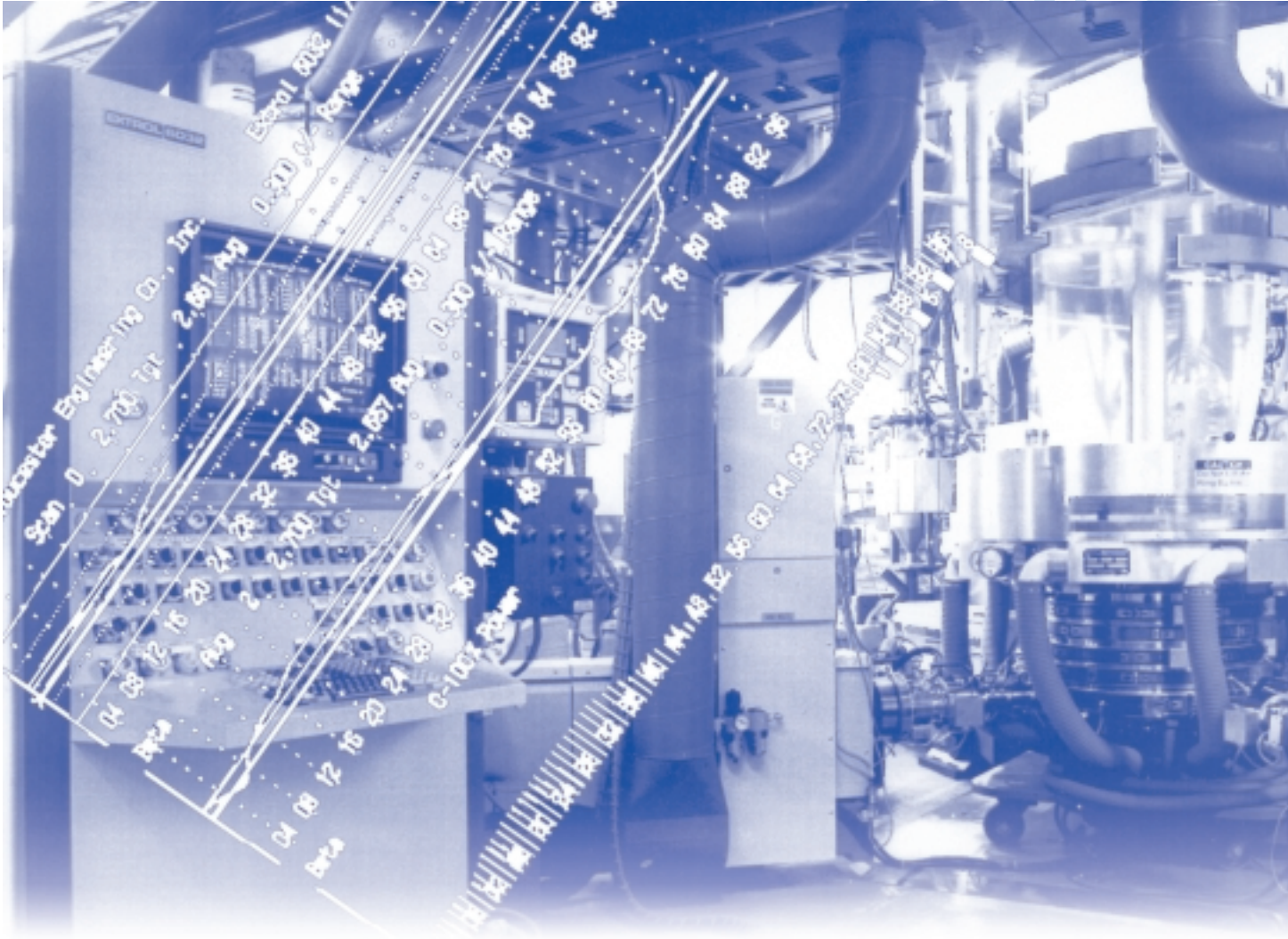
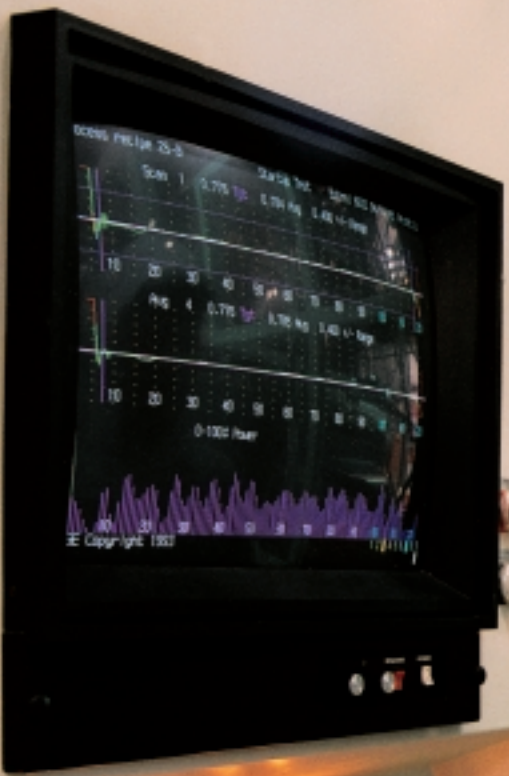


