Boston Digital Arm System with iLimb Hand

Boston Digital Arm System:
The Boston Arm is compatible with all manufacturers' terminal devices including those that have internal controllers and those that do not. Now it is also compatible with the **iLimb** hand, thus providing a new option for above-elbow amputees.

iLimb Hand:
The iLimb hand is completely different from traditional electric hands which clamp the thumb against the first two fingers. This hand independently powers the fingers and thumb allowing the hand to grasp objects by conforming to the shape of the object. As a result, the grasp does not require as much gripping force to hold an object securely. Since this hand has five motors, its power requirements are significantly different from traditional electric hands.


iLimb Pulse Hand

With the introduction of the new dexterous hands, battery requirements have changed. Traditional single-motor electric terminal devices require batteries that deliver 7.4 volts and about 1.5 amps. The dexterous hands have multiple motors rather than one and require batteries that deliver 7.4 volts but significantly more current (3-6 amps). When all of the hand motors close/stall simultaneously, the current requirements are quite high and traditional batteries are simply not capable of delivering the current required for the full grasp force. Additionally, running 5 motors results in greater power consumption so these hands require larger capacity batteries. Traditional single-motor terminal devices require batteries with capacities of 450-800 mAHr. But the new dexterous hands require larger capacities, typically 1350-2000 mAHr.


Boston Digital Arm System

New Boston Arm Battery:
Powered elbow systems like the Boston Digital Arm were supplied with 1100 mAHr capacity batteries. These batteries were adequate to operate the elbow and a single-motor powered terminal device for an entire day. The patient charged the system every night and operated for a full day without recharging or replacing the battery. The introduction of dexterous hands has changed this. These 1100 mAHr batteries are no longer adequate to run the elbow and dexterous hand for a full day. So the patient has three options; 1) replace the battery mid-day, 2) recharge the battery mid-day, or 3) add a "supplemental" battery to power the dexterous hand.

LTI Liberating Technologies, Inc.
325 Hopping Brook Road, Suite A, Holliston, MA 01746-1456 Phone 508-893-6363 FAX 508-893-9966
www.liberatingtech.com

The Boston Digital Arm was designed to operate multiple devices simultaneously. With independent inputs, the user can run the elbow and hand simultaneously for greater efficiency and more natural motion. Running more device motors simultaneously increases the load on the battery, requiring more current and greater capacity.

The other issue is battery voltage. Elbow motors like the Boston Digital Arm's deliver more torque for greater lifting capability. These high torque motors are not required for terminal devices. As a result, elbow motors often require higher voltages (11-14 volts) whereas terminal device motors operate at lower voltages (7.2-8.4 volts). To assure optimal performance of the elbow and dexterous hand, several requirements must be met if a single battery is to be used. The battery must produce both 11-14 volts at 10-13 amps for the elbow and 7.2-8.4 volts at 3-6 amps for the hand. This is difficult to do for a single battery unless it has an efficient regulator circuit.

Redesigned Boston Digital Arm:
The Boston Digital Arm was redesigned in 2010 with new high-strength urethane molded forearm and battery covers and the battery was upgraded, eliminating the Ni-CAD technology and replacing this with a new lithium-polymer battery. Lithium-polymer chemistry's high energy density makes it an excellent choice for this application. This new 2000 mAHr battery has twice the capacity of the original battery and yet is 30% lighter. The battery also has an on-board fuel gauge and appropriate safety features to assure safe and reliable operation under normal operating conditions. The light-weight battery reduces the total weight of the Boston Digital Arm to less than 2 pounds, making it the lighter than competitive microcontroller-based powered adult elbows.

Lithium-polymer Battery (BC360)

The new Lithium-polymer battery (BE360) also has an optional Voltage Regulator circuit board (BE361) to reduce the voltage to 7.4 volts (nominal) for the dexterous hands. This efficiently delivers the regulated voltage and adequate current to the hand for optimal performance.

The new Lithium-polymer battery can also be fit to existing Boston Digital Arm Systems, so when the patient's Ni-Cad battery reaches 2-4 years of age, consider this battery for a replacement. Also, if the patient wants an iLimb hand to replace their existing terminal device, consider offering the battery upgrade at the same time to optimize the hand's performance.

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For additional information on the **Boston Digital Arm System** and **iLimb** hand, contact Liberating Technologies, Inc. at **800-437-0024**.

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