CONTROLLING A SPEECH GENERATING DEVICE THROUGH A POWER WHEELCHAIR

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Interfacing

- How to control an external assistive technology device through the drive control
  - Speech generating devices (SGDs)
  - External mouse emulators
  - External EADLs
- Pros
- Cons
- Components required
- Programming required

Case Study

- Sally
  - Age: 8 years
  - Diagnosis: cerebral palsy
  - Driving a power wheelchair using a Head Array
  - Accessing her SGD using a left head switch

Case Study

- Sally
  - Problem: Sally doesn't have another means to drive the wheelchair efficiently and has been accessing her SGD very well with a left head switch
  - Solution: Share the left head switch! "How?" Interface!
  - More in a bit…

Poll Time

- Are you Interfacing as a part of your job?
  - Yes
  - No
  - I want to!

Advantages of Interfacing

- Many technologies work together
- Streamlines access for individuals with limited switch sites and control
- Allows strong switch sites to be used for more than one function
- Interfacing may be less expensive since additional access methods are not needed

PROS

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Disadvantages of Interfacing

- If interfacing is too difficult and/or does not work well, people will shy away from it. It is challenging to find experts in this area.
- The system is more interdependent
- Back-up access methods required outside of power wheelchair
- Interfacing adds to the cognitive load
  - memory and sequencing
- Interfacing can be difficult visually or for those who do not read English
  - display

CONS

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Disadvantages of Interfacing

- Interfacing may add to access requirements
  - if only 1 item is being interfaced, adding a reset switch may be no different than adding another control switch
  - the same switch may be used in a very different manner
    - sustained contact for driving, quick release
    - momentary contact for scanning, quick activation

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Disadvantages of Interfacing

- Sharing an access method may compromise access efficiency
  - Interfaced method may not be optimal access method

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Components Required

- Interfacing component
- Interfacing cable

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Components Required

- Interfacing component
  - MK 6i: Aux1/2 or Aux3/4
  - R-net: Input/Output Module (IOM)
  - Q-Logic: ECU Module

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Components Required

- Interfacing cable
  - Several manufacturers
  - Adaptive Switch Labs (ASL) 802 series

802-4

802-2 L/R

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How Does It Work?

- Consumer puts chair in an Auxiliary Mode to send a signal through the Interfacing Component
- Same as accessing power seating functions
- Some electronics require the auxiliary port to be activated with a programmer

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Movie Time, part 1

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Movie Time, part 2

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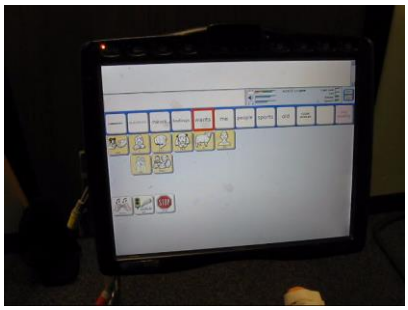
Movie Time, part 3



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INTERFACING SGDS

Through the Power Wheelchair

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Interfacing SGDs

- Pros
  - streamlines access
  - shares a strong access method
  - SGD access method does not have to be moved to the power wheelchair

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Interfacing SGDs

- Cons
  - May compromise access efficiency if shared switch cannot be accessed well for scanning
  - Cables required
  - Need to provide a back-up access method when not in power wheelchair
  - Do not use with Standby

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SGD Access Methods

- Direct
  - don't interface
- Scanning
  - single or dual switch
  - use cable with 1 or 2 switch jacks
- Joystick
  - 9 pin to 9 pin cable
- Mouse
  - mouse emulator required

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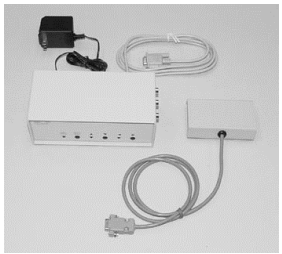
Mouse Emulator

ASL



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Case Study: Sally

- Age: 8 years
- Diagnosis: cerebral palsy
- Driving a power wheelchair using a Head Array
- Accessing her SGD using a left head switch

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Case Study: Sally

- Problem: Sally doesn't have another means to drive the wheelchair efficiently and has been accessing her SGD very well with the left head switch
- Can use a Reset switch by her left hand
- Solution: Interface! How?

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Case Study: Sally

- What components will be required?
  - Head Array
  - Mode switch
  - Interfacing component
  - Interfacing cable (ASL 802-1 L)

Case Study: Sally

- Connections
  - Mode switch plugs into display or main electronics
  - Interfacing component plugs into electronics
  - Interfacing cable plugs into a port on Interfacing Component (9 pin) and into SGD switch jack

Case Study: Sally

- What programming will be required?
  - Turn on port 1 of Interfacing Component, if required
  - Choose transmission method, if required
    - *Momentary
    - Latched
    - *Communication
      - Allows for diagonal control
      - Speeds up transmission slightly

Questions?

