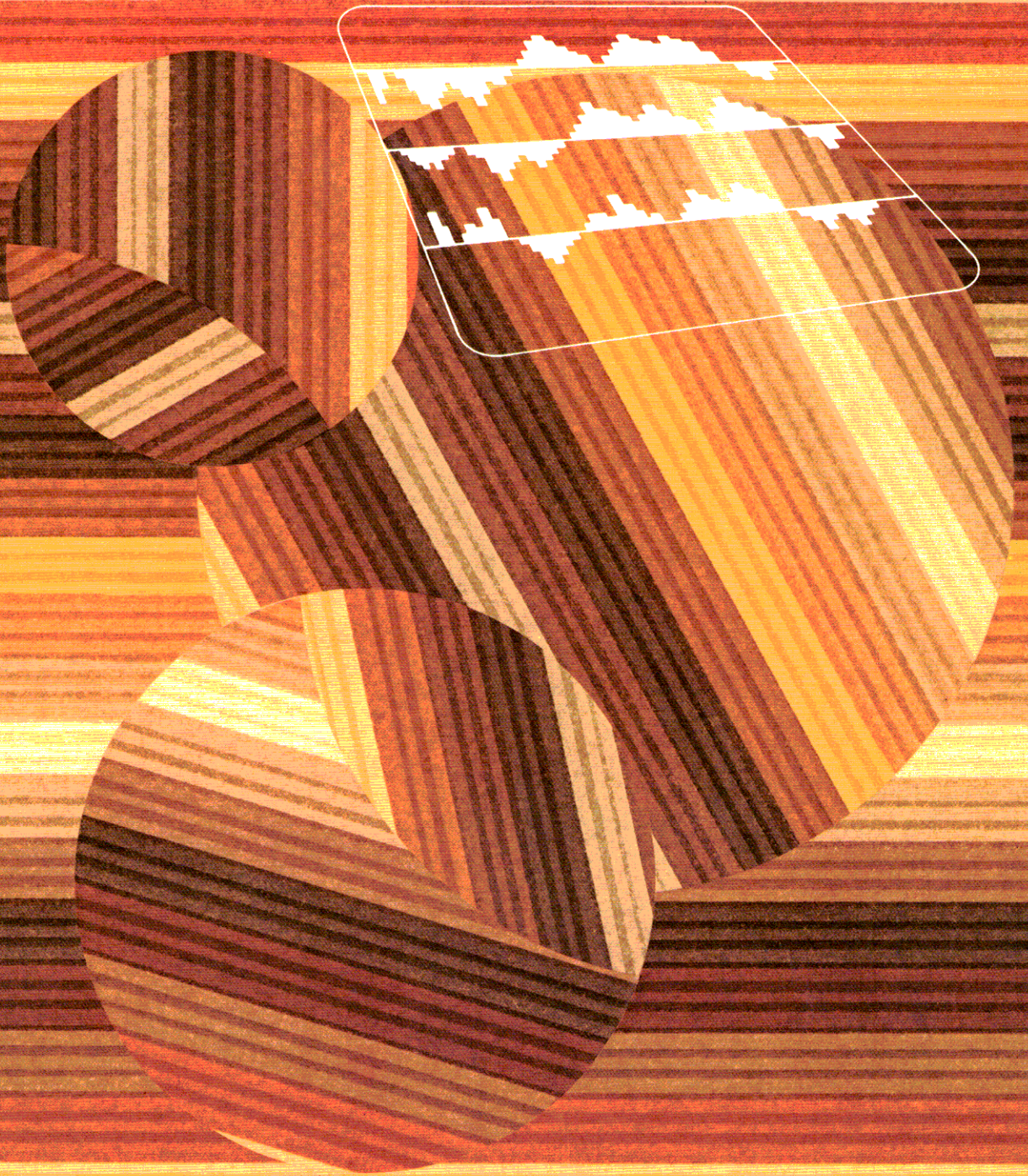


AccuRay[®] 1180 MICRO.

For better control
of paper machine
profits.



And a step toward total millwide management — Micro/Manager 8000.

Process measurement, control, information.

These are the functions AccuRay Corporation has been implementing since 1950 when we perfected our first Beta gauge. Since then, we've built upon our reputation for measurement accuracy, precise control and information reporting. An AccuRay MICRO system takes major steps forward in each of these areas.

The results are savings in materials and energy while assuring quality improvements in pulp and paper mills, cigarette factories, metals rolling plants, plastics plants and textiles operations. Measurable improvements result in economic payback in a matter of months.

AccuRay knows how to get maximum measurement accuracy for you.

Backed by over 30 years expertise, we have built an outstanding reputation for sensor design — which leads to measurement accuracy. That's why our MicroTec™ sensors are the standard others are judged by.

AccuRay knows how to optimize process control for you.

Building on its sensor expertise, AccuRay developed fast, precise computer control of manufacturing processes. Its control strategies, enhanced by the move to MICROtechnology in 1974, span the spectrum from basic process control to the most sophisticated optimizing controls in the industry. The results are improved yields, reduced scrap, enhanced reaction speed and increased reliability.

AccuRay knows the value of operator guidance and production information to you.

Dedicated process control computers can rapidly build a data base of information. AccuRay knows how to manage this data base to turn process data into useful production information. Information is compiled, analyzed and summarized to make it most valuable to the people who need it — machine operators, foremen, production managers and top management. A modular approach to both hardware and software allows you to customize information reporting to your needs.

That's what AccuRay process management systems do: measure, control and provide production information at all levels. They all come with over 30 years experience behind them.



AccuRay experience pays off in the 1180 MICRO.

AccuRay products first entered the paper mill in 1953. Since then, we've enjoyed a close relationship with the pulp and paper industry which has led to many exciting product developments.

The year 1968 saw the first AccuRay computer control system for a paper mill. In 1976, we introduced to the industry the first control system based on microprocessor technology — the 1180 MICRO. Today, hundreds of MICRO systems are at work around the world, giving customers results like these:

- Fiber savings to 4%
- Energy savings to 15%
- Machine speed increases to 10%
- Reduction in winder and converting losses to 10%
- Reduction in sheet breaks to 40%
- Uptime exceeding 99%
- Return on investment in one year or less

Modular design for flexibility.

When you invest in an 1180 MICRO, your investment is in a modular system designed to adapt to your mill's changing needs.

You can begin with a base 1180 MICRO system today and add more sophisticated control strategies and additional measurement capabilities as you need them. Modules are designed for compatibility, so you can take advantage of future developments as well as existing capabilities.

Measurement precision.

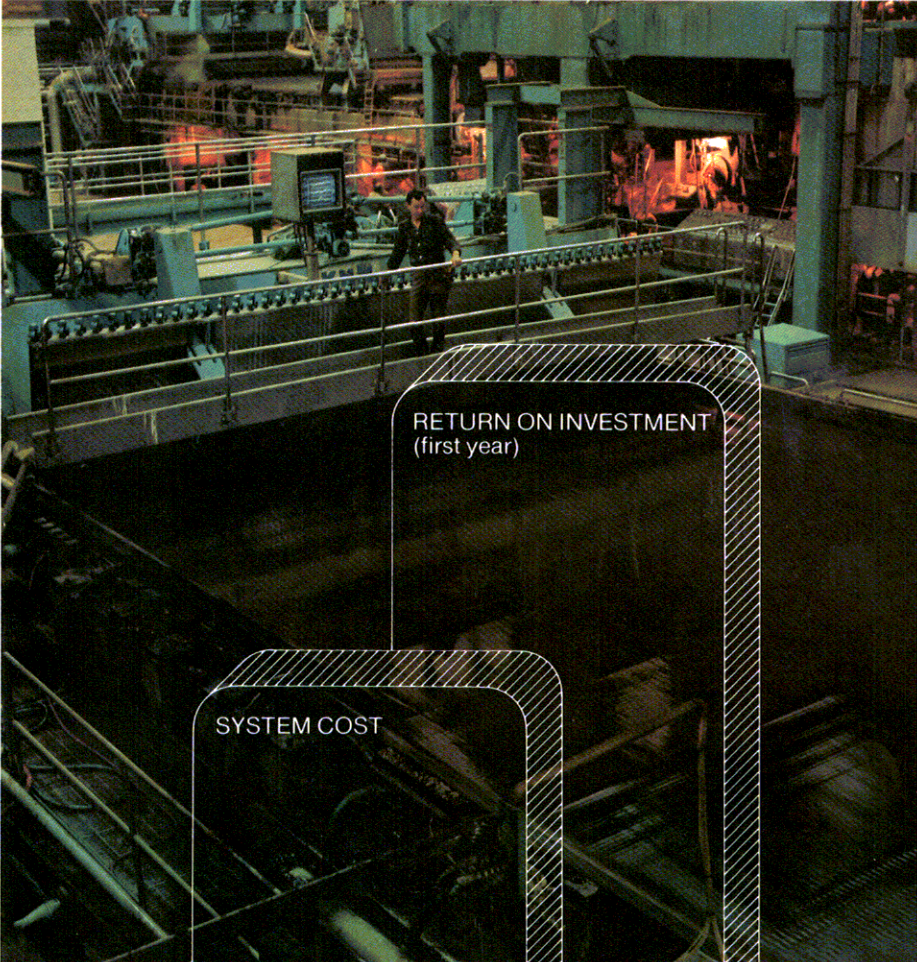
Your 1180 MICRO begins with precise measurement of paper properties. Converting sensor signals into accurate measurements is what an 1180 MICRO does well. The MICRO has the computing power to make the complex arithmetic computations needed to turn these signals into exact measurements — not approximations.

Control flexibility.

