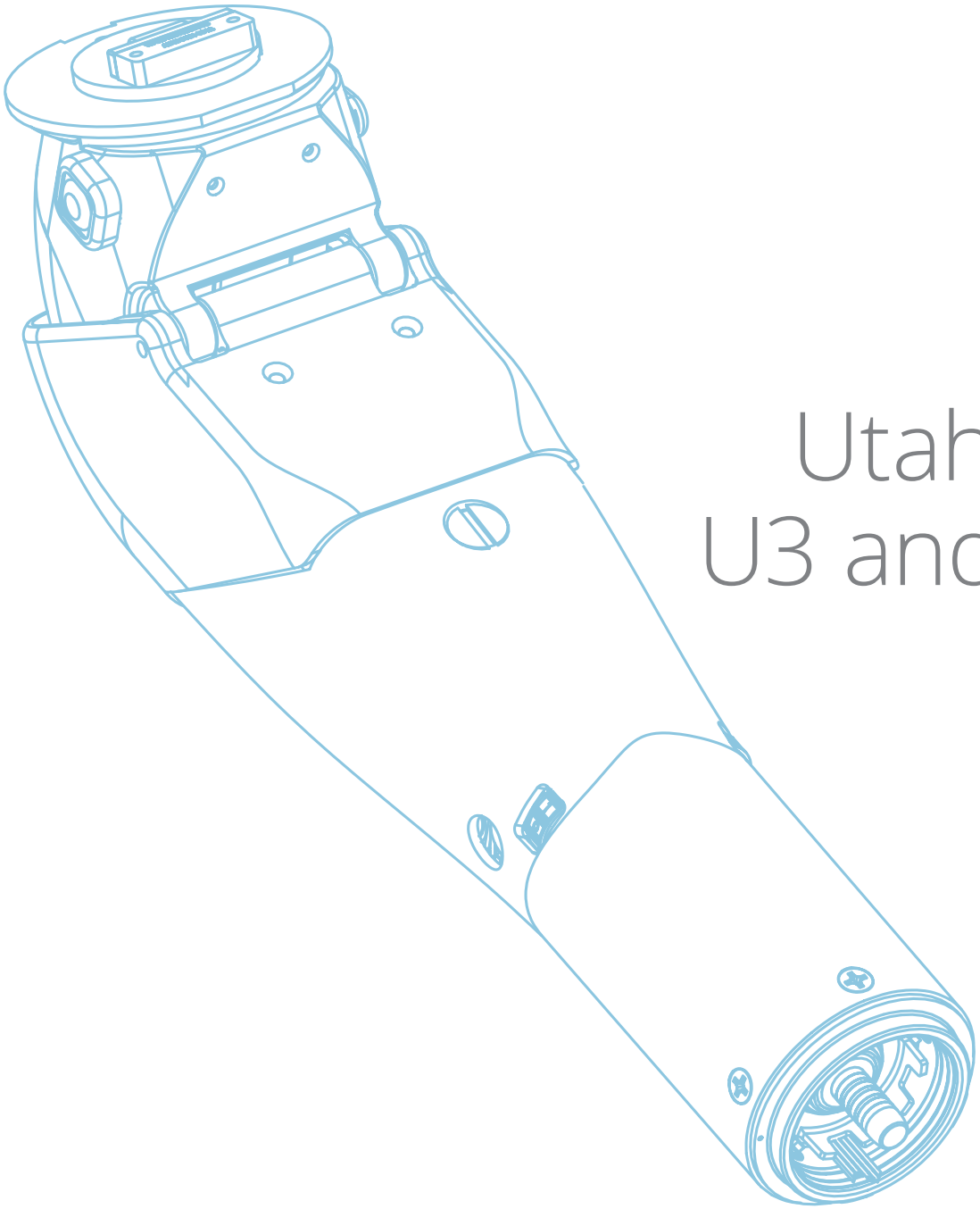


Utah Arm U3 and U3+

User Guide

Fillauer®
Motion Control

Special Precautions

Risk Management

To minimize the risk of device damage or injury to the user while maximizing the functions of this device, follow the instructions for installation, and use this device as described in this manual.

Lithium-Ion (Li-Ion) Batteries

Lithium-Ion Batteries must be installed as described in this manual and charged only using the chargers included with your prosthesis. Do not place any objects in or on the metal contacts of the battery. Failure to follow these instructions could result in malfunction, and damage your battery pack.

Battery Chargers

Use ***only*** the power supply provided with the battery charger. The use of any other power supply could result in malfunction, improper charge, or fire and explosion.

Moisture and Perspiration

The U3 and U3+ elbows are ***not*** water resistant. Care should be taken to not expose the elbow to excessive moisture. On rainy days, a jacket to cover the prosthesis is usually adequate. Perspiration will severely damage the sensitive electronics of the system. Examine your prosthesis periodically. If it appears that perspiration is entering the elbow, see your prosthetist immediately. Perspiration can also cause the electrodes in the socket to “short”. If the prosthesis begins to function poorly and you are perspiring heavily, turn the prosthesis **OFF**, remove it, dry your remnant limb, dry the inside of the socket and put the prosthesis back on. Then turn the power **ON**. Moisture and Perspiration damage is ***not*** covered by warranty.

Dirty and Sandy Environments

Avoid dirty or sandy environments. Do not wear your Utah Arm to the beach. Sand and grit will cause serious damage to your prosthesis. Sand and dirt damage to the prosthesis is ***not*** covered by warranty.

Exchanging Terminal Devices

When exchanging Terminal Devices (TDs) turn the elbow power OFF.

