

# COMPLETE CONTROL SYSTEM GEN2 HANDBOOK (V3.5)

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## SECTION 1: ELECTRODE SITE PLANNING

# ELECTRODE SITE PLANNING

Planning EMG electrode sites for Coapt GEN2 Pattern Recognition

*Pattern recognition loves information. The more information it can be fed, the better it will work. Valuable EMG information can come from all over a user's residual limb, so, unlike a conventional single- or dual-site myo system, you will be planning several pattern recognition electrode contacts to capture all their limb has to offer.*

You are likely already aware that pattern recognition is quite different than conventional single- or dual-site myoelectric control. Maybe it's no surprise that myotesting and evaluating users for electrode placement is quite different too. Yes, there may be a higher number of electrode contacts with pattern recognition, BUT, as you'll experience that will produce some wonderful benefits.

Here, we will guide you through the two major electrode site-planning tasks:

1. Determining where there is underlying muscle tissue on the residual limb of your user.
2. Planning the Coapt electrode contacts to reliably cover those areas with residual muscle activity.

## **Step 1: Have a thorough discovery chat with your user.**

Before you dive into any palpation for muscle activity with a prospective user, plan to have a thorough discussion with them about what they can feel and do with their limb. Forget instructing them to imagine isolating wrist flexion and extension or simple elbow up/down (we know—it can be hard to change old habits) but instead, have them tell you ALL of what their finger, hand, wrist, elbow, etc. perceptions are.

Why? Well, this is a great way for both clinicians AND users to explore and learn what intuitive motions and feelings they may want to use for their prosthesis control together. Let them tell you what they can do. And don't mistakenly limit them by cornering them into the old "flex/extend" box.



**GOALS** of this discussion are to determine what muscle contractions (motions) the user feels:

1. Are intuitive to use for prosthesis control.
2. Can be performed consistently.
3. Are unique for each intended prosthesis action.

**A few tips for leading this discussion:**

- Ask questions to determine what movements the user can perceive and produce with their phantom limb, such as:
  - “Can you feel your hand? Which fingers do you feel you can move?”
  - “Can you imagine making a fist? What about opening your hand with your fingers spread apart?”
  - “Does it feel like your hand is squeezing down on something?”
  - “Do you feel like you can turn your wrist? Does your hand stay relaxed?”
  - “Does your thumb move? How far? Which direction?”
  - ... and so on. Remember, the goal is to learn together what more might be available for control with more multi-site contacts.
- When you have your user perceive these motions, ask that they hold them at a medium intensity and for about 3-4 seconds each. This is good practice for the eventual prosthesis controls’ (and users’ self-led) calibration procedure.
- Encourage the user to mirror their perceived motions with their sound limb if possible.
- Start the discussion with the most intuitive motions and add variations as needed; i.e. try natural hand close for “hand close” and if they have poor perception of hand close but good perception of one specific finger (for example), try practicing the use of that finger perception for “hand close.” In another example, if wrist rotation is difficult to perceive, discuss the feeling of adding thumb or pinky finger ab/adduction to accentuate rotation.
- Focus on motions that are distinct and repeatable.
- Take considerable time with this process.
- Be patient and listen.
- Perform this discussion in a relaxed environment.
- Develop a common vocabulary for specific motions.

**Step 2: Determine where there is underlying muscle tissue on the residual limb.**

Palpation isn't what it used to be. For single- or dual-site, conventional myoelectric control electrode planning, you may have been used to feeling for strong, isolated contractions using your fingertips. Forget that. For pattern recognition go all in. Use all of your hands to feel as much of their residual limb as possible, at once. Hold on and feel while you repeat and continue the discussion from Step 1.

What's going on here? The continued discussion helps to further discover their intuitive motion plans while, at the same time, lets you feel for the general and global areas of underlying muscle tissue. Remember, pattern recognition doesn't always require strong and isolated sites, it wants to get info from lots of muscle areas—even the areas that may seem weak and hardly perceptible.

**GOALS of this whole-handed palpation are to:****GOALS**

1. Feel for all “areas of interest” corresponding to any and all underlying muscle activity related to the control motions.
2. Keep note/remember these “areas of interest” as good locations to place electrode contacts.

**A few tips for performing this palpation:**

- Perform this exercise in a relaxed environment
- Take time with this process.
- Be patient and listen.
- Grasp and cover as much of the user's limb as possible; do not use only your fingertips to feel.
- Have the user perform and hold (3-4 seconds) each of the useful motions discovered during the discussion phase.
- Feel for the overall muscle activity – like what the pattern recognition algorithm does – by sensing the patterns of activity at multiple areas simultaneously.
- Do not ignore areas of slight/subtle/weak underlying muscle contraction (these signals are just as valuable).
- Note any unique and unexpected areas of underlying muscle contraction.
  - For transhumeral amputees, this may mean unique muscle activity distal on their residual limb.
  - If the user tenses muscles quite hard for all motions, ask them to make contractions a little more softly.
  - If desired, make temporary markings on the user's residual limb to help remember areas of activity.

**GENERAL THINGS TO AVOID:**

- Do NOT seek only strong muscle contraction sites (subtle signals are important too)
- Do NOT focus only on precise and isolated muscle sites
- Do NOT limit electrode placement to "hotspot" areas