recharged, however, after the drawer was opened. So there must be a time interval of 6 seconds between two outputs with KLAx = 1. Also the mechanics of drawers is somewhat slow, so that you shouldn't expect getting LAZUxN = 1 immediately after output of KLAx = 1.

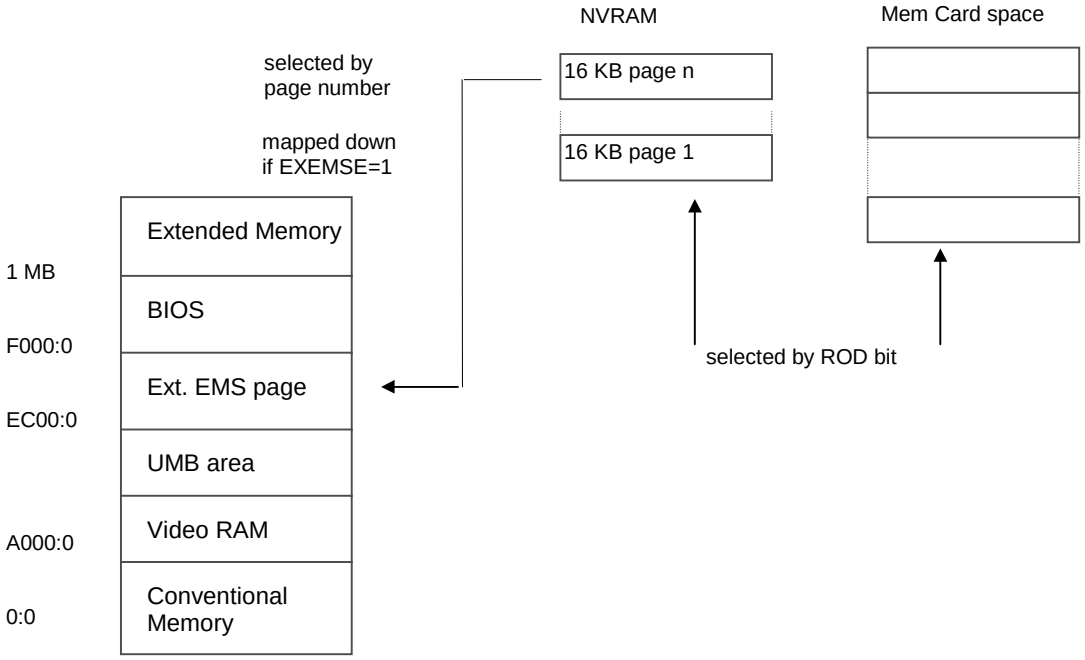
Access to NVRAM

NVRAM is accessed using External EMS functions. NVRAM is selected if ROD = 1. A 16 KB page is selected dependent on the page number written to the EMS page registers 319H (page no bits 7..0) and 31AH (page no bits 11..8). EXEMSE must be set to 1 to enable External EMS. The 16 KB page selected is then mapped down into the page frame at EC00:0. In case EXEMSE = 0 the RAM at EC00:0 would be selected instead.
The 16 KB page frame at address EC00:0 should be treated like RAM of a controller board in an ISA slot. This means, when running MS-DOS, the EMM386.SYS entry in CONFIG.SYS has to exclude it, e.g.:

```
DEVICE=\DOS\EMM386.SYS X=EC00-EFFF noems
```

Note: The parameter "noems" has nothing to do with the External EMS function, since it refers to the EMS functionality implemented by EMM386.SYS using 80x86 paging mechanism according to the LIM specification!

Physically the address range of the NVRAM is located outside, i.e. above the main processor RAM.



The procedure to follow is:

- compute page number to access
- request semaphore if required, e.g. CLI
- first read ROD bit from port 310H, the active page number and the EXEMSE bit from ports 319H and 31AH and save it
- write ROD = 1 to port 310H, write EXEMSE = 1, page number to ports 319H and 31AH
- access page at address EC00:0 for a short time, if interrupts were disabled
- restore saved values of ROD, old active page number and EXEMSE by writing to ports 310H, 319H, and 31AH
- release semaphore if required, e.g. STI

Of course, special care has to be taken in case accesses may occur near the end of a 16 KB page, overlapping the following page!

The physical size of the NVRAM specified in KB can be found in the second byte of the NVRAM, e.g. a value of 20H would indicate 32 MB. This value is entered by the BIOS power on self-test. The first 256 bytes are reserved for system use, and must not be used to avoid risk of data loss! After that area Runtime Diagnostics data follow like device error statistics of RDI drivers and error log file.

Power Management

Power Management deals with battery charging and the internal UPS functionality. The battery can be charged in one of two modes:

- quick charge (QC = 1) and
- trickle charge (QC = 0)

The regime implemented by the Siemens Nixdorf drivers, which is strongly recommended to follow, is described in the following.

When decision is made for quick charge, this is done only for some time, for BEETLE x/50 8 hours, for other BEETLE systems 4 hours. After this time it is switched over to trickle charge. The decision for quick charge is dependent on:

- whether there was a power fail before in conjunction with using the UPS function, which means battery energy was consumed
- whether the system was yet in quick charge state before it was switched off last time
- whether the battery wasn't quick charged for a longer time; the battery should be quick charged about every month

It should be mentioned that AKLOW is not very helpful at all. It doesn't tell too much about the energy available and so about the time available to support a given configuration with power in case of power fail.

The power fail interrupt IRQ9 has to be enabled by the power management driver before. When it occurs, the battery should be connected by setting AKOFF = 0. After an IRQ9 occurred, it is recommendable that the driver waits some short time, let's say 1 second, before a message is given to the application to shut down. This overcomes the in some countries frequently occurring short power fails. The application has to poll the power management driver for a power fail in short time periods, otherwise the application cannot do a shutdown in time. If the power management driver detects that it isn't polled by the application, or if the application shutdown time is too long, the power management driver should disconnect the battery from the system by setting AKOFF = 1. If all is going well, the application tells the power management driver, that shutdown activity was done. Then AKOFF is set to 1 to disconnect the battery. The system switches off now.

So the power management driver has to handle the proper timers. Another good idea is to have the power management driver informed that there is an application able to do a shutdown or not, normally by OPEN/CLOSE to the power management driver. This avoids discharging the battery too much in a situation where no application is running that could do a shutdown.

For MS-DOS, even when the RDI is not to be used, the power management driver POSPOWER.EXE is available and can be called by an interface to:

- open
- close
- poll for a power fail
- indicate application shutdown complete
- switch off the system

There is also a program POWERTST.EXE including the source to show it's use.

POSPOWER.EXE is installed with the following parameters:

C:\RETAIL\POSPOWER -Pddhh -Qcc

dd	Time interval in seconds (range 00 to 60) between detection of a power fail and its indication reported to the application. The default value is 00.
hh	Time (in minutes) between detection of a power fail and switch off the system in case the application didn't indicate shutdown completely to the POSPOWER.EXE driver. Default is 3 minutes.
cc	Quick charge time in hours (≤ 8 hours). For a BEETLE x/50 to specify 8 hours (08), for BEETLE x/60 and BEETLE x/L boxes specify 4 hours (04).

POSPOWER.EXE uses NVRAM to remember events that have been occurred.

Keyboards

TA61

Introduction

The keyboard TA61 for POS-Systems has 60 keys. It has a swipe-card-reader for reading 3 tracks simultaneously and a key-lock-switch with 7 different positions.

For the connection between the keyboard and the POS-system an IBM-AT-keyboard interface is used.

A microprocessor 8052 scans the key-matrix, the key-lock-switch and the swipe-card-reader. The same processor also generates the CLOCK and the DATA Signals for the interface.

After Power Up a self-test is running. If no error is found the keyboard sends the hex code AA, else it sends the hex code FC to the host-system.

The keyboard has a TWO-KEY-ROLLOVER. An auto-repeat-function is not implemented. For every key the keyboard generates a MAKE- and a BREAK-code.
The key-matrix has 8 rows and 8 columns and the processor 8052 scans it every 10ms.

Instructions from System to Keyboard

The following instructions are used to control the keyboard :

Hex-Value	Instruction
EE	Echo Request
F4	Enable Keyboard
F5	Reset and Disable Keyboard
F6	Reset Keyboard
FE	Repeat Command
FF	Reset and Self-Test

Messages from Keyboard to System

The keyboard will send the following messages to the host system:

Hex-Value	Message
00	FIFO-Overrun
AA	Self-Test - NO Error
FC	Self-Test-Error
E0	Extra-Code (for additional Scan-Codes)
EE	Echo
F0	Break-Code
FA	Instruction-Acknowledge
FE	Repeat Request

Key-Scan-Codes

The following table shows the scan codes of the keyboard:

Key No.	Make	Break	Key No.	Make	Break
1	76	F0,76	31	34	F0,34
2	66	F0,66	32	33	F0,33
3	05	F0,05	33	43	F0,43
4	06	F0,06	34	3B	F0,3B
5	04	F0,04	35	42	F0,42
6	0C	F0,0C	36	4B	F0,4B
7	03	F0,03	37	E0,69	E0,F0,69
8	0B	F0,0B	38	E0,72	E0,F0,72
9	83	F0,83	39	E0,7A	E0,F0,7A
10	0A	F0,0A	40	69	F0,69
11	01	F0,01	41	72	F0,72
12	09	F0,09	42	7A	F0,7A
13	E0,6C	E0,F0,6C	43	5A	F0,5A
14	E0,75	E0,F0,75	44	3A	F0,3A
15	E0,7D	E0,F0,7D	45	1A	F0,1A
16	6C	F0,6C	46	44	F0,44
17	75	F0,75	47	4D	F0,4D
18	7D	F0,7D	48	15	F0,15
19	1C	F0,1C	49	79	F0,79
20	32	F0,32	50	7B	F0,7B
21	21	F0,21	51	70	F0,70
22	23	F0,23	52	2D	F0,2D
23	24	F0,24	53	1B	F0,1B
24	2B	F0,2B	54	71	F0,71
25	E0,6B	E0,F0,6B	55	3C	F0,3C
26	29	F0,29	56	2A	F0,2A
27	E0,74	E0,F0,74	57	1D	F0,1D
28	6B	F0,6B	58	22	F0,22
29	73	F0,73	59	35	F0,35
30	74	F0,74	60	31	F0,31

Position of Key No. 1 - 60

The following table shows the position of the keys:

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60

TA85

General

The TA85 keyboard has a keypad with maximum 84 usable keys. Except for the numeric keys (0 to 9), the “C” key and the “,” key, the key layout is flexible, i.e. any two contiguous keys can be combined to form a double key and any four keys can be combined to form a quadruple key, either horizontally or vertically.

The TA85 keyboard is equipped with a key switch with 6 switch positions and is available with or without a swipecard reader.

A power-up reset and an automatic self-test are performed each time the POS terminal is switched on. Following these self-tests, the keyboard is ready for operation. The keyboard receives its power from the POS system.

Keypad

In the TA85 keypad, two keys can be combined to form a double key and four keys to form a quadruple key, either horizontally or vertically. Only one key code is generated by each double or quadruple key. Different key codes can be set for the multiple keys by rotating the key caps. These caps have a guide cylinder that is shifted when the cap is rotated, resulting in different key codes.
Key caps can be changed on the spot using the key cap remover included in the scope of supply. When using the key caps for multiple keys, note the position of the pin on the underside, making sure that the desired code is set.

LEDs

The TA85 has 3 LEDs:

Num Lock
When the LED Num Lock lights up the numerical keypad is active on this level, numerics and characters are valid, which were programed as such. The basic level is active when the LED is off.

Shift Lock
When the use of capital letters is activated, this LED lights up. All letters will be output as caps. The other characters are output normally, e.g. numerics.

Scroll Lock
Scrolling is inactive, when this LED lights up. The scrolling function is only used by few software programs.

Technical data

Cable length	Optional: 1.5 m or 3.0 m
Power supply	5V +/- 10%, max. 140mA
Protocol	PC AT interface, bidirectional, serial, synchronous
Connection	Mini-DIN connector (6-pin.)
Keyboard	Keyboard with variable key assignment, two-Key rollover
Microprocessor	NMOS-CPU 8052, 12MHz, ROM 8 Kbyte CMOS-CPU 80C52, 12MHz, ROM 8 KByte
Power-up reset	Yes
Self-test	Yes
LEDs	3 (Num Lock, Shift Lock, Scroll Lock)
Technology	NMOS, CMOS, standard TTL
Key switch	Switch positions: 5 plus insertion position
Swipecard reader	Number of tracks : 3 Magnetic card coding: to ISO 7811/2 Reading rate: 15 to 80cm/s

TA64/TA125

General

The TA64 POS keyboard can be used wherever keyboards are exposed to difficult environmental conditions such as liquids, grease, dust, etc. It is therefore e.g. well suited to the catering sector.
The keyboard can be connected to all BEETLE models via the standard keyboard interface. In addition to the central keylock, a waiter keylock is optionally available. A further option is the integrated swipecard reader.

Keypad

The keypad on the TA64 comprises 125 keys, 112 of which are freely programmable. The transparent keyboard cover which you can lift allows you to use exchangeable keyboard templates. These keyboard templates can be labelled to meet customer-specific requirements.

Self-test

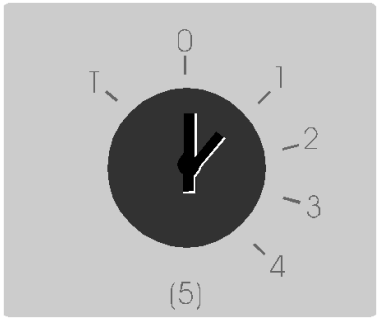
A brief self-test of the keyboard is performed each time the system is switched on. Data cannot be transmitted during this test. The system is informed of the successful completion of the test.

Technical data

Cable length	1 m 2-m extension cable
Power supply	5 V DC +/- 10%, max. 300 mA
Connection	Mini-DIN connector (6-pin)
Keypad - Key mechanism - Number of keys - Key matrix - Key grid - Key stroke	 Mechanical contacts 125, 112 of which are freely programmable 12 x 11 keys Horizontal - 20 mm; vertical - 15 mm Short-stroke keys
Central keylock Switch positions	 5, plus insertion position
Swipecard reader Number of tracks Magnetic card coding	 3 To ISO 3554
Protocol	PC/AT keyboard Interface
Climatic Category	IEC 721-3-3 Cl ass 3K3

The Key-Lock-Switch

The central key lock has 7 switch positions. Position 0 is the basic position, positions 1-4 are provided for customer-specific applications. Position (5) is for special functions and position T will be used for Customer Service.



Positions of the central key lock

DOS Protocol

Code table for Central Key Lock Data

With every change of the key position the TA61 will send a MAKE-code to the system.

Key position:	the position of the key
Make-Code:	the scan-code, transmitted from the TA61
Cod 8042:	system-scan-code, decoded from the 8042 in the host system
System:	reproduced data in the host system

Key position	Make-Code	Cod8042 and System
0	10, 50	65, 6D
1	10, 51	65, 73
2	10, 52	65, 28
3	10, 53	65, 74
4	10, 54	65, 1A
(5)	10, 55	65, 0D
T	10, 56	65, 62

Instructions from System to Key lock

Before using the key lock, the system must send a key lock-enable to the TA61:

KEYLOCK-ENABLE: hexD1

Then the TA61 sends back an acknowledge hexFA and then all the make-codes from key position 0 to the actual position. For example on position 0 no make-code, or on position 4 the make-codes 10,51, 10,52, 10,53, 10,54.
If the system sends the key lock-enable code hexD1 later again, the TA61 always sends back an acknowledge hexFA and the make-code of the key position.

Windows Protocol

Coding of Key Lock, Waiter Key and Magnetic Card Reader Data

The DOS Protocol coding of key lock, waiter key and magnetic card reader data implemented in TA61, TA57, and TA64 is not quite conforming to Windows. As e. g. the code of an ALT key may occur in the magnetic card reader data, running an application in

a Windows DOS box may lead to some unexpected result like switching to the Windows task manager, when a magnetic card is read. Although this effect can be prohibited by disabling some hot keys using the PIF editor, the method of coding may in general lead to problems when running Windows or even OS/2.

So a new method of coding was invented, that is implemented first in the SNIkey. Let us call the "old" method of coding the DOS protocol (although used also in conjunction with UNIX) and the "new" method the Windows protocol.

The following design goals had to be met:

- avoid codes of function keys and possible hot keys
- compatibility to existing installed systems (BIOS, drivers, operating systems, applications, and driver software written by OEM customers)
- ability to run under Windows 3.x, Windows 95 and Windows NT as well
- avoid a need to write new or modify existing virtual device drivers, but allow to do so
- provide security against entering a position of the key lock switch by entering some keyboard codes
- differences of national language keyboards should be considered, this also applies to Caps Lock vs. Shift Lock behaviour of keyboards

Reference Keyboard

As a reference keyboard the US layout MF2 keyboard is used. This has no keys with diacritical behaviour. So in the following refer to this keyboard layout, when talking about scan codes. Data is always coded the usual way with Make and Break Codes. The codes of the numeric part of the keyboard are not used, so one has not to worry about the NumLock state.

Start Sequence for Key Lock, Waiter Key and Magnetic Card Reader Data

The start sequence consists of the scan codes for

Make CtrlLeft, Break CtrlLeft, Break CtrlLeft

This sequence cannot be entered by hand. If the keyboard is in a Caps Lock or Shift Lock state, it sends the proper scan codes like Make CapsLock, Break CapsLock or Make ShiftLeft, Break ShiftLeft accordingly before. At the end of the transmission of a whole sequence of Key Lock, Waiter Key or Magnetic Card Data the state of the keyboard is restored by sending the proper scan codes for Make CapsLock, Break CapsLock or Make ShiftLock, Break ShiftLock respectively.

Coding of Key Lock Switch Data

When the position of the keylock switch changes, the keyboard sends
start sequence,
indicator key lock switch data,
key position using (possibly make Shift) make and break scan code
of the proper key in the alphanumeric area of the US MF2 keyboard
(rsp. followed by break Shift).

STARTSEQUENCE,
KEYIND,
KEYPOS

STARTSEQUENCE: make CtrlLeft, break CtrlLeft, break CtrlLeft

KEYIND: make and break scan code ("k")

KEYPOS: make and break scan code ("0") position 0
("1") 1
("2") 2
("3") 3
("4") 4
("5") 5
("t") T

Coding of Waiter Key Data

When the state of the waiter key changes, i. e. a key removed or a new one entered, the keyboard sends

start sequence,
indicator waiter key data,
waiter key number using (possibly make Shift), make and break scan codes of the alphanumeric area of the US MF2 keyboard to build a three digit decimal number representation of the proper waiter key (rsp. followed by break Shift).

STARTSEQUENCE,
WAITERKEYIND,
WAITERKEYNO

STARTSEQUENCE: make CtrlLeft, break CtrlLeft, break CtrlLeft

WAITERKEYIND: make and break scan code ("k")

WAITERKEYNO: make and break scan codes for always three digits ("0") .. ("9")

Coding of Key Lock Switch Data

When a card is read, the keyboard sends

start sequence,
indicator card data,
track number,
track status,
track data using (possibly make Shift and break Shift in between), make and break scan codes of the proper key in the alphanumeric area of the US MF2 keyboard.
The same for tracks 2 and 3. Always the data for all three tracks are transmitted.

```
STARTSEQUENCE,
   CARDIND,
      TRACKNO1, STATUS, DATABYTES, LRC,
      TRACKNO2, STATUS, DATABYTES, LRC,
      TRACKNO3, STATUS, DATABYTES, LRC,
   CR

STARTSEQUENCE: make CtrlLeft, break CtrlLeft, break CtrlLeft


CARDIND:      make and break scan code ("c")

TRACKNO1:     make and break scan code ("1")
TRACKNO2:     make and break scan code ("2")
TRACKNO3:     make and break scan code ("3")

STATUS:       make and break scan code ("0") = no error
              make and break scan code ("1") = no start sentinel found,
                                    dummy LRC follows
              make and break scan code ("2") = LRC or parity error,
                                    dummy LRC follows

CR:           make and break scan code (Carriage Return)

LRC:          2 digits (hex. ASCII) coded by
              make and break scan codes ("0") .. ("9"),
              make and break scan codes ("a") .. ("f"),
```

Mapping of scan into ASCII codes is always unambiguous, there is no QWERTY - QWERTZ problem. When the code positions hex. 5B, 5C, 5D (e. g. for german umlaut) are used (ISO reserved for national use), they don't change their rsp. national meaning.

Request Key Lock Switch Position

A new low level command code hex. D4 is introduced. It can be used to send a request for sending the position of the key lock switch to the keyboard. This is a Request, not an Enable Command! It can only be used at a very low level, e. g. in drivers that have access to the 8042 keyboard controller.

Compatibility

A Siemens Nixdorf retail keyboard having the Windows protocol also has the DOS protocol for coding of key lock, waiter key and magnetic card reader data. After switch on the keyboard is in the state "Windows protocol". In this state there is no enable command required for key lock, waiter key, and magnetic card reader. When the first enable command (hex. D0, hex. D1, hex D2) is issued, the firmware switches to "DOS protocol". A keyboard reset command (hex. FF) switches back to "Windows protocol".

The drivers used today recognize when a keyboard was disconnected and is connected again. In this case they reenable the additional devices of the keyboard by sending the proper enable commands. So there is no compatibility problem by using "Windows protocol" as default.

Compatibility to the BEETLE BIOS is also given. In the boot phase the BIOS sends a reset to the keyboard after it has sent an enable to check for the key lock position.

Table of required Codes (according to ISO 3554)

Character	ASCII	8042 Scan Code	Remark
Space	20	39	
!	21	2A 02	ISO: reserved
"	22	2A 28	ISO: reserved
#	23	2A 04	ISO: reserved
$	24	2A 05	
%	25	-	Start sentinel, not transmitted
&	26	2A 08	ISO: reserved
'	27	28	ISO: reserved
(	28	2A 0A	
)	29	2A 0B	
*	2A	2A 09	ISO: reserved
+	2B	2A 0D	ISO: reserved
,	2C	33	ISO: reserved
-	2D	0C	
.	2E	34	
/	2F	35	
0	30	0B	

up to			
9	39	0A	
:	3A	2A 27	ISO: reserved (DKV cards use it!)
;	3B	27	ISO: reserved
<	3C	2A 33	ISO: reserved
=	3D	0D	Separator Track 2, 3
>	3E	2A 34	ISO: reserved
?	3F	2A 35	End Sentinel Track 1, 2, 3
@	40	2A 03	ISO: reserved
A	41	2A 1E	
up to			
Z	5A	2A 2C	
[Ä etc.	5B	1A	ISO: only for national use!
\ Ö etc.	5C	2B	ISO: only for national use!
] Ü etc.	5D	1B	ISO: only for national use!
^	5E	2A 07	Separator Track 1
_	5F	2A 0C	ISO: reserved

The Swipe-Card-Reader

The swipe-card-reader has three separately installed magnetic heads and can read magnetic cards with max. three tracks. The TA61 will send the swipe-card-data in the following data format:

```
START,
        TRACKNR1,   STATUS,     BYTECOUNT,  DATABYTES,
        TRACKNR1,   STATUS,     BYTECOUNT,  DATABYTES,
        TRACKNR1,   STATUS,     BYTECOUNT,  DATABYTES,
END
```

The following Codes are used :

START:	hex65,hex60
TRACKNR1:	hex41
TRACKNR2:	hex42
TRACKNR3:	hex43
STATUS:	hex48 = correct data
	hex49 = no start code found, no byte count, no data bytes
	hex4A = LRC- or parity-error, no byte count, no data bytes
BYTECOUNT:	hex30 - hex39 three ASCII digits, count is decimal
DATABYTES:	data from the magnetic card without start-code, with end-code and with LRC
END:	hex44

Hints: According to the ISO standard format for magnetic cards the start-code for track 1 is hex05 and for tracks 2 and 3 is hex0B. Since the start-code is not transmitted by the TA61, for checking the LRC to ensure having received all card data properly you should insert the corresponding start-code! Take special care of the code 0, which is encoded as hex40!

Instructions from System to Swipe-Card-Reader

Before using the Swipe-Card-Reader, the system must send a Swipe-Card-Reader enable to the TA61:

SWIPECARD-READER-ENABLE: hexD0

The TA61 will send back an acknowledge hexFA .

Code table for Swipe-card-read-data

Read-data:	the data read from the swipe-card
Output TA61:	the scan-code, transmitted from the TA61
Cod 8042:	system-scan-code, decoded from the 8042 in the host system
System:	reproduced data in the host system

Code Table for Read-data:

Read-data	OutputTA61	Cod 8042	System
00	0B	40	00
01	76	01	01
02	16	02	02
03	1E	03	03
04	26	04	04
05	25	05	05
06	2E	06	06
07	36	07	07
08	3D	08	08
09	3E	09	09
0A	46	0A	0A
0B	45	0B	0B
0C	4E	0C	0C
0D	55	0D	0D
0E	66	0E	0E
0F	0D	0F	0F
10	15	10	10
11	1D	11	11
12	24	12	12
13	2D	13	13
14	2C	14	14
15	35	15	15
16	3C	16	16
17	43	17	17
18	44	18	18
19	4D	19	19
1A	54	1A	1A

1B	5B	1B	1B
Read-data	**OutputTA61**	**Cod 8042**	**System**
1D	14	1D	1D
1E	1C	1E	1E
1F	1B	1F	1F
20	23	20	20
21	2B	21	21
22	34	22	22
23	33	23	23
24	3B	24	24
25	42	25	25
26	4B	26	26
27	4C	27	27
28	52	28	28
29	DE	29	29
2A	12	2A	2A
2B	5D	2B	2B
2C	1A	2C	2C
2D	22	2D	2D
2E	21	2E	2E
2F	2A	2F	2F
30	32	30	30
31	31	31	31
32	3A	32	32
33	41	33	33
34	49	34	34
35	4A	35	35
36	59	36	36
37	7C	37	37
38	11	38	38
39	29	39	39
3A	58	3A	3A
3B	05	3B	3B
3C	06	3C	3C
3D	04	3D	3D
3E	0C	3E	3E

3F	03	3F	3F
Read-data	**OutputTA61**	**Cod 8042**	**System**
TrackNr2	0A	42	---> TrackNr2
TrackNr3	01	43	---> TrackNr3
End	09	44	---> End
45	77	45	45
46	7E	46	46
47	6C	47	47
o.k.	75	48	---> o.k.
StartError	7D	49	---> StartError
LRC-,P-Error	7B	4A	---> LRC-,P-Error
4B	6B	4B	(P= Parity)
4C	73	4C	4C
4D	74	4D	4D
4E	79	4E	4E
4F	69	4F	4F
50	72	50	50
51	7A	51	51
52	70	52	52
53	71	53	53
54	7F/84	54	54
55	60	55	55
56	61	56	56
57	78	57	57
58	07	58	58
59	0F	59	59
5A	17	5A	5A
5B	1F	5B	5B
5C	27	5C	5C
5D	2F	5D	5D
5E	37	5E	5E
5F	3F	5F	5F
60	47	60	60
61	4F	61	61
62	56	62	62
63	5E	63	63

64	08	64	64
Read-data	**OutputTA61**	**Cod 8042**	**System**
66	18	66	66
67	20	67	67
68	28	68	68
69	30	69	69
6A	38	6A	6A
6B	40	6B	6B
6C	48	6C	6C
6D	50	6D	6D
6E	57	6E	6E
6F	6F	6F	6F
70	13	70	70
71	19	71	71
72	39	72	72
73	51	73	73
74	53	74	74
75	5C	75	75
76	5F	76	76
77	62	77	77
78	63	78	78
79	64	79	79
7A	65	7A	7A
7B	67	7B	7B
7C	68	7C	7C
7D	6A	7D	7D
7E	6D	7E	7E
7F	6E	7F	7F
FF	00	FF	FF

Keyboard Code Tables

For every key you find two lines. The upper specifies the keyboard scan code. This can be an extended code or not. The lower line gives the meaning of the equivalent key on an alphanumeric keyboard (ASCII code).
For the numeric POS keyboards it is assumed that no country specific keyboard driver is loaded. This is essential especially for the BEETLE/20 keyboard (84 keys). As for some countries there are keys with diacritical behaviour (dead keys), this would be unacceptable for an operator. So it is strongly recommended to use only the US keyboard driver. The meaning of the key codes given below assumes this.

When a BIOS call

```
MOV     AH,10H
INT     16H
```

is made, a key

```
011B
Esc
```

would return AH = 01H, AL = 1BH (ASCII code for Esc, no extended code). This is equivalent to the Esc key of an alphanumeric keyboard.

A key

```
47E0
Home
```

would return AH = 47H, AL = 0E0H (extended code). It is equivalent to the Home key of an alphanumeric keyboard.

Double Size and Quad Size Keys

The convention for double size and quad size keys is that their code is determined by the position at their upper left corner.

Code Assignment Philosophy

Although there are codes of alpha characters for the numeric keyboards, this is a side effect and was not the intention. Normally, because there are double and (maybe) quad

size keys, not all alpha characters will be available. Instead, an application should have the view, that with the exception of the keys '0',..,'9' and '.' all other keys are to be handled as function keys. The position of the key with the code for carriage return (CR) has been chosen in a way, that it can be used nicely as a double or quad size Enter key.

TA61 (60 keys)

011B ESC	0E08 BS	3B00 F1	3C00 F2	3D00 F3	3E00 F4	3F00 F5	4000 F6	4100 F7	4200 F8	4300 F9	4400 F10
47E0 Home	48E0 CUp	49E0 PgUp	4737 '7'	4838 '8'	4939 '9'	1E61 'a'	3062 'b'	2E63 'c'	2064 'd'	1265 'e'	2166 'f'
4BE0 CLft	3920 Space	4DE0 CRgt	4B34 '4'	4C35 '5'	4D36 '6'	2267 'g'	2368 'h'	1769 'i'	246A 'j'	256B 'k'	266C 'l'
4FE0 End	50E0 CDwn	51E0 PgDn	4F31 '1'	5032 '2'	5133 '3'	1C0D CR	326D 'm'	2C7A 'z'	186F 'o'	1970 'p'	1071 'q'
4E2B +	4A2D -	5230 '0'	1372 'r'	1F73 's'	532E '.'	1675 'u'	2F76 'v'	1177 'w'	2D78 'x'	1579 'y'	316E 'n'

TA84 (84 keys)

0B30 '0'	0231 '1'	0332 '2'	0433 '3'	0534 '4'	0635 '5'	0736 '6'	0837 '7'	0938 '8'	1474 't'	8500 F11	8600 F12
352F '/'	273B ';'	0D3D '='	1A5B '['	2B5C '\'	1B5D ']'	2827 ""	2960 '`'	342E '.'	565C ' '	372A '*'	0C2D '-'
011B ESC	0E08 BS	3B00 F1	3C00 F2	3D00 F3	3E00 F4	3F00 F5	4000 F6	4100 F7	4200 F8	4300 F9	4400 F10
47E0 Home	48E0 CUp	49E0 PgUp	4737 '7'	4838 '8'	4939 '9'	1E61 'a'	3062 'b'	2E63 'c'	2064 'd'	1265 'e'	2166 'f'
4BE0 CLft	3920 Space	4DE0 CRgt	4B34 '4'	4C35 '5'	4D36 '6'	2267 'g'	2368 'h'	1769 'i'	246A 'j'	256B 'k'	266C 'l'
4FE0 End	50E0 CDwn	51E0 PgDn	4F31 '1'	5032 '2'	5133 '3'	1C0D CR	326D 'm'	2C7A 'z'	186F 'o'	1970 'p'	1071 'q'
4E2B +	4A2D -	5230 '0'	1372 'r'	1F73 's'	532E '.'	1675 'u'	2F76 'v'	1177 'w'	2D78 'x'	1579 'y'	316E 'n'

TA125 / TA64 (125 keys)

011B ESC	3B00 F1	3C00 F2	3D00 F3	3E00 F4	3F00 F5	4000 F6	4100 F7	4200 F8	4300 F9	4400 F10
1E61 ‘a’	3062 ‘b’	2E63 ‘c’	2064 ‘d’	1265 ‘e’	2166 ‘f’	2267 ‘g’	2368 ‘h’	1769 ‘i’	246A ‘j’	256B ‘k’
266C ‘l’	326D ‘m’	316E ‘n’	186F ‘o’	1970 ‘p’	1071 ‘q’	1372 ‘r’	1F73 ‘s’	1474 ‘t’	1675 ‘u’	2F76 ‘v’
1177 ‘w’	2D78 ‘x’	1579 ‘y’	2C7A ‘z’	3920 Space	2827 ‘`’	332C ‘,’	0C2D ‘-‘	342E ‘.’	352F ‘/’	273B ‘;’
0D3D ‘=’	1A5B ‘[‘	2B5C ‘\’	1B5D ‘]’	2960 ‘`’	43E0	41E0	3FE0	3DE0	3BE0	3CE0
44E0	42E0	40E0	3EE0	66E0	69E0	6AE0	6BE0	6CE0	6DE0	73E0
0D0F Tab	57E0	4AE0	54E0	532E	4E2B	44E0	0BE0	0AE0	0EE0	56E0
0231 ‘1’	0332 ‘2’	0433 ‘3’	0534 ‘4’	0635 ‘5’	0736 ‘6’	0837 ‘7’	0938 ‘8’	0A39 ‘9’	0B30 ‘0’	565C ‘>’
52E0 Ins	47E0 Home	49E0 Pgup	27E0	0CE0	4737 ‘7’	4838 ‘8’	4939 ‘9’	1C5A	5778	5807
53E0 Del	4FE0 End	51E0 Pgdn	0DE0	1BE0	4B34 ‘4’	4C35 ‘5’	4D36 ‘6’	Cr	F11	F12
0E08 Bs	48E0 Cup	2BE0	01E0	4EE0	4F31 ‘1’	5032 ‘2’	5133 ‘3’	1AE0	28E0	26E0
4BE0 Clft	50E0 Cdn	4DE0 Crgt	25EO	5230 ‘0’		0231 ‘*’	4A2D ‘-‘			

POS Printers

BEETLE /20 One Station Printer

Default Setup

When power is applied or command ESC @ is sent, the following default is set:

Item	Default Setup
Font	7 x 9
Down-load character	Same as the internal character set
Character set	Internal character set (PC 437)
Character right-side spacing	0 dot (no right-side spacing)
Print mode	normal
Horizontal tab position	8 columns in 7 x 9 font

Serial Interface

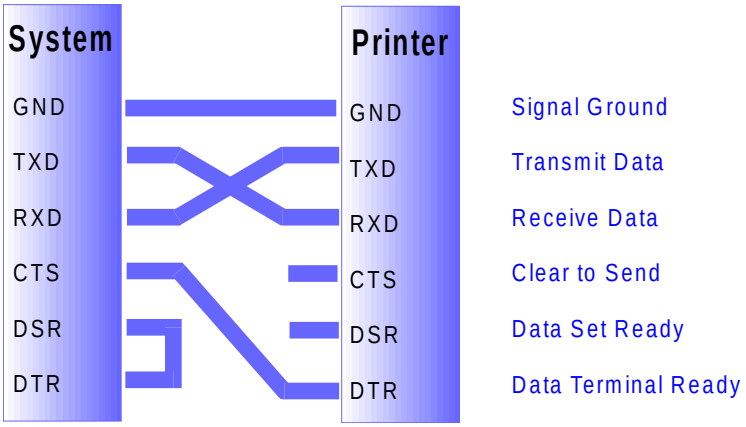
① Data transmission:	Serial	
② Synchronization:	Asynchronous	
③ Handshaking:	DTR/DSR control	
④ Signal levels:	MARK = -3 to - 15 V :	Logic „1“
	SPACE = +3 to + 15 V :	Logic „0“
⑤ Baud rates:	1200, 2400, 4800, 9600 bps	
⑥ Data length:	7, 8 bits	
⑦ Parity:	Non, even, odd	

⑧ Stop bits: 1 or more
⑨ Connector pin assignments and signal descriptions

The printer controller has the following settings:
Baud rate: 9600 bps
Data length: 8 bits
Parity: odd
Stop bits: 1

Pin No.	Signal Name	Signal Source	Function
housing	FG	-	Frame ground
5	TXD	Printer	Transmitted data
3	RXD	System	Receive data
9	GND	-	Signal ground
7	DTR	Printer	When DTR/DSR control is selected „SPACE“ indicates that the printer is ready to receive data and „MARK“ indicates that is not ready. The signal goes to „MARK“ under the following conditions: (1) when the receive buffer is full (2) in an error state

The interface connection is:



Control Sequences of the One Station Printer BEETLE /20

Control sequences serve to perform actions on the printer like, e.g. feeding paper. They also allow to change default settings like, eg character spacing, and they are used to request sending a status by the printer.

However, a precondition for proper use is the correct installation and/or configuration of the system. In addition, you should be familiar with the operating system of your computer. With the RS232 interface, all the status information can be retrieved using the proper control commands. Via the RS232 interface, it is possible to synchronize the application software with the execution of the print commands given before. This is done with the aid of the ESC v control command.

