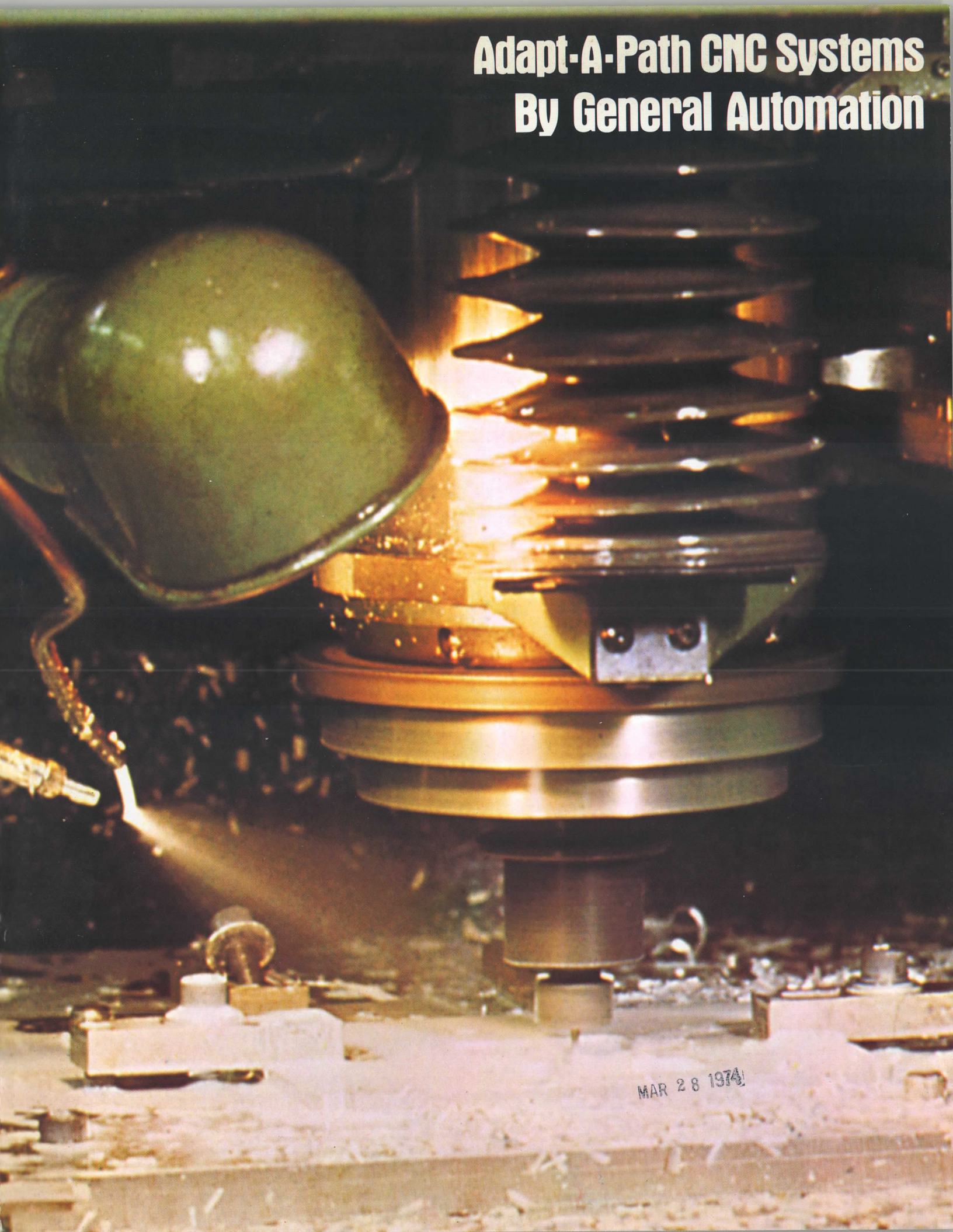
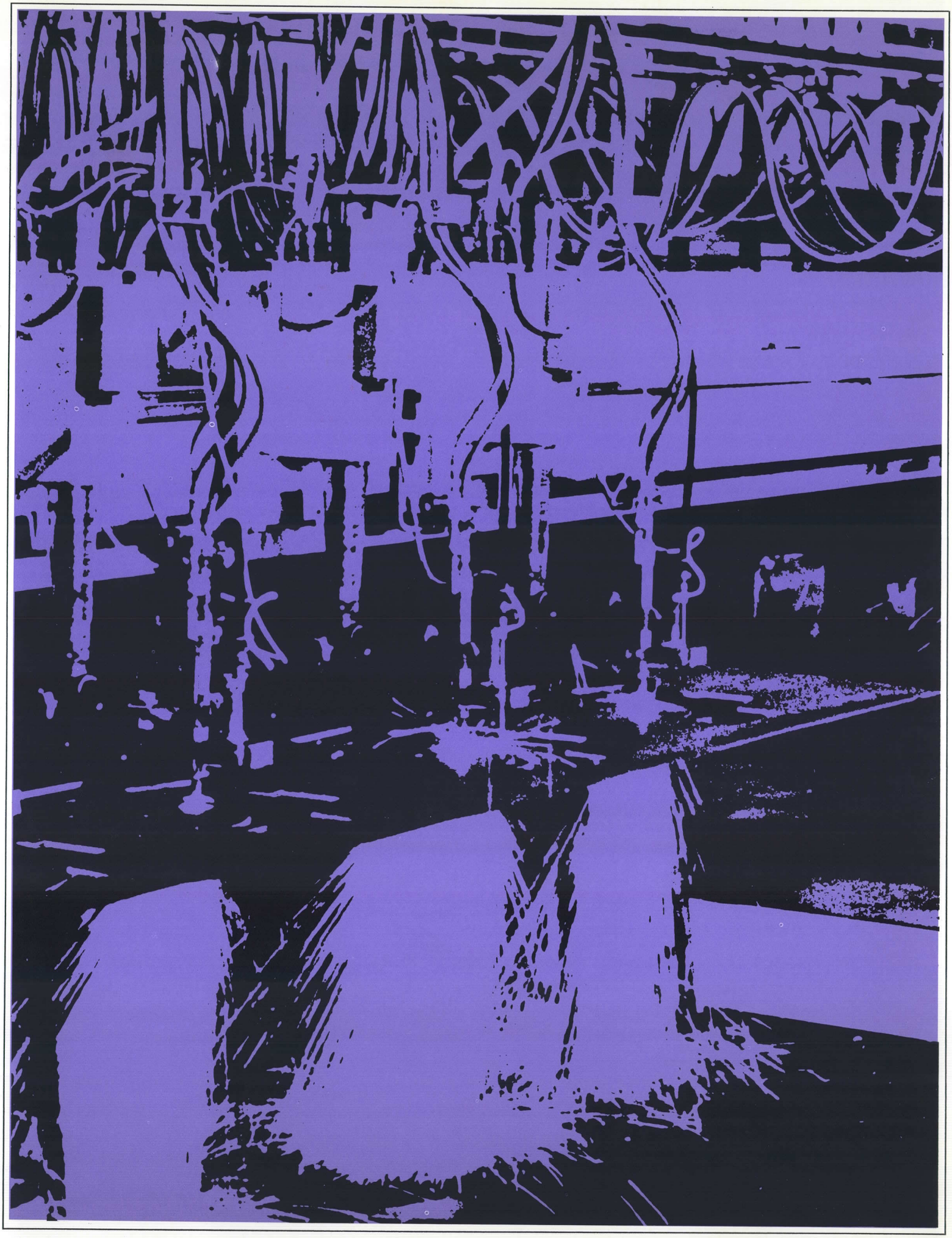
Adapt-A-Path CNC Systems By General Automation





