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## Alternative Drive & Mode Controls: What are the options?

Prescribing a power wheelchair can be overwhelming with all the choices on not only the power base, power seat functions, and seating options, but also determining what is the most effective drive control for the rider. The Education in Motion resource “Alternative Drive Controls – Implication and Considerations” summarizes the features and benefits of various wheelchair alternative drive controls. These controls need to be considered should a standard joystick mounted on the armrest not meet the needs of the rider.

The following is a supplemental guide to summarize alternative drive options and switch access to other modes for a power wheelchair. This resource leads with considerations for the assessment, then reviews the basic characteristics of various input drive controls, and finally, delineates between the various proportional and non-proportional options available. For more in-depth clinical application, Michelle Lange, OTR/L, ABDA, ATP/SMS, offers resources, such as her “Decision-Making Tree for Non-Joystick Driving Methods”, to help guide clinicians in evaluations for alternative drive controls.<sup>1</sup>



## Drive Controls: Assessment

- Diagnosis - Progressive?
- Strength/Force
- Range of Motion
- Motor Control – Consistent/reliable?
- Abnormal Tone/Reflexes
- Proprioception
- Cognition – Learning Rate/Memory
- Alertness
- Vision/Perception
- Motor Planning/Sensory Processing
- Optimal Positioning/Postural Support
- Mobility Concepts – Cause/effect, stop/go, directional, problem-solving, judgment (Livingstone, 2010)
- Transfer Status
- Functional Goals
- What drive directions (single vs multi-direction) do you anticipate the rider will be operating?
- Will the rider be managing power seat functions?

## Characteristics of Input Control

- Proportional vs. non-proportional
- How much force is needed?
- Is auditory feedback needed?
- Is visual cueing or feedback needed?
- Gross vs. fine motor for consistent activation?
- Large or small movement?
- Durability
- Body part used - match to switch/mount
- Movable for transfers?
- Available mounting location

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## Proportional Drive Controls

### Proportional Characteristics

- Multi-directional control (360°)
- Speed control: the farther the input device is moved from its neutral position, the faster the wheelchair will move.
- Provides more precise control than non-proportional devices by allowing the rider to quickly increase or decrease speeds in all directions.

### Proportional Clinical Application

- Provides increased control for the rider while navigating different environments and through various terrains.
- Requires the ability to voluntarily grade the amount of force applied to the input device to control speed and direction.
  - Difficult for riders with abnormal muscle tone (i.e., cerebral palsy (CP), traumatic brain injury).
  - It can be difficult for young children and those with cognitive limitations.
- There are proportional controls designed for riders with weaknesses and compromised motor control.
- Preferred access method whenever possible

### Proportional Drive Control Examples

- Standard joysticks
  - LED
  - CJSM
- Compact joysticks
  - SWITCH-IT VersaGuide
  - SWITCH-IT VersaGuide EZ
- Mini joysticks
  - SWITCH-IT MicroGuide
- Multi-switch head control
  - SWITCH-IT Dual Pro head array
- Headset head control
  - SWITCH-IT Vigo
- Multi-switch arrays
  - SWITCH-IT Cool Cube

## Non-Proportional Drive Controls

### Non-Proportional Characteristics

- Functions like an on/off switch. Once a non-proportional drive control is activated, it is completely on and when it is released, it is completely off.
- Each switch is preprogrammed for one direction and one speed.

### Non-Proportional Clinical Application

- Requires less coordination and motor control to activate than a proportional control device.
  - The rider only needs to be able to move a body part in two directions (one to activate the switch and one to move off it).
- AND/OR
  - If the rider can move multiple body parts in two directions, various switches assigned to different directions or functions can be mounted near those body parts to capitalize on those abilities to increase successful driving in all directions.
- Precise movements are not needed to control the speed.
- Can be utilized to train an individual who has never driven a power wheelchair to build foundational skills and application of cause and effect.
  - i.e., switches can be introduced to teach a rider how to start/stop the wheelchair and to learn directionality.

- Good for riders who have limited motor control, weakness, or fluctuating tone.
- Easier learning process for those with cognitive impairments.

