Advantages of Thermal Printing

Thermal printing: the basic concept

Thermal printing is a non-impact method of creating images on paper and synthetic film. The process applies heat from a thermal printhead onto thermal material. The base material used in the thermal printing process may be selected from a variety of paper grades or synthetic films (e.g. PP, PE, or PET) with a special chemical coating applied to one side to make it sensitive to heat.

Thermal printing has a number of important advantages over traditional printing processes; it is fast, clean, quiet, reliable and easy to maintain. There are a limited number of mechanical parts, no messy ribbons or toners, and no inking devices are needed to create the image.

Since thermal printers only have one or two moving components, they are very reliable and economical to operate and maintenance costs are extremely low. The entire system is compact, simple to operate and suitable for use in virtually all applications.

Thermal printheads are usually much smaller and lighter than the printing elements used by other imaging processes, so thermal printers are suitable when compact size, portability and on-demand printing are needed. At the same time, a sharp and precise image of excellent quality is produced consistently and quickly by properly matching the thermal paper to the printhead by varying the chemical coating formulation.

In recent years, microprocessors have been installed to control printhead operation with major improvements in image sharpness and clarity. A thermal printhead has a large number of tiny resistors, which individually react to convert an electrical impulse into heat. The heat from the printhead on thermal material creates a reaction with the chemical coating to produce an image. The image is produced within milliseconds of contact and is normally black in color. The depth and range of colors may be produced by varying the chemical formulation applied to the base material.

The quality and performance of thermal printing depends heavily on the careful matching of thermal material to printhead equipment specification. As a result, a range of thermal materials is used across a wide spectrum of thermal printers for different applications. To give the required physical characteristics and properties, the type of base material - paper, board, or synthetic film - varies from application to application, as does the thickness and weight of various base materials.

The end result is a specialized high-tech product with thermal characteristics and properties compatible with the thermal printing system in its specific printing application. The end product also possesses the physical and product characteristics and

properties essential to the very application itself, (which are typically stiffness, durability, tear-resistance, water-resistance and other similar performance criteria.)

Advantages of Thermal Printing

Thermal technology: the benefits

The benefits of thermal printers are compelling. A thermal receipt printer uses a printhead with few moving parts and it fits in a thin space about three inches across. By contrast, the standard receipt printer is composed of about 20 moving parts and electrical devices and takes up a least twice the space.

Due to the simple nature of the printing process, there is none of the whir, clatter and buzz inherent in other printers. What's more, there is no toner, ink or ribbons. Since there are at least a few hundred dots to the inch, a thermal printer can deliver an image that is sharper and clearer than the standard receipt printer. And it's a more consistent image because there is no ribbon to wear out. What's more, a wide variety of fonts can be used to quickly and clearly print many logos and graphical images that are beyond the capability of most current printers.

Thermal printing also creates less dust than the typical printing unit while the paper coatings prevent abrasive wear to printheads and rollers. And, since the printhead has few moving parts, it requires far less interim maintenance than the more complicated devices that currently dominate the market.

Thermal technology users enjoy printing speeds that range from one line to over thirty lines per second. This rapid performance not only helps move the checkout line, it eliminates the need for two-ply paper. The merchant simply prints a charge slip and asks the customer to sign it. While this is happening, the second copy is produced for the shopper. Thermal benefits include;

* **Excellent, crisp print quality**
* **Consistent print quality**
* **High reliability**
* **Quiet operation**
* **Easy handling -- no ink/ribbon**
* **High speed printing**
* **Lower maintenance costs**
* **Compact mechanism**
* **Flexible use of fonts**
* **High quality graphics/logos**
* **Quality bar codes/coupons**
* **Easier paper loading**

* **Lower operating costs**
* **Reduced training time**
* **Increased cashier productivity**
* **Clean receipt**

Advantages of Thermal Printing

Thermal applications: expanding uses

The inherent features of thermal printing systems mean they have widespread use across an extensive and growing range of applications. Thermal printing, compared with conventional printing techniques, produces consistent and precise bar code labels at point-of-sale outlets. This has been a major contributing factor to the rapid growth in the scope and scale of thermal applications.