WHAT IS ADAPT-A-PATH?

Adapt-A-Path by General Automation is a new line of Computer Numerical Controls (CNC) systems that can increase machine productivity, deliver a finished product of higher surface quality, and allow you to change functions without expensive hardware redesign. All at a cost less than conventional NC systems offering far less capability.

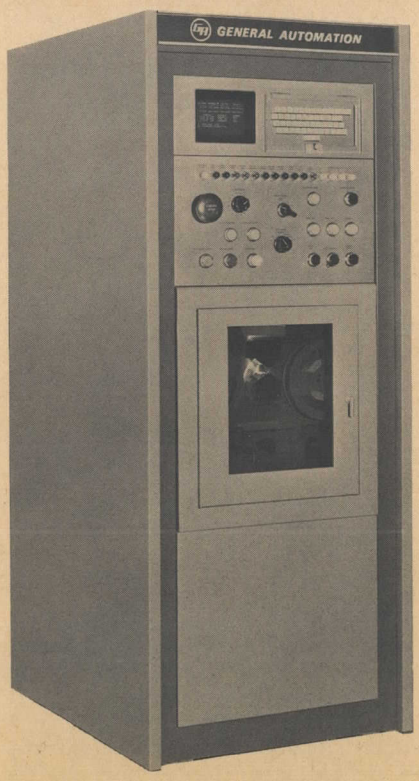
In addition, the Adapt-A-Path CNC family lets you choose from the broadest range of systems available today. Everything from basic positioning control systems, turning control systems, milling machine control systems, and machining center control systems. In fact, Adapt-A-Path systems cover approximately 95% of all machine tool functions.