Donning and Doffing

Turn the elbow OFF before doffing (removing) the prosthesis. It could move very unpredictably. This can result in damage to the prosthesis or injury to yourself or others.

Inadvertent Signals and Interference

Inadvertent signals and interference can cause the prosthesis to move in a way you did not expect. Do not use the prosthesis for activities that such interference might cause injury or death to yourself or others. These activities include but are not limited to, use of a chain saw, circular saws and firearms.

Driving

Turn the elbow OFF whenever driving. Inadvertent motion of the elbow could result in an accident, injury, or death to yourself or others.

Solvents and Volatile Substances

Avoid solvents and volatile substances. Solvents may damage the plastic components and/or system electronics. The elbow also contains electric motors that could cause a spark and explosion in the presence of flammable gases.

Disassembly

Do not disassemble any part of the elbow, battery, forearm or socket of the prosthesis. There are no user serviceable components in the system. Disassembly of any part of the prosthesis will void the warranty.

Special Precautions (Continued)

Load Limit

The elbow will support 22 kg (50 lbs) when the elbow is locked. Do not overload the elbow as this could damage the elbow.

Serious Incidents

In the unlikely event a serious incident occurs in relation to the use of the device, users should seek immediate medical help and contact their prosthetist at the earliest possible convenience. Clinicians should contact Motion Control immediately in the event of any device failure.

Technical Specifications

Excursion Range	135° (20° - 155°)
Excursion Time	With Myoelectric Hand TD: 1.2 seconds
Active Lift	1 kg (2.2 lbs)
Load Limit	22 kg (50 lbs) locked
Humeral Rotation	Quick Disconnect Wrist: 360°
Weight (without Terminal Device)	913 gm (2 lbs)
Heat Tolerance	Operating Temperature: 0° - 44° C (32° - 110° F)
	Storage Temperature: -18° - 60° C (0° - 140° F)
Maximum Current	4 amps
Quiescent Current	30 mA
Battery Specifications	Rechargeable Lithium-Ion (Li-Ion), 1150 mAh
	Dual Supply +7.2 v / -7.2 v DC; (total 14.4 v DC)
Forearm Length	(from rearmost point of the forearm to the end of the wrist)
Maximum	32 cm (12¾ in) with forearm extension
Minimum	27 cm (9 in) with short forearm option
Electric Shock Protection	Class III, Type B
Device Life	5 Years

Utah Arm U3 and U3+

User Guide

Introduction

The Utah Artificial Arm was first introduced in 1981, and is now in its third generation with the U3. The U3 is a microprocessor-controlled electric elbow system that controls multiple degrees-of-freedom such as elbow flexion and extension, hand/terminal device, and wrist rotation. It is one of the lightest weight electric elbows available, with unparalleled speed, reliability and function, providing natural-like function for transhumeral or higher levels of amputation.

The U3+ version has two features, Silent Freeswing and a Friction Brake in addition to the features of the U3. Silent Freeswing allows the elbow to swing freely when not in use, and the Friction Brake allows silent locking in any position throughout the range of motion, then the elbow may transition to high-load locking automatically.

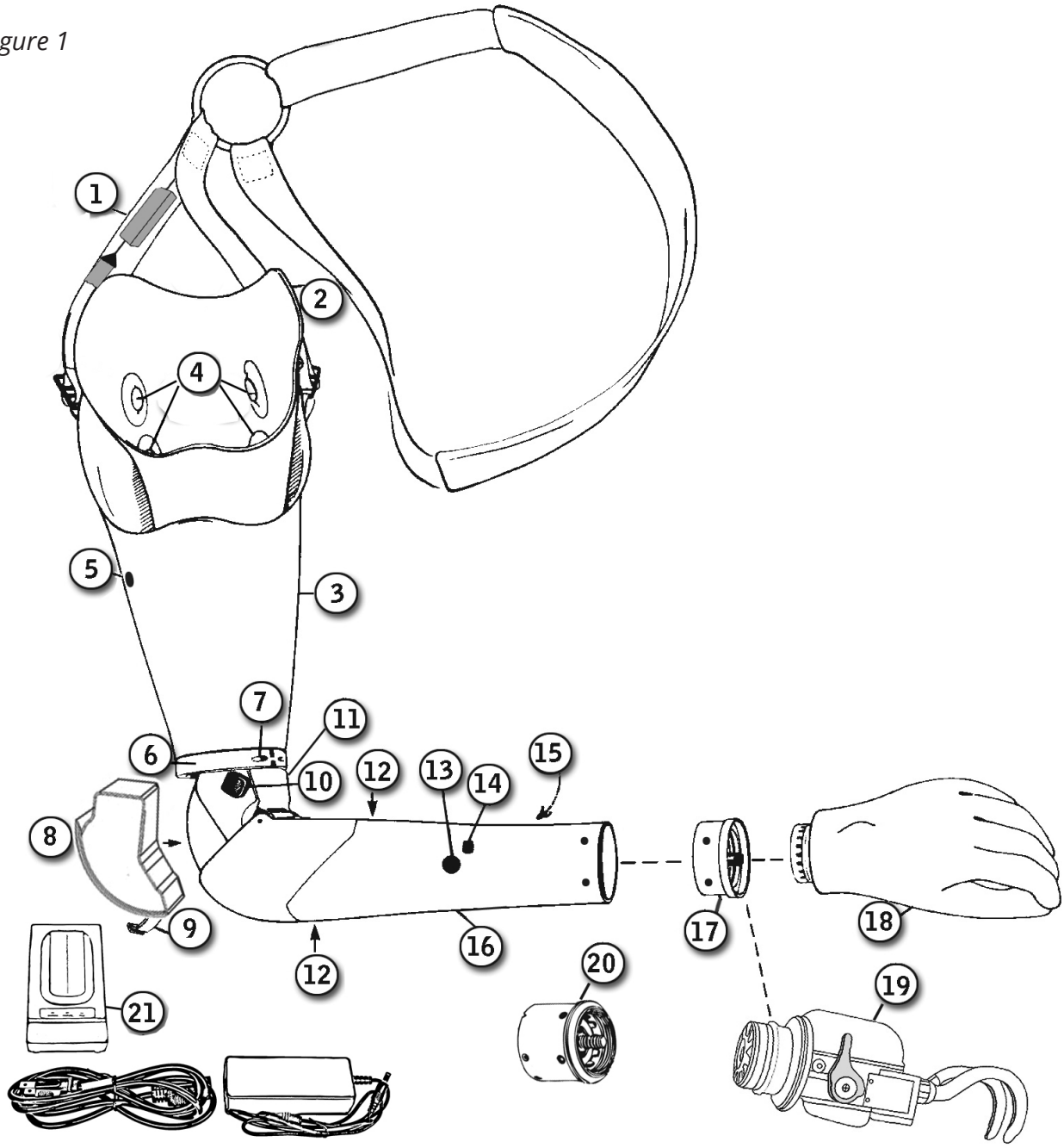
Both the U3 and U3+ incorporate an interchangeable Lithium-Ion (Li-Ion) battery for seamless function throughout the day. A supplemental battery can also be added for hands and terminal devices (TDs) with high current draw.