The oldest and best-known use of thermal paper is facsimile machines, but constantly advancing technology has led to a proliferation of important new uses. The following industries currently use thermal imaging; Aerospace, Airlines, Auto, Banking, Business Forms, Chemicals, Computer, Defense, Education, Entertainment, Food, Health Care, Lottery, Material Management, Packaging, Parcel Delivery, Pharmaceutical, Postal, Retail, Textiles, Transportation and Vending. Some examples are;

* **point-of-sale receipts**

restaurants
service stations
parking lots
retail outlets
supermarkets

* **labels**

supermarket - POS items
stock control labels - retail
counting terminals
airline baggage tags
ski lift tags

* **monitoring**

weather charts
electricity voltage meters
depth sounders
cardiograph paper

* **plotting**

seismic and geophysical
drafting paper
maps
meteorology

* **ticketing**

airline boarding passes
entertainment/theater
horse racing
lottery
transportation

* **analysis**

pathology - blood count
analytical tissue reading

The rapid growth of thermal applications will continue to drive the volume up and the costs of thermal paper down. Especially since thermal printers are now beginning to be accepted by general merchandise retailers. Overall, acceptance of thermal POS printing in particular is quickly escalating. The total U.S. installed base of thermal printers used in Retail in 1993 was only 4.3% and moved to 11.5% in 1995. Current estimates place thermal technology at 25% of the POS market by the year 2000.

Advantages of Thermal Printing

Thermal vs. Impact: ROI Analysis

By far, the largest single contributor to POS system operating costs is the printer. It is the only part of the POS system that requires supply items and it also requires more attention than any other POS peripherals. In the new era of POS system open architecture, retailers have the chance to select from many choices, a printer that provides them with the least "trouble" and operating expense. A shift in printing technologies, which has just gotten underway in the POS arena, is beginning to provide retailers with reduced operating costs.

Thermal printing is fast replacing impact printing in many key retail sectors. By its very nature, impact printing wears out parts faster and requires more frequent maintenance. Impact printers also require more attention because they have two supply items; ribbon and paper. Loading paper is complicated by the fact that the paper must be threaded under the ribbon. Nearly everyone has experienced the annoyance of waiting in line while the check out clerk goes looking for the resident paper/ribbon loading guru. With thermal receipt printing, their are no impact parts to deal with.

Originally, thermal printers were selected for POS applications where use of impact printers was not possible. The best example of this is the credit card receipt printers embedded in gasoline pumps. Thermal printers could be designed to withstand any foreseen weather conditions. Thermal POS printers then began to gain acceptance in less hostile environments such as grocery stores, restaurants, and theaters on the basis of higher printing speeds and better print quality. Replacement of impact printers in these latter applications has taken place even though thermally coated paper is slightly more expensive.

Epson has dealt with this issue by designing the TM-H5000II thermal printer to operate with even the lower cost third party supplied thermal papers that are appearing on the market. The compactness of Epson's TM-H5000II hybrid thermal printer has meant that larger paper rolls can be used in a small footprint printer. Thus, many more receipts can be printed per roll, reducing the frequency of the cash register being down for change of paper roll. Furthermore, the TM-H5000II takes advantage of ribbonless receipt by making paper loading a matter of dropping the roll into a hinged paper housing and

making the whole process very simple. Extensive life testing has established actuarial data on thermal printers that have allowed service agencies to offer annual on-site maintenance contracts that are much lower than that charged for covering impact printers. The attention paid to the hardware design of the Epson TM-H5000II has made the cost of operating thermal POS printers actually lower than the cost of slower and less aesthetic (both visually and audibly) impact printers.

1.) Cost of Paper

A good quality grade of thermal paper for most POS applications will average about three times the cost of plain paper. For example, based on similar volume purchases, a plain roll of receipt paper that now costs $.40 per roll will cost $1.20 for thermal.