The control sequences of the printer controller are based on EPSON´s ESC/POS standard. A table shows all available sequences.

Code	Function
HT	Horizontal tab
LF	Print and line feed
CR	Carriage return
DLE EOT n	Transmit real time status
DLE ENQ n	Real time request to printer
ESC SP n	Set right side character spacing
ESC ! n	Select print modes (all stations)
ESC % n	Select / cancel user-defined character set
ESC &	Define user defined characters
ESC -n	Turn underline mode on/off
ESC @	Initialize printer
ESC D [n] k NUL	Set horizontal tab position
ESC E n	Turn emphasized mode on /off
ESC G n	Turn double-strike mode on / off
ESC R n	Select an international character set

ESC U n	Turn unidirectional print mode on/off
ESC c 5 n	Enable/ disable panel buttons
ESC d n	Print and feed “ n” lines
ESC t n	Select character code table
GS ENQ	Transmit real time printer status
GS a n	Enable / disable automatic status back

Notation of the Command Description

XXXX	Command Character or Command Sequence

Function:	Name of the command	
Code:	Code Sequence (Notation)	
	Hexadecimal	= < > H
	Decimal	= < >
	Repeat bracket contents	= ( )k Format
Range:	Describes the permitted range of values.	
Description:	Describes the function of the command.	
Remarks:	Provides important information on settings.	
Default:	Describes the standard values.	
Example:	Examples of the command in use.	

Description of the Control Characters and Sequences

HT

Function:	Horizontal tab
Code:	<09>H
Description:	Moves the print position to the next horizontal tab position
Remarks:	This command is ignored when the next horizontal tab position is not set

LF

Function:	Print and line feed
Code:	<0A>H
Description:	Prints the data located in the buffer and executes a line feed. This command sets the next printing position on the left edge of the selected printing station.
Remarks:	The command LF should only be used for a line feed of one line. For reasons of speed, the command ESC d should be used for line feeds of more than one line.
Default:	1/6“

CR

Function: Carriage return

Code: <0D>H

Description: Prints the data located in the buffer and sets the next printing position on the left edge of the selected printing station.

DLE EOT n

Function: Transmit real time status

Code: <10>H<04>H<n>

Range: 1 ≤n ≤ 3

Description: Transmits the selected printer status specified by n in real time, according to the following table:

n	Function
1	Transmit printer status
2	Transmit off-line factor status
3	Transmit error factor status

Remarks: The status information to be transmitted is shown in the following tables.
The POS printer starts processing data when receiving this command. When transmitting the status, only one (!) byte is sent by the POS printer, without confirming the condition of the DSR signal. This command is executed also when the POS printer is off-line or the receive buffer is full or when an error occurs.

The status is transmitted whenever the data sequence <10>H<04>H<n> (1≤ n ≤4) is received.

This command should not be used within the data sequence of another command that consists of two or more bytes.

If the value of n is out of the specified range the POS printer ignores this command.

When automatic status back (ASB) is enabled using the „GS a“ command, then the status transmitted by the DLE EOT command and the ASB status must be differentiated according to this table:

Command + Function	Status reply
ESC v	<0**0****>B
DLE EOT (1 to 4)	<0**1**10>B
ASB (1st byte)	<0**1**00>B
ASB (2nd to 4th byte)	<0**0****>B
GS ENQ	<1*******>B

n = 1: Printer status

Bit	Function	Value 0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Undefined		
3	On-Line / Off-Line	On-Line	Off-Line
4	Not used	Fixed to 1	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

n = 2: Off-Line factor status

Bit	Function	Value 0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Undefined		
3	Paper feeding with paper feed button	Except during paper feeding	During paper feeding
4	Not used	Fixed to 1	
5	Undefined		
6	Error	No error	Error occured
7	Not used	Fixed to 0	

n = 3: Error factor status

Bit	Function	Value 0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Mechanical errors	No error	Error occured
3	Auto cutter error*	No error	Error occured
4	Not used	Fixed to 1	
5	Unrecoverable error	No error	Error occured
6	Undefined		
7	Not used	Fixed to 0	

* not used in BEETLE /20

Bit 2 and 3: If these errors occur due to paper jams, or the like, then it is possible to recover by correcting the cause of the error and executing DLE ENQ n.
If an error occurs due to a circuit failure (broken head wire), it is impossible to recover.

Note: The processing of data when receiving this command.

Only 1 byte is transmitted without checking DSR signal when status is transmitted.
The command is also executed when the POS printer is off-line, the receive buffer is full, or error occurs.
This command should not be used within the data sequence of another command that consists of two or more bytes.
If the value of „n“ is out of the specified range, this command is ignored.
It is necessary to distinguish status and ASB status due to this command when ASB is valid due to GS a.

DLE ENQ n

Function: Real time request to printer

Code: <10>H<05>H<n>

Range: $1 \leq n \leq 2$

Description: Responds to a request from the host system. „n“ specifies the request as follows:

n	Request
1	Recover from an error and restart printing from the line where the error occurred.
2	Recover from an error after clearing the receive and print buffers.

Remarks: The POS printer starts the processing of data when receiving this command.
This command is also executed when the POS printer is off-line, the receive buffer is full, or an error occurs.
The status is also transmitted whenever the data sequence of <10>H<05>H<n> ($1 \leq n \leq 2$) is received.
This command should not be used within the data sequence of another command that consists of two or more bytes.
„DLE ENQ 1“ starts printing from the line where an error occured.
This command is available only for errors that have the possibility of recovery, except print head temperature errors.
„DLE ENQ 2“ enables the POS printer to recover from an error after clearing the data in the receive buffer and the print buffer. The POS

printer retains the settings (by ESC !) that were in effect when the error occurred. The POS printer can be initialized completely by using this command and „ESC @“ . This command is enabled only for errors possible to recover.
If the value of „n“ is out of the specified range, this command is ignored.

ESC SP n

Function: Set right side character spacing

Code: <1B>H <20>H <n>

Range: $0 \leq n \leq 32$

Description: Sets the character right-side spacing in dot units
n expresses the numbers of dots, spacing of n dots is inserted at right-side. Therefore, character width is as follows:
Initiation value n=0.

Character width (dot) that character right-side spacing as n dots.

Font	Normal	Double width
5 x 9	12 + n	(12 + n) x 2
7 x 9	9 + n	(9 + n) x 2

Remarks: Valid only when the input at beginning of a line.
If only validation is selected, roll paper will not be fed in this time of one line printing. Line printing by printing sheet.
Only one line is valid with validation selection.

ESC ! n

Function: Select print mode(s) and CG mode

Code: <1B>H<21>H<n>

Range: 0 ≤ n ≤ 255

Description: Set a print mode and a CG mode.
Each bit of n is used in the following way:

Bit	Function	Value 0	1
0	Character font	7 x 9 font	5 x 9 font
1	Not used		
2	Not used		
3	Emphasized	canceled	selected
4	Not used		
5	Double width	canceled	selected
6	Not used		
7	Underline	canceled	selected

ESC % n

Function: Select down-load character set

Code: <1B>H <25>H <n>

Range: 0 ≤ n ≤ 255

Description: Set or cancel the down-load character set.
Only the lowest bit of n is valid.
When n=1, the user-defined character set is set.
When n=0, the user-defined character set is canceled.

Remarks: A downloaded bit image and a user defined character set are useable at the same time!

Default: n = 0

ESC & s n m [a [p] s x a]m -n+1

Function: Define user defined characters

Code: <1B>H <26>H <s><n><m>[<a><p1><p2>...<pk x 2>] m-n +1

Range: s=1 (under-line is set), 2 (under-line is canceled)
$32 \leq n \leq m \leq 126$
$0 \leq a \leq 9$ (select 7x9)
$0 \leq a \leq 6$ (select 5x9)
$0 \leq$ p1.....p s x a ≤ 255

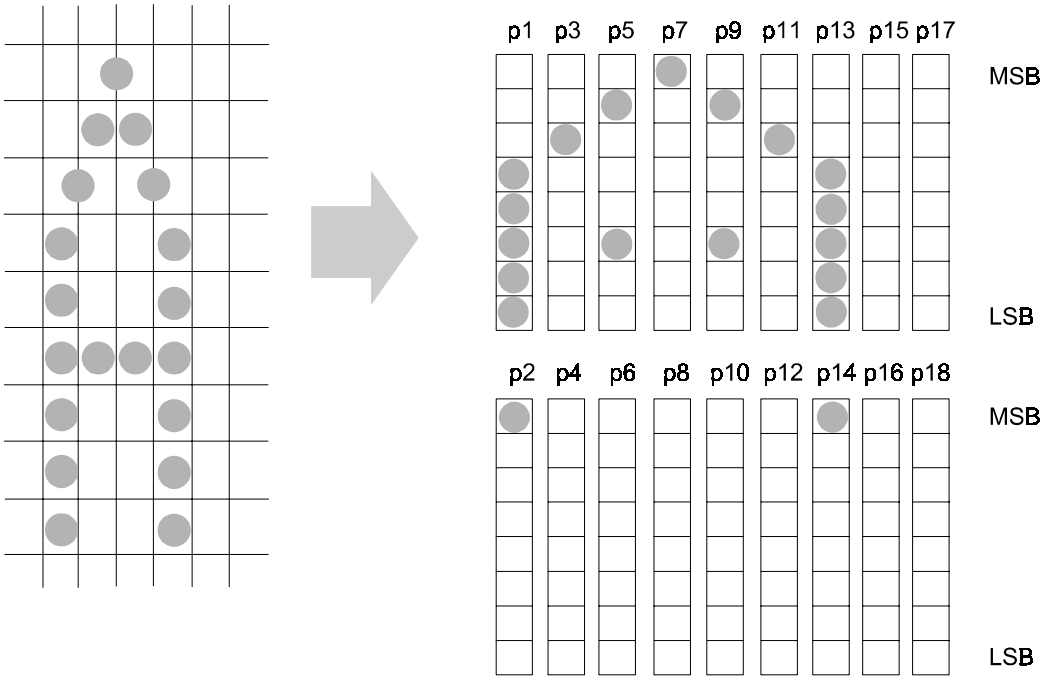
Description: Define ASCII code of down-load character set from n to m with the pattern of p1 .....ps x a
- s → specifies the number of bytes in the vertical direction.
- n → specifies the beginning ASCII code for the definition
- m → specifies the final code. If only one character is defined, use n=m.
- a → specifies the number of dots in the horizontal direction.
- p → is the dot data for the characters. The dot pattern is in the horizontal direction from the left side. The remaining dot pattern on the right side is space.

Prints same characters as internal character set for undefined character.
Suspends treatment at once when both of s, n, m, a value deviate from each requirements, afterward data is treated as text data.

Remarks: Down-load character matrix is 6x9 dots in case of 5x9 font, is 7x9 in case of 9x9 font. (same the graphic character)
p1~ps x a are assigned by the indicated pattern as follows.
Can not print adjoined dots in succession for horizontal direction in case of 7x9 font.
Only highest order bit of second byte in the vertical direction is valid.
The POS printer becomes font organization that is different from

canceled under-line due to the printer carry special font in case of under-line state. It is 7x7 font in case of set to 7x9 font, 5x7 font in case of set to 5x9 font.

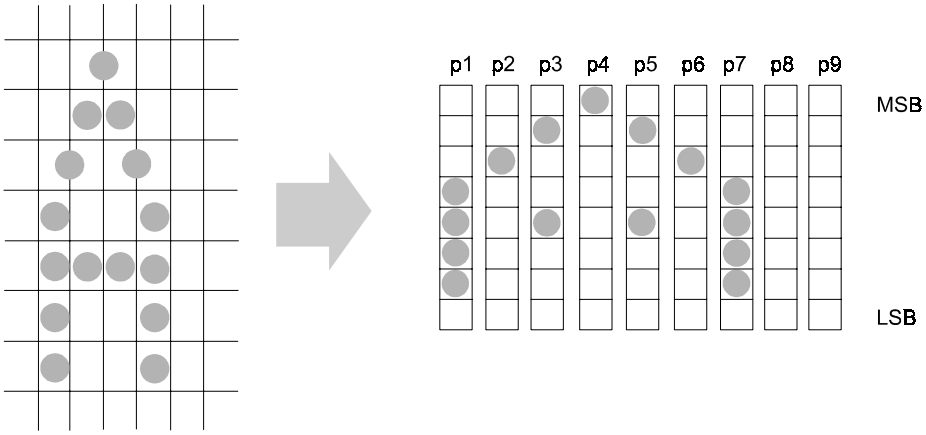
Example: s=2, in case of 7 x 9 font



When above pattern is defined to code 20H
ESC & s n m a p1 p2 p3 p4 p5 p6 p7 p8 p9 p10 p11 p12 p13 p14

Code 1B 26 02 20 20 07 1F 80 20 00 44 00 80 00 44 00 20 00 1F 80
(It is 1 when equivalence bit is printed and 0 when is not printed)

Example: s=1, in case of 7 x 9 font



When above pattern is defined to code 20H
ESC & s n m a p1 p2 p3 p4 p5 p6 p7

Code 1B 26 01 20 20 07 1E 20 48 80 48 20 1E
(It is 1 when equivalence bit is printed and 0 when is not printed)

ESC - n

Function: Turn under-line mode on/off

Code: <1B>H <2D>H<n>

Range: $0 \leq n \leq 1$

Description: Sets or cancels under-line
n= 0, cancels under-line
n= 1, sets under-line
5 x 7 or 7 x 7 font is selected when under-line is set.

Remarks: All characters width are attended on under-line, except skipped part due to HT.

ESC @

Function: Initialize Printer

Code: <1B>H<40>H

Description: Resets the adjustable printer parameters to the standard values (default setting; equal to the state after switching on the printer).

ESC D [n] k NUL

Function: Set horizontal tab position

Format: <1B>H<44>H[<n>]k<0>

Range: $1 \leq n \leq 255$
$0 \leq n \leq 32$

Description: Sets horizontal tab position.
„n“ specifies the column number from the beginning of the line for setting a horizontal tab position.
[n = (Column number) - 1]. For example, when a tab is to be set at column 9, n = 8.
A horizontal tab position is stored as the absolute value of (character width x n) measured from the beginning of the line. The character width includes the character right-side spacing, and double-width characters should be set with twice the width of normal characters.
Up to 32 tab positions can be set. Data which exceeds 32 tab positions will be ignored.
Set <n>k in ascending order and place a NUL code <0> at the end.
ESC D NUL clears all tabs. Initial value are at intervals of 8 character for 5x9 font.

Remarks: When a data value <n>k is less than or equal to the preceding value <n>k-1, the setting is considered to be finished.
Set which exceed print width will be ignored.

ESC E n

Function:	Turn emphasized mode on/off
Code:	<1B>H<45>H<n>
Range:	0 ≤ n ≤ 255
Description:	Turns emphasized mode on or off Only the lowest bit is valid. n=<*******0> B turns emphasized mode off n=<*******1> B turns emphasized mode on
Remarks:	The 2 - pass printing is slower in emphasized mode. This command and ESC ! Turn on and off emphasized mode in the same way. Be careful when using this command with " ESC !" Only the lowest bit of " n" is enabled.
Default:	n = 0

ESC G n

Function:	Turn double strike mode on/off
Code:	<1B>H<47>H<n>
Range:	0 ≤ n ≤ 255
Description:	Sets or cancels the double print. Only the lowest bit of „n“ is valid. n=<*******0> Cancels double print. n=<*******1> Sets double print
Remarks:	The print speed will be fallen due to the double print is performed with 2 pass print.
Default:	n = 0

ESC R n

Function:	Select International Character Set
Code:	<1B>H<52>H<n>
Range:	0 ≤ n ≤ 10
Description:	One of the following character sets can be selected by n:

n	Character set
0	USA
1	France
2	Germany
3	Great Britain
4	Denmark I
5	Sweden
6	Italy
7	Spain
8	Japan
9	Norway
10	Denmark II

The following list represents a country-specific character set. With **ESC R** one of the given countries from the table can be chosen. The parameter n within the control sequences represents the country, the value of the code is equal to the marked characters of the previous table.

n	Character set	Code value (Hex)											
		23	24	40	5B	5C	5D	5E	60	7B	7C	7D	7E
0	USA	#	$	@	[	\	]	^	`	{	|	}	~
1	France	#	$	à	·	ç	§	^	`	é	ù	è	¨
2	Germany	#	$	§	Ä	Ö	Ü	^	`	ä	ö	ü	ß
3	UK	£	$	@	[	\	]	^	`	{	|	}	~
4	Denmark I	#	$	@	Æ	Ø	Å	^	`	æ	ø	å	~
5	Sweden	#	¤	É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
6	Italy	#	$	@	·	\	é	^	ù	à	ò	è	ì
7	Spain I	Pt	$	@	¡	Ñ	¿	^	`	¨	ñ	}	~
8	Japan	#	$	@	[	¥	]	^	`	{	|	}	~
9	Norway	#	¤	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü
10	Denmark II	#	$	É	Æ	Ø	Å	Ü	é	æ	ø	å	ü

Remarks: If the value of n is out of the specified range, the command is ignored.

ESC U n

Function: Unidirectional Print ON/OFF

Code: <1B>H<55>H<n>

Range: $0 \leq n \leq 255$

Description: Sets or cancels the unidirectional print.
Only bit 0 of n is relevant; bits 1 ... 7 can have arbitrary values.
Bit 0 = 0: Unidirectional Print off
Bit 0 = 1: Unidirectional Print on

Remarks: With Unidirectional Print ON, printing occurs from left to right.

Default: n = 0

ESC c 5 n

Function: Enable/Disable All Panel Buttons

Code: <1B>H<63>H<35>H<n>

Range: $0 \leq n \leq 255$

Description: This command enables or disables the control buttons.
Only the lowest bit of „n“ is enabled.
n=<*******0> B panel switch is enabled.
n=<*******1> B panel switch is disabled.

Note: Not used in BEETLE /20.
Paper feed, when the panel-switch is invalid with this command.

Default: n = 0

ESC d n

Function: Print and feed paper n lines

Code: <1B>H<64>H<n>

Range: $0 \leq n \leq 255$

Description: Print the data in the print-buffer and performs n line feeds.

ESC t n

Function: Select character code table

Code: <1B>H <74>H <n>

Range: n = 0, 2

Description: Selects page n of the character set from the following table.

n	Character code table
0	PC437 (USA, Standard Europe)
2	PC850 (Multilingual)

Only page 0 of the character set is implemented.

If the value of n is out of the specified range, the command will be ignored.

Default: n = 0

HEX	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0		DLE		0	§	P	`	p	Ç	É	á	▒	└	╨	α	≡
-1			!	1	A	Q	a	q	ü	æ	í	▓	┴	╤	β	±
-2			"	2	B	R	b	r	é	Æ	ó	▓	┬	╥	Γ	≥
-3			#	3	C	S	c	s	â	ô	ú	▏	├	╙	π	≤
-4	EOT		$	4	D	T	d	t	ä	ö	ñ	┤	─	╘	Σ	⌠
-5	ENQ		%	5	E	U	e	u	à	ò	Ñ	╡	┼	╒	σ	⌡
-6			&	6	F	V	f	v	å	û	ª	╢	╞	╓	µ	÷
-7			'	7	G	W	g	w	ç	ù	º	╖	╟	╫	τ	≈
-8			(	8	H	X	h	x	ê	ÿ	¿	╕	╚	╪	Φ	°
-9	HT		)	9	I	Y	i	y	ë	Ö	⌐	╣	╔	┘	Θ	•
-A	LF		*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Ω	•
-B		ESC	+	;	K	[	k	{	ï	¢	½	╗	╦	▉	δ	√
-C		FS	,	<	L	\	l	|	î	£	¼	╝	╠	■	∞	n
-D	CR	CS	-	=	M	]	m	}	ì	¥	¡	╜	═	▌	ϕ	²
-E			.	>	N	^	n	~	Ä	Pt	«	╛	╬	▐	ε	■
-F			/	?	O	_	o	SP	Å	ƒ	»	┐	╧	▀	∩	(RSP)

Character Code Page 437

Hex	0-	1-	2-	3-	4-	5-	6-	7-	8-	9-	A-	B-	C-	D-	E-	F-
-0		DLE		0	@	P	`	p	Ç	É	á	▒	└	ð	Ó	−
-1			!	1	A	Q	a	q	ü	æ	í	▓	┴	Ð	ß	±
-2			"	2	B	R	b	r	é	Æ	ó	▓	┬	Ê	Ô	=
-3			#	3	C	S	c	s	â	ô	ú	|	├	Ë	Ò	¾
-4	EOT		$	4	D	T	d	t	ä	ö	ñ	┤	─	È	õ	¶
-5	ENQ		%	5	E	U	e	u	à	ò	Ñ	Á	┼	ı	Õ	§
-6			&	6	F	V	f	v	å	û	ª	Â	ã	Í	µ	÷
-7			'	7	G	W	g	w	ç	ù	º	À	Ã	Î	þ	¸
-8			(	8	H	X	h	x	ê	ÿ	¿	©	╚	Ï	Þ	°
-9	HT		)	9	I	Y	i	y	ë	Ö	®	╣	╔	┘	Ú	"
-A	LF		*	:	J	Z	j	z	è	Ü	¬	║	╩	┌	Û	•
-B		ESC	+	;	K	[	k	{	ï	ø	½	╗	╦	█	Ù	¹
-C		FS	,	<	L	\	l	|	î	£	¼	╝	╠	▄	ý	³
-D	CR	CS	-	=	M	]	m	}	ì	Ø	¡	¢	=	¦	Ý	²
-E			.	>	N	^	n	~	Ä	×	«	¥	╬	Ì	¯	■
-F			/	?	O	_	o	⌂	Å	ƒ	»	┐	¤	▪	´	(RSP)

Character Code Page 850

GS ENQ

Function: Transmits real time printer status.

Code: <1D>H <05>H

Description: Transmits printer status when command is received.

Transmitting status

Bit	Function	Value 0	1
0 1	Undefined		
2	Undefined		
3	On Line / Off Line	On Line	Off Line
4	Undefined		
5	Undefined		
6	Device Error	no error	error occur
7	Not used	fixed to 1	

Remarks: The printer transmits only 1 byte without checking the DSR signal. This command is executed even if the printer is in the off-line state, in the receive buffer full state, or in the mechanical error state. This command should not be used within the data sequence of another command that consists of two or more bytes. It is necessary to distinguish status and ASB status due to this command when ASB is valid due to GS a.

Attention! The controller transmits the status byte even when it finds the sequence <1D>H <05>H in the data of another control command.

Bit 6, device error

Device errors are reported when mechanical malfunctions in the printer occur, which are recognized by the firmware to have exceeded the time-outs. Possible device errors are:

– Interference in carrier movement, recognized by time-out of consecutive carrier motor stepping.

GS a n

Function: Enable / disable automatic status back

Code: <1D>H <61>H<n>

Range: 0≤n≤255

Description: Selects a status for Automatic Status Back (ASB)
Each bit of „n“ is used as follows:

Bit	Function	Value	
		0	1
0	Undefined		
1	On-line / Off-line	Disabled	Enabled
2	Device error	Disabled	Enabled
3	Undefined		
4	Undefined		
5	Undefined		
6	Undefined		
7	Undefined		

Remarks:

- Auto Status Back (ASB) is enabled. If only one status is selected,. the POS printer automatically transmits a status of 4 bytes whenever the status changes.
- If no status is selected, ASB is enabled.
- If ASB is enabled while processing this command, the current status is transmitted without regulations.
- When transmitting a status, the POS printer transmits only 4 bytes without confirming the condition of the DSR signal.
- It is possible that delays occur between receiving the command and transmitting the first status due to receive buffer state, because this

command is executed in the time unfolding receive buffer.

- It is necessary to distinguish status due to this command or ASB when one uses the DLE EOT, GS ENQ.
- The status to be transmitted is as follows:

First byte (printer information)

Bit	Function	Value	
		0	**1**
0	Not used	Fixed to 0	
1	Not used	Fixed to 0	
2	Undefined		
3	On-line / Off-line	On-line	Off-line
4	Not used	Fixed to 1	
5	Undefined		
6	Paper feeding with paper feed button	Except during paper feed	During paper feed
7	Not used	Fixed to 0	

Second byte (error information)

Bit	Function	Value 0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 0	
2	Printer error	Low	High
3	Auto cutter error*	On Line	Off Line
4	Not used	Fixed to 0	
5	Unrecoverable error		
6	Undefined		
7	Not used	Fixed to 0	

* not used in BEETLE /20

Third byte (paper detector information)

Bit	Function	Value 0	1
0 1	Undefined		
2 3	Undefined		
4	Not used	Fixed to 0	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

Fourth byte (error information)

Bit	Function	Value 0	1
0	Undefined		
1	Undefined		
2	Undefined		
3	Undefined		
4	Not used	Fixed to 0	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

BEETLE /20 Two Stations Printer

Default Setup

When power is applied or command ESC @ is sent, the following default is set:

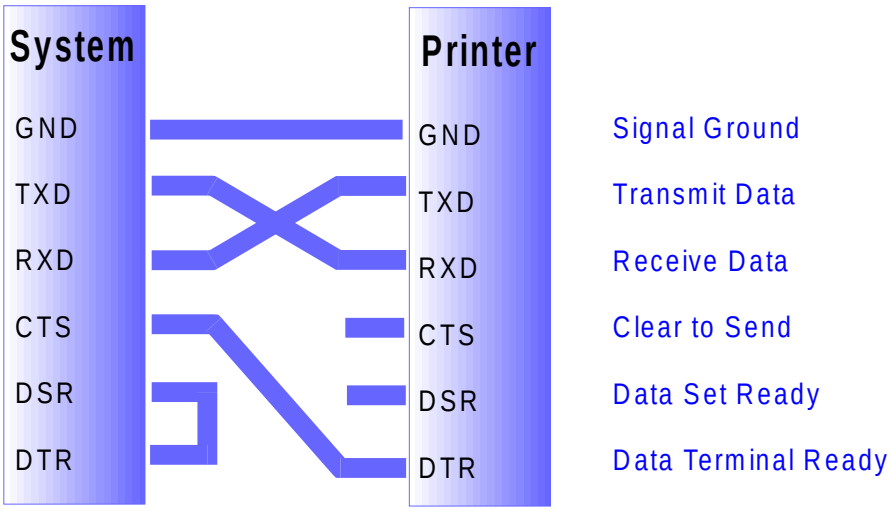
Item	Default Setup
Font	9 x 9
Down-load character	Same as the internal character set (PC437)
Character set	Internal character set (PC 437)
Character right-side spacing	0 dot (no right-side spacing)
Print mode	normal

Serial Interface

① Data transmission: Serial
② Synchronization: Asynchronous
③ Handshaking: DTR/DSR control
④ Signal levels: MARK = -3 to - 15 V : Logic „1“
SPACE = +3 to + 15 V : Logic „0“
⑤ Baud rates: 9600 bps
⑥ Data length: 8 bits
⑦ Parity: odd
⑧ Stop bits: 1
⑨ Connector pin assignments and signal descriptions

Pin No.	Signal Name	Signal Source	Function
housing	FG	-	Frame ground
5	TXD	Printer	Transmitted data
3	RXD	System	Receive data
9	GND	-	Signal ground
7	DTR	Printer	When DTR/DSR control is selected „SPACE“ indicates that the printer is ready to receive data and „MARK“ indicates that is not ready. The signal goes to „MARK“ under the following conditions: (1) when the receive buffer is full (2) in an error state

The interface connection is:



Control Sequences of the Two Stations Printer BEETLE /20

Control sequences serve to perform actions on the printer like, e.g. feeding paper. They also allow to change default settings like, e.g. character spacing, and they are used to request sending a status by the printer.
However, a precondition for proper use is the correct installation and/or configuration of the system. In addition, you should be familiar with the operating system of your computer.
With the RS232 interface, all the status information can be retrieved using the proper control commands. Via the RS232 interface, it is possible to synchronize the application software with the execution of the print commands given before. This is done with the aid of the ESC v control command.
The control sequences of the printer controller are based on EPSON´s ESC/POS standard. A table shows all available sequences.

Code	Function
LF	Print and line feed
FF	Print slip paper
CR	Carriage return
DLE EOT n	Transmit real time status
DLE ENQ n	Real time request to printer
RS	Journal tab
ESC SP n	Set right side character spacing
ESC ! n	Select print modes (all stations)
ESC $	Set absolute print position
ESC % n	Select / cancel user-defined character set
ESC &	Define user defined characters
ESC *	Select bit-image mode
ESC -n	Turn underline mode on/off
ESC <	Return home
ESC ?	Cancel user-defined character
ESC @	Initialize printer
ESC E n	Turn emphasized mode on/off

ESC G n	Turn double-strike mode on/off
ESC R n	Select an international character set
ESC U n	Turn unidirectional print mode on/off
ESC \	Set relative print position
ESC a	Select justification
ESC c 0	Select print station
ESC c 4	Select paper detectors(s) to stop printing
ESC c 5	Enable/ disable panel buttons
ESC d n	Print and feed “ n” lines
ESC f	Set slip paper waiting time
ESC i	Full cut
ESC m	Partial cut
ESC o	Stamp
ESC t n	Select character code table
ESC v	Transmit paper sensor status
ESC z	Turn parallel printing mode on/off
ESC {	Turn upside-down printing mode on/off
GS ENQ	Transmit real time printer status
GS I	Transmit printer ID
GS P	Set fundamental calculation pitch
GS a n	Enable / disable automatic status back
GS r	Transmit status

The following commands will be ignored by the printer. The printer knows these commands, but they have no effect.

Ignored Commands
ESC 2
ESC 3n
ESC Gn
ESC In
ESC Kn
ESC c3n
ESC c6n

Notation of the Command Description

XXXX	Command Character or Command Sequence

Function:	Name of the command	
Code:	Code Sequence (Notation)	
	Hexadecimal	= < > H
	Decimal	= < >
	Repeat bracket contents	= ( )k Format
Range:	Describes the permitted range of values.	
Description:	Describes the function of the command.	
Remarks:	Provides important information on settings.	
Default:	Describes the standard values.	
Example:	Examples of the command in use.	

Description of the Control Characters and Sequences

LF

Function:	Print and line feed
Code:	<0A>H
Description:	Prints the data located in the buffer and executes a line feed. This command sets the next printing position on the left edge of the selected printing station.
Remarks:	The command LF should only be used for a line feed of one line. For reasons of speed, the command ESC d should be used for line feeds of more than one line.

FF

Function: Prints the data located in the buffer

Code: <0C>H

Description: Prints the data located in the buffer.

Notes: The command is only enabled when slip paper is selected for printing.

Reference: ESC c 0

CR

Function: Carriage Return

Code: <0D>H

Description: This command prints the data in the print buffer and does not feed the paper.

Note: Sets the print starting position to the left edge of the selected station.

Reference: LF

DLE EOT

Function: Transmit real time status

Code: <10>H <04>H<n>

Range: $1 \leq n \leq 5$

Description: Transmits the selected printer status specified by n in real time, according to the following parameters:

n	Function
1	Transmit printer status
2	Transmit off-line factor status
3	Transmit error factor status
4	Transmit paper roll sensor status
5	Transmit slip paper status

Notes: The status information to be transmitted is shown in the following tables.

The printer starts processing data upon receiving this command.
When transmitting the status, only one (!) byte is send by the printer, without confirming the condition of the DSR signal.
This command is executed also when the printer is off-line or the receive buffer is full or when an error occurs.
The status is transmitted whenever the data sequence
<10>H <04>H<n> ($1 \leq n \leq 5$) is received.
This command should not be used within the data sequence of another command that consists of 2 or more bytes.
If the value of n is out of the specified range the printer ignores this command.

When automatic status back (ASB) is enabled using the GS a command, than the status transmitted by the DLE EOT command and the ASB status must be differentiated according to the following table:

Command + Function	Status reply
ESC v	<0**0****>B
GS I	<0**0****>B
GS r	<0**0****>B
DLE EOT (1 to 5)	<0**1**10>B
ASB (1st byte)	<0**1**00>B
ASB (2nd to 4th byte)	<0**0****>B
GS ENQ	<1*******>B

n = 1: Printer status

Bit	Function	Value 0	Value 1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Cash-drawer connector 3	Fixed to 1	
3	On-line / Off-line	On-line	Off-line
4	Not used	Fixed to 1	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

n = 2: Off-line factor status

Bit	Function	Value 0	Value 1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Cover status	Closed	Open
3	Paper feeding with paper feed button	Except during paper feeding	During paper feeding
4	Not used	Fixed to 1	
5	Printing stop due to an paper end	No paper end stop	Printing stops
6	Error	No error	Error occurs
7	Not used	Fixed to 0	

Bit 5 is transmitted (printing stops) when printing stops due to paper selected, ESC c 0 and ESC c 4, and due to paper sensor conditions.

n = 3: Error factor status

Bit	Function	Value 0	Value 1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Mechanical errors	No error	Error occurs
3	Auto cutter error	No error	Error occurs
4	Not used	Fixed to 1	
5	Unrecoverable error	No error	Error occurs
6	Print head temperature	No error	Error occurs
7	Not used	Fixed to 0	

Bit 2:
Mechanical errors include home position, carriage sensor

Bit 2 and 3:
If these errors occur due to paper jams, or the like, than it is possible to recover by correcting the cause of the error and executing DLE ENQ n (1≤n≤2).
If an error occurs due to a circuit failure (broken head wire), it is impossible to recover.

Bit 6:
If the print head temperature becomes high, bit 6 is transmitted until the head temperature drops significantly. The printer automatically recovers from such an error.

n = 4: Continuous paper sensor status

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Journal near end sensor	Paper present	No paper
3	Receipt near end sensor	Paper present	No paper
4	Not used	Fixed to 1	
5	Journal paper sensor	Paper present	No paper
6	Receipt paper sensor	Paper present	No paper
7	Not used	Fixed to 0	

n = 5: Slip paper status

Bit	Function	Value 0	Value 1
0	Not used	Fixed to 0	
1	Not used	Fixed to 1	
2	Slip paper selection	Selected	Not selected
3	Slip insertion waiting	Not waiting	Waiting
4	Not used	Fixed to 1	
5	Slip insertion sensor	Paper present	No paper
6	Slip insertion sensor	Paper present	No paper
7	Not used	Fixed to 0	

Bit 2:
There may be a time lag between receiving the paper selection command ESC c 0 and selecting the slip paper. During this time, bit 2 remains 1.

After the slip paper is removed, bit 2 is removed (slip paper is not selected).

Bit 3:
is not transmitted (slip insertion is not waiting) just before loading slip paper, after detecting it.

Bit 5 and 6:
transmit the current status of the slip sensor.

Reference: DLE ENQ, ESC v, GS ENQ, GS a, GS r

DLE ENQ n

Function: Real time request to printer

Code: <10>H<05>H<n>

Range: 1≤n≤3

Description: Responds to a request from the host system. n specifies the request as follows:

n	Request
1	Recover from an error and restart printing from the line where the error occurred.
2	Recover from an error after clearing the receive and print buffers.
3	Cancel the slip waiting status.

Note: The printer starts processing data upon receiving this command. This command is also executed when the printer is off-line, the receive buffer is full, or an error occurs.

The status is also transmitted whenever the data sequence of <10>H<05>H<n> (1≤n≤3) is received.

This command should not be used within the data sequence of another command that consists of two or more bytes.
DLE ENQ 1 starts printing from the line where an error occurred. This command is available only for errors that have the possibility of recovery, except print head temperature errors.
When the printer recovers from an error (possible to recover) using DLE ENQ 1, and slip paper is selected, the printer demands a new slip paper after removing the old slip paper. After the paper is inserted, the printer repeats the last line.
DLE ENQ 2 enables the printer to recover from an error after clearing the data in the receive buffer and the print buffer.
The printer retains the settings (by ESC! etc.) that were in effect when

the error occurred. The printer can be initialized completely by using this command and ESC @. This command is enabled only for errors (possible to recover), except print head temperature errors.
When the printer recovers from an error by DLE ENQ 2 with slip paper selected, the printer waits for removing the slip paper, and goes to the two-sheet mode. Therefore, when printing on slip paper is to be continued, select two-sheet mode again using ESC c 0 4 after the printer had waited for removing the slip paper.
DLE ENQ 3 is ignored except when the printer is in the slip waiting state. Therefore, be sure to check (by using DLE EOT 5) whether slip paper is selected and the printer is in the slip waiting state before executing DLE ENQ 3.
After the printer is released from the slip waiting state, receipt and journal papers are selected.
When the slip waiting status is canceled by DLE ENQ 3, the data in the receive buffer and the print buffer are cleared.
If the value of n is out of the specified range, this command is ignored.

Reference: DLE EOT

RS

Function: Journal tab

Code: <1E>H

Description: Moves the printing position to the beginning of the journal paper.

Notes: This code is ignored if the actual print position is behind the beginning of the journal paper.
This command is only activated when the receipt and journal station is selected and parallel printing is disabled.

Reference: ESC c 0

ESC SP n

Function: Set right side character spacing

Code: <1B>H <20>H <n>

Range: $1 \leq n \leq 255$

Description: Sets the character spacing for the right side of the character using the horizontal motion units. The right side character spacing is [n x (horizontal motion units)] inches.

