Programmer's Guide

P/N 1-960366-01
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FINGERPRINT
PROGRAMMING LANGUAGE

Intermec Fingerprint 6.13

Intermec
A UNOVA Company

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1. INTRODUCTION, cont'd.

2. Preface

Intermec Fingerprint is a Basic-inspired, printer-resident programming language that has been developed for use with computer-controlled direct thermal and thermal transfer printers manufactured by *Intermec Technologies Corp*.

The *Intermec Fingerprint* firmware is an easy-to-use intelligent programming tool for label formatting and printer customizing, which allows you to design your own label formats and write your own printer application software.

You may easily create a printer program by yourself that exactly fulfils your own unique requirements. Improvements or changes due to new demands can be implemented quickly and without vast expenses.

This version (6.13) of the *Intermec Fingerprint* programming language has been further enhanced by a number of new program instructions. It also includes the *Intermec Direct Protocol* for combining variable input data from a host with predefined label layouts, but is still compatible with all its forerunners. A concise list of new features is found on next page.

This tutorial manual describes how to start up *Intermec Fingerprint* programming and how to use the various instructions in their proper context. Programming instructions are explained only briefly. The *Intermec Direct Protocol* is described in a separate *Programmer's Guide*.

The *Intermec Fingerprint Reference Manual* contains detailed information on all programming instructions in the *Intermec Fingerprint* programming language in alphabetical order. It also contains other types of program-related information that are common for all *Intermec Fingerprint*-compatible printer models from Intermec.

All information needed by the operator, like how to run the printer, how to load the paper supply and how to maintain the printer, can be found in the *Operator's Guide* and *User's Manual* for the printer model in question and in the software manuals, e.g. *Intermec Shell* or *Intermec Stand-Alone Concept*.

The *Technical Manual* for each printer model provides information on installation, setup, density, paper specifications, positioning, and other technical data, which are specific for the printer model in question. It also includes information on optional equipment like interface boards, sensors, cutters, and memory cards.

Intermec Fingerprint 6.13 supports:

- *Intermec Shell 4.01 Enhanced & Standard*
  Startup program for *EasyCoder* printers with or without a built-in keyboard
- *Intermec Stand-Alone Concept*
  Startup program for *EasyCoder Stand-Alone* printers, i.e. for printers without permanent computer connection.
- *Intermec LabelShop*
  A series of label-editing program for varrious versions of *MS Windows.*
- *Intermec Windows Drivers*
  For using an *EasyCoder* printer with most programs run under various versions of *MS Windows*.

For the sake of brevity, in this manual, the *Intermec* brand will be implied in the names such as *Intermec Fingerprint*, *Intermec Shell*, *Intermec LabelShop*, *Intermec EasyCoder* etc.

1. INTRODUCTION, cont'd.

3. News in Fingerprint 6.13

Compared to the last published version of Fingerprint Programmer's Guide, i.e. Fingerprint 6.0, this new version contains the following improvements and enhancements:

- **General *Fingerprint* enhancements:**
  New setup option for high resistance transfer ribbon (UBI HR 31) for *EasyCoder 501* with 11.81 dots/mm printhead density.

  A paper cutter can now be fitted on all models of *EasyCoder 501*.

- **Corrections and improvements of RS 422/485 interface:**
  Previously, to decide between RS 422 and RS 485, the XON/XOFF option “Data to host” was used. This has been changed to look at “Data from host” instead, so as to allow the host to send binary data on RS 422 to the printer with XON/XOFF flow control.

  RS 422 (4-wire):
  PROT_ADDR=DISABLE; XON/XOFF,DATA FROM HOST=ENABLE

  RS 485 (2-wire) point-to-point:
  PROT_ADDR=DISABLE; XON/XOFF,DATA FROM HOST=DISABLE

  RS 485 (2-wire) multidrop loop:
  PROT_ADDR=ENABLE; XON/XOFF,DATA FROM HOST=DISABLE

  Not used:
  PROT_ADDR=ENABLE; XON/XOFF,DATA FROM HOST=ENABLE

  Previously, when
  PROT_ADDR=DISABLE; XON/XOFF,DATA FROM HOST=DISABLE
  was selected, the printer was erroneously put into send mode. The only way around this was to send a character to the port. Now, the interface is set to reception mode and the dummy write is no longer necessary.

- **Improvements of RS 485 interface:**
  After the port has been set for transmission, a delay for at least 10 ms is inserted before writing the data. This is done to take care of a hardware deficiency, which states that a stabilization time is needed after the loop has been turned.

  A possible break character is taken care of if **PROT_ADDR=ENABLE** and break handling for the RS 485 channel is enabled.

  Previously, it was not possible to use addressees over 9, when the printer was appointed “master”. Now, it is possible to use addresses 0 – 31.

Continued!

1. INTRODUCTION, cont'd.

3. News in Fingerprint 6.13, cont'd.

- **Extended Instructions:**
  ERROR
  This statement now can set a specified error, in addition to enabling error-handling and creating error messages in the *Direct Protocol*.

  FILE& LOAD
  An optional leading parameter has been added that specifies the number of characters to ignore before the real data. This makes it possible to use the instruction as an MS/DOS command (CR/ LF problem). The instruction is compatible with *Fingerprint* 6.0.

  IMAGE LOAD
  An optional leading parameter has been added that specifies the number of characters to ignore before the real data. This makes it possible to use the instruction as an MS/DOS command (CR/ LF problem). The instruction is compatible with *Fingerprint* 6.0.

  LAYOUT
  Two layout types have been added:
  E = Bar code extended field, sets up complex bar code in regard of:
  - Security
  - Aspect height
  - Aspect width
  - Rows in bar code
  - Column in bar code
  - Truncation
  This corresponds to the 6 last parameters in the BARSET statement.
  J = Baradjust (adjust left or adjust right)
  This corresponds to the BARADJUST statement.

  SYSVAR
  New parameter. SYSVAR (25). Not intended for public use.

  VERSION$
  Supports *EasyCoder 401 Linerless* and CPU board 1-040700-30.

- **New Instruction:**
  FONT LOAD
  This instruction downloads and converts .ATF fonts to the printer's internal font format.

- **Remaining bugs and limitations:**
  Please refer to *Intermec Fingerprint 6.13* Reference Manual.

2. GETTING STARTED

1. Computer Connection

The *Fingerprint* firmware is stored in two EPROM packages fitted on the printer's CPU board at delivery (IC-1 & IC-2 in *EasyCoder 201 II*, IC-100 & IC-101 in *EasyCoder 401/501/601*). No floppy disks or operative system, like e.g. MS-DOS, is required. The printer only needs to be connected to a mains supply.

Unless the printer is fitted with a program that allows it to be used independently ("stand-alone"), you must also connect it to some kind of device, which can transmit characters in ASCII format. It can be anything from a non-intelligent terminal to a mainframe computer system.

For programming the printer, you need a computer with a screen and an alphanumeric keyboard, that provides two-way serial communication, preferably using RS 232C, (e.g. a personal computer with *Microsoft Windows 3.11*[1]). Use e.g. *Windows Notepad* or *Write* for writing programs and *Windows Terminal* for communication with the printer.

Connect the printer and host as described in the *Technical Manual* for the printer model in question. If the printer has several communication ports, it is recommended to use the serial port "uart1:" for programming, which by default is set up for RS 232C. Other serial communication ports could also be used, see the *Technical Manual* for the printer model in question.

It is possible to set up the printer's communication protocol to fit the host computer. However, until you have become familiar with the *Fingerprint* concept, it may be easier to adapt the host to the printer's default setup parameters:

Default communication setup on "uart1:"	
• Baud rate:	9600
• Parity:	None
• Character length:	7
• No. of stop bits:	2
• Flow control:	XON/XOFF to and from host
• New line:	CR/LF (Carriage Return + Line Feed)

☞ ***Communication Setup***
Also see:
- Chapter 15.6
- Technical Manual

2. Check Paper Supply

Check that the printer has an ample supply of paper or other receiving material and, when applicable, of thermal transfer ribbon. Refer to the *Operator's Guide* or the *User's Manual* for loading instructions.

☞ ***Paper and Ribbon Load***
Also see:
- Operator's Guide
- User's Manual

[1] */. Although most examples in this manual assumes a host running MS Windows 3.11, other operative systems can also be used, e.g. Windows 95, Windows NT, DOS, Mac OS, OS-2 etc, as long you have a terminal program that can communicate with the printer and some kind of word processing program.*

2. GETTING STARTED, cont'd.

3. Turn On the Printer

Check that the printhead is lowered. Turn on the main switch, which usually is fitted on the printer's rear plate and check that the “Power” control lamp comes on. Then watch the display window. What happens next depends on what kind of startup file there is in the printer.

WARNING!
Make sure that any paper cutter is locked in closed position.
The cutter may be activated when the power is turned on!

4. Shell Startup Program

After a short while, when the printer has performed certain self-diagnostic tests and loaded the startup program, a countdown menu will usually be displayed:

```
ENTER=SHELL
5 sec.    v.4.01
```

or

```
PRINT=SHELL
5. sec.   v.4.01
```

☞ ***Shell Startup Programs***
Also see:
- Intermec Shell Startup manuals

These menus indicate that the printer is fitted with one of the *Shell* startup programs (standard or enhanced). Wait until the 5 seconds countdown is completed. Then, by default, this menu will be displayed:

```
Fingerprint
6.13
```

This or similar messages indicates that the printer has entered the immediate mode of *Fingerprint*, where you can start your programming. Please proceed at chapter 2.10.

If the *Shell* countdown menus are shown, but are followed by any other message than *“Intermec Fingerprint 6.xx”*, some other application has already been selected in *Shell*. Refer to the *Intermec Shell* Startup Manuals for information on how to select the *Fingerprint* option.

5. Stand-Alone Program

If the following menu is displayed after power-up, the printer is fitted with the *Stand-Alone* program (also indicated by the special keyboard on the printer):

☞ ***Stand -Alone Program***
Also see:
- Intermec Stand-Alone Concept, Operating Instructions

```
Select Mode
1:Run 2:Set
```

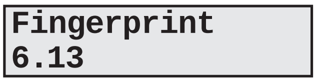
You can break the Stand-Alone program and enter the immediate mode of *Fingerprint* by pressing the <**C**> + <**Pause**> keys (*EasyCoder 201 IISA*), or <**Shift**> + <**Pause**> keys (*EasyCoder 501 SA*), and then enter the password 1138. The printer will enter the immediate mode with the communication parameters reset to default values. Proceed at chapter 2.10.

Continued!

2. GETTING STARTED, cont'd.

6. No Startup Program

If the printer is not fitted with any startup program at all, the display window should show the following message directly after power-up:



```
Fingerprint
6.13
```

This means that the printer has entered *Fingerprint's* immediate mode. Proceed at chapter 2.10.

7. Custom-Made Startup Program

If any other kind of message is displayed than those illustrated above, the printer is provided with some kind of custom-made startup program, which you must break before you can start programming.

- If the printer is equipped with a keyboard, or if the way of breaking the program is known, go on to chapter 2.8, *"Breaking a Startup Program"*.
- If the printer is not equipped with a keyboard and the method of breaking the program is not known (or is missing), go on to chapter 2.9, *"Bypassing a Startup Program"*.

8. Breaking a Startup Program

The following method requires that the printer is either fitted with a keyboard or that the way of breaking the program is known.

Default Method (break from keyboard)

- Press the <**C**> key and keep it pressed down while also pressing the <**Pause**> key.

Other Methods

- The program may be provided with other means for breaking the program, e.g. by sending a certain character from the host or by pressing another key or combination of keys. Break from keyboard may also be disabled completely.

☞ ***Breaking a Program***
Also see:
- Chapter 5.12

When a break interrupt has been executed and you have entered the immediate mode, there will be no change in the printer's display, but a message should appear on the screen of the host, provided you have a working two-way communication:

```
User break in line XXXX
```

How to go on

- If you cannot break the program from the keyboard and do not know how to break the program from the host, go on to chapter 2.9.
- If you have succeeded in breaking the program, proceed at chapter 2.10.

2. GETTING STARTED, cont'd.

9. Bypassing a Startup Program

The following methods are only recommended as a last resort, when there is no other way of breaking a startup program.

By default, there is no facility for breaking a startup file in a printer without a keyboard. Although a break interrupt can be issued from the host, this option is disabled by default. Thus, the startup file should always be provided with some facility for issuing a break interrupt from the host. Refer to the instructions for the program in question.

☞ ***Test Mode***
Also see:
- Service Manual

If such a facility still is missing, or you do not have the required information, you may use the Test Mode to bypass the startup program, provided your printer is fitted with a keyboard:

- Turn off the printer.
- Lift the printhead.
- Press the <**Print**> key and keep pressing it while you turn on the power. Do not release the <**Print**> key yet.
- After half a minute or less, the printer will enter the Test Mode, which is indicated by this message:

```
TESTMODE:
TESTPRINT
```

- Now you can release the <**Print**> key. The Test Mode is primarily intended for factory and service tests (see the *Service Manual*), but it also contains another facility which is very convenient in this situation.
- Press the <**Setup**> or <**Save**> key. A new message is displayed:

```
Fingerprint
6.13
```

The printer has now entered *Fingerprint's* immediate mode, ignoring the startup file. The communication parameters have been reset to their default values and the standard IN/OUT channel has been set to "uart1:".

If nothing else works, you may need to remove the configuration EPROM's or memory card containing the startup program.

Furthermore, if the startup program resides in the RAM memory, you may be forced to erase the entire RAM memory by removing all RAM packages from the CPU-board, wait for a few minutes and then reinstall the RAM packages. Finally restart the printer. Note that this may cause valuable data to be lost!

Note that this does only apply until you restart the printer without entering the Test Mode. Then the startup file with its original setup and choice of communication channel will become effective again. However, after entering Fingerprint via the Test Mode you can KILL the startup program and – if so desired – recreate it later, see chapter 5.13 "Creating a Startup Program".

Proceed at chapter 2.10.

10. Communications Test

☞ ***Version Check***
Also see:
- Chapter 15.11

Check that you have entered the immediate mode and have a working two-way serial communication by sending a simple instruction from the host to the printer. On the keyboard of the host, type:

```
? VERSION$ ↵
```

(↵ = Carriage Return key)

The printer should respond immediately by returning the version of the installed *Fingerprint* firmware to the screen of the host, e.g.:

```
Fingerprint 6.13
Ok
```

☞ ***Communication Setup***
Also see:
- Chapter 15.6
- Technical Manual

☞ ***Verbosity***
Also see:
- Chapter 7.7
- Chapter 15.7

☞ ***Intermec Shell***
Also see:
- Intermec Shell Startup manuals

This indicates that the communication is working both ways.

If the communication does not work, turn off the printer and check the connection cable and CPU board straps. Also check if the communication setup in the host corresponds to the printer's setup and if the connection is made between the correct ports. Check the verbosity level. Then try the communication test again.

Another possible cause of error may be that another communication channel than "uart1:" has been selected for *Fingerprint* in *Shell*. Reselect the *Fingerprint* application for "uart1:" as described in the *Shell* startup manuals.

☞ ***Text Field Printing***
Also see:
- Chapter 10.2

Once you know that the communication is working, you may go on and send a line of text to make sure that characters transmitted from the terminal are interpreted as expected by the printer's firmware:

```
FONT "SW030RSN" ↵
PRTXT "ABCDEFGHIJKLM" ↵
PRINTFEED ↵
```

Each line will be acknowledged by “Ok” on the screen, provided that it has been entered correctly, that there is a working two-way serial communication, and that the verbosity is on. When you press the “Carriage Return” key the third time, the printer will feed out a label, ticket, tag or piece of strip with the text printed near the lower left corner of the printable area.

ABCDEFGHIJKLM

☞ ***Character Sets***
Also see:
- Chapter 9.1
- Intermec Fingerprint Reference Manual

Try using other characters between the quotation marks in the third line, especially typical national characters like ÅÄÖÜ¿¢¥ç etc. Should any unexpected characters be printed, you may need to select another character set, see NASC statement in chapter 9.1, or switch from 7-bit to 8-bit communication.

3. CREATING A SIMPLE LABEL

1. Introduction

To get a quick impression of how *Fingerprint* works, start by creating a simple label following the step-by-step instructions below. Later in this manual, the various functions will be explained in greater detail. You can also look up the instructions in the *Intermec Fingerprint 6.13 Reference Manual*.

☞ ***Carriage Return Character***
Also see:
- Chapter 4.1

Use a word processing program, e.g. *Windows Notepad*, to enter the program lines. Use a space character to separate the line number from the instruction that follows. Finish each line with a carriage return character, indicated by ↵ below.

When you have entered a batch of program lines, copy the lines and paste them into a communication program, e.g. *Windows Terminal*, which is connected to the printer (see chapter 2.11).

The printer will not execute the program until you have entered RUN + Carriage Return.

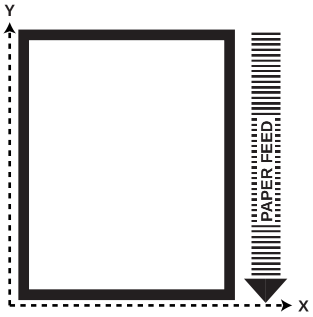
2. Printing a Box

☞ ***Box Field Printing***
Also see:
- Chapter 10.5

Let us start by printing a box 400 dots high and 300 dots wide with a line thickness of 10 dots. The box is inserted at position X=10, Y=10:

```
NEW
10   PRPOS 10, 10 ↵
20   PRBOX 400,300,10 ↵
200  PRINTFEED ↵
300  END ↵
RUN ↵
```

Note: The printer does not execute the program until you have typed RUN ↵.



Note:
This example is designed to be run on any present Fingerprint 6.13-compatible EasyCoder printer connected to a terminal or computer and loaded with a paper web (preferably labels) according to the following specifications.
Label size:

Width:	*≥ 52.8 mm*	*(2.08")*
Length:	*≥ 70 mm*	*(2.75")*

Continued!

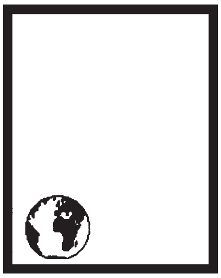
3. CREATING A SIMPLE LABEL, cont'd.

3. Printing an Image

☞ ***Image Field Printing***
Also see:
- Chapter 10.4

Now we add the image "GLOBE.1" after changing the position coordinates to X=25,Y=25.

```
30   PRPOS 25,25 ↵
40   PRIMAGE "GLOBE.1" ↵
RUN ↵
```

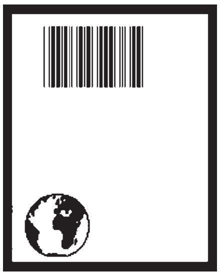


4. Printing a Bar Code

☞ ***Bar Code Field Printing***
Also see:
- Chapter 10.3

Before you print a bar code, you need to choose a bar code type. We will use Code 39, which allows alphanumeric input. Note there is no blank space in the bar code name in the BARTYPE instruction.

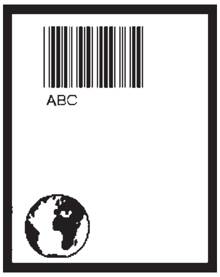
```
50   PRPOS 75,250 ↵
60   BARTYPE "CODE39" ↵
70   PRBAR "ABC" ↵
RUN ↵
```



5. Printing Human Readables

To get the bar code input data printed as human readable text under the bar code, add these lines:

```
1    BARFONT ON ↵
2    BARFONT "SW030RSN" ↵
RUN ↵
```



Continued!

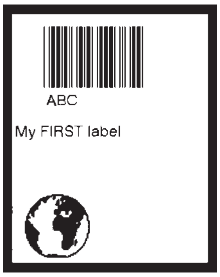
3. CREATING A SIMPLE LABEL, cont'd.

6. Printing Text

☞ ***Text Field Printing***
Also see:
- Chapter 10.2

Add a line of text at position X=25,Y=200:

```
80   PRPOS 25,200 ↵
90   FONT "SW030RSN" ↵
100  PRTXT "My FIRST Label" ↵
RUN ↵
```



7. Listing the Program

To view the whole program, type:

```
LIST ↵
```

☞ ***Program Editing and Listing***
Also see:
- Chapter 5.4

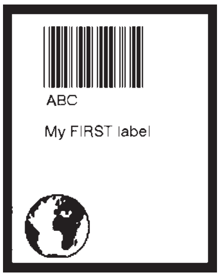
The program lines will be listed in ascending order on your terminal's screen:

```
1 BARFONT ON
2 BARFONT "SW030RSN"
10 PRPOS 10,10
20 PRBOX 400,300,10
30 PRPOS 25,25
40 PRIMAGE "GLOBE.1"
50 PRPOS 75,250
60 BARTYPE "CODE39"
70 PRBAR "ABC"
80 PRPOS 25,200
90 FONT "SW030RSN"
100 PRTXT "My FIRST label"
200 PRINTFEED
300 END
ok
```

8. Changing a Program Line

If you want to change a program line, simply rewrite the line using the same line number. For example, move the text to the right by rewriting line number 80 with new coordinates:

```
80   PRPOS 75,200 ↵
RUN ↵
```



Continued!

3. CREATING A SIMPLE LABEL, cont'd.

9. Saving the Program

☞ ***Saving***
Also see:
- Chapter 5.13

If you want to save your first attempt, issue the following instruction:

```
SAVE "LABEL1" ↵
```

Your program will be saved in the printer's memory under the name: LABEL1.PRG

10. Error Handling

☞ ***ERRHAND.PRG***
Also see:
- Chapter 16.4

The program above is very simple and there is a very small risk of encountering any errors. When writing more complex programs, you might find use for an errorhandler. For that purpose we have installed a program called ERRHAND.PRG in the standard Configuration EPROM's. Should your printer not contain any error-handling program, you will find ERRHAND.PRG listed in chapter 16.4.

ERRHAND.PRG contains subroutines that e.g. displays the type of error on the printer's LCD display (e.g. "OUT OF PAPER" or "HEAD LIFTED"), prints the error number on your screen, and assigns subroutines to some of the keys on the keyboard (if any). There is also a subroutine that performs a PRINTFEED with error-checking. The ERRHAND.PRG occupies lines 10, 20 and 100000–1900000.

11. Renumbering Lines

☞ ***Renumbering Program Lines***
Also see:
- Chapter 5.4

If ERRHAND.PRG is merged with the program you just wrote, lines 10 and 20 in your program will be replaced with lines 10 and 20 from ERRHAND.PRG. Therefore you have to renumber your program, so that your program begins with an unoccupied number, e.g. 50, before ERRHAND.PRG is merged:

```
RENUM 50,1,10 ↵
Ok

LIST ↵
50 BARFONT ON
60 BARFONT "SW030RSN"
70 PRPOS 10,10
80 PRBOX 400,300,10
90 PRPOS 25,25
100 PRIMAGE "GLOBE.1"
110 PRPOS 75,250
120 BARTYPE "CODE39"
130 PRBAR "ABC"
140 PRPOS 25,200
150 FONT "SW030RSN"
160 PRTXT "My FIRST label"
170 PRINTFEED
180 END
ok
```

Continued!

3. CREATING A SIMPLE LABEL, cont'd.

12. Merging Programs

☞ ***Merging programs***
Also see:
- Chapter 6.3

Now your label-printing program LABEL1.PRG will not interfere with ERRHAND.PRG and you can merge the two programs into a single program. In fact, you will create a copy of ERRHAND.PRG which is merged into LABEL1.PRG. Thus the original ERRHAND.PRG can be merged into more programs later:

```
MERGE "rom:ERRHAND.PRG" ↵
```

13. Using the Print Key

☞ ***Branching and Loops***
Also see:
- Chapter 5.6 (GOTO)
- Chapter 5.7 (GOSUB)

Note:
The designations of the keys and buttons in ERRHAND.PRG refer to the standard type of keyboard of the “Enhanced” models.

Instead of using a PRINTFEED statement, we will use a subroutine in ERRHAND.PRG. Because ERRHAND.PRG assigns functions to e.g. the PRINT key, you can create a loop in the program so you will get a label every time you press the PRINT key.

```
160  GOSUB 500000 ↵
170  GOTO 170 ↵
RUN ↵
```

If your printer is fitted with a membrane keyboard, try pressing different buttons on the printer's keyboard. Only those, to which functions been assigned in ERRHAND.PRG (i.e. the <**Pause**>, <**Print**>, <**Setup**> and <**Feed**> keys), will work.

You can break the program by simultaneously pressing the <**C**> and <**Pause**> keys.

Save the program again using the same name as before:

```
SAVE "LABEL1"
```

The previously saved program "LABEL1.PRG" will be replaced by the new version.

With this example, we hope you have got a general impression of the basic methods for Intermec Fingerprint programming and that you also see the advantages of using ERRHAND.PRG or a similar program for errorhandling and initiation.

ERRHAND.PRG can easily be modified to fit into more complex programs and we recommend that you use it when writing your programs until you feel ready to create errorhandling programs yourself (see chapter 16 “Error Handling”).

4. TERMINOLOGY AND SYNTAX

1. Lines

You will always use one or several lines to give the instructions to the printer, regardless whether you work in the immediate mode, in the programming mode, or in the *Direct Protocol*. The difference is that in the programming mode, the lines are **always** numbered (visibly or invisibly), whereas in the immediate mode and the *Direct Protocol*, they must not be numbered.

Note:
If you enter a carriage return on your terminal, the printer will, by default, echo back a Carriage Return + a Line Feed (ASCII 13 + 10 decimal). Using the setup option "New Line", you may restrict the printer only to echo back either a Carriage Return (ASCII 13 dec.) or a Line Feed (ASCII 10 dec.).

A line may contain up to 300 characters. A line must always be terminated by a Carriage Return character (ASCII 13 decimal), see note. When the line reaches the right edge of the screen of the host, it will usually wrap to the next screen line.

Theoretically, line numbers up to > 2 billion can be used. If you choose to enter the line numbers manually, start by numbering the lines from 10 and upwards with an increment of 10, i.e. 10, 20, 30, 40 etc. That makes it possible to insert additional lines (e.g. 11,12,13...etc.), when the need arises. However, the line numbers are your own decision, since you must type them yourself.

☞ ***Programming Mode***
Also see:
- Chapter 5.4

You can also omit line numbers at edition and let the software number the lines automatically. Such line numbers will not be visible before the program is listed.

After having typed the line number, use a blank space to separate it from the statement or function that follows. That makes it easier to read the program without having to list it.

Several instruction may be issued on the same line, provided they are separated by colons (:), e.g.:

```
100  FONT "SW030RSN":PRTXT "HELLO"
```

☞ ***Immediate Mode***
Also see:
- Chapter 5.3

☞ ***Intermec Direct Protocol***
Also see:
- Intermec Direct Protocol, Programmer's Guide

This is especially useful in the immediate mode (see chapter 5.3) and in the *Direct Protocol*, where you can send a complete set of instructions as a single line, e.g.:

```
PP100,250:FT"SW050BSN":PT"Text 1":PF ↵
```

It is not possible to alter a line after it has been transmitted to the printer. If you want to change such a line, you must send the whole line again using the same line number, or delete it using a DELETE statement (see chapter 5.4).

2. Statements

☞ ***Keywords***
Also see:
- Chapters 4.7 and 4.8

A statement is an instruction, which specifies an operation. It consists of a keyword (e.g. PRTXT), usually followed by one or several parameters, flags, or input data, which further define the statement.

The keyword can be entered as uppercase or lowercase letters but will always appear as uppercase letters, when the program is listed on the screen of the host. Some keywords can be used in an abbreviated form, e.g. PRTXT may also be entered as PT.

Continued!

4. TERMINOLOGY AND SYNTAX, cont'd.

2. Statements, cont'd.

You may use a blank space to separate the keyword from the rest of the statement, which must be entered exactly according to the specified syntax. Note that in some cases, a space character is a compulsory part of the keyword, e.g. LINE↔INPUT. When such is the case, it is indicated by the syntax description in the *Fingerprint Reference Manual*.

3. Functions

☞ ***Keywords***
Also see:
• Chapter 4.7 amd 4.8

☞ ***Operators***
Also see:
• Chapter 4.9

A function is a procedure, which returns a value. A function consists of a keyword combined with values, flags, and/or operators. The keyword can be entered as uppercase or lowercase letters, but it will always appear as uppercase letters, when the program is listed on the screen. Values, flags, and operators must be enclosed by parentheses ( ). The operators will be explained later on.

Examples:

`CHR$(65)`	*Keyword with parameter*
`TIME$("F")`	*Keyword with flag*
`ABS (20*5)`	*Keyword with arithmetic operator (*) and values*
`IF(PRSTAT AND 1)...`	*Keywords, logical operator (AND) and value*

☞ ***Conditional Instructions***
Also see:
• Chapter 5.5

A function can be entered inside a statement or on a line containing other instructions. They are often used in connection with conditional statements, e.g.:

```
320  IF (PRSTAT AND 1) THEN GOTO 1000
```

Blank spaces may be inserted to separate the function from other instructions and also to separate the keyword from the rest of the statement.

4. Other Instructions

In addition to statements and functions, there are a few other types of specialized instructions such as the DATE$ and TIME$ variables, the SYSVAR system array and the PCX2BMP external command, which do not fit into the above-mentioned categories.

5. Expressions

In the descriptions of the syntax for the various instructions, the word “Expression” is used to cover both constants and variables.

Expressions are of two kinds:

- ***String expressions*** are carriers of alphanumeric text, i.e. string constants and string variables. Numbers are treated as text, not as values.
- ***Numeric expressions*** contain numeric values and operators, i.e. numeric constants and numeric variables.

Continued!

4. TERMINOLOGY AND SYNTAX, cont'd.

6. Constants

Constants are fixed text or values. There are two kinds:

- ***String constants*** are sequences of characters, i.e. text. If digits or operators are included, they will be considered as text and will not be processed. String constants must always be started and terminated by double quotation marks ("..."), for example "LABEL1.PRG".
- ***Numeric constants*** are fixed numeric values. Only decimal integers are allowed, i.e. 1, 2, 3, 4, 5 etc. Decimal points (e.g. 1.56890765) are not supported. Values may be positive or negative. Positive number may optionally be indicated by a leading plus sign (+), whereas negative numbers always must be indicated by a leading minus sign (-).

Note that certain characters, e.g. digits, can be either string constants (text) or numeric constants (numbers). To allow the firmware to detect that difference, string constants must always be enclosed by double quotation marks (" ....."), as opposed to numeric constants.

7. Variables

Variables are value holders. There are two main types:

- ***String variables*** are used to store strings entered as string constants or produced by *Fingerprint* instructions. Max. size is 64 kbytes. String variables are indicated by a trailing $ sign.

  Examples:
  ```
  A$ = "EASYCODER PRINTER"
  B$ = TIME$
  LET C$ = DATE$
  ```
- ***Numeric variables*** are used to store numbers, entered as numeric constants, or produced by *Fingerprint* instructions or operations. Numeric variables are indicated by a trailing % sign.

  Examples:
  ```
  A% = 150
  B% = DATEDIFF ("981001","981130")
  LET C% = 2^2
  ```

The name of a variable may consist of letters, numbers and decimal points. The first character must always be a letter. No keywords or keyword abbreviations must be used. However, completely embedded keywords are allowed.

Examples:

LOC	*is a keyword*
CLOCK$ = "ABC"	*is OK*
LOC$ = "ABC"	*causes an error*
LOCK$ = "ABC"	*causes an error.*

Continued!

4. TERMINOLOGY AND SYNTAX, cont'd.

8. Keyword List

The presently used keywords and keywords reserved for future program enhancement are listed below.

- #
- '
- (
-)
- *
- +
- ,
- -
- /
- :
- ;
- <
- <=
- <>
- =
- =<
- =>
- >
- ><
- >=
- ?
- ABS
- ACTLEN
- ALIGN
- AN
- AND
- AS
- ASC
- BARADJUST
- BARFONT
- BARHEIGHT
- BARMAG
- BARRATIO
- BARSET
- BARTYPE
- BEEP
- BF
- BH
- BM
- BR
- BREAK
- BT
- BUSY
- CHDIR
- CHECKSUM
- CHR$
- CLEANFEED
- CLEAR
- CLL
- CLOSE
- COM ERROR
- COMBUF$
- COMSET
- COMSTAT
- CONT
- COPY
- COUNT&
- CSRLIN
- CSUM
- CUT
- DATA
- DATE$
- DATEADD$
- DATEDIFF
- DELETE
- DEVICES
- DIM
- DIR
- ELSE
- END
- EOF
- EQV
- ERL
- ERR
- FF
- FIELD
- FIELDNO
- FILE&
- FILES
- FIX
- FONT
- FONTNAME$
- FONTS
- FOR
- FOR APPEND AS
- FOR INPUT AS
- FOR OUTPUT AS
- FORMAT
- FORMFEED
- FRE
- FT
- FUNCTEST
- GET
- GOSUB
- GOTO
- HEAD
- HEX$
- HOLIDAY$
- IF
- II
- IMAGE
- IMAGENAME$
- IMAGES
- IMMEDIATE
- IMP
- INKEY$
- INPUT
- INPUT$
- INSTR
- INT
- INVIMAGE
- IP
- KEY
- KEYBMAP$
- KILL
- LAYOUT
- LBLCOND
- LED
- LEFT$
- LEN
- LET
- LINE INPUT
- LIST
- LOAD
- LOC
- LOCATE
- LOF
- LSET
- LTS&
- MAG
- MAP
- MERGE
- MID$
- MOD
- NAME
- NASC
- NEW
- NEXT
- NI
- NORIMAGE
- NOT
- OFF
- OFF LINE
- ON
- ON BREAK
- ON COMSET
- ON ERROR GOTO
- ON KEY
- ON LINE
- OPEN
- OPT
- OPTIMIZE
- OR
- PB
- PEC2DATA
- PEC2LAY
- PECTAB
- PF
- PL
- PLAY
- PM
- PORTIN
- PORTOUT
- PP
- PRBAR
- PRBOX
- PRIMAGE
- PRINT
- PRINT USING
- PRINTFEED
- PRINTONE
- PRLINE
- PRPOS
- PRSTAT
- PRTXT
- PT
- PUT
- PX
- RANDOM
- RANDOMIZE
- READ
- READY
- REBOOT
- REDIRECT OUT
- REM
- REMOVE
- RENUM
- RESET
- RESTORE
- RESUME
- RESUME NEXT
- RETURN
- RIBBON
- RIGHT$
- RND
- RSET
- RUN
- SAVE
- SET FAULTY DOT
- SETSTDIO
- SETUP
- SGN
- SORT
- SOUND
- SPACE$
- SPC
- SPLIT
- STEP
- STOP
- STORE
- STR$
- STRING$
- SWAP
- SYSTEM
- SYSVAR
- TAB
- TESTFEED
- THEN
- TICKS
- TIME$
- TIMEADD$
- TIMEDIFF
- TO
- TRANSFER
- TRANSFER$
- TRANSFERSET
- TROFF
- TRON
- VAL
- VERBOFF
- VERBON
- VERSION$
- WEEKDAY
- WEEKNUMBER
- WEND
- WHILE
- WRITE
- XOR
- XYZZY
- \
- ^

4. TERMINOLOGY AND SYNTAX, cont'd.

9. Operators

There are three main types of operators – arithmetic, relational, and logical:

Arithmetic Operators (integers only)

+	Addition (e.g. 2 + 2 = 4)
-	Subtraction (e.g. 4 - 1 = 3)
*	Multiplication (e.g. 2 * 3 = 6)
\	Integer division (e.g. 6 \ 2 = 3)
MOD	Modulo arithmetic (results in an integer value which is the remainder of an integer division, e.g. 5MOD2 = 1)
^	Exponent (e.g. 5 ^ 2 = 25)

Parentheses can be used to specify the order of calculation, e.g.:

```
7+5^2\8 = 10
(7+5^2)\8 = 4
```

Relational Operators

<	less than
< =	less than or equal to
< >	not equal to
=	equal to *(also used as an assignment operator)*
>	greater than
> =	greater than or equal to

Relational operators return:

-1	if relation is TRUE.
0	if relation is FALSE.

The following rules apply:

- Arithmetic operations are evaluated before relational operations.
- Letters are greater than digits.
- Lowercase letter are greater than their uppercase counterparts.
- The ASCII code "values" of letters increase alphabetically and the leading and trailing blanks are significant.
- Strings are compared by their corresponding ASCII code value.

Logical Operators

AND	conjunction
OR	disjunction
XOR	exclusive or
EQV	equivalent

Logical operators combine simple logical expressions to form more complicated logical expressions. The logical operators operate bitwise on the arguments, e.g.:

```
1 AND 2 = 0
```

Logical operators can be used to connect relational operators, e.g.:

```
A%10 AND A%<100
```

Continued!

4. TERMINOLOGY AND SYNTAX, cont'd.

9. Operators, cont'd.

Logical operators can also be used to mask bits, e.g.:

```
A%=A% AND 128
```

The principles are illustrated by the following tables, where A and B are simple logical expressions.

Logical operator: AND

A	B	A **AND** B
1	1	1
1	0	0
0	1	0
0	0	0

Logical operator: OR

A	B	A **OR** B
1	1	1
1	0	1
0	1	1
0	0	0

Logical operator: XOR

A	B	A **XOR** B
1	1	0
1	0	1
0	1	1
0	0	0

Logical operator: EQV

A	B	A **EQV** B
1	1	1
1	0	0
0	1	0
0	0	1

4. TERMINOLOGY AND SYNTAX, cont'd.

10. Devices

“Device” is a generic term for communication channels, various parts of the printer's memory, and operator interfaces such as the printer's display and keyboard.

Name	No.	Can be OPENed for...	Remarks
Communication:			
console:	0	Input/Output	Printer's display/keyboard unit
uart1:	1	Input/Output	Serial communication
uart2:	2	Input/Output	Serial communication
uart3:	3	Input/Output	Serial communication
centronics:	4	Input	Parallel communication
rs485:	2	Input/Output	Serial communication (RS 485)
prel:	N/A	Input/Output	Serial communication (RS 485)
Memory:			
rom:	N/A	Input (files only)	Printer's internal EPROMs plus non DOS-formatted memory card
ram:	N/A	Input/Output/Append/ Random (files only)	Printer's internal RAM memory
card1:	N/A	Input/Output/Append/ Random (files only)	DOS-formatted memory card
Special:			
msg:	N/A	Input/Output	Implementation of SITA/CUTE 2
par:	N/A	Input/Output	Implementation of SITA/CUTE 2
bscrypt:	N/A	N/A	Internal use only
null:	N/A	N/A	Internal use only
cutter:	N/A	N/A	Internal use only
ind:	N/A	N/A	Internal use only

☞ ***Files***
Also see:
- Chapter 6 (File system)
- Chapter 7 (Input, Append, Random)
- Chapter 8 (Output, Random)

The devices can be listed by means of a DEVICES statement. All devices will be listed regardless if they are installed or not.

Devices are referred to by name in connection with instructions concerning directories (e.g. SAVE, KILL, FORMAT) and with OPEN statements. Note that the names of all devices should end with a colon (:) and the name should be enclosed by double quotation marks, e.g. "ram:". Upper- or lowercase characters in the name do not matter.

In instructions used in connection with communication (e.g. BREAK, BUSY/READY, COMSET), the keyboard/display unit and the communication channels are specified by numbers instead of names:

0	=	"console:"
1	=	"uart1:"
2	=	"uart2:"/"rs485:"
3	=	"uart3:"
4	=	"centronics:"

5. FINGERPRINT PROGRAMMING

1. Introduction

The Fingerprint firmware works in two main modes, the *“Immediate Mode”* and the *“Programming Mode”*. A special case is the *Direct Protocol*, which is described in a separate *Programmer's Guide* and will not be explained any further in this manual.

Immediate Mode implies that the instructions are executed at once as soon as a carriage return is received. Most instructions can be used, but the instructions cannot be saved after execution.

Programming Mode is used to enter instructions in the form of program lines. The lines can be manually provided with visible line numbers at editing, or be automatically provided with invisible line numbers by the printer's firmware. No execution is performed until a RUN statement is issued in the Immediate Mode, i.e. on a line without number. The program can be saved in the printer's memory and used again.

2. Editing Methods

☞ ***Computer Connection***
Also see:
- Chapter 2.1

To be able to program a printer, you need a terminal or host computer with a screen and a keyboard and a working two-way serial communication between printer and host, preferably RS 232C on communication channel "uart1:". The host must be able to transmit and receive ASCII characters, e.g. by means of a communication program like *Windows Terminal*.

There are three main methods of writing and transmitting a program to the printer:

- **Line-by-Line Method**

  If you have an “non-intelligent” terminal that just can transmit and receive ASCII characters, you must write and send each line separately.

  Each line will be checked for possible syntax errors as soon as the printer receives it and the printer will return either “Ok” or an error message to the screen of the host, provided verbosity is on.

  If you need to correct a mistake, you must rewrite the complete line using the same line number. Thus, this method is not suited for the programming without line numbers.

☞ ***Verbosity***
Also see:
- Chapter 7.7
- Chapter 15.7

☞ ***Error Messages***
Also see:
- Chapter 16.1

Note that even if most examples of computer connection in this manual assumes a PC running under MS Windows 3.11, Fingerprint is by no means restricted to such computers. Other personal computers and operating systems, such as DOS, Windows 95, Windows NT, Mac OS, OS-2, Unix etc., as well as larger computer systems, can be used following the same principles.

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

2. Editing Methods, cont'd.

☞ ***Verbosity***
Also see:
- Chapter 7.7
- Chapter 15.7

☞ ***Error Messages***
Also see:
- Chapter 16.1

- **Copy-and-Paste Method**

  If the host computer is fitted with both a communication program (e.g. *Windows Terminal*) **and** a word-processing program (e.g. *Windows Write* or *Windows Notepad*), you can write the program, partly or completely, in the word processor and then *Copy* and *Paste* it into the communication program.

  Each line will be checked for possible syntax errors as soon as the printer receives it and the printer will return an error message after each line where an error has been detected, provided verbosity is on.

  If you need to correct a mistake, you can make the correction in the word processor and then copy and paste the line into the communication program. If you do not use line numbers, you must *Copy* and *Paste* the complete corrected program back to the communication program.

- **Send Text Method**

  If the host computer is fitted with both a communication program (e.g. *Windows Terminal*) and a word-processing program (e.g. *Windows Write* or *Windows Notepad*), you can write the program, partly or completely, in the word processor and send the whole text file to the printer by means of the communication program (e.g. *“Transfers; Send Text File”* in *Windows Terminal*).

  Each line will be checked for possible syntax errors as soon as the printer receives it and the printer will return an error message after each line where an error has been detected, provided verbosity is on.

  If you need to correct a mistake, you can make the correction in the word processing program and then send the complete program again via the communication program.

