# ARTUS – Instructions for Use

| | |
|---|---|
| Company Name: | Digity GmbH |
| Company Address: | Karl-Grüneklee-Str. 22,<br>DE-37077, Göttingen,<br>Germany |
| Product Name: | ARTUS Passive Exoskeleton |
| Product Version: | 2.1 |
| Product Certificate: | CE |
| Document number: | CE-0503-01-EN |

**Figure 1.** Hand equipped with one ARTUS for the thumb and one for the index finger

## Purpose

The exoskeleton described herein as "ARTUS" is Personal Protective Equipment (hereinafter referred to as "PPE") within the meaning of the "PPE Regulation" (EU Regulation 2016/425).

The sole purpose of PPE is to protect against minor risks such as superficial mechanical injuries and ergonomic stresses. The PPE therefore falls into Category I as defined in Annex I of the PPE Regulation.

## Intended use

The exoskeleton is intended to be worn on the fingers (possibly over a protective glove). It is intended to provide preventive support for activities that may result in injury or overuse of the hands and fingers.

It can protect against the following injuries and strains:

- Injuries caused by overstretching fingers

Copyright © Digity GmbH

- Non-ergonomic strain due to repetitive activities (repeated pressing with the fingertips)
- Cuts or abrasions caused by superficial contact with sharp or rough surfaces
- Minor crushing and impact to fingers

Any use other than that described above is considered improper use. The operator bears the full risk.

## Foreseeable misuse

The following are misuse (and are therefore prohibited):

- The use of PPE to protect against injuries and stresses other than those for which it is intended,
- Improper use as cut protection,
- Use of the exoskeleton on fingers with long and/or artificial nails,
- Use in potentially explosive atmospheres,
- use for work where there is a risk of the exoskeleton being loaded with more than 50 N in the direction of pressure,
- Use for work on electrical equipment,
- Use by users with limited finger and upper limb mobility,
- Use by users who have not been instructed in its use.

In addition, non-compliance with EU regulations, occupational health and safety, safety and disposal regulations and improper or unsafe working practices are also considered to be improper use.

The manufacturer cannot be held responsible for catastrophes caused by foreign objects or *force majeure*.

## Limits of use

The PPE is suitable for

- Indoors and outdoors,
- in damp environments with humidity up to 95% with no condensation,
- in environments with a temperature between -10 ... +45°C.

Use outside these limits is considered improper use.

## Operator's obligations

The user must carry out a risk assessment for the workplace or activity/activities in which the exoskeleton is to be used. They must assess the suitability of the PPE as a protective measure for the application.

When determining the protective measures, they must follow the hierarchy of measures. This means that appropriate technical or organizational measures must be considered before personal measures (such as wearing PPE) are used.

Copyright © Digity GmbH

## Declaration of Conformity

The product is a "Category 1" PPE according to the "PPE Regulation" (EU Regulation 2016/425). This product is subject to the conformity assessment procedure according to Annex IV of the Regulation: Module A (internal production control).

The full Declaration of Conformity can be found at the following link:

https://www.3digity.com/public/docs/ARTUS/ARTUS_conformity.pdf

## Description

The PPE is available in two basic versions, the exoskeleton for the long fingers (index to little finger) as shown on Figure 2-Right, and the exoskeleton for the thumb, as shown on Figure 2-Left.

The exoskeletons feature the "DigiLock" joints, which connect the individual segments and that has an integrated locking mechanism. This ensures that the fingers remain free to move within the natural range of motion but get blocked when reaching a non-ergonomic overstretching angle.

The exoskeleton also features "DigiSkin", an exchangeable fingertip tool element that allows the user to have application-specific tools, balancing protection and sensitivity in their desired ratio.

The exoskeleton variant for the thumb includes also a "Wrist band" with a connector that couples to a "Wrist link", that connects then to the exoskeleton proximal segment. This ensures a secure fit of the exoskeleton while maintaining free movements.

**Figure 2.** The two versions of the ARTUS Finger Exoskeleton.
**Left**: the ARTUS version for the thumb. **Right**: The ARTUS version for long fingers (Index to Little).

## Storage

To ensure protection from the exoskeleton, ensure that the exoskeleton and DigiSkin are stored away from direct sunlight, at a moderate room temperature and not in excessively humid conditions (max. 95% humidity).