Notes: This command is effective when right side character spacing of normal width character [n x (horizontal motion units)] = 32/150 inches or less or the 64/150 when double width mode is selected.
The right side character spacing for double width mode is twice the normal value.
If the value of n is out of the specified range, this command is ignored.

Default: n=0

Reference: GS P

ESC ! n

Function: Select print mode(s)

Code: <1B>H <21>H <n>

Description: Each bit of n is used in the following way:

The same mode is set for all stations.

Bit	Function	Value 0	Value 1
0	Character font	9 x 9 font	7 x 9 font
1	Undefined		
2	Undefined		
3	Emphasized	canceled	selected
4	Undefined		
5	Double width	canceled	selected
6	Undefined		
7	Underline	canceled	selected

Notes: If you turn on underline mode, some printed characters may be difficult to read, because the underline overlaps the lowest dot in the characters.

Default: n = 0 or 1 depends on DIP switch setting.

Reference: ESC E, ESC -

ESC $ nL nH

Function: Set absolute print position

Code: <1B>H <24>H <nL><nH>

Range: 0 ≤ n L ≤ 255
0 ≤ n H ≤ 255

Description: This command sets the distance from the beginning of the line to the position at which subsequent characters are to be printed.
The distance (inches) from the beginning of the line is calculated by the formula [(nL + nH x 256) x (fundamental calculation pitch)] in inches.

Note: Any value outside the printable area is ignored.

Reference: ESC \, GS P

ESC % n

Function: Select/cancel user-defined character set

Code: <1B>H <25>H <n>

Range: 0 ≤ n ≤ 255

Description: Selects or cancels the user-defined character set.
When n = <*******0>B, the user-defined character set is canceled and the internal character set is enabled.
When n = <*******1>B, the user-defined character set is enabled.
Using ESC &, the user can define character set. While switching on the printer, the internally stored character set (PC437, USA) is copied into the loadable range for character set (RAM).

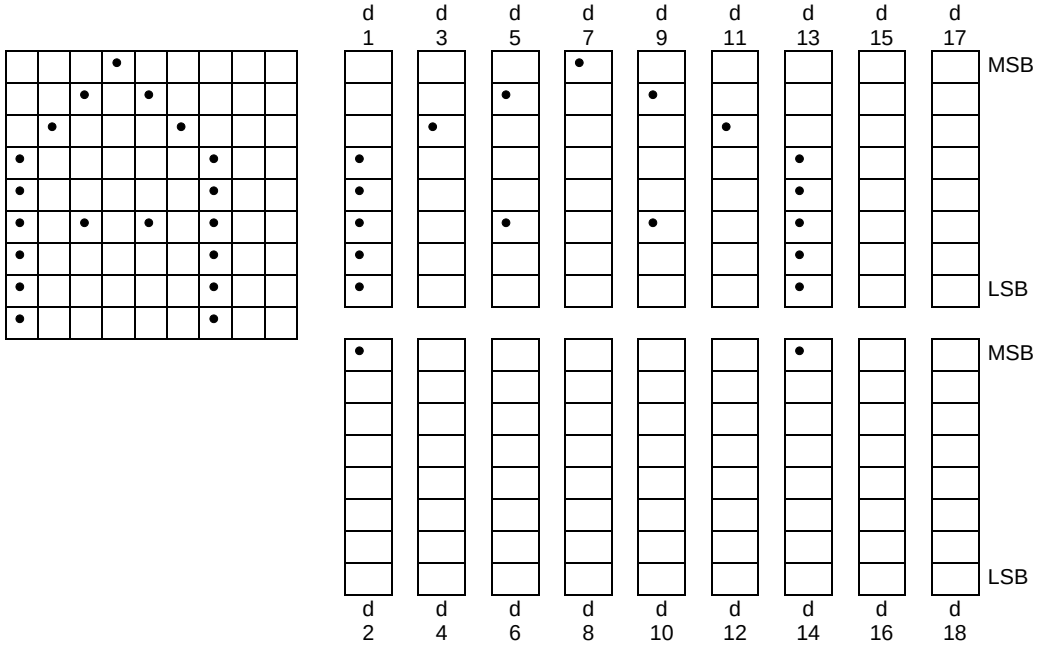
Default: n = 0

Reference: ESC &

ESC & y c1 c2 [X[d]y * x] c2-c1+1

Function:	Define user-defined characters
Code:	<1B>H <26>H y c1 c2 [x d1.....d(y*x)]c2-c1+1
Range:	y = 2 32 ≤ c1 ≤ c2 ≤ 126 0 ≤ x ≤ 12 (9x9 font) or 0 ≤ x ≤ 9 (7x9 font) 0 ≤ d1 .... dy*x ≤ 255
Description:	Defines user-defined characters for the specified character code. y specifies the number of bytes in the vertical direction. x specifies the number of dots in the horizontal direction. c1 specifies the beginning ASCII code for the definition, and c2 specifies the final code. For only one character, use c1 = c2. d is the dot data for the characters. The dot pattern is in the horizontal direction from the left side. Any remaining dots on right side are blank.
Notes:	The allowable character code range is from ASCII code <20>H to <7E>H. Horizontally adjacent dots cannot be printed. Only the top bit in the secondary data bytes in the vertical direction is valid. After user-defined character are defined, they are available until nother definition is made; ESC @ is executed; the printer is reset; or the power is turned off. A If the value of y, c1, c2 or x are out of the specified range, the printer ignores the command and processes the following data as normal data.
Default:	The internal character set
Reference:	ESC %, ESC ?

Example:



When the dot pattern for code 20H is defined as shown above.

ESC & y c1 c2 x d1 d2 d3 d4 d5 d6 d7 d8 d9 d10 d11 d12 d13 d14
HEX Code 1B 26 02 20 20 07 1F 80 20 00 44 00 80 00 44 00 20 00 1F 80

The corresponding bit is 1 when printing and 0 when not printing.

ESC * m nL nH [d] nL + 256 * nH

Function: Select bit-image mode
G
Code: <1B>H <2A>H <m> <nL> <nH> [d]nL + 256 * nH

Range: m = 0 or 1

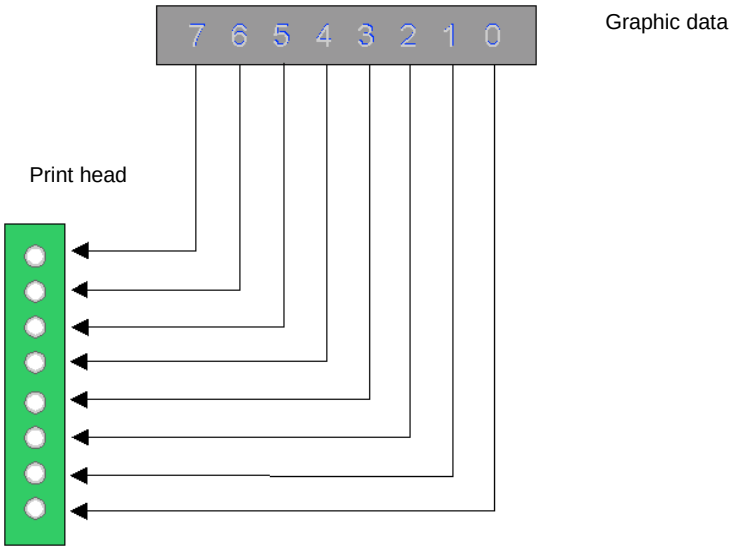
$0 \leq nL \leq 255$
$0 \leq nH \leq 3$
$0 \leq d \leq 255$

Description: Selects a bit-image mode using m for the number of dots specified by nL and nH as follows:

m	No. of Vertical Dots	Horizontal Direction		Maximal number of dots	
		Dot Density	Adjacent Dot	Paper Roll	Slip
0	8	Single Density	Permitted	108	247
1	8	Double Density	Prohibited	216	495

Divide the number of dots to be printed by 256. The integer answer is nH and the remainder is nL. Therefore, the number of dots in the horizontal direction is calculated by nL + 256 nH.
If the bit-image data input exceeds the number of dots to be printed on a line, the access data is ignored.
d indicates the bit-image data. Set a corresponding bit to 1 to print a dot or to 0 to not print a dot.

Notes: If the value of m and nH are out of the specified range, the following data is processed as normal data.
After printing a bit image, the printer returns to normal data processing mode.
If Graphic lines with double density are printed adjacent dots are prohibited.
No line feed is executed. In fact of the printer mechanics only a feed of „1/6“ is possible. Therefore it is not possible to print the graphic lines joined closed together. It makes only sense to create a one-line graphic.
The relationship between the image data and the dots to be printed is shown on the next below:



ESC -

Function:	Turn underline mode on/off
Code:	<1B>H <2D>H <n>
Range:	n = 0, 1, 48, 49
Description:	Turns underline mode on/off. n = 0 or 48: Turns off underline mode. n = 1 or 49: Turns on underline mode.
Notes:	This command and ESC ! turn underline mode on or off in the same way. If the value of n is out of the specified range, the printer ignores the command.
Default:	n = 0
Reference:	ESC !

ESC <

Function:	Return home
Code:	<1B>H <3C>H
Description:	Moves the print head to the leftmost position.
Note:	The leftmost end is detected by the home position sensor.

ESC ?

Function:	Cancel user-defined characters
Code:	<1B>H<3F>H<n>
Range:	32 ≤ n ≤ 126
Description:	Cancels the specified user defined characters
Notes:	This command deletes the defined pattern for the character code specified by n in the selected font. After the defined pattern is deleted, the printer prints the same pattern for the internal characters (Code Page PC437). The printer ignores this command when the value of n is out of the specified range, and when the specified character code is not defined.
Reference:	ESC &, ESC %

ESC @

Function: Initialize Printer

Code: <1B>H <40>H

Description: Clears the data in the print buffer and resets the printer mode to the mode that was in effect when power was turned on.

Notes: The data in the receive buffer is not cleared.
When this command is executed in slip mode, the slip paper is to remove. It switches from slip mode to two sheet mode.

ESC E

Function: Turn emphasized mode on/off

Code: <1B>H <45>H <n>

Range: $0 \leq n \leq 255$

Description: Turns emphasized mode on or off.
n=<*******0>B turns off the emphasized mode.
n=<*******1>B turns on the emphasized mode.

Notes: Printer output is the same in double-strike and in emphasized.
This command and ESC ! turn on and off emphasized mode in the same way. Be careful when using this command with ESC !
Only the lowest bit of n is valid.

Default: n = 0

Reference: ESC !

ESC G

Function:	Turn double strike mode on/off
Code:	<1B>H <47>H <n>
Range:	0 ≤ n ≤ 255
Description:	Turns double strike mode on or off. n=<*******0>B turns off the double strike mode. n=<*******1>B turns on the double strike mode.
Notes:	Printer output is the same in double-strike and in emphasized. Only the lowest bit of n is valid.
Default:	n = 0
Reference:	ESC E

ESC R n

Function:	Select an international character set
Code:	<1B>H <52>H <n>
Range:	0 ≤ n ≤ 10
Description:	Selects a country’s character set using n as follows:

n	Character set
0	USA
1	France
2	Germany
3	Great Britain
4	Denmark I
5	Sweden
6	Italy
7	Spain
8	Japan
9	Norway
10	Denmark II

Notes: If the value of n is out of the specified range, the command is ignored.

Default: n = 0 USA

Reference: Character code table

ESC U n

Function: Turn unidirectional printing mode on/off

Code: <1B>H <55>H <n>

Range: 0 ≤ n ≤ 255

Description: Turns unidirectional print mode on or off.
n=<*******0>B turns off the unidirectional mode.
n=<*******1>B turns on the unidirectional mode.

Notes: When unidirectional printing mode is switched on, the printer prints from left to right.
To avoid horizontal printing misalignment, unidirectional printing mode should be used.
Only the lowest bit of n is valid.

Default: n = 0

ESC \ nL nH

Function: Set relative print position

Code: <1B>H <5C>H <nL><nH>

Range: 0 ≤ nL ≤ 255
0 ≤ nH ≤ 255

Description: Sets the print starting position based on the current position.

Notes: A positive number specifies movement to the right, and a negative number specifies a movement to the left.
Use the supplement of N pitch movement to the left:
- N pitch = 65536 - N
The print starting position is
[(nL+nHx256) x (fundamental calculation pitch) inches
calculated from the current position.]
Any value that falls outside the printable area is ignored.

Reference: ESC $, GS P

ESC a n

Function: Select justification

Code: <1B>H <61>H <n>

Range: 0 ≤ n ≤ 2, 48≤ n ≤ 50

Description: Aligns all the data in one line to the specified position.
n selects the justification as follows:

n	Justification
0, 48	Left justification
1, 49	Centering
2, 50	Right justification

Notes: The command is enabled only when input at the beginning of the line.
This command justifies the space area according to ESC $ or ESC \.
If the value of n is out of the specified range, the printer ignores the command.

Default: n = 0

Example:

Left justification	Centering	Right justification
ABC	ABC	ABC
ABCD	ABCD	ABCD
ABCDE	ABCDE	ABCDE

ESC c 0 n

Function: Select print station(s)

Code: <1B>H <63>H <30>H <n>

Range: $1 \leq n \leq 4$

Description: Selects the printing station described by n.

Bit	Function	Value	
		0	1
0	Journal	disabled	enabled
1	Receipt	disabled	enabled
2	Slip	disabled	enabled
3	undefined		
4	undefined		
5	undefined		
6	undefined		
7	undefined		

Notes: This command is enabled only when input at the beginning of the line.
Slip paper and another paper cannot be selected simultaneously.
When this command is input, the printer executes the following:
(1) If either receipt or journal paper is selected, a previously selected slip paper is canceled and the the printer waits for removing the paper.
(2) If a slip was previously selected and is selected again, no operation is executed.
(3) If either receipt or journal paper was previously selected, and then slip paper is selected, the printer waits for the slip paper to be loaded.
If the value of n is out of the specified range, the printer ignores the command.

Default: n=3 Receipt and Journal

ESC c 4n

Function: Select paper detectors(s) to stop printing

Code: <1B>H <63>H <34>H <n>

Range: $0 \leq n \leq 255$

Description: Selects the paper detectors(s) used to stop printing when paperend is detected.
Each bit of n is used as follows:

Bit	Function	Value	
		0	1
0	Journal near end sensor	Disabled	Enabled
1	Receipt near end sensor	Disabled	Enabled
2	Journal (end) sensor	Disabled	Enabled
3	Receipt (end) sensor	Disabled	Enabled
4	Slip insertion sensor	Disabled	Enabled
5	Slip insertion sensor	Disabled	Enabled
6	undefined	-	-
7	undefined	-	-

Notes: When paper sensor is enabled with this command, printing is stopped only when the corresponding paper is selected for printing.
It is possible to select multiple sensors for print control to stop printing.
Then if any sensor detects a paper end, the printer stops printing.
When a paper end is detected, printing is stopped after printing the current line and feeding the paper.
When a paper-end is detected by the journal or receipt sensor, the printer goes off-line after printing stops.

Default: n = 12

ESC c 5 n

Function:	Enable / Disable panel buttons
Code:	<1B>H <63>H <35>H <n>
Range:	0 ≤ n ≤ 255
Description:	This command enables or disables the control buttons (line feed journal, line feed receipt). When n=<*******0>B, the panel buttons are enabled. When n=<*******1>B, the panel buttons are disabled.
Notes:	Only the lowest bit of n is valid. When the panel buttons are disabled, no button on the panel are usable. Therefore, paper can be fed with the panel buttons only when the printer cover is open.
Default:	n = 0

ESC d n

Function:	Print and feed n lines
Code:	<1B>H <64>H <n>
Range:	0 ≤ n ≤ 255
Description:	Prints the data in the print buffer and feeds n lines.
Notes:	This command sets the print starting position to the beginning of the line. The maximum paper feed amount is 40 inches. If the specified amount exceeds 40 inches, the paper feed amounts is automatically set to 40 inches.

ESC f t1 t2

Function: Set slip paper waiting time

Code: <1B>H <66>H t1 t2

Range: $0 \leq t1 \leq 15$
$0 \leq t2 \leq 64$

Description: Sets the time the printer waits for slip paper to be inserted and time from when the slip is inserted to when the printer starts operation
The slip waiting time is t1*1 minutes. If slip paper is not inserted within this time, the printer cancels slip mode automatically and selects the default paper in ESC c 0.
When t1=0, the printer waits until slip paper is inserted.
The printer starts operation t2*0.1 seconds after detecting a slip.

Notes: If either t1 or t2 is out of the specified range, this command is ignored and the previously set value is not changed.
Using DLE ENQ 3 cancels the slip waiting state. The data in the receive buffer and the print buffer are cleared in this time.

Default: t1=0, t2=0

ESC i

Function: Execute full cut (one point left uncut)

Code: <1B>H <69>H

Description: Executes a partial cut with one point left uncut.

Notes: In standard mode, this command is enabled only when input at the beginning of the line. This command is available only when receipt paper is selected for printing by ESC c 0.

Reference: ESC m

ESC m

Function: Execute partial cut (three positions left uncut)

Code: <1B>H <6D>H

Description: Executes partial cut of the paper roll, with three portions left uncut.

Notes: In standard mode, this command is enabled only when input at the beginning of the line.
This command is available only when receipt paper is selected for printing by ESC c 0.

Reference: ESC i

ESC o

Function: Stamp

Code: <1B>H <6F>H

Description: Executes stamp on the receipt paper.

Notes: This command is available only when input at the beginning of a line.
This command is available only when the receipt station is selected for printing by ESC c 0.

ESC t n

Function: Select character code table

Code: <1B>H <74>H <n>

Range: $0 \le n \le 5$, $254 \le n \le 255$

Description: Selects page n of the character set from the following table.

n	Character code table
0	PC437 (USA, Standard Europe)
1	Katakana
2	PC850 (Multilingual)
3	PC860 (Portuguese)
4	PC863 (Canadian-French)
5	PC865 (Nordic)
254	Space page I (7x9 or 9x9)
255	Space page II (7x9 or 9x9)

Notes: If the value of n is out of the specified range, the command will be ignored.
The space page is the code page, which could be downloaded in the FLASH EPROM.

Default: n = 0

Reference: Character code tables.

ESC v

Function: Transmit paper detector status

Code: <1B>H <76>

Description: Transmits the current paper sensor status.
The status to be transmitted is shown in the following:

Bit	Function	Value	
		0	1
0	Journal near end	paper available	No paper
1	Receipt near end	paper available	No paper
2	Journal end	paper available	No paper
3	Receipt end	paper available	No paper
4	Not used	fixed 0	-
5	Slip insertion sensor	paper available	No paper
6	Slip insertion sensor	paper available	No paper
7	Not used	fixed 0	-

Notes: The ESC V command is used for synchronization between host software and printer. The reply to this command is only transmitted when all previous job prints have been carried out.
When DTR/DSR control is selected, the printer transmits only 1 byte after confirming that the host is ready to receive data (DSR signal is SPACE).
If the host computer is not ready to receive data (DSR signal is MARK), the printer waits until the host is ready.
The 1 byte status data is transmitted after printing and paper feed operation completely stops (transmit time differs from (GS I and GS r)
This command is executed when the data is processed in the receive buffer. Therefore, there may be a time lag between receiving the command and transmitting the status, depending on the receive buffer status.
When Auto Status Back (ASB) is enabled using GS a, the status transmitted by ESC v and the ASB status must be differentiated.

Reference: DLE EOT, GS ENQ, GS a, GS r

ESC z n

Function: Turn parallel printing mode for receipt and journal on/off

Code: <1B>H <7A>H <n>

Range: 0 ≤ n ≤ 255

Description: Turns parallel printing mode on or off. When parallel printing mode is turned on, the printer prints the same data on both receipt and journal station.
When n = <*******0>B, parallel print mode is switched off.
When n = <*******1>B, parallel print mode is switched on.

Notes: Only the lowest bit of n is valid.
This command is enabled only when input at the beginning of a line.
If neither receipt nor journal paper is not selected by ESC c 0 in parallel printing mode, parallel printing is not performed.

Default: n = 0

Reference: ESC c 0

ESC {

Function: Turns upside down printing mode on/off

Code: <1B>H <7B>H <n>

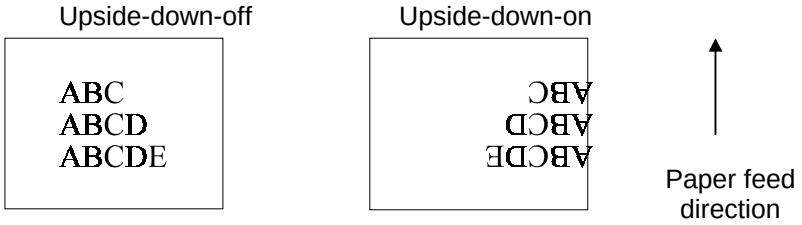
Range: $0 \leq n \leq 255$

Description: Turns upside down printing mode on or off.
When n=<*******0>B, upside-down printing mode is turned off.
When n=<*******1>B, upside-down printing mode is turned on.

Notes: In upside-down printing mode, the printer rotates the line to be printed by 180^{o} and then prints it.
This command is enabled only when input at the beginning of a line.
Only the lowest bit of n is valid.

Default: n=0

Example:



GS ENQ

Function: Transmit real-time printer status.

Code: <1D>H <05>H

Description: The current printer status is transmitted as a status byte via the V.24 interface as soon as the controller receives this sequence of control characters, even within other sequences.

Bit	Function	Value	
		0	1
0	Journal End	paper present	no paper
1	Receipt End	paper present	no paper
2	Cover, open / close	close	open
3	On Line / Off Line	On Line	Off Line
4	not used		fixed 1
5	Document Sensor	paper present	no paper
6	Device Error	no error	error occurred
7	not used		fixed 1

Bit 3:
It becomes 1 when the printer is off-line due the paperend stop or cover open

Bit 6:
It becomes 1 when an error occurred due autocutting, home position detection, carriage detection or print head high temperature error.

Notes: The printer transmits only one byte without checking the DSR signal
This command is executed even if the printer is in off-line state, if the receive buffer is full, or in the mechanical error state.
The printer status is transmitted whenever the data sequence of <1D>H <05>H is received.
This command should not be used within the data sequence of another command that consists of two or more bytes.
When Auto Status Back (ASB) is enabled using GS a, the status transmitted by GS ENQ and the ASB status must be differentiated (see table DLE EOT)

Reference**:** DLE EOT, ESC v, GS a, GS r

GS I n

Function: Transmit printer ID

Code: <1D>H <49>H<n>

Range: $0 \leq n \leq 3$, $49 \leq n \leq 51$

Description: Transmit the specified printer ID.
n specifies the ID of the printer as follows:

n	Printer ID	Specifications	ID (hexadecimal)
1, 49	Model ID	BEETLE /20 2 stations printer	6FH
2, 50	Type ID	See table below	
3, 51	Firmware ID	Firmware version	See Remarks below

Notes: The printer transmits only one byte after confirming that the host system is ready to receive data (DSR signal is SPACE). If the host system is not is ready to receive data (DSR signal is MARK), the printer waits until the host system is ready.
The ID of the printer is transmitted when the data in the receive buffer is developed. Therefore, there may be a time lag between receiving this command and transmitting the status, depending on the receive buffer status.

The Firmware version may be changed.
When Auto Status Back (ASB) is enabled using GS a, the status transmitted by GS I and the ASB status must be differentiated using the table in DLE EOT.
When n is out of the specified range, this command is ignored.

n = 2 Type ID:

Bit	Function	Value	
		0	1
0	Two byte code characters	Not mounted	Mounted
1	Auto cutter	Fixed to 1 (mounted)	
		Fixed to 1	
2	undefined		
3	undefined		
4	Not used	Fixed to 0	
5	undefined		
6	undefined		
7	Not used	Fixed to 0	

GS P n m

Function: Set fundamental calculation pitch

Code: <1D>H <50>H<x><y>

Range: $0 \leq x \leq 255$
$0 \leq y \leq 255$

Description: Sets the units for setting the values in the horizontal direction to 1/x inch, and in the vertical direction to 1/y inch.

When setting x = 0 and y = 0, the values are reset to the default values.

Notes: The current settings remain unchanged after this command is executed.
The calculated result when using this command and the line spacing setting command is adjusted with the minimum pitch of the mechanism (horizontal:1/150)
The vertical calculation pitch has no effect because the linefeed is fixed to 1/6“ .

Default: x = 150

GS a n

Function: Enable / disable automatic status back

Code: <1D>H <61>H<n>

Range: 0 ≤ n ≤ 255

Description: Selects a status for Automatic Status Back (ASB)
Each bit of n is used as follows:

Bit	Function	Value	
		0	1
0	undefined		
1	On-line / Off-line	Disabled	Enabled
2	Error	Disabled	Enabled
3	Roll paper sensor	Disabled	Enabled
4	undefined		
5	Slip paper sensor Slip paper status	Disabled	Enabled
6	undefined		
7	undefined		

Notes:

ASB becomes disabled, when no status is selected.
Auto Status Back (ASB) is enabled. If only one status is selected. The printer automatically transmits a status of 4 bytes whenever the status changes.
If ASB is enabled while processing this command, the current status is transmitted with no regulations.
When transmitting a status, the printer transmits only 4 bytes without confirming the condition of the DSR signal.
This command is executed when the data in the receive buffer is developed. Therefore, there may be a time lag between receiving this command and transmitting the first status, depending on the receive buffer status.
When using ESC v, GS I, GS r, DLE EOT or GS ENQ, the status transmitted by this command, the ASB status, and the status transmitted by another command must be differentiated, according to table Transmit Status Identification (see DLE ENQ).

The status to be transmitted is as follows:

First byte (printer information)

Bit	Function	Value	
		0	1
0	Not used	Fixed to 0	
1	Not used	Fixed to 0	
2	Not used	Fixed to 1	
3	On-line / Off-line	On-line	Off-line
4	Not used	Fixed to 1	
5	Cover open / close	Close	Open
6	Paper feeding with paper feed button	Except during paper feed	During paper feed
7	Not used	Fixed to 0	

Second byte (error information)

Bit	Function	Value	
		0	1
0	Undefined		
1	Undefined		
2	Mechanical error	No error	Error occurs
3	Auto-cutter error	No error	Error occurs
4	Not used	Fixed to 0	
5	Error impossible to recover	No error	Error occurs
6	Head temperature	No error	Error occurs
7	Not used	Fixed to 0	

Third byte (error information)

Bit	Function	Value	
		0	1
0	Journal near end sensor	Paper present	No paper
1	Receipt near end sensor	Paper present	No paper
2	Journal sensor	Paper present	No paper
3	Receipt sensor	Paper present	No paper
4	Not used	Fixed to 0	
5	Slip insertion sensor	Paper present	No paper
6	Slip insertion sensor	Paper present	No paper
7	Not used	Fixed to 0	

Fourth byte (error information)

Bit	Function	Value	
		0	1
0	Slip selection	Selected	Not selected
1	Slip status	Possible to print	Impossible to print
2	Undefined		
3	Undefined		
4	Not used	Fixed to 0	
5	Undefined		
6	Undefined		
7	Not used	Fixed to 0	

Bit 1:
This is 0 (possible to print) when paper insertion has finished and is 0 when the printer waits for removing the slip paper or when time out occurs.
When the slip paper is selected and the printer goes to the slip waiting state:
Bits 5 and 6 of the third byte are 1 (no paper)
Bits 0 and 1 of the fourth byte are 0 (selected) and 1 (impossible to print) respectively.
When the printer goes to the removing of the slip paper waiting with selected paper:
Bits 5 and 6 of the third byte are 1 (no paper), and 0 (paper present) respectively.
Bits 0 and 1 of the fourth byte are 0 (selected) and 1 (impossible to print) respectively.
When printing stops due to paper end is disabled using ESC c 4, bit 1of the fourth byte (slip status) does not become 1 (impossible to print) even when there is no remaining printing space on the slip.
Use GS 3 to check the remaining printing space on the slip.

Default: n=0

Reference: DLE EOT, ESC v, GS ENQ, GS r

GS r n

Function: Transmit status

Code: <1D>H <72>H<n>

Range: n = 1, n = 3, n = 49, n = 51

Description: Transmits the status specified by n as follows:

n	Function
1, 49	Transmits paper sensor status (same as ESC v)
3, 51	Transmits slip paper status

Notes: The printer transmits only one byte after confirming the host system is

ready to receive data (DSR signal is SPACE). If the host system is not ready to receive data (DSR signal is MARK), the printer transmits only one byte without confirming the condition or the DSR signal.
This command is executed when the data in the receive buffer is developed. Therefore, there may be a time lag between receiving this command and transmitting the first status, depending on the receive buffer status.
When Auto Status Back (ASB) is enabled using GS a, the status transmitted by GS r and the ASB status must be differentiated using the table in DLE ENQ.
If the value of n is out of the specified range, the printer ignores this command
The status bytes to be transmitted are shown below:

n = 1: Paper sensor status

Bit	Function	Value	
		0	1
0	Journal near end sensor	Paper present	No paper
1	Receipt near end sensor	Paper present	No paper
2	Journal sensor	Paper present	No paper
3	Receipt sensor	Paper present	No paper
4	Not used	Fixed to 0	
5	Slip insertion sensor	Paper present	No paper
6	Slip insertion sensor	Paper present	No paper
7	Not used	Fixed to 0	

n = 3: Slip status

Value	Slip status
00000000B	There is no printing area on the current slip, or slip paper is not selected.
00000001B	It is possible to print one on the current slip.

When one line is available, the printer transmits <01>H.
If no lines remain on the current slip, the printer transmits <00>H.

Reference: DLE EOT, ESC u, ESC v, GS ENQ, GS a

ND69

Default Setup

When power is applied or command ESC @ is sent, the following default is set:

Item	Default Setup
Font	7 x 9
Down-load character	Same as the internal character set
Character set	Internal character set (PC 437)
Character right-side spacing	0 dot (no right-side spacing)
Print mode	normal
Horizontal tab position	8 columns in 7 x 9 font

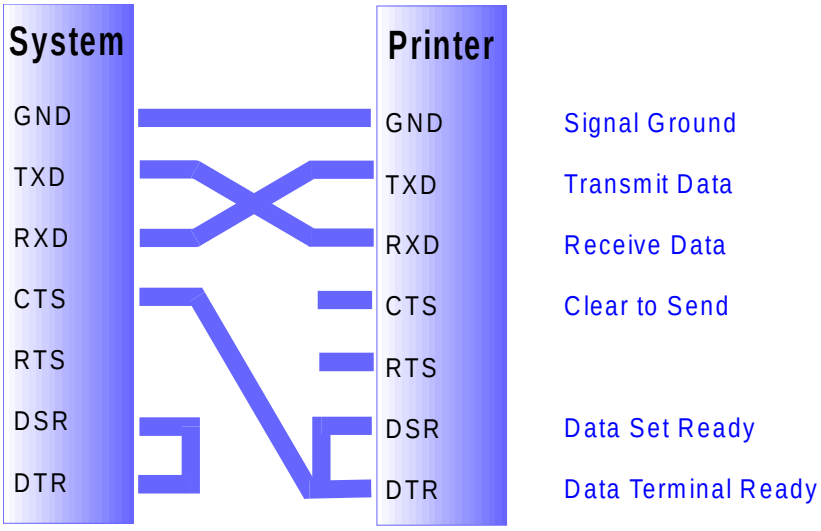
Serial Interface to the System

①	Data transmission:	serial, full duplex
②	Synchronization:	synchronous
③	Handshaking:	DTR/DSR or XON/XOFF control (can be selected by DIP switch 4) XON/XOFF handshaking has no effect on the data transmission from the printer to the system. The system have a sufficiency large reception buffer (e.g. 64 bytes) for reception data.
④	Signal levels:	MARK = logical „1“ : -3V to -15V SPACE = logical „0“ : +3V to +15V
⑤	Baud rate:	9600 bps
⑥	Data length:	8 bits
⑦	Parity:	odd or none
⑧	Stop bits:	1
⑨	Connector pin assignments and signal descriptions	

The printer controller has the following settings:
Baud rate: 9600 bps
Data length: 8 bits
Parity: odd
Stop bits: 1

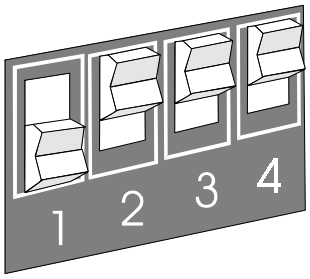
Pin No.	Signal Name	Signal Source	Function
1	FG	-	Frame ground
2	TXD	Output	Transmitted data
3	RXD	Input	Receive data
6	DSR	Input	This signal indicates whether the system can receive data or not. DSR = "0" indicates that the system can receive data; otherwise, DSR = "1" If the DTR / DTS control has been selected, the printer only transmits when DSR = "0" (except when it transmits data in reply to GS ENQ).
7	SG	-	Signal ground
20	DTR	Output	This signal indicates whether the system can receive data or not. If the DTR / DTS control has been switched on, DTR = "0" indicates that the printer can receive data; otherwise, DTR = "1". DTR = "1" is switched in the following cases: during switch-on norming; during the self-test printing; when the reception buffer is full. If the XON / XOFF control is switched on, DTR is always "0", except in the following cases: during switch-on norming; during the self-test printing; when a device error has been recognized.

The interface connection is:



DIP Switches

The DIP switches make it possible for the ND69 to be operated in the ND69 mode or to be compatible with other printers so that existing application software can be used.
The DIP switches are located on the terminal strip on the underside of the ND69, on the right, beside the V.24 interface.



ON

OFF

Default setting

DIP Switch 1:	Meaning of the parallel interface SELECT signal.
Switch **on**	SELECT represents the COVER SWITCH, i.e. SELECT = "HIGH" -> cover closed SELECT = "LOW" -> cover open
Switch **off**	SELECT indicates whether the parallel or the V.24 interface is active SELECT = "HIGH" -> parallel interface is active SELECT = "LOW" -> serial interface is active
DIP Switch 2 and DIP Switch 3	These two switches serve to select the compatibility and set the effects of control commands between the operating modes ND69 mode BEETLE/60 mode or EPSON-TM930 mode Moreover, the switches are used to execute an AUTOFEED, i.e. an automatic line feed with the control character CR.
Switch 2 **off** and Switch 3 **off**	The ND69 is in the ND69 mode and CR is executed without a line feed
Switch 2 **on** and Switch 3 **off**	The ND69 is in the BEETLE/60 mode and CR is executed without a line feed
Switch 2 **off** and Switch 3 **on**	The ND69 is in the EPSON-TM930 mode and CR is executed without a line feed
Switch 2 **on** and Switch 3 **on**	1. The ND69 is in the EPSON-TM930 mode and the parallel interface is active. The parallel interface signal AUTOFEED/N determines whether CR executes an automatic line feed. AUTOFEED/N = "HIGH" - CR without line feed AUTOFEED/N = "LOW" - CR with line feed 2. The ND69 is in the EPSON-TM930 mode and the V.24 interface is active: CR is executed with a line feed.
DIP Switch 4: Switch **on** Switch **off**	Selection of DTR/DSR or XON/XOFF control XON/XOFF control is switched on DTR/DSR control is switched on

Control Sequences of the ND69 Printer

With the aid of a control sequence, i.e. a series of characters, a printing station, for example, the document printing, can receive direct communications. The standard setting is thus overridden, which means that you are able to set many print functions individually if the standard values do not correspond to your requirements. Possible changes are, among others, the selection of a different set of characters, the printing of graphics (logos), and the individualized activation of the various printing stations. You will see that it is very simple to control the printer according to your own personal requirements. However, a precondition for proper use is the correct installation and/or configuration of the system. In addition, you should be familiar with the operating system of your computer. In the case of the bi-directional V.24 interface, all the status information can be called up using the hardware and software protocols in the form of control commands (as with the BEETLE/60 Compact POS System). Via this V.24 interface, it is possible to synchronize the user software and the printing properties. This occurs with the aid of the ESC v control command.
The command set of the ND69 represents an upper quantity limit of command sets of the BEETLE /60 and of the EPSON-TM930. The individual modes (BEETLE /60, ND69 and EPSON- TM930) provide more ESC sequences than the individual printers permit, for example, ESC c 6.
If the printer is operated via the Centronics interface (standard PC interface), only the ESC sequences that expect no reply from the printer can be used. The error reports use the signal connections: paper end, select and error connections. Please note that the BEETLE /60 mode is not supported in connection with the Centronics-Interface. The control sequences of the printer controller are based on the ESC/POS standard. A table shows which of the available sequences are implemented in the ND69.