### Non-Proportional Drive Control Examples

- Head array (switched)
- Sip 'N Puff
- Mechanical switches - array
- Proximity switches - array

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# Joysticks

## Standard Joystick

- Joystick control requires grading of the force and distance of movement.
- Must have adequate movement and motor control to use a joystick.
- Typically requires 180-220 grams of force to operate.
- Ensure optimal setup:
  - Consider the programming: based on the force needed, speed, auditory feedback, tremor damping, etc.
  - Handle options: ball, knob, goalpost, etc.
  - Position/mounting: right, left, center, swing-away, angled.
  - Size and location of buttons: ensure the rider can see, reach, and activate the buttons.
  - Screen or no screen: for some riders, screens can be very distracting, while others benefit significantly from seeing the display. Also, consider the resolution and lights on the joystick related to the display.
  - Sounds: tones and noises can be beneficial or distracting.
  - Additional technology: Bluetooth vs. non-Bluetooth embedded in the joystick.

## SWITCH-IT Joysticks - used when standard joystick is not viable

### Compact Joystick

- Similar in size to a standard joystick (case is smaller/compact)
- Basic operation (no screens or additional buttons for operation of other functions)
- Unlimited mounting options (armrest, midline, chin/mouth)
  - Mounting at midline/close to the body requires less strength/range of motion)
- Can have a shorter throw
- Two smartjacks sense additional proximity/mechanical mode switches (mode and on/off)
- Option of adding two flex switches (6" gooseneck) – zero-touch proximity sensors
- Light to moderate force

### Compact Joysticks



**VersaGuide**

- 240g force



**VersaGuide EZ**

- 120g force (lighter force/shorter throw)

### Micro Proportional Joystick

- Significantly smaller than standard joysticks
- Very limited range of motion/strength (CP, ALS, quadriplegia)
- Mounting options for operation with various body parts (lips, chin, fingers, toes, etc.)
- Durable metal construction
- Minimal force, light touch
- Approximate dimensions: 5/8" diameter x 2 1/4" height without knob

### Micro Proportional Joysticks



**MicroGuide**

- 40g force
- Displacement style (1/4" neutral to forward joystick throw with standard knob)

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## SWITCH-IT Head Controls

- Fair to good head control (midline head positioning and some lateral and anterior/posterior movement available).
- Head movements allow directional control of the wheelchair.
- Strong extensor tone or ATNR - may have difficulty coming off pad for stopping or changing direction.

### SWITCH-IT Head Controls



#### Head Array (Switched)

- Proximity activation (10mm sensing distance).
- 3, 4, or 5 switches available.
- Short & long and straight & curved wings available.
- External mode switch swing-away mounting capability.
- Activation of each switch is for the designated direction and specified speed.



#### Dual Pro Head Array

- Utilizes both proximity and force switches.
- Full range of acceleration/deceleration.
- 360° turning range.
- Veering control.
- Convenient programmability on the back of the headrest.
- Adjustable to each person's strengths/capabilities (left and right individual adjustability).
- Can be combined with all Whitmyer accessories.
- Pad options:
  - Long (6") lateral
  - Round (2") spot
- Three "smartjacks" - external mode switch mounting capability (flexible, rigid).



#### Head Array Sip 'N Puff Combo

- Pneumatic control allows for independent mobility when extremity and head control are insufficient.
- Combo gives the rider the ability to turn with side-to-side head movements through the head array and drive forward/reverse through the pneumatic switch.
- Long curved wings.



#### RIM Proportional Head Control

- Compact joystick mounted to the headrest pad.
- Forward activated by pressing back. Left and right activated by pressure on the coordinating side of the back pad.
- Reverse achieved by programming wheelchair electronics (i.e., reflecting red switch can toggle forward/reverse or shut off).
- Speed is dependent on how much the joystick is deflected.



#### Vigo

- Headset design - discreet and does not inhibit rider's vision.
- Wireless proportional headset.
- Subtle and intuitive head movements control direction.
- Adjustable for driver's range of head movement (can be adjusted for rest in asymmetric position).
- Option of controlling other devices via Bluetooth technology.