If these sound like bold claims, you're right. Because when you're competing with some of the biggest and best known conventional control manufacturers in the business, you had better have something superior to what's available. And, that's just what Adapt-A-Path is.

Consider this. General Automation pioneered the development of Computer Numerical Controls and in fact, offered the first commercially available CNC to American industry. Today's Adapt-A-Path systems reflect the experience that resulted from our long involvement in developing custom numerical controllers for our industrial users and machinery manufacturers.

Our design criteria was to use off-the-shelf, field proven computer hardware and major new software developments. The resulting systems provide maximum flexibility. In other words, the same hardware serves as the foundation for all Adapt-A-Path systems. Only the software changes.

Stated simply, Adapt-A-Path is better than any other control systems around. But, don't take our word for it. Read through the following pages and then compare. We think you'll agree. Adapt-A-Path makes all other controls obsolete.




EMERG
STOP

CHECK THESE FEATURES

Unparalleled Surface Quality

If surface quality is vital to your work, Adapt-A-Path makes it better than ever. A new concept of path generation called Adaptive Trajectory Generation features an inherent smoothing capability which eliminates surface imperfections due to unmatched or inbalanced servo systems. This results in unparalleled surface quality and dynamic path accuracy.

More Machine Output

All Adapt-A-Path systems are fully buffered and machine control is directly from high speed computer memory. This allows for independent operation between the data input device and the machine control signals.

Part Program Storage

Single or multiple programs may be stored in the system and called out when required. This completely eliminates the repetitive usage, handling, loading, rewinding, and reading of paper tape.

Maximum Machine Performance

Adapt-A-Path systems are designed to obtain maximum performance from the machine. Control signals are matched exactly to the performance characteristics of a machine's drive system. As a result, machines are able to realize the maximum production capabilities for which they were mechanically designed.

Economical Expansion

Adapt-A-Path systems can grow modularly from very small control tasks to large supervisory direct control systems. You buy only the system you need — when you need it. Should you have to expand functions, you merely add the appropriate software, memory capacity and new function plug-in modules to do the job, without costly redesign of your entire system.

Remote Buffer Storage

All Adapt-A-Path systems have the capability of receiving data from either a remote distributor or a data processing facility. This means that tape handling may be completely eliminated on the shop floor thus assuring management and manufacturing control of part production.

Two-Way Communication

Unlike conventional systems with their "Behind the Reader (BTR)" approach to DNC, Adapt-A-Path is the only family of systems in its price range which offer the capability of true two-way dialogue between the machine on your shop floor and your management information system or data processing equipment — a major step toward total shop automation.

