TECHNICAL NOTE

AN ALTERNATIVE TO THE "PLUG-BOARD" METHOD OF PROGRAMMING AUTOMATED RESEARCH APPARATUS¹

To obtain maximum flexibility in automatic programming apparatus, computer-type plug-board programming units are often employed to make feasible a rapid changeover in experiment. These units have the disadvantage of high cost both in terms of the plug-board receptacle and the plug-boards with associated wiring.

An economical and readily available substitute for the plug-board unit is the multi-connector plug (such as the Cinch-Jones "hinge-connector" or the Amphenol "micro-ribbon" connector), normally employed as a transmitter of inputs and outputs to and from plug-board units. The male half of the multiconnector may be wired to the programming terminal points in the apparatus, as is usually the case in solid-state apparatus, or to the snap-studs in electromechanical programming devices. The female portion of the multi-connector may be wired with jumper connections between its rear terminal points according to the logic of the program that would normally appear on the plug-board. Thus, the female plug becomes the equivalent of the plug-board, while the male plug becomes the equivalent of the plug-board receptacle.

Several plugs may be used to achieve the number of connector points usually found in the standard plug-board unit; the maximum number of points in the commercially available multiconnector is 100 (multiconnector manufacturers may supply plugs with more contacts on special order). Since miniaturization is an attractive feature of the proposed system, it is interesting to note that the multiconnector sacrifices no electrical rating because of reduced size relative to the standard plug-board units (Amphenol micro-ribbon connectors are rated at 700 dcv, 5 amps, while Cinch-Jones plugs are rated at 1300 dcv, 4.5 amps).

A possible disadvantage of the system proposed is that the plugs are not easily modified once the pattern of jumper connections has been fixed (by soldering once the program is satisfactory). The low cost of the multiconnector female component and the comparative ease of wiring make it possible to prepare another plug rather than to correct the existing one. The soldered connections should be protected by one of several commercially available wiring fixatives.

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Fig. 1. Top: Sample program. Bottom: arrangement on standard relay rack.

The present system is in operation, using Grason-Stadler electromechanical components, as illustrated in Fig. 1. Several programs have been constructed using the female Cinch-Jones plug as the plug-board. Wiring time varied from 1 to 2 hr per original program and the number of solder points varied from 30 in the simplest to 60 in the most complex program. Since a total of 12 units was to be supplied with this programming system, copies of programs were readily constructed in "assembly-line" fashion, reducing the time of wiring to considerably less than 1 hr per unit. The schedules programmed to date are fixed ratio, fixed interval, variable interval, differential reinforcement of low rate, Sidman avoidance, alternative, conjunctive, tandem, chained, and interlocking. In addition, a successive discrimination program and a discriminated avoidance program have been completed.

The programs were constructed by using normal snap-lead connectors, temporarily positioned over the

snap-lead terminals on the apparatus components leading to the male Cinch-Jones plug. Once a satisfactory program had been devised, the connector points were translated to a number system and the representative terminals were wired on the female Cinch-Jones plug. A short time was required visually to inspect the program, and once wired appropriately, no failure occurred.

The primary application of this system has been to permit sharing of apparatus in research and teaching usage. It is felt that despite the time involved in permanently soldering the female plug, this system represents a far more economical method of programming research apparatus than the commercial plug-board system.

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