Control programs for the MICRO are designed in modules so you can choose the level of control most economical for you. Basic controls provide you with immediate economic payback. Higher level controls actually help you optimize the process.

Information reporting options.

Information gathered by the 1180 MICRO is available in a format and frequency of your choosing, to help you make better production management decisions. The MICRO communicates with your operators through its video screen and printout reports. It communicates with supervisors and lab technicians through remote monitors. And, it communicates with top management as part of a millwide management network.



The move to MICRO technology can pay off big for you.

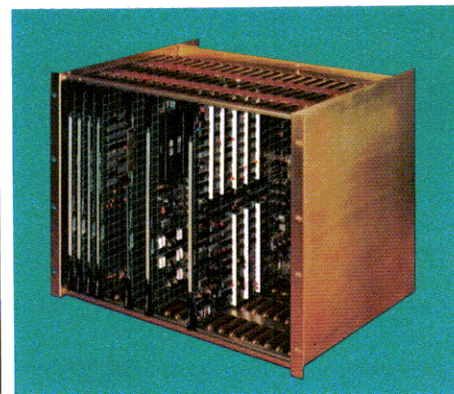


MICROtechnology does more for you — with less.

MICROtechnology brings you AccuRay's Optimized Operator Station, which gives your operators a powerful window into the pulp and papermaking process. By simple interactions with the MICRO, your operators can see product dynamics in both numeric and graphic form.

The Optimized Operator Station was engineered to work in concert with your operators and features:

- **Colorgraphic Video Monitor.** Color blocks, designed for easy viewing from work distances, are used to code information for instant recognition.
- **Friendly Cursor.** On video reports which require interaction with your operators, the cursor positions itself only over data requiring change — eliminating possible errors in data entry.
- **Video Select, Process Control & Data Entry Panels.** Multiple pushbuttons are provided for rapid access to video reports. A 12-key numeric pad with LED readout ensures accuracy of data entries. Assignable pushbuttons allow you to design for your operators' needs without presenting a bewildering array of buttons.

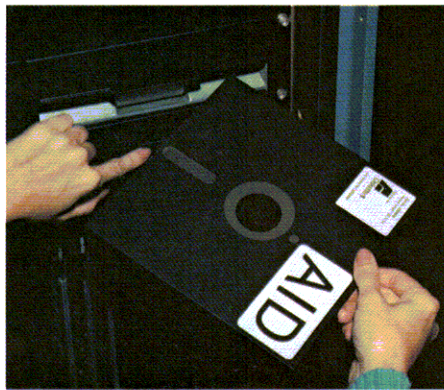
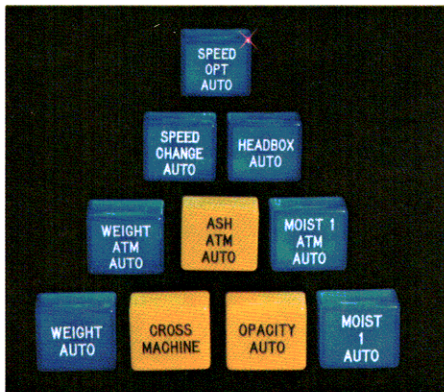


MICROtechnology makes possible Programmable Microcomputer Modules (PMMs). Each PMM processes signals to and from sensors, scanners and the process. An unlimited number of PMM's can be added to increase control capabilities.

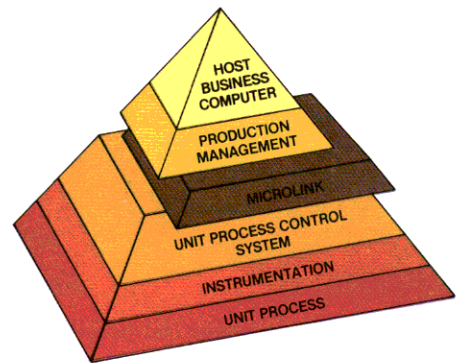
Reliability.

A MICRO is reliable. At its heart is the Honeywell Level 6 minicomputer with memory and built-in diagnostics rivalling large, main frame computers.

Inherent in every Level 6, and in each Programmable Microcomputer Module, is Error Detection and Correction (EDAC). EDAC checks the integrity of information and corrects single bit errors, accounting for the high reliability and trouble-free life of the MICRO.



Advanced Interactive Diagnostics (AID) come with each MICRO to pinpoint hardware problems.



Flexibility.

You get the control you want because AccuRay designed the MICRO in a series of modules. You can start with a basic control system and add modules of hardware and software to fit your needs.

Modification of existing software modules, without process interruptions, has been simplified. AccuRay provides complete training on the creative uses of Program One and Program Two:

- **Program One** permits creation of report formats by following the step-by-step Program One manual.
- **Program Two** allows changing or adding to system software in an English language style format. This degree of user programmability while the system is on-line is unique to AccuRay.

Maintainability.

With the MICRO comes a variety of service plans to meet your requirements. And, powerful built-in maintenance tools.

For example, we've built into the mini and microcomputer hardware self-checking capabilities. Whenever power is applied to the system, each computer board is automatically checked. Any problems are immediately reported, so you can maximize system uptime.

A software module — AID — comes with every MICRO to help pinpoint hardware problems accurately. AID automatically checks every hardware subsystem and prints out a report of its findings. It saves time in troubleshooting and preventive maintenance.

To simplify repair, all the hardware modules in the MICRO have been grouped into Optimum Replacement Units (ORU). Critical ORU's are inventoried at your mill and are packaged for quick installation.

If you wish to perform service and maintenance yourself, AccuRay will train your people. Or, you can contract for an AccuRay specialist to do the job.

Communications capability.

MICROLINK™ is a module which permits two-way communications between MICRO systems and higher level computers. Useful information from the mill floor is now available in the production manager's office at the touch of a button.

MICROLINK makes possible the linking of MICRO systems into a total millwide management network. By viewing summaries of production data throughout his mill, your production manager can make better production decisions based on current information.

AccuRay has the software to fit your mill.



Just as the hardware components of the 1180 MICRO are modular in design, so is the software created for it.

Software is available in varying levels of sophistication — building blocks you can add to your system as you need them. Because of this approach, you can have the control you want. You choose the reports you want. And, your people can be trained to modify software programs on-site if you desire.

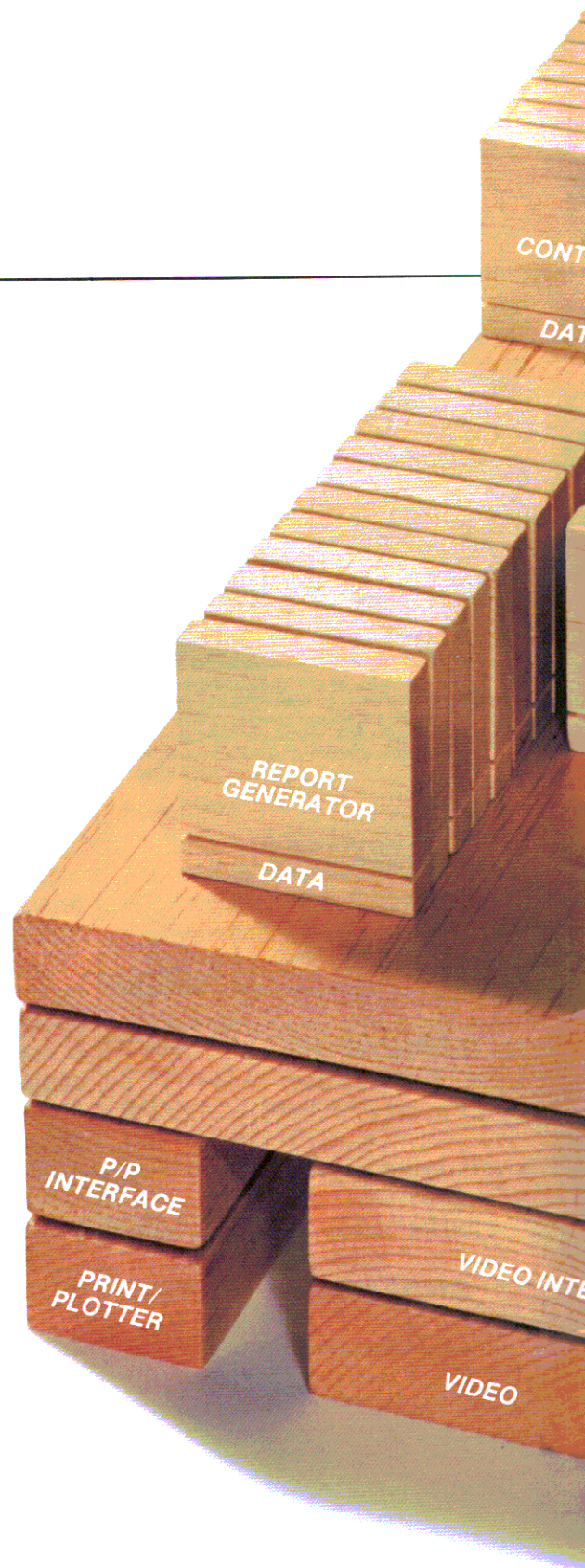
The software “factory.”

Part of the reason for the success of the building block approach is AccuRay’s software “factory.” At its heart is a powerful computer called Multics which stores over 1,300 software modules and the tools to link them together.

Multics makes it possible for AccuRay programmers to choose the modules you need, in the way you request them. It also permits new modules to be added to existing programs at any time so you can upgrade to new features with ensured compatibility.

Only the MICRO can give you this much flexibility.

Because only AccuRay has a computer as powerful as Multics. And, only AccuRay has over 30 years experience in process control — backed by the strength of the MICRO.





Measurement.