2.) Paper Roll Length

Thermal paper is slightly thinner than plain bond paper so more feet per roll can be added. This means more receipts can be printed per roll for thermal than impact. More receipts per roll means less paper replacement resulting in less labor costs and downtime.

3.) Clean Receipt

Clean receipt is the ability to scan/enter items as usual but rather than printing line by line, all items are buffered for printing at the end of the total transaction. The buffered items can then be grouped according to alphabetical order and exact like items, no matter when they are scanned, can be grouped together. There are many different ways items can be grouped.

For example, grouping like items will eliminate having to print two lines on the receipt. Additionally, the ability to net out all voided items so that they do not appear on the receipt tape can also be accomplished thereby saving paper. Test show paper savings gained using clean receipt can exceed 33% is some retail environments. Clean receipt has only been made recently possible by the huge increase in thermal printing speed.

4.) Time to change paper roll

Epson's TM-H5000II incorporates an easy drop and load paper feature. This saves cashiers a tremendous amount of time over the older, more tedious paper loading requirements of impact printers. Internal testing has shown that the time to change paper can be reduced from a few minutes to less than thirty seconds. Not only does this produce hard labor savings but it also means less down time, quicker checkouts and reduced training costs.

5.) Excess stock handling fees

Another direct labor saving is the reduction in stock handling fees. Paper and ribbon supplies will last longer resulting in less handling. Additionally, the ribbon inventory requirement will be much less.

6.) Journal tape

The purchase of a thermal printer facilitates the immediate implementation of Electronic Journaling (EJ). The by-product of EJ is that the Journal station is removed thereby eliminating the cost of the second roll of paper. This is now captured electronically. Additionally, the labor cost of removing, marking and physically storing this paper roll is eliminated as well as the high cost of storage space. Instead, all data is now captured and stored on either high capacity ZIP or hard drives. This also allows for the ability to easily query and retrieve old transaction data rather than going through boxes of journal tapes.

7.) Ribbon Cost

Total ribbon usage will drop dramatically when installing thermal printers. Since all receipts are now being printed using thermal technology, the ribbons are now only used for check and document printing. The entire cost of ribbons used for receipt printing has been completely eliminated.

8.) Time to change ribbon

The time to change ribbons will be dramatically reduced. Since ribbons will last much longer, they will be changed much less. This will result in direct labor savings. It will also reduce the amount of down time per lane as a result of having to change those ribbons.

9.) Faster transaction time

The sheer speed of the thermal printers will allow for faster transaction time. In essence, this should result in the ability to process customers faster, especially during peak periods such as holidays. This should result in less labor costs and happier customers.

10.) Less Maintenance Costs

Thermal printer mechanisms have less moving parts so they will inherently last much longer and require less maintenance. This can be capitalized upon by either re-negotiating service costs or by implementing a different method of service such as depot maintenance. Depot can be considered a much more attractive service option with thermal printers because of their longevity.

ROI Worksheet

Summary of Cost Components

	Impact		*Thermal*		
	Qty/Time	Annual Cost	Qty/Time	Annual Cost	Difference
Paper	Cost Roll		Cost Roll		
	Roll Length		Roll Length		
	Avg. Receipts		Avg. Receipts		
	Clean Receipt		Clean Receipt		
	Change Roll		Change Roll		
	Journal Tape		Journal Tape		
Ribbon	Ribbon Cost		Ribbon Cost		
	Change Ribbon		Change Ribbon		
Excess Stock	Handling Fees		Handling Fees		
Training	Reduced Time		Reduced Time		
Maintenance	Service Costs		Service Costs		
Transaction	Reduced Time		Reduced Time		
Others					

** *The above ROI worksheet is a guide only. The actual thermal ROI categories will vary somewhat for each retailer. Most studies so far have shown that the total cost of ownership for thermal printers is much less than that for impact printers.*