Copyright © Digity GmbH

## Unboxing of the Exoskeleton

The ARTUS Exoskeleton is either delivered in a box that contains two packages, or directly as two individual packages. One package (*ARTUS Passive Exoskeleton*) contains the rigid structure of the device and, for thumb exoskeletons, the wrist band and the connector between the device and the wrist band. A second package (*DigiSkin Set*) contains several fingertip tools, i.e., DigiSkins.

The DigiSkin element is to be assembled to the exoskeleton, as depicted in the graphics inside the packages and in Figure 3-Top Sequence. **The ARTUS Exoskeleton shall not be used without DigiSkin element attached to it.**

For thumb exoskeletons (AT variant), the wrist link and wrist connector shall be assembled too. The steps are depicted in Figure 3-Bottom Sequence. **The AT exoskeletons shall not be used without the wrist link and bands attached to them.**

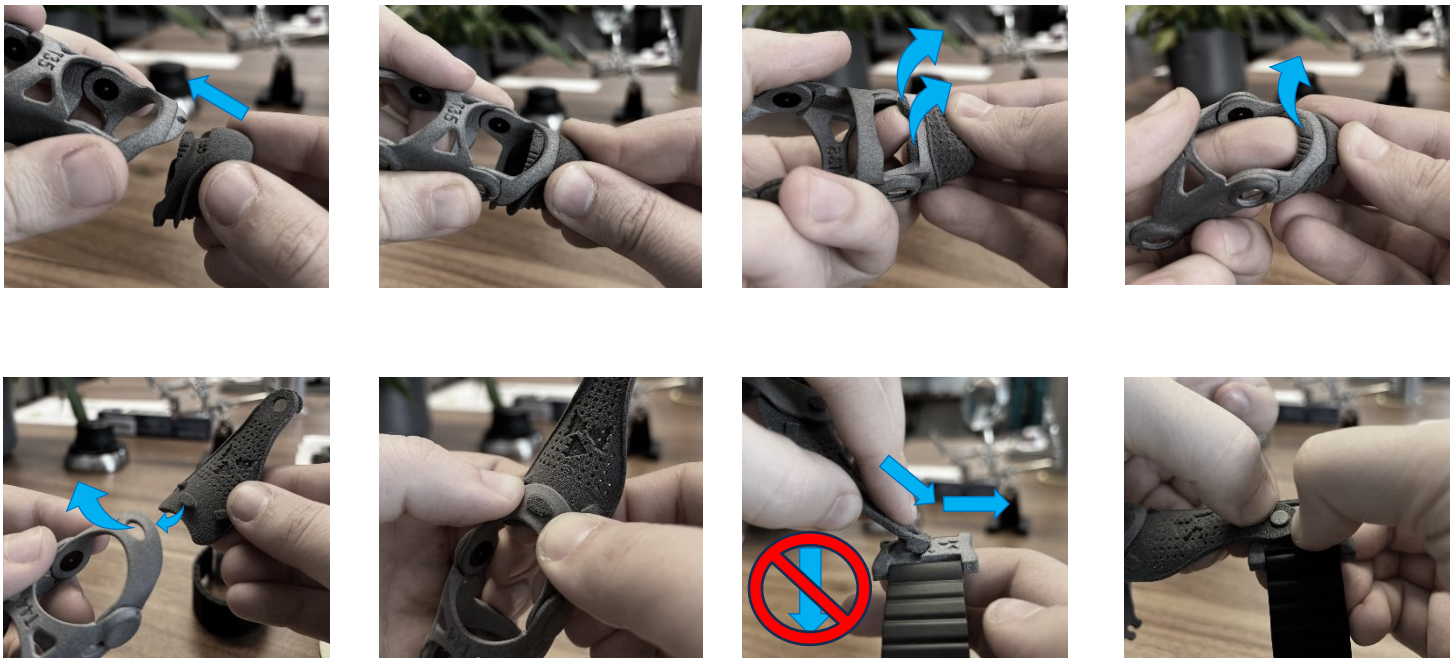

**Figure 3. Top Sequence** (left to right): assembly of the DigiSkin element into the exoskeleton tip. **Bottom sequence** (left to right): assembly of wrist accessories (**thumb variant (AT) only**).

Copyright © Digity GmbH

## Sizing

The size of the PPE is defined by two numbers (Figure 4), the first is the length and the second is the width of the PPE. This information is embossed on the exoskeleton itself.
The size embossed may have the prefix "T", e.g., T45. This defines the thumb exoskeletons.
The user can determine their size manually, using the "Finding your size" instructions below, or semi-automatically using the online Virtual Onboarding Tool via www.digity.de [from Q2 2025] [Recommended].

