BIJLAGE H

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High Quality Printing of TEX - DVI Output Files in the VAX/VMS Environment

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Océ-van der Grinten N.V. is the parent of an international group of companies, the Océ Group, which distributes, produces and develops a large range of copiers and copying supplies as well as office automation products, including word processors and laser printers, for both commercial and design engineering offices.

Océ-Nederland B.V. has developed the Océ 6750 laser printer. This printer is based on the well-known engine of the Océ 1900 copier family. The laser printer has a resolution of 508 dpi (20 dots/mm). The printspeed is 23 pages per minute. The heavy duty engine prints a target load of up to 200,000 pages per month. Paper input and paper output are as advanced as usual for the Océ copiers. The level of quality printing of the Océ 6750 laser printer is perfectly suited for printing the output of the high quality typesetting program TEX. For this reason Océ has developed software for connecting the Océ 6750 laser printer to a wide range of VAX/VMS computers. On these VAX/VMS computers TEX runs as an application and the TEX-DVI files are converted to the ECMA/ODA protocol of the Océ 6750 laser printer. The combination of the high quality typesetting program TEX, the VAX/VMS computer and the Océ 6750 laser printer is responsible for a high level of quality printing.

The Océ 6750 laser printer

In this part we will describe the printing process. The information of the VAX/VMS computer is received via an IEEE 488 interface. This information has the ECMA/ODA format and is processed in the Raster Image Electronics. Here the information is converted into pixels, a processable form for the Laser Scan Module. The electrophotographic process consists of six steps:

1. charging
2. exposure
3. developing
4. transferring
5. fusing
6. cleaning

1. Charging.

The 370-inch continuous photoconductor is a polyester belt coated with a thin layer of zinc-oxide. Zinc-oxide has the following characteristics: in the dark it is not electrically conductive. It is an insulator. But when you expose zinc-oxide to the light it becomes a conductor. The photoconductor is charged from the corona unit.

2. Exposure.

The charged parts of the photoconductor move in the direction of the exposure area where the Laser Scan Module will expose the photoconductor. The laser discharges the non-black part of

the image (write white engine). The black part of the image is still charged and is called a latent image.

3. Developing.

This image has to be made visible. The process is called developing. The latent image is passed along a rotating metal tube to which toner has been applied. We use a dry monocomponent toner. The toner particles on the tube are attracted by the electrical charge of the latent image. Now we have a visible black image on the photoconductor.

4./5. Transferring and fusing.

The next task is to bring the image to the paper. This is achieved in two transfer steps. In the first transfer step a soft belt is pressed up against the photoconductor and picks up the image. The rubber belt is heated and at a temperature of 105 degrees Celsius, the melted toner is fused on the warmed paper (second transfer step). The paper has been fed from one of the two paper trays.

6. Cleaning.

The final step of the process is to discharge the photoconductor and then brush off the toner residue. The photoconductor is now ready for recharging.

The size of the toner particles, the spot size of the laser and the described process are of great importance for the final print quality. The benefits of this process are a high image resolution, uniform density, consistent quality from first to last print, no developer to be mixed, no direct contact between photoconductor and paper, no paper jams.

As mentioned in the introduction the paper handling is as advanced as usual for Océ copiers. This includes the following:

- *Input.* The printer has two input trays (1600 + 600 A4 sheets) available. The large capacity and the fact that the paper compartment is outside of the printer give you the possibility of non-stop printing.
- *Output.* The sorter with 20 selectable bins of 100 sheets each takes care of the collation and storage of a large capacity of 2,000 sheets. You can use the ergonomic designed sorter in a personal, set or sortwise printing mode.

ODA

As stated the Océ 6750 laser printer uses the ECMA/ ODA protocol.

What is ODA?
ODA, Office Document Architecture, is an international standard which offers a solution for integrating office systems. ODA is an interchange standard for multi-media documents which has been produced in order to allow documents (text and/or graphics) to be interchanged between computer systems anywhere in the world. ODA documents can contain information represented in the form of character text, raster graphics and geometric graphics. ODA enables communicating systems to interchange documents across networks with the integrity of the content, format and layout. It is possible to reproduce, reprocess, store or print the document in the form intended by the originator. To assist in the integration of computer systems, ODA employs the following established standards:

- the character content of ODA is compatible with ISO 6937, and thus with Telex and Teletex.

- the geometric graphics content is compatible with ISO 8632, and thus with the GKS/CGM family of graphics standards.
- the raster graphics content is compatible with CCITT Recommendations T4 and T6 and thus with group 3 and group 4 facsimile.

At Cebit 1988 and 1989 at Hannover ODA was used to demonstrate mixed media document interchange. Complex pages of text, image and graphics were originated by one company, displayed and edited by a second company and printed by the Océ 6750 laser printer with communications via X.400 mail and X.25 lines.

Interfacing to VAX/VMS computers

With the standard IEEE 488 interface of the Océ 6750 laser printer it is very easy to connect the printer to a wide range of VAX/VMS computers. In the VAX/VMS computer range we find three types of busses:

1. Q-bus
2. Unibus
3. BI-bus

Connecting the Océ 6750 to a VAX with respectively one of these busses can be done with standard from Digital Equipment Corporation available IEEE boards and drivers. Besides the hardware and the driver you need host resident software for the communication with the printer and the conversion of TEX-DVI files to ECMA/ODA. The software developed by Océ contains:

1. the printer protocol
2. the symbiont
3. the conversion programs
4. the font management tools

1. The printer protocol

The Low Level and the High Level Printer Protocol (LLPP and HLPP) take care of the cooperation between symbiont and the IEEE 488 device driver. The printer protocol is used for informing the host about the printer status and setting the printer in a certain status. The font downloading procedures are also implemented in the printer protocol. Other typical tasks of the printer protocol are:

- sending/receiving packets to/from the Océ 6750
- initialize the printer at start time
- converting messages to packets (two way)
- font management

2. Symbiont

The standard symbiont of the VAX was not applicable to control the conversion programs and the communication between the user and the printer (two input trays, 20 output bins, setwise, sortwise or personal printing, handle messages coming from the printer etc.). Océ developed a symbiont specially for the 6750. The symbiont controls all the conversion programs and interacts with the job controller. Typical aspects of the symbiont are:

- errorhandling
- starting and controlling the HLPP and conversion programs
- communicates with the job controller
- interpretes the DCL extensions and options

- including burst/flag/trailer pages

3. Conversion programs

The conversion programs re-sort under the "umbrella" of the symbiont and take care of several conversions to ECMA/ODA, the input standard of the 6750 laser printer. There are converters for:

- LN03 Plus to ECMA/ODA
- Lineprinter to ECMA/ODA
- TEX-DVI to ECMA/ODA

4. Font management tools

With an easy to use font-tool it is possible to use Metafont to generate PXL-fonts. These are transformed to the Océ format and can be downloaded to the printer.

The combination of the high quality typesetting program TEX, the VAX/VMS computers and the Océ 6750 laser printer is responsible for producing high quality documents.

If you wish to receive an original set of printouts or additional information, please contact:

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