

POWER WHEELCHAIR FUNCTION AND PERFORMANCE: PROGRAMMING AND CONFIGURATION STRATEGIES FOR JOYSTICKS AND ALTERNATE CONTROLS

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Recent improvements in drive control options allow a person with minimal functional abilities to control a power wheelchair. Evaluation will determine the most reliable, consistent and efficient method and placement of control device. Simulation and trial is crucial to successful prescription. Drive control devices can be loosely placed in 2 categories: Proportional devices offer 360 degrees of directional control and speed variability. Non proportional or digital devices create action with a switch closure – one direction at one established speed. These devices can be helpful for clients with less motor control, cognitive involvement or those that are new to powered mobility. During this session, we will use the below defined parameters and apply them to case studies; emphasizing the clinical and environmental applications.

General programming for all driving controls

- User template (standard programs): selects parameters for common user profiles
- Global programming: changes made to parameters effect every drive profile
- By drive: changes made to programming parameters are specific to each drive profile
- Accelerations: time required to reach maximum speed
- Decelerations/braking: time required to decrease the speed
- Speeds: determines max speed in given direction
- Torque: the motors' access to available power
 - High speed torque: Delphi parameter - torque at high speed
 - Low speed torque: Delphi parameter - torque at low speed
- Power: access to motor current
- Sensitivity/tremor dampening: determines the amount of movement necessary to activate drive control. High number = very sensitive, device will recognize very small movements
- Speed: Invacare parameter - changes all speeds
- Response: Invacare parameter - alters accelerations, braking, torque
- Traction: Invacare parameter - amount of over-ride the controller provides when driving

Proportional Devices

- Joystick: heavy duty, mini, mushroom
- RIM control: action occurs with displacement of headrest pad connected to joystick-like gimble
- Touch pad: action occurs with placement of a finger over a pressure sensitive pad.
- Peach Tree: action occurs with movement of the head in relation to a movement- sensitive pad
- Programming considerations:
 - Joystick sensitivity /tremor dampening
 - Joystick throw: decrease excursion required to reach max speed
 - Neutral horizontal: Delphi parameter - increase middle inactive zone for left/right
 - Neutral vertical: Delphi parameter - increase middle inactive zone for forward/reverse
 - Assign direction / axes selection: alter directional commands of joystick
 - Auto mode: provide access to mode menu without switch

Non-Proportional Devices

- Switched joystick: similar to a proportional joystick but speed is predetermined and has 4 directional quadrants.
- Proximity switches: motion over switch creates action. The number and placement of switches will be determined by the user's evaluation findings.
- Mechanical switches: activation of a mechanical switch creates action. The number, type and placement of switches is determined by the user's evaluation findings

- Programming considerations:
 - Accelerations/decelerations, speeds
 - Access to mode menu

- Head array: 3 proximity switches are mounted in a headrest. Head movement activates switches.

- Programming considerations:
 - Reverse direction:
 - Mode switch toggles back pad between forward and reverse
 - Time toggles back pad between forward and reverse
 - Double quick hit toggles back pad
 - Access to mode menu
 - Mode switch activation sends user to mode menu
 - Auto mode / stand by mode: time sends user to mode menu
 - Axes selection: determines which switches are active in mode menu. L/R selection will allow back pad to be inactive in mode menu
 - Accels/decels, speeds
 - Power
 - Torque settings

- Breath volumes close switches. Several versions are available.
 - 4 Direction: hard puff = forward, hard sip = reverse
soft puff = right command, soft sip = left command
 - 2 Direction with head switches Puff and Sip = forward and reverse
Switches in the head rest provide turning
 - 2 Direction: Puff and sip = forward and reverse
Double puff and sip provide turning
 - Mode/stop switch
 - Normally open: closure of switch is action command
 - Normally closed: opening of switch is action command (infra-red, beam switch)

- Programming considerations:
 - Calibration: end user sets breath volumes for hard puff, sip and soft puff and sip
 - Feedback: visual feedback on display for volume of air required
 - Command time: time required to create breath volume
 - Latch mode: step, cruise, forward, reverse
 - Access to mode menu
 - Mode switch: activation of switch sends user to mode menu
 - Auto mode / stand by mode: time sends user to mode menu
 - Axes selection: determines which switches are active in mode menu
 - Accels/decels, speeds
 - Power
 - Torque settings

- 1 switch (any type) creates driving commands.
 - 5 direction: forward, reverse, left, right and mode
 - 7 direction: forward, reverse, left, right, diagonal left, diagonal right, mode
- Programming considerations:
 - Scan time
 - Accels/decels, speeds

Power seat functions

Tilt, recline and seat elevate can be controlled via a separate toggle or thru the drive control.

- Programming considerations:
 - Control via separate switches
 - Toggle mode: determines how actuator is reversed
 - Latched mode
 - Creep mode: determines amount of tilt, recline, elevate or combination that will place chair into creep (slow driving mode)
 - Drive lockout: determines amount of tilt, recline, elevate or combination that will place chair into no drive mode
 - Thru drive control
 - Creep mode
 - Drive lockout
 - Auto mode / standby with mode selection: allows access to alternate functions thru time setting with no need for mode/reset switch.
 - L/R mode / 2 switch mode: when using head array, actuator functions occur thru right and left switches. The back pad is inactive
 - Auto scroll: display scrolls through items on modes menu at programmed speed. Drive control switch closure selects function and then controls function
 - Auto scroll time: selects scroll speed
 - No driving: drive profile can be programmed for alternate device control only

Household devices

Everyday appliances run by infrared technology, such as TVs, Radios and DVDs, can now be controlled through power wheelchair electronics. Lights can be controlled by linking into X-10 technology. An infrared-capable display or joystick sends an infrared signal to device acting like universal remote control.

- Programming considerations:
 - Access to mode menu
 - Switch activation
 - Auto mode / standby with mode selection: allows access to alternate functions thru time setting with no need for mode/reset switch.
 - Auto scroll: display scrolls through items on modes menu at programmed speed. Drive control switch closure selects function and then controls function
 - No driving: drive profile is specific to alternate mode
 - Escape time out / stand by in ECU: will stay in alternate mode until given command
 - User menu customization
 - Device selection and order
 - Language vs icons

Programming and Diagnostic Stations

Programming systems are more intuitive to use, several utilizing computer set up stations with windows-based software. “Live” battery status, voltage and temperature information provides easy trouble shooting.

Speaker Bio

Amy is a clinical education specialist at Sunrise Medical providing education, training and consultation regarding wheelchair seating and functional mobility. She has over 11 years experience as a physical therapist working with the adult and pediatric populations, with specialties in the treatment of spinal cord injury, and assistive technology evaluation for clients with physical challenges.