# Integrated Process Control Systems

# Extrol



**EXTROL 6032**



The control panel features a grid of buttons and knobs. At the top, there are four orange indicator lights. Below them are several rows of buttons, some with green and red indicators. A keyboard with black, grey, and yellow keys is integrated into the panel. The man's hands are positioned over the keyboard and a knob.



# EXTROL® Extrusion Specific Process Control

The Battenfeld Gloucester Extrol® 6000 Series was designed from the very beginning as a process control system specifically for extrusion. It has been refined and optimized by engineers who have a deep understanding of the extrusion process and the relationship of different variables to the quality of the finished film, sheet or shape.

Microcomputer based, the Extrol system gives you direct digital control of every phase of the extrusion processing line from resin loading and melting to finished product, all at one central station that has been designed for easy operator interface. It constantly monitors thousands of process variables and reports both absolute values and trends in easy to read, highly understandable graphic form.

Used to control hundreds of extrusion lines around the world, the Extrol system is so successful because of its

unique concept. Based on the most advanced computer hardware available, it includes a powerful 32-bit operating system capable of running equally powerful software programs. But the real key to its success is the fact that these software programs were created specifically to control extrusion processes. What's more, the system's control logic, algorithms, displays and reports have been created by Gloucester engineers with years of experience and expertise in:

- Blown film
- Cast film
- Rigid sheet
- Foam sheet
- Coating & laminating
- Profile extrusion



Diagnostics

## Complete Control of Process Functions

The Extrol system controls all process functions from the beginning to the end of the production line, including:

- Resin loading
- Materials blending
- Gravimetric/volumetric feeding
- Resin melting
- Extrusion pressure & temperature
- Film or sheet gauge
- Flat or round die profiling
- Web cooling
- Hauloff
- Auxiliary Equipment

But the Extrol system is not only ready to begin controlling your process from the moment your production line is installed. It's also very easy to customize it to fit your operating conditions and

## A Powerful, Yet User Friendly System

The Extrol control system is designed for maximum operator convenience. User-defined system parameters are clearly displayed as easy to understand color graphics on a high-resolution monitor. A logical, easy to use color coded function keyboard makes setup and monitoring fast and easy, eliminating

procedures. You can set parameters, limits and alarms simply by pushing a few buttons, and online monitoring is equally easy.

More than just a process controller, Extrol is a complete management information system as well. The system automatically provides management reports, audit trails, SPC statistics, and a wealth of other valuable information.

Hundreds of satisfied Extrol system users have realized increased uptime, sustained maximum throughput, consistently higher quality and minimum operator intervention. These benefits flow directly to your bottom line and immediately increase your profitability.

time consuming menu searches.

Programming can be easily customized to meet the requirements of your process and procedures. All modifications are thoroughly tested by trained Gloucester technicians before the system goes online.



Extrol 6032  
Microcomputer Control System

## Reliable Hardware

The Extrol System incorporates the most advanced hardware available, including:

- The Motorola 68020 (32 bit) for the Extrol 6032 and 68000 (16 bit) for the Extrol 6016P. These powerful processors provide excellent reliability at high operating speeds.
- One megabyte of DRAM memory (512K for 6016P) for virtually unlimited processing power.
- EEPROM memory for storage of product recipes and tuning parameters.

The entire system features rugged construction for continuous use in demanding production environments.