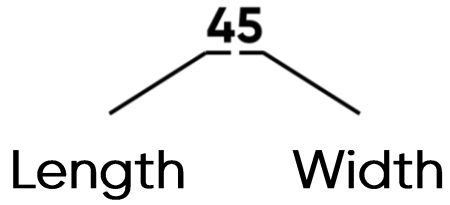


**Figure 4.** Elements that form the size of an exoskeleton. The first digit is the length. The second digit is the width.

## Finding your size

The size of the PPE consists of a length and a width/thickness. The length and width options are consistent across combinations, i.e., the length of the AF34 is the same as the length of AF32. This does not hold true between the finger variant (AF) and the thumb variant (AT).

Given the independence between length and width value within each exoskeleton variant, the size for each dimension can be found in a three-step process. It must be noted that the fine fit of the exoskeleton is a mostly subjective perception that depends on the user, the application, and in some cases the environmental conditions (e.g., temperature). The guideline below provides a solid starting point.

### Preparation

To start, decide which exoskeleton variant is appropriate for the finger you want to use: use the AF Set for index and/or middle, and the AT Set for the thumb.

**Recommendation 1**: After testing each device, put it back in the catalog, to avoid creating chaos from mixing all of them.

**Recommendation 2**: Check out our Virtual Onboarding Tool: our online tool that will take over and ease this tedious process, empowering you to just focus on how each device feels.

### [Step 1] Finding your approximate width

Note: If you are using the thumb (AT), the wrist link and band do not need to be attached in this step.

The objective is to find a width that fits your finger widely: not an ideal fit, but a loose one. To do that, find the first exoskeleton that fits around your finger without much force, from the next sequence:

21 → 22 → 33 → 44 → 55 → 66 → 67

Then, use one more width value (second number) for [Step 2].

Copyright © Digity GmbH

**Example**

Anna tries **AT21** but she cannot fit it on her thumb. She could fit **AT22**, but it is so tight that she could not flex the finger. Then, she tries **AT33**, which fits comfortably. Anna then choses the width four [**AT3**(3 + 1 = 4)] to continue with Step 2.

## [Step 2] Finding your best fitting length

Note: If you are using the thumb (AT), the wrist link and band do not need to be attached in this step.

The objective is to find the best fitting length. To do that, test all the exoskeletons in the width value found in [Step 1] from shortest to longest.

The exoskeletons will likely feel too wide; this is intended, and it is to avoid friction/pressure due to non-fitting widths.

Put the exoskeleton on the finger until your fingertip touches the inner wall of the exoskeleton tip (DigiSkin). Then, check if the joints align with your finger joints. You can perform some flexion-extensions to feel if the joints are aligned: they are if the exoskeleton does not move up and down while doing the movements, and it does not crash into your finger segments creating pressing points.

See Figure 5 to focus on the three **length** key fitting points: (1) the reach to the tip, (2) the alignment of the joints, and that (1) and (2) are fulfilled while the exoskeleton looks parallel to your finger segments.

**If two or more lengths feel right, choose the shorter one; this will ensure the best tip reach, ensuring the sensitivity is maintained.**

Once you find the best length (first number) fitting device, memorize it and move to [Step 3].

**Example (continuation)**

Anna finds the following exoskeletons having a width four: AT24, AT34, AT44, AT54. The AT24 looks good, but when flexing the finger, the exoskeleton tilts forwards, creating a pressure point just on top of the thumb knuckle (Figure 5A). She feels a good fit with AT34 and AT44. The AT54 joints do not align with hers.
Therefore, among the good fits, Anna choses AT34 to maximize fingertip reach.