MicroTec sensors are known for their measurement accuracy

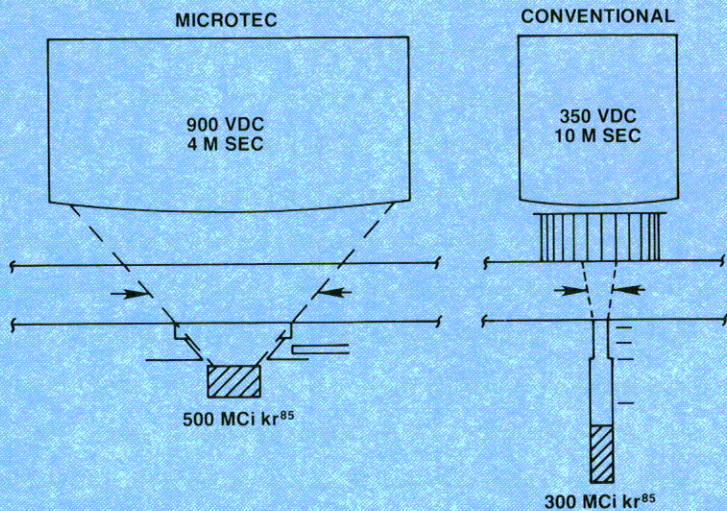
Control actions can never be better than the measurements they're based on. That's why AccuRay dedicates almost one-third of its R & D, year in and year out, to sensor design.

AccuRay's experience in sensor design can help you, no matter what grade of paper you're making.

Tissue.

No matter what grade paper you produce, the key to lowering production costs is an accurate basis weight measurement. For tissue, you need a measurement that ignores the effects of temperature and prevents dust build-up.

Bar none, AccuRay has the best basis weight sensor in the industry. A unique conical beam provides the highest signal-to-noise ratio — at least 10 times better than conventional pencil beam sensors.

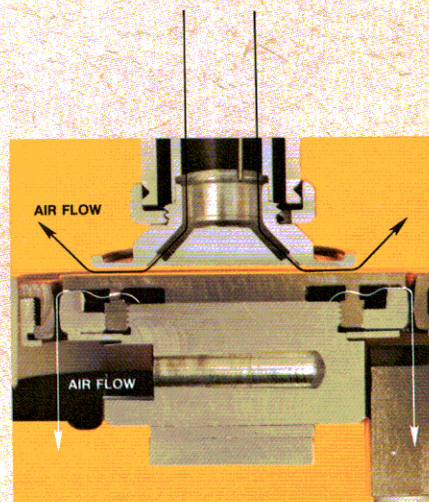


Single-range, permanent calibration gives you accurate basis weight measurement from your lightest to heaviest grades.

Newsprint.

To get a repeatable and believable caliper profile measurement, turn to a MicroTec caliper sensor. It uses eddy current to measure accurately at high speeds.

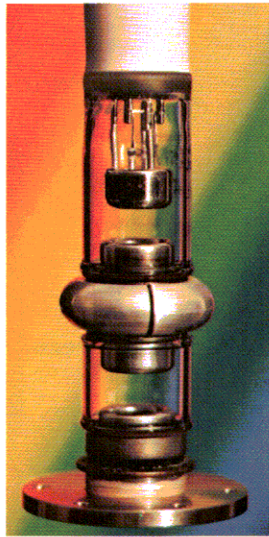
The chance of sheet break is greatly reduced because of its air bearing design, which contacts only one side of the sheet. A friction-resistant base plate helps stabilize the sheet.



Fine.

Need an accurate way to measure ash content so you can choose the best balance of fillers and fiber? Look to MicroTec for supreme ash measurement accuracy.

This sensor uses a proprietary X-ray tube, working within a tuned energy spectrum. It is highly sensitive to ash, but insensitive to other compositions. And, we guarantee it won't drift.



Coated Papers.

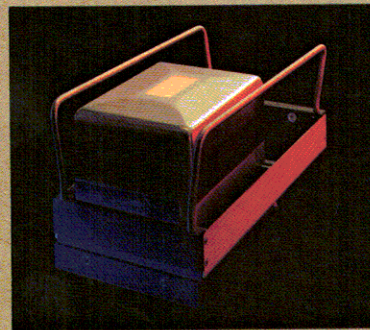
You need an accurate moisture measurement so you can get coat pick-up — either on or off-machine. Two hemispherical mirrored reflectors in our MicroTec Hemi IR sensor focus the infrared beam for maximum number of passes through the sheet, with minimum energy loss.

The result is a highly reliable, non-contacting moisture measurement for precise measurement and control of net coat weight.

Board.

On multi-ply applications, your requirement is for accurate moisture measurement through the entire thickness of the board to maintain the proper balance between stiffness, strength and economics.

A microwave moisture sensor delivers accuracy through a penetrating microwave field. It's insensitive to fillers and AccuRay designs it to compensate for basis weight and temperature.



Control.

The 1180 MICRO can control any paper machine, anywhere.

Turning signals into measurement.

It's the job of MicroTec sensors to generate measurement data in the form of electrical signals. Converting signals into accurate measurements is one job of the 1180 MICRO — a job it performs very well.

Sensors work with dedicated microcomputer modules in the 1180 MICRO. Each microcomputer has its own memory and is capable of making the complex arithmetic computations needed to process sensor data — eight times a second. So, MicroTec sensor signals are converted exactly into measurements — not approximations or averages.

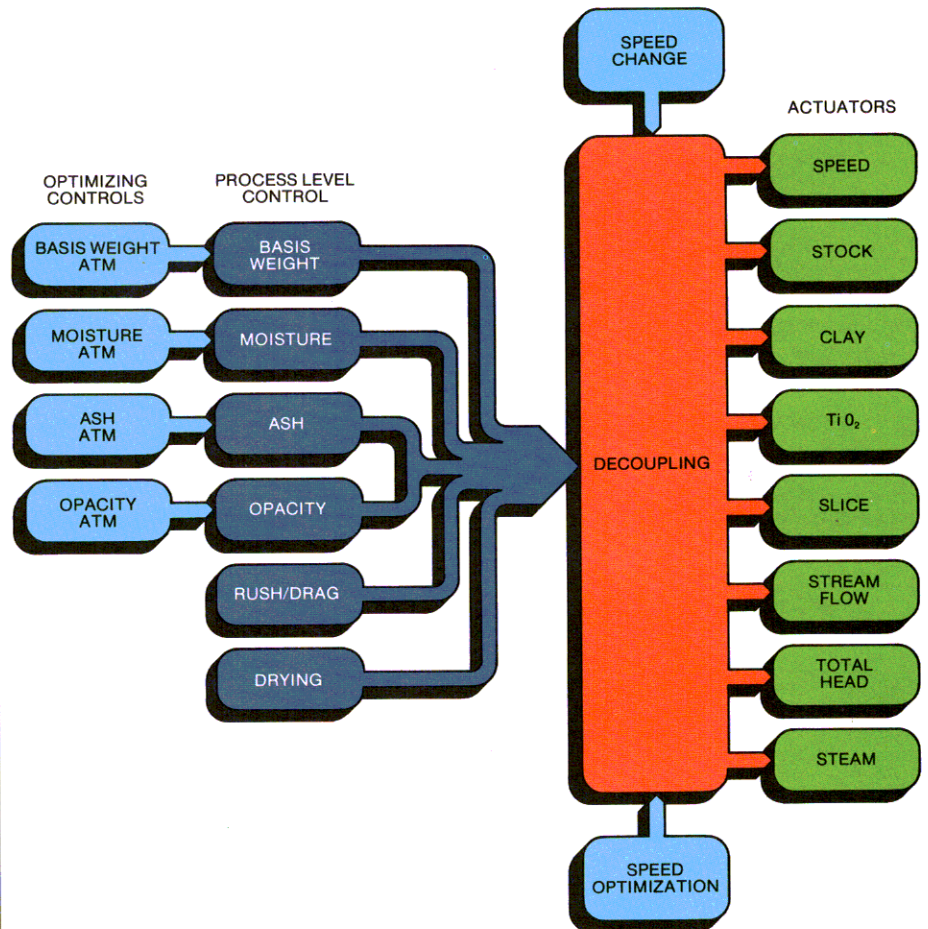
Turning measurement into control.