This guide will provide an overview of the warnings, functions and limitations of the Utah Arm U3 and U3+. Please read this guide to familiarize yourself with the functions of your elbow. Your prosthetist has been specially trained by Motion Control for the fitting, function and operation of the Utah Arm. They can provide any further information regarding your prosthesis.

Utah Arm U3+ Package (Tan)

Components

Figure 1



1. Harness with optional linear potentiometer (provided by your prosthetist), pg. 6
2. Inner Socket (provided by your prosthetist), pg. 6
3. Outer Socket (provided by your prosthetist), pg. 6
4. EMG Electrodes/preamps, pg. 10
5. Supplemental battery charging port (optional), pg. 8
6. Humeral Friction Band, pg. 6
7. Humeral Friction Band Screw, pg. 6
8. Lithium-Ion (Li-Ion) Battery (5 included), pg. 7
9. Battery Door Lock, pg. 7
10. Lock/Unlock Button, pg. 8
11. Data Port (on left side), pg. 8
12. Forearm Screws (top and bottom), pg. 8
13. On/Off Switch, pg. 9
14. Forearm Gain (previous models), pg. 9
15. Removed
16. Forearm Cover, pg. 8
17. Lamination Collar
18. Hand Terminal Device (purchased separately)
19. Electric Terminal Device [ETD] (purchased separately)
20. Electric Wrist Rotator (optional; located in forearm), pg. 9
21. Battery Charger (2 included), pg. 7

U3/U3+ Components

Harness

The harness for the prosthesis *(Figure 1)* is provided and fitted by your prosthetist, and may provide two functions. The harness suspends the prosthesis and keeps it in place. In some cases, a control cable may be used in conjunction with a linear potentiometer or force sensor for prosthesis function *(Figure 2).* The harness should be as comfortable as possible. Examine the harness periodically for tears, worn areas, or anything that could result in harness failure, thus causing the arm to fall and be damaged. Any adjustments or repairs should be provided by your prosthetist.

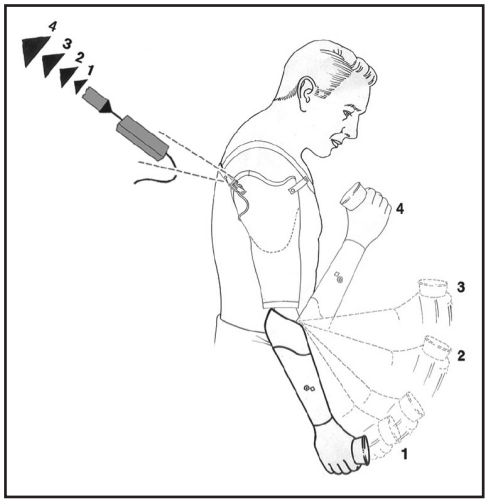


Figure 2 – How a linear potentiometer functions

Socket

The prosthetic socket *(Figure 1)* is also provided by your prosthetist. It provides a comfortable interface between you and the prosthesis. It should also be designed in a way to maximize function and comfort when using the prosthesis. The socket may also contain electrodes to pick up muscle signals that control the prosthesis. This requires a very intimate fit. If the socket no longer fits well, it will likely result in poor performance of the prosthesis. Visit your prosthetist to adjust your socket to maintain an intimate fit.

Humeral Friction Band

The humeral friction band *(Figure 3)* is the connection between the prosthetic socket and the elbow. There is a small 7/64 inch hex screw that can be tightened or loosened to determine the ease or difficulty of rotating the elbow. This friction band may wear and require adjustment. Replacement may be performed by your prosthetist, if it is worn.