Copyright © Digity GmbH

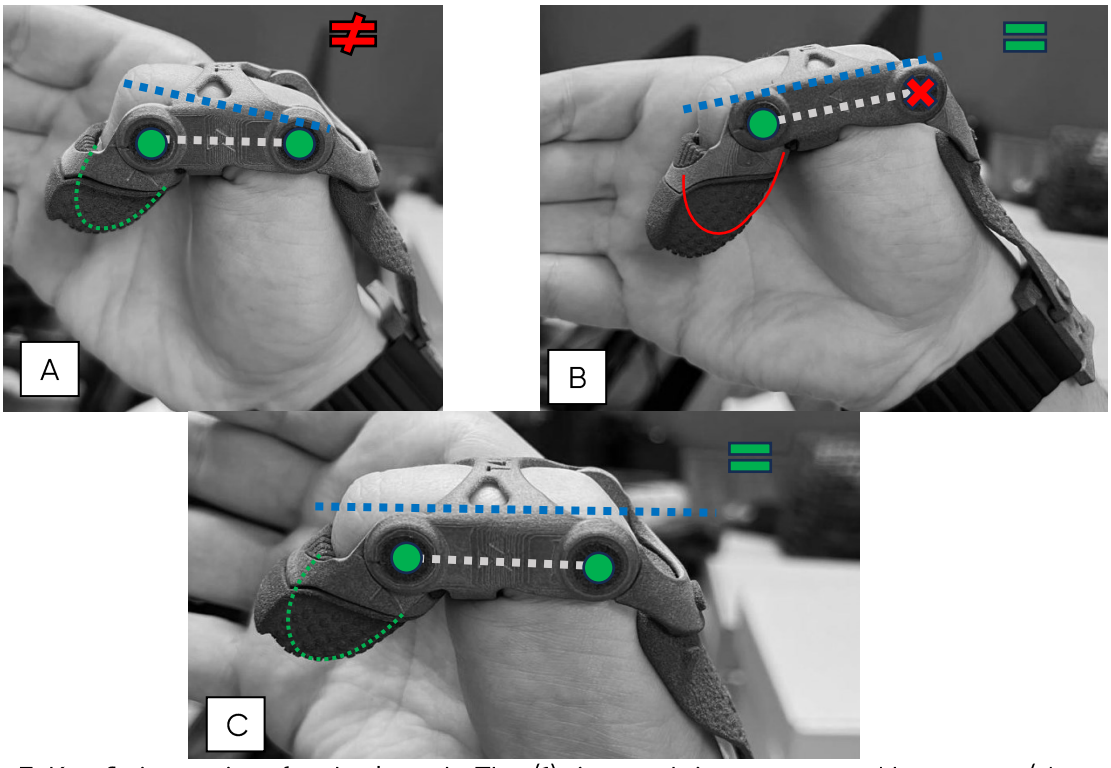


**Figure 5.** Key fitting points for the length. The (1) tip reach is represented by an arc (dotted green = good reach; solid red = no reach); the (2) joint alignment is represented by a green circle on the joint (good alignment) or a red cross (misalignment); the (3) parallelism between exoskeleton (straight, gray dotted line connecting the device joints) and finger segments (upper blue dotted line following finger segment) is represented by a green equal (parallel) or red non-equal sign (non-parallel).
**A**: Good tip reach and alignment, but non-parallel segments. ARTUS is likely too short.
**B**: Poor tip reach and alignment, and good parallel segments. ARTUS is likely too long.
**C**: Good tip reach and alignment, and good parallel segments. Best fitting ARTUS.

### [Step 3] Finding your best fitting width

Note: If you are using the thumb (AT), it is time to attach the wrist link and band for every fitting try.

Once your ideal length is determined, you can fine tune your width selection to have a perfect feeling. To do so, take an exoskeleton with the length found in Step 2, and the following widths (if available): the width of Step 1 (W), W+1, and lastly W-1.

If you can fit them, test all three devices before making your decision. Note that your subjective feeling prevails at this point.

Among the three exoskeletons, choose the device that creates the most uniform pressure along your finger. No pressure **points** or friction **points** should be felt. The movement should feel natural, and the sensitivity should be present.

If any pressure or pain point is present, consider (1) returning to [Step 2] if it is because the exoskeleton moves up and down during flexion-extension, or (2) test thicker exoskeletons if the pressure is uncomfortable.

Copyright © Digity GmbH

**Example (final)**
Anna has her three final candidates: AT33, AT34 and AT35.
After testing all three, she finds the two smaller ones the best fitting ones. She feels that she would love an AT33.5 and asks Digity for custom-made devices.
In the meantime, Anna chooses AT34 as she remembers that her fingers tend to swell during the long hours at her assembly line.

### [Adjustments] Boosting thumb dynamic tip reach: The wrist adjustment

For AT devices (thumb), the exoskeleton is connected via the wrist link to a wrist attachment point (see Figure 6). This connector is asymmetric, which enables the wrist band to control the distance from the wrist to the exoskeleton itself by rotating the wrist band around that attachment point.

This adjustment can be used to (1) improve the wrist mobility (longer setting), (2) increase the pulling that the wrist link makes to the exoskeleton towards the wrist to ensure tip reach during flexion movements (shorter setting), and/or (3) adjust the position of the wrist band itself on the wrist (shorter/longer setting).