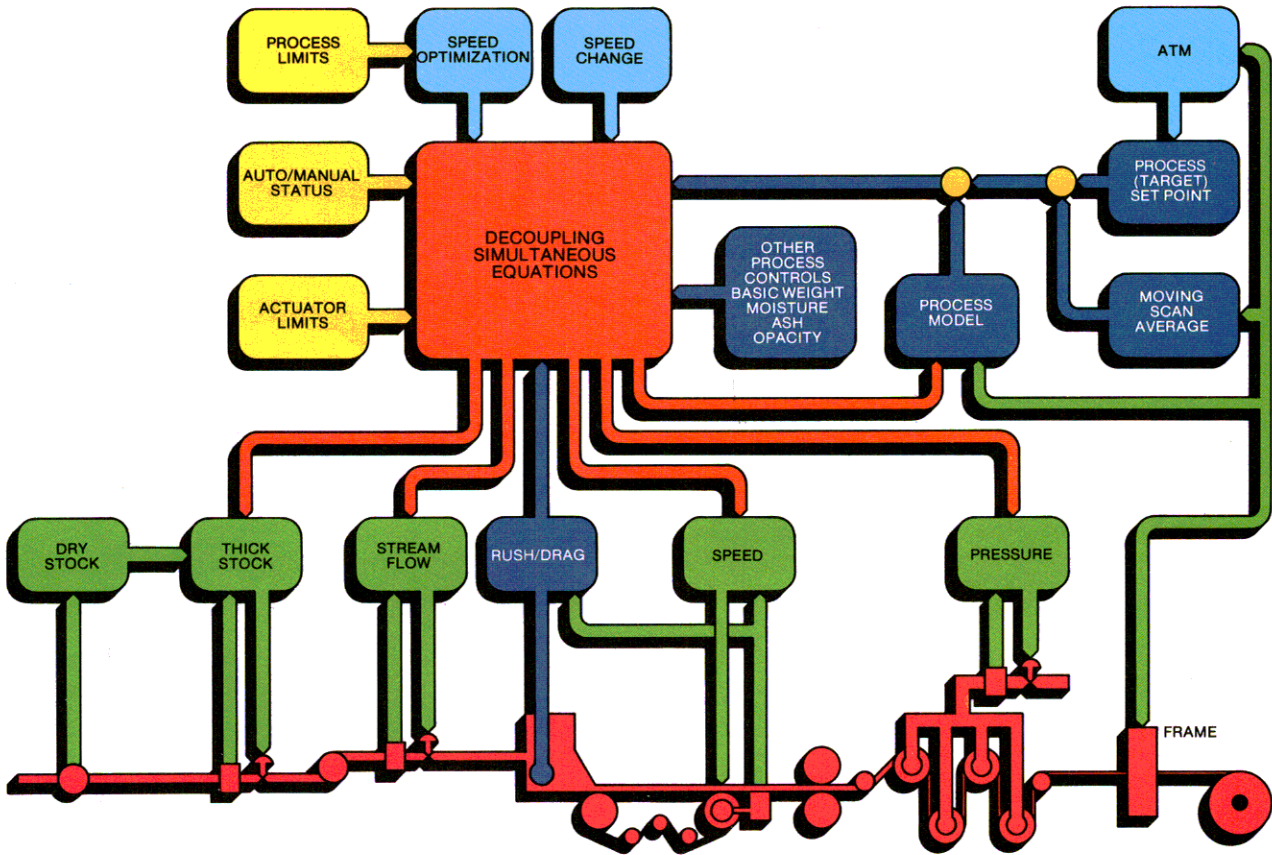
To control the complex papermaking process, you have to know it intimately. Starting in 1953 with our first paper mill installation, we've built a wealth of knowledge about paper machine control.

We know that a control action doesn't just involve turning a valve. Rather, it requires monitoring and adjusting limits along the line to keep your product on spec.

That's what an 1180 MICRO does. And, it does it with the most sophisticated decoupling technique known to papermakers.

If inputs to basis weight, moisture, ash, or opacity controls call for a change, the control signals the MICRO's decoupling program. Decoupling takes a look at the paper machine in its entirety — signalling the proper actuators automatically. This is extremely important in smoothing energy usage and optimizing the process.





Optimizing controls.

Automatic Target Management adjusts key control targets for maximum production yield. Each target shift is based on a sophisticated statistical analysis of the machine's performance, compared to limits preset by mill management.

Speed Change maintains your product to spec while ramping machine speed up or down automatically.

Speed Optimization allows your operators to automatically upramp machine speed until a production limit is reached. Limits are continually checked by the MICRO to keep your machine running at maximum speed. It optimizes energy usage and gives you maximum profitability.

These are just a few of the controls in the 1180 MICRO.

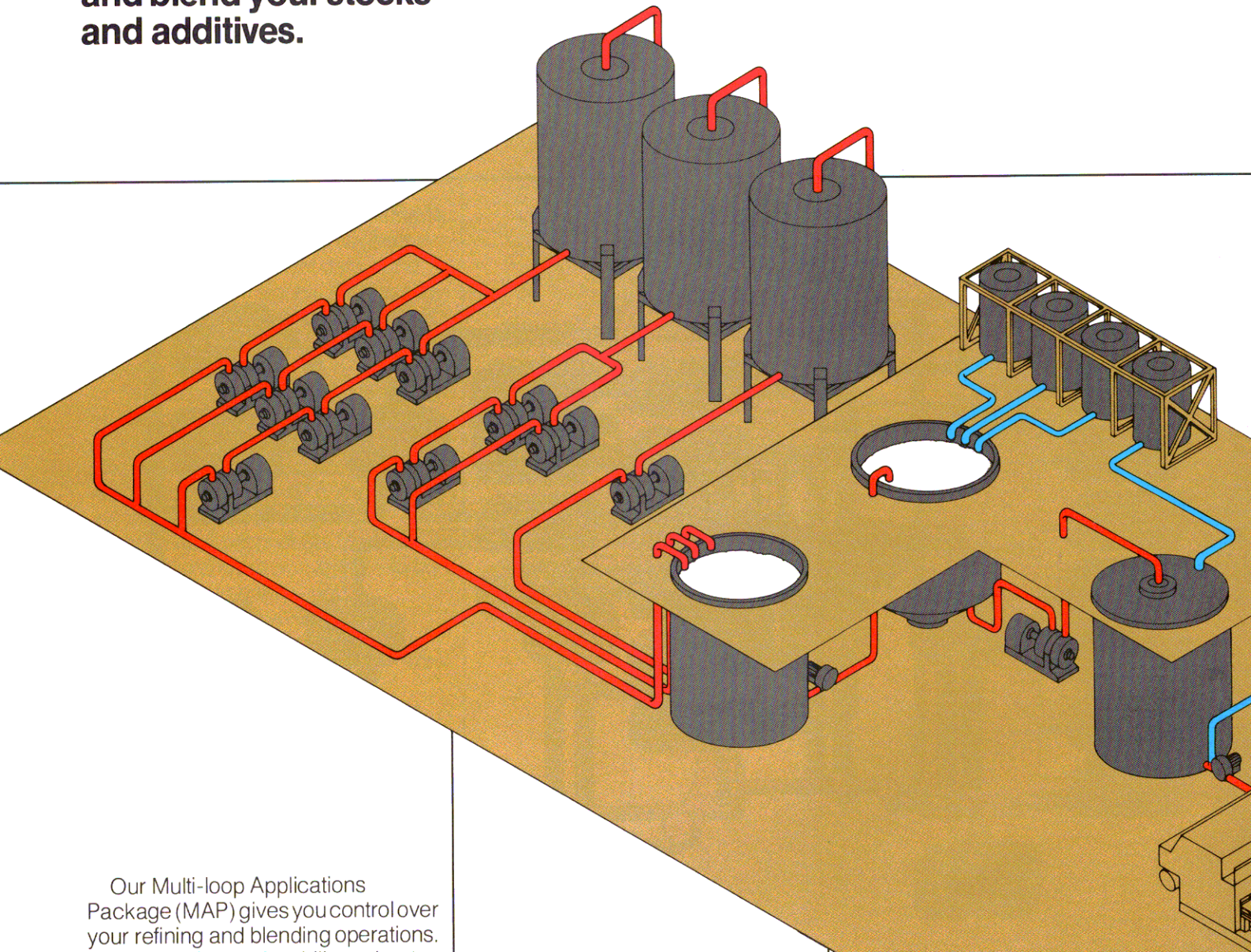
You get a choice of these, and more, which you can add as your production needs expand:

- Cross-Machine caliper, hardness and moisture
- Refiner
- Stock and additive blend
- Stock loading
- Ply loading
- Headbox
- Coordinated dryer startup/shutdown

All designed to take the surprises out of papermaking — for greater product consistency, productivity and profitability.

Control.

The 1180 MICRO can control your refiners and blend your stocks and additives.



Our Multi-loop Applications Package (MAP) gives you control over your refining and blending operations.

Refiner Control stabilizes sheet drainage by controlling refiner power and helps control stock flow. Your operators can “swing” refiners and enter the new configuration into the 1180 MICRO. Then, they get automatic control of every refiner, for every branch and set in your mill. By simple interactions with the MICRO, your operators can change the status of any refiner using pushbutton entries. No programmer is needed.

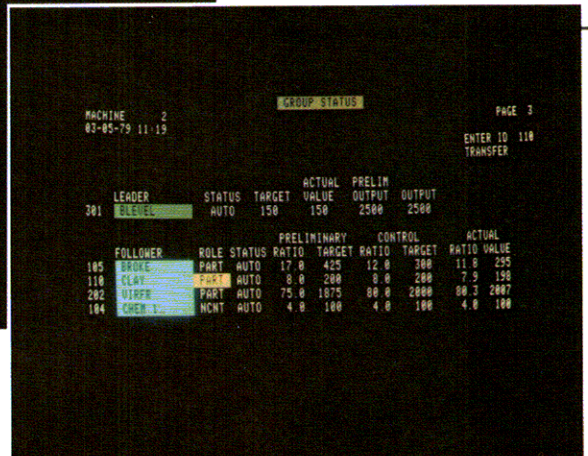
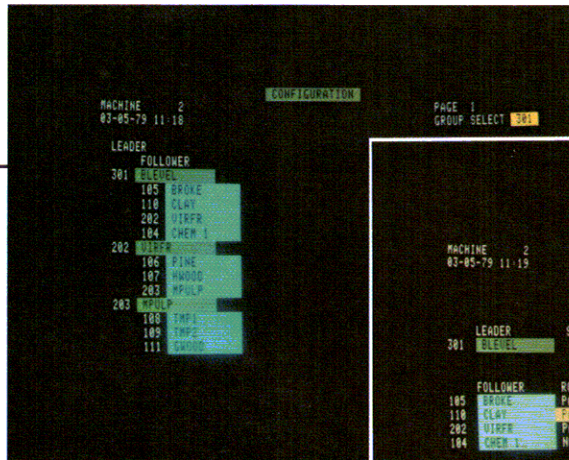
Benefits include increased sheet uniformity, uniform power consumption and higher production. Sheet uniformity means better physical strength and drying characteristics.