## A Complete Management Information System

The Extrol 6000 Series not only provides information required by the operator, but also generates reports that help management make better informed decisions. And it presents this information in the form of visual color graphics that are easy to recognize and understand. For example:

- Up to three variables can be tracked and displayed simultaneously as multi-colored trend plots, with SPC data plotted as an X-bar graph alongside.
- Trends, alarms, events and operator parameters are not only recorded, but also identified as to the time and the point of the operation at which they occurred.
- Product and shift reports on variables such as material and energy consumption, quantities of acceptable product versus scrap, percentage of downtime, and average drive speed can all be generated on command.
- Product recipes and tuning parameters are stored in reliable, non-volatile EEPROM memory.



Alarm and Event

## Constant, True Control of All Process Functions

Because the slightest change in a process variable in one section of the production line can instantly affect other sections of the line and ultimately the quality of the product, it is imperative that a single system monitor and control the entire production process. The Extrol system is designed to do exactly this, resulting in increased throughput and tighter conformity to specifications.

From a single control station on the production floor, the operator commands:

### Gravimetric Feeding and Blending

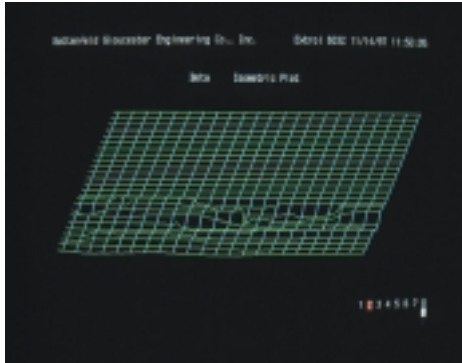
The Extrol system precisely controls both the output of the gravimetric hoppers and the speed of the screw to maintain uniform thickness and accurate layer-to-layer ratios. It also controls Integrated Gravimetric Blending by monitoring either loss-in-weight, batch weight/mix, or feed throat blend systems to ensure accurate formulations and resin inventory control.



Gravimetric Blending

## Precise Gauge Control

Extrol constantly monitors average thickness and/or thickness profile utilizing infrared, Beta, Gamma or capacitance gauges.



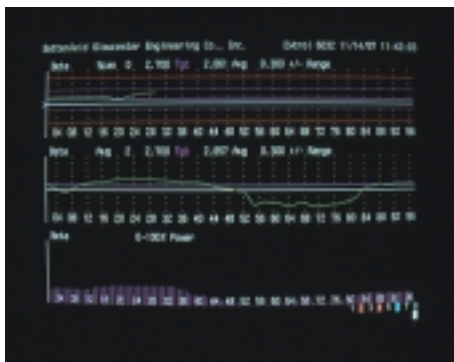
Isometric Plot

Extrol works in conjunction with Gloucester's Autoprofile™ Air Ring in blown film applications to automatically ensure gauge consistency for improved yields and reduced scrap. In blown film as well as cast film, sheet, or extrusion coating/laminating applications, the Extrol system automatically controls average sheet and film thickness by constantly regulating either extruder output or line speed.



Polar Plot

The Extrol system controls transverse gauge by regulating die bolt operations with no additional computer required. Full profile displays as well as composite roll and distribution curves are included in roll or batch reports.



Gauge Plot

## Temperature Control

True set point control of all heating and cooling zones for extruders, dies, adapters, melt pumps and cooling rolls is achieved through the use of preprogrammed non-linear PID control algorithms. This allows the Extrol operator to expertly manage the entire process by using independent temperature tuning parameters.



Temperature Set Point and Data

## Drive Control

The Extrol system regulates the output of an extruder with gravimetric feed by Volumetric Control, setting the speed of the screw at a constant RPM. When a melt pump is used, a pressure feedback loop controls output. For coextrusion applications, Tandem Speed Control synchronizes extruder ramp up rates to maintain product uniformity and reduce scrap.



Speed/Temperature/Amp Page with Gravimetrics

## Useful Management Reports

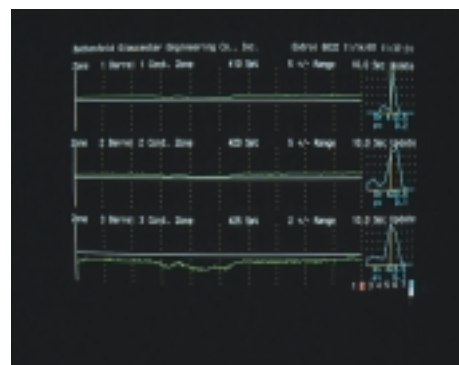
The Extrol system includes a host of management reports that provide useful information such as:

- Product and Shift Reports
- Trend Charts and Numerical Data
- Alarm and Event Audits
- Statistical Process Control (SPC) Data
- Storage of Material Recipes and Tuning Parameters
- Interactive Link to Personal Computer
- Electronic Mail Communication

With Extrol, management has the constantly updated support and documentation needed to validate the manufacturing process as required by regulatory agencies such as GMP, FDA or ISO 9000.