Code	Function	Mode
LF	Print and Line Feed	
FF	Print and Document Transport	B E N
CR	Print and Carriage Return	
HT	Horizontal Tabulating	
RS	Journal Tab	
ESC SP	Select Character Spacing	
ESC !	Select Print Mode (All Stations)	B E N
ESC Y 1	Select Print Mode (Individual Station)	B E N
ESC *	Activate Graphic Printing	
ESC 2	Set 1/6" Line Spacing	
ESC 3	Set Line Spacing in Microsteps	
ESC <	Move Print Head to Home Position	

ESC @	Initialize Printer	B E N
ESC C	Select Document Output Length	
ESC D	Set Horizontal Tabs	
ESC J	Print and Line Feed in Microsteps	
ESC K	Print and Reverse Line Feed in Microsteps	
ESC R	Select International Character Set	
ESC %	Activate User-Defined Character Set	
ESC X 3	Copy Character Set into RAM	
ESC & <02>H	Load User-Defined Characters	
ESC U	Unidirectional Print on/off	
ESC c 0	Select Printing Station	
ESC c 1	Select Station (Set Line Spacing)	
ESC X 4	Set Paper Width	
ESC c 3	Select Paper End Signal for Parallel Interface	
ESC c 4	Select Paper Sensors for Print Stop	
ESC c 5	Enable/Disable All Control Keys	
ESC c 6	Enable/Disable of ONLINE Button	
ESC d	Print and Execute n Line Feeds	
ESC e	Print and Execute n Reverse Line Feeds	
ESC f	Define Document Waiting Time	
ESC i	Cut Off Receipt	
ESC m	Cut Receipt	
ESC o	Print Logo	
ESC & <03>H	Load Logo	
ESC #	Transmit Data to Sub-device (Customer Display)	
ESC p	Open Cash Drawer	
ESC t	Select Character Set Page	
ESC u	Transmit Cash Drawer Status *	
ESC v	Transmit Printer Status *	B E N
ESC +	Demand Data	B E N
ESC z	Switch On/Off Parallel Print on Receipt + Journal	
GS ENQ	Status Enquiry *	B E N

The ESC sequences marked with * only apply for the V.24 interfaces.

The Mode column provides information on how a control command operates in the two compatibility modes:
no entry -> the control command is compatible (but must not necessarily be available in the BEETLE /60!),
B E N -> the control command is not compatible, "B", "E" and "N" stand for BEETLE/60, EPSON-TM930 and ND69 compatibility.

Notation of the Command Description

XXX	Command Character or Command Sequence

Function:	Name of the command
Code:	Code Sequence (Notation) Hexadecimal = <>H Decimal = <> Repeat bracket contents = ()k Format
Range:	Describes the permitted range of values.
Description:	Describes the function of the command.
Remarks:	Provides important information on settings.
Default:	Describes the standard values.
Example:	Examples of the command in use.

Description of the Control Characters and Sequences

LF	Description

Function:	Print and Line Feed
Code:	<0A> H
Description:	Prints the data located in the buffer and executes a line feed. This command sets the next printing position on the left edge of the selected printing station.

Remarks: The command LF should only be used for a line feed of one line. For reasons of speed, the command ESC d should be used for line feeds of more than one line.

The line spacing of one line feed can be set with the commands ESC c1, ESC 2 and ESC 3.

Default: 1/6"

FF

Function: Print and Document Transport

Code: <0C> H

Description: Prints the data located in the buffer and then transports a document which was previously inserted.

Remarks: The command only functions when the document station has been activated; otherwise it is ignored.

ND69 Mode and EPSON-TM930 Mode
If no control command ESC C n or one with n=0 has been received, the document is only transported out. Depending on the set compatibility, the station is changed:

ND69 Mode	receipt station
EPSON-TM930 Mode	receipt and journal station

If a control command ESC C n or one with n>0 has been received, the document is transported out by the number of lines indicated. After the transport, the station remains selected.

If the set document output length, which was set using ESC C n, is larger than the distance for the first line, the document is transported out and the station is changed in the manner described above. The yellow LED "Document" is switched off.

BEETLE/60 Mode

If no control command ESC C n or one with n = 0 has been received beforehand, the document is transported out as far as the paper edge. The transport rolls, however, continue to grip the document.
The document station remains selected. The yellow LED "Document" remains switched on. If the document is pulled out of the printer from this position, a user error is reported when a V.24 interface is connected. If a Centronics interface is connected, the paper end signal appears.

If a control command ESC C n with n>0 has been received beforehand, the document is transported out by the specified number of lines. The document station remains selected after the transport. If the output length specified by ESC C n is greater than the distance to the first line, the document is transported out to the paper edge. The document station remains selected. The yellow LED remains switched on.

CR

Function: Print and Carriage Return

Code: <0D> H

Description: Prints the data located in the buffer and sets the next printing position on the left edge of the selected printing station.
If AUTOFEED is switched on by means of DIP switch 2, a line feed is executed, possibly dependent on the interface signal AUTOFEED/N of the parallel interface.

HT

Function: Horizontal Tabulating

Code: <09> H

Description: Addresses the next horizontal tab.

Remarks: This command is only executed if the next tab position is actually set. Tab positions can be set with the control sequence ESC D.

RS

Function: Journal Tab

Code: <1E> H

Description: Sets the next printing position at the beginning of the journal.

Remarks: The command only functions if the receipt + journal station is selected and parallel printing is not switched on (by means of ESC z).

ESC SPn

Function: Select Character Spacing

Code: <1B> <20> H <n>

Range: $1 \leq n \leq 32$

Description: Sets the distance between consecutive characters as the number of half dots indicated by n.

Remarks: The space for characters of double width is double the value of n. The setting is valid for the current print station.

Default: Dependent on the selected character density:
10 cpi 5 half dots
11.7 cpi 3 half dots
14 cpi 3 half dots
15.6 cpi 2 half dots

ESC ! n

Function: Select Print Mode

Code: <1B> H <21> H <n> H

Description:

Bit	Function		Value	Value
			(BEETLE /60, ND69)	(EPSON-TM930)
0..2	Character Density :	10 cpi	0	-
		11.7 cpi	1	0, 2, 4, 6
		14 cpi	2	-
		15.6 cpi	3	1, 3, 5, 7
		unchanged	4,5,6,7	
3	undefined		-	
4	undefined		-	
5	wide print		0:off-- 1:on	0:off-- 1:on
6	undefined			
7	undefined			

The same mode is set for all stations.
In the case of BEETLE/60 or ND69 mode, if the value of the lower 3 bits for n>3, only the wide print is switched off/on.
e. g. n = <24>H switch on wide print (character density unchanged)
n =<04> H switch off wide print (character density unchanged)

Default: no wide print. In addition:
in BEETLE/60 or ND69 mode, all stations 14 cpi,
in EPSON-TM930 mode, all stations 11.7 cpi.

ESC Y 1 m n a

Function: Select Print Mode

Code: <1B> H < 59> H <31> H <m> < n> <a>

Description: This command allows each station to be provided with a character density. Bytes n, m and a are constructed in the following manner:

Bit	Function		Value	Value
			(BEETLE, ND69)	(EPSON-TM930)
0..2	Character Density :	10 cpi	0	-
		11.7 cpi	1	0, 2, 4, 6
		14 cpi	2	-
		15.6 cpi	3	1, 3, 5, 7
		undefined	4,5,6,7	
3	undefined		-	-
4	undefined		-	-
5	undefined		-	-
6	undefined		-	-
7	undefined		-	-

Remarks: Byte m is for the journal station, n for the receipt station and a for the document printing. If the receipt and journal station is selected, the character density for the receipt station will be used.

Default: in BEETLE/60 or ND69 mode, all stations 14 cpi,
in EPSON-TM930 mode, all stations 11.7 cpi.

ESC * m n1 n2 data

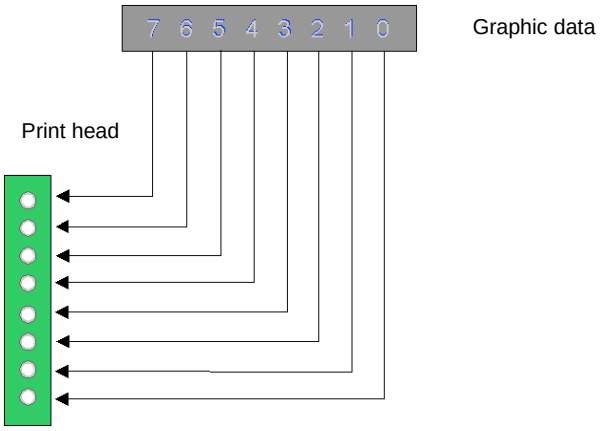
Function: Activate Graphic Printing

Code: <1B> H < 2A> H <m> < n1> < n2> (<data>)k

Range:
m = 0 or 1
0 ≤ n1 ≤255
0 ≤ n2 ≤ 4
k = n1 +256 * n2
1 ≤ k ≤ 1117
0 ≤ data≤ 255

Description: Activates the graphic printing (8 pins) and prints a graphic line in the resolution specified by m.
m determines the resolution of the graphic printing:
m = 0-> simple graphic density (70 dpi, corresponds to full dot)
m = 1-> double graphic density (140 dpi, corresponds to half dot)

The number of columns to be printed, and thus the number of data bytes following n2 that are part of this control command, is the result of k= n1 + (n2*256). n1 is therefore the low part, n2 the high part of the data field length.
If the number of columns determined in this way is larger than the printing area of the selected printing station, the extra data bytes have no effect.
When m=0, the maximum number of columns is exactly half of this amount, when m=1, it is exactly this amount.
After the graphic has been printed, the printer returns to the text mode; text can be printed directly after the graphic.
The following illustration shows the relationship between the data bit and the matrix point of the print head:



Remarks: Graphic lines with double density are printed at half the normal printing speed as dots cannot follow one another at full printing speed in the half-dot matrix.
No line feed is executed. The command ESC J with n=16, for example, must be used for the line feed between graphic lines which are to bejoined close together.

ESC 2

Function: Set 1/6" Line Spacing

Code: <1B> H <32> H

Description: The line spacing for the subsequent line feeds and for the automatic line break of lines which are too long is set at 1/6".

Remarks: The line spacing is only set for the station(s) previously selected with the control command ESC c 1.

ESC 3 n

Function:	Set Line Spacing in n Microsteps
Code:	<1B> H <33> H <n>
Range:	1≤ n≤ 255
Description:	The line spacing in the subsequent line feeds and for the automatic line break of lines which are too long is set in n microsteps.
Remarks:	The line spacing is only set for the station(s) previously selected with the control command ESC c 1.
Default:	n=24 (1/6")

ESC <

Function:	Move Print Head to Home Position
Code:	<1B> H <3C> H
Description:	The print head is moved from whatever position it is in to the furthest left printing position, i.e. the half dot position 0. The data in the buffer re printed!
Remarks:	The furthest left printing position is determined by a home sensor signal. This applies to this control command only, which thus also norms the location between the print head position and the half dot position in the line buffer. Otherwise, every position is determined by counting the carrier pulses depending on direction. Owing to the norming of the carrier position, shifts in the location of lines can occur.

ESC @

Function: Initialize Printer

Code: <1B> H < 40> H

Description: Resets the adjustable printer parameters to the standard values (default setting; corresponds to the state after switching on the printer) and norms the printer.

Print station :	Receipt	ND69 mode
	receipt	BEETLE/60 mode
	receipt and journal	EPSON-TM930 mode
Character density :	14 cpi	ND69 mode
	14 cpi	BEETLE/60 mode
	11.7 cpi	EPSON-TM930 mode
Character set :	Integrated (Standard)	
Int. character set :	Germany	ND69 mode
	Germany	BEETLE/60 mode
	USA	EPSON-TM930 mode
Wide print :	No	
Unidirect. print :	No	
Waiting time Document :	m = 1 ND69 mode m = 1 BEETLE/60 mode Time for inserting a document: 1 minute or m = 0 EPSON-TM930 mode Time for inserting a document: unlimited n = 10 Waiting time after recognition of document: 1 second	
Print stop Sensors:	Receipt end, journal end sensors (BEETLE/60 mode) Receipt end, journal end and document end sensors (ND69- and EPSON-TM930-mode)	
Tab positions :	Interval of 8 characters (character no. 8, 16, 24...) With default character density 14 cpi in the ND69 mode and BEETLE/60 mode, and 11.7 cpi in the EPSON-TM930 mode.	
Paper widths :	Receipt and Journal 76mm, Document 210mm	
Logo:	no logo loaded	
On-line key:	disabled	in BEETLE/60 mode
	enabled	in ND69 mode
	enabled	in EPSON-TM930 mode

Paper end:	receipt-journal-document end	in BEETLE/60 and ND69 mode
signal, parallel interface:	receipt-journal end	in EPSON-TM930 mode

Remarks: The default values depend on the positions of DIP switches 2 and 3 (BEETLE/60 mode, ND69 mode or EPSON-TM930 mode)
This command - in that it bypasses the reception buffer - is executed immediately following reception.
Any data in the reception buffer that have not yet been processed are erased. If the document station was selected beforehand, this command advances the document and switches off the yellow "document" LED.
The print head returns to the home position.

ESC C n

Function: Select Document Output Length

Code: <1B> H <43> H <n>

Range: $0 \leq n \leq 127$

Description: The number of lines by which the document is transported at the document station by the command FF is set.
No output length is determined with n=0; the document is transported out of the printer. The output of the document from the printer depends on the compatibility mode (see control sequence FF):

ND69 mode, EPSON-TM930	The document is transported out mode
BEETLE/60 mode	The document is transported out to the paper edge. The transport rollers, how-ever, continue to grip the document.

Remarks: If the line spacing is altered after the output length has been set, the output length (number of microsteps) remains unchanged.

ESC D (n)k NUL

Function: Set Tabs

Code: <1B> H <44> H <n1> H (<n>)k <0>

Range: $1 \leq n \leq 123$
$1 \leq k \leq 32$

Description: Sets up to 32 horizontal tabs, which are entered as n1, n2, n3 etc. between 1 and 123 in a rising sequence with 0 at the end.
All horizontal tabs can be erased with ESC D 0. Any subsequent HT command is ignored. When switching on the printer, or after entering ESC @, tabs are set at intervals of 8 characters (11.7 cpi in Epson-TM930 mode, 14 cpi in BEETLE/60 and ND69 mode).

The positions are shown as number of characters (with current character density) between the beginning of a print line and the tab position. However, they are stored as absolute half-dot values, which means that they are preserved even if the character density is altered later.

If the receipt + journal station (without parallel printing) is selected, the tab positions apply from the beginning of the receipt. In the character count, the gap between receipt and journal is bypassed, and the first character position on the journal is always the beginning of the journal, even when the length of the receipt printing area (in half dots) is more than a complete multiple of the amount of receipt characters.

"n" specifies the character number of the tab position. (The 1.character of the print line has the no. 0.)
"k" specifies the amount of tab positions (max 32)
If the final 0 is not present after 32 positions, the control command ends after the 32nd position value and the subsequent values are regarded as print characters or new control commands.
If a value defined as n_k is equal to or less than the previously transmitted value n_{k-1}, or greater than 123, the control sequence is regarded as finished and the n_k value and the subsequent characters are interpreted as print characters or new control commands.

Tab positions that lie outside the printing field are regarded as lying

directly behind the last character of the printing field, which means that a compulsory line break is executed when a print character follows the corresponding HT.

Default: Tabs at intervals of 8 characters (14 cpi), i.e. character no. 8, 16, 24 etc.

Example: Set 2 tabs on characters no. 10 and 15:
<1B> H <44> H <0A> H <0F> H <0> H

ESC J n

Function: Print and Line Feed in Microsteps (n/144")

Code: <1B> H <4A> < n>

Range: 0 ≤ n ≤ 255

Description: The contents of the data buffer are printed, and the paper is line fed by the amount of microsteps specified by n. This command sets the next print position on the left edge of the selected print station. The line spacing set with ESC 2 or ESC 3 is not influenced by this control sequence.

ESC K n

Function: Print and Reverse Line Feed in Microsteps (n/144")

Code: < 1B> H <4B >H <n>

Range: 0≤ n ≤ 255

Description: The contents of the data buffer are printed, and the paper is line fed in reverse by the amount of microsteps specified by n.
Following this command, the left edge of the station is the next print position.

Remarks: This command only applies when the document station is selected.
If the sensors relevant to this station are activated with ESC c4, they must issue the message "paper available" so that the command can be executed and/or completely processed. The line spacing set with ESC 2 or ESC 3 is not influenced by this control sequence.

ESC R n

Function: Select International Character Set

Code: <1B> H <52> H <n>

Range: 0≤ n ≤12

Description: By means of the variable n, one of the following sets of characters can be selected :

n	Set of Characters
0	USA
1	France
2	Germany
3	Great Britain
4	Denmark I
5	Sweden
6	Italy
7	Spain I
8	Japan
9	Norway
10	Denmark II
11	Spain II
12	Latin America

Standard Value: n = 2 Germany (compatible with BEETLE/60 printer and ND69 printer) or
n = 0 USA (compatible with EPSON-TM930 printer)

ESC % n

Function: Activate User-Defined Character Set

Code: <1B> H <25> H <n>

Range: 0≤ n ≤ 255

Description: This command selects either the internal set of characters or the set of characters defined by the user.

Using ESC &, the user can define a set of characters. While switching on the printer, the internally stored chracter set (ROM) is copied into the loadable range for character sets (RAM).
Only bit 0 of n is relevant; bits 1 ...7 can have arbitrary values.
Bit 0 = 1: selects the user-defined set of characters
Bit 0 = 0: selects the standard set of characters

Remarks: As with the standard set of characters, a switch to country-specific characters can be made by means of ESC R n insofar as they have not been written over with the "load user-defined characters" sequence (ESC & 2 m n data).

Default: n = 0

ESC X 3 n

Function: Copy Character Sets

Code: <1B> H <58> H <33>H <n>

Range: $1 \leq n \leq 3$

Description: The internally stored character sets (ROM) are copied into the loadable range for character sets (RAM).
n determines which set of characters is copied:
n = 1 character set 9 *9 is copied
n = 2 character set 9 *7 is copied
n = 3 both character sets are copied

Remarks: The country variation which was previously set using ESC R n is copied.

ESC & 02 m n data

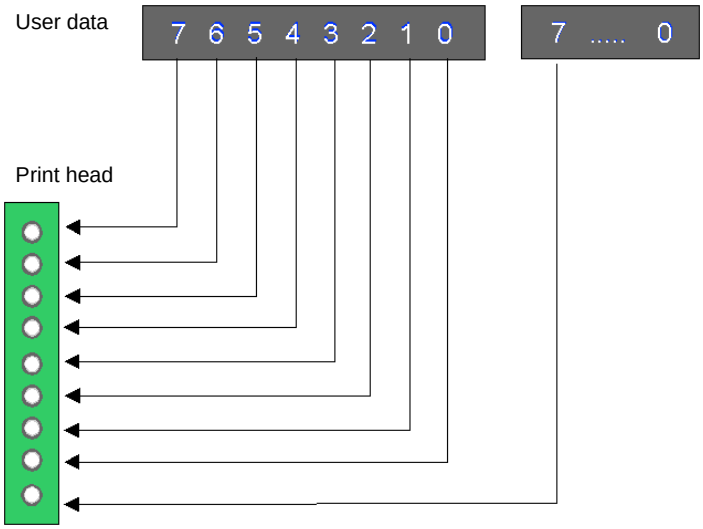
Function: Load User-Defined Characters

Code: <1B> H <26> H <02> H <m> <n> (<a> (<p>)k1)k2

Range: $21H \leq m \leq n \leq FFH$
a = 7 or a = 9
k1 = 2*a
k2 = n - m +1
$0 \leq p \leq 255$

Description: Self-defined characters can be loaded with this command.

"m" is the character code of the 1st character to be loaded, and "n" is the code of the last character. If, for example, only one character needs to be newly defined, n=m.
This produces the number of characters for k2 = n - m +1.
"a" is the character width in half dots. This value has to be passed on for each character; however, it must not change during loading.
Character sets which are loaded with a = 7 can be printed with a character density of 14 or 15.6 cpi.
Character sets which are loaded with a = 9 can be printed with a character density of 10 or 11.7 cpi.
"p" is the user data (pin information). The amount of user data (bytes) to be bypassed is k1 = 2 * a.
The following illustration shows the relationship between the data bit and the matrix point of a 9-pin print head:



Remarks: The character representation must be selected in such a way that no two horizontally consecutive dots are set. If this rule is breached, the printer will remove every second dot to avoid mechanical malfunctions.

ESC U n

Function: Unidirectional Print ON/OFF

Code: <1B> H <55> H <n>

Range: 0 ≤ n≤ 255

Description: With this command, it is decided whether the print head should print in only one or in both directions.
Only bit 0 of n is relevant; bits 1 ... 7 can have arbitrary values.
Bit 0 = 0: Unidirectional Print off
Bit 0 = 1: Unidirectional Print on

Remarks: With Unidirectional Print ON, printing occurs from left to right.

Default: n = 0

ESC c 0 n

Function: Select Printing Station

Code: <1B> H <63> H <30> H <n>

Description: Selects the printing station described by n.

Bit	Function	Value	
		0	1
0	Journal	off	on
1	Receipt	off	on
2	Document	off	on
3	undefined	-	-
4	undefined	-	-
5	undefined	-	-
6	undefined	-	-
7	undefined	-	-

Remarks: Only one station can be selected at one time.
Exception: it is possible to select the receipt and journal station at the same time. This station is then assigned the character density and set of characters set at the receipt station.
If the document station is selected, the document can be inserted in the time specified by ESC f. During this period, the yellow LED "document" flashes. If no document is inserted within the specified time a user error message is issued and the receipt station is selected.
If the document is inserted within the specified time, the yellow LED lights up continuously and printing takes place.
The wait for a document (yellow LED flashing) can be interrupted by the command "initialize printer" (ESC @).
If a switch is made from the document station to the receipt, journal or receipt/journal stations, the printer transports out any document present at the station and switches the yellow LED off.

Default: n = 2 Receipt (compatible with BEETLE/60 printer and ND69 printer)
n = 3 Receipt and Journal (compatible with EPSON-TM930 printer)

ESC c 1 n

Function: Select Station to Set Line Spacing

Code: <1B> H <63> H <31> H <n >

Range: 1≤ n ≤7

Description: Selects the station(s) for placement of the next sequence (ESC 2 , ESC 3) - setting the line spacing. At least one station has to be selected.

Bit	Function	Value	
		0	1
0	Journal	off	on
1	Receipt	off	on
2	Document	off	on
3	undefined	-	-
4	undefined	-	-
5	undefined	-	-
6	undefined	-	-
7	undefined	-	-

ESC X 4 m n a

Function: Set Paper Width of the 3 Stations

Code: <1B> H <58> H <34> H <m> <n> <a>

Description: This command sets the paper widths to be used.
The values are in millimetres. The following values are permissible:

Byte	Station	Range
m	Journal	40, 45, 58, 64, 69, 76mm
n	Receipt	40, 45, 58, 64, 69, 76mm
a	Document	50...216mm

Default: m=76, n=76, a=210

ESC c 3 n

Function: Select Paper End Signal for Parallel Interface

Code: <1B> H <63> H <33 >H <n >

Range: 0≤ n ≤ 255

Description: This command selects the paper sensors which activate the PE message of the parallel interface. The PE message is active, i.e. issues the message "no paper", when at least one of the sensors with the switching signal "on" issues the message "no paper".

Bit	Function	Value	
		0	1
0	Journal End	off	on
1	Receipt End	off	on
2	undefined	-	-
3	undefined	-	-
4	Document End	off	on
5	undefined	-	-
6	undefined	-	-
7	undefined	-	-

Remarks: The sensors are selected when the command is executed.
A delay can therefore occur between transmission of the command and selection of the sensors; the extent of this delay depends on how full the reception buffer is.
To select the document paper end, you need only set bit 4 or bit 5 to 1.

Default: n = 13 H Journal end, receipt end, document end (compatible with ND69 printer)
n = 03 H Journal end, receipt end (compatible with EPSON-TM930 printer)

ESC c 4 n

Function: Select Paper Sensors for Print Stop

Code: <1B> H <63> H <34 >H <n >

Range: 0 ≤ n ≤ 255

Description: This command selects the sensor which produces a print stop.

Bit	Function	Value	
		0	1
0	Journal End	off	on
1	Receipt End	off	on
2	undefined	-	-
3	undefined	-	-
4	Document End	off	on
5	undefined	-	-
6	undefined	-	-
7	undefined	-	-

Remarks: The printing and/or line feed is always halted when the sensor belonging to the station is activated and it issues the message "no paper". It is possible to select more than one sensor at a time. The printing is only stopped when the end of a line has been reached and a line feed has been executed.
If a paper end has been found at the receipt or journal station, the printer goes into the offline mode after the printing has been halted. Two sensors are present at the document station (document beginning and document end); however, this command regards them as one sensor, which is observed or not observed. Independent of the selection of the document station, the sensors must always issue the message "paper available" before a document is confirmed to be

properly inserted (see ESC v and/or ESC +4).
To select the document paper end, you need only set bit 4 or bit 5 to 1.

Note — It is advisable not to switch off the print stop of the document end as the paper is to be gripped by the transport rollers.

Default: n = 13 H Document end, journal end, receipt end (compatible with ND69 and EPSON-TM930 printer).
n = 11 H Document end, journal end (compatible with BEETLE /60 printer).

ESC c 5 n

Function: Enable / Disable All Control Keys

Code: <1B>H <63>H <35>H <n>

Range: $0 \leq n \leq 255$

Description: This command executes a common enable or disable for all control keys (ONLINE, line feed journal, line feed receipt).
Only bit 0 of n is relevant; bits 1 ... 7 can have arbitrary values.
Bit 0 = 1: all control keys disabled
Bit 0 = 0: all control keys enabled.

Remarks: In the BEETLE /60 mode this command has no influence upon the ONLINE button

Default: n = 0

ESC c 6 n

Function: Enable / Disable of ONLINE Button

Code: <1B>H <63>H <36>H <n>

Range: $0 \leq n \leq 255$

Description: This command enables or disables the ONLINE button.
Only bit 0 of n is relevant; bits 1 ... 7 can have arbitrary values.
Bit 0 = 1: ONLINE button disabled
Bit 0 = 0: ONLINE button enabled.

Remarks: When the ONLINE button is disabled, it is no longer possible to switch between online and offline by means of the button.
The printer is then in the online mode; however, the line feed buttons for receipt and journal can be used. This command does not work in the BEETLE /60 mode!

Default: n = 0

ESC d n

Function: Print and Execute n Line Feeds

Code: <1B> H <64> H <n>

Range: $0 \leq n \leq 255$

Description: Prints the contents of the data buffer, then executes n line feeds. This command sets the next printing position at the left edge of the selected printing station.
The line spacing of one line feed can be set using the commands ESC 2 and ESC 3.

Default: 1/6" line spacing

ESC e n

Function: Print and Execute n Reverse Line Feeds

Code: < 1B >H <65> H <n>

Range: $0 \leq n \leq 255$

Description: Prints the contents of the data buffer, then executes n reverse line feeds at the document station. This command sets the next printing position at the left edge of the selected printing station.

Remarks: This command only applies when the document station has been selected.
If the appropriate sensors for the station have been activated with ESC c4, they must issue the message "paper available", so that the command can be executed and/or completely processed. The line spacing of one reverse line feed can be set using the commands ESC 2 and ESC 3.

Default: 1/6" line spacing

ESC f m n

Function: Define Document Waiting Time

Code: <1B>H <66>H <m > <n>

Range: $0 \leq m \leq 15$
$0 \leq n \leq 64$

Description: Specifies the waiting time for insertion of a document, and the time interval from insertion until the processing of subsequent commands begins.
m determines the waiting time for the insertion of documents in minutes.
If m is given the value 0, the printer waits for the insertion of a document without interruption.

Further functions of the printer start after after a delay of n * 100ms following insertion of a document.

Default: m = 1, n = 10 (compatible with BEETLE/60 printer and ND69 printer)
or
m = 0, n = 10 (compatible with EPSON-TM930 printer)

ESC i

Function: Cut Off Receipt

Code: <1B>H <69>H

Description: The command means that the receipt is cut off.

Remarks: The command only applies at the beginning of a line.
The command only applies when the receipt station has been selected.
In BEETLE /60 mode the command applies for every station.

ESC m

Function: Cut Receipt

Code: <1B>H <6D>H

Description: The command means that the receipt is cut.

Remarks: The command only applies at the beginning of a line.
The command only applies when the receipt station has been selected.
In BEETLE /60 mode the command applies for every station.

ESC o

Function: Print Logo

Code: <1B>H <6F>H

Description: The logo that has been loaded is printed by the previously selected printing station, but only at the receipt or document station.
If the journal station has been selected, or if no logo has been loaded, the control command has no effect.

Remarks: The command only applies at the beginning of a line.
See ESC & 3 to load the logo.

ESC & 03 m n1 n2 data

Function: Load Logo

Code: <1B> H <26> H <03> H <m> <n1> <n2> (<p>)k

Range: <0> ≤ m≤ 18 and m = 255
n1 = 0
0 ≤ n2 ≤ 200
k = n2 + 256*n1
0 ≤ p ≤ 255

Description: A logo is a series of graphic lines that are stored in the printer RAM. Printing takes place by means of the control command ESC o at the selected print station, but only at the receipt or document station.

A certain format must be adhered to when loading a logo.
A logo consists of a maximum of 18 lines, each with a maximum of 200 data bytes, and its horizontal position can be varied. It is printed with 8 pins per line, whereby a dot that is to be printed is marked by setting the corresponding bit to "1". The relationship between the data bit and the printer head pins is defined in the control command

ESC * print graphic.
A sequence with a maximum of 18 control commands with line numbers from 1 upwards, as well as the data bytes for each line, defines the logo. A control command with the line number 0 is placed in front of this sequence as a start command, and a command with the line number 255 is placed after the sequence as a stop command. The start command passes on a data byte which determines the horizontal position of the logo. ND69 mode/EPSON mode: The contents of this data byte determine the column number of the first column of the logo in the printing area, beginning with 1. BEETLE/60 mode: The contents of this data byte moves the start position of the logo a whole character. If the data byte equals <01>H, then the start position is not being moved. If moved too far over, it is possible in certain circumstances that the logo can no longer be printed in its entirety. The excess data bytes are then ignored.
Missing lines in the control command sequence are left empty in the logo.
If a control command with line 0 is transmitted during a transmission already taking place, the logo memory is erased and transmission is restarted from the beginning. When line 0 and then line 255 are transmitted, only the erasure of the logo takes place.
Logos are always defined in full-dot graphics, i.e. two consecutive graphic columns are separated by an empty column.
(as for graphics of simple density, see ESC * with m = 0)

Remarks: Here, in contrast to ESC/POS TM standard (e.g. ESC *), the data field length is indicated with the high byte n1 first, followed by the low byte n2.

Example: for one-line logo:
start command (line 0 shift position = 01)
ESC & 03 00 00 01 01 < 1B 26 03 00 00 01 01>H
data transmission command (line 1)
ESC & 03 01 00 8C data < 1B 26 03 01 00 8C Daten> H
stop command (line 255) ESC & 03 FF 00 00 <1B 26 03 FF 00 00> H

ESC # m n data

Function: Transmit Data to Sub-device (Customer Display)

Code: <1B>H <23>H <m> <n> (<p>)n

Range: m = 0
0 ≤ n ≤ 255
0 ≤ p ≤ 255

Description: With this command, the following n bytes are transmitted to the sub-channel. The ND69 has only the sub-channel 0, which is the V.24 interface for connection to the customer display.
The data transmission is transparent, i.e. the n bytes can have arbitrary values, which means they may also contain control commands (for the customer display).

Remarks: No data are transmitted from the customer display to the host computer. After switching on, the customer display transmits data (ID).
These can be printed during the self test.

ESC p m n1 n2

Function: Open Cash Drawer Cover

Code: <1B>H <70>H <m> <n1> <n2>

Range: m = 0 or 1
0 ≤ n1 ≤ 255
0 ≤ n2 ≤ 255

Description: The opening impulse defined by n1 and n2 is transmitted to the selected cash drawer.

m = 0: Open first cash drawer,
m = 1: Open second cash drawer.
n1 * 10ms is the duration of the opening impulse;
n2 * 10ms is the minimum period between two impulses to the same cash drawer.

n1 = 5 and n2 = 255 are required for Siemens Nixdorf cash drawers.

ESC t n

Function: Select Character Set Page

Code: <1B>H <74>H <n>

Range: Currently, only n = 0.

Description: The command selects page n of the character set.
Only page 0 of the character set is implemented.

Default: n = 0

ESC u n

Function: Transmit Cash Drawer Status

Code: <1B>H <75>H <n>

Range: n = 0

Description: The status of the cash drawer(s) connected to the system is transmitted to the system via the V.24 interface.
The status byte has the configuration:

Bit	Meaning	Value	
		0	1
0	Cash drawer 1	open	closed
1	Cash drawer 2	open	closed
2	not used	-	fixed 1
3	not used	-	fixed 1
4	not used	-	fixed 1
5	not used	-	fixed 1
6	not used	-	fixed 1
7	not used	fixed 0	-

Remarks: This command only applies when the serial interface has been selected.
With the parallel interface, it is ignored.
If no cash drawer is connected, the bit in question has the value "1" in the status byte.
The status is transmitted back when the command is executed.
A delay can therefore occur between transmission of the command and reception of the status byte; the extent of this delay depends on how full the reception buffer is.

ESC v

Function: Transmit Printer Status

Code: <1B>H <76>

Description: The ESC v command is used for synchronization between host software and printer. The reply to this command is only transmitted when all previous job prints have been carried out.
This command only applies when the serial interface has been selected. In the case of the parallel interface, it is ignored.
This command induces the controller to transmit the current status via the V.24 interface. After the system has indicated that it is able to receive, the printer transmits a byte (status byte).
Depending on the position of DIP switches 2 and 3, which determine the compatibility of the ND69, the status byte contains the following:

Bit	Meaning (BEETLE /60 mode, ND69 mode)	Value	
		0	1
0	Front document sensor	no paper	paper available
1	Back document sensor	no paper	paper available
2	Receipt	no paper	paper available
3	Journal	no paper	paper available
4	Not used	fixed 0	-
5	Cover	closed	open
6	Error	no	yes
7	Not used	fixed 0	-

Remarks: Bit 6 "error" is an or-connection of the error bits from ESC +1 and is automatically deleted when ESC + 1 or ESC v has been executed. The error can be more clearly specified and removed by means of the extended error message (ESC +1). In the BEETLE/60 mode Bit 6 is set every time an ESC sequence is received (if at this time an error bit of the extended error message (ESC + <01>H) is set). Bit 0, "Begin of Document", remains to be set in the BEETLE /60 mode after inserting the paper as long as another station is selected. Bit 1, "End of Document", is set in the BEETLE /60 mode as soon as the document is inserted.

This bit will be deleted when the document has left the printing station.

Bit	Meaning (EPSON-TM930 mode)	Value	
		0	1
0	Journal	paper available	no paper
1	Receipt	paper available	no paper
2	not used		fixed 1
3	not used		fixed 1
4	not used		fixed 0
5	Document	paper available	no paper
6	not used		fixed 0
7	not used		fixed 0

Remarks: The status is transmitted back when the command is executed. A delay can therefore occur between transmission of the command and reception of the status bytes; the extent of this delay depends on how full the reception buffer is (applies to both cases).

ESC + m

Function: Demand Data

Code: <1B>H <2B>H <m>

Description: In response to this command, the printer controller transmits a

message sequence which - dependent on m - contains the following data:

0	**device configuration**
1	extended error message
2	-
3	read printer parameters
4	switches and sensors
128	power-up error

Commands with m = 2 and m = 5 ... 127 are ignored.

The message sequence has the following configuration:

ESc r n1 n2 data <1B>H <72>H <n1> <n2> (<p>)k

This command only applies when the serial interface has been selected. In the case of the parallel interface it is ignored.

Range: n1 = 0
1≤ n2 ≤ 24
k = n2 + 256 * n1

Remarks: In contrast to ESC/POS TM standard (e.g. ESC *), the data field length is indicated with the high byte n1 first, followed by the low byte n2.

ESC + 0

With the device configuration, the printer controller supplies a statement about the configuration (the expansion stage) and the program version in use.
The information is transmitted by means of n2 = 24. All the information is coded in ASCII, which means it can be read as text.
The device configuration is as follows (see next page):

Byte No.	Number of Bytes	Content Text	Hex	Description
1, 2, 3	3	ESC[?	1B,5B,3F	Start sequence
4, 5	2	B5	42, 35	Ident.No. for ND69
6	1	;	3B	Separator
7, 8	2			Program version
9	1	,	2C	Separator
10, 11	2			Program sub-version
12	1	;	3B	Separator
13, 14	2			Characters/line of the selected paper width and character density
15	1	,	2C	Separator
16,17	2			...on Receipt
18	1	,	2C	Separator
19, 20, 21	3			...on Document. In two-digit values byte 19 is replaced by a blank <20>H
22	1	;	3B	Separator
23	1	1 0	30 31	cutter available cutter not available
24	1	c	63	configuration end

The data field "program version" provides the version number of the firmware used by the controller. The program sub-version is a version of the software used internally. The numbers of characters per printing station represent the current value that results either when the printer is switched on (default value) or when the control command ESC X 4 is received.