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## Other Input Devices



### Joystick in a Can

- Versatile and durable.
- Arm and foot control.
- Mode switch options.



### Cool Cube

- Central Hub automatically senses the type of switch that is engaged.
- Compatible with all switch alternatives currently available on the market.
- You can utilize Pro Spot proportional switches or opt for any combination of switches.
- If non-proportional driving is desired, single switches can be selected.



### Cool Cube with Pro Spot

- Full and continuous range of speed and direction for superior drivability (harder pushed, faster it will go).
- Multiple mounting options (head, leg, tray, hand).
- 4-5 Pro Spot Proportional Switches:
  - 5 color options
  - Audible feedback available (3 tones: off, soft, loud)
  - 150-300g force

## Mode Controls

### Mechanical Switches

- Requires a depression of the switch (button or other surface)/physical movement to activate.
- Provides access to modes: power, seat functions, Bluetooth, etc.
- Different switches use varying degrees of strength and range of motion.
  - Range in size and amount of force needed to activate.
  - Consider the reliability of the access point.
- Best for momentary switch activation.
- May enhance tactile feedback as reassurance that they have activated a switch.
- Available in assorted colors - enhance visual feedback to assist with learning/recalling the function of the switch.
- Auditory feedback.
- 1/8" mono plug output unless otherwise specified.

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## Single Switches

Single switches can be used as input for drive control systems or other functions (modes).

### Single Switches



#### 2.5" Single Switch Button

- 5 color options
- Durable/reliable
- 2.5" activation surface
- 142g force
- 5' cable with a 1/8" right angle mono plug



#### 1" Single Switch

- 6 color options
- Extremely durable
- 1/2" x 1 1/8" switch
- 125g force
- 5' cable with a 1/8" right angle mono plug



#### Egg Switch

- 5 color options
- 1 1/16" x 2 3/4" surface
- Slight touch anywhere on the surface for activation
- Sealed to help prevent food or other spillage from penetrating the switch
- 4.5' cable with a 1/8" diameter right angle mono plug



#### Spec Switch

- 5 color options
- 1 3/8" activation surface
- Space-saving flush base
- 100g force
- 6' cable with a 1/8" right angle mono plug



#### Mini Button - Single Switch

- 3 color options
- Small/easily accessible
- 1/2" diameter
- 6' cable with a 1/8" mono plug for each button



#### Flex Switch

- Proximity sensor on a 6" or 12" gooseneck
- Stereo plug output
- Works with VersaGuide, VersaGuide EZ, and Dual Pro



#### Twister Switch

- 3 colors
- Allows for adjustable positioning at various body parts (head, knee, shoulder)



#### Micro-Light Switch

- Activate by pressing down on 1 7/10" x 1/2" area
- Feather-light touch (11.3g)



#### Uni-Wob Wobble Switch

- Activated by moving flexible arm
  - 360° activation - any swiping motion
  - Automatically returns to the original position and ready for reactivation
- 6' cable with a 1/8" mono plug
- Black

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## Multi-Function Switches



### Dual Switch Selection

- 2 mini button switches (red and green)
- Dual 1/8" mono or single 1/8" stereo jack output



### Quad Switch Selection

- Mini 4 button
- DB9 connector



### Ctrl+5

- 5 buttons/toggles
- Controls up to 10 separate power seat functions
- DB9 or R-Net connector
- Powered USB port (charge cell phones or other electronic devices)
- The wheelchair must have an assignable button feature

## Electronic Switches



### Zero Touch Sensor System

- 4 or 5 switches available
- DB9 connector
- Can be used as a simple mode switch or with multiple switches as a drive device.

## Other Switches



### Remote Stop Switch

- Allows attendant to stop a powered wheelchair via an RF remote from up to 98 feet (30 meters) away (dependent on the environment).

## References:

1. Lange, M. L., & Jean, M. L. (2018). Seating and Wheeled Mobility: A Clinical Resource Guide (pp. 179-198). Slack Inc.
2. Livingstone, R. (2010). A critical review of powered mobility assessment and training for children. Disability & Rehabilitation: Assistive Technology, 5 (6), 392-500.

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