Stock and Additive Blend Control stabilizes the mixing of all stocks and additives in your blend chest for consistent sheet quality.

You get better sheet formation and drainage while keeping your refiner power consumption at the level needed to meet your strength requirements.

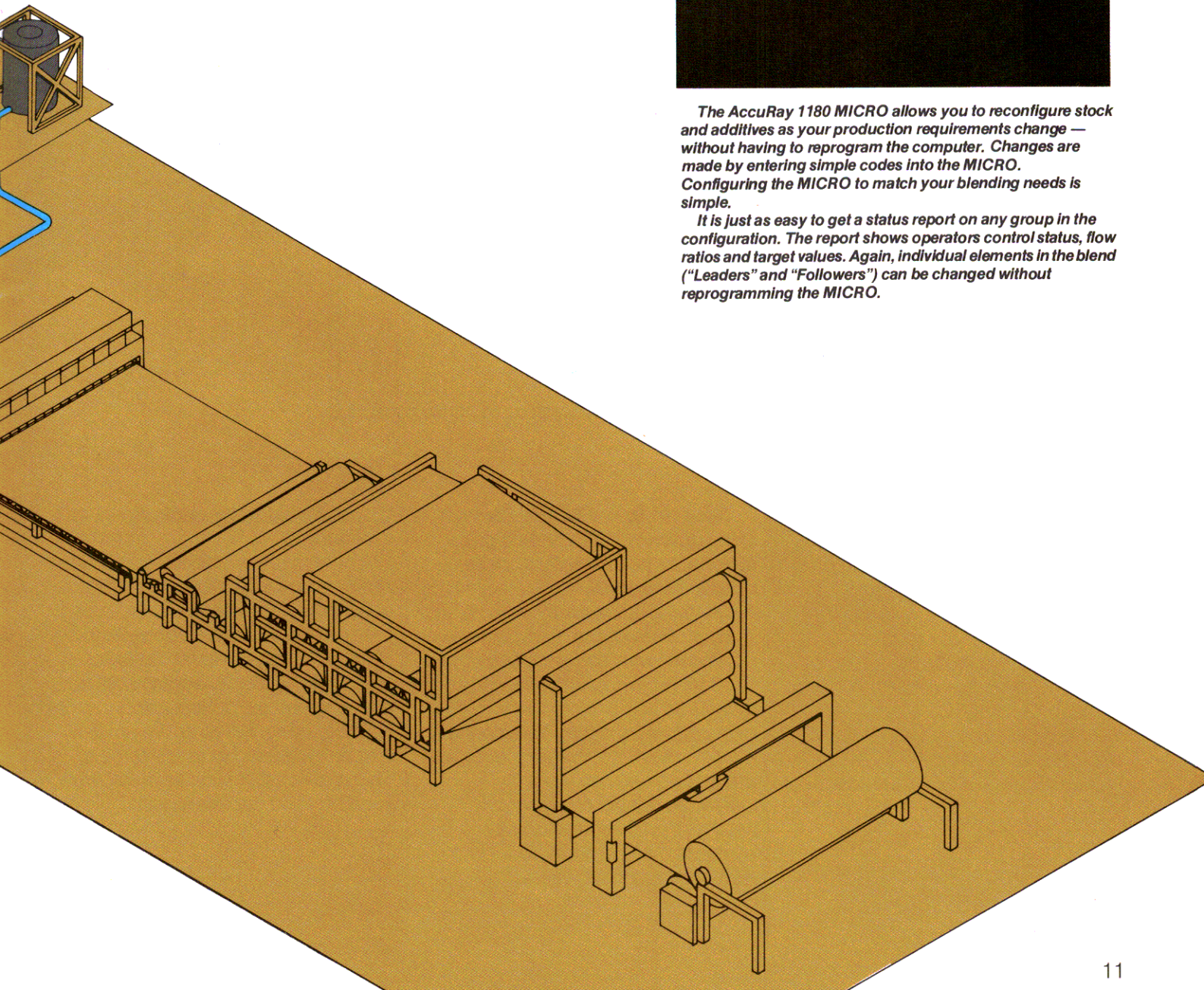
Stock and Additive Blend Control does this by controlling the levels and flows of individual components. When a grade change occurs, your operators can change the blend by pushbutton entries at the operator station.

That's the beauty of the 1180 MICRO. It's a system designed to give you better quality and economics from refiners to rewind — and even through the coater. All automatically. All configurable by your people on site.



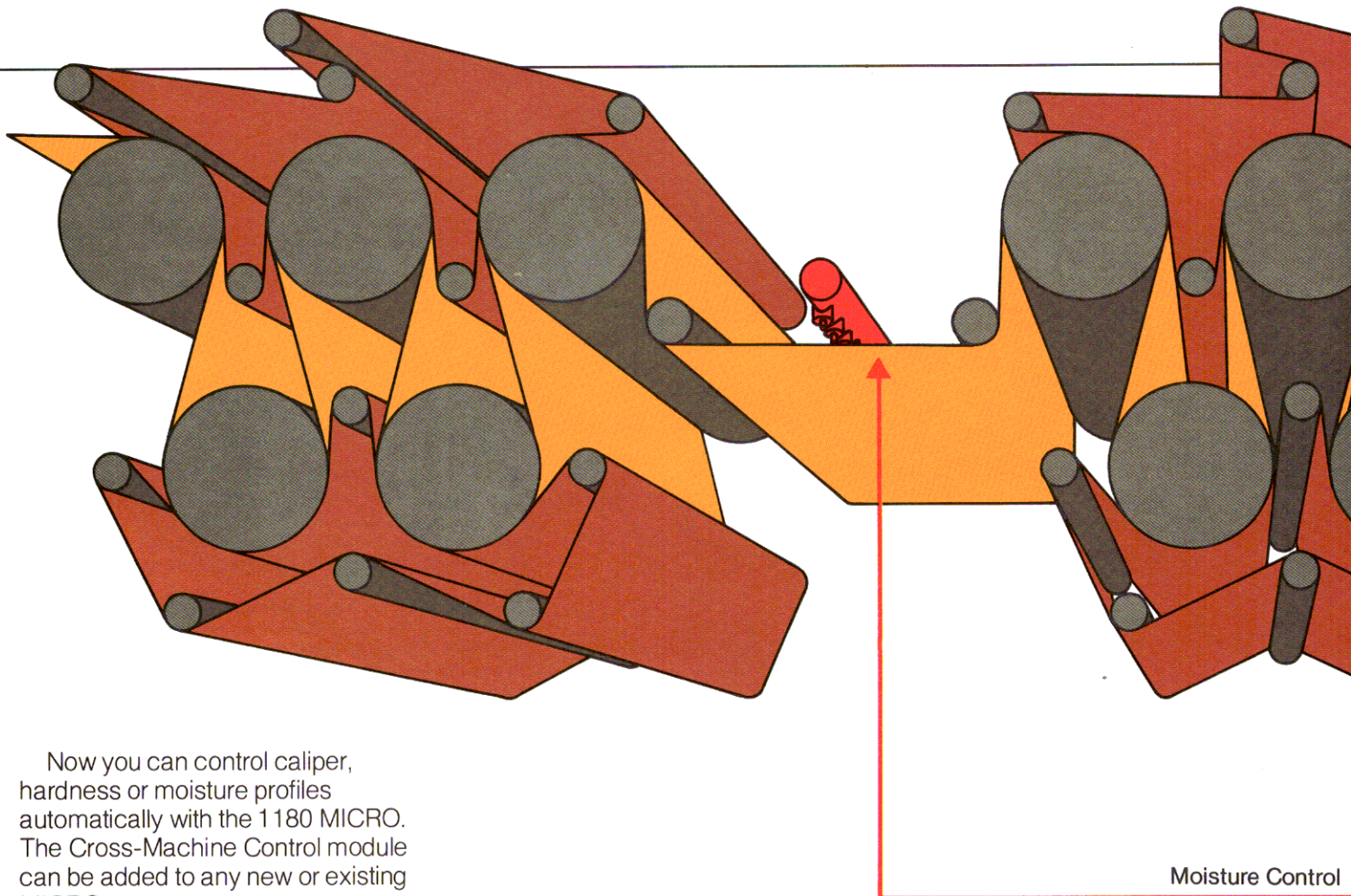
The AccuRay 1180 MICRO allows you to reconfigure stock and additives as your production requirements change — without having to reprogram the computer. Changes are made by entering simple codes into the MICRO. Configuring the MICRO to match your blending needs is simple.

It is just as easy to get a status report on any group in the configuration. The report shows operators control status, flow ratios and target values. Again, individual elements in the blend ("Leaders" and "Followers") can be changed without reprogramming the MICRO.



Control.

The 1180 MICRO controls quality across the sheet with the industry's most modern Cross-Machine Control.



Now you can control caliper, hardness or moisture profiles automatically with the 1180 MICRO. The Cross-Machine Control module can be added to any new or existing MICRO.

Cross-Machine Control of caliper or hardness.

When it comes to automatic control of caliper or hardness, only AccuRay offers you a single source of supply.

AccuRay calender air showers are expressly designed to work with the direct digital control of the 1180 MICRO. Or, the MICRO can interface with most automated air showers commercially available.

Using exclusive **Full Width Decoupling**, single zone control actions are simultaneously balanced across the sheet to compensate for overlapping actuators.

Your operators can shape the profile they want by interacting with the 1180 MICRO. Paper profile is measured and adjusted automatically. Or, they can manually adjust certain zones while the rest stay under automatic control.