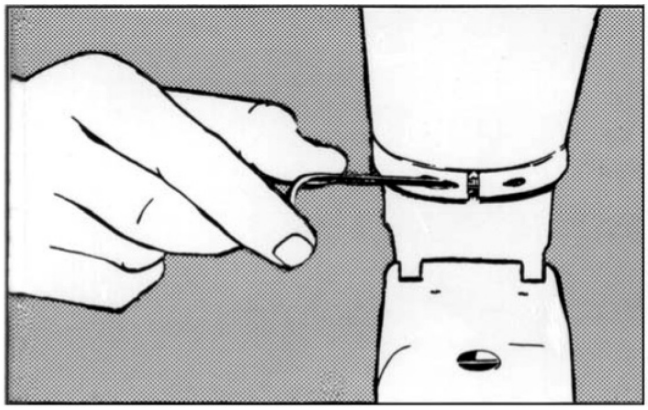


Figure 3

Elbow

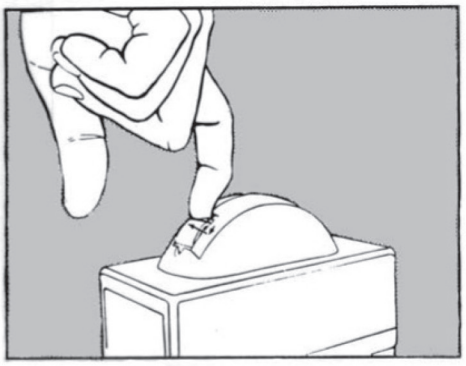
The U3 and U3+ elbows contain two microprocessors, electronics, electric motors, and transmission to not only flex and extend the elbow, but also control the hand, and/or electric wrist rotator optimally.

Lithium-Ion (Li-Ion) Batteries
Lithium-Ion Batteries must be installed as described in this manual and charged only using the chargers included with your prosthesis. Do not place any objects in or on the metal contacts of the battery. Failure to follow these instructions could result in malfunction, and damage your battery pack.

Battery

Each battery pack (5 included with the U3 and U3+) provides all the energy to operate the elbow, terminal device and electric wrist rotator (if included). This battery is interchangeable and rechargeable. The elbow must be fully-flexed to exchange a discharged battery with a fully-charged one. Li-Ion batteries will not develop memory, so it is ***not*** necessary to fully-discharge the battery. Battery life varies greatly, and depends upon usage, and the type of hand and wrist.

Figure 3a



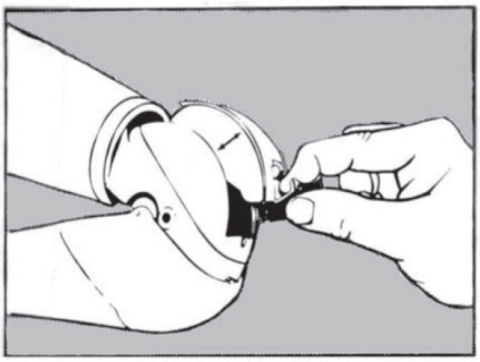


Figure 3b

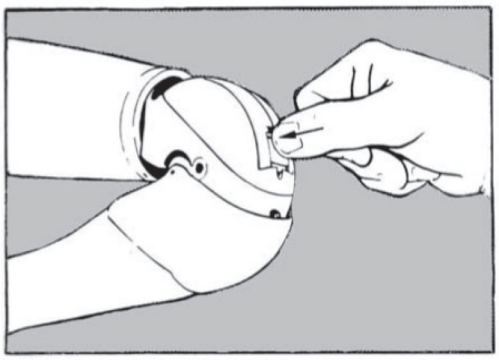


Figure 3c

Open the battery door with the finger and thumb of one hand *(Figure 3a).* Slide the rectangular portion of the battery directly into the elbow cap in the back of the elbow *(Figure 3b).* Once the battery is flush with the elbow cap, gently push the battery door down until a "click" is heard *(Figure 3c).*
Ensure the battery is flush with the elbow cap, and you may now turn on the elbow. With practice, this can be easily accomplished with one hand, or even with another prosthesis if necessary.

Battery Charger

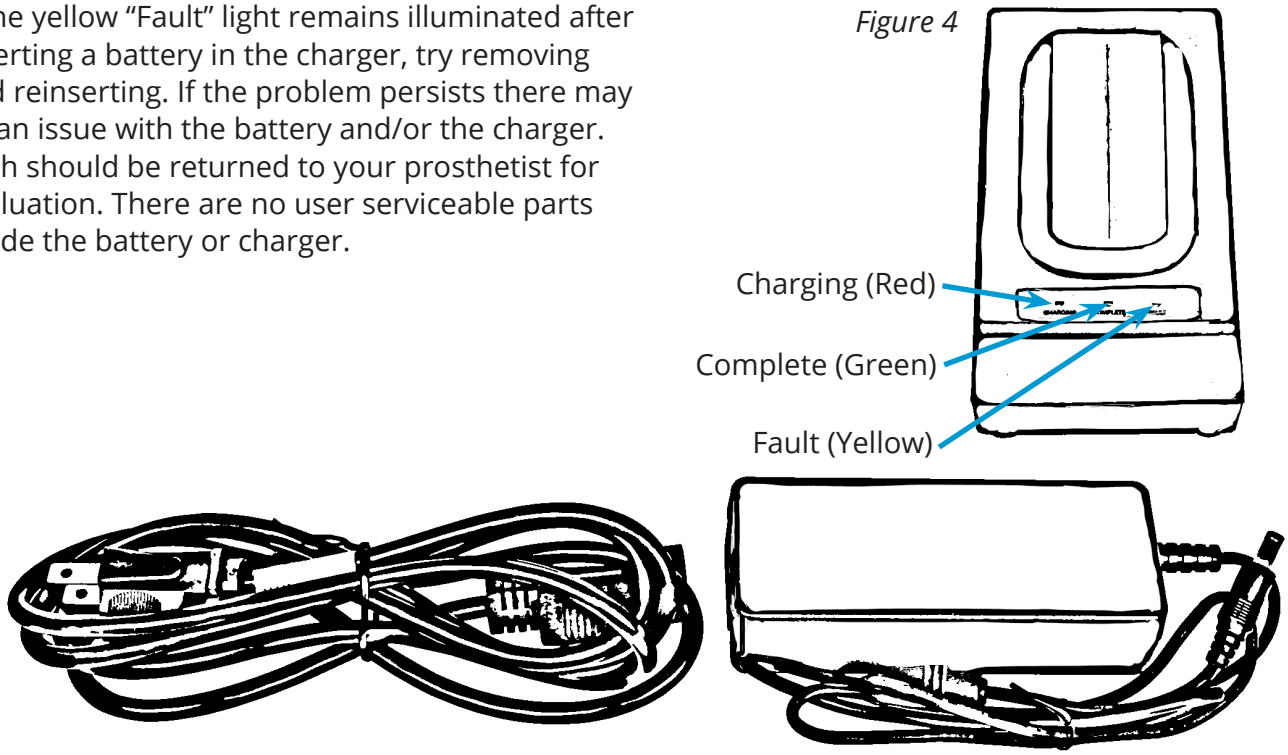
Battery Chargers
Use ***only*** the power supply provided with the battery charger. The use of any other power supply could result in malfunction, improper charge, or fire and explosion.