Program Format Compatible With Many NC Systems

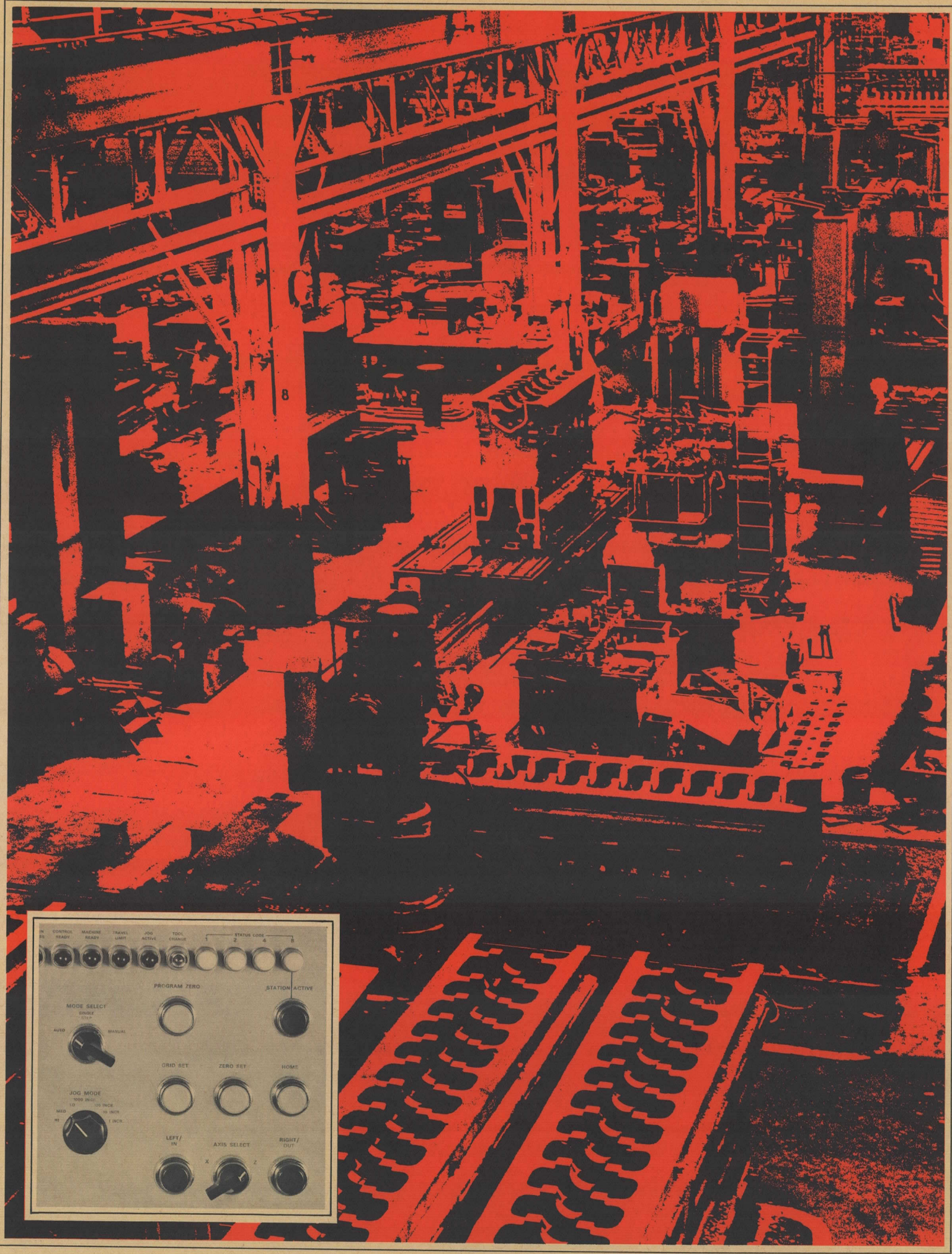
Adapt-A-Path systems have the ability to accept and use programs from many different types of conventional machine controller formats. This unprecedented flexibility eliminates the time needed to retrain programmers and operators as well as the problem of having to maintain a library of expensive post-processor programs.

Reliability and Maintainability

Adapt-A-Path systems use our field proven SPC-16 minicomputer, the most powerful in the industry. The power of this machine allows us to do complex functions in software whereas competitive systems require complicated special purpose circuitry. As a result, fewer printed circuit boards and less wiring is required. This allows for a completely modular design and construction making installation and maintenance much easier.

Low Cost

For the first time, the advantages of true computer control are no longer a luxury. Adapt-A-Path CNC systems are priced competitively with conventional control systems.


CONTROL READY
MACHINE READY
TRAVEL LIMIT
JOG ACTIVE
TOOL CHANGE
STATUS CODE
1
2
4
8
PROGRAM ZERO
STATION ACTIVE
MODE SELECT
SINGLE STEP
AUTO
MANUAL
GRID SET
ZERO SET
HOME
JOG MODE
1000 INCR
100 INCR
10 INCR
1 INCR
LO
MED
HI
LEFT/ IN
AXIS SELECT
X
Z
RIGHT/ OUT

POSITIONING CONTROL SYSTEMS

Adapt-A-Path Positioning Control Systems are designed for applications where production requires high feed rates and accurate positioning. These include applications such as insertion machines, drilling machines, boring machines, punch presses and wire wrap machines.