**Figure 6.** The asymmetric wrist connector allows tuning the distance wrist-exoskeleton. It is useful to boost tip reach, wrist mobility, and comfort.

## Selection of the DigiSkin

There are different types of DigiSkin (Figure 7) which must be selected according to the application and inserted into the ARTUS Finger exoskeleton. There are currently four different versions, moving from maximum sensitivity at the fingertip to maximum protection.

- **DigiSkin Invisible** is effectively the absence of fingertip tool. It enables using the ARTUS Exoskeleton without any sensitivity sacrifice. It, however, offers no fingertip protection. Optimal for tasks with very fine manipulation.
- **DigiSkin Grip** is the thinnest, most sensitive variants of fingertip tool. It offers very good sensitivity and grip, and a minimum of fingertip protection. Optimal for fine manipulation, and also for heterogeneous task protocols (e.g., at assembly lines).

Copyright © Digity GmbH

- **DigiSkin Push** is like DigiSkin Grip, yet it includes a reinforced fingertip pushing area. This area provides a wide contact point for the fingertip in high force applications, relieving the perceived stress.
- **DigiSkin Tough** is the thickest, most protective variant of the fingertip tools. It offers the maximum protection of the catalog, at the expense of allowing little to no sensitivity. Optimal for high force applications where manipulation of small parts is not required.

**Figure 7.** DigiSkin catalog. Left to Right: DigiSkin Invisible, DigiSkin Grip, DigiSkin Push, DigiSkin Tough

## Putting on the Exoskeleton

To use the exoskeleton, the size must be first determined. After the size is known, put on your protective gloves. Use only textile gloves without protection for liquids, chemical, temperature, or impact, as these may prevent the exoskeleton from fitting or move naturally.

The thickness of the glove is particularly important. For gloves with a fabric thickness of 1 to 1.5 mm (typical assembly gloves), one thickness value must be added to the measured thickness determined without glove. If thicker gloves are worn, wider PPE may be required.

The exoskeleton must be equipped with one DigiSkin, properly fitted in its fingertip, before use. The device shall be pulled onto the finger until the fingertip contacts the exoskeleton's tip inner wall. The exoskeleton joints should be aligned with the finger joints.

The exoskeleton should move freely without slipping. If the exoskeleton wiggles on the finger or moves relative to the finger during flexion indicates poor fitting. Try a different length value (first digit) until the alignment of the joints is ideal, and a different thickness value until the pressure of the shell on your finger is consistent throughout the range of motion.

Only one exoskeleton per finger may be worn. You can wear multiple exoskeletons on multiple fingers at the same time. Digity recommends wearing these PPE on two to three fingers: the thumb, index finger and/or middle finger. This may vary depending on the activity and intended use.

## Use of ARTUS

The ARTUS, whether on the finger or the thumb, is designed to stop the finger segments from overstretching during pressing activities. It is not a force augmentation device, hence the operator shall not use more force than they would use without device. For this reason,

Copyright © Digity GmbH

there are two permissible pressing directions, each with an intended limit. This applies to both variants of the device: finger and thumb.

Pressing direction 1 with the fingertip is permissible up to a pressing force of 5 kg or 50 N (see Figure 8, left). The second pressing direction is pressing downwards with the fingertip, here a pressing force of 2 kg or 20 N is permissible (see Figure 8, right). These forces and pressing directions must be validated by the operator.