3. Immediate Mode

The Immediate Mode can be used for four main purposes:

- Printing of labels that you will never need to print again.
- Printing of labels, which have been edited and saved in the host computer and are downloaded as text strings to the printer.
- Editing of programs to be executed in the programming mode.
- Issuing of instructions outside the execution of programs in the programming mode, e.g. DELETE, LOAD, MERGE, NEW, REBOOT or RUN.

Rather than creating programs in the Programming Mode, in some cases you may want to edit the label in your host computer and transmit the printing instructions and data to the printer in the form of text strings.

Continued!

3. Immediate Mode, cont'd.

To make the strings shorter, use the *Fingerprint* abbreviations. Several statements can be issued on the same line separated by colons (:), or on separate lines.

Examples:
A line of text can be defined and printed this way....

```
PP160,250:DIR3:AN4:FT"SW030RSN":PT"Hello":PF ↵
```

or this way...

```
PP160,250 ↵                       (print start position)
DIR3 ↵                            (print direction)
AN4 ↵                             (alignment)
FT"SW030RSN" ↵                    (font select)
PT"Hello" ↵                       (text input data)
PF ↵                              (print one copy)
```

☞ ***Standard Error-Handling***
Also see:
- Chapter 16.1

As soon as a carriage return is received, the firmware checks the instructions for syntax errors. Provided there is a working two-way communication and the verbosity is on, the printer will either return an error message or “Ok” to the host.

This type of communication works well and is easy to learn, but it does not take full advantage of the flexibility and computing capacity offered by the *Fingerprint* printers. For example, you cannot save the labels in the printer but must download each new label, and all error-handling must be taken care of by the host.

☞ ***Intermec Direct Protocol***
Also see:
- Intermec Direct Protocol, Programmer's Guide

Rather than using the *Immediate Mode*, the *Direct Protocol* is usually to prefer, since it allows variable input data to be combined with predefined layouts, handles counters and contains a flexible error-handler.

Beside printing text, bar codes and graphics, you can perform other tasks in the *Immediate Mode* as well, e.g. calculation. Try typing this instruction on the keyboard of the host:

```
? ((5^2+5)\3)*5 ↵       (↵ = Carriage Return key)
```

The calculation will be performed immediately and the result will be returned to the screen of the host:

```
50
Ok
```

Important:
To send an instruction from the terminal to the printer, press the Carriage Return key. In the programming examples later on in this manual, this character will be omitted, but you must not forget to enter it via the keyboard of the host.

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

3. Immediate Mode, cont'd.

Three keys are enabled in the Immediate **Mode**, obviously provided that the printer is fitted with the key(s) in question:

- The <**Print**> key or button produces a FORMFEED operation.
- The <**Feed**> key produces a FORMFEED operation.
- The <**Setup**> key gives access to the Setup Mode.

When the printhead is lowered and the <**Print**> or <**Feed**> keys are pressed, three possible error conditions can cause an error message in English to be displayed:

• "Error 1005 -Press any key!-"	*(Out of paper)*
• "Error 1031 -Press any key!-"	*(Next label not found)*
• "Error 1027 -Press any key!-"	*(Out of ribbon)*

After the error has been attended to, the error message can be cleared by pressing any of the above-mentioned keys.

When the printhead is lifted, the <**Print**> and <**Feed**> keys will run the printers mechanism in order to facilitate cleaning of the print roller, i.e. the rubber-coated roller that drives the paper forward under the printhead. The motor(s) will stop automatically when the print roller has completed a few rotations.

4. Programming Mode

The *Programming Mode* is used to execute instructions entered in the form of program lines. The firmware assumes input to the *Programming Mode* in two cases:

- When a line starts with a number.
- After an IMMEDIATE OFF statement has been executed. (See *"Programming without Line Numbers"* later in this chapter).

One or several lines make up a program, which can executed as many times as you wish. A program can also be saved, closed, copied, loaded, listed, merged, and killed, see chapter 6.3. All lines have line numbers, that are either manually entered when the program is edited, or provided automatically and invisibly by the firmware when an IMMEDIATE ON statement has been executed.

Each time the printer receives a program line followed by a Carriage Return character, the firmware checks the line for possible syntax errors. If an error is encountered, an error message will be returned to the host, provided there is a working two-way communication and the verbosity is on.

The program is executed in ascending line number order when a RUN statement is issued in the *Immediate Mode*, i.e. on a line without any line number. However, various types of branching and loops can be created in the program that makes the execution deviate from a strict ascending order.

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

4. Programming Mode, cont'd.

☞ ***Autoexec-files (startup files)***
Also see:
- Chapter 5.13

Note that the editing of the program takes place in the *Immediate Mode*, while the execution is performed in the *Programming Mode*. Often, programs are made as an autoexec (startup) file that starts up automatically when the printer is turned on, and keeps on running infinitely.

Important:
To send an instruction from the terminal to the printer, press the Carriage Return key. In the programming examples later on in this manual, this character will be omitted, but you must not forget to enter it via the keyboard of the host.

Programming with Line Numbers

In this case you will start each line by manually entering a line number. We recommend that you start with line number 10 and use an increment of 10 between lines to allow additional lines to be inserted later. To make the program easier to read, you can use a space character between the line number and the instruction. If not, the firmware will insert a space character automatically, that will appear when the program is LISTed. Let us use the calculation example from the *Immediate Mode*. It would look like this in the *Programming Mode*:

```
10 ? ((5^2+5)\3)*5 ↵
RUN ↵
```

yields:

```
15
Ok
```

Let us have a look at the lines:

- The first line consists of a line number (10) followed by an optional space character and the instruction **? ((5^2+5)\3)*5** **?** is a shorthand form for the statement PRINT, which returns the result of the calculation to the screen of the host). The line is terminated by a Carriage Return character.
- Next line has no line number, and contains the statement RUN, which orders the printer to execute all preceding numbered lines in consecutive ascending order according to their line numbers.
- The result (15) will be displayed on the terminal's screen followed by “Ok” to indicate that execution was successful.

In this manual, the programming examples will generally have line numbers in order to make them easier to understand. For more complex programs, programming without line numbers, as explained on next page, may be both easier and quicker.

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

4. Programming Mode, cont'd.

Programming without Line Numbers

You can choose to omit entering line numbers manually when writing a program. This is a special case of the *Programming Mode*, but in order to make the printer understand what you want to do, you must turn off the *Immediate Mode* by means of an IMMEDIATE OFF statement. (Normally, the firmware interprets the lack of line numbers as *Immediate Mode*).

Then you can write the program line by line without having to type a line number at the start of each line. In other respects, you can generally work just as in the normal programming mode.

☞ ***Branching the Program Execution***
Also see:
- Chapter 5.6 – 5.8

However, a major difference is when you want to make the execution branch to a certain line, e.g. by a GOTO statement. You cannot use line numbers to specify the line in question. Instead, there is a feature called “line labels”. The line you want to refer to must start with a line label, i.e. a number of characters appended by a colon (:). The line label must not start with a digit or interfere with any keyword (see chapter 4.8).

When you want to refer to a line marked with a line label, just enter the line label (without any colon), where you otherwise would have put the line number.

Finish the program by issuing an IMMEDIATE ON statement before you RUN it. The lines will automatically be numbered 10-20-30-40-50 etc., but the line numbers will not be visible until you LIST the program. Line labels will not be replaced by line numbers.

Two simple examples show the difference between using line numbers and line labels:

```
Line Numbers             Line Labels
                         IMMEDIATE OFF
10   GOSUB 1000          GOSUB Q123
20   END                 END
1000 SOUND 440,50        Q123:SOUND 440,50
1010 RETURN              RETURN
                         IMMEDIATE ON
RUN                      RUN

LIST                     LIST
10   GOSUB 1000          10 GOSUB Q123
20   END                 20 END
1000 SOUND 440,50        30 Q123: SOUND 440,50
1010 RETURN              40 RETURN
```

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

4. Programming Mode, cont'd.

Programming Instructions

There are a number of instructions that are used in connection with the editing of programs in the *Programming Mode*:

NEW

Before you enter the first program line, always issue a NEW statement in the *Immediate Mode* to clear the printer's working memory, close all files and clear all variables.

Warning!
If there already is a program in the working memory, it will be deleted and cannot be restored unless it has been SAVEd.

IMMEDIATE OFF

If you want to write the program without entering line numbers manually, this statement should be issued in the *Immediate Mode* before the first line is entered.

REM (')

To make the program easier to understand, you can enter remarks and explanations on separate lines or in lines containing other instructions. Any characters preceded by REM, or its shorthand version **'** (single quotation mark), will not be regarded as part of the program and will not be executed. REM statements can also be used at the end of lines, if they are preceded by a colon (:).

END

Usually, subroutines are entered on lines with higher numbers than the main program. It is a good programming habit to finish the main program with an END statement in order to separate it from the subroutines. When an END statement is encountered, the execution is terminated and all OPENed files and devices are CLOSEd.

IMMEDIATE ON

If you have issued an IMMEDIATE OFF statement before you started to write the program, you must turn on the *Immediate Mode* again by means of an IMMEDIATE ON statement before you can start the execution, i.e. issue a RUN statement.

LIST

You can LIST the entire program, i.e. make the printer return the lines to the screen of the host. You can also choose to list part of the program or variables only. If you have edited the program without line numbers, the numbers automatically assigned to the lines at execution will now appear. LIST is usually issued in the *Immediate Mode*.

Continued!

4. Programming Mode, cont'd.

DELETE

Program lines can be removed using the DELETE statement in the *Immediate Mode*. Both single lines and ranges of lines in consecutive order can be deleted.

RENUM

The program lines can be renumbered, e.g. to provide space for new program lines, to change the order of execution, or to make it possible to MERGE to programs. Line references for GOSUB, GOTO and RETURN statements will be renumbered accordingly (see chapter 5.6 – 5.8).

5. Conditional Instructions

☞ ***TRUE and FALSE***
Also see:
- Chapter 4.9 (Relational Operators)

Conditional instructions control the execution according to whether a numeric expression is true or false. *Fingerprint* has one conditional instruction, which can be used in two different ways:

- IF...THEN...[ELSE]
- IF...THEN...[ELSE]...ENDIF

IF...THEN...[ELSE]

If a numeric expression is TRUE, then a certain statement should be executed, but if the numeric expression is FALSE, optionally another statement should be executed.

This example allows you to compare two values entered from the keyboard of the host.

```
10   INPUT "Enter first value ", A%
20   INPUT "Enter second value ", B%
30   C$="1:st value > 2:nd value"
40   D$="1:st value ≤ 2:nd value"
50   IF A%>B% THEN PRINT C$ ELSE PRINT D$
60   END
RUN
```

Another way to compare the two values in the example above is to use three IF...THEN statements:

```
10   INPUT "Enter first value ", A%
20   INPUT "Enter second value ", B%
30   C$="First value is larger than second value"
40   D$="First value is less than second value"
50   E$="First value and second value are equal"
60   IF A%>B% THEN PRINT C$
70   IF A%<B% THEN PRINT D$
80   IF A%=B% THEN PRINT E$
90   END
RUN
```

5. Intermec FINGERPRINT PROGRAMMING, cont'd.

5. Conditional Instructions, cont'd.

IF...THEN...[ELSE]...ENDIF

It is possible to execute multiple THEN and ELSE statements. Each statement must be entered on a separate line and the end of the instruction must be indicated by ENDIF on a separate line, e.g.:

```
10   TIME$ = "121500":FORMAT TIME$ "HH:MM"
20   A%=VAL(TIME$)
30   IF A%>120000 THEN
40   PRINT "TIME IS ";TIME$("F"); ". ";
50   PRINT "GO TO LUNCH!"
60   ELSE
70   PRINT "CARRY ON - ";
80   PRINT "THERE'S MORE WORK TO DO!"
90   ENDIF
RUN
```

yields e.g.:

```
TIME IS 12:15. GO TO LUNCH!
```

6. Unconditional Branching

GOTO

The most simple type of unconditional branching is the "waiting loop". This means that a program line branches the execution back to itself, waiting for something to happen, for example a key being pressed or a communication buffer becoming full.

☞ ***Keyboard Control***
Also see:
- Chapter 15.1

This example shows how the program waits for the key F1 to be pressed (line 30). Then a signal is emitted by the printer's buzzer:

```
10   ON KEY (10) GOSUB 1000
20   KEY (10) ON
30   GOTO 30
40   END
1000 SOUND 880,100
1010 END
RUN
```

It is also possible to branch to a different line. This is useful when you want create a waiting loop containing a number of lines, e.g.:

```
10   INPUT "Enter a number:", A%
20   IF A%<0 THEN GOTO 100 ELSE GOTO 200
30   GOTO 10
40   END
100  PRINT "NEGATIVE VALUE"
110  GOTO 40
200  PRINT "POSITIVE VALUE"
210  GOTO 40
RUN
```

GOTO in line 30 diverts the execution back to line 10 over and over again until you type a value on the host (waiting loop). Depending on whether the value is less than 0 or not, the execution branches to one of two alternative lines (100 or 200), which print different messages to the screen. In both cases, the execution branches to line 40, where the program ends. Line 20 is an example of conditional branching, which is explained in chapter 5.8.

5. FINGERPRINT PROGRAMMING, cont'd.

7. Branching to Subroutines

GOSUB and RETURN

A subroutine is a number of program lines intended to perform a specific task, separately from the main program execution. Branching to subroutine can e.g. take place when:

- An error condition occurs.
- A condition is fulfilled, such as a certain key being pressed or a variable obtaining a certain value.
- A break instruction is received.
- Background communication is interrupted.

Another application of subroutines is branching to one and the same routine from different places in the same program. Thereby, you do not need to write the routine more than once and can make the program more compact.

The main instruction for branching to subroutines is the GOSUB statement. There are also a number of instructions for conditional branching to subroutines, which will be explained later in this chapter.

After branching, the subroutine will be executed line by line until a RETURN statement is encountered.

The same subroutine can be branched to as many times as you need from different lines in the main program. GOSUB remembers where the last branching took place, which makes it possible to return to the correct line in the main program after the subroutine has been executed. Subroutines may be nested, i.e. a subroutine may contain a GOSUB statement for branching to a secondary subroutine etc.

Subroutines should be placed on lines with higher numbers than the main program. The main program should be appended by an END statement to avoid unintentional execution of subroutines.

Example illustrating nested subroutines:

```
10   PRINT "This is the main program"
20   GOSUB 1000
30   PRINT "You're back in the main program"
40   END
1000 PRINT "This is subroutine 1"
1010 GOSUB 2000
1020 PRINT "You're back from subroutine 2 to 1"
1030 RETURN
2000 PRINT "This is subroutine 2"
2010 GOSUB 3000
2020 PRINT "You're back from subroutine 3 to 2"
2030 RETURN
3000 PRINT "This is subroutine 3"
3010 PRINT "You're leaving subroutine 3"
3020 RETURN
RUN
```

8. Conditional Branching

As the name implies, conditional branching means that the program execution branches to a certain line or subroutine when a specified condition is fulfilled. The following instructions are used for conditional branching:

☞ ***Relational Operators***
Also see:
- Chapter 4.9

IF...THEN GOTO...ELSE

If a specified condition is TRUE, the program branches to a certain line, but if the condition is FALSE, something else will be done.

Example:
```
10   INPUT "Enter a value: ",A%
20   INPUT "Enter another value: ",B%
30   IF A%=B% THEN GOTO 100 ELSE PRINT "NOT EQUAL"
40   END
100  PRINT "EQUAL"
110  GOTO 40
RUN
```

ON...GOSUB

Depending on the value of a numeric expression, the execution will branch to one of several subroutines. If the value is 1, the program will branch to the first subroutine in the instruction, if the value is 2 it will branch to the second subroutine and so on.

Example:
```
10   INPUT "Press key 1, 2, or 3 on host: ", A%
20   ON A% GOSUB 1000, 2000, 3000
30   END
1000 PRINT "You have pressed key 1": RETURN
2000 PRINT "You have pressed key 2": RETURN
3000 PRINT "You have pressed key 3": RETURN
RUN
```

ON...GOTO

This instruction is similar to ON...GOSUB, but the program will branch to specified lines instead of subroutines. This implies that you cannot use RETURN statements to go back to the main program.

Example:
```
10   INPUT "Press key 1, 2, or 3 on host: ", A%
20   ON A% GOTO 1000, 2000, 3000
30   END
1000 PRINT "You have pressed key 1": GOTO 30
2000 PRINT "You have pressed key 2": GOTO 30
3000 PRINT "You have pressed key 3": GOTO 30
RUN
```

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

8. Conditional Branching, cont'd.

☞ ***Breaking the Execution***
Also see:
- Chapter 5.12

ON BREAK...GOSUB

When a BREAK condition occurs on a specified device, the execution will be interrupted and branched to a specified subroutine. There, you can e.g. let the printer emit a sound signal or display a message before the program is terminated. You can also let the program execution continue along a different path.

This example shows how the program is interrupted when the <C> and <Pause> keys on the printer's keyboard are pressed. The execution branches to a subroutine, which emits a siren-sounding signal three times. Then the execution returns to the main program, which is indicated by a long shrill signal. If the printer is not fitted with a keyboard, you can isue a break interrupt by transmitting the character “#" from the host on the communication channel "uart1:".

```
10   BREAK 1,35
20   BREAK 1 ON
30   ON BREAK 0 GOSUB 1000:REM Break from keyboard
40   ON BREAK 1 GOSUB 1000:REM Break from host (#)
50   GOTO 40
60   SOUND 800,100
70   BREAK 1 OFF: END
1000 FOR A%=1 TO 3
1010 SOUND 440,50
1020 SOUND 349,50
1030 NEXT A%
1040 GOTO 60
RUN
```

ON COMSET...GOSUB

☞ ***Background Communication***
Also see:
- Chapter 7.8

When one of several specified conditions interrupts the background communication on a certain communication channel, the program branches to a subroutine, e.g. for reading the buffer. The interrupt conditions (end character, attention string and/or max. number of characters) are specified by a COMSET statement .

Example:

```
1    REM Exit program with #STOP&
10   COMSET1,"#","&","XYZ","=",50
20   ON COMSET 1 GOSUB 2000
30   COMSET 1 ON
40   IF A$ <> "STOP" THEN GOTO 40
50   COMSET 1 OFF
...
...
1000 END
2000 A$=COMBUF$(1)
2010 PRINT A$
2020 COMSET 1 ON
2030 RETURN
```

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

8. Conditional Branching, cont'd.

☞ ***Branching at Errors***
Also see:
- Chapter 16.3

Two instructions are used to branch to and from an error-handling subroutine when an error occurs:

ON ERROR GOTO
This statement branches the execution to a specified line when any kind of error occurs, ignoring the standard error-trapping routine. If line number is specified as 0, the standard error-trapping routine will be used.

RESUME
The RESUME statement is used to resume the program execution after an error-handling subroutine has been executed. RESUME is only used in connection with ON ERROR GOTO statements and can be used in five different ways:

`RESUME`	Execution is resumed at the statement where the error occurred.
`RESUME 0`	Same as RESUME.
`RESUME NEXT`	Execution is resumed at the statement immediately following the one that caused the error.
`RESUME <ncon>`	Execution is resumed at the specified line.
`RESUME <line label>`	Execution is resumed at the specified line label.

This example shows branching to a subroutine when an error has occurred. The subroutine determines the type of error and takes the appropriate action. In this example only one error; "1019 Invalid font" is checked. After the error is cleared by substituting the missing font, the execution will be resumed.

```
10   ON ERROR GOTO 1000
20   PRTXT "HELLO"
30   PRINTFEED
40   END
1000 IF ERR=1019 THEN FONT "SW030RSN" ELSE GOTO 2000
1010 PRINT "Substitutes missing font"
1020 FOR A%=1 TO 3
1030 SOUND 440,50
1040 SOUND 359,50
1050 NEXT A%
1060 RESUME
2000 PRINT "Undefined error, execution terminated"
2010 END
RUN
```

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

8. Conditional Branching, cont'd.

☞ ***Keyboard Control and Key Id. No:s***
Also see:
- Chapter 15.1

ON KEY...GOSUB

Many *Fingerprint*-compatible *EasyCoder* printer models are provided with a built-in keyboard. However, unless there is a program running in the printer, e.g. the *Stand-Alone* program or *Shell*, the keys have no purpose (with the exception of <**Print**>, <**Feed**>, and <**Setup**/**Save**> keys, which work in the *Immediate Mode*). To make use of the keyboard, each key must be enabled individually by means of a KEY ON statement and then be assigned to a subroutine using an ON KEY GOSUB statement. The subroutine should contain the instructions you want to be performed when the key is pressed.

In the statements KEY (<id.>), ON KEY (<id.>) OFF, and ON KEY (<id.>) GOSUB..., the keys are specified by id. numbers enclosed by parentheses, see chapter 15.1.

Note that ON KEY...GOSUB excludes input from the printer's keyboard (see chapter 7.6) and vice versa.

This example shows how the two keys <F1> (id. No. 10) and <F2> (id. No. 11) are used to change the printer's setup in regard of printout contrast.

```
10   PRPOS 100,500
20   PRLINE 100,100
30   FONT "SW030RSN"
40   PRPOS 100,300
50   MAG 4,4
60   PRTXT "SAMPLE"
70   KEY (10) ON : KEY (11) ON
80   ON KEY (10) GOSUB 1000
90   ON KEY (11) GOSUB 2000
100  GOTO 70
110  PRINTFEED
120  END
1000 SETUP "CONTRAST,0"
1010 PRPOS 100,100 : PRTXT "Weak Print"
1020 RETURN 110
2000 SETUP "CONTRAST,10"
2010 PRPOS 100,100 : PRTXT "Dark Print"
2030 RETURN 110
RUN
```

5. FINGERPRINT PROGRAMMING, cont'd.

9. Loops

GOTO

One type of loop has already been described in connection with the GOTO statement in chapter 5.6, where GOTO was used to refer to the same line or a previous line. There are also two more advanced type of loops:

FOR...NEXT

These statements are to used create loops, where a counter is incremented or decremented until a specified value is reached. The counter is defined by a FOR statement with the following syntax:

FOR<numeric variable>=<start value>TO<final value>[STEP<±interval>]

All program lines following the FOR statement will be executed until a NEXT statement is encountered. Then the counter will be updated according to the optional STEP value, or by the default value +1, and the loop will be executed again. This will be repeated until the final value, as specified by TO <final value>, is reached. Then the loop is terminated and the execution proceeds from the statement following the NEXT statement.

FOR...NEXT loops can be nested, i.e. a loop can contain another loop etc. Each loop must have a unique counter designation in the form of a numeric variable. The NEXT statement will make the execution loop back to the most recent FOR statement. If you want to loop back to a different FOR statement, the corresponding NEXT statement must include the same counter designation as the FOR statement.

This example shows how five lines of text entered from the keyboard of the host can be printed with an even spacing:

```
10   FONT "SW030RSN"
20   FOR Y%=220 TO 100 STEP -30
30   LINE INPUT "Type text: ";TEXT$
40   PRPOS 100, Y%
50   PRTXT TEXT$
60   NEXT
70   PRINTFEED
80   END
RUN
```

Here is an example of two nested FOR...NEXT loops:

```
10   FOR A%=20 TO 40 STEP 20
20   FOR B%=1 TO 2
30   PRINT A%,B%
40   NEXT : NEXT A%
RUN
```

Yields:

```
20       1
20       2
40       1
40       2
```

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

9. Loops, cont'd.

FOR...NEXT, cont'd.

This example shows how an incremental counter can be made:

```
10   INPUT "Start Value: ", A%
20   INPUT "Number of labels: ", B%
30   INPUT "Increment: ", C%
40   X%=B%*C%
50   FOR D%=1 TO X% STEP C%
60   FONT "SW030RSN"
70   MAG 2,2
80   PRPOS 100,200
90   PRTXT "TEST LABEL"
100  PRPOS 100,100
110  PRTXT "COUNTER: "; A%
120  PRINTFEED
130  A%=A%+C%
140  NEXT D%
RUN
```

WHILE...WEND

These statements are used to create loops where series of statements are executed provided a given condition is TRUE.

☞ ***Relational Operators***
Also see:
- Chapter 4.9

WHILE is supplemented by a numeric expression, that can be either TRUE (-1) or FALSE (0). If the condition is TRUE, all subsequent program lines will be executed until a WEND statement is encountered. The execution then loops back to the WHILE statement and the process is repeated, provided the WHILE condition still is TRUE. If the WHILE condition is FALSE, the execution bypasses the loop and resumes at the statement following the WEND statement.

WHILE...WEND statements can be nested. Each WEND statement matches the most recent WHILE statement.

This example shows a program that keeps running in a loop (line 20–50) until you press the Y key on the host (ASCII 89 dec.), i.e. the WHILE condition becomes true.

```
10   B%=0
20   WHILE B%<>89
30   INPUT "Want to exit? Press Y=Yes or N=No",A$
40   B%=ASC(A$)
50   WEND
60   PRINT "The answer is Yes"
70   PRINT "You will exit the program"
80   END
RUN
```

5. FINGERPRINT PROGRAMMING, cont'd.

10. Program Structure

Although *Fingerprint* gives the programmer a lot of freedom in how to compose his programs, based on experience we recommend that the structure below is more or less implemented, with the obvious exception of such facilities that are not needed.

❑ **Program Information**

- Program information, e.g. program type, version, release date and byline (REM).

❑ **Initiation**

Decides how printer will work and branch to subroutines.

- References to subroutines using e.g. ON BREAK GOSUB, ON COMSET GOSUB, ON ERROR GOSUB, ON KEY GOSUB.
- Printer setup using e.g. SETUP, RIBBON SAVE ON/OFF, OPTIMIZE ON/OFF, LTS& ON/OFF, CUT ON/OFF, FORMAT DATE$, FORMAT TIME$, NAME DATE$, NAME WEEKDAY$, SYSVAR).
- Character set and map tables (NASC, MAP).
- Enabling keyboard (KEY ON, KEYBEEP, KEYBMAP$).
- Initial LED setting (LED ON/OFF).
- Open "console:" for output (OPEN)
- Assign string variables for each line in the display (PRINT#).
- Select current directory (CHDIR).
- Select standard I/O channel (SETSTDIO).
- Open communication channels (OPEN).
- Open files (OPEN).
- Define arrays (DIM).

❑ **Main Loop**

Executes the program and keeps it running in a loop.

- Reception of input data (INPUT, INPUT#, INPUT$, LINE INPUT#).
- Printing routine (FORMFEED, PRINTFEED, CUT).
- Looping instructions (GOTO).

❑ **Subroutines**

- Break subroutines (BREAK ON/OFF, BREAK).
- Background communication subroutines (COMERROR ON/OFF, COMSET, COMSET ON/OFF, COMBUF$, COMSTAT).
- Subroutines for key-initiated actions.
- Subroutines for display messages.
- Error handling subroutines (ERR, ERL, PRSTAT).
- Label layouts subroutines.

5. FINGERPRINT PROGRAMMING, cont'd.

11. Execution

To start the execution of the program currently residing in the printer's working memory, issue a RUN statement in the *Immediate Mode*, i.e. without a preceding line number. By default, the program will be executed in ascending line number order – with the exception of possible loops and branches – starting from the line with the lowest number, but you can optionally start the execution at a specified line.

You can also execute a program that is not LOADed.

If a program has been written without line numbers, the lines will be numbered 10-20-30-40-50.... etc.

The first program or hardware error that stops the execution will cause an error message to be returned to the screen of the host, provided there is a working two-way communication[1]. In case of program errors, the number of the line where the error occurred will also be reported by default, e.g. *"Field out of label in line 110"*. After the error has been corrected, the execution must be restarted by means of a new RUN statement, unless a routine for dealing with the error in question is included in the program.

☞ ***Standard Error-Handling***
Also see:
- Chapter 16.1

For demonstration purposes, we will now:
- write a short program without line numbers,
- execute it,
- and finally list it.

Note:
For program instructions you can usually use upper- or lowercase characters at will, i.e. "NEW" and "new" will work the same way.

```
NEW
Ok
IMMEDIATE OFF
Ok
REM This is a demonstration program
PRINT "This is the main program"
GOSUB sub1
END
sub1: PRINT "This is a subroutine":' Line label
RETURN
IMMEDIATE ON
Ok
RUN
```

yields:

```
This is the main program
This is a subroutine
Ok
LIST
```

yields:

```
10 REM This is a demonstration program
20 PRINT "This is the main program"
30 GOSUB SUB1
40 END
50 SUB1: PRINT "This is a subroutine" : ' Line label
60 RETURN
```

[1]. For a working two-way communication, three conditions must be fulfilled:
• Serial communication
• Std IN channel = Std OUT channel
• Verbosity on

5. FINGERPRINT PROGRAMMING, cont'd.

12. Breaking Execution

In chapter 2 *"Getting Started"* at the beginning of this manual, the methods of breaking a startup program was briefly explained. Startup programs (autoexec files) start up automatically when the printer is turned on and continues to run infinitely by means of some kind of loop.

In printer models provided with a keyboard, you can – by default – break a program by pressing the <**C**> key and keep it pressed while you also press down the <**Pause**> key. There is no such default facility in printers without keyboard! Unless the startup program contains facilities for breaking the execution or the printer is provided with a keyboard, it will be impossible to make the printer do something else but keep on running the same program. It will also be difficult to check the printer if some kind of error occurs.

The only remaining way to stop a startup program, which contains no break facilities, is to physically remove the part of the memory where the program resides, i.e. the configuration EPROM packages, the RAM packages or a memory card. Therefore, it is strongly recommended always to include break facilities in startup programs, especially when the program is to be used in a printer without keyboard.

Four instructions can be used for providing a program with a break interrupt facility:

`BREAK`	Specifies an interrupt character.
`BREAK...ON`	Enables break interrupt.
`BREAK...OFF`	Disables break interrupt.
`ON BREAK...GOSUB...`	Branches the execution to a subroutine when a break interrupt is executed.

In all break-related instructions, the serial communication channels and the keyboard are referred to by numbers:
0 = "console:" (i.e. the printer's keyboard)
1 = "uart1:"
2 = "uart2:"/"rs485:"
3 = "uart3:"

BREAK does not work on the parallel Centronics channel.

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

12. Breaking Execution, cont'd.

Note:
A break interrupt character is saved in the no-save area of the RAM memory, and will not be removed before the printer is restarted, unless you specifically delete it by a BREAK...OFF statement for the device in question.

BREAK

The BREAK statement specifies an interrupt character by its decimal ASCII value. BREAK can be separately specified for each **serial** communication channel and for the printer's built-in keyboard.

The interrupt character for all serial channels is by default ASCII 03 dec. (ETX). Also see BREAK...ON.

The interrupt character from the printer's keyboard is by default ASCII 158 dec. (<**C**> + <**Pause**> keys). Also see BREAK...ON.

BREAK...ON

Break interrupt for all serial communication channels is **disabled** by default, but can be enabled by means of a BREAK ON statement for the channel in question.

Break interrupt from the keyboard is **enabled** by default.

BREAK... OFF

The BREAK OFF statement revokes BREAK ON for the specified device and deletes the specified break character from RAM.

ON BREAK ...GOSUB...

This instruction is not necessary for issuing a break interrupt, but is useful for making the printer perform a certain task when a break occurs, e.g. branch the execution to another part of the program, show a message in the display, emit a warning signal, ask for a password etc. ON BREAK... GOSUB... can be specified separately for each serial communication channel and for the keyboard.

This example shows how a break interrupt will occur when you press the X-key on the host connected to "uart1:". A signal is emitted and a message appears in the printer's display.

```
10   BREAK 1,88
20   BREAK 1 ON
30   OPEN "console:" FOR OUTPUT AS 1
40   PRINT #1 : PRINT #1
50   PRINT #1, "Press X"
60   PRINT #1, "to break program";
70   ON BREAK 1 GOSUB 1000
80   GOTO 80
90   BREAK 1 OFF
100  END
1000 SOUND 880,50
1010 PRINT #1 : PRINT #1
1020 PRINT #1, "PROGRAM"
1030 PRINT #1, "INTERRUPTED";
1040 RETURN 90
RUN
```

5. FINGERPRINT PROGRAMMING, cont'd.

13. Saving the Program

Saving in Printer

When you are satisfied with the program, you can SAVE it in the printer's RAM memory ("ram:") or in an optional DOS-formatted memory card ("card1:"), see chapter 6.1. It is also recommended to LIST the program back to the host and make backup copy, e.g. on a floppy disk.

Naming the Program

When you save a program for the first time, you must give it a name consisting of up to 30 characters including possible extension. If you omit the extension, the software will add the extension ".PRG" automatically. When naming the program, consider conventions and restrictions imposed by the operating system of the host, e.g. MS-DOS.

The following names are used for standard *Fingerprint* programs and should not be used:

• **AUTOEXEC.BAT**	*(Startup program)*
• **DISPSET2.PRG**	*(Setup for printers w/o keyboard)*
• **ERRHAND.PRG**	*(Standard error-handler)*
• **FILELIST.PRG**	*(Lists content of a file)*
• **LBLSHTXT.PRG**	*(Used for Intermec LabelShop)*
• **LSHOPDEF.SUP**	*(Default Setup for Intermec LabelShop)*
• **MKAUTO.PRG**	*(Creates startup programs)*
• **PRSETUP.PRG**	*(Prints current setup)*
• **SHELLEHD.PRG**	*(Intermec Shell for Enhanced printers)*
• **SHELLSTD.PRG**	*(Intermec Shell for printers w/o keyboard)*
• **UBIDEF.SUP**	*(Fingerprint default setup)*
• **WIN1.PRG**	*(Used for Intermec Windows Driver)*

☞ ***Current Directory***
Also see:
- Chapter 6.1

Examples:

```
SAVE "PROGRAM1"
```

saves the program as PROGRAM1.PRG in the current directory (by default "ram:").

```
SAVE "card1:PROGRAM1.TXT"
```

saves the program as PROGRAM1.TXT in a DOS-formatted memory card inserted in the printer's optional memory card adapter.

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

13. Saving the Program, cont'd.

Protecting the Program

When a program is SAVEd, it can optionally be protected, i.e. it cannot be listed after being loaded and program lines cannot be changed, added or deleted. Once a program has been protected, it cannot be deprotected. Thus, make an unprotected backup copy as a safety measure, should you need to make any changes later.

Example (saves and protects the program as PROGRAM1.PRG in the current directory (by default "ram:"):

```
SAVE "PROGRAM1.PRG",P
```

Saving Without Line Numbers

A program can also be SAVEd without line numbers to make it easier to MERGE it with another program without risking that the line numbers interfere. Both programs should make use of line labels for referring to other lines, e.g. in connection with loops and branching instructions.

Example (saves the program as PROGRAM1.PRG without line numbers in the current directory (by default "ram:"):

```
SAVE "PROGRAM1.PRG",L
```

Making Changes

If you LOAD a program, possibly make some changes and then SAVE the program under the original name and in the original directory, the original program will be replaced.

Example (changes the value of a variable in a program and replaces the original version with the changed version):

```
LOAD "PROGRAM1.PRG"
50 A%=300
SAVE "PROGRAM1.PRG"
```

Making a Copy

The easiest way to copy a program is to use a COPY statement. You can optionally include directory references in the statement.

Example (copies a program from the ROM memory to the RAM memory and gives the copy a new name):

```
COPY "rom:FILELIST.PRG","ram:COPYTEST.PRG"
```

By LOADing a program and then SAVE it under a new name and/or in another directory, you will create a copy of the original program.

Example (creates a copy of the program LABEL1.PRG and gives the copy the name LABEL2.PRG):

```
LOAD "LABEL1.PRG"
SAVE "LABEL2.PRG"
```

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

13. Saving the Program, cont'd.

Renaming a Program

To rename a program, LOAD it, SAVE it under a new name, and finally KILL the original program.

Example (renames LABEL1.PRG with the name LABEL2.PRG):

```
LOAD "LABEL1.PRG"
SAVE "LABEL2.PRG"
KILL "LABEL1.PRG"
```

Note: The same general principles also apply to files!

Saving in EPROM:s and Non DOS-formatted Memory Cards

Saving a program or file in the printer's read-only memory ("rom:"), i.e. EPROM's, or non DOS-formatted memory cards requires special equipment such as a PROM programmer and special software (*Toolbox*).

You can edit and test the program in the printer's working memory as described earlier in this chapter. When it works properly, LIST it back to the host computer. Save the file in the host and convert it to a format suitable for the PROM programmer or the memory card programming device.

Creating a Startup Program

The MKAUTO.PRG program is used to create so called startup programs or autoexec-files, i.e. programs that will be LOADed and RUN automatically as soon as the power to the printer is turned on. Usually, a startup program contains some kind of loop which makes it run infinitely, awaiting some input or action from the operator. “Autoexec” programs are very useful for applications when one single program is to be run all the time.

The MKAUTO.PRG program is included in all *Fingerprint* EPROMs.

Startup files can be stored in RAM, ROM or in optional memory cards. Each **part** of the memory can hold one startup file[1]. If there are more than one startup file in the printer's **entire** memory, they will be used with the following priority:

1. Inserted DOS-formatted memory card	("card1:")
2. Printer's RAM memory	("ram:")
3. Inserted Non DOS-formatted memory card	("rom:")
4. Printer's ROM memory	("rom:")

The MKAUTO.PRG program consists of the following lines:

```
10   OPEN "AUTOEXEC.BAT" FOR OUTPUT AS 1
20   INPUT "Startup file name:",S$
30   PRINT#1,"RUN";CHR$(34);S$;CHR$(34)
40   CLOSE1
```

Continued!

[1]/. There must not be more than one startup program in each part of the memory, i.e.:
- **DOS-formatted memory cards:** Max. one startup program per card.
- **Printer's RAM memory:** Max. one startup program.
- **Non DOS-formatted memory cards:** Max. one startup program per card.
- **Printer's RAM memory:** Max. one startup program.

5. FINGERPRINT PROGRAMMING, cont'd.

13. Saving the Program, cont'd.

Creating a Startup Program, cont'd.

A startup program can easily be created from an ordinary program using the following method:

- After having written and tested the program, SAVE it.
- Enter the following statement:
  `RUN "rom:MKAUTO"`
- The following prompt will be displayed on the screen:
  `STARTUP FILE NAME?`
- Type the name of the program you just SAVEd (with or without the extension .PRG) and press the Carriage Return key.
- “Ok” on the screen indicates that the operation is ready.
- The startup program will be stored in the printer's current directory (by default "ram:", i.e. the printer's RAM memory).
- When you restart the printer, the new startup program will start running, provided there is no other startup program with higher priority (see previous page).

☞ **Current Directory**
Also see:
- Chapter 6.1

To undo the operation, use the statement:

```
KILL "AUTOEXEC.BAT"
```

This will not erase the original program, but it will no longer be used as a startup program. Note that you cannot KILL startup programs stored in EPROM:s or Non DOS-formatted memory cards.

In most cases startup programs are stored in EPROM's, which requires special equipment, such as an EPROM programming device and the *Toolbox* software.

14. Rebooting the Printer

Rebooting the printer has the same consequences as turning off and then on the power.

REBOOT

The REBOOT statement allows you to reboot the printer from the host or as a part of the program execution. A typical example of the use of REBOOT in a program is found in Intermec Shell, where the printer is automatically rebooted when a new application has been selected.

When the printer is rebooted, or the power to the printer is turned on, a number of things happens (refer to the *Fingerprint 6.13 Reference Manual*, REBOOT statement for a complete list):

- The printer's working memory is erased, i.e. any program not already SAVEd will be irrevocably lost, all buffers will be emptied, all files will be closed, all date- and time-related formats will be lost, all arrays will be lost and all variables will be set to zero. Fonts and images stored in the no-save area of the printer's RAM memory will be erased.

Continued!

5. FINGERPRINT PROGRAMMING, cont'd.

14. Rebooting the Printer, cont'd.

- All parameters in *Fingerprint* instructions will be reset to default.
- The printer performs a number of self-diagnostic tests, e.g. printhead resistance check (certain models only) and memory checksum calculations.
- The printer checks for possible optional devices like interface boards, memory card adapter or cutter.
- The various parts of the printer's memory are searched for possible startup programs in the following order:
  1. Inserted DOS-formatted memory card ("card1:").
  2. Printer's RAM memory ("ram:").
  3. Inserted Non DOS-formatted memory card ("rom:")
  4. Printer's ROM memory ("rom:")

  The first startup program encountered will be executed.

Note that rebooting does not change the printer's setup, unless any physical changes has been done to the printer during the power-off period, such as a change of printhead density or installation or removal of an interface board.

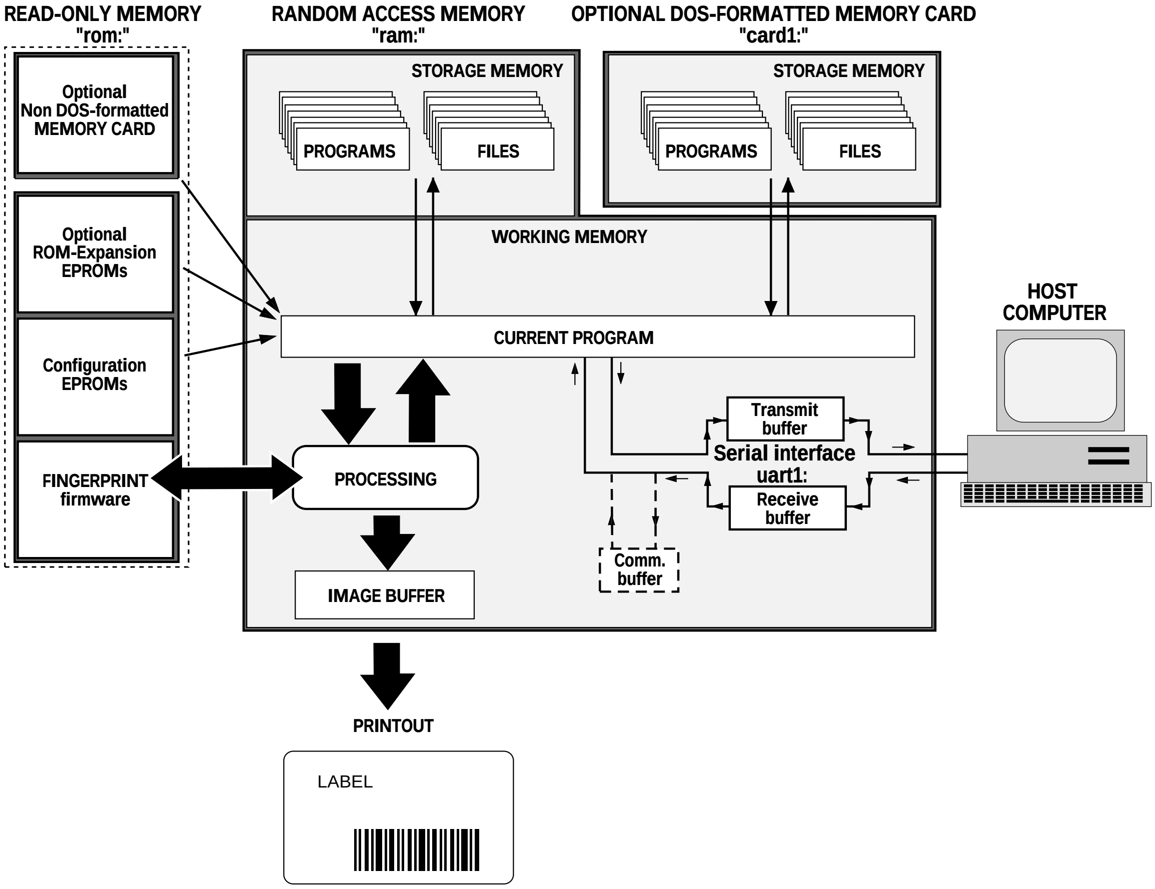
6. FILE SYSTEM

1. Printer's Memory

The printer's memory is divided in a number of parts, or directories:

- ***Read-Only Memory ("rom:")***
  This directory is designated "rom:" and consists of the 2, 4 or 6 EPROM packages fitted on the printer's CPU board plus any non DOS-formatted memory card inserted in the printer's optional memory card adapter. As the name implies can this part of the memory only be read from, but not written to.
- ***Random Access Memory ("ram:")***
  The RAM memory is designated "ram:" and consists of 2 or 4 RAM packages fitted on the printer's CPU board. The RAM memory can both be read from and written to.
- ***Memory Cards: ("card1:")***
  The RAM memory can be supplemented with a DOS-formatted memory card that is inserted in the printer's optional memory card adapter. Such a card is referred to as "card1:" and can be both read from and written to. (Note the distinction between DOS-formatted and non DOS-formatted memory cards).