ESC +1

In the case of an error message following the command ESC v, bit 6, "error", the error is described in more detail by the extended error message.
A data byte (n2 = 1) with the following configuration is transmitted :

Bit	Functions
0="1"	device error
1="1"	cover error (only BEETLE /60, otherwise = 0)
2="1"	user error
3="1"	memory error
4="1"	power-up error
5="1"	logo format error
6="1"	job loss error (only BEETLE /60, otherwise = 1)
7="1"	not used

After transmission, all error bits are removed - with the exception of device errors. Device errors have to be removed by means of the ESC @ control command, by activating the init-signal of the Centronics interface, or by switching the printer off and on.

Remarks:

Bit 0, device error
Device errors are reported when mechanical malfunctions in the printer occur, which are recognized by the microprogram to have exceeded the timeouts. Possible device errors are:

- Interference in carrier movement, recognized by timeout of consecutive carrier pulses.
- Interference in cutter movement, recognized by timeout of the cutter disc revolutions and/or a change of signal at its home sensor.

Device error message in BEETLE/60 mode occurs only when a cut command was sent to the printer.

Bit 1, cover error
In the EPSON-TM930 and ND69 modes, Bit 1 always equals 0. A cover error is reported when a print job cannot be carried out with open cover.

Bit 2, user error
User error is reported when no document has been inserted within the time specified by ESC f. User errors are reported in the BEETLE/60 mode when there is no paper on a station (printstop sensor active) and when a line feed on the receipt station shall be executed after an interference on the cutter has occured.

Bit 3 memory error
Memory error is reported when an error occurs during the memory test (RAM and ROM).

Bit 4 power-up error
Power-up error is reported when a hardware error is recognized while the printer is being switched on.
Bit 5 logo format error
Logo format error is reported when a format error is recognized while a logo is being loaded (ESC & 3).
Bit 6 job loss error
In the EPSON-TM930 and ND69 operating modes, bit 6 is always equal to 1. In BEETLE/60 mode, job loss error is reported when the ND69 receives printing data in the following states:

- in all off-line states (e.g. device fault, open cover);
- at paper end on one of the three stations, when print stop is switched on.

In this mode bit 6 is set at each received control sequence when one of the other error bits (0 to 5) is set at the same time.

Remarks: Unlike the BEETLE/60 printer, all jobs that do not lead to printing or line feed are correctly executed (e.g. setting line space).

ESC + 3

The set printer parameters can be read. A data field of 6 bytes (n2 = 6) with the following meaning is transmitted:

Byte 1			
Parameter	**Bit**	**Value**	**Explanation**
Character density Journal	1, 0	00 01 10 11	10 cpi 11.7 cpi 14 cpi 15.6 cpi
Character density Receipt	3, 2	00 01 10 11	10 cpi 11.7 cpi 14 cpi 15.6 cpi
Character density Document	5, 4	00 01 10 11	10 cpi 11.7 cpi 14 cpi 15.6 cpi
-	7, 6	fixed 11	not used

Byte 2			
Parameter	**Bit**	**Value**	**Explanation**
Wide print	0	0 1	switched off switched on
-	1		undefined
Unidirectional printing	2	0 1	switched off switched on
selected station	4, 3	00 01 10 11	Journal Receipt & Journal Receipt Document
-	7, 6, 5	fixed 111	not used

Byte No.: 3 Bit 0-3 : international character set (see ESC R)
Bit 4-7 : not used, fixed 0000
Byte No.: 4 Print stop sensors (see ESC c4)
Byte No.: 5 Waiting time for document insertion (see ESC f)
Byte No.: 6 Waiting time for restart (see ESC f)

ESC + 4

The set printer parameters can be read. A data field of 7 bytes (n2 = 7) with the following meaning is transmitted:

Byte No.: 1 Sensors

Bit	Function
0="1"	Document at start position
1="0"	Document at end position
2="0"	Receipt end
3="0"	Journal end paper roll
4="1"	not used
5="1"	not used
6="1"	not used
7="1"	Unidirectional printing

Byte No.: 2 Switches

Bit	Function
0="0"	Carrier in home position
1="0"	Cutter in home position
2="0"	Cover open
3="1"	DIP1 on
4="1"	DIP2 on
5="1"	DIP3 on
6="1"	DIP4 on
7="1"	not used

Byte No.: 3 to 7 not used, fixed 0

ESC + 5

A power failure can be detected. A data field of 1 byte (n2 = 1) is transmitted, where bit 0 = 1 means "power failure". The bits 1 to 7 equal 0 and are not used. The bit "power failure" is transmitted after switching on the ND 69. After transmission of the command ESC + 5 it will be deleted.

ESC + 128

When the status byte reports a power-up error, a more detailed description of the cause of the error is provided by this enquiry. A datafield of 2 bytes (n2 = 2) with the following meaning is transmitted:

Byte 1	
Contents	**Error Messages**
= 66H	No Error
= 01H	CPU Error (commands)
= 02H	CPU Error (internal RAM)
= 20H	External RAM Error
= 30H	EPROM Error

Byte No.: 2 not used, fixed 0

ESC z n

Function:	Switch On/Off Parallel Print on Receipt + Journal
Code:	<1B>H <7A>H <n>
Range:	$0 \leq n \leq 255$
Description:	This command switches the parallel printing (printing of the same data) on the receipt and journal on or off. Only Bit 0 of n is relevant; Bits 1 ... 7 can have arbitrary values. Bit 0 = 0: Parallel printing is switched off; Bit 0 = 1: Parallel printing is switched on.
Remarks:	This command only applies at the beginning of a print line, and only when (with ESC c 0) the receipt+journal is selected as one printing station. With parallel printing OFF, receipt+journal are interpreted together as one printing station with one print line that covers both stations. With parallel printing ON, receipt+journal are two separate printing stations at which the same text is printed.
Default:	n = 0

GS ENQ

Function:	Status Enquiry
Code:	<1D>H <05>H
Description:	The current printer status is transmitted as a status byte via the V.24 interface as soon as the controller receives this sequence of control characters.

Bit	Meaning	Value	
		0	**1**
0	Journal End	paper available	no paper
1	Receipt End	paper available	no paper
2	Cover	closed	open
3	On Line/Off Line	On Line	Off Line
4	Cash drawer	1 or 2 open	both closed
5	Document End	paper available	no paper
6	Device Error	no error	error
7	not used	-	fixed 1

Remarks:

This command only applies when the V.24 interface and the data transmission control are selected with DTR/DSR. In addition, either the EPSON-TM930 or the ND69 mode is to be set. When the parallel interface or the XON/XOFF control for V.24 interface or BEETLE /60 mode are selected, this command is ignored.
This command is also executed when the printer is in the offline mode, when the reception buffer is full, or when a device error has occurred.

Attention!
The controller transmits the status byte even when it finds the sequence <1D>H <05>H in the data of another control command.

Bit 6, device error
Device errors are reported when mechanical malfunctions in the printer occur, which are recognized by the microprogram to have exceeded the timeouts. Possible device errors are:

- Interference in carrier movement, recognized by timeout of consecutive carrier pulses.
- Interference in cutter movement, recognized by timeout of the cutter discrevolutions and/or a change of signal at its home sensor.

AXIOHM 793

Commands

The commands control all operations and functions of the 793 printer, from selecting the size and placement of characters and graphics on the receipt to feeding and cutting the paper.

Note: All versions of the 793 use the same commands as listed in this section unless otherwise noted. For example, the Parallel interface does require unique commands for controlling the cash drawer.
Some commands listed and described here are not implemented in the 793 (they are identified as not implemented). If received, they are ignored and not sent to the print buffer as data. Non-legal commands are sent to the print buffer as data.

Command List

This section groups the commands according to the following categories:

- Printer Function Commands
- Print Characteristics Commands
- Graphics Commands
- Printer Status Commands
- Real Time Commands
- Bar Code Commands

Within each group, the commands are listed in numerical order of their Hex codes. The page number refers to where a complete description of each command is given in the "Command Descriptions" section.

Printer Function Commands

These commands control the following basic printer functions and are listed in numerical order of their Hex codes:

- Printing
- Feeding the paper
- Resetting the printer
- Cutting the paper

- Opening the cash drawers

Printer Function Commands	
Hex Code	**Command**
09	Horizontal Tab
0A	Line Feed
0D	Carriage Return
10	Clear Printer
14 n	Feed n Print Lines
15 n	Feed n Dot Rows
16 n	Add n Extra Dot Rows
17	Print
19 1B 69	Full Knife Cut
1A 1B 6D	Partial Knife Cut
1B 07	Generate Tone
1B 14 n	Set Column
1B 20 n	Set Character Right Side Spacing (Not Implemented)
1B 24 etc.	Set Absolute Starting Position
1B 32	Set Line Spacing to 1/6 Inch
1B 33 n	Set Line Spacing to n Minimum Units
1B 3D n	Select Printer
1B 40	Initialize Printer
1B 44 etc.	Set Horizontal Tab Positions

Printer Function Commands	
Hex Code	**Command**
1B 4A n	Print and Feed n Minimum Units
1B 5C etc.	Set Relative Starting Position
1B 61 n	Align Character Positions
1B 63 34 n	Select Sensors to Stop Printing (Not Implemented)
1B 63 35 n	Enable or Disable Panel Switch
1B 64 n	Print and Feed n Lines
1B 6A k	Read from Non-Volatile Memory
1B 70 n etc.	Generate Pulse to Open Cash Drawer
1B 73 n etc.	Write to Non-Volatile Memory

Print Characteristics Commands

These commands control what the printed information looks like and are listed in numerical order of their Hex codes.

Print Characteristics Commands	
Hex Code	**Command**
12	Select Double-Wide Characters
13	Select Single-Wide Characters
1B 12	Rotate Characters Counter-Clockwise
1B 16 n	Select Pitch (Column Width)
1B 21 m	Set Print Mode
1B 25 n	Select Character Set
1B 26 etc.	Define User-Defined Character Set
1B 3A 0 0 0	Copy Character Set From ROM to RAM
1B 52 n 1B 74 n	Select Character Code Table
1B 56 n	Set or Cancel Rotated Characters Clockwise
1B 7B n	Set or Cancel Upside-Down Characters

Graphics Commands

These commands print graphics data and are listed in numerical order of their Hex codes.

Graphics Commands	
Hex Code	**Command**
1B 24 etc.	Set Absolute Starting Position
1B 2A m etc.	Set Bit Image Mode
1B 4B etc.	Single-Density Graphics
1B 4C etc. 1B 59 etc.	Double-Density Graphics
1D 2A etc.	Define Downloaded Bit Image
1D 2F m	Print Downloaded Bit Image

Printer Status Commands

These commands send printer status information to the host system and are listed in numerical order of their Hex codes.

Printer Status Commands	
Hex Code	**Command**
1B 75 0	Transmit Cash Drawer Status (RS-232C Only)
1B 75 n	Request Alternate Status (Parallel Only)
1B 76	Transmit Printer Status (Not Implemented for Parallel)

Real Time Commands

These commands correct difficulties with the original version of the 793 RS-232C communication interface.

Real Time Commands	
Hex Code	**Command**
1D 04 n	Real Time Status Transmission, GS Sequence
10 04 n	Real Time Status Transmission, DLE Sequence
1D 03 n	Real Time Request to Printer, GS Sequence
10 05 n	Real Time Request to Printer, DLE Sequence
1D 05	Real Time Printer Status Transmission

Bar Code Commands

These commands print bar codes. HRI means Human Readable Interface and are listed in numerical order of their Hex codes.

Bar Code Commands	
Hex Code	**Command**
1D 48 n	Select Printing Position of HRI Characters
1D 66 n	Select Pitch for HRI Characters (Not Implemented)
1D 68 n	Select Height of Bar Code
1D 6B n etc.	Print Bar Code
1D 6B 49 n	Print Code 128 Bar Code
1D 77 n	Select Width of Bar Code

Command Descriptions

This section lists the commands with their Hex, Decimal, and ASCII codes. The commands are grouped in the following categories:

- Printer Function Commands
- Print Characteristics Commands
- Graphics Commands
- Printer Status Commands
- Real Time Commands
- Bar Code Commands

Printer Function Commands

The printer function commands control the following basic printer functions and are described in order of their Hex codes:

- Printing and feeding paper
- Cutting paper
- Resetting printer
- Performing miscellaneous functions

Horizontal Tab

Moves the print position to the next tab position set by the **Set Horizontal Tab Positions (1B 44 *n*1 ... *n*32 00)** command. The print position is set to column one after each line.

HEX	DECIMAL	ASCII
09	9	HT

Line Feed

Prints one line from the buffer and feeds paper one line.

HEX	DECIMAL	ASCII
0A	10	LF

Carriage Return

Prints one line from the buffer and feeds paper one line. The printer can be set through the DIP switches to ignore or use this command. Some applications expect the command

to be ignored while others use it as print command. See "Ignoring/Using the Carriage Return" in the "Diagnostics" chapter for more information.

HEX	DECIMAL	ASCII
0D	13	CR

Clear Printer

Clears the print line buffer without printing and sets the printer to the following condition:

- Double-Wide (12) command is cancelled
- Line Spacing, Pitch, and User-Defined Character Sets are maintained at current selections (RAM is not affected)
- Single-Wide, Single-High, Non-Rotated, and Left-Aligned characters are set
- Printer is restarted and error status is cleared in a fault condition
- Returns paper exhaust to the paper status line if an alternate status has been requested (Parallel interface only)

HEX	DECIMAL	ASCII
10	16	DLE

Feed *n* Print Lines

Feeds the paper *n* lines at the current line height without printing.

HEX	DECIMAL	ASCII	VALUE OF N
14 n	20 n	DC4 n	0-255

Feed *n* Dot Rows

Feeds the paper *n* dot rows (*n*/152 inch, *n*/6 mm), without printing.

HEX	DECIMAL	ASCII	VALUE OF N	RECEIPT	SLIP
15 n	21 n	NAK n	0-255	n/152 inch	n/72 inch

Add *n* Extra Dot Rows

Adds *n* extra dot rows (*n*/152 inch, *n*/6 mm) to the character height to increase space between print lines or decrease the number of lines per inch.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
16 n	22 n	SYN n	0-12	2

The following table shows the relationship between the number of lines per inch and each extra dot row added:

EXTRA ROWS	LINES PER INCH	DOT ROWS
0	8.5	18
1	8.0	19
2	7.6	20
3	7.2	21
4	7.0	22
5	6.6	23
6	6.3	24
7	6.1	25
8	5.9	26
9	5.6	27
10	5.4	28
11	5.2	29
12	5.1	30

Print

Prints one line from the buffer and feeds paper one line.

HEX	DECIMAL	ASCII
17	23	ETB

Full Knife Cut

This command is implemented the same as **Partial Knife Cut (1A/1B 6D)**.

HEX	DECIMAL	ASCII
19 1B 69	25 27 105	EM ESC i

Partial Knife Cut

Partially cuts the receipt, leaving .20 inch (5 mm) of paper. The length of the cut can be changed through the DIP switches. See "Setting Partial Cut Distance" in the "Diagnostics" chapter. The cut edge is 108 dot rows or .71 inch (18 mm) above the print station. It is valid only at the beginning of a line.

Generate Tone

Generates an audible tone.

HEX	DECIMAL	ASCII
1B 07	27 7	ESC BEL

Set Column

Prints the first character of the next print line in column *n*. It must be sent for each line not printed at column one. The value of *n* is set to one after each line. It cannot be used with Single- or Double-Density graphics.

HEX	DECIMAL	ASCII	VALUE OF N
1B 14 n	27 20 n	ESC DC4 n	1-44 (Standard Pitch) 1-56 (Compressed pitch)

Set Character Right-Side Spacing

This command is not implemented and is ignored if received.

HEX	DECIMAL	ASCII
1B 20 n	27 32 n	ESC (SPACE) n

Set Absolute Starting Position

Sets the print starting position to the specified number of dots (up to the right margin) from the beginning of the line. The print starting position is reset to the first column after each line.

HEX	DECIMAL	ASCII
1B 24 n1 n2	27 36 n1 n2	ESC $ n1 n2
n = Number of dots to be moved from the beginning of the line		
n1 = Remainder after dividing n by 256		
n2 = Integer after dividing n by 256		

The values for *n*1 and *n*2 are two bytes in low byte, high byte word orientation. Determine the value of *n* by multiplying the column for the absolute starting position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to calculate column 29 (10 dots per column) as the absolute starting position.

28 x 10 = 280 dots (beginning of column 29)
280/256 = 1, remainder of 24
*n*1 = 24 *n*2 = 1

Note: This command is also used in the graphics mode to emulate the Epson LQ-950™ dot matrix printer. See "Graphics Commands" later in this chapter for more information.

Set Line Spacing to 1/6 Inch

Sets the line spacing to 1/6 of an inch (4.25 mm). It is not affected by the **Print (17)** command.

HEX	DECIMAL	ASCII	DEFAULT
1B 32	27 50	ESC 2	0.13 Inch (3.33 mm)

Set Line Spacing to *n* Minimum Units

Sets the line spacing to *n*/360 of an inch. The minimum line spacing is 8.5 lines per inch. The line spacing equals the character height when *n* is too small.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 33 n	27 51 n	ESC 3 n	0-255	0.13 Inch (3.33 mm)

Select Printer

This command is not implemented and is ignored if received.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 3D n	27 61 n	ESC = n	0 (bit 0), printer not selected 1 (bit 0), printer selected	1

Initialize Printer

Clears the print line buffer and resets the printer to the following default selections (startup configuration):

- Single-Wide, Single-High, Non-Rotated, and Left-Aligned characters are set
- Extra Dot Rows are set to two
- User-defined characters or logo graphics (from RAM) are cleared
- Character Set is set to Code Page 437 (default)
- Character Pitch is reset to 15.2 CPI and column width to 44 (default)
- Returns paper exhaust to the paper status line if an alternate status has been requested (Parallel interface only)

HEX	DECIMAL	ASCII
1B 40	27 64	ESC @

Set Horizontal Tab Positions

Sets up to 32 horizontal tab positions in ascending order *n* columns from column one, but does not move the print position. See the **Horizontal Tab (09)** command. The command ends with Hex 00; Hex 1B 44 00 clears all tabs. The tabs cannot be set higher than the column width of the current pitch: standard pitch = 44 columns; compressed pitch = 56 columns.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 44 n1 ... n32 00	27 68 n1 ... n32 00	ESC D n1 ... n32 00	Column for Tab Minus 1	Every 8 chars. from col. 1 (9, 17, 25, etc.)

Print and Feed *n* Minimum Units

Prints one line from the buffer and feeds the paper *n*/360 inch. The line height equals the character height when *n* is too small.

HEX	DECIMAL	ASCII	VALUE OF N
1B 4A n	27 74 n	ESC J n	0-255

Set Relative Starting Position

Moves the print starting position the specified number of dots either right (up to the right margin) or left (up to the left margin) of the current position.
The print starting position is reset to the first column after each line.

HEX	DECIMAL	ASCII	VALUE OF N
1B 5C n1 n2	27 92 n1 n2	ESC \ n1 n2	See Examples Below

To Move the Relative Starting Position Right of the Current Position

n = Number of dots to be moved right of the current position
*n*1 = Remainder after dividing *n* by 256
*n*2 = Integer after dividing *n* by 256

The values for *n*1 and *n*2 are two bytes in low byte, high byte word orientation. Determine the value of *n* by multiplying the number of columns to move right of the current position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to set the relative position two columns in standard pitch (10 dots per column) to the right of the current position.
2 x 10 = 20 dots (two columns to be moved right of the current position)
20/256 = 0, remainder of 20
*n*1 = 20 *n*2 = 0

To Move the Relative Starting Position Left of the Current Position

n = Number of dots to be moved left of the current position
*n*1 = Remainder after dividing (65,536-*n*) by 256
*n*2 = Integer after dividing (65,536-*n*) by 256

The values for *n*1 and *n*2 are two bytes in low byte, high byte word orientation. Determine the value of *n* by multiplying the number of columns to move left of the current position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to set the relative position two columns in standard pitch (10 dots per column) to the left of the current position.

2 x 10 = 20 dots (two columns to be moved left of the current position)
65,536-20 = 65516
65,516/256 = 255, remainder of 236
*n*1 = 236 *n*2 = 255

Align Character Positions

Specifies the alignment of characters, graphics, logos, and bar codes (see table). It is valid only at the beginning of a line.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 61 n	27 97 n	ESC a n	0 (Left Aligned) 1 (Center Aligned) 2 (Right Aligned)	0

Select Sensors to Stop Printing

This command is not implemented and is ignored if received.

HEX	DECIMAL	ASCII
1B 63 34 n	27 99 52 n	ESC c 4 n

Enable or Disable Panel Switch

Toggles the panel switches on and off. Functions that require the panel switches cannot be used when the panel switches are disabled with this command.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 63 35 n	27 99 53 n	ESC c 5 n	0 = Enable 1 = Disable	0

Print and Feed *n* Lines

Prints one line from the buffer and feeds paper *n* lines at the current line height.

HEX	DECIMAL	ASCII	VALUE OF N
1B 64 n	27 100 n	ESC d n	1-255 (0 interpreted as 1)

Read from Non-Volatile Memory

Reads a two-byte word from location *k* in history EEROM. The printer will return the word at the next available opportunity.
This command is not available on Parallel printers.

HEX	DECIMAL	ASCII	VALUE OF K
1B 6A k	27 106 k	ESC j k	0-63 (Hex)

Generate Pulse to Open Cash Drawer

Outputs a pulse to open the cash drawer.
The value for either *p*1 or *p*2 is the Hex number multiplied by 2 msec. to equal the total time. The off-time is the delay before the printer performs the next operation.

HEX	DECIMAL	ASCII	VALUE OF N	VALUE OF P
1B 70 n p1 p2	27 112 n p1 p2	ESC p n p1 p2	00 = Drawer 1 01 = Drawer 2	p1 (Hex) x 2 msec. = On-time p2 (Hex) x 2 msec. = Off-time

Write to Non-Volatile Memory

Writes two-byte word *n*1:*n*2 to location *k* in history EEROM.

HEX	DECIMAL	ASCII	VALUE OF N	VALUE OF K
1B 73 n1 n2 k	27 115 n1 n2 k	ESC s n1 n2 k	n1 = 1st Byte n2 = 2nd Byte	16-63 (Hex Locations 00-15 are reserved)

Print Characteristics Commands

These commands control what the printed information looks like: selection of character sets, definition of custom-defined characters, and setting of margins. The commands are described in order of their Hex codes.

Select Double-Wide Characters

Prints double-wide characters. The printer is reset to single-wide mode after a line has been printed or a **Clear Printer (10)** command is received. It may be used with single-wide characters on the same line, but not with Single and Double Density Graphics modes.

HEX	DECIMAL	ASCII
12	18	DC2

Select Single-Wide Characters

Prints single-wide characters. It may be used with double-wide characters on the same line, but not with Single and Double Density Graphics modes.

HEX	DECIMAL	ASCII
13	19	DC3

Rotate Characters Counter-Clockwise

Rotates characters 90 degrees counter-clockwise. It remains in effect until the printer is reset or until a **Clear Printer (10)**, **Set/Cancel Upside-Down Print (1B 7B)**, or **Set/Cancel Rotated Print (1B 56)** command is received. It is valid only at the beginning of a line. It cannot be used with non-rotated print on the same line. See " Summary of Rotated Printing" .

HEX	DECIMAL	ASCII
1B 12	27 18	ESC DC2

Select Pitch (Column Width)

Selects the character pitch for a print line. It is valid only at the beginning of a line. Standard and compressed pitches cannot be used together on the same line.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 16 n	27 22 n	ESC SYN n	0 = Standard Pitch 1 = Compressed Pitch	0

Set Print Mode

Selects the print mode: standard, compressed, double high, or double wide.

HEX	DECIMAL	ASCII	VALUE OF M	DEFAULT
1B 21 m	27 33 m	ESC ! m	See Next Table	0

VALUE OF M			
Bit	Function	0	1
Bit 0[1]	Pitch	Standard Pitch[2] 44 Col/Line, 15 CPI (Rec) 66 Col/Line, 13.9 CPI (Slip)	Compressed Pitch 56 Col/Line, 19 CPI (Rec) 80 Col/Line, 17.1 CPI (Slip)
Bit 4	Double High[3]	Canceled	Set
Bit 5	Double Wide	Canceled	Set

[1] Bit 0 is ignored unless it is at begining of line. Bits 1, 2, 3, 6, 7 are not used.

[2] Standard and compressed pitch cannot be used together in the same line.

[3] Cannot be used together with normal height in same line.

Select Character Set

Selects the character set. The character sets cannot be used together on the same line. When an undefined RAM character is selected, the Code Page 437 character is used.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 25 n	27 37 n	ESC % n	0 = Code Page 437 1 = User Defined (RAM) 2 = Code Page 850	0

Define User-Defined Character Set

Defines and enters downloaded characters into RAM. It may be used to overwrite single characters. The user-defined characters are available until power is turned off, the **Initialize Printer (1B 40)** command is received, or a downloaded bit image (1D 2A) is defined. User-defined characters and a downloaded bit image cannot be used at the same time. The command clears bit image logo data from RAM. Any invalid byte (*s*, *c*1, *c*2, *n*1, *n*2) aborts the command.

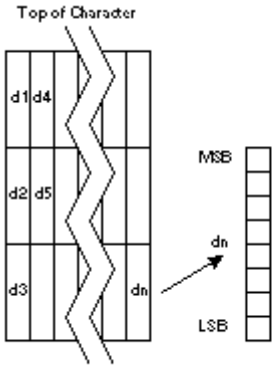
HEX	DECIMAL	ASCII
1B 26 s c1 c2 n1 d1 ... nn dn	27 38 s c1 c2 n1 d1 ... nn dn	ESC & s c1 c2 n1 d1 ... nn dn

s = 3, the number of bytes (vertically) in the character cell
c = the ASCII codes of the first *(c*1) and last (*c*2) characters respectively

c1 = Hex 20-FE (20 is always printed as a space)
c2 = Hex 20-FE (20 is always printed as a space)

To define only one character, use the same code for both c1 and c2
n = the number of dot columns for the nth character as specified by n1 . . . nn
n = 0-10 (standard pitch), 12 and less acccepted but ignored
n = 0-8 (compressed pitch), 12 and less accepted but ignored
d = the column data for the nth character as specified by d1 . . . dn

The number of bytes for a character cell is *s* x n1
The bytes are printed down and across each cell
See the illustration on the facing page.



Copy Character Set from ROM to RAM

Copies characters in the active ROM set to RAM. Use it to modify characters in one of the character set variations, such as Rotated Print. Select one of the Rotated Print commands, copy to RAM, then use the command, **Define User-Defined Character Set (1B 26)**.

HEX	DECIMAL	ASCII
1B 3A 0 0 0	27 58 0 0 0	ESC : 0 0 0

Select Character Code Table

Selects the character set. The character sets cannot be used together on the same line.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 52 n 1B 74 n*	27 82 n 27 116 n*	ESC R n ESC t n*	0 = Code Page 437 1 = Code Page 850	0

Set or Cancel Rotated Characters Clockwise

Rotates characters 90 degrees clockwise. It remains in effect until the printer is reset or until a **Clear Printer (10)** or **Rotated Print (1B 12)** command is received. It is valid only at the beginning of a line. It cannot be used with non-rotated print on the same line. See "Summary of Rotated Printing" on the next page.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 56 n	27 86 n	ESC V n	0 = Cancel 1 = Set	0

Set or Cancel Upside-Down Characters

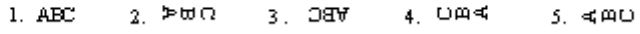
Prints upside-down characters. It is valid only at the beginning of a line. The character order is inverted in the buffer so text is readable. It cannot be used with right-side up characters on the same line. The **Rotated Print (1B 12)** command cancels this command. Only bit 0 is used. Bits 1-7 are not used. See "Summary of Rotated Printing" on the next page.

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1B 7B n	27 123 n	ESC { n	0 = Cancel 1 = Set	0

Summary of Rotated Printing

The table shows the combinations of Set/Cancel Upside-Down Print, Set/Cancel Rotated Print (clockwise), and Rotated Print (counterclockwise). Rotated CCW is mutually exclusive with the other two commands.
The samples of the print show only the normal size characters. Double-wide and double-high characters are printed in the same orientation. They may also be mixed on the same line.

UPSIDE DOWN 1B 7B N	ROTATED CW 1B 56 N	ROTATED CCW 1B 12	RESULTING OUTPUT
Canceled	Canceled	Cleared	1 (See Below)
Canceled	Set	X	2 (See Below)
Set	Canceled	X	3 (See Below)
Set	Set	X	4 (See Below)
X	X	Set	5 (See Below)



Note: The following print modes cannot be mixed on the same line:

- Standard and compressed pitch
- Vertical (normal) and rotated
- Right-side up and upside down
- Single high (normal) and double high

Graphics Commands

These commands are used to enter and print graphics data and are described in order of their Hex codes:

Set Absolute Starting Position

Sets the print starting position for graphics at the specified number of dots from the beginning of the line as expressed in the following formula: *n* = ((*n*1 + (256 x *n*2)) x 2). The resulting dot column must be less than 448. The print starting position is reset to column one after each line.
This command emulates the Epson LQ-950™ dot matrix printer. This allows the 793 to accept graphics that are normally output from word processing programs to a half-dot matrix printer.

HEX	DECIMAL	ASCII
1B 24 n1 n2	27 36 n1 n2	ESC $ n1 n2
n = Number of half dots to be moved from the beginning of the line Note: The 793 converts two half-dots to one full dot		
n1 = Remainder after dividing n by 256		
n2 = Integer after dividing n by 256		

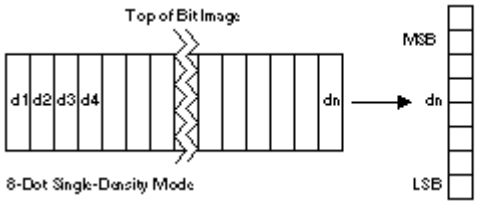
Set Bit Image Mode

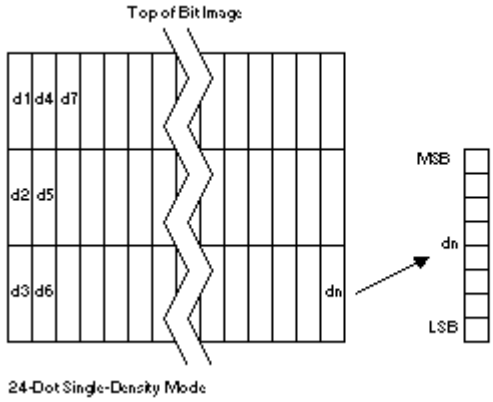
Sets the print resolution and enters one line of graphics data into the print buffer. Any print command is required to print the data, after which the printer returns to normal processing mode. See the illustrations for graphic representations of the bit image.

HEX	DECIMAL	ASCII
1B 2A m n1 n2 d1 ... dn	27 42 m n1 n2 d1 ... dn	ESC * m n1 n2 d1 ... dn

Value of m	Mode	No. of Dots (Vertical)	No. of Dots (Horizontal)	Number of Dots/LIne
0	8 Dot Single Density	8 (51 DPI)	0-224 (76 DPI)	8 x 224
1	8 Dot Double Density	8 (51 DPI)	0-448 (152 DPI)	8 x 448
32	24 Dot Single Density	24 (152 DPI)	0-224 (76 DPI)	24 x 224
33	24 Dot Double Density	24 (152 DPI)	0-448 (152 DPI)	24 x 448

VALUE OF N (8-DOT SINGLE DENSITY MODE)	VALUE OF N (24-DOT SINGLE DENSITY MODE)	VALUE OF D
n1 + (256 x n2)	3 x [n1 + (256 x n2)]	Number of Bytes of Data (Printed Down, Then Across)





Single-Density Graphics

Enters one line of 8-dot single-density graphics into the print buffer. Any print command is required to print the line, after which the printer returns to normal processing mode. When the print buffer is full, incoming data will be accepted but not printed. Single-density mode allows 0-224 dot columns. The number of bytes sent is represented by the formulas in the second table. Each bit corresponds to two horizontal dots.

HEX	DECIMAL	ASCII
1B 4B n1 n2 d1 ... dn	27 75 n1 n2 d1 ... dn	ESC K n1 n2 d1 ... dn

VALUE OF N (8-DOT SINGLE DENSITY MODE)	VALUE OF N (24-DOT SINGLE DENSITY MODE)	VALUE OF D
n1 + (256 x n2)	3 x [n1 + (256 x n2)]	Number of Bytes of Data (Printed Down, Then Across)

Double-Density Graphics

Enters one line of 8-dot double-density graphics into the print buffer. Any print command is required to print the line, after which the printer returns to normal processing mode. When the print buffer is full, incoming data will be accepted but not printed. Double-density mode allows 0-448 dot columns. The number of bytes sent is represented by the formulas in the second table. Each bit corresponds to one horizontal dot.

HEX	DECIMAL	ASCII
1B 59 n1 n2 d1 ... dn	27 89 n1 n2 d1 ... dn	ESC Y n1 n2 d1 ... dn
1B 4C n1 n2 d1 ... dn	27 76 n1 n2 d1 ... dn	ESC L n1 n2 d1 ... dn

VALUE OF N (8-DOT DOUBLE DENSITY MODE)	VALUE OF N (24-DOT DOUBLE DENSITY MODE)	VALUE OF D
n1 + (256 x n2)	3 x [n1 + (256 x n2)]	Number of Bytes of Data (Printed Down, Then Across)

Define Downloaded Bit Image

Enters a downloaded bit image (such as a logo) into RAM with the number of dots specified by *n*1 and *n*2. It is available until power is turned off, another bit image is defined, or either **Initialize Printer (1B 40)**, or **Define User-Defined Character Set (1B 26)**, command is received.
A downloaded bit image and user-defined characters cannot be defined at the same time. Any user-defined characters will be cleared from RAM when this command is used. See the illustration on the next page for a representation of the bit image.

HEX	DECIMAL	ASCII
1D 2A n1 n2 d1 ... dn	29 42 n1 n2 d1 ... dn	GS * n1 n2 d1 ... dn

VALUE OF N1	VALUE OF N2	VALUE OF D
1-56 (8 x n1 = Number of Horizontal Dot Columns)	1-48 (Number of Vertical Bytes)[1]	Bytes of Data (Printed Down, Then Across)

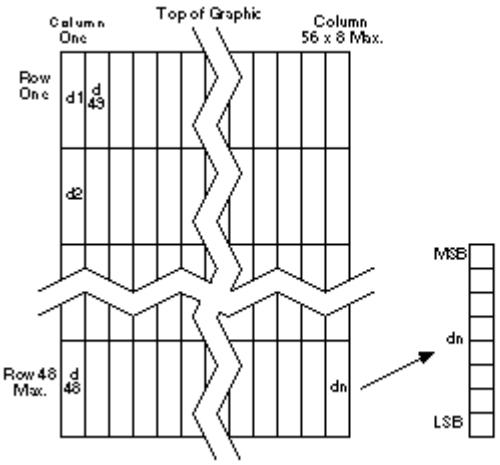
[1]The number of bytes sent is represented by the following formula:
n = 8 x n1 x n2 (n1 x n2 must be less than or equal to 1344).

Print Downloaded Bit Image

Prints the downloaded bit image in RAM at a density specified by *m*. It is ignored if any data is available in the print buffer, if the downloaded bit image is undefined, or if the data defined exceeds one line. A downloaded bit image and user-defined characters cannot be used at the same time. See the illustration for a representation of the bit image.

HEX	DECIMAL	ASCII	VALUE OF M	PRINT MODE	VERTICAL DPI[1]	HORIZONTAL DPI*
1D 2F m	29 47 m	GS / m	0	Normal	152	152
			1	Double Wide	152	76
			2	Double High	76	152
			3	Quadruple	76	76

[1]Dot density measured in dots per inch.



Printer Status Commands

For RS-232C printers, these commands enable the printer to communicate with the host system following the selected handshaking protocol, either DTR/DSR or XON/XOFF. They are stored in the printer's data buffer as they are received, and are handled by the firmware in the order in which they were received.
When a fault occurs, the printer will go busy at the RS-232C interface and not respond to either of the Printer Status commands. If the fault causing the busy condition can be cleared, such as by loading paper, or letting the thermal printhead cool down, the printer will resume processing the data in its receive buffer.
Printers manufactured after mid 1996 include Real Time commands which are handled when the printer is busy at the RS-232C interface. See the following section, " Real Time Commands," for details about these commands.

Transmit Cash Drawer Status

Transmits current status of the cash drawers. One byte is sent to the host system. This command is available only on RS-232 printers.
In DTR/DSR protocol the printer waits for DSR = SPACE. If a drawer is not connected, the status will indicate closed.

HEX	DECIMAL	ASCII	BIT	1 SIGNIFIES	0 SIGNIFIES
1B 75 0	27 117 0	ESC u 0	0	Drawer 1 Closed	Drawer 1 Open
			1	Drawer 2 Closed	Drawer 2 Open

Request Alternate Status

This command is available only on Parallel printers. It allows the printer to inform the host when the data in the buffer has been processed, compensating for the lack of bi-directional communication. Status information is limited to what can be sent by the dedicated lines: BUSY, ACK, PAPER EXHAUST, and FAULT.