The battery charger can be plugged into the wall and remain plugged in. The yellow "Fault" light will be illuminated if a battery is not in the charger.

The top of the battery charger has the same shape as the elbow of the U3 or U3+. The battery pack installs in the same way. Once you slide the battery into the charger and snap the door in place, the yellow "Fault" light should change to the red "Charging" light. When the light changes from red to the green "Complete" light, it is fully-charged and ready for use *(Figure 4).*

If the yellow “Fault” light remains illuminated after inserting a battery in the charger, try removing and reinserting. If the problem persists there may be an issue with the battery and/or the charger. Both should be returned to your prosthetist for evaluation. There are no user serviceable parts inside the battery or charger.

Figure 4



Supplemental Battery

Systems with multi-digit hands, such as Taska®, i-limb™ or bebionic™, will likely require a supplemental battery built into the socket portion of the prosthesis. This battery will have its own charger provided by your prosthetist. Follow the instructions provided with this battery system.

The supplemental battery should be charged every night. If this battery should deplete, power to the hand will switch automatically to the elbow battery. This happens seamlessly. If both the supplemental battery and the elbow battery become discharged, it could be very difficult to replace the Utah Arm battery while using your prosthesis. You will need to charge both batteries (see “Dead Battery Situations” on page 11).

Lock/Unlock Button

Pushing this button will change the state of the elbow lock, when power is ON. With the U3, if the elbow is locked, it will unlock and vice versa. With the U3+, the Lock/Unlock button will cycle through three states: Unlock / Friction Brake / Pin Lock, then back to Unlock *(Figure 5).*

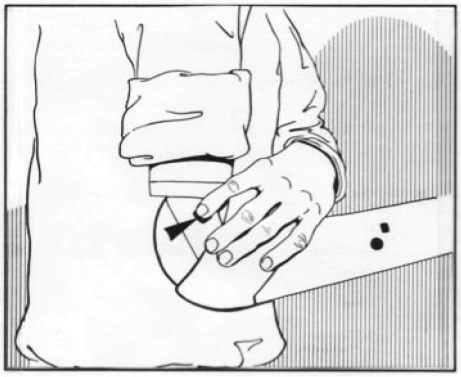


Figure 5

Data Port

Your prosthetist uses this port to attach your elbow to a computer to make adjustments.

Forearm Screws

The forearm screws hold the forearm cover onto the structural portion of the elbow. These may loosen over time. They are easily tightened using a coin.

ON/OFF switch

The ON/OFF switch is a slide switch located in the center of the forearm. As you are wearing the arm, pressing on the left side of the arm pushing the switch toward the right side turns the arm ON. Pushing in the opposite directions, turns the arm OFF *(Figure 6).* When the arm first powers up, you will hear and feel a “whir” of the elbow unlock motor, and you will likely hear two beeps as the electronics “boot up” (these beeps can be disabled by your prosthetist). If the elbow was locked, when it turns on the elbow will always be unlocked.

Figure 6

Forearm gain adjustments

NOTE: The forearm gain window was removed in 2024 from all models of the arm and adjustments aren't necessary. For earlier models gain adjustments ***only*** affect the elbow function. Turning the gain higher will make the arm flex more easily. Gains seldom require adjustment. We recommend it be set to 7 and left alone. The dial can also get accidently bumped. If the elbow seems to not be functioning correctly, check to make sure these have not been inadvertently moved. Covering the window is an option.

Electric Wrist Rotator (Optional)

An electric wrist rotator may be installed inside your forearm. Your prosthetist will explain the function and control of your electric wrist.

Quick Disconnect Wrist

The U3 and U3+ arms have a quick disconnect wrist that is common with almost all manufacturers’ terminal devices. Follow your prosthetist’s instructions regarding use of the quick disconnect wrist.

Terminal Device

Exchanging Terminal Devices
When exchanging Terminal Devices (TDs) turn the elbow power OFF.

The Hand or Terminal Device is purchased separately. Each brand of hand or hook has instructions. Follow the instructions provided with the Terminal Device.

Donning your U3 or U3+

Donning and Doffing
Turn the elbow OFF before doffing (removing) the prosthesis. It could move very unpredictably. This can result in damage to the prosthesis or injury to yourself or others.