ROM Memory ("rom:")



Continued!

6. FILE SYSTEM, cont'd.

1. Printer's Memory, cont'd.

The Read-Only Memory in your printer consists of up to four parts:

- Two EPROM packages containing the *Fingerprint* firmware, which controls how the printer works. These EPROM:s are common for all *Fingerprint 6.xx*-compatible printers.
- Two Configuration EPROM's, which may contain fonts, images, and certain programs and files, such as e.g. *Shell*. Custom-made versions can be ordered, containing e.g. application programs, additional fonts and bar codes.
- Optionally, two ROM expansion EPROM's can be fitted in some models. They may contain the same type of files as the configuration EPROM's, object files (e.g. two-dimensional bar codes), and/or an optional *Scalable Fonts Kit*.
- If the printer is fitted with a memory card adapter, a non DOS-formatted, preprogrammed memory card can be inserted to supplement the ROM memory.

There is no way you can affect the content of the Read-Only Memory (rom:), other than changing the EPROM packages, or optionally fitting another memory card. However, programs in "rom:" can be copied to "ram:", where modifications can be performed. The EPROM's require no current to retain their content.

RAM Memory ("ram:")

The Random Access Memory in your printer has two main parts:

- The storage memory, where you store the programs and other files that you create or download. Part of the storage memory is a “no-save area”, the content of which is erased at power-up.
- The working memory, which contains the program you currently are using. Part of the working memory must also be set aside for various types of buffers:
  - **Image buffer:** Used to level out differences of speed between the processing of the print image and the actual printing. Its size is decided by the setup.
  - **Receive/Transmit buffers:** Each serial communication channel must have one buffer of each kind. The size of each buffer is decided separately by the setup.
  - **Communication buffers:** In a program, you may set up one communication buffer for each communication channel. This makes it possible to receive data simultaneously from several sources to be fetched at the appropriate moment during the execution of the program.

There is no fixed division between the working memory and the storage memory, i.e. the more data in the storage memory, the less working memory is left.

The RAM packages are battery backed-up in order to retain their content when the power to the printer is off.

Continued!

6. FILE SYSTEM, cont'd.

1. Printer's Memory, cont'd.

DOS-Formatted Memory Cards ("card1:")

A special case of the RAM memory is the DOS-formatted memory card, which can be both read from and written to, just like RAM, but is referred to as a special device ("card1:"). In order to retain its content when the power to the printer is off, each SRAM memory card is fitted with an internal battery.

Current Directory

“Current directory” means the directory the Fingerprint firmware will use unless you specifically instruct it to use another directory. By default, the current directory is "ram:".

To appoint another directory as current directory, use a CHDIR statement.

Example:
Changing directory from the default directory ("ram:") to "rom:" and back.

```
10   CHDIR "rom:"
. . . . .
90   CHDIR "ram:"
```

Checking Free Memory

You can check the size of the RAM memory and see how much free memory space there is by issuing a FILES, FONTS, or IMAGES statement in the immediate mode.

Another way is to use the FRE function to making a small instruction, that returns the number of free bytes, for example:

```
? FRE(1)                                        yields e.g.:
391248
```

Providing More Free Memory

In order to free more memory space in RAM, you can use a CLEAR statement to empty all strings, set all variables to zero and reset all arrays to default. If even more memory is required, you will have to consider either to KILL some programs or files, or to REMOVE some fonts or images stored in RAM. If the printer is not fitted with a maximum size RAM memory, you could also fit more or larger RAM packages after having made backup copies on the host.

Formatting Memory Cards or RAM Memory

A RAM-type memory card, inserted in the printer's optional memory card adapter, can be formatted to MS-DOS format by means of a FORMAT statement. FORMAT can also be used to format the printer's RAM memory, i.e. erase all **files** in the storage part of the RAM memory. No other data will be affected.

2. Files

File Types

A number of different types of files can be stored in the various parts of the printer's memory. They can be divided into four main groups:

- *Program Files*
- *Data Files*
- *Image Files*
- *Outline Font Files*

Object files, fonts, bar codes and images are not treated as files by the *Fingerprint* firmware.

> ☞ ***Fonts, Bar Codes and Images***
> Also see:
> - Chapter 12 (Fonts)
> - Chapter 13 (Bar codes)
> - Chapter 14 (Images)

File Names

The name of a file may consist of up to 30 characters including extension, but possible restrictions imposed by the operating system of the host should be considered if the file is to be transferred. Refer to chapter 5.13 for a list of file names reserved for *Intermec Fingerprint* utilities.

> ☞ ***Current Directory***
> Also see:
> - Chapter 6.1

Listing Files

The files stored in the printer's memory can be listed by means of the FILES statement. By default, the files stored in the current directory will be listed. Optionally, another directory can be selected by adding a reference to the FILES statement:

`FILES`	lists all files in the **current** directory.
`FILES "rom:"`	lists all files stored in EPROM and in any inserted non DOS-formatted memory card.
`FILES "ram:"`	lists all files stored in the printer's RAM packages.
`FILES "card1:"`	lists all files stored in any inserted DOS-formatted memory card.

You can COPY a file to the standard OUT channel, where it will be printed on the screen of the host, e.g.:

```
COPY "[device]filename", "uart1:"
```

Note:
The FILELIST.PRG program is included in all Intermec Fingerprint EPROMs.

> ☞ ***Standard OUT channel***
> Also see:
> - Chapter 7.1

The FILELIST.PRG program also LISTs a line-orientated file to the standard OUT channel:

- On your terminal, enter:

  ```
  RUN "rom:FILELIST.PRG"
  ```

- The printer will respond by prompting you to enter the name of the file to be listed:

  ```
  Filename?
  ```

- Enter the filename, possibly preceded by a directory reference, e.g.:

  ```
  "rom:*.*".
  ```

6. FILE SYSTEM, cont'd.

3. Program Files

Program File Types

Program files are used to run and control the printer and to produce labels or other printouts. A program file is always composed of numbered lines, although the numbers may be invisible during the editing process (see chapter 5.4).

A special case of program files is startup files, i.e. files that automatically start running when the printer is turned on (also called “autoexec-files”). Startup files were explained in chapter 5.13 “Creating a Startup Program”.

Instructions

The following instructions are used for creating and handling program files:

`LOAD`	Copies a specified program file to the printer's working memory.
`LIST`	Lists the program file in the working memory to the standard OUT channel, usually the screen of the host.
`MERGE`	Adds copy of a specified program file to the program file currently residing in the printer's working memory.
`RUN`	Executes the instruction in the program file. RUN must be issued in the Immediate Mode, i.e. not in a numbered line.
`SAVE`	Saves a copy of the program file in the working memory to the printer's RAM memory ("ram:") or, optionally, to a non DOS-formatted memory card ("card1:"). If a file with the same name already exists the that directory, it will be replaced by the new file.
`NEW`	Clears the working memory to allow a new program file to be created.
`COPY`	Copies a file to another name and/or directory.
`KILL`	Deletes a file from the RAM memory or from a DOS-formatted memory card.

☞ ***Standard OUT Channel***
Also see:
- Chapter 7.1

☞ ***Creating, Saving, Copying, Killing and Executing Program Files***
Also see:
- Chapter 5.11 and 5.13

6. FILE SYSTEM, cont'd.

4. Data Files

Data File Types

Data files are used by the program files for storing various types of data and can be divided into several subcategories:

• *Sequential Input Files*	*See chapter 7.4*
• *Sequential Output Files*	*See chapter 8.3*
• *Sequential Append Files*	*See chapter 8.3*
• *Random Access Files*	*See chapters 7.5 and 8.4*

Instructions

The following instructions are used in connection with the creation and handling of data files:

`OPEN` Creates and/or opens a file for a specified mode of access and optionally specifies the record size in bytes.

`CLOSE` Closes an OPENed file.

`REDIRECT OUT` Creates a file to which the output data will be redirected (see chapter 8.2).

`TRANSFERSET` Sets up the transfer of data between two files.

`TRANSFER$` Executes the transfer of data between two files according to TRANSFERSET.

`COPY` Copies a file to another name and/or directory.

`KILL` Deletes a file.

`LOC` Returns the position in an OPENed file.

`LOF` Returns the length in bytes of an OPENed file.

6. FILE SYSTEM, cont'd.

5. Image Files

Image files in .PCX format can be downloaded to the printer's RAM memory and at the same time be converted to images in *Fingerprint's* internal bitmap format by means of the statement IMAGE LOAD.

☞ ***Images***
Also see:
- Chapter 14

Image files in .PCX format that have been downloaded to the printer's RAM memory using *Kermit* file transfer protocol (see chapter 6.8) or stored in a DOS-formatted memory card cannot be used to produce a printable image before they have been converted to Fingerprint's internal bitmap format by means of the following instruction:

```
RUN "pcx2bmp <name of .PCX file> <name of image>"
```

Image files in Intelhex format, or the formats UBI00, UBI01, UBI02, UBI03 or UBI10, can be downloaded and converted to images using the STORE IMAGE and STORE INPUT statements.

Images files can be listed by means of a FILES statements.

6. Outline Font Files

Outline font files are files in *Speedo* (*.SPD) or *TrueType* (*.TTF) format containing scalable outline fonts. Such files can be downloaded to the printer's RAM memory using Kermit file transfer protocol (see chapter 6.8) or the FILE& LOAD instruction, or be stored in a DOS-formatted memory card.

☞ ***Fonts and Font Conversion***
Also see:
- Chapter 12

They can be used in some printer models (e.g. *EasyCoder 401/501/601*) to produce customized bitmap fonts. This requires special software (*“Scalable Fonts Kit”*) and a CPU board with 6 EPROM sockets.

The Scalable Fonts Kit also allows fonts in *.ATF format to be downloaded using the FONT LOAD statement.

The *Configuration* program in the *Toolbox* allows outline font files to be transferred to EPROM:s or non DOS-formatted memory cards.

Outline font files can be listed by means of a FILES statements.

7. Transferring Text Files

Text files, e.g. program files and data files in ASCII format, can be downloaded via a communication program in the host, e.g. Windows Terminal (“Transfers; Send Text File”).

Text files can be transferred back to the host, e.g. for backup purposes, by LOADing the file and LISTing it to a communication program in the host.

6. FILE SYSTEM, cont'd.

8. Transferring Binary Files using Kermit

Outline font files and some image files come in binary format and can be downloaded from the host to the printer or vice versa using the Kermit file transfer protocol, which is commonly used for binary transfer of data and is included in many communication programs, e.g. *DCA Crosstalk, MS Windows Terminal,* and *MS Works.*

Warning! Tests have shown that MS Windows Terminal versions 3.0 and 3.1 are unable to receive a file from the printer, even if they are capable of sending a file to the printer.

More information on the *Kermit* protocol can be found in the manual of the communication program or in the reference volume *"Kermit – A File Transfer Protocol"* by Frank da Cruz (Digital Press 1987, ISBN 0-932376-88-6).

☞ ***Standard IN and OUT Channels***
Also see:
- Chapter 7.1

TRANSFER KERMIT

The TRANSFER KERMIT statement allows you to specify direction (Send or Receive), file name, input device and output device. By default, a file name designated "KERMIT.FILE" will be transferred on the standard IN or OUT channel.

Note that there is a 30 sec. timeout between issuing the TRANSFER KERMIT "R" statement and the start of the transmission.

Example:
The printer is set up to receive a file on the standard IN channel.

```
TRANSFER KERMIT "R"
```

☞ ***Arrays***
Also see:
- Chapter 6.10

TRANSFER STATUS

After a file have been transferred by means of a TRANSFER KERMIT statement, the transfer can be checked using the TRANSFER STATUS statement. The statement will place the result of the check into two one-dimensional arrays:

5-element numeric array (requires a DIM stmt)

Element 0 returns:	Number of packets
Element 1 returns:	Number of NAKs
Element 2 returns:	ASCII value of last character
Element 3 returns:	Last error
Element 4 returns:	Block check type used

2-element string array (requires no DIM stmt)

Element 0 returns:	Type of protocol, i.e. "KERMIT"
Element 1 returns:	Last file name received

Example:

```
10   TRANSFER KERMIT "R"
20   DIM A%(4)
30   TRANSFER STATUS A%,B$
40   PRINT A%(0), A%(1), A%(2), A%(4), A%(4)
50   PRINT B$(0), B$(1)
RUN
```

6. FILE SYSTEM, cont'd.

9. Transferring Files Between Printers

If you want to transfer a file from one printer to another printer, start by transferring the file to the host. Then disconnect the first printer and download the file to the second printer (or have the two printers connected to separate serial ports). After the transfer of programs between two connected printers is completed, you can check if the transfer was successful by means of a CHECKSUM function.

Note:
Do not confuse CHECKSUM with CSUM, see chapter 6.10 "Arrays".

CHECKSUM

The CHECKSUM function uses an advanced algorithm on parts of the printer's internal code. Thus, calculate the CHECKSUM on the program in the transmitting printer before the transfer. After the transfer is completed, LOAD the program in the receiving printer and perform the same calculation. If the checksums are identical, the transfer was successful.

Note that the algorithm was changed in *Fingerprint 4.0*. Thus, the CHECKSUM function will return other checksums in printers using earlier versions of *Fingerprint* than 4.0 compared to printers using 4.0 or later versions. If possible, use the same *Fingerprint* version in both printers.

Example:
This example calculates the checksum in the lines 10–90000 in the program "DEMO.PRG".

```
LOAD "DEMO.PRG"
PRINT CHECKSUM (10,90000)
```

6. FILE SYSTEM, cont'd.

10. Arrays

Variables containing related data may be organized in arrays. Each value in an array is called an element. The position of each element is specified by a subscript, one for each dimension (max 10). Each array variable consists of a name and a number of subscripts separated by commas and enclosed by parentheses, for example ARRAY$(3,3,3).

The number of subscripts in an array variable, the first time (regardless of line number) it is referred to, decides its number of dimensions. The number of elements in each dimension is by default restricted to four (No. 0–3).

Four instructions are specifically used in connection with arrays:

DIM	Specifies the size of an array in regard of elements and dimensions.
SORT	Sorts the elements in a one-dimensional array in ascending or descending order.
SPLIT	Splits a string into an array.
CSUM	Returns the checksum for a string array.

DIM

If more than 4 elements are needed, or if you want to limit the size of the array, a DIM statement can be used to specify the size of the array in regard of the number of dimensions as well as the number of elements in each dimension. In most cases, one- or two-dimensional arrays will suffice.

This example shows how three 1-dimensional, 5-element arrays can be used to return 125 possible combinations of text strings:

```
10   DIM TYPE$(4),COLOUR$(4),SIZE$(4)
20   TYPE$(0)="SHIRT"
30   TYPE$(1)="BLOUSE"
40   TYPE$(2)="TROUSERS"
50   TYPE$(3)="SKIRT"
60   TYPE$(4)="JACKET"
70   COLOUR$(0)="RED"
80   COLOUR$(1)="GREEN"
90   COLOUR$(2)="BLUE"
100  COLOUR$(3)="RED"
110  COLOUR$(4)="WHITE"
120  SIZE$(0)="EXTRA SMALL"
130  SIZE$(1)="SMALL"
140  SIZE$(2)="MEDIUM"
150  SIZE$(3)="LARGE"
160  SIZE$(4)="EXTRA LARGE"
170  INPUT"Select Type (0-4): ", A%
180  INPUT"Select Colour (0-4): ", B%
190  INPUT"Select Size (0-4): ", C%
200  PRINT TYPE$(A%)+", "+COLOUR$(B%)+", "+SIZE$(C%)
RUN
```

Continued!

6. FILE SYSTEM, cont'd.

10. Arrays, cont'd.

SORT

The SORT statement is used to sort a one-dimensional array in ascending or descending order according the character's ASCII values in the Roman 8 character set. You can also choose between sorting the complete array or a specified interval. For string arrays, you can select by which character position the sorting will be performed.

This example shows how one numeric array is sorted in ascending order and one string array is sorted in descending order according to the fifth character in each element:

```
10   FOR Q%=0 TO 3
20   A$=STR$(Q%)
30   ARRAY%(Q%)=1000+Q%:ARRAY$(Q%)="No. "+A$
40   NEXT Q%
50   SORT ARRAY%,0,3,1
60   SORT ARRAY$,0,3,-5
70   FOR I%=0 TO 3
80   PRINT ARRAY%(I%), ARRAY$(I%)
90   NEXT I%
RUN
```

Yields:

```
1000      No. 3
1001      No. 2
1002      No. 1
1003      No. 0
```

SPLIT

The SPLIT function is used to split a string expression into elements in an array and to return the number of elements. A specified character indicates where the string will be split.

In this example a string expression is divided into six parts by the separator character “/” (ASCII 47 dec.) and arranged in a six element array:

```
10   A$="ONE/TWO/THREE/FOUR/FIVE/SIX"
20   X$="ARRAY$"
30   DIM ARRAY$(6)
40   B%=SPLIT(A$,X$,47)
50   FOR C%=0 TO (B%-1)
60   PRINT ARRAY$(C%)
70   NEXT
RUN
```

Yields:

```
ONE
TWO
THREE
FOUR
FIVE
SIX
```

Continued!

6. FILE SYSTEM, cont'd.

10. Arrays, cont'd.

Note!
Do not confuse CSUM with CHECKSUM, see chapter 6.9.

CSUM

The checksum for string arrays can be calculated according to one of two different algorithms (LRC or DRC) and returned by means of the CSUM statement.

In this example, the checksum of a string array is calculated according both to the LRC (Logitudinal Redundancy Check) and the DRC (Diagonal Redundancy Check) algorithms:

```
10   FOR Q%=0 TO 3
20   A$=STR$(Q%)
30   ARRAY$(Q%)="Element No. "+A$
40   NEXT
50   CSUM 1,ARRAY$,B%:PRINT "LRC checksum: ";B%
60   CSUM 2,ARRAY$,C%:PRINT "DRC checksum: ";C%
RUN
```

Yields:

```
LRC checksum: 0
DRC checksum: 197
```

7. INPUT TO FINGERPRINT

1. Standard I/O Channel

The standard IN and standard OUT channels are the default channels for input to the printer or output from the printer respectively (in both cases "uart1:" by default). In most instructions, you can override the standard IN or OUT channel by specifying another channel. Usually, the same channel is used for both input and output, but different channels can be specified.

☞ ***Output from Intermec Fingerprint***
See:
- Chapter 8

SETSTDIO

You can appoint any of the following communication channels as standard IN and/or standard OUT channel by means of the SETSTDIO statement:

Standard IN channel	*Standard OUT channel*
0 = "console:"[1]	0 = "console:"[1]
1 = "uart1:" (default)	1 = "uart1:" (default)
2 = "uart2:"/"rs485:"	2 = "uart2:"/"rs485:"
3 = "uart3:"	3 = "uart3:"
4 = "centronics:"[2]	

[1]/. Do not select "console:" as both std in and out channel, since it would only make characters entered on the printer's keyboard appear in the display.

[2]/. The parallel communication channel "centronics:" can only be used for input (one-way communication only).

2. Input from Host (Std IN Channel only)

The std IN channel is used for sending instructions and data from the host to the printer in order to control the printer in the immediate mode, to write programs in the programming mode, to download program files and to transmit input data.

Some instructions receives data on the std IN channel only:

`INKEY$`	Reads the 1:st character in the receive buffer.
`INPUT`	Receives input data during execution of a program.
`LINE INPUT`	Assigns an entire line to a string variable.

3. Input from Host (Any Channel)

The following instructions are used to receive input from **any** communication channel (incl. the std IN channel). The same instructions are also used to read sequential files, see chapter 7.4:

`OPEN`	Opens a channel for sequential INPUT.
`INPUT#`	Receives input data during execution of a program on the specified channel.
`INPUT$`	Reads a string of data from the specified channel.
`LINE INPUT#`	Assigns an entire line from the specified channel to a string variable.
`CLOSE`	Closes the channel.

7. INPUT TO FINGERPRINT, cont'd.

4. Input from a Sequential File

Refer to chapter 7.3 for a summary of instructions used for reading sequential files.

OPEN

Before any data can be read from a sequential file (or a communication channel other than the std IN channel), it must be OPENed for INPUT and assigned a number, which is used when referred to in other instructions. The number mark (#) is optional. Up to 10 files and devices can be open at the same time.

Example: The file "ADDRESSES" is opened for input as number 1:

```
OPEN "ADDRESSES" FOR INPUT AS #1
```

After a file or device has been OPENed for INPUT, you can use the following instructions for reading the data stored in it:

INPUT#

Reads a string of data to a variable. Commas can be used to assign portions of the input to different variables. When reading from a sequential file, the records can be read one after the other by repeated INPUT# statements. The records are separated by commas in the string. Once a record has been read, it cannot be read again until the file has been CLOSEd and then OPENed again.

Example (reads six records in a file and places the data into six string variables):

```
10   OPEN "QFILE" FOR OUTPUT AS #1
20   PRINT #1, "Record A","a","b","c"
30   PRINT #1, "Record B",1,2,3
40   PRINT #1, "Record C","x";"y";"z"
50   PRINT #1, "Record D,Record E,Record F"
60   CLOSE #1
70   OPEN "QFILE" FOR INPUT AS #1
80   INPUT #1, A$
90   INPUT #1, B$
100  INPUT #1, C$
110  INPUT #1, D$,E$,F$
120  PRINT A$
130  PRINT B$
140  PRINT C$
150  PRINT D$
160  PRINT E$
170  PRINT F$
180  CLOSE #1
RUN
```

Yields:

```
Record A   a          b          c
Record B   1          2          3
Record C   xyz
Record D
Record E
Record F
```

Continued!

7. INPUT TO FINGERPRINT, cont'd.

4. Input from a Sequential File, cont'd.

INPUT$

Reads a specified number of characters from the specified sequential file or channel. (If no file or channel is specified, the data on the standard IN channel will be read). The execution is held up waiting for the specified number of characters to be received. If a file does not contain as many characters as specified in the INPUT$ statement, the execution will be resumed as soon as all available characters in the file have been received.

Sequential files are read from the start and once a number of characters have been read, they cannot be read again until the file is CLOSEd and OPENed again. Subsequent INPUT$ statements will start with the first of the remaining available characters.

Example (reads portions of characters from a file OPENed as #1):

```
10   OPEN "QFILE" FOR OUTPUT AS #1
20   PRINT #1, "ABCDEFGHIJKLMNOPQRSTUVWXYZ"
30   CLOSE #1
40   OPEN "QFILE" FOR INPUT AS #1
50   A$=INPUT$(10,1)
60   B$=INPUT$(5,1)
70   C$=INPUT$(100,1)
80   PRINT "Record 1:",A$
90   PRINT "Record 2:",B$
100  PRINT "Record 3:",C$
110  CLOSE #1
RUN
```

Yields:

```
Record1:  ABCDEFGHIJ
Record2:  KLMNO
Record3:  PQRTSUVWXYZ
```

LINE INPUT#

Works similar to INPUT#, but reads an entire line including all punctuation marks to a string variable instead of reading just one record. Note that commas inside a string will be regarded as punctuation marks and will not divide the string into records (compare with INPUT#).

Example (reads a complete line in a file and places the data into a single string variable):

```
10   OPEN "QFILE" FOR OUTPUT AS #1
20   PRINT #1, "Record A,Record B,Record C"
30   CLOSE #1
40   OPEN "QFILE" FOR INPUT AS #1
50   LINE INPUT #1, A$
60   PRINT A$
70   CLOSE #1
RUN
```

Yields:

```
Record A,Record B,Record C
```

Continued!

7. INPUT TO FINGERPRINT, cont'd.

4. Input from a Sequential File, cont'd.

CLOSE

When a file is no longer used, it can be closed by means of a CLOSE statement containing the same reference number as the corresponding OPEN statement. An END statement also closes all open files.

A few instructions facilitate the use of files for sequential input:

EOF (End of File)

The EOF function can connection with the statements INPUT#, LINE INPUT# and INPUT$ to avoid the error condition "Input past end". When the EOF function encounters the end of a file, it returns the value -1 (TRUE). If not, it returns the value 0 (FALSE).

☞ ***Relational Operators***
Also see:
- Chapter 4.9

Example:

```
10   DIM A%(10)
20   OPEN "DATA" FOR OUTPUT AS #1
30   FOR I%=1 TO 10
40   PRINT #1, I%*1123
50   NEXT I%
60   CLOSE #1
70   OPEN "DATA" FOR INPUT AS #2
80   I%=0
90   WHILE NOT EOF(2)
100  INPUT #2, A%(I%):PRINT A%(I%)
110  I%=1+1:WEND
120  IF EOF(2) THEN PRINT "End of File"
RUN
```

LOC (Location)

The LOC function returns the number of 128-byte blocks, that have been read or written since the file was OPENed.

This example closes the file "ADDRESSES" when record No. 100 has been read from the file:

```
10   OPEN "ADDRESSES" FOR INPUT AS #1
.....
.....
.....
200  IF LOC(1)=100 THEN CLOSE #1
.....
.....
```

LOF (Length-of-File)

The LOF function returns the length in bytes of an OPENed file.

The example illustrates how the length of the file "Pricelist" is returned:

```
10   OPEN "PRICELIST" AS #5
20   PRINT LOF(5)
.....
.....
```

7. INPUT TO FINGERPRINT, cont'd.

5. Input from a Random File

The following instructions are used in connection with input from random files:

OPEN Creates and/or opens a file for RANDOM access and optionally specifies the record length in bytes.

FIELD Creates a random buffer, divides it into fields and assigns a variable to each field.

GET Reads a record from the buffer to the file.

CLOSE Closes an OPENed file.

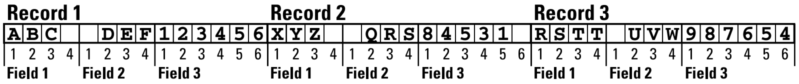
LOC Returns the number of the last record read by the use of a GET statements in the specified file.

LOF Returns the length in bytes of the specified file.

OPEN

To read the data stored in a random file, you must OPEN it.

The example in this chapter uses the random file created in chapter 8.4, which can be graphically illustrated like this:



```
10   OPEN "ZFILE" AS #1 LEN=14
```

The appending "LEN=14" refers to the length of each record which is 14 bytes (4 + 4 + 6). Do not confuse the "LEN" parameter in the OPEN statement with the LEN function, see chapter 9.2.

FIELD

Then enter the same field definitions as when the data was put into the file:

```
20   FIELD#1, 4 AS F1$, 4 AS F2$, 6 AS F3$
```

GET

Use a GET statement to copy the desired record from the file. Note that you can select whatever record you want, as opposed to sequential files, where you reads the records one after the other. In this case, we will copy record No. 1 (compare with the illustration above).

```
30   GET #1,1
```

If you like, you can copy data from other records in the same file by issuing additional GET statements with references to the records in question.

Continued!

7. INPUT TO FINGERPRINT, cont'd.

5. Input from a Random File, cont'd.

☞ ***VAL function***
Also see:
- Chapter 9.2

Now you can use the variables assigned to the fields in the record by means of the FIELD statement to handle the data. Possible numeric expressions converted to string format before being put into the record can now be converted back to numeric format using VAL functions. In our example, we will simply print the data on the screen:

```
40   PRINT F1$,F2$,F3$
```

CLOSE

Finally, close the file and execute:

```
50   CLOSE #1
RUN
```

Yields:

```
ABC       DEF      123456
```

Two instructions facilitate the use of random files:

LOC (Location)

The LOC function returns the number of the last record read by the use of GET statement.

This example closes the file "ADDRESSES" when record No. 100 has been read from the file:

```
10   OPEN "ADDRESSES" AS #1
.....
.....
.....
200  IF LOC(1)=100 THEN CLOSE #1
.....
.....
```

LOF (Length-of-File)

The LOF function returns the length in bytes of an OPENed file.

The example illustrates how the length of the file "Pricelist" is returned:

```
10   OPEN "PRICELIST" AS #5
20   PRINT LOF(5)
. . . .
. . . .
```

7. INPUT TO FINGERPRINT, cont'd.

6. Input from Printer's Keyboard

All *Fingerprint*-compatible *EasyCoder* printers are provided with at least one key or button. Enhanced models have a set of numeric keys supplemented with a number of function keys. This also applies to the *EasyCoder 201 II SA* (Stand-Alone). *EasyCoder 501 SA* (Stand-Alone) has a full QWERTY keyboard, like a typewriter. There are also separate alphanumeric keyboards available as options[1].

Note that input from the printer's keyboard excludes the use of ON KEY...GOSUB statements (see chapter 5.8) and vice versa.

The following instructions are used in connection with input from the printer's keyboard:

`OPEN`	Opens the device "console:" for sequential INPUT.
`INPUT#`	Reads a string of data to a variable.
`INPUT$`	Reads a limited number of characters to a variable.
`LINE INPUT#`	Reads an entire line to a variable
`CLOSE`	Closes the device.

The table below shows which ASCII characters the various keys will produce in unshifted and shifted position, and which key will work as Shift key by default. However, the keyboard can be remapped (see later in this chapter).

Default ASCII decimal values for Enhanced Printers

Key	Unshifted	Shifted[1]	Notes
F1	1	129	
F2	2	130	
F3	3	131	
F4	4	132	
F5	5	133	
C	8	N/A	Shift key by default
Enter	13	141	Unshifted Enter = Carriage Return
Feed	28	156	
Setup	29	157	
Pause	30	158	C+Pause is by default “Break from keyboard“
Print	31	159	
.	46	174	
0	48	176	
1	49	177	
2	50	178	
3	51	179	
4	52	180	
5	53	181	
6	54	182	
7	55	183	
8	56	184	
9	57	185	

[1] /. Input from an **external** alphanumeric keyboard is a case of ASCII input on a communication channel, see chapter 7.1-3.

[1] /. Some keys will not produce any ASCII values in Shifted position depending on printer model and choice of Shift key. Test using the programming example at the end of this chapter!

Continued!

7. INPUT TO FINGERPRINT, cont'd.

6. Input from Printer's Keyboard, cont'd.

The printable characters actually generated by the respective ASCII value depend on the selected character set (NASC) and possible MAP statements, see chapter 9.1.

In case of INPUT# and LINE INPUT#, the input will not be accepted until a carriage return (< Enter >) is issued.

*This example demonstrates how the printable character and decimal ASCII value of various keys on the printer's keyboard can be printed to the screen of the host. You can break the program by holding down the <**C**> key and pressing <**Pause**>.*

```
10   PRINT "Character", "ASCII value"
20   OPEN "console:" FOR INPUT AS 1
30   A$=INPUT$(1,1)
40   B%=ASC(A$)
50   PRINT A$, B%
60   GOTO 30
70   CLOSE 1
RUN
```

7. INPUT TO FINGERPRINT, cont'd.

7. Communication Control

☞ ***Communication***
Also see:
- Technical Manual, Setup Parameters

The following instruction are used to control the communication between the printer and the host or other connected devices:

`BUSY/READY`	Transmits a busy or ready signal on the specified communication channel.
`ON LINE/OFF LINE`	Controls the SELECT signal on the parallel communication channel ("centronics:").
`VERBON/VERBOFF`	Turns printer's verbosity on/off.
`SYSVAR(18)`	Selects the printer's verbosity level.

BUSY/READY

By means of these two statements, you can let the program execution turn a selected communication channel on or off. There is a difference between serial and parallel communication.

- ***Serial communication***
  The type of busy/ready signal is decided in the Setup Mode (Ser-Com; Flowcontrol), see the Technical Manual.
  - When a BUSY statement is executed, the printer sends a busy signal , e.g. XOFF or RTS/CTS low.
  - When a READY statement is executed, the printer sends a ready signal , e.g. XON or RTS/CTS high.
- ***Parallel communication***
  The parallel Centronics communication channel uses the BUSY/READY statements to control the PE (paper end) signal on pin 12:
  - BUSY = PE high
  - READY = PE low

  The status of the PE signal can be read by a PRSTAT statement, for example:
  ```
  IF (PRSTAT AND 4) GOTO.....ELSE GOTO.....
  ```

Note that issuing a READY statement is no guarantee that the printer will receive data, since there may be other conditions that hold up the reception, e.g. a full receive buffer.

ON LINE/OFF LINE

These two statements is only used for the parallel Centronics communication channel and controls the SELECT signal (pin 13 on the parallel interface board):

- ON LINE 4 sets the SELECT signal high (default)
- OFF LINE 4 sets the SELECT signal low

Continued!

7. INPUT TO FINGERPRINT, cont'd.

7. Communication Control, cont'd.

☞ ***Standard IN/OUT Channel***
Also see:
- Chapter 7.1

VERBON/VERBOFF

These two statements control the printer's verbosity, i.e. the response from the printer on the standard OUT channel to instructions received on the standard IN channel. Both can be substituted by SYSVAR (18), see below.

By default, verbosity is on (VERBON). The verbosity level is controlled by the system variable SYSVAR(18).

All responses will be turned suppressed when a VERBOFF statement is issued. However, VERBOFF does not suppress question marks and prompts displayed as a result of e.g. an INPUT statement. Instructions like DEVICES, FILES, FONTS, IMAGES, LIST and PRINT will also work normally.

Important:
RS 485 with "Prot addr enable" requires the verbosity to be turned off (VERBOFF), see chapter 7.9 "RS 422/485 Communication".

SYSVAR

The system variable SYSVAR is used for many purposes, one of which is to control the verbosity level.

The verbosity level can be selected or read by specifying bits in SYSVAR(18):

All levels enabled	*-1*
No verbosity	*0*
Echo received characters	*1*
"Ok" after correct command lines	*2*
Echo INPUT characters from communication port	*4*
Error after failed lines	*8*

The levels can be combined, so e.g. 3 means both *"Echo received characters"* and *"Ok after correct command line"*.

By default, all levels are enabled, i.e. SYSVAR(18) = -1.
VERBON statement enables all levels, i.e. SYSVAR(18) = -1.
VERBOFF statement disables all levels, i.e. SYSVAR(18) = 0.

When the printer receives a character, e.g. from the keyboard of the host, by default the same character is echoed back on the standard OUT channel, i.e. usually to the screen of the host. When an instruction has been checked for syntax errors and accepted, the printer returns "Ok". Else an error message is returned.

This example demonstrates how the printer is set to only return "Ok" after correct lines (2) or error messages after failed lines (8):

```
SYSVAR(18) = 10
```

7. INPUT TO FINGERPRINT, cont'd.

8. Background Communication

☞ ***Memory and Buffers***
Also see:
- Chapter 6.1

Background communication means that the printer receives data on an IN channel while the program runs in a loop. The data are stored in a buffer, that can be emptied at an appropriate moment by the running program, which then can use the data. Note that background communication buffers are not the same as the receive buffers. Any input received on a communication channel is first stored in the channel's receive buffer, awaiting being processed. After processing, the data may be stored in the background communication buffer.

The following instructions are used in connection with background communication:

`COMSET`	Decides how the background reception will work in regard of: - Communication channel. - Start character(s) of message string. - End character(s) of message string. - Characters to be ignored. - Attention string that interrupt reception. - Max. number of characters to be received.
`ON COMSET GOSUB`	Branches the program execution to a subroutine when background reception on a specified channel is interrupted.
`COMSET ON`	Empties the buffer and turns on background reception on the specified channel.
`COMSET OFF`	Turns off background reception on the specified channel and empties the buffer.
`COM ERROR ON`	Enables error handling on a channel.
`COM ERROR OFF`	Disables error handling on a specified channel (default).
`COMSTAT`	Reads the status of the buffer of a channel.
`COMBUF$`	Reads data in the buffer of a channel.
`LOC`	Returns the status of the buffers in a channel.
`LOF`	Returns the status of the buffers in a channel.

To set up the printer for background communication, proceed as follows:

- Start by enabling the error handling for background communication using a COM ERROR ON statement and specifying the communication channel you intend to use:
  0 = "console:"
  1 = "uart1:"
  2 = "uart2:"/"rs485:"
  3 = "uart3:"
  4 = "centronics:"

Continued!

7. INPUT TO FINGERPRINT, cont'd.

8. Background Communication, cont'd.

- It may be useful to create a few messages indicating what have caused the interruption.

Example:
Error handling is enabled for communication channel "uart1:" and messages will be printed to the standard out channel for all conditions that can be detected by a COMSTAT function.

```
10   COM ERROR 1 ON
20   A$="Max. number of characters"
30   B$="End char. received"
40   C$="Communication error"
50   D$="Attention string received"
```

- Continue with a COMSET statement specifying:
  - Which communication channel will be used (0–4, see above).
  - Which character, or string of characters, will be used to tell the printer to start receiving data?
  - Which character, or string of characters, will be used to tell the printer to stop receiving data?
  - Which character or characters should be ignored, i.e. filtered out from the received data?
  - Which character, or string of characters, should be used as an attention string, i.e. to interrupt the reception.

    Start, stop, ignore and attention characters are selected according to the protocol of the computing device that transmits the data. Non printable characters, e.g. STX (Start of Text; ASCII 02 dec.) and ETX (End of Text; ASCII 03 dec.) can be selected by means of a CHR$ function. To specify no character, use an empty string, i.e. "".
  - How many characters should be received before the transmission is interrupted? This parameter also decides the size of the buffer, i.e. how much of the RAM memory will be allocated.

☞ ***CHR$ Function***
Also see:
- Chapter 9.2

Example (designed to make the example easy to run rather than to illustrate a realistic application):
Background reception on the serial channel "uart1:".
Start character: A
End character: CHR$ (90) i.e. the character “Z”.
Characters to be ignored: #
Attention string: BREAK
Max. number of characters in buffer: 20

```
60   COMSET 1,"A",CHR$(90),"#","BREAK",20
```

Continued!

7. INPUT TO FINGERPRINT, cont'd.

8. Background Communication, cont'd.

- Decide what will happen, when the reception is interrupted, by specifying a subroutine to which the execution will branch, using an ON COMSET GOSUB statement.

  Interruption will occur when any of the following conditions is fulfilled:
  - an end character is received.
  - an attention string is received.
  - the maximum number of characters have been received.

  Example:
  When the reception of data on communication channel 1 ("uart1:") is interrupted, the execution will branch to a subroutine starting on line number 1000.

  ```
  70   ON COMSET 1 GOSUB 1000
  ```

- After returning from the subroutine, use a COMSET ON statement to empty the buffer and turn on background reception again. e.g.:

  ```
  80   COMSET 1 ON
  ```

- When the reception has been interrupted, it is time to see what the buffer contains. You can read the content of the buffer, e.g. to a string variable, using a COMBUF$ function:

  ```
  1000 QDATA$=COMBUF$(1)
  ```

- The COMSTAT function can be used to detect what has caused the interruption. Use the logical operator AND to detect the following four reason of interruption as specified by COMSET:
  - Max. number of characters received (2).
  - End character received (4).
  - Attention string received (8).
  - Communication error (32).

  Example:
  The various cases of interruption makes different messages to be printed to the standard OUT channel.

  ```
  1010 IF COMSTAT(1) AND 2 THEN PRINT A$
  1020 IF COMSTAT(1) AND 4 THEN PRINT B$
  1030 IF COMSTAT(1) AND 8 THEN PRINT C$
  1040 IF COMSTAT(1) AND 32 THEN PRINT D$
  ```

- If you want to temporarily turn off background reception during some part of the program execution, you can issue a COMSET OFF statement and then turn off the background reception again using a new COMSET ON statement. Remember that the COMSET ON/OFF statements empties the buffer and the content will be lost if you do not read it first, using a COMBUF$ function.

Continued!

7. INPUT TO FINGERPRINT, cont'd.

8. Background Communication, cont'd.

- After adding a few lines to print the content of the buffer (line 1050) and to create a loop that waits from input from the host (line 90), the entire example will look like this. You can run the example by typing RUN and pressing *Enter* on the keyboard of the host. Then enter different characters and see what happens, comparing with the start character, stop character, ignore character, attention string, and max. number of characters parameters in the COMSET statement.

```
NEW
10   COM ERROR 1 ON
20   A$="Max. number of char. received"
30   B$="End char. received"
40   C$="Attn. string received"
50   D$="Communication error"
60   COMSET 1, "A",CHR$(90),"#","BREAK",20
70   ON COMSET 1 GOSUB 1000
80   COMSET 1 ON
90   IF QDATA$="" THEN GOTO 90
100  END
1000 QDATA$=COMBUF$(1)
1010 IF COMSTAT(1) AND 2 THEN PRINT A$
1020 IF COMSTAT(1) AND 4 THEN PRINT B$
1030 IF COMSTAT(1) AND 8 THEN PRINT C$
1040 IF COMSTAT(1) AND 32 THEN PRINT D$
1050 PRINT QDATA$
1060 RETURN
RUN
```

Two instructions facilitate the use of background communication:

LOC (Locate)

The LOC function returns the status of the receive or transmitter buffers in an OPENed communication channel:

- If the channel is OPENed for INPUT, the remaining number of characters (bytes) to be read from the receive buffer is returned.
- If the channel is OPENed for OUTPUT, the remaining free space (bytes) in the transmitter buffer is returned.

  The number of bytes includes characters that will be MAPped as NULL.