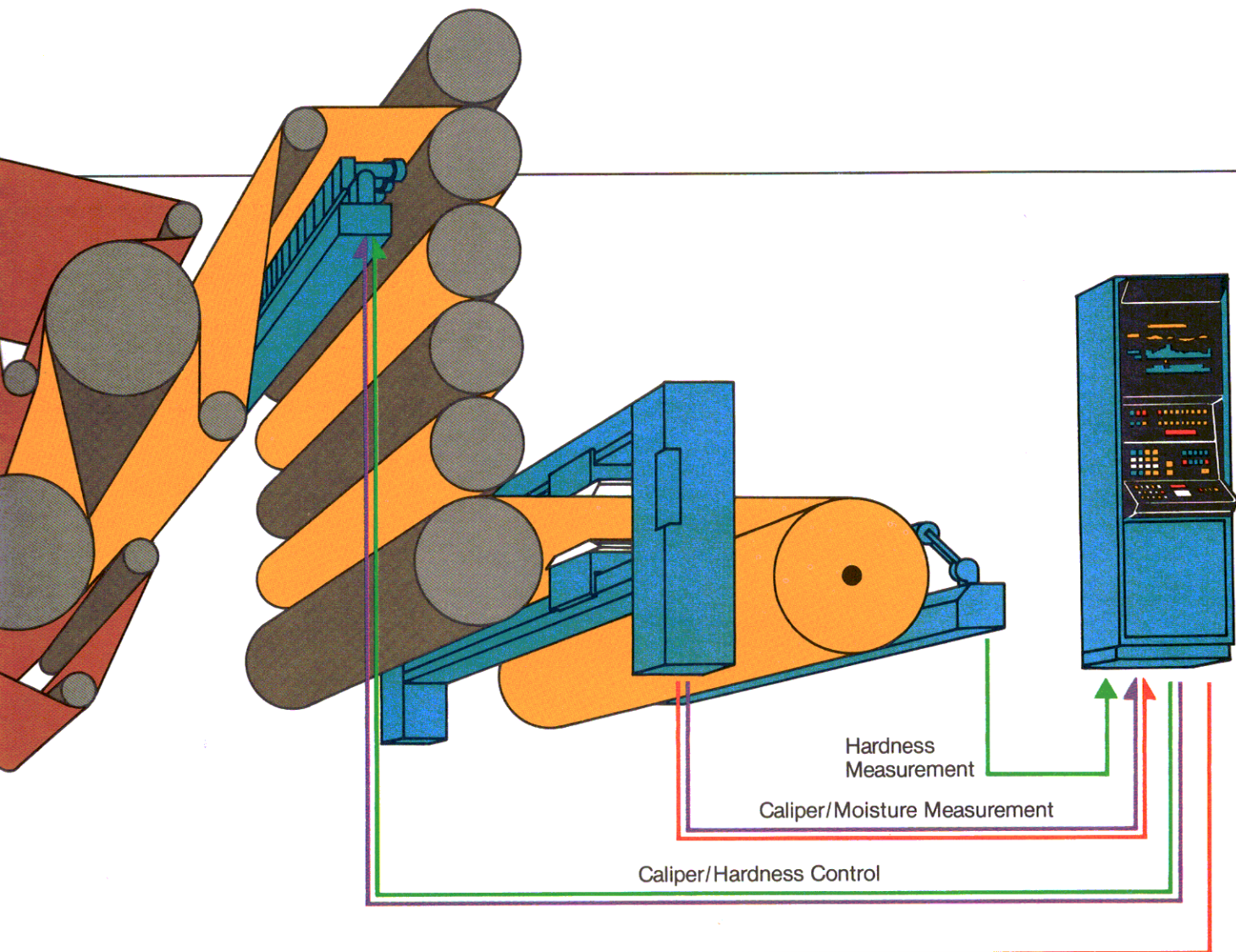
Precise control of caliper or hardness profiles means better printability. And, a sharp reduction in rejects due to culled reels.

Cross-Machine Control of moisture .

Your operators select the moisture profile you want. The 1180 MICRO controls it automatically.

Again, **Full Width Decoupling** adjusts shower zones simultaneously to avoid overlaps or overcompensation, ensuring precise control without streaking.

Better control of moisture profiles means increased moisture targets. This can result in substantial savings in energy and materials costs.



Cross-Machine Control reports its findings.

On the MICRO's video screen, your operator can see what's happening to the profile you've chosen. It gives a continuous status report — actuator by actuator. Paper printouts are available at the touch of a button.

It can even help if a sheet breaks.

During start-up after a break, your operators have the option of retaining the last automatic control settings or starting over. If sheet break downtime is minimal, they can save time in producing paper to spec by relying on the MICRO's memory.



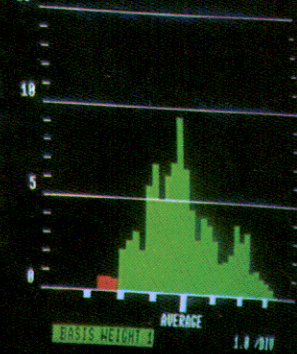
LINE 1
6-80 19:39

HISTOGRAM

PAGE 1

PCT. OF
SAMPLES

CT LIMIT 97.5
MED % DEFECTIVE 1.8
AL % DEFECTIVE 2.2
AGE 35.7
CMA 2.6
LE SIZE 5000.0
T TIME 18:15



The control panel features several rows of buttons. The top row includes buttons for 'LINE DATA COLLECT', 'STOP', 'START', and 'HOLD'. Below this are two rows of orange buttons labeled 'MODE 1', 'MODE 2', 'MODE 3', 'MODE 4', 'MODE 5', 'MODE 6', 'MODE 7', 'MODE 8', 'MODE 9', 'MODE 10'. There are also several blue buttons with labels like 'MODE 1', 'MODE 2', 'MODE 3', 'MODE 4', 'MODE 5', 'MODE 6', 'MODE 7', 'MODE 8', 'MODE 9', 'MODE 10'. At the bottom, there is a numeric keypad with white buttons and a red button.

Information.

The 1180 MICRO keeps everyone informed.

Your operators, foremen, lab technicians and production managers can all have important production information at their fingertips with the 1180 MICRO.

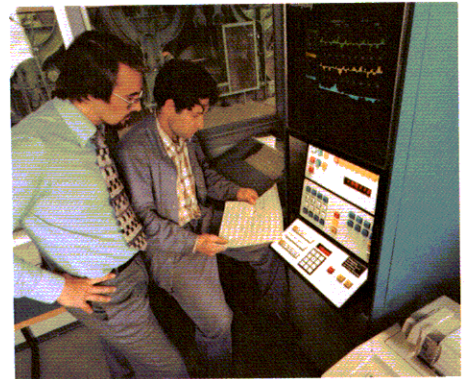
A MICRO system doesn't just provide raw data to run the process. Rather, it summarizes, analyzes and presents reports with a format and frequency dictated by you.



Mill management receives summaries of production data in a convenient format of its choice. A production manager expands visibility into various processes, makes decisions to balance flows and sends instructions directly to operators through the MICRO's video screen with Micro/Manager 8000.



Supervisory people have access to the same video reports operators do with remote monitors in visible areas of your mill.



Or, they can obtain printouts of video reports at the touch of a button.

MACHINE 1		PROCESS SUMMARY			PAGE 1	
10-17-88 14:23		PRESENT PRODUCT 2			NEW PRODUCT 2	
		PRESENT STANDARD	PRESENT TARGET	ACTUAL	NEW TARGET	STATUS
MOIST HEIGHT	1 LBS	38.6	72.2	64.1	67.7	
MOIST HEIGHT	2 LBS	38.6	75.0	73.7	65.0	
MOISTURE	1 PCT	4.5	3.0	2.6	4.1	LOCAL
MOISTURE	2 PCT	4.5	5.1	5.4	5.0	AUTO
WOME DRY HT	1 LBS	27.0	70.0	62.4	65.0	
WOME DRY HT	2 LBS	27.0	71.2	69.6	61.0	
CALIPER	H/LS	6.3	6.3	7.3	6.3	
ASH	PCT	6.3	6.3	7.1	6.3	
MACHINE SPEED	FT./MIN	2200.0	795.1	795.1	2200.0	

Operators have a variety of video reports available to keep them constantly advised of process conditions. And, they receive instant communications from production managers on the MICRO's screen via MICROLINK.



Lab technicians have access to current process information through AccuRay's Table-Top Operator Station.

An AccuRay MICRO system is a step toward total millwide management — Micro/Manager 8000.

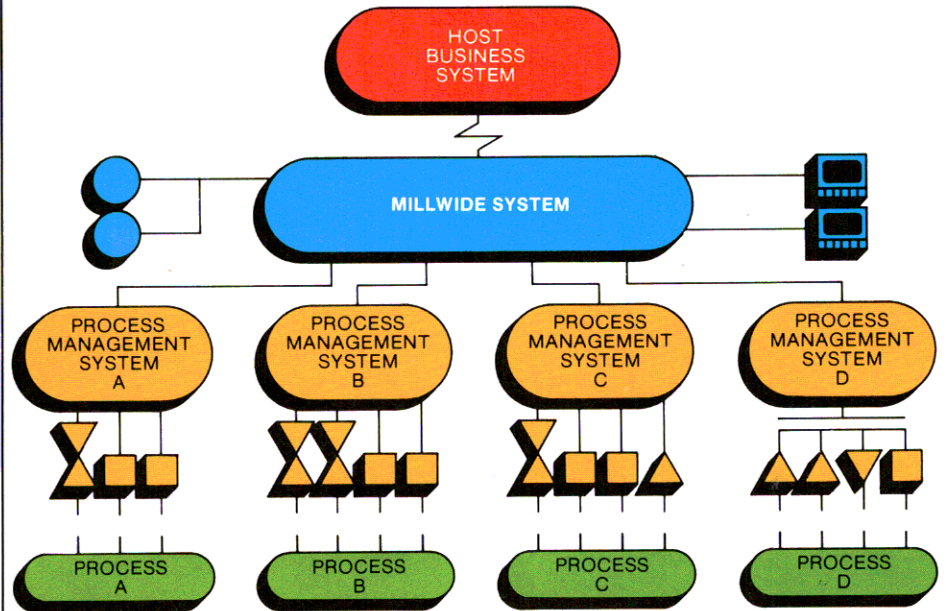
Before the first MICRO system was designed and built, it was conceived as a building block in a total millwide management system. AccuRay calls its concept for millwide management **Micro/Manager 8000**.