What about those Tablets?

- Interfacing provides switch access only
- Tecla Shield provides switch access through the PWC to a variety of Tablet platforms

MOUSE EMULATION

For Access to Speech Generating Devices

Poll Time

- Are you programming mouse emulation in PWC electronics?
  - Yeppers
  - No
  - I would like to!

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AT Access

- There are many ways to access a computer or Speech Generating Device
- Before looking at mouse emulation, make sure this is the optimal access method

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Mouse Emulation

- Transmission Method
- Cursor movement
- Clicks
- Keyboard Emulation

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Transmission Methods

- Infrared (IR): outdated, line of sight, interference
- Radio (RF): may be interference with other users
  - Includes ZigBee and Bluetooth
  - Bluetooth (BT): not always reliable, may need to be recharged

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Transmission Methods

- BT may be an issue if the client is using a computer and a SGD
  - BT mouse on PWC won't pair with more than one device at a time
    - Can set up 2 Invacare mouse emulators, one for each
- "Discovery" of the
- wheelchair BT mouse feature
- can be difficult, but once done,
- it usually sticks

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Transmission Methods

- PRC SGDs
  - Have to add BT dongle
  - Have to download software to make discoverable

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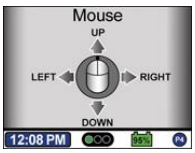
Transmission Method

- MK6i: Radio
  - Separate from display, retrofittable
- R-net: Blue Tooth
  - Separate from display, retrofittable
- Q-Logic: Blue Tooth
  - Built into display
  - Built into joystick (Q-Logic 2)



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Transmission Method

- Signal sent from the power wheelchair, typically the display
- A receiver is connected to the SGD
- Consumer must buy the receiver
  - Not Invacare

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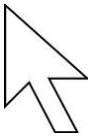
Cursor Movement

- Drive method is used to move the cursor on the SGD screen
- Consumer has to change “modes” from Driving to mouse emulation
- Proportional access
- Digital access



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Pros and Cons

- Pros
  - Streamlines access
  - Wireless, increases independence
  - Cost savings (if built-in)
- Cons
  - May not be the optimal access method
  - Takes more refined control than driving

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Cursor Movement

- Proportional access
  - 360 degree movement
  - The further the joystick is deflected, the faster the cursor will move

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Cursor Movement

- Digital access
  - Directional switches move the cursor in the corresponding direction
  - If three switch access is used (i.e. head array), Forward often moves the cursor up. The cursor wraps around to the bottom of the screen
  - Forward/Reverse and Left/Right can be combined to provide diagonal movement
  - One speed, set on the computer

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Clicks

- Click emulation
- Physical clicks

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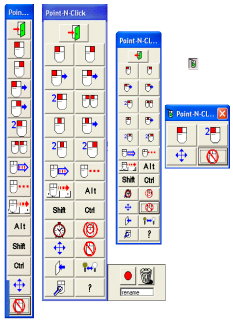
Clicks

- Click emulation
  - Software (i.e. Point-N-Click, www.polital.com/pnc)
  - Cursor hovers over the desired selection
    - Left Click, Right Click, Double Click, Drag
  - The selection is executed when the cursor hovers over an item
  - Customize bars



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Physical Clicks

- Consumer has to be able to use an additional switch or be able to discriminate between quick hits and sustained contact to move the cursor

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Mouse Emulation

- Invacare Specifics:
  - Discovery
    - Plug in USB dongle
      - Flashes red
    - Plug switch into left mouse jack while turning on chair
      - Flashes green

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Mouse Emulation

- Invacare Specifics:
  - 3 or 4 quadrant control

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3 or 4 Quadrants?

- 4 Quadrant control
  - 4 quadrants of driver control operate the mouse in 4 directions
  - Typically used with joystick
- 3 Quadrant control
  - Forward toggles Mouse up, Mouse down (MK6i)
  - Forward is changed to reverse with external switch or back pad hit (R-Net, Q-Logic)
  - Typically used with Head Array

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Mouse Emulation

- Invacare Specifics:
  - 3 quadrant control:
    - R command = L/R
    - F command = Up/Down
    - L command = mouse click/double click/drag (or latch)
    - 4th quadrant can be R click
  - Clicks
    - 2 switch jacks on mouse module for L/R clicks
      - 1 switch: L click
      - 2 switches: L/R clicks

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Mouse Emulation

- R-net Specifics:
  - 3 or 4 quadrant control
  - Cursor speed increases when switch is held down (digital access)
  - 30 yard range