This example reads the number of bytes which remains to be received from the receiver buffer of "uart2:":

```
10   OPEN "uart2:" FOR INPUT AS #2
20   A%=LOC(2)
30   PRINT A%
...
...
```

Continued!

7. INPUT TO FINGERPRINT, cont'd.

8. Background Communication, cont'd.

LOF (Length-of-File)

The LOF function returns the status of the buffers in an OPENed communication channel:

- If a channel is OPENed for INPUT, the remaining free space (bytes) in the receive buffer is returned.
- If a channel is OPENed for OUTPUT, the remaining number of characters to be transmitted from the transmitter buffer is returned.

The example shows how the number of free bytes in the receive buffer of communication channel "uart2:" is calculated:

```
10   OPEN "uart2:" FOR INPUT AS #2
20   A%=LOF(2)
30   PRINT A%
...
...
80   COMSET 1 ON
90   IF QDATA$="" THEN GOTO 90
100  END
1000 QDATA$=COMBUF$(1)
1010 IF COMSTAT(1) AND 2 THEN PRINT A$
1020 IF COMSTAT(1) AND 4 THEN PRINT B$
1030 IF COMSTAT(1) AND 8 THEN PRINT C$
1040 IF COMSTAT(1) AND 32 THEN PRINT D$
1050 PRINT QDATA$
1060 RETURN
RUN
```

7. INPUT TO FINGERPRINT, cont'd.

9. RS 422/485 Communication

☞ ***RS 422/485 Interface***
Also see:
- Technical Manual

As an option, some *EasyCoder* printers can be fitted with an interface board that provides either RS 422 or RS 485 on "uart2:". Some models also have a built-in provision for RS 422 on "uart1:" on the CPU board.

In neither of these protocols, there are any lines for hardware handshake (RTS/CTS). Thus, in the printer's setup, the option *"RTS/CTS Enable/Disable"* for "uart2:" has been replaced by the option *"Prot Addr Enable/Disable"*, which is only intended for RS 485, see below.

The strap on the RS 422/485 interface board, that selects 2- or 4 wire communication, only controls the hardware, but the firmware cannot read this strap. Instead, 2- or 4-wire communication is determined by the printer's setup on "uart2:" in regard of *"XON/ XOFF, Data from Host, Enable/Disable"* and *"Prot. Addr. Enable/ Disable"*

RS 422

RS 422 is a point-to-point four-line screened cable connection between a host computer and a printer, or between two printers. Two lines transmit data and the other two receive data. No hardware handshake can be used (4 lines only), but XON/XOFF or ENQ/ ACK can be used if so desired.

- **RS 422 on "uart1:"** *(EasyCoder 401/501/601)*
  Optional driver circuit fitted on CPU board.
  Either the standard IN/OUT channel should be set to 1 (default), or the device "uart1:" should be OPENed for INPUT, e.g.:
  `OPEN "uart1:" for INPUT AS #1`
- **RS 422 on "uart2:"** *(optional RS 422/485 interface board)*
  Two voltage reference straps and two terminator straps must be fitted on the interface board.

  Set the printer's flowcontrol setup parameters as follows:

RTS/CTS:	Always Disable
ENQ/ACK:	Enable or Disable
XON/XOFF, Data from host:	Always Enable
XON/XOFF, Data to host:	Enable or Disable
Prot. addr:	Always Disable

  Either the standard IN/OUT channel should be set to 2, or the device "rs485:" should be OPENed for INPUT, e.g.:
  `OPEN "rs485:" for INPUT AS #1`

Continued!

7. INPUT TO FINGERPRINT, cont'd.

9. RS 422/485 Communication, cont'd.

☞ ***Verbosity***
Also see:
- Chapter 7.7

RS 485

RS 485 is only available on the optional RS 422/485 interface board (communication port "uart2:"). It is a 2-line screen cable point-to-point or multidrop loop connection, where the two lines switch between transmitting and receiving data according to instructions from the software. By default, the port is set to receive data. Before transmission of data, the port is switched to transmit. After the last character has been transmitted, the port is switched back to receive.

- **Point-to-Point**

  For a point-to-point RS 485 communication between a host computer and a printer, or between two printers, no special protocol is required. No handshake can be used, but communication control must be taken care of by the application software.

  Set the printer's flowcontrol setup parameters as follows:

RTS/CTS:	Always Disable
ENQ/ACK:	Always Disable
XON/XOFF, Data from host:	Always Disable
XON/XOFF, Data to host:	Always Disable
Prot. addr:	Disable

  Either the standard IN/OUT channel should be set to 2, or the device "rs485:" should be OPENed for INPUT, e.g.:

  ```
  OPEN "rs485:" for INPUT AS #1
  ```

- **Multidrop Loop**

  This type of communication is intended for sending packets of data from a **master** unit (usually some kind of computer) to any of a number of connected printers ("**slaves**"), according to a destination address included in message. The addresses of the printers are specified by straps on their RS 422/485 interface boards.

  Transmissions should consist of packets of data with a maximum size of 255 bytes. Longer records must be divided into two packets or more.

  When a printer is set up for *“Prot addr. enable”*, it will automatically use a special protocol described later in this chapter, but a connected host computer must be provided with some application software that composes its transmissions accordingly.

  No handshake can be used, but communication control must be taken care of by the application software.

7. INPUT TO FINGERPRINT, cont'd.

9. RS 422/485 Communication, cont'd.

- **Multidrop Loop, cont'd.**

Set the printer's flowcontrol setup parameters as follows:

RTS/CTS:	Always Disable
ENQ/ACK:	Always Disable
XON/XOFF, Data from host:	Always Disable
XON/XOFF, Data to host:	Always Disable
Prot. addr:	Enable

Set verbosity to off using a VERBOFF statement or a SYSVAR(18)=0 instruction.

Master Unit

The master unit controls the data flow in the loop and must always have **address 0**.

In case of using a **computer** as master, refer to the computer's manual for information on how to appoint the computer master and how to set its address to 0.

In case of using a **printer** as master (e.g. in a printers-only loop), the address 0 must be strapped and two voltage reference straps must be fitted on the printer's RS 422/485 interface board.

Example showing communication between master and a slave with the address 8:

```
OPEN "rs485:8" FOR OUTPUT AS #1
OPEN "rs485:8" FOR INPUT AS #2
PRINT #1,"SEND STATUS"   (a status request is sent to Slave No. 8)
LINE INPUT #2, A$            (message is read from Slave No. 8)
.....
```

Slave Units

Commonly, the master in a loop is a computer and the slaves are printers, each with an individual address (1–31).

The computer controls the data flow by sending data to a specified printer, or by sending a request to check if the master needs any data from the printer. An application program must be created that defines a protocol within the data record, which defines when a slave is allowed to send data.

In the program of the slave printer, rs485 is OPENed for both input and output. No destination address is required in the OPEN statement, since address **0** (i.e. master) is automatically assumed. When a complete packet of data is available, the application program is able to read the data record sent from the master. If the data is a status request, the printer can send data back to the master. The header record will automatically be added to the packet.

Example showing communication between slave and master:

```
OPEN "rs485:" FOR INPUT AS #1
OPEN "rs485:" FOR OUTPUT AS #2
LINE INPUT #1,A$                (data from master are read)
PRINT #2, "DATA TO MASTER"       (data are sent to master)
.....
```

Continued!

7. INPUT TO FINGERPRINT, cont'd.

9. RS 422/485 Communication, cont'd.

Note:
Do not confuse this ESC character with the ASCII ESCape character = ASCII 27 decimal).
If a byte somewhere in the packet should be the same code as the START or ESC characters, it must be substituted by a two-byte sequence:
If a byte = START,
send ESC+ASCII 220 dec.
If a byte = ESC,
send ESC+ASCII 221 dec.

Protocols

All packets of data must be preceded by a header record, in which all data are binary:

START	**DST**	**SRC**	**LEN**	**PROTO**	**CRC**	**<Data record/Request >**

Header record: 5 bytes

START indicates the start of the header record. Either of the following two characters can be used as start character:
START ASCII 192 decimal, or
ESC ASCII 219 decimal, see note!

DST is the destination address 0–31 (1 byte).

SRC is the source address 0–31 (1 byte).

LEN is the size in bytes of the data record, max. 249 characters (1 byte).

PROTO specifies type of protocols 0 or 1 (1 byte), see below.

CRC is the checksum of the header record (1 byte), i.e. the inverted sum of DST+SRC+LEN+PROTO bytes.

- **PROTO = 0**
  This protocol is used for transfer of data. The syntax is:

START	**DST**	**SRC**	**LEN**	**PROTO=0**	**CRC**	**<Data record>**

- **PROTO = 1**
  This protocol is used for communication check from a host computer (cannot be sent from a printer!). Instead of a data record, a REQUEST byte (0 or 1) appends the header record. Any printer in the loop can be checked if it is on-line (REQUEST = 0), or inquired for the number of seconds that have passed since its last startup or reboot (REQUEST = 1). If the printer is on-line, it will answer by returning the corresponding REQUEST byte, in the latter case followed by the time expressed as a 10-digit value with leading zeros.

Example 1. The host computer sends:

START	**DST**	**SRC**	**LEN**	**PROTO =1**	**CRC**	**REQUEST=0**

The printer replies:

START	**DST**	**SRC**	**LEN**	**PROTO=1**	**CRC**	**REQUEST=0**

Example 2. The host computer sends:

START	**DST**	**SRC**	**LEN**	**PROTO =1**	**CRC**	**REQUEST=1**

The printer replies:

START	**DST**	**SRC**	**LEN**	**PROTO=1**	**CRC**	**REQUEST =1+time (nnnnnnnnnn)**

7. INPUT TO FINGERPRINT, cont'd.

10. External Equipment

Industrial Interface

The *Fingerprint* firmware not only allows you to control the printer, but various types of external equipment, like conveyor belts, gates, turnstiles, control lamps etc. can be controlled as well by the program execution. Likewise, the status of various external devices can be used to control both the printer and other equipment. The computing capacity of the *Fingerprint* printer can thus be used to independently control workstations without the requirement of an on-line connection to a host computer.

What makes this possible is the *Industrial Interface Board*, which is available as an option for most *Fingerprint*-compatible *EasyCoder* printer models. The board contains a female DB-15 connector with 4 IN ports and 4 OUT ports.

The IN ports are connected to optocouplers that allows the *Fingerprint* firmware to read their status, i.e. to detect whether a current through the port is on or off.

The OUT ports are connected to four relays that can switch a current on or off. The status of the relays can also be read.

There are two instruction solely used in connection with the *Industrial Interface Board*:

PORTOUT ON/OFF

This statement sets one of the four relays to either Open or Closed, depending on how the Industrial Interface Board is strapped.

PORTIN

This function returns the status of a specified IN or OUT port:

IN ports (101, 102, 103, or 104)

-1 (true)	indicates that the optocoupler detects a current.
0 (false)	indicates that the optocoupler detects no current.

OUT ports (201, 202, 203, or 204)

-1 (true)	indicates that PORTOUT ON is selected.
0 (false)	indicates that PORTOUT OFF is selected.

Example:
The relay on OUT port 201 will be activated when a switch connected to IN port 101 is turned on.

```
10   PORTOUT 201 OFF
20   IF PORTIN (101) THEN GOTO 1000 ELSE GOTO 10
1000 PORTOUT 201 ON
1010 GOTO 20
```

8. OUTPUT FROM FINGERPRINT

1. Output to Std OUT Channel

☞ ***Input to Fingerprint***
See:
- Chapter 7

☞ ***Standard Error-Handling***
Also see:
- Chapter 16.1

☞ ***Verbosity***
Also see:
- Chapter 7.7

The std. OUT channel is used for returning the printer's responses to instructions received from the host. That is why the same device usually is selected both standard IN and OUT channel (see SETSTDIO statement in chapter 7.1). By default, "uart1:" is std OUT channel.

After every instruction received on the std IN channel, the printer will either return *"Ok"* or an error message (e.g. *"Feature not implemented"* or *"Syntax Error"*) on the std. OUT channel. If the std OUT channel is connected to the host computer, this message will appear on the screen.

The response can be turned off/on by means of VERBOFF/ VERBON statements, the verbosity level can be selected by SYSVAR(18), and the type of error message can be selected by SYSVAR(19).

Some instructions return data on the std OUT channel only:

DEVICES	Lists all devices, regardless if they are installed or not (also see chapter 4.10).
FILES	Lists all files in the current directory or another specified directory (also see chapter 6.2).
FONTS	Lists all bitmap fonts in the printer's entire memory (also see chapter 12.5).
IMAGES	Lists all images in the printer's entire memory (also see chapter 14.4).
LIST	Lists the current program in its entity or within a specified range of lines (also see chapter 5.4.
PRINT	Prints the content of numeric or string expressions and the result of functions and calculations (see below).
PRINTONE	Prints characters entered as ASCII values (see below).

PRINT (or ?)

The PRINT statement prints a line on the std OUT channel, i.e. usually the screen of the host. The PRINT statement can be followed by one or several expressions (string and/or numeric).

If the PRINT statement contains several expressions, these must be separated by either commas (,) semicolons (;), or plus signs (+, only between string expressions):

- A comma places the expression that follows at the start of next tabulating zone (each zone is 10 characters long).

  Example:
  ```
  PRINT "Price","$10"
  ```
  Yields:
  ```
  Price     $10
  ```

Continued!

8. OUTPUT FROM FINGERPRINT, cont'd.

1. Output to Std OUT Channel, cont'd.

PRINT (or ?), cont'd.

- A semicolon places the expression that follows immediately adjacent to the preceding expression.

  Example:
  ```
  PRINT "Price_";"$10"                            Yields:
  Price_$10
  ```

- A plus sign places the string expression that follows immediately adjacent to the preceding string expression (plus signs can only be used between two string expressions).

  Example:
  ```
  PRINT "Price_"+"$10"                            Yields:
  Price_$10
  ```

- Each line is terminated by a carriage return, as to make the next PRINT statement being started on a new line. However, if a PRINT statement is appended by a semicolon, the carriage return will be suppressed and next PRINT statement will be printed adjacently to the preceding one.

  Example:
  ```
  10 PRINT "Price_";"$10";
  20 PRINT "_per_dozen"
  RUN                                             Yields:
  Price_$10_per_dozen
  ```

- A PRINT statement can also be used to return the result of a calculation or a function.

  Example:
  ```
  PRINT 25+25:PRINT CHR$ (65)                     Yields:
  50
  A
  ```

- If the PRINT statement is not followed by any expression, a blank line will be produced.

PRINTONE

The PRINTONE statement prints the alphanumeric representation of one or several characters specified by their respective ASCII values (according to the currently selected character set, see NASC statement in chapter 9.1) to the standard OUT channel.

The PRINTONE statement is useful e.g. when a certain character cannot be produced from the keyboard of the host.

PRINTONE is very similar to the PRINT statement and follows the same rules regarding separating characters, i.e. commas and semicolons).

Example:
```
PRINTONE 80;114;105;99;101,36;32;49;48            Yields:
Price     $_10
```

8. OUTPUT FROM FINGERPRINT, cont'd.

2. Redirecting Output from Std Out Channel to File

As described in chapter 8.1, by default some instructions return data on the standard OUT channel. However, it is possible to redirect such output to a file using the REDIRECT OUT statement, as described below.

REDIRECT OUT

This statement can be issued with or without an appending string expression:

- **`REDIRECT OUT <sexp>`**
  The string expression specifies the name of a sequential file that will be created and in which the output will be stored. Obviously, in this case no data will be echoed back to the host.
- **`REDIRECT OUT`**
  When no file name appends the statement, the output will be directed back to the std. OUT channel.

Example:
The output is redirected to the file "IMAGES.DAT". Then the images in the printer's memory is read to the file after which the output is redirected back to the standard OUT channel. Then the file is copied to the communication channel "uart1:" and printed on the screen of the host.

```
10 REDIRECT OUT "IMAGES.DAT"
20 IMAGES
30 REDIRECT OUT
RUN
Ok

COPY "IMAGES.DAT","uart1:"
```

Yields e.g.:

```
CHESS2X2.1                CHESS4X4.1
DIAMONDS.1                GLOBE.1

391084 bytes free   1352 bytes used
Ok
```

8. OUTPUT FROM FINGERPRINT, cont'd.

3. Output and Append to Sequential Files

The following instructions are used in connection with output to sequential files:

OPEN	Creates and/or opens a file for sequential OUTPUT or APPEND and optionally specifies the record length in bytes.
PRINT#	Prints data entered as numeric or string expressions to the specified file.
PRINTONE#	Prints data entered as ASCII values to the specified file.
CLOSE	Closes an OPENed file.
LOC	Returns the number of 128-byte blocks, that have been written since the file was OPENed.
LOF	Returns the length in bytes of the specified file.

To print data to a sequential file, proceed as follows:

OPEN

Before any data can be written to a sequential file, it must be opened. Use the OPEN statement to specify the name of the file and the mode of access (OUTPUT or APPEND).

- OUTPUT means that existing data will be replaced.
- APPEND means that new data will be appended to existing data.

In the OPEN statement you must also assign a number to the OPENed file, which is used when the file is referred to in other instructions. The number mark (#) is optional. Optionally, the length of the record can also be changed (default 128 bytes). Up to 10 files and devices can be open at the same time.

Examples:
The file "ADDRESSES" is opened for output and given the reference number 1:

```
OPEN "ADDRESSES FOR OUTPUT AS #1
```

The file "PRICELIST" is opened for append and is given the reference number 5:

```
OPEN "PRICELIST" FOR APPEND AS #2
```

Continued!

8. OUTPUT FROM FINGERPRINT, cont'd.

3. Output and Append to Sequential Files, cont'd.

After a file or device has been OPENed for OUTPUT or APPEND, you can use the following instructions for writing data to it:

PRINT#
Prints data entered as string or numeric expressions to a sequential file. Expressions can be separated by commas or semicolons:

- Commas prints the expression in separate zones.
- Semicolons prints expressions adjacently.

There are two ways to divide the file into records:

- Each PRINT# statement creates a new record (see line 20-40 in the example below).
- Commas inside a string divides the string into records (see line 50 in the example below).

Example:

```
10   OPEN "QFILE" FOR OUTPUT AS #1
20   PRINT #1, "Record A", "a", "b", "c"
30   PRINT #1, "Record B", 1, 2, 3
40   PRINT #1, "Record C", "x"; "y"; "z"
50   PRINT #1, "Record D,Record E,Record F"
```

PRINTONE#
Prints characters entered as decimal ASCII values according to the selected character set to the selected file or device. This statement is e.g. useful when the host cannot produce certain characters. Apart from using ASCII values instead of string or numeric expressions, the PRINTONE# works in the same way as the PRINT# statement.

Example (prints two records ”Hello” and “Goodbye” to "file1"):

```
10   OPEN "file1" FOR OUTPUT AS 55
20   PRINTONE#55,72;101;108;108;111
30   PRINTONE#55,71;111;111;100;98;121;101
```

CLOSE
After having written all the data you need to the file, CLOSE it using the same reference number as when it was OPENed, e.g.:

```
10   OPEN "file1" FOR OUTPUT AS 55
20   PRINTONE#55,72;101;108;108;111
30   PRINTONE#55,71;111;111;100;98;121;101
40   CLOSE 55
```

LOC (Location)
The LOC function returns the number of 128-byte blocks, that have been written since the file was OPENed.

This example closes the file "ADDRESSES" when record No. 100 has been read from the file:

```
10   OPEN "ADDRESSES" FOR OUTPUT AS #1
.....
200  IF LOC(1)=100 THEN CLOSE #1
.....
```

Continued!

8. OUTPUT FROM FINGERPRINT, cont'd.

3. Output and Append to Sequential Files, cont'd.

LOF (Length-of-File)

The LOF function returns the length in bytes of an OPENed file.

The example illustrates how the length of the file "Pricelist" is returned:

```
10   OPEN "PRICELIST" FOR OUTPUT AS #5
20   PRINT LOF(5)
. . . .
. . . .
```

8. OUTPUT FROM FINGERPRINT, cont'd.

4. Output to Random Files

The following instructions are used in connection with output to random files:

OPEN Creates and/or opens a file for RANDOM access and optionally specifies the record length in bytes.

FIELD Creates a random buffer, divides it into fields and assigns a variable to each field.

LSET/RSET Places data left- or right-justified into the buffer.

PUT Writes a record from the buffer to the file.

CLOSE Closes an OPENed file.

LOC Returns the number of the last record written by the use of a PUT statement in the specified file.

LOF Returns the length in bytes of the specified file.

To write data to a random file, proceed as follows:

OPEN

Start by OPENing a file for random input/output. Since random access is selected by default, the mode of access can be omitted from the statement, e.g.:

```
10   OPEN "ZFILE" AS #1
```

Optionally, the length of each record in the file can be specified in number of bytes (default 128 bytes):

```
10   OPEN "ZFILE" AS #1 LEN=14
```

FIELD

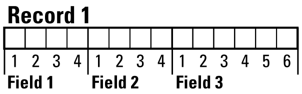
Next action to take is to create a buffer by means of a FIELD statement. The buffer is given a reference number and divided into a number of fields with individual length in regard of number of characters. To each field, a string variable is assigned.

The buffer specifies the format of each record in the file. The sum of the length of the different fields in a record must not exceed the record length specified in the OPEN statement.

In the example below, 4 bytes are allocated to field 1, 4 bytes to field 2 and 6 bytes to field 3. The fields are assigned to the string variables A1$, A2$ and A3$ respectively.

```
20   FIELD#1, 4 AS F1$, 4 AS F2$, 6 AS F3$
```

Graphically illustrated, the record produced in the line above will look like this:



Continued!

8. OUTPUT FROM FINGERPRINT, cont'd.

4. Output to Random Files, cont'd.

The file can consist of many records, all with the same format. (To produces files with different record lengths, the file must be OPENed more than once and with different reference numbers).

Now it is time to write some data to the file. Usually the data comes from e.g. the host or from the printer's keyboard. In this example, we will type the data directly on the host and assign the data to string variables:

```
30   QDATA1$="ABC"
40   QDATA2$="DEF"
50   QDATA3$="12345678"
```

☞ ***STR$ Function***
Also see:
- Chapter 9.2

Note that only string variables can be used. Possible numeric expressions must therefore be converted to strings by means of STR$ functions.

LSET/RSET

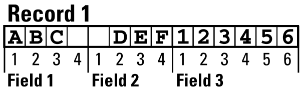
There are two instructions for placing data into a random file buffer:
- **LSET** places the data left-justified.
- **RSET** places the data right-justified.

In other words, if the input data consist of less bytes that the field into which it is placed, it will either be placed to the left (LSET) or to the right (RSET).

If the length of the input data exceeds the size of the field, the data will be truncated from the end in case of LSET, and from the start in case of RSET.

```
60   LSET F1$=QDATA1$
70   RSET F2$=QDATA2$
80   LSET F3$=QDATA3$
```

Using the graphic illustration from previous page, the result is meant to be like this:



Record 1

A	B	C			D	E	F	1	2	3	4	5	6
1	2	3	4	1	2	3	4	1	2	3	4	5	6
Field 1				Field 2				Field 3					

Note that the first field is left-justified, the second field is right-justified, and the third field is left-justified and truncated at the end (digits 7 and 8 are omitted since the field is only six bytes long; if the field had been right-justified, digits 1 and 2 had been omitted instead).

PUT

Next step is to transfer the record to the file. For this purpose we use the PUT statement. PUT is always followed by the number assigned to the file when it was OPENed, and the number of the record in which you want to place the data (1 or larger).

Continued!

8. OUTPUT FROM FINGERPRINT, cont'd.

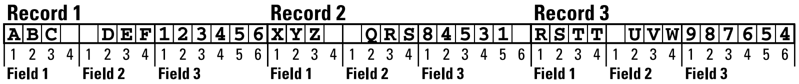
4. Output to Random Files, cont'd.

PUT, cont'd.

In our example, the file ZFILE was OPENed as #1 and we want to place the data in the first record. Note that you can place data in whatever record you like. The order is of no consequence.

```
90   PUT #1,1
```

If you want, you can continue and place data into other records using additional sets of LSET, RSET and PUT statements. Below is a graphic example of a three-record file:



Record 1			Record 2			Record 3		
A B C	D E F	1 2 3 4 5 6	X Y Z	Q R S	8 4 5 3 1	R S T T	U V W	9 8 7 6 5 4
1 2 3 4	1 2 3 4	1 2 3 4 5 6	1 2 3 4	1 2 3 4	1 2 3 4 5 6	1 2 3 4	1 2 3 4	1 2 3 4 5 6
Field 1	Field 2	Field 3	Field 1	Field 2	Field 3	Field 1	Field 2	Field 3

CLOSE

When you are finished, close the file:

```
100  CLOSE #1
```

Nothing will actually happen before you execute the program using a RUN statement. Then the data will be placed into the fields and records as specified by the program, e.g.:

```
10   OPEN "ZFILE" AS #1 LEN=14
20   FIELD#1, 4 AS F1$, 4 AS F2$, 6 AS F3$
30   QDATA1$="ABC"
40   QDATA2$="DEF"
50   QDATA3$="12345678"
60   LSET F1$=QDATA1$
70   RSET F2$=QDATA2$
80   LSET F3$=QDATA3$
90   PUT #1,1
100  CLOSE #1
RUN
```

LOC (Locate)

The LOC function returns the number of the last record read or written by the use of GET or PUT statements respectively in an OPENed file.

This example closes the file "ADDRESSES" when record No. 100 has been read from the file:

```
10 OPEN "ADDRESSES" AS #1
.....
200 IF LOC(1)=100 THEN CLOSE #1
.....
```

LOF (Length-of-File)

The LOF function returns the length in bytes of an OPENed file.

The example illustrates how the length of the file "Pricelist" is returned:

```
10 OPEN "PRICELIST" AS #5
20 PRINT LOF(5)
.....
```

8. OUTPUT FROM FINGERPRINT, cont'd.

5. Output to Communication Channels

Output from a *Fingerprint* program can be directed to any serial communication channel OPENed for sequential OUTPUT following the same principles as for output to files (see chapter 8.3).

Note that in this case, the parallel communication channel "centronics:" cannot be used (one-way communication only).

The communication channels are specified by name as follows:
• "uart1:" • "uart2:" • "uart3:"

A special case is communication via the RS 422/485 interface board, where the communication channel "uart2:" is specified as "rs485:[n]" or "prel:[n;]rs485:" (also see chapter 7.9).

The following instructions are used in connection with output to a communication channel:

`OPEN`	Opens a serial communication channel for sequential output.
`PRINT#`	Prints data entered as numeric or string expressions to the selected channel.
`PRINTONE#`	Prints data entered as ASCII values to the selected channel.
`CLOSE`	Closes an OPENed channel.
`LOC`	Returns the remaining number of free bytes in the transmitter buffer of the selected communication channel.
`LOF`	Returns the remaining numbers of characters to be transmitted from the transmitter buffer is returned.
`COPY`	Copies a file to a communication channel.

Example 1 (prints the records “Record 1” and “Record 2” to the serial communication channel "uart3:"):

```
10   OPEN "uart3:" for OUTPUT AS #1
20   PRINT #1, "Record 1"
30   PRINTONE #1, 82;101;99;111;114;100;32;50
40   CLOSE #1
```

Example (prints the file "datafile" in a DOS-formatted memory card to the serial communication channel "uart2:"):

```
COPY "card1:datafile","uart2:"
```

6. Output to Display

The only device, other than the serial communication channels, that can be OPENed to receive output from a *Fingerprint* program, is the printer's LCD display ("console:"). This is explained in chapter 15.2 together with other methods for controlling the display.

9. DATA HANDLING

1. Preprocessing Input Data

All input data to the printer come in binary form via the various communication channels. Text files are transmitted in ASCII format, which upon reception will be preprocessed by the printer's software according to two instructions as to provide full compatibility between the printer and the host:

`MAP`	Remaps the selected character set.
`NASC`	Selects a suitable character set

A character received by the printer on a communication channel will first be processed in regard of possible MAP statements. Then the character will be checked for any COMSET or ON KEY... GOSUB conditions. When a character is to be printed, it will be processed into a bitmap pattern that makes up a certain character according to the character set selected by means of a NASC statement.

☞ ***COMSET statement***
Also see:
- Chapter 7.8

☞ ***ON KEY...GOSUB statement***
Also see:
- Chapter 15.1

`MAP`

The MAP statement is used to modify a character set or to filter out undesired characters on a specified communication channel by mapping them as Null (ASCII 0 dec).

If no character set meets your requirements completely (see NASC below), select the set that comes closest and modify it using MAP statements. Do not map any characters to ASCII values occupied by characters used in *Fingerprint* instructions, e.g. keywords, operators, %, $, #, and certain punctuation marks. Mapped characters will be reset to normal at power-up or reboot.

☞ ***Character Sets***
Also see:
- Intermec Fingerprint Reference Manual for complete character set tables.

Example. You may want to use the German character set (49) and 7 bits communication protocol. However, you need to print £ characters, but have no need for the & character. Then remap the £ character (ASCII 187 dec.) to the value of the & character (ASCII 38 dec.) . Type a series of & characters on the keyboard of the host and finish with a carriage return:

```
10   NASC 49
20   MAP 38,187
30   FONT "SW030RSN"
40   PRPOS 100,100
50   INPUT "Enter character";A$
60   PRTXT A$
70   PRINTFEED
RUN
Enter character?
```
(see note!)

Note!
If you use 7 bit communication, the printer cannot echo back the correct character to the host if its ASCII value exceeds 127, hence "`;`" characters will appear on the screen. Nevertheless, the desired "`£`" characters will be printed on the label.

Continued!

9. DATA HANDLING, cont'd.

1. Preprocessing Input Data, cont'd.

NASC

The NASC statement is used to select a character set that decides how the various ASCII characters transmitted from the host[1] will be printed. This instruction makes it possible to adapt the printer to various national standards. By default, ASCII characters will be printed according to the Roman 8 character set.

Suppose you order the printer to print the character ASCII 124 dec. If you check the character set tables at the end of the *Fingerprint 6.13 Reference Manual*, you will see that ASCII 124 will generate the character "|" according to the Roman 8 character set, "ù" according to the French character set and ñ according to the Spanish set etc. The same applies to a number of special national characters, whereas digits 0–9 and characters A–Z, a–z plus most punctuation marks are the same in all sets. Select the set that best matches your data equipment and printout requirements.

If none of the sets matches your requirements exactly, select the one that comes closest. Then, you can make final corrections by means of MAP statements, see above.

A NASC statement will have the following consequences:

- ***Text printing***
  Text on labels etc. will be printed according to the selected character set. However, instructions that already has been processed before the NASC statement is executed, will not be affected. This implies that labels may be multilingual.
- ***LCD display***
  New messages in the display will be affected by a preceding NASC statement. However, a message that is already displayed will not be updated automatically. The display is able to show most printable characters.
- ***Communication***
  Data transmitted from the printer via any of the communication channels will not be affected, as the data is defined by ASCII values, not as alphanumeric characters. The active character set of the receiving unit will decide the graphic presentation of the input data, e.g. on the screen of the host.
- ***Bar code printing***
  The pattern of the bars reflects the ASCII values of the input data and is not affected by a NASC statement. The bar code interpretation (i.e. the human readable characters below the bar pattern) is affected by a NASC statement. However, the interpretation of bar codes, that have been processed and are stored in the print buffer, before the NASC statement is executed, will not be affected.

This example selects the Italian character set:

```
NASC 39
```

[1] /. *We will not concern ourselves with how your computer and its keyboard are mapped. Refer to their respective manuals.*

9. DATA HANDLING, cont'd.

2. Input Data Conversion

There are a number of instruction for converting data in numeric or string expressions. You will find them used in many examples in this volume. The instructions will only be described in short terms. For full information, please refer to the *Fingerprint 6.13 Reference Manual*.

ABS

The ABS function returns the absolute value of a numeric expression. Absolute value means that the value is either positive or zero.

Example: *Yields:*

```
PRINT ABS (10–15)
5
```

ASC

The ASC function returns the decimal ASCII value of the first character in a string expression.

Example: *Yields:*

```
PRINT ASC("HELLO")
72
```

CHR$

The CHR$ function returns the readable character from a decimal ASCII value. This function is useful when you cannot produce a certain character from the keyboard of the host.

Example: *Yields:*

```
PRINT CHR$(72)
H
```

INSTR

The INSTR function searches a string expression for a certain character, or sequence of characters, and returns the position.

Example: *Yields:*

```
PRINT INSTR ("Intermec","NT")
2
```

LEFT$

The LEFT$ function returns a certain number of characters from the left side of a string expression, i.e. from the start. The complementary instruction is RIGHT$.

Example: *Yields:*

```
PRINT LEFT$("INTERMEC PRINTER",8)
INTERMEC
```

Continued!

9. DATA HANDLING, cont'd.

2. Input Data Conversion, cont'd.

LEN

The LEN function returns the number of characters including space characters in a string expression.

Example:

```
PRINT LEN ("INTERMEC TECHNOLOGIES CORP.")
```

Yields:

```
27
```

MID$

The MID$ function returns a part of a string expression. You can specify start position and, optionally, the number of characters to be returned.

Example:

```
PRINT MID$ ("INTERMEC PRINTER",10,2)
```

Yields:

```
PR
```

RIGHT$

The RIGHT$ function returns a certain number of characters from the right side of a string expression, i.e. from the end. The complementary instruction is LEFT$.

Example:

```
PRINT RIGHT$("INTERMEC PRINTER",7)
```

Yields:

```
PRINTER
```

SGN

The SGN function returns the sign (1 = positive, -1 = negative or 0 = zero) of a numeric expression.

Example:

```
PRINT SGN(5-10)
```

Yields:

```
-1
```

SPACE$

The SPACE$ function returns a specified number of space characters and is e.g. useful for creating tables with monospace characters.

Example:

```
10   FONT "MS050RMN"
20   X%=100 : Y%=300
30   FOR Q%=1 TO 5
40   INPUT "Commodity: ", A$
50   INPUT "Price $:", B$
60   C$=SPACE$(15-LEN(A$))
70   PRPOS X%,Y%
80   PRTXT A$+C$+"$ "+B$
90   Y%=Y%-40
100  NEXT
110  PRINTFEED
```

Note:
When entering the price in the example for SPACE$, make sure to use a period character (.) to indicate the decimal point.

Continued!

9. DATA HANDLING, cont'd.

2. Input Data Conversion, cont'd.

STR$

The STR$ function returns the string representation of a numeric expression. The complementary instruction is VAL.

Example:

```
10   A%=123
20   A$=STR$(A%)
30   PRINT A%+A%
40   PRINT A$+A$
RUN                                          Yields:
246
123123
```

STRING$

The STRING$ function returns a specified number of a single character specified either by its ASCII value or by being the first character in a string expression.

Example:

```
10   A$="*THE END*"
20   FIRST$=STRING$(4,42)
30   LAST$=STRING$(4,A$)
40   PRINT FIRST$+A$+LAST$
RUN                                          Yields:
*****THE END*****
```

VAL

The VAL function returns the numeric representation of a string expression. The complementary instruction is STR$.

VAL is for example used in connection with random files, which only accept strings (see chapters 7.5 and 8.4). Thus numeric expressions must be converted to string format using STR$ before they are PUT in a random file and be converted back to numeric values using VAL after you GET them back from the file.

Another application is when you want to calculate using data in a string expression, e.g. when reading the printer's clock (also see chapter 9.3).

Example of using the priner as an alarm clock (requires either a real-time clock or that the time has been set manually):

```
10   INPUT "Set Alarm"; A%
20   B%=VAL(TIME$)
30   IF B%>=A% THEN GOTO 40 ELSE GOTO 20
40   SOUND 880,100: END
RUN
```

9. DATA HANDLING, cont'd.

3. Date and Time

The printer's CPU board is provided with an internal clock/calendar without battery backup, i.e. the setting will be lost when the printer is turned off.

Fingerprint-compatible *EasyCoder* printers may also be fitted with a real-time clock circuit (RTC) in a socket on the CPU board. The RTC is battery backed-up and will keep on running even when the printer is turned off.

If no RTC is installed and you try the read the date or time before the internal clock has been set, an error will occur (error 1010 *"Hardware Error"*). Once either time or date has been set, the internal clock will work until next power off or reboot. If only time has been set, by default the current date will be Jan 01 1980 and if only date has been set, by default the clock will start running at 00:00:00.

The built-in calendar runs from 1980 through 2048 and corrects illegal values automatically, e.g. 981232 will be corrected to 990101.

Please refer to chapter 15.5 for information on how to **set** the printer's clock/calendar.

The standard formats for date and time are:

Date: **YYMMDD**, where...
YY are the two last digits of the year
MM are two digits representing the month (01–12)
DD are two digits representing the day (01–28|29|30|31)

Time: **HHMMSS** where...
HH are two digits representing the hour (00-23)
MM are two digits representing the minute (00-59)
SS are two digits representing the second (00-59)

In addition to the standard formats, other formats for date and time can be specified by the following instructions:

FORMAT DATE$	Specifies the format of date strings returned by DATE$ and DATEADD$ instructions.
FORMAT TIME$	Specifies the format of date strings returned by TIME$ and TIMEADD$ instructions.
NAME DATE$	Specifies the names of the months.
NAME WEEKDAY$	Specifies the names of the weekdays.

Continued!

3. Date and Time, cont'd.

The following instructions are used to read the clock/calendar:

`<svar> = DATE$` Returns the current date in standard format to a string variable.

`<svar> = DATE$("F")` Returns the current date in the format specified by FORMAT DATE$ to a string variable.

`<svar> = TIME$` Returns the current time in standard format to a string variable.

`<svar> = TIME$("F")` Returns the current time in the format specified by FORMAT TIME$ to a string variable.

**DATEADD$** Adds or subtracts a number of days to/from the current date or a specified date and returns it in standard format, or the format specified by FORMAT DATE$.

**TIMEADD$** Adds or subtracts a number of seconds to/from the current time or a specified moment of time and returns it in standard format, or the format specified by FORMAT TIME$.

DATEDIFF Calculates the difference in days between two specified dates.

TIMEDIFF Calculates the difference in seconds between two specified moments of time.

WEEKDAY Returns the weekday of a specified date as a numeric constant (1–7).

**WEEKDAY$** Returns the name of the weekday of a specified date in plain text according to the weekday names specified by NAME WEEKDAY$, or – if such a name is missing – the full name in English.

WEEKNUMBER Returns the week number of a specified date.

TICKS Returns the time passed since last startup in $^{1}/_{100}$ seconds.

Note that in most instructions, you can specify the current date or time by means of DATE$ or TIME$ respectively, e.g.:

```
WEEKDAY$ (DATE$)
TIMEDIFF (TIME$, "120000")
```

Continued!

9. DATA HANDLING, cont'd.

3. Date and Time, cont'd.

This example shows how the date and time is set in the immediate mode (not required if the printer has an RTC). The date and time formats are set and a table of the names of months is created. Finally, a number of date and time parameters are read and printed to the standard OUT channel after being provided with some explanatory text:

```
DATE$ = "980609"                                  (Setting the date)
TIME$ = "080000"                                  (Setting the time)

10   FORMAT DATE$ "MMM/DD/YYYY"
20   FORMAT TIME$ "hh.mm pp"
30   NAME DATE$ 1, "Jan":NAME DATE$ 2, "Feb"
40   NAME DATE$ 3, "Mar":NAME DATE$ 4, "Apr"
50   NAME DATE$ 5, "May":NAME DATE$ 6, "Jun"
60   NAME DATE$ 7, "Jul":NAME DATE$ 8, "Aug"
70   NAME DATE$ 9, "Sep":NAME DATE$ 10, "Oct"
80   NAME DATE$ 11, "Nov":NAME DATE$ 12, "Dec"
90   A%=WEEKDAY(DATE$)
100  PRINT WEEKDAY$(DATE$)+" "+ DATE$("F")+" "
     +TIME$("F")
110  PRINT "Date:",DATE$("F")
120  PRINT "Time:",TIME$("F")
130  PRINT "Weekday:", WEEKDAY$(DATE$)
140  PRINT "Week No.:",WEEKNUMBER  (DATE$)
150  PRINT "Day No.:", DATEDIFF ("950101",DATE$)
160  PRINT "Run time:", TICKS\6000;" minutes"
170  IF A%<6 THEN PRINT "This is ";WEEKDAY$(DATE$);
     ". Go to work!"
180  IF A%>5 THEN PRINT "This is ";WEEKDAY$(DATE$);
     ". Stay home!"
RUN
```

Yields e.g.:

```
Friday Jun/09/1998 08.00 am
Date:     Jun/09/1998
Time:     08.00 am
Weekday:  Friday
Week No.: 23
Day No.:  159
Run time: 1  minutes
This is Friday. Go to work!
```

This example shows how the TICKS function is used to delay the execution for a specified period of time:

```
10   INPUT "Enter delay in sec's: ", A%
20   B%=TICKS+(A%*100)
30   GOSUB 1000
40   END
1000 SOUND 440,50                                 (Start signal)
1010 IF B%<=TICKS THEN SOUND 880,100 ELSE GOTO 1010
1020 RETURN
RUN
```

9. DATA HANDLING, cont'd.

4. Random Number Generation

The *Fingerprint* firmware provides two instructions for generating random numbers, e.g. for use in test programs.

RANDOM

The RANDOM function generates a random integer within a specified interval.

This example tests a random dot on the printhead of a 8 dots/mm EasyCoder 501 printer:

```
10   MIN%=HEAD(-7)*85\100: MAX%=HEAD(-7)*115\100
20   DOTNO%=RANDOM(0,832)
30   IF HEAD(DOTNO%)<MIN% OR HEAD(DOTNO%)>MAX% THEN
40   BEEP
50   PRINT "ERROR IN DOT "; DOTNO%
60   ELSE
70   BEEP
80   PRINT "HEADTEST: OK!"
90   END IF
RUN
```

RANDOMIZE

To obtain a higher degree of randomization, the random number generator can be reseeded using the RANDOMIZE statement. You can either include an integer in the statement with which the generator will be reseeded, or a prompt will appear asking you to do so.