It's a system to expand visibility into your mill's operations — to give you new management tools.

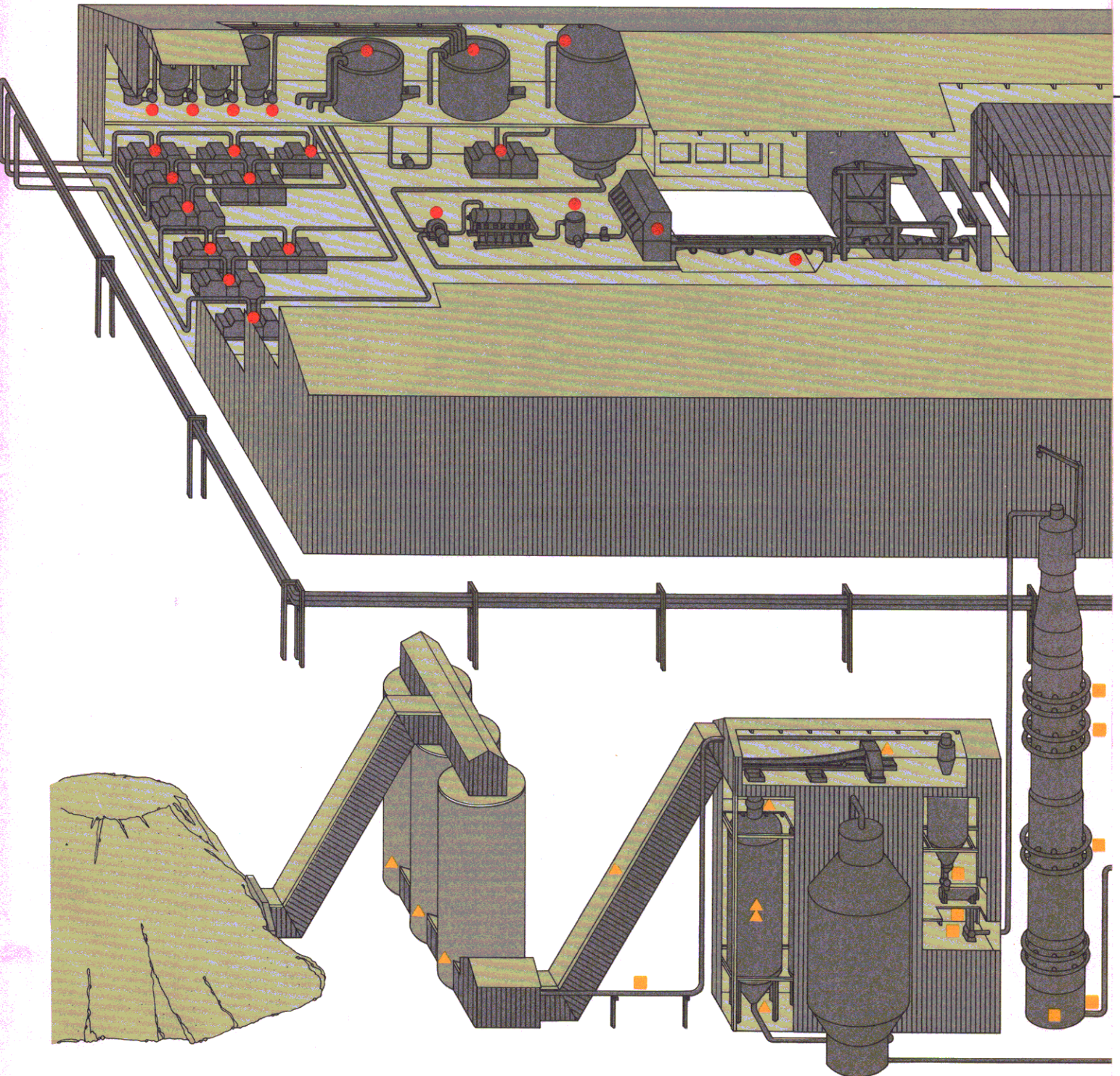
Your MICRO works as a full partner in assembling and analyzing production information for Micro/Manager 8000. Information that can help you:

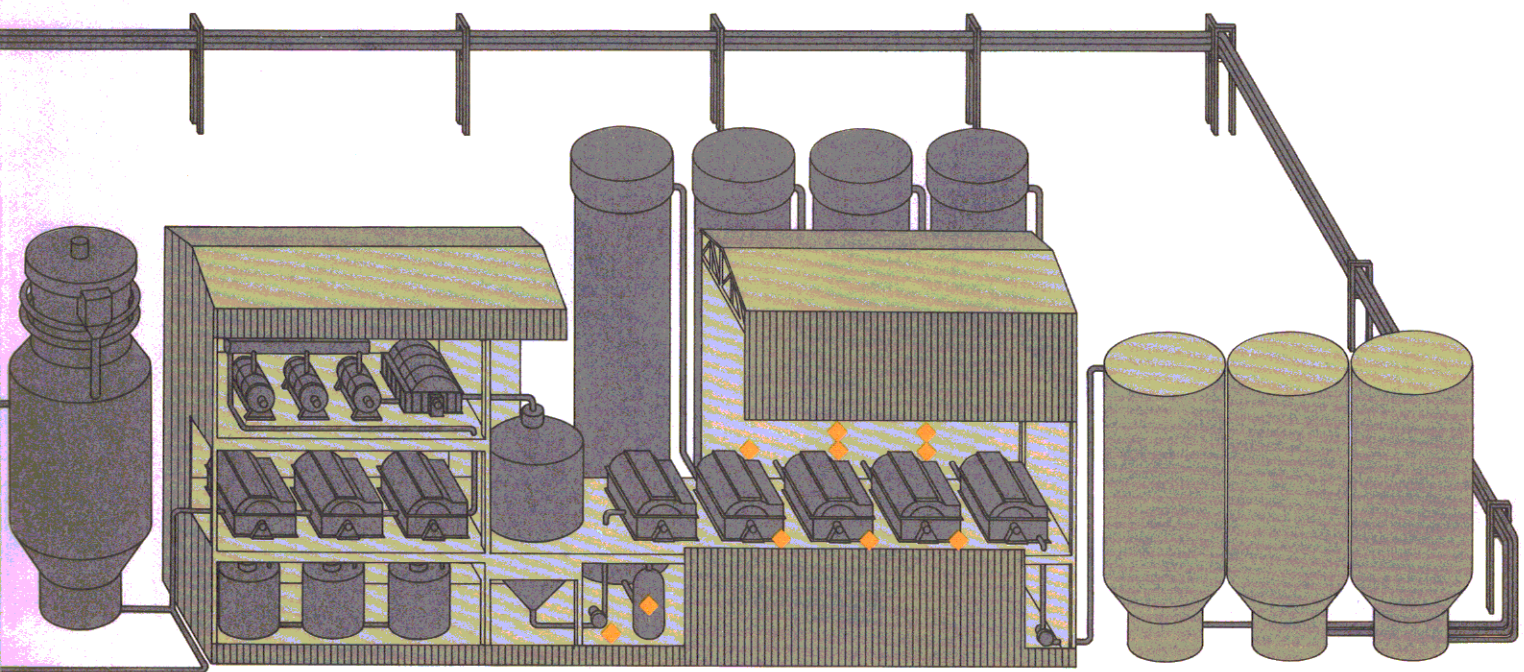
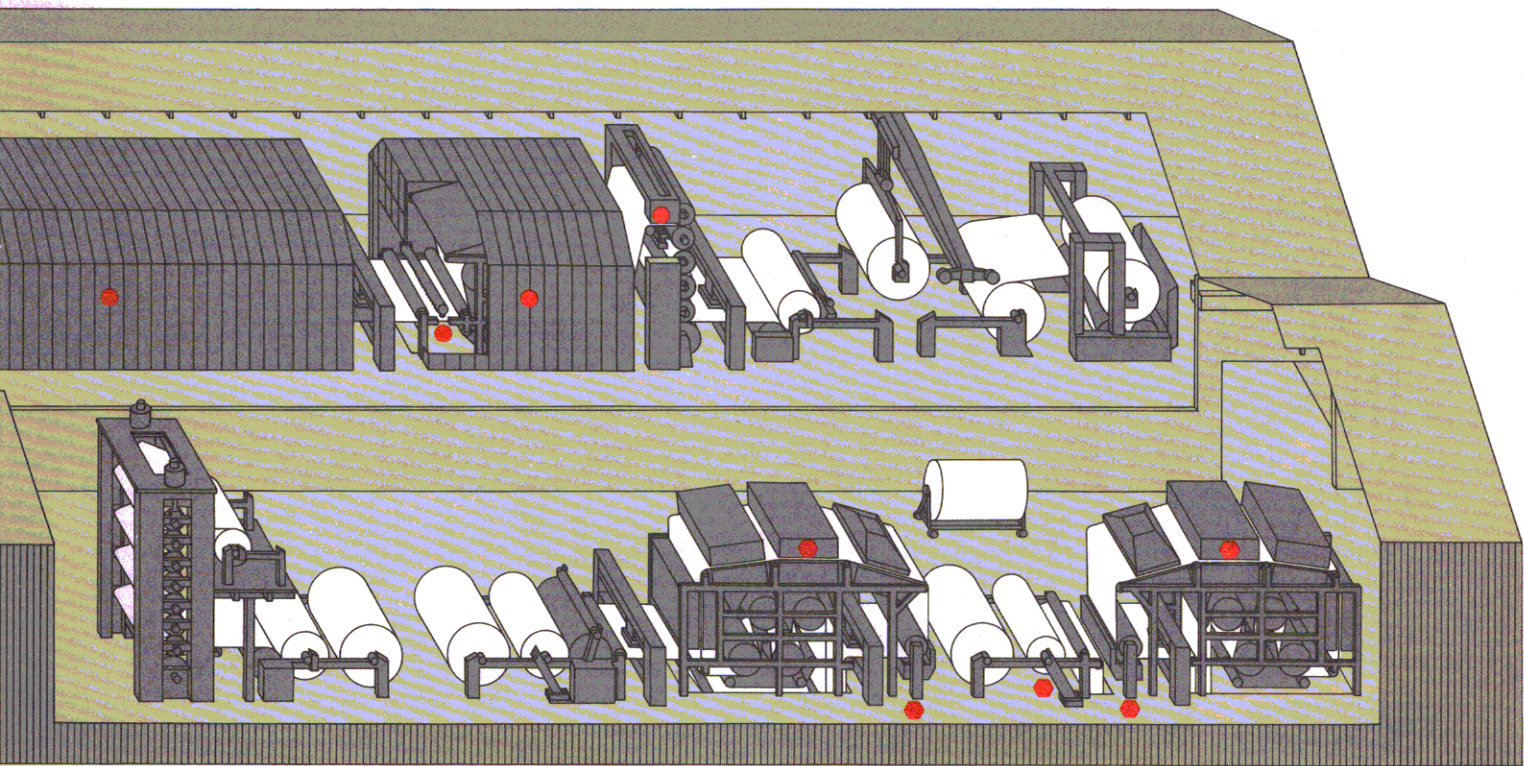
- Balance the flow of production in your mill by optimizing chest and tank levels, identifying bottlenecks, eliminating waste.
- Improve process visibility so you can manage your mill more effectively.
- Provide a historical data base of grade cost information to better understand the economics of each grade you produce and sell.