HEX	DECIMAL	ASCII	VALUE OF N
1B 75 n	27 117 n	ESC u n	See Table Below

When this command is sent to the printer, the printer goes "Busy" until all data which has been sent to the printer has been processed. The PAPER EXHAUST line shows the status for the cash drawer or receipt paper as follows:

VALUE OF N	FUNCTION	DESCRIPTION
00	Drawer 1	High = Open Low = Closed or Not Present
01	Drawer 2	High = Open Low = Closed or Not Present
02	Paper Low (Not Implemented)	High = Paper Low Low = Not Used
03	Paper Out	High = Paper Out (Default) Low = Not Used
>03	Ignored, No Change	Printer Does Not Stay BUSY[1]

[1]PAPER EXHAUST LINE is valid to indicate previously requested status.

Transmit Printer Status

Sends status data to the host system.
This command is available only on RS-232C printers.

HEX	DECIMAL	ASCII
1B 76	27 118	ESC v

The printer sends one byte to the host system when it is not busy or in a fault condition. See "Busy Line and Fault Conditions" in the following section, "Real Time Commands," for details about fault condition reporting.
See the table below. In DTR/DSR protocol, the printer waits for DSR = SPACE.

STATUS BYTE (RS-232)			
Bit	**Function**	**0 Signifies**	**1 Signifies**
0	Receipt Paper	Present	Out
1	Receipt Cover	Closed	Open
2	Receipt Paper	Present	Out
3	Not Used	Fixed to Zero	Fixed to Zero
4	Not Used	Fixed to Zero	Fixed to Zero
5	Not Used	Fixed to Zero	Fixed to Zero
6	Not Used	Fixed to Zero	Fixed to Zero
7	Not Used	Fixed to Zero	Fixed to Zero

Real Time Commands

The Real Time commands correct difficulties with the original version of the 793 RS-232C communication interface:

- Real Time Status Transmission: GS (Hex 1D) Sequence and DLE (Hex 10) Sequence
- Real Time Request to Printer: GS (Hex 1D) Sequence and DLE (Hex 10) Sequence
- Real Time Printer Status Transmission

The original Printer Status commands, **Transmit Printer Status (Hex 1B 76, ASCII ESC v)** and **Transmit Cash Drawer Status (Hex 1B 75 0, ASCII ESC u 0)** are placed in the printer's data buffer as they are received and handled by the firmware in the order in which they were received. If the paper exhausts while printing data which was in the buffer ahead of the status command, the printer goes busy at the RS-232C interface and suspends processing the data in the buffer until paper is reloaded. This is true for all error conditions: knife home error, thermal printhead overheat, etc. In addition, there is no way to restart the printer after a paper jam or other error.
The Real Time commands are implemented in two ways to correct these problems. Both implementations offer the same functionality; which one you choose depends on the current usage of your application.

First Implementation

For a new application the GS (Hex 1D) sequences of the first implementation are recommended to avoid possible misinterpretation of a DLE (Hex 10) sequence as a **Clear Printer (Hex 10 0, ASCII DLE NUL)** command.

The first implementation builds upon the GS ENQ sequence as implemented on Epson's TM-930II™, TM-950™ and TM-U950™ by defining two new GS (Hex 1D) sequences to provide the same functions as the DLE (Hex 10) sequences above, and to provide complete backward compatibility to the original 793 Clear Printer command.
An application using these GS (Hex 1D) sequences does not need to distinguish for the printer between the new Real Time commands and the old Clear Printer command. This implementation is ideal for an existing 793 application which already uses the Clear Printer command or for a new application being developed.
This implementation also provides the original GS ENQ Real Time sequence in addition to the newer Real Time sequences.

Alternate Implementation

The alternate implementation uses the DLE (Hex 10) sequences as implemented on Epson's TM-T85™ and TM-U950™. An application using these DLE (Hex 10) sequences and the original 793 Clear Printer command must distinguish for the printer between the new Real Time commands and the old Clear Printer command by adding a NUL (Hex 00) to the Clear Printer command.
An application using these DLE (Hex 10) sequences must also send the second byte of the sequence within 100 milliseconds of the first, to prevent the first byte being mistaken for a Clear Printer command. This implementation is useful for an existing TM-T85™ or TM-U950™ application which is being migrated to a 793. This application would not be using the 793 Clear Printer command at all since it is not recognized by the Epson printers.
Note: The DLE (Hex 10) sequences as implemented on Epson's TM-T85™ and TM-U950™ are not exactly the same as those implemented on Epson's TM-950™.
This implementation also provides the original GS ENQ Real Time sequence in addition to the newer Real Time sequences.

Rules for Using Real Time Commands

Three situations must be understood when using Real Time commands.

1. First, the printer executes the Real Time command upon receiving it and will transmit status regardless of the condition of the DSR signal.
2. Second, the printer transmits status whenever it receives the Real Time status transmission command sequence, even if that sequence happens to occur within the data of another command, such as graphics data.

In this case the sequence will also be handled correctly as the graphics data it is intended to be, when the graphics command is executed from the buffer.

3. Care must be taken not to send a Real Time command within the data sequence of another command that consists of two or more bytes.
   In this case the printer will use the Real Time command sequence bytes instead of the

other command's bytes when finally executing that other command from the buffer or the other command will not be executed correctly.

These three situations generally preclude use of standard DOS drivers for the serial communication ports when using Real Time commands.

Moving Data Through the Buffer

Applications should not let the buffer fill up with Real Time commands when the printer is busy at the RS-232C interface. A busy condition at the RS-232C interface can be determined by bit 3 of the response to GS ENQ or GS EOT 1 or DLE EOT 1. The reason for a particular busy condition can be determined by other responses to GS EOT n or DLE EOT n.
Although the printer responds to Real Time commands when it is busy, it will place them into the buffer behind any other data there, and flush them out in the order in which they were received. When the printer is busy due simply to buffer full (that is, it can't print data as fast as it can receive it), then data continues to be processed out of the buffer at approximately print speed and the Real Time commands will eventually get flushed out. When the printer is busy due to an error condition, then data stops being processed of the buffer until the condition clears one way or another. In either case, but more quickly in the case of an error condition, the buffer can fill with Real Time commands.
When the DLE sequences are being used, the last byte stored when the buffer fills up could be the DLE code, with no room for the subsequent EOT or ENQ. When this lone DLE byte is finally processed out of the buffer it will be interpreted as a Clear Printer command.
Similarly, when the GS sequences are being used, the last byte stored when the buffer fills up could be the GS code, with no room for the subsequent EOT or ETX or ENQ. When this lone GS byte is finally processed out of the buffer it will use the next byte, whatever it is, as the second byte in its GS sequence.
To guard against this situation, the application must determine the cause of a busy condition and take appropriate action or pace the Real Time commands to avoid filling the buffer. There is a minimum of 256 bytes available in the printer's buffer when it goes busy.

Busy Line and Fault Conditions

An additional improvement is made in the way the 793 RS-232C handles the busy line (or busy condition when using XON/XOFF) during a fault condition.
Before this improvement, the printer would go busy at the RS-232C interface when the receipt door was opened or the paper was exhausted as soon as it received the next input byte. Bytes would continue to be accepted until the buffer was full or the condition was cleared, but would stop processing data out of the receive buffer. This resulted in the printer being unable to respond to the batch mode status commands (ESC v and ESC u), or handle the cash drawer commands even when it was not printing.

The improvement overcomes this limitation by not going busy at the RS-232C interface until it attempts to process a command out of the receive buffer which it can't do: for example, print on the receipt when it's out of paper. It will stay busy and stop processing data out of the receive buffer until the condition clears.
Now if the cover is open or the paper is exhausted, the 793 printer will still accept data, respond to the batch mode status commands (ESC v and ESC u), handle the cash drawer commands, and not go busy until it actually tries to execute a print command. Then it will stay busy and stop processing data out of the receive buffer until the condition clears. It will respond to the Real Time commands as described below.
The only potential backward compatibility issue is if some application expects the 793 to go busy when it processes a batch mode status command, which it now won't. To handle this case, there is now a parameter setup in NVRAM to have the printer handle the busy line the old way. The default will be the new way, but the printer can be programmed in the field if it proves to be a problem.
To program the printer to handle the busy line the old way do the following steps:

- Record the current switch settings for their RS-232C parameters.
- Set switches 2 and 3 to OFF, and set switches 1, 4, 5, and 6 to ON.
- Power cycle the printer.
- Wait until the printer beeps to store the parameter change in NVRAM.
- Restore the switches to their RS-232C parameters.
- Power cycle the printer.
- Print out the diagnostics to be sure that the busy line parameter changed.

If you have programmed the printer to handle the busy line the old way, but wish to re-program it to the new way, do the following steps:

- Record the current switch settings for their RS-232C parameters.
- Set switches 2, 3, and 6 to OFF, and set switches 1, 4, and 5 to ON.
- Power cycle the printer.
- Wait until the printer beeps to store the parameter change in NVRAM.
- Restore the switches to their RS-232C parameters.
- Power cycle the printer.
- Print out the diagnostics to be sure that the busy line parameter changed.

Real Time Status Transmission

Transmits the selected one byte printer status specified by *n* in Real Time according to the following parameters.

GS Sequence

HEX	DECIMAL	ASCII	VALUE OF N
1D 04 n	29 4 n	GS EOT n	1 = Transmit printer status 2 = Transmit RS-232C busy status 3 = Transmit error status 4 = Transmit receipt paper status
The command is ignored if n is out of range. n=2:			

HEX	DECIMAL	ASCII	VALUE OF N
10 04 n	16 4 n	DLE EOT n	1 = Transmit printer status 2 = Transmit RS-232C busy status 3 = Transmit error status 4 = Transmit receipt paper status 5 = Transmit slip paper status
The command is ignored if n is out of range.			

Note: An application using the DLE sequence must send EOT within 100 milliseconds of DLE or the printer will misinterpret the DLE and execute a Clear Printer command. Avoid this possibility by using the GS EOT n sequence which is handled exactly the same as DLE EOT n.

1 = Transmit Printer Status

BIT	STATUS	HEX	DECIMAL	FUNCTION
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off On	00 04	0 4	One or both cash drawers open Both cash drawers closed
3	Off On	00 08	0 8	Not busy at the RS-232C interface Printer is Busy at the RS-232C interface
4	On	10	16	Fixed to On
5				Undefined
6				Undefined
7	Off	00	0	Fixed to On

2 = Transmit RS-232C Busy Status

BIT	STATUS	HEX	DECIMAL	FUNCTION
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off On	00 04	0 4	Both receipt and cassette doors closed Receipt or cassette door open
3	Off On	00 08	0 8	Paper feed button is not pressed Paper feed button is pressed
4	On	10	16	Fixed to On
5	Off On	00 20	0 32	Printing not stopped due to paper condition Printing stopped due to paper condition
6	Off On	00 40	0 64	No error condition Error condition exists in the printer
7	Off	00	0	Fixed to Off

3 = Transmit Error Status

BIT	STATUS	HEX	DECIMAL	FUNCTION
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off On	00 04	0 4	No slip motor jam Slip motor jam occured
3	Off On	00 08	0 8	No knife error Knife error occurred
4	On	10	16	Fixed to On
5	Off On	00 20	0 32	No unrecoverable error Unrecoverable error occurred
6	Off On	00 40	0 64	Thermal printhead temp./power supply voltage are in range Thermal printhead temp./power supply voltage are out of range
7	Off	00	0	Fixed to Off

4 = Transmit Receipt Paper Status

BIT	STATUS	HEX	DECIMAL	FUNCTION
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off On	00 04	0 4	Receipt paper adequate Receipt paper low
3	Off On	00 08	0 8	Receipt paper adequate Receipt paper low
4	On	10	16	Fixed to On
5	Off On	00 20	0 32	Receipt paper present Receipt paper exhausted
6	Off On	00 40	0 64	Receipt paper present Receipt paper exhausted
7	Off	00	0	Fixed to Off

Real Time Request to Printer

The printer responds to a request from the host specified by *n*. The operations performed depend on the value of *n*, according to the following parameters.

GS Sequence

HEX	DECIMAL	ASCII	VALUE OF N
1D 03 n	29 3 n	GS ETX n	1 = Recover and restart 2 = Recover and clear buffers 3 = Cancel slip waiting
The command is ignored if n is out of range.			

DLE Sequence

HEX	DECIMAL	ASCII	VALUE OF N
10 05 n	16 5 n	DLE ENQ n	1 = Recover and restart 2 = Recover and clear buffers 3 = Cancel slip waiting
The command is ignored if n is out of range.			
Note: An application using the DLE sequence must send ENQ within 100 milliseconds of DLE or the printer will misinterpret the DLE and execute a Clear Printer command. Avoid this possibility by using the GS ETX n sequence which is handled exactly the same as DLE ENQ n.			

n = 1

Restarts printing from the beginning of the line where an error occurred, after recovering from the error. Print settings that are normally preserved from line to line, such as character height and width, are still preserved with this command. This sequence is ignored except when the printer is busy due to an error condition.
If the receipt is selected, this command will attempt recovery from a knife error. Other errors associated with the receipt, such as paper out or printhead overheating, can be recovered from only by clearing the specific condition, such as loading paper or letting the printhead cool down.

n = 2

Recovers from an error after clearing the receive and print buffers. Print settings that are normally preserved from line to line, such as character height and width, are still preserved with this command. This sequence is ignored except when the printer is busy due to an error condition.
The same error recovery possibilities exist as for *n* = 1.

Real Time Printer Status Transmission

Transmits one byte status of the printer in real time.

HEX	DECIMAL	ASCII
1D 05	29 5	GS ENQ

BIT	STATUS	HEX	DECIMAL	FUNCTION
0	Off On	00 01	0 1	Receipt paper adequate Receipt paper low
1	Off On	00 02	0 2	Receipt paper adequate Receipt paper low
2	Off On	00 04	0 4	Both receipt and cassette doors closed Receipt or cassette door open
3	Off On	00 08	0 8	Not busy at the RS-232C interface Printer is busy at the RS-232C interface
4	Off On	00 10	0 16	One or both cash drawers open Both cash drawers closed
5	Off On	00 20	0 32	Paper present at both slip sensors Paper not present at one or both slip sensors
6	Off On	00 40	0 64	No error condition Error condition exists in the printer
7	On	80	128	Fixed to On

793 Clear Printer Command

Resets certain parameters and clears the print buffer as originally defined. This is NOT a Real Time command. It only distinguishes the Clear Printer command from other DLE sequences.

HEX	DECIMAL	ASCII
10 00	16 0	DLE NUL

Recognizing Data from the Printer

An application sending various Real Time and non-Real Time commands to which the printer responds can determine which command a response belongs to by the following table. Responses to ESC u and ESC v are non-Real Time responses and will arrive in the order in which they were solicited.

Note also that although the original intent of the response to ESC v was to provide error information in its one-byte response, the response up to now has always been Hex 00 when transmitted. This is because ESC v was not processed until the error condition was cleared. With the improvement to the busy line handling described earlier in this section, ESC v will be processed as long as there is not an error condition caused by trying to print with no paper or with the cover open.

ESC u 0	0	0	0	0	0	0	x	x	Binary
ESC v	0	0	0	0	0	x	x	x	Binary
GS EOT n	0	x	x	1	x	x	1	0	Binary
DLE EOT n	0	x	x	1	x	x	1	0	Binary
GS ENQ	1	x	x	x	x	x	x	x	Binary
XON	0	0	0	1	0	0	0	1	Binary
XOFF	0	0	0	1	0	0	1	1	Binary

Bar Code Commands

These commands format and print bar codes and are described in order of their Hex codes.

Select Printing Position of HRI Characters

Prints HRI characters (Human Readable Interface) above or below the bar code.

HEX	DECIMAL	ASCII	VALUE OF N (PRINTING POSITION)	DEFAULT
1D 48 n	29 72 n	GS H n	0 = Not Printed 1 = Above the Bar Code 2 = Below the Bar Code 3 = Both Above and Below the Bar Code	0

Select Pitch of HRI Characters

This command is not implemented and is ignored if received.

HEX	DECIMAL	ASCII	VALUE OF N (PITCH)	DEFAULT
1D 66 n	29 102 n	GS f n	0 = Standard Pitch at CPI 1 = Compressed Pitch at 19 CPI	0

Select Height of Bar Code

Sets the bar code height to *n* dots or *n*/152 inch (*n*/6 mm).

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1D 68 n	29 104 n	GS H n	1-255	162

Print Bar Code

Selects the bar code type and prints a bar code for the ASCII characters entered. When data is present in the print buffer, the command is ignored. The required paper feeding is performed, regardless of the current line spacing. If the width exceeds one line, the excess data is not printed. Illegal data cancels the command.

HEX	DECIMAL	ASCII	VALUE OF N	VALUE OF C
1D 6B n c1 c2...00	29 107 n c1 c2...00	GS k n c1 c2...00	0-7 (See Table)	ASCII Characters
00 = End of command.				

N	BAR CODE	LENGTH
0	UPC-A	Fixed Length
1	UPC-E	Fixed Length
2	JAN13 (EAN)	Fixed Length
3	JAN8 (EAN)	Fixed Length
4	Code 39	Variable Length
5	Interleaved 2 of 5	Variable Length
6	Codabar	Variable Length

Note: Fixed-length codes can be aligned left, center, or right using the **Align Positions (1B 61)** command. Variable-length codes are always center aligned.
The check digit is calculated for UPC and JAN (EAN) codes if it is not sent from the host system. Six-character zero-suppressed UPC-E tags are generated from full 11 or 12 characters sent from the host system according to standard UPC-E rules. Start/Stop characters are added for Code 39 if they are not included.

Print Code 128 Bar Code

Selects and prints the Code 128 bar code.
This command is available only on RS-232C and Parallel printers.

HEX	DECIMAL	ASCII	VALUE OF N	VALUE OF DN
1D 6B 49 n dn	29 107 73 n dn	GS k I n dn	1-255	0-105

Since the characters encoded via Code 128 include the NUL (Hex 00) character, a NUL cannot be used to terminate the Code 128 bar code sequence as is done with other bar code sequences. The number of characters to be encoded is variable and is specified by *n*.
Following *n* are the data bytes: d*n*. The printer processes *n* bytes from the next character data as bar code data.

- The first data byte must be a Start code: d1 = 103-105.
- Data bytes past the Start code: d2 = 0-102.
- The printer provides the Stop code.

If character code d cannot be printed, the printer prints the processed bar code data up to that point and the following data is treated as normal data. If the horizontal size exceeds one line, the printer does not print the excess data.
This command is enabled only when no data is in the print buffer. When data is in the printer buffer, the printer processes the data following 'GS k I' as normal data.

Select Width of Bar Code

Sets the bar code width to *n* dots or *n*/152 inch (*n*/6 mm).

HEX	DECIMAL	ASCII	VALUE OF N	DEFAULT
1D 77 n	29 119 n	GS w n	2, 3, 4	3

AXIOHM 756

Command List

This section groups the commands according to the following categories:

- Printer Function Commands
- Print Characteristics Commands
- Station Select Commands
- Graphics Commands
- Printer Status Commands
- Real Time Commands
- Bar Code Commands
- MICR Reader Commands

Within each group, the commands are listed in numerical order of their Hex codes. The page number refers to where a complete description of each command is given in the "Command Descriptions" section.

Printer Function Commands

These commands control the following basic printer functions and are listed in numerical order of their Hex codes:

- Printing
- Feeding the paper
- Moving the printhead (slip station)
- Resetting the printer
- Cutting the paper

Printer Function Commands	
Hex Code	**Command**
09	Horizontal Tab
0A	Line Feed
0C	Print and Eject Slip
0D	Carriage Return
10	Clear Printer
11	Close Form (Slip Station)
14 n	Feed n Print Lines
15 n	Feed n Dot Rows
16 n	Add n Extra Dot Rows
17	Print
18	Open Form (Slip Station)
19 1B 69	Full Knife Cut
1A 1B 6D	Partial Knife Cut
1B 07	Generate Tone
1B 14 n	Set Column
1B 20 n	Set Character Right-Side Spacing (Not Implemented)
1B 24 etc.	Set Absolute Starting Position
1B 32	Set Line Spacing to 1/6 Inch
1B 33 n	Set Line Spacing to n Minimum Units
1B 3C	Return Home (Slip Station)
1B 3D n	Select Device (Not Implemented)
1B 40	Initialize Printer
1B 43 n	Set Slip Eject Length
1B 44 etc.	Set Horizontal Tab Positions
1B 4A n	Print and Feed n Minimum Units
1B 4B n	Print and Reverse Feed n Minimum Units

1B 55 n	Set or Cancel Unidirectional Print (Slip Station)
1B 5C etc.	Set Relative Starting Position
1B 61 n	Align Positions (Receipt Station)
1B 63 33 n	Select Paper-End Signal Output
1B 63 34 n	Select Sensors to Stop Printing
1B 63 35 n	Enable or Disable Panel Switch (Paper Feed Button)
1B 63 36 n	Enable or Disable On-Line Button
1B 64 n	Print and Feed n Lines
1B 65 n	Print and Reverse Feed n Lines
1B 66 m n	Set Slip Waiting Time
1B 6A k	Read from Non-Volatile Memory
1B 70 etc.	Generate Pulse to Open Cash Drawer
1B 73 n etc.	Write to Non-Volatile Memory
1B 7A n	Set or Cancel Parallel Journal Printing
1D 14 n	Reverse Feed n Lines (Slip Station)
1D 15 n	Reverse Feed n Dots (Slip Station)
1E	Journal Tab (ignored if 1B 63 30 used to select station) This command can also be interpreted as Select Receipt Station (if 1C used to select slip station) For more information, see the descriptions for the Journal Tab command and the Select Receipt Station command in the next section, “ Command Descriptions.”

Print Characteristics Commands

These commands control what the printed information looks like and are listed in numerical order of their Hex codes.

Print Characteristics Commands	
Hex Code	**Command**
12	Double-Wide Characters
13	Single-Wide Characters
1B 12	Rotated Print
1B 16 n	Select Pitch (Column Width)
1B 21 m	Set Print Mode
1B 25 n	Select Character Set
1B 26 etc.	Define User-Defined Character Set (Receipt & Slip Stations)
1B 3A 0 0 0	Copy Character Set From ROM to RAM
1B 47	Enable Double Strike (Slip Station)
1B 48	Disable Double Strike (Slip Station)
1B 52 n 1B 74 n	Select Character Code Table
1B 56 n	Set or Cancel Rotated Print
1B 7B n	Set or Cancel Upside-Down Print

Station Select Commands

These commands control which station incoming data is printed on.

Station Select Commands	
Hex Code	**Command**
1B 63 30 n	Select Receipt or Slip for Printing, Slip for MICR Read
1B 63 31 n	Select Receipt or Slip for Setting Line Spacing
1C	Select Slip Station
1E	Select Receipt Station (if 1C used to select slip station) This command can also be interpreted as Journal Tab (ignored if 1B 63 used to select station) For more information, see the descriptions for the Journal Tab command and the Select Receipt Station command in the next section, “ Command Descriptions.”

Graphics Commands

These commands print graphics data and are listed in numerical order of their Hex codes.

Graphics Commands	
Hex Code	**Command**
1B 24 etc.	Set Absolute Starting Position
1B 2A m etc.	Set Bit Image Mode
1B 4C etc. 1B 59 etc.	Double-Density Graphics
1D 2A etc	Define Downloaded Bit Image (Receipt Station)
1D 2F m	Print Downloaded Bit Image (Receipt Station)

Printer Status Commands

These commands send printer status information to the host system and are listed in numerical order of their Hex codes.

Printer Status Commands	
Hex Code	**Command**
1B 75 0	Transmit Cash Drawer Status
1B 76	Transmit Printer Status

Real Time Commands

These commands correct difficulties with the original version of the 756 RS-232C communication interface.

Real Time Commands	
Hex Code	**Command**
1D 04 n	Real Time Status Transmission, GS Sequence
10 04 n	Real Time Status Transmission, DLE Sequence
1D 03 n	Real Time Request to Printer, GS Sequence
10 05 n	Real Time Request to Printer, DLE Sequence
1D 05	Real Time Printer Status Transmission

Bar Code Commands

These commands print bar codes on the receipt station and are listed in numerical order of their Hex codes. HRI means Human Readable Interface.

Bar Code Commands	
Hex Code	**Command**
1D 48 n	Select Printing Position of HRI Characters (Receipt Station)
1D 66 n	Select Pitch of HRI Characters (Receipt Station—Not Implemented)
1D 68 n	Select Height of Bar Code (Receipt Station)
1D 6B n etc.	Print Bar Code (Receipt Station)
1D 6B 49 n	Print Code 128 Bar Code (Receipt Station)
1D 77 n	Select Horizontal Size of Bar Code (Receipt Station)

MICR Reader Commands

These commands control the Magnetic Ink Character Recognition (MICR) Reader, including how it parses the character strings on checks.

MICR Reader Commands	
Hex Code	**Command**
1B 77 01	Read MICR Data and Transmit
1B 77 50	Define Parsing Format, Save in NVRAM
1B 77 52	Reread MICR Data
1B 77 70	Define Parsing Format, Do Not Save Permanently

Command Descriptions

This section lists the commands with their Hex, Decimal, and ASCII codes. The commands are grouped according to the following categories:

- Printer Function Commands
- Print Characteristics Commands
- Station Select Commands
- Graphics Commands
- Printer Status Commands
- Bar Code Commands
- MICR Reader Commands

Printer Function Commands

These commands control the following basic printer functions:

- Printing
- Feeding the paper
- Moving the printhead (slip station)
- Resetting the printer
- Cutting the paper

Horizontal Tab

Moves the print position to the next horizontal tab position set by the command, **Set Horizontal Tab Positions (1B 44 *n*1 *n*2 . . . 00)**. The print position is reset to column one after each line.

Hex	Decimal	ASCII
09	9	HT

Line Feed

Prints one line from the buffer and feeds paper one line.

Hex	Decimal	ASCII
0A	10	LF

Print and Eject Slip

Prints data from the buffer to the slip station and reverses the slip out the front of the printer until it clears the feed roller. The command is ignored if the receipt station is the current station. Upon completion, the receipt station is assigned as the current station.

Hex	Decimal	ASCII
0C	12	FF

Carriage Return

Prints one line from the buffer and feeds paper one line. The printer can be set through the DIP switches to ignore or use this command. Some applications expect the command to be ignored while others use it as a print command. See “Ignoring/Using the Carriage Return” in the “Diagnostics” chapter earlier in this book.

Hex	Decimal	ASCII
0D	13	CR

Clear Printer

Clears the print line buffer without printing and sets the following configuration:

- Receipt station: selected
- Line Spacing, Pitch (Print Mode), User-Defined Character Sets: maintained at current selections (RAM is not affected)
- Normal mode: Single-Wide, Single-High, Non-Rotated, and Left-Aligned
- Printing position: column one
- Error status: clears a fault condition
- Slip platen: opened
- Slip printhead: homed
- Printer: restarted
- Knife: homed

Hex	Decimal	ASCII
10	16	DLE

Close Form (Slip Station)

Closes the feed roller and platen (forms compensation arm assembly) and retracts the forms arm stop. If the printer is reset or the **Clear (10)** is received, the feed roller and platen are opened.

Hex	Decimal	ASCII
11	17	DC1

Feed *n* Print Lines

Feeds paper *n* lines at the current line height without printing.

Hex	Decimal	ASCII	Value of n
14 n	20 n	DC4 n	0-255

Feed *n* Dot Rows

Feeds paper *n* dot rows without printing.

Hex	Decimal	ASCII	Value of n	Receipt	Slip
15 n	21 n	NAK n	0-255	n/152 inch	n/72 inch

Add *n* Extra Dot Rows

Adds *n* extra dot rows to the character height to increase space between print lines or decrease number of lines per inch.

Hex	Decimal	ASCII	Value of n	Receipt	Slip
16 n	22 n	SYN n	0-12	n/152 inch	n/72 inch
				Default = 2	Default = 3

The following table shows the relationship between the number of lines per inch and each extra dot row added for both the receipt and slip stations:

Receipt Station		
Extra Rows	Lines Per Inch	Dot Rows
0	8.5	18
1	8.0	19
2	7.6	20
3	7.2	21
4	7.0	22
5	6.6	23
6	6.3	24
7	6.1	25
8	5.9	26
9	5.6	27
10	5.4	28
11	5.2	29
12	5.1	30

Slip Station		
Extra Rows	Lines Per Inch	Dot Rows
0	10.3	7
1	9.0	8
2	8.0	9
3	7.2	10
4	6.5	11
5	6.0	12
6	5.5	13
7	5.1	14
8	4.8	15
9	4.5	16
10	4.2	17
11	4.0	18
12	3.8	19

Print

Prints one line from the buffer and feeds paper one line.

Hex	Decimal	ASCII
17	23	ETB

Open Form (Slip Station)

Opens the feed roller and platen (forms compensation arm assembly) so that a form may be inserted (default position).

Hex	Decimal	ASCII
18	24	CAN

Full Knife Cut

This command is implemented the same as **Partial Knife Cut (1A, 1B 6D)**. Use either Hex 19 or Hex 1B 69.

Hex	Decimal	ASCII
19 1B 69	25 27 105	EM ESC i

Partial Knife Cut

Partially cuts the receipt. The length of the cut can be changed through the DIP switches. See " Setting Partial Cut Distance" on page 43. The default setting leaves .20 inches (5 mm) of paper on the left edge. The cut edge is 108 dot rows or .71 inches (18 mm) above the receipt print line. The command is valid only at the beginning of a line.
Use either Hex 1A or Hex 1B 6D.

Hex	Decimal	ASCII
1A 1B 6D	26 27 109	SUB ESC m

Generate Tone

Activates a short tone.

Hex	Decimal	ASCII
1B 07	27 7	ESC BEL

Set Column

Prints the first character of the next print line in column *n*. The command is not valid with Single or Double Density graphics.

Hex	Decimal	ASCII	Value of n Receipt (Pitch)	Value of n Slip (Pitch)
1B 14 n	27 20 n	ESC DC4 n	1-44 (Standard) 1-56 (Compressed)	1-66 (Standard) 1-80 (Compressed)
			n resets to one after each line is printed.	

Set Character Right-Side Spacing

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII
1B 20 n	27 32 n	ESC (SPACE) n

Set Absolute Starting Position

Sets the print starting position to the specified number of dots (up to the right margin) from the beginning of the line. The print starting position is reset to the first column after each line.

Hex	Decimal	ASCII
1B 24 n1 n2	27 36 n1 n2	ESC $ n1 n2
n = Number of dots to be moved from the beginning of the line		
n1 = Remainder after dividing n by 256		
n2 = Integer after dividing n by 256		

The values for *n*1 and *n*2 are two bytes in low byte, high byte word orientation. Determine the value of *n* by multiplying the column for the absolute starting position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to calculate column 29 (10 dots per column) as the absolute starting position.

28 x 10 = 280 dots (beginning of column 29)
280/256 = 1, remainder of 24
*n*1 = 24 *n*2 = 1

Note: This command is also used in the graphics mode to emulate the Epson LQ-950™ dot matrix printer. See “ Graphics Commands” later in this chapter for more information.

Set Line Spacing to 1/6 Inch

Sets the line spacing to 1/6 of an inch (4.25 mm) or 6 lines/inch on the selected station. The command is not affected by the **Print (17)** command. At initialization the receipt is reset to .13 inch (7.6 lines/inch, 2 extra dot rows); the slip is reset to .14 inch (7.2 lines/inch, 3 extra dot rows).

Hex	Decimal	ASCII	Default: Receipt	Default: Slip
1B 32	27 50	ESC 2	.13 inch (7.6 lines per inch, 2 extra dot rows)	.14 inch (7.2 lines per inch, 3 extra dot rows)

Set Line Spacing to *n* Minimum Units

Sets the line spacing on the selected station:

- Receipt station: *n*/360 of an inch
- Slip station: *n*/144 of an inch (on some models, the command may not affect the slip station)

The minimum line spacing is 8.5 lines per inch. The line spacing equals the character height when *n* is too small.

Hex	Decimal	ASCII	Value of n	Default	Default: Slip
1B 33 n	27 51 n	ESC 3 n	0-255	.13 inch (7.6 lines per inch, 2 extra dot rows)	.14 inch (7.2 lines per inch, 3 extra dot rows)

Return Home (Slip Station)

Moves the impact printhead to the home position (beginning of line on the left side). If the printhead is already in the home position, it is not re-homed.
As the 756 is able to detect carriage motor jams, the printhead does not need to be homed after each receipt. The Epson TM-930™ homes the printhead after each receipt because it is unable to detect carriage motor jams.

Hex	Decimal	ASCII
1B 3C	27 60	ESC <

Select Device

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII	Value of n	Default
1B 3D n	27 61 n	ESC = n	0 (bit 0), printer not selected 1 (bit 0), printer selected	1

Initialize Printer

Clears the buffer and resets printer to the default settings (startup configuration).

- Receipt station is selected
- Normal mode: Single-Wide, Single-High, Non-Rotated, and Left-Aligned (printing position set to column one)
- Extra Dot Rows is set to 2 (receipt), and 3 (slip)
- User-defined characters or logo graphics (from RAM) are cleared
- Character Set is set to Code Page 437 (default)
- Character Pitch is reset to 15.2 CPI (receipt default), 13.9 CPI (slip default)
- Column Width is reset to 44 characters (receipt) and 66 characters (slip)

Hex	Decimal	ASCII
1B 40	27 64	ESC @

Set Slip Eject Length

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII
1B 43 n	27 67 n	ESC C n

Set Horizontal Tab Positions

Sets up to 32 horizontal tab positions *n* columns from column one, but does not move the print position. See the **Horizontal Tab (09)** command.

Set the tab positions in ascending order and put Hex 00 at the end. Hex 1B 44 00 (number of tabs not specified) clears all tab positions. The tab positions remain unchanged if the character widths are changed after the tabs are set. The default tab positions are at intervals of eight characters (column 9, column 17, column 25, and so forth) for normal print.

Hex	Decimal	ASCII	Value of n
1B 44 n1 n2...00	27 68 n1 n2...00	ESC D n1 n2...00	Column number minus one*
n is always less than or equal to the current selected column width.			

Print and Feed *n* Minimum Units

Prints one line from the buffer and feeds the paper *n*/360 of an inch on the receipt station or *n*/144 of an inch on the slip station. On the receipt station, the line height equals the character height when *n* is too small. This does not apply to the slip station. Use *n* = 0 to print a line without feeding the paper. This allows the printer to print on the last line of the slip (at .59 inches from the trailing edge) and still retain the slip in the feed rollers for reverse feeding the paper back out of the slip station.

Hex	Decimal	ASCII	Value of n
1B 4A n	27 74 n	ESC J n	0-255
n is always less than or equal to the current selected column width.			

Print and Reverse Feed *n* Minimum Units (Slip Station)

Prints one line from the buffer and reverse feeds the paper *n*/144 of an inch on the slip station. The receipt station cannot be reverse fed. If the receipt station is selected, the paper is fed forward *n*/360 of an inch.

Hex	Decimal	ASCII	Value of n
1B 4B n	27 75 n	ESC K n	0-255

Set or Cancel Unidirectional Print (Slip Station)

Toggles between unidirectional and bidirectional printing on the slip station. Unidirectional printing reduces column alignment tolerances and provides higher quality printing. Printing is normally bidirectional because of the faster speed.

Hex	Decimal	ASCII	Value of n	Default
1B 55 n	27 85 n	ESC U n	0 = select bidirectional 1 = select unidirectional	0

Set Relative Starting Position

Moves the print starting position the specified number of dots either right (up to the right margin) or left (up to the left margin) of the current position.
The print starting position is reset to the first column after each line.

Hex	Decimal	ASCII	Value of n
1B 5C n1 n2	27 92 n1 n2	ESC \ n1 n2	See Examples Below

To Move the Relative Starting Position Right of the Current Position

n = Number of dots to be moved right of the current position
*n*1 = Remainder after dividing *n* by 256
*n*2 = Integer after dividing *n* by 256

The values for *n*1 and *n*2 are two bytes in low byte, high byte word orientation. Determine the value of *n* by multiplying the number of columns to move right of the current position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to set the relative position two columns in standard pitch (10 dots per column) to the right of the current position.

2 x 10 = 20 dots (two columns to be moved right of the current position)
20/256 = 0, remainder of 20
*n*1 = 20 *n*2 = 0

To Move the Relative Starting Position Left of the Current Position

n = Number of dots to be moved left of the current position
*n*1 = Remainder after dividing (65,536-*n*) by 256
*n*2 = Integer after dividing (65,536-*n*) by 256

The values for *n*1 and *n*2 are two bytes in low byte, high byte word orientation. Determine the value of *n* by multiplying the number of columns to move left of the current position by 10 (standard pitch) or 8 (compressed pitch). The example shows how to set the relative position two columns in standard pitch (10 dots per column) to the left of the current position.

