



Technology Opportunity

Technology Transfer & Partnership Office

TOP3-00205

Programmable Motion System

Technology

The Programmable Motion System is a combination of hardware and software for remotely controlling motorized devices. The system enables users to control the speed position and other parameters of motion for each axis via preprogrammed profiles that can be adjusted in real time.

Technology Description

The Programmable Motion System is a combination of hardware and software for remotely controlling motorized devices.

It can guide a mechanism's position using several standard commands:

- Move to a specified absolute position
- Move a specified positive or negative increment from the present position
- Find the home position
- Jog (in the positive or negative direction)
- Move according to an external parameter or signal

The user-friendly, versatile Programmable Motion System enables the user to control the speed, position, and other parameters of motion for each axis. The system has three main parts: a programmable logic controller (PLC), a human-machine interface (HMI), and a motor drive subsystem.

The programmable logic controller is used for main control of the system. The human-machine interface is implemented in software on a personal computer. The motor drive subsystem includes motor drive circuits and dc brushless motors. The controller, interface, and motor drive subsystem all operate together to control speeds and positions on the various axes. The system can interact with standard data-acquisition systems and other data and control systems.

Benefits

- Advantages include flexibility, speed, expandability, and compatibility with data-acquisition and control systems
- Minimal communication overhead—Testing at NASA Glenn has shown that data can be taken 30 to 40 percent

faster with the Programmable Motion System than with other commercially available probe motion systems. Minimal communication overhead—the time it takes for the device to move to the selected location—is useful when a device must be moved quickly.

- Electrically clean—The electronic circuitry of the Programmable Motion System does not affect sensitive instrumentation such as pressure transducers and hot-wire probes.
- User-friendly operation—Real-time editing of axis parameters, integrated profile programming, and point-and-click mouse input serve to simplify operation. Troubleshooting is easy.
- Accurate and repeatable motion—The system can accommodate auxiliary positioning devices on the driven ends. While in operation, the system maintains continuous communication with the data-acquisition system used in the initial application. These features are helpful for obtaining accurate and repeatable results.
- Can be customized—Functions specific to a test can be programmed in the field. Due to its modular design, the entire system can be upgraded or expanded, as needed.



Figure 1.—The Programmable Motion System was used to control hotwire probes to characterize the flow through a fan model tested in the NASA Glenn 9- by 15-Foot Low Speed Wind Tunnel.

- Flexible—The system is independent of specific motor-driven circuits or motors, possibly allowing operators to use familiar existing equipment. Although originally developed to control probe actuators, the Programmable Motion System can also be used to control the actions of movable statovanes, laser tables, or other devices that accept velocity control signals from -10 to 10 Vdc.

Potential Commercial Applications

- Aerospace—As designed, for positioning pressure, temperature, and flow angle probes in aerodynamic research facilities. For positioning laser tables for nonintrusive measurement systems
- Automotive technology—To study the aerodynamic performance of vehicles in wind tunnels
- Biomedicine—To adjust parameters in real time for robotic surgery and radiographic imaging

Communications

- Controls—For wireless control of devices
- Energy and power—For remote operation of devices in power plants
- Environmental sciences—For positioning of instrumentation for stack emissions testing and monitoring, or moving probes in hostile environments

Information technology

- Instrumentation—To move sensitive probes, such as hot wires or hot films, since the Programmable Motion System is electrically clean
- Materials—For automated materials testing

Manufacturing

- For automation in many industrial settings—to move valve actuators, robotic assembly devices, and automated tools
- Space—As designed for positioning pressure, temperature, and flow angle probes in space research facilities on Earth and to adjust parameters in real time in space for experiments or space station equipment

Options for Commercialization

NASA has been assigned a patent for this technology and is seeking industrial partners for commercialization. Technical assistance for application of the technology is available from NASA technical and commercialization staff. If your company is interested in licensing this technology, please contact our office.

Contact

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References

Assembly for moving a robotic device along selected axes
 Patent number 6,308,113 (<http://patft.uspto.gov/netacgi/nph-Parser?Sect1=PTO2&Sect2=HITOFF&p=1&u=/netahtml/search-bool.html&r=1&f=G&l=50&co1=AND&d=ptxt&s1=6308113.WKU.&OS=PN/6308113&RS=PN/6308113>)
 U.S. Patent and Trademark Office (<http://www.uspto.gov>)
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 Issue date—October 23, 2001
 NASA Tech Briefs, Programmable Motion System for Positioning Flow Probes
<http://www.nasatech.com/Briefs//Nov99/LEW16690.html>
 Performing NASA Glenn Organizations
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<http://www.grc.nasa.gov/WWW/ETSD/>
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 9- by 15-Foot Low-Speed Wind Tunnel
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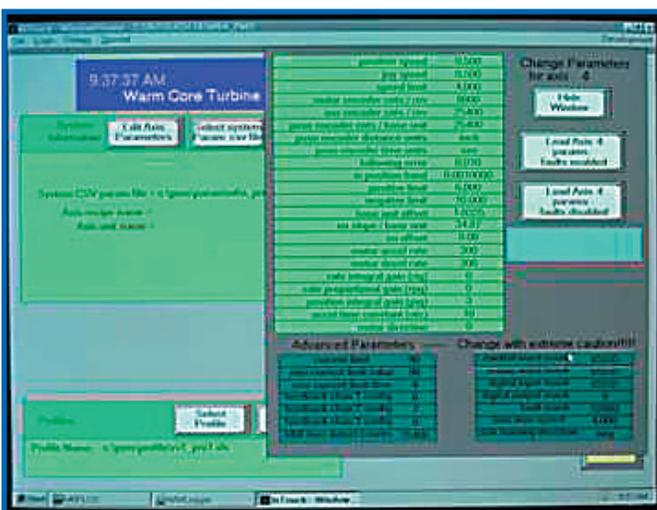


Figure 2.—Programmable Motion System software can be customized by the user for specific applications.