The MICRO system you install this year not only allows you to expand your horizons in process control, but it is a step toward your own Micro/Manager 8000. Managers who plan for this today will be the first to reap bottom line rewards in the future.

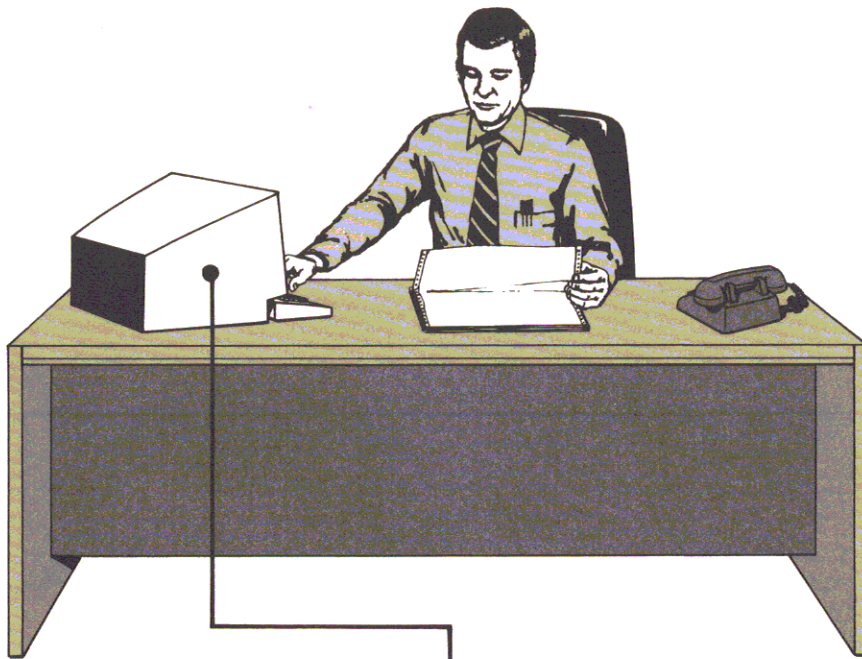


AccuRay Micro/Manager 8000 Millwide Management System

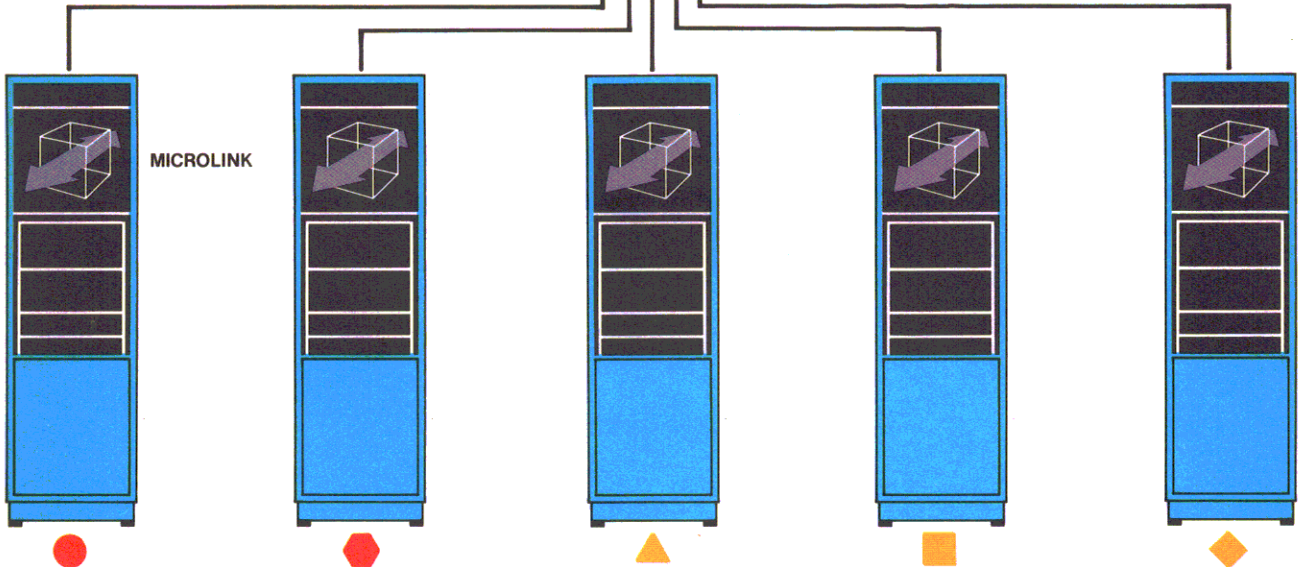




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Production Manager MICRO



**1180 MICRO System
Paper Machine Controls**

- Digital Weight
- Digital Moisture
- Dry Stock Flow
- Cascade Weight
- Coordinated Dryer Shutdown/Start-up
- Ash
- Opacity
- Basis Weight ATM
- Moisture ATM
- Ash ATM
- Opacity ATM
- Digital Headbox
- Speed Optimization
- Coordinated Speed Change
- Automatic Grade Change Refiner
- Freeness Optimization
- Chest Level
- Stock & Additive Blend
- Program One User
- Cross-Machine Caliper
- Cross-Machine Hardness
- Cross-Machine Moisture
- Stock Loading
- Ply Loading
- Multiforming

**1180 MICRO System
Coater Controls**

- Coat Weight (single or dual blade)
- Moisture
- Automatic Next Grade Set-up
- Coordinated Speed Change
- Speed Optimization
- Start-up
- Coat Weight ATM
- Moisture ATM

**4200 MICRO System
Batch Digester Controls**

- Production Rate
- Scheduling
- Yield
- Overcook Prevent
- Maximum Production Rate
- Maximum Impregnation
- Smooth Steam
- Chip Moisture Compensation
- Automatic Capping
- Liquor Conductivity
- Cook Safety
- Accumulator Counter Reset
- Blow Heat Accumulator
- Low Pressure Steaming
- Indirect Steaming
- Charge
- Cook
- Blow

**4200 MICRO Kamyr™
Digester Controls**

- Chip Meter
- White Liquor
- Top Dilution
- Temperature
- Extraction
- Cold Blow Flow
- Outlet Device
- Bottom Dilution
- Blow Flow A
- Blow Flow B
- Temperature Trim
- IV Bottom Dilution flow
- IV Outlet Device
- IV Bypass Flow
- Chip Moisture Compensation
- Second Chip Meter
- High Pressure Feeder
- Dilution Factor
- Upper Heater
- Chip Storage
- Automatic Grade Change
- Residual Alkali

**4200 MICRO System
Bleach Plant Control**

- Incoming Stock Flow
- Chlorine Stage
- Chlorine Flow
- Chlorine Dioxide Flow
- Caustic Stage
- Caustic Flow
- Caustic Tower Temperature
- Hypo Stage
- Hypo Flow
- Caustic Flow
- Hypo Tower Temperature
- Dioxide Stage
- Chlorine Dioxide Flow
- Caustic Flow
- Dioxide Tower Temperature
- pH
- Brightness
- Residual
- Production Rate

**AccuRay systems
work in 50 countries
—and 33 languages.**



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And we're proving it every day.**

