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DIRECT READING TEST METER SIMPLIFIES
MAGNETIC INK PRINTING QUALITY CONTROL

This Application Note describes the use of the Φ Model H06 428A Magnetic Printing Tester. Information is included on accuracy of the instrument and on methods of compensating for various practical operating conditions.

INTRODUCTION

Bank checks and other documents can be processed by automatic sorting and computing devices if the necessary information is imprinted on them with magnetic ink. A type face has been selected, and printing standards established to provide the banking industry with nationwide automation of check sorting and clearing procedures.¹

¹Standards for magnetic ink printing are detailed in Bank Management Publication 147, "The Common Machine Language", published by the Bank Management Commission, American Bankers Association, 12 East 36th Street, New York 16, New York.

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A major factor in making these procedures work is control of the magnetic ink printing process. Various optical methods are used to determine that the printed characters and symbols are within dimensional tolerances acceptable by the automatic equipment. The Φ Magnetic Printing Tester completes the testing equipment requirement for the printer by providing an economical and convenient means for determining that the magnetic content of the ink is correct, and that the proper amount is being deposited during the printing process.

The Magnetic Printing Tester can assist the printer in three major phases of his operation:

1. Checking ink for the proper ferric oxide content (this is the component which determines magnetic intensity). Ink manufacturers can also use the instrument for this purpose.
2. Setting up the press so the correct amount of ink is deposited (this determines that the printed information will properly actuate the automatic machines).
3. Maintaining uniform conditions during a press run by periodically checking production samples.



WHAT THE MAGNETIC PRINTING TESTER DOES

A standard optimum ink intensity has been established for operating automatic check sorting and computing equipment. The meter on the H06 428A Magnetic Printing Tester shows the percentage of this optimum intensity for selected test symbols. To use the instrument a sample of the printing is magnetized and placed under a measuring head. The total magnetic flux passing through the head determines the reading on the meter. Total magnetic flux is affected by the amount of ink deposited on the paper, and the total area covered by the ink, as well as by the magnetic intensity of the ink.

For convenient use the instrument is calibrated for a standard test patch and two standard symbols -- the dash and the "on us", at least one of which will almost always appear on the checks being printed. A three-position switch connects the metering circuits so the percentage of optimum ink intensity can be read directly for the symbol being checked. Checking these symbols for optimum ink intensity provides ample assurance that all other magnetic printing is within tolerance. Laborious and tedious monitoring of all symbols and characters is not necessary. The meter face has a center green area bordered by red areas on either side. Calibration is such that any sample which produces a reading in the green area will be adequate for use, while anything testing in the red area should be rejected.

Repeatability of Readings

Inherent repeatability of the Φ instrument is guaranteed to be within 5%, so that errors in the instrument itself should never be the controlling factor in the printing operation. Simple instructions are provided with the meter for checking its operation and for adjusting it to obtain optimum performance.

SAFETY MARGIN

There are several factors to consider when evaluating the Φ Magnetic Printing Tester, and in interpreting its readings. Dimensional inaccuracies in the printed information as well as ink depth on the paper are interrelated with ink intensity in determining whether the automatic equipment will be properly actuated by a specific printed sample.

The automatic sorting and computing equipment is designed to accept variations of 100% from the standard values (i.e., from 50% to 200% of the nominal 100% value). The green zone of the Magnetic Printing Tester meter extends from 75% to 150%. This allows a substantial margin of error to accommodate allowable tolerances in character dimensions as well as differences caused by variations in ink penetration. In practice, the printer should always maintain printing conditions that provide a reading near mid-scale in the green zone (about 115%), using the methods explained below to compensate for any variations from normal in paper or printing conditions. This provides the maximum tolerance for other variations in the printing process such as uneven ink distribution over the total area printed.

HOW TO USE THE MAGNETIC PRINTING TESTER

Each Φ Model H06 428A Magnetic Printing Tester is calibrated against standard printed samples before shipment, and a calibration sheet is supplied with the instrument.² When used in an actual printing operation, the effects of paper thickness, paper porosity, and dryness of the tested sample should be considered. Correction factors should be applied as necessary when these effects are sufficient to cause major variations from the normal calibration. Since thickness, porosity, and testing conditions normally remain constant for a given printing operation, correction factors can be easily determined and applied, as explained below.

