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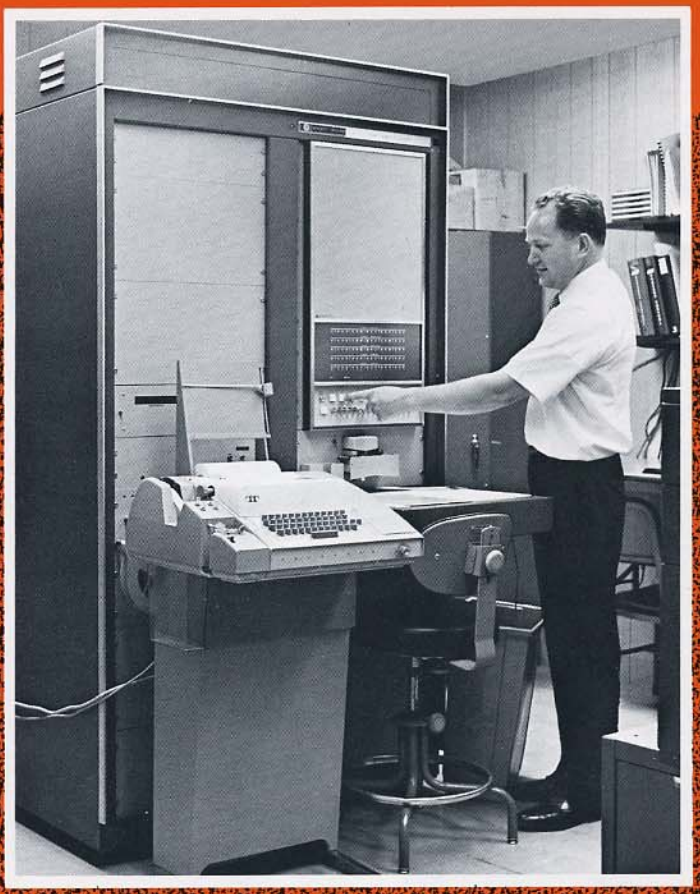
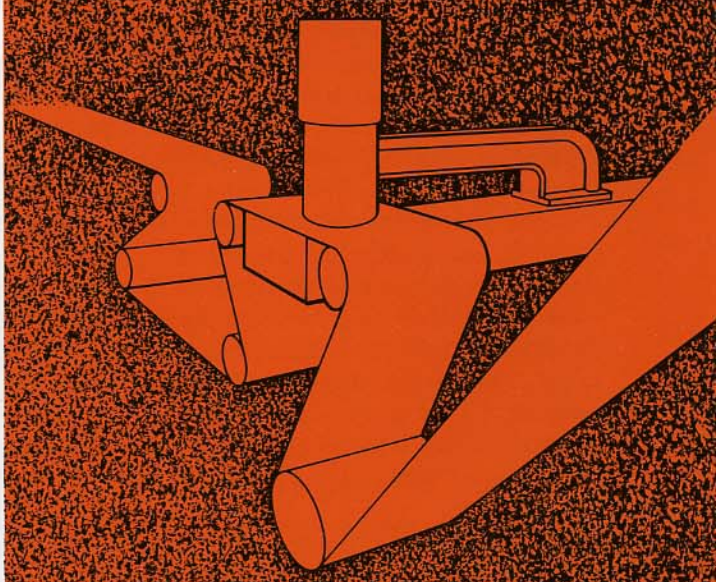
APPLICATIONS OF COMPUTERIZED DIGITAL DATA ACQUISITION SYSTEMS

Process monitoring in manufacturing

A Solution to a Measurement Problem for: Norton Company
Troy, New York





THE APPLICATION

The Norton Company in Troy, New York manufactures coated materials; specifically, the process involves application of one or more coatings to moving webs of various materials including paper, cloth, and plastic.

THE MEASUREMENT PROBLEM

Measurement and control of coating material weights is essential to successful operation of Norton's manufacturing facility. Variations in the amount of coating material applied is directly related to cost and future sales – money is wasted if the coating material exceeds optimum or specifications standards and, conversely, customers will be dissatisfied if the coating thickness is less than specified, or if the product varies within a shipment or from shipment to shipment. The long-used destructive sampling process requires stopping the coating machine, punching a sample out of the web material before and after each of two stages of coating application, and then weighing the sample to determine the coating thickness. (When used as the primary sampling method, the actual material destroyed in this process amounts to a considerable amount of money.) Beta gages also monitor the process, providing an electrical output related to the mass of material in the gage measuring gap (representing total web weights) before and after each application, which is then displayed on a recorder. Both of these methods for measuring coating weights are affected by weight variations in the uncoated material, which frequently exceed the allowable coating weight tolerance.

After studying the measurement problem, the Norton Company decided they needed a *continuous-reading, non-destructive* method for determining coating weights, that could be used *on-line during the manufacturing process.* Further, the system should automatically correct for web weight variations, and compute summary data for each production run.

THE SOLUTION

The Norton Company selected the computerized data acquisition system shown in the block diagram. Now the coating thicknesses are measured automatically using a non-destructive method. Additionally, the computerized system allows more frequent sampling of coating weight than is practical with the destructive sampling technique, and without shutting down the process for sampling.

COVER:
Setting Up the Coating Process (lower right) for Measurement by a Beta Gage (lower left). The Computerized Data Acquisition System (top left) Computes and Displays Net Coating Weights to Assure a Uniformly-Coated Product.