This example prints a random pattern of dots after the random number generator has been reseeded:

```
10   RANDOMIZE
20   FOR Q%=1 TO 100
30   X%=RANDOM(50,400)
40   Y%=RANDOM(50,400)
50   PRPOS X%,Y%
60   PRLINE 5,5
70   NEXT
80   PRINTFEED
RUN
```

Yields:

```
Random Number Seed (0 to 99999999) ?
```

(prompt)

Very high degree of randomization is obtained in the random integer generator is reseeded using e.g. TICKS:

```
10   RANDOMIZE TICKS
20   PRINT RANDOM (1,100)
RUN
```

10. LABEL DESIGN

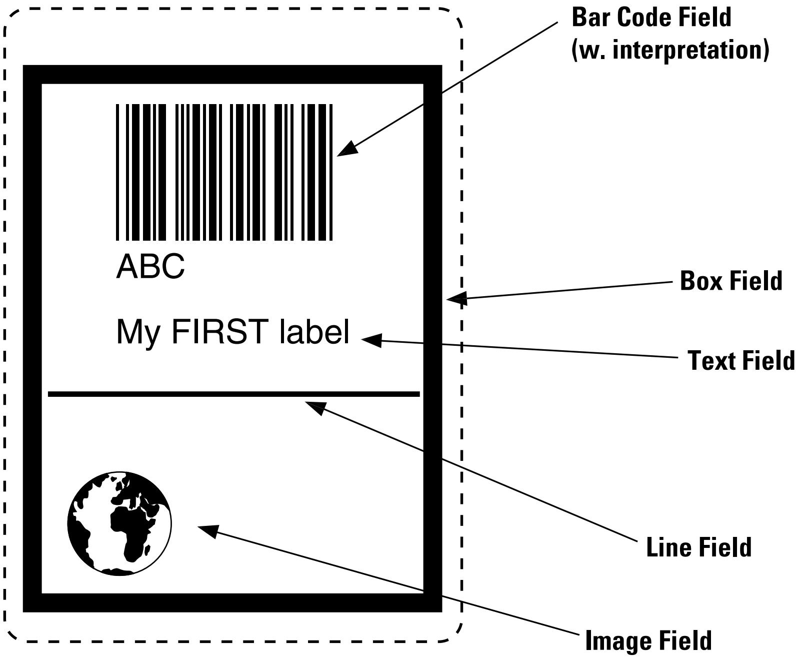
1. Creating a Layout

Field Types

A label layout is made up of a number of fields. There are five different types of fields:

- **Text Field** A text field consists of a single line of text.
- **Bar Code Field** A bar code field consists of a single bar code, with or without a bar code interpretation in human readable characters.
- **Image Field** An image field is a picture, drawing, logotype or other type of illustration in the internal *Fingerprint* bitmap format.
- **Box Field** A box field is a square or rectangular paper-coloured area surrounded by a black border line. If the border is sufficiently thick, the whole area may appear black.
- **Line Field** A line field is a black line that goes either along or across the paper web. A short but thick line can look like a black box.

There are no restrictions, other than the size of the printer's memory, regarding the number of fields on a single label.



Continued!

10. LABEL DESIGN, cont'd.

1. Creating a Layout, cont'd.

☞ ***PRINTFEED Statement***
Also see:
- Chapter 11.3

☞ ***Printer Setup***
Also see:
- Chapter 15.6
- Technical Manual

Origin

The positioning of all printable objects on the label, i.e. text fields, bar code fields, images, boxes, and lines, uses a common system. The starting point is called "origin" and is the point on the paper that corresponds to the innermost active dot on the printhead at the moment when the PRINTFEED statement is executed.

The location of the origin is affected by the following factors:

- *Position across the paper web (X-axis):*
  The position of the origin is determined by the *X-Start* value in the Setup Mode.
- *Position along the paper web (Y-axis):*
  The position of the origin is determined by the *Feed adjustment* in the Setup Mode and any FORMFEED<nexp> statements executed before the current PRINTFEED statement or after the preceding PRINTFEED statement.

Coordinates

Starting from origin, there is a coordinate system where the X-axis runs across the paper web from left to right (as seen when facing the printer) and the Y-axis runs along the paper web from the printhead and towards the rear end of the paper.

Units of Measure

The unit of measure is always "dots", i.e. all measures depend on the density of the printhead. For example, in a printer with an 8 dots/mm printhead, a dot is $^1/_8$ mm = 0.125 mm = 0.00492" or 4.92 mils. This implies that a certain label, originally designed for 8 dots/mm, will be printed smaller in an 11.81 dots/mm printer and larger in a 6 dots/mm printer.

Generally, a dot has the same size along both the X-axis and the Y-axis. An exception is 11.81 dots/mm printers, where – for technical reasons – there is a very small difference (see Technical Manual).

Insertion Point

The insertion point of any printable object is specified within this coordinate system by means of a PRPOS<x-pos>,<y-pos> statement. For example, "PRPOS 100, 200" means that the object will be inserted at a position 100 dots to the right of the origin and 200 dots further back along the paper.

Continued!

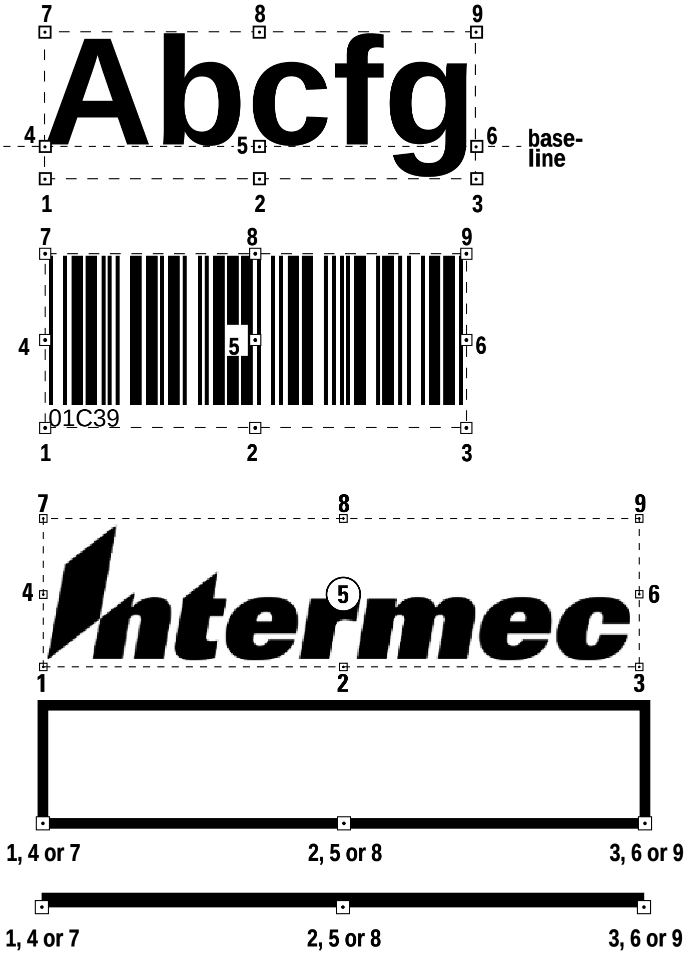
10. LABEL DESIGN, cont'd.

1. Creating a Layout, cont'd.

Alignment

Once the insertion point is specified, you must also decided which part of the object should match the insertion point. For example, a text field forms a rectangle. There are 8 anchor points along the borders and one in the centre. The anchor points are numbered 1–9 and specified by means of an ALIGN statement. By specifying e.g. ALIGN 1, you will place the lower left corner of the text field at the insertion point specified by PRPOS.

The illustration below shows the anchor points for the various types of fields. Refer to the *Intermec Fingerprint 6.13 Reference Manual, ALIGN statement* for detailed information on the anchor points of such bar codes, where the interpretation is an integrated part of the bar code pattern, e.g. EAN and UPC codes.



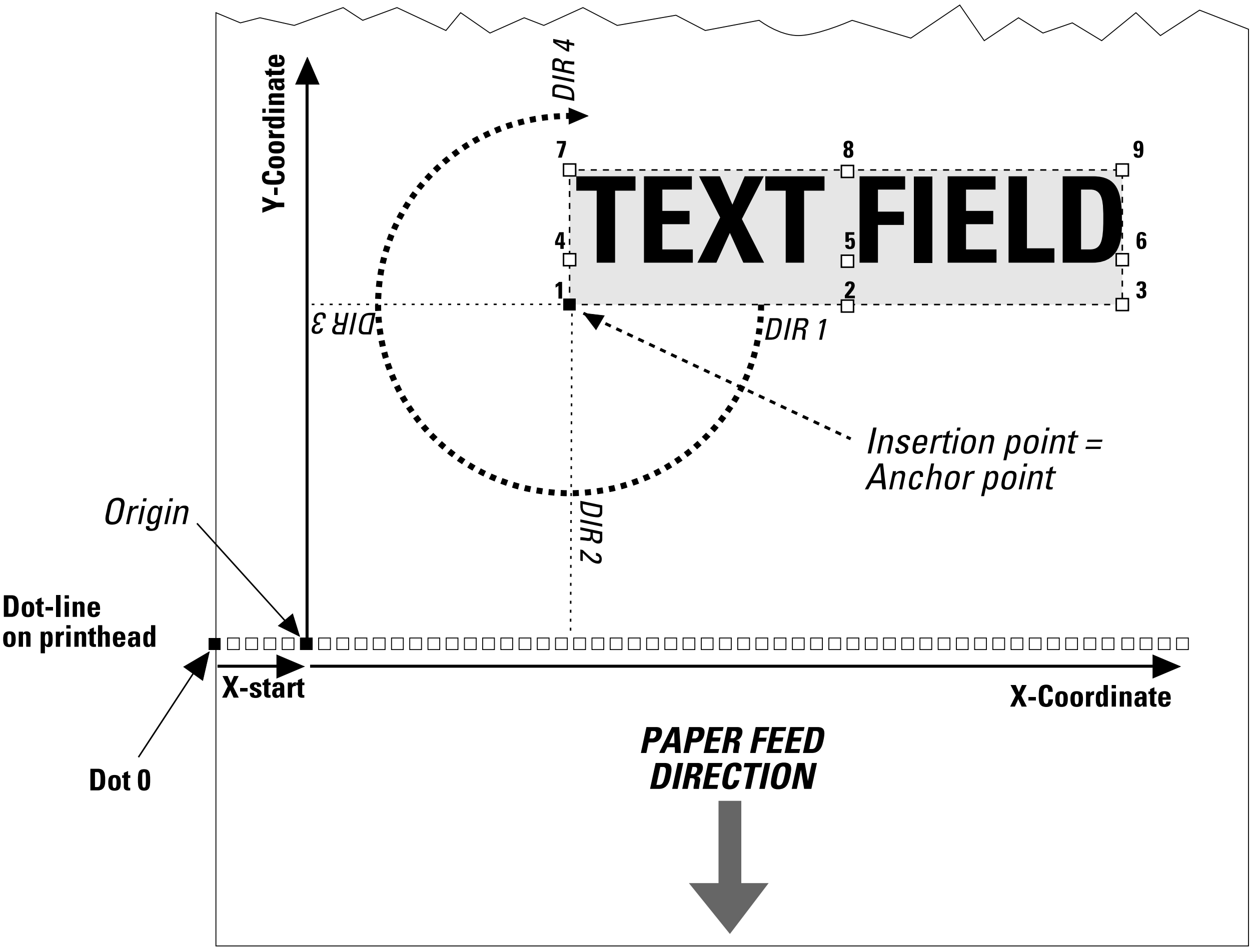
Continued!

10. LABEL DESIGN, cont'd.

1. Creating a Layout, cont'd.

Directions

Intermec Fingerprint allows printing in four different directions. Using a DIR statement, you can rotate the printable object clockwise around the anchor point/insertion point with a 90° increment (0°, 90°, 180°, or 270°), as illustrated below:



Continued!

10. LABEL DESIGN, cont'd.

1. Creating a Layout, cont'd.

Layout Files

In addition to the method described above, there is an alternative method using files for specifying the various fields and their input data separately (see chapter 10.7). However, the various parameters of the layout file are based on the same principles as described in chapters 10.1 – 10.6.

Checking Current Position

After having positioned and specified an object, you can find out the current position of the insertion point by means of a PRSTAT function. This implies that after having e.g. entered a line of text, you can find out how long it will be and where any new object will be placed unless a new position is specified.

- In print direction 1 or 3, PRSTAT (1) returns the absolute value of the insertion point along the X-axis, whereas PRSTAT (2) returns the Y-value of the last executed PRPOS statement.
- In print direction 2 or 4, PRSTAT (2) returns the absolute value of the insertion point along the Y-axis, whereas PRSTAT (1) returns the X-value of the last executed PRPOS statement.

Example:
An unknown number of logotypes will be printed with 10 dots spacing across the paper web. The size of the logotype is not known. To avoid an “field out of label” error, a limitation in regard of paper width is included (line 80, change if necessary).

```
10   PRPOS 0,50
20   PRIMAGE "GLOBE.1"
30   X%=PRSTAT(1)
40   FOR A%=1 TO 10
50   Z%=PRSTAT(1)
60   PRPOS Z%+10,50
70   PRIMAGE "GLOBE.1"
80   IF Z%>550 THEN GOTO 100
90   NEXT
100  PRINTFEED
110  END
RUN
```

Note:
The PRSTAT function can also be used for checking the printer's status in regard of a number of conditions, see chapter 16.3.

10. LABEL DESIGN, cont'd.

2. Text Field

A text field consists of one or several alphanumeric characters on the same line (max 300 characters). *Intermec Fingerprint* cannot wrap text to a new line, but each line must be specified as a separate text field.

In addition to the standard positioning statements PRPOS, ALIGN and DIR, a text field can contain the following instructions:

☞ ***Fonts***
Also see:
- Chapter 12

FONT (FT)

Specifies the bitmap font to be printed. There is no default font. Therefore, a font must **always** be specified or an error condition will occur. Once a font has been specified, it will be used in all text fields until a new FONT statement is executed.

Optionally, the extension can be included in the font name. If so, the extension of the selected font must match the print direction:
Extension .1 matches DIR 1 and DIR 3
Extension .2 matches DIR 2 and DIR 4

If no extension is specified in the font name, the software automatically selects the font according to the selected direction.

In some *EasyCoder* printers, outline fonts in *Speedo* and *TrueType* format can be scaled and converted to bitmap fonts.

MAG

Bitmap fonts can be magnified 1-4 times independently in regard of height and width. Scalable fonts can be scaled to a suitable size when the bitmap font is generated.

NORIMAGE
INVIMAGE

NORIMAGE (NI) / INVIMAGE (II)

Normally, text is printed in black on a paper-coloured background (NORIMAGE). Using INVIMAGE the printing can be inversed so the paper gives the colour of the characters, whereas the background will be black. The size of the background is decided by the character cell. A NORIMAGE statement is only needed when changing back from INVIMAGE printing.

PRTXT (PT)

Text can be entered in the form of numeric expressions and/or string expressions. Two or more expression can be combined using semicolons (;) or, in case of string expressions, by plus signs (+). String constants must be enclosed by double quotation marks ("..."). Variables are useful for printing e.g. time, date or various counters, and when the same information is to appear in several places, e.g. both as plain text and as bar code input data.

Continued!

10. LABEL DESIGN, cont'd.

2. Text Field, cont'd.

Summary:

To print a text field, the following information and instructions must be given (in most cases default values will substitute missing parameters):

Purpose	Instruction	Default	Remarks
X/Y Position	PRPOS (PP)	0/0	Number of dots
Alignment	ALIGN (AN)	1	Select ALIGN 1 – 9
Direction	DIR	1	Select DIR 1 – 4
Typeface	FONT (FT)	n.a.	e.g. "SW030RSN"
Magnification	MAG	1,1	Height 1–4, Width 1–4
Style	INVIMAGE (II)	no	White on black print
	NORIMAGE (NI)	yes	Blackprint (revokes INVIMAGE)
Text	PRTXT (PT)	n.a.	
Print a label	PRINTFEED (PF)	n.a.	Resets parameters to default

Example:

```
10   PRPOS 100,200
20   ALIGN 7
30   DIR 2
40   FONT "SW030RSN"
50   MAG 2,2
60   INVIMAGE
70   PRTXT "HELLO"
80   PRINTFEED
RUN
```

10. LABEL DESIGN, cont'd.

3. Bar Code Field

☞ ***Bar Codes***
Also see:
- Chapter 13

As standard, *Intermec Fingerprint* supports more than 30 of the most common bar code symbologies. Other two-dimensional bar codes and dot codes like PDF417, USD5, MaxiCode, and LEB are available as options. Each bar code (optionally including its human readable interpretation) makes up a bar code field.

In addition to the standard positioning statements PRPOS, ALIGN and DIR, a bar code field can contain the following instructions:

BARSET

This statement specifies the type of bar code and how it will be printed and can, if so desired, replace the following statements:

`BARHEIGHT (BH)`	Height of the bars in the code
`BARRATIO (BR)`	Ratio between wide and narrow bars
`BARTYPE (BT)`	Bar code type
`BARMAG (BM)`	Enlargement

The BARSET statement contains optional parameters for specifying complex 2-dimensional bar or dot codes, e.g. PDF417 (see *Intermec Fingerprint* Reference Manual).

For common one-dimensional bar codes the following parameters should be included in the statement:

• Bar code type	Name must be given according to list in chapter Appendix A.1 and be enclosed by double quotation marks ("..."). Default: "INT2OF5"
• Ratio (wide bars)	Default: 3
• Ratio (narrow bars)	Default: 1
• Enlargement	Affects the bar pattern but not the interpretation, unless the bar font is an integrated part of the code, e.g. EAN/UPC. Default: 2
• Height	Height of the bars in dots. Default: 100.

BARFONT...ON

Specifies the bitmap font or fonts to be used for the bar code interpretation (human readables). You can e.g. specify one barfont for printing across the web (DIR 1 & 3) and another for printing along the web (DIR 2 & 4).

Optionally, the extension can be included in the barfont name. If so, the extension of the selected barfont must match the print direction:
Extension .1 matches DIR 1 and DIR 3
Extension .2 matches DIR 2 and DIR 4

If no extension is specified in the font name, the firmware automatically selects the barfont according to the selected direction.

Continued!

10. LABEL DESIGN, cont'd.

3. Bar Code Field, cont'd.

☞ ***Fonts***
Also see:
- Chapter 12

BARFONT...ON, cont'd.

In some *EasyCoder* printers, outline fonts in *Speedo* and *TrueType* format can be scaled and converted to bitmap fonts.

By default, no barfont is selected. However, in some bar codes the interpretation is an integrated part of the code, EAN/UPC.

The bar font(s) can also be specified in regard of:

• Distance	Specifies the distance in dots between the bottom of the bar pattern and the top of the interpretation characters. Default: 6.
• Magnification (height)	Specifies the magnification in regard of height. Default: 1
• Magnification (width)	Specifies the magnification in regard of width. Default: 1
• ON	Enables the printing of the interpretation. Default: Disabled

BARFONT OFF

To disable bar code interpretation printing, use BARFONT OFF.

PRBAR (PB)

Input data to be used to generate the bar code can be entered in the form of a numeric or expressions. String constants must be enclosed by double quotation marks ("..."). Variables are useful for printing e.g. time, date or various counters, and when the same information is to appear in several places, e.g. both as plain text and as bar code input data.

Summary

To print a bar code field, the following information and instructions be must given (in most cases default values will substitute missing information):

Purpose	Instruction	Default	Remarks
X/Y Position	PRPOS (PP)	0/0	Number of dots
Alignment	ALIGN (AN)	1	Select ALIGN 1 – 9
Direction	DIR	1	Select DIR 1 – 4
Bar Code Select	BARSET	see above	
Human Readables	BARFONT...ON	Off	Can be omitted
Input Data	PRBAR (PB)	n.a.	
Print a label	PRINTFEED (PF)	n.a.	Resets parameters to default

Example:

```
10   PRPOS 50,500
20   ALIGN 7
30   DIR 4
40   BARSET "CODE39",2,1,3,120
50   BARFONT #2,"SW030RSN",5,1,1 ON
60   PRBAR "ABC"
70   PRINTFEED
RUN
```

10. LABEL DESIGN, cont'd.

4. Image Field

☞ ***Image Downloading***
Also see:
- Chapter 14

An image field is a field containing a picture or logotype, which has been converted to the internal bitmap format of *Intermec Fingerprint*.

In addition to the standard positioning statements PRPOS, ALIGN and DIR, an image field can contain the following instructions:

MAG

Images can be magnified 1-4 times independently in regard of height and width.

NORIMAGE (NI) / INVIMAGE (II)

Normally, images are printed as created, i.e. in black without any background (NORIMAGE). Using INVIMAGE the black and non-printed background can exchange colours. The size of the background is decided by the size of the image. A NORIMAGE statement is only needed when changing back from INVIMAGE printing.

PRIMAGE (PM)

Specifies the image by name in the form of a string expression. A string constant must be enclosed by double quotation marks ("..."). A string variable may be useful when the same image is to appear in several places. The extension indicates the suitable directions:
Extension .1 matches DIR 1 and DIR 3
Extension .2 matches DIR 2 and DIR 4

Summary

To print an image field, the following instructions must be given (in most cases default values will substitute missing information):

Purpose	**Instruction**	**Default**	**Remarks**
X/Y Position	PRPOS (PP)	0/0	Number of dots
Alignment	ALIGN (AN)	1	Select ALIGN 1 – 9
Direction	DIR	1	Select DIR 1 – 4
Magnification	MAG	1,1	Height 1–4, Width 1–4
Style	INVIMAGE (II)	no	Black and white parts switched
	NORIMAGE (NI)	yes	Normal (revokes INVIMAGE)
Image	PRIMAGE (PM)	n.a.	.1 or .2 depending on direction
Print a label	PRINTFEED (PF)	n.a.	Resets parameters to default

Example:

```
10   PRPOS 50,50
20   ALIGN 9
30   DIR 3
40   MAG 2,2
50   INVIMAGE
60   PRIMAGE "GLOBE.1"
70   PRINTFEED
RUN
```

10. LABEL DESIGN, cont'd.

5. Box Field

A box is a hollow square or rectangle that can be rotated with an increment of 90° according to the print direction. If the line thickness is sufficiently large, the box will appear to be filled (another method is to print an extremely thick short line).

In addition to the standard positioning statements PRPOS, ALIGN and DIR, a box field can only contain the following instruction:

PRBOX (PX)

Specifies the size of the box in regard of height, width and line weight (thickness) in dots.

Summary

To print a box, the following information and instructions must be given (in some cases default values will substitute missing information):

Purpose	Instruction	Default	Remarks
X/Y Position	PRPOS (PP)	0/0	Number of dots
Alignment	ALIGN (AN)	1	Select ALIGN 1 – 9
Direction	DIR	1	Select DIR 1 – 4
Box spec:s	PRBOX (PX)	n.a.	Height, width and line weight in dots
Print a label	PRINTFEED (PF)	n.a.	Resets parameters to default

Example:

```
10   PRPOS 250,250
20   ALIGN 1
30   DIR 3
40   PRBOX 200,200,10
50   PRINTFEED
RUN
```

10. LABEL DESIGN, cont'd.

6. Line Field

A line can be printed in right angles along or across the paper according to the print direction.

In addition to the standard positioning statements PRPOS, ALIGN and DIR, a line field can only contain the following instruction:

PRLINE (PL)

Specifies the size of the line in regard of length and line weight (thickness) in dots.

Summary

To print a line, the following information and instructions must be given (in some cases default values will substitute missing information):

Purpose	Instruction	Default	Remarks
X/Y Position	PRPOS (PP)	0/0	Number of dots
Alignment	ALIGN (AN)	1	Select ALIGN 1 – 9
Direction	DIR	1	Select DIR 1 – 4
Line spec:s	PRLINE (PL)	n.a.	Length and thickness in dots
Print a label	PRINTFEED (PF)	n.a.	Resets parameters to default

Example:

```
10   PRPOS 100,100
20   ALIGN 1
30   DIR 4
40   PRLINE 200,10
50   PRINTFEED
RUN
```

10. LABEL DESIGN, cont'd.

7. Layout Files

Introduction

Many application, e.g. in connection with booking and ticketing, require the label layout as well as variable input data and logotypes to be sent to the printer as files or arrays. This method requires less programming in the printer and less data to be transferred between printer and host, but some kind of overhead program in the host, that handles file transfers as well as the input of data, is of great help.

The *Intermec Fingerprint* instruction is a statement called LAYOUT. Before using this statement, a number of files or arrays must be created.

Creating a Layout File

The basis of the method is a layout file in random format, that contains a number of records of various types, each with a length of 52 bytes.

Each record starts with a 2-byte **hexadecimal** element number (bytes 0–1) which is used to link the layout record with a variable input record or a record in a layout name file as explained later.

Byte 2 contains a single character that specifies the type of record:
A = Logotype (specified by its name)
B = Bar Code
C = Character (i.e. plain text)
E = Bar code extended field
Corresponds to 6 last parameters in BARSET statement. Must have lower element number than the corresponding barcode record (B).
H = Bar Code Font
J = Baradjust (corresponds to BARADJUST statement)
L = Logotype (specified by its number)
S = Separation line
X = Box

The remaining bytes are used differently depending on type of record and may specify direction, position, font etc. Each such instruction corresponds to an *Intermec Fingerprint* instruction, e.g. direction corresponds to DIR statement, alignment to ALIGN, x- and y-positions to PRPOS etc.

Text and bar code records can contain both fixed and variable data. The fixed data (max. 20 characters) are entered in the layout record. A parameter (bytes 43–44) specifies how many characters (starting from the first character) of the fixed data that will be printed or used to generate the bar code. Possible variable data will be appended to the fixed data at the position specified in bytes 43–44.

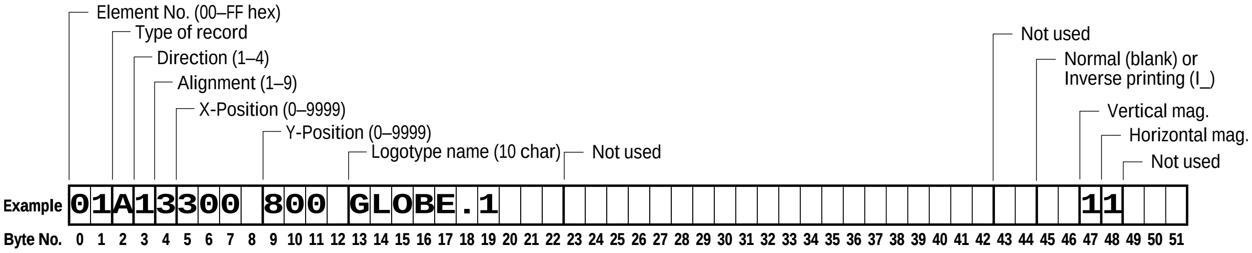
Continued!

10. LABEL DESIGN, cont'd.

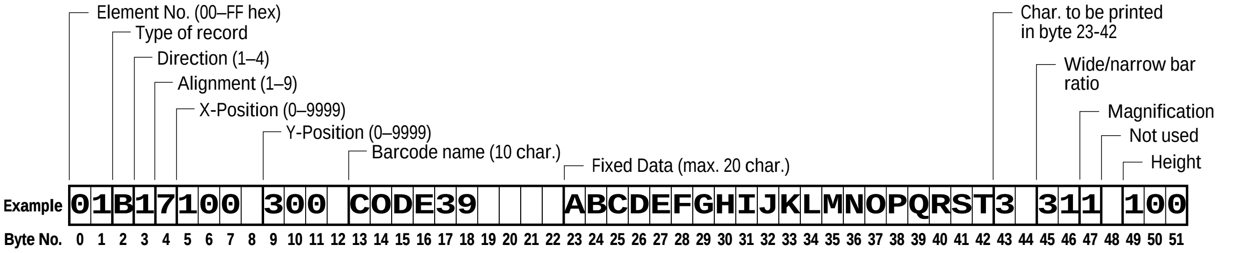
7. Layout Files, cont'd.

Creating a Layout File, cont'd.

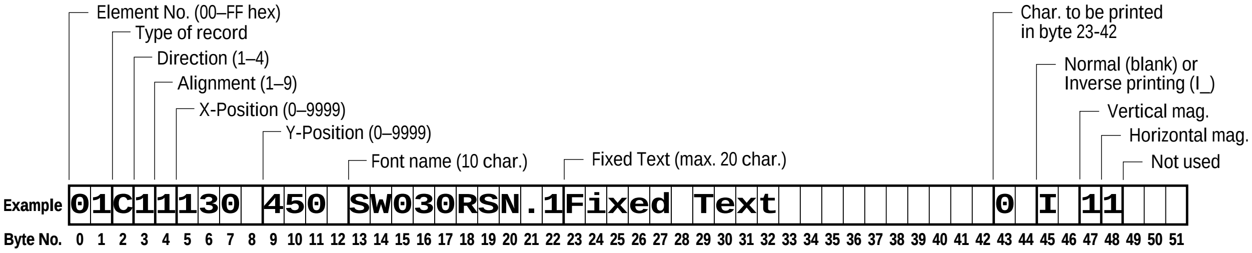
LOGOTYPE RECORD (by name):



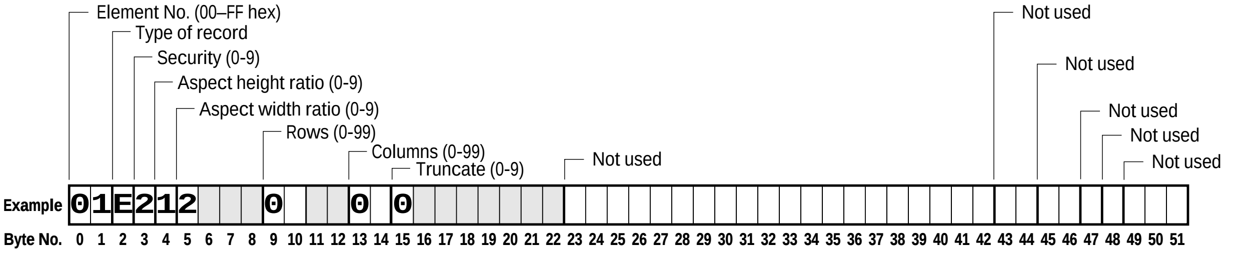
BAR CODE RECORD:


Element No. (00–FF hex)
Type of record
Direction (1–4)
Alignment (1–9)
X-Position (0–9999)
Y-Position (0–9999)
Barcode name (10 char.)
Fixed Data (max. 20 char.)
Char. to be printed in byte 23-42
Wide/narrow bar ratio
Magnification
Not used
Height
Example
01B17100 300 CODE39 ABCDEFGHIJKLMNOPQRST3 311 100
Byte No. 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51

TEXT RECORD:


Element No. (00–FF hex)
Type of record
Direction (1–4)
Alignment (1–9)
X-Position (0–9999)
Y-Position (0–9999)
Font name (10 char.)
Fixed Text (max. 20 char.)
Char. to be printed in byte 23-42
Normal (blank) or Inverse printing (I_)
Vertical mag.
Horizontal mag.
Not used
Example
01C11130 450 SW030RSN.1Fixed Text 0 I 11
Byte No. 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51

BAR CODE EXTENDED FIELD RECORD:



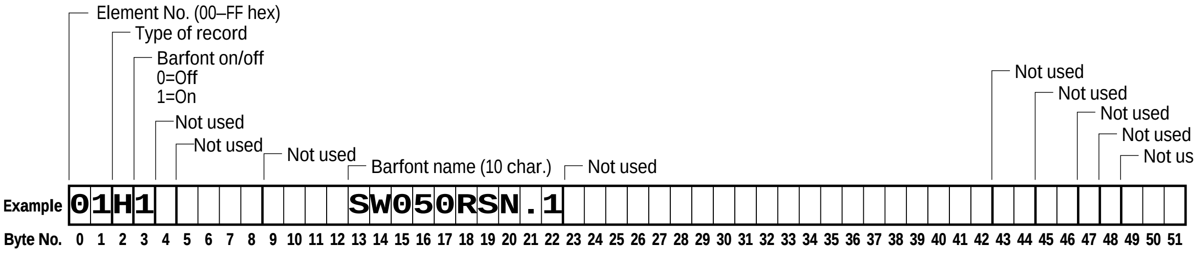
Continued!

10. LABEL DESIGN, cont'd.

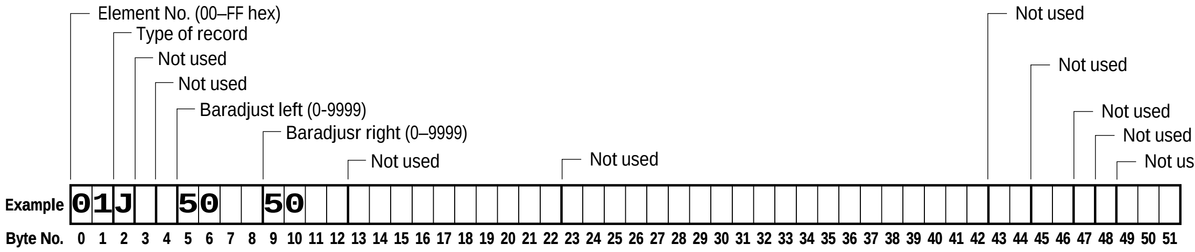
7. Layout Files, cont'd.

Creating a Layout File, cont'd.

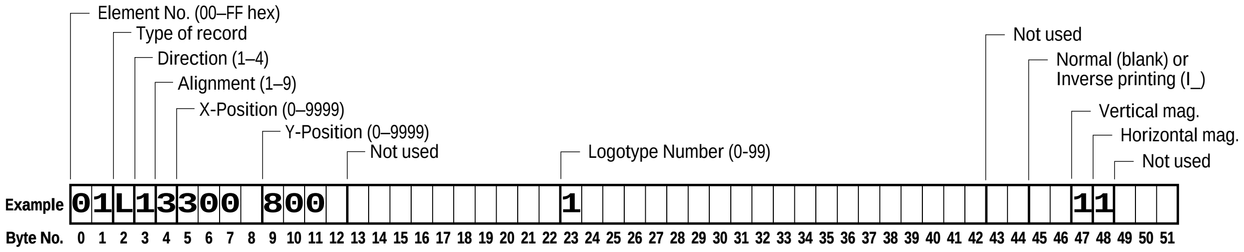
BAR CODE INTERPRETATION RECORD:



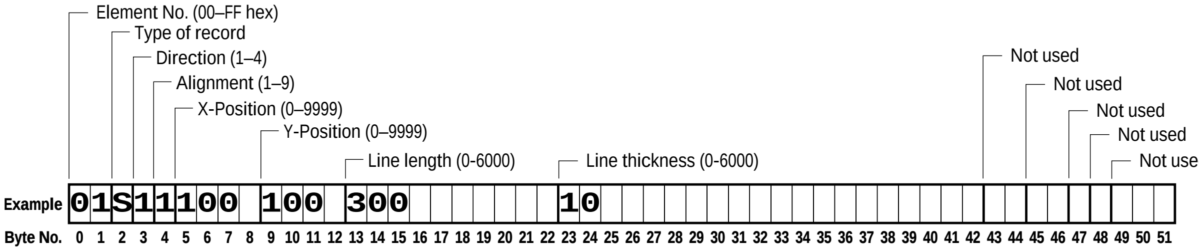
BARADJUST RECORD:



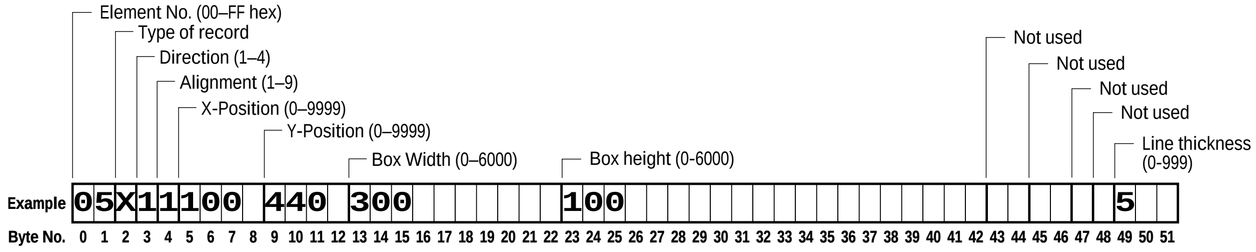
LOGOTYPE RECORD (by number):



LINE RECORD:



BOX RECORD:



Continued!

10. LABEL DESIGN, cont'd.

7. Layout Files, cont'd.

Creating a Layout File, cont'd.

This example shows how a small layout file can be composed:

```
10 OPEN "LAYOUT.DAT" FOR OUTPUT AS 2                                   Open random file
20 PRINT #2, "01H1         SW030RSN.1                             ";   Barfont record
30 PRINT #2, "02C11100 650 SW030RSN.1Fixed Text          11I 22   ";   Text record
40 PRINT #2, "02C11130 450 SW030RSN.1Fixed Text          0   11   ";   Text record
50 PRINT #2, "03B17100 300 CODE39    ABC                 3 311 100";   Bar code record
60 PRINT #2, "04A12300 800 GLOBE.1                           11   ";   Logotype record
70 PRINT #2, "05X11100 440 300       100                       5  ";   Box record
80 PRINT #2, "06S11100 100 300       10                           ";   Line record
90 CLOSE 2                                                             Close file
```

There are certain rules that should be observed:

- Each record must be exactly 52 bytes long and be appended by a semicolon (;).
- It is essential that the different types of data are entered exactly in the correct positions. Any input in unused bytes will be ignored.
- The records are executed in the order they are entered. The reference number at the start of each record does not affect the order of execution. This implies that a barfont record will affect all following bar code records, but not those already entered.
- When using bar code interpretation, do not enter a bar code record directly after a record with inverse printing, since the bar code interpretation will be inversed as well. A text or logotype record without inverse printing between the bar code record and the inversed record will reset printing to normal.

Creating a Logotype Name File

Next step is to create a logotype name file. This is a necessary step even if you are not going to use any logotype in your layout (in this case the file can be empty). In the layout file, you can set a logotype record to use logotypes specified either by name or by number.

- If you specify logotype-by-name (record type A), the printer's entire memory will be searched for an image with the specified name. A logotype-by-name file is composed by a number of records with a length of 10 bytes each that contain the image names, e.g.:

  ```
  10 OPEN "LOGNAME.DAT" FOR OUTPUT AS 1
  20 PRINT#1, "GLOBE.1   "
  30 PRINT#1, "GLOBE.2   "
  40 PRINT#1, "DIAMONDS.1"
  50 PRINT#1, "DIAMONDS.2";
  60 CLOSE 1
  ```

  Note that the last record in a sequential file must be appended by a semicolon (;).

Continued!

10. LABEL DESIGN, cont'd.

7. Layout Files, cont'd.

Creating a Logotype Name File, cont'd.

- If you specify logotype-by-number (record type L), you must have a logotype name file. A logotype-by-number file is composed by a number of records with a length of 13 bytes each. The first 2 bytes is a reference number (0–99), the third byte is always a colon (:) and the following 10 bytes are used for the image name:

```
10 OPEN "LOGNAME.DAT" FOR OUTPUT AS 1
20 PRINT#1, "0 :GLOBE.1   "
30 PRINT#1, "1 :GLOBE.2   "
40 PRINT#1, "2 :DIAMONDS.1"
50 PRINT#1, "3 :DIAMONDS.2";
60 CLOSE 1
```

Note that the last record in a sequential file must be appended by a semicolon (;).

Creating a Data File or Array

You will also need a data file or data array. This file or array contains variable data that will be placed in the position specified by the layout. Each data record starts with a **hexadecimal** element number (00-FF hex) that links the data to the layout record or records that start with the **same** element number. Thus you can e.g. use a single data record to generate a number of text fields with various locations and appearances as well as to generate a bar code.

IMPORTANT!
The LAYOUT statement requires that you use the same format (either files or arrays) for both data and errors.

If you for some reason do not use variable data, you will still need to create either an empty data file or an empty data array.

☞ ***Arrays***
Also see:
- Chapter 6.10

- Create a **data array** like this:

```
10   DIM LAYDATA$(7)
20   LAYDATA$(0)="01Mincemeat"
30   LAYDATA$(1)="0AVeal"
40   LAYDATA$(2)="17Roast Beef"
50   LAYDATA$(3)="3FSausages"
60   LAYDATA$(4)="02Venison"
70   LAYDATA$(5)="06Lamb Chops"
80   LAYDATA$(6)="7CPork Chops"
```

- You can create a **data file** with the same content in a similar way:

```
10   OPEN "LAYDATA.DAT" FOR OUTPUT AS 1
20   PRINT#1,"01Mincemeat"
30   PRINT#1,"0AVeal"
40   PRINT#1,"17Roast Beef"
50   PRINT#1,"3FSausages"
60   PRINT#1,"02Venison"
70   PRINT#1,"06Lamb Chops"
80   PRINT#1,"7CPork Chops";
90   CLOSE 1
```

Note that the last record in a sequential file must be appended by a semicolon (;).

Continued!

10. LABEL DESIGN, cont'd.

7. Layout Files, cont'd.

Creating an Error File or Array

The last requirement is an error file or array that can store any errors that may occur. If you use a data array, you must use an error array, and if you use a data file, you must use an error file. The following errors will be stored and presented in said order:

1 If an error occurs in a layout record, the number of the record (1...nn) and the error number is placed in the error array or file.

2 If a data record cannot be used in a layout record, an the index of the unused data record (0...nn) plus the error code -1 is placed in the error array or file.

☞ ***Arrays***
Also see:
- Chapter 6.10

- ***Error arrays*** must be large enough to accommodate all possible errors. Thus, use a DIM statement to specify a one-dimensional array with a number of elements that is twice the sum of all layout records plus twice the sum of all data records. You should also include some routine that reads the array, e.g.:

```
10 DIM QERR%(28)
20 QERR%(0)=0
.....
190 IF QERR%(1)=0 THEN GOTO 260
200 PRINT "-ERROR- LAYOUT 1"
210 I%=0
220 IF QERR%(I%)=0 THEN GOTO 260
230 PRINT "ERROR ";QERR%(I%+1);" in record ";QERR%(I%)
240 I%=I%+2
250 GOTO 220
260 PRINTFEED
```

- ***Error files*** require a little more programming to handle the error message, e.g.:

```
220 OPEN "ERRORS.DAT" FOR INPUT AS 10
230 IF EOF(10) THEN GOTO 280 ELSE GOTO 240
240 FOR A%=1 TO 28
250 INPUT #10, A$
260 PRINT A$
270 NEXT A%
280 PRINTFEED
```

Note that the loop in line 240 must be large enough to accommodate all possible errors.

Continued!

10. LABEL DESIGN, cont'd.

7. Layout Files, cont'd.

Using the Files in a LAYOUT Statement

Now, you have all the files you need to issue a LAYOUT statement. This statement combines the layout file, the logotype file, the data file/array, and the error file/array into a printable image. Depending on whether you have selected to use data and error files or arrays, the statement will have a somewhat different syntax:

Files:

LAYOUT F, <layout file>, <logotype file>,<data file>,<error file>

Arrays:

LAYOUT <layout file>,<logotype file>,<data array>,<error array>

Note that you cannot omit any file or array, since the syntax requires a file name or array designation in each position. If you, for example, do not require any logotype, you must still create an empty logotype file.