Hardware Features

- 2 axis positioning control with third axis up-down control to stops.
- Optional additional axes with closed or open loop positioning.
- Standard resolution of .0001 inches or .001 millimeters from optional or customer provided feedback transducers. (Optional 5 digit resolution as required.)
- Feed rates limited only by the machine characteristics.
- Feed rate override from 0 to 150% (may be eliminated if not required.)
- Multiple block buffer which allows independent operation between input and active block.
- Sprocket drive photoelectric tape reader with 7½" reels.
- Auto, single block or manual mode selection.
- Block delete.
- Optional Stop.
- High, medium and low jog ranges (scaled by feedrate override.)
- Incremental jog of 1, 10, 100 and 1000 system increments.
- Three mode control initialization—GRID SET, ZERO SET and HOME.
- System status display indicators.
- 0 to ±10 volt (10 milliamps) velocity reference output per axis.
- Totally sealed enclosure with double wall heat exchanger.
- Power input 115/230 volts (±10%), single phase, 47 to 63 Hz.
- 32 relay driver outputs are included in this basic system for driving customer magnetics with expansion in groups of 32. These are rated to drive conventional 28 volt dc relays up to 200 milliamps.
- 16 machine status inputs are provided. These accept contact closures from the customer magnetics. Additional inputs may be added in groups of 32.
- Lead screw error compensation (when required).
- A complete set of diagnostics verify the operational integrity of the control hardware.
- Complete parameter display and MDI data entry via optional CRT and keyboard.
- Optional part program buffer expandable in increments equal to 66ft of Part Program Tape.
- Optional high level AC inputs for sensing 110 to 220 volt signals for customer equipment.
- Optional part program editing.
- Optional plug-in communications interface for remote part program entry.
- Optional punched paper tape output for permanent record.
- Optional high level AC drivers are available (110/220 volt, 5 amp maximum).

Programming Features

- Absolute or incremental programming (g90, g91).
- Leading or trailing zero suppression.
- Departure range to 99.9999 inches or alternately 999.999 millimeters.
- Tape selectable position preset (g92).
- Automatic format selection. Accepts either EIA tape code RS-244 or ASCII tape code RS-358.
- Parity and data validity check.
- Format n4, g2, x±2.4, y±2.4, s2, t2, m2 (f 3.2 when required).
- Program control codes, m00, m01, m02 and m30.
- Programmable lead screw backlash takeup (when required).
- Optional format compatibility with most standard tape formats.
- Step and repeat functions (when required).
- Tape selectable mirror image (when required).
- Canned cycles when required (g80 series).
- Special canned cycles (when required).


SLIDE ABSOLUTE TO GO OFFSET
X-CS +00.0000 +00.0000 +00.0000
Z-LS +00.0000 +00.0000 +00.0000
FEEDS SPINDLE CODES
002.5 IPM RANGE-1 M00
020.0 SFM DIR CW T01
0.001 IPR 0025RPM G80
* SEQ NO: 000
* CURRENT BLOCK: T01

LATHE CONTROL SYSTEM

Adapt-A-Path Turning Control Systems are designed for applications where production requires high feed rates and smooth and accurate continuous path contouring. These include applications such as horizontal and vertical chuckers, engine lathes and vertical boring mills.

Hardware Features

- Two axis turning control with linear and circular interpolation.
- Optional additional axis for u and w axis control.
- Optional thread cutting. Programmable lead range from .00001 to 9.99999 inches per revolution.
- Automatic Turret Control.
- Standard resolution of .0001 inches or .001 millimeters resolution as required.
- Feed rates limited only by the machine characteristics.
- Feed rate override from 0 to 150%.
- Multiple block buffer which allows independent operation between input and active block.
- Sprocket drive photoelectric tape reader with 7½" reels.
- Auto, single block, or manual mode selection.
- Block delete.
- Optional stop.
- High, medium and low jog ranges (scaled by feedrate override).
- Incremental jog of 1, 10, 100 and 1000 system increments.
- Three mode control initialization—GRID SET, ZERO SET and HOME.
- System status display indicators.
- 0 to ±10 volt (10 milliamps) velocity reference output per axis.
- Totally sealed enclosure with double wall heat exchanger.
- Power input 115/230 volts (±10%), single phase, 47 to 63 Hz.
- 32 relay driver outputs are included in the basic system for driving customer magnetics with expansion in groups of 32. These are rated to drive conventional 28 volt dc relays up to 200 milliamps. These may be used for spindle speed control, turret selection and miscellaneous machine control functions.
- 16 machine status inputs are provided. These accept contact closures from the customer magnetics. Additional inputs may be added in groups of 32.
- Optional D/A spindle speed control. 0 to ±10 volt RPM reference signal.
- A complete set of diagnostics verify the operational integrity of the control hardware.
- Complete parameter display and MDI data entry via optional CRT and keyboard.
- Optional part program buffer expandable in 66 foot increments.
- Optional high level AC inputs for sensing 110 or 220 volt signals from customer equipment.
- Optional part program editing.
- Optional plug-in communications interface for remote part program entry.
- Optional punched paper tape output for permanent record.
- Optional high level AC drivers are available (110/220 volt, 5 amp maximum).