When putting on your Utah Arm, make sure the power switch is in the OFF position. Put on the arm in the manner your prosthetist and occupational therapist instructed. Once it is on and the harness is securely in place, you may now slide the power switch to the ON position. You will hear the “whir” of the unlock motor, then two beeps. These beeps can be disabled by your prosthetist.

Doffing your U3 or U3+

Before removing a **U3** elbow, make sure the elbow is in the ***unlocked*** position, switch the elbow OFF, and remove the prosthesis.

Before removing a **U3+** elbow, you will find it more convenient to extend the elbow, enabling Silent Freeswing. Then turn the elbow OFF and remove the prosthesis.

Control of your Prosthesis

EMG Control

The elbow may be flexed (raised) or extended (lowered) in response to a contraction of the muscles that control the arm, usually the biceps and triceps. The elbow will rise to 150° above vertical. The harder the muscle contracts, the faster the arm moves. If you learn to control your muscle inputs well, the arm is capable of both very smooth, steady motions and very quick motions *(Figure 7).*

Harness-Mounted Input

If harness-mounted inputs are used, the pressure you exert on the sensor determines the speed of the arm. By relaxing the pressure on the sensor, the elbow will drop (extend) – the lower your pressure on the sensor, the faster the elbow drops.

Silent Freeswing[1]

When you relax the input(s) to the elbow completely, it will swing freely. This freeswing feature allows the arm to look and feel more natural. For instance, it will swing by your side while you walk. Also, you can lower the elbow quickly, without any muscle effort. The motor produces this freeswing, however, so it uses up some of the battery charge.

[1]Silent Freeswing feature for U3+ wearers only. The elbow drive disconnects when the elbow reaches full extension with a bump. To reconnect, simply use the motor to raise the elbow and the elbow drive will auto reconnect.

The battery charge will last longer if you turn the arm OFF at times when you don't care to have the freeswing function.

Automatic Lock

The Lock is activated automatically using the arm motor, when the elbow is held motionless. Use a steady input signal to hold the arm still, and it will lock. The lock time is set by the prosthetist. If the elbow is hanging freely, or the weight of the forearm is supported, e.g., on a table or on your knee, the lock will not activate.

Automatic Unlock

The elbow is unlocked by the rapid contraction of the control input(s), followed by rapid relaxation. Strong efforts are not necessary, the quickness of the input signal is what triggers the unlock. The lock will not actually disengage until the weight of the arm is lifted off the lock mechanism, by raising the arm up, or pushing it up slightly.

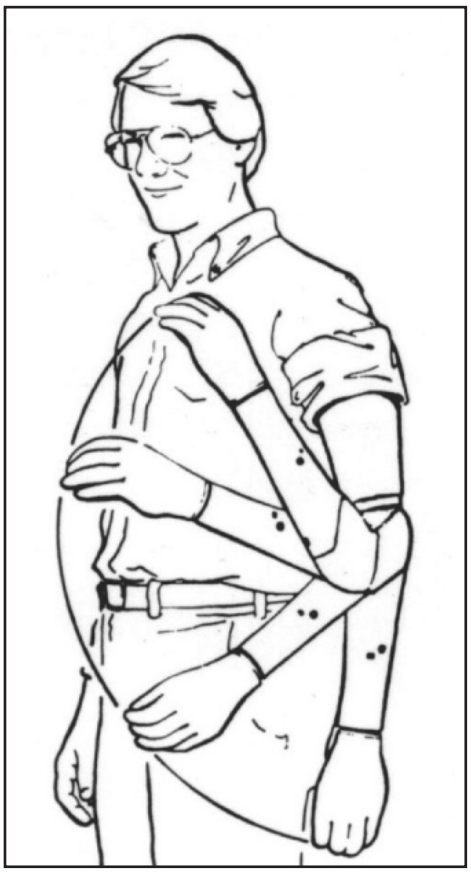


Figure 7 – Myoelectric Elbow Control; contract your "up" muscle to raise. Relax both muscles to lower with "Silent Freeswing"

The microprocessors in the Utah Arm allow use of several different control inputs and control schemes. These are programed through the User Interface. Your prosthetist has been trained to do this and will make those settings in your system. They will also instruct you how to operate the arm. Occupational therapy will provide training to ensure you are as functional as possible with your prosthesis.

You and your prosthetist should complete the following chart on what body action you perform for each prosthesis motion. It is a good idea to use a pencil as these functions may change as your control improves.

Prosthesis Function (Arm Motion)	Body Action
Elbow Flexion	
Elbow Extension	
Elbow Lock	
Elbow Unlock	
Wrist Rotation (if available) – Palm Up	
Wrist Rotation (if available) – Palm Down	
Hand/Terminal Device – Open	
Hand/Terminal Device – Close	
Other Features	

Troubleshooting

Dead Battery Situations

To change the battery in a Utah Arm, the elbow must be completely flexed. A scenario can occur where the elbow is extended and the battery is discharged, thus not being able to replace it with a fully-charged battery. Following the above directions for donning and doffing the prosthesis will minimize this possibility, but with newer multi-articulating hands (e.g., aska®, i-limb™ or bebionic™) the battery can discharge unexpectedly. Always starting the day with a fully-charged Utah Arm battery, and a fully-charged supplemental battery (if you have one) will minimize this problem.

If the battery cannot be reached to remove it, and it is discharged, turn the power to the OFF position. Allow the prosthesis to sit for at least 3 hours, preferably overnight. Turn the power switch ON, and listen for the unlock motor “whir” and double beep. If this happens, immediately flex the elbow completely, and turn the switch to the OFF position. You can now replace the battery with a fully-charged battery. If this is not possible, return to your prosthetist to remedy the issue.

