NEW PROSTHETIC CONTROLLER EXPANDS CAPABILITIES

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INTRODUCTION

The new VariGrip™ III Multi-Device Controller from LTI has expanded the capabilities of microprocessor-based prosthetic controllers. Traditionally, one or two prosthetic devices were controlled by two myoelectric input signals. This worked well for some people, but others could not master it and therefore they needed a different control strategy. The VariGrip solves this problem by offering a variety of pre-programmed control strategies. It allows prosthetists to set up systems to control up to four devices for greater versatility. Rather than restricting the user to myoelectrodes, the VariGrip III accepts inputs from myoelectrodes, Touch Pads™, servo transducers or switches to fully utilize the user’s capabilities. The controller is compatible with all manufacturer’s single-motor terminal devices which further expands the options available to the prosthetist.

CONTROL STRATEGIES

The new VariGrip III Multi-Device Prosthetic Controller represents the “next generation” of prosthetic control system for externally powered upper-limb prosthetics. Its versatility allows practitioners to customize the controller to suit each user. Not only can the best control strategy be chosen from the pre-programmed selection, but user-specific adjustments can be made to further adapt the system. This generally simplifies the operation and results in improved functionality. Prosthetists can try more than one control strategy to determine the best one for their patient. Strategies are easily down-loaded to the prosthetic controller for these trials. Once the strategy is found, various adjustments can be made to optimize the system’s performance.

VARIGRIP CIRCUIT

The VariGrip III is considerably smaller than other microprocessor-based prosthetic controllers (Figure 1). At just 1” x 1½” x 3/8” (25½ x 38 x 9½ mm) for the two-device controller, it can easily fit in the forearm of most adult and pediatric prostheses. It is also small enough to pass through the opening in a Bock Quick-Disconnect wrist for easy assembly and service. This size allows prosthetists to build the lamination without unnatural bulges and odd protrusions. It weighs just 14.6 grams, 22% lighter than other controllers and compared to prosthetic components such as batteries at 50 to 70 grams or hands at 500 grams, the weight of the controller is insignificant. If more than two devices are to be controlled, a second circuit can be...
The VariGrip controller connects to a personal computer through an interface unit that provides optical isolation, protecting the patient from potential shock hazards. A proprietary low-profile connector is used at the controller end. A convenient switch, recharge connector and programming plug is offered as an option with LTI built-in batteries (Figure 2). This provides an accessible connection port without compromising the cosmesis of the system. Once a cosmetic glove is installed, these components are hidden.

Figure 2  Programming Plug

The input device(s) chosen depend on the capabilities of the user, and several inputs can be used on a single system. These can also be mixed so that one device is controlled by one input signal and another device by a second. In fact, with this approach, two prosthetic devices can be controlled independently and therefore simultaneously for greater functional efficiency. The system is compatible with most common terminal devices and the current limit for each device is programmed into the software. By selecting the devices to be used in the prosthetic system, the current limit is automatically set to protect these devices and to conserve battery power.

SOFTWARE

The VariGrip III uses software developed by the Bloorview-MacMillan Centre in Canada. This software is also used with the Variety Ability Systems’ Single Programming Module (SPM), so users can easily switch back and forth between these systems. MyoWizard™ and MyoAssistant™ are software packages that enable prosthetists to communicate with the prosthetic controller. Both use convenient graphical user interface screens, enabling the prosthetist to make system adjustments. MyoWizard is used to determine or change the control strategy on an existing system or to load a strategy onto a new system. These strategies are available in a pull-down menu and presently, sixteen control strategies are pre-programmed so the prosthetist can select the optimal control technique for the user. MyoAssistant is designed to “assist” the prosthetist in evaluating the patient, setting parameters such as gains and thresholds and selecting the output devices. In addition, co-contraction thresholds and time windows can be set to match the user’s capabilities. This software will be discussed in a separate presentation.

FUTURE ENHANCEMENTS

The hardware has been designed to allow for expanded capabilities as the software develops further. For example, the hardware is capable of accepting up to five input signals on a single prosthetic system and providing user feedback. Future software enhancements will include single-site control strategies and two-motor terminal devices. For users with only one useful muscle site, single-site control is a useful alternative to the traditional two-site control. Both Centri and Otto Bock offer two-motor terminal devices. Centri’s UltraLite hand for adults and Otto Bock’s 2000 pediatric hands use two motors. These require different strategies however, because one employs two drive motors and the other a drive motor plus a brake motor. As new control strategies and devices are added, they will appear in future releases of the software.