Example:
The example below shows a simple layout created using the layout statement in combination with data and error arrays:

```
10  DIM QERR%(28)
20  LAYDATA$(0)="02Var. input"
30  LAYDATA$(1)="03 PRINTER"
40  QERR%(0)=0
50  OPEN "LOGNAME.DAT" FOR OUTPUT AS 1
60  PRINT #1, "Intermec.1";
70  CLOSE 1
80  REM:LAYOUT FILE
90  OPEN "LAYOUT.DAT" FOR OUTPUT AS 2
100 PRINT #2, "01H1         SW030RSN.1                             ";
110 PRINT #2, "02C11100 650 SW030RSN.1Fixed Text          11I 22   ";
120 PRINT #2, "02C11130 450 SW030RSN.1Fixed Text          0   11   ";
130 PRINT #2, "03B17100 300 CODE39    ABC                 3 311 100";
140 PRINT #2, "04A12300 800 GLOBE.1                           11   ";
150 PRINT #2, "05X11100 440 300       100                       5  ";
160 PRINT #2, "06S11100 100 300       10                           ";
170 CLOSE 2
180 LAYOUT "LAYOUT.DAT","LOGNAME.DAT",LAYDATA$,QERR%
190 IF QERR%(1)=0 THEN GOTO 260
200 PRINT "-ERROR- LAYOUT 1"
210 I%=0
220 IF QERR%(I%)=0 THEN GOTO 260
230 PRINT "   ERROR   "; QERR%(I%+1); " in record "; QERR%(I%)
240 I%=I%+2
250 GOTO 220
260 PRINTFEED
RUN
```

11. PRINTING CONTROL

1. Paper Feed

In order to provide maximum flexibility, there are a number of instructions for controlling the paper feed without actually printing any labels:

`CLEANFEED`	Runs the printer's paper feed mechanism in order to facilitate cleaning of the print roller.
`FORMFEED`	Feeds out a blank label or optionally feeds out or pulls back a certain amount of paper without printing.
`TESTFEED`	Feeds out a blank label while adjusting the label stop sensor or black mark sensor.
`LBLCOND`	Overrides the paper feed setup.

The paper is feed past the printhead by a rubber-coated roller driven by a stepper motor controlled by the firmware. The movement of the paper is detected by the label stop sensor (LSS) or black mark sensor (BMS), except when various types of paper strip are used.

The printer's setup in regard of *Service; Media Size; Length* and *Service; Media Type* is essential for how the paper feed will work. There are four or five different types of *Media Type* options (also see Technical Manual):

- Label (w gaps)
- Ticket (w mark) *(some printer models only)*
- Ticket (w gaps)
- Fix length strip
- Var length strip

When a FORMFEED, TESTFEED or PRINTFEED statement is executed, the photoelectrical label stop sensor detects the front edge of each new label or the front edge of each detection gap (or the alternative black mark sensor detects the front edge of each black mark), as the paper is moved past the sensor in question.

By performing a couple of FORMFEED or TESTFEED operations after loading a new supply of paper, the firmware is able to measure the distance between the front edges of two consecutive labels, thereby determining the label length, and can adjust the paper feed accordingly. The same principle applies to tickets or tags with detection gaps and tickets with black marks.

In case of paper strip, the LSS will only detect possible out-of-paper conditions, and the amount of paper feed is decided in two different ways:

- ***Fixed length strip***
  The amount of paper feed for each FORMFEED, TESTFEED and PRINTFEED operation is decided by the *Service; Media Size; Length* setup.

Continued!

11. PRINTING CONTROL, cont'd.

1. Paper Feed, cont'd.

- ***Variable length strip***
  At the execution of a PRINTFEED, the firmware will add a sufficient amount of paper feed after the last printable object to allow the paper to be torn off. Note that e.g. a blank space character or a “white” part of an image is also regarded as a printable object. The length of TESTFEED and FORMFEED operations is decided by the *Service; Media Size; Length* setup.

The *Detection; Feedadjust* setup allows you to perform two global adjustments to the paper feed described above:

- *Start Adjust*
- *Stop Adjust*

By default, both are set to 0, which allows for proper tear-off operation when there is no requirement of printing immediately at the front edge of the label (or equivalent media).

- Start Adjust decides how much paper will be fed out or pulled back before the FORMFEED, TESTFEED or PRINTFEED is executed. Usually, there is a small distance between the dispenser shaft or tear off edge and the printhead. Thus, if you want to start printing directly at the front edge of the label, you must pull back the paper before printing by means of a negative start adjust value.
- Stop Adjust decides how much extra or less paper will be fed out after the FORMFEED, TESTFEED or PRINTFEED is executed.

Note that so far we have only discussed how the paper feed will work regardless which program is run or what labels are printed.

There are several ways to let the program control the paper feed without changing the setup:

- **FORMFEED**
  As already mentioned, if the FORMFEED statement is issued without any specification of the feed length, it will feed out a complete blank label (or the equivalent). But if the FORMFEED statement is specified as a positive or negative number of dots, it can be used to substitute or modify the global Start Adjust and Stop Adjust setup as a part of the program execution. It is important whether the FORMFEED statement is executed before or after the PRINTFEED statement:
  - FORMFEED **before** PRINTFEED corresponds to Start Adjust.
  - FORMFEED **after** PRINTFEED corresponds to Stop Adjust.

- **LBLCOND**
  The LBLCOND statement can be used to override the values for the Start Adjust and/or Stop Adjust set in the Setup Mode. It can also be used to disable the LSS/BMS for a specified length of paper feed, e.g. to avoid text or pictures on the backside of a ticket being mistakenly detected as black marks, or when using irregularly shaped labels.

Continued!

11. PRINTING CONTROL, cont'd.

1. Paper Feed, cont'd.

The relation between paper and printhead when the PRINTFEED statement is executed decides all positioning along the Y-axis, i.e. along the paper web. Likewise, the relation between the paper and the cutting edge when a CUT statement is executed decides where the paper will be cut off.

2. Preparing the Printing

In some applications, it is essential that the printout is delivered immediately after the printing has been triggered, e.g. by an external device, see chapter 7.10. The PRINTFEED NOT statement is used for such purposes.

PRINTFEED NOT

This statement does not produce any printout, but prepares the printer by preprocessing as much of the label layout as the size of image buffer allows. Thus the printing can start as soon as a PRINTFEED statement is executed. The larger the image buffer, the more processing time is saved.

3. Printing

The following instructions are used in connection with the actual printing:

`CUT`	Activates the optional paper cutter.
`CUT ON/OFF`	Enables/disables automatic cut-off operation in connection with each PRINTFEED statement.
`LTS& ON/OFF`	Enables/disables the label-taken sensor.
`PRINT KEY ON/OFF`	Enables/disables PRINTFEED execution by means of the <**Print**> key.
`PRINTFEED`	Prints a single label, ticket, tag or piece of strip, or a batch of labels, tickets etc.

CUT

Activates the optional paper cutter. As opposed to the CUT ON/OFF statement (see below), this statement allows you to control the cutter independently from the PRINTFEED statements. Since there is a longer distance from the printhead to the cutting edge than to the tear-off edge, the paper feed will need to be adjusted by means of the Start- and Stopadjust setup or FORMFEED statements.

CUT ON/OFF

Enables/disables automatic cut-off initiated by each PRINTFEED statement and also allows you to decide the distance in dots by which the paper will be fed out before cutting and pulled back afterwards.

Continued!

11. PRINTING CONTROL, cont'd.

3. Printing, cont'd.

LTS& ON/OFF

These statements enables or disables the label-taken sensor, which is an photoelectrical sensor that detects when a label has not been removed from the printer's outfeed slot, and holds the printing until the label has been removed.

PRINT KEY ON|OFF

These two instructions can only be issued in the Immediate Mode and in the *Intermec Direct Protocol* and enables/disables a single PRINTFEED operation to be automatically executed each time the <**Print**> key is pressed.

PRINTFEED (PF)

At the execution of a PRINTFEED statement, the firmware processes all previously entered text fields, bar code fields, image fields, box fields and line fields (see chapter 10) into a bitmap pattern. The bitmap pattern controls the heating of the printhead dots and the stepper motor that feeds the paper past the printhead. By default, each PRINTFEED statement produces one single copy, but the size of a batch of labels (or the equivalent) can optionally be specified.

The execution of a PRINTFEED statement (as opposed to PRINTFEED NOT) resets these statements to their respective default values:

```
ALIGN       BARFONT    BARFONT ON/OFF  INVIMAGE
BARHEIGHT   BARMAG     BARRATIO        MAG
BARTYPE     DIR        FONT            PRPOS
BARSET
```

This does only affect new statements executed after the PRINTFEED statement, but not already executed statements. The amount of paper fed out at the execution of a PRINTFEED statements under various conditions was discussed in chapter 11.1.

Example (printing five identical labels):

```
10   PRPOS 100, 100
20   FONT "SW030RSN"
30   PRTXT "TEST LABEL"
40   PRINTFEED 5
RUN
```

Example (printing five copies of the same label layout with consecutive numbering):

```
10   FOR A%=1 TO 5
20   PRPOS 100, 100
30   FONT "SW030RSN"
40   PRTXT "LABEL ";A%
50   PRINTFEED
60   NEXT A%
RUN
```

Continued!

11. PRINTING CONTROL, cont'd.

4. Length of Last Feed Operation

ACTLEN

This function returns the approximate length in dots of most recently executed paper feed operation. It can for example be used to determine the length of the labels before printing a list, so the list can be divided into portions that fit the labels.

Example:

```
10   FORMFEED
20   PRINT ACTLEN
RUN
```

5. Batch Printing

The term *“Batch Printing”* means the process of printing several labels without stopping the paper feed motor between labels. The labels may be exact copies or differ more or less in appearance.

For batch printing, the most critical factor is the time required to process the print image, as specified by the program, into a bitmap pattern and store it in the image buffer. The image buffer compensates for differences between processing time and printing time. If the label layout is too large as to be stored in its entity in the image buffer, the layout will be divided into a number of segments across the paper feed direction, that will be processed one after the other and downloaded to the image buffer. As the buffer is emptied by printing, a new segment can be processed and downloaded.

A large image buffer takes more time to process and fill, which may delay the start of the printing, whereas a small image buffer may be emptied before a new segment has been processed and downloaded. The print speed is also important. Obviously, the faster a label is printed, the faster next segment or label must be processed.

There are a number of instructions that facilitate batch printing:

FIELDNO	Divides the program into portions that can be cleared individually.
CLL	Clears part or all of the image buffer.
OPTIMIZE ON	Enables optimizing. Three optimizing strategies are available.
OPTIMIZE OFF	Disables optimizing.

When using batch printing, consider this:

- The program must be written as to allow batch printing.
- In case of small differences between labels, make use of CLL and FIELDNO instructions and write the program so the variable data are processed last.
- Always use the OPTIMIZE "BATCH" ON strategy.
- Increase or decrease the size of the image buffer as to obtain a smooth flow of data to the printhead.

Continued!

11. PRINTING CONTROL, cont'd.

5. Batch Printing, cont'd.

Should any problems arise, e.g. the printer stops between labels, the image buffer is probably too small. Increase the image buffer in the Setup Mode, lower the print speed, or make the print image easier to process. Vertical printing (DIR 2 & 4) is more demanding for text in regard of buffer size and processing time. If possible, design the label so most of the text is printed horizontally (DIR 1 & 3). The print direction does not matter so much for bar codes, lines, boxes and images. However, ladder style bar codes (DIR 2 & 4) generally lowers the print speed.

CLL & FIELDNO

The image buffer stores the bitmap pattern of the label layout between processing and printing. The size of the image buffer is decided in the Setup Mode. The image buffer can be cleared partially or completely by means of a CLL statement.

- Complete clearing is obtained by a CLL statement without any reference to a field (see below) and is useful to avoid printing a faulty label after certain errors have occurred.
- Partial clearing is used in connection with print repetition when only part of the label should be modified between the copies. In this case, the CLL statement must include a reference to a field, specified by a FIELDNO function. When a CLL statement is executed, the image buffer will be cleared from the specified field to the end of the program.

In this example, the text “Month” is kept in the image buffer, whereas the names of the months are cleared from the image buffer as soon as they are printed, one after the other:

```
10   FONT "SW030RSN"
20   MAG 2,2
30   PRPOS 100,300
40   PRTXT "MONTH:"
50    PRPOS 100,200
70   A%=FIELDNO
80   PRTXT "JANUARY":PRINTFEED
90   CLL A%
100  PRPOS 100,200
110  PRTXT "FEBRUARY":PRINTFEED
120  CLL A%
130  PRPOS 100,200
140  PRTXT "MARCH":PRINTFEED
150  CLL A%
RUN
```

Continued!

11. PRINTING CONTROL, cont'd.

5. Batch Printing, cont'd.

OPTIMIZE ON/OFF

The OPTIMIZE ON statement is used to speed up batch printing. There are three optimizing strategies:

"PRINT" The processing, which is performed before the printing starts, is minimized on the basis of an analysis of the preceding label's appearance.

"STRING" All printable strings are converted to bitmap format, which makes the printing faster, provided the strings are not altered between copies. However, this requires more RAM memory. Should any difficulties be encountered during printing, disable the "STRING" optimizing strategy and try again.

"BATCH" The program execution will not wait for the label to be printed, but proceeds as soon as the print image has been transferred to the image buffer.

If no strategy is specified in the OPTIMIZE ON statement, both "PRINT" and "STRING" optimizing strategies will be enabled at the same time.

In case of batch printing with LTS& OFF and CUT OFF, the "BATCH" optimizing strategy is automatically enabled.
OPTIMIZE OFF revokes OPTIMIZE ON.

Continued!

12. FONTS

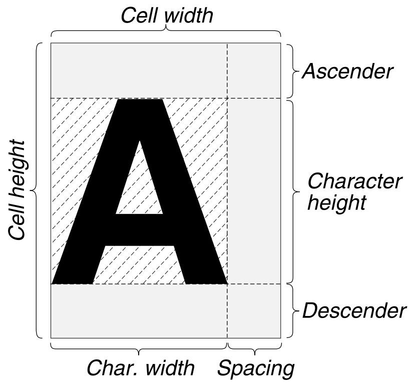
1. Bitmap Fonts

Fonts in *Intermec Fingerprint* come in bitmap format and are derived from scalable outline fonts in *Speedo* or *TrueType* format. Usually, each font comes in two versions, one has the extension "**.1**" and is used for printing across the paper web (DIR 1 & 3), and another with the extension "**.2**" for printing along the paper web (DIR 2 & 4). Fonts can be used both for printing plain text and bar code interpretations in human readable characters (barfonts).

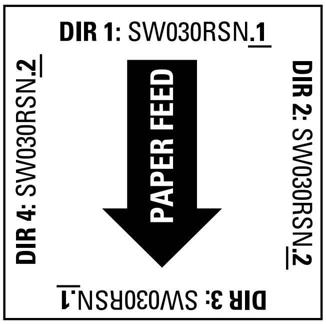
Note that there is no default font. Before a text or bar code interpretation can be printed, a font must be specified using a FONT or BARFONT statement. An exception is such bar codes where the interpretation is an integrated part of the code, e.g. EAN and UPC.

If no extension is included in the name of the font or barfont, the firmware will automatically select the version that fits the current print direction.

The *Intermec Fingerprint* EPROMs fitted in the first pair of sockets on the CPU board always contain the fonts "SW030RSN.1" and "SW030RSN.2.". The other EPROMs may contain additional fonts.



Height of the character cell



Print directions and fontname extensions.

The *Intermec Fingerprint* font designation system is made up by 10 characters providing information on the characteristics of the font:

VVnnnXYZ.d, where....

VV is a two-character abbreviation of the font name, e.g. SW for Swiss, MS for Monospaced, or PS for Prestige.

nnn is the height of the font matrix cell in dots incl. ascenders and descenders.

X is the style:
R = Regular (Roman)
I = *Italic*
B = **Bold**
O = ***Bold Italic***

Y is the letter spacing:
S = Proportionally spaced.
M = Monospaced

Z is the character width:
N = Normal
C = Compressed
E = Extended

. is a separating period character between name and extension.

d is the extension, which specifies in which print directions the font can be used:
1 = DIR 1 & DIR 3
2 = DIR 2 & DIR 4

Example:
SW030RSN.1 means "**S**wiss, **030** dots high, **R**egular, Proportionally **s**paced, **N**ormal width, Direction **1** & 3".

Continued!

12. FONTS, cont'd.

2. Converting Outline Font Files via Toolbox

Outline font files in *Speedo* format can be converted to the *Intermec Fingerprint* *.ATF format using the *Toolbox Fonts* program. The *.ATF fonts can then be specified in regard of direction and range of characters and be converted to binary files in *Toolbox Configuration*, after which they are either stored as fonts in EPROM's or memory cards, or downloaded to the printer's RAM memory, e.g. using the *Kermit* protocol (see chapter 6.8) or the FILE& LOAD statement.

Fonts can be deleted from the RAM memory using a REMOVE FONT statement.

3. Converting Outline Font Files via Scalable Fonts Kit

Some printer models have a CPU board with a third pair of EPROM sockets, e.g. *EasyCoder 401/501/601*. Such printers can be fitted with a *"Scalable Fonts Kit"* which allows standard outline font files in *Speedo* and *TrueType* formats to be converted to bitmap fonts in sizes and appearances decided by a FONT statement.

Fonts converted from outline font files by means of a FONT statement can be given any name, but it is recommended to follow the *Intermec Fingerprint* convention regarding extensions.

Intermec Shell Enhanced provides an even easier way of converting outline font files to bitmap fonts, provided the printer is fitted with **both** a *"Scalable Fonts Kit"* **and** a keyboard. The operator is prompted by messages in the display to specify the various parameters via the printer's keyboard (see the Technical Manual).

Fonts converted from *Intermec Shell* are automatically given a name based on the name of the original outline font file.

After conversion, the bitmap fonts will be stored in the printer's RAM memory, either permanently or until next power up. Fonts can be deleted from the RAM memory using a REMOVE FONT statement.

4. Converting .ATF Fonts

In printers fitted with the two extra EPROMs of the scalable fonts kit, it is possible to use the statement FONTLOAD to download and convert fonts in .ATF format to the printer's memory, where they can be saved either permanently or until next power-up. Fonts can be deleted from the RAM memory using a REMOVE FONT statement.

Continued!

12. FONTS, cont'd.

5. Listing Fonts

Regardless in which parts of the memory the different bitmap fonts are stored, they can all be listed to the standard OUT channel by a single statement, namely FONTS. This statement does not list dedicated bar code fonts.

Another method of listing bitmap fonts is to use a FONTNAME$ function, which also will list dedicated barcode fonts.

Font files can be listed to the standard OUT channel by means of the FILES statement.

This example shows how all fonts can be listed:

```
10   A$ = FONTNAME$(0)
20   IF A$ ="" THEN END
30   PRINT A$
40   A$ = FONTNAME$(-1)
50   GOTO 20

RUN
```

5. Special Fonts

If you have special requests regarding fonts, these can be solved in different ways:

- Order a set of configuration EPROM:s or a memory card containing the font(s) you require directly from your local *Intermec* distributor.
- Use *Toolbox* to convert an outline font file to bitmap format and download it to the desired part of the printer's memory (EPROM's, RAM memory or memory card).
- Use the optional *“Scalable Fonts Kit”* to convert an outline font file to a bitmap font (certain printer models only).
- Use the FONT LOAD statement to download fonts in .ATF format (certain printer models only).

Outline font files can be bought directly from *Intermec*.

For more information on the conversion of fonts, please refer to:

- *Intermec Fingerprint 6.13* Reference Manual, FONT and FONT LOAD statements.
- Technical Manual; Scalable Fonts Kit (some printer models only)
- *Toolbox 4.0*, Programmer's Manual (only available in *UBI* version).

13. BAR CODES

1. Standard Bar Codes

A large number of commonly used bar code symbologies are included in the *Intermec Fingerprint* EPROMs fitted in the first pair of sockets on the CPU board. As an option, Configuration and ROM-expansion EPROMs may contain additional bar codes according to the customer's request. Bar codes cannot be downloaded to the printer, but must be ordered from *Intermec* and “burned” into EPROMs using e.g. the *Toolbox Configuration* program.

Some bar codes require special barcode fonts, e.g. UPC and EAN bar codes.

Bar codes cannot be listed by means of any *Intermec Fingerprint* instruction. As standard, *Intermec Fingerprint 6.13* contains the following bar codes.

Bar Code Type	Designation
Codabar	"CODABAR"
Code 11	"CODE11"
Code 39	"CODE39"
Code 39 full ASCII	"CODE39A"
Code 39 w. checksum	"CODE39C"
Code 93	"CODE93"
Code 128	"CODE128"
DUN-14/16	"DUN"
EAN-8	"EAN8"
EAN-13	"EAN13"
EAN-128	"EAN128"
Five-Character Supplemental Code	"ADDON5"
Industrial 2 of 5	"C2OF5IND"
Industrial 2 of 5 w. checksum	"C2OF5INDC"
Interleaved 2 of 5	"INT2OF5"
Interleaved 2 of 5 w. checksum	"I2OF5C"
Interleaved 2 of 5 A	"I2OF5A"
Matrix 2 of 5	"C2OF5MAT"
MSI (modified Plessey)	"MSI"
Plessey	"PLESSEY"
Straight 2 of 5	"C2OF5"
Two-Character Supplemental Code	"ADDON2"
UCC-128 Serial Shipping Container Code	"UCC128"
UPC-5 digits Add-On Code	"SCCADDON"
UPC-A	"UPCA"
UPC-D1	"UPCD1"
UPC-D2	"UPCD2"
UPC-D3	"UPCD3"
UPC-D4	"UPCD4"
UPC-D5	"UPCD5"
UPC-E	"UPCE"
UPC Shipping Container Code	"UPCSCC"

Continued!

13. BAR CODES, cont'd.

2. Special Bar Codes

Special bar codes, such as PDF417, USD-5, MaxiCode and LEB code, can be ordered from *Intermec*, either in the form of ready-made configuration EPROM:s, or as “object files” that can be burned into EPROM:s by means of the program *Toolbox Configuration* and a EPROM programming device.

At the moment of the publishing of this manual, the following **optional** bar codes were available:

Bar Codes	Designation
Code 16K	"CODE16K"
Code 49	"CODE49"
LEB	"LEB"
MaxiCode	"MAXICODE"
PDF 417	"PDF417"
Philips	"PHILIPS"
Philips (alternative designation)	"DOT CODE A"
USD5	"USD5"

14. IMAGES

1. Images vs Images Files

There is a similar distinction between *"Images"* and *"Image Files"*as with *"Fonts"* and *"Font Files"* (see chapter 12):

- "Image" is a generic term for all kinds of printable pictures, e.g. symbols, logotypes or other illustrations, in the **internal** bitmap format of *Intermec Fingerprint*.
- "Image Files" are files in various bitmap formats that can be converted to "Images" in the internal bitmap format of *Intermec Fingerprint*. Images files can be stored in the printer's memory, but cannot be used for printing before they have been converted to "Images".

2. Standard Images

As standard, the *Intermec Fingerprint* EPROMs fitted in the first pair of sockets on the CPU board contain the GLOBE.1 image for training purposes and a few other images used for printing test labels. Other images may be included in the Configuration EPROMs depending on application program or according to the customers request. Such images can converted from images files in .PCX or .PCC format by the *Toolbox Configuration* program and can be "burned" into the configuration EPROMs.

3. Downloading Image Files

☞ ***Downloading via Kermit***
Also see:
- Chapter 6.8

Image files in .PCX format can be downloaded to the printer's RAM memory using the *Kermit* protocol and then converted to *Intermec*'s internal image format by means of the instruction RUN "pcx2bmp" (see chapter 6.5) .

Image files in .PCX format can also be both downloaded and converted to images by means of the IMAGE LOAD statement.

The program *Toolbox Image* can be used to convert and download image files in .PCC or .PCX format to images and store them in the printer's RAM memory.

☞ ***Image Transfer Protocols***
Also see:
- Intermec Fingerprint Reference Manual

Image files in Intel hex formats, or formats according to *Intermec Fingerprint* file transfer protocols UBI00, UBI01, UBI02, UBI03, or UBI10, can be downloaded to the printer's RAM memory using the instructions STORE (obsolete), STORE IMAGE, STORE INPUT and STORE OFF, e.g.:

```
10   STORE OFF
20   INPUT "Name:", N$
30   INPUT "Width:", W%
40   INPUT "Height:", H%
50   INPUT "Protocol:", P$
60   STORE IMAGE N$, W%, H%, P$
70   STORE INPUT 100
80   STORE OFF
RUN
```

Continued!

14. IMAGES, cont'd.

3. Downloading Image Files, cont'd.

The system variable SYSVAR allows you to check the result of an image download by means of STORE or STORE INPUT:

- `SYSVAR (16)` reads the number of bytes received.
- `SYSVAR (17)` reads the number of frames received.

Both values are reset when a new STORE IMAGE statement is executed.

4. Listing and Removing Images

The names of all images stored in the various parts of the printer's memory can be listed to the std. OUT channel by means of an IMAGES statement or a program using the IMAGENAME$ function.

Image files can be listed to the std. OUT channel by means of a FILES statement.

Images can be removed from the RAM memory using a REMOVE IMAGE statement.

15. PRINTER FUNCTION CONTROL

1. Keyboard

Note:
An external keyboard does not work in the Setup and Test Modes.

All *Intermec Fingerprint*-compatible *EasyCoder* printers are provided with at least one key or button. *Enhanced* models have a set of numeric keys supplemented with a number of function keys. This also applies to *EasyCoder 201 IISA* (Stand-Alone). *EasyCoder 501 SA* (Stand-Alone) has a full QWERTY keyboard, like a typewriter, supplemented by numeric and function keys. Separate alphanumeric keyboards are available as options.

The keys have three purposes:

- To control the printer in the Setup and Test Modes, and to some extent also in the Immediate Mode.
- To enter input data in the form of ASCII characters.
- To make the program execution branch to subroutines according to ON KEY...GOSUB statements.

Note that input from the printer's keyboard (see chapter 7.6) excludes the use of ON KEY...GOSUB statements (see chapter 5.8) and vice versa.

Controlling the Printer in the Setup, Test, and Immediate Modes

- The use of the keyboard in the *Setup Mode* is described in the Technical Manual for the printer model in question.
- The use of the keyboard in the *Test Mode* is described in the Service Manual for the printer model in question.
- In a printer running in the *Immediate Mode*, only three keys are working:
  - The <**Print**> key or button produces a FORMFEED operation, or – if the printhead is lifted – runs the printer's print roller a number of rotations in order to facilitate cleaning (CLEANFEED).
  - The <**Feed**> key works the same way as the <**Print**> button.
  - The <**Setup**> or <**Save**> key gives access to the Setup Mode.
- In the Immediate Mode, the printing of labels by means of the print key can be enabled or disabled using a PRINT KEY ON/ OFF statement, also see chapter 11.3.

Enabling the Keys

Before a key can be used to make the execution branch to a subroutine using an ON KEY...GOSUB statement, the key must be enabled using a KEY...ON statement. Enabled keys can also be disabled again using KEY...OFF statements.

However, the keyboard can also be used to enter input data (provided "console:" is OPENed for INPUT), and also be used in the Setup and Test Modes, regardless if the keys are enabled or not.

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

1. Keyboard, cont'd.

Key Id. Numbers

The keys are specified by identification numbers in connections with the following statements:

`KEY...ON`	Enables the specified key.
`KEY...OFF`	Disables the specified key.
`ON KEY...GOSUB...`	Branches the program execution to a subroutine when the specified key is pressed.

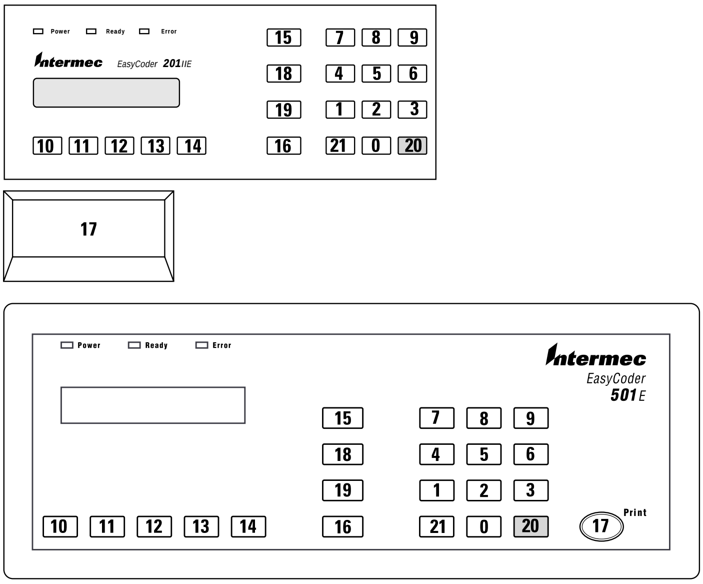
Each key has two id. numbers, one for its **unshifted** position and another for its **shifted** position[1]. By default, the <**C**> key works as Shift key (compare with the shift key of a typewriter).

To select the shifted position of a certain key, keep the Shift key (<**C**>) depressed while you press the desired key. The id. number of the shifted key is equal to its unshifted id. number **+ 100**. For example, the <**F1**> key has id. number 10 in unshifted position, but id. number 110 in shifted position.

The illustration below shows the default id. numbers of the keyboards of the *Enhanced* models of *EasyCoder 201 II* and *501/601*. The id. number of the <**Print**> button or key also applies to printers models without keyboard, such as *Easycoder 201 IIS*, *EasyCoder 401*, *Easycoder 501S*, and *EasyCoder 601S*.

If the keyboard is remapped (see later in this chapter), the id. numbers will be affected.

[1] */. Due to technical restrictions in the keyboard decoding, some keys will not work in Shifted position depending on the combination of printer model and selected Shift key.*



Default I.d. numbers of the most common keyboard types in the *EasyCoder* printer line.
(Some printers only have a Print key or button)

The **C** or Clear key (i.d. No. 20) works as a Shift key. When pressed in connection with another key, it adds 100 to the i.d number of the other key.

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

1. Keyboard, cont'd.

Key-initiated Branching

What will happen when an enabled key is pressed is decided by an ON KEY...GOSUB statement, that branches the program execution to a subroutine, where additional instructions specify the action to be taken. Refer to chapter 5.8 for further information and additional program example.

Here is an example of how two keys (<F1> and <F2>) are enabled and used to branch to different subroutines. The keys are specified by their id. numbers (10 and 11 respectively):

```
10   KEY (10) ON: KEY (11) ON
20   ON KEY (10) GOSUB 1000
30   ON KEY (11) GOSUB 2000
40   GOTO 40
50   END
1000 PRINT "You have pressed F1"
1010 RETURN 50
2000 PRINT "You have pressed F2"
2010 RETURN 50
RUN
```

Audible Key Response

Each time a key is pressed, the printer's beeper will, by default, emit a short signal (1200 Hz for 0.03 sec). The frequency and duration of the signal can be globally changed for **all** keys by means of a KEY BEEP statement. Obviously, setting the frequency or duration to 0 will turn off the signal for all keys.

Input from Printer's Keyboard

Provided "console:" is OPENed for sequential INPUT, the keys can be used to enter ASCII characters to the program using the following instructions:

`INPUT#`	reads a string of data to a variable.
`INPUT$`	reads a limited number of characters to a variable.
`LINE INPUT#`	reads an entire line to a variable.

Refer to chapter 7.6 for a table showing the ASCII values that the various keys generate and for a program example. Note that input from keyboard does not require any keys to be enabled.

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

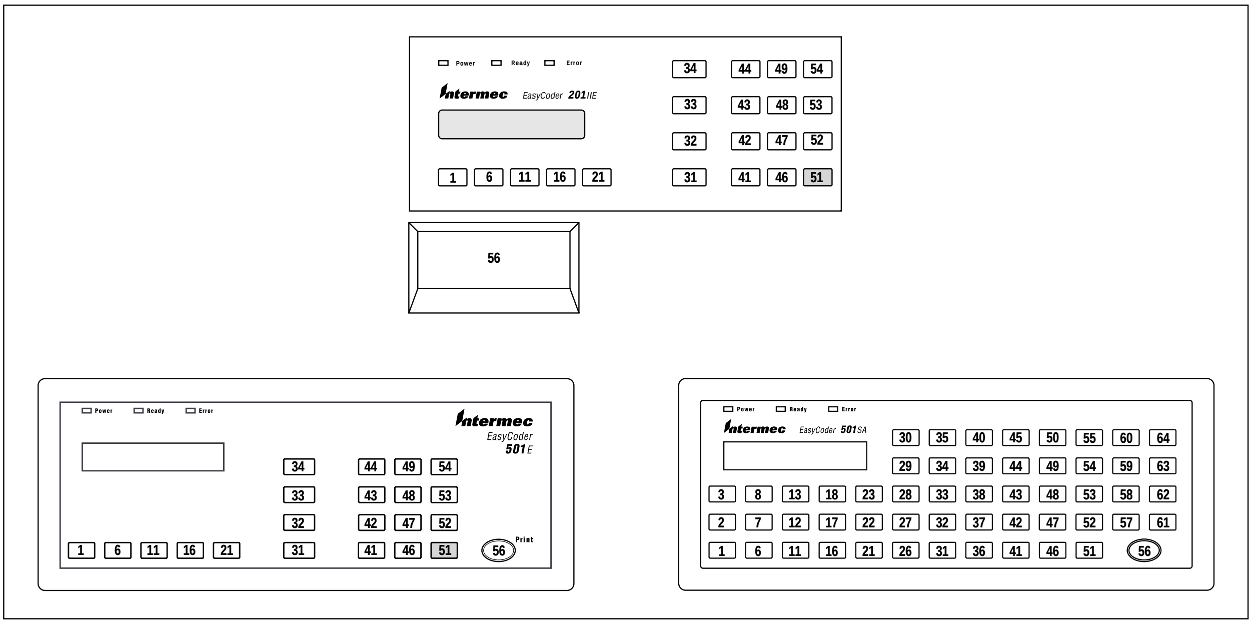
1. Keyboard, cont'd.

Remapping the Keyboard

The keyboards of the various printer models are fully remappable[1], as to allow the printer to be adapted to special applications or national standards. Thus you can decide which two ASCII characters each key will produce, with and without the Shift key being activated, and which key will work as Shift key. The mapping also decides the id. numbers for the keys.

The basis of the remapping process is the position number of each key. The numbers vary between different types of keyboards, as illustrated below.

Note the distinction between id. numbers and position numbers!



The present keyboard mapping can be read to a string variable using the KEYBMAP$ instruction with the following syntax:

<string variable>=KEYBMAP$(n) *where....*

n = 0 reads the unshifted characters.
n = 1 reads the shifted characters.
n = 2 reads the position of the Shift key.

This example reads the unshifted characters on the keyboard of an EasyCoder 501 E. Non existing key positions get ASCII value 0:

```
10   PRINT "Pos","ASCII","Char."
20   A$=KEYBMAP$(0)
30   FOR B%=1 TO 64
40   C$=MID$(A$,B%,1)
50   E%=ASC(C$)
60   PRINT B%,E%,C$
70   NEXT
RUN
```

Continued!

[1]/. *There is one exception: The single <Print> key on the EasyCoder 401/501 cannot be remapped.*

15. PRINTER FUNCTION CONTROL, cont'd.

1. Keyboard, cont'd.

Remapping the Keyboard, cont'd.

You can also use the KEYBMAP$ instruction to remap the keyboard, using the following syntax:

KEYBMAP$(n) = <string> *where...*

n = 0 maps the unshifted characters in ascending pos. No. order.
n = 1 maps the shifted characters in ascending pos. No. order.
n = 2 maps the position of the Shift key.

The string that contains the desired keyboard map should contain the desired character for each of 64 key positions (in ascending order) regardless if the keyboard contains that many keys.

Characters, that cannot be produced by the keyboard of the host, can be substituted by CHR$ functions, where the character is specified by its ASCII decimal value according to the selected character set (see NASC statement). The same applies to special characters. See table below.

Non-existing key positions are mapped as Null, i.e. CHR$(0).

The key appointed as <**Shift**> key is specified by its keyboard position number in a separate string.

The single <**Print**> key of *EasyCoder 401/501* cannot be remapped.

ASCII decimal values for Special Keys

Special key	Unshifted	Shifted	Special key	Unshifted	Shifted
F1	1	129	Ins	18	146
F2	2	130	⇐	19	147
F3	3	131	⇒	20	148
F4	4	132	Feed	28	156
F5	5	133	Setup	29	157
C (Clear)	8	136	Pause	30	158
Enter	13	141	Print	31	159
Alt	14	142	Del	127	255
Save	15	143	Shift	144	
Caps	17	145			

In this example, the unshifted keyboard map is read back to the host. The string is modified (<F1> is replaced by <Feed>) and used to change the keyboard map.

```
10 A$ = KEYBMAP$(0)
20 B$ = CHR$(28) + MID$(A$,2)
30 KEYBMAP(0)=B$
40 END
```

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

1. Keyboard, cont'd.

Remapping the Keyboard, cont'd.

The following example illustrates the mapping of the keyboard for an EasyCoder 201 IIE (unshifted keys only). Note the limit of max. 300 characters per program line that makes it necessary to divide the string between two lines:

```
10  A$=CHR$(1)+CHR$(0)+CHR$(0)+CHR$(0)
    +CHR$(0)+CHR$(2)+CHR$(0)+CHR$(0)+CHR$(0)
    +CHR$(0)+CHR$(3)+CHR$(0)+CHR$(0)+CHR$(0)
    +CHR$(0)+CHR$(4)+CHR$(0)+CHR$(0)+CHR$(0)
    +CHR$(0)+CHR$(5)+CHR$(0)+CHR$(0)+CHR$(0)
    +CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)
    +CHR$(0)+CHR$(13)
20  A$=A$+CHR$(28)+CHR$(29)+CHR$(30)+CHR$(0)
    +CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)
    +"."+"1"+"4"+"7"+CHR$(0)+"0"+"2"+"5"+"8"
    +CHR$(0)+CHR$(8)+"3"+"6"+"9"+CHR$(0)
    +CHR$(31)+CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)
    +CHR$(0)+CHR$(0)+CHR$(0)+CHR$(0)
30  KEYBMAP$(0)= A$
40  END
```

15. PRINTER FUNCTION CONTROL, cont'd.

2. Display

All present *Intermec Fingerprint*-compatible printers from *Intermec* have a 2 lines × 16 characters LCD (*Liquid Crystal Display*). The *Intermec Fingerprint* firmware uses it to show a number of standardized messages, e.g. in the Setup and Test Modes, but it can also be controlled by programming instructions (see *"Output to Display"* below). The display is provided with a controllable cursor, as described later in this chapter (*"Cursor Control"*).

☞ ***Clearing the Display***
Also see:
- "Cursor Control: Clearing the Display" later in this chapter.

Output to Display

Before you can print any text to the display, it must be opened for sequential output, e.g.:

```
10   OPEN "console:" FOR OUTPUT AS 1
```

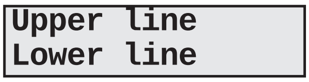
Then you should clear any previously displayed message by sending two empty PRINT# or PRINTONE# statements:

```
20   PRINT#1:PRINT#1
```

Now you can send a string to each of the two lines. Note the appending semicolon on the second line:

```
30   PRINT#1, "Upper line"
40   PRINT#1, "Lower line";
RUN
```

This will result in the following message being displayed:



```
Upper line
Lower line
```

As a alternative to sending two separate lines, you can also send a single line consisting of max. 33 characters, where:

- Character 1–16 specifies the upper line
- Character No. 17 is not displayed at all
- Character No. 18–33 specifies the lower line
- The line should be appended by a semicolon (;).

Using this method, the example above would look like this (underscore characters indicate space characters):

```
10   OPEN "console:" FOR OUTPUT AS 1
20   PRINT#1:PRINT#1
30   PRINT#1,"Upper_line_______Lower_line";
RUN
```

15. PRINTER FUNCTION CONTROL, cont'd.

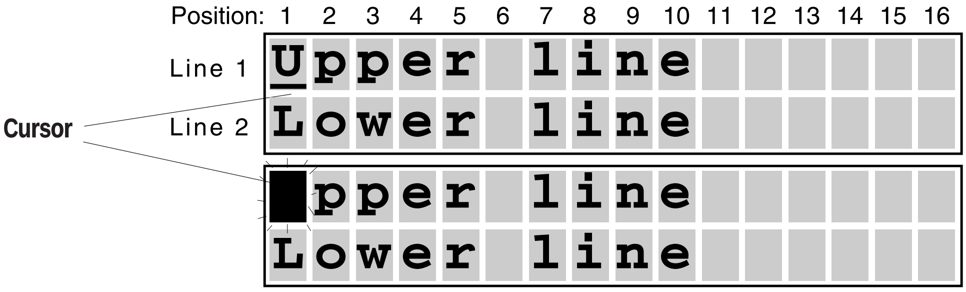
2. Display, cont'd.

Cursor Control

The cursor control instructions can be used for four purposes:

- To clear the display from messages (as an alternative to the double PRINT# statement on line 20 in the example above).
- To enable or disable the cursor.
- To select cursor type (underscore or block/blink)
- To place the cursor at a specified position or to move it.

The cursor is either a black line under a character position in the display, or a blinking block that intermittently blacks out the character position:



Each cursor control command should start with the character **CSI** (Control Sequence Introducer) = ASCII 155 decimal, or (in case of 7-bit communication) with the characters “**ESC**” + “**[**” (ASCII 27 + 91 decimal).

Clearing the Display

Syntax: <**CSI**> + <<**0**|**1**|**2**>**J**>
where: **CSI** = ASCII 155 dec.
0 = From active position to end, inclusive (default)
1 = From start to active position, inclusive
2 = All of the display
J = Must always append the string

Example (clears all of the display):

```
10   OPEN "console:" FOR OUTPUT AS 1
20   PRINT#1, CHR$(155) + "2J";
```

Selecting Cursor Type

Syntax: <**CSI**> + <**4p**|**5p**>
where: **CSI** = ASCII 155 dec.
4p = Underscore
5p = Block/Blink (default)

Example (selects underscore-type cursor):

```
10   OPEN "console:" FOR OUTPUT AS 1
20   PRINT#1, CHR$(155) + "4p";
```

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

2. Display, cont'd.

Cursor Control, cont'd.

Enabling/Disabling the Cursor

Syntax: <**CSI**> + <**2p**|**3p**>
where: **CSI** = ASCII 155 dec.
2p = Cursor On
3p = Cursor Off (default)

Example (enables the cursor):

```
10   OPEN "console:" FOR OUTPUT AS 1
20   PRINT#1, CHR$(155) + "2p";
```

Note that a semicolon should append the PRINT# instructions in order to avoid interfering with existing messages in the display.