Programming Features

- Absolute or incremental programming (g90, g91).
- Leading or trailing zero suppression.
- Departure range to 99.9999 inches or alternately 999.999 millimeters (optional 7 digit departure as required).
- Arc center offset range to 99.9999 inches or 999.999 millimeters.
- Direct IPM programming.
- Tape selectable position preset (g92).
- Surface feet per minute programming mode (optional).
- Automatic Format Selection. Accepts either EIA tape code RS-244 or ASCII tape code RS-358.
- Format n4, g2, x±2.4, z±2.4, i2.4, k2.4, f3.2, s2, t4, m2.
- Program control codes m00, m01, m02, and m30.
- Parity and data validity check.
- Threading and inches per revolution programming (optional).
- Automatic lead in computation for multiple lead with threading option.
- Optional format compatibility with most standard tape formats.
- Optional parametric programming.
- Optional special canned cycles available.
- Optional diameter programming of the x axis.

MILLING MACHINE CONTROL SYSTEM

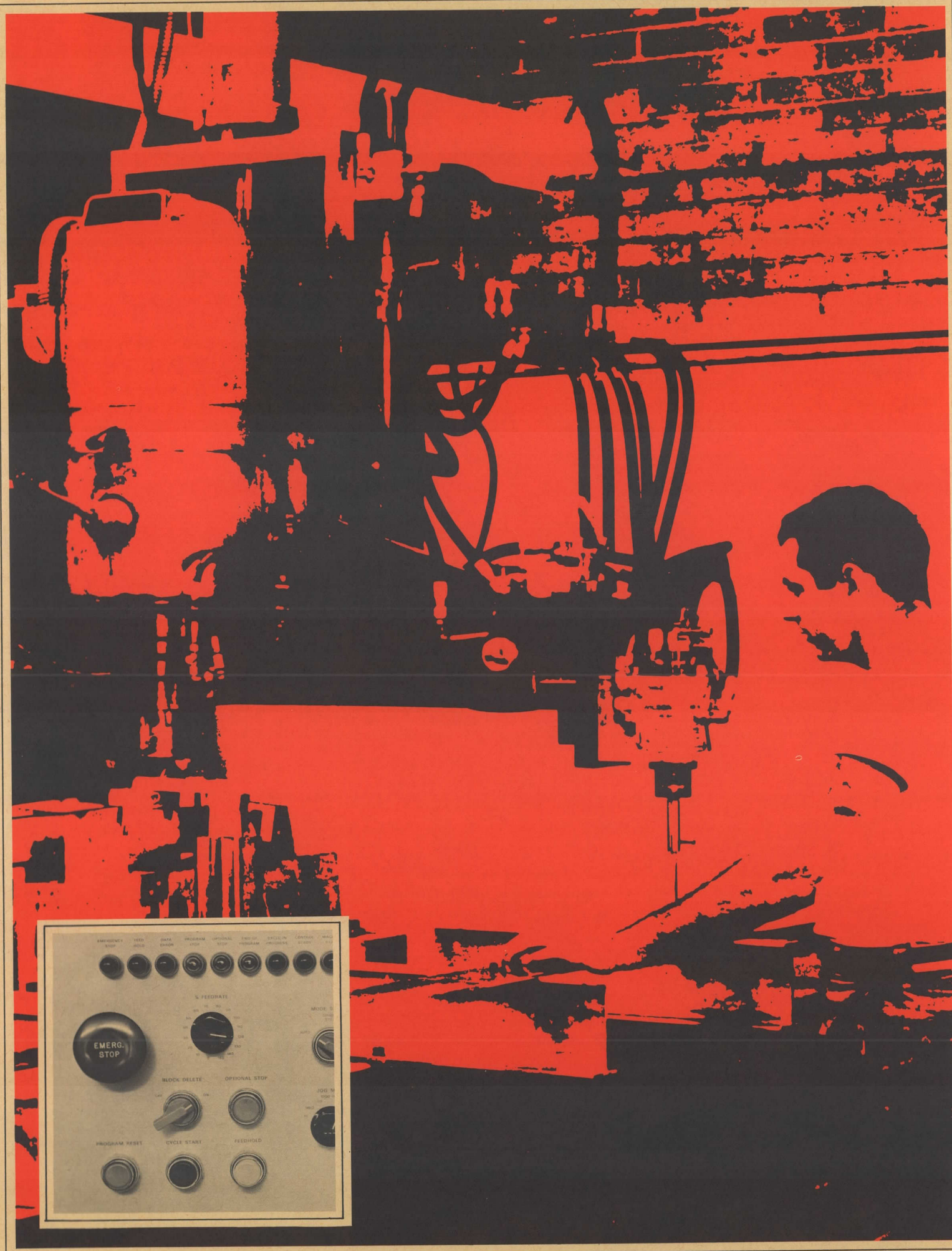
Adapt-A-Path Milling Machine Control Systems are designed for applications where production requires high feed rates and smooth and accurate continuous path contouring. These include applications on machine types such as x-y milling machines, routers, and drafting machines.