Align Positions (Receipt Station)

Specifies the alignment of the characters, graphics, logos, and bar codes on the receipt station according to the table below. The command is valid only when input at the beginning of a line.

Hex	Decimal	ASCII	Value of n	Default
1B 61 n	27 97 n	ESC a n	0 = Left Aligned 1 = Center Aligned 2 = Right Aligned	0

Select Paper-End Signal Output

This command is not implemented and is ignored if received. The four bytes of this command are used for backward compatibility to Epson TM-930™ applications. The RS-232C interface can accept multiple status bits, unlike the parallel interface (used in the Epson TM-930™).

Hex	Decimal	ASCII
1B 63 33 n	27 99 51 n	ESC c 3 n

Select Sensors to Stop Printing

Determines which sensor stops printing on the respective station. The command does not affect the paper out sensor on the receipt station which automatically stops the printer when the paper runs out.

Hex	Decimal	ASCII	Bit (of n)
1B 63 34 n	27 99 52 n	ESC c 4 n	0, 1 = Stop Receipt on Receipt Low 4 = Stop Slip if Trailing Edge Uncovered 5 = Stop Slip if Leading Edge Uncovered

Enable or Disable Panel Switch (Paper Feed Button)

Only the lowest bit is used to toggle the paper feed button. If the last bit is 0, the paper feed button is enabled. If the last bit is 1, the paper feed button is disabled. Functions that require using the paper feed button cannot be used when it is disabled with this command.

Hex	Decimal	ASCII	Value of n	Default
1B 63 35 n	27 99 53 n	ESC c 5 n	0-255	0

Enable or Disable On-Line Button

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII
1B 63 36 n	27 99 54 n	ESC c 6 n

Print and Feed *n* Lines

Prints one line from the buffer and feeds paper *n* lines at the current line height.

Hex	Decimal	ASCII	Value of n
1B 64 n	27 100 n	ESC d n	0-255 (0 interpreted as 1 on the receipt station)

Print and Reverse Feed *n* Lines

Prints one line from the buffer and reverse feeds the paper *n* lines on the slip station. The receipt station cannot be reverse fed. If the receipt station is selected, the paper is fed forward *n* lines.

Hex	Decimal	ASCII	Value of n
1B 65 n	27 101 n	ESC e n	0-255

Set Slip Waiting Time

Sets the time (in *m* minutes) that the printer waits for a slip to be inserted into the slip station and the time (*n* x 0.1 seconds) for the printer to close the platen and start printing once the slip has been inserted. The printer reads that a slip is inserted when the leading edge and trailing edge sensors are covered. The LED on the slip table is lit (green) when both sensors are covered.
If a slip is not inserted in the time specified, the receipt station is selected for the next function. If *m* = 0, the printer waits forever for a slip to be inserted. The times set by this command are used only by the command, **Select Receipt or Slip for Printing, Slip for MICR Read (1B 63 30 *n*)**, with *n* set to 04.

Hex	Decimal	ASCII	Value of m	Value of n
1B 66 m n	27 102 m n	ESC f m n	0-255	0-255

Read from Non-Volatile Memory

Reads a two-byte word from location *k* in the history EEROM.

Hex	Decimal	ASCII	Value of k
1B 6A k	27 106 k	ESC j k	0-63

With LCSIO (RS-485), the printer returns the word in response to a subsequent poll. The word is be appended to the normal three-byte response as shown.

STA1	STA2	ADDR	6A	N1	N2

Generate Pulse to Open Cash Drawer

Outputs a pulse defined by *n*1 and *n*2 to open a cash drawer.

Hex	Decimal	ASCII	Value of m	Value of n
1B 70 m n1 n2	27 112 m n1 n2	ESC p m n1 n2	0 = Drawer 1 1 = Drawer 2	0-255
n1 = (Pulse Ontime) n2 = (Pulse Offtime) The pulse is measured as 2 ms. x n (1 or 2).				

Write to Non-Volatile Memory

Writes two-byte word *n*1:*n*2 to location *k* in history EEROM.

Hex	Decimal	ASCII	Value of n	Value of n
1B 73 n1 n2 k	27 115 n1 n2 k	ESC s n1 n2 k	n1 = First Byte n2 = Second Byte	16-63*
Locations 00-15 (Hex) are reserved.				

Set or Cancel Parallel Journal Printing

Because there is no journal station on the 756, this command is not implemented and is ignored if received.

Hex	Decimal	ASCII
1B 7A n	27 122 n	ESC z n

Reverse Feed *n* Lines (Slip Station)

Reverses the paper feed in the slip station by *n* lines at the current spacing. The next Character Feed command reverses the paper feed back to the normal feed direction.

Hex	Decimal	ASCII	Value of n
1D 14 n	29 20 n	GS DC4 n	1-255

Reverse Feed *n* Dots (Slip Station)

Reverses the paper feed in the slip station by *n* dots at 1/72 inch (NCR 7150™ command). The next Dot Feed command reverses the paper feed back to the normal feed direction.

Hex	Decimal	ASCII	Value of n
1D 15 n	29 21 n	GS NAK n	1-255

Journal Tab

As there is no journal station on the 756, this command is ignored as a tab command. However, it is identical to the **Select Receipt Station (1E)** command and is used as indicated under the following conditions:

- If either the receipt or slip station is selected by **Select Receipt or Slip for Printing or MICR (1B 63 60 *n*)**, the command (1E) is ignored
- If the slip station is selected by **Select Slip Station (1C)**, the command (1E) selects the receipt station

See " Station Select Commands" later in this chapter for more information.

Hex	Decimal	ASCII
1E	30	RS

Print Characteristics Commands

These commands control what the printed information looks like. They control which character set is selected, enable you to define your own characters, set the margins, and allow you to produce graphics.

Double-Wide Characters

Prints double-wide characters. The printer is reset to single-wide mode after a line has been printed or after the **Clear Printer (10)** command is received. Double-wide characters may be used in the same line with single-wide characters, but not in the same line with rotated characters or with single or double-density graphics.

Hex	Decimal	ASCII
12	18	DC2

Single-Wide Characters

Prints single-wide characters. Single-wide characters may be used in the same line with double-wide characters, but not in the same line with rotated charatcters or with single or double-density graphics.

Hex	Decimal	ASCII
13	19	DC3

Rotated Print

Rotates characters 90 degrees counterclockwise. The command remains in effect until the printer is reset or the **Clear Printer (10)** command is received. The command is valid only when input at the beginning of a line. Rotated print and non-rotated print characters cannot be used together in the same line.

Hex	Decimal	ASCII
1B 12	27 18	ESC DC2

Select Pitch (Column Width)

Selects the character pitch for a print line. This command is valid only when input at the beginning of a line. Standard and compressed pitches cannot be used together in the same line.

Hex	Decimal	ASCII	Value of n	Default
1B 16 n	27 22 n	ESC SYN n	0 = Standard Pitch 1 = Compressed Pitch	0

The following table provides the print characteristics for both pitches on the receipt and slip stations.

Pitch	Receipt Columns	Receipt CPI	Slip Columns	Slip CPI
Standard	44	15.2	66	13.9
Compressed	56	19.0	80	17.1

Set Print Mode

The print mode: standard, compressed, double high, or double wide.

Hex	Decimal	ASCII	Value of m	Default
1B 21 m	27 33 m	ESC ! m	See Next Table	0

Value of m			
Bit	Function	0	1
Bit 0[1]	Pitch	Standard Pitch[2] 44 Col/Line, 15 CPI (Rec) 66 Col/Line, 13.9 CPI (Slip)	Compressed Pitch 56 Col/Line, 19 CPI (Rec) 80 Col/Line, 17.1 CPI (Slip)
Bit 4	Double High[3]	Canceled	Set
Bit 5	Double Wide	Canceled	Set

[1]Bit 0 is ignored unless it is at begining of line. Bits 1, 2, 3, 6, 7 are not used.
[2]Standard and compressed pitch cannot be used together in the same line.
[3]Double-high characters cannot be used with normal characters in the same line, nor can they be used on the slip station.

Select Character Set

Selects the character set. The character sets cannot be used together on the same line. When an undefined RAM character is selected, the Code Page 437 character is used.

Hex	Decimal	ASCII	Value of n	Default
1B 25 n	27 37 n	ESC % n	n = 0: Code Page 437 n = 1: User defined (RAM character set) n = 2: Code Page 850	0

Define User-Defined Character Set (Receipt Station)

Defines and enters downloaded characters (for the receipt station) into RAM. It may be used to overwrite single characters. The user-defined characters are available until power to the printer is turned off, an Initialize Printer command (1B 40) is received, or a downloaded bit image (1D 2A) is defined.
User-defined character sets for both slip and receipt may be used at the same time. The command clears bit image logo data from RAM. See the illustration on the next page of a sample character cell.

Hex	Decimal	ASCII
1B 26 3 c1 c2 n1 d1 . . . nn dn	27 38 3 c1 c2 n1 d1 . . . nn dn	ESC & 3 c1 c2 n1 d1 . . . nn dn

c = the ASCII codes of the first (*c*1) and last (*c*2) characters respectively
*c*1 = Hex 20-FF (Hex 20 is always printed as a space)
*c*2 = Hex 20-FF (Hex 20 is always printed as a space)
To define only one character, use the same code for both *c*1 and *c*2
n = the number of dot columns for the nth character as specified by *n*1 . . . *n*n
n = 1-10 (standard pitch), 12 and less accepted but ignored
n = 1-8 (compressed pitch), 12 and less accepted but ignored
d = the column data for the nth character as specified by *d*1 . . . *d*n
The number of bytes for a particular character cell is 3 x *n*1
The bytes are printed down and across each cell

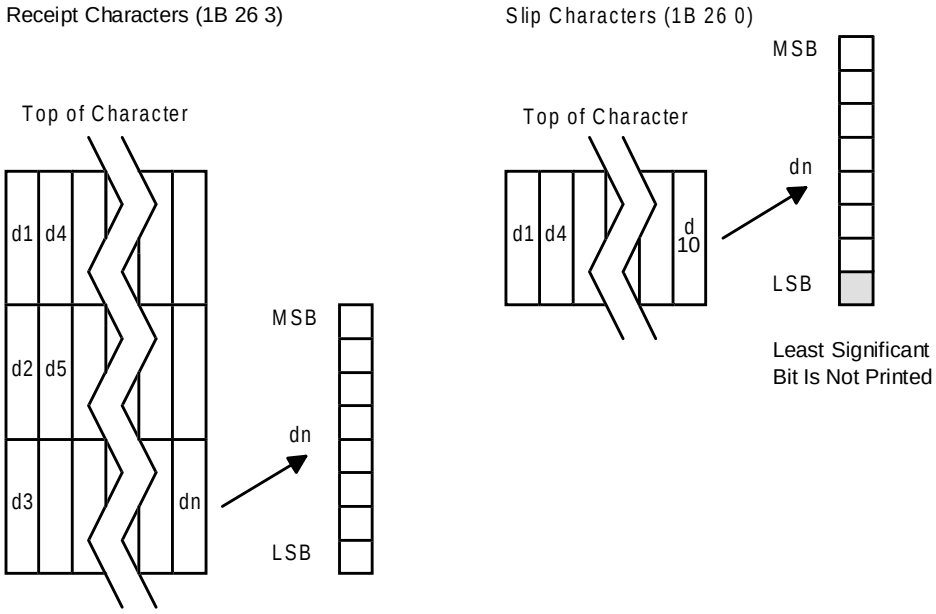
Define User-Defined Character Set (Slip Station)

Defines and enters downloaded characters (for the slip station) into RAM (this command is both an NCR 7150™ and an Epson TM-T80™ command).

Hex	Decimal	ASCII
1B 26 0 c1 c2 d1 . . . dn	27 38 0 c1 c2 d1 . . . dn	ESC & 0 c1 c2 d1 . . . dn

c = the ASCII codes of the first (*c*1) and last (*c*2) characters respectively
*c*1 = Hex 20-FF (Hex 20 is always printed as a space)
*c*2 = Hex 20-FF (Hex 20 is always printed as a space)
To define only one character, use the same code for both *c*1 and *c*2
d = the column data for the nth character as specified by *d*1 . . . *d*n
Each character is defined by 12 bytes (only bytes 2-11 are printed)
Each byte is one 7-dot high column (full- or half-dot column)
Overlapped dots are not printed
The data must contain [(*c*2 - *c*1 + 1) x 12] bytes

This command may be used to overwrite single characters. It will clear bit image data from RAM. The user-defined characters are available until power to the printer is turned off, an Initialize Printer command (1B 40) is received, or a downloaded bit image (1D 2A) is defined.
User-defined character sets for both slip and receipt may be used at the same time. See the illustration below of a sample character cell.



Copy Character Set from ROM to RAM

Copies characters in the active ROM set to RAM. Use this command to re-initialize the user defined character set. Code Page 437 is copied by default at initialization.

Hex	Decimal	ASCII
1B 3A 0 0 0	27 58 0 0 0	ESC : 0 0 0

Enable Double Strike (Slip Station)

Overprints a second pass of the print line on the slip station to improve penetration of multiple forms and increase print contrast. The second pass is printed the same direction as the first to ensure accuracy of the overprint. The printer is reset to the standard print mode after a line has been printed or after a **Clear Printer (10)** command is received.

Hex	Decimal	ASCII
1B 47	27 71	ESC G

Disable Double Strike (Slip Station)

Turns off the double strike mode on the slip station.

Hex	Decimal	ASCII
1B 48	27 72	ESC H

Select Character Code Table

Selects the character set to be used. Code Page 437 and Code Page 850 cannot be used together on the same line.

Hex	Decimal	ASCII	Value of n	Default
1B 52 n 1B 74 n*	27 82 n 27 116 n*	ESC R n ESC t n*	0 = Code Page 437 1 = Code Page 850	0

Set or Cancel Rotated Print

Rotates characters 90 degrees clockwise. It remains in effect until the printer is reset or until a **Clear Printer (10)** or **Rotated Print (1B 12)** command is received. It is valid only at the beginning of a line. Rotated print and non-rotated print cannot be used together in the same line. See " Summary of Rotated Printing" on the next page.

Hex	Decimal	ASCII	Value of n	Default
1B 56 n	27 86 n	ESC V n	0 = Cancel 1 = Set	0

Set or Cancel Upside-Down Print

Prints upside-down characters. It is valid only at the beginning of a line. The character order is inverted in the buffer so text is readable. Upside-down and right-side up print cannot be used together in the same line. It remains in effect until the **Rotated Print (1B 12)** command is received. Only bit 0 is used. Bits 1-7 are not used. See " Summary of Rotated Printing" on the next page.

Hex	Decimal	ASCII	Value of n	Default
1B 7B n	27 123 n	ESC { n	0 = Cancel 1 = Set	0

Summary of Rotated Printing

The table shows the combinations of Set/Cancel Upside-Down Print, Set/Cancel Rotated Print (clockwise), and Rotated Print (counterclockwise). Rotated CCW is mutually exclusive with the other two commands.
The samples of the print show only the normal size characters. Double-wide and double-high characters are printed in the same orientation (double-high characters cannot be printed on the slip station). They may also be mixed on the same line.

Upside Down 1B 7B n	Rotated CW 1B 56 n	Rotated CCW 1B 12	Resulting Output
Canceled	Canceled	Cleared	1 (See Below)
Canceled	Set	X	2 (See Below)
Set	Canceled	X	3 (See Below)
Set	Set	X	4 (See Below)
X	X	Set	5 (See Below)

Note: The following print modes cannot be mixed on the same line:

- Standard and compressed pitch
- Vertical (normal) and rotated
- Right-side up and upside down
- Single high (normal) and double high

Station Select Commands

These commands decide which station any incoming data will be printed on.

Select Receipt or Slip for Printing, Slip for MICR Read

Selects the station for printing. If a slip is present and the station selected changes from slip to receipt, the slip is ejected. If the station selected changes from receipt to slip, the printer waits for a slip or check to be inserted, either for printing or for reading the MICR characters. See **Set Slip Waiting Time (1B 66 m n)**.

As there is no journal station on the 756, bit 0 and bit 1 both select the receipt station. In the Epson TM-930™ the command can be used to select the journal station (bit 0). The command is valid only when input at the beginning of a line.

Hex	Decimal	ASCII	Value of n
1B 63 30 n	27 99 48 n	ESC c 0 n	1, 2, 3 = Receipt 4 = Slip

Select Receipt or Slip for Setting Line Spacing

Selects the station for setting line spacing. As there is no journal station on the 756, bit 0 and bit 1 both select the receipt station. In the Epson TM-930™ the command can be used to select the journal station (bit 0).

Hex	Decimal	ASCII	Value of n
1B 63 31 n	27 99 49 n	ESC c 1 n	1, 2, 3 = Receipt 4 = Slip

Select Slip Station

Selects the Slip Station for all functions. The receipt station is the default setting after the printer is initialized or the **Clear Printer (10)** command is received. If a select command for one station is followed by a select for another station with no data sent for the first station, only the second station will be selected.

Hex	Decimal	ASCII
1C	28	FS

Select Receipt Station

Selects the Receipt Station for all functions. The receipt station is the default setting after the printer is initialized or the **Clear Printer (10)** command is received. If a select command for one station is followed by a select for another station with no data sent for the first station, only the second station will be selected.

Note: This command is identical to **Journal Tab (1E)**, an Epson TM-930™ command. As there is no journal station on the 756, this command is ignored as a tab command. The following conditions occur when this command is used:

- If either the receipt or slip station is selected by **Select Receipt or Slip for Printing or MICR (1B 63 60 *n*)**, the command (1E) is ignored
- If the slip station is selected by **Select Slip Station (1C)**, the command (1E) selects the receipt station

See "Printer Function Commands" earlier in this chapter for more information.

Hex	Decimal	ASCII
1E	31	RS

Graphics Commands

These commands are used to enter and print graphics data.

Set Absolute Starting Position

Sets the print starting position for graphics on the receipt station at the specified number of dots from the beginning of the line as expressed in the following formula: *n* = ((*n*1 + (256 x *n*2)) x 2). The resulting dot column must be less than 448. The print starting position is reset to column one after each line. This command emulates the Epson LQ-950™ dot matrix printer. This allows the 756 to accept graphics that are normally output from word processing programs to a half-dot matrix printer.

Hex	Decimal	ASCII
1B 24 n1 n2	27 36 n1 n2	ESC $ n1 n2
n = Number of half dots to be moved from the beginning of the line **Note:** The 756 converts two half-dots to one full dot		
n1 = Remainder after dividing n by 256		
n2 = Integer after dividing n by 256		

Set Bit Image Mode

Sets the print resolution and enters one line of graphics data into the print buffer. Excess data is accepted but ignored. Any print command is required to print the data, after which the printer returns to normal processing mode. See the illustration on the next page for a graphic representation of the bit image.

Hex	Decimal	ASCII
1B 2A m n1 n2 d1...dn	27 58 m n1 n2 d1...dn	ESC : m n1 n2 d1...dn

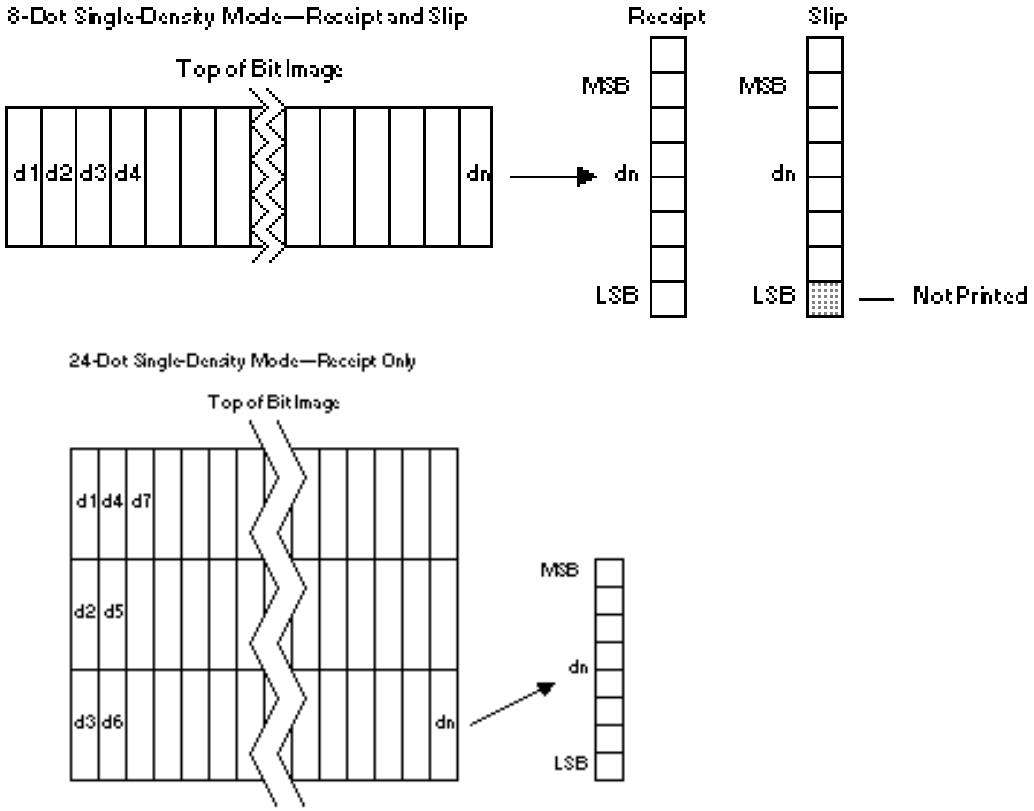
Receipt Station				
Value of m	Mode	No. of Dots (Vertical)	No. of Dots (Horizontal)	Number of Dots/LIne
0	8 Dot Single Density	8 (51 DPI)	224 (76 DPI)	8 x 224
1	8 Dot Double Density	8 (51 DPI)	448 (152 DPI)	8 x 448
32	24 Dot Single Density	24 (152 DPI)	224 (76 DPI)	24 x 224
33	24 Dot Double Density	24 (152 DPI)	448 (152 DPI)	24 x 448

Slip Station				
Value of m	Mode	No. of Dots (Vertical)	No. of Dots (Horizontal)	Number of Dots/LIne
0	7 Dot Single Density	7 (72 DPI)	330 (69.5 DPI)	7 x 330
1*	7 Dot Double Density	7 (72 DPI)	660 (139 DPI)	7 x 660
32, 33	Not Available on Slip			

In single density, one byte (7 dots) is printed in each full dot column; in double density, one byte is printed in each half/full dot column.
*Adjacent horizontal dots (overlapping dots) are not printed on the slip.

Value of n (8-Dot Single-Density Mode)	Value of n (24-Dot Single-Density Mode)	Value of d
n1 + (256 x n2)	3 x [n1 + (256 x n2)]	Number of Bytes of Data*

*Printed left to right (8-dot mode); Printed down then across (24-dot mode).



Single-Density Graphics

This NCR 7150™ command is not available. Use **Set Bit Image Mode (1B 2A)** described on the previous page. The Hex code, 1B 4B, is used for an Epson command, **Print and Reverse Feed *n* Mininimum Units (1B 4B *n*)**.

Double-Density Graphics

Enters one line of 8-dot double-density graphics into the print buffer. Excess data is accepted but ignored. Any print command is required to print the data, after which the printer returns to normal processing mode.
Double-density mode allows 0-448 dot columns on the receipt, 0-660 dot columns on the slip. The number of bytes sent is represented by the formulas in the second table. Each bit corresponds to one horizontal dot. Adjacent horizontal dots (overlapping dots) will not be printed on the slip. Compare this command to **Set Bit Image Mode (1B 2A...)**.

Hex	Decimal	ASCII
1B 4C n1 n2 d1...dn 1B 59 n1 n2 d1...dn	27 76 n1 n2 d1...dn 27 89 n1 n2 d1...dn	ESC L n1 n2 d1...dn ESC Y n1 n2 d1...dn

Value of n (8-Dot Double-Density Mode)	Value of d
n1 + (256 x n2)	Number of Bytes of Data*
Printed left to right.	

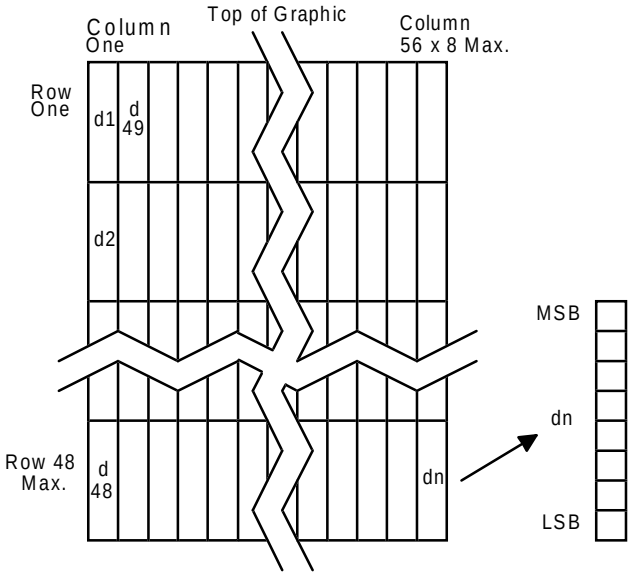
Define Downloaded Bit Image (Receipt Station)

Enters a downloaded bit image (such as a logo) into 16K of RAM for the receipt station with the number of dots specified by *n*1 and *n*2. The downloaded bit image is available until power to the printer is turned off, or until **Initialize Printer (1B 40)**, another **Downloaded Bit Image (1D 2A)**, or **Define User-Defined Character Set (1B 26)** is received.

The downloaded bit image and user-defined characters cannot be defined at the same time. Any user-defined characters will be cleared from RAM when this command is used. See the illustration for a graphic representation of the downloaded bit image.

Hex	Decimal	ASCII
1D 2A n1 n2 d1...dn	29 42 n1 n2 d1...dn	GS * n1 n2 d1...dn

Value of n1	Value of n2	Value of d
1-56 (8 x n1 = Number of Horizontal Dot Columns)	1-48 (Number of Vertical Bytes)*	Bytes of Data (Printed Down Then Across)
*The number of bytes sent is represented by the following formula: n = 8 x n1 x n2 (n1 x n2 must be less than or equal to 1344).		



Print Downloaded Bit Image (Receipt Station)

Prints a downloaded bit image (such as a logo) on the receipt station at a density specified by *m*. It is ignored if any data is in the print buffer, if the downloaded bit image is undefined, or if the data defined exceeds one line. A downloaded bit image and user-defined characters cannot be used at the same time.

Hex	Decimal	ASCII	Value of m	Print Mode	Vertical DPI*	Horizontal DPI*
1D 2F m	29 47 m	GS / m	0 1 2 3	Normal Double Wide Double High Quadruple	152 152 76 76	152 76 152 76
*Dot density measured in dots per inch.						

Printer Status Commands

These commands enable the printer to communicate with the host system following the selected handshaking protocol, either DTR/DSR or XON/XOFF. They are stored in the

printer's data buffer as they are received, and are handled by the firmware in the order in which they were received.
When a fault occurs, the printer will go busy at the RS-232C interface and not respond to either of the Printer Status commands. If the fault causing the busy condition can be cleared, such as by loading receipt or slip paper, or letting the thermal printhead cool down, the printer will resume processing the data in its receive buffer.
If a slip jam caused the busy condition and the application is not using Real Time commands for status and recovery, clear the jam and press the online button to cycle the printer. See the following section, "Real Time Commands" for details about the Real Time commands.

Transmit Cash Drawer Status

Transmits the current status of the cash drawers. One byte is sent to the host system. In DTR/DSR protocol, the printer waits for DSR = SPACE. If a drawer is not connected, the status will indicate it is closed.

Hex	Decimal	ASCII	Bit	1 Signifies	0 Signifies
1B 75 0	27 117 0	ESC u 0	0	Drawer 1 Closed	Drawer 1 Open
			1	Drawer 2 Closed	Drawer 2 Open

Transmit Printer Status

Sends status data to the host system.

Hex	Decimal	ASCII
1B 76	27 118	ESC v

The printer sends one byte to the host system. See the table below. In DTR/DSR protocol, the printer waits for DSR = SPACE.

Status Byte (RS-232C)			
Bit	Function	0 Signifies	1 Signifies
0	Receipt Paper	Ok	Low
1	Receipt Cover or Front Cover	Closed	Open
2	Receipt Paper	Ok	Out
3	Always Zero		
4	Always Zero		
5	Slip Leading Edge Sensor	Not Covered	Covered
6	Slip Trailing Edge Sensor	Not Covered	Covered
7	Always Zero		

Real Time Commands

These commands correct difficulties with the original version of the 756 RS-232C communication interface:

- Real Time Status Transmission (GS Sequence and DLE Sequence)
- Real Time Request to Printer (GS Sequence and DLE Sequence)
- Real Time Printer Status Transmission

The original Printer Status commands, **Transmit Printer Status (1B 76—ESC v)** and **Transmit Cash Drawer Status (1B 75 0—ESC u 0)** are placed in the printer's data buffer as they are received and handled by the firmware in the order in which they were received. If the paper exhausts while printing data which was in the buffer ahead of the status command, the printer goes busy at the RS-232C interface and suspends processing the data in the buffer until paper is reloaded. This is true for all error conditions: knife home error, slip paper jam, thermal printhead overheat, etc.
In addition, there is no way to restart the printer after a paper jam, or to cancel a slip waiting condition when using the **Wait for Slip (ESC c 0 0x04)** command.

The Real Time commands are implemented in two ways to correct these problems. Both implementations offer the same functionality; which one you choose depends on the current usage of your application. For a new application the GS sequences of the first implementation are recommended to avoid possible misinterpretation of a DLE sequence as a **Clear Printer (10 0—DLE NUL)** command.

The first implementation builds upon the GS ENQ sequence as implemented on Epson's TM-930II™, TM-950™ and TM-U950™ by defining two new GS (0x1D) sequences to provide the same functions as the DLE sequences above, and to provide complete backward compatibility to the original 756 Clear Printer command.

An application using these GS sequences does not need to distinguish for the printer between the new real time commands and the old Clear Printer command. This implementation is ideal for an existing 756 application which already uses the Clear Printer command or for a new application being developed.

The alternate implementation uses the DLE (0x10) sequences as implemented on Epson's TM-T85™ and TM-U950™. An application using these DLE sequences and the original 756 Clear Printer command (0x10) must distinguish for the printer between the new real time commands and the old Clear Printer command by adding a NUL (0x00) to the Clear Printer command.

An application using these DLE sequences must also send the second byte of the sequence within 100 milliseconds of the first, to prevent the first byte being mistaken for a Clear Printer command. This implementation is useful for an existing TM-T85™ or TM-

U950™ application which is being migrated to a 756. This application would not be using the 756 Clear Printer command at all since it is not recognized by the Epson printers.

Note: The DLE sequences as implemented on Epson's TM-T85™ and TM-U950™ are not exactly the same as those implemented on Epson's TM-950™.
Both implementations also provide the original GS ENQ real time sequence in addition to the newer real time sequences.
Three situations must be understood when using real time commands.

1. First, the printer executes the real time command upon receiving it and will transmit status regardless of the condition of the DSR signal.
2. Second, the printer transmits status whenever it receives the real time status transmission command sequence, even if that sequence happens to occur within the data of another command, such as graphics data.
   In this case the sequence will also be handled correctly as the graphics data it is intended to be when the graphics command is executed from the buffer.
3. Care must be taken not to send a real time command within the data sequence of another command that consists of two or more bytes.
   In this case the printer will use the real time command sequence bytes instead of the other command's bytes when finally executing that other command from the bufferthe other command will not be executed correctly.

These three situations generally preclude use of standard DOS drivers for the serial communication ports when using real time commands.

Another consideration is that an application should take care not to let the buffer fill up with real time commands when the printer is busy at the RS-232C interface. A busy condition at the RS-232C interface can be determined by bit 3 of the response to GS ENQ or GS EOT 1 or DLE EOT 1. The reason for a particular busy condition can be determined by other responses to GS EOT n or DLE EOT n.

Although the printer responds to real time commands when it is busy, it will place them into the buffer behind any other data there, and flush them out in the order in which they were received. When the printer is busy due simply to buffer full (that is, it can't print data as fast as it can receive it), then data continues to be processed out of the buffer at approximately print speed and the real time commands will eventually get flushed out. When the printer is busy due to an error condition, then data stops being processed out of the buffer until the condition clears one way or another. In either case, but more quickly in the case of an error condition, the buffer can fill with real time commands.

When the DLE sequences are being used, the last byte stored when the buffer fills up could be the DLE code, with no room for the subsequent EOT or ENQ. When this lone

DLE byte is finally processed out of the buffer it will be interpreted as a Clear Printer command.
Similarly, when the GS sequences are being used, the last byte stored when the buffer fills up could be the GS code, with no room for the subsequent EOT or ETX or ENQ. When this lone GS byte is finally processed out of the buffer it will use the next byte, whatever it is, as the second byte in its GS sequence.
To guard against this situation, an application should determine the cause of a busy condition and take appropriate action or pace further real time commands to avoid filling the buffer. There are a minimum of 256 bytes available in the printer's buffer when it goes busy.

Real Time Status Transmission

Transmits the selected one byte printer status specified by *n* in real time according to the following parameters.

GS Sequence

Hex	Decimal	ASCII	Value of n
1D 04 n	29 4 n	GS EOT n	1 = Transmit printer status 2 = Transmit RS-232C busy status 3 = Transmit error status 4 = Transmit receipt paper status 5 = Transmit slip paper status
The command is ignored if n is out of range.			

DLE Sequence

Hex	Decimal	ASCII	Value of n
10 04 n	16 4 n	DLE EOT n	1 = Transmit printer status 2 = Transmit RS-232C busy status 3 = Transmit error status 4 = Transmit receipt paper status 5 = Transmit slip paper status
The command is ignored if n is out of range.			
Note: An application using the DLE sequence must send EOT within 100 milliseconds of DLE or the printer will misinterpret the DLE and execute a Clear Printer command. Avoid this possibility by using the GS EOT n sequence which is handled exactly the same as DLE EOT n.			

1 = Transmit Printer Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off On	00 04	0 4	One or both cash drawers open Both cash drawers closed
3	Off On	00 08	0 8	Not busy at the RS-232C interface Printer is Busy at the RS-232C interface
4	On	10	16	Fixed to On
5				Undefined
6				Undefined
7	Off	00	0	Fixed to On

2 = Transmit RS-232C Busy Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off On	00 04	0 4	Both receipt and cassette doors closed Receipt or cassette door open
3	Off On	00 08	0 8	Paper feed button is not pressed Paper feed button is pressed
4	On	10	16	Fixed to On
5	Off On	00 20	0 32	Printing not stopped due to paper condition Printing stopped due to paper condition
6	Off On	00 40	0 64	No error condition Error condition exists in the printer
7	Off	00	0	Fixed to Off

3 = Transmit Error Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off On	00 04	0 4	No slip motor jam Slip motor jam occured
3	Off On	00 08	0 8	No knife error Knife error occurred
4	On	10	16	Fixed to On
5	Off On	00 20	0 32	No unrecoverable error Unrecoverable error occurred
6	Off On	00 40	0 64	Thermal printhead temp./power supply voltage are in range Thermal printhead temp./power supply voltage are out of range
7	Off	00	0	Fixed to Off

4 = Transmit Receipt Paper Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to On
2	Off On	00 04	0 4	Receipt paper adequate Receipt paper low
3	Off On	00 08	0 8	Receipt paper adequate Receipt paper low
4	On	10	16	Fixed to On
5	Off On	00 20	0 32	Receipt paper present Receipt paper exhausted
6	Off On	00 40	0 64	Receipt paper present Receipt paper exhausted
7	Off	00	0	Fixed to Off

5 = Transmit Slip Paper Status

Bit	Status	Hex	Decimal	Function
0	Off	00	0	Fixed to Off
1	On	02	2	Fixed to Off
2	Off On	00 04	0 4	Slip paper selected Receipt paper selected
3	Off On	00 08	0 8	Not waiting for slip to be inserted Waiting for slip to be inserted
4	On	10	16	Fixed to On
5	Off On	00 20	0 32	Slip leading edge sensor: paper present Slip leading edge sensor: no paper
6	Off On	00 40	0 64	Slip trailing edge sensor: paper present Slip trailing edge sensor: no paper
7	Off	00	0	Fixed to Off

Real Time Request to Printer

The printer responds to a request from the host specified by *n*. The operations performed depend on the value of *n*, according to the following parameters.

GS Sequence

Hex	Decimal	ASCII	Value of n
1D 03 n	29 3 n	GS ETX n	1 = Recover and restart 2 = Recover and clear buffers 3 = Cancel slip waiting
The command is ignored if n is out of range.			

DLE Sequence

Hex	Decimal	ASCII	Value of n
10 05 n	16 5 n	DLE ENQ n	1 = Recover and restart 2 = Recover and clear buffers 3 = Cancel slip waiting
The command is ignored if n is out of range.			
Note: An application using the DLE sequence must send ENQ within 100 milliseconds of DLE or the printer will misinterpret the DLE and execute a Clear Printer command. Avoid this possibility by using the GS ETX n sequence which is handled exactly the same as DLE ENQ n.			