See the YouTube video “Patient Guide to Utah Arm Battery Care” at https://youtu.be/ujG5iI_ZuxM for more information.

Elbow functions fine but Terminal Device (hand) does not function

All hands and terminal devices have their own ON/OFF switch. Check to make sure the TD is turned ON.

Gently pull on the terminal device in case it’s accidentally disconnected. Make sure the terminal device is securely engaged in the wrist.

Hand functions fine but Elbow will not function (or only flexes partially)

Check elbow forearm gains to make sure they have not been moved.

Neither the Elbow nor the Hand function (no whir or beeps from the system)

Replace the battery with a fully-charged battery (as indicated by the green “Complete” light on the charger). If you are unable to access the battery, follow the instructions for “Dead Battery Situations” above.

Also check the forearm gains to ensure they have not been changed.

Elbow and Hand function sluggishly

If you are using EMG signals for control, immediately after doffing the prosthesis, check the skin of your remnant limb for red marks where the electrodes are placed in the socket. If there are not distinct red marks corresponding to each electrode, this will result in poor function of the prosthesis. See your prosthetist for adjustments to your socket.

General Considerations

Your Prosthetist

Your prosthetist has received specialized training provided by Motion Control. Motion Control requires this training before being allowed to fit U3 or U3+ elbows. They can provide service and troubleshooting for issues greater than the ones above. If you have problems with your system, your prosthetist will be able to help. It is also important you visit your prosthetist periodically (at least once a year) to preemptively remedy any problems that may arise. There may be times when the system must be returned to Motion Control for repairs. Loaner systems are available on a limited basis. Your prosthetist should contact Motion Control for availability.

Avoid extreme temperatures

Motion Control products are tested in normal temperatures (0° - 44° C / 32° - 110° F). Avoid extremes above and below these temperatures. This includes leaving the prosthesis in a hot car or trunk. It could also include wearing the prosthesis in hot sunny conditions with extreme temperature such as in the southwest United States.

Dyes

Some clothing and other materials have dyes that can stain the plastic components of the arm and cosmetic gloves. These include blue jeans and newsprint. Be aware that these can permanently stain the plastic components.

Cleaning your Prosthesis

The inside of your socket should be cleaned at least once a week. A cloth dampened with rubbing alcohol is usually adequate.

The outside of the prosthesis and elbow can be cleaned with glass cleaner. Dampen a cloth with glass cleaner or other mild cleaner, and wipe the surfaces.

Do not spray cleaners directly onto the prosthesis. Use care that the cleaning liquid does not enter the prosthesis.

Forearm Screws

These screws may loosen over time. Periodically check to make sure these are still tight.

Single Patient Use

Each amputee is unique. The shape of their residual limb, the control signals each generates and the tasks an amputee performs during the day require specialized design and adjustment of the prosthesis. Motion Control products are manufactured to be fit to one individual.

Disposal/Waste Handling

This device, including any associated electronics and batteries should be disposed of in accordance with applicable local laws and regulations. This includes laws and regulations regarding bacterial or infectious agents, if necessary.

Limited Warranty

Seller warrants to Buyer that the equipment delivered hereunder will be free from defects in materials and manufacturing workmanship, that it will be of the kind and quality described and that it will perform as specified in Seller's written quotation. The limited warranties shall apply only to failures to meet said warranties that appear within the effective period of this Agreement. The effective period shall be two years years (24 months) from the date of delivery to the fitting center that has purchased the components. Refer to the shipping receipt for the date of shipment.

IT Hardware and IT Security

Hardware requirements are a personal computer with Windows 3.1 or later. IT Security is accomplished by using a proprietary hardware interface that is only available from the manufacturer, or through Bluetooth communication using a unique pairing key.

Return Policy

Returns are accepted for a full refund up to 90 days from date of shipment as long as the item is in resalable condition. Beyond 90 days, returns are not accepted.

Declaration of Conformity

The product herewith complies with Medical Device Regulation 2017/745 and is registered with the United States Food and Drug Administration. (Registration No. 1723997)

Safety Warning

Bluetooth 2.0 and 4.0 devices like the Motion Arm emit low levels of nonionizing radiation. Exposure to low amounts of this type of radiation is not harmful to humans.

RoHS COMPLIANT CE Bluetooth®

Home Training Program for PNF Exercises

Proprioceptive Neuromuscular Facilitation (PNF) is a strengthening exercise. We recommend this and/or other exercises to be part of a conditioning program under the direction of a qualified Physical or Occupational Therapist. Also refer to Motion Control's video course, "Training the Client with an Electric Arm Prosthesis".

Your prosthetist or a therapist can instruct you in this exercise program. It takes about 10 minutes and will help you improve the strength and control of the muscles in your remnant limb. This will improve your control of a prosthesis and possibly diminish phantom limb pain.

Note: All exercises are to be done while lying comfortably in a relaxed state of mind. You should concentrate on imagining that your amputated arm is still there (especially the thumb) if you do experience a phantom sensation.

The instructions as written are for unilateral amputees. For bilateral amputees, replace the "uninvolved arm" wording with "one amputated arm."

