A MODULAR POSITIONER CONTROL SYSTEM

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ABSTRACT

A variety of positioner control systems are available for making antenna and RCS measurements, but few can be upgraded economically as test facilities are expanded. Positioner control system components may include a controller, positioner motor drive unit, and a position indicator. Integration of these functional components into a single modular unit to operate the desired number of axes provides the basis for a positioner control system. Other desired features may include programmability, remotability, operation outdoors, and expansion capability.

This paper will address the development of a modular positioner control system that provides users with a basic system that can economically be upgraded as changing test requirements dictate. Functional capabilities such as remotability, expansion capability, and programmability will be highlighted. System configuration and integration will also be discussed.

1. INTRODUCTION

The Model 4139 Positioner Controller from Scientific-Atlanta integrates the positioner control, indication, and programming functions into a single unit for various positioner applications. The controller can be used for short indoor ranges as well as outdoor far-field ranges where remote operation is required. The basic Model 4139 Positioner Controller consists of an RCU (Remote Control Unit) and a PAU (Power Amplifier Unit). The two units are interfaced via a single serial interface cable.

2. MODES OF OPERATION

The Model 4139 Positioner Controller can be operated in any one of the following modes by front panel pushbutton or programmable operation:

- **Manual** - Positioner Axis, Speed, and Direction are selected and controlled from the front panel in this mode.

- **Position** - Positioner Axis, Speed, Direction, and required position are selected and entered for operation of this mode.

- **Scan** - Parameters are entered for performing a single or multi-scan operation.

- **Configuration** - This mode allows operators to tailor the positioning system to the control unit for various positioner motor and synchro configurations.

- **Diagnostics** - Service and instrument status information is available in this mode of operation.

- **Special Functions** - Other features such as enabling the speed margin calculator for display and setting positioner ring delay are performed in this mode.

3. SYSTEM CONFIGURATIONS

The 4139 RCU can interface to one or two PAU's and operate up to a total of eight axes. A single PAU may be configured for either a four (see figure 1) or eight axis system (see figure 2). Two PAU's are used when remote positioner control is required at either end of a far-field range or when simultaneous operation of two axes are required (see figure 3).

Spherical Near Field Application

![Figure 1: Four Axis Operation with One PAU](image-url)
Positioner motors, limits, tachometers, and synchros are cabled directly to the PAU thus eliminating expensive range cabling. The Model 4133 Local Control Hand-Held Unit also interfaces directly to the 4139 PAU to provide operators with local control of the positioner. A single RS232C/449 interface provides the communication link with the RCU. The link allows up to 4,000 feet separation and can be extended with compatible modems. When operating the PAU in an outdoor environment a weather resistant enclosure is available for protection.

The 4139 PAU also provides a TTL compatible record increment trigger output. This output is provided on the PAU so that a hard-wired interface may be made directly to the PAU when highly accurate record increments are required.

The maximum record increment output latency is 100 microseconds, thus eliminating the group delay associated with the communication link. A record increment trigger output generated from the position data is also available from the Model 4139 RCU.

The 4139 RCU is a microprocessor-based, menu-driven controller that can be operated either manually or automatically. The RCU also provides output of position data in analog and digital format for pattern recording. Automatic operation is performed via the front panel or from an external controller. The CRT of the 4139 RCU assists the operator with data entry and displays the current status of the position control system.

For positioning control systems that require position accuracy better than what synchro transmitters provide, the Model 4139 RCU has the capability to interface to Scientific-Atlanta's standard encoder position indicating system. The Model 1885 Position Indicator System processes the encoder data for output to the 4139 RCU thus providing a highly accurate position control system. For systems with more than one encoded axis, the 4139 RCU can select the desired axis from the Model 1885 to be output.

Another important design improvement over previous programmable control systems is the ability to select two record increment spacing and positioner speeds when performing scans. This capability was added to the controller to improve the efficiency of the antenna testing facility. As an example, when a very narrow-beam antenna is required to be tested over a wide scan angle, widely spaced record increments and a relatively faster positioner speed may be selected for scan angles of least importance. When scanning the sector around the main beam, smaller record increments and a slower positioner speed may be selected. This method of choosing the optimum record increment spacing and positioner speed for antenna measurements provides the user with the most efficient means of operating his positioner control system thus providing the lowest cost operating system.

Scientific-Atlanta's Model 4139 Positioner Controller is an integrated controller, indicator, and programmer capable of efficiently operating the majority of positioning systems with applications. Its modularity and expandability provides a cost-effective approach to antenna range design. The programmable instrument makes it a wise choice for integration into an antenna measurement system.

4. SUMMARY