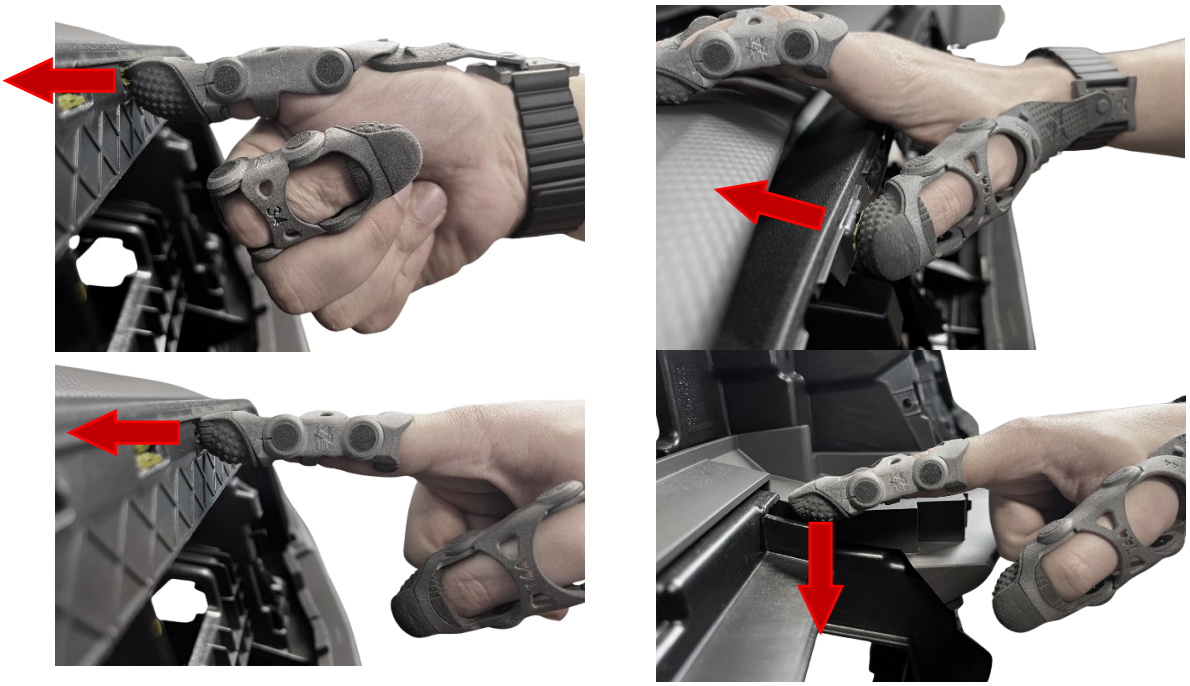

**Figure 8.** Pushing direction 1 (left) Permissible force up to 5 kg / 50 N. Pushing direction 2 (right) Permissible force up to 2 kg / 20 N

Furthermore, the use of a second hand to exert more force on the object to be pressed (Figure 9) is strictly prohibited.

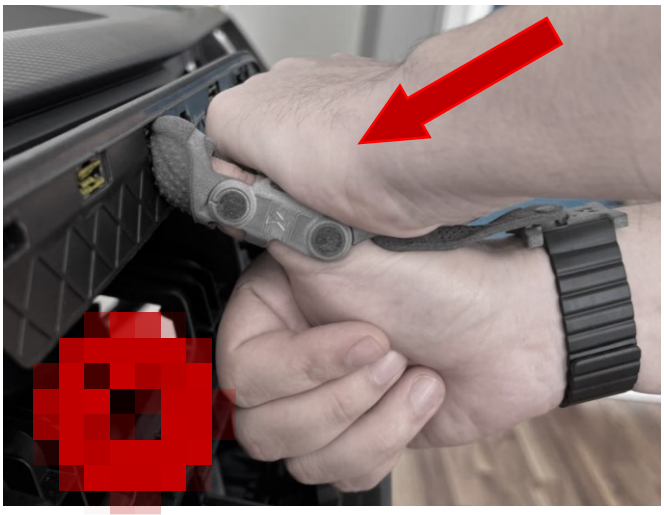

**Figure 9.** Addition of a second hand strictly prohibited.

Copyright © Digity GmbH

## Cleaning and Care

We recommend cleaning the exoskeleton with damp cloth and neutral soap. Dry with a soft cloth before using the exoskeleton again. Do not use harsh detergents or solvents.

## Desinfection

If necessary, the exoskeleton can be disinfected with an alcohol-based cleaner.

⚠ Do not use alcohol-based cleaners to disinfect DigiSkin!

## Inspection

Check the integrity of the exoskeleton and DigiSkin before each use. Look for damage or wear and replace the DigiSkin if necessary. If the other components show signs of damage in the form of cracks, replace the entire exoskeleton.

## Durability

The durability of the exoskeleton depends on many factors such as temperature, frequency of use, and type of application.
We recommend checking DigiSkin every week of use and replacing it if necessary.
The complete exoskeleton should be replaced after six months of use at the latest, as the accumulation of material fatigue can compromise the device's performance.

## Disposal

Dispose of in accordance with national and local regulations. Comply with all waste prevention and recycling or disposal requirements for raw materials.

Ensure that raw materials are recycled wherever possible, e.g. recycle metallic materials by type and dispose of plastics properly. Verify the materials of each component using the product datasheet.

The exoskeleton does not contain batteries or electrical components.

Copyright © Digity GmbH