Hardware Features

- Two axis contouring control with linear and circular interpolation.
- Open loop positioning of the third axis to programmed stops.
- Optional closed loop positioning of additional rotary or linear axes.
- Optional continuous path cutter radius compensation.
- Standard resolution of .0001 inches or .001 millimeters from optional or customer provided feedback transducers. (Optional five-digit resolution as required).
- Feed rates limited only by the machine characteristics.
- Incremental jog of 1, 10, 100 and 1000 system increments.
- Feed rate override from 0 to 150%.
- Multiple block buffer which allows independent operation between input and active block.
- Sprocket drive photoelectric tape reader with 7½″ reels.
- Auto, single block, or manual mode selection.
- Block delete.
- Optional Stop.
- High, medium and low jog ranges (scaled by feedrate override).
- Three mode control initialization—GRID SET, ZERO SET and HOME.
- System status display indicators.
- 0 to ±10 volt (10 milliamps) velocity reference output per axis.
- Totally sealed enclosure with double wall heat exchanger.
- Power input 115/230 volts (±10%) single phase, 47 to 63 Hz.
- 32 relay driver outputs are included in this system for driving customer magnetics with expansion in groups of 32. These are rated to drive conventional 28 volt dc relays up to 200 milliamps. These may be used for spindle speed control and miscellaneous machine control functions.
- 16 machine status inputs are provided. These accept contact closures from the customer magnetics. Additional inputs may be added in groups of 32.
- Optional D/A spindle speed control. 0 to ±10 volt RPM reference signal.
- Optional A/D input converter for adaptive control of spindle speed and feed rate.
- Complete parameter display and MDI data entry via optional CRT and keyboard.
- Optional part program buffer expandable in increments of 66ft of Part Program Tape.
- Optional high level AC inputs for sensing 110 or 220 volt signals from customer equipment.
- Optional part program editing.
- A complete set of diagnostics verify the operational integrity of the control hardware.
- Optional punched paper tape output for permanent record.
- Optional plug-in communications interface for remote part program entry.
- Optional high level AC drivers are available (110/220 volt, 5 amp maximum).

Programming Features

- Absolute or incremental programming (g90, g91).
- Leading or trailing zero suppression.
- Departure range to 99.9999 inches or 999.999 millimeters (optional 7-digit departure as required).
- Arc center offset range to 99.9999 inches or 999.999 millimeters.
- Direct IPM programming.
- Tape selectable position preset (g92).
- Automatic format selection. Accepts either EIA tape code RS-244 or ASCII tape code RS-358.
- Format n4, g2, x±2.4, y±2.4, i2.4, j2.4, f3.2, s2, m2.
- Program control codes, m00, m01, m02, m06 and m30.
- Parity and data validity check.
- Programmable backlash takeup when in point-to-point mode.
- Applicable g80 series canned cycles.
- R plane programming with third axis option.
- Optional format compatibility with most standard tape formats.


EMERG. STOP
BLOCK DELETE
OPTIONAL STOP
PROGRAM RESET
CYCLE START
FEEDHOLD

MACHINING CENTER CONTROL SYSTEM

Adapt-A-Path Machining Center Control Systems are designed for applications where production requires high feed rates and smooth and accurate continuous path contouring using tool changers and tool compensation. These include applications such as horizontal and vertical spindle machining centers.