Mouse Module

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Mouse Emulation

- R-net Specifics:
  - Clicks:
    - Joystick
      - Speed Up and Speed Down buttons for L/R clicks in mouse mode
      - Any quick hit (nudge) of a directional command can be programmed as L or R click or Scroll Up or Scroll Down
    - Alternative Access
      - Any quick hit of a directional command can be programmed as L or R click or Scroll Up or Scroll Down
      - Switch jacks on emulator

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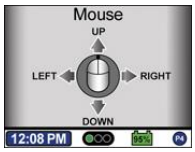
Mouse Emulation

- Q-Logic Specifics
  - 3 or 4 quadrant control
  - BT must be paired to PC
  - Mouse Emulation takes up one drive profile
  - Reset switch required for some functions
  - Programming
    - Mouse speed: slow, medium, fast (Scaling)



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Mouse Emulation

- Q-Logic Specifics
  - Clicks, method #1:
    - L quick hit = L click
    - L double hit = double click
    - R quick hit = R click

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Mouse Emulation

- Q-Logic Specifics
  - Clicks, method #2:
    - Base Toggle
    - One switch toggles between mouse movement and mouse click
    - Mouse click screen displays options for each directional movement: L click, R click, double click and drag
    - Base Auto
      - Automatically returns to mouse move after any click

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Mouse Emulation

- Q-Logic Specifics
  - Clicks, method #3:
    - Add external switches
    - External cable required
    - L/R clicks

Keyboard Emulation

- For computer control
- some SGDs have an integrated computer
- On-screen keyboards
- Requires precise cursor control
- Dwell or Click

Interfacing External Mouse Emulators

- Accessing other assistive technology through the drive method
  - External mouse emulators
- Components required for
  - interfacing
  - Interfacing component
  - Interfacing cable

Interfacing External Mouse Emulators

- Wired (ASL 519)
- Wireless
  - Zigbee signals
- Switch for Left, Right and Center
- Can control more than one device
  - i.e. computer, SGD

Interfacing External Mouse Emulators

- ASL 554
  - 3 or 5 switch configuration
- 3 switch
  - R switch: moves cursor right and left
  - F switch: moves mouse up and down
  - L switch: left click, double click, drag

Interfacing External Mouse Emulators

- ASL 554
  - 3 or 5 switch configuration
- 5 switch
  - Joystick acts like a joystick operated mouse
  - Separate switch for L click and drag

Access Method Specific Mouse Emulators

- ASL dedicated mouse emulators for MEC joystick, ATOM head array and Extremity Control Joystick
- These bypass the PWC electronics altogether

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Interfacing External Mouse Emulators

- Switch-It! Mouse Driver
- 3 to 5 switch control
- Proportional access methods
- Radio transmission

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External Mouse Emulators

- Magitek Mouse Mover
  - Proportional
  - "Magi-Mouse" Mouse Mover

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External Mouse Emulators

- Dynamic Controls
  - I-Portal Mouse Mover
    - Compatible with DX Electronics
    - MK6i compatibility in 2015?

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Resources

- ASL has a terrific series of step-by-step instructions for mouse emulation on each electronics package!
  - Ask for copies!
  - http://www.asl-inc.com/technical-support/programming-documents.php

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What about those Tablets?

- What if the client is using a tablet for communication?
- Android and Windows based tablets accept mouse input
- Permobil iDevice provides mouse input to iPads

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Questions?

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Thanks!

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Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Power Wheelchair Bases supported	TDX series, FDX, Storm Series, Power Tiger	All Permobil bases Quickie Redman, other manufacturers	All Quantum
Tracking technology	True Track: (GB Motors, Standard on TDX SR, Arrow) Upgrade on Storm bases G-Trac™ (Gyro Module) available on all MK6 systems G-Trac can be enabled or disabled in any one or more individual drive profiles	Permobil: ESP (gyro technology) (standard on some, optional on some bases, not available on K450) Can be enabled or disabled	Accu-Trac Technology (tachometer) (optional) Can be enabled or disabled
Firmware upgrades	Insert upgraded Pro (SD) Memory card into joystick or display – follow prompts. (Software upgrades available from web)	'Future Proofing' feature (new modules can be added without programming). Some modules are 'flash' upgradeable. Can upgrade by PC Programming, if needed.	Yes, software download by computer or hand held programmer (Software upgrades available from PrideProvider.com)
Initial system set-up	Factory settings (4 standard drive profiles). Programmer or SD card to modify for user needs. All modules added are recognized automatically – some (IR / Mouse) require initial programming	Plug and Play, modules and actuators recognized and programmed automatically	Plug and Play, modules recognized and programmed automatically
Factory Reset	Yes	Yes	No
Programming			
Separate hand held programmer	Yes Help/Info key provides assistance. MK6 Hand Held Programmer (HHP) works on MK5 and MK6 systems. MK5 HHP compatible with MK6 SD card available to back up or store commonly used programs.	Yes DTT – includes USB memory stick option for transferring files, mini-USB port for connection to PC. Permobil: use dongle for Permobil specific features (dongle plugs into display or PC)	Yes Programmer compatible with NE (non-expandable), NE+, and Q-Logic electronics. Help key to describe parameter functions. Internal 64mb memory & SD card available for additional memory storage.
HHP revision independent	Yes	Yes	No, upgrades available on PrideProvider.com, plugs into computer via USB cable

Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Program through display (manual buttons)	Yes, with SD card, can see all 4 drives at once on display	Yes, with dongle on Permobil	Very limited
Program through joystick display	Yes, with SD card on all expandable systems – views one drive profile at a time.	Yes. On Board Programming (except Permobil LED joystick) Can see 4 Profiles at once	Limited
Consumer can program through access method	Yes, with Professional SD card IR programming with Professional or Basic card	Yes Quickie: keycode Permobil: User Menu provides access to clock, diagnostics, background color, percentage of backlight, reset odometer and tripometer	Limited- 24 hour time clock, language, trip odometer reset, reminders, backlight
Can program through computer	Yes, indirectly via Professional SD card	Yes PC Programming Tool through dongle – required to change text and for some mouse features (uses printer cable)	Yes PC Programming Station
Memory backup	Yes, onto Basic or Pro SD Card. (Not computer dependent) Card data can be read using USB card reader to view settings on PC.	Yes Through computer	Yes Through computer or handheld programmer. Programs can be shared between two with SD card or through USB plug-in.
Can do “real time” programming	No on Expandable systems. (Programmer can remain plugged in, but turned off when driving) Yes on Non-expandable (SPJ+ Remote Joysticks)	Yes	Yes
Diagnostics	Time and Date stamped error codes available on programmer - on color display without using programmer. Error Code Help Screens (Definition & action required for remediation) with SD Card. Additional diagnostics for actuators and driver controls. Battery voltage and connected device diagnostics viewable on color display screens	Each module has its own error log. Faults recorded sequentially for ease of use when diagnosing intermittent faults PC shows detailed list	Through computer and handheld: includes descriptions and error code help screens. Time and Date Stamp on fault codes. Help key will aid in diagnostics by providing possible causes of fault as well as steps to correct the error.

Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Monitoring	Actuator Amp draw & Angle Position with Smart Actuators Status of limit switches.	voltage, currents, inhibits etc. with both PC and DTT	Through computer and handheld programmer: 100+ items available to monitor including seat position, actuator run time, multiple motor parameters, switch and button status, can check how far the PWC has been driven
Number of Drives/Profiles	4 (plus one for Attendant Control)	8 (8th is attendant by default)	5 (5 for each drive control device), can eliminate any unneeded drives, 1 dedicated to power seating menu
Preset programs	Up to 13 available Standard driving programs, each can be modified, each can quickly be saved into any drive profile.	Single program of factory settings Permobil loads program that aligns with access method used, can request from manufacturer	Single program of factory settings for each device type. Additional programs available on by request via email
Simple vs. Advanced programming options	Can change Overall Speed and Response in each dive profile, or access all Programming adjustments	Advanced only	Advanced only
Torque *Increased power to overcome resistance, even at low speeds*	Yes, programmable	Yes, programmable, per profile	Programmable, labeled Power
Power *Percentage of power available during driving*	Yes	Yes, per profile	Same as Torque. Stops PWC movement if a set amount of power is required
Sensitivity *how quickly the chair responds to joystick movement*	"Tremor dampening" settings as well as individual acceleration adjustments for forward, turning and reverse quadrants allow accommodation of user needs. Applies to digital and analog controls. "Traction" parameter adjustment reduces speed when going into or coming out of a turn. Helpful for softening veer correction w/ digital or latched controls	"Tremor dampening" in each profile Also separate "Acceleration" parameters for Forward, Reverse and Turn at minimum and maximum speeds in each profile	"Turn Sensitivity" parameter available to increase or decrease sensitivity. Speed turn rate parameter available to adjust sensitivity at higher speeds for steer correction. (all options per Drive) Tremor Suppression is global

Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Initial travel (distance) of the joystick is ignored	No	Deadband, programmable	Center Deadband, programmable
Latch *Movement of the PWC continues until a command is received to stop*	Yes, Forward (Reverse is additional parameter) Six latched types to choose from	Yes, Forward and Reverse Step Latch: puff each time to increase speed Cruise Latch: hold puff to increase speed	Yes
No Drive Mode *allows Driver to enter a Mode or Drive in which the chair will not drive*	No Driving mode - disables driving in selected profile with all other programmable functions available. Can disable entire drive profile so it doesn't appear on display as a choice.	Yes, in desired Profile, turn Mode 1 off so client cannot drive	Yes, Rest Profile can be programmed
Sleep Mode *all functions disabled until Mode switch activated*	Yes Can disable in ECU or mouse emulation modes	Yes, programmable up to 30 minutes, turn off by setting to 0	"Rest" profile can be programmed, no seating or drive functions available in this profile, mode command exits profile.
Program which drive to start in at Power On	Yes Program last drive used or a specific drive profile	Goes to last Profile used or a specific profile Power-up 'Mode' programmable on some JSMs	Yes Program to last drive used or specific profile
Display			
Color display	Yes	Yes. Two contrast options – indoor (white) or outdoor (blue)	Index Matching on displays to absorb ambient light for outdoor use
Backlit display	Yes Auto adjusts to ambient light (place tape over sensor to keep bright)	Yes, adjustable	Yes, programmable dimming time and backlight. Programmer also has programmable backlight.
Languages supported	English	English	English, German, Spanish, Italian, French
Customize text wording	Yes, with MK6i Programmer or Professional SD Card	Yes, through computer	Yes, through computer

Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Change font size	Enhanced View Mode enlarges Icons on Monochrome display. Enhanced & Sequential Scanning Modes with enlarged icons	Programmable option of large 'momentary' screens when changing speed or profile. Highlighted "User Menu" items are enlarged	No
Icons/Graphics	Yes, some combined with text	Yes, some with programmable text, e.g. mode names. Permobil uses own icons for power seating.	Yes, profiles can be assigned as preset text, icons, or colors and shapes (pediatric).
Display required for alternative access method	No, can add to any system with MPJ Joystick or Stand Alone Display	Yes Can use Input/Output Module (IOM) instead, but this has no power button (has 1/8" jack) or charger port (secondary charger port needs to be installed)	Yes
Buttons on Display	Info (help), Save, Select, Directional arrows.	Profiles, Mode, Power, Speed Up, Speed Down	Power, Mode and Directional Arrows (enhanced display 2.0)
Switch Jacks on Display	Two: 1 = Remote power on/off, 2 = mode port with up to 2 available functions using splitter or stereo switch (Mode, Drive Select, Power Seating)	Omni Display: Three: 1/8" Power, Port 1 and 2 9 pin for alternative drives, each has a dedicated mode switch jack Quickie: Mode can be programmed to be Power Seating or Mode. 2 power seating commands can be sent using a splitter.	1 = Remote power on/off Can be programmed to be Power, Power/Mode, Kill, toggle (fwd/rev) Power/Mode: hold switch for Power and quick hit for Mode. 2 = mode port Mode- simple and advanced programming *Simple: cycles through modes* *Advanced:* *short command cycles through Drive Profiles* *long command toggles between Drive Profiles and Aux. & Seat functions*
Access to functions: consumer level of control	Consumer can add new IR devices using Basic SD Card. Consumer can change date & time on color displays	Consumer has access to User Menu to change clock time/settings, trip odometer, backlight color & display color, IR control	Consumer can only change clock, trip odometer, language, backlight and reminders. These can be restricted, as well.

Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Shortcut Menu on Display	No	Mode selection enters User Menu or can be programmed to Sequence to move through options with repeated Mode selections (Drive, Reverse, etc.)	Can program a "Quick Access List" of desired shortcuts that are shown when chair goes into auxiliary menu.
Locking feature to prevent any external access to chair	No	Yes: Either button sequence, key, both or neither – fully programmable, on joystick only	System Lock - can be turned on or off
Other		Clock, speed display Mode name and profile name text programmable	Can download digital photos to display or hand control Clock, MPH, Battery %, Trip Odometer, Odometer
Joystick			
Joystick: hand rest	Multiple Joystick Styles	Yes, option on any PermaFix joystick (Permobil)	Yes, through custom department.
Joystick: display	Yes, color MPJ	Yes, color except LED joystick	Yes, color, index matching Ambient light sensor. Automatic display diming or brightness depending on lighting of environment.
Joystick: buttons or toggle switches	Various options	Buttons, Toggles and / or speed pot optional	Buttons, side mounted dial (speed) and toggle (on/off, profile)
Joystick: shortcut buttons	No	Profile button can be reassigned to provide access to both profiles or speed	2 – 1 for profile 1 and 1 for seat profile- Labeled I and II Menu button displays Menu of shortcuts on display for user programming.