Setting the Absolute Cursor Position

Syntax: <**CSI**> + <<**v**>**;**<**h**>**H>**
where: **CSI** = ASCII 155 dec.
v = Is the line (1 = Upper; 2 = Lower)
h = Is the position in the line (1–16)
H = Must always append the string
If v, h or both are missing, the default value is 1.

Example (setting the cursor in upper left position):

```
10   OPEN "console:" FOR OUTPUT AS 1
20   PRINT#1, CHR$(155) + "H";
```

Example (setting the cursor in lower right position):

```
10   OPEN "console:" FOR OUTPUT AS 1
20   PRINT#1, CHR$(155) + "2;16H";
```

Move the Cursor Relative to Current Position

Syntax: <**CSI**><n>**A** | **B** | **C** | **D**
where: **CSI** = ASCII 155 dec.
n = Is number of steps relative to current position (default = 1).
A-D = Is the direction, where A = Up, B = Down,
C = Forward, D = Backward

The relative movement must not place the cursor outside the display area (2 × 16 positions) or the instruction will be ignored.

Example (moving the cursor from the first position in the upper line to the last position in the lower line):

```
10   OPEN "console:" FOR OUTPUT AS 1
20   PRINT#1, CHR$(155) + "1B";
30   PRINT#1, CHR$(155) + "15C";
```

15. PRINTER FUNCTION CONTROL, cont'd.

3. LED Control Lamps

Beside showing messages in the printer's display window (see chapter 15.2, the program can use two of the three LED's (Light Emitting Diodes) on the printer's front panel to notify the operator by means of the following two statements:

`LED...ON`	Turns the specified LED on.
`LED...OFF`	Turns the specified LED off.

The printer's front panel contains three LED's labelled ”Power”, ”Ready” (0), and ”Error” (1):

- The “Power” LED is connected to the printer's power supply and is lit when the power is on. It cannot be controlled by the program.
- The two other LED's (“Ready” and “Error”) can be programmed at will using LED ON and LED OFF statements, even though the printed text on the keyboard imposes certain restrictions.

Example:
In this example, the “Ready” LED (0) is lit until an error occur. Then the “Error” LED (1) is lit instead. The “Error” LED remains lit until the error is cleared. A suitable error can be generated by running the program with the printhead lifted.

```
10   LED 0 ON
20   LED 1 OFF
30   ON ERROR GOTO 1000
40   PRPOS 100,100
50   FONT "SW030RSN"
60   MAG 3,3
70   PRTXT "OK!"
80   PRINTFEED
90   LED 0 ON
100  LED 1 OFF
110  END
1000 LED 0 OFF
1010 LED 1 ON
1020 RESUME
RUN
```

15. PRINTER FUNCTION CONTROL, cont'd.

4. Buzzer

In addition to the visual signals given by means of the display and the LED control lamps (see chapter 15.2 and 15.3), audible signals can also be initiated by the program execution in order to notify the operator.

The following instructions can be used:

BEEP	Initiates a short signal of fixed frequency and duration.
SOUND	Initiates a signal vith variable frequency and duration.

The printer is provided with a buzzer fitted on the CPU board. The buzzer can be controlled by either a BEEP statement, which gives a short shrill signal (≈800 Hz for 0.25 sec.), or by a SOUND statement, which allows you to vary both the frequency and duration. You can even compose your own melodies, if your musical ear is not too sensitive!

In this example, a warning signal is emitted from the buzzer e.g. when the error "printhead lifted" occurs and keeps sounding until the error is cleared. A short beep indicates that the printer is OK.

```
10   ON ERROR GOTO 1000
20   PRPOS 100,100
30   FONT "SW030RSN"
40   MAG 3,3
50   PRTXT "OK!"
60   PRINTFEED : BEEP
70   END
1000 SOUND 880,25 : SOUND 988,25 : SOUND 30000,10
1010 RESUME
RUN
```

15. PRINTER FUNCTION CONTROL, cont'd.

5. Clock/Calendar

The printer's CPU board is provided with an internal clock/calendar **without** battery backup, i.e. the setting will be lost when the printer is turned off.

Intermec Fingerprint-compatible printers may be fitted with a real-time clock circuit (RTC) in a socket on the CPU board. The RTC is battery backed-up and will keep running even when the printer is turned off.

If no RTC is installed and you try the **read** the date **or** time before the internal clock has been set, an error will occur (error 1010 *"Hardware Error"*). Once either time **or** date has been set, the internal clock will work until next power off or reboot. If only time has been set, by default the current date will be Jan 01 1980 and if only date has been set, by default the clock will start running at 00:00:00.

Please refer to chapter 9.3 for information on how to read the printer's clock/calendar, and on the standard formats for date and time.

The following instructions are to set the clock/calendar:

`DATE$ = <sexp>`	Sets the date (YYMMDD format)
`TIME$ = <sexp>`	Sets the time (HHMMSS format)

Example (setting the clock/calendar to 08.11.30 September 1, 1998):

```
DATE$ = "980901"
TIME$ = "081130"
```

Note that the values must always be entered as string expressions. Possible numeric expressions can be converted to string format using STR$ functions (see chapter 9.2).

15. PRINTER FUNCTION CONTROL, cont'd.

6. Printer Setup

> ☞ ***Intermec Shell Startup Programs***
> Also see:
> - Intermec Shell Standard Startup Manual
> - Intermec Shell Enhanced Startup Manual

The printer's setup can be changed manually if the printer is provided with a built-in keyboard (*Enhanced* and *Stand-Alone* models). Printers without a keyboard (*Standard* models) are often delivered with some kind of startup program (e.g. *Intermec Shell*) that allows setup parameters to be changed manually. The *Intermec Shell* startup programs also allows the setup to be read or changed from a connected terminal. This was discussed more thoroughly in chapter 2.

Detailed information on the methods of manual setup and the various setup parameters can be found in the *"Technical Manual"* manual for the printer model in question.

If the printer has no built-in keyboard[1], or if you want to change some setup parameter either by remote control or as a part of the program execution, you can use the SETUP statement.

SETUP

The SETUP statement can be used in four different ways:

`SETUP`	Makes the printer enter the Setup Mode. *Never use this statement in a printer without keyboard as you can neither leave the Setup Mode nor do anything else without any keys!*
`SETUP WRITE`	Creates a copy of the printer's current setup and saves it as a file in RAM under a specified name or returns the current setup to the specified communication channel.
`SETUP<file name>`	Changes one, several, or all of the setup parameters in the printer's current setup according to a setup file.
`SETUP<string>`	Changes a single setup parameter

Reading the Current Setup

The easiest way to read the printer's current setup is to use a SETUP WRITE statement to return the setup to the serial communication channel used for output to the host (usually "uart1:").

Example:

```
SETUP WRITE "uart1:"
```

[1]/. *An external keyboard cannot be used in the Setup Mode.*

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

6. Printer Setup, cont'd.

Creating a Setup File

There are two ways of creating a setup file:

- Create a setup file using *Intermec Fingerprint* instructions:
  - OPEN a file for sequential OUTPUT. See chapter 8.3.
  - Use a PRINT# statement to enter each parameters you want so change. The input must follow the stipulated syntax exactly (see the *Intermec Fingerprint 6.13* Reference Manual, SETUP statement).
  - CLOSE the file.
- Use the *Toolbox Setup* program to create the file.

Changing the Setup using a Setup File

Use a SETUP<filename> statement to change the printer's setup. If the setup file is stored in another part of the printer's memory than the current directory, the file name should contain a reference to the device in question.

In the following example, we will first save the current setup under a new file name and then make a setup file that changes the size of the transmit buffer on "uart1:" just a little. Finally, we use the setup file to change the printer's setup.

```
10 SETUP WRITE "SETUP1.SYS"
20 OPEN "SETUPTEST.SYS" FOR OUTPUT AS #1
30 PRINT#1,"SERVICE,MEMORY ALLOC,TRANS BUF UART1,310"
40 CLOSE #1
50 SETUP "SETUPTEST.SYS"
RUN
```

Changing the Setup using a Setup String

A single setup parameter can be changed without creating any file. The SETUP statement should be followed by a string following exactly the same syntax as the corresponding parameter in a Setup file, but without any leading PRINT# statement.

The same change as in the example above would look this way when using a setup string:

```
SETUP "SERVICE,MEMORY ALLOC,TRANS BUF UART1,310"
```

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

6. Printer Setup, cont'd.

PRSETUP.PRG Utility Program

The program PRSETUP.PRG is included in some Configuration EPROM:s and allows you to print the current setup values both on the screen of your terminal/computer and on paper in your *Intermec Fingerprint* printer. For best result, labels or tickets should have a length of at least 70 mm (≈ 2^3/4").

```
1    'Prsetup.prg ver 1.2 92-06-26 (ew)
5    ON ERROR GOTO 500
6    F$="SW020BSN.2":FONT F$
7    IF EFLAG%<>0 THEN F$="SW030RSN.2"
10   SETUP WRITE "qzqw"
20   OPEN "qzqw" FOR INPUT AS # 1
30   FONT F$ : DIR 4
40   X% = 50 : Y% = 10
50   LINE INPUT # 1 , A$
60   PRINT A$
65   EFLAG%=0
70   PRPOS X% , Y%
80   IF EFLAG%<>0 THEN PRINTFEED:FONT F$ :
     X% = 50: Y% = 10: DIR 4:GOTO 65
85   A%=SPLIT(A$,"B",44)
90   IF B$(0)="SER-COM" THEN PRTXT
     B$(1)+","+B$(A%-2)+","+B$(A%-1):GOTO 95
91   PRTXT B$(A%-2)+","+B$(A%-1)
95   FOR I%=0 TO A%
96   B$(I%)=""
97   NEXT I%
100  X% = X% + 30
110  IF EOF ( 1 ) = 0 THEN GOTO 50
120  IF X% > 50 THEN PRINTFEED
130  CLOSE # 1
140  KILL "qzqw"
199  END
500  EFLAG%=ERR
510  RESUME NEXT
RUN
```

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

6. Printer Setup, cont'd.

DISPSET2.PRG Utility Program

DISPSET2.PRG is included in many Configuration EPROM:s and can be used for setting up such printers that are fitted with a display but not a keyboard, e.g. *EasyCoder 201 IIS*, *EasyCoder 401*, *EasyCoder 501 S* and *EasyCoder 601 S*. DISPSET2.PRG allows the label stop sensor (LSS) to be adjusted and – when necessary – the printhead resistance to be set. It also provides the possibility of reading the present value of all other setup parameters in the display. DISPSET2.PRG is a part of the *Intermec Shell Standard* startup program for printers without keyboard. It also illustrates how to solve the setup programming for printers with custom-made programs and no keyboard. Also refer to the *Technical Manual* of the printer model in question.

Note:
Printer model 910 is no longer produced.

```
1000 'Display setup in slave printer 201/910
1010 '930301 GI New LSS for 501
1100 on error goto 9500:dim S$(9)
1110 open "CONSOLE:" for input as #11
1115 open "CONSOLE:" for output as #10
1117 print #10,"Print=Setup":print #10,T$
1120 DUMMY$=input$(loc(11),11):close #11
1130 QSTEP$="FALSE":X$="S"
1140 on key(17) gosub 2000: key(17) on:'Print
1150 T1%=TICKS:OT$=""
1151 T$="0"+str$(500-(ticks-T1%))
1153 T$=right$(T$,3):T$=left$(T$,1)
1154 if OT$=T$ then goto 1160
1155 print #10:print #10,"Print=Setup":
     print #10,T$+" Sec. left";:OT$=T$
1160 if (TICKS-T1%)<400 then goto 1151
1170 gosub 4800
1199 END
2000 setup write "SETUP0.SYS"
2010 on key(17) gosub 9200: key(17) on:'Print
2030 if (prstat and 1) then gosub 3000
     else gosub 4000
2990 RETURN
2999 'Setup - - - - - - - - - -
3000 'Head up - LSS adj., HEAD RESISTANCE.
3005 setup write "XSETUP0X.SYS"
3010 open "XSETUP0X.SYS" for input as #5
3020 open "XSETUP1X.SYS" for output as #6
3030 gosub 9100: 'Read setup file
3040 if T$=”EOF” then close #5:close #6:goto 3500
3050 S%=SPLIT(T$,X$,44)
3060 if S$(2)="HEAD RESIST" then gosub 3200
     else goto 3030
3070 print #6,T$:close #5:close #6:goto 3500:
     'Copy to file #6.
```

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

6. Printer Setup, cont'd.

DISPSET2.PRG Utility Program, cont'd.

```
3200 D1$="HEAD RESISTANCE":D2$=S$(3)
3210 gosub 9000: 'Display
3220 if (prstat and 1) then gosub 3300
3299 RETURN
3300 'Change resistance
3310 QRES%=head(-8): 'Min
3315 D2$=str$(QRES%):
     T$=S$(0)+","+S$(1)+","+S$(2)+","+D2$
3320 gosub 9000: 'Display
3330 if (prstat and 1) then goto 3340 else RETURN
3340 QRES%=QRES%+10:QRES$=str$(QRES%)
3345 if (QRES%>head(-8) and right$(QRES$,1)<>"0")
     then QRES$=left$(QRES$,2)+”0"
3346 QRES%=val(QRES$)
3370 if QRES%>head(-9) then QRES%=head(-8)
3380 goto 3315
3499 RETURN
3500 'LSS- Adjust
3505 setup "XSETUP1X.SYS" :  kill "XSETUP1X.SYS"
3510 D1$="LSS ADJUST":D2$="":gosub 9000
3520 D1$="LABEL   <>   GAP":QLSS%=SYSVAR(8)
3555 LASTF$="YES":gosub 3600
3560 if (prstat and 1)=0 then goto 3585
3565 if VERSION$(1)<>"501" then gosub 3800
     else gosub 3900
3585 gosub 4000: 'Show par.
3590 RETURN
3600 'Display LSS receiver
3615 POS%=sysvar(1)\16:X1$=" "
3617 LASTPOS%=POS%
3620 D2$=string$(pos%,X1$)+chr$(255)
3623 QLSS$=right$("00"+str$(QLSS%),3)
3625 D1$="LABEL <"+QLSS$+">  GAP"
3630 print#10:print#10,left$(D1$,16)
3640 print#10,left$(D2$,16);
3641 POS%=sysvar(1)\16
3643 if (prstat and 1) then LASTF$="NO" :goto 3645
3644 if (LASTF$<>”YES”) then TESTFEED:LASTF$="YES"
3645 if LASTPOS%<>POS% then goto 3617
3650 if QSTEP$<>"TRUE" then goto 3641
3660 QSTEP$="FALSE"
3690 RETURN
3800 'Change LSS , 101, 201 printer. lss = 0 - 3
3810 QLSS%=0
3820 if QLSS%>3 then QLSS%=0
3840 SYSVAR(8)=QLSS%
3850 gosub 3600
3855 QLSS%=QLSS%+1
3860 if (prstat and 1) then goto 3820 else RETURN
```

Continued!

6. Printer Setup, cont'd.

DISPSET2.PRG Utility Program, cont'd.

```
3900 'Change LSS ,501 printer lss = 0-7-127
3910 QLSS%=0
3920 if QLSS%=8 then QLSS%=7
3930 if QLSS%>127 then QLSS%=0
3940 SYSVAR(8)=QLSS%
3950 gosub 3600
3955 QLSS%=QLSS%+8
3960 if (prstat and 1) then goto 3920 else RETURN
3990 RETURN
3999 'Head down - show parameters
4000 'CONTRAST
4005 open "SETUP0.SYS" for input as #5
4010 gosub 9100:'Read setup file
4025 S%=SPLIT(T$,X$,44)
4030 D1$=S$(0):D2$=S$(1)
4040 gosub 9000
4050 if (prstat and 1) then goto 4800
4100 'SER-COM
4110 gosub 9100:'Read setup file
4122 if left$(T$,7)<>"SER-COM" then goto 4210
4125 S%=SPLIT(T$,X$,44)
4130 if S$(2)<>"FLOWCONTROL" then goto 4138
4135 if S$(3)<>"XON/XOFF" then goto 4137
4136 D1$="U"+right$(S$(1),1)+",XO,"+mid$(S$(4),6):
     D2$=S$(5):goto 4140
4137 D1$=S$(1)+","+S$(3):D2$=S$(4):goto 4140
4138 if S$(2)="CHAR LENGTH" then S$(2)="CHAR-LEN"
4139 D1$=S$(1)+","+S$(2):D2$=S$(3)
4140 gosub 9000
4150 if (prstat and 1) then goto 4800 else goto 4110
4200 ‘FEEDADJ
4210 gosub 9100:’Read setup file, ignore LSS
4222 S%=SPLIT(T$,X$,44)
4225 if S$(1)<>"FEEDADJ" then goto 4322
4230 D1$=S$(2):D2$=S$(3)
4240 gosub 9000
4250 if (prstat and 1) then goto 4800 else goto 4210
4300 'MEDIA SIZE
4310 gosub 9100:'Read setup file
4322 S%=SPLIT(T$,X$,44)
4325 if S$(1)<>"MEDIA SIZE" then goto 4422
4330 D1$=S$(2):D2$=S$(3)
4340 gosub 9000
4350 if (prstat and 1) then goto 4800 else goto 4310
4400 'MEDIA TYPE
4410 gosub 9100:’Read setup file
4422 S%=SPLIT(T$,X$,44)
4430 D1$=S$(1):D2$=S$(2)
4440 gosub 9000
4450 if (prstat and 1) then goto 4800
```

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

6. Printer Setup, cont'd.

DISPSET2.PRG Utility Program, cont'd.

```
4500 'PAPER TYPE
4510 gosub 9100:gosub 9100:
     'Read setup file, ignore head res.
4522 S%=SPLIT(T$,X$,44)
4530 D1$=S$(2):D2$=S$(3)
4540 gosub 9000
4550 if (prstat and 1) then goto 4800
4600 'PERFORMANCE
4610 gosub 9100:'Read setup file
4622 S%=SPLIT(T$,X$,44)
4630 D1$=S$(1):D2$=S$(2)
4640 gosub 9000
4650 if (prstat and 1) then goto 4800
4700 'MEMORY ALLOC
4710 gosub 9100:'Read setup file
4720 if T$="EOF" then close #5:goto 4000
4722 S%=SPLIT(T$,X$,44)
4725 if S$(1)<>"MEMORY ALLOC" then goto 4710
4730 D1$=S$(2):D2$=S$(3)
4740 gosub 9000
4750 if (prstat and 1) then goto 4800 else goto 4710
4800 print#10
4805 print #10:print #10,version$;
4810 close:kill "SETUP0.SYS":key(17) off
4999 RETURN
9000 'Display
9010 print#10:print#10,left$(D1$,16)
9020 print#10,left$(D2$,16);
9030 if QSTEP$<>"TRUE" then goto 9030
9040 QSTEP$="FALSE"
9050 RETURN
9100 'Read setup file
9110 if EOF(5) then T$="EOF":RETURN
9120 line input #5,T$
9150 RETURN
9200 'Print key, step to next setup parameter
9210 QSTEP$="TRUE"
9299 RETURN
9500 'error rut.
9599 RESUME NEXT
```

15. PRINTER FUNCTION CONTROL, cont'd.

7. System Variables

Some sensors and other conditions can be read or set by means of the SYSVAR system variable.

SYSVAR

The following SYSVAR parameters are released for public use:

`SYSVAR(1)` returns the value of the LSS/BMS receiver.
`SYSVAR(8)` returns or sets the level of the LSS/BMS emitter.
`SYSVAR(12)` returns the value of the paper counter *(requires an optional sensor, some printer models only).*
`SYSVAR(13)` returns the value of the ribbon counter *(requires an optional sensor, some printer models only).*
`SYSVAR(14)` returns the number of errors since last power on.
`SYSVAR(15)` returns the number of errors since the previously executed SYSVAR(15) instruction.
`SYSVAR(16)` returns the number of bytes received at the execution of a STORE or STORE INPUT statement.
`SYSVAR(17)` returns the number of frames received at the execution of a STORE or STORE INPUT statement.
`SYSVAR(18)` returns or sets the verbosity level.
`SYSVAR(19)` returns or sets the type of error messages transmitted by the printer.
`SYSVAR(20)` returns 0 if the printer is set up for direct thermal or 1 if set up for thermal transfer printing.
`SYSVAR(21)` returns the printhead density in dots/mm.
`SYSVAR(22)` returns the number of dots in the printhead.
`SYSVAR(23)` returns 1 if a transfer ribbon is detected, else 0.
`SYSVAR(24)` returns 1 if a power-up has been performed since last SYSVAR(24), else 0.

Parameters 1 and 8 can be used to control the LSS/BMS (label stop sensor or black mark sensor), either automatically as a part of the program execution, or remotely. They are also useful for setting up printers with neither a keyboard nor a standard startup program. However, if the printer either has a keyboard and/or is provided with *Intermec Shell* startup program, it is easier to do this in the Setup Mode.

Parameters 12 and 13 are intended for use with the optional sensor kit available for some *EasyCoder* printers.

Parameters 14 and 15 are primarily intended for service purposes.

Parameters 16 and 17 are used in connection with transfer of images from the host to the printer and are explained in chapter 14.3.

Parameter 18 is used for returning or setting the printer's verbosity level, i.e. the printer's response to received instructions as explained in chapter 7.7.

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

7. System Variables, cont'd.

Parameter 19 is used for returning or selecting one of four types of error messages, see chapter 16.1.

Parameter 20 checks if the printer is printer is set up for direct thermal printing or thermal transfer printing, which depends on the choice of paper type in the Setup Mode, see the Technical Manual.

Parameters 21 and 22 are used to check the printhead in regard of printhead density and number of dots respectively. Together with parameter 20 and the VERSION$ function, see chapter 15.11, these parameters allows the program to identify different printer models. Thereby it is possible to design programs that will work in all *EasyCoder* printers.

Parameter 23 checks the status of the ribbon end sensor in thermal transfer printers.

Parameter 24 is useful, when certain data, e.g. date and time formats, are not generated as a part of the program execution. Since such data are stored in the no-save area of the RAM memory, they will be lost at power-up or reboot. Using SYSVAR(24), the printer can be polled for power-ups, so lost data can be renewed.

For detailed explanations, please refer to the *Intermec Fingerprint 6.13* Reference Manual.

Example showing how the error type is set from the host and the new setting is read back:

```
10   INPUT "Error type: ", A%
20   SYSVAR(19)=A%                        (sets error type)
30   B%=SYSVAR(19)                        (reads error type)
40   PRINT "The error type is set to: "; B%
RUN
```

Yields e.g.

```
Error type: 2
The error type is set to: 2
```

15. PRINTER FUNCTION CONTROL, cont'd.

8. Printhead

In addition to the setup, four instructions can be used to check and control the thermal printhead.

SYSVAR

Two parameters in the system variable SYSVAR allows you to check the printhead, also see chapter 15.7:

`SYSVAR(20)`	returns if the printer is set up for direct thermal or transfer printing.
`SYSVAR(21)`	returns the printhead density in dots/mm.

HEAD

The HEAD function requires a CPU board that supports dot sensing and allows you to:

- Identify possible faulty dots by means of abnormal resistance values. This application is closely connected to the SET FAULTY DOT and BARADJUST statements, see below. Note that some printhead errors, e.g. deglazed, cracked or dirty dots, will not be detected by this function, since only the resistance is measured.
- Read the mean resistance value of the printhead, e.g. in order to make a program that sets up the printhead resistance automatically (this features is standard in some printer models).

SET FAULTY DOT

This statement is used to mark specified dots on the printhead as faulty, either manually or automatically in connection with a HEAD function. Then, using a BARADJUST statement (see below), you can adjust the location of picket fence bar codes so the dots marked as faulty will not affect the printing, i.e. the faulty dot(s) will be situated between the bars.

You can also revoke all previous SET FAULTY DOT statements by marking all dots as correct.

BARADJUST

This statement enables automatic horizontal relocation of picket fence bar codes within specified limits. The firmware will keep record of all dots marked as faulty (see SET FAULTY DOT above) and relocate the bar code as to place the spaces between the bars in line with the faulty dot(s). Thereby, it will be possible to use the printer pending printhead replacement.

Note that the BARADJUST statement cannot be used for ladder bar codes, stacked bar codes (e.g. Code 16K), bar codes with horizontal lines (e.g. DUN-14) and EAN/UPC bar codes.

Continued!

15. PRINTER FUNCTION CONTROL, cont'd.

8. Printhead, cont'd.

This example shows how a program can be made that checks the printhead for faulty dots and warns the operator when a faulty dot is encountered. Pending printhead replacement, the bar code is repositioned to ensure continued readability. Such a program takes a few seconds to execute (there may be more than a thousand dots to check), so it is advisable either to restrict the dot check to the part of the printhead that corresponds to the location of the bar code, or to perform the test at startup only.

```
10   OPEN "console:" FOR OUTPUT AS 10
20   IF HEAD(-1)<>0 THEN GOTO 9000
30   BEEP:D1$="Printhead Error!":D2$="":GOSUB 2000
40   GOSUB 1000
50   BARADJUST 20,20
60   GOTO 9000
1000 FUNCTEST "HEAD",TMP$
1010 A$=":" : TMP%=INSTR(TMP$,A$)+1
1020 RETURN
1030 SET FAULTY DOT -1
1040 QMEAN%=HEAD(-7)
1050 QMIN%=QMEAN%*85\100
1060 QMAX%=QMEAN%*115\100
1070 FOR I%=0 TO WHEAD%-1
1080 QHEAD%=HEAD(I%)
1090 IF QHEAD%>QMAX% OR QHEAD%<QMIN% THEN SET FAULTY
     DOT I%
1100 NEXT
2000 PRINT #10 : PRINT #10, LEFT$(D1$,16)
2010 PRINT #10, LEFT$(D2$,16);
2020 RETURN
9000 PRPOS 200,20
9010 BARTYPE "CODE39"
9020 BARRATIO 2,1 : BARMAG 2
9030 BARHEIGHT 150
9040 PRBAR "1234567890"
9050 PRINTFEED
9060 END
```

15. PRINTER FUNCTION CONTROL, cont'd.

9. Transfer Ribbon

SYSVAR

A number of parameters in the system variable SYSVAR can be used to check the transfer ribbon, also see chapter 15.7:

SYSVAR(13)	returns the value of the optional ribbon counter (some models only).
SYSVAR(20)	returns if the printer is set up for direct thermal or transfer printing.
SYSVAR(23)	returns if a transfer ribbon is fitted or not.

RIBBON SAVE ON/OFF

Some thermal transfer printers can be provided with a “Ribbon Save Device”, i.e. a mechanism that stops feeding the ribbon while blank parts of the labels are fed out, thereby reducing the consumption of transfer ribbon. By default, ribbon save is enabled whenever a ribbon save device is fitted in the printer. Using the statements RIBBON SAVE OFF and RIBBON SAVE ON, you can disable and enable this function at will.

Important:
Due to the increased risk of ribbon wrinkling, avoid using RIBBON SAVE OFF in connection with negative start values or negative FORMFEED statements, i.e. instructions that makes the printer pull back the paper.

15. PRINTER FUNCTION CONTROL, cont'd.

10. Memory Test

FUNCTEST

The FUNCTEST statement is used to perform the following tests and place the result in a string variable:

- Test of the internal RAM memory
- Test of a specified EPROM package
- Test of a memory card (DOS-formatted or non DOS-formatted).
- Test of the printhead in regard of number of dots, head lifted or possible errors.

Example using an EasyCoder 501 with 6 EPROM:s. The program takes a few seconds to execute:

```
10   FUNCTEST "RAM",A$
20   FUNCTEST "ROM1",B$
30   FUNCTEST "ROM2",C$
40   FUNCTEST "ROM3",D$
50   FUNCTEST "ROM4",E$
60   FUNCTEST "ROM5",F$
70   FUNCTEST "ROM6",G$
80   FUNCTEST "HEAD",H$
90   PRINT "RAM Test:","", A$
100  PRINT "Checksum IC-100:", B$
110  PRINT "Checksum IC-101:", C$
120  PRINT "Checksum IC-102:", D$
130  PRINT "Checksum IC-103:", E$
140  PRINT "Checksum IC-104:", F$
150  PRINT "Checksum IC-105:", G$
160   PRINT "Printhead Test:", H$
RUN
```

Yields e.g.:

```
RAM Test:           RAM OK
Checksum IC-100:    9825
Checksum IC-101:    C08A
Checksum IC-102:    28A3
Checksum IC-103:    06B2
Checksum IC-104:    87D5
Checksum IC-105:    C1ED
Printhead Test:     HEAD OK,SIZE:832 DOTS
```

FUNCTEST$

The FUNCTEST$ function is very similar to the FUNCTEST statement and is used for the same purposes. Due to the different syntax, programming is more simple:

```
10   PRINT "RAM Test:","", FUNCTEST$ ("RAM")
20   PRINT "Checksum IC-100:", FUNCTEST$ ("ROM1")
30   PRINT "Checksum IC-101:", FUNCTEST$ ("ROM2")
40   PRINT "Checksum IC-102:", FUNCTEST$ ("ROM3")
50   PRINT "Checksum IC-103:", FUNCTEST$ ("ROM4")
60   PRINT "Checksum IC-104:", FUNCTEST$ ("ROM5")
70   PRINT "Checksum IC-105:", FUNCTEST$ ("ROM6")
80   PRINT "Printhead Test:", FUNCTEST$ ("HEAD")
RUN
```

15. PRINTER FUNCTION CONTROL, cont'd.

11. Version Check

VERSION$

The VERSION$ function returns one of three characteristics of the printer:

VERSION$(0)	returns the firmware version (e.g. “Intermec Fingerprint 6.13”)
VERSION$(1)	returns the printer family (e.g. “501”).
VERSION$(2)	returns the CPU board generation (e.g. “hardware version #4”).

This instruction allows you to create programs that will work with several different printer models. For example, you may use the VERSION$ function to determine the type of printer and select the appropriate one of several different sets of setup parameters.

Example (sets the setup according to the type of printer):

```
10   A$=VERSION$(1)
20   IF A$="101" THEN GOTO 1000
30   IF A$="201" THEN GOTO 2000
40   IF A$="401" THEN GOTO 3000
50   IF A$="501" THEN GOTO 4000
60   IF A$="601" THEN GOTO 5000
70 .....
80 .....
1000 SETUP "SETUP101.SYS"
1010 GOTO 70
2000 SETUP "SETUP201.SYS"
2010 GOTO 70
3000 SETUP "SETUP401.SYS"
3010 GOTO 70
4000 SETUP "SETUP501.SYS"
4010 GOTO 70
5000 SETUP "SETUP601.SYS"
5010 GOTO 70
```

16. ERROR-HANDLING

1. Standard Error-Handling

Intermec Fingerprint is intended to be as flexible as possible. Thus, there are very few fixed error-handling facilities, but instead there are a number of tools for designing error-handling routines according to the demands of each application.

The following error-handling facilities are always available:

- **Out-of-Media Detection**
  Provided the printhead is lowered, the software will check for three possible errors when either the < **Print** > or < **Feed** > key on the printer is pressed. If an error is detected, a message will appear in the display:
  - Error 1005 *(Out of paper)*
  - Error 1031 *(Next label not found)*
  - Error 1027 *(Out of ribbon – thermal transfer printers only)*

  After the error has been attended to, the error message can be cleared by pressing any of the keys.

- **Syntax Check**
  Each program line or instruction that is received on the standard IN channel will be checked for possible syntax errors before it is accepted. Provided there is a working two-way communication[1], possible syntax errors will be transmitted to the host on the standard OUT channel, e.g. *"Feature not implemented"* or *"Font not found"*.

- **Execution Check**
  Any program or hardware error that stops the execution will be reported on the standard OUT channel, provided there is a working two-way communication[1]. In case of program errors, the number of the line where the error occurred will also be reported, e.g. *"Field out of label in line 110"*. After the error has been corrected, the execution must be restarted by means of a new RUN statement, unless there is a routine for dealing with the error condition included in the program.

Error Messages

By means of the system variable SYSVAR(19), see chapter 15.7, you can choose between four types of error messages as illustrated by the following examples using error #19:

1. *"Invalid font in line 10"* *(default)*
2. *"Error 19 in line 10: Invalid font"*
3. *"E19"*
4. *"Error 19 in line 10"*

[1] */. For a working two-way communication, three conditions must be fulfilled:*
• Serial communication
• Std IN channel = Std OUT channel
• Verbosity enabled.

16. ERROR-HANDLING, cont'd.

2. Tracing Programming Errors

TRON/TROFF

Large program can be difficult to grasp. If the program does not work as expected, it may depend on some programming error that prevents the program from being executed in the intended order. The TRON (Trace On) statement allows you to trace the execution. When the program is run, each line number will be returned on the standard OUT channel in the order of execution, provided you have a working two-way communication[1].

TROFF (Trace Off) disables TRON.

3. Creating an Error-Handling Routine

In most application programs, it is useful to include some kind of error-handler. Obviously, how comprehensive the error-handler needs to be depends on the application and how independent from the host the printer will work. In this chapter, we will explain the general principles and the related instructions, and in chapter 16.4 you will find an example on how an error-handling program can be composed.

ON ERROR GOTO...

This statement is described in more detail in the chapter 5.8. It is used to branch the execution to a subroutine if **any** kind of error occurs when a program is run. The major benefit is that the program will not stop, but the error can be identified and dealt with. The execution can then be resumed at an appropriate program line.

ERR

The ERR function returns the reference number of an error that has occurred. The actual meaning of the numbers can be found in the chapter *"Error Messages"* in the *Intermec Fingerprint 6.13* Reference Manual.

ERL

The ERL function returns the number of the line on which an error has occurred.

RESUME

This statement is used resume the execution after the error has been taken care of in a subroutine. The execution can be resumed at the statement where the error occurred, at the statement immediately following the one where the error occurred, or at any other specified line. Also see the chapter 5.8.

[1]/. For a working two-way communication, three conditions must be fulfilled:
- *Serial communication*
- *Std IN channel = Std OUT channel*
- *Verbosity enabled.*

Continued!

16. ERROR-HANDLING, cont'd.

3. Creating an Error-Handling Routine, cont'd.

Example:
The four instructions described above can be used to branch to a subroutine, identify the error, branch to a secondary subroutine where the error is cleared and resume the execution. In the example only one error condition 1019 “Invalid Font” is taken care of, but the same principles can be used for more errors. You can test the example by either adding a valid font name or lifting the printhead before running the program.

```
10   OPEN "console:" FOR OUTPUT AS 1
20   ON ERROR GOTO 1000
30   PRPOS 50,100
40   PRTXT "HELLO"
50   PRINTFEED
60   A%=TICKS+400
70   B%=TICKS
80   IF B%<A% THEN GOTO 70 ELSE GOTO 90
90   PRINT #1 : PRINT #1
100  END
1000 SOUND 880,50
1010 EFLAG%=ERR : ELINE%=ERL
1020 IF EFLAG%=1019 THEN GOTO 2000 ELSE GOTO 3000
2000 PRINT #1 : PRINT #1
2010 PRINT #1, "Font missing"
2020 PRINT #1, "in line ", ELINE%;
2030 FONT "SW030RSN" : MAG 2,2 : INVIMAGE
2040 RESUME
3000 PRINT #1 : PRINT #1
3010 PRINT #1, "Undefined error"
3020 PRINT #1, "Program Stops!";
3030 RESUME NEXT
```

PRSTAT

Another instruction that can be used in connection with error-handling is the PRSTAT function. In addition to returning the current position of the insertion point (see chapter 10.1), it can also return the printer's status in regard several conditions, using a logical operator:

`IF PRSTAT (AND 0)`	Ok
`IF PRSTAT (AND 1)`	Printhead lifted
`IF PRSTAT (AND 2)`	Label not removed (LTS only)
`IF PRSTAT (AND 4)`	Printer out of paper
`IF PRSTAT (AND 8)`	Printer out of transfer ribbon
`IF PRSTAT (AND 16)`	Printhead voltage too high
`IF PRSTAT (AND 32)`	Printer is feeding

☞ ***Logical Operators***
Also see:
- Chapter 4.9

Multiple simultaneous errors are indicated by the sum of the values for each error, e.g. if both the printhead is lifted (1) and the printer is out paper (4) and ribbon (8), it can be detected by:

`IF PRSTAT (AND 13)`

16. ERROR-HANDLING, cont'd.

4. Error-Handling Program

ERRHAND.PRG Utility Program

The "ERRHAND.PRG" is primarily intended for use with printer models fitted with a display and possible also a membrane keyboard and is included in many Configuration EPROM:s. The program contains routines for handling errors, managing the keyboard and display, and for printing. Use ERRHAND.PRG to quickly get started with your programming.

By merging ERRHAND.PRG with your program, the latter can gain access to ERRHAND's subroutines. Do not use the lines 10–20 and 100000–1900200 in your program, since those line numbers are used by ERRHAND.PRG.

Example:

```
NEW
LOAD "XXX.PRG"
MERGE "ROM:ERRHAND.PRG"
RUN
```

If you have more than one application program that requires error-handling in your printer, you will save valuable memory space by keeping ERRHAND.PRG stored separately and merging it with the current program directly after loading, compared with saving ERRHAND.PRG merged with each program. The approximate size of ERRHAND.PRG is 4 kilobyte.

Variables and subroutines in ERRHAND.PRG that your program can use, or which you can modify, are:

Variables

- NORDIS1$ and NORDIS2$ at line 10 contain the main display texts. You may replace them with your own text.
- DISP1$ and DISP2$ contain the actual text that will appear on the printer's display on line 1 and 2 respectively.

Subroutines

- **At line 160,000**
  The errors which normally may occur during printing are taken care of:

Error 1005	*Out of paper*
Error 1006	*No field to print*
Error 1022	*Head lifted*
Error 1027	*Out of transfer ribbon*
Error 1031	*Next label not found*

The subroutine shows the last error that occurred, if any, and the line number where the error was detected. The information is directed to your terminal. Called by the statement GOSUB 160000.

Continued!

16. ERROR-HANDLING, cont'd.

4. Error-Handling Program, cont'd.

ERRHAND.PRG Utility Program, cont'd.

- **At line 200,000**
  Error-handling routines, which can be called from routines where error may occur, e.g.:
  ```
  IF EFLAG% < > 0 THEN GOSUB 200000
  ```
  The error-handling routine can be modified to handle other errors than those previously mentioned.
- **At line 400,000**
  The FEED-routine executes a FORMFEED with error-checking. Called by the statement GOSUB 400000.
- **At line 500,000**
  The PRINT-routine executes a PRINTFEED with error-checking. Called by the statement GOSUB 500000.
- **At line 600,000**
  This subroutine clears the printer's display and makes the display texts stored in the variables DISP1$ and DISP2$ appear on the first and second line respectively in the display. Called by the statement GOSUB 600000.
- **At line 700,000**
  The Init routine initiates error-checking, opens the console for output and displays the main display texts (NORDIS1$ and NORDIS2$). It also sets up the some of the keys on the keyboard (if any) and assigns subroutines to each key. Called by the statement GOSUB 700000.
- **At line 1,500,000**
  The <**Pause**> key (key No. 15) interrupts the program until the same key is pressed a second time. Called by the statement GOSUB 1500000.
- **At line 1,700,000**
  Routine for the <**Print**> key (key No. 17), that calls subroutine 500,000. Called by the statement GOSUB 1700000.
- **At line 1,800,000**
  Routine for the <**Setup**> key (key No. 18). Enters the Setup Mode of the printer. Not suited for printers without a keyboard! Called by the statement GOSUB 1800000.
- **At line 1,900,000**
  Routine for the <**Feed**> key (key No. 19), that calls subroutine 400,000. Called by the statement GOSUB 1900000.

For more information, refer to the complete listing that follows.

Continued!

16. ERROR-HANDLING, cont'd.

4. Error-Handling Program, cont'd.

Listing of ERRHAND.PRG Utility Program

```
10      PROGNO$ = "Ver. 1.2 92-01-10"
15      NORDIS1$ = "TEST PROGRAM" :
        NORDIS2$ = "VERSION 1.2"
20      GOSUB 700000 : 'Initiate
100000  'Error routine
100010  EFLAG% = ERR
100050  'PRINT EFLAG%:'Activate for debug
100060  LASTERROR% = EFLAG%
100200  RESUME NEXT
160000  'PRINT "Last error = ";LASTERROR%:
        'Activate for debug
160050  'IF LASTERROR% <> 0 THEN PRINT "At line ";ERL
160100  LASTERROR% = 0
160200  RETURN
200000  'Error handling routine
200010  IF EFLAG% = 1006 THEN GOTO 200040:
        'Formfeed instead of print
200020  LED (1) ON : LED (0) OFF : BUSY
200030  SOUND 400, 10
200040  IF EFLAG% = 1031 THEN GOSUB 300000
200050  IF EFLAG% = 1005 THEN GOSUB 310000
200060  IF EFLAG% = 1006 THEN GOSUB 320000
200070  IF EFLAG% = 1022 THEN GOSUB 330000
200080  IF EFLAG% = 1027 THEN GOSUB 340000
200090  DISP1$ = NORDIS1$ : DISP2$ = NORDIS2$
200100  GOSUB 600000
200110  LED (1) OFF : LED (0) ON : READY
200400  RETURN
300000  'Error 1031 Next label not found
300010  DISP1$ = "LABEL NOT FOUND"
300020  DISP2$ = "ERR NO. " + STR$ (ERR)
300030  GOSUB 600000
300040  EFLAG% = 0
300050  FORMFEED
300060  IF EFLAG% = 1031 THEN GOTO 300040
300200  RETURN
310000  'Error 1005 Out of paper
310010  DISP1$ = "OUT OF PAPER"
310020  DISP2$ = "ERR NO. " + STR$ (ERR)
310030  GOSUB 600000
310040  IF (PRSTAT AND 1)=0 THEN GOTO 310040:
        'Wait until head lifted
310050  EFLAG% = 0
310060  IF (PRSTAT AND 1) = 0 THEN FORMFEED
        ELSE GOTO 310060
310070  IF EFLAG% = 1005 THEN GOTO 310040
310080  IF EFLAG% = 1031 THEN GOSUB 300000
310200  RETURN
320000  'Error 1006 No field to print
320010  GOSUB 400000
320200  RETURN
```

Continued!