SYSTEM OPERATION

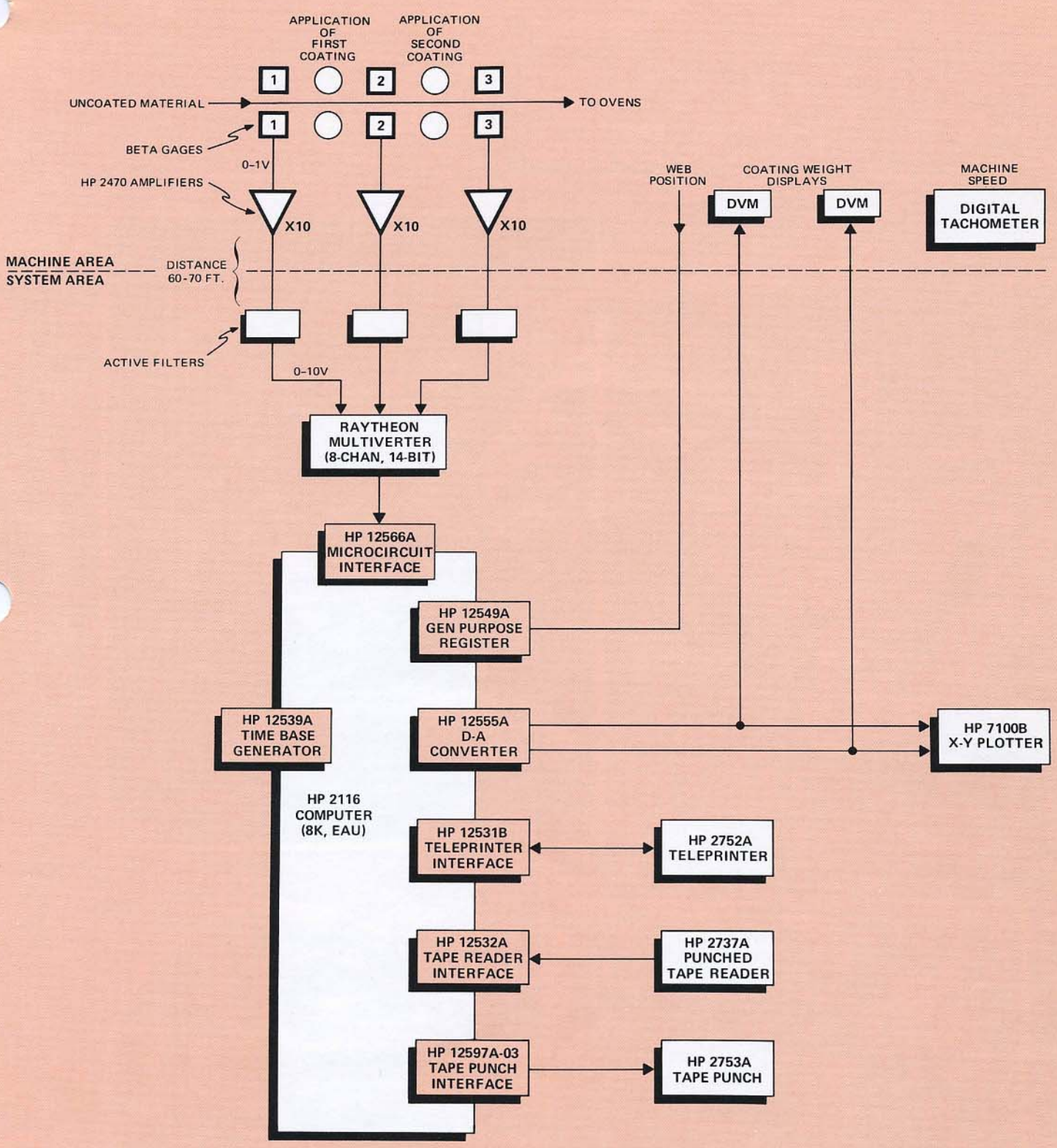
The beta gages, formerly used for monitoring purposes in the destructive sampling system, are now used as primary sensors, measuring the web before and after each of the two coating applications. Gage outputs are initially calibrated (by destructive sampling) for the backing material and coatings used, and these correction factors are incorporated into the computation. Computed digital displays for the two coating weights are provided for the machine operator, using the two outputs of the digital-to-analog converter to drive two 3-digit digital voltmeters. The digital tachometer (HP tachometer generator and counter) can be switched by the operator to read web speed, coating material supply speed, and various other speeds.

In operation the system measures, computes, and displays the actual net coating weights to the process operator approximately 5 times per second. At the completion of each run (up to 1000 yards) the system outputs a run data summary, listing average weights and standard deviations for the backing material and each of the coatings; the system also outputs the run length and amount of each coating material used.

The flexibility of the computerized system has allowed the Norton Company to make improvements which enable the system to generate information regarding product quality and cost. The computer is also used to determine the operating status of the measurement system both before and after a run. (The value of this feature was clearly shown when a beta gage malfunction was detected and repaired before the malfunction progressed to a point requiring system shut down.)

BENEFIT OF COMPUTERIZED DATA ACQUISITION

The HP on-line real-time process-monitor system has proved to be a very powerful tool for developing and improving both the manufacturing process and the end product. Non-destructive sampling also saves money, both from the standpoint of machine downtime and material wasted. The ultimate benefit is to the customer, who can be assured of a uniformly-coated product matched to his specifications.



Coating Thickness Measuring System

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