Using the Three Calibrated Symbols

Readings taken with the dash or "on us" symbols will be affected by dimensional inaccuracies. Any variation from the standard against which the instrument is calibrated will be reflected directly in the meter readings obtained. Adjacent symbols or characters should be punched out of the check before readings are taken of the dash or "on us"; a suitable paper punch is provided with each Magnetic Printing Tester. Punching of adjacent symbols is not necessary if they are always the same, as is normally the case. It is only necessary to determine the effect of the adjacent symbols on the desired reading, and apply a correction factor.

The standard .250" x .150" test patch can be used as the measurement symbol to eliminate any error from dimensional variations. The test patch is somewhat larger than the sensing probe in the instrument's measuring head, so any inaccuracies in its dimensions will not affect the readings. For this reason the standard test patch can be particularly useful for checking the composition of ink, and in setting up the press.

When checking press proofs or making periodic measurements for quality control during printing, the dash or "on us" symbols may be preferable since knowledge of the effects of dimensional errors might be desirable.

Effects of Different Types of Paper (Thickness and Ink Penetration)

Both thickness and ink penetration are important because the sorter and computer equipment respond to a dynamic reading which is a function of the spacing between the sample and the reading head. The degree to which the ink penetrates into the paper can affect this spacing.

In the Φ Magnetic Printing Tester, the meter responds to the quantity of ink and the measurement is independent of the penetration into the paper. Thus, for a non-porous paper, the Magnetic Printing Tester

²Hewlett-Packard has worked closely with the General Electric Computer Laboratory, Palo Alto, California, to establish the calibration of the Model H06-428A Magnetic Printing Tester against a reference standard.

will give a low reading with relation to the requirements of the computer; and for a very porous paper, the tester will give a high reading. Extensive tests in the ϕ laboratories indicate that paper porosity can cause variations of as much as $\pm 50\%$ from the correct reading on the meter scale. Normal variations were much lower than this (over half of 62 samples were within 10%).

Compensation for the effects of ink penetration can be made easily. The most reliable method is to run a sample of the printing through the automatic sorter equipment to obtain a reference reading. By comparing this to the Magnetic Printing Tester reading, a correction factor can be determined for application to all future test readings with the same type of paper. Periodic re-checking against the reference sample will assure long-term accuracy. In many cases, the correction factor can be set into the meter by offsetting the zero set control the proper amount.

Abnormal pressure (high or low) in letterpress printing can cause effects similar to those caused by paper porosity. Method of compensation is the same.

Correlation with Dynamic Type Readers

Paper porosity, variations in character area, and wet ink can cause differences in readings between the "static" reading instruments and the "dynamic" type. The "static" type instrument (H06-428A) is neither affected by the depth of ink penetration (paper porosity) nor by the leading and trailing edge dimensions of the characters whereas the "dynamic" tester is. These differences can cause large discrepancies between readings on the two types of testers.

To overcome these differences in readings it is sufficient to apply a correction factor, as explained previously, if correlation between the two types of testers is desired.

Measurements with Wet Ink

The H06 428A Magnetic Printing Tester will accept and measure either wet or dry printed samples, although the readings for the two conditions may differ. Tests made under operating conditions show that for a given sample the wet reading will be from 10% to 20% higher than the dry reading. This, of course, is a fixed error which can easily be determined for a particular set of conditions, and corrected for during operation by offsetting the meter with the zero set control.

If the printer does not wish to make wet readings and use a correction factor, the sample can be held under a heat lamp for about 30 seconds to hasten the drying process.

Two precautions should be taken when working with wet ink. First, all samples should be placed under the magnetizing head the same number of times, preferably once (repeated insertions will cause artificially high readings). Second, precautions should be taken to prevent the wet ink from fouling the measuring head. The paper should be inserted so that the wet ink does not touch the measuring head. Ample clearance is provided for this.

MIXING INK

A simple procedure has been used for evaluating the magnetic qualities of a new lot of ink in terms of a previous lot known to be satisfactory. Two daubs of new ink are placed about two inches apart on a piece of normally used check paper. One daub of old ink is placed between them. The three daubs are then drawn down uniformly with a clean knife to form lines, and the paper is cut at right angles to the lines. Magnetic intensity of the three lines is read with the Magnetic Printing Tester. Relative readings of the two outside samples will indicate if the drawdown was even. The relative reading between the new and old ink samples will indicate the magnetic intensity of the new lot as compared to the old.

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