***n* = 1**
Restarts printing from the beginning of the line where an error occurred, after recovering from the error. Print settings that are normally preserved from line to line, such as character height and width, are still preserved with this command. This sequence is ignored except when the printer is busy due to an error condition.

If the receipt is selected, this command will attempt recovery from a knife error. Other errors associated with the receipt, such as paper out or printhead overheating, can be recovered from only by clearing the specific condition, such as loading paper or letting the printhead cool down.

If the slip is selected, this command will attempt recovery from a slip motor jam by rehoming the printhead and waiting for a slip to be inserted before restarting the print. Other errors associated with the slip, such as cassette door open, can be recovered from only by clearing the specific condition, such as closing the cassette door.

***n* = 2**
Recovers from an error after clearing the receive and print buffers. Print settings that are normally preserved from line to line, such as character height and width, are still preserved with this command. This sequence is ignored except when the printer is busy due to an error condition.

If the slip was selected when the error occurred, the receipt becomes selected when the buffers are cleared. When printing on the slip is to continue, the slip must be selected again.

The same error recovery possibilities exist as for *n* = 1.

***n* = 3**
Cancels the slip waiting status. This sequence is ignored except when the printer is waiting for a slip to be inserted.

When slip waiting is canceled, the receive and print buffers are cleared and the receipt is selected. When printing on the slip is to continue, the slip must be selected again.

Real Time Printer Status Transmission

Transmits one byte status of the printer in real time.

Hex	Decimal	ASCII
1D 05	29 5	GS ENQ

Bit	Status	Hex	Decimal	Function
0	Off On	00 01	0 1	Receipt paper adequate Receipt paper low
1	Off On	00 02	0 2	Receipt paper adequate Receipt paper low
2	Off On	00 04	0 4	Both receipt and cassette doors closed Receipt or cassette door open
3	Off On	00 08	0 8	Not busy at the RS-232C interface Printer is busy at the RS-232C interface
4	Off On	00 10	0 16	One or both cash drawers open Both cash drawers closed
5	Off On	00 20	0 32	Paper present at both slip sensors Paper not present at one or both slip sensors
6	Off On	00 40	0 64	No error condition Error condition exists in the printer
7	On	80	128	Fixed to On

756 Clear Printer Command

Resets certain parameters and clears the print buffer as originally defined. This is NOT a Real Time command. It only distinguishes the Clear Printer command from other DLE sequences.

Hex	Decimal	ASCII
10 00	16 0	DLE NUL

Recognizing Data from the Printer
An application sending various real time and non-real time commands to which the printer responds can determine which command a response belongs to by the following table. Note that a response to GS EOT *n* or DLE EOT *n* cannot be distinguished from ASCII data coming from a MICR read.

While MICR data is still outstanding, an application should use the real time GS ENQ. A response to GS ENQ can still arrive "inside" ASCII MICR data, but it can be recognized and extracted. And although ASCII MICR data cannot be distinguished from responses to ESC u and ESC v, those are all non-real time responses and will arrive in the order in which they were solicited.

Note also that although the original intent of the response to ESC v was to provide motor jam information in bit 3 and out-of-range temperature and voltage information in bit 7, these bits will always be 0 when transmitted. This is due to the fact that ESC v is not processed until the error condition is cleared.

ESC u 0	0	0	0	0	0	0	x	x	Binary
ESC v	0	x	x	0	0	x	x	x	Binary
ESC w 1 (MICR read)	0 0 0	0 0 1	0 1 1	0 x x	1 x x	1 x x	0 x x	1 x x	Binary (Carriage Return) Binary (n = 0x20-0x2F Binary (n = 0x30-0x7F)
GS EOT n	0	x	x	1	x	x	1	0	Binary
DLE EOT n	0	x	x	1	x	x	1	0	Binary
GS ENQ	1	x	x	x	x	x	x	x	Binary
XON	0	0	0	1	0	0	0	1	Binary
XOFF	0	0	0	1	0	0	1	1	Binary

Bar Code Commands

These commands format and print bar codes on the receipt station.

Select Printing Position of HRI Characters (Receipt Station)

Prints HRI characters (Human Readable Interface) above or below the bar code.

Hex	Decimal	ASCII	Value of n (Printing Position)	Default
1D 48 n	29 72 n	GS H n	0 = Not Printed 1 = Above the Bar Code 2 = Below the Bar Code 3 = Both Above and Below the Bar Code	0

Select Pitch of HRI Characters (Receipt Station)

This command is not implemented and is ignored if received.

Hex	Decimal	ASCII	Value of n (Pitch)	Default
1D 66 n	29 102 n	GS f n	0 = Standard Pitch at CPI 1 = Compressed Pitch at 19 CPI	0

Select Height of Bar Code (Receipt Station)

Sets the bar code height to *n* dots or *n*/152 inch (*n*/6 mm).

Hex	Decimal	ASCII	Value of n	Default
1D 68 n	29 104 n	GS H n	1-255	162

Print Bar Code (Receipt Station)

Selects the bar code type and prints a bar code for the ASCII characters entered.

Hex	Decimal	ASCII	Value of n	Value of c
1D 6B n c1 c2...00	29 107 n c1 c2...00	GS k n c1 c2...00	0-7 (See Table)	ASCII Characters
00 = End of command.				

n	Bar Code	Length
0	UPC-A	Fixed Length
1	UPC-E	Fixed Length
2	JAN13 (EAN)	Fixed Length
3	JAN8 (EAN)	Fixed Length
4	Code 39	Variable Length
5	Interleaved 2 of 5	Variable Length
6	Codabar	Variable Length
7	Not Used	

Note: Fixed length codes can be aligned left, center, or right using the **Align Positions (1B 61)** command. Variable length codes are center aligned. When data is present in the print buffer, this command is ignored. The required paper feeding is performed, regardless of the current line spacing. If the horizontal size exceeds one line, the excess data is not printed. Illegal data cancels the command.
The printer will calculate the check digit for the UPC and JAN (EAN) codes if it is not sent from the host system. The printer will also generate six-character zero-suppressed UPC-E tags from full 11 or 12 characters sent from the host system according to standard UPC-E rules. Start/stop characters are provided for Code 39 if they are not included.

Print Code 128 Bar Code (Receipt Station)

Selects and prints the Code 128 bar code.

Hex	Decimal	ASCII	Value of n	Value of dn
1D 6B 49 n dn	29 107 73 n dn	GS k I n dn	1-255	0-105

Since the characters encoded via Code 128 include the NUL (0x00) character, a NUL cannot be used to terminate the Code 128 bar code sequence as is done with other bar code sequences. The number of characters to be encoded is variable and is specified by *n*.

Following *n* are the data bytes: d*n*. The printer processes *n* bytes from the next character data as bar code data.

- The first data byte must be a Start code: d1 = 103-105.
- Data bytes past the Start code: d2 = 0-102.
- The printer provides the Stop code.

If character code d cannot be printed, the printer prints the processed bar code data up to that point and the following data is treated as normal data. If the horizontal size exceeds one line, the printer does not print the excess data.

This command is enabled only when no data is in the print buffer. When data is in the printer buffer, the printer processes the data following 'GS k l' as normal data.

Select Horizontal Size of Bar Code (Receipt Station)

Sets the bar code width to *n* dots or *n*/152 inch (*n*/6 mm).

Hex	Decimal	ASCII	Value of n	Default
1D 77 n	29 119 n	GS w n	2, 3, 4	3

MICR Reader Commands

These commands control the Magnetic Ink Character Recognition (MICR) Reader, including how it parses the character strings on checks.

Read MICR Data and Transmit

Reads and transmits the MICR data and adds a **Carriage Return (0D)**. This command must follow **Select Receipt or Slip for Printing, Slip for MICR Read (1B 63 30 *n*)**. If no parsing format is selected with either of the **Define Parsing Format** commands (see below), all data will be returned, which is the default.

Hex	Decimal	ASCII
1B 77 01	27 119 1	ESC w 1

Define Parsing Format, Save in NVRAM

Defines and saves parsing format. Send this command at the start of day or use in the setup application. If no parameters are selected, parsing is not performed.

Hex	Decimal	ASCII
1B 77 50 parameters	27 119 80 parameters	ESC w P parameters

Reread MICR Data

Resends the unparsed MICR data (as if the parsing has not been defined).

Hex	Decimal	ASCII
1B 77 52	27 119 80	ESC w P

Define Parsing Format, Do Not Save Permanently

Defines, but does not save parsing format. Send this command at the start of day or use in the setup application. If no parameters are selected, parsing is not performed.

Hex	Decimal	ASCII
1B 77 70 parameters	27 119 112 parameters	ESC w p parameters

SNIkey DSTN and SNIkey TFT

SNIkey DSTN

Software Interfaces

Keyboard Codes (Standard)

(F1) 3B	(F9) 43	(ESC) 01	(BS) 0E
(F2) 3C	(F10) 44	(s) 1F	(u) 16
(F3) 3D	(Clft) E0,4B	(Crgt) E0,4D	(Y) 15
(F4) 3E	(PgUp) **C** E0,49	(PgDn) E0,51	(n) 31
(F5) 3F	**7** 47	**8** 48	**9** 49
(F6) 40	**4** 4B	**5** 4C	**6** 4D
(F7) 41	**1** 4F	**2** 50	**3** 51
(F8) 42	**0** 52	**.** 53	**(CR)** 1C

Possible key assignment

Scan code of the
8042 keyboard controller

Fixed keyboard assignment

Scan code of the
8042 keyboard controller

Touch Screen

In the case of the touch screen, the mouse interface is controlled by the interrupt INT 33H. Here, touching the screen corresponds to pressing the left mouse key. The touch screen programming interface is identical to that of the mouse interface. The driver provides the corresponding mouse coordinates additionally in a 640 x 200 coordinate system.

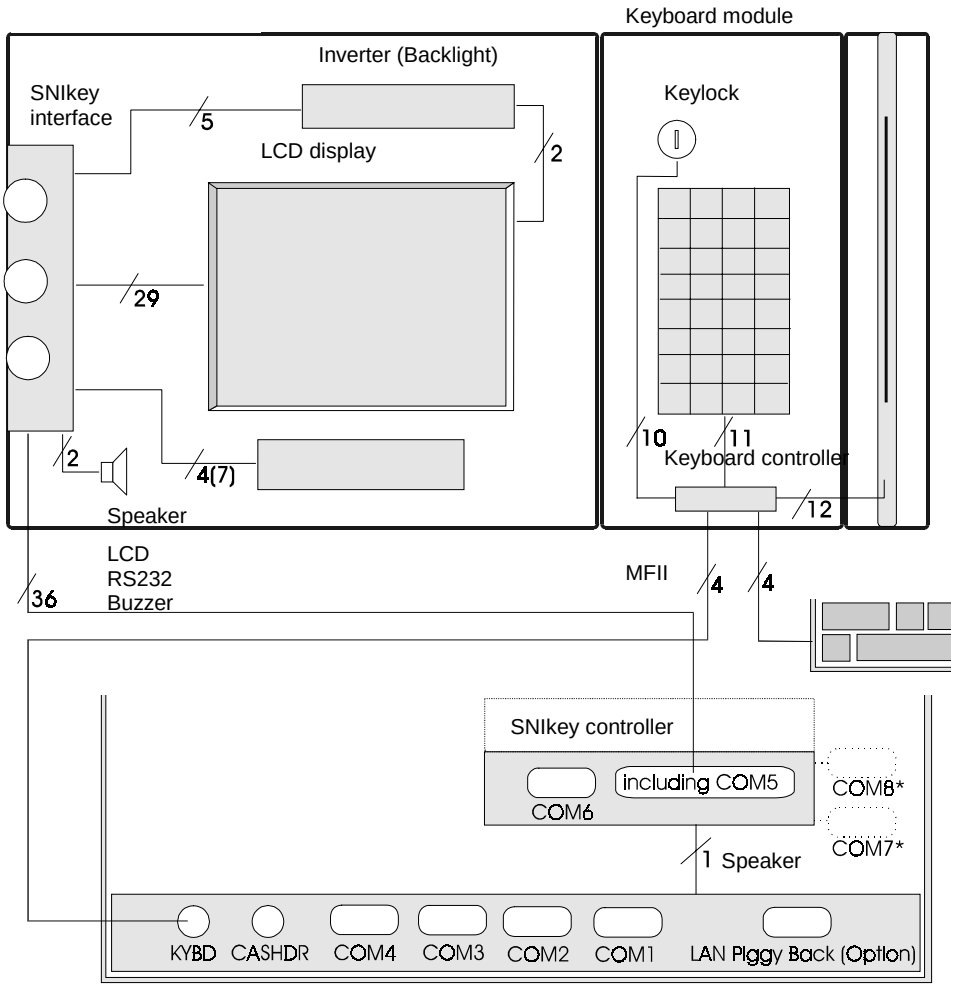
Touch screen and Sleep Mode

When using the SNIkey together with the BEETLE-CPU 486 DX2/50, errors may occur when making touch screen inputs in sleep mode. The LCD flat screen cannot be read when “sleeping”. Touch screen inputs are processed further by the system, without the system “waking-up”. It is therefore not permissible to set sleep mode.

LCD Flat Screen

The LCD flat screen is VGA-compatible. The CRT controller of the SNIkey is a Chips & Technologies 65535 VGA controller. The resolution of the LCD flat screen is 640 x 480 pixel with 16 colours. Up to 256 colours can, however, be generated in the VESA mode with a special driver.

Automated Logic Diagram (ALD) and Pin Assignments



SNIkey Interface

The LCD interface is connected to the SNIkey controller via a 36-pin cable. The inverter, LCD display, touch screen controller and beeper are connected to this interface in the SNIkey screen module. The loudness of the beeper, the contrast and brightness of the LCD display are controlled via three controllers on the SNIkey interface.

Inverter (High-Voltage Generator)

Inside the SNIkey, the high voltage needed for backlighting the LCD display is generated by the inverter!
High Voltage!
Before opening the device, make sure, that the device is disconnected from the main power supply.

Touch Screen and Controller

An analog capacitive touch screen is connected. The touch screen controller has an RS232 interface. The controller is connected to the SNIkey interface.

Keyboard Controller with Switch

The keyboard controller with switch is connected to the BEETLE via the MF2 interface. A key field with 32 keys, a central lock and a swipe card reader can be connected to the controller. The controller is supplied with the P5V voltage from the system via the MF2 cable.
An MF2 keyboard can also be connected to the controller. This can be a usual PC-keyboard or - alternatively - a TA57, TA61 or a TA64 (in this case you cannot use a swipe card reader).

SNIkey TFT

Software Interfaces

Keyboard Codes (Standard)

(F1) 3B	(F9) 43	(ESC) 01	(BS) 0E
(F2) 3C	(F10) 44	(s) 1F	(u) 16
(F3) 3D	(Clft) E0,4B	(Crgt) E0,4D	(Y) 15
(F4) 3E	(PgUp) **C** E0,49	(PgDn) E0,51	(n) 31
(F5) 3F	**7** 47	**8** 48	**9** 49
(F6) 40	**4** 4B	**5** 4C	**6** 4D
(F7) 41	**1** 4F	**2** 50	**3** 51
(F8) 42	**0** 52	**.** 53	(CR) 1C

Possible key assignment

Scan code of the
8042 keyboard controller

Fixed keyboard assignment

Scan code of the
8042 keyboard controller

fixed key legend
free key legend but fix effect of key

The software installation refers to the installation of corresponding display drivers; the installation of the touch screen comprises the allocation of resources or the COM interfaces, too. For this, corresponding diskettes are available.
The installation of display drivers is normally done after a VGA card is re-placed with the SNIkey TFT controller. As these normally need different drivers, it is highly recommended to set the standard VGA mode (resolution 640 x 480 pixel, 16 colors), before installing the controller.

At any rate you should check, whether the file CONFIG.SYS contains an entry for a store manager (like e.g. EMM386.EXE).
This entry must take into account the necessary cluster of 40 KB (segment address C000-C9FF) for the BIOS of the SNIkey TFT controller.
A possible entry would be:

DEVICE= C:\WINDOWS\EMM386.EXE X=C000-C9FF NOEMS
This may be important for MS-DOS, Windows 3.x or Windows 95. If you don´t pay attention to it, the system may crash while starting.

When installing the touch screen software and resource allocation (I/O address; interrupt) for the COM interfaces, mind the following:
During the installation there may be conflicts concerning the I/O addresses and the interrupt. So inform yourself of the resources already allocated and read the instructions in the files, e.g. readme file, of the installation diskettes very carefully.
Then you can allocate the resources and set the corresponding jumper configuration on the SNIkey COM board.
The SNIkey is supported by the operating systems MS DOS; Win95 and Win NT. The hardware interfaces and the firmware interfaces of the SNIkey are open. Now it is possible to develop drivers, e.g. for other operating systems, by software companies.

Softkey Codes

The softkey code corresponds to the first column of the keyboard code.
Press the shift key to get the functions of the softkeys.

(F1) 3B
(F2) 3C
(F3) 3D
(F4) 3E
(F5) 3F
(F6) 40
(F7) 41
(F8) 42

Touch Screen

Touching the screen corresponds to pressing the left mouse key. The touch screen programming interface is identical to that of the mouse interface. For example, in the operating system DOS the driver provides the corresponding mouse coordinates in a 640 x 200 coordinate system by the interrupt INT33H.

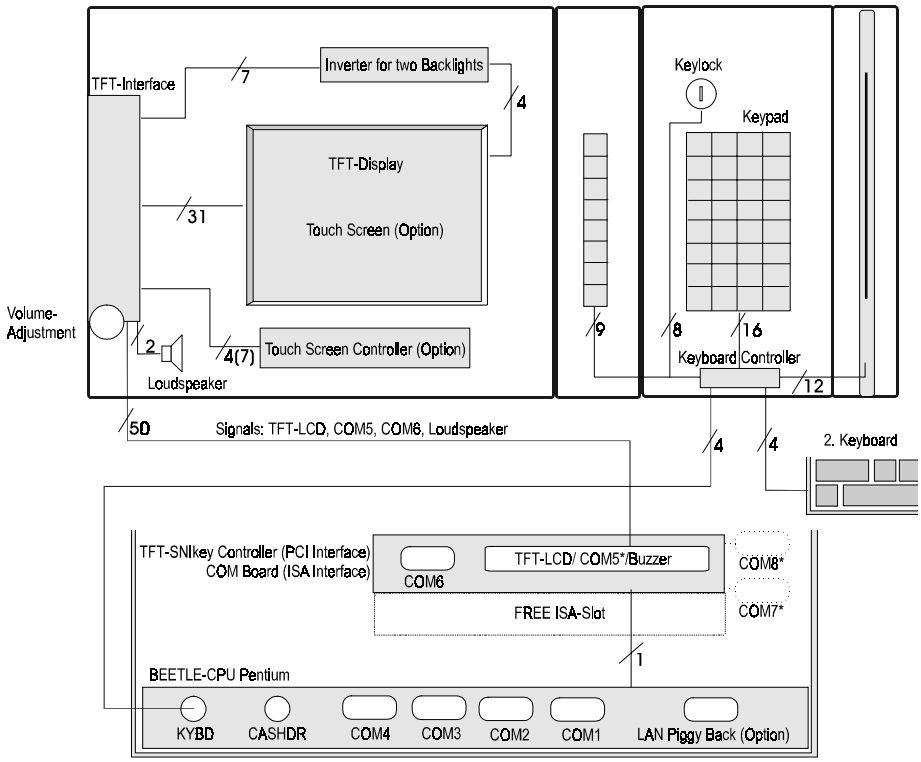
Touch screen and Sleep Mode

When using the SNIkey TFT together with the BEETLE-CPU Pentium, errors may occur when making touch screen inputs in sleep mode. The TFT LCD flat screen cannot be read when “sleeping”. Touch screen inputs are processed further by the system, without the system “waking-up”. It is therefore not permissible to set sleep mode.

TFT LCD Flat Screen

The TFT LCD flat screen is SVGA-compatible. The LCD controller of the SNIkey TFT is a Chips & Technologies, 65550 B module. The resolution of the TFT LCD flat screen is 800 x 600 Pixel (SVGA mode).

Automated Logic Diagram (ALD) and Pin Assignments



SNIkey Interface

The LCD interface is connected to the SNIkey TFT controller via a 50-pin cable. The inverter, LCD display, touch screen controller and beeper are connected to this interface in the SNIkey TFT screen module.

Keyboard Controller with Switch

The keyboard controller with switch is connected to the BEETLE via the MF2 interface. A key field with 32 keys, a key switch and a swipe card reader can be connected to the controller. The controller is supplied with the P5V voltage from the system via the MF2 cable.

An MF2 keyboard can also be connected to the controller. This can be a usual PC-keyboard or - alternatively - a TA57, TA61 or a TA64 (in this case you cannot use a swipe card reader).
You should use the key switch with the SNIkey TFT system. If there is no lock, you can use the key switch in combination with the keyboards TA57, TA61 or TA64.
The keyboard controller with switch allows either the SNIkey TFT keyboard or the second keyboard to be used, but not both simultaneously.

Pin Assignments

SNIkey Connectors of the SNIkey Controller and the SNIkey Interface

PIN #	signal	PIN #	signal
1	P12VLCD	2	P12VLCD
3	RxD1	4	TxD1
5	HUOUT	6	GND
7	BLUE0	8	GND
9	BLUE1	10	GND
11	BLUE2	12	GND
13	BLUE3	14	GND
15	BLUE4	16	GND
17	BLUE5	18	GND
19	GREEN0	20	GND
21	GREEN1	22	GND
23	GREEN2	24	GND
25	GREEN3	26	GND
27	GREEN4	28	GND
29	GREEN5	30	GND
31	RED0	32	GND
33	RED1	34	GND
35	RED2	36	GND
37	RED3	38	GND
39	RED4	40	GND
41	RED5	42	GND
43	ENAB	44	GND
45	SHFCLK	46	GND
47	VSYNC	48	GND
49	HSYNC	50	FPEN

COM 6 Interface of the SNIkey Controller

PIN #	signal
1	+12V
2	RxD
3	TxD
4	DTR
5	GND
6	DSR
7	RTS
8	CTS
9	+5V

Internal Speaker Connector for SNIkey Controller and BEETLE-CPU

PIN #	signal
1	n.c.
2	n.c.
3	n.c.
4	HUIN

Important Considerations Before Starting Setup

The SNIkey LCD display is based either on DSTN or TFT technology. So there are two versions of SNIkey controllers, the DSTN controller and the TFT controller. The DSTN controller has an ISA interface, whereas the TFT controller has a PCI interface.

Installing the SNIkey controller

Important: The SNIkey controller must be the only active video controller!

When you install the SNIkey controller into your BEETLE POS system or a PC, ensure that there is no other video controller in your system, let it be the BEETLE piggyback VGA controller, an ISA, VESA or PCI VGA controller. An onboard video controller that may be active, has to be disabled. This in most cases will have to be done by changing some jumper configuration on the motherboard. Refer to the technical information about your system for more information!

Resolution and maximum number of colors

SNIkey DSTN, Windows 95
Under Windows 95 the maximum number of colors is 256. However, if you have 16 MB installed, you must (!) install the page mode VGA driver W3PM480.DRV for using 256 colors! You will find this driver on a separate installation diskette.

SNIkey DSTN, Windows NT
Under Windows NT the maximum number of colors to be used with the SNIkey is 16! Before you are going to install the SNIkey controller, ensure that the number of colors were set to 16 before installation. The maximum resolution should be set to 640 * 480!

TFT SNIkey, Windows 95
There are two resolutions available: 640 * 480 and 800 * 600. For applications it is strongly recommended only to use 800 * 600! The standard VGA resolution 640 * 480 is required to have for the BIOS, as a fallback in case of configuration problems and the like. So before you are going to install the SNIkey controller, ensure that the settings are 640 * 480 and 16 colors!

Another important point is, that the SVGA BIOS of the SNIkey controller occupies 40 KB, i. e. the memory area C0000H to C9FFFH, whereas many VGA controllers only use C0000H to C7FFFH. So you should check whether you have in CONFIG.SYS an entry for

a memory manager like e. g. EMM386.EXE. Such an entry has to be changed accordingly, which then could look like:

DEVICE = C:\WINDOWS\EMM386.EXE X=C000-C9FF NOEMS

If this is not observed, the result could be a system crash in the start phase. Another possible conflict could be caused by a controller, like e.g. a LAN board, that has been configured to use that area as shared memory or even for a boot PROM.

After successful installation you should install the driver software for the LCD controller, i.e. for the 65550 chip from Chips&Technologies, Inc. You find this on a separate installation diskette.

Then you can change resolution and number of colors.

In the resolution 800 * 600, that is intended for applications under Windows 95 16, 256, and 65536 colors can be used with the SNIkey.

TFT SNIkey, Windows NT
There are two resolutions available: 640 * 480 and 800 * 600. For applications it is strongly recommended only to use 800 * 600! The standard VGA resolution 640 * 480 is required for the BIOS, as a fallback in case of configuration problems and the like. So before you are going to install the SNIkey controller, ensure that the settings are 640 * 480 and 16 colors!
After successful installation you should install the driver software for the LCD controller, which is for the 65550 chip from Chips&Technologies, Inc. Then you can change resolution and number of colors.
In the resolution 800 * 600, that is intended for applications, 256 and 65536 colors can be used with the SNIkey.

Considerations about assignment of COM port addresses and interrupts

Important: Ensure that there is no conflict of hardware port addresses or interrupt requests (IRQs) used by your system and the SNIkey controller!

The interrupts available for use are dependent on the controller.

DSTN SNIkey

The DSTN SNIkey controller (current version at the time of this writing: 3) allows for the following interrupt configurations (see your manual for more details):

	COM5(Touch)	COM6	COM7	COM8
Config. 1	IRQ12	IRQ15	IRQ11	IRQ11
Config. 2	IRQ12	IRQ15	IRQ11	-
Config. 3	IRQ15	IRQ12	IRQ12	IRQ12
Config. 4	IRQ12	IRQ15	-	-
			available only with BEETLE/XL or additional AT slot connector	

TFT SNIkey

The TFT SNIkey controller in addition to the above scheme allows to configure IRQ9, IRQ10, IRQ11, IRQ12, or IRQ15 for COM5 and also a shared IRQ9, IRQ10, IRQ11, IRQ12, or IRQ15 for COM6,7,8. The interrupt requests have to be enabled explicitly by jumpers on the controller. See your manual for details.
COM5 is for the touchscreen and always has to have an interrupt of its own.
To assist you further, some hints at the assignment of interrupts are given in the following. Please note, that only some possible conflicts are mentioned. There are many more possible to occur.

IRQ9, conflict with powerfail interrupt of BEETLE systems

IRQ9 (only to be used with TFT SNIkey) cannot be used with BEETLE systems, since this would conflict with the powerfail interrupt.
For other systems, no hint can be given for a conflict that is likely to occur. So you will have to check your specific configuration.

IRQ10, conflict with COM3, COM4 of BEETLE systems

IRQ10 (only to be used with TFT SNIkey) cannot be used with BEETLE systems, since this conflict is with COM3 and COM4. Factory settings of the BEETLE provide using IRQ10 for COM3 and COM4.
For other systems, no hint can be given for a conflict that is likely to occur. So you will have to check your specific configuration.

IRQ11, most likely conflict SCSI controller

The Adaptec product line of SCSI controllers uses IRQ11 as default. If you have this type of controller, please check. Refer to your technical documentation, if a change of the configuration is required.
BEETLE systems factory settings provide to use shared IRQ10 for COM3 and COM4, but COM4 can be configured by jumpers on the motherboard to use IRQ11 instead.

IRQ12, most likely conflict Mouse Port or PS/2 Mouse

The mouse usually has a (small) cylindric 6 pin connector. It seems that these type of mice mostly will use IRQ12. The Siemens PC product line e. g. is delivered with this type of mouse.
If you want for example to use IRQ12 for the SNIkey touch screen, you have to disable the mouse port, which in all cases known to us was possible by the BIOS Setup. You could then use a serial mouse instead, if required e. g. for testing, but this would require an additional COM port.

In case you disabled the mouse port and cannot use any mouse for Setup, the Setup program can be started as follows:

Use Tab and the cursor keys to navigate between buttons, menus, and edit fields and Return to start a function actually selected.

- hit Tab until you see the Start button is selected
- hit Return
- navigate with the Cursor keys to the Run menu
- enter a:setup (assumes setup disk inserted in drive A:) and hit Return

After Setup is finished, you can shutdown the system by using Tab, cursor keys and Return. When the system is restarted and installation was successful, you are able to use the Touch Screen function.

IRQ15, most likely conflict IDE controller

A possible conflict that could occur with IRQ15 would be the secondary IDE controller. A lot of motherboards of the Pentium class will have IDE type controllers, which use IRQ14 for the first IDE controller (2 channels) and IRQ15 for the secondary IDE controller (2 channels). So, even if you only have one hard disk and one ATAPI type Compact Disk drive, the CD drive will be most likely connected to the second IDE controller (using IRQ15 then), since each IDE controller will run in the fastest possible PIO mode allowed by both

connected devices. For this performance reasons in most cases the hard disk and the Compact Disc will not be configured to share the same IDE controller.

Adding COM ports

Adding COM ports, Windows 95

To add a COM port to your system configuration, run the Add New Hardware wizard. It is not recommendable to run the automatic hardware detection! Add the new COM port explicitly instead. It would get some (presumably wrong) port address and IRQ. Change these according to the jumper configuration you set before. See your SNIkey manual for details about setting the jumpers. After having made these changes to the Windows 95 configuration, you will have to reboot the system, before they can get into effect. It is not recommended, however, to reboot before having entered the port address and IRQ correctly.

The SNIkey manual numbers the COM ports from 5 to 8. The origin of this numbering is from the BEETLE, which has COM1 to COM4 on the motherboard.

To provide for a numbering according to that, the following procedure is recommendable:

1. first install the touchscreen, which will always be COM5 of the SNIkey controller
2. run the Add New Hardware wizard to configure new COM ports, so adding COM5, COM6 and (if you have) COM7 and COM8
3. reboot to activate the configuration

There are two reasons for not letting Windows 95 perform an automatic hardware detection for SNIkey COM ports. Not counting for the waste of time, Windows 95 doesn't detect them correctly anyway. On BEETLE systems, the automatic hardware detection may even lead to activation of the internal UPS with the effect, that it may be impossible to switch off the system later. In such a situation a call of the RDI utility POWEROFF.EXE e.g. in DOS mode would be required.

Adding COM ports, Windows NT

To add a COM port to your system configuration, run the Control Panel from the Program Manager. Click on the Ports icon and then on the Add button to make a new COM port known to the system. Then enter IRQ and hardware address according to the jumper configuration you set before. See your SNIkey manual for details about setting the jumpers.

Using shared interrupts

Using shared interrupts for SNIkey COM ports with Windows 95

As mentioned above, the touchscreen COM5 port always needs an interrupt of it´s own. COM6 to COM8 may share a common interrupt. Under Windows 95, this requires no special provision other than correctly specifying the resources used in the Device Manager.

Using shared interrupts for SNIkey COM ports with Windows NT

As mentioned above, the touchscreen COM5 port always needs an interrupt of ist own. COM6 to COM8 may share a common interrupt, but under Windows NT this requires specific configuration in the Registry. To provide for interrupt sharing the steps are:

- run REGEDT32.EXE, which can be called by clicking on Run in the File menu of the Program Manager
- assure that you have permission to change the Registry, which maybe only an Administrator is allowed to do
- in HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Services\Serial set the value of the variable 'PermitShare' to 1
- be careful to do this correctly, since the documentation says that bad Registry entries may have the result that Windows NT cannot come up; a good idea could be to backup the Registry before

Since the 'PermitShare' variable has global effect on all COM ports, it is your responsibility to ensure that sharing of interrupts can be performed on all COM ports installed. In a PC configuration with COM1 and COM2 integrated in the motherboard chipset using IRQ4 and IRQ3 rsp., you could e. g. have the idea to install another ISA multiport card with two ports COM3 and COM4 and wish to run them with IRQ4 and IRQ3 too. This will be impossible by hardware reasons!
Of course, it would also be impossible that the SNIkey controller and such a multiport card share the same interrupt!

Refer to the technical information about your system for the details you need!

If you configured SNIkey COM ports to share a common interrupt and didn't set 'Permit Share' to 1, it will occur that you can use all these, but only one at a time like:

- open COM n
- use COM n
- close COM n
- open COM n+1
- use COM n+1
- close COM n+1

etc., but not (!):

- open COM n
- open COM n+1
- use COM n
- use COM n+1
- close COM n
- close COM n+1

Important: Check your hardware configuration before using shared COM interrupts!

Hint: The 'PermitShare' variable is specific to Windows NT. Windows 95 is different.

Installing the Touch Screen Software

Before you start:

- Take notice, that the installation procedure was changed considerably in comparison to earlier versions, so with Touchware 5.0 now there are 3 installation diskettes to be used for both Windows 95 and Windows NT 4.0
- Uninstall a possibly used old version of the Touchscreen software
- Check your system carefully regarding hardware ports and interrupt requests (IRQs) used
- Assign hardware port address and IRQ for the Touchscreen COM port (COM5) and maybe other COM ports as well
- Set I/O and IRQ jumpers on the SNIkey COM controller board accordingly
- Connect the SNIkey controller and motherboard with the loudspeaker cable

- Add the COM5 port for the Touchscreen and maybe other COM ports too as described above for Windows 95 or Windows NT rsp., ensure you specified hardware port address and IRQ correctly

Start Installation:

- Ensure that the installation diskettes are write protected
- Make security copies from Touchscreen Setup diskettes
- Write protect the copied diskettes
- Put copied first diskette with Touchscreen Setup in drive A: or B:
- From the Start button, select Run, then enter a:setup or b:setup accordingly and press the Enter button
- You will see a Welcome Screen, press Next
- The installation is started and should tell you, whether the Touchscreen port was found
- Then you can Select the Installation Type, either Express or Custom
  Install, choose and press the one you want
  Next, the installation program will copy the required files to the hard disk and will prompt you for the next diskettes to be inserted

Finish Installation:

- When you see the Setup Complete Screen, select if you want to restart the system now and press the Finish button
- Remove the diskette now
- After you rebooted the system, in the Programs folder to be selected from the start button you will find a MicroTouch folder, there select the Touchscreen Control Panel, which allows you to customize your Touch environment

Important: It is strongly recommended to set the baud rate to 2400, since the Touchscreen otherwise may produce a fairly high interrupt load, to change the settings click on the Hardware tab

- Here you also can test whether the Touchscreen is found

- At this point time the Touchscreen will not yet beep when touched. To change the Touch environment, click on the Touch Settings tab and select and test the Touch evironment you want

If for some reason the installation fails, because the touchscreen COM port could not be found, you first should check if assignment of hardware port address and IRQ match to the software configuration.

If the settings are incorrect, you will also detect that the Touchscreen is not found in the Touchscreen Control Panel, Hardware tab, when clicking on the Find Touchscreen button. You now can change the settings for COM5 in the Device Manager to be selectable from the Control Panel by clicking on the System icon (Windows 95) or clicking on the Ports icon (Windows NT). You also may detect those settings for COM5 are correct, but you want to change the jumper settings. In such a case, perform a system shutdown, switch off the system, change the jumper settings and switch on the system.

If that all seems to be OK but even after a restart of the system the Touchscreen is not found, you should run the TCONFIG.EXE utility.

Running the TCONFIG.EXE Utility

First make sure that the jumpers of the SNIkey controller are set correctly for your configuration. It is very important that there is no conflict with another controller in terms of port address and interrupt request (IRQ)!

Refer to your manual to get the information about how to configure the SNIkey controller board.

The default configuration for SNIkey version B2 and later is:

Port address:	2E0H
IRQ:	12
Line parameters:	2400 Baud, no parity, 8 data bits, 1 stop bit

NOTE: You must run TCONFIG.EXE directly from DOS or in DOS mode of Windows 95. It will not work in a DOS shell or a full-screen DOS shell within Windows NT.

To run TCONFIG.EXE:

You can run

TCONFIG.EXE /?

which tells you about the parameters that can be specified. The parameters to be used are:

```
/Appp   ppp base port address of the controller (hexadecimal)
/Inn    nn  interrupt request (decimal)
/Ppdsb  p   parity     (set to N)
        d   data bits  (set to 8)
        s   stop bits  (set to 1)
        b   baud rate  (set to 4, i. e. 2400 baud)
```

1. Make sure the touchscreen is connected to your computer.

2. Access the DOS command line prompt.

3. Insert the diskette that contains the TCONFIG.EXE file, and make that the default drive.

4. Type TCONFIG with the proper parameters (see above) and press Enter to start the configuration utility. The program talks to the communication port specified trying to get connected by varying baud rates, and communication settings (parity, data bits, stop bits).
   If the communication was successful the baud rate and communication settings are programmed into the controller and displayed on the screen.
   If it was not successful, TCONFIG.EXE reports it. Before you repeat it, make sure the touchscreen controller is properly connected and the jumper configuration is correct.