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Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Joystick: speed dial	Yes	Yes, option	Yes - can be programmed for: Limited: high and low limits Continuous: no limits Continuous forward: only forward movement of dial is required to change speed, will cycle through Continuous rearward: only reverse movement of dial is required to change speed, will cycle through
Joystick: switch jacks	Two: 1 = Remote power on/off 2 = Stereo (two choice) switch port. (Can be programmed for Mode select, Drive Select, or Single actuator operation, (up, down, and up/down). May program two actuator functions to allow toggle switch function of actuator. If only one port is used, default is Mono Port 1	Two: power and profile / mode	1 = Remote power on/off *Power- smart switch if enabled will change profile with short commands and power unit off with long commands* 2 = mode port Mode- simple and advanced programming *Simple: cycles through modes* *Advanced:* *short command cycles through Drive Profiles* *long command toggles between Drive Profiles and Aux. & Seat functions.*
Mode switch sequence: joystick	Reverse, Automatic Positioning, Powered Seating, Actuators, Drive Select, IR, Mouse, I-Portal, ECU 1/2, ECU3/4	Profiles, Actuators, Aux., Drive. Sequence programmable	Drive, Actuators, Aux. Profiles 1-5 individually programmable for Drive, Seat, Aux. Disabled, or Rest
Standby option: joystick	Standby Select: (programmable time) allows driver control to select next operating mode after chair enters Stand By using directional command (Driving, Actuators, ECU, Mouse, IR, Drive Select). Standby can be disabled in ECU and Mouse/IR mode, Mode switch returns to Drive mode.	Yes, adjustable time or via mode switch Can enter all modes and profiles from Standby, programmable directional commands.	Standby Select: go to Menu of Profiles Can individually enable for drive, seat, aux. (global) Scroll time programmable

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Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Joystick: Can program the same joystick to be proportional or switched	No-Except if using latched driving. (latched mode with joystick operates in digital or switch mode for directional control only)	No (Step latched drive operates in digital manner)	Yes, if joystick is deflected more than 50% it will act as switched joystick when programmed
Joystick: swap axes *Assign any direction to any quadrant*	Yes	Yes	Yes
Joystick: can use with only 3 directions	Yes, activate RIM Mode Enter "Reversing" mode either with Mode switch or through "Standby Select"	No Could accomplish through any alternative proportional joystick and Omni display, 3 axis proportional	Yes, 3-Direction Profile, using Left, Right and Reverse Forward/Reverse toggle accomplished by quick movement in Reverse Double hit to left to access actuators
Joystick: compact/remote joystick	Yes, no buttons	Permobil: Compact Joystick & Compact Joystick Lite	Stand Alone joystick Power and Mode buttons 3 Drive & Actuator Functions
Separate switch for actuators: with joystick *Required by CMS*	Yes	Yes, via ICS Alternative Switch Box. Attach up to 8 custom programmable ability switches.	Yes
Other	User can view battery voltage and date / time stamped error codes to report to RTS prior to service calls on MPJ joystick		Built in Bluetooth standard on Q-logic 2. -Mouse emulation -connection to Apple and Android devices.
Alternative Access Methods Specifics			
Component required for alternative access connection	-Digital Interface for Sip n Puff & digital driver controls. -Interface for ASL digital systems.	Omni Display (2 9 pin ports) or IOM (9 pin port)	Enhanced Display (9 pin) and Sip and Puff Interface SCIM (Specialty Control Interface Module) -Alternative controls through Q-logic 2 joystick. -Does not support sip and puff or single switch scan
Number of alt. input devices that can be connected	Up to 4 Driver Controls plus attendant control. (5)	2 (on each Omni, each 9 pin port also has a dedicated mode switch) 1 (IOM) System can support up to 2 Omnis with 2 access methods each	Up to 4 driver controls- 1 Joystick, 1 Stand Alone, 1 Attendant Control, and 1 Specialty Control

Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Transfer of control between alternative input devices	Choose Drive Profile with desired driver control assigned	Choose Profile programmed with that access method "Allow Grab": hit mode switch on desired access method	Turn on the input device using power button for that device (i.e. on display)
Head Array Access to Reverse Options	2 options: 1. Separate Mode switch: 1st activation enables Reverse. 2nd activation returns to forward driving. 2. Bypass mode switch by programming "Standby Select". Once in Standby, left driver command activates Reverse driving. Forward command activates Forward driving.	*Mode switch:* single operation toggles direction Or *Rear Pad:* first activation toggles direction, second activation drives 'Switch Medium' mode switch activation time to access user menu 'Switch Long' mode switch activation time to access Sleep 2 axis option for seating actuator control under Omni Port Controls menu (choose L/R or R/L)	*Mode switch:* 1st activation chooses Reverse, second activation can be either mode or standby select Or *Rear Pad:* first activation toggles direction, second activation drives
Sip 'n puff	4 pressure Hard Puff = Forward, Soft Puff = Right, Hard Sip = Reverse, Soft Sip = Left Digital Interface required Pressure programmable in all 4 quadrants to match user's abilities Reduce Tremor Dampening value and shorten tubing for best performance	4 pressure (programmable thresholds) Built into Omni display Programmable 'ramp up', 'ramp down' time (standard .3, works better at .25) to allow client to build pressure before signal is accepted	2 or 4 pressure option 2 pressure: 2 puffs = Forward, 1 puff = Right, 2 sips = Reverse, 1 sip = Left Separate module required Can adjust Sampling Delay to allow consumer to "ramp up" to allow client to build pressure before signal is accepted Visual and audible pressure meter on client's display screen.
Switch Access	Supports single, 3, 4 and 5 switch access Can do 2 switch access using ASL 2 switch fiberoptic array	Supports single, 3, 4 and 5 switch access Can do 2 switch access using ASL 2 switch fiberoptic array	Supports single, 2, 3, 4 and 5 switch access <u>2 switch:</u> 1st switch – double click and hold is Forward, single activation is Left. Double click and release is Mode. 2nd switch – double click and hold is Reverse, single activation is Right Can also do 2 switch access using ASL 2 switch fiberoptic array <u>3 switch:</u> Double hit on left to access actuators

Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Single switch scanning	Requires external scanner	4 directions on display Can scan all chair functions Programmable speed for drive and menus	12 scanner options: single or 2 stage options. Scanners can be programmed to specific profiles or be global. Mode option can be disabled when scanning for communication devices.
Alternative Access Power, Mode and Navigation			
Mode switch functioning	Mode switch activation enters next available activated function (Reverse, Aux, Powered seating, etc.), and also acts as an emergency stop switch.	Mode switch activation takes consumer to User's Menu on display or can activate sequence	Mode switch activation sequence: Reverse, Profiles, Power. Can be programmed in multiple different ways.
Standby option	Standby Select Mode occurs after a programmable time elapses. Directional driver control command chooses function / active mode. Standby in ECU and Mouse Mode can be disabled.	Yes, adjustable time or switch to standby via mode switch Directional command chooses function.	Standby Select takes consumer to list on display after a programmable time elapses. Can be enabled for drive, seat, aux. individually. Directional command chooses next function.
Display function navigation: manual	Manual scroll: directional switches move through displayed choices Drive Select: right command can scroll through Drives 1-4, Mode switch selects available modes in each drive. Standby Select can bypass mode switch function. Drive Control Navigation (no switches) programmable.	Manual scroll: Forward command moves up displayed list, Reverse moves down (can Invert Forward and Reverse), Right selects, Left moves back a level. Order of menu programmable. If using Head Array, Forward moves up the list and loops	Manual scroll: Forward command moves up displayed list, Reverse moves down, Right selects, Left moves back a level Holding down the Forward or Reverse command will continue to scan after a programmed amount of time
Display function navigation: scanning	3 scanning types - any drive command makes selection: Modified row column enhanced (version of row/column w/large icons) sequential (one mode in each drive at a time). All with adjustable speed, adjustable initiation time.	Auto scroll: adjustable speed. Right selects and Left moves back a level.	Auto scroll: adjustable speed. Right selects and Left moves back a level.

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	Invacare MK 6i (Dynamic)	PG Drive Technology R-net	Quantum Q-Logic 2 (Curtis)
Display function navigation: auditory scanning (speech)	No Auditory feedback available for screen/mode changes whether through manual operation or in scanning modes. Different beeps used for different modes. Allows Display to be non-visual dependent. (Can mount on back of chair).	No Auditory feedback to indicate Profile, operating Mode or selection on User Menu (beeps can be turned on/off)	No Different tones for each drive profile, seat, and auxiliary. Auditory feedback available for screen/mode changes whether through manual operation or in scanning modes
Infrared Transmission			
IR signal output	IR Module, 6 devices ($995 IR/ and RF Mouse pkg.)	Yes, standard on Omni	Yes (built-in) Back of Display, multidirectional
Preset codes	Yes	Yes Can download many from internet	No
Learning	Yes	Yes	Up to 288 (depending on size of code), macros (up to 3 commands)
Macros	No	No	Yes
Insteon control	Through IRLinc (not included) which converts IR to Insteon signals. Included remote can be used to teach IR signals to power wheelchair electronics. Separate Insteon modules required.	Through IRLinc (not included) which converts IR to Insteon signals. Included remote can be used to teach IR signals to power wheelchair electronics. Separate Insteon modules required.	Through IRLinc (not included) which converts IR to Insteon signals. Included remote can be used to teach IR signals to power wheelchair electronics. Separate Insteon modules required.
Telephone	Through IR receiving phone (not included). Can also interface external switch operated phone. Options to control a Smartphone through the PWC.	Through IR receiving phone (not included). Can also interface external switch operated phone. Options to control a Smartphone through the PWC.	Through IR receiving phone (not included). Can also interface external switch operated phone. Options to control a Smartphone through the PWC. Built-in BT to connect to Apple or Android devices.