16. ERROR-HANDLING, cont'd.

4. Error-Handling Program, cont'd.

Listing of ERRHAND.PRG Utility Program, cont'd.

```
330000  'Error 1022 Head lifted
330010  DISP1$ = "HEAD LIFTED"
330020  DISP2$ = "ERR NO. " + STR$ (ERR)
330030  GOSUB 600000
330040  IF (PRSTAT AND 1) THEN GOTO 330040
330050  FORMFEED
330060  IF PCOMMAND% THEN GOSUB 500000
330200  RETURN
340000  'Error 1027 Out of transfer ribbon
340010  DISP1$ = "OUT OF RIBBON"
340020  DISP2$ = "ERR NO. " + STR$ (ERR)
340030  GOSUB 600000
340040  IF (PRSTAT AND 8) THEN GOTO 340040
340050  GOSUB 1500000
340200  IF PCOMMAND% THEN GOSUB 500000
349000  RETURN
400000  'Feed routine
400010  EFLAG% = 0
400020  FORMFEED
400200  IF EFLAG% <> 0 THEN GOSUB 200000
400300  RETURN
500000  'Print routine
500010  EFLAG% = 0
500020  PCOMMAND% = 1
500030  PRINTFEED
500040  IF EFLAG% <> 0 THEN GOSUB 200000
500100  PCOMMAND% = 0
500300  RETURN
600000  'Display handler
600010  PRINT # 10
600020  PRINT # 10
600030  PRINT # 10, DISP1$
600040  PRINT # 10, DISP2$;
600200  RETURN
700000  'Init routine
700010  ON ERROR GOTO 100000
700020  OPEN "console:" FOR OUTPUT AS # 10
700030  DISP1$ = NORDIS1$ : DISP2$ = NORDIS2$
700040  GOSUB 600000
700100  ON KEY (15) GOSUB 1500000 : 'PAUSE
700110  ON KEY (17) GOSUB 1700000 : 'PRINT
700120  ON KEY (18) GOSUB 1800000 : 'SETUP
700130  ON KEY (19) GOSUB 1900000 : 'FEED
700140  KEY (15) ON
700150  KEY (17) ON
700160  KEY (18) ON
700170  KEY (19) ON
700230  LED (0) ON
700240  LED (1) OFF
```

Continued!

16. ERROR-HANDLING, cont'd.

4. Error-Handling Program, cont'd.

Listing of ERRHAND.PRG Utility Program, cont'd.

```
700300  PAUSE% = 0
700500  RETURN
1500000 'Pause function
1500010 KEY (15) ON
1500020 PAUSE% = PAUSE% XOR 1
1500030 BUSY : LED (0) OFF
1500040 DISP1$ = "Press <PAUSE>" :
        DISP2$ = "to continue"
1500050 GOSUB 600000
1500060 IF PAUSE% = 0 THEN GOTO 1500100
1500070 SOUND 131, 2
1500080 SOUND 30000, 20
1500090 IF PAUSE% THEN GOTO 1500070
1500100 READY : LED (0) ON
1500110 DISP1$ = NORDIS1$ : DISP2$ = NORDIS2$
1500120 GOSUB 600000
1502000 RETURN
1700000 'Printkey
1700010 KEY (17) OFF
1700020 GOSUB 500000
1700030 KEY (17) ON
1700200 RETURN
1800000 'Setup key
1800010 KEY (18) OFF
1800020 LED (0) OFF
1800030 BUSY
1800040 SETUP
1800050 READY
1800060 LED (0) ON
1800080 KEY (18) ON
1800090 DISP1$ = NORDIS1$ : DISP2$ = NORDIS2$
1800100 GOSUB 600000
1800200 RETURN
1900000 'Feed key
1900010 KEY (19) OFF
1900020 GOSUB 400000
1900030 KEY (19) ON
1900200 RETURN
```

Continued!

16. ERROR-HANDLING, cont'd.

4. Error-Handling Program, cont'd.

Extensions to ERRHAND.PRG Utility Program

The following subroutines are **not** included in ERRHAND.PRG, but may be added manually to stop new input via the printer's keyboard while a subroutine is executed:

- Turn off all keys before entering a subroutine by issuing the statement GOSUB 900000.
- Turn on all keys after having completed a subroutine by issuing the statement GOSUB 800000.

```
800000 'Turn all keys on
800010 I% = 0
800020 IF I% > 21 THEN GOTO 800060
800030 KEY (I%) ON
800040 I% = I% + 1
800050 GOTO 800020
800060 RETURN

900000 'Turn all keys off
900010 I% = 0
900020 IF I% > 21 THEN GOTO 900060
900030 KEY (I%) OFF
900040 I% = I% + 1
900050 GOTO 900020
900060 RETURN
```

17. REFERENCE LISTS

1. Instructions in Alphabetical Order

Instruction	See chapter	Purpose
ABS	9.2	Returning the absolute value of a numeric expression.
ACTLEN	11.4	Returning the length of the most recently executed PRINTFEED, FORMFEED or TESTFEED statement.
ALIGN (AN)	10.1	Specifying which part (anchor point) of a text, bar code field, image field, line or box will be positioned at the insertion point.
ASC	9.2	Returning the decimal ASCII value of the first character in a string expression.
BARADJUST	15.8	Enabling/disabling automatic adjustment of bar code position in order to avoid faulty printhead dots.
BARFONT (BF)	10.3, 12.1	Specifying fonts for the printing of bar code interpretation.
BARFONT (BF) ON/OFF	10.3	Enabling/disabling the printing of bar code interpretation.
BARHEIGHT (BH)	10.3	Specifying the height of a bar code.
BARMAG (BM)	10.3	Specifying the magnification in regard of width of the bars in a bar code.
BARRATIO (BR)	10.3	Specifying the ratio between the wide and the narrow bars in a bar code.
BARSET	10.3	Specifying a bar code and setting additional parameters to complex bar codes.
BARTYPE (BT)	10.3	Specifying the type of bar code.
BEEP	15.4	Ordering the printer to emit a beep.
BREAK	5.12	Specifying a break interrupt character separately for the keyboard and each serial communication channel.
BREAK ON/OFF	5.12	Enabling/disabling break interrupt separately for the keyboard and each serial communication channel.
BUSY	7.7	Ordering a busy signal, e.g. XOFF, CTS/RTS or PE, to be transmitted from the printer on the specified communication channel.
CHDIR	6.1	Specifying the current directory.
CHECKSUM	6.9	Calculating the checksum of a range of program lines in connection with the transfer of programs.
CHR$	9.2	Returning the readable character from a decimal ASCII code.
CLEANFEED	11.1	Running the printer's feed mechanism.
CLEAR	6.1	Clearing strings, variables and arrays to free memory space.
CLL	11.5	Partial or complete clearing of the print image buffer.
CLOSE	6.4, 7.3-7.6, 8.3-8.5	Closing one or several files and/or devices for input/output.
COM ERROR ON/OFF	7.8	Enabling/disabling error handling on the specified communication channel.
COMBUF$	7.8	Reading the data in the buffer of the specified communication channel.
COMSET	7.8	Setting the parameters for background reception of data to the buffer of a specified communication channel.
COMSET OFF	7.8	Turning off background data reception and emptying the buffer of the specified communication channel.
COMSET ON	7.8	Emptying the buffer and turning on background data reception on the specified communication channel.
COMSTAT	7.8	Reading the status of the buffer of the specified communication channel.
COPY	5.13, 6.2-6.4, 8.5	Copying files.
CSUM	6.10	Calculating the checksum of an array of strings.
CUT	11.3	Activating an optional paper cutting device.
CUT ON/OFF	11.3	Enabling/disabling automatic cutting after PRINTFEED execution and optionally adjusting the paper feed before and after the cutting.
DATE$	9.3, 15.5	Setting or returning the current date.
DATEADD$	9.3	Returning a new date after a number of days have been added to, or subtracted from, the current date or optionally a specified date.
DATEDIFF	9.3	Returning the difference between two dates as a number of days.
DELETE	5.4	Deleting one or several consecutive program lines from the printer's working memory.
DEVICES	4.10, 8.1	Returning the names of all devices to the standard OUT channel.

Continued!

17. REFERENCE LISTS, cont'd.

1. Instructions in Alphabetical Order, cont'd.

Instruction	See chapter	Purpose
DIM	6.10	Specifying the dimensions of an array.
DIR	10.1	Specifying the print direction.
END	5.4	Ending the execution of the current program or subroutine and closing all OPENed files and devices.
ENDIF	5.5	Ending multiple IF...THEN...ELSE statements.
EOF	7.4	Checking for an end-of-file condition.
ERL	16.3	Returning the number of the line on which an error condition has occurred.
ERR	16.3	Returning the code number of an error that has occurred.
FIELD	7.5, 8.4	Creating a single-record buffer for a random file and dividing the buffer into fields to which string variables are assigned.
FIELDNO	11.5	Getting the current field number for partial clearing of the print buffer by a CLL statement.
FILE& LOAD	6.6, 12.2	Reception and storing of binary files in the printer's RAM memory
FILES	6.1, 6.2, 8.1, 12.5, 14.4	Listing the files stored in one of the printer's directories to the standard OUT channel.
FONT (FT)	10.2, 12.1	Selecting a font for the printing of the subsequent PRTXT statements, and optionally generating a bitmap font from a scalable outline font in Speedo or TrueType format.
FONT LOAD	6.6, 12.4	Converting and downloading fonts in .ATF format.
FONTNAME$	12.5	Returning the names of the bitmap fonts stored in the printer's memory.
FONTS	6.1, 8.1, 12.5	Returning the names of all bitmap fonts stored in the printer's memory to the standard OUT channel.
FOR	5.9	Creating a loop in the program execution, where a counter is incremented or decremented until a specified value is reached.
FORMAT	6.1	Formatting the printer's RAM memory, or formatting a RAM-type memory card to MS-DOS format.
FORMAT DATE$	9.3	Specifying the format of the string returned by DATE$("F") and DATEADD$(...,"F") instructions.
FORMAT TIME$	9.3	Specifying the format of the string returned by TIME$("F") and TIMEADD$(...,"F") instructions.
FORMFEED	11.1	Activating the paper feed mechanism in order to feed out or pull back a certain length of the paper web.
FRE	6.1	Returning the number of free bytes in the printer's RAM memory.
FUNCTEST	15.10	Performing various hardware tests.
FUNCTEST$	15.10	Performing various hardware tests.
GET	7.5	Reading a record from a random file to a random buffer.
GOSUB	5.7	Branching to a subroutine.
GOTO	5.6	Branching unconditionally to a specified line.
HEAD	15.8	Returning the result of a thermal printhead check.
IF..GOTO...[ELSE]	5.8	Conditional branching controlled by the result of a numeric expression.
IF..THEN...[ELSE]	5.5	Conditional execution controlled by the result of a numeric expression.
IMAGE LOAD	6.5, 14.3	Reception and conversion of image files in .PCX format to images in the *Intermec Fingerprint* internal bitmap format.
IMAGENAME$	14.4	Returning the names of the images stored in the printer's memory.
IMAGES	6,1, 8.1	Returning the names of all images stored in the printer's memory to the standard OUT channel.
IMMEDIATE ON/OFF	5.4	Enabling/disabling the immediate mode of *Intermec Fingerprint* in connection with program editing without line numbers.
INKEY$	7.2	Reading the first character in the receive buffer of the standard IN channel.
INPUT (IP)	7.2	Receiving input data via the standard IN channel during the execution of a program.
INPUT#	7.3, 7.4, 7.6, 15.1	Reading a string of data from an OPENed device or sequential file.

Continued!

17. REFERENCE LISTS, cont'd.

1. Instructions in Alphabetical Order, cont'd.

Instruction	See chapter	Purpose
INPUT$	7.2-7.6, 15.1	Returning a string of data, limited in regard of number of characters, from the standard IN channel, or optionally from an OPENed file or device.
INSTR	9.2	Searching a specified string for a certain character, or sequence of characters, and returning its position in relation to the start of the string.
INVIMAGE (II)	10.2, 10.4	Inversing the printing of text and images from “black-on-white” to “white-on-black.
KEY BEEP	15.1	Resetting the frequency and duration of the sound produced by the beeper, when any key on the printer's keyboard is pressed down.
KEY ON/OFF	15.1	Enabling/disabling a specified key on the printer's front panel to be used in connection with an ON KEY...GOSUB statement.
KEYBMAP$	15.1	Returning or setting the keyboard map table.
KILL	5.13, 6.1, 6.3-6.4	Deleting a file from the printer's RAM memory or from a DOS-formatted memory card inserted in an optional memory card adapter.
LAYOUT	10.7	Handling of layout files.
LBLCOND	11.1	Overriding the paper feed setup.
LED ON/OFF	15.3	Turning a specified LED control lamp on or off.
LEFT$	9.2	Returning a specified number of characters from a given string starting from the extreme left side of the string, i.e. from the start.
LEN	9.2	Returning the number of character positions in a string.
LET	4.7	Assigning the value of an expression to a variable.
LINE INPUT	7.2	Assigning an entire line, including punctuation marks, from the standard IN channel to a single string variable.
LINE INPUT#	7.2, 7.4, 7.6, 15.1	Assigning an entire line, including punctuation marks, from a sequential file or a device to a single string variable.
LIST	5.4, 6.3, 8.1	Listing the current program completely or partially, or listing all variables, to the standard OUT channel.
LOAD	5.13, 6.3	Loading a copy of a program, residing in the current directory or in another specified directory, into the printer's working memory.
LOC	6.4, 7.4-7.5, 7.8, 8.3-8.5	Returning the current position in an OPENed file or the status of the buffers in an OPENed communication channel.
LOF	6.4, 7.4-7.5, 7.8, 8.3-8.5	Returning the length in bytes of an OPENed sequential or random file or returning the status of the buffers in an OPENed communication channel.
LSET	8.4	Placing data left-justified into a field in a random file buffer.
LTS& ON/OFF	11.3	Enabling or disabling the label taken sensor.
MAG	10.2, 10.4	Magnifying a font, barfont or image up to four times separately in regard of height and width.
MAP	9.1	Changing the ASCII value of a character when received on the standard IN channel, or optionally on another specified communication channel.
MERGE	6.3	Merging a program in the printer's current directory, or optionally in another specified directory, with the program currently residing in the printer's working memory.
MID$	9.2	Returning a specified part of a string.
NAME DATE$	9.3	Formatting the month parameter in return strings of DATE$("F") and DATEADD$(...,"F").
NAME WEEKDAY$	9.3	Formatting the day parameter in return strings of WEEKDAY$.
NASC	9.1	Selecting a character set.
NEW	5.4, 6.3	Clearing the printer's working memory in order to allow a new program to be created.
NEXT	5.9	Creating a loop in the program execution, where a counter is incremented or decremented according to a FOR statement.
NORIMAGE (NI)	10.2, 10.4	Returning to normal printing after an INVIMAGE statement has been issued.

Continued!

17. REFERENCE LISTS, cont'd.

1. Instructions in Alphabetical Order, cont'd.

Instruction	See chapter	Purpose
ON BREAK GOSUB	5.8, 5.12	Branching to a subroutine, when a break interrupt instruction is received.
ON COMSET GOSUB	5.8, 7.8	Branching to a subroutine, when the background reception of data on the specified communication channel is interrupted.
ON ERROR GOTO	5.8, 16.3	Branching to an error-handling subroutine when an error occurs.
ON GOSUB	5.8	Conditional branching to one or several subroutines.
ON GOTO	5.8	Conditional branching to one of several lines.
ON KEY GOSUB	5.8, 15.1	Branching to a subroutine when a specified key on the printer's front panel is activated.
ON/OFF LINE	7.7	Controlling the SELECT signal on the Centronics communication channel.
OPEN	6.4, 7.3-7.6, 8.3-8.5, 15.2	Opening a file or device – or creating a new file – for input, output or append, allocating a buffer and specifying the mode of access.
OPTIMIZE ON/OFF	11.5	Enabling/disabling optimizing strategies for batch printing.
PCX2BMP	6.5, 14.3	Converting image files in .PCX format to the internal bitmap format of *Intermec Fingerprint*.
PORTIN	7.10	Reading the status of a port on the Industrial Interface Board.
PORTOUT ON/OFF	7.10	Setting one of four relays on the Industrial Interface Board to either Open or Closed.
PRBAR (PB)	10.3	Providing input data to a bar code.
PRBOX (PX)	10.5	Creating a box.
PRIMAGE (PM)	10.4	Selecting an image stored in the printer's memory.
PRINT (?)	8.1	Printing of data to the standard OUT channel.
PRINT#	8.3, 8.5, 15.2	Printing of data to a specified OPENed device or sequential file.
PRINT KEY ON/OFF	11.3	Enabling/disabling printing of a label by pressing the Print key.
PRINTFEED (PF)	11.3	Printing and feeding out one or a specified number of labels, tickets, tags or portions of strip, according to the printer's setup.
PRINTFEED (PF) NOT	11.2	Preparing the printing.
PRINTONE	8.1	Printing of characters specified by their ASCII values to the standard OUT channel.
PRINTONE#	8.3, 8.5	Printing of characters specified by their ASCII values to a device or sequential file.
PRLINE (PL)	10.6	Creating a line.
PRPOS (PP)	10.1	Specifying the insertion point for a line of text, a bar code, an image, a box or a line.
PRSTAT	10.1, 16.3	Returning the printer's current status or, optionally, the current position of the insertion point.
PRTXT (PT)	10.2	Providing the input data for a text field, i.e. a line of text.
PUT	8.4	Writing a given record from the random buffer to a given random file.
RANDOM	9.4	Generating a random integer within a specified interval.
RANDOMIZE	9.4	Reseeding the random number generator, optionally with a specified value.
READY	7.7	Ordering ready signal, e.g. XON, CTS/RTS or PE, to be transmitted fro the printer on the specified communication channel.
REBOOT	5.14	Restarting the printer.
REDIRECT OUT	6.4, 8.2	Redirecting the output data to a created file.
REM (')		Adding headlines and explanations to a program without including them in the execution.
REMOVE IMAGE/FONT	6.1, 12.2-12.4, 14.4	Removing a specified image or bitmap font from the printer's memory.
RENUM	5.4	Renumbering the lines of the program currently residing in the printer's working memory.
RESUME	5.8, 16.3	Resuming program execution after an error-handling subroutine has been executed.
RETURN	5.7	Returning to the main program after having branched to a subroutine because of a GOSUB statement.

Continued!

17. REFERENCE LISTS, cont'd.

1. Instructions in Alphabetical Order, cont'd.

Instruction	See chapter	Purpose
RIBBON SAVE ON/OFF	15.9	Enabling/disabling the optional Ribbon Save mechanism.
RIGHT$	9.2	Returning a specified number of characters from a given string starting from the extreme right side of the string, i.e. from the end.
RSET	8.4	Placing data right-justified into a field in a random file buffer.
RUN	5.11, 6.3	Starting the execution of a program.
SAVE	5.13, 6.3	Saving a file in the printer's RAM memory or optionally in a DOS-formatted memory card.
SET FAULTY DOT	15.8	Marking one or several dots on the printhead as faulty, or marking all faulty dots as correct.
SETSTDIO	7.1	Selecting standard IN and OUT communication channel.
SETUP	15.6	Entering the printer's Setup Mode, changing the setup by means of a setup file or setup string, or creating a setup file containing the printer's current setup values.
SGN	9.2	Returning the sign (positive, zero or negative) of a specified numeric expression.
SORT	6.10	Sorting a one-dimensional array.
SOUND	15.4	Making the printer's beeper produce a sound specified in regard of frequency and duration.
SPACE$	9.2	Returning a specified number of space characters.
SPLIT	6.10	Splitting a string into an array according to the position of a specified separator character and returning the number of elements in the array.
STORE	14.3	Storing protocol frames of image data in RAM.
STORE IMAGE	14.3	Setting up parameters for storing an image in RAM.
STORE INPUT	14.3	Receiving and storing protocol frames of image data in RAM.
STORE OFF	14.3	Terminating the storing of an image and resetting the storing parameters.
STR$	9.2	Returning the string representation of a numeric expression.
STRING$	9.2	Repeatedly returning the character of a specified ASCII value, or the first character in a specified string
SYSVAR	7.7, 14.3, 15.7-15.9, 16.1	Reading or setting various system variables.
TESTFEED	11.1	Performing a formfeed to allow the label stop sensor to adjust itself according to the presently loaded paper web.
TICKS	9.3	Returning the time that has passed since the last power-up in the printer, expressed in number of “TICKS” (1 TICK = 0.01 seconds).
TIME$	9.3, 15.5	Setting or returning the current time.
TIMEADD$	9.3	Returning a new time after a number of seconds have been added to, or subtracted from, the current time or optionally a specified time.
TIMEDIFF	9.3	Returning the difference in number of seconds between two specified moments of time in number of seconds.
TRANSFER KERMIT	6.8	Transferring of data files using *Kermit* communication protocol.
TRANSFER STATUS	6.8	Checking last TRANSFER KERMIT operation.
TRANSFER$	6.4	Executing a transfer from source to destination as specified by a TRANSFERSET statement.
TRANSFERSET	6.4	Entering setup for the TRANSFER$ function.
TRON/TROFF	16.2	Enabling/disabling tracing of the program execution.
VAL	9.2	Returning the numeric representation of a string expression.
VERBON/VERBOFF	7.7	Specifying the verbosity level of the communication from the printer on the standard OUT channel (serial communication only).
VERSION$	15.11	Returning the version of the *Intermec Fingerprint* programming language, printer family, or type of CPU board
WEEKDAY	9.3	Returning the weekday of a specified date.
WEEKDAY$	9.3	Returning the name of the weekday from a specified date.
WEEKNUMBER	9.3	Returning the number of the week for a specified date.
WHILE...WEND	5.9	Executing a series of statements in a loop providing a given condition is true.

17. REFERENCE LISTS, cont'd.

2. Instructions by Field of Application

Instruction	Abbr.	Type	Purpose
SETUP AND PREFERENCES			
General Intermec Fingerprint Control:			
CHDIR<scon>		Stmt	Change current directory
MAP[<nexp>,]<nexp>,<nexp>		Stmt	Remapping
NASC<nexp>		Stmt	Select national character set
REBOOT		Stmt	Restart printer
SETUP [[WRITE<sexp>] | [<sexp>]]		Stmt	Printer setup
SYSVAR(<nexp>)		Array	Read or set various system variables
Setting the Clock/Calendar:			
DATE$=<sexp>		Var	Set the date
TIME$=<sexp>		Var	Set the time
OPERATOR INTERFACE			
Keyboard Setup:			
KEY(<nexp>)ON|OFF		Stmt	Enable/disable key on printer's keyboard
ON KEY(<nexp>)GOSUB<ncon>|<line label>		Stmt	Key-initiated branching
KEY BEEP<nexp>,<nexp>		Stmt	Set frequency and duration of key response
KEYBMAP$(<nexp>)=<sexp>		Var	Set the keyboard map table
Output to Display:			
OPEN "console:" FOR OUTPUT AS[#]<nexp>		Stmt	Open display for output
PRINT#<nexp>[,<<nexp>|<sexp>>[<,|;><<nexp|<sexp>>...][;]]		Stmt	Print data to display
CLOSE [#]<nexp>		Stmt	Close display for output
LED Control Lamps:			
LED<nexp>ON|OFF		Stmt	Turn LED on or off
Audible Signals:			
BEEP		Stmt	Emit a beep
SOUND<nexp>,<nexp>		Stmt	Produce sound
Breaking Program Execution:			
BREAK<nexp>,<nexp>		Stmt	Specify break interrupt character
BREAK <nexp> ON|OFF		Stmt	Enable/disable break interrupt
ON BREAK<nexp>GOSUB<ncon>|<line label>		Stmt	Branching at break interrupt
PRINTER CHECKOUT AND CONTROL			
Memory :			
CLEAR		Stmt	Clear strings, variables and arrays
FORMAT<sexp>[,<nexp>[,<nexp>]]		Stmt	Format RAM memory or memory card
FRE(<<nexp>|<sexp>>)		Func	Return number of free bytes in RAM
FUNCTEST <sexp>,<svar>		Stmt	Checking RAM:s and ROM:s
FUNCTEST$ (<sexp>)		Func	Checking RAM:s and ROM:s
REMOVE IMAGE|FONT<sexp>		Stmt	Remove image or font from RAM memory
Printhead:			
BARADJUST<nexp>,<nexp>		Stmt	Enable/disable auto bar code repositioning
HEAD(<nexp>)		Func	Checking printhead dots
FUNCTEST <sexp>,<svar>		Stmt	Checking printhead
SET FAULTY DOT<nexp>[,<nexp>...]		Stmt	Marking dots as faulty for BARADJUST
SYSVAR(21|22)		Array	Read density or no. of dots
Transfer Ribbon:			
RIBBON SAVE ON|OFF		Stmt	Turn ribbon save on or off
SYSVAR(13|20|23)		Array	Read counter, mode or ribbon end sensor
Paper Supply:			
SYSVAR(12)		Array	Read paper end sensor

17. REFERENCE LISTS, cont'd.

2. Instructions by Field of Application, cont'd.

Instruction	Abbr.	Type	Purpose
PROGRAMMING:			
Managing Programs and Files:			
CHECKSUM(<nexp>,<nexp>)		Func	Calculate checksum at program transfer
COPY<sexp>[,<sexp>]		Stmt	Copy file
KILL<sexp>		Stmt	Delete file
LOAD<scon>		Stmt	Load program
MERGE<scon>		Stmt	Merge programs
NEW		Stm	Clear the working memory
SAVE<scon>[,P|L]		Stmt	Save program
Listings:			
DEVICES		Stmt	List devices to standard I/O channel
FILES[<scon>]		Stmt	List files to standard I/O channel
FONTNAME$(<nexp>)		Func	Return font name
FONTS		Stmt	List all fontnames to standard I/O channel
IMAGENAME$(<nexp>)		Func	Return image name
IMAGES		Stmt	List all imagenames to standard I/O channel
LIST[[<ncon>[- <ncon>]]|,V]		Stmt	List current program or all variables to std I/O
VERSION$[(<nexp>)]		Func	Returns S/W or H/W version or printer model
<svar>=KEYBMAP$(<nexp>)		Var	Read the keyboard map table
Program Editing and Execution:			
DELETE<ncon>[-<ncon>]		Stmt	Delete program lines
END		Stmt	Terminate program execution
IMMEDIATE ON|OFF		Stmt	Start/stop writing program w/o line numbers
LIST[[<ncon>[- <ncon>]]|,V]		Stmt	List current program or all variables to std I/O
NEW		Stmt	Clear the working memory
REM|'<remark>		Stmt	Remark
RENUM[<ncon>][,[<ncon>][,<ncon>]]		Stmt	Renumber program lines
RUN[<<scon>|<ncon>>]		Stmt	Execute program
SAVE<scon>[,P|L]		Stmt	Save program
Data Manipulation:			
ABS(<nexp>)		Func	Return the absolute value of an expression
ASC(<sexp>)		Func	Return ASCII code for 1:st char. in string
CHR$(<nexp>)		Func	Convert ASCII code
INSTR([<nexp>,]<sexp>,<sexp>]		Func	Return position of character in string
LEFT$(<sexp>,<nexp>)		Func	Return characters from left side of string
LEN(<sexp>)		Func	Return number of characters in string
[LET]<<nvar>=<nexp>>|<<svar>=<sexp>>		Stmt	Assign a value to a variable
MID$(<sexp>,<nexp>[,<nexp>])		Func	Return part of string
RANDOM (<nexp>,<nexp>)		Func	Generate a random integer
RANDOMIZE [<nexp>]		Stmt	Reseed random number generator
RIGHT$(<sexp>,<nexp>)		Func	Return characters from right side of string
SGN(<nexp>)		Func	Return sign of numeric expression
SPACE$(<nexp>)		Func	Return specified number of space characters
STR$(<nexp>)		Func	Return string representation of num. expr.
STRING$(<nexp>,<<nexp>|<sexp>>)		Func	Return a number of repeated characters
VAL(<sexp>)		Func	Return numeric representation of string expr.

17. REFERENCE LISTS, cont'd.

2. Instructions by Field of Application, cont'd.

Instruction	Abbr.	Type	Purpose
PROGRAMMING, cont'd:			
Branching and Conditionals:			
END IF		Stmt	Ending multiple IF...THEN...ELSE statements
FOR<nvar>=<nexp>TO<nexp>[STEP<nexp>)		Stmt	Creating a program loop
GOSUB<ncon>|<line label>		Stmt	Branch to subroutine
GOTO<ncon>|<line label>		Stmt	Unconditional branching
IF<nexp>[,][THEN]GOTO<ncon>|<line label>[ELSE<stmt>]		Stmt	Conditional branching
IF<nexp>[,]THEN<stmt>[ELSE<stmt>		Stmt	Conditional execution
IF<nexp>[,]THEN↵ <stmt>↵ ...[<stmt]↵ [ELSE↵ <stmt>↵ ...[<stmt>]]↵ ENDIF		Stmt	Conditional execution of multiple statements
NEXT[<nvar>]		Stmt	Creating a program loop
ON <nexp>GOSUB<ncon>|<line label>[,<ncon>|<line label>...]		Stmt	Cond. branching to one of many subroutines
ON <nexp>GOTO<ncon>|<line label>[,<ncon>|<line label>...]		Stmt	Conditional branching to one of several lines
RETURN[<ncon>|<line label>]		Stmt	Return from subroutine
WHILE<nexp>↵ <stmt>↵ [...<stmt>]↵ WEND		Stmt	Conditional execution of loop of statements
Arrays:			
CSUM<ncon>,<svar>,<nvar>		Stmt	Calculate checksum of array of strings
DIM<<nvar>|<svar>>(<nexp>[,<nexp>...])...[,<<nvar>|<svar>>(nexp>[,<nexp>...])]		Stmt	Set array dimensions
SORT<<nvar>|<svar>>,<nexp>,<nexp>,<nexp>		Stmt	Sort a one-dimensional array
SPLIT(<sexp>,<sexp>,<nexp>)		Func	Split a string into an array
Clock/Calendar Facilities:			
<svar>=DATE$[("F")]		Var	Read the date
<svar>=TIME$[("F")]		Var	Read the time
DATEADD$[(<sexp>,]<nexp>[,"F"])		Func	Add days to a date
TIMEADD$[(<sexp>,]<nexp>[,"F"])		Func	Add seconds to a time
DATEDIFF(<sexp>,<sexp>)		Func	Calculate difference between dates
TIMEDIFF(<sexp>,<sexp>)		Func	Calculate difference between times
FORMAT DATE$<sexp>		Stmt	Specify date format
FORMAT TIME$<sexp>		Stmt	Specify time format
NAME DATE$<nexp>,<sexp>		Stmt	Specify names of the months
NAME WEEKDAY$		Stmt	Specify names of the weekdays
WEEKDAY(<sexp>)		Func	Return weekday of a date
WEEKDAY$(<sexp>)		func	Return name of the weekday for a date
WEEKNUMBER		Func	Return weeknumber for a date
TICKS		Func	Return time passed since startup
Error-handling:			
ERL		Func	Error on line
ERR		Func	Error code
ON ERROR GOTO<ncon>|<line label>		Stmt	Branch at error
PRSTAT[(<nexp>)]		Func	Returns printer status or current X/Y position
RESUME[<<ncon>|<line label>|<NEXT>|<0>>]		Stmt	Resume program execution after error
SYSVAR(19)		Array	Set type of error message
TRON		Stmt	Enable tracing
TROFF		Stmt	Disable tracing
COMMUNICATION:			
Communication Control:			
BUSY[<nexp>]		Stmt	Send busy signal on communication channel
READY[<nexp>]		Stmt	Send ready signal on communication channel
ON LINE<nexp>		Stmt	SELECT signal high (Centronics)
OFF LINE<nexp>		Stmt	SELECT signal low (Centronics)
REDIRECT OUT[<sexp>]		Stmt	Redirect output data to file
SETSTDIO<nexp>[,<nexp>]		Stmt	Set standard I/O channels
SYSVAR(18)		Array	Set verbosity level
VERBON		Stmt	Verbosity on
VERBOFF		Stmt	Verbosity off

17. REFERENCE LISTS, cont'd.

2. Instructions by Field of Application, cont'd.

Instruction	Abbr.	Type	Purpose
COMMUNICATION, cont'd.			
Background Communication:			
COM ERROR<nexp>ON|OFF		Stmt	Enable/disable error handling
COMBUF$(<nexp>)		Func	Read communication buffer
COMSET<nexp>,<sexp>,<sexp>,<sexp>,<sexp>,<nexp>		Stmt	Set communication parameters
COMSET<nexp>ON|OFF		Stmt	Turn on/off background data reception
COMSTAT(<nexp>)		Func	Read communication buffer status
ON COMSET<nexp>GOSUB<nexp>|<line label>		Stmt	Branch at background comm. interrupt
FILE TRANSFER:			
Binary Files:			
TRANSFER K[ERMIT]<sexp>[,<sexp>[,<sexp>[,<sexp>]]]		Stmt	Data transfer using KERMIT
TRANSFER S[TATUS]<nvar>,<svar>		Stmt	Check last KERMIT transfer
FILE& LOAD<sexp>,<nexp>[,<nexp>]		Stmt	Receive and store binary files
Data Files:			
TRANSFER$(<nexp>)		Func	Execute transfer and set time-out
TRANSFERSET[#]<nexp>,[#]<nexp>,<sexp>[,<nexp>]		Stmt	Enter setup for file transfer using TRANSFER$
Image Files:			
IMAGE LOAD<sexp>,<nexp>,<sexp>[,<nexp>]		Stmt	Receive and convert .PCX files to images
RUN "pcx2bmp [-i][-v] <scon> [<scon>]"		–	Convert image files in .PCX format
STORE<sexp>		Stmt	Store Intelhex frames of image data
STORE IMAGE[RLL][KILL]<sexp>,<nexp>,<nexp>,[<nexp>],<sexp>		Stmt	Set up image storage parameters
STORE INPUT<nexp>[,<nexp>]		Stmt	Receiving and storing image data
STORE OFF		Stmt	End storing of image data
SYSVAR(16|17)		Array	Read no. of bytes/frames received
INPUT TO FINGERPRINT			
Input from Standard IN Channel:			
INKEY$		Func	Read 1:st character from std IN channel
INPUT[<scon><;|,>]<<nvar>|<svar>>[,<<nvar>|<svar>>...]	IP	Stmt	Input to variables
INPUT$(<nexp>[,<nexp>])		Func	Input, limited no. of characters
LINE INPUT[<scon>;]<svar>		Stmt	Input, entire line
Input from Host on Any Channel:			
OPEN<sexp>FOR INPUT AS[#]<nexp>		Stmt	Open device
INPUT#<nexp>,<<nvar>|<svar>>[,<<nvar>|<svar>...]		Stmt	Input to variables
INPUT$(<nexp>[,<nexp>])		Func	Input, limited no. of characters
LINE INPUT#<nexp>,<svar>		Stmt	Input, entire line
CLOSE[[#]<nexp>[,[#]<nexp>...]]		Stmt	Close device
LOC(<nexp>)		Func	Remaining no. of characters in receive buffer
LOF(<nexp>)		Func	Remaining free space in receive buffer
Input from Sequential File:			
OPEN<sexp>FOR INPUT AS[#]<nexp>		Stmt	Open file
INPUT#<nexp>,<<nvar>|<svar>>[,<<nvar>|<svar>...]		Stmt	Input to variables
INPUT$(<nexp>[,<nexp>])		Func	Input, limited no. of characters
LINE INPUT#<nexp>,<svar>		Stmt	Input, entire line
CLOSE[[#]<nexp>[,[#]<nexp>...]]		Stmt	Close file
EOF(<nexp>)		Func	End of file
LOC(<nexp>)		Func	Return current position in file
LOF(<nexp>)		Func	Return length of file
Input from Random File:			
OPEN<sexp>AS[#]<nexp>[LEN=<nexp>]		Stmt	Open a random file
FIELD[#]<nexp>,<nexp>AS<svar>[,<nexp>AS<svar>...]		Stmt	Create a buffer for a random file
GET[#]<nexp>,<nexp>		Stmt	Read rec. from random file to random buffer
CLOSE[[#]<nexp>[,[#]<nexp>...]]		Stmt	Close file
LOC(<nexp>)		Func	Return current position in file or buffer
LOF(<nexp>)		Func	Return length of file

17. REFERENCE LISTS, cont'd.

2. Instructions by Field of Application, cont'd.

Instruction	Abbr.	Type	Purpose
INPUT TO FINGERPRINT, cont'd.			
Input from Printer's Keyboard			
OPEN"console:" FOR INPUT AS[#]<nexp>		Stmt	Open keyboard for input or append
INPUT#<nexp>,<<nvar>|<svar>>[,<<nvar>|<svar>...]		Stmt	Input to variables
INPUT$(<nexp>[,<nexp>])		Func	Input, limited no. of characters
LINE INPUT#<nexp>,<svar>		Stmt	Input , entire line
CLOSE [#]<nexp>		Stmt	Close keyboard for input
Industrial Interface:			
PORTIN(<nexp>)		Func	Reading status of a specified port
PORTOUT(<nexp>)ON|OFF		Stmt	Set the relay on a specified port
OUTPUT FROM Intermec FINGERPRINT			
Output to Standard OUT Channel :			
PRINT[<<nexp>|<sexp>>[<,|;><<nexp>|<sexp>>...][;]]	?	Stmt	Print data to standard I/O channel
PRINTONE[<nexp>[<,|;><nexp>...][;]]		Stmt	Print ASCII characters to std I/O channel
Output to Any Communication Channel:			
OPEN<sexp>[FOR <OUTPUT|APPEND>]AS[#]<nexp>		Stmt	Open device
PRINT#<nexp>[,<<nexp>|<sexp>>[<,|;><<nexp|<sexp>>...][;]]		Stmt	Print data to device
PRINTONE#<nexp>[,<nexp>[<,|;><nexp>...][;]]		Stmt	Print ASCII characters to device
CLOSE[[#]<nexp>[,[#]<nexp>...]]		Stmt	Close device
LOC(<nexp>)		Func	Remaining free bytes in transmitter buffer
LOF(<nexp>)		Func	Remaining no. of char. in transmitter buffer
Output to a Sequential File:			
OPEN<sexp>[FOR <INPUT|OUTPUT|APPEND>]AS[#]<nexp>		Stmt	Open file
PRINT#<nexp>[,<<nexp>|<sexp>>[<,|;><<nexp|<sexp>>...][;]]		Stmt	Print data to sequential file
PRINTONE#<nexp>[,<nexp>[<,|;><nexp>...][;]]		Stmt	Print ASCII characters to sequential file
CLOSE[[#]<nexp>[,[#]<nexp>...]]		Stmt	Close file
LOC(<nexp>)		Func	Current position in file
LOF(<nexp>)		Func	Length of file
Output to Random File:			
OPEN<sexp>AS[#]<nexp>[LEN=<nexp>]		Stmt	Open a random file
FIELD[#]<nexp>,<nexp>AS<svar>[,<nexp>AS<svar>...]		Stmt	Create a buffer for a random file
LSET<svar>=<sexp>		Stmt	Place data in random file buffer (left justified)
RSET<svar>=<sexp>		Stmt	Place data in random file buffer (right justified)
PUT[#]<nexp>,<nexp>		Stmt	Write rec. from random buffer to random file
CLOSE[[#]<nexp>[,[#]<nexp>...]]		Stmt	Close file
LOC(<nexp>)		Func	Current position in file
LOF(<nexp>)		Func	Length of file
FORMATTING AND PRINTING			
General Formatting Instructions:			
ALIGN<nexp>	AN	Stmt	Alignment
DIR<nexp>		Stmt	Select print direction
PRPOS<nexp>,<nexp>	PP	Stmt	Set coordinates for insertion point
LAYOUT [F,]<sexp>,<sexp>,<svar>,<nvar>		Stmt	Creating and using layout files
Text Printing:			
INVIMAGE	II	Stmt	Inverse image printing
MAG<nexp>,<nexp>		Stmt	Magnification of font
NORIMAGE	NI	Stmt	Return to normal image printing
FONT<sexp>	FT	Stmt	Select bitmap font
FONT<sexp>[,<sexp>[,<nexp>[,<nexp>[,<nexp>[,<nexp>[,<sexp> [,<nexp>[,<nexp>[,<sexp>]]]]]]]]]	FT	Stmt	Scale outline font (range of ASCII values)
FONT<sexp>[,<sexp>[,<nexp>[,<sexp>[,<nexp>[,<sexp>[,<nexp> [,<nexp>[,<sexp>]]]]]]]]	FT	Stmt	Scale outline font (string of characters)
PRTXT<<nexp>|<sexp>>[;<<nexp>|<sexp>>...][;]	PT	Stmt	Input data to text field

Continued!

17. REFERENCE LISTS, cont'd.

2. Instructions by Field of Application, cont'd.

Instruction	Abbr.	Type	Purpose
FORMATTING AND PRINTING, cont'd.			
Bar Code Printing:			
BARFONT[#<ncon>,]<sexp>[,sexp>[,<nexp>[,nexp>[,nexp]]]][ON]	BF	Stmt	Specify bar code interpretation fonts
BARFONT ON	BF ON	Stmt	Enable bar code Interpretation
BARFONT OFF	BF OFF	Stmt	Disable bar code interpretation
BARHEIGHT<nexp>	BH	Stmt	Bar code height
BARMAG<nexp>	BM	Stmt	Bar code magnification
BARRATIO<nexp>,<nexp>	BR	Stmt	Wide/narrow bar ratio
BARSET[#<ncon>,][<sexp>[,<nexp>[,<nexp>[,<nexp>[,<nexp>[,<nexp> [,<nexp>[,<nexp>[,<nexp>[,<nexp>[,<nexp>]]]]]]]]]]		Stmt	Specifying complex bar codes
BARTYPE<sexp>	BT	Stmt	Bar code type
MAG<nexp>,<nexp>		Stmt	Magnification of barfont
PRBAR<<sexp>|<nexp>>	PB	Stmt	Input data to bar code field
Image and Graphics Printing:			
INVIMAGE	II	Stmt	Inverse image printing
MAG<nexp>,<nexp>		Stmt	Magnification of image
NORIMAGE	NI	Stmt	Return to normal image printing
PRBOX<nexp>,<nexp>,<nexp>	PX	Stmt	Create a box
PRIMAGE<sexp>	PM	Stmt	Select a preprogrammed image
PRLINE<nexp>,<nexp>	PL	Stmt	Create a line
Printing and Paper Feed Control:			
ACTLEN		Func	Read length of last paper feed
CLEANFEED<nexp>		Stmt	Running the printer's feed mechanism
CLL[<nexp>]		Stmt	Clear print buffer
CUT		Stmt	Activate optional cutting device
CUT <nexp> ON|OFF		Stmt	Enable/disable automatic cut-off
FIELDNO		Func	Get current field number for CLL
FORMFEED[<nexp>]	FF	Stmt	Paper feed
LBLCOND<nexp>,<nexp>		Stmt	Overriding paper feed setup
LTS& ON|OFF		Stmt	Enable/disable label taken sensor
OPTIMIZE[<sexp>] ON|OFF		Stmt	Enable/disable optimizing for batch printing
PRINT KEY ON|OFF		Stmt	Enable/disable PRINTFEED using Print key
PRINTFEED<nexp>	PF	Stmt	Print and feed out label or batch of labels
PRINTFEED NOT	PF NOT	Stmt	Prepare printing
TESTFEED		Stmt	Auto adjustment of label stop sensor