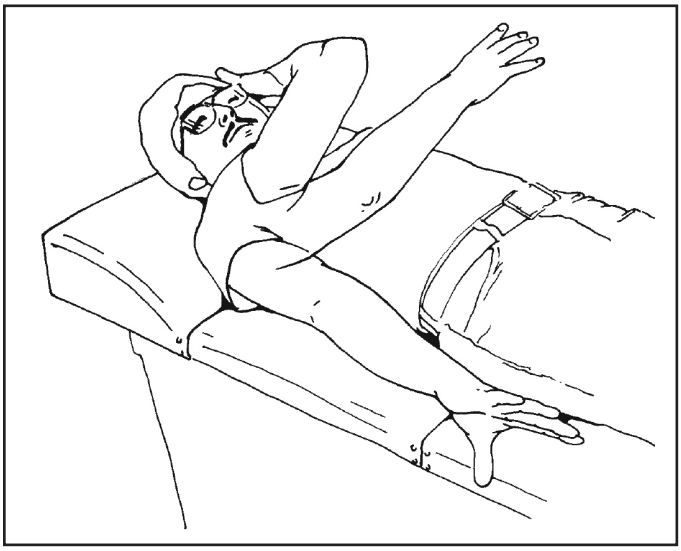
Biceps

Step 1

Begin by lying down on your back. Close your eyes and concentrate on breathing slowly and rhythmically. Try to relax.

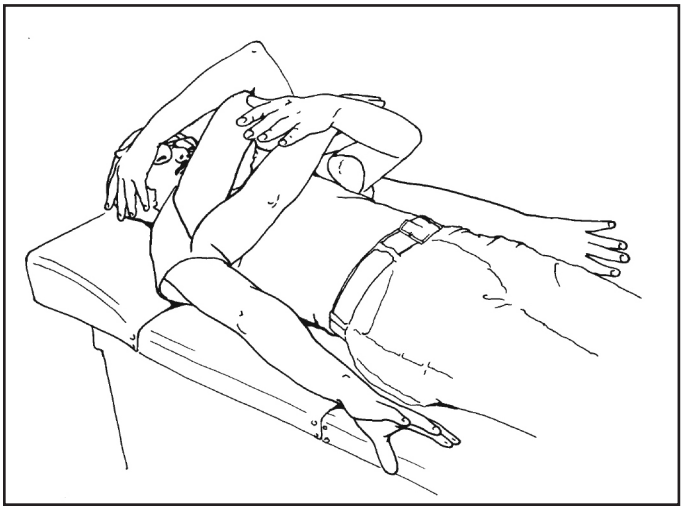
Step 2

Next, practice flexing the biceps muscles (flexion pattern). Begin by moving your uninvolved arm through the full pattern. With your arm at your side and the palm rotated up and the thumb out, pull your arm up and across your nose, bending the elbow and turning the arm so that your thumb is now up. Repeat several times concentrating on the movement.



Step 3

Now move both arms together through the biceps pattern. Imagine the movement of the amputated elbow and thumb. Repeat several times concentrating on the movement.



Step 4

Next, move your amputated arm through the pattern while you push against its movement with the uninvolved hand over the biceps muscle. Repeat several times and again concentrate on imagining the movement of the missing elbow and thumb.

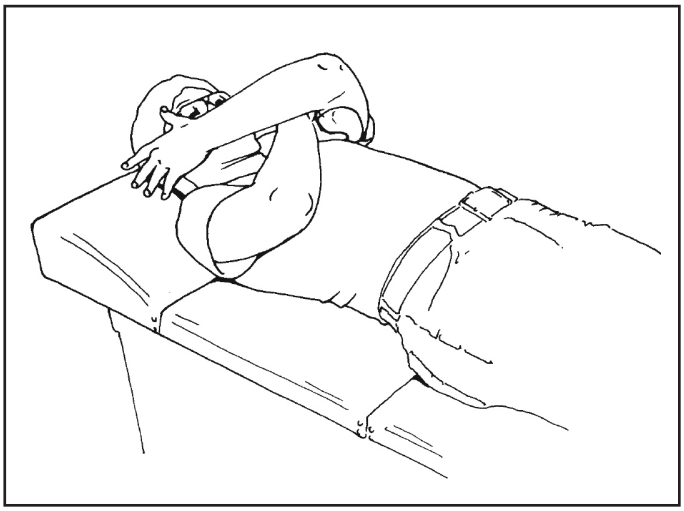
Step 5

Now practice the biceps pattern with your amputated arm and concentrate on not moving your shoulder. Start with your shoulder and arm relaxed at your side and your hand over the biceps muscle. Without moving the shoulder, contract the biceps while imagining the elbow bending and the palm turning up. Feel the contraction with your hand. Relax completely. Repeat 10 times then rest. Repeat Step 5 a total of 3 times.

Triceps

Step 1

Begin by moving your uninvolved arm through the full pattern. With your arm across and in front of your face with the elbow bent and the thumb up, push your arm down and to the side, straightening the elbow and turning your arm so your thumb is out. Repeat several times concentrating on the movement.



Step 2

Next, move both arms together through the triceps pattern. Imagine the movement of the amputated elbow and thumb. Repeat several times, concentrating on the movement.

Step 3

Now move your amputated arm through the pattern while resisting the movement with your hand over the triceps. Repeat several times, and again concentrate on imagining the movement of the elbow and thumb.

Step 4

Next, practice the triceps pattern without moving your shoulder. Start with the shoulder and arm relaxed at your side, and your hand over your triceps muscle. Imagine the elbow straightening and the palm turning down. Feel the contraction with your hand. Relax completely. Repeat 10 times then rest. Repeat Step 4 a total of 3 times.

Co-contraction Exercise

Lastly, practice co-contraction. Place your hand around the amputated arm so you can feel both the triceps and biceps muscles. Quickly contract both muscles at the same time, immediately relax, then contract the biceps only. Repeat 10 times.

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