Complex Rehab Power Wheelchair electronics
Comparison matrix

	Invacare MK 6i (Dynamic)	PG Drive Technology R-net	Quantum Q-Logic 2 (Curtis)
Other	Can program Favorite Channels or use keypad to enter a channel. Can't change text in IR templates		
Mouse Emulation			
Mouse emulation	-Yes, separate from display, optional -Radio Frequency (RF), requires included USB dongle -Proportional with joystick 3 or 4 quadrant operation Wireless Control of PC, MAC, Comm Devices Tecla shield available through ASL for iOS I-Portal soon to be available for iOS and HID	Yes, separate from display, optional Blue Tooth Mouse Module Proportional with joystick $854 MRSP Controls computer, Windows, and Android devices, new BlueTooth device pending for iPad Tecla Shield allows iPad/iPhone access (additional cost)	Yes, built into display Blue Tooth or IR IR requires ASL or GEWA mouse receiver Proportional with joystick Harness to power module with 1-2 switch jacks
Mouse emulation Clicks	2 switch jacks on mouse module for left and right clicks Or Use dwell software Or Use 3 quadrant mode Left command = left click, reverse if available can be right click	Joystick: can use Speed up and Speed down buttons for L/R clicks in Mouse Mode Joystick or Alt. Access: any quick hit (nudge) of a directional command can be programmed to L or R click or Scroll up or down (requires PC) or Use dwell software Mouse Module: 2 switch jacks for L/R clicks (programmable L/R, double L/R or scroll up/scroll down)	Left directional switch: click, double hit = double click Right directional switch: right click or separate switch: toggles between mouse movement and mouse click. Mouse click screen: 4 directions for L click, R click, double click and drag or Use dwell software Programming option to make the clicks through the input device. Double left or Double right toggles between mouse movement and mouse clicks.
Interfacing			
Auxiliary function templates	N/A	No	Yes, can customize
Component required for interfacing	Aux1/2 or Aux3/4 (can use both) Aux1/2 = 2 outputs, 4 switch closures each Aux3/4 = 2 outputs, 5 switch closures each	IOM: Input/Output Module and cable Both ports can be used as output	ECU Module (8 switch outputs), cable

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Comparison matrix

	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Attendant Control	Proportional or Digital		
Attendant control features	PWC control, does not use up a drive profile Programmable Performance Adjustments for both Proportional & Digital Attendant Controls If attendant control is on, Driver access method will not operate.	Uses Profile 8 as standard Can be programmed to any profile(s) Programmable 'grab' option to allow either the caregiver or the user to regain control. Can access all user modes, seating, mouse, etc. or programmable to specific modes (includes Mode button)	Power mode button Doesn't use up a profile If attendant control is on, access method will not operate. Profiles individually programmable. Profiles 2-3 can be turned off
Actuators			
General comments	Can control actuators during driving with Smart Actuators or Motion Concepts	Permobil: ICS Intelligent Control System (not R-net).	Joystick control allows proportional speed control (unless in latch)
Programmable combination of movements	Smart actuator: can execute Automatic Positioning (from only 1 or up to 6 steps each sequence), up to 4 pre-set positions (1 per Drive). Automatic Positioning with tilt, recline, and center mount legs.	Up to 16 axes of seat motion can be defined using up to 6 actuators, either singly or in multiple combinations. Permobil includes Tilt, Recline, ELRs, seat elevate, stand, power swing away chin, power transfer (footplate to floor and auto raise seat), power leg length	No
Programmable Speed, Acceleration, Deceleration	Yes	No Joystick – proportional speed	Yes
Drive Inhibit (slows speed past programmed actuator angle)	No	Yes	Yes
Drive Lock out (prohibits driving past programmed actuator angle)	Yes	Yes	Yes
Limit movement (programs start and stop point/angle of actuator movement)	Motion limits can be programmed on Smart Actuators or Motion Concepts Memory Seating	Yes	No

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	Invacare **MK 6i (Dynamic)**	**PG Drive Technology** **R-net**	**Quantum** **Q-Logic 2 (Curtis)**
Pressure Relief Signal	Series of beeps and a visual prompt to perform pressure relief. Chair will not drive until the mode switch is activated (user acknowledges beeps). Frequency (time) is programmable up to 60 minutes. If the client is driving, the prompt will be delayed until driving stops	Virtual Seating Coach Records/tracks weight shift data	Can program individualized reminder for pressure relief. Can program for set time or as an interval. Will repeat to programmable frequency until confirmed. Optional audible alert.
Other			
Other comments	Memory card works on Expandable level electronics only (4 Drive Systems). Can store/archive multiple systems or individual drives in a library for downloading to other systems. MK6 Laptop IVS can view / change / print programmed settings	HMC products now part of Permobil USA	User Reminder feature- programmable time or interval with customized wording programmed in PC programmer. Icons pending Maintenance Reminder feature - programmed by days or miles. Can be individualized with PC programmer to input company name / number or other text.