Hardware Features

- Two axis contouring control with linear and circular interpolation and third axis positioning.
- Optional simultaneous third axis with or without plane selection (g17, 18 and 19).
- Optional additional linear or rotary axis with closed or open loop positioning or contouring.
- Tool selection with automatic length compensation.
- Optional continuous path cutter radius compensation.
- Standard resolution of .0001 inches or .001 millimeters from optional or customer provided feedback transducers. (Optional 5-digit resolution as required).
- Feed rates limited only by the machine characteristics.
- Incremental jog of 1, 10, 100 and 1000 system increments.
- Feed rate override from 0 to 150%.
- Multiple block buffer which allows independent operation between input and active block.
- Sprocket drive photoelectric tape reader with 7½" reels.
- Auto, single block or manual mode selection.
- Block delete.
- Optional stop.
- High, medium and low jog ranges (scaled by feedrate override).
- Three mode control initialization—GRID SET, ZERO SET and HOME.
- System status display indicators.
- 0 to ±10 volt (10 milliamps) velocity reference output per axis.
- Totally sealed enclosure with double wall heat exchanger.
- Power input 115/230 volts (±10%), single phase, 47 to 63 Hz.
- 32 Relay driver outputs are included in the basic system for driving customer magnetics with expansion in groups of 32. These are rated to drive conventional 28 volt dc relays up to 100 milliamps. These may be used for spindle speed control, tool changer and miscellaneous machine control functions.
- 16 machine status inputs are provided. These accept contact closures from the customer magnetics. Additional inputs may be added in groups of 32.
- Optional D/A spindle speed control. 0 to ±10 volt RPM reference signal.
- Optional A/D input converter for adaptive control of spindle speed and feed rate.
- A complete set of diagnostics to verify the operational integrity of the control hardware.
- Complete parameter display and MDI data entry via optional CRT and keyboard.
- Optional high level A/D inputs for sensing 110 or 220 volt signals from customer equipment.
- Optional part program buffer expandable in 66 foot increments.
- Optional part program editing.
- Optional plug-in communications interface for remote part programming entry.
- Optional punched paper tape output for permanent record.
- Optional high level AC drivers (110/220 volt, 5 amp maximum).

Programming Features

- Absolute or incremental programming (g90, g91).
- Leading or trailing zero suppression.
- Departure range to 99.9999 inches or 999.999 millimeters. (Optional 7-digit departure as required).
- Arc center offset range to 99.9999 inches to 999.999 millimeters.
- Direct IPM programming.
- Tape selectable position preset (g92).
- Automatic format selection. Accepts either EIA tape code RS-244 or ASCII tape code RS-358.
- Format n4, g2, x±2.4, y±2.4, z±2.4, i2.4, j2.4, r2.4, f3.2, s2, t2, m2.
- Program control codes m00, m01, m02, m06 and m30.
- Parity and data validity check.
- Programmable backlash takeup when in point-to-point mode.
- Applicable g80 series canned cycles.
- R plane programming.
- Optional format compatibility with most standard tape formats.

THE COMPANY

Solving the time-wasting precision-robbing problems of production machine control was not something we approached lightly. As a result, more than 25 man-years of concentrated effort were expended in transforming "custom-built" production machine control solutions into our new family of "standard" systems.

Our decision to develop the Adapt-A-Path CNC family resulted from our early experiences in developing custom computer numerical controllers for our industrial users. The design criteria was to use Off-the-Shelf, field proven computer hardware, minimal new hardware packaging, and major new software developments. Among these was the inherent capability of each of the lines to grow in modular fashion from a basic to a complex system with no additional redesign.

Another design goal was the development of totally flexible systems that could be linked together in an on-line hierarchy and operate as a free-standing, self-sustaining system.

This "solutions" approach to the problem of production machine control is typical of the way General Automation has been doing business since its founding in 1967.

In fact, we like to think of GA as the "total solution" company. One who speaks your language. One whose end product is results — not just hardware, software or system elements. And, one whose product is supported with a full range of technological services and offers professional aid for any phase of project analysis or implementation — even full turnkey project responsibility.

This philosophy is what makes GA different from the other computer or control manufacturers. And also the reason why we enjoy an excellent reputation for technical and systems quality among the biggest companies in the industrial marketplace.

Stated simply — at GA, we can solve *your* problems because we understand *you.*

For further information on the Adapt-A-Path CNC family of production machine control systems simply return the attached postage paid reply card or contact a local General Automation representative. They're located in principal cities throughout the world.
Or call (714) 778-4800.

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