SPC Data



Trend Analysis



## Shift to Shift Consistency

Several features of the Extrol system are designed to assure shift to shift production consistency. For instance:

- Self-calibrating diagnostics continually troubleshoot the computer system to correct problems before they occur.
- Automatic orderly startup and shutdown procedures protect the process, the system and the operator.
- An audible and visual alarm network alerts the operator immediately to any variance in pre-programmed system operation variables.
- High/low deviation and safety alarms are provided for all control zones, including:
  - Temperature control zones
  - Drives
  - Amps and pressure control zones
  - Gauge control
  - Feeding and blending control

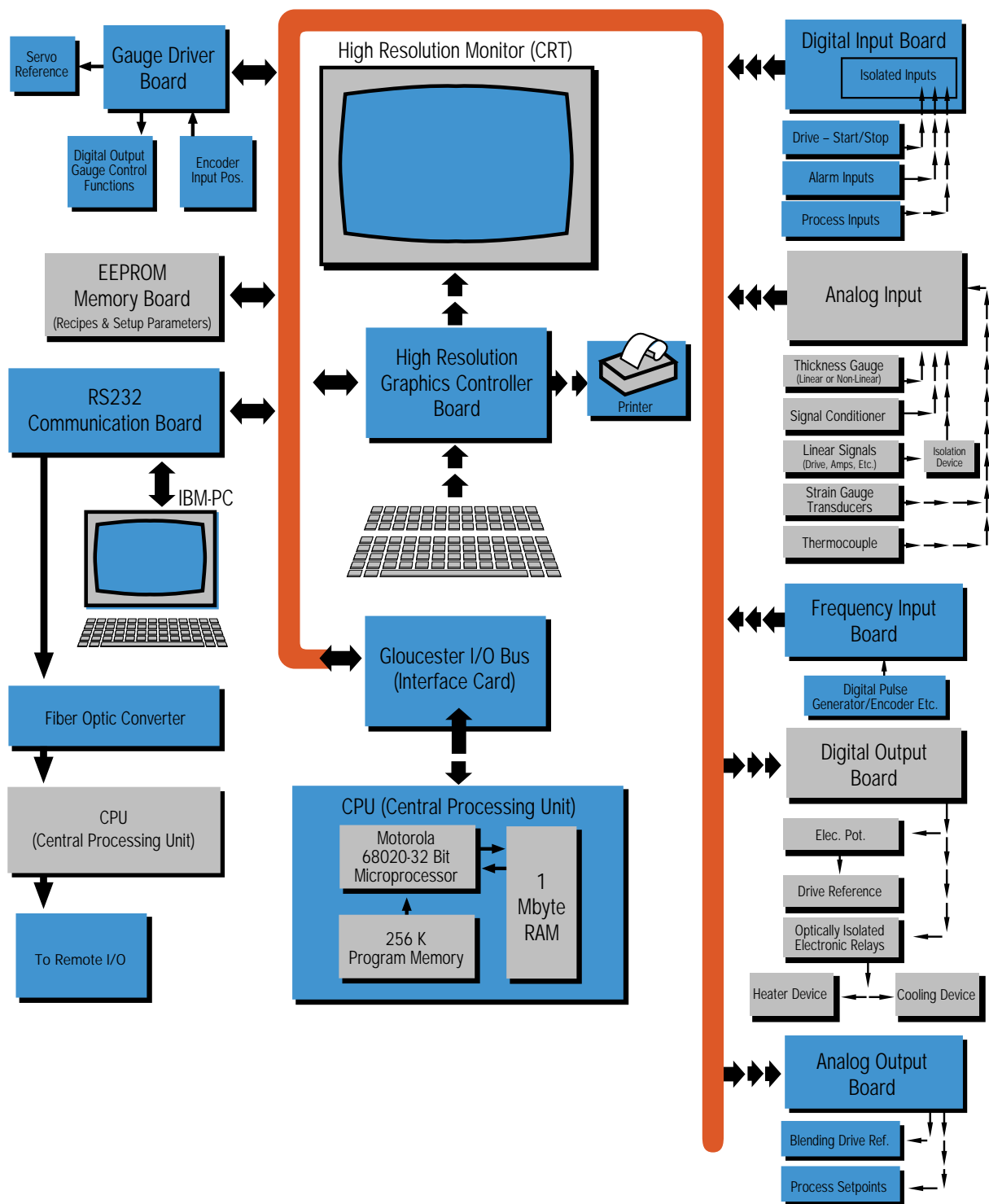


Production Report



Shift Report

# Extrol 6032 Control System



## Outstanding Service and Superior Support



Battenfeld Gloucester Engineering provides the tools and the technology for completed integrated extrusion and control systems. We serve as a

single source for required technical expertise, engineering and process knowledge that always delivers the end product. Support includes:

- Fully inclusive process consultation
- Comprehensive engineering services
- Use of Gloucester's dedicated Technical Center for material and equipment testing
- Gloucester's worldwide network of skilled, knowledgeable service engineers
- Our extensive inventory of parts and supplies

## Battenfeld Gloucester Engineering

From its headquarters in Gloucester, Massachusetts, USA, Battenfeld Gloucester Engineering is a worldwide leader in extrusion based plastics production systems. In addition to integrated microcomputer control systems, Gloucester supplies production lines, including tandem foam, blown film, cast film, rigid sheet, extrusion coating, bag making and reclaim processing.

A member of the Battenfeld Group, a leading worldwide supplier of plastics processing systems, Gloucester has led in the development, engineering, manufacture and support of individual production components and complete extrusion lines since 1961.

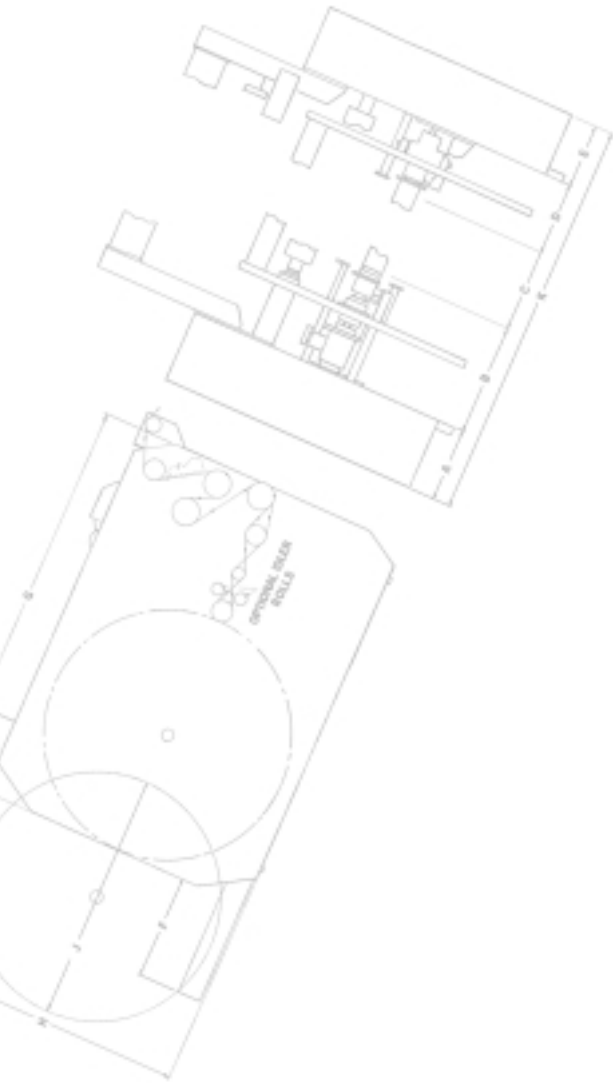


*Battenfeld Gloucester • USA*

Total production facilities of almost 360,000 square feet include CAD/CAM/CAE and CNC equipment for precision manufacturing of components such as extrusion screws and dies. Complete integration of design and engineering enable Battenfeld Gloucester to stay at the forefront of the latest technologies.



*Battenfeld Gloucester Europe • UK*